SEN06603-07

Shop Manual

HYDRAULIC
EXCAVATOR

PC650LC-11

SERIAL NUMBERS 80001 and up

KOMATSU

FOREWORD, SAFETY, BASIC INFORMATION

HOW TO READ THE SHOP MANUAL

- Some of the attachments and options described in this shop manual may not be available in some areas. If they are required, consult your Komatsu distributor.
- The materials and specifications are subject to change without notice.
- Shop Manuals are available for "machine part" and "engine part". For the engine unit, see the shop manual for the machine which has the same engine model.
- Actual machine may differ from the images which are contained in this manual. A typical model is shown in the illustrations of this shop manual.

Composition of the shop manual

This shop manual contains technical information necessary to perform services in workshops. It is divided into the following chapters for the ease of use.

00 INDEX AND FOREWORD

This section describes the index, foreword, safety, and basic information.

01 SPECIFICATIONS

This section describes the specifications of the machine.

10 STRUCTURE AND FUNCTION

This section describes the structure and operation of each component with respect to each system. "STRUCTURE AND FUNCTION" is helpful in not only understanding the structure of each component but performing troubleshooting.

20 STANDARD VALUE TABLE

This section describes the standard values for new machine and failure criteria for testing and adjusting, and troubleshooting. Use the standard values table to check the standard values for testing and adjusting, and judge troubles in troubleshooting.

30 TESTING AND ADJUSTING

This section describes the measuring tools and measuring methods for testing and adjusting as well as the adjusting method of each part. The standard values and repair limit for TESTING AND ADJUSTING are described in "STANDARD VALUE TABLE".

40 TROUBLESHOOTING

This section describes troubleshooting of failure part and its remedy method on the occurrence of the failure. Descriptions of troubleshooting are sorted by failure mode.

50 DISASSEMBLY AND ASSEMBLY

This section describes the special tools, work procedures, and safety precautions necessary for removal, installation, disassembly, and assembly of the components and parts. In addition, tightening torques, quantity, and weight of the coating materials, lubricants, and coolant necessary to these works are shown.

60 MAINTENANCE STANDARD

This section describes the maintenance standard value of each component. The maintenance standard shows the criteria and remedies for disassembly and assembly.

80 THE OTHER INFORMATION

This section describes the structure and function, testing and adjusting, and troubleshooting for all of the other components or equipment which cannot be separately classified in the appendix.

90 Circuit diagrams

This section describes hydraulic circuit diagrams and electrical circuit diagrams.

Symbols

Important safety and quality portions are marked with the following symbols so that shop manual is used effectively.

Check that there is no looseness on the exhaust equipment and mounting bolts, nuts, and clamps on the installation portion.

If there is any looseness, retighten the part.

Check of function of muffler in exhaust system

REMARK

When an equipment is described as an muffler in exhaust system, it is one of the followings. (The applications or components of equipment are different depending on its models or specifications.)

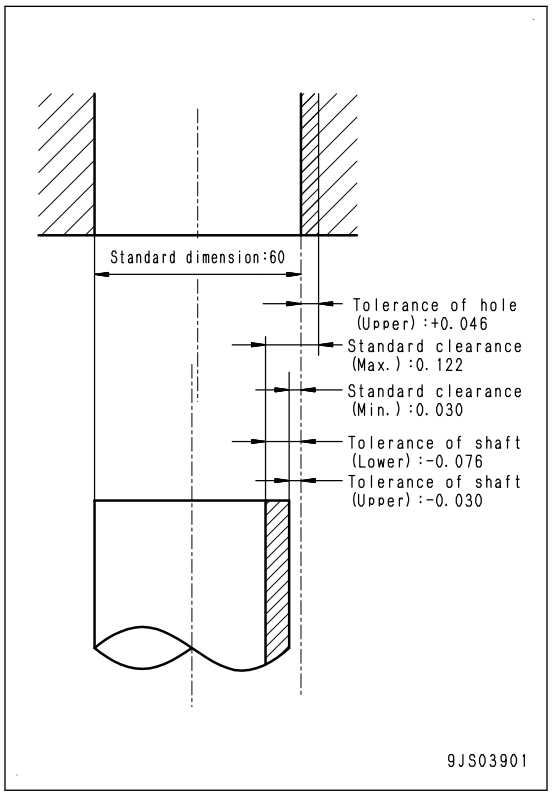
- KDPF
- AdBlue/DEF mixing tube
- SCR assembly
- KDOC muffler
- Muffler
- Exhaust pipe
- Parts which connects the above, or etc.

Check that there is no unusual noise by comparing to it of the time when the machine was new.

If there is any unusual noise, repair KDPF or muffler, referring to "TROUBLESHOOTING" and "DISASSEMBLY AND ASSEMBLY".

Standard clearance and standard value

- The clearance made when new parts are assembled is called the standard clearance, which is indicated by the range from the minimum clearance to the maximum clearance.
- When some parts are repaired, the clearance is generally adjusted to the standard clearance.
- The values indicating performance and function of new products or equivalent are called "standard value", which is indicated by a range or a target value.
- When some parts are repaired, the value of performance/ function is set to the standard value.



Standard interference

- When the diameter of a hole of a part shown in the given standard dimension and tolerance table is smaller than that of the shaft to be inserted, the difference between those diameters is called "interference".
- Subtract the maximum dimension of the hole from the minimum dimension of the shaft and call it (A). Subtract the minimum dimension of the hole from the maximum dimension of the shaft and call it (B). The range between (A) and (B) is "standard interference".
- After repairing or replacing some parts, measure the dimension of their hole and shaft and check that the interference is in the standard range.

Repair limit and allowable value or allowable dimension

- The dimension of parts changes due to the wear or deformation while they are used. When the dimension changes exceeding certain value, parts cannot be used any longer. This value is called "repair limit".
- If a part is worn to the repair limit, it must be replaced or repaired.
- The performance and function of products lower while they are used. A value with which the product can be used without causing a problem is called "allowable value" or "allowable dimension".
- A product whose dimension is out of the allowable value, must be repaired. However, since the allowable values are generally estimated through various tests or experiences in most cases, the judgment must be made in consideration of the operating condition and customer's requirement.

Allowable clearance

- Parts can be used until the clearance between them is increased to a certain limit. The limit at which those parts cannot be used is called "allowable clearance".
- If the clearance between the parts exceeds the allowable clearance, they must be replaced or repaired.

Allowable interference

- The allowable maximum interference between the hole of a part and the shaft of another part to be assembled is called "allowable interference".
- The allowable interference shows the repair limit of the part of smaller tolerance.

Machine model	Unit	PC650LC-11
Type	-	4-cycle, water-cooled, in-line, vertical, direct injection, water-cooled type with turbocharger, aftercooler, and (EGR) cooler
No. of cylinders - bore x stroke	mm	6-140x165
Total piston displacement	ℓ { cc}	15.24{15.240}
Performance		
Rated horsepower		
• Gross (SAE J1995)	kW { HP} / min^{-1} { rpm}	327.3{438.9}/1800{1800}
• ISO 14396		327.3{438.9}/1800{1800}
• Net (ISO 9249/SAE J1349)		325.3{436.2}/1800{1800}
Maximum torque	Nm { kgm} / min^{-1} { rpm}	1969.8{201}/1400{1400}
Max. speed with no load		
• When mounted on machine (*3)	min^{-1} { rpm}	1950±50{1950±50}
• As a bare engine		1977±50{1977±50}
Min. speed with no load	min^{-1} { rpm}	800{800}
Min. fuel consumption ratio	g/kWh { g/HPh}	211{157}
Starting motor	-	24 V, and11 kW
Alternator	-	24 V, and90 A
Battery (*4)	-	12 V, 160 Ahx2 pieces
Radiator type		CF90–4

*3: When swing lock is ON

*4: The battery capacity (Ah) is indicated in the 5-hour rate.

REMARK

The engine rated horsepower is indicated in the net value and gross value. Gross denotes the rated horsepower measured on the basic engine unit while net denotes the value measured of an engine under the condition nearly the same as that when it is installed on a machine.

Undercarriage

Carrier roller	-	3 piece on one side
Track roller	-	9 piece on one side
Track shoe	-	Assembly type triple grouser shoe, 52 pieces on one side

Hydraulic system

Main pump		
Type x quantity	-	Variable displacement piston type (HPV95 + +95) x 2 piece Piston+gear type (LPV75+SAL(2)56+(2)8
Discharged volume	ℓ/min	Piston type: 410x2 Gear type: 137
Set pressure	MPa { kg/cm^2}	Piston type: 34.5{350} Gear type: 2.9{30}

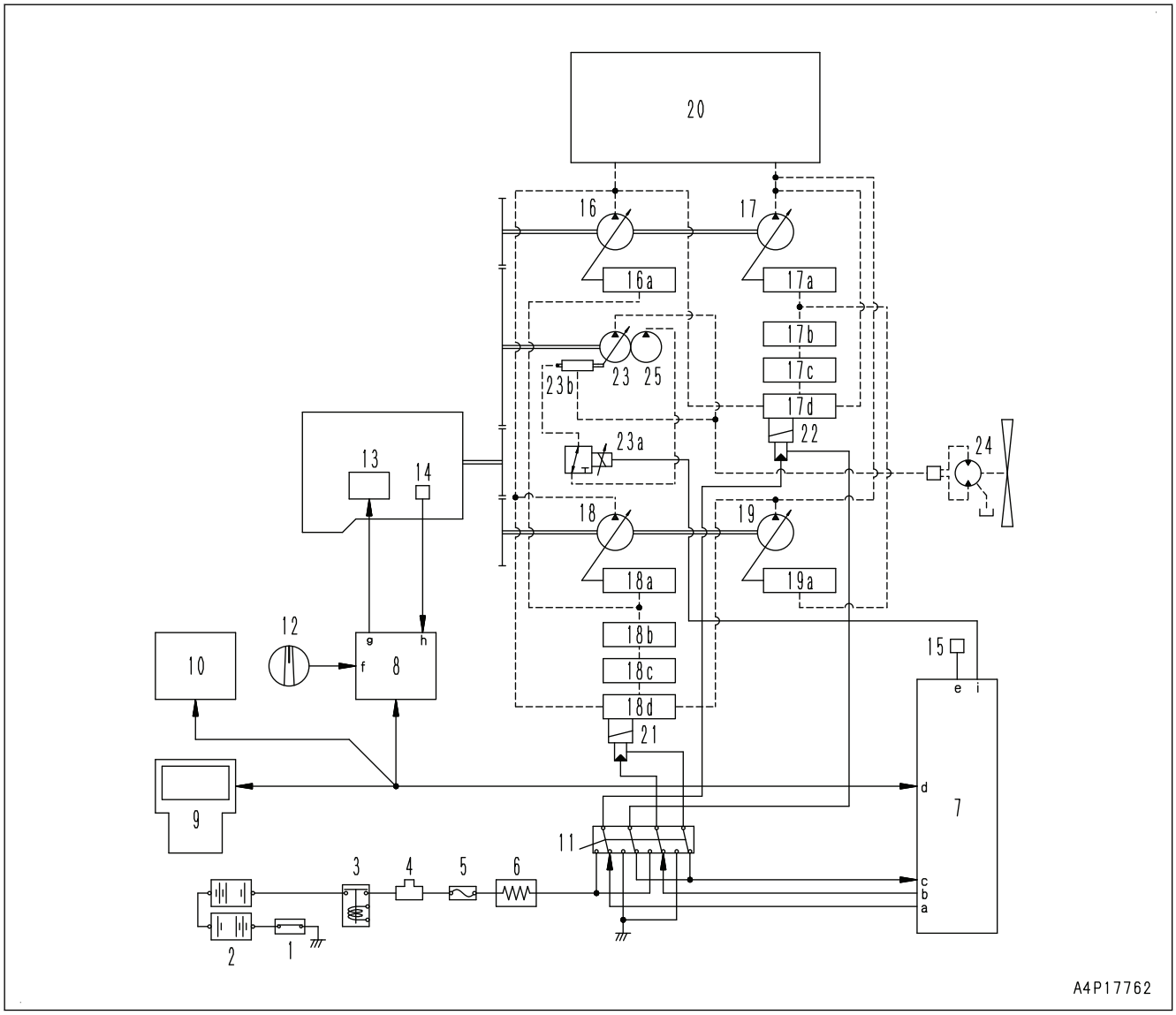
INDUCEMENT STRATEGY WHEN ABNORMALITY IS FOUND IN THE UREA SCR SYSTEM DEVICES (FOR NORTH AMERICA)

- AdBlue/DEF system caution lamp lights up on machine monitor, and an action level is displayed when an abnormality occurs in quality in AdBlue/DEF or in urea SCR system. In addition to the caution by the AdBlue/DEF system caution lamp, alarm sounds as time passes after the abnormality occurred. Then, inducement strategy starts so that the engine output is lowered.
- The Inducement strategy status and the categories of abnormalities can be checked on the “SCR Information” screen of the machine monitor.
- The table shows warning indications and engine power derations by each Inducement strategy status.

Status		Elapsed time (*1)	Machine monitor					Engine deration (*5)
			Message of SCR Information	Caution lamp (Action level)	Tone of audible alert	Failure code for abnormality (*2),(*3)	Failure code for Inducement strategy status (*4)	
1	Warning	1 hour	1: Please inspect and maintain SCR system.	Yellow  APP14417 Yellow  APP14412	No sound	CA3571 CB3571	No indication	No deration
2	Escalated Warning (Warning 2)	2 hours	2: Without treatment, engine power will be derated.	Yellow  APP14417 Yellow  APP14412	Triplet (*6) Short intermittently (*7)	CA3571 CB3571	AS00R2 (Warning 2 (SCR Device Abnormality))	No deration
3	Mild Inducement (Inducement 1)	3 hours	3: Engine power is under deration.	Red  APP14415 Red  APP14414	Long intermittently	CA3571 CB3571	AS00R3 (Inducement 1(SCR Device Abnormality))	Torque: over 25%

ENGINE AUTOMATIC WARM-UP SYSTEM

ENGINE AUTOMATIC WARM-UP SYSTEM DIAGRAM



Input and output signals

a: Rear pump TVC valve solenoid driving signal

b: Front pump TVC valve solenoid driving signal

c: Solenoid valve GND

d: CAN signal

1: Battery disconnect switch

2: Battery

3: Battery relay

4: Circuit breaker

5: Fuse box

6: TVC valve solenoid resistor

7: Pump controller

8: Engine controller

9: Machine monitor

e: Hydraulic oil temperature signal

f: 1st throttle signal

g: Fuel supply pump control signal

h: Various sensor signals

i: Cooling fan pump EPC valve drive signal

10: Air conditioner unit

11: Pump secondary drive switch

12: Fuel control dial

13: Fuel supply pump

14: Various sensors

15: Hydraulic oil temperature sensor

16: Front main pump (No. 1)

16a: Servo

17: Rear main pump (No. 1)

REMARK

When regeneration function on the machine monitor is disabled, or outside air temperature is extremely low, or continuous light load operation is carried out, relatively low exhaust temperature continues. In such case, “automatic regeneration” is not performed and the amount of soot accumulation is increased.

- If “automatic regeneration” is not performed due to the excess amount of accumulated soot in KCSF (2), perform “manual stationary regeneration” to burn (oxydize) the soot and reduce the amount of soot inside KCSF (2).

REMARK

Excessive amount of the soot interferes the flow of exhaust gas to worsen fuel consumption and engine combustion state. It may lead to other failures.
If the amount of soot increases further, “manual stationary regeneration” cannot be performed safely. This will result in a KDPF failure and replacement is unavoidable. Make sure to follow the procedures in the Operation and Maintenance Manual when performing “manual stationary regeneration”

*1: Soot purification (oxidation) treatment

TYPES OF REGENERATION FUNCTIONS

Regeneration means to purify (oxidize) the soot accumulated on the soot collecting filter (KCSF) in KDPF or maintain the urea SCR system normal.

Passive regeneration

When the exhaust temperature of the engine is relatively high, the oxidation power of soot in the exhaust gas components is increased by the catalysis of KDOC to oxidize (burn) the soot accumulated in KCSF naturally.

Active regeneration (engine exhaust temperature rise control + fuel dosing)

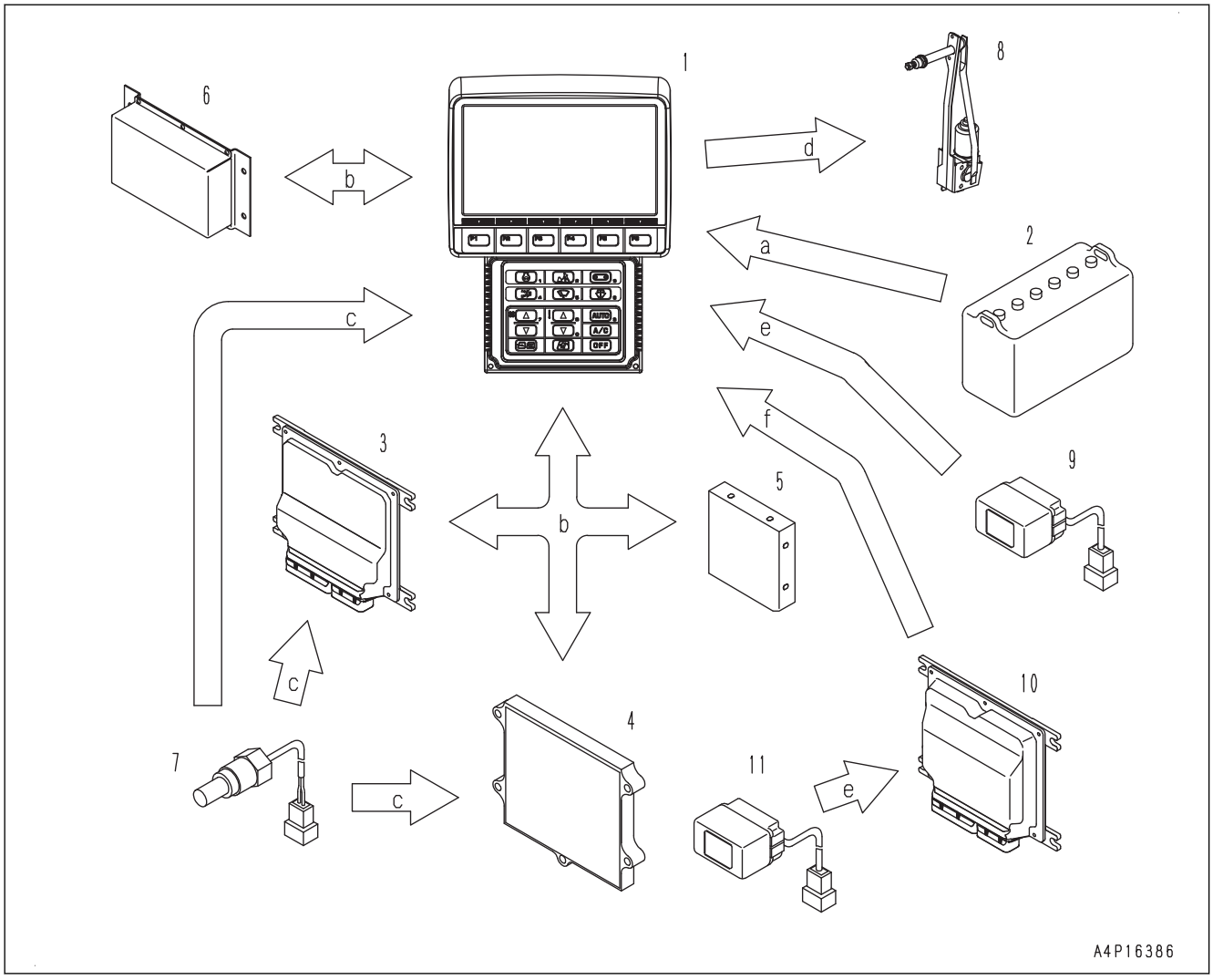
- Automatic regeneration
  - When soot is accumulated more than a certain level or the urea SCR system makes a request to maintain itself normal, the engine enters the exhaust temperature rise control mode (*1) and performs fuel dosing (*2) and starts regeneration automatically.
    The automatic regeneration is also performed by the direction from the engine controller at a set time after the previous regeneration, regardless of soot accumulation in KCSF.

    *1: Control to increase the engine exhaust temperature by controlling the fuel injection timing or VGT.

    *2: Fuel injection performed to accelerate regeneration by increasing the exhaust temperature.
- Manual stationary regeneration
  - When the exhaust temperature does not reach a certain level, depending on the operating condition of the machine, or when the operator disables regeneration, the automatic regeneration is not performed and accumulated soot in KCSF increases. Also, when the automatic regeneration is performed upon receiving a request from the urea SCR system, the exhaust temperature may not reach a certain level, depending on the operating condition of the machine. In these cases, a request for the manual stationary regeneration request is displayed on the machine monitor, and the operator must perform regeneration by the operation on the machine monitor screen.
    In addition, when the engine controller is replaced or ash in KCSF is washed, a serviceman performs regeneration by the operation on the machine monitor screen (“active regeneration for service”).

MACHINE MONITOR SYSTEM

MACHINE MONITOR SYSTEM DIAGRAM



a: Power supply
b: CAN signal
c: Sensor signal and switch signal
1: Machine monitor
2: Battery
3: Pump controller
4: Engine controller
5: Air conditioner controller
6: KOMTRAX terminal
*1:Machine without KomVision.
*2:Machine with KomVision.
d: Drive signal
e: Camera signal
f: Image signal
7: Sensors and switches
8: Wiper motor and window washer motor
9: Rearview camera (*1)
10: KomVision controller (*2)
11: KomVision camera (*2)

FUNCTION OF MACHINE MONITOR SYSTEM

- The monitor system keeps the operator informed of all the machine conditions, by monitoring them by using the sensors and switches installed in various parts of the machine and processing them instantly to display on the machine monitor.
  The information displayed on the machine monitor falls into the following types:

Pin No.	Signal name	Input and output signals
86	(*1)	-
87	System operation output	Output
88	(*1)	-
89	WAKE	Input
90	(*1)	-
91	(*1)	-
92	(*1)	-
93	(*1)	-
94	(*1)	-
95	(*1)	-
96	ACC (key input)	Input
97	ACC (key input)	Input
98	NTSC output GND	Output
99	(*1)	-
100	(*1)	-
101	(*1)	-
102	Shield	-
103	(*1)	-
104	Power supply GND	Input
105	Power supply GND	Input
106	NTSC signal output	Output
107	(*1)	-
108	(*1)	-
109	(*1)	-
110	CAN0 signal +	Input and output
111	CAN0 signal -	Input and output
112	Continuous power supply	Input
113	Continuous power supply	Input
114	(*1)	-
115	(*1)	-
116	(*1)	-
117	(*1)	-
118	(*1)	-
119	(*1)	-
120	(*1)	-
121	(*1)	-

*1: Never connect these pins. Malfunctions or failures may occur.

Variable displacement type piston pump

- Variable displacement type piston pump consists of 2 pumps, front and rear. This pump can control the flow rate by changing the swash plate angle.

Servo piston

- Servo piston is a piston that changes the pump swash plate angle in proportion to the input signal from servo valve.

Valve for control of swash plate angle

- Servo valve
  Servo valve is a valve that controls the main pump discharged volume in proportion to the input signal to the servo valve.
- TVC (Torque Variable Control) valve
  TVC valve is a valve that controls the main pump discharged volume with the command current sent from the controller according to the engine speed. TVC valve prevents the engine from stopping due to the large load applying to the engine.
- CO (Cut-OFF) valve
  CO valve is a valve that acts to reduce the pump discharged volume in order to reduce the relief loss when the main pump discharge pressure rises to a point close to the relief pressure.
- NC (Negative Control) valve
  NC valve is a valve that controls the main pump discharged volume according to the stroke of control lever (jet sensor signal).

Jet sensor

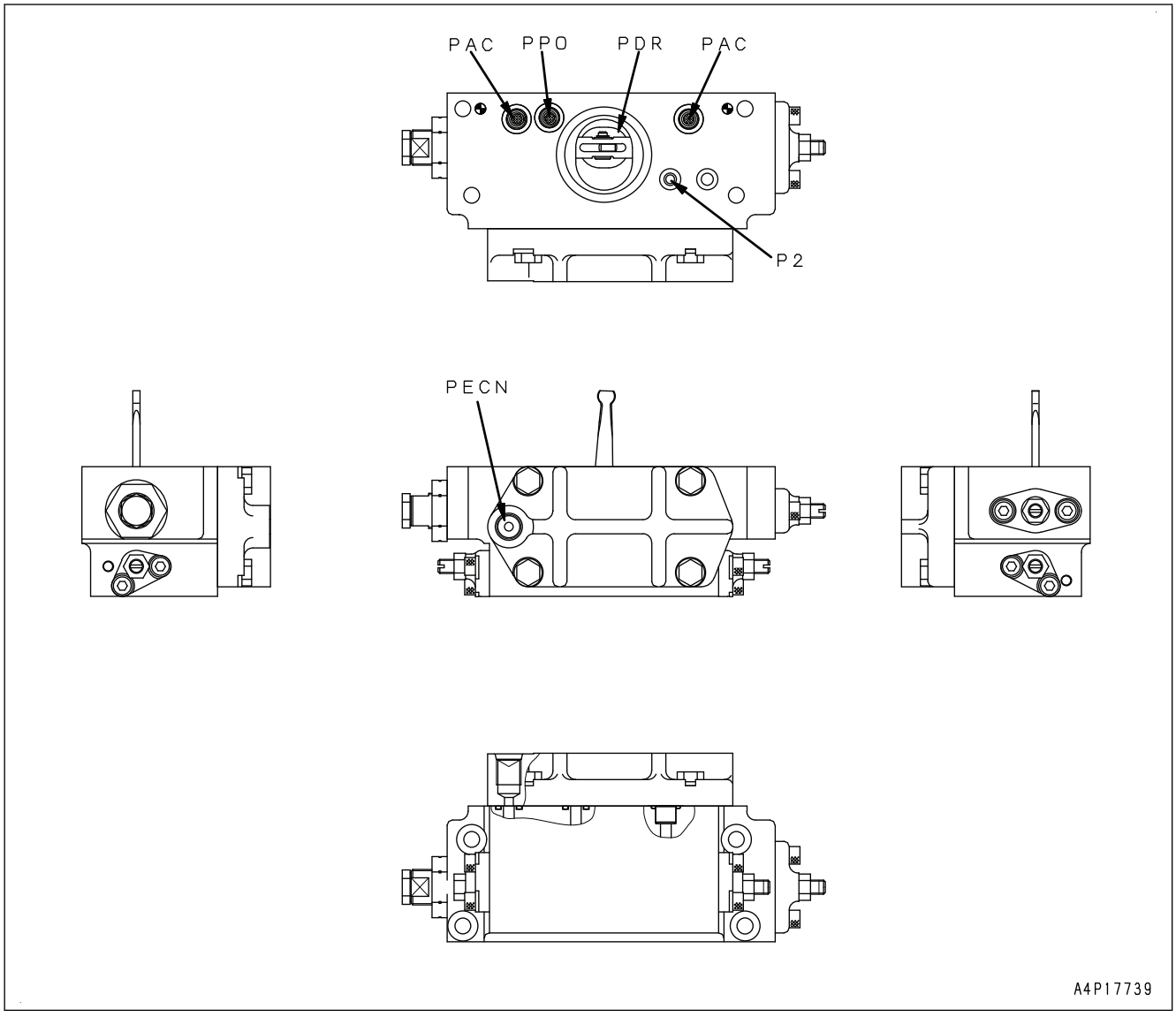
- Jet sensor is a sensor that senses the flow of oil returning through the control valve to the tank and outputs the control lever stroke signal.

MAIN PUMP SERVO VALVE

STRUCTURE OF MAIN PUMP SERVO VALVE

General view

Servo valve (No. 1 for front, No. 2 for rear)



P2: Main pump pressure input port

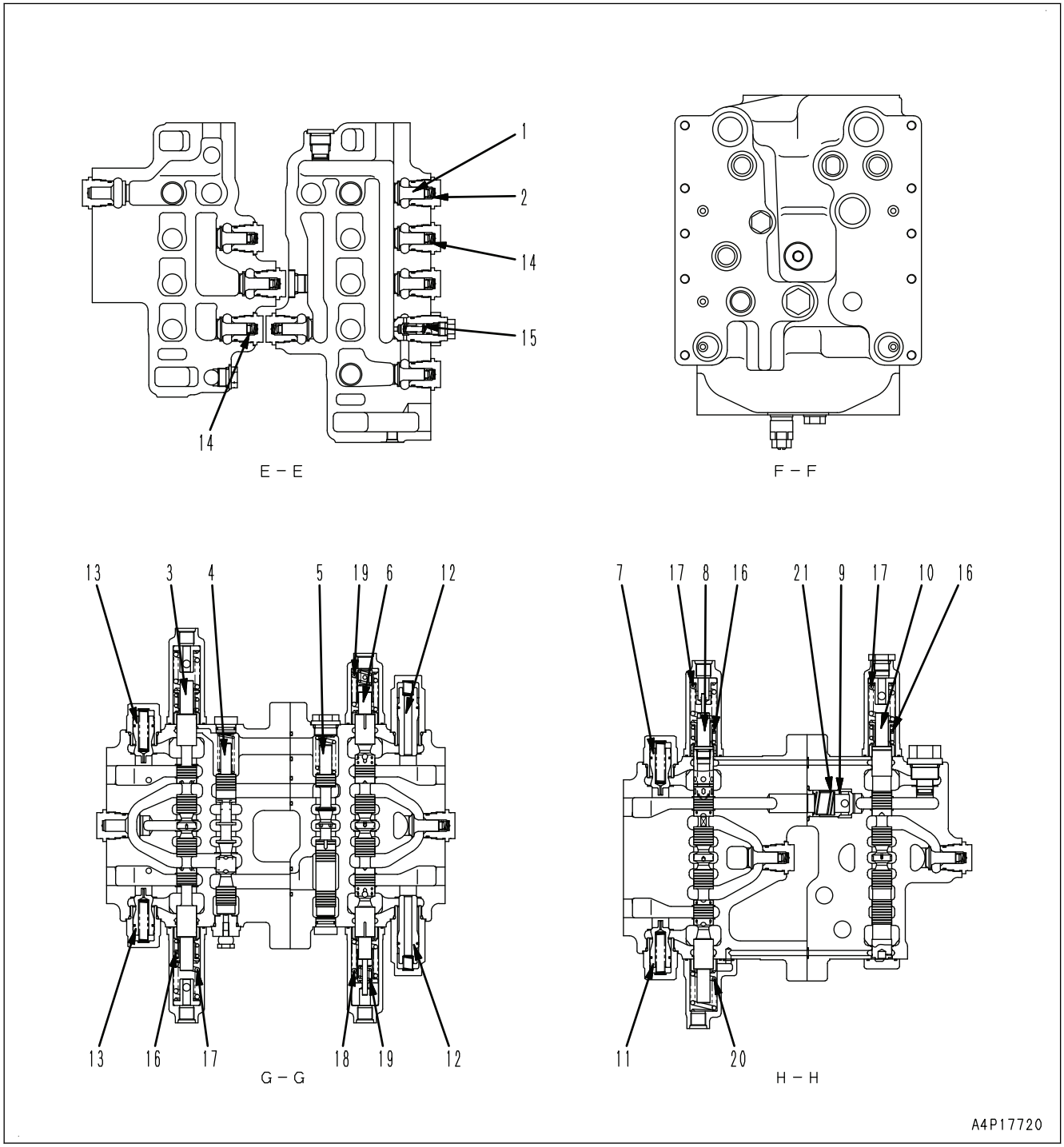
PPO: Servo source pressure input port

PAC: Servo actuator port

PECN: CO and NC valve output pressure input port

PRDR: Servo valve drain output port

Sectional views (E-E, F-F, G-G, H-H)



1: Check valve
2: Check valve spring
3: Spool (left TRAVEL)
4: Spool (straight-travel)
5: Spool (swing priority)
6: Spool (swing)
7: Suction valve
8: Spool (boom Lo)
9: Check valve
10: Spool (boom Hi)
11: Suction valve
12: Suction valve
13: Suction valve
14: Check valve spring
15: Check valve spring
16: Return spring
17: Return spring
18: Return spring

3: Battery relay
4: Circuit breaker
5: Fuse box
6: TVC valve solenoid resistor
7: Pump controller
8: Engine controller
9: Machine monitor
10: Pump secondary drive switch
11: Fuel control dial
12: Fuel supply pump
13: Various sensors
14: One-touch power maximizing switch
15: Front pump oil pressure sensor
16: Rear pump oil pressure sensor
17: Front main pump (No. 1)
17a: Servo
18: Rear main pump (No. 1)
18a: Servo
18b: NC valve
18c: CO valve
18d: TVC valve
19: Front main pump (No. 2)
19a: Servo
19b: NC valve
19c: CO valve
19d: TVC valve
20: Rear main pump (No. 2)
20a: Servo
21: Control valve
21a: Main relief valve
22: Front pump TVC valve solenoid
23: Rear pump TVC valve solenoid
24: 2-stage relief solenoid valve
25: Cooling fan pump
26: Cooling fan motor
27: Control pump

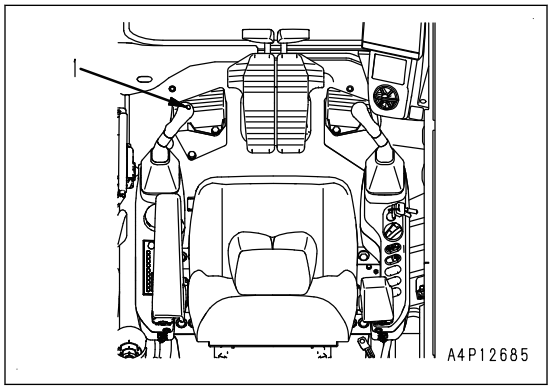
FUNCTION OF ONE-TOUCH POWER MAXIMIZING SYSTEM

- The one-touch power maximizing system is a system that increases the power for a certain time by operation of the one-touch power maximizing switch installed to the knob of L.H. work equipment control lever.
- This function is used to increase the digging force for a certain time for digging out rocks, etc. during excavation work.
- If the one-touch power maximizing switch is pressed when the load pressure in P mode and E mode, the hydraulic force increases approximately 7 %, and the digging force increases.

Each function is set automatically as follows;

Function	Setting
Engine and pump combined control	Matching at rated horsepower point
Cut-off function	Cancel

The one-touch power maximizing system keeps increasing the power while one-touch power maximizing switch (1) is pressed. When the switch is kept pressed, this function is canceled automatically in approximately 8.5 seconds.

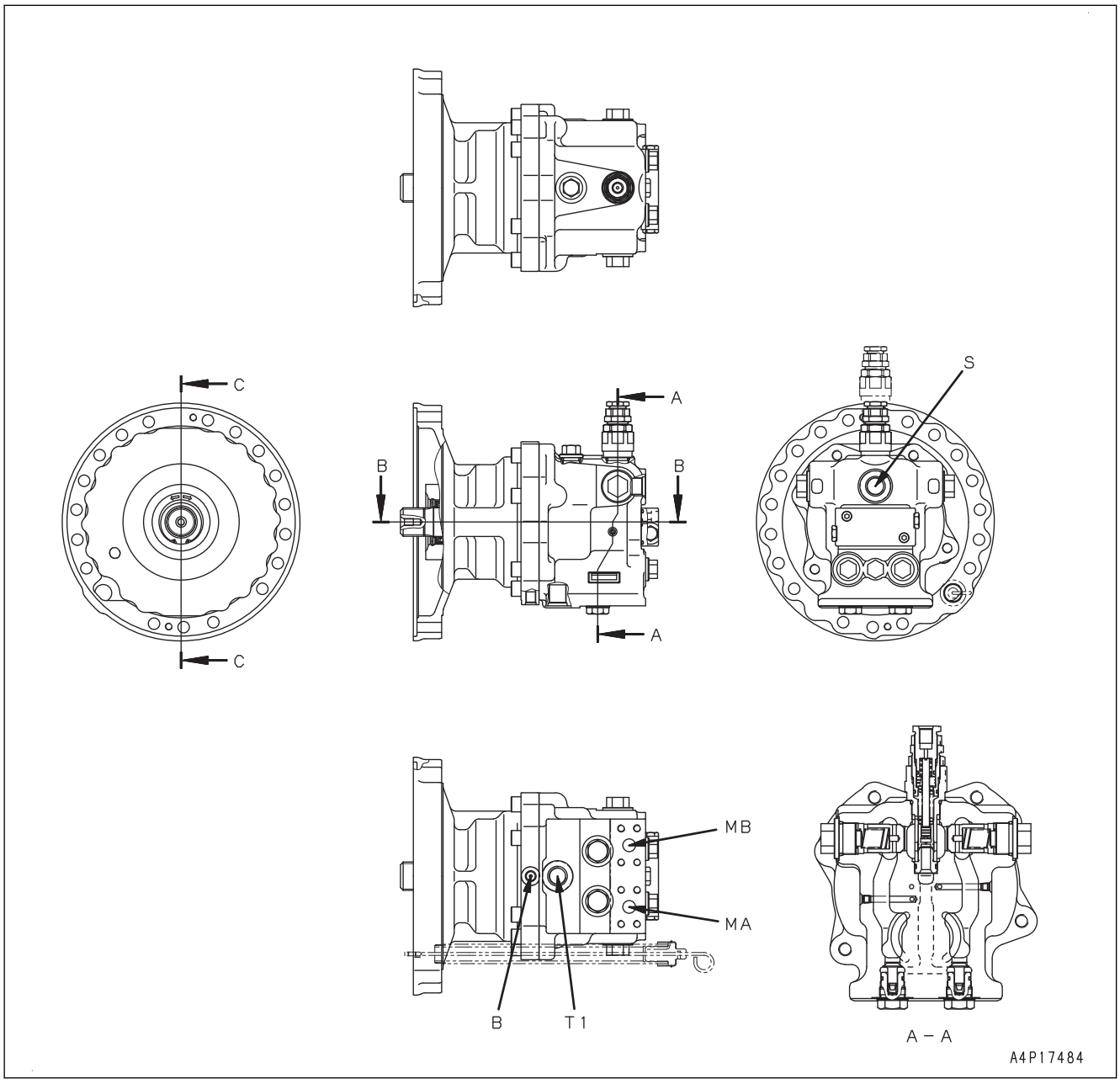


COMPONENT PARTS OF SWING SYSTEM

SWING MOTOR

STRUCTURE OF SWING MOTOR

General view



T1: To tank

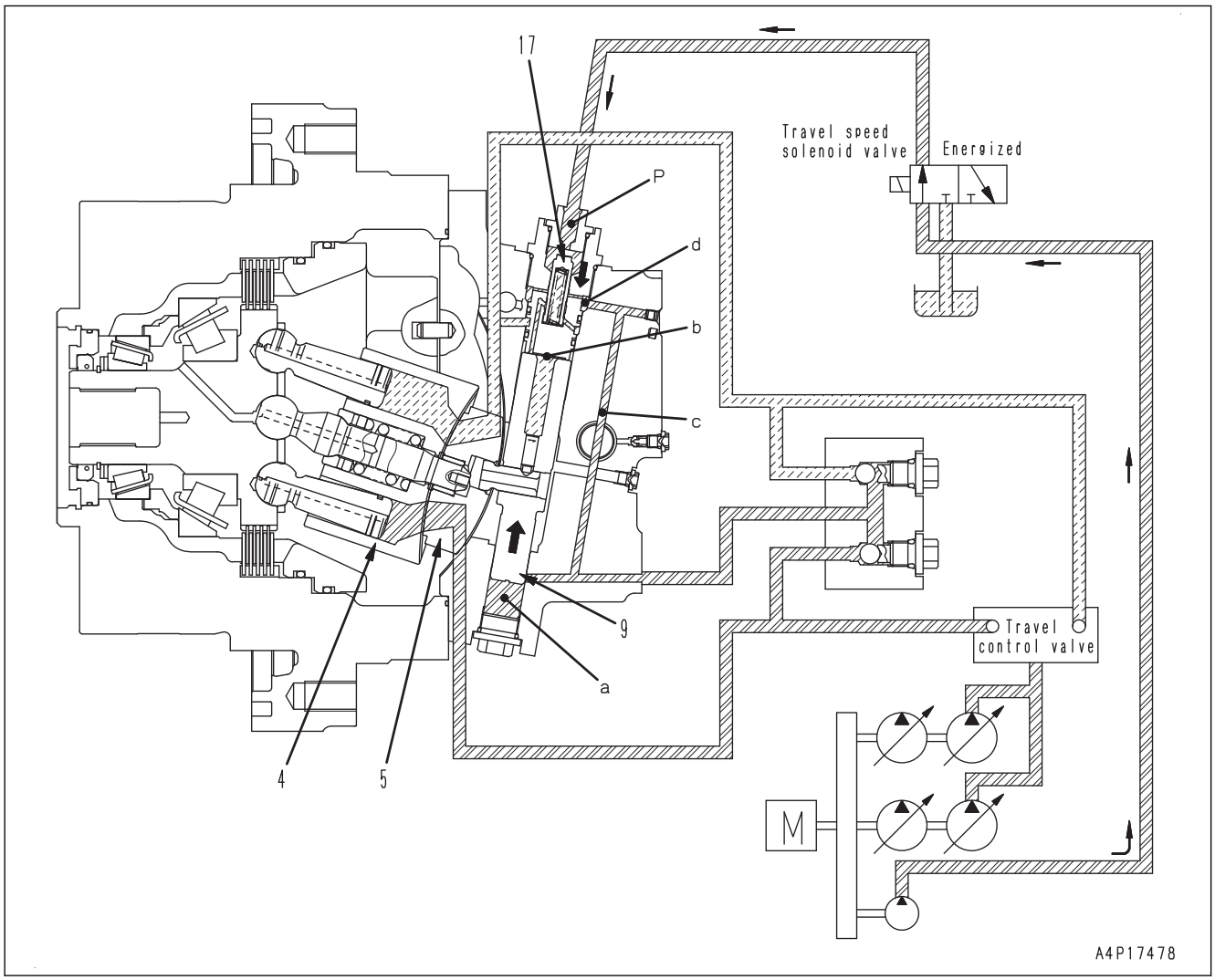
S: From control valve

MA: From control valve

MB: From control valve

B: From swing brake solenoid valve

During high-speed travel (motor swash plate angle is minimum)



1. The pilot pressure oil flows from the pump to port (P) when the solenoid valve is energized.
2. The pilot pressure oil pushes the regulator valve (17) downward.
3. The main pressurized oil flowing to chamber (d) is shut off by the regulator valve (17), and oil in the chamber (b) is drained into the tank.
4. The thrust force acts upward by the pressurized oil of the chamber (a) side of the regulator piston (9).
5. The valve plate (5) and cylinder block (4) move to the direction of minimum tilt angle. The motor capacity becomes the minimum and machine travels at high speed.

20 STANDARD VALUE TABLE

<table>
<tr><td colspan="4">Machine model</td><td colspan="2">PC650LC-11</td></tr>
<tr><td colspan="4">Engine</td><td colspan="2">SAA6D140E-7</td></tr>
<tr><td>Item</td><td colspan="3">Measurement condition</td><td>Unit</td><td>Standard value for new machine</td><td>Repair limit</td></tr>
<tr><td rowspan="2">Arm speed</td><td rowspan="2">• Hydraulic oil temperature: 45 to 55 °C
• Working mode: P (Power Mode)
• Fuel control dial: MAX (High idle) position
• Time required for the arm to be operated from the arm OUT stroke end (just before cushion) to the arm IN stroke end
• Measuring posture: See “MACHINE POSTURE AND PROCEDURE FOR MEASURING PERFORMANCE”, “Fig. 10”.</td><td colspan="2">CURL</td><td rowspan="2">Sec.</td><td>4.5±0.5</td><td>5.5 or less</td></tr>
<tr><td colspan="2">DUMP</td><td>3.7±0.4</td><td>4.7 or less</td></tr>
<tr><td rowspan="4">Bucket speed</td><td rowspan="4">• Hydraulic oil temperature: 45 to 55 °C
• Working mode: P (Power Mode)
• Fuel control dial: MAX (High idle) position
• Time required for the bucket to be operated from the DUMP stroke end to the CURL stroke end
• Measuring posture: See “MACHINE POSTURE AND PROCEDURE FOR MEASURING PERFORMANCE”, “Fig. 11”.</td><td rowspan="2">CURL</td><td>STD</td><td rowspan="4">Sec.</td><td>3.2±0.4</td><td>4.0 or less</td></tr>
<tr><td>SE</td><td>3.6±0.4</td><td>4.4 or less</td></tr>
<tr><td rowspan="2">DUMP</td><td>STD</td><td>3.2±0.4</td><td>4.1 or less</td></tr>
<tr><td>SE</td><td>3.7±0.4</td><td>4.5 or less</td></tr>
</table>

Testing tools for oil leakage

Symbol	Part No.	Part name	Q'ty	Remarks
A	Commercially available	Measuring cylinder	1	
B	07379-01044	Flange	2	Size: 10
C	07376-70522	Plug	1	Size: 05
D	07379-01260	Flange	2	Size: 12
E	07376-70315	Flange	3	Size: 03
F	Commercially available	Block	1	• Material: SS400 • Size: 200x400x300 mm
G	07376-70628	Plug	1	Size: 06

TEST FUEL RETURN RATE AND LEAKAGE

Tools for testing fuel return rate and leakage

Symbol	Part No.	Part name	Q'ty	Remarks
A	6164-81-5750	Joint	1	
B	6164-81-5790	Joint	1	
C	Commercially available	Hose	1	Inside diameter: Approximately : 9 mm
D	Commercially available	Hose	1	Inside diameter: Approximately : 12 mm
E	Commercially available	Measuring cylinder	1	
F	Commercially available	Stopwatch	1	
G	07206-31214	Joint bolt	1	
H	Commercially available	Cap nut	1	Size: M14x1.5 mm
J	07376-70315	Plug	1	
K	Commercially available	Hose	1	Inside diameter: Approximately : 16 mm
L	Commercially available	Oil container	1	Approximately 20 ℓ

⚠ Place the machine on a flat ground, lower the work equipment completely to the ground in a stable posture. Set the lock lever to LOCK position, and then stop the engine.

⚠ The parts and oil are still very hot immediately after the engine is stopped. It may cause burn injury. Wait for the temperature to go down, and then start the work.

⚠ Wait for the remaining pressure in the fuel circuit to have been released, for at least 30 seconds after stopping the engine. Then, perform removing or installing the testing tools. (Do not start the work immediately after the engine is stopped since remaining pressure is still in the circuit.)

Check this item under the following conditions.

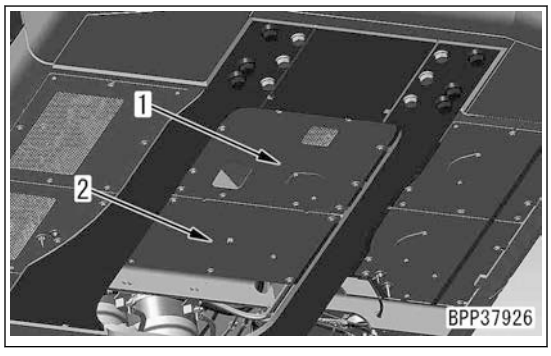
- Engine coolant temperature: 60 to 100 °C
- Hydraulic oil temperature: 45 to 55 °C

For testing of fuel return rate and leakage to perform troubleshooting, refer to this section.

METHOD FOR TESTING FUEL RETURN RATE AND LEAKAGE

Testing of leakage from pressure limiter

1. Remove the undercovers (1) and (2).



TEST INJECTION AMOUNT FROM AdBlue/DEF INJECTOR

Tools for testing of injection amount from AdBlue/DEF injector

Symbol	Part No.	Part name	Q'ty	Remarks
A	799-601-4340	Socket	1	
B	Commercially available	Multimeter	1	
C	Commercially available	Measuring cylinder	1	Capacity: 200 to 500 mℓ
D	Commercially available	Rubber gloves	1	

⚠ Place the machine on a level ground, lower the work equipment with a stable posture to the ground, set the lock lever in LOCK position, and stop the engine.

⚠ For handling AdBlue/DEF, see Operation and Maintenance Manual, "PRECAUTIONS FOR DEF".

⚠ When handling AdBlue/DEF injector by hand, be sure to wear the protective eyeglasses and rubber gloves.

NOTICE

- **If KOMNET communication error remains less than 1 second, engine controller is unable to detect it, and the test may be continued while the machine monitor does not continue (standard screen). In that case, turn the starting switch to OFF position once, and then system operating lamp goes out, and the engine controller shuts down to reset the test.**
- **If the testing of this item is performed without removing AdBlue/DEF injector, the machine may have a trouble. Accordingly, be sure to remove AdBlue/DEF injector before starting the testing.**
- **AdBlue/DEF may freeze when the outside air temperature is low. AdBlue/DEF should be thawed completely before performing the test. Devices will get damaged if the calibration is performed when the AdBlue/DEF is still frozen.**

AdBlue/DEF Injection Test function can boost the pressure of AdBlue/DEF pump to inject constant amount, and can check if AdBlue/DEF injector has any failure.

For testing of AdBlue/DEF injector to perform troubleshooting , refer to this section.

METHOD FOR TESTING INJECTION AMOUNT FROM AdBlue/DEF INJECTOR

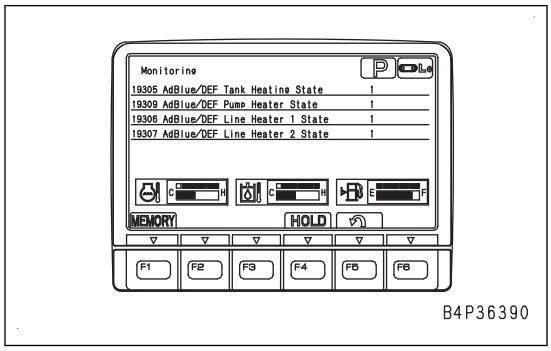
1. Start the engine.
2. Check the AdBlue/DEF conditions.
   1) Select the following monitoring items on "Monitoring Selection Menu". See "SET AND OPERATE MACHINE MONITOR".

      Monitoring code 19305: "AdBlue/DEF Tank Heating State"

      Monitoring code 19309: "AdBlue/DEF Pump Heater State"

      Monitoring code 19306: "AdBlue/DEF Line Heater 1 State"

      Monitoring code 19307: "AdBlue/DEF Line Heater 2 State"



POWER TRAIN

TEST SWING CIRCLE BEARING CLEARANCE

Tools for testing swing circle bearing clearance

Symbol	Part No.	Part name	Q'ty	Remarks
A	Commercially available	Dial gauge	1	

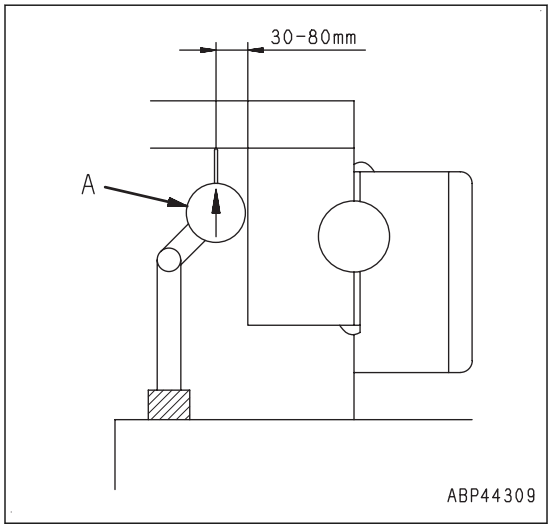
⚠ Do not put your hand or foot under the truck during the test.

For testing of swing circle bearing clearance to perform troubleshooting, refer to this section.

METHOD FOR TESTING SWING CIRCLE BEARING CLEARANCE

1. Fix dial gauge A to track frame (center frame), and put the probe to the end face of revolving frame.

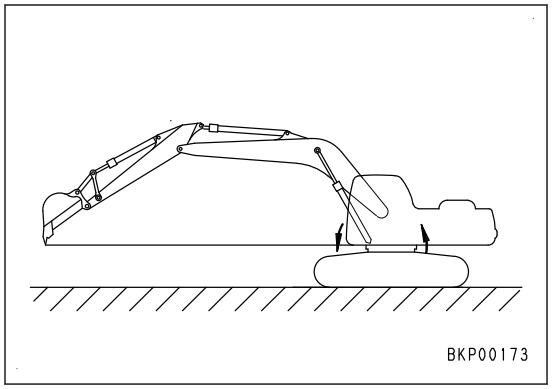
   Set dial gauge A in the front or rear of the machine.



2. Set the work equipment to the maximum reach posture, and set the bucket tip to the height of the underside of the revolving frame.

   The front side of the upper structure lowers and the rear side rises.

3. Set dial gauge A to the zero point.



4. Set the arm almost perpendicular to the ground and lower the boom until the front part of the tracks float by 150 to 200 mm.

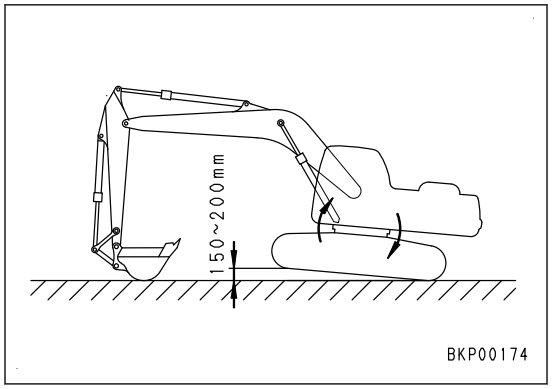
   The front side of the upper structure rises and the rear side lowers.

5. Read the value indicated by dial gauge A.

   The value indicated by dial gauge A is the clearance of the bearing.

6. Return the machine to the state in step 2, and check that dial gauge A indicates 0 point again.

   If the dial gauge does not indicate 0 point, repeat steps 3 through 5.

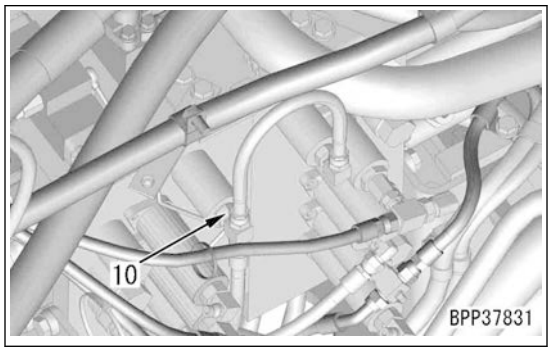


METHOD FOR ADJUSTING MAIN RELIEF VALVE FOR 4-SPOOL CONTROL VALVE (HIGH PRESSURE SETTING) ON THE LEFT SIDE

Adjust the high pressure setting side of main relief valve (10) for the 4-spool control valve on the left side when L (“Lifting Mode”) relief pressure in the rear pump circuit is abnormal by referring to the following procedure.

REMARK

Method for adjustment is the same as that of main relief valve for 5-spool control valve (high pressure setting) on the right side.



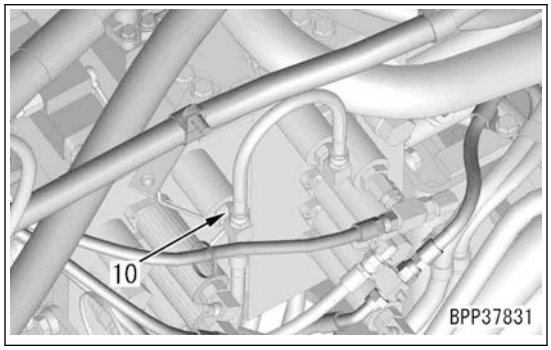
- After the adjustment, recheck the oil pressure according to the testing procedure previously described.
- The low pressure setting side is affected by the adjustment being done on the high pressure setting side. Adjust the low pressure setting side as well.

METHOD FOR ADJUSTING MAIN RELIEF VALVE FOR 4-SPOOL CONTROL VALVE (LOW PRESSURE SETTING) ON THE LEFT SIDE

- Adjust the low pressure setting side of the main relief valve (10) for 4-spool control valve on the left side when usual relief pressure is not normal or the high pressure setting side has been adjusted.
- Adjust the low pressure setting side of the main relief valve for 4-spool control valve on the left side when right travel oil pressure and the oil pressure when one-touch power maximizing is actuated are not normal.

  REMARK

  Method for adjustment is the same as that of main relief valve for 5-spool control valve (low pressure setting) on the right side.



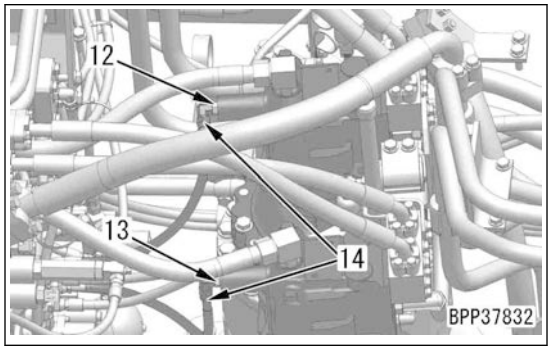
After the adjustment, recheck the oil pressure according to the testing procedure previously described.

METHOD FOR ADJUSTING SWING RELIEF PRESSURE

Adjust the swing 2-stage relief valves (12) and (13) according to the following procedure when the swing relief pressure is not normal.

(12): 2-stage swing relief valve of the left swing motor

(13): 2-stage swing relief valve of the right swing motor



1. Disconnect the pilot hose (14) of the valve which is to be adjusted.

TEST COOLING FAN SPEED

⚠ Place the machine on a level ground, lower the work equipment to the ground in a stable posture, set the lock lever to LOCK position, and stop the engine.

Test this item under the following conditions.

Hydraulic oil temperature : 45 to 55 °C

For checking cooling fan speed to perform troubleshooting or Pm Clinic, or periodic maintenance, etc. refer to this section.

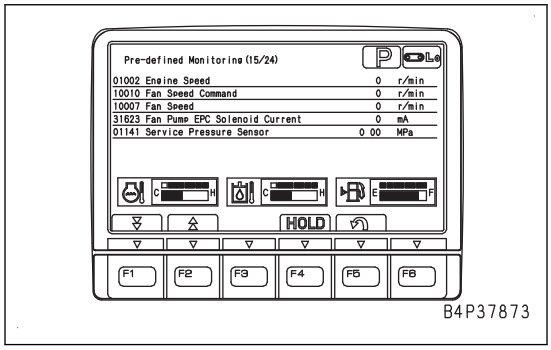
METHOD FOR TESTING COOLING FAN SPEED

1. Start the engine, select “Pre-defined Monitoring” (15/24) or the following monitoring items, and display it by referring to “SPECIAL FUNCTIONS OF MACHINE MONITOR”.

   Monitoring code: 10007 “Fan Speed”

   Monitoring code: 04401 “Hydraulic Oil Temperature”
2. Adjust the hydraulic oil temperature within the specified range.
3. Test “Fan Speed” when the fuel control dial is at MIN (Low idle) position, and when it is at MAX (High idle) position.

   For standard values, see STANDARD VALUE TABLE, “STANDARD VALUE TABLE FOR MACHINE”.

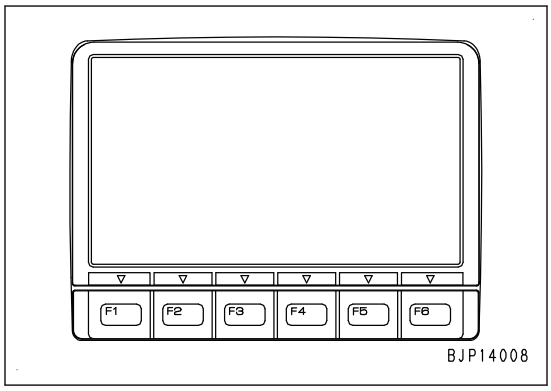


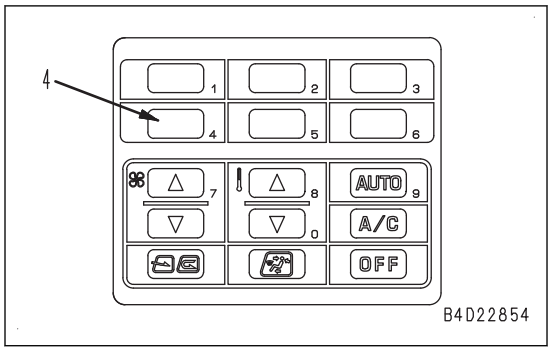
CHECKING FUNCTION BY LCD (LIQUID CRYSTAL DISPLAY)

While the standard screen is displayed, if the numeral input switches or function switches are operated in the following manner, the entire LCD screen turns white.

Switch operations (simultaneously): 4 + F2

- When finishing the operation of the switches, release F2 first.
- If there is a display error in the LCD, only that part is indicated in black.
- To return to the former screen, press any one of the function switches.





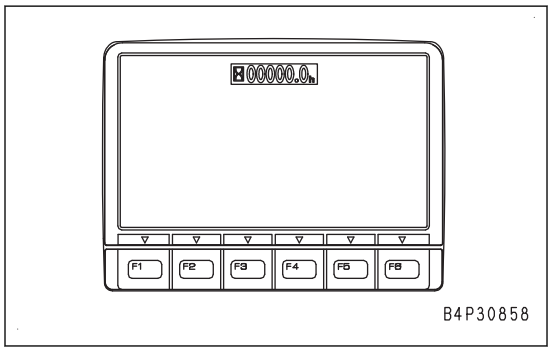
CHECKING FUNCTION OF SERVICE METER

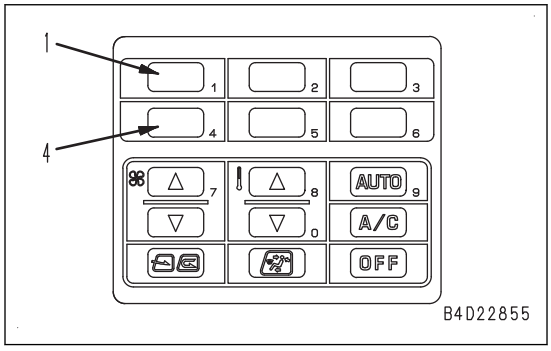
When checking the service meter with the starting switch in OFF position, operate the numeral input switches as follows to display only the service meter section.

Operate the switches (simultaneously): 4 + 1

REMARK

- There is some time lag in start of the LCD, so hold down the switches until the service meter is displayed.
- If you release one of the switches, the monitor goes off.





METHOD FOR SETTING USAGE LIMITATION AND CHANGING PASSWORD

On the machine monitor, a password can be set as a user limitation setting. If the password has been set, a password enter screen is displayed for resetting of maintenance items.

For the operating method for “Operator ID Change” see Operation and Maintenance Manual

Perform the Usage Limitation Setting and Change Password functions according to the following procedure.

F5: Returns the screen to “Abnormality Record screen”.

F6: Clears the selected abnormality record.

REMARK

- To delete a selected abnormality record, select the abnormality record with F3 or F4, and then press F6 to execute the deletion of abnormality record.
- To clear all abnormality records together, press F2, and then all the records are deleted regardless of the selection.
- If “E” is displayed on the left of a failure code, the clearing operation is received but the information is not cleared.

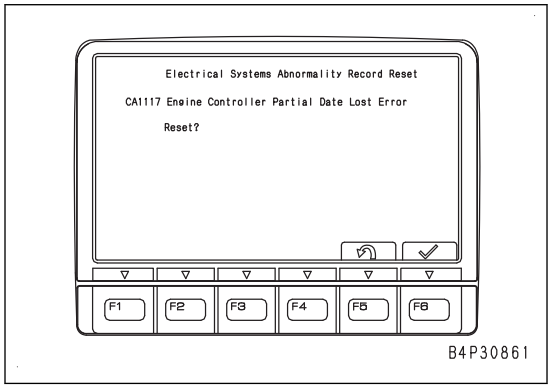
3) After the “Electrical Sys Abnormality Rec Reset” screen is displayed, operate the function switches to delete all the records.

F5: Returns the screen to “Electrical Sys Abnormality Record” screen (deleting mode).

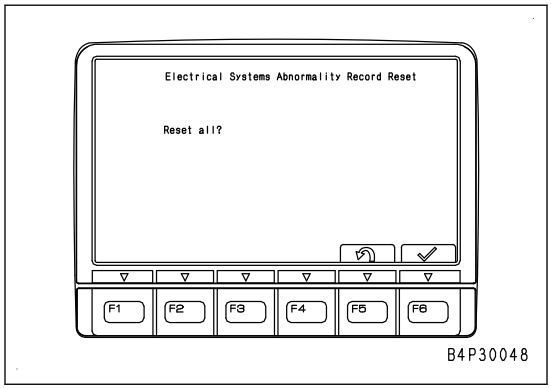
F6: Executes the deletion

REMARK

- This is the screen when a selected abnormality record is going to be deleted.



- This is the screen when all the abnormality records are going to be deleted.



4) When the screen to notify the completion of the deletion is displayed and then “Electrical Sys Abnormality Record” (deleting mode) screen is displayed, the deletion of the selected abnormality record is completed.

REMARK

The 3-digit number in the left column does not change. This is the code for this function.

Relation between the set value and torque adjustment value

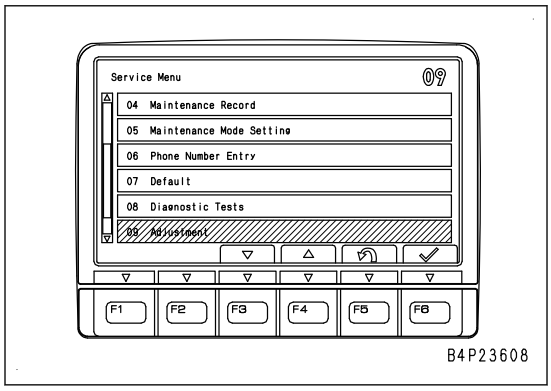
Code	Set value	Torque adjustment value
022	000	+98.1 Nm {+10.0 kgm}
	001	+73.5 Nm {+7.5 kgm}
	002	+49.0 Nm {+5.0 kgm}
	003	+24.5 Nm {+2.5 kgm}
	004	0.0 Nm {0.0 kgm}
	005	-24.5 Nm {-2.5 kgm}
	006	-49.0 Nm {-5.0 kgm}
	007	-73.5 Nm {-7.5 kgm}
	008	-98.1 Nm {-10.0 kgm}

METHOD FOR ADJUSTING (Fan Rotation Mode Selection)

Adjustment menu is used to check the various settings of the machine or to adjust the value.

Fan speed mode selection is for selecting the maximum speed of hydraulic drive fan from100% or 70% speed mode.

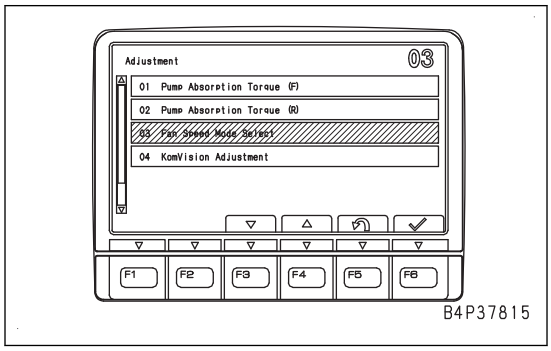
1. Select “Adjustment” on “Service Menu” screen.



2. Select “Fan Speed Mode Select” with the function switches or numeral input switches on “Adjustment” screen.

REMARK

Selecting method is the same as on “Service Menu” screen.



REMARK

- Perform calibration for all cameras always when the controller is replaced or when the specification is changed.
- Perform only the necessary calibrations relevant to the camera which has been replaced.

NOTICE

Perform "Camera Calibration" according to the table always when the camera angle, etc. is adjusted after camera image check.

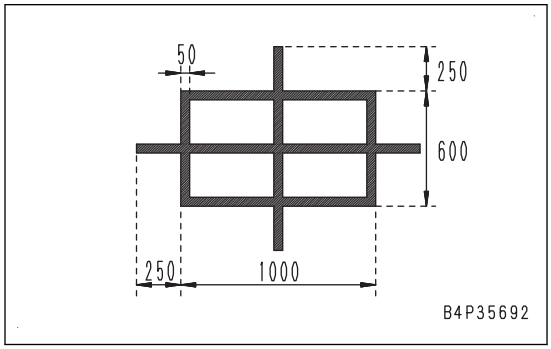
Adjusted camera	Item to be performed			
	Angle calibration			
	Rear camera	Rear R.H. camera	Front R.H. camera	Rear L.H. camera
Rear camera	○	-	-	-
Rear R.H. camera	-	○	-	-
Front R.H. camera	-	-	○	-
Rear L.H. camera	-	-	-	○

Operation of “position calibration”

1. Make the position setting calibration marker B.

   REMARK

   - Make the position setting calibration marker B according to the figure.
   - Stick some 50 mm wide black tapes on a board when making the calibration marker.



2. Set the position setting calibration marker B according to the Table 1.

   NOTICE

   Start with the rear R.H. camera for performing “position calibration”. Then, perform in the order of the right rear, right front, and left rear) when 4 cameras are installed.

   REMARK

   Perform “Position calibration” by each camera.

   B: Position setting calibration marker B

   y: Machine

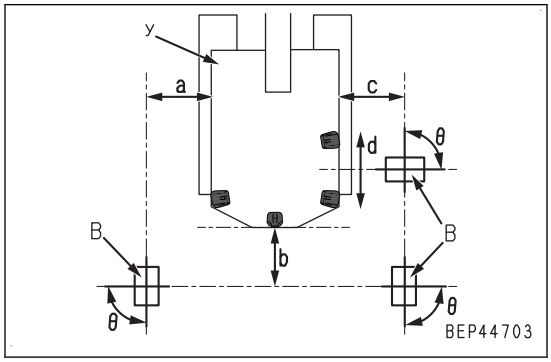


Table 1

Dimension, angle	Positive value
a	1 to 1.5 m (From upper structure end)
b	1 to 1.5 m (From counterweight end)

Machine model				PC650LC-11			Good	No good
Engine				SAA6D140E-7				
Item	Testing conditions		Unit	Standard value for new machine	Repair limit	Measured value		
F pump TVC valve outlet pressure	• Hydraulic oil temperature: 45 to 55 °C • Working mode: P (Power Mode) • Fuel control dial: MAX (High idle) position	All control levers and control pedals: When levers are returned from fine control to NEUTRAL	MPa {kg/cm^2}	2.05 to 2.45 {21 to 25}	1.76 or more {18 or more}			
		Work equipment operation: Boom RAISE relief		0.57 to 1.30 {5.8 to 13.2}	0.52 to 1.25 {5.3 to 12.7}			
		Operation of work equipment: Boom RAISE relief + One-touch power maximizing function is actuated		0.90 to 1.40 {9.1 to 14.3}	0.85 to 1.35 {8.6 to 13.8}			
R pump TVC valve outlet pressure	• Hydraulic oil temperature: 45 to 55 °C • Working mode: P (Power Mode) • Fuel control dial: MAX (High idle) position	All control levers and control pedals: When levers are returned from fine control to NEUTRAL	MPa {kg/cm^2}	2.05 to 2.45 {21 to 25}	1.76 or more {18 or more}			
		Work equipment operation: Boom RAISE relief		0.57 to 1.30 {5.8 to 13.2}	0.52 to 1.25 {5.3 to 12.7}			
		Operation of work equipment: Boom RAISE relief + One-touch power maximizing function is actuated		0.90 to 1.40 {9.1 to 14.3}	0.85 to 1.35 {8.6 to 13.8}			

RELATED INFORMATION ON TROUBLESHOOTING

GENERAL TROUBLESHOOTING POINTS

⚠ If you remove the radiator cap while the engine is still hot, hot coolant may spout out and can scald you. Wait until the engine cools down.

⚠ Take extreme care not to touch a hot portion or not to be wound in a turning portion.

⚠ Before removing a plug or a cap of a portion where oil pressure, hydraulic pressure, or air pressure is applied, release the internal pressure first, then connect the measuring tool securely.

⚠ When disconnecting wiring, remove the key and turn the battery disconnect switch to OFF position.

⚠ Park the machine on a level place and check the frame lock bar, chocks, parking brake, etc.

⚠ When working in a group, make signs and allow only the persons concerned to approach the machine.

- Troubleshooting means to investigate the root cause of a failure, repair immediately, and prevent recurrence of the failure.
- One important thing when you perform troubleshooting is to understand the structure and operation.
- It is important to have an interview with the operator and set up an aim of failure cause for performing a troubleshooting effectively.
- If you disassembly the machine hastily when it has a failure, you may disassemble unrelated portions and may not be able to find the cause. As a result, the costs of the man-hours, parts, oil, or grease may increase, and you may lose the confidence of the users and operators. Accordingly, sufficient advance check and proper procedure are necessary for troubleshooting.

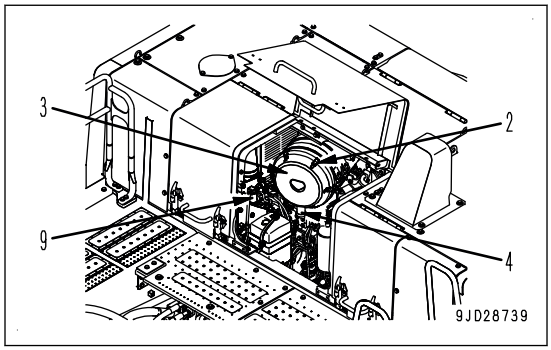
1. Ask users or operators the following questions.
   1) Have any other problems occurred apart from the problem that has been reported?
   2) Is there anything strange about the machine before the failure occurred?
   3) Did the failure occur suddenly, or were there problems with the machine condition before this?
   4) Under what conditions did the failure occur?
   5) Had any repairs been performed before the failure? When were these repairs performed?
   6) Has the same kind of failure occurred before?
2. Perform the following checks before troubleshooting.
   1) Check the machine for a symptom of abnormality.
   2) Perform the Check before starting items.
   3) Check the other check items.
   4) Check other maintenance matters which can be checked externally and are considered to be necessary.
3. Check the degree of the trouble by yourself and judge if it is a real failure or it is a problem of handling or operation.

   When reproducing the trouble phenomenon by operating the machine, do not perform check or measurement that can increase the failure.
4. Use the results of the investigation and inspection to narrow down the probable causes of the failure, then use the troubleshooting flow chart (matrix) to locate the failure exactly.

   The basic troubleshooting procedure is as follows.
   - Start from the simple points.
   - Start from the most likely points.
   - Investigate other related parts or information.
5. If the root cause is not corrected, a similar failure may occur again even if the apparent failure has been repaired. Always find out the cause of a failure first and remove the root cause of each failure.

- When the outer element is cleaned 6 times or used for 1 year, replace it. When replacing it, replace the inner element at the same time.
- Even when the number of cleanings of the outer element is 6 times or less, it must be replaced along with the inner element if air cleaner clogging monitor (1) lights up prematurely after cleaning.

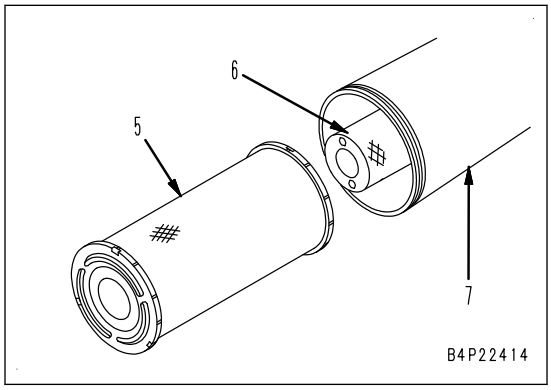
1. Open the engine food, remove the hooks (2) (6 places), and remove the cover (3).



2. Hold the outer element (5), rock it lightly up and down and to the right and left, and pull it out while turning it to the right and left.

NOTICE

- **Never remove inner element (6). If it is removed, dirt will enter and can cause an engine trouble.**
- **Do not use a screwdriver or other tool.**
- **After removing outer element (5) is removed, check that inner element does not come off or incline. If it is tilted, push it straight to the bottom with your hand.**

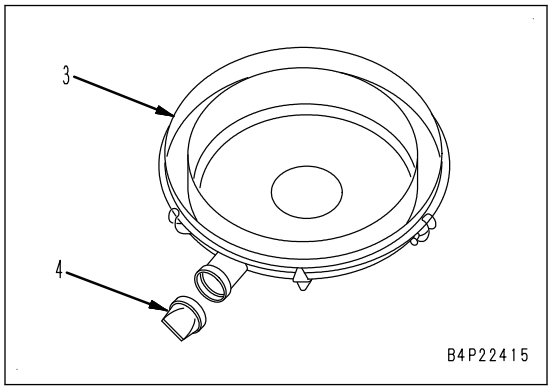


3. After removing the outer element (5), cover the inner element (6) with a clean cloth or tape to protect from dusts.
4. Wipe off dusts in inside and on cover (3) of air cleaner body (7) by using a clean cloth or brush.

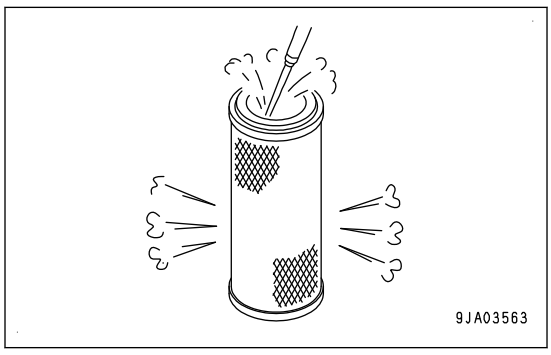
NOTICE

Never tap or hit the element against any other object when cleaning it.

5. Remove any dirt or dust that is accumulated on vacuator valve (4) installed to cover (3).



6. Blow dry compressed air (0.2 MPa {2.1 kg/cm^2} or less) from the inside of the outer element along the pleats.

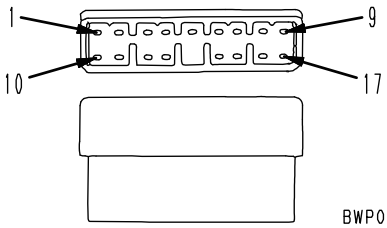
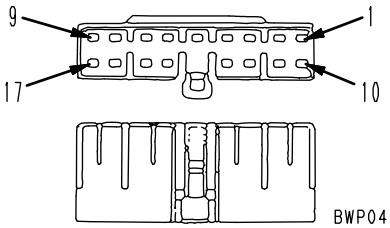
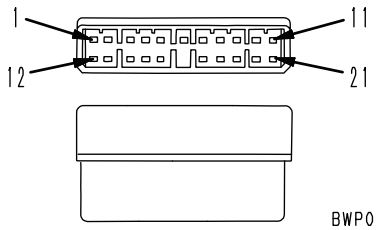
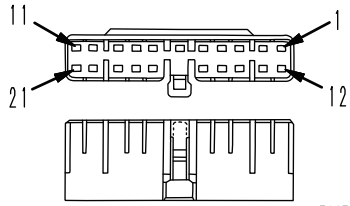


INFORMATION DESCRIBED IN TROUBLESHOOTING TABLE

The following types of information are described in the troubleshooting list and related circuit diagram. Fully understand the description and perform troubleshooting.

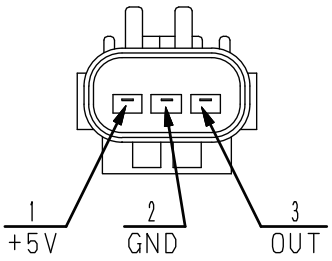
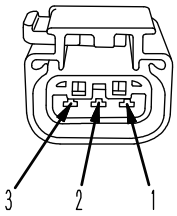
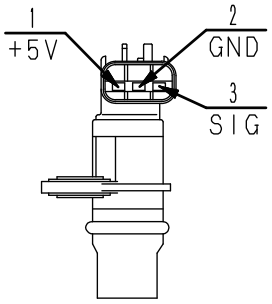
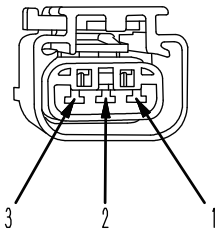
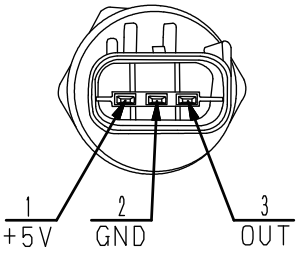
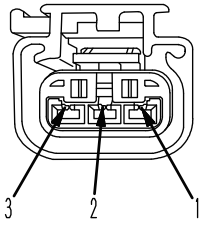
Action level	Failure code	Failure	Failure name displayed on "Abnormality Record" screen of the machine monitor
Display on machine monitor	Display on machine monitor		
Details of failure	Description of the failure detected by the machine monitor or controller		
Action of controller	An action that is performed to protect the system and devices when a failure is detected by the machine monitor or controller		
Problem on machine	A problem that is displayed as a failure on the lift truck as a result of an action (shown above) that is performed by the machine monitor or controller.		
Related information	Information related to the occurred failure and its troubleshooting		

No.	Cause	Procedure, measuring location, criteria, and remarks
1	Defective ---	Contents of description • Procedure • Measuring point "Between A and B" denotes measuring values such as voltage and resistance between A and B. "Between A and ground" means the measurement of voltage, resistance or others between place A and the place which has a continuity with chassis frame such as unpainted hexagonal head bolt or bolt hole which has no rust, etc. • Criteria to judge probable causes (standard value), remarks How to use troubleshooting sheet • Perform troubleshooting procedures in following order. • If the check result does not meet the criteria, the probable cause described on the left column is the actual cause of the failure. • If the check result meet the criteria and there is no specific instruction, proceed to the next step (cause). • If a defect is found and repaired, check that the defect has been corrected. Failures in wiring harness • Open circuit When the wiring and the internal circuit of the connector are not connected with each other, and there is no continuity • Ground fault A wiring harness not to be connected to the GND (ground) circuit comes into contact with the GND (ground) circuit or chassis accidentally. • Hot short circuit A wiring harness not to be connected to the power circuit comes into contact with the power circuit accidentally. • Short circuit An independent wire in the harness abnormally comes into contact with one of another wire. (Defective insulation in connector or others)
2	Open or short circuit in wiring harness	
3	Open circuit in wiring harness (wire breakage or defective contact of connector)	
4	Ground fault in wiring harness (contact with ground circuit)	
5	Hot short circuit	
6	Short circuit in wiring harness	

No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
17	 BWP04747	 BWP04748	799-601-2730 (T-adapter)
	Body part No. : 79A-222-2730 (Q'ty:2)	Body part No. : 79A-222-2720 (Q'ty:2)	
21	 BWP04749	 BWP04750	799-601-2740 (T-adapter)
	Body part No. : 79A-222-2750 (Q'ty:2)	Body part No. : 79A-222-2740 (Q'ty:2)	
	Terminal part No. : 79A-222-2770 (Q'ty:50)	Terminal part No. : 79A-222-2760 (Q'ty:50)	

B4D18197

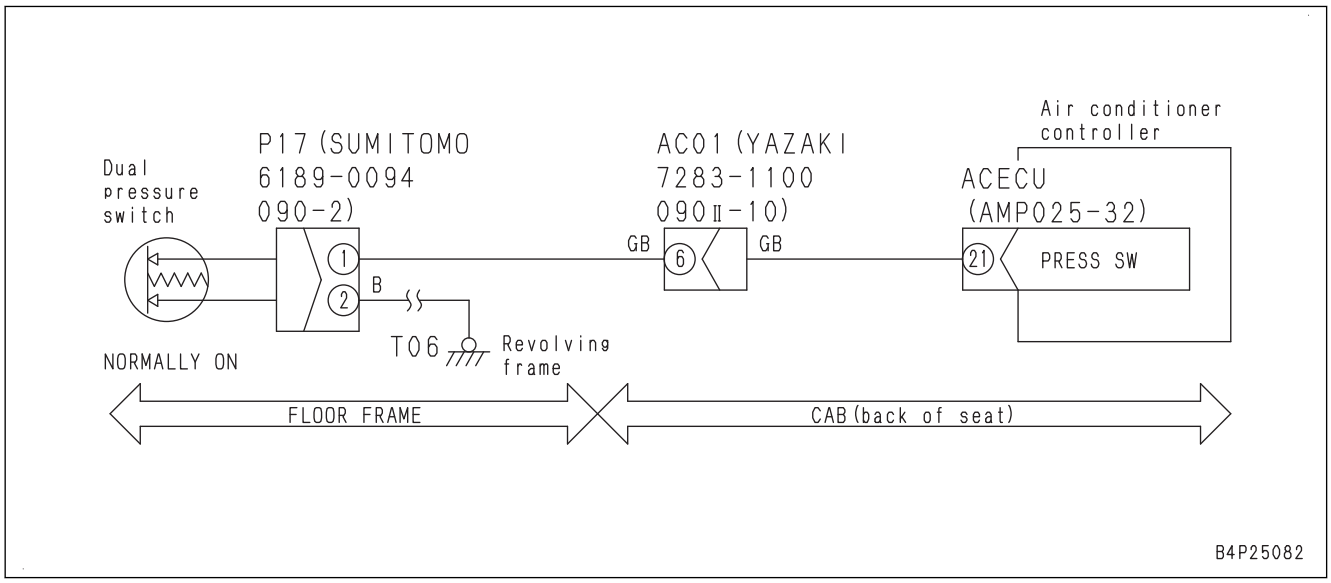
FRAMATOME connector for engine

No. of pins	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
3	Crankcase pressure sensor, ambient pressure sensor (95, 107, 114, 125, 140 engine) Dosing fuel pressure sensor (125, 140 engine) 		799-601-4140 (T-adapter) (Kit : 799-601-4101) (Kit : 799-601-4201)
	—	—	
3	NE speed sensor (95, 107, 114, 125, 140 engine) and CAM sensor (95, 107, 114 engine) 		799-601-4130 (T-adapter) (Kit : 799-601-4101) (Kit : 799-601-4201)
	—	—	
3	Boost (air intake) pressure sensor (125, 140 engine) Exhaust manifold pressure sensor (107, 114 engine) 		799-601-4180 (T-adapter) (Kit : 799-601-4101) (Kit : 799-601-4201)
	—	—	

B4W21627

Failure code	Failure (Displayed on screen)	Applicable component	Action level	History category	Remarks
CA731	Engine Backup Speed Sensor Phase Error	ENG	L01	Electrical system	
CA778	Engine Backup Speed Sensor Error	ENG	L01	Electrical system	
CA1117	Engine Controller Partial Data Lost Error	ENG	L04	Electrical system	
CA1664	KDOC Abnormality	ENG	L03	Electrical system	
CA1669	AdBlue/DEF Level Sensor Voltage High Error	ENG	L01	Electrical system	
CA1673	AdBlue/DEF Level Low Error 3	ENG	L03	Electrical system	
CA1677	AdBlue/DEF Temperature Sensor Low Error	ENG	L01	Electrical system	
CA1678	AdBlue/DEF Temperature Sensor High Error	ENG	L01	Electrical system	
CA1682	AdBlue/DEF Pump Priming Error	ENG	L01	Electrical system	
CA1683	AdBlue/DEF Tank Heating Valve Voltage High Error	ENG	L01	Electrical system	
CA1684	AdBlue/DEF Tank Heating Valve Voltage Low Error	ENG	L01	Electrical system	
CA1686	AdBlue/DEF Quality Sensor Voltage High Error	ENG	L01	Electrical system	
CA1691	Defective Regeneration	ENG	L03	Electrical system	
CA1694	SCR Outlet NOx Sensor In Range Error	ENG	L01	Electrical system	
CA1695	Sensor 5 Supply Voltage High Error	ENG	L03	Electrical system	
CA1696	Sensor 5 Supply Voltage Low Error	ENG	L03	Electrical system	
CA1712	AdBlue/DEF Tank Thawing Error	ENG	L01	Electrical system	
CA1713	AdBlue/DEF Tank Heater Valve Open Stuck Error	ENG	L01	Electrical system	
CA1714	AdBlue/DEF Quality Sensor Out of Calibration Error	ENG	L01	Electrical system	
CA1715	AdBlue/DEF Quality Sensor Internal Circuit Error	ENG	L01	Electrical system	
CA1776	Sensor Supply Relay Voltage High Error	ENG	L01	Electrical system	
CA1777	Sensor Supply Relay Voltage Low Error	ENG	L01	Electrical system	
CA1843	Crankcase Pressure Sensor High Error	ENG	L01	Electrical system	

Circuit diagram related to refrigerant (dual) pressure switch



FAILURE CODE [AS10NR]

Action level	Failure code	Failure	AdBlue/DEF Injector High Temperature Warning (Engine controller system)
—	AS10NR		
Detail of failure	The temperature of the AdBlue/DEF injector may become so high that it is damaged, so the output is limited.		
Action of controller	• Changes to output limitation		
Phenomenon on machine	• Engine power deration		
Related information	• This may occur if a heavy load operation is performed for a long time during AdBlue/DEF thawing. • This may occur if a heavy load operation is performed for a long time when an error related to SCR system occurs. • If the engine coolant temperature is high, the cooling capability of the AdBlue/DEF injector is degraded and a warning may appear. • If the ambient temperature sensor and engine room temperature sensor shows different values (values much lower than the actual temperature), unnecessary thawing control is applied and a warning may appear. • This failure code is a warning for equipment protection and does not indicate any failures. • Both failure code and output limitation are cleared by turning OFF and ON the starting switch.		

No.	Cause	Procedure, measuring location, criteria and remarks
1	Occurrence of an error related to SCR components (error that stops AdBlue/DEF injection)	Confirm if an error that stops AdBlue/DEF injection is displayed. If displayed, perform a cancellation process.
2	Rising coolant temperature (degraded radiator capability)	Check the radiator condition if the radiator shutter prevents the coolant from working properly, or the radiator is clogged. Correct so that the radiator cooling capability works sufficiently.
3	Defective ambient temperature sensor	Turn the starting switch to ON position.
		If the temperature sensed by ambient temperature sensor is significantly low compared to the actual temperature, the ambient temperature sensor is defective.
4	Defective engine room temperature sensor	1. Turn starting switch to ON position. 2. Open the pump side cover and wait for 5 minutes.
		If the temperature sensed by engine room temperature sensor is significantly low compared to the actual temperature, the engine room temperature sensor is defective.
5	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

FAILURE CODE [CA145]

Action level	Failure code	Failure	Coolant Temperature Sensor Low Error (Engine controller system)
L01	CA145		
Details of failure	Low voltage occurs in signal circuit of engine coolant temperature sensor.		
Action of controller	Sets coolant temperature to fixed value for operation.		
Phenomenon on machine	• Engine startability becomes poor in low temperature. • Overheat prevention function does not operate.		
Related information	• Signal voltage from engine coolant temperature sensor can be checked by monitoring function. (Code: 04105 (V)) • Temperature in engine oil coolant sensor can be checked by monitoring function. (Code: 04107 (°C)) • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn starting switch to ON position. • When temperature sensor connector is removed, failure code for High Error [CA144] is displayed instead of this failure code. ⚠ **Do not work at high coolant temperature, when testing and replacing coolant temperature sensor.**		

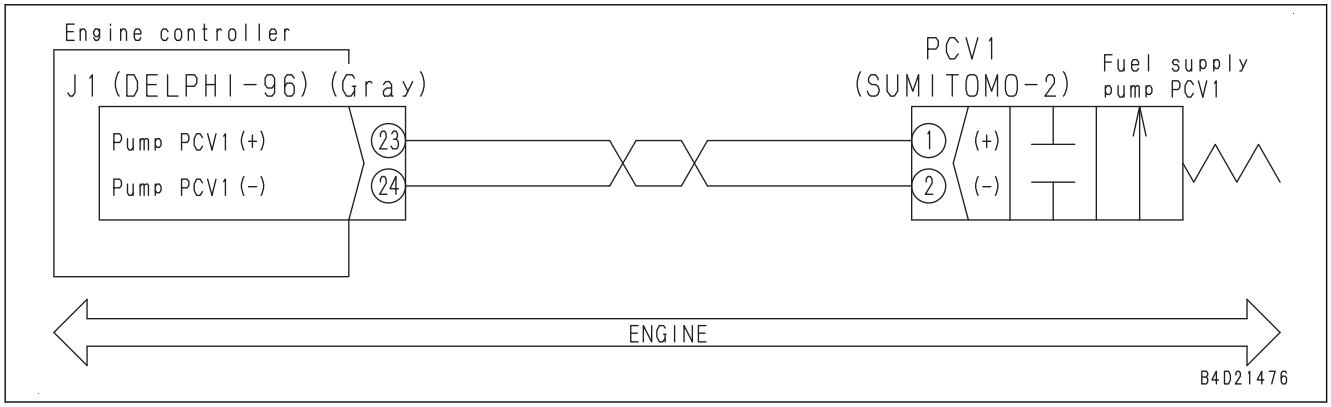
No.	Cause	Procedure, measuring location, criteria and remarks			
1	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in “c: Electrical equipment” in “CHECKS BEFORE TROUBLESHOOTING” of “RELATED INFORMATION ON TROUBLESHOOTING”, and check it. 2. Turn starting switch to ON position.			
		If this failure code is cleared, wiring harness connector is defective.			
2	Defective coolant temperature sensor	1. Turn starting switch to OFF position. 2. Disconnect connector TWTR and connect socket to male side. **REMARK** Regard coolant temperature sensor as normal if its resistance is 700 Ω to 37 kΩ when coolant temperature is min. 0 °C.			
		Resistance	**REMARK** Coolant temperature characteristics between TWTR (male) (A) and (B)	0 °C	30 to 37 kΩ
				25 °C	9.3 to 10.7 kΩ
				50 °C	3.2 to 3.8 kΩ
				80 °C	1.0 to 1.3 kΩ
				95 °C	700 to 800 Ω
			Between TWTR (male) (B) and ground	All coolant temperature range	Min. 1 MΩ
3	Ground fault in wiring harness (contact with ground circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors J1 and TWTR, and connect T-adapter to female side of J1.			
		Resistance	Between J1 (female) (83) and ground		Min. 1 MΩ

FAILURE CODE [CA272]

Action level	Failure code	Failure	IMV/PCV 1 Open Circuit Error (Engine controller systems)
L03	CA272		
Details of failure	Wire breakage is detected in supply pump PCV1 circuit.		
Action of controller	None in particular		
Phenomenon on machine	• Engine output lowers. • Engine startability is poor.		
Related information	• After repairing, check if the failure code is cleared by the following procedure. Procedure: Start engine. • While engine is running normally, approx. 24 V of pulse voltage is supplied to PCV (1). Because it is pulse voltage, it cannot be measured by using multimeter. • Because female connector alone is provided in “Socket” for troubleshooting for this sensor, socket cannot be connected to female connector on wiring harness side of sensor and check for wire breakage cannot be performed (T-adapter is not provided).		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	1. Check according to sections related to wiring harnesses and connectors in “TROUBLESHOOTING-RELATED INFORMATION”, “CHECKS BEFORE TROUBLESHOOTING”, “c Electrical equipment”. 2. Start engine.		
		If this failure code goes out, wiring harness connector is defective.		
2	Defective supply pump PCV1 (internal short circuit)	1. Turn starting switch to OFF position. 2. Disconnect connector PCV1, and connect socket to male side.		
		Resistance	Between PCV1 (male) (1) and (2)	2.3 to 5.3 Ω
3	Open or short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector J1, and connect T-adapter to female side.		
		Resistance	Between J1 (female) (23) and (24) (PCV1 resistance)	2.3 to 5.3 Ω
4	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

Circuit diagram related to IMV/PCV1



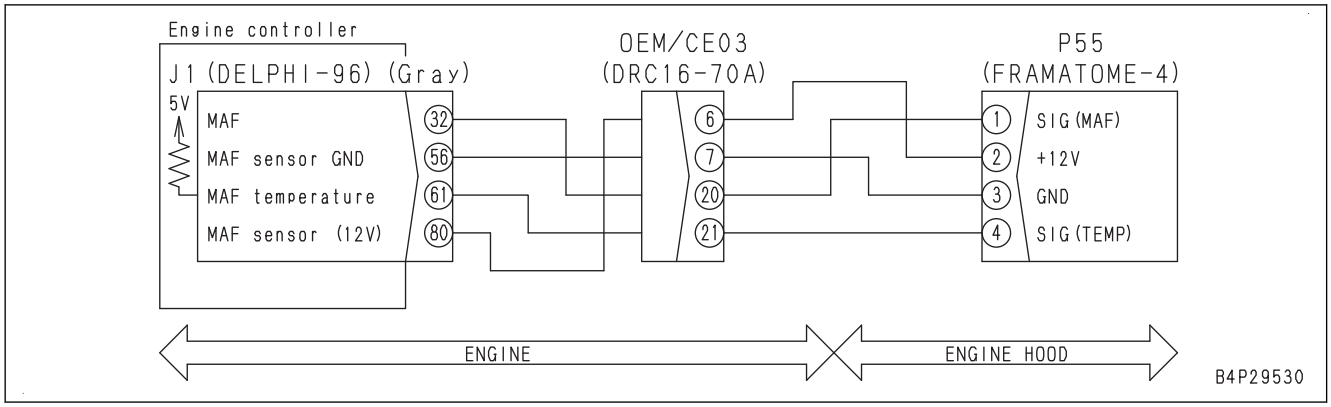
FAILURE CODE [CA441]

Action level	Failure code	Failure	Power Voltage Low Error (Engine controller system)
L04	CA441		
Detail of failure	Low voltage occurs in power supply circuit of controller.		
Action of controller	Operates at fixed value (approximately 6.0 V) of battery voltage.		
Phenomenon on machine	Engine runs normally. However, engine may be stopped during operation or stopped engine may not be started.		
Related information	• Battery voltage of engine controller can be checked by monitoring function. (Code: 03203) • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn engine starting switch to ON position.		

No.	Cause	Procedure, measuring location, criteria and remarks			
1	Loose or corroded battery terminal	Battery terminal may be loose or corroded. Check it directly.			
2	Loose terminal or partial open circuit at terminal	1. Turn starting switch to OFF position.			
		Check terminals of the alternator, battery, ground terminal (T12), etc.			
3	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in “Electrical equipment” in “CHECKS BEFORE TROUBLESHOOTING” of “RELATED INFORMATION ON TROUBLESHOOTING”, and check it. 2. Turn starting switch to ON position.			
		If this failure code is cleared, wiring harness connector is defective.			
4	Improper battery voltage	1. Perform troubleshooting with starting switch at OFF position and when starting engine.			
		Voltage	Between battery (+) and (-).		20 to 30 V
5	Defective alternator	1. Turn the starting switch to OFF position. 2. Insert T-adapter into connector ST. 3. Start the engine.			
		Voltage	Between ST (2) and ground	Engine speed: Medium or higher	26 to 30.5 V
6	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)			
		1. Turn starting switch to OFF position, and set battery disconnect switch to OFF position. 2. Insert T-adapter into connector J2. 3. Turn battery disconnect switch to ON position. 4. Measure voltage with starting switch at OFF position and when starting engine.			
		Voltage	Between J2 (1) and (73)		20 to 30 V
			Between J2 (25) and (49)		20 to 30 V
			Between J2 (26) and (50)		20 to 30 V
			Between J2 (27) and (51)		20 to 30 V
			Between J2 (28) and (52)		20 to 30 V

No.	Cause	Procedure, measuring location, criteria and remarks		
4	Hot short circuit in wiring harness	1. Perform preparation when starting switch is in OFF position. 2. Disconnect connector P55. 3. Insert T-adapter into connector J1, or connect T-adapter to female side of P55.		
		Voltage	Between J1 (61) and (56) or P55 (female) (1) and (3)	Max. 5.25 V
5	Short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connectors J1 and P55, and connect T-adapter to female side of J1. Investigate it by continuity mode of tester.		
		Continuity	Between J1 (female) (61) and each pin other than pin (61)	No continuity
6	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

CIRCUIT DIAGRAM (MASS AIR FLOW SENSOR)



No.	Cause	Procedure, measuring location, criteria and remarks
2	Defective exhaust gas color	Suddenly accelerate the engine from low idle to high idle two times, and then keep the engine running at high idle speed for 5 seconds. **NOTICE** • **If an excess black smoke is seen at high idle speed during acceleration, perform "S-9 KDPF GETS CLOGGED IN A SHORT TIME".** • **Even excessive black smoke is exhausted during engine acceleration, if it is not at engine high idle, it is not defective.**
3	Defective KDOC (stain, crack, damage on KDOC surface)	⚠ **Perform after KDPF and KDOC cooled down sufficiently.** 1. Remove KDPF. 2. Remove KDOC. 3. Blow air from KDOC outlet and remove stains on ceramic surface inside KDOC. 4. Check if the ceramic inside KDOC has cracks.
		KDOC is defective if any cracks are found in KDOC (change KDOC). **NOTICE** **Perform the following whether or not KDOC is changed:**
4	Reset after KDOC change	1. Attach KDOC and KDPF. 2. Turn starting switch to ON position. 3. On the Service screen of the machine monitor, display "Diagnostic Tests" screen, open 03 "KDPF Memory Reset", and perform 03 "KDOC Change" (Reset after KDOC change).
		NOTICE • **Failure codes [CA1691] and [CA2637] are cleared when reset after KDOC change is performed. At this point, a corrective action which is effective when the failure code is displayed and is taken for dozing fuel which is not injected is reset.** • **Check that reset after KDOC change is complete successfully (by reset count). If not, perform troubleshooting again.** • **If KDOC is changed, troubleshooting is complete without performing manual stationary regeneration.**

FAILURE CODE [CA1879]

Action level	Failure code	Failure	KDPF Differential Pressure Sensor High Error (Engine controller system)
L03	CA1879		
Details of failure	High voltage error is detected in signal circuit of KDPF differential pressure sensor.		
Action of controller	• Operates at estimated value of KDPF differential pressure sensor. (If other failure code also is displayed, operation may be performed at 0 kPa.) • EGR valve closes and VGT opens fully. • Engine power deration • Regeneration control stops.		
Phenomenon on machine	Engine power deration		
Related information	⚠ **KDPF becomes hot (Min. 500 °C). Be careful not to get burned.** • KDPF differential pressure sensor and KDPF outlet pressure sensor are provided as a unit. • If failure code [CA3133] is displayed instead of failure code [CA1695], wire breakage (defective contact of connector) of GND line is highly possible. • Signal voltage from KDPF differential pressure sensor can be checked by monitoring function. (Code: 47101 (V)) • Differential pressure in KDPF differential pressure sensor can be checked by monitoring function. (Code: 47100 (kPa)) • Engine power deration is canceled when the failure code is cleared and the starting switch is turned OFF (not canceled only by deactivation of the failure code). • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn starting switch to ON position.		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in “Electrical equipment” in “CHECKS BEFORE TROUBLESHOOTING” of “RELATED INFORMATION ON TROUBLESHOOTING”, and check it. 2. Turn starting switch to ON position.		
		If this failure code is cleared, wiring harness connector is defective.		
2	Defective sensor power supply system	If failure code [CA1695] or [CA1696] is displayed, perform troubleshooting for [CA1695] or [CA1696] first.		
		1. Turn starting switch to OFF position. 2. Disconnect connector E25, and connect T-adapter to female side. 3. Turn starting switch to ON position.		
		Voltage	Between E25 (female) (4) and (1)	4.75 to 5.25 V

FAILURE CODE [CA1925]

Action level	Failure code	Failure	Fuel Doser Solenoid 1 In Range Error (Engine controller system)
L03	CA1925		
Detail of failure	Fuel doser solenoid valve 1 does not operate correctly. (Dosing fuel pressure is not sufficiently lowered due to half-open valve that must be originally closed on fuel inlet side.)		
Action of controller	Stops regeneration control.		
Phenomenon on machine	• Automatic regeneration is not performed. • Manual stationary regeneration is disabled.		
Related information	⚠ **Exhaust connector and KDPF are heated to 500 °C and above. Be careful not to get burn injury.** • If failure code [CA1927] or [CA1928] is displayed, the dosing fuel pressure sensor may be defective, perform troubleshooting for it first. • Connectors of electrical parts around engine may be defective due to heat and vibration. See descriptions of wiring harness and connectors in “Electrical equipment” in “CHECKS BEFORE TROUBLESHOOTING” of “RELATED INFORMATION ON TROUBLESHOOTING”, and check it. • Defective dosing fuel solenoid valve 1-A (shut off valve) indicated by this code is determined according to dosing fuel pressure that changes with solenoid valve operation. Therefore, fuel pressure sensor must be checked. • Engine controller tests and checks dosing fuel pressure when turning starting switch to ON position. • Signal voltage from dosing fuel pressure sensor can be checked with monitoring. (Code: 47601) • Pressure detected by dosing fuel pressure sensor can be checked with monitoring. (Code: 47600) • Ambient pressure detected by ambient pressure sensor can be checked with monitoring. (Code: 37400) • After completion of repair, check that the failure code is cleared by the following procedure. Procedure: Turn the starting switch from OFF to ON position to start the engine. Run the engine at low idle for approximately 3 minutes.		

No.	Cause	Procedure, measuring location, criteria and remarks
1	Defective doser fuel shut off valve	1. Turn starting switch to OFF position. 2. Disconnect fuel supply line (2) from fuel doser (1). 3. Disconnect connector DSOV1. 4. Connect disconnected connector DSOV1 to new SOV. **REMARK** If connector DSOV1 has open circuit, failure code [CA1923] is displayed and pressure test (to check fuel dosing system) is not performed, and fuel pump is not driven. 5. Turn starting switch to ON position. 6. Start engine.
		If fuel leaks through fuel connector going to fuel supply line (2), fuel doser solenoid valve 1 (shut off valve) (3) is defective.
2	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

FAILURE CODE [CA2271]

Action level	Failure code	Failure	EGR Valve Position Sensor High Error (Engine controller system)
L03	CA2271		
Detail of failure	High voltage occurs in signal circuit of EGR valve position sensor.		
Action of controller	• Engine power deration. • EGR valve closed. • Regeneration control stops. • Advances to Inducement strategy. (EU Specification)		
Phenomenon on machine	• Engine power deration • Engine power deration according to inducement strategy. (EU Specification).		
Related information	• Signal voltage from EGR valve position sensor can be checked with monitoring function. (Code: 18101 (V)) • EGR valve position (mm) sensed by EGR valve position sensor can be checked with monitoring function. (Code: 18100 (mm)) • Engine power deration is canceled when the failure code is cleared and the starting switch is turned OFF (not canceled only by deactivation of the failure code). • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn starting switch to ON position.		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in “Electrical equipment” in “CHECKS BEFORE TROUBLESHOOTING” of “RELATED INFORMATION ON TROUBLESHOOTING”, and check it. 2. Turn starting switch to ON position.		
		If this failure code is cleared, wiring harness connector is defective.		
2	Defective sensor power supply system	If failure code [CA187] or [CA227] is displayed, perform troubleshooting for those codes first.		
3	Defective EGR valve lift sensor (internal defect)	1. Turn starting switch to OFF position. 2. Disconnect connector SEGR. 3. Turn starting switch ON (with connector SEGR disconnected).		
		If failure code [CA2271] changes to [CA2272], the sensor is defective.		
4	Open circuit in wiring harness (wire breakage of GND line or defective contact of connector)	1. Turn starting switch to OFF position. 2. Disconnect connectors J1 and SEGR, and connect T-adapters to each female side.		
		Resistance	Between J1 (female) (57) and SEGR (female) (2)	Max. 1 Ω
5	Short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connectors J1 and SEGR, and connect T-adapter to either female side.		
		Resistance	Between J1 (female) (81) and (88) or between SEGR (female) (1) and (3) or between SEGR (female) (1) and (4)	Min. 1 MΩ

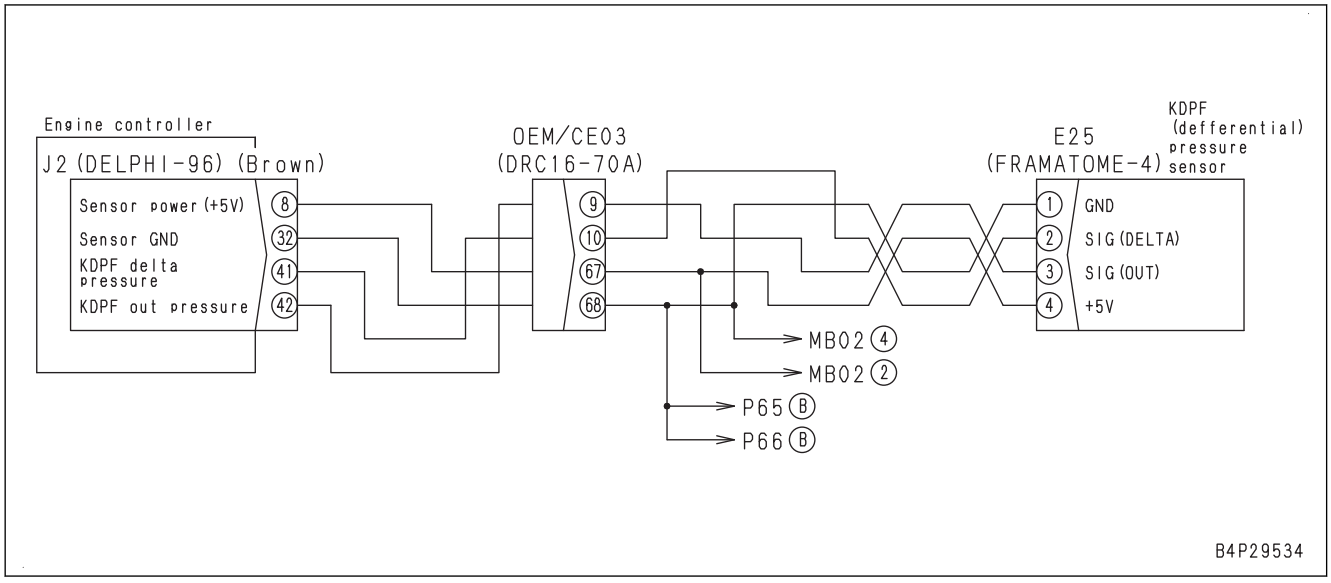
FAILURE CODE [CA2732]

Action level	Failure code	Failure	Fuel Doser Solenoid 2 High Error (Engine controller system)
L03	CA2732		
Detail of failure	Abnormal high voltage occurs in fuel doser solenoid valve 2 (drain valve).		
Action of controller	Regeneration control stops.		
Phenomenon on machine	• Automatic regeneration is disabled. • Manual stationary regeneration is disabled.		
Related information	⚠ **Since exhaust connector and KDPF are heated to 500°C or above, be careful not to get burn injury.** • If failure code [CA1923] is also displayed, the ground line may have open circuit. • If connector DSOV2 is disconnected, this failure code is displayed. • See failure code [CA1963]. • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn starting switch to ON position.		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in “c: Electrical equipment” in “CHECKS BEFORE TROUBLESHOOTING” of “RELATED INFORMATION ON TROUBLESHOOTING”, and check it. 2. Turn starting switch to ON position.		
		If this failure code is cleared, wiring harness connector is defective.		
2	Defective dosing fuel solenoid valve 2 (drain valve)	1. Turn starting switch to OFF position. 2. Disconnect connector DSOV2, and connect T-adapter to male side.		
		Resistance	Between DSOV2 (male) (2) and (1)	4 to 6 Ω
3	Open or short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector J1, and connect T-adapter to female side.		
		Resistance	Between J1 (female) (6) and (30) Resistance is the same as resistance of dosing fuel solenoid valve 2.	4 to 6 Ω
4	Open circuit in wiring harness (wire breakage of ground line or defective contact of connector)	If failure code is still displayed after above checks on cause 3, this check is not required. 1. Turn starting switch to OFF position. 2. Disconnect connectors J1 and DSOV2 and connect T-adapters to each female side.		
		Resistance	Between J1 (female) (6) and DSOV2 (female) (1)	Max. 1 Ω
			Between J1 (female) (30) and DSOV2 (female) (2)	Max. 1 Ω
5	Hot short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connector DSOV2, and connect T-adapter to female side. 3. Turn starting switch to ON position.		
		Voltage	Between DSOV2 (female) (1) and (2)	Max. 4.7 V

No.	Cause	Procedure, measuring location, criteria and remarks		
4	Ground fault in wiring harness (contact with ground circuit)	1. Turn starting switch to OFF position. 2. Disconnect connectors J2 and E25 and connect T-adapters to either female side.		
		Resistance	Between J2 (female) (42) and ground, or between E25 (female) (3) and ground	Min. 1 MΩ
5	Short circuit in wiring harness	1. Turn starting switch to OFF position. 2. Disconnect connectors J2 and E25, and connect T-adapter to female side of J2.		
		Continuity	Between J2 (female) (42) and each pin other than pin (42)	No continuity (no sound)
6	Defective KDPF outlet pressure sensor	1. Turn starting switch to OFF position. 2. Insert T-adapter into connector E25. 3. Turn starting switch to ON position.		
		Voltage	Between E25 (3) and (1)	0.5 to 4.5 V
7	Defective engine controller	Turn starting switch to ON position.		
		If this failure code is still displayed and no failure is found by preceding checks, engine controller is defective. (In case of an internal defect, troubleshooting is impossible as an assembly. Replace whole assembly.)		

Circuit diagram related to KDPF outlet pressure sensor



FAILURE CODE [CA3231]

Action level	Failure code	Failure	SCR Temperature High Error - Non Regeneration (Engine controller system)
L03	CA3231		
Detail of failure	SCR temperature remains at high level (800 °C and above) when active regeneration is not performed.		
Action of controller	• Activates Inducement strategy. • Stops AdBlue/DEF injection.		
Phenomenon on machine	• NOx emission increases because AdBlue/DEF injection is disabled. • Engine output is reduced based on Inducement strategy.		

No.	Cause	Procedure, measuring location, criteria and remarks
6	Defective KDOC (lowered KDOC catalyzer function)	When not replacing KDOC 1. Turn the starting switch to ON position. 2. Record the initial states of KDOC inlet temperature sensor and KDPF outlet temperature sensor, and temperature during the manual stationary regeneration, and check if KDOC outlet temperature sensor is normal. 3. Start the engine. 4. Secure the safety of the machine. 5. Display “Diagnostic Tests” screen from “Service Menu” screen of the machine monitor, open “Active Regeneration for Service”, and perform Manual Stationary Regeneration (manual stationary regeneration finishes in approximately. 40 minutes). 6. Turn the starting switch to OFF position. 7. Start the engine, and perform Manual Stationary Regeneration again. When the failure code does not appear, perform KDPF Memory Reset and finish the troubleshooting. 8. If failure code [CA2637] appears after finishing the manual stationary regeneration, KDOC is defective. (Catalyzer function of KDOC is lowered. Replace the KDOC.) 9. Perform KDPF Memory Reset after replacement of KDOC. For details, see TESTING AND ADJUSTING, “SET AND OPERATE MACHINE MONITOR”, “SERVICE MODE”, “METHOD FOR OPERATING TESTING MENU (KDPF MEMORY RESET)”. **REMARK** If KDPF Memory Reset is performed, failure codes [CA1691] and [CA2637] do not appear. At this point, a corrective action which is effective when the failure code is displayed and is taken for dosing fuel which is not injected is reset.
7	Defective installation of KDOC inlet temperature sensor	For details, see DISASSEMBLY AND ASSEMBLY, “REMOVE AND INSTALL KDPF ASSEMBLY” and “DISASSEMBLE AND ASSEMBLE OF KDPF ASSEMBLY”. Repair as necessary.
8	Defective installation of KDOC outlet temperature sensor	For details, see DISASSEMBLY AND ASSEMBLY, “REMOVE AND INSTALL KDPF ASSEMBLY” and “DISASSEMBLE AND ASSEMBLE OF KDPF ASSEMBLY”. Repair as necessary.
9	Defective KDPF temperature sensor	If the failure code is not cleared after performing above-mentioned troubleshooting, replace KDPF temperature sensor.
10	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

Loaded Diagnostics Operation To Clear Failure Code

Check if the repair has been completed with the following procedure:

(Make sure this failure code is cleared after this procedure.)

1. Turn the starting switch from OFF to ON.
2. Start the engine and run it at low idle speed for 15 minutes.
   If the failure code is cleared, repair is complete. Otherwise, perform the following:

FAILURE CODE [CA3318]

Action level	Failure code	Failure	KDOC Outlet Temperature Sensor In Range Error (Engine controller system)
L03	CA3318		
Detail of failure	The difference between the temperature detected by KDOC outlet temperature sensor and the temperature detected by KDOC inlet temperature sensor differs from the expected value. (Signal voltage is within input range.)		
Action of controller	• Substitutes KDOC inlet temperature for KDOC outlet temperature, and run the engine. (If KDOC inlet temperature sensor also has an error, uses KDOC outlet temperature as a default value (250 °C).) • Closes EGR valve. • Derates engine power for operation. • Stops regeneration control. • Stops fuel dosing.		
Phenomenon on machine	Engine output lowers.		

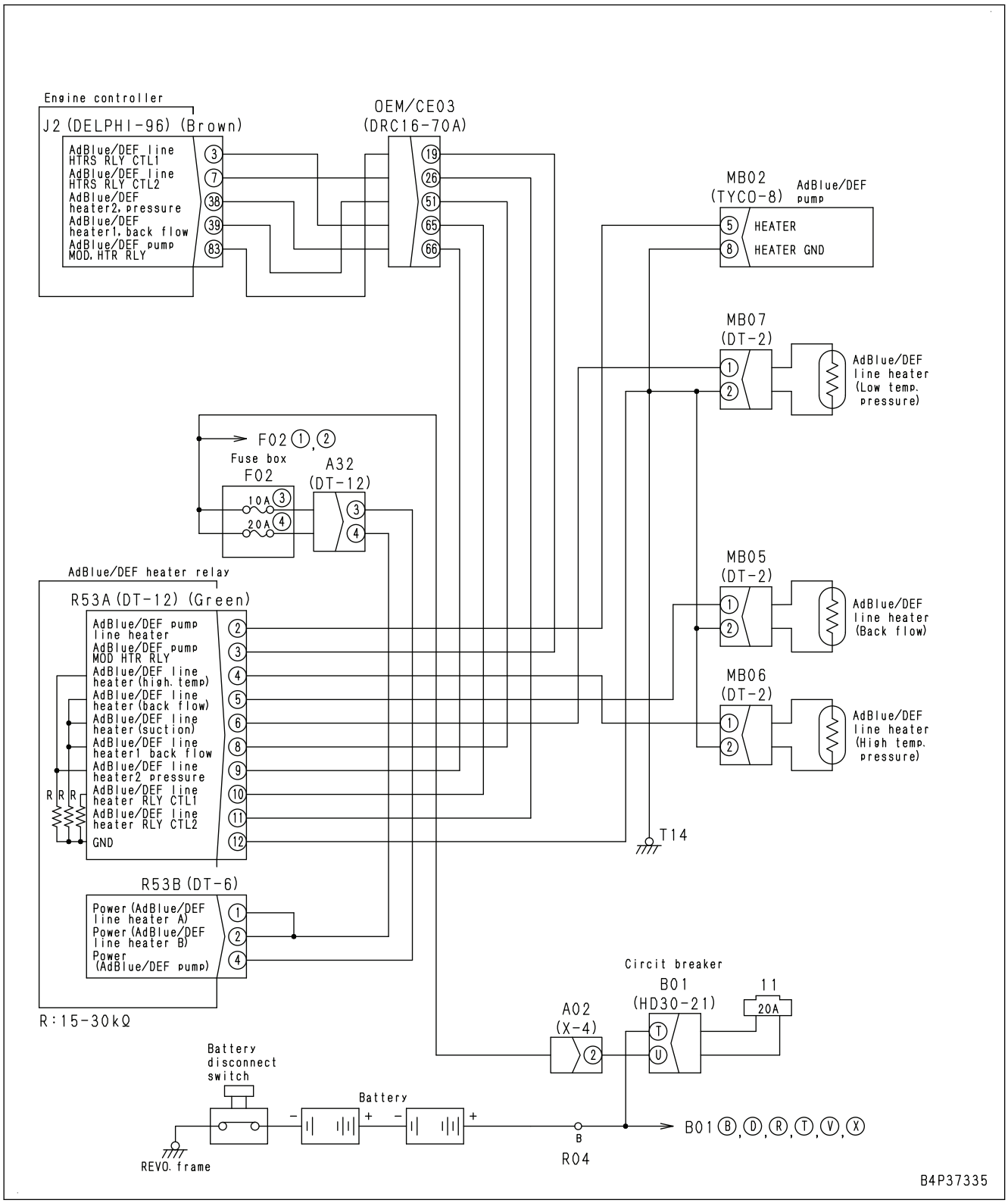
FAILURE CODE [CA3562]

Action level	Failure code	Failure	AdBlue/DEF LineHeater Relay 1 Voltage High Error (Engine controller system)
L01	CA3562		
Detail of failure	High voltage error occurs in the AdBlue/DEF line heater relay 1 circuit.		
Action of controller	None in particular		
Phenomenon on machine	• AdBlue/DEF line stops thawing. • NOx emission increases because AdBlue/DEF injection is disabled at low temperature.		
Related information	• The AdBlue/DEF line heater relay 1 operates in AdBlue/DEF supply system thawing, warning, or implementation of AdBlue/DEF line heater relay 1 test. • The AdBlue/DEF line heater relay 1 is built in the AdBlue/DEF heater relay. • Troubleshooting of this failure code covers circuits from engine controller through AdBlue/DEF heater relay to power supply. • This failure code is detected only when the AdBlue/DEF line heater relay 1 is ON. • After repairing, check if the failure code is cleared by the following procedure. Procedure: Starting the engine at low temperature (ambient temperature of 5 °C or less) or see “Service mode” and “Testing menu (SCR service test) - Operate” of Setting and operating machine monitor to perform “AdBlue/DEF line heater relay 1 test”.		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	1. See descriptions of wiring harness and connectors in “Electrical equipment” in “CHECKS BEFORE TROUBLESHOOTING” of “RELATED INFORMATION ON TROUBLESHOOTING”, and check them. 2. Start the engine in low temperature (ambient temperature of 5 °C or lower) or perform “AdBlue/DEF Line Heater Relay 1 Test”. For details, see SET AND OPERATE MACHINE MONITOR, “SERVICE MODE” and “METHOD FOR SETTING WITH TESTING MENU (SCR SERVICE TEST)”.		
		If this failure code is cleared, the wiring harness connector is defective.		
2	Hot short circuit in wiring harness	1. Turn the starting switch to OFF position. 2. Disconnect connector R53A, and connect T-adapter to female side. 3. Turn the starting switch to ON position (with connector R53A disconnected).		
		Voltage	Between R53A (female) (10) and (12)	Max. 3 V
3	Defective AdBlue/DEF heater relay	1. Turn starting switch to OFF position. 2. Check that system operating lamp does not light up, and then turn the battery disconnect switch OFF. 3. Disconnect connector R53A and R53B, and replace AdBlue/DEF heater relay. 4. Turn the battery disconnect switch ON. 5. Start the engine in low temperature (ambient temperature of 5 °C or below) or see “SERVICE MODE” of “SETTING AND OPERATION OF MACHINE MONITOR”, and “METHOD FOR SETTING WITH TESTING MENU (SCR SERVICE TEST)” to perform “AdBlue/DEF Line Heater Relay 1 Test”.		
		If this failure code is cleared, the original AdBlue/DEF heater relay is defective.		
4	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

Related information	• For the procedure to remove and replace AdBlue/DEF injector, see DISASSEMBLY AND ASSEMBLY, “REMOVE AND INSTALL AdBlue/DEF INJECTOR”. • The cause of this failure code is cleared after accumulation of urea deposit is resolved by active regeneration. Troubleshooting is not necessary. • This failure code is displayed for the purpose of monitoring for cause identification of the failure codes [CA3151] and [CA3543]. It is not necessary to troubleshoot and replace parts when this failure code is displayed alone. • Even if cause of failure is eliminated, it takes time to detect that the cause has been eliminated, so the failure code may be displayed continuously, but no action is required. • If this failure code is displayed more than 20 times during the latest SMR 50 h, specify the cause of failure according to following process. • On “Pre-defined Monitoring” screen, following 4 diagnoses are displayed. Operation standard, machine operation environment related, SCR sensor related, AdBlue/DEF tank sensor related (The numbers below denote displayed monitoring codes.) • Operation standard 01002 Engine Speed 18600 Inject Fueling Command 19200 Exhaust Gas Flow Rate 47300 KDOC 1 Inlet Temperature 19300 SCR Temperature 19302 SCR Outlet Temperature • Machine operation environment related 37400 Ambient Pressure 19400 Ambient Temperature 18400 Intake Temperature 19133 Engine Room Temperature 19115 AdBlue/DEF Temperature in Tank • SCR sensor related 19120 AdBlue/DEF Injection Quantity 19205 SCR NH3 Concentration Corrected 19202 Turbo Outlet NOx Corrected 19209 SCR Outlet NOx Corrected 19203 Turbo Outlet NOx Sensor State 19210 SCR Outlet NOx Sensor State • AdBlue/DEF tank sensor related 19100 AdBlue/DEF Concentration 19110 AdBlue/DEF Level 19111 AdBlue/DEF Level Corrected 19115 AdBlue/DEF Temperature in Tank 19400 Ambient Temperature 19305 AdBlue/DEF Tank Heating State **NOTICE** **This failure code requires “Loaded Diagnostics Operation To Clear Failure Code”. After investigating the cause of the problem and completing the repair, perform “Loaded Diagnostics Operation To Clear Failure Code” to make sure the failure code is cleared. (This failure code is not cleared by simply turning the starting switch to ON position.)**

Circuit diagram related to AdBlue/DEF line heater



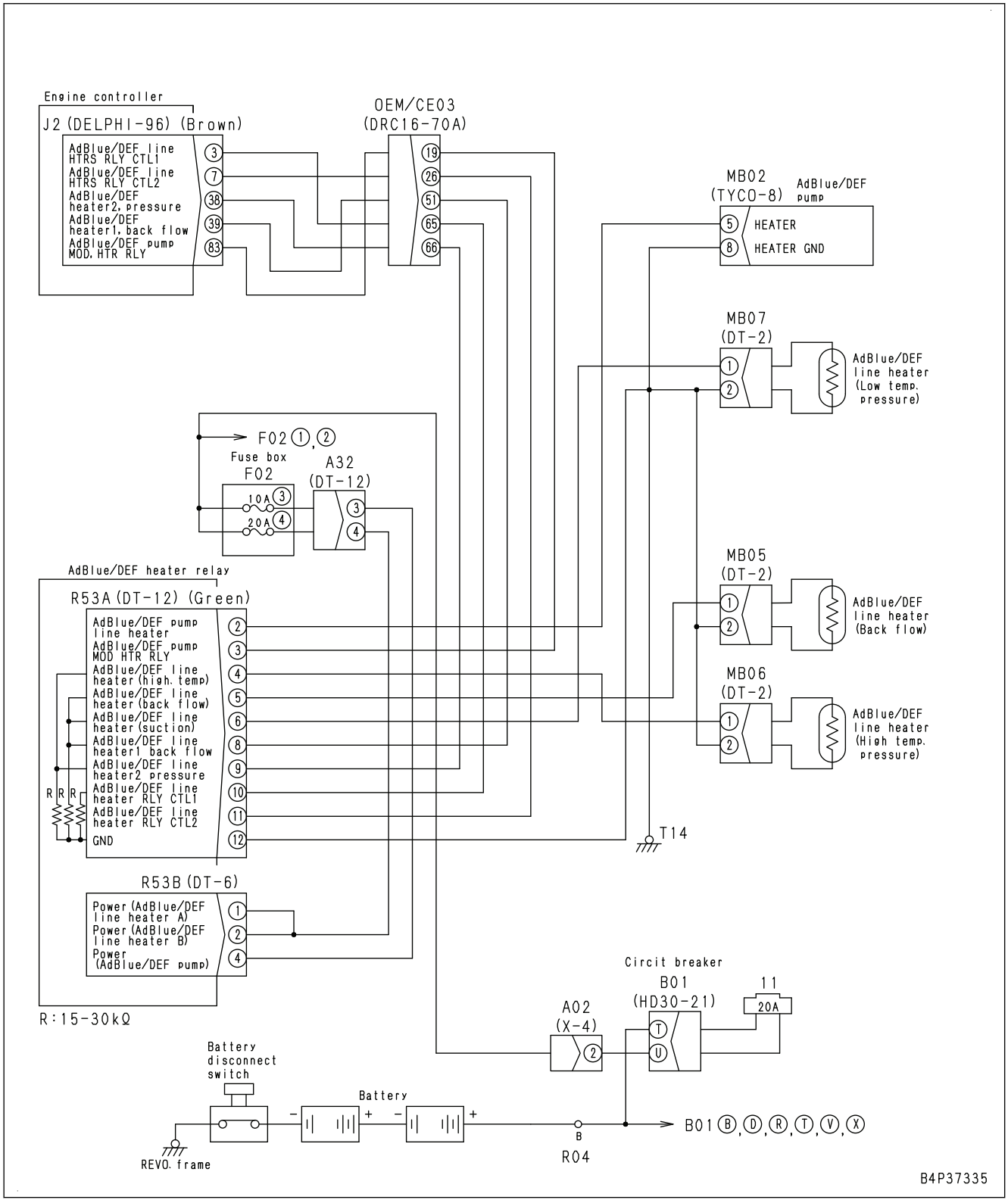
FAILURE CODE [CA3911]

Action level	Failure code	Failure	SCR NH3 Sensor Datalink Timeout Error (Engine controller system)
L01	CA3911		
Detail of failure	The engine controller does not receive ammonia sensor data due to a communication error with the ammonia sensor.		
Action of controller	• Uses AdBlue/DEF injection control without using the ammonia sensor. • Advances to Inducement strategy.		
Phenomenon on machine	• NOx emission may increase or ammonia may be exhausted because AdBlue/DEF injection works inappropriately. • Engine output is reduced based on inducement strategy. • Ammonia concentration is undetectable.		
Related information	⚠ **SCR assembly, the sensor installation piping, and the sensor probe become hot (Min. 400 °C). Be careful not to get burned.** ⚠ **Be careful not to get burned by the sensor probe as it is heated by itself even if the ambient temperature is not high.** • The ammonia sensor is separated from the sensor controller and communicated via CAN with the engine controller along with other sensors. • This failure code is displayed if the sensor controller's connector or a smart sensor (power supply) relay connector is disconnected. • CAN communication failure codes related to engine sensors include [CA2771], [CA3232], [CA3868], [CA3911], [CA4151], and [CA4152]. If all of these failure codes are displayed, a defect in any of the 6 sensors, a defective smart sensor power supply relay/relay system, or a ground fault, short circuit, or hot short circuit in wiring harness (CAN communication line) can be suspected. • Since signal of active CAN communication line is pulse voltage, it cannot be measured by using multimeter. • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn starting switch to ON position.		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective wiring harness connector	Perform checks on causes 1 to 10 for failure code [CA2771].		
2	Open circuit and short circuit in wiring harness (broken or short-circuited communication line)	• Communication line As CAN terminating resistors of 120 ohm are connected in parallel, therefore, when circuit resistance is measured at connector of CAN communication, if combined resistance is 60 ohm, there is no open circuit. 1. Turn starting switch to OFF position. 2. Check that system operating lamp does not light up, and then turn battery disconnect switch to OFF position. 3. Disconnect connectors J2 and E32 and connect T-adapters to each female side.		
		Resistance	Between E32 (female) (2) and (3)	Approx. 60 Ω
			Between J2 (female) (21) and (45)	Approx. 60 Ω

No.	Cause	Procedure, measuring location, criteria and remarks
5	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

Electrical circuit diagram related to AdBlue/DEF heater relay



Loaded Diagnostics Operation To Confirm Failure Correction

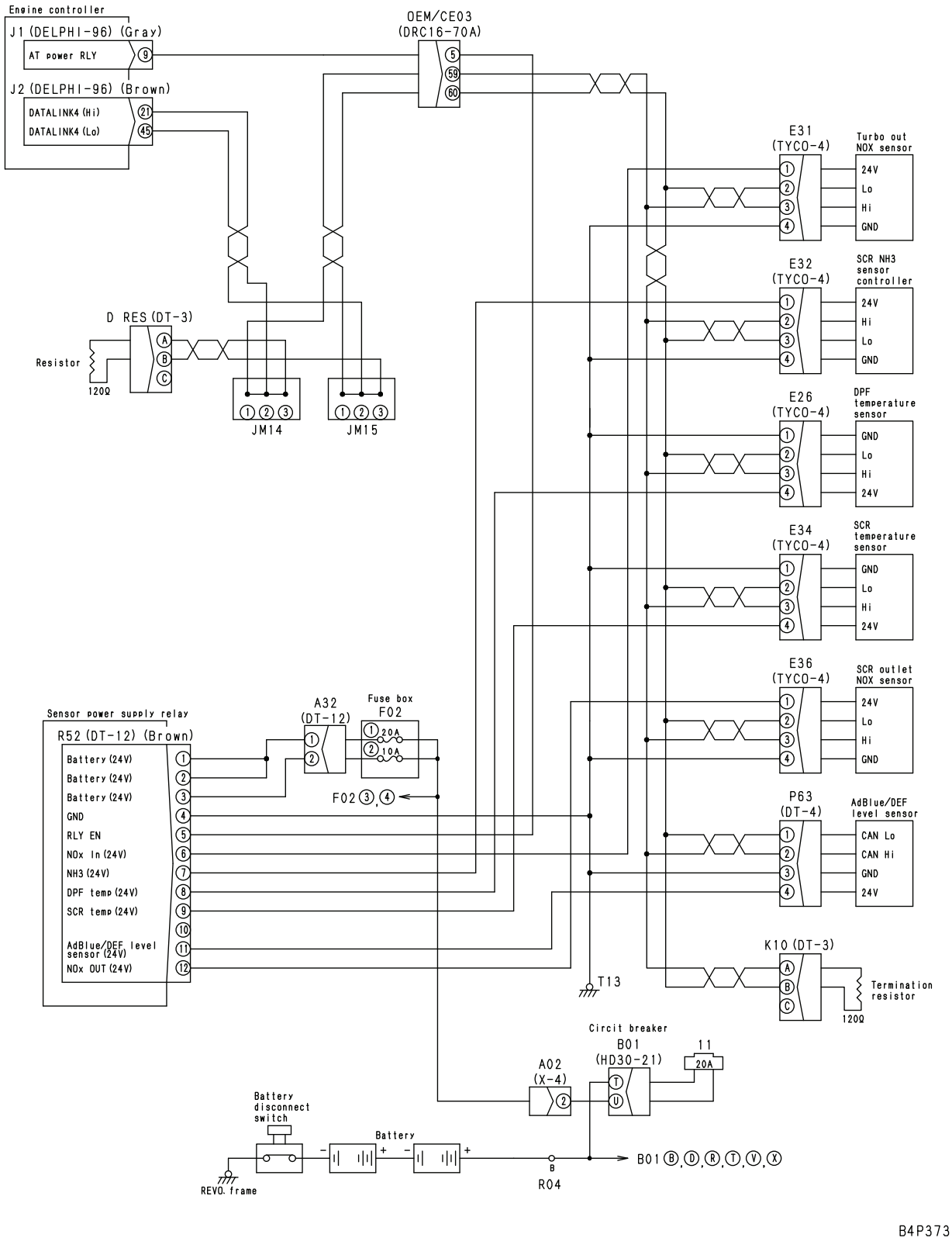
REMARK

If this failure code is displayed during “Loaded Diagnostics Operation To Confirm Failure Correction”, return to troubleshooting.

Check if the repair has been completed with the following procedure:

1. Turn the starting switch to OFF position, and shut down the engine controller.
2. Turn the starting switch to the ON position, and check the failure code is cleared. If this failure code is displayed, return to troubleshooting.
3. Start the engine.
4. Run the engine at low idle speed for 10 minutes.
5. Run the engine at high idle speed for 10 minutes.
6. If this failure code is cleared, repair is completed.

Circuit diagram related to KDOC temperature sensor



FAILURE CODE [CA4769]

Action level	Failure code	Failure	AdBlue/DEF Level Measurement Impossible (Engine controller system)
L01	CA4769		
Detail of failure	AdBlue/DEF level sensor cannot measure the AdBlue/DEF level and that state continues.		
Action of controller	Inducement strategy is activated.		
Phenomenon on machine	• AdBlue/DEF level cannot be measured. • Indication of AdBlue/DEF level on the monitor changes. • Engine output is reduced based on Inducement strategy.		
Related information	• This failure code is displayed when AdBlue/DEF tank becomes completely empty. • Possible causes other than empty AdBlue/DEF tank are sticking of foreign material to sensing part and defective sensor. • For this failure code, if the temperature of AdBlue/DEF in tank is 0 °C or lower, the failure code cannot be cleared. • On “Pre-defined Monitoring” screen, items related to AdBlue/DEF tank sensor are used. • Troubleshooting for AdBlue/DEF tank sensor related 19100 AdBlue/DEF Concentration 19110 AdBlue/DEF Level 19111 AdBlue/DEF Level Corrected 19115 AdBlue/DEF Temperature in Tank 19400 Ambient Temperature 19305 AdBlue/DEF Tank Heating State **NOTICE** **This failure code requires machine operation for clearing the failure code. After investigating the cause of the problem and completing the repair, perform “Loaded Diagnostics Operation To Clear Failure Code” to make sure the failure code is cleared.**		

FAILURE CODE [D19JKZ]

Action level	Failure code	Failure	Personal Code Relay Open Circuit or Short Circuit (Machine monitor system)
L03	D19JKZ		
Detail of failure	Open circuit or short circuit error is detected in primary side (coil side) circuit of personal code relay.		
Action of controller	None in particular (at open circuit error) Stops driving the personal code relay (at short circuit error). If cause of failure is eliminated, machine becomes normal by itself (at open circuit error). Even if cause of failure is eliminated, machine does not become normal until the starting switch is turned to OFF position once (at short circuit error).		
Phenomenon on machine			
Related information	• This failure code is displayed only when engine lock function is enabled. • After completion of repair, check that the failure code is cleared by the following operation. Procedure: Turn the starting switch to ON position (at open circuit error). Failure code cannot be reproduced on the machine (at short circuit error).		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective fuse	1. Turn the starting switch to OFF position. 2. Check that system operating lamp is not lit, and then turn the battery disconnect switch to OFF position. 3. Remove the fuse No.3 in fuse box F01. Check visually if it is not burnt out. 4. When it is not burnt out, check if it is blown out by continuity test.		
		• When it is burnt out, check the wiring harness for ground fault. • When it is not burnt out but it has no continuity, replace the fuse.		
2	Defective personal code relay	1. Turn the starting switch to OFF position. 2. Disconnect the connector R07, and connect the T-adapter to male side.		
		Resistance	Between R07 (male) (1) and (2)	200 to 600 Ω
3	Open circuit in wiring harness	1. Turn the starting switch to OFF position. 2. Remove the fuse No.3 in fuse box F01 3. Disconnect the connectors CM01 and R07, and connect the T-adapter to each female side.		
		Resistance	Between F01-3 and R07 (female) (1)	Max. 1 Ω
			Between R07 (female) (2) and CM01 (female) (6)	Max. 1 Ω
4	Ground fault in wiring harness	1. Turn the starting switch to OFF position. 2. Disconnect the connectors CM01 and R07, and connect the T-adapter to either female side. 3. Disconnect the connectors, terminals, and fuses of all the devices which branch out from connector R07 (1).		
		Resistance	Between ground and either F01-3 or R07 (female) (1)	Min. 1 MΩ
			Between ground and either R07 (female) (2) or CM01 (female) (6)	Min. 1 MΩ
5	Defective machine monitor	If no failure is found by above checks, machine monitor is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

FAILURE CODE [DA2QKR]

Action level	Failure code	Failure	Controller Area Network 2 Defective Communication (Pump Controller) (Machine monitor system)
L03	DA2QKR		
Detail of failure	Machine monitor does not recognize pump controller through CAN communication 2 line (KOMNET/c).		
Action of controller	Retains information when the failure occurred.		
Phenomenon on machine	Information to be obtained from pump controller is not displayed and special functions that need information do not work. Or, updating of receiving data is disabled (such as failure codes and monitoring codes sent from the pump controller)		
Related information	• After completion of repair, check that the failure code is cleared by the following operation. Procedure: Turn the starting switch to ON position. • ACC signal of starting switch is the command to start CAN communication for each controller. • 4 different failure codes, [DA2QKR], [DB2QKR], [D8AQKR], and [DAZQKR] are used for defective CAN communication by CAN 2 when it is detected by machine monitor. When all of these 4 failure codes are displayed, ground fault, short circuit or hot short circuit in wiring harness (CAN communication circuit) can be suspected. In such case, check whether air conditioner is operable (ON/OFF and air flow of air conditioner) with air conditioner screen since air conditioner is also operated through CAN communication. • This can be activated even when power supply to pump controller is turned off. **REMARK** Air conditioner can be controlled even when failure code is displayed on the monitor screen. If air conditioner is controlled, there is no possibility of ground fault, short circuit, or hot short circuit occurring in wiring harness (CAN communication line). • Since each controller and machine monitor are connected directly to battery, they are supplied with power even after the starting switch is turned to OFF position. • Since signal of active CAN communication line is pulse voltage, it cannot be measured by using multimeter.		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective pump controller power supply circuit	1. Turn the starting switch to OFF position. 2. Check that system operating lamp is not lit, and then turn the battery disconnect switch to OFF position. 3. Disconnect the connector CP01 and connect the T-adapter to female side. 4. Turn the battery disconnect switch to ON position. 5. Turn the starting switch to ON position. **REMARK** If there is no failure, troubleshooting for No. 2 is not required.		
		Voltage	Between CP01 (female) (1) and (2)	20 to 30 V
			Between CP01 (female) (4) and (5)	20 to 30 V

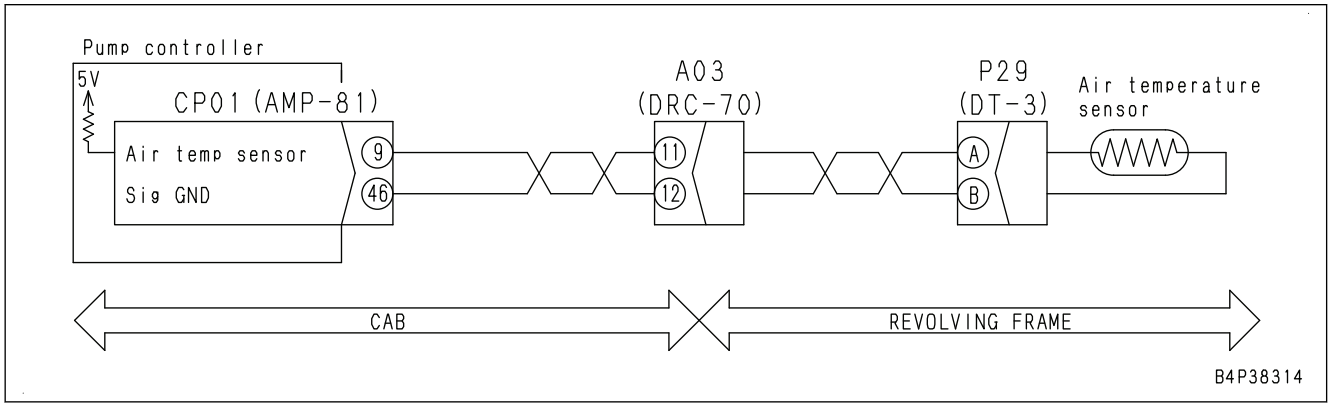
<table>
<tr><th>No.</th><th>Cause</th><th colspan="3">Procedure, measuring location, criteria and remarks</th></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective CAN 2 terminating resistor</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect connectors CM02 and K02, and connect T-adapter to each male side.</td></tr>
<tr><td rowspan="2">Resistance</td><td>Between CM02 (male) (7) and (9)</td><td>120 ± 12 Ω</td></tr>
<tr><td>Between K02 (male) (A) and (B)</td><td>120 ± 12 Ω</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Open circuit in wiring harness (CAN 2 communication line)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Check that system operating lamp is not lit, and then turn the battery disconnect switch to OFF position.
3. Disconnect connectors CM02, AC01, and K02, and connect T-adapter to each female side.</td></tr>
<tr><td rowspan="5">Resistance</td><td>Between CM02 (female) (7) and AC01 (female) (2)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between CM02 (female) (8) and AC01 (female) (2)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between CM02 (female) (9) and AC01 (female) (1)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between AC01 (female) (1) and K02 (female) (B)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between AC01 (female) (2) and K02 (female) (A)</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Ground fault in wiring harness (CAN 2 communication line)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Check that system operating lamp is not lit, and then turn the battery disconnect switch to OFF position.
3. Disconnect connectors AC01, and CM02, and connect T-adapter to either female side.
4. Disconnect connector, terminal, and fuse of all the devices which branch out connector AC01 (2), and (1).</td></tr>
<tr><td rowspan="2">Resistance</td><td>Between ground and any of AC01 (female) (2), CM02 (female) (7), and (8)</td><td>Min. 1 MΩ</td></tr>
<tr><td>Between ground and either AC01 (female) (1) or CM02 (female) (9)</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Hot short circuit in wiring harness (CAN 2 communication line)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Check that system operating lamp is not lit, and then turn the battery disconnect switch to OFF position.
3. Insert T-adapter into connector K02.
4. Turn the battery disconnect switch to ON position.
5. Turn the starting switch to ON position.
REMARK
Voltage of CANH and CANL is 2.5 ± 1 V including during communication, so regard wiring harness as normal if measured voltage is 1 to 4 V.</td></tr>
<tr><td rowspan="2">Voltage</td><td>Between K02(A) and ground</td><td>1 to 4 V</td></tr>
<tr><td>Between K02(B) and ground</td><td>1 to 4 V</td></tr>
<tr><td>7</td><td>Defective air conditioner controller</td><td colspan="3">If no failure is found by above checks, air conditioner controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)</td></tr>
<tr><td>8</td><td>Defective machine monitor</td><td colspan="3">If no failure is found by above checks, machine monitor is defective. (Since this is an internal defect, troubleshooting cannot be performed.)</td></tr>
</table>

FAILURE CODE [DGE5KB]

Action level	Failure code	Failure	Ambient Temperature Sensor Short Circuit (Pump controller system)
L01	DGE5KB		
Detail of failure	Controller detects short circuit of ambient temperature sensor.		
Action of controller	• Fan speed may be increased (depending on the operating condition). • If cause of failure is eliminated, machine becomes normal by itself.		
Phenomenon on machine	None		
Related information	• Signal voltage from ambient temperature sensor can be checked with monitoring function. (Code: 37503 Ambient temperature sensor voltage) • Temperature detected by ambient temperature sensor can be checked with monitoring function. (Code: 37502) • Method of reproducing failure code: Turn the starting switch to ON position.		

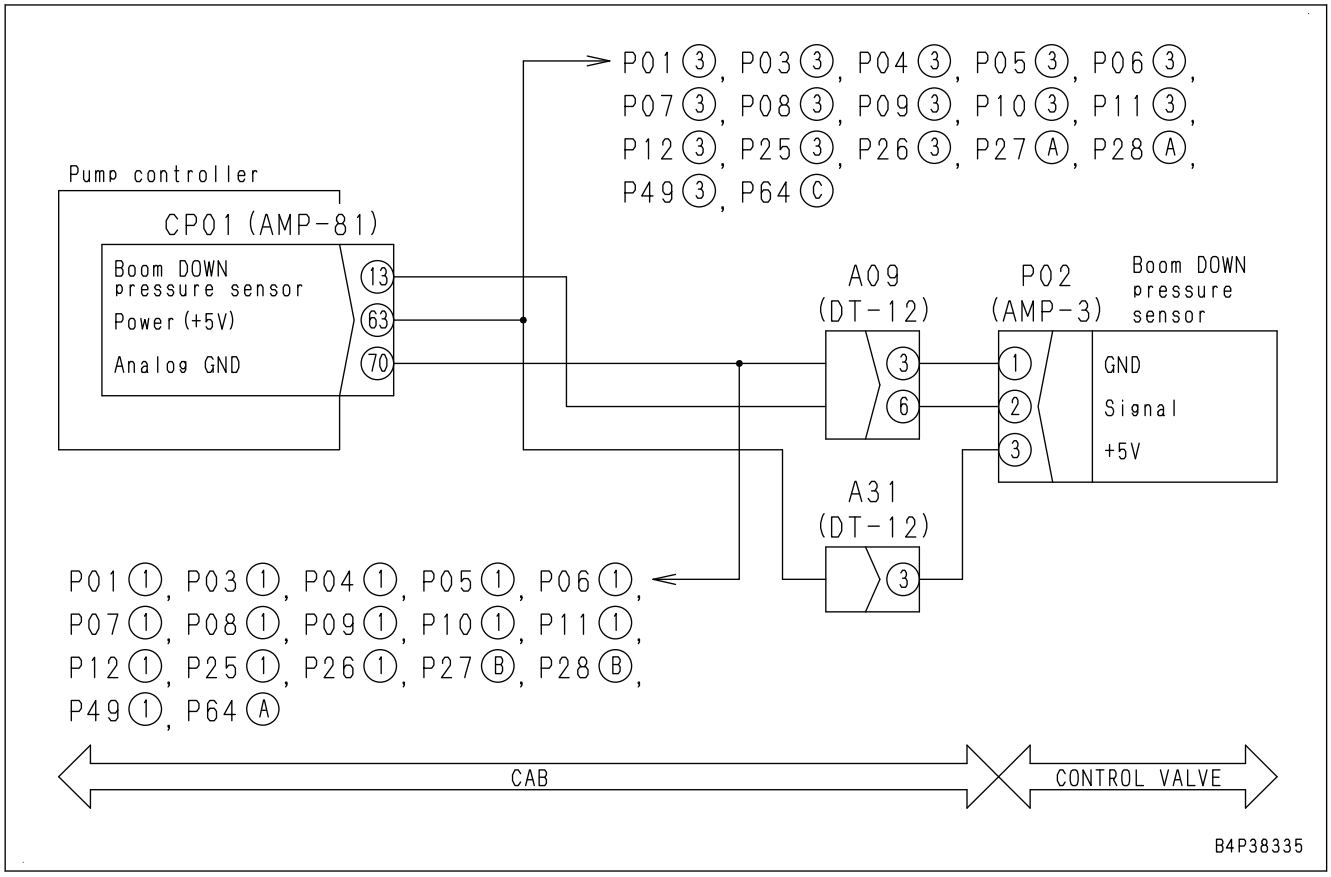
No.	Cause	Procedure, measuring location, criteria and remarks			
1	Defective ambient temperature sensor	1. Turn the starting switch to OFF position. 2. Disconnect the connector P29, and connect the T-adapter to male side.			
		Resistance	Between P29 (male) (A) and (B) **REMARK** Characteristic between temperature of ambient temperature sensor and resistance value	-30 °C	Approx. 50 kΩ
				0 °C	Approx. 12 kΩ
				25 °C	Approx. 4 kΩ
				45 °C	Approx. 2 kΩ
			Between P29 (male) (A) and ground		Min. 1 MΩ
2	Ground fault in wiring harness (contact with ground circuit)	1. Turn the starting switch to OFF position. 2. Disconnect the connectors CP01 and P29.			
		Resistance	Between CP01 (female) (9) , or between P29 (female) (A) and ground		Min. 1 MΩ
3	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).			

Circuit diagram related to ambient temperature sensor



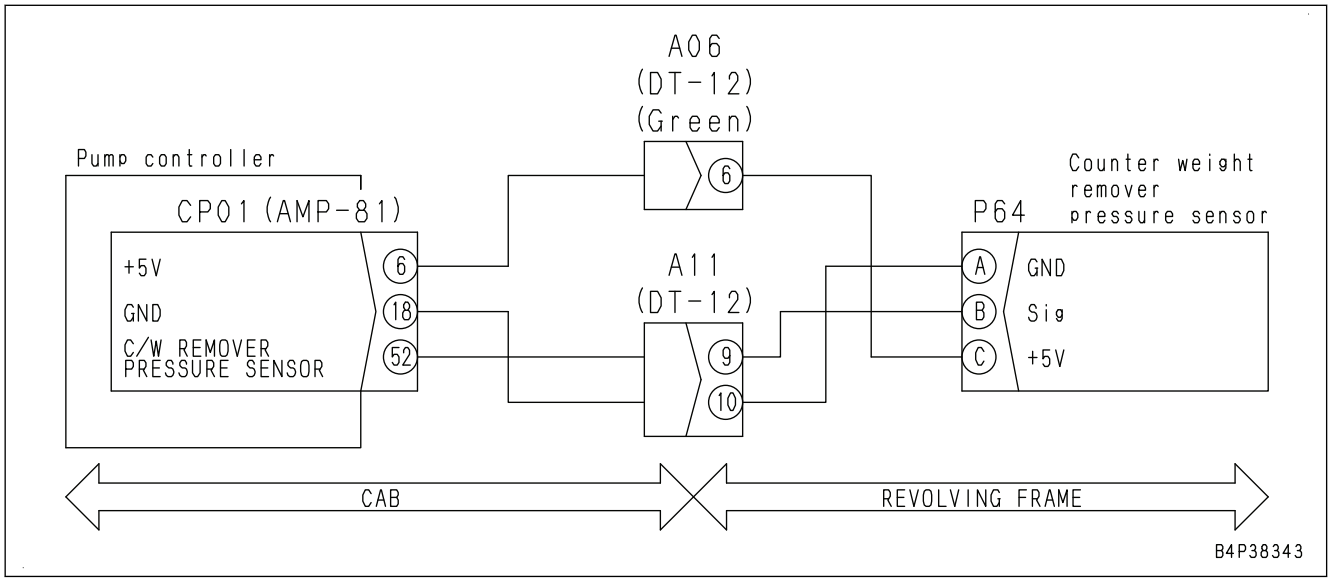
No.	Cause	Procedure, measuring location, criteria and remarks		
6	Hot short circuit in wiring harness (Contact with 5 V circuit and 24 V circuit)	1. Turn the starting switch to OFF position. 2. Disconnect the connector P02. 3. Connect the T-adapter to female side of the connector P02. 4. Turn the starting switch to ON position.		
		Voltage	Between P02 (female) (2) and ground	Max. 1 V
7	Defective pump controller	If no failure is found by preceding checks, pump controller is defective. (In case of an internal defect, troubleshooting is impossible as an assembly. Replace whole assembly).		

Circuit diagram related to boom LOWER PPC pressure sensor



No.	Cause	Procedure, measuring location, criteria and remarks		
4	Ground fault in wiring harness (contact with ground circuit)	1. Turn the starting switch to OFF position. 2. Disconnect the connectors CP01 and P64, and connect the T-adapter to either female side.		
		Resistance	Between ground and CP01 (female) (52) or P64 (female) (2)	Min. 1 MΩ
5	Hot short circuit in wiring harness (contact with 5 V circuit or 24 V circuit)	**REMARK** Measure the voltage with counterweight remover not actuated. 1. Turn the starting switch to OFF position. 2. Disconnect the connector P64. 3. Connect the T-adapter to female side of the connector P04. 4. Turn the starting switch to ON position.		
		Voltage	Between P64 (female) (2) and ground	Max. 1 V
6	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		

Circuit diagram related to counterweight remover pressure sensor

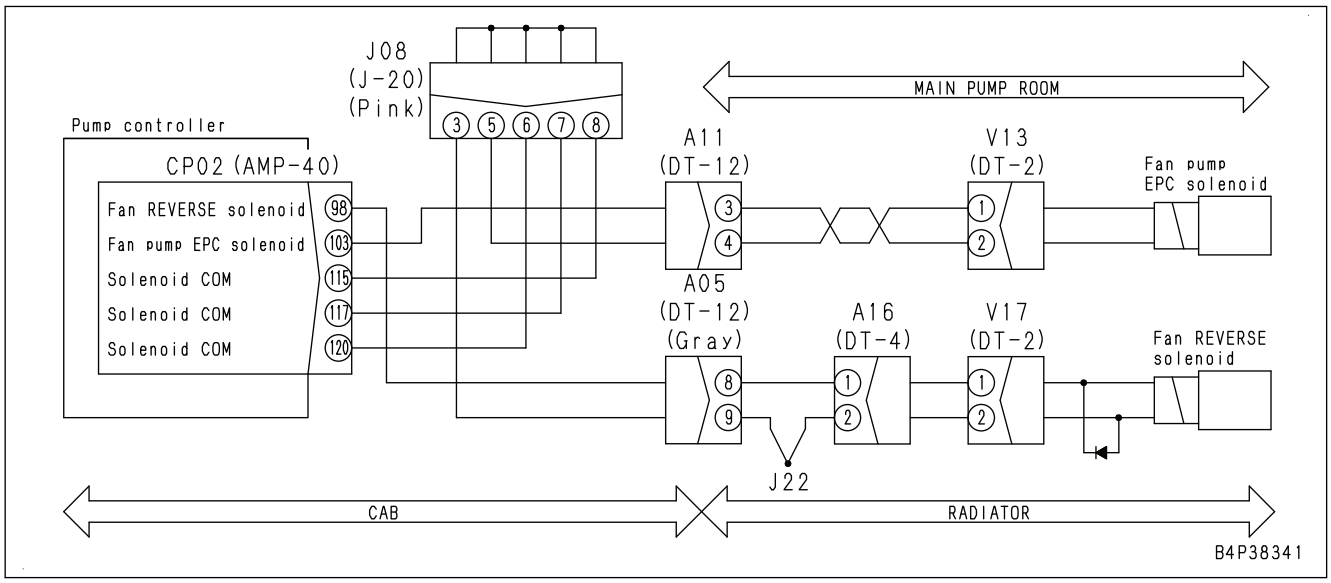


FAILURE CODE [DW43KB]

Action level	Failure code	Failure	Travel Speed Solenoid Short Circuit (Pump controller system)
L01	DW43KB		
Detail of failure	Abnormal current flows when pump controller drives travel speed solenoid, so pump controller determines that short circuit exists in travel speed solenoid circuit.		
Action of controller	Stops driving travel speed solenoid. Even if cause of failure disappears, machine does not become normal until starting switch is turned to OFF position.		
Phenomenon on machine	Machine travels slow in Hi travel speed setting (machine monitor shows Hi setting but the speed is kept at around Lo).		
Related information	• Controller's command (ON/OFF) to travel speed selector solenoid can be checked with monitoring function. (As long as controller's command to solenoid is "ON", sensor state displayed on monitoring screen is "ON" even if solenoid is not energized due to short circuit.) (Code: 02300 Solenoid 1) • After repairing, check if the failure code is cleared by the following procedure. Procedure: Start engine, set travel speed to Hi, and operate travel lever.		

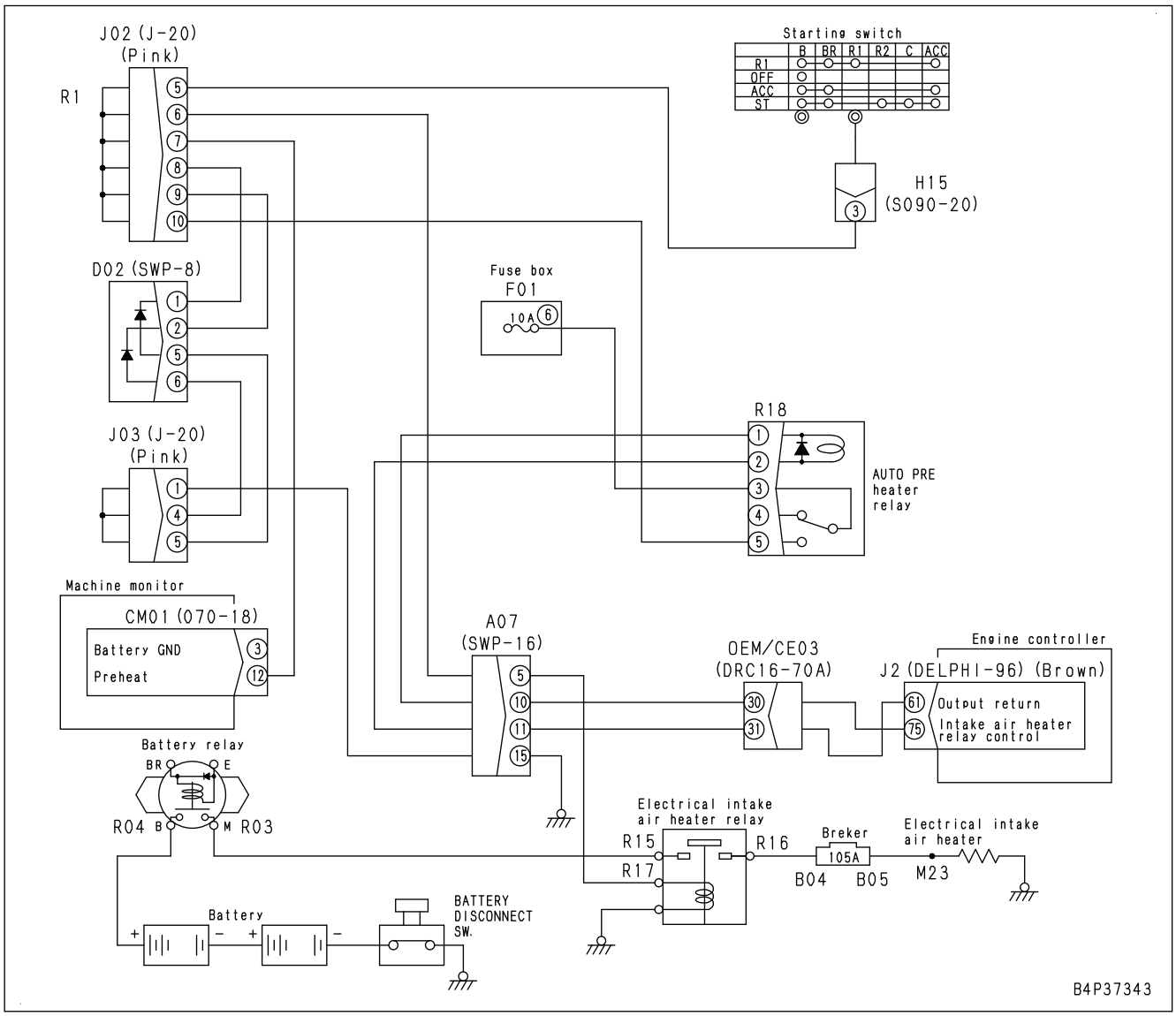
No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective travel speed Hi/Lo solenoid	1. Turn the starting switch to OFF position. 2. Disconnect the connector V04, and connect the T-adapter to male side.		
		Resistance	Between V04 (male) (1) and (2)	20 to 60 Ω
			Between V04 (male) (1) and ground	Min. 1 MΩ
2	Ground fault in wiring harness	1. Turn the starting switch to OFF position. 2. Disconnect the connectors CP02 and V04, and connect the T-adapter to either female side.		
		Resistance	Between ground and either CP02 (female) (93) or V04 (female)	Min. 1 MΩ
3	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).		

Circuit diagram related to hydraulic drive fan EPC



<table>
<tr><th>No.</th><th>Cause</th><th colspan="3">Procedure, measuring location, criteria and remarks</th></tr>
<tr><td rowspan="8">3</td><td rowspan="8">Open circuit in wiring harness (wire breakage or defective contact of connector)</td><td colspan="3">REMARK
If no failure is found by check on cause 3, this check is not required.
1. Turn the starting switch to OFF position.
2. Disconnect the connectors CP02 and V11, and connect the T-adapter to each female side.
REMARK
If an abnormality is found, remove further the connector S25 to perform troubleshooting.</td></tr>
<tr><td rowspan="6">Resistance</td><td>Between CP02 (female) (96) and V11 (female) (1)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between V11 (female) (2) and each of CP02 (female) (115), (117) and (120)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between CP02 (female) (96) and S25 (female) (9)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between S25 (female) (2) and V11 (female) (1)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between S25 (female) (6) and each of CP02 (female) (115), (117) and (120)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between S25 (female) (5) and V11 (female) (2)</td><td>Max. 1 Ω</td></tr>
<tr><td>4</td><td>Defective pump controller</td><td colspan="3">If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).</td></tr>
</table>

CIRCUIT DIAGRAM (ENGINE PREHEATING SYSTEM)

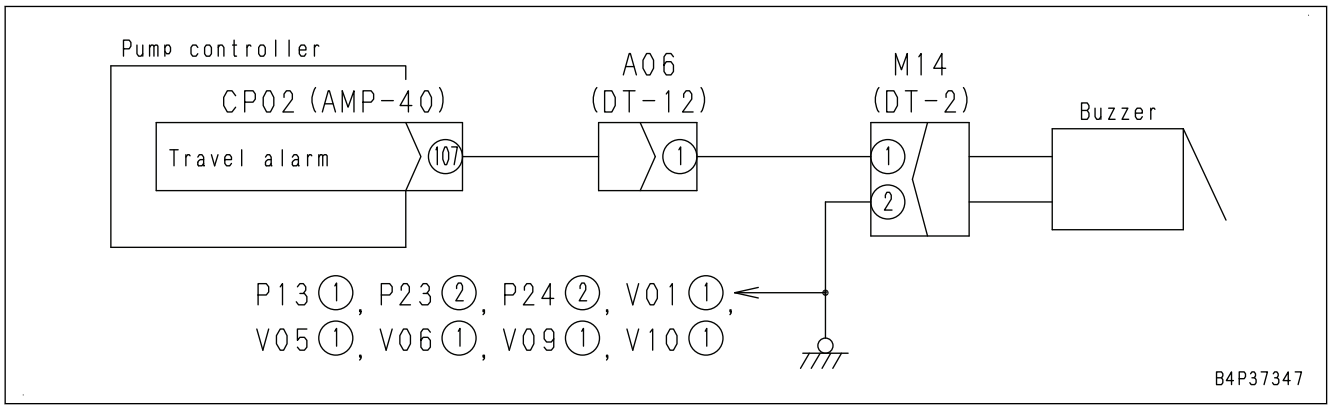


E-22 SOME AREAS OF MACHINE MONITOR SCREEN ARE NOT DISPLAYED

Failure	• Some areas of machine monitor screen are not displayed.
Related information	

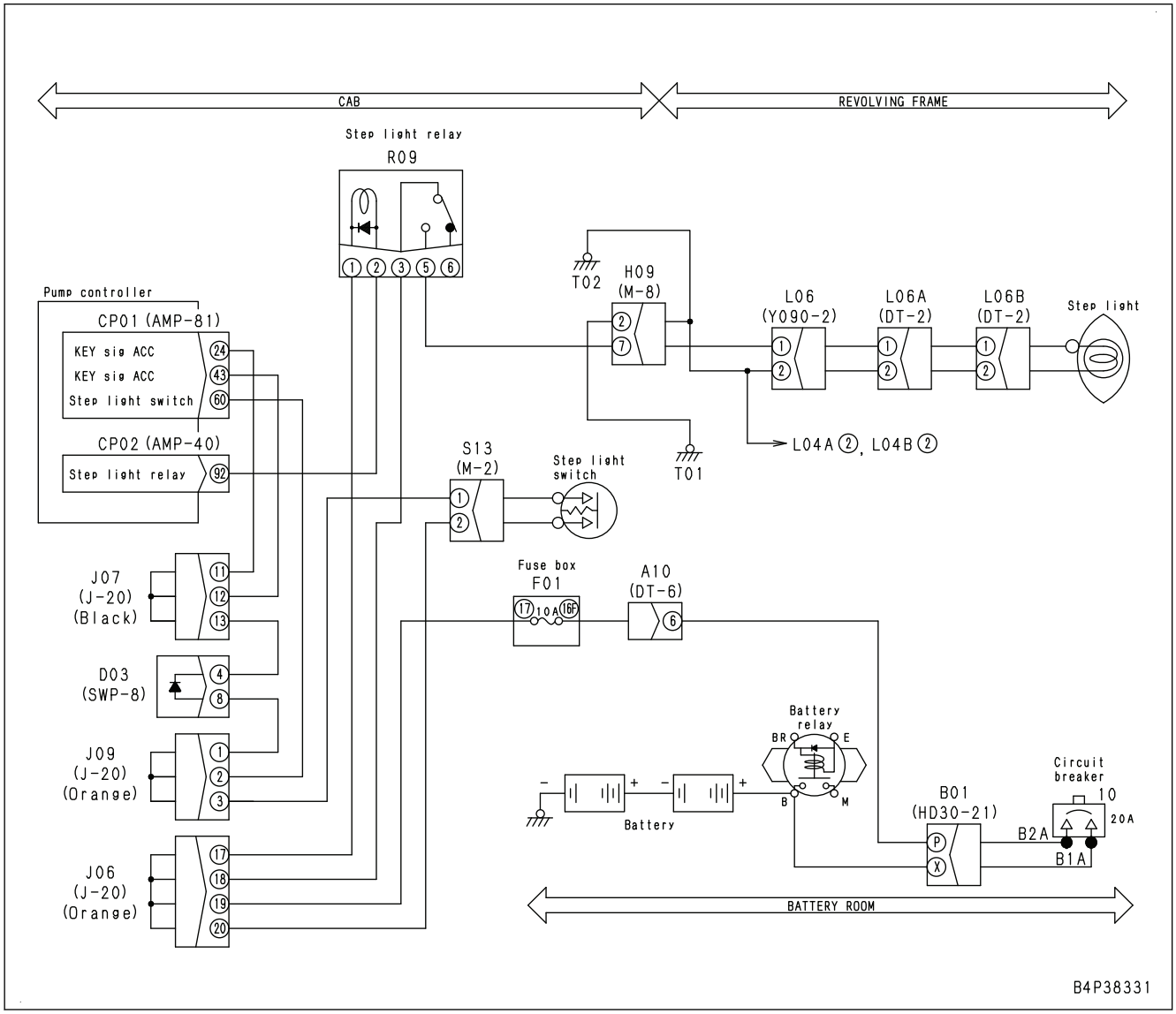
No.	Cause	Procedure, measuring location, criteria and remarks
1	Defective machine monitor (Liquid crystal display panel part)	Perform troubleshooting when starting switch is in ON position.
		When all the lights of liquid crystal display panel is on (entirely white) by the following switch operation, machine monitor is normal. • Switch operation: [4] + [F2] (Press them simultaneously.)
2	Defective machine monitor	If failure code still displays after above checks on Cause 1, machine monitor may be defective. (In case of an internal defect, troubleshooting is impossible as an assembly. Replace whole assembly.)

Circuit diagram related to travel alarm



No.	Cause	Procedure, measuring location, criteria and remarks		
8	Ground fault in wiring harness (contact with GND circuit)	1. Turn the starting switch to OFF position. 2. Remove the fuses No.16 to 20 in fuse box F01. 3. Disconnect the connectors B01, CP01, L06B, R09, S13, and D03, and connect the T-adapter to each female side.		
		Resistance	Between ground and either B01 (female) (P) or F01-16F	Min. 1 MΩ
			Between ground and any of F01-17, S13 (female) (2), R09 (female) (1), and (3)	Min. 1 MΩ
			Between ground and either R09 (female) (5) or L06B (female) (1)	Min. 1 MΩ
			Between ground and any of S13 (female) (1), D03 (female) (8), and CP01 (female) (60)	Min. 1 MΩ
9	Defective pump controller	If no failure is found by above checks, pump controller is defective. (Since this is an internal defect, troubleshooting cannot be performed).		

Circuit diagram related to step light relay



H-16 MACHINE PUSH-UP FUNCTION DOES NOT OPERATE

Failure	Boom speed or power is low.
Related information	• Machine push-up mode means the state that machine push-up switch is turned on. • Check that other work equipment, travel and swing operation are normal. (If they are not normal, perform the related troubleshooting.) • Check that there is no travel deviation. (If there is a travel deviation, perform the related troubleshooting.) • Perform all troubleshooting with working mode at P mode.

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Malfunction of machine push-up solenoid valve	Be ready with engine stopped, then perform the troubleshooting with engine at high idle.		
		Solenoid outlet pressure	When the machine push-up switch is turned off	Min. 2.74 MPa {Min. 28 kg/cm^2}
			When the machine push-up switch is turned on	0 MPa {0 kg/cm^2}
2	Malfunction of boom rebuilt valve (safety and suction valve)	Malfunction of safety and suction valve (high-pressure side) in boom rebuilt valve is suspected. Check it directly.		

S-3 FUEL IS BEING INJECTED BUT ENGINE DOES NOT START (MISFIRING: ENGINE CRANKS BUT DOES NOT START)

Failure	Fuel is being injected but engine does not start (misfiring: engine cranks but does not start).
Related information	If any failure code is displayed, perform troubleshooting for that code first.

No.	Cause	Point to check, remarks	Remedy
1	Defective battery	Gravity of electrolyte and voltage of battery are low.	Filling of battery electrolyte
2	Fuel level is low.	If fuel tank is checked, it is empty.	Refueling
3	Clogging fuel tank cap air bleeding hole	Fuel tank cap air bleeding hole is clogged.	Flush air breather hole in fuel tank cap surrounding area.
4	Clogged fuel filter element	Check used hours of fuel filter element. If it is used over specified time, fuel filter element may be clogged.	Fuel filter element replacement
5	Foreign materials are mixed into fuel.	If drain fuel from fuel tank, rust or water comes out.	Fuel replacement
6	Air mixed in fuel piping system	When performing bleeding air from the fuel system, air comes out. (For details, see Testing and adjusting, “Bleeding air from fuel system”).	• Perform air bleeding operation • Correct or replace fuel piping
7	Leakage from fuel piping system	Fuel leaks from fuel piping. (For details, see Testing and adjusting, “Test fuel circuit for leakage”).	Correct or replace fuel piping related parts
8	Defective priming pump	Priming pump has no or heavy resistance to operation.	Priming pump replacement
9	Clogged feed pump gauze filter	Clogged gauze filter	Gauze filter cleaning or replacement
10	Clogged air cleaner element	Air cleaner dust indicator is at caution level.	Air cleaner element check and cleaning
11	Defective intake air heater	• Installation part of intake air heater is not warmed during preheat operation. • Engine preheating monitor does not operate normally during preheat operation or when it is low temperature.	Intake air heater replacement
12	Worn valve, rocker arm, etc.	• Check valve clearance (Reference: See Testing and adjusting, “Testing and adjusting valve clearance”). • When engine is operated, unusual noise is heard from around cylinder head.	Valve or rocker arm replacement
13	Defective piston ring	Check compression pressure (Reference: See “TESTING AND ADJUSTING”, “Testing compression pressure”).	Piston ring and piston replacement
14	Defective injector (clogged injector, defective spray)	Perform cylinder cutout mode operation to identify cylinder that does not change in speed (see “TESTING AND ADJUSTING”, “HANDLING CYLINDER CUTOUT MODE OPERATION”).	Replace injector.
15	Defective engine controller	In case of an internal defect, troubleshooting is impossible as an assembly. Replace whole assembly.	Engine controller replacement

S-22 ACTIVE REGENERATION TAKES TIME

Failure	Active regeneration takes time.
Related information	• If any failure code is displayed, perform troubleshooting for that code first. • Since the time required for manual stationary regeneration depends on the accumulated soot level, see failure code CA2639.

No.	Cause	Point to check, remarks	Remedy
1	Defective operation of VGT	VGT may have a mechanical failure. Check it. If KDOC inlet temperature: approximately 250 °C or below and VGT solenoid current: approximately 1000 mA are kept after active regeneration for service, VGT is defective (See failure code CA2639 because approximate manual stationary regeneration time depends on the soot level estimation).	Replace VGT assembly (including hydraulic actuator and VGT position sensor)
2	Bad exhaust gas color	Remove plug of bore for measuring the exhaust gas color in front of KDPF, and check color of the exhaust gas coming out of the bore. (Reference: See TESTING AND ADJUSTING “TEST EXHAUST GAS COLOR”)	Perform troubleshooting for “Exhaust gas is black”
3	Defective regeneration for soot accumulation of fuel doser	Check of fuel doser	Fuel doser cleaning
4	Blocked KDOC when exhaust gas color is defective	If regeneration frequently is not improved after a corrective action for cause 2, KDOC is blocked.	KDOC cleaning
5	Coolant leakage to exhaust system	Check for lowering of coolant level.	Perform troubleshooting of “WATER MIXES INTO ENGINE OIL (MILKY)” in S mode, and take corrective action.
6	Blocked KCSF caused by coolant leakage to exhaust system	Check for clogged KCSF.	KCSF cleaning
7	Unspecified fuel is used.	Unspecified fuel is used.	Use recommended fuel described in Operation and Maintenance Manual.
8	Urea deposit (white deposit) is accumulated in the AdBlue/DEF mixing tube.	Check whether urea deposit is accumulated in the AdBlue/DEF mixing tube.	• Cleaning inside AdBlue/DEF mixing tube • Perform service regeneration.
9	Defective AdBlue/DEF injector	• Perform AdBlue/DEF injector injection amount test and detect any leakage. • Perform troubleshooting for failure code [CA3568] and [CA3582].	Replacement of AdBlue/DEF injector
10	Deteriorated KDOC by the use of non-designated fuel	Deteriorated KDOC by high sulfur content (If the check result does not correspond to cause 1 to 9 and regeneration time is not improved, KDOC is deteriorated.)	KDOC replacement
11	Blocked KDOC	If the check result does not correspond to cause 1 to 10 and regeneration time is not improved, KDOC is blocked.	KDOC cleaning

SPECIAL TOOLS LIST

How to read the tool list

- Part No.:
  Tools with part number 79*T-***-**** are not supplied (to be locally manufactured).
- Necessity:
  ■: Not substitutable, and work cannot be performed without the tool.
  ●: Tools extremely useful if available or tools that can be substituted with commercially available tool.
- New/Redesign:
  N: Tools with new part numbers, newly developed for this model.
  R: Tools, with advanced part numbers, developed by improving existing tools for other models.
  Blank: Tools already available for other models that can be used without any modification.
- Sketch:
  ○: Tools marked with ○ in the sketch column have the sketches.
  Sketches are introduced in “SKETCHES OF SPECIAL TOOLS”, and all sketches of “79*T-***-***” are described.

Tools to be used when removing and installing the supply pump assembly

Symbol	Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Remarks
A	Commercially available	Wrench type torque wrench	●	1			Tightening of sleeve nut

Tools to be used when removing and installing the cylinder head assembly

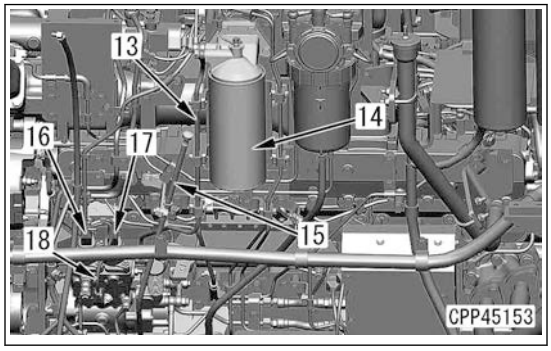
Symbol	Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Remarks
A	Commercially available	Wrench type torque wrench	●	1			Tightening of sleeve nut
B	Commercially available	L-shaped bar	●	1			Removal of injector assembly
C	Commercially available	Eyebolt	●	2			Removal and installation of cylinder head
D	790-331-1110	Wrench	■	1			Bolt angle tightening

Tools to be used when removing and installing the cooling fan motor assembly

Symbol	Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Remarks
A	Commercially available	Puller	●	1			Removal of cooling fan motor assembly

Tube, EGR oil tube

13. Disconnect the fuel tube (13).
14. Remove the bolts (4 pieces), and remove the fuel filter assembly (14).
15. Remove the dipstick pipe (15).
16. Disconnect the connectors PCV1 (16), PCV2 (17), and G (18).

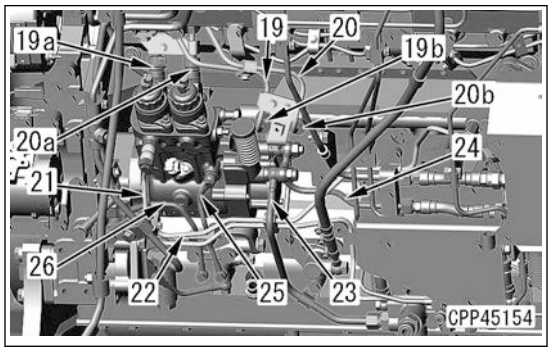


Fuel high-pressure pipe

17. Remove the fuel spray prevention caps (19a), (19b), (20a), and (20b) of the fuel high-pressure pipes (19) and (20), loosen the sleeve nut, and disconnect the fuel high-pressure pipes (19) and (20).

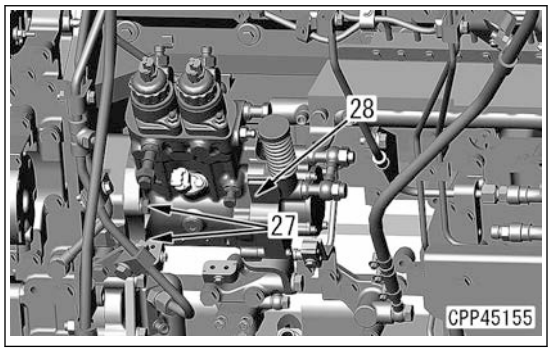
    REMARK

    Loosen the sleeve nut on the common rail side, as well.
18. Disconnect the fuel tubes (21), (22), (23), and (24).
19. Disconnect the oil tubes (25) and (26).



Supply pump assembly

20. Remove the bolts (27) (4 pieces), and remove the supply pump assembly (28).



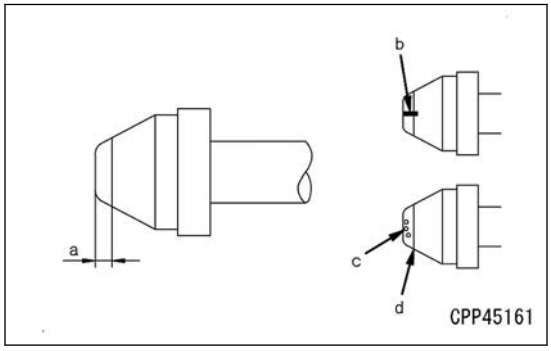
METHOD FOR INSTALLING SUPPLY PUMP ASSEMBLY

Checking for the fuel high-pressure pipe connecting parts

1. Check for the fuel high-pressure pipe connecting parts according to the following.

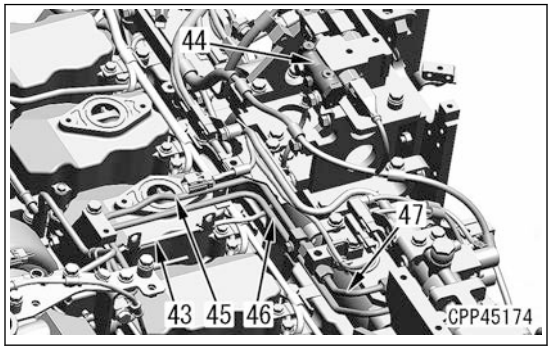
    NOTICE

    - **Do not bend the fuel high-pressure pipes to correct before installing.**
    - **Check the following conditions of the fuel high-pressure pipe before installing the pipe. If the high-pressure pipe has any defect, replace it with a new one since fuel may leak.**
    - **Visually check that the taper seal part (a) of the connection part (2 mm area from the tip-end) is free from longitudinal slits (b) or spotty dents (c).**
    - **Make sure that the part (d) (the end of the taper seal: 2 mmfrom the tip-end) is free from steps you can feel by your fingernails (free from fatigue).**



Fuel tube

30. Remove the clamps (8 places), remove the joint of the fuel tube (43), and then remove the relief valve (44) and fuel tube (43).
31. Remove the clamp (1 place), remove the oil spray prevention caps installed to VGT side of VGT oil tubes (45) and (46), loosen the sleeve nut, and remove VGT oil tubes (45), (46), and (47).

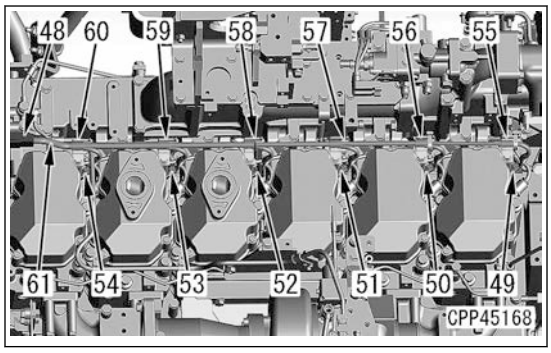


EGR cooler assembly

32. Remove EGR cooler assembly. See “REMOVE AND INSTALL EGR COOLER ASSEMBLY”.

Connector

33. Disconnect the connector INJ (48).
34. Disconnect the connectors CN1 (49), CN2 (50), CN3 (51), CN4 (52), CN5 (53), and CN6 (54) on the injector side.
35. Remove the wiring harness brackets (55), (56), (57), (58), (59), and (60), and remove the injector relay harness (61).



EGR valve

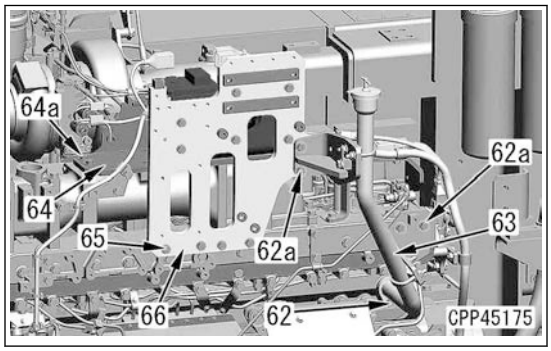
36. Remove EGR valve assembly by referring to “REMOVE AND INSTALL EGR VALVE ASSEMBLY”.

Oil filler pipe

37. Remove the bolt (62) (1 piece) on the cylinder block side and clamp bracket mounting bolts (62a) (4 pieces), and remove the oil filler pipe (63).
38. Remove the bolts (64a) (10 pieces), and remove the bracket (64).
39. Remove the bolts (6 pieces), and remove the fuel filter bracket (66) together with the dosing fuel solenoid valve as a unit.

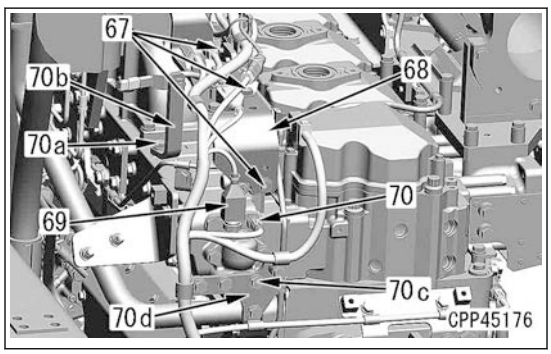
    REMARK

    Remove the clip fixed to the fuel filter bracket (66).



Connector, bracket

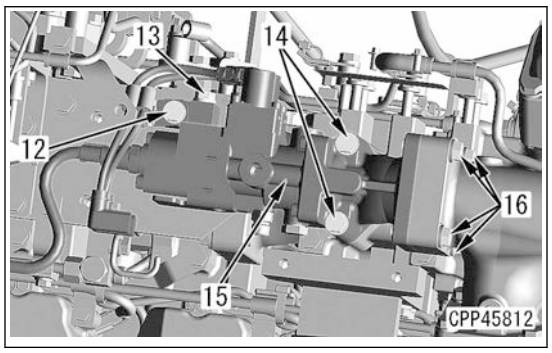
40. Remove the bolts (67) (3 pieces), and remove the bracket (68).
41. Disconnect the connectors PIM (69) and TIM (70).
42. Remove the bolt (70a) (1 piece), and remove the bracket (70b).
43. Remove the bolts (70c) (2 pieces), and remove the bracket (70d).



METHOD FOR INSTALLING EGR VALVE ASSEMBLY

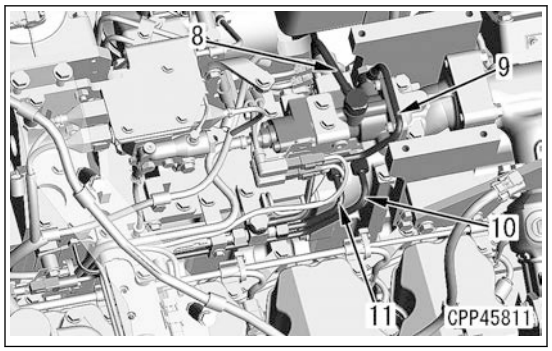
EGR valve assembly

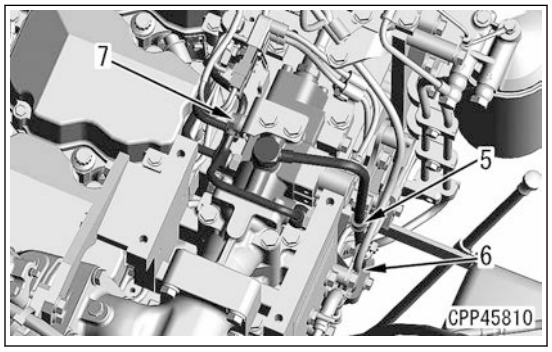
1. Install EGR valve assembly (15) with the bolts (14) (2 pieces) and bolts (16) (4 pieces).
2. Install the bolts (12) and (13).



Oil tube

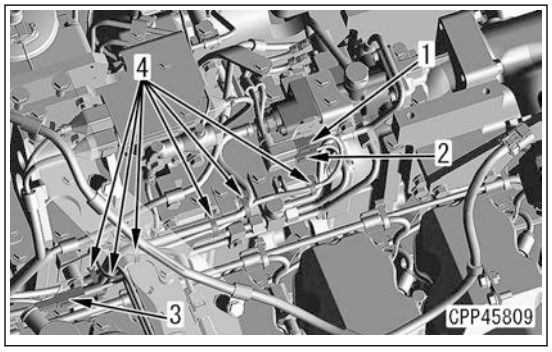
3. Connect the oil tubes (8), (9), (10) and (11).
   - Oil tubes (10) and (11): 24 to 27 Nm {2.4 to 2.7 kgm}
   - Oil tube (9) (EGR valve side): 34.3 to 44.1 Nm {3.5 to 4.5 kgm}
   - Oil tube (9) (air vent block side): 24.5 to 34.3 Nm {3.5 to 4.5 kgm}
   - Joint of oil tube (8): 34.3 to 44.1 Nm {3.5 to 4.5 kgm}
4. Install the clamps (5), (6), and (7).





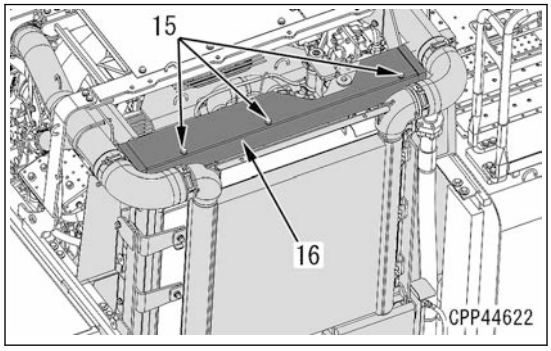
Connector

5. Bind the cable ties (4) (6 places) to the marked positions when disassembling.
6. Connect the solenoid connectors EGR-SOL (1), VGT-SOL (2), and SEGR (3).

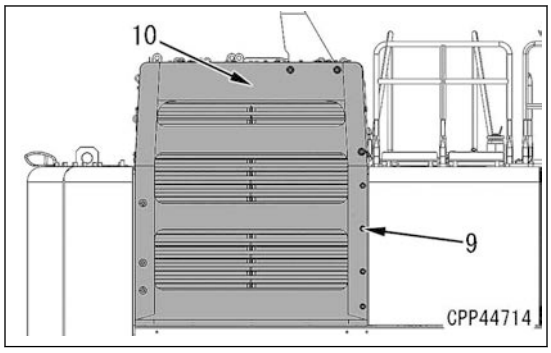


Cover

8. Install the cover (16) with the bolts (15) (3 pieces).

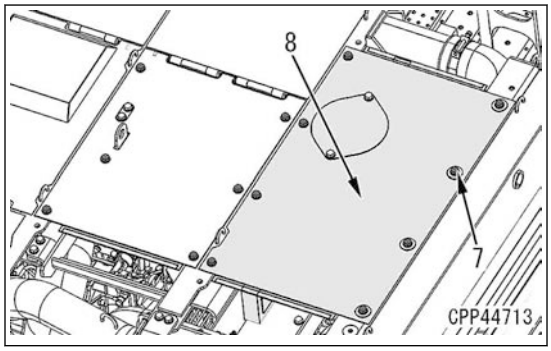


9. Close the cover (10), and install the bolts (9) (7 pieces).

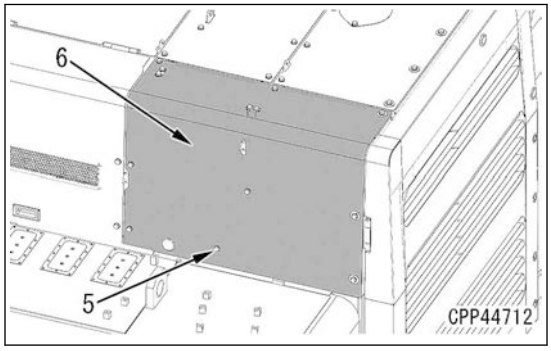


R.H. engine hood

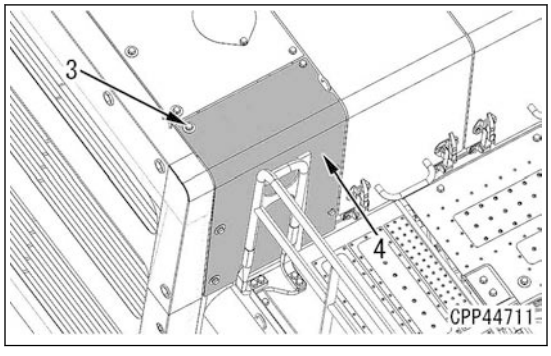
10. Install the cover (8) with the bolts (7) (8 pieces).



11. Install the cover (6) with the bolts (5) (9 pieces).



12. Install the cover (4) with the bolts (3) (6 pieces).



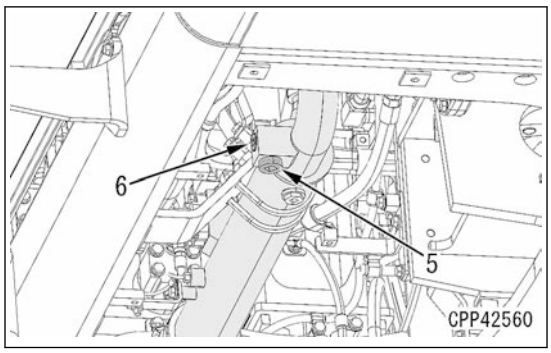
5. Remove the plug (5), loosen the valve (6), and drain the hydraulic oil.

   Hydraulic oil:

   360 ℓ (Specified level520 ℓ)

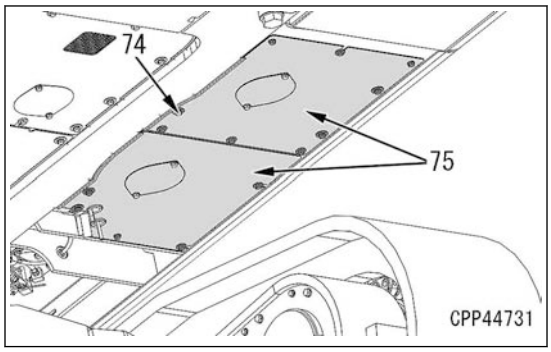
   REMARK

   After draining the hydraulic oil, install the plug (5), and tighten the valve (6).



Draining the coolant

6. Remove the bolts (74) (14 pieces), and remove the undercovers (75) (2 places).



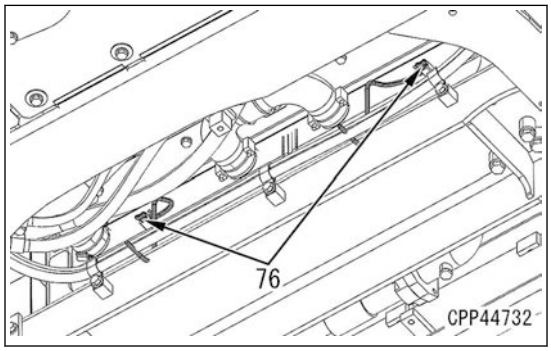
7. Open the drain valve (76), and drain from the radiator.

   REMARK

   After draining is completed, close the drain valve (76).

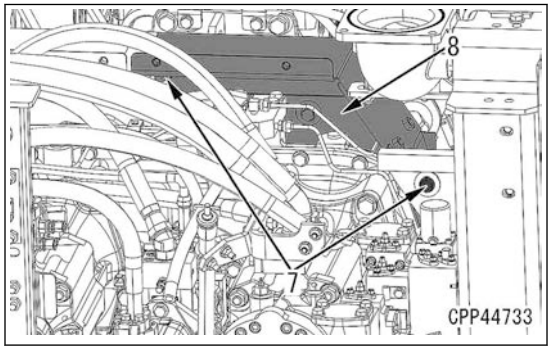
   Radiator:

   76 ℓ

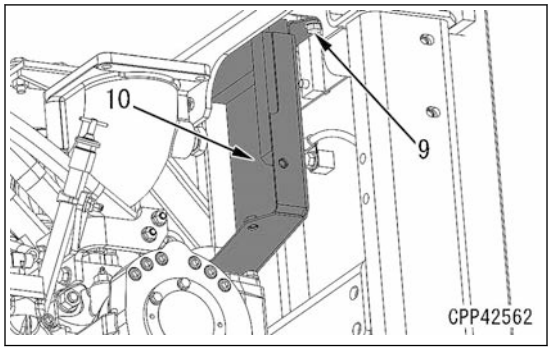


Partition plate, frame

8. Remove the bolts (7) (2 pieces), and remove the partition plate (8).

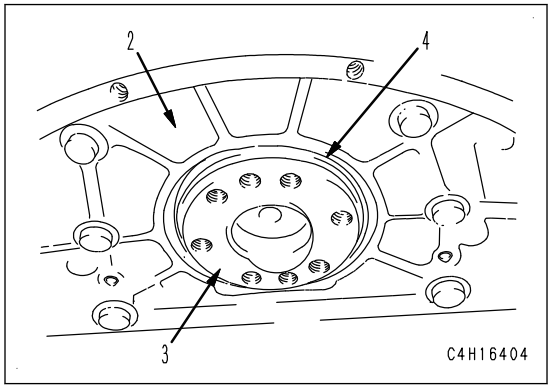


9. Remove the bolts (9) (2 pieces), and remove the partition plate (10).



Engine rear oil seal

5. Remove the engine rear oil seal (4)



- When a hook type seal puller is used
  1) Change the tip of the seal puller (J) to the hook type, and hook it to the outer case (a) of the engine rear oil seal (4).
  2) Pull the slide hammer (SH) of the seal puller (J) toward you, and remove the engine rear oil seal (4) by using impact force.
  3) Slightly drive in the engine rear oil seal (4) to unstick it from the flywheel housing (2) before pulling off the engine rear oil seal (4).

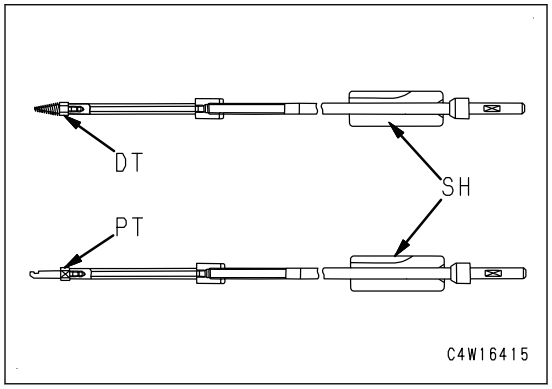
  REMARK

  - Take care not to damage the contact surfaces of the oil seal between the flywheel housing (2) and crankshaft (3).
  - If it is difficult to remove the engine rear oil seal (4), remove it according to the following procedure.

- When a drill type seal puller is used
  1) Drill the several holes of approximately 3 mm in diameter on the rear seal (4).

  REMARK

  Remove chips completely.
  2) Change the tip of the seal puller (J) to the drill type, and insert it in the hole made in previous section.
  3) Pull the slide hammer (SH) of the seal puller (J) toward you, and remove the engine rear oil seal (4) by using impact force.



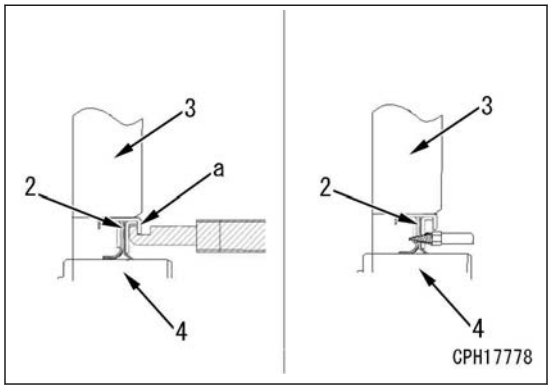
  REMARK

  Perform this operation evenly at several places so that the engine rear oil seal (2) is not tilted.

- Removing the sleeve of sleeved oil seal
  1) Remove the seal part (2) with the push tool (A) according to previous sections 1) and 2).
  2) Cut the sleeve (7) and remove it by using a chisel and a hammer.
  3) Select the puller type (PT) for the tip of the seal puller (J).
  4) Hook the tip of the seal puller (J) on the metal ring of rear seal, and pull it out by using the impact force of the slide hammer (SH).

  REMARK

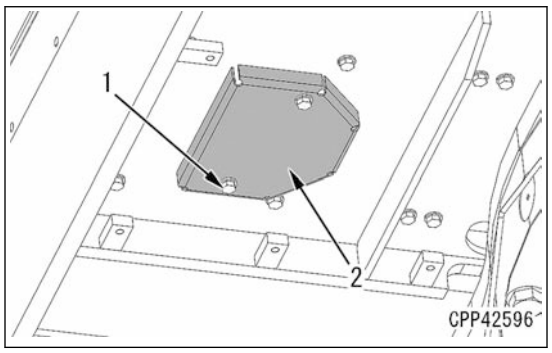
  Be careful not to damage the crankshaft (3).



METHOD FOR REMOVING AdBlue/DEF TANK ASSEMBLY

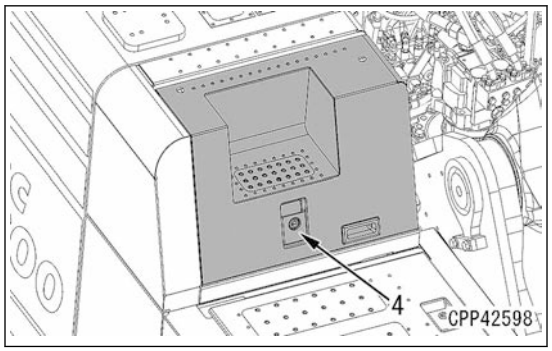
Draining AdBlue/DEF

1. Swing the machine body in the right or left 90 °, remove the bolts (1) (2 pieces), and remove the cover (2).

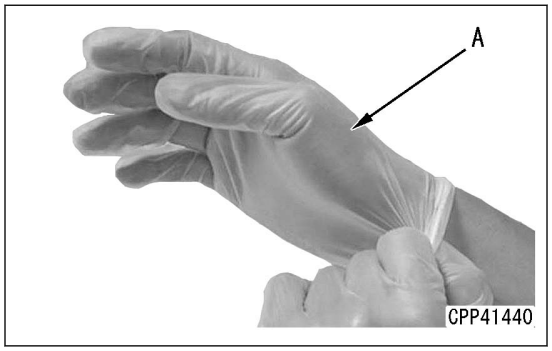


Cover

2. Open the cover (4).
3. Drain AdBlue/DEF according to the following procedure.

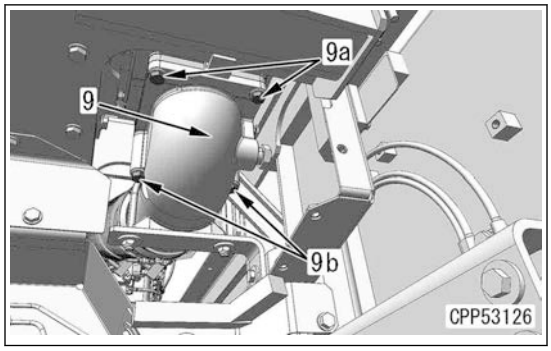


1) Put on the gloves (A).



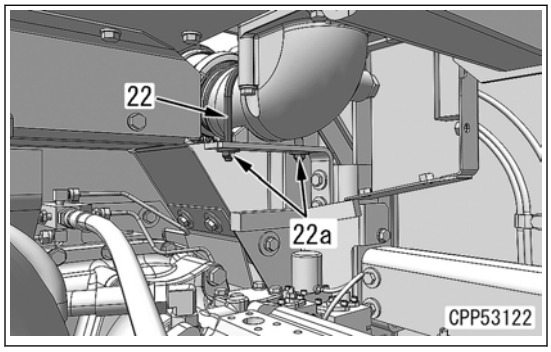
23. Tighten KDPF-side piping (9) to the specified torque with the bolts (9a) (2 pieces) and (9b) (2 pieces).

    Bolts (9a), (9b):
    78.5 to 88.3 Nm {8 to 9 kgm}

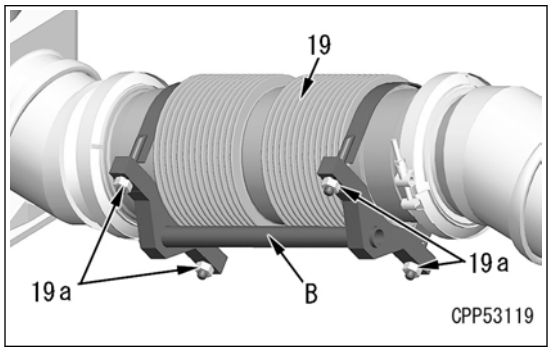


24. Tighten U-bolt (22) to the specified torque with the nuts (22a) (2 pieces).

    Nut (22a):
    14.7 to 19.6 Nm {1.5 to 2 kgm}

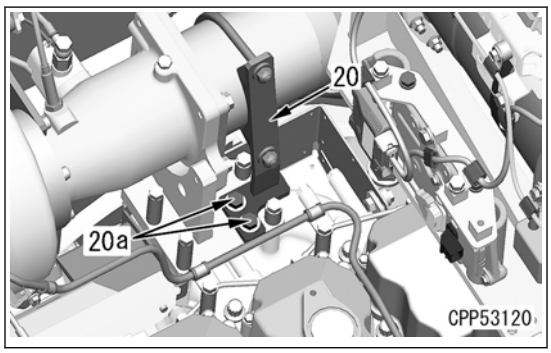


25. Remove the nut (19a), and remove the restraint jig (B).



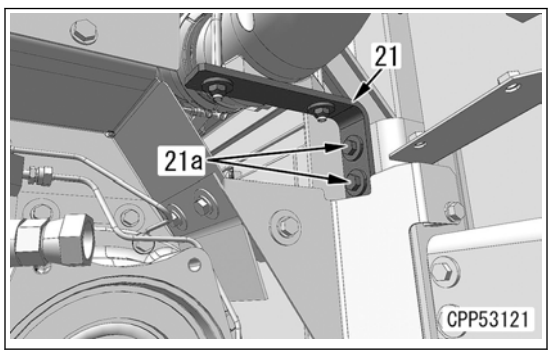
26. Tighten the bracket (20) to the specified torque with the bolts (20a) (2 pieces).

    Bolt (20a):
    98 to 123 Nm {10.0 to 12.5 kgm}

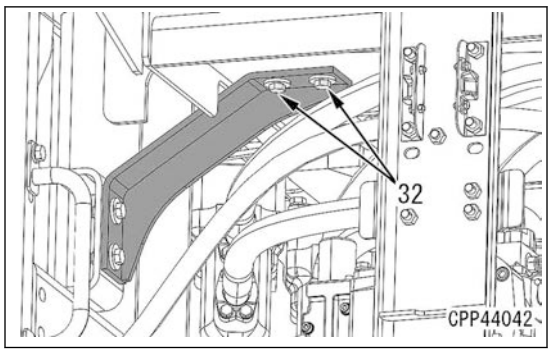


27. Tighten the bracket (21) to the specified torque with the bolts (21a) (2 pieces).

    Bolt (21a):
    98 to 123 Nm {10.0 to 12.5 kgm}

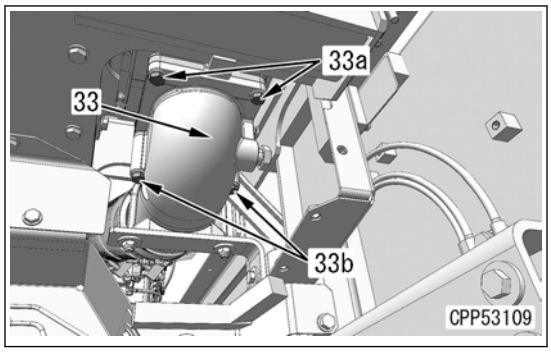


26. Remove the bolts (32) (2 pieces).



Bellows pipe

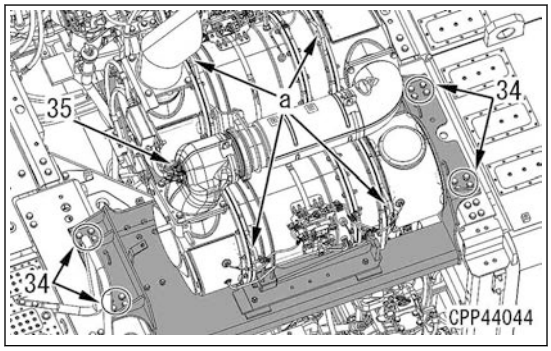
27. Remove the bolts (33a) and (33b), and remove the pipe (33) on the KDPF side.



KDPF and SCR assembly

28. Install the lifting tool to the slinging positions (a).
29. Remove the bolts (34) (16 pieces), and remove KDPF and SCR assembly (35).

    KDPF and SCR assembly (35):
    460 kg



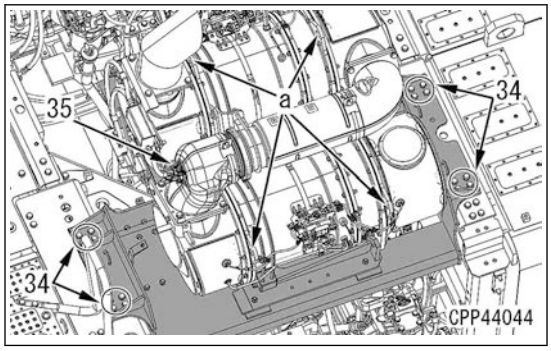
METHOD FOR INSTALLING KDPF, SCR ASSEMBLY

KDPF and SCR assembly

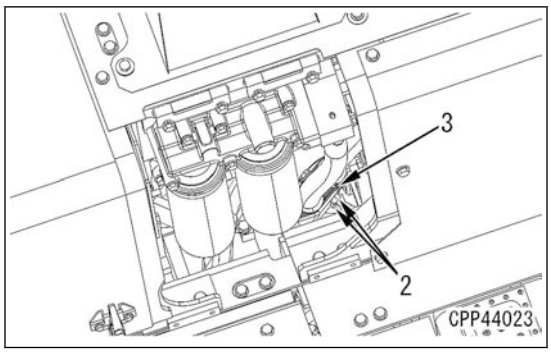
1. Install the lifting tool to the slinging positions (a), and set KDPF and SCR assembly (35) on the installing position.
2. Install KDPF and SCR assembly (35) with the bolts (34) (16 pieces).

    KDPF and SCR assembly (35):
    460 kg

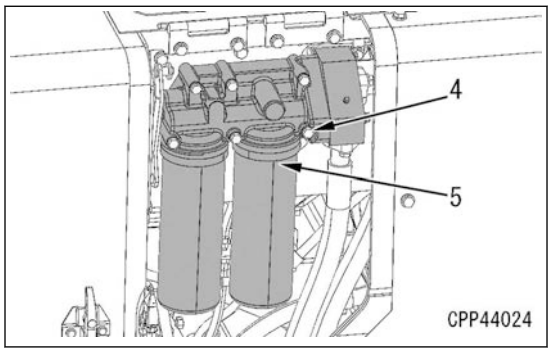
    Bolt (34):
    98 to 122.5 Nm {10 to 12.5 kgm}



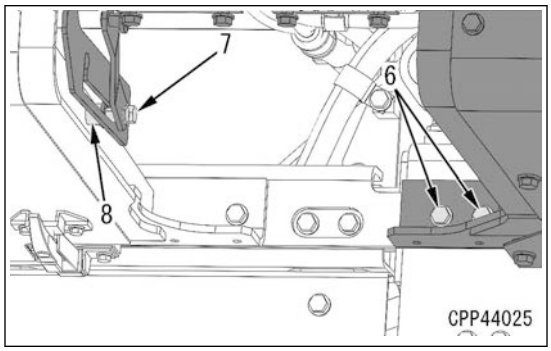
2. Remove the bolts (2) (2 pieces), and remove the clamp (3).



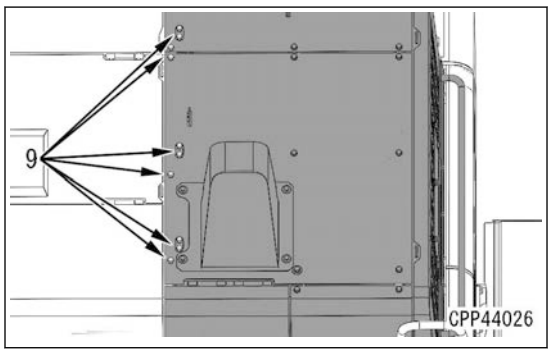
3. Remove the bolts (4) (6 pieces), and move the engine oil filter (5) aside so that it does not hinder the work.



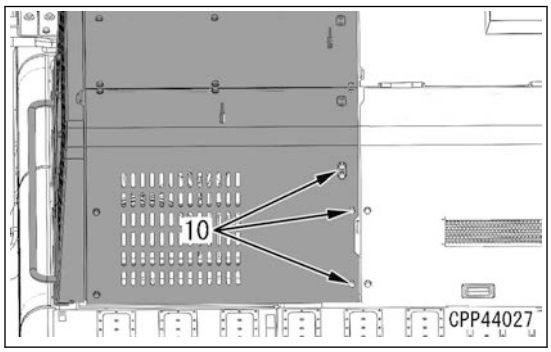
4. Remove the bolts (6) (2 pieces).
5. Remove the bolt (7) and spacer (8).



6. Remove the bolts (9) (10 pieces).



7. Remove the bolts (10) (4 pieces).

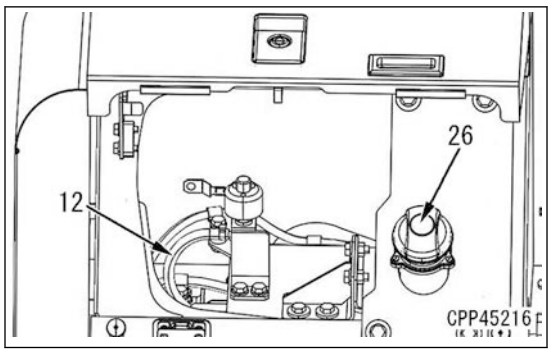


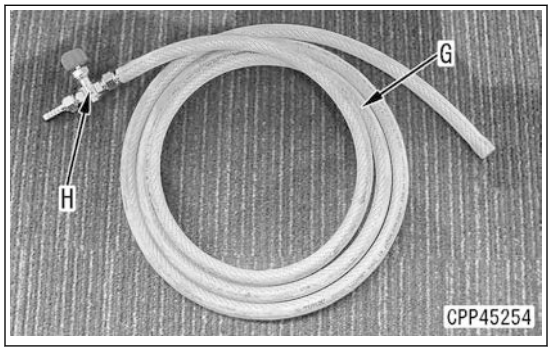
2) Disconnect the breather hose (12), and connect the vinyl hose (G).

REMARK

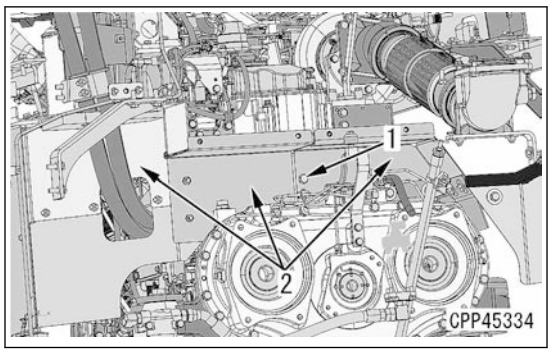
Be sure to close the fitting with valve (H) when connecting the vinyl hose (G).

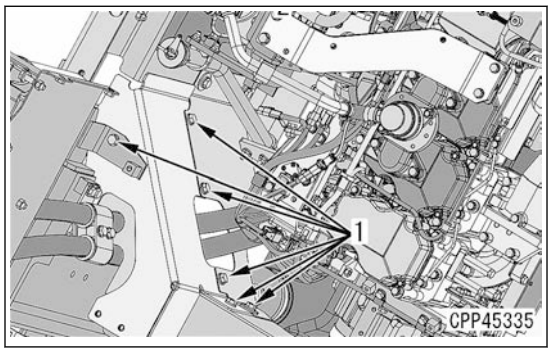
3) Check that the cap (26) is securely closed.





7. Install the covers (2) (3 places) with the bolts (1) (7 pieces).





Hydraulic pump assembly

8. Install the hydraulic pump assembly. See “REMOVE AND INSTALL HYDRAULIC PUMP ASSEMBLY”.

Refilling PTO case with oil

9. Tighten the drain plug, and refill it with Komatsu genuine oil to the specified level through the oil filler port. (For details, see STRUCTURE AND FUNCTION, “TABLE OF FUEL, COOLANT, AND LUBRICANTS”.)

PTO case:
7.2 ℓ

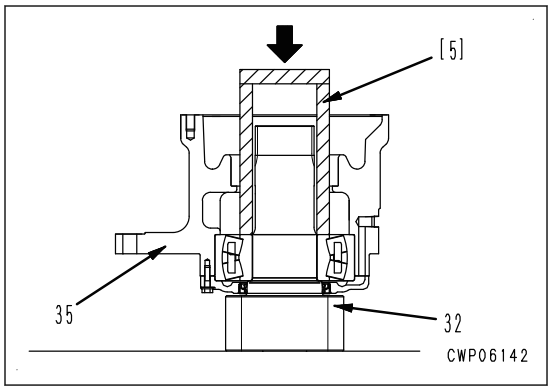
Bolt (28):
66.2±7.4 Nm {6.75±0.75 kgm}

Case assembly

4. Set the shaft (32) to the case assembly (35), and press fit the bearing inner race part by using the push tool (G).

   REMARK

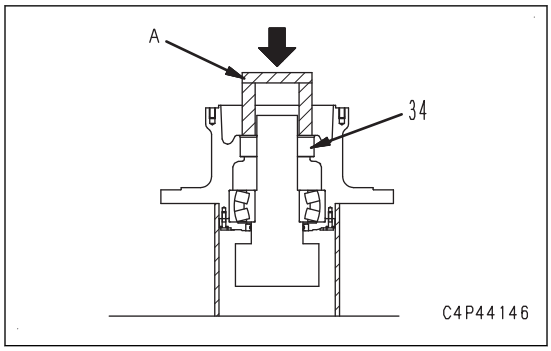
   Take extreme care not to damage the oil seal when setting the case assembly (35) to the shaft (32).



5. Press fit the bearing (34) by using the push tool (A).

   REMARK

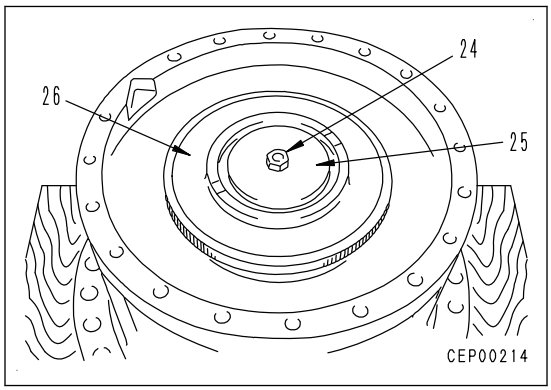
   - Press fit the bearing (34) by pressing the bearing inner race and outer race simultaneously. Do not press only the inner race part to press fit.
   - After press fitting the bearing (34), check that the case assembly (35) rotates smoothly.



6. Install the gear (26) and holder (25), and tighten the bolt (24).

   Bolt (24):
   Liquid adhesive (LT-2)

   Bolt (24):
   179 to 196 Nm {16 to 20 kgm}

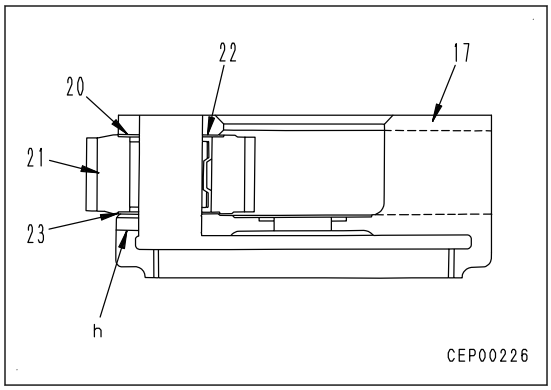


No.2 carrier assembly

7. Assemble No. 2 carrier assembly according to the following procedure.

   REMARK

   There is a punch mark made during pin insertion on the end surface of the carrier side hole (h). Remove protrusions to the hole inside diameter of the punch mark in advance.

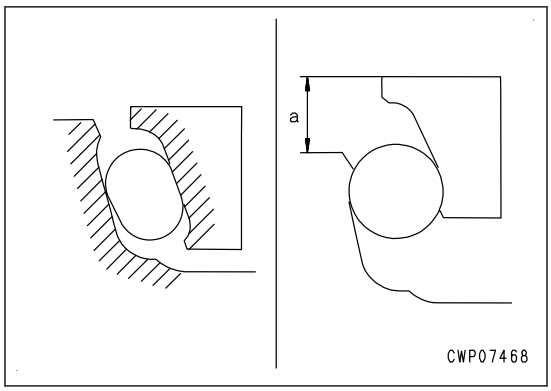


NOTICE

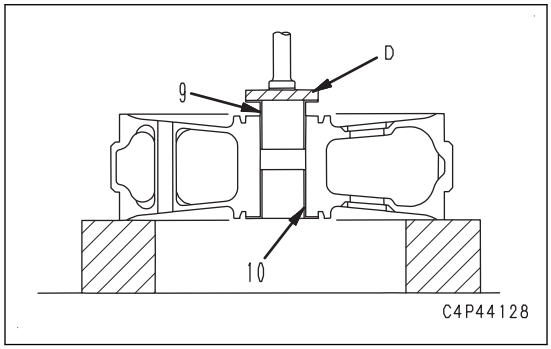
- **When installing the floating seal, clean the contact surfaces (hatched area) of O-ring and floating seal, and completely degrease and dry them.**
- **Also, take care that dirt dose not stick to the floating seal contact face.**

REMARK

After inserting the floating seal, check that the tilt of the seal is 1 mm or less and protrusion dimension (a) of the seal is within the range of 9 to 11 mm.



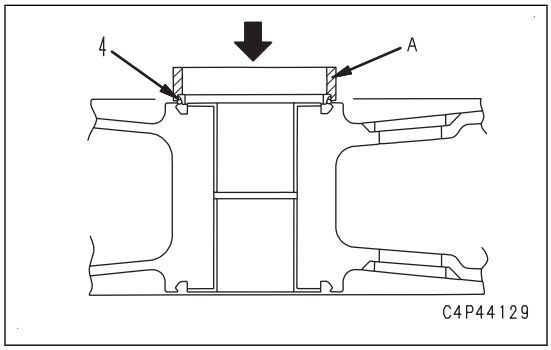
2. Press fit the bushings (9) and (10) into the idler by using the plate (D).



3. Install the floating seal (4) to the idler by using the installer (A).

REMARK

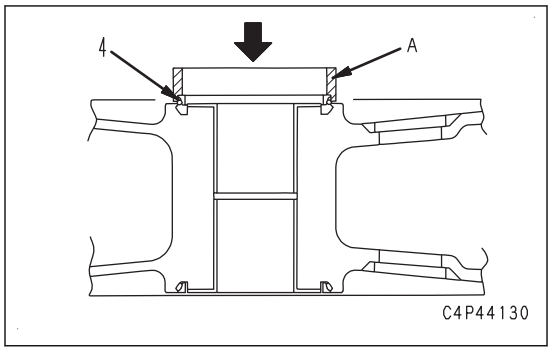
For installation of the floating seal, see the precautions in step 1.



4. Invert the idler, and install the floating seal (4) by using the installer (A).

REMARK

For precautions for installing the floating seal, see step 1.

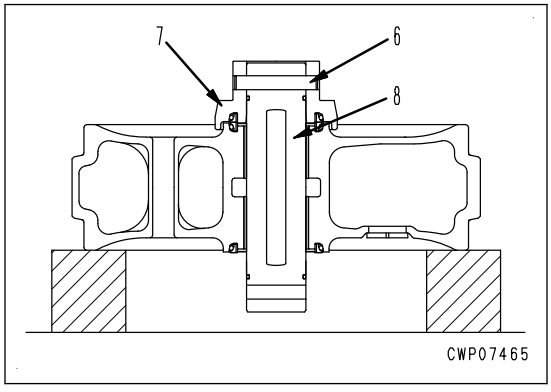


5. Install the shaft (8) to the idler.
6. Install the support (7) to the shaft.

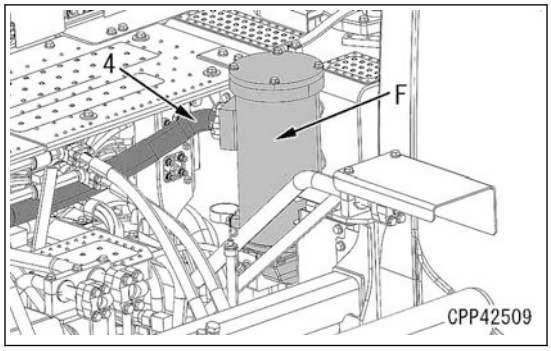
REMARK

Align the pin hole of the shaft with that of the support for installation.

7. Install the pin (6), and fix the support (7).

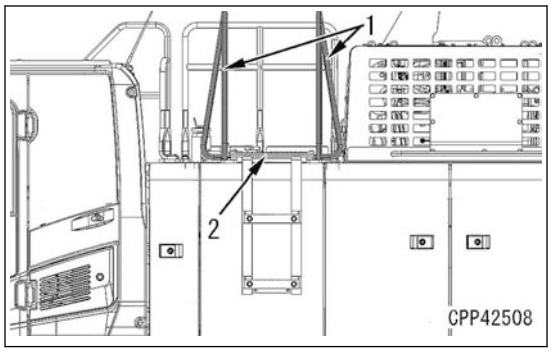


9. Connect the hose (4) to the hydraulic oil filter (F).



Handrail

10. Install the plate (2).
11. Install the handrail (1).



Refilling with hydraulic oil

12. Refill the hydraulic tank with Komatsu genuine oil to the specified level through the oil filler port. Start the engine to circulate the oil through the piping, and check the oil level again. (For details, see STRUCTURE AND FUNCTION, “TABLE OF FUEL, COOLANT, AND LUBRICANTS”.)

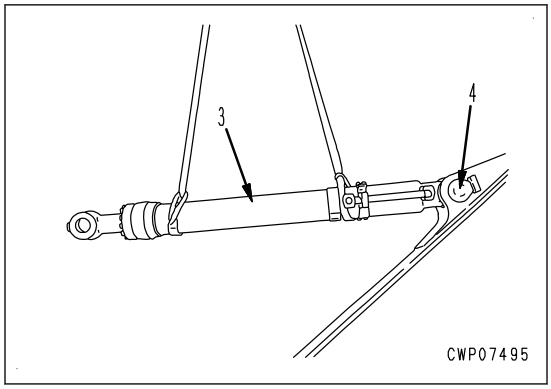
    Hydraulic tank:

    360 ℓ (Specified level520 ℓ)

Air bleeding

13. Bleed air from the hydraulic circuit. See TESTING AND ADJUSTING, “BLEED AIR FROM HYDRAULIC CIRCUIT”.

5. Sling the bucket cylinder assembly (3), hold it, remove the pin (4) on the bottom side, and remove the bucket cylinder assembly.



REMARK

Write down the quantity of the shims installed on the right side in advance.

Pin (4):
25 kg

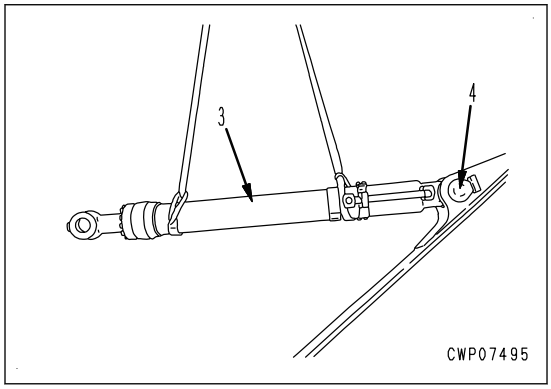
Bucket cylinder assembly (3):
480 kg

METHOD FOR INSTALLING BUCKET CYLINDER ASSEMBLY

⚠ Never insert your fingers into the pin holes when aligning their positions.

Bucket cylinder assembly

1. Sling the bucket cylinder assembly (3), hold it, and install the bucket cylinder assembly with the pin (4) on the bottom side.



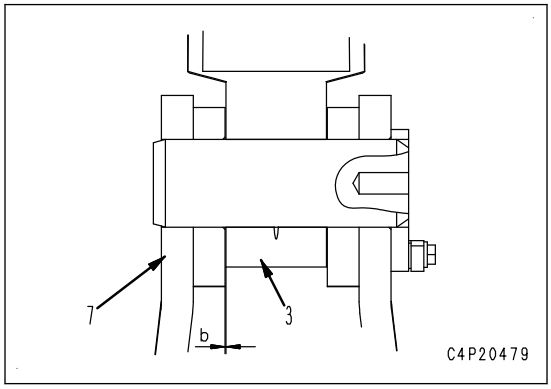
Pin (4):
25 kg

Bucket cylinder assembly (3):
480 kg

NOTICE

Adjust the clearance (b) between the bottom end surface of the cylinder (3) and bracket (7) to 1 mm or less by using shims.

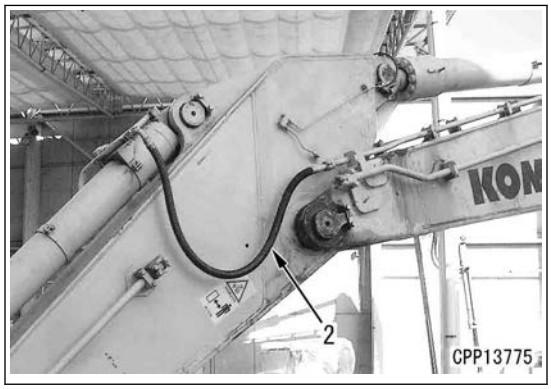
Shim thickness: 0.8 mm



Inner surface of pin hole:
Molybdenum disulfide lubricant (LM-P)

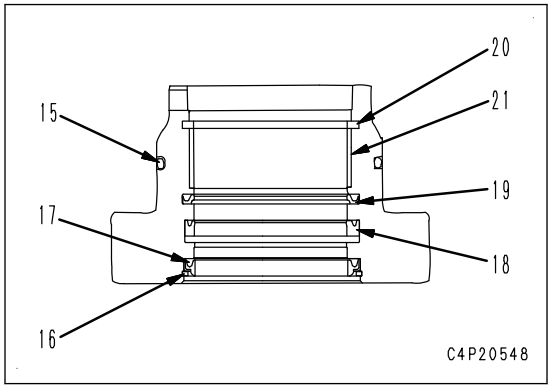
Greasing after assembling pin:
Molybdenum disulfide grease (LM-G)

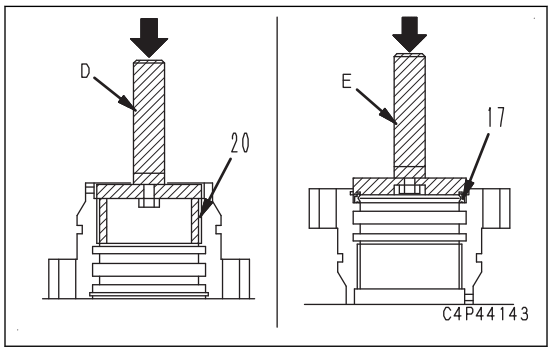
2. Install the hoses (2) on the right and left sides.



Assembling the cylinder head assembly

1. Press fit the bushing (21) by using the push tool kit (D).
2. Install the snap ring (20).
3. Install the buffer ring (19) and rod packing (18).
4. Install the dust seal (17) by using the push tool kit (E), and fix it with the snap ring (16).
5. Install the backup ring and O-ring (15).



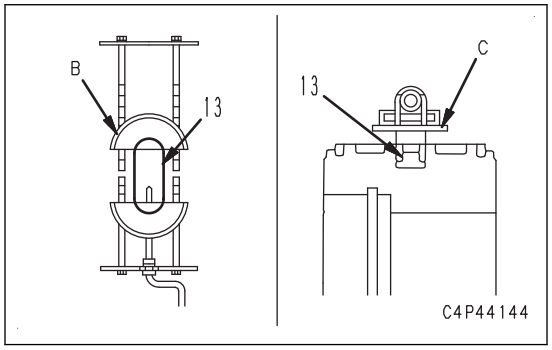


Assembling the piston assembly

6. Expand the piston ring (13) by using the expander (B).

   REMARK

   Set the piston ring on the clamp (C), and then rotate the handle by 8 to 10 turns to expand it.
7. Set the ring (C), and compress the piston ring (13).



8. Install the backup ring (14) and O-ring.
9. Install the wear ring (12).

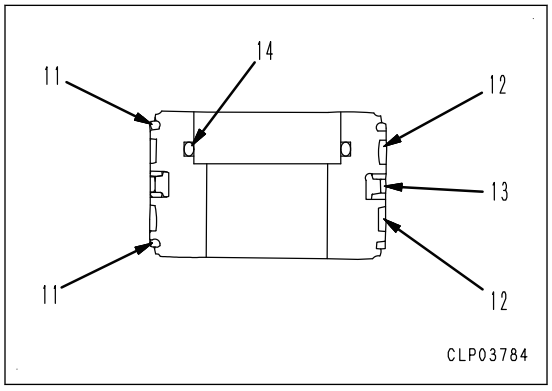
   Bucket, boom cylinder: 2 pieces

   Arm cylinder: 4 pieces
10. Install the ring (11).

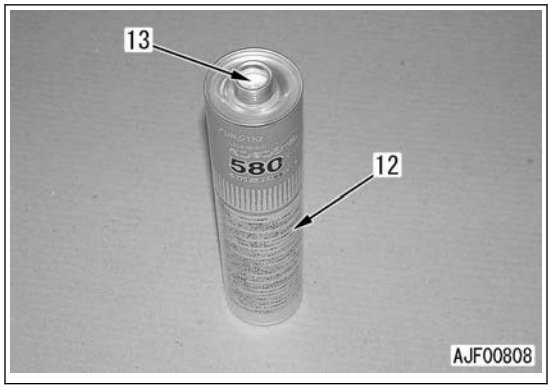
    REMARK

    Take care not to expand the ring abutment joint part excessively.
11. Apply grease to the groove of the ring (11).

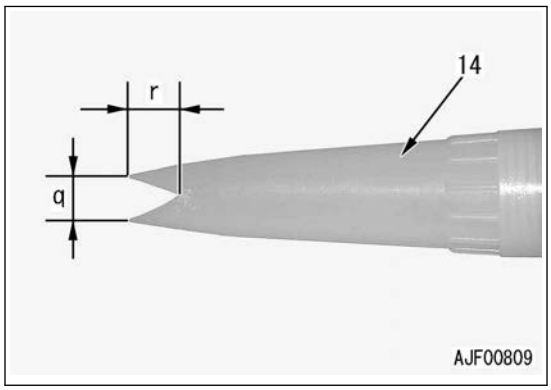
    Ring groove:
    Grease (G2-LI)



1) Break the aluminum dehumidification film (13) at the mouth of the adhesive cartridge (12), and attach the nozzle.



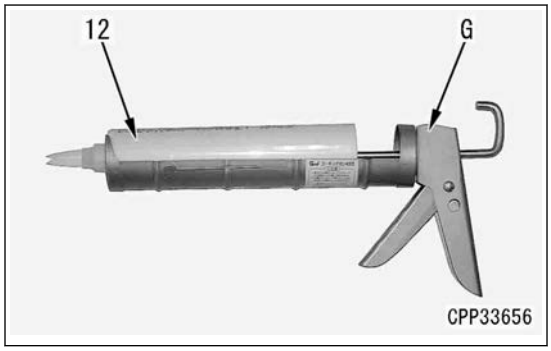
2) Cut the tip of the adhesive nozzle (14) to the dimensions (q) and (r) as shown in the figure.
(q): 10 mm
(r): 15 mm



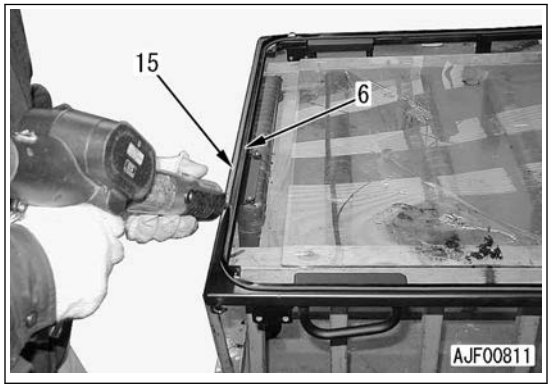
3) Set the adhesive cartridge (12) on the caulking gun (G).

REMARK

A better workability is obtainable from an electrical power caulking gun.



4) Remove the protective tape on the glass-bonding side of dam rubber.

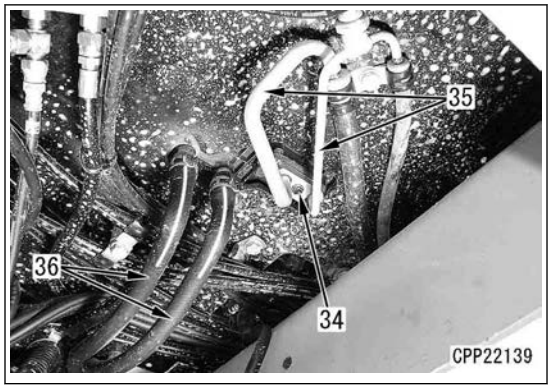


5) Apply the adhesive (15) to the outside of the dam rubber (6) on the operator's cab.

REMARK

Apply the adhesive (15) to the dam rubber (6) of the operator's cab (8) according to the dimensions (s) and (t) shown in the drawing.
(s): 10 mm
(t): 15 mm

2. Connect the heater hoses (36) (2 pieces).



NOTICE

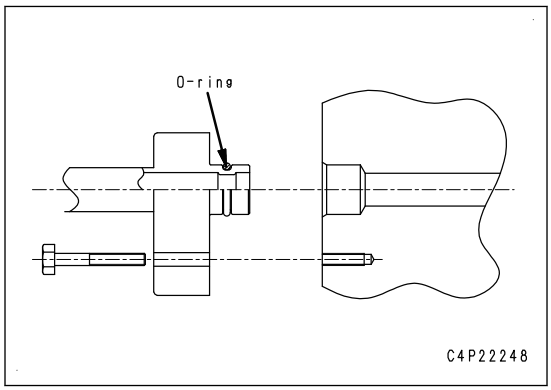
Connect the heater hose (36) so that the white and red lines (marks) become straight lines to avoid any twist of the heater hose.

3. Connect the tubes (35) (2 pieces), and install the bolt (34).

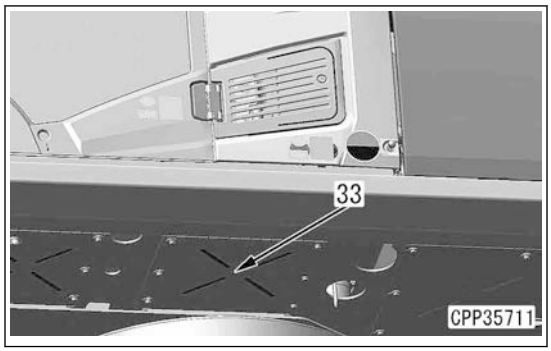
Bolt (34):
8 to 12 Nm {0.8 to 1.2 kgm}

NOTICE

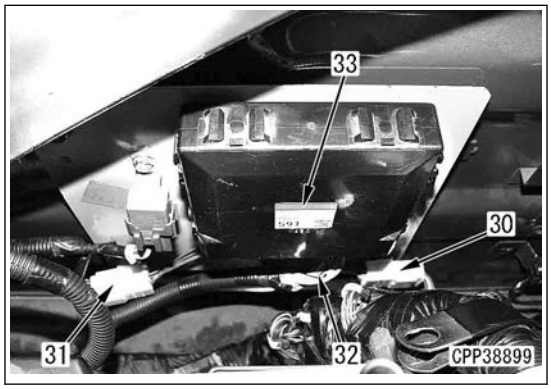
- **When connecting the air conditioner piping, be careful so that dirt, dusts and water do not enter the hose.**
- **Check that O-ring is installed to the connecting part of the air conditioning piping before connecting.**
- **Do not reuse O-ring because it is deformed and deteriorated if it is used once.**
- **When removing O-ring, use a cloth, etc. so that the piping is not damaged.**
- **Check that O-ring is not damaged or deteriorated.**
- **Apply the compressor oil (DENSO: ND-OIL8) for refrigerant (R134a) to O-ring.**



4. Install the undercover (33).



5. Connect the connectors AC01 (30), AC02 (31), and AC04 (32) of the air conditioner controller (33).



ELECTRICAL SYSTEM

REMOVE AND INSTALL ENGINE CONTROLLER ASSEMBLY

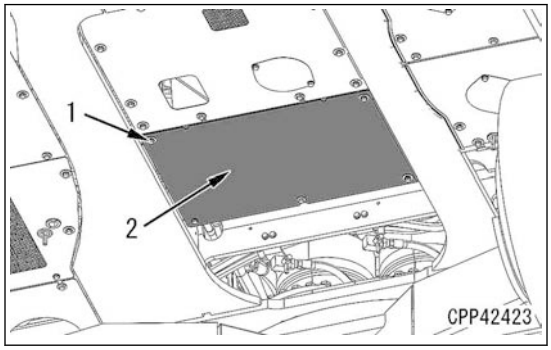
⚠ **Place the machine on a level ground, and set the lock lever to LOCK position.**

⚠ **Stop the engine, turn the battery disconnect switch to OFF position, and remove the key. (For details, see TESTING AND ADJUSTING, "HANDLE BATTERY DISCONNECT SWITCH".)**

METHOD FOR REMOVING ENGINE CONTROLLER ASSEMBLY

Undercover

1. Remove the bolts (1) (5 pieces), and remove the undercover (2).

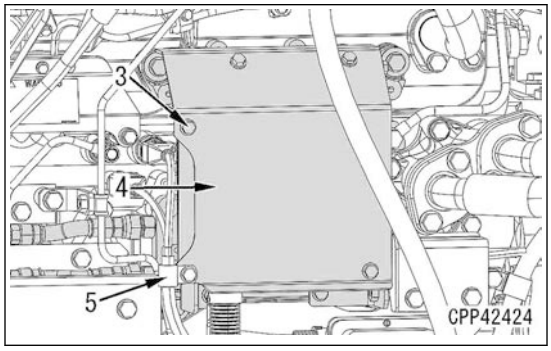


Engine controller assembly

2. Remove the bolts (3) (6 pieces), and remove the cover (4).

   REMARK

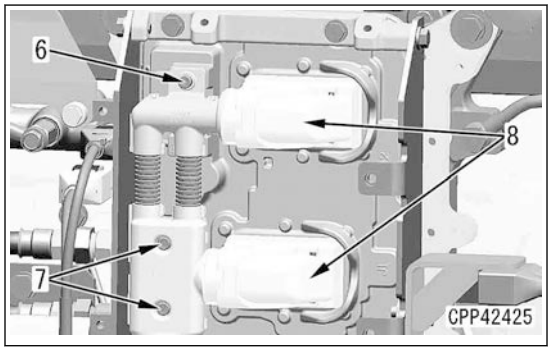
   One of the bolts (3) is tightened together with the clamp (5).



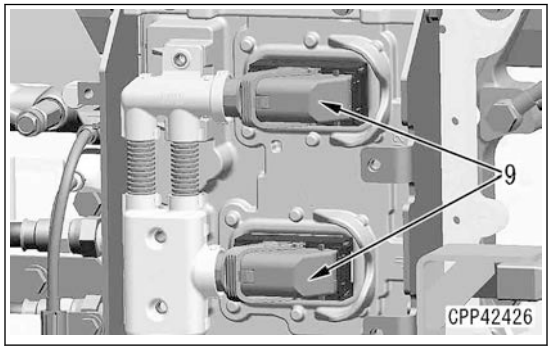
3. Remove the connector cover (8).
4. Remove the bolts (6) and (7).

   REMARK

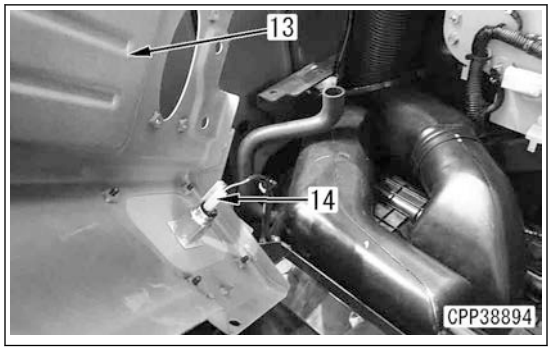
   - Blow off and remove the dust around the engine before starting the work.
   - Remove the bolts (6) and (7) always before disconnecting the connector.



5. Disconnect the connector (9) according to the following procedure.

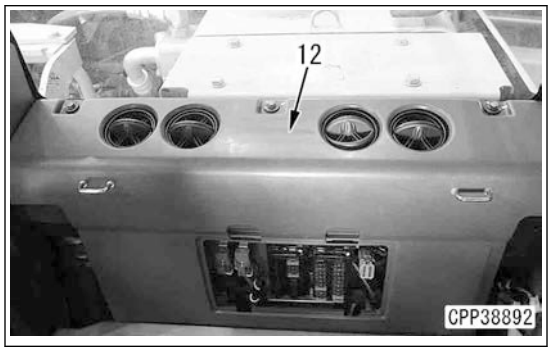


3. Connect the connector M04 (14).



4. Install the cover (13) with the bolts (7 pieces).

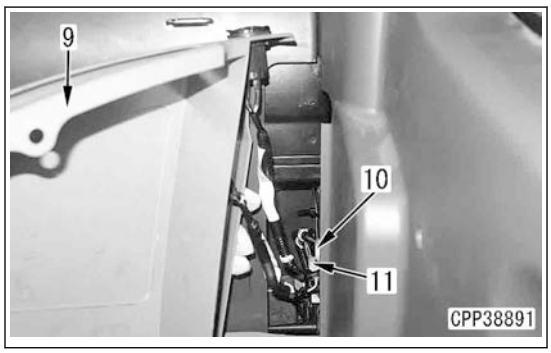
5. Install the cover (12) with the bolts (3 pieces).

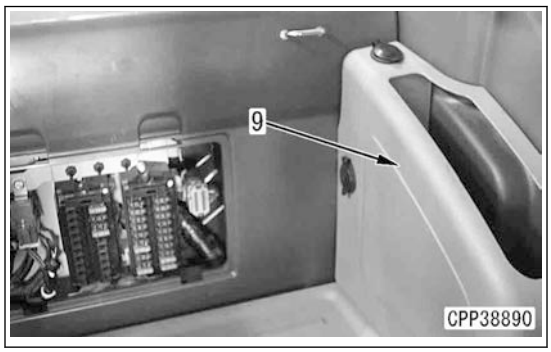


6. Connect the connectors M13A (10) and M13B (11).
7. Install the box (9) with the bolts (3 pieces).

REMARK

When installing the box (9), be careful not to catch the harness of the connectors M13A (11) and M13B (12).

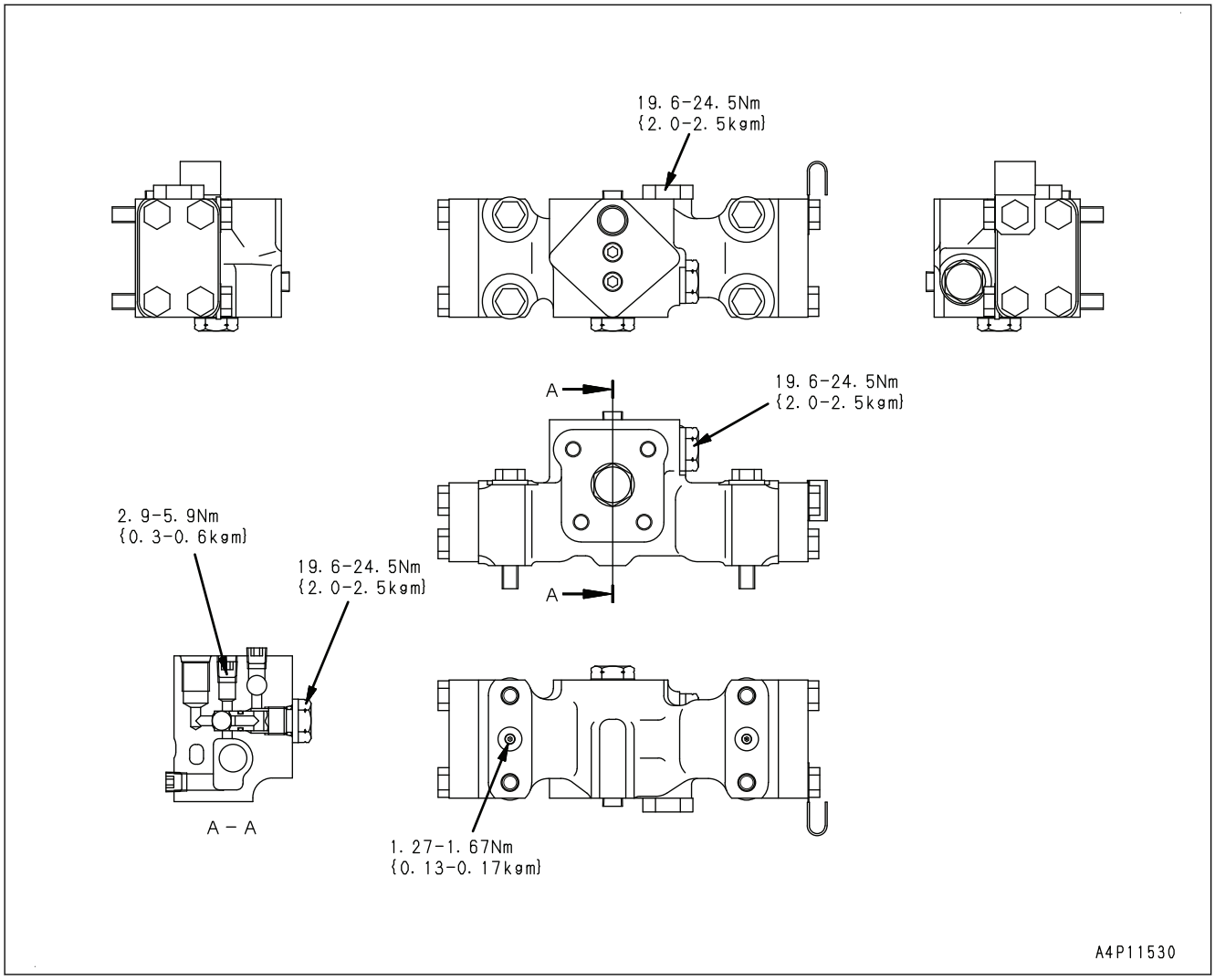




Unit: mm

No.	Item		Judgment criteria			Remedy
			Standard dimensions	Tolerance	Repair limit	
2	Vertical width of idler guard	Track frame	163.5	+4 0	167.5	Repair by build-up welding or replace
		Idler support	161	+1 0	159	
3	Lateral width of idler guide portion	Track frame	329	+4 0	334	
		Idler support	324	-	322	

MAINTENANCE STANDARD OF TRAVEL SHUTTLE VALVE OF CONTROL VALVE



SENSORS FOR AIR CONDITIONER SYSTEM

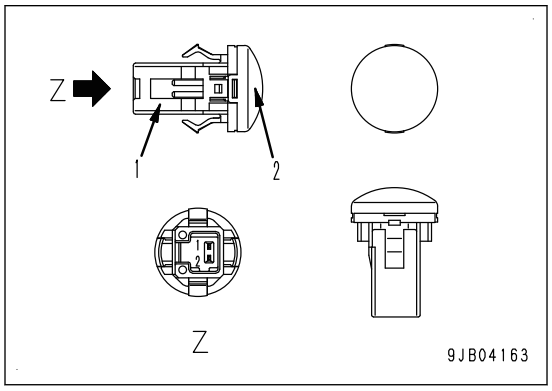
STRUCTURE OF SUNLIGHT SENSOR

The sunlight sensor is installed to the top of the machine monitor.

General view

1: Connector

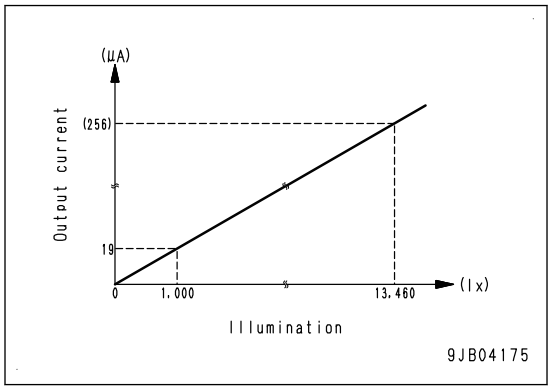
2: Sensor



FUNCTION OF SUNLIGHT SENSOR

- The sunlight sensor senses the sunlight intensity and sends signals to the air conditioner controller.
- Only in the automatic air conditioner mode, the air conditioner controller controls the blower motor and air mix servomotor to adjust the air temperature and flow rate by using the data of the sunlight sensor.

Output characteristics



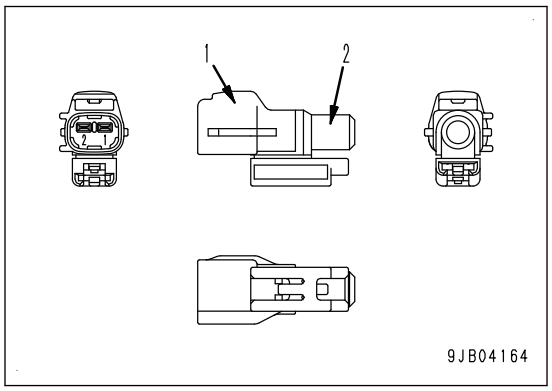
STRUCTURE OF AMBIENT TEMPERATURE SENSOR

The outside air temperature sensor is installed to the cooling unit.

General view

1: Connector

2: Sensor



FUNCTION OF AMBIENT TEMPERATURE SENSOR

- The resistance of the sensor changes according to the temperature, and the sensor senses the outside air temperature.
- The air conditioner controller converts the change in resistance of the outside air temperature sensor into the change in voltage to determine the outside air temperature.