SEN03862-02

Shop Manual

WHEEL LOADER

WA200 -6
WA200PZ-6

SERIAL NUMBERS WA200- 70001 and up
WA200PZ- 70001

ecot3

KOMATSU

2. Standard clearance and standard value

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

3. Standard interference

- When the diameter of a hole of a part shown in the given standard size and tolerance table is smaller than that of the mating shaft, the difference between those diameters is called the “interference”.
- The range (A – B) from the difference (A) between the minimum size of the shaft and the maximum size of the hole to the difference (B) between the maximum size of the shaft and the minimum size of the hole is the “standard interference”.
- After repairing or replacing some parts, measure the size of their hole and shaft and check that the interference is in the standard range.

4. Repair limit and allowable value

- The size of a part changes because of wear and deformation while it is used. The limit of changed size is called the “repair limit”.
- If a part is worn to the repair limit must be replaced or repaired.
- The performance and function of a product lowers while it is used. A value below which the product can be used without causing a problem is called the “allowable value”.
- If a product is worn to the allowable value, it must be checked or repaired. Since the permissible value is estimated from various tests or experiences in most cases, however, it must be judged after considering the operating condition and customer's requirement.

5. Clearance limit

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

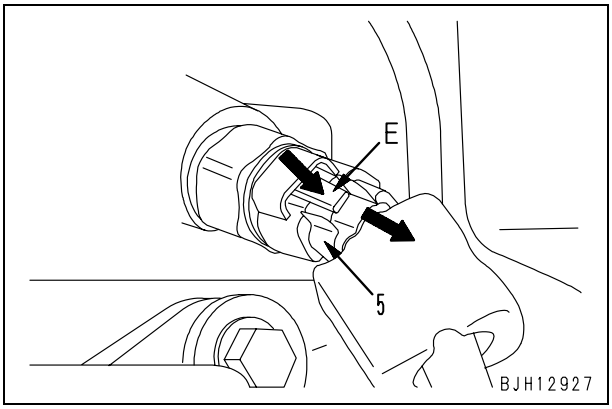
6. Interference limit

- The allowable maximum interference between the hole of a part and the shaft of another part to be assembled is called the “interference limit”.
- The interference limit shows the repair limit of the part of smaller tolerance.
- If the interference between the parts exceeds the interference limit, they must be replaced or repaired.

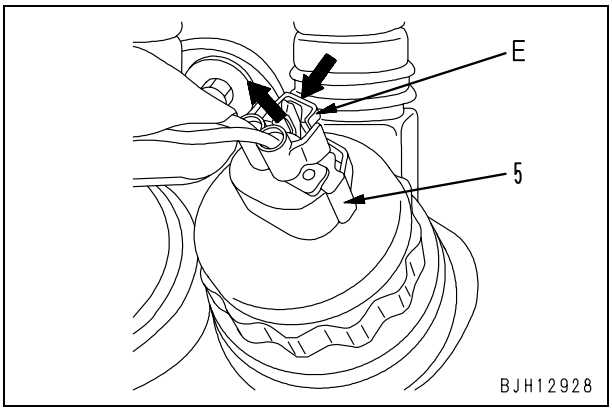
- 125 – 170, 12V140 engine

4) While pressing lock (E) of the connector, pullout connector (5) in the direction of the arrow.

Example)
Fuel pressure in common rail: PFUEL etc. (**AMP-3**)

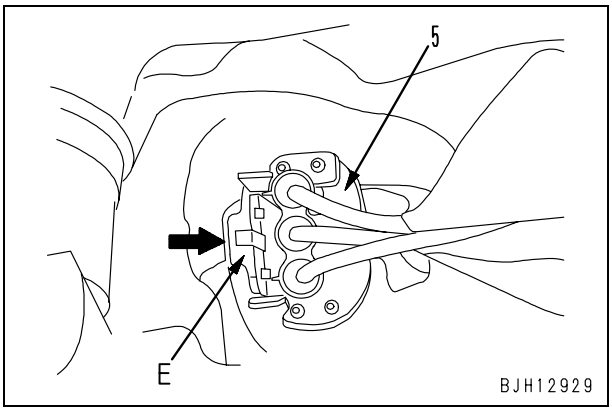


Example)
Injection pressure control valve of fuel supply pump: PCV (**SUMITOMO-2**)



Example)
Speed sensor of fuel supply pump: G (**SUMITOMO-3**)

★ Pull the connector straight up.



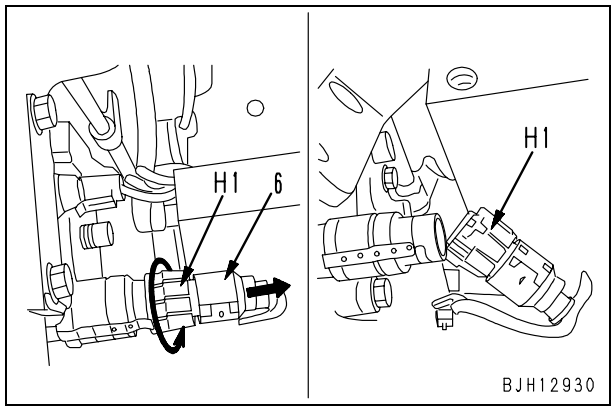
4. Turn-housing type (Round green connector)

- 140 engine

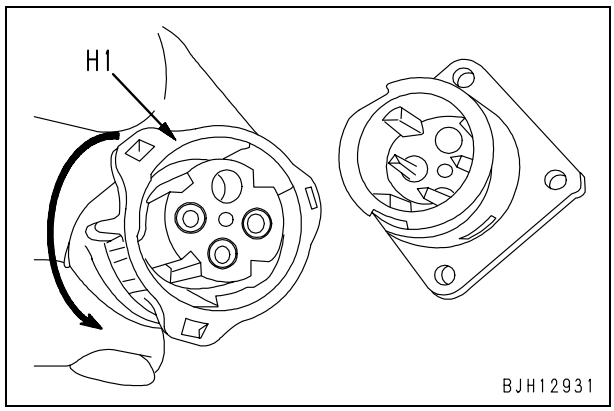
Example)
Intake air pressure sensor in intake manifold (CANNON-04): PIM etc.

1) Disconnect connector (6) according to the following procedure.
   1] Turn housing (H1) in the direction of the arrow.
      ★ When connector is unlocked, housing (H1) becomes heavy to turn.
   2] Pull out housing (H1) in the direction of the arrow.

   ★ Housing (H1) is left on the wiring harness side.



2) Connect the connector according to the following procedure.
   1] Insert the connector to the end, while setting its groove.
   2] Turn housing (H1) in the direction of the arrow until it “clicks”.



5. Table of tightening torques for hoses (taper seal type and face seal type)

★ Unless there are special instructions, tighten the hoses (taper seal type and face seal type) to the torque below.

★ Apply the following torque when the threads are coated (wet) with engine oil.

Nominal No. of hose	Width across flats	Tightening torque Nm {kgm}		Taper seal	Face seal	
		Range	Target	Thread size (mm)	Nominal No. - Number of threads, type of thread	Thread diameter (mm) (Reference)
02	19	34 – 54 { 3.5 – 5.5}	44 { 4.5}	–	9/16-18UN	14.3
		34 – 63 { 3.5 – 6.5}		14	–	–
03	22	54 – 93 { 5.5 – 9.5}	74 { 7.5}	–	11/16-16UN	17.5
	24	59 – 98 { 6.0 – 10.0}	78 { 8.0}	18	–	–
04	27	84 – 132 { 8.5 – 13.5}	103 {10.5}	22	13/16-16UN	20.6
05	32	128 – 186 {13.0 – 19.0}	157 {16.0}	24	1-14UNS	25.4
06	36	177 – 245 {18.0 – 25.0}	216 {22.0}	30	1-3/16-12UN	30.2
(10)	41	177 – 245 {18.0 – 25.0}	216 {22.0}	33	–	–
(12)	46	197 – 294 {20.0 – 30.0}	245 {25.0}	36	–	–
(14)	55	246 – 343 {25.0 – 35.0}	294 {30.0}	42	–	–

6. Table of tightening torques for 102, 107 and 114 engine series (Bolts and nuts)

★ Unless there are special instructions, tighten the metric bolts and nuts of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
	Bolts and nuts	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22
14	—	—

7. Table of tightening torques for 102, 107 and 114 engine series (Eye joints)

★ Unless there are special instructions, tighten the metric eye joints of the 102, 107 and 114 engine series to the torque below.

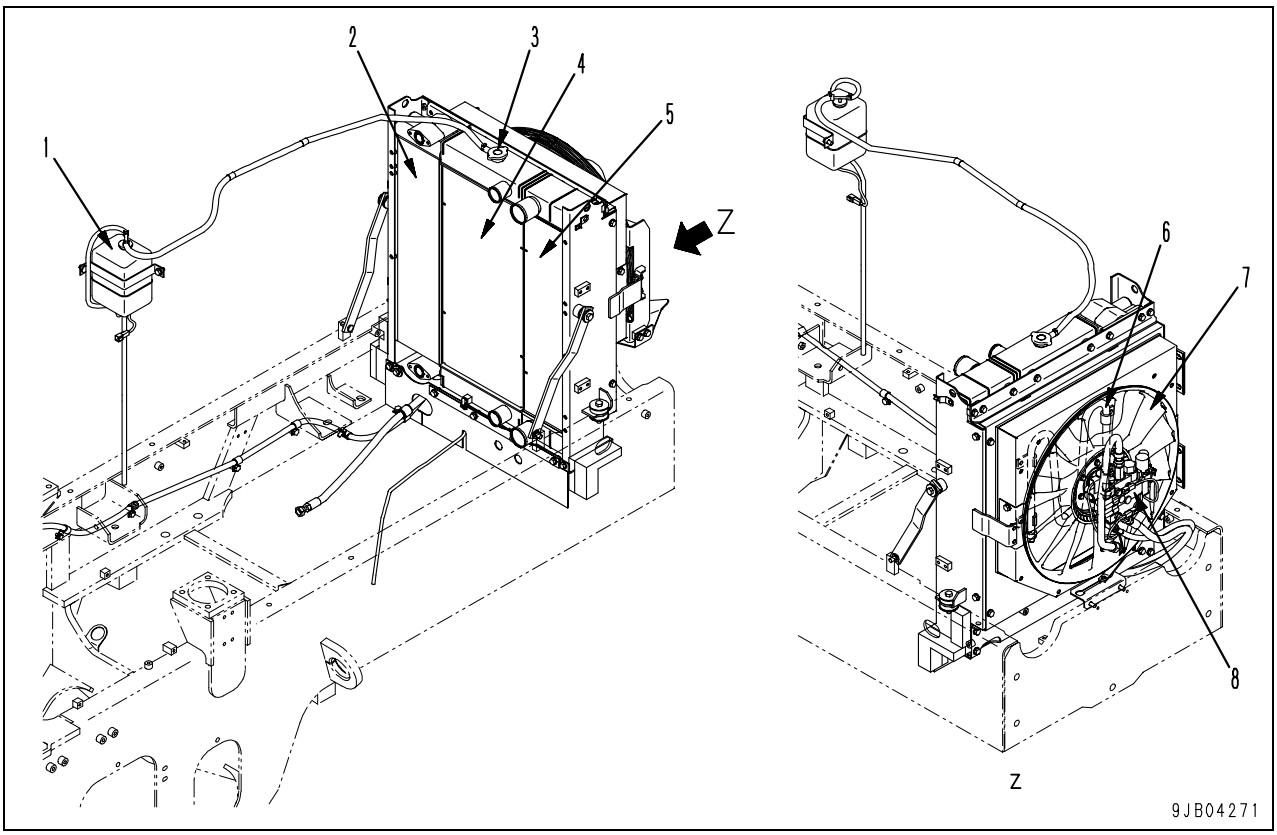
Thread size	Tightening torque	
mm	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

Specifications

Machine model name			WA200-6	WA200PZ-6
Serial No.			70001 and up	70001 and up
Weight	Machine weight	kg	9,890	11,740
	Machine weight (front wheel) in SAE travel posture	kg	3,730	5,210
	Machine weight (rear wheel) in SAE posture	kg	6,160	6,530
Performance	Bucket capacity (heaped)	m^3	2.0	2.0
	Normal load	kN {kg}	31.4 {3,200}	31.4 {3,200}
	Travel speed • Forward 1st • Forward 2nd • Forward 3rd • Forward 4th	km/h	 4.0 – 13.0 13.0 20.0 34.5	 4.4 – 14.3 14.3 22.0 38.0
	• Reverse 1st • Reverse 2nd • Reverse 3rd • Reverse 4th	km/h	4.0 – 13.0 13.0 20.0 34.5	4.4 – 14.3 14.3 22.0 38.0
	Max. traction force • Forward • Reverse	kN{kg}	 86 {8,800} 86 {8,800}	 80 {8,200} 80 {8,200}
	Gradeability	deg.	25	25
	Min. turning radius (center of outside tire)	mm	5,100	5,100
	Turning radius (cutting edge/BOC tip), SAE travel posture	mm	5,830/5,850	5,730/5,755
Dimension	Overall length (with BOC)	mm	6,895	7,230
	Overall width (chassis)	mm	2,375	2,375
	Bucket width (with BOC)	mm	2,550	2,550
	Overall height (cab top)	mm	3,110	3,110
	Overall height with bucket lifted up	mm	4,885	5,150
	Wheelbase	mm	2,840	2,840
	Tread	mm	1,930	1,930
	Minimum ground clearance	mm	425	425
	Max. hinge pin height	mm	3,685	3,880
	Dumping clearance (*1) (cutting edge/BOC tip)	mm	2,820/2,760	2,925/2,865
	Dumping reach (*1) (cutting edge/BOC tip)	mm	975/1,000	1,000/1,025
	Steering angle	deg.	38 (frame stopper 40)	38 (frame stopper 40)
	Bucket tilt angle (operating posture/max. height)	deg.	48/67	47/66
	Bucket dump angle (max. height)	deg.	45	48
	Digging depth, 10° (cutting edge/BOC tip)	mm	285/320	300/335

*1: Indicates the value at the 45° bucket dump angle.
★ BOC: Abbreviation for Bolt-On Cutting edge

Cooling system



1. Reservoir tank
2. Oil cooler
3. Radiator cap
4. Radiator
5. Aftercooler
6. Transfer oil cooler
7. Cooling fan
8. Cooling fan motor

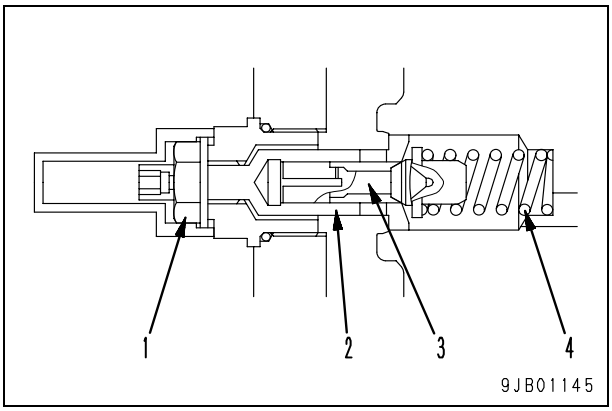
Specifications

	Radiator	Oil cooler	Aftercooler
Core type	AL WAVE-4	CF40-1	AL WAVE
Fin pitch (mm)	3.5/2	3.5/2	4.0/2
Total heat dissipation area (m^2)	29.86	4.15 x 2	10.87
Pressure valve cracking pressure (kPa {kg/cm^2})	68.6 {0.7}	—	—
Vacuum valve cracking pressure (kPa {kg/cm^2})	0 – 4.9 {0 – 0.05}	—	—

WA200-6, WA200PZ-6 GALEO Wheel loader

Form No. SEN03874-00

Low-pressure relief valve

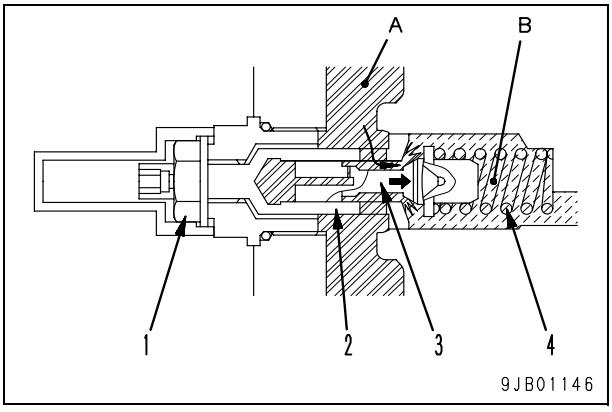


1. Locknut
2. Adjustment screw
3. Piston
4. Spring

Function

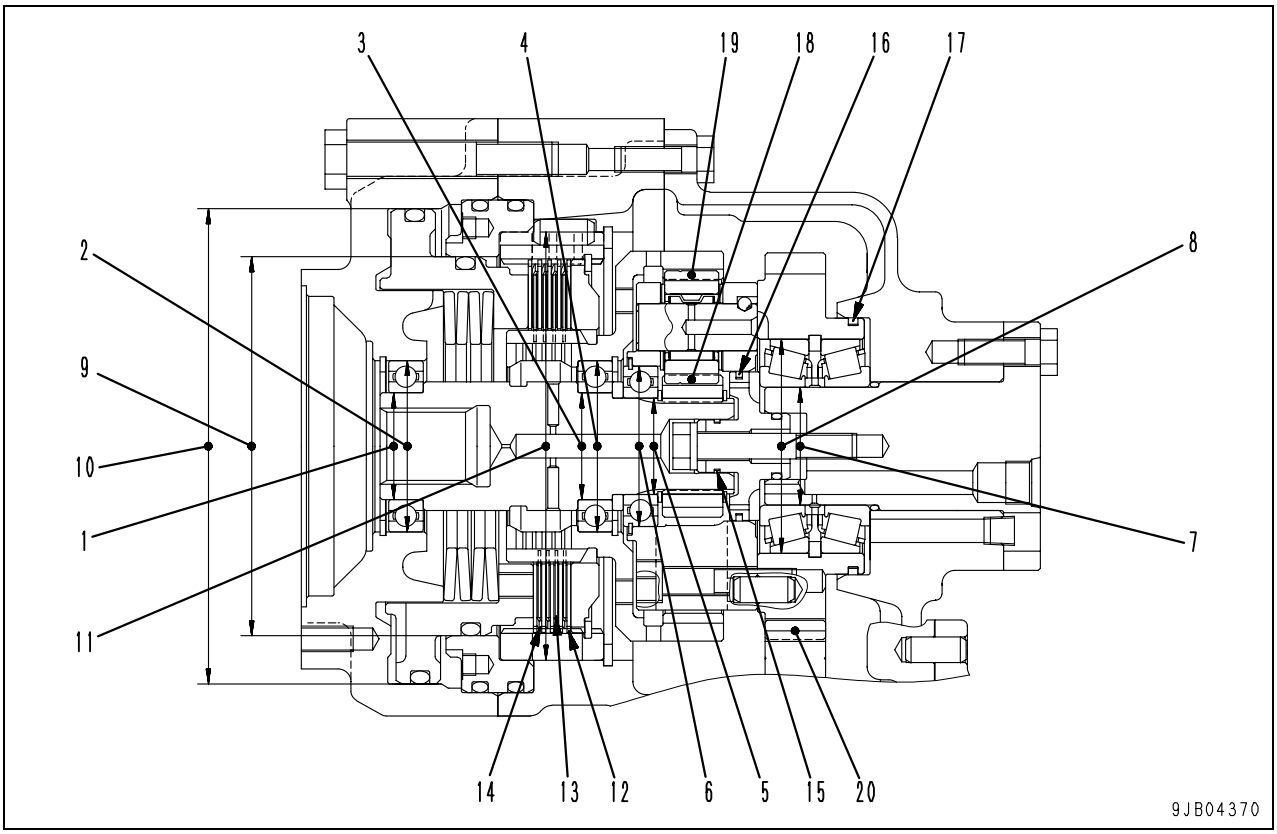
- This valve is installed on the HST pump. If the oil pressure on the low pressure circuit side across the HST pump and HST motor goes beyond the set pressure, it drains the oil to the hydraulic tank.
  This valve sets the oil pressure of the HST pump charge circuit in this manner to protect the circuit.

Operation



- Port (A) is connected to the HST pump charge circuit and port (B) is connected to the drain circuit.
- As long as port (A) is below the set pressure, oil does not flow to port (B).
- If oil pressure in port (A) goes beyond the set pressure, piston (3) is pushed in the right direction. As a result, the oil pressure in port (A) is released to port (B) and the oil pressure in port (A) is decreased.
- Increasing or decreasing the repulsive force of spring (4) allows adjusting the set pressure.
- When increasing the set pressure, loosen locknut (1) and screw adjustment screw (2). When decreasing, loosen the adjustment screw.

Input shaft

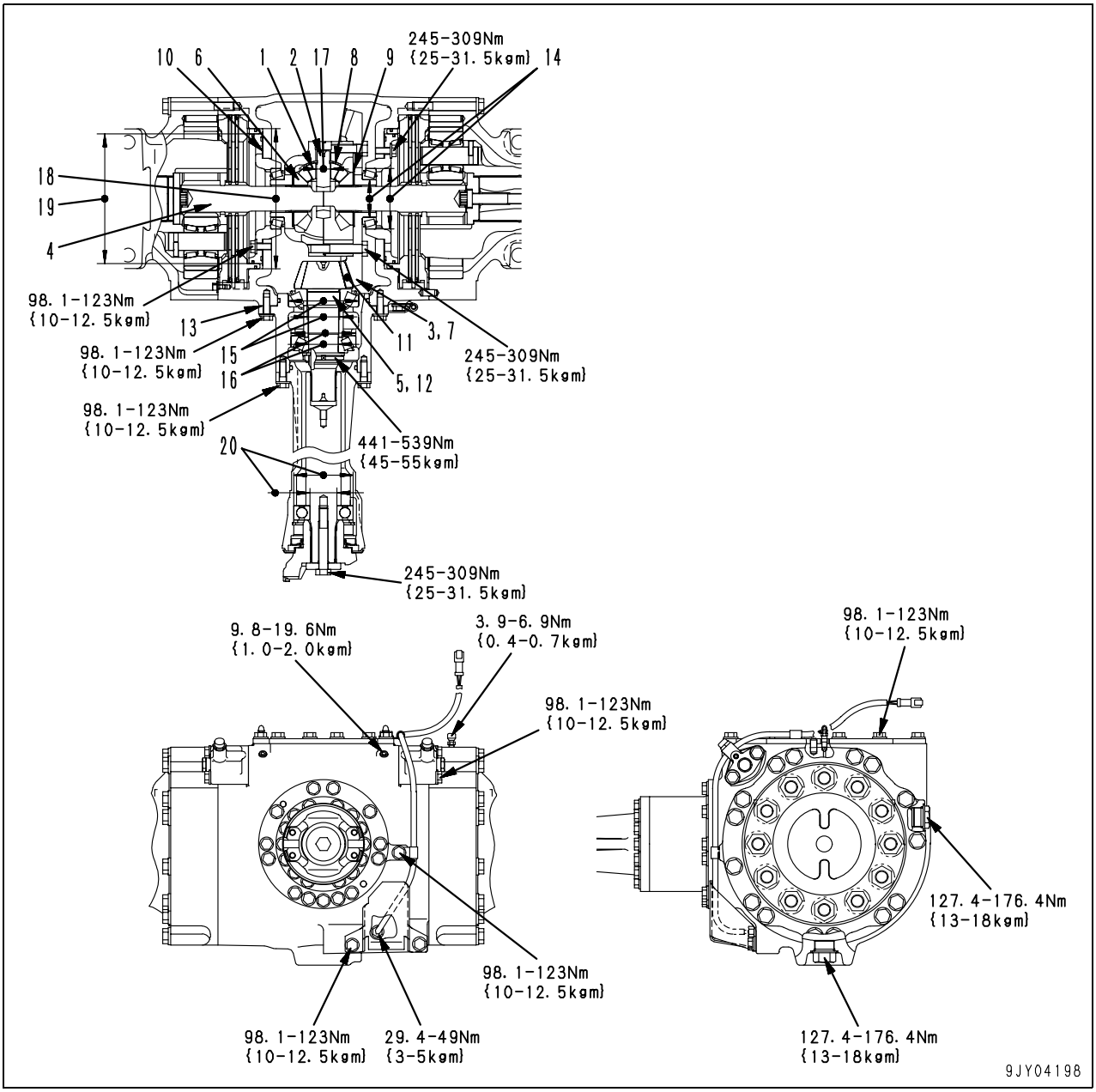


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between input shaft and bearing (front)	50	+0.011 –0.005	0 –0.012	–0.023 – 0.005	—	Replace
2	Clearance between input shaft bearing and cage (front)	80	0 –0.013	+0.013 –0.006	–0.006 – 0.026	—	
3	Clearance between input shaft and bearing (middle)	50	+0.011 –0.005	0 –0.012	–0.023 – 0.005	—	
4	Clearance between input shaft bearing and ring gear (middle)	80	0 –0.013	+0.013 –0.006	–0.006 – 0.026	—	
5	Clearance between input shaft and bearing (rear)	45	+0.011 –0.005	0 –0.012	–0.023 – 0.005	—	
6	Clearance between input shaft bearing and carrier (rear)	75	0 –0.013	+0.013 –0.006	–0.006 – 0.026	—	
7	Clearance between press fitting shaft and bearing	55	+0.039 +0.020	0 –0.015	–0.054 – –0.020	—	
8	Clearance between press fitting shaft bearing and motor 1 gear	100	0 –0.018	–0.016 –0.038	–0.038 – 0.002	—	
9	Clearance between piston and spacer	177	–0.085 –0.125	+0.040 0	0.085 – 0.165	—	
10	Clearance between piston and cage	222	–0.550 –0.650	+0.046 0	0.550 – 0.696	—	
11	Clearance between clutch housing and front case	200	+0.061 +0.015	+0.046 0	–0.061 – 0.031	—	

Differential

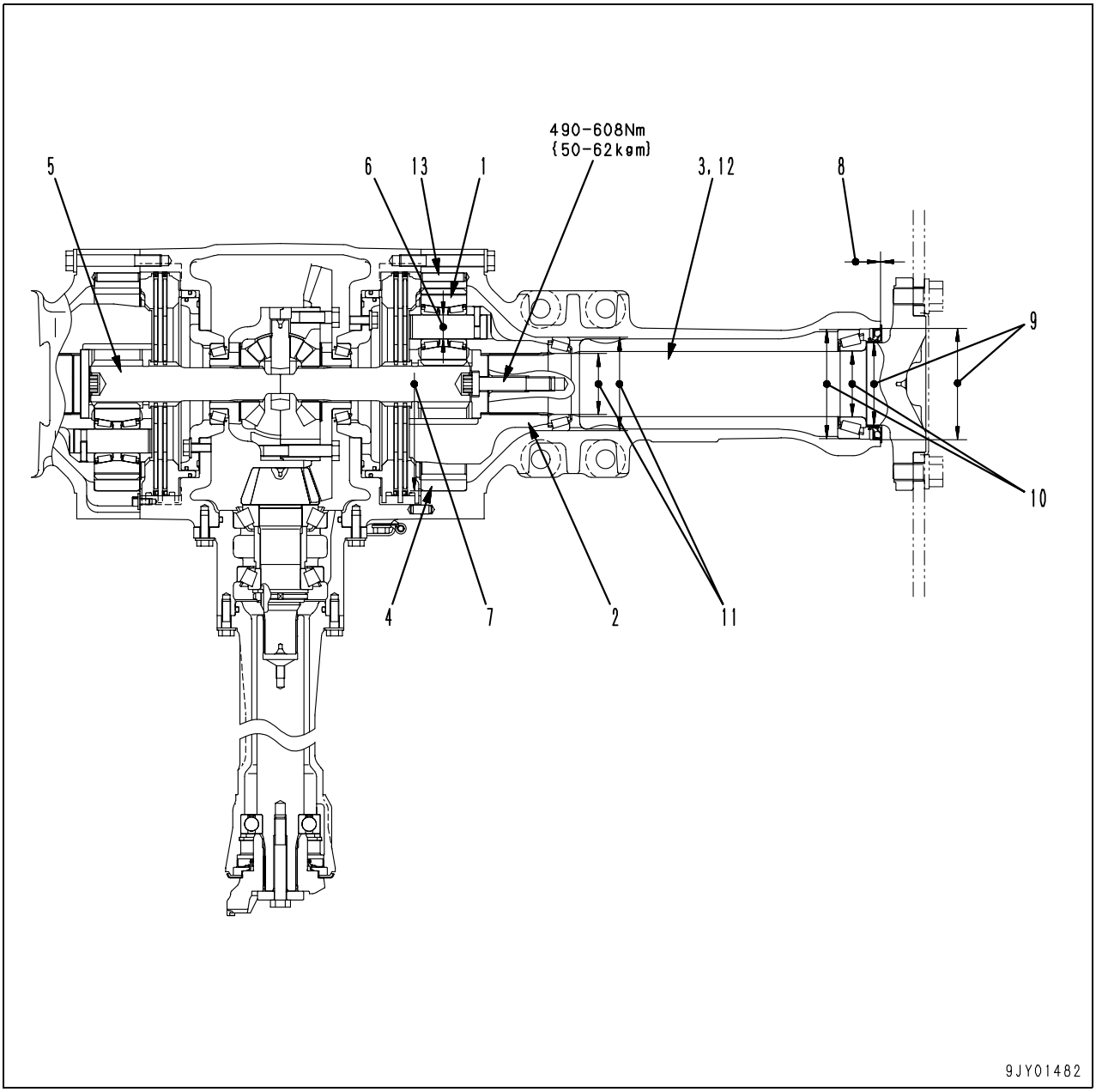
Front differential



1. Pinion (number of teeth: 9)
2. Shaft
3. Bevel gear (number of teeth: 43)
4. Sun gear shaft
5. Bevel pinion (number of teeth: 12)
6. Side gear (number of teeth: 12)

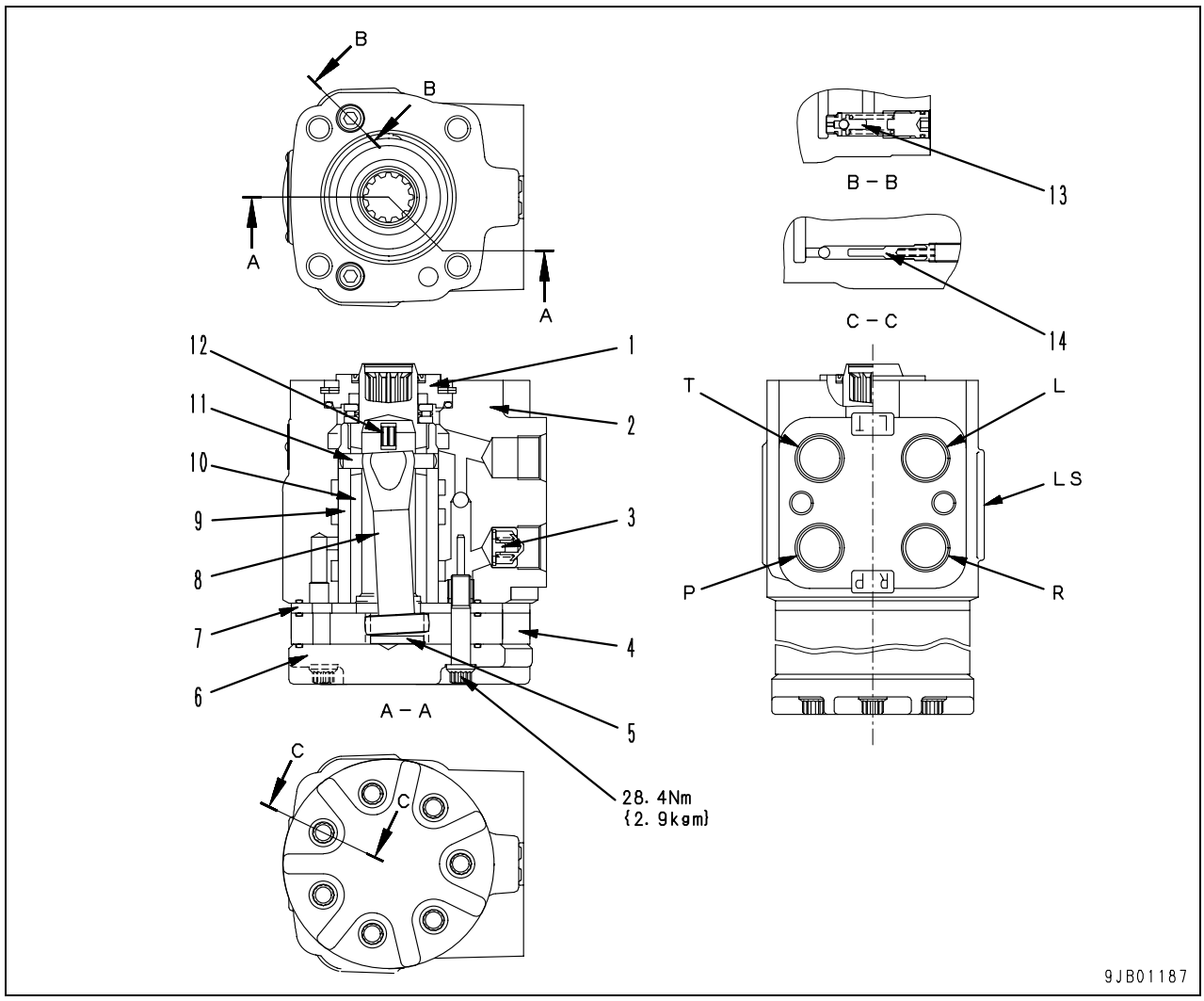
Final drive

Front final drive



1. Planetary gear (number of teeth: 26)
2. Planetary carrier
3. Axle shaft
4. Ring gear (number of teeth: 69)
5. Sun gear shaft (number of teeth: 15)

Orbit-roll valve



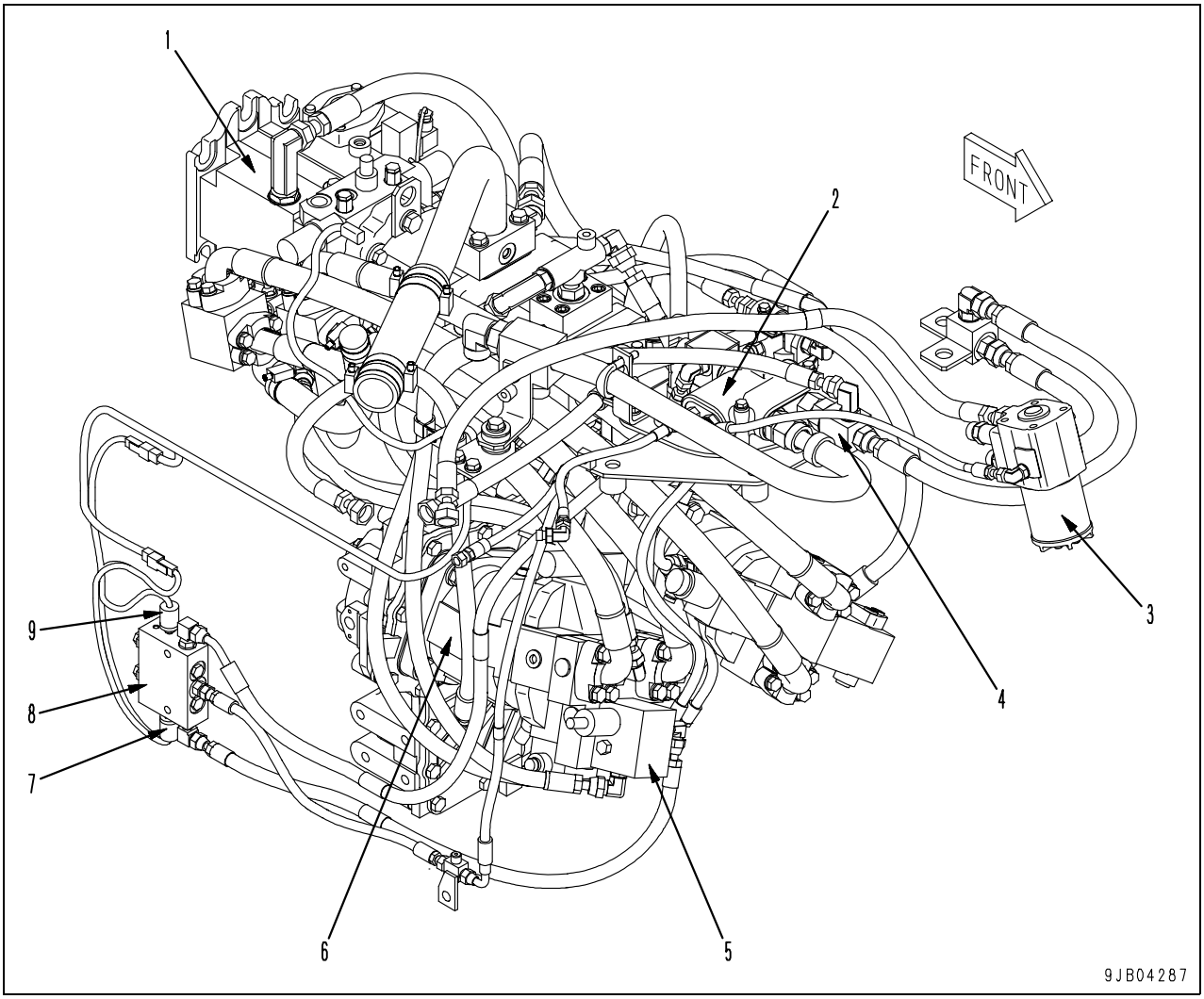
P: From steering pump
L: To steering cylinder
R: To steering cylinder

LS: To priority valve
T: To hydraulic tank

1. Gland
2. Valve body
3. Check valve
4. Gerotor
5. Spacer
6. Cover
7. Spacer
8. Drive shaft
9. Sleeve
10. Spool
11. Center pin
12. Centering spring
13. Anti-cavitation valve
14. Overload relief valve

Emergency steering piping diagram

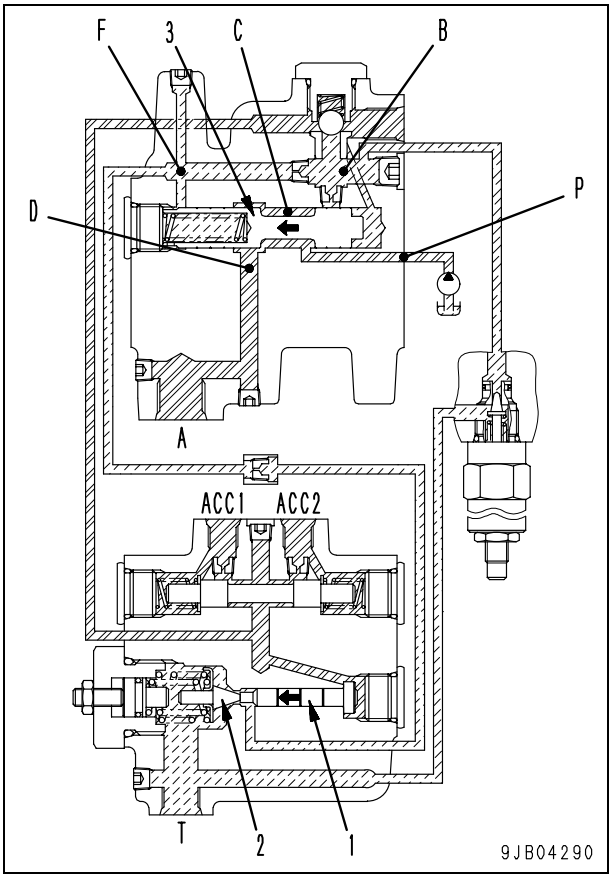
(if equipped)



1. Steering pump
2. Priority valve
3. Orbit-roll valve
4. Check valve
5. Emergency steering valve
6. HST motor 2
7. Pressure switch (for detecting emergency steering operation)
8. Steering relief valve
9. Pressure switch (for detecting low oil pressure on steering)

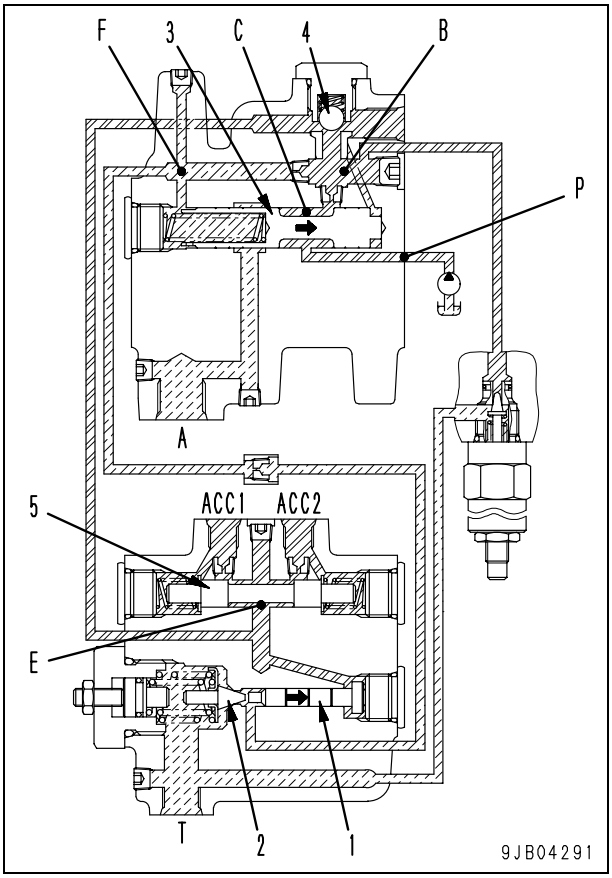
Operation

When oil is not supplied to accumulator
(cut-out state)



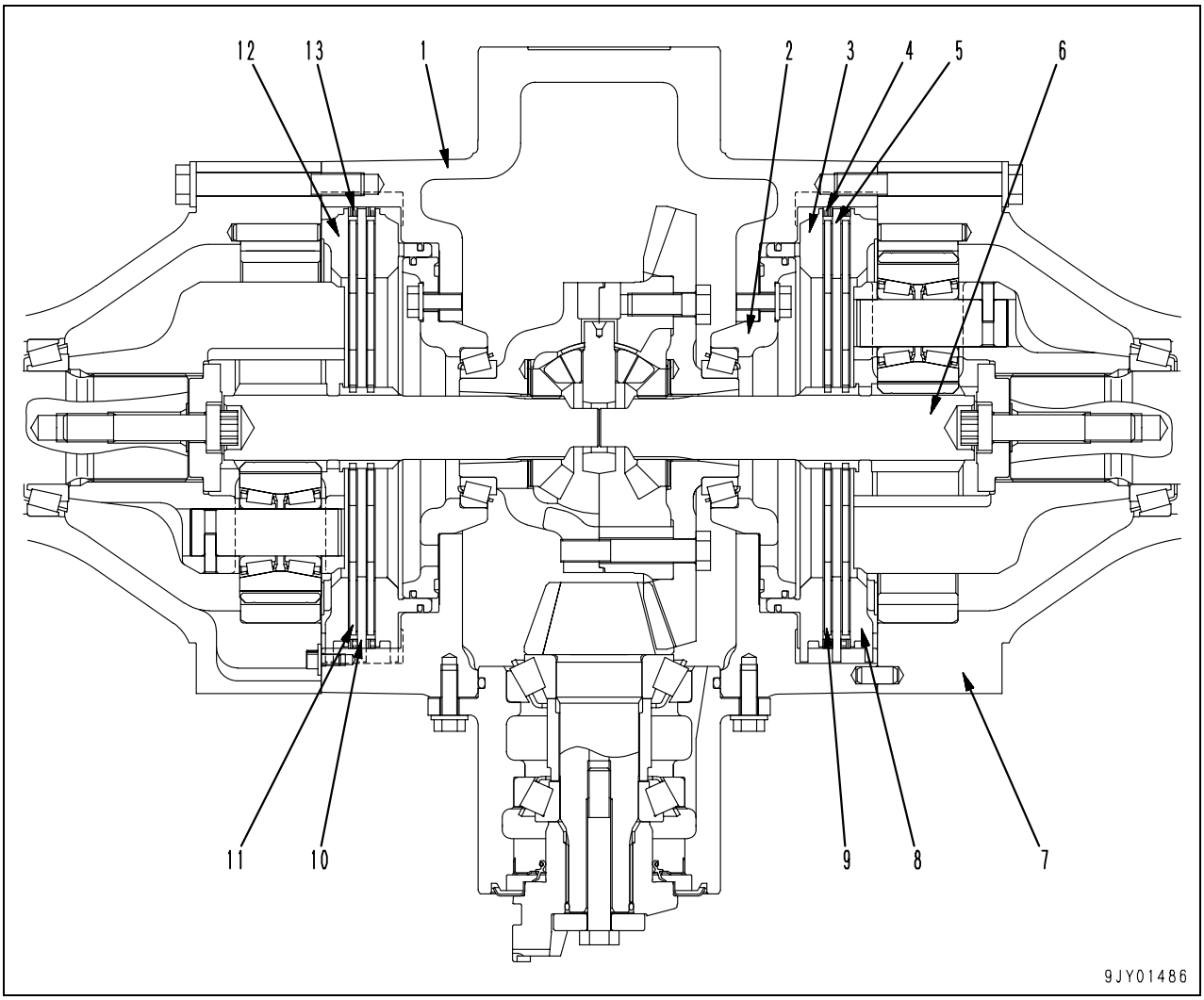
- Plunger (1) is moved in the left direction by the accumulator pressure, and maintains unload relief valve (2) being pushed open.
- The oil in the spring chamber of unload valve (3) is drained to the hydraulic tank through port (F), unload relief valve (2) and port (T).
- Since oil pressure in port (F) is decreased, unload valve (3) moves in the left direction being subjected to the action of the oil from chamber (B).
- Port (C) and port (D) are opened, supplying most of the oil from the pump to the cooling fan motor through port (P), ports (C) and (D), and port (A).

When oil is supplied to accumulator
1. Cut-in state

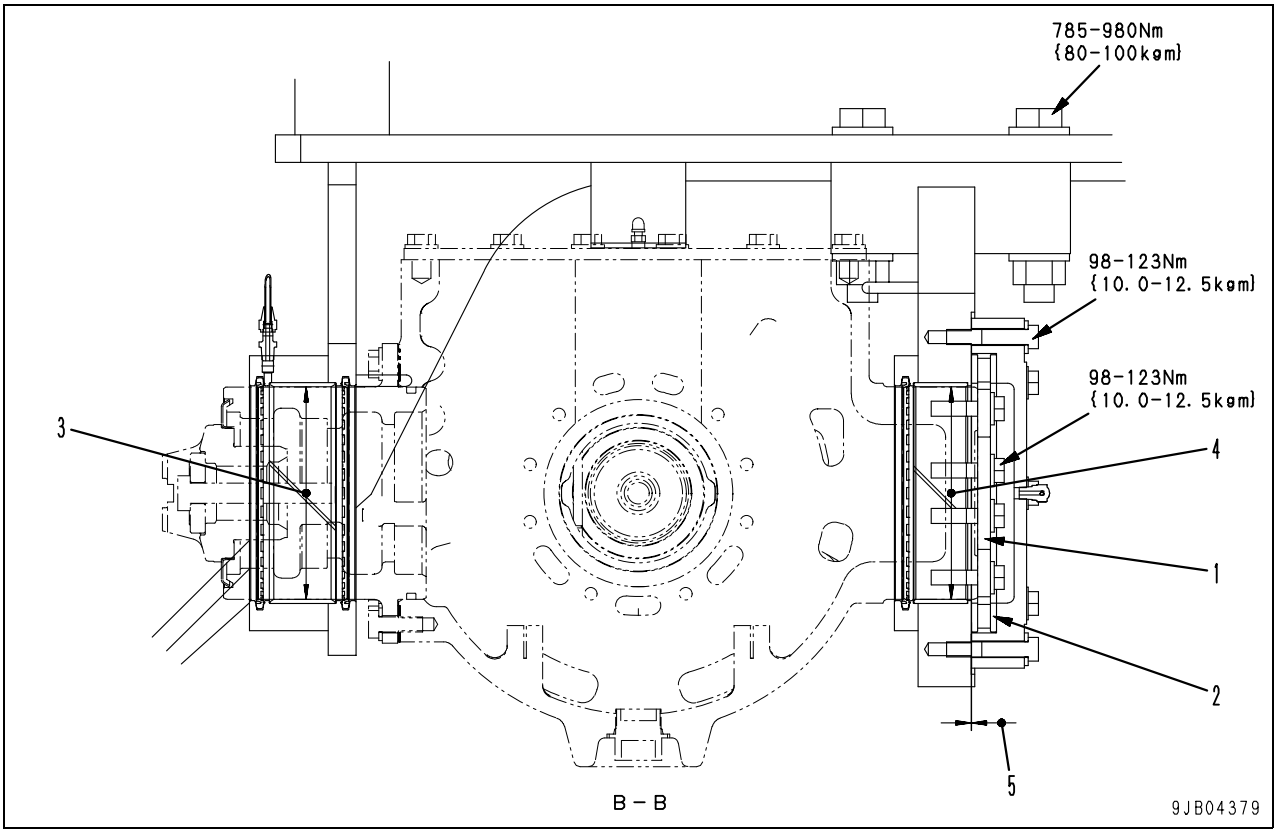


- As the accumulator pressure goes low, pressure on port (E) goes low, allowing plunger (1) to move in the right direction and unload relief valve (2) to close the drain circuit.
- Since the oil pressure in port (F) and the spring chamber of unload valve (3) increases, unload valve (3) moves in the right direction.
- Port (C) and port (B) are opened, conducting the oil from the pump to port (B).
- As oil pressure in port (B) increases beyond the set pressure of check valve (4), check valve opens, allowing the oil to be supplied to the accumulator through port (E). The pressure for supplying oil to the accumulator depends on the set pressure of check valve (4).
- Amount of oil supplied to the accumulator is constant independent of the engine speed, thus surplus of the oil flows to the cooling fan motor through port (A).
- Inverse shuttle valve (5) supplies precedence to the accumulator of lower pressure when supplying oil.

Rear brake



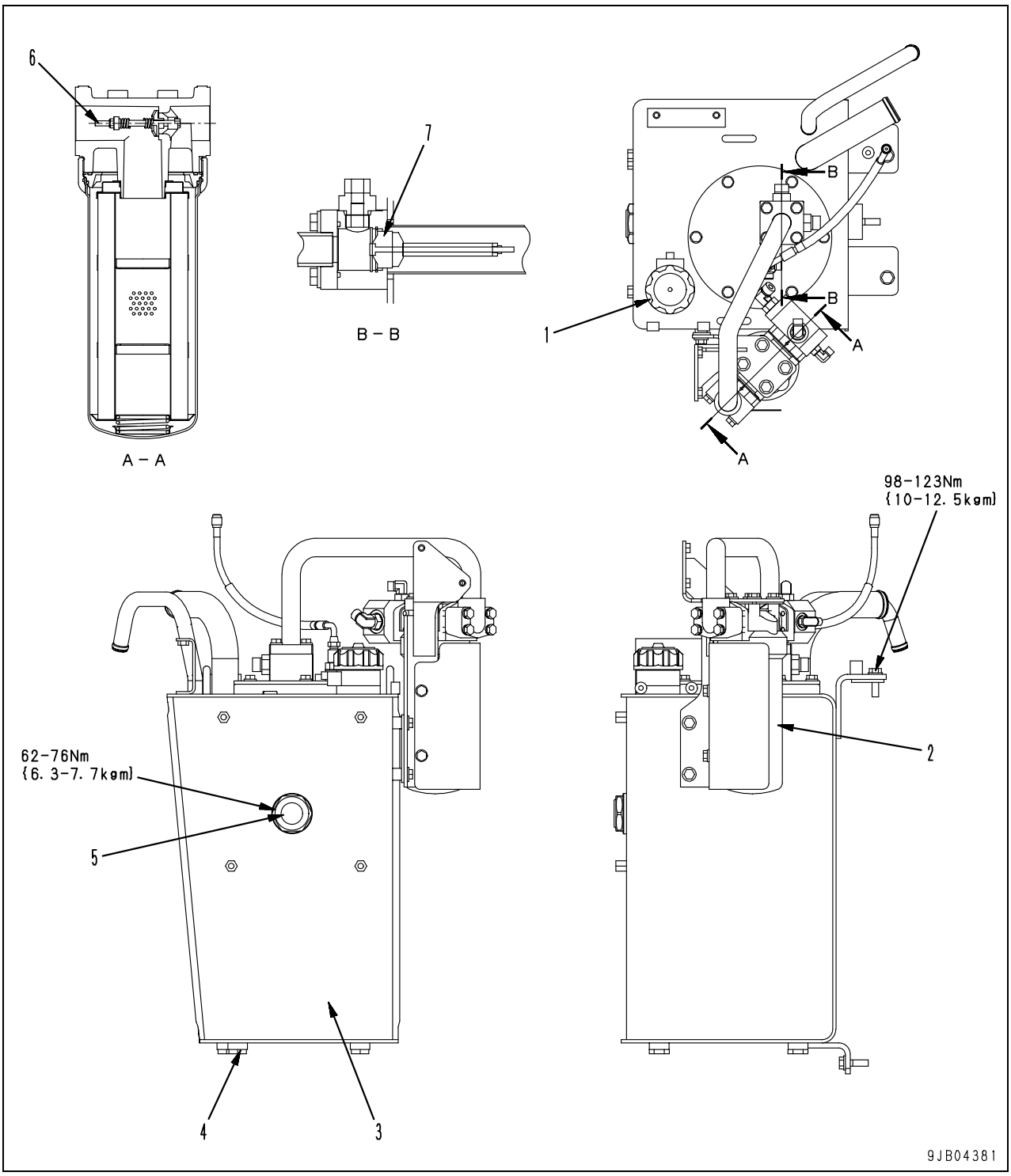
1. Differential housing
2. Bearing carrier
3. Piston
4. Spring
5. Inner ring
6. Sun gear shaft
7. Axle housing
8. Outer ring
9. Disc (2 pieces)



Unit: mm

No.	Check item	Criteria					Remedy
1	Thickness of thrust plate	Standard size: 10	Tolerance: 0 –0.15		Repair limit: —		Replace
2	Thickness of thrust washer	Standard size: 5	Tolerance: +0.3 –0.1		Repair limit: —		
3	Clearance between shaft and hole on front support side	Standard size	Tolerance: Shaft	Tolerance: Hole	Standard clearance	Clearance limit	
		170	–0.043 –0.106	+0.550 +0.050	0.093 – 0.656	—	
4	Clearance between shaft and hole on rear support side	170	–0.043 –0.106	+0.550 +0.050	0.093 – 0.656	—	
5	Standard thickness of shim in thrust cap	0.2					—

Hydraulic tank

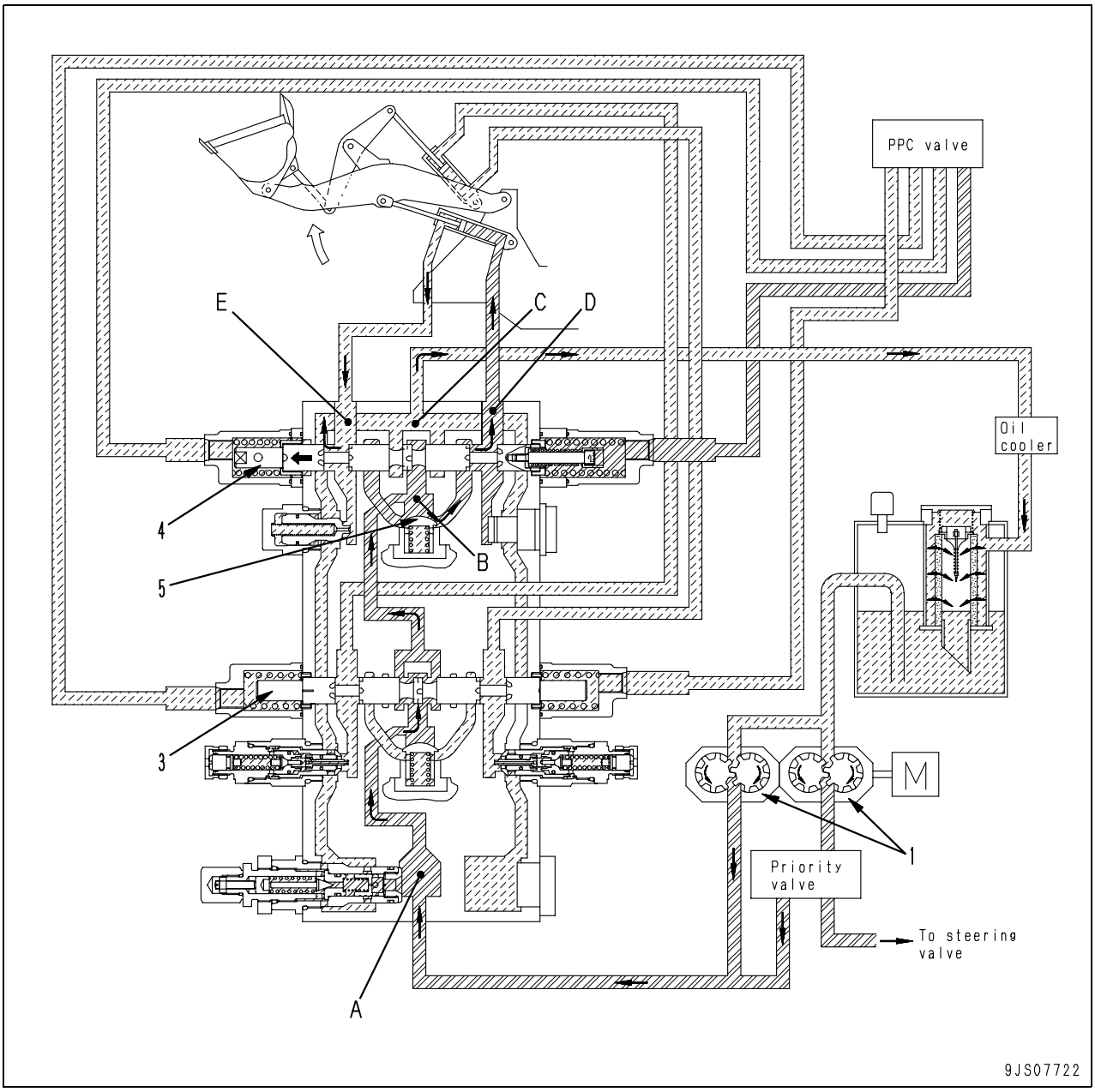


1. Oil filler cap and breather
2. Return filter
3. Hydraulic tank
4. Drain plug
5. Sight gauge
6. Return filter bypass valve
7. Check valve

Specifications

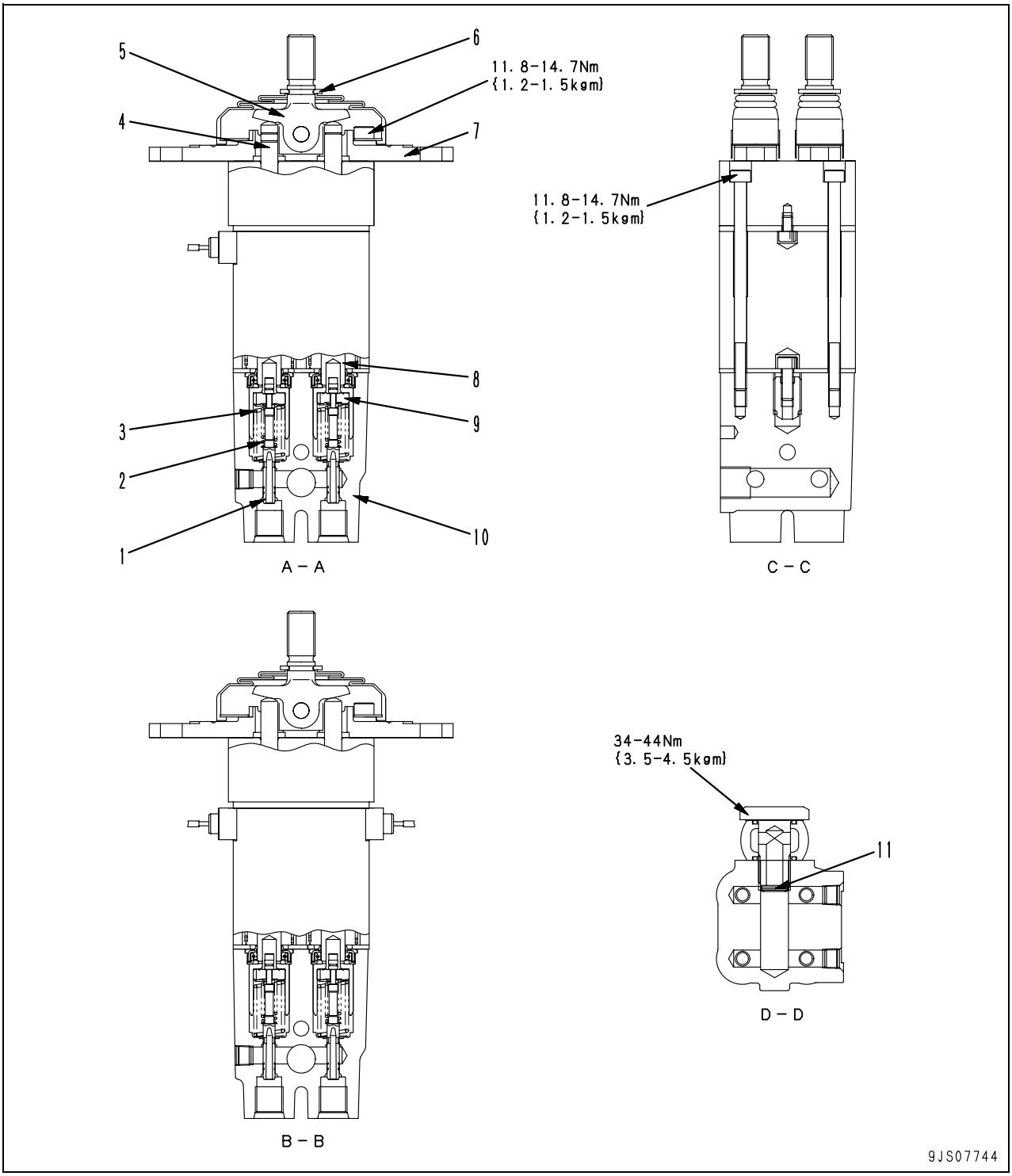
Capacity of hydraulic tank (ℓ)	83
Quantity of oil in hydraulic tank (ℓ)	58
Set pressure of bypass valve (MPa {kg/cm²})	0.2 {2.04}
Cracking pressure of check valve (MPa {kg/cm²})	0.1 ± 0.02 {0.98 ± 0.2}

2. When lift arm spool is at raise position



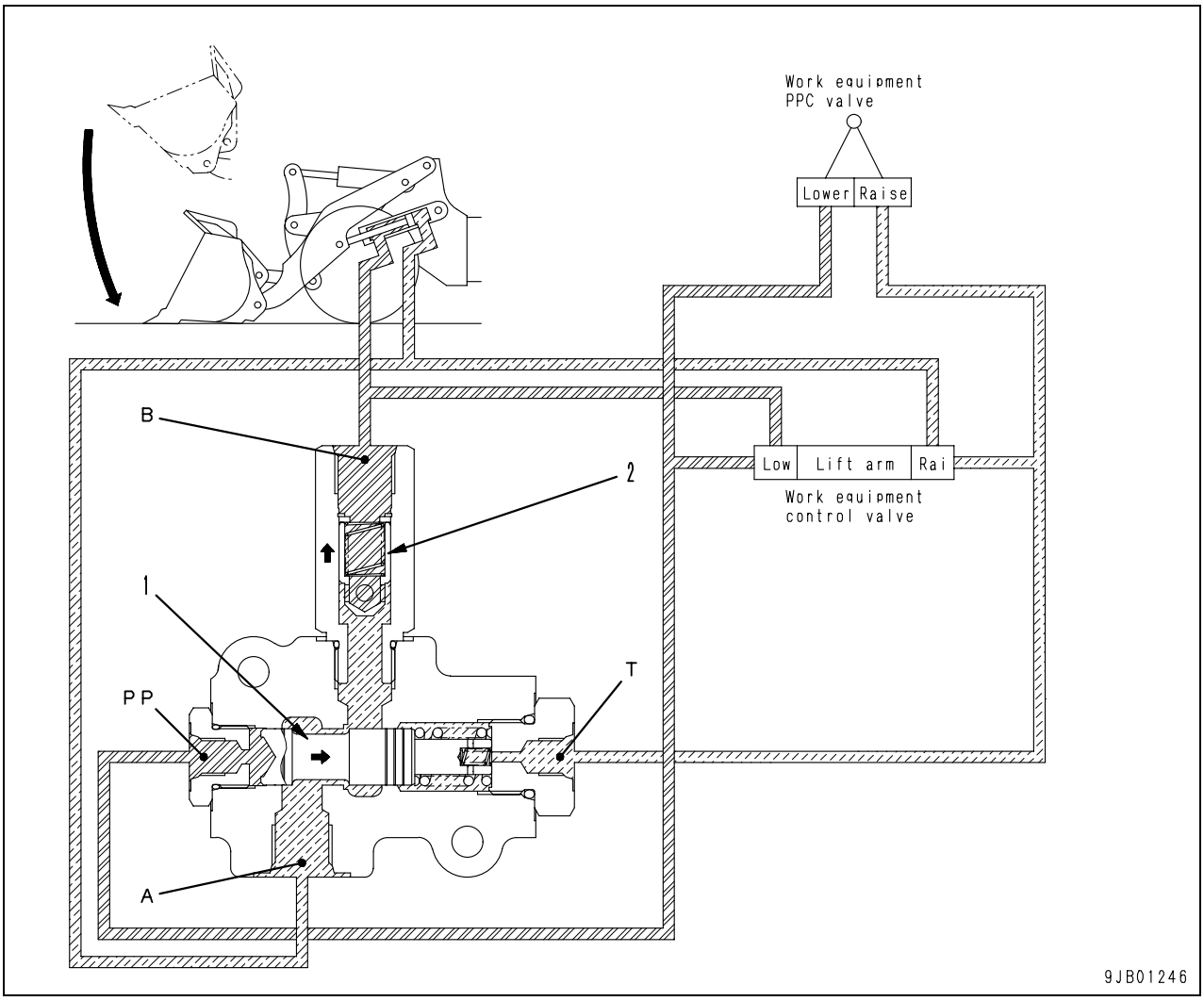
Operation

- Pulling the work equipment control lever pulls out lift arm spool (4) to set it to the raise position.
- The pressurized oil from pump (1) flows to the bypass circuit of lift arm spool (4) through the bypass circuit of bucket spool (3).
- Since the bypass circuit is closed by the spool, the pressurized oil from port (B) pushes open check valve (5).
- The pressurized oil from port (B) flows to the cylinder bottom through port (D).
- The pressurized oil on the cylinder head side returns to the hydraulic tank through port (E) and drain port (C). Thus, the lift arm is moved upward.



1. Spool
2. Metering spring
3. Centering spring
4. Rod
5. Lever
6. Ring
7. Plate
8. Piston
9. Retainer
10. Body
11. Filter

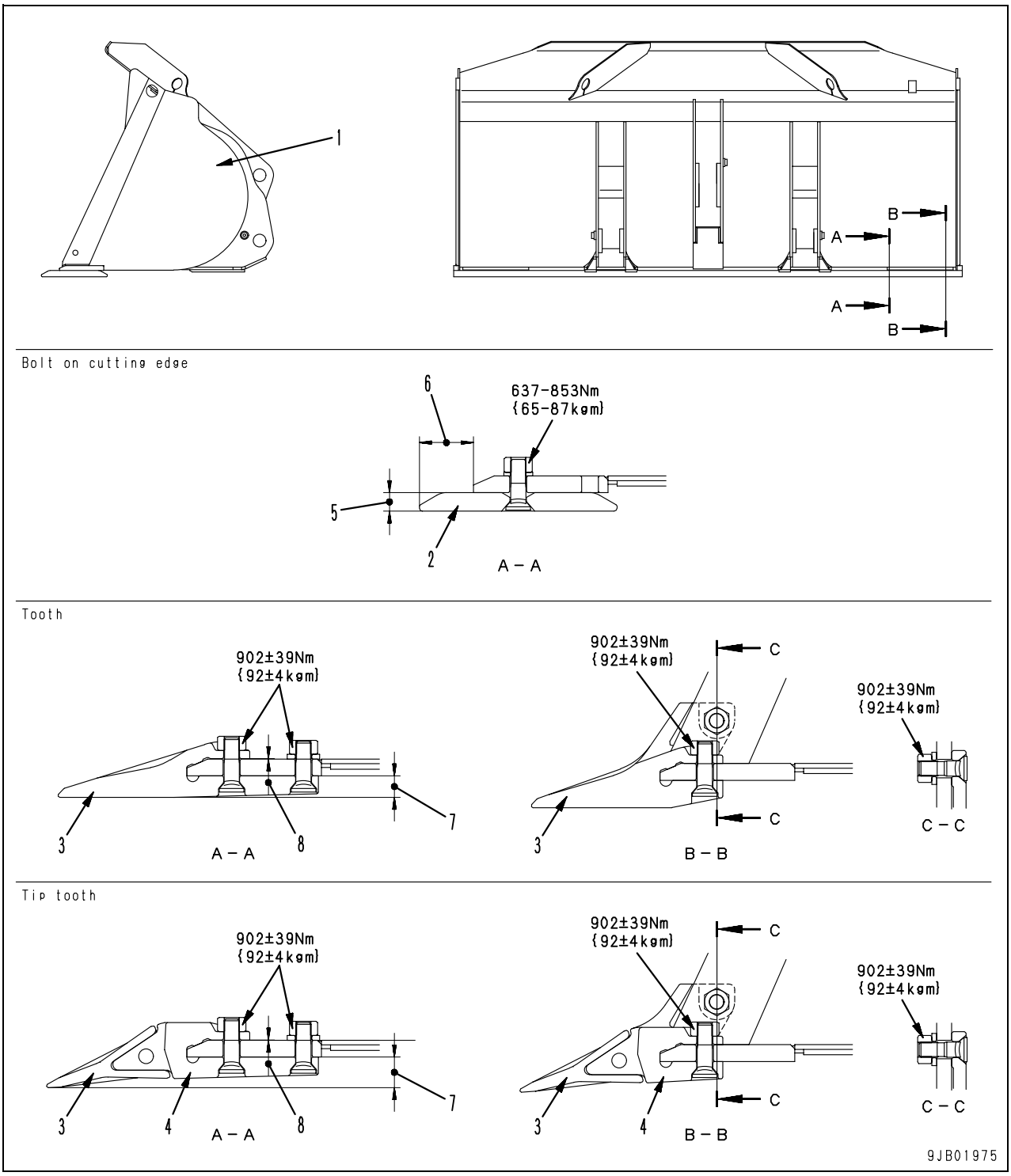
When lift arm is "LOWER" operation



- If the lift arm is "LOWER" operation, the oil of the work equipment PPC valve operates the work equipment control valve and the oil from the work equipment pump flows to the lift cylinder head side.
- At this time, the oil of the work equipment PPC valve flows to port (PP) to push spool (1) to the right and opens ports (A) and (B).
- When the lift arm is lowered, a part of the oil on the lift cylinder bottom side flows through the work equipment control valve into the hydraulic tank. A pressure higher than the pressure on the cylinder head side is generated on the cylinder bottom side by the weight of the work equipment, however.
- The hydraulic pressure generated on the lift cylinder bottom side pushes up and opens check valve plunger (2) and flows through port (B) to the cylinder head side, thus the lift arm lowers smoothly.

Bucket

WA200-6

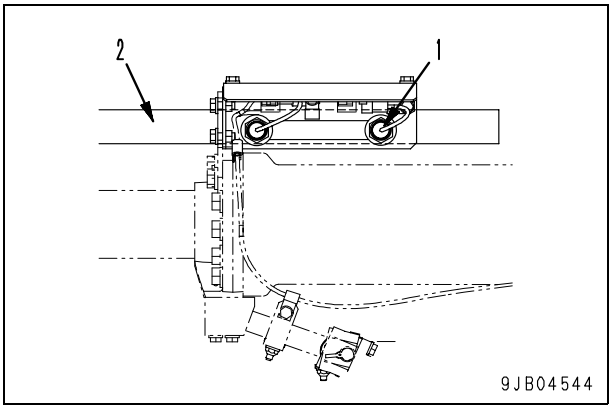


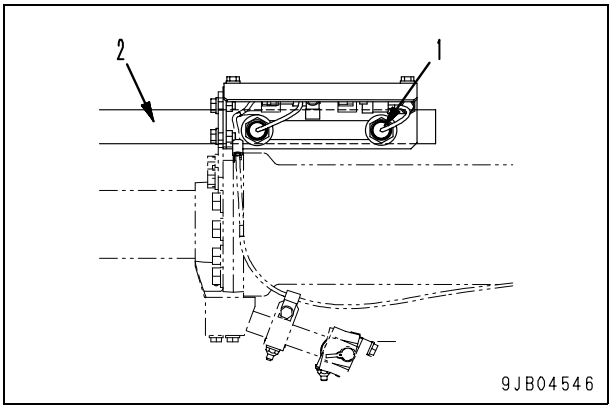
1. Bucket
2. Bolt-on cutting edge
3. Bucket teeth (if equipped)
4. Adapter (if equipped)

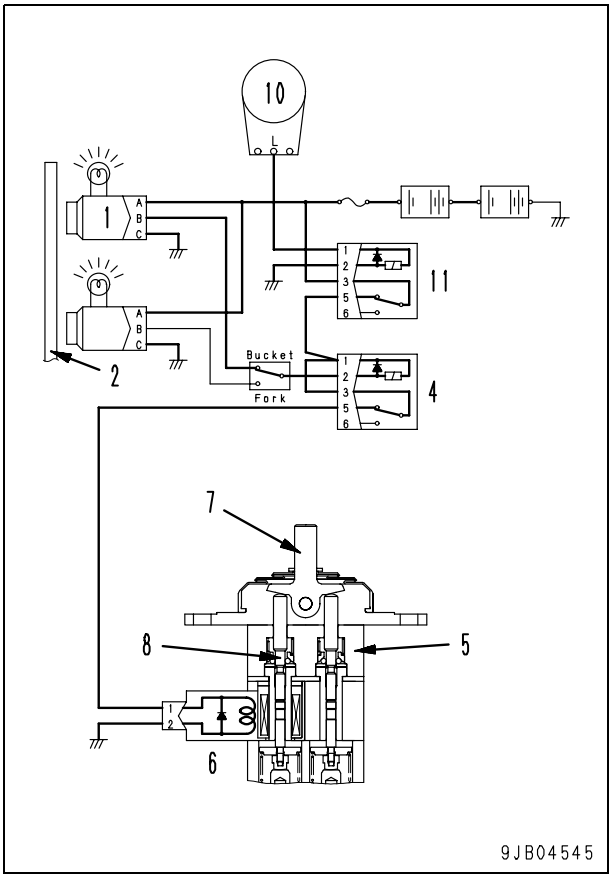
Operation of proximity switch

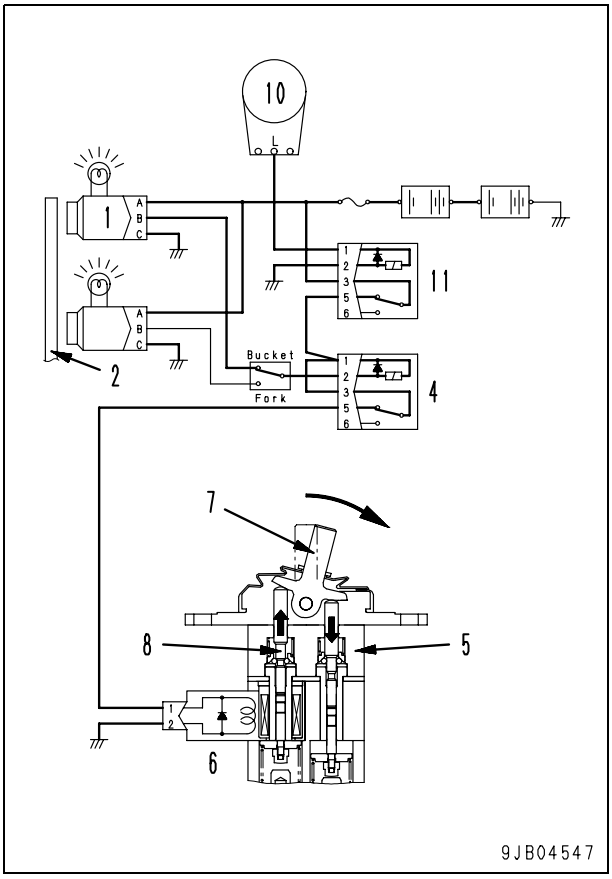
When bucket is tilted

★ The case when the attachment selector switch is in the "BUCKET" position is shown below.







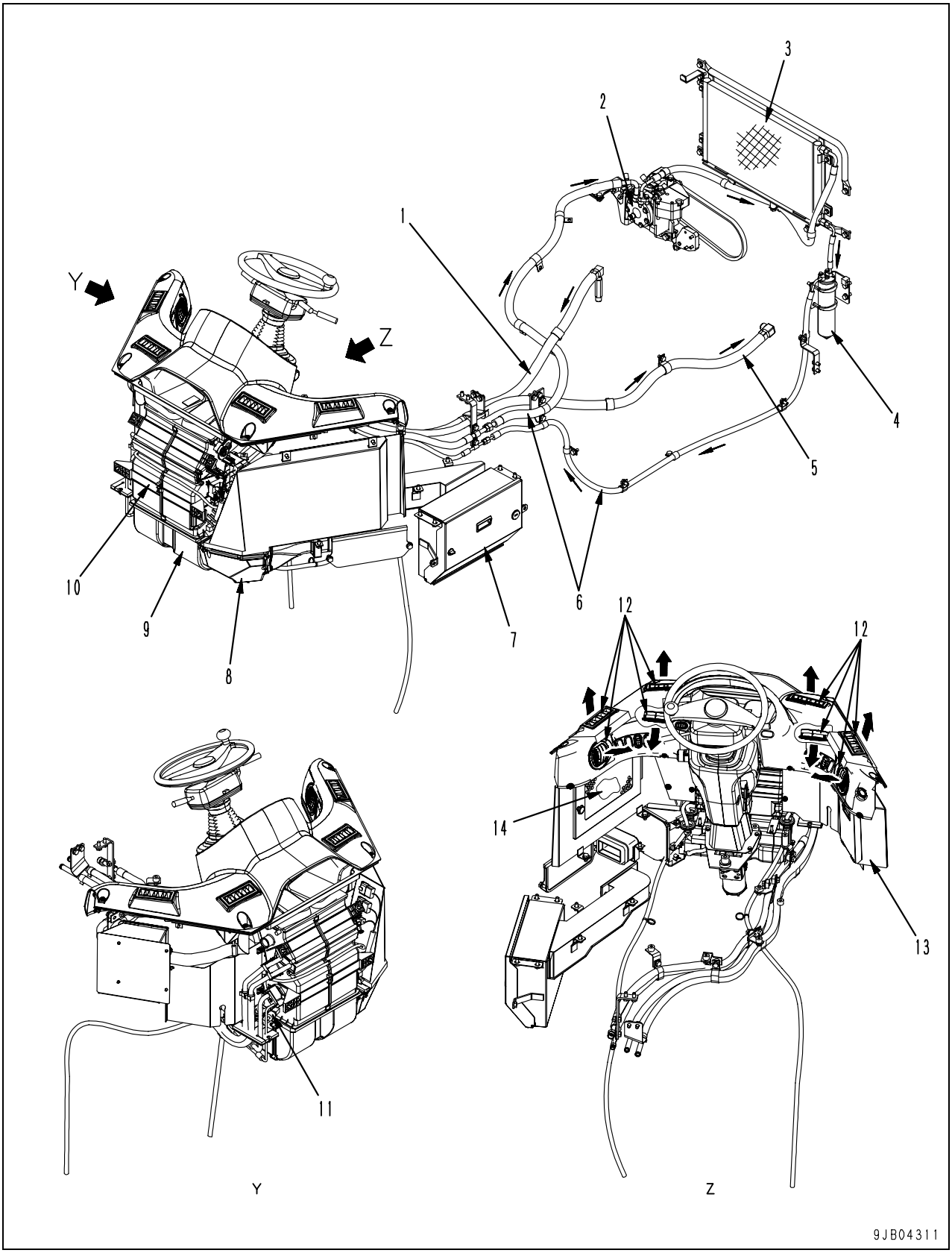


- While the bucket is dumped more than the position being set from the bucket positioner, bar (2) moves on to the sensing face of proximity switch (1), turning on the proximity switch (1) lamp.
  At this point, bucket positioner relay (4) is "ON" and current flows to detent solenoid (6) of work equipment PPC valve (5) to energize the coil.

- Shifting work equipment (bucket) control lever (7) toward the tilt position moves spool (8) to the position of the arrow. And spool is held there by the energized coil of detent solenoid (6).
  As a result, work equipment (bucket) control lever (7) is held at "tilt" position and the bucket tilts.

Air conditioner

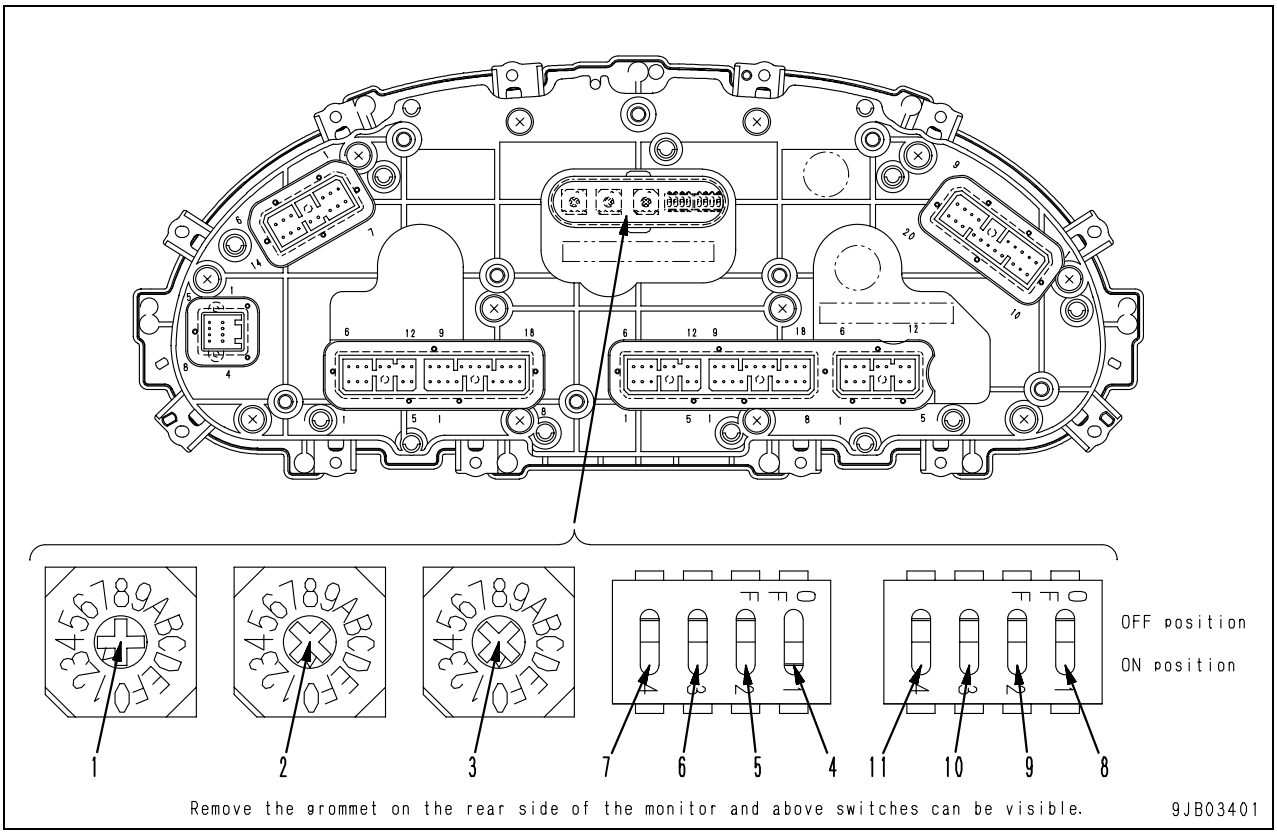
Air conditioner piping diagram



WA200-6, WA200PZ-6 GALEO Wheel loader

Form No. SEN03881-00

Setting of machine monitor



1. Spare rotary switch (SW1)
2. Spare rotary switch (SW2)
3. Spare rotary switch (SW3)
4. Spare dip switch (SW5-1)
5. Spare dip switch (SW5-2)
6. Spare dip switch (SW5-3)
7. Spare dip switch (SW5-4)
8. Spare dip switch (SW6-1)
9. Spare dip switch (SW6-2)
10. Spare dip switch (SW6-3)
11. Spare dip switch (SW6-4)

★ It is prohibited to change setting of spare rotary switch and DIP switch.

Troubleshooting function

- The machine monitor monitors the input and output signals constantly for troubleshooting for the system.
- If each controller detects abnormality by the self-diagnosis, abnormality information is forwarded to the machine monitor over the network.
- Abnormality information can be checked on the character display using the failure code display mode of the machine monitor.

AMP070-18P(2)[CN-L27]

Pin No.	Specifications	I/O	Group	Form of use	Signal name	Remarks
1	D_IN_26 (24 V/GND, 5 mA)	I	E	D/I (GND)	Parking brake	
2	D_IN_28 (24 V/GND, 5 mA)	I	E	D/I (GND)	Parking brake left-unapplied prevention	
3	D_IN_30 (24 V/GND, 5 mA)	I	E	D/I (GND)	Normal emergency steering	If equipped
4	(NC)	—	—	—	—	
5	D_IN_34 (24 V/GND, 5 mA)	I	F	D/I (GND)	Dimmer switch	
6	D_IN_36 (24 V/GND, 5 mA)	I	G	D/I (GND)	Parking brake dummy	
7	D_IN_38 (24 V/GND, 5 mA)	I	G	D/I (GND)	< switch	
8	(NC)	—	—	—	—	
9	GND	O	—	GND	GND	
10	D_IN_27 (24 V/GND, 5 mA)	I	E	D/I (GND)	Coolant level	
11	D_IN_29 (24 V/GND, 5 mA)	I	E	D/I (GND)	(engine oil level)	
12	(NC)	—	—	—	—	
13	(NC)	—	—	—	—	
14	D_IN_35 (24 V/GND, 5 mA)	I	F	D/I (GND)	Parking brake left-unapplied prevention dummy	
15	D_IN_37 (24 V/GND, 5 mA)	I	G	D/I (GND)	> switch	
16	D_IN_39 (24 V/GND, 5 mA)	I	G	D/I (GND)	Operation of emergency steering	If equipped
17	(NC)	—	—	—	—	
18	(NC)	—	—	—	—	

AMP070-12P(2)[CN-L28]

Pin No.	Specifications	I/O	Group	Form of use	Signal name	Remarks
1	A_IN_2 (high-resistance input)	I	J	A/I	Fuel level sensor	
2	A_IN_4 (high-resistance input)	I	J	A/I	HST oil temperature sensor	
3	(NC)	—	—	—	—	
4	(NC)	—	—	—	—	
5	(NC)	—	—	—	—	
6	GND	O	—	GND	GND	
7	A_IN_3 (high-resistance input)	I	J	A/I	Brake oil temperature sensor	
8	(NC)	—	—	—	—	
9	(NC)	—	—	—	—	
10	(NC)	—	—	—	—	
11	GND	O	—	GND	(GND)	
12	(NC)	—	—	—	—	

HST controller protection function

HST motor 1 overrun prevention function 1

- If the 1st or 2nd speed is selected while the machine is traveling at a high speed with the travel speed range selector switch being set to the 3rd or 4th, the transfer clutch is engaged during the high speed travel, preventing HST motor 1 to overrun beyond the allowable rotating speed.
- In order to prevent the overrun, this function disables the gear shift from the 3rd or 4th to the 2nd or 1st when the transfer clutch is released.
- As above gear shift is disabled, this function generates "OVERRUN PROTECT" message on the machine monitor character display and activates the alarm buzzer.
- This error status is reset as the transfer clutch is engaged or the travel speed range selector switch is set to an allowable gear shift position.

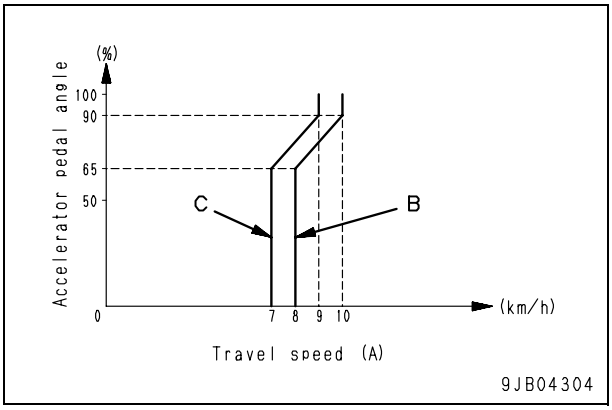
★ Above error message is not sent to KOMTRAX terminal.

Gear shift operation			Behavior after gear shift		
Switch position before gear shift	State of transfer clutch after gear shift	Switch position after gear shift	Actual speed range after gear shift	Display of message	Remarks
1st	Connected	2nd	2nd	Not displayed	Gear shift available independent of traveling speed
		3rd	3rd		
		4th	4th		
2nd	Connected	1st	1st	Not displayed	Gear shift available independent of traveling speed
		3rd	3rd		
		4th	4th		
3rd	Connected	1st	1st	Not displayed	Gear shift to 1st or 2nd becomes available only when the clutch is engaged.
		2nd	2nd		
		4th	4th		
	(*1) Other than the connected state	1st	3rd	Displayed	
		2nd	3rd		
		4th	4th	Not displayed	
4th	Connected	1st	1st	Not displayed	Gear shift to 1st or 2nd becomes available only when the clutch is engaged.
		2nd	2nd		
		3rd	3rd		
	(*1) Other than the connected state	1st	3rd	Displayed	
		2nd	3rd		
		3rd	3rd	Not displayed	

*1: The clutch is released including the ongoing clutch connection modulation (*2) and clutch release modulation state.
*2: It indicates the period 1.2 seconds after the clutch connection modulation has been started while the machine is traveling at 7 up to 9 km/h.

Relationship between accelerator pedal angle and travel speed (A) for starting transfer clutch switching modulation

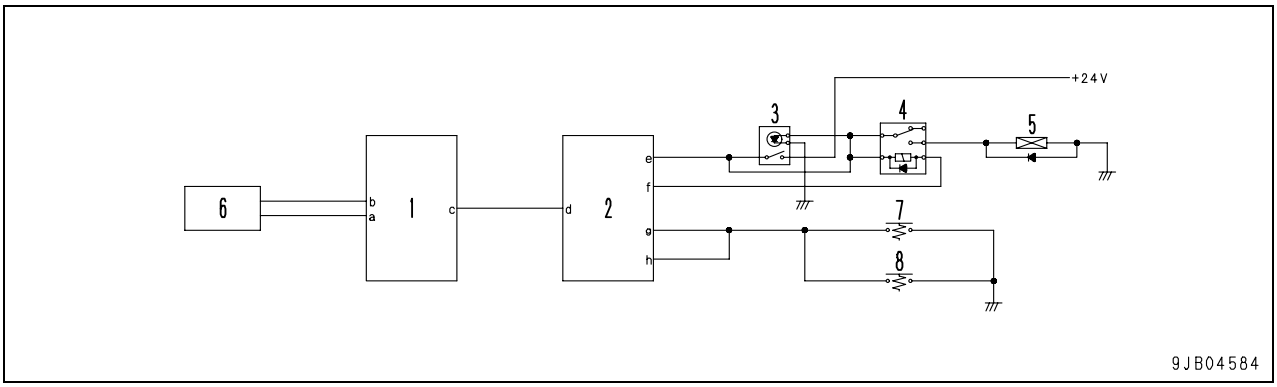
Transfer clutch	Accelerator pedal angle (%)		
	0 – 65	65 – 90	90 – 100
Engaged → Disengaged (B)	8 km/h	8 – 10 km/h	10 km/h
Disengaged → Engaged (C)	7 km/h	7 – 9 km/h	9 km/h



ECSS system

(if equipped)

★ ECSS: Abbreviation for Electronically Controlled Suspension System



1. HST controller
2. Machine monitor
3. ECSS switch
4. ECSS relay
5. ECSS solenoid valve
6. Speed sensor
7. Bucket tilt PPC oil pressure switch
8. Lift arm lower PPC oil pressure switch

Input and output signals

HST controller
a. Travel speed signal A
b. Travel speed signal B
c. CAN signal

Machine monitor
d. CAN signal
e. ECSS switch "ON" signal
f. ECSS operation signal
g. ECSS cut off signal
h. ECSS cut off (dummy) signal

Outline

- When the machine travels at high speed, the damping effect of the accumulator charged with high-pressure gas and the automatic control of the lift cylinder circuit relief pressure under each travel condition damp the vertical movement of the work equipment and reduce rocking of the chassis. As a result, the operator comfort is improved, spillage of material is prevented, and the working efficiency is improved.

Setting method

- The ECSS can be enabled only when "ADD" is selected for "5. E.C.S.S." item from the "Optional device selecting function" of the machine monitor.

★ For the setting procedure, see "Special functions of machine monitor (EMMS)" in Testing and adjusting.

Coupler plunger control system

WA200PZ-6

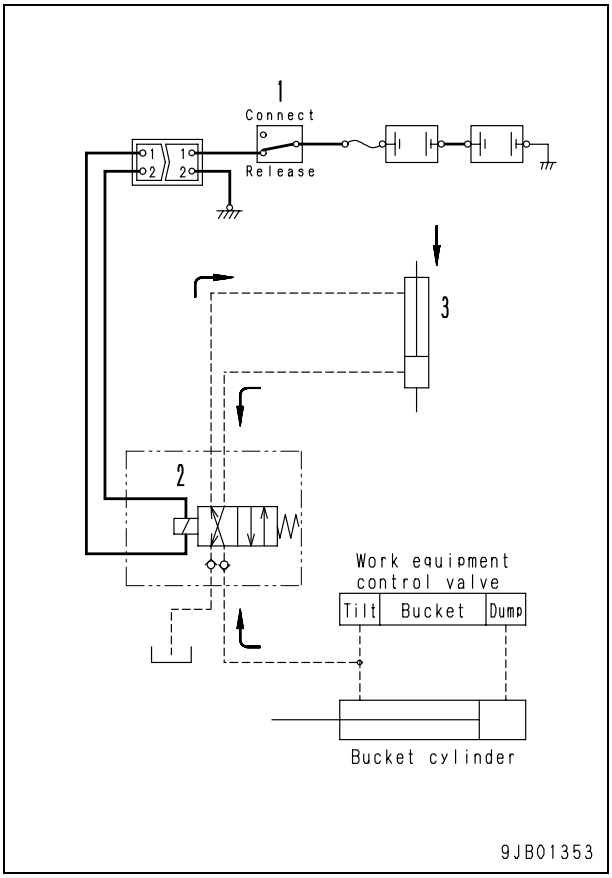
Outline

- The coupler plunger is extracted or retracted by operating the quick coupler attachment switch to connect and release each attachment and the coupler.

Operation

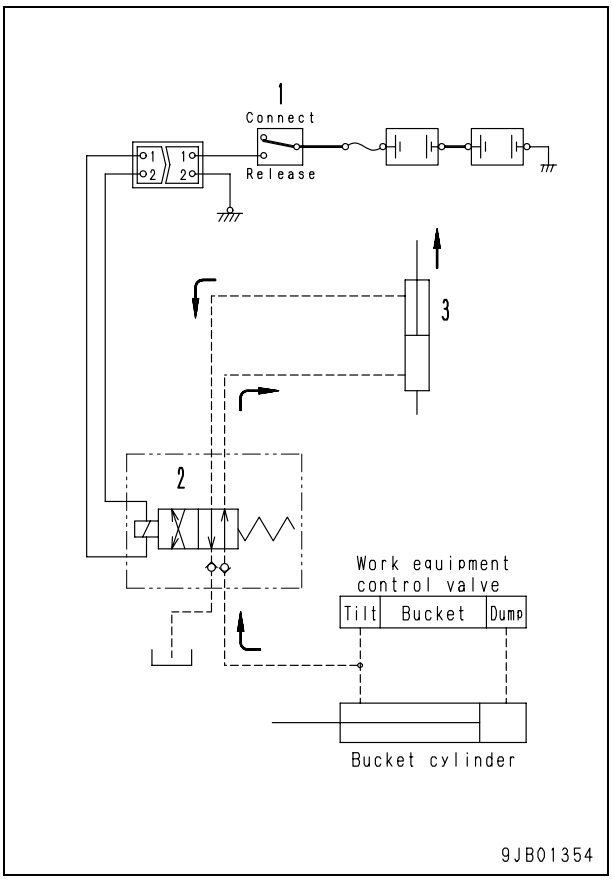
When quick coupler attachment switch is in "Release" position

- If the quick coupler attachment switch (1) is set in the “Release” position, quick coupler solenoid valve (2) is energized.
  If the work equipment (bucket) control lever is moved to the tilt side, the oil flows into the head side of coupler plunger (3). Then, coupler plunger (3) is retracted and the attachment and coupler are released.



When quick coupler attachment switch is in "Connect" position

- If the quick coupler attachment switch (1) is set in the “Connect” position, quick coupler solenoid valve (2) is de-energized.
  If the work equipment (bucket) control lever is moved to the tilt side, the oil flows into the bottom side of coupler plunger (3). Then, coupler plunger (3) is extracted and the attachment and coupler are connected.



Standard service value table for engine

Machine model				WA200-6	
Engine				SAA4D107E-1	
Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	High idle (*)		rpm	2,225 (+70/-50)	2,225 (+70/-50)
	Low idle (*)			825 (+25/-50)	825 (+25/-50)
Exhaust temperature (Turbocharger outlet temperature)	All revolution ranges (Atmospheric temperature: 20°C)		°C	Max. 700	750
Intake air pressure (Boost pressure)	• At rated output • At aftercooler outlet side		kPa {mmHg}	Min. 133 {Min. 1,000}	107 {800}
Exhaust gas color	Engine coolant temperature: Within operating range	At rated output	Pollution level % (Bosch index)	Max. 12 (Max. 1.7)	22 (2.7)
		At sudden acceleration		Max. 25 (Max. 3.0)	35 (4.0)
Valve clearance	Normal temperature	Intake valve	mm	0.25 ± 0.05	0.152 – 0.382
		Exhaust valve		0.51 ± 0.05	0.381 – 0.763
Blow-by pressure	• At rated output • Engine coolant temperature: Within operating range		kPa {mmH2O}	Max. 0.98 {Max. 100}	1.96 {200}
Oil pressure	At high idle Engine coolant temperature: Within operating range	SAE0W30EOS SAE0W40EOS SAE10W30DH SAE15W40DH SAE30DH	MPa {kg/cm2}	Min. 0.29 {Min. 3.0}	0.25 {2.5}
	At low idle Engine coolant temperature: Within operating range			Min. 0.10 {Min. 1.0}	0.07 {0.7}
Oil temperature	All engine speed ranges (Inside oil pan)		°C	80 – 110	Min. 120
Belt tension	Deflection under finger pressure of approx. 58.8 N {approx. 6 kg}	Idler pulley – crankshaft pulley	mm	Auto-tensioner	Auto-tensioner
	Deflection under finger pressure of approx. 98 N {approx. 10 kg}	Air conditioner compressor – crankshaft pulley		8 – 11	8 – 11

*: Value when mounted on machine (Different from value in Engine Shop Manual)

Testing and adjusting item	Sym-bol	Part No.	Part Name	Q'ty	Remarks
Diagnosis for engine related controller, sensor actuator and harness	Z	799-601-7400	T-adapter assembly	1	AMP040 Connector
		799-601-7500	T-adapter assembly	1	AMP070 Connector
		799-601-9000	T-adapter assembly	1	DT, HD30 Connector
		799-601-9300	T-adapter assembly	1	DRC26-40 (5 pins)
		799-601-7360	Adapter	1	REL-5P (5 pins)
		799-601-7310	T-adapter	1	SWP (12 poles)
		799-601-7070	T-adapter	1	SWP (16 poles)
		799-601-4101	T-adapter assembly	1	Connected with engine
		795-799-5530	• T-adapter	1	Engine coolant temperature
		799-601-4230	• T-adapter	1	Boost temperature/pressure sensor
		799-601-4130	• T-adapter	1	Ne sensor, CAM sensor
		799-601-4160	• T-adapter	1	Hydraulic pressure sensor
		799-601-4211	• T-adapter	1	Controller (50 poles)
		799-601-4220	• T-adapter	1	Controller (60 poles)
		799-601-4140	• T-adapter	1	Atmospheric pressure sensor
		799-601-4340	• T-adapter	1	Pump actuator
		799-601-4260	• T-adapter	1	Controller (4 poles)
		799-601-4190	• T-adapter	1	Common rail pressure sensor
Diagnosis for chassis related controller, sensor actuator and harness	Z	799-601-2500 or 799-601-2700 or 799-601-2800 or 799-601-2900 or 799-601-7100 or 799-601-8000	T-adapter	1	799-601-2900 is not supplied
		799-601-2600	• T-adapter box	1	Econo (Excl. 799-601-2700)
		799-601-2740	• Adapter for MIC	1	For MIC-5P
		799-601-4101	T-adapter assembly	1	
		799-601-4211	• Adapter for DRC	1	For DRC50
		799-601-9020	• Adapter for DT	1	For DT2P
		799-601-9030	• Adapter for DT	1	For DT3P
		799-601-7000 or 799-601-7100 or 799-601-7400 or 799-601-8000	T-adapter assembly	1	
		799-601-7010	• Adapter for X	1	For X1P
		799-601-7020	• Adapter for X	1	For X2P
		799-601-7030	• Adapter for X	1	For X3P
		799-601-7040	• Adapter for X	1	For X4P
		799-601-7050	• Adapter for SWP	1	For SWP6P
		799-601-7060	• Adapter for SWP	1	For SWP8P (Excl. 799-601-8000)

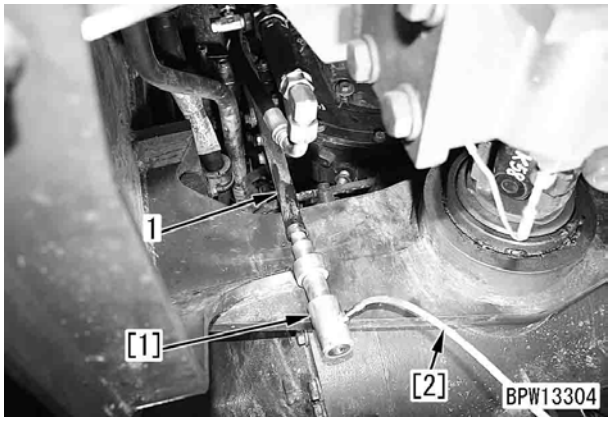
Measuring blow-by pressure

★ Necessary tools

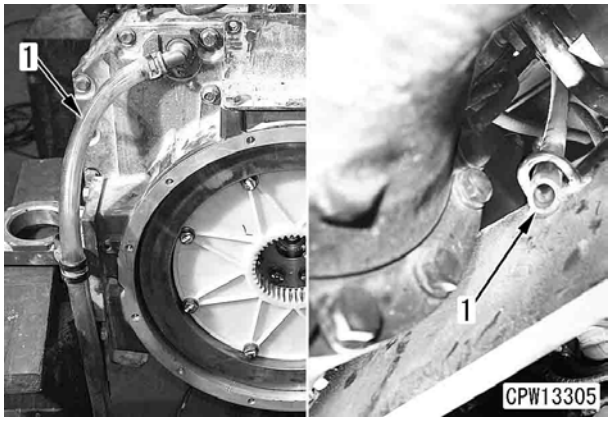
Symbol	Part No.	Part Name
D	799-201-1504	Blow-by checker

★ Measure the blow-by pressure under the following condition.
- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range
- HST oil temperature: Within operating range

1. Stop the engine. Install nozzle [1] and hose [2] of blow-by checker **D** to blow-by hose (1) and connect them to gauge [3].



★ Blow-by hose (1) comes out from the rear left of the engine and its end is fixed to the machine lower frame.



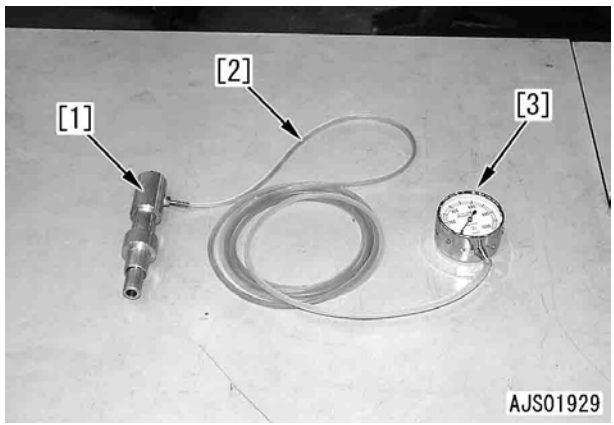
2. Start the engine and increase the engine coolant temperature to the operating range.

3. Press the left brake pedal securely.

4. Release the parking brake.

5. While pressing the brake pedal, set the directional lever or switch to the F (forward) or R (reverse) position.
⚠ Keep pressing the brake pedal securely.

6. Press the accelerator pedal gradually to the high idle. While running the engine at HST stalling and hydraulic stalling, measure the blow-by pressure.
★ Do not keep stalling the HST for more than 20 seconds. Take care that the HST oil temperature will not exceed 120°C.
★ Normally, the blow-by pressure should be measured while the engine is operated at the rated output. In the field, however, an approximate value can be obtained by HST stalling and hydraulic stalling.
★ If it is impossible to run the engine at the rated output or HST stalling and hydraulic stalling, measure while the engine is running at high idle. The value obtained in this case is about 80% of the blow-by pressure at the rated output.
★ Precaution for measuring blow-by pressure
The blow-by pressure may vary largely with the engine condition. If the measured value is judged abnormal, check for increase of oil consumption, bad exhaust gas color, deterioration of oil, high deterioration speed of oil, etc. which are related to the abnormal blow-by pressure.



7. Remove the measurement tool after the measurement, and make sure that the machine is back to normal condition.

Checking leakage in fuel system

⚠ **Very high pressure is generated in the high-pressure circuit of the fuel system. If fuel leaks while the engine is running, it is dangerous since it can catch fire.**
After testing the fuel system or removing its parts, check it for fuel leakage according to the following procedure.

★ Clean and degrease the engine and the parts around it in advance so that you can test it easily for fuel leakage.

1. Spray color checker (developer) over the fuel supply pump, common rail, fuel injector, and joints of the high-pressure piping.

2. Run the engine at a speed below 1,000 rpm and stop it after its speed is stabilized.

3. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.

4. Run the engine at low idle.

5. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.

6. Run the engine at high idle.

7. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.

8. Start the engine and stall the HST or relieve the hydraulic pump to apply some load on the engine.

9. Inspect the fuel piping and devices for fuel leakage.
   ★ Check mainly around the high-pressure circuit parts coated with the color checker for fuel leakage.
   ★ If fuel leakage is recognized, repeat the procedure from step 1 after repairing the leakage.
   ★ If no fuel leakage is detected, check is completed.

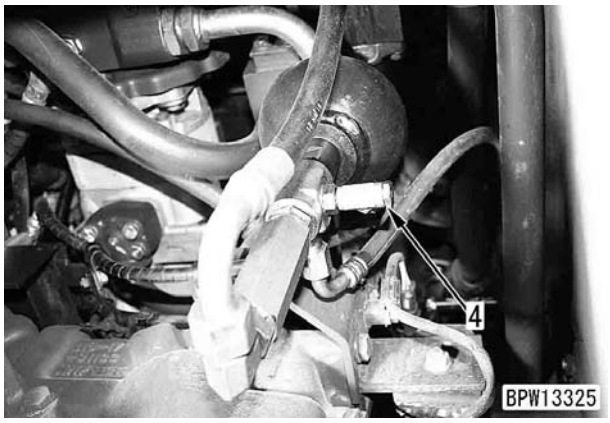
Testing low-pressure relief pressure (basic pressure of work equipment PPC circuit)

[Testing with monitoring function]

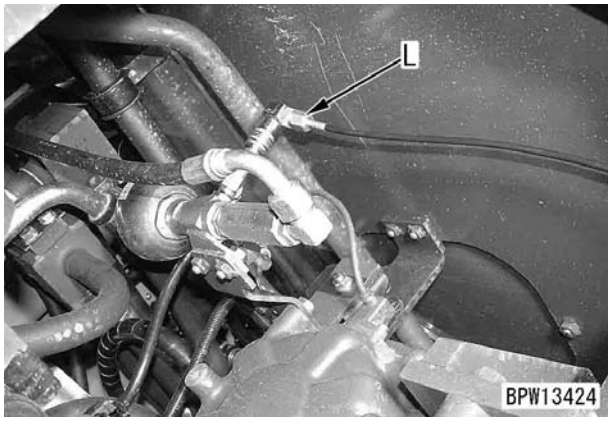
See “Testing high-pressure cut-off oil pressure”.

[Testing with tools]

1. Remove low-pressure relief pressure measurement plug (4) (10 mm, P = 1.25 mm) from under the machine.
   ★ The oil pressure pickup plug is installed to the accumulator bottom near the lower right of the transfer on the right side of the rear frame.



2. Install a nipple, then connect oil pressure gauge **L** (6 MPa {60 kg/cm²}).

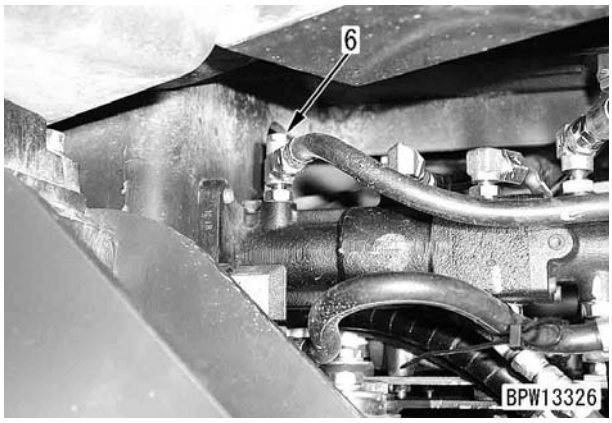


3. Place the directional lever at N, run the engine at high idle, and measure the low-pressure relief pressure.
4. After finishing the work, remove the measuring instruments and return the removed parts.

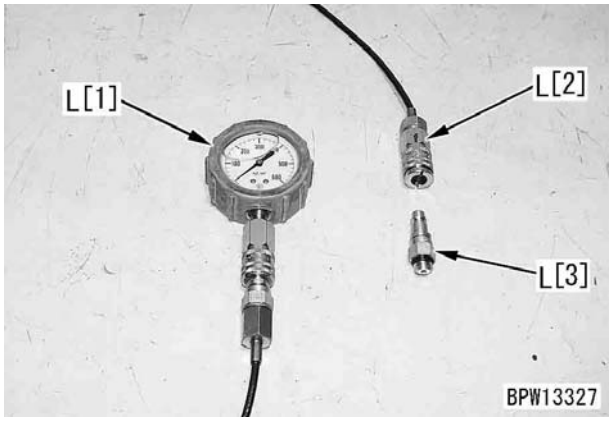
Testing servo piston control pressure (DA pressure)

1. Remove floor frame cover (5) (bottom left of operator's cab).

2. Remove servo piston control pressure measurement plug (6) (DA pressure) (10 mm, P = 1.25 mm).



3. Install nipple **L** [3], then connect oil pressure gauge **L** [1], **L** [2] (6 MPa {60 kg/cm²}).



4. Place the directional lever at N, run the engine at high idle, and measure the control pressure when the brake pedal is depressed and when it is released.
   ★ The brake pedal is connected to the inching valve and controls the control pressure.
5. After finishing the work, remove the measuring instruments and return the removed parts.

Testing and adjusting brake pedal linkage

Testing

1. Check for play in linkage mounting pin (7), pin-hole of lever (6), and lever bushing.

2. Measure length of link (1), and check that it is within the standard value.
   Standard link length (a): 184 mm
   ★ Measure the length from the center of pin (5) to the center of ball joint (3).

3. Measure the distance of movement of rod (8) and check that clearance (b) is within the standard value.
   Standard clearance (b): 0 – 0.3 mm
   ★ When doing this, check that the brake pedal is in contact with the stopper.

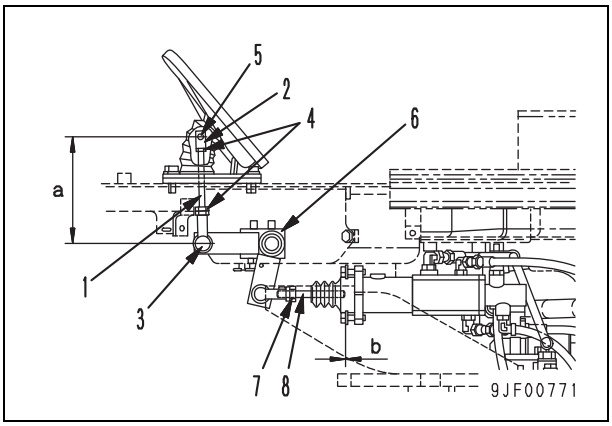
Adjusting

Adjusting link length (a)

1. Remove pin (5) and ball joint (3), then remove rod (1).
2. Loosen locknut (4), then turn yoke (2) and ball joint (3) to adjust the length.
3. After adjusting the length of link (a), connect it to the brake pedal.
   ★ Standard value (a): 184 mm

Adjusting clearance (b)

1. Loosen locknut (7), turn rod (8) so that the tip of the rod contacts the booster cylinder piston, then turn rod (8) back 1/4 turn.
2. Tighten locknut (7).
   ★ Standard value (b): 0 – 0.3 mm



Measuring and adjusting work equipment control lever

Necessary tools

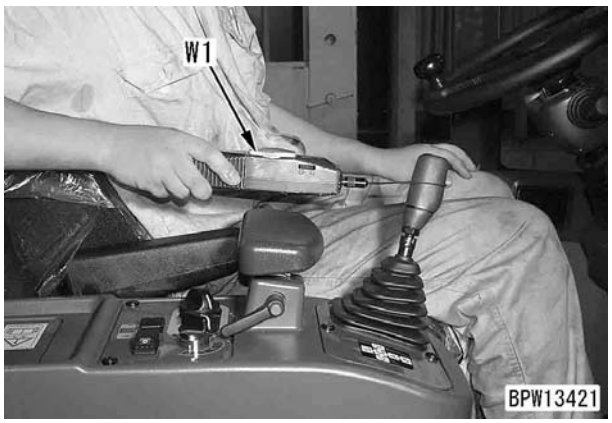
Symbol		Part No.	Part Name
W	1	79A-264-0021	Push-pull scale
	2	Commercially available	Scale

⚠ **Install the frame lock bar to the frame.**

★ Measuring condition

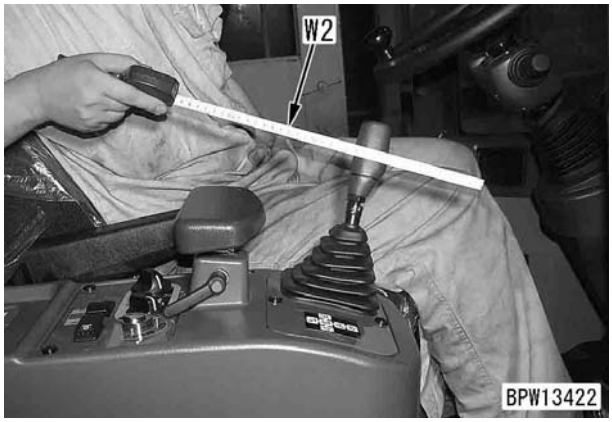
- Engine coolant temperature: Operating range of engine coolant thermometer
- Hydraulic oil temperature: 45 – 55°C
- Engine speed: Low idle

1. Measuring operating effort of work equipment control lever
   1) Install tool **W1** to the work equipment control lever and secure it in position.
      ★ Install tool **W1** to the center of the knob.
      ★ Operate the control lever at the same speed as for normal operations, and measure the minimum value for the effort needed to operate the knob.



   2) After finishing the work, remove the measuring instruments and return the removed parts.

2. Measuring travel of work equipment control lever
   1) Measure the travel at each position when operating the work equipment control lever.
      ★ Mark the lever knob and use a scale **W2** to measure.
      ★ If the stroke is not within the standard value, check for play in the work equipment PPC valve.



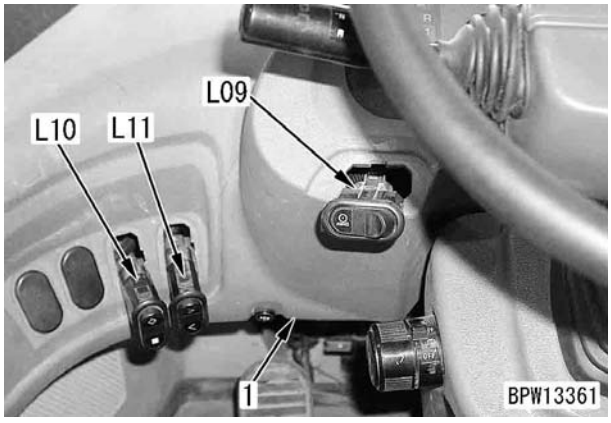
Preparation work for troubleshooting for electric system

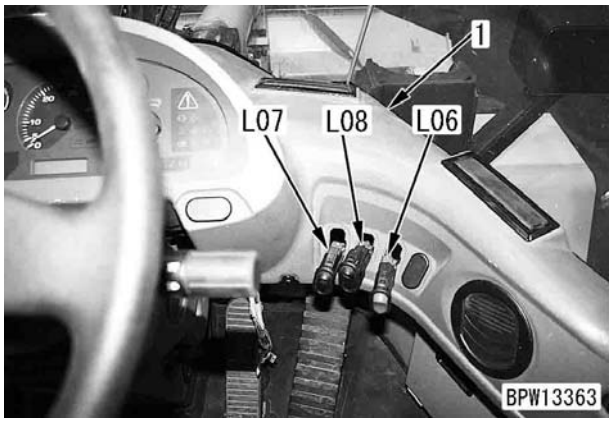
★ When carrying out troubleshooting for an electric circuit related to the machine monitor, transmission controller, work equipment controller, or KOMTRAX terminal, expose the related connectors according to the following procedure.
★ Disconnect and connect the connectors of special lock types according to the following procedure.

1. Machine monitor

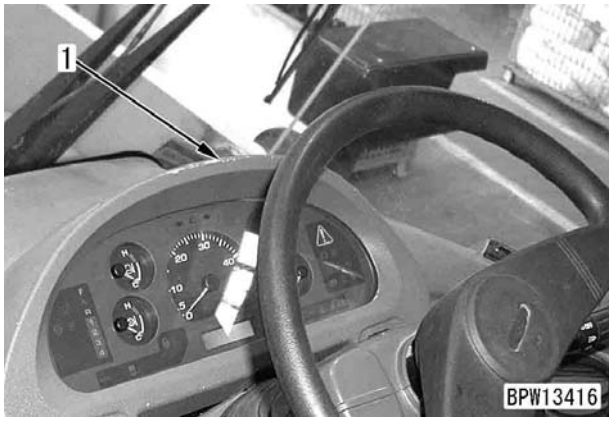
1) Disconnect the following connectors from cover (1).
- Connector **L06**: Hazard switch
- Connector **L07**: Front working lamp switch
- Connector **L08**: Rear working lamp switch
- Connector **L09**: ECSS switch (If equipped)
- Connector **L10**: Machine monitor mode selector switch 1
- Connector **L11**: Machine monitor mode selector switch 2

★ Pull the switch out of the cover and disconnect each connector.
★ If you insert your hands from under the cover and disconnect a connector forcibly, you many damage the connector or switch. Take care.

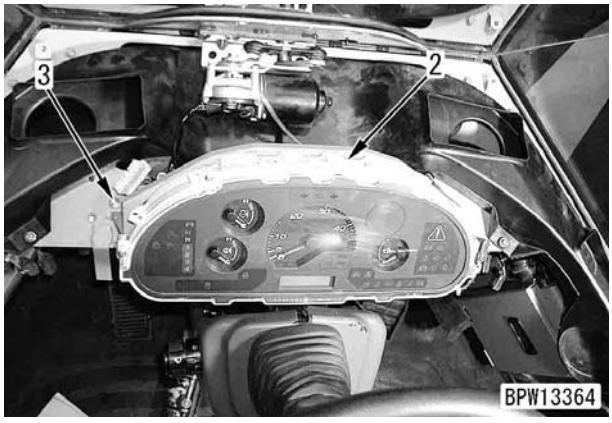




2) Remove cover (1).



3) Remove 3 bracket mounting bolts (3) of machine monitor (2) and reverse the machine monitor.
★ Take care not to pull the wiring harness forcibly.



WA200-6, WA200PZ-6 Wheel loader

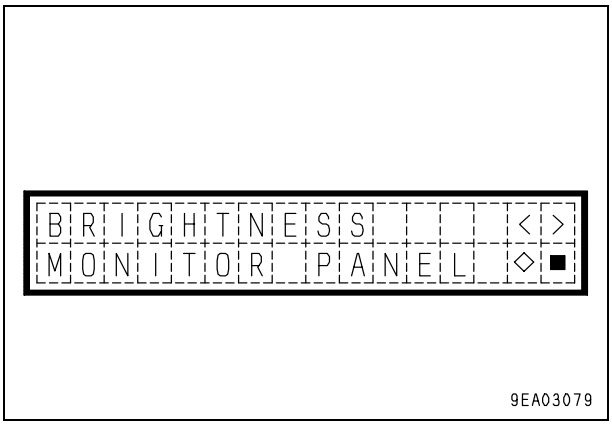
Form No. SEN03886-02

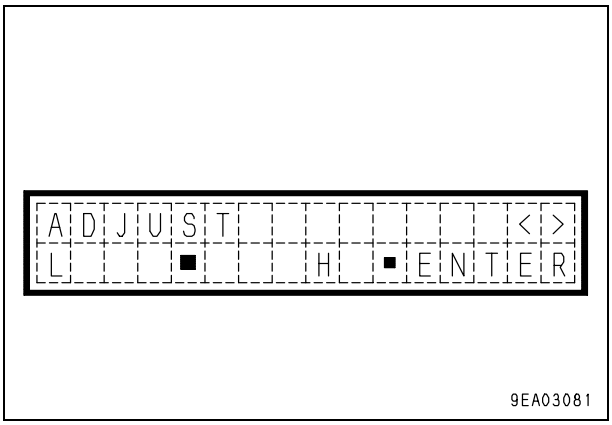
8. Monitor brightness adjustment function

Brightness of the machine monitor is adjustable in seven levels through the switch operation.

★ Adjustment of brightness is available in two approaches – adjustment of the monitor alone and separate adjustment of the monitor and liquid crystal.

★ For details, see the “Other functions of machine monitor” of the Operation section in the Operation and maintenance manual.

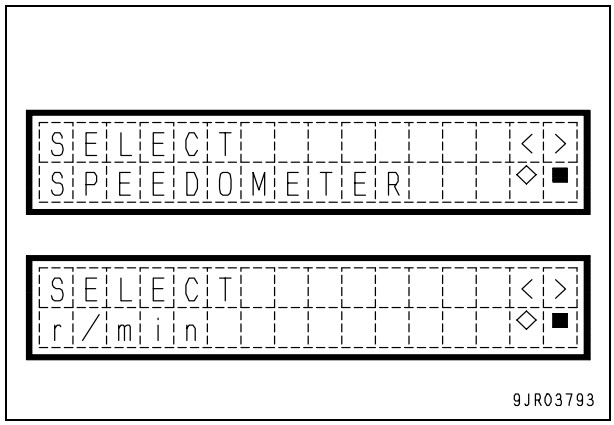




9. Travel speed/engine speed display selecting function

A unit to be used for the machine monitor speed display is selectable from km/h and MPH. It is also possible to turn on or off the display of the travel speed and engine speed.

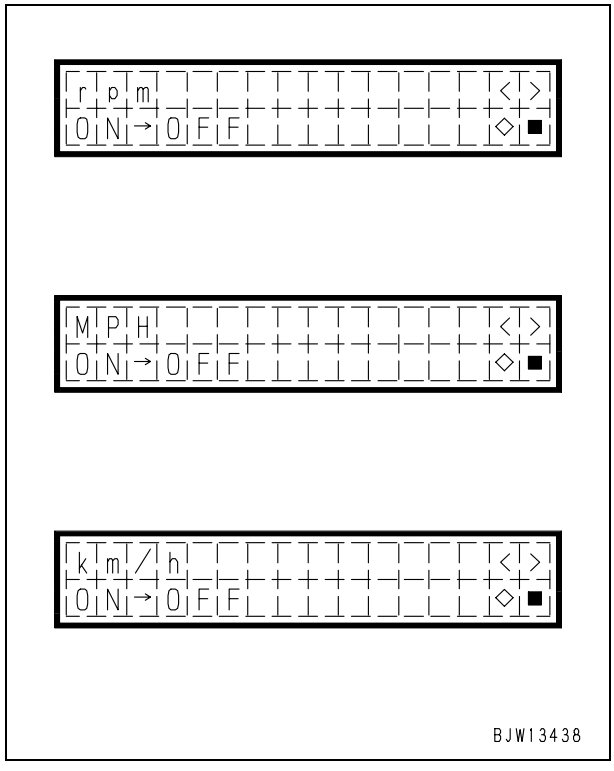
★ For details, see the “Other functions of machine monitor” of the Operation section in the Operation and maintenance manual.



10. Travel speed/engine speed display/non-display selecting function

A unit for the machine monitor speed display is selectable from km/h and MPH. It is also possible to turn on or off display of the travel speed and engine speed.

★ For details, see the “Other functions of machine monitor” of the Operation section in the Operation and maintenance manual.



Failure code	Troubled part/item	Trouble	Controller	Action code	Category of record
J141N1	Steering pump	Overrun alarm	HST	E02	Mechanical system
M100N1	HST pump	Overrun alarm	HST	E02	Mechanical system
M400N1	Motor 1	Overrun alarm	HST	E02	Mechanical system

★ Failure codes:
The failure code table is written in alphabetical order and also starting from small number.
The failure code in parentheses is not recorded in the failure history for both electrical system and mechanical system.
★ Applicable controller:
Applicable controller indicates in which controller system the failure has occurred.
MON : machine monitor system
ENG : Engine controller system
HST : HST controller system
★ Action codes:
Action codes indicate what is displayed in the operator mode when a failure is detected.
★ History classification:
History classification indicates in which system, either electrical system or mechanical system in the failure history display function, a failure has been recorded.
★ Note: Optional equipments are also included in the table.

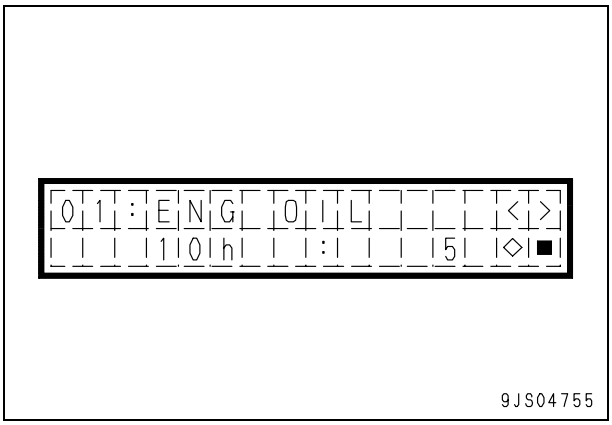
★ Use this page in next page and a spread.

HST [HST controller system]

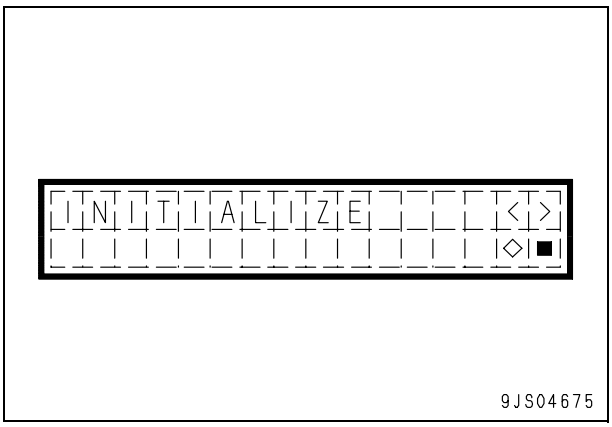
No.	Monitoring code	Real-time monitoring item (*1)	Displayed item (*2)	Data display range (*3)
22	99100	Parking brake switch signal	PARKING A/B	11/00/10/01
23	04302	Alternator R voltage signal	ALTERNATOR	0.0 – 30.0
24	99200	Travel speed control dial	SPEED POT	0.0 – 50.0
25	99201	Travel speed control dial	SPEED POT	0.001 – 5.000
26	80200	Traction level setting	TRACTION	0 – 100
27	99101	Forward-Reverse selector switch FNR signal	MULTI FNR	100/010/001
28	99300	Machine status	HST STATUS	0 – 6
29	99301	Clutch status	CLUTCH STATUS	0 – 4
30	99302	Forward-Reverse recognition	TRAVEL F/R	F/R

3) Select “YES” or “NO” using [<] or [>] switch.
★ The selected cursor will start flashing. If “YES” is selected and [■] switch is pressed, the information will be deleted. If “NO” is selected and [■] switch is pressed, deletion is cancelled and the maintenance interval change item screen is restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.
★ An interval time is changed, the timer remaining time is changed as shown below.
● Timer remaining time = Interval time being set – Elapsed time from the last replacement

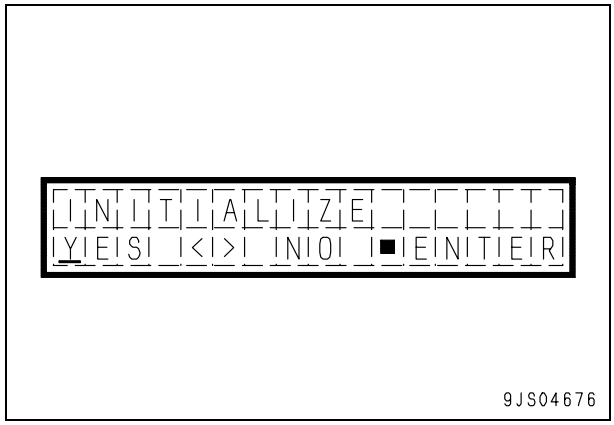
8-3. Changing set default value.
1) Press [◇] switch from the MAINTENANCE MONITOR screen of Service mode to display 01: ENG OIL screen.



2) Using [<] or [>] switch, select the INITIALIZE screen from the following table.

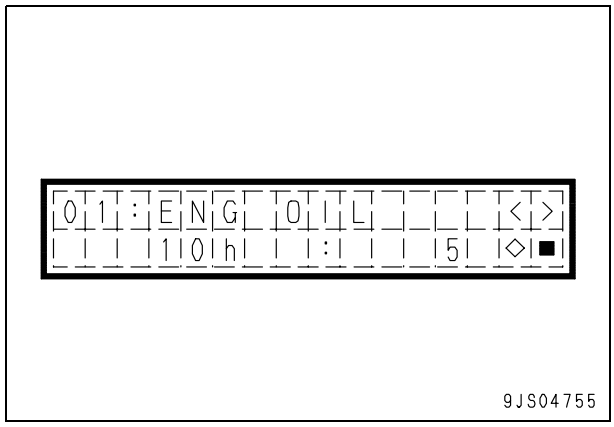


3) Press [◇] switch from this state.
4) Select “YES” or “NO” using [<] or [>] switch.
★ The selected cursor will start flashing. If “YES” is selected and [■] switch is pressed, the change will be enabled If “NO” is selected and [■] switch is pressed, the change will not be implemented and the maintenance monitoring screen will be restored.
★ By default, the cursor is set to NO (cancel) to prevent resetting error.



★ If the default value setting is executed, all the currently changed interval times are returned to the default values. It is executed on every item independent of whether or not the function is enabled for a specific item.
★ Timer remaining time shall be Default value – Elapsed time since the last replacement.
★ Executing the default value setting does not affect the reset frequency. Namely, it remains the same as before this operation was executed.
★ Set enable for enable or disable of individual items.

8-4. Selection between timer stop for all items and enable by item
1) Press [◇] switch from the MAINTENANCE MONITOR screen of Service mode to display 01: ENG OIL screen.



WA200-6 Serial No. 70001 and up

<>: Reference value

Item		Conditions		Unit	Standard value for new machine	Service limit value	Measurement results	Pass	Fail
Steering	Steering wheel operating time	Engine low idle		sec.	3.3 – 4.1	Max. 4.8			
		Engine high idle			3.4 – 4.0	2.7 – 4.7			
	Lock frame with frame lock bar								
	Steering relief pressure	Engine high idle		MPa {kg/cm²}	19.9 – 21.3 {203 – 217}	18.6 – 22.6 {190 – 230}			
Brake	Service brake	Lining thickness	Front right	mm	0.9 – 1.1	Max. 0.6			
			Front left		0.9 – 1.1	Max. 0.6			
			Rear right		0.9 – 1.1	Max. 0.6			
			Rear left		0.9 – 1.1	Max. 0.6			
Work equipment	Relief pressure	Engine high idle	Bucket relief	MPa {kg/cm²}	20.2 – 21.0 {206 – 214}	18.6 – 22.6 {190 – 230}			
	Lift arm speed		Raising time	sec.	5.0 – 6.0	Max. 8.2			
			Lowering time		3.1 – 4.1	Max. 4.7			
	Bucket speed		Dumping time		1.1 – 1.7	Max. 2.5			
			Tilting-back time (At full stroke)		2.0– 2.6	Max. 3.8			
	Hydraulic drift	Engine stopped	Bucket cylinder	mm/15 min.	Max. 17	Max. 20			
			Lift cylinder		Max. 20	Max. 30			
Axle	Check differential oil visually		Front axle	—	Must be no excessive metal particles				
			Rear axle						

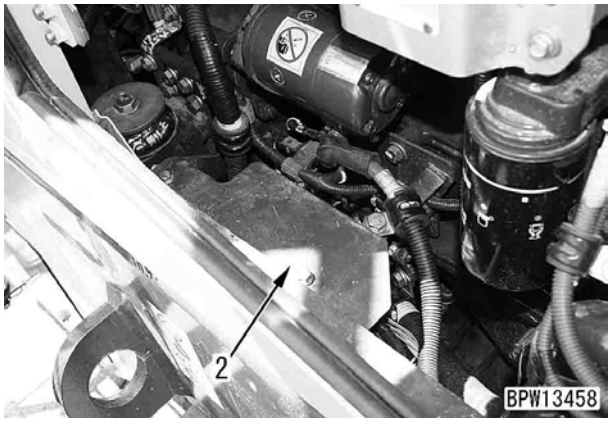
MEMO

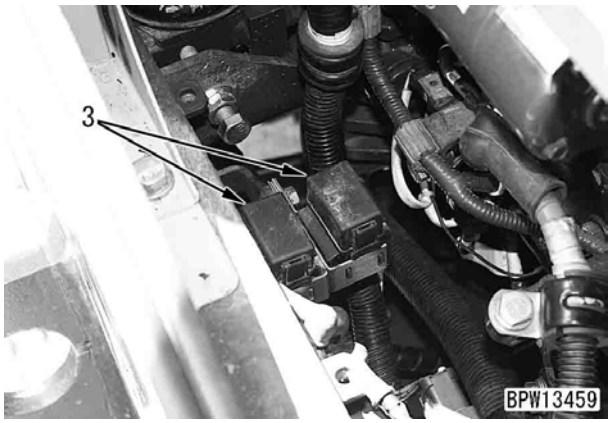
Slow blow fuse

Type of power supply (Power source)	Fuse capacity	Destination of power
Accessory power supply (Battery)	80 A	Fuse box FS1 No.8 – 15 Fuse box FS2 No.1 – 15
	120A	Engine intake air heater relay
Unswitched power supply (Battery)	50 A	Fuse box FS1 No.1 – 7

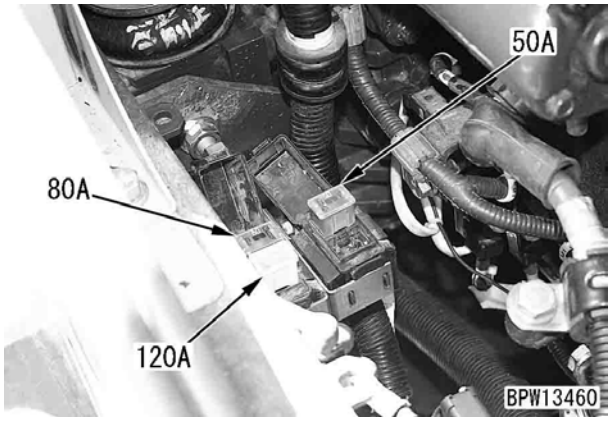
Location

Remove plate (2) on left side of engine compartment and remove covers (3).





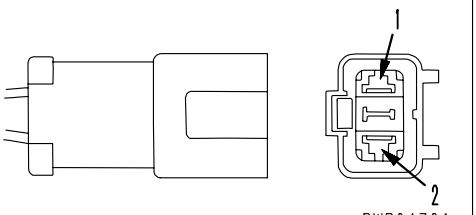
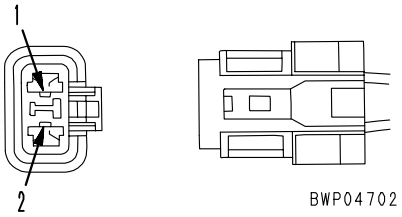
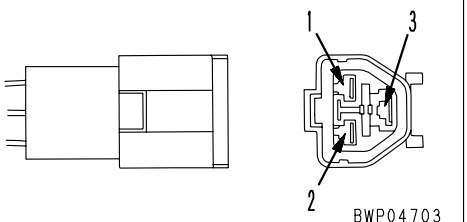
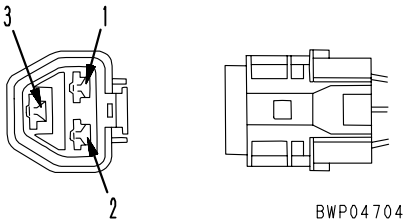
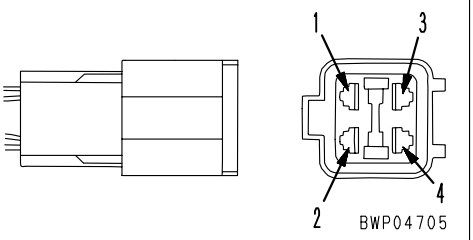
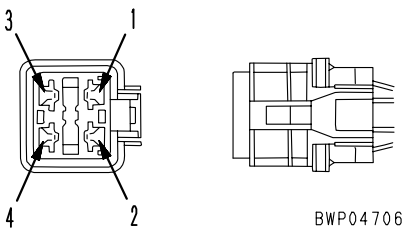
Arrangement of slow blow fuse



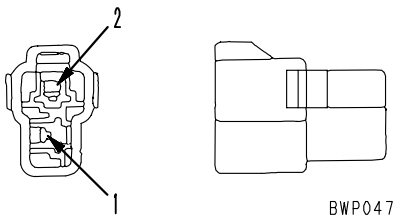
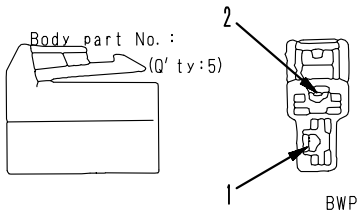
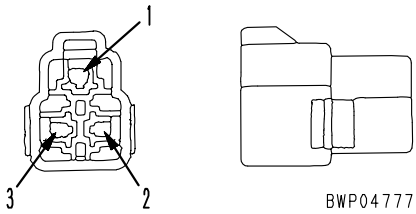
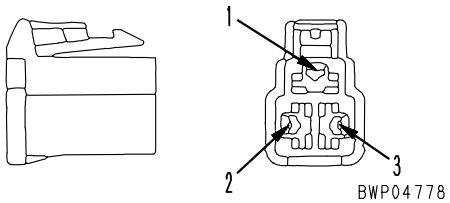
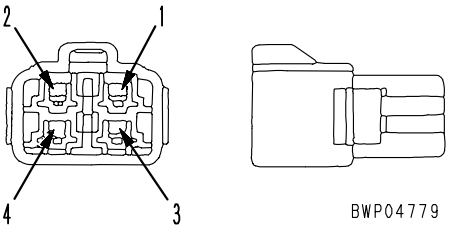
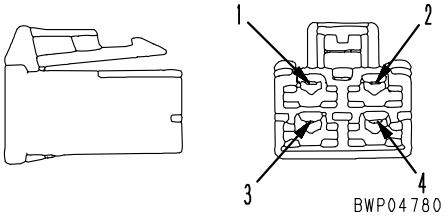
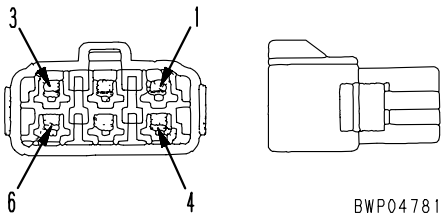
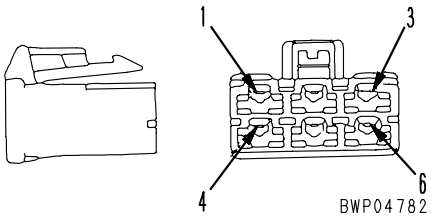
Connection table for connector pin numbers

(Rev. 2009.04)

★ The terms of male and female refer to the pins, while the terms of male housing and female housing refer to the mating portion of the housing.

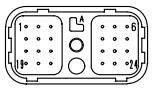
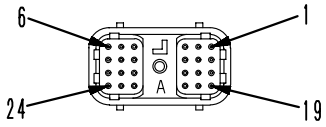
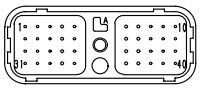
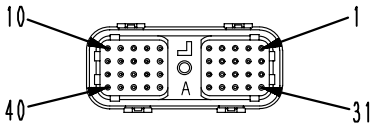
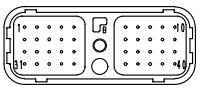
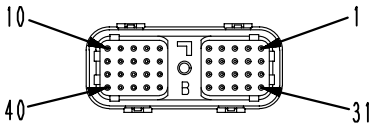
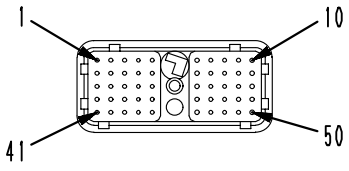
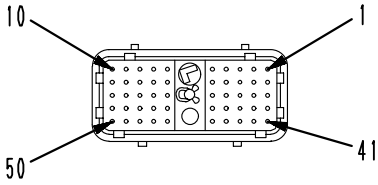
No. of pins	X type connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
1	Part No. : 08055-00181	Part No. : 08055-00191	99-601-7010 (T-adapter)
2	 BWP04701	 BWP04702	799-601-7020 (T-adapter)
	Part No. : 08055-00282	Part No. : 08055-00292	
3	 BWP04703	 BWP04704	799-601-7030 (T-adapter)
	Part No. : 08055-00381	Part No. : 08055-00391	
4	 BWP04705	 BWP04706	799-601-7040 (T-adapter)
	Part No. : 08055-00481	Part No. : 08055-00491	
—	Terminal part No. : 79A-222-3370 ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	Terminal part No. : 79A-222-3390 ·Electric wire size: 0.85 ·Grommet: Black ·Q'ty: 20	—
—	Terminal part No. : 79A-222-3380 ·Electric wire size: 2.0 ·Grommet: Red ·Q'ty: 20	Terminal part No. : 79A-222-3410 ·Electric wire size: 2.0 ·Grommet: Red ·Q'ty: 20	—

B4D18190

No. of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	Testing connection use special tool Part No.
2			—
	Part No. : 08027-10210 (Natural color) 08027-10220 (Black)	Part No. : 08027-10260 (Natural color) 08027-10270 (Black)	
3			—
	Part No. : 08027-10310	Part No. : 08027-10360	
4			—
	Part No. : 08027-10410 (Natural color) 08027-10420 (Black)	Part No. : 08027-10460 (Natural color) 08027-10470 (Black)	
6			—
	Part No. : 08027-10610 (Natural color) 08027-10620 (Black)	Part No. : 08027-10660 (Natural color) 08027-10670 (Black)	

B4D18402

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

No. of pins	DRC26 Series connector		
	Male pin (female housing)	Female pin (male housing)	Testing connection use special tool Part No.
24	 BJD12722	 BJD12723	799-601-9360 (T-adapter) (Kit:799-601-9300)
	–	Part No. :08194-01101	
40 (A)	 BJD12724	 BJD12725	799-601-9350 (T-adapter) (Kit:799-601-9300)
	–	Part No. :08194-02101	
40 (B)	 BJD12726	 BJD12727	799-601-9350 (T-adapter) (Kit:799-601-9300)
	–	Part No. :08194-02102	
50	 9JS02951	 9JS02952	799-601-4211 (T-adapter) (Kit:799-601-4101)
	–	Part No. :08194-03103	

B4D18414

T- branch box and T- branch adapter table

(Rev. 2009.03)

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

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

Failure code [AB00MA] Alternator R system: Ground fault/Disconnection charge/Low charge voltage

Action code	Failure code	Trouble	Alternator R system: Ground fault/Disconnection charge/Low charge voltage (Machine monitor system)
E03	**AB00MA**		
Contents of trouble	• While the engine is running, the alternator terminal R input voltage is below 5 V.		
Action of machine monitor	• Turns the charge circuit failure caution lamp ON. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Deterioration of battery or insufficient charging • Engine does not start. • Service meter does not advance.		
Related information	• The input state (voltage) from the alternator can be checked with the monitoring function (Monitoring code: HST – 04302 – ALTERNATOR R). • Method of reproducing failure code: Start engine		

<table>
<tr><td rowspan="15">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>The battery is deteriorated.</td><td colspan="4">The battery may be deteriorated. Check it directly.</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective alternator (Internal trouble)</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>Alternator</td><td>Engine</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Wiring harness between E02 (female) (1) – ground</td><td>Running (Throttle: Above 1/2)</td><td colspan="2">27.5 – 29.5 V</td></tr>
<tr><td>Holds in position</td><td colspan="2">Max. 1.5 V</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Disconnection in wiring harness (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harnesses between E02 (female) (1) – L25 (female) (18)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Grounding fault in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare by turning starting switch OFF and then start engine to carry out troubleshooting.</td></tr>
<tr><td colspan="2">Wiring harness between E02 (female) (1) – L25 (female) (18) – circuit branch end and ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Defective machine monitor</td><td colspan="4">★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.</td></tr>
<tr><td>L25</td><td>Engine</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (18) and ground</td><td>Running (Throttle: Above 1/2)</td><td colspan="2">27.5 – 29.5 V</td></tr>
<tr><td>Holds in position</td><td colspan="2">Max. 1.5 V</td></tr>
</table>

Failure code [CA115] Engine Ne or Bkup speed sensor error

Action code	Failure code	Trouble	Engine Ne or Bkup speed sensor error (Engine controller system)
E03	**CA115**		
Contents of trouble	• Abnormality occurred in signals of engine Ne speed sensor and engine Bkup speed sensor circuit.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine stops • The engine does not start.		
Related information	• Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting
	1	Defective connection of sensor connector	Check Ne speed sensor and Bkup speed sensor directly for defective connection (wrong connection).

Failure code [CA145] Coolant sensor low error

Action code	Failure code	Trouble	Coolant sensor low error (Engine controller system)
E01	**CA145**		
Contents of trouble	• Low voltage is detected in coolant temperature sensor signal circuit.		
Action of controller	• Fixes engine coolant temperature and continues operation.		
Problem that appears on machine	• Exhaust smoke becomes white • Overheat prevention function does not function.		
Related information	• The input state (temperature) from the engine coolant temperature sensor can be checked with the monitoring function (Code: ENGINE, 04104, COOLANT TEMP). • The input state (voltage) from the engine coolant temperature sensor can be checked with the monitoring function (Code: ENGINE, 04105, COOLANT TEMP). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective coolant temperature sensor (Internal trouble)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			COOLANT TEMP (male)	Coolant temperature	Resistance	
			Between (A) and (B)	0°C	30 – 37 kΩ	
				25°C	9.3 – 10.7 kΩ	
				50°C	3.2 – 3.8 kΩ	
				80°C	1.0 – 1.3 kΩ	
				95°C	700 – 800 Ω	
			Between (B) and ground	All range	Min. 100 kΩ	
	2	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC1 (female) (15) – COOLANT TEMP (female) (B) and ground	Resistance	Min. 100 kΩ	
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness among all pins between EC1 (female) (15) – EC1 (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	4	Defective wiring harness connector	Connecting parts among coolant temperature sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			

Failure code [CA222] Atmospheric sensor low error

Action code	Failure code	Trouble	Atmospheric sensor low error (Engine controller system)
E01	**CA222**		
Contents of trouble	• Low voltage is detected in atmospheric pressure sensor		
Action of controller	• Fixes atmospheric pressure and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output drops.		
Related information	• The input state (atmospheric pressure) from the atmospheric pressure sensor can be checked with the monitoring function (Code: ENGINE, 37400, AMBIENT PRESS). • The input state (voltage) from the atmospheric pressure sensor can be checked with the monitoring function (Code: ENGINE, 37402, AMBIENT PRESS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 1 system	If failure code [**CA352**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective atmospheric pressure sensor (Internal trouble)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			AMBAIR PRESSURE		Voltage	
			Between (1) and (2)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Ground fault in wiring harness (Short circuit with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC1 (female) (3) – AMBAIR PRESSURE (female) (3) and ground		Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC1 (female) (3) – AMBAIR PRESSURE (female) (3), EC1 (female) (38) – AMBAIR PRESSURE (female) (2)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among atmospheric pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			EC1		Voltage	
			Between (33) and (38)	Power supply	4.75 – 5.25 V	

Failure code [CA331] Injector #2 open/short error

Action code	Failure code	Trouble	Injector #2 open/short error (Engine controller system)
E03	CA331		
Contents of trouble	• There is disconnection or short circuit in drive circuit of injector No. 2.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• There is irregular combustion or hunting. • Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective injector No. 2	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ CYL 2	Resistance		
			Between (1) and (2)	Max. 2 Ω		
			Between (2) and ground	Min. 100 kΩ		
	2	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC1 (female) (57) – INJ CYL 2 (1)	Resistance	Max. 2 Ω	
			Wiring harness between EC1 (female) (59) – INJ CYL 2 (2)	Resistance	Max. 2 Ω	
	3	Ground fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC1 (female) (57) – INJ CYL 2 (1) and ground	Resistance	Max. 2 Ω	
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness among all pins between EC1 (female) (57) – EC1 (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
			Wiring harness among all pins between EC1 (female) (59) – EC1 (female) (With all connectors of wiring harness disconnected)	Resistance	Min. 100 kΩ	
	5	Defective wiring harness connector	Connecting parts among injector No. 2, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective other cylinder injector or harness	If other failure codes are indicated simultaneously, carry out troubleshooting for them.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			EC1 (female)	Resistance		
			Between (57) and (59)	Max. 2 Ω		
			Between (57) and ground	Min. 100 kΩ		

WA200-6, WA200PZ-6 Wheel loader

Form No. SEN03891-01

Failure code [CA432] Idle validation action error

Action code	Failure code	Trouble	Idle validation action error (Engine controller system)
E03	**CA432**		
Contents of trouble	• Signals from the idle validation switch and throttle sensor do not agree (they are contradictory)		
Action of controller	1. When the idle validation switch recognized the accelerator pedal is OFF and the throttle sensor, on the contrary, recognized the accelerator pedal is ON: Control the opening ratio of the throttle to 0% after the accelerator pedal is OFF and then control the opening ratio of the throttle to 50% while after the accelerator pedal is ON. 2. When the idle validation switch recognized the accelerator pedal is ON and the throttle sensor, on the contrary, recognized the accelerator pedal is OFF: Control the opening ratio of the throttle to 0% (fix to the low idle). • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine speed does not rise from low idle.		
Related information	• The input state (ON/OFF) from the idle validation switch 1 can be checked with the monitoring function (Code: ENGINE, 18300, IVS 1). • The input state (ON/OFF) from the idle validation switch 2 can be checked with the monitoring function (Code: ENGINE, 18301, IVS 2). • The input state from throttle position sensor can be checked with the monitoring function (Code: ENGINE, 31701/31707, THROTTLE POS) • Method of reproducing failure code: Turn the starting switch ON.		

<table>
<tr><td rowspan="11">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Defective accelerator pedal</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>PD1</td><td>Signal name</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (2) and (3)</td><td rowspan="2">APS sig.</td><td>When released</td><td>0.50 – 0.80 V</td></tr>
<tr><td>When pressed</td><td>3.70 – 4.00 V</td></tr>
<tr><td>Between (5) and (4)</td><td>IVS 1</td><td colspan="2" rowspan="2">See Fig. 1</td></tr>
<tr><td>Between (6) and (4)</td><td>IVS 2</td></tr>
<tr><td colspan="4">Sensor voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller for another cause of trouble before judgment</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Disconnection in wiring harness (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between EC2 (female) (22) – PD1 (female) (1)</td><td>Resistance</td><td>Max. 10 Ω</td></tr>
<tr><td colspan="2">Wiring harness between EC2 (female) (9) – PD1 (female) (2)</td><td>Resistance</td><td>Max. 10 Ω</td></tr>
<tr><td colspan="2">Wiring harness between EC2(female) (21) – PD2 (female) (1)</td><td>Resistance</td><td>Max. 10 Ω</td></tr>
</table>

Failure code [CA451] Common rail pressure sensor high error

Action code	Failure code	Trouble	Common rail pressure sensor high error (Engine controller system)
E03	**CA451**		
Contents of trouble	• High voltage occurred in common rail pressure sensor.		
Action of controller	• Limits output and continues operation. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• The engine does not start. • Engine speed or output drops.		
Related information	• The input state (common rail pressure) from the common rail pressure sensor can be checked with the monitoring function (Code: ENGINE, 36400, RAIL PRESS). • The input state (voltage) from the common rail pressure sensor can be checked with the monitoring function (Code: ENGINE, 36402, RAIL PRESS). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective sensor power supply 2 system	If failure code [**CA227**] is indicated simultaneously, carry out troubleshooting for it first.			
	2	Defective common rail pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			FUEL RAIL PRESS		Voltage	
			Between (3) and (1)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5V, 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between EC1 (female) (25) – FUEL RAIL PRESS (female) (2) and ground		Voltage	Max. 1 V
	4	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between EC1 (female) (25) – FUEL RAIL PRESS (female) (2), EC1 (female) (37) – FUEL RAIL PRESS (female) (3)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among common rail pressure sensor, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			EC1		Voltage	
			Between (37) and (47)	Power supply	4.75 – 5.25 V	

<table>
<tr><td rowspan="4">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="3">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>8</td><td>Defective wiring harness connector</td><td colspan="3">Connecting parts among fuse No. 4 of fuse box FS1, engine unit wiring harness, and engine controller are suspected. Inspect them directly.
• Loose connector, broken lock, broken seal
• Corrosive, bent, broken, forced-in, or extended pin
• Humidity in connector, entry of dirt or dust, poor insulation</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Defective engine controller</td><td colspan="3">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>EC3 (female)</td><td>Starting switch</td><td>Voltage</td></tr>
<tr><td rowspan="2">Between (3) and (1)</td><td>ON</td><td>Min. 24 V</td></tr>
<tr><td>START</td><td>Min. 12 V</td></tr>
</table>

Failure code [CA2311] Abnormality in IMV (IMA) solenoid

Action code	Failure code	Trouble	Abnormality in IMV (IMA) solenoid (Engine controller system)
E03	**CA2311**		
Contents of trouble	• Resistance in supply pump actuator circuit is abnormally high or low.		
Action of controller	• Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Engine output drops.		
Related information	• Method of reproducing failure code: Start engine		

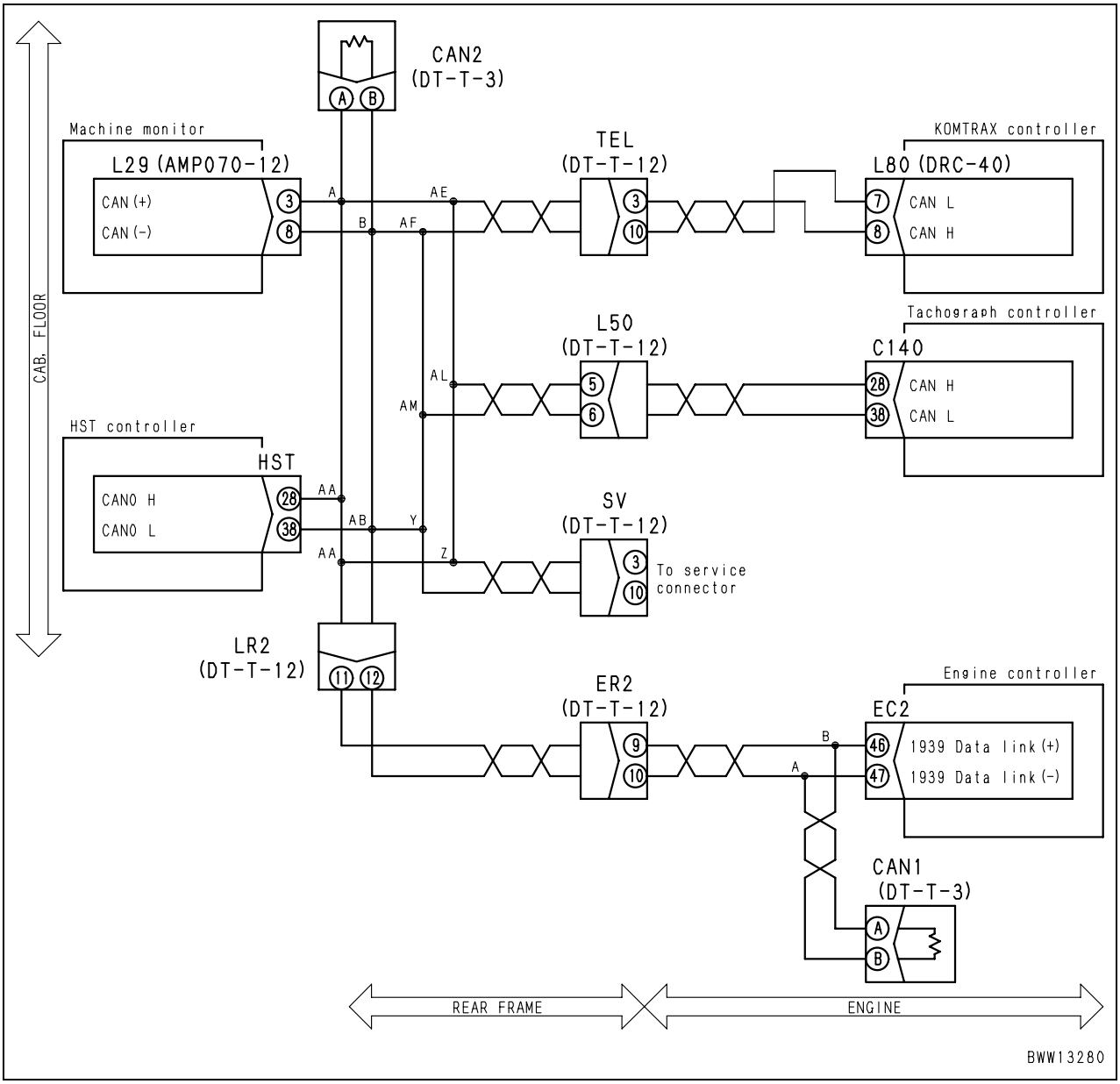
		Causes	Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defect in related system	If another code is displayed, carry out troubleshooting for it.		
	2	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP3 PUMP REGULATOR (male)	Resistance	
			Between (1) and (2)	Max. 5 Ω	
			Between (1) and ground	Min. 100 kΩ	
	3	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between EC1 (female) (2) – CP3 PUMP REGULATOR (female) (1)	Resistance	Max. 5 Ω
			Wiring harness between EC1 (female) (32) – CP3 PUMP REGULATOR (female) (2)	Resistance	Max. 5 Ω
	4	Ground fault in wiring harness (Contact with ground circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between EC1 (female) (2) – CP3 PUMP REGULATOR (female) (1) and ground	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts among supply pump actuator, engine wiring harness, and engine controller are suspected. Inspect them directly. • Loose connector, broken lock, broken seal • Corrosive, bent, broken, forced-in, or extended pin • Humidity in connector, entry of dirt or dust, poor insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			EC1 (female)	Resistance	
			Between (2) and (32)	Max. 5 Ω	
			Between (2) and ground	Min. 100 kΩ	

Failure code [D1B0KA] HST safety relay: Disconnection

Action code	Failure code	Trouble	HST safety relay: Disconnection (HST controller system)
E03	**D1B0KA**		
Contents of trouble	• Disconnection was detected in HST safety relay circuit when starting switch is turned ON.		
Action of machine monitor	• Turns clutch EPC solenoid output OFF. • Turns motor 1 solenoid output OFF. • Turns HST safety relay output OFF. • Even if trouble disappears, system does not reset itself until starting switch is turned OFF. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Traction force decreases. • Travel speed is not limited with speed range selector switch and travel speed control dial. • If engine is stopped without applying parking brake securely on slope, machine moves down suddenly.		
Related information	• If [**DAJ2L3**] or [**DAJ2L4**] is displayed, carry out troubleshooting for it first. • Following output command values can be checked with monitoring function. Motor 1 solenoid output: HST – 80000 – MOTOR SOL DIR (mA) HST safety relay output: HST – 40979 – D_OUT_15 (ON/OFF) Clutch EPC solenoid output: HST – 80100 – CLUTCH SOL DIR (mA)		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective HST safety relay (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Replace HST safety relay (L111) with another relay.	Condition becomes normal.	Relay (L111) is defective.	
				Condition does not become normal.	Relay (L111) is normal.	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between L111 (male) (1) – (2)		Resistance	200 – 400 Ω
	2	Defective VIS power supply holding relay (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Replace VIS power supply holding relay (L102) with another relay.	Condition becomes normal.	Relay (L102) is defective.	
				Condition does not become normal.	Relay (L102) is normal.	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between L102 (male) (1) – (2)		Resistance	200 – 400 Ω
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between HST (female) (17) – L111 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L102 (female) (3) – L111 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between fuse FS1 (No. 3) – L102 (female) (5)		Resistance	Max. 1 Ω
	4	Defective HST controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			HST		Voltage	
			Between (17) – ground		Max. 1 V	

Related circuit diagram

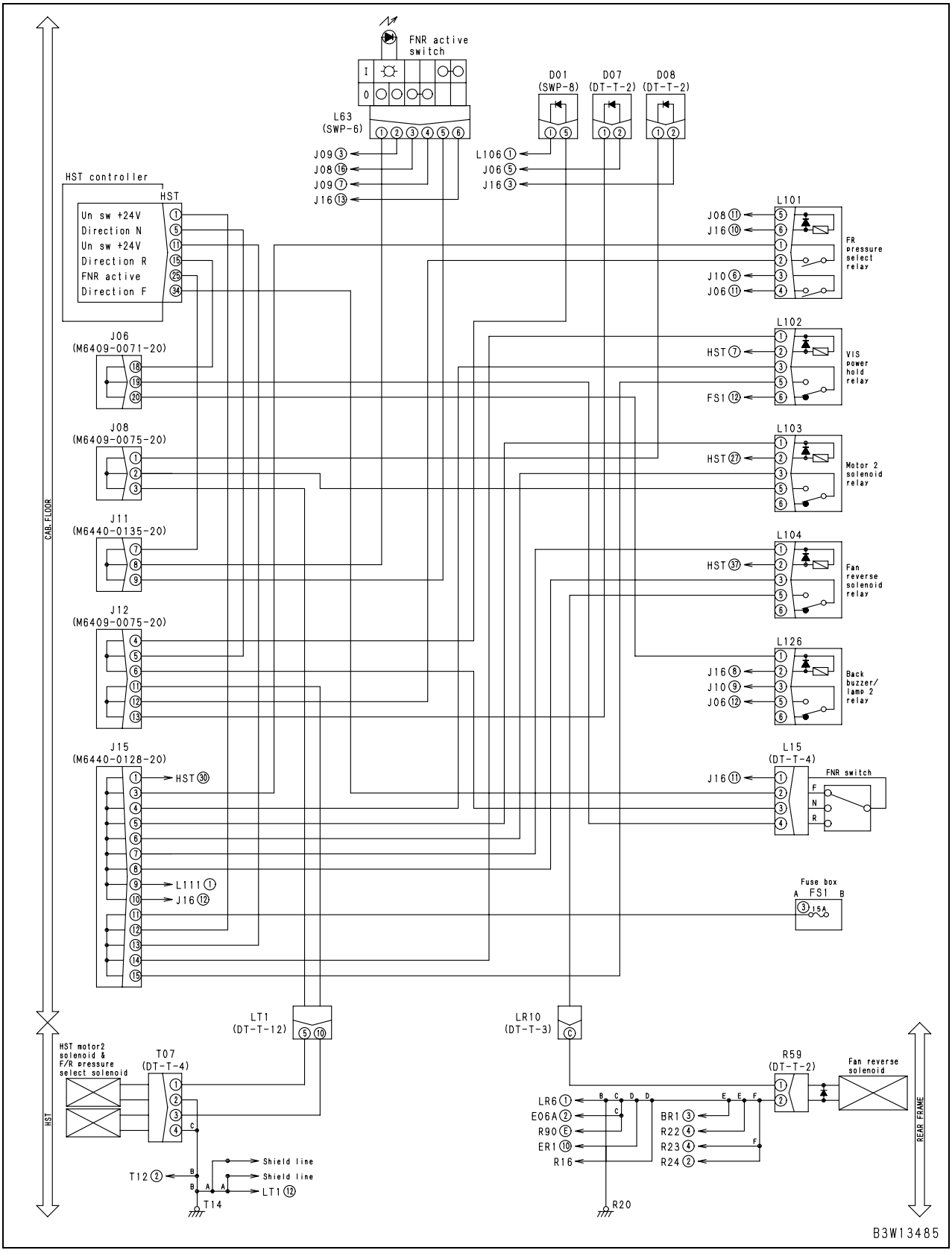


Failure code [DAJ2L3] HST controller load power supply holding line: Hot short in wiring harness

Action code	Failure code	Trouble	HST controller load power supply holding line: Hot short in wiring harness (HST controller system)
E01	**DAJ2L3**		
Contents of trouble	• Hot short was detected in HST controller load power supply holding line. (When output command was ON, output terminal voltage above 5.7 V was detected.)		
Action of machine monitor	• Turns output OFF (Control protection function works).		
Problem that appears on machine	• When starting switch is turned OFF, parking brake check cannot be controlled and machine moves down. • If starting switch is turned OFF while fan is rotating in reverse, peak pressure may occur.		
Related information			

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective VIS power supply holding relay (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace VIS power supply holding relay (L102) with another relay.	Condition becomes normal.	Relay (L102) is defective.	
				Condition does not become normal.	Relay (L102) is normal.	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between L102 (male) (1) – (2)		Resis-tance	200 – 400 Ω
	2	Hot short (Contact with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Between wiring harness HST (female) (7) – L102 (female) (2) and ground		Voltage	Max. 1 V
	3	Defective HST controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			HST		Voltage	
			Between (7) – ground		Max. 1 V	

Related circuit diagram (When HST controller power supply circuit is defective)



Failure code [DD1NLD] Fan reverse switch signal: Abnormality

Action code	Failure code	Trouble	Fan reverse switch signal: Abnormality (HST controller system)
E01	**DD1NLD**		
Contents of trouble	• Since the fan manual reverse switch system is shorted with the power source, the fan manual reverse switch remains at ON position. (Continuation for 30 seconds determines fault)		
Action of controller	• None in particular.		
Problem that appears on machine	• Fan remains in the reverse rotation.		
Related information	• The input state (ON/OFF) from the fan manual reverse switch can be checked with the monitoring function (Code: HST – 93400 – FAN REVERSE SW). (Code: MONITOR PANEL – 40900 – D-IN-1). • Method of reproducing failure code: Turn the starting switch ON.		

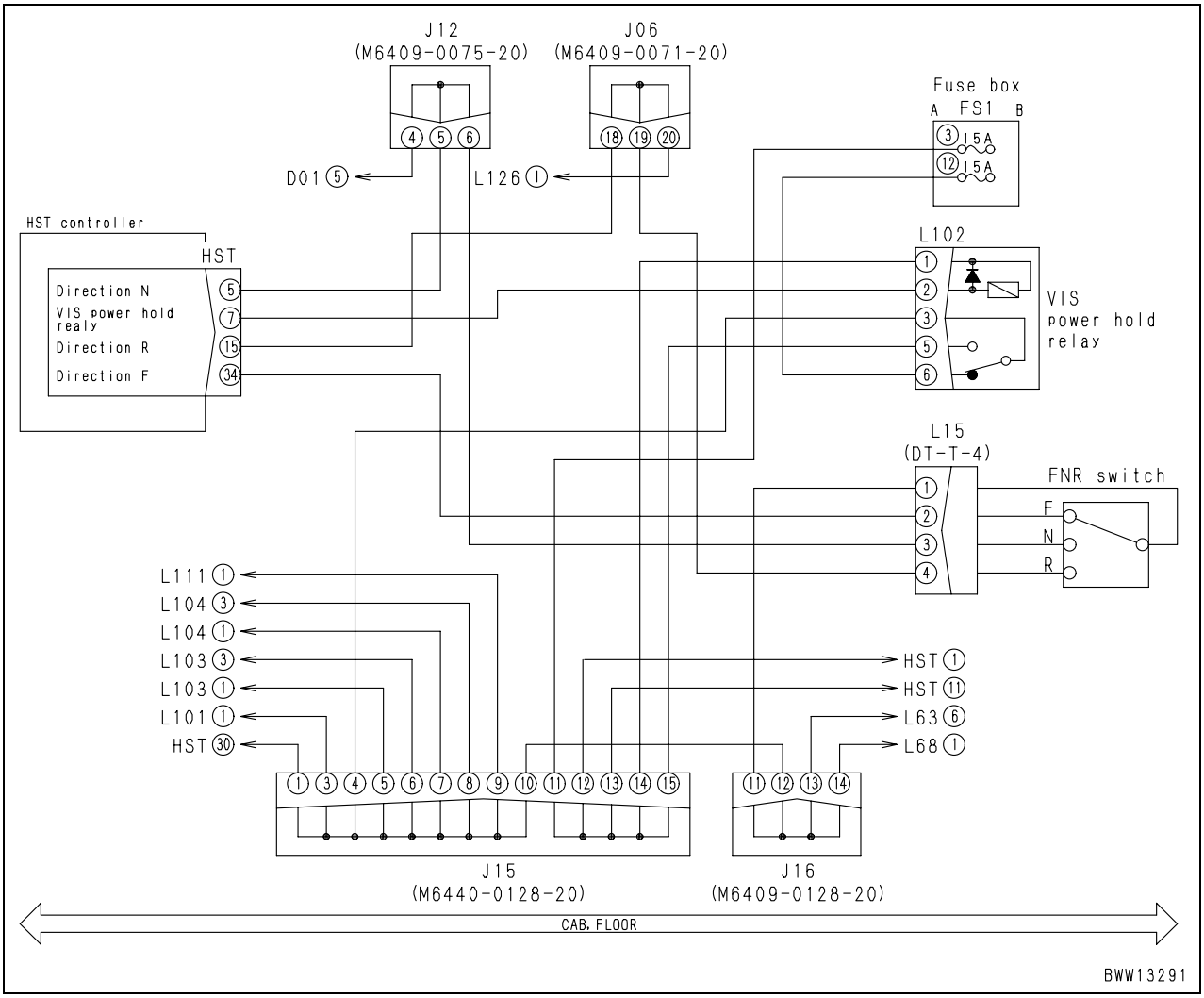
	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fan reverse switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L69 (male)	Fan manual reverse switch	Resistance	
			Between (5) – (1), (16)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between L25 (female) (10) – L69 (female) (1), (6) and ground		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L25 (male)	Fan manual reverse switch	Voltage	
			Between (10) and ground	ON	20 – 30 V	
				OFF	Max. 1 V	

Failure code [DDD7KX] Travel speed control dial signal: Disconnection/ Ground fault

Action code	Failure code	Trouble	Travel speed control dial signal: Disconnection/Ground fault (HST controller system)
E01	**DDD7KX**		
Contents of trouble	• Travel speed control dial signal voltage lowered below 0.3 V.		
Action of controller	• Continue controls on assumption that travel speed control dial is set to minimum speed side. • Even if trouble disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Travel speed cannot be adjusted with travel speed control dial. • If speed range selector switch is set in 1st, travel speed is set to about 4 km/h.		
Related information	• If failure code [DAJ5KX] is also displayed, carry out troubleshooting for it first.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective travel speed control dial (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between L54 (female) (1) – (3)	Voltage	4.7 – 5.3 V
			Between L54 (female) (2) – (3) (Max. speed side of dial)	Voltage	0.3 – 0.9 V
			Between L54 (female) (2) – (3) (Min. speed side of dial)	Voltage	4.1 – 4.7 V
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between HST (female) (23) – L54 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between HST (female) (22) – L54 (female) (1)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between wiring harness HST (female) (23) – L54 (female) (2) and ground	Resistance	Min. 1 MΩ
	4	Defective HST controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			HST (female)	Resistance	
			Between (32) – ground	Max. 1 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			HST (female)	Voltage	
			Between (22) – ground	4.7 – 5.3 V	
			Between (23) – ground	0.3 – 4.7 V	

Related circuit diagram



Failure code [DF10KB] Travel speed range selector switch: Hot short

Action code	Failure code	Trouble	Travel speed range selector switch: Hot short (HST controller system)
E01	**DF10KB**		
Contents of trouble	• Multiple travel speed range selector switch signal is input because of hot short in travel speed range selector switch input signal system.		
Action of controller	• Fixes gear to speed range before error occurrence. • If trouble disappears, system resets itself.		
Problem that appears on machine	• Once starting switch is turned OFF, gear speed is assumed to be 4th for control, regardless of selected speed range. • Gear is not set in selected speed range. • Indicator displays range before error occurrence. (Once starting switch is turned OFF, 4th gear is displayed)		
Related information	• Method of reproducing failure code: Turn starting switch ON + Operate speed range selector switch.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective travel speed range selector switch (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L03 (female)	Switch position	Resistance
			Between (1) – (2)	2nd	Max. 1 Ω
				Other than above	Min. 1 MΩ
			Between (1) – (3)	1st	Min. 1 MΩ
				2nd	Min. 1 MΩ
				3rd	Max. 1 Ω
				4th	Max. 1 Ω
			Between (1) – (4)	4th	Max. 1 Ω
				Other than above	Min. 1 MΩ
			Between (2) – (3)	– (Anytime)	Min. 1 MΩ
			Between (2) – (4)	– (Anytime)	Min. 1 MΩ
			Between (3) – (4)	1st	Max. 1 Ω
				2nd	Min. 1 MΩ
				3rd	Min. 1 MΩ
				4th	Max. 1 Ω
	2	Defective travel speed range selector resistor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			L70 (male)		Resistance
			Between (1) – (5)		100 Ω ± 1%
			Between (2) – (6)		220 Ω ± 1%
			Between (3) – (7)		330 Ω ± 1%
			Between (4) – (8)		470 Ω ± 1%
	3	Hot short (Contact with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between wiring harness HST (female) (32) – L70 (female) (7) and ground	Voltage	Max. 1 V
			Between wiring harness HST (female) (39) – L03 (female) (3), L70 (female) (5), (3) and ground	Voltage	Max. 1 V
			Between wiring harness L03 (female) (1) – L70 (female) (6) and ground	Voltage	Max. 1 V

Failure code [DJF1KA] Fuel level sensor: Disconnection/Hot short

Action code	Failure code	Trouble	Fuel level sensor: Disconnection/Hot short (Machine monitor system)
E01	**DJF1KA**		
Contents of trouble	• Voltage above 4 V was detected in fuel level sensor signal circuit.		
Action of machine monitor	• None in particular.		
Problem that appears on machine	• Fuel level gauge does not indicated normally (but keeps indicating “empty”).		
Related information	• Input signal from fuel level sensor can be checked with monitoring function. (Monitoring code: MONITOR PANEL – 04200 – FUEL SENSOR (V)) (Monitoring code: MONITOR PANEL – 04202 – FUEL SENSOR (%)) • Method of reproducing failure code: Turn starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuel level sensor (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R21 (male)	Fuel level	Resistance	
			Between (1) – (2)	When full	7 – 11 Ω	
				When 1/2	25 – 35 Ω	
				When empty	60 – 95 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between L28 (female) (1) – R21 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between L26 (female) (6) – R21 (female) (2)		Resistance	Max. 1 Ω
	3	Hot short (Contact with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Between wiring harness L28 (female) (1) – R21 (female) (1) and ground (Value is upper limit when empty.)		Voltage	Max. 2 V
			Wiring harness between L26 (female) (6) – R21 (female) (2)		Voltage	Max. 1 V
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			L26, L28	Fuel level	Voltage	
			Between L28 (1) – L26 (6)	When full	0.1 – 0.4 V	
				When 1/2	0.7 – 1.0 V	
				When empty	1.4 – 2.0 V	

Failure code [DW26KA] Motor 2 solenoid: Disconnection/Ground fault

Action code	Failure code	Trouble	Motor 2 solenoid: Disconnection/Ground fault (HST controller system)
E01	DW26KA		
Contents of trouble	• Motor 2 cannot be controlled because of disconnection or ground fault in motor 2 solenoid relay output system.		
Action of controller	• Keeps output to motor 2 solenoid relay turned OFF (If there is ground fault, output cannot be turned OFF actually). • Even if trouble disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• When there is disconnection: Travel speed is not limited and maximum speed is equivalent to 4th gear speed in 3rd speed range. • When there is ground fault: Travel speed is set equivalent to 3rd gear speed in 4th speed range.		
Related information	• Output state (ON/OFF) to motor 2 solenoid relay can be checked with monitoring function. (Monitoring code: HST – 40980 – D-OUT-16) • Method of reproducing failure code: Travel at speed above about 11 km/h in 4th speed range.		

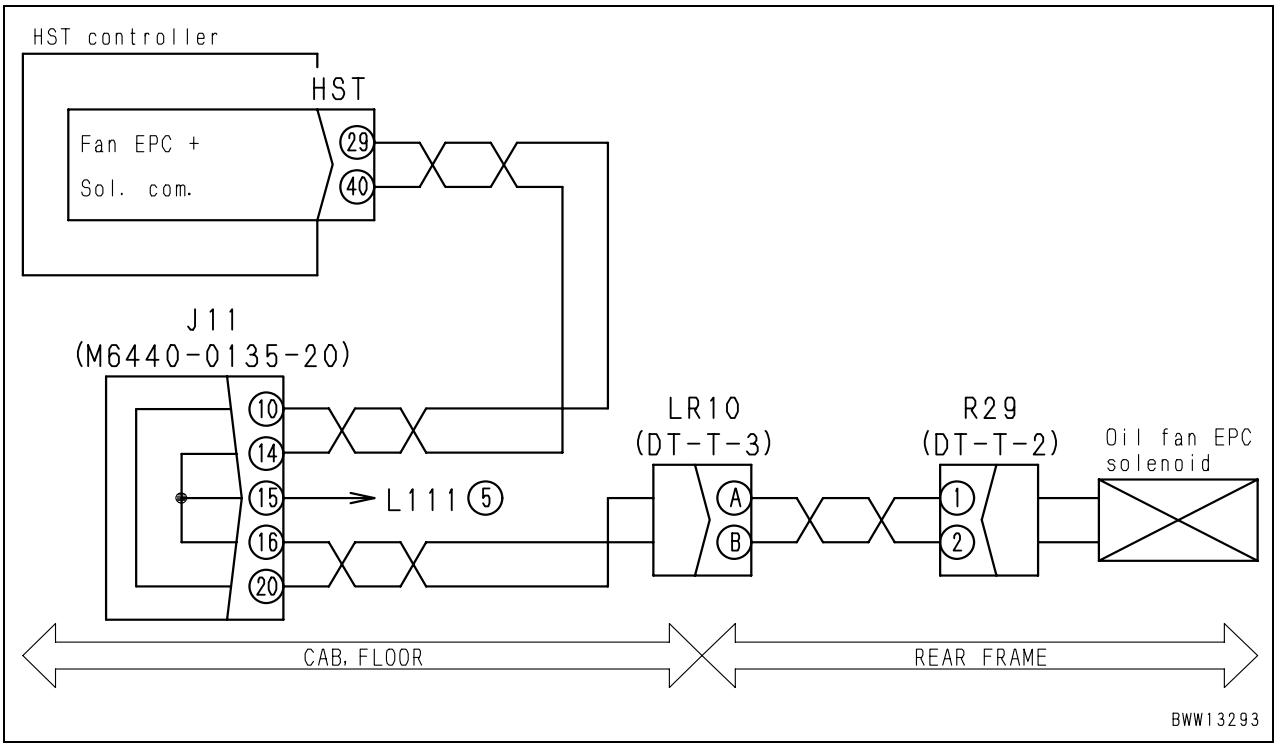
	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective motor 2 solenoid relay (Internal defect)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Replace motor 2 solenoid relay (L103) with another relay.	Condition becomes normal	Relay (L103) is defective	
				Condition does not become normal	Relay (L103) is normal	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between L103 (male) (1) – (2)		Resistance	200 – 400 Ω
	2	Defective VIS power supply holding relay (Internal short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Replace VIS power supply holding relay (L102) with another relay.	Condition becomes normal.	Relay (L102) is defective.	
				Condition does not become normal.	Relay (L102) is normal.	
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between L102 (male) (1) – (2)		Resistance	200 – 400 Ω
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between HST (female) (27) – L103 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between L103 (female) (1) – L102 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Contact with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between wiring harness HST (female) (27) – L103 (female) (2) and ground		Resistance	Min. 1 MΩ
	5	Defective HST controller	★ Prepare with starting switch OFF, then start engine, travel, and carry out troubleshooting.			
			HST	Condition	Voltage	
			Between (27) – ground	Stopped	Max. 1 V	
				Speed range: 4th Travel speed: Above 11 km/h	20 – 30 V	

Failure code [DX16KY] Fan EPC solenoid: Hot short

Action code	Failure code	Trouble	Fan EPC solenoid: Hot short (HST controller system)
E01	**DX16KY**		
Contents of trouble	• Since the fan EPC solenoid system is shorted with the power source, abnormal voltage is applied when the fan EPC solenoid output is OFF.		
Action of controller	• Turns the output to the fan EPC solenoid OFF. • If problem is removed, system is returned to normal operating state.		
Problem that appears on machine	• The fan speed is minimized.		
Related information	• The output state (current) to the fan EPC solenoid can be checked with the monitoring function (Code: HST – 41400 – FAN EPC DIR). • Method of reproducing failure code: Turn the starting switch ON.		

	Causes		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fan EPC solenoid (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			R29 (male)	Resistance	
			Between (1) – (2)	5 – 10 Ω	
			Between (1), (2) and ground	Min. 1 MΩ	
	2	Hot short in wiring harness (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between HST (female) (29) – R29 (female) (1) and ground	Voltage	Max. 1 V
	3	Defective HST controller	• If causes 1 – 2 are not detected, HST controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Related circuit diagram



Failure code [DX20KY] Clutch EPC solenoid: Hot short

Action code	Failure code	Trouble	Clutch EPC solenoid: Hot short (HST controller system)
E03	**DX20KY**		
Contents of trouble	• Hot short was detected in clutch EPC solenoid circuit.		
Action of controller	• Turns clutch EPC solenoid output OFF. • Turns motor 1 solenoid output OFF. • Turns HST safety relay output OFF. • Even if trouble disappears, system does not reset itself until starting switch is turned OFF. • Turns the centralized warning lamp and alarm buzzer ON.		
Problem that appears on machine	• Traction force is decreased. • Travel speed is not limited with speed range selector switch and travel speed control dial. • If engine is stopped without applying parking brake securely on slope, machine moves down suddenly.		
Related information	• Following output command values can be checked with monitoring function. Motor 1 solenoid output: HST – 80000 – MOTOR SOL DIR (mA) HST safety relay output: HST – 40979 – D_OUT_15 (ON/OFF) Clutch EPC solenoid output: HST – 80100 – CLUTCH SOL DIR (mA) • [DX19KA], [DX19KY] or [DX20KA] may be also displayed, depending on condition when error was detected.		

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective clutch EPC solenoid (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			T05 (male)	Resistance		
			Between (1) – (2)	5 – 15 Ω		
			Between (1), (2) – ground	Min. 1 MΩ		
	2	Hot short (Contact with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Between wiring harness HST (female) (9) – T05 (female) (1) and ground	Voltage	Max. 1 V	
			Between wiring harness L111 (female) (3) – T05 (female) (2)	Voltage	Max. 1 V	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting (Troubleshoot with traction switch OFF and machine is stopped (do not travel))			
			Between wiring harness HST (female) (9) – T05 (female) (1) and ground	Voltage	10 – 15 V	
	3	Defective HST controller	• If causes 1 – 2 are not detected, HST controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)			

WA200-6, WA200PZ-6 GALEO Wheel loader

Form No. SEN03896-00

b) Preheater operates constantly

Contents of trouble	• Preheater operates constantly.
Related information	• If failure code [CA144] or [CA145] is displayed, carry out troubleshooting for it first. • Engine boost air temperature can be checked with monitoring function. (Monitoring code: ENG-18500-CHG TEMP (°C)) (Monitoring code: ENG-18501-CHG TEMP (V))

<table>
<tr><th rowspan="2">Possible causes and standard value in normal state</th><th colspan="2">Causes</th><th colspan="5">Standard value in normal state/Remarks on troubleshooting</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Defective heater relay (Internal defect)</td><td colspan="5">★ Turn starting switch OFF and remove heater relay.
★ Check heater relay unit.</td></tr>
<tr><td>Heater relay</td><td colspan="2">E06 – R90</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between E05 – E07A</td><td colspan="2">When 24 V is applied (When relay is "ON")</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="2">Other than above (When relay is "OFF")</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td colspan="3">Between E06 – R90</td><td colspan="2">19 – 25 Ω</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Ground fault in wiring harness (Contact with GND circuit)</td><td colspan="5">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="3">Between wiring harness EC2 (40) – E06 (5) and ground</td><td>Resis-tance</td><td>Min. 1 MΩ</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Hot short (Contact with 24V circuit) in wiring harness</td><td colspan="5">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td rowspan="2">Between wiring harness E07A – E07B and ground</td><td>When preheater is ON</td><td>Voltage</td><td>20 – 30 V</td></tr>
<tr><td>When preheater is OFF</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td>4</td><td>Defective engine controller</td><td colspan="5">If cause 1 – 3 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)</td></tr>
</table>

Related circuit diagram

★ See the circuit diagram in “E-2 a) Preheater does not operate”.

<table>
<tr><td rowspan="8">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Hot short (Contact with 24V circuit) in wiring harness</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON, turn ECSS switch OFF, and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Between wiring harness L09 (female) (5) – L25 (female) (5), L110 (female) (1), (3), branch end and ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td colspan="2">Between wiring harness L110 (female) (5) – F07 (female) (1), branch end and ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Defective machine monitor or HST controller</td><td colspan="4">★ Prepare with starting switch OFF, then turn ECSS switch ON, start engine, and carry out troubleshooting.</td></tr>
<tr><td>L24</td><td>Travel speed</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between (5) – (6)</td><td>0 – 4 km/h</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Min. 5 km/h</td><td colspan="2">Max. 1 V</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON, turn ECSS switch OFF, and carry out troubleshooting.</td></tr>
<tr><td colspan="2">Between L24 (11) – ground</td><td>Voltage</td><td>Max. 1 V</td></tr>
</table>

Possible causes and standard value in normal state	Causes		Standard value in normal state/Remarks on troubleshooting		
	7	Hot short-circuiting between harnesses (Contact with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON, operate lift arm FLOATING, and carry out troubleshooting.		
			Wiring harness between F04 (female) (B) – L113 (female) (2) and ground	Voltage	Max. 1 V
			★ In this case, lift arm FLOATING detent does not function (lever returns to neutral).		

E-12 Wiper does not operate

Contents of trouble	(1) Front wiper does not operate.
Related information	• The front wiper does not operate due to the defective front wiper switch, timer, or wiring harness.

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No. 14 of fuse box (FS1)</td><td colspan="4">If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Defective front wiper motor (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>L57</td><td>Front wiper switch</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (6) and ground</td><td>Constant</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (2) and ground</td><td>Lo</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (1) and ground</td><td>Hi</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="4">• If wiper switch is turned OFF while wiper is operating, voltage is applied between L57 (5) and ground until wiper motor stops.</td></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Defective wiper timer (relay) (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td>L48</td><td>Front wiper switch</td><td colspan="2">Voltage</td></tr>
<tr><td>Between (3) and ground</td><td>Constant</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (4) and ground</td><td>INT</td><td colspan="2">20 – 30 V</td></tr>
<tr><td>Between (2) and ground</td><td>Washer side</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="8">4</td><td rowspan="8">Defective front wiper switch (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="2">L05</td><td colspan="2">Voltage</td></tr>
<tr><td colspan="2">Between (7) and ground</td><td colspan="2">20 – 30 V</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L05</td><td>Front wiper switch</td><td colspan="2">Resistance</td></tr>
<tr><td>Between (7) and (5)</td><td>Lo</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (7) and (4)</td><td>Hi</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (7) and (2)</td><td>INT</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>Between (3) and (5)</td><td>INT</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td colspan="2">Other than above</td><td colspan="2">Min. 1 MΩ</td></tr>
</table>

Contents of trouble	(4) Headlamp (high beam) does not light up or go off.
Related information	• The switch, lamp, or wiring harness of the headlamp (high beam) is disconnected or shorted with the ground. • Carry out the following troubleshooting when the low beam lights up (goes off) normally. • The input state (ON/OFF) to the machine monitor from the lamp switch (head lamp) can be checked with the monitoring function (Code: MONITOR PANEL 40900, D-IN-0). • The input state (ON/OFF) to the machine monitor from the dimmer switch (high beam) can be checked with the monitoring function (Code: MONITOR PANEL 40904, D-IN-34).

<table>
<tr><td rowspan="12">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Broken bulb</td><td colspan="4">If a specific headlamp does not light up, its bulb may be broken or may have a defective contact. Check the bulb directly.</td></tr>
<tr><td rowspan="5">2</td><td rowspan="5">Defective dimmer switch (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L04 (male)</td><td>Dimmer switch</td><td colspan="2">Resistance</td></tr>
<tr><td rowspan="2">Between (5) and (3)</td><td>Low</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>High</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="2">Between (4) and (3)</td><td>Low</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td>High</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Disconnection in wiring harness (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between FLH (female) (C) – L04 (female) (5)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="4">Reference: Connector "FLH" is installed to both right and left sides.</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Ground fault in wiring harness (Contact with ground circuit)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between FLH (female) (C) – L04 (female) (5), – circuit branch end and ground</td><td>Resistance</td><td>Min. 1 MΩ</td></tr>
<tr><td colspan="4">Reference: Connector "FLH" is installed to both right and left sides.</td></tr>
</table>

Contents of trouble	(3) Hazard lamp does not light up or go off.
Related information	• The switch or lamp of the hazard lamp is defective. • Carry out the following troubleshooting when the turn signal lamp flashes normally.

	Causes		Standard value in normal state/Remarks on troubleshooting			
Possible causes and standard value in normal state	1	Defective fuse No. 2 of fuse box (FS1)	If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 5.)			
	2	Defective hazard relay (L125) (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L125 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			When hazard relay (L125) is replaced with a relay of the same type, if the condition becomes normal, the hazard relay is defective.			
	3	Defective hazard/turn signal relay (L124) (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L124 (male)	Resistance		
			Between (1) and (2)	200 – 400 Ω		
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			When hazard/turn signal relay (L124) is replaced with a relay of the same type, if the condition becomes normal, the hazard/turn signal relay is defective.			
	4	Defective hazard lamp switch (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			L06 (male)	Hazard lamp switch	Resistance	
			Between (5) and (6)	ON	Max. 1 Ω	
				OFF	Min. 1 MΩ	
	5	Disconnection in wiring harness (Disconnection or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between fuse No. 2 of fuse box (FS1) – L125 (female) (5)		Resistance	Max. 1 Ω
			Wiring harness between fuse No. 2 of fuse box (FS1) – L06 (female) (6)		Resistance	Max. 1 Ω
			Wiring harness between L125 (female) (1) – L06 (female) (5)		Resistance	Max. 1 Ω
			Between L124 (female) (6) – ground		Resistance	Max. 1 Ω
			Between L125 (female) (2) – ground		Resistance	Max. 1 Ω
			Between L49 (female) (4) – L124 (female) (1), (3)		Resistance	Max. 1 Ω
			Between L124 (female) (2) – FLC [right] (C), R23 (1)		Resistance	Max. 1 Ω
			Between L124 (female) (4) – FLC [left] (C), R22 (1)		Resistance	Max. 1 Ω

E-20 Horn does not sound or it keeps sounding

Contents of trouble	Horn does not sound or it keeps sounding.
Related information	—

<table>
<tr><td rowspan="20">Possible causes and standard value in normal state</td><td colspan="2">Causes</td><td colspan="4">Standard value in normal state/Remarks on troubleshooting</td></tr>
<tr><td>1</td><td>Defective fuse No.9 of fuse box (FS2)</td><td colspan="4">If the fuse is burn, the circuit probably has a grounding fault, etc. (See cause 6.)</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Defective horn relay (L116) (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">L116 (male)</td><td colspan="2">Resistance</td></tr>
<tr><td colspan="2">Between (1) and (2)</td><td colspan="2">200 – 400 Ω</td></tr>
<tr><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.</td></tr>
<tr><td colspan="5">When horn relay (L116) is replaced with a relay of the same type, if the condition becomes normal, the horn relay is defective.</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Defective L13 horn switch (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td>L13 (male)</td><td>Horn switch</td><td colspan="2">Resistance</td></tr>
<tr><td>Between (1) and ground</td><td>ON</td><td colspan="2">Max. 1 Ω</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Defective horn (Internal defect)</td><td colspan="4">★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Disconnect connector and measure on female side)</td></tr>
<tr><td>OFF</td><td colspan="2">Min. 1 MΩ</td></tr>
<tr><td>F01, F02</td><td>Horn switch</td><td colspan="2">Voltage</td></tr>
<tr><td rowspan="2">Between F01 (1) and (2)</td><td>ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>OFF</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="2">Between F02 (1) and (2)</td><td>ON</td><td colspan="2">Max. 1 V</td></tr>
<tr><td>OFF</td><td colspan="2">20 – 30 V</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Disconnection in wiring harness (Disconnection or defective contact in connector)</td><td colspan="4">★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.</td></tr>
<tr><td colspan="2">Wiring harness between fuse No. 9 of fuse box (FS2) – L116 (female) (1), (3)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L116 (female) (2) – L13 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between L116 (female) (5) – F01 (female) (1), – F02 (female) (1)</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between F01 (female) (2) – F02 (female) (2) – ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
<tr><td colspan="2">Wiring harness between steering wheel horn switch – ground</td><td>Resistance</td><td>Max. 1 Ω</td></tr>
</table>

H-7 The steering wheel is heavy

Ask the operator about the following:

- Did the problem suddenly start?
  → **Breakage of steering related equipment**
- Was there previously any symptom, such as heavy steering?
  → **Internal wear of steering related equipment, defective seal**

Inspection before diagnosis

- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is there any abnormality in Orbit-roll, steering column linkage?
- Is the any external oil leak found around the hydraulic piping, valve and cylinder?
- Is there any gouging of center hinge pin bearing and steering cylinder pin, bushing?
- Is the tire inflation pressure correct?

Check for abnormalities

- Measure operating effort of steering wheel and time taken to turn steering, and check standard judgement value table to see if there is any abnormality.

		Cause						
		Hydraulic pump	Valve	Others				
		a	**b**	**c**		**d**	**e**	**f**
No.	**Diagnosis** / **Remedy**	The hydraulic pump is defective / The steering pump is defective	Internal defective steering cylinder (Defective piston seal)	Priority valve: Spool	Priority valve: Relief valve	Orbit-roll internal defect	Clogging of hydraulic oil return filter, defective bypass valve	Clogging of oil cooler
		△ X	△ X	△ X A	△ X	△ X	△ X C	△ X C
1	Steering wheel is heavy when turned in both directions (left and right)	○	○	○	○	○		
2	Steering wheel is heavy when turned in one direction (left and right)		○			○		
3	Steering wheel is heavy particularly when engine is running at low speed	○	○	○	○			
4	Lift arm lifting speed is slow when engine is running at full speed	○		○				
5	Steering wheel is heavy and there is jerking	○				○		
6	Hydraulic oil overheats			○	○			○
7	Oil pressure of steering circuit is low or there is no pressure		○		○			
8	Pressure rises in return piping of steering cylinder						○	

H-27 The ECSS does not operate and machine pitches and bounces

Check the following points with the operator.

- Did the machine starts pitching and bouncing suddenly?
  → **Breakage of related device**
  Did abnormal sound come out when the machine started pitching and bouncing? From what part did the abnormal sound come out?
- Did the machine starts pitching and bouncing gradually?
  → **Wear of related device or defective seal**

Check before troubleshooting

- Check that the hydraulic tank is filled with oil of a proper type up to a proper level.
- Check that the ECSS switch is set properly.

No.	Troubleshooting \ Remedy	Cause: Solenoid valve (Malfunction of solenoid valve)	Accumulator (Gas leakage from accumulator or defective seal)	Controller (Malfunction of controller)	Sensor (Defective travel speed sensor)
		a	**b**	**c**	**d**
		X	X	X	X
1	Travel speed to start operation of ECSS (6 km/h) changes largely			○	○
2	ECSS does not work while machine is loaded		○	○	
3	ECSS does not work while machine is empty		○	○	
4	Lift arm lowers more than 30 cm at maximum when ECSS operated while machine is loaded			○	
5	ECSS does not work at all	○	○	○	○

S-3 Engine does not pick up smoothly

General causes why engine does not pick up smoothly
- Insufficient intake of air
- Insufficient supply of fuel
- Defective condition of fuel injection
- Improper selection of fuel
- Controller is controlling in derate mode
  (limiting injection rate (output) because of an error in electrical system)

			Causes										
			Clogged air cleaner element	Defective contact of valve and valve seat	Improper valve clearance	Seized turbocharger, interference of turbocharger	Worn piston ring, cylinder	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogging of fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△	△			△			△		
	Engine pick-up suddenly became worse					◎		○	○			○
	Non-specified fuel is being used									◎	◎	◎
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		◎							◎		
	Oil must be added more frequently						◎					
Check items	Dust indicator is red		◎									
	Air breather hole of fuel tank cap is clogged							◎				
	Rust and water are found when fuel tank is drained									◎		
	Fuel is leaking from fuel piping								◎			
	When priming pump is operated, it makes no reaction or it is heavy								◎	○		
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										○	◎
	Color of exhaust gas is	Blue under light load					◎					
		Black	◎	○		◎						◎
	When engine is cranked, abnormal sound is generated around cylinder head				◎							
	When engine is cranked, interference sound is generated around turbocharger					◎						
	High idle speed under no load is normal, but speed suddenly drops when load is applied							○		◎		
	There is hunting from engine (rotation is irregular)							○		○		○
	Blow-by gas is excessive						◎					
Troubleshooting	Inspect air cleaner directly		●									
	When compression pressure is measured, it is found to be low			●			●					
	Inspect valve clearance directly				●							
	When turbocharger is rotated by hand, it is found to be heavy					●						
	When air is bled from fuel system, air comes out								●			
	Inspect fuel filter, strainer directly									●		
	Carry out troubleshooting according to “No-pressure feed by supply pump (*1)” in display of code										●	
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●
		Remedy	Clean	Correct	Adjust	Replace	Replace	Clean	Correct	Replace	Replace	Replace

*1: Failure codes [CA559] and [CA2249] in the display of code

S-15 Abnormal noise is made

General causes why abnormal noise is made
- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system

★ Judge if the noise is an internal noise or an external noise before starting troubleshooting.

★ The engine is operated in the low-temperature mode while it is not warmed up sufficiently. Accordingly, the engine sound becomes a little larger. This does not indicate abnormality, however.

★ When the engine is accelerated, it is operated in the acceleration mode and its sound becomes a little larger for up to about 3 seconds. This does not indicate abnormality, however.

			Causes												
			Leakage of air between turbocharger and cylinder head	Interference of turbocharger, seized turbocharger	Broken dynamic valve system (valve, rocker lever)	Defective inside of muffler (dividing board out of position)	Improper valve clearance	Excessive wear of piston ring, cylinder	Improper gear train backlash	Removed, seized bushing	Deformed cooling fan, loose fan belt, interference of fan belt	Clogged, seized injector	Dirt caught in injector	Improper fuel injection timing (abnormality in coolant temperature sensor, boost temperature sensor)
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period						△						
	Condition of abnormal noise	Gradually occurred						○			○			
		Suddenly occurred		○	○					○				
	Non-specified fuel is being used											○		
	Oil must be added more frequently							◎						
	Metal particles are found when oil filter is drained							◎		◎				
Check items	Air leaks between turbocharger and cylinder head		◎											
	When engine is cranked, interference sound is generated around turbocharger			◎										
	When engine is cranked, abnormal sound is generated around cylinder head				◎		◎							
	When engine is cranked, beat noise is generated around muffler					◎								
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎	○	
	Color of exhaust gas is	Blue under light load						◎						
		Black	○	◎			○							
	Engine does not pick up smoothly and combustion is irregular											◎		
	Abnormal noise is loud when engine is accelerated						○		○		○	○		
	Blow-by gas is excessive							◎						
Troubleshooting	When turbocharger is rotated by hand, it is found to be heavy			●										
	Inspect dynamic valve system directly				●									
	When muffler is removed, abnormal noise disappears					●								
	Inspect valve clearance directly						●							
	When compression pressure is measured, it is found to be low							●						
	Inspect gear train directly								●	●				
	Inspect fan and fan belt directly										●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●	●	
	Abnormal noise is heard only when engine is started												●	
	Confirm with monitoring function													●
		Remedy	Replace	Replace	Replace	Replace	Adjust	Replace	Replace	Replace	Correct	Replace	Replace	Replace

Component	Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch	Nature of work, remarks
Hydraulic cylinder assembly	U	5	790-201-1500	Push tool kit	■	1			Installation of dust seal
			790-101-5021	• Grip		1			
			01010-50816	• Bolt		1			
			790-201-1610	• Plate (Lift, bucket)		1			
			790-201-1550	• Plate (Steering)		1			
		6	790-720-1000	Expander	●	1			Installation of piston ring
		7	796-720-1670	Ring (Lift, bucket)	●	1			
			07281-01159	Clamp (Lift, bucket)	●	1			
			796-720-1740	Ring (Steering)	●	1			
			07281-00809	Clamp (Steering)	●	1			
Operator's cab glass (stuck glass)	X	1 1	793-498-1120	Clear plate	■	2			Adjustment of clearance of window glass
		1 2	793-498-1130	Plate	■	2			
		1 3	793-498-1110	Magnet	■	2			
		2	793-498-1210	Lifter (Suction cup)	■	2			Removal, installation of window glass

Removal and installation of fuel supply pump assembly

Removal

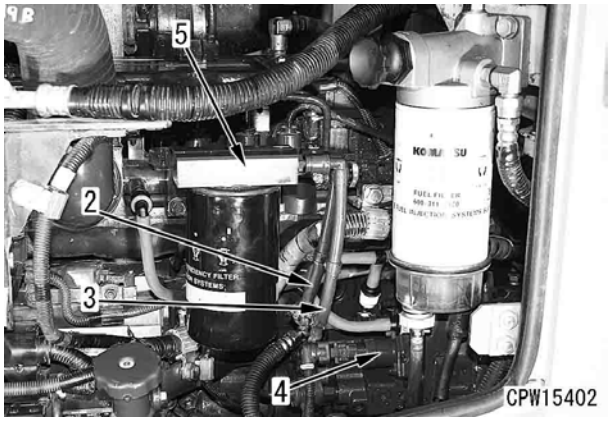
⚠ Stop the machine on a level ground and install the lock bar to the frame to fix the front and rear frames.

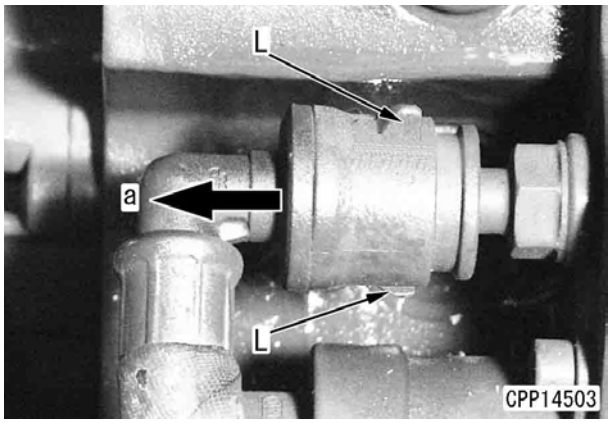
⚠ Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

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

1. Open and fix right engine side cover (1).
   ★ Check that the cover is locked securely.

2. Disconnect fuel hoses (2) and (3) from fuel supply pump (4).
   ★ If mud is sticking, lock (L) may become stiff. Accordingly, clean the connecting area.
   ★ Press lock (L) from both sides and pull out hose (a).
   ★ Plug the disconnected hoses to prevent fuel leakage.

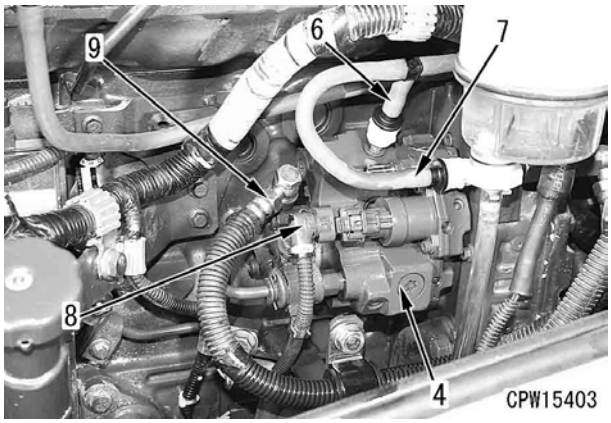




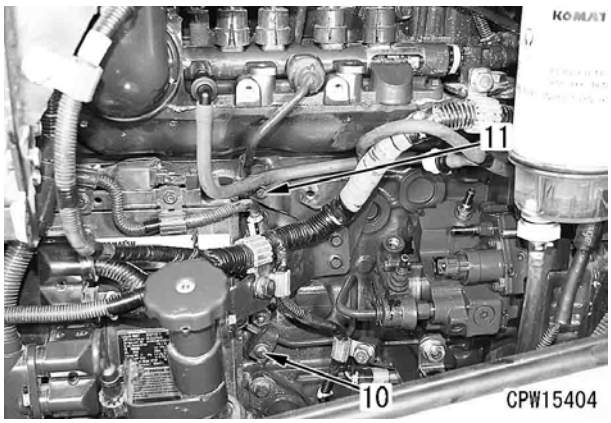
3. Disconnect fuel return hoses (6) and (7) from fuel supply pump (4).

4. Disconnect wiring harness connector CN-CP3 (8) from fuel supply pump (4).

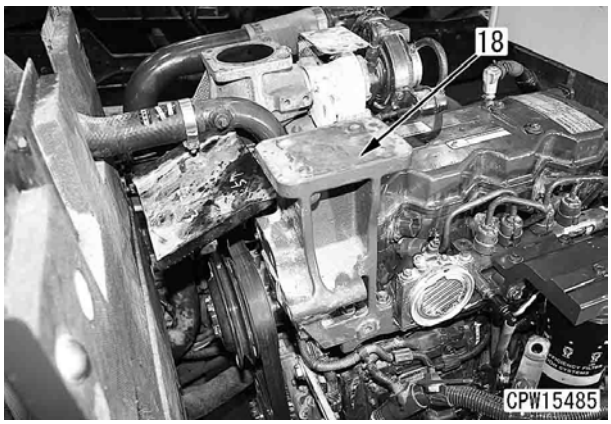
5. Disconnect fuel supply hose (9) from fuel supply pump (4). [*1]



6. Remove fuel high-pressure pipe clamps (10) and (11).

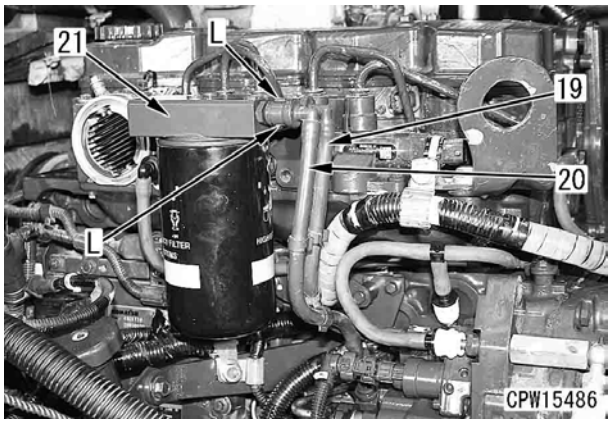


15. Remove muffler mounting bracket (18).

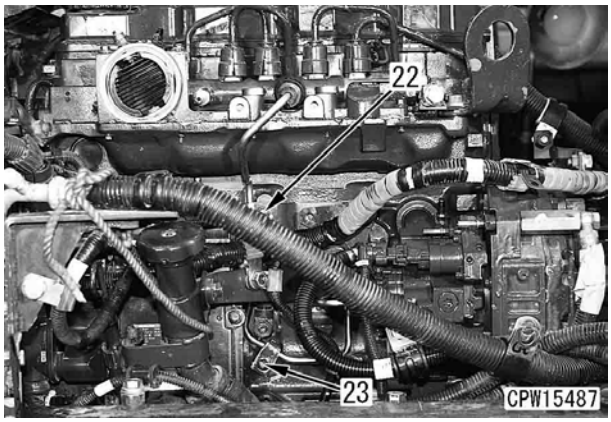


16. Disconnect fuel filter hoses (19) and (20).
    - ★ If mud is sticking, lock (L) may become stiff. Accordingly, clean the connecting area.
    - ★ Press lock (L) from both sides and pull out hoses (19) and (20).
    - ★ Plug the disconnected hoses to prevent fuel leakage.

17. Remove fuel filter and bracket assembly (21).



18. Remove fuel high-pressure pipe clamps (22) and (23).



19. Remove wiring harness clamp (24).

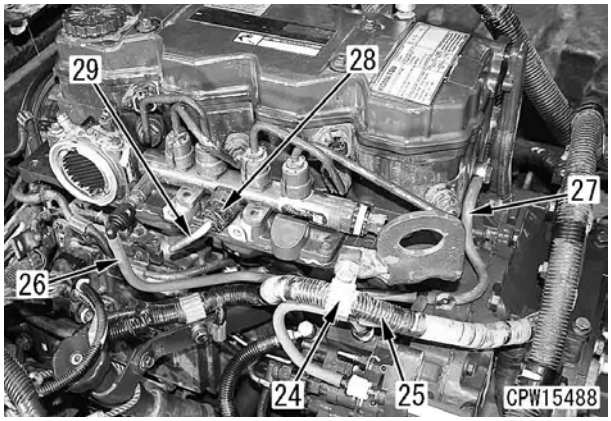
20. Move wiring harness (25) down.

21. Disconnect fuel return hose (26) of the cylinder head. [*5]

22. Disconnect fuel return hose (27) of the common rail. [*6]

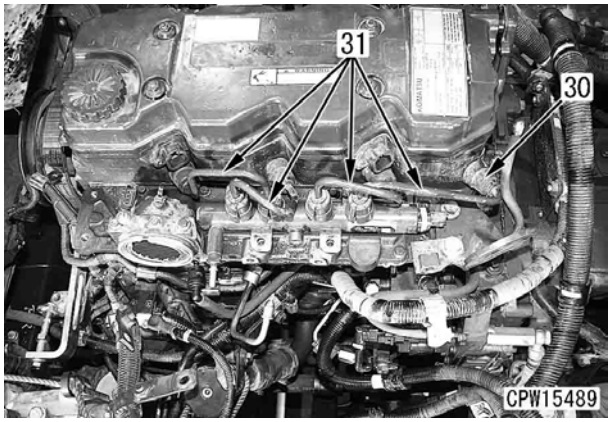
23. Remove boot (28). [*7]

24. Disconnect high-pressure pipe (29). [*8]
    - ★ Remove the boot of the fuel high-pressure pipe on the fuel supply pump side and loosen the sleeve nut.

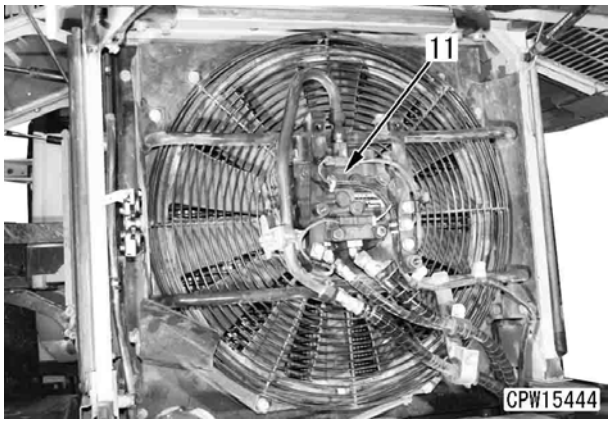


25. Remove 4 boots (30). [*9]

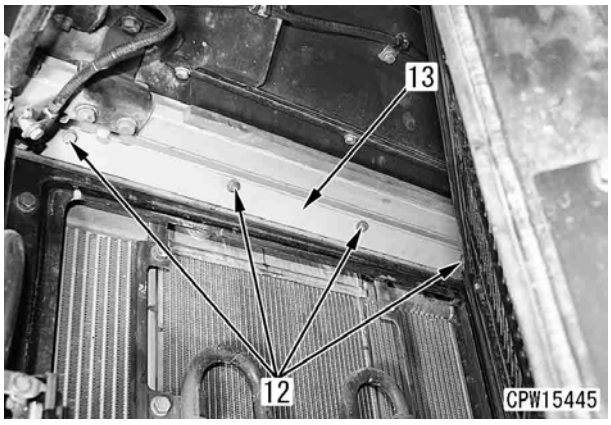
26. Remove 4 high-pressure pipes (31). [*10]
    - ★ Remove the boots of the fuel high-pressure pipes on the common rail side and loosen the sleeve nuts.



9. Open and fix cooling fan motor assembly (11).
   ★ Check that cooling fan motor assembly is locked securely.



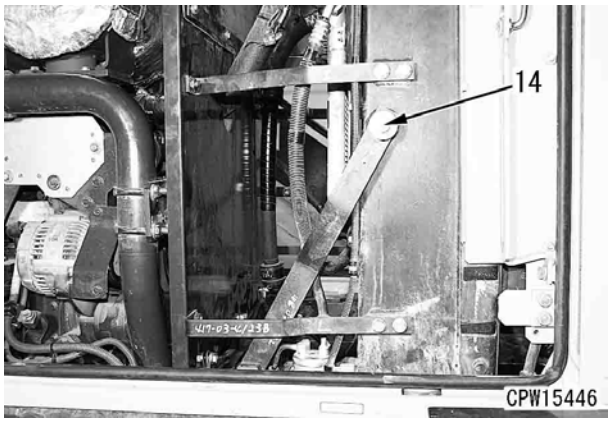
10. Remove 4 mounting bolts (12) and cover (13).

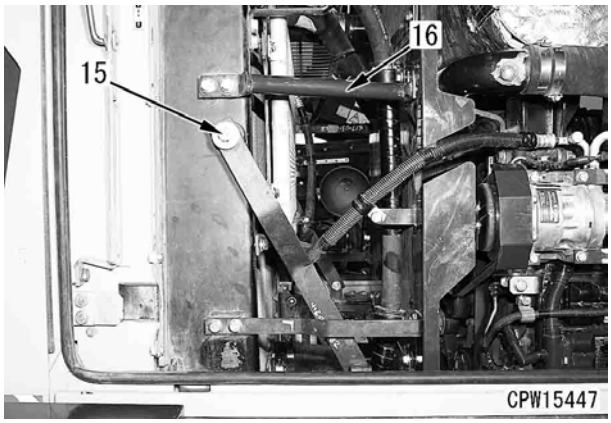


11. Remove left stay mounting bolt (14).

12. Remove right stay mounting bolt (15).

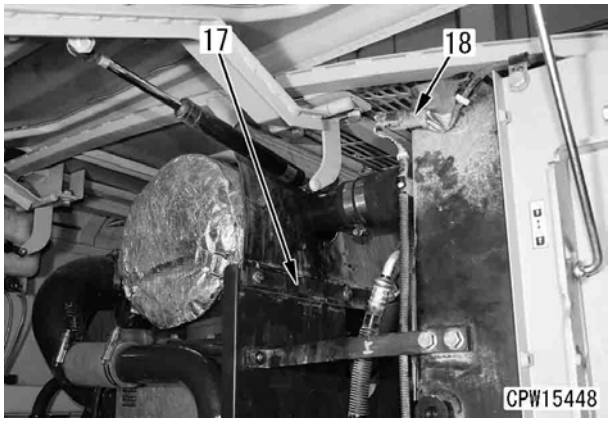
13. Remove right stay (16).
   ★ The right stay must be removed since it interferes with the engine hood when the latter is removed.



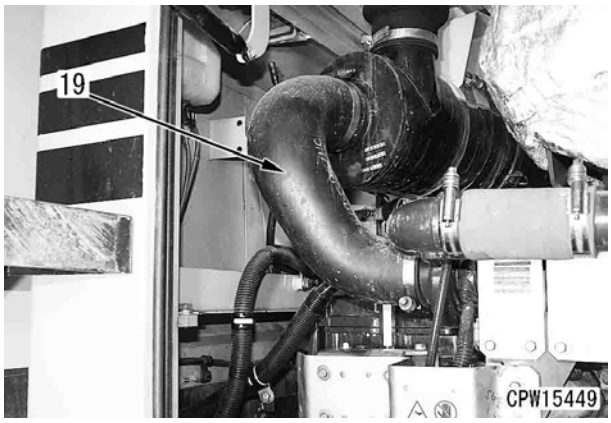


14. Remove 2 heat insulation sheet fixing plates (17).

15. Disconnect rear combination lamp connector CN-BR1 (18).



16. Remove hose (19) between the air cleaner and turbocharger. [*1]

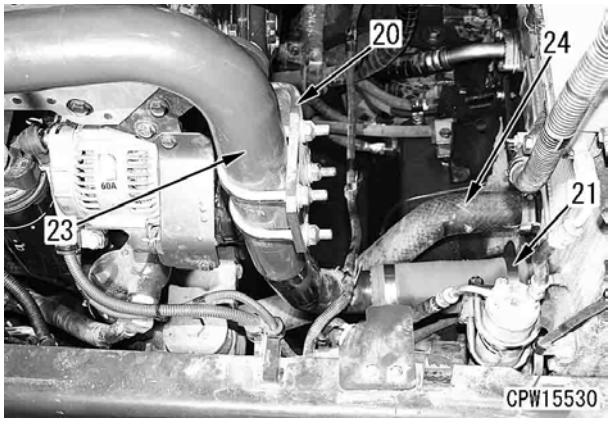


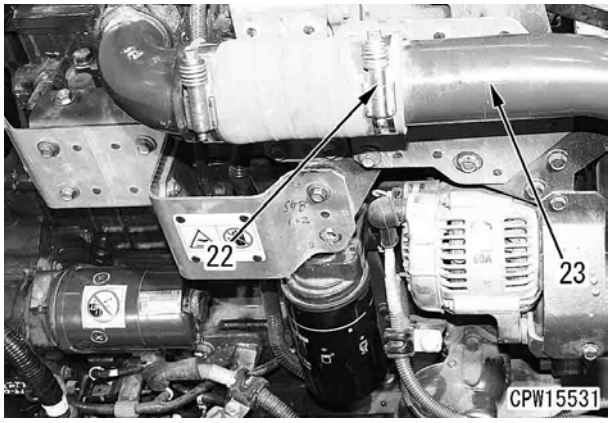
19. Remove the mounting bolts of bracket (20).

20. Remove hose clamps (21) and (22). [*5]

21. Disconnect air tube and hose assembly (23) between the air aftercooler and turbocharger.
    ★ Remove bracket (20) and air tube and hose assembly (23) together.

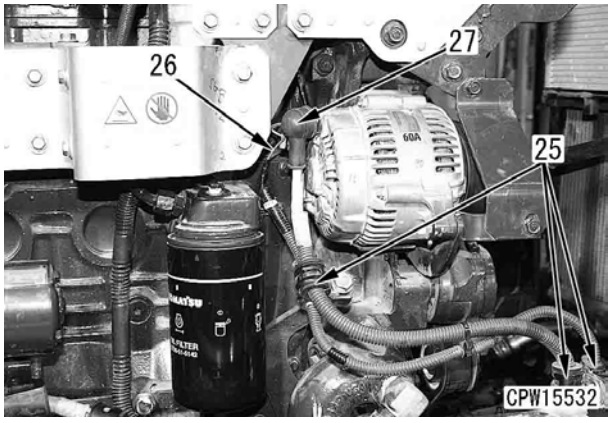
22. Disconnect radiator lower hose (24). [*6]





23. Remove 3 wiring harness clamps (25).

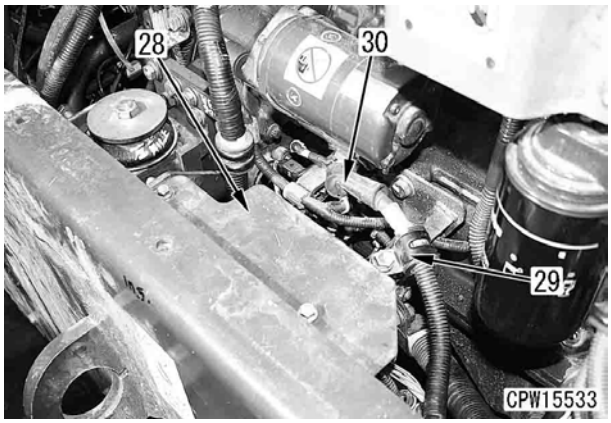
24. Disconnect alternator wiring harness terminals CN-E02 (26) and CN-E03 (27).



25. Remove plate (28) on the left side of the engine compartment.

26. Remove wiring harness clamp (29).

27. Disconnect terminal B (30) from the starting motor.



28. Remove 2 hose clamps (31).

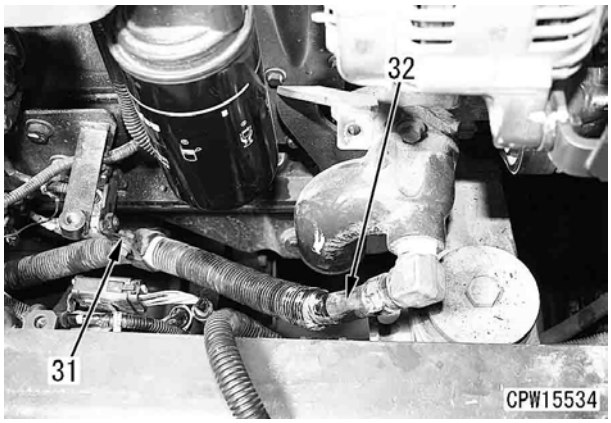
29. Disconnect heater return hose (32).
    ★ Move heater return hose (32) to a place where it will not be an obstacle.

30. Disconnect wiring harness terminal CN-E07A (33).

31. Disconnect wiring harness connector CN-ER1 (34).

32. Disconnect wiring harness connector CN-ER3 (35).

33. Disconnect wiring harness connector CN-ER2 (36).

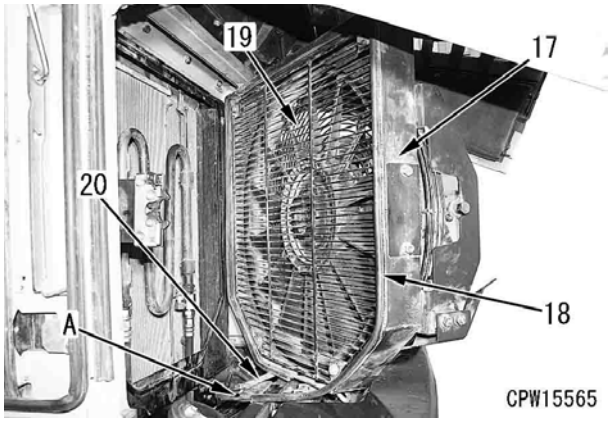


11. Open cooling fan and fan motor assembly (17).

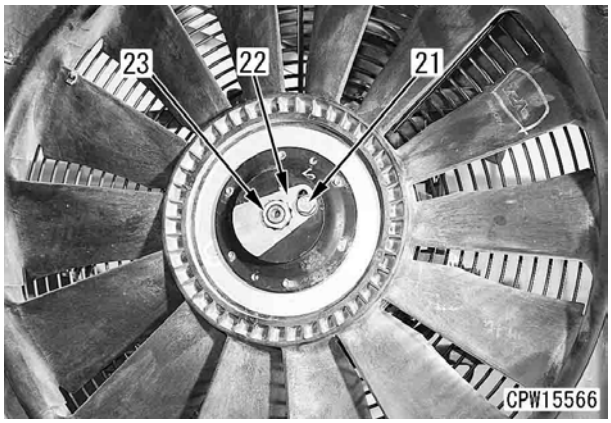
12. Remove cushion (18) from all the periphery of the shroud.

13. Remove fan guard (19).

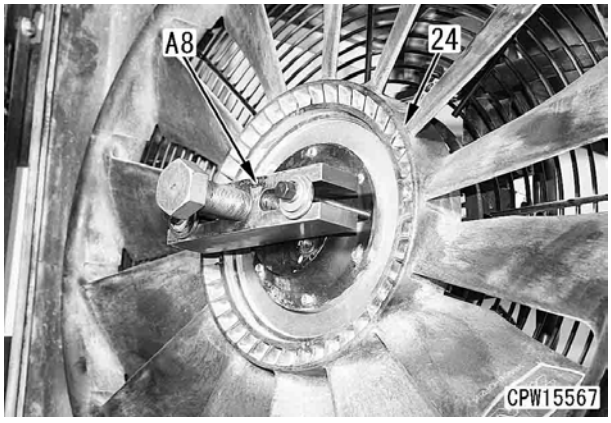
14. Move the lock portion of stopper link (20) to hole (A) of the bracket to remove it from the bracket.



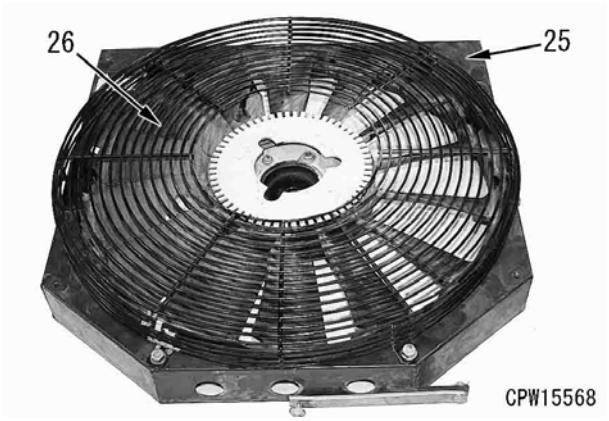
15. Remove mounting bolt (21), stopper plate (22) and nut (23). [*2]



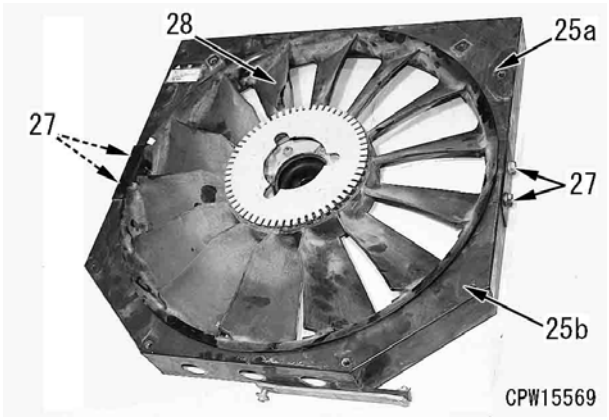
16. Using tool **A8**, remove cooling fan assembly (24). [*3]



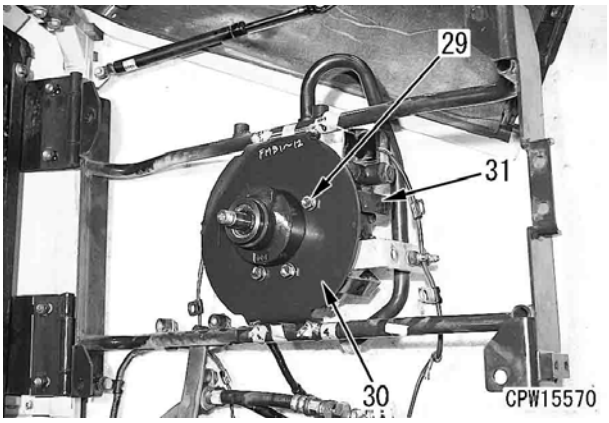
17. Remove fan guard (26) from shroud (25).



18. Remove 2 mounting bolts (27) from each of the right and left sides to separate upper shroud (25a) and lower shroud (25b) from each other and remove fan assembly (28).
    ★ Since the inside of the shroud is fitted in the groove on the ring end of fan assembly (28), fan assembly (28) cannot be removed unless the shroud is divided.

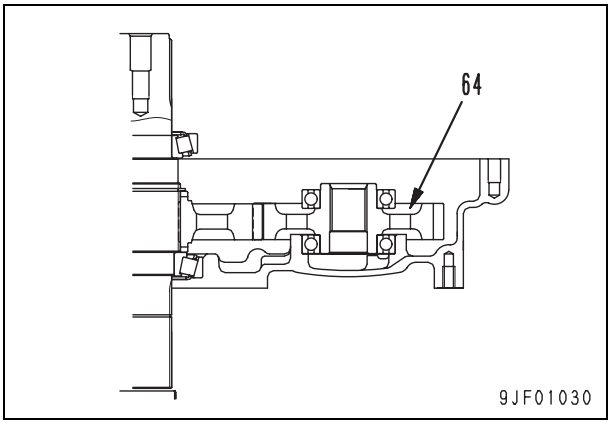


19. Remove 4 mounting bolts (29) and remove fan motor assembly (31) from bracket (30). [*4]



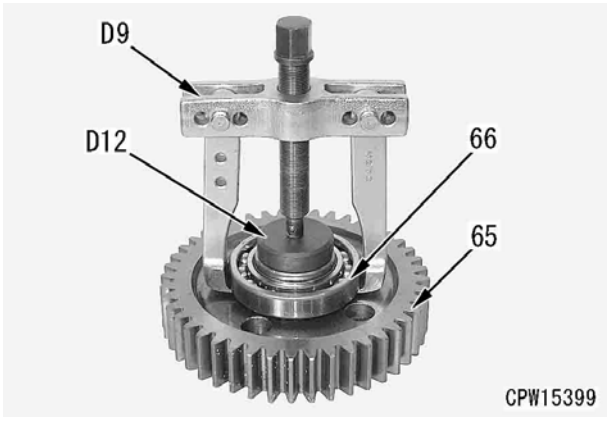
21. Removal of HST motor 2 gear and bearing assembly

1) Remove HST motor 2 gear and bearing assembly (64).



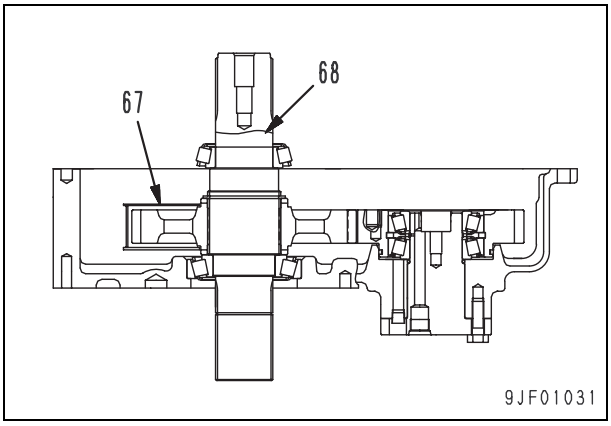
22. Disassembly of HST motor 2 gear and bearing assembly

1) Using tool **D9** and tool **D12**, remove 2 bearings (66) from HST motor 2 gear (65).



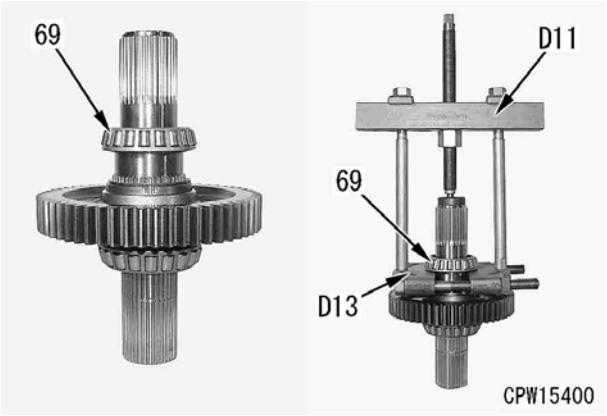
23. Removal of output shaft and gear assembly

1) Remove 2 mounting bolts of cover (67).
2) Remove output shaft and gear assembly (68) and cover (67).

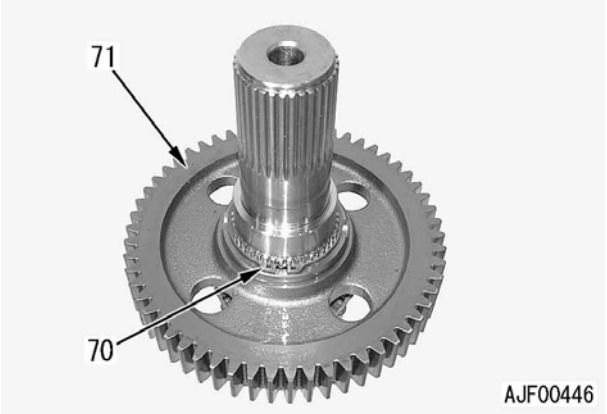


24. Disassembly of output shaft and gear assembly

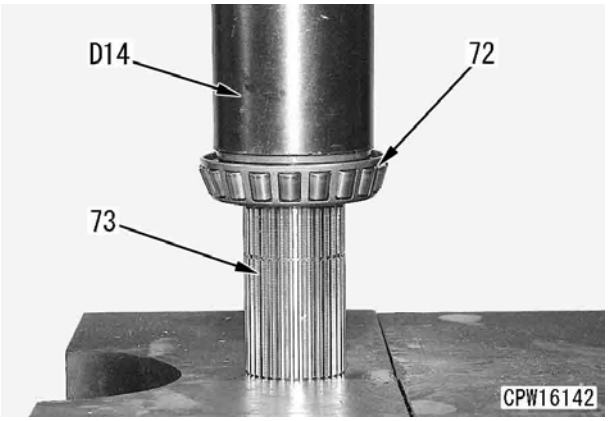
1) Using tool **D11** and tool **D13**, remove front bearing (69).



2) Remove snap ring (70) and output gear (71).

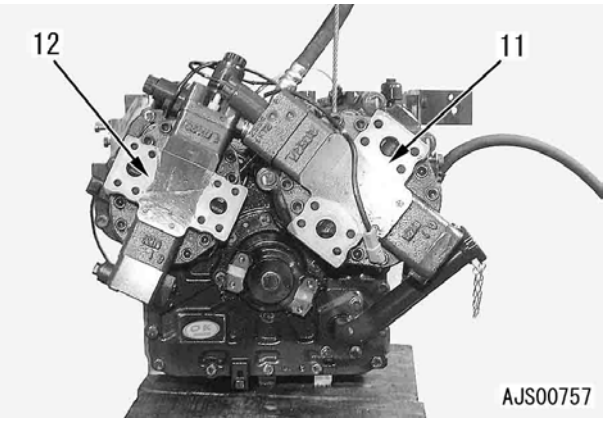


3) Using tool **D14** and the press, push rear bearing (72) out of output shaft (73).

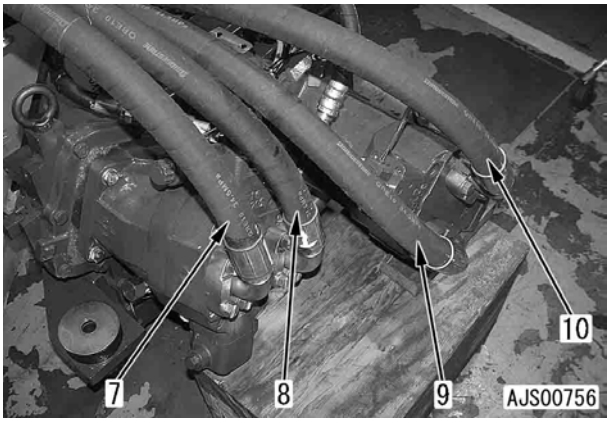


28. HST motor

1) Sling and install HST motor 2 (12).
   - Spline of HST motor 2: **Molybdenum disulfide lubricant (LM-G)**
   - Mounting bolt: **98 – 123 Nm {10.0 – 12.5 kgm}**
2) Sling and install HST motor 1 (11).
   - ★ Do not apply LM-G to the spline of HST motor 1.
   - Mounting bolt: **98 – 123 Nm {10.0 – 12.5 kgm}**

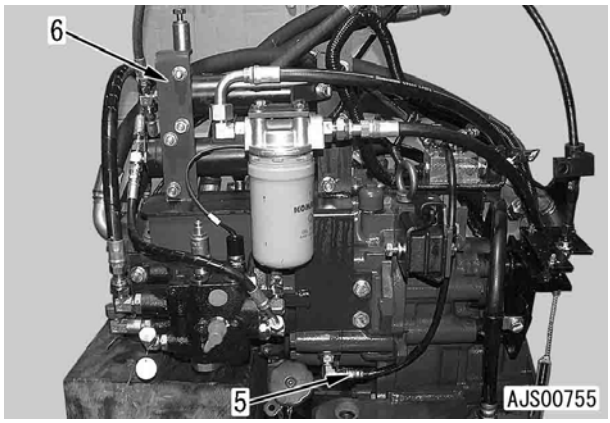


3) Install hoses (7) – (10) to HST motors 1 and 2.

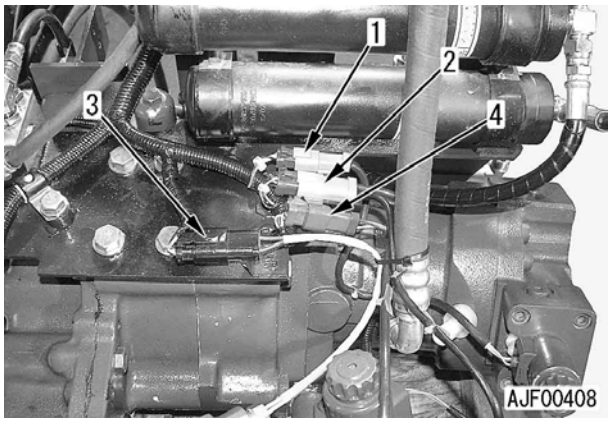


29. Brake accumulator

1) Install brake accumulator and transfer oil filter bracket assembly (6) with the 6 mounting bolts.
2) Connect clutch port hose (5) and fix it with the clamp.

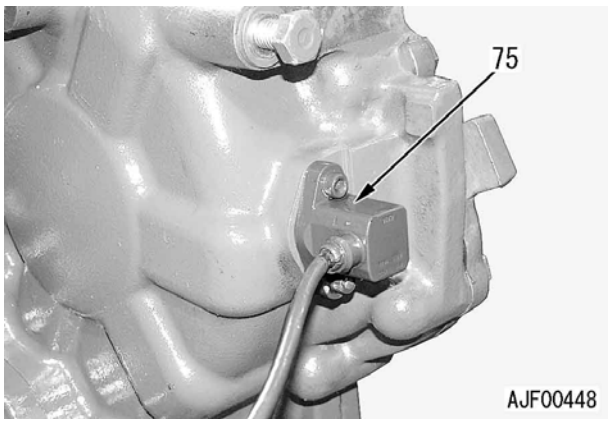


3) Connect wiring harness connectors CN-T06 (1), CN-T07 (2), CN-T10 (3) and CN-T11 (4).



30. Speed sensor

1) Install speed sensor (75).



31. Refilling with oil

Refill the transfer case with oil.

- Transfer case: **Approx. 6.5 ℓ (TO10)**

Removal and installation of rear axle assembly

Removal

⚠ **Stop the machine on a level ground and set the lock bar to the frame to fix the front and rear frames.**

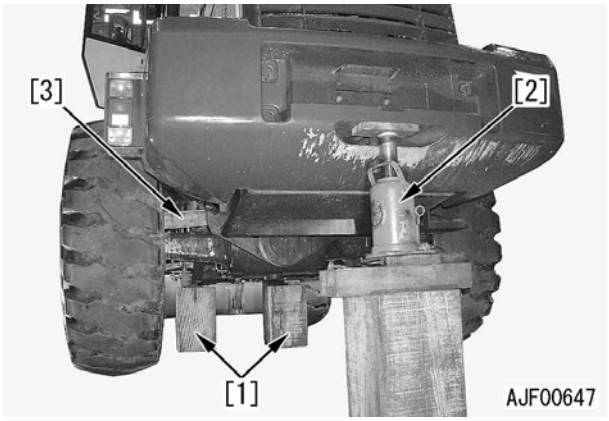
⚠ **Lower the work equipment to the ground, stop the engine, apply the parking brake, and set chocks under the tires.**

⚠ **Release the residual pressure in the brake accumulator circuit. For details, see "Releasing remaining pressure in hydraulic circuit".**

1. Raise the chassis with the work equipment and set stands [1] under the frame in front of the rear wheels to float the rear of the chassis.

2. Support the counterweight on jack [2].

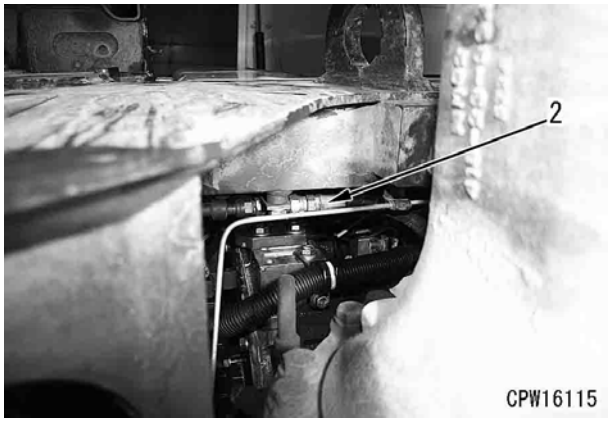
3. Set blocks [3] between top of each side of the rear axle and the rear frame.



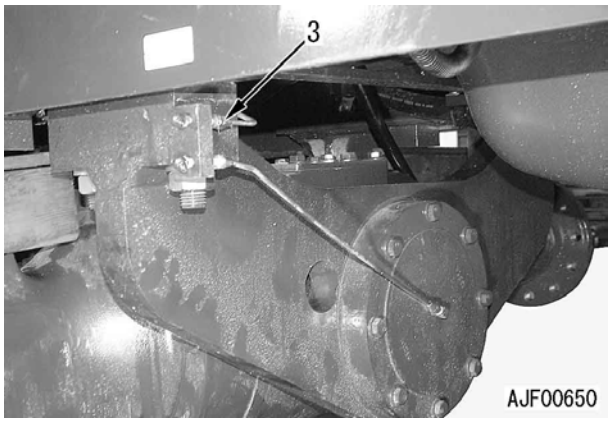
4. Lift off rear wheel (1). [*1]
   - ★ Remove the right and left fenders.
   - ★ Lift off the rear wheel on the other side similarly.

   Rear wheel (1 side): **210 kg**

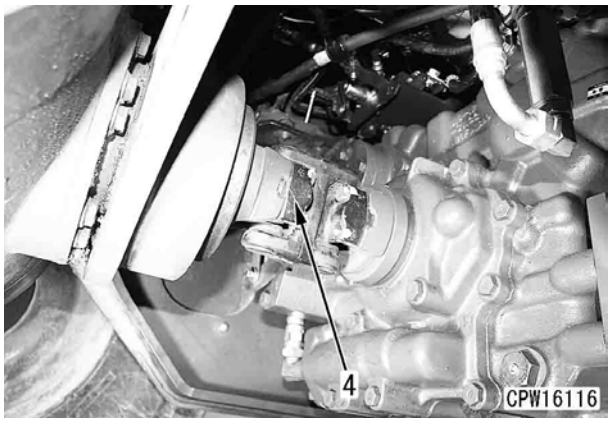
5. Disconnect brake hose (2) from the left inside of the frame.



6. Disconnect grease supply tube (3).

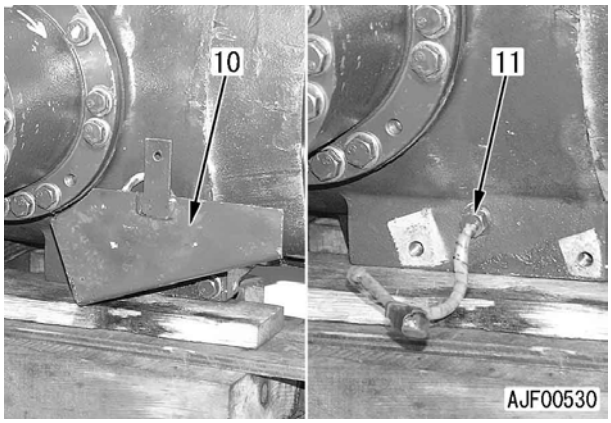


7. Remove rear drive shaft (4). [*2]



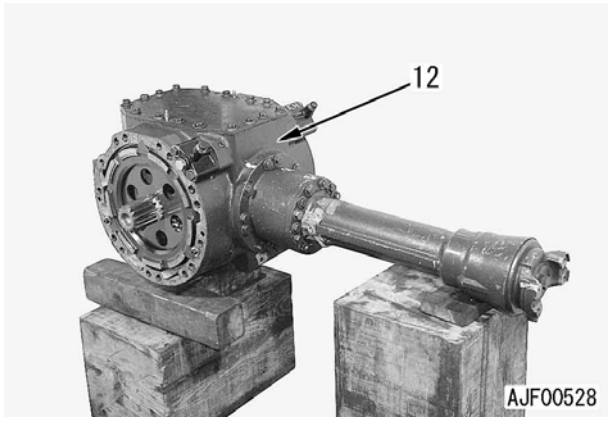
5. Axle oil temperature sensor (Only front axle)

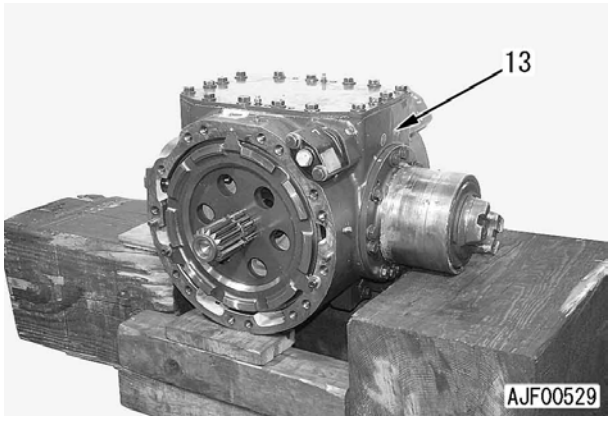
1) Remove cover (10).
2) Remove axle oil temperature sensor (11). (The shape of the cover in the figure is different more or less from the shape of the actual cover.)



6. Differential assemblies

1) Place and stabilize differential assemblies (12) and (13) on blocks.
   ★ (12): Front differential
   (13): Rear differential

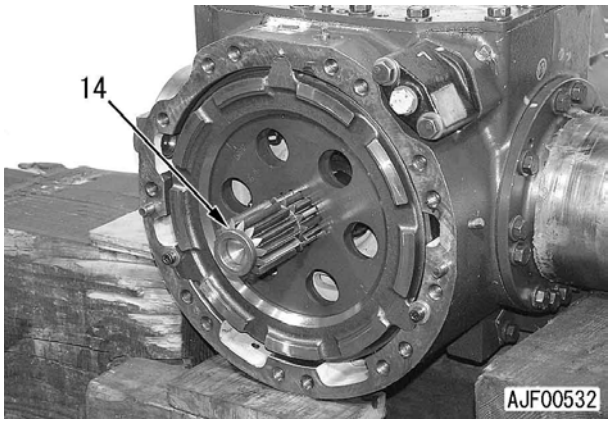




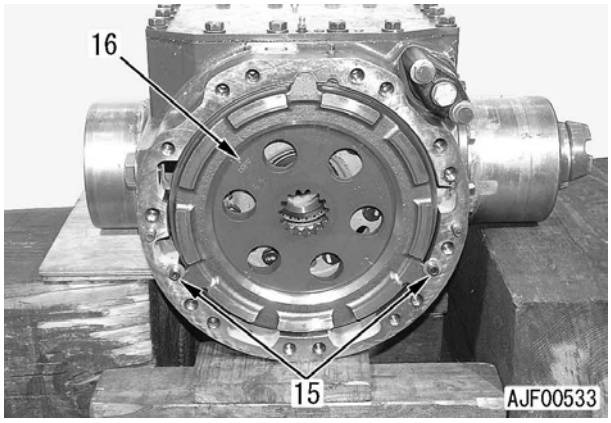
7. Brakes

★ Remove both brakes according to the following procedure.

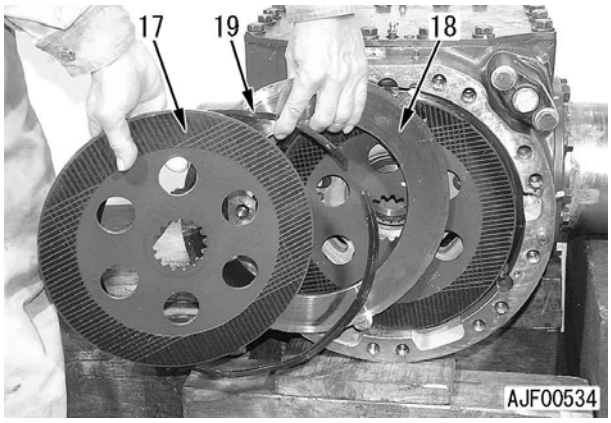
1) Remove sun gear shafts (14).



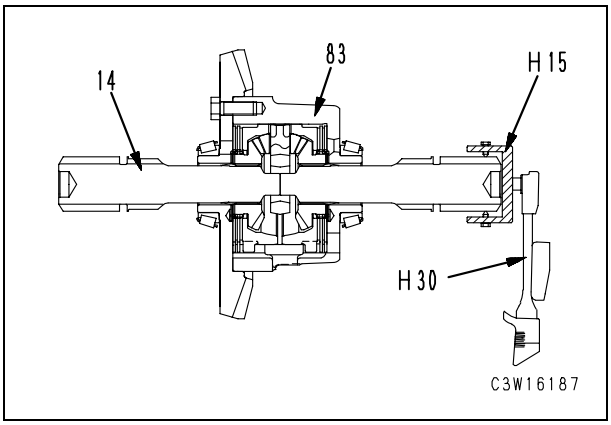
2) Remove 2 inside hexagon bolts (15) and outer plate (16).



3) Remove 2 discs (17), 1 plate (18), and 4 wave springs (19).

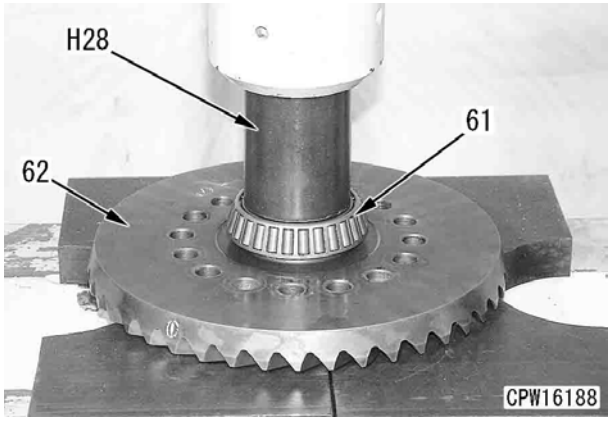


16) Measure the no-load operation torque.
   1] Install sun gear shafts (14) to both sides of limited-slip differential assembly (83).
   2] Fix the sun gear shaft on one side and install tool **H15** to the sun gear shaft on the other side.
   3] Install tool **H30** (torque wrench) to tool **H15** and measure the no-load operation torque.
      ★ When measuring, let the case rotate freely.
      ● No-load operation torque:
      Max. 10 Nm {1.0 kgm}
      ● If the no-load operation torque exceeds the standard value, disassemble the limited-slip differential again and perform "11) Selection of thickness of plate" and "15) Adjust the clearance of the side gear in the axial direction".

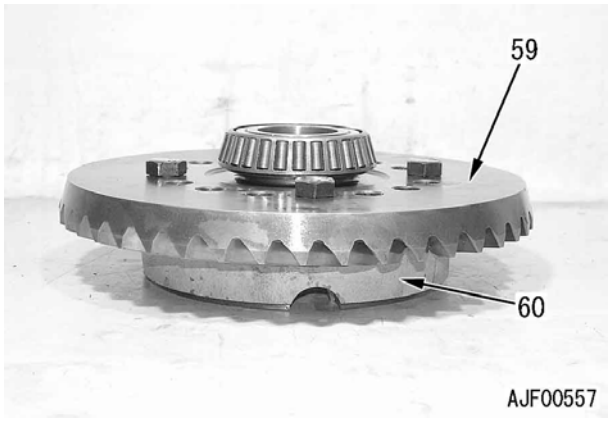


2. Assembly of standard differential carrier assembly

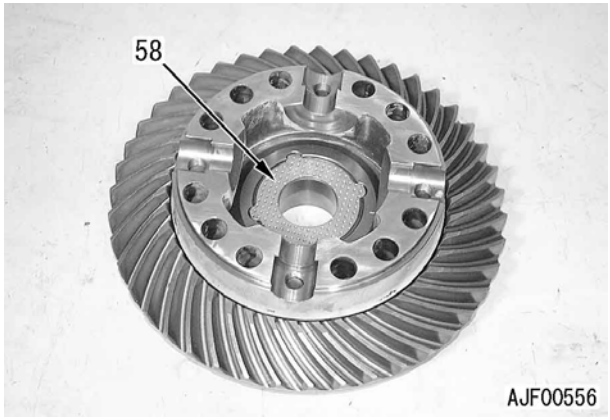
1) Install bearing (61) to bevel gear (62).
   ★ Install the bearing by shrink fit at temperature below 100°C or by using tool **H28** and a press.



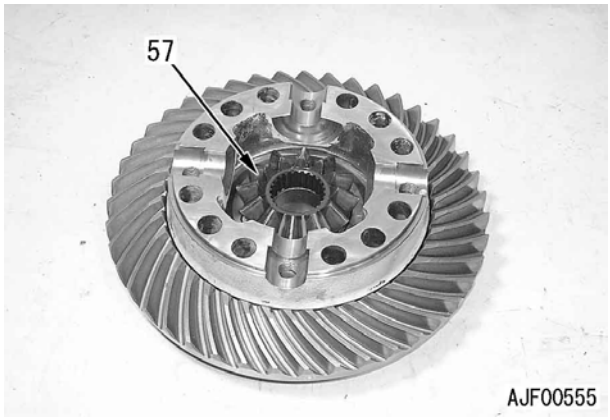
2) Install bevel gear and bearing assembly (59) to case (60) with the 4 mounting bolts.
   ★ Match the match marks made when the assembly was removed.
   ★ Install the mounting bolts to the 4 places of the spider shaft.
   Mounting bolt: **Adhesive (LT-2)**
   Mounting bolt:
   245 – 309 Nm {25.0 – 31.5 kgm}



3) Install washer (58).
   ★ Install the washer with the dimpled side up (toward the side gear).

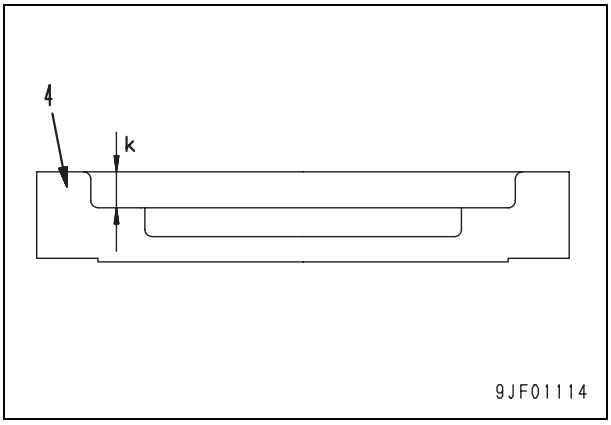


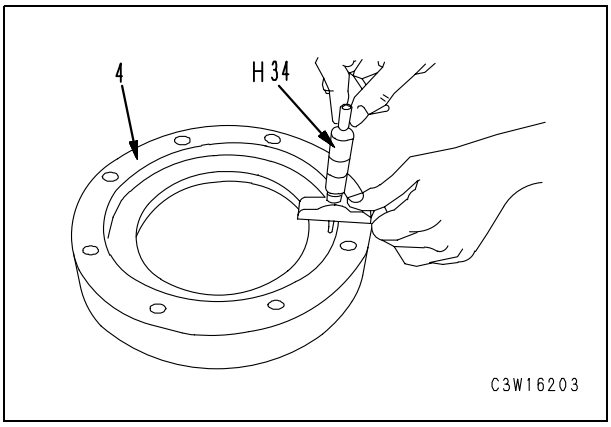
4) Install side gear (57).



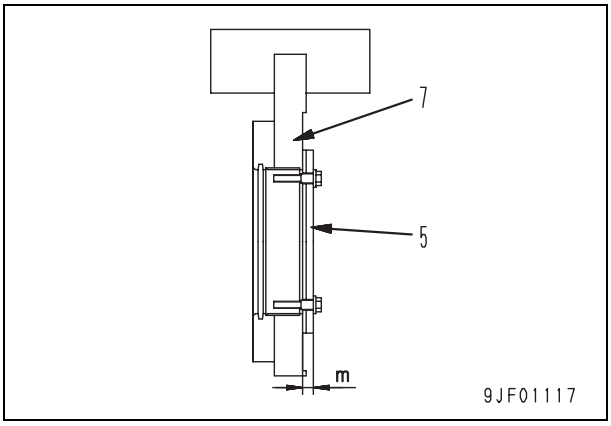
20. Adjust the shim of cover (trunnion cap) (4).

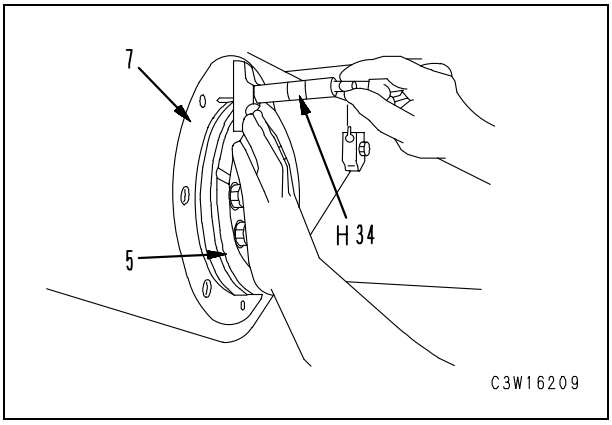
1) Measure dimension (k) of cover (4) with tool **H34** at 4 places on the diagonal lines and obtain the average.
   - ★ Clean the contact face of the depth micrometer thoroughly.
   - ● Standard average value (k):
     19.85 – 20.00 mm





2) Measure dimension (m) between rear axle support (7) and thrust washer (5) with tool **H34** at 4 places on the diagonal lines and obtain the average.
   - ★ Clean the contact face of tool **H34** (depth micrometer) thoroughly.
   - ● Standard average value (m) (Reference): **19.65 – 20.00 mm**

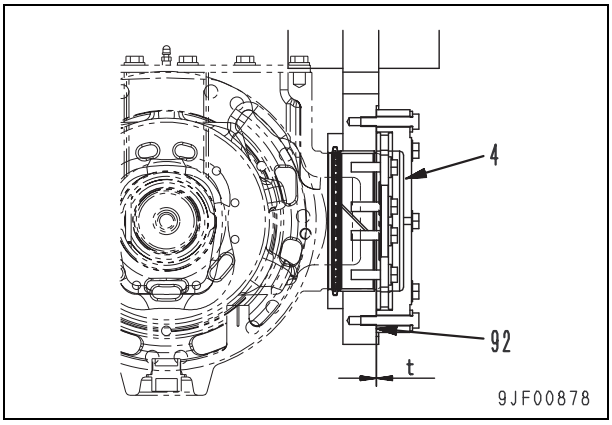




3) Calculate shim thickness (t).
   - ● Shim thickness (t) = (m) – (k)
   - ★ Decide the number of the shims by the calculated shim thickness and the following table.
   - ● Shim thickness (1 piece): 0.2 mm

Shim thickness	Number of shims
0 – 0.07 mm	1
0.08 – 0.27 mm	2
0.28 – 0.47 mm	3

4) Install selected shim (92), and then install cover (4) again.
   - Cover: **Grease (G2-LI)**
   - Mounting bolt:
     93.1 – 122.5 Nm {9.5 – 12.5 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 system. Then, check the oil level again.

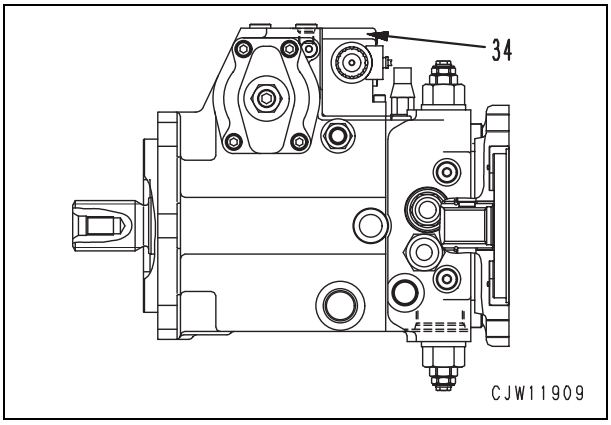
  Hydraulic oil (For details, see "Table of fuel, coolant and lubricants"):
  Only necessary quantity

- **Refilling with coolant**
  Add coolant through the coolant filler to the specified level. Run the engine to circulate the coolant through the system. Then, check the coolant level again.

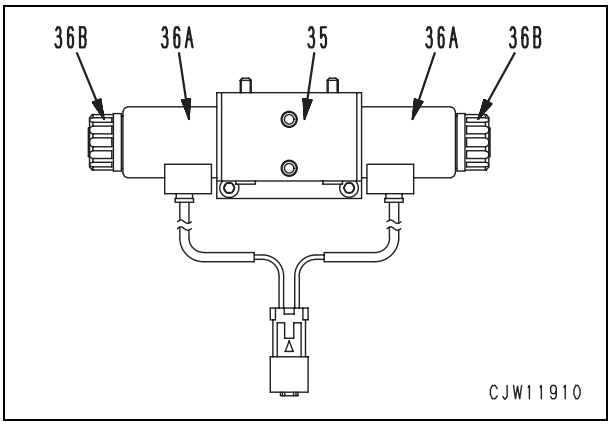
  Total amount of coolant: **Approx. 17 ℓ**
  (For details, see "Table of fuel, coolant and lubricants")

5. Directional solenoid valve (34)

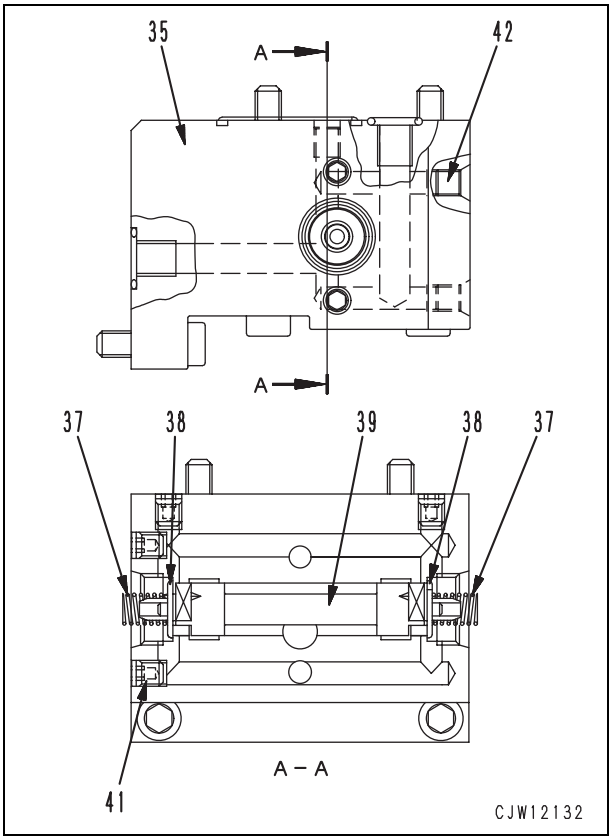
1) Remove directional solenoid valve assembly (34).



2) Remove 2 solenoid valves (36) from directional solenoid valve assembly (34).
   ★ Remove cap (36B) by turning it and remove coil (36A) by pulling it from the solenoid valve, and then remove the tube from valve housing assembly (35).



3) Disassemble valve housing assembly (35) according to the following procedure.
   1] Remove 2 springs (37) and 2 collars (38).
   2] Remove piston (39).
   ★ Do not remove 4 plugs (41) and plug (42) from housing.



5. Cylinder block and piston assembly

1) Assemble the cylinder block and piston assembly according to the following procedure.