SEN04343-08

Shop Manual

BULLDOZER

D31EX-22
D31PX-22
D37EX-22
D37PX-22

SERIAL NUMBERS D31EX-60001
D31PX-60001
D37EX-60001
D37PX-60001
and up

ecot3

KOMATSU

How to read the shop manual

- Some attachments and optional parts in this shop manual may not be delivered to certain areas. If one of them is required, consult KOMATSU distributors.
- Materials and specifications are subject to change without notice.
- Shop manuals are divided into the “Chassis volume” and “Engine volume”. For the engine unit, see the engine volume of the engine model mounted on the machine.

1. Composition of shop manual

This shop manual contains the necessary technical information for services performed in a workshop. For ease of understanding, the manual is divided into the following sections.

00. Index and foreword

This section explains the shop manuals list, table of contents, safety, and basic information.

01. Specification

This section explains the specifications of the machine.

10. Structure, function and maintenance standard

This section explains the structure, function, and maintenance standard values of each component. The structure and function sub-section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting. The maintenance standard sub-section explains the criteria and remedies for disassembly and service.

20. Standard value table

This section explains the standard values for new machine and judgement criteria for testing, adjusting, and troubleshooting. This standard value table is used to check the standard values in testing and adjusting and to judge parts in troubleshooting.

30. Testing and adjusting

This section explains measuring instruments and measuring methods for testing and adjusting, and method of adjusting each part. The standard values and judgement criteria for testing and adjusting are explained in Testing and adjusting.

40. Troubleshooting

This section explains how to find out failed parts and how to repair them. The troubleshooting is divided by failure modes. The “S mode” of the troubleshooting related to the engine may be also explained in the Chassis volume and Engine volume. In this case, see the Chassis volume.

50. Disassembly and assembly

This section explains the special tools and procedures for removing, installing, disassembling, and assembling each component, as well as precautions for them. In addition, tightening torque and quantity and weight of coating material, oil, grease, and coolant necessary for the work are also explained.

90. Diagrams and drawings (chassis volume)/Repair and replacement of parts (engine volume)

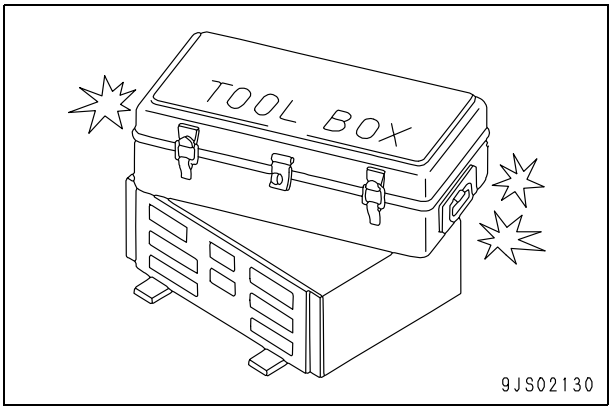
- Chassis volume
  This section gives hydraulic circuit diagrams and electrical circuit diagrams.
- Engine volume
  This section explains the method of reproducing, repairing, and replacing parts.

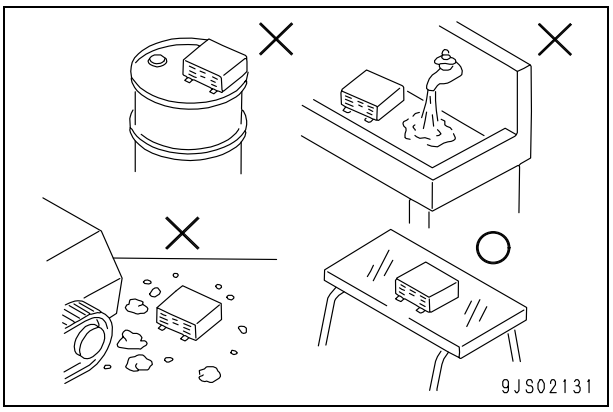
2. Revision and distribution

Any additions, revisions, or other change of notices will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

4. Handling controller

1) The controller contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the controller.
2) Do not place objects on top of the controller.
3) Cover the control connectors with tape or a vinyl bag. Never touch the connector contacts with your hand.
4) During rainy weather, do not leave the controller in a place where it is exposed to rain.
5) Do not place the controller on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand).
6) Precautions when carrying out arc welding
When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the controller. Fit an arc welding ground close to the welding point.





5. Points to remember when troubleshooting electric circuits

1) Always turn the power OFF before disconnecting or connecting connectors.
2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
   ★ Disconnect and connect the related connectors several times to check.
3) Always connect any disconnected connectors before going on to the next step.
   ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
   ★ If there is any change, there is probably defective contact in that circuit.

2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference and fix them with intermediate clamps, if there are any.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pins and lock plates securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2 – 3 drops of adhesive.
- When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- Clean all parts, and correct any damage, dents, burrs, or rust.
- Coat rotating parts and sliding parts with engine oil.
- When press fitting parts, coat the surface with anti-friction compound (LM-P).
- After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
- When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:
  1) Start the engine and run at low idle.
  2) Operate the work equipment control lever to operate the hydraulic cylinder 4 – 5 times, stopping the cylinder 100 mm from the end of its stroke.
  3) Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.
  4) After doing this, run the engine at normal speed.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operation

1) Refilling with coolant, oil and grease
   - If the coolant has been drained, tighten the drain valve, and add coolant to the specified level. Run the engine to circulate the coolant through the system. Then check the coolant level again.
   - If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
   - If the piping or hydraulic equipment have been removed, always bleed the air from the system after reassembling the parts.
     ★ For details, see Testing and adjusting, “Bleeding air”.
   - Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.
2) Checking cylinder head and manifolds for looseness
   Check the cylinder head and intake and exhaust manifold for looseness.
   If any part is loosened, retighten it.
   - For the tightening torque, see “Disassembly and assembly”.
3) Checking engine piping for damage and looseness
   Intake and exhaust system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for air suction and exhaust gas leakage.
   If any part is loosened or damaged, retighten or repair it.
   Cooling system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for coolant leakage.
   If any part is loosened or damaged, retighten or repair it.
   Fuel system
   Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for fuel leakage.
   If any part is loosened or damaged, retighten or repair it.

Millimeters to inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liters to U.S. Gallons

1 ℓ = 0.2642 U.S.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Machine model/type				D31EX-22	D31PX-22
				400 mm Single shoe	600 mm Single shoe
Serial No.				60001 and up	60001 and up
Engine	Model name		—	SAA4D95LE-5	
	Type		—	4-cycle, water-cooled, in-line 4-cylinder, direct injection type with turbocharger and air-cooled aftercooler	
	Number of cylinders – Bore x Stroke		mm	4 – 95 x 115	
	Total displacement		ℓ {cc}	3.26 {3,260}	
	Performance	Rated output • Net [ISO 9249/SAE J1349] (*1) • Gross [SAE J1995] (*2)	kW{HP}/rpm	58 {78}/2,200 59.6 {80}/2,200	
		Max. torque	Nm{kgm}/rpm	350 {35.7}/1,500	
		High idle speed under no load	rpm	2,400	
		Low idle speed under no load	rpm	975	
		Min. fuel consumption	g/kWh{g/HPh}	235 {175}	
	Starting motor		—	24 V, 4.5 kW	
	Alternator		—	24 V, 35 A (Canopy specification) 60 A (Cab specification)	
	Battery (*3)		—	12 V, 92 Ah x 2 pieces	
	Radiator core type		—	Aluminum corrugate, 8/2	
Power train	HST pump	Type, number of unit (Main pump) (Charge pump)	—	Variable displacement swash plate piston type x 2 Fixed displacement gear type x 1	
		Delivery (Main pump) (Charge pump)	cm^3/rev	63 36	
		Set pressure (Main pump) (Charge pump)	MPa{kg/cm^2}	41.2 {420} 3.23 {33}	
	HST motor	Type, number of unit	—	Variable displacement bent axis piston type (with parking brake) x 2	
		Delivery	cm^3/rev	105	
	Final drive		—	Planetary gear, 2-stage reduction, splash lubrication type	
Undercarriage	Suspension type		—	Rigid type	
	Carrier roller		—	1 piece on each side	
	Track roller		—	6 pieces on each side	
	Track shoe • Assembly-type single grouser		—	Width: 400 mm Each side: 40 pieces Pitch: 154 mm	Width: 600 mm Each side: 40 pieces Pitch: 154 mm
	• Assembly-type special swamp shoe		—	—	—

*1: Indicates the value at the lowest cooling fan speed.
*2: Indicates the value of the engine alone (without cooling fan.)
★ The engine rated output is indicated in the net value and gross value. Gross denotes the rated output measured of an independent engine. While, net denotes the value measured of an engine under the condition essentially the same as that when it is installed on machine.
★ Following shows the rated output (net) at the maximum cooling fan speed.
53 kW {71 HP}/2,200 rpm
*3: The battery capacity (Ah) is indicated in the 5-hour rate value.

Unit: kg

Machine model/type	D37EX-22	D37PX-22
Serial No.	60001 and up	60001 and up
Power angle and power tiltdozer assembly (Including center ball, pitch link and pin)	1,070	1,140
• Blade	580	650
• Dozer frame	400	400
• Tilt cylinder assembly	20	20
• Angle cylinder assembly	23 x 2	23 x 2
Lift cylinder assembly	20 x 2	20 x 2
Ripper assembly (Including ripper cylinder)	490	—
Ripper cylinder assembly	30	—
ROPS cab assembly (Including floor, seat, and air conditioner)	1,176 (2,590)	1,176 (2,590)
ROPS canopy assembly (Including floor and seat mount)	800	800
Operator seat		
• Standard seat	64 (141)	64 (141)
• High-back seat	67 (148)	67 (148)
• Air suspension seat	74 (163)	74 (163)
Rear mask assembly	33	33
Engine hood assembly (Including door, pre-cleaner and air cleaner)	167	167

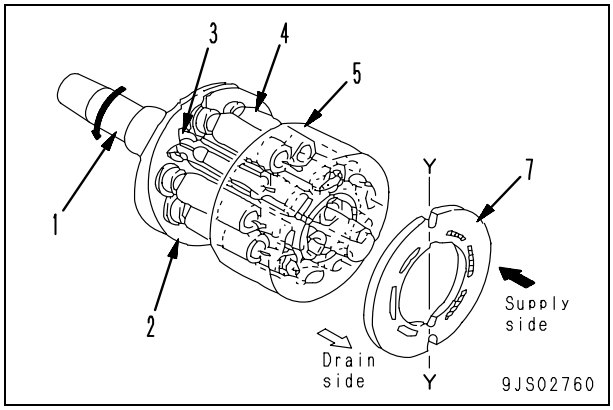
Hydraulic motor

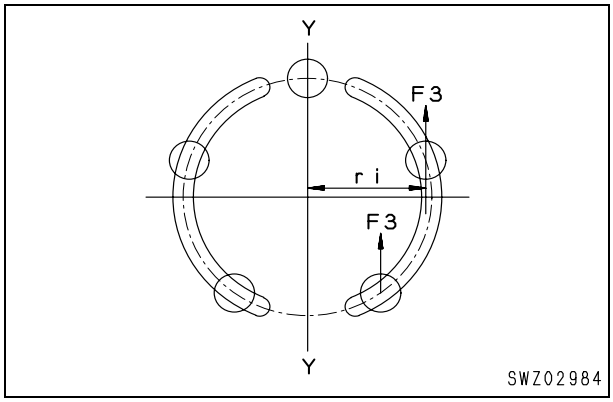
Function

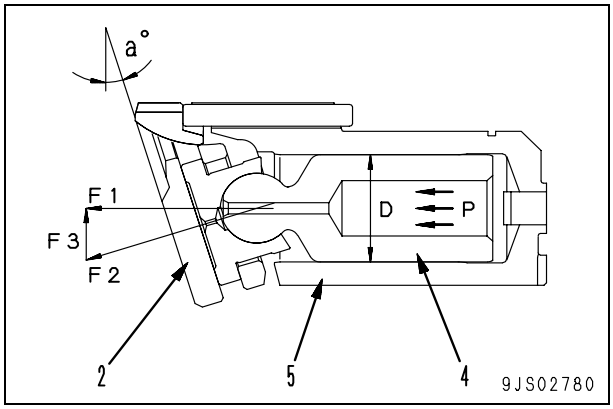
- This hydraulic motor is called a swash plate axial piston motor. It converts the energy of the pressurized oil sent from the hydraulic pump into rotary motion.

Principle of operation

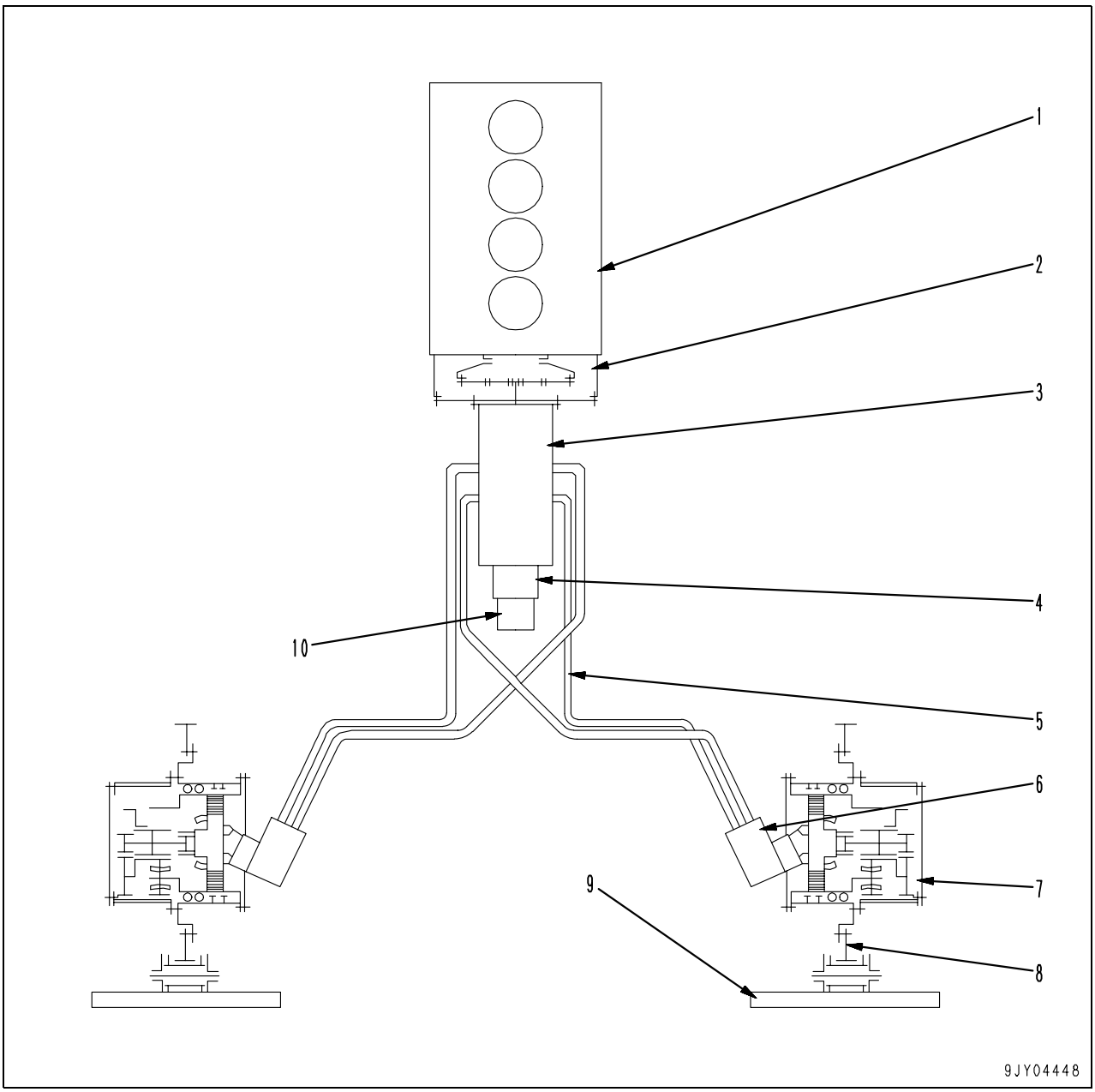
- The pressurized oil sent from the hydraulic pump flows through valve plate (7) into cylinder block (5).
- This pressurized oil flows to the only one side of the (Y - Y) line connecting the top dead center and bottom dead center of the stroke of piston (4).
- The oil sent to one side of cylinder block (5) presses respective pistons (4) [2 or 3 pieces], and generates force (F1) [F1 = P x π D^2/4].
- This force is applied to thrust plate (2). Since thrust plate (2) is fixed at the specified angle of (a) degrees to output shaft (1), the force is divided into components (F2) and (F3).
- The radial component (F3) generates torque (T = F3 x ri) against the (Y -Y) line connecting the top dead center and bottom dead center.
- The result of this torque [T = ∑ (F3 x ri)] rotates cylinder block (5) through piston (4).
- Since this cylinder block (5) is splined to the output shaft, the output shaft revolves to transmit the torque.







Power train system

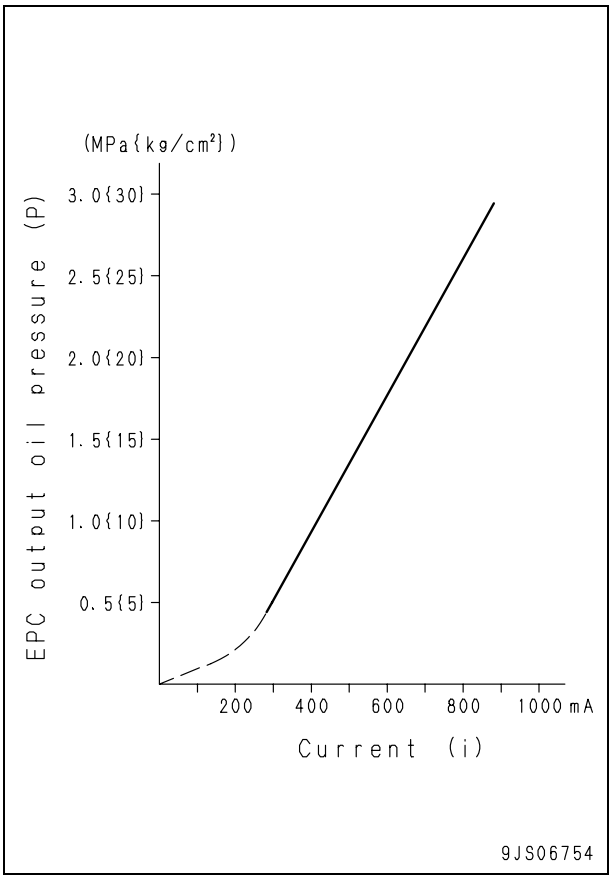


1. Engine
2. Damper
3. HST pump
4. Work equipment and fan pump
5. High-pressure hose
6. HST motor
7. Final drive
8. Sprocket
9. Track shoe
10. Charge pump

Unit: mm

No.	Item	Criteria					Remedy
		Standard size			Repair limit		
7	Return spring	Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	If damaged or deformed, replace EPC valve assembly
		9.0	8.4	3.14 N {0.32 kg}	—	2.55 N {0.26 kg}	

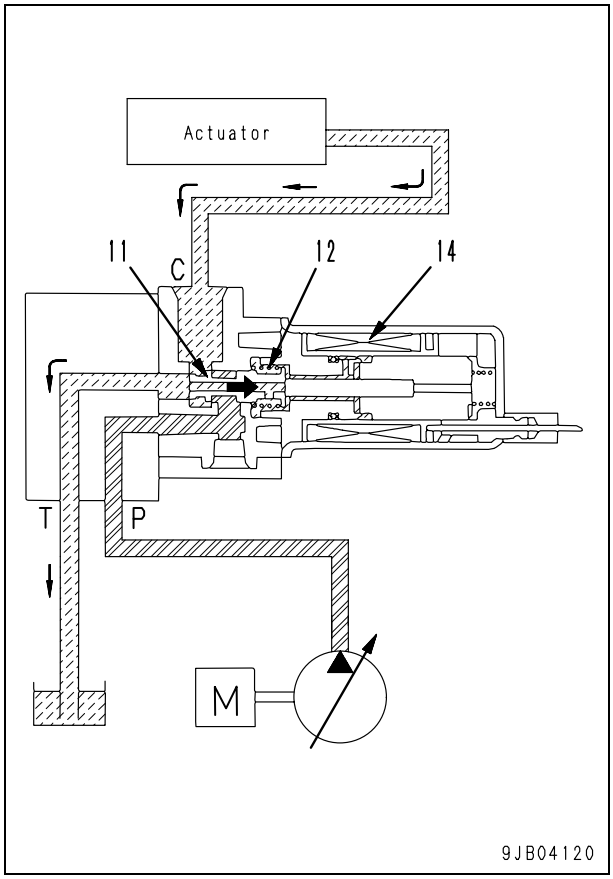
Function



- The EPC valve consists of the proportional solenoid and hydraulic valve.
- Upon receiving signal current (i) from the controller, EPC valve generates EPC output pressure proportional to signal current (i), and outputs it to the actuator.

Operation

1. When signal current is 0 (coil is de-energized)

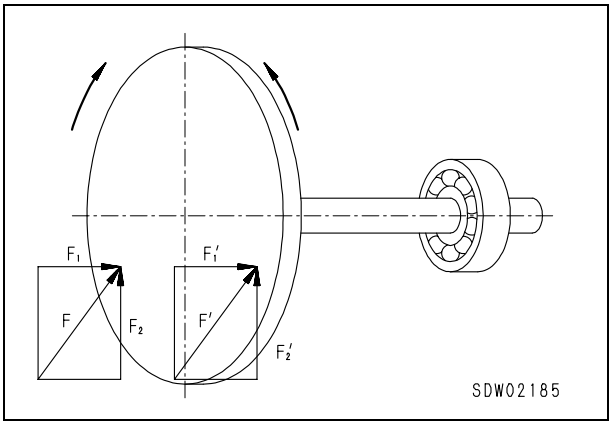


- While the signal current from the controller is not flowing to coil (14), coil (14) is de-energized.
- Spool (11) is pushed to the right by spring (12).
- Port (P) is closed and the pressurized oil from the self pressure reducing valve does not flow to the actuator.
- The pressurized oil from the actuator is drained to the tank through port (C) and port (T).

3. Operation of piston motor

Principle

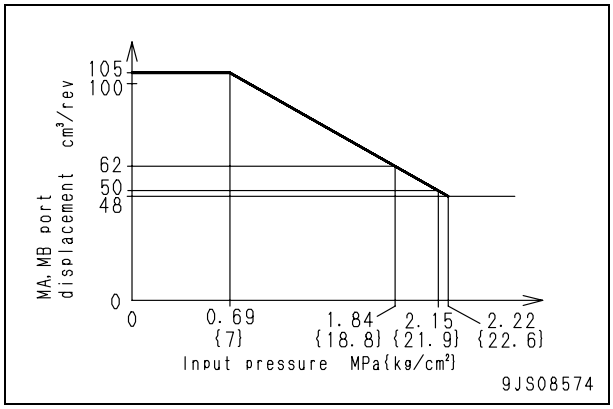
- It is assumed that the shaft of the disc is supported to enable free rotation of the disc. If force (F) is applied to this disc at an angle, this force (F) is divided into force (F1) applied at a right angle to the face of the disc and force (F2) applied in the direction of the circumference of the disc. Then force (F1) pushes the disc in the axial direction, and force (F2) rotates the disc in a clockwise direction.
- Similarly, if force (F') is applied to the disc instead of (F), (F') is divided to (F'1) and (F'2), and (F'2) rotates the disc in the counterclockwise direction.

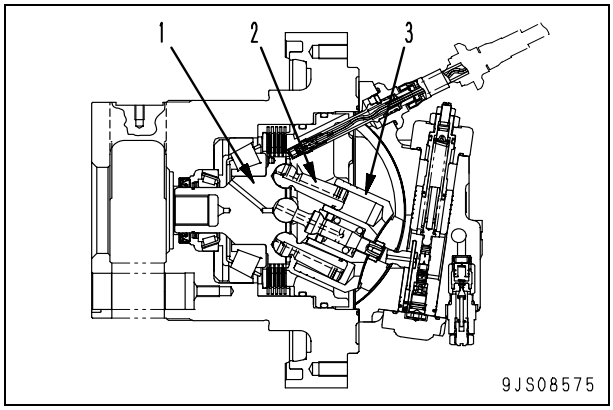


Structure

- Seven pistons (2) are installed on the disc portion of drive shaft (1) like spherical joints. Pistons (2) being installed at a certain angle to drive shaft (1) are fitted inside cylinder block (3).
- The inclination angle of cylinder block (3) and pistons (2) is determined by the capacity control signal pressure applied to port (P). The following figure illustrates the relationship between the signal pressure and volume.

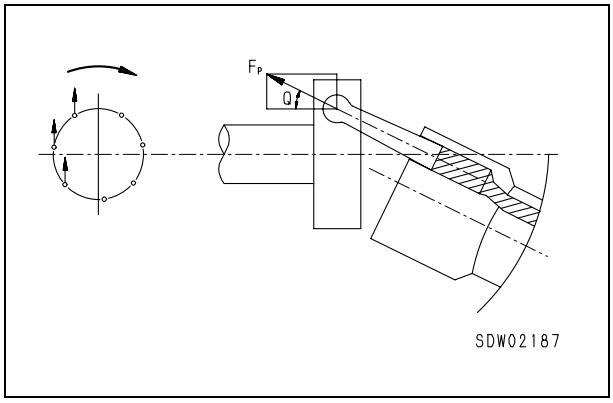
Pilot pressure – Displacement chart (Under no load)





Operation

- The oil sent under pressure from the main piston pump enters from the piston motor inlet port and generates oil pressure on the rear face of piston (2). And drive shaft (1) is rotated by angle (Q) of piston (2) and cylinder block (3).



BULLDOZER

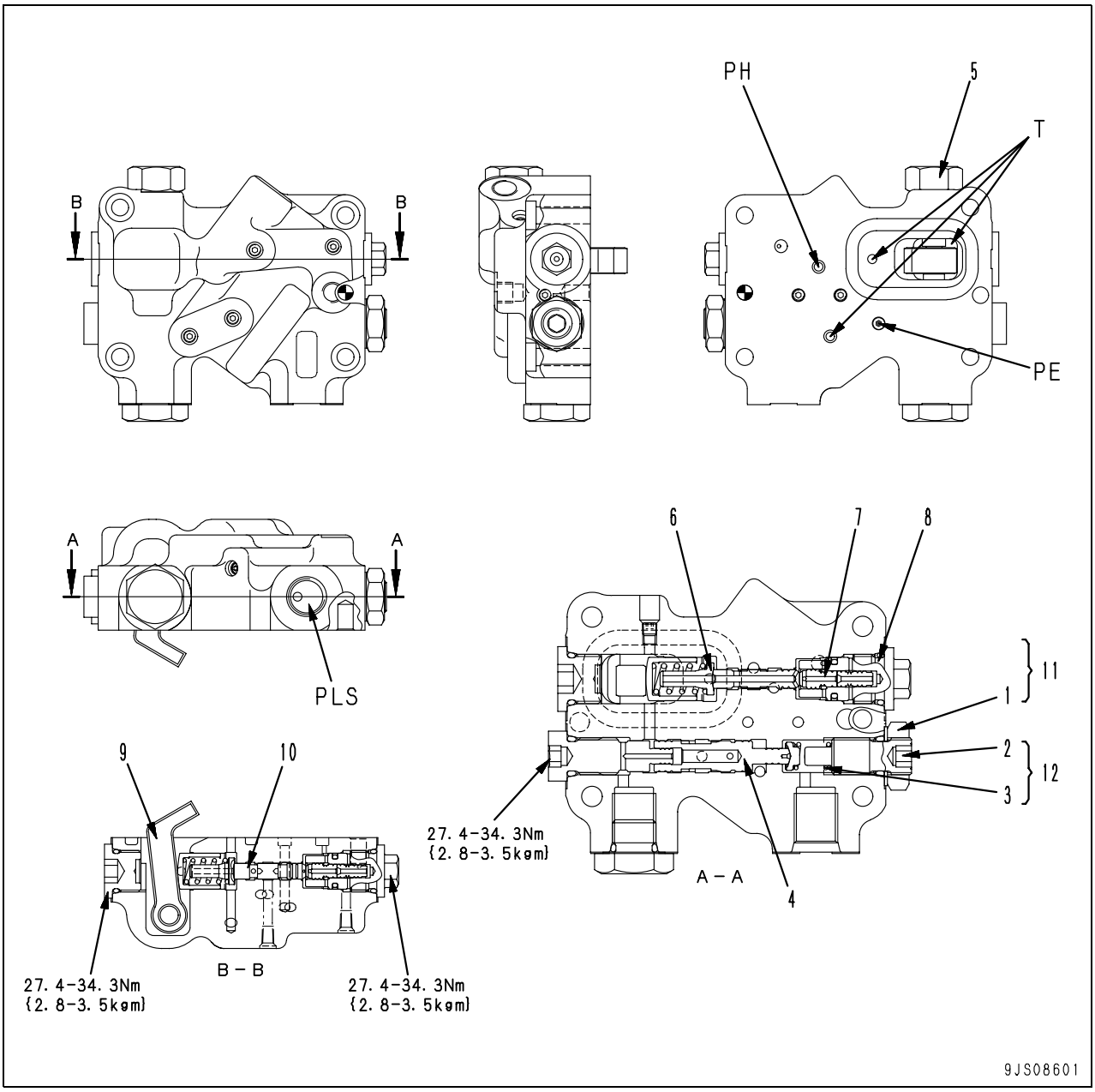
D31EX-22
D31PX-22
D37EX-22
D37PX-22

Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

10 Structure, function and maintenance standard

300 Undercarriage and frame

Servo valve



PE: Control pressure output port
PH: Pump pressure port
PLS: LS pressure input port
T: Drain port

1. Locknut
2. Plug
3. Spring
4. Spool
5. Plug
6. Seat
7. Piston
8. Sleeve
9. Lever
10. Spool
11. PC valve
12. LS valve

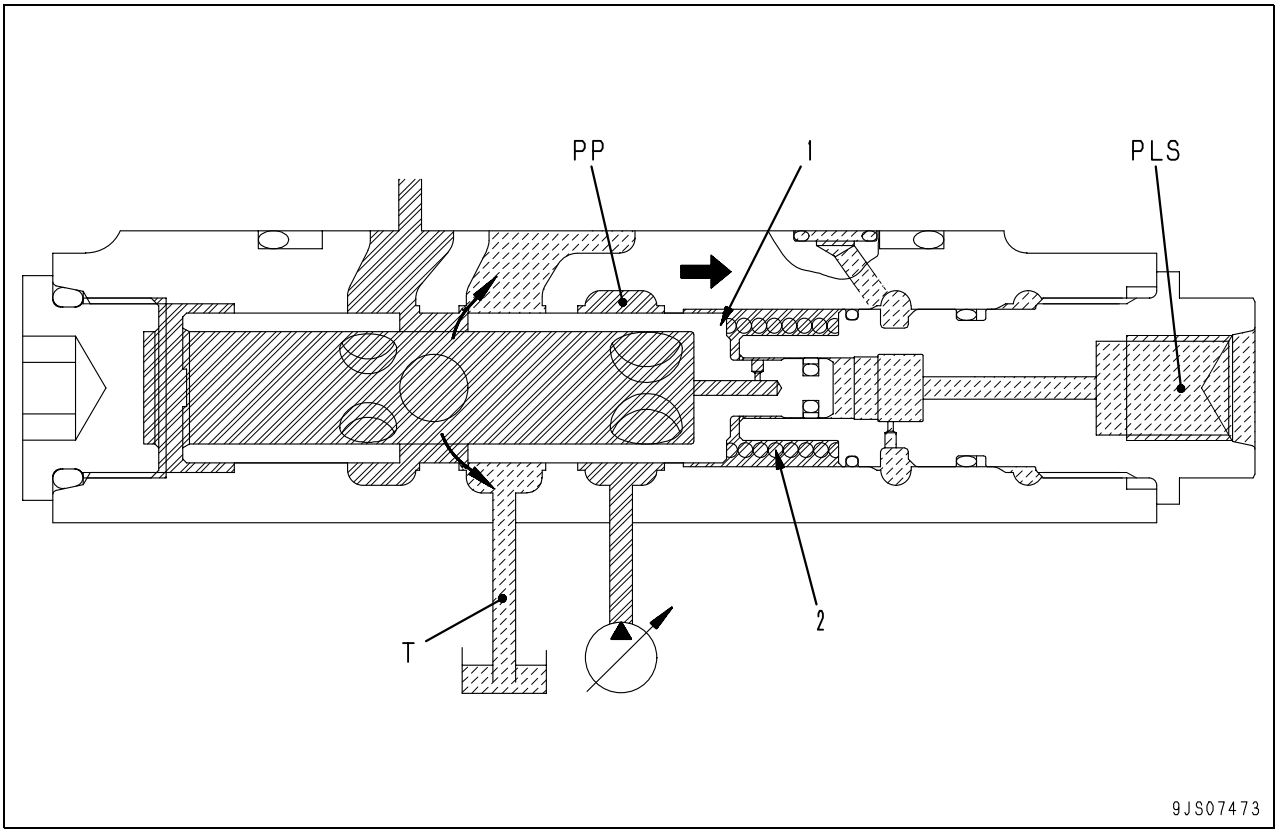
1. Unload valve
2. Pressure compensation valve F (fan)
3. Pressure compensation valve F (lift)
4. Pressure compensation valve F (tilt)
5. Pressure compensation valve F (angle)
6. Pressure compensation valve F (ripper)
7. Pressure compensation valve R (ripper)
8. Pressure compensation valve R (angle)
9. Pressure compensation valve R (tilt)
10. Pressure compensation valve R (lift)
11. Pressure compensation valve R (fan)

F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Item	Criteria					Remedy
		Standard size			Repair limit		
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
12	Unload valve spring	28.64 x 18.6	18	91.2 N {9.3 kg}	—	73.0 N {7.44 kg}	If damaged or deformed, replace the spring

2. When control valve is controlled in fine control



PP: Pump circuit
PLS: LS circuit
T: Tank circuit

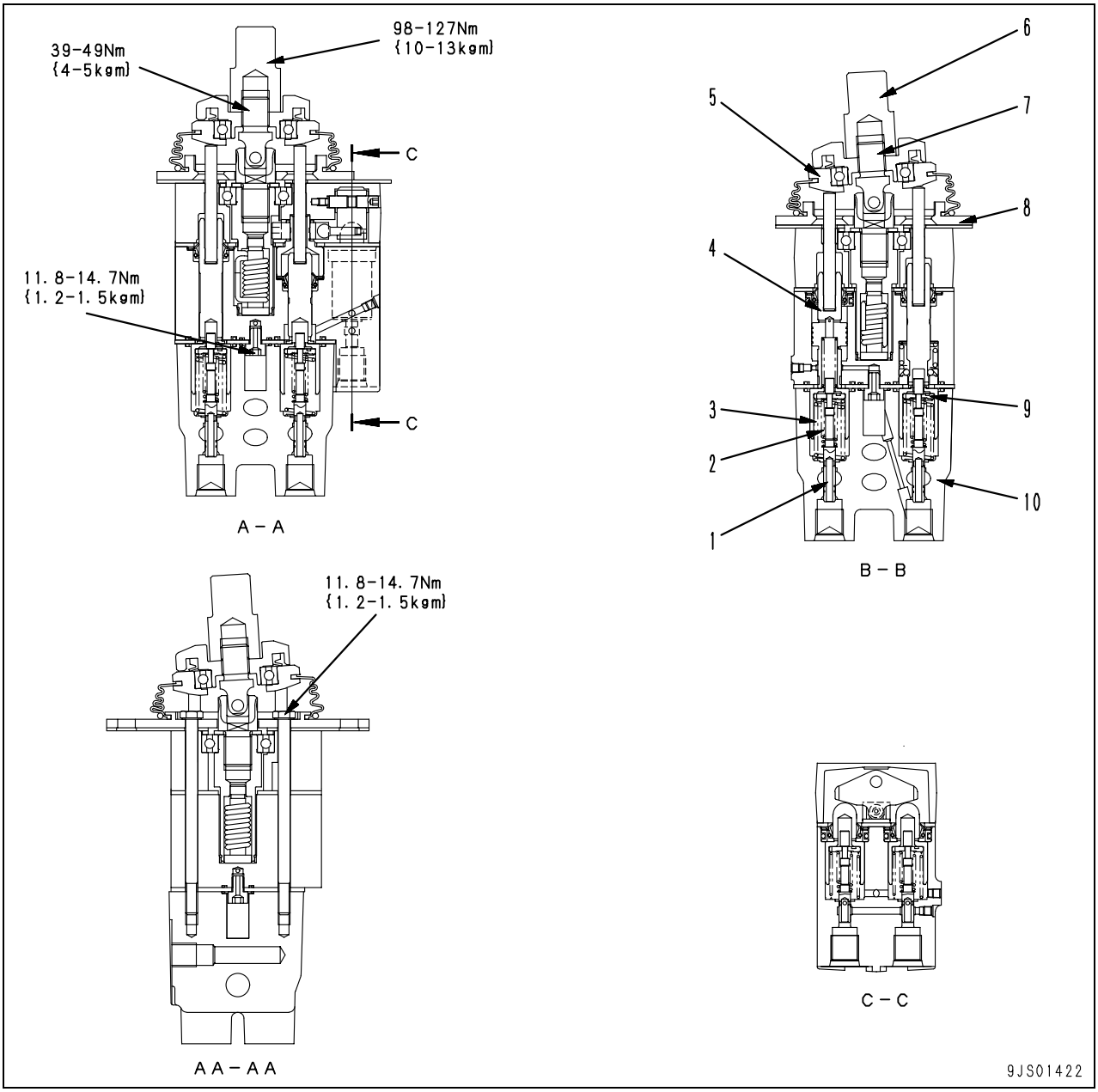
1. Spool
2. Spring

Function

- If the flow rate demanded for the actuator is within the delivery available with the minimum pump swash plate angle when the control valve is controlled in fine control, pump pressure (PP) is set to the sum of LS pressure (PLS) + 2.16 MPa {22 kg/cm^2}. When the differential pressure between pump pressure (PP) and LS pressure (PLS) reaches the spring load of spring (2) (2.16 MPa {22 kg/cm^2}), the unload valve opens. Thus, LS differential pressure (ΔPLS) is set to 2.16 MPa {22 kg/cm^2}.

Operation

- If the control valve is controlled in fine control, LS pressure (PLS) is generated and applied to the right end face of spool (1). Since the open area of the control valve spool is narrow, the difference between LS pressure (PLS) and pump discharge pressure (PP) is large.
- When the differential pressure between pump pressure (PP) and LS pressure (PLS) reaches the spring load of spring (2) (2.16 MPa {22 kg/cm^2}), spool (1) moves to the right and pump circuit (PP) is connected to tank circuit (T).
- In short, pump pressure (PP) is set to the sum of the spring force (3.43 MPa {35 kg/cm^2}) + LS pressure (PLS), and LS differential pressure (ΔPLS) is set to 2.16 MPa {22 kg/cm^2}.



P: From control pump
T: To hydraulic tank
P1: To blade tilt valve (left tilt)
P2: To blade tilt valve (right tilt)

P1: To blade lift valve (raise)
P4: To blade lift valve (lower)
P5: To blade angle valve (right angle)
P6: To blade angle valve (left angle)

1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Disc
6. Cap (For connecting the lever)
7. Joint
8. Plate
9. Retainer
10. Body

BULLDOZER

D31EX-22
D31PX-22
D37EX-22
D37PX-22

Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

10 Structure, function and maintenance standard

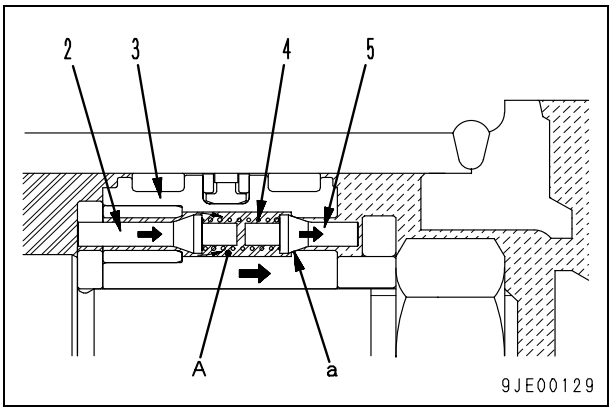
500 Work equipment

Piston valve
(Angle cylinder)

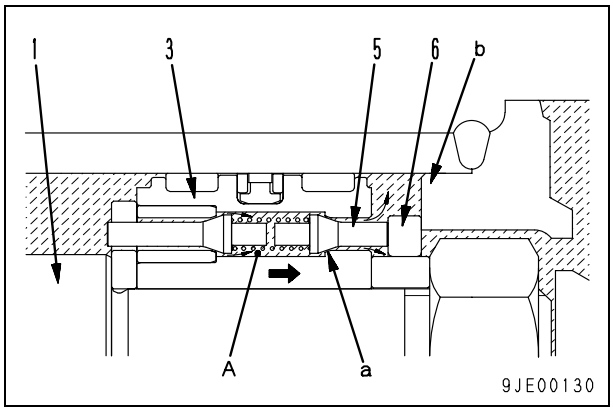
Outline
- The piston valve is installed to the piston section of the angle cylinder.
- When the piston rod is at the stroke end, the pressurized oil from the pump is released into the port on the opposite side to lower the pressure applied to the piston.

Operation

When piston valve is "closed"
- The pressurized oil from the pump pushes piston (2) open against the force of spring (4) and flows in chamber (A).
- The pressurized oil fills up chamber (A) and presses piston valve (5) to the right to seal the tapered part of piston valve seat (a).
- Accordingly, the pressure in the cylinder increases and piston (3) moves to the right.



When piston valve is "opened"
- Before piston rod (1) reaches the stroke end, slider (6) meets cylinder bottom (b) and stops.
- Slider (6) meets the end of piston valve (5) and only piston (3) keeps moving.
- The pressurized oil in chamber (A) sealed by piston valve (5) is released through piston valve seat (a) to the bottom side, thus the pressure in the cylinder decreases.



BULLDOZER

D31EX-22
D31PX-22
D37EX-22
D37PX-22

Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

10 Structure, function and maintenance standard

700 Electrical system

Set travel speeds corresponding to gear speeds

Gear speed	Number of lighting segments in gear speed gauge						Set travel speed (km/h)					
	F-shift gauge	R-shift gauge					Forward	Reverse				
		A	B	C	D	E		A	B	C	D	E
	2	2	2	2	2	2	0.8	0.8	0.8	0.8	0.8	0.8
	4	3	4	4	5	5	1.0	0.9	1.0	1.1	1.2	1.3
	6	5	6	7	8	9	1.5	1.2	1.5	1.7	1.9	2.2
	8	7	8	9	11	12	2.0	1.6	2.0	2.3	2.7	3.0
	10	8	10	12	14	16	2.4	2.0	2.4	2.9	3.4	3.8
	12	10	12	14	17	19	2.9	2.3	2.9	3.5	4.1	4.7
1	**14**	**11**	**14**	**17**	**20**	**23**	**3.4**	**2.7**	**3.4**	**4.1**	**4.8**	**5.5**
	16	13	16	19	22	25	3.8	3.0	3.8	4.5	5.2	6.0
	18	15	18	21	25	28	4.1	3.4	4.1	4.9	5.7	6.4
	20	16	20	24	27	31	4.5	3.7	4.5	5.3	6.1	6.9
	22	18	22	26	30	33	4.9	4.0	4.9	5.7	6.5	7.4
	24	20	24	28	32	36	5.2	4.4	5.2	6.1	7.0	7.8
2	**26**	**22**	**26**	**30**	**34**	**38**	**5.6**	**4.7**	**5.6**	**6.5**	**7.4**	**8.3**
	28	24	28	32	36	40	6.0	5.1	6.0	6.9	7.8	8.5
	30	26	30	34	38	40	6.4	5.5	6.4	7.3	8.2	8.5
	32	28	32	36	40	40	6.8	5.9	6.8	7.7	8.5	8.5
	34	30	34	38	40	40	7.3	6.4	7.3	8.2	8.5	8.5
	36	32	36	40	40	40	7.7	6.8	7.7	8.5	8.5	8.5
	38	34	38	40	40	40	8.1	7.2	8.1	8.5	8.5	8.5
3	**40**	**36**	**40**	**40**	**40**	**40**	**8.5**	**7.6**	**8.5**	**8.5**	**8.5**	**8.5**

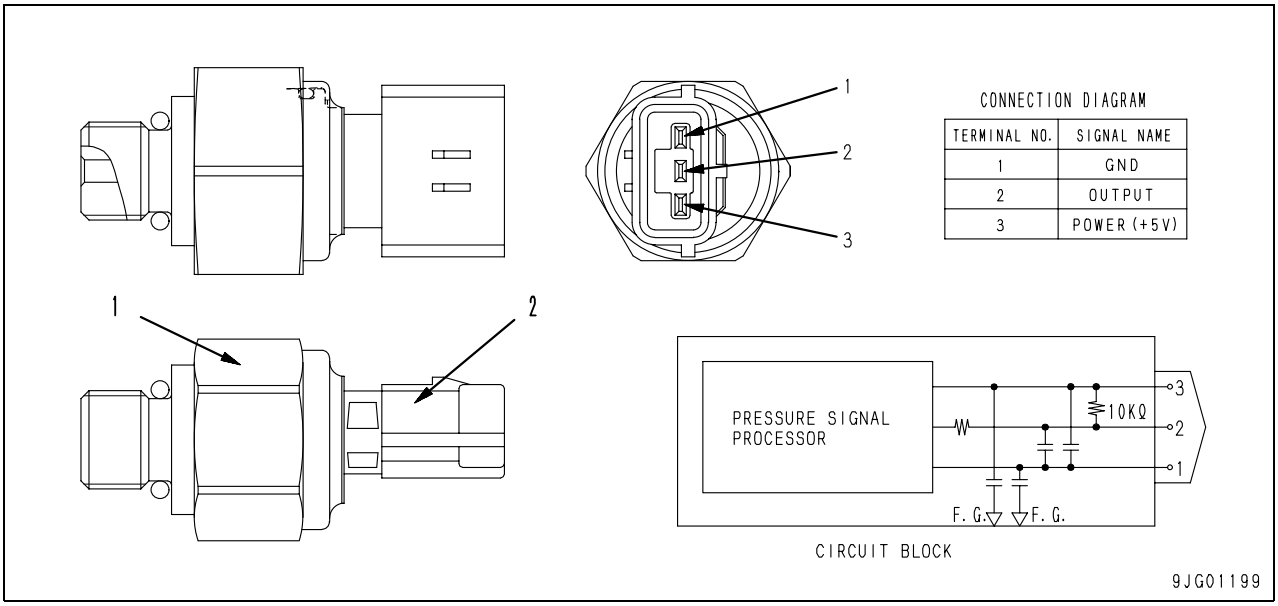
★ The values of bold-face type are for the quick shift mode.

No.	Display category	Display items	Display range	Display method	Alarm lamp output	Alarm buzzer output	Display color	Remarks
1a	Gauge	Coolant temperature	See figure at left	Corresponding segment and segments below it light up	—	—	Black	LCD
1b	Caution		Max. 102°C	OFF	OFF	OFF	Red	LED
			102°C – 105°C	Flashing	Flashing	OFF		
			Min. 105°C	Flashing	Flashing	ON		
2a	Gauge	Hydraulic oil temperature	See figures at left	Corresponding segment and segments below it light up	—	—	Black	LCD
2b	Caution		Max. 100°C	OFF	OFF	OFF	Red	LED
			100°C – 110°C	Flashing	Flashing	OFF		
			Min. 110°C	Flashing	Flashing	ON		
3	Gauge	Fuel level	See figures at left	Corresponding segment and segments below it light up	—	—	Black	LCD
4a	Indicator	Display panel A (Travel direction, gear speed, shift mode)	Travel direction (P, N, F and R)	P: Parking lever "Lock" N: PCCS lever "Neutral" F: PCCS lever "Forward" R: PCCS lever "Reverse"	OFF	OFF		
4b			[*3] Gear speed (1, 2, and 3)	1: PCCS lever Shift switch "1st" 2: PCCS lever Shift switch "2nd" 3: PCCS lever Shift switch "3rd"				
4c	Gauge		[*1] Forward gear shift (See figures at left)	Corresponding segment and segments below it light up	—	—		
4d			[*1] Reverse gear shift (See figures at left)					
4e	Pilot		Variable shift mode	ON	—	—		
4f			Quick shift mode	ON	—	—		
5	Character display	[*2] Display panel B (Service meter/ engine speed)	0 – 99999.9 h/ 0 – 9999 rpm	Time is counted while engine is running (alternator is generating)	—	—		
6	Caution	Charge level	When charge is faulty (Max. 12 V)	OFF (While engine is stopped)	OFF	OFF	Red	LED
				Flashing (While engine is running)	Flashing	OFF		
7		Engine oil pressure	Below set pressure (49 kPa {0.5 kg/cm²})	OFF (While engine is stopped)	OFF	OFF		
				Flashing (While engine is running)	Flashing	ON		
8		Charge filter clogging	Above set value (200 kPa {2.0 kg/cm²})	OFF (While engine is stopped)	OFF	OFF		
				Flashing (While engine is running)	Flashing	ON		
9		HST charge oil pressure	Below set pressure (785 kPa {8.0 kg/cm²})	OFF (While engine is stopped)	OFF	OFF		
				Flashing (While engine is running)	Flashing	ON		
10	Pilot	Preheater	When preheater is turned ON	ON	OFF	OFF	Green	
11	Caution	Maintenance	Before 30 h or more	OFF	OFF	OFF	Red	
			Before 30 h – Replacement time	Flashes for 30 seconds after starting switch is turned "ON"				
			After replacement time	Lights for 30 seconds after starting switch is turned "ON"				
12		Warning lamp	See the "Aram lamp output" column of this table		—	—	Red	
13		Clogging of air cleaner	Below specified value (–7.47 kPa)	Flashing	OFF	OFF	Red	
14		Check fan operation	• Operate fan selector switch while the engine is running.	Flashing (several times)	OFF	OFF	Orange	
			• Fan in cleaning mode (reverse)	ON				
			• Fan in normal rotation mode	OFF				
15		Water separator (Not used)	• When water level rising	Flashing	OFF	OFF	Red	

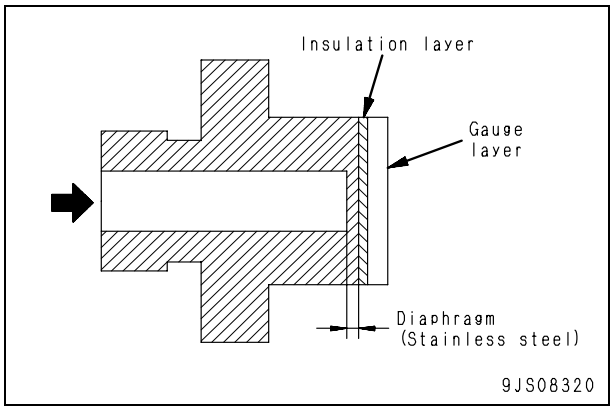
*1: For details, see HST control system.
*2: For details on the service mode, see Testing and adjusting, Special functions of monitor panel (EMMS).
*3: Displays only in the quick shift mode.
★ PCCS: Abbreviation for Palm Command Control System

Brake oil pressure sensor

(HST charge oil pressure sensor)



1. Sensor
2. Connector

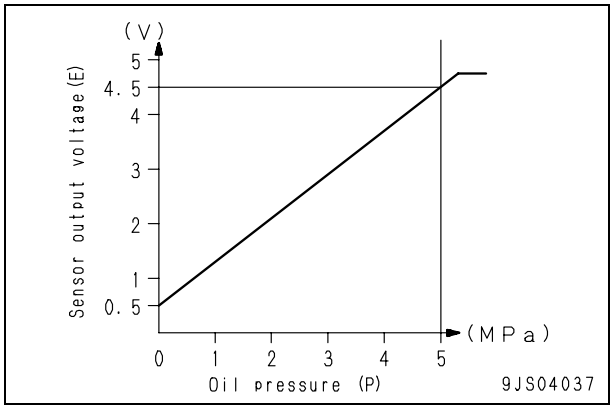


Function

- Installed to the parking brake solenoid valve piping, this sensor detects the brake circuit pressure with a built-in semiconductor as voltage variation. A signal is generated according to the measured pressure.

Operation

- Oil pressure from the hydraulic oil intake port is applied to the diaphragm of oil pressure sensor to deform it.
- Deformed diaphragm causes the gauge resistance to change. Output voltage changes accordingly and the voltage is transmitted to the amplifier (of the voltage).
- Relation between pressure (P) applied to the sensor and output voltage (E) is shown to the right.



HST motor speed sensor

★ See Power train, "HST motor".

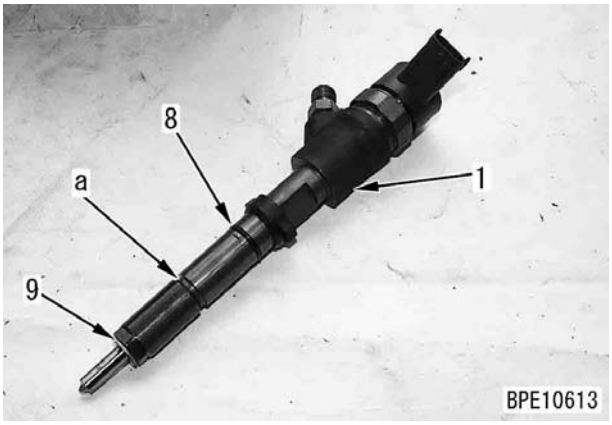
Machine model							D37EX-22, D37PX-22	
Serial No.							60001 and up	
Category	Item		Measurement conditions			Unit	Standard value for new machine	Service limit value
HST	HST oil pressure	Main circuit pressure	• Engine: High idle • HST oil temperature (hydraulic oil temperature): Within operating range (40 – 60°C) • Stall pressure test mode	Forward	Left	MPa {kg/cm²}	40.2 – 44.1 {410 – 450}	39.2 – 45.1 {400 – 460}
					Right		40.2 – 44.1 {410 – 450}	39.2 – 45.1 {400 – 460}
				Reverse	Left		40.2 – 44.1 {410 – 450}	39.2 – 45.1 {400 – 460}
					Right		40.2 – 44.1 {410 – 450}	39.2 – 45.1 {400 – 460}
		Charge circuit pressure	• Engine: High idle • HST oil temperature (hydraulic oil temperature): Within operating range (40 – 60°C)	PCCS lever: Neutral			3.23 ± 0.29 {33 ± 3.0}	3.23 ± 0.29 {33 ± 3.0}
				PCCS lever: Forward or reverse			3.04 ± 0.29 {31 ± 3.0}	3.04 ± 0.49 {31 ± 5.0}
	Travel speed		• Engine: High idle • Quick shift mode • Reverse travel speed: Set to default • HST oil temperature (hydraulic oil temperature): Within operating range (40 – 60°C) • Measure on flat place.	Forward	1st	km/h	3.4 ± 0.2	3.4 ± 0.4
					2nd		5.6 ± 0.3	5.6 ± 0.6
					3rd		8.5 ± 0.5	8.5 ± 0.8
				Reverse	1st		4.1 ± 0.2	4.1 ± 0.4
					2nd		6.5 ± 0.3	6.5 ± 0.6
					3rd		8.5 ± 0.5	8.5 ± 0.8
			• Engine: High idle • Variable shift mode • Reverse travel speed: Set to default • HST oil temperature (hydraulic oil temperature): Within operating range (40 – 60°C) • Measure on flat place.	Forward	MIN		0.8 ± 0.2	0.8 ± 0.3
					MAX		8.5 ± 0.5	8.5± 0.8
				Reverse	MIN		0.8 ± 0.2	0.8 ± 0.3
					MAX		8.5 ± 0.5	8.5 ± 0.8
	Travel deviation		• Engine: High idle • HST oil temperature (hydraulic oil temperature): Within operating range (40 – 60°C) • Flat place (Hard and level place such as concrete floor) • After approach run of at least 10 m, measure deviation in travel of 20 m. • Measure deviation (x). • For measuring posture, see “Travel 1”.			mm	Max. 120	Max. 150
	Hydraulic drift of travel		• Engine: High idle • HST oil temperature (hydraulic oil temperature): Within operating range (40 – 60°C) • Travel lever: N (Neutral) • Travel lock lever: Free • Stop machine on slope of 20°. • Posture of machine: With front side up and down • Hydraulic drift (Hydraulic travel distance) in 1 minute • For measuring posture, see “Travel 2”.			m	Max. 3.6	Max. 4.0

Testing and adjusting item	Sym-bol	Part No.	Part Name	Q'ty	Remarks
Diagnosis for chassis related controller, sensor actuator and harness	—	799-601-9000 or 799-601-9200 or 799-601-4101 or 799-601-4202	T-adapter assembly	1	
	—	799-601-9020	Adapter for DT	1	For DT
	—	799-601-9030	Adapter for DT	1	For DT (Excl. 799-601-4101 and 799-601-4201)
	—	799-601-9040	Adapter for DT	1	For DT
	—	799-601-9050	Adapter for DT	1	For DT (Excl. 799-601-4101 and 799-601-4201)
	—	799-601-9060	Adapter for DT (Gray)	1	For DT (Excl. 799-601-4101 and 799-601-4201)
	—	799-601-9070	Adapter for DT (Black)	1	For DT (Excl. 799-601-4101 and 799-601-4201)
	—	799-601-7000 or 799-601-7100 or 799-601-7400 or 799-601-8000	T-adapter assembly	1	
	—	799-601-7050	Adapter for SWP	1	For SWP (Excl. 799-601-8000)
	—	799-601-7060	Adapter for SWP	1	For SWP (Excl. 799-601-8000)
	—	799-601-7090	Adapter for M	1	For M
	—	799-601-7500	T-adapter assembly	1	
	—	799-601-7550	Adapter for 070	1	For 070
	—	799-601-7520	Adapter for 070	1	For 070

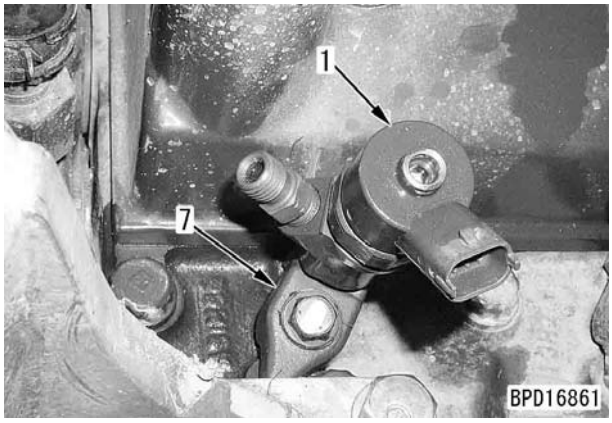
6. Set it in the no-injection cranking mode.
   ★ For operating method, see “Special function of monitor panel (EMMS)”.
   ⚠ **Since starting of engine is dangerous, be sure to set the injectors so that they will not inject fuel before starting the check.**

7. Crank the engine with the starting motor and measure the compression pressure.
   ★ Read the pressure when the gauge pointer is stabilized.

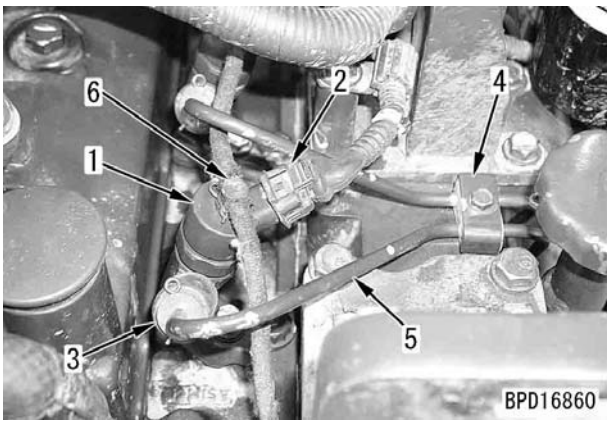
8. After finishing measurement, remove the measuring instruments and return the removed parts according to the following procedure.
   1) Install O-ring (8) and gasket (9) to injector (1).
      ★ Do not install O-ring (8) to groove "a".

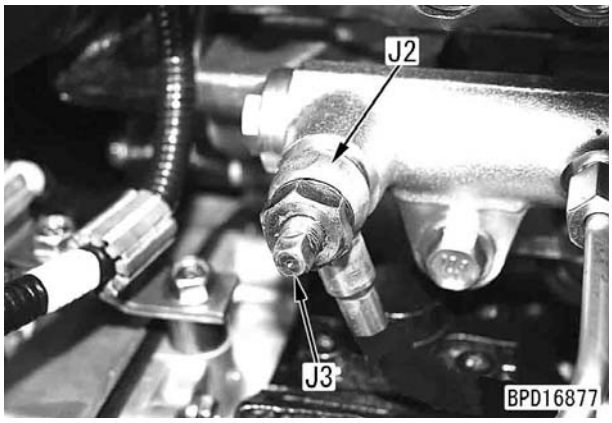


   2) Insert injector (1) in the cylinder head and fix it with holder (7).
      Holder mounting bolt:
      27 – 30 Nm {2.8 – 3.1 kgm}
      ★ Seat the fulcrum of the holder perfectly before tightening the mounting bolts.

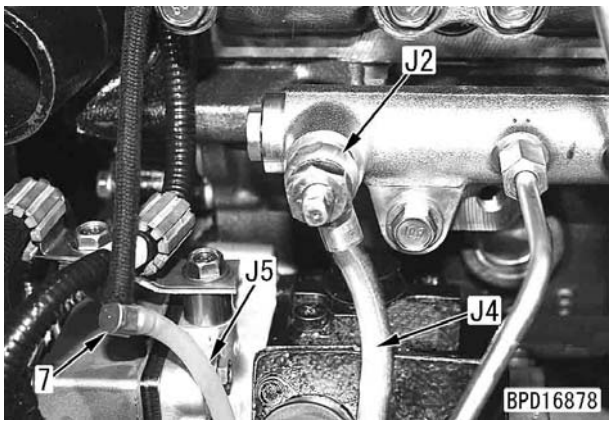


   3) Connect spill hose connector (6) to injector (1).
   4) Install high-pressure pipe (5).
      High-pressure pipe flare nut (Both ends):
      25.5 – 29.4 Nm {2.6 – 3.0 kgm}
   5) Install fuel scatter prevention cover (3) to the joint of high-pressure pipe (5).
      ★ Install fuel scatter prevention cover (3) with the slit down (on both injector side and common rail side).
   6) Install clamp (4) to high-pressure pipe (5).
      ★ Install the clamp to the position from which it was removed. (The mounting bolt goes through the clamp and enters the bolt hole of the air intake manifold. Accordingly, if the mounting bolt is installed normally, the clamp is installed to its original position.)
   7) Connect wiring harness connector (2) to injector (1).





8) Connect test hose **J4** to the end of joint **J2**.
   ★ Bind the connecting part of the test hose with a wire, etc. to prevent it from coming off.
9) Connect test hose **J5** to connector (7) side of spill hose (3).
   ★ Bind the connecting part of the test hose with a wire, etc. to prevent it from coming off.



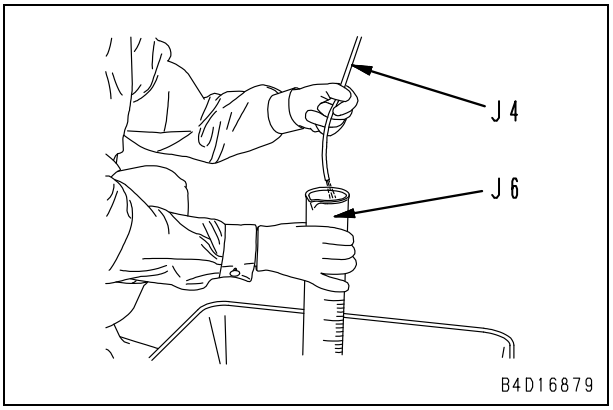
10) The above is the preparation work for testing.

2. Testing leakage from pressure limiter

1) Lay test hose **J4** so that it will not slacken and put its end in the oil pan.
2) Set the machine so that the engine speed can be checked. For details, see “Testing engine speed”.
3) Run the engine at the rated output.
4) After the engine speed is stabilized, test the leakage in 1 minute with measuring cylinder **J6**.
   ★ You may test for 20 seconds and judge by multiplying the result by 3.
   ★ If the leakage from the pressure limiter is in the following range, it is normal.

Engine speed (rpm)	Leakage (cc/min)
At rated output	Max. 20

Reference:
A limit value is the value mentioned above, but a standard value in normalcy is “0 cc/min. (no leak)”.



5) After finishing testing, stop the engine.

Measuring solenoid valve output oil pressure

Necessary tools

Symbol		Part No.	Name
L	1	799-101-5002	Hydraulic tester
		790-261-1204	Digital hydraulic tester
	2	799-401-3100	Adapter
		799-401-3200	Adapter
	3	799-101-5230	Nipple
		07002-11423	O-ring

⚠ Stop the machine on a flat place and lower the work equipment to the ground.
⚠ Take care not to touch a hot part when installing or removing a testing tool.
⚠ Before raising the blade, check that the side cover on the left side of the engine and front cover are closed.

★ Measure the solenoid valve outlet pressure under the following condition.
- HST oil (Hydraulic oil) temperature: Within operating range (40 – 60°C)

1. Preparation work

★ If the pressures in the parking brake solenoid valve and slow brake solenoid valve are not measured simultaneously, the operation cannot be checked.

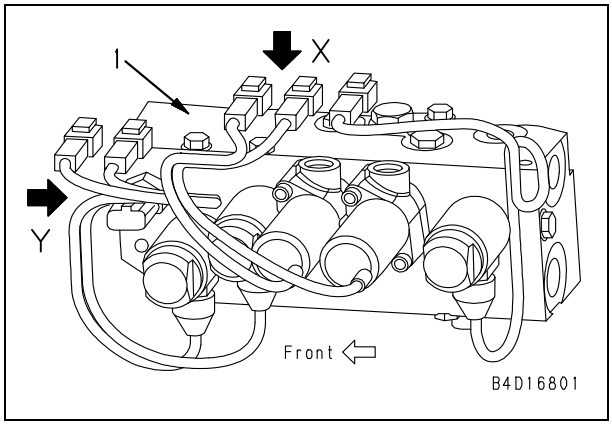
⚠ Turn the starting switch ON, set the work equipment lock lever in the FREE position, and lower the blade to the ground. Move the blade control lever until it is not held in the FLOAT position to release the residual pressure in the accumulator. After the residual pressure is released, set the work equipment lock lever in the LOCK position and turn starting switch OFF.

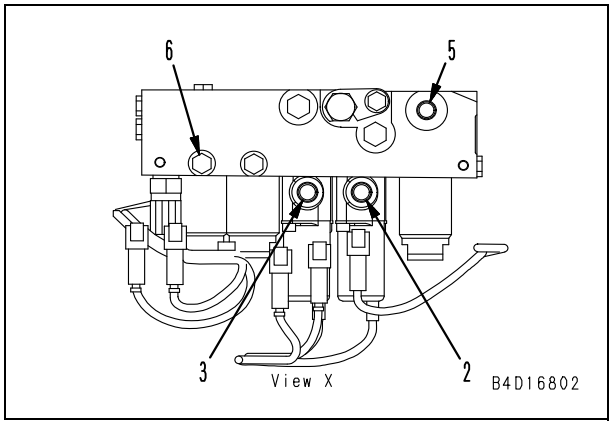
⚠ Loosen the oil filler cap of the hydraulic tank slowly to release the residual pressure in the hydraulic tank.

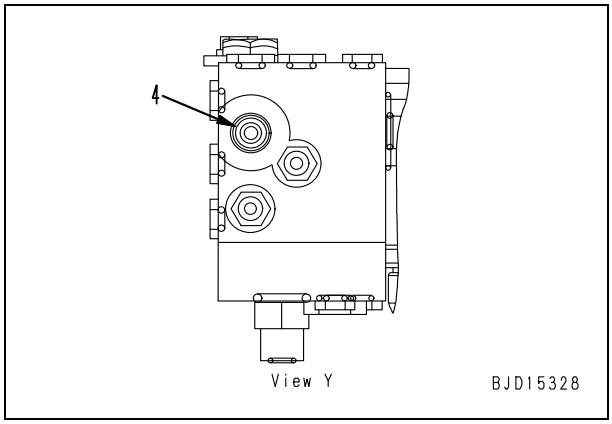
1) Remove the inspection cover at the floor.
2) Disconnect solenoid valve outlet hoses (2), (3), (4) and (5) of the circuit to be measured or remove oil pressure pickup plug (6) from the valve block (1).
   - Hose (2): Right HST motor EPC valve
   - Hose (3): Left HST motor EPC valve
   - Hose (4): Parking brake solenoid valve
   - Hose (5): Work equipment lock solenoid valve
   - Plug (6): Slow brake solenoid valve

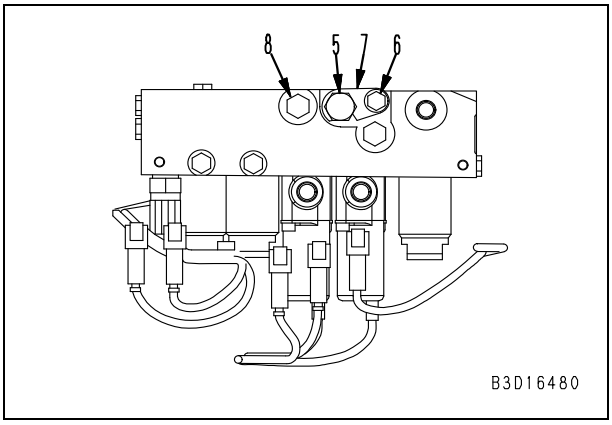
★ The output pressure of the parking brake solenoid valve can be measured with the “Real-time monitoring mode” of the monitor panel.
★ For the operating method, see “Special functions of monitor panel (EMMS)”.
- Controller: **HST**
- Monitoring code:

91902-BRAKE PRESS

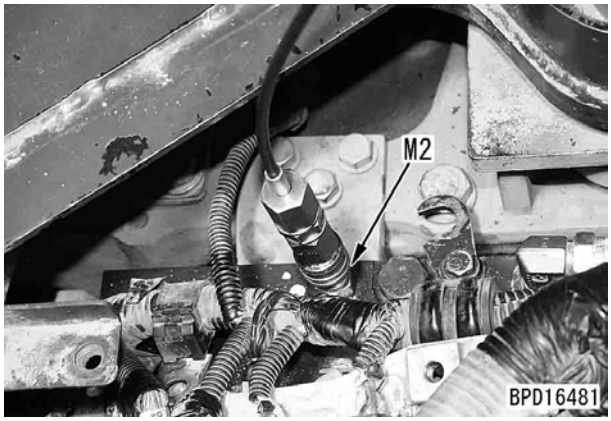








4) Connect the quick coupler at the end of pump assembly **M1** to nipple **M2**.

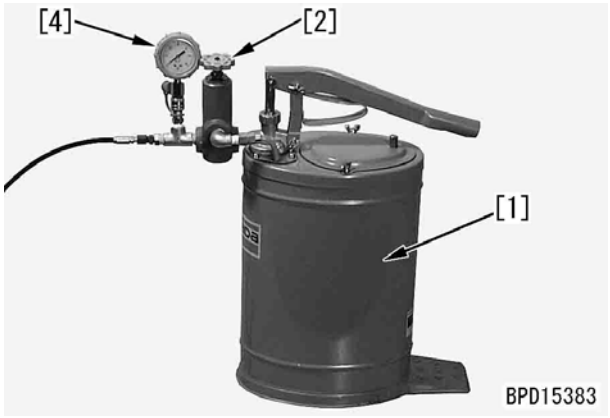


4. Releasing parking brake and towing machine

1) Close the valve of volume pump [1] and operate the handle to supply oil to the parking brake circuit.
   - ★ Increase the supply pressure until relief valve [2] relieves once.
   - ★ Check that the supply pressure is lower than the specified relief pressure with oil pressure gauge [4].
   - ● Specified relief pressure:
     2.7 – 3.1 MPa {28 – 32 kg/cm²}

   ⚠ **If the supply pressure rises above the specified relief pressure, the brake piston of the HST motor may be damaged. Accordingly, if the supply pressure exceeds the specified relief pressure, open the valve of the volume pump immediately and adjust the relief pressure by the method in 1.**

   - ★ If the supply pressure becomes the specified relief pressure, the parking brake is released.



2) Remove the block of the track shoe and tow the machine at speed lower than 2 km/h.

   ⚠ **If the supply pressure lowers below 1.5 MPa {15 kg/cm²}, the parking brake is not released completely (it works partially). Accordingly, keep checking oil pressure gauge [4] while towing the machine. If the oil pressure lowers, operate the handle to maintain the oil pressure in the range of 1.5 – 3.1 MPa {15 – 32 kg/cm²}.**

3) After towing the machine to a safe place, open the valve of volume pump [1] to release the pressure supplied to the parking brake circuit.

5. Remedy to take after towing machine

★ After towing the machine to a safe place, take the following remedy without fail to return the machine to the condition before towing.

1) Remove pump assembly **M1** and nipple **M2** and install plug (8).
2) Loosen plug (5) of the 5-spool valve and return lock plate (7) and then tighten plug (5) and bolt (6) to fix lock plate (7).
3) Install the inspection cover to the floor.
4) Return plugs (4) of towed valves (1) and (2) of the HST pump and secure them with locknuts (3).
   Plug and locknut:
   24.5 – 34.3 Nm {2.5 – 3.5 kgm}
5) Install the undercover of the HST pump.
   Undercover: **25 kg**

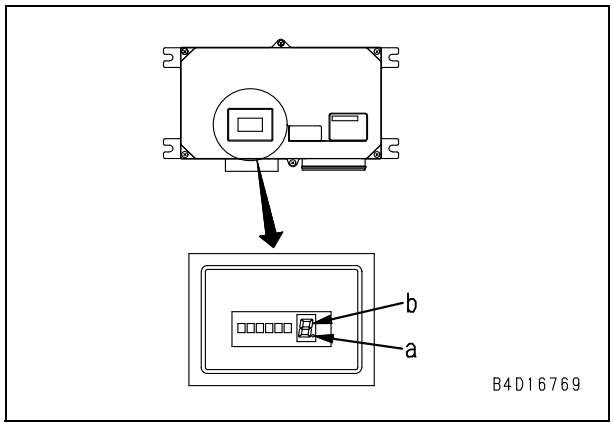
4) While running the engine at high idle, operate the blade control lever to the Right position and relieve the tilt cylinder.
   ⚠ **Take care not to operate the lever to the Left tilt position.**
5) Start measuring the oil leakage 30 seconds after relieving is started and measure for 1 minute.
6) After finishing measurement, return the removed parts.

3. Testing leakage from blade angle cylinder

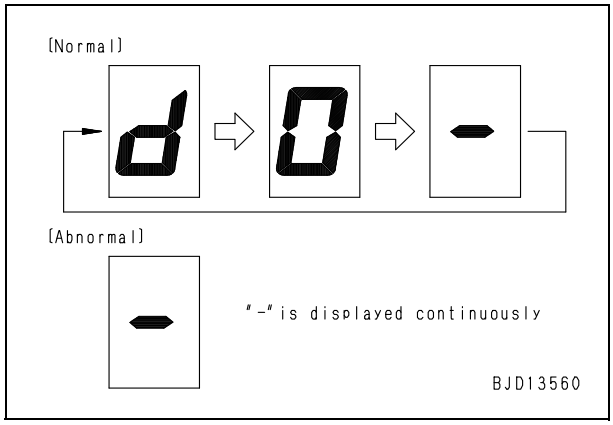
- Since the angle cylinder has a piston valve, leakage cannot be tested.

★ A test stand is necessary for testing.

KOMTRAX terminal

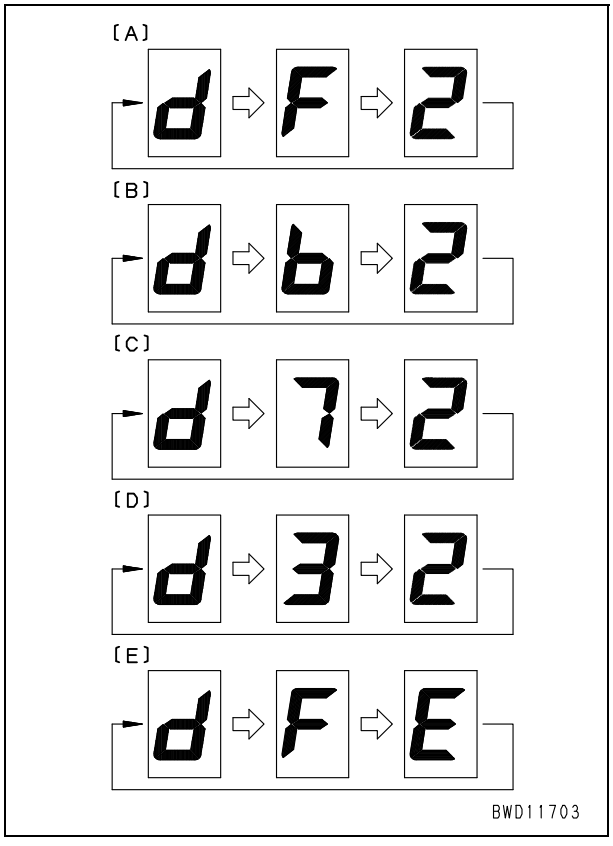


9) Check that display (b) of the monitor panel or KOMTRAX terminal is displaying normally.
   - ★ If the indication is normal, “d”, “0” and “–” are displayed repeatedly on the monitor panel for 30 seconds after 8) is completed.
   - ★ Go to the next step if you can check that the display is “Normal”.
   - ★ If the display is “Abnormal”, repeat from procedure 1).



10) Turn the starting switch to the START position, keep it more than 5 seconds, and check that the engine does not start.
   - ★ If the engine starts or the starting switch is returned to the OFF position, repeat from procedure 1).
11) Turn the starting switch to the START position again and ensure that the engine starts.
12) Check that display (b) of the monitor panel or KOMTRAX terminal is indicating normally.
   - ★ Go to the next step if you ensured that the display is [Normal]. (It takes from 90 seconds to 15 minutes before the display turns normal.)
   - ★ If [GPS position data detection trouble] is indicated, check if there is any external abnormality on the GPS antenna or cable. If there is any abnormality, repair it and repeat from procedure 1) again.
   - ★ If [Receiving trouble] is indicated, check if there is any external abnormality on the appearance of the communication antenna or cable. If there is any abnormality, repair it then repeat from procedure 1) again.
   - ★ If [GPS position data detection trouble and receiving trouble] is indicated, check if there is any external abnormality on the GPS antenna or cable and communication antenna or cable. If there is any abnormality, repair it and repeat from procedure 1) again.
   - ★ If [Network trouble] is indicated, check the display of [LED-C4] referring to “Lamp display of KOMTRAX terminal”. (If CAN is not recognized, check the CAN harness of the KOMTRAX terminal, and then if there is any abnormality, repair it and repeat from procedure 1) again.)

[A]: Normal
[B]: GPS position data detection trouble
[C]: Receiving trouble
[D]: GPS position data detection trouble and receiving trouble
[E]: Network trouble



Reference: The following Nos. correspond to those in the table on the previous page. Each No. in the table is put in [ ] in the title of each item in the text.

Operator mode

★ No. 4 – No. 5 is displayed endlessly by following the switch operation.
★ When a failure occurs, the screen changes automatically to No. 2 regardless of the displayed screen.
★ If the switch is not operated for over 30 seconds regardless of the display screen, the screen automatically;
  - Changes to No. 1.
    (If malfunction has not occurred.)
  - Changes to No. 2.
    (If malfunction has occurred.)

★ After moving from No. 3 to No. 1 by the switch operation, if no switch operation is performed for longer than 10 seconds, then it automatically moves to No. 2.

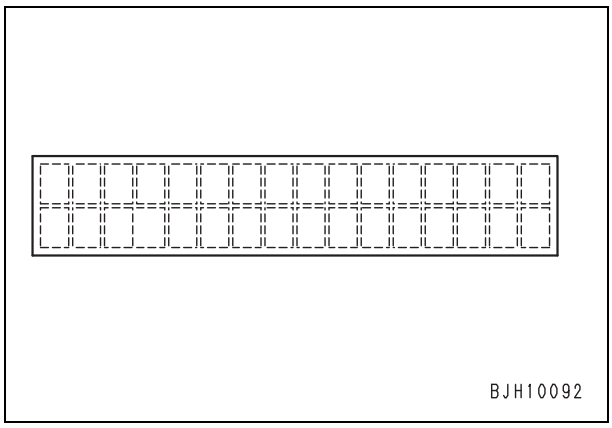
Service mode

★ No. 6 – No. 16 is displayed endlessly by following the switch operation.
★ By inputting and determining the ID once, it will be effective until the starting switch is turned off.

Character display portion

16 characters can be displayed on each upper and lower row of the character display section, and depending on the contents displays the combination of the next figures, letters, and symbols.

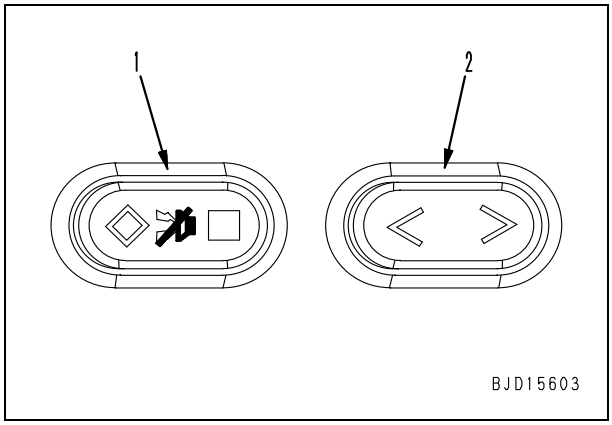
1) Arabic numbers: 1, 2, 3, . . .
2) Small letters: a, b, c, . . .
3) Capital letters: A, B, C, . . .
4) Symbols: @, ?, $, . . .
5) Special letters:



Control switch section

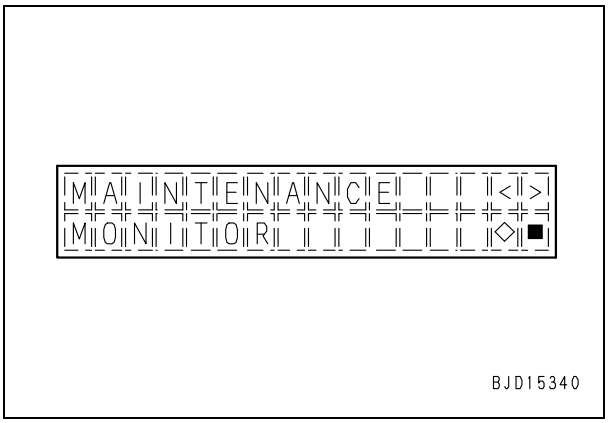
All the display operation of the monitor panel is operated by the buzzer cancel switch (1) and information switch (2).
Each switch of [◇], [■], [>], [<] is assigned to the following function.

◇ : Determine and execute
■ : To cancel or release
> : To right, to next, to proceed, to increase
(only when inputting Arabic numbers)
< : To left, to previous, to return, to decrease
(only when inputting Arabic numbers)

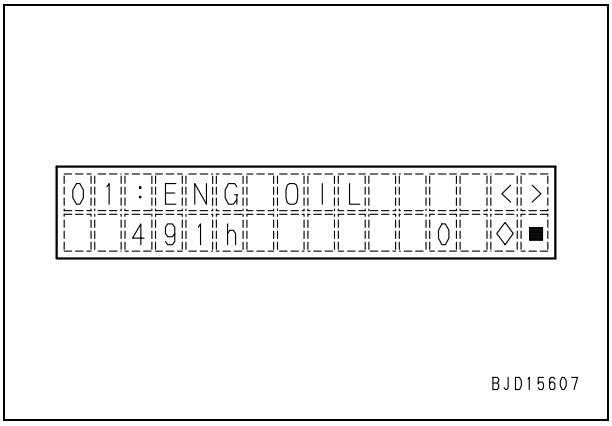


[4] Oil/filter maintenance mode (MAINTENANCE MONITOR)

1. If buzzer cancel switch [◇] is pressed on the normal display screen, the maintenance mode is selected and the filter/oil maintenance mode screen is displayed first.



2. Replacement time display of filter and oil (displayed automatically)
When the replacement interval for the various filters or oils approaches, the monitor panel automatically displays the information to remind an operator of maintenance.

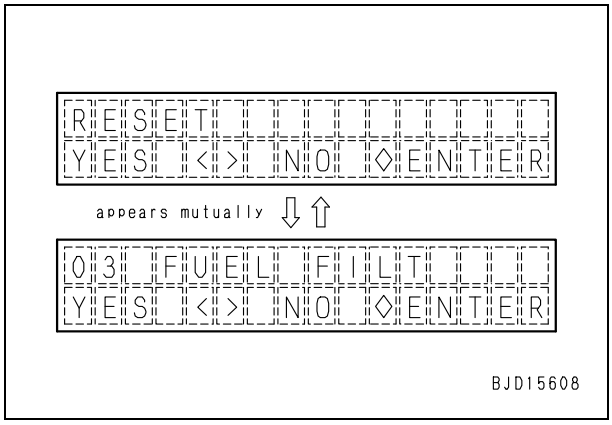


- Table of maintenance item

Code	Display	Maintenance items
01	01: ENG OIL	Engine oil
02	02: ENG FILT	Engine oil filter
03	03: FUEL FILT	Fuel main filter
41	41: P FUEL FILT	Fuel pre filter
04	04: HYD FILT	Hydraulic oil filter
06	06: CORR RES	Corrosion resistor (*)
18	18: BYPS FILT	Bypass filter (*)
07	07: DAMP OIL	Damper filter (*)
08	08: FNL OIL	Final drive oil
10	10: HYD OIL	Hydraulic oil
19	19: POWL OIL	Power train oil (*)
20	20: POWL FILT	Power train oil filter (*)
21	21: HST FILT	HST charge filter

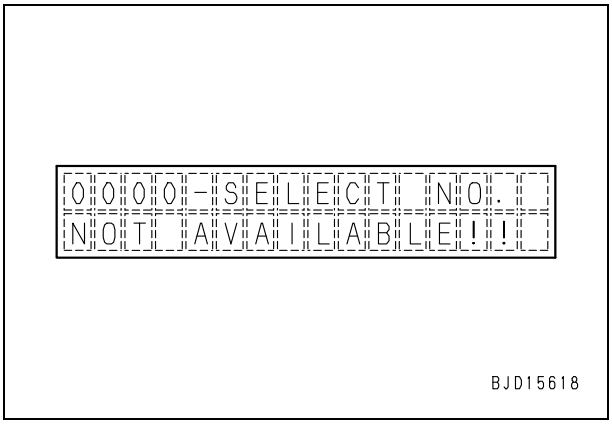
* Set ineffective on this machine.

3. Reset of replacement time (selection menu)
The monitor panel can reset the interval time by operating the switch, if various filters and oil maintenances are finished.
- ★ For details, see Operation and maintenance manual.
- ★ Replacement interval time setting can be operated by the maintenance mode in the service mode.

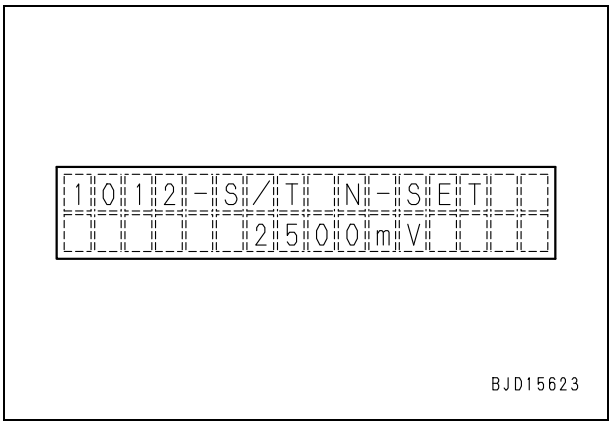


HST CONTROLLER [HST controller system]					
Display order	Monitoring item	Item display	Monitoring code	Data display range	Unit
1	Machine model code	MACHINE CODE	00204	D39 (Example of display)	–
2	HST oil temperature	HST TEMP	04401	-99.9 – 999.9	°C
3	HST oil temperature sensor voltage	HST TEMP	04402	0 – 5.00	V
4	Travel speed (Faster one of right and left)	VEHICLE SPEED	40010	0 – 99.9	km/h
5	Right travel speed	R SPEED	40002	0 – 99.9	km/h
6	Left travel speed	L SPEED	40003	0 – 99.9	km/h
7	Right travel speed	R SPEED	40963	0 – 9999	Hz
8	Left travel speed	L SPEED	40964	0 – 9999	Hz
9	HST right circuit pressure	HST R PRESS	52501	0 – 99.9	MPa
10	HST left circuit pressure	HST L PRESS	52503	0 – 99.9	MPa
11	HST right circuit pressure sensor voltage	HST R PRESS	52500	0 – 5.00	V
12	HST left circuit pressure sensor voltage	HST L PRESS	52502	0 – 5.00	V
13	Brake pressure	BRAKE PRESS	91902	0.00 – 9.99	MPa
14	Brake pressure sensor voltage	BRAKE PRESS	91903	0 – 5000	mV
15	FR lever stroke	FR LEVER	50204	-100.0 – 100.0	%
16	FR potentiometer 1 voltage	FR LEVER 1	50202	0 – 5.00	V
17	FR potentiometer 2 voltage	FR LEVER 2	50203	0 – 5.00	V
18	Steering stroke	S/T LEVER	50303	-100.0 – 100.0	%
19	Steering potentiometer 1 voltage	S/T LEVER 1	50300	0 – 5.00	V
20	Steering potentiometer 2 voltage	S/T LEVER 2	50301	0 – 5.00	V
21	Brake pedal stroke	BREAK PEDAL	50401	0.0 – 100.0	%
22	Brake potentiometer voltage	BREAK PEDAL	50400	0 – 5.00	V
23	Throttle dial command speed	FUEL DIAL	03003	0 – 9999	rpm
24	Throttle dial voltage	FUEL DIAL	03002	0 – 5.00	V
25	Right forward pump capacity command value	RF PUMP	52404	0.0 – 95.0	cc/r
26	Left forward pump capacity command value	LF PUMP	52405	0.0 – 95.0	cc/r
27	Right reverse pump capacity command value	RR PUMP	52406	0.0 – 95.0	cc/r
28	Left reverse pump capacity command value	LR PUMP	52407	0.0 – 95.0	cc/r
29	Right forward pump output current command value	RF PUMP	52400	0 – 9999	mA
30	Left forward pump output current command value	LF PUMP	52401	0 – 9999	mA
31	Right reverse pump output current command value	RR PUMP	52402	0 – 9999	mA
32	Left reverse pump output current command value	LR PUMP	52403	0 – 9999	mA
33	Right forward pump output current sensed value	RF PUMP FB	52408	0 – 9999	mA

★ For the detailed information and actual tuning procedure, see “Tuning mode table and tuning procedure”.
★ If a wrong code is input, the following is displayed and screen returns to the tuning code input screen. In this case, input again.



4. Tuning item selection (Tuning 1 and tuning 2)
★ The tuning items which are often tuned simultaneously are arranged in the groups of tuning 1 and tuning 2 and can be changed in order without inputting the tuning codes.
1) While tuning 1 (TUNING 1) or tuning 2 (TUNING 2) is selected on the tuning pattern selection screen, press the [◇] switch to display the first tuning screen of the change order.
● [◇]: Execute the tuning pattern.
★ When tuning 1 (TUNING 1) is selected, the following screen is displayed.

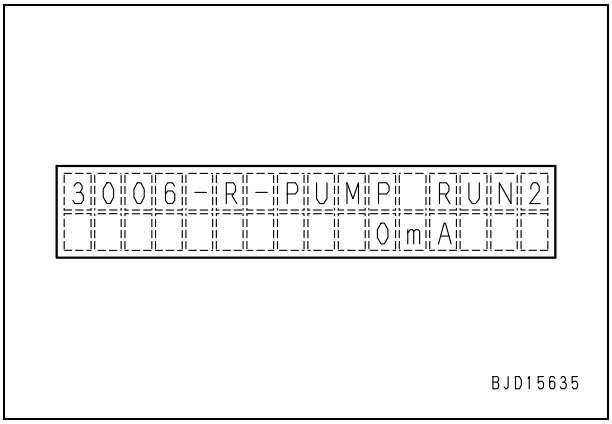


★ For the actual tuning procedure, see “Tuning mode table and tuning procedure”.

2) The tuning items in the group can be changed repeatedly by pressing the [>] switch or [<] switch.
● [>]: Go to the next tuning item.
● [<]: Return to the previous tuning item.
★ For the change order of the tuning items in tuning 1 and tuning 2, see “Tuning mode table and tuning procedure”.

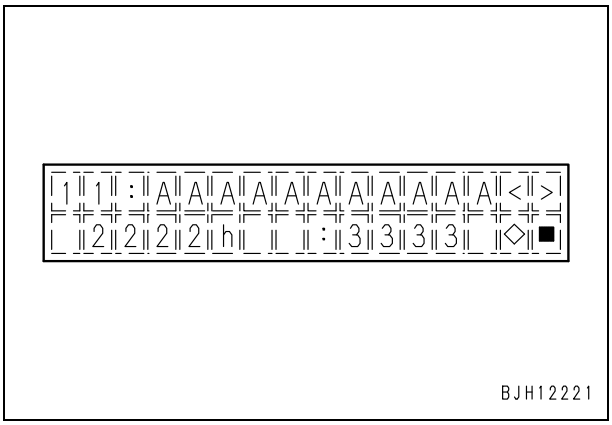
[3006] Reverse pump medium capacity set (For travel)

- This code is used to adjust the command current of the medium capacity of the reverse pump while the machine is traveling.
- The command current of the reverse pump is displayed on the lower line.

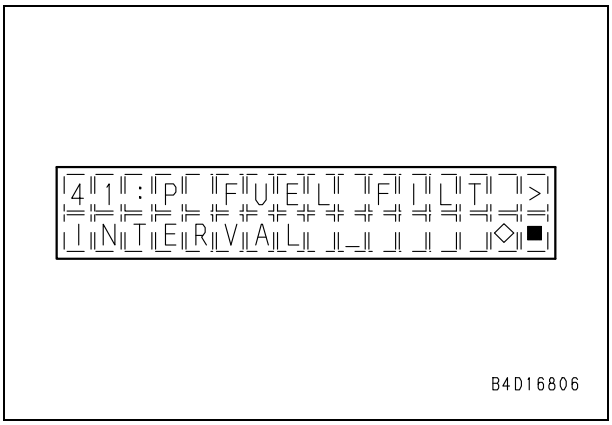


- Adjustment method:
  - i) Move the machine to a wide and flat place where it can travel straight for at least 15 m.
    - ⚠ **Since the machine will travel straight in reverse during adjustment, work in a place where there is not an obstacle through length of at least 15 m.**
  - ii) Run the engine at high idle.
  - iii) Check that the parking brake lever is in the LOCK position and the PCCS lever is in the neutral position and [**P**] is flashing in the gear speed/set travel speed/shift mode indicator section.
  - iv) Set the parking brake lever in the FREE position and set the PCCS lever in the reverse travel position, and adjustment starts.
    - ⚠ **If adjustment starts, the pump command current increases and the machine starts traveling in reverse automatically. (The machine starts traveling reverse, then stops and starts again. Take care.)**
    - ★ The caution buzzer keeps sounding during adjustment.
    - ★ The command current of the reverse pump increases to 805 mA, then the machine stops.
    - ★ When adjustment is finished, [SETTING NOW!!] is displayed on the lower line.
    - ★ If the PCCS lever, fuel control dial, decelerator pedal, or brake pedal is operated, the machine moves as operated. In this case, however, adjustment is interrupted, the caution buzzer stops sounding, and caution lamp lights up.
    - ★ When moving the machine after interrupting adjustment, operate it as usually. The travel speed at the time of interruption is kept, however.
  - v) After adjustment is finished, set the PCCS lever in the neutral position and set the parking brake lever in the LOCK position.
  - ★ When starting adjustment again after interrupting it, perform the procedures from i).
  - ★ Even if this code is turned OFF, the setting is effective.

3. Display contents of the maintenance item (Items with code No.)
If the maintenance item is selected, the following contents are displayed.
1: Code (2 digits)
A: Maintenance item
2: Remaining time to set replacement time
3: Number of times of replacement up to present



4. Changing the interval time by maintenance item (Items with code No.)
1) With the item to change the interval time (ex: P FUEL FILT) selected on the maintenance item and the function selection screen, press the [◇] switch to display the interval change screen.
- [◇]: Execute the function to change maintenance item.



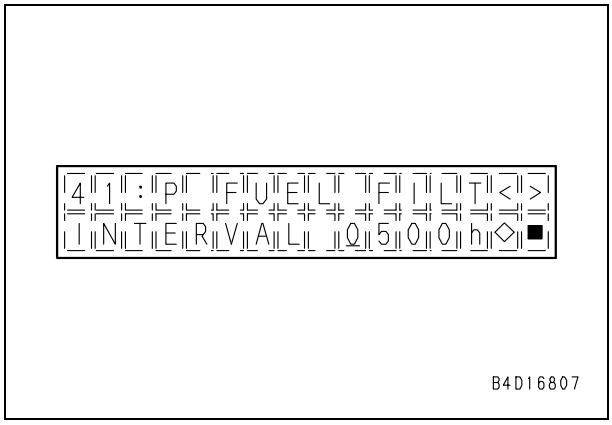
★ With this screen displayed, if the [>] switch is operated, the screen switches to the setting screen for enable or disable the maintenance item.

2) With the interval change screen displayed, press the [◇] switch to display the interval time input screen.
- [◇]: Select interval time input screen.

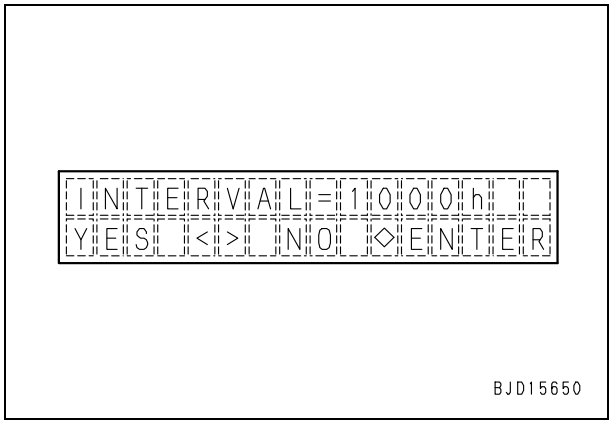
★ The current set interval is displayed on the screen.

3) On the interval change screen, operate the switches [>], [<], [◇] and [■] to input the interval time.
- [>]: Number at the cursor increases.
- [<]: Number at the cursor decreases.
- [◇]: Number at the cursor is determined.
- [■]: Cursor moves to left end or the display returns to interval change screen.

★ The time must always be input with 4 digits. For the time with less than 4 digits, input 0s in place of the vacant number.



4) When the interval time is completely determined, the screen to confirm the changes is displayed. Then, operate the switches [<], [>] and [◇].
- [<]: Select YES (move cursor)
- [>]: Select NO (move cursor)
- [◇]: Execute YES or NO



Adjustment procedure after replacement of monitor panel

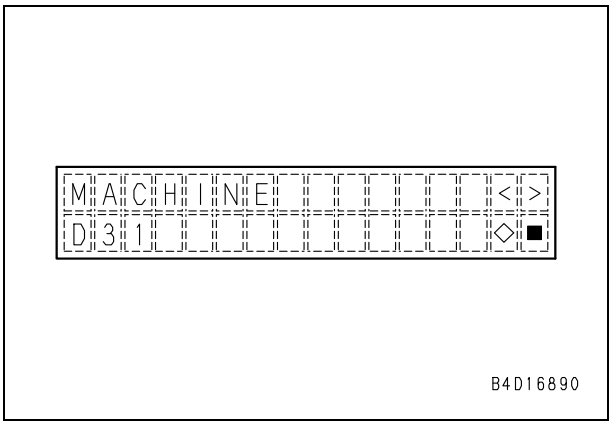
★ After the monitor panel is replaced, adjust the system according to the following procedure.

⚠ **If the system is not adjusted, the machine may not operate normally but may move unexpectedly. Accordingly, be sure to adjust the system.**

★ Precautions before replacement of monitor panel:
If the monitor panel is replaced, the saved values of the service meter, oil and filter maintenance mode and phone No. are reset. Accordingly, check and record the service meter reading, time before maintenance and phone No. before replacing the monitor panel.

★ Precautions for replacing monitor panel:
When replacing the monitor panel, stop the machine on a safe place and turn the starting switch OFF.

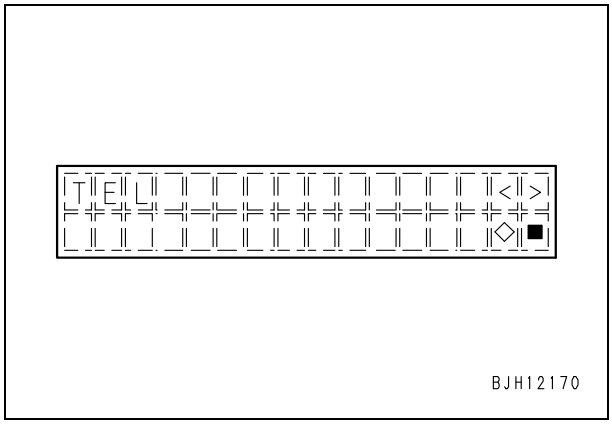
1. Selecting machine model
1) Turn the starting switch ON, set the monitor panel in “Machine model selection mode” in the service mode, and select the machine model.



2) Turn the starting switch OFF.

2. Setting service meter
Set the service meter to the value recorded before replacement.
★ Referring to “Service News”, set the service meter.

3. Setting phone No.
Set the monitor panel in “Phone No. setting mode” in the service mode and set the phone No.



4. Checking failure code
1) Set the monitor panel in “Electrical system fault history display mode” in the service mode.
2) Check to see if there is any failure code being indicated. If there is not any, delete all the recorded failure codes.

★ If there is any failure code being indicated, remove the cause of the failure by troubleshooting and then perform steps 1) and 2).

★ Precautions after replacement of monitor panel:
If the monitor panel is replaced, the service meter for the oil and filter maintenance function restarts from 0. As a result, the replacement time shown on the monitor panel may be different from the actual operating time. Accordingly, apply the time before the maintenance recorded before the replacement until the first maintenance after the replacement.

★ For the system adjustment, use “Machine model selection mode”, “Tuning mode”, and “Electrical system failure history display mode” of “Service mode” of “Special functions of monitor panel (EMMS)”.

★ For the using method of “Special functions of monitor panel (EMMS)”, see Testing and adjusting, Part 3, page 2.

★ For the using method of “Service mode”, see Testing and adjusting, Part 3, page 16.

★ For the using method of “Machine model selection mode”, see Testing and adjusting, Part 3, page 59

★ For the using method of “Tuning mode”, see Testing and adjusting, Part 3, page 33.

★ For the using method of each tuning item, see the page of the corresponding ID.

★ For the using method of “Electrical system failure history display mode”, see Testing and adjusting, Part 3, page 18.

Pm-clinic service (D37EX-22, D37PX-22)

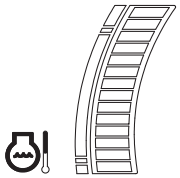
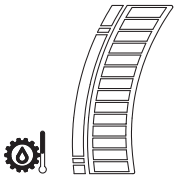
Pm - Clinic Service (D37EX-22, D37PX-22)

Model	Serial No.	Service meter
☐ D37EX-22 ☐ D37EX-22		h

User's name	Date of inspection	Inspector
	/ /	

Specifications		
Blade	Rear attachment	Shoe width
☐ PAPT blade ☐ Narrow blade ☐	☐ Hitch draw bar ☐ Fixed multi ripper ☐ Hydraulic winch	☐ 400 mm single ☐ 600 mm arc ☐ 460 mm single ☐ 600 mm single

Working condition			
Quarry, mining	Construction	Type of soil (Specific gravity: ____)	Contents of work
☐ Coal	☐ Construction, civil engineering	☐ Rock	☐ Dozing %
☐ Gold	☐ Road	☐ Gravel	☐ Side cutting %
☐ Limestone	☐ Tunnel	☐ Sand	☐ Ripping %
☐	☐	☐ Clay	☐ Travel %

Abnormality		
Check of oil and coolant levels		
☐ Engine coolant level ☐ Engine oil level ☐ Hydraulic oil level	When necessary ☐ Final drive ☐	
Max. range of engine coolant temperature	Max. range of HST oil temperature	Ambient temperature
 BJD15401	 BJD15402	Max. ˚C Min. ˚C
		Elevation m

Operator's opinion

Visual inspection result

Service code history			
	h		h
Contents:		Contents:	
	h		h
Contents:		Contents:	

BULLDOZER

D31EX-22
D31PX-22
D37EX-22
D37PX-22

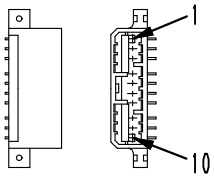
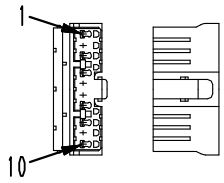
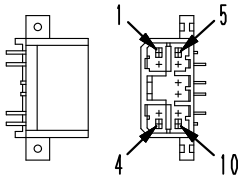
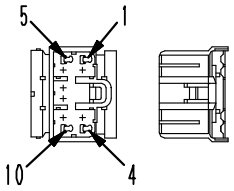
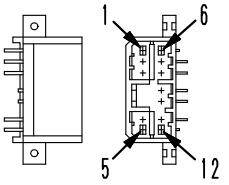
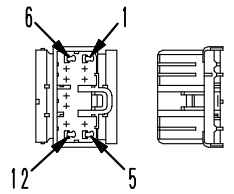
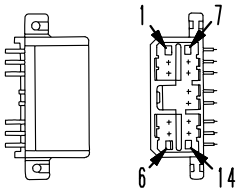
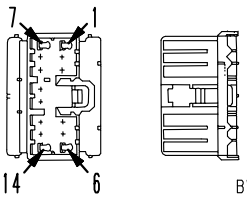
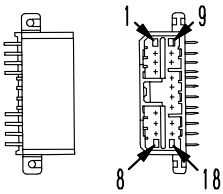
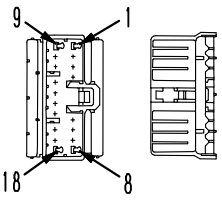
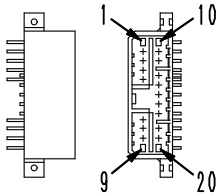
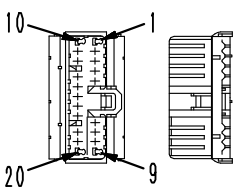
Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

40 Troubleshooting
100 Failure code table and fuse locations

Related circuit diagram

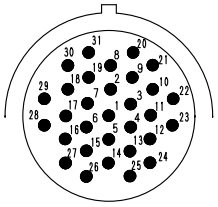
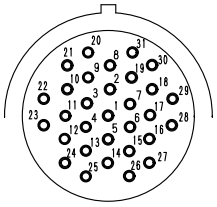
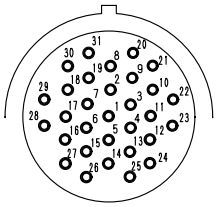
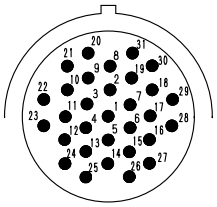
This is the excerpted circuit diagram related to trouble

- **Connector No.: Indicates (Model – No. of pins) (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 (⟷): Roughly shows the location on the machine.**

No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
10	 BWP04759	 BWP04760	—
	—	—	
10	 9JS02245	 9JS02246	799-601-7510 (T-adapter)
	—	Part No. :7821-92-7330	
12	 BWP04761	 BWP04762	799-601-7520 (T-adapter)
	—	Part No. :7821-92-7340	
14	 BWP04763	 BWP04764	799-601-7530 (T-adapter)
	—	Part No. :7821-92-7350	
18	 BWP04765	 BWP04766	799-601-7540 (T-adapter)
	—	Part No. :7821-92-7360	
20	 BWP04767	 BWP04768	799-601-7550 (T-adapter)
	—	Part No. :7821-92-7370	

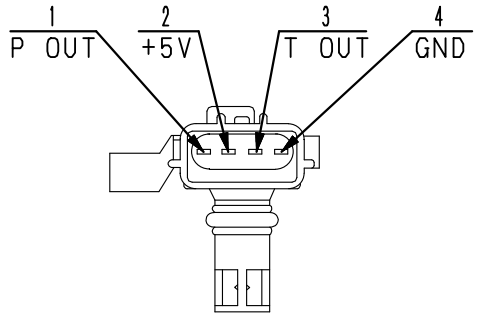
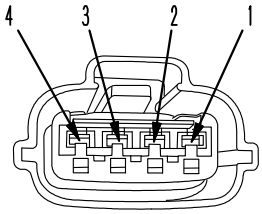
B4D18199

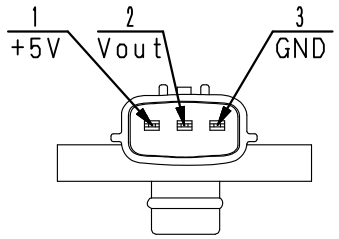
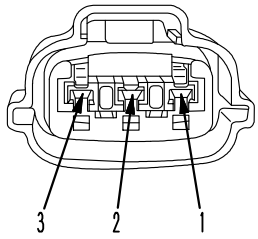
[The pin No. is also marked on the connector (electric wire insertion end)]

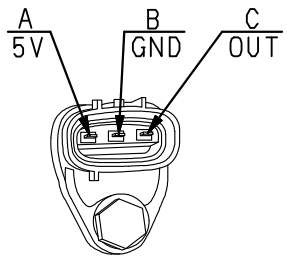
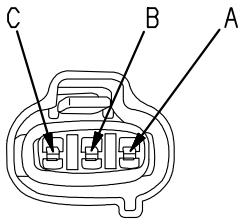
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	Testing connection use special tool Part No.
24-31 (9)	Pin (male terminal)	Socket (female terminal)	799-601-9290 (T-adapter)
	 BWP05033	 BWP05034	
	Part No. :08191-91203, 08191-91204, 08191-91205, 08191-91206	Part No. :08191-94103, 08191-94104, 08191-94105, 08191-94106	
	Socket (female terminal)	Pin (male termial)	799-601-9290 (T-adapter)
	 BWP05035	 BWP05036	
	Part No. :08191-92203, 08191-92204, 08191-92205, 08191-92206	Part No. :08191-93103, 08191-93104, 08191-93105, 08191-93106	

B4D18409

SUMITOMO connector for engine

No. of pins	Boost (air intake) pressure and temeperature sensor (107, 114 engine)		
	Sensor side (plug)	Harness side (receptacle)	Testing connection use special tool Part No.
4			799-601-4230 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

No. of pins	Boost (air intake) pressure sensor (125, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4250 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

No. of pins	G sensor (fuel supply pump speed sensor) (125, 140, 170, 12V140 engine)		
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-4330 (Socket) (Kit:799-601-4101) (Kit:799-601-4201)
	-	-	

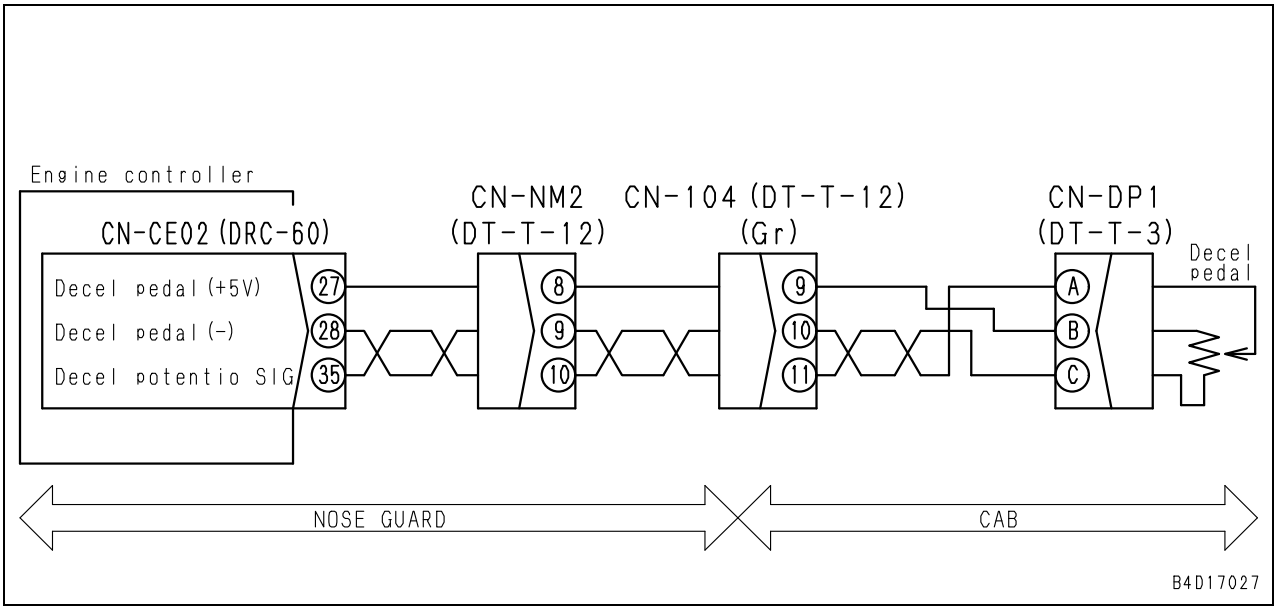
B4D18419

Failure code [B@CRNS] HST oil: Overheating

Action code	Failure code	Trouble	HST oil: Overheating (Mechanical system)
–	**B@CRNS**		
Contents of trouble	• The HST oil temperature caution was indicated while the engine was running.		
Action of controller	• Flashes the HST oil temperature caution lamp. • Flashes the warning lamp and sounds the alarm buzzer. • If cause of error disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, HST hydraulic equipment or hydraulic equipment on the work equipment may be damaged.		
Related information	• Input state from the HST oil temperature sensor (oil temperature, oil temperature sensor voltage) can be checked with the monitoring mode. (Controller: HST, Code: 04401 HST TEMP and code: 04402 HST TEMP) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state		Cause	Standard value in normal state/Remarks on troubleshooting
	1	Overheat of HST oil (When system is normal)	Possibly overheat of HST oil has been detected at present or in the past. It is, therefore, required to investigate the cause and check damages and then repair or replace it.
	2	Defective HST oil temperature caution lamp system	Carry out troubleshooting for EST oil temperature caution lamp system in E-mode "Emergency warning items flash while engine is running."

Related circuit diagram



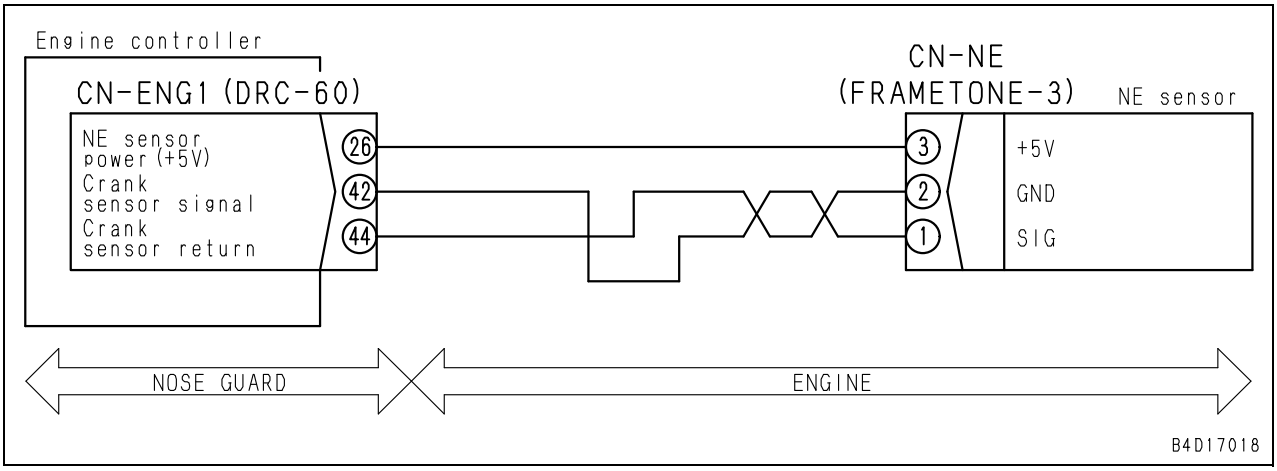
Failure code [CA187] Sensor power source 2 too low: Excessively low voltage detected

Action code	Failure code	Trouble	Sensor power source 2 too low: Excessively low voltage detected (Engine controller system)
E03	**CA187**		
Contents of trouble	• Excessively low voltage has been detected at sensor power source 2 circuit.		
Action of controller	• Flashes the warning lamp and sounds the alarm buzzer. • Operates with a fixed boost pressure (101 kPa {1.02 kg/cm²}). • Operates with a fixed atmospheric pressure (55.44 kPa {0.53 kg/cm²}). • Runs by limiting output.		
Problem that appears on machine	• Engine output is reduced.		
Related information	• Duplication of failure code: turn ON the starting switch.		

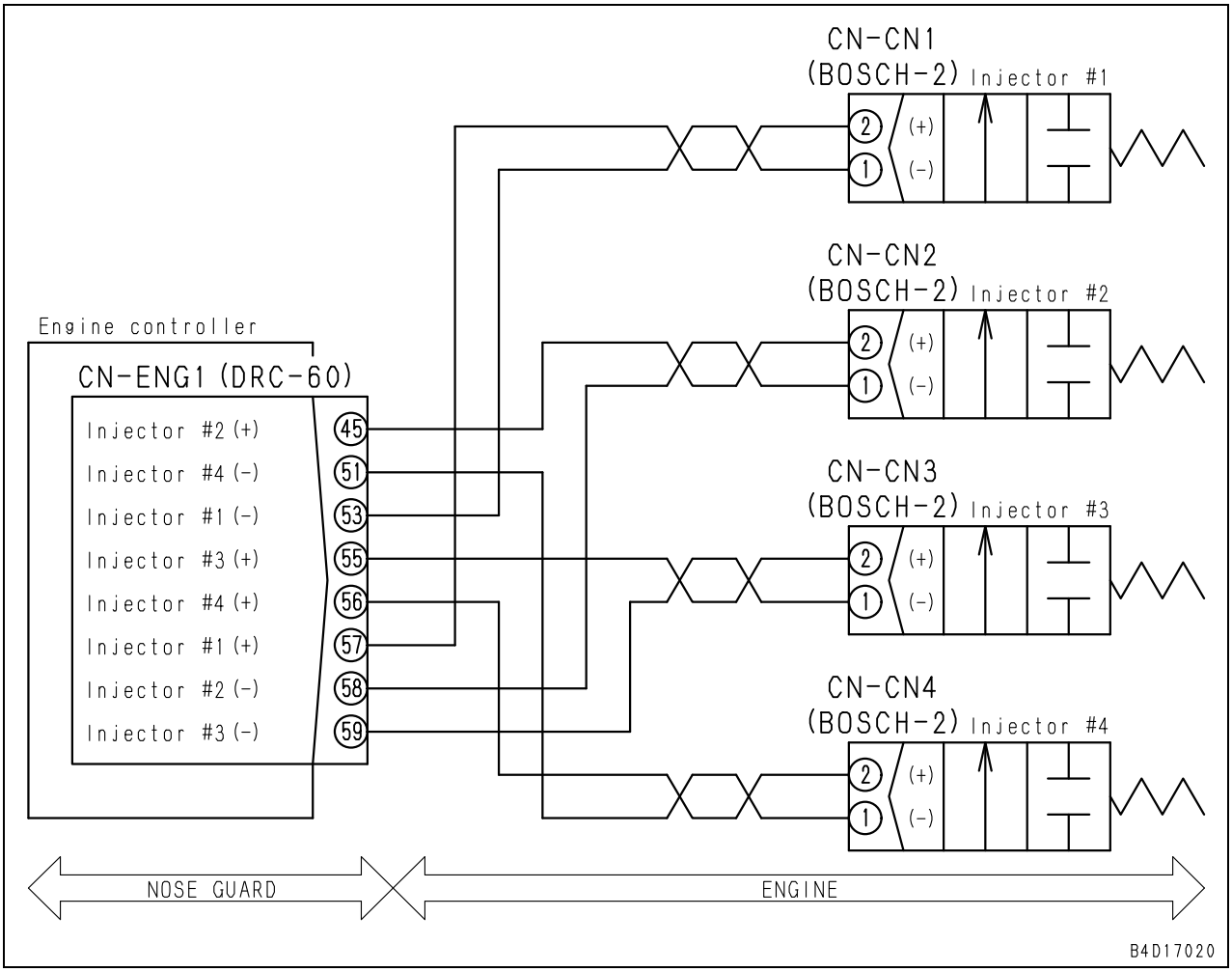
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [**CA227**].	

Reference: Bkup speed sensor = Cam speed sensor

Related circuit diagram



Related circuit diagram



Failure code [CA553] Common rail pressure too high (1): Excessively high pressure detected

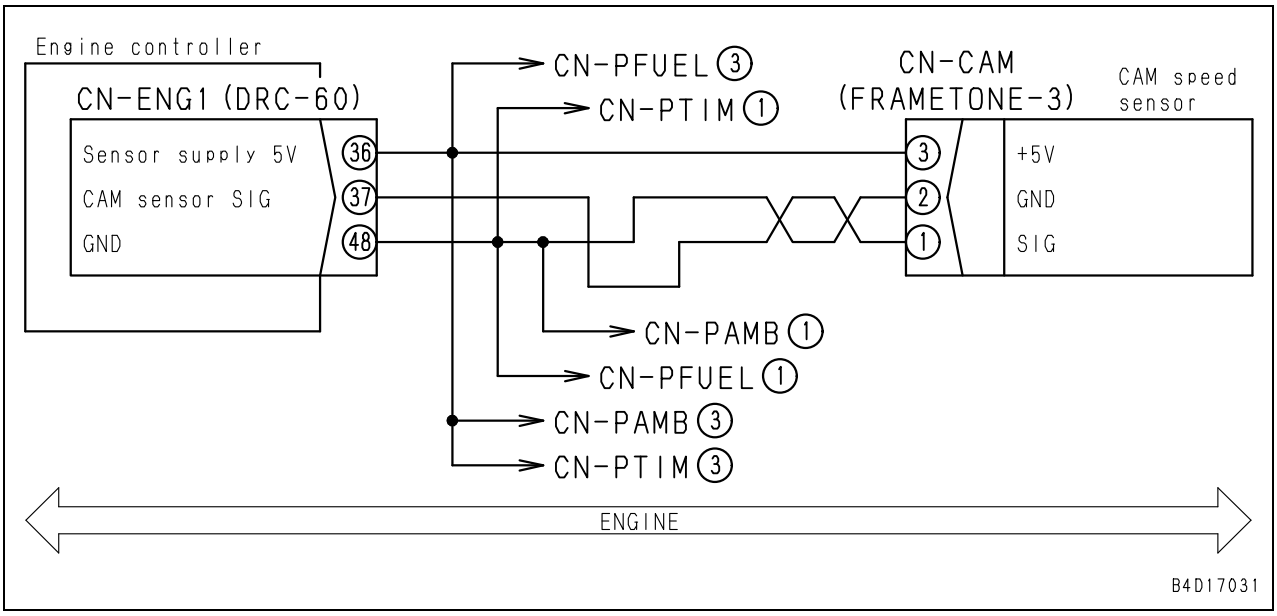
Action code	Failure code	Trouble	Common rail pressure high trouble (1): Excessively high pressure trouble occurred. (Engine controller system)
E02	**CA553**		
Contents of trouble	• Excessively high pressure trouble (1) has occurred in the common rail circuit.		
Action of controller	• Flashes the warning lamp and sounds the alarm buzzer.		
Problem that appears on machine	• Engine output is reduced.		
Related information	• Common rail pressure can be checked with the monitoring mode. (Controller: ENGINE, Code: 36400 - RAIL PRESS) • Duplication of failure code: Start the engine.		

	Causes		Standard value in normal state/Remarks on troubleshooting
Possible causes and standard value in normal state	1	Defective related system	If another failure code is indicated, carry out troubleshooting for it.
	2	Use of improper fuel	Check fuel used directly (for high viscosity).
	3	Defective electrical system of common rail pressure sensor	Common rail pressure sensor may have electric trouble. Carry out troubleshooting for failure code [**CA451**].
	4	Defective mechanical system of common rail pressure sensor	Check mechanical system of common rail pressure sensor directly.
	5	Defective overflow valve	Check overflow valve directly for broken spring, worn seat, and stuck ball.
	6	Clogging of overflow piping	Check overflow piping directly for clogging.
	7	Defective pressure limiter	Check pressure limiter directly for mechanical defect.

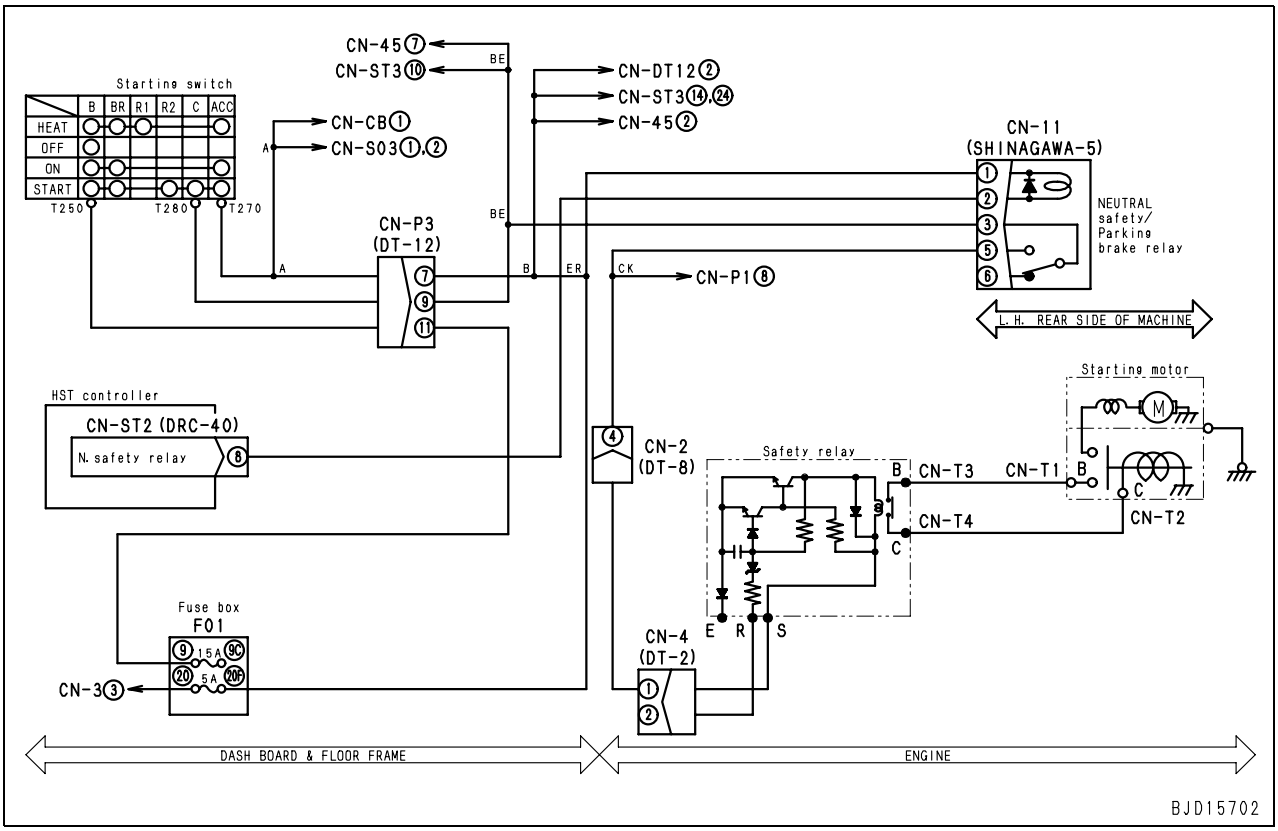
Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	6	Defective engine Bkup speed sensor	If causes 1 – 5 are not detected, engine Bkup speed sensor may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)
	7	Defective engine controller	If causes 1 – 6 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Reference: Bkup speed sensor = Cam speed sensor

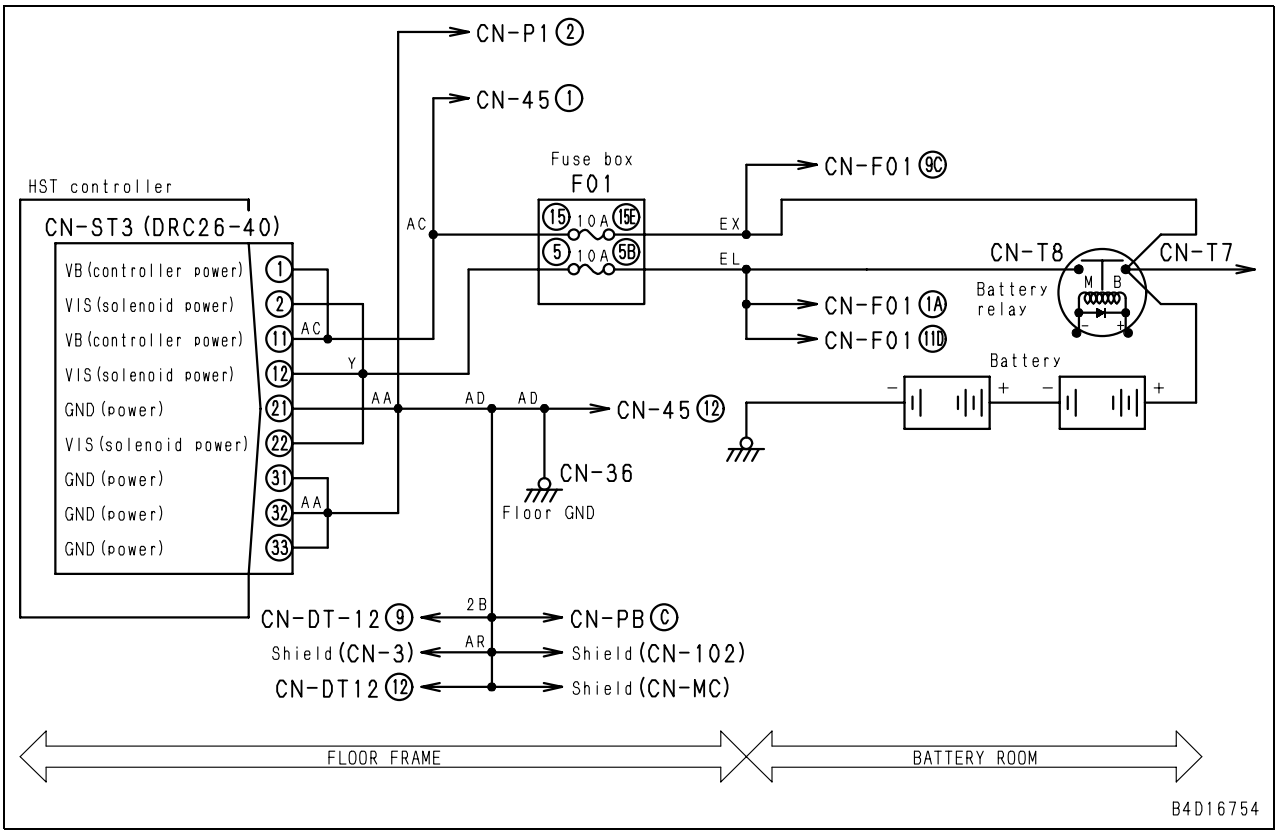
Related circuit diagram



Related circuit diagram



Related circuit diagram

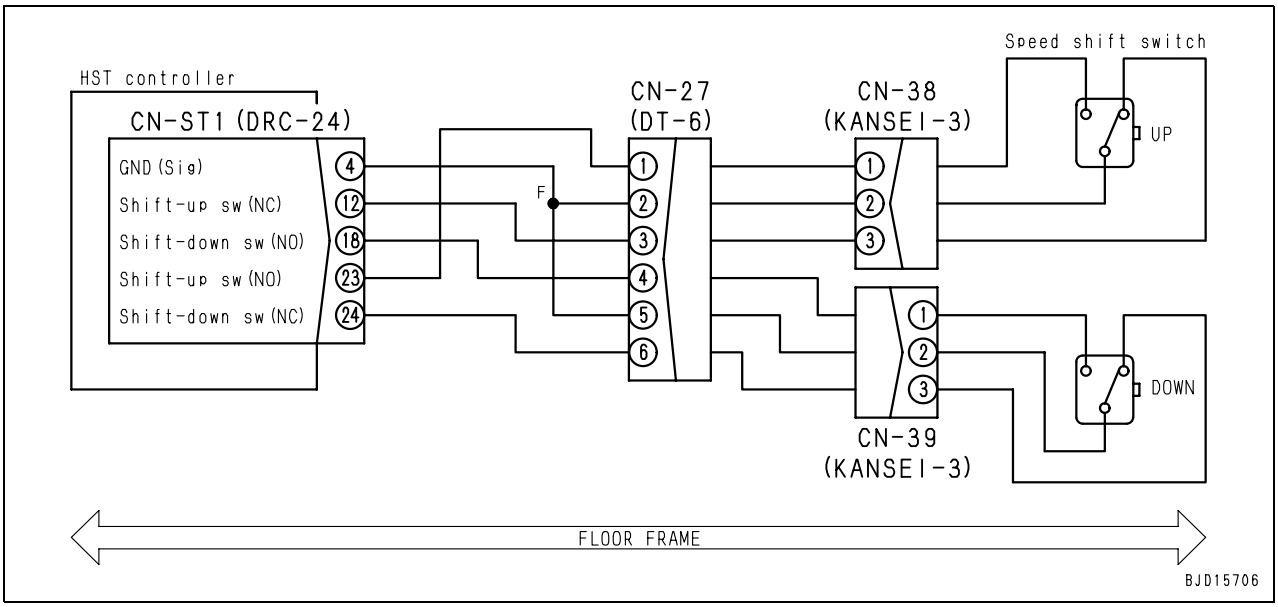


Failure code [DB2RKR] CAN communication (HST controller – Engine controller): Defective communication (Abnormality in objective component system)

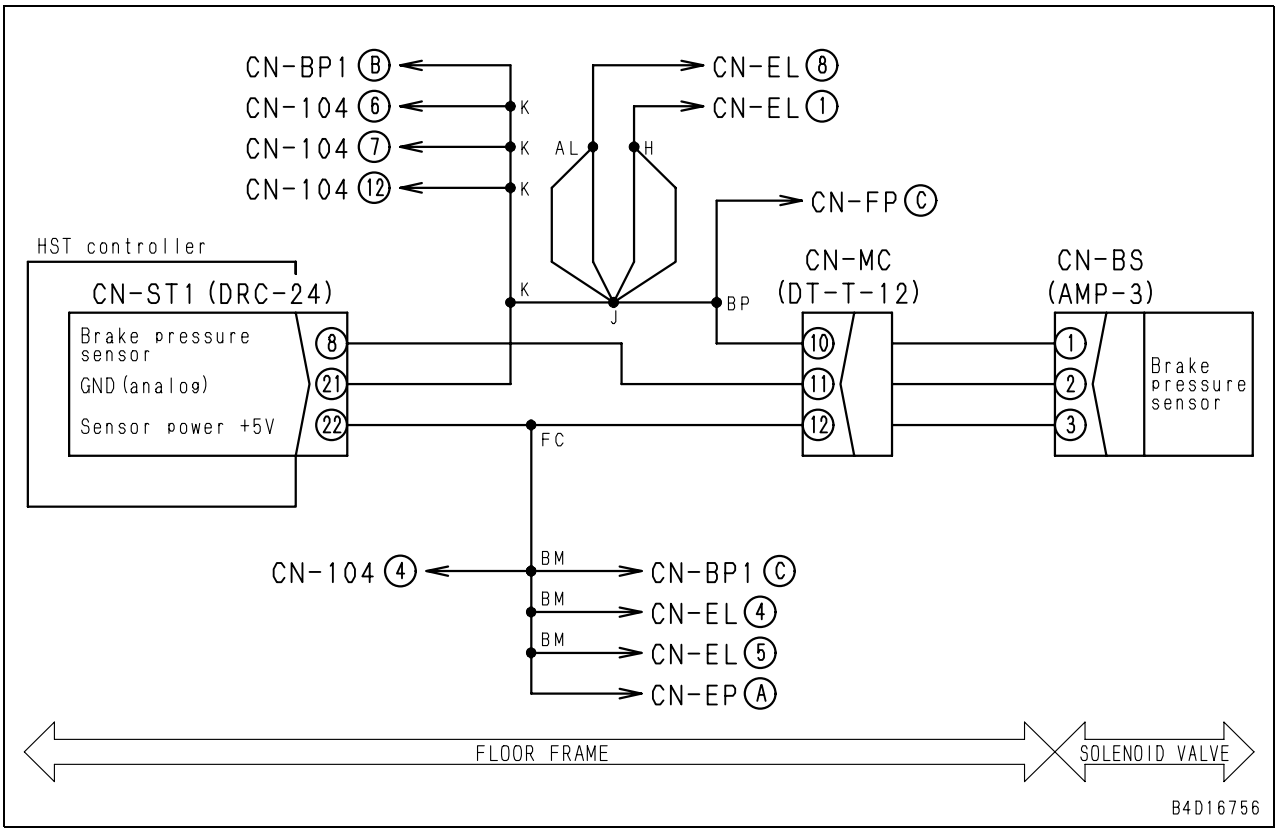
Action code	Failure code	Trouble	CAN communication (HST controller – Engine controller): Defective communication (Abnormality in objective component system) (HST controller system)
E03	**DB2RKR**		
Contents of trouble	• Abnormality was detected in the communication between the HST controller and engine controller.		
Action of controller	• Flashes the warning lamp and sounds the alarm buzzer. • Limits the functions partly. • If cause of error disappears, system resets itself.		
Problem that appears on machine	• The system may not work properly. • Engine speed is limited to medium (half) speed by modulated rate. • Once the machine is stopped and started again, its travel speed is limited to 50%.		
Related information	Method of reproducing failure code: Turn the starting switch ON [**DAFRKR**] is output when the monitor panel cannot recognize the HST controller. [**DAFRMC**] is output when the monitor panel cannot recognize the engine controller. [**DAJRKR**] is output when the HST controller cannot recognize the monitor panel. [**CA1633**] is output when the engine controller cannot recognize the HST controller.		

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Short circuit in wiring harness	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			CN-PT12 (male)	Resistance	
			Between (3) and (10)	50 – 70 Ω	
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Wiring harness between CN-S04 (female) (1), (6) – CN-CE02 (female) (1), – CN-ST2 (female) (32), – CN-G01 (female) (8), – CN-119 (female) (A), CN-DT12 (male) (3)	Resistance	Max. 1 Ω
			Wiring harness between CN-S04 (female) (3) – CN-CE02 (female) (21), – CN-ST2 (female) (22), – CN-G01 (female) (7), – CN-119 (female) (B), CN-DT12 (male) (10)	Resistance	Max. 1 Ω
	3	Grounding fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Wiring harness between CN-S04 (female) (1), (6) – CN-CE02 (female) (1), – CN-ST2 (female) (32), – CN-G01 (female) (8), – CN-119 (female) (A), CN-DT12 (male) (3) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between CN-S04 (female) (3) – CN-CE02 (female) (21), – CN-ST2 (female) (22), – CN-G01 (female) (7), – CN-119 (female) (B), CN-DT12 (male) (10) and chassis ground	Resistance	Min. 1 MΩ

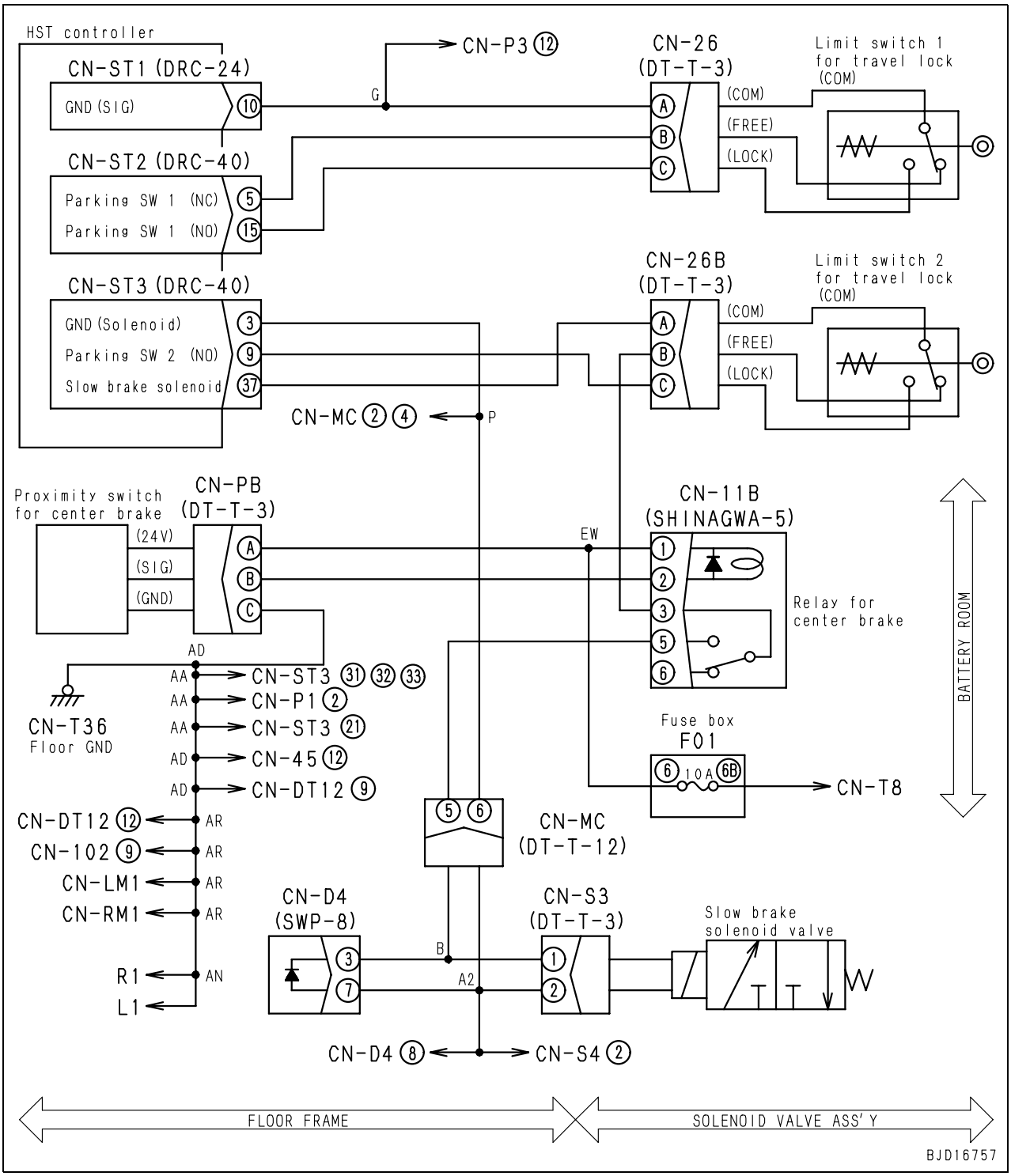
Related circuit diagram



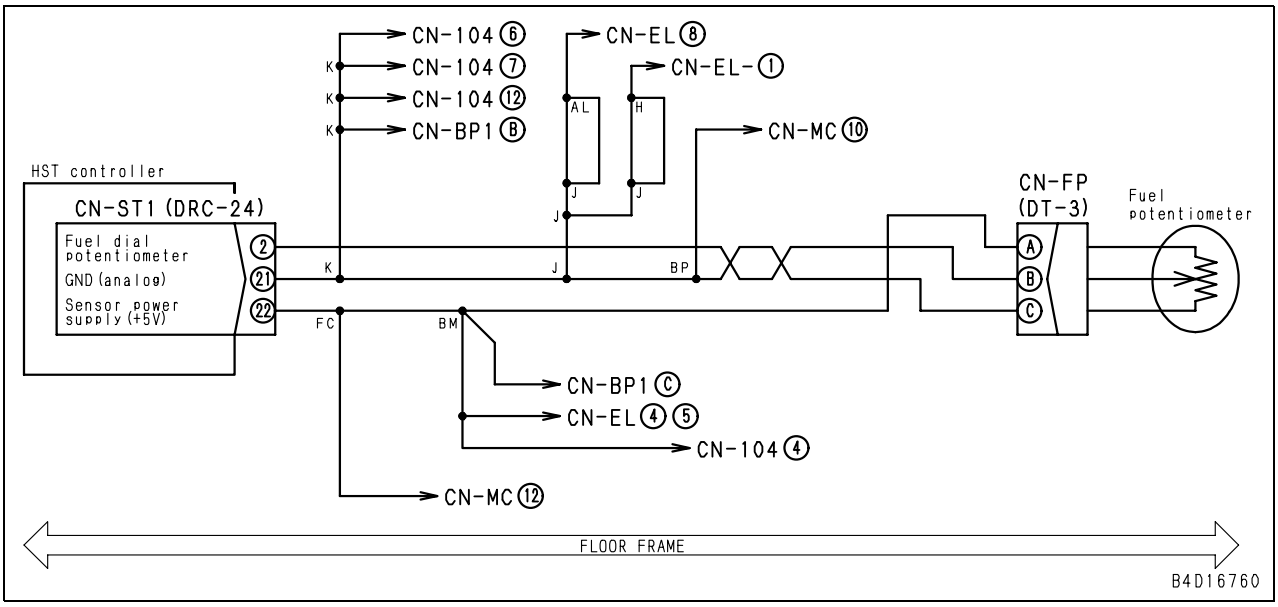
Related circuit diagram



Related circuit diagram



Related circuit diagram

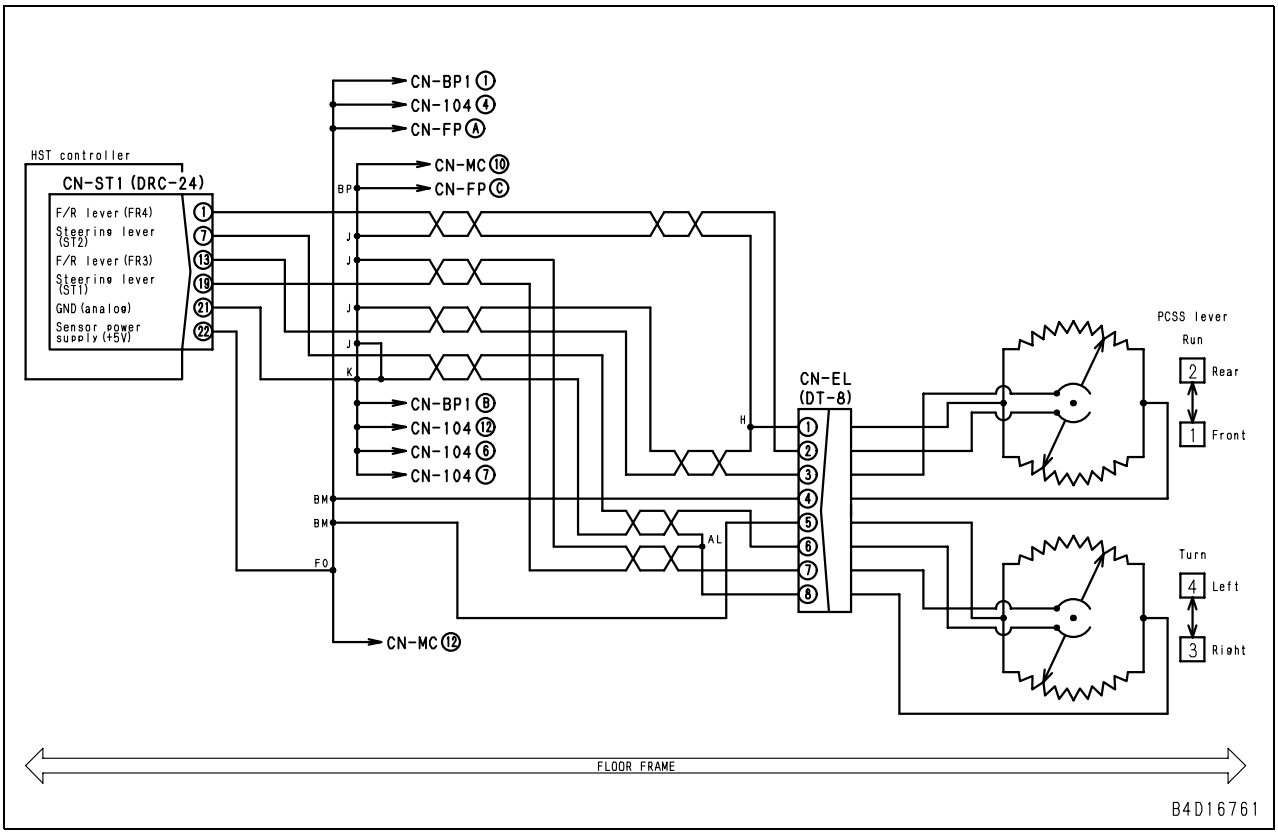


Failure code [DK55KZ] Directional potentiometer: Disconnection or short circuit

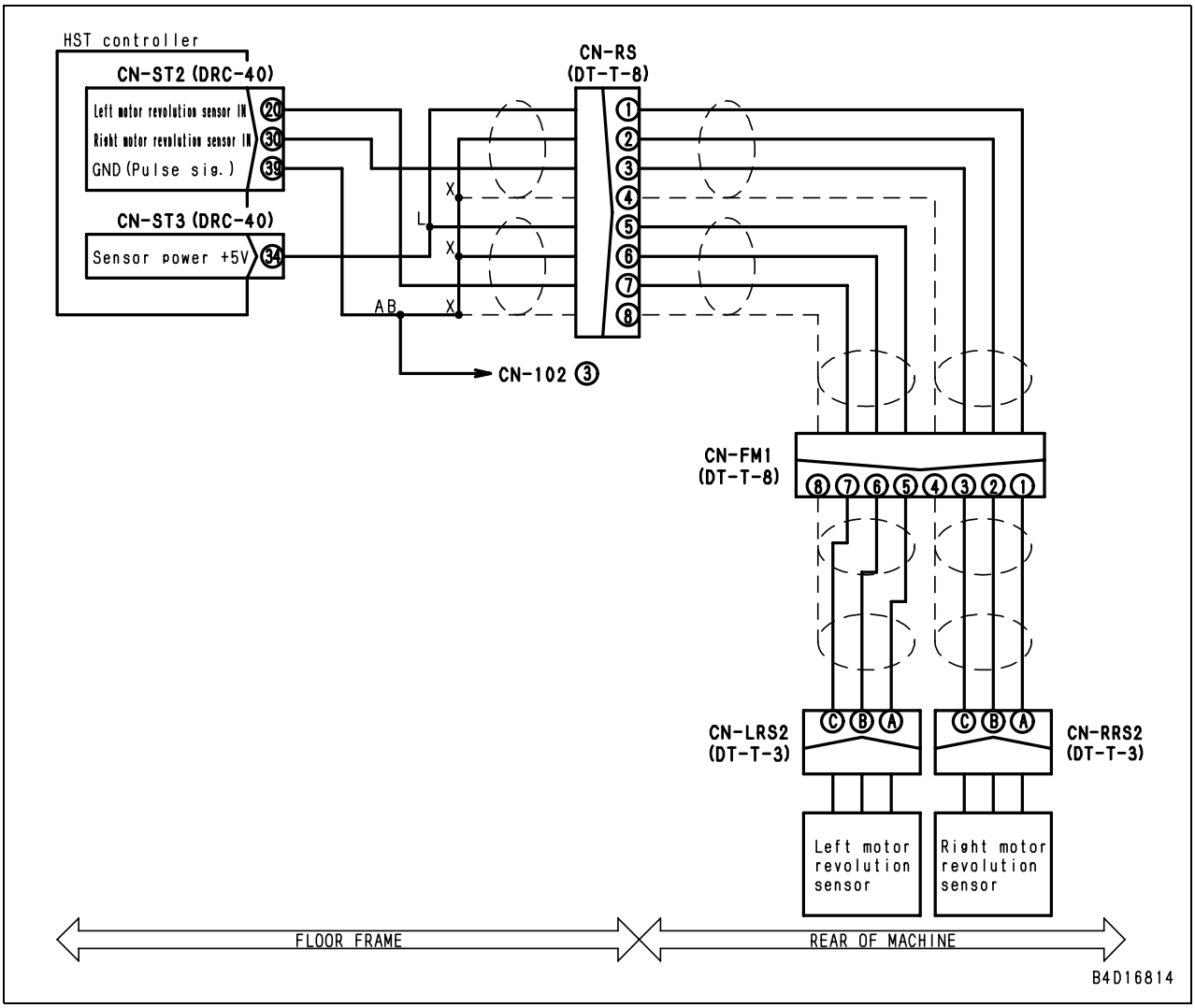
Action code	Failure code	Trouble	Directional potentiometer: Disconnection or short circuit (HST controller system)
E04	**DK55KZ**		
Contents of trouble	• When the starting switch was turned ON, either of System 1 or System 2 of the directional potentiometer was defective, but, later, a trouble occurred to the other that was normal at that time. When the starting switch was turned ON, directional potentiometer 2 was only defective, but, later, [**DK56KA**] or [**DK56KB**] appeared. Or, when the starting switch was turned ON, directional potentiometer 1 was only defective, but, later, [**DK57KA**] or [**DK57KB**] appeared.		
Action of controller	• Flashes the warning lamp and sounds the alarm buzzer. • Until the machine stops, the controller maintains the control using the position signal being received immediately prior to the failure. • Even if cause of error disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Once the machine is stopped, Engine speed is limited to 50% of the value. • Once the machine is stopped, it cannot be started again.		
Related information	• Input state (voltage) from the directional potentiometers 1 and 2 can be checked with the monitoring mode. (Controller: HST, code: 50202 FR LEVER 1 and code: 50203 FR LEVER 2) • Method of reproducing failure code: Turn the starting switch ON and operate the PCCS lever (directional operation)		

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for the failure codes [**DK56KA**], [**DK56KB**], [**DK57KA**], and [**DK57KB**].	

Related circuit diagram



Related circuit diagram



BULLDOZER

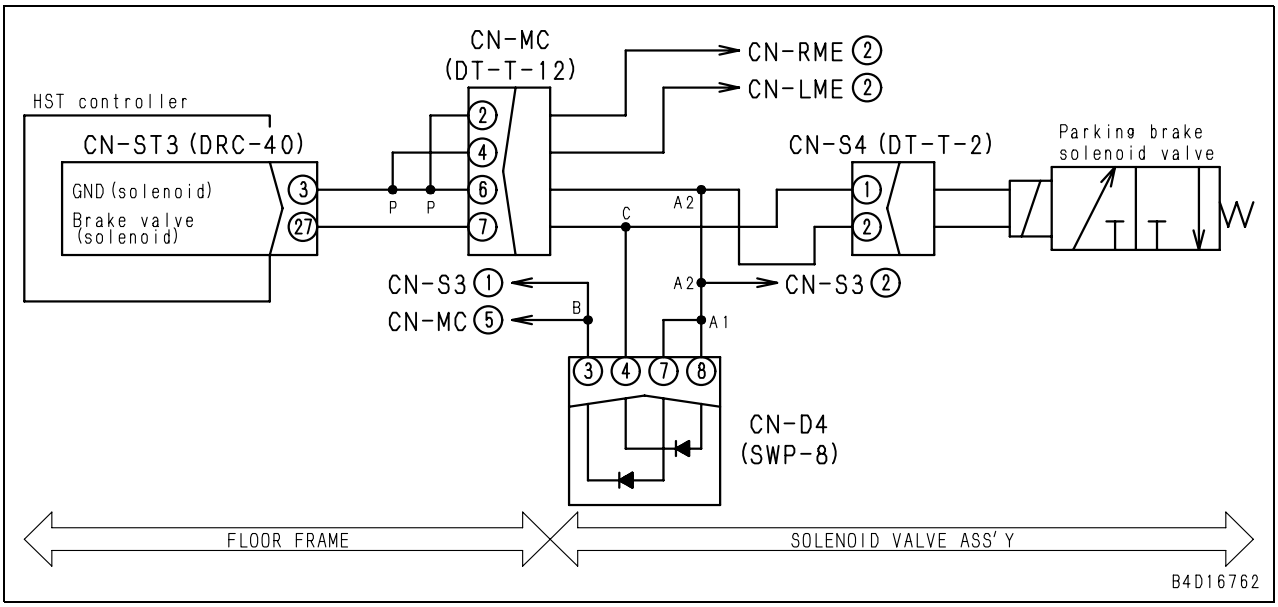
D31EX-22
D31PX-22
D37EX-22
D37PX-22

Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

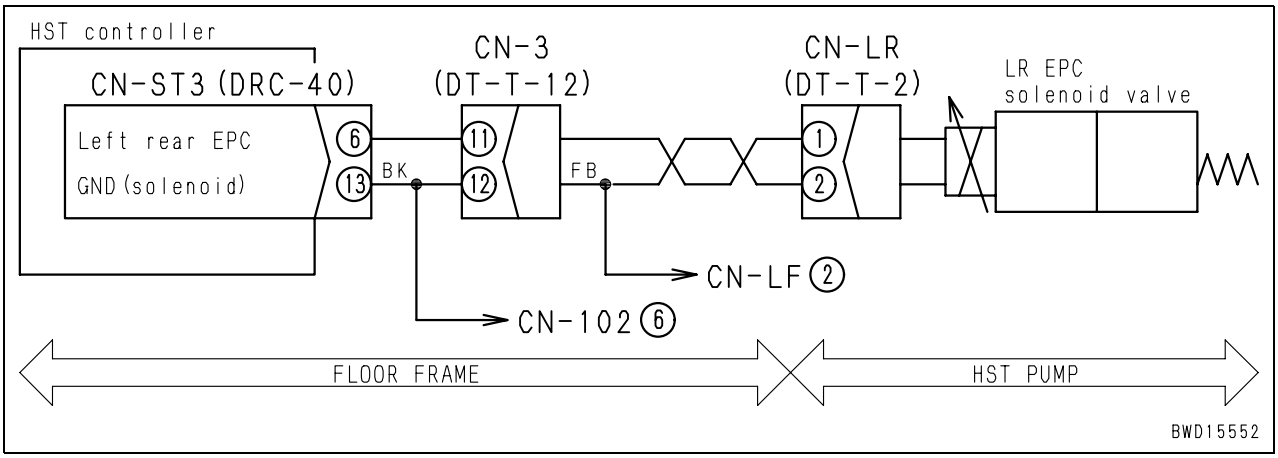
40 Troubleshooting

350 Troubleshooting by failure code (Display of code), Part 5

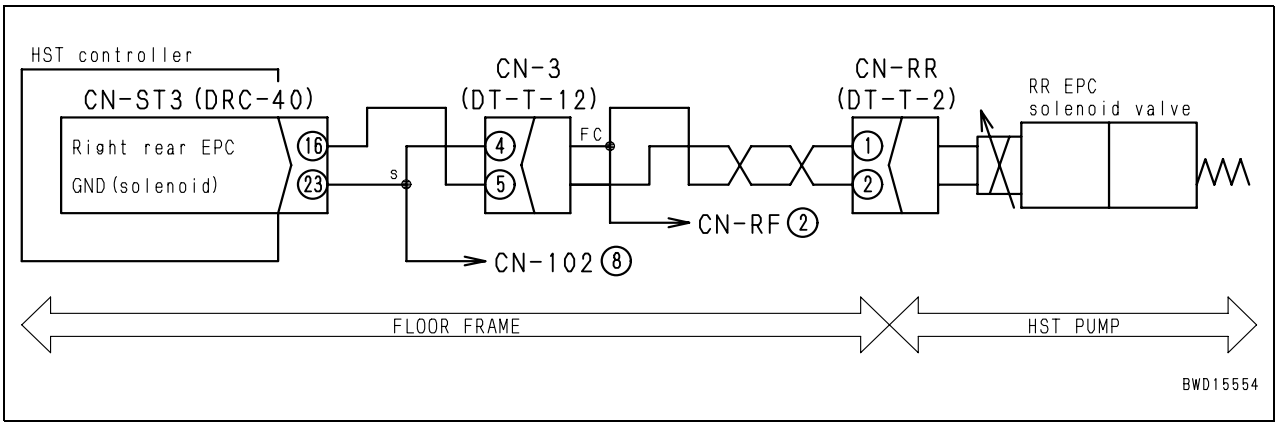
Related circuit diagram



Related circuit diagram



Related circuit diagram



BULLDOZER

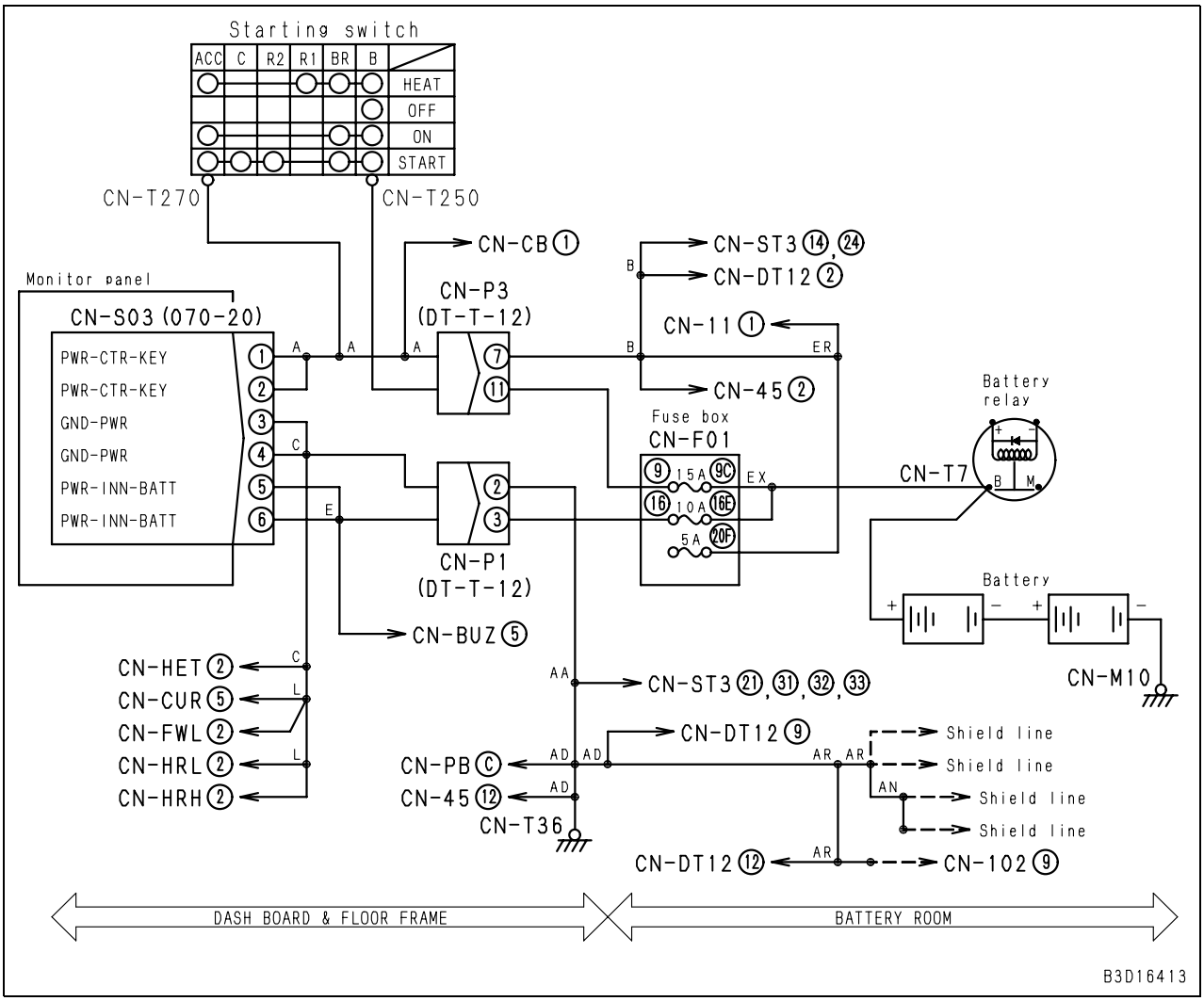
D31EX-22
D31PX-22
D37EX-22
D37PX-22

Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

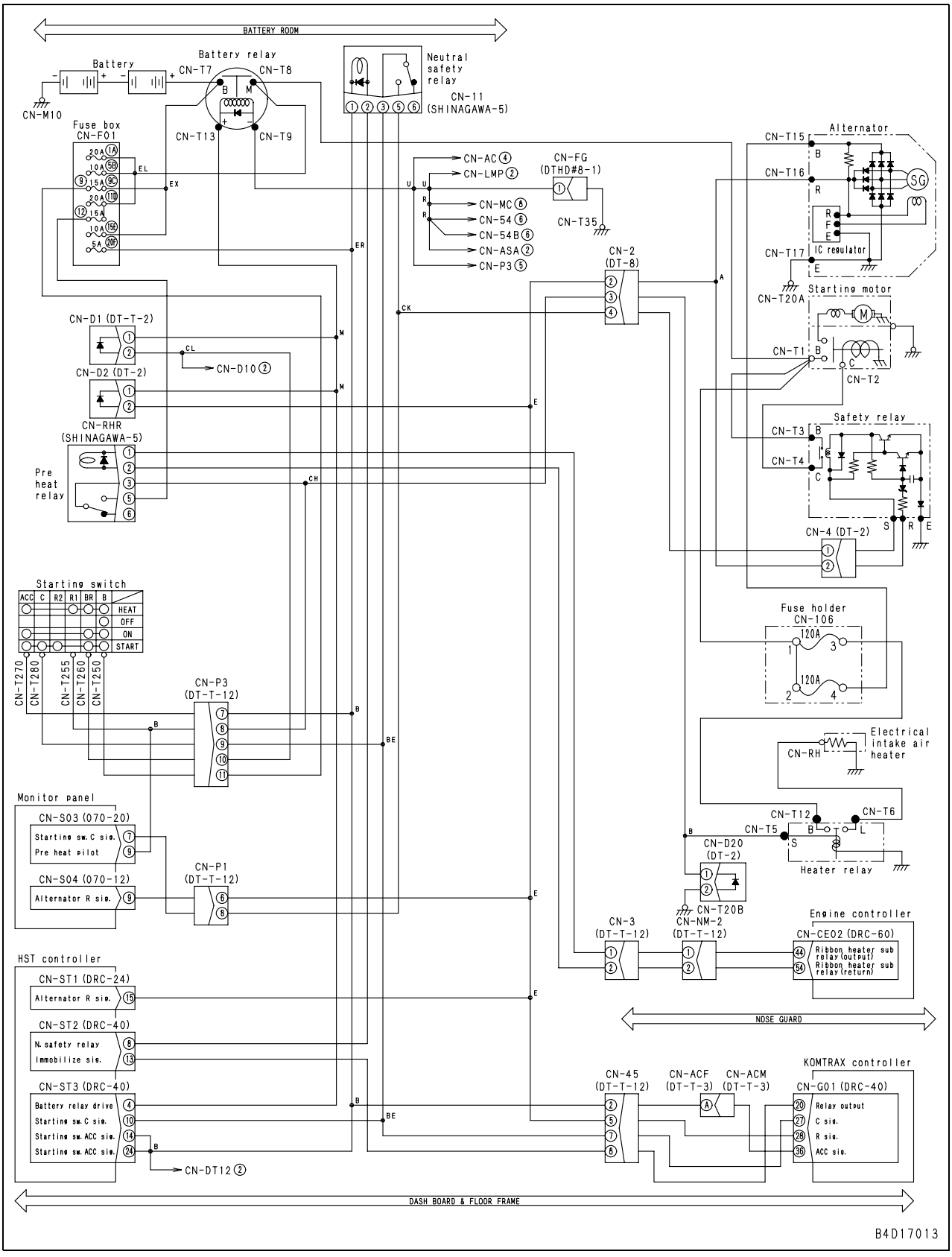
40 Troubleshooting

400 Troubleshooting of electrical system (E-mode)

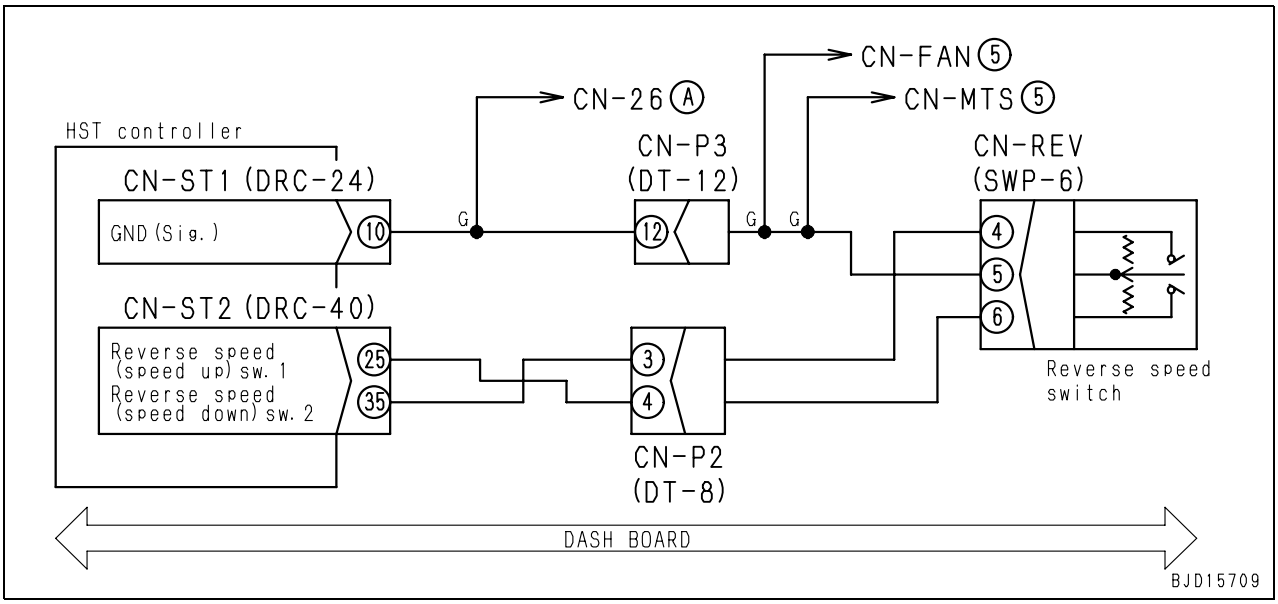
Related circuit diagram



Related circuit diagram



Related circuit diagram

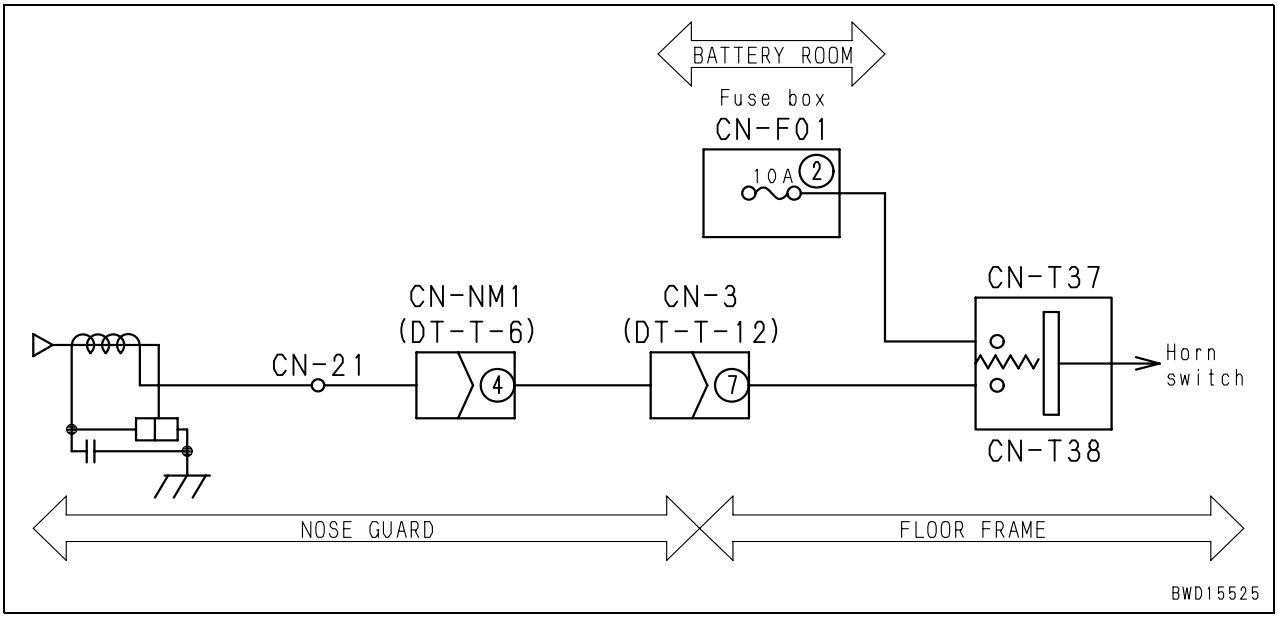


E-20 The horn does not sound or does not stop

Trouble	• The horn does not sound or does not stop.
Related information	

	Cause		Standard value in normal state / Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Disconnection of fuse CN-F01 (2A)	If the fuse is broken, the circuit probably has a grounding fault, etc. (See cause 4)		
	2	Defective horn switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Terminal (switch)	Horn switch	Resistance
			CN-T37 and CN-T38	OFF	Min. 1 MΩ
				ON	Max. 1 Ω
	3	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Wiring harness between CN-F01 (2) and CN-T37	Resistance	Max. 1 Ω
			Wiring harness between CN-T38 and CN-21	Resistance	Max. 1 Ω
	4	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			Between CN-F01 (2) – CN-T37 wiring harness and chassis ground	Resistance	Min. 1 MΩ
			Between CN-T38 – CN21 wiring harness and chassis ground	Resistance	Min. 1 MΩ
	5	Short circuit with power source in wiring harness (Contact with 24 V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between CN-T38 – CN21 wiring harness and chassis ground	Voltage	Max. 1 V
	6	Defective horn (Internal defect)	If neither of causes 1 – 5 is the cause of the trouble, the horn may be defective.		

Related circuit diagram



Trouble	(2) Air is not cooled.
Related information	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Disconnection of fuse (CN-F01 (4))	If the fuse is broken, the circuit probably has a grounding fault, etc.		
	2	Defective blower selector switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			CN-AC4 (male)	Blower selector switch	Resistance
			Between (5) and (4)	OFF	Min. 1 MΩ
				Other than OFF	Max. 1 Ω
	3	Defective mode selector switch (Internal disconnection or short circuit	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			CN-AC5 (male)	Mode selector switch	Resistance
			Between (1) and (3)	COOL	Min. 1 MΩ
				A/C	Max. 1 Ω
	4	Defective heater mode relay (Contact side)	★ Prepare with starting switch OFF, then turn starting switch and blower switch ON and carry out troubleshooting.		
			CN-ACR1 (male)	Mode selector switch	Voltage
			Between (87A) and chassis ground	Other than HEAT	20 – 30 V
	5	Defective compressor clutch relay (Coil side)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			CN-ACR2 (male)	Resistance	
			Between (86) and (85)	305 ± 15 Ω	
	6	Defective compressor clutch relay (Contact side)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.		
			CN-ACR2 (male)	Resistance	
			Between (30) and (87A)	Max. 1 Ω	
	7	Defective condenser fan relay (Coil side)	★ Prepare with starting switch OFF, then turn starting switch and blower switch ON and carry out troubleshooting.		
			CN-ACR3 (male)	Resistance	
			Between (86) and (85)	305 ± 15 Ω	
	8	Defective condenser fan relay (Contact side)	★ Prepare with starting switch OFF, then turn starting switch and blower switch ON and carry out troubleshooting.		
			CN-ACR3 (male)	Mode selector switch	Voltage
			Between (87) and chassis ground	Other than HEAT	20 – 30 V
	9	Defective condenser motor	★ Prepare with starting switch OFF, then turn starting switch and blower switch ON and carry out troubleshooting.		
			Turn blower switch ON and set mode selector switch in position other than HEAT. If condenser motor rotates at this time, condenser motor is normal.		
	10	Defective compressor magnetic clutch	The compressor magnetic clutch may be defective. Check it directly		
	11	Defective compressor	The compressor may be defective. Check it directly.		

Trouble	(6) Left door wiper does not operate (Continuous operation is defective).
Related information	• If fuse (FUSE (6)) is broken, operations of both right door wiper and left door wiper become defective. • Carry out troubleshooting with left door wiper switch ON and intermittent switch OFF.

	Cause		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Disconnection of fuse (FUSE (6))	If the fuse is broken, the circuit probably has a grounding fault, etc. (See cause 7).			
	2	Defective left door wiper motor (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CN-A24	Left door wiper switch	Voltage	
			Between (3) and (1)	ON	20 – 30 V	
			If voltage is normal but wiper does not operate, motor is defective.			
	3	Defective left door wiper switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.			
			CN-A15 (male)	Left door wiper switch	Resistance	
			Between (2) and (3)	OFF	Min. 1 MΩ	
				ON	Max. 1 Ω	
	4	Defective left door wiper intermittent selector relay (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace left door wiper intermittent selector relay (Right No.) with another relay. If left door wiper becomes normal at this time, intermittent selector relay is defective.			CN-A27
	5	Defective left door wiper intermittent relay (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace left door wiper intermittent relay (Right No.) with another relay. If left door wiper becomes normal at this time, intermittent relay is defective.			CN-A26
	6	Disconnection in wiring harness (Disconnection in wiring harness or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.			
			Wiring harness between FUSE (6) and CN-A15 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between CN-A27 (female) (3) and CN-A15 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between CN-A27 (female) (4) and CN-A26 (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between CN-A26 (female) (6) and GND3		Resistance	Max. 1 Ω
			Wiring harness between CN-A26 (female) (5) and CN-A24 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between CN-A26 (female) (1) and CN-A24 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between FUSE (6) and CN-A24 (female) (4)		Resistance	Max. 1 Ω
			Wiring harness between CN-A24 (female) (1) and GND6		Resistance	Max. 1 Ω
	7	Short circuit with chassis ground in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch.			
			Between FUSE (6) – CN-A15 (female) (3) wiring harness and chassis ground		Resistance	Min. 1 MΩ
			Between FUSE (6) – CN-A24 (female) (4) wiring harness and chassis ground		Resistance	Min. 1 MΩ

BULLDOZER

D31EX-22
D31PX-22
D37EX-22
D37PX-22

Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

40 Troubleshooting

500 Troubleshooting of hydraulic and mechanical system (H-mode)

H-7 Machine deviates largely during travel

Contents of trouble	• Machine deviates largely during travel.
Related information	

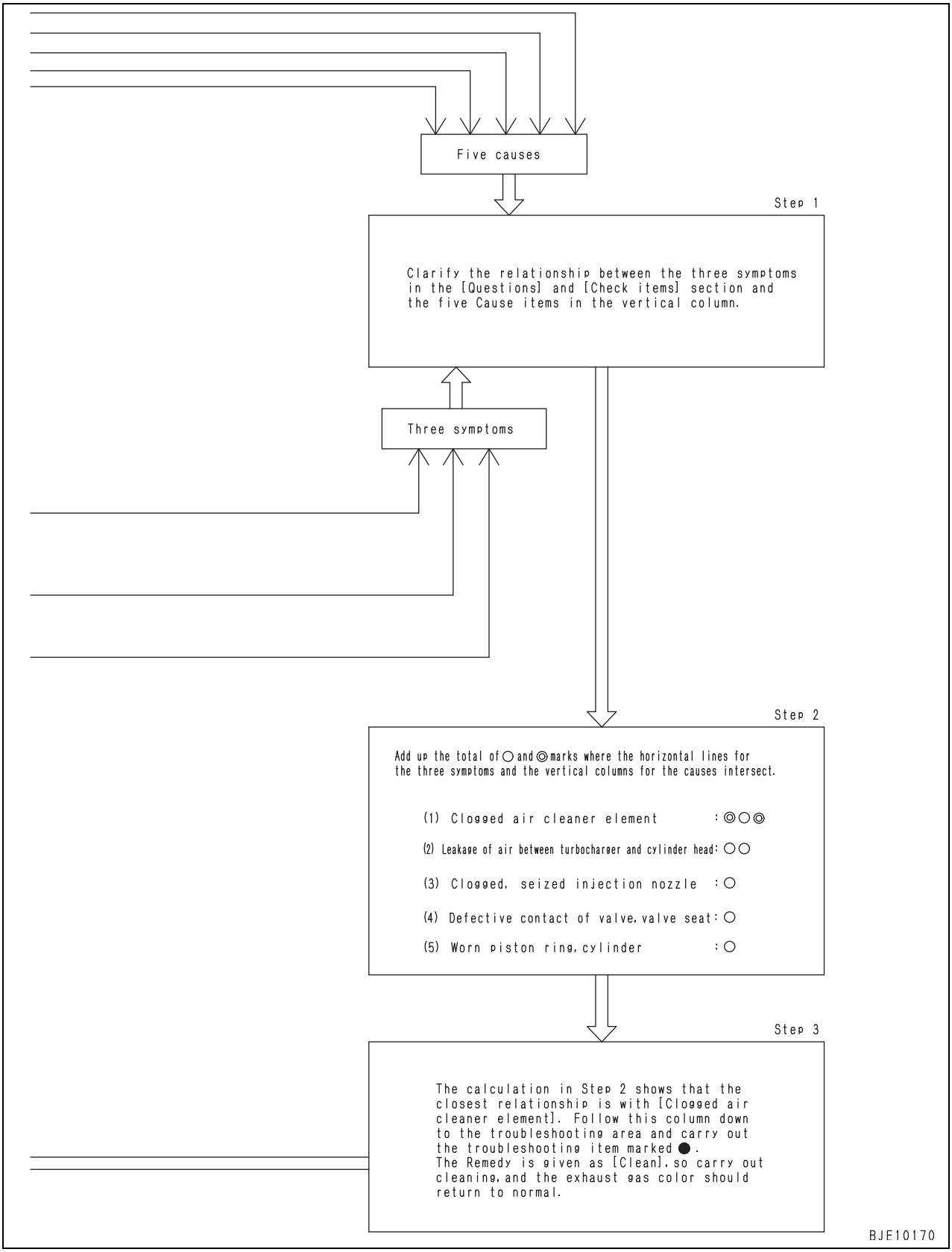
<table>
<tr><td rowspan="16">Possible causes and standard value in normal state</td><td colspan="2">Cause</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Malfunction of HST pump (servo valve)</td><td colspan="3">The servo valve of the HST pump (on 1 side) may be malfunctioning. Check it directly.</td></tr>
<tr><td>2</td><td>Wrong operation of HST pump (towed valve)</td><td colspan="3">The towed valve of the HST pump (on 1 side) may be operated (opened) wrongly. Check it directly.</td></tr>
<tr><td>3</td><td>Defect in HST pump (pump unit)</td><td colspan="3">The pump unit of the HST pump (on 1 side) may have a defect in it. Check it directly.</td></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Malfunction of 5-spool valve (HST motor EPC valve)</td><td colspan="3">★ Prepare with engine stopped, then carry out troubleshooting.</td></tr>
<tr><td>Travel mode</td><td>Travel speed and travel condition</td><td>Output pressure of right and left HST motor EPC valves</td></tr>
<tr><td rowspan="3">Quick shift mode</td><td>Stop and travel in 1st</td><td>0 MPa {0 kg/cm²}</td></tr>
<tr><td>Travel in 2nd</td><td>1.47 ± 0.49 MPa {15 ± 5 kg/cm²}</td></tr>
<tr><td>Travel in 3rd</td><td>2.16 ± 0.49 MPa {22 ± 5 kg/cm²}</td></tr>
<tr><td>5</td><td>Defect in HST pump (parking brake)</td><td colspan="3">The parking brake of the HST motor (on 1 side) may have a defect in it. Check it directly.</td></tr>
<tr><td>6</td><td>Malfunction of HST motor (charge relief valve)</td><td colspan="3">The charge relief valve of the HST motor (on 1 side) may be malfunctioning. Check it directly.</td></tr>
<tr><td>7</td><td>Defect in HST motor (motor unit)</td><td colspan="3">The motor unit of the HST motor (on 1 side) may have a defect in it. Check it directly.</td></tr>
<tr><td>8</td><td>Defective HST motor (speed sensor)</td><td colspan="3">If failure code [DLM1KB], [DLM1MA], [DLM2KB], or [DLM2MA] is displayed, carry out troubleshooting for it.</td></tr>
<tr><td>9</td><td>Defective air bleeding from HST pump</td><td colspan="3">Air may be left in the servo valve of the HST pump. Bleed air again.</td></tr>
<tr><td>10</td><td>Defective initial adjustment of HST pump</td><td colspan="3">Initial adjustment of HST pump may have been performed wrongly. Perform it again.
★ If there is still travel deviation at low travel speed, adjust in fine tuning mode.
Change of forward pump start adjustment value (Change right and left sides separately) 3035-F-PUMP MAP1
Change of reverse pump start adjustment value (Change right and left sides simultaneously) 3036-R-PUMP MAP1</td></tr>
<tr><td>11</td><td>Defective initial adjustment of HST motor</td><td colspan="3">Initial adjustment of HST motor may have been performed wrongly. Perform it again.</td></tr>
<tr><td rowspan="5">12</td><td rowspan="5">Defective adjustment of steering lever</td><td colspan="3">• Prepare with starting switch ON, then carry out troubleshooting in real-time monitoring mode.</td></tr>
<tr><td colspan="3">Controller: HST
Monitoring code: 50303 S/T LEVER</td></tr>
<tr><td colspan="2">PCCS lever</td><td>Stroke</td></tr>
<tr><td colspan="2">Neutral</td><td>0 ±10%</td></tr>
<tr><td colspan="3">If there is any abnormality, initialize steering lever.</td></tr>
</table>

H-19 Abnormal sound comes out from around work equipment pump and control valve

Contents of trouble	• Abnormal sound comes out from around work equipment pump and control valve.
Related information	• Check that the oil level in the hydraulic tank is normal before carrying out troubleshooting.

	Cause		Standard value in normal state/Remarks on troubleshooting	
Possible causes and standard value in normal state	1	Low oil level in hydraulic tank or use of improper oil	The oil level in the hydraulic tank may be low or improper oil may be used. Check the oil directly.	
	2	Clogging of work equipment pump suction strainer	The work equipment pump suction strainer may be clogged. Check it directly.	
	3	Looseness of work equipment suction piping	The work equipment suction piping may be loosened. Check it directly.	
	4	Defective adjustment or malfunction of control valve (main relief valve)	★ Prepare with engine stopped, then run engine at high idle and carry out troubleshooting.	
			Blade control lever	Work equipment pump relief pressure
			Relief of blade circuit (by lifting or tilting)	27.4 ± 1.0 MPa {280 ± 10 kg/cm²}
			If the oil pressure does not become normal after adjustment, the main relief valve may have a malfunction or a defect in it. Check the main relief valve directly.	
	5	Defect in work equipment pump (pump unit)	The pump unit of the work equipment pump may have a defect in it. Check it directly.	
	6	Loosening of piping between HST pump and HST motor	The piping between the HST pump and HST motor may be loosened. Check it directly.	

If we look from these 3 symptoms to find the causes, we find that there is a relationship with 5 causes. Let us explain here the method of using this causal relationship to pinpoint the most probable cause.



S-8 Oil consumption is excessive (or exhaust smoke is blue)

General causes why oil consumption is excessive

- Abnormal consumption of oil
- Long-time operation of engine at low idle or high idle (Do not run engine at idle for more than 20 minutes continuously)
- External leakage of oil
- Wear of pats in lubrication system

			Causes														
					Turbocharger												
			Dust sucked in from intake system	Worn, damaged valve (stem, guide, seal)	Worn seal at turbine end	Worn seal at blower end	Clogged breather, breather hose	Broken piston ring	Worn piston ring, cylinder	Worn, damaged rear oil seal	Broken oil cooler	Oil leakage from oil cooler	Oil leakage from oil filter	Oil leakage from oil piping	Oil leakage from oil drain plug	Oil leakage from oil pan, cylinder head, etc.
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period		△	△	△			△								
	Oil consumption suddenly increased							◎			○						
	Oil must be added more frequently								◎		○						
	Oil becomes contaminated quickly						○	○	◎								
Check items	Outside of engine is dirty with oil											◎	◎	◎	◎	◎
	There are loose piping clamps in intake system		◎														
	Inside of turbocharger intake outlet pipe is dirty with oil					◎											
	Inside of turbocharger exhaust outlet pipe is dirty with oil			○	◎												
	There is oil in coolant										◎						
	Oil level in damper chamber is high									◎							
	Exhaust smoke is blue under light load							◎	◎								
	Amount of blow-by gas	Excessive		○		○		◎	◎								
		None					◎										
Troubleshooting	When intake manifold is removed, dust is found inside		●														
	When intake manifold is removed, inside is found to be dirty abnormally			●													
	Excessive play of turbocharger shaft				●	●											
	Check breather and breather hose directly						●										
	When compression pressure is measured, it is found to be low							●	●								
	Inspect rear oil seal directly									●							
	Pressure-tightness test of oil cooler shows there is leakage										●	●					
	There is external leakage of oil from engine												●	●	●	●	
		Remedy	Correct	Correct	Replace	Replace	Clean	Replace	Replace	Correct	Replace	Replace	Correct	Correct	Correct	Correct	Correct

BULLDOZER

D31EX-22
D31PX-22
D37EX-22
D37PX-22

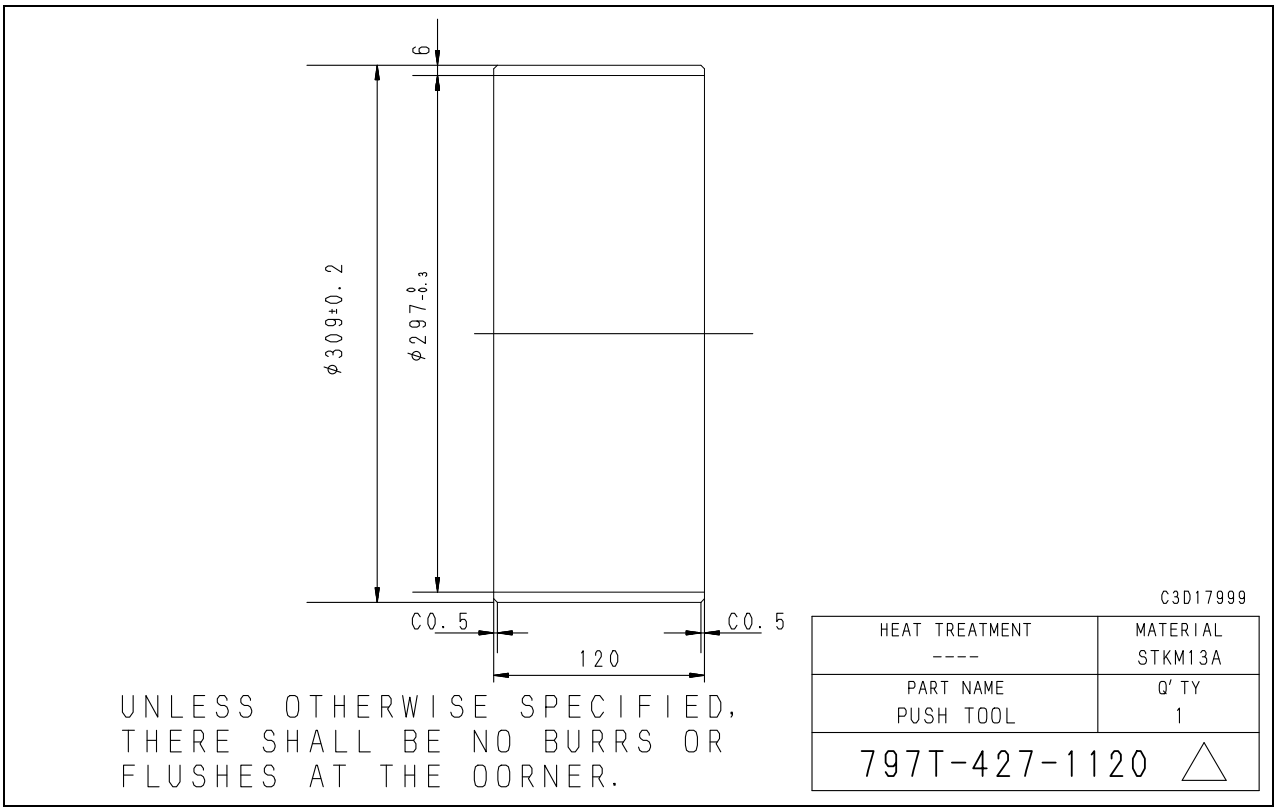
Machine model	Serial number
D31EX-22	60001 and up
D31PX-22	60001 and up
D37EX-22	60001 and up
D37PX-22	60001 and up

50 Disassembly and assembly

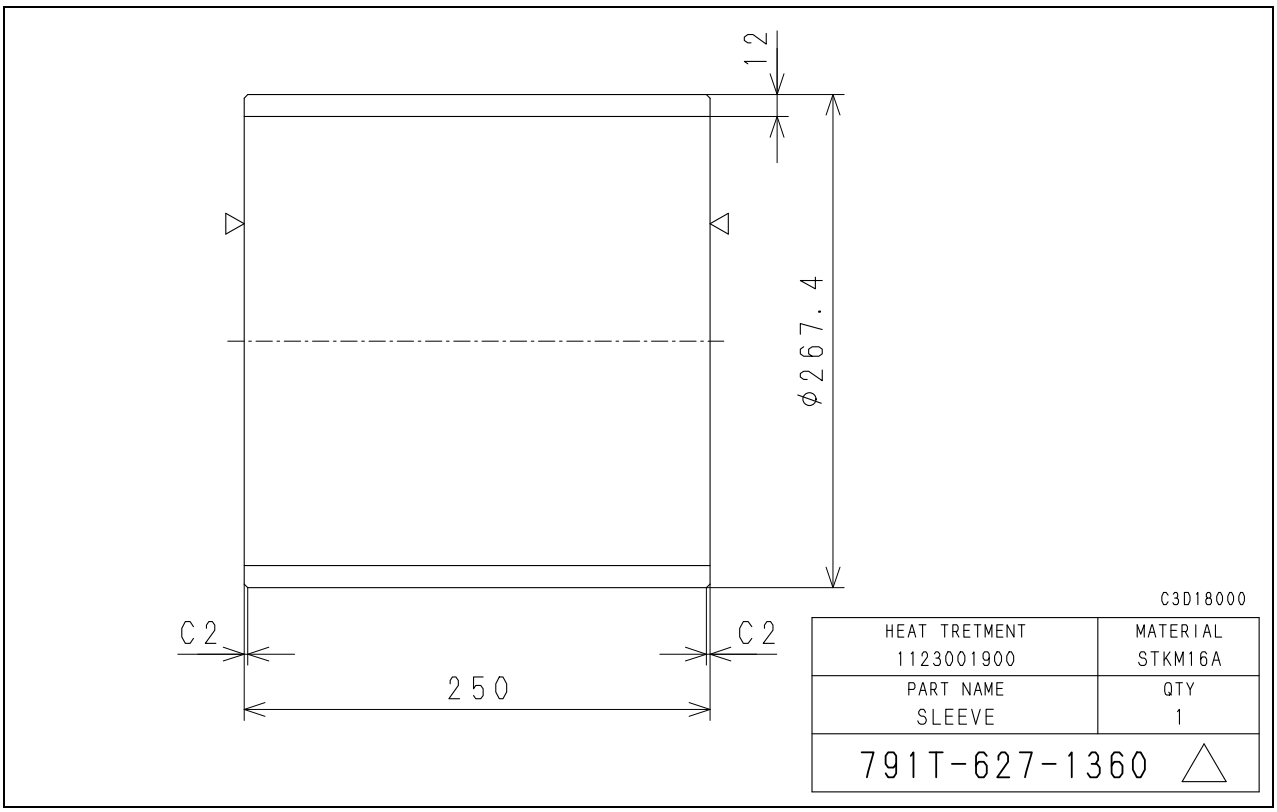
100 General information on disassembly and assembly

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

J4 Push tool



J5 Sleeve



Installation

- Carry out installation in the reverse order to removal.

[*1]

⚠ **Direct the slit of each boot out and down.**

★ The boots are installed so that fuel will not spout over the hot parts of the engine to catch fire when it leaks for some reason.

[*2]

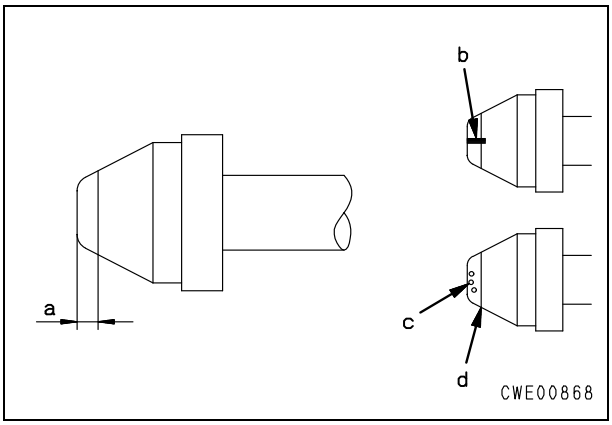
⚠ **Do not bend the fuel high-pressure pipe to collect before installing.**

⚠ **Be sure to use the genuine fuel high-pressure pipe clamps and observe the tightening torque.**

⚠ **After installing the high-pressure pipe, be sure to install the boots to the sleeve nuts.**

★ Before installing the high-pressure pipe, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure pipe.

- Check the taper seal of the connecting part (Part [a]: Part of 2 mm from the end) for visible lengthwise slit [b] and dent [c].
- Check part [d] (End of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.



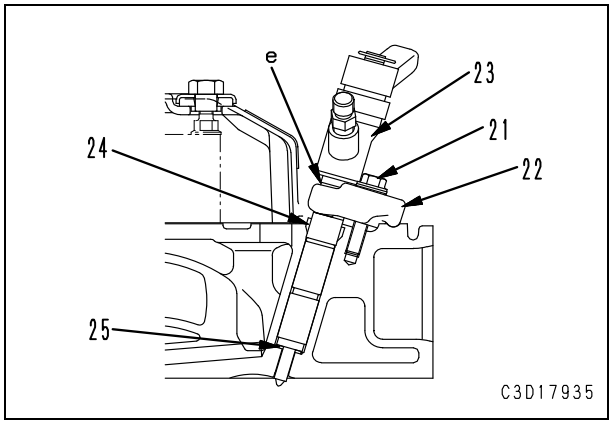
Sleeve nut: **25.5 – 29.4 Nm {2.6 – 3.0 kgm}**

[*3]

★ If the injector assembly was removed, be sure to replace seal (24) and gasket (25) with new ones.

- Installation procedure for injector assembly
  1) Install seal (24) to injector assembly (23).
  2) Install gasket (25) to injector assembly (23).
  3) Insert injector assembly (23) in the cylinder head.
     ★ After installing the gasket to the injector, check that it will not fall by its weight before inserting the injector.
  4) Install holder (22) to injector assembly (23).
  5) Tighten holder (22) with injector mounting bolt (21).
     ★ Before tightening the bolt, ensure that holder (22) is fitted to groove (e) of the injector assembly.

Holder mounting bolt:
27– 30 Nm {2.8 – 3.1 kgm}



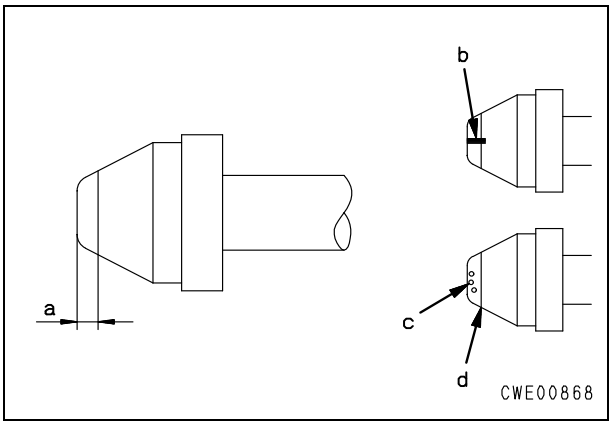
Installation

- Carry out installation in the reverse order to removal.

[*1]
For adjustment of the alternator drive belt tension, see Testing and adjusting, "Adjusting alternator drive belt tension".

[*2]
⚠ **Direct the slit of each boot out and down.**
★ The boots are installed so that fuel will not spout over the hot parts of the engine to catch fire when it leaks for some reason.

[*3]
⚠ **Do not bend the fuel high-pressure pipe to collect before installing.**
⚠ **Be sure to use the genuine fuel high-pressure pipe clamps and observe the tightening torque.**
⚠ **After installing the high-pressure pipe, be sure to install the boots to the sleeve nuts.**
★ Before installing the high-pressure pipe, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure pipe.
- Check the taper seal of the connecting part (Part [a]: Part of 2 mm from the end) for visible lengthwise slit [b] and dent [c].
- Check part [d] (End of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.

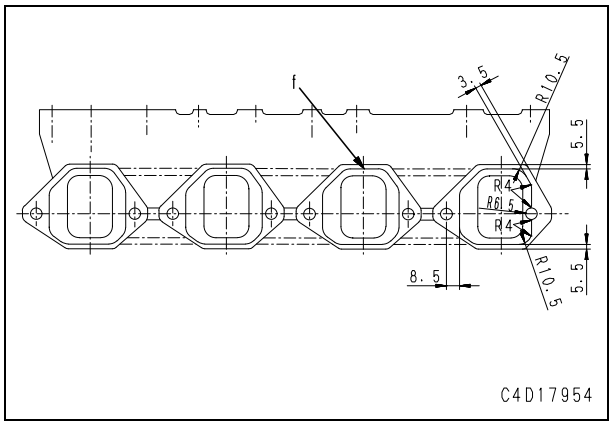


Sleeve nut: **25.5 – 29.4 Nm {2.6 – 3.0 kgm}**

[*4]
- When installing the intake manifold, apply gasket sealant to the intake manifold mounting face according to the following procedure.

★ Evenly apply a string of gasket sealant about 1 mm in diameter without breakage around each air intake opening.

Intake manifold mounting face:
Gasket sealant (LG-7)



★ Install the mounting bolts to their respective locations recorded when they were removed.

Installation

- Carry out installation in the reverse order to removal.

[*1]

Coolant: **Approx. 18 ℓ**

[*2]

Radiator upper hose clamp mounting bolt:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}

[*3]

★ Before installing the radiator assembly, align the radiator lower hose with the outlet hole at the radiator bottom and then insert the hose while pressing the radiator assembly.

Radiator lower hose mounting bolt:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}

[*4]

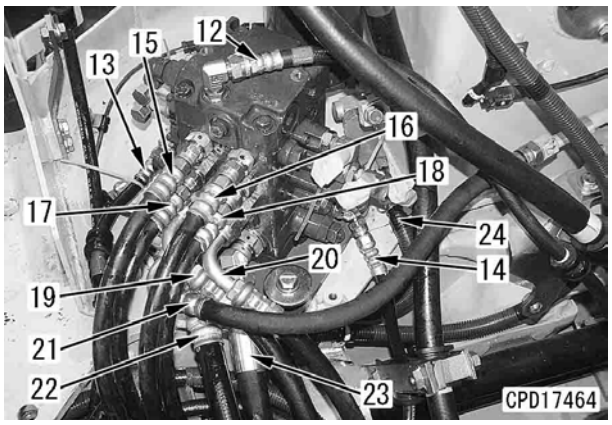
Radiator upper mounting bolt:
30 – 44 Nm {3.0 – 4.5 kgm}

[*5]

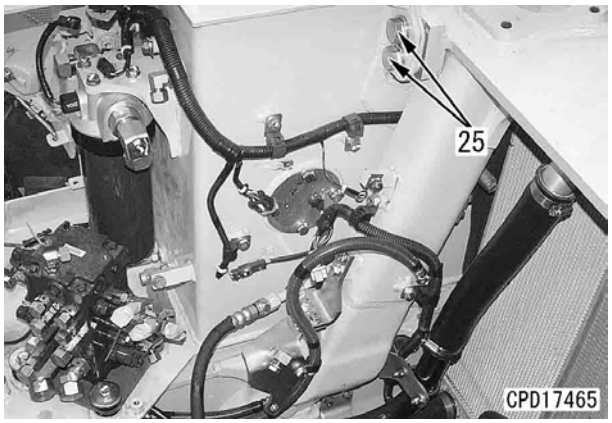
⚠ **When aligning the radiator lower mounting holes with the holes on the bracket and machine, never insert your finger in a hole. Use a wood or steel bar to check the hole alignment.**

14. Disconnect the 12 control valve hoses.
    - (12): To tank (Hose color band: Red)
    - (13): Lift lower (Hose color band: Yellow)
    - (14): Lift raise (Hose color band: Green)
    - (15): To angle cylinder bottom (Hose color band: 2 red bands)
    - (16): To angle cylinder head (Hose color band: 2 orange bands)
    - (17): To tilt cylinder bottom (Hose color band: 2 blue bands)
    - (18): To tilt cylinder head (Hose color band: 2 white bands)
    - (19): To lift cylinder bottom (Hose color band: Yellow)
    - (20): To lift cylinder head (Hose color band: Green)
    - (21): To fan pump
    - (22): To tank
    - (23): From work equipment pump

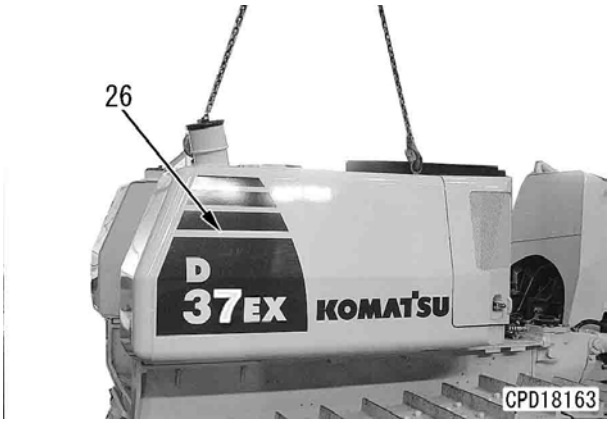
15. Disconnect fuel supply hose (24).



16. Remove fuel tank mounting bolts (25) and 4 lower mounting bolts. [*1]



17. Lift off fuel tank assembly (26).
    Fuel tank assembly: **200 kg**



Installation

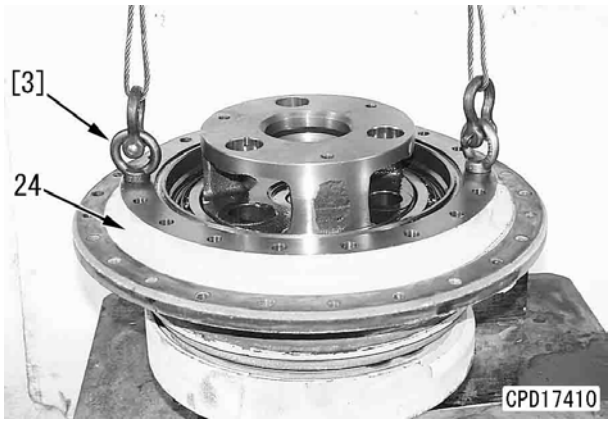
- Carry out installation in the reverse order to removal.

[*1]
Fuel tank mounting bolt:
455 – 565 Nm {46.5 – 58 kgm}
Fuel tank lower mounting bolt:
235 – 285 Nm {23.5 – 29.5 kgm}

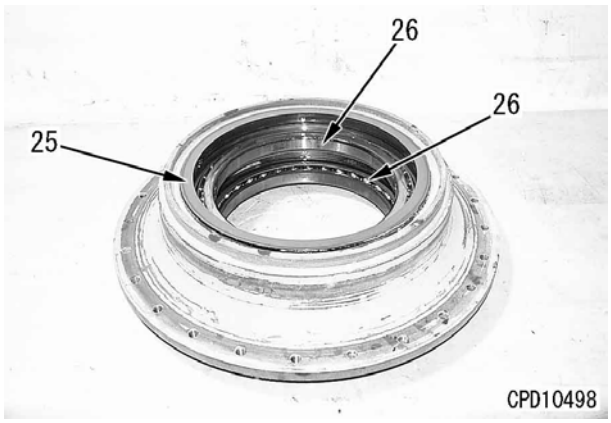
- **Refilling with oil (Hydraulic tank)**
  ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the piping. Then, check the oil level again.

- **Bleeding air (HST circuit)**
  ★ Bleed air from the HST circuit. For details, see Testing and adjusting, "Bleeding air from hydraulic circuit".

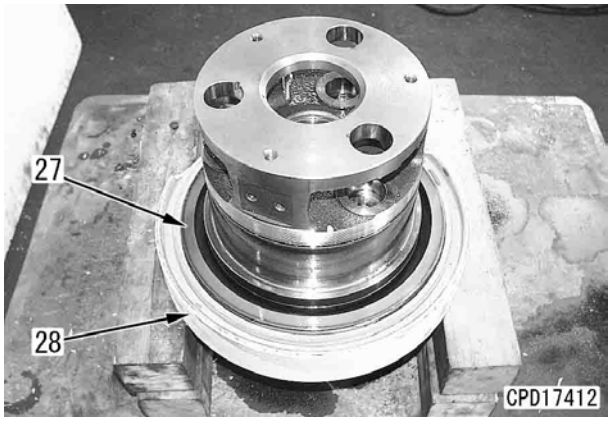
3) Using 2 eyebolts [3], remove hub assembly (24) from No. 2 planetary carrier (HST motor case).



4) Disassemble the hub assembly according to the following procedure.
   1] Remove floating seal (25).
   2] Remove 2 bearings (26).



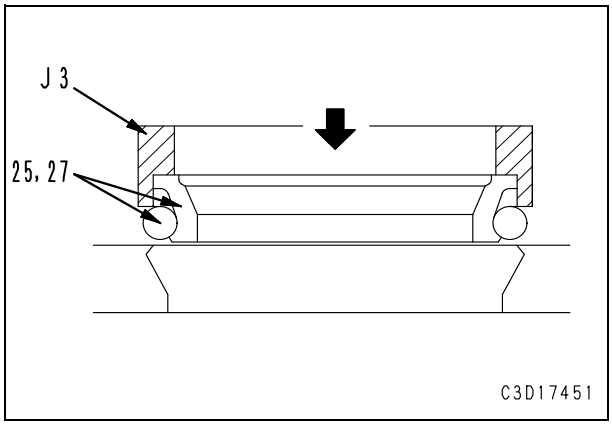
9. No. 2 planetary carrier (HST motor case)
Remove floating seal (27) from No. 2 planetary carrier (28).



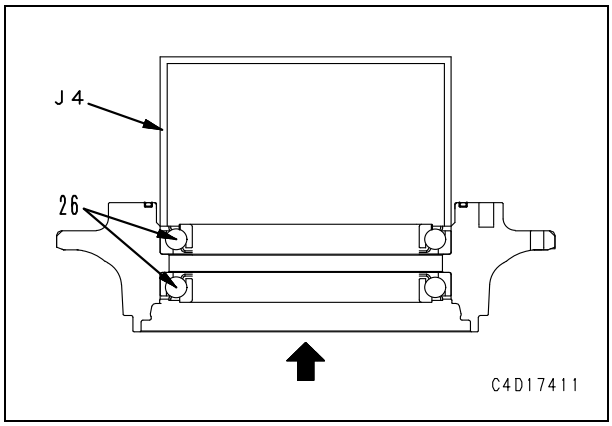
Assembly

★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with engine oil before installing.
★ Adjust the pre-load at the normal temperature while the temperature difference between the No. 2 planetary carrier, bearing, hub, and nut is 3°C or less.

1. No. 2 planetary carrier (HST motor case)
Using tool **J3**, install floating seals (25) and (27).
★ Remove all oil and grease from the O-ring and O-ring contact surface, and dry them before installing the floating seal.
★ Insert the O-ring by pushing it with tool **J3**.
★ After installing the floating seal, check that its slant is within 1 mm.
★ After installing the floating seal, thinly apply power train oil (TO30) to the sliding parts.



2. Assembly of hub assembly
1) Using tool **J4**, press fit 2 bearings (26).
   ★ Press fit each bearing until its outer race end comes in full contact with the hub.
   ★ After press fitting each bearing, check that a thickness gauge of 0.03 mm cannot go through the clearance between the outer race end and hub.



Installation

- Carry out installation in the reverse order to removal.

[*1]

★ Adjust the tension of the track shoe. For details, see Testing and adjusting, “Testing and adjusting track shoe tension”.

[*2]

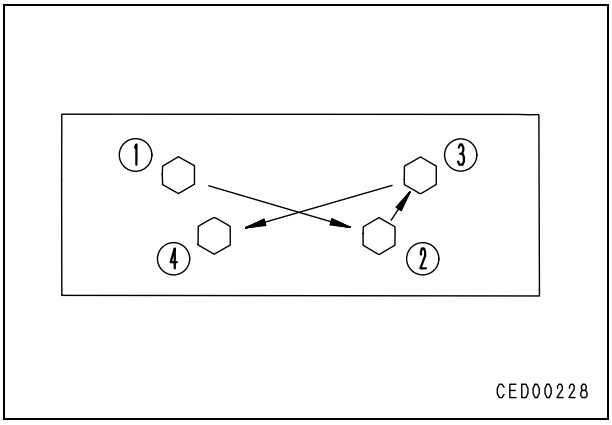
★ When winding the track shoe, use a bar, etc. to prevent the link from parting from the sprocket.

★ Take proper measures so that the mating faces and threads of the master link will not be rusted, bruised, or deformed. In addition, check that the mating faces and threads are free from dirt.

★ Tighten the master link bolts in the order of [1] – [4] in 2 steps.

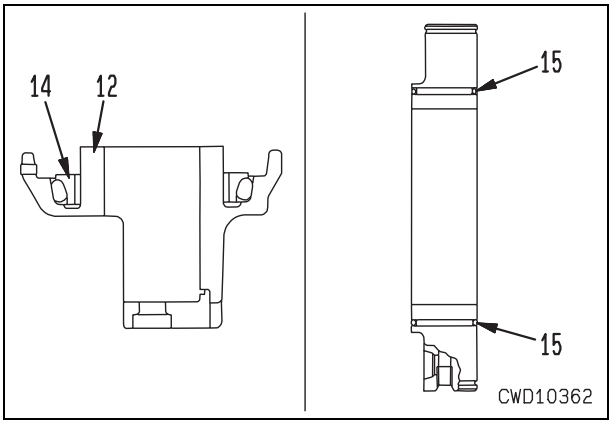
Master link bolt:
Seizure prevention compound (MARUZEN MOLYMAX No. 2 or equivalent)

Master link bolt:
Initial torque:
150 ± 40 Nm {15 ± 4 kgm}
Retightening angle: **180 ± 10°**



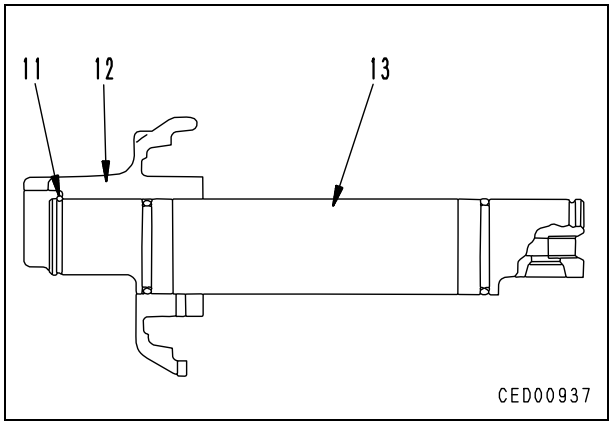
9. Remove floating seal (14) from collar (12).

10. Remove O-rings (15) from shaft (13).

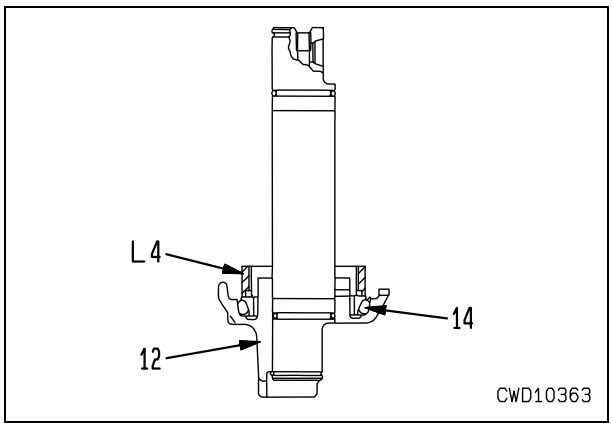


Assembly

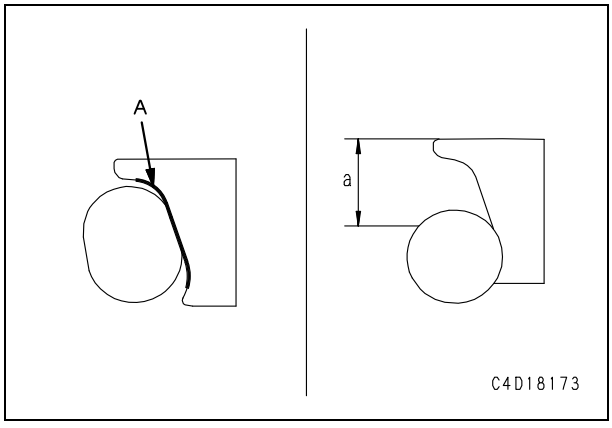
1. Fit O-rings (15) to shaft (13) and assemble collar (12), then install ring (11).
   ★ After assembling, tighten plug (1) temporarily.



2. Using tool **L4**, install floating seal (14) to collar (12).



   ★ When installing the floating seal, degrease and dry the mating faces of the O-ring and floating seal (indicated with **thick** line **A**) completely. The contact surfaces of the floating seal must be free from dirt.
   ★ After installing the floating seal, check that its slant is within 1mm and its projection "**a**" is 7 – 11 mm.



Installation

- Carry out installation in the reverse order to removal.

[*1]
- Hydraulic tank mounting bolt (12):
  455 – 565 Nm {46.5 – 58 kgm}
- Hydraulic tank lower mounting bolt:
  235 – 285 Nm {23.5 – 29.5 kgm}

- **Refilling with oil (Hydraulic tank)**
  ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the piping. Then, check the oil level again.

- **Bleeding air (HST circuit)**
  ★ Bleed air from the HST circuit. For details, see Testing and adjusting, "Bleeding air from hydraulic circuit".