

SHOP MANUAL

KOMATSU

WA380-3MC

WHEEL LOADER

MACHINE MODEL	SERIAL NUMBERS
WA380-3MC	A51001 and up

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FOREWORD

GENERAL

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop. For ease of understanding, the manual is divided into the following sections. These sections are further divided into each main group of components.

GENERAL

This section lists the general machine dimensions, performance specifications, component weights, and fuel, coolant and lubricant specification charts.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

TESTING AND ADJUSTING

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs. Troubleshooting charts correlating "Problems" to "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your distributor for the latest information.

kgm to ft. lb

1 kgm = 7.233 ft. lb

kgm	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

PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

WA380-3MC

It is not our policy to approve fuel, coolant and lubricants or to guarantee performance in service. The responsibility for the quality of the fuel, coolant and lubricant must remain with the supplier. When in doubt, consult your Komatsu distributor. The specified fuel, coolant and lubricants recommended for this machine are as shown in the following table.

RESERVOIR	FLUID TYPE	AMBIENT TEMPERATURE								CAPACITY	
		-22 -30	-4 -20	14 -10	32 0	50 10	68 20	86 30	104EF 40EC	Specified	Refill
Engine with filter(s)	Engine oil	SAE 5W-30								22 R 5.9 gal (US)	19 R 4.2 gal (US)
		SAE 10W-30									
		SAE 15W-40									
Torque converter, transmission, transfer case & oil cooler	Engine oil	SAE 10W								42 R 11.1 gal (US)	40 R 10.6 gal (US)
		SAE 30W									
Service brakes		SAE 10W								-	-
Drive axles Front & rear (each)	Axle oil	See page 9 "Drive Axle Oil Specifications"								32 R 8.5 gal (US)	32 R 8.5 gal (US)
Hydraulic system	Engine oil	SAE 10W								190 R 50.2 gal (US)	138 R 36.4 gal (US)
		SAE 15W-40									
		SAE 10W-30									
Fuel tank	Diesel fuel	ASTM D975 No. 2								287 R 75.8 gal (US)	-
		ASTM D975 No. 1									
All lubrication fittings	Grease	Komatsu Super Grease or NLGI No.2 Multi-purpose lithium grease with 3% molybdenum disulfide								Fill as instructed	
Cooling system	Coolant	See COOLANT SPECIFICATIONS in section 01								53 R 14 gal (US)	-

API: American Petroleum Institute

ASTM: American Society of Testing and Materials

NLGI: National Lubricating Grease Institute

SAE: Society of Automotive Engineers

Specified Capacity: Total amount of oil including oil for components and piping.

Refill Capacity: Amount of oil needed to refill system during normal maintenance.

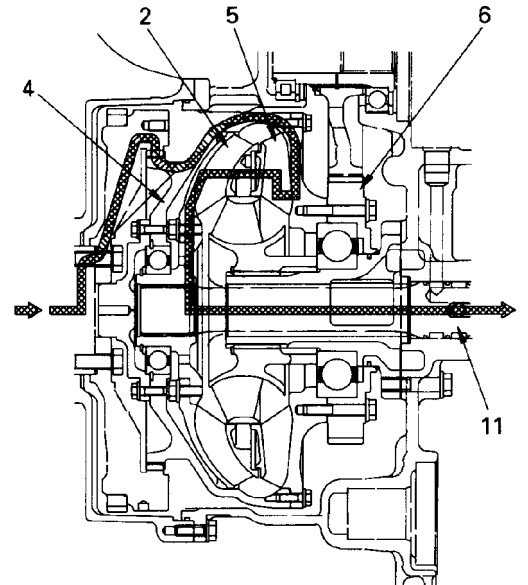
Other equipment may be necessary when operating the machine at temperatures below -20EC (-4EF), therefore consult your Komatsu distributor for your specific needs.

10 STRUCTURE AND FUNCTION

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Path of motive force

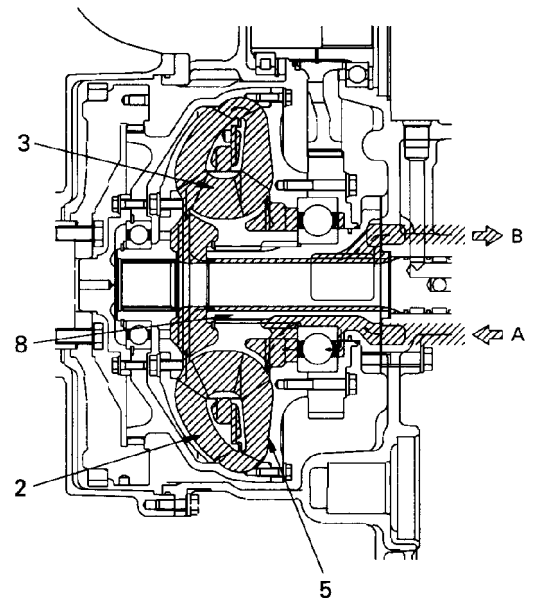
! The torque converter is installed between the engine and the transmission.
 The motive force from the engine enters drive case (4) from flywheel.
 Drive case (4), pump (5), and PTO gear (drive) (6) are each secured by bolts and are rotated directly by the rotation of the engine.
 The motive force of pump (5) uses oil as a medium to rotate turbine (2) and transmit the motive force to transmission input shaft (11).
 The motive force of drive case (4) is used as the motive force to drive the gear pump through PTO gear (drive) (6).



SAW00428

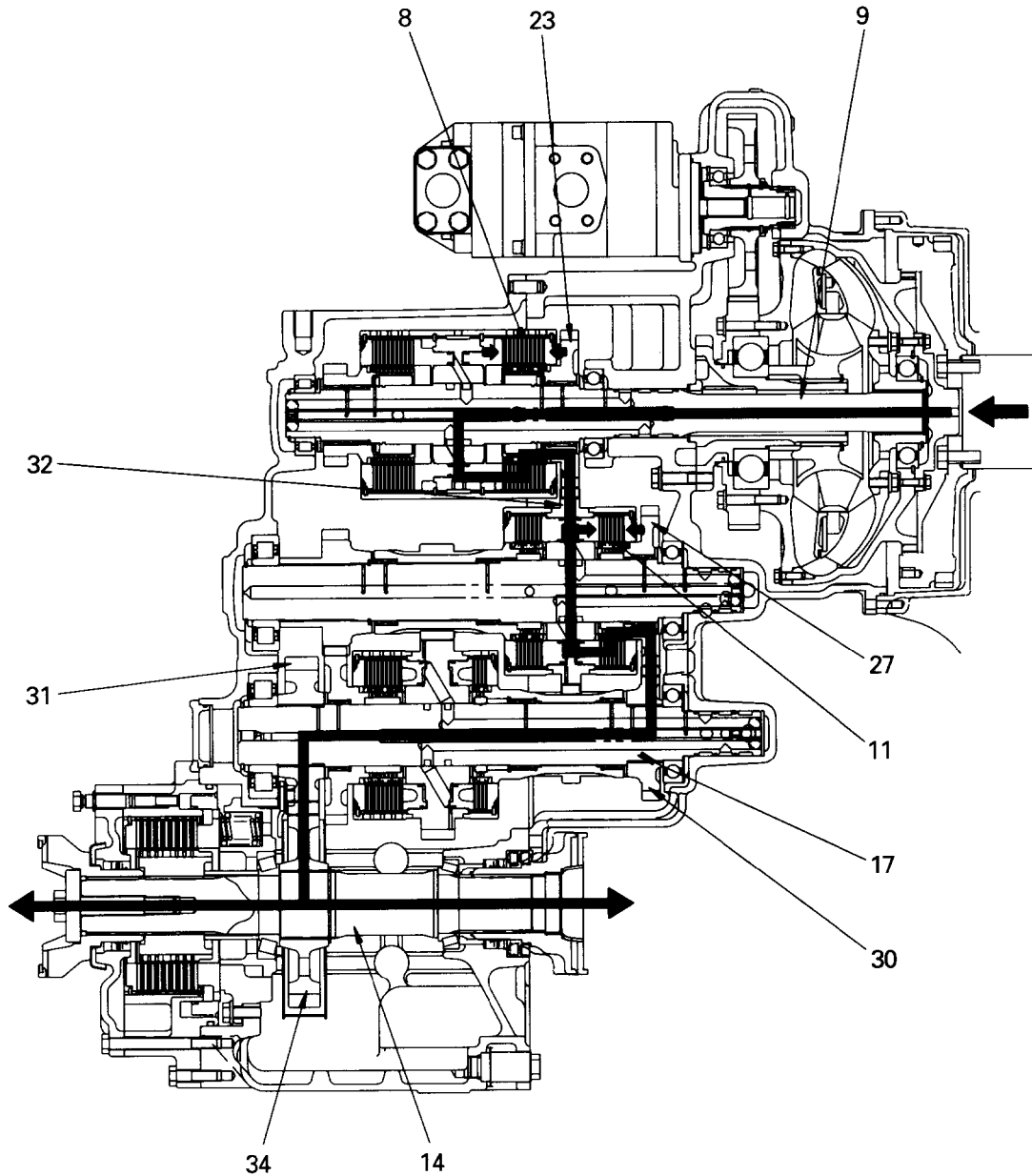
Flow of oil

! The oil supplied from the torque converter charging pump enters inlet port **A** passes through the oil passage of stator shaft (8), and flows to pump (5).
 The oil is given centrifugal force by pump (5), enters turbine (2), and transmits the energy of the oil to the turbine. Turbine (2) is fixed to transmission input shaft (11), so the motive force is transmitted to the transmission input shaft.
 The oil from turbine (2) is sent to stator (3), and enters the pump again. However, part of the oil is sent from the stator through outlet port **B** to the cooler.



SAW00429

FORWARD 3RD



SAW00441

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** gear (32).
- ! Since **3rd** clutch (11) is engaged, the motive force transmitted to **1st** and **3rd** 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).

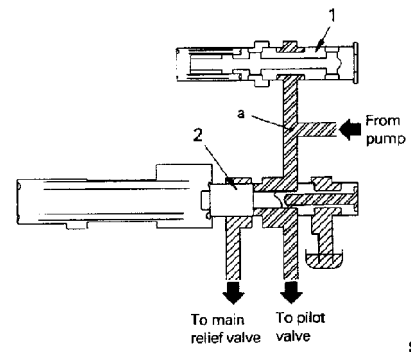
PRIORITY VALVE

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

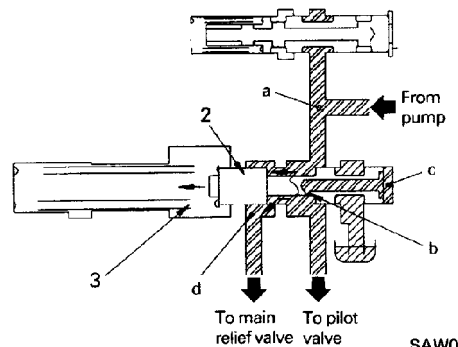
1. The oil from the pump enters port **a** and separates into the oil flowing to the parking brake valve (1), priority valve (2) and the pilot circuit.



SAW00457

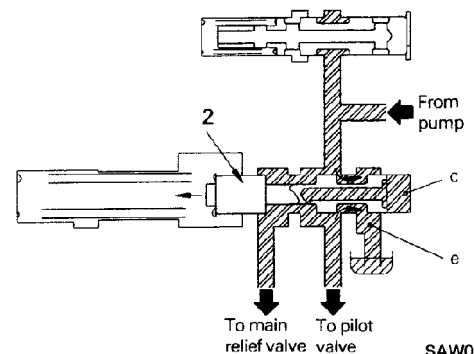
2. The oil at port **a** passes through priority valve (2) orifice **b** and flows to port **c**.

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



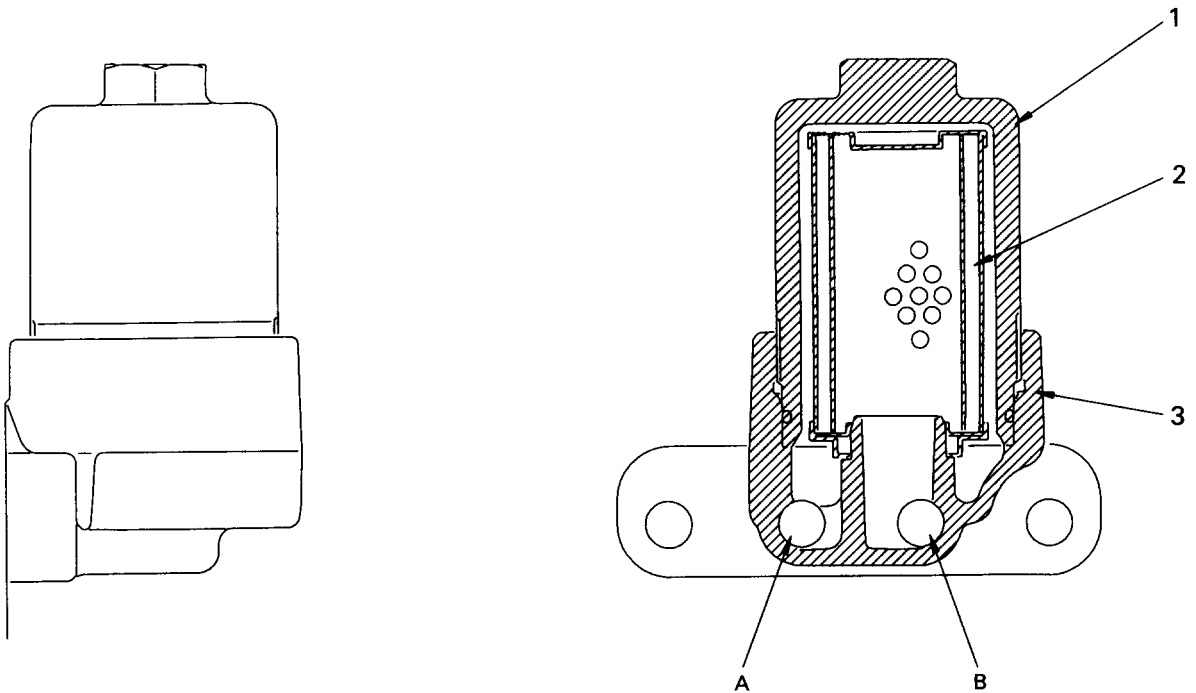
SAW00458

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.



SAW00459

PILOT OIL FILTER



SBW00482

1. Case
2. Element
3. Oil filter header

- A. Inlet port
- B. Outlet port

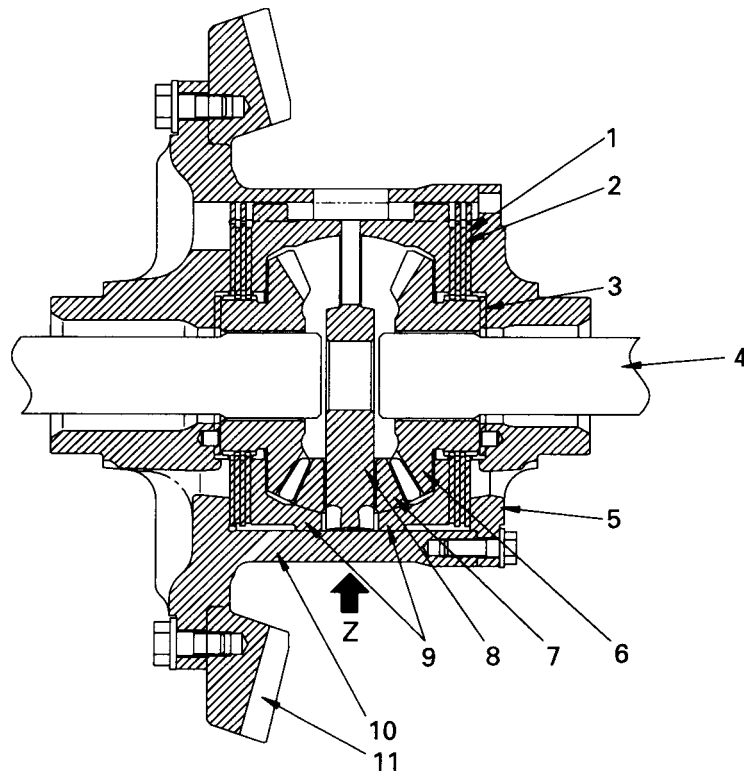
SpecificationsFiltering area: 170 cm²

Filter mesh size: 105 Fm

Outline

- ! The pilot oil filter is mounted on the transmission lower valve , and filters dirt from the oil flowing to the pilot circuit.

LIMITED SLIP DEFERENTIAL (OPTION)



SKW00411

1. Plate
2. Disc
3. Washer
4. Shaft
5. Cover
6. Side gear
7. Pinion
8. Shaft
9. Pressure ring
10. Case
11. Bevel pinion

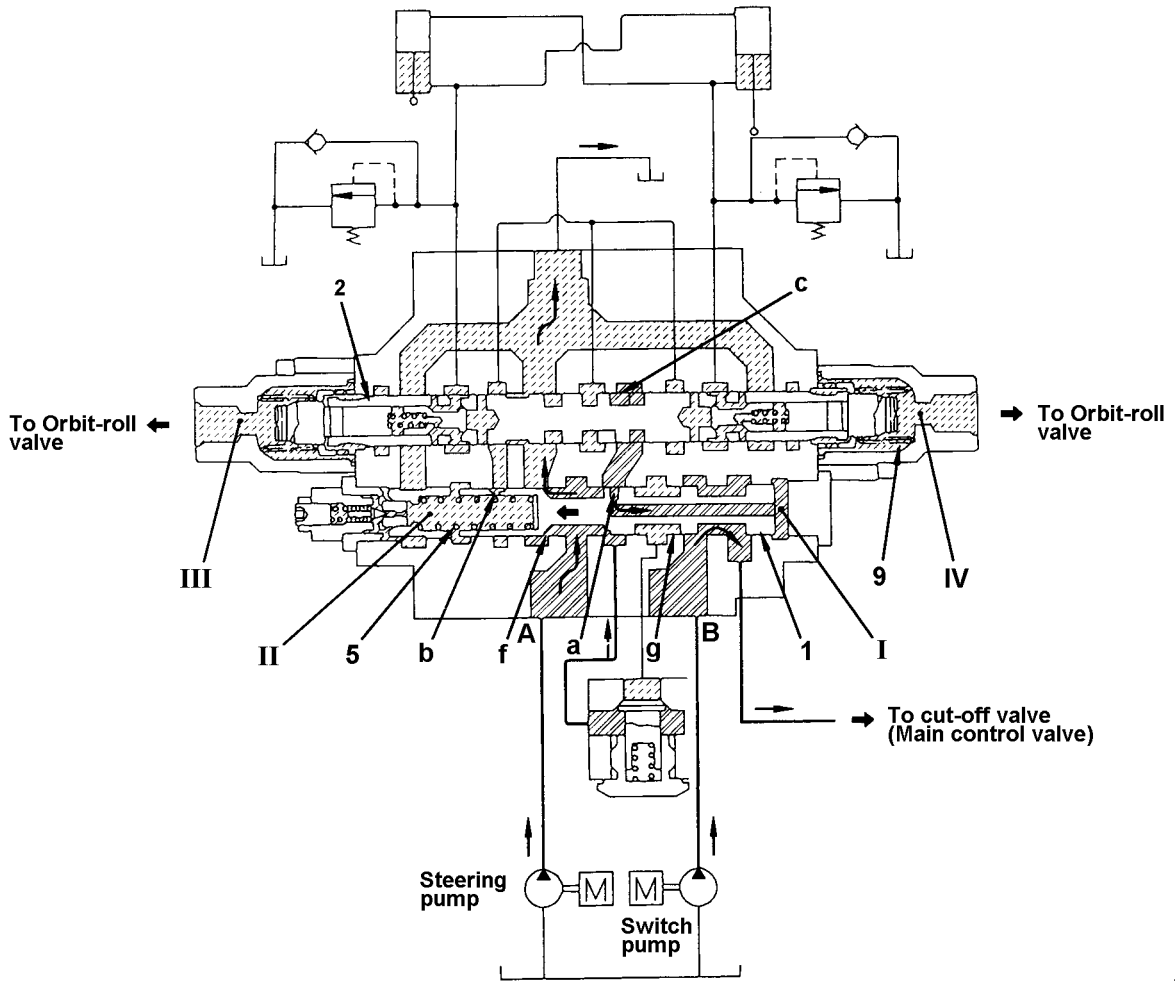
Operation of limited slip differential

The power transmitted from the transmission goes from bevel gear (11) to case (10), pressure ring (9), shaft (8), pinion (7), and gear (6), and is then divided and sent to left and right shafts (4). A brake mechanism consisting of disc (2) and plate (1) is assembled at the rear face of side gear (6), and the brake torque is generated in proportion to the torque transmitted from pressure ring (9) to shaft (8).

In order for this brake torque to act to suppress the rotation in relation to side gear (6) and case (10), it is made difficult for left and right side gears (6) to rotate mutually, and the action of the differential is suppressed.

Operation of demand valve

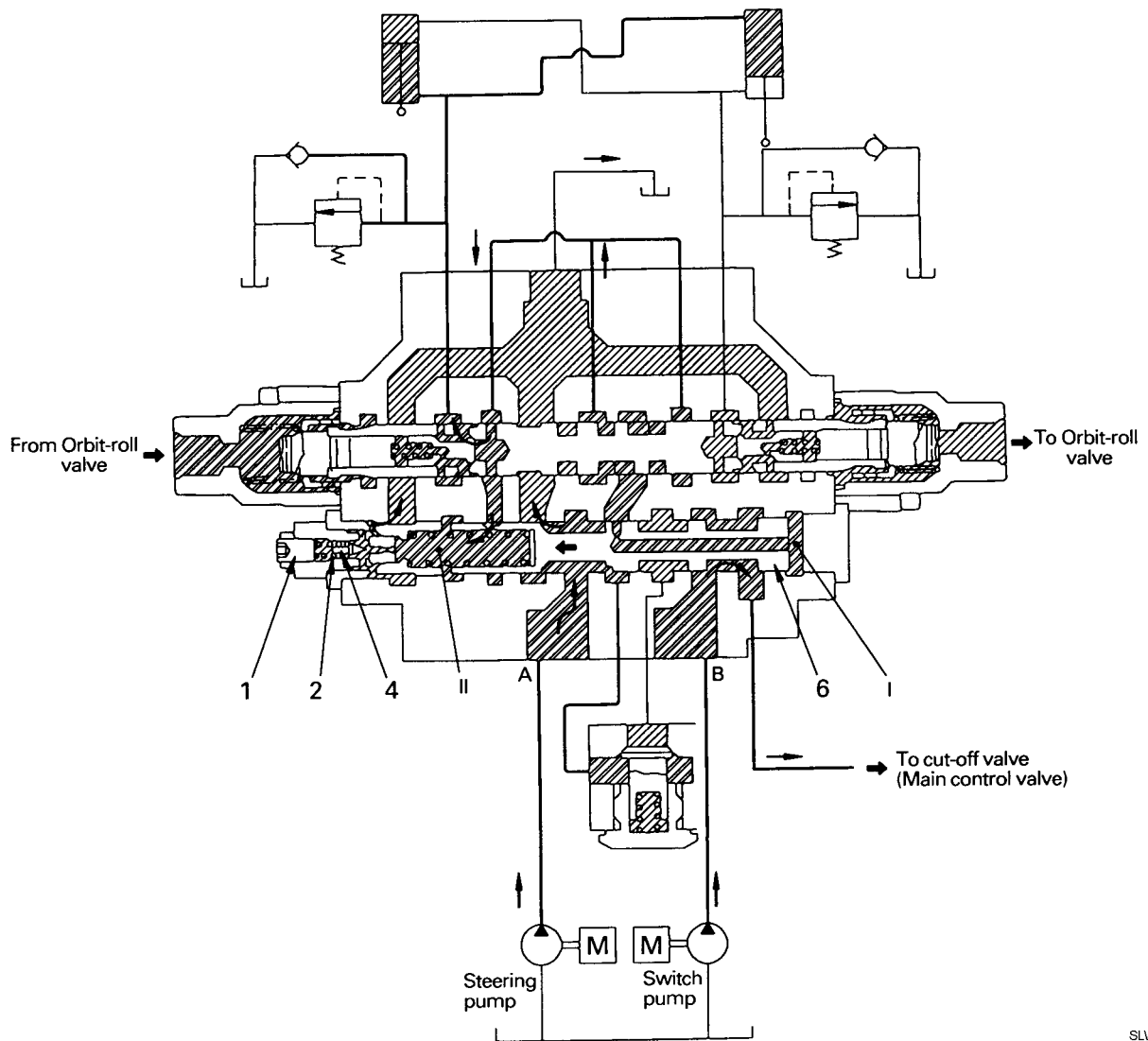
STEERING SPOOL AT NEUTRAL



SLW01223

- ! The oil from the steering pump enters port **A**, and the oil from the switch pump enters port **B**.
- ! When steering spool (2) is at neutral, pressure-receiving chamber **y** is connected to the drain circuit through orifice **b**, and notch **c** is closed.
- ! Notch **c** is closed, so the pressure of the oil at port **A** and port **B** rises. This pressure passes through orifice **a**, goes to pressure receiving chamber **y** and moves demand spool (1) to the left in the direction of the arrow.
- ! When the pressure at pressure-receiving chamber (**y**) reaches a certain value (set by spring (5)), notch **f** opens, and the oil from the steering pump flows to the drain circuit. At the same time notch **g** closes, and the oil from the switch pump all flows to the main control valve.

Operation of relief valve

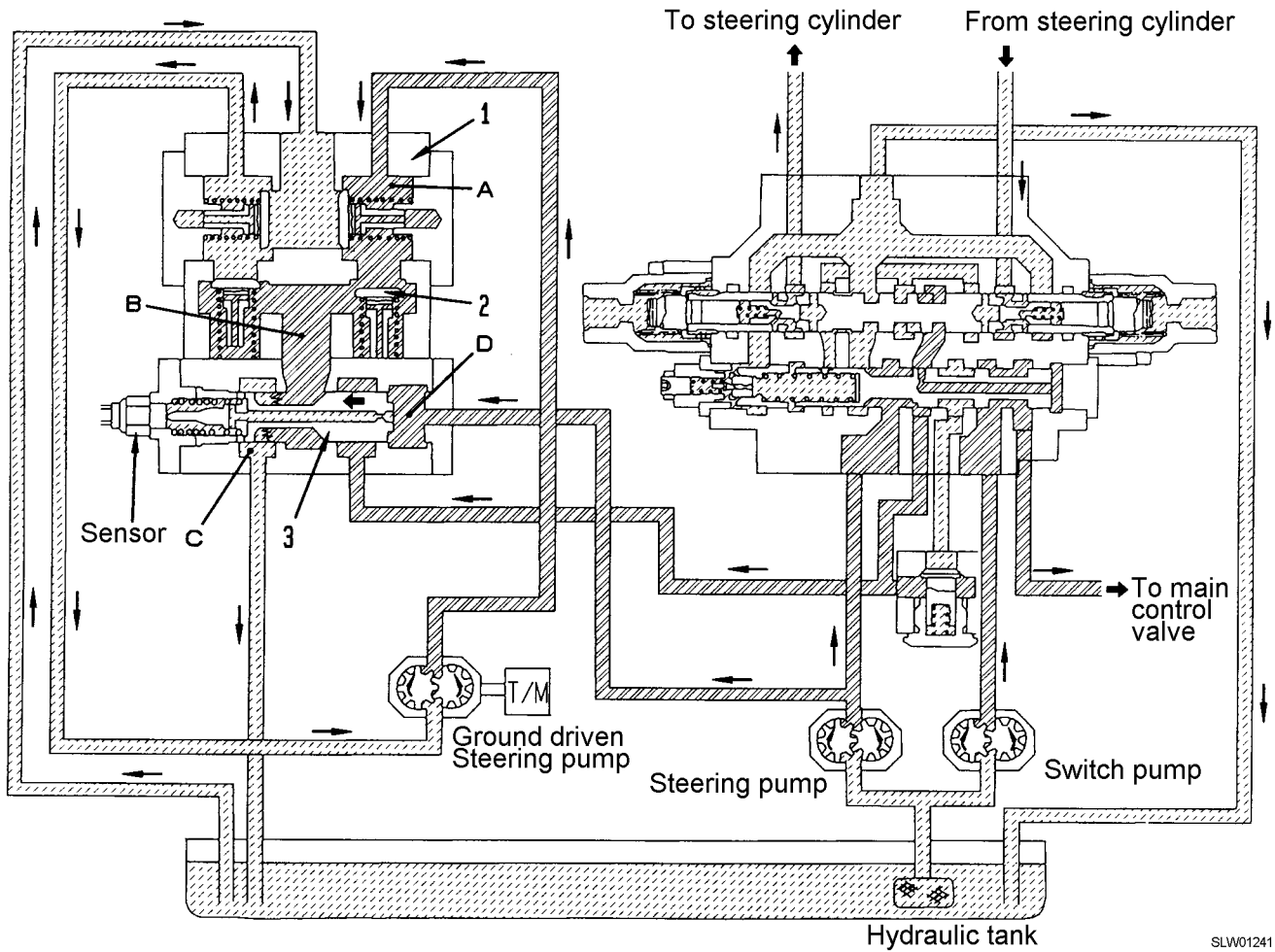


SLW01233

- ! When the pressure in the circuit rises, and it reaches the pressure set by adjustment screw (1) and spring (2), pilot poppet (4) opens, and the oil is drained.
- ! When this happens, the balance in pressure between pressure-receiving chamber (I) and pressure-receiving chamber (II) is lost, so demand spool (6) moves to the left in the direction of the arrow.
- ! When demand spool (6) moves, the oil from the steering pump is drained, and the oil from the switch pump is released to the main control valve. This prevents the pressure in the steering circuit from going above the set value.

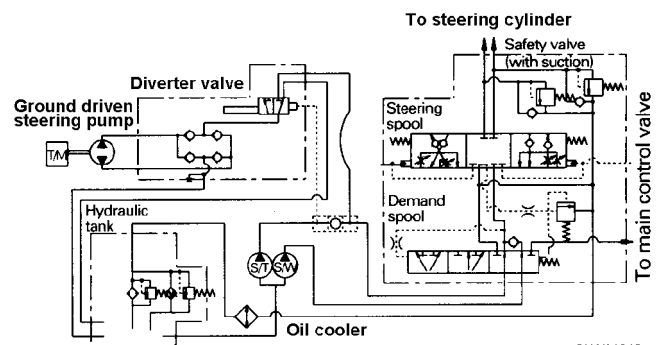
Operation

Pump and engine are working normally



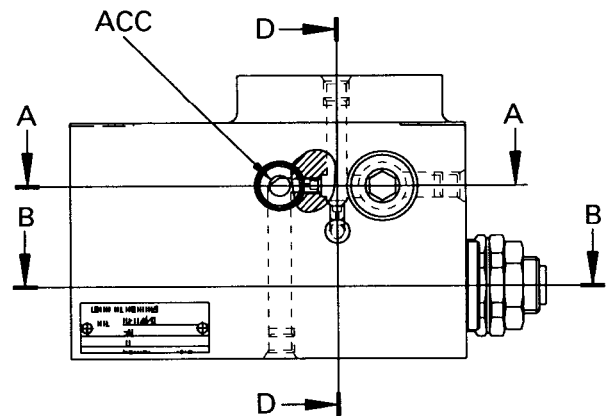
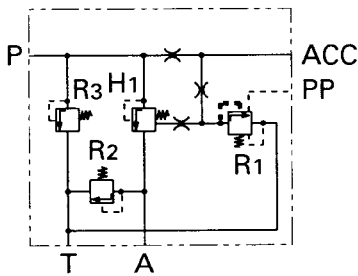
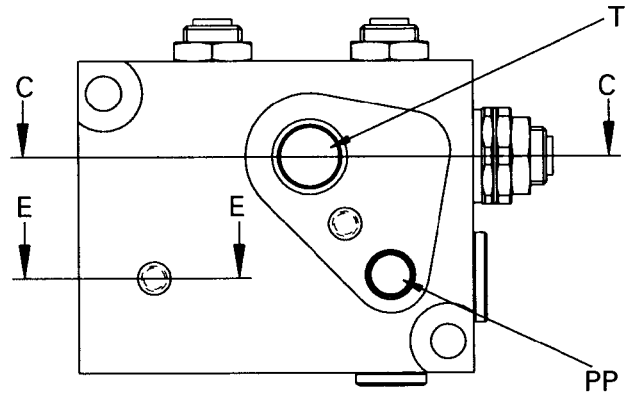
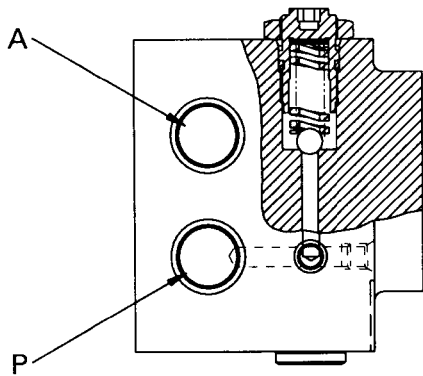
SLW01241

! When the steering pump and engine are working normally, the hydraulic pump, steering pump, and switch pump are rotated by the engine. Therefore, oil is sent to the steering valve, and the machine can be steered. In addition, the ground driven steering pump is rotated by the transmission, so oil from port **A** of the diverter valve pushes open check valve (2) and enters port **B**. Pressure oil from the steering pump is flowing to port **D**, so it pushes spool (3) in the direction of the arrow. As a result, the oil from port **B** flows to port **C** and is drained to the hydraulic tank.



SLW01242

ACCUMULATOR CHARGE VALVE



SDW00114

- 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 VALVE

Function

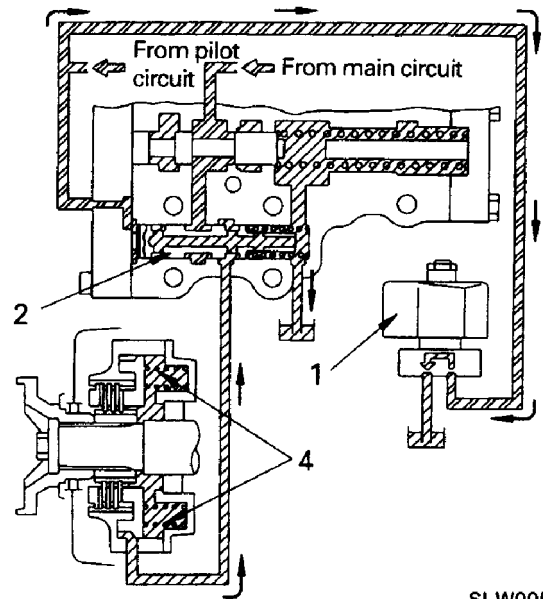
! The parking brake valve is installed inside the transmission control valve and lower valve, and controls the parking brake cylinder.

Operation

1. Parking brake applied

! When the parking brake switch is turned **ON**, solenoid valve (1) is turned **OFF** and the drain circuit is opened. The oil in the pilot circuit from the pump then flows to drain circuit.

! The oil in the main circuit is shut off by spool (2), and the oil in the brake cylinder flows to the drain circuit. Therefore, the parking brake is applied by the force of the spring (4) in the parking brake cylinder.

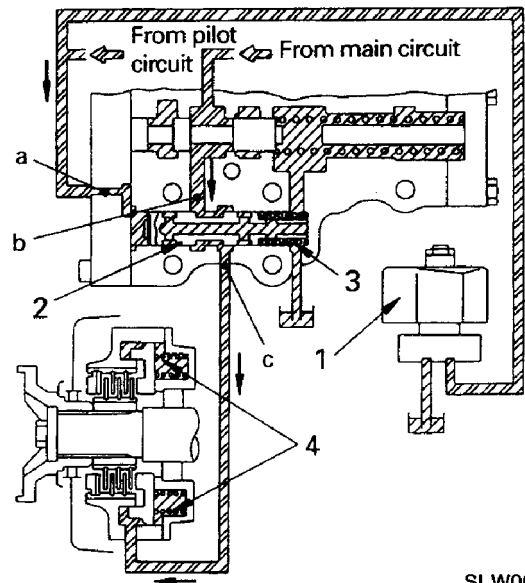


SLW00523

2. Parking brake released

! When the parking brake switch is turned **OFF**, solenoid valve (1) is turned **ON**, and the drain circuit is closed.

! When the oil pressure at port **a** rises, it pushes against spring (3) and moves spool (2) to the right in the direction of the arrow. This shuts off the drain circuit of the brake cylinder, so the oil from the main circuit flows from port **b** to port **c** to actuate the brake cylinder and release the parking brake.

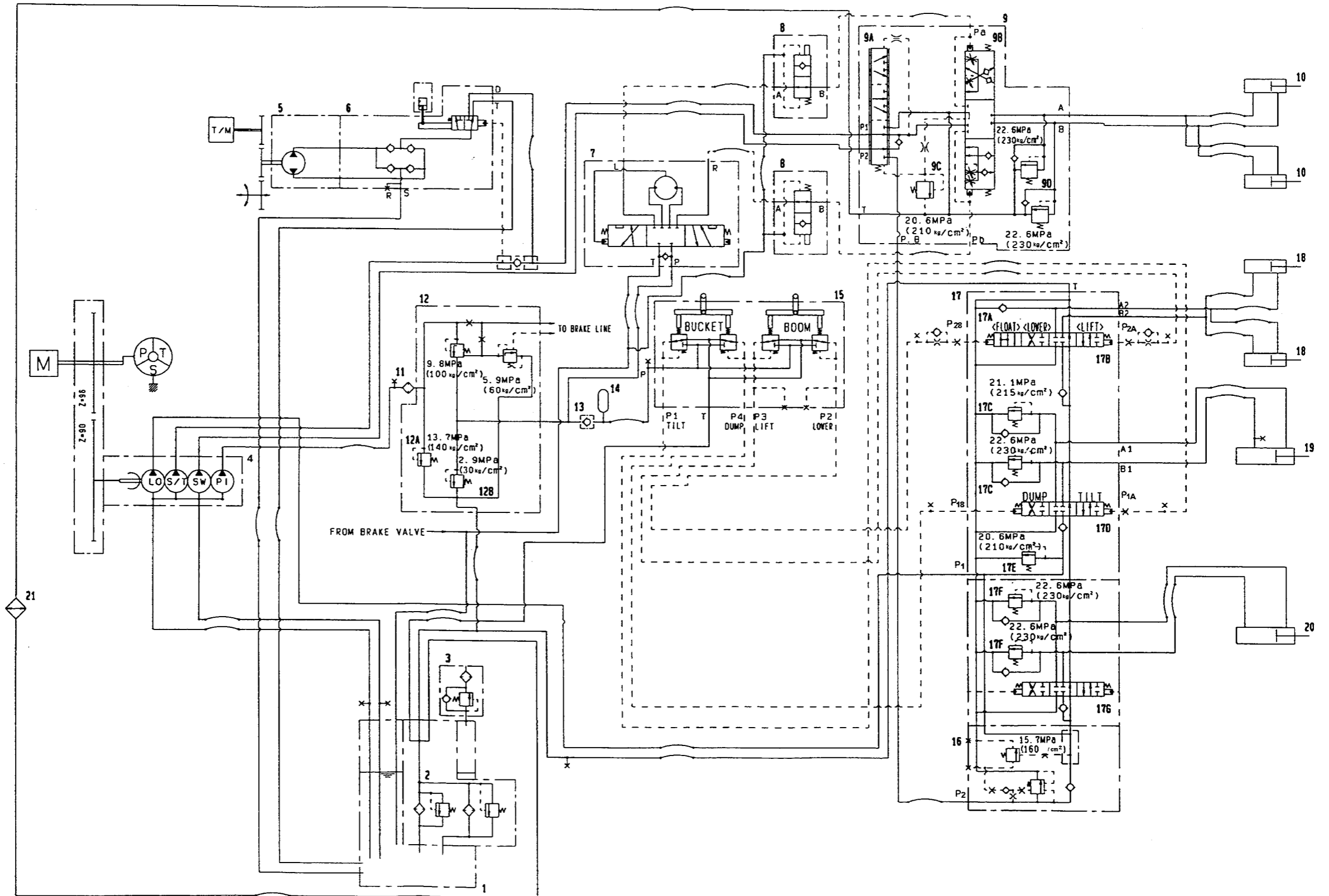


SLW00524

WORK EQUIPMENT HYDRAULIC CIRCUIT DIAGRAM
FOR 3-SPOOL VALVE

Foldout 10-111

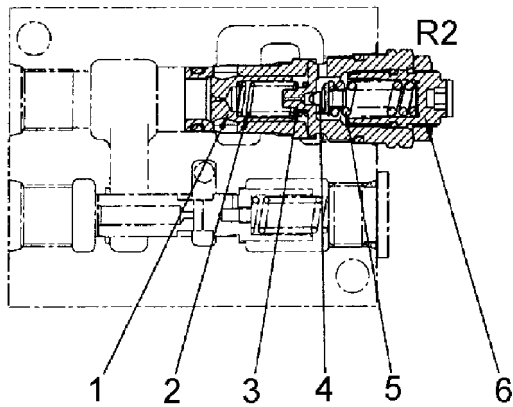
1. Hydraulic tank
2. Filter
3. Breather
4. Hydraulic pump
5. Emergency steering pump (option)
6. Diverter valve (option)
7. Orbit-roll valve
8. Stop valve
9. Steering control valve
 - 9A. Demand valve
 - 9B. Steering valve
 - 9C. Relief valve
 - 9D. Safety valve (with suction)
10. Steering cylinder
11. Strainer
12. Accumulator charge valve
 - 12A. Relief valve
 - 12B. PPC relief valve
13. Check valve
14. PPC Accumulator
15. PPC valve
16. Cut-off valve
17. Main control valve
 - 17A. Suction valve
 - 17B. Boom spool
 - 17C. Safety valve (with suction)
 - 17D. Bucket spool
 - 17E. Main relief valve
 - 17F. Safety valve (with suction)
 - 17G. Attachment spool
18. Boom cylinder
19. Bucket cylinder
20. Attachment cylinder
21. Oil cooler



SDW01247

PPC RELIEF VALVE

(Proportional Pressure Control Relief Valve)



1. Main valve
2. Spring
3. Valve seat
4. Pilot poppet
5. Spring
6. Screw

SDW00149

Function

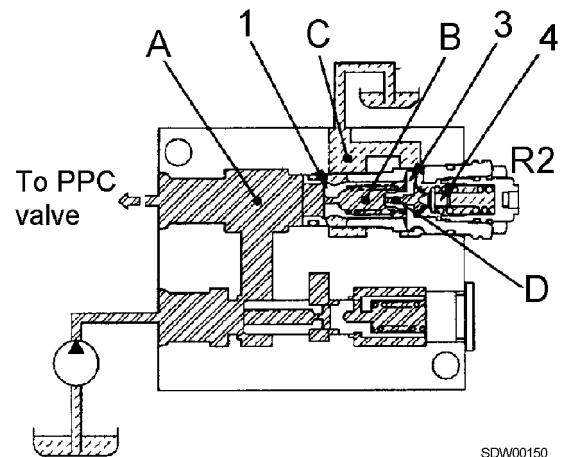
! The PPC relief valve is between the PPC pump and the PPC valve. When the PPC pump is not being actuated, or when any abnormal pressure is generated, the oil sent from the pump is relieved from this valve to prevent any damage to the pump or circuit.

Operation

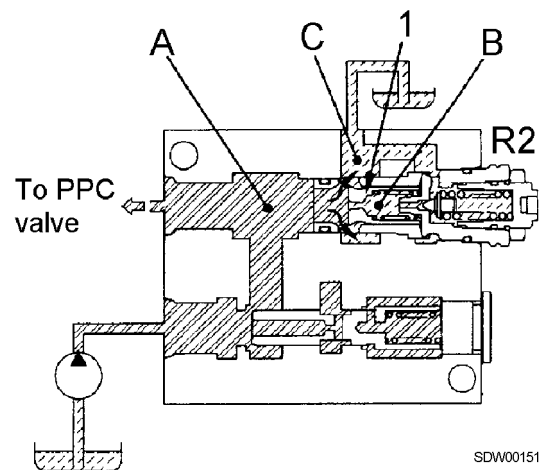
! The relief valve is installed to the charge valve. Port **A** is connected to the pump circuit and port **C** is connected to the drain circuit. The oil passes through the orifice in main valve (1) and fills port **B**. In addition, pilot poppet (4) is seated in valve seat (3).

! When the pressure at port **A** and port **B** reaches the set pressure, pilot poppet (4) opens and the oil pressure at port **B** escapes from port **D** to port **C** to lower the pressure at port **B**.

! When the pressure at port **B** goes down, a difference in pressure is generated at ports **A** and **B** by the orifice of main valve (1). Main valve (1) is opened by the pressure at port **A** and the oil at port **A** is drained to port **C** to relieve the circuit.



SDW00150



SDW00151

OPERATION OF CUT-OFF VALVE

Function

! The cut-off valve is mounted between the switch pump and work equipment valve. It switches the oil flow from the switch pump between the working equipment valve and the drain, according to operating conditions, and controls the speed of the work equipment.

- ! Cut-off operation conditions
 O : Cut-off (drain)
 X : Not actuated (to main control valve)

More than 15.7 MPa 160 kg/cm ²	Less than 15.7 MPa 160 kg/cm ²
O	X
O	X

Operation

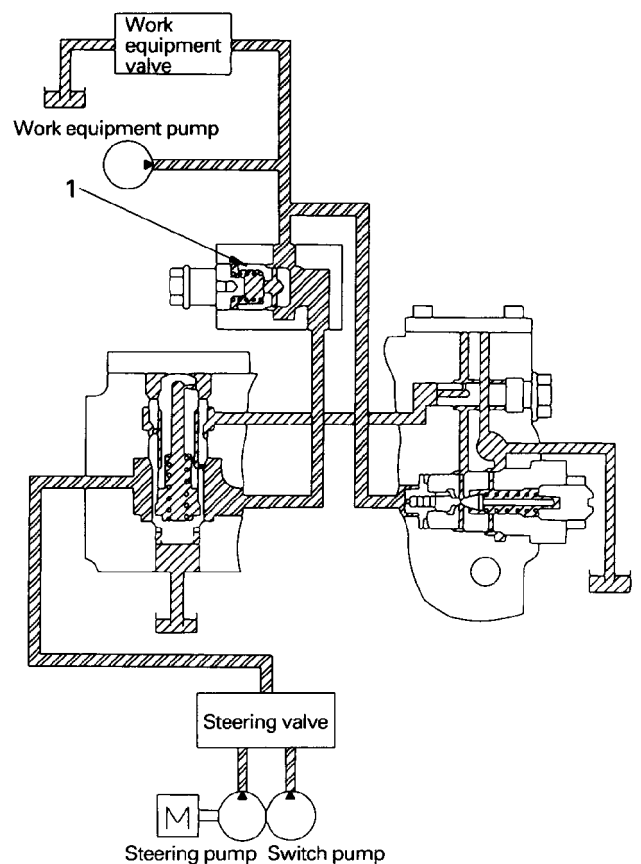
1. When the work equipment valve is held

The oil at the switch pump (the oil from the steering valve) presses up check valve (1), merges with the oil from the work equipment pump and flows to the work equipment valve.

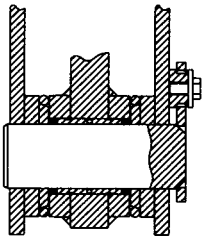
2. When the work equipment valve is activated

1) When the work equipment pump pressure is lower than the cut-off pressure

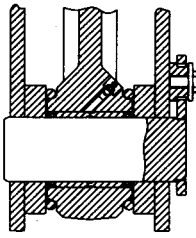
As when the work equipment valve is held, the oil at the switch pump (the oil from the steering valve) presses up check valve (1), merges with the oil from the work equipment pump and flows to the work equipment valve.



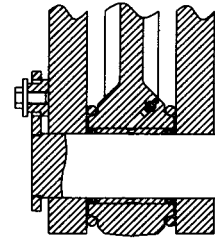
SBW00744



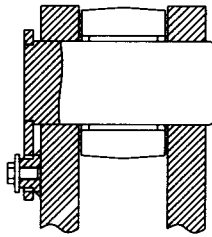
A-A



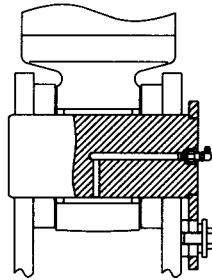
B-B



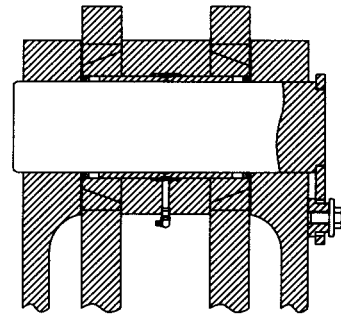
C-C



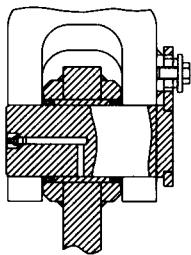
D-D



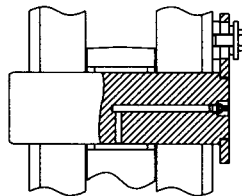
E-E



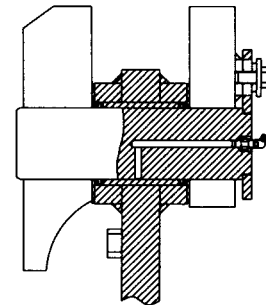
F-F



G-G



H-H



J-J

SAW00561

MEMORANDA

MAINTENANCE MONITOR DISPLAY FUNCTION

Display category	Symbol	Display item	Display range	Display method
Check		Engine water level	Below low level	Displays when engine is stopped and starting switch is ON Display when normal: OFF Display when abnormal: Flashes CHECK lamp flashes
		Engine oil level	Below low level	
Caution		Engine water level	Below low level	Displays when engine is running Display when normal: OFF Display when abnormal: Flashes CAUTION lamp flashes Buzzer sounds
		Engine oil pressure	Below specified pressure	
		Brake oil pressure	Below specified pressure	
		Engine water temperature	Above 102°C	Buzzer sounds if above 105°C
		Torque converter oil temperature	Above 120°C	Buzzer sounds if above 130°C
		Fuel level	Below low level	Displays when engine is running Display when normal: OFF Display when abnormal: Flashes CAUTION lamp flashes
		Battery charge	When charge is abnormal	Displays when engine is running Display when normal: OFF Display when abnormal: Flashes CHECK lamp flashes
Service meter		Air cleaner	Above specified negative pressure	
		Service meter	0 - 9999.9h	Actuated when charge is normal Advances 1 for every hour
Gauges		Service meter indicator		Lights up when service meter is running
		Fuel level		All lamps light up below applicable level Flashes when level is 1
		Engine water temperature		One place lights up to show applicable level Flashes when level is 6 or 7
	Torque converter oil temperature		One place lights up to show applicable level Flashes when level is 6 or 7	

4. Self-diagnostic function

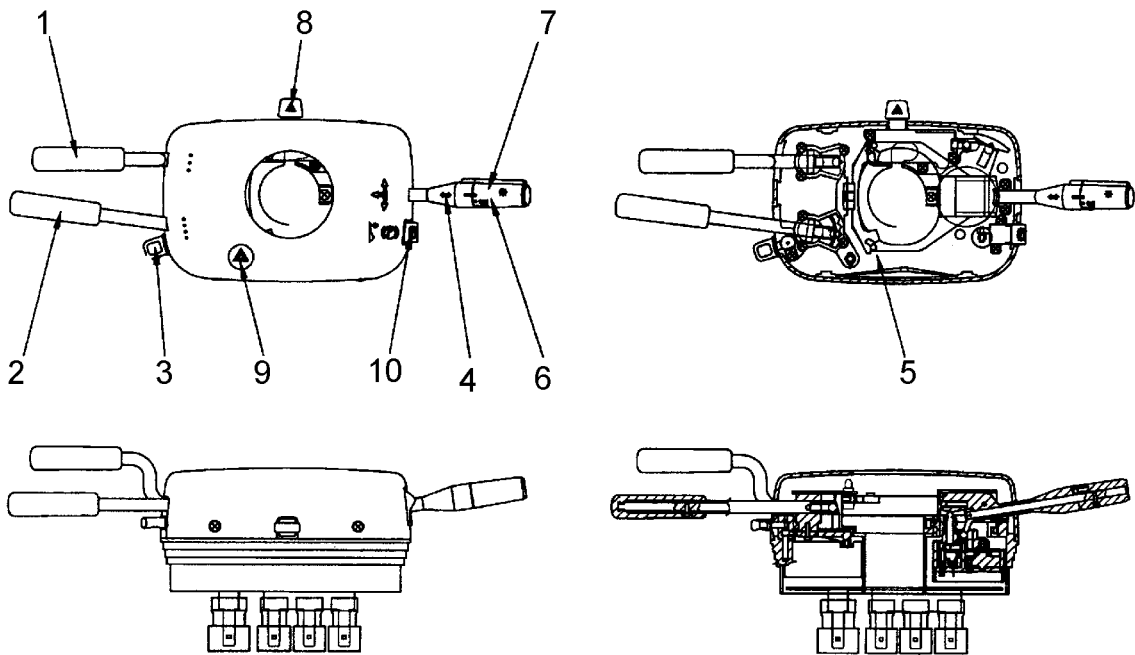
- ! This system always observes the condition of the system, and displays the condition of the system (**LED** code, see table below) in the controller self-diagnostic display portion.
- ! If there is any abnormality in the controller itself or in the input or output devices, the controller carries out troubleshooting of the abnormality. It turns all the output **OFF** and displays the error code (failure code) in the self-diagnostic display portion and the main monitor.

LED codes

LED display	Content	Condition of system	
01	Selects model as WA320	Normal	
02	Selects model as WA380		
03	Selects model as WA420		
04	Selects model as WA450		
55	Pressure switch ON (displays only when ON)		
Error code	d0	Error in solenoid (relief) system	Abnormal
	d1	Error in solenoid (high pressure) system	
	d2	Error in solenoid (low pressure) system	
	d3	Abnormality in travel speed sensor system	
	d4	Abnormality in model selection (non-available combination is selected)	

- 1) Displays on controller
 - ! Error code displays [E]ö [dxl] (where x is a numeral from 0 to 4 in the table above) repeatedly in turn.
 - ! If more than one abnormality occurs at the same time, all the appropriate error codes are displayed in turn.
 - ! When the starting switch is turned **OFF** (controller power **OFF**, the error codes are reset and not written to memory.
 - ! When checking the **LED** display, read the code with the connector facing down.
- 2) Displays on main monitor
 - ! For details, see MAIN MONITOR TROUBLE DATA DISPLAY.

COMBINATION SWITCH



SDW00301

Outline

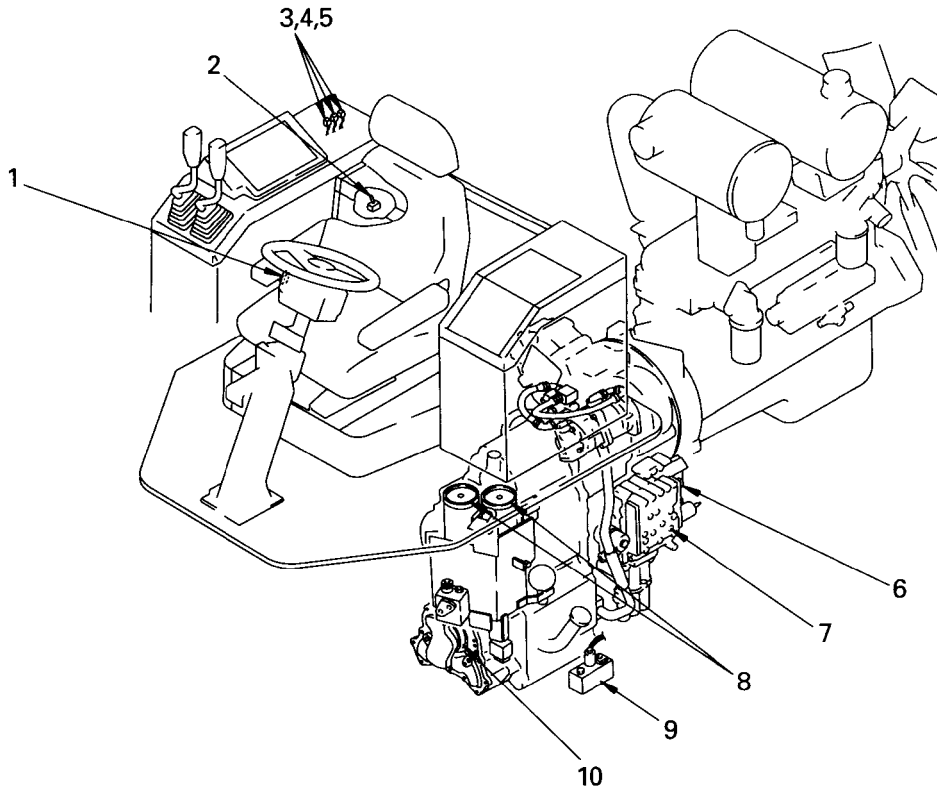
The directional lever has three positions and the speed lever switch has four positions. As an individual part, the switch does not have a detent mechanism; the detent mechanism is in the combination switch. Each switch is positioned by two pins, and is secured to the

body by three screws. When each lever is operated to the desired position, the switch, which is interconnected by a shaft, acts to allow electric current to flow to that circuit only.

General locations, function

1	Directional lever switch	Switches between F, R, and N
2	Speed lever switch	Selects speed range
3	Speed lever stopper	Stopper used to prevent speed lever from entering 3rd or 4th during operations
4	Turn signal indicators	Direction indicator lamps used when turning left or right
5	Self cancel	Turn signal indicator lever automatically returns to central position after machines turns left or right
6	Lamp switch	Switches on clearance lamp, head lamp, parking lamp, etc.
7	Dimmer switch	Selects high beam for travel and low beam for passing
8	Hazard switch	Makes both left and right turn signal indicator lamps flash at the same time
9	Emergency flashing pilot lamp	Flashes at the same time as the emergency flashing lamp flashes
10	Parking brake switch	Applies or releases parking brake

ELECTRIC PARKING BRAKE CONTROL



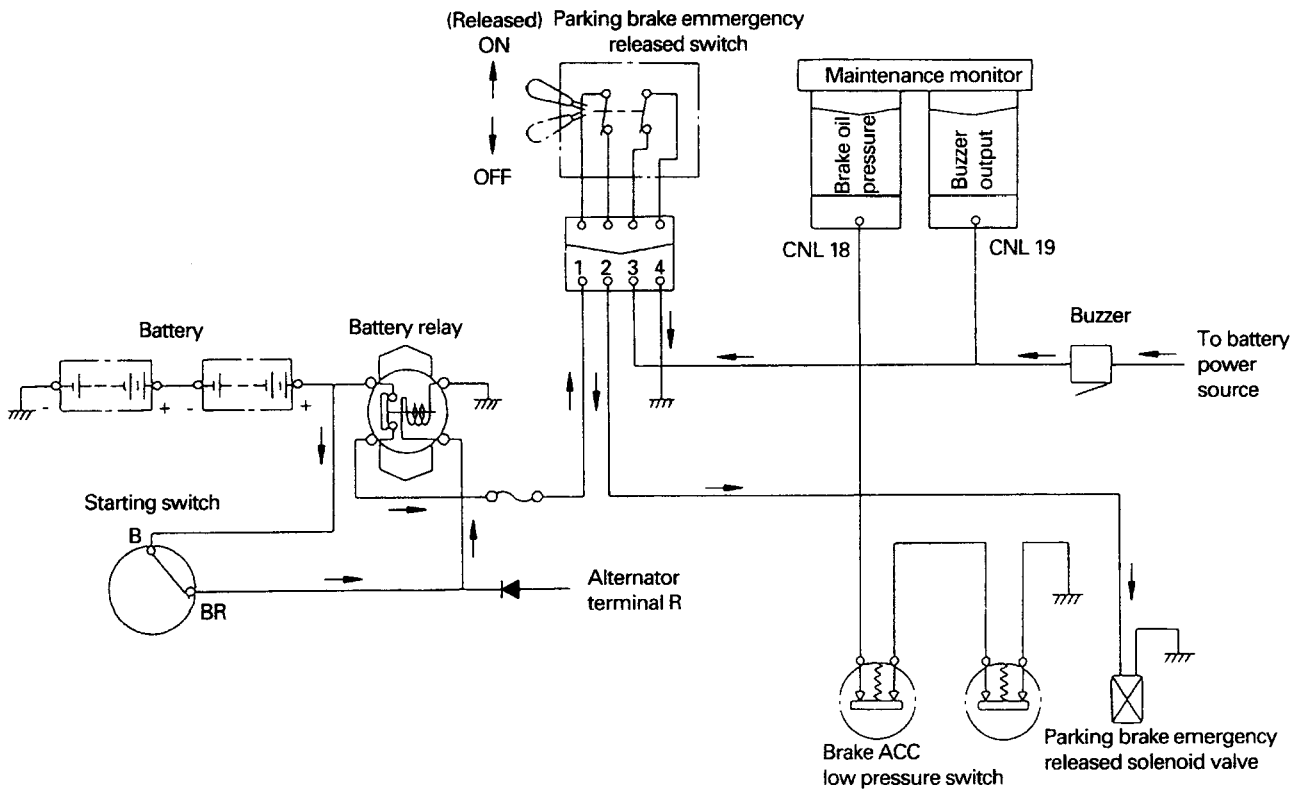
SBW00627

Outline

- ! The parking brake is a wet-type multiple disc brake built into the transmission. When an electric current flows to the parking brake valve (solenoid valve), the oil pressure from the transmission pump is applied to the parking brake cylinder and the parking brake is released.
- ! When the electric current is cut, the oil pressure from the transmission pump is shut off, and the oil pressure inside the parking brake cylinder passes through the parking brake valve and is drained. The parking brake is then applied by the force of the brake spring.

1. Parking brake switch
2. Parking brake emergency release switch
3. Parking brake safety relay
4. Parking brake emergency release relay
5. Neutralizer relay
6. Parking brake solenoid valve
7. Transmission control valve
8. Accumulator
9. Parking brake emergency release solenoid valve
10. Transmission (built-in parking brake)

6. Parking brake emergency release



SLW00636

Operation

! If the machine should stop because of engine trouble, the oil pressure from the transmission pump to the parking brake cylinder is shut off, and the parking brake is applied. When this happens, oil pressure in the main brake line is stored in the accumulator. When the emergency release switch is turned on (released), the buzzer sounds, and at the same time, electric current flows to the emergency parking brake release solenoid valve.

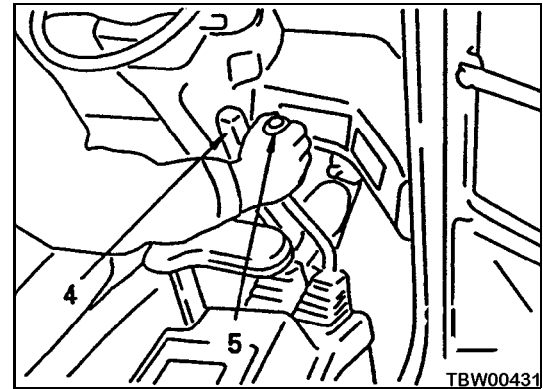
- ! The oil pressure stored in the accumulator in the main brake line then flows to the parking brake cylinder to release the parking brake.
- ! The emergency release switch should normally be kept at the **OFF** position and should be returned to the **OFF** position after the emergency release.

STANDARD VALUE TABLE FOR ELECTRICAL SYSTEM

System	Name of component	Connector No.	Inspection method	Judgment table	Measurement conditions					
Maintenance monitor	Fuel level sensor	CNR07 (male)	Resistance measurement	Normal if as follows: <table border="1"> <tr> <td>Full stopper</td> <td rowspan="2">Between Ī and İ</td> <td>Approx. 4 S</td> </tr> <tr> <td>Empty</td> <td>85 S</td> </tr> </table>	Full stopper	Between Ī and İ	Approx. 4 S	Empty	85 S	1) Starting switch OFF 2) CNR07 disconnected
	Full stopper	Between Ī and İ	Approx. 4 S							
	Empty		85 S							
	Engine water temperature sensor	CNE06 (male)	Resistance measurement	Normal if as follows: <table border="1"> <tr> <td>25EC</td> <td rowspan="2">Between Ī and İ</td> <td>Approx. 4 S</td> </tr> <tr> <td>130EC</td> <td>Approx. 1.7 S</td> </tr> </table>	25EC	Between Ī and İ	Approx. 4 S	130EC	Approx. 1.7 S	1) Starting switch OFF 2) CNE06 disconnected
	25EC	Between Ī and İ	Approx. 4 S							
	130EC		Approx. 1.7 S							
	Torque converter oil temperature sensor	CNT07 (male)	Resistance measurement	Normal if as follows: <table border="1"> <tr> <td>25EC</td> <td rowspan="2">Between Ī and İ</td> <td>Approx. 4 S</td> </tr> <tr> <td>130EC</td> <td>Approx. 1.7 S</td> </tr> </table>	25EC	Between Ī and İ	Approx. 4 S	130EC	Approx. 1.7 S	1) Starting switch OFF 2) CNT07 disconnected
	25EC	Between Ī and İ	Approx. 4 S							
	130EC		Approx. 1.7 S							
Radiator water level sensor	CNR06 (male)	Continuity	Normal if as follows: <table border="1"> <tr> <td>Radiator water level normal</td> <td rowspan="2">Between İ and Ī</td> <td>Continuous</td> </tr> <tr> <td>Radiator water level abnormal</td> <td>Non-continuous</td> </tr> </table>	Radiator water level normal	Between İ and Ī	Continuous	Radiator water level abnormal	Non-continuous	1) Starting switch OFF 2) CNR06 disconnected	
Radiator water level normal	Between İ and Ī	Continuous								
Radiator water level abnormal		Non-continuous								
Engine oil level sensor	CNE10 (male)	Continuity	Normal if as follows: <table border="1"> <tr> <td>Engine oil level normal</td> <td rowspan="2">Between Ī and chassis</td> <td>Continuous</td> </tr> <tr> <td>Engine oil level abnormal</td> <td>Non-continuous</td> </tr> </table>	Engine oil level normal	Between Ī and chassis	Continuous	Engine oil level abnormal	Non-continuous	1) Starting switch OFF 2) CNE10 disconnected	
Engine oil level normal	Between Ī and chassis	Continuous								
Engine oil level abnormal		Non-continuous								
Brake oil pressure sensor	CNB13 (male) CNR08 (male)	Continuity	Normal if as follows: <table border="1"> <tr> <td>Brake oil pressure normal</td> <td rowspan="2">Between Ī and İ</td> <td>Continuous</td> </tr> <tr> <td>Brake oil level abnormal</td> <td>Non-continuous</td> </tr> </table>	Brake oil pressure normal	Between Ī and İ	Continuous	Brake oil level abnormal	Non-continuous	1) Starting switch OFF 2) CNB13 disconnected LNB08 disconnected	
Brake oil pressure normal	Between Ī and İ	Continuous								
Brake oil level abnormal		Non-continuous								
Dust indicator	CNE19 (male) CNE20 (female)	Continuity	Normal if as follows: <table border="1"> <tr> <td>Dust indicator normal</td> <td rowspan="2">Between CNE19 (male) and CNE20 (female)</td> <td>Non-continuous</td> </tr> <tr> <td>Dust indicator abnormal</td> <td>Continuous</td> </tr> </table>	Dust indicator normal	Between CNE19 (male) and CNE20 (female)	Non-continuous	Dust indicator abnormal	Continuous	1) Starting switch OFF 2) CNE19 disconnected CNE20 disconnected	
Dust indicator normal	Between CNE19 (male) and CNE20 (female)	Non-continuous								
Dust indicator abnormal		Continuous								
Engine oil pressure sensor	Ring terminal	Continuity	Normal if as follows: <table border="1"> <tr> <td>Engine oil pressure normal</td> <td rowspan="2">Between ring terminal and chassis</td> <td>Non-continuous</td> </tr> <tr> <td>Engine oil pressure abnormal</td> <td>Continuous</td> </tr> </table>	Engine oil pressure normal	Between ring terminal and chassis	Non-continuous	Engine oil pressure abnormal	Continuous	1) Starting switch OFF 2) Ring terminal disconnected	
Engine oil pressure normal	Between ring terminal and chassis	Non-continuous								
Engine oil pressure abnormal		Continuous								
Alternator	Between alternator terminal R and chassis	Voltage measurement	When engine is running (½ throttle or greater) $\bar{U} \approx 27.5$ to 29.5v In cold regions or if the battery is weak, the voltage may not rise directly after the engine is started.	1) Engine started						

HYDRAULIC STALL SPEED

1. Start the engine and run at high idle.
2. Operate the bucket (4) or boom lever (5), set the cylinder to the stroke end and activate the work equipment valve relief valve.
3. Use multi-tachometer to measure the engine
 - Ū Do not hold the stall condition for more than 20 seconds. Operate the control lever quickly.

**FULL STALL SPEED**

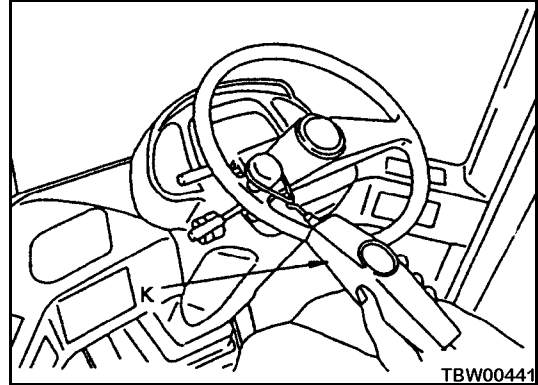
- ! Measure the engine speed when the torque converter stall and hydraulic stall are both carried out at the same time.
 - i Before measuring the full stall, check that the torque converter stall and hydraulic stall speeds are normal. If either of the stall speeds is abnormal, correct the problem and measure again.

MEASURING OPERATING FORCE OF STEERING WHEEL**i Measurement conditions**

- ! Road surface: Flat, horizontal, dry paved surface
- ! Engine coolant temperature: Within green range on engine coolant temperature gauge
- ! Hydraulic oil temperature: 45 - 55EC
- ! Tire inflation pressure: Specified pressure
- ! Engine speed: Low idle (bucket empty)

Measurement method

1. Install push-pull scale **K** to the steering wheel knob.
2. Start the engine.
 - i After starting the engine, raise the bucket approx. 400 mm and remove the safety bar.
3. Pull push-pull scale **K** in the tangential direction and measure the value when the steering wheel moves smoothly.
 - i Avoid measuring when the steering wheel starts to move.



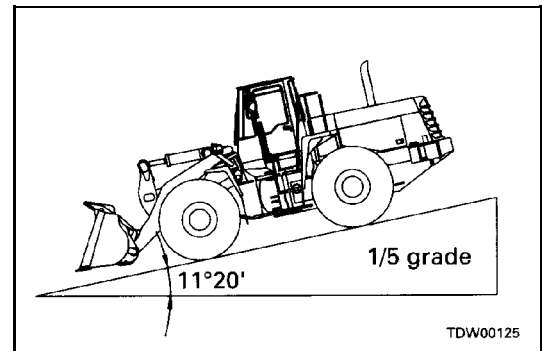
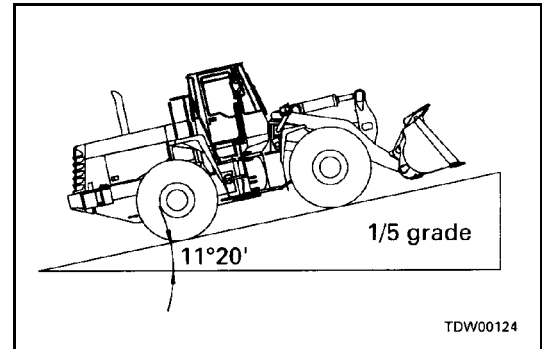
TBW00441

MEASURING PARKING BRAKE PERFORMANCE

- Ú Measurement conditions:
- ! Tire inflation pressure: Specified pressure
- ! Road surface: Flat, dry paved road surface with slope of 1/5 grade (11E20')
- ! Machine: Operating condition

Measurement method

1. Start the engine, set the machine facing in a straight line, then drive the machine up a 1/5 grade slope with the bucket empty.
2. Depress the brake, stop the machine, set the directional lever to the neutral position, then stop the engine.
3. Turn the parking brake switch **ON**, then gradually release the brake pedal and check that the machine is held in position.
 - Ú When the engine is stopped, the parking brake is automatically switched **ON**.
 - Ú Carry out the measurement in two ways: Once with the machine facing uphill, and once more with the machine facing downhill.



MEASURING WORK EQUIPMENT HYDRAULIC DRIFT

Ú Measurement conditions:

- ! Engine coolant temperature: Within green range on engine coolant temperature gauge
- ! Hydraulic oil temperature: 45 - 55EC
- ! Stop the engine, leave for 5 minutes, then measure for 15 minutes.
- ! Boom: Horizontal
- ! Bucket: Horizontal
- ! No load



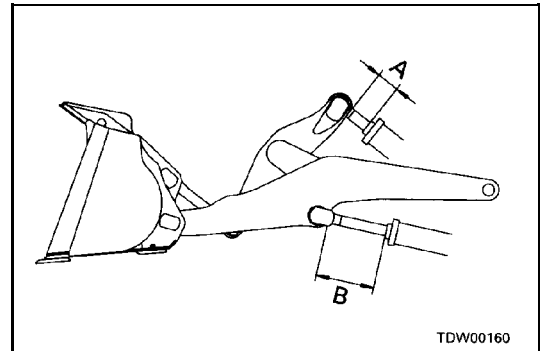
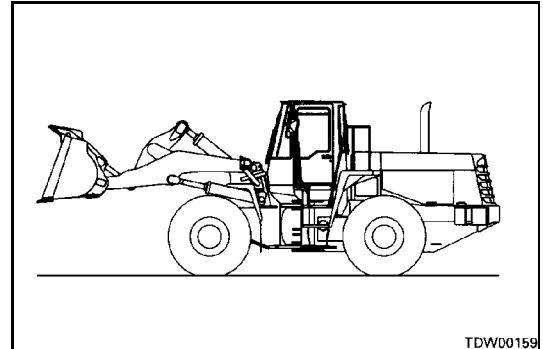
WARNING! Apply the safety lock to the work equipment control levers.



WARNING! Never go under the work equipment.

Measurement method

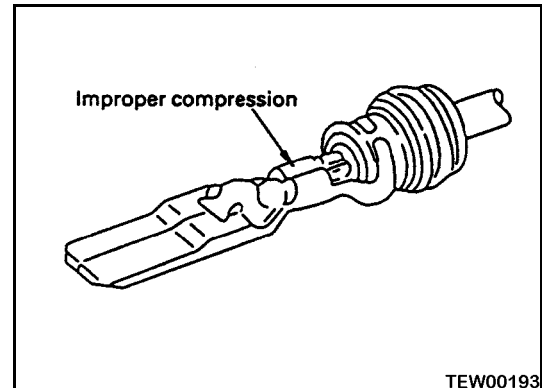
1. Set the boom and bucket in a horizontal position, then stop the engine.
2. Wait **5 minutes**, make a base measurement.
3. Wait for **15 minutes**, then measure retraction amount **A** of the bucket cylinder rod and retraction amount **B** of the boom cylinder rod.



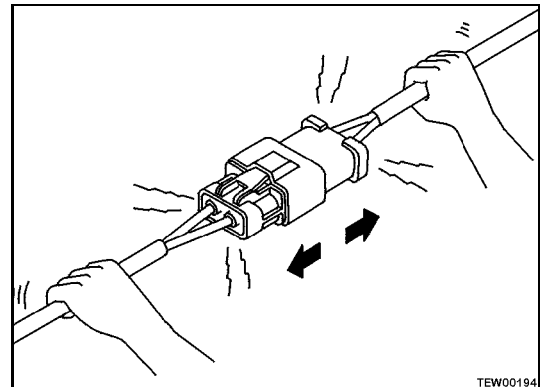
A: Retraction amount of bucket cylinder rod
B: Retraction amount of boom cylinder rod

b) **Defective compression or soldering of connectors**

The pins of the male and female connectors are in contact at the compressed terminal or soldered portion, but there is excessive force on the wiring, and the plating peels to cause improper connection or breakage.

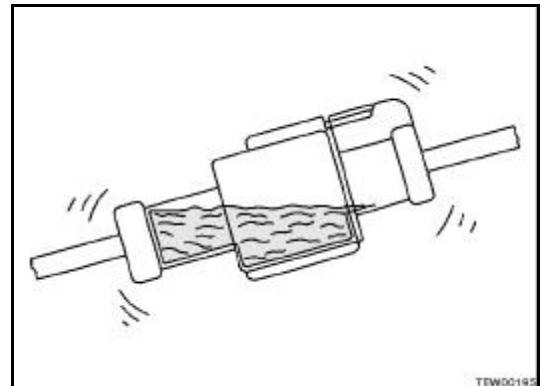
c) **Disconnections in wiring**

If the wiring is held and tugged and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping compression of the connectors to the wire may be loosened, or the soldering may be damaged, or the wiring may be broken.

d) **High pressure water entering a connector**

The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector depending on the direction of the water jet.

The connector is designed to prevent water from entering, but if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.

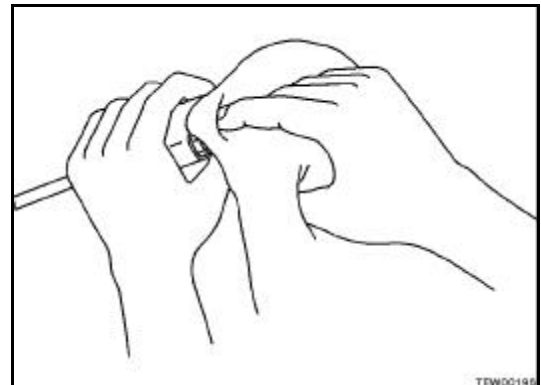
e) **Oil, grease or dirt stuck to connector**

If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, and this will cause a defective contact.

If there is oil or grease or dirt stuck to the connector, wipe it off with a dry cloth or blow dry with air, and spray it with a contact restorer.

i When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.

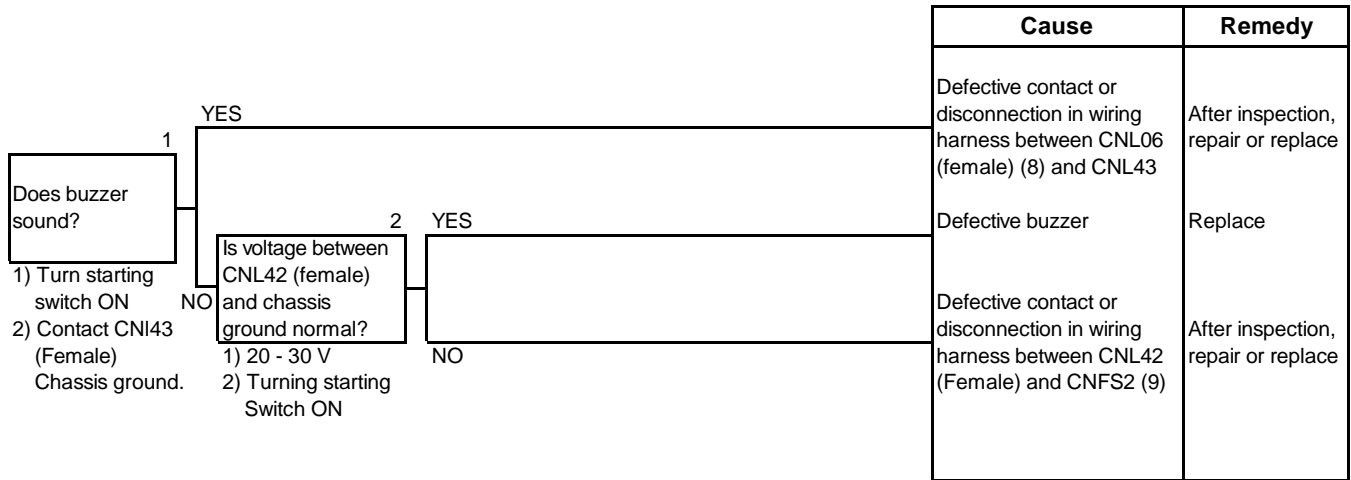
i If there is water or oil present, it will increase the contamination of the points, so clean with air until all water and oil has been removed.



<Example>

(1) M-15 Abnormality i buzzer

(2) (a) Buzzer does not sound when starting switch is turned ON (during self check)



(4)

Ú Before carrying out troubleshooting, check that all the related connectors are properly inserted.

Ú Always connect any disconnected connectors before proceeding to the next step.

TROUBLESHOOTING OF ENGINE SYSTEM TABLE OF CONTENTS (S-MODE)

S-1 Starting performance is poor (starting always takes time)	20-202
S-2 Engine does not start	20-203
1) Engine does not turn	20-203
2) Engine turns but no exhaust gas comes out (fuel is not being injected)	20-204
3) Exhaust gas comes out but engine does not start (fuel is being injected)	20-205
S-3 Engine does not pick up smoothly (follow-up is poor)	20-206
S-4 Engine stops during operations	20-207
S-5 Engine does not rotate smoothly (hunting)	20-208
S-6 Engine lacks output (no power)	20-209
S-7 Exhaust gas is black (incomplete combustion)	20-210
S-8 Oil consumption is excessive (or exhaust gas is blue)	20-211
S-9 Oil becomes contaminated quickly	20-212
S-10 Fuel consumption is excessive	20-213
S-11 Oil is in coolant water, or coolant water spurts back, or water level goes down	20-214
S-12 Oil pressure lamp lights up (drop in oil pressure)	20-215
S-13 Oil level rises	20-216
S-14 Coolant water temperature becomes too high (overheating)	20-217
S-15 Abnormal noise is made	20-218
S-16 Vibration is excessive	20-219

S-8 Oil consumption is excessive (Or exhaust gas is blue)

⏸ Do not run the engine at idle for more than 20 minutes continuously. (Both low and high idle)

General causes why oil consumption is excessive

- ! Abnormal combustion of oil
- ! External oil leaks
- ! Wear of lubrication system

		Causes													
		Broken piston ring	Worn piston ring, cylinder liner	Clogged breather or breather hose	Leak from oil filter, oil cooler	Leaks from oil piping	Leak from oil drain plug	Leaks from oil pan, cylinder, etc.	Broken oil cooler	Worn seal at turbine end	Turbocharger	Worn seal at blower end	Worn, broken rear seal, seal surface	Dust sucked in from intake system	Worn valve (stem guide), broken seal
Questions	Confirm recent repair history														
	Degree of use	Operated for long period of time		△								△	△		△
	Oil consumption suddenly increased		⊙							○					
	Engine oil must be added more frequently		⊙							○					
	Engine oil becomes contaminated quickly		○	⊙	○										
Check items	Exhaust gas is blue under light load		⊙	⊙											
	Amount of blow-by gas	Abnormally excessive	⊙	⊙								○			○
		None			⊙										
	Area around engine is dirty with oil				⊙	⊙	⊙	⊙							
	There is oil in the engine Coolant water								⊙						
	When exhaust pipe is removed, inside is found to be dirty									⊙					
	Inside of turbocharger intake pipe is dirty with oil										⊙				
	Oil level in clutch or TORQFLOW transmission damper chamber rises											⊙			
Clamps for intake system												⊙			
Troubleshooting	When compression pressure is measured, it is found to be low	℥	℥												
	When breather element oil is inspected, it is found to be clogged with dirty oil			℥											
	There is external leaks of oil from engine				℥	℥	℥	℥							
	Pressure-tightness test of oil cooler shows there are leaks								℥						
	Excessive play of turbocharger shaft										℥	℥			
	Check rear seal												℥		
	When intake manifold is removed, dust is found inside													℥	
	When intake manifold is removed, inside is found to be dirty with oil														℥
Remedy	Replace	Replace	Clean	Repair	Repair	Repair	Repair	Replace	Replace	Replace	Replace	Repair	Repair	Repair	

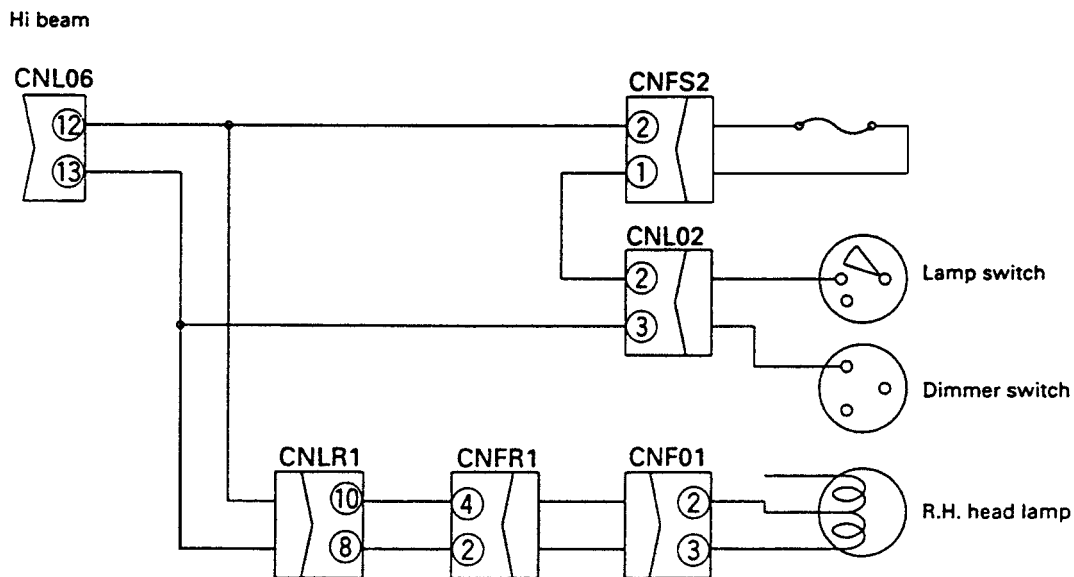
TROUBLESHOOTING OF MAIN MONITOR SYSTEM (M-MODE)

TROUBLE DATA DISPLAY	20-253
M-1 Main monitor display does not work	20-255
M-2 When starting switch is turned ON and engine is started immediately, all lamps stay lit up	20-256
M-3 Speedometer display does not work properly	20-257
M-4 Abnormality in shift indicator	20-258
a) Stays at N even when directional lever is at F	20-258
b) Stays at N even when directional lever is at R	20-258
c) Does not display N when directional lever is at N and displays R when directional lever is at F ..	20-258
d) Does not display N when directional lever is at N and displays F when directional lever is at R ..	20-259
e) Does not display 1st, 4th	20-259
f) Does not display 3rd, 4th	20-259
g) Does not display 2nd, 3rd	20-260
h) Does not display 1st, 2nd	20-260
M-5 High beam does not light up	20-261
M-6 Turn signal display does not light up	20-262
a) L.H. turn signal does not light up	20-262
b) R.H. turn signal does not light up	20-262
M-7 Abnormality in parking display	20-263
a) Parking lamp does not light up	20-263
b) Parking lamp stays lit	20-263
M-8 M-8 is not applicable to this model	20-264
M-9 Night lighting does not light up	20-265
M-10 Abnormality in front working lamp	20-266
a) Neither monitor display or working lamp light up	20-266
b) Working lamp lights up but monitor display does not light up	20-266
c) Monitor lights up but working lamp does not light up	20-266
M-11 Abnormality in rear working lamp	20-267
a) Neither monitor display nor rear working lamp light up	20-267
b) Working lamp lights up but monitor display does not light up	20-267
c) Monitor lights up but working lamp does not light up	20-267
M-12 Abnormality in transmission cut-off	20-269
a) When monitor switch is pressed, cut-off function is not switched and display is not given	20-269
b) Monitor display goes out but cut-off function stays on	20-269
c) Monitor display lights up but cut-off function is not actuated	20-270
M-13 Abnormality in parking brake dragging warning	20-271
a) When parking brake is applied, buzzer sounds (intermittently) even when directional lever is at N and caution lamp flashes	20-271
b) When parking brake is applied, buzzer does not sound and caution lamp does not light up even when directional lever is at any position other than N	20-271
M-14 When parking brake dragging warning is given, buzzer and caution lamp are actuated continuously, or they are not actuated	20-271
a) Actuated continuously	20-272
b) Not actuated	20-272
M-15 Abnormality in buzzer	20-273
a) Buzzer does not sound when starting switch is turned ON (during self-check)	20-273
b) Buzzer always sound	20-273
M-16 Condition of monitor switches are not stored in memory	20-274
M-17 Abnormality in failure display mode	20-275
a) Does not enter failure display mode	20-275
b) Time for time elapsed since failure on failure display mode does not advance	20-275

M-5 High beam does not light up

- Ú Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- Ú Always connect any disconnected connectors before going on to the next step.
- Ú Before starting troubleshooting, check that the lamp bulb is not blown.

		Cause	Remedy
<p>1</p> <p>Is voltage between CNL06 (12) and chassis ground normal?</p> <p>1) 20 - 30 V 2) Turn starting switch ON.</p>	YES	<p>2</p> <p>Is there continuity between CNL06 (female) (13) and chassis ground?</p> <p>1) Turn starting switch OFF. 2) Disconnect CNL06. 3) Dimmer switch: Hi beam</p>	<p>YES</p> <p>Defective main monitor</p> <p>Replace</p>
	NO		<p>NO</p> <p>Defective contact, or disconnection in wiring harness between L06 (female) (13) and L02 (3)</p> <p>After inspection, repair or replace</p>
	NO		<p>Defective contact, or disconnection in wiring harness between CNL06 (female) (12) and CNFS2 (2)</p> <p>After inspection, repair or replace</p>

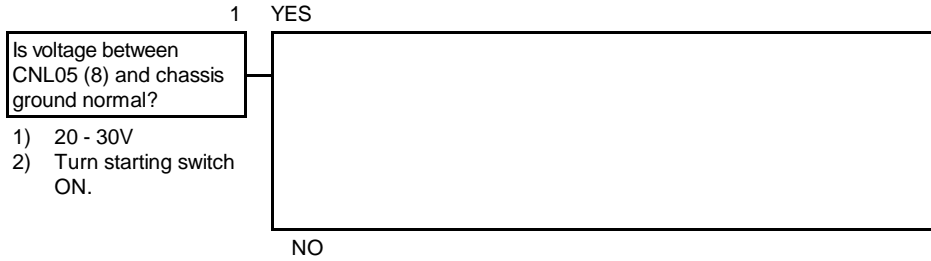


TDW00290

M-13 Abnormality in parking brake dragging warning

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

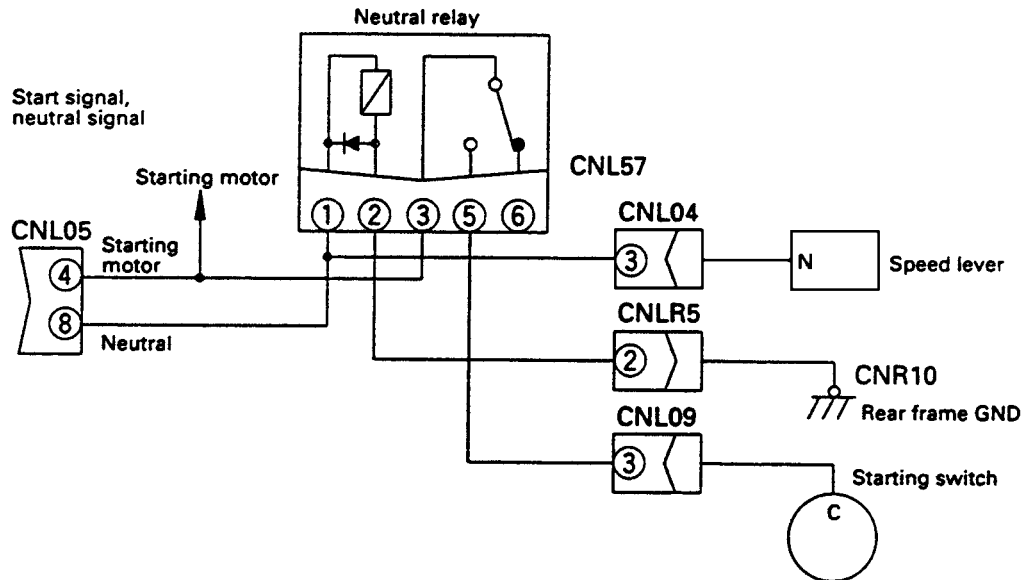
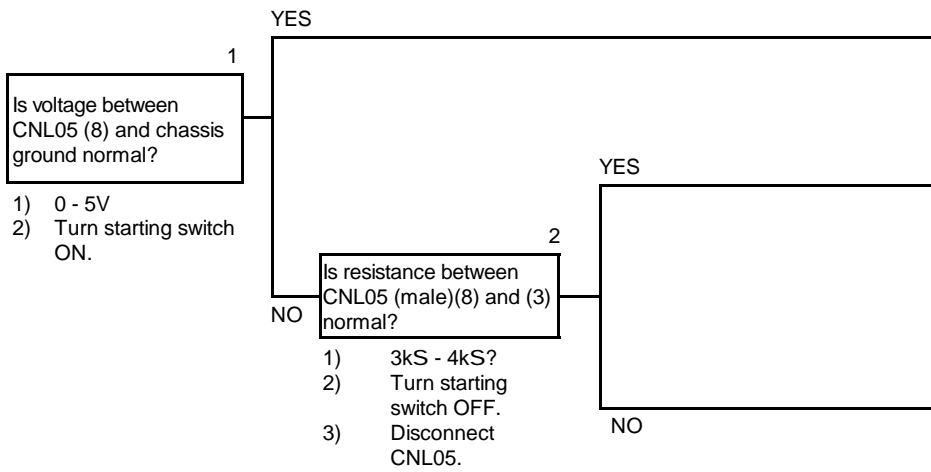
a) When parking brake is applied, buzzer sounds (intermittently) even when directional lever is at N and caution lamp flashes



Cause	Remedy
Defective main monitor	Replace
Defective contact, or disconnection in wiring harness between CNL05 (female)(8) and CNL04 (3)	After inspection, repair or replace
Defective main monitor	Replace
Contact of power source with wiring harness between CNL05 (female)(8) and CNL04 (female)(3)	After inspection, repair or replace
Defective main monitor	Replace

b) When parking brake is applied, buzzer does not sound and caution lamp does not light up even when directional lever is at any position other than N

- i Check that the synchronous flash signal is normal.



TDW00286

TROUBLESHOOTING OF MAINTENANCE MONITOR SYSTEM (K-MODE)

K-1	When starting switch is turned ON, all lamps on maintenance monitor do not light up for 3 seconds, maintenance monitor does not work	20-302
	a) All lamps on maintenance monitor do not light up for 3 seconds	20-302
	b) Some lamps do not light up	20-303
K-2	When starting switch is turned ON, all lamps on maintenance monitor light, but do not go out	20-303
K-3	When engine is started immediately after starting switch is turned ON (within 3 seconds), all lamps on maintenance monitor do not go out	20-304
K-4	When starting switch is turned ON (engine stopped), CHECK items flash	20-305
	a) Engine oil level display flashes	20-305
	b) Engine coolant water level display flashes	20-306
K-5	When starting switch is turned ON (engine started), CAUTION items flash	20-307
	a) Engine oil pressure display flashes	20-307
	b) Battery charge level display flashes	20-308
	c) Brake oil pressure display flashes	20-309
	d) Air cleaner display flashes	20-310
K-6	CAUTION items are flashing, but alarm buzzer does not sound	20-311
K-7	There is no abnormality in monitor display, but alarm buzzer sounds	20-312
K-8	CAUTION items are flashing, but warning lamp (CHECK lamp, CAUTION lamp) does not light up	20-313
	a) CHECK lamp	20-313
	b) CAUTION lamp	20-313
K-9	There is no abnormality in maintenance monitor display, but warning lamp (CHECK lamp, CAUTION lamp) light up	20-314
	a) CHECK lamp	20-314
	b) CAUTION lamp	20-314
K-10	Night lighting does not light up when lamp switch is turned ON (only lighting of maintenance monitor does not light up)	20-315
K-11	Night lighting lights up even when lamp switch is OFF	20-316
K-12	Service meter does not work	20-317
K-13	Service meter is running even when engine is stopped	20-317
K-14	Abnormality in gauge items	20-318
	a) Abnormality in fuel gauge	20-318
	b) Abnormality in engine coolant water temperature gauge	20-319
	c) Abnormality in torque converter oil temperature gauge	20-320

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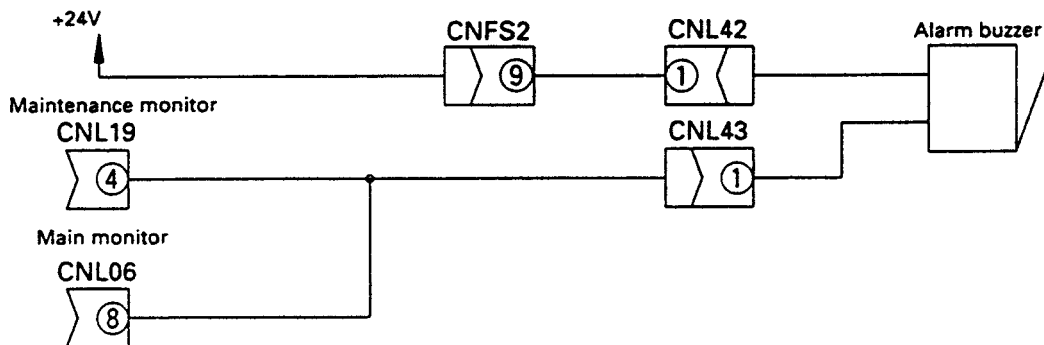
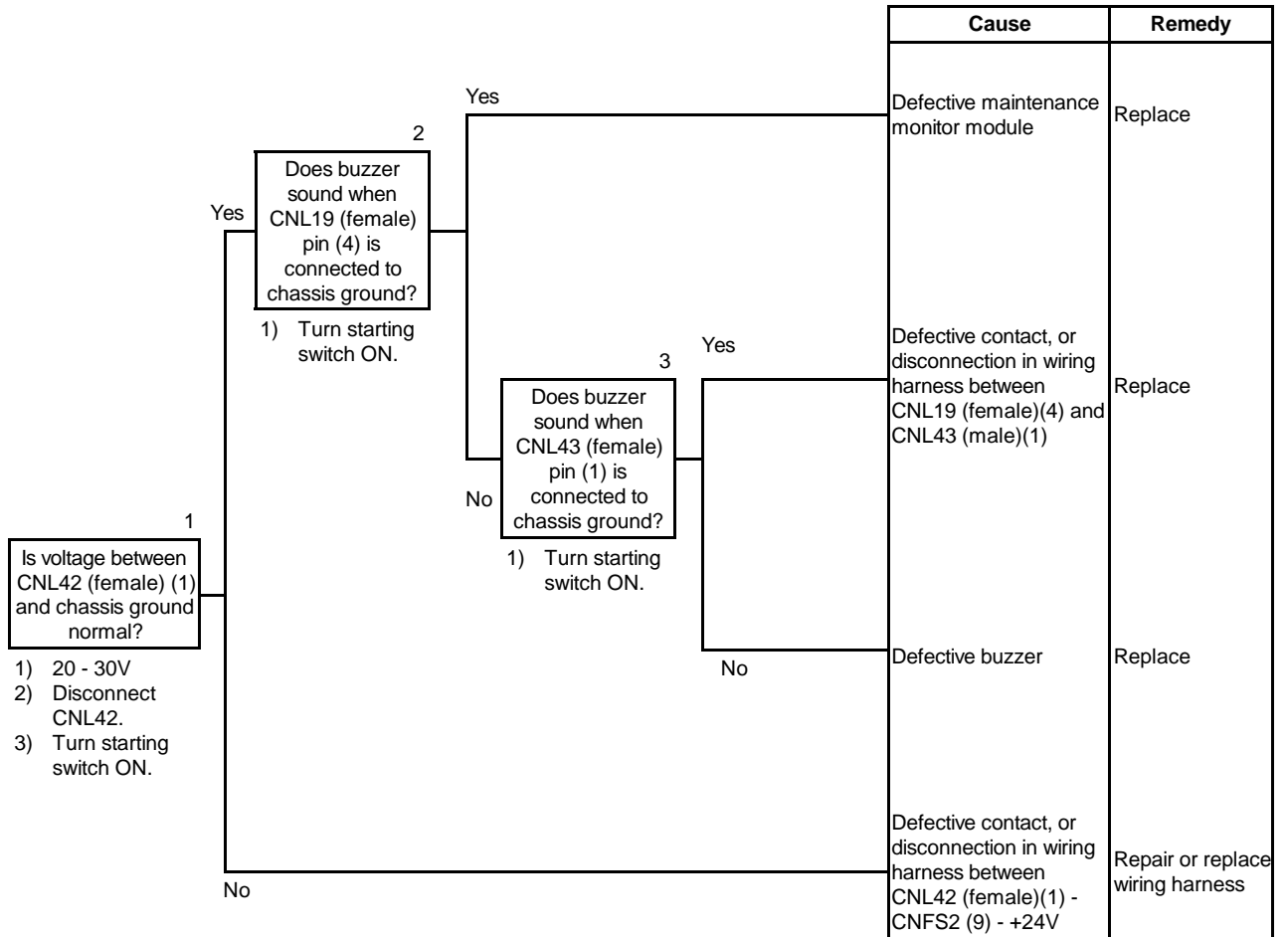


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K-6 CAUTION items are flashing, but alarm buzzer does not sound

- Ú The buzzer does not sound for CHARGE or ENGINE OIL LEVEL.
- Ú Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- Ú Always connect any disconnected connectors before going on to the next step.



TDW00322

TROUBLESHOOTING OF ELECTRICAL SYSTEM (E-MODE)

E-1 Engine does not start	20-352
E-2 Engine does not stop	20-356
E-3 Engine stops when machine is traveling	20-356
E-4 Parking brake does not work	20-357
E-5 Parking brake is applied when machine is traveling	20-358
E-6 Parking brake is released when starting switch is turned ON	20-360
E-7 Transmission does not change to neutral when parking brake is applied (but parking brake works normally)	20-360

**TROUBLESHOOTING OF
HYDRAULIC AND MECHANICAL SYSTEM (CHASSIS RELATED)
(T-MODE)**

POWER TRAIN

T-1 Machine does not start 20-402
 T-2 Travel speed is slow, thrusting power is weak, lacks power on slopes 20-403
 T-3 Excessive shock when starting machine or shifting gears 20-404
 T-4 Excessive time lag when starting machine or shifting gears 20-405
 T-5 Torque converter oil temperature is high 20-406

STEERING SYSTEM

T-6 Steering wheel does not turn 20-407
 T-7 Steering is heavy 20-408
 T-8 Steering wheel wobbles or there is excessive shock 20-409
 T-9 Machine steers to one side when traveling 20-409
 T-10 Turning radius to left and right is different 20-409

BRAKE SYSTEM 20-410

T-11 Brakes do not work or braking effect is poor 20-410
 T-12 Brakes are not released or brakes drag 20-411
 T-13 Parking brake is not released or brake drags 20-412

WORK EQUIPMENT 20-413

T-14 Boom does not rise 20-413
 T-15 Boom movement is slow or boom lacks lifting power 20-414
 T-16 When boom is raised, it moves slowly at a certain height 20-415
 T-17 Bucket cannot be pushed with boom cylinder (bucket floats) 20-415
 T-18 Excessive hydraulic drift of boom 20-415
 T-19 Boom shakes during operation 20-415
 T-20 Boom drops momentarily when control lever is operated from HOLD to RAISE 20-415
 T-21 Bucket does not tilt back 20-416
 T-22 Bucket movement is slow or tilt-back lacks power 20-417
 T-23 Bucket movement becomes slow during tilt-back operation 20-418
 T-24 Bucket cannot be pushed with bucket cylinder 20-418
 T-25 Excessive hydraulic drift of bucket 20-418
 T-26 Bucket shakes during loading operation 20-419
 T-27 Bucket dumps momentarily when control lever is operated from HOLD to TILT 20-419
 T-28 Boom, bucket control levers are heavy or do not move smoothly 20-420

Explanation of symbols in Tables on following pages

The following symbols are used on the Cause column to show the action to be taken to remove the cause.			
X	Δ	A	C
Replace	Correct	Adjust	Clean

T-12 Brakes are not released or brakes drag

Checks before troubleshooting

- ! Does the brake pedal come back fully?
- ! Is the parking brake fully released?

Checking for abnormalities

- ! Is there any abnormal heat from the brakes?
- ! Does the machine travel smoothly under inertia on level ground?

No.	Problems	Remedy	Causes		
			Defect inside brake valve (piston stuck)	Abnormality in brake lining inside axle	Defective operation of brake piston inside axle
			a	b	c
			△	△	△
			X	X	X
1	Brake remains applied even when brake pedal is released		O	O	O
2	When brake pedal is released and oil is bled from air bleeder, circuit pressure goes down and brake is released		O		
3	Jack up 4 wheels and set axles on stand. When engine is stopped and parking brake is released, certain wheels are heavy when they are rotated by hand			O	O

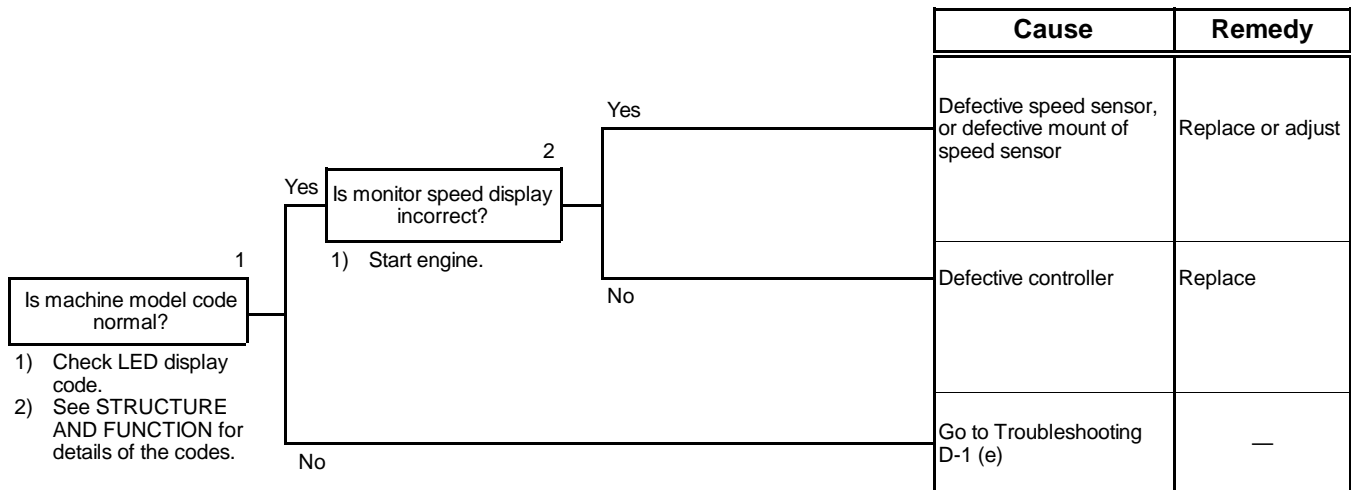
Legend
 X: Replace
 △: Correct
 A: Adjust
 C: Clean

**TROUBLESHOOTING OF
ECSS
(ELECTRONICALLY CONTROLLED SUSPENSION SYSTEM)
(D-MODE)**

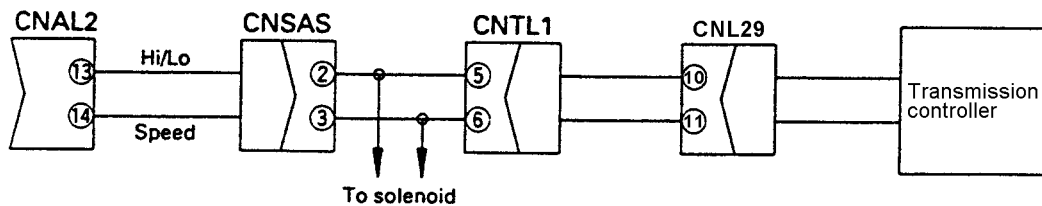
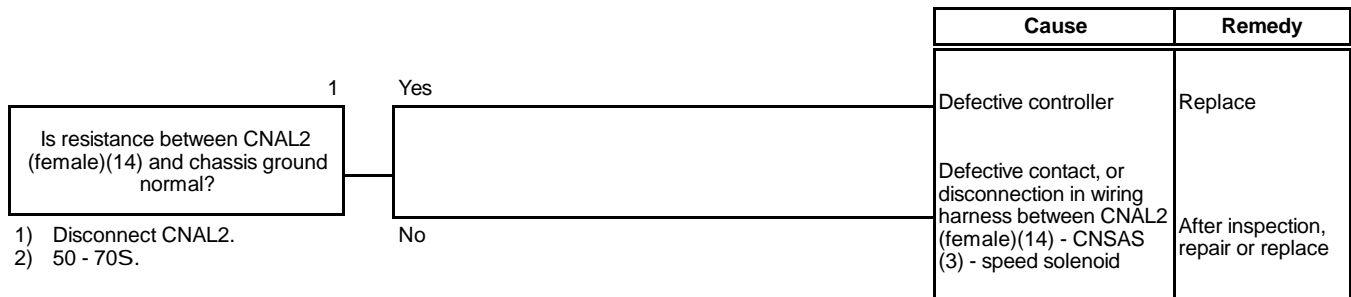
Judgement table for controller electrical system	20-452
D-1 ECSS does not work	20-453
a) Error code [d0] is displayed	20-454
b) Error code [d1] is displayed	20-454
c) Error code [d2] is displayed	20-455
d) Error code [d3] is displayed	20-455
e) Error code [d4] is displayed	20-456
f) No abnormality display is given	20-456
D-2 ECSS cannot be canceled	20-460
D-3 Output is turned ON (travel speed does not become 5 km/h)	20-461
D-4 Output is turned ON when transmission is in 1st	20-461
D-5 Output is turned ON when transmission is in 4th	20-462
D-6 Controller LED code is not displayed	20-463
D-7 ECSS is abnormal, but main monitor does not give abnormality display	20-463

**D-3 Output is turned ON (travel speed does not become 5 km/h)
(Deviates around 5 km/h)**

- Ú Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- Ú Always connect any disconnected connectors before going on to the next step.
- Ú Carry out troubleshooting with the starting switch ON.
- Ú Check that the ECSS switch on the main monitor is OFF.



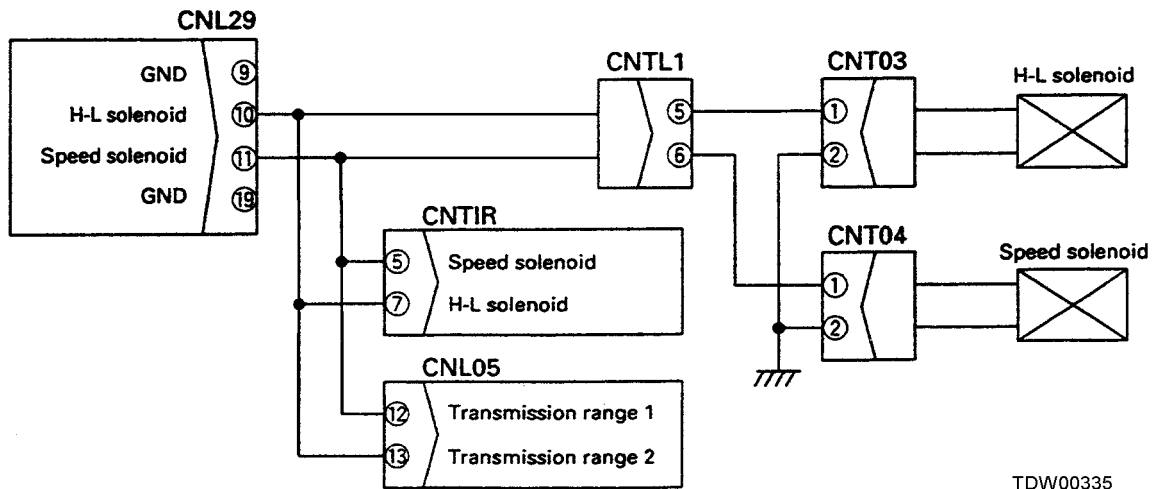
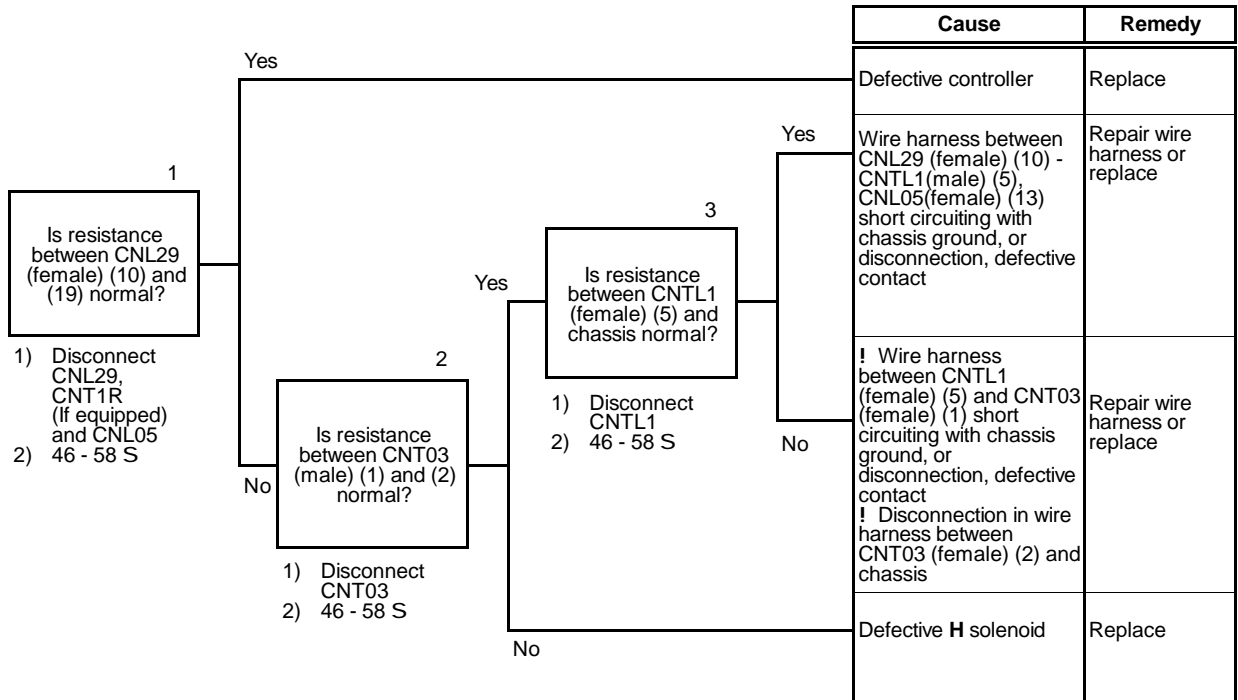
D-4 Output is turned ON when transmission is in 1st



VLSM0037

A-5 Troubleshooting code [14] Abnormality in H-L solenoid signal system

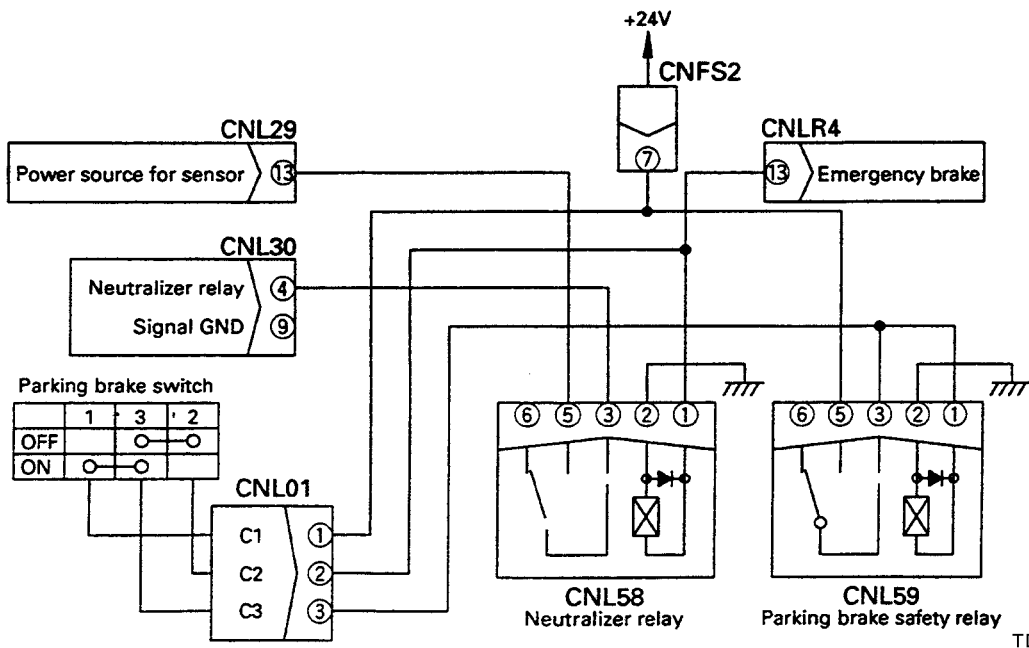
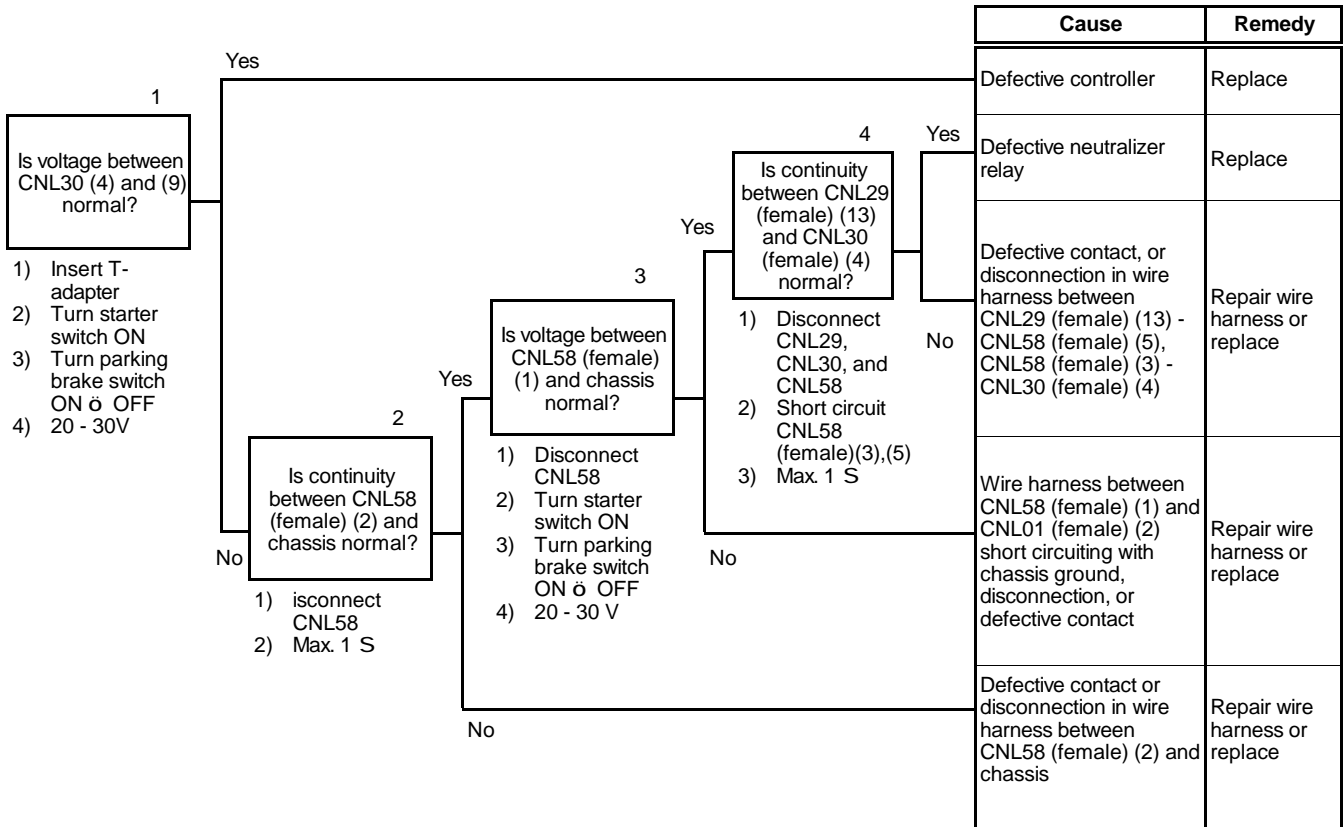
- Ú Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- Ú Always connect any disconnected connectors before going on to the next step.
- Ú When disconnecting connectors to connect the T-adaptor (or socket adaptor), always turn the starting switch OFF.



TDW00335

A-16 Neutralizer signal system


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



TDW00345

METHOD OF USING MANUAL


1. When removing or installing unit assemblies


- 1. When removing or installing a unit assembly, the order of work and techniques used are given for the removal operation; the order of work for the installation operation is not given.
- 2. Any special techniques applying only to the installation procedure are marked , and the same mark is placed after the relevant step in the removal procedure to indicate which step in the installation procedure it applies to.

(Example)

(COMPONENT OR ASSEMBLY NAME) Removal Title of operation


 **WARNING!** Precautions related to safety when carrying out the operation

- 1. XXXX (1) Step in operation
- i Technique or important point to remember when removing XXXX (1)
- 2. - - - (2)  indicates that a technique is listed for use during installation
- 3. 9 9 9 9 assembly (3)

 Quantity of oil or water drained

Installation Title of operation


! Installation is the reverse of removal

 Technique used during installation

i Technique or important point to remember when installing - - - (2)

! Adding water, oil Step in operation

i Point to remember when adding water or oil

 Quantity when filling with oil and water

2. **General precautions** when carrying out installation or removal (disassembly or assembly) of units are given together as PRECAUTIONS WHEN CARRYING OUT OPERATION, so be sure to follow these precautions when performing out the operation.

3. Listing of special tools

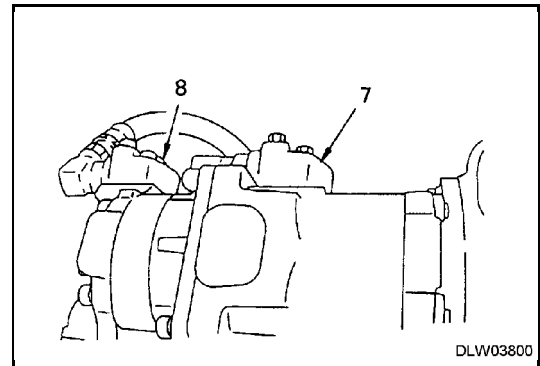
- (1) For details of the description, part number, and quantity of any tools (A1, etc.) that appear in the operation procedure, see the SPECIAL TOOL LIST later in this section.

WATER PUMP


Refer to the Engine Shop Manual.

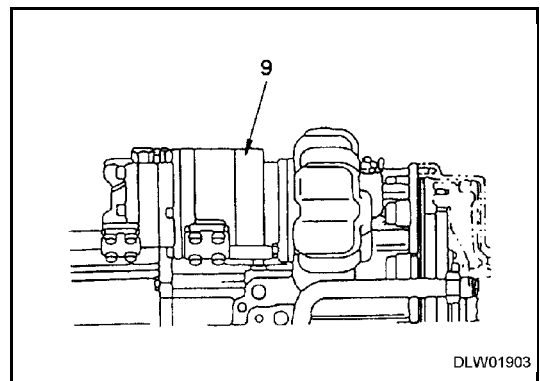
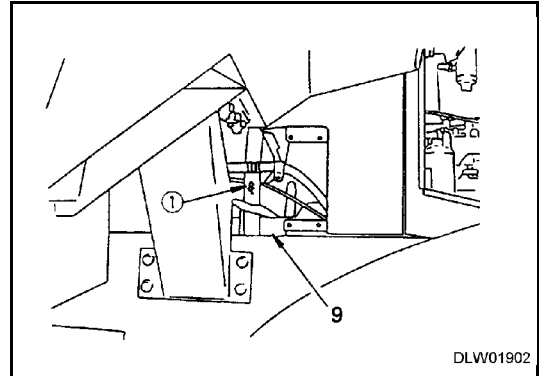
- ! Tighten the plugs on top of the hydraulic tank filter and the plugs of the hydraulic piping, then add hydraulic oil through the oil filler to the specified level.
 - i Run the engine to circulate the oil through the system, then check the oil level again.
 - i Bleed the system of air as detailed in Section 20, TESTING AND ADJUSTING.

- i The hose (7) from between the charging pump and the torque converter oil filter.
- i The hose (8) from between the charging pump and the top of the transmission.



4. Remove the mounting bolts, then remove the torque converter charging pump (9).
 - i The work space is very restricted so be careful to avoid injured hands or fingers.
 - i This step requires 2 workers to install the lifting tool \hat{I} to prevent the pump from falling.

 Torque converter charging pump: 10 kg (22 lb)



Installation


! Installation is the reverse of removal.




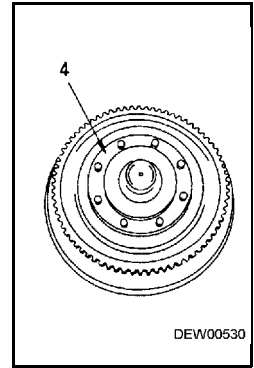
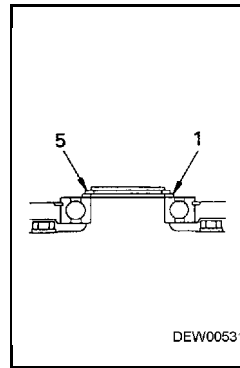
- i Install a new O-ring at the mating surface with the housing.
- i Fit the O-ring securely in its groove being careful not to damage it.

iv) Fit the plate (1) and install the snap ring (5).


v) Install the pilot (4).


 Mounting bolt: Thread tightener (LT-2)

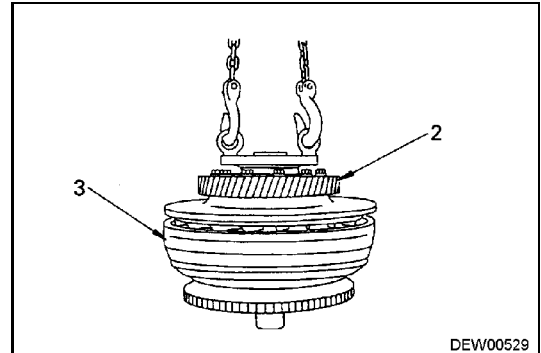
 Mounting bolt: $30.9 \pm 3.4 \text{ N! m}$ ($22.8 \pm 25.1 \text{ lbf ft}$)



B. Install the turbine and case assembly (3) to the stator shaft and pump assembly (2).

 Mounting bolt: Thread-tightener (LT-2)

 Mounting bolt: $30.9 \pm 3.4 \text{ N! m}$ ($22.8 \pm 25.1 \text{ lbf ft}$)



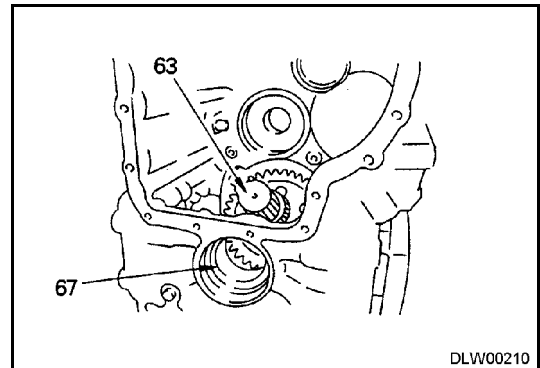
- D. Push in the shaft (63) toward the rear, then pass the shaft through the front housing and remove.



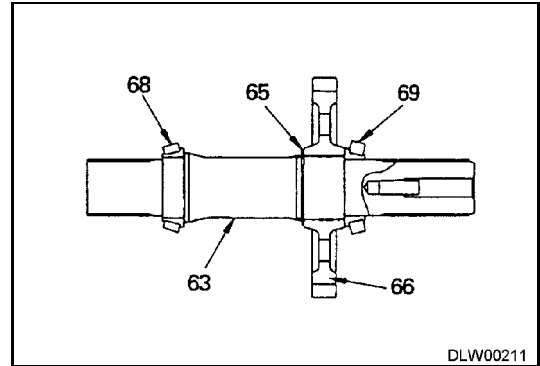
WARNING! Be careful not to get fingers caught between a gear and the housing.

- Ú Be careful not to damage the spline grooves of the shaft.

- E. Remove the bearing cup (67).

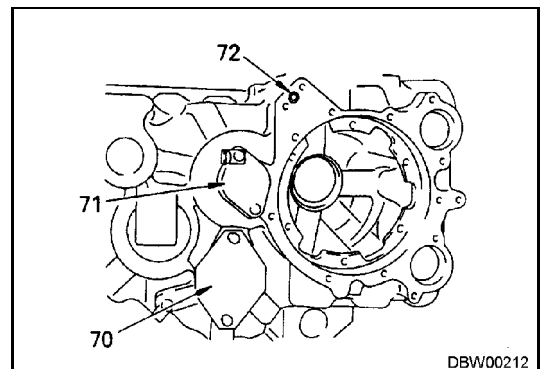


- F. Remove the bearing cone (68), snap ring (65), gear (66), and bearing cone (69) from the shaft (63).

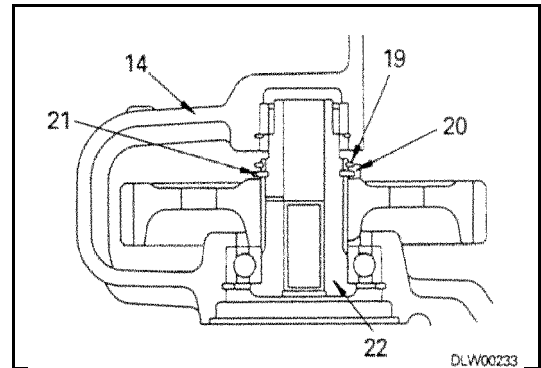


19. Covers

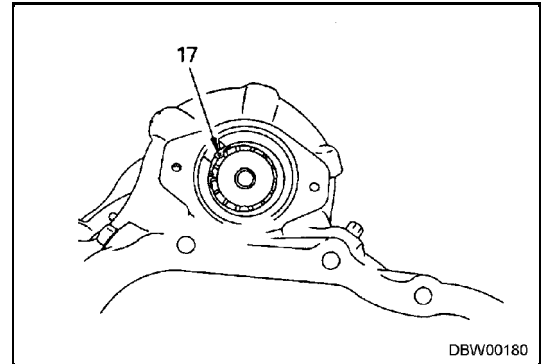
- A. Remove the covers (70) and (71).
 - Ú Remove both O-rings.
- B. Remove the O-ring (72).



- C. Assemble split spacer (21) to stepped portion of shaft, then assemble ring washer (20) to split spacer, and install snap ring (19).




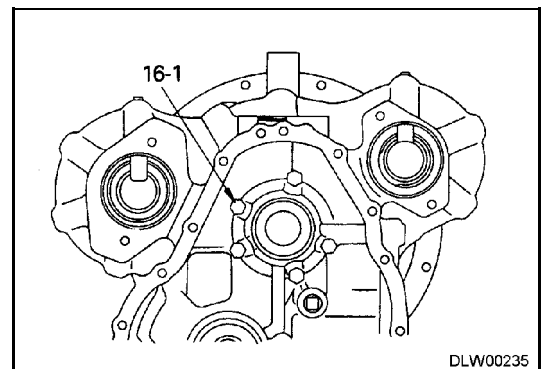
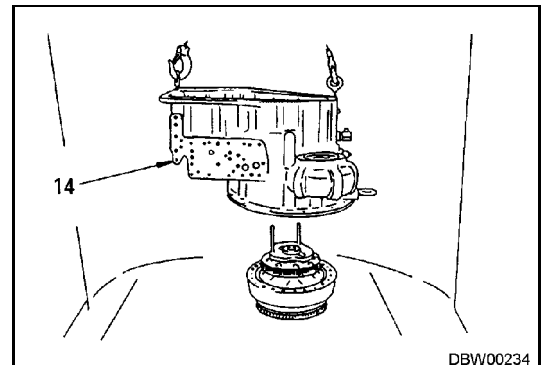
- D. Turn over rear housing, and install snap ring (17) at pump mount.
 - Ú Perform the same procedure at the loader pump end.



- 12. Use eye bolts to raise the rear housing (14), then it set to the mounting position of the torque converter, and tighten the mounting bolts (16-1).

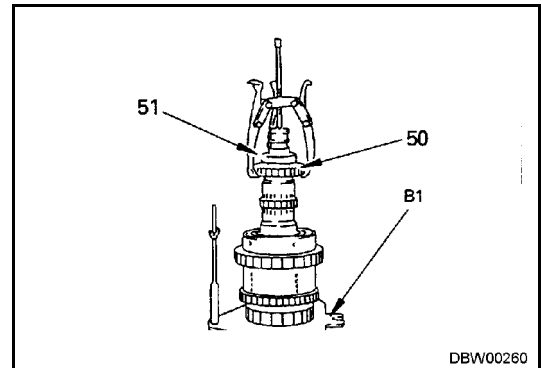
- Ú Align the mounting bolt holes properly, being careful of the meshing with the pump accessory gear, and install.
- Ú Blow air into the oil holes to check that they are correctly aligned.

 Mounting bolt: $112.8 \pm 9.8 \text{ N! m}$ ($83.2 \pm 7.2 \text{ lbf ft}$)

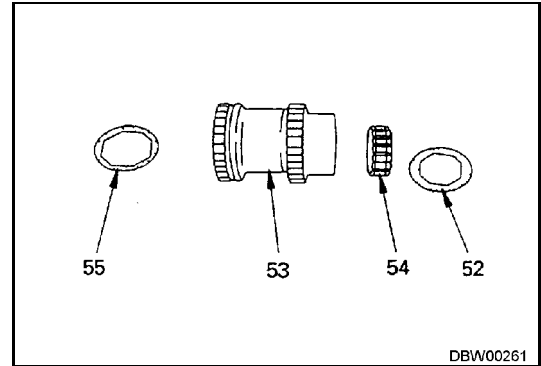


Disassembly of 2nd, 4th clutch pack

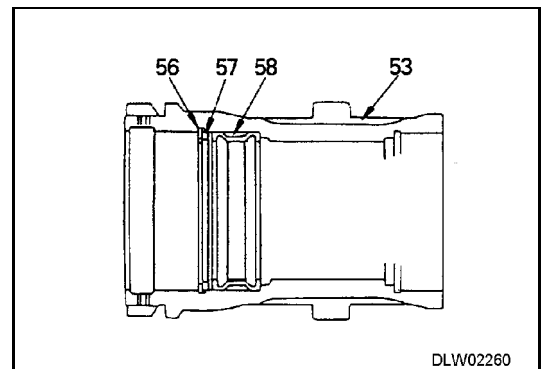
1. Set on tool **B1** with the 4th clutch side at the top, fit a puller to the idler gear (50), then remove the bearing (51) together with the idler gear.



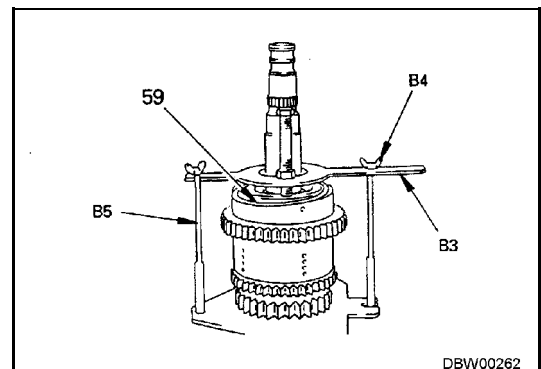
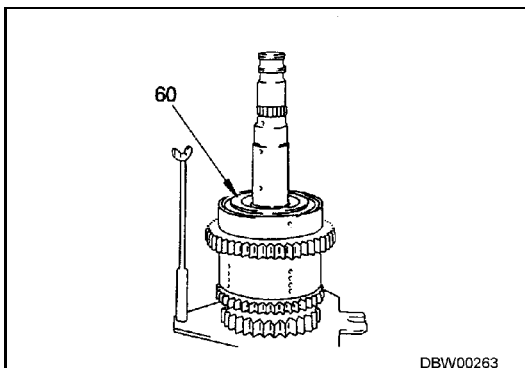
2. 4th gear
 A. Remove the thrust washer (52), 4th gear (53), needle bearing (54), and thrust washer (55).
 B. Remove the snap ring (56), spacer (57), and needle bearing (58) from the 4th gear (53).




3. End plate
 A. Install tools **B3** and **B5**, then tighten tool **B4**, and remove the ring (59).
 Ú Remove tool **B3** after removing the ring.



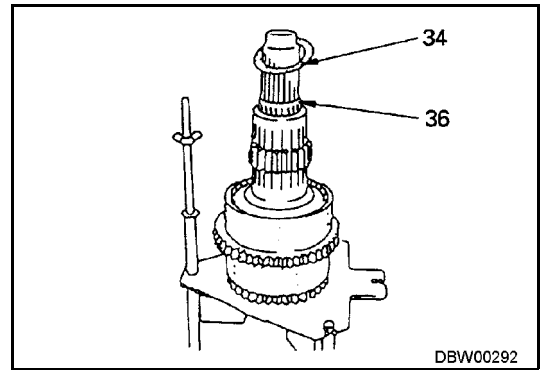
B. Remove the end plate (60).



- B. Assemble the needle bearing (36) and thrust washer (34).

 Thrust washer: Transmission oil

- C. Assemble the snap ring (33).
 - Ú Fit the snap ring securely in the groove of the shaft.

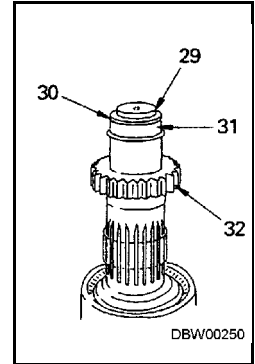
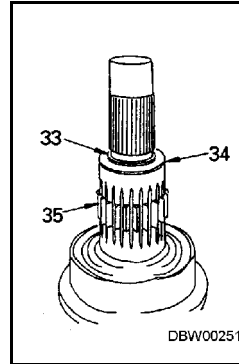


- 11. Assemble the idler gear (32).

12. Bearing

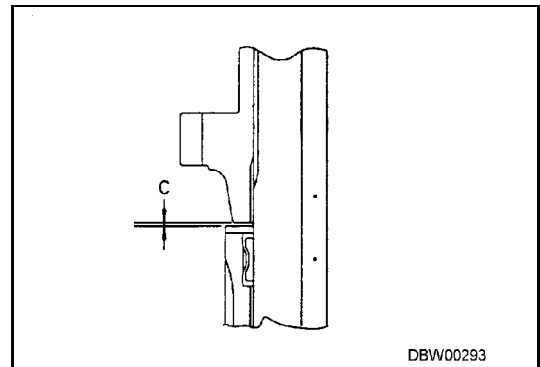
- A. Press-fit the inner bearing (31) and spacer (30).

- B. Assemble the snap ring (29).
 - Ú Fit the snap ring securely in the shaft groove.



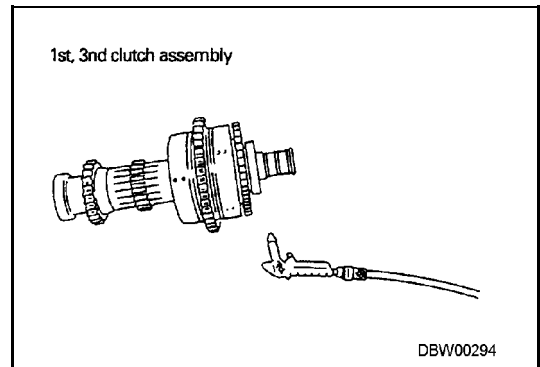
- C. After press-fitting the bearing, check that clearance "c" between the thrust washer and the gear is within the standard value.

Ú $c = 0.02 - 1.58 \text{ mm} (0.0007 - 0.0622 \text{ in.})$



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

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





Disassembly

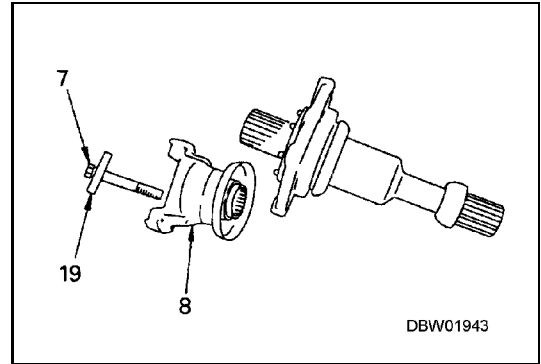
1. Remove the mounting bolts, disconnect upper valve (2) from the lower valve (1), then remove the gasket (3).
2. Upper valve disassembly
 - A. Remove the mounting bolts, remove the lock plate (4), then remove the manual valve (5).
 - B. Remove the O-ring (6) and orifice (7) from the manual valve (5).
 - C. Remove the plug (8) and O-ring (9).
 - D. Remove the mounting bolts, then remove the bracket (10), cover (11), gasket (12), pilot valve (13), and pilot spring (14).
 - E. Remove the valve (15), spring (16), valve (17), main relief valve (18), and mode spring (19).
 - Ú Record the shim thickness.
 - F. Remove the dummy spool (20), torque converter out-spring (21), and torque converter out-valve (22).
 - G. Remove the mounting bolts, remove the cover (23), gasket (24), and dump spring (25), then remove the dump valve assembly (64).
 - H. Remove the orifice plug (26) from the dump valve assembly (64), remove the valve plug (28) from the dump valve (27), then remove the check spring (29) and ball (30).
 - I. Remove the orifice (31) and plug (32) from the upper valve (2).
3. Lower valve disassembly
 - A. Remove the mounting bolts, then remove the pilot filter (33) and O-ring (34).
 - B. Remove the mounting bolts, then remove the parking brake solenoid (35), and O-rings (36) and (37).
 - C. Remove the mounting bolts, then remove the solenoid valve (38), and O-rings (39) and (40).
 - D. Remove the mounting bolts, then remove the cover (41), gasket (42), the F-return spring (43), and sleeve (44).
 - E. Remove the priority valve (45).
 - F. Remove the brake valve (46) and return spring (47).
 - G. Remove the mounting bolts, then remove the cover (48), gasket (49), and priority spring (50).
 - H. Remove F return spring (51) and sleeve (52) then remove F-R valve (53).
 - I. Remove the plug (54) from the F-R valve (53).
 - J. Remove the return spring (55) and spring spacer (56), then remove the speed valve (57) and the H-L valve (58).
 - K. Remove the orifices (59), (60), and (61), and plugs (62) and (63) from the lower valve (1).

- B. Align the match marks, and tighten the coupling (8) and retainer (19) with the mounting bolt (7).

- Ú Torque the bolt as specified tightening after installation on the machine.

-  Spline: Grease (G2-L1)


-  Mounting bolt: 276 ± 29 N! m (204 ± 21 lbf ft)

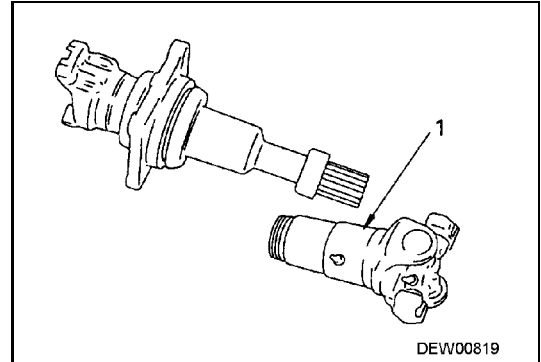


- C. Align the match marks, then install the coupling and tube (1).

- Ú Check that the couplings face in the same direction.

- Ú If the spline is worn, replace the entire drive shaft assembly.

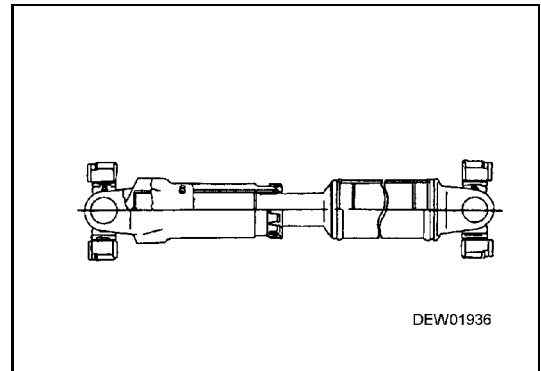
-  Spline: Grease (G2-L1)



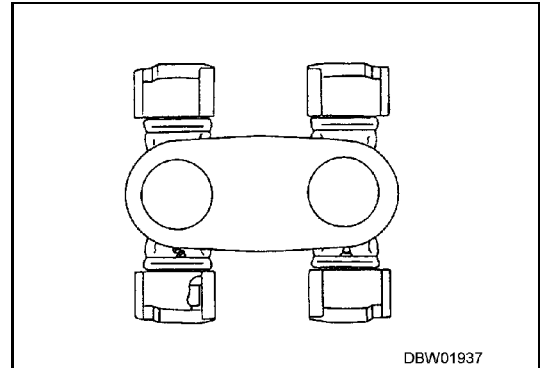
3. Center drive shaft rear drive shaft installation

- Ú Perform the procedure in Step 2C, front the drive shaft.

Center drive shaft



Rear drive shaft

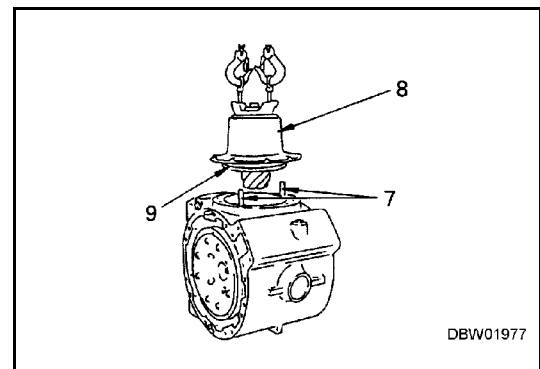


5. Cage

- A. Thread in the jacking screws and using guide bolts (7) (16 mm, P=2, L=50 mm), remove the cage assembly (8).
 - i Check the number of shims and use this as a reference during reassembly.
 - i Loosen the coupling mounting bolts and fit them temporarily.



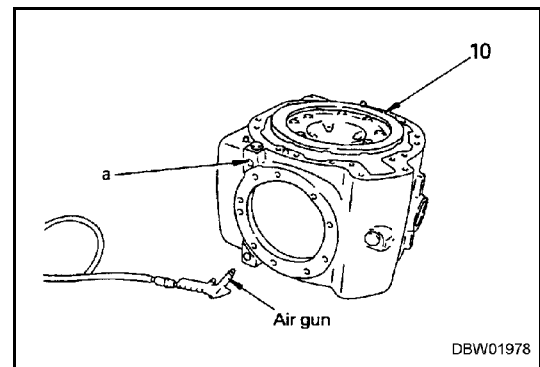
Cage assembly: 46 kg (101 lb)



- B. Remove the O-ring (9) from the cage.

6. Install the bleeder screw, blow in compressed air from portion a, raise the housing and piston (10), then remove the brake piston.

- i If the D-ring is damaged, blow in air suddenly to form a gap between the housing and the piston. Then lever it out and remove it.
- i Be careful not to damage the housing and piston surface when removing the piston.

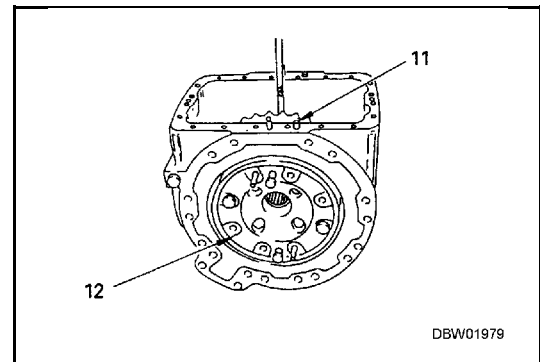


7. Bearing carrier assembly removal

- A. Sling the differential carrier assembly (11), thread in forcing screws, raise it evenly, then remove the bearing carrier (12).

B. Remove the square ring and D-ring.

- Ú Count the shims and use this number as a reference during reassembly.
- Ú Mark the right and left carriers to prevent confusion during reassembly.
- Ú Fit a sling around the differential carrier, then raise the carrier.
- Ú Use a puller to remove the bearing cone from the bearing carrier.

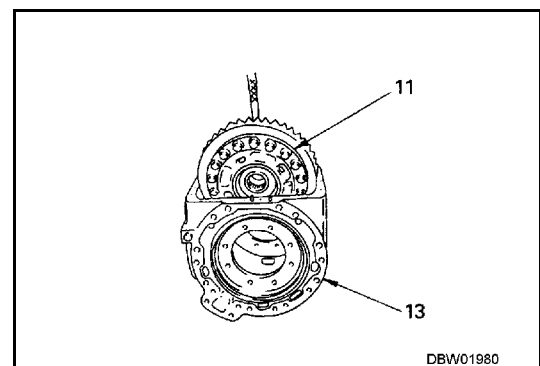


8. Differential carrier assembly removal

- A. Lift off the differential carrier assembly (11) from the differential housing (13).
 - Ú Use extreme care to prevent the lifting tool from coming off during removal.

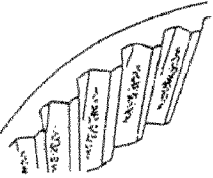
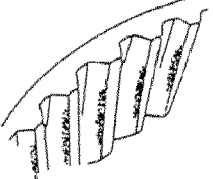
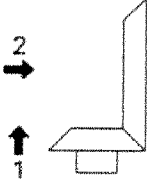
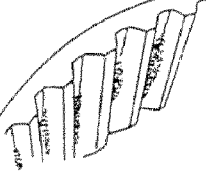
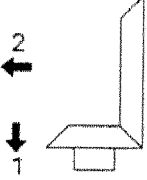
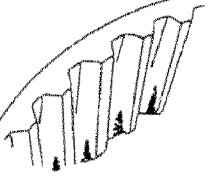
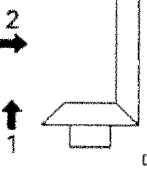
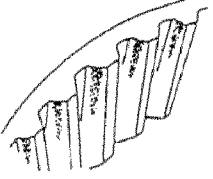
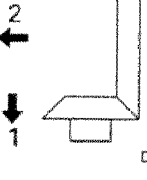


Differential carrier assembly: 55 kg (265 lb)



10. Adjusting tooth contact

Apply a light coat face of red lead to a minimum of seven or eight teeth of bevel gear. Hold the bevel gear by hand to act as a brake, rotate the pinion gear forward and backward and inspect the pattern left on the teeth.

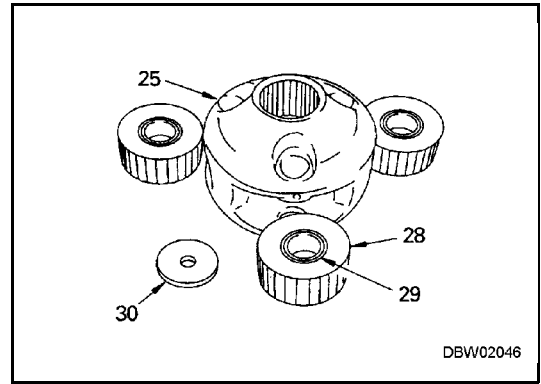
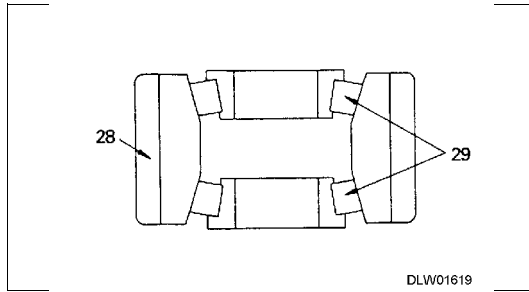
Tooth contact	Cause	Procedure for adjustment
 <p>DEW00910</p>	<p>The tooth contact pattern should start from about 5 mm from the toe of the bevel gear and cover about 50% of the length of the tooth. It should be in the center of the tooth height.</p>	<p>Adjust the pinion gear by adjusting the shims at the cage. Adjust the bevel gear in the same way as when adjusting backlash.</p>
 <p>DEW00904</p>	<p>Bevel pinion gear is too far from bevel gear.</p>	<p>1. Reduce shims at pinion gear to bring closer to bevel gear. 2. Move bevel gear further away from pinion gear and adjust backlash correctly.</p>  <p>DEW00908</p>
 <p>DEW00905</p>	<p>Bevel pinion gear is too close to bevel gear.</p>	<p>1. Increase shims at pinion gear to move away from bevel gear. 2. Move bevel gear closer to pinion gear and adjust backlash correctly.</p>  <p>DEW00909</p>
 <p>DEW00906</p>	<p>Bevel gear is too close to pinion gear.</p>	<p>1. Reduce shims at pinion gear to bring closer to bevel gear. 2. Move bevel gear further away from pinion gear and adjust backlash correctly.</p>  <p>DEW00908</p>
 <p>DEW00907</p>	<p>Bevel gear is too far from pinion gear.</p>	<p>1. Increase shims at pinion gear to move away from bevel gear. 2. Move bevel gear closer to pinion gear and adjust backlash correctly.</p>  <p>DEW00909</p>

U When adjusting the bevel gear, do not change the preload of the bearing. Adjust by moving shims between the left and right. Always keep the same total thickness of shims.

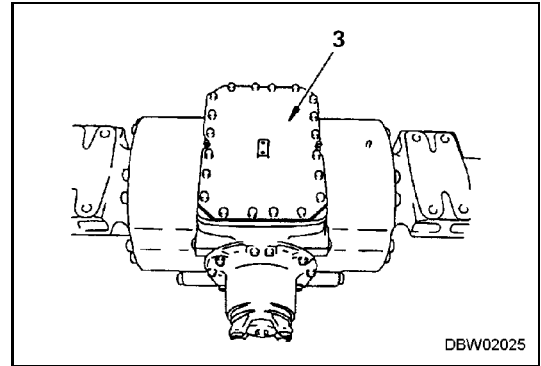
- D. Remove the pinion gears (28) from the planetary carrier (25), then remove the bearing cones (29) and spacers (30).



Planetary carrier 19 kg (41.9 lb)

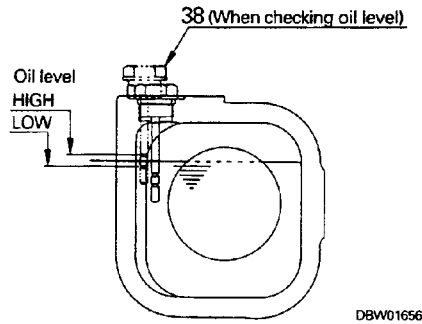
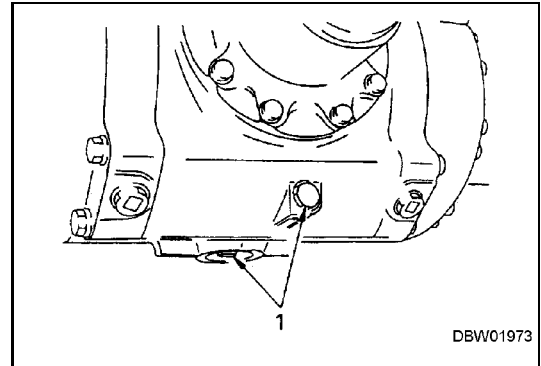


12. If the differential cover (3) was removed, see DIFFERENTIAL ASSEMBLY, Disassembly, elsewhere in this section.

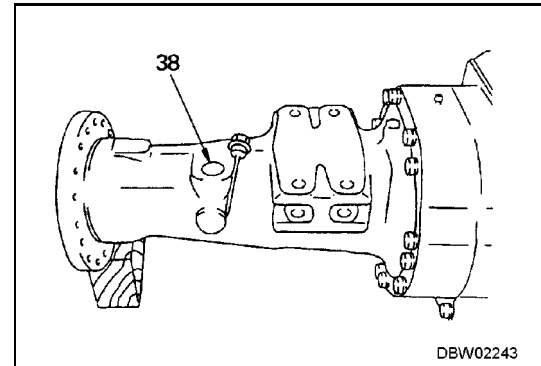


13. Tighten the drain plugs (1), then add oil through oil filler (38) to specified level.

- Ú Position the axle so it is horizontal and add a small amount of oil before installing to assembly to the chassis.
- Ú Add oil and check the oil level again after installing to the chassis.



- Ú Be sure the housing is horizontal when checking the oil level.






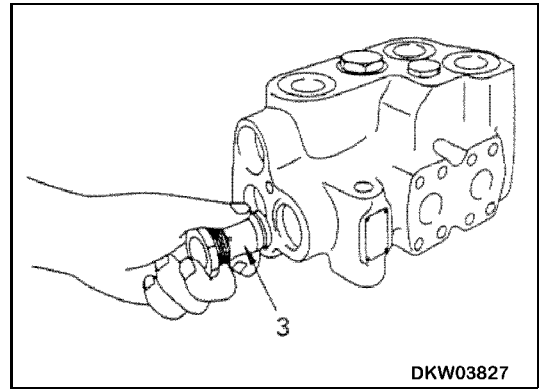
- i Be sure to install the shims.
- i Adjust the shims so that the clearance between the cylinder and rear frame is 0-5 mm (0-0.20 in.).



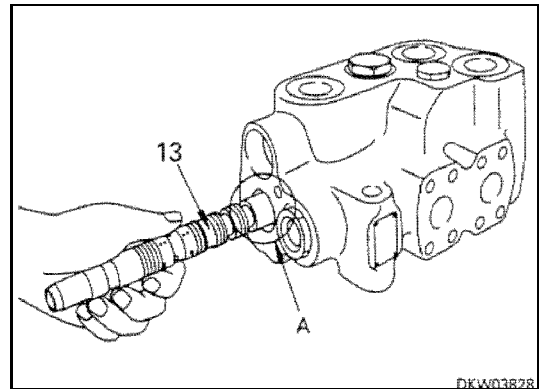
- i Install the cab and floor assembly as described later in this section.

- D. Install an O-ring and backup ring to the plug (3), then thread the plug into the valve body.

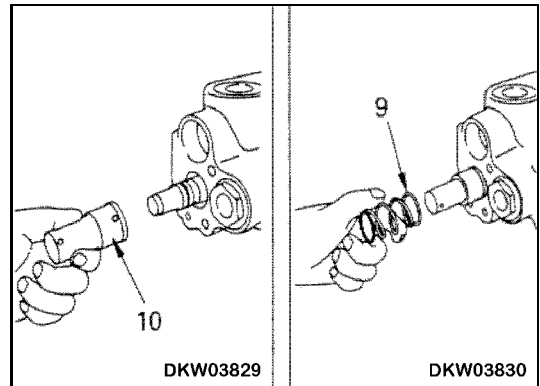
 Plug: $137.3 \pm 2.0 \text{ N! m}$ ($101.3 \pm 1.5 \text{ lbf ft}$)




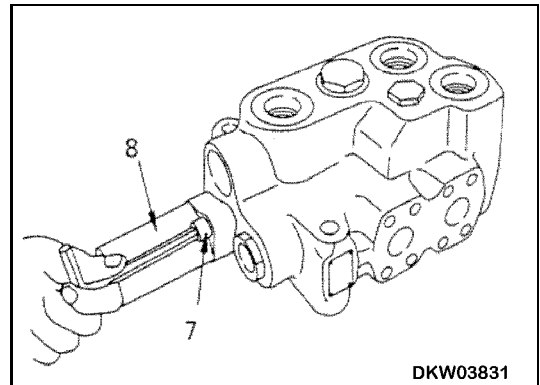
- 5. Installing the steering spool assembly
 - A. Insert the steering spool assembly (13) into the valve body.
 - i Ensure that portion **A** of the spool faces the correct direction.



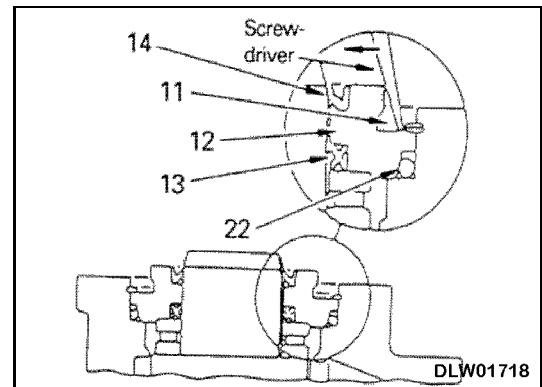
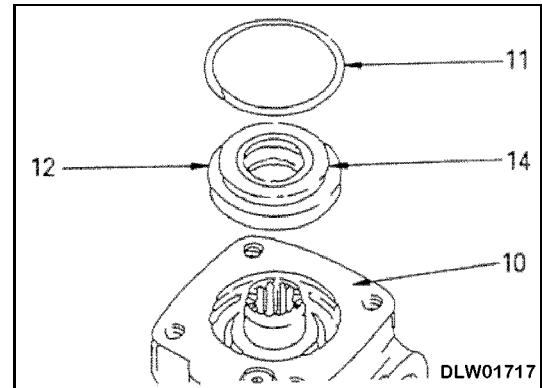
- B. Install the spring seat (10).
- C. Install the spring (9).
 - i Install the other spring and seat to the opposite side of the valve body at this time.



- D. Install an O-ring to the case (8), then install the case onto the valve body.
- E. Install the two bolts (7) to secure the case to the valve body.
 -  Bolts: $41.2 \pm 2.0 \text{ N! m}$ ($30.4 \pm 1.5 \text{ lbf ft}$)
 - i Install the other case and bolts to the opposite side of the valve body at this time.

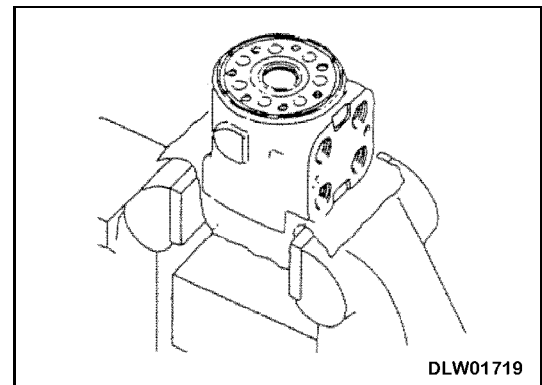


11. Install the dust seal (11) in the bushing (12).
12. Install the X-ring seal (13) in the bushing (12).
13. Insert the bushing (12) in the spool. Rotate the bushing to install it in place.
 - i Use a plastic hammer to tap the bushing into final position.
 - i The bushing must be in contact horizontally with the bearing race.
14. Use a screwdriver or similar tool to fit the snap ring (11) in its groove in the orbitrol valve housing.

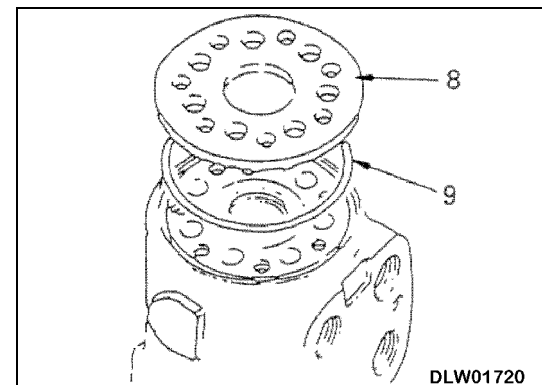


Rotor

15. Place the orbitrol valve housing in a vise as shown.
 - i Line the vise jaws with copper plates, then tighten the vise only enough to hold the orbitrol valve in place. Do NOT to tighten the vise excessively or equipment damage will result.
 - i Check that the spool and sleeve are recessed inside the housing surface with 14 holes.



16. Install the O-ring (9) in the orbitrol valve housing.
17. Install the spacer plate (8), then align the bolt holes in the spacer plate with the tap holes in the housing.



Assembly


1. Valve

Use the mounting bolts (5) to secure the S-flange assembly (8) to the jig $\bar{\Gamma}$, then secure the jig to the vise.

A. Install springs (14) and (15) to the S-flange assembly (8) in this order, then install the holder (13) on the top spring (17).


B. Install the O-ring (20) to the T-flange assembly (9).

i Use a new O-ring.


 O-ring: Lithium grease


C. Set the S-cylinder assembly (7) to the S-flange assembly (8), and secure it in place with the mounting bolts (5).


i Align the match marks during assembly.

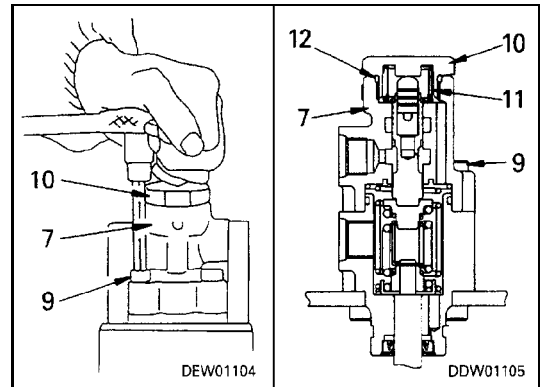
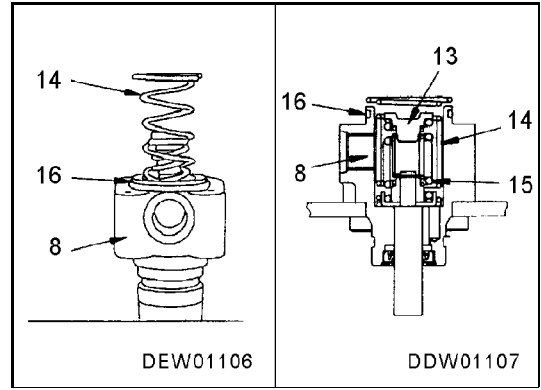
 Mounting bolts: 58.8 - 73.6 N! m (43.4 - 54.3 lbf ft)

D. Install the spring (11) and O-ring (12) to the S-cylinder assembly (7), then tighten with plug (10).

 O-ring: Lithium grease

 Plug threads: Thread tightener (Thread lock 1303B)

 Plug: 152.0 ± 24.5 N! m (112.1 ± 18.1 lbf ft)



2. Bracket assembly


Remove the valve from the jig $\bar{\Gamma}$.

A. Set the S-flange assembly face up, then install the oil seal (6).

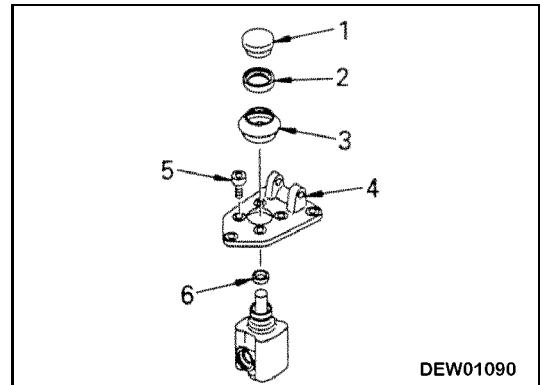
i Use a new oil seal

i Lip of the oil seal: Lithium grease

B. Install the bracket assembly (4) and tighten the mounting bolts (5).

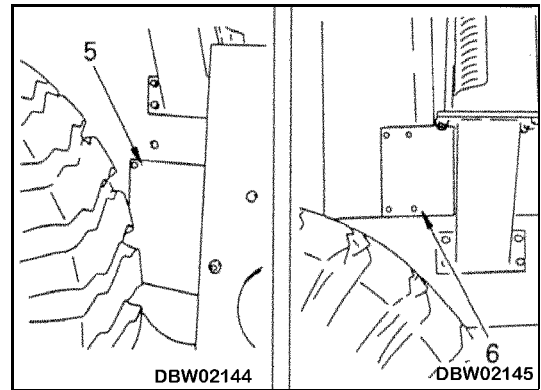
 Mounting bolts: 58.8 - 73.6 N! m (43.4 - 54.3 lbf ft)

C. Install the seat (1), pedal stopper (2) and boot (3) to the valve.



4. Floor support

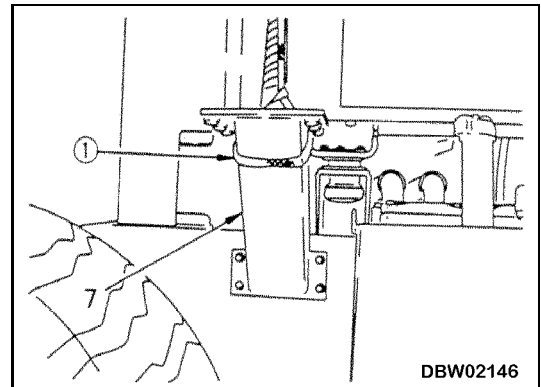
- A. Remove the inspection covers (5) and (6) on the right side.



- B. Use the nylon lifting tool \hat{I} to sling the right floor support (7), remove the mounting bolts and lift the floor support free.

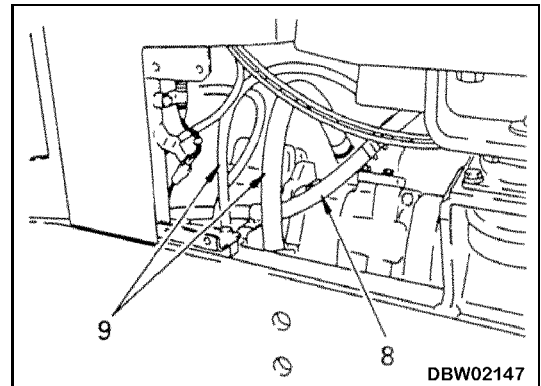


Floor support: 19 kg (41.9 lb)



5. Hydraulic piping

- A. Remove the clamps from the air conditioner hose (8) and the hydraulic hoses (9), then move the hoses to the rear.

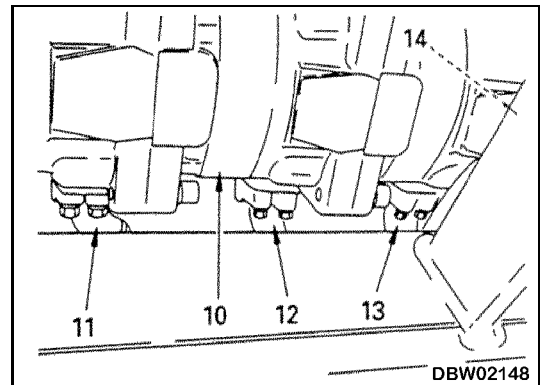


- B. Remove the hydraulic hoses (11), (12), (13) and (14) at the bottom of the hydraulic pump (10).














- i Fit covers to the openings to prevent dirt or water from entering the connections and hoses.

- i Label the hoses to ease reconnection later.



Assembly

1. Cut-off valve assembly
 - A. Fit new O-rings to the plugs (43), (42) and (41), then thread the plugs into the valve body (1).
 Plug: $275 \pm 29.4 \text{ N! m}$ ($203 \pm 21.7 \text{ lbf ft}$)
 - B. Assemble the valve (40), spring (39) and seat (38) to the valve body (2); fit a new O-ring to the bar (37), then secure the bar to the valve body with the screws provided.
 Bar screws: $66.7 \pm 7.8 \text{ N! m}$ ($49.2 \pm 5.8 \text{ lbf ft}$)
 - C. Assemble the valve (36), spring (35) and piston (34) to the valve body (2); fit a new O-ring to the flange (33), then secure the flange to the valve body with the screws provided.
 Flange screws: $66.7 \pm 7.8 \text{ N! m}$ ($49.2 \pm 5.8 \text{ lbf ft}$)
 - D. Thread the screen (32) and pilot valve (31) into the cut-off valve body (2).
 Screen: $34.3 \pm 4.9 \text{ N! m}$ ($25.3 \pm 3.6 \text{ lbf ft}$)
 Pilot valve: $147 \pm 9.8 \text{ N! m}$ ($108 \pm 7.2 \text{ lbf ft}$)
2. Check valve assembly, flange and plugs
 - A. Thread the plugs (45) and (44) into the body (1).
 Plug: $152 \pm 24.5 \text{ N! m}$ ($112 \pm 18.1 \text{ lbf ft}$)
 - B. Fit a new O-ring to the flange (30), then secure the flange to the valve body (1) with the bolts provided.
 Flange bolts: $66.7 \pm 7.8 \text{ N! m}$ ($49.2 \pm 5.8 \text{ lbf ft}$)
 - C. Install the valve (29) and spring (28) to the valve body (1), then fit a new O-ring to the plug (27) and thread the plug into the valve body.
 Plug: $466 \pm 24.5 \text{ N! m}$ ($344 \pm 18.1 \text{ lbf ft}$)
3. Thread the suction valve (26) into the body (1).
 Suction valve: $226 \pm 9.8 \text{ N! m}$ ($167 \pm 7.2 \text{ lbf ft}$)
4. Thread the safety valve (25) into the body (1).
 Safety valve: $226 \pm 9.8 \text{ N! m}$ ($167 \pm 7.2 \text{ lbf ft}$)
5. Thread the main relief valve (24) into the body (1).
 Valve: $152 \pm 24.5 \text{ N! m}$ ($112 \pm 18.1 \text{ lbf ft}$)

PPC VALVE

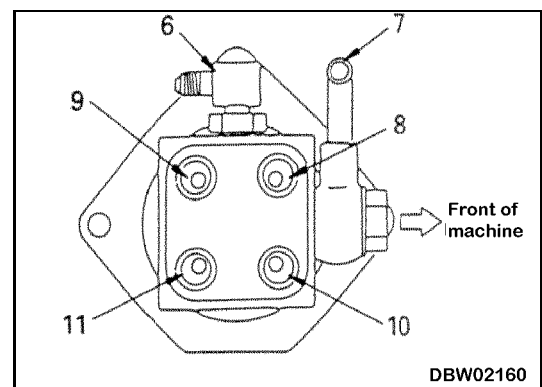
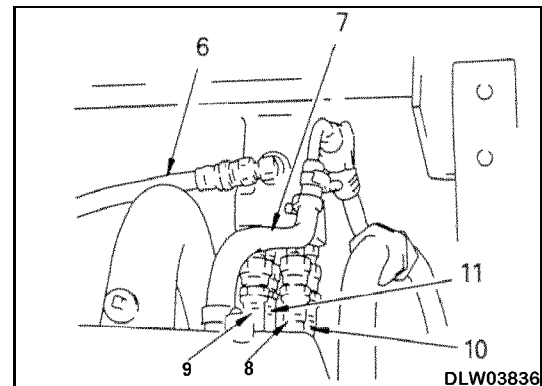
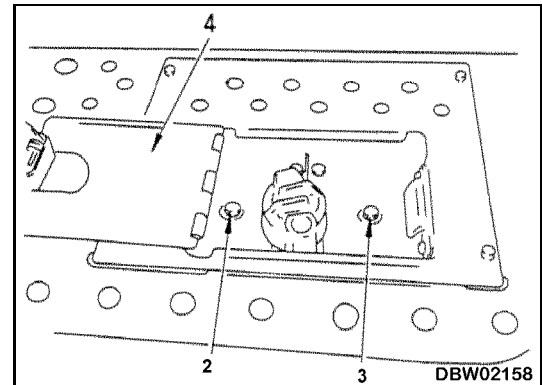
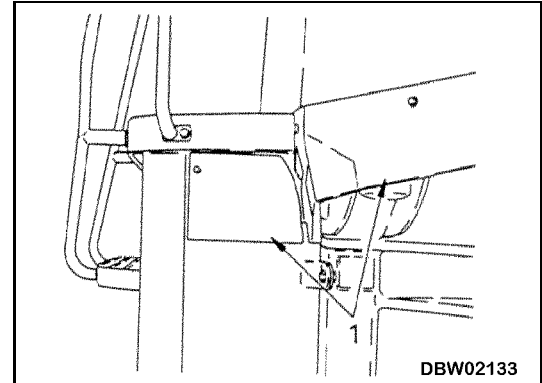
Removal

WARNING! 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 block the wheels to prevent the machine from moving.

WARNING! 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.

1. Remove the covers (1).
2. Loosen the plugs (2) and (3) on top of the hydraulic tank filter to prevent the oil inside from flowing out.
3. Remove the floor inspection cover (4).

4. Disconnect the hydraulic piping:
 - ! Hose (6) between the PPC valve and the PPC valve
 - ! Hose (7) between the PPC valve and the hydraulic tank
 - ! Hose P2 (8) and hose P3 (9) for the boom spool
 - ! Hose P4 (10) and hose P1 (11) for the bucket spool
 - i When removing the 4 hoses at the bottom of the PPC valve, remove the hoses from the outside, then remove the nipples and disconnect the hoses.
 - i Label the hoses to ease reconnections later.



Installation

! Installation is the reverse of removal.



WARNING! Use a bar to align the pin holes. NEVER use your fingers to align the pin holes.



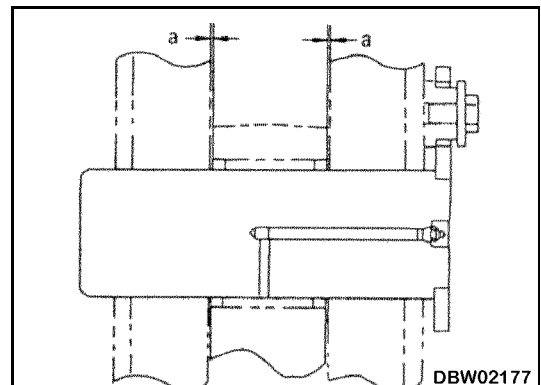
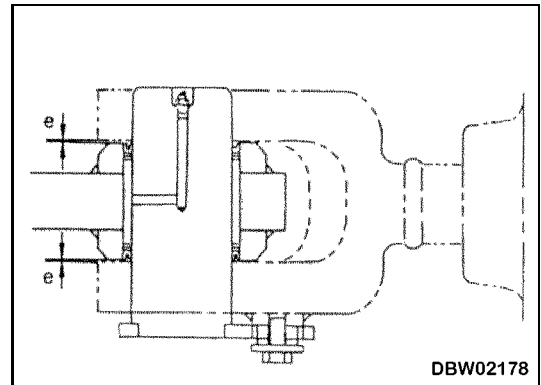
- ú Clearance **e**: Maximum 2.0 mm (0.079 in.)
- ú Remove the support.
- ú Coat each pin with grease.



- i Fit the O-ring securely in the groove.
- i Be careful not to twist or crimp the hoses during installation.



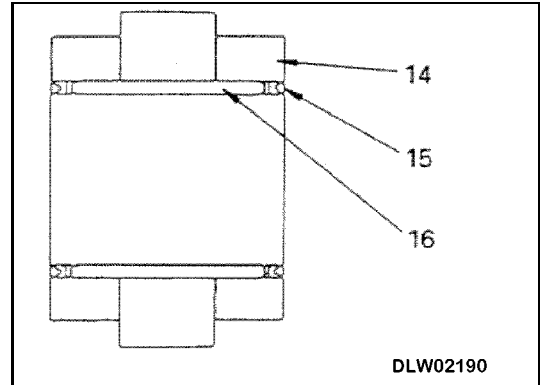
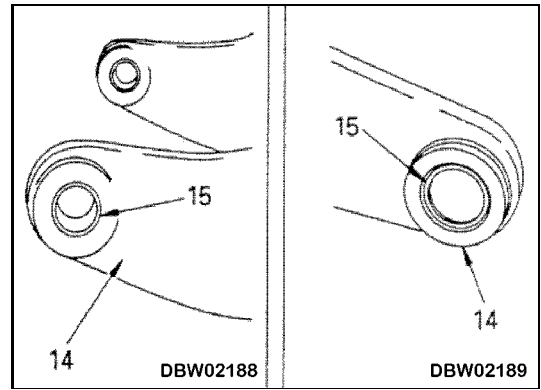
- i Clearance **a**: Maximum 1.5 mm (0.059 in.)



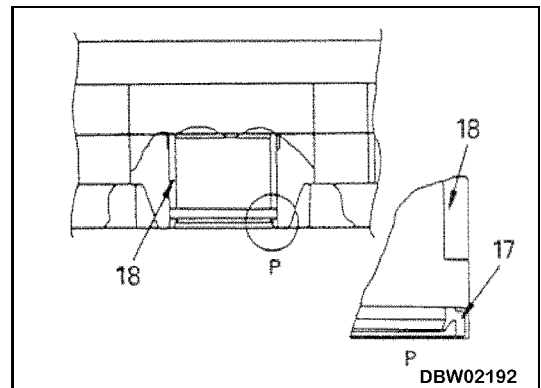
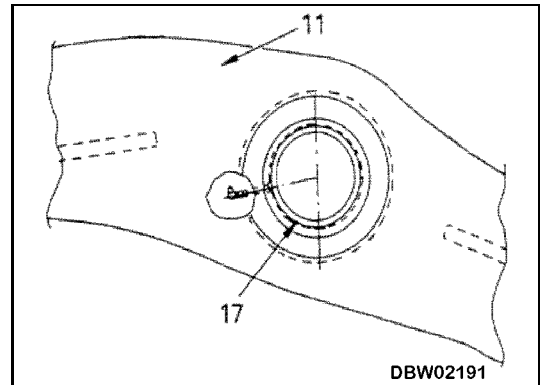
6. Dust seal and bushing



- A. Pull out dust seal (15) and bushing (16) from boom (14).



- B. Pull out the dust seal (17) and bushing (18) from the bellcrank (11).



Installation

! Installation is the reverse of removal.



i Tighten the mounting bolts in the following order:

Left
Rear
Right



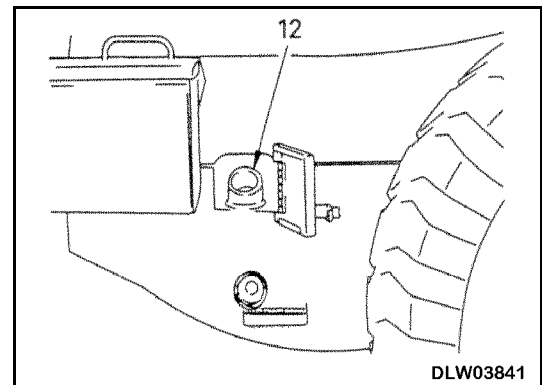
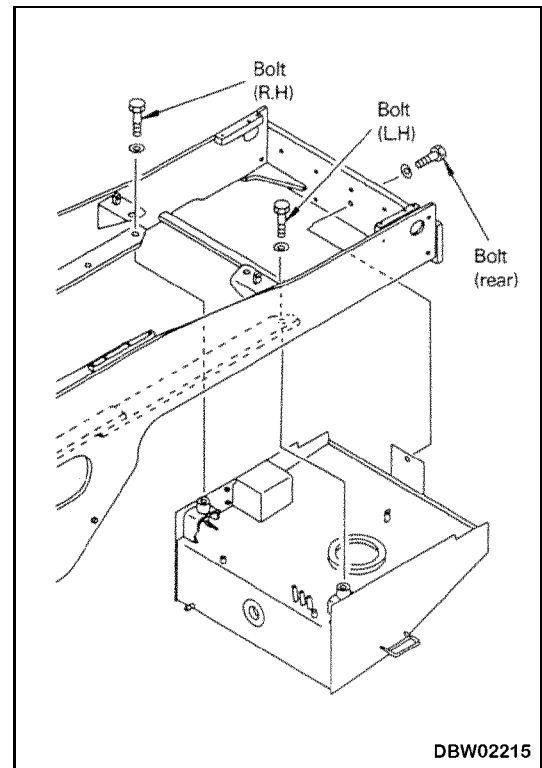
Mounting bolts: $927 \pm 103 \text{ N}\cdot\text{m}$ ($684 \pm 76 \text{ lbf}\cdot\text{ft}$)
Width across flats: 36 mm

- i Keep the tank horizontal while raising it into position.
- i Raise the palleter fully, then lift the fuel tank.



- i Pull the breather tube under the chassis before connecting.

! Refilling with fuel
Tighten the fuel tank drain valve, then add fuel through the fuel filler (12).



MAINTENANCE MONITOR

Removal

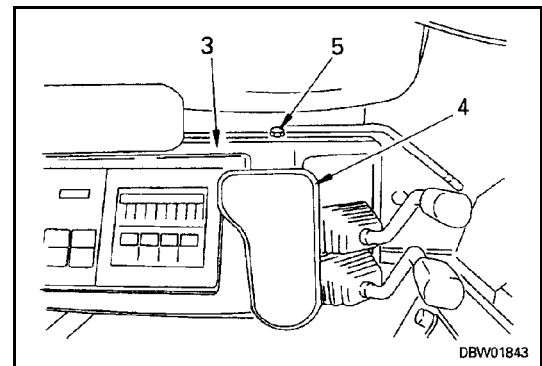
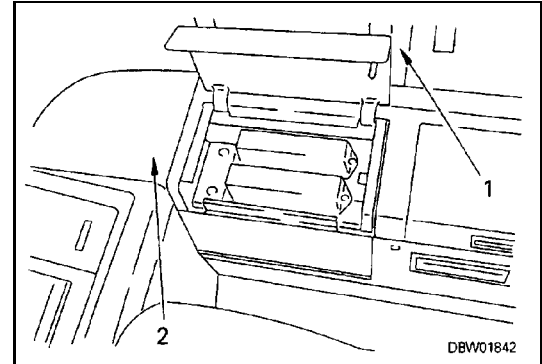


WARNING! Stop the machine on level ground and install the safety bar on the frame. Lower the bucket to the ground and stop the engine. Then apply the parking brake and block the wheels to prevent the machine from moving.

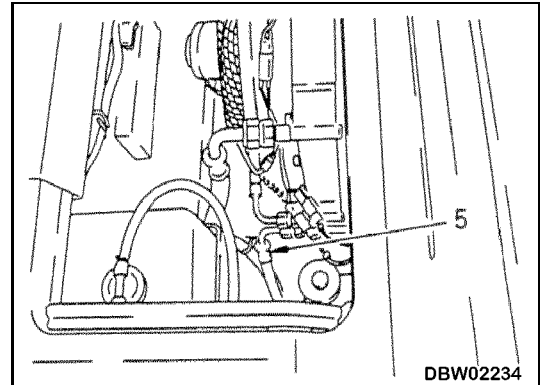
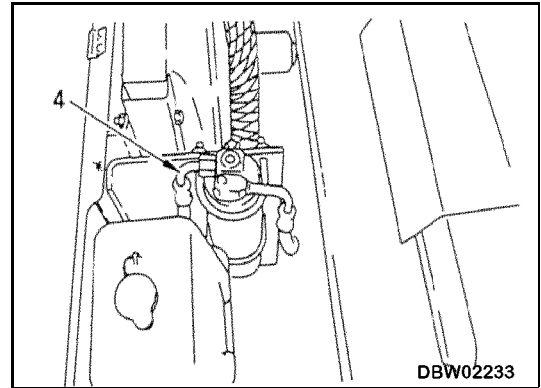


WARNING! Disconnect the cable from the negative terminal of the battery.

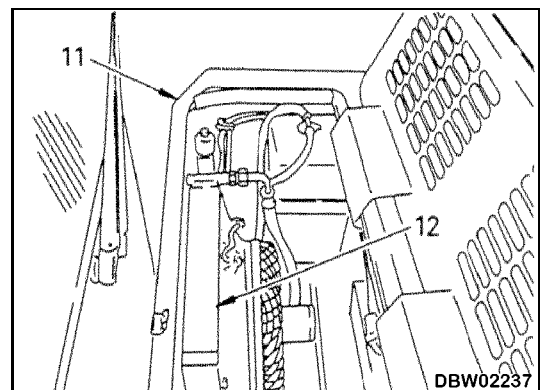
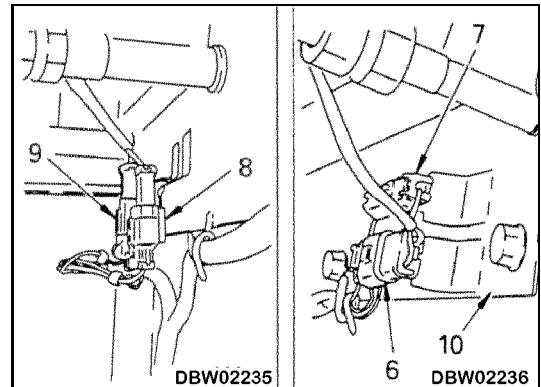
1. Cover
 - A. Remove cover (1) from cab.
 - i Remove the cover and leave the bolts loosened.
 - B. Remove cover (2).
 - i Open the fuse box cover and leave the bolts loosened.
 - C. Remove monitor cover (3).
 - i Remove pad assembly (4) and mounting bolt cap (5).
 - i Remove the boot.
 - i Turn the cover to the outside.



4. Disconnect hoses (4) and (5).
 - i Fit covers to the open hose joints to prevent the entrance of water and debris.



5. Unplug electrical wiring connectors (6), (7), (8) and (9).
6. Sling the condenser and bracket assembly (10), then remove all except 2 of the bracket assembly mounting bolts
 - i Temporarily leave 1 mounting bolt installed at the top left and right sides of the bracket.

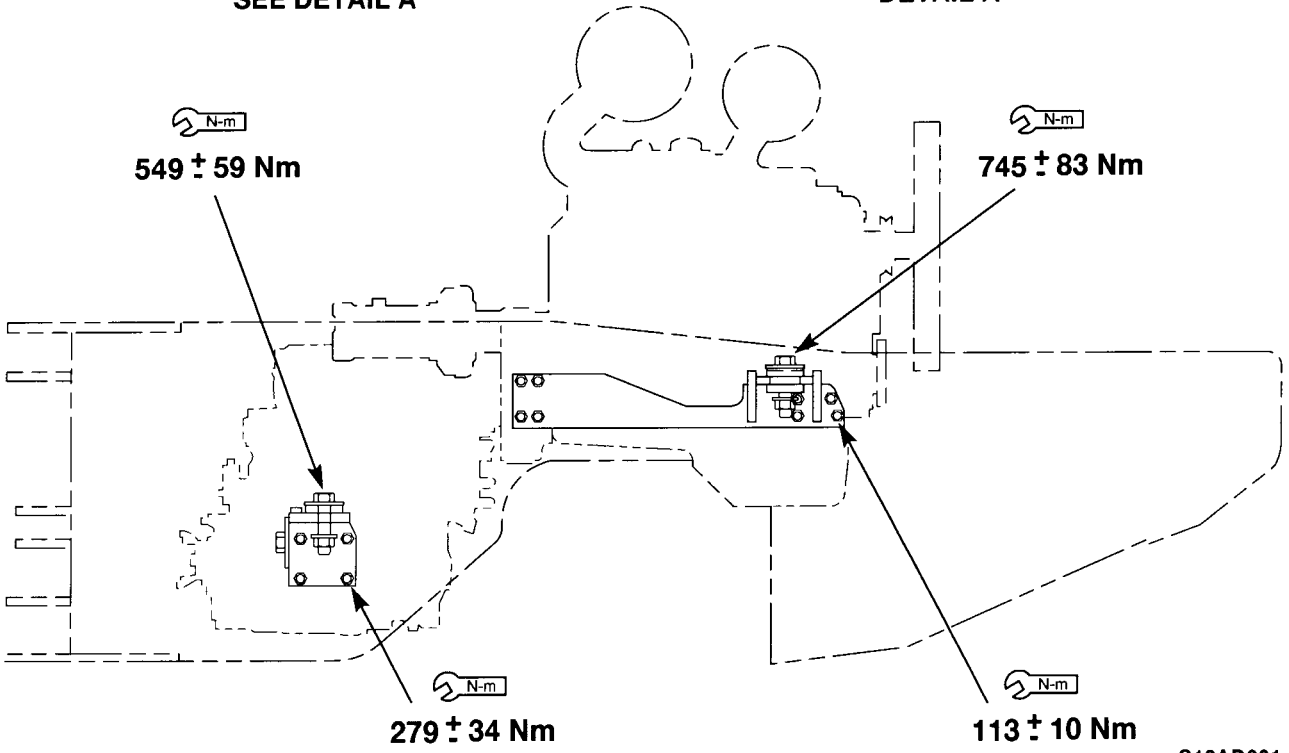
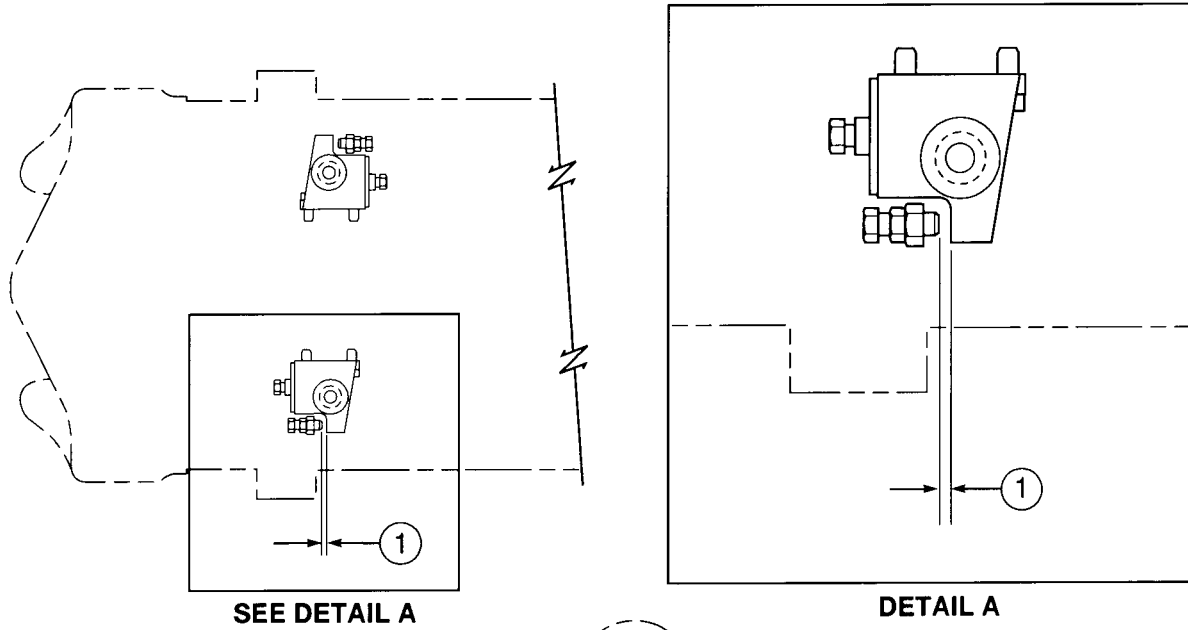


7. Support the condenser and bracket assembly, then remove the remaining 2 mounting bolts and lift off the condenser and bracket assembly (12) from the inside of the bulkhead (11).
 - U Leave the receiver drier installed to the bracket.



Condenser and bracket assembly: 20 kg (44 lb)

ENGINE MOUNT, TRANSMISSION MOUNT

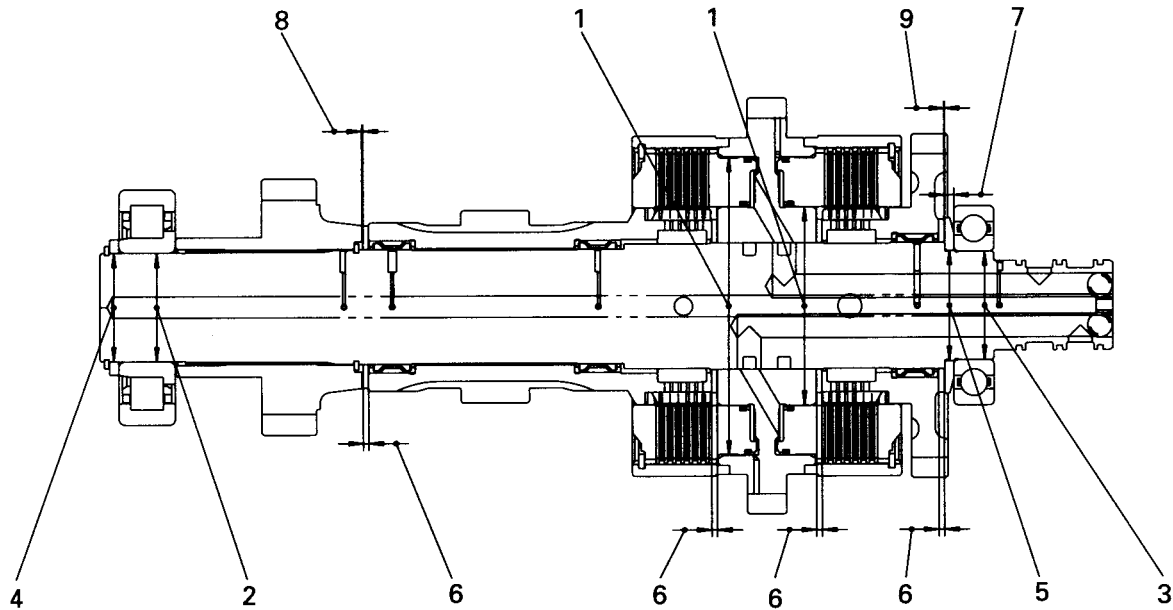


S12AD001

Unit: mm

No.	Check item	Criteria	Remedy
1	Clearance between transmission bracket and adjustment bolt typ. (4-places)	1 - 2	Adjust

1ST AND 3RD CLUTCH

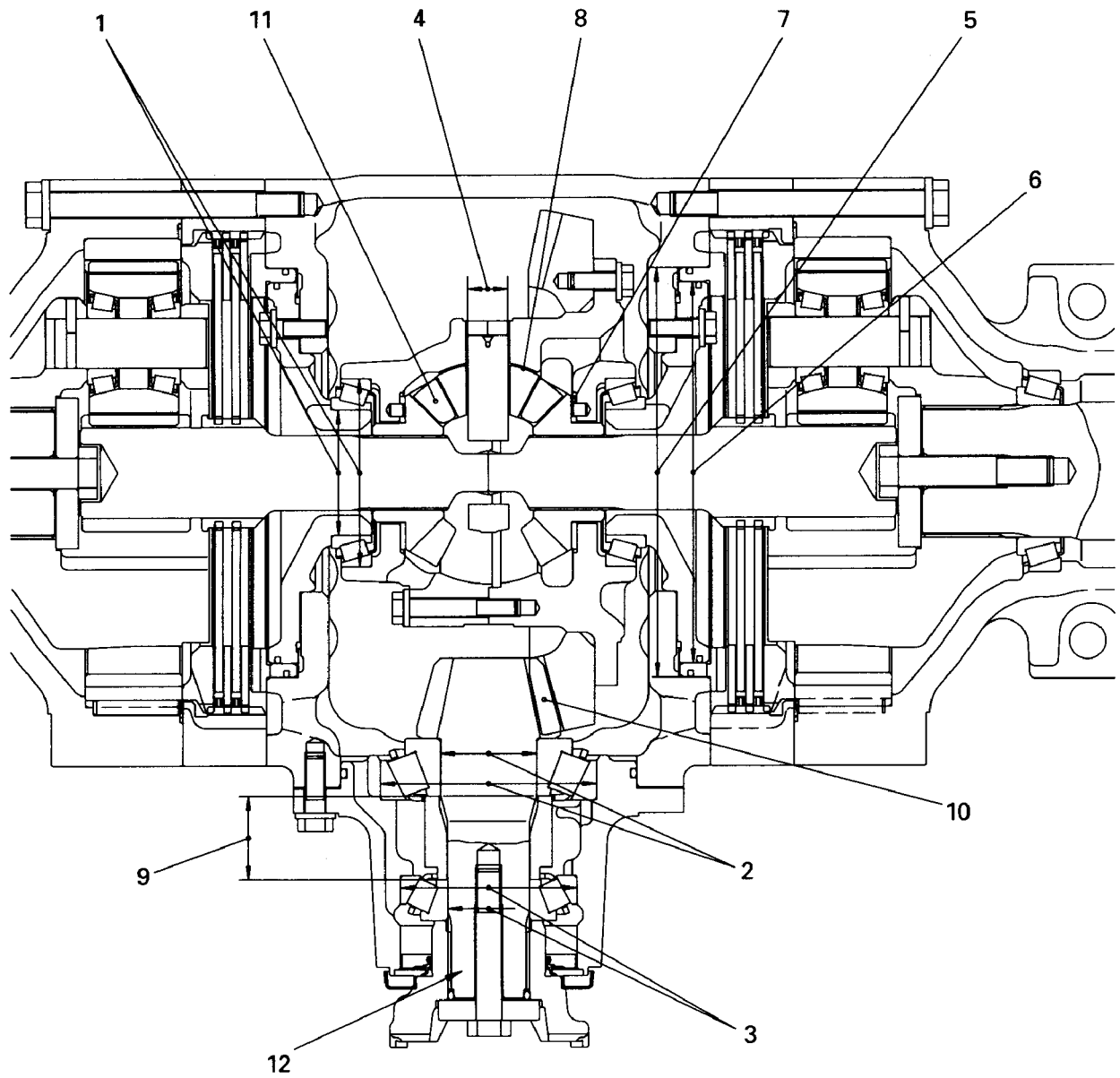


SAW00648

Unit: mm

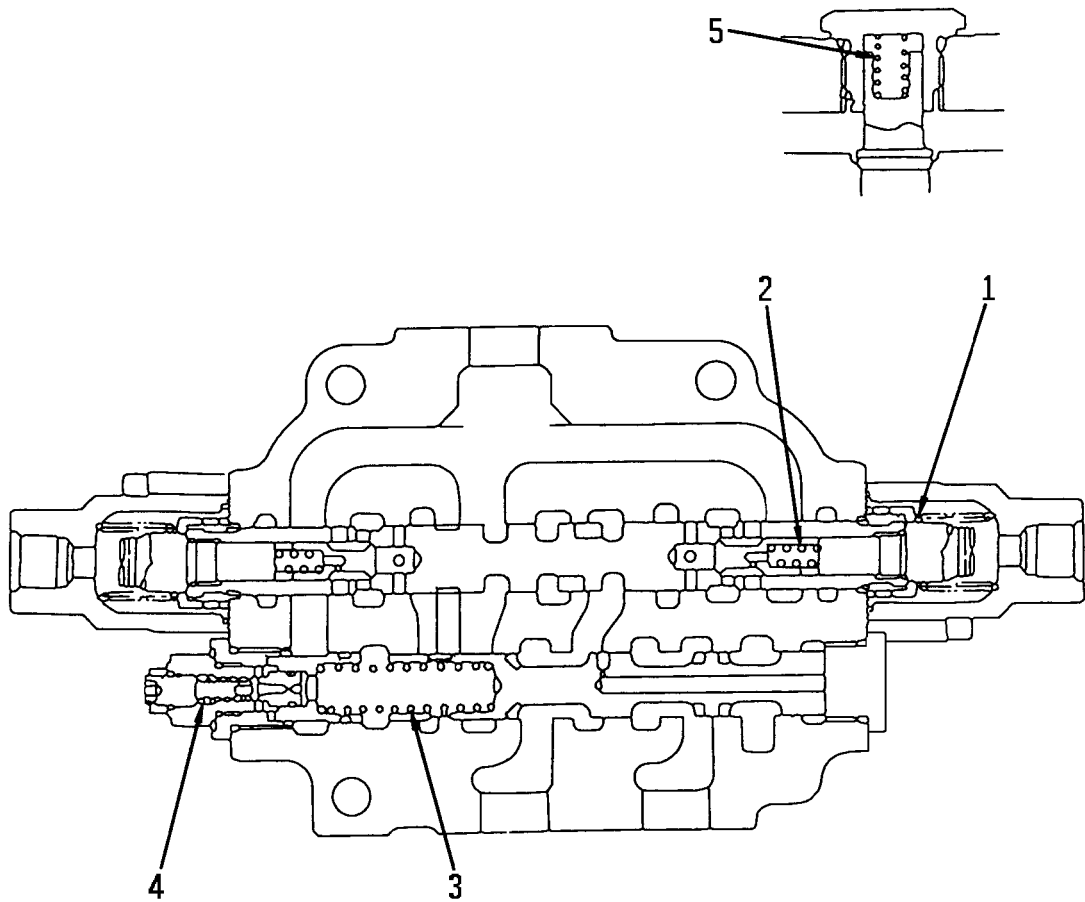
No.	Check item	Criteria				Remedy
		Standard size	Tolerance		Standard clearance	
	Shaft		Hole			
1	Clearance between piston and cylinder (inner)	110	- 0.27 - 0.32	+ 0.06 - 0.07	0.20 - 0.38	0.43
		165	- 0.27 - 0.32	+ 0.06 - 0.07	0.20 - 0.38	0.43
2	Clearance at 1st and 3rd clutch shaft bearing press-fit section (F)	60	+ 0.054 + 0.044	0 - 0.015	- 0.044 - - 0.069	-
3	Clearance at 1st and 3rd clutch shaft bearing press-fit section (R)	60	+ 0.030 + 0.011	0 - 0.015	- 0.011 - - 0.045	-
4	Clearance at 1st and 3rd clutch shaft spacer press-fit section (F)	60	+ 0.054 + 0.044	- 0.02 - 0.04	- 0.064 - - 0.094	-
5	Clearance at 1st and 3rd clutch shaft spacer press-fit section (R)	61	+ 0.030 + 0.011	0 - 0.03	- 0.011 - - 0.06	-
6	Thickness of gear and thrust washer	Standard size	Tolerance		Repair limit	
		3.0	± 0.1		2.7	
7	Thickness of 3rd clutch side spacer	5.0	± 0.05		-	
8	End play of 1st gear	0.02 - 1.58				
9	End play of 3rd gear	0.1 - 0.9				

DIFFERENTIAL (2/2)



SAW00660

STEERING VALVE

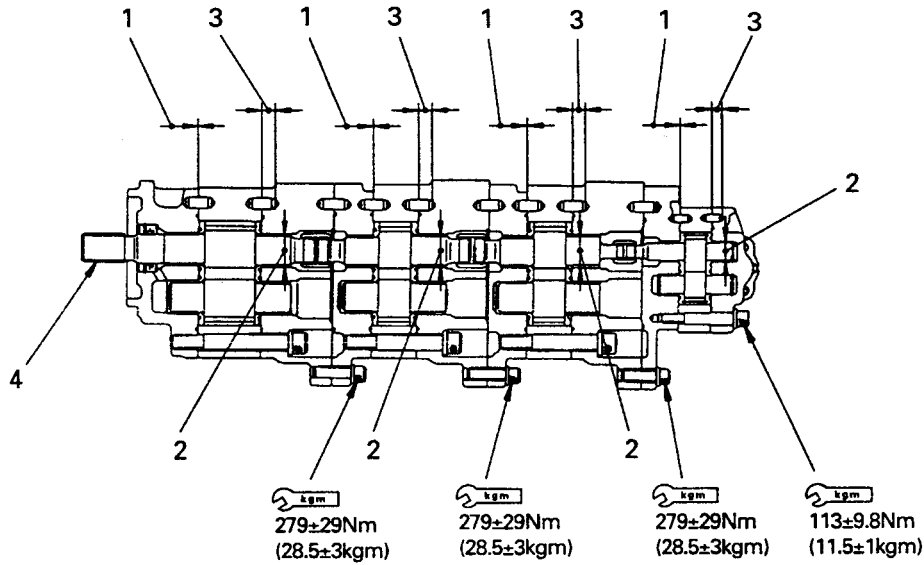


SLW01253

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 (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 ± 0.5kg)	-	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)	-	1451.1N (14.8 kg)	
5	Check valve return spring	21.6	17.0	2.3 N (0.23 kg)	-	1.8 N (0.18kg)	

HYDRAULIC PUMP (Hydraulic, steering, switch, PPC pump)



SBW00672

Unit: mm

No.	Check item	Criteria			Remedy	
		Model	Standard clearance	Clearance limit		
1	Side clearance	SAL (3) 100	0.13 - 0.18	0.22	Replace	
		SAL (3) 50				
		SAL (3) 36	0.10 - 0.15	0.19		
		SAL (1) 25				
2	Clearance between inside diameter of plain bearing and outside diameter of gear shaft	SAL (3) 100	0.060 - 0.149	0.20		
		SAL (3) 50				
		SAL (3) 36				
		SAL (1) 25	0.060 - 0.119			
3	Depth for knocking in pin	Model	Standard size	Tolerance		
		SAL (3) 100	14	0 - 0.5		
		SAL (3) 50				
		SAL (3) 36				
		SAL (1) 25	10			
4	Rotating torque of spline shaft	22.6 - 40.2Nm (2.3 - 4.1kgm)				
-	Discharge amount Oil: EO10-CD Oil temperature: 45 - 55EC	Model	Rotating speed	Delivery pressure	Standard delivery amount	Delivery amount limit
		SAL (3) 100	2,500 rpm	20.6 MPa (210 kg/cm ²)	231 R/min	214 R/min
		SAL (3) 50			112 R/min	102 R/min
		SAL (3) 36			84 R/min	77 R/min
		SAL (1) 25			2.9 MPa (30 kg/cm ²)	60 R/min

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