

Shop Manual

HYDRAULIC
EXCAVATOR

PC228US -3E0
PC228USLC-3E0

SERIAL NUMBERS PC228US- 40001
 PC228USLC- 40001 and up

ecot3

KOMATSU

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Disassembly and assembly of final drive assembly	3
Removal and installation of swing machinery assembly	11
Disassembly and assembly of swing machinery assembly	13
Removal and installation of swing circle assembly	21
Undercarriage and frame	SEN01926-02
Disassembly and assembly of track roller assembly	2
Disassembly and assembly of idler assembly	3
Disassembly and assembly of recoil spring	6
Expansion and installation of track shoe assembly	8
Removal and installation of revolving frame	10
Removal and installation of counterweight assembly	12
Removal and installation of maintenance counterweight (at rear of engine)	13
Removal and installation of maintenance counterweight assembly (above pump)	14
Hydraulic system	SEN01927-02
Removal and installation of center swivel joint assembly	2
Disassembly and assembly of center swivel joint	4
Removal and installation of hydraulic tank assembly	5
Removal and installation of work equipment pump	7
Removal and installation of control valve assembly	11
Disassembly and assembly of control valve assembly	13
Disassembly and assembly of work equipment PPC valve assembly	15
Disassembly and assembly of travel PPC valve assembly	17
Disassembly and assembly of hydraulic cylinder assembly	20
Work equipment	SEN01928-01
Removal and installation of work equipment assembly	2
Cab and its attachments	SEN01929-01
Removal and installation of operator's cab assembly	2
Removal and installation of operator's cab glass (Stuck glass)	4
Removal and installation of front window assembly	13
Removal and installation of floor frame assembly	14
Electrical system	SEN01930-01
Removal and installation of air conditioner compressor assembly	2
Removal and installation of air conditioner condenser assembly	4
Removal and installation of air conditioner unit assembly	5
Removal and installation of machine monitor assembly	7
Removal and installation of pump controller assembly	8
Removal and installation of engine controller assembly	9
Removal and installation of KOMTRAX communication modem assembly	11
90 Diagrams and drawings	
Hydraulic diagrams and drawings	SEN01439-01
Hydraulic circuit diagram	3
Electrical diagrams and drawings	SEN01440-02
Electrical circuit diagram	3
Connector list and stereogram	17

3. Filing method

File by the brochures in the correct order of the form number printed in the shop manual composition table.

- **Revised edition mark**

When a manual is revised, the ones and tens digits of the form number of each brochure is increased by 1. (Example: 00, 01, 02 ...)

- **Revisions**

Revised brochures are shown in the shop manual composition table.

4. Symbols

Important safety and quality portions are marked with the following symbols so that the shop manual will be used practically.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing work.
	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing work.
	Weight	Weight of parts of component or parts. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Places that require special attention for tightening torque during assembly.
	Coat	Places to be coated with adhesives, etc. during assembly.
	Oil, coolant	Places where oil, etc. must be added, and capacity.
	Drain	Places where oil, etc. must be drained, and quantity to be drained.

5. Units

In this shop manual, the units are indicated with International System of units (SI). For reference, conventionally used Gravitational System of units is indicated in parentheses { }.

Points to remember when handling hydraulic equipment

With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1. Be careful of the operating environment.

Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

2. Disassembly and maintenance work in the field

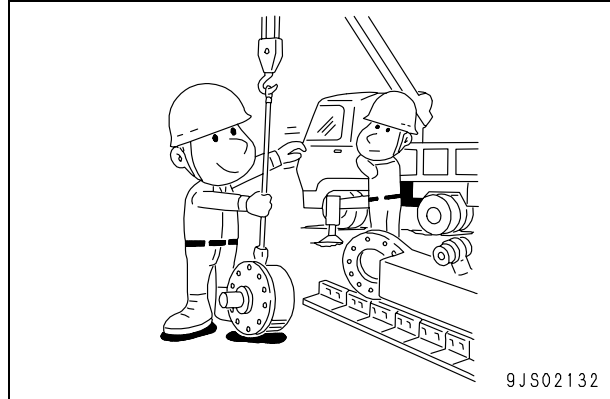
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be checked with special test equipment.

3. Sealing openings

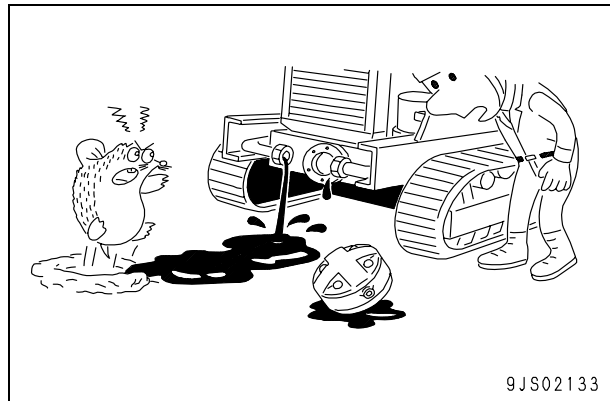
After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this. Do not simply drain oil out onto the ground, but collect it and ask the customer to dispose of it, or take it back with you for disposal.

4. Do not let any dirt or dust get in during refilling operations

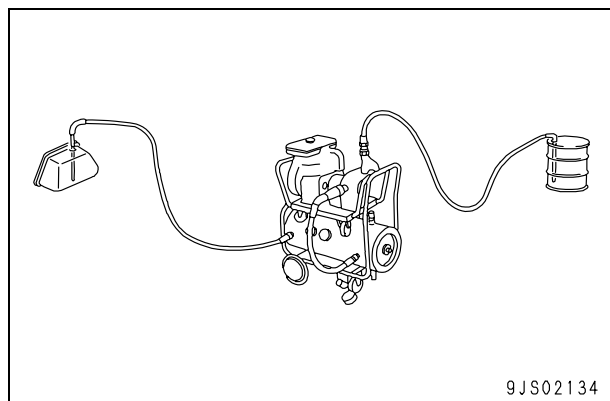
Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.



9JS02132



9JS02133



9JS02134

- 4) Checking muffler and exhaust pipe for damage and looseness
 - 1] Visually check the muffler, exhaust pipe and their mounting parts for a crack and damage.
If any part is damaged, replace it.
 - 2] Check the mounting bolts and nuts of the muffler, exhaust pipe and their mounting parts for looseness.
If any bolt or nut is loosened, retighten it.
- 5) Checking muffler function
Check the muffler for abnormal sound and sound different from that of a new muffler.
If any abnormal sound is heard, repair the muffler, referring to "Troubleshooting" and "Disassembly and assembly".

Liters to U.K. Gallons

1 ℓ = 0.21997 U.K.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft.lb

1 kgm = 7.233 ft.lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

Weight table

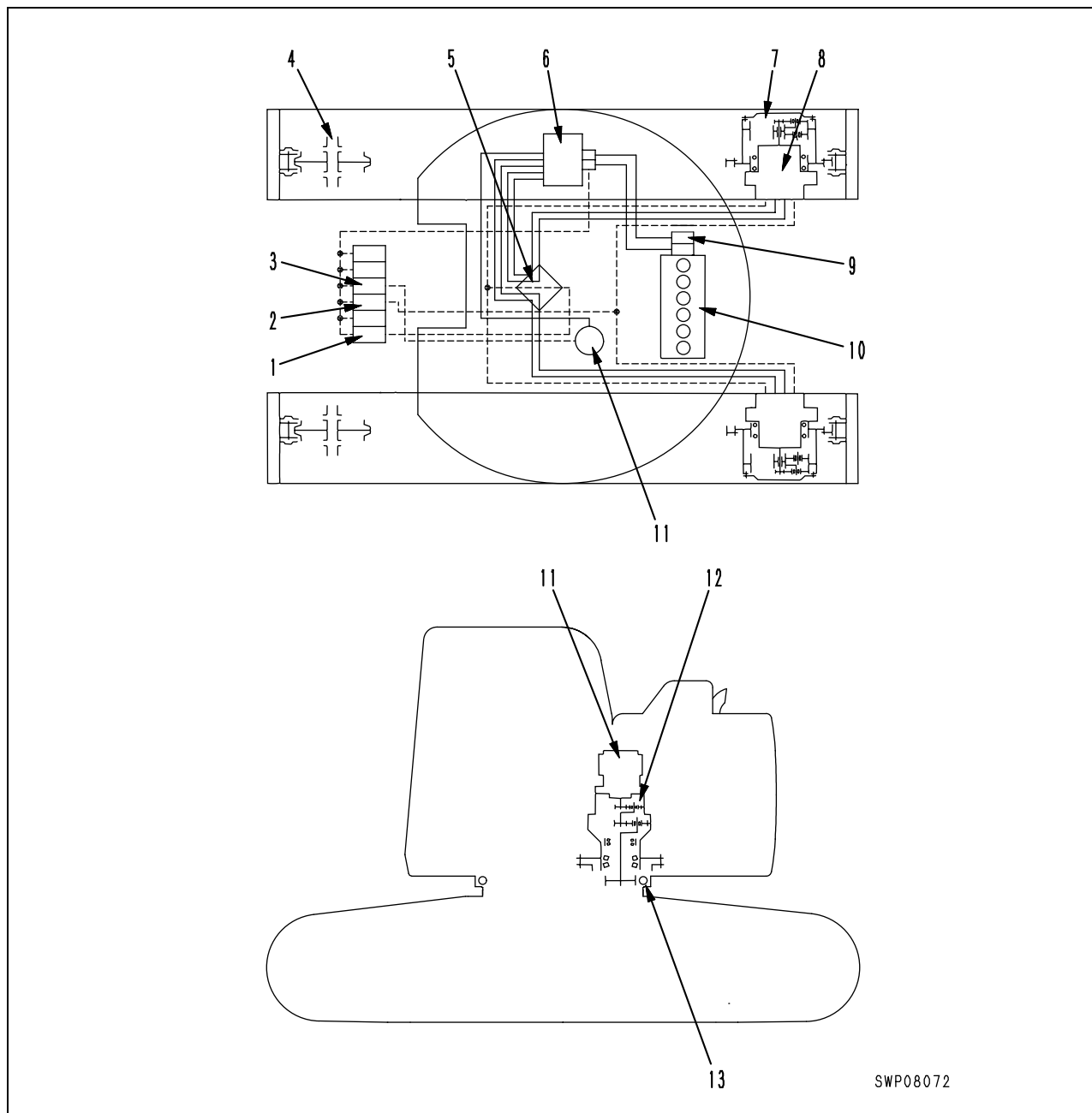
⚠ This weight table is prepared for your reference when handling or transporting the components.

Unit: kg

Machine model	PC228US-3E0	PC228USLC-3E0
Serial number	40001 and up	
Engine assembly	735	735
• Engine	575	575
• Damper	6	6
• Hydraulic pump	154	154
Radiator and oil cooler assembly	126	126
Hydraulic tank and filter assembly (Not including hydraulic oil)	146	146
Fuel tank assembly (Not including fuel)	131	131
Revolving frame	1,854	1,854
Cab	251	251
Operator's seat	27	27
Counterweight	6,060	6,060
Swing machinery	224	224
Control valve	280	280
Swing motor	51.5	51.5
Travel motor	98 x 2	98 x 2
Center swivel joint	30.3	30.3
Track frame assembly (Not including piping)	4,269	4,797
• Track frame	2,260	2,644
• Swing circle	267	267
• Idler	101 x 2	101 x 2
• Idler cushion	118 x 2	118 x 2
• Carrier roller	14 x 4	14 x 4
• Track roller	36 x 14	36 x 18
• Final drive (including travel motor)	372 x 2	372 x 2
Track shoe assembly		
• Standard triple shoe (600 mm)	1,215 x 2	1,395 x 2
• Standard triple shoe (700 mm)	1,405 x 2	1,530 x 2
• Standard triple shoe (800 mm)	1,530 x 2	1,670 x 2
• Flat shoe (600 mm)	1,635 x 2	1,780 x 2
• Swamp shoe (860 mm)	1,630 x 2	1,775 x 2
• Road liner (Rubber pad type) (600 mm)	1,470 x 2	1,600 x 2

Power train

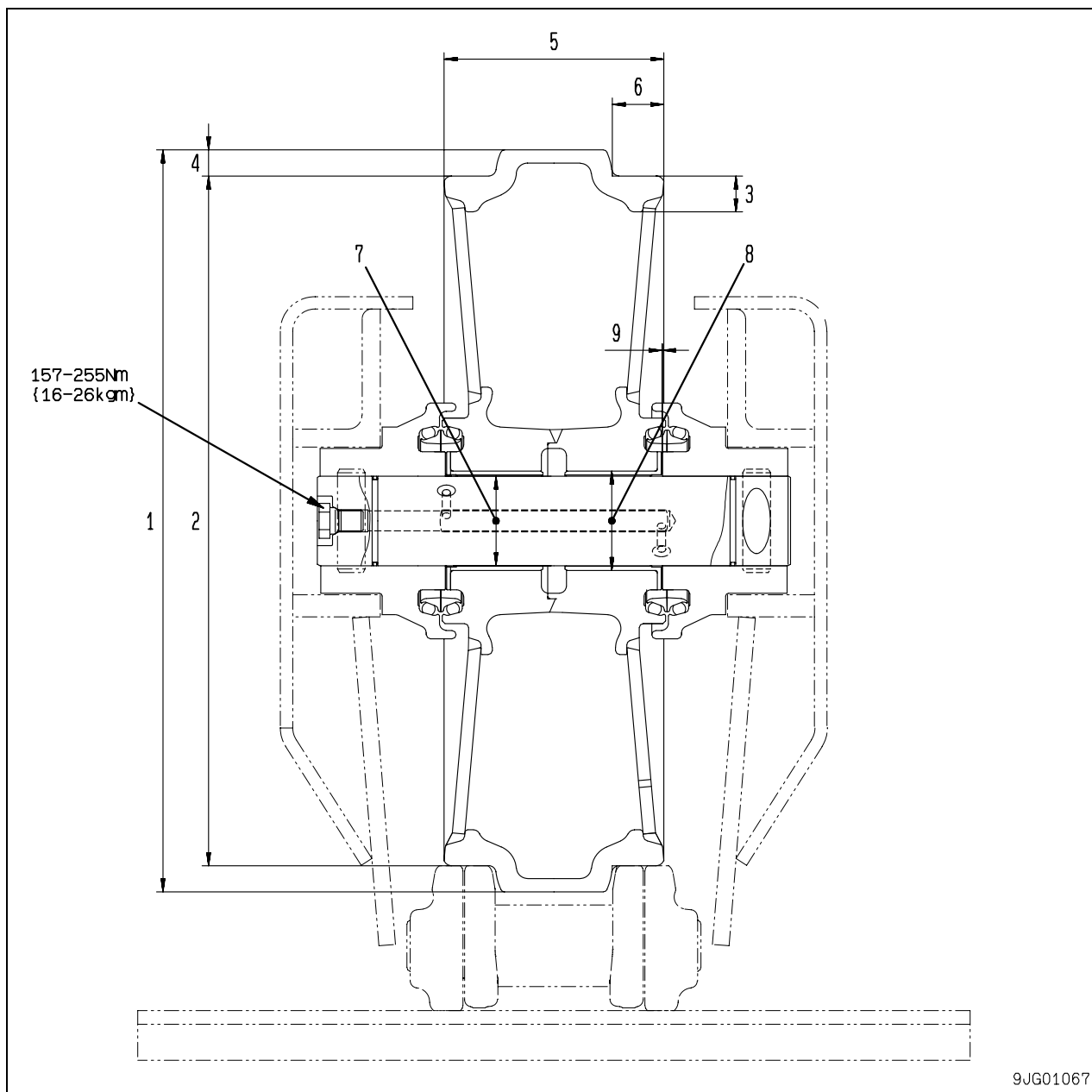
Power train



1. PPC lock solenoid valve
2. Travel speed switch solenoid valve
3. Swing brake solenoid valve
4. Idler
5. Center swivel joint
6. Control valve

7. Final drive
8. Travel motor (HMF110ADT-2)
9. Hydraulic pump (HPV95+95)
10. Engine (SAA6D107E-1)
11. Swing motor (KMF125ABE-6)
12. Swing machinery
13. Swing circle

Idler



HYDRAULIC EXCAVATOR

PC228US-3E0 PC228USLC-3E0

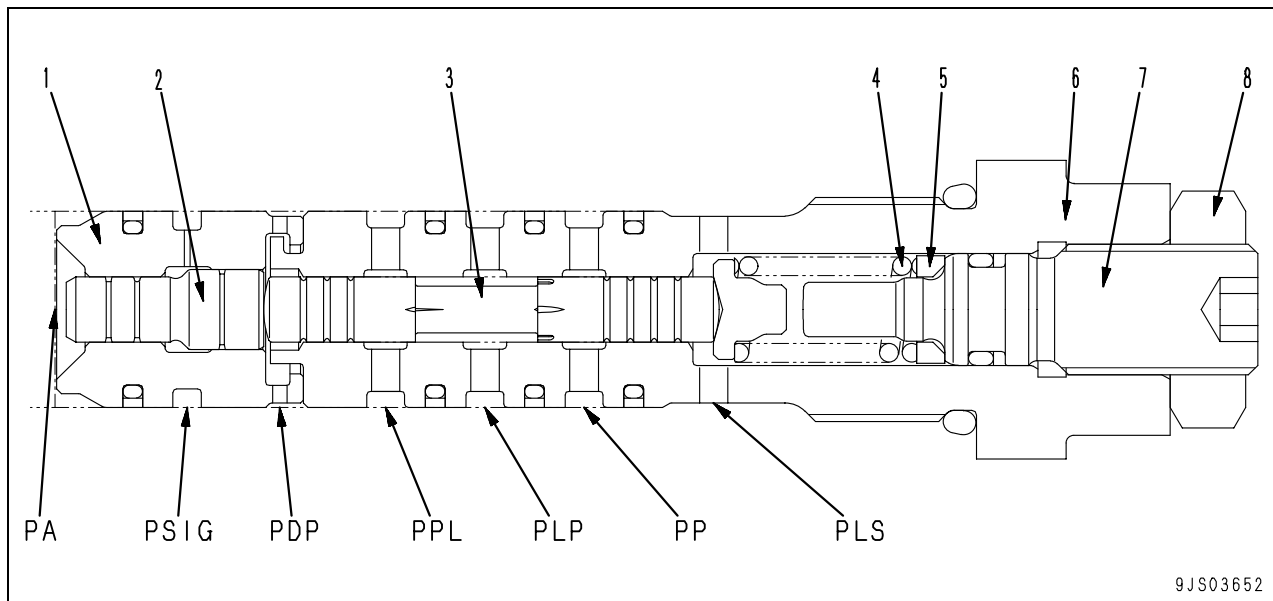
Machine model	Serial number
PC228US-3E0	40001 and up
PC228USLC-3E0	40001 and up

10 Structure, function and maintenance standard

Hydraulic system, Part 1

Hydraulic system, Part 1	2
Hydraulic equipment layout drawing	2
Hydraulic tank	4
Hydraulic pump	6

1. LS valve

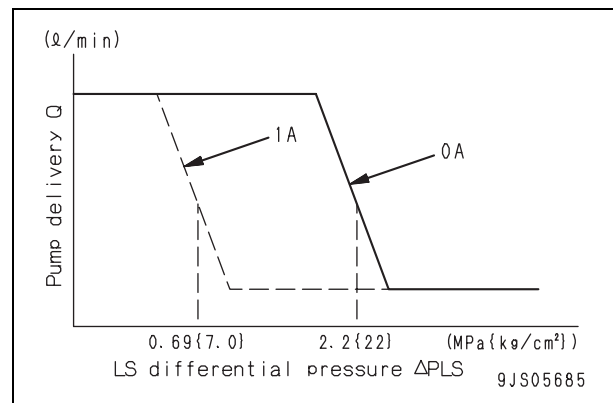


PA : Pump port
 PDP : Drain port
 PLP : LS control pressure output port
 PLS : LS pressure input port
 PP : Pump port
 PPL : Control pressure input port
 PSIG : LS mode selector pilot port

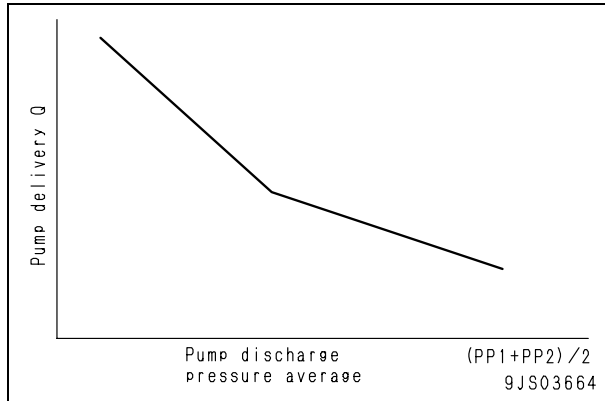
1. Sleeve
 2. Piston
 3. Spool
 4. Spring
 5. Sheet
 6. Sleeve
 7. Plug
 8. Locknut

Function

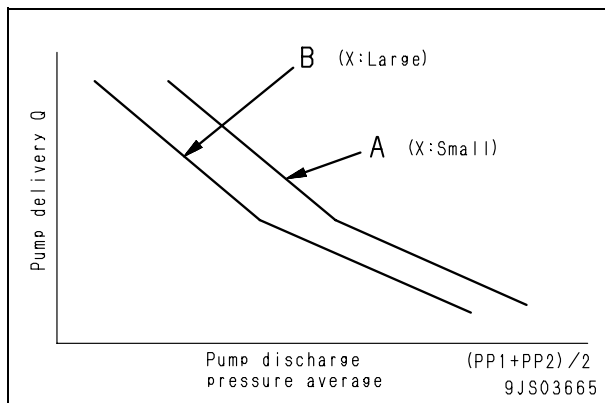
- The LS (load sensing) valve detects the load and controls the delivery.
- This valve controls main pump delivery (Q) according to differential pressure (ΔPLS) [= PP – PLS], called the LS differential pressure (the difference between main pump pressure (PP) and control valve outlet port pressure (PLS)).
- Main pump pressure (PP), pressure (PLS) (called the LS pressure) coming from the control valve output, and pressure (PSIG) (called the LS selector pressure) from the proportional solenoid valve enter this valve.
- The relationship between the LS differential pressure between the main pump pressure (PP) and LS pressure (PLS) (ΔPLS) [= (PP) – (PLS)] and the pump delivery (Q) changes as shown in the diagram according to LS selector current (ISIG) of the LS-EPC valve.
- If (ISIG) changes from 0 to 1A, setting force of the spring changes, too. As the result, the specified median of the pump delivery volume switching point changes as shown in the diagram. It will change in the range of 0.69 to 2.2 MPa {in the range of 7.0 to 22.0 kg/cm²}.



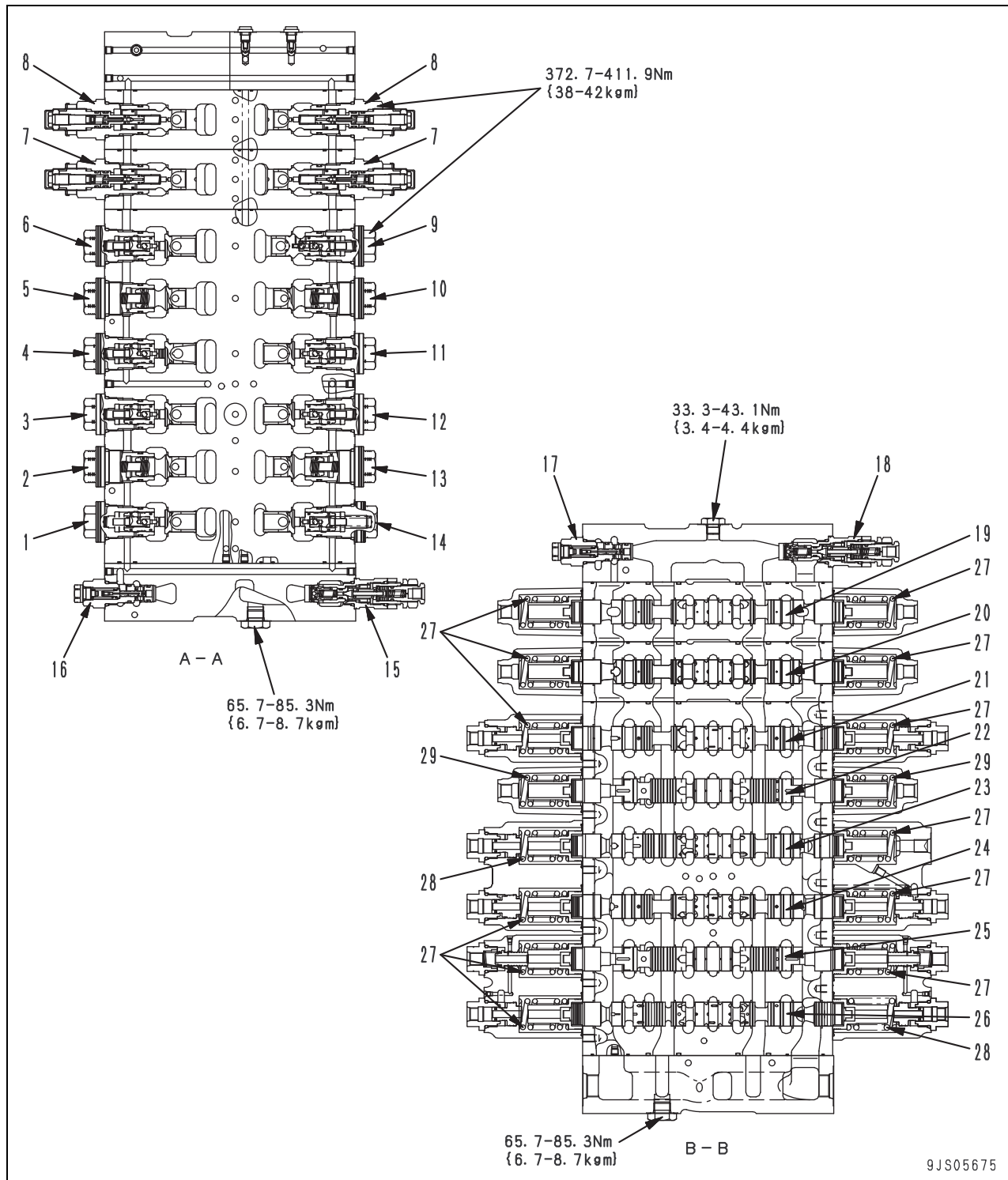
- The relationship between the average pump pressure $(PP1 + PP2)/2$ and servo piston (9) in terms of their positions can be represented by the broken line in the figure springs (4) and (6) form the double springs.
- The relationship between the average pump pressure $(PP1 + PP2)/2$ and average pump delivery (Q) becomes as shown below.



- If command voltage (X) sent to PC-EPC valve solenoid (1) increases further, the relationship between average pump pressure $(PP1 + PP2)/2$, and pump delivery (Q) is proportional to the force of the PC-EPC valve solenoid and moves in parallel.
- Namely, the force of PC-EPC valve solenoid (1) is added to the pushing force to the right because of the pump pressure applied to the spool (3), so the relationship between the average pump pressure $(PP1 + PP2)/2$ and the pump delivery (Q) moves from (A) to (B) as the command current (X) is increased.

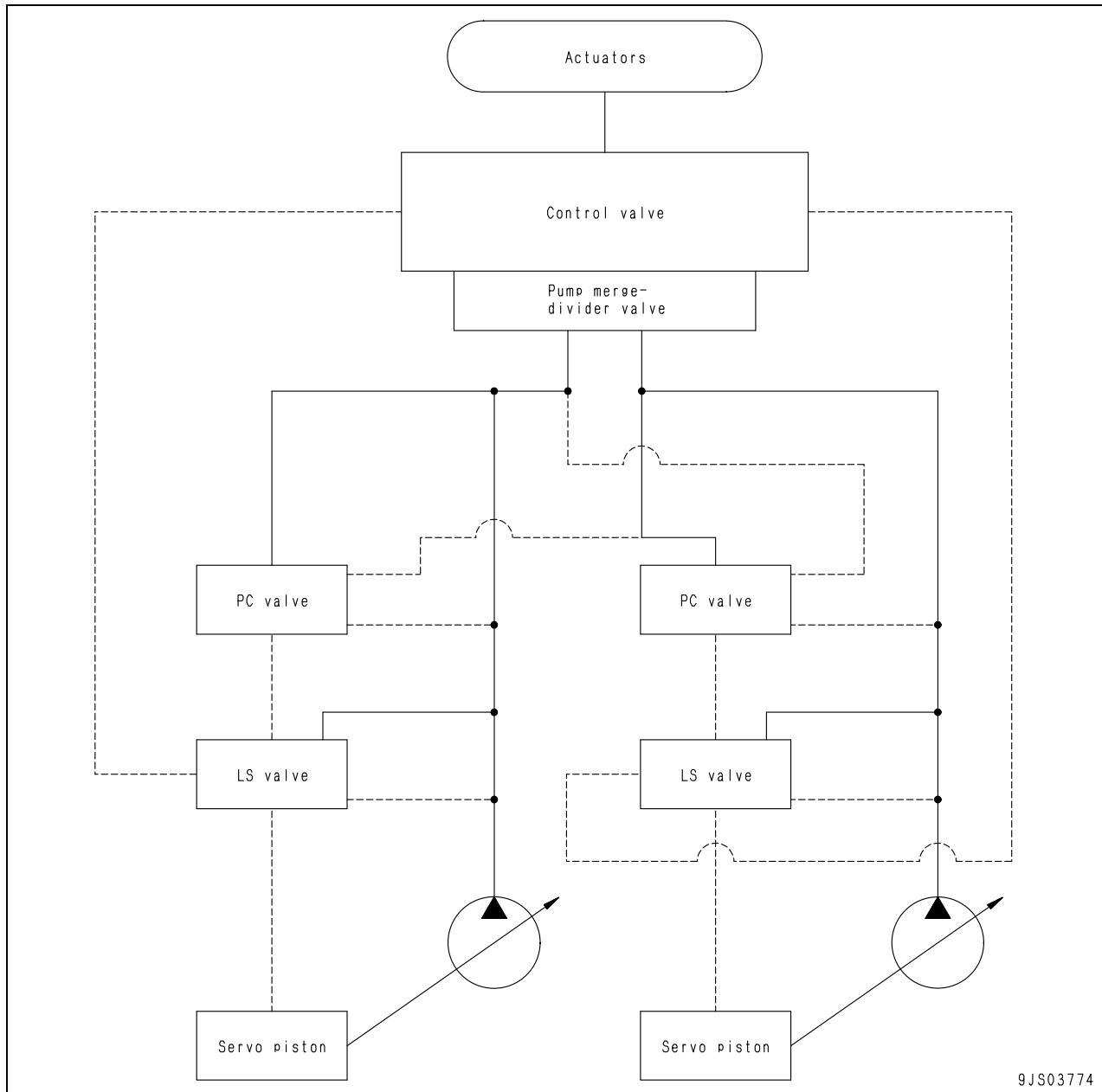


Sectional view (1/5)



CLSS

Outline of CLSS



Features

CLSS stands for Closed center Load Sensing System, which has the following characteristics:

- Fine control not influenced by load
- Controllability enabling digging even with fine control
- Ease of compound operation ensured by flow divider function using area of opening of spool during compound operations
- Energy saving using variable pump control

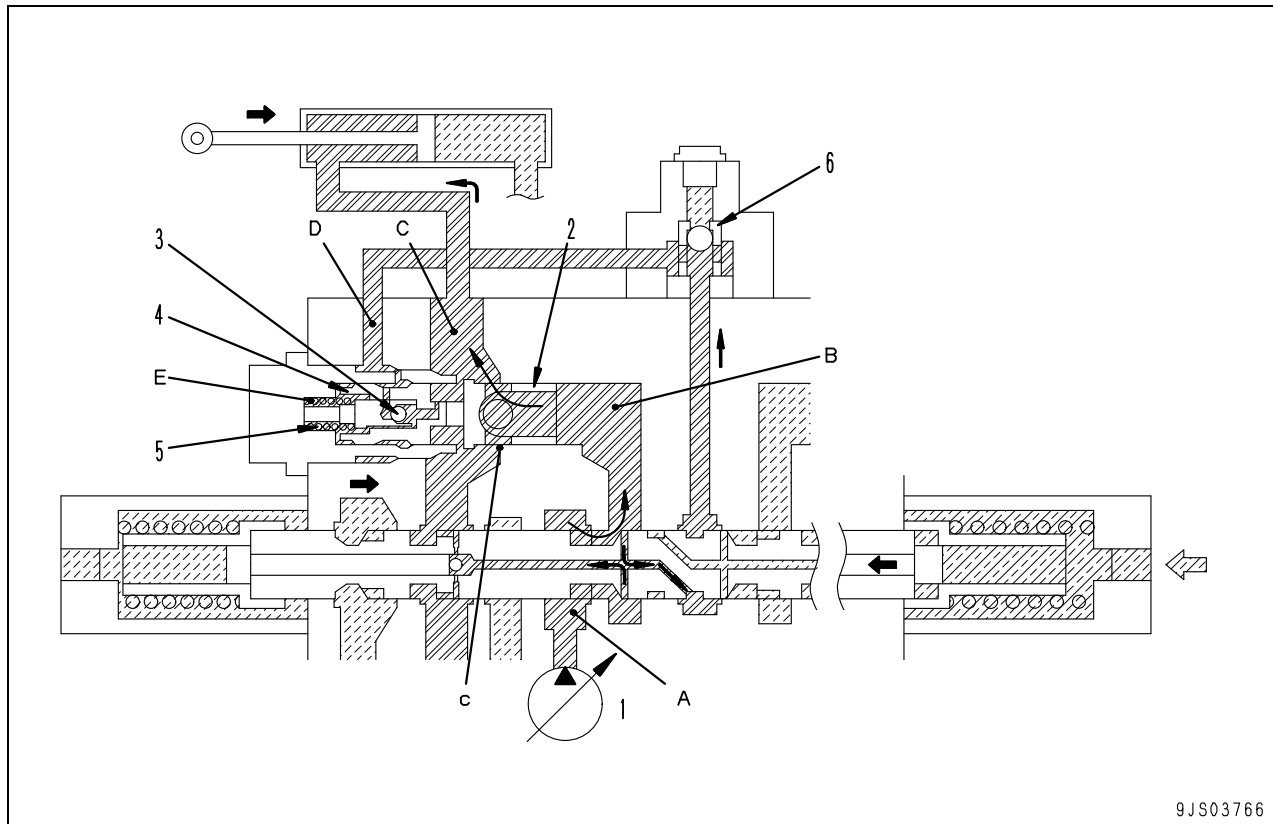
Configuration

- CLSS is configured with variable capacity piston pumps, control valves, and respective actuators.
- The hydraulic pump is configured with pump body, PC valve and LS valve.

Pressure compensation valve

1. During independent operation and under maximum load pressure

(If the load pressure is higher than other work equipment during a combined operation)



1. Hydraulic pump
2. Valve
3. Shuttle valve

4. Piston
5. Spring
6. LS shuttle valve

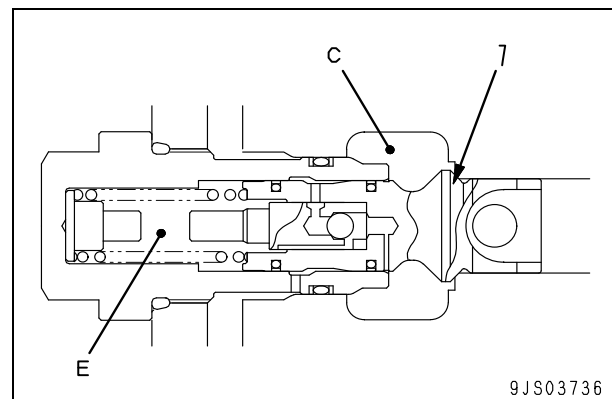
Function

- Pressure compensation valve works as the load check valve.
- If the pump pressure (LS pressure) is lower than the load at port (c), shuttle valve (3) in pressure compensation valve piston (4) interconnects spring chamber (E) and port (C).
- The force of spring (5) operates piston (4) and valve (2) to the closing direction.

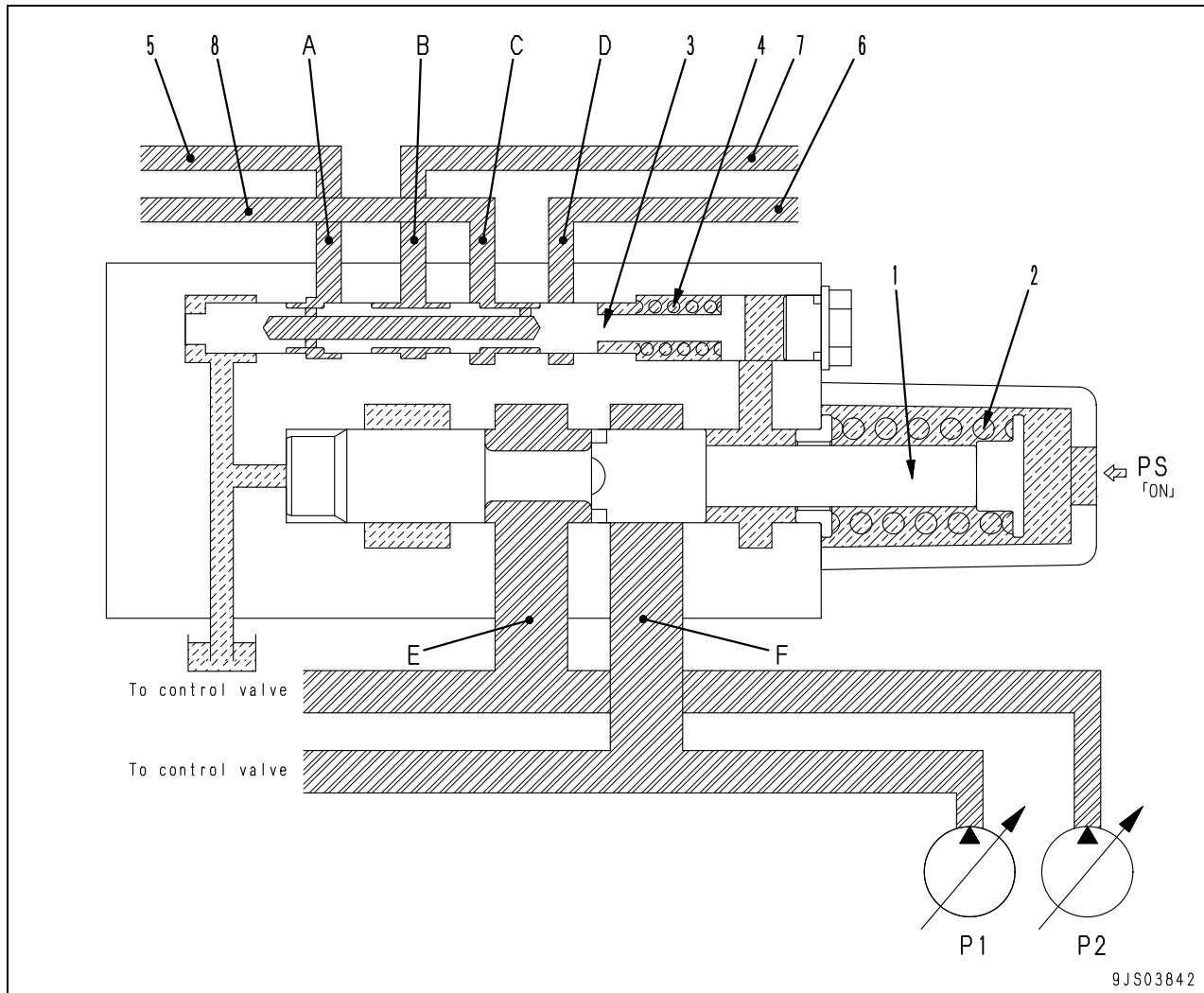
- As principle, port (C) and spring chamber (E) are not interconnected in an integrated pressure compensation valve.
- If high peak pressure is generated at port (C), valve (7) does not collide with the valve chamber.
- With a bucket valve, etc., port (C) and spring chamber (E) are designed to interconnect before valve (7) is seated.

Integrated pressure compensation valve

- High stress may occur when valve (2) collides with valve chamber seat portion (C) if a high peak pressure is generated in the actuator circuit or repetitive peak pressure occurs continuously (example: when using the breaker).
- To prevent this, a pressure compensation valve with integrated valve (2) and piston (4) is used.
- With the present machine, this device is adopted for the bucket valve (cylinder bottom) and the service valve.



2. When flows from the pumps are divided [if pilot pressure (PS) is ON]



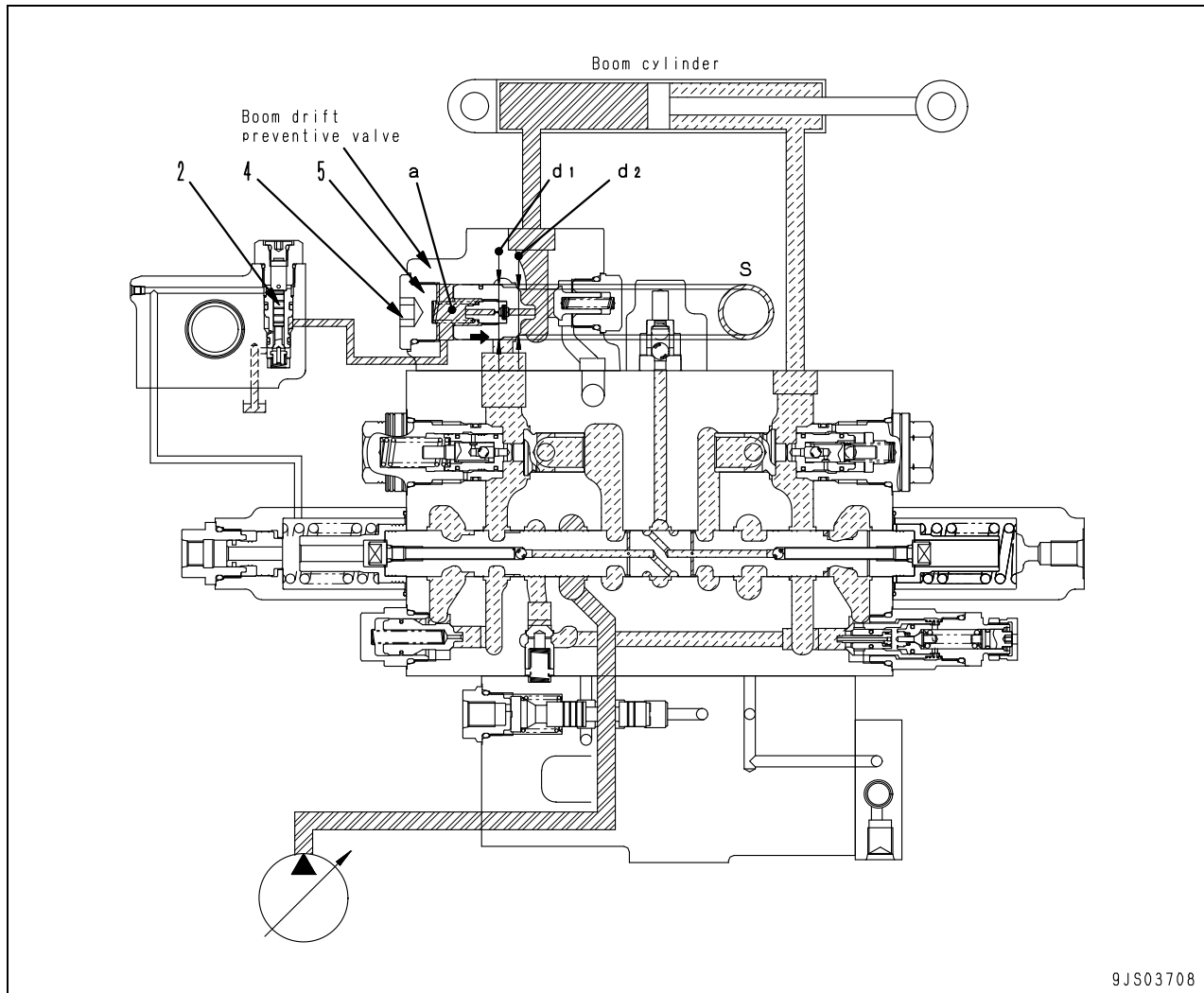
Operation

- Pilot pressure (PS) turns ON, and output pressure from the PPC valve shifts main spool (1) to the left, and ports (E) and (F) are divided.
- Pressurized oil discharged from the two pumps are sent to respective control valves.

P1 pressure: To bucket, L.H. travel, and boom
 P2 pressure: To swing, R.H. travel, and arm

- LS spool (3) too shifts to the left under the output pressure from the PPC valve, interconnects ports (A) and (C) and divides other ports.
- Forwards LS pressure led from each control valve spool to LS circuits (5), (6), (7) and (8) to respective control valves.

2. When the boom is in neutral

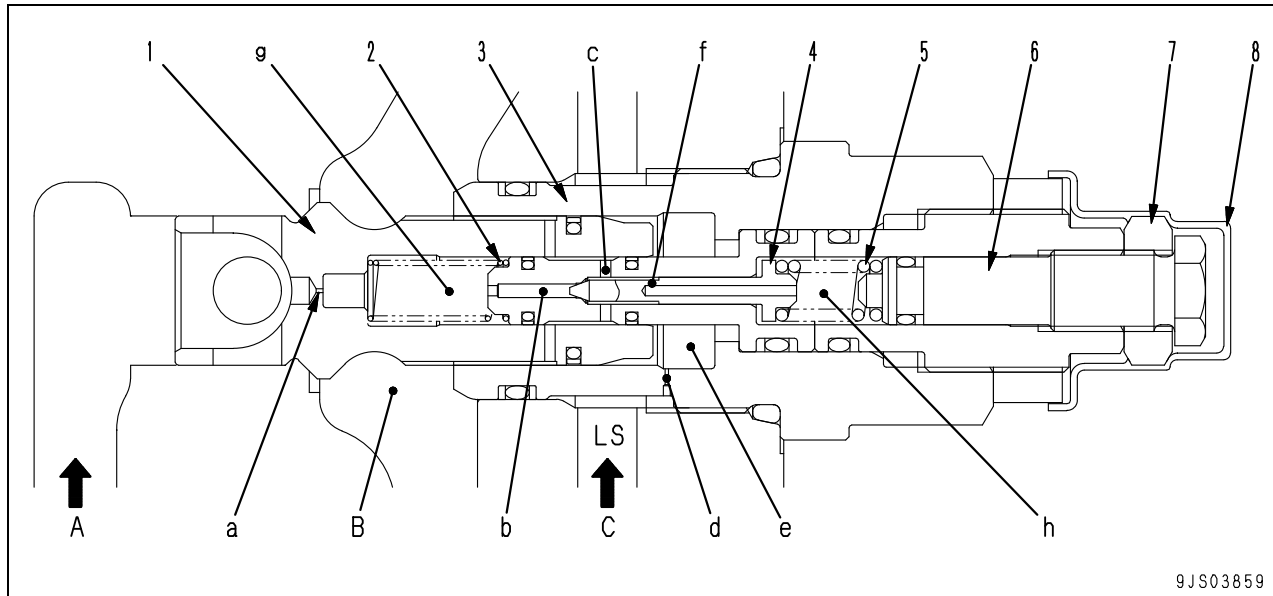


Operation

- Moves the lever to neutral with the boom raised.
- Pressurized oil flown inside poppet (5) from orifice (a) of poppet (5) is closed by pilot piston (2).
- The holding pressure of boom cylinder bottom works on the ring-shaped area (S) caused by the difference between outside diameter (d1) of poppet (5) and seat diameter (d2) to move it to the right.
- The sum of this force and the force of spring (4) closes poppet (5).
- Pressurized oil from the control valve and the holding pressure of the boom cylinder bottom are shut off.

Variable pressure compensation valve

(Installed to the service valve)



- A. Pump discharge pressure (P) (From service valve spool)
- B. Cylinder port
- C. Load pressure of other work equipment

- 1. Valve
- 2. Spring
- 3. Sleeve
- 4. Poppet
- 5. Spring
- 6. Screw
- 7. Locknut
- 8. Cap

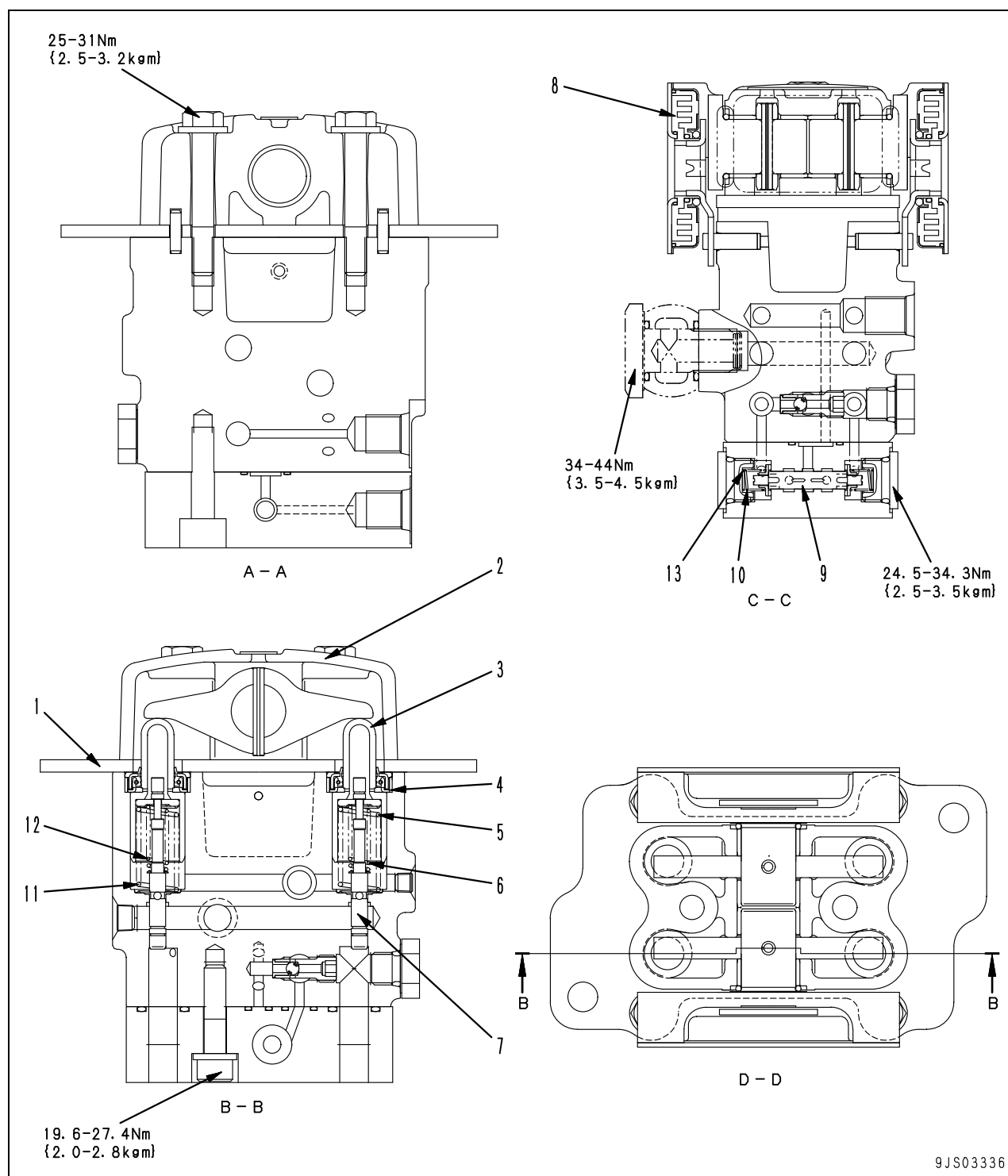
Function

- Regulates flow distribution to the service valve when the service valve (attachment) and the work equipment valve (boom raising, etc.) are operated together. (Equivalent surface area ratio variable)
- Pressurized oil from the service valve spool is applied to the left side of valve (1) and is led to chamber (g) via orifice (a).
- LS pressure is led to chamber (e) via orifice (d).
- Pressurized oil of cylinder port is led to chamber (h) via passage (c) and orifice (f).
- The force of spring (2) acts on valve (1), and the force of spring (5) acts on poppet (4).
- The force of spring (5) can be adjusted with screw (6).

PC228US, 228USLC-3E0 Hydraulic excavator

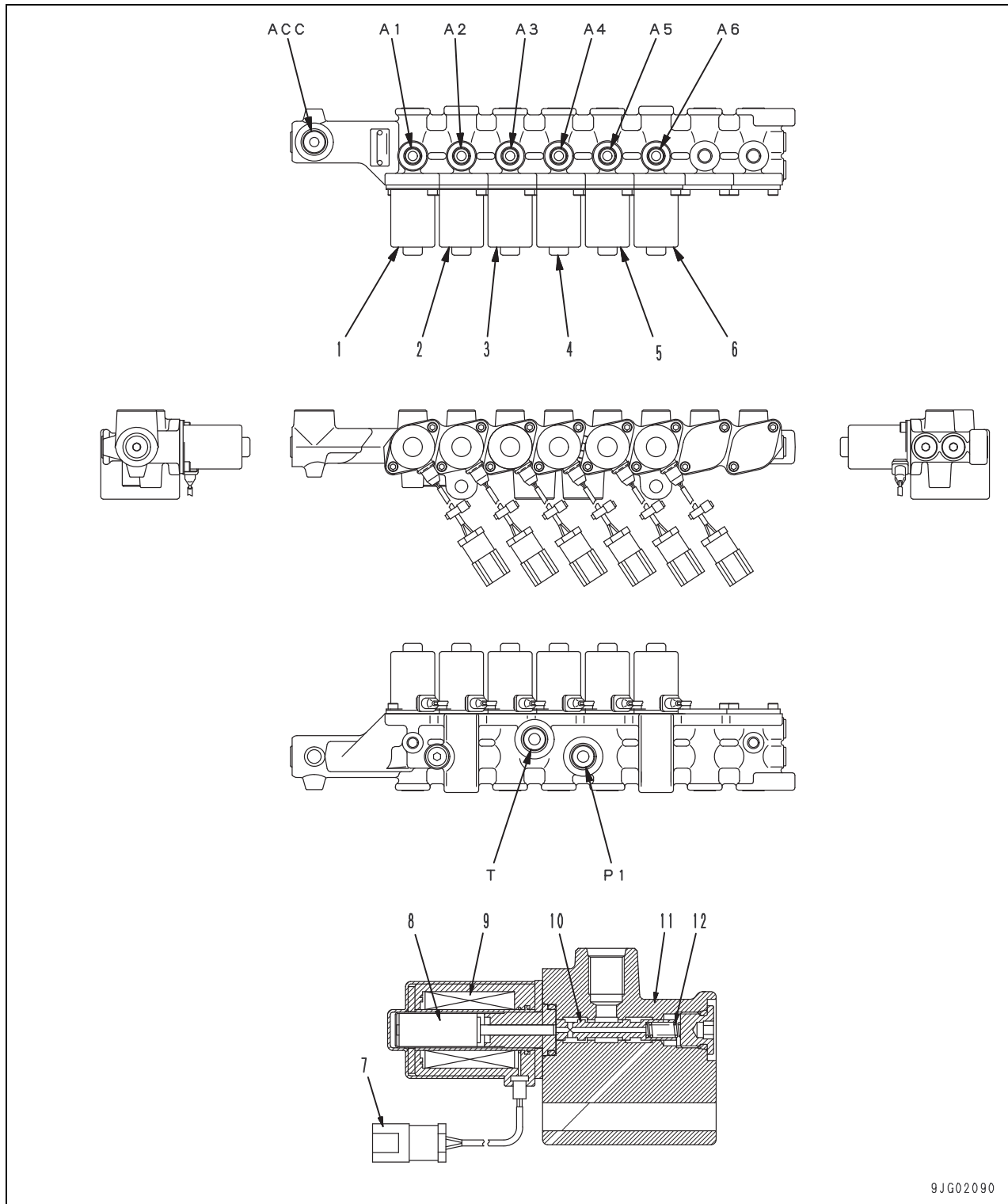
Form No. SEN01429-01

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Solenoid valve

PPC lock, 2-stage relief, swing brake, travel speed, travel junction, and merge-divider solenoid valves



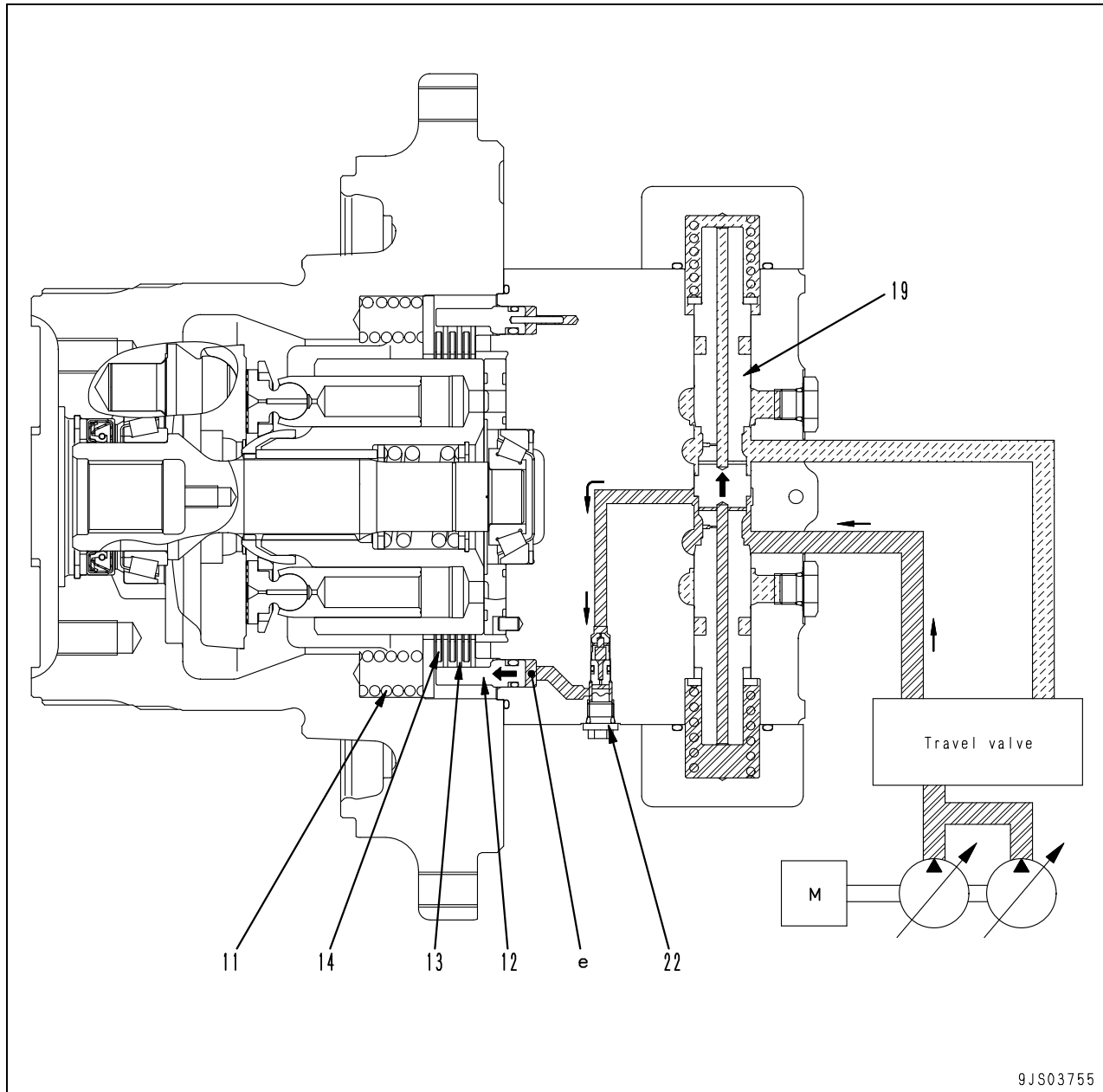
9JG02090

1. PPC lock solenoid valve
2. 2-stage relief solenoid valve
3. Travel speed solenoid valve
4. Swing brake solenoid valve
5. Travel junction solenoid valve
6. Merge-divider solenoid valve
7. Connector

8. Moving core
9. Coil
10. Spool
11. Block
12. Spring

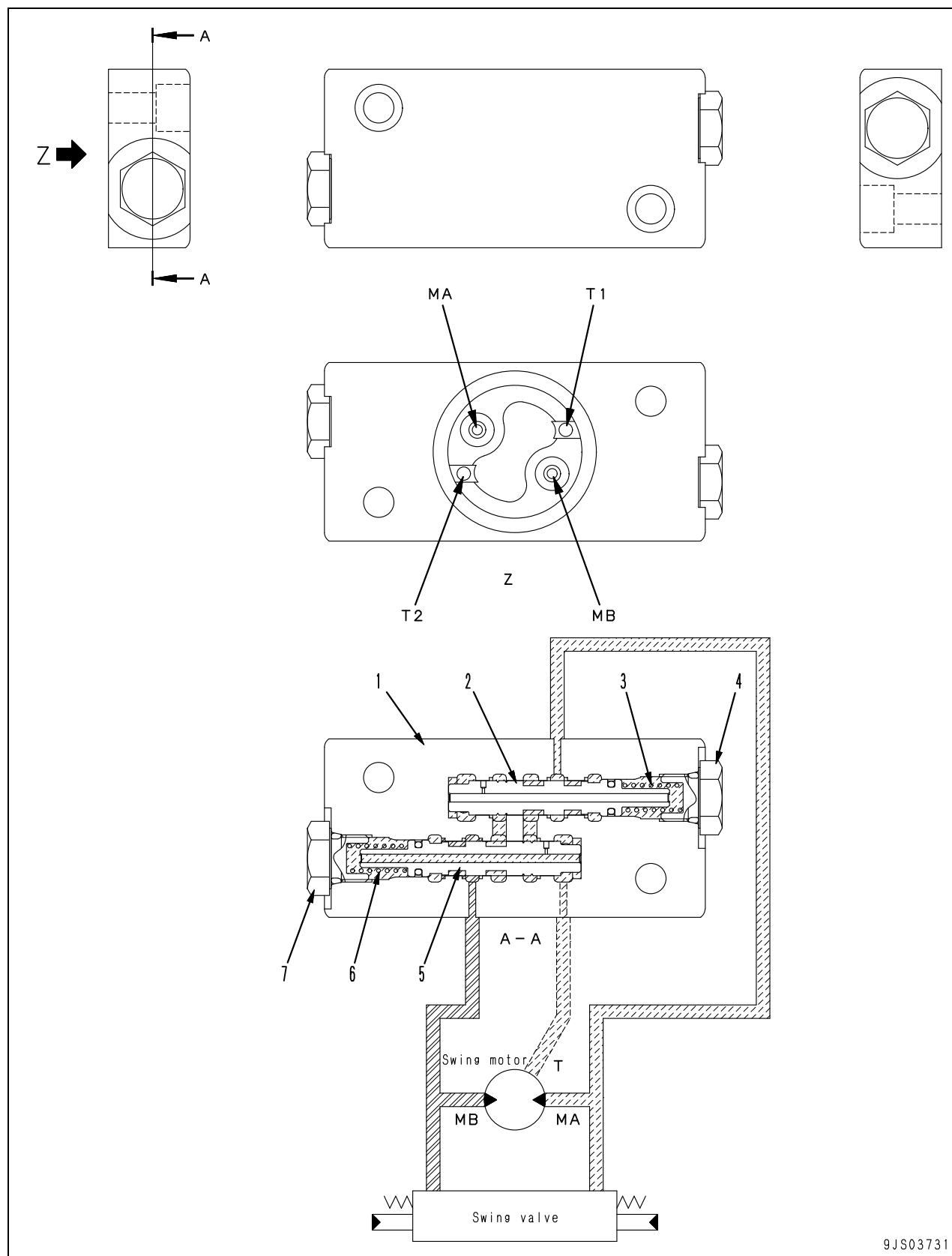
Operation of parking brake

1) When starting travel



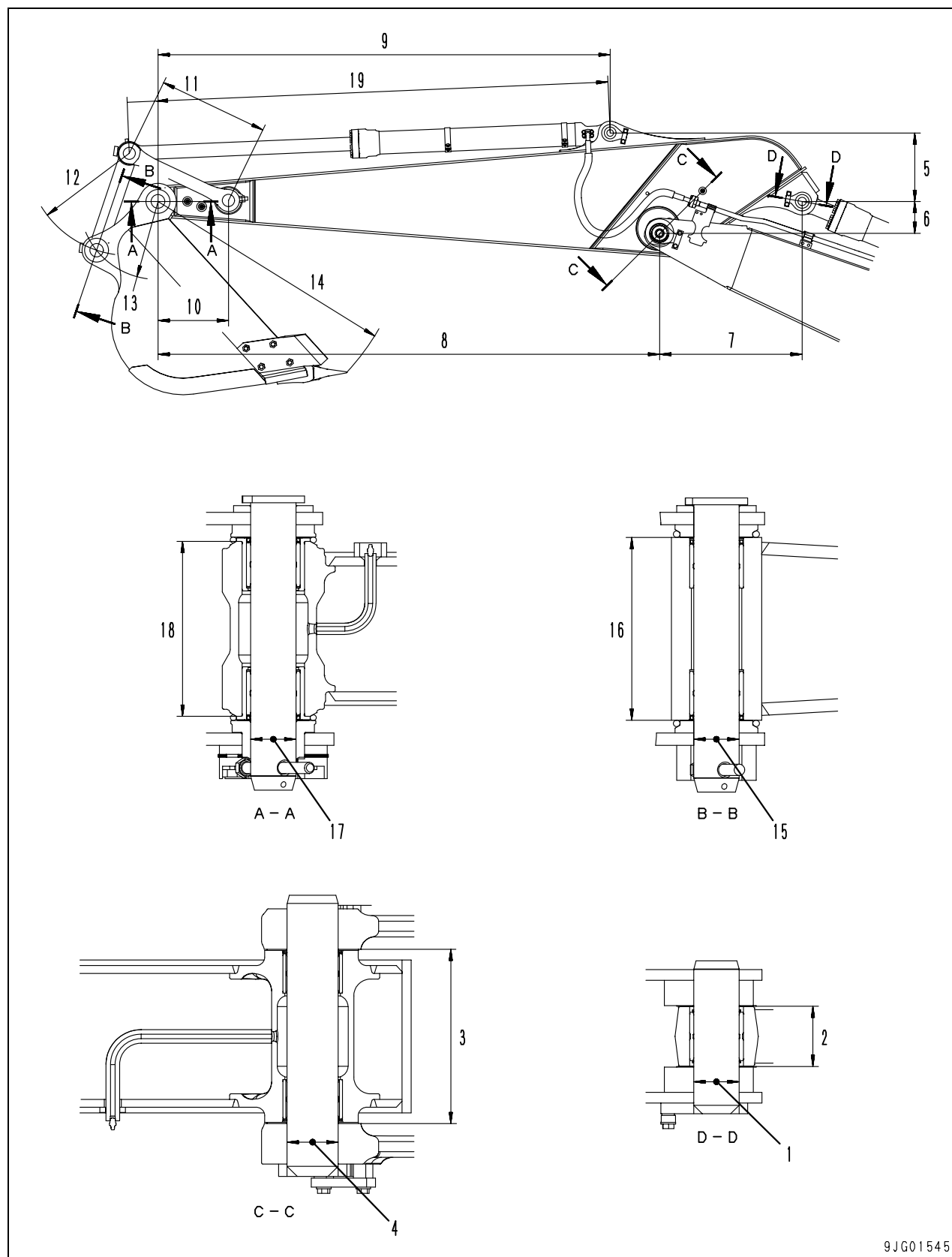
- As the travel lever is operated, pressurized oil from the pump activates counterbalance valve spool (19), opening the parking brake circuit.
- The pressurized oil is conducted to chamber (e) of brake piston (12) and compresses spring (11), pushing piston (12) toward left.
- Since the pushing force to plate (13) and disc (14) disappears, plate (13) is separated from disc (14) and the brake is released.

Reverse prevention valve



Dimensions of components

1. Dimension of arm

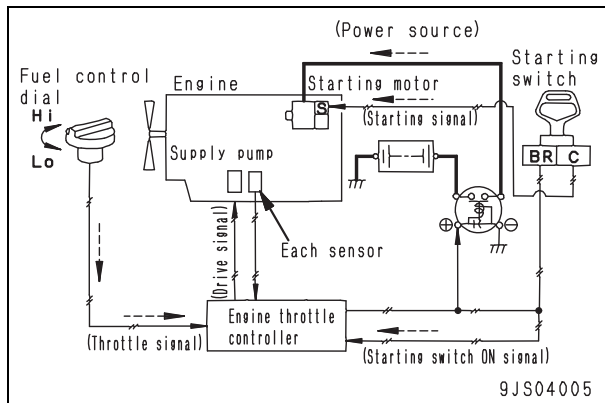


Operation of system

Starting engine

- When the starting switch is turned to the START position, the starting signal flows to the starting motor. Then, the starting motor turns to start the engine.

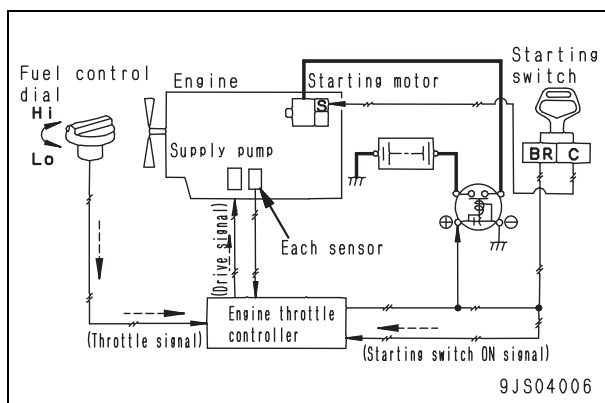
When it happens, the engine controller checks the signal voltage from the fuel control dial and sets the engine speed to the speed set by the fuel control dial.



Engine speed control

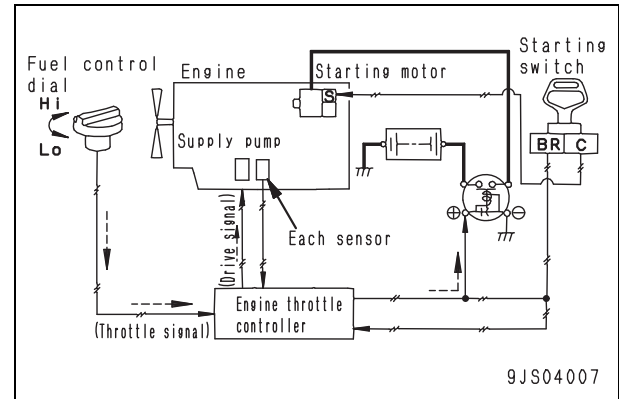
- The fuel control dial sends a signal voltage corresponding to the rotation angle to the engine controller.

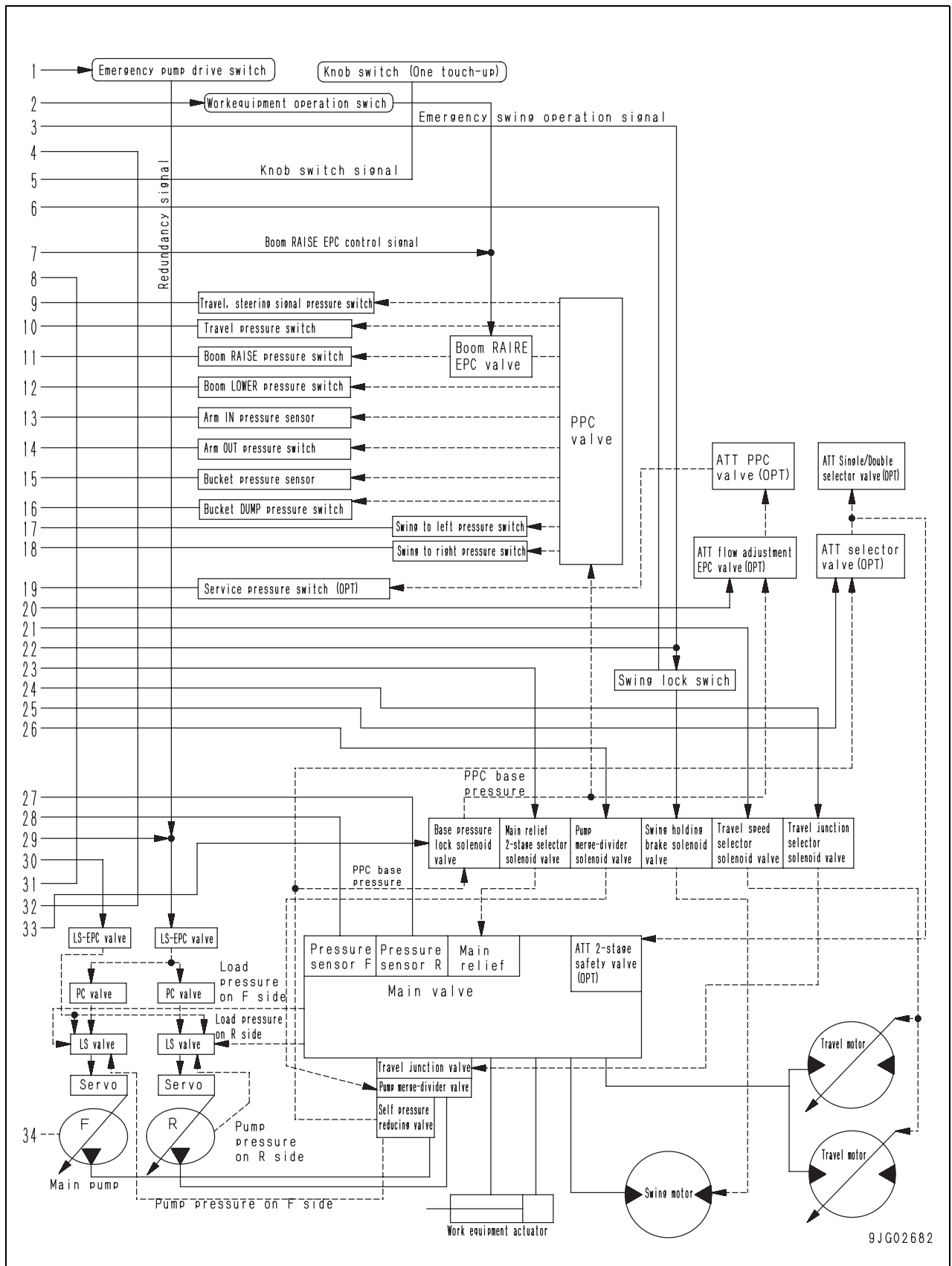
The engine controller sends a driving signal to the supply pump depending on the signal voltage to control the fuel injection pump, and eventually controls the engine speed.



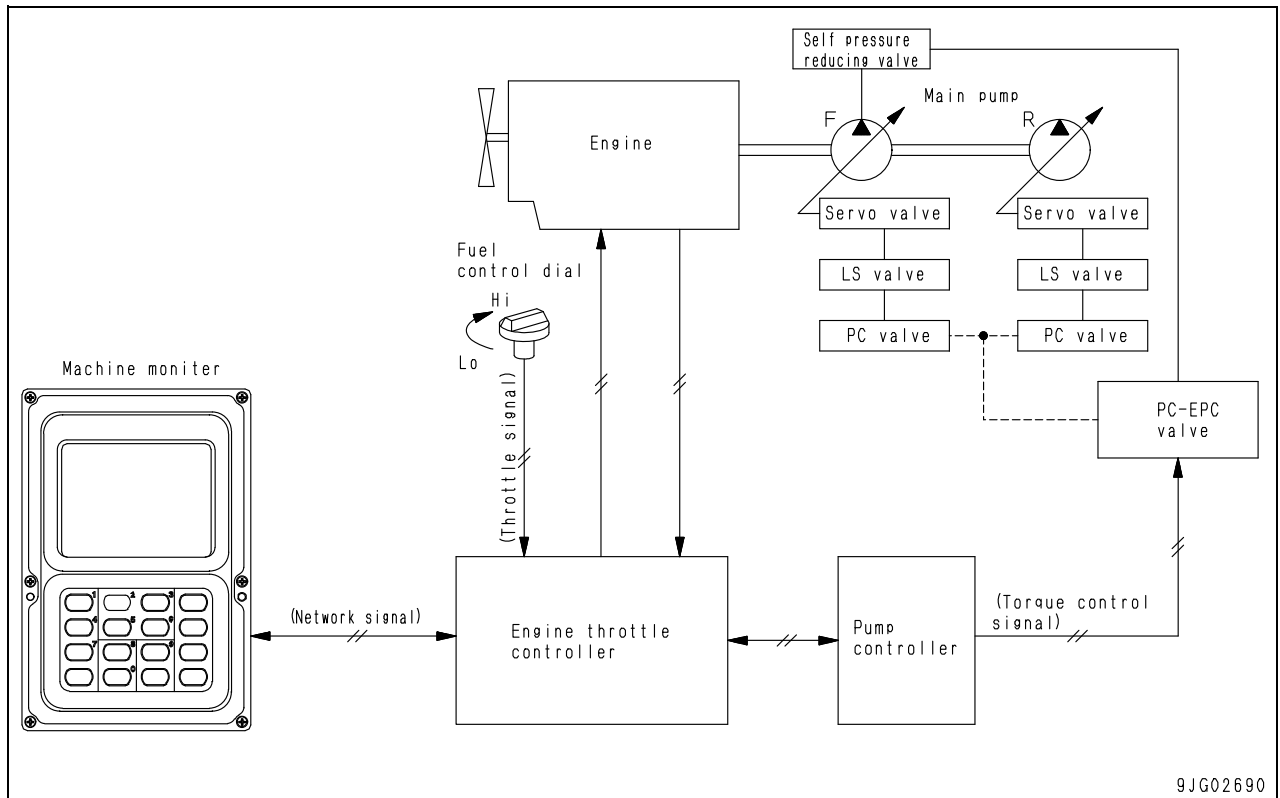
Stopping engine

- When detecting that the starting switch is set to the "STOP" position, the engine controller cuts the signal of the supply pump drive solenoid to stop the engine.





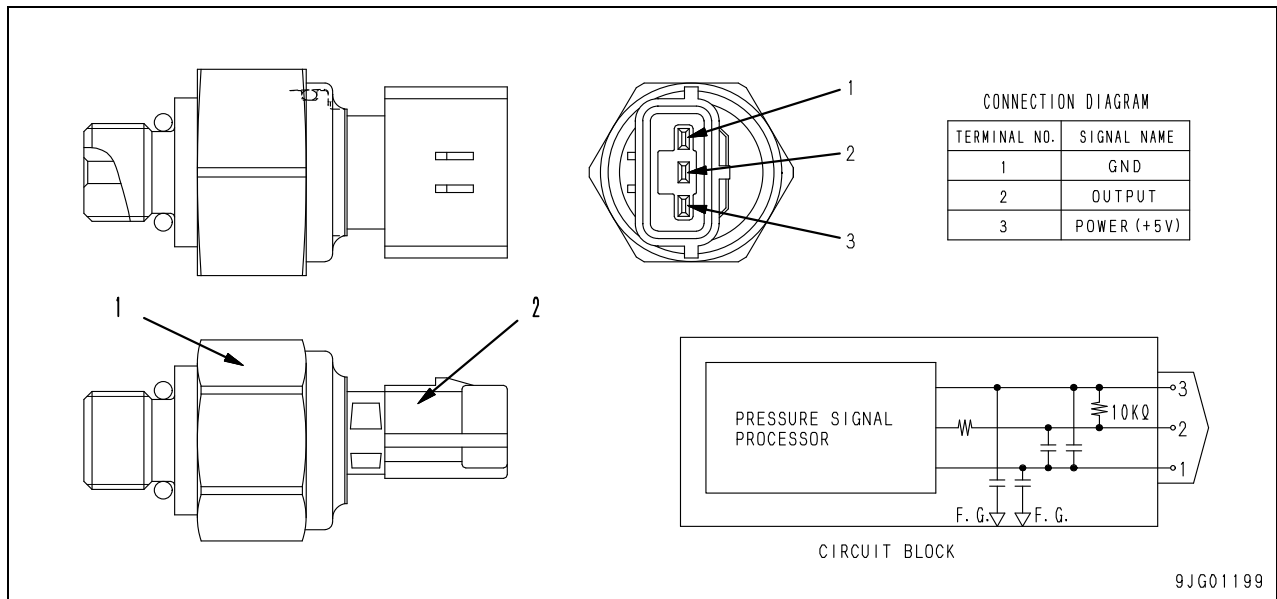
5. Auto-warm-up and overheat prevention function



Function

- The engine automatic warm-up function increases the engine speed to warm up the engine if coolant temperature is too low after the engine starts.
- The overheat prevention function reduces the pump load when coolant or hydraulic oil temperature is too high during operation to protect the engine from overheating.

2) Oil pressure sensor



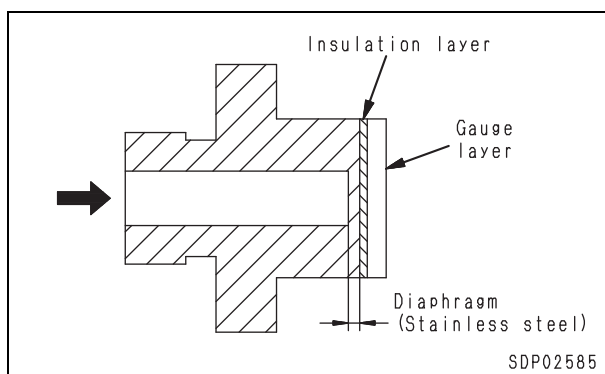
1. Sensor
2. Connector

Function

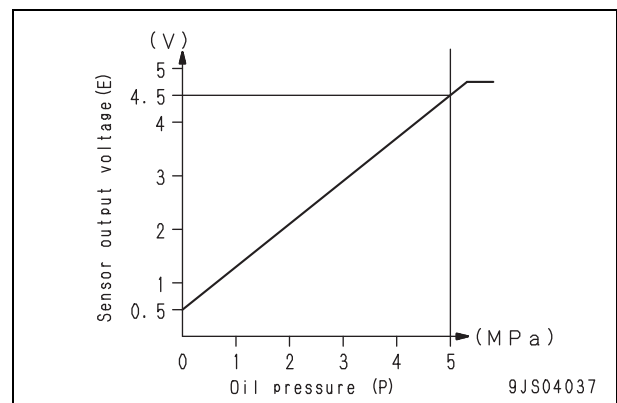
- The pump pressure sensor is installed to the input circuit of the control valve.
- It converts the pump discharge pressure into a voltage and transmits it to the pump controller.

Operation

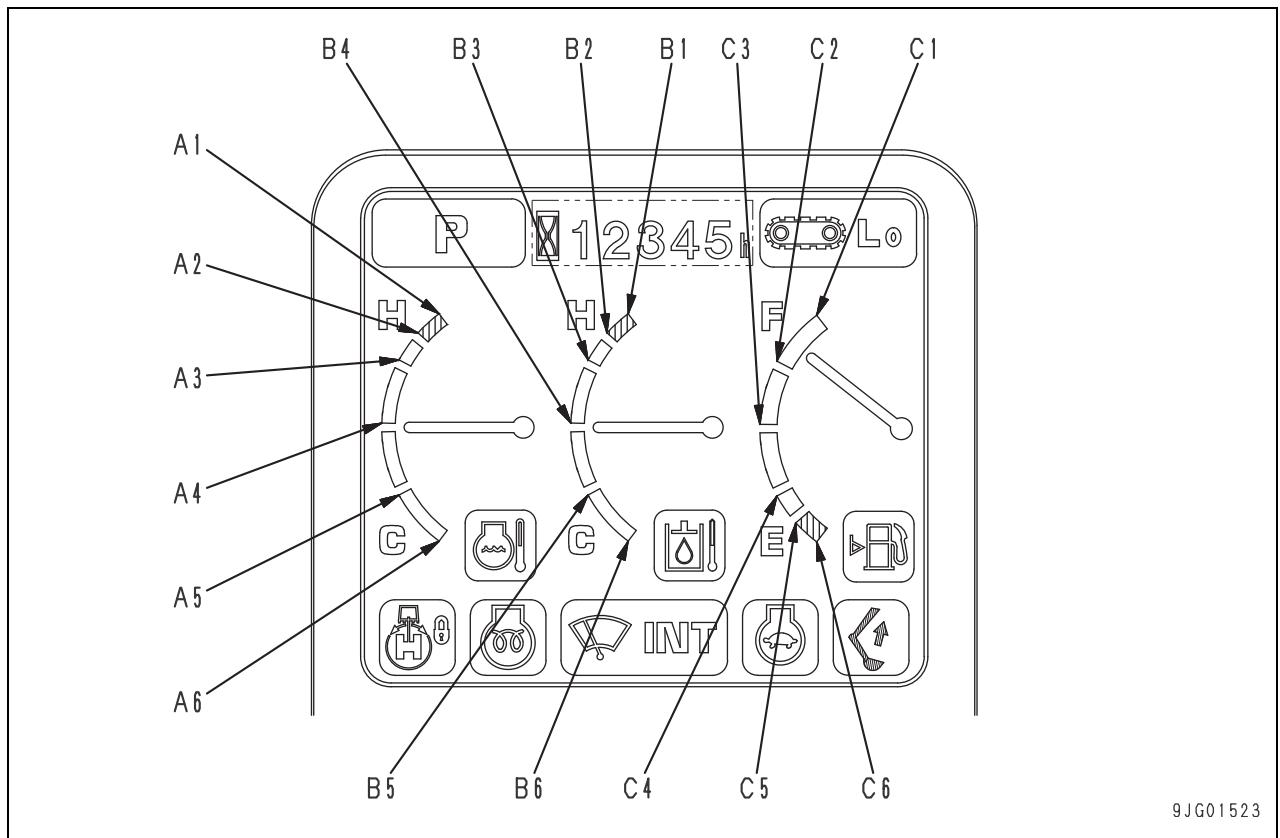
- The oil pressure is applied to the diaphragm of the oil pressure sensor from the pressure intake part, the diaphragm is deformed.
- The deformation in the diaphragm causes the resistance of the gauge to change. This causes a change in the output voltage, which is transmitted to the amplifier (voltage amplifier).



- The relationship between the pressure applied to sensors (P) and output voltage (E) is shown in the figure below.



- The amplifier magnifies output voltage (E) and transmits it to the pump controller.



Gauge	Range	Temperature or volume	Indicator	Buzzer sound
Engine coolant temperature (°C)	A1	105	Red	○
	A2	102	Red	
	A3	100	Green	
	A4	80	Green	
	A5	60	Green	
	A6	30	White	
Hydraulic oil temperature (°C)	B1	105	Red	
	B2	102	Red	
	B3	100	Green	
	B4	80	Green	
	B5	40	Green	
	B6	20	White	
Fuel level (ℓ)	C1	230	Green	
	C2	195	Green	
	C3	160	Green	
	C4	80	Green	
	C5	60	Green	
	C6	40	Red	

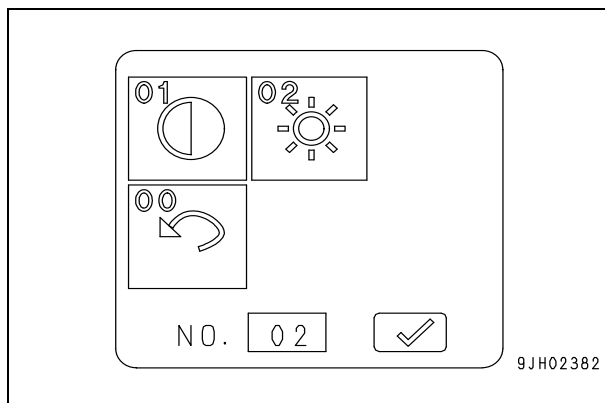
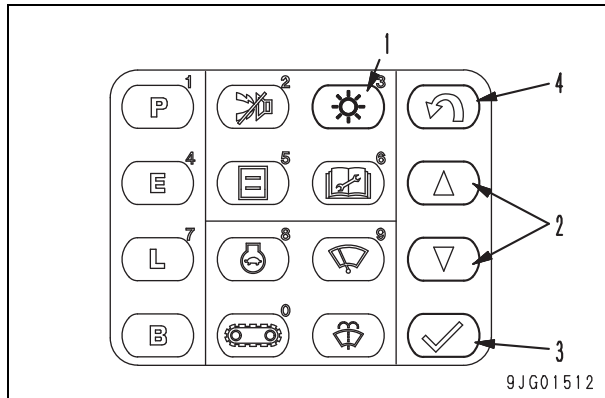
Brightness, contrast adjustment function

This function is used to adjust the brightness and contrast of the display.

★ Carry out the setting on the normal screen

1. Adjustment method

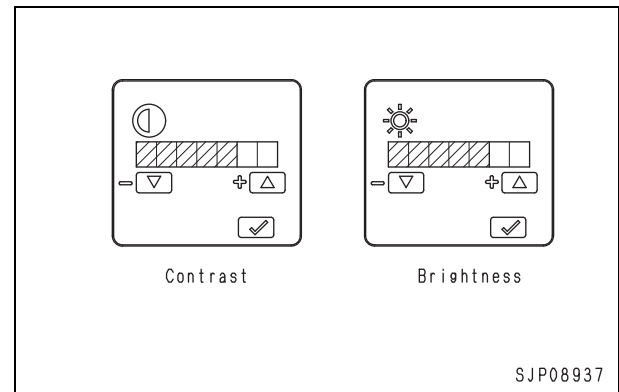
- 1) Press display brightness/contrast adjustment switch (1) and switch to the adjustment screen.



- Relationship between menu symbol and content.

No.	Symbol	Content
00	Return mark	Return
01		Contrast
02		Brightness

- 2) Press operation switch (2), or use the 10-key pad to input the number (01 – 02) to select either contrast or brightness.
- 3) After completing the selection, press input confirmation switch (3) to return to the adjustment screen. Pressing return switch (4) without pressing input confirmation switch (3) or entering 00 with the 10-key pad and then pressing input confirmation switch (3) causes the screen to return to the normal screen.



- 4) Press operation switch (2) and adjust the brightness or contrast as desired.

Control switch	Actuation
	Flow level bar graph extends to the right
	Flow level bar graph retracts to the left

HYDRAULIC EXCAVATOR

PC228US-3E0

PC228USLC-3E0

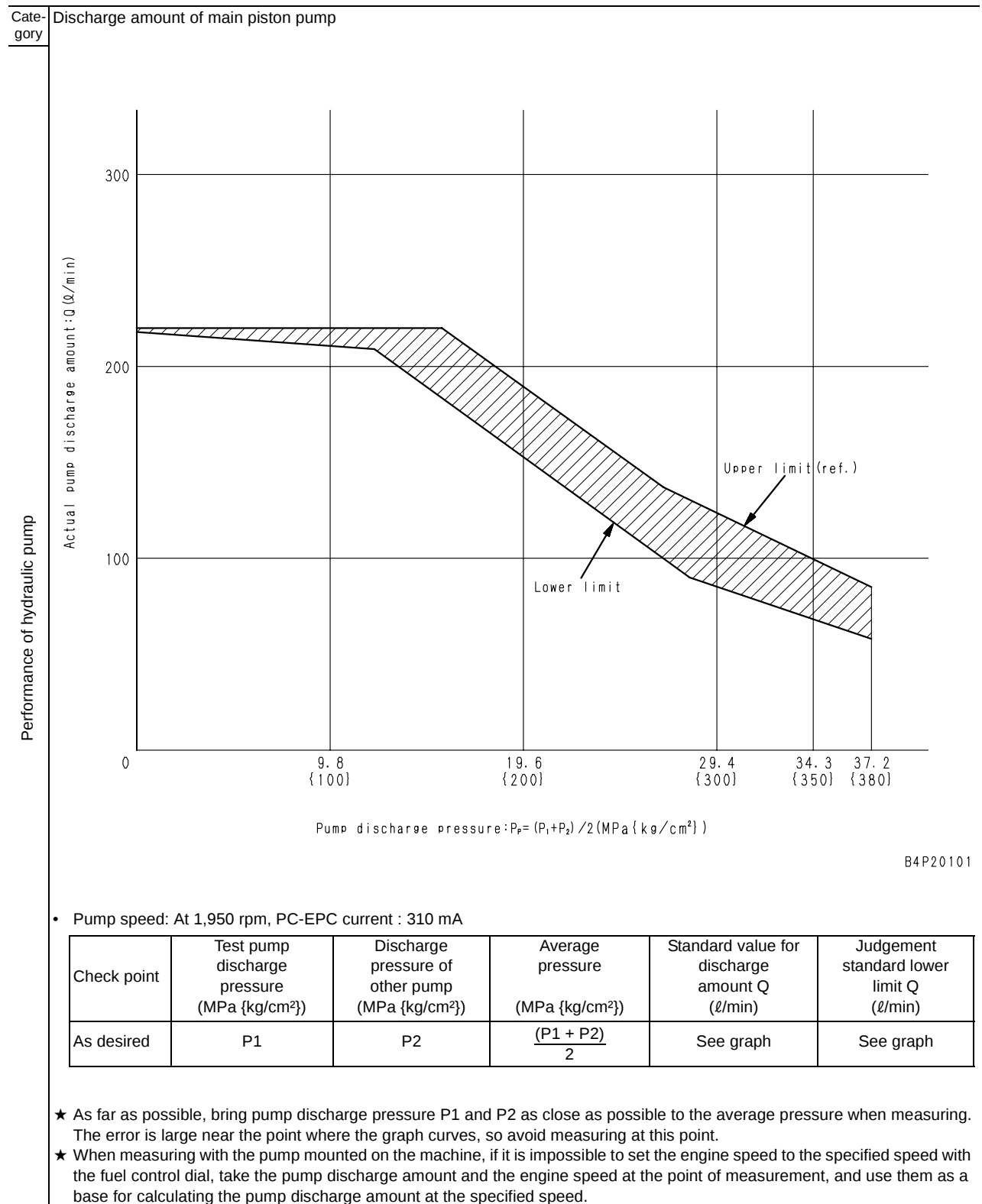
Machine model	Serial number
---------------	---------------

PC228US-3E0	40001 and up
PC228USLC-3E0	40001 and up

20 Standard value table

Standard service value table

Standard value table for engine related parts	2
Standard value table for chassis	3



B4P20101

Testing/Adjusting item	Sym- bol	Part No.	Part name	Q'ty	Sketch	Remarks
Machine related controller and sensors/wiring harnesses diagnosis	—	799-601-9270	• T-adapter	1		For HD36 24-21P (Does not include in assembly No.799-601-9200) (Include in assembly No.799-601-9100, too)
	—	799-601-9300	T-adapter assembly	1		
	—	799-601-9360	• T-adapter	1		For pump controller (DRC26-24P)
	—	799-601-9350	• T-adapter	1		For pump controller (DRC26-40P)
	—	799-601-7360	• T-adapter	1		For relay 5P (No assembly No.)
	—	799-601-7370	• T-adapter	1		For relay 6P (No assembly No.)
	—	799-601-9420	• T-adapter	1		For AMP 3P (Pressure sensor) (Include in assembly No.799-601-4101, 799-601-4201)

Testing blow-by pressure

★ Testing tools for blow-by pressure

Symbol		Part No.	Part name
D	1	799-201-1504	Blow-by checker
	2	795-790-3300	Blow-by tool

⚠ Stop the machine on a level ground and lower the work equipment to the ground.

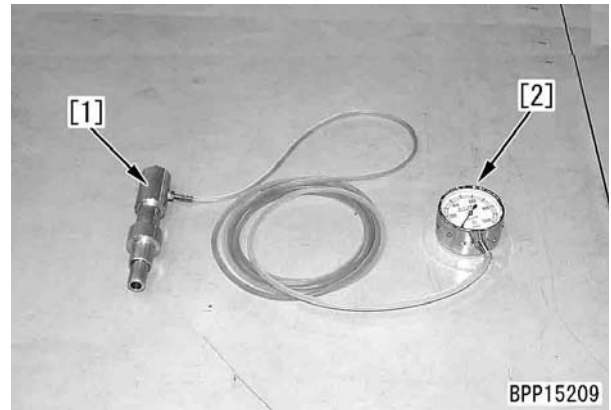
★ Measure the blow-by pressure under the following condition.

- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

1. Remove the undercover of the hydraulic pump.
2. Install tool and adapter [1] of blow-by checker **D1** or blow-by tool **D2** to breather hose (1) and connect gauge [2].

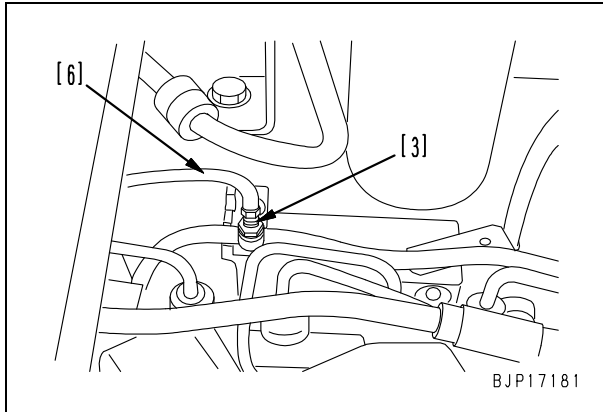


3. Start the engine, set the working mode in the power mode (P), and turn the swing lock switch ON.
 - ★ If the swing lock switch is turned ON, the main relief valve is set for high-pressure relief.
4. While running the engine at high idle, relieve the arm circuit at the IN and measure the blow-by pressure.
 - ★ Read the gauge when the pointer is stabilized.



5. After finishing measurement, remove the measuring tools and return the removed parts.

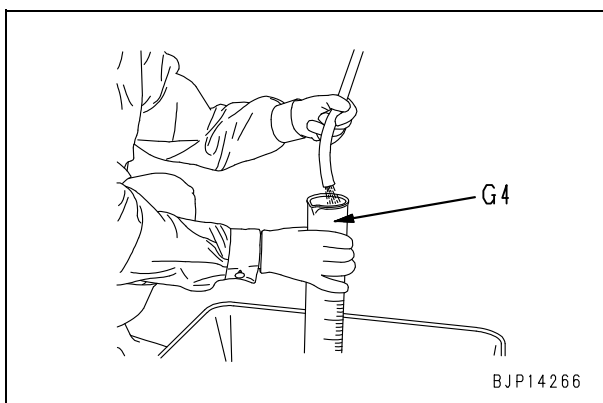
- 3) Install connector bolt [3] of adapter **G2** instead of the removed connector bolt, and connect test hose [6].
- ★ Lay the test hose so that it will not slacken and put its end in the oil (receiving) pan.



- 4) Run the engine at low idle and measure the return rate in 1 minute with measuring cylinder **G4**.
- ★ If the return rate from the injector is in the following range, it is normal.

At low idle	Max. 180 cc
During cranking	Max. 90 cc

- ⚠ If the engine cannot be started, you may measure the fuel return rate while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.



- 5) After finishing measurement, remove the measuring tools and return the removed parts.

⚙ Joint bolt:

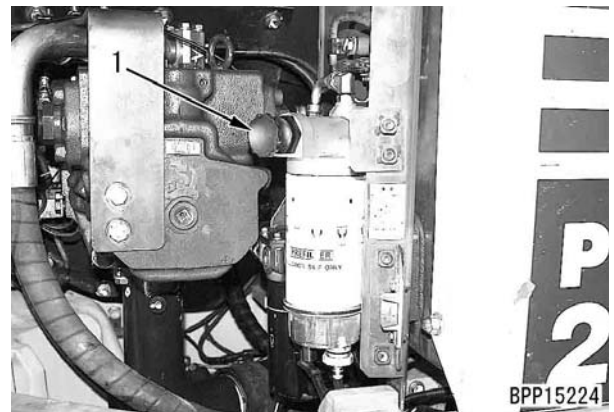
$24 \pm 4 \text{ Nm} \{2.4 \pm 0.4 \text{ kgm}\}$

Bleeding air from fuel circuit

- ★ If fuel is used up or if a fuel circuit part is removed and installed, bleed air from the fuel circuit according to the following procedure.

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

1. Fill the fuel tank with fuel.
 - ★ Add fuel until the float of the sight gauge reaches the maximum position.
2. Open the side cover of the pump room.
3. Loosen knob (1) of the feed pump and pull it out, and then operate it forward and backward.
 - ★ Move the knob until it becomes heavy.
 - ★ The plug at the top of the fuel main filter does not need to be removed.



4. After bleeding air, push in and tighten knob (1).

2. Combination of pump, actuator and valve

- ★ When oil flow from the pumps is divided, the front and rear pumps work independently of each other for each actuator, as well as that different relief valves are activated then. See the table below.
- ★ Oil flow from the pumps is merged in the single pressure relief when the work equipment swings, while it is divided in the single pressure relief when the machine travels.
- ★ The actuators in the table below are arranged in the order that the control valves are viewed from the machine front. (Service: 1 attachment is installed)

Pump	Actuator	Relieve valve activated
Rear pump	(R unload valve) (R main relief valve)	
	Service	Safety valve
	Bucket	R main relief valve
	Travel, left	R main relief valve
	Boom	R main relief valve
(Pump merge-divider valve) (Travel junction valve)		
Front pump	Swing	Swing motor safety valve
	Travel, right	F main relief valve
	Arm	F main relief valve
	(F unload valve) (F main relief valve)	
(Centralized safety valve) (Back-pressure valve)		

3. Measurement of unload pressure

- 1) Start the engine.
- 2) Measure hydraulic oil pressure, when the engine is running at high idle and all the control levers are moved to the NEUTRAL position.
 - ★ Hydraulic oil pressure when the unload valve unloads is displayed.

4. Measurement of work equipment relief pressure

- 1) Start the engine and move the cylinder to be measured to its stroke end.
- 2) Measure hydraulic oil pressure, when the engine is running at high idle and the cylinder is in relief condition.
 - ★ Hydraulic oil pressure when the main relief valve is in relief condition is displayed.
 - ★ If one-touch power max. switch is depressed, the oil pressure is turned to high relief pressure, and if released, it is turned to low relief pressure.

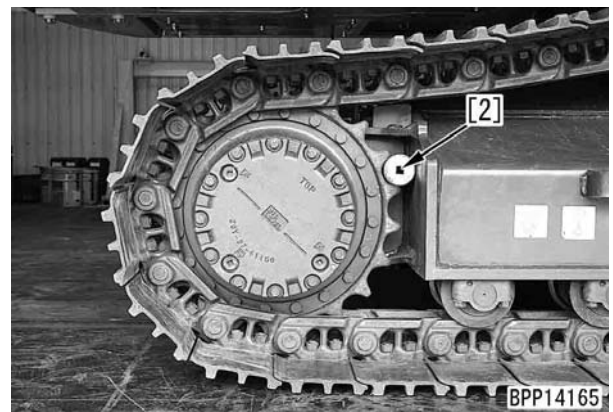
- ★ Keep the swing lock switch in the OFF position during the inspection. If it is moved to the ON position, hydraulic oil pressure is turned to high relief pressure, as the constant 2-stage relief valve is moved to the ON position.

5. Measurement of swing relief pressure

- 1) Start the engine and move the swing lock switch to the ON position.
- 2) Measure hydraulic oil pressure when the engine is running at high idle and the swing circuit is relieved.
 - ★ Hydraulic oil pressure when the swing motor safety valve is relieved is displayed.
 - ★ The swing motor relief pressure is lower than the main relief pressure.

6. Measurement of travel circuit relief pressure

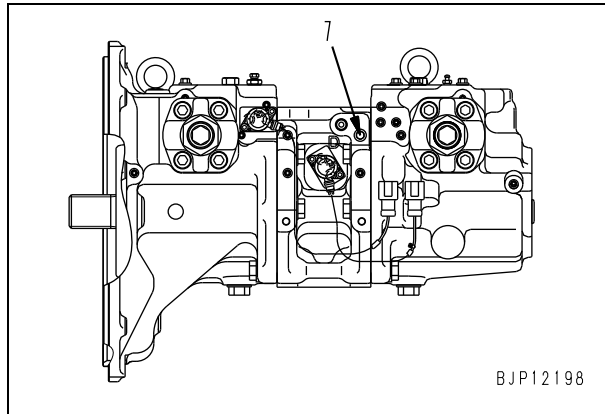
- 1) Start the engine and lock travel.
 - ⚠ Put pin [2] in between the sprocket and the track frame to make sure locking travel.



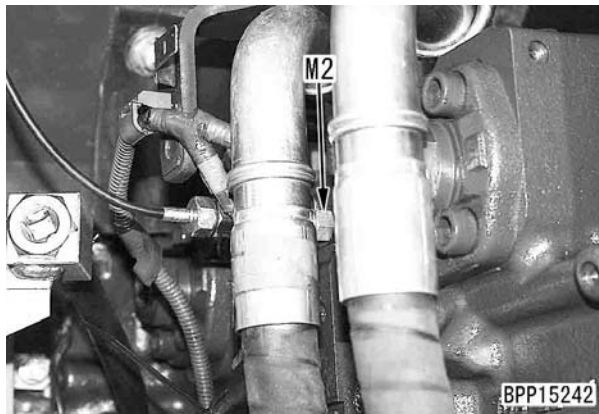
- 2) Measure hydraulic oil pressure when the engine is running at high idle and the travel circuit is relieved.
 - ★ Hydraulic oil pressure with the main relief valve in relief condition is displayed. In the travel circuit relief, the pressure is high pressure relief all the time.

3. Measurement of LS-EPC valve output pressure

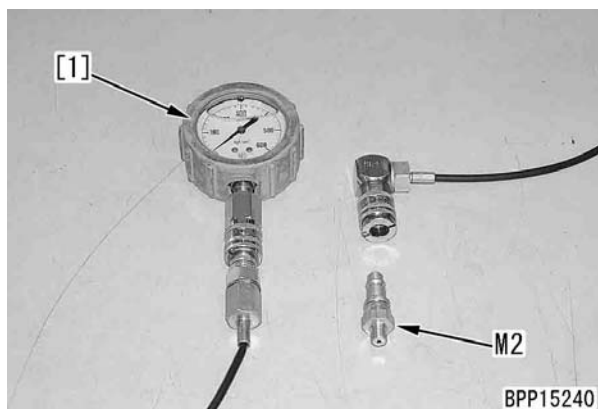
- 1) Remove oil pressure pickup plug (7).



- 2) Install nipple **M2** and connect it to oil pressure gauge [1] of hydraulic tester **M1**.
 - ★ Use the oil pressure gauge of 6 MPa {60 kg/cm²}.



- 3) Run the engine and heighten the hydraulic oil temperature to the operating range.



- 4) Running the engine at high idle, operate the travel speed switch and travel lever and measure the oil pressure.

★ If the LS-EPC valve output pressure is as follows, it is normal.

Travel Speed	Travel Lever	Oil Pressure
Lo	Neutral	Approx. 2.9 MPa {Approx. 30 kg/cm ² }
Hi	Fine operation (Note)	0 MPa {0 kg/cm ² }

Note: Move the travel lever to a degree that the PPC oil pressure switch is turned ON (before the track starts moving).

- 5) After finishing measurement, remove the measuring instruments and return the removed parts.

Testing oil leakage

★ Testing tools for oil leakage

Symbol	Part No.	Part name
Q	Commercially available	Measuring cylinder

- ★ Measure the oil leakage under the following condition.
- Hydraulic oil temperature: Within operating range

1. Measuring oil leakage from boom cylinder

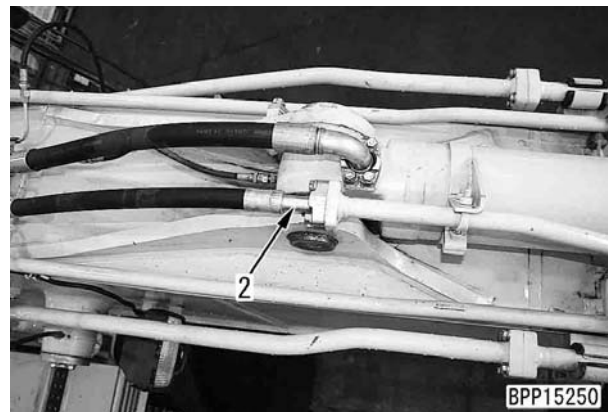
- Move the boom cylinder to the RAISE stroke end and stop the engine.
 - ⚠ Release the residual pressure from the piping on the boom cylinder head side. For details, see “Release of residual pressure from hydraulic circuit” (Operate the lever in the boom RAISE direction only, however).**
- Disconnect hose (1) on the cylinder head side and block the hose side with a flange.
 - ⚠ Take care not to disconnect the hose on the cylinder bottom side.**
 - ★ Use the following part to block the hose side.
07379-00640 (Flange #06)



- Run the engine at high idle and relieve the boom circuit by raising the boom.
 - ⚠ Take care not to “lower the boom”.**
- Start measuring the oil leakage in 30 seconds after relieving is started and measure for 1 minute.
- After finishing measurement, return the removed parts.

2. Measuring oil leakage from arm cylinder

- Move the arm cylinder to the IN stroke end and stop the engine.
 - ⚠ Release the residual pressure from the piping on the arm cylinder head side. For details, see “Release of residual pressure from hydraulic circuit” (Operate the lever in the arm IN direction only, however).**
- Disconnect hose (2) on the cylinder head side and block the hose side with a flange.
 - ⚠ Take care not to disconnect the hose on the cylinder bottom side.**
 - ★ Use the following part to block the hose side.
07379-00640 (Flange #06)



- Run the engine at high idle and relieve the arm circuit by moving the arm IN.
 - ⚠ Take care not to “move the arm OUT”.**
- Start measuring the oil leakage in 30 seconds after relieving is started and measure for 1 minute.
- After finishing measurement, return the removed parts.

HYDRAULIC EXCAVATOR

PC228US-3E0 PC228USLC-3E0

Machine model	Serial number
PC228US-3E0	40001 and up
PC228USLC-3E0	40001 and up

30 Testing and adjusting

Testing and adjusting, Part 3

Special functions of machine monitor	2
Handling voltage circuit of engine controller	30
Starting KOMTRAX terminal operations	31
Indicator lamps of KOMTRAX terminal	35
Preparation work for troubleshooting of electrical system	38
Pm-clinic service	40

Action code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record
E15	CA689	Eng Ne Speed Sensor Error	ENG	Electrical system
E15	CA731	Eng Bkup Speed Sens Phase Error	ENG	Electrical system
E10	CA757	All Continuous Data Lost Error	ENG	Electrical system
E11	CA778	Eng Bkup Speed Sensor Error	ENG	Electrical system
E0E	CA1633	KOMNET Datalink Timeout Error	ENG	Electrical system
E14	CA2185	Throt Sens Sup Volt High Error	ENG	Electrical system
E14	CA2186	Throt Sens Sup Volt Low Error	ENG	Electrical system
E11	CA2249	Rail Press Very Low Error	ENG	Electrical system
E11	CA2311	IMV Solenoid Error	ENG	Electrical system
E15	CA2555	Grid Htr Relay Volt High Error	ENG	Electrical system
E15	CA2556	Grid Htr Relay Volt Low Error	ENG	Electrical system
—	D110KB	Battery Relay Drive Short Circuit	PUMP	Electrical system
—	D196KA	Service Return Relay Disc.	PUMP	Electrical system
—	D196KB	Service Return Relay S/C	PUMP	Electrical system
E0E	DA22KK	Pump Solenoid Power Low Error	PUMP	Electrical system
—	DA25KP	5V Sensor 1 Power Abnormality	PUMP	Electrical system
E0E	DA2RMC	CAN Discon (Pump Con Detected)	PUMP	Electrical system
—	DA2SKQ	Model Selection Abnormality	PUMP	Electrical system
E0E	DAFRMC	CAN Discon (Monitor Detected)	MON	Electrical system
—	DGH2KB	Hyd Oil Sensor Short	PUMP	Electrical system
—	DHPAMA	F Pump Press Sensor Abnormality	PUMP	Electrical system
—	DHPBMA	R Pump Press Sensor Abnormality	PUMP	Electrical system
—	DHSAMA	Swing RH PPC Press Sensor Abnormality	PUMP	Electrical system
—	DHSBMA	Swing LH PPC Press Sensor Abnormality	PUMP	Electrical system
—	DW43KA	Travel Speed Sol Open Circuit	PUMP	Electrical system
—	DW43KB	Travel Speed Sol Short Circuit	PUMP	Electrical system

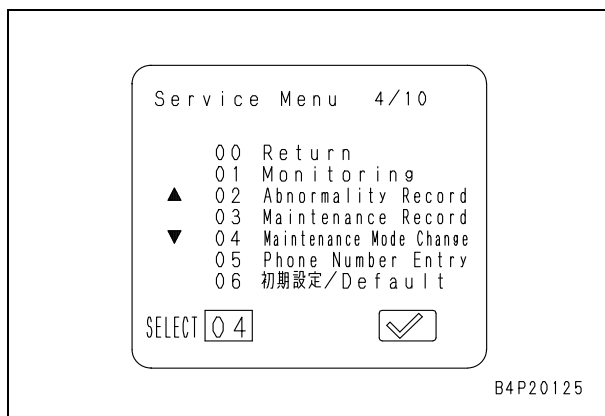
19. Function of maintenance mode change [04]

Following procedure allows changing the currently set operating conditions of the maintenance display function.

- Set function effective or ineffective
- Change set replacement interval

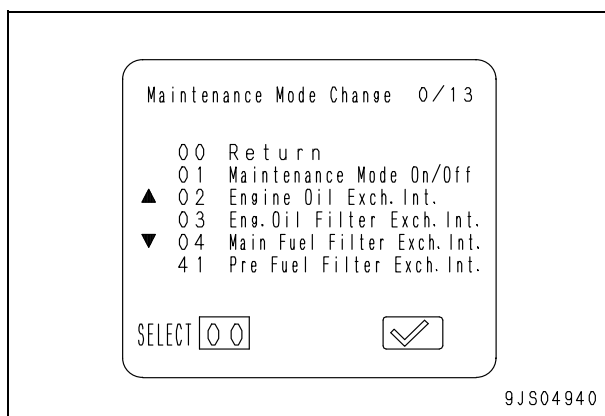
1) Menu selection

Select "04 Maintenance Mode Change" from the "Service Menu" and then depress [✓] switch.



2) Selection of item to be changed

Select the item to be changed from the "Maintenance Mode Change Selection Menu" screen.

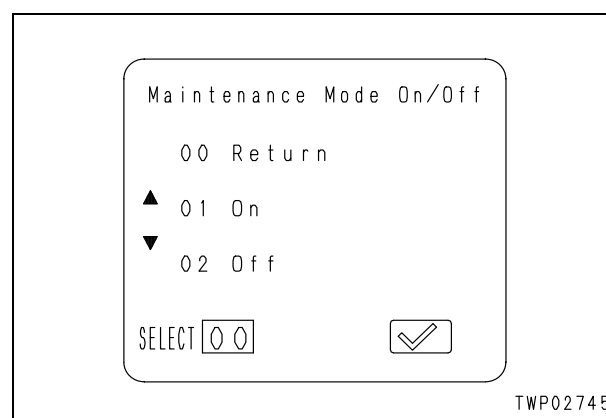


Num ber	Items of the maintenance mode change
00	Return (End of change in the maintenance mode)
01	Maintenance mode on/off
02	Engine oil change int.
03	Engine oil filter change int.
04	Fuel main filter change int.
41	Fuel pre filter change int.
06	Hyd oil filter change int.
07	Hyd tank breather change int.
08	Corrosion resistor change int.
09	Damper case service int.
10	Final drive case oil change int.
11	Machinery case oil change int.
12	Hydraulic oil change int.
13	Initialize all items

- ★ 01 and 13 menus are provided for setting the whole maintenance mode, while those from 02 through 12 are for setting individual items.

3) Contents of "Maintenance Mode On/Off"

- Use (On): The maintenance display function of all oil and filter-related items are turned effectual. (Irrespective of whether "On" or "Off" set for individual items, this setting prevails)
- Not use (Off): The maintenance display function of all oils and filter-related items is disabled (precedence is given to this setting over the "On" or "Off" selected for an individual items).



Starting KOMTRAX terminal operations

In the case where the KOMTRAX terminal has already been installed at the plant before shipment:

- ★ Implement the following procedure in the case where the KOMTRAX terminal has already been installed at the plant before shipment (as standard equipment).

1. Notification of model, part number and serial number

Notify the KOMTRAX operations administrator of model, part number and serial number.

2. Registration of machine

The KOMTRAX operations administrator shall use a KOMTRAX client PC to register the machine.

- ★ Refer to "Manual for KOMTRAX operations administrator" for the procedure.
- ★ Now the terminal is ready for use.

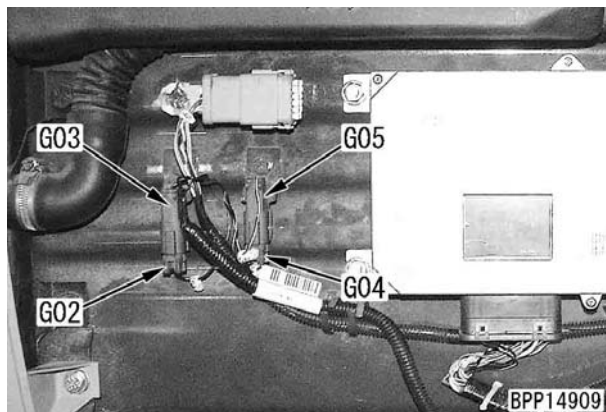
In the case where the KOMTRAX terminal is retrofitted:

- ★ When retrofitting the KOMTRAX terminal after shipment (retro-fitted machine), follow the steps below.

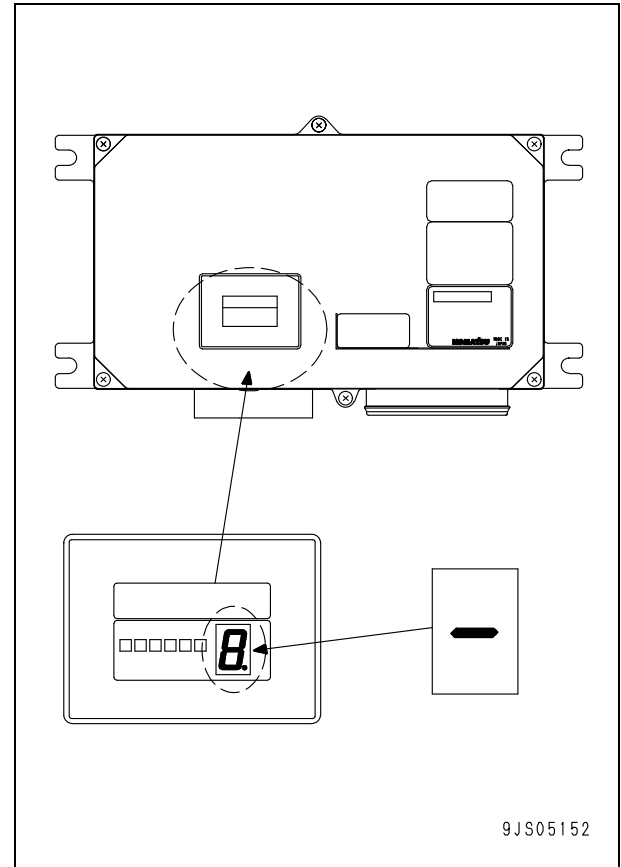
1. Station opening check in machine side

- ★ Complete steps 3) to 5) within 60 seconds. If 60 seconds or above elapsed, begin with step 1) again.

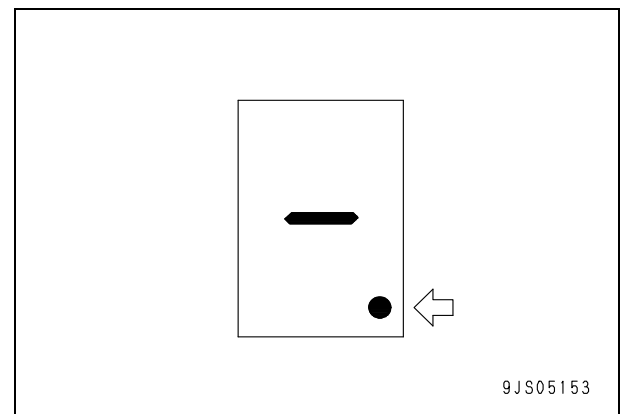
- 1) Turn OFF the starting switch and then, after making sure 5 seconds have elapsed, proceed to the next step.
- 2) Visually check that two check connectors are connected.
 - Check connector 1: G02 (female) and G03 (male)
 - Check connector 2: G04 (female) and G05 (male)



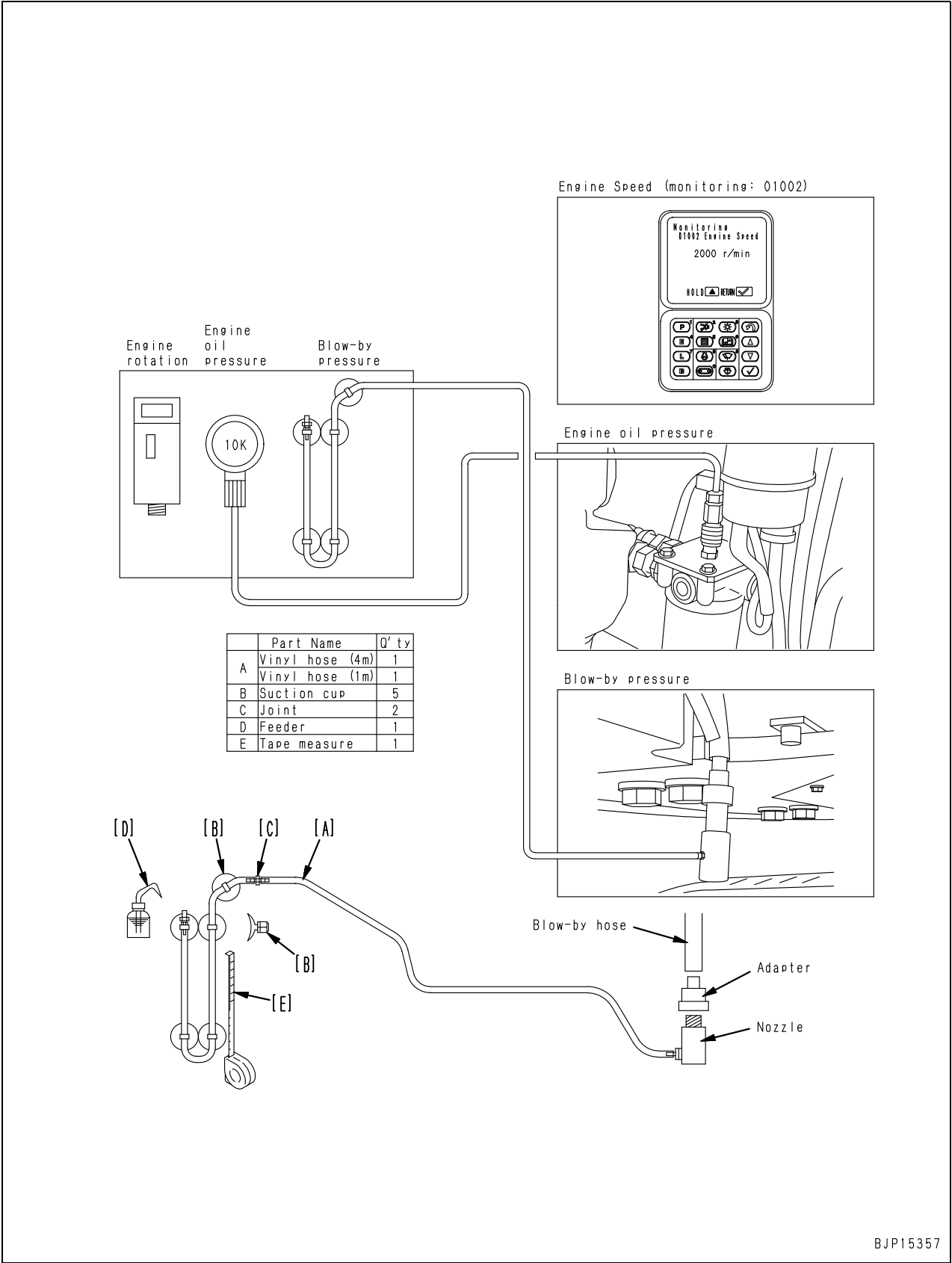
- 3) When about 3 to 5 seconds elapsed after the starting switch was set to ACC, make sure that the 7-segment indicator lamp changes to hyphen "—" on the KOMTRAX terminal.



- 4) Disconnect check connector 1, and wait for about 3 to 5 seconds as it is.
 - ★ Ensure that the connector is disconnected.
- 5) Reconnect check connector 1, and wait for about 3 to 5 seconds as it is.
 - ★ If the KOMTRAX terminal detects that the connector was disconnected and connected, the dot on the 7-segment indicator lamp blinks a few times.



Engine



BJP15357

Fuse locations

Connection table of fuse box

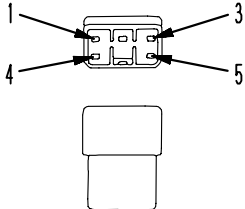
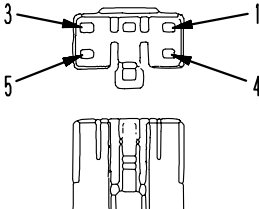
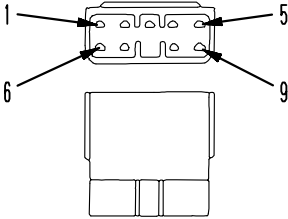
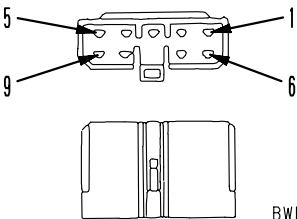
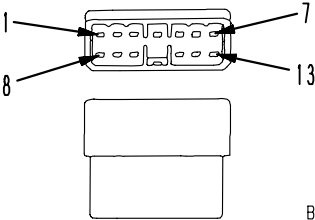
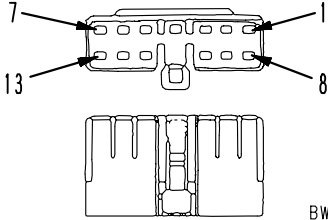
- ★ This connection table shows the devices to which each power supply of the fuse box supplies power (A switch power supply is a device which supplies power while the starting switch is in the ON position and a constant power supply is a device which supplies power while the starting switch is in the OFF and ON positions).
- ★ When carrying out troubleshooting related to the electrical system, you should check the fuses and fusible links to see if the power is supplied normally.

Type of power supply	Fusible link	Fuse No.	Fuse capacity	Destination of power
Switch power supply	F04 (60A)	1	10A	Lamp relay, rear lamp relay, cab lamp relay
				PC-EPC (F) solenoid valve, PC-EPC (R) solenoid valve [When pump drive switch is operated in emergency]
				Swing holding brake solenoid valve [When swing holding brake release switch is operated]
		2	20A	Pump controller (Solenoid power supply)
		3	20A	PPC oil pressure lock solenoid valve
				Starting motor cut-out relay (PPC lock)
				Starting motor cut-out relay (Personal code)
		4	10A	Cigarette lighter
				Windshield washer motor
		5	10A	Horn relay, horn
Switch power supply	F04 (60A)	6	10A	Intake air heater
		7	10A	Rotary lamp
		8	20A	Right headlamp, working lamp (boom), working lamp (rear)
		9	10A	Radio
				Left knob switch (pump controller input)
10	10A	(Spare)		
Switch power supply	F04 (60A)	11	20A	Air conditioner unit
				Air conditioner compressor electromagnetic clutch
		12	10A	(Spare)
		13	20A	Headlamp
		14	10A	Optional power supply (1)
		15	10A	Travel alarm
Optional power supply (2)				
Constant power supply	F05 (30A)	16	10A	Radio (backup power supply)
				A/C servo
		17	20A	Starting switch
				Machine monitor
				Pump controller
		18	10A	(Spare)
19	30A	Engine controller		
Switch power supply	Starting switch ACC	20	5A	Engine controller (ACC signal)

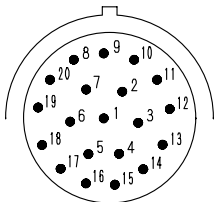
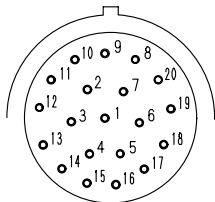
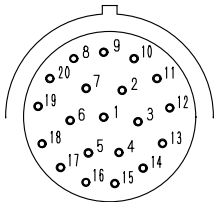
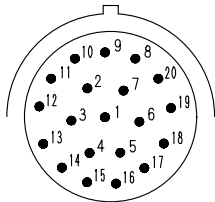
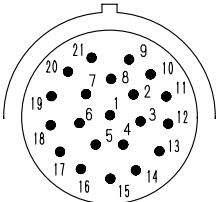
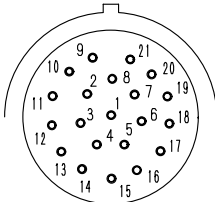
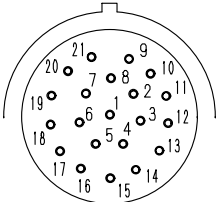
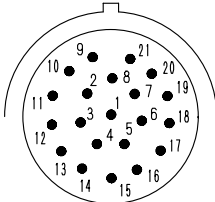
Related circuit diagram

This drawing is a part of the electric circuit diagram related to trouble-shooting.

- Connector No.: Indicates (Model – Number of pins) and (Color).
- “Connector No. and pin No.” from each branching/merging point: Shows the ends of branch or source of merging within the parts of the same wiring harness.
- Arrow ($\Leftrightarrow$): Roughly shows the location on the machine.

No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
7	Body part No. : 79A-222-2640 (Q' ty:5)	Body part No. : 79A-222-2630 (Q' ty:5)	—
11	Body part No. : 79A-222-2680 (Q' ty:5)	Body part No. : 79A-222-2670 (Q' ty:5)	—
5	 BWP04741	 BWP04742	799-601-2710 (T-adapter)
	Body part No. : 79A-222-2620 (Q' ty:5)	Body part No. : 79A-222-2610 (Q' ty:5)	
9	 BWP04743	 BWP04744	799-601-2950 (T-adapter)
	Body part No. : 79A-222-2660 (Q' ty:5)	Body part No. : 79A-222-2650 (Q' ty:5)	
13	 BWP04745	 BWP04746	799-601-2720 (T-adapter)
	Body part No. : 79A-222-2710 (Q' ty:2)	Body part No. : 79A-222-2690 (Q' ty:2)	

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[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
18-20 (3)	Pin (male terminal)	Socket (female terminal)	799-601-9230 (T-adapter)
	 BWP05009	 BWP05010	
	Part No. : 08191-31201, 08191-31202	Part No. : 08191-34101, 08191-34102	799-601-9230 (T-adapter)
	Socket (female terminal)	Pin (male terminal)	
18-21 (4)	 BWP05011	 BWP05012	799-601-9240 (T-adapter)
	Part No. : 08191-32201, 08191-32202	Part No. : 08191-33101, 08191-33102	
	Pin (male terminal)	Socket (female terminal)	799-601-9240 (T-adapter)
	 BWP05013	 BWP05014	
18-21 (4)	Part No. : 08191-41201, 08191-42202	Part No. : 08191-44101, 08191-44102	799-601-9240 (T-adapter)
	Socket (female terminal)	Pin (male terminal)	
	 BWP05015	 BWP05016	799-601-9240 (T-adapter)
	Part No. : 08191-42201, 08191-42202	Part No. : 08191-43101, 08191-43102	

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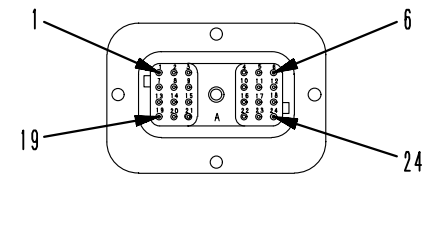
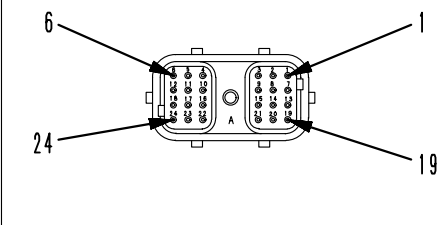
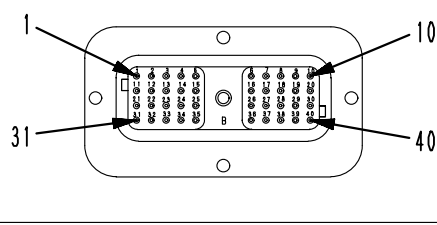
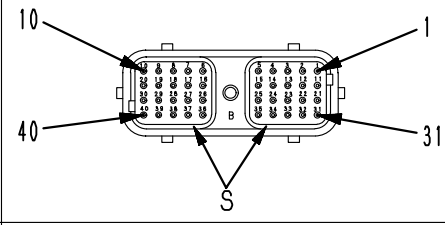
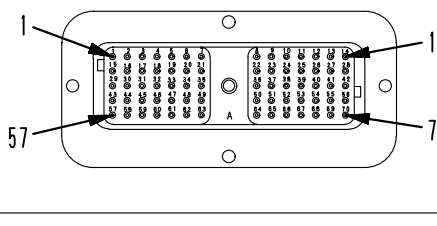
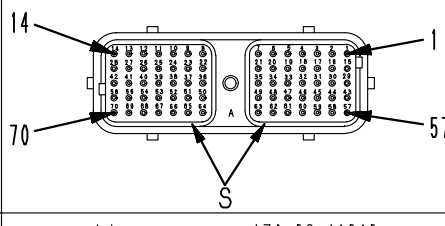
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[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DRC12.16 Series connector		
	DRC12:Male pin (female housing)	DRC16:Female pin (male housing)	Testing connection use special tool Part No.
24 (A)※ (B) (C)			-
	-	-	
40 (A)※ (B) (C)			-
	-	Seal (S) Part No. : 17A-06-41830	
70 (A)※ (B) (C)			-
	-	Seal (S) Part No. : 17A-06-41840	
※ (A)、(B)、(C) :Key position			

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T- branch box and T- branch adapter table

(Rev. 2009.03)

- ★ The vertical column indicates a part number of T-branch box or T-branch adapter while the horizontal column indicates a part number of harness checker assembly.

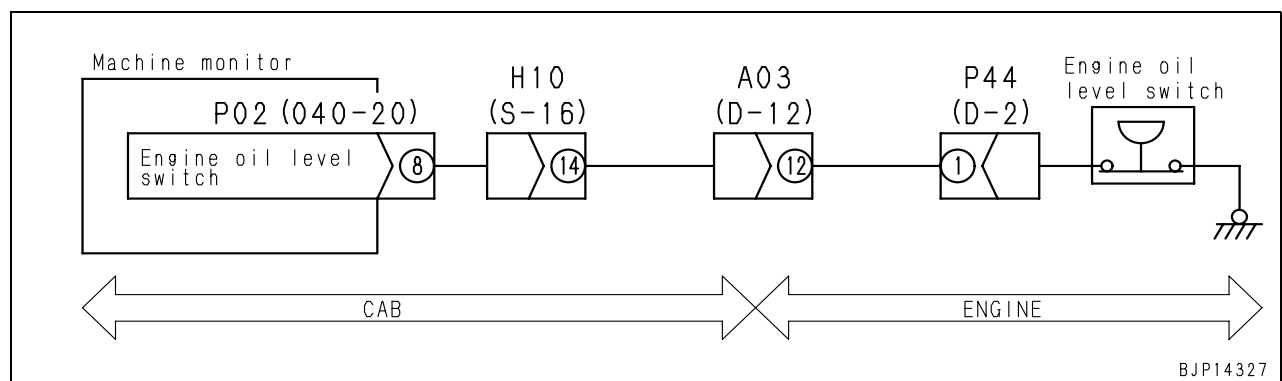
Part No.	Part name	Number of pins	Identification symbol	T-adapter kit												Out of kit		
				799-601-2500	799-601-2700	799-601-2800	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300		799-601-4101	799-601-4201
799-601-2600	T-box (for ECONO)	21		●		●		●	●		●							
799-601-3100	T-box (for MS)	37																●
799-601-3200	T-box (for MS)	37																●
799-601-3380	Plate for MS (14-pin)																	●
799-601-3410	Adapter for BENDIX (MS)	24	MS-24P															●
799-601-3420	Adapter for BENDIX (MS)	24	MS-24P															●
799-601-3430	Adapter for BENDIX (MS)	17	MS-17P															●
799-601-3440	Adapter for BENDIX (MS)	17	MS-17P															●
799-601-3450	Adapter for BENDIX (MS)	5	MS-5P															●
799-601-3460	Adapter for BENDIX (MS)	10	MS-10P															●
799-601-3510	Adapter for BENDIX (MS)	5	MS-5P															●
799-601-3520	Adapter for BENDIX (MS)	17	MS-17P															●
799-601-3530	Adapter for BENDIX (MS)	19	MS-19P															●
799-601-2910	Adapter for BENDIX (MS)	14	MS-14P															●
799-601-3470	Case																	●
799-601-2710	Adapter for MIC	5	MIC-5P	●	●				●									
799-601-2720	Adapter for MIC	13	MIC-13P	●	●				●									
799-601-2730	Adapter for MIC	17	MIC-17P	●	●	●		●	●		●							
799-601-2740	Adapter for MIC	21	MIC-21P	●	●	●		●	●		●							
799-601-2950	Adapter for MIC	9	MIC-9P				●	●	●		●							
799-601-2750	Adapter for ECONO	2	ECONO2P	●	●													
799-601-2760	Adapter for ECONO	3	ECONO3P	●	●													
799-601-2770	Adapter for ECONO	4	ECONO4P	●	●													
799-601-2780	Adapter for ECONO	8	ECONO8P	●	●													
799-601-2790	Adapter for ECONO	12	ECONO12P	●	●													
799-601-2810	Adapter for DLI	8	DLI-8P	●	●													
799-601-2820	Adapter for DLI	12	DLI-12P	●	●													
799-601-2830	Adapter for DLI	16	DLI-16P	●	●													
799-601-2840	Extension cable (ECONO type)	12	ECONO12P	●	●				●									
799-601-2850	Case			●														
799-601-4350	T-box (for DRC 60, ECONO)	60															●	
799-601-4360	Case																●	
799-601-7010	Adapter for X (T-adapter)	1							●		●							
799-601-7020	Adapter for X	2	X2P				●	●	●		●							
799-601-7030	Adapter for X	3	X3P				●	●	●		●							
799-601-7040	Adapter for X	4	X4P				●	●	●		●							
799-601-7050	Adapter for SWP	6	SW6P				●	●	●									
799-601-7060	Adapter for SWP	8	SW8P				●	●	●									
799-601-7310	Adapter for SWP	12	SW12P															●
799-601-7070	Adapter for SWP	14	SW14P						●		●							
799-601-7320	Adapter for SWP	16	SW16P															●
799-601-7080	Adapter for M (T-adapter)	1							●		●							
799-601-7090	Adapter for M	2	M2P				●	●	●		●							
799-601-7110	Adapter for M	3	M3P				●	●	●		●							

Failure code [B@BAZK] Eng Oil Level Low

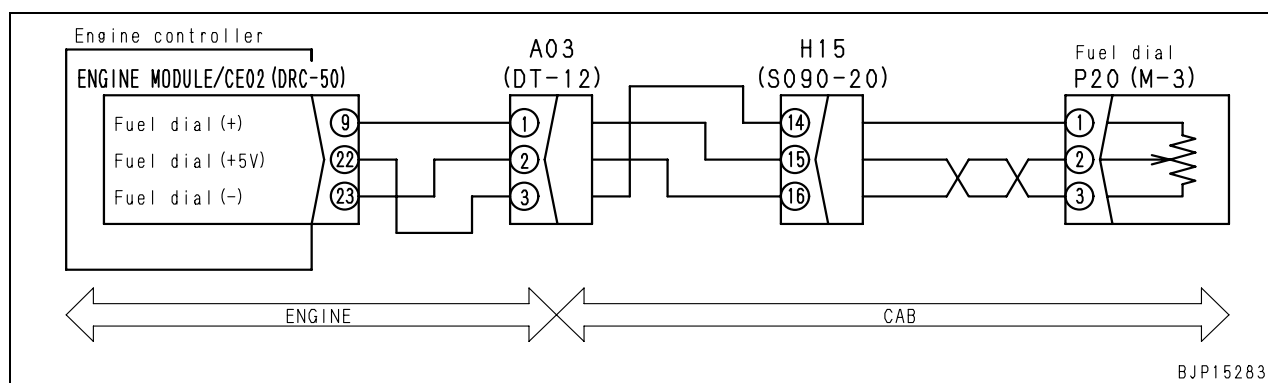
Action code	Failure code	Trouble	Engine oil level low (Machine monitor system)
—	B@BAZK		
Contents of trouble	When starting switch is turned ON (but engine is not started), signal circuit of engine oil level switch detected low engine oil level (sensor contact opened).		
Action of machine monitor	- Displays engine oil level monitor on machine monitor. - Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	If machine is operated as it is, engine may be damaged.		
Related information	- Engine oil level switch signal can be checked with monitoring function. (Code 04501: Monitor Input 2) - Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Lowering of engine oil level (when system is normal)	★ Check the engine oil level and add new oil. (If this phenomenon frequently occurs, investigate the cause.)			
	2	Defective engine oil level switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P44 (male)	Engine oil level	Resistance	
			Between (1) – chassis ground	Value in normal state	Max. 1 Ω	
		Value when oil level is low		Min. 1MΩ		
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (8) – H10 – A03 – P44 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P02	Engine oil level	Voltage	
Between (8) – chassis ground			Value in normal state	Max. 1 V		
		Value when oil level is low	20 – 30 V			

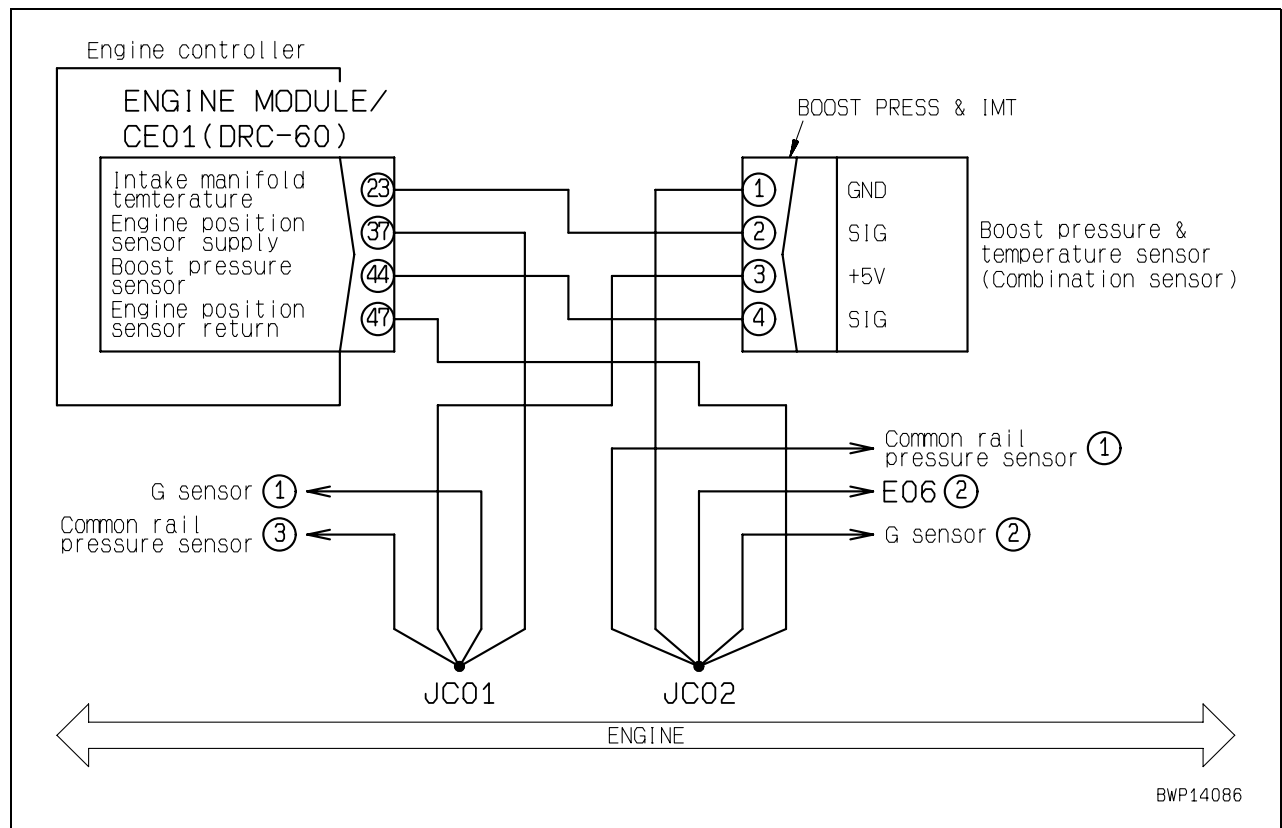
Circuit diagram related to engine oil level switch of machine monitor



Circuit diagram related to fuel control dial



Circuit diagram related to boost pressure/temperature sensor (Combination sensor)

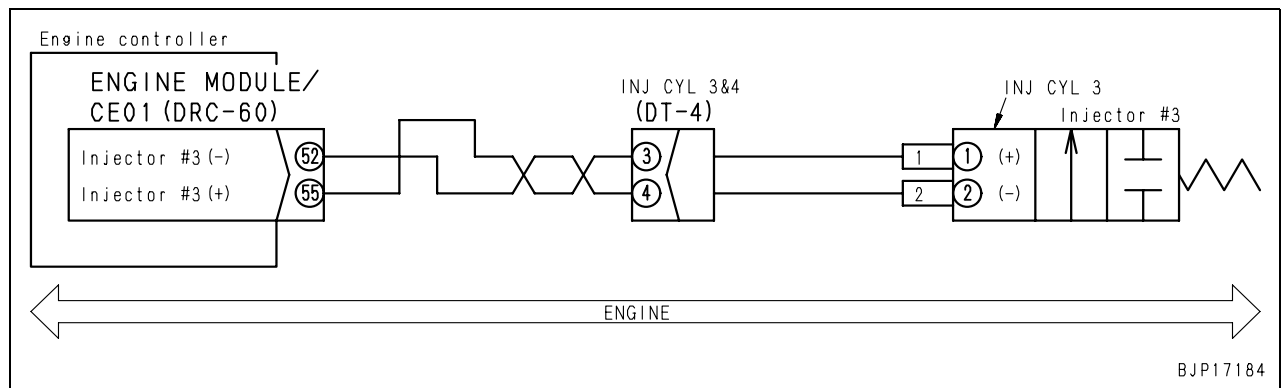


Failure code [CA234] Eng. Overspeed

Action code	Failure code	Trouble	Engine overspeed (Engine controller system)
—	CA234		
Contents of trouble	• Engine speed exceeded control upper speed limit.		
Action of controller	• Stops injection until engine speed lowers to normal level.		
Problem that appears on machine	• Engine speed fluctuates.		
Related information	• Method of reproducing failure code: Run engine at high idle.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Use of improper fuel	Fuel used may be improper. Check it directly.
	2	Improper use	Machine may be used improperly. Teach operator proper using method.
	3	Defective engine controller	If causes 1 and 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Related electrical circuit diagram

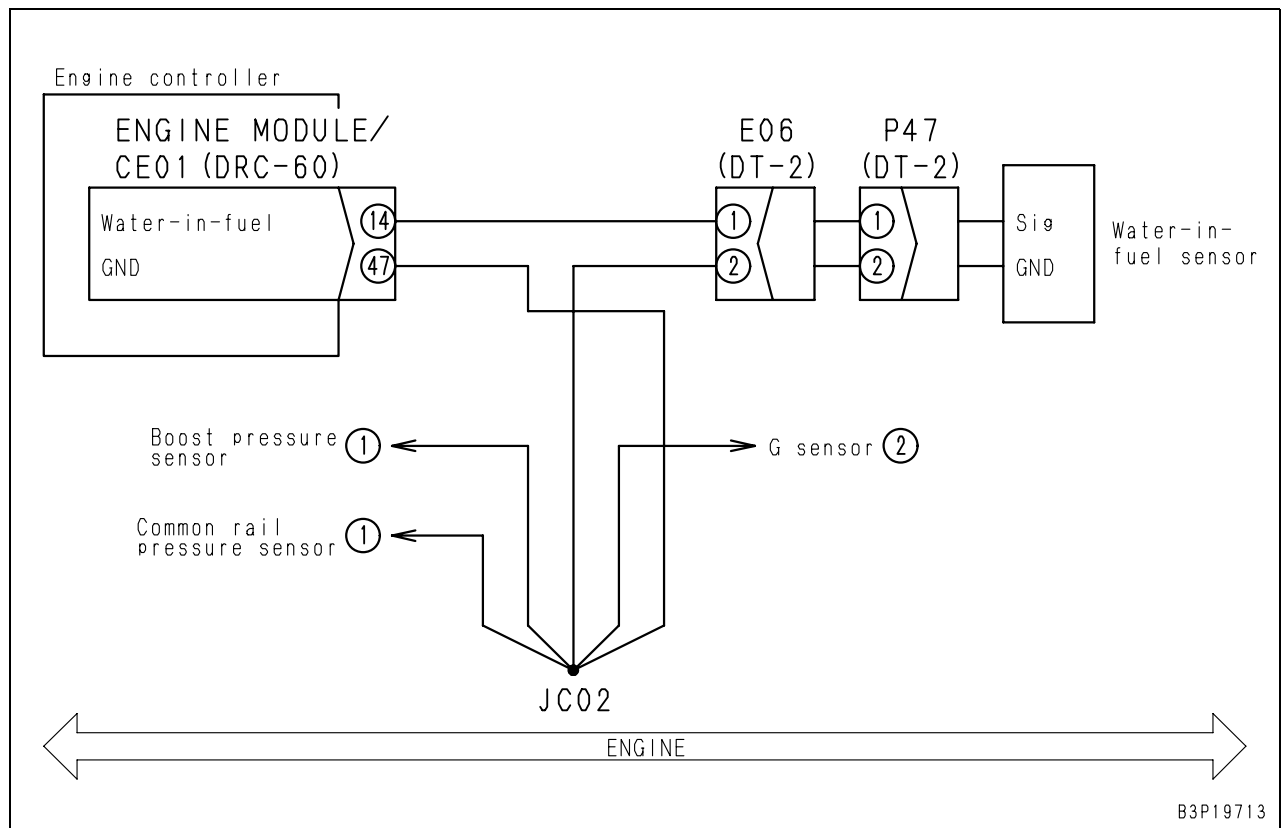


Failure code [CA342] Calibration Code Incompatibility

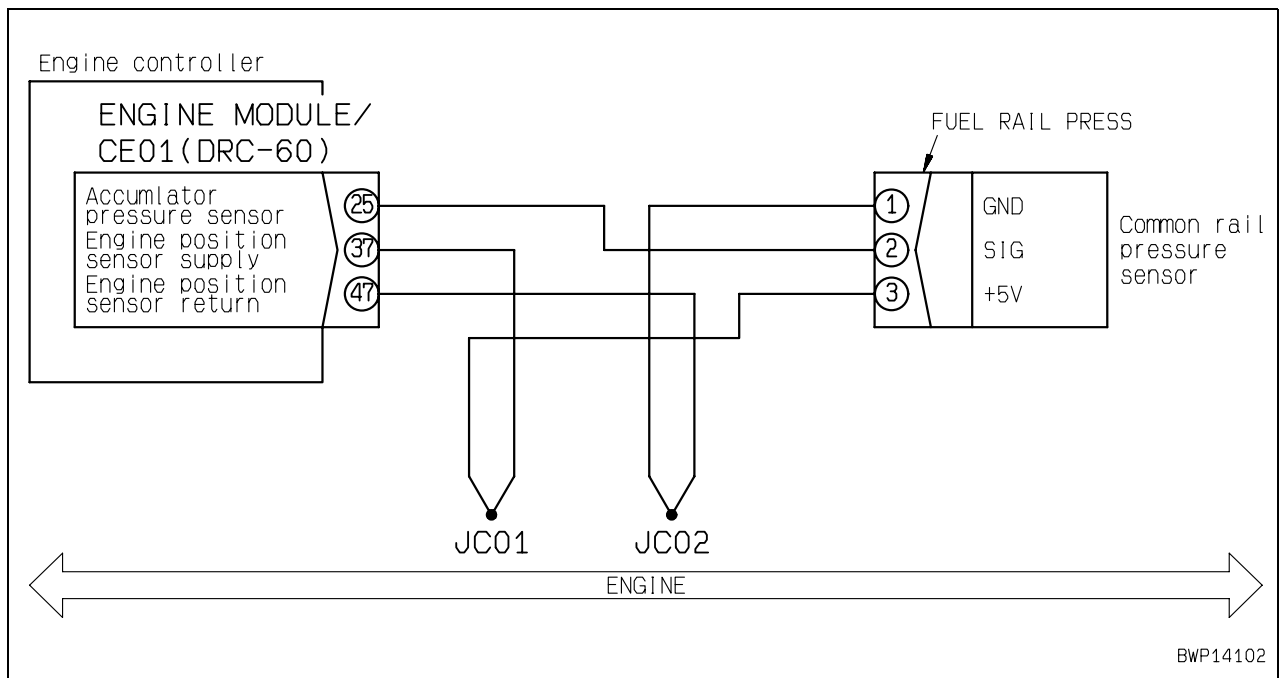
Action code	Failure code	Trouble	Calibration code incompatibility (Engine controller system)
E10	CA342		
Contents of trouble	• Incompatibility of data occurred in engine controller.		
Action of controller	• None in particular.		
Problem that appears on machine	• Continues normal operation. • Engine stops or does not start.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Carry out troubleshooting for failure code [CA757].	

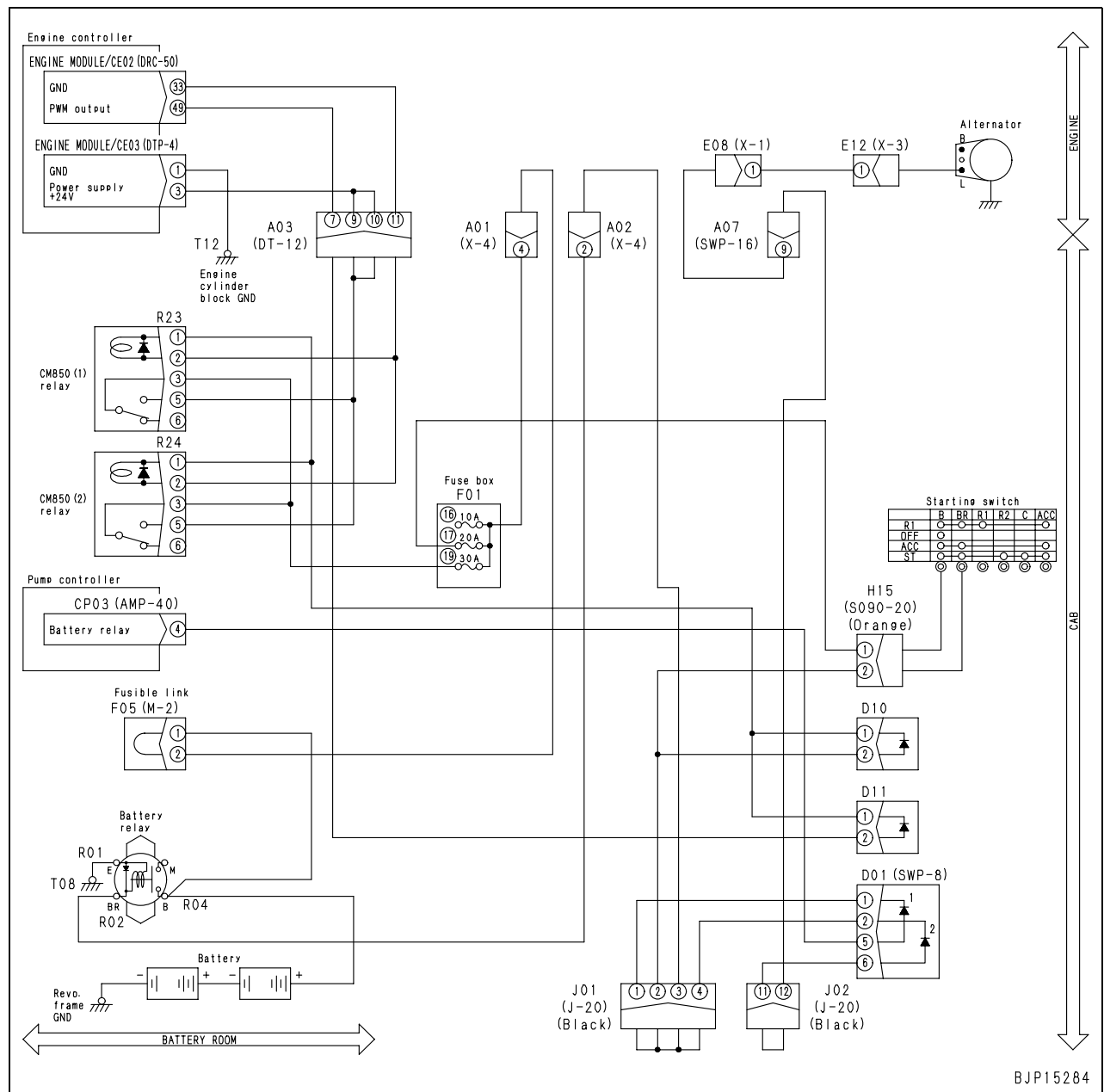
Circuit diagram related to water-in-fuel sensor



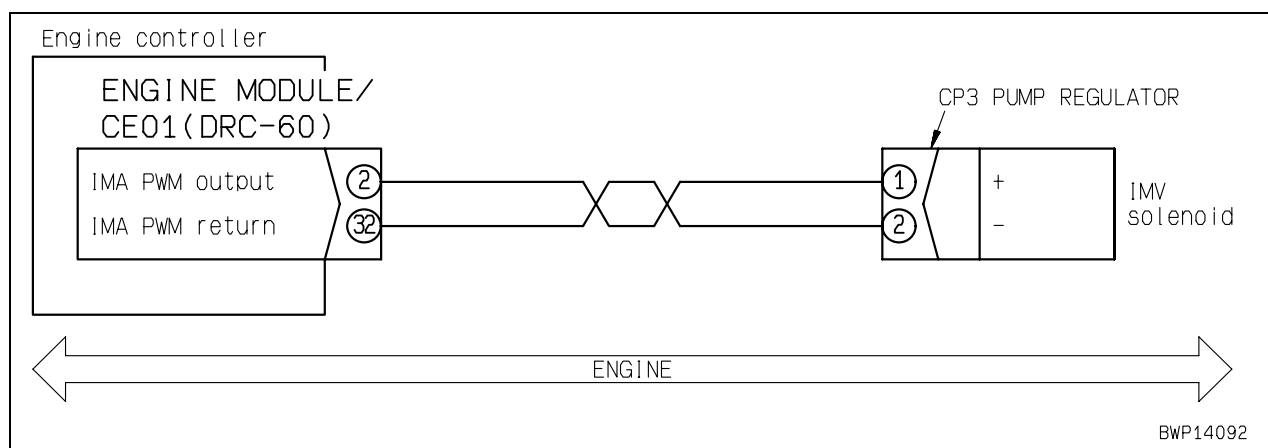
Circuit diagram related to common rail pressure sensor and engine controller ground line



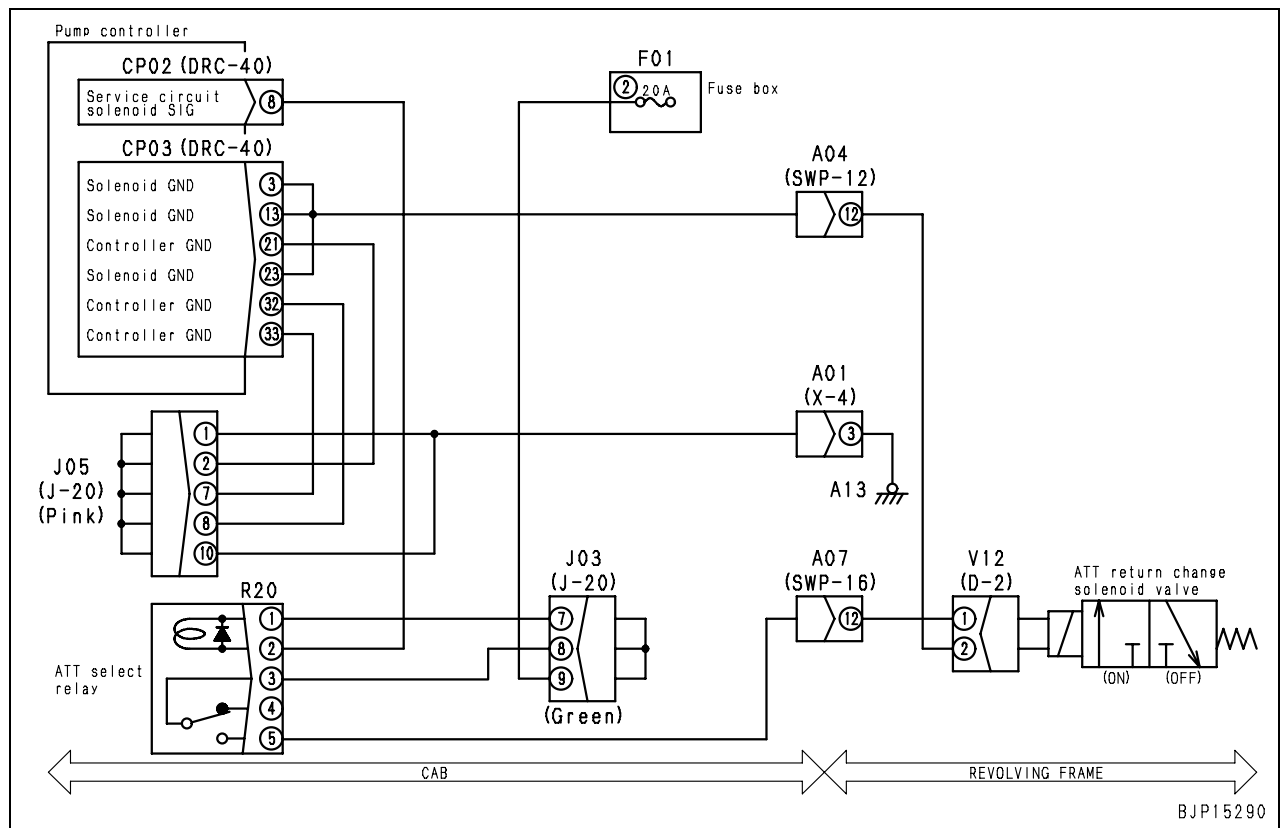
Circuit diagram related to engine controller power supply



Circuit diagram related to supply pump actuator (metering unit)

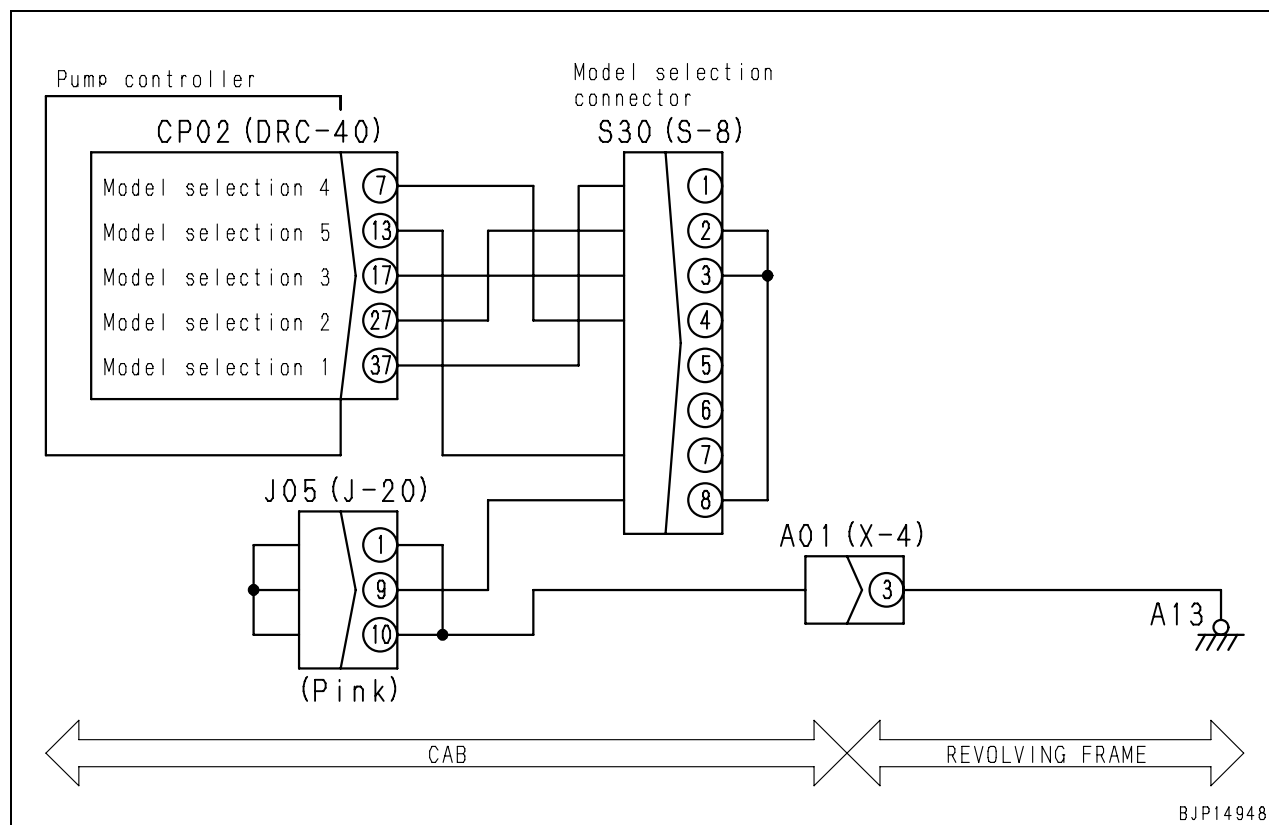


Circuit diagram related to service return relay and solenoid of pump controller

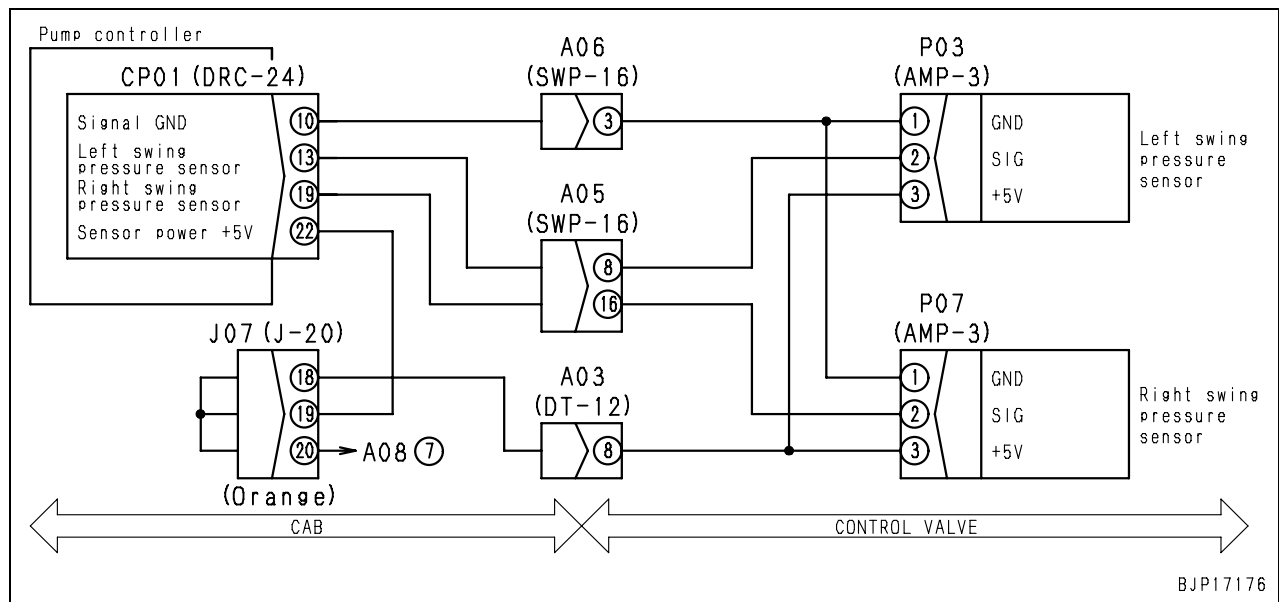


Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	4	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.	
			CP02	Voltage
			Between (7), (13), (37) – chassis ground	20 – 30 V
			Between (17) (27) – chassis ground	Max. 1 V

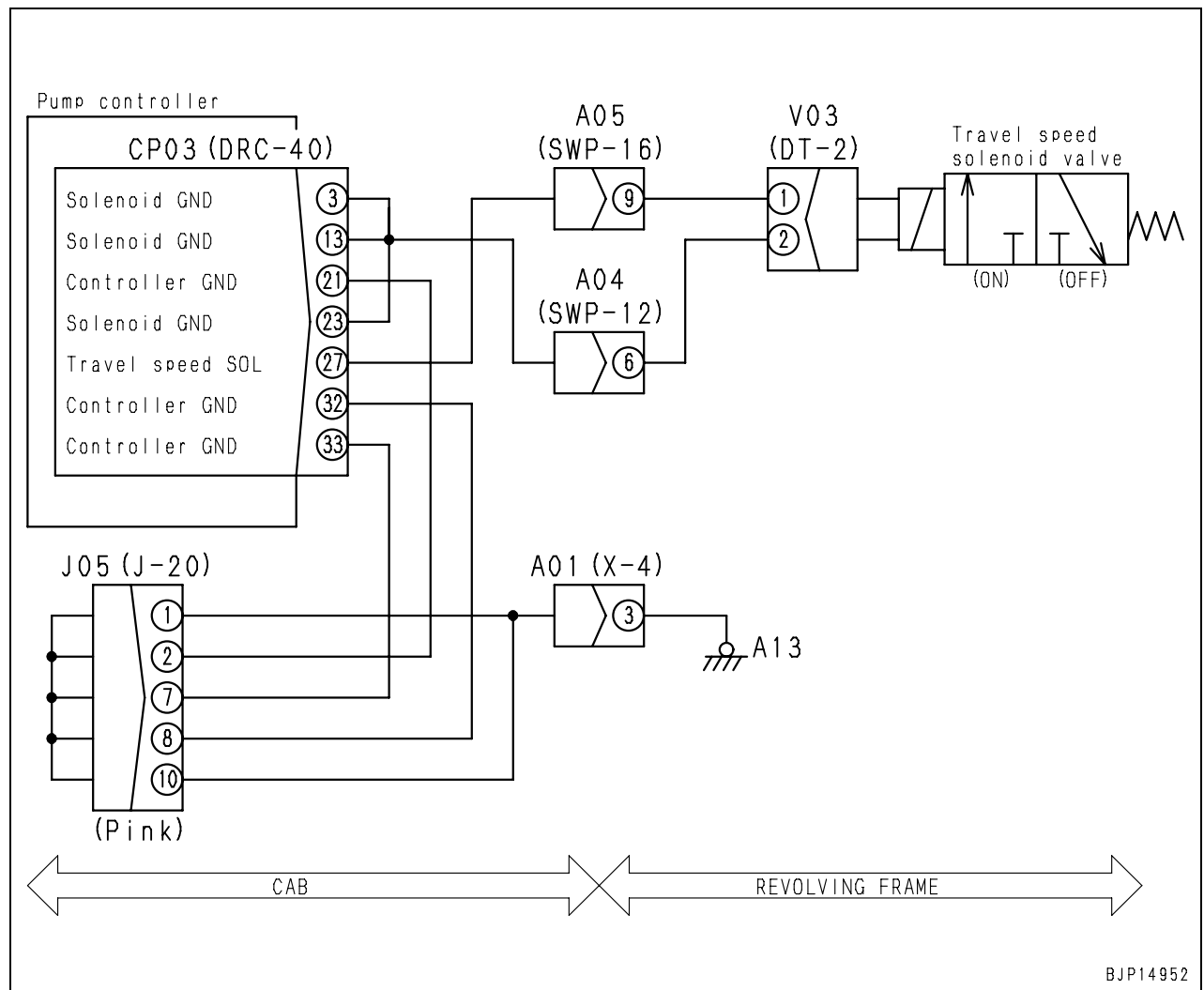
Circuit diagram related to model selection connector of pump controller



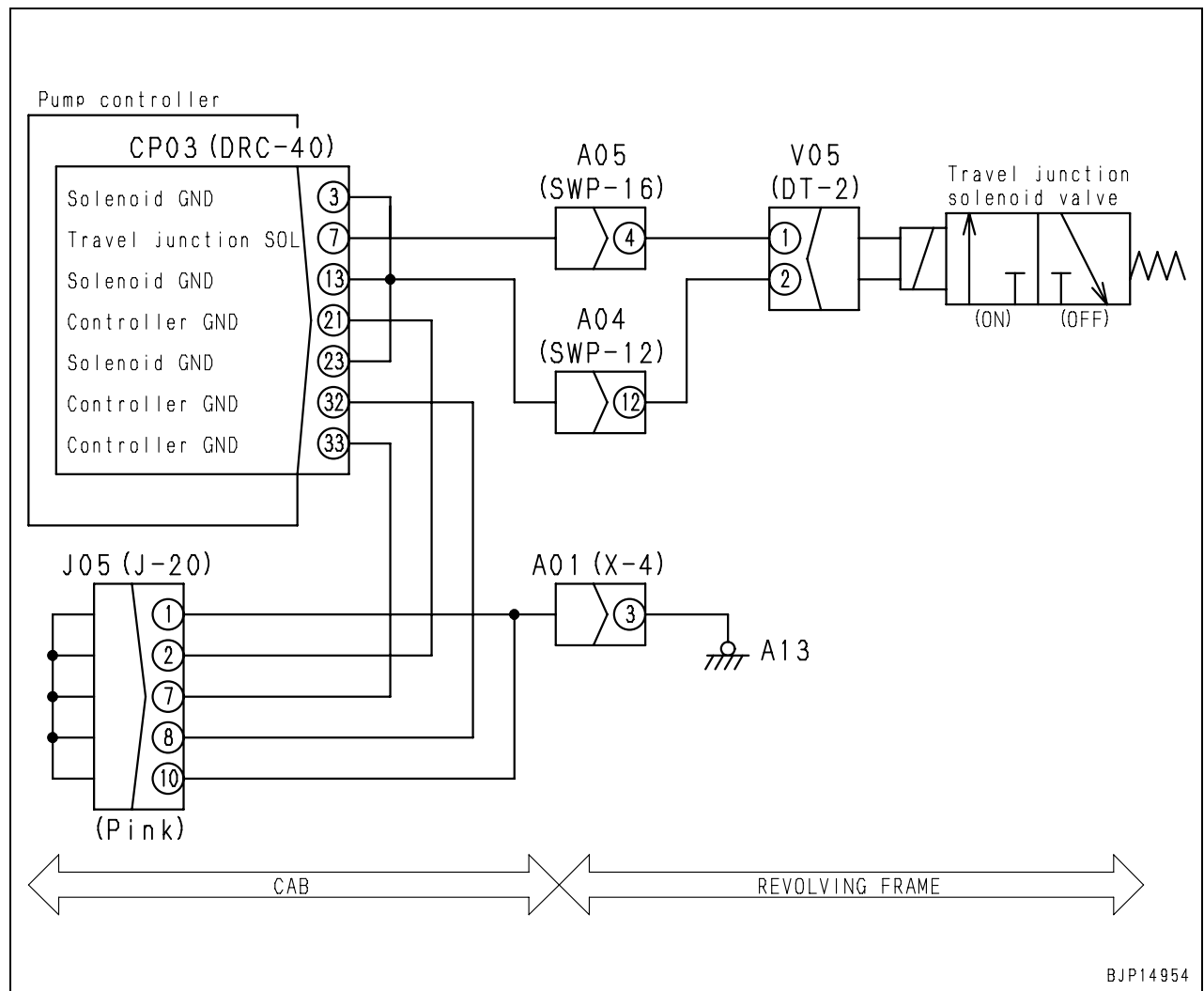
Circuit diagram related to swing right PPC pressure sensor of pump controller



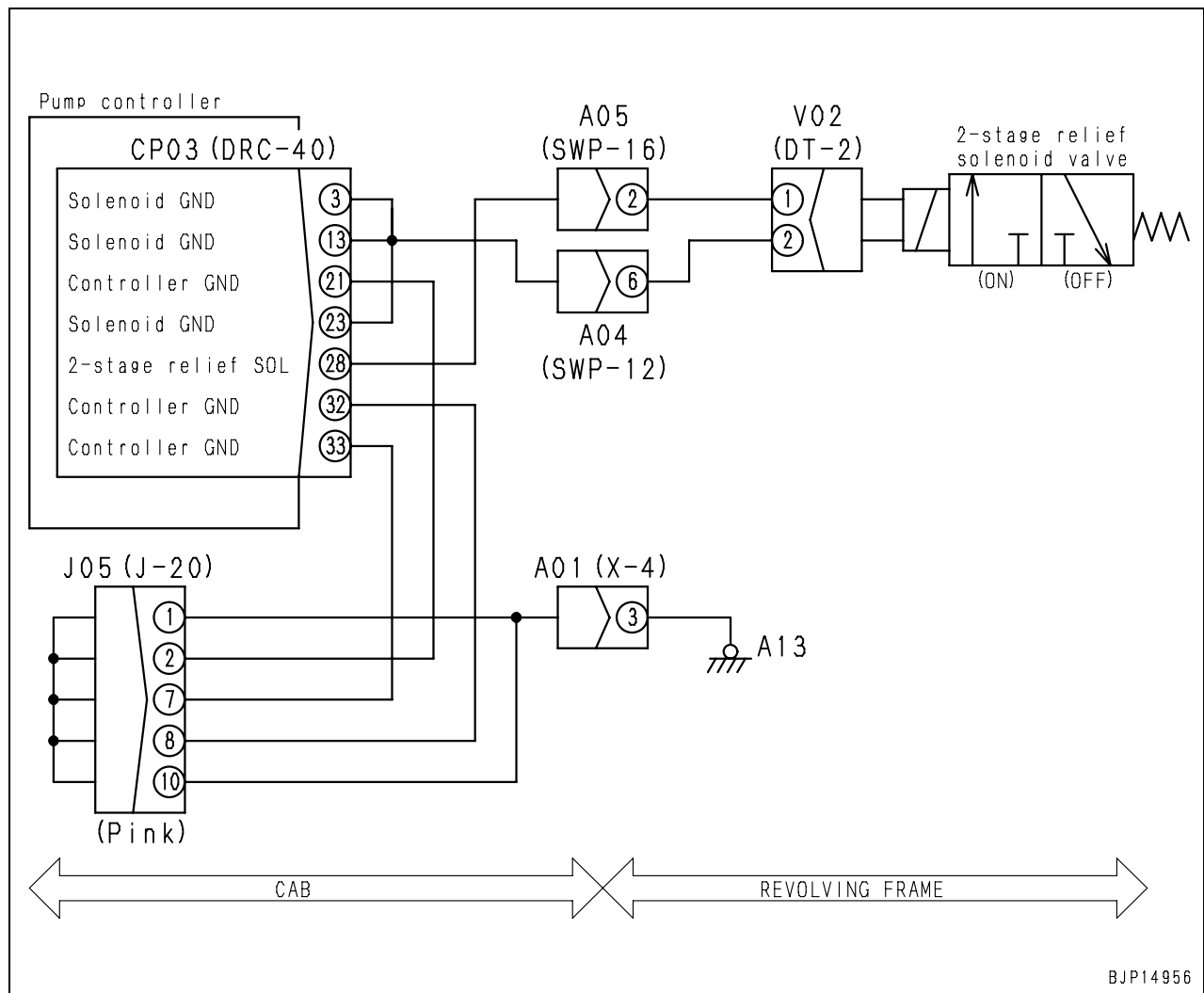
Circuit diagram related to travel speed solenoid of pump controller



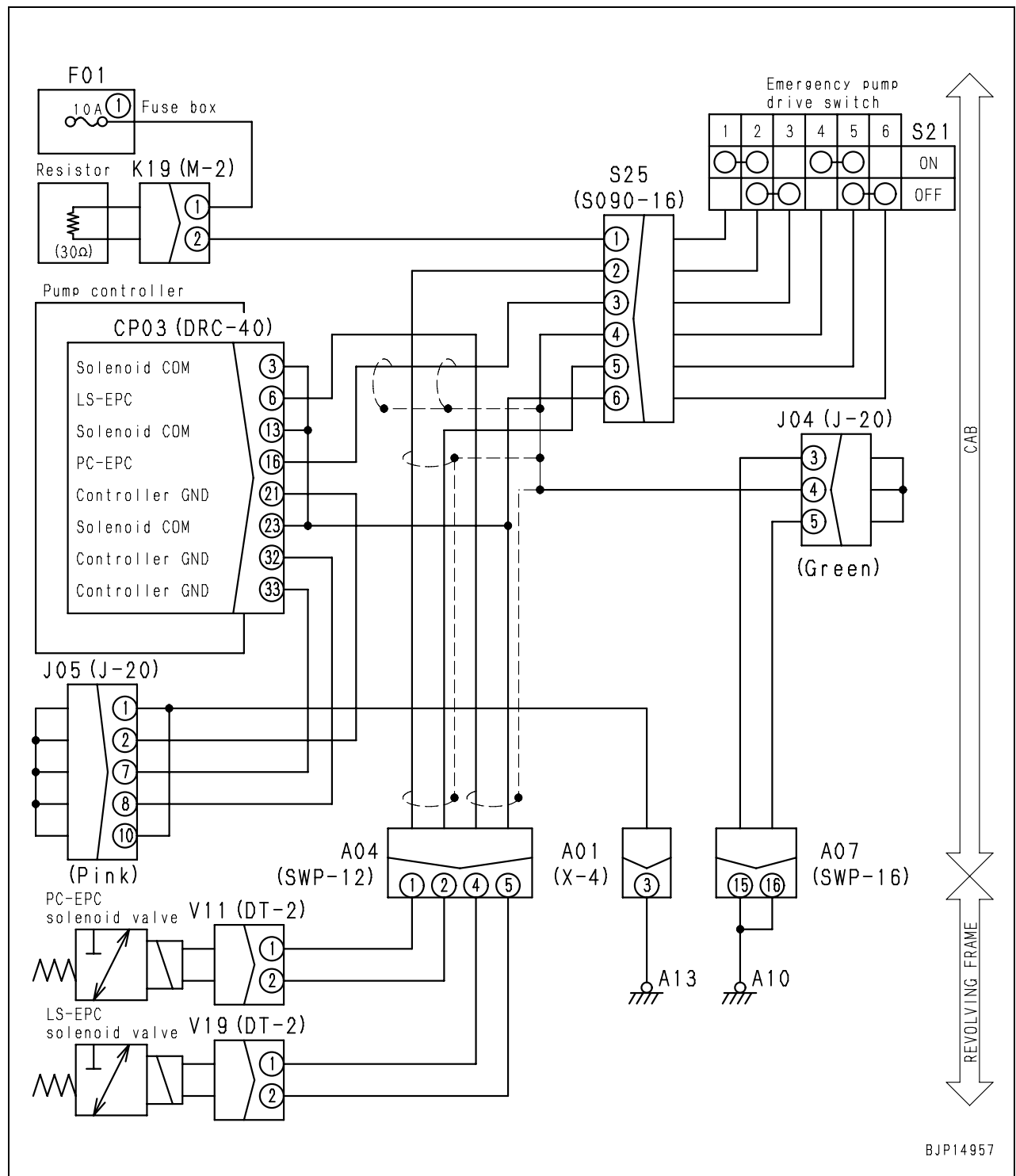
Circuit diagram related to travel junction solenoid of pump controller



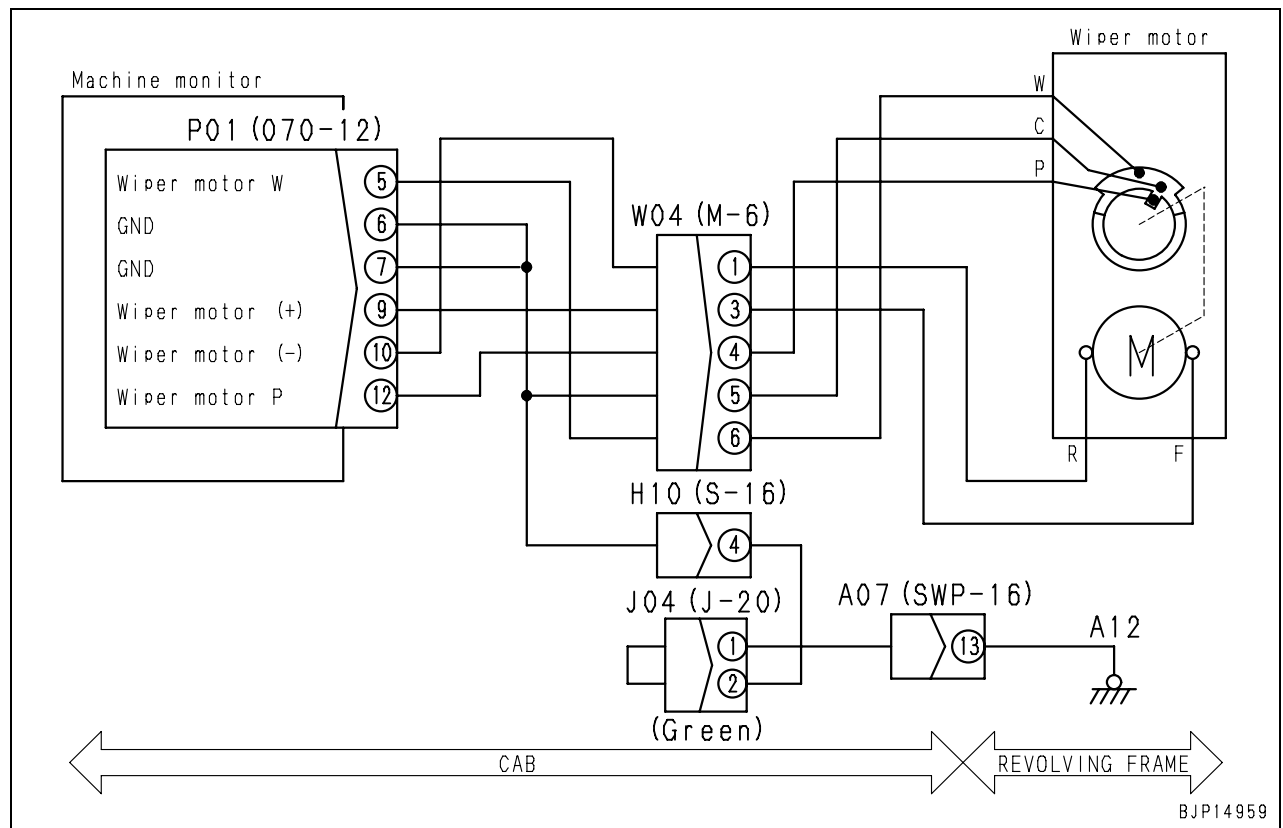
Circuit diagram related to 2-stage relief solenoid of pump controller



Circuit diagram related to LS-EPC and PC-EPC solenoids of pump controller

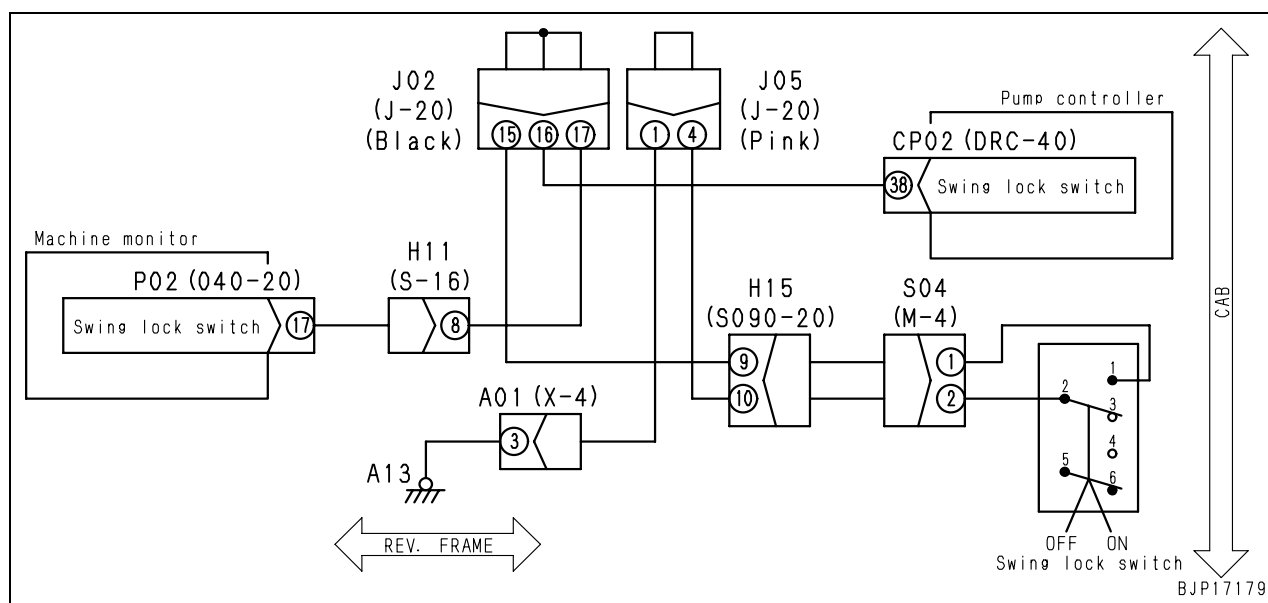


Circuit diagram related to wiper motor of machine monitor



	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	8	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01-17 outlet – H15 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between H15 (female) (4) – J01 – R06 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between R07 (female) (3) – A07 – R17 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between F01-3 outlet – J06 – S14 (male) (1)	Resistance	Max. 1 Ω
			Wiring harness between S14 (male) (3) – R06 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between R06 (female) (3) – R07 (female) (6)	Resistance	Max. 1 Ω
			Wiring harness between R06 (female) (2) – J04 – A07 – chassis ground	Resistance	Max. 1 Ω
	9	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay terminal B (R04) – F05 – A01 – F01-17 inlet and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between F01-17 outlet – H15 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between H15 (female) (4) – J01 – R06 (female) (5) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between R07 (female) (3) – A07 – R17 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between F01-3 outlet – J06 – S14 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between S14 (female) (3) – R06 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between R07 (female) (2) – J05 – H11 – P02 (female) (14) and chassis ground	Resistance	Min. 1 MΩ
	10	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between P02 (female) (11) – H11 – J02 – A07 – R17 (female) (2), – D01 (female) (6), – alternator terminal L and chassis ground	Voltage	Max. 1 V
	11	Defective engine controller power supply	As the engine controller power supply can be defective, carry out troubleshooting for "Failure code CA441, CA442".		

Circuit diagram related to swing lock switch

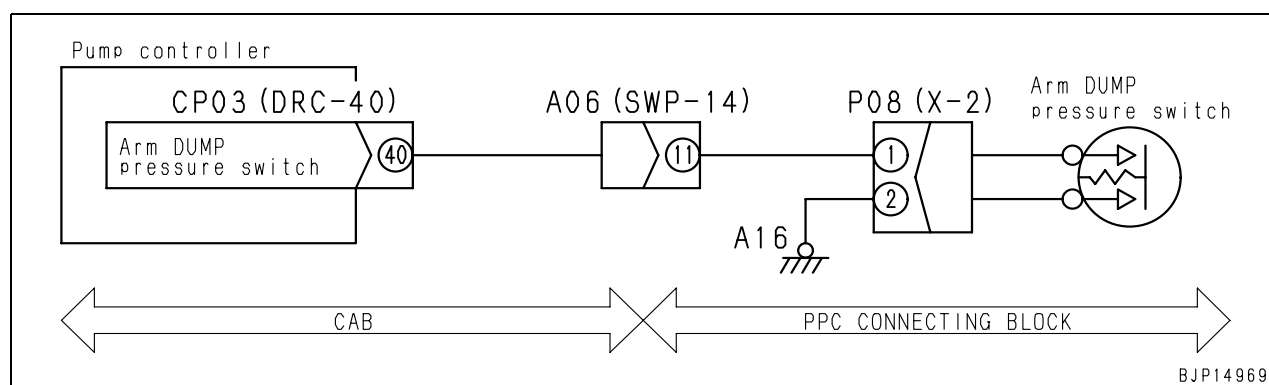


E-20 Monitoring function fails to display “arm OUT” normally

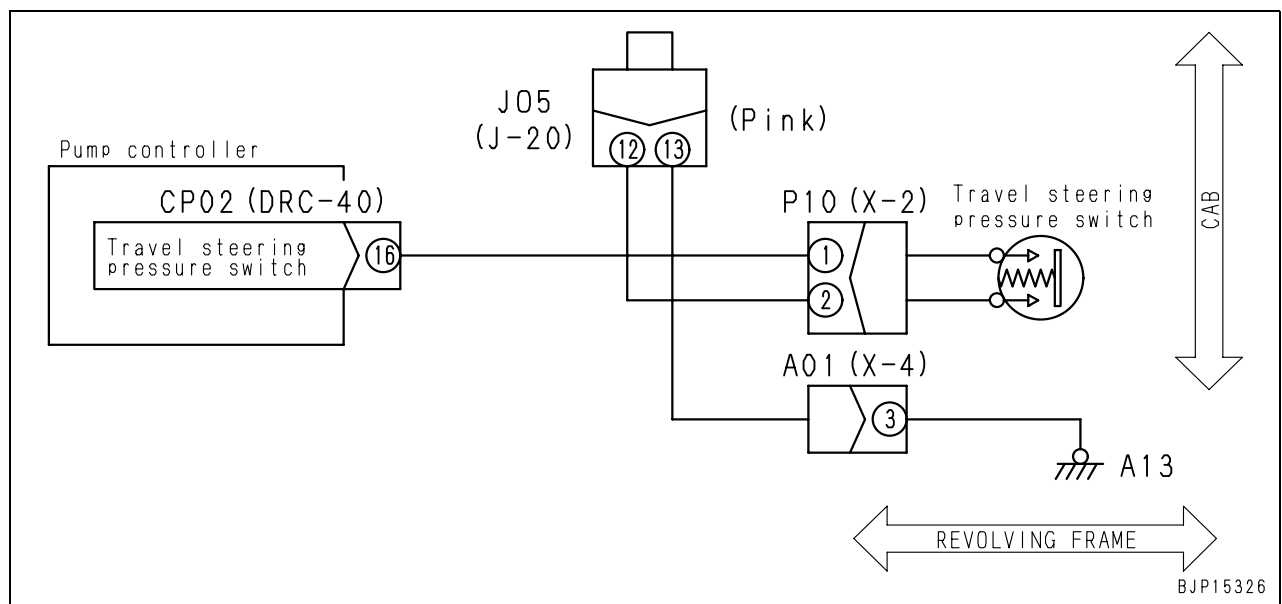
Trouble	Arm OUT operation is not displayed normally by machine monitoring function (Special functions)
Related information	Monitoring code: 01900 (Output Switch 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective arm OUT PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P08 (male)	Arm lever	Resistance	
			Between (1) – (2)	Neutral	Min. 1 MΩ	
	Arm OUT	Max. 1 Ω				
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (40) – A06 – P08 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between P08 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (40) – A06 – P08 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (40) – A06 – P08 (female) (1) and chassis ground		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP03	Arm lever	Voltage	
			Between (40) – chassis ground	Neutral	20 – 30 V	
Arm OUT				Max. 1 V		

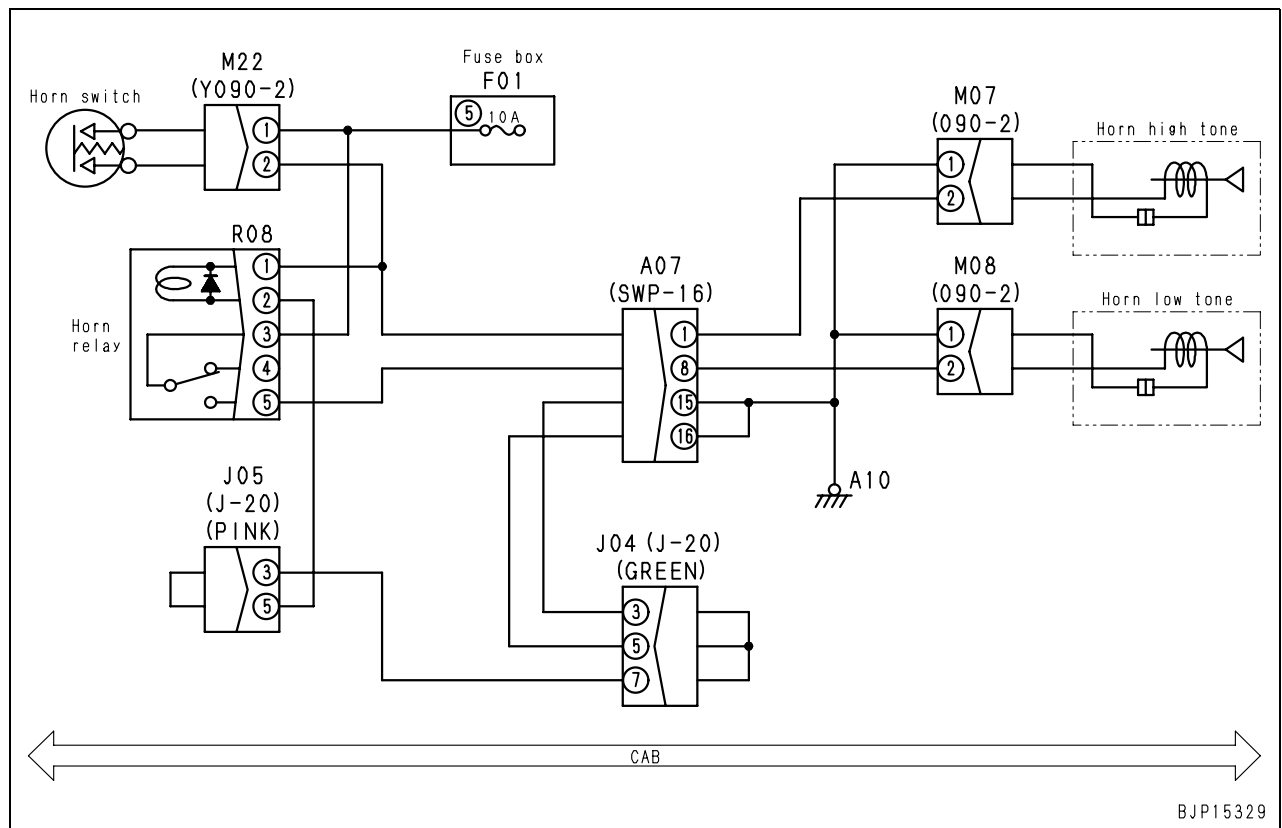
Circuit diagram related to arm OUT PPC oil pressure switch



Circuit diagram related to travel steering PPC oil pressure switch



Circuit diagram related to horn



H-1 All work equipment lack power, or travel and swing speeds are slow

Trouble	All the work equipment lack power, or their travel and swing speeds are slow.
Related information	Set the working mode at P mode for troubleshooting.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunctioning of unload valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.		
			Control lever		Unload pressure
			All control levers in NEUTRAL		3.9 ± 1.0 MPa {40 ± 10kg/cm ² }
	2	Improper adjustment or malfunctioning of main relief valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.		
			Control lever		Main relief pressure
			Arm, DIGGING		33.3 – 36.8 MPa {340 – 375kg/cm ² }
			If the pressure does not return to normalcy even after the adjustment, malfunctioning of main relief valve or its internal failure is suspected. In that case, check the valve itself.		
	3	Malfunctioning of self pressure decompression valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.		
			Control lever		Control circuit source pressure
			All control levers in NEUTRAL		2.84 – 3.43 MPa {29 – 35kg/cm ² }
	4	Improper adjustment or malfunctioning of PC valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.		
			Oil pressure to be measured	Measurement condition	Oil pressure ratio
			Pump delivery pressure	Swing lock: ON Arm: Digging relief	1
			PC valve output pressure		Approx. 0.6 (Approx. 3/5)
			If the oil pressure does not return to normalcy even after the adjustment, malfunctioning of PC valve or its internal failure is suspected. In that case, check the valve itself.		
	5	Malfunctioning of LS-EPC valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.		
			Travel speed	Travel control lever	LS-EPC output pressure
			Lo	NEUTRAL	Approx. 2.9 MPa {Approx. 30 kg/cm ² }
			Hi	OPERATED	0 MPa {0 kg/cm ² }

H-15 In compound operation, work equipment with larger load moves slowly

Trouble	• In a compound operation, work equipment with larger load tends to move slowly.			
Related information	—			
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunctioning of pressure compensation valve for work equipment with larger load	The pressure compensation valve for the work equipment with larger load is presumed to malfunction. Check the valve itself.	
			Combination of compound operation	Work equipment with larger load
			Boom RAISE + arm DIGGING	Boom
			Boom RAISE + arm DUMPING	Arm
			Boom RAISE + bucket DIGGING	Boom
			Arm DUMPING + bucket DIGGING	Arm
			Boom LOWER + arm DUMPING	Arm

H-16 In swing + boom RAISE operation, boom moves slowly

Trouble	• In a compound operation of swing + boom RAISE, the boom tends to move slowly.			
Related information	• If the boom moves slowly in the single operation of boom RAISE, carry out the H-7 check first.			
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunctioning of LS select valve or seal defective	The LS select valve of control valve is presumed to malfunction, or the seal is suspected to be defective. Check the valve and seal themselves.	

H-17 In swing + travel, travel speed drops sharply

Trouble	• In a compound operation of swing + travel, the travel speed drops sharply.			
Related information	• If the travel speed is slow in the single operation of travel, carry out the H-19 check first.			
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunctioning of LS shuttle valve (left travel and swing)	The LS shuttle valve in the left travel control valve or the swing control valve is presumed to malfunction. Check both of them directly.	

H-26 There is big shock when stopping swing

Trouble	• There is a big shock caused when stopping a swing motion.
Related information	• Set the working mode at P mode for the troubleshooting.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunctioning of swing PPC valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.	
			L.H. work equipment control lever	PPC valve output pressure
			NEUTRAL	0 MPa {0 kg/cm ² }
			Swing operated	Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunctioning of swing PPC slow return valve	The swing PPC slow return valve is presumed to malfunction. Check the valve itself. (Whether the valve malfunctions or not may well be determined by swapping the right and left valves and watching the result.)	
	3	Malfunctioning of swing motor (shockless valve)	The swing motor shockless valve is presumed to malfunction. Check the valve itself.	

H-27 There is big abnormal noise caused when stopping swing

Trouble	• There is a big abnormal noise caused when stopping a swing motion.
Related information	• Set the working mode at P mode for the troubleshooting.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunctioning of backpressure valve	The backpressure valve is presumed to malfunction. Check the valve itself.	
	2	Malfunction of swing motor (safety valve)	The safety valve in the swing motor is presumed to malfunction. Check the valve itself.	
	3	Malfunction of swing motor (suction valve)	The seal in suction valve of the swing motor is suspected of defect. Check the seal itself. (Whether the seal is defective or not may well be determined by swapping the right and left valves and watching the result.)	
	4	Swing machinery defective	The swing machinery is suspected of an internal failure. Check the inside of the machinery itself. (A failure inside the swing machinery may well be determined by monitoring abnormal noise, abnormal heat generated or metal dust or chips contained in the drained oil.)	

S-2 Engine does not start

a) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
→ See "S-4 Engine stops during operations"
- Defective electrical system
- Defective electrical system (Starting circuit)

			Causes							
			Broken flywheel ring gear	Defective or deteriorated battery	Defective connection of battery terminal	Defective battery relay	Defective starting switch	Defective safety relay	Defective starting motor (motor section)	Defective starting circuit wiring
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△						
	Condition of horn when starting switch is turned ON	Horn does not sound			○		○			○
		Horn volume is low		○						
Check items	Battery electrolyte is low			○						
	Battery terminal is loose				○					
	When starting switch is turned ON, there is no operating sound from battery relay			○		○				
	When starting switch is turned to START, starting pinion does not move out			○			○			○
	When starting switch is turned to START, starting pinion moves out, but	Speed of rotation is low		○						
		Makes grating noise	○						○	
		Soon disengages again						○		
		Makes rattling noise and does not turn		○				○	○	

Troubleshooting	Inspect flywheel ring gear directly		●							Carry out troubleshooting in E-mode
	When specific gravity of electrolyte and voltage of battery are measured, they are low			●						
	Turn starting switch OFF, connect cord, and carry out troubleshooting at ON	There is not voltage (20 – 30 V) between battery relay terminal B and terminal E				●				
		When terminal B and terminal C of starting switch are connected, engine starts					●			
		When terminal B and terminal C at safety relay outlet are connected, engine starts						●		
		Even if terminal B and terminal C at safety relay outlet are connected, engine does not start							●	
		When safety switch terminal and terminal B of starting motor are connected, engine starts							●	
	Remedy	Replace	Replace	Correct	Replace	Replace	Replace	Replace	—	

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive

- Leakage of fuel
- Defective condition of fuel injection (fuel pressure, injection timing)
- Excessive injection of fuel

General causes why fuel consumption is excessive			Causes									
			Fuel leakage inside head cover	Fuel leakage from fuel filter, piping, etc.	Defective feed pump oil seal	Defective supply pump plunger	Defective common rail pressure	Defective spray by injector	Defective operation of injector	Improper fuel injection timing	Defective coolant temperature sensor, wiring harness	
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period			△	△		△				
	Condition of fuel consumption	More than for other machines of same model				○		○	○	○		
		Gradually increased				○						
Suddenly increased			○	○								
Check items	There is external leakage of fuel from engine			○								
	Combustion is irregular							○				
	Engine oil level rises and oil smells of diesel fuel		○		○							
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							○				
	Low idle speed is high								○			
	Pump relief speed is high								○			
	Exhaust smoke color	Black					○	○		○	○	
		White	○									
	Troubleshooting	Remove and inspect head cover directly		●								
Inspect feed pump oil seal directly				●								
Carry out troubleshooting according to “Rail Press (Very) Low Error (*1)” indicated by code					●							
When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change							●					
If spill hose from injector is disconnected, much fuel spills								●				
Carry out troubleshooting according to “Coolant Temp Sens High (Low) Error (*2)” indicated by code										●		
Check with monitoring function						●			●			
		Remedy	Correct	Correct	Replace	Replace	Correct	Replace	Replace	Replace	Replace	

*1: Displayed failure codes [CA559] and [CA2249]

*2: Displayed failure codes [CA144] and [CA145]

2. Disassembly and assembly of assemblies

Special tools

- Special tools which are necessary for disassembly and assembly of parts are described as **A1**, **•• X1** etc. and their part numbers, part names and quantities are described in the special tool list.
 - Also the following information is described in the special tool list.
- 1) Necessity
 - : Special tools that cannot be substituted and should always be used.
 - : Special tools that will be useful if available and are substitutable with tools available on the market.
 - 2) Distinction of new and existing special tools
 - N : Tools newly developed for this model. They have a new part number respectively.
 - R : Tools made available by redesigning the existing tools which were developed for other models. Each of them has a new part number assigned by setting forward the part number of the existing tool.
 - Blank : Tools already available for other models. They can be used without any modification.
 - 3) Circle mark ○ in sketch column:
 - The sketch of the special tool is presented in the section of "Sketches of special tools".
 - Part No. of special tools starting with 79*T-***-****: means that they are not available from Komatsu Ltd. (i.e. tools to be made locally).

Disassembly

- In "Disassembly" section, the work procedures, precautions and know-how to do the work, and the amount of oil and coolant to be drained are described.
- Common tools that are necessary for disassembly are described as [1], [2]•• etc. and their part numbers, part names and quantities are not described.
- The meanings of the symbols used in "Disassembly" section are as follows.

: Precautions related to work safety

- ★ : Guidance or precautions for the work
-  : Amount of oil or coolant drained

Assembly

- In "Assembly" section, the work procedures, precautions and know-how to do the work, and the amount of oil and coolant to be replenished are described.
- Common tools that are necessary for assembly are described as [1], [2]•• etc. and their part numbers, part names and quantities are not described.
- The meanings of the symbols used in "Assembly" section are as follows.

: Precautions related to work safety

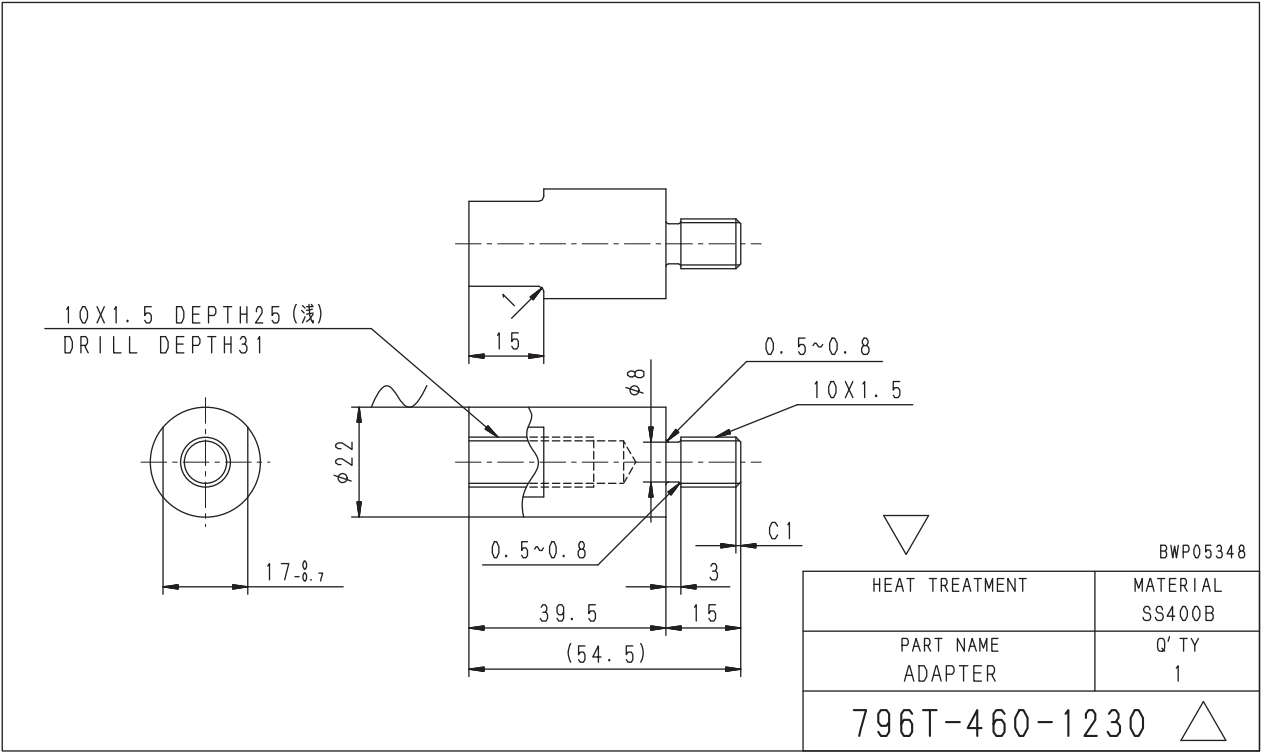
- ★ : Guidance or precautions for the work
-  : Type of coating material
-  : Tightening torque
-  : Amount of oil or coolant to be replenished

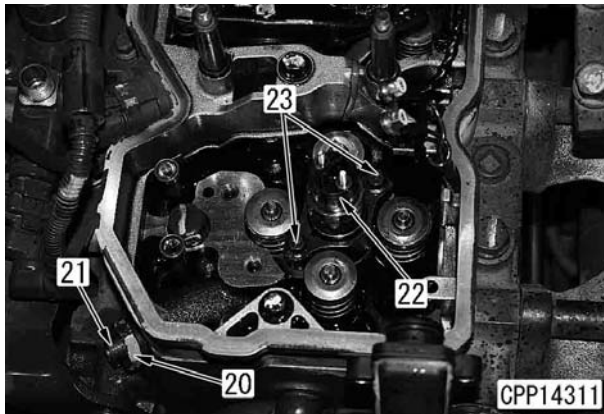
Sketches of special tools

- Various special tools are illustrated for the local manufacture.

NOTE: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.

N2 Adapter

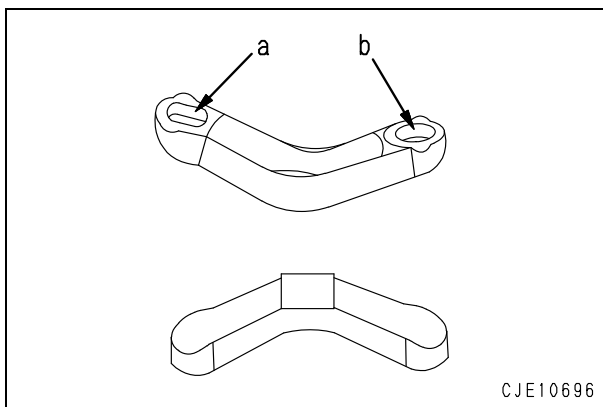
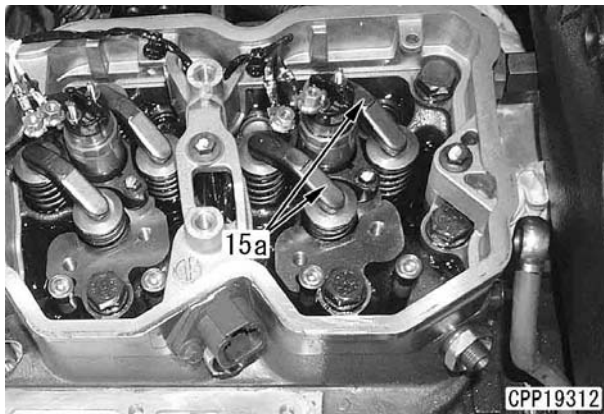




2. Install the rocker arm according to the following procedure.

1) Install crossheads (15a).

- ★ Install the crossheads in the position and direction (shapes of holes (a) and (b)) recorded when removed.



2) Install rocker arm (15) and tighten mounting bolt (14).

- ★ Check that adjustment screw (17) is loosened thoroughly.

⌚ Rocker arm mounting bolt (14):

$36 \pm 5 \text{ Nm}$ $\{3.7 \pm 0.5 \text{ kgm}\}$

3) Adjusting the valve clearance. For details, see Testing and adjusting, "Adjusting valve clearance".

- ★ Use tool **A4** to rotate the engine.

4) After adjusting the valve clearance, check that locknut (16) is tightened to the specified torque.

⌚ Locknut (16):

$24 \pm 4 \text{ Nm}$ $\{2.4 \pm 0.4 \text{ kgm}\}$

5) Install wirings (11) and tighten the wiring nuts (41).

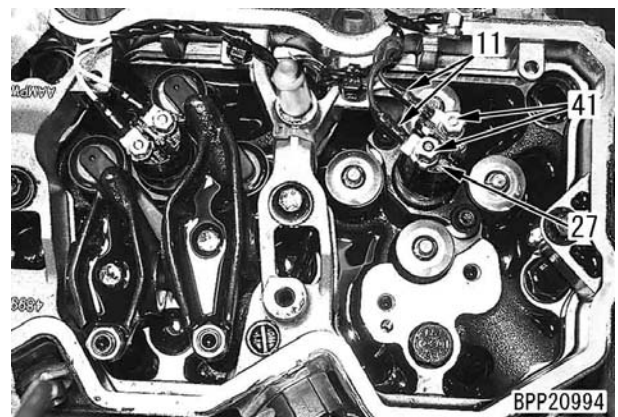
- ★ Check that the wiring does not interfere with the rocker arm.

- ★ Installed positions of wires

Wire color	Cylinder No.
White	1, 3, 5
Black	2, 4, 6

⌚ Wiring mounting nut:

$1.5 \pm 0.25 \text{ Nm}$ $\{0.15 \pm 0.03 \text{ kgm}\}$

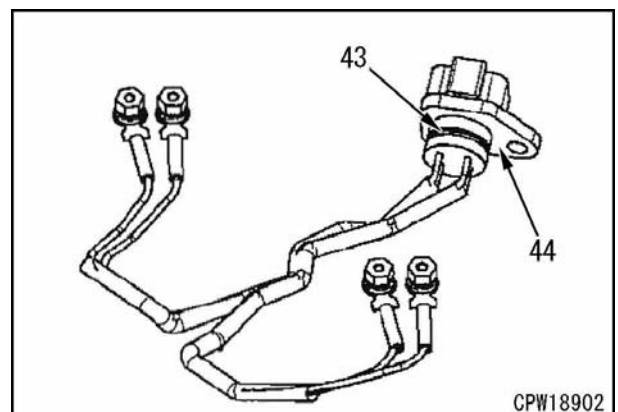


- ★ When the connector of injector harness is removed:

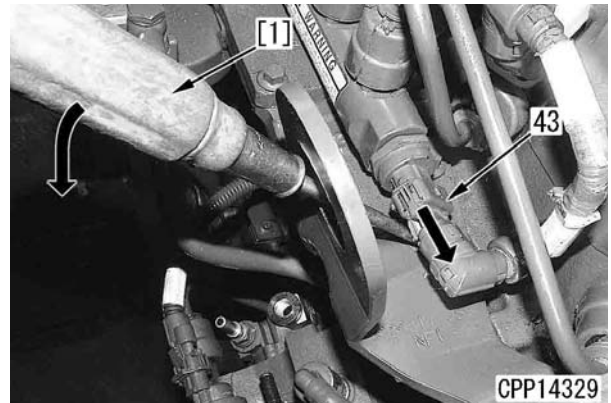
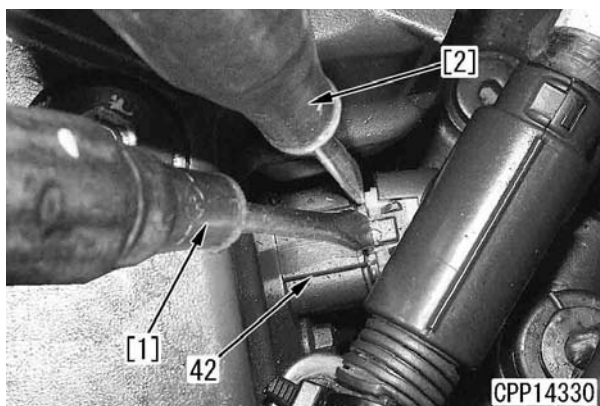
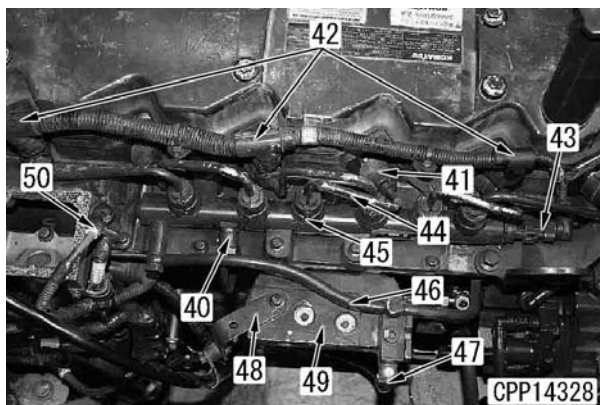
When assembling the injector harness connector (42) to the housing, apply gasket sealant (LG-7) to the O-ring portion (43) and the flange face of connector (44). When applying gasket sealant (LG-7) to the O-ring portion, be sure to apply a string of LG-7 $\phi 3 \text{ mm}$ in diameter until O-ring groove is completely filled.

If O-ring is damaged, replace as a harness assembly.

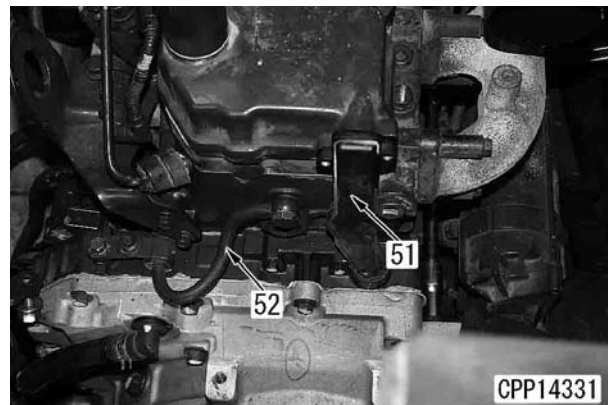
⌚ Connector flange mounting bolt (45): **$10 \pm 2 \text{ Nm}$ $\{1.0 \pm 0.2 \text{ kgm}\}$**



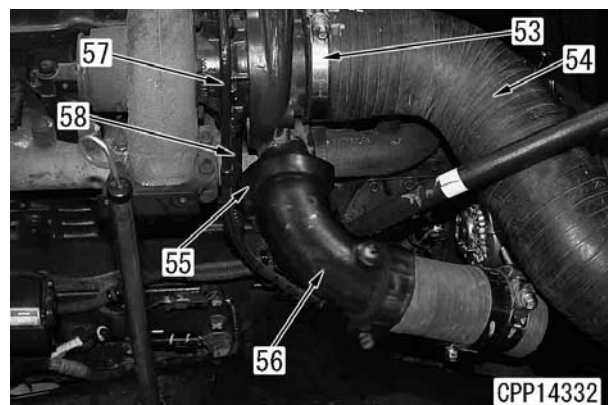
33. Disconnect connector (43).
 - ★ While pushing up the lock of connector (43) with flat-head screwdriver [1], pull the connector in the direction of the arrow.
34. Remove 6 fuel spray prevention caps (41).
 - ★ Remove only the fuel spray prevention cap on the cylinder head side.
35. Disconnect 6 high-pressure pipes (44) from the cylinder head. [*7]
36. Remove common rail and high-pressure pipe assembly (45). [*8]
37. Disconnect high-pressure pipe (40) from the common rail mounting part.
38. Disconnect fuel return hose (46). [*9]
39. Disconnect fuel return hose (47).
40. Remove bracket (48). [*10]
41. Remove fuel block (49). [*11]
42. Connector: Disconnect boost pressure/intake air temperature sensor connector (50).
 - ★ Move the disconnected connector aside. [*12]



43. Remove blow-by duct (51).
44. Disconnect fuel drain hose (52).



45. Loosen air hose clamp (53) and disconnect hose (54). [*13]
46. Loosen air tube clamp (55) and disconnect tube (56). [*14]
47. Disconnect lubrication inlet hose (57) and lubrication outlet hose (58). [*15]
 - ★ Fix the turbocharger side connector (53) with wrench so that the inlet hose does not move together.

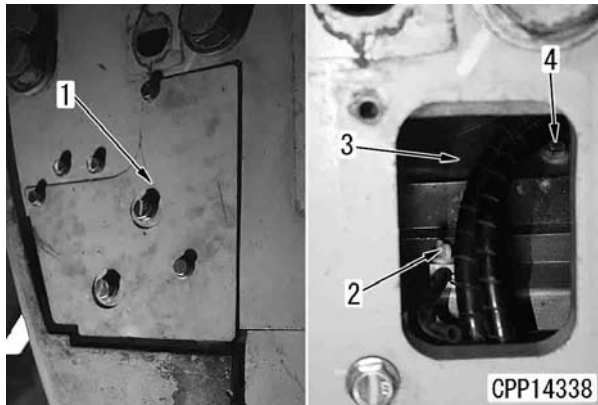


Removal and installation of radiator assembly

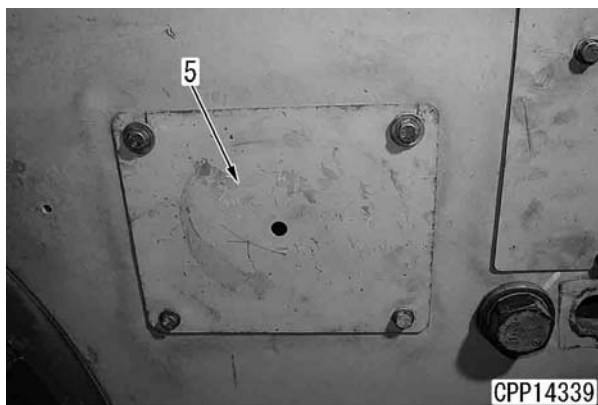
Removal

- ⚠ Swing the upper structure 90°, lower the work equipment to the ground safely and stop the engine. Then, loosen the hydraulic tank cap gradually to release the internal pressure of the hydraulic tank.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

1. Remove cover (1).
2. Drain the coolant through drain valve (2).
 Coolant: 21 ℓ
3. Remove mounting bolts (4) for cover (3).

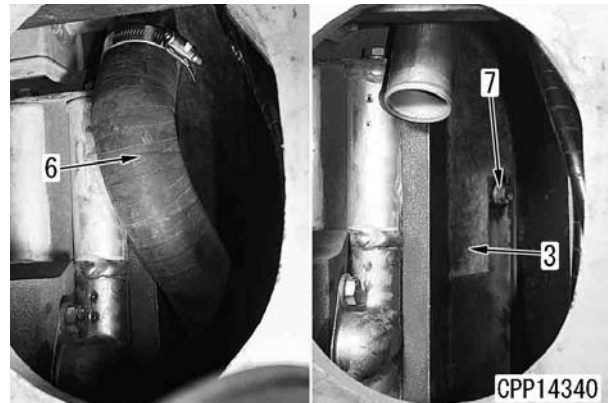


4. Remove cover (5).

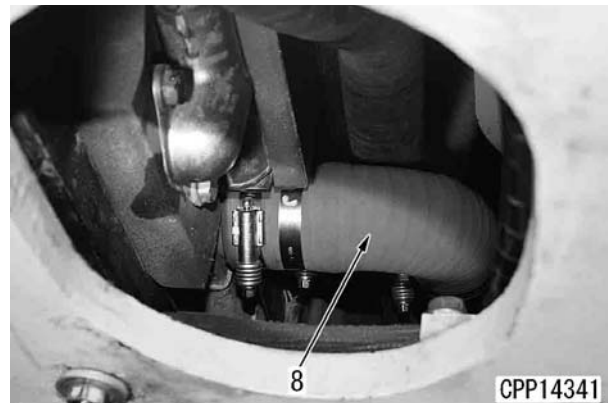


5. Disconnect radiator hose (6). [*1]

6. Remove mounting bolts (7) for cover (3).



7. Remove aftercooler hose (8).



Installation

- Installation is done in the reverse order of removal.

[*1]

- ★ Align the hose to the original position (marking position).
- ★ Align the clamp to the original position.

★ Reference

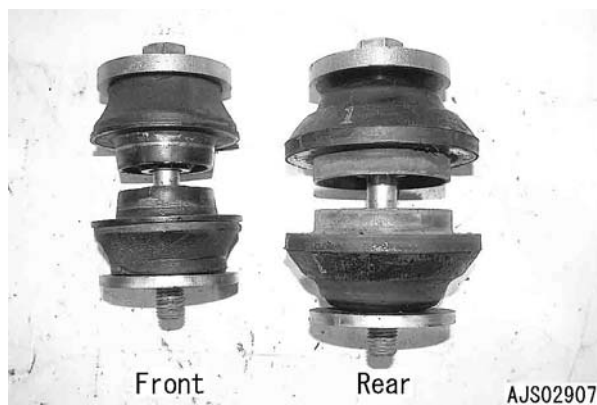
Inserted hose length: 49 mm

 Radiator hose clamp:

10.8 – 11.8 Nm {1.1 – 1.2 kgm}

[*2]

- ★ The bolt length of the engine front side is shorter than that of rear side.
- ★ The engine mounting rubber size of the engine front side is smaller than that of rear side.



 Engine mounting bolt:

245 – 308.9 Nm {25 – 31.5 kgm}

• Refilling engine coolant

Refill coolant through the coolant filler port up to the specified level. Start the engine and circulate the coolant, and then check the coolant level.

 Coolant: **21 ℓ**

• Refilling with oil (hydraulic tank)

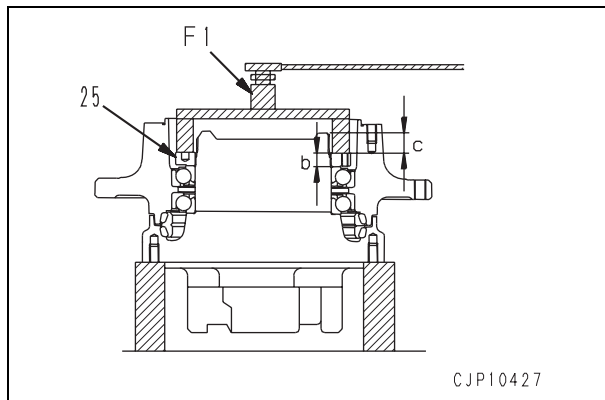
Refill with hydraulic oil through the oil filler port to the specified level. Let the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.

 Hydraulic tank: **126 ℓ**

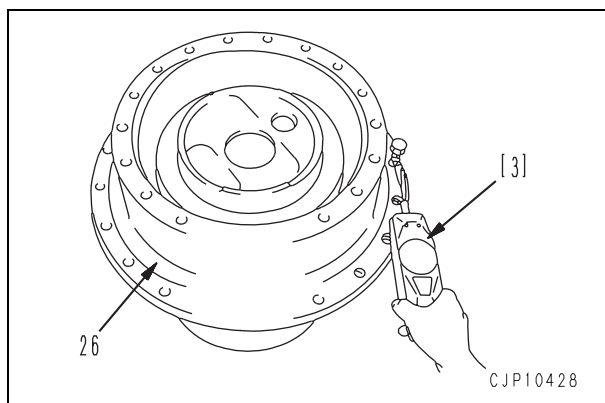
 Hydraulic tank drain plug:

58.8 – 78.5 Nm {6.0 – 8.0 kgm}

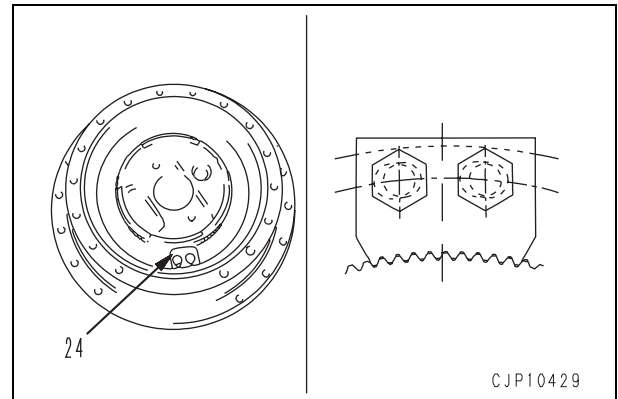
- 4) Measure thickness (b) of lock (25).
- 5) Calculate screwing depth (c) of lock (25) from measured distance (a) and thickness (b).
 - $(c) = (a) - (b) - (0 \text{ to } 0.1)$
- 6) Using tool **F1**, screw in lock (25) to calculated depth (c).
 - ★ Screwing depth (c) is the distance from the top of the travel motor to the top of the lock.



- 7) Using push puller scale [3], measure the tangential force (starting force) of hub assembly (26).
 - ★ Measure the tangential force (starting force) at the sprocket mounting bolt hole.
 - Tangential force (Starting force): Max. 294 N {Max. 30 kg}
 - ★ If the tangential force (starting force) is abnormal, disassemble again and check for the cause.

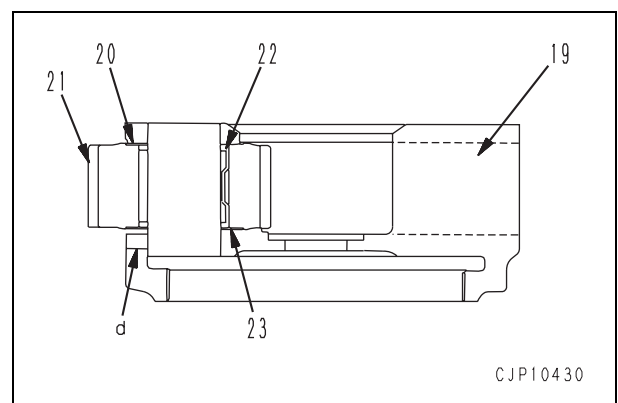


- 8) Install lock (24).
 - ✎ Mounting bolt: **Adhesive (LT-2)**
 - ★ Do not apply adhesive to the screw hole of the lock.
 - ★ When installing the lock, fit it to the spline of the travel motor.



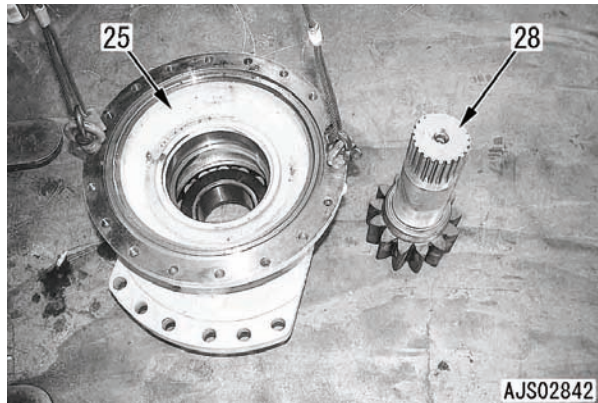
4. No. 2 carrier assembly

- 1) Assemble the No. 2 carrier assembly according to the following procedure.
 - 1] Install thrust washer (23), needle roller bearing (22), No. 2 planetary gear (21), and thrust washer (20) to carrier (19).
 - ★ When using the disassembled carrier as it is, repair the caulked parts around pin hole (d) of the carrier in advance.
 - ★ Replace the thrust washer with new one.

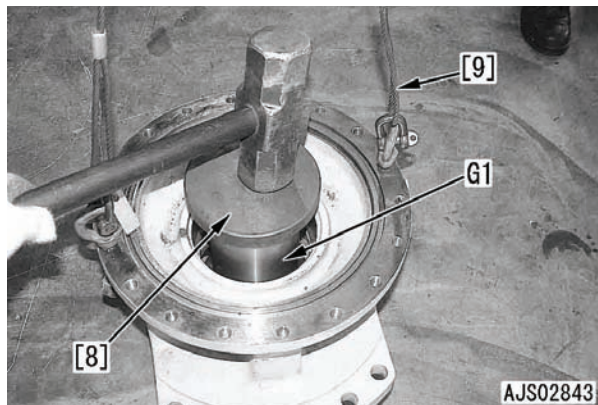


3. Shaft and case assembly

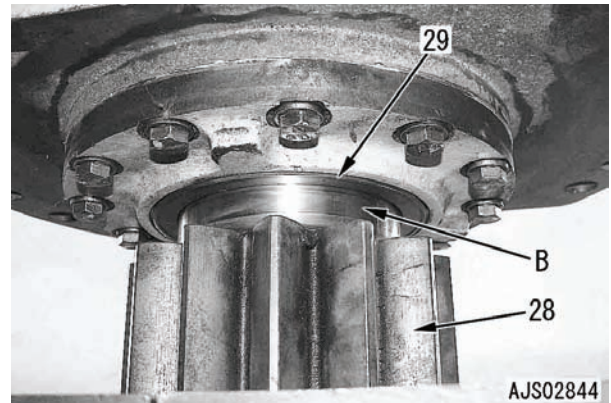
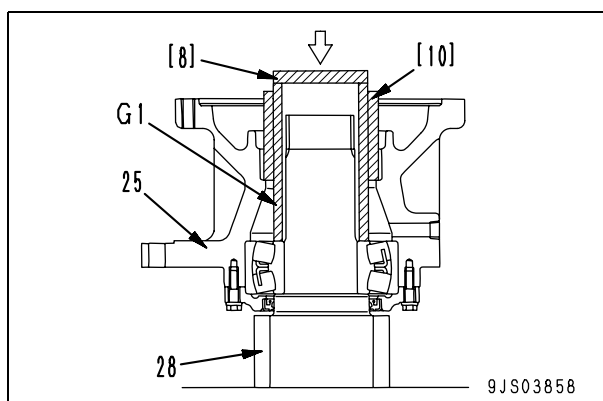
- 1) Set case assembly (25) to shaft (28).
- ★ Take care not to damage the oil seal.



- 2) Using push tools **G1** and [8], hit the shaft so that it will not fall down.
- ★ Loosen sling [9].



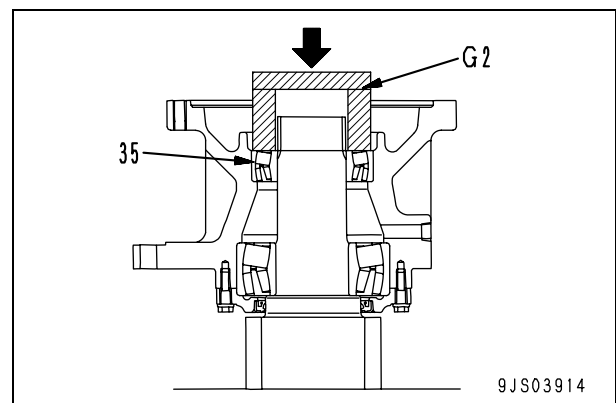
- 3) Set the assembly on the press.
- 4) Using push tools **G1**, [8] and [10], press fit the bearing inner race.
- ★ Press fitting force: Several ton
- ★ Set push tool [10] so that case assembly (25) will not slant largely.
- ★ Hit the flange of case assembly (25) lightly and frequently to correct its slant.
- ★ Set case assembly (25) horizontally so that oil seal lip contact face (B) of shaft (28) will be at the center of oil seal (29).



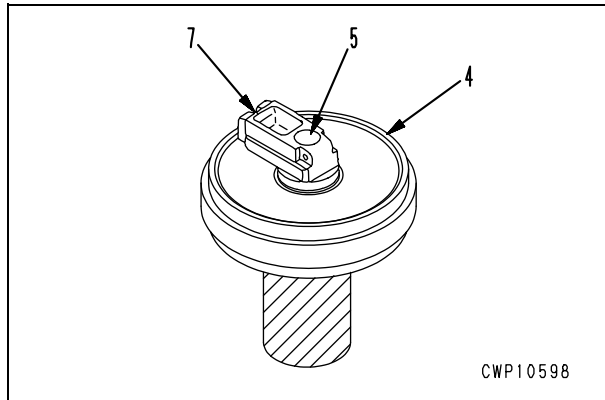
4. Sub bearing

Using tool **G2**, press fit bearing (35).

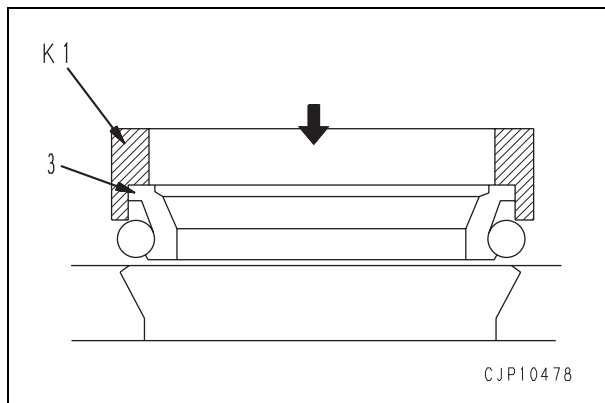
- ★ Use new bearing (35).
- ★ Press the bearing inner race and outer race simultaneously.
- Press fitting force for bearing (Reference):
Inner race side:
 $9.4 - 26.6 \text{ kN} \{960 - 2,710 \text{ kg}\}$
Outer race side: $0 - 8.9 \text{ kN} \{0 - 910 \text{ kg}\}$
- ★ After press fitting the bearing, check that the case rotates smoothly.



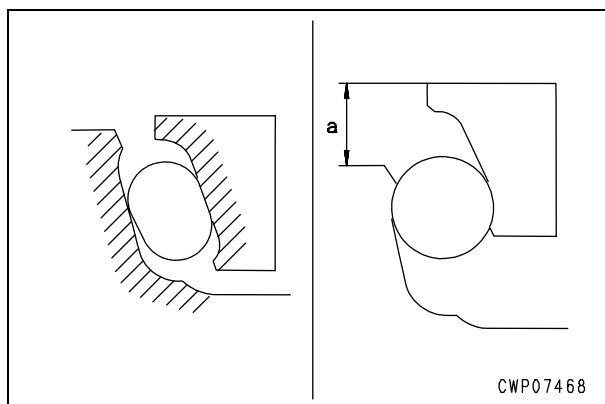
4. Install shaft and support assembly (5 and 7) to idler (4).



5. Using tool **K1**, install floating seal (3) to idler (4) and support (2).



- ★ Thoroughly degrease and dry the O-ring and O-ring fitting surface of the floating seal (hatched parts) before installing. Take care that the contact surfaces of the floating seal will be free from dirt.
- ★ After installing the floating seal, check that its slant is less than 1 mm and its projection (a) is 5 – 7 mm.



6. Fit the O-ring, install support (2) to shaft (5), and secure them with dowel pin (1).

7. Using tool **K2**, fill the shaft with oil.



Quantity of oil: **70 – 80 cc (SAE30)**



Oil filler plug:

157 – 255 Nm {16 – 26 kgm}

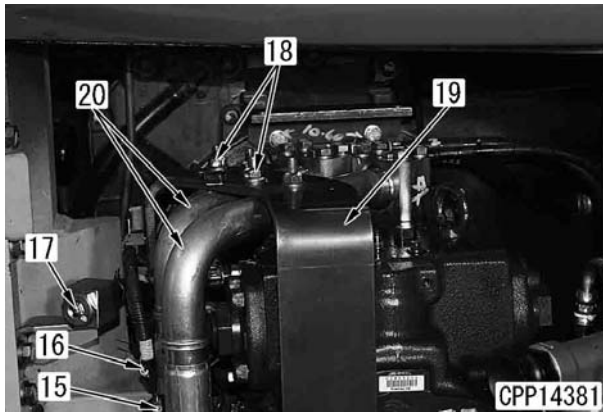
13. Disconnect connectors (15) and (16).
 - (15) : V19 (Red) on front pump side
 - (16) : V11 (White) on rear pump side

14. Disconnect damper case oil feed hose (17).

15. Disconnect high-pressure pipe clamps (18).

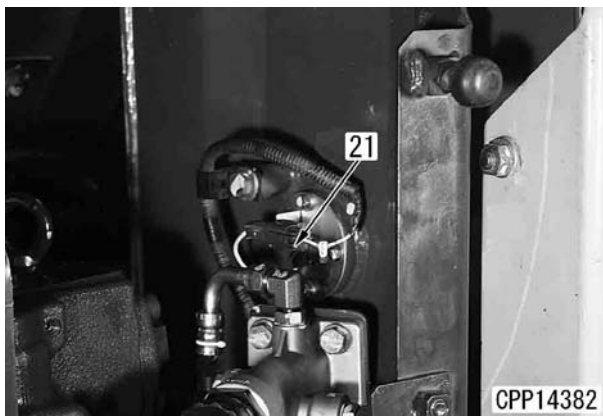
16. Remove bracket (19).

17. Disconnect 2 high-pressure pipes (20).



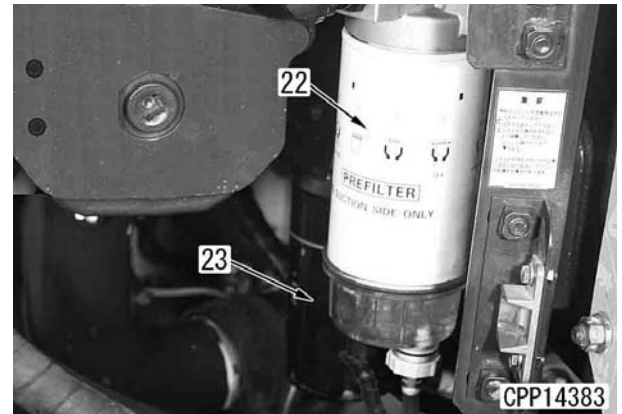
18. Disconnect fuel tank fuel level sensor connector (21).

★ Disconnect the wiring clamp, too.



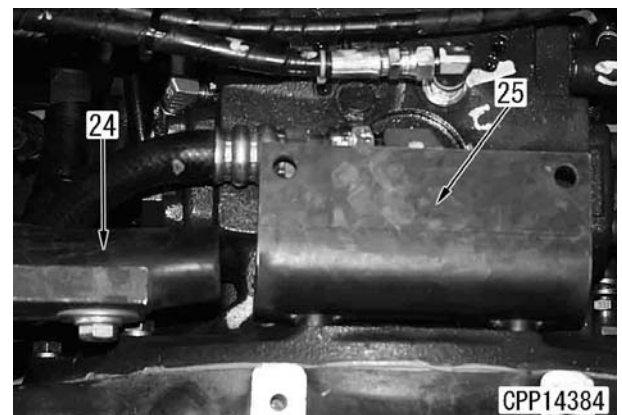
19. Disconnect pre-filter (22) and its bracket together.

20. Disconnect engine oil filter (23) and its bracket together.



21. Remove partition (rubber) (24) and its bracket together from the hydraulic tank.

22. Remove bracket (25).



- ★ Apply grease (G2-LI) to the rocking part of shaft (14) and the contact surfaces of lever (15) and piston (7) and the contact surfaces of damper (16) and pin (17).

 Quantity of grease (G2-LI)

Rocking part of shaft: **4 – 8 cc/periphery**

Contact surfaces of lever (15) and piston (7):

0.3 – 0.8 cc/place

Contact surfaces of damper (16) and pin

(17): **0.3 – 0.8 cc/place**

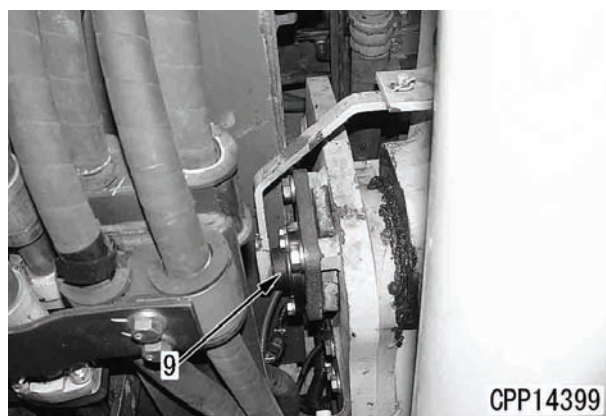
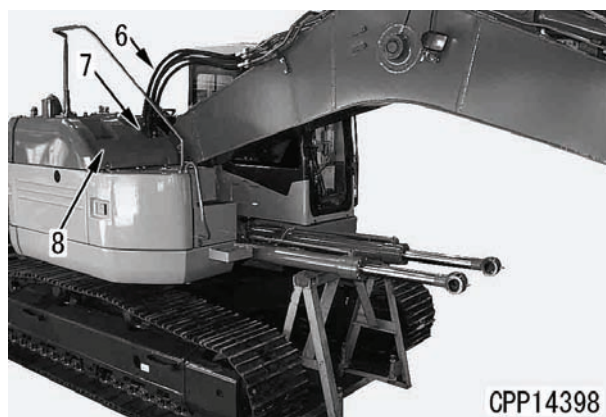
- ★ Install washer (18) 1.6 mm thick first. If the difference between both sides at the stroke end of the lever exceeds 0.7°, change the washer thickness to reduce the difference to below 0.7°. (If the washer thickness is reduced by 0.3 mm, the stroke end angle is increased by 0.39°.)

- Thickness of washer (t):
1.0, 1.3, 1.6, 1.9, 2.2 mm

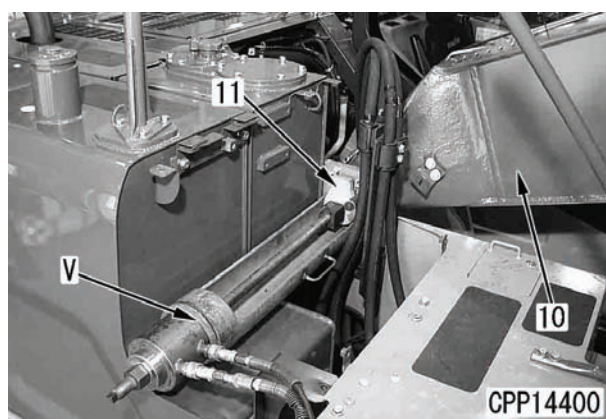
- ★ Tighten each part to the following torque.

- Bolt (19): 27 – 34 Nm {2.8 – 3.5 kgm}
- Screw (20):
0.441 – 0.558 Nm {0.045 – 0.06 kgm}
- Bolt (21): 25 – 31 Nm {2.5 – 3.2 kgm}
- Bolt (24): 19.6 – 27.4 Nm {2.0 – 2.8 kgm}
- Plug (25): 24.5 – 34.3 Nm {2.5 – 3.5 kgm}
- Plug (26): 24.5 – 34.3 Nm {2.5 – 3.5 kgm}
- Plug (27): 9.8 – 14.7 Nm {1.0 – 1.5 kgm}
- Plug (28): 4 – 9 Nm {0.4 – 0.9 kgm}
- Plug (29): 6 – 11 Nm {0.6 – 1.1 kgm}
- Plug (30): 1.27 – 1.67 Nm {0.13 – 0.17 kgm}

6. Disconnect the hoses (6) for the arm cylinder and bucket cylinder (4 pieces in total) and put oil stopper plugs.
7. Disconnect working lamp connector (CN-A42).
8. Remove covers (7) and (8) and boom angle potentiometer (9).
[*3]
★ See Testing and adjusting, "Replacement procedure for boom angle potentiometer".



9. Sling work equipment assembly (9). Using tool V, remove foot pin (10). Remove the work equipment assembly.
[*4]
 Work equipment assembly: 3,400 kg

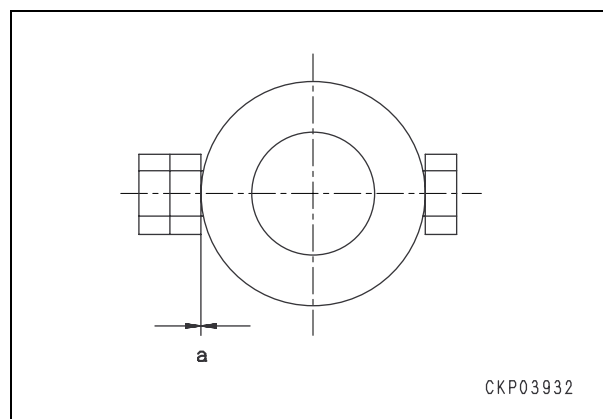


Installation

- Carry out installation in the reverse order to removal.

[*1]

- ★ Tighten the locknut so that clearance (a) between the plate and nut will be 0.5 – 1.5 mm.



[*2]

-  Inside wall of bushing before assembling pin:

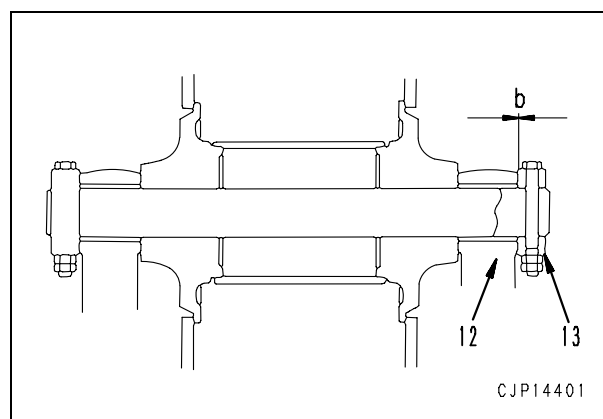
Anti-friction composition (LM-P)

-  Greasing after assembling pin:

Grease (LM-G)

- ⚠ **When aligning the pin holes, never insert your fingers in them.**

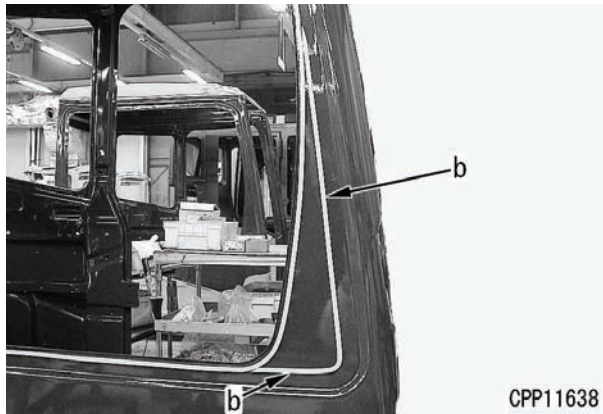
- ★ Adjust the shim thickness so that clearance (b) between cylinder rod (12) and plate (13) will be 1 mm or less.
★ Standard shims: 0.8, 1.5 mm



[*3]

- ★ Initialize the boom positioner. For details, see Testing and adjusting, "Special functions of machine monitor".

- ★ As for right side window glass (1), apply the primer to only the surfaces to stick both-sided adhesive tapes and the surfaces out of those surfaces.
 - Part (b)
- ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.

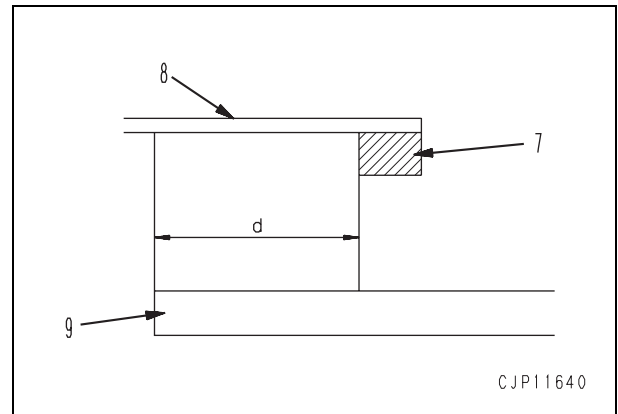


- ★ Never apply wrong primer. If the glass primer is applied by mistake, wipe it off with white gasoline.
- 4) Evenly apply glass primer to the sticking surfaces of window glass (9).
-  Glass primer: **SUNSTAR GLASS PRIMER 580 SUPER or equivalent**
- ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)

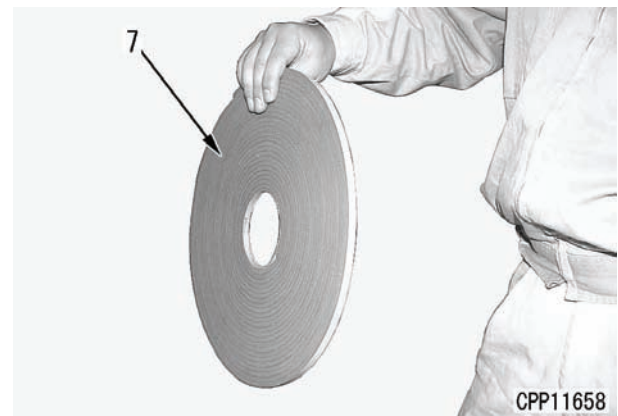


- ★ Parts to be coated with primer: Apply the primer to the sticking surfaces of window glass (9) and all over dimension (d) which will be on both-sided adhesive tape (7) and operator's cab (8).
- ★ Do not apply the primer to the boarder about 5 mm wide between the black part and transparent part of the glass.
- ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.

- ★ Never apply wrong primer. If the glass primer is applied by mistake, wipe it off with white gasoline.



4. Stick both-sided adhesive tape (7) along the inside edge of the glass sticking section.
- ★ Do not remove the release tape of the both-sided adhesive tape on the glass sticking side before sticking the glass.
 - ★ When sticking the both-sided adhesive tape, do not touch the cleaned surface as long as possible.
 - ★ Take care that the both-sided adhesive tape will not float at each corner of the window frame.



Removal and installation of engine controller assembly

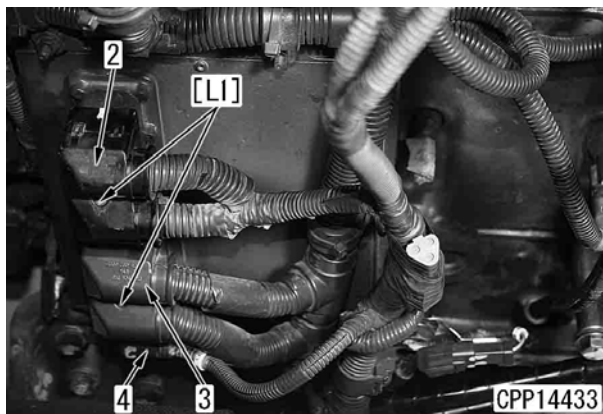
Removal

⚠ Disconnect the cable from the negative (-) terminal of the battery.

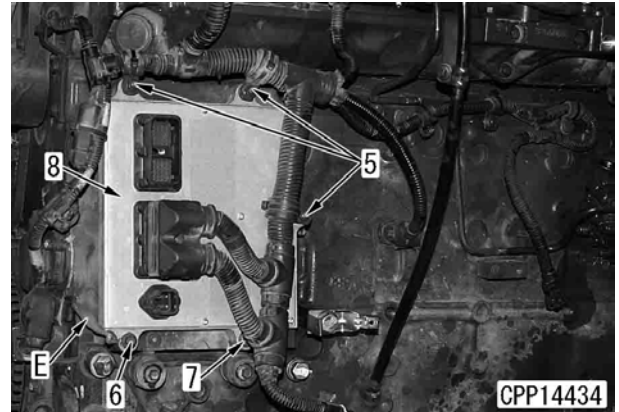
1. Remove counterweight (1). For details, see "Removal and installation of maintenance counterweight assembly (at rear part of engine)".



2. Disconnect connectors (2), (3) and (4).
 - ★ Connectors (2) and (3) are locked with hexagon socket head bolts [L1] (4 mm).
 - ★ When disconnecting connector (4), press its lock.



3. Remove 3 controller mounting nuts (5). [*1]
 - ★ Bolts (5) are used to fix the wiring harness clamps, too.
4. Remove 2 controller mounting bolts (6) and (7). [*2]
 - ★ Bolt (6) is used to fix ground wire (E), too.
5. Remove engine controller (8).



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