

# Shop Manual

# WA450-3

## WHEEL LOADER

SERIAL NUMBERS **WA450-3 - 53001** and up

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## HOW TO READ THE SHOP MANUAL

### VOLUMES

Shop manuals are issued as a guide to carrying out repairs. They are divided as follows:

- Chassis volume:** Issued for every machine model
- Engine volume:** Issued for each engine series
- Electrical volume:** Each issued as one volume to cover all models
- Attachments volume:** Each issued as one volume to cover all models

These various volumes are designed to avoid duplicating the same information. Therefore, to deal with all repairs for any model, it is necessary that chassis, engine, electrical and attachment volumes be available.

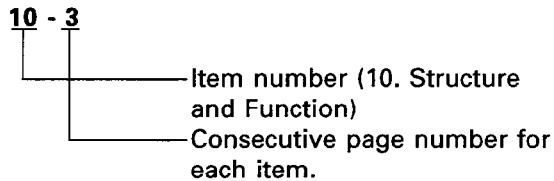
### DISTRIBUTION AND UPDATING

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

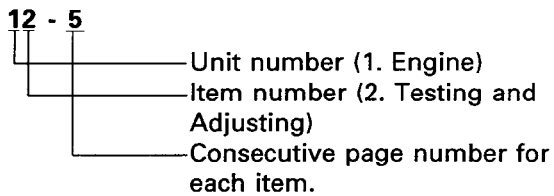
### FILING METHOD

1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.

Example 1 (Chassis volume):

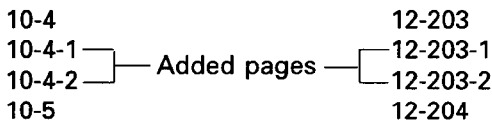


Example 2 (Engine volume):



3. Additional pages: Additional pages are indicated by a hyphen (-) and number after the page number. File as in the example.

Example:



### REVISED EDITION MARK

When a manual is revised, an edition mark (①②③....) is recorded on the bottom of the pages.

### REVISIONS

Revised pages are shown in the LIST OF REVISED PAGES next to the CONTENTS page.

### SYMBOLS

So that the shop manual can be of ample practical use, important safety and quality portions are marked with the following symbols.

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

Liter to U.S. Gallon

1ℓ = 0.2642 U.S. Gal

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

Liter to U.K. Gallon

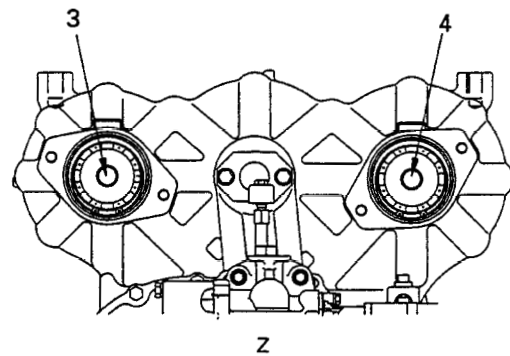
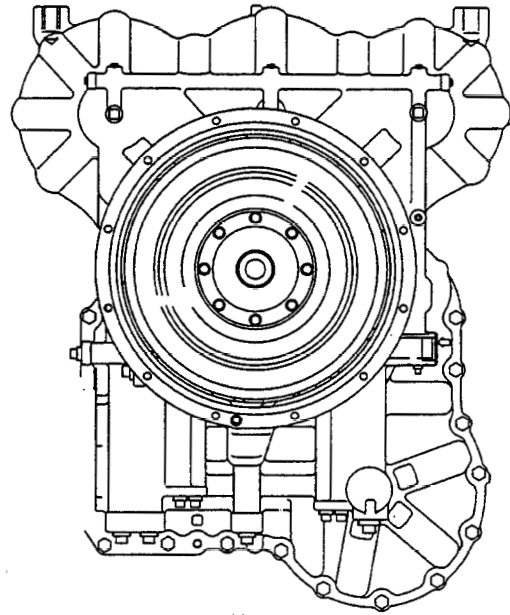
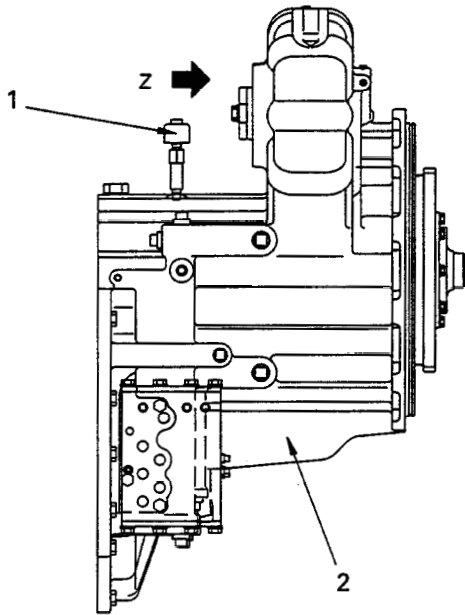
1ℓ = 0.21997 U.K. Gal

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

Unit: kg

Machine model	WA450-3
Serial No.	53001 and up
Counterweight	1600
Fuel tank	260
Battery (each)	53
Floor frame assembly	375
Floor, cab assembly	677
Air conditioner unit	12.5
Operator's seat	35
Floor board	245
ROPS cab	635

TORQUE CONVERTER



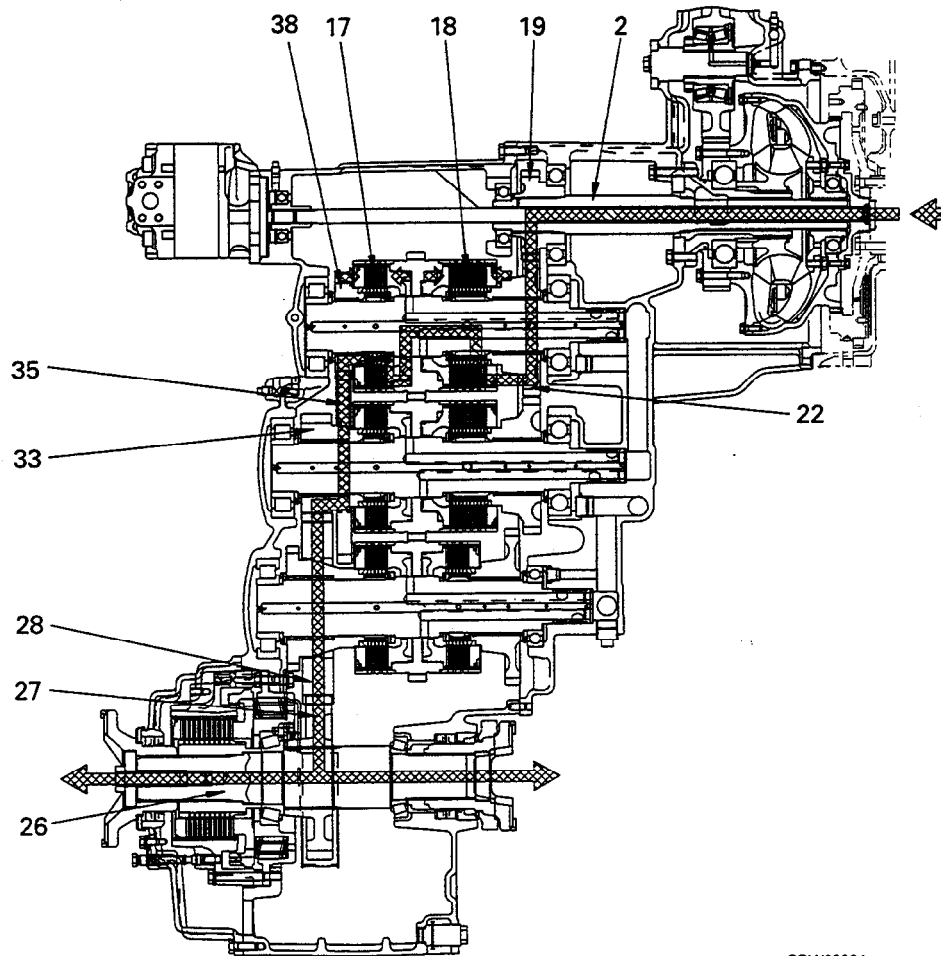
SDW00010

- 1. Breather
- 2. Housing
- 3. Hydraulic, PPC tandem pump mount
- 4. Steering, switch tandem pump mount

**Specifications**

Model: TCA38-4Z  
 Type: 3 element, 1 stage, 1 phase  
 Stall torque ratio: 3.15

## FORWARD 1ST

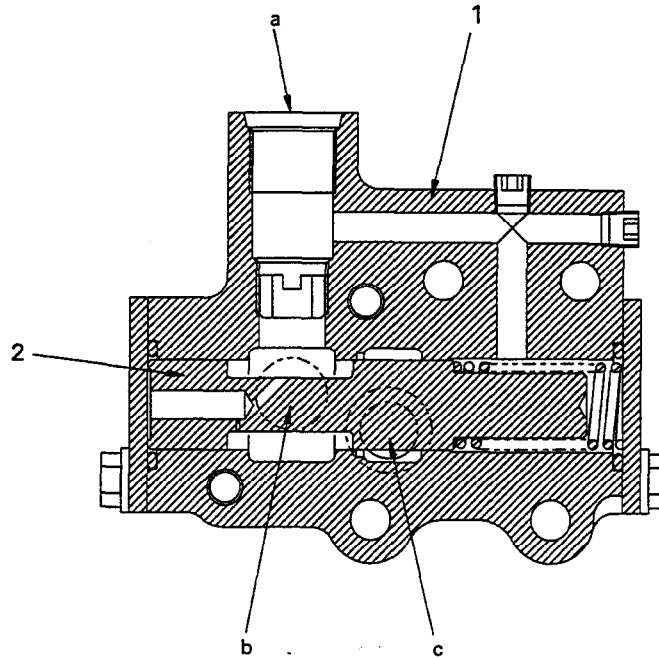


SDW00024

**Operation**

- In the case of FORWARD 1st, FORWARD clutch (18) and 1st clutch (17) are engaged. The motive force transmitted from the torque converter to input shaft (2) is transmitted to gear (19), which is installed to the input shaft.
- Each clutch disc of FORWARD clutch (18) and 1st clutch (17) is engaged by the oil pressure applied to the piston.
- The motive force from the torque converter passes from input shaft (2) through gear (19) and is transmitted to FORWARD gear (22). When FORWARD clutch (18) is engaged, the motive force is transmitted to the FORWARD 1st cylinder.
- The 1st clutch is engaged, so the motive force transmitted to the FORWARD 1st cylinder passes through 1st clutch (17) and is transmitted from 1st gear (38) to 2nd clutch gears (35, 33). It then passes through 3rd clutch gear (28) and output gear (27) and is transmitted to output shaft (26).

## FLOW VALVE



SDW00038

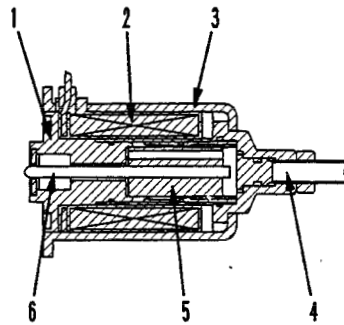
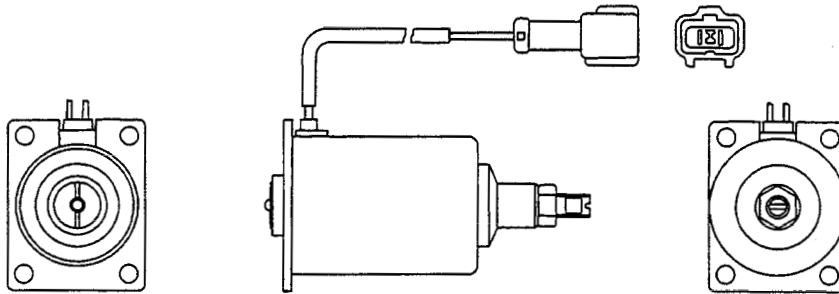
1. Valve body
2. Valve spool

- a. To transmission clutch circuit
- b. From pump
- c. To transmission lubrication circuit

**Operation**

- The oil from the pump flows to the transmission clutch circuit but when it becomes greater than the specified flow, the flow valve acts to send oil to the transmission lubrication circuit.
- When the oil from the pump becomes greater than the specified flow, valve spool (2) moves and part of the oil from the oil pump flows to the transmission lubrication circuit.

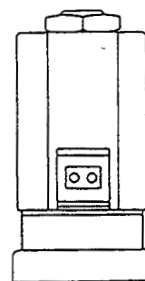
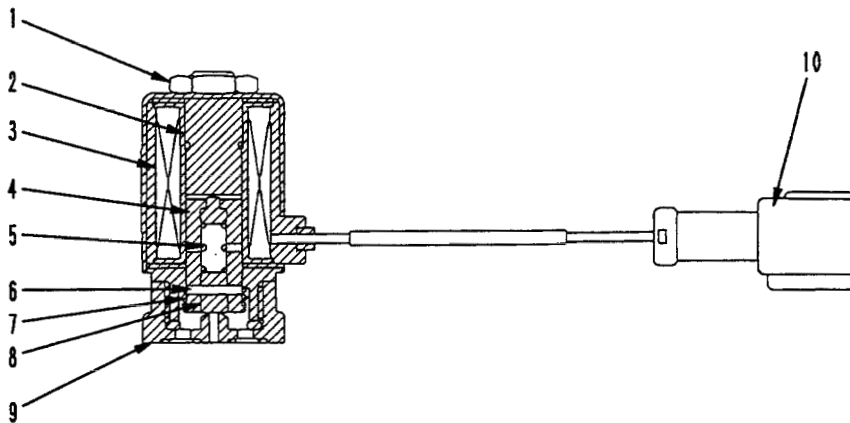
PROPORTIONAL SOLENOID VALVE



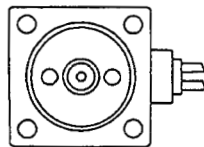
- 1. Body
- 2. Coil
- 3. Case
- 4. Adjustment screw
- 5. Plunger
- 6. Shaft

SWW03743

TRANSMISSION SOLENOID VALVE



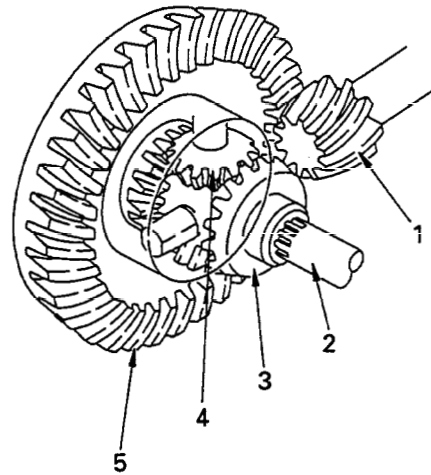
SWW03744



- 1. Nut
- 2. Cor
- 3. Coil
- 4. Plunger
- 5. Spring
- 6. Pin
- 7. Spring
- 8. Valve seat
- 9. Body
- 10. Connector

**Outline**

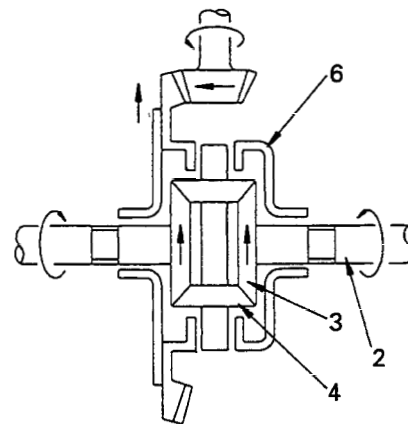
- The motive force from the drive shaft passes through bevel pinion (1) and is transmitted to bevel gear (5). The bevel gear changes the direction of the motive force by 90°, and at the same time reduces the speed. It then transmits the motive force through differential (4) to sun gear shaft (2).



SEW00077

**When driving straight forward**

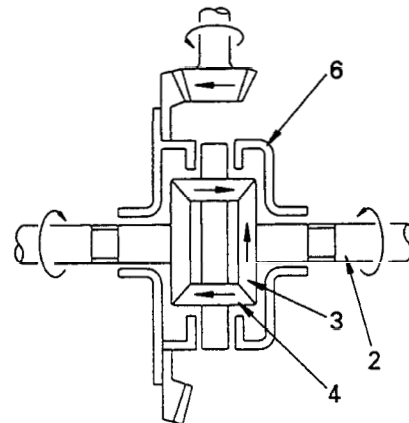
- When the machine is driven straight forward, the rotating speed of the left and right wheels is the same, so pinion gear (4) inside the differential assembly is sent through pinion gear (4) and side gear (3) and is transmitted equally to left and right sun gear shafts (2).



SEW00078

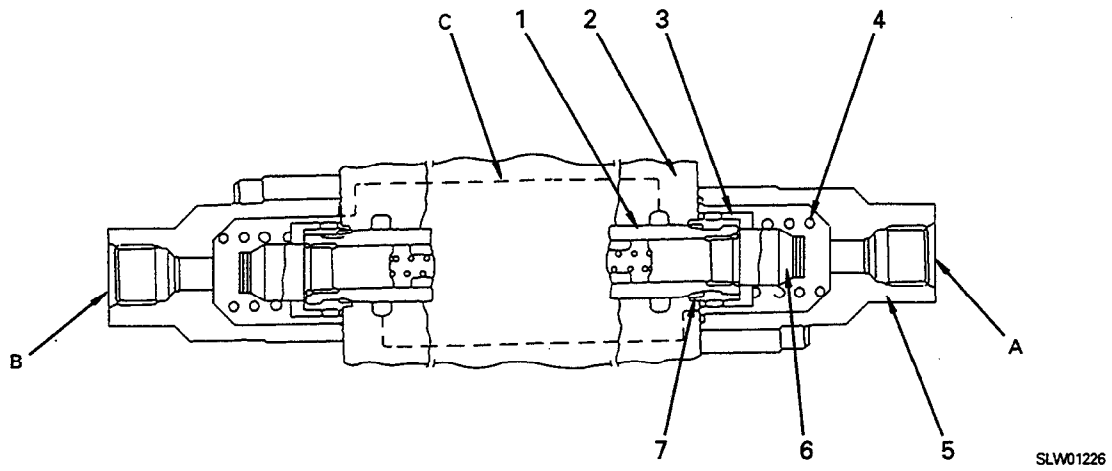
**When turning**

- When turning, the rotating speed of the left and right wheels is different, so pinion gear (4) and side gear (3) inside the differential assembly rotate in accordance with the difference between the rotating speed of the left and right wheels. The motive force of carrier (6) is then transmitted to sun gear shafts (2).



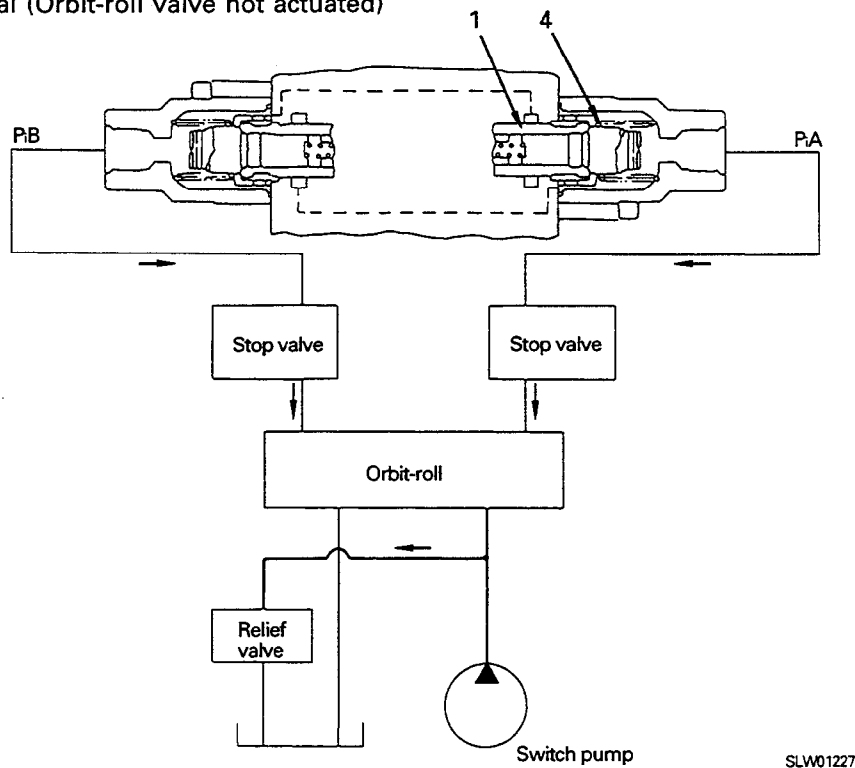
SEW00079

FLOW AMP



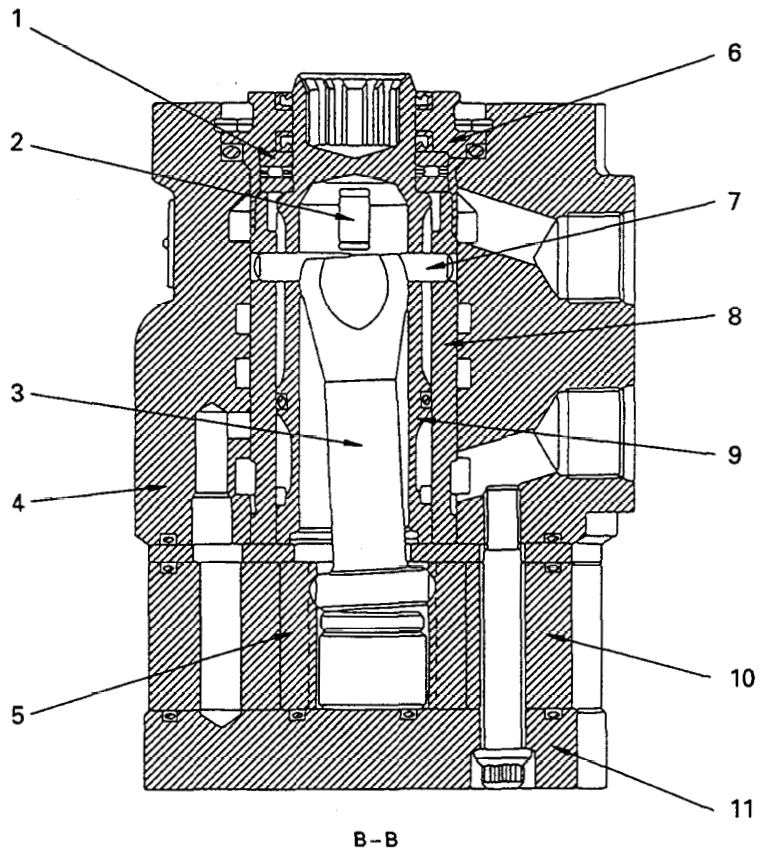
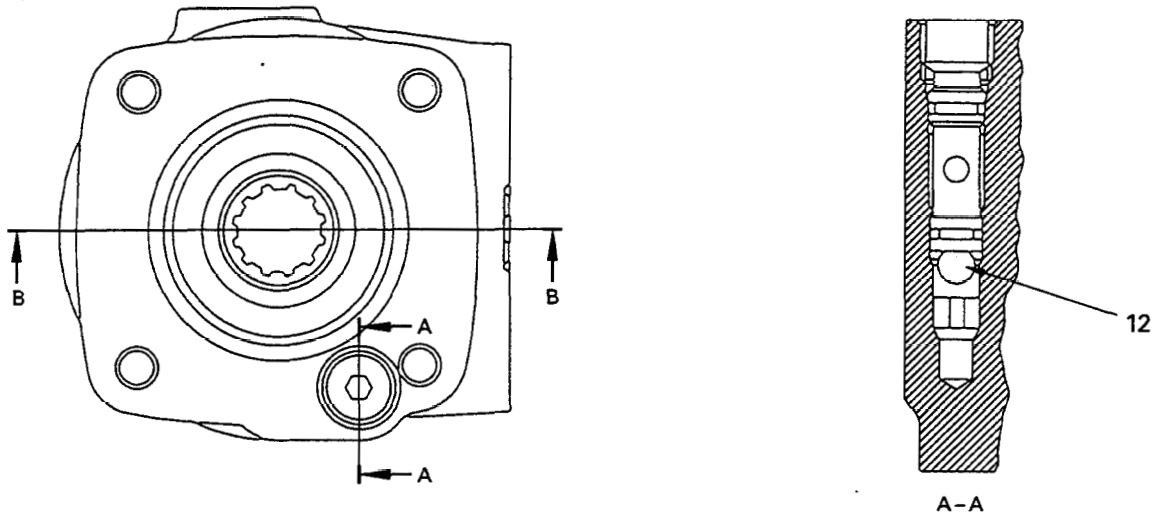
- |                         |                   |                             |
|-------------------------|-------------------|-----------------------------|
| 1. Steering spool       | 5. Cap            | A: From Orbit-roll valve    |
| 2. Valve housing (body) | 6. Capscrew       | B: From Orbit-roll valve    |
| 3. Spring seat          | 7. Flow arm notch | C: Passage (inside housing) |
| 4. Return spring        |                   |                             |

- Operation of flow amp
- 1. Spool at neutral (Orbit-roll valve not actuated)



- When the Orbit-roll valve is not actuated, both pilot port **PiA** and pilot port **PiB** are connected through the Orbit-roll to the drain (return) circuit, so steering spool (1) is kept at neutral by return spring (4).

ORBIT-ROLL VALVE

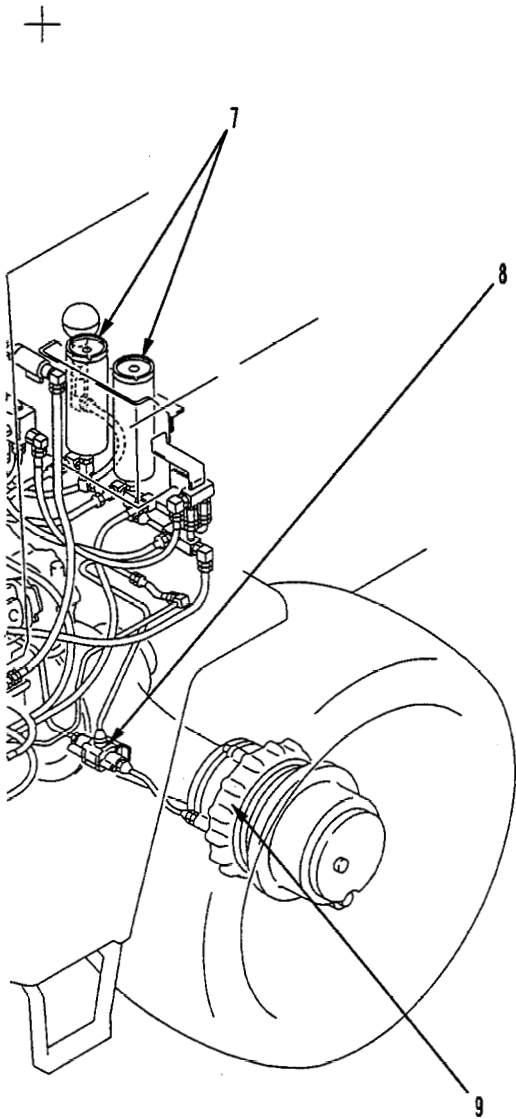


SEW01234

- 1. Needle bearing
- 2. Center spring
- 3. Drive shaft
- 4. Valve body

- 5. Rotor
- 6. Cover
- 7. Center pin
- 8. Sleeve

- 9. Spool
- 10. Stator
- 11. Lower cover
- 12. Check valve



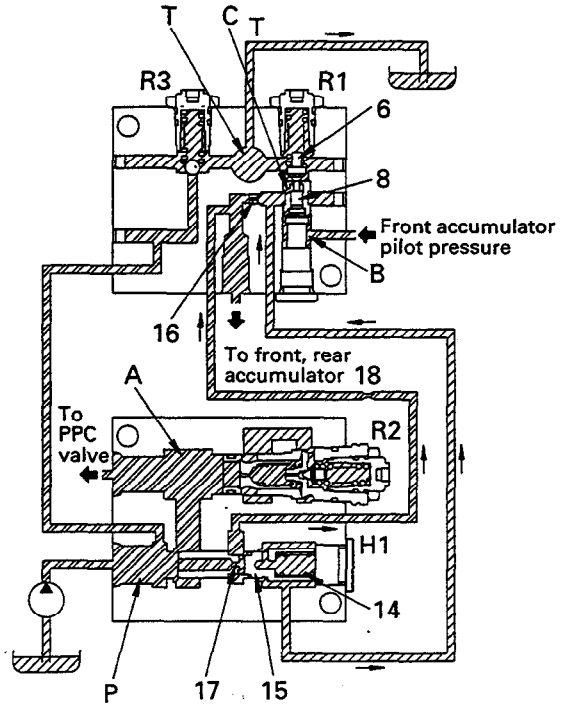
1. Brake valve (right)
2. Hydraulic tank
3. Parking brake switch
4. Parking brake emergency cancel switch
5. Rear brake
6. Charge valve
7. Accumulator
8. Slack adjuster
9. Rear brake
10. PPC brake pump
11. Transmission control valve
12. Parking brake valve
13. Parking brake
14. Brake valve (left)
15. Front brake
16. Slack adjuster
17. Front brake

SWW03752

**Operation**

**1. When no oil is being supplied to accumulator (cut-out condition)**

- The pressure at port **B** is higher than the set pressure of the relief valve (R1), so piston (8) is forcibly pushed up by the oil pressure at port **B**. Poppet (6) is opened, so port **C** and port **T** are short circuited.
- The spring chamber at the right end of spool (15) is connected to port **C** of the relief valve (R1), so the pressure becomes the tank pressure. The oil from the pump enters port **P**, pushes spool (15) to the right at a low pressure equivalent to the load on spring (14), and flows from port **A** to the PPC valve. At the same time, it also passes through orifices (17), (18), and (16), and flows to the tank.

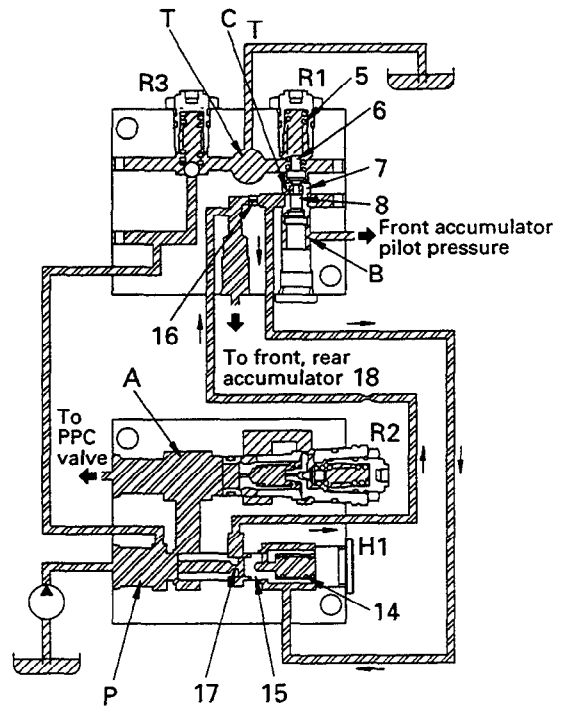


SDW00116

**2. When oil is supplied to accumulator**

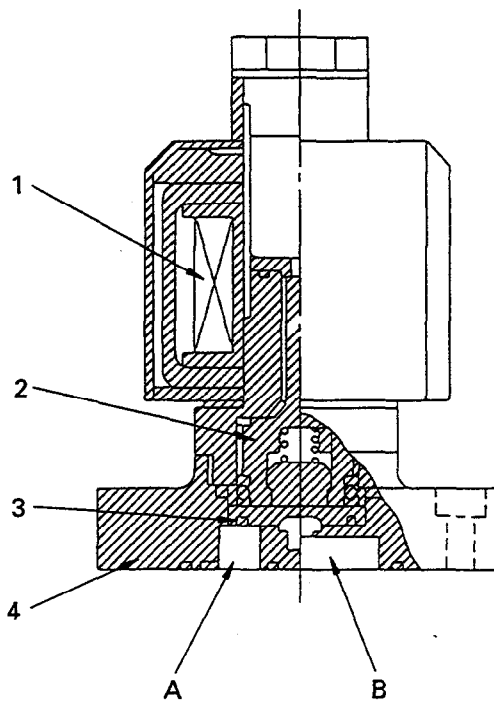
1) Cut-in condition

- When the pressure at port **B** is lower than the set pressure of the relief valve (R1), piston (8) is pushed back down by spring (5). Valve seat (7) and poppet (6) are brought into tight contact, and port **C** and port **T** are shut off.
- The spring chamber at the right end of spool (15) is also shut off from port **T**, so the pressure rises, and the pressure at port **P** also rises in the same way.
- When the pressure at port **P** goes above the pressure at port **B** (accumulator pressure), the supply of oil to the accumulator starts immediately. In this case, it is decided by the size (area) of orifice (17) and the pressure difference (equivalent to the load on spring (14)) generated on both sides of the orifice. A fixed amount is supplied regardless of the engine speed, and the remaining oil flows to port **A**.



SDW00117

## PARKING BRAKE SOLENOID VALVE



SEW00131

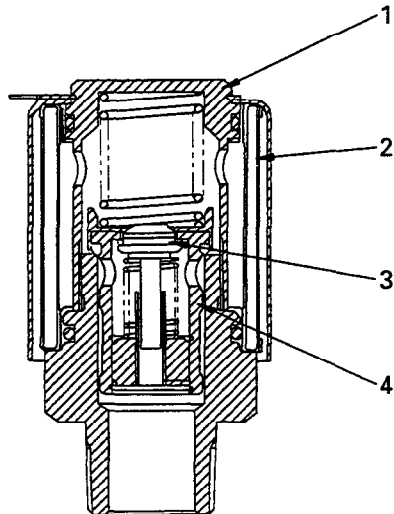
1. Coil
2. Valve ass'y
3. Spring
4. Body
- A. IN port
- B. OUT port

**Function**

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

**Operation**

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

**BREATHER**

SEW00141

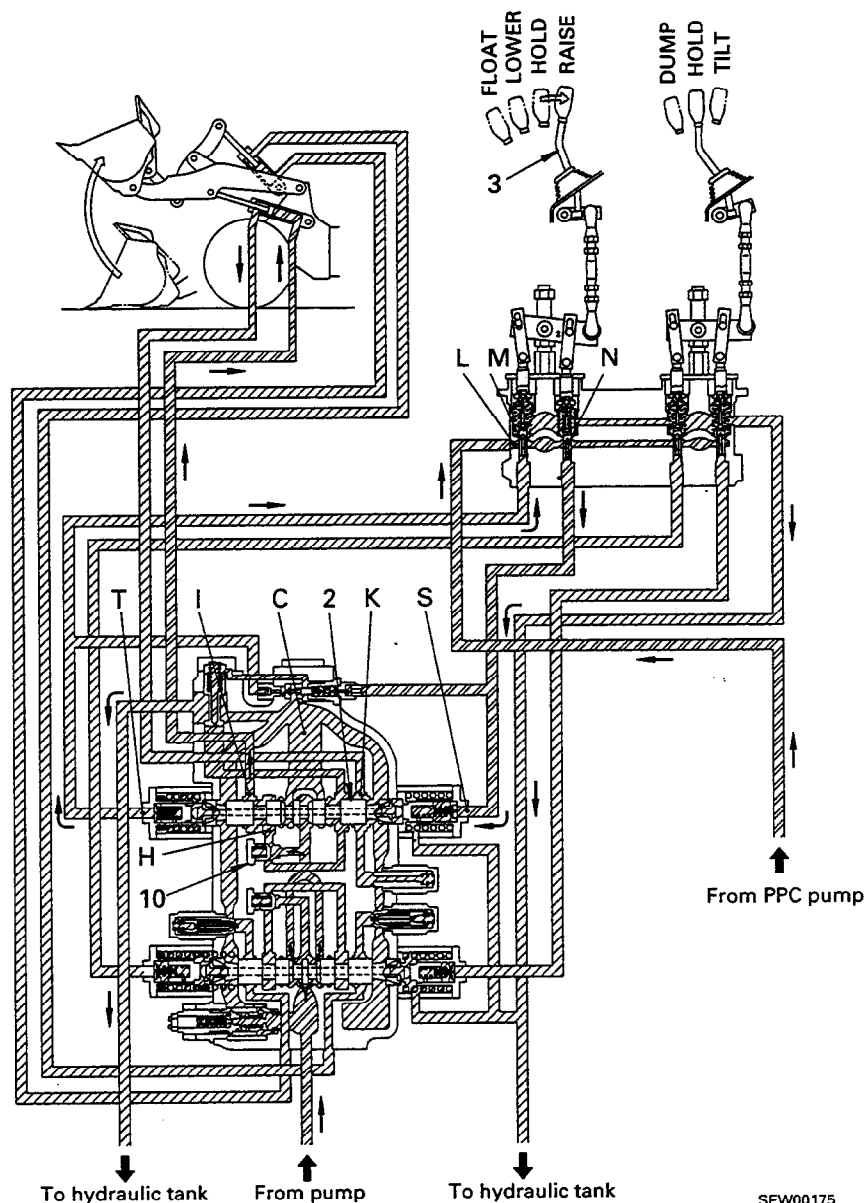
1. Body
2. Filter element
3. Poppet
4. Sleeve

- **Preventing negative pressure inside tank**  
The tank is a pressurized sealed type, so if the oil level inside the hydraulic tank goes down, there will be negative pressure in the tank. If this happens, a poppet is opened by the difference between the pressure inside the tank and the atmospheric pressure, and air is let in to prevent negative pressure from forming inside the tank.

- **Preventing rise in pressure inside tank**  
If the pressure in the circuit rises above the set pressure during operations because of the change in the oil level in the hydraulic cylinders or the rise in the temperature, the sleeve is actuated to release the pressure inside the hydraulic tank.



BOOM SPOOL AT RAISE POSITION



Operation

- When boom lever (3) is pulled, the oil flows from port L of the PPC valve to port N and port S. In addition, the oil at port T passes through port M and flows to the drain circuit. The oil pressure at port S pushes boom spool (2) and moves it to the RAISE position.
- The oil from the pump passes through the bypass circuit of the bucket spool and flows

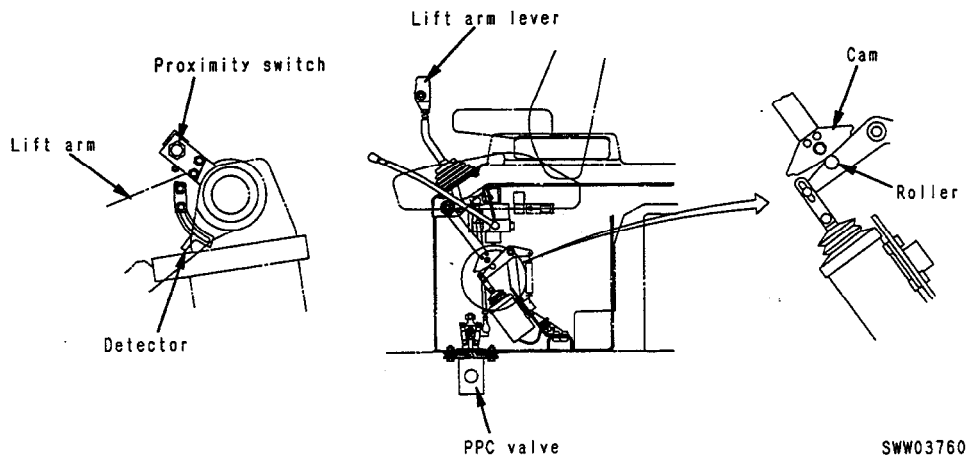
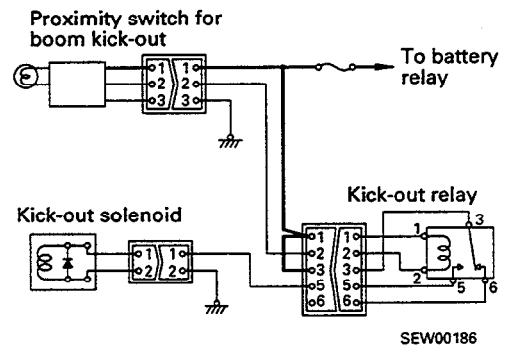
to the bypass circuit of boom spool (2). The bypass circuit is closed by the spool, so the oil pushes open check valve (10). The oil flows from port H to port I, and flows to the cylinder bottom.

- At the same time, the oil at the cylinder rod end enters drain port C from port K and returns to the tank. Therefore, the lift arm rises.

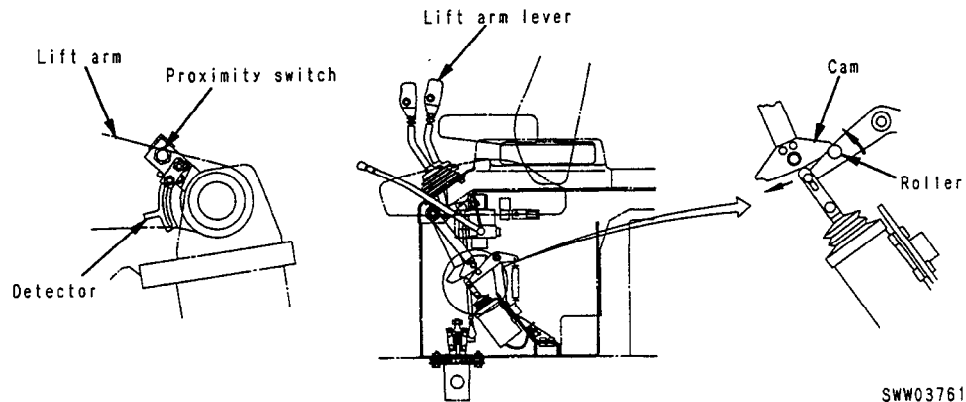
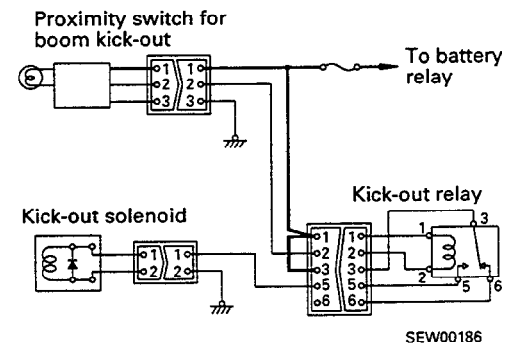
Operation of proximity switch

Lift arm RAISE

- When the lift arm is lower than the set position for the kick-out, the detector (steel plate) is not above the detection surface of the proximity switch, so the proximity switch load circuit is shut off. The relay switch is turned OFF and the current for the solenoid is shut off.

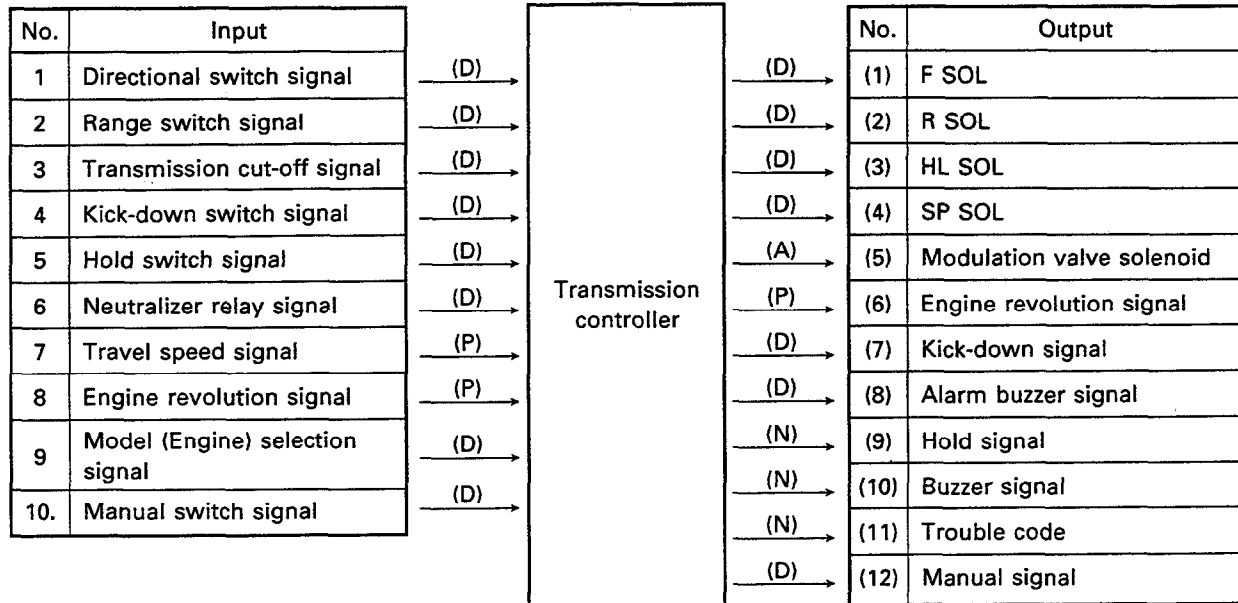


- When the boom lever is moved to the RAISE position, the boom spool is held at the RAISE position by the cam follower and cam on the lever, and the lift arm rises.



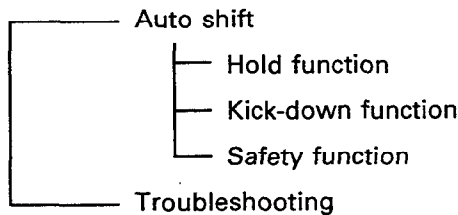


**TRANSMISSION AUTO-SHIFT CONTROL SYSTEM**  
 (With auto-shift transmission)  
**SYSTEM STRUCTURE DIAGRAM**



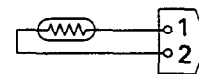
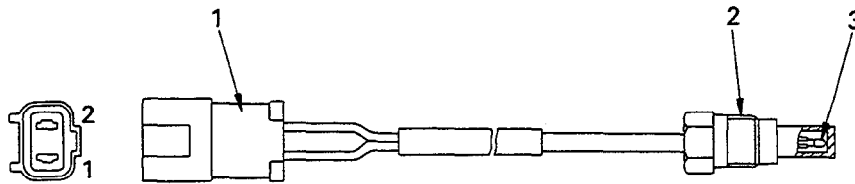
A: Analog signal  
 D: Digital signal  
 P: Pulse signal  
 N: Network signal

**CONTROL FUNCTION**



**Outline**

The auto-shift control system receives the position signals from the directional lever and range lever, the engine speed signal, travel speed signal, and signals from other switches. The transmission controller drives the speed solenoid valve and automatically carries out shift control to select the optimum speed range for the transmission.

**ENGINE WATER TEMPERATURE SENSOR  
TORQUE CONVERTER OIL TEMPERATURE SENSOR**

Structure of circuit

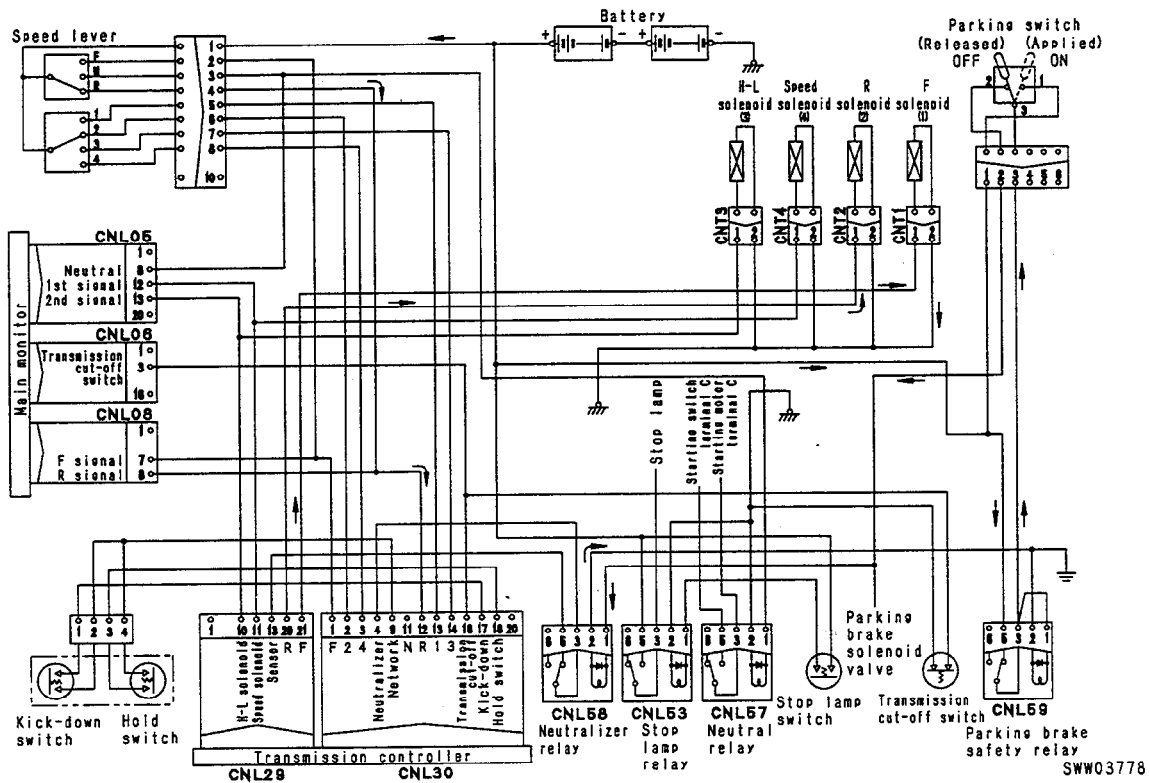
SEW00294

1. Connector
2. Plug
3. Thermistor

**Function**

- These sensors are installed to the engine cylinder block and transmission case. The change in the temperature changes the resistance of the thermistor, and a signal is sent to the maintenance monitor to display the temperature. If the display on the sub monitor reaches the specified position, the lamp flashes and the buzzer sounds to warn of the abnormality.

**Canceling actuation of kick-down switch (Case I)**  
(Directional lever moved to N or R)



- When the directional lever is moved to the **R** position, the **F** terminal contacts of the lever are turned off, so the electric current stops flowing from the battery (+) → speed lever switch terminal 1 – 2 → transmission controller.
- The **FORWARD** circuit inside the transmission controller is opened, so no electric current flows to the kick-down circuit. In this way, the self-hold circuit of the kick-down is canceled and solenoid (4) is no longer actuated.  
(When the directional lever is moved to **N** position, the actuation is the same as above and the kick-down circuit is canceled.)  
In addition, the **FORWARD** circuit is also opened, so solenoid (1) is no longer actuated.

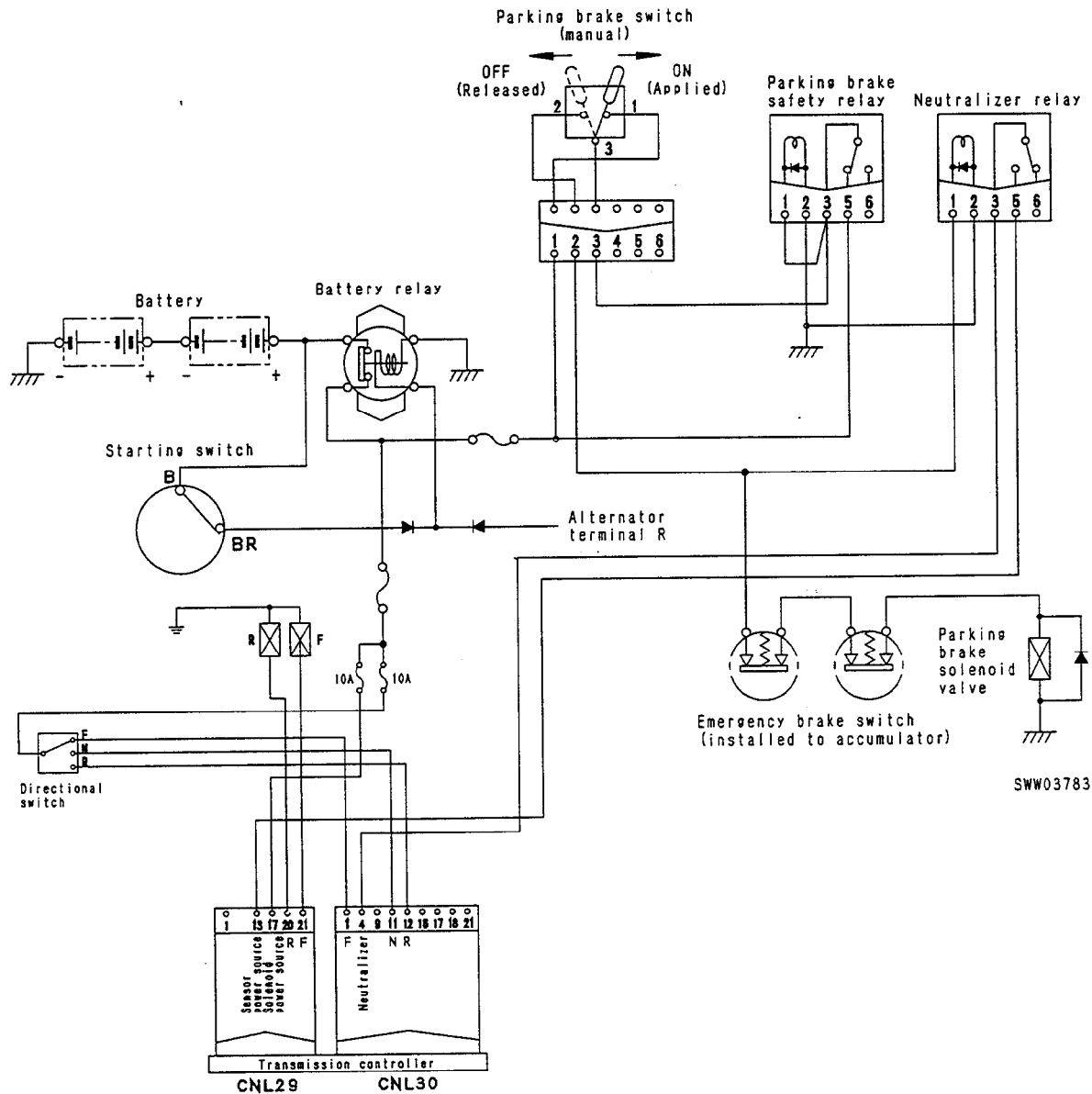
- When the directional lever is moved the **R** position, the **REVERSE** circuit is formed from the battery (+) → speed lever terminal 1 – 4 → transmission controller **REVERSE** terminal 12 → inside of controller. Current flows from the output signal terminal (20) → **REVERSE** solenoid 2 → ground, and the **REVERSE** solenoid valve is actuated. Therefore, only **REVERSE** solenoid (2) is actuated, and the transmission is set to **R2**.

**Solenoid actuation table**

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

2. Starting switch ON

2-1 When parking brake switch is ON (actuated) before starting switch is turned ON

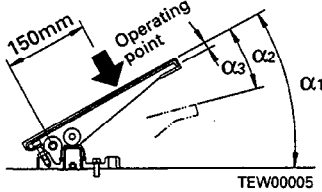


SWW03783

- The electric current flows in circuit ① from the battery ⊕ → starting switch → battery relay coil → ground, so the battery relay is closed. When this happens, electric current flows in circuit ② from the battery ⊕ → battery relay → parking brake switch terminal 1 – 3 → parking brake safety relay terminal 1 – 2 → ground. In this way, the parking safety relay is actuated and safety relay terminals 3 – 5 are closed.
- When this happens, circuit ③ is formed from the battery ⊕ → battery relay → parking

safety relay terminal 5 – 3 → parking safety relay terminal 1 – 2 → ground. From this point, the parking safety relay is in the condition of circuit ③ until the starting switch is turned OFF.

- In this condition, electric current does not flow to the parking brake solenoid valve, so the parking brake is actuated.
- In addition, in this condition, neutralizer relay terminals 3 and 5 are open, so electric current does not flow to the transmission directional circuit, and the transmission is shifted to neutral.

Category	Item	Measurement conditions	Unit	Standard value	Permissible value	
Steering wheel	Play	Engine stopped, machine facing straight to front	mm	Max. 20	50	
	Operating effort	Flat, horizontal, straight, dry paved road surface	N (kg)	9.8 – 14.7 (1.0 – 1.5)	22.5 (2.3)	
	Operating time	Low idling	Hydraulic oil temperature: 45 – 55°C	Sec.	Max. 4.5	6.8
		High idling			Max. 3.2	4.8
Frame	Clearance between front frame and rear frame	Hydraulic oil temperature: 45 – 55°C Engine speed: 1200 rpm	mm	40 ± 5	—	
Steering valve	Relief pressure	Engine speed: High idling Hydraulic oil temperature: 45 – 55°C	MPa (kg/cm <sup>2</sup> )	20.58 <sup>+0.5</sup> <sub>-0.4</sub> (210 <sup>+5</sup> <sub>-4</sub> )	20.58 <sup>+1.0</sup> <sub>-0.6</sub> (210 <sup>+10</sup> <sub>-6</sub> )	
	Operating effort	Engine speed: Low idling Hydraulic oil temperature: 45 – 55°C	N (kg)	294.2 ± 29.4 (30 ± 3)	421.7 (43)	
Brakes	Operating angle		deg.	45	—	
	Play			alpha 1	15 <sup>+1</sup> <sub>-0</sub>	—
				alpha 2	5 ± 0.5	—
	Performance	Flat, horizontal, straight, dry paved road surface Speed when depressing brake pedal: 20 km/h, braking delay: 0.1 sec. Brake pedal operating effort: Specified value Tire inflation pressure: Specified value	m	Max. 5	5	
	Drop in hydraulic pressure	4.9 MPa (50 kg/cm <sup>2</sup> ) in 5 minutes	MPa (kg/cm <sup>2</sup> )	Max. 0.5 (Max. 5)	0.5 (5)	
Disc wear	Piston stroke	mm	1.2 – 4.7	6.2		
Accumulator	Charge cut-in pressure	• Engine speed: Low idling • Hydraulic oil temperature: 45 – 55°C	MPa (kg/cm <sup>2</sup> )	60 <sup>+2</sup> <sub>0</sub>	60 <sup>+2</sup> <sub>-10</sub>	
	Charge cut-out pressure	• Point where brake oil pressure warning lamp goes out • Point where oil pressure is going up and then starts to go down		100 <sup>+10</sup> <sub>0</sub>	100 ± 10	
Parking brake	Performance	Tire inflation pressure: Specified value Flat paved road with 1/5 (11°20') grade Dry road surface Machine at operating condition	—	Stopped	—	
	Disc thickness		mm	3.2 ± 0.08	2.83	

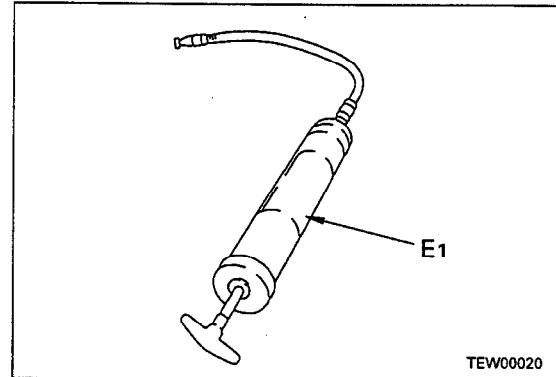
## MEASURING EXHAUST GAS COLOR

- ★ When measuring in the field when there is no air or power supply, use smoker the checker; when recording official data, use the smoke meter.

### Measuring with handy smoke checker E1

- ⚠ When measuring the exhaust gas color, be careful not to touch the exhaust pipe or any other high temperature part.

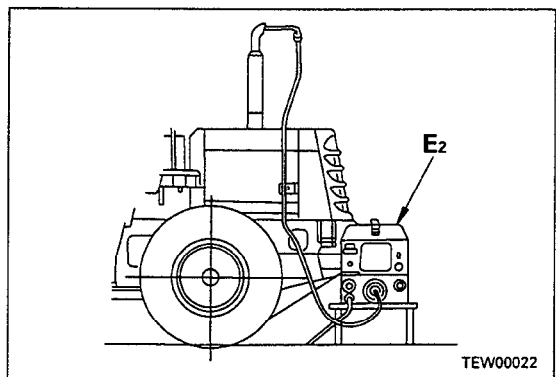
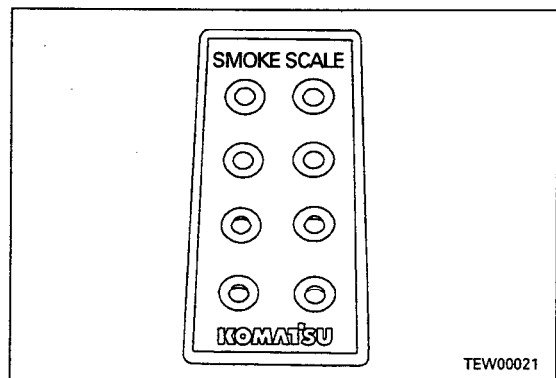
- ★ Warm up the engine (oil temperature: 60°C) before measuring the exhaust gas color.
  - 1) Fit filter paper in tool E1.
  - 2) Insert the exhaust gas intake port into the exhaust pipe, accelerate the engine suddenly, and at the same time operate the handle to catch the exhaust gas on the filter paper.
  - 3) Remove the filter paper and compare it with the scale provided to judge the condition.



### Measuring with smoke meter E2

- ⚠ When measuring the exhaust gas color, be careful not to touch the exhaust pipe or any other high temperature part.

- ★ Warm up the engine (oil temperature: 60°C) before measuring the exhaust gas color.
  - 1) Insert the probe into the outlet port of the exhaust pipe, then tighten the clip to secure it to the exhaust pipe.
  - 2) Connect the probe hose, accelerator switch plug, and air hose to tool E2.
    - ★ The pressure of the air supply should be less than 1.5 MPa {15 kg/cm<sup>2</sup>}.
  - 3) Connect the power cord to the AC100V outlet.
    - ★ When connecting the cord, check first that the power switch is OFF.
  - 4) Loosen the cap nut of the suction pump, then fit the filter paper.
    - ★ Fit the filter paper securely so that the exhaust gas does not leak.
  - 5) Turn the power switch.
  - 6) Accelerate the engine suddenly, and at the same time, depress the accelerator pedal and operate the relief valve to catch the exhaust gas color on the filter paper.
  - 7) Lay the filter paper used to catch the exhaust gas color on top of unused filter papers (10 sheets or more) inside the filter paper holder, and read the indicated value.

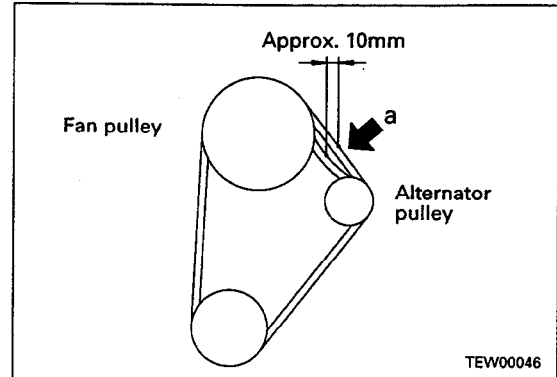


## TESTING AND ADJUSTING FAN BELT TENSION

### 1. Testing fan belt tension

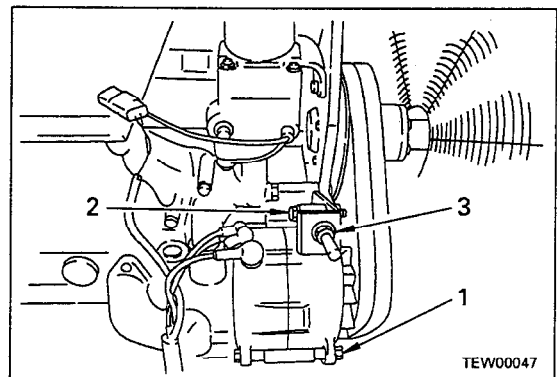
Measure the deflection of the belt when it is pushed with a finger force (approx. 58.8 N {6 kg}) at point a midway between the fan pulley and the alternator pulley.

★ Deflection of V-belt: Approx. 10 mm



### 2. Adjusting belt

- 1) Loosen alternator mount bolt (1) and adjust plate mounting bolt (2).
- 2) Loosen the locknut, then tighten adjustment nut (3) to adjust the tension of the belt.
- 3) After adjusting the belt tension to the standard value, tighten the locknut, then tighten adjust plate mounting bolt (2) and alternator mount bolt (1).



## TESTING AND ADJUSTING STEERING WHEEL

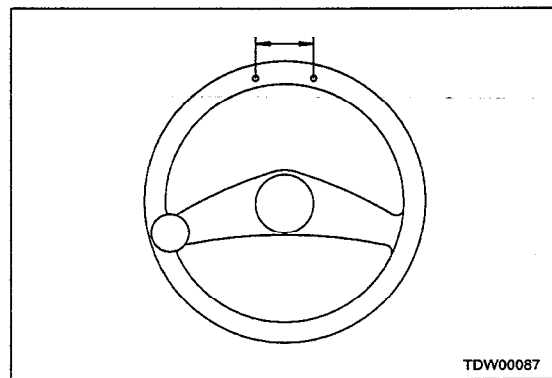
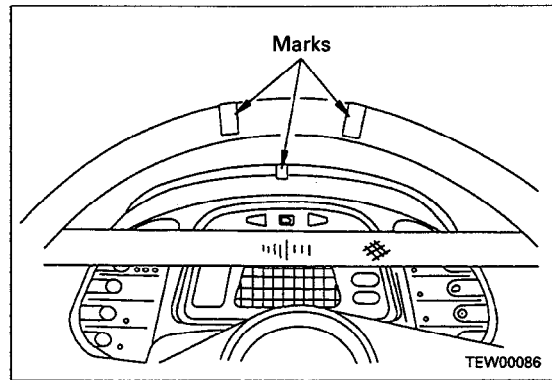
### MEASURING PLAY OF STEERING WHEEL

#### ★ Measurement conditions

- Engine speed: Stopped
- Machine posture: Facing straight forward

#### Measuring

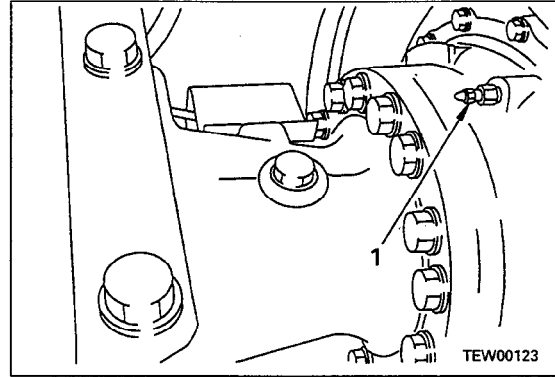
1. Move the steering wheel 2 or 3 times lightly to the left and right, check that the steering mechanism is at the neutral position, then make a mark on the outside frame of the machine monitor.
2. Turn the steering wheel to the right, and make a mark at the position where the operating force starts to become heavy (when the steering valve lever starts to move).
3. Turn the steering wheel to the left in the opposite direction from Step 2, and make a mark at the point where the operating force becomes heavy (when the steering valve lever starts to move). Then measure the distance in a straight line between the marks made in Step 2 and Step 3.



## BLEEDING AIR FROM BRAKE SYSTEM

**⚠** Put blocks securely under the tires.

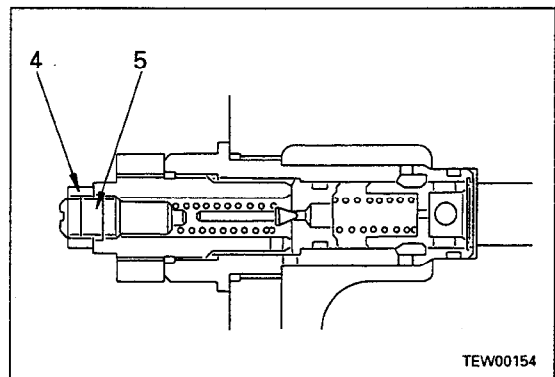
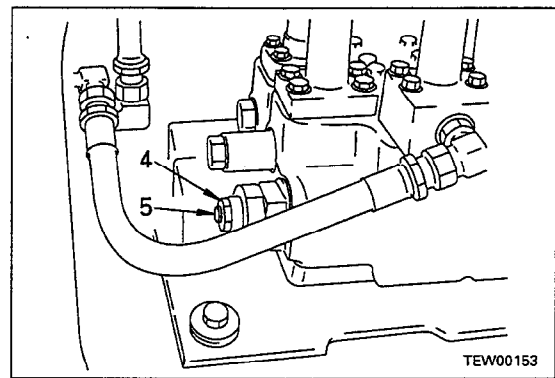
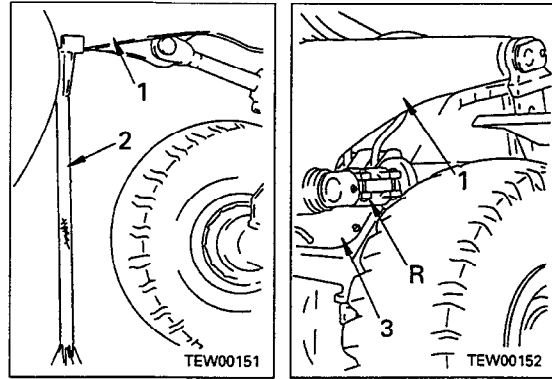
1. Remove cap (1) of the bleeder screw, insert a vinyl hose into the screw, and insert the other end in a container.
2. Start the engine.
3. Depress the brake pedal, then loosen the bleeder screw and bleed the air.
  - ★ This operation is carried out with two workers. One worker operates the brake pedal while the other worker bleeds the air from the bleeder screw.
  - ★ When depressing the brake pedal, use the left pedal.
4. When no more bubbles come out with the fluid from the hose, depress the pedal fully and tighten the bleeder screw while the oil is still flowing.
  - ★ Repeat the operation to bleed the air from the other cylinders, and after completing the operation, check the level in the oil tank and add more oil if necessary.
  - ★ To bleed the air completely, bleed the air first from the cylinder which is farthest from the brake pedal.



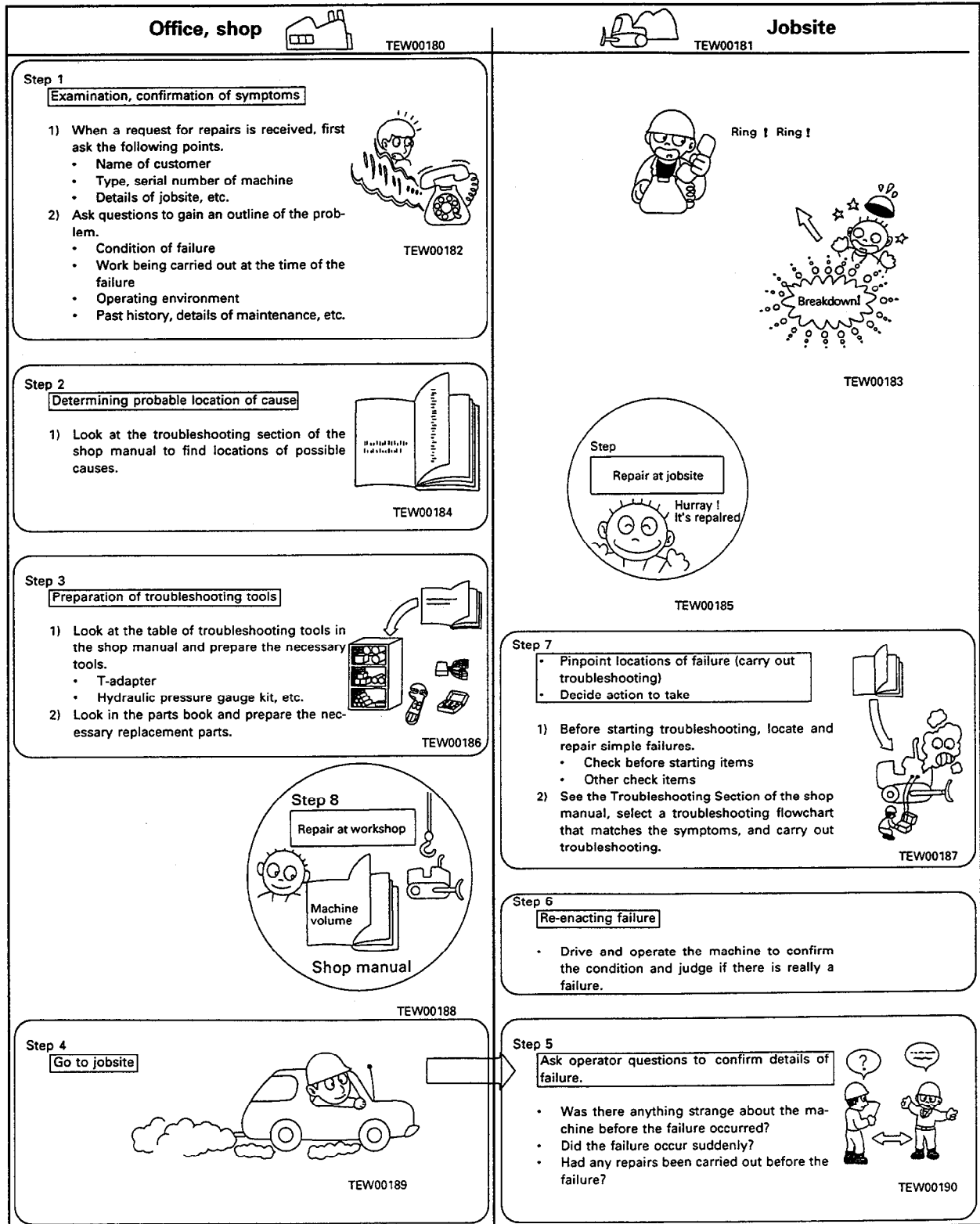
**Adjusting**

**⚠** Always stop the engine when adjusting the oil pressure.

- 1) Raise boom (1), set support (2) or stopper R in position under the boom, then remove cover (3).
- 2) Remove locknut (4) of the relief valve.
- 3) Turn adjustment screw (5) to adjust.
  - ★ Pressure adjustment for one turn of adjustment screw:  
Approx. 5.18 MPa {52.9 kg/cm<sup>2</sup>}
  - ★ Turn the adjustment screw to adjust the set pressure as follows.  
TIGHTEN to INCREASE pressure  
LOOSEN to DECREASE pressure
  - ★ Do not carry out any adjustment if the relief pressure cannot be measured accurately.



# SEQUENCE OF EVENTS IN TROUBLESHOOTING



## METHOD OF USING TROUBLESHOOTING CHARTS

### 1. Category of troubleshooting code number

Troubleshooting code No.	Component
S-○○	Troubleshooting of engine
M-○○	Troubleshooting of main monitor system
K-○○	Troubleshooting of maintenance monitor system
E-○○	Troubleshooting of electrical system
A-○○	Troubleshooting of transmission controller system
T-○○	Troubleshooting of hydraulic and mechanical system

### 2. Method of using troubleshooting table for each troubleshooting mode

#### 1) Troubleshooting code number and problem

The title of the troubleshooting chart gives the troubleshooting code, service code, and failure mode (problem with the machine). (See Example (1))

#### 2) Distinguishing conditions

Even with the same failure mode (problem), the method of troubleshooting may differ according to the model, component, or problem. In such cases, the failure mode (problem) is further divided into sections marked with small letters (for example, (a)), so go to the appropriate section to carry out troubleshooting.

If the troubleshooting table is not divided into sections, start troubleshooting from the first check item in the failure mode. (See Example (2))

#### 3) Method of following troubleshooting chart

- Check or measure the item inside  <sup>YES</sup>/<sub>NO</sub>, and according to the answer follow either the YES line or the NO line to go to the next . (Note: The number written at the top right corner of the  is an index number; it does not indicate the order to follow.)

- Following the YES or NO lines according to the results of the check or measurement will lead finally to the Cause column. Check the cause and take the action given in the Remedy column on the right. (See Example (3))

- Below the [ ] there are the methods for inspection or measurement, and the judgement values.

If the judgement values below the  are correct or the answer to the question inside the  is YES, follow the YES line; if the judgement value is not correct, or the answer to the question is NO, follow the NO line.

- Below the  is given the preparatory work needed for inspection and measurement, and the judgement values. If this preparatory work is neglected, or the method of operation or handling is mistaken, there is danger that it may cause mistaken judgement, or the equipment may be damaged. Therefore, before starting inspection or measurement, always read the instructions carefully, and start the work in order from Item 1).

#### 4) General precautions

When carrying out troubleshooting for the failure mode (problem), precautions that apply to all items are given at the top of the page and marked with ★. (See Example (4))

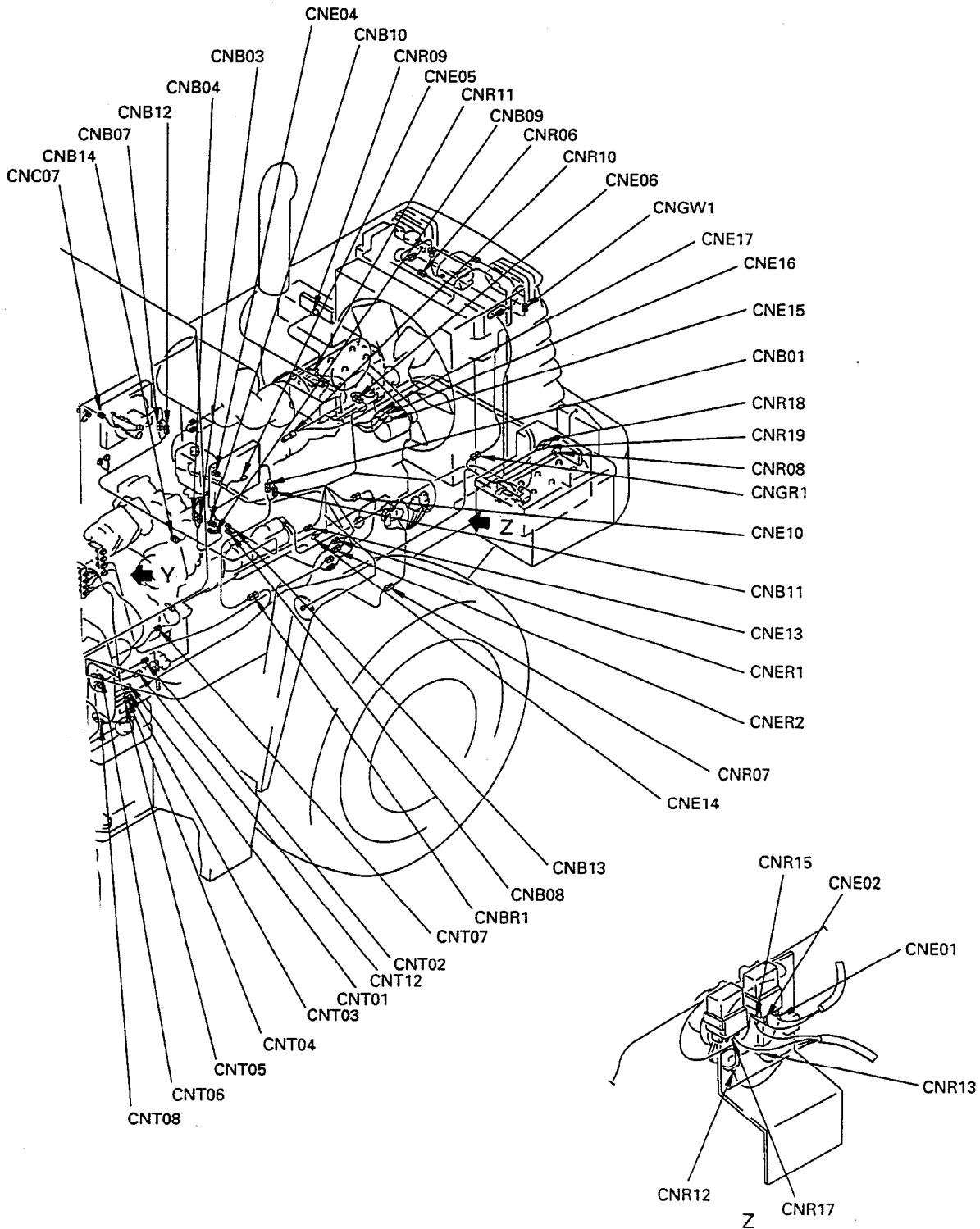
The precautions marked ★ are not given in the , but must always be followed when carrying out the check inside the .

#### 5) Troubleshooting tools

When carrying out the troubleshooting, prepare the necessary troubleshooting tools. For details, see TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING.

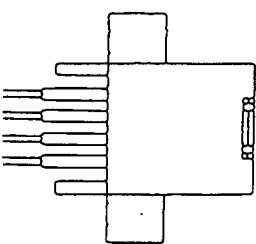
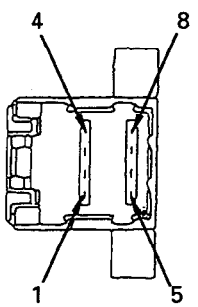
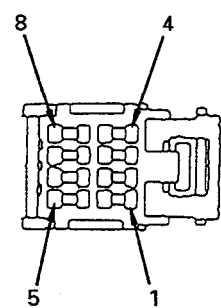
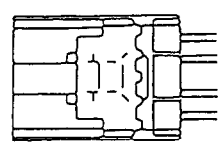
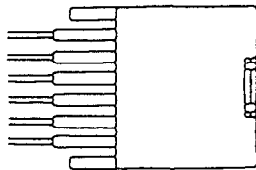
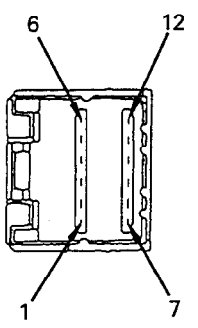
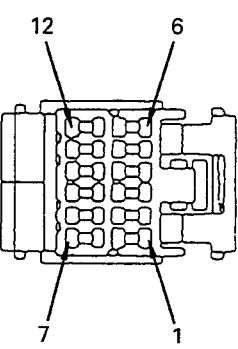
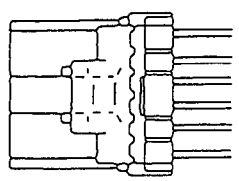
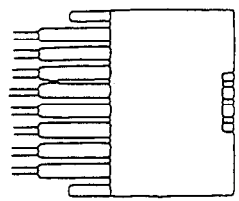
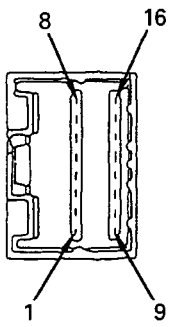
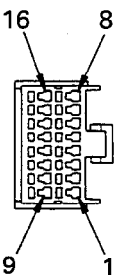
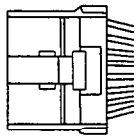
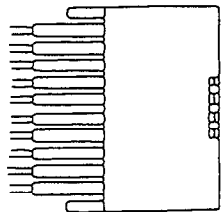
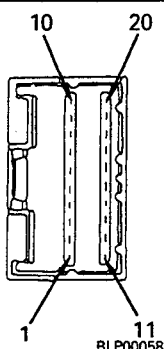
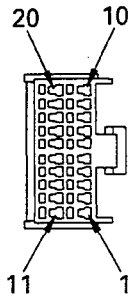
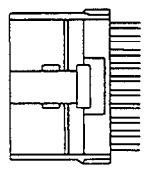
#### 6) Installation position, pin number

A diagram or chart is given for the connector type, installation position, and connector pin number connection. When carrying out troubleshooting, see this chart for details of the connector pin number and location for inspection and measurement of the wiring connector number appearing in the troubleshooting flow chart for each failure mode (problem).



TNW01030



No. of pins	AMP040 type connector			
	Male (female housing)		Female (male housing)	
8		 BLP00053	 BLP00054	
12		 BLP00055	 BLP00056	
16		 BLP00057	 TEW00232	
20		 BLP00058	 TEW00234	

### S-3 Engine does not pick up smoothly

General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used

		Causes											
		Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump strainer	Clogged injection nozzle, defective spray	Worn piston ring, cylinder	Seized turbocharger, interference	Improper valve clearance	Clogged fuel tank air breather hole	Defective contact of valve, valve seat			
Questions	Confirm recent repair history												
	Degree of use	△	△	△		△						△	
	Operated for long period												
	Replacement of filters has not been carried out according to operation manual	○	○	○									
	Non-specified fuel has been used		○	○	○								
	Engine oil must be added more frequently					○							
	Rust and water are found when fuel is drained		○	○									
	Dust indicator is red	○											
	Noise of interference is heard from around turbocharger						○						
	Engine pick-up suddenly became poor			○		○		○	○				
	Color of exhaust gas												
	Blue under light load					○							
	Black	○		○		○						○	
	Clanging sound is heard from around cylinder head						○						
	Check Items	Mud is stuck to fuel tank cap							○				
There is leakage from fuel piping									○				
High idling speed under no load is normal, but speed suddenly drops when load is applied			○	○					○				
There is hunting from engine (rotation is irregular)			○	○					○				
When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low				○	○								
Blow-by gas is excessive						○							
Troubleshooting		When air element is inspected directly, it is found to be clogged	●										
		When fuel filter, strainer are inspected directly, they are found to be clogged		●									
		When feed pump strainer is inspected directly, it is found to be clogged			●								
		Speed of some cylinders does not change when operating on reduced cylinders				●							
	When control rack is pushed, it is found to be heavy, or does not return					●							
	When compression pressure is measured, it is found to be low						●				●		
	When turbocharger is rotated by hand, it is found to be heavy							●					
	When valve clearance is checked directly, it is found to be outside standard value								●				
	When fuel cap is inspected directly, it is found to be clogged									●			
	When feed pump is operated, operation is too light or too heavy										●		
Remedy	Clean	Clean	Clean	Repair	Replace	Replace	Replace	Adjust	Clean	Repair	Replace		

### S-13 Oil level rises

- ★ If there is oil in the cooling water, carry out troubleshooting for "Oil is in cooling water".

General causes why oil level rises

- Water in oil (cloudy white)
- Fuel in oil (diluted, and smells of diesel fuel)
- Entry of oil from other component

Legend

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

Cause
Broken oil cooler core, O-ring
Defective nozzle holder sleeve
Broken head, head gasket (including precombustion chamber)
Clogged water pump breather hole, defective seal
Worn, damaged rear seal surface
Defective seal of pump or auxiliary equipment
Leakage of fuel from piping inside head cover
Defective inside injection pump (flange type)
Damaged liner O-ring, holes made by pitting
Cracks inside cylinder block

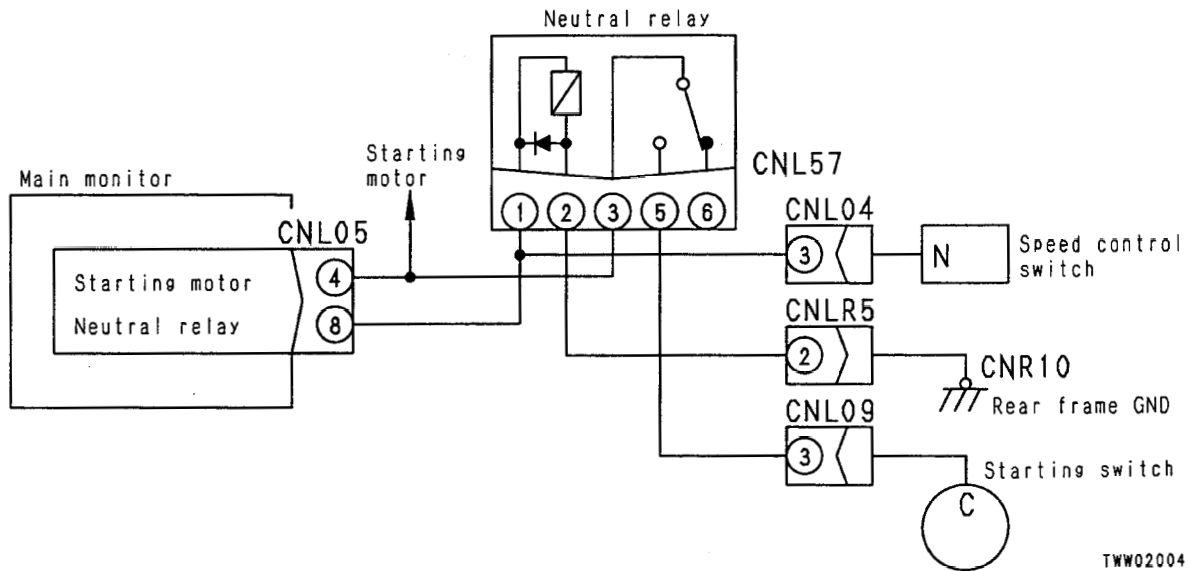
Questions	Confirm recent repair history													
	Degree of use	Operated for long period												
There is oil in radiator cooling water	⊙	○	○										○	○
Exhaust gas is white			⊙						○				○	
When engine is first started, drops of water come from muffler			⊙											
Leave radiator cap open. When engine is run at idling, an abnormal number of bubbles appear, or water spurts back				⊙									○	
Water pump breather hole is clogged with mud					⊙									
When water pump breather hole is clean, water comes out					⊙									
Oil level goes down in clutch, TORQFLOW transmission, or damper chamber						⊙								
Oil level goes down in hydraulic tank							⊙							
Engine oil smells of diesel fuel									⊙	⊙	⊙			
Fuel is added more frequently									⊙	⊙	⊙			

Troubleshooting											Remedy	
Pressure-tightness test of oil cooler shows there is leakage	●											Replace
Pressure-tightness test of cylinder head shows there is leakage		●										Replace
When compression pressure is measured, it is found to be low			●									Replace
Remove water pump and check directly				●								Replace
Check rear seal directly					●							Repair
When pump auxiliary equipment is removed, seal is found to be broken						●						Replace
Remove head cover and check directly							●					Repair
Remove injection pump and check directly								●				Replace
There is improper contact of thermostat seat valve									●			Replace
Remove oil pan and check directly										●	●	Replace

### M-2 When starting switch is turned ON and engine is started immediately, all lamps stay lighted up

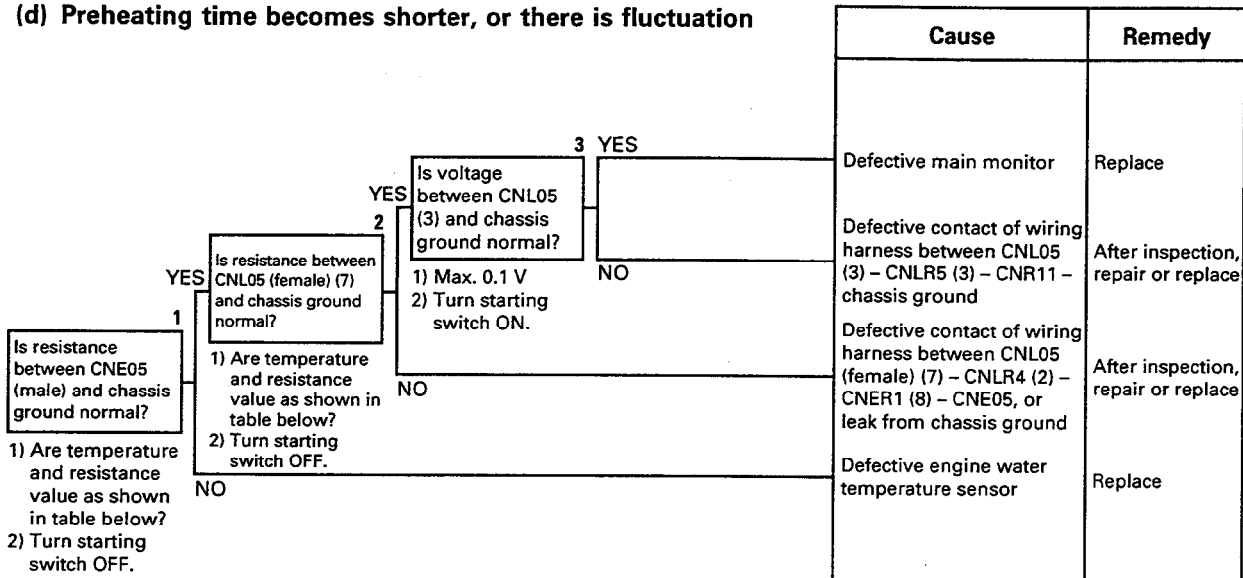
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on the next step.

		Cause	Remedy
Is voltage between CNL05 (4) and chassis ground normal? 1) 20 - 30 V 2) Turn starting switch START.	1 YES	Defective main monitor	Replace
	NO	Defective contact, or disconnection in wiring harness between CNL05 (female) (4) and CNL57 (3)	After inspection, repair or replace



TWW02004

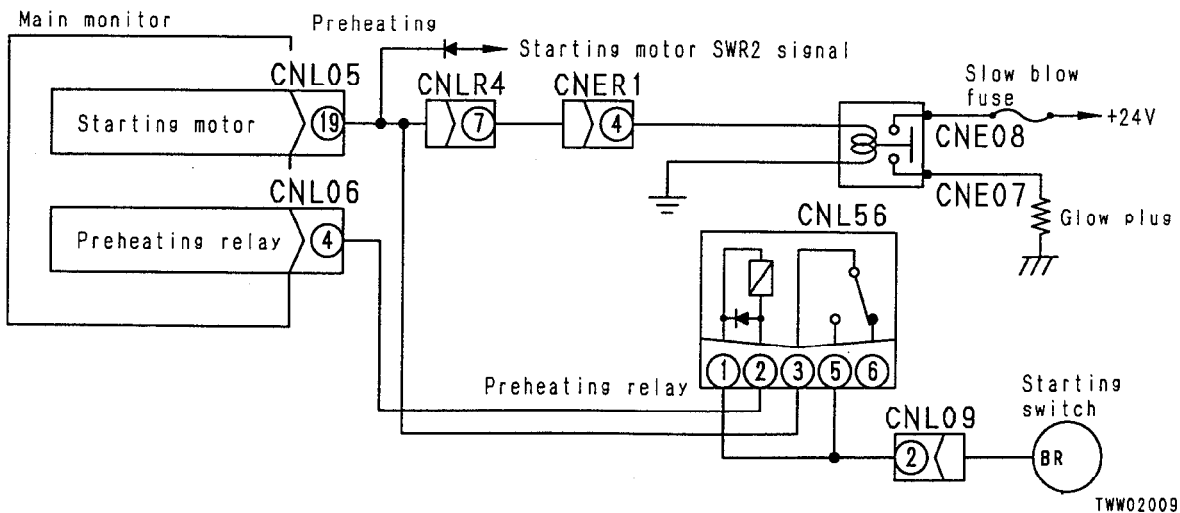
(d) Preheating time becomes shorter, or there is fluctuation



Table

(Tolerance  $\pm 0.5 \text{ k}\Omega$ )

Temperature(°C)	-10	-8	-6	-4	-2	0	2	4
Resistance value(kΩ)	7.7	7.1	6.5	6.0	5.5	5.1	4.7	4.3

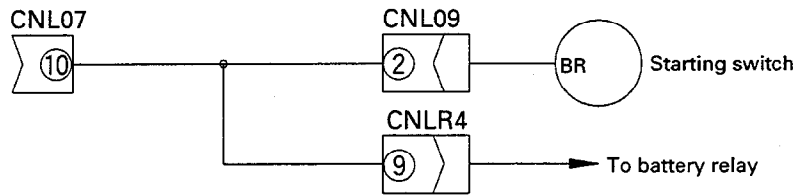


### M-16 Condition of monitor switches is not stored in memory

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

		Cause	Remedy
Is voltage between CNL07 (10) and chassis ground normal? 1) 20 – 30 V 2) Turn starting switch ON.	1 YES	Defective main monitor	Replace
	NO	Defective contact, or disconnection in wiring harness between CNL07 (female) (10) and CNL09 (2)	After inspection, repair or replace

Starting switch ACC



TDW00302

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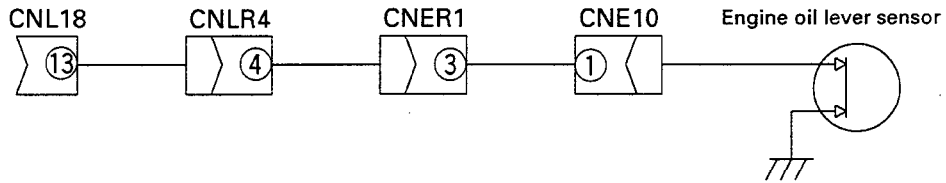
### K-4 When starting switch is turned ON (engine stopped), CHECK items flash

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

**(a) Engine oil level display flashes**

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

	Cause	Remedy
<p>Is there continuity between CNE10 (male) (1) and chassis ground?</p> <p>1) Turn starting switch OFF. 2) Disconnect CNE10.</p> <p>YES</p>		
<p>Is there continuity between CNL18 (female) (13) and chassis ground?</p> <p>1) Turn starting switch OFF. 2) Disconnect CNL18.</p> <p>NO</p>	Defective maintenance monitor module	Replace
<p>Is there continuity between CNL18 (female) (13) and chassis ground?</p> <p>1) Turn starting switch OFF. 2) Disconnect CNL18.</p> <p>YES</p>	Defective contact, or disconnection in wiring harness between CNL18 (female) (13) – CNLR4 (4) – CNER1 (3) – CNE10 (female) (1)	Repair wiring harness or replace
<p>Is there continuity between CNL18 (female) (13) and chassis ground?</p> <p>1) Turn starting switch OFF. 2) Disconnect CNL18.</p> <p>NO</p>	Defective engine oil level sensor	Replace

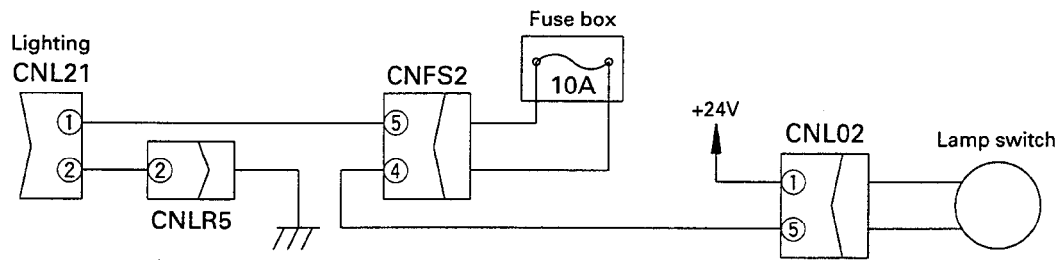


TDW00316

### K-10 Night lighting does not light up when lamp switch is turned ON

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

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



TDW00326

	Cause	Remedy
	Defective neutral relay	Replace
	Defective contact, or disconnection in wiring harness between CNL57 (female) (3) – CNLR4 (8) – CNR01, 02 (diode) – CNER1 (10) – CNE13 (female) (1)	After inspection, repair or replace
	Defective contact, or disconnection in wiring harness between starting switch terminal C – CNL09 (3) – CNL57 (female) (5)	After inspection, repair or replace
	Defective starting switch	Replace
	Defective contact, or disconnection in wiring harness between starting switch terminal B – CNL09 (1) – CNFS3 (4) – fuse – CNFS3 (6) – CNLR5 (1) – CNR17 – slow blow fuse 30A – battery relay	After inspection, repair or replace
	Defective contact, or disconnection in wiring harness between CNL04 (female) (3) and CNL57 (female) (1)	After inspection, repair or replace
	Defective directional lever switch	Replace
	Defective contact, or disconnection in wiring harness between battery relay – slow blow fuse 80A – CNR15 – CNLR6 (1) – CNFS1 (2) – fuse – CNFS2 (8) – CNL04 (female) (1)	After inspection, repair or replace
<p style="text-align: center;">10</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Is voltage between both battery relay terminals and chassis 20 – 30 V?</p> </div> <p>1) Turn starting switch ON. 2) Check voltage between chassis and both terminals connected by thick cable.</p>	<p style="text-align: center;">YES</p>	
	<p style="text-align: center;">NO</p>	
	<ul style="list-style-type: none"> <li>• If answer is NO for both terminals: Defective contact or disconnection in wiring harness between battery and battery relay</li> <li>• If answer is NO for one terminal: Defective battery relay</li> </ul>	After inspection, repair or replace
	Defective contact, or disconnection in wiring harness between CNL57 (female) (2) and chassis ground	After inspection, repair or replace

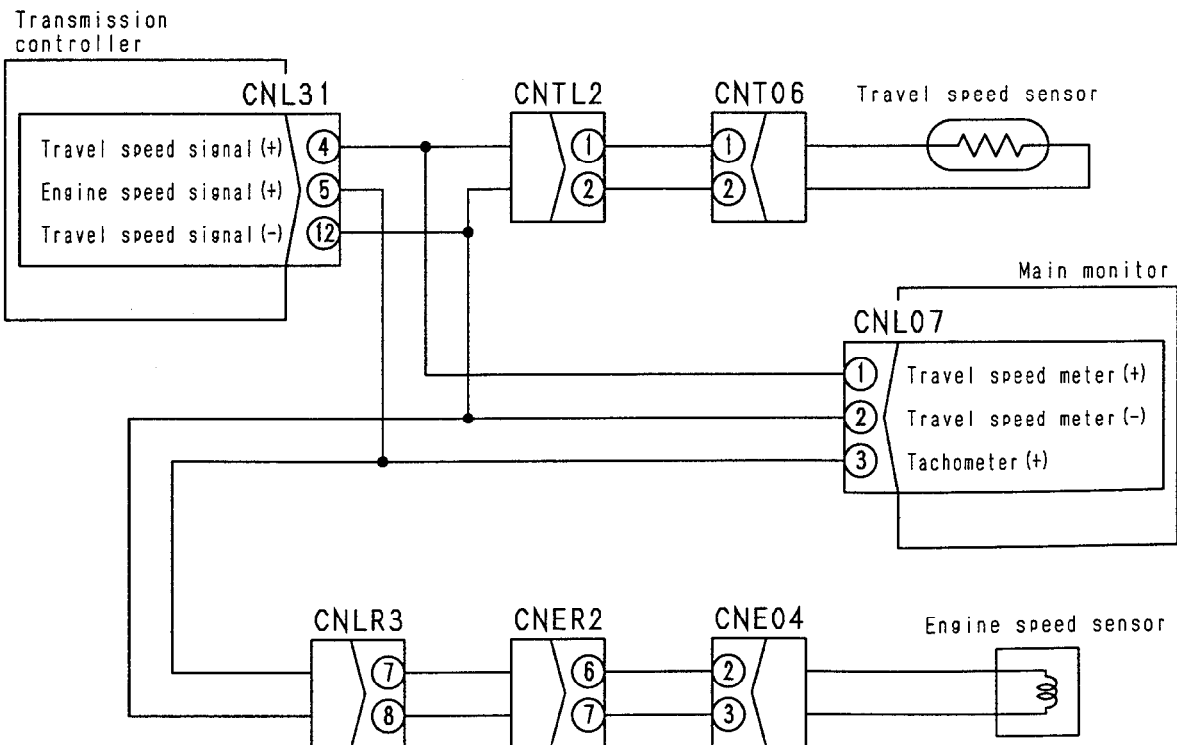
4. Table of failure modes and causes

Cause of failure  Failure mode	Related equipment													Reference items when no failure code is displayed				
	F solenoid system	R solenoid system	H-L solenoid system	Speed solenoid system	Modulation valve solenoid system	Directional lever signal system	Speed control lever signal system	Travel speed sensor signal system	Engine speed sensor signal system	Hold switch signal system	Kickdown signal system	Transmission cut-off signal	Neutralizer signal system		Alarm buzzer signal system	Network signal system	Controller power supply system	Model selection wiring harness
Failure code	12	13	14	16	10 11	20	21	22	23	—	—	—	—	—	—	—	—	—
Impossible to travel	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>						<input type="radio"/>	<input type="radio"/>			<input type="radio"/>		14, 15, 18
Auto-shift does not work			<input type="radio"/>	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>										
Position of directional lever and direction of travel do not match						<input type="radio"/>												
Machine travels forward when directional lever is not at F position	<input type="radio"/>																	
Machine travels in reverse when directional lever is not at R position		<input type="radio"/>																
Transmission does not shift down in accordance with travel speed			<input type="radio"/>	<input type="radio"/>				<input type="radio"/>										
Transmission does not shift up in accordance with travel speed			<input type="radio"/>	<input type="radio"/>														
Transmission stays in same range as speed lever regardless of travel speed								<input type="radio"/>										
There is excessive shock when shifting gear					<input type="radio"/>			<input type="radio"/>									<input type="radio"/>	
There is shift hunting when traveling							<input type="radio"/>											
There is shift hunting when shifting gear								<input type="radio"/>									<input type="radio"/>	
Transmission range cannot be controlled with speed lever							<input type="radio"/>											
Shift cannot be held										<input type="radio"/>								12
Transmission does not shift to 1st with kick-down switch											<input type="radio"/>							13
No power for scooping operations when kick-down switch is ON																		
Transmission is not cut off when left brake is operated												<input type="radio"/>						14
Machine can travel when parking brake is applied													<input type="radio"/>					15
Buzzer does not sound when travel direction is switched between forward and reverse when traveling at high speed														<input type="radio"/>				16
Buzzer does not stop														<input type="radio"/>				16
Main monitor does not display transmission controller information (alarm buzzer, failure code, etc.)															<input type="radio"/>			17
Model selection does not work																<input type="radio"/>		

### A-11 Failure code [23] Abnormality in engine speed signal

- ★ Check that there is no error given for the engine speed signal for the electric engine throttle controller.
- ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
- ★ Always connect any disconnected connectors before going on the next step.
- ★ Before disconnecting connectors to connect the T-adaptor (or socket adapter), always turn the starting switch OFF.

		Cause	Remedy
<p>1</p> <p>Is insulation between CNL31 (female) (5), (12) – chassis normal?</p> <p>1) Disconnect CNL31, CNE04, and CNL07. 2) Min. 1 MΩ</p>	YES		
	2 YES	Defective controller	Replace
	NO	Defective contact or disconnection in wiring harness between CNL31 (female) (5), (12) – CNE04 (female) (2), (3)	Repair wiring harness or replace
	NO	Short circuit with ground in wiring harness between CNL31 (female) (5), (12) – CNL07 (female) (3), (2), between CNL31 (female) (5), (12) – CNE04 (female) (2), (3)	Repair wiring harness or replace



TWW02018

## T-2 Travel speed is slow, thrusting power is weak, lacks power on slopes

### Checking for abnormalities

- Measure digging operations and speed when traveling on level ground and on slopes, and check if there is actually an abnormality or whether it is just the feeling of the operator.

### Checks before troubleshooting

- Is the transmission oil level correct?  
Is the type of oil correct?
- Is the transmission filter or strainer clogged?
- Is there any oil leaking from the joints of the piping or valves?
- Is there any dragging of the wheel brake or parking brake?
- Is the tire inflation pressure and tread pattern normal?
- Is the method of operation correct?

No.	Problems	Remedy						
		Charging pump		Torque converter			Transmission control valve	
		a	b	c	d	e	f	g
		△	△	△	△	△	△	△
		×	×	×	×	×	×	×
1	Abnormality in all transmission ranges	○	○	○	○	○	○	○
2	Abnormality in certain transmission ranges						○	
3	When oil temperature is low, abnormal noise comes from charging pump	○						
4	Torque converter oil overheats	○	○		○	○		
5	Abnormality in high idling and low idling speeds					○		
6	Abnormality in each stall engine speed		○	○	○	○		
7	Torque converter relief pressure is low	○	○	○	○	○		
8	Transmission clutch pressure	Low in every transmission range		○	○			○
9		Low in certain transmission ranges					○	
10		Indicator is unstable and fluctuates violently		○				
11	Transmission oil level changes							
12	Metal particles stuck to transmission strainer or torque converter filter		○			○		
13	Cut-off valve does not cut-off even when hydraulic pressure in work equipment circuit is high.							

### Causes

- Air sucked in at charging pump suction end
- Defective charging pump
- Defective torque converter
- Oil leakage inside torque converter relief valve
- Breakage inside torque converter
- Defect inside torque converter (seal ring, bushing, snap ring, bearing, etc.)
- Defective transmission control valve (bearing, turbine, pump, stator, etc.)
- Defective modulation valve of control valve

### T-13 Parking brake is not released or brake drags

**Checks before troubleshooting**

- Is the emergency parking brake cancel switch OFF?  
(it is always canceled when this switch is ON)
- Is the parking brake always applied automatically when the engine is stopped?

		Remedy						Causes					
<b>No.</b>	<b>Problems</b>	△	△	△	△	△	△	×	×	×	×	×	×
1	When parking brake switch is turned OFF, parking brake is not released	○	○	○	○	○	○						
2	When parking brake switch is OFF and engine is stopped, parking brake is not applied					○	○						
3	When parking brake switch is ON, parking brake effect is weak		○	○									

- When emergency parking brake switch is turned ON, parking brake is not released  
In such a case, the probable cause is following.
  - a. Defective operation of emergency parking brake cancel valve
  - b. Breakage in wiring harness in line for emergency parking brake cancel switch
  - c. Insufficient gas pressure in brake accumulator, damaged piston seal

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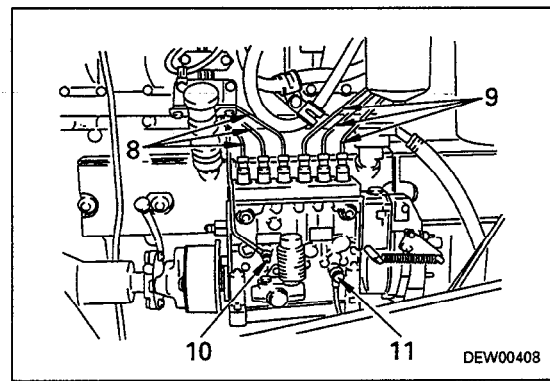
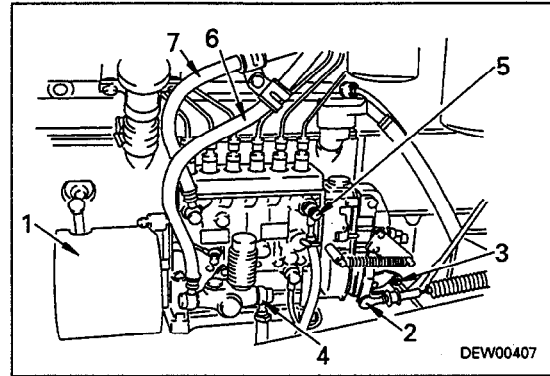
# 30 DISASSEMBLY AND ASSEMBLY

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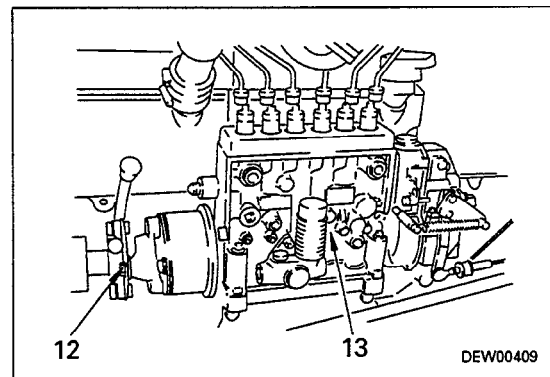
METHOD OF USING MANUAL .....	30- 3	TRANSMISSION	
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OPERATION .....	30- 4	Assembly .....	30-53
SPECIAL TOOL LIST .....	30- 6	TRANSMISSION CLUTCH PACK	
STARTING MOTOR		Disassembly .....	30-59
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Installation .....	30- 9	PARKING BRAKE	
ALTERNATOR		Disassembly .....	30- 80
Removal .....	30-10	Assembly .....	30- 82
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ENGINE OIL COOLER		Removal .....	30- 85
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Removal .....	30-14	DRIVE SHAFT	
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Installation .....	30-15	Removal .....	30-105
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Removal .....	30-16	REAR AXLE	
Installation .....	30-16	Removal .....	30-108
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Removal .....	30-17	FRONT DIFFERENTIAL	
Installation .....	30-17	Removal .....	30-113
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Disassembly .....	30-43		
Assembly .....	30-45		

## REMOVAL OF FUEL INJECTION PUMP ASSEMBLY

1. Remove coupling cover (1) of fuel injection pump.
2. Disconnect accelerator cable (2) and stop motor cable (3).
3. Disconnect fuel hoses (4), (5), (6), and (7).  
★ After disconnecting fuel supply hose (4), bend it and tie it with wire to prevent the fuel from leaking.
4. Disconnect fuel injection pipes (8) and (9). ※ 1
5. Remove lubrication tubes (10) and (11).




6. Remove 2 lock bolts (12) of cross coupling and laminate coupling. ※ 2  
★ Before removing the bolts, mark the mounting position of the laminate coupling and cross coupling.
7. Remove fuel injection pump assembly (13). ※ 3




## INSTALLATION OF CYLINDER HEAD ASSEMBLY


- Carry out installation in the reverse order to removal.

※ 1

 Air cleaner intake connector clamp:  
 $8.3 \pm 0.5 \text{ Nm}$  ( $0.85 \pm 0.05 \text{ kgm}$ )


※ 2

 Fuel injection pipe sleeve nut:  
 $29.4 \pm 5 \text{ Nm}$  ( $3.0 \pm 0.5 \text{ kgm}$ )


 Spill pipe mounting bolt:  
 $24.5 \pm 5 \text{ Nm}$  ( $2.5 \pm 0.5 \text{ kgm}$ )

※ 3

- ★ Screw in the exhaust manifold mounting bolts 2 – 3 threads by hand, tighten mounting bolts ① – ③, then tighten the other mounting bolts.


 Exhaust manifold mounting bolt:  
 $66.7 \pm 7.9 \text{ Nm}$  ( $6.8 \pm 0.8 \text{ kgm}$ )

※ 4

 Head cover mounting bolt:  
 $9.8 \pm 1 \text{ Nm}$  ( $1.0 \pm 0.1 \text{ kgm}$ )

※ 5


- ★ Tighten the nozzle holder mounting bolts in turn uniformly.


 Nozzle holder mounting bolt:  
 $21.6 \pm 3 \text{ Nm}$  ( $2.2 \pm 0.3 \text{ kgm}$ )

※ 6


- ★ Check that the ball of the adjustment screw is fitted securely in the socket of the push rod.

- ★ Adjust the valve clearance. For details, see TESTING AND ADJUSTING, Adjusting valve clearance.


 Rocker arm assembly mounting bolt:  
 $66.2 \pm 7.4 \text{ Nm}$  ( $6.75 \pm 0.75 \text{ kgm}$ )

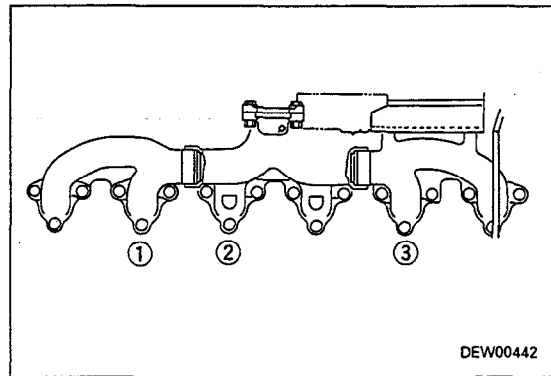
 Locknut:  
 $66.2 \pm 7.4 \text{ Nm}$  ( $6.75 \pm 0.75 \text{ kgm}$ )

※ 7

 Rocker arm housing mounting bolt:  
 $66.2 \pm 7.4 \text{ Nm}$  ( $6.75 \pm 0.75 \text{ kgm}$ )

- ★ Adjust the crosshead as follows.
  - Loosen the locknut and turn the adjustment screw back.
  - Press the top of the crosshead lightly and screw in the adjustment screw.
  - When the adjustment screw contacts the valve stem, screw it in a further 20°.
  - Tighten the locknut to hold it in position.


 Locknut:  
 $66.2 \pm 7.4 \text{ Nm}$  ( $6.75 \pm 0.75 \text{ kgm}$ )




## INSTALLATION OF ENGINE ASSEMBLY

- Carry out installation in the reverse order to removal.


※ 1

 **kgm** Compressor hose:  
7.9 – 11.8 Nm (0.8 – 1.2 kgm)


※ 2 ※ 5

 **kgm** Accelerator cable mounting bolt:  
53.9 ± 5 Nm (5.5 ± 0.5 kgm)

※ 3


 **kgm** Condenser hose:  
19.6 – 24.5 Nm (2.0 – 2.5 kgm)

※ 4

 **kgm** Receiver hose:  
3.9 – 6.9 Nm (0.4 – 0.7 kgm)

※ 6

- ★ Clean the connection and mating surface of the drive shaft before installing.

 **kgm** Drive shaft mounting bolt:  
112.8 ± 9.8 Nm (11.5 ± 1.0 kgm)

※ 7

- ★ Be careful of the direction of installation of the cushions and spacers at the engine mount when assembling.


 **kgm** Mount bolt:  
926.7 ± 103 Nm (94.5 ± 10.5 kgm)

※ 8

- ★ When connecting the engine to the torque converter, adjust the height so that the torque converter shaft and ring gear go in smoothly.

Never try to use force when connecting.


- ★ Use new parts for the torque converter and flywheel housing O-rings.

 O-ring at mating surface of torque converter and engine flywheel:

**Soapy water**


- **Refilling with oil**


Tighten drain plugs (1) and (2) at the top of the hydraulic tank filter, and add hydraulic oil through the oil filler to the specified level.

 **kgm** Plug at top of filter:  
11.8 ± 1 Nm (1.2 ± 0.1 kgm)

※ 12


★ Align the pin hole securely.

 **kgm** Mounting bolt of bracket (65):  
279.5 ± 29.4 Nm (28.5 ± 3.0 kgm)

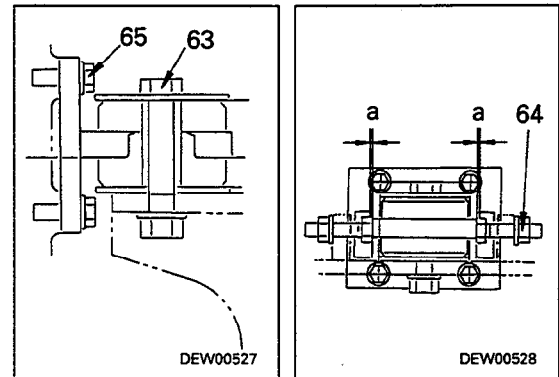
 **kgm** Mount bolt (63):  
926.7 ± 103 Nm (94.5 ± 10.5 kgm)

• Adjust so that the clearance at center bolt (64) is clearance a.

★ Clearance a: 1.0 – 1.5 mm


 **kgm** Set bolt (64):  
122.6 ± 24.5 Nm (12.5 ± 2.5 kgm)

 Set bolt: **Thread tightener (LT-2)**



• **Refilling with oil**

Tighten drain plugs (1) and (2) at the top of the hydraulic tank filter, and add hydraulic oil through the oil filler to the specified level.

 **kgm** Plug at top of filter:  
11.8 ± 1 Nm (1.2 ± 0.1 kgm)

• **Bleeding air**

1) Bleed air from brake line.

For details of the procedure for bleeding the air, see TESTING AND ADJUSTING.

2) Bleed air from steering line.

For details of the procedure for bleeding the air, see TESTING AND ADJUSTING.

• Fill the air conditioner with new refrigerant.

★ **Precautions when filling air conditioner line with new refrigerant**

1) Keep the temperature inside the room at above 3°C.

(If the temperature is below 3°C, the system will not work.)

2) Use R134a as the refrigerant.

3) When filling with refrigerant, always use the repeat vacuum method to completely evacuate. (Attainment of vacuum: Min.750 mmHg.)

4) Charge with 1.5 – 1.6 kg of refrigerant.

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

6) Do not operate the compressor before charging with refrigerant.

- 2) Install eyebolt to output shaft (10) and lift off output shaft.

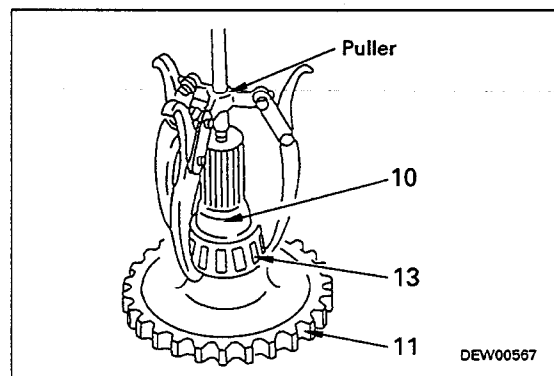
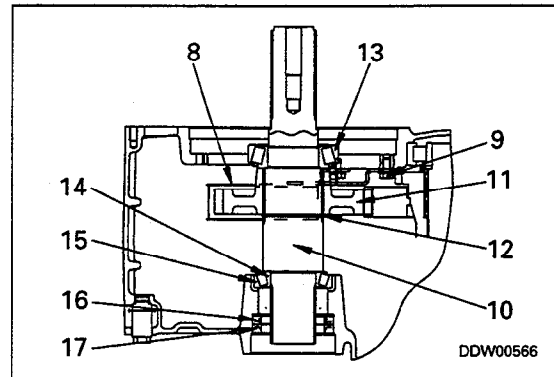


Output shaft (including gear): 33 kg

- 3) Remove snap ring (12) of output gear (11), then remove inner bearing (13) using puller, and remove output gear from shaft.
- 4) Using puller, remove inner bearing (14) on opposite side of output shaft.  
 ★ When setting the puller in position, use a block at the end face of the clutch shaft when carrying out the operation.

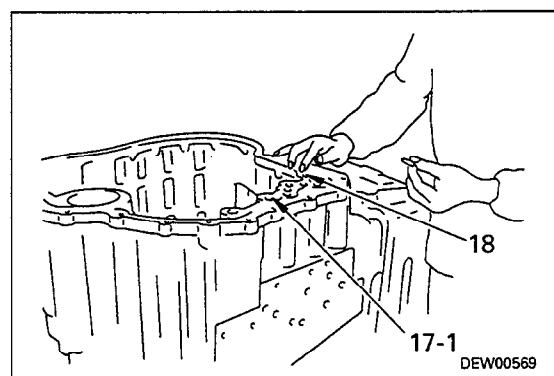
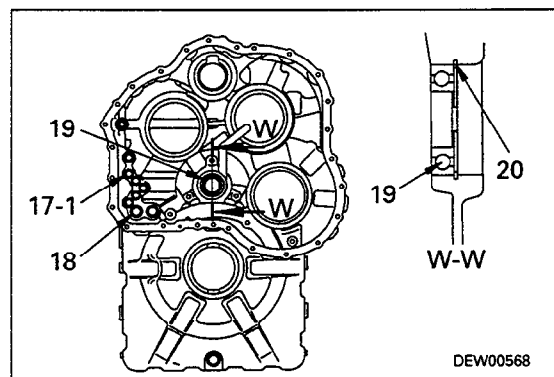
**⚠** There is oil on the shaft and gears, so be careful not to let them slip.

- 5) Remove bearing outer race (15) from transmission case.
- 6) Remove oil seal (16) and dust seal (17) of rear coupling.



## 7. Transmission case

- 1) Remove O-rings (17-1) and (18) from transmission case.
- 2) Remove bearing (19) and snap ring (20) of driven gear from case.

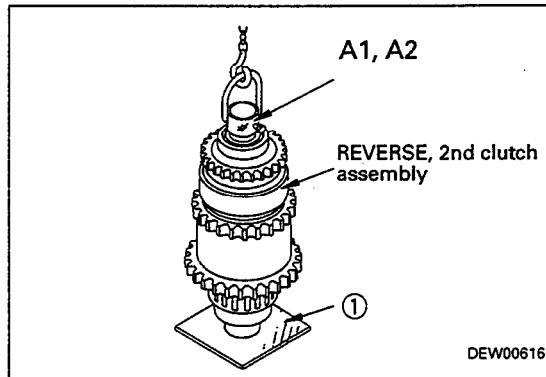


**REVERSE, 2ND CLUTCH ASSEMBLY**

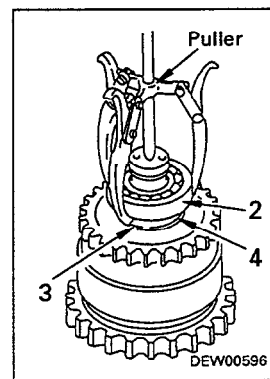
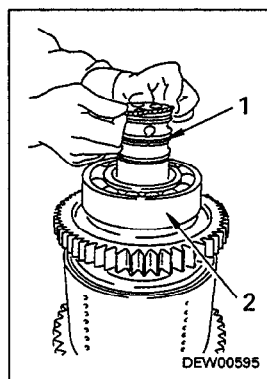
**1. Disassembly of REVERSE clutch pack**

- ★ Lift the clutch pack assembly with lifting tools A1 and A2, and install to stand ①.

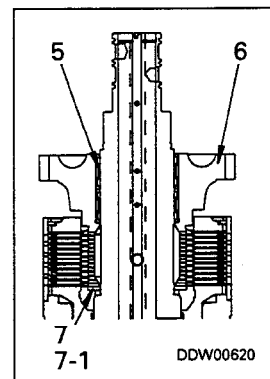
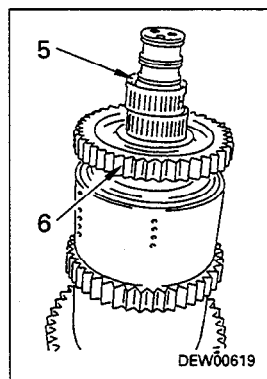
 REVERSE, 2nd clutch assembly: 90 kg



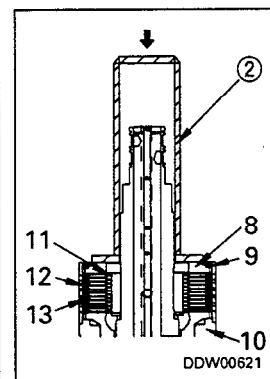
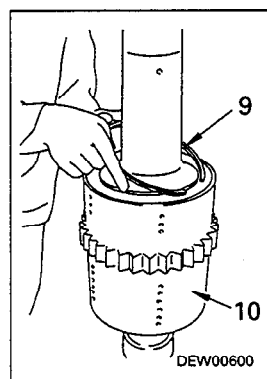
- 1) Seal rings  
Remove 3 seal rings (1) installed to shaft.
- 2) Bearing, thrust washer
  - i) Install puller to end face of shaft, and remove bearing (2).  
★ When setting the puller in position, install a block to the end face of the clutch shaft before carrying out the operation.
  - ii) Remove thrust washer (3) and spacer (4) from shaft.



- 3) Needle bearing, REVERSE gear
  - i) Remove needle bearing (5) and REVERSE gear (6) from shaft.
  - ii) Remove thrust washer (7) and spacer (7-1).



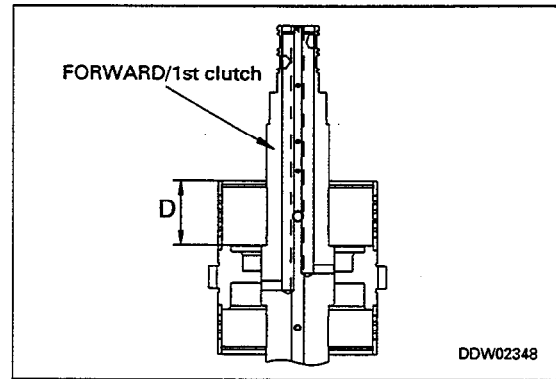
- 4) End plate  
Push end plate (8) with tool ②, remove snap ring (9), then remove end plate from clutch case (10).



**REVERSE, 2ND CLUTCH ASSEMBLY**

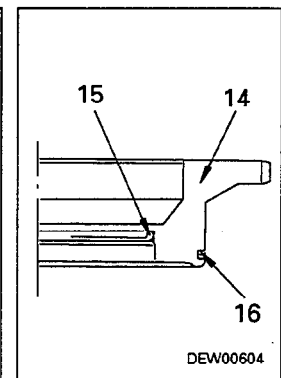
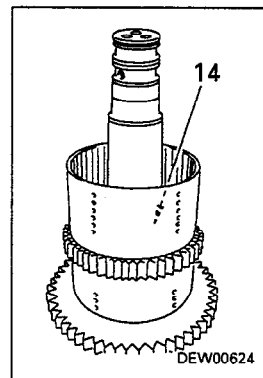
When assembling the REVERSE, 2nd clutch, always check dimension "D" of the REVERSE clutch case.

★ D: 90.5 mm

**1. Assembly of REVERSE clutch pack****1) REVERSE piston**


Install piston seals (15) and (16) to REVERSE piston (14), then install inside clutch case.

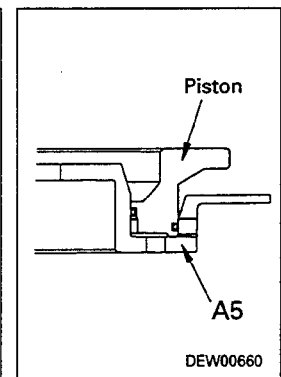
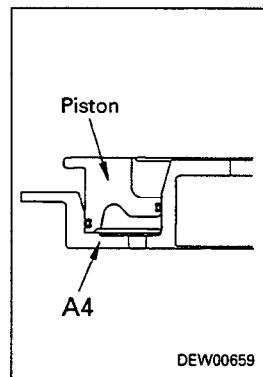
★ Replace the piston seal rings with new parts.



★ After assembling the seal rings to piston, set to tools A4 and A5 and settle for at least 5 seconds.

★ Carry out the settling operation for each piston.

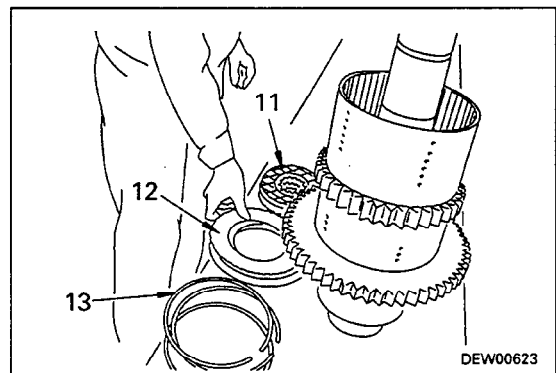
 Outer circumference of seal ring, contact surface: Oil (EO10-CD)

**2) Clutch plates**

Install separator plates (12), disc plates (11), and wave springs (13) inside clutch case (10).

★ Before assembling clutch disc plates (11), put them in a soaking bath for at least 2 minutes.

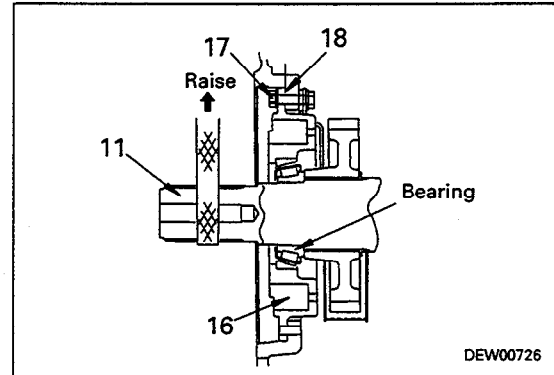
Oil: EO10-CD (API 10W-CD Class or above)



## ASSEMBLY OF PARKING BRAKE ASSEMBLY


### 1. Parking brake

- 1) Press fit bearing outer race to retainer (16), and bearing inner race to output shaft (11).
- 2) Install output shaft to transmission case, then insert shim (18) in retainer (16), and tighten with mounting bolts (17).
  - ★ Keep the output shaft horizontal when raising it.

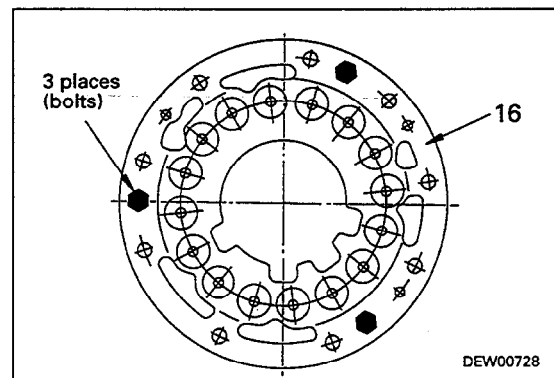


### 3) Adjusting shim


- i) Assemble shim of standard value, then tighten retainer (16) with 3 bolts.
  - ★ Standard shim thickness: 1.2 mm

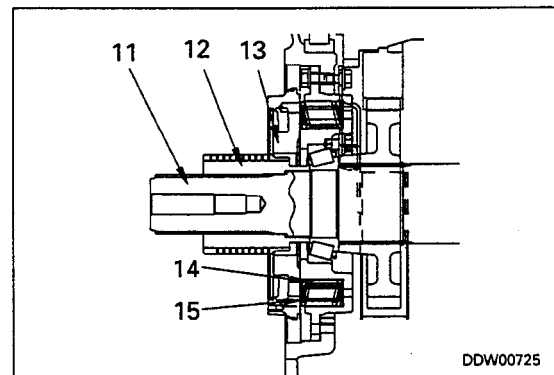
 **kgm** Mounting bolt:  
 $112.8 \pm 9.8 \text{ Nm}$  ( $11.5 \pm 1.0 \text{ kgm}$ )

- ★ Assemble retainer (16) so that the 4 casting holes are at the bottom.
- ii) Adjust shim so that rotating torque of output shaft is 9.8 – 98.1 Ncm (1 – 10 kgcm).
  - ★ When doing this, check that there is no end play.

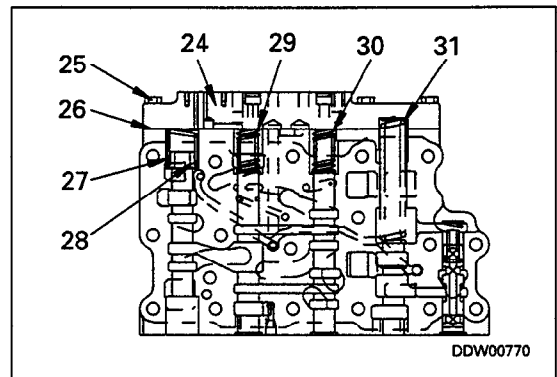


- 4) Install springs (14) and (15) to retainer, then install piston (13) and spline hub (12) to output shaft (11).

 Tip of spline hub: **Grease (LM-G)**



- 8) Lower R cover
- i) Remove mounting bolts (25) of lower R cover (24), then remove cover and gasket (26).
  - ii) Remove R return spring (27) and sleeve (28) of directional valve, return springs (29) and (30) of H-L selector valve and range selector valve, and spring (31) of priority valve from valve body.
- ★ After removing, cover with tape to prevent dirt or dust from entering the valve.

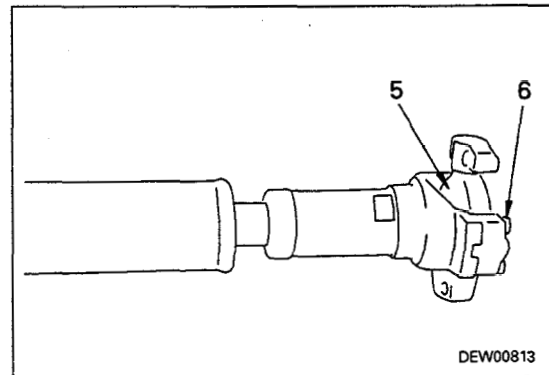


**2. Center drive shaft, rear drive shaft**

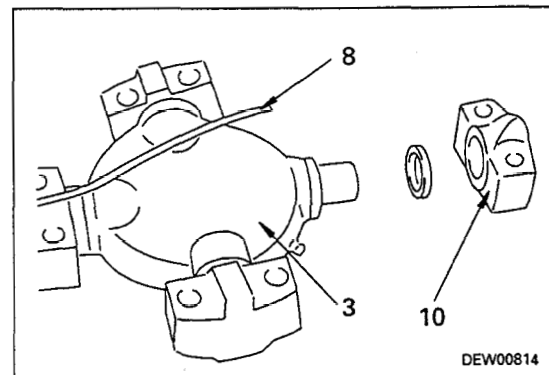
- ★ Carry out the same operation as in Step 1) for the front drive shaft.
- ★ When removing the rear drive shaft, push it in towards the transmission.

**3. Spider, bearing**

- 1) Remove bolts (6) of spider and bearing assembly (5), and tap with plastic hammer to remove.



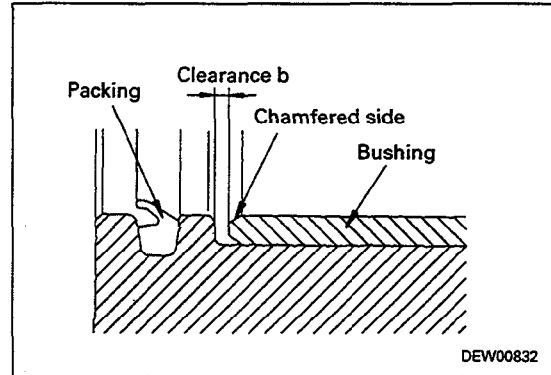
- 2) Remove strap (8) of spider (7), and pull out bearing cap (10).
  - ★ Use the same procedure for the front, center, and rear drive shafts.



※ 7

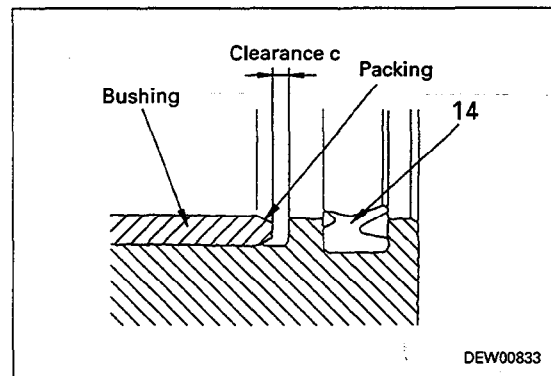
- ★ Pay attention to the direction of the packing, fit it securely in the groove, and assemble so that the lip is not turned over.
- ★ Check that the slit in the bushing is facing the side.

 Rear axle mount: Grease (G2-LI)



※ 8 ※ 10

- ★ Set so that the chamfered side of the bushing is on the axle housing side, and assemble so that the clearance is clearance b.
  - ★ Clearance b: Min. 0.5 mm
- ★ Pay attention to the direction of the packing, fit it securely in the groove, and assemble so that the lip is not turned over.
- ★ Install the bushing and packing to the front support in the same way as for the rear support.
  - ★ Clearance c: Min. 0.5 mm

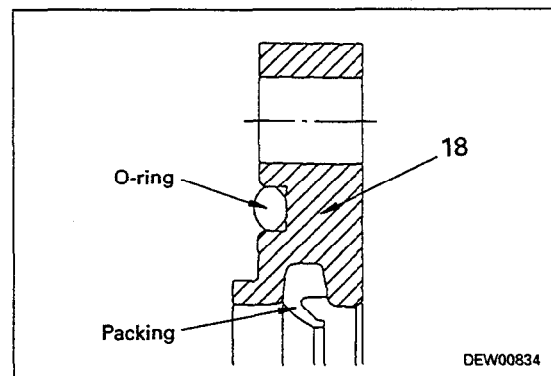


※ 9

- ★ Use new parts for the O-rings and packing.
- ★ Pay attention to the direction of the packing, fit it securely in the groove, and assemble so that the lip is not turned over.


 Retainer mounting bolt: Thread tightener (LT-2)


- Bleed the air from the brake system and carry out an actuation check.
  - ★ For details, see TESTING AND ADJUSTING, Bleeding air.
- Add hydraulic oil through the oil filler of the hydraulic tank to the specified level.



※ 7

- ★ Use a new part for the O-ring.
- ★ Fit the O-ring securely in the groove, and be careful that it does not get caught when installing.

 Differential mounting bolt:  
**Thread tightener (LT-2)**

 Differential mounting bolt:  
**176.5 ± 19.6 Nm (18.0 ± 2.0 kgm)**

- **Refilling with oil**

- Tighten the drain plug and add oil through the level plug to the specified level.
  - ★ Set the machine with the drain plug immediately at the bottom, then add oil through the level plug.


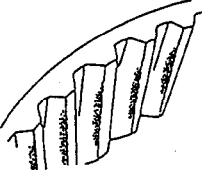
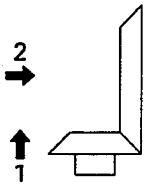
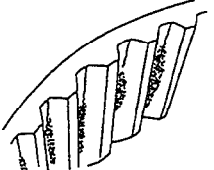
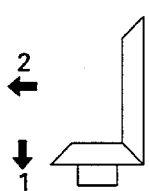

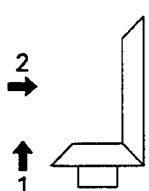

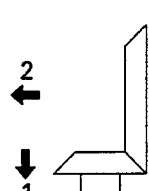


Axle oil: **65 l**

- Add hydraulic oil through the oil filler of the hydraulic tank to the specified level.
- Bleed the air from the brake system and carry out an actuation check.
  - ★ For details, see TESTING AND ADJUSTING, Bleeding air.

**11. Adjusting tooth contact**

Coat face of 7 or 8 teeth of bevel gear lightly with red lead (minimum). 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>

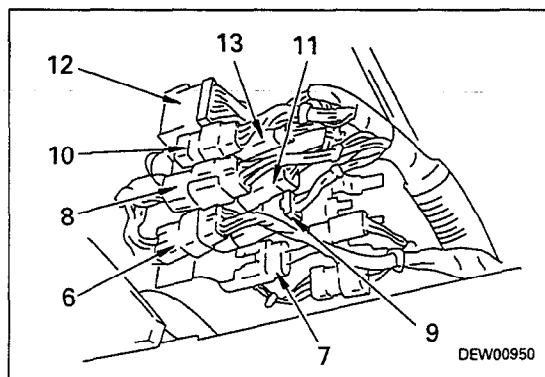
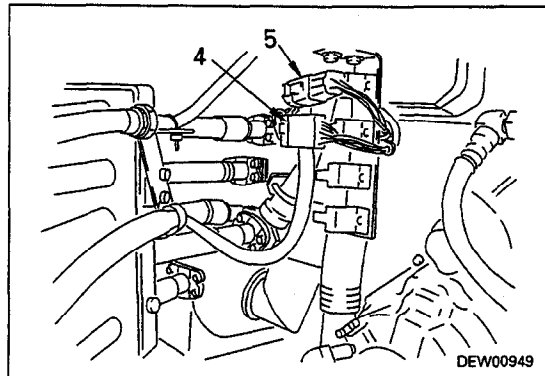
★ When adjusting the bevel gear, do not change the preload of the bearing. Adjust by moving shims between the left and right. Always keep the same total thickness of shims.

**3. Electric wiring**

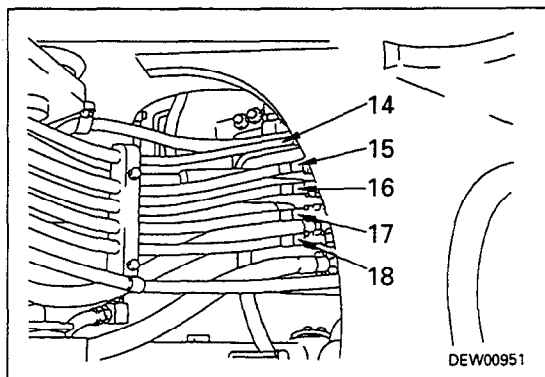
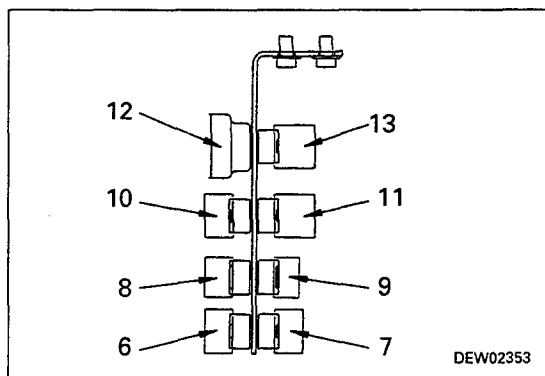
Disconnect the following electric wiring.

- 1) Disconnect front frame wiring FR1 (4) and FR2 (5).
- 2) Disconnect transmission wiring TL1 (6) and TL2 (7).
- 3) Disconnect floor wiring harnesses LR5 (8), LR6 (9), LR3 (10), LR4 (11), LR1 (12), and LR2 (13).

★ After disconnecting the connectors, mark with a tag to distinguish when installing.

**4. PPC piping**

- 1) Disconnect hoses (14), (15), (16), (17), and (18) between PPC valve and main control at connection inside front frame.




※ 11

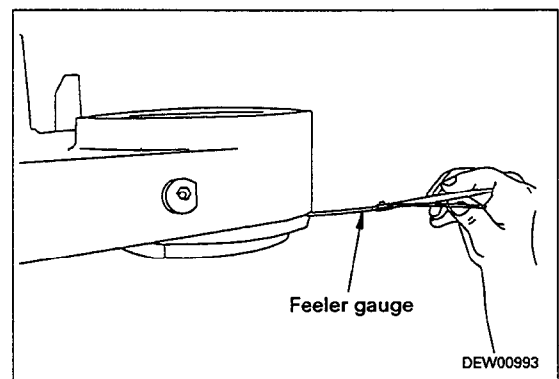
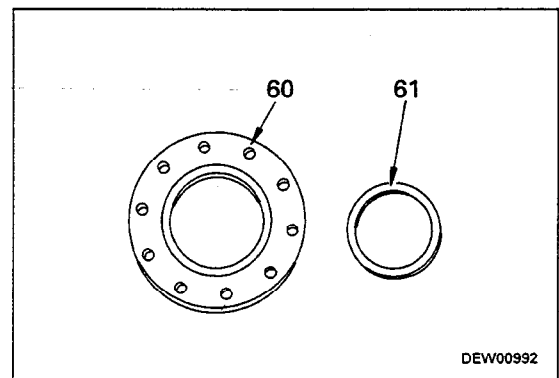
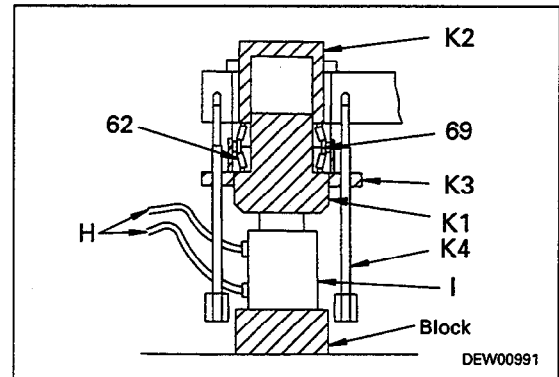
**Lower hinge**

- 1) Using tools H, I, K1, K2, and K3, press fit bearing (62) and spacer (69) to front frame.
  - ★ When press fitting, use tool K3 as a guide.
  - ★ Be careful not to fit the bearing at an angle.
  - ★ Fill the inside of the bearing with grease.
  - ★ When assembling the bearing, be careful not to forget to assemble the spacer.
  - ★ The bearing clearance is adjusted, so do not change the combination with the spacer.


When replacing, always replace as a set.


- 2) Press fit dust seal (61) to retainer(60).
  - ★ Press fit so that the dust seal lip surface is facing the outside.

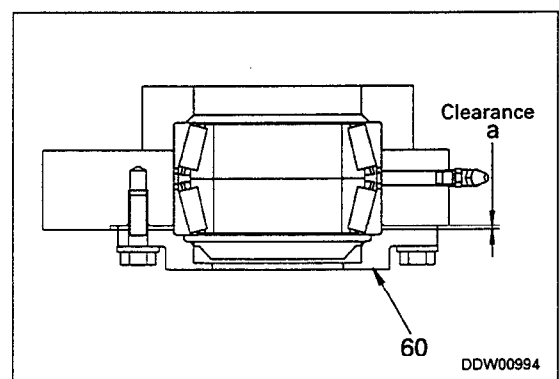
 Lip of oil seal: **Grease (G2-LI)**



- 3) Tighten retainer (60) with 3 mounting bolts, select shims so that maximum clearance a between retainer and hinge is less than 0.1 mm, then assemble.

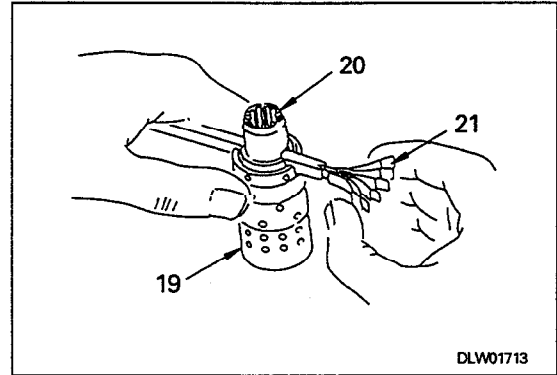
 **kgm** Mounting bolt:  
 $19.6 \pm 2 \text{ Nm}$  ( $2.0 \pm 0.2 \text{ kgm}$ )  
 (when adjusting shims)

 **kgm** Mounting bolt:  
 $112.8 \pm 9.8 \text{ Nm}$  ( $11.5 \pm 1.0 \text{ kgm}$ )

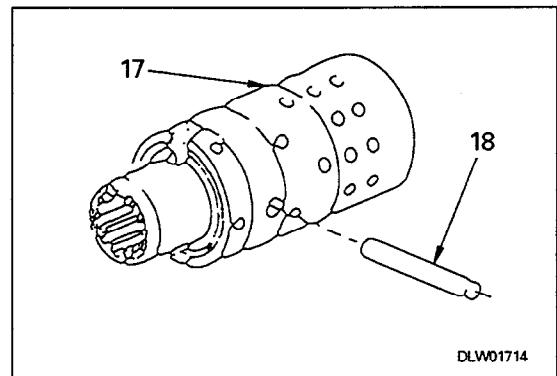


6. Align spring groove positions of spool (20) and sleeve (19), and set on flat plate, then insert spring (21) in spring groove.

★ Set so that the notches at both ends are at the bottom.



7. Insert pin (18) in spool and sleeve assembly (17).



8. Insert spool and sleeve assembly (17) in housing (10) in the direction of the arrow.

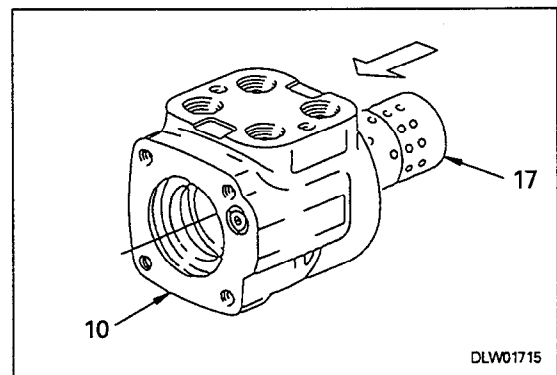
1) Keep pin horizontal and rotate to left and right a little at a time to insert.

★ Be extremely careful not to get it caught.

2) Make the spool and sleeve assembly flush with the rear end face of the housing.

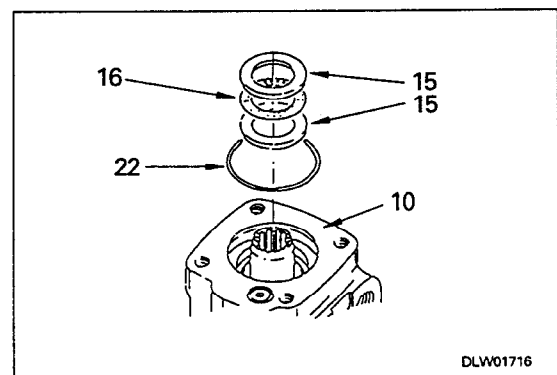
★ If it is inserted beyond the end face, the pin will fall out.

3) Check that spool and sleeve rotate smoothly inside housing.




9. Install O-ring (22) to housing (10).

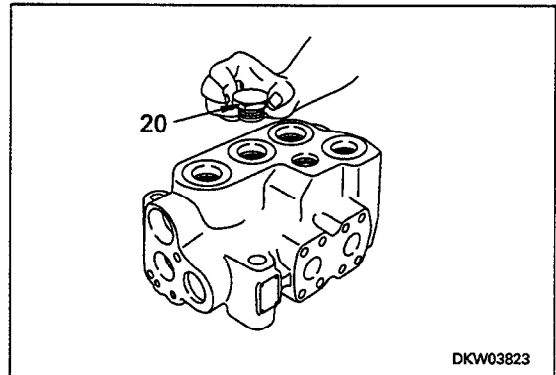
10. Fit 2 bearing races (15) and thrust needle (16) in case (10).



## ASSEMBLY OF STEERING DEMAND VALVE

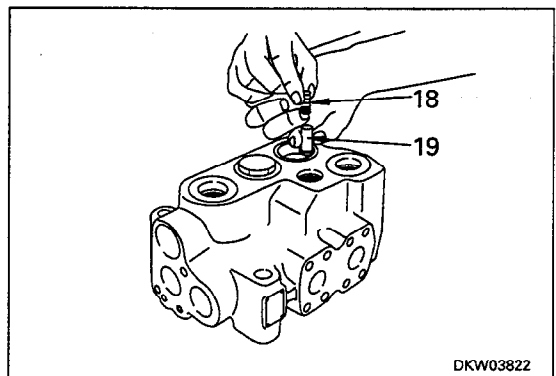
1. Fit O-ring to plug (20) and install to valve body.

 Plug:  $93.2 \pm 4.9 \text{ Nm}$  ( $9.5 \pm 0.5 \text{ kgm}$ )




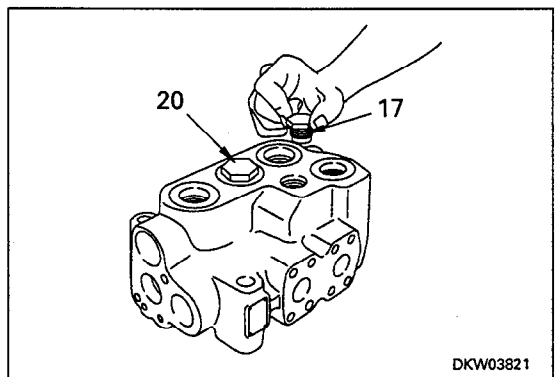
2. **Assembly of check valve**

- 1) Install poppet (19) and spring (18).



- 2) Fit O-ring (17) and install to valve body.


 Plug:  $63.7 \pm 4.9 \text{ Nm}$  ( $6.5 \pm 0.5 \text{ kgm}$ )

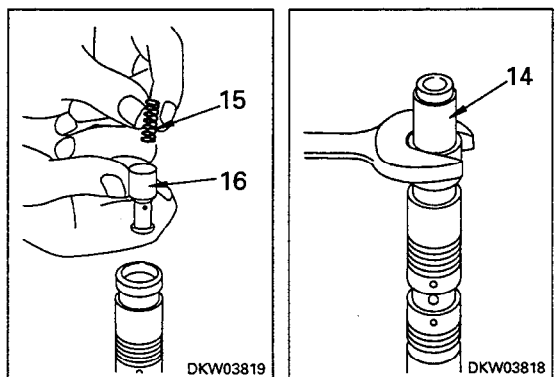


3. **Assembly of steering spool**

- 1) Install poppet (16) and spring (15) to spool.  
2) Fit O-ring to cap screw (14) and install to spool.

 Spool thread: **Adhesive (Loctite #271)**

 Cap screw:  
 $8.8 \pm 1.0 \text{ Nm}$  ( $0.9 \pm 0.1 \text{ kgm}$ )



## REMOVAL OF BRAKE VALVE ASSEMBLY

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

⚠ Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then operate the steering wheel and control levers several times to release the remaining pressure in the hydraulic piping.

⚠ Release the pressure inside the accumulator by depressing the brake pedal slowly and repeatedly (at least 17 times) until there is no more reaction when the brake pedal is depressed.

### 1. Covers

Remove covers (1) under cab.

### 2. Piping (right brake valve)

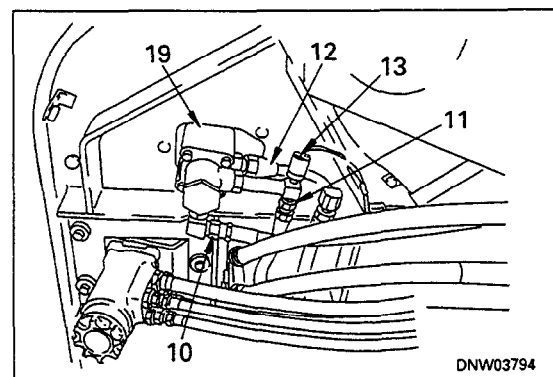
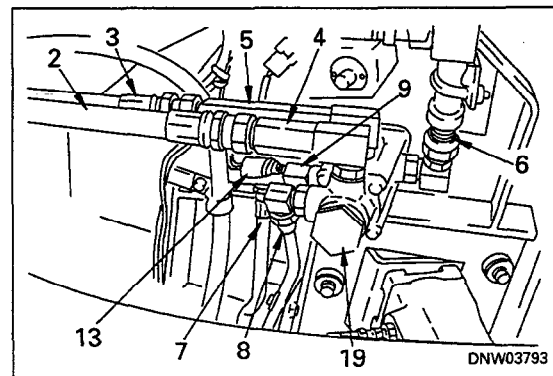
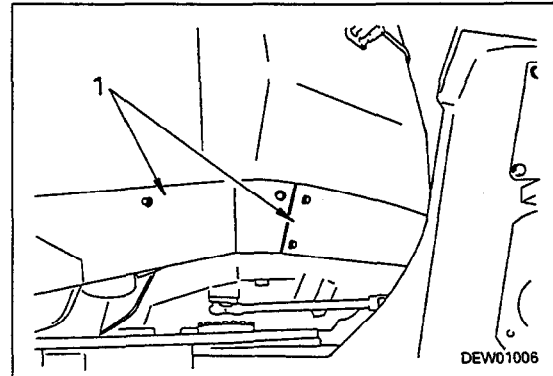
- 1) Disconnect hoses (2) and (3) between accumulator and brake valve, and adapters (4) and (5) at valve end. ※ 1
- 2) Disconnect brake valve drain hose and tube (6) at valve end.
- 3) Disconnect hose (7) going to left brake valve at valve end.
- 4) Disconnect tube (8) which goes to front brake and tube (9) going to rear brake at valve end. ※ 2

### 3. Piping (left brake valve)

- 1) Disconnect tube (10) and hose from accumulator to left brake valve at brake valve end. ※ 3
- 2) Disconnect left and right brake valve hoses and elbow (11) at brake valve end. ※ 4
- 3) Remove brake valve drain tube (12) and hose at valve end.
  - ★ After disconnecting the piping, make marks and fit plugs to prevent the entry of dirt or dust.

### 4. Wiring

Disconnect connector of brake valve switch sensor (13).



## DISASSEMBLY OF BRAKE ASSEMBLY

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

**⚠** Release the remaining pressure in the piping. For details, see REMOVAL OF RADIATOR ASSEMBLY.

- Jack up the axle, and set block ① under the front frame.

### 1. Tire, wheel

Jack up axle, and insert stand under axle, then lift off tire and wheel (1).

★ After removing the tire and wheel, set a stand under the axle housing.



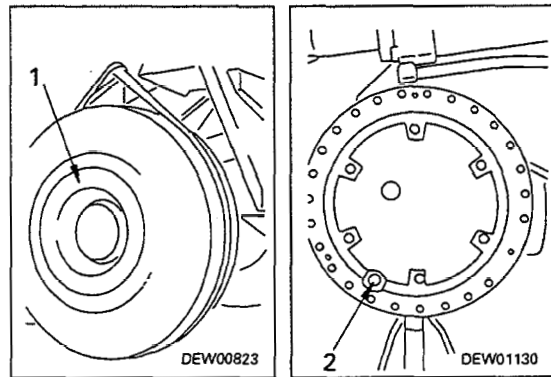
Tire, wheel: 675 kg (26.5-R25 tire)

### 2. Draining oil


Set drain plug (2) immediately at bottom, then remove plug and drain oil from case.

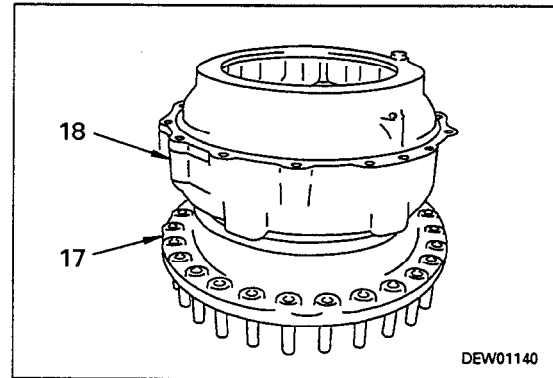


Axle oil: 65 ℓ

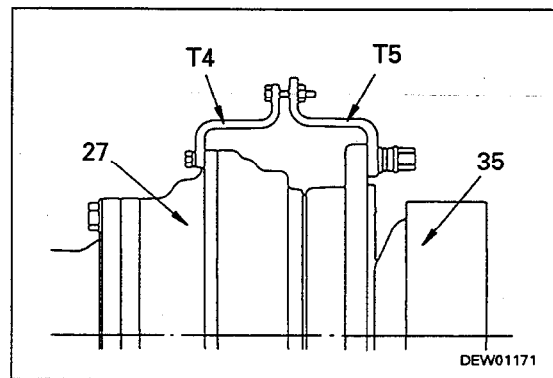


- 5) Using eyebolts, install cylinder assembly (18).

 Mounting bolt:  
 $176.5 \pm 19.6 \text{ Nm}$  ( $18.0 \pm 2.0 \text{ kgm}$ )




- 6) Set wheel hub (35) at bottom, and using tools T4 and T5, tighten uniformly so that it does not come out.



**5. Axle housing**

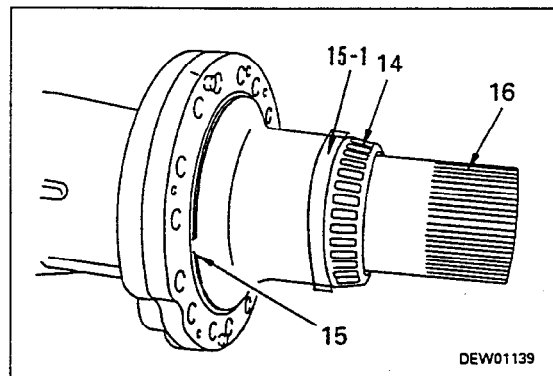
- 1) Install O-ring to trunnion and axle housing, and tighten with bolts.

★ Use a new part for the O-ring.

 Mounting bolt:  
 $34 \pm 5 \text{ Nm}$  ( $3.5 \pm 0.5 \text{ kgm}$ )

- 2) Install O-ring (15) and retainer (15-1) to trunnion (16), and press fit bearing (14).

★ Use a new part for the O-ring.




**6. Brake, wheel hub**

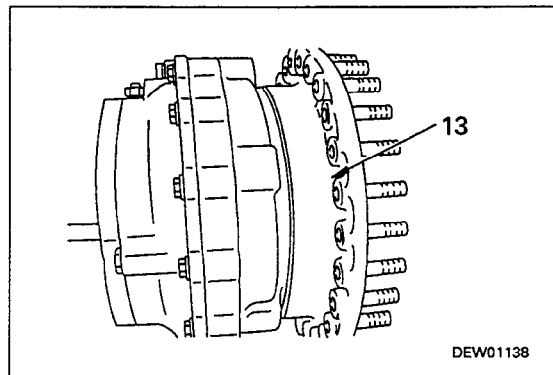
- 1) Raise brake and wheel hub (13), and set to axle housing mount, then tighten with mounting bolts.

★ Be careful of the center of gravity and raise the brake horizontally.

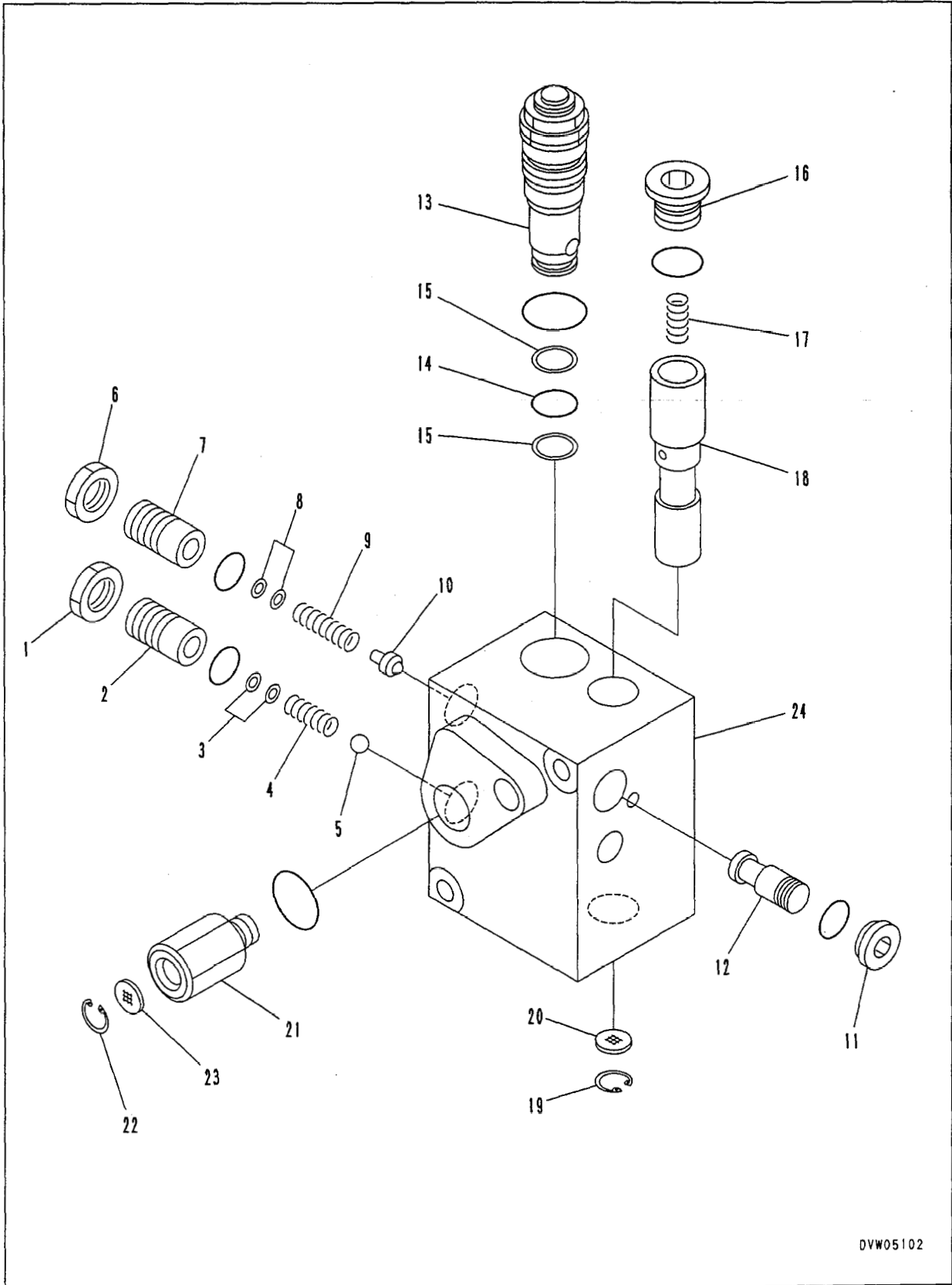
★ If it is forced in, the O-ring will be twisted and damaged, so align the center and install slowly.

 Mounting bolt:  
**Thread tightener (LT-2)**

 Mounting bolt:  
 $926.7 \pm 103 \text{ Nm}$  ( $94.5 \pm 10.5 \text{ kgm}$ )



# ASSEMBLY OF ACCUMULATOR CHARGE VALVE ASSEMBLY



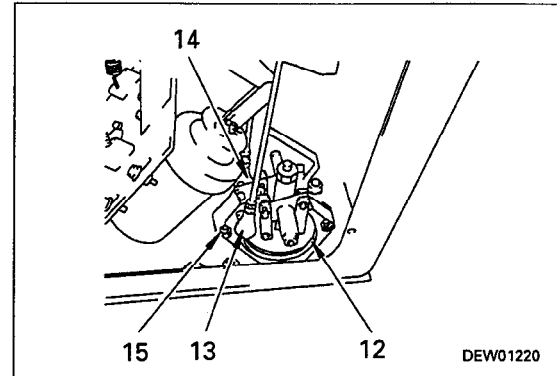
DVW05102


**5. PPC valve**

- 1) Remove joints (13) and (14) of rod installed to PPC valve assembly (12).
- 2) Remove mounting bolts (15) of PPC valve assembly, then remove valve assembly.



PPC valve assembly: 3 kg

**INSTALLATION OF PPC VALVE ASSEMBLY**

- Carry out installation in the reverse order to removal.
- **Refilling with oil**  
Tighten drain plugs (1) and (2) at the top of the hydraulic tank filter, and add hydraulic oil through the oil filler to the specified level.  
 Plug at top of filter:  
**11.8 ± 1 Nm (1.2 ± 0.1 kgm)**
- **Bleeding air**  
Bleed air from PPC line.  
For details of the procedure for bleeding the air, see TESTING AND ADJUSTING.

## REMOVAL OF DUMP CYLINDER ASSEMBLY

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

⚠ Release the remaining pressure in the piping. For details, see REMOVAL OF RADIATOR ASSEMBLY.

1. Disconnect connector (1) of bucket positioner wiring.

2. Disconnect grease hose (2) at front frame end.

### 3. Hydraulic piping

※ 1

1) Disconnect rod hose (3) at cylinder end.

2) Disconnect bottom hose (4) at cylinder end.

★ After disconnecting the hoses, fit plugs to prevent the entry of dirt or dust.

### 4. Dump cylinder

1) Sling dump cylinder (7), then remove lock bolts, and remove pin (5) and pin (6). ※ 2

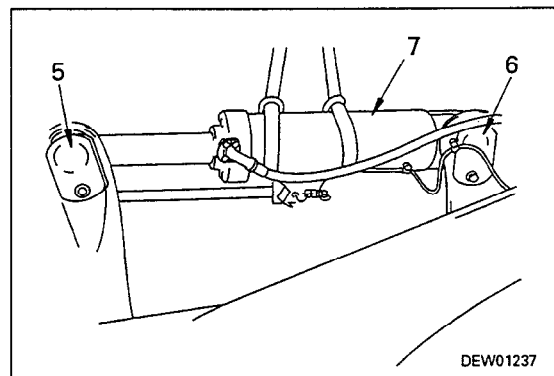
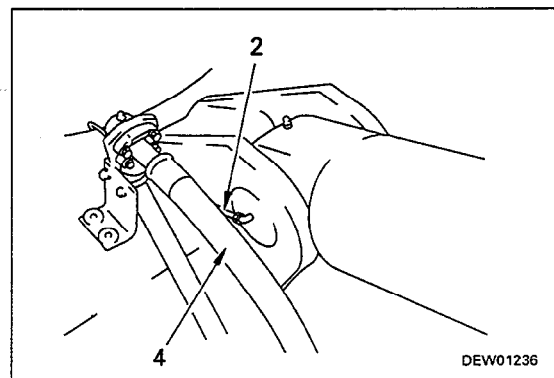
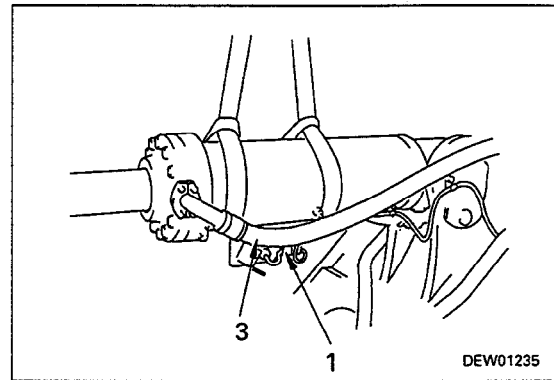
★ When slinging, be careful of the center of gravity and sling from two points.

★ If there are shims installed, check the number and thickness of the shims, and keep in a safe place.

2) Lift off dump cylinder (1).



Dump cylinder: 227 kg



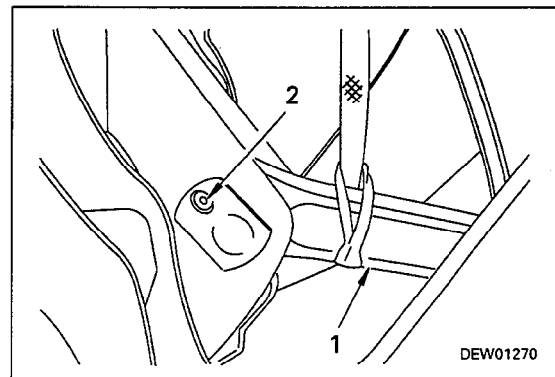
## REMOVAL OF WORK EQUIPMENT ASSEMBLY

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

**⚠** Release the remaining pressure in the piping. For details, see REMOVAL OF RADIATOR ASSEMBLY.

### 1. Bucket link, hinge pin ※ 1

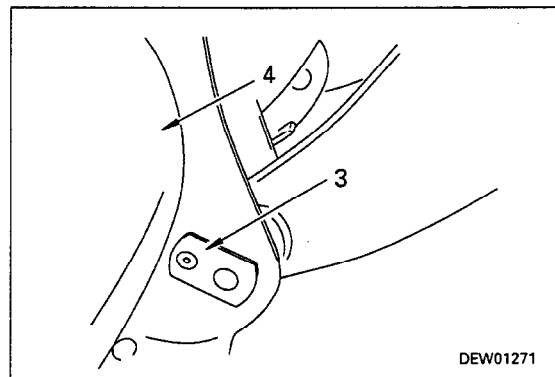
- 1) Sling bucket link (1), and remove mounting pin (2).
  - ★ Remove the cord ring.
  - ★ Secure bucket link (1) to the bellcrank with wire.



- 2) Remove bucket hinge mounting pin (3).
  - ★ Remove the cord ring.

**⚠** Never insert your fingers in the pin hole.


- 3) Move machine to rear and disconnect bucket (4).

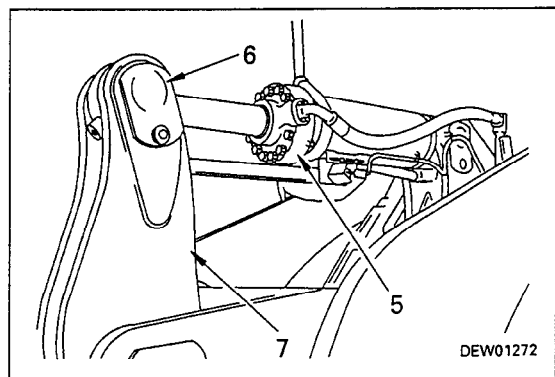


### 2. Dump cylinder pin ※ 2

Sling dump cylinder (5), then remove mounting pin (6), and disconnect cylinder rod and bellcrank (7).

- ★ Fit a lifting tool to the dump cylinder and fix it to the rear.

 Dump cylinder: 227 kg

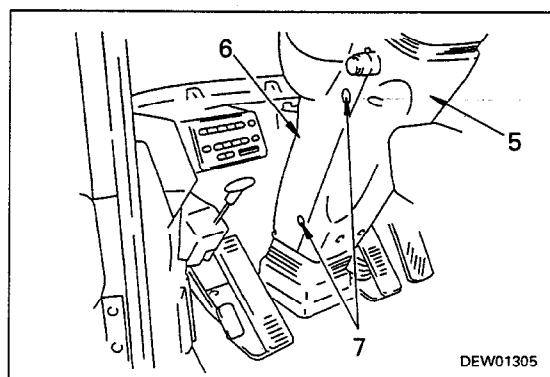
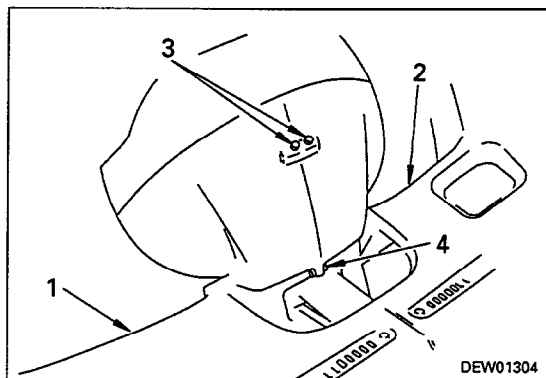


## REMOVAL OF MAIN MONITOR ASSEMBLY

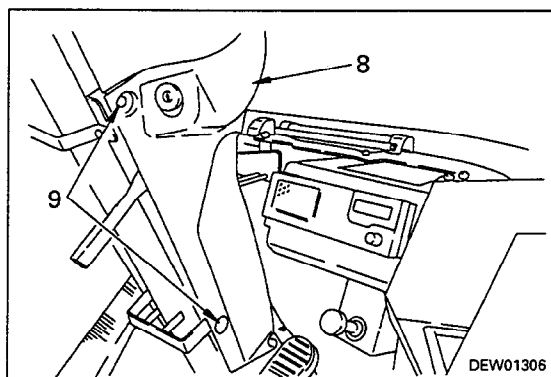
**⚠** Stop the machine on level ground and install the safety bar on the frame. Lower the bucket to the ground and stop the engine. Then apply the parking brake and put blocks under the wheels to prevent the machine from moving.

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

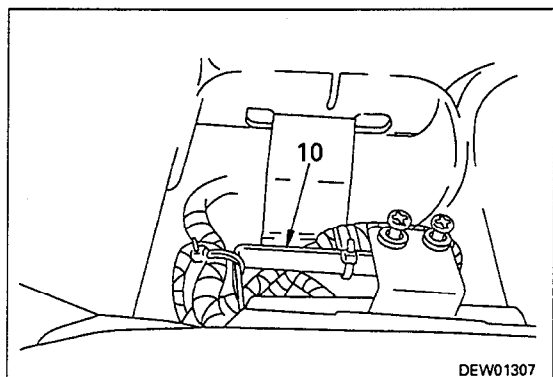
1. Remove dashboards (1) and (2).
2. Remove steering post cover mounting bolts (3) and (4).
3. Remove steering post cover (5).
4. Remove mounting bolt caps (7) of steering post cover (6), then remove bolts.



5. Remove mounting bolt caps from steering post cover (8), then remove mounting bolts (9).  
★ Tip the steering post cover to the front.



6. Remove bracket (10) at back of main monitor.



## INSTALLATION OF AIR CONDITIONER CONDENSER ASSEMBLY

- Carry out installation in the reverse order to removal.


※ 1


- ★ Do not remove the plugs from the hoses or condenser connections until immediately before installing.

- ★ Install the hoses without twisting.

 Hose, connection:

**Compressor oil for new refrigerant  
(ND-OIL8)**

 Condenser top connection:  
**19.6 – 24.5 Nm (2.0 – 2.5 kgm)**

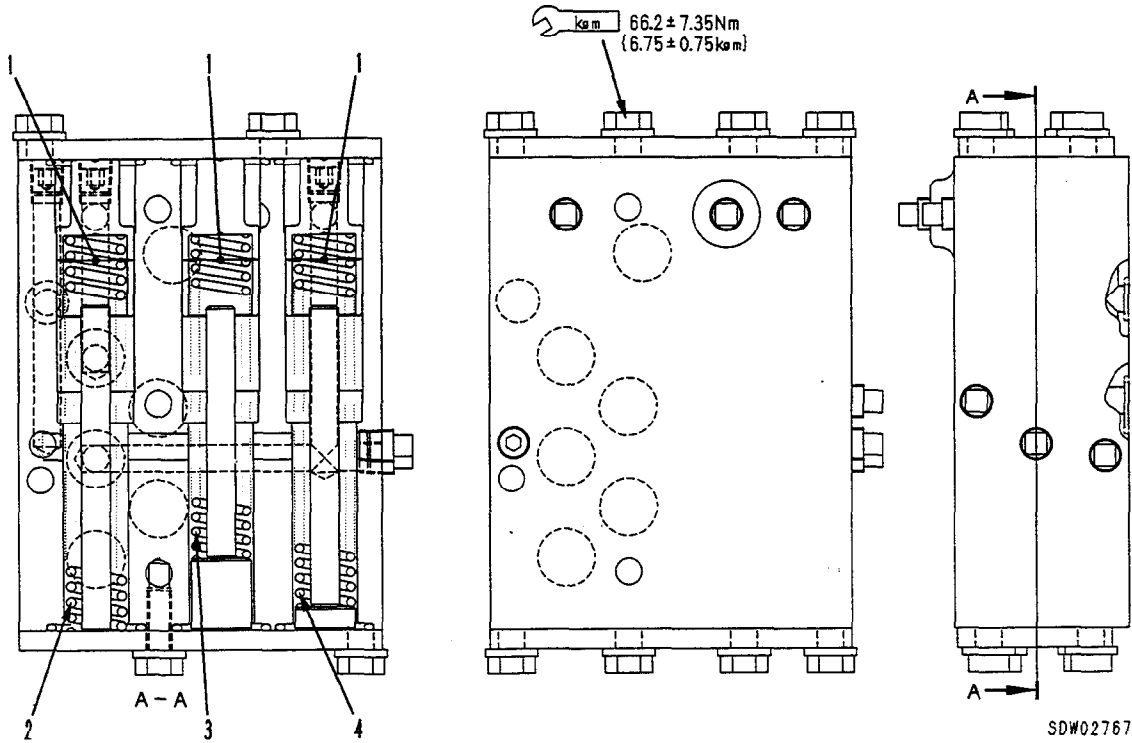
 Condenser bottom connection:  
**11.8 – 14.7 Nm (1.2 – 1.5 kgm)**

- Fill the air conditioner with new refrigerant.
  - ★ **Precautions when filling air conditioner line with new refrigerant**
    - 1) Keep the temperature inside the room at above 3°C.  
(If the temperature is below 3°C, the system will not work.)
    - 2) Use R134a as the refrigerant.
    - 3) When filling with refrigerant, always use the repeat vacuum method to completely evacuate. (Attainment of vacuum: Min. 750 mmHg.)
    - 4) Charge with 1.5 – 1.6 kg of refrigerant.
    - 5) Do not use the can of refrigerant upside-down or use any other mistaken method. Be careful not to let liquid freon get into the refrigerating system.
    - 6) Do not operate the compressor before charging with refrigerant.

Unit: mm

No.	Check item	Criteria				Remedy
		Standard size	Tolerance		Standard clearance	
Shaft	Hole					
21	Clearance (R) between 3rd/4th clutch bearing and housing	130	0 -0.018	+0.030 0	0 - 0.048	—
22	Clearance (F) between 3rd/4th clutch bearing and housing	160	0 -0.025	+0.030 0	0 - 0.055	—
23	Clearance (R) between countershaft and bearing	45	+0.025 +0.009	0 -0.012	-0.037 - -0.009	—
24	Clearance (R) between countershaft bearing and housing	100	0 -0.015	+0.030 0	0 - 0.045	—
25	Clearance (F) between countershaft and bearing	40	+0.025 +0.009	0 -0.012	-0.037 - -0.009	—
26	Clearance (F) between countershaft bearing and housing	80	0 -0.013	+0.030 0	0 - -0.043	—
27	Inside diameter of seal ring fitting face	Standard size	Tolerance		Clearance limit	
		55	+0.05 0		55.1	
	Seal ring groove width	3.2	+0.076 0		3.5	
	Seal ring width	3.1	±0.05		2.8	
	Seal ring thickness	2.29	0 -0.1		2.1	
28	Outside diameter of sliding face of coupling oil seal (R)	105	0 -0.087		104.8	
29	Outside diameter of sliding face of coupling oil seal (F)	105	0 -0.087		104.8	
30	Clearance between output shaft cover and housing	Standard clearance		Clearance limit		
		0.5 - 1.4 (Standard shim thickness)		—		
31	Free turning torque of output shaft	0.098 - 0.98 Nm (0.01 - 0.1 kgm)				

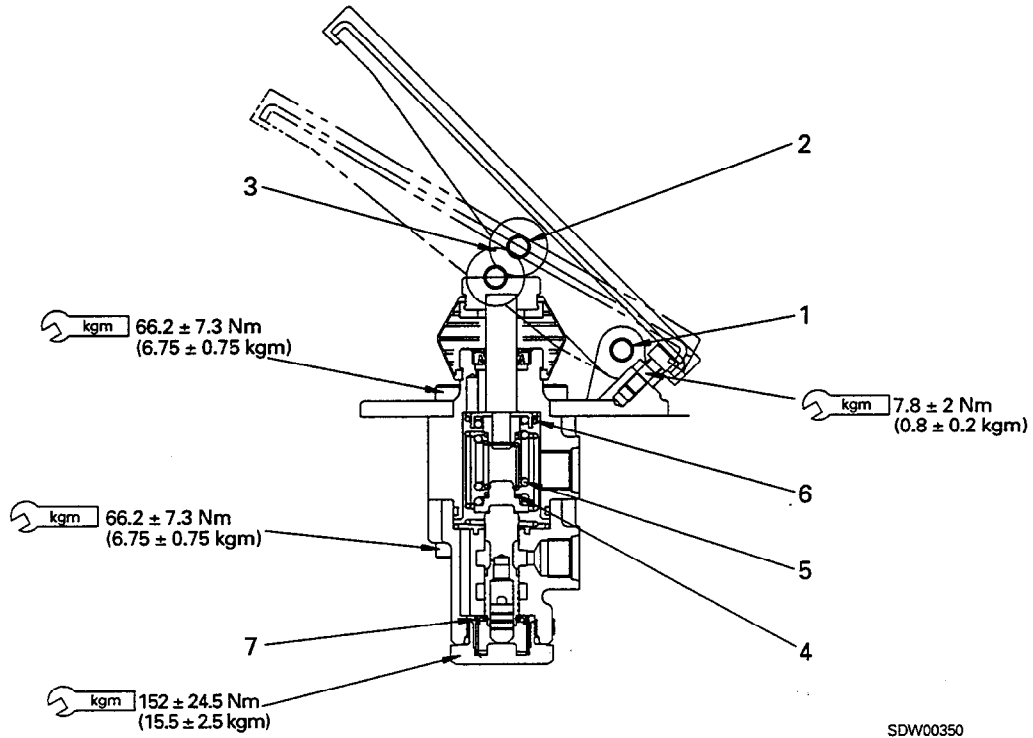
ACCUMULATOR VALVE



Unit: mm

No.	Check item	Criteria				Remedy	
		Standard size	Tolerance		Standard clearance		Allowable clearance
	Shaft		Hole				
1	Clearance between accumulator valve and body	32	-0.035 -0.045	+0.025 0	0.035 - 0.07	0.09	
2	Forward accumulator valve spring	Standard size			Clearance limit		Replace
		Free length	Fitting height	Fitting load	Free length	Fitting load	
		184.8	165	319 N (32.5 kg)	179.3	303 N (30.9 kg)	
3	1st gear accumulator valve spring	145	135	78.5 N (8.0 kg)	140.7	74.5 N (7.60 kg)	
4	2nd gear accumulator valve spring	157.7	155	33.3 N (3.4 kg)	153.0	31.7 N (3.23 kg)	

**BRAKE VALVE (SINGLE)**

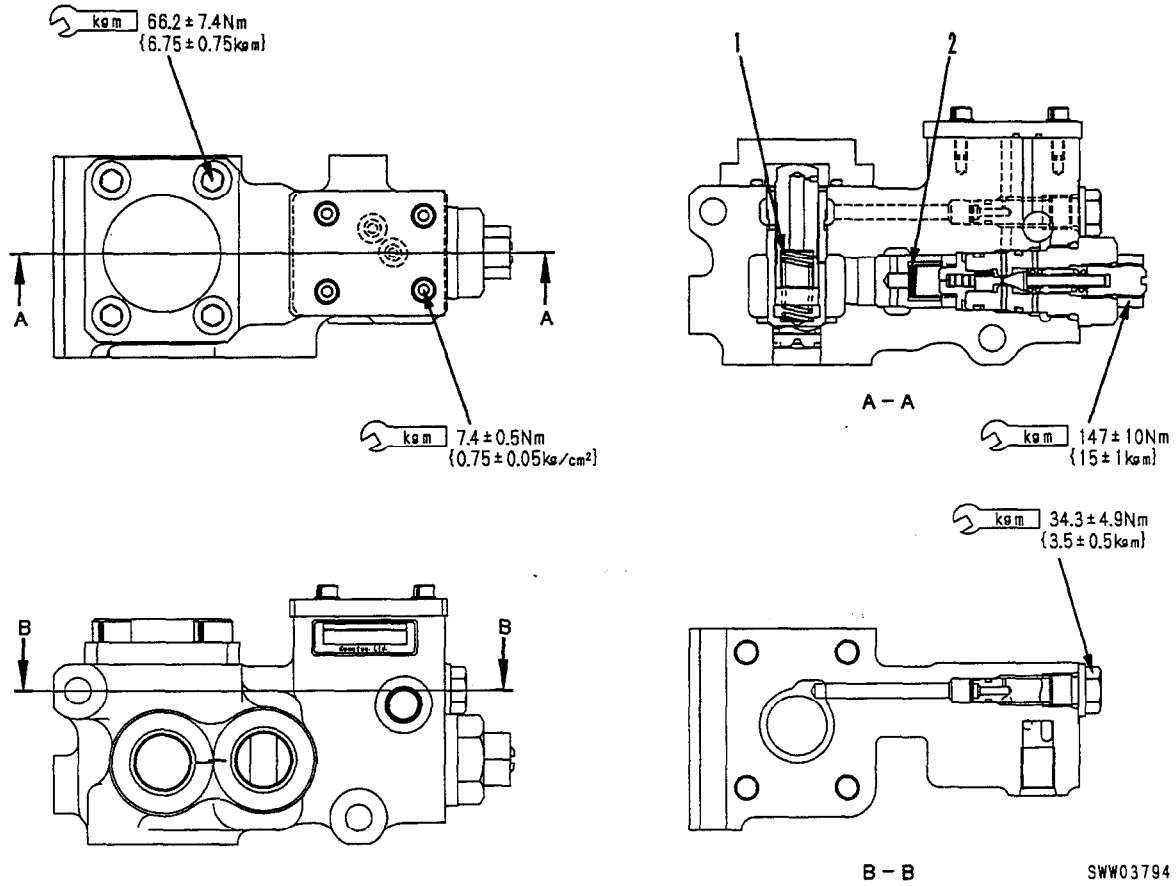


SDW00350

Unit: mm

No.	Check item	Criteria				Remedy
		Standard size	Tolerance		Standard clearance	
1	Clearance between pedal mount hole and bracket hole	10	-0.025 -0.075	+0.1 0	0.025 – 0.175	0.25
2	Clearance between roller and pin	10	-0.025 -0.075	+0.1 0	0.025 – 0.175	0.25
3	Outside diameter of roller	Standard size	Tolerance		Repair limit	
		30	0 -0.5		29.2	
4	Control spring	Standard size			Repair limit	
		Free length	Test height	Test load	Free length	Test load
		34	33.5	3.82 N (0.39 kg)	33	
5	Control spring	46.3	46	11.8 N (1.2 kg)	45.3	
6	Return spring	86.2	58	60.8 N (6.2 kg)	78	
7	Return spring	31.5	19.5	16.7 N (1.7 kg)	28	

CUT-OFF VALVE



Unit: mm

No.	Check item	Criteria				Remedy	
		Standard size		Repair limit			
		Free length	Installed length	Installed load	Free length	Installed load	
1	Unload valve spring	37	30	35.3 N (3.6 kg)	—	28.4 N (2.9 kg)	Replace
2	Check valve spring	33	20	1.7 N (0.17 kg)	—	1.4 N (0.14 kg)	

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