UENBM00463

Shop Manual

HYDRAULIC EXCAVATOR

HB215LC-3

SERIAL NUMBERS 70009 and up
K70001 and up

KOMATSU

SAFETY NOTICE FOR OPERATION

- Appropriate servicing and repair are extremely important to ensure safe operation of the machine. The shop manuals describe the effective and safe servicing and repair methods recommended by Komatsu. Some of the servicing and repair methods require the use of special tools designed by Komatsu for special purposes.
- The symbol mark ⚠ is indicated for such matters that require special precautions. The work indicated with this warning mark ⚠ should be performed according to the instructions with special attention. Should a hazardous situation occurs or be anticipated during such work, be sure to keep safe first and take every necessary measures.

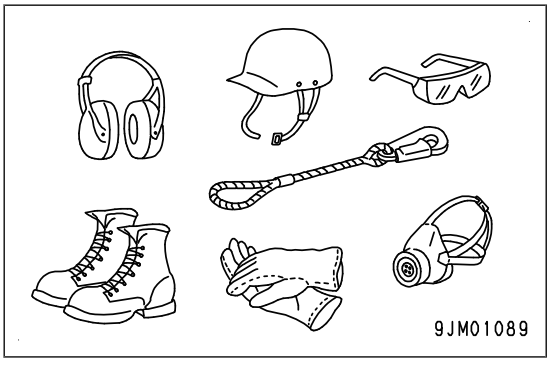
Safety matters

- Well organized work place
- Correct work clothes
- Observance of work standard
- Enforcement of hand signals
- Prohibition against unlicensed persons operating and handling the machine
- Safety check before starting work
- Wear of dust glasses (for cleaning or grinding work)
- Wear of welding goggles and protectors (for welding work)
- Being in good physical condition, and good preparation
- Always be alert and careful.

General precautions

⚠ **If the machine is handled incorrectly, it is dangerous. Read and understand what is described in the operation and maintenance manual before operation. Read and understand what is described in this manual before operation.**

- Read and understand the meaning of all the safety labels stuck to the machine before performing any greasing or repairs. For the locations of the safety labels and detailed explanation of precautions, see Operation and Maintenance Manual.
- Tools and removed parts in the workshop should be well organized. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dust, dirt, oil, or water on the floor. Smoke only in the designated areas. Never smoke while working.
- Keep all tools in good condition, learn the correct way to use them, and use the proper ones. Check the tools, machine, forklift truck, service car, etc. thoroughly before starting the work.
- Always wear safety shoes and helmet when performing any operation. Do not wear loose clothes, or clothes with buttons missing.

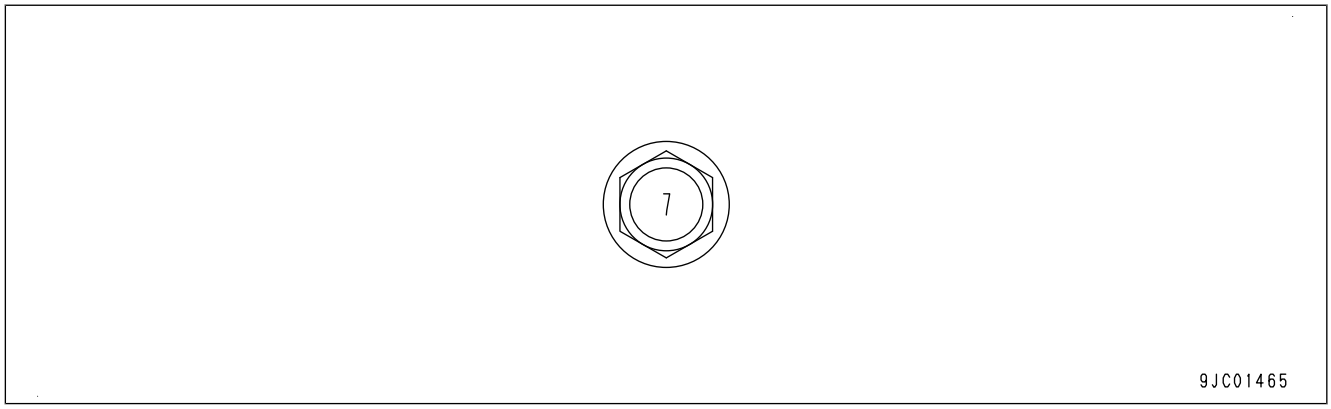


PRECAUTIONS FOR THE MACHINE NOT TO BE TIPPED OVER AND FOR HYBRID COMPONENTS NOT TO BE DAMAGED

⚠ If you carelessly touch the hybrid components or high voltage wiring (conduit wiring in orange color), it may lead a serious injury or death when the machine is tipped over, or the hybrid components or high voltage wiring are damaged by the accident such as a tipping over.

Observe the following and take extreme care for performing the work safe.

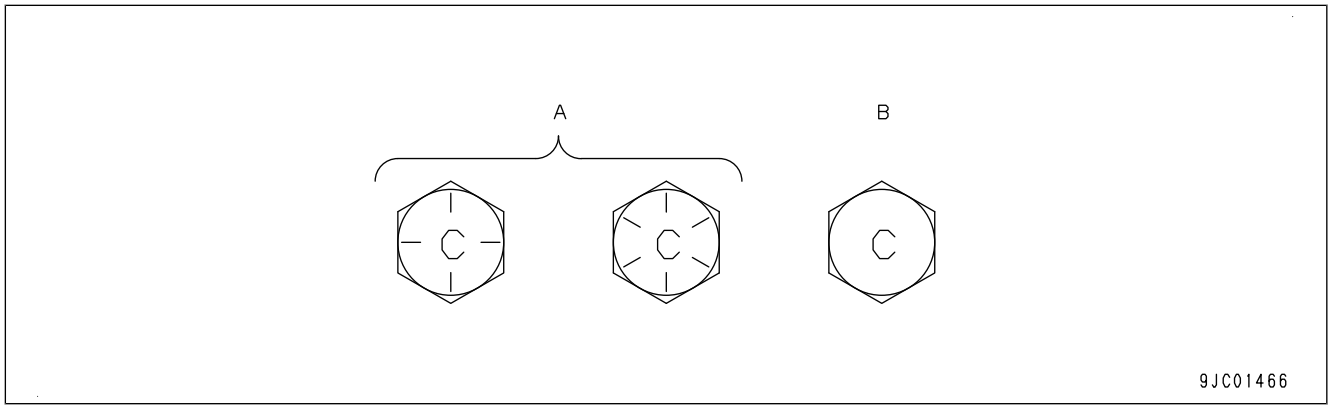
- Stop the engine always when performing maintenance so that the hybrid component does not suffer from the high voltage stress.
- Extinguish the fire with “ABC fire extinguisher” (which is effective to burning of oil and electrical fires) if the fire breaks out.
  If you use water to extinguish the fire, use a large amount of water from the fire hydrant otherwise an attempt to extinguish the fire with a small amount of water is dangerous.
- Wear a pair of insulated gloves (rubber gloves), protective eyeglasses, safety shoes (insulated type).
- Raise this machine by using another machine, and move the machine to the safe place.
- Do not touch the bare cables. It can cause serious injury or death by electric shock if it is a high voltage wiring. Wear a pair of insulated gloves if you are touching it out of necessary or there is a risk of touching it in the work. Check that the voltage at the body ground cable is 50 V or less (safe voltage) by measuring it with a tester. Wind the portion with the packing tape to insulate it.
- Disconnect the one-touch connector of the capacitor.
- Discharge the electric charge from the capacitor by using the discharger for the capacitor.
- See the inspection window in the contactor box on the capacitor. Check the LED display indicating the charging state of the capacitor that it shows “not yet charged state”.
  If it does not show “not yet charged state”, leave it as it is until the LED display goes out (it can be left for 14 days maximum as a guide). Stick the indication of “Discharging capacitor” written on the packing tape, etc. to the capacitor body.
- Perform the work such as check, maintenance, and removal of the hybrid component by referring to the items 6. and after that are described in the “PRECAUTIONS FOR NORMAL CHECK AND MAINTENANCE”.
  Take extreme care not to directly touch the cell if the capacitor case is damaged.



Thread diameter (mm)	Width across flats (mm)	Tightening torque (Nm {kgfm})
6	10	5.9 to 9.8 {0.6 to 1.0}
8	12	13.7 to 23.5 {1.4 to 2.4}
10	14	34.3 to 46.1 {3.5 to 4.7}
12	17	74.5 to 90.2 {7.6 to 9.2}

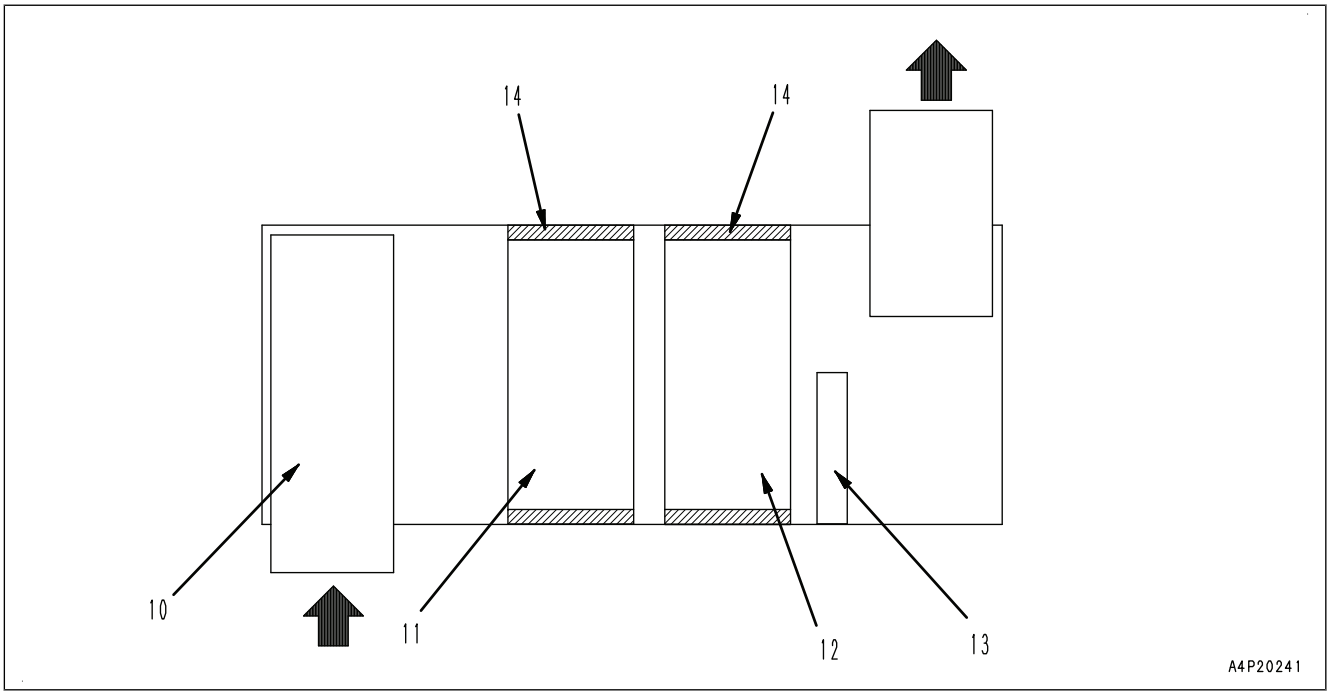
REMARK

Tighten the unified coarse threaded bolts and nuts to the torque shown in the table below unless otherwise specified.



Type of bolt	A		B	
Nominal size - threads per inch	Tightening torque (Nm {kgfm})		Tightening torque (Nm {kgfm})	
	Range	Target	Range	Target
$^{1}/_{4}$-20UNC	9.8 to 14.7 {1 to 1.5}	12.7 {1.3}	2.9 to 3.9 {0.3 to 0.4}	3.43 {0.35}
$^{5}/_{16}$-18UNC	24.5 to 34.3 {2.5 to 3.5}	29.4 {3}	6.9 to 8.8 {0.7 to 0.9}	7.8 {0.8}
$^{3}/_{8}$-16UNC	44.1 to 58.8 {4.5 to 6}	52.0 {5.3}	9.8 to 14.7 {1 to 1.5}	11.8 {1.2}
$^{7}/_{16}$-14UNC	73.5 to 98.1 {7.5 to 10}	86.3 {8.8}	19.6 to 24.5 {2 to 2.5}	21.6 {2.2}
$^{1}/_{2}$-13UNC	108 to 147 {11 to 15}	127 {13}	29.4 to 39.2 {3 to 4}	34.3 {3.5}
$^{9}/_{16}$-12UNC	157 to 216 {16 to 22}	186 {19}	44.1 to 58.8 {4.5 to 6}	51.0 {5.2}
$^{5}/_{8}$-11UNC	226 to 294 {23 to 30}	265 {27}	63.7 to 83.4 {6.5 to 8.5}	68.6 {7}
$^{3}/_{4}$-10UNC	392 to 530 {40 to 54}	461 {47}	108 to 147 {11 to 15}	127 {13}
$^{7}/_{8}$-9UNC	637 to 853 {65 to 87}	745 {76}	177 to 235 {18 to 24}	206 {21}

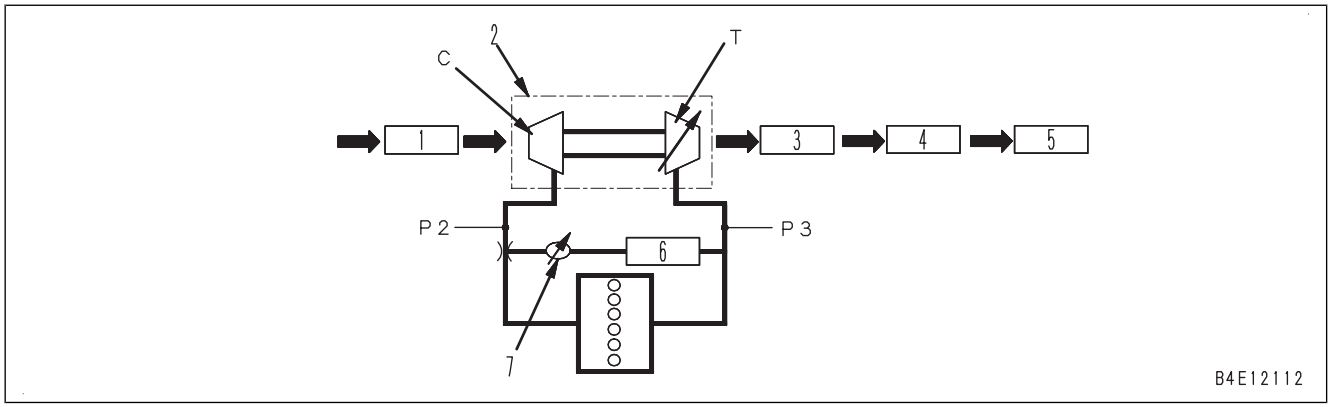
10 STRUCTURE AND FUNCTION



10: Rectifier tube
11: Upstream SCR catalyst
12: Downstream SCR catalyst and ammonia oxidation catalyst (integrated type)
13: Water dam
14: Catalyzer holding mat

- SCR assembly consists of rectifier tube (10) equalizing the distribution of flow speed by leading exhaust gas, upstream SCR catalyst (11), downstream SCR catalyst, ammonia oxidation catalyst (integrated type) (12), and water dam which prevents rain water from entering downstream SCR catalyst and ammonia oxidation catalyst (integrated type) (12) while exhausting gas.
- Ammonia oxidation catalyst oxidizes ammonia to water and nitrogen with ammonia oxidation catalyst to prevent ammonia which is supplied to SCR assembly from being released out if SCR catalyst cannot completely consume it.
- SCR assembly has SCR temperature sensor (2) (1 piece), SCR outlet temperature sensor (5) (1 piece), and SCR outlet NOx sensor (3) (1 piece). These temperature sensors that SCR catalyst is functioning normally, and used for various troubleshooting.
- Rectifying tube (10) equalizes the distribution of exhaust gas flow speed.
- SCR catalyst uses the ceramic honeycomb.
- The catalyzer holding mat is made with special fibers to prevent breakage of the ceramics under the vibration condition of the engine and machine body. This mat also thermally insulates the periphery of SCR assembly from the heat of ceramics that becomes high temperature during operation.
- Water dam (13) is located at the upstream side of the outlet and prevents rainwater from entering downstream SCR catalyst unit and ammonia oxidation catalyst (integrated type) (12).
- Water baffle (4) is located at the downstream side of the outlet and prevents rainwater at outlet from splashing over the detection part of NOx sensor.

FUNCTION OF VGT



C: Blower impeller
T: Turbine impeller
1: Air cleaner
5: SCR assembly
2: VGT
6: EGR cooler
3: KDPF (*1), KDOC (*2)
7: EGR valve
4: AdBlue/DEF mixing tube
*1: Six cylinder engine is shown.
*2: Four cylinder engine is shown.

- The exhaust gas regulations are applied to the exhaust gas from the engine running at low speed, as well as at high speed. To meet this, the EGR ratio is improved. (EGR ratio = Ratio of amount of EGR to amount of fresh suction air)
- To attain high EGR ratio, turbine inlet pressure (P3) must be set higher than boost pressure (P2) (P3 > P2). For this reason, the variable turbocharger (VGT) is employed, in which the exhaust gas pressure acting on turbine impeller (T) is adjustable.
  Also, since the boost pressure increases more quickly, generation of particulate caused by lack of oxygen during low-speed operation (rotation) is reduced.
- The shaft joined to turbine impeller (T) drives blower impeller (C) and sends much air to the cylinder for combustion.
  If VGT (2) sends more air, the fuel injection rate can be increased, thus the engine output is increased.
  In addition, the air cooled by aftercooler becomes dense, that is, more oxygen is supplied, thus the fuel injection rate can be increased and the engine output is increased.

NOTICE

Adequate amount of clean high quality oil is required to maintain VGT performance. Be sure to use Komatsu genuine high quality oil. Follow the procedures in the Operation and Maintenance Manual when replacing oil or oil filter.

REMARK

It sounds like air is leaking from VGT or a boost pipe, but it is not abnormal.

OPERATION OF VGT

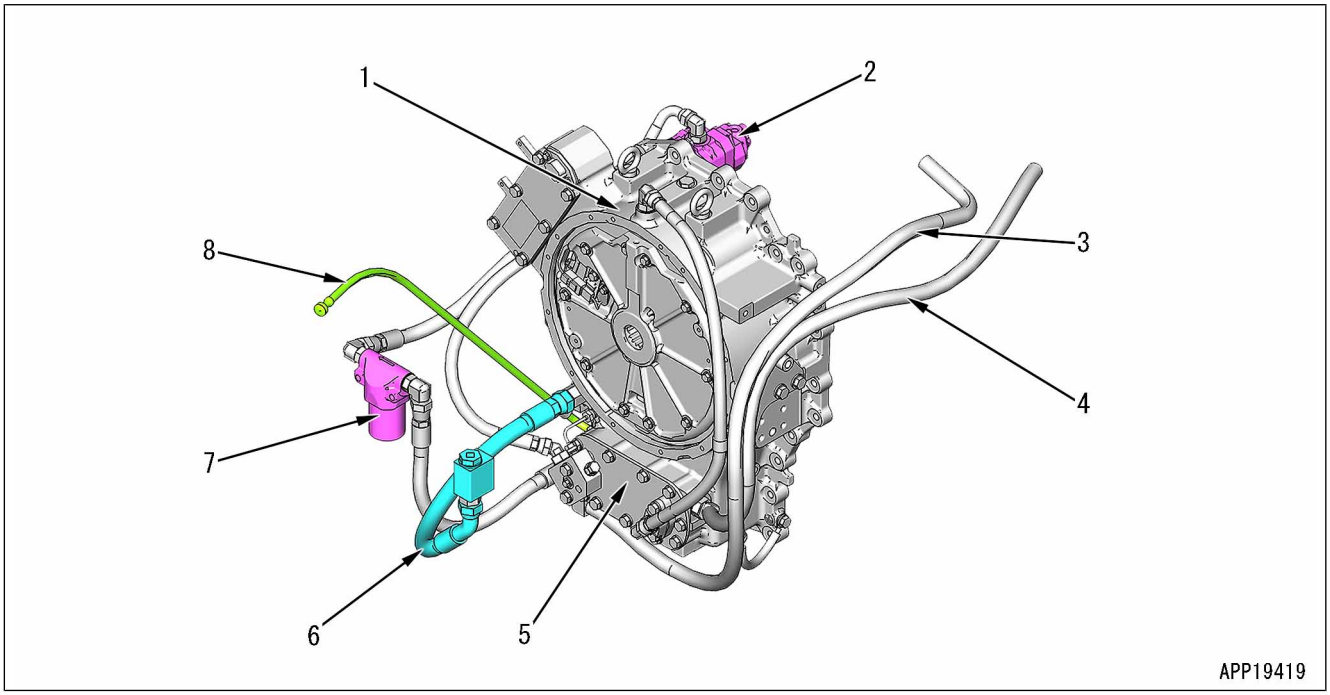
REMARK

Four cylinder engine is shown in this item.

COMPONENT PARTS OF HYBRID SYSTEM

MOTOR-GENERATOR

LAYOUT DRAWING OF MOTOR-GENERATOR



1: Generator
2: Lubrication pump (for motor-generator and electric swing motor)
3: Coolant pipe
4: Coolant pipe
5: Oil cooler
6: Oil filler pipe
7. Filter
8: Level gauge

SPECIFICATIONS OF MOTOR-GENERATOR

Model: ZG034
Lubricating oil (specified amount): 6.9 ℓ
Lubricating oil (refill amount): 6.5 ℓ
Specified oil: TO10
Weight: 180 kg

FUNCTION OF MOTOR-GENERATOR

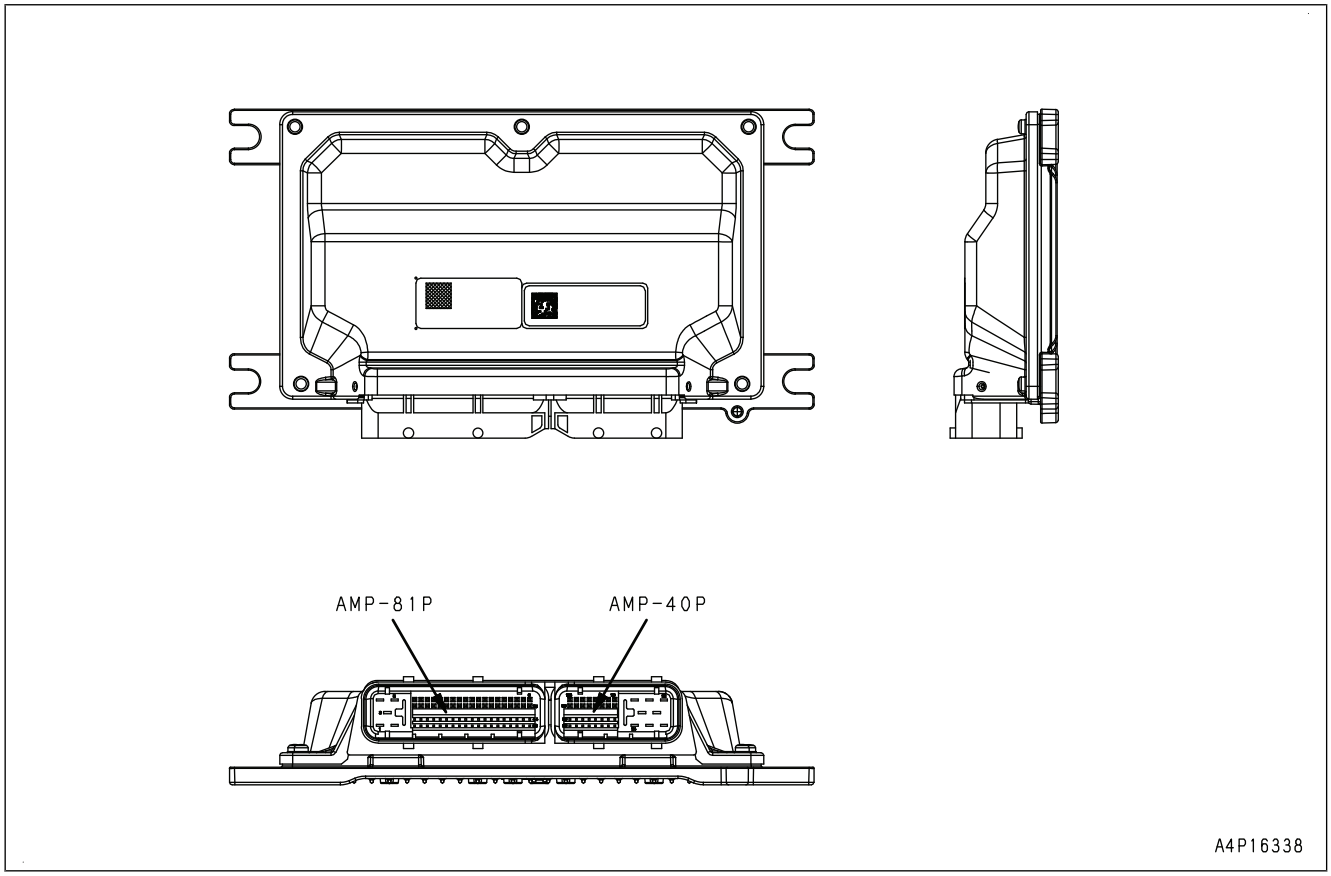
- The motor-generator is a component that converts the engine rotation and torque to the electrical power, and provides them to the electric swing motor.
- The motor-generator is a component that assists the engine output by supplying the electrical power from the capacitor.

KOMTRAX Settings	Terminal Status
	GPS & Communication State
	Modem Information
Service Message	

KomVision CONTROLLER

STRUCTURE OF KomVision CONTROLLER

General view



INPUT AND OUTPUT SIGNALS OF KOMVISION CONTROLLER

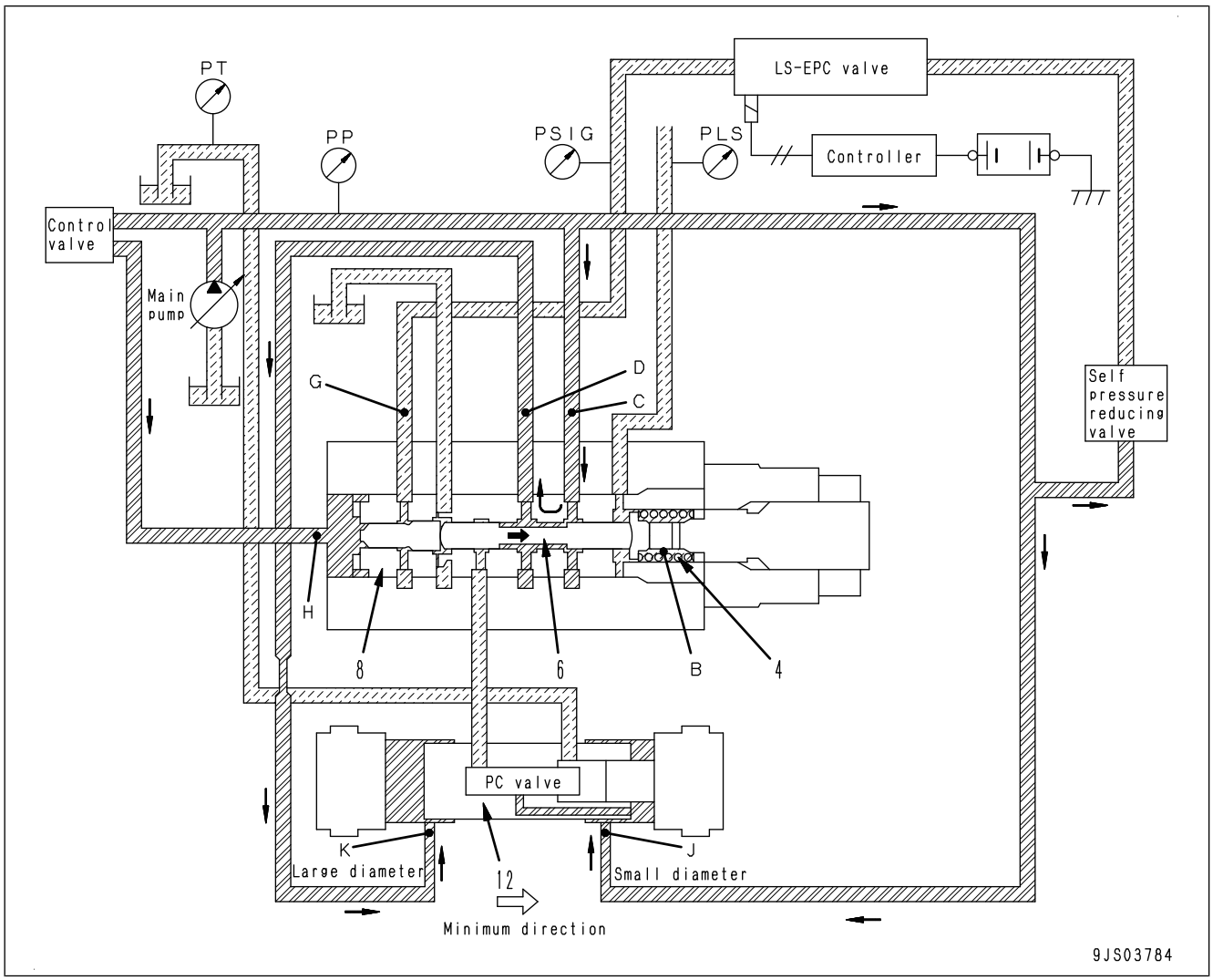
AMP-81P“CA01”

Pin No.	Signal name	Input and output signals
1	(*1)	-
2	(*1)	-
3	(*1)	-
4	(*1)	-
5	(*1)	-
6	Power supply for camera (8 V)	Output
7	(*1)	-
8	(*1)	-

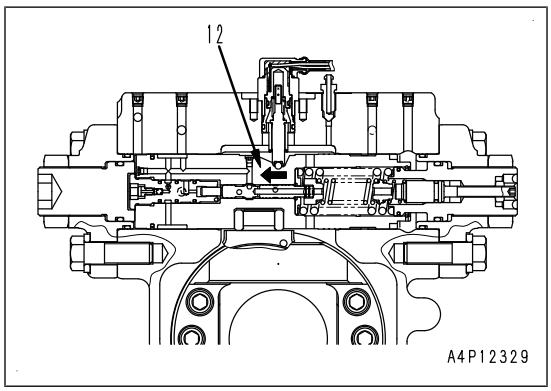
3: Control valve
4: Spool
5: 2-stage relief valve
6: Unload valve
7: LS bypass valve
8: Main pump
9: Seavo piston
10: LS valve
11: PC valve
12: PC-EPC valve
13: LS-EPC valve
14: Controller
15: Self-pressure reducing valve
16: 2-stage relief solenoid valve

OPERATION OF MAIN PUMP LS VALVE

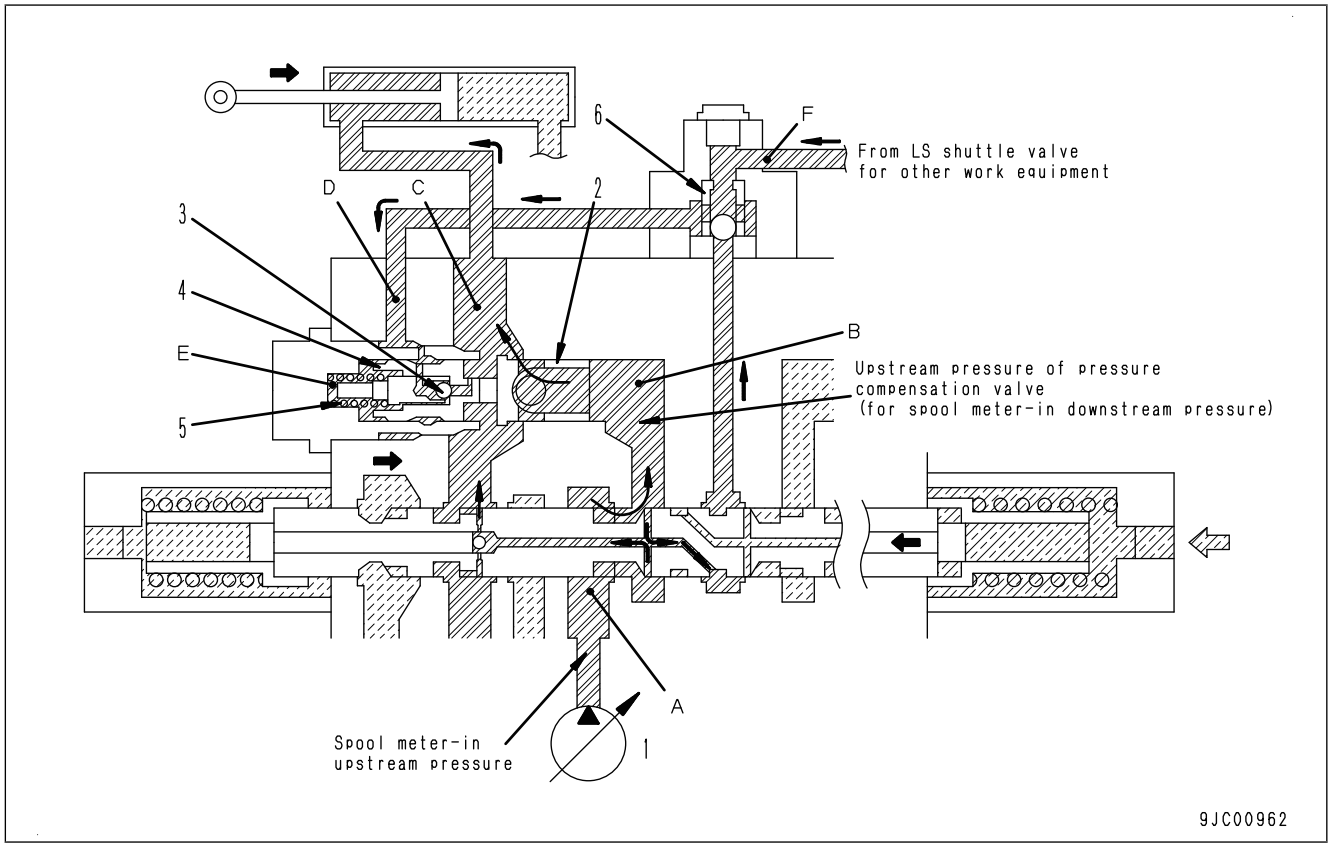
When control valve is in neutral position



1. LS valve is a 3-way selector valve, and LS pressure (PLS) at the control valve outlet (actuator load pressure) is supplied to spring chamber (B), and pump discharged pressure (PP) is supplied to port (H) of sleeve (8).
   The position of spool (6) is decided by the difference between the force caused by LS pressure (PLS), the force of spring (4), and the force caused by pump discharged pressure (self-pressure) (PP).
   However, the position of spool (6) also varies with the level of output pressure (OSIG) (called the LS set select pressure) of EPC valve for LS valve which enters port (G). (The set force of the spring changes.)
2. Before the engine is started, servo piston (12) is pushed to the left. (See the figure below.)
3. When the engine is started, if the control lever is in neutral, LS (PLS) is 0 MPa {0 kgf/cm^2}. (It is connected to the drain circuit through the control valve spool.)
4. Spool (6) is pushed to the right and port (C) and port (D) are connected.
5. Pump discharged pressure (PP) enters the large diameter piston side from port (K).
6. The same pump discharged pressure (PP) also enters port (J) on small diameter piston side.



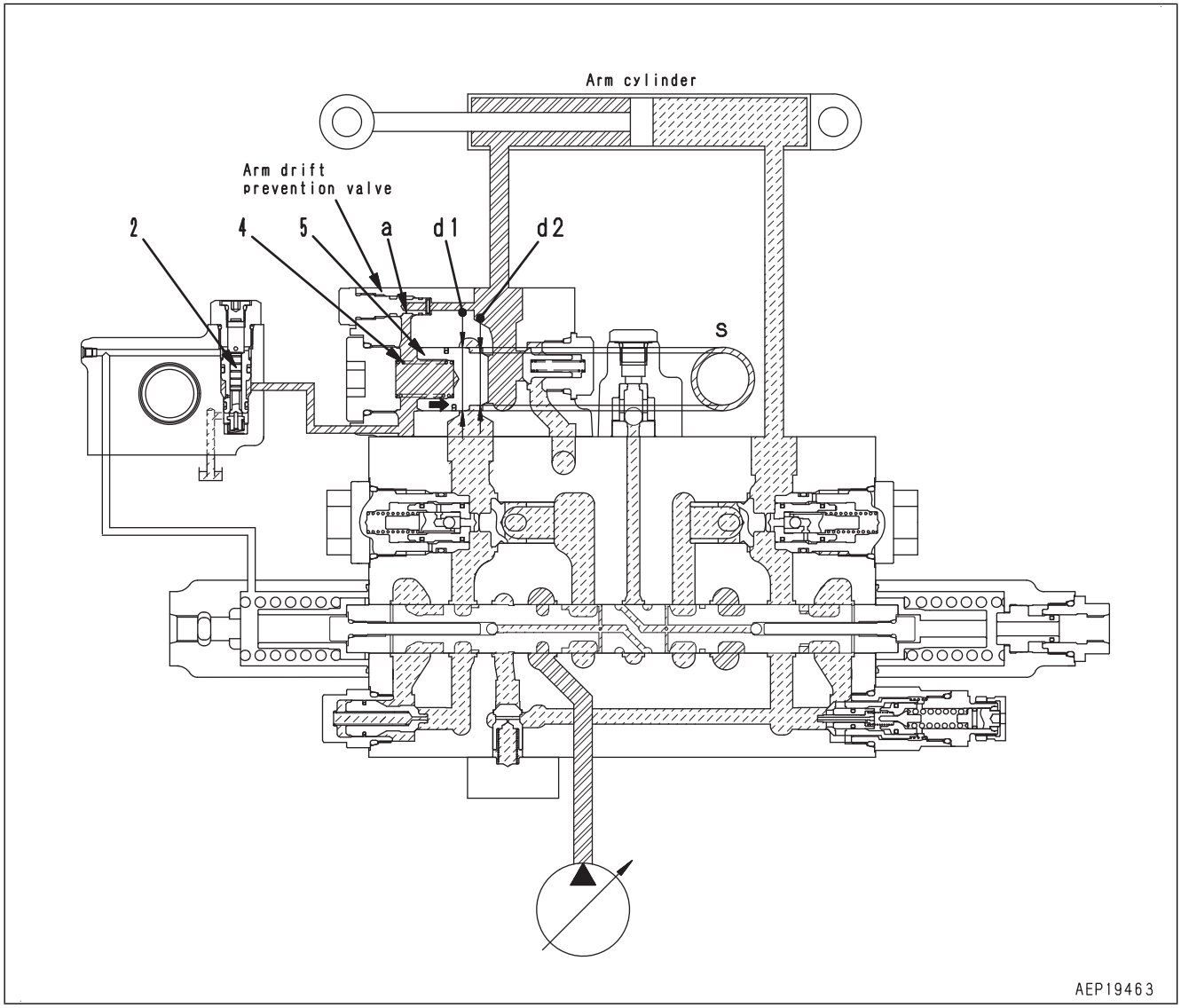
When load pressure is lower than that of other work equipment during combined operation, or when compensated



1: Main pump
2: Valve
3: Shuttle valve
4: Piston
5: Spring
6: LS shuttle valve

- The pressure compensation valve is closed by LS pressure in port (D), and the spool meter-in downstream pressure at port (B) becomes equal to the maximum pressure in the other actuator.
- Since the spool meter-in upstream pressure at port (A) is the pump pressure, the spool meter-in differential pressure “Upstream pressure (Port (A) pressure) - Downstream pressure (Port (B))” is the same in all the spools in operation.
- The pump discharged volume is divided at the meter-in opening area ratio.

When the arm is in “NEUTRAL”



1. When the arm operation is returned to “NEUTRAL” position, the pressurized oil flowing through orifice (a) into the poppet (5) is stopped by pilot piston (2).
2. The holding pressure of the arm cylinder head acts rightward on the left side of area (S) of the ring formed by the difference between outside diameter “d1” of the poppet (5) and seat diameter “d2”.
3. The combined force of the force acting rightward on area (S) and the reaction force of spring (4) moves the poppet (5) to the right.
4. The circuit from the control valve to the arm cylinder head is shut off, and the oil pressure on the arm cylinder head side is hold.

1: Spool
2: Piston
3: Lever
4: Plate
5: Retainer
6: Body
7: EPC valve

OPERATION OF 1ST-LINE ATTACHMENT PPC VALVE (WITH EPC VALVE)

REMARK

For explanation of operation of PPC valve, see “Operation of work equipment and swing PPC valve”.

EPC VALVE OF 1ST-LINE ATTACHMENT PPC VALVE

PPC

Abbreviation for Proportional Pressure Control

EPC

Abbreviation for Electromagnetic Proportional Control

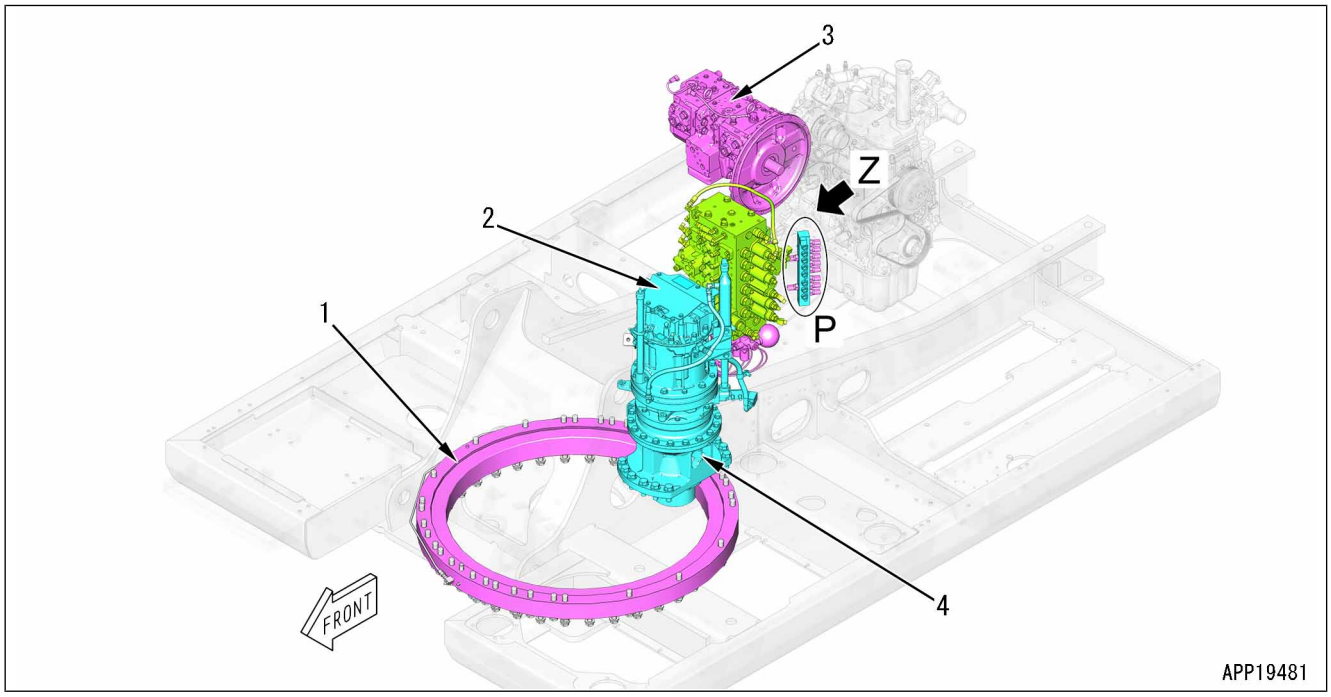
STRUCTURE OF EPC VALVE OF 1ST-LINE ATTACHMENT PPC VALVE

(Machines ready for installation of attachment)

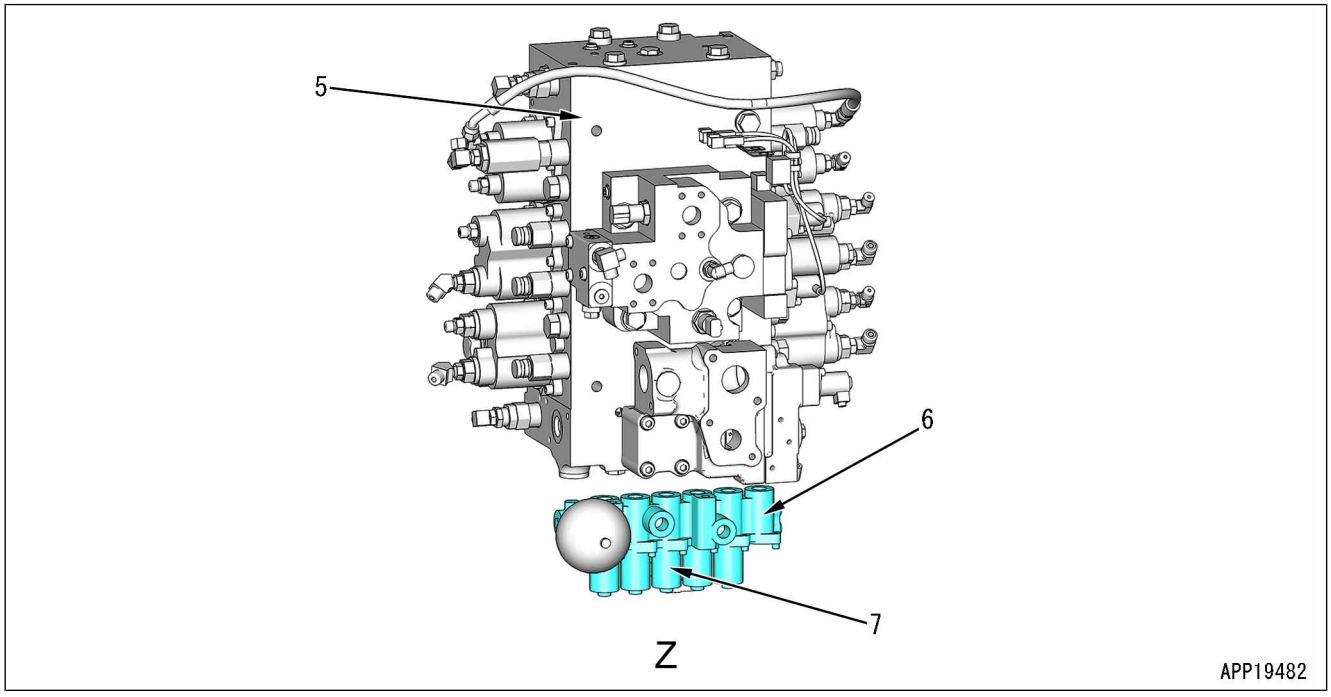
SWING SYSTEM

LAYOUT DRAWING OF SWING SYSTEM

Chassis part



1: Swing circle
2: Electric swing motor
3: Main pump
4: Swing machinery



5: Control valve
6: Solenoid valve
7: Swing parking brake solenoid valve

5: No. 2 sun gear (number of teeth: 21)
6: No. 1 planetary carrier
7: Cover
8: Ring gear (number of teeth: 95)
9: No. 2 planetary carrier
10: Ring nut
11: Hub
12: Sprocket
13: Floating seal
14: Travel motor
15: No.2 planetary gear (number of teeth: 36)

SPECIFICATIONS OF FINAL DRIVE

Reduction ratio: -((10 + 95) / 10 x (21 + 95) / 21) + 1 = -57.000

FUNCTION OF FINAL DRIVE

The travel motor is high in speed but low in torque. Accordingly, the final drive reduces the speed, increases the driving force, and transmits it to the sprocket.

TRAVEL PPC VALVE

PPC

Abbreviation for Proportional Pressure Control

Machine model				HB215LC-3	
Engine				SAA4D107E-3	
Item	Measurement condition		Unit	Standard value for new machine	Repair limit
“AdBlue/DEF injector resistance”	AdBlue/DEF injector20 °C		Ω	11.4 to 12.6	11.4 to 12.6
AdBlue/DEF Injection Quantity Test	Injection volume when AdBlue/DEF Injection Quantity Test is completed		mℓ	100(+7/-26)	100(+7/-26)
AdBlue/DEF Line Heater Relay 1 Test	Within 900 seconds after starting AdBlue/DEF Line Heater Relay 1 Test		V	24.5±1.5	24.5±1.5
AdBlue/DEF Line Heater Relay 2 Test	Within 900 seconds after starting AdBlue/DEF Line Heater Relay 2 Test		V	24.5±1.5	24.5±1.5
AdBlue/DEF Pump Heater Relay Test	Within 900 seconds after starting AdBlue/DEF Pump Heater Relay Test		V	24.5±1.5	24.5±1.5
AdBlue/DEF Tank Heater Valve Test	Within 900 seconds after starting AdBlue/DEF Tank Heater Valve Test		V	24.5±1.5	24.5±1.5
SCR Denitration Efficiency Test	Display which appears on the machine monitor when SCR Denitration Efficiency Test is completed	AdBlue/DEF Injection Test Result	-	1 (Normal)	1 (Normal)
		SCR Efficiency Test Result		1 (Normal)	1 (Normal)

Control valve spool stroke

Machine model				HB215LC-3	
Engine				SAA4D107E-3	
Item	Measurement condition		Unit	Standard value for new machine	Repair limit
Boom control valve	• Engine: Stopped • Measuring posture: See “MACHINE POSTURE AND PROCEDURE FOR MEASURING PERFORMANCE”, “Fig. 1”.	RAISE	mm	11.5±0.5	11.5±0.5
		LOWER		9.5±0.5	9.5±0.5
Arm control valve		CURL	mm	11.5±0.5	11.5±0.5
		DUMP		9.5±0.5	9.5±0.5
Bucket control valve		CURL	mm	9.5±0.5	9.5±0.5
		DUMP		9.5±0.5	9.5±0.5
Travel control valve		Forward	mm	9.5±0.5	9.5±0.5
		Reverse		9.5±0.5	9.5±0.5

Symbol	Part No.	Part name	Q'ty	Remarks
B	Commercially available	Plug	1	Hose inside diameter24 mm
C	Commercially available	Cap	2	Tube outside diameter25.4 mm

Tools for testing engine oil pressure

Symbol		Part No.	Part name	Q'ty	Remarks
A	-	799-101-5002	Hydraulic tester	1	
	1	799-101-5160	Nipple	1	Size: R1/8
B		799-401-2320	Gauge	1	Pressure range1 MPa

Tools for testing fuel pressure

Symbol		Part No.	Part name	Q'ty	Remarks
A	-	799-101-5002	Hydraulic tester	1	
	1	799-101-5160	Nipple	1	Size: R1/8
	2	799-101-5140	Gauge	1	Pressure range2.5 MPa
B		795-790-4430	Adapter	1	
C		6215-81-9710	O-ring	1	
D		795-790-5110	Screw	1	
E		799-401-2320	Gauge	1	Pressure range1 MPa
F		795-790-5120	Screw	1	
G	-	799-201-2202	Boost gauge kit	1	
	1	799-101-5160	Nipple	1	Size: R1/8
	2	799-401-2311	Gauge	1	Pressure range-101 to 200 kPa

Tools for testing fuel discharge volume, return volume and leakage volume

Symbol	Part No.	Part name	Q'ty	Remarks
A	795-790-4700	Tester kit	1	
B	6164-81-5790	Joint	1	
C	07206-30812	Joint bolt	1	
D	6745-71-1130	Seal washer	1	
E	Commercially available	Stopwatch	1	
F	Commercially available	Hose	1	Inside diameter: Approx.14 mm
G	Commercially available	Measuring cylinder	1	
H	Commercially available	Hose	1	Inside diameter: Approx.8 mm
I	Commercially available	Oil container	1	Capacity: Approx.20 ℓ

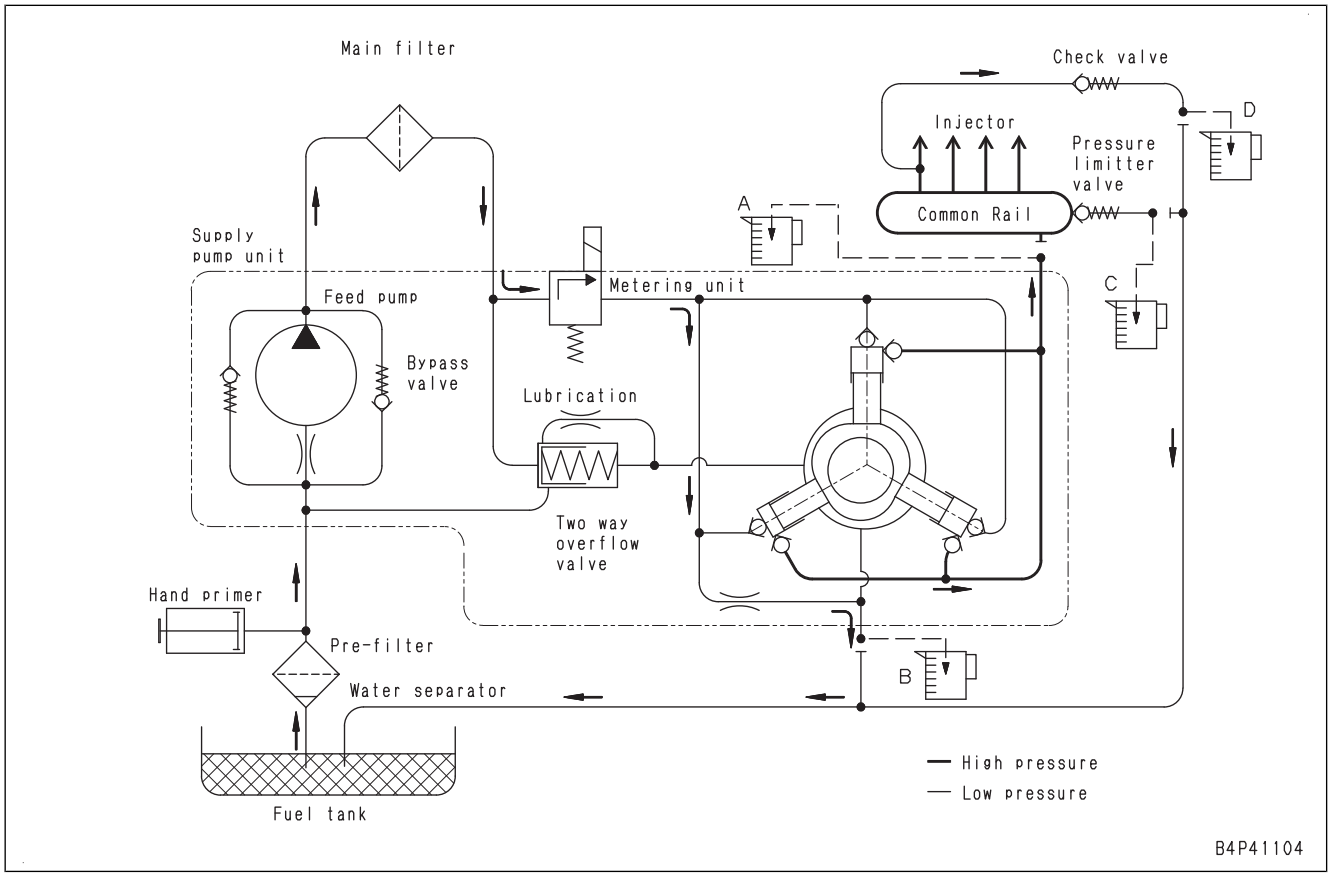
TEST FUEL DISCHARGE, RETURN AND LEAKAGE

Tools for testing fuel discharge volume, return volume and leakage volume

Symbol	Part No.	Part name	Q'ty	Remarks
A	795-790-4700	Tester kit	1	
B	6164-81-5790	Joint	1	
C	07206-30812	Joint bolt	1	
D	6745-71-1130	Seal washer	1	
E	Commercially available	Stopwatch	1	
F	Commercially available	Hose	1	Inside diameter: Approx.14 mm
G	Commercially available	Measuring cylinder	1	
H	Commercially available	Hose	1	Inside diameter: Approx.8 mm
I	Commercially available	Oil container	1	Capacity: Approx.20 ℓ

⚠ **Place the machine on a level 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.**

⚠ **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.)**



A: Measuring position of supply pump discharged volume

B: Measuring position of supply pump return rate

NOTICE

- **If "Test State" does not change to "10" after pressing F1 and the test does not start, turn the starting switch to OFF position. Then, repeat the testing procedure from Step 5.**
- **Do not turn the starting switch to ON position soon even if you turn the starting switch to OFF position by mistake during the test. Check that the system operating lamp is not lit. When the engine controller shuts down completely, turn the starting switch to ON position.**
- **The engine controller cannot detect a KOMNET communication error which does not remain for 1 second. The test by engine controller may be continuously performed even when the machine monitor discontinues the test (standard screen) due to such an error. In such a case, turn the starting switch to OFF position. The system operating lamp goes out, and the engine controller is shut down. Then the test is reset.**

REMARK

- Display of "Test State" changes to flashing of "10", and display of "Remaining Time to Start Test" is counted down from "60 " to "0 sec".
- When the display of "Test State" shows the number between "11" and "41", follow instructions according to "Parameter list of test state".
- When the display of "Remaining Time to Start Test" changes to "0 sec", voltage is output.
- The heater relay operates 900 seconds at maximum, and its remaining operable time is displayed as "Remaining Permitted Test Time". However, the heater relay stops automatically if the temperature of the pump reaches to upper limit in order to protect the pump heater. The operation will resume automatically if the temperature of the pump drops, and the pump heater is energized or de-energized repeatedly.
- Do not measure the voltage when the AdBlue/DEF pump heater is energized or de-energized repeatedly. Measure the stable voltage.
- When the AdBlue/DEF pump heater is energized or de-energized repeatedly, press F2 to stop the test. Wait for the pump temperature to drop.
- When the sum of "Remaining Time to Start Test" (1 min) + Heater relay operating time exceeds 16 minutes after F1 is pressed, the test stops automatically.
- This check can be also performed by the following method; When the AdBlue/DEF pump temperature is below 45°C, perform "AdBlue/DEF Pump Heater Relay Test". Abnormality of the pump can be checked when the temperature rises more than 5°C.

10. Measure the voltage between pin 2 and pin 12.

REMARK

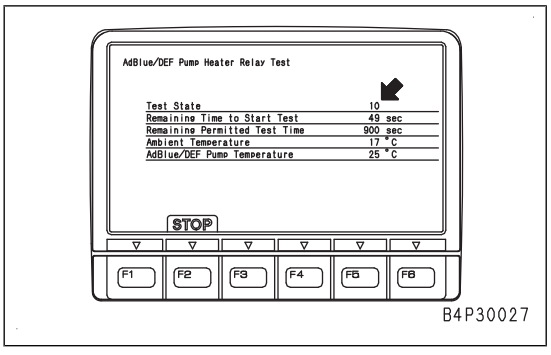
- If an abnormality occurs during measurement, failure codes [CA4115] , [CA4156], and [CA4169] are displayed. Perform troubleshooting if these failure codes appear.
- If 24.5±1.5 V is obtained within 900 seconds of "Remaining Permitted Test Time", you can finish the measurement by pressing F2.

For standard values, see STANDARD VALUE TABLE, "STANDARD VALUE TABLE FOR MACHINE".

11. When the voltage of 24.5±1.5 V is obtained, press F2.

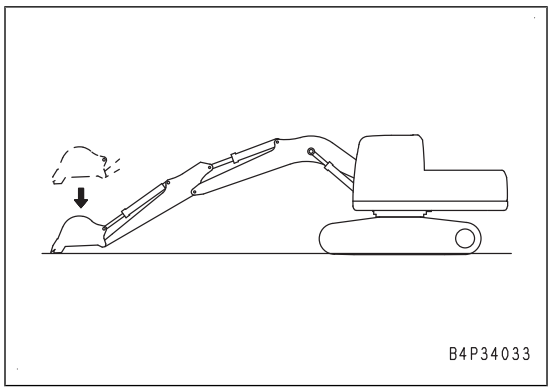
REMARK

Display of "Test State" changes and "0" starts flashing.



Remove the testing tools and restore the machine after the test is finished.

5) Operate the work equipment control lever fully to the stroke end in boom LOWER direction, and check that the work equipment is lowered to the ground.



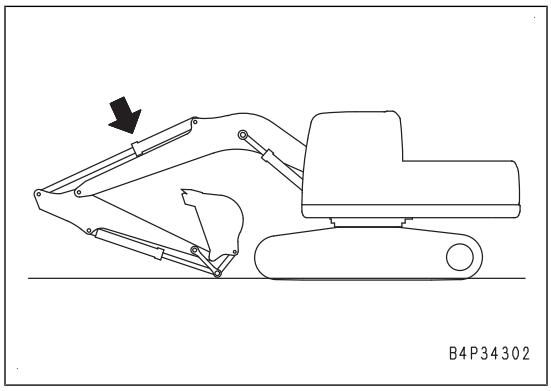
NOTICE

- **Pressure of PPC accumulator drops gradually after the engine stops. Be sure to perform Steps 2) to 5) in 15 seconds.**
- **If the work equipment is not lowered or stops lowering halfway through the operation, pressure in PPC accumulator may be low. Pressure cannot be released with this procedure.**

REMARK

- The function of PPC accumulator is normal if the work equipment is lowered by its own weight to the ground.
- PPC accumulator is a periodic inspection item and an important periodic replacement part.

2. Start the engine.
3. Set the arm cylinder to the most extended state (to the maximum digging side). Lower the work equipment to the ground.



REMARK

- The anti-drop valve is attached to arm cylinder head side. Hydraulic oil on head side of arm cylinder is drained when work equipment is lowered to the ground, and remaining pressure drops.
- The amount of oil on the head side decreases as well.

4. Turn the starting switch to OFF position.
5. Loosen the oil filler cap of the hydraulic tank gradually, and release the air in the tank.

REMARK

Leave the oil filler cap of the hydraulic tank removed.

6. Release the remaining pressure in hydraulic cylinder circuit
   1) Turn the starting switch to ON position.
   2) Set the lock lever to FREE position. Operate the R.H. and L.H. work equipment control levers to back and forth, left to right.

   REMARK

   The work equipment is operated by the pressure in PPC accumulator. Pressure in PPC accumulator is lost by operating the work equipment control levers 2 or 3 times.

   3) Set the lock lever in LOCK position.
   4) Start the engine and run it with the fuel control dial at MIN (Low idle) position for approximately 5 seconds to increase the pressure in PPC accumulator.
7. Repeat Steps 1) to 4) 4 or 5 times to release the remaining pressure from the hydraulic cylinder circuit.

⚠ When disassembling the anti-drop valve, loosen anti-drop valve mounting bolts gradually. Make sure that hydraulic oil pressure is released, then disassemble it.

TEST PUMP SWASH PLATE SENSOR

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

Check this item under the following conditions.

- Hydraulic oil temperature45 to 55 °C
- Working mode: P Mode

Before testing pump swash plate sensor, check that oil pressure in work equipment, swing, travel, control circuits, and travel speed at running track idle off the ground are correct.

For testing the pump swash plate sensor to perform troubleshooting, refer to this section.

METHOD FOR TESTING PUMP SWASH PLATE SENSOR

1. Start the engine.
2. Select “Monitoring Selection Menu” and display the following monitoring items by referring to “SET AND OPERATE MACHINE MONITOR”.

   Monitoring code: 01138 “F Pump Swash Plate Sensor volt”

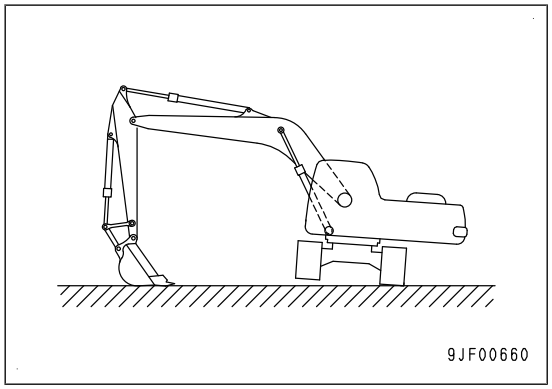
   Monitoring code: 01140 “R Pump Swash Plate Sensor volt”

   Monitoring code: 04401 “Hydraulic Oil Temperature”
3. Adjust the hydraulic oil temperature so that it is within the specified range.
4. Raise the track shoe to be tested off the ground by operating the work equipment.

   When testing front pump: L.H. track shoe

   When testing rear pump: R.H. track shoe

   ⚠ Provide enough work space to run the raised track shoe idle off the ground for testing.



5. Set the working mode to P (“Power Mode”).
6. Set the travel speed to “Hi”.
7. Turn the swing lock switch to ON position.
8. Turn the fuel control dial to MAX (High idle) position.
9. Set all the control levers and pedals to NEUTRAL, and then set the travel control lever and pedal to stroke end in order to run the track idle off the ground, and measure the voltage.

   ⚠ When idling the raised track shoe by using the work equipment, secure the safety of surroundings.

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

“Pre-defined Monitoring” (05/28) Intake/exhaust pressure

No.	Monitoring code	Self-define Monitoring items (screen display)	Unit			Applicable component
			SI	Metric	Imperial	
1	01002	Engine Speed	r/min	rpm	rpm	ENG
2	37400	Ambient Pressure	kPa	kg/cm2	psi	ENG
3	36500	Charge Pressure	kPa	kg/cm2	psi	ENG
4	48300	Exhaust Manifold Pressure	kPa	kg/cm2	psi	ENG
5	48100	Turbocharger Speed	r/min	rpm	rpm	ENG
6	48200	MAF	kg/sec	kg/min	lb/min	ENG

“Pre-defined Monitoring” (06/28) Related to aftertreatment

No.	Monitoring code	Monitoring items (screen display)	Unit			Applicable component
			SI	Metric	Imperial	
1	47300	KDOC 1 Inlet Temperature	°C	°C	°F	ENG
2	47400	KDOC 1 Outlet Temperature	°C	°C	°F	ENG
3	19300	SCR Temperature	°C	°C	°F	ENG
4	36400	Rail Pressure	MPa	kg/cm2	psi	ENG
5	47500	Dosing Instant Fuel Consumption	l/h	l/h	gal/h	ENG
6	19200	Exhaust Gas Flow Rate	kL/h	kL/h	kgal/h	ENG

“Pre-defined Monitoring” (07/28) Related to engine

No.	Monitoring code	Self-define Monitoring items (screen display)	Unit			Applicable component
			SI	Metric	Imperial	
1	01002	Engine Speed	r/min	rpm	rpm	ENG
2	37212	Engine Oil Pressure SW	ON/OFF	ON/OFF	ON/OFF	ENG
3	48400	Crankcase Pressure	kPa	mmAq	psi	ENG
4	47300	KDOC 1 Inlet Temperature	°C	°C	°F	ENG
5	36500	Charge Pressure	kPa	kg/cm2	psi	ENG
6	48100	Turbocharger Speed	r/min	rpm	rpm	ENG

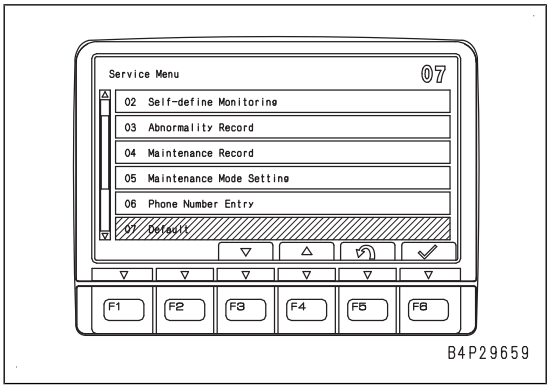
“Pre-defined Monitoring” (08/28) Related to front and rear pump basics

No.	Monitoring code	Self-define Monitoring items (screen display)	Unit			Applicable component
			SI	Metric	Imperial	
1	01002	Engine Speed	r/min	rpm	rpm	ENG
2	01100	Front Pump Pressure	MPa	kg/cm2	psi	PUMP
3	01101	Rear Pump Pressure	MPa	kg/cm2	psi	PUMP
4	01300	PC-EPC Front Solenoid Current	mA	mA	mA	PUMP
5	01302	PC-EPC Rear Solenoid Current	mA	mA	mA	PUMP
6	04401	Hydraulic Oil Temperature	°C	°C	°F	PUMP

1. Select “Default” from the “Service Menu” screen.

   REMARK

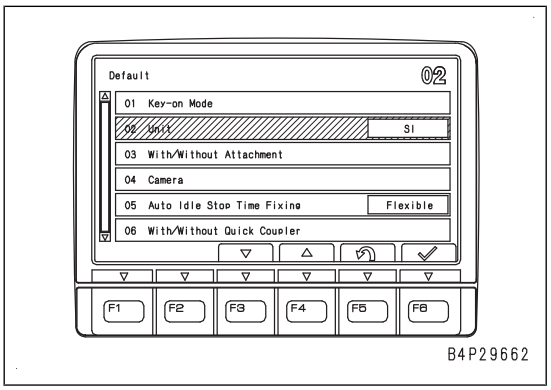
   For selecting method, see “Operating method of service mode” in “SERVICE MODE”.



2. On the “Default” screen, select “Unit” with function switches or numeral input switches.

   REMARK

   For selecting method, see “Operating method of service mode” in “SERVICE MODE”.



3. On the “Unit” screen, select the unit to be set with the function switches.

   F3: Moves down the selected item

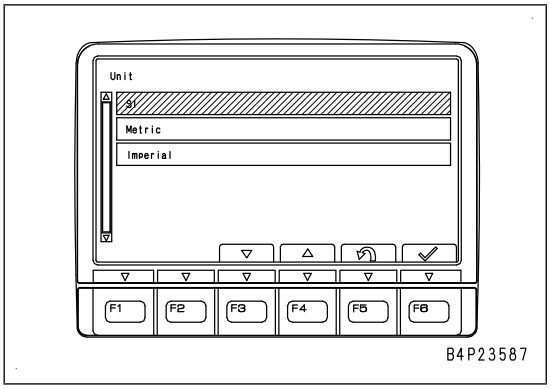
   F4: Moves up the selected item

   F5: Cancels the selection and returns the screen to “Default” screen

   F6: Enters the selected item and returns the screen to “Default” screen

   REMARK

   Default value at the shipment is SI Unit.



METHOD FOR SETTING WITH DEFAULT SETTING MENU (WITH/WITHOUT ATTACHMENT)

Default setting menu is used to check or change default values of the machine monitor and the machine.

“With/Without Attachment” is a function for setting the necessary items when the attachment is installed or removed.

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

   REMARK

   See “METHOD FOR OPERATING SERVICE MODE” in “SERVICE MODE” for selecting method.

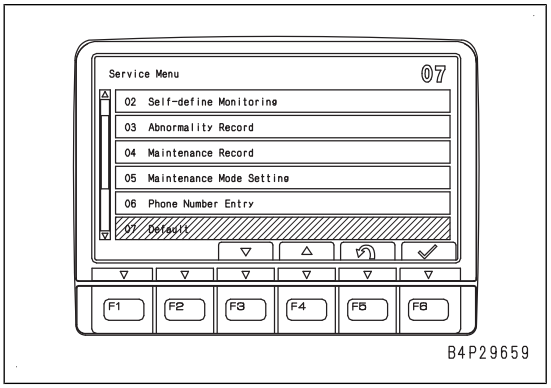


Table 1. Failure cause codes (Displayed in descending order of priority)

Cause code	Object			Content	Required action
	MIN swash plate calibration	MAX swash plate calibration	Pump IT calibration		
A-1	●	●	●	Engine speed signal is 0 rpm.	Check that engine is started.
A-2	●	●	●	Hydraulic oil temperature is low.	Check the hydraulic oil temperature (Max. 45 °C).
A-3	●	●	●	Hydraulic oil temperature is high.	Check the hydraulic oil temperature (Min. 55 °C).
A-4	●	●	●	Overheating	Check for overheating
A-6	●	●	●	Pump pressure sensor (F, R) is defective.	Perform troubleshooting for pump pressure sensor.
A-7	●	●	-	Pump swash plate (F, R) sensor is defective.	Perform troubleshooting for pump swash plate sensor.
A—8	-	-	●	Arm IN PPC pressure sensor is defective.	Perform troubleshooting for the arm IN PPC pressure sensor
A-9	-	-	●	PC-EPC is abnormal.	Perform troubleshooting for PC-EPC.
A-A	-	-	●	Defective CAN communication (Eng, Monitor, Pump)	Perform troubleshooting for CAN.
A-B	-	-	●	Boom RAISE PPC pressure sensor is defective	Perform troubleshooting for the boom RAISE PPC pressure sensor
B-1	●	-	-	Pump pressure on calibration side is specified value or more.	Perform troubleshooting for relief valve and pump.
B-3	●	-	-	Lever is not set to NEUTRAL position.	Set the lever to NEUTRAL position.
C-1	-	●	-	Pump pressure on calibration side is specified value or less.	Perform troubleshooting for relief valve and pump.
C-2	-	●	-	Travel speed is not Hi.	Select travel Hi on the monitor.
C-3	-	●	●	Fuel control dial is not at MAX position.	Check that the fuel control dial is in MAX position.
C-4	-	●	-	Travel operation is not recognized as a single operation.	Check that travel lever is set to full stroke and work equipment control lever is in NEUTRAL position.
C-5	-	●	-	Pump is not separated	Check service adjustment (Normally separated while travel operation is performed singly)
C-6	-	●	-	Travel PPC pressure sensor is faulty.	Perform troubleshooting for travel PPC.
C-7	-	●	-	Travel PPC pressure is specified value or less.	Check the travel lever is set to full stroke.

REMARK

- This message is different from that sent to the operator in the operator mode.
- Since this message is special for the technician, the message monitor is not displayed as it is displayed in the operator mode.

HANDLE VOLTAGE CIRCUIT OF ENGINE CONTROLLER

NOTICE

- **Before connecting the wiring harness connector, be sure to completely remove sand, dust, water, etc., inside the connector on the controller side.**
- **Disconnecting or connecting work of the connector between the engine controller and the engine must be performed only when the starting switch and battery disconnect switch are in OFF position.**
- **Even when you perform troubleshooting, do not start the engine while a T-adapter is inserted into or connected to the connector between the engine controller and engine.**

  REMARK

  You may turn the starting switch to OFF or ON position but do not turn it to START position. (Do not start the engine).

Abbreviation	Actual word spelled out	Purpose of use (major applicable machine (*1), or component/system)	Explanation
CRI	Common Rail Injection	Engine	This is a function that maintains optimum fuel injection amount and fuel injection timing. This is performed the engine controller which electronically controls supply pump, common rail, and injector.
ECM	Electronic Control Module	Electronic control system	This is an electronic control device that send the command to actuators using the signals from the sensors on the machine so that the optimum actuation is performed. (Same as ECU)
ECMV	Electronic Control Modulation Valve	Transmission (D, HD, WA, etc)	This is a proportional electromagnetic valve that decreases the transmission shock by gradually increasing oil pressure for engaging clutch.
ECSS	Electronically Controlled Suspension System	Travel (WA)	This is a device that ensures smooth high-speed travel by absorbing vibration of machine during travel with hydraulic spring effect of accumulator.
ECU	Electronic Control Unit	Electronic control system	This is an electronic control device that send the command to actuators using the signals from the sensors on the machine so that the optimum actuation is performed. (Same as ECM)
EGR	Exhaust Gas Recirculation	Engine	This is a function that recirculates a part of exhaust gas to combustion chamber, so that it reduces combustion temperature, and reduces emission of NOx.
EMMS	Equipment Management Monitoring System	Machine monitor	This is a function with which operator can check information from each sensor on the machine (filter, oil replacement interval, malfunctions on machine, failure code, and failure history).
EPC	Electromagnetic Proportional Control	Hydraulic system	Electromagnetic proportional control This is a mechanism with which actuators operate in proportion to the current.
FOPS	Falling Object Protective Structure	Cab and canopy	This structure protects the operator's head from falling objects. (Falling object protective structure) This performance is standardized as ISO 3449.
F-N-R	Forward-Neutral-Reverse	Operation	Forward - Neutral - Reverse
GPS	Global Positioning System	Communication (KOMTRAX, KOMTRAX Plus)	This system uses satellites to determine the current location on the earth.
GNSS	Global Navigation Satellite System	Communication (KOMTRAX, KOMTRAX Plus)	This is a general term for system uses satellites such as GPS, GALILEO, etc.
HSS	Hydrostatic Steering System	Steering (D Series)	This is a function that enables the machine to turn without steering clutch by controlling a difference in travel speed of right and left tracks with a combination of hydraulic motor and bevel shaft.
HST	Hydro Static Transmission	Transmission (D, WA)	Hydraulic transmission system that uses a combination of hydraulic pump and hydraulic motor without using gears for stepless gear shifting.

Check with machine monitor (Abnormality Record, Self-define Monitoring)						Good	No good
4	Check of monitoring information						
	Item to be displayed	Code	Testing conditions	Reference value	Measured value	Good	No good
	Engine speed	01002		600 to 2200 r/min			
	Throttle Position	31701		0 to 100 %			
	Swing Motor DC Current	09100		±400 A			
	Capacitor Voltage	09300		190 to 400 V			
	Booster Low-voltage Side Voltage	09400		190 to 400 V			
	Capacitor Base Temperature	09304		-30 to 65 °C			
	Capacitor Bus Bar Temperature	09305		-30 to 65 °C			
	Capacitor Cell Temperature	09306		-30 to 65 °C			
	Booster IGBT Base Temperature	09403		-30 to 100 °C			
	Booster IGBT Junction Temp	09404		-30 to 135 °C			
	Booster Inductor Temperature	09402		-30 to 130 °C			
	Swing Motor Coil Temperature	09101		-30 to 160 °C			
	Swing Driver Ph-U IGBT Base Temp	09504		-30 to 85 °C			
	Swing Driver Ph-V IGBT Base Temp	09505		-30 to 85 °C			
	Swing Driver Ph-W IGBT Base Temp	09506		-30 to 85 °C			
	Motor-Generator Temperature	09600		-30 to 190 °C			
	Motor-Generator Driver IGBT Base Temp #0	09607		-30 to 100 °C			
	Motor-Generator Driver IGBT Base Temp #1	09608		-30 to 100 °C			
	Swing Driver IGBT Junction Temp	09507		-30 to 135 °C			
	HYB Controller Solenoid	09700					
	Motor-Generator Speed	09602		Same as engine speed			
	Motor-Generator Target Speed	09605		600 to 2500 r/min			
	Capacitor Target Voltage	09303		280 to 375 V			
	Swing Lever Stroke	42103		-100 to 100 % (When lever in NEUTRAL: 0)			

DISCONNECT AND CONNECT CONNECTOR WITH A SPECIAL LOCK

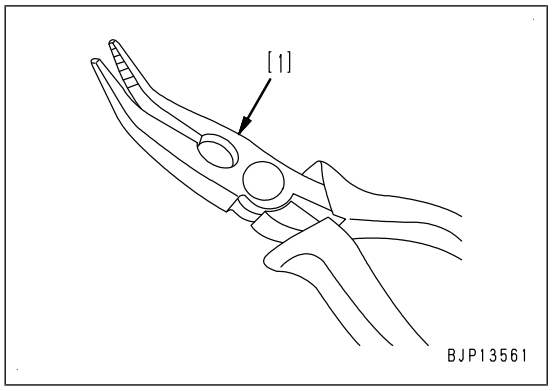
REMARK

For the type of each connector, see “CONNECTORS LIST AND LAYOUT”.

- Precautions for disconnection of connectors
  Since the direction of the lock on the connector changes by the screwed in position of the sensor, the lock can be facing a direction difficult for unlocking.

  In such a case, use a bent needle nose pliers (commercially available) [1]. The lock can be released easily.

  Lock is unlocked with the click sound, so check the sound when disconnecting the connector.
- Precautions for connecting connectors
  When connecting the connectors, pay attention not to connect the connectors reverse.

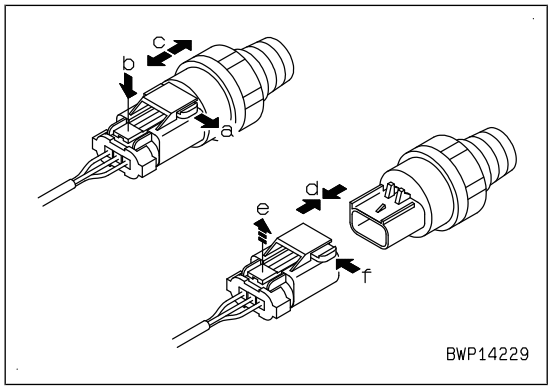


FRAMATOME-3 and FRAMATOME-2 connectors

- Disconnection and connection of connector
  Disconnect the connector by moving in the order of (a) to (c), and connect in the order of (d) to (f) as shown in the figure.

  Disconnection: (a) Slide the lever (b) Unlock (c) Disconnect the connector

  Connection: (d) Connect the connector (e) Engage the lock (f) Slide the lever

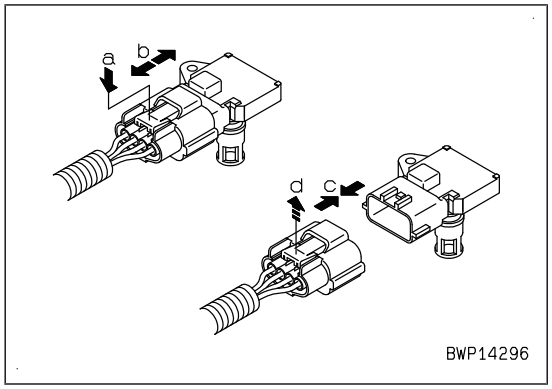


SUMITOMO-3 connector

- Disconnection and connection of connector
  Disconnect the connector by moving in the order of (a) to (b), and connect it in the order of (c) to (d) as shown in the figure.

  Disconnection: (a) Unlock (b) Disconnect the connector

  Connection: (c) Connect the connector (d) Engage the lock

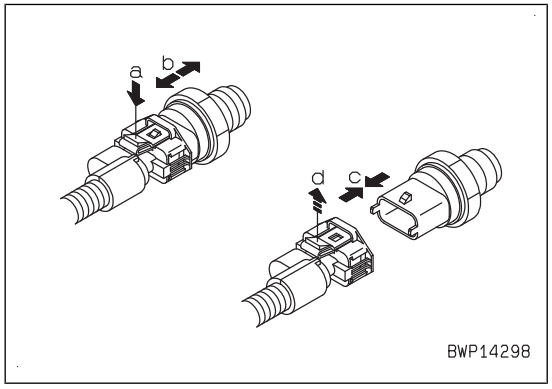


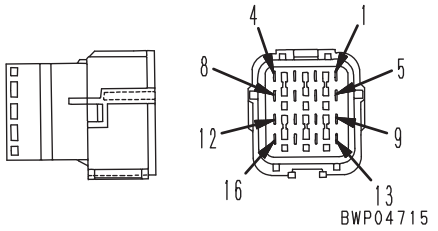
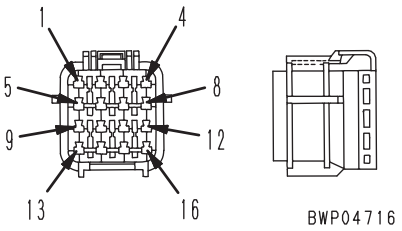
BOSCH connector and BDK connector

- Disconnection and connection of connector
  Disconnect the connector by moving in the order of (a) to (b), and connect it in the order of (c) to (d) as shown in the figure.

  Disconnection: (a) Unlock (b) Disconnect the connector

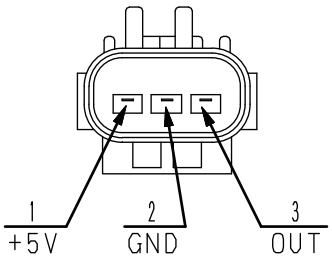
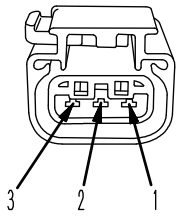
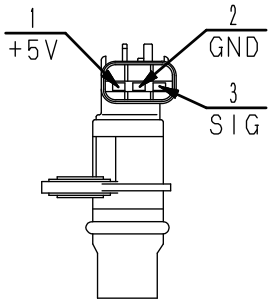
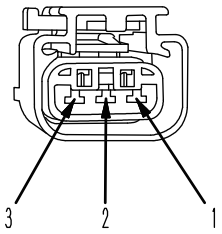
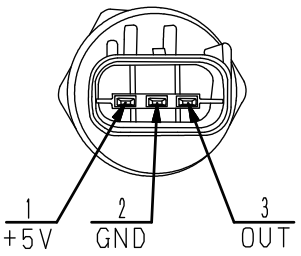
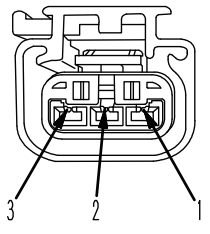
  Connection: (c) Connect the connector (d) Engage the lock



No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
16	 BWP04715	 BWP04716	799-601-7320 (T-adapter)
	Part No. : 08055-11681	Part No. : 08055-11691	
—	Terminal part No. : 79A-222-3510 ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	Terminal part No. : 79A-222-3530 ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	—
—	Terminal part No. : 79A-222-3520 ·Electric wire size: 1.25 ·Grommet: Red ·Q'ty: 20	Terminal part No. : 79A-222-3540 ·Electric wire size: 1.25 ·Grommet: Red ·Q'ty: 20	—

B4D18192

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	Category of history	Remarks
DLM5KA	Fan Speed Sensor Open Circuit	PUMP	L01	Electrical system	
DLM5MB	Fan control:Mismatch	PUMP	L01	Electrical system	
DR21KX	Camera 2 Picture Reverse Drive Input Out of Range	MON	L01	Electrical system	
DR31KX	Camera 3 Picture Reverse Drive Input Out of Range	MON	L01	Electrical system	
DUMBKA	System Operating Lamp Open Circuit (KomVision)	KomVision	L01	Electrical system	
DUMBKB	System Operating Lamp Short Circuit (KomVision)	KomVison	L01	Electrical system	
DV20KB	Travel Alarm Short Circuit	PUMP	L01	Electrical system	
DW43KA	Travel Speed Solenoid Open Circuit	PUMP	L01	Electrical system	
DW43KB	Travel Speed Solenoid Short Circuit	PUMP	L01	Electrical system	
DW43KY	Travel Speed Solenoid Hot Short Circuit	PUMP	L01	Electrical system	
DW45KA	Swing Parking Brake Solenoid Open Circuit	HYB	L03	Electrical system	
DW45KB	Swing Parking Brake Solenoid Short Circuit	HYB	L03	Electrical system	
DW45KK	Swing Parking Brake Solenoid Valve Power Voltage Low Error	HYB	L03	Electrical system	
DW45KY	Swing Parking Brake Solenoid Hot Short Circuit	HYB	L03	Electrical system	
DW4CKY	PPC Lock Solenoid Hot Short Circuit	PUMP	L03	Electrical system	
DW91KA	Travel Junction Solenoid Open Circuit	PUMP	L01	Electrical system	
DW91KB	Travel Junction Solenoid Short Circuit	PUMP	L01	Electrical system	
DW91KY	Travel Junction Solenoid Hot Short Circuit	PUMP	L01	Electrical system	
DWA2KA	Attachment Single or 2-Way Change Solenoid Open Circuit	PUMP	L03	Electrical system	
DWA2KB	Attachment Single or 2-Way Change Solenoid Short Circuit	PUMP	L03	Electrical system	
DWA2KY	Attachment Single or 2-Way Change Solenoid Hot Short Circuit	PUMP	L03	Electrical system	
DWK0KA	2-Stage Relief Solenoid Open Circuit	PUMP	L01	Electrical system	
DWK0KB	2-Stage Relief Solenoid Short Circuit	PUMP	L01	Electrical system	

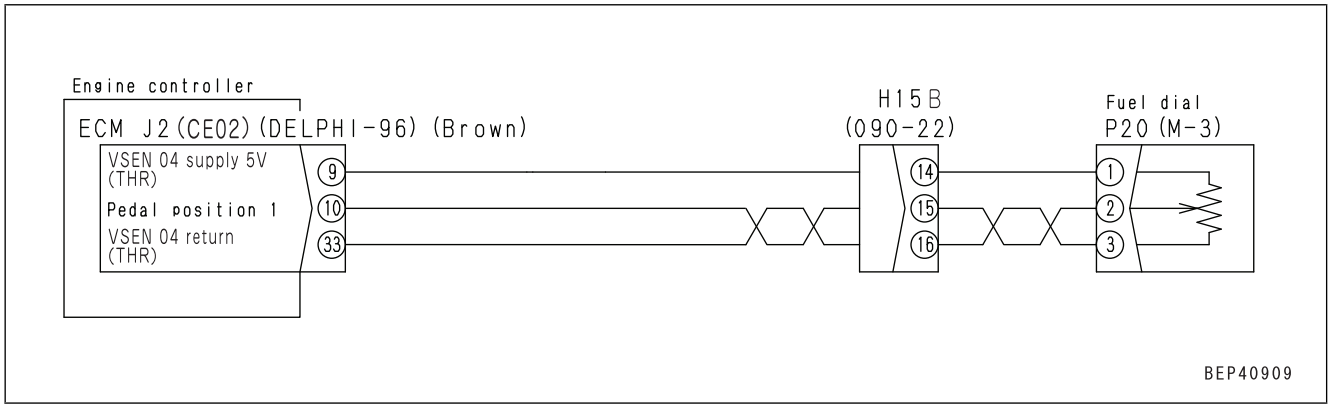
FAILURE CODE [AA10NX]

Action level	Failure code	Failure	Air Cleaner Clogging (Machine monitor system)
L01	AA10NX		
Detail of failure	Air cleaner clogging switch signal voltage is not 1 V and below while engine is running, and machine monitor detects clogging of air cleaner (open of sensor contacts).		
Action of controller	Displays air cleaner clogging monitor in yellow on machine monitor.		
Phenomenon on machine	If machine is used as it is, engine may be damaged.		
Related information	• Input (ON/OFF) from air cleaner clogging switch can be checked with monitoring function. (Code: 04501) • After completion of repair, check that the failure code is cleared by the following procedure. Procedure: Start the engine.		

No.	Cause	Procedure, measuring location, criteria and remarks			
1	Clogging of air cleaner	Air cleaner may be clogged. Check it for clogging and then clean or replace if clogged.			
2	Defective air cleaner clogging sensor	1. Turn the starting switch to OFF position. 2. Disconnect the connector P23, and connect the T-adapter to male side. 3. Start the engine. **REMARK** Air cleaner suction resistance value *1: -3430 Pa Max. {-350 mmH_2O} *2: -7470±490 Pa {-762±50 mmH_2O}			
		Resistance	Between P23 (male) (1) and (2)	When air cleaner: is normal *1	Max. 1 Ω
				When air cleaner is clogged *2	Min. 1 MΩ
3	Open circuit in wiring harness	1. Turn the starting switch to OFF position. 2. Disconnect the connectors CM02 and P23, and connect the T-adapter to each female side.			
		Resistance	Between CM02 (female) (4) and P23 (female) (1)		Max. 1 Ω
			Between P23 (female) (2) and ground		Max. 1 Ω
4	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.)			

No.	Cause	Procedure, measuring location, criteria and remarks			
6	Defective engine controller	Reference 1. Turn the starting switch to OFF position. 2. Insert T-adapter into connector ECM J2. 3. Turn the starting switch to ON position. 4. Depress the decelerator pedal and perform troubleshooting.			
		Voltage	Between ECM J2 (9) and (33)	Power supply	4.75 to 5.25 V
			Between ECM J2 (10) and (33)	Depress the decelerator pedal.	Approx. 4 V
				Release the decelerator pedal.	Approx. 1 V

Circuit diagram related to throttle sensor



FAILURE CODE [CA295]

Action level	Failure code	Failure	Ambient pressure sensor in-range error (Engine controller system)
L03	CA295		
Detail of failure	For output from ambient pressure sensor, value out of normal range is displayed.		
Action of controller	• Sets ambient pressure to fixed value (36.64 kPa (0.37 kgf/cm^2)) for operation. • Derates engine power for operation. • Stops regeneration control. • Activates inducement strategy.		
Phenomenon on machine	Engine output is reduced.		
Related information	• Signal voltage from ambient pressure sensor can be checked with monitoring function. (Code: 37401) • Ambient pressure detected by ambient pressure sensor can be checked with monitoring function. (Code: 37400) • After completion of repair, check that the failure code is cleared by the following operation. • Procedure: Turn the starting switch to OFF position while the engine coolant temperature is higher than 70 °C, turn the system operating lamp off, and then turn the starting switch to ON position. • Engine power deration is canceled by turning starting switch to OFF position after this failure code is cleared. (This deration is not canceled by simply failure code being cleared.)		

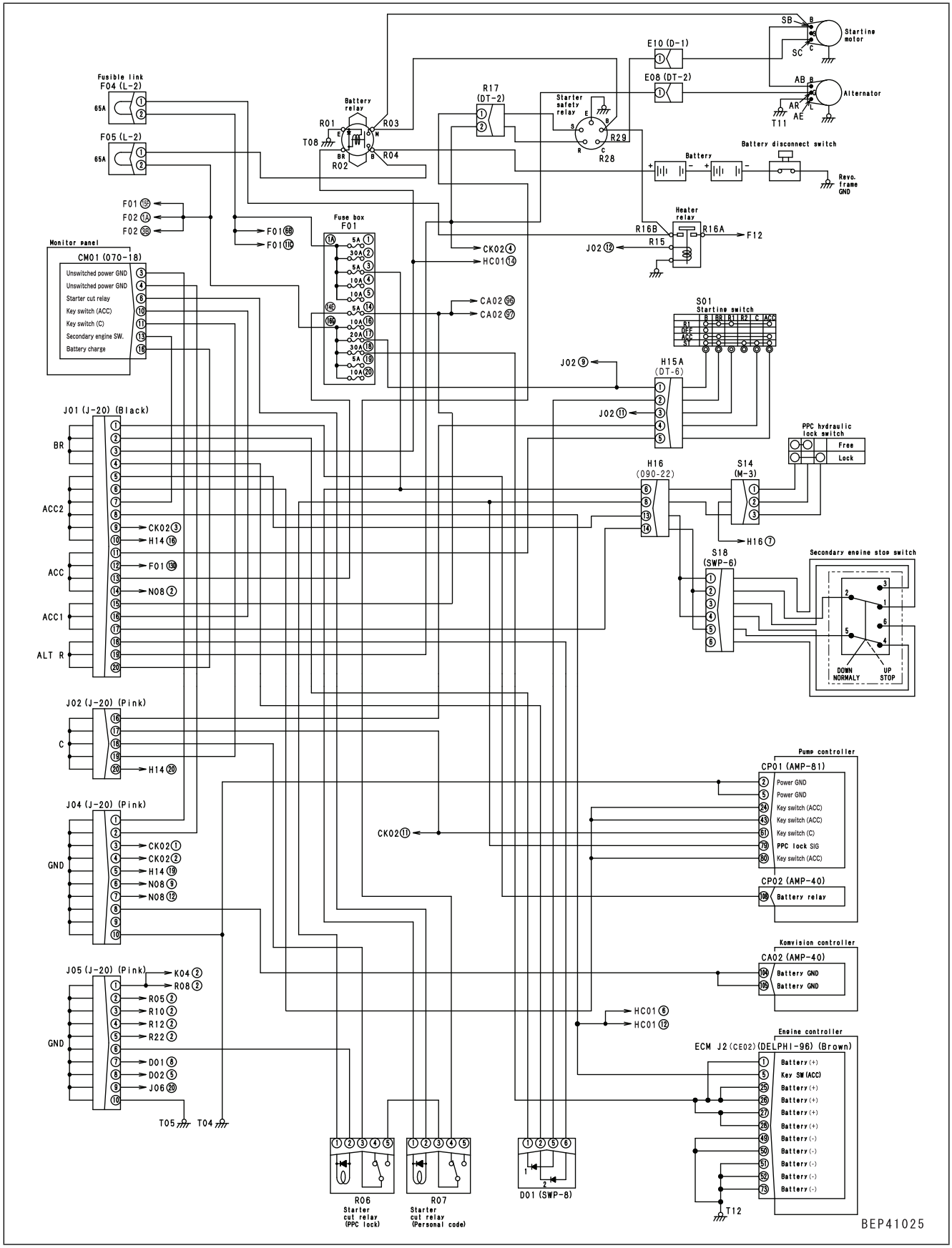
No.	Cause	Procedure, measuring location, criteria and remarks
1	Defective ambient pressure sensor system	Perform troubleshooting for failure codes [CA221] and [CA222].

FAILURE CODE [CA488]

Action level	Failure code	Failure	Charge Air Temperature High Torque Derate (Engine controller system)
L03	CA488		
Details of failure	Temperature signal from boost pressure & temperature sensor exceeds upper limit of control temperature.		
Action of controller	Restricts engine output and allows engine to run.		
Phenomenon on machine	Engine power deration		
Related information	• Boost temperature can be checked with monitoring function. (Code: 18500) • After repairing, check if the failure code is cleared by the following procedure. Procedure: Start engine.		

No.	Cause	Procedure, measuring location, criteria and remarks
1	Drop of cooling performance of aftercooler	Aftercooler cooling performance may be degraded. Check for following points: • Defective fan rotation • Insufficient cooling air • Clogged aftercooler fins
2	Unusual rise of turbocharger outlet temperature	Outlet temperature of turbocharger may be unusually high. Check related parts.
3	Defective boost temperature sensor system	Perform troubleshooting for failure codes [CA153] and [CA154].

CIRCUIT DIAGRAM (ENGINE CONTROLLER POWER SUPPLY)



FAILURE CODE [CA1776]

Action level	Failure code	Failure	Sensor Supply Relay Voltage High Error (Engine controller system)
L01	CA1776		
Detail of failure	A high voltage error occurs in sensor power supply relay circuit.		
Action of controller	None in particular		
Phenomenon on machine	• Inoperative KDOC temperature sensor, turbocharger outlet NOx sensor, SCR outlet NOx sensor, SCR temperature sensor and AdBlue/DEF tank sensor. • NOx emission increases because AdBlue/DEF injection is disabled.		
Related information	• This failure code is displayed if the connector is removed when the sensor power supply relay is turned OFF. • Note that sensor power supply relay connector is energized even if starting switch is turned to OFF position. • This failure code is detected until the sensor power supply relay is turned OFF, during which the engine controller shuts down since starting switch is turned to OFF position. • This failure code is not detected when starting switch is at ON position and not displayed on the monitor standard screen. Check the detection on “Abnormality Record” screen. • Troubleshooting of this failure code covers circuits from engine controller through sensor power supply relay to ground. **NOTICE** • **If the failure code is displayed, perform investigation of the cause, perform repair, clear “Electrical Sys Abnormality Record”, turn starting switch off, and shut down the engine controller. (See “PROCEDURE FOR TROUBLESHOOTING” in this chapter.) Turn starting switch to ON position again and check “Abnormality Record” screen. If this failure code is not logged, the repair is completed.**		

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. 3. Perform deletion of “Electrical Sys Abnormality Record” in “SERVICE MODE” of machine monitor. 4. Turn the starting switch to OFF position, and shut down the engine controller. 5. Turn starting switch to ON position.
		If this failure code is not logged on Abnormality Record screen, wiring harness connector is defective.

FAILURE CODE [CA2288]

Action level	Failure code	Failure	Turbocharger Speed High Error 1 (Engine controller system)
L01	CA2288		
Detail of failure	Turbocharger rotates at abnormally high speed.		
Action of controller	Sets turbocharger speed to internally-calculated value for operation.		
Phenomenon on machine	Engine output is reduced.		
Related information	• Turbocharger speed in turbocharger speed sensor can be checked by monitoring function. (Code: 48100) • After completion of repair, check that the failure code is cleared by the following operation. Procedure: Start the engine.		

No.	Cause	Procedure, measuring location, criteria and remarks
1	Increased turbocharger speed	Turbocharger speed may increase abnormally high. Check it.
2	Defective turbocharger	Turbocharger may be defective. Check it.
3	Defective turbocharger speed sensor	If failure code is still displayed after above checks on cause 1, turbocharger speed sensor system may be defective. Perform troubleshooting for failure code [CA687].

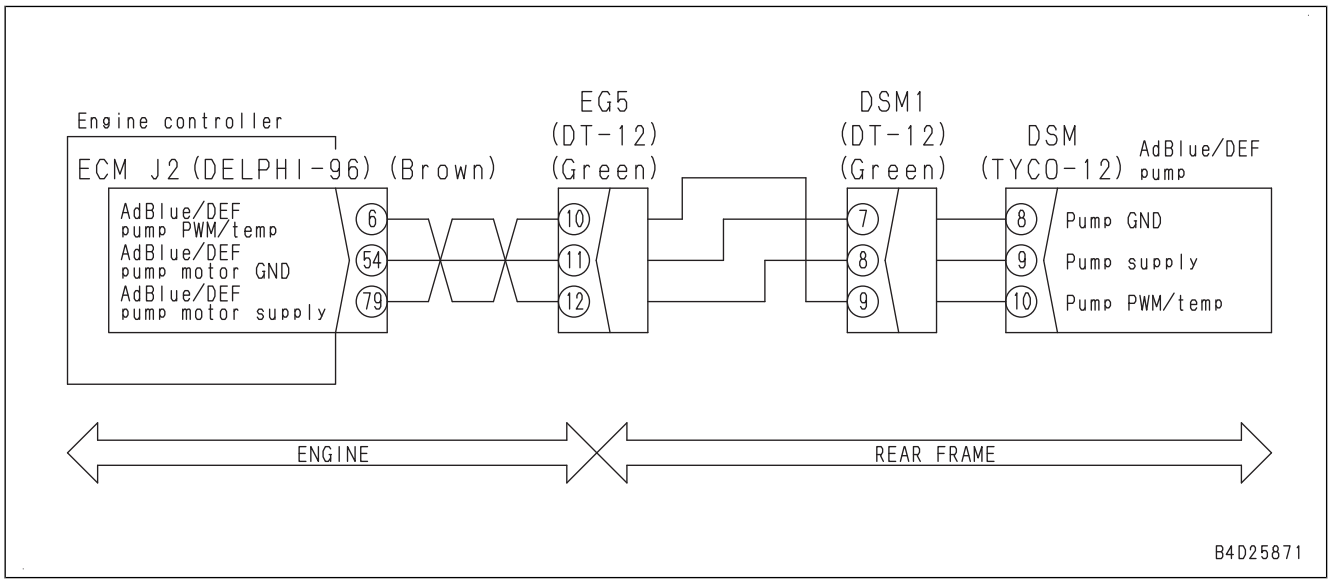
<table>
<tr><th>No.</th><th>Cause</th><th colspan="3">Procedure, measuring location, criteria and remarks</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defective smart sensor</td><td colspan="3">If all of 5 failure codes of [CA2771], [CA3232], [CA3868], [CA4152] and [CA5391] are displayed,
1. Turn the starting switch to OFF position.
2. Disconnect the connectors of turbocharger outlet NOx sensor (E31), DOC temperature sensor (E26), SCR temperature sensor (E34), SCR outlet NOx sensor (E36), and AdBlue/DEF tank sensor (P63) one by one in this order.
3. Perform the troubleshooting when starting switch is in ON position.
4. Return to step 1 to check the following sensor.</td></tr>
<tr><td colspan="2">Did any of displayed failure codes [CA2771], [CA3232], [CA3868], [CA4152] and [CA5391] disappear?</td><td>If YES, the disconnected sensor is defective.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Open circuit in wiring harness (broken power line)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the connector E36, and connect the T-adapter to female side.
3. Turn the starting switch to ON position.</td></tr>
<tr><td>Voltage</td><td>Between E36 (female) (1) and (4)</td><td>Min. 22 V</td></tr>
<tr><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the connectors R52 and E36, and connect the T-adapter to each female side.</td></tr>
<tr><td rowspan="2">Resistance</td><td>Between R52 (female) (12) and E36 (female) (1)</td><td>Max. 10 Ω</td></tr>
<tr><td>Between E36 (female) (4) and ground</td><td>Max. 10 Ω</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective CAN terminating resistor</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the connectors K10 and K11, and connect the T-adapter to each male side.</td></tr>
<tr><td rowspan="2">Resistance</td><td>Between K10 (male) (A) and (B)</td><td>Approx. 120 Ω</td></tr>
<tr><td>Between K11 (male) (A) and (B)</td><td>Approx. 120 Ω</td></tr>
<tr><td rowspan="7">4</td><td rowspan="7">Open circuit in wiring harness (CAN communication line)</td><td colspan="3">• Communication line
If no failure is found by check on cause 11, this check is not required.
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 connectors ECM J2, E36, K10 and K11, and connect the T-adapter to each female side.</td></tr>
<tr><td rowspan="6">Resistance</td><td>Between ECM J2 (female) (21) and E36 (female) (3)</td><td>Max. 10 Ω</td></tr>
<tr><td>Between ECM J2 (female) (45) and E36 (female) (2)</td><td>Max. 10 Ω</td></tr>
<tr><td>Between K10 (female) (A) and E36 (female) (3)</td><td>Max. 10 Ω</td></tr>
<tr><td>Between K10 (female) (B) and E36 (female) (2)</td><td>Max. 10 Ω</td></tr>
<tr><td>Between K11 (female) (A) and E36 (female) (3)</td><td>Max. 10 Ω</td></tr>
<tr><td>Between K11 (female) (B) and E36 (female) (2)</td><td>Max. 10 Ω</td></tr>
</table>

FAILURE CODE [CA3232]

Action level	Failure code	Failure	Turbocharger Outlet NOx Sensor Datalink Timeout Error (Engine controller system)
L01	CA3232		
Detail of failure	The engine controller cannot receive the data of the turbocharger outlet NOx sensor due to error of communication with the turbocharger outlet NOx sensor.		
Action of controller	• Operate using the NOx value in the memory. • Advances to Inducement strategy.		
Phenomenon on machine	• The AdBlue/DEF injection becomes inappropriate, NOx emission increases. • Engine power deration according to inducement strategy. • Turbocharger Outlet NOx Concentration undetectable		
Related information	⚠ **The turbocharger outlet, sensor fitting piping, and KDOC become hot (Min. 500 °C). Be careful not to get burned.** ⚠ **The SCR assembly, sensor fitting piping, and 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.** • 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 them. • The turbocharger outlet NOx sensor is a smart sensor which performs CAN communication with the engine controller together with the other sensors. • If the sensor connector or smart sensor (power supply) relay connector is disconnected, this failure code is displayed. • The failure codes of the CAN communication related to the engine sensor are [CA2771], [CA3232], [CA3868], [CA4152], and [CA5391]. If all of these failure codes are displayed, the cause may be defect of any of the 5 sensors, defective smart sensor power supply relay, defective relay system, or ground fault, short circuit, or hot short circuit of the harness (CAN communication line). • 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 smart sensor	If all of 5 failure codes of [CA2771], [CA3232], [CA3868], [CA4152] and [CA5391] are displayed, 1. Turn the starting switch to OFF position. 2. Disconnect the connectors of turbocharger outlet NOx sensor (E31), DOC temperature sensor (E26), SCR temperature sensor (E34), SCR outlet NOx sensor (E36), and AdBlue/DEF tank sensor (P63) one by one in this order. 3. Perform the troubleshooting when starting switch is in ON position. 4. Return to step 1 to check the following sensor.	
		Did any of displayed failure codes [CA2771], [CA3232], [CA3868], [CA4152] and [CA5391] disappear?	If YES, the disconnected sensor is defective.

Circuit diagram related to AdBlue/DEF pump

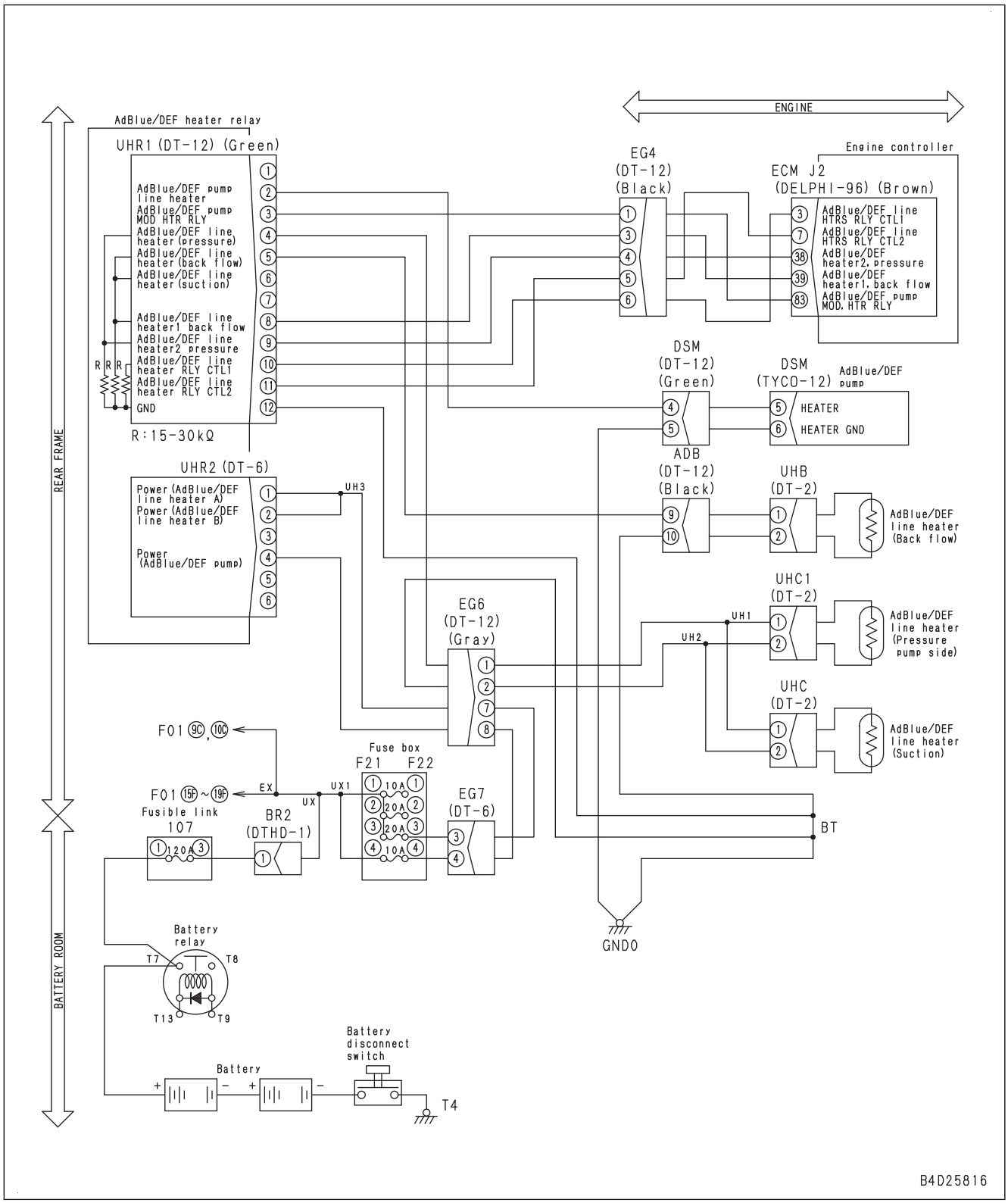


Related information	• If active regeneration occurs frequently, engine oil dilution by fuel occurs. Check the engine oil (increase of oil level, smell and abnormal viscosity), and change the oil or replace the engine oil filter, etc. as needed. (Frequent regeneration: Failure code [CA3582] is displayed 20 times or more in 50 hours of SMR. When the regeneration is confirmed by KOMTRAX, it is judged as frequent regeneration if the interval of completion of SCR active regeneration is 10 hours/time or less.) • The purpose of this failure code is monitoring to identify the cause of failure codes [CA3151] and [CA3543]. The troubleshooting for this code alone and replacement of parts are not necessary. • Even if the cause of this failure code is eliminated, it takes time to detect the elimination and failure code may remain to be displayed. No remedy is needed. • If this failure code is displayed 20 times or more in last 50 hours of SMR, specify the cause according to the following flow. • On “Pre-defined Monitoring” screen, following 4 diagnoses are displayed. Operation basics related, operating environment related, SCR sensor related, AdBlue/DEF tank sensor related (The numbers below denote displayed monitoring codes.) • Pre-defined Monitoring (14/23) Operation basics related 1. 01002 Engine Speed 2. 18600 Inject Fueling Command 3. 19200 Exhaust Gas Flow Rate 4. 47300 KDOC 1 Inlet Temperature 5. 19300 SCR Temperature 6. 19302 SCR Outlet Temperature • Pre-defined Monitoring (22/23) Operating environment related 1. 37400 Ambient Pressure 2. 19400 Ambient Temperature 3. 18400 Intake Temperature 4. 19133 Engine Room Temperature 5. 19115 AdBlue/DEF Temperature in Tank • Pre-defined Monitoring (17/23) SCR sensor related 1. 19120 AdBlue/DEF Injection Quantity 2. 19202 Turbo Outlet NOx Corrected 3. 19209 SCR Outlet NOx Corrected 4. 19203 Turbo Outlet NOx Sensor State 5. 19210 SCR Outlet NOx Sensor State • Pre-defined Monitoring (18/23) AdBlue/DEF tank sensor related 1. 19100 AdBlue/DEF Concentration 2. 19110 AdBlue/DEF Level 3. 19111 AdBlue/DEF Level Corrected 4. 19115 AdBlue/DEF Temperature in Tank 5. 19400 Ambient Temperature 6. 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.)**

FAILURE CODE [CA3748]

<table>
<tr><td>Action level</td><td>Failure code</td><td rowspan="2">Failure</td><td rowspan="2">Turbo outlet NOx sensor stuck in range error
(Engine controller system)</td></tr>
<tr><td>L01</td><td>CA3748</td></tr>
<tr><td>Detail of failure</td><td colspan="3">Operation state of engine is changing but engine outlet NOx does not change.</td></tr>
<tr><td>Action of controller</td><td colspan="3">• Stops AdBlue/DEF injection.
• Activates inducement strategy.</td></tr>
<tr><td>Phenomenon on machine</td><td colspan="3">• NOx emission may become large because AdBlue/DEF injection is disabled.
• Engine output is reduced based on Inducement strategy.</td></tr>
<tr><td>Related information</td><td colspan="3">⚠ KDOC, sensor fitting piping, and sensor probe become hot (500 °C or higher). Be careful not to get burn injury.
⚠ SCR assembly, sensor fitting piping, and sensor probe become hot (400 °C or higher). Be careful not to get burn injury.
⚠ As for the sensor probe, be careful not to get burn injury even if the surroundings are not hot, because sensor itself is heated.
• 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 them.
• If failure code [CA1885], [CA3228], [CA3232], [CA3649], [CA3682], or [CA3718] is displayed, perform troubleshooting for these first.
• Turbo outlet NOx sensor operates when 47300 “KDOC 1 Inlet Temperature” is 150 °C or higher (19203 “Turbo Outlet NOx Sensor Power Voltage Error” is “1”).
• Turbo outlet NOx sensor is smart sensor which communicates with engine controller with other sensors through CAN communication.
• The turbocharger outlet NOx sensor does not operate when 47300 “KDOC 1 Inlet Temperature” is 150 °C or lower, and correct value is not displayed (the sensor does not operate by simply turning the starting switch to ON even when it is normal).
• On Pre-defined Monitoring screen, items related to basic machine operation and SCR sensor are used. (The numbers below denote 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
• SCR sensor
19120 AdBlue/DEF Injection Quantity
19202 Turbo Outlet NOx Corrected
19209 SCR Outlet NOx Corrected
19203 Turbo Outlet NOx Sensor State
19210 SCR Outlet NOx Sensor State
NOTICE
This failure code requires “Loaded Diagnostics Operation To Confirm Failure Correction”. After investigating the cause of the problem and completing the repair, perform “Loaded Diagnostics Operation To Confirm Failure Correction” to make sure the failure code is cleared. (Even if this failure code is not displayed with starting switch in ON position, completion of repair cannot be determined unless exhaust temperature becomes high.)</td></tr>
</table>

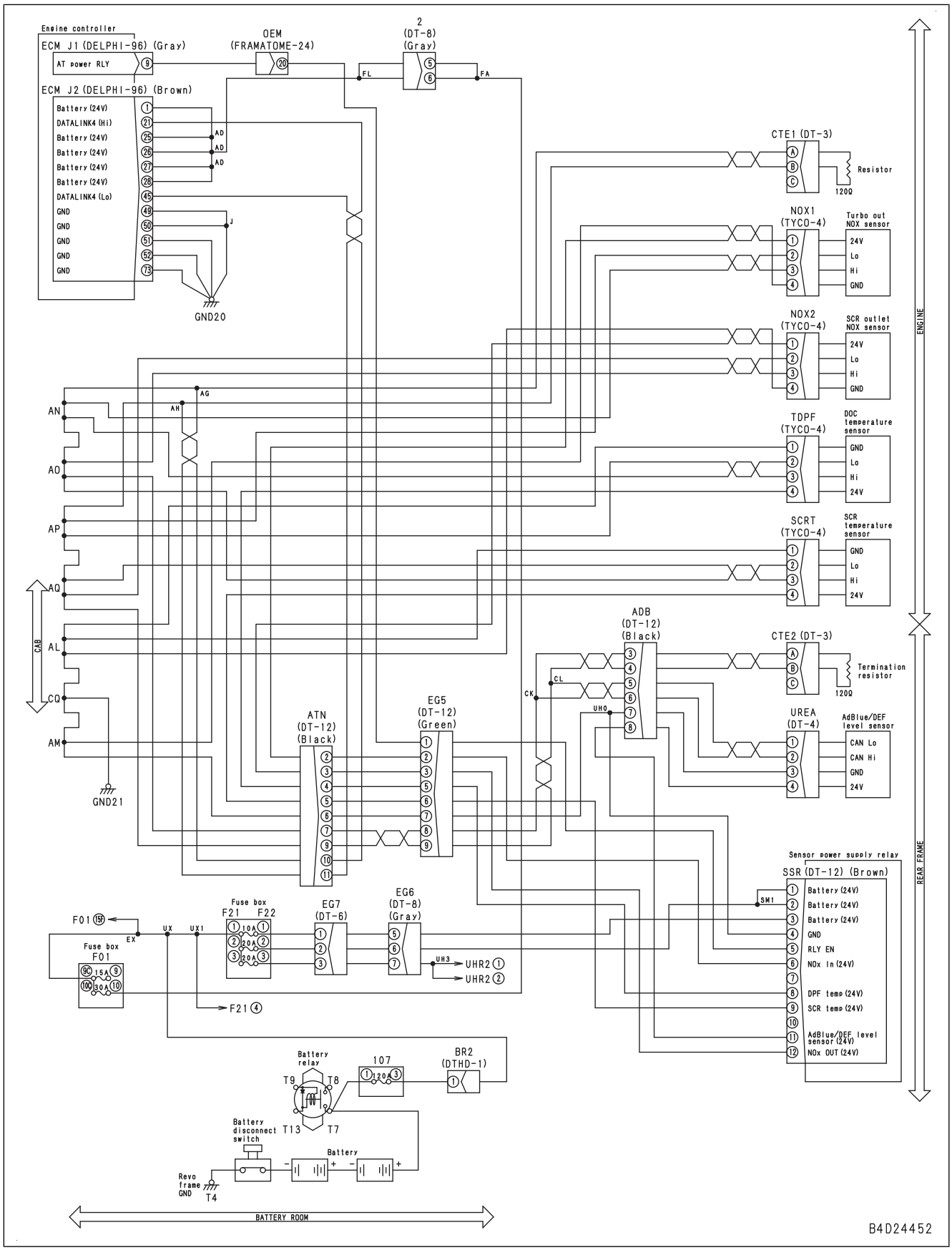
Electrical circuit diagram related to AdBlue/DEF pump heater



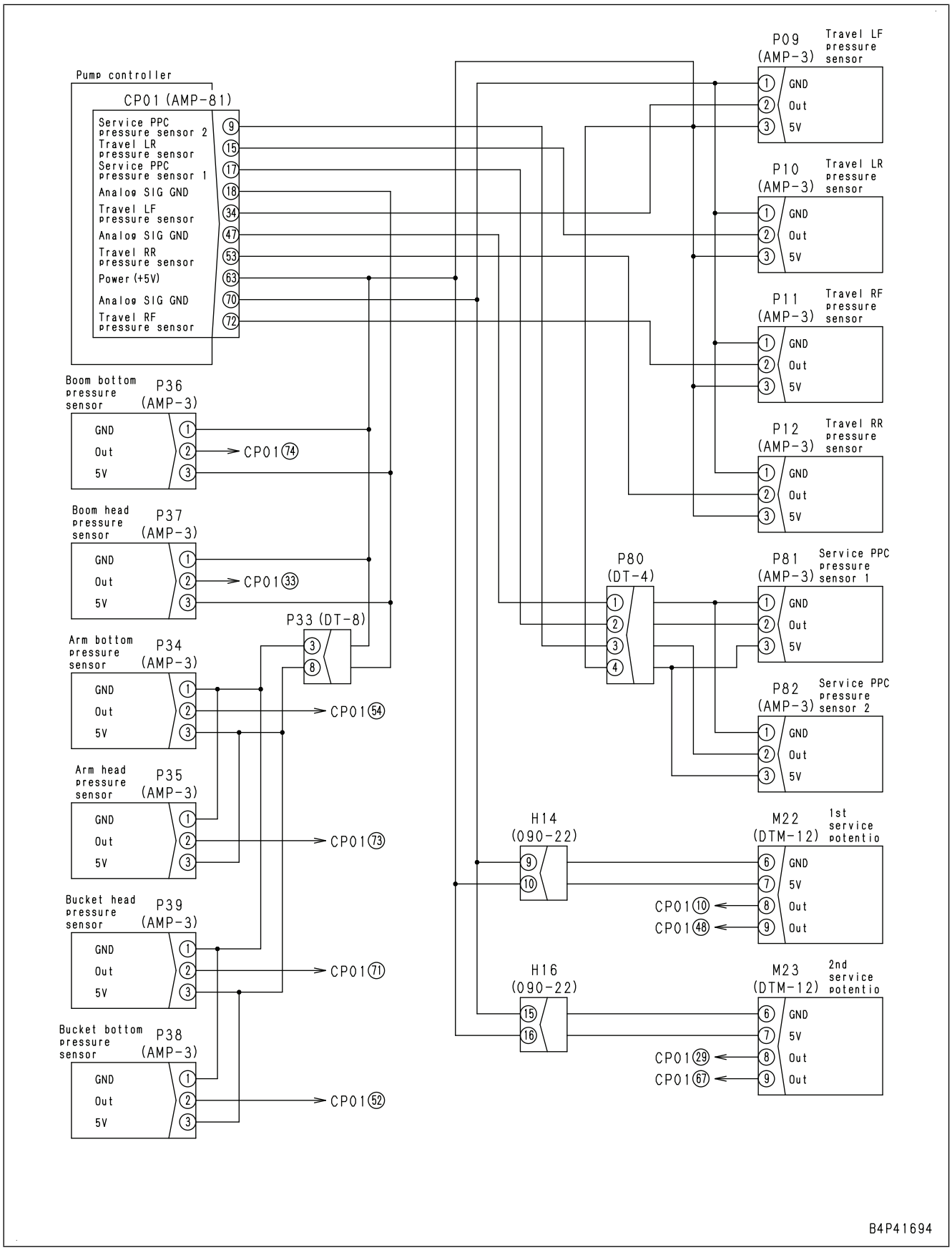
FAILURE CODE [CA4842]

Action level	Failure code	Failure	AdBlue/DEF high concentration error (Engine controller system)
L01	CA4842		
Detail of failure	High AdBlue/DEF concentration		
Action of controller	• Activates inducement strategy. • Stops AdBlue/DEF injection. • Stops driving AdBlue/DEF pump.		
Phenomenon on machine	Engine output is reduced based on Inducement strategy.		
Related information	When machine is operated on slopes or travels on rough ground, top surface of AdBlue/DEF in the tank fluctuates largely, and the level or concentration of AdBlue/DEF may not be detected correctly. If AdBlue/DEF level monitor lights up in red or warning for concentration is displayed when machine is operated on slopes or travels on rough ground, immediately move the machine to level ground, clear the failure code related to concentration according to step 3 “Contaminated AdBlue/DEF” and subsequent procedures, and add AdBlue/DEF. If these phenomena occur repeatedly, increase the AdBlue/DEF in AdBlue/DEF tank. • When AdBlue/DEF temperature in tank is 0 °C or lower, the engine controller does not troubleshoot this failure code. (Failure code is not cleared even after performing “Loaded Diagnostics Operation to Clear Failure Code”.) • Check that AdBlue/DEF temperature in tank is 0 °C or higher on Pre-defined Monitoring screen, and then troubleshoot this failure code. • When AdBlue/DEF level in tank is 0 %, the engine controller does not troubleshoot this failure code. (Failure code is not cleared even after performing “Loaded Diagnostics Operation to Clear Failure Code”.) • Check that AdBlue/DEF level is 20 % or more on Pre-defined Monitoring screen, and then troubleshoot this failure code. • For details of drain method and clean method of AdBlue/DEF tank, see TESTING AND ADJUSTING, “CLEAN AdBlue/DEF TANK”. • For AdBlue/DEF level sensor replacement, see DISASSEMBLY AND ASSEMBLY, “REMOVE AND INSTALL AdBlue/DEF LEVEL SENSOR”. • On “Pre-defined Monitoring” screen, items related to AdBlue/DEF tank sensor diagnosis is used. (The numbers below denote monitoring codes). • 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 “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.)**		

Electrical circuit diagram related to the KDOC temperature sensor

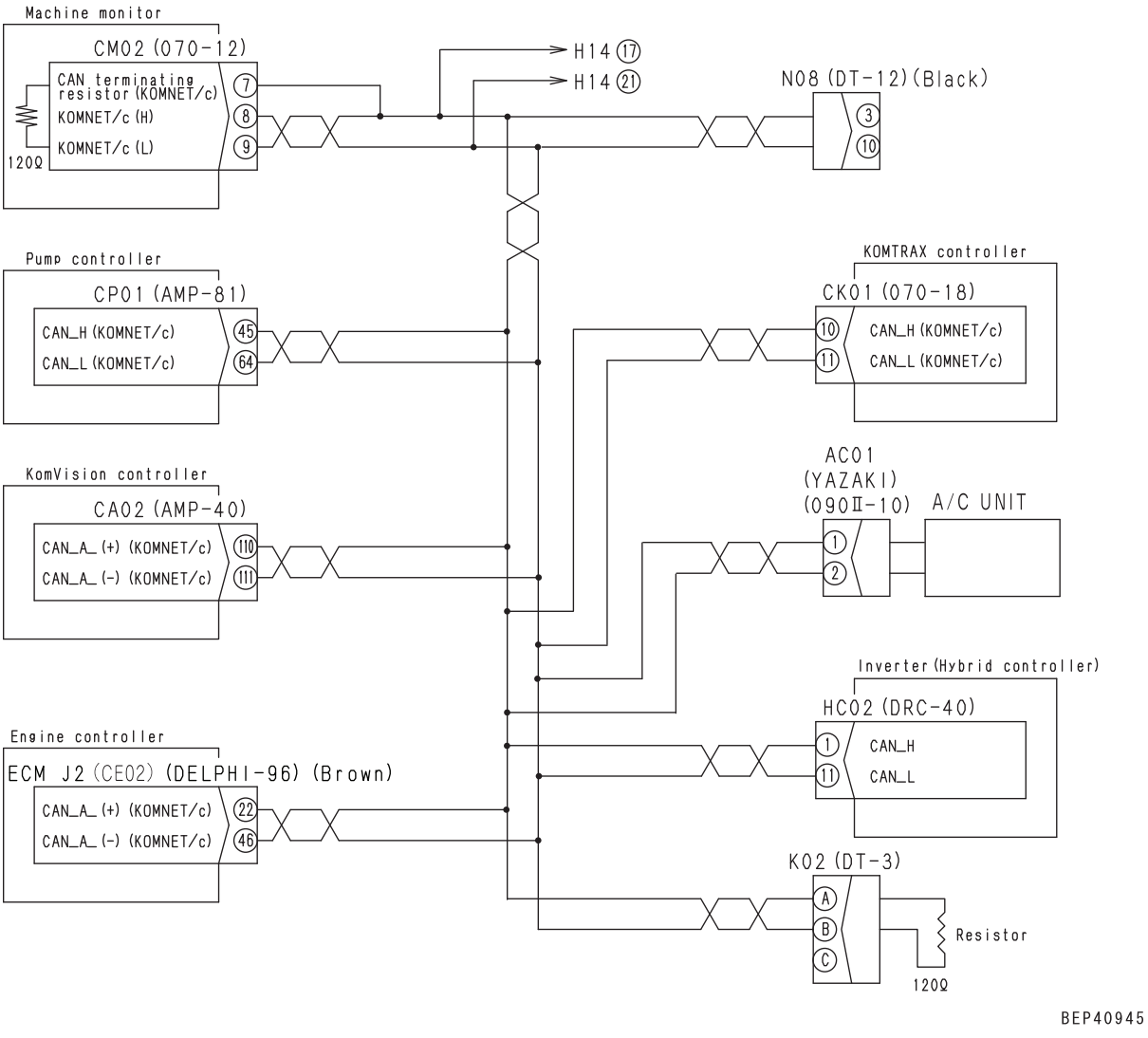


Circuit diagram related to pump controller 5V sensor power supply

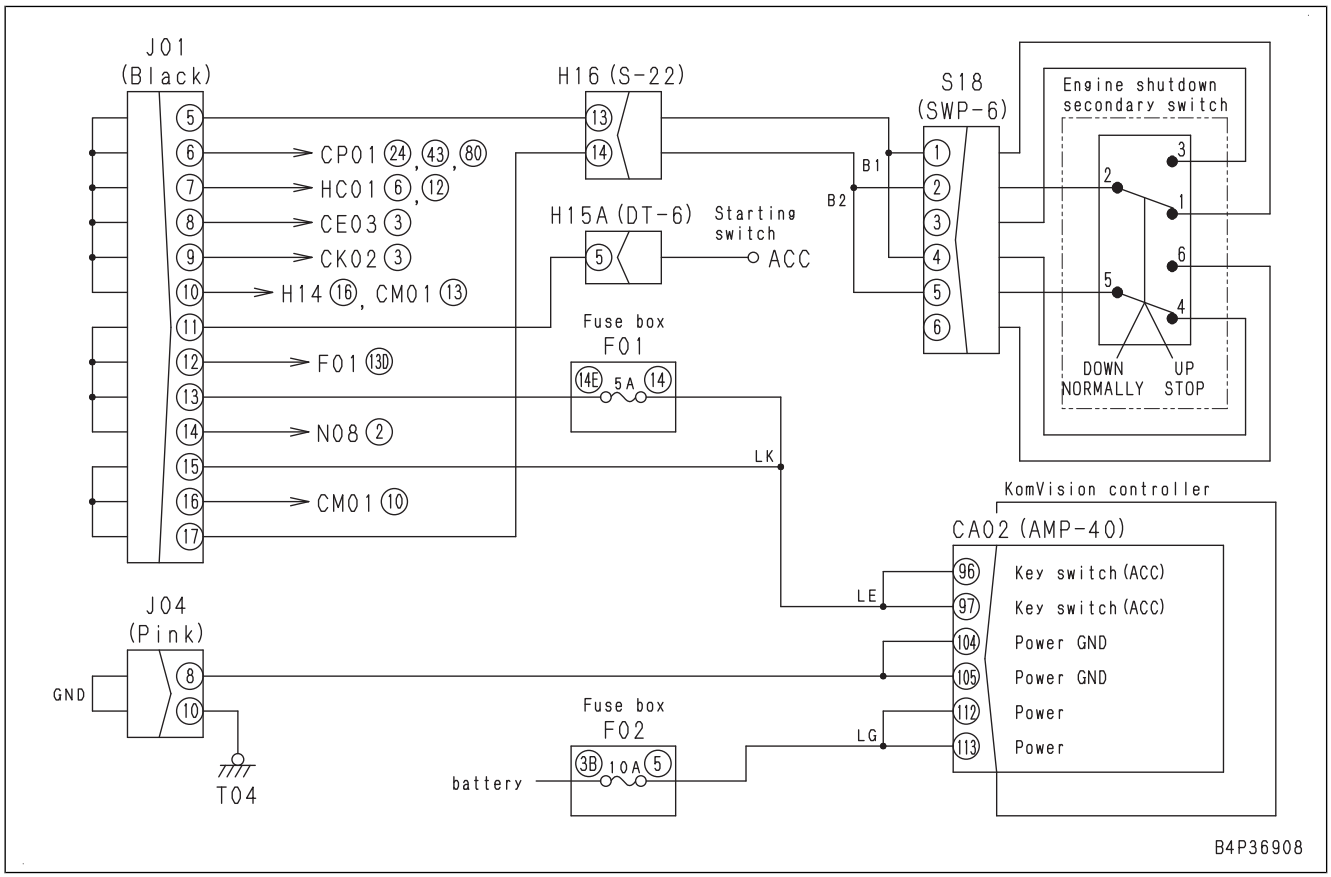


<table>
<tr><th>No.</th><th>Cause</th><th colspan="3">Procedure, measuring location, criteria and remarks</th></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Hot short circuit in wiring harness (CAN 2 communication line)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Check that system 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>9</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>

CIRCUIT DIAGRAM (CAN2 COMMUNICATION)



Circuit diagram related to KomVision controller power supply



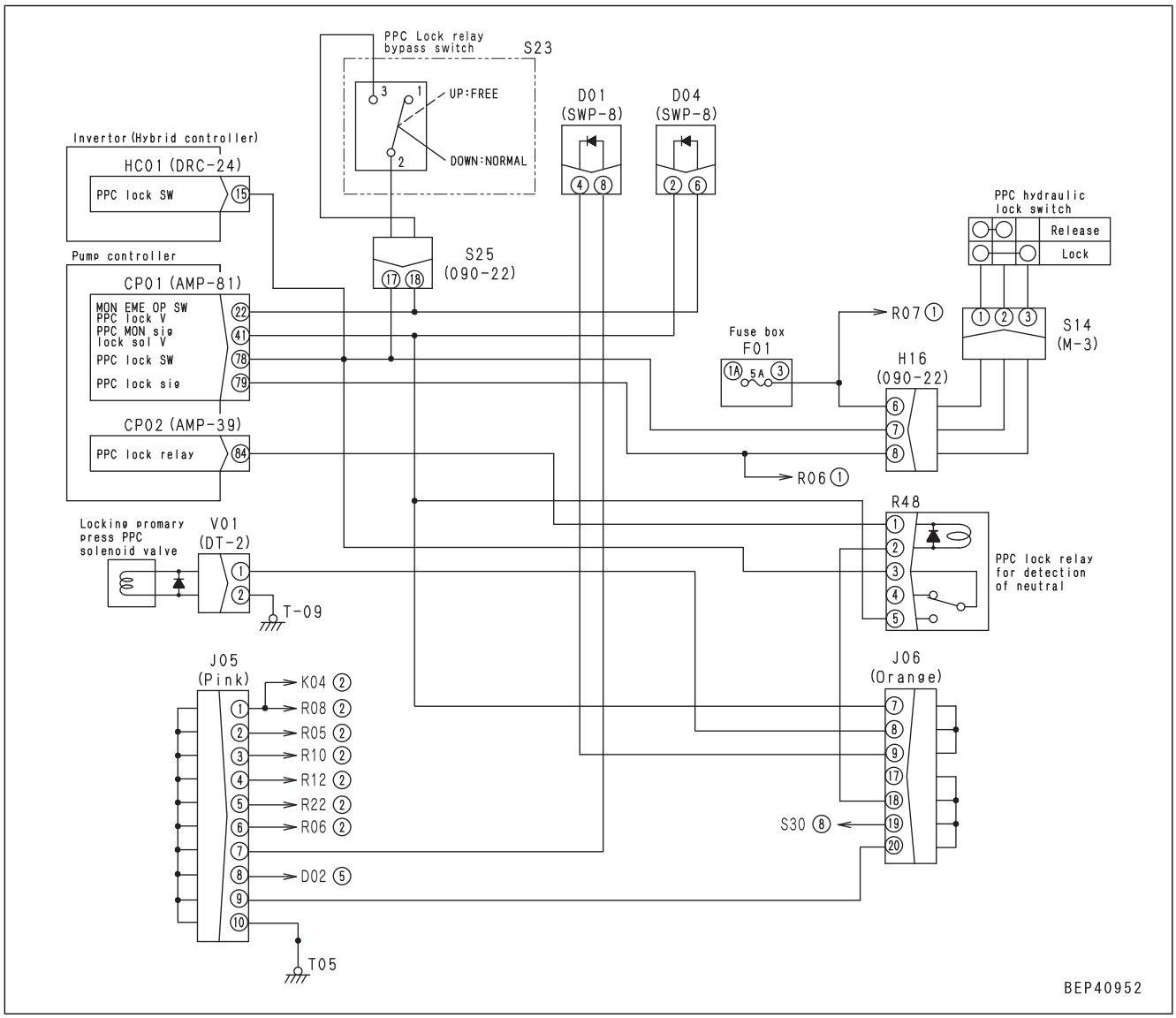
No.	Cause	Procedure, measuring location, criteria and remarks
3	Defective mass air flow and temperature sensor	Check the installation of the mass air flow and temperature sensor. If there is a defective installation, install it again correctly.
4	Defective engine controller	If no failure is found by above checks, engine controller is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

FAILURE CODE [DHVAL8]

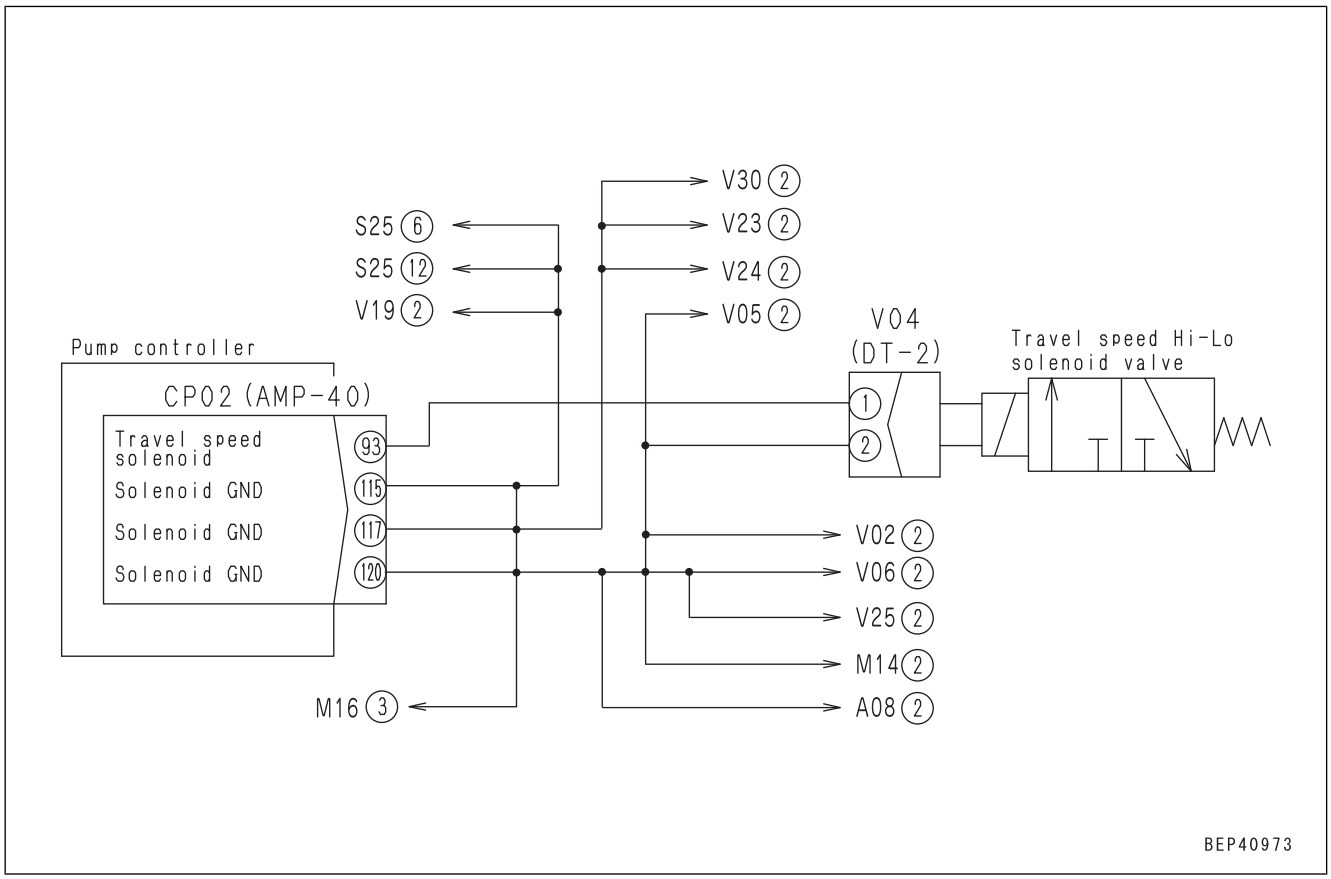
Action level	Failure code	Failure	Hybrid swing RIGHT PPC pressure sensor signal mismatch (Hybrid controller system)
L03	DHVAL8		
Detail of failure	Difference between the values detected by hybrid swing RIGHT PPC pressure sensor and pump controller swing RIGHT PPC pressure sensor is 0.49 MPa {5.0 kgf/cm^2 or more} when motor-generator is running.		
Action of controller	• Selects the minimum values of pump controller swing RIGHT PPC pressure and hybrid controller swing RIGHT PPC pressure, and controls each swing RIGHT PPC pressure. • Restricts swing speed. • Even if cause of failure is cleared naturally, machine does not become normal until starting switch is set to OFF position once.		
Phenomenon on machine	Swing speed, etc. is restricted.		
Related information	• Pressure detected by hybrid swing RIGHT PPC pressure sensor can be checked with monitoring function. (Code: 09008) • Pressure detected by pump controller swing RIGHT PPC pressure sensor can be checked with monitoring function. (Code: 09002) • After completion of repair, check that the failure code is cleared by the following operation. Procedure: Start the engine.		

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective swing RIGHT PPC pressure sensor (for hybrid)	1. Turn the starting switch to OFF position. 2. Insert T-adapter into the connector HP06. 3. Turn the starting switch to ON position.		
		Voltage	Between HP06 (2) and (1)	0.5 to 4.5 V
2	Defective swing RIGHT PPC pressure sensor	1. Turn the starting switch to OFF position. 2. Insert the T-adapter into connector P07. 3. Turn the starting switch to ON position.		
		Voltage	Between P07 (2) and (1)	0.5 to 4.5 V
3	Defective inverter (hybrid controller)	If no failure is found by above checks, inverter (hybrid controller) is defective. (Since this is an internal defect, troubleshooting cannot be performed.)		
4	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).		

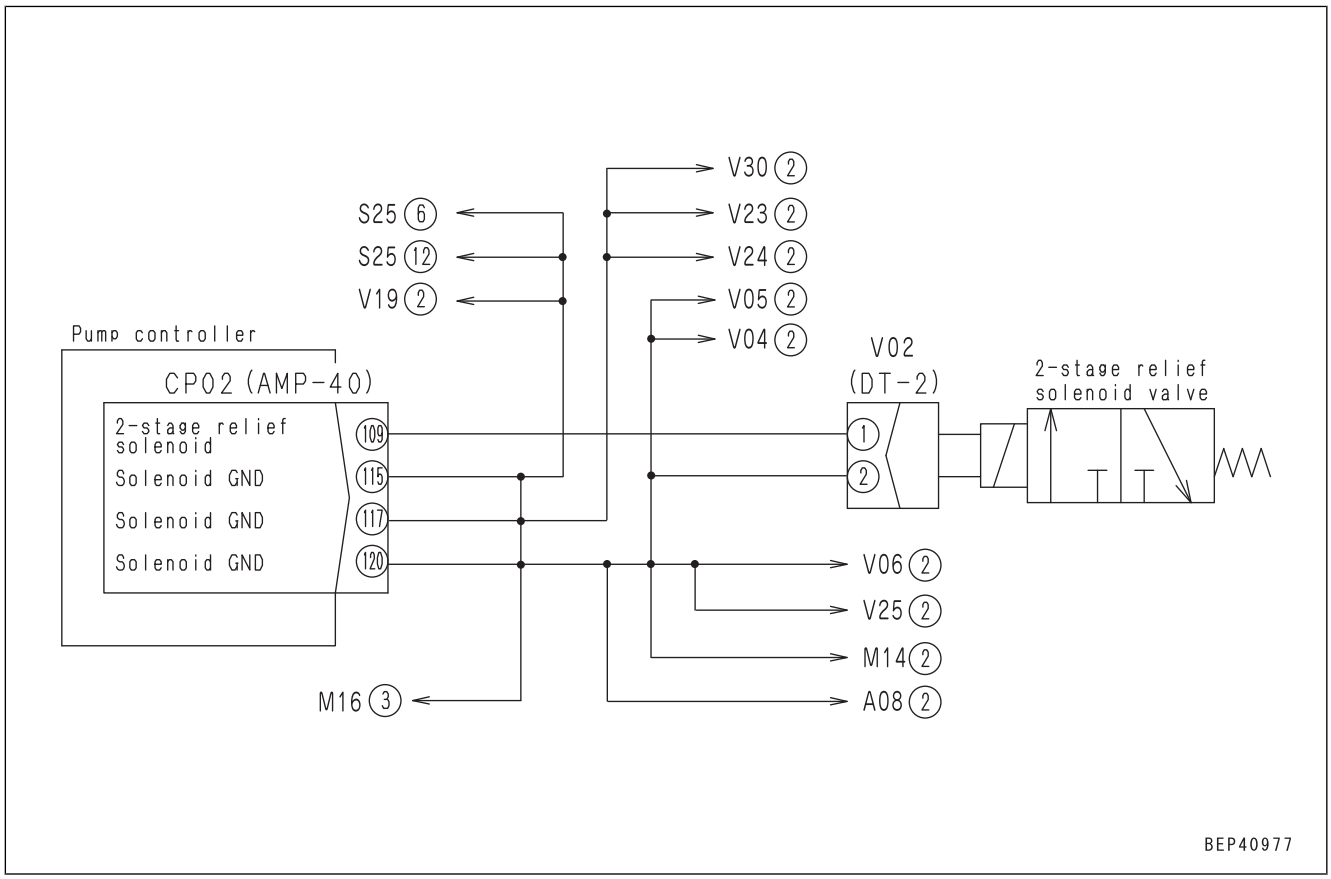
Circuit diagram related to PPC lock switch



Circuit diagram related to travel Hi/Lo solenoid



Circuit diagram related to 2-stage relief solenoid system



FAILURE CODE [DXA9KB]

Action level	Failure code	Failure	Rear Pump PC-EPC Solenoid Short Circuit (Pump controller system)
L03	DXA9KB		
Detail of failure	Abnormal current flows when pump controller drives rear pump PC-EPC Solenoid, so pump controller determines that short circuit exists in rear pump PC-EPC Solenoid circuit.		
Action of controller	Stops output to rear pump PC-EPC Solenoid. Even if cause of failure disappears, machine does not become normal until starting switch is turned to OFF position.		
Phenomenon on machine	If pump load increases, engine speed decreases largely and engine may stop.		
Related information	• When solenoid and wiring harness are normal, engine can be prevented from stopping by setting pump drive secondary switch to ON position. • Drive current of rear pump PC-EPC Solenoid can be checked with monitoring function. (Code: 01302) • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn starting switch to ON position.		

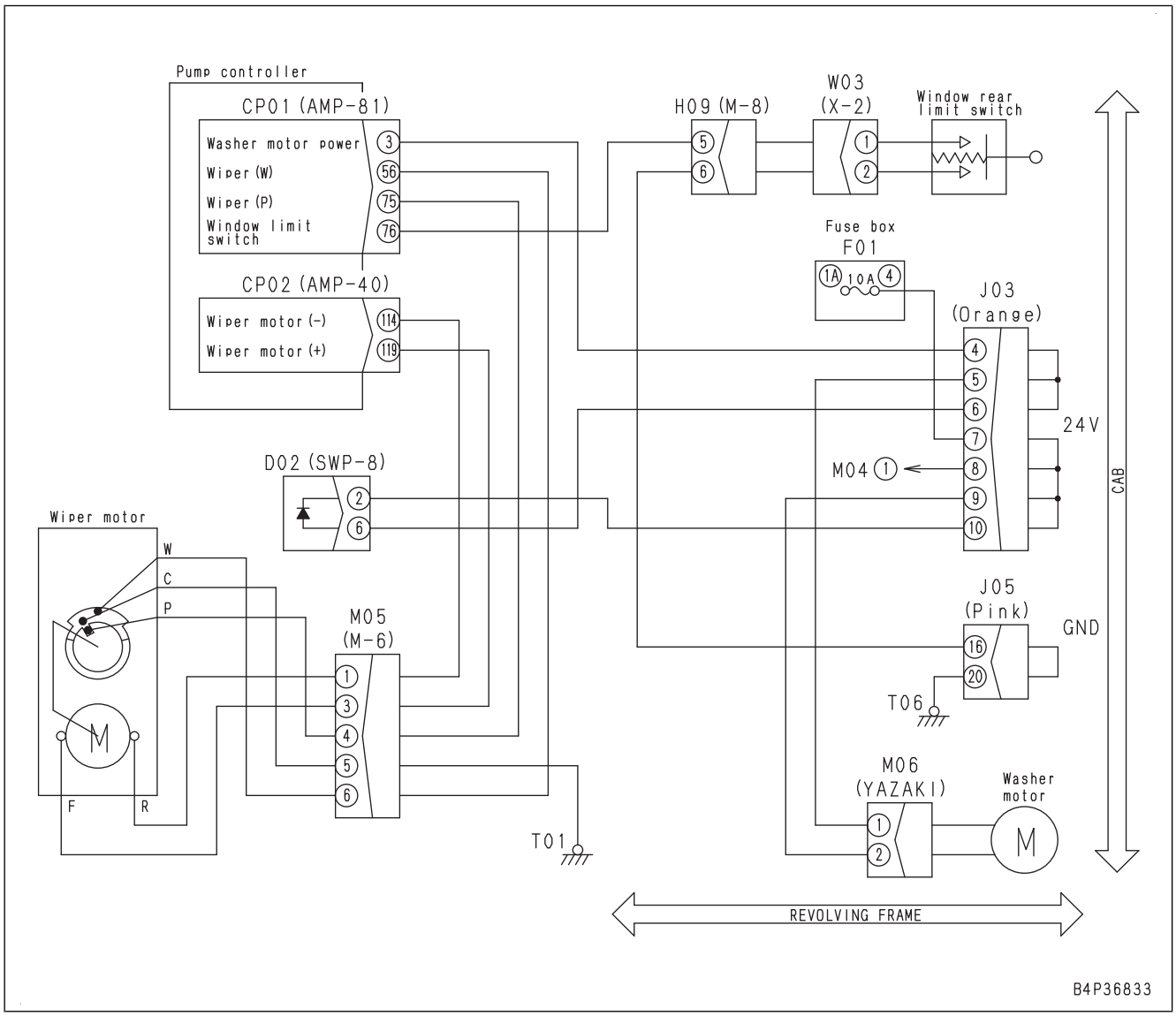
No.	Cause	Procedure, measuring location, criteria and remarks			
1	Defective R pump PC-EPC solenoid	1. Turn the starting switch to OFF position. 2. Disconnect the connector V12, and connect the T-adapter to male side.			
		Resistance	Between V12 (male) (1) and (2)		3 to 14 Ω
			Between V12 (male) (1) and ground		Min. 1 MΩ
2	Defective pump secondary drive switch	1. Turn the starting switch to OFF position. 2. Disconnect the connector S25 and connect the T-adapter to male side.			
		Resistance	Between S25 (male) (8) and (9)	Switch position: Normal	Max. 1 Ω
				Switch position: Drive	Min. 1 MΩ
			Between S25 (male) (11) and (12)	Switch position: Normal	Max. 1 Ω
				Switch position: Drive	Min. 1 MΩ
			Between S25 (male) (8) and (11)	Switch position: Normal	Min. 1 MΩ
			Between S25 (male) (9) and (11)	Switch position: Normal	Min. 1 MΩ
			Between S25 (male) (8) and ground		Min. 1 MΩ
			Between S25 (male) (9) and ground		Min. 1 MΩ
3	Ground fault in wiring harness	1. Turn the starting switch to OFF position. 2. Disconnect the connectors CP02, S25, and V12, and connect the T-adapter to any female side.			
		Resistance	Between ground and either CP02 (female) (104) or S25 (female) (9)		Min. 1 MΩ
			Between ground and either S25 (female) (8) or V12 (female) (1)		Min. 1 MΩ
4	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).			

FAILURE CODE [DXE9KA]

Action level	Failure code	Failure	Attachment Flow Regulating EPC 4 Solenoid Open Circuit (Pump controller system)
-	DXE9KA		
Detail of failure	Controller detects open circuit in attachment flow rate adjustment EPC4 solenoid.		
Action of controller	• Stops driving attachment flow rate adjustment EPC1, EPC2, EPC3, and EPC4 solenoids. • Even if cause of failure disappears, machine does not become normal until starting switch is turned to OFF position.		
Phenomenon on machine	Attachment does not move.		
Related information	• Drive current of attachment flow rate adjustment EPC4 solenoid can be checked with monitoring function (code: 01704). • After repairing, check if the failure code is cleared by the following procedure. Procedure: Turn the starting switch to ON position and set machine in attachment mode (ATT).		

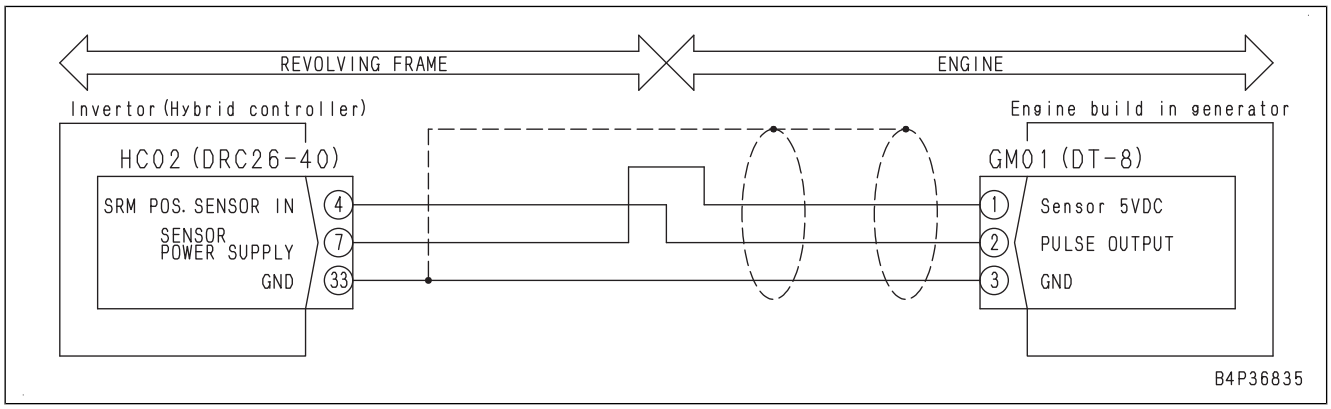
No.	Cause	Procedure, measuring location, criteria and remarks		
1	Defective right EPC solenoid for attachment 2nd oil flow adjustment	1. Turn the starting switch to OFF position. 2. Disconnect the connector V94, and connect the T-adapter to male side.		
		Resistance	Between V94 (male) (1) and (2)	7 to 14 Ω
			Between V94 (male) (1) and ground	Min. 1 MΩ
2	Defective circuit related to right EPC solenoid for attachment 2nd oil flow adjustment	1. Turn the starting switch to OFF position. 2. Disconnect the connector V94, and connect the T-adapter to female side. 3. Turn the starting switch to ON position.		
		Voltage	Between V94 (female) (1) and (2)	1 to 4.5 V
3	Open circuit in wiring harness	1. Turn the starting switch to OFF position. 2. Disconnect the connectors CP02 and V94, and connect the T-adapter to each female side.		
		Resistance	Between CP02 (female) (95) and V94 (female) (1)	Max. 1 Ω
			Between CP02 (female) (115) and V94 (female) (2)	Max. 1 Ω
			Between CP02 (female) (117) and V94 (female) (2)	Max. 1 Ω
			Between CP02 (female) (120) and V94 (female) (2)	Max. 1 Ω
4	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 wiper



<table>
<tr><th>No.</th><th>Cause</th><th colspan="3">Procedure, measuring location, criteria and remarks</th></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Deterioration of insulation in capacitor system</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the inverter side of connectors HC06(DC+) and HB01(DC-).
REMARK
• Wipe dirt of capacitor (case).
• When the measured values are not stable, use the value measured after 1 minute.
• Measure it by mega-ohm tester.</td></tr>
<tr><td rowspan="4">Resistance</td><td>Between HC06 (DC+) (male): tester (red) and capacitor (case): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>Between HC06 (DC+) (male): tester (black) and capacitor (case): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td>Between HB01 (DC-) (male): tester (red) and capacitor (case): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>Between HB01 (DC-) (male): tester (black) and capacitor (case): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Open circuit in power cable
(electric swing motor)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the connectors HC05 and PM02.
REMARK
If the connector on the capacitor side has already disconnected, leave it as it is.</td></tr>
<tr><td rowspan="3">Resistance</td><td>Between HC05 (U) (male) and PM02 (U) (male)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between HC05 (V) (male) and PM02 (V) (male)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between HC05 (W) (male) and PM02 (W) (male)</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Internal short circuit in power cable
(electric swing motor)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the connectors HC05 and PM02.
REMARK
If the connector on the capacitor side has already disconnected, leave it as it is.</td></tr>
<tr><td rowspan="3">Resistance</td><td>Between HC05 (U) (male) and HC05 (V) (male)</td><td>Min. 10 MΩ</td></tr>
<tr><td>Between HC05 (V) (male) and HC05 (W) (male)</td><td>Min. 10 MΩ</td></tr>
<tr><td>Between HC05 (W) (male) and HC05 (U) (male)</td><td>Min. 10 MΩ</td></tr>
</table>

Circuit diagram related to 5 V sensor power supply (hybrid)



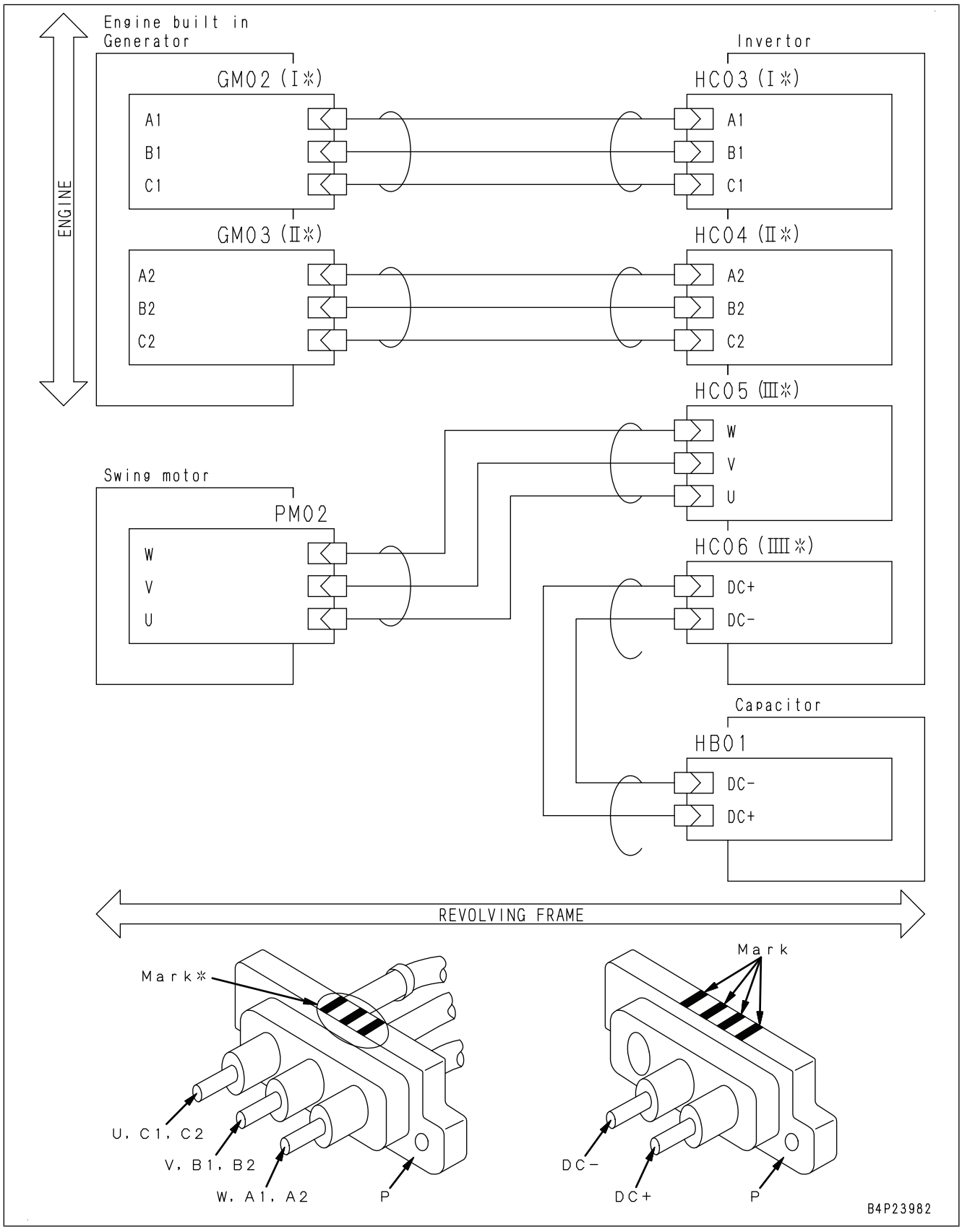
FAILURE CODE [GA1KKZ]

Action level	Failure code	Failure	Swing motor driver phase-W temperature sensor open and short circuit (Hybrid controller system)
L03	GA1KKZ		
Detail of failure	Swing motor inverter phase W output circuit temperature sensor error is detected.		
Action of controller	• Restricts swing speed. • If cause of failure is eliminated while swing control lever is in NEUTRAL position, machine becomes normal by itself.		
Phenomenon on machine	Swing speed, etc. is restricted.		
Related information	• Swing motor coil temperature can be checked with monitoring function. (Code: 09101) • After completion of repair, check that the failure code is cleared by the following operation. Procedure: Turn the starting switch to ON position or start the engine.		

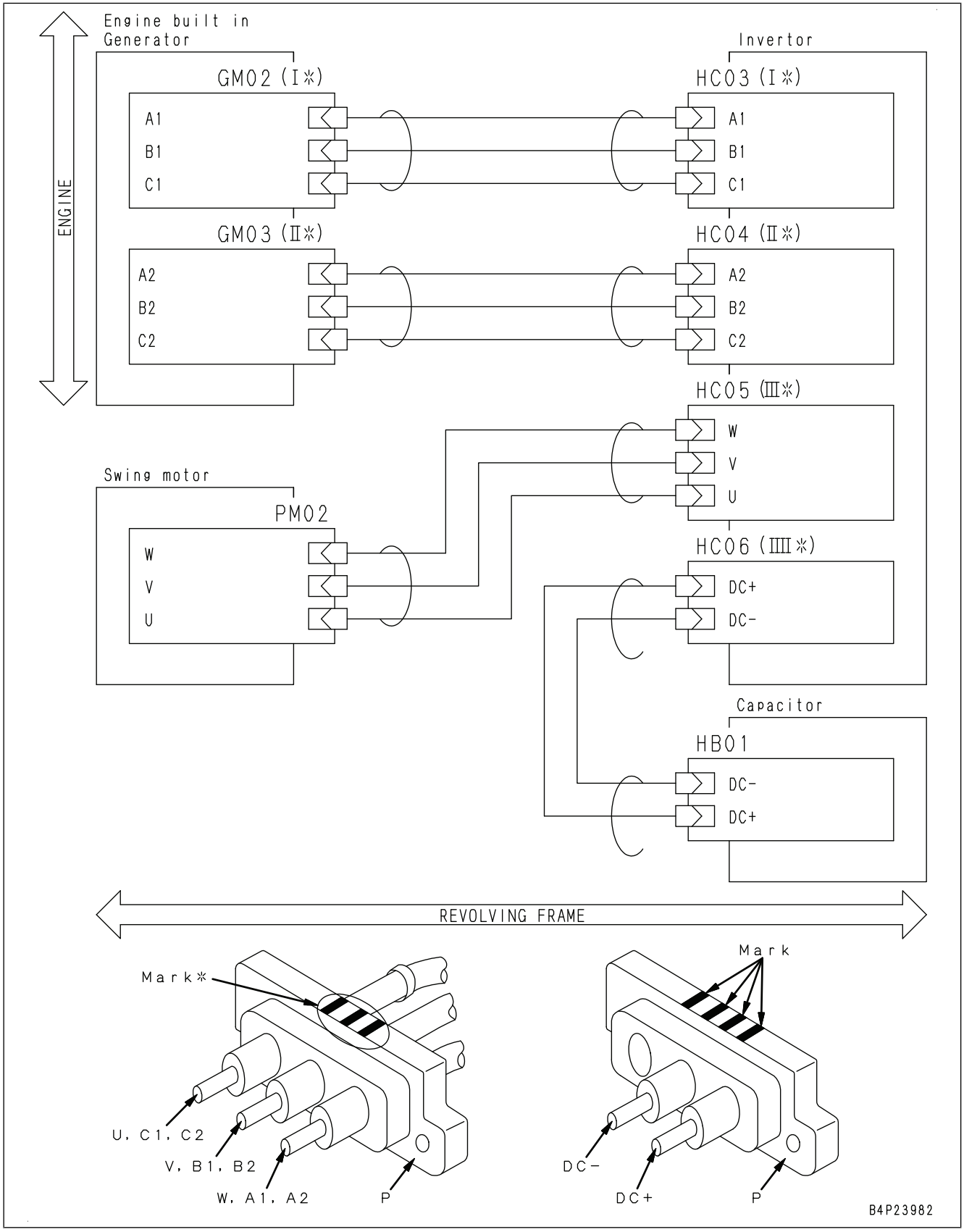
No.	Cause	Procedure, measuring location, criteria and remarks
1	Defective inverter (hybrid controller)	Inverter is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

<table>
<tr><th>No.</th><th>Cause</th><th colspan="3">Procedure, measuring location, criteria and remarks</th></tr>
<tr><td rowspan="14">3</td><td rowspan="14">Deterioration of insulation in power cable (motor-generator)</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the connectors HC03, HC04, GM02 and GM03.
REMARK
• If the connector on the capacitor side has already disconnected, leave it as it is.
• Wipe the dirt of the metal part of the cable housing.
• When the measured values are not stable, use the value measured after 1 minute.
• Measure it by mega-ohm tester.</td></tr>
<tr><td rowspan="13">Resistance</td><td>HC03 (A1) (male): tester (red) and cable housing metal (P part): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC03 (A1) (male): tester (black) and cable housing metal (P part): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC03 (B1) (male): tester (red) and cable housing metal (P part): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC03 (B1) (male): tester (black) and cable housing metal (P part): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC03 (C1) (male): tester (red) and cable housing metal (P part): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC03 (C1) (male): tester (black) and cable housing metal (P part): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC04 (A2) (male): tester (red) and cable housing metal (P part): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC04 (A2) (male): tester (black) and cable housing metal (P part): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC04 (B2) (male): tester (red) and cable housing metal (P part): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC04 (B2) (male): tester (black) and cable housing metal (P part): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC04 (C2) (male): tester (red) and cable housing metal (P part): tester (black)</td><td>Min. 10 MΩ</td></tr>
<tr><td>HC04 (C2) (male): tester (black) and cable housing metal (P part): tester (red)</td><td>Min. 10 MΩ</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Open circuit between phases of motor-generator system</td><td colspan="3">1. Turn the starting switch to OFF position.
2. Disconnect the connectors HC03, HC04, HC06 (DC+) and HB01 (DC-).
REMARK
There is a coil resistance of motor in the motor-generator.</td></tr>
<tr><td rowspan="3">Resistance</td><td>Between HC03 (A1) (male) and HC04 (A2) (male)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between HC03 (B1) (male) and HC04 (B2) (male)</td><td>Max. 1 Ω</td></tr>
<tr><td>Between HC03 (C1) (male) and HC04 (C2) (male)</td><td>Max. 1 Ω</td></tr>
</table>

Circuit diagram related to high-voltage equipment



Circuit diagram related to high-voltage equipment



E-2 MANUAL PREHEATING SYSTEM DOES NOT WORK

Failure	Manual preheating system does not work.
Related information	This troubleshooting describes procedures to be followed when manual preheating does not function to heat the intake air heater mounting section. • This machine has “Automatic preheating” and “Manual preheating” functions. When either preheating works, preheating monitor lights up. (When only preheating monitor does not light up, perform troubleshooting for failure “While preheating is working, preheating monitor does not light up”.) • If failure symptom “Machine monitor does not light up” or “Battery relay does not make operating sound” is displayed when starting switch is turned to ON position, main electric power supply system may be defective. In these cases, perform troubleshooting for E-mode “ENGINE DOES NOT START (ENGINE DOES NOT CRANK)” , “WHEN STARTING SWITCH IS TURNED TO ON POSITION, MACHINE MONITOR DISPLAYS NOTHING” respectively. • If fuse No. 17 in fuse box F01 is blown out, perform troubleshooting for “Machine monitor displays nothing”. • Before performing troubleshooting, check that no related failure code is displayed.

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Looseness of terminal and wire breakage at terminal part	1. Turn starting switch to OFF position.		
		Check terminals of heater relay, battery relay, and intake air heater, etc.		
2	Defective fuse	If the slow-blow fuse is blown, circuit probably has ground fault, etc.		
3	Open or short circuit in wiring harness	1. Turn the starting switch to OFF position. 2. Disconnect the connector CM01.		
		Resistance	Between starting switch terminal R1 and ground (heater relay coil resistance)	Approx. 20 Ω
		Secondary side 1. Turn starting switch to OFF position. 2. Turn starting switch to ON position.		
		Voltage	Between R16B (input terminal on contact side of heater relay) and ground	20 to 30 V
		Primary 1. Turn starting switch to OFF position. 2. Disconnect heater relay terminal R16A. (To perform checks without passing an electric current when starting switch is in HEAT position) 3. Turn the starting switch to HEAT position (R1 connected)		
		Voltage	Between heater relay terminal R15 and ground	20 to 30 V
		1. Turn starting switch to OFF position. 2. Disconnect heater relay terminal R16A.		
		Continuity	Between R16A (wiring harness side) and ground	Continuity

E-24 HYBRID TEMPERATURE GAUGE DOES NOT MOVE FROM MINIMUM OR MAXIMUM

Failure	• While hybrid temperature gauge is rising normally, it does not rise from white range (C). • While hybrid temperature gauge is stabilized normally, it rises to red range (H).
Related information	• Signal from each hybrid temperature gauge sensor is input to controller, and then data is transmitted to machine monitor through CAN communication. • Each hybrid temperature gauge can be checked with monitoring function. • Capacitor cell temperature can be checked with monitoring function. (Code: 09306) • Booster inductor temperature can be checked with monitoring function. (Code: 09402) • Booster IGBT base temperature can be checked with monitoring function. (Code: 09403) • Booster IGBT junction temperature can be checked with monitoring function. (Code: 09404) • Swing motor coil temperature can be checked with monitoring function. (Code: 09401) • Swing driver IGBT junction temperature can be checked with monitoring function. (Code: 09507) • Motor-generator temperature can be checked with monitoring function. (Code: 09600) • Generator driver IGBT base temperature #0 can be checked with monitoring function. (Code: 09607) • Generator driver IGBT base temperature #1 can be checked with monitoring function. (Code: 09608)

No.	Cause	Procedure, measuring location, criteria and remarks
1	Hybrid temperature sensor system fault	Since the hybrid temperature sensor system may be defective, perform the troubleshooting for failure codes starting with “GA”.
2	Defective machine monitor	If no failure is found by preceding checks, machine monitor is defective. (Since this is an internal defect, troubleshooting cannot be performed.)

Table for detailed thermal load on hybrid system

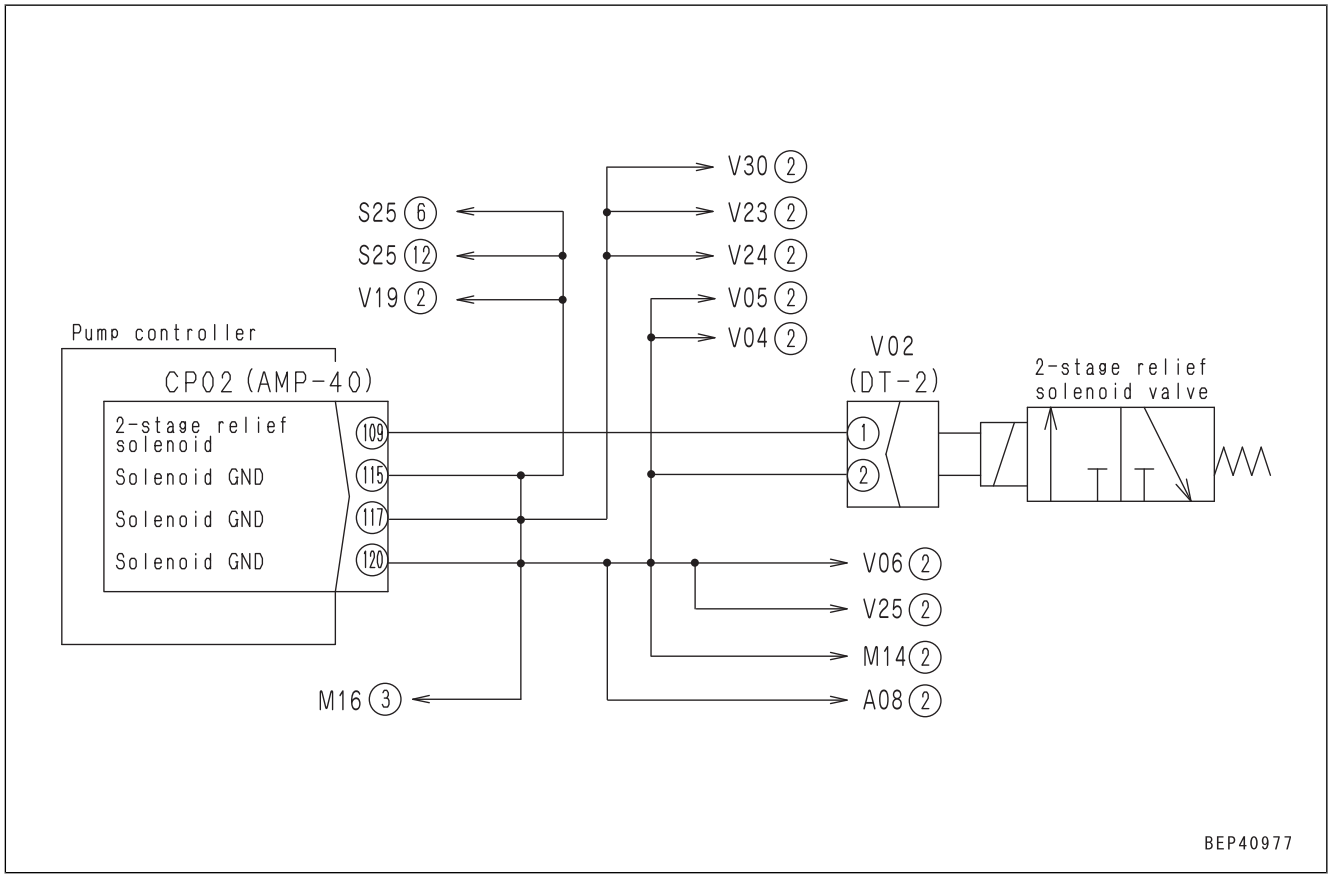
Thermal load on hybrid component	Display position of hybrid component temperature gauge	Color of the hybrid temperature caution lamp (a)	Capacitor cell temperature	Booster IGBT base temperature	Booster IGBT junction temperature	Booster inductor temperature	Swing motor coil temperature	Motor-generator temperature	Generator driver temperature	Swing inverter junction temperature
102 %	A1 (red)	Red	65	95	130	127	140	180	95	134
100 %	A2 (green)	Red	63	93	125	122	120	127	85	133
95 %	A3 (green)	Blue	60	75	110	110	100	115	75	115
50 %	A4 (white)	Blue	40	55	90	90	80	95	55	95
20 %	A5 (white)	Blue	0	0	0	0	0	0	0	0
0 %	A6 (white)	Blue	-30	-30	-30	-30	-30	-30	-30	-30

E-43 ONE-TOUCH POWER MAXIMIZING FUNCTION IS NOT CANCELLED

Failure	One-touch power maximizing function is not cancelled.
Related information	• Condition of L.H.knob switch signal can be checked with monitoring function. (Code: 02200)

No.	Cause	Procedure, measuring location, criteria and remarks		
1	Hot short circuit in wiring harness (Contact with 24 V circuit)	1. Turn starting switch to OFF position. 2. Disconnect connector V02, and connect T-adapter to female side. 3. Turn starting switch to ON position.		
		Voltage	Between V02 (female) (1) and (2)	Max. 4.5 V
2	Defective pump controller	If failure code still displays after above checks on cause 1, pump controller is defective. (In case of an internal defect, troubleshooting is impossible as an assembly. Replace whole assembly.)		

Circuit diagram related to 2-stage relief solenoid system



Failure mode			Component causing failure: Control valve														
			Merge-divider main valve	Merge-divider LS valve	Boom throttling EPC solenoid	Boom regeneration valve	Boom lock valve	Safety valve	Suction valve	LS shuttle valve	Arm regeneration valve	Arm quick return valve	Arm lock valve	Swing LS selector valve	Travel junction valve	Back pressure valve	Service valve (safety valve)
Work equipment, Swing, Travel	All of work equipments, swing and travel lack speed or power.																
	Engine speed drops significantly or engine stalls.																
	All of work equipment, travel and swing do not work																
	Unusual noise is heard from around hydraulic pump.																
	Fine control performance or response is poor.																
Work equipment	Boom speed or power is low.		○	○	○	○	○	○	○	○							
	Arm speed or power is low.		○	○				○	○	○	○	○	○				
	Bucket speed or power is low.							○	○	○							
	Work equipment does not move in single operation.							○									
	Hydraulic drift of work equipment is large.	Boom					○	○									
		Arm						○					○				
		Bucket						○			○						
	Time lag of work equipment is large.					○											
	When single work equipment is relieved hydraulically, other work equipment moves.																
	One-touch power maximizing function does not operate.																
	In combined operation of work equipment, equipment having heavier load moves slower.																
Swing + Boom	In combined operations of swing and boom RAISE, boom rising speed is low													○			
Swing + Travel	In combined operation of swing and travel, travel speed drops largely.									○							

<table>
<tr><th>No.</th><th>Cause</th><th colspan="4">Procedure, measuring location, criteria and remarks</th></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Malfunction of boom control valve (suction safety valve)
(LOWER side)</td><td colspan="4">Be ready with engine stopped, then perform the troubleshooting with engine at high idle.</td></tr>
<tr><td rowspan="2">Boom relief pressure</td><td rowspan="2">Hydraulic oil temperature: 45 to 55 °C</td><td>Boom RAISE relief</td><td>33.1 to 37.2 MPa {338 to 380 kgf/cm^2}</td></tr>
<tr><td>Boom LOWER relief</td><td>29.7 to 33.8 MPa {303 to 345 kgf/cm^2}</td></tr>
<tr><td colspan="4">Among above relief pressures, if only relief pressure of boom LOWER side is low, suction safety valve may be defective. Check the safety valve.
Check for damaged sealing materials, etc. by appearance. (Be careful about the dirt to enter during restoring.)
When the suction safety valve is disassembled, replace it as an assembly since the relief pressure cannot be adjusted with safety valve installed on machine,.
• Check that suction valve is seated on safety valve body in position (it is not stuck halfway).
• After pushing in suction valve to release the external force, check that the check valve returns smoothly and be seated on valve body.</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Malfunction of boom control valve (spool)</td><td colspan="4">Release remaining pressure from hydraulic tank and piping, and then perform troubleshooting with engine stopped.</td></tr>
<tr><td colspan="4">• Check for stuck or seized LS spool in merge-divider valve body (spool should move smoothly).
• Remove LS spool from valve body and check for defects and dirt.
Be careful to prevent foreign matter from entering the valve during restoration.</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Malfunction of boom control valve (pressure compensation valve)</td><td colspan="4">Check whether boom cylinder moves slowly when performing hydraulic relief of other work equipment. (If boom cylinder moves, it is abnormal.)</td></tr>
<tr><td colspan="4">If any failure is found in either of above check items, interchange pressure compensation valves on RAISE and LOWER sides, and check whether failure symptom changes. (Each area ratio is different, so be sure to restore it after checking the symptom.)</td></tr>
</table>

H-34 LARGE UNUSUAL NOISE IS HEARD WHEN UPPER STRUCTURE STOPS SWINGING

Failure	Large unusual noise is heard when upper structure stops swinging.
Related information	Set working mode to power mode (P), and perform all troubleshooting with power mode (P).

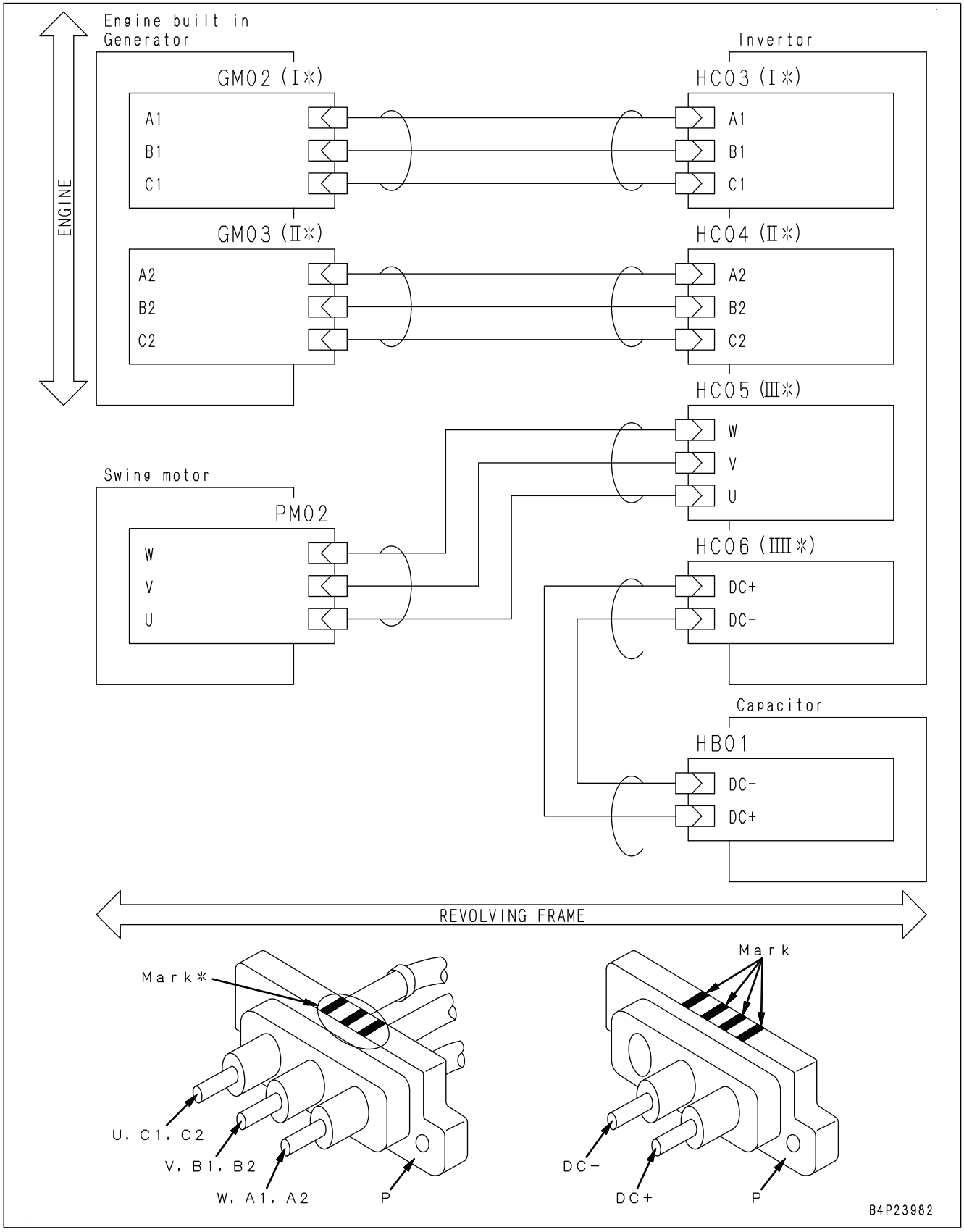
No.	Cause	Procedure, measuring location, criteria and remarks
1	Defective swing machinery	Check for unusual noise, unusual heat, and metallic powders in drained oil to make judgment.

S-19 VIBRATION IS EXCESSIVE

Failure	Vibration is excessive.
Related information	• If unusual noise is heard and vibration is excessive, perform troubleshooting for “Unusual noise is heard” as well. • If any failure code is displayed, perform troubleshooting for that code first.

No.	Cause	Point to check, remarks	Remedy
1	Loose engine mounting bolts or defective cushions	Visually check engine mounting bolts for looseness and cushions for cracks and hardening.	Retighten bolts or cushions replacement
2	Abnormality of output shaft and inside of damper	Check output shaft and damper for internal damage.	Defective parts replacement
3	Misalignment and facial runout at connection of engine output side is out of standard range.	Measure misalignment and facial runout at connection of engine output side.	Defective parts replacement
4	Defective injector	• A low-temperature cylinder is found when touching the exhaust manifold right after the engine starts. • A cylinder running at the unchanged speed is found during operation in the cylinder cut-out mode. (Reference: See TESTING AND ADJUSTING, “HANDLE CYLINDER CUT-OUT MODE OPERATION”.) **REMARK** If a black smoke is seen continuously during warm-up operation after storage for a few days, injector may be defective.	Replace injector.
5	Wear of main bearing and connecting rod bearing	If metallic powder is found in oil pan and oil filler, disassemble engine and check it.	Damaged parts repair and replacement
6	Broken valve or rocker arm	If there is metallic powder in oil pan or oil filter, open head cover and check valve and rocker arm.	Damaged parts repair and replacement
7	Worn camshaft bushing	If metal particles are found in oil pan or oil filter, overhaul engine and check camshaft bushings.	Camshaft bushings replacement

Circuit diagram related to high-voltage equipment



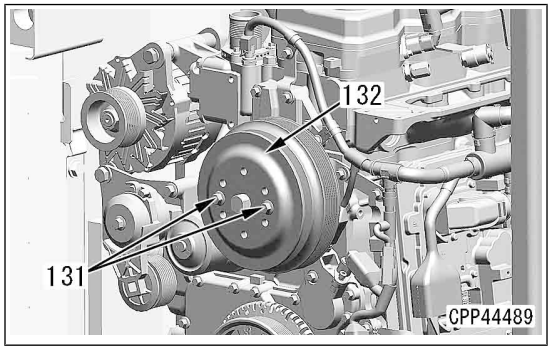
Symbol		Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Remarks
B		796-426-1120	Push tool	■	1			
C		796T-426-1130	Plate	■	1		○	
		790-101-5421	Grip	■	1			
		01010-81240	Bolt	●	1			
D		790-201-2710	Spacer	●	1			
E		790-201-2840	Spacer	●	1			
F		790-201-2470	Push tool	●	1	N		
G		790-201-2890	Spacer	●	1		○	
H		790-201-2660	Plate	●	1			
J		Commercially available	Block	■	1			
K		Commercially available	Hammer	■	1			
L		Commercially available	Air gun	●	1			
M		Commercially available	Lifting tool	■	1			
N		Commercially available	Push tool	■	1			
R	1	796-426-1710	Collet	■	1			
	2	796-426-1720	Taper cone	■	1			
	3	796-426-1730	Collar	■	1			
S		01124-51490	Guide bolt	■	3			M14 x 2 x 90 mm

Tools to be used when separating and connecting the track shoe assembly

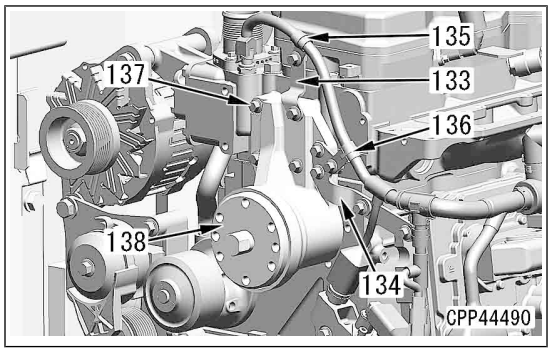
Symbol	Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Remarks
A	791-650-3000	Remover and installer	■	1			
	790-101-1300	Cylinder (980 kN {100 t})	■	1			
	790-101-1102	Pump	■	1			
B	-	Guide pin	■	1			
C	-	Block	●	1			
D	-	Wire	●	1			
E	-	Lever rod	●	1			
F	-	Hammer	●	1			

Fan pulley

58. Remove the bolts (131) (2 pieces), and remove the pulley of the fan pulley (132).

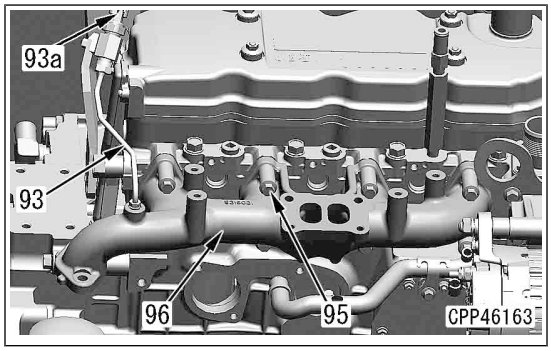


59. Remove the clamps (135) and (136) of the brackets (133) and (134).
60. Remove the bolts (137) (4 pieces), and remove the fan hub (138).



Exhaust manifold

61. Disconnect the tube (93).
62. Disconnect the exhaust manifold pressure sensor (93a).
63. Remove the bolts (95) (8 pieces), and remove the exhaust manifold assembly (96).



Cylinder head cover

64. Remove the blowby duct (97).

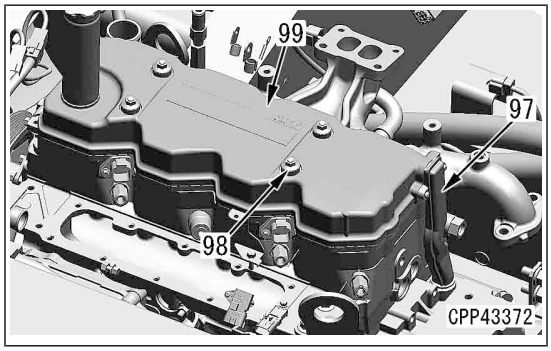
    REMARK

    O-ring is installed on the mating face of the blowby duct (97). Be careful to prevent it from falling off when removing the blowby duct.

65. Remove the nuts, spacers, and isolators (98) (4 pieces each), and remove the cylinder head cover (99).

    REMARK

    The nuts, spacers, and isolators are installed in this order from the top.



66. When removing the cylinder head cover (99) while VGT is not removed

METHOD FOR INSTALLING STARTER ASSEMBLY

Starting motor assembly

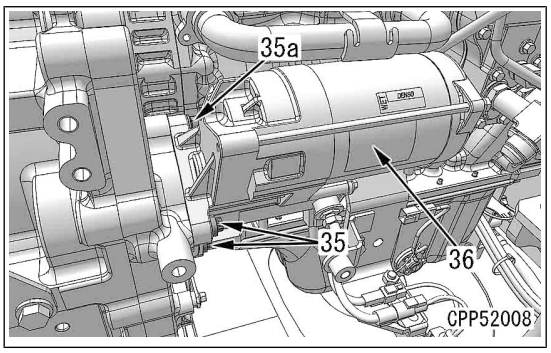
1. Install the gasket, and install the starting motor assembly (36) with the bolts (35) (2 pieces) and nuts (35a).

   NOTICE

   Be sure to use a new gasket.

   Bolt (35):
   43±6 Nm {4.4±0.6 kgfm}

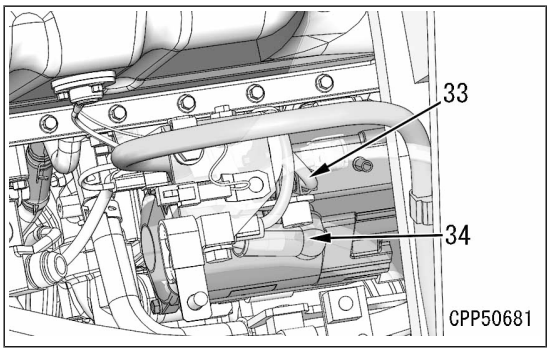
   Nut (35a):
   43±6 Nm {4.4±0.6 kgfm}



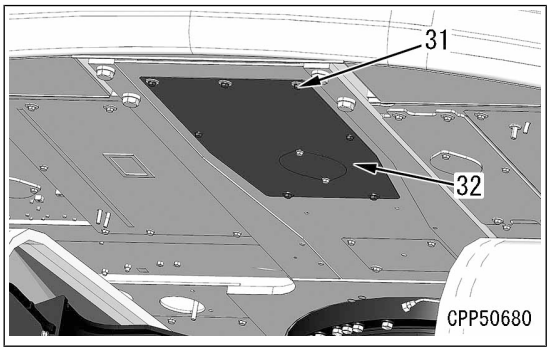
2. Connect the terminal B (33) and terminal C (34).

   Terminal B (33):
   17.7 to 24.5 Nm {1.8 to 2.5 kgfm}

   Terminal C (34):
   2.6 to 4.6 Nm {0.27 to 0.47 kgfm}

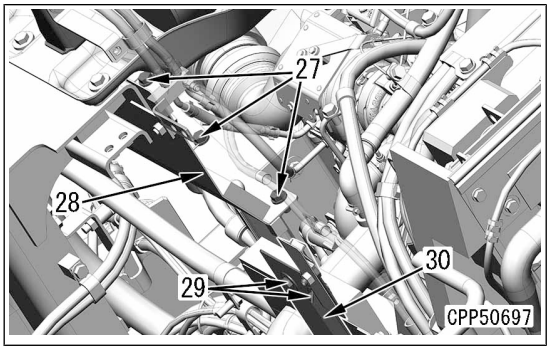


3. Install the undercover (32) with the bolts (31) (7 pieces).

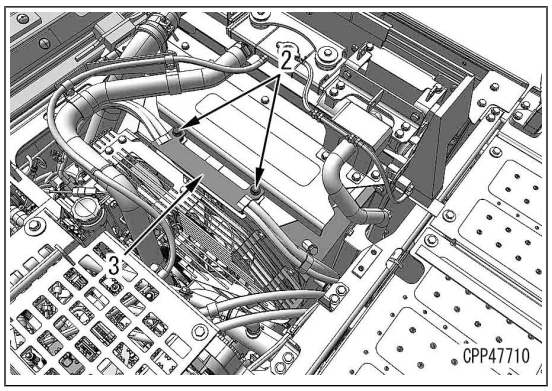


Partition plate

4. Install the partition plate (30) with the bolts (29) (2 pieces).
5. Install the cover (28) with the bolts (27) (3 pieces).

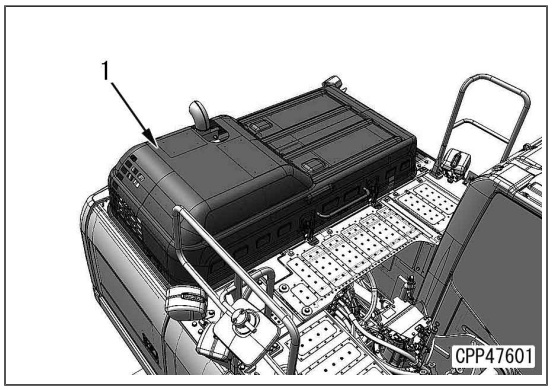


7. Install the cover (3) with the bolts (2) (2 pieces).
   [Bolt M10/Width across flats: 17 mm]
   [Tool: Impact wrench]

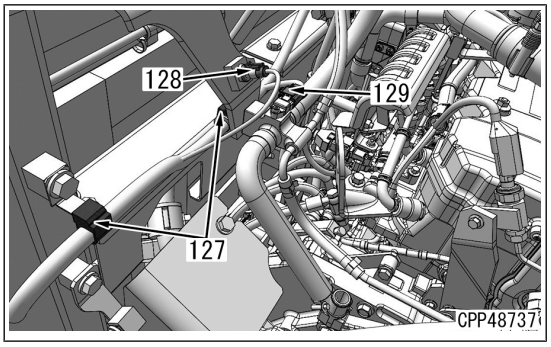


Engine hood assembly

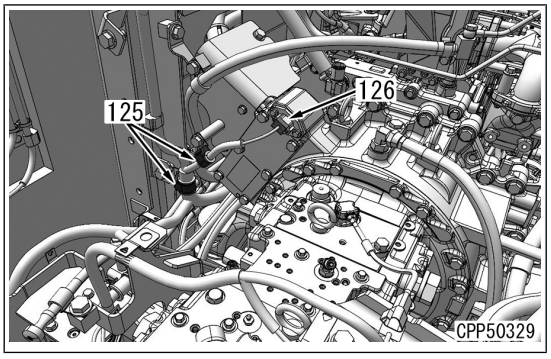
8. Close the engine hood assembly (1).



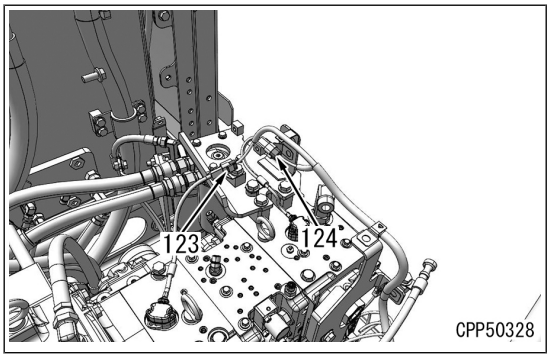
29. Connect the connectors P66 (128) and P57 (129), and install the clips (127) (2 places).



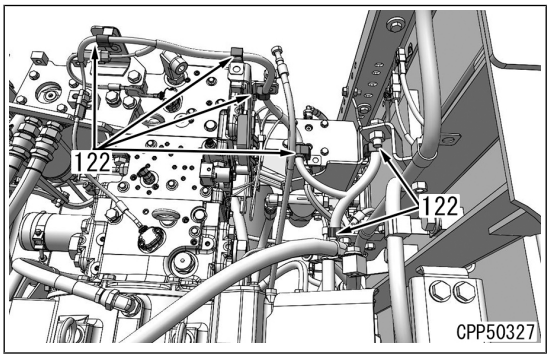
30. Connect the connector GM01 (126), and install the clips (125) (2 places).



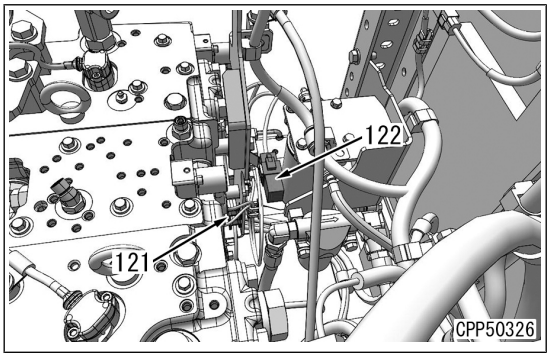
31. Connect the connectors P27 (123) and P28 (124).



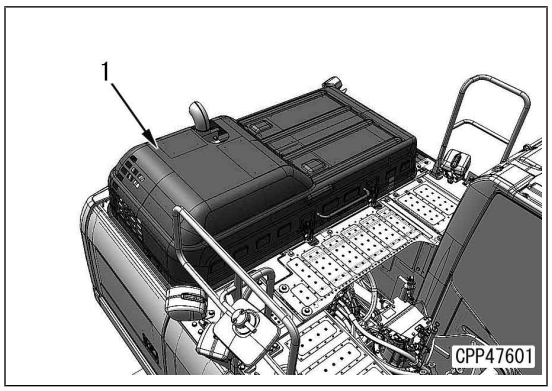
32. Install the clips (122) (6 places).



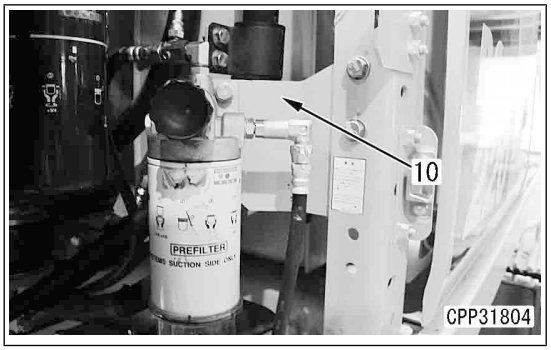
33. Install the connector (122) to the connector table.
34. Install the clip (121).



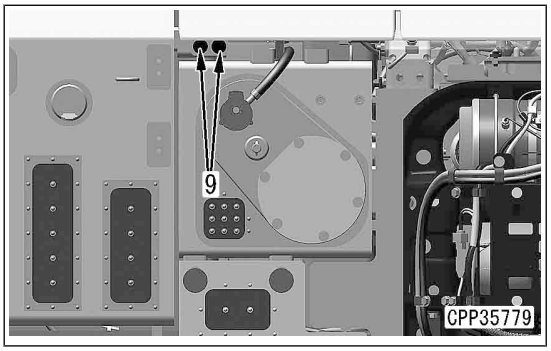
8. Close the engine hood assembly (1).



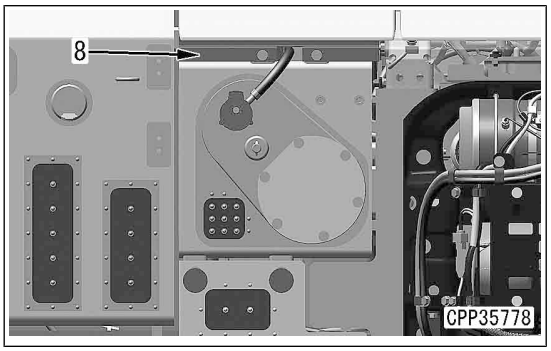
13. Install the bracket (10), and close the cover on the right side of the machine.



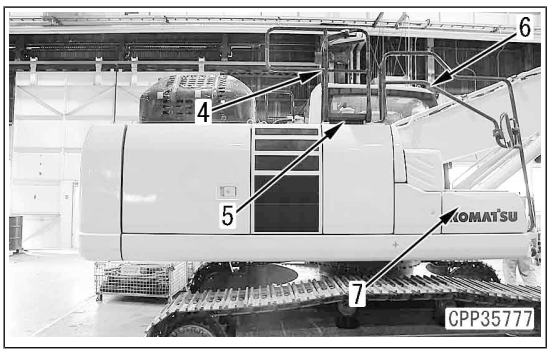
14. Install the bolts (9) (2 pieces).



15. Install the top cover (8).

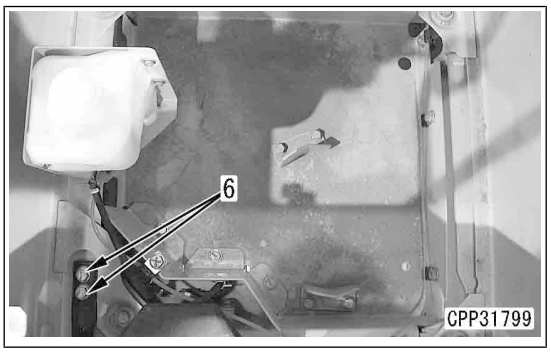


16. Install the handrails (4) and (6), and install the plate (5).

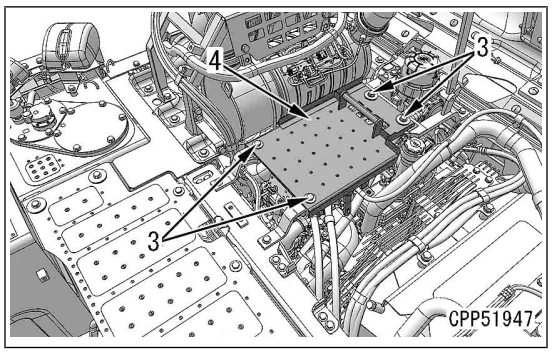


REMARK

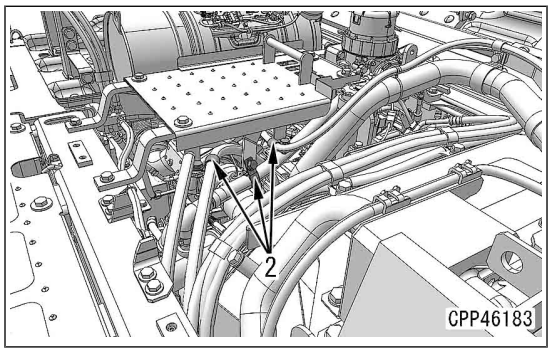
Install the mounting part on the bottom side of the handrail (6) to the inside of the tool case (7).



[Tool: Impact wrench]

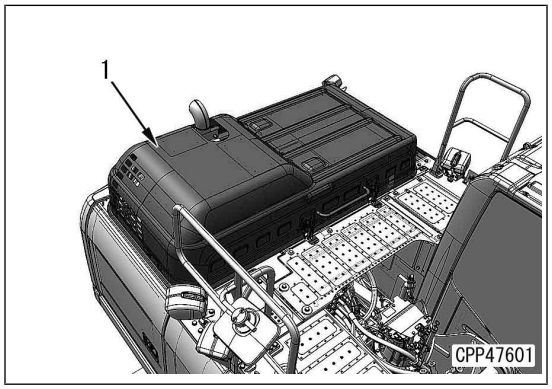


5. Install the clamps (2) (3 places).
[Bolt M12/Width across flats: 19 mm]
[Tool: Impact wrench]



Engine hood assembly

6. Close the engine hood assembly (1).

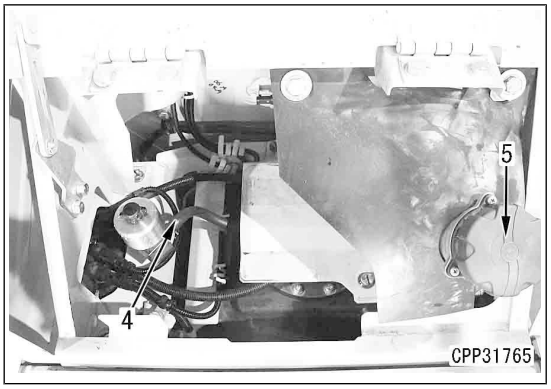


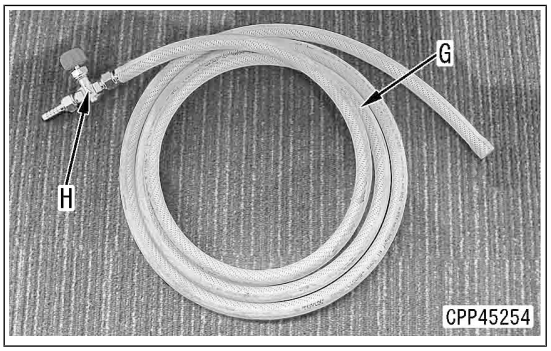
2) Disconnect the breather hose (4), and connect the vinyl hose (E).

REMARK

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

3) Check that the cap (5) is securely closed.

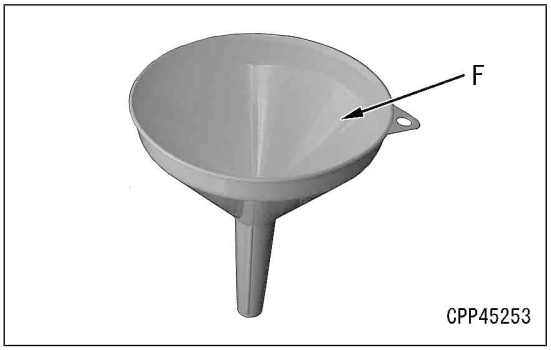


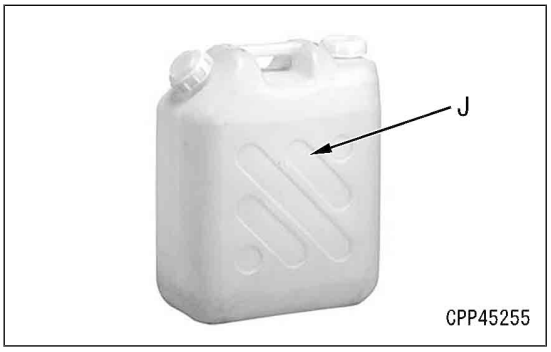


4) Set the funnel (F) and resin container (J) under AdBlue/DEF tank.

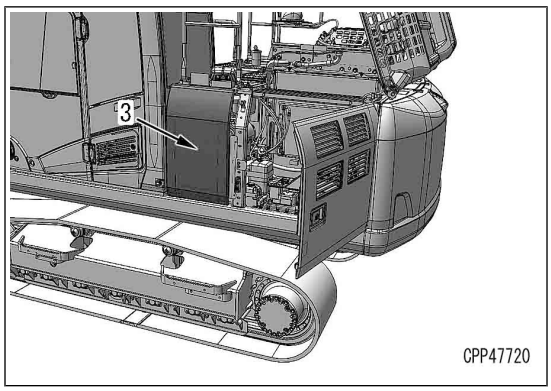
REMARK

Insert the tip of the funnel (F) into the resin container (J).

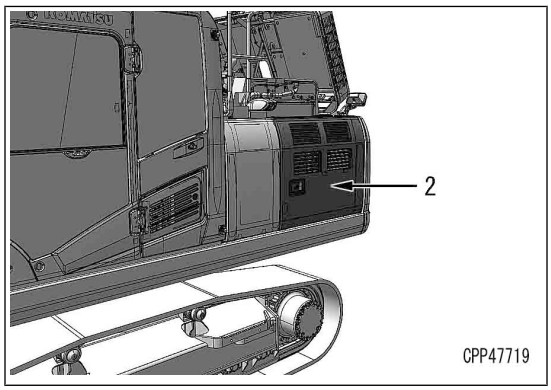




10. Close the cover (3).

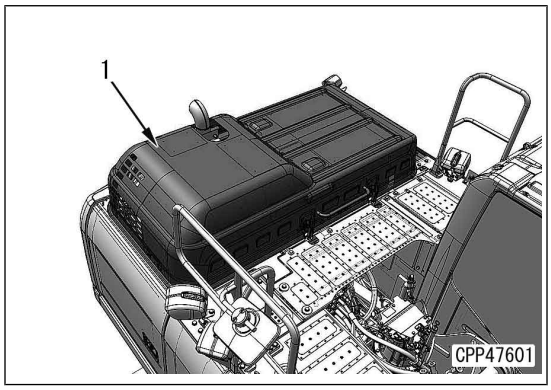


11. Close the cover (2).



Engine hood assembly

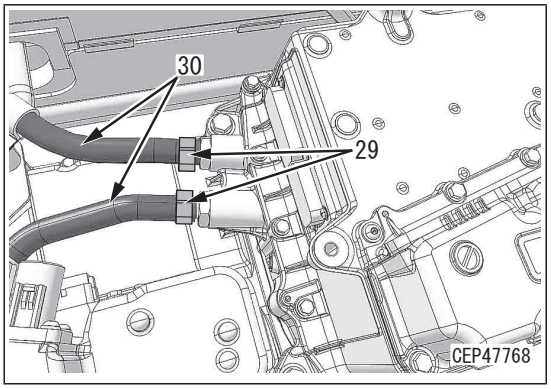
12. Close the engine hood assembly (1).

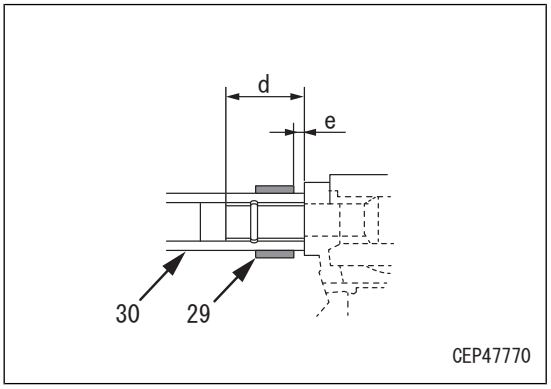


2. Connect the hoses (30) (2 pieces), and install the clips (29) (2 places).

REMARK

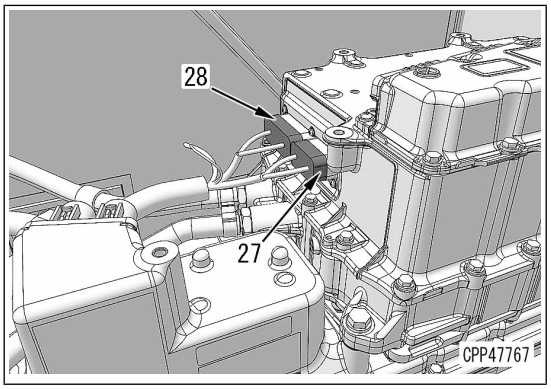
The following shows the installed dimension of the hose (30) and clip (29).
Insertion depth of hose (30): d = 33 mm
Clip (29): e = 5 mm





3. Connect the connectors HC01 (27) and HC02 (28).

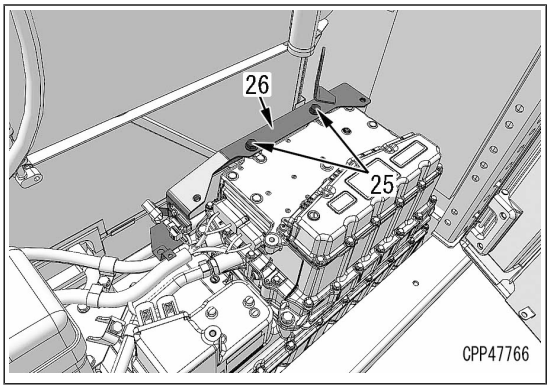
Connectors HC01 (27), HC02 (28):
2.6 to 3.1 Nm {0.27 to 0.32 kgfm}



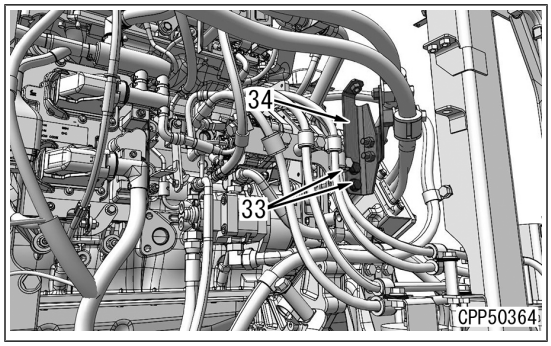
4. Install the bracket (26) with the bolts (25) (2 pieces).

[Bolt M12/Width across flats: 19 mm]

[Tool: Impact wrench]

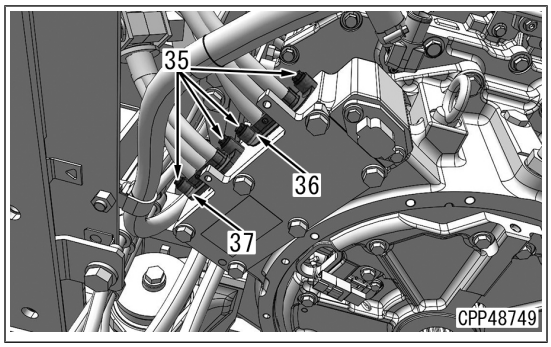


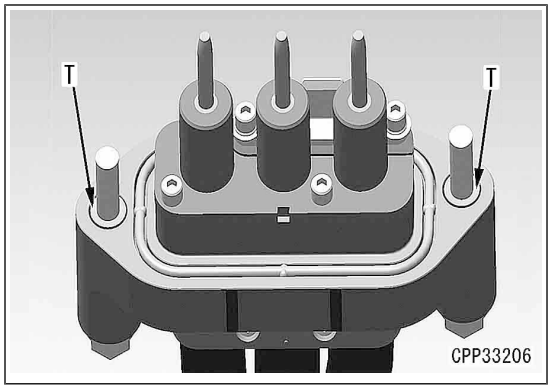
23. Remove the bolts (33) (2 pieces), and remove the bracket (34).
    [Bolt M12/Width across flats: 19 mm]
    [Tool: Impact wrench]



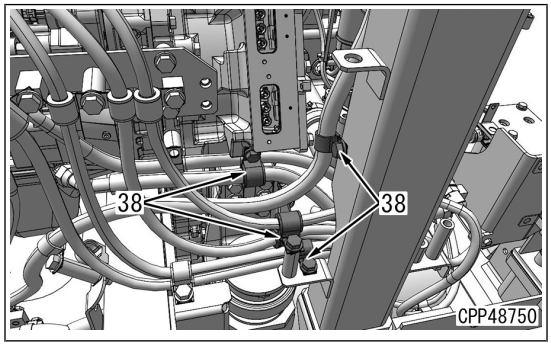
24. Remove the bolts (35) (4 pieces), and disconnect the connectors GM03 (36) and GM02 (37).
    NOTICE
    - **After disconnecting the high voltage wiring, be sure to install the cap to the connector part.**
    - **The cap prevents water and dust from entering the connector part.**
    - **Be careful not to lose the stopper rubber washer (T) installed to the high-voltage wiring connector.**

    [Bolt M6/Width across flats: 10 mm]
    [Tool: Ratchet wrench]



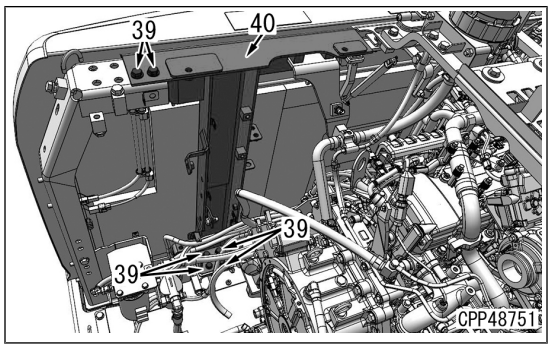


25. Remove the clamps (38) (4 places).
    [Bolt M12/Width across flats: 19 mm]
    [Tool: Impact wrench]



26. Remove the bolts (39) (6 pieces), sling the bracket (40), and remove it.
    [Bolt M12/Width across flats: 19 mm]
    [Tool: Impact wrench, nylon sling]

    Bracket (40):
    25 kg



Final drive case :

HB205-3: 3.8 ℓ

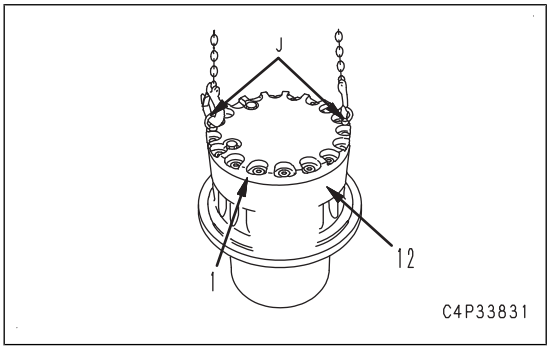
HB205LC-3: 5.4 ℓ

2. Remove the bolts (20 pieces), sling the cover (1) by using the eyebolt (J), and remove it.

Cover (1):

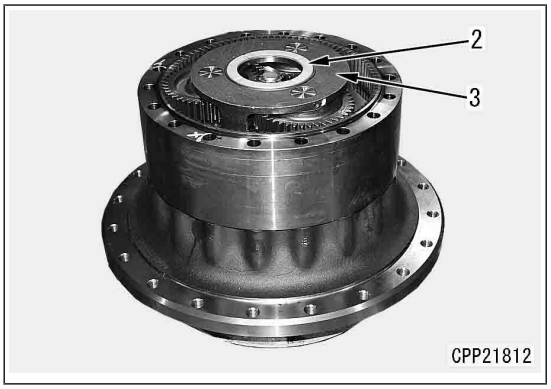
20 kg

3. If the ring gear (12) is lifted together, tap the ring gear lightly with a plastic hammer to separate it.



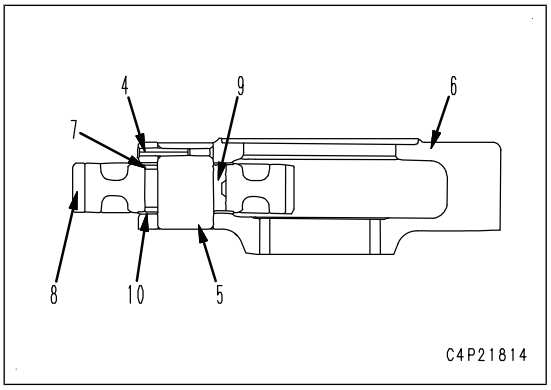
No.1 planetary carrier assembly

4. Remove the washer (2).
5. Remove No.1 planetary carrier assembly (3).



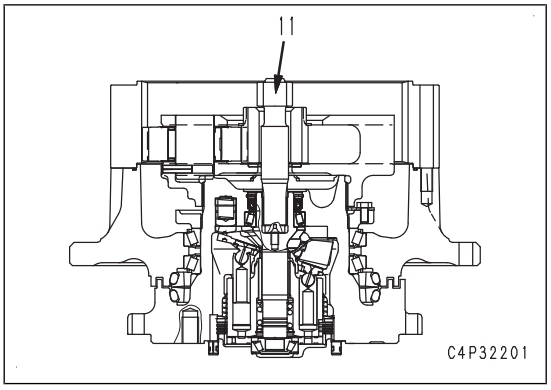
Disassembling No.1 planetary carrier assembly

6. Drive the pin (4) into the shaft (5), and remove the shaft (5) from No.1 planetary carrier (6).
7. After removing the shaft (5), remove the pin (4) from the shaft (5).
8. Remove the thrust washer (7), No.1 planetary gear (8), needle bearing (9), and thrust washer (10).

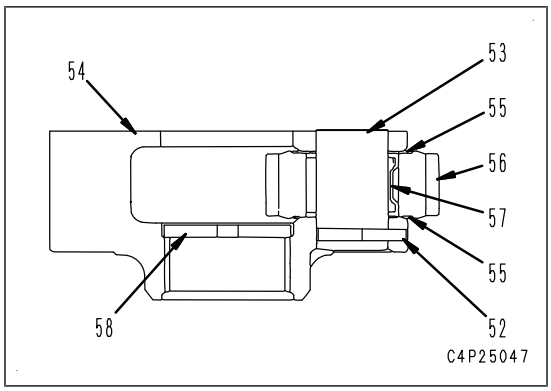


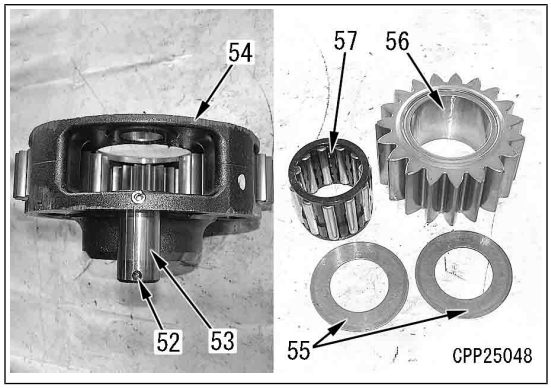
No.1 sun gear shaft

9. Remove No.1 sun gear shaft (11).



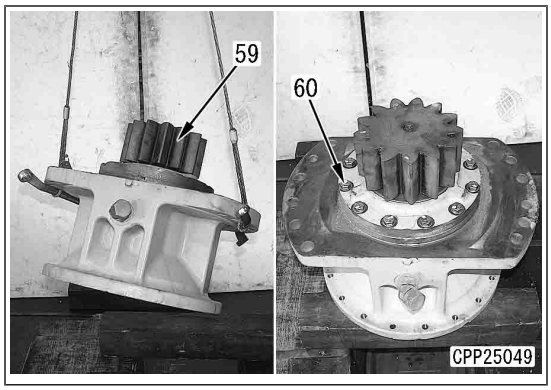
28. Disassemble No.3 carrier assembly according to the following procedure.
    1) Push in the pin (52), and drive the shaft (53) out of the carrier (54).
    2) After removing the shaft, remove the pin (52).
    3) Remove the thrust washer (55), planetary gear (56), and bearing (57).
    4) Remove the plate (58).



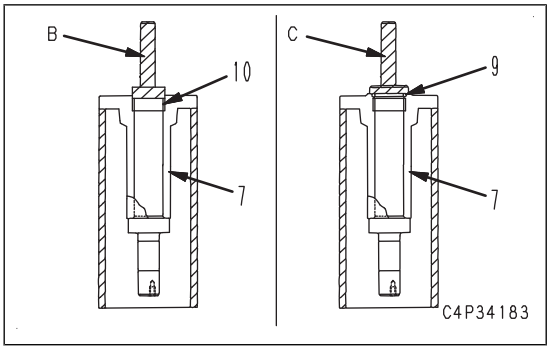


Shaft and case assembly

29. Invert the shaft and case assembly (59).
30. Remove the bolt (60).

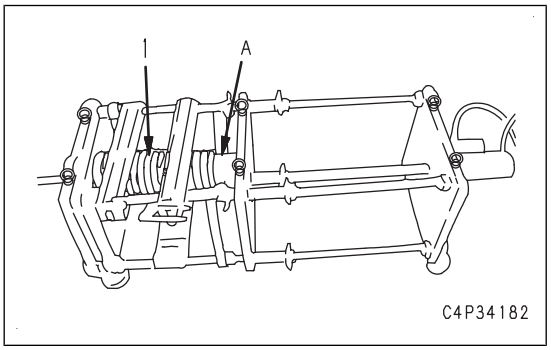


4. Press-fit bushing (10) to cylinder (7) by using tool B.
5. Install dust seal (9) to cylinder (7) by using tool C.
6. Secure them with snap ring (8).



7. Install cylinder (7), plate (7a), and yoke (6) to spring (5) and set them to tool A.

   Cylinder sliding surface:
   Grease (G2-LI)



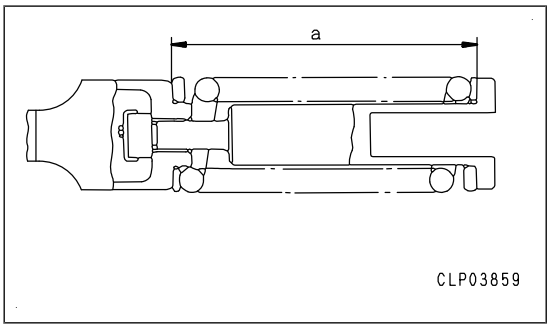
8. Apply oil pressure slowly to compress the spring, tighten nut (4) until the installed height of the spring becomes dimension (a), and secure it with lock plate (3).

   REMARK

   Installed length (a) of spring: 433 mm
9. Remove idler cushion assembly (1) from tool A.
10. Install piston assembly (2) to idler cushion assembly (1).

    Piston sliding surface:
    Grease (G2-LI)

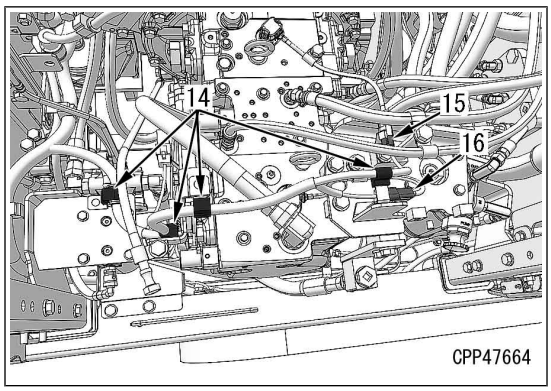
    Wear ring:
    Grease (G2-LI)



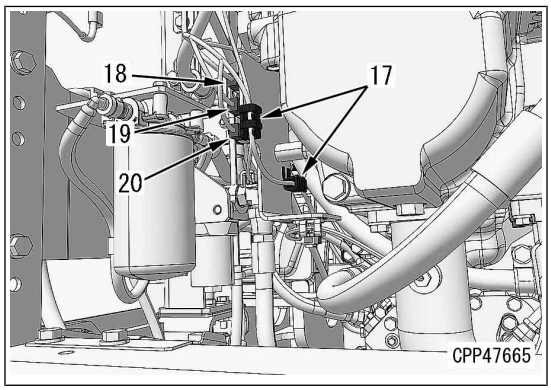
REMARK

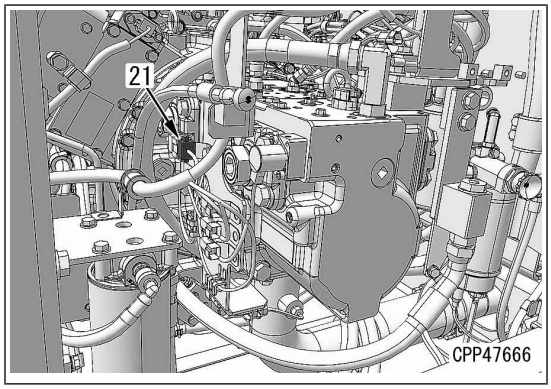
- Install the piston assembly with the valve installed position facing outward.
- Supply 300 cc of grease (G2-LI) into the cylinder to bleed air and check that grease comes out of the grease hole.

7. Remove the clips (14) (4 places), and disconnect the connectors (15) and (16).
   [Bolt M12/Width across flats: 19 mm]
   [Tool: Impact wrench]

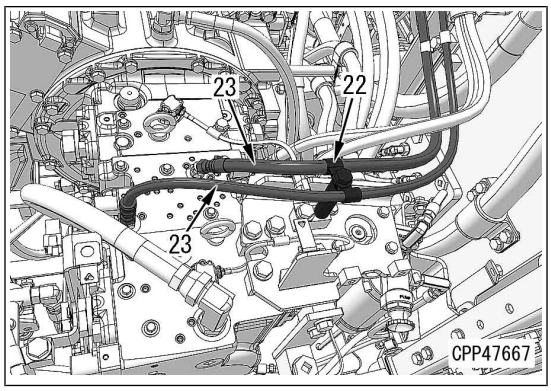


8. Remove the clips (17) (2 places), and disconnect the connectors (18), (19), (20), and (21).

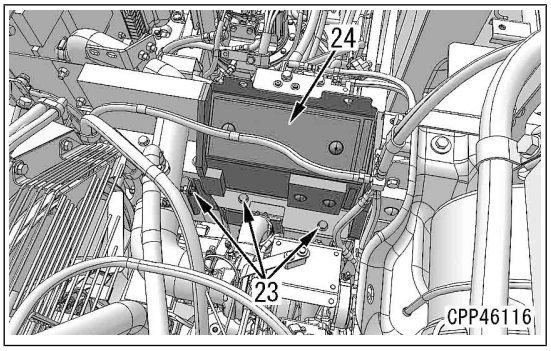




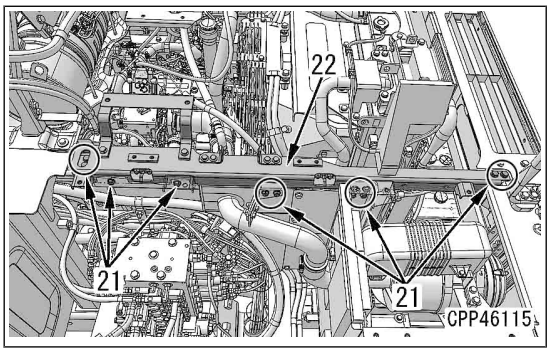
9. Remove the clamp (22), and disconnect the hoses (23) (2 pieces).
   [Bolt M12/Width across flats: 19 mm]
   [Tool: Impact wrench]



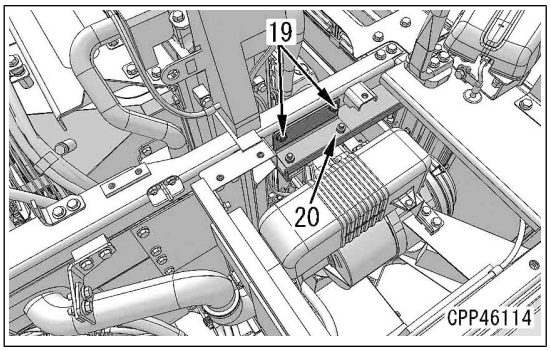
43. Install the cover (24) with the bolts (23) (3 pieces).
[Bolt M12/Width across flats: 19 mm]
[Tool: Impact wrench]



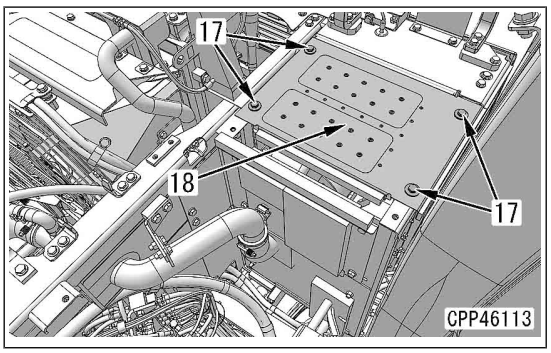
44. Install the bracket (22) with the bolts (21) (12 pieces).
[Bolt M12/Width across flats: 19 mm]
[Tool: Impact wrench]



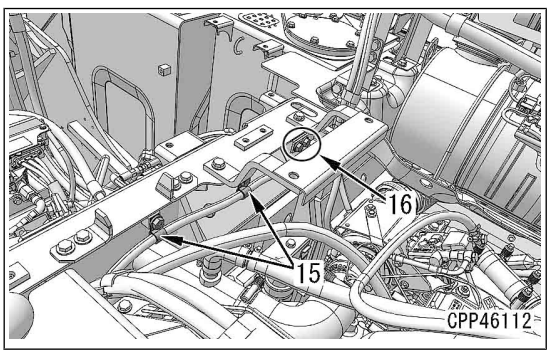
45. Install the bracket (20) with the bolts (19) (2 pieces).
[Bolt M12/Width across flats: 19 mm]
[Tool: Impact wrench]



46. Install the cover (18) with the bolts (17) (4 pieces).
[Bolt M12/Width across flats: 19 mm]
[Tool: Impact wrench]



47. Install the clamps (15) (2 places) and bolts (16) (2 pieces).
[Bolt M12/Width across flats: 19 mm]
[Tool: Impact wrench]

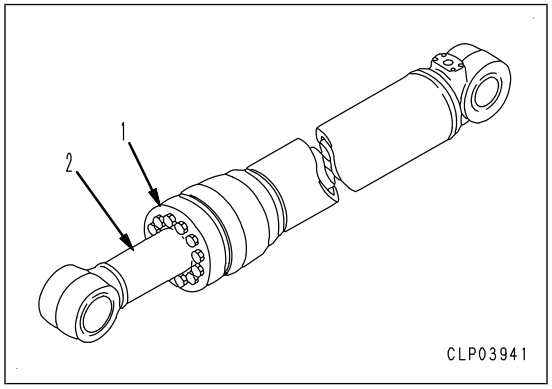


Piston rod assembly

2. Remove the mounting bolts (12 pieces), and disconnect cylinder head assembly (1).
3. Pull out piston rod assembly (2).

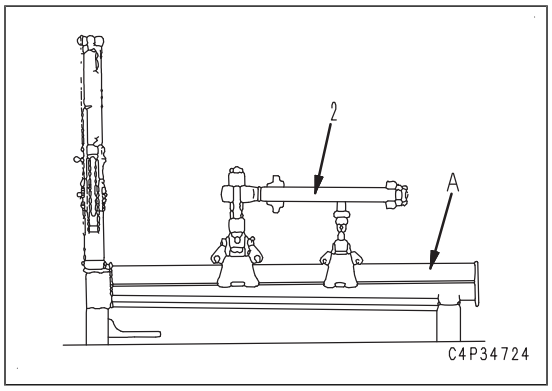
   REMARK

   Place a container under the cylinder to collect oil from the cylinder.



Lock screw

4. Set piston rod assembly (2) on tool A.



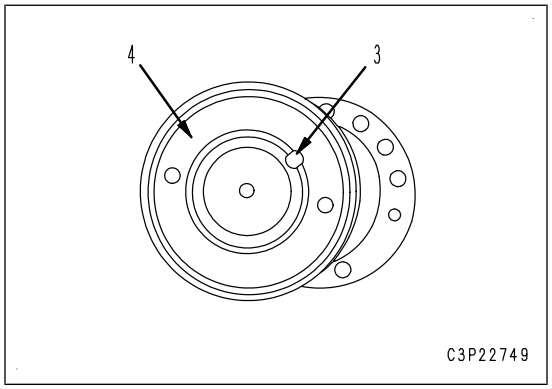
Piston assembly

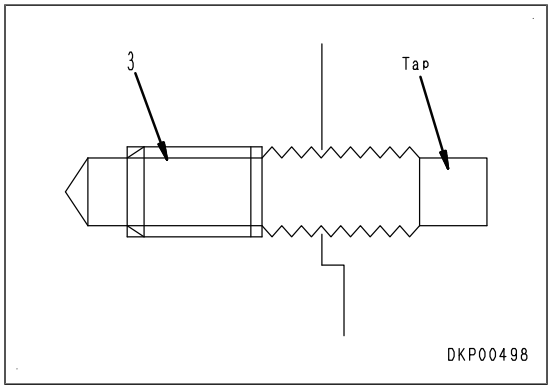
5. Remove lock screw (3) from the top end of piston assembly (4) by using a hexagonal wrench (6 mm).

   REMARK

   - This step is common in work of the boom, arm, and bucket cylinder.
   - If screw (3) is too firm to remove, tighten the screw further in and tap on the screw with tap (T), and remove it.

   Screw size: M12x1.75 mm



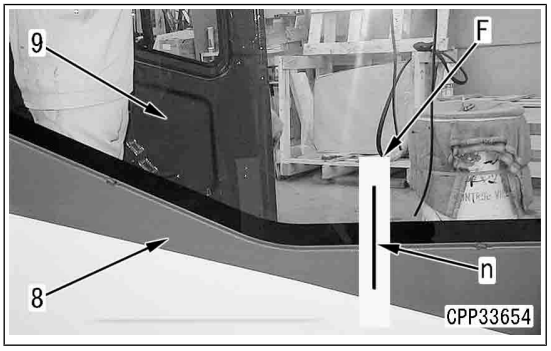


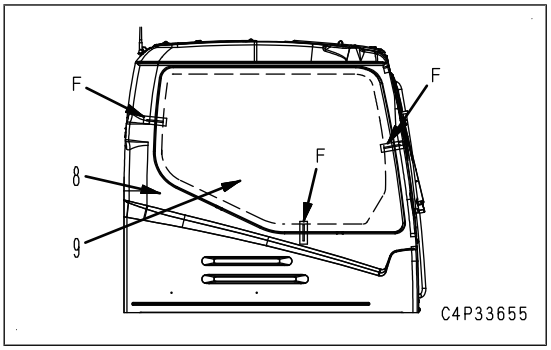
Adjusting the glass position

5. Perform positioning adjustment of window glasses to be replaced.
   1) Check the clearances on the right and left, upper and lower sides between the glass and operator's cab (8). Adjust the position of the glass so that the clearances are even.
   2) Stick the tape (F) between the glass (9) and operator's cab (8). Draw the positioning line (n) on each tape.

      REMARK

      Attach the tape (F) at 3 positions, R.H. window glass, L.H. rear window glass, and door lower window glasses, for positioning adjustment.





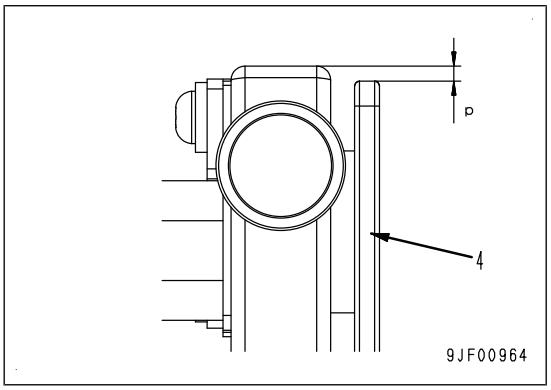
   3) Cut the tape at a position between the glass (9) and operator's cab (8) by using a utility knife, etc., and remove the window glass.

      REMARK

      - Do not remove the tapes left on the glass side and the operator's cab (8) side until the glasses are installed.
      - When positioning the front window glass (4)

        Set the right and left installing positions to the frame width.

        Position the upper and lower installing positions so that height dimension (p) of the frame top and front window glass (4) is 3 mm.



Applying the adhesive

6. Apply the adhesive.

   NOTICE

   - **2 types of adhesives must be selectively used depending on the season.**
   - **Do not use an adhesive if it expires the date of 4 months from its production.**
   - **Adhesives must be stored at 25 °Cor lower in a dark and cool place.**
   - **Do not heat the adhesive higher than 30 °C.**
   - **When reusing the adhesive, remove the hardened adhesive at the nozzle tip end completely.**

   Adhesive (summer):
   SUNSTAR Penguin Seal 580 SUPER "S"

   Adhesive (winter):
   SUNSTAR Penguin Seal 580 SUPER "W"

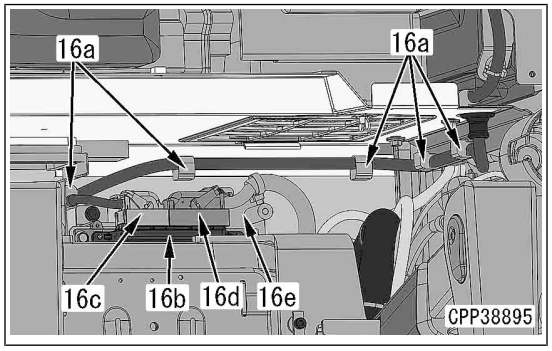
KomVision controller

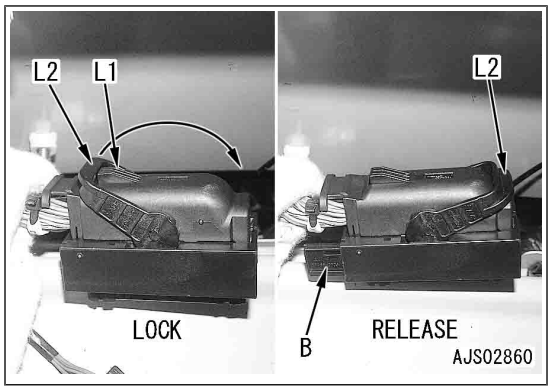
15. Install KomVision controller (16b) together with the bracket (16e) as a unit.

    REMARK

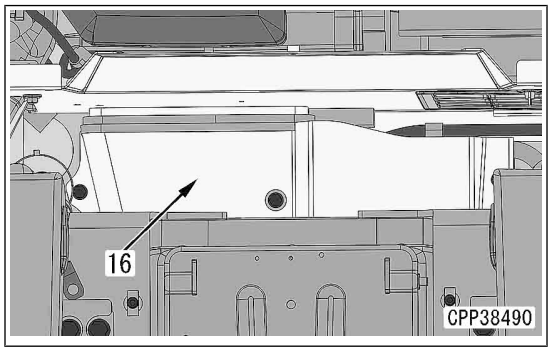
    Be careful not to step KomVision controller (16b) wrongly. KomVision controller (16b) may be damaged if it is accidentally stepped on.

16. Connect the connectors CA02 (16c) and CA01 (16d) to KomVision controller (16b) according to the following procedure.
    1) Connect the connectors CA02 (16c) and CA01 (16d).
    2) Tilt down the lock (L2) to LOCK side, and the slider (B) is pushed to be locked.
17. Install the clamps (16a) (5 places).

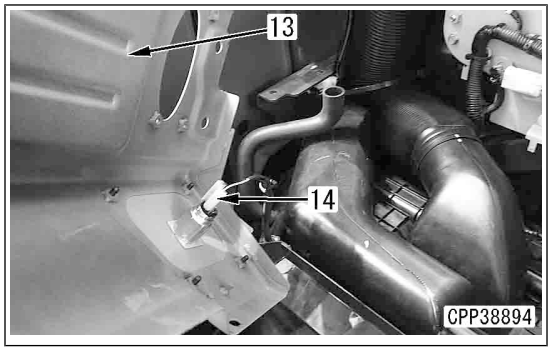




18. Install the cover (16) with the bolts (4 pieces).

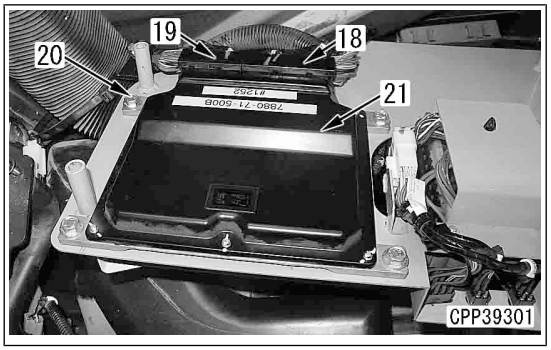


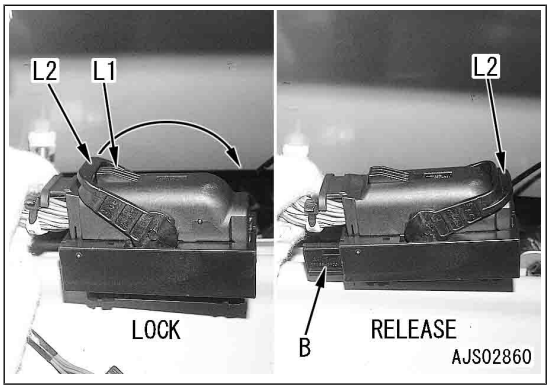
19. Connect the connector M04 (14).



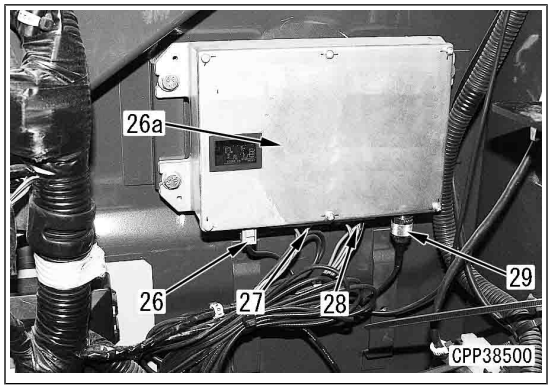
20. Install the cover (13) with the bolts (7 pieces).

10. Disconnect the connectors CP01 (18) and CP02 (19) according to the following procedure.
    1) While pressing lock (L1), tilt lock (L2) to the opposite side.
    2) Slider (B) comes out and lock is released.
    3) Disconnect the connectors CP01 (18) and CP02 (19).
11. Remove the bolts (20) (4 pieces), and remove the pump controller assembly (21).





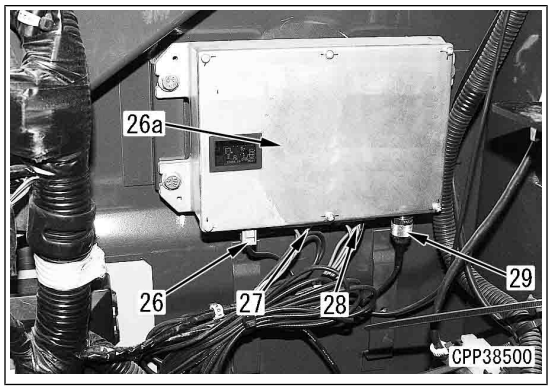
7. Disconnect the connector antenna GPS (26), connectors CK01 (27), CK02 (28), and communication antenna (29).
8. Remove KOMTRAX terminal (26a).



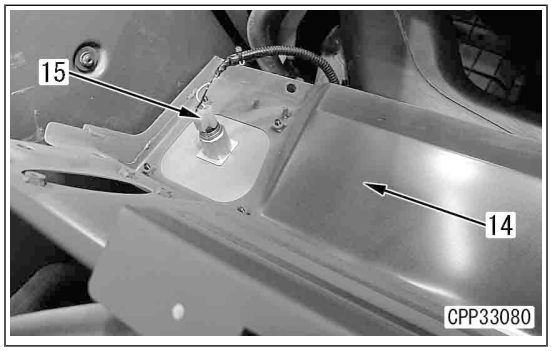
METHOD FOR INSTALLING KOMTRAX TERMINAL ASSEMBLY

KOMTRAX terminal

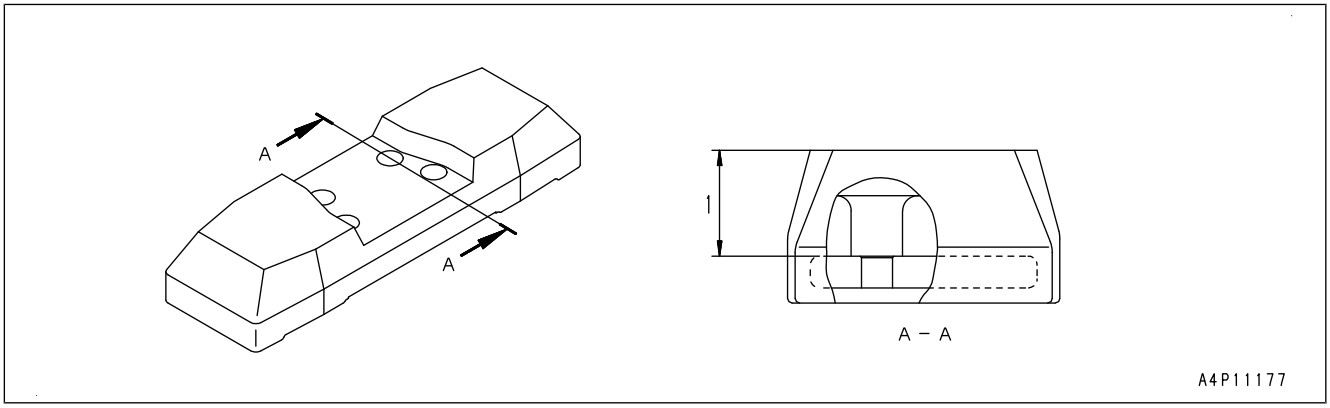
1. Install KOMTRAX terminal (26a).
2. Connect the connector antenna GPS (26), connectors CK01 (27), CK02 (28), and communication antenna (29).



3. Connect the connector M04 (15) on the back side of the cover (14).



MAINTENANCE STANDARD OF ROAD LINER



Unit: mm

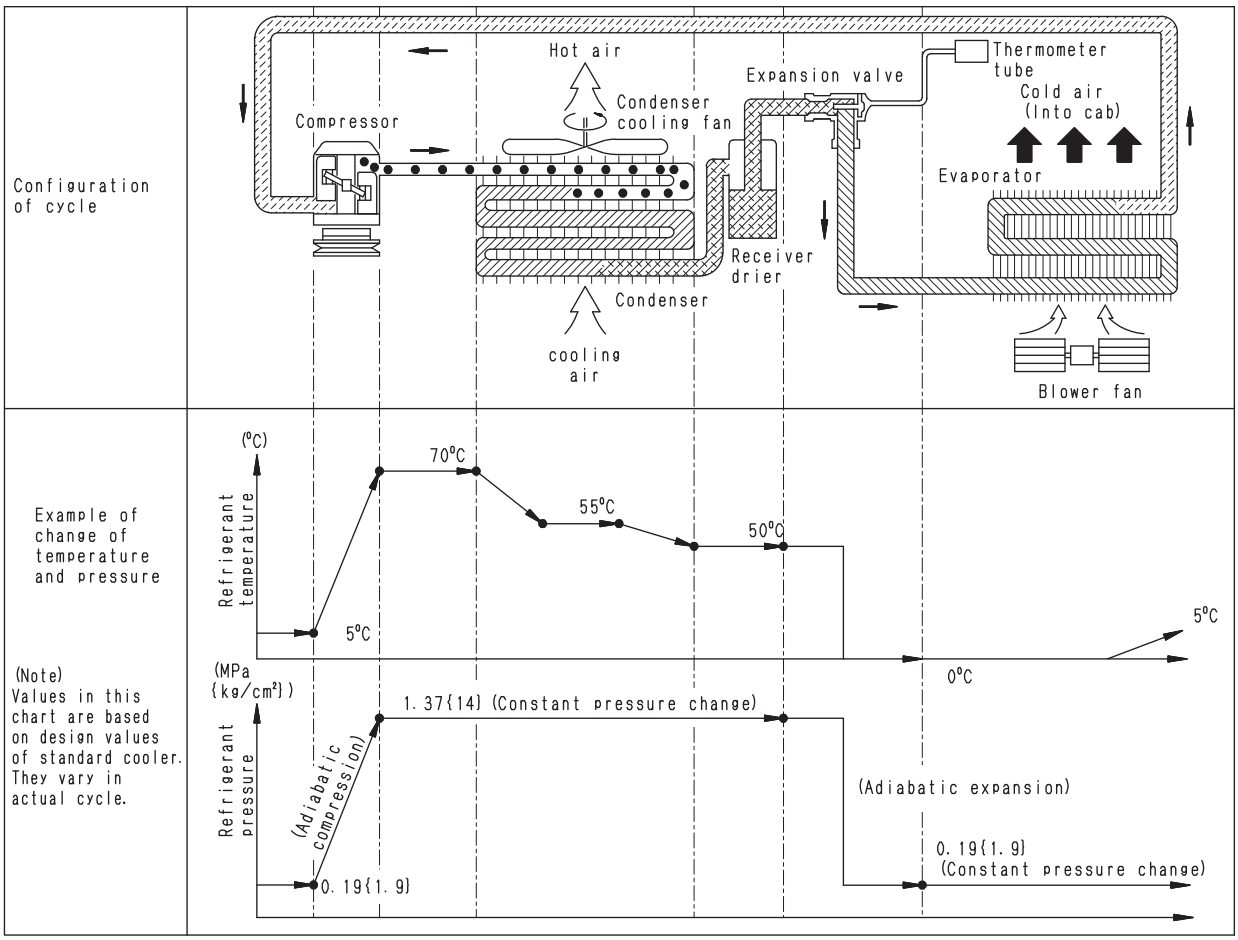
No.	Item	Judgment criteria		Remedy
1	Height	Standard dimensions	Repair limit	Replace
		70	25	

Unit: mm

No.	Item	Criteria					Remedy
1	Centering spring	Standard dimension			Repair limit		Replace spring if damaged or deformed
		Free height x outside diameter	Installed height	Load at installed height	Free height	Load at installed height	
		33.9 x 15.3	28.4	125 N {12.7 kg}	-	100 N {10.2 kg}	
2	Metering spring	22.7 x 8.10	22.0	16.7 N {1.70 kg}	-	13.3 N {1.36 kg}	
3	Tightening torque of bolt	11.76 to 14.7 Nm {1.2 to 1.5 kgfm}					Retighten

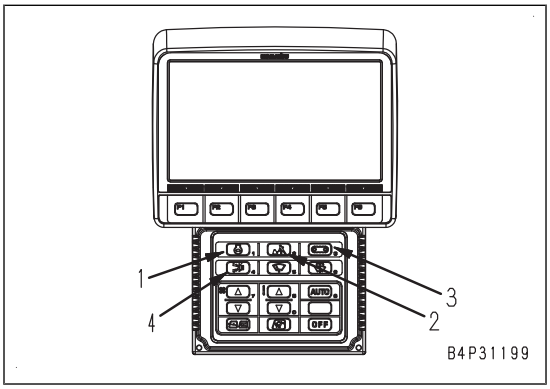
CONFIGURATION AND FUNCTION OF REFRIGERATION CYCLE

Cycle (component)	Compression (compressor)	Condensation (condenser)	Expansion (Expansion valve)	Evaporation (Evaporator)
Location of component	Engine compartment	Front part of radiator	Inside of operator's cab (built in air conditioner unit)	Inside of operator's cab (built in air conditioner unit)
Function	Circulates refrigerant and increases temperature and pressure of gas refrigerant so that it is liquefied easily in condenser. (Compression of refrigerant)	Condenses refrigerant to discharge heat absorbed in evaporator. (condensation of refrigerant)	Decreases temperature and pressure of refrigerant with throttle and convert it partially into gas so that it is evaporated easily, and controls flow rate. (Throttling of refrigerant)	Absorbs heat from air around evaporator to cool that air by evaporating refrigerant. (Evaporation of refrigerant)
State of refrigerant	Gas → gas Adiabatic compression	Gas → liquid Isobaric change	Liquid → liquid, gas Adiabatic expansion	Liquid, gas → gas Isobaric change

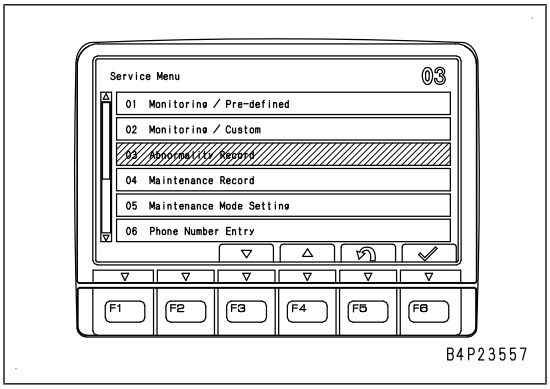


HOW TO OPEN THE ELECTRICAL SYSTEM ABNORMALITY RECORD SCREEN IN SERVICE MODE OF THE MACHINE MONITOR

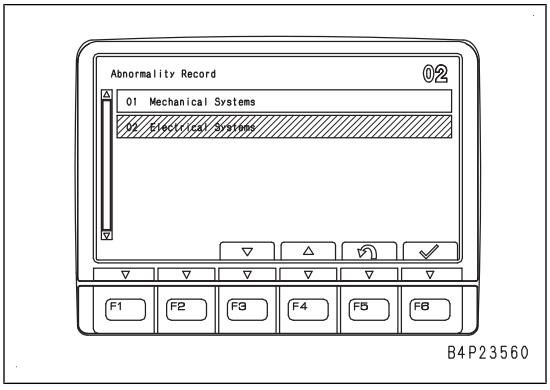
1. Press“1”, “2”, and “3” in this order on the standard screen while pressing numeric key “4”.



2. Press F3 twice on the Service Menu screen, and select “03 Abnormality Record”.
3. Press F6 to enter the selection.



4. Press F3 once on the Abnormality Record screen, and select “02 Electrical Systems”.
5. Press F6 to enter the selection.



Circuit diagram related to compressor and refrigerant system