SEBM006105

SHOP MANUAL

KOMATSU

avance LOADER

WA380-3

MACHINE MODEL	SERIAL NUMBER
WA380-3	**50001 and up**

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require. Materials and specifications are subject to change without notice.
- WA380-3 mount the S6D108 engine.
  For details of the engine, see the 108 Series Engine Shop Manual.

Printed in Japan 09-97(03)00001

HOISTING INSTRUCTIONS

HOISTING

> Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg or more is indicated clearly with the symbol kg

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
  1) Check for removal of all bolts fastening the part to the relative parts.
  2) Check for existence of another part causing interference with the part to be removed.

WIRE ROPES

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

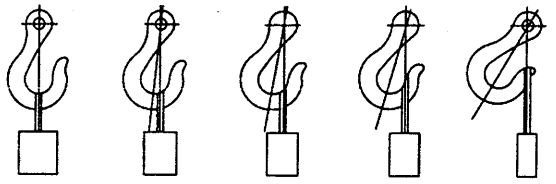
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.2	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

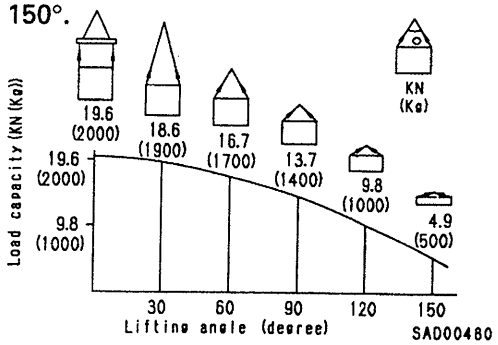
Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



SAD00479

3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.
   ⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles.
   When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



SAD00480

kgm to ft. lb

1 kgm = 7.233 ft. lb

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

Serial No. 53001 and up

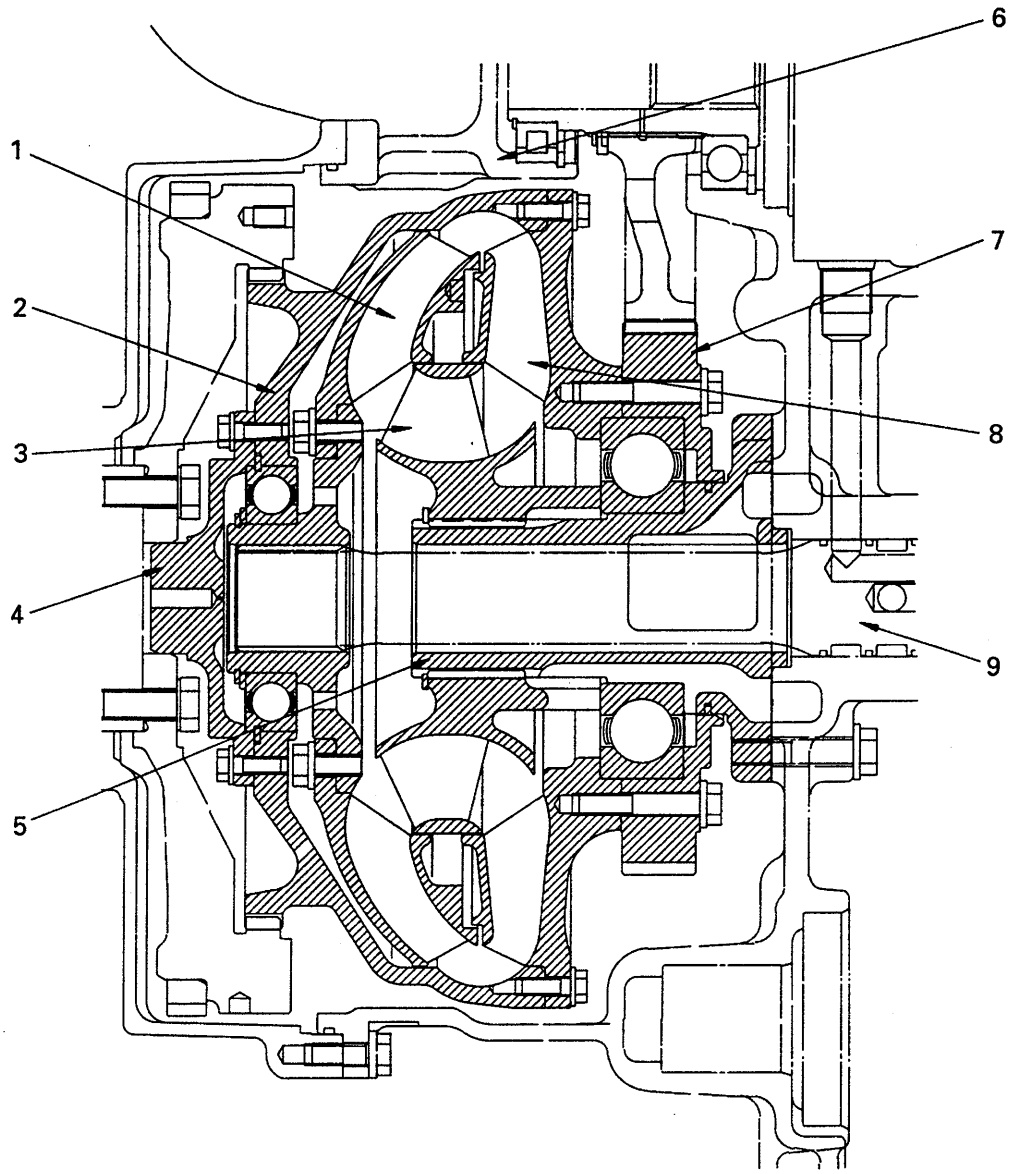
Unit: kg

Machine model	WA380-3
Serial No.	53001 and up
Engine	730
Radiator	165
Torque converter	54
Transmission	700
Center drive shaft	25
Front drive shaft	22
Rear drive shaft	10
Front axle	1,021
Rear axle	971
Axle pivot	111
Wheel (each)	110
Tire (each)	207
Steering valve	24
Steering cylinder (each)	25
Hydraulic tank	193
Hydraulic, Steering, Switch, PPC pump	46
Main control valve	71
Boom cylinder (each)	164

Machine model	WA380-3
Serial No.	53001 and up
Bucket cylinder	175
Engine hood (with side panel)	191
Front frame	1,465
Rear frame	1,230
Bucket link	56
Bellcrank	309
Boom (including bushing)	1,090
Bucket (with BOC)	1,629
Counterweight	1,455
Fuel tank	179
Battery (each)	44
Floor, Cab assembly	677
Floor freme assembly	375
Cab	302
Air conditioner unit	14
Operator's seat	38
ROPS canopy	398
ROPS cab	635

U42303

TORQUE CONVERTER



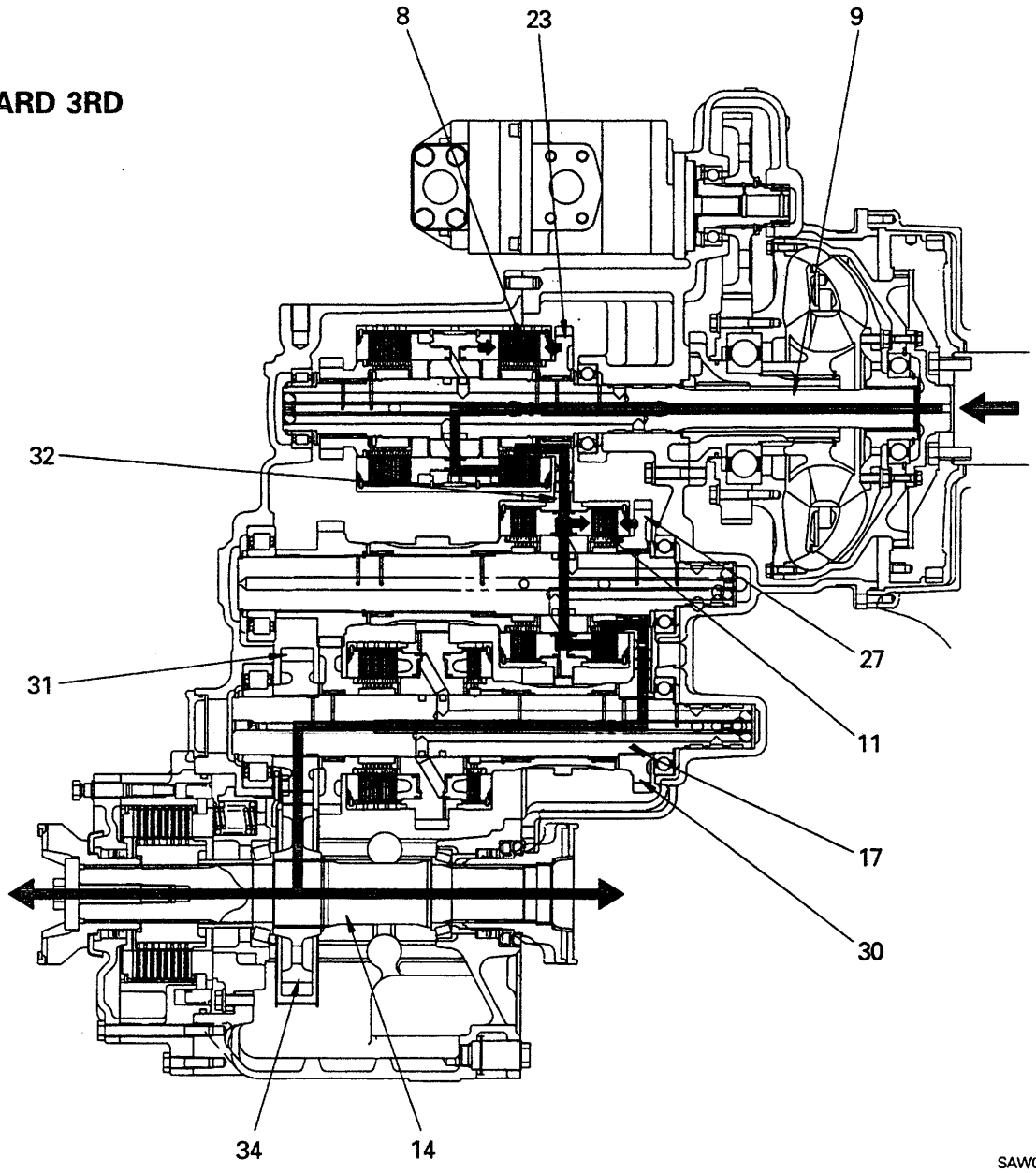
SAW00472

U42303

1. Turbine
2. Drive case
3. Stator
4. Pilot
5. Stator shaft
6. Housing
7. PTO gear (drive)
8. Pump
9. Output shaft (Transmission input shaft)

Specifications
Model: TCA37-2A
Type: 3 element,1 stage,1 phase
Stall torque ratio: 3.37

FORWARD 3RD



U42303

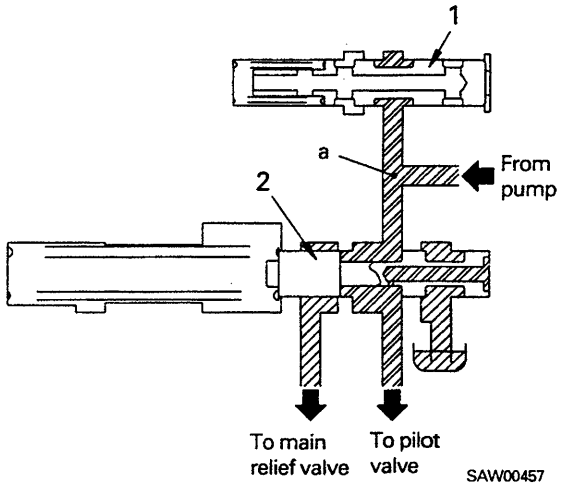
Operation

- In forward 3rd, forward clutch (8) and 3rd clutch (11) are engaged. The motive force from the torque converter transmitted to input shaft (9) is transmitted to output shaft (14).
- The clutch discs of forward clutch (8) and 3rd clutch (11) are held by the hydraulic pressure applied to the clutch piston.
- The motive force from the torque converter is transmitted from input shaft (9) via forward clutch (8) to forward gear (23), then to 1st and 3rd cylinder gear (32).
- Since 3rd clutch (11) is engaged, the motive force transmitted to 1st and 3rd cylinder gear (32) is transmitted from 3rd gear (27) via the 3rd clutch, then to output shaft (14) via 2nd and 4th shaft (17), idler gear (31) and output gear (34).

PRIORITY VALVE

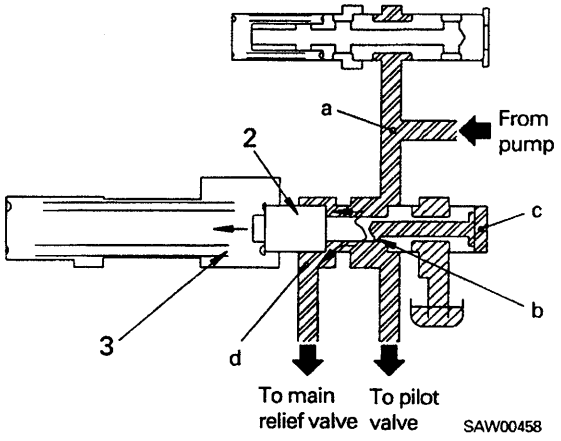
Function

- The priority valve regulates the pump's discharge pressure and provides the pilot oil pressure and parking brake release oil pressure.
- If the pressure in the circuit reaches a level above the measured oil pressure, the priority valve acts as a relief valve, releasing the pressure to protect the hydraulic circuitry.

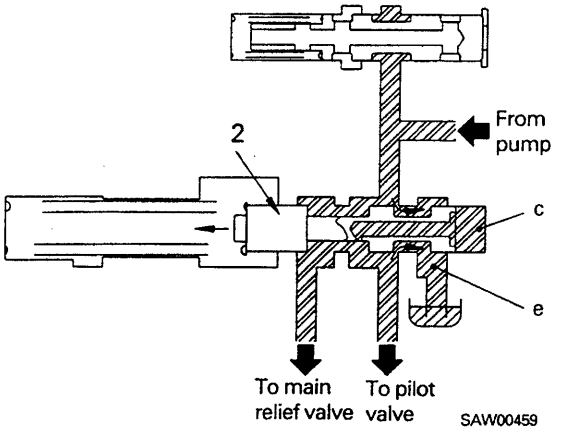


Operation

1. The oil from the pump enters port **a** and separates into the oil flowing to parking brake valve (1), priority valve (2) and the pilot circuit.



2. The oil at port **a** passes through priority valve (2) orifice **b** and flows to port **c**.
   When the oil pressure at port **c** overcomes the force of return spring (3), priority valve (2) moves to the left and the oil flows to port **d**.

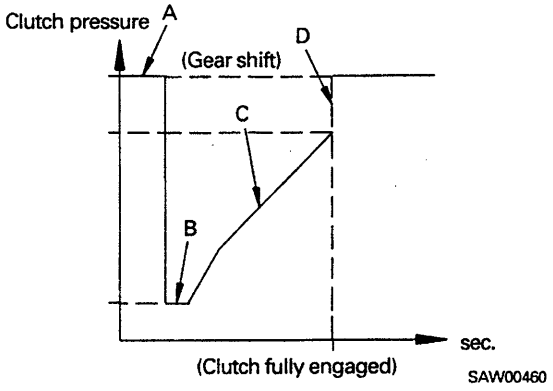


3. If the oil pressure at port **c** reaches a level above the measured value, priority valve (2) moves further to the left and is connected to the drain circuit from port **e**, protecting the hydraulic circuitry.

U42303

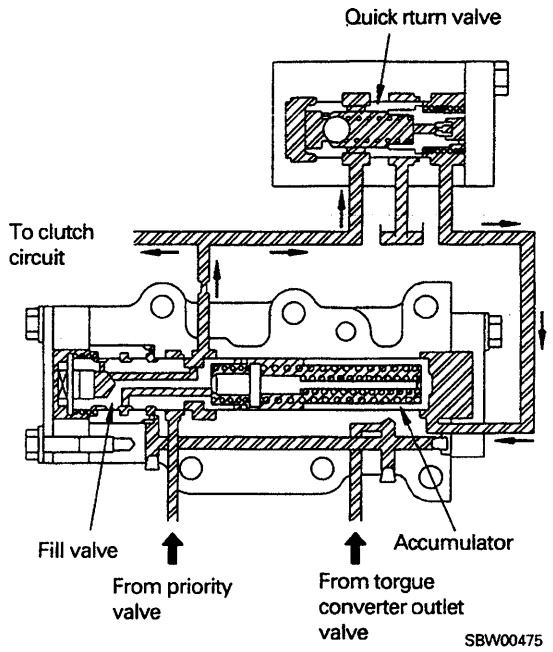
Function

- The modulation valve consists of a fill valve and an accumulator. It controls the pressure and flow of the oil flowing to the clutch and increases the clutch pressure.



Operation

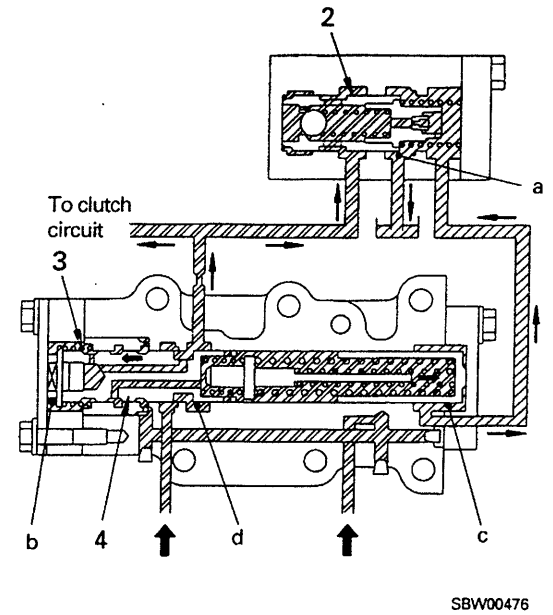
1. **The diagram shows the clutch fully engaged (point A).**



U42303

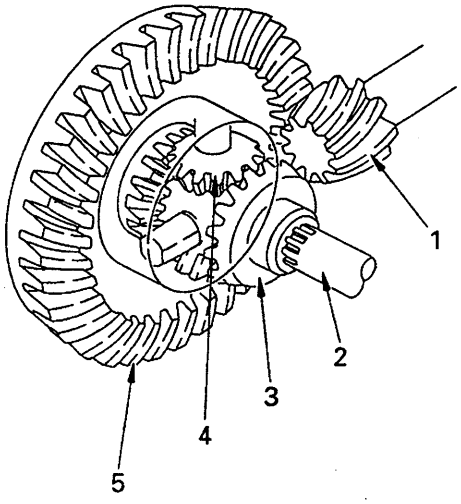
2. **When shifted from forward to reverse (point B)**

- When the directional lever is switched from forward to reverse, the pressure of the clutch circuit decreases while oil is filling the reverse clutch, so quick return valve (2) moves to the left.
- This causes, the oil in the accumulator to drain from quick return valve (2) port **a**. At this time, the pressure in chamber **b** and chamber **c** decreases, the force of spring (3) moves fill valve (4) to the left, and port **d** opens.



Outline

- The motive force from the engine is transmitted to the front and rear axles via the torque converter, the transmission and the propeller shaft.
- In the axle, the motive force is transmitted from bevel pinion (1) to bevel gear (5), shifted 90° and reduced, and transmitted to sun gear shaft (2) via pinion gear (4).
- The motive force of the sun gear is further reduced by planetary gear-type final drive, and transmitted to the axle shaft and wheel.

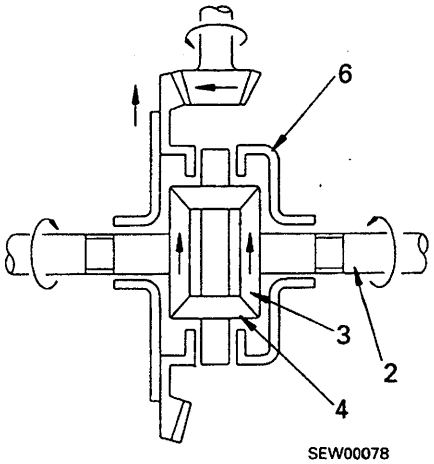


SEW00077

When moving straight forward

- When moving straight forward, the speed of rotation of the left and right wheels is equal, so pinion gear (4) in the differential assembly does not rotate, and the motive force of carrier (6) is transmitted equally to the left and right sun gear shafts (2) via the pinion gear (4) and side gear (3).

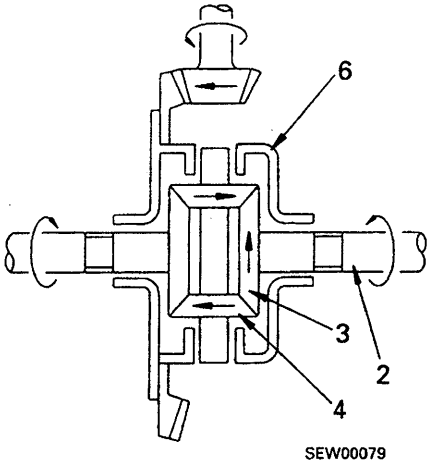
U42303



SEW00078

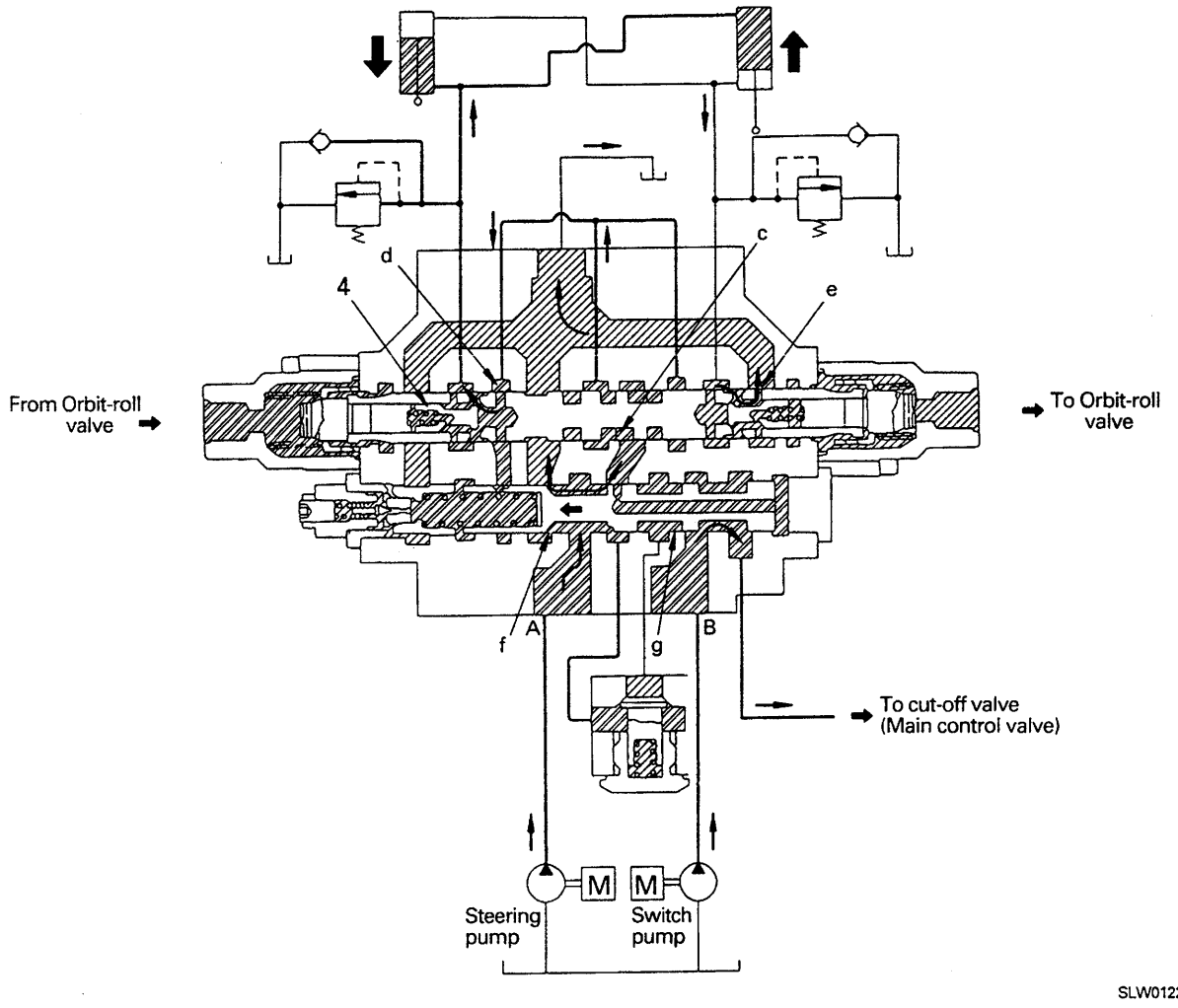
When slewing

- When slewing, the speed of rotation of the left and right wheels is unequal, so pinion gear (4) and side gear (3) in the differential assembly rotate according to the difference in the left and right rotation speeds, and the motive force of carrier (6) is transmitted to the sun gear shafts (2).



SEW00079

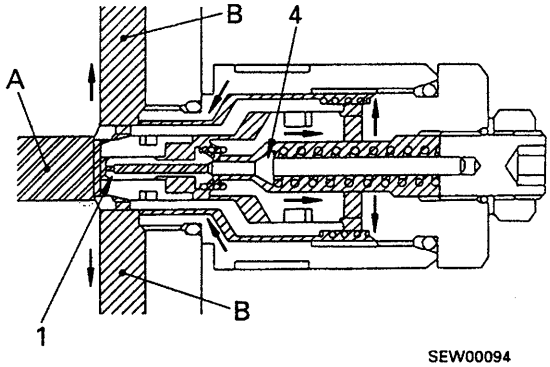
- Engine at high speed



U42303

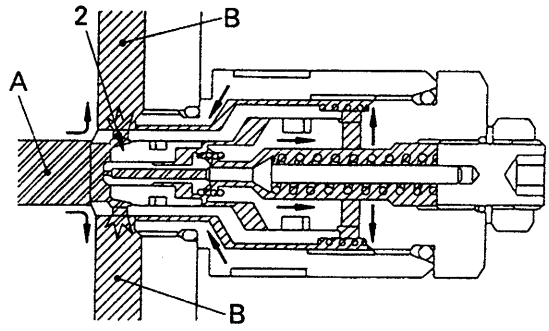
- The extra oil from the switch pump is not needed, so the steering pump pressure rises until notch (g) closes, and shuts off the merge passage at port **B**.
- The pressure difference on the two sides of notch (c) is controlled only by notch (f), so the excess oil from the steering pump is drained from notch (f) to the drain circuit (when this happens, notch (g) is completely closed).
- The oil from the steering pump passes through notch (c) and notch (d), pushes up load check valve (4), and flows to the cylinder. The oil returning from the cylinder passes through notch (e) and flows to the drain circuit.
- Notch (g) is closed, so the oil from the switch pump is sent from port **B** to the main control valve.

- When pilot poppet (4) opens, the pressure at the back of poppet (1) drops, so poppet (1) moves and is seated with pilot poppet (4).



SEW00094

- Compared with the pressure at port **A**, the internal pressure is low, so relief valve poppet (2) opens. When this happens, the oil flows from port **A** to port **B**, and prevents any abnormal pressure from forming.

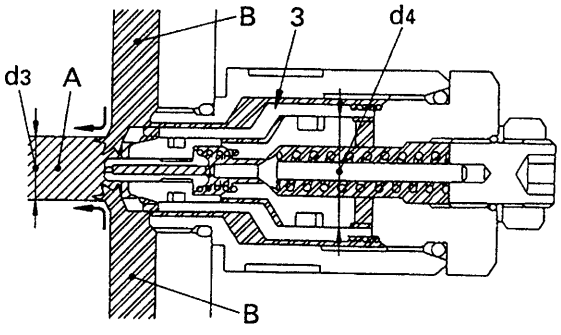


SEW00095

U42303

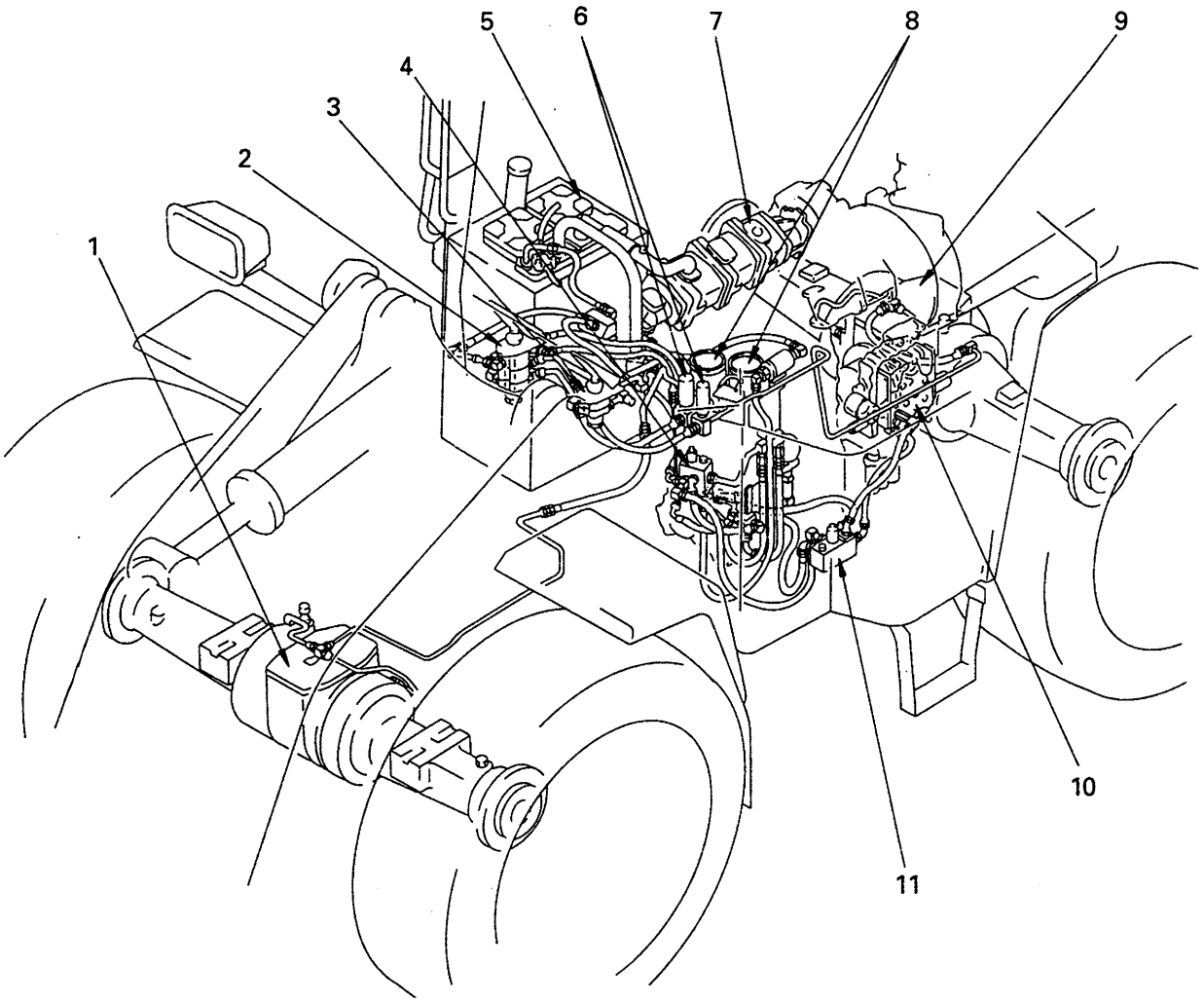
Acting as suction valve

- When negative pressure is formed at port **A**, the difference in area of diameters **d3** and **d4** causes check valve poppet (3) to open. When this happens, the oil from port **B** flows to port **A**, and prevents any vacuum from forming.



SEW00096

BRAKE PIPING



U42303

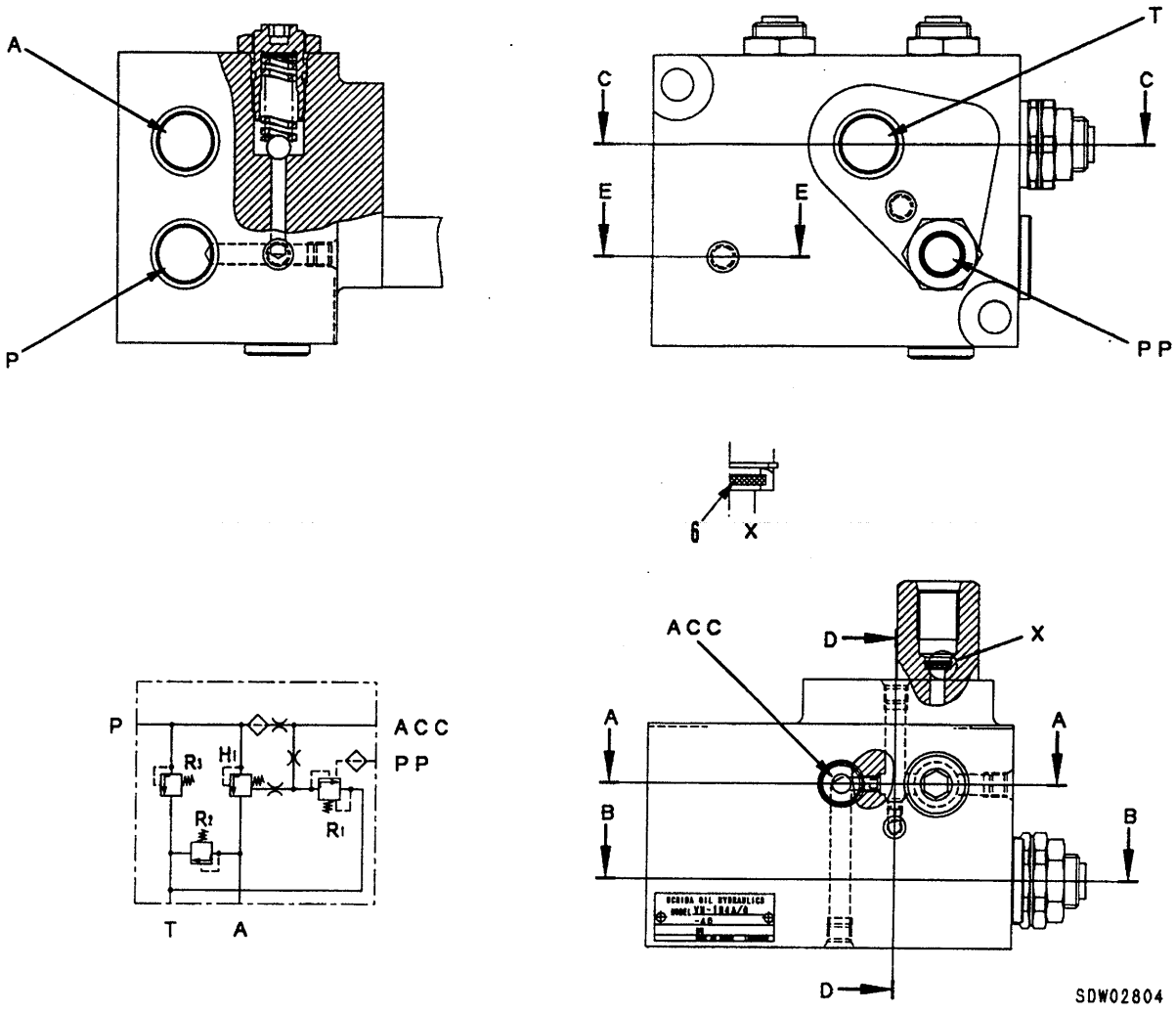
SBW00508

1. Front axle (with multi-disc brake)
2. Right brake valve
3. Left brake valve
4. Accumulator charge valve
5. Hydraulic oil tank
6. Accumulator
7. Hydraulic pump (series of four pumps)
8. Accumulator
9. Rear axle (with multi-disc brake)
10. Transmission valve
11. Emergency parking brake valve

Outline

- When the brake valve is activated, the oil sent from the pump passes through the accumulator charge valve, shuts off the drain circuit in the valve, actuates the piston, and activates the front and rear brakes.

Serial No. 50035 and up



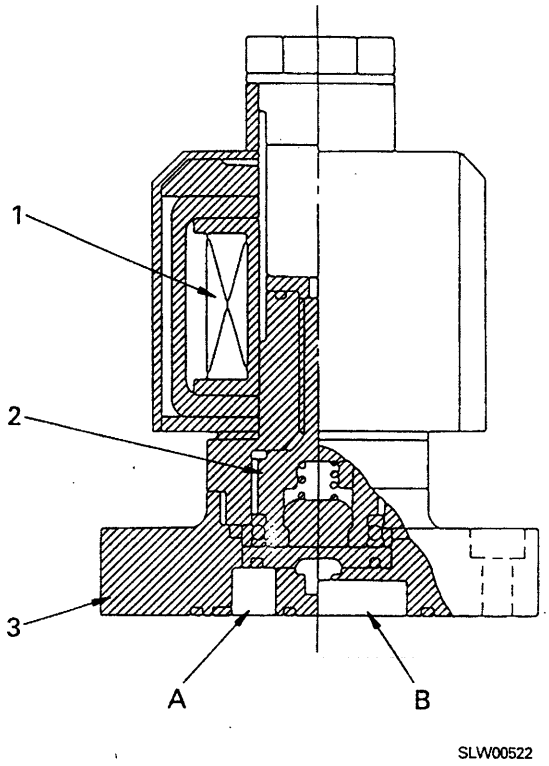
U42303

A. To PPC valve
ACC. To brake valve
PP. To brake valve
P. From pump
T. Drain

Function

- The accumulator charge valve is actuated to maintain the oil pressure from the pump at the specified pressure and to store it in the accumulator.
- When the oil pressure reaches the specified pressure, the oil from the pump is connected to the drain circuit to reduce the load on the pump.

PARKING BRAKE SOLENOID VALVE



1. Coil
2. Valve assembly
3. Body
A. IN port
B. OUT port

U42303

Function

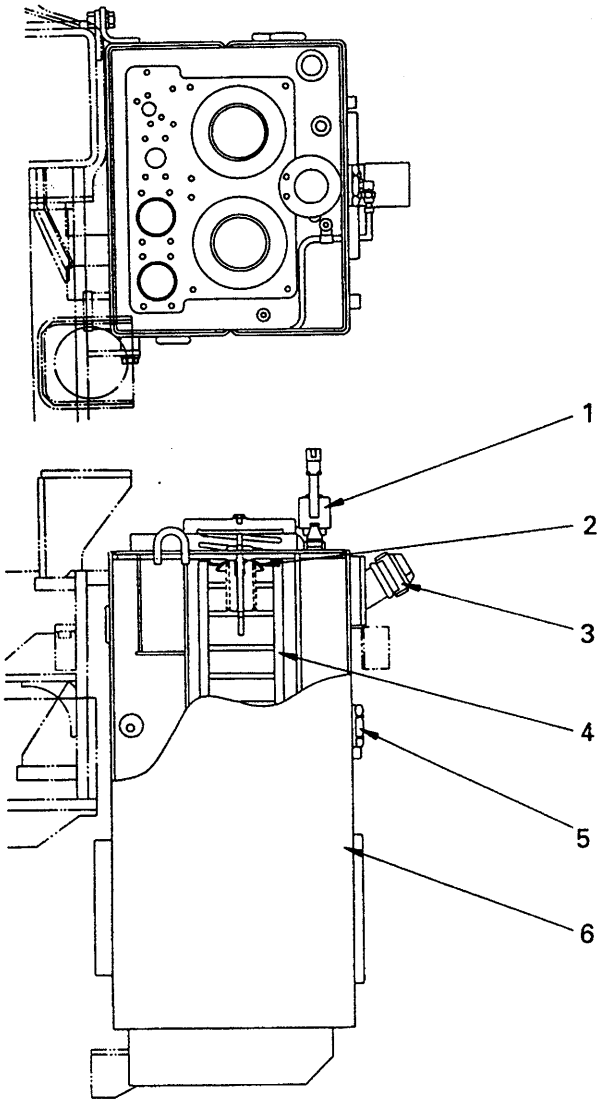
- This solenoid valve is controlled by the parking brake switch in the operator's compartment and acts to switch the flow of oil to the parking brake.

Operation

- **Parking brake applied**
  When the parking brake switch in the operator's compartment is turned ON, the solenoid valve is turned OFF (electric current is cut), and the oil in the pilot circuit from the transmission pump flows from the IN port to the OUT port and opens the drain circuit.

- **Parking brake released**
  When the parking brake switch in the operator's compartment is turned OFF, the solenoid valve is turned ON (electric current flows). The valve closes and the flow of oil in the pilot circuit to the drain circuit is shut off.

HYDRAULIC TANK

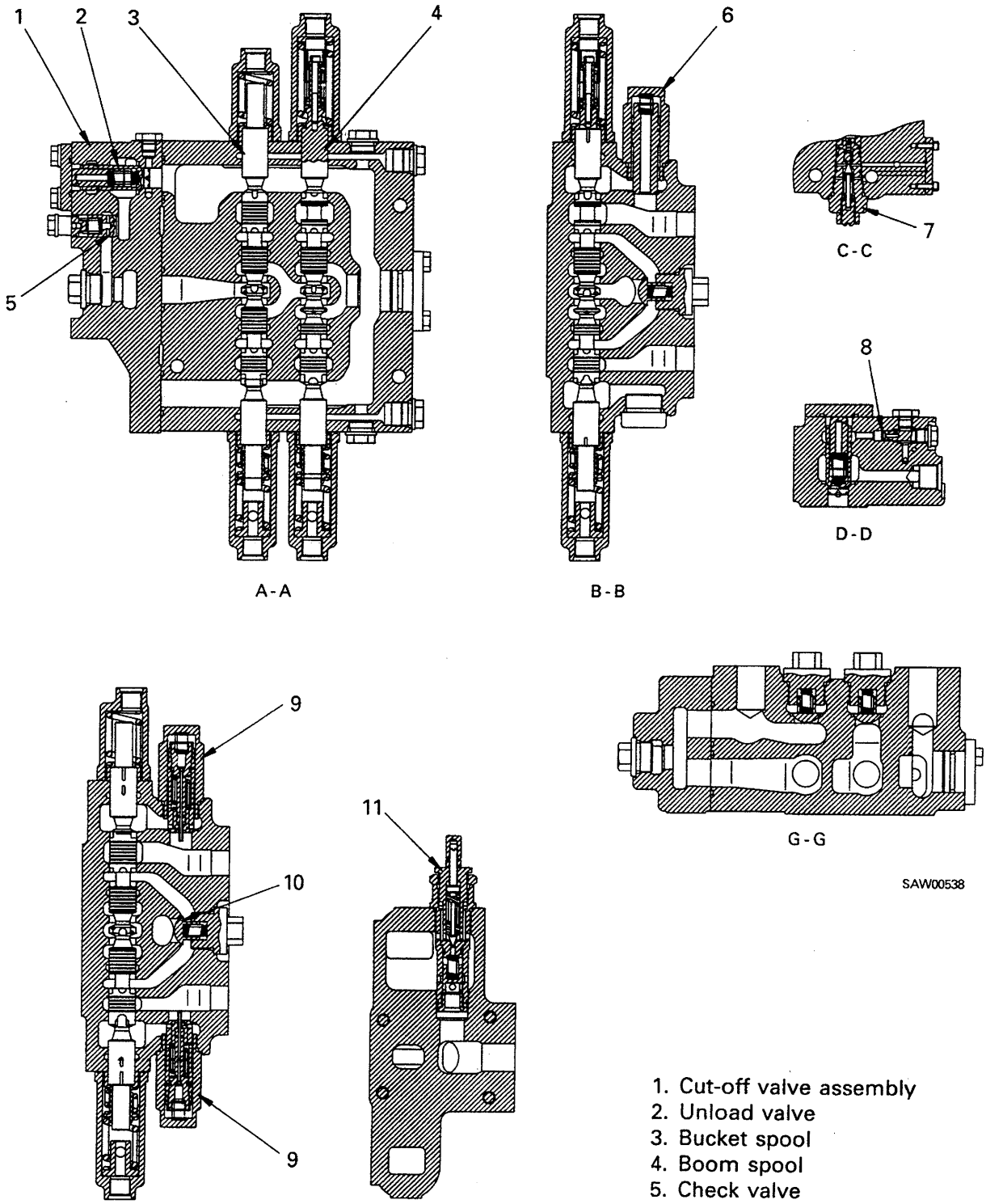


U42303

1. Breather
2. Filter bypass valve
3. Oil filler
4. Oil filter
5. Sight gauge
6. Hydraulic tank

Outline

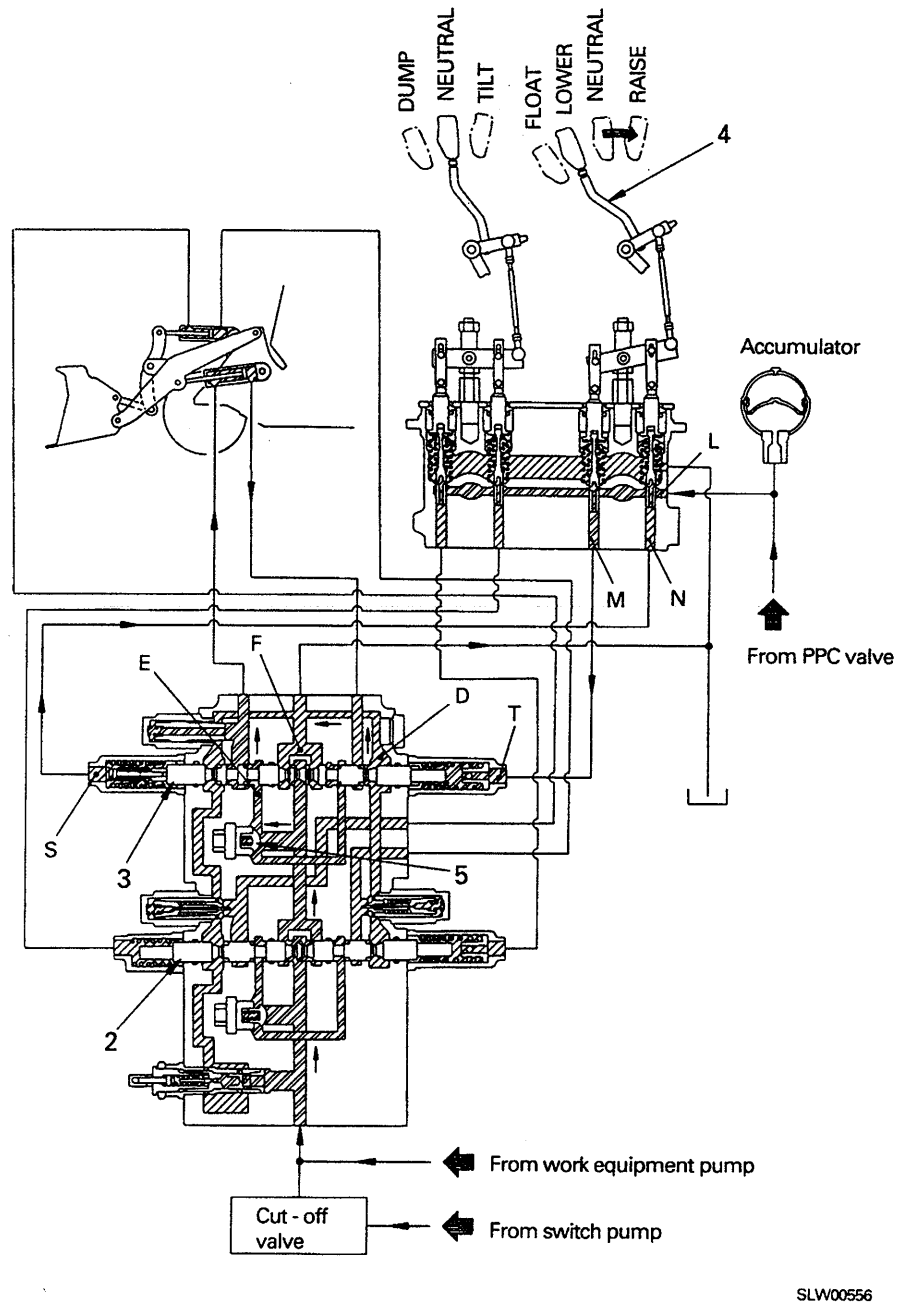
- The oil sent to the cylinders from the hydraulic tank via the pump and through the work equipment control valve merges with the oil of the various parts in the return circuit. Some of this oil is cooled by the oil cooler, flows into the tank, is filtered by oil filter (4), and returns to hydraulic tank (6).
- Oil filter (4) is of a type which filters all the oil in the circuit. If the oil filter is clogged, the filter bypass valve is activated, preventing the oil from returning directly to the tank and causing damage to the oil filter. In addition, the filter bypass valve is also activated when a vacuum is generated in the circuit.



U42303

1. Cut-off valve assembly
2. Unload valve
3. Bucket spool
4. Boom spool
5. Check valve
6. Suction valve
7. Cut-off relief valve
8. Screen
9. Safety valve (with suction)
10. Check valve
11. Main relief valve

BOOM SPOOL AT LOWER POSITION

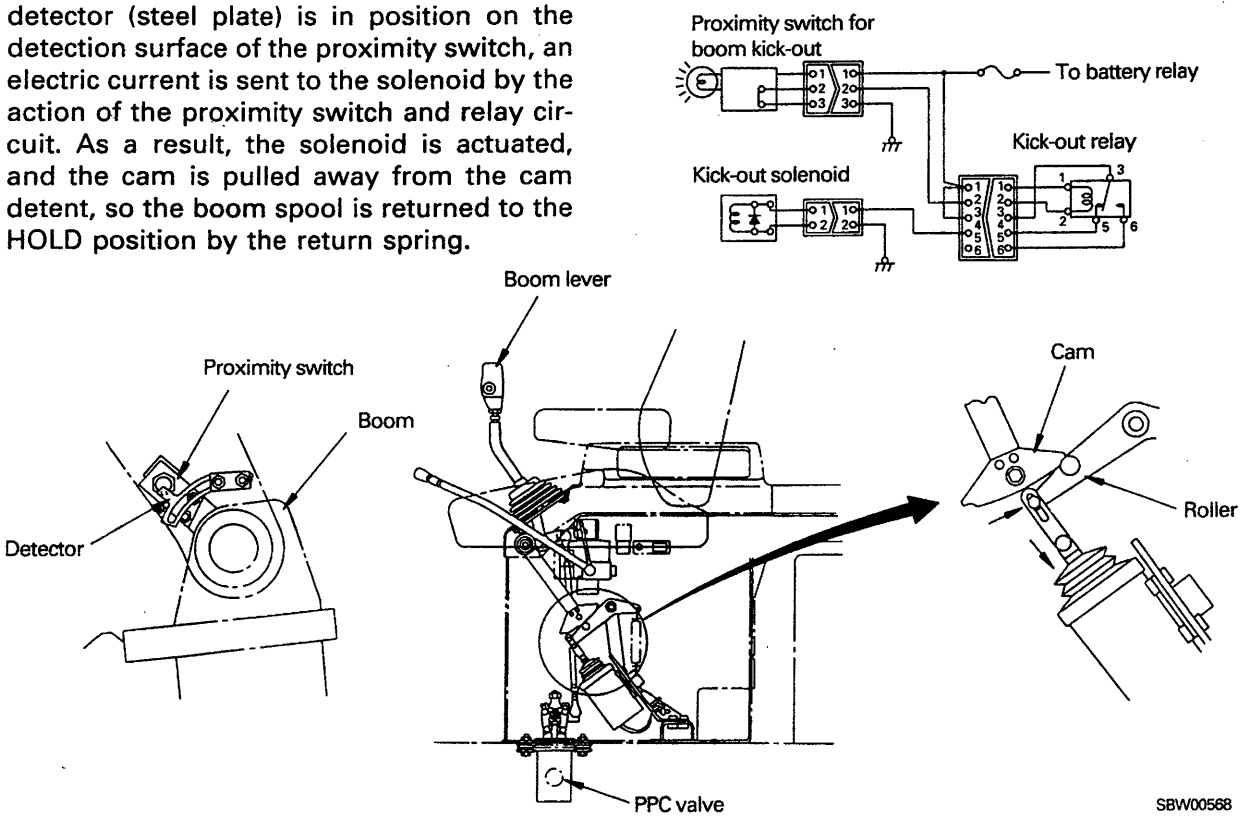


U42303

Operation

- When boom lever (4) is pushed, oil flows from PPC valve port **L** to port **M** and port **T**, and the oil at port **S** flows to the drain circuit. The oil pressure at port **T** pushes boom spool (3) and sets it to the LOWER position.
- The oil from the pump passes through the bucket spool (2) bypass circuit and flows to the boom spool (3) bypass circuit. The bypass circuit is closed by boom spool (3), so the oil pushes open check valve (5). The oil from check valve (5) flows to port **E** and to the cylinder rod side.
- The oil on the cylinder bottom side enters drain port **F** from port **D** and returns to the tank, causing the boom to lower.

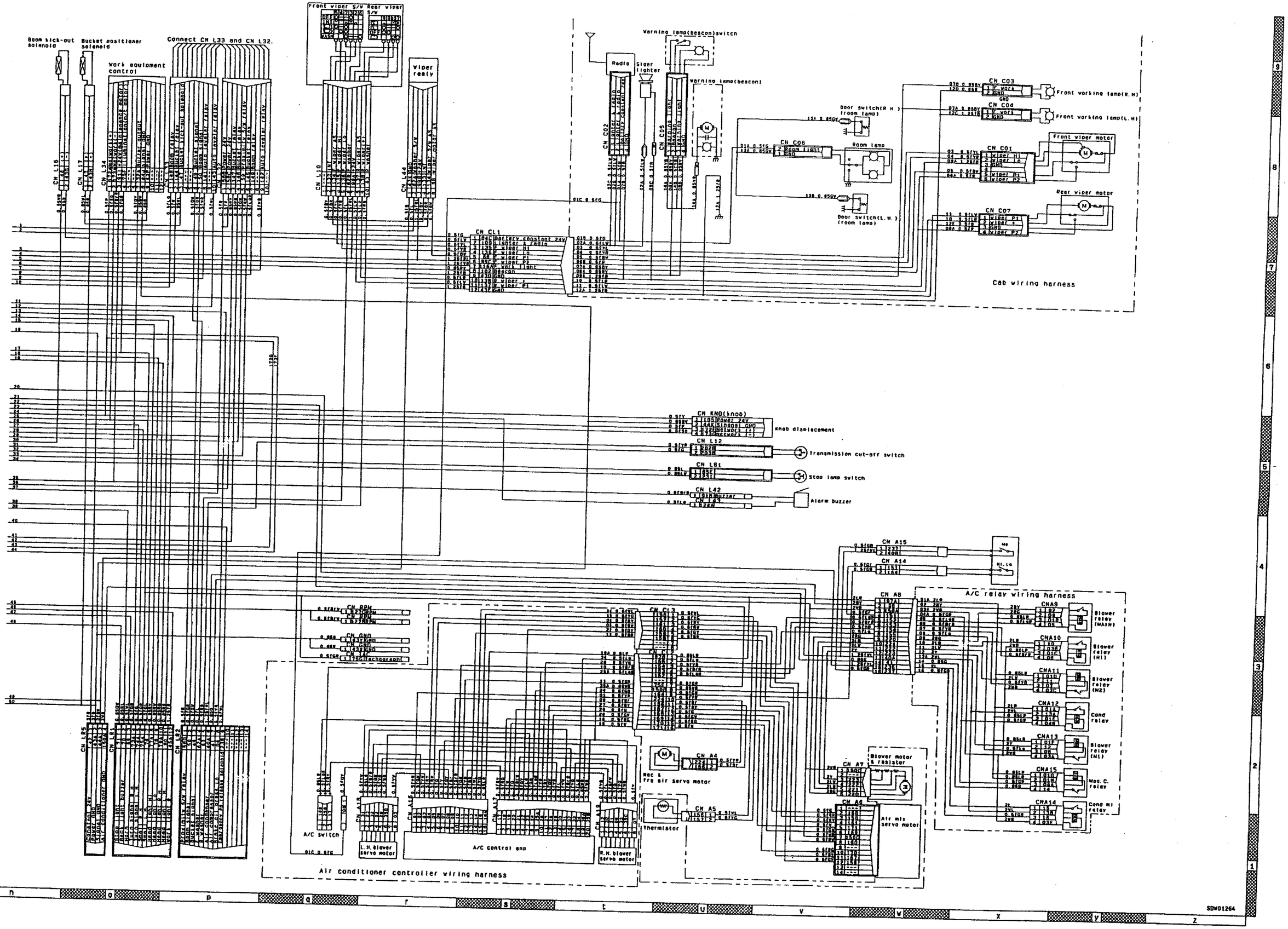
- When the boom rises and reaches the set position for the kick-out, in other words, the detector (steel plate) is in position on the detection surface of the proximity switch, an electric current is sent to the solenoid by the action of the proximity switch and relay circuit. As a result, the solenoid is actuated, and the cam is pulled away from the cam detent, so the boom spool is returned to the HOLD position by the return spring.



U42303

Action of proximity switch

Position	When detector is in position at detection surface of proximity switch	When detector is separated from detection surface of proximity switch
Proximity switch actuation display	Lights up	Goes out
Proximity switch load circuit (relay switch circuit)	Current flows	Current is shut off
Relay switch load circuit (solenoid circuit)	Current flows	Current is shut off


Boom kick-out solenoid
Bucket positioner solenoid
Work equipment control
Connect CN L33 and CN L32.
Front wiper S/V
Rear wiper S/V
Wiper relay
Warning lamp(beacon)switch
Radio
Siger lighter
Warning lamp(beacon)
Door switch(R.H.) (from lamp)
Door switch(L.H.) (from lamp)
Room lamp
Front working lamp(R.H)
Front working lamp(L.H)
Front wiper motor
Rear wiper motor
Cab wiring harness
Knob displacement
Transmission cut-off switch
Stop lamp switch
Alarm buzzer
A/C relay wiring harness
Blower relay (MAIN)
Blower relay (HI)
Blower relay (M2)
Cond relay
Blower relay (M1)
Mag.C. relay
Cond M1 relay
Blower motor & resistor
Air mix servo motor
Rec & fre air servo motor
Thermistor
A/C switch
L.H. blower servo motor
A/C control and
R.H. blower servo motor
Air conditioner controller wiring harness
SDW01264

U42303

MAIN MONITOR DISPLAY FUNCTION

Display category	Symbol	Display item	Display range	Display method
Check	CHECK	Check	When there is abnormality display on maintenance monitor	Display flashes (for details, see MAINTENANCE MONITOR DISPLAY FUNCTION)
Caution		Emergency steering actuated	When actuated	Display flashes
	CAUTION	Caution	Parking brake actuated, transmission not at neutral	Display flashes and buzzer sounds
			When there is abnormality display on maintenance monitor	Display flashes (buzzer may also sound) (for details, see MAINTENANCE MONITOR DISPLAY FUNCTION)
Pilot		Hi beam	When operated	Display lights up
	◁ ▷	Turn signal (left, right)	When operated	Display lights up
	Parking brake (P)	Parking brake	When operated	Display lights up Buzzer sounds when parking brake is applied and shift lever is not at N
		Emergency steering normal	When normal (oil is flowing in hydraulic circuit)	Display lights up
		Preheating	When preheating	Lights up Lighting up time changes according to engine water temperature when starting switch is turned ON (for details, see PREHEATING OUTPUT FUNCTION)
Speedo-meter	88	Travel speed	0 – 99 km/h	Digital display (display switches between tachometer and speedometer)
Shift indicator		Shift indicator	1 – 4,N	Digital display
Failure action code	8.8.8.8	Failure action code	When controller detects failure and action by operator is needed, CALL is displayed, or CALL and E □ □ (action code) are displayed in turn	Digital display Buzzer sounds (For details of the travel data display mode, see TROUBLE DATA DISPLAY MODE)

U42303

REMOTE POSITIONER FUNCTION

1. Boom RAISE/LOWER position stop

- The controller always detects the direction of operation of the lever from the pressure switch installed to the boom PPC valve and the angle (position) of the boom from the boom angle potentiometer.
  1) RAISE kick-out (RAISE lamp ON)
     When the boom lever is placed in the RAISE detent and the boom rises to the set position, it slows down and then stop, and at the same time, the detent is released. If the boom is at any position other than the RAISE detent, it will rise as normal.

  2) LOWER boom stop (LOWER lamp ON)
     If the boom lever is placed at the FLOAT or LOWER position and the boom goes down to the set position, it will slow down and stop. If the lever is placed at HOLD, the boom will stay stopped. If the lever is moved back slightly, the boom will go down again.
     The RAISE position (which the operator can set to the desired position) and the LOWER stop position differ according to the model. For details, see Table 1.

Table 1

Stop position / Model	RAISE	LOWER
WA320-3	0° – 44.8°	–27°
WA380-3	0° – 40.5°	–27°
WA420-3	0° – 39°	–26°
WA470-3	0° – 38°	–26°

The setting of the control can be changed in the order given below by pressing the mode positioner RAISE/LOWER selector switch. When the lamp is lighted up, the boom will automatically stop at that position.

①	→ ②	→ ③	→ ④
RAISE ●	RAISE ○	RAISE ●	RAISE ○
LOWER ○	LOWER ●	LOWER ●	LOWER ○

Lamp ON : ● Lamp OFF : ○

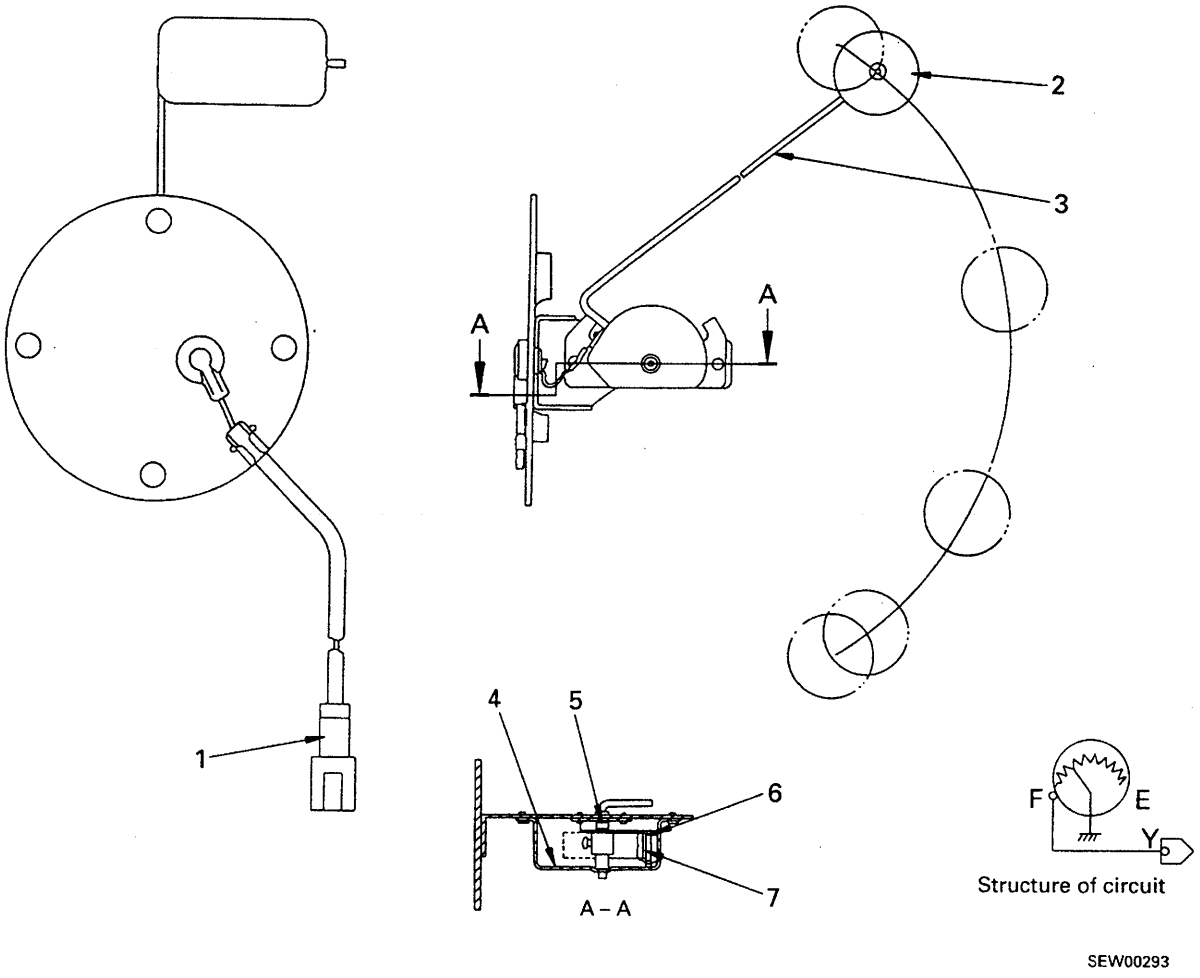
2. Setting remote positioner (setting RAISE stop position)

When the RAISE lamp is ON, set the stop position as desired. The setting position is retained even when the key is turned OFF.

1) Setting stop position
   i) Operate the boom lever to decide the position (above horizontal), then return the lever to the neutral.
   ii) Press the remote positioner set switch.
   iii) The RAISE lamp will go out and the remote positioner set lamp will flash. (2.5 sec)
   iv) When the remote positioner set lamp goes out and the RAISE lamp lights up, the stop position is written to memory.
2) Setting horizontal stop position
   i) Operate the boom lever to move the boom to a position above horizontal, then return the lever to the neutral.
   ii) Press the remote positioner set switch.
   iii) The RAISE lamp will go out and the remote positioner set lamp will flash.
   iv) While the lamp is flashing, press the remote positioner set switch.
   v) The remote positioner set lamp goes out immediately and the RAISE lamp lights up, and the horizontal angle is set. (This horizontal angle is the standard for the machine, so the work equipment may not necessarily be horizontal to the ground for reasons such as the weight of the work equipment or the angle of the machine.)

U42303

FUEL LEVEL SENSOR



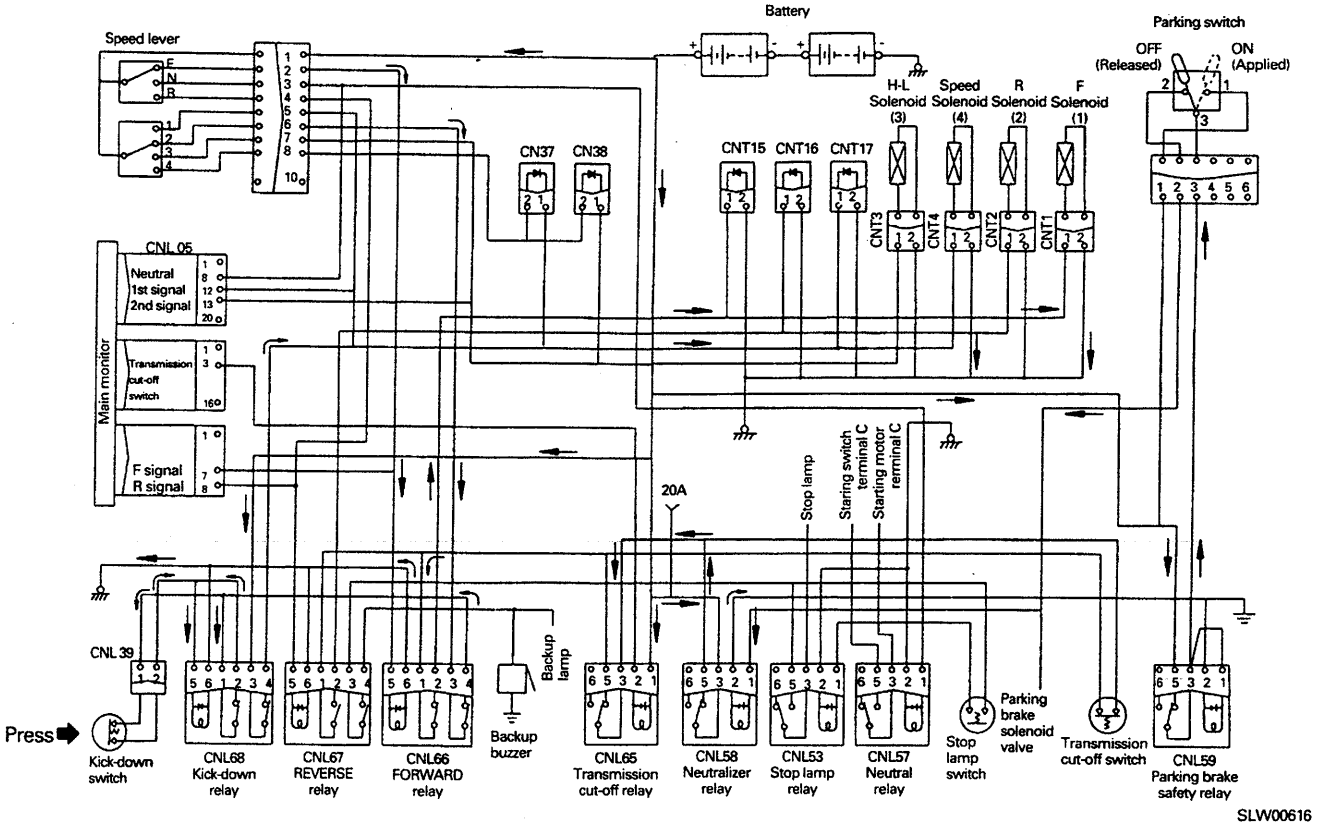
U42303

1. Connector
2. Float
3. Arm
4. Body
5. Spring
6. Contact
7. Spacer

Function

- The fuel level sensor is installed to the side face of the fuel tank. The float moves up and down as the level of the fuel changes. As the float moves up and down, the arm actuates a variable resistance, and this sends a signal to the maintenance monitor to display the fuel level. When the display on the maintenance monitor reaches the specified level, the warning lamp flashes.

Kick-down switch operated
(When operating or traveling in F2)
(When kick-down switch is pressed ON)



U42303

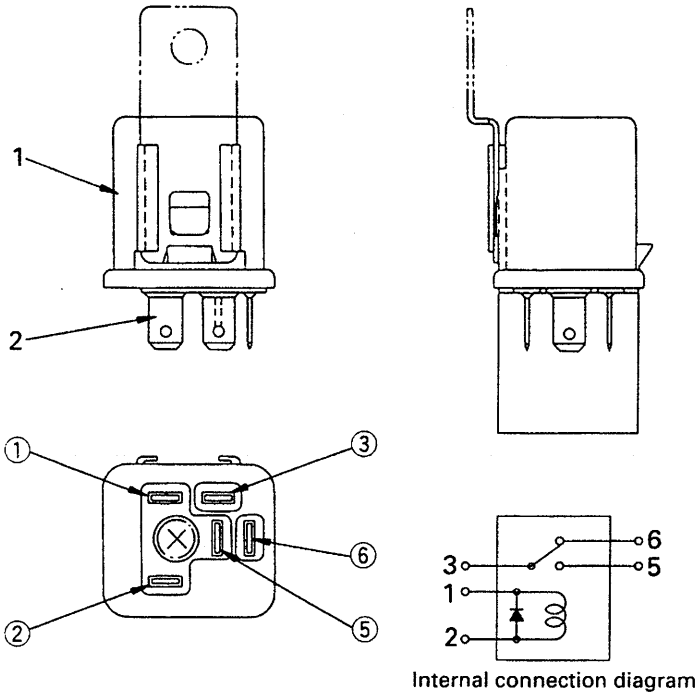
- When the kick-down switch is pressed, electric current flows from the battery ⊕ → speed lever 2 → FORWARD relay terminal 3 – 4 → kick-down switch → kick-down relay terminal 5 – 6 → ground.
  As a result, the kick-down is actuated, and kick-down relay terminals 1 and 2 and terminals 3 and 4 are closed. A circuit from kick-down relay terminal 1 – 2 → kick-down relay terminal 5 – 6 → ground is formed, so the kick-down relay continues to be actuated even if the kick-down switch is returned. (Self-hold circuit of kick-down relay)
- When the kick-down relay is actuated and terminals 3 and 4 are closed, electric current flows from the battery ⊕ → kick-down relay terminal 3 – 4 → solenoid 4 → ground, and solenoid (4) is actuated. Solenoids (1) and (4) are actuated, so the transmission is set to **F1**.

In this way, if the kick-down switch is pressed when the speed lever is at **F2**, the transmission will shift to **F1**. At the same time, it will be held in **F1** by the self-hold function of the kick-down relay even when the kick-down switch is released. However many times the kick-down switch is pressed, the transmission will stay in **F1**.

Solenoid actuation table

Solenoid		F1	F2	F3	F4	N	R1	R2	R3	R4
FORWARD	(1)	●	○	○	○					
REVERSE	(2)						○	○	○	○
H-L select	(3)			○	○				○	○
Speed select	(4)	●			○		○			○

PARKING SAFETY RELAY
NEUTRALIZER RELAY



Internal connection diagram

Relay actuation table

Terminal No. / Current between 1 and 2	3	5	6
ON	○—○		
OFF	○		○

U42303

1. Case
2. Base

SEW00321

STANDARD VALUE TABLE FOR ENGINE

Machine model			WA380-3	
Engine			S6D108	
Item	Measurement conditions	Unit	Standard value	Permissible value
Engine speed	High idling	rpm	2,450 ± 50	2,450 ± 100
	Low idling		760^{+50}_{0}	760^{+100}_{-50}
	Rated speed		2,200	2,200
Exhaust temperature (Turbine inlet temp.)	All speed (intake air temp. 20°C)	°C	Max.650	700
Intake resistance	At rated output	mmHg	950 – 1,200	750
Exhaust gas color	At sudden acceleration	Bosch index	Max. 5.5	7.5
	At high idling		Max. 1.0	2.0
Valve clearance (cold)	Intake valve	mm	0.34	—
	Exhaust valve		0.66	—
Compression pressure (SAE30 oil)	Oil temperature: 40 – 60°C (engine speed: 250 – 300 rpm)	MPa (kg/cm²)	Min. 2.9 (Min. 30)	2.4 (24)
Blowby pressure (SAE30 oil)	At rated output (Water temperature: Operating range)	mmH_2O	Max. 80	160
Oil pressure	(Water temperature: Operating range) At high idling (SAE30)	MPa (kg/cm²)	0.29 – 0.49 (3.0 – 5.0)	0.21 (2.1)
	At low idling (SAE30)		Min. 0.12 (Min. 1.2)	0.07 (0.7)
	At high idling (SAE10W)		0.25 – 0.44 (2.5 – 4.5)	0.18 (1.8)
	At low idling (SAE10W)		Min. 0.1 (Min. 1.0)	0.07 (0.7)
Oil temperature	Whole speed range (inside oil pan)	°C	90 – 110	120
Fuel injection timing	Before top dead center	° (degree)	22 ± 1	22 ± 1
Fan belt tension	Deflection when pressed with finger force of approx. 6 kg. (Alternator pulley – Fan pulley)	mm	5 – 10	5 – 10

U42303

ADJUSTING VALVE CLEARANCE

1. Lift and remove the engine hood.
2. Disconnect the two dust indicator wires (1), then disconnect intake connector (2).
3. Remove air cleaner assembly (3).
4. Remove intake connector (4), then remove cylinder head cover (5).
5. Turn the crankshaft forward, watch the function of the 6th cylinder's intake valve, and line up the "1.6TOP" line (6) on the crank pulley with the pointer (7).
6. If the 1st cylinder is at the upper compression dead point, adjust the valves indicated with "●" in the valve layout table, then turn the crankshaft 360° in the forward direction and adjust the valves indicated with "○".

★ Valve arrangement

Cylinder no.	1	2	3	4	5	6
Intake valve	●	●	○	●	○	○
Exhaust valve	●	○	●	○	●	○

To adjust, insert filler gauge **F** between locker lever (8) and valve stem (9), adjust the adjust screw (10) so that it turns gently, then tighten locknut (11).

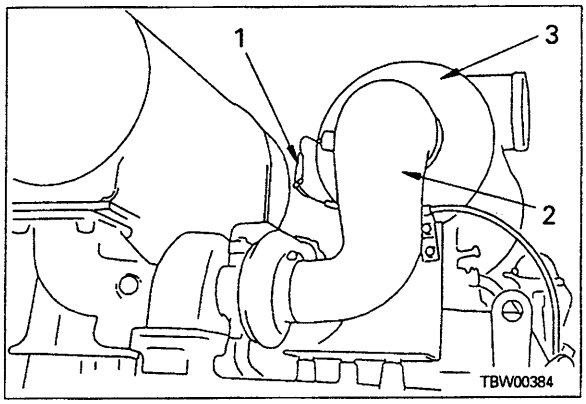
- Valve clearance (when cold)
  Intake side: 0.34
  Exhaust side: 0.66

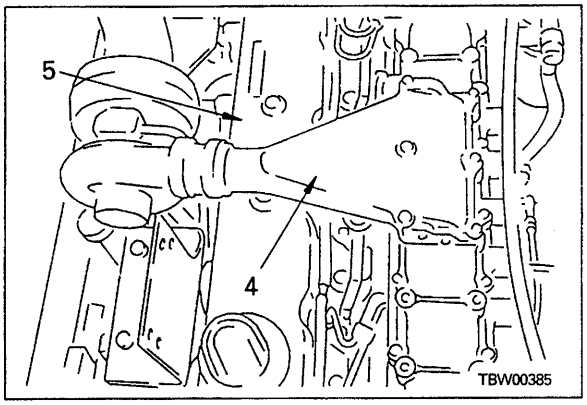
kgm Locknut: **44.1 ± 4.9 Nm (4.5 ± 0.5 kgm)**

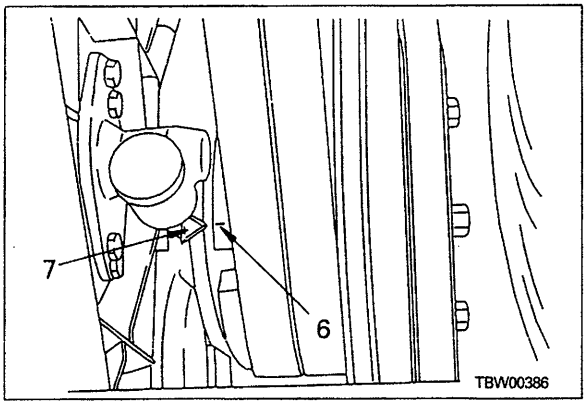
★ Set the 1st cylinder to the upper compression dead point, adjust the 1st cylinder, turn 120°, and adjust the valve clearance for all cylinders in this way in the order of ignition.

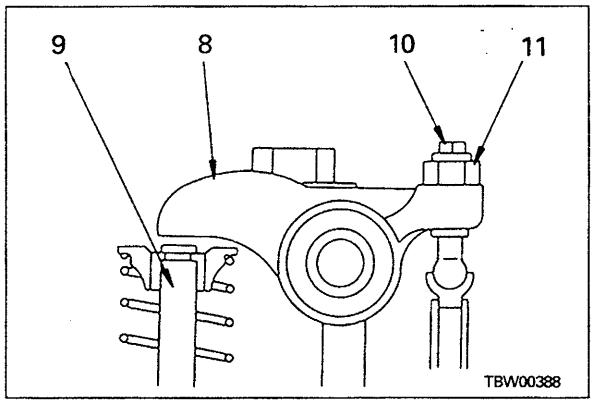
- Order of ignition: 1 - 5 - 3 - 6 - 2 - 4

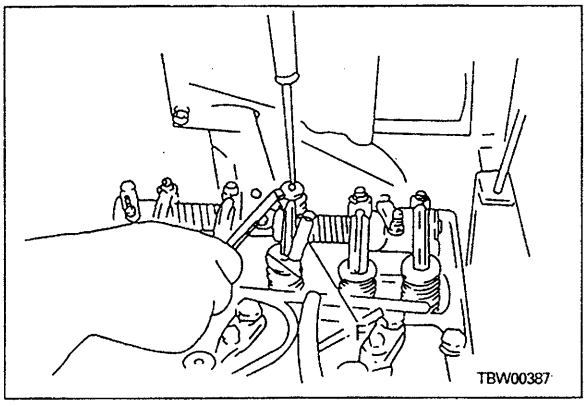
★ After tightening the locknut, check the valve clearance once again.









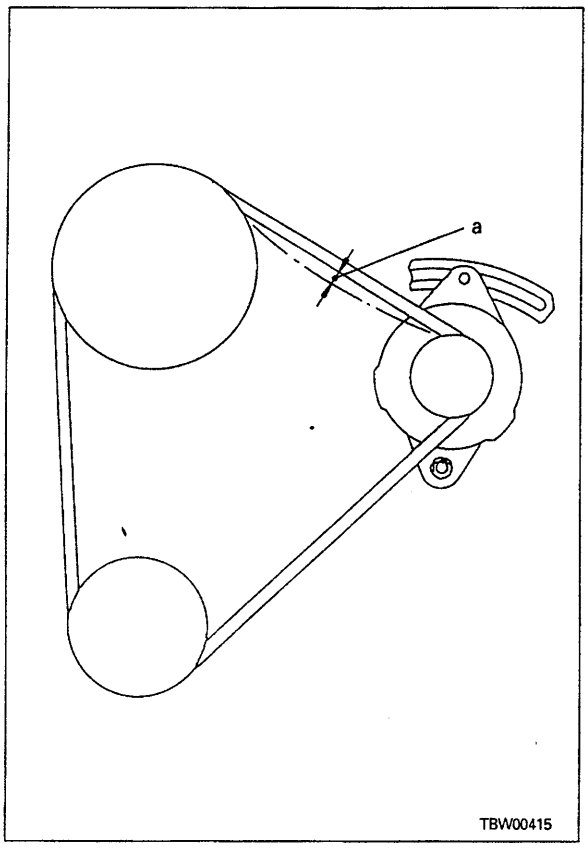


U42303

TESTING AND ADJUSTING FAN BELT TENSION

Testing the fan belt tension

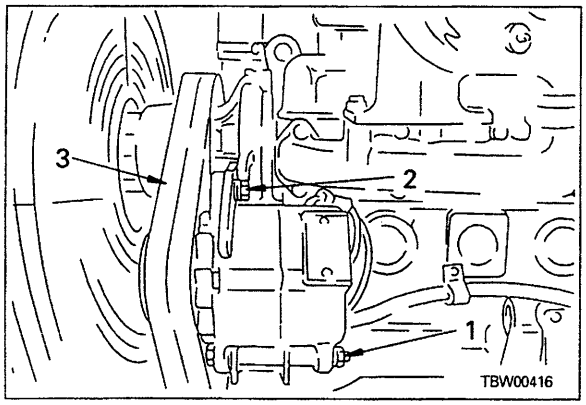
1. Apply a force of approximately 6 kg to the fan belt midway between the fan pulley and alternator pulley and check its deflection "**a**".
   - Belt deflection **a** : 5 to 10 mm



U42303

Adjusting the fan belt tension

1. Loosen the alternator assembly installation bolt and nut (1) and belt tension adjustment bolt (2).
2. Move the alternator using a pipe, etc., check the belt (3) tension, then first tighten the adjustment nut, then the alternator installation bolt.



METHOD OF OPERATING EMERGENCY MANUAL SPOOL

Outline

The transmission valve is controlled electrically, but if there should be any failure in the electrical system, or if there is any failure in the solenoid valve or spool and the machine cannot move, it is possible to operate the emergency manual spool to move the machine.

⚠ This operation of the spool is designed only for use if the machine cannot be moved because of a failure in the transmission control, and it is necessary to move the machine from a dangerous working area to a safe place where repairs can be carried out.
This spool must not be operated except when there has been a failure.

⚠ When carrying out this operation, keep strictly to the order of operation and pay careful attention to safety when moving the machine.

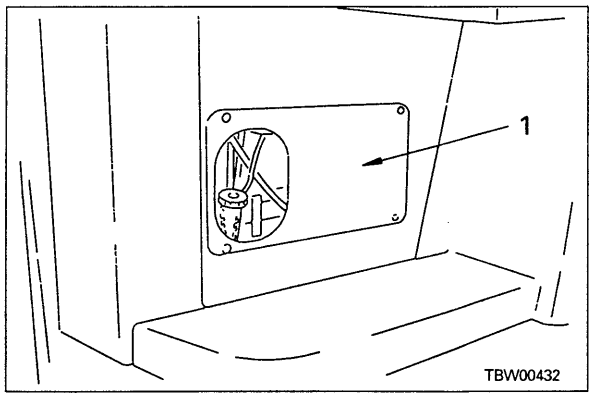
⚠ To prevent the machine from moving, lower the bucket to the ground, apply the parking brake, and put blocks under the tires.

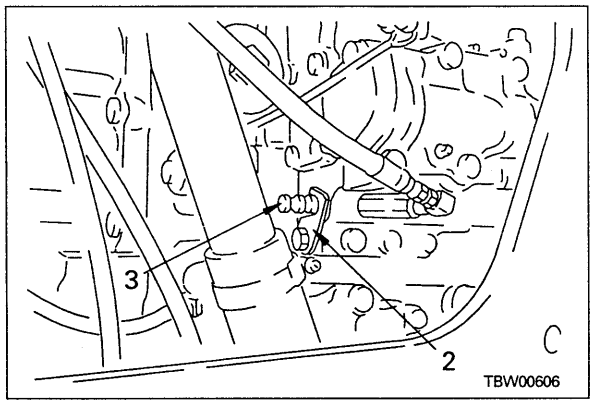
⚠ Always stop the engine before operating the spool.

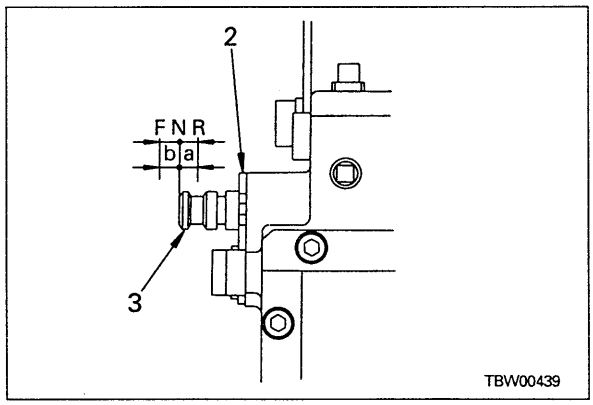
1. Remove cover (1) from the left side of the rear frame.

2. Remove lock plate (2) from emergency manual spool (3) of the transmission valve.
   ★ The lock plate can be removed simply by loosening the mounting bolts.

3. Operate emergency spool (3) to the operating position according to the direction of movement of the machine (forward or reverse).
   - REVERSE: Push in the spool until it enters the detent.
     a = Approx. 8 mm
   - FORWARD: Pull the spool until it enters the detent.
     b = Approx. 8 mm







U42303

MEASURING BRAKE PERFORMANCE

★ **Measurement conditions**
- Road surface: Flat, horizontal, dry paved surface
- Travel speed: 20 km/h when brakes are applied
- Delay in applying brakes: 0.1 sec
- Tire inflation pressure: Specified pressure

Measurement method

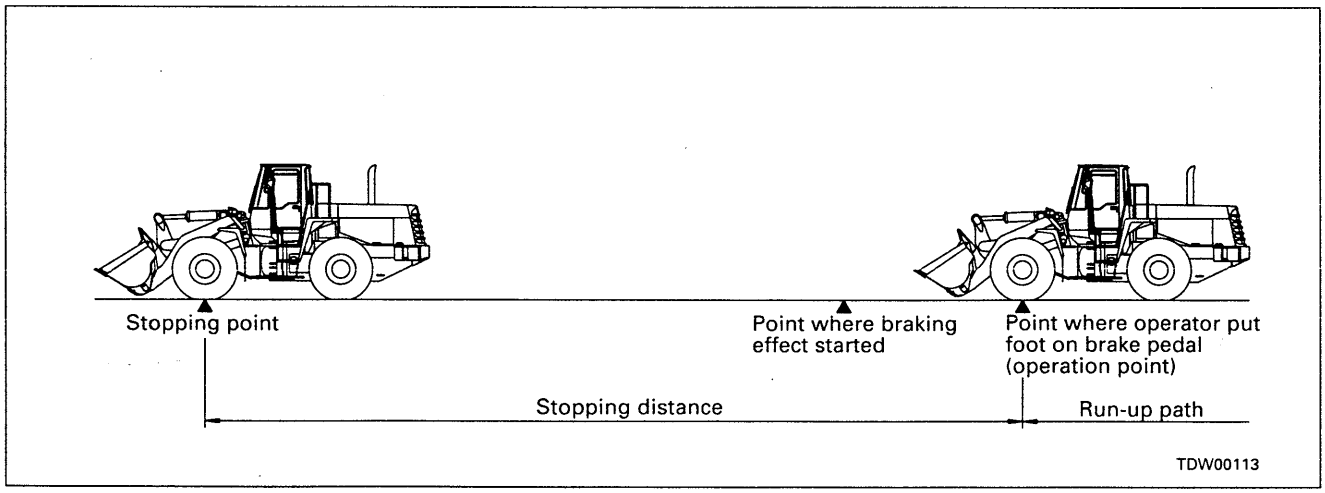
1. Start the engine and move the machine.

2. Set the speed lever to the highest speed position and drive the machine.

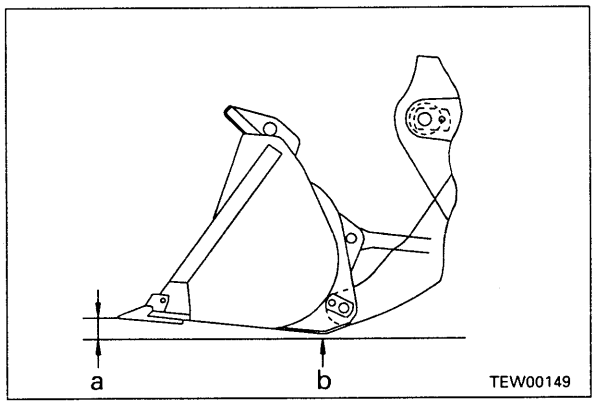
3. When the travel speed reaches 20 km/h, depress the left brake pedal with the specified operating force.
   Specified operating force: **265N (27 kg)**
   ★ Before carrying out this operation, determine the run-up path and the point for applying the brakes, then apply the brakes when the machine reaches that point.
   ★ Switch the transmission cut-off switch ON when carrying out this operation.

4. Measure the distance from the point where the brakes were applied to the point where the machine stopped.
   ★ Repeat this measurement three times and take the average.

U42303



MEASURING WORK EQUIPMENT HYDRAULIC PRESSURE



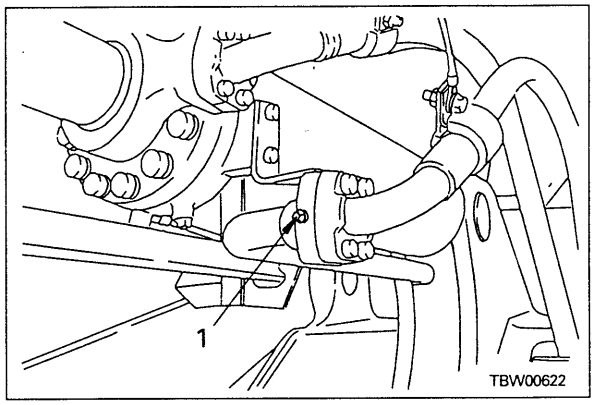
★ **Measurement conditions**
- Engine water temperature: Within green range on engine water temperature gauge
- Hydraulic oil temperature: 45 – 55°C
- Engine speed: High idling

Work equipment relief valve pressure measuring procedure

★ Raise bucket tip "**a**" 30 to 50 mm and ground the bucket at point "**b**", then stop the engine.

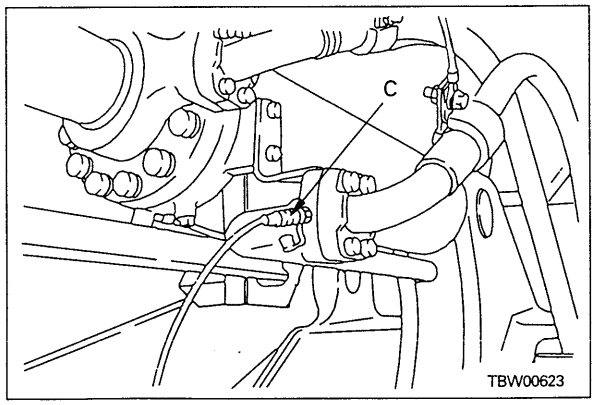
★ After operating the levers, check that both points "**a**" and "**b**" on the bottom of the bucket are touching the ground.

⚠ Loosen the oil supply cap to release the pressure inside the hydraulic oil tank, then operate the control levers two or three times to release any pressure remaining in the piping.



1. Remove bucket cylinder circuit oil pressure measuring plug (1).

2. Install hydraulic test kit **C** to the measuring port.
   ★ Check that there is no oil leakage from any joints.
   ★ Use a hose which is long enough to reach the operator's seat.



3. Start the engine, raise the boom about 400 mm, tilt back the bucket using the control lever, and measure the pressure when the relief valve is activated.

   ★ Be careful not to apply any sudden pressure to the pressure gauge.

⚠ When removing the hydraulic pressure gauge, release the pressure inside the circuit in the same way as when it was installed.

U42303

ADJUSTING BOOM, BUCKET ANGLE POTENTIOMETER

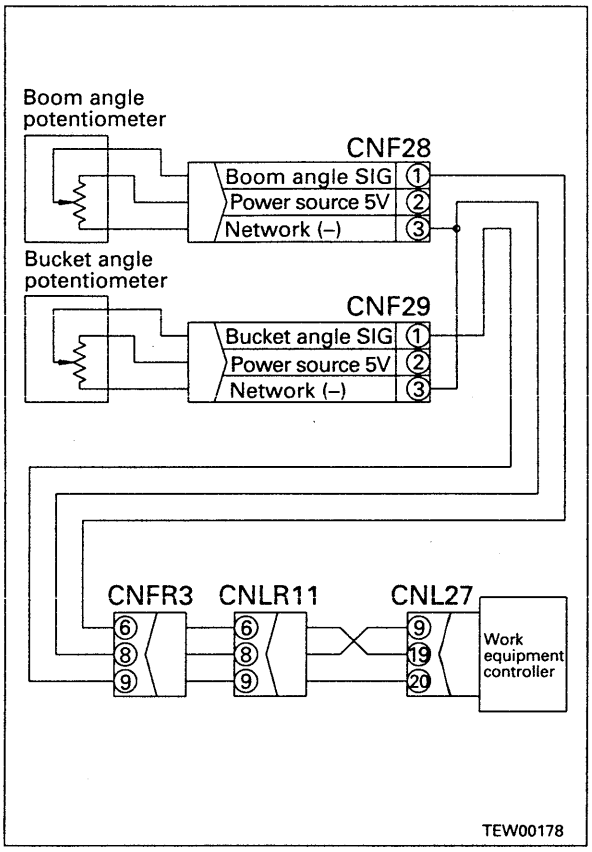
- The work equipment control system is equipped with a sensor adjustment function to compensate for any error in the mounting of the potentiometer and to make it possible to detect the correct position data for the work equipment.
  Always carry out adjustment when the controller, potentiometer, or work equipment are replaced.

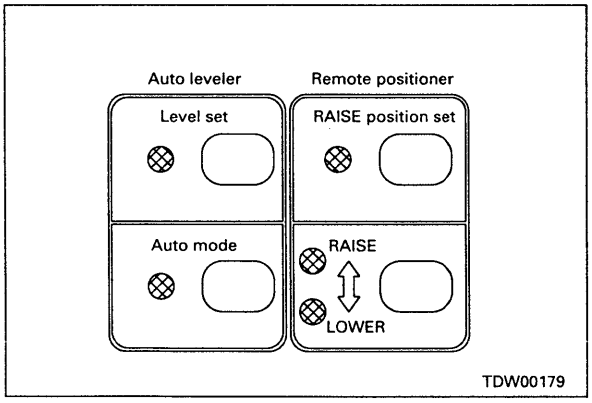
1. Potentiometer output voltage range
When correctly installed
Boom angle signal input (CNL27 (9) – (19)):
0.3 – 4.7 V
Bucket angle signal input (CNL27 (9) – (20)):
0.6 – 4.3 V

2. Method of adjusting sensor
1) Set the work equipment to the following posture.
   Boom: Max. height
   Bucket: Max. dump
2) Keep the remote positioner set switch and auto leveler set switch pressed continuously for at least 3 seconds at the same time. When the remote positioner set lamp and auto leveler set lamp light up, release the switch. (Sensor adjustment mode)
3) The remote positioner set lamp and auto leveler set lamp will light up for 2 seconds and then both lamps will go out. (Offset written to memory)

3. If the lamps flash in Step 2-3)
The potentiometer output is not within the range that can be offset, so adjust the installation of the potentiometer. The range which can be adjusted is as shown in the table with the posture in Step 2-1). In addition, the condition of the lamp corresponds to each potentiometer.

4. If the potentiometers have been adjusted from the condition in Step 3, always carry out Step 2 again and check that the lamps are actuated as in Step 3) (set lamps light up for 2 seconds and then go out).





Unit: V

Model	Boom angle potentiometer (between CNL27 (9) – (19))	Bucket angle potentiometer (between CNL27 (9) – (20))
WA320	0.51 – 0.72	3.34 – 3.95
WA380	0.51 – 0.75	3.41 – 4.02
WA420	0.45 – 0.75	3.35 – 3.96
WA470	0.55 – 0.76	1.12 – 1.72

U42303

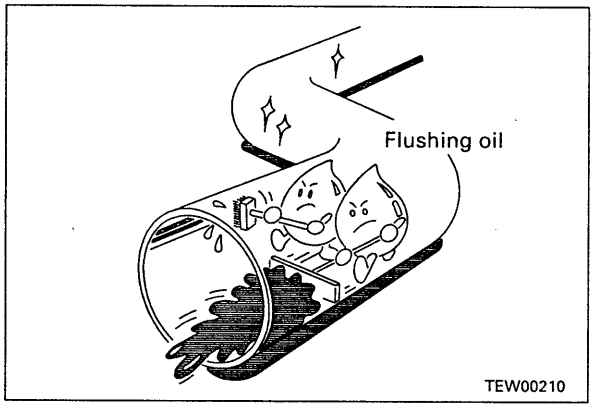
5) Change hydraulic oil when the temperature is high.

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Do not drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

6) Flushing operations

After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit.

Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.

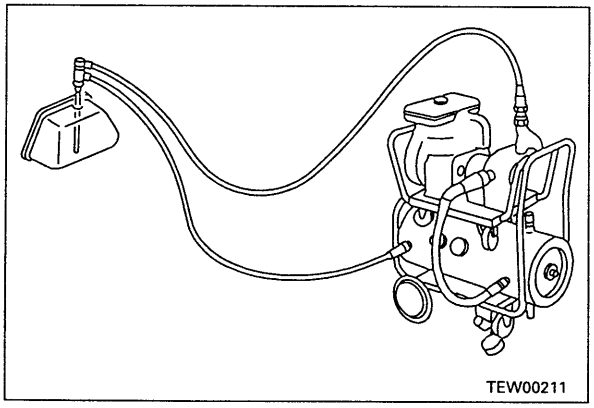


U42303

7) Cleaning operations

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit.

The oil cleaning equipment is used to remove the ultrafine (about 3μ) particles that the filter built into the hydraulic equipment cannot remove, so it is an extremely effective device.



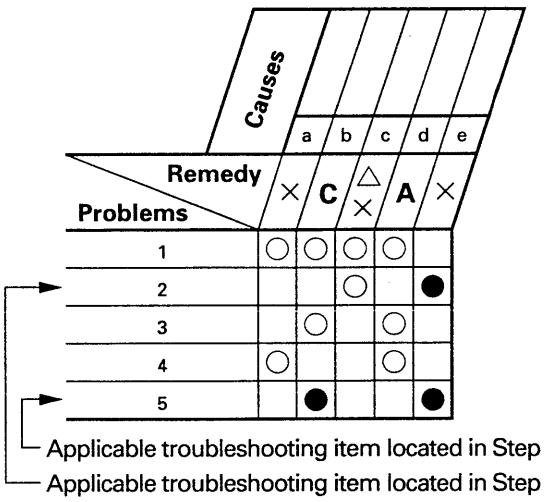
3) Operate the machine and check the troubleshooting items other than those in 1).
Operate the machine and check the items in the same way as in 1), and if the symptom appears, mark that item. (In the chart on the right, the symptom appears again for item 5).

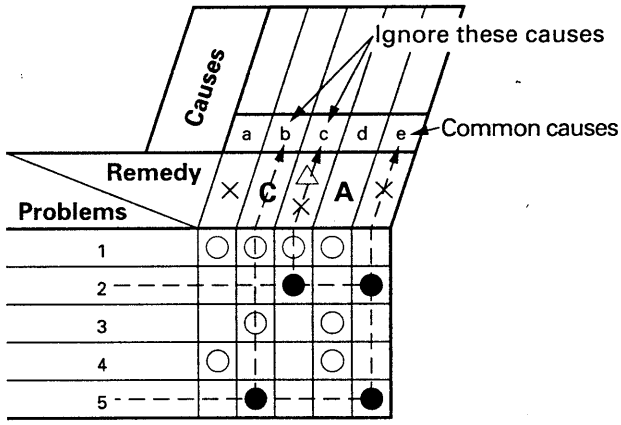
4) Find the appropriate cause from the cause column. In the same way as in Step 2), if the symptom appears, the ○ marks on that line indicate the possible causes. (For item No.5 in the table on the right, the possible causes are **b** or **e**.)

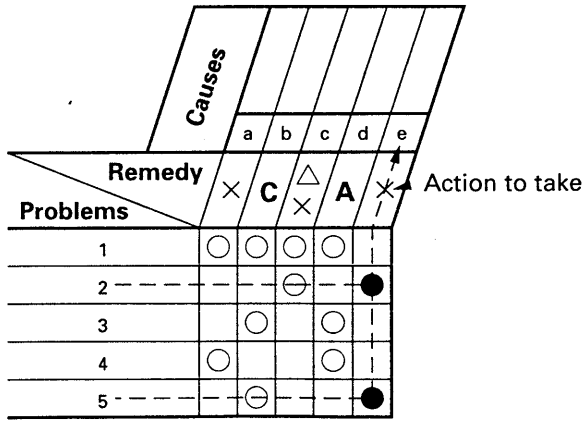
5) Narrow down the possible causes.
There is one common cause among the causes located in Steps 2) and 4). (One cause marked ○ appears on the line for both items.) This cause is common to both the symptoms in troubleshooting Steps 1) and 3).
★ The causes which are not common to both troubleshooting items (items which are not marked ○ for both symptoms) are unlikely causes, so ignore them.
(In the example given on the right, the causes for Troubleshooting Item 2 are **c** or **e**, and the causes for Troubleshooting Item 5 are **b** or **e**, so cause **e** is common to both.)

6) Repeat the operations in Steps 3), 4) and 5) until one cause (one common cause) remains.
★ If the causes cannot be narrowed down to one cause, narrow the causes down as far as possible.

7) Remedy
If the causes are narrowed down to one common cause, take the aciton given in the remedy column.
The symbols given in the remedy column indicate the following:
X: Replace, △: Repair, A; Adjust, C: Clean

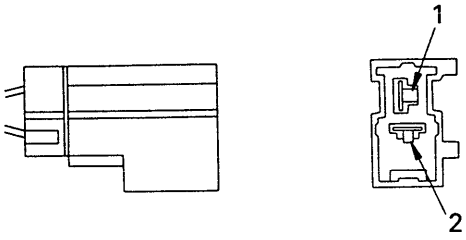
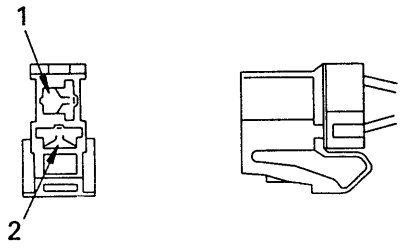
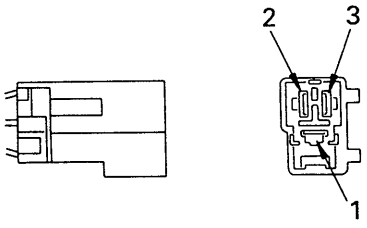
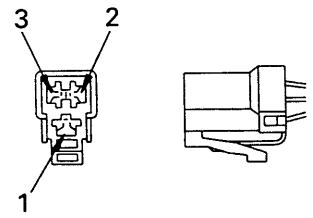
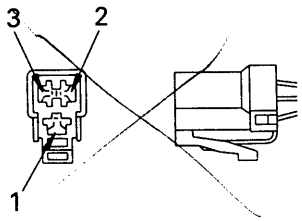
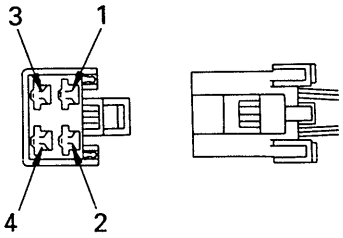
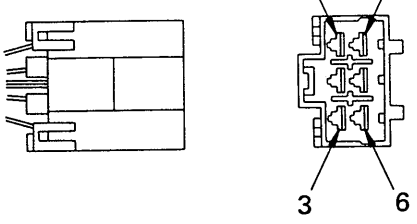
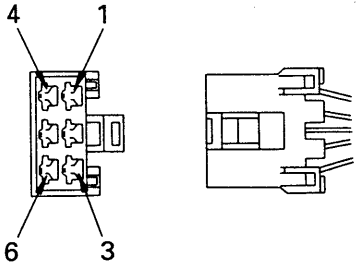






U42303

U42303

No. of pins	M type connector	
	Male (female housing)	Female (male housing)
2	 TEW00241	 TEW00242
3	 TEW00243	 TEW00244
4	 TEW00244	 TEW00246
6	 TEW00247	 TEW00248

S-4 Engine stops during operations

General causes why engine stops during operations

- Seized parts inside engine
- Insufficient supply of fuel
- Overheating
  - ★ If there is overheating and insufficient output, carry out troubleshooting for overheating.
- Failure in power train
  - ★ If the engine stops because of a failure in the power train, carry out troubleshooting for the chassis.

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and Check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Causes: Broken, seized piston connecting rod	Broken, seized crankshaft bearing	Broken valve system (valve, rocker lever, etc.)	Broken, seized gear train	Broken pump auxiliary equipment	Broken fuel pump drive shaft, key	Lack of fuel	Clogged fuel filter, strainer	Clogged feed pump strainer	Broken, seized feed pump piston	Clogged, leaking fuel piping	Clogged fuel tank air breather hole	Defective injection pump (rack, plunger stuck)	Failure in chassis power train
Questions	Confirm recent repair history															
	Degree of use	Operated for long period							△	△						
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	◎	◎	◎	◎	◎	◎			○			○		◎
		Engine overheated and stopped	◎	○			○									
		Engine stopped slowly							◎	○	○					
		There was hunting and engine stopped							◎	○	○			○		
	Fuel gauge lamp lights up								◎							
	Fuel tank is found to be empty								◎							
	Replacement of filters has not been carried out according to operation manual									◎	◎					
	Non-specified fuel has been used								○	○	○			○		
	When feed pump is operated, there is no response or it is heavy								○	○		◎				
	Mud is stuck to fuel tank cap												◎			
	Engine turns, but stops when transmission control lever is operated															◎
Check items	Try to turn by hand using barring tool	Does not turn at all	◎	◎												
		Turns in opposite direction			◎											
		Moves amount of backlash				◎	◎									
		Shaft does not turn						◎								
	Rust and water are found when fuel is drained								◎	◎						
	Metal particles are found when oil is drained		◎	◎					○	○						
Troubleshooting	Remove oil pan and check directly		●	●												
	Remove head cover and check directly				●											
	When gear train is inspected, it does not turn					●										
	Turns when pump auxiliary equipment is removed						●									
	When fuel filter, strainer are inspected directly, they are found to be clogged								●							
	When feed pump strainer is inspected directly, it is found to be clogged									●						
	Check feed pump directly										●					
	When control rack is pushed, it is fond to be heavy or does not return												●			
		Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Add	Clean	Clean	Replace	Repair	Clean	Replace	-

Carry out troubleshooting in chassis volume

U42303

S-14 Water temperature becomes too high (overheating)

General causes why water temperature becomes too high
- Lack of cooling water (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Defective cooling circulation system
- Rise in oil temperature of power train

★ Carry out troubleshooting for chassis.

Legend
◯: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and Check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

			Causes: Broken water pump	Clogged, crushed radiator fin	Clogged radiator core	Defective thermostat (does not open)	Defective water temperature gauge	Insufficient cooling water	Fan belt slipping, worn fan pulley	Clogged, broken oil cooler	Defective pressure valve	Broken head, head gasket	Damaged liner O-ring, holes made by pitting	Rise in torque converter oil temperature
Questions	Confirm recent repair history													
	Degree of use	Operated for long period		△	△							△	△	
	Condition of overheating	Suddenly overheated	◎					◯	◯					
		Always tends to overheat		◎	◎	◯			◯					
	Water temperature gauge	Rises quickly				◎		◯						
		Does not go down from red range					◎							
	Radiator water level sensor lights up							◎						
Check items	Fan belt whines under sudden load								◎					
	Cloudy white oil is floating on cooling water									◎				
	Cooling water flows out from overflow hose										◎			
	Excessive air bubbles inside radiator, water spurts back											◎		
	Engine oil level has risen, oil is cloudy white									◯			◎	
	There is play when fan pulley is rotated		◎											
	Radiator shroud, inside of underguard are clogged with dirt or mud			◎					◎					
	When light bulb is held behind radiator, no light passes through			◎										
	Water is leaking because of cracks in hose or loose clamps							◎						
	Belt tension is found to be slack								◎					
	Power train oil temperature enters red range before engine water temperature													◎
Troubleshooting	Temperature difference between top and bottom radiator tank is excessive		●											
	Temperature difference between top and bottom radiator tank is slight			●										
	When water filler port is inspected, the core is found to be clogged				●									
	When a function test is carried out on the thermostat, it does not open even at the cracking temperature					●								
	When water temperature is measured, it is found to be normal						●							
	When oil cooler is inspected directly, it is found to be clogged								●					
	When measurement is made with radiator cap tester, set pressure is found to be low									●				
	When compression pressure is measured, it is found to be low										●			
	Remove oil pan and check directly											●		
		Remedy	Replace	Repair	Repair	Replace	Repalce	Add	Repair	Replace	Replace	Replace	Replace	-

Carry out troubleshooting for chassis

U42303

M-4 Abnormality in shift indicator

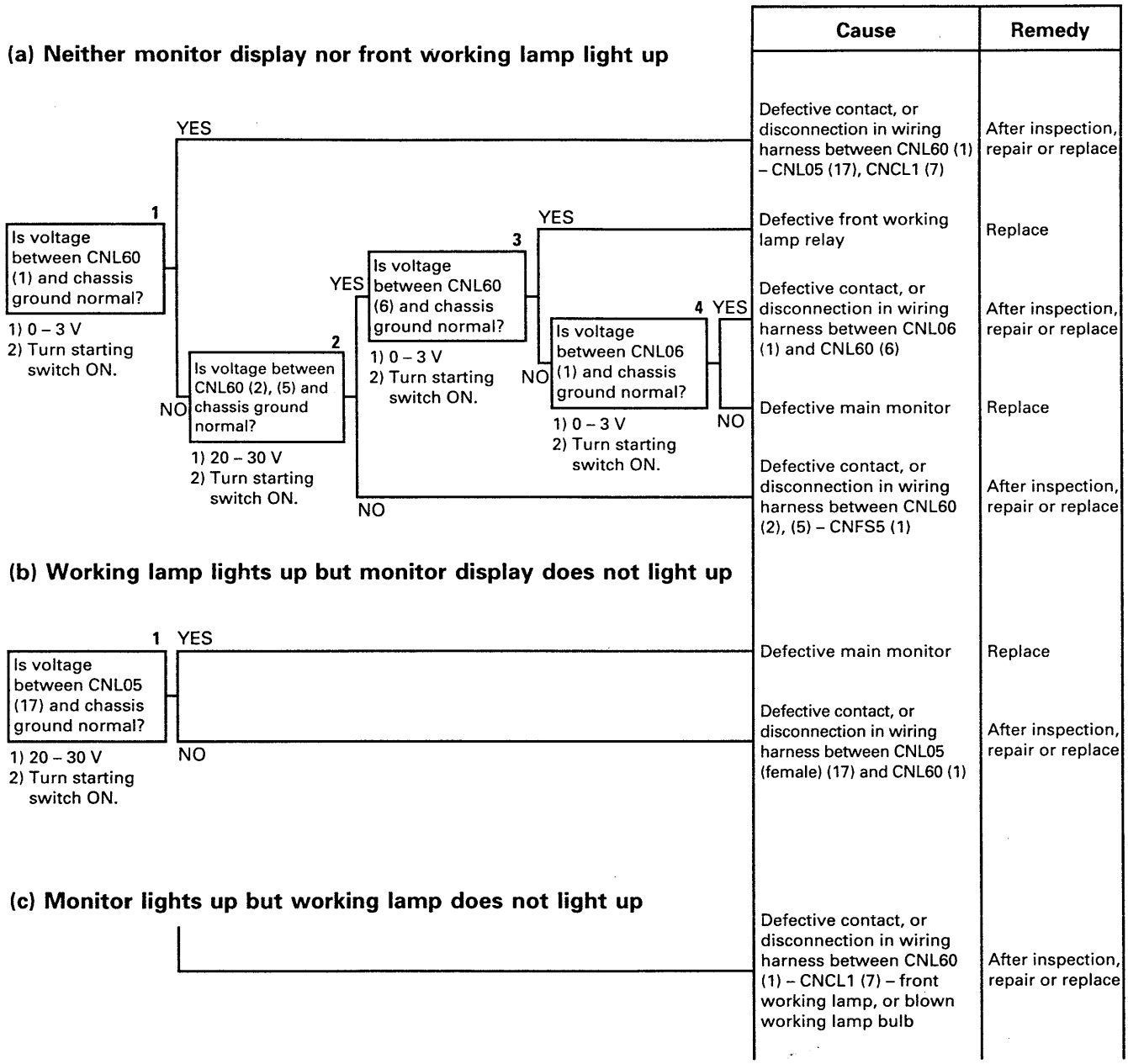
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.
★ Check that the transmission shifts.

	Cause	Remedy
(a) Stays at N even when directional lever is at F		
1 Is voltage between CNL08 (7) and chassis ground normal? 1) 20 – 30 V 2) Turn starting switch ON. 3) Directional lever: F		
YES	Defective main monitor	Replace
NO	Defective contact, or disconnection in wiring harness between CNL08 (female) (7) and CNL04 (2)	After inspection, repair or replace
(b) Stays at N even when directional lever is at R		
1 Is voltage between CNL08 (8) and chassis ground normal? 1) 20 – 30 V 2) Turn starting switch ON. 3) Directional lever: R		
YES	Defective main monitor	Replace
NO	Defective contact, or disconnection in wiring harness between CNL08 (female) (8) and CNL04 (4)	After inspection, repair or replace
(c) Does not display N even when directional lever is at N and displays R when directional lever is at F		
1 Is voltage between CNL08 (8) and chassis ground normal? 1) 0 – 5 V 2) Turn starting switch ON. 3) Directional lever: N		
YES	Defective main monitor	Replace
NO	Contact of power source with wiring harness between CNL08 (female) (8) and CNL04 (4), or defective control lever	After inspection, repair or replace

U42303

M-10 Abnormality in front working lamp

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.
★ Before starting troubleshooting, check that the monitor lighting is lighted up.



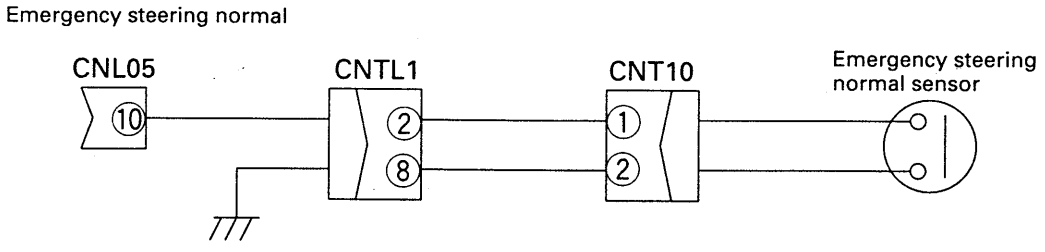
U42303

M-18 Abnormality in emergency steering normal display

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

	Cause	Remedy
(a) Emergency steering normal display does not light up		
1 Is there continuity between CNT10 (male) (1) and (2)? 1) Disconnect CNT10. 2) Turn starting switch ON. — YES	Defective emergency steering normal sensor	Replace
2 Is voltage between CNL05 (10) and chassis ground normal? 1) 20 – 30 V 2) Turn starting switch ON. — YES	Defective main monitor	Replace
NO	Wiring harness between CNL05 (female) (10) – CNTL1 (2) – CNT10 (female) (1) short circuiting with chassis ground	After inspection, repair or replace
(b) Emergency steering normal display stays lighted up		
3 Is voltage between CNL05 (10) and chassis ground normal? 1) 0 – 2 V 2) Turn starting switch ON. — YES	Defective main monitor	Replace
2 Is there continuity between CNT10 (female) (2) and chassis ground? 1) Disconnect CNT10. — YES	Defective contact, or disconnection in wiring harness between CNL05 (female) (10) – CNTL1 (2) – CNT10 (female) (1)	After inspection, repair or replace
1 Is there continuity between CNT10 (male) (1) and (2)? 1) Disconnect CNT10. 2) Turn starting switch ON. — YES	Defective contact, or disconnection in wiring harness between CNT10 (female) (2) – CNTL1 (8) – chassis ground	After inspection, repair or replace
NO	Defective emergency steering normal sensor	Replace

U42303



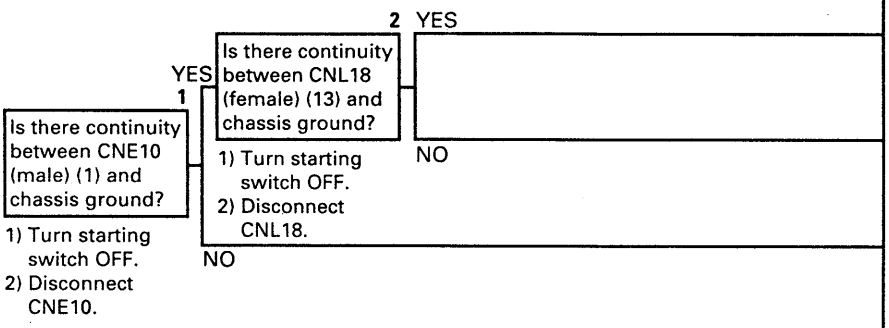
TDW00307

K-4 When starting switch is turned ON (engine stopped), CHECK items flash

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

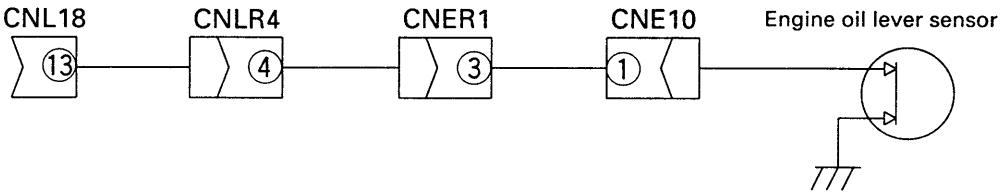
(a) Engine oil level display flashes

★ Before starting troubleshooting, check the engine oil level again.



Cause	Remedy
Defective maintenance monitor module	Replace
Defective contact, or disconnection in wiring harness between CNL18 (female) (13) – CNLR4 (4) – CNER1 (3) – CNE10 (female) (1)	Repair wiring harness or replace
Defective engine oil level sensor	Replace

U42303



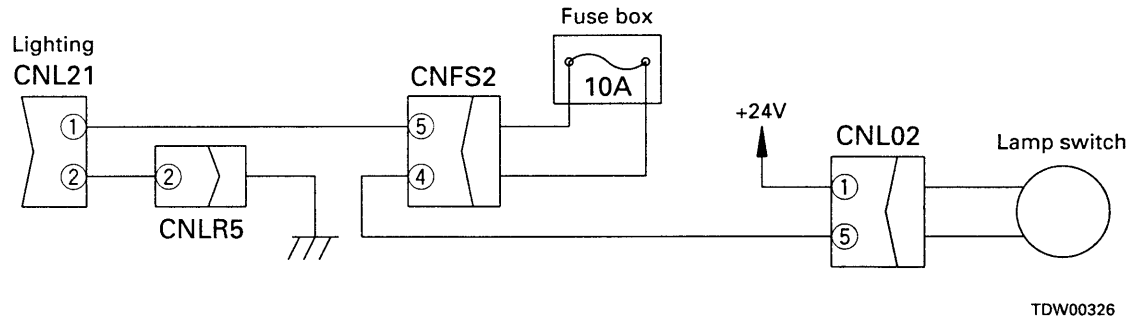
TDW00316

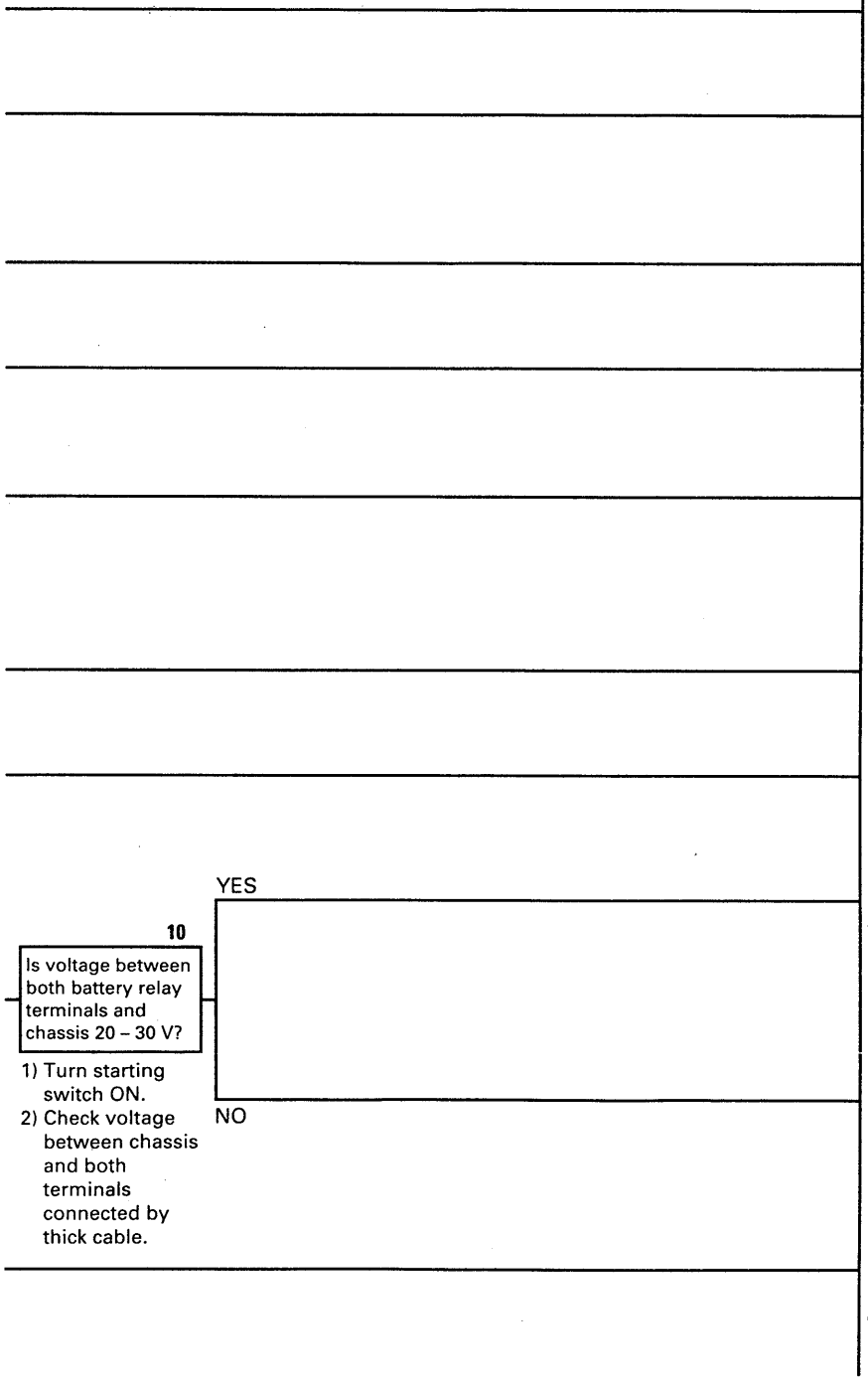
K-10 Night lighting does not light up when lamp switch is turned ON (only lighting of maintenance monitor does not light up)

★ Before carrying out troubleshooting, check that there are no blown lamp bulbs.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

	Cause	Remedy
1 Is voltage between CNL21 (female) (1) and (2) normal? 1) 20 – 30 V 2) Disconnect CNL21. 3) Turn starting switch ON. 4) Turn lamp switch ON.		
YES	Disconnection in wiring harness of lamp holder	Replace
NO	Defective contact, or disconnection in wiring harness between CNL21 (female) (1) and CNFS2 (5)	Repair wiring harness or replace

U42303

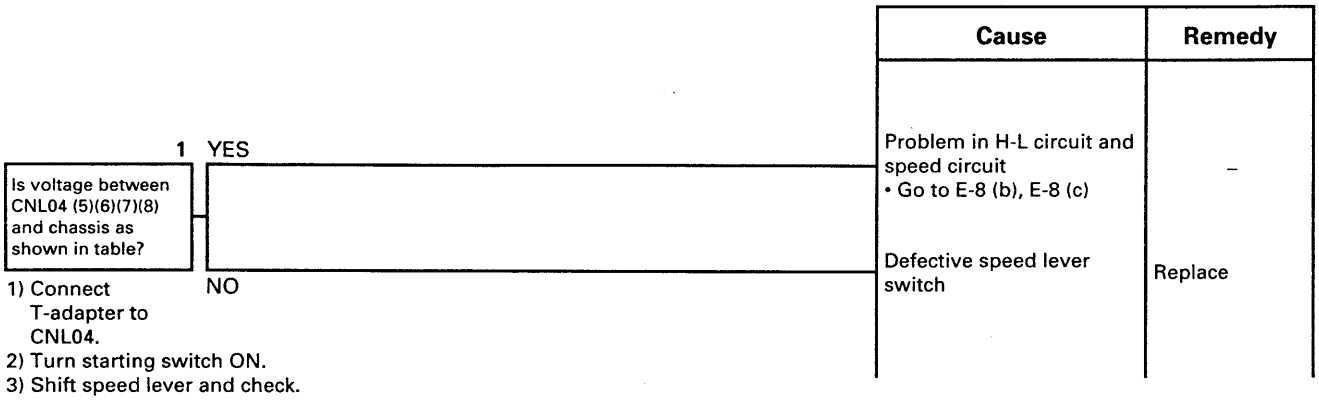




Cause	Remedy
Defective neutral relay	Replace
Defective contact, or disconnection in wiring harness between CNL57 (female) (3) – CNLR4 (8) – CNR01, 02 (diode) – CNER1 (10) – CNE13 (female) (1)	After inspection, repair or replace
Defective contact, or disconnection in wiring harness between starting switch terminal C – CNL09 (3) – CNL57 (female) (5)	After inspection, repair or replace
Defective starting switch	Replace
Defective contact, or disconnection in wiring harness between starting switch terminal B – CNL09 (1) – CNFS3 (4) – fuse – CNFS3 (6) – CNLR5 (1) – CNR17 – slow blow fuse 30A – battery relay	After inspection, repair or replace
Defective contact, or disconnection in wiring harness between CNL04 (female) (3) and CNL57 (female) (1)	After inspection, repair or replace
Defective directional lever switch	Replace
Defective contact, or disconnection in wiring harness between battery relay – slow blow fuse 80A – CNR15 – CNLR6 (1) – CNFS1 (2) – fuse – CNFS2 (8) – CNL04 (female) (1)	After inspection, repair or replace
• If answer is NO for both terminals: Defective contact or disconnection in wiring harness between battery and battery relay • If answer is NO for one terminal: Defective battery relay	After inspection, repair or replace
Defective contact, or disconnection in wiring harness between CNL57 (female) (2) and chassis ground	After inspection, repair or replace

U42303

(a) Problem in common circuit for transmission (always stays in 2nd)

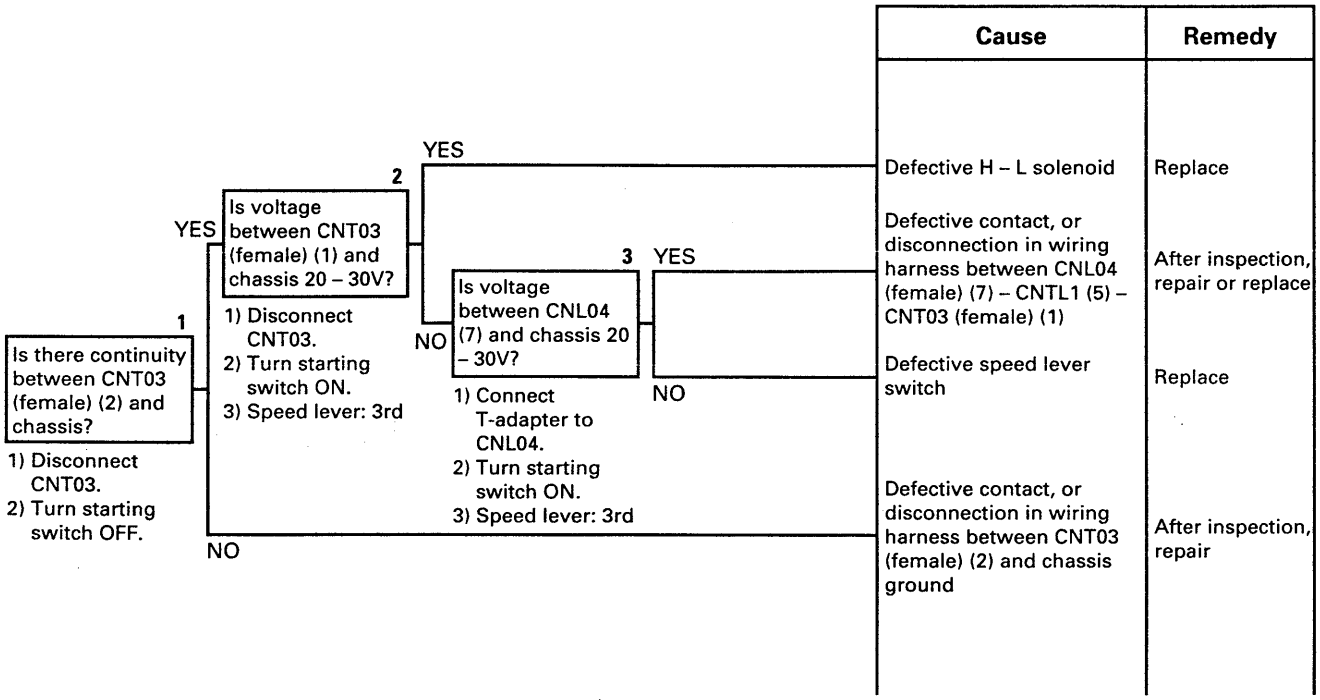


● : 20 – 30 V
○ : 0 – 0.5 V

Transmission range	Between CN04(5) – chassis	Between CN04(6) – chassis	Between CN04(7) – chassis	Between CN04(8) – chassis
1	●	○	○	○
2	○	●	○	○
3	○	○	●	○
4	○	○	○	●

U42303

(b) Problem in H-L circuit

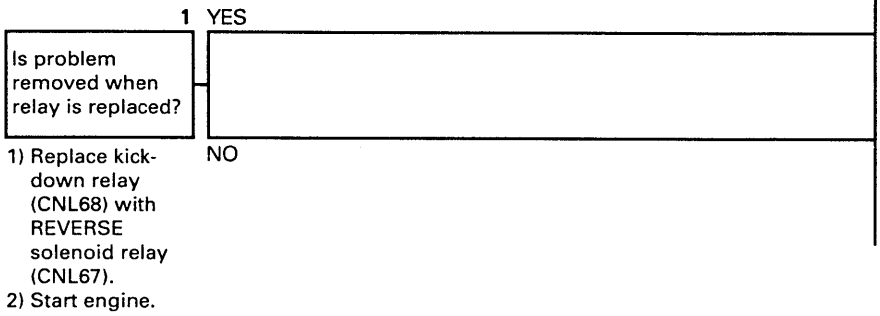


Cause	Remedy
Defective contact, or disconnection in wiring harness between CNT02 (female) (2) and chassis	After inspection, repair or replace
Defective REVERSE solenoid	Replace
Defective REVERSE relay	Replace
Defective contact, or disconnection in wiring harness between CNL04 (female) (4) and CNL67 (female) (5)	After inspection, repair or replace
Defective directional lever switch	Replace
Defective contact, or disconnection in wiring harness between CNL67 (female) (6) and chassis	After inspection, repair or replace
Defective contact, or disconnection in wiring harness between CNL67 (female) (2) – CNTL1 (4) – CNT02 (female) (1)	After inspection, repair or replace
Defective contact, or disconnection in wiring harness between CNL66 (female) (1) and CNL67 (female) (1)	After inspection, repair or replace

U42303

E-10 Kick-down works only when kick-down switch is ON (Kick-down switch relay does not hold in position (self-holding function))

★ When connecting or disconnecting the T-adapter (or socket adapter) or short connector to carry out checks, always turn the starting switch OFF before starting.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified as CN○△( ).
★ After checking, connect the disconnected connectors and disconnect the T-adapter immediately to return to the original condition before going on to the next check.



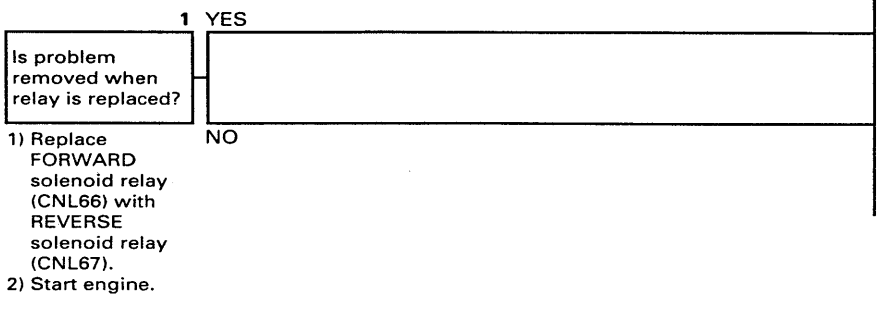
1) Replace kick-down relay (CNL68) with REVERSE solenoid relay (CNL67).
2) Start engine.

Cause	Remedy
Defective kick-down relay	Replace
Defective contact, or disconnection in wiring harness between CNL66 (female) (4) – CNL68 (female) (1) or CNL68 (female) (2) – CNL68 (female) (5)	After inspection, repair or replace

U42303

E-11 Kick-down operation cannot be canceled

(a) Not canceled even when directional lever is moved from F to N or R



1) Replace FORWARD solenoid relay (CNL66) with REVERSE solenoid relay (CNL67).
2) Start engine.

Cause	Remedy
Defective FORWARD solenoid relay	Replace
Contact of wiring harness between CNL66 (female) (3) and (4)	After inspection, repair or replace

T-4 Excessive time lag when starting machine or shifting gear

Ask the operator the following questions.

- Was there excessive time lag? Was there any abnormality in the travel speed or thrusting force? Was there any lack of power when traveling up slopes?
  Yes = Go to T-2 Travel speed is slow, thrusting power is weak, lacks power on slopes

Checks before troubleshooting

- Is the transmission oil level correct? Is the type of oil correct?
- Is there any oil leaking from the joints of the piping or valves?

U42303

No.	Problems \ Causes / Remedy	Transmission control valve a	b	c	d	Transmission e	f	g	Accumulator valve h
		△ ×	C △	△ ×	△ ×	△ ×	△ ×	△ ×	△ ×
1	Time lag is excessive in every transmission range	○	○	○	○				
2	Time lag is excessive in certain transmission ranges					○			○
3	Clutch pressure is low in every transmission range		○		○				
4	Clutch oil pressure is low in transmission ranges where time lag is excessive				○	○			○

Causes:
a. Defective operation of accumulator
b. Clogged orifice
c. Defective operation of quick return valve
d. Leakage of oil due to wear of piston, spool, or bore
e. Leakage of oil from transmission clutch pack, piston seal
f. Leakage of oil from transmission clutch pack, shaft seal ring
g. Leakage of oil from joint of transmission housing and valve
h. Breakage inside accumulator valve (broken spring, worn spool)

T-16 When boom is raised, it moves slowly at a certain height

Checks before troubleshooting
- Can any deformation be seen in the boom cylinder?

Cause
- Swelling or internal damage to boom cylinder tube

★ For other abnormalities when the boom is raised, go to **"T-15 Boom movement is slow or boom lacks lifting power."**

T-17 Bucket cannot be pushed with boom cylinder (bucket floats)

See "T-15 Boom movement is slow or boom lacks lifting power."

Checks before troubleshooting
- Is the stroke of the boom spool in the main control valve properly adjusted?

Cause
- Defective seating of suction valve at boom cylinder rod end of main control valve
- Oil leakage from boom cylinder piston seal

T-18 Excessive hydraulic drift of boom

Ask the operator the following questions.
- Did the problem suddenly start?
  Yes = Dirt caught in valve, broken part
- Did the problem gradually appear?
  Yes = Worn parts

Checks before troubleshooting
- Is the boom spool at the neutral position?
  Yes = Seized link bushing, defect in spool detent

Troubleshooting and Cause
- When measuring the hydraulic drift, is there any sound of oil leakage from inside the boom cylinder?
  Yes = Defective cylinder packing

U42303

T-19 Boom shakes during operation

When digging or leveling operations are carried out with the boom control lever at HOLD, the bucket and boom move up and down to follow the shape of the ground.

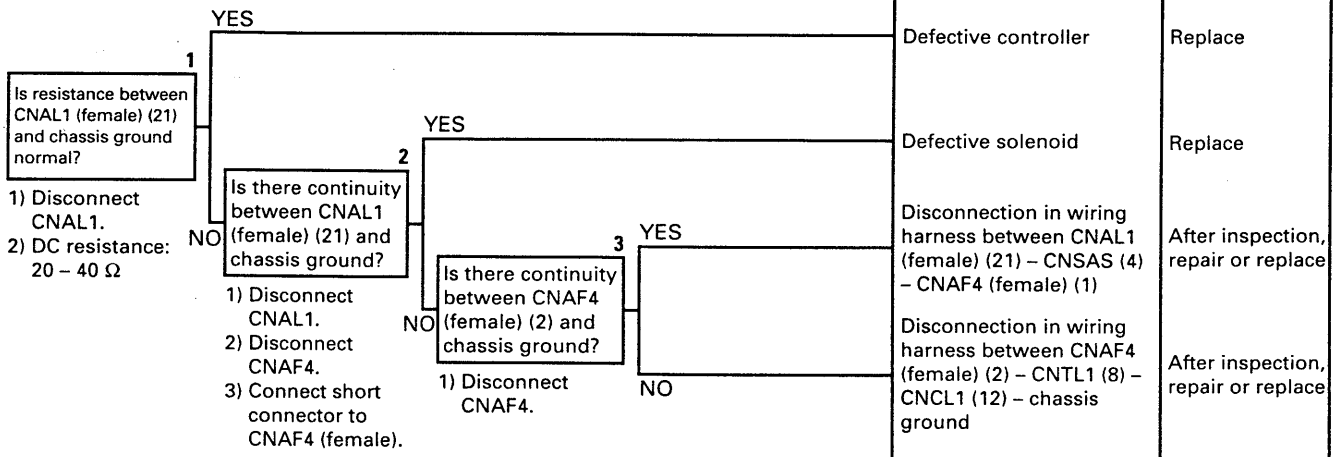
Troubleshooting and Cause

Measure the hydraulic drift of the boom and check if it is possible to lift the chassis with the boom cylinder.

1. If the hydraulic drift of the boom cylinder is outside the standard value, go to **"T-18 Excessive hydraulic drift of boom."**
2. If the chassis cannot be raised with the boom cylinder, go to **"T-17 Bucket cannot be pushed with boom cylinder."**
3. If the hydraulic drift of the boom is normal, operate the boom several times, and operate the boom cylinder to the end of its stroke. Is it now possible to raise the chassis with the boom cylinder?
   Yes = Vacuum had formed inside cylinder

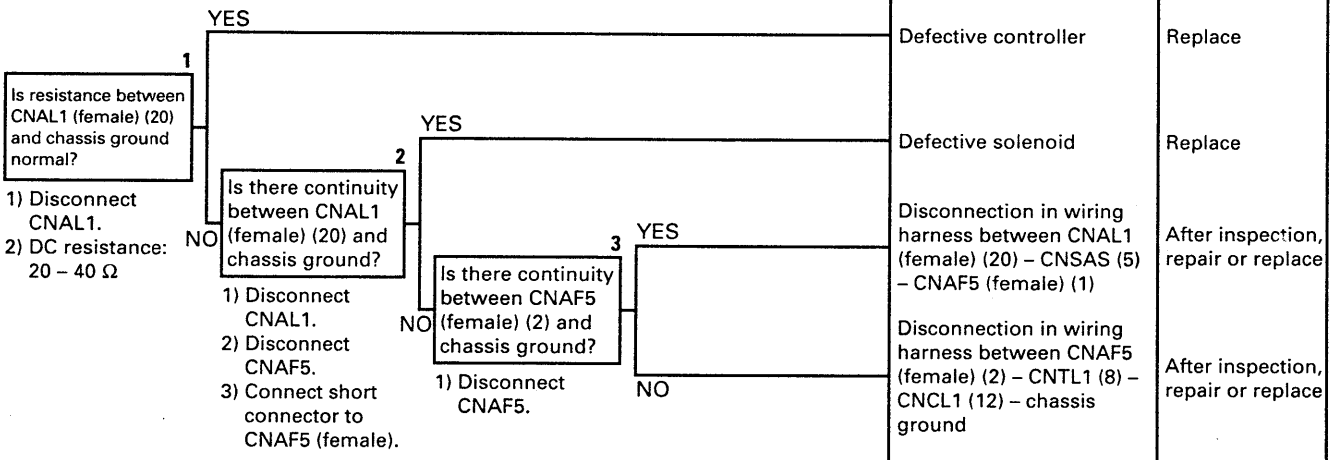
★ However, if this problem appears frequently, the suction valve at the boom cylinder rod end is defective.

(a) Error code [d0] is displayed



Cause	Remedy
Defective controller	Replace
Defective solenoid	Replace
Disconnection in wiring harness between CNAL1 (female) (21) – CNSAS (4) – CNAF4 (female) (1)	After inspection, repair or replace
Disconnection in wiring harness between CNAF4 (female) (2) – CNTL1 (8) – CNCL1 (12) – chassis ground	After inspection, repair or replace

(b) Error code [d1] is displayed



Cause	Remedy
Defective controller	Replace
Defective solenoid	Replace
Disconnection in wiring harness between CNAL1 (female) (20) – CNSAS (5) – CNAF5 (female) (1)	After inspection, repair or replace
Disconnection in wiring harness between CNAF5 (female) (2) – CNTL1 (8) – CNCL1 (12) – chassis ground	After inspection, repair or replace

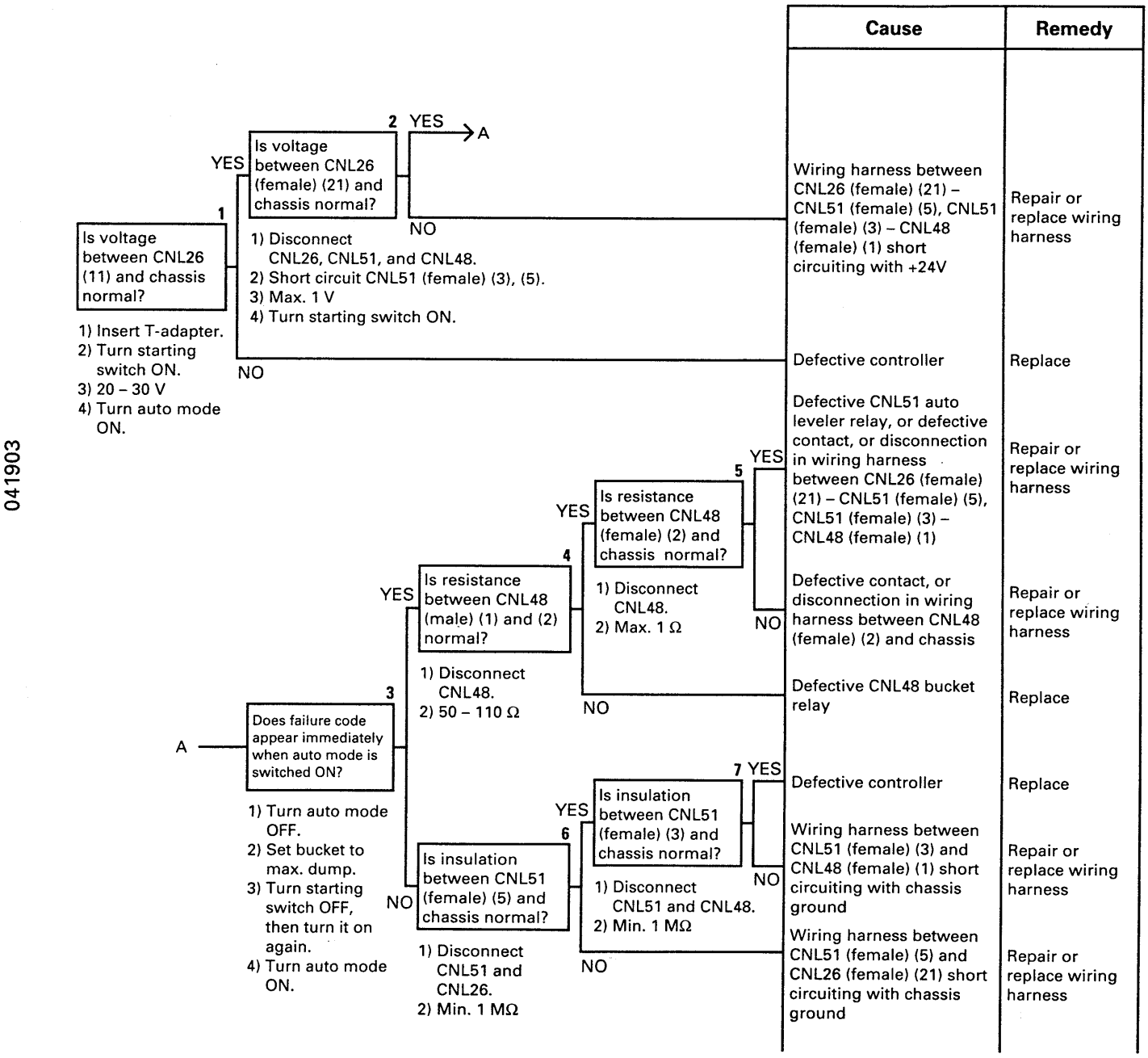
U42303

TROUBLESHOOTING OF WORK EQUIPMENT CONTROLLER SYSTEM (W MODE)

041903

W-7 Failure code [48] Abnormality in bucket lever kick-out relay system

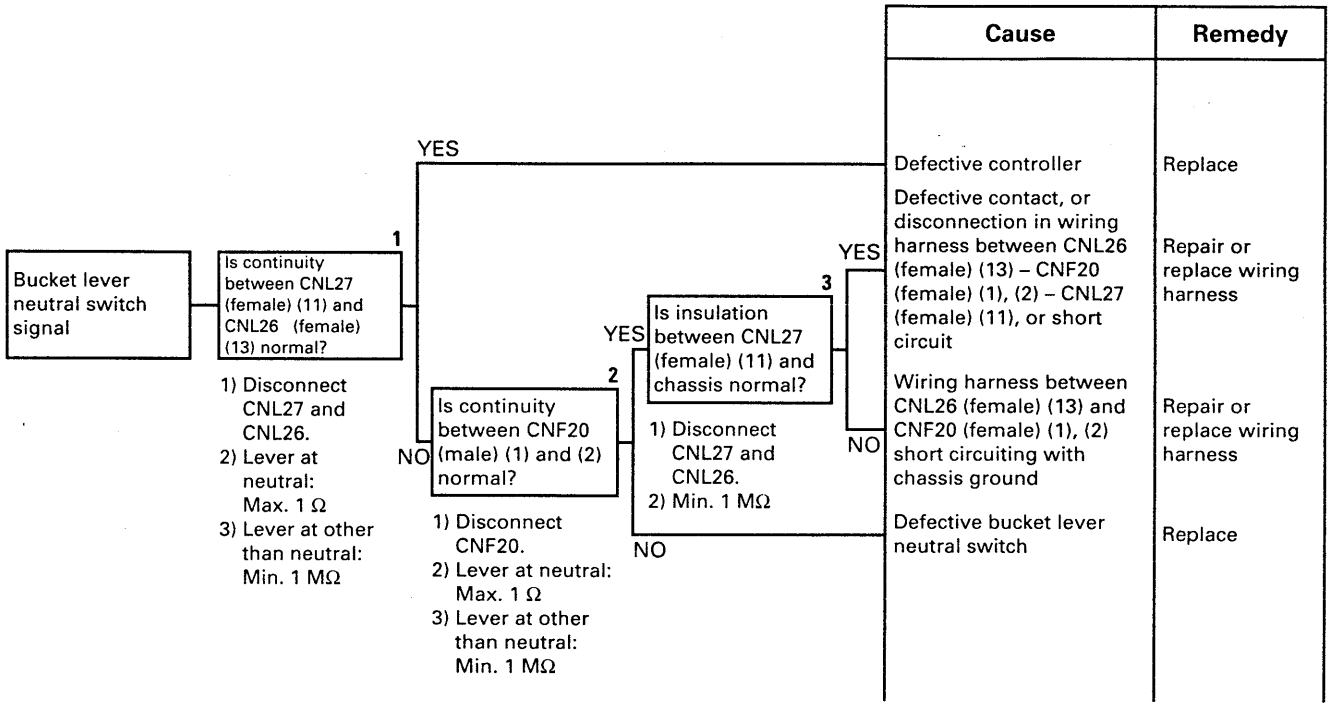
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.
★ When disconnecting connectors to connect the T-adapter (or socket adapter), always turn the starting switch OFF.



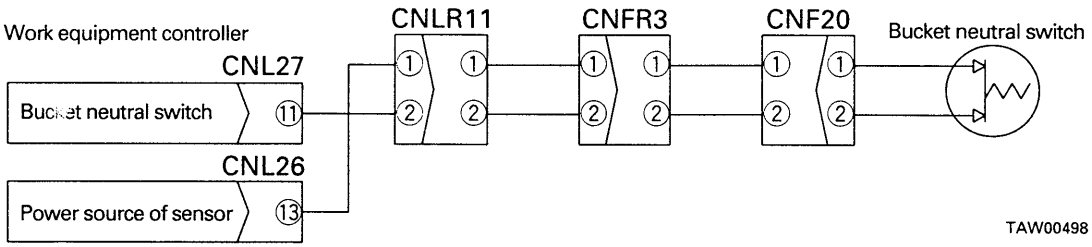
041903

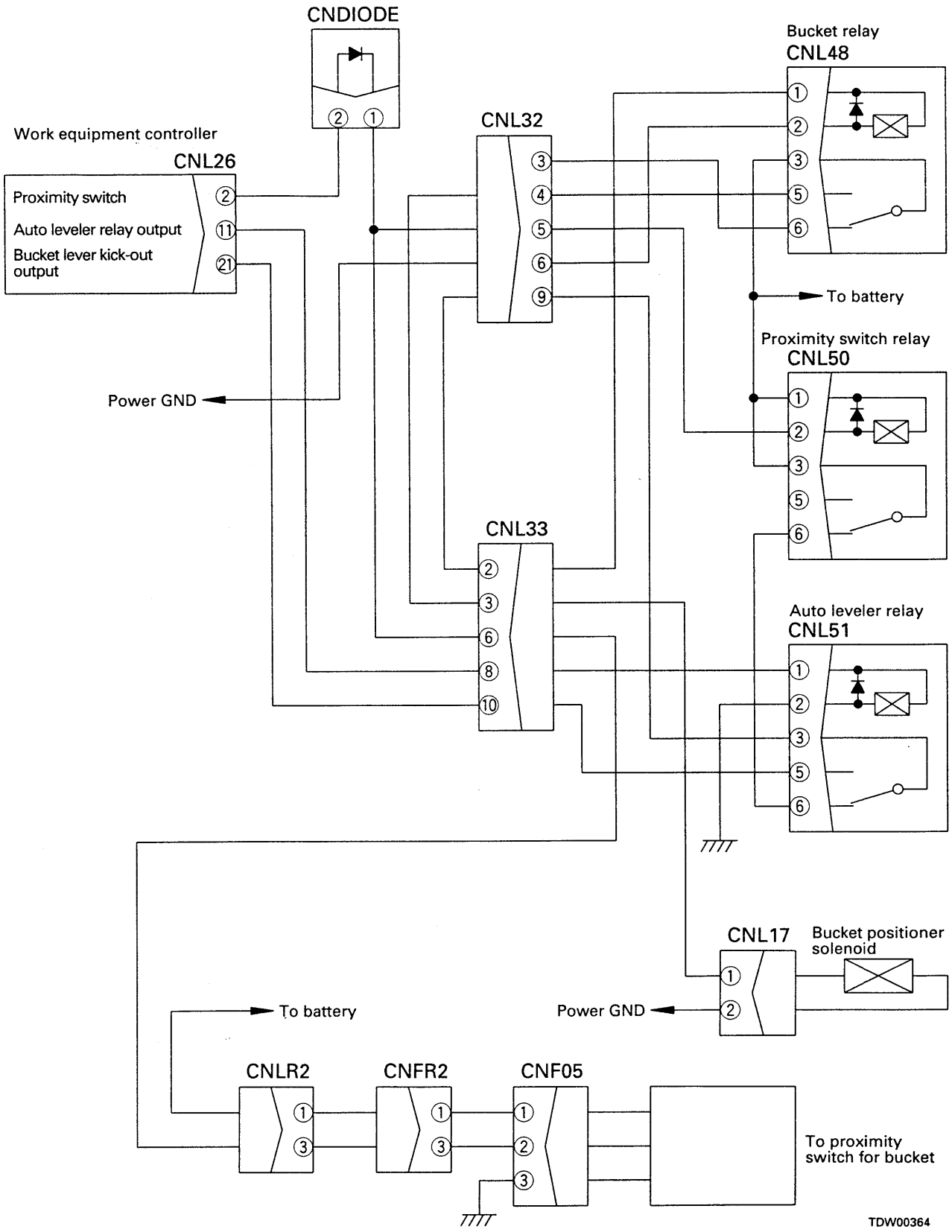
(c) Bucket lever neutral switch system

- Insert the T-adapter into CNL26, turn the starting switch ON, and check that the voltage between CNL26 (11) and (9) is 20 – 30 V.



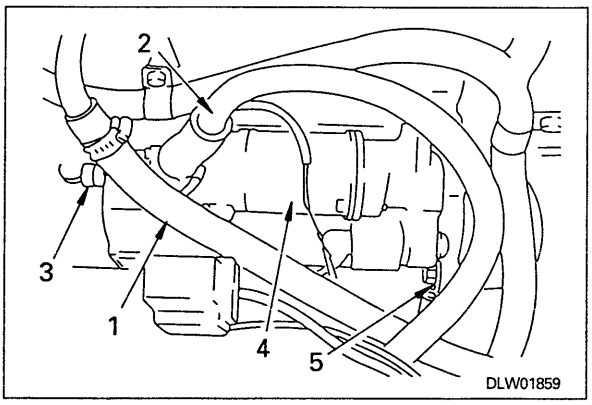
041903




CNDIODE
Bucket relay
CNL48
Work equipment controller
CNL26
CNL32
Proximity switch
Auto leveler relay output
Bucket lever kick-out output
To battery
Proximity switch relay
CNL50
Power GND
CNL33
Auto leveler relay
CNL51
CNL17
Bucket positioner solenoid
To battery
Power GND
CNLR2
CNFR2
CNF05
To proximity switch for bucket
TDW00364

041903

REMOVAL OF STARTING MOTOR ASSEMBLY



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

1. Open engine hood side cover and lock in position.
2. Disconnect hose (1).
3. Disconnect wiring (2).
4. Disconnect wiring connector (3).
5. Remove starting motor assembly (4). [※ 1]

INSTALLATION OF STARTING MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

[※ 1]

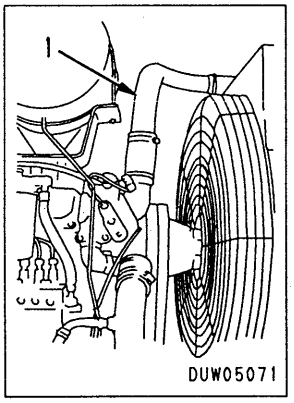
★ When installing the starting motor assembly, install ground connection (5) securely.

U42303

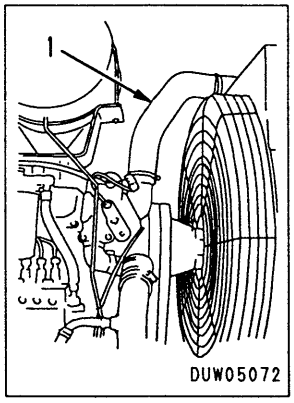
REMOVAL OF CYLINDER HEAD ASSEMBLY

1. Lift off engine hood assembly.
2. Drain engine coolant.
3. Remove radiator upper tube (1).

Serial No. 50001 – 52999

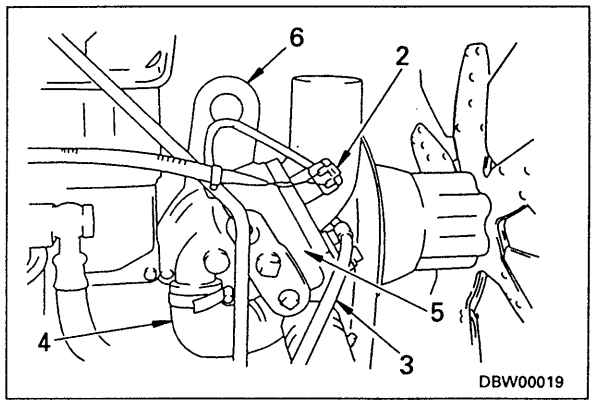


Serial No. 53001 and up



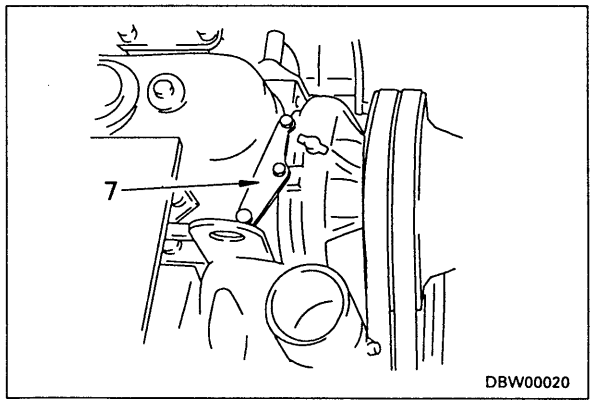
4. Remove water temperature sensor connector (2) from clip and disconnect.

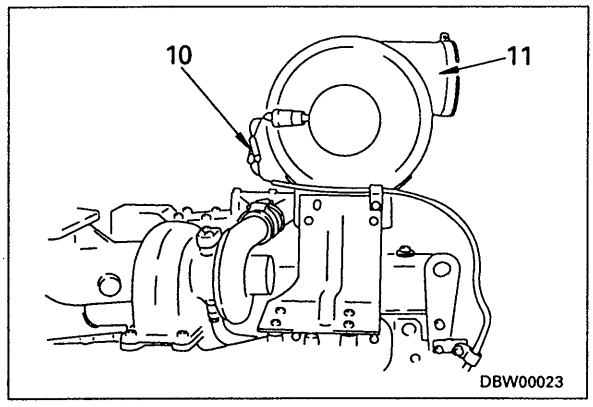
5. Disconnect spill hose (3), loosen clamp of hose (4), then remove thermostat connector (5).
   ★ Thermostat connector (5) is tightened together with the cylinder head hanger, so after removing the connector, secure hanger (6) with the bolts.

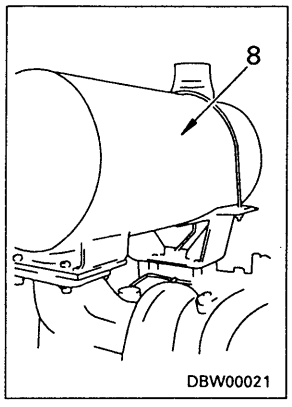


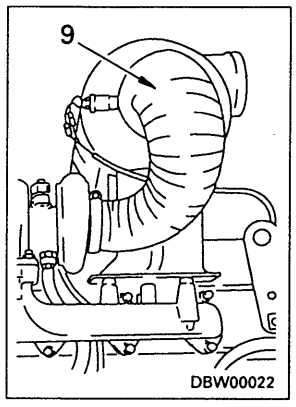
U42303

6. Remove mounting bracket (7) at top of water pump assembly.
7. Remove muffler assembly (8) together with bracket.
8. Remove intake hose (9). ※ 1
9. Disconnect dust indicator connector (10), and remove air cleaner assembly (11) together with mounting bracket.
   ★ There are 4 spacers between the mounting bracket and the exhaust manifold, so be careful not to lose them.









INSTALLATION OF RADIATOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1
★ Run the engine to circulate the water through the system. Then check the water level again.

※ 2
★ Temporarily install the radiator stays.
kgm Mounting bolt :
110.3 ± 12.3 Nm (11.25 ± 1.25 kgm)
★ Install the fan guard so that the clearance between the fan and fan guard is uniform.

※ 3
kgm Hose clamp : **5.9 ± 0.5 Nm (0.6 ± 0.05 kgm)**

※ 4
★ Fit the O-ring securely into the groove and be careful that it does not get caught when assembling.
★ Install the hoses without twisting or interference.
kgm Joint nut : **196 ± 49 Nm (20.0 ± 5.0 kgm)**
(width across flats: 41 mm)

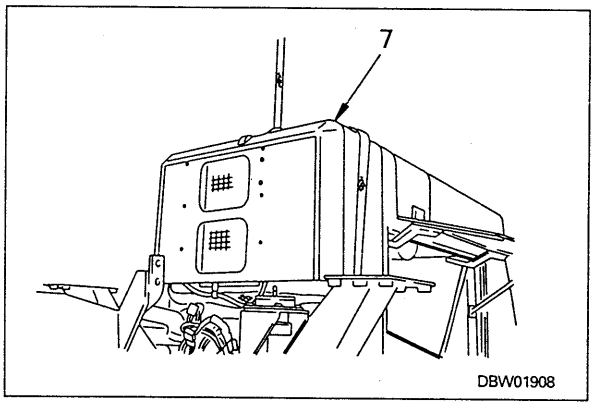
※ 5
★ Be careful not to damage the radiator fins.
★ Install the radiator from the counterweight slowly.
★ Install so that the clearance from the fan is uniform.
kgm Radiator mounting bolt :
176 ± 19.6 Nm (18.0 ± 2.0 kgm)
★ Tighten the mounting bolts of the radiator stay fully.

- **Refilling with oil**
  1) Tighten drain valve and add transmission oil through oil filler to the specified level.
     ★ Run the engine to circulate the oil through the system. Then check the oil level again.

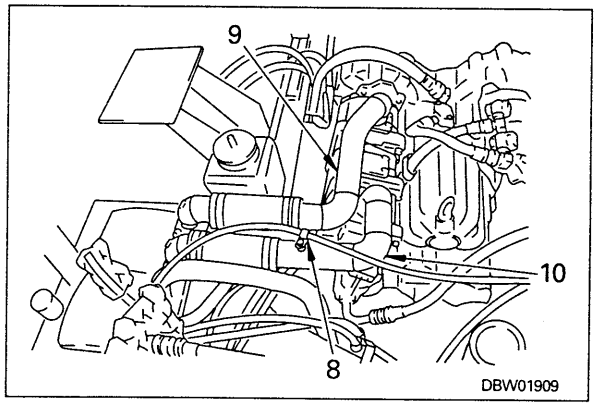
     Transmission : **35 ℓ**
  2) Tighten plug at top of hydraulic tank filter and plug of pump piping, then add hydraulic oil through oil filler to specified level.

U42303

5) Sling bulkhead (7), remove mounting bolt, then remove bulkhead.



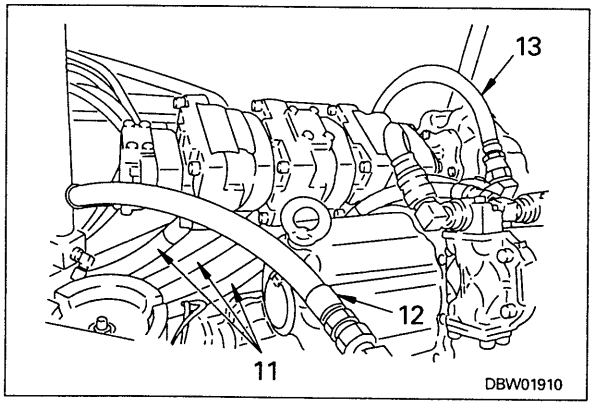
4. Remove hose clamp (8), then remove pipes (9) and (10) at top of hydraulic and steering pump.



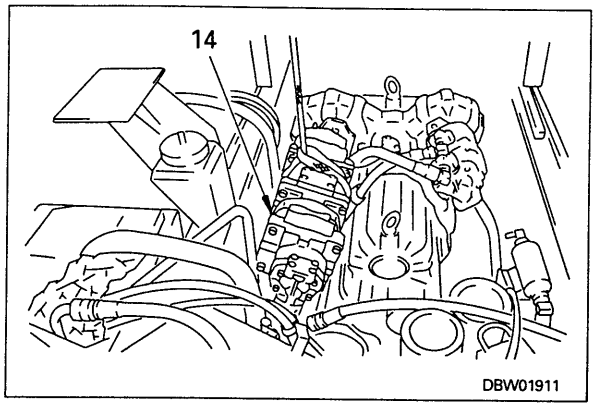
U42303

5. Disconnect hoses (11) and (12) mounted at bottom of hydraulic and steering pump. ※ 2
   ★ The hose flange and spacer are tightened together, so be careful not to lose them when disconnecting hoses (11).

6. Disconnect transmission cooler hose (13).

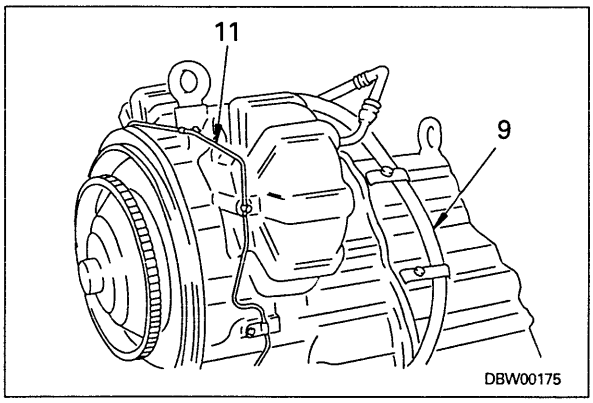


7. Sling hydraulic and steering pump assembly (14), remove mounting bolts, then lift off.



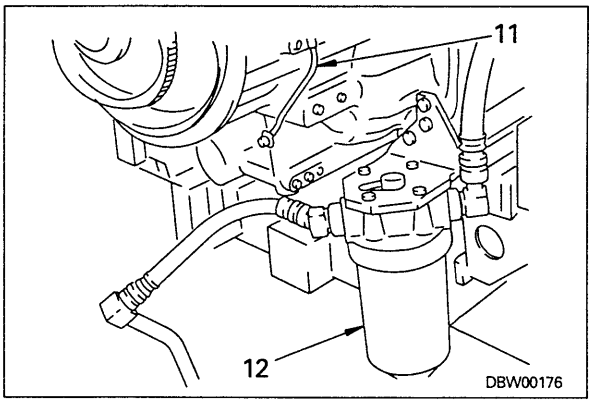
5. Hydraulic piping

1) Remove PTO lubrication tube (11).
   - ★ Be careful not to crush the tube during the operation.
   - ★ After removing the tube, fit a cover to protect the thread.
2) Remove clamp of hose (9).



6. Oil filter

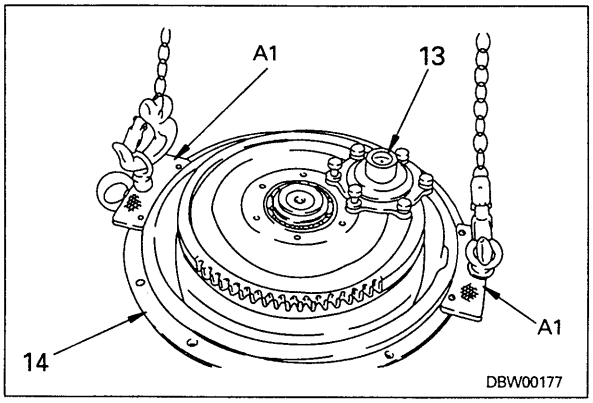
1) Remove mounting bracket of oil filter (12), then remove together with bracket, filter, and hose.



U42303

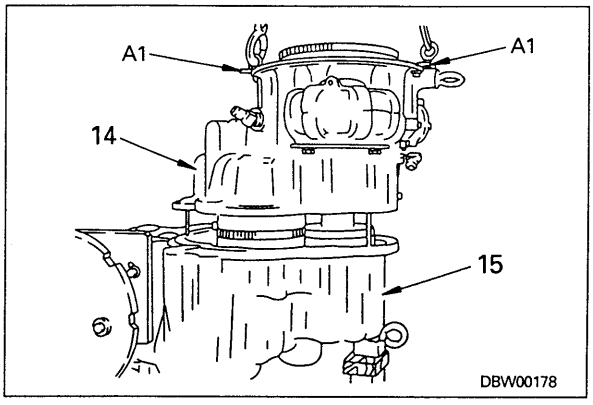
7. Rear housing

1) Remove torque converter pilot cap (13).
2) Install tool **A1** to rear housing (14) and sling.
   - ★ Install tool **A1** securely so that it does not come off.



3) Using forcing screws, raise rear housing (14), then use tool **A1** to lift it off.
   - ★ Remove slowly and be careful not to damage the seal ring.
   - ★ When removing, install a guide bolt to front housing (15), then lift off horizontally.

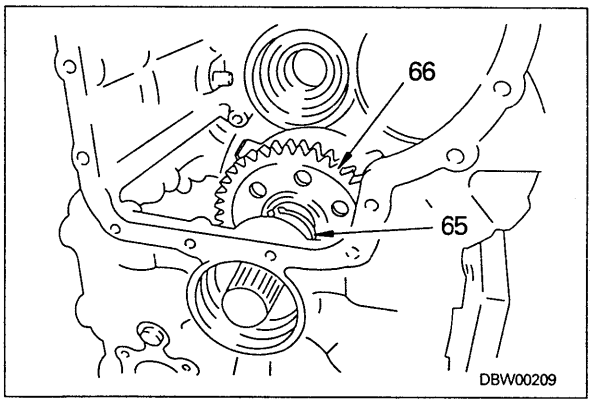
kg Rear housing, torque converter assembly : **190 kg**

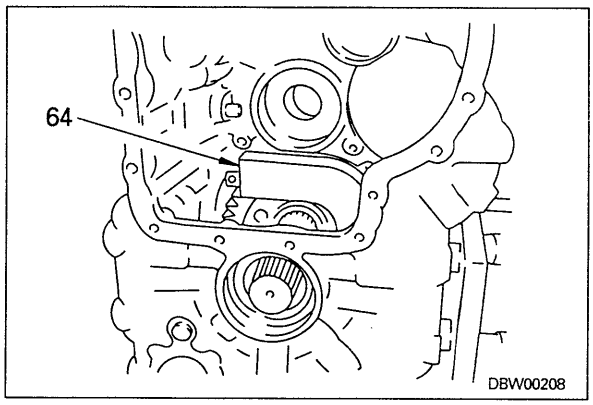


5) Insert gear (66) in shaft spline portion, and secure with snap ring (65).

6) Coat mounting bolts with thread tightener, and install shroud (64).
   - ★ Wash and remove all oil and grease from the mounting bolt hole and mounting bolt.
   - ★ Insert the shroud from immediately above the gear, then turn over and assemble.
   - ★ Check that the gear does not interfere with the shroud.

   kgm Mounting bolt :
   110.3 ± 12.3 Nm (11.25 ± 1.25 kgm)
   Mounting bolt :
   Thread tightener (LT-2)

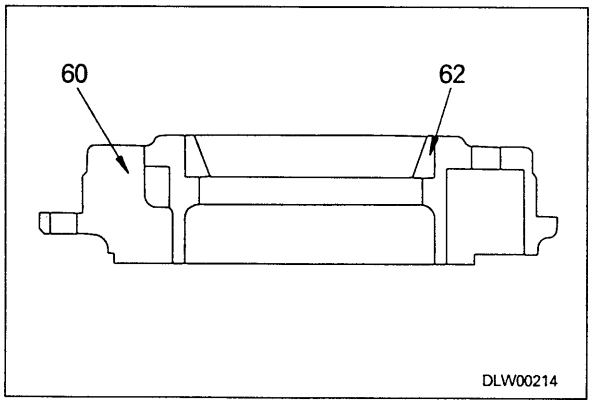




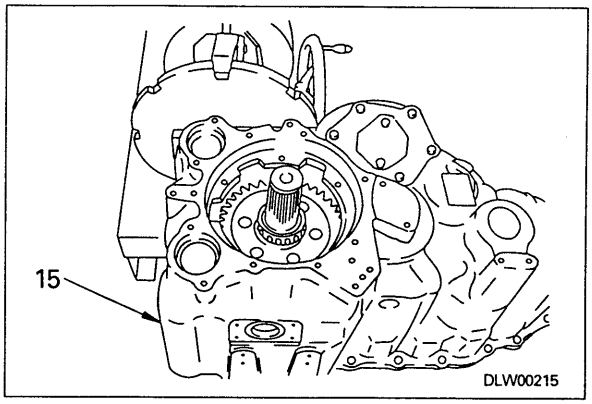
U42303

3. Parking brake retainer

1) Press fit bearing cup (62) to parking brake retainer (60).
   - ★ Press fit the bearing cup fully to the stepped portion of the retainer, and check that there is no clearance.

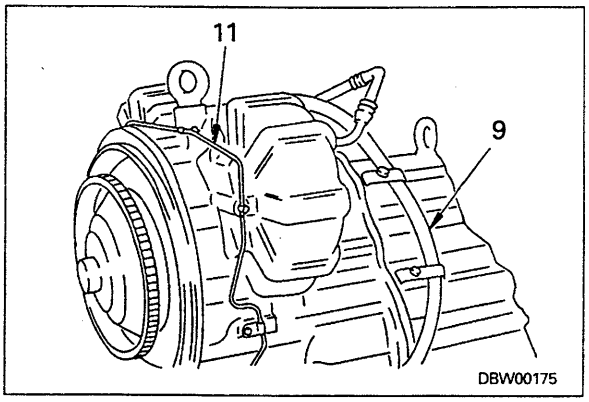


2) Turn over front housing (15).
   - ★ When turning over, be careful that the output shaft does not become at an angle.
   - ★ Set a stand under the top of the front housing.
   - ★ After turning over, hold the output shaft bearing cone in the bottom bearing cup.



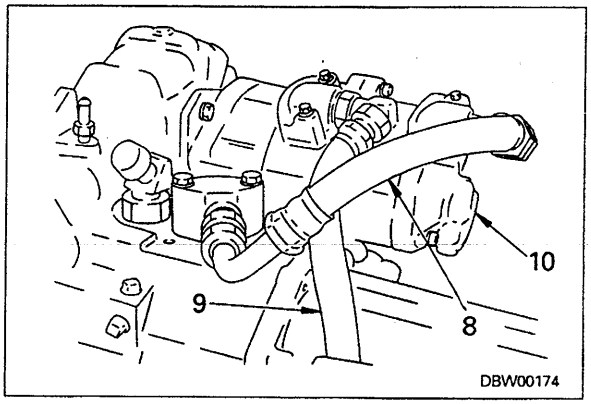
15. Hydraulic piping

1) Install PTO lubrication tube (11).
   ★ Be careful not to crush the tube during the operation.
2) Assemble clamp to hose (9) between torque converter oil filter and torque converter charging pump.



16. Charging pump

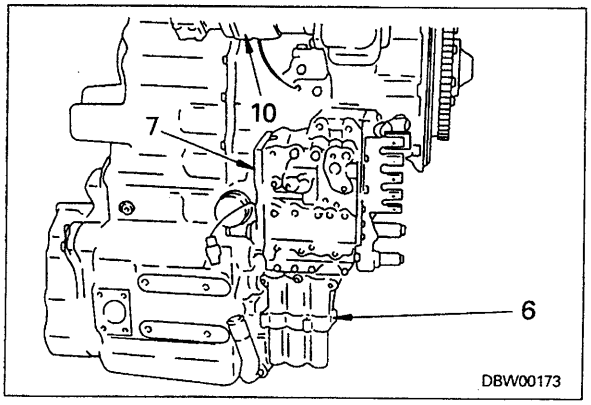
1) Assemble O-ring to charging pump (10), and install to transmission.
   ★ Be careful not to get the O-ring caught.
   kgm Mounting bolt :
   110.3 ± 12.3 Nm (11.25 ± 1.25 kgm)
2) Install hose and flange (8) and (9) to charging pump (10) and rear housing.
   ★ Be careful not to get the O-ring caught.
   kgm Hose, flange (pump end) :
   30.9 ± 3.4 Nm (3.15 ± 0.35 kgm)
   kgm Hose, flange (housing end) :
   66.2 ± 7.4 Nm (6.75 ± 0.75 kgm)
   kgm Hose joint :
   177 ± 29 Nm (18.0 ± 3.0 kgm)

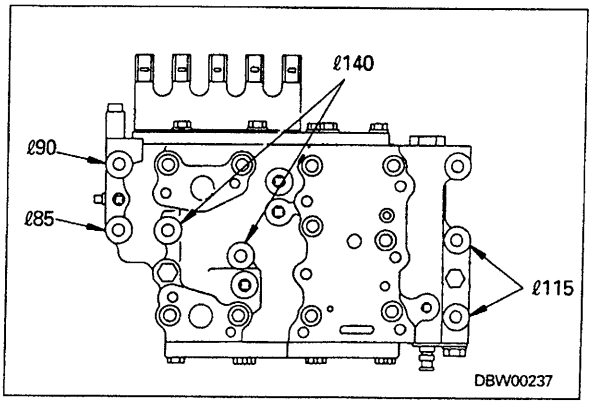


U42303

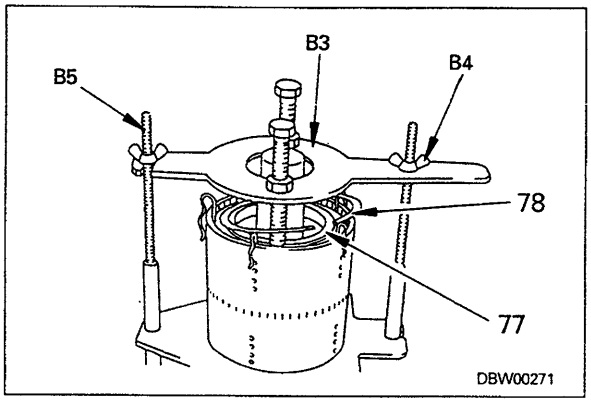
17. Transmission control valve

1) Install guide bolt to mount portion of transmission control valve (7).
   ★ Wash and remove all oil and grease from the control valve mounting bolt hole and mounting bolt thread.
2) Align with guide bolt and assemble gasket, then fit control valve (7) temporarily.
3) Coat mounting bolts of control valve (7) with thread tightener and tighten.
   ★ Tighten the mounting bolts in turn on diametrically opposite sides and be careful not to tighten too much.
   ★ The length of the mounting bolts is different, so be careful when using them.
   Mounting bolt :
   Thread tightener (LT-2)
   kgm Mounting bolt :
   34.3 ±4.9 Nm (3.5 ± 0.5 kgm)



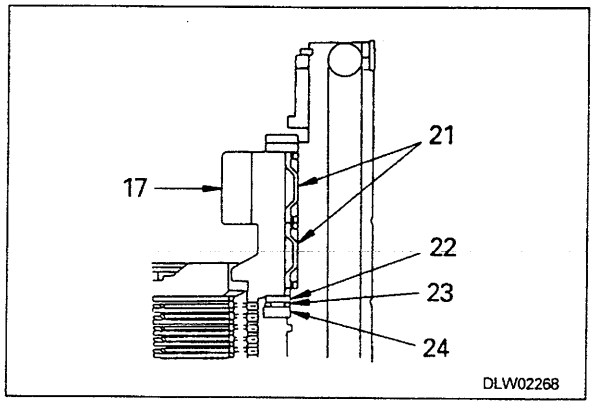


6. **End plate**
   1) Install tools **B3** and **B5**, then tighten tool **B4** to push in end plate (77).
   2) Assemble ring (78), and remove tool **B3**.
      ★ Check that the disc rotates smoothly by hand.

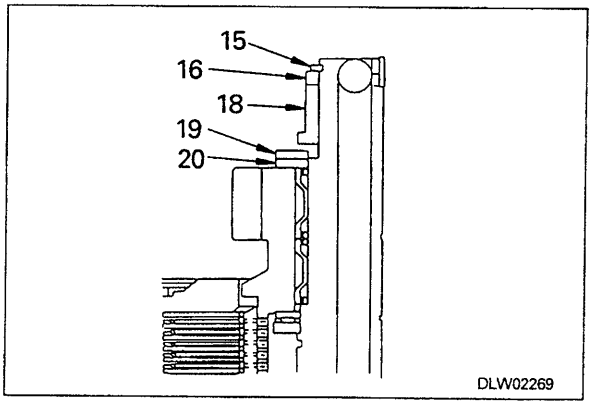


7. **Thrust washer**
   Assemble washer (24), thrust bearing (23), and thrust washer (22).

8. **REVERSE gear**
   Align spline groove on inside of plate with a screwdriver to assemble gear (17).
   ★ If the gear spline does not match, turn lightly when assembling. Never use force to push it in.

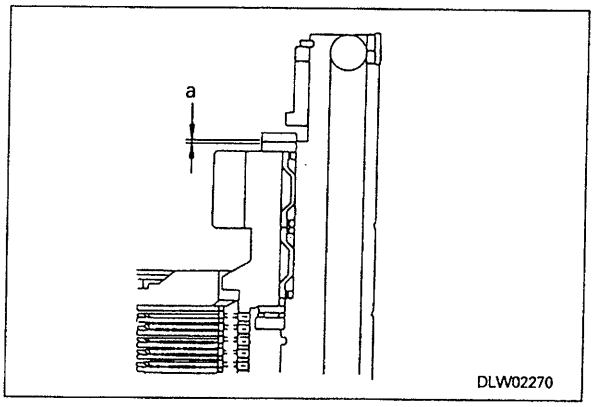


9. **Needle bearing**
   Assemble needle bearing (21) and thrust washer (20).
   ★ Check that the end face of the thrust washer is below the surface of the stepped portion of the shaft.



10. **Bearing**
    1) Assemble spacer (19), then press fit inner bearing (18) and spacer (16).
       ★ Press fit completely so that there is no clearance.
       Thrust washer : **Transmission oil**
    2) Assemble snap ring (15).

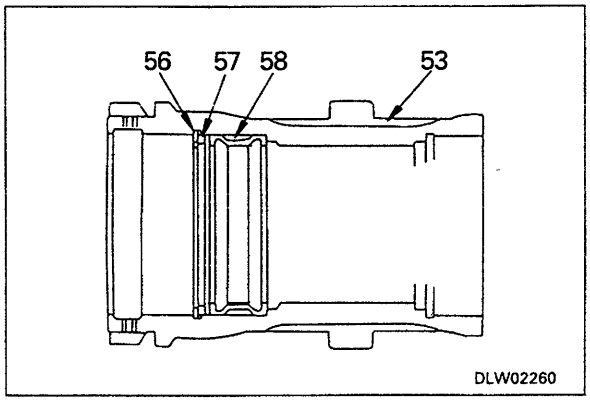
    3) After press fitting bearing, check that clearance "**a**" between thrust washer and spacer is within standard value.
       ★ **a** = 0.106 – 0.991 mm



U42303

12. 4th gear

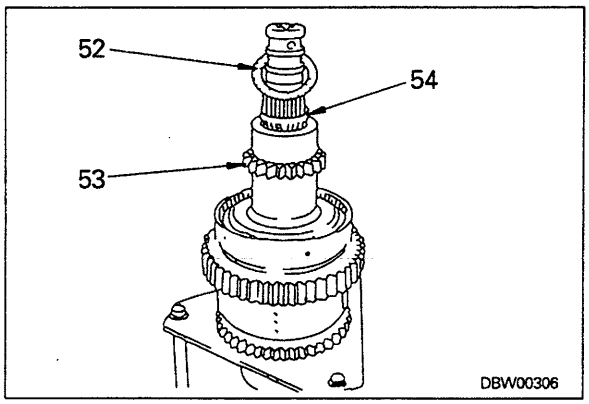
1) Assemble in same way as for 2nd gear.
2) Assemble needle bearing (58), spacer (57), and snap ring (56) to 4th gear (53), then assemble 4th gear (53).
3) Assemble top needle bearing (54).
4) Assemble thrust washer (52).
   ★ Check that the end face of the thrust washer is below the surface of the stepped portion of the shaft.

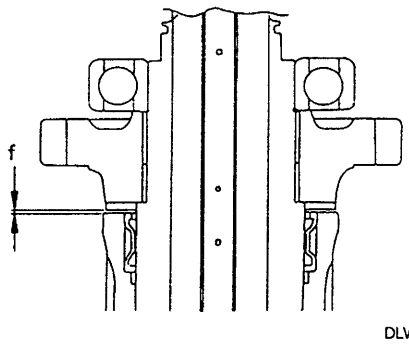


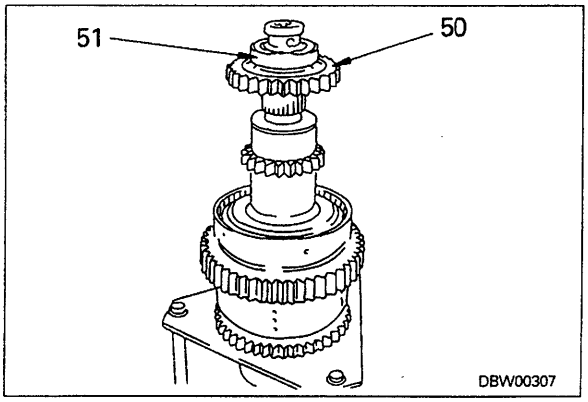
13. Bearing

Assemble idler gear (50), then press fit bearing (51).

★ Press fit completely so that the idler gear is in tight contact with bearing (51) at the stepped portion of the shaft.
★ After press fitting the bearing, check that clearance "**f**" between the thrust washer and the idler gear is within the standard value.
   ★ **f** = 0.17 – 1.43 mm



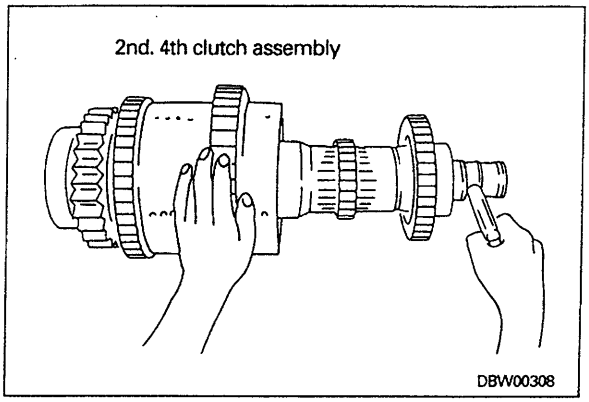




14. Clutch pack operation test

Blow in compressed air through oil hole in shaft and check that each clutch works properly.

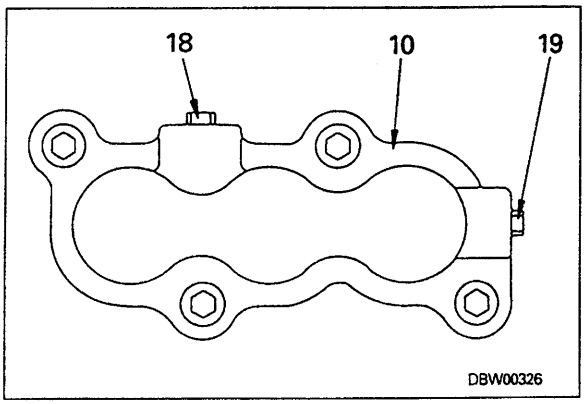
★ If the gear where the air is blown in is held in position, the clutch is working properly.

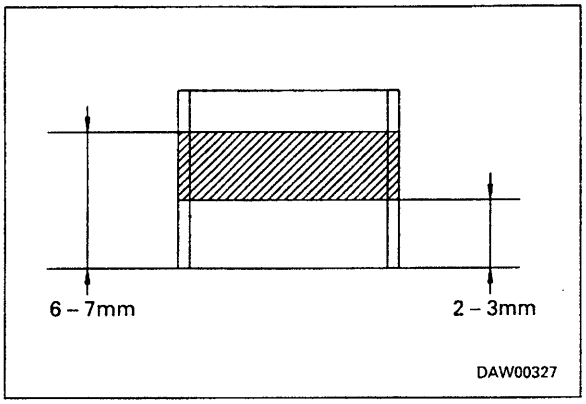


U42303

7. Remove plugs (18) and (19) from cover (10).
   - Plug : 5 mm (width across flats)
   - ★ Do not remove the plugs unless necessary.
   - ★ If plugs (18) and (19) have been removed, coat the thread with thread tightener as shown in the diagram below, then tighten the plugs.
   - ★ Be careful not to let the thread tightener drip on to the hatched portion when coating with thread tightener.

   Plug : **Thread tightener (LG-1)**





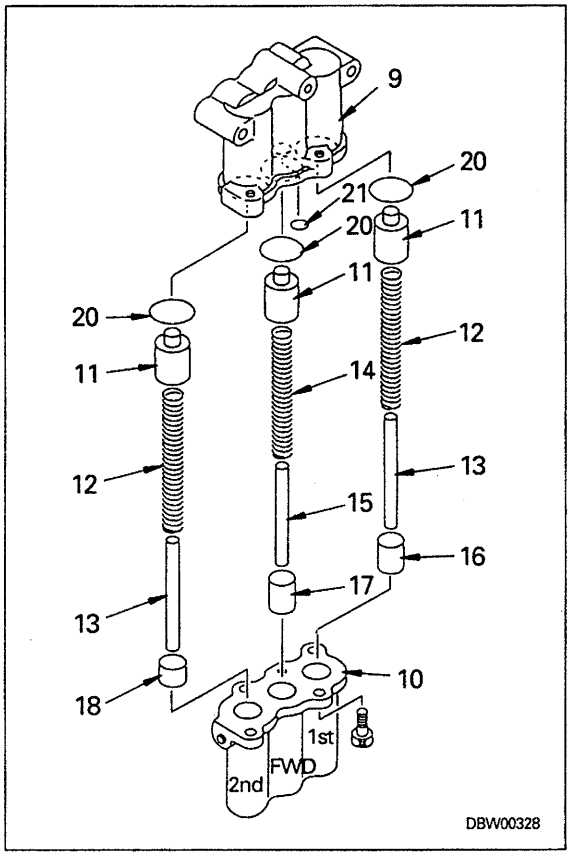
U42303

ASSEMBLY OF TRANSMISSION ACCUMULATOR VALVE ASSEMBLY

1. Using pads, set accumulator valve cover (10) in vice.
   - ★ Be careful not to tighten the vice on the cover with excessive force.
2. Assemble spacers (18), (17), and (16), stoppers (13), (15), and (13), and springs (12), (14), and (12) to accumulator valve cover (10), then insert valves (11) from top of each spring.
3. Fit O-rings (20) and (21) in each groove of accumulator valve body (9).
   - ★ Assemble the O-ring securely in the body groove.
4. Assemble accumulator valve body (9) perpendicularly from above cover (10), then temporarily install with guide bolts.
   - ★ Assemble the body carefully and be sure that the O-ring does not fall out.
5. Push in accumulator valve body (9), and remove guide bolts, then secure with standard bolt.

   kgm Mounting bolt :

   54 ± 19.6 Nm (5.5 ± 2.0 kgm)
   - Mounting bolt : 8 mm (width across flats)



INSTALLATION OF FRONT AXLE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ Raise the front frame with the bucket, and remove block ① when the frame is slightly raised.

※ 2

kgm Mounting bolt :
927 ± 103 Nm (94.5 ± 10.5 kgm)
(Width across flats : 36 mm)

※ 3

kgm Drive shaft mounting bolt :
110.3 ± 12.3 Nm (11.25 ± 1.25 kgm)

※ 4

★ Be careful not to tighten the tube nut too far.

kgm Tube nut : **80.9 ± 12.3 Nm (8.25 ± 1.25 kgm)**

※ 5

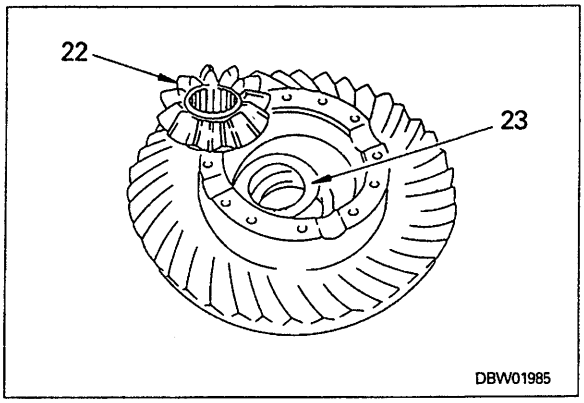
★ Use the bolt as a guide to align the mounting position.

kgm Mounting bolt :
132.4 ± 14.7 Nm (13.5 ± 1.5 kgm)
(Width across flats : 41 mm)

- Bleed the air from the brake system and carry out an actuation check.
  ★ For details, see TESTING AND ADJUSTING, Bleeding air.

U42303

6) Remove side gear (22) and thrust washer (23).



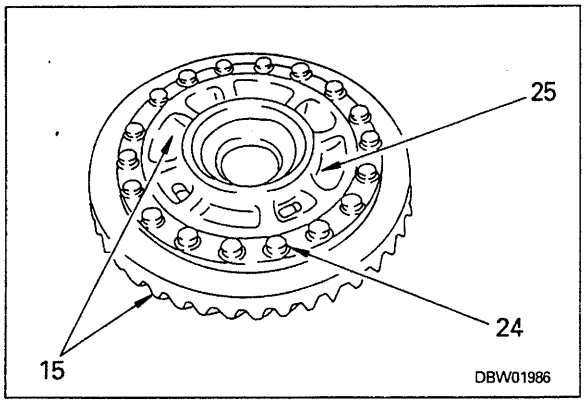
7) Turn over bevel gear and flange half assembly (15), then remove mounting bolts (24), and remove flange half (25).

kg Bevel gear, flange half assembly : **50 kg**

kg Bevel gear : **24 kg**

kg Flange half : **25 kg**

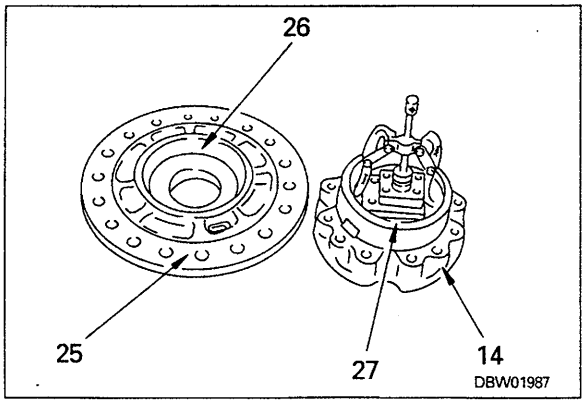
8) Use a puller to pull out bearing cups (26) and (27) from plain half (14) and flange half (25).

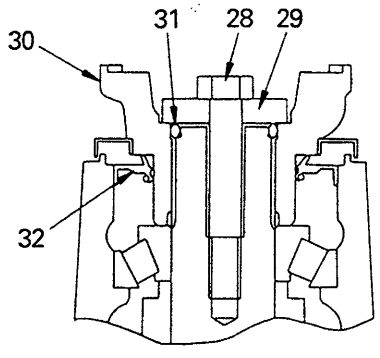


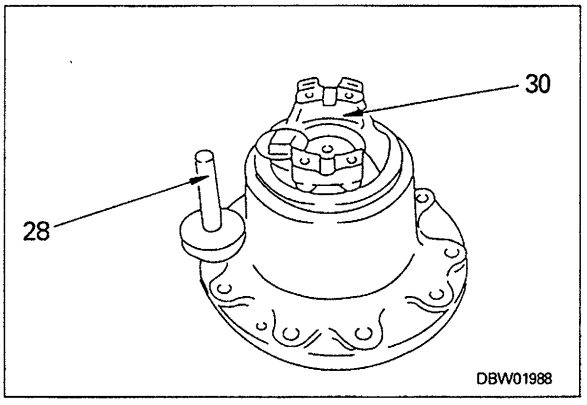
U42303

9. Coupling

1) Remove mounting bolt (28), then remove holder (29), coupling (30), and O-ring (31).
   ★ Do not remove the protector press fitted to the coupling unless necessary.
2) Remove oil seal (32).

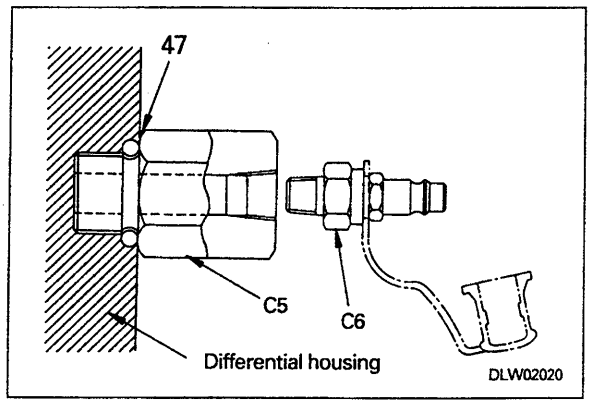


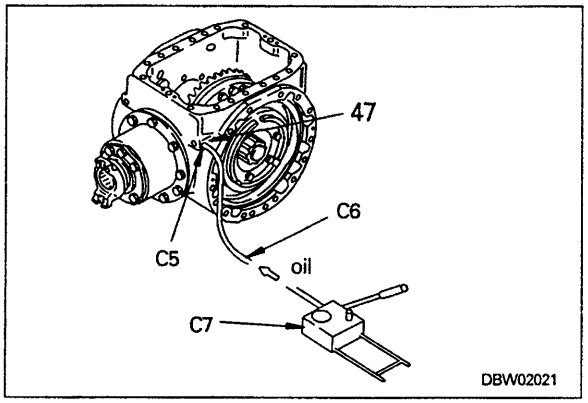




13. Checking for brake oil leakage

1) Install bleeder screw.
2) After screwing in tool **C3** of each piston press-fitting tool **C2** fully, turn back one turn.
3) Install tools **C5** and **C6** to brake tube mount (47), then bleed air inside cylinder.
4) Operate tool **C7**, and raise pressure to 1.4 MPa (14 kg/cm²).
   - ★ After raising pressure to 1.4 MPa (14 kg/cm²), leave for 5 minutes and check that the drop in pressure is less than 0.35 MPa (3.5 kg/cm²).
5) If the result of the inspection shows that there is no oil leakage, raise the pressure further to 4.9 MPa (50 kg/cm²).
   - ★ After raising pressure to 4.9 MPa (50 kg/cm²), leave for 5 minutes and check that the drop in pressure is less than 0.1 MPa (1.0 kg/cm²).
   - ★ If there is oil leakage, remove the brake piston, check the O-ring and other parts for damage, then assemble again.
   - ★ After checking for brake oil leakage, insert the piston fully.





U42303

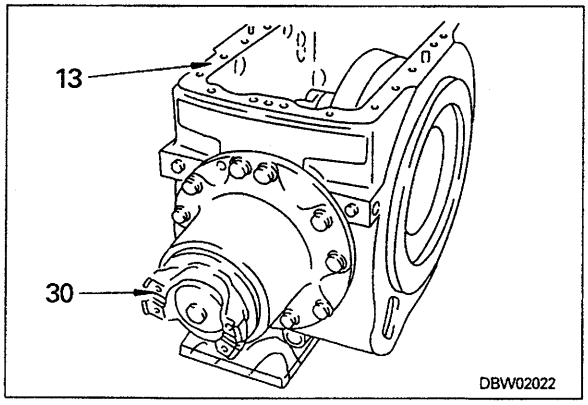
14. Coupling

Tighten mounting bolts of coupling (30) fully.

Mounting bolt : Thread tightener (LT-2)

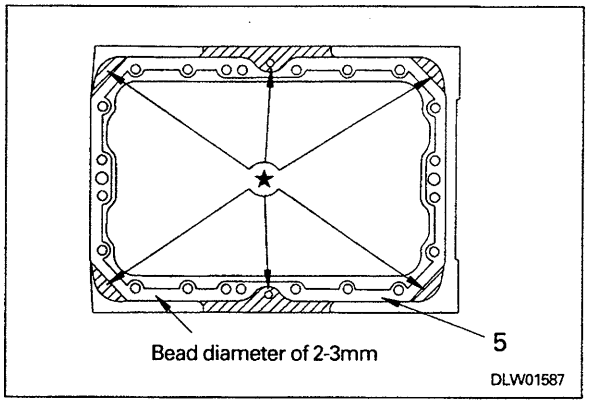
kgm Mounting bolt :

549 ± 59 Nm (56.0 ± 6.0 kgm)



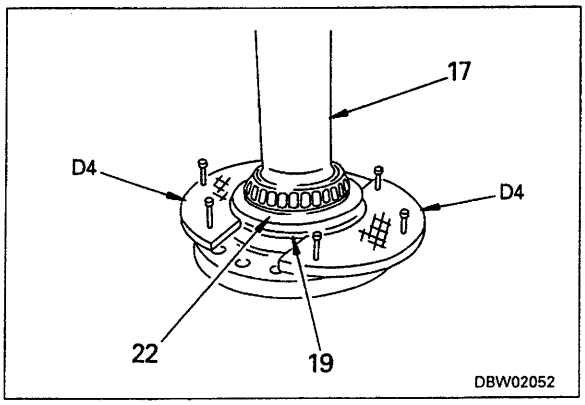
15. Differential cover

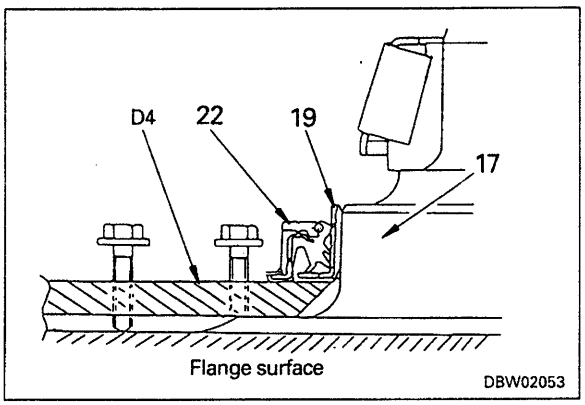
1) Wash and remove all oil and grease from mounting surface of differential cover (5) and differential housing (13), then coat with gasket sealant.
   - ★ Guide bolt : 14 mm, P = 2, L = 40 mm
   - ★ When installing the differential cover, screw the mounting bolts into the forcing screw holes, and raise.
   - ★ Temporarily assemble the bleeder screw so that gasket sealant does not get into the mounting hole of the bleeder screw.
   - ★ See the diagram on the right for details of coating.
     - Coat continuously with a bead diameter of 2 – 3 mm.
     - The shape of the differential cover at portion ★ is different, so coat and take care that the bead does not come off.



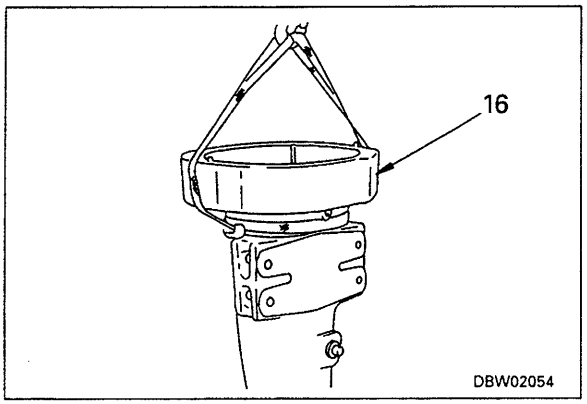
3. Housing, shaft

1) Stand shaft (17) upright and install tool **D4**.
   ★ Adjust the height of the seal support with the adjustment bolts, put the top surface of tool **D4** in light contact with seal (22), then set so that the clearance is uniform.
   ★ Set tool **D4** securely so that it does not come off.
2) Assemble oil seal (22) to oil seal sleeve (19).
   ★ When assembling the oil seal, be extremely careful not to damage the lip surface.
   Lip of oil seal : **Grease (G2-LI)**

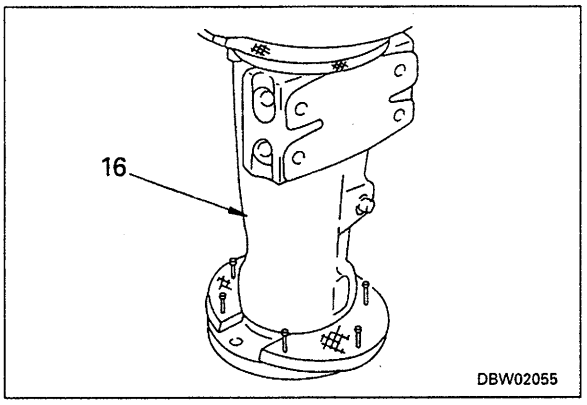




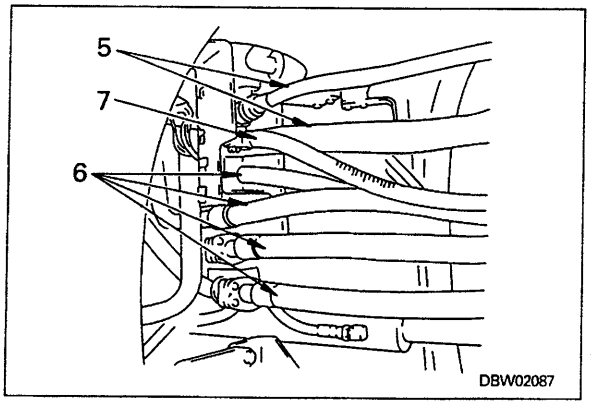
U42303



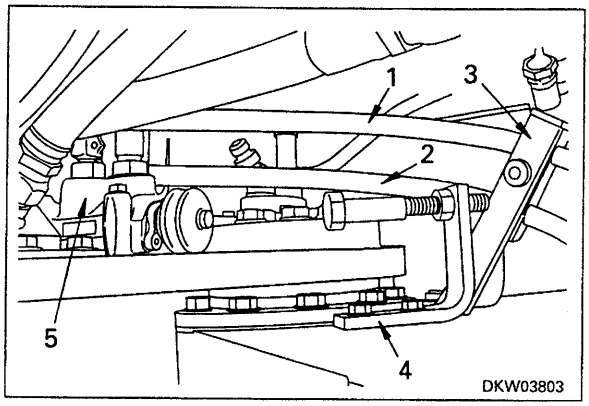
   ★ When raising axle housing (16), coat the oil seal press-fitting portion of the housing with oil.
   Oil seal press-fitting portion : **Oil (axle oil)**
3) Raise axle housing (16) to a horizontal position, then insert to shaft carefully.
   ★ Stop axle housing (16) before press fitting the oil seal.
4) Align axle housing (16) with oil seal press-fitting portion, then lower housing slowly.
   ★ Use the weight of the axle housing to insert it.



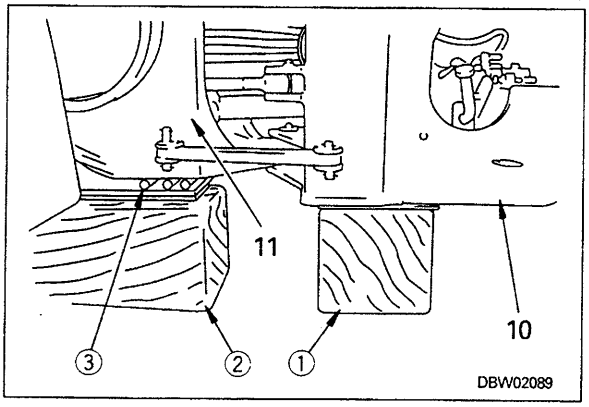
5. Disconnect hoses (5) and (6), and cable (7).
   ★ Disconnect hose (5) at the connecting portion at the rear frame end, then disconnect hose (6) at the valve end.



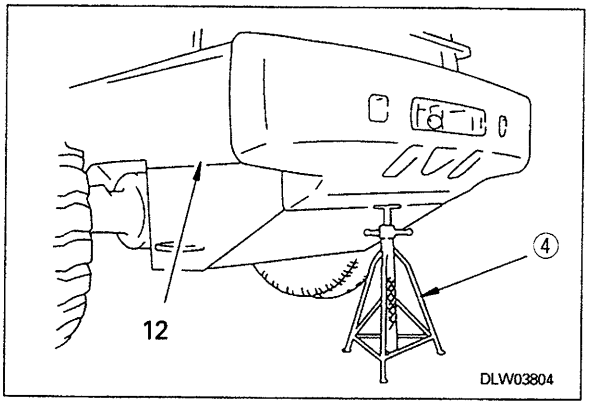
6. Disconnect stop valves as follows.
   1) Disconnect hoses (1) and (2) from the steering valve.
   2) Remove blocks (3) on the front and rear frame sides.
   3) Remove adjustment brackets (4) for stop valves on the left and right sides. ※ 3
   4) Remove left and right stop valves (5).
      ★ Remove the left side stop valve (5) and under spacer. Then put them aside on the right side of the frame.



7. Disconnect frame as follows. ※ 4
   1) Adjust height of rear frame (10) and set block ① in position.
      ★ Set block ① under the frame on the left and right sides.
   2) Adjust height of front frame (11), then set block ② in position, and assemble rollers ③ between frame (11) and block ②.
      ★ Set block ② and rollers ③ under the frame on the left and right sides.
      ★ Adjust the height of the frame carefully.

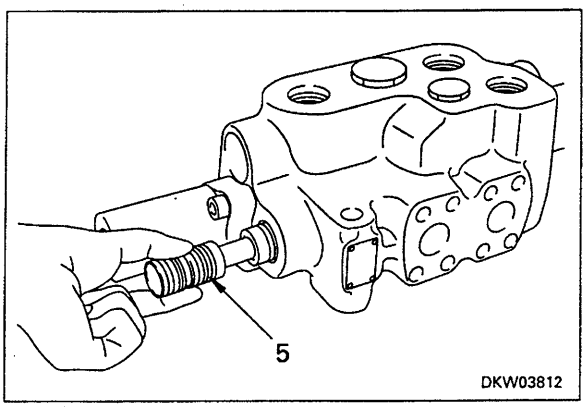


   3) Set support ④ under counterweight (12).
      ★ Block the left and right rear tires securely to prevent them from moving.
      ★ Choose a support with adjustable height for support ④.
   4) Remove safety bar.

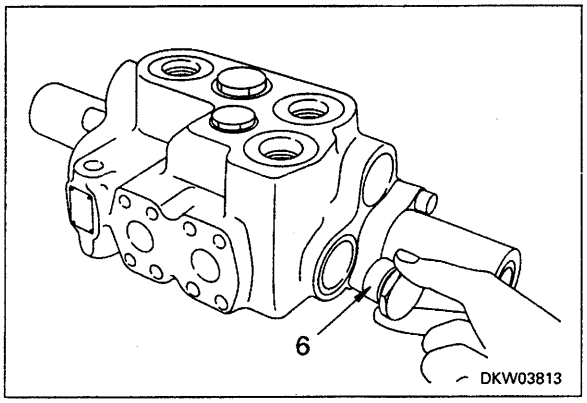


U42303

3) Remove demand spool (5).
   ★ Remove slowly, taking care not to damage the spool.
   ★ If shims are fitted, check the number and thickness of the shims, and keep in a safe place.



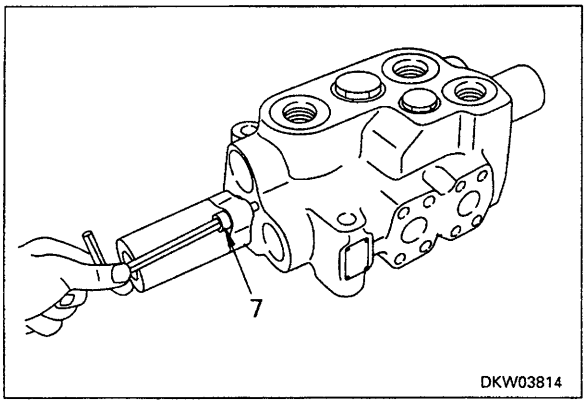
4) Remove plag (6).



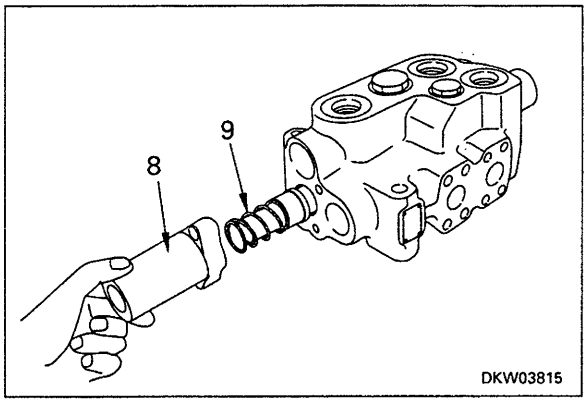
U42303

4. Removal of steering spool

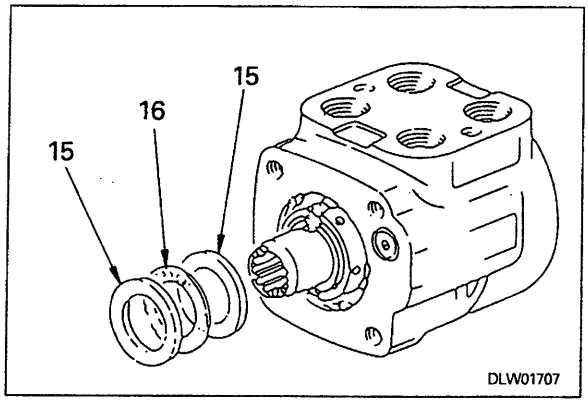
1) Remove 2 bolts (7).
   ★ Remove on the opposite side in the same way.



2) Remove case (8) and spring (9).
   ★ Remove on the opposite side in the same way.



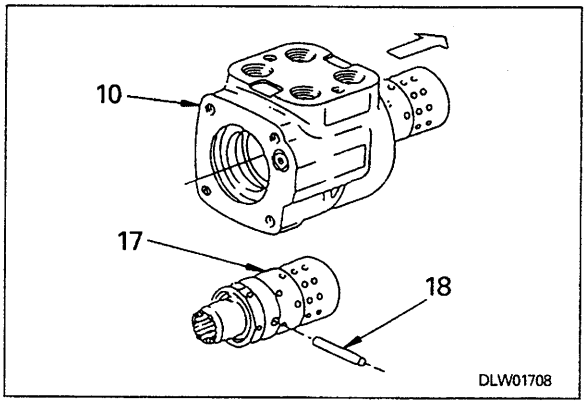
14. Remove 2 bearing races (15) and thrust needle (16) from spool and sleeve.



15. Pull out spool and sleeve assembly (17) from housing (10) in the direction of the arrow.

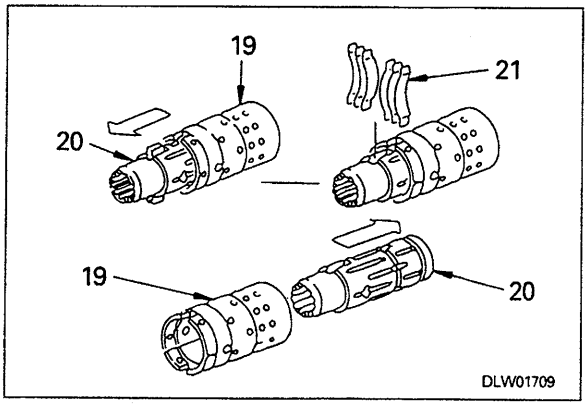
★ To prevent the spool and sleeve assembly from catching in the housing, rotate the spool and sleeve assembly slowly to the left and right when pulling out from the housing.

16. Pull out pin (18) from spool and sleeve assembly (17).



17. Push spool (20) inside sleeve (19) slightly to front, and remove 6 centering springs (21) from spool (20) carefully by hand.

18. Turn spool (20) slowly and pull out from rear of sleeve (19) (in the direction of the arrow).



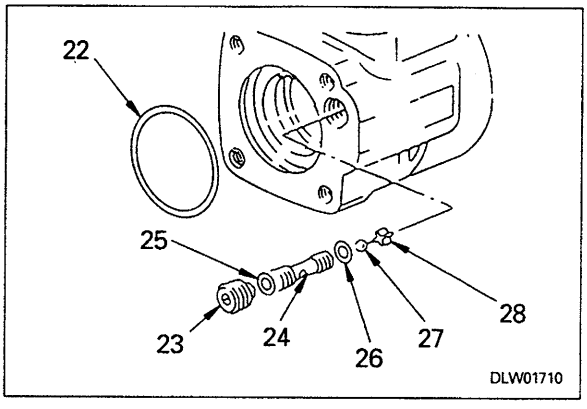
19. Remove O-ring (22) from housing.

20. Remove set screw (23) from housing.

21. Screw a threaded bar into check sheet (24), and pull out check sheet (24).

22. Remove O-rings (25) and (26) from check sheet (24).

23. Tap housing, and remove ball (27) and retainer (28).

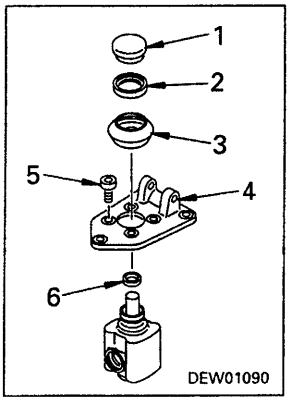


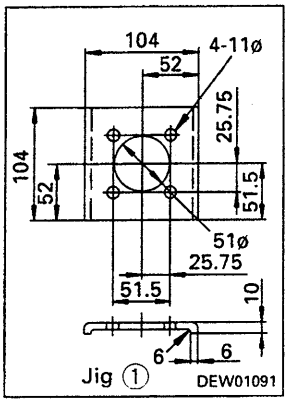
U42303

DISASSEMBLY OF RIGHT BRAKE VALVE ASSEMBLY (TANDEM)

1. Bracket assembly

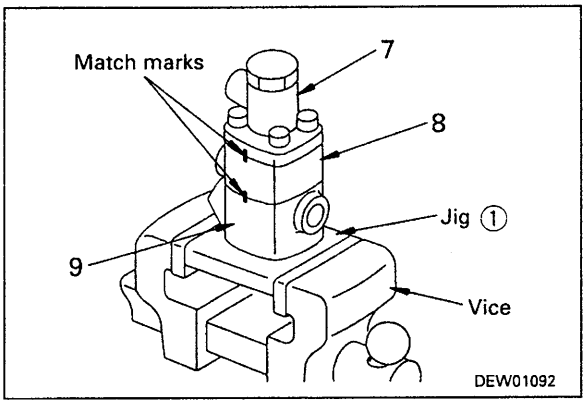
1) Remove seat (1), pedal stopper (2), and boot (3) from brake valve.
2) Remove mounting bolts (5) of bracket assembly (4), then remove bracket assembly.
3) Remove oil seal (6) from upper portion of brake valve.





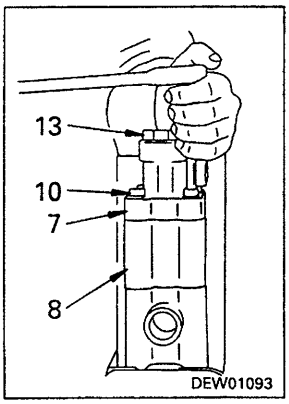
2. Valve

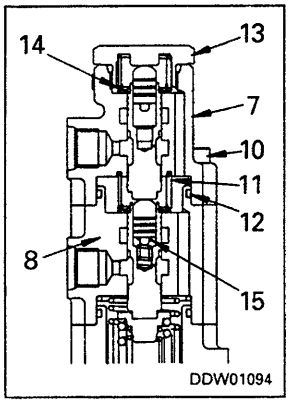
1) Install valve to jig ① with bolts (5), and secure jig in vice.
   ★ Make match marks before disassembling the valve.
2) Remove valve mounting bolts (10), then remove S cylinder assembly (7).



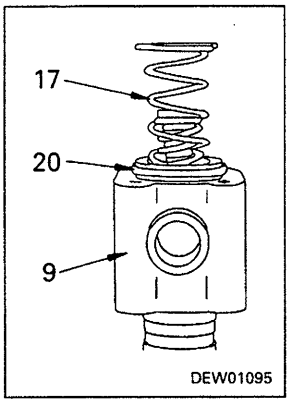
U42303

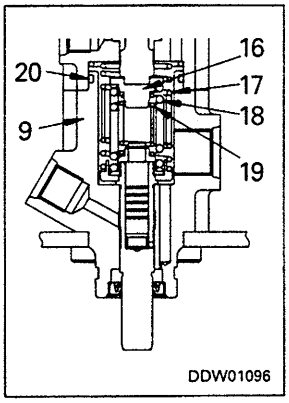
3) Remove plug (13) of S cylinder assembly, then remove spring (14) and O-ring.
4) Remove spring (11) and O-ring (12), then remove P cylinder assembly (8).
   ★ Remove spring (15) inside the plunger of the P cylinder assembly.



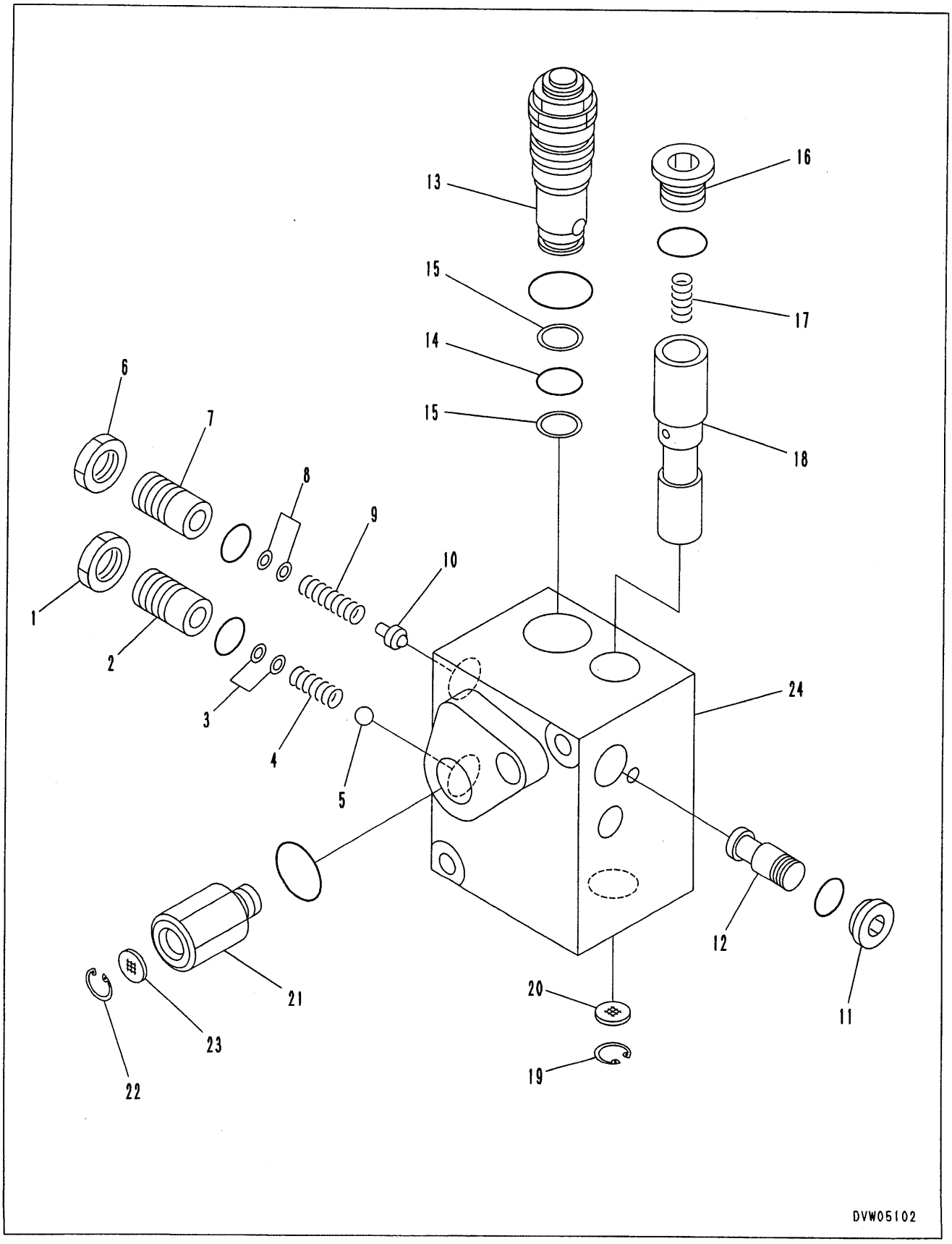


5) Remove holder (16), springs (17), (18), and (19) and O-ring (20) from T flange assembly (9).
   ★ The cylinders, plungers, and spools inside the T flange assembly and the S and P cylinders form sets, so be careful not to mix the parts for any set.
   ★ Fit seals to prevent dirt or dust from entering, and be careful not to damage the cylinders or flange assembly.





ASSEMBLY OF ACCUMULATOR CHARGE VALVE ASSEMBLY

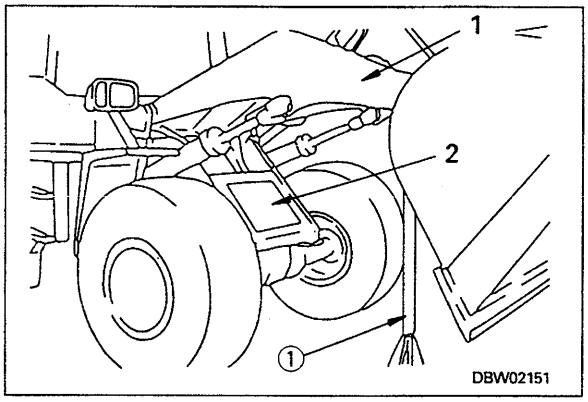


U42303

REMOVAL OF MAIN CONTROL VALVE ASSEMBLY

⚠ Stop the machine on level ground and install the safety bar on the frame. Lower the bucket to the ground and stop the engine. Then apply the parking brake and put blocks under the wheels to prevent the machine from moving.

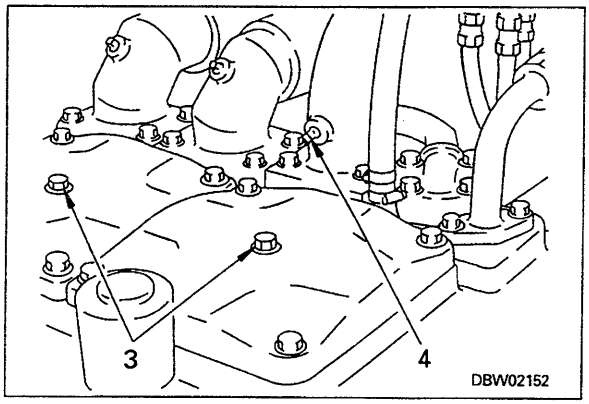
- Raise the boom, and set support ① under boom (1), then remove front cover (2).
  ⚠ Set the support securely.



⚠ Operate the control levers several times to release the remaining pressure in the hydraulic piping. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

★ Remove the cover at the front of the hydraulic tank.

- Loosen plugs (3) at top of hydraulic tank filter and plugs (4) of pump piping to prevent oil inside tank from flowing out.



U42303

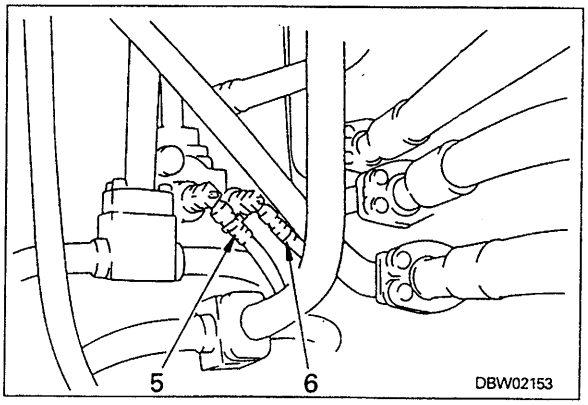
1. PPC hoses ※ 1

Disconnect following hoses from main control valve.

- Hose (5) for bucket spool between PPC valve (P4) and main control valve (J)
- Hose (6) for boom spool between PPC valve (P2) and main control valve (K)
- Hose (7) for bucket spool between PPC valve (P1) and main control valve (H)
- Hose (8) for boom spool between PPC valve (P3) and main control valve (I)

★ After disconnecting the hoses, move them towards the rear of the machine.

★ After disconnecting the hoses, mark them with tags to distinguish them.

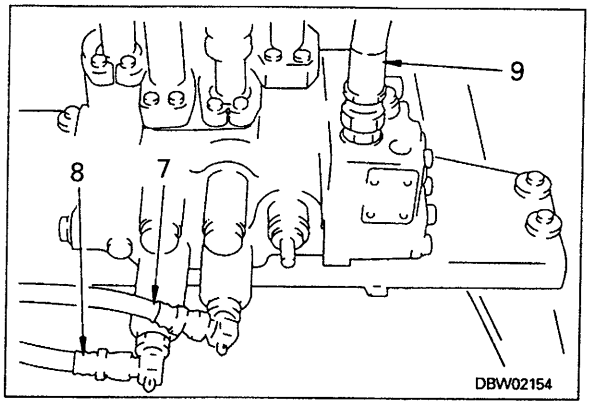


2. Hydraulic hoses ※ 2

Disconnect following hydraulic piping.

★ After removing each hose and tube, move them to the side.

- Hose (9) between steering valve and main control valve



INSTALLATION OF PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

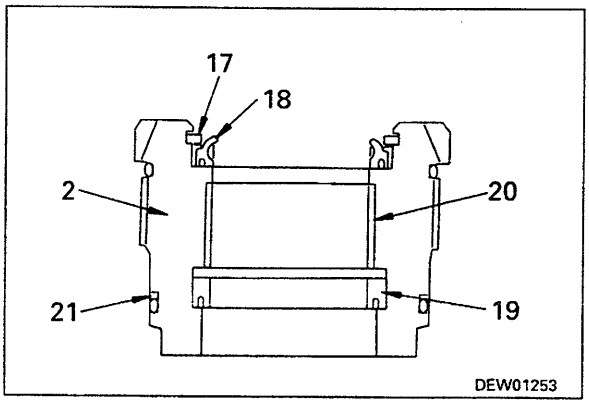
★ Adjust the linkage.
For details, see TESTING AND ADJUSTING.

- **Refilling with oil**
Tighten the plugs at the top of the hydraulic tank filter, and add hydraulic oil through oil filler to the specified level.
kgm Plug at top of filter :
11.8 ± 1.0 Nm (1.2 ± 0.1 kgm)
★ Run the engine to circulate the oil through the system. Then check the oil level again.

U42303

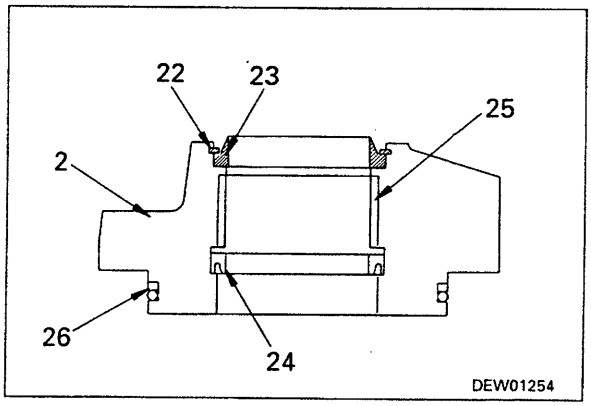
6. **Disassembly of cylinder head assembly**
   - **Steering cylinder assembly**

1) Remove snap ring (17), then remove dust seal (18).
2) Remove rod packing (19), then remove bushing (20) from cylinder head (2).
3) Remove O-ring and backup ring (21).



- **Boom, bucket cylinder assembly**

1) Remove snap ring (22), then remove dust seal (23).
2) Remove rod packing (24), then remove bushing (25) from cylinder head (2).
3) Remove O-ring and backup ring (26).

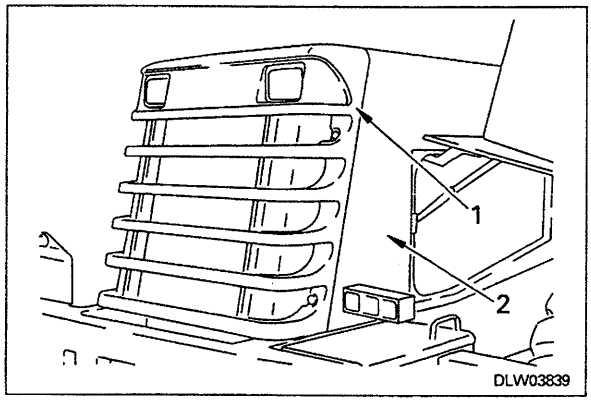


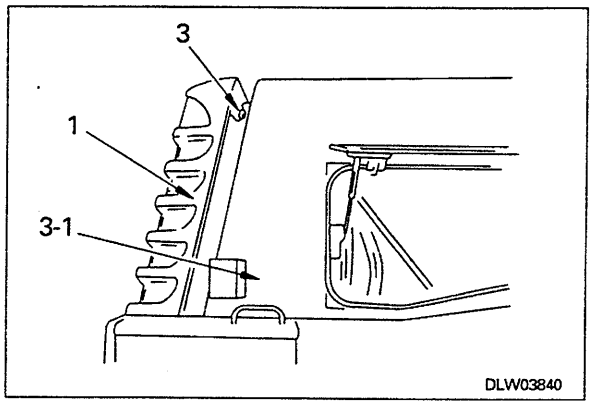
U42303

REMOVAL OF FUEL TANK ASSEMBLY

⚠ Stop the machine on level ground and install the safety bar on the frame. Lower the bucket to the ground and stop the engine. Then apply the parking brake and put blocks under the wheels to prevent the machine from moving.
⚠ Open the inspection cover and apply the lock.

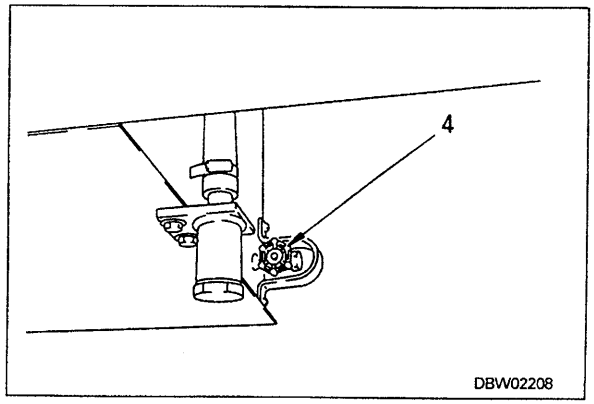
1. **Grill**
   1) Loosen mounting bolts of grill (1), then fit grill to engine hood (2) temporarily, and remove light wiring from engine hood (3-1) clip portion.
   2) Disconnect wiring connector (3), and remove grill (1).



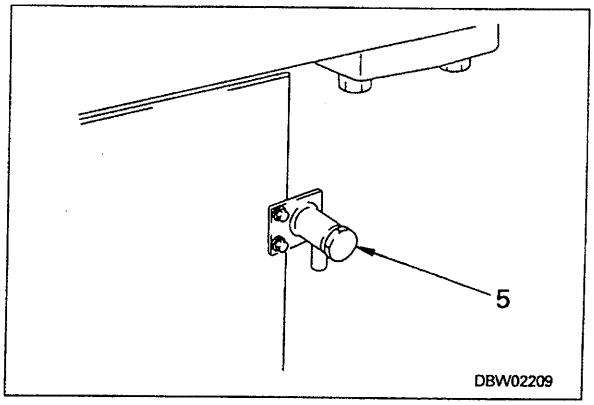


U42303

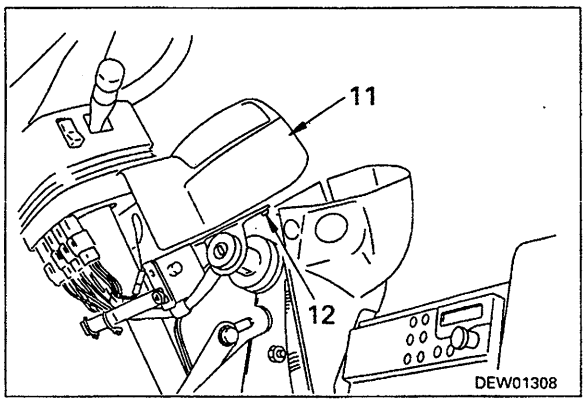
2. **Draining fuel**
   Loosen drain valve (4) and drain fuel.



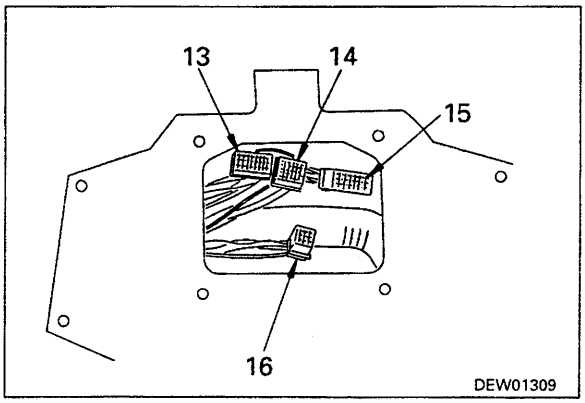
3. **Drain valve**
   Remove engine oil drain valve (5) from fuel tank.
   ★ Remove the drain valve, then tie with wire and move to the side.



7. Remove 8 mounting bolts (12) of main monitor (11).
   ★ When removing the main monitor, be careful not to subject it to any strong shock.



8. Disconnect wiring connectors (13), (14), (15), and (16) from main monitor, and remove main monitor (11). ※ 1

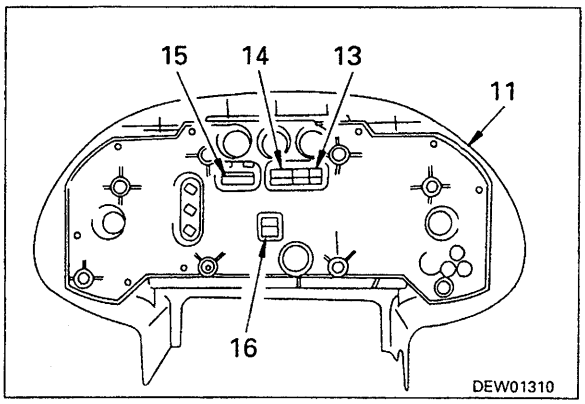


U42303

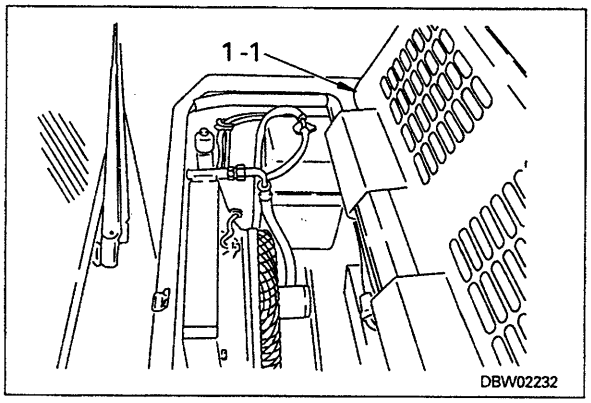
INSTALLATION OF MAIN MONITOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1
★ Fit the connector lock securely.



REMOVAL OF DRY RECEIVER ASSEMBLY



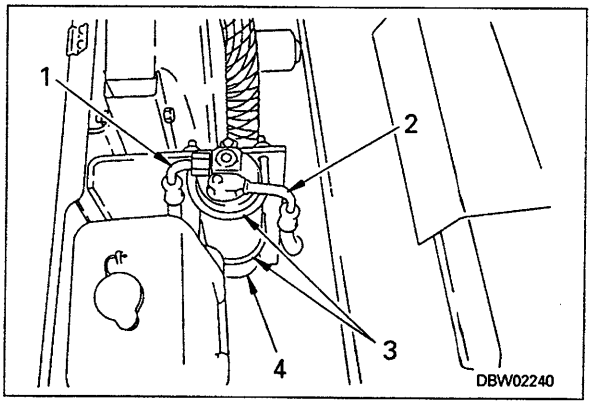
⚠ Stop the machine on level ground and install the safety bar on the frame. Lower the bucket to the ground and stop the engine. Then apply the parking brake and put blocks under the wheels to prevent the machine from moving.

★ Open inspection cover (1-1) on top of the bulkhead.

1. Carry out oil return operation for compressor, then use a gauge manifold and release refrigerant slowly from compressor high-pressure and low-pressure valves.

• **Procedure for oil return operation**
Set fan switch to maximum position, run engine at low idling, and operate air conditioner for 5 minutes.

2. Disconnect hoses (1) and (2). ※ 1
   ★ After disconnecting the hoses, fit covers to the joint.
3. Remove mounting U-bolts (3), then remove dry receiver (4) from bracket. ※ 2



U42303

INSTALLATION OF DRY RECEIVER ASSEMBLY

• Carry out installation in the reverse order to removal.

※ 1

kgm Hose mounting bolt :
5.4 ± 1.5 Nm (0.55 ± 0.15 kgm)

★ To prevent dirt, dust, or water from entering, do not remove the covers from the air conditioner hoses until immediately before installing.

Hose joint : **Compressor oil**

※ 2

kgm U-bolt : **18.6 ± 7.8 Nm (1.9 ± 0.8 kgm)**

★ Be careful not to tighten the U-bolts too far.

• **Filling with gas**

★ Fill the air conditioner with gas. (R134a)

★ Before filling with refrigerant, always use the repeat vacuum method to completely evacuate.

★ Do not use the can of refrigerant upside-down or use any other mistaken method. Be careful not to let liquid freon get into the refrigerating system.

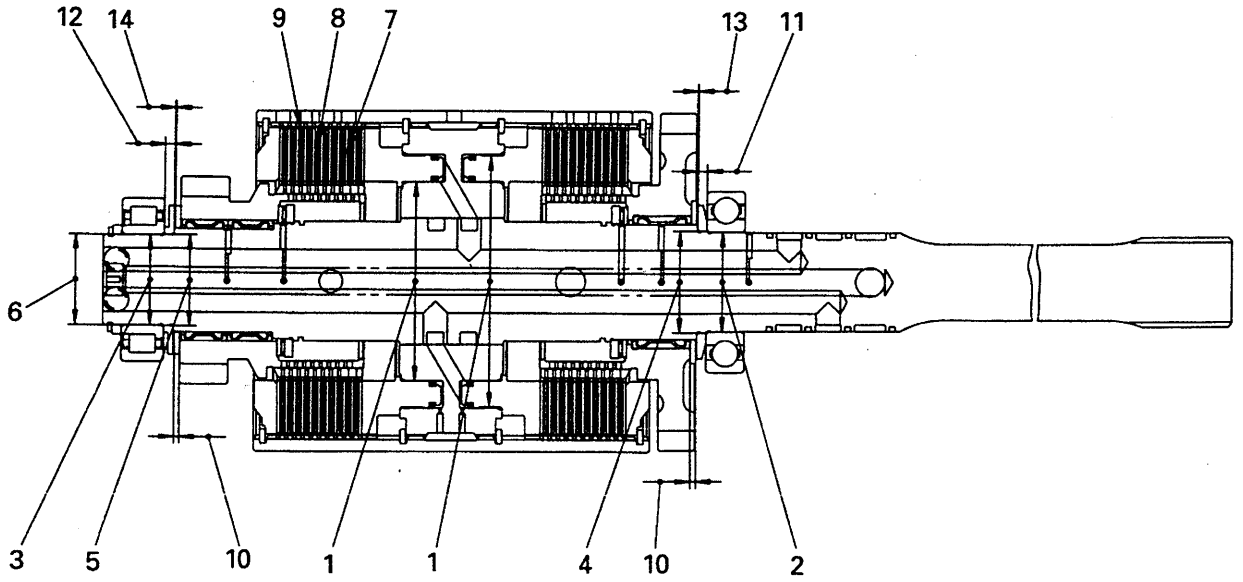
★ Do not operate the compressor before charging with refrigerant.

★ Check that the refrigerant level is correct.

★ Check the oil level in the compressor.
(Specified oil level: 150^{+14}_{0} cc ND-OIL8)

	Amount of bubbles in receiver sight glass	Remedy
Correct	Almost completely transparent; even if there are bubbles, becomes transparent when engine speed is raised or lowered	———
Low	Continuous stream of bubbles passes	Connect charging hose to compressor, then add refrigerant until condition becomes normal

FORWARD/REVERSE Clutch



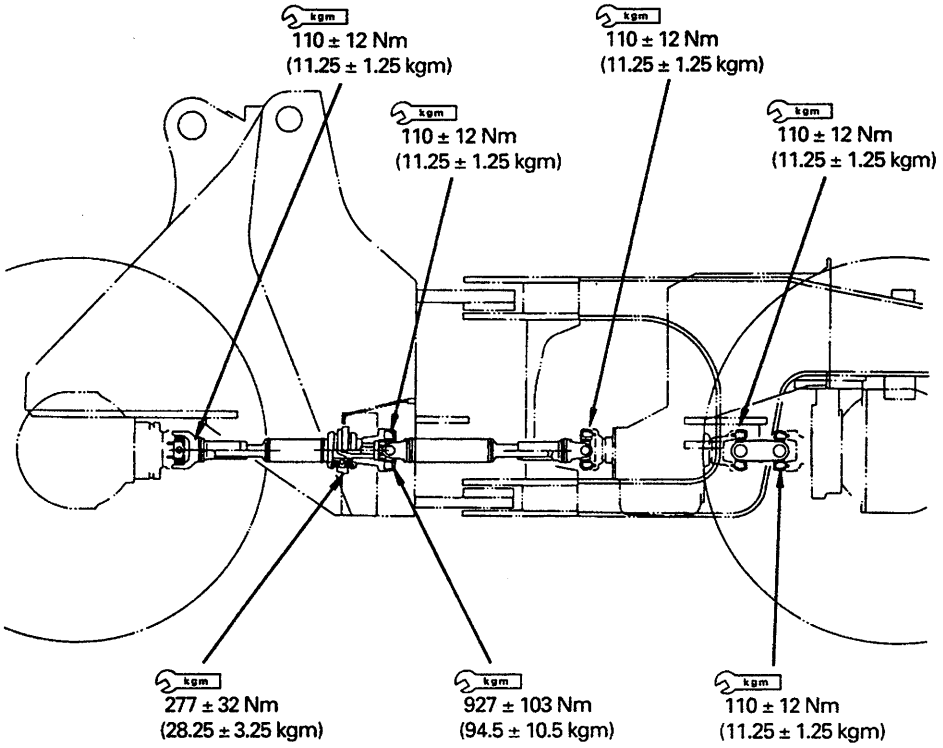
SAW00646

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between piston and cylinder (forward/reverse) (inner)	110	−0.27 −0.32	+0.06 −0.07	0.02 – 0.38	0.43	Replace
	(outer)	140	−0.20 −0.25	+0.13 0	0.02 – 0.38	0.43	
2	Clearance at forward/ reverse clutch shaft bearing press-fitted section (R)	55	+0.030 +0.011	0 −0.015	−0.011 – −0.045	—	
3	Clearance at forward/ reverse clutch shaft bearing press-fitted section (F)	50	+0.034 +0.021	0 −0.012	−0.021 – −0.046	—	
4	Clearance at forward/ reverse clutch shaft spacer press-fitted section (R)	56	+0.030 +0.011	0 −0.030	−0.011 – −0.060	—	
5	Clearance at forward/ reverse clutch shaft spacer press-fitted section (F)	50.5	+0.025 +0.009	0 −0.030	−0.009 – −0.055	—	
6	Clearance at forward/ reverse clutch shaft bearing end spacer press-fitted section	50	+0.034 +0.021	−0.020 −0.040	−0.041 – −0.074	—	
		Standard size	Tolerance		Repair limit		
7	Separator plate thickness	1.7	±0.05		1.6		
	Separator plate distortion	—	0.1		0.15		
8	Friction plate thickness	2.2	±0.08		1.95		
	Friction plate distortion	—	0.1		0.25		

U42303

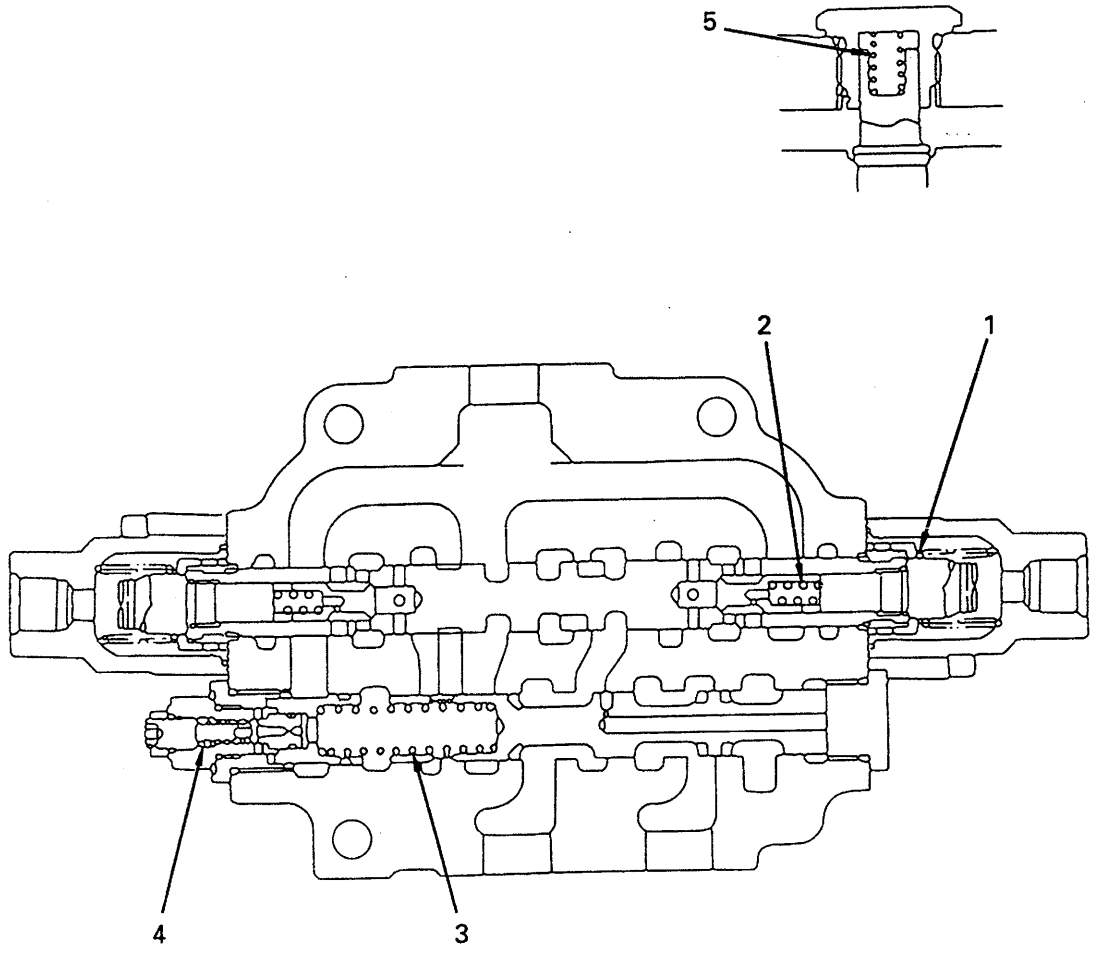
DRIVE SHAFT



SLW01252

U42303

STEERING VALVE



U42303

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
1	Steering spool return spring	37.2	32.0	56.9 N (5.8 kg)	—	47.1 N (4.8 kg)	Replace
2	Load check valve spring	20.9	13.2	9.3±4.9 N (0.95±0.5 kg)	—	7.8 N (0.8 kg)	
3	Demand spool return spring	75.1	68.5	136.1 N (13.88 kg)	—	114.7 N (11.7 kg)	
4	Relief valve spring	24.0	22.19	182.4 N (18.6 kg)	—	145.1 N (14.8 kg)	
5	Check valve return spring	21.6	17.0	2.3 N (0.23 kg)	—	1.8 N (0.18 kg)	