UH02
WH03

1. GENERAL

The HITACHI UH02 hydraulic excavator consists mainly of the revolving frame and cab (or upper structure); track frame and crawler assembly (or undercarriage); and various front end equipments. Fig. 1-1 shows the names of component parts of the excavator.

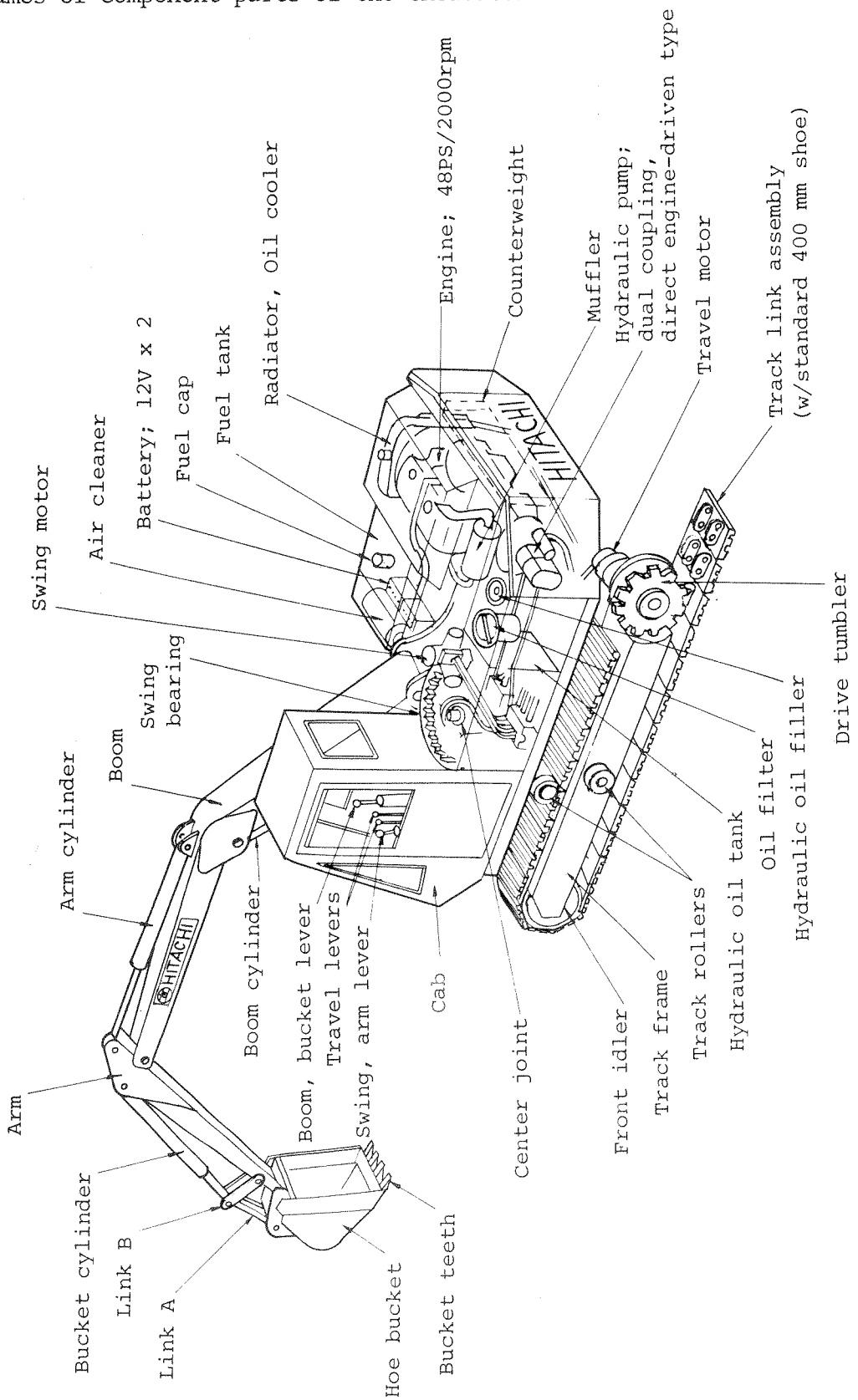


Fig. 1-1 HITACHI Model UH02 Hydraulic Excavator (Backhoe)

2. ENGINE

Refer to ISUZU SHOP MANUAL for more details of Engine Service Data.

2.1 GENERAL SPECIFICATION

(1) Model	ISUZE C330
(2) Type	4-stroke cycle, water-cooled, overhead valve, vertical, in-line, swirl chamber type diesel.
(3) Number of cylinders	4
(4) Bore x Stroke	98 mm x 110 mm
(5) Piston displacement	3318 cc
(6) Compression ratio	19.5
(7) Performance characteristics	(Refer to Fig. 2-2)
Rated output	48^{+4}_{-0} HP/2000 rpm
Max. torque	not less than 19.5 kgm (at 1600 rpm)
Fuel consumption rate	less than 200 g/HP.hr (at 2000 rpm)
Oil consumption	less than 50 cc/hr (at rated output)
No load max. rpm	2150±50 rpm
No load min. rpm	650±50 rpm
(8) Dry weight	325 kg
(9) Dimensions	Overall length x Overall width x Overall height 812 mm x 630 mm x 791 mm
(10) Firing order	1-3-4-2
(11) Direction of rotation	Clockwise as viewed from fan side
(12) Fuel system	
(a) Fuel injection pump	
Model	DIESEL KIKI NP-PES4A80 C912
Type	BOSCH type, in-line
Plunger	Dia. 8 mm
(b) Fuel injection nozzle	DIESIL KIKI NP-DNOSD211
Type	BOSCH type, closed throttle type
Injection pressure	120 kg/cm^2
Injection timer	Nil
(c) Feed pump	
Model	DIESEL KIKI NP-FP/KS22AC47
Type	BOSCH type, plunger type
(d) Governor	
Model	DIESEL KIKI NP-EP/RSV
Type	BOSCH type, mechamical, all-speed controlled
(e) Fuel filter	Paper element type

Standard	Remark
(a) Shaft journals are damaged due to foreign particles stuck in between, or to high pressure built up in the pump. (b) Gears are damaged on their sides due to seizure.	
(2) The drive and driven shafts must be replaced with new ones as a matched set if any gear is worn locally so that the difference in thickness in that gear exceeds 0.01 mm.	Worn gears will usually be accompanied by worn pedestal on that area where it is in contact with the gear. Usual practice to remedy this condition is to replace the pump as a unit. If the pedestal is not worn and in good condition, replace the driven and drive shafts only as a set. Replace the pump with a new one as a unit.
(3) If any one shaft is found to be taper by more than 0.01 mm along its entire length, replace both shafts together with the gears.	
4. Pedestal	
(1) Replace the pump as a unit if pedestal is worn, damaged or cracked on the side due to high pressure, cavitation, seizure or improper grade of oil.	(1) Replace the pump as a unit (gears might have been also damaged).
(2) Replace the pump as a unit if pedestal is damaged due to foreign particles or abnormal pressure built up in the pump.	(2) Replace the pump as a unit (gears might have been also damaged).
(3) Roughness in naturally worn surface of pedestal in excess of 0.02 mm.	(3) Replace pedestal only if amount of wear on gear is below 0.01 mm.
(4) Out of roundness of metal in excess of 0.02 mm.	(4) Replace the pump as a unit.

(3) Pulling plunger

When the plunger is moved to the righthand side overcoming against the force of return spring, pressure oil from the pumps flows through the high pressure passage, forcing the poppet valve up and enters into the actuator.
Return oil from the actuator enters through the cylinder port A into the control valve, flows the low pressure passage to the tank.
(Refer to Fig. 4-8 and 4-9)
When the plunger is returned to the neutral position, it is moved by return spring.

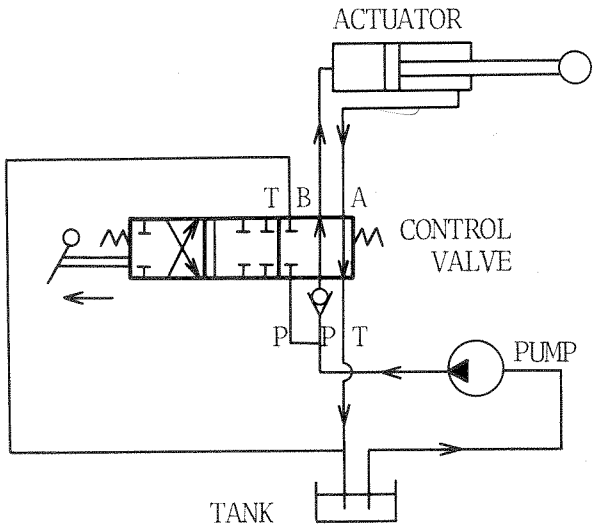
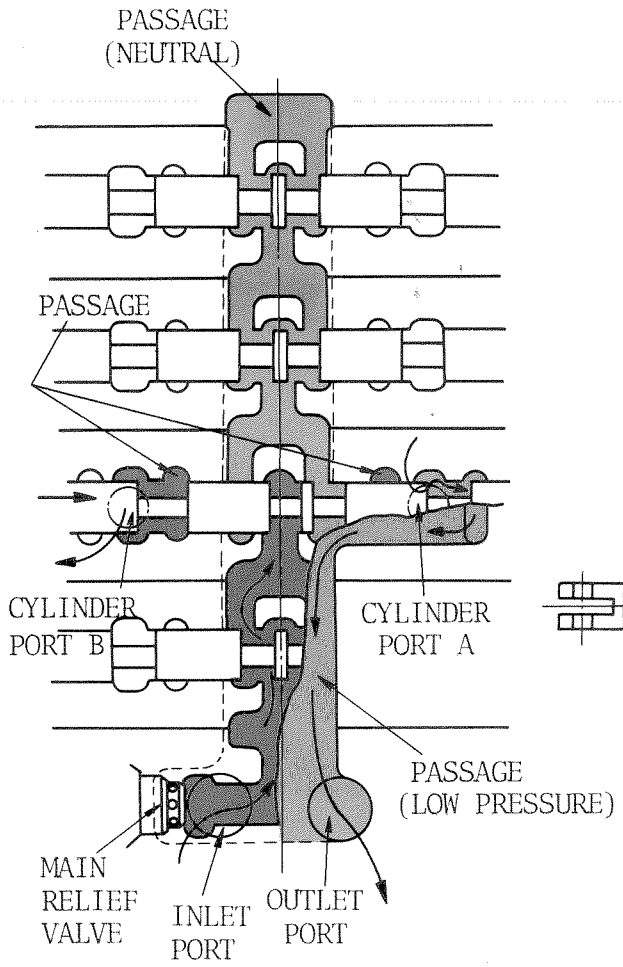


Fig. 4-8



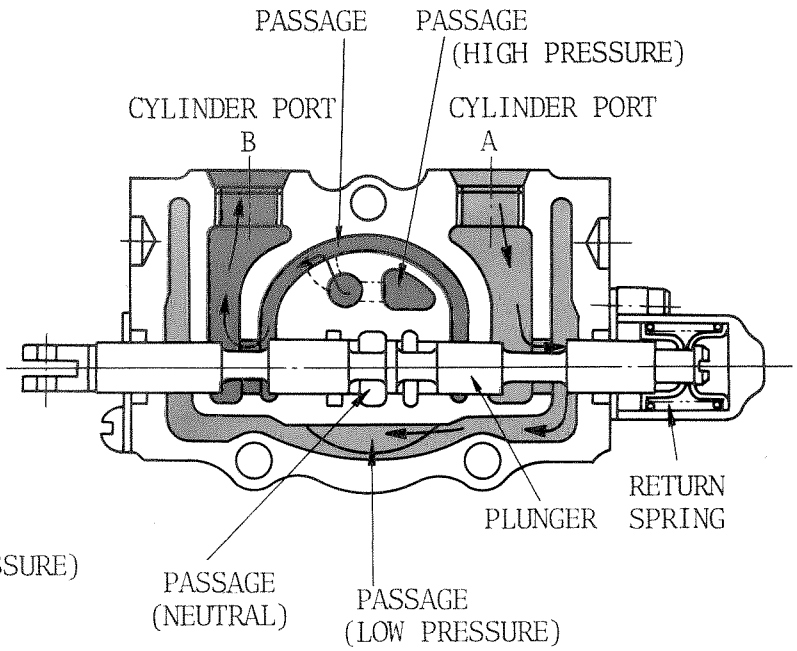
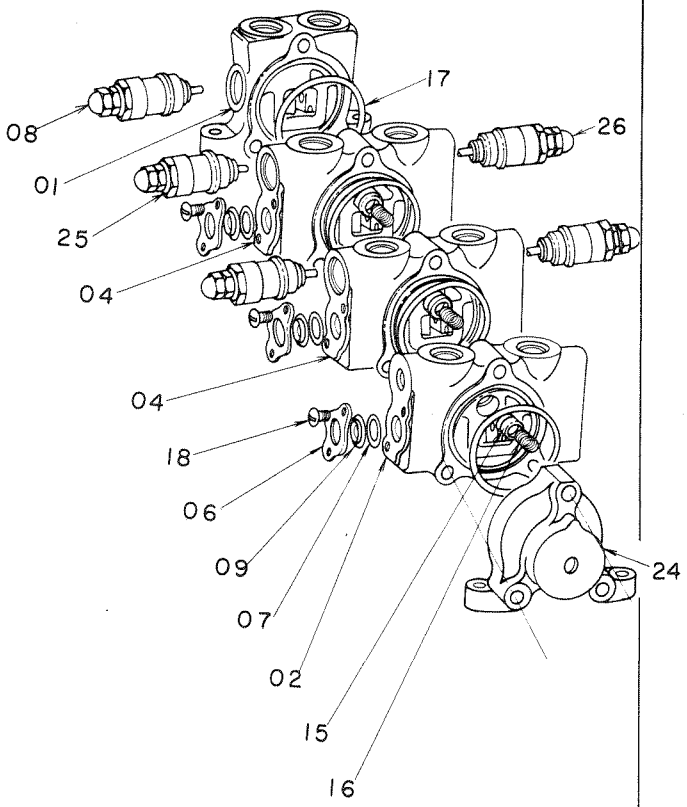
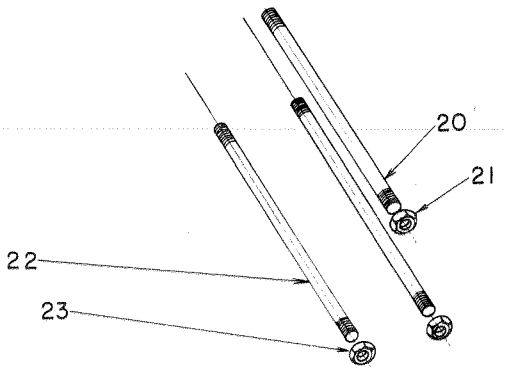
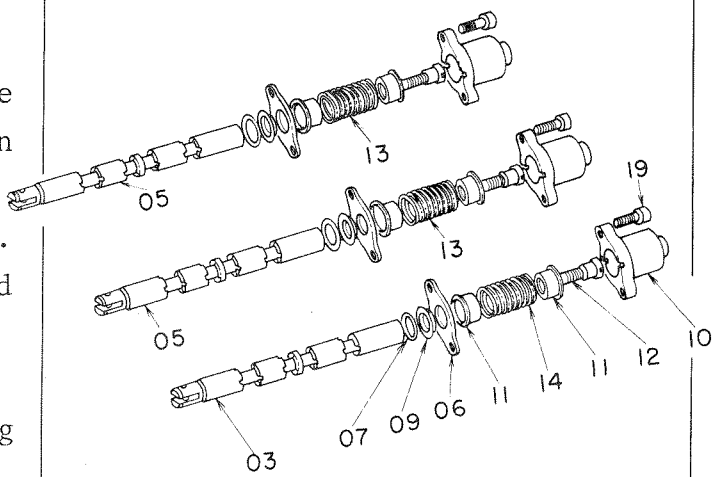


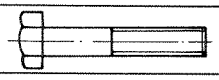
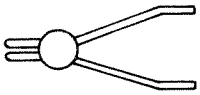
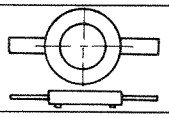
Fig. 4-9

4.6 DISASSEMBLY AND ASSEMBLY OF CONTROL VALVE

(1) Disassembly (Right)

Procedure	Illustration
1. Clean the outside of the control valves and the connected pipelines. Prevent the machined surface of the control valves from marring which causes leakage at the port connectors. 2. Remove nuts (21) and (23) and rods (20) and (22) holding housings (01), (02), (04) and (24). Their housings will then be free. Remove O-rings (17) from their housings. 3. Inlet section disassembly 3.1 Remove relief valve (08) from housing (01). Take the removed relief valve to pieces at the time of trouble only.	 
4. Plunger section disassembly (02). 4.1 Remove screws (18) which hold plate (06), wiper (09) and O-ring (07) in position. Remove the plate, wiper and O-ring. 4.2 Remove socket bolts (19) which hold cap (10) in place. Remove the cap. 4.3 Remove screw (12) which hold spring guides (11) and spring (14) in the plunger.	

(2) Disassembling (Assembling) tools

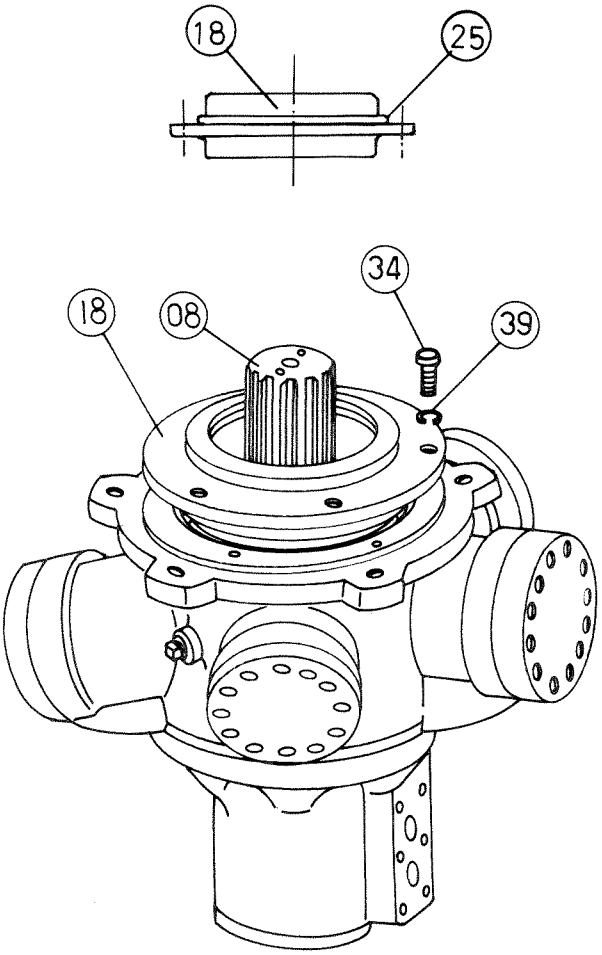
Name		Quantity	
Allen wrench (For M8. JIS, B4648)		1	
Bolt M10 x 1.5 x 80 ℓ		2	
Pliers	For shaft	1	
	For hole	1	
Ring nut disassembling (assembling) jig		1	

(3) Bolts to be used

		MR-100x-S-A	
		Bolt size	Tightening torque
Shaft casing	(34)	M10 (8)	5.8 kg-m
Piston cap	(35)	M10 (8)	5.8 kg-m
Cage	(36)	M8 (6)	3.0 kg-m
Valve casing	(37)	M14 (12)	13.0 kg-m
Ring nut (screw)	(21)	M8 (4)	3.0 kg-m

NOTES: 1. The figure enclosed with a circle located on the right side of each part name, denotes "Item".

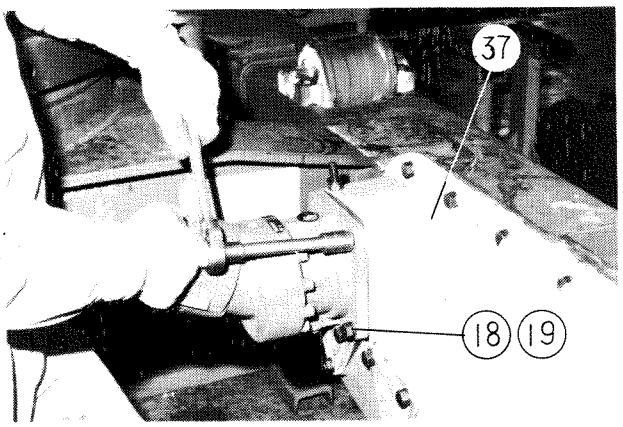
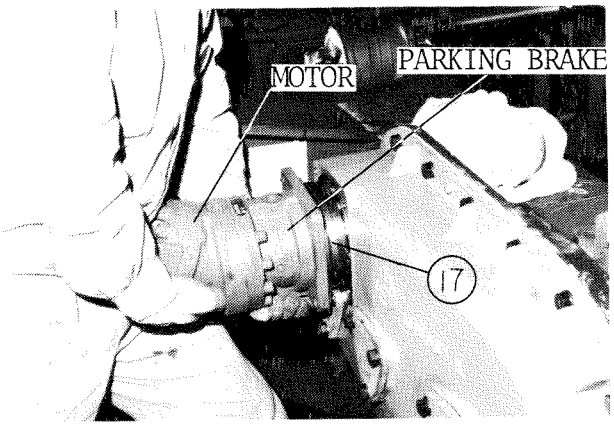
2. The figure enclosed in parentheses located on the right side of each bolt size, denotes the nominal size of an Allen wrench (JIS, B4648).

Procedure	Illustration
9. Install the O-ring (25) into the groove in casing assembly (18) and install it on the body by tightening bolts (34) and spring washers (39).	

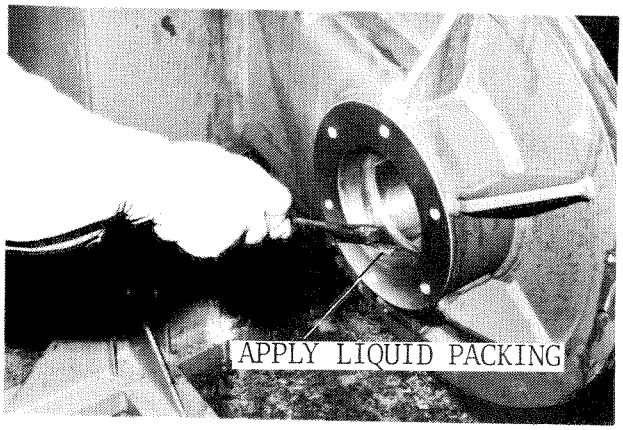
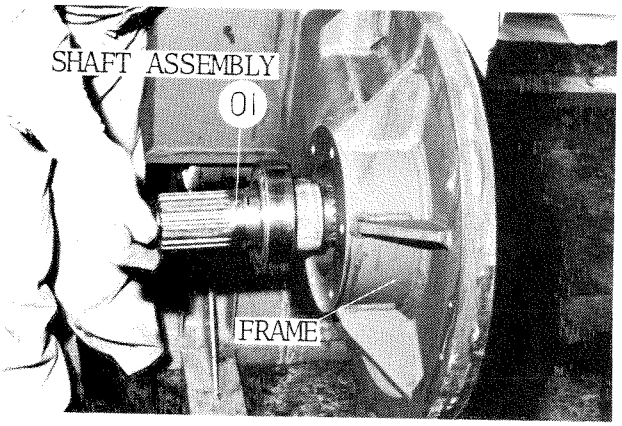
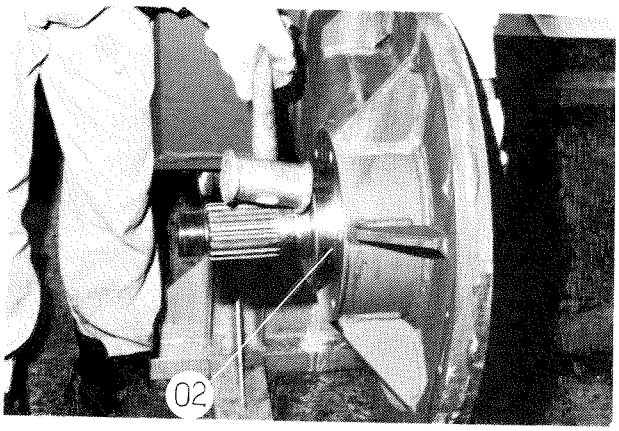
6.2.2 Disassembly and assembly

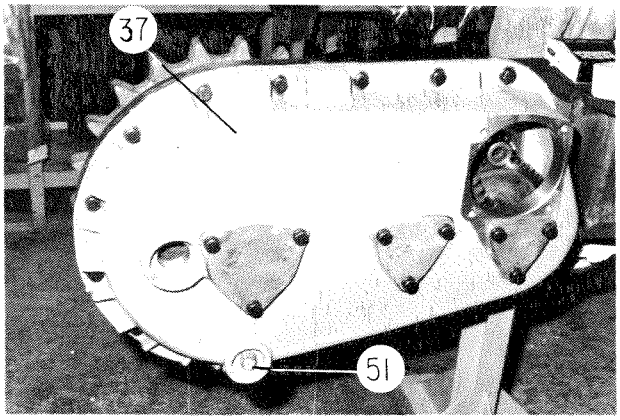
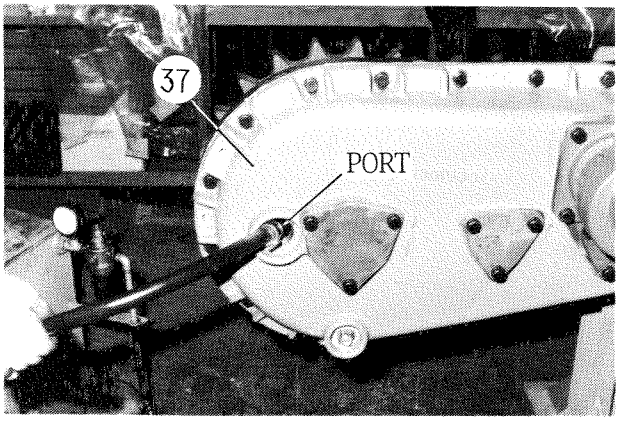
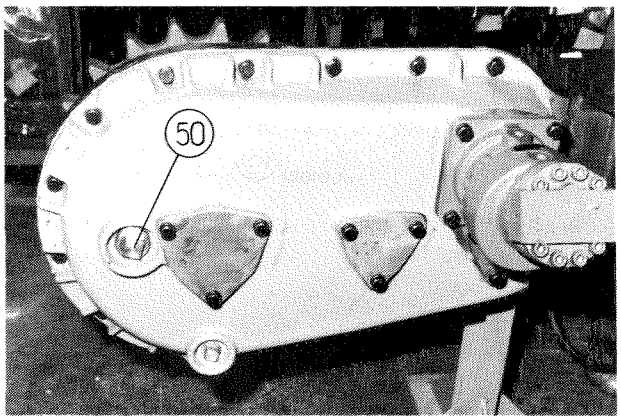
Refer to Fig. 6-3

(1) Disassembly

Procedure	Photo
1. Before disassembly, clean surface of assembly with solvent. 2. Remove oil pipes from the motor and parking brake.	
3. Remove the motor and parking broke from cover (37) by removing bolts (18) and washers (19).	
4. Remove O-ring (17) from the groove in the parking brake.	

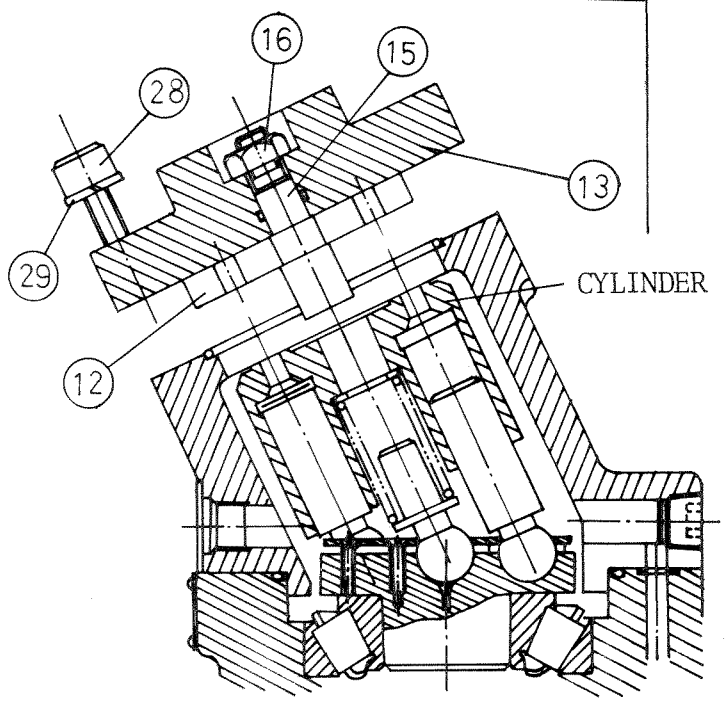
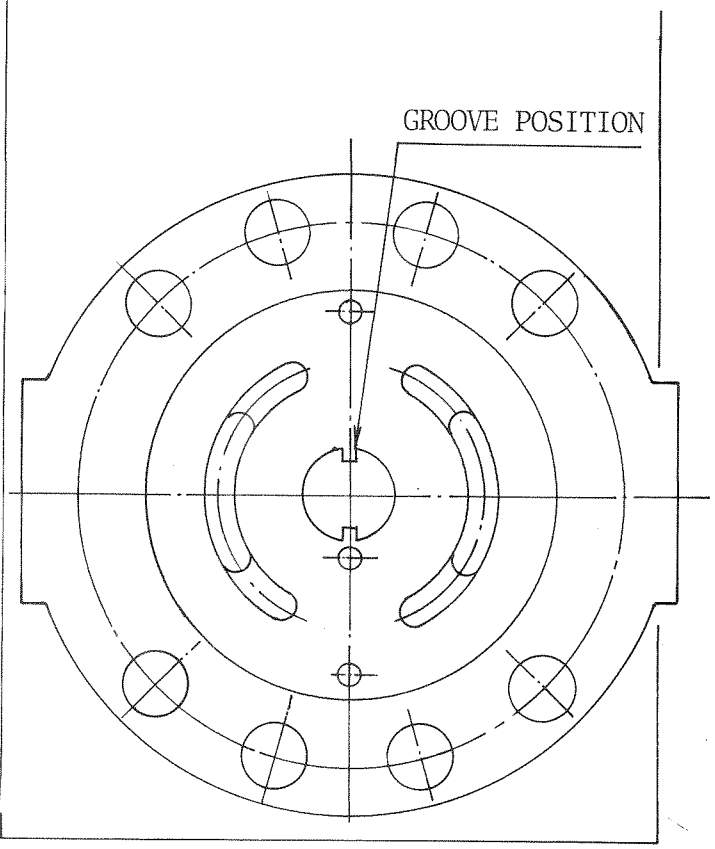
(3) Assembly

Procedure	Photo
1. Apply liquid packing to the inner surface of cage.	
2. Carry shaft (01) assembly into the bore in the frame from the outside as shown in Fig. Press bearing (02) of shaft assembly into position in the cage of the frame by hammering against the outer diameter of bearing race.	 

Procedure	Photo
23. Wrap seal tape around plug (51) and tighten the plug in position of the cover (37).	
24. Fill bydraulic oil (6 liters) from port in cover (37) as shown. Wrap seal tape around plug (50) and tighten the plug in position of the cover.	 

Disconnect the pipe and remove the shuttle valve and brake valve from the plunger motor. Remove the plunger motor from the speed reduction device. At that time take care not to allow oil to leak from the pipe, the port in the motor and the valve passage and then dust and dirt to enter them.

(2) Disassembly

Procedure	Illustration
1. Check the sliding surface between the motor plate and cylinder for condition. 1.1 Loosen and pull out the eight bolts (28) (M12 x 1.75 socket bolts) and remove the plate (13) carefully. At that time do not loosen the U-nut (16). (Take care not to allow the cylinder to come off.) If the sliding surface of the plate (12) is rough, loosen and remove the U-nut (16) and pull out the rod (15) to permit the plate (12) to be removed. Recondition the rough surface by lapping. When the rough surface cannot be easily reconditioned by lapping, replace the plate. 1.2 Replace the O-rings with new ones. 1.3 Assemble in the reverse order of disassembly. Before installing the O-rings, apply clean grease to them. Torque the nut and bolts to specification. U-nut (16) 1.8 - 2.7 kg-m Bolts (28) 7.6 - 12.0 kg-m Position the groove in the rod (15) as shown.	 

[UH02]

Valve; Shuttle

Item	Part Name	Q'ty
	Valve; shuttle	1
01	. Body	1
02	. . Spool	1
03	. Seat; spring	2
04	. Spring	2
05	. O-Ring	2
06	. Plug	2
07	. O-Ring	2
08	. O-Ring	1
09	. Plug	1
10	. Pin; Spring	2

7. HYDRAULIC CYLINDER

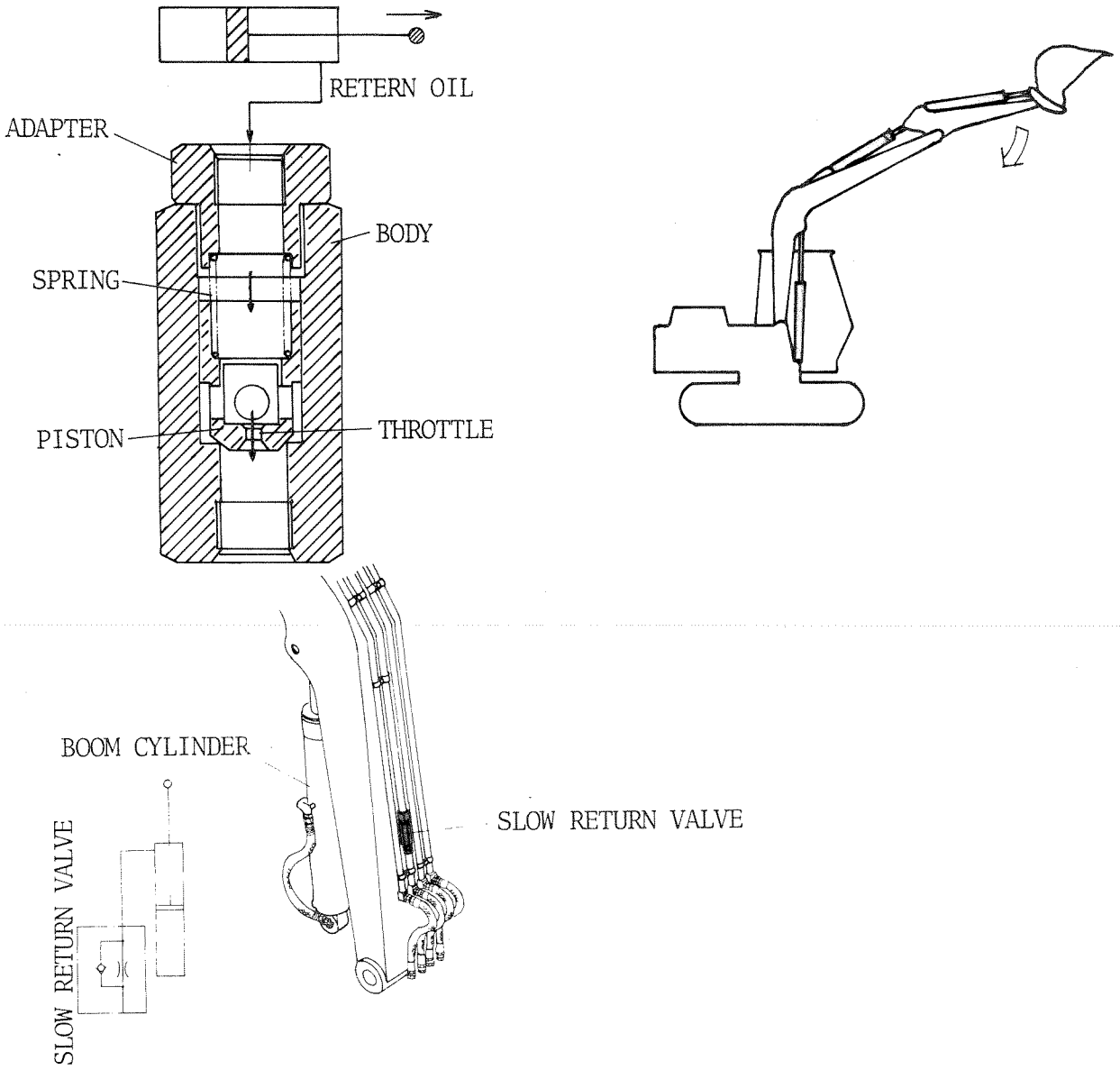
7.1 GENERAL DESCRIPTION

Refer to COMMON SERVICE MANUAL (A), Paragraph 11.

7.2 SLOW RETURN VALVE

The slow return valve is used in the arm cylinder circuits on UH02.

(1) Construction and operation



When the arm is lowered from its maximum height, the tendency is that the arm will lower faster than the pump can deliver oil, causing vacuum formed within the cylinder.

The slow return valve prevents such formation of vacuum within the arm cylinder when the arm is lowered from its maximum height.

When the arm cylinder is retracted so as to dump the bucket, the piston is just pushed up by the oil, allowing the oil to flow freely with no restriction to the oil flow.

1. GENERAL CONSTRUCTION

1.1 SPECIFICATION

Type:	Hitachi WH03 wheel-type excavator
Gross weight:	9.2 tons
Overall height (travelling condition):	3,450 mm
Overall length (travelling condition):	6,790 mm
Overall width:	2,470 mm
Wheel base:	2,600 mm
Wheel track of front wheel:	1,925 mm
Wheel track of rear wheel:	1,820 mm
Rear end radius:	1,955 mm
Slewing:	360° full circumference
Slewing speed:	13.4 r.p.m.
Travelling speed:	Forward 1st speed: 2.9 km/hr. 2nd speed: 5.8 km/hr. 3rd speed: 9.9 km/hr. Top speed: 19.5 km/hr. Reverse 1st speed: 2.9 km/hr. 2nd speed: 9.9 km/hr.
Max. gradeability:	35%
Engine rated output:	Isuzu DA 220 diesel engine 63PS/2100 r.p.m.
Hydraulic pump:	Gear pump
Slewing motor:	Piston motor x 1
Travelling motor:	Piston motor x 1
Steering mechanism:	Full hydraulic power steering wheel
Speed change gear:	Synchromesh 2-step speed change
Cycle time:	Standard: 14 ∿ 17 sec. (90° slewing)
Crane capacity:	2.9 t x 3 m
Brake:	Front & rear wheel braking, intemal expansion vacuum - oil hydraulic system
Tire size:	Front tire: 9.00-20-14PR Rear tire: 9.00-20-14PR

3. HYDRAULIC SYSTEM

3.1 GENERAL

WH03 wheel hydraulic excavator consists of various type of hydraulic units.

A thorough knowledge of design and principle of operation of these can be obtained from the hydraulic circuit diagram will help to diagnose the cause of the failure.

Fig. 3-1 shows the hydraulic circuit, and the components of the hydroulic system are listed in Table 3-1.

5. CONTROL VALVE

Details of Control Valve is described in COMMON SERVICE MANUAL (A) For UHC3 UH04.

5.1 SPECIFICATIONS

Model TOSHIBA V33MDDM for Outrigger, 1st Boom, Bucket and Propelling motor (Forward and Reverse)
TOSHIBA V33DDDX for 2nd Boom, Propelling motor (High and Low), Arm and Swing motor.

5.1.1 V33MDDM

Type	Spring-loaded 4-spool cotrol valve
Main releif pressure	155 kg/cm^2
Overload relief pressure	
For boom (down)	200 kg/cm^2
For boom (rise)	170 kg/cm^2
For bucket	200 kg/cm^2
Spool type	
For boom and bucket	D
For outrigger and propelling motor	M

5.1.2 V33DDDZ

Type	Spring-loaded 4-spool control valve
Main relief pressure	155 kg/cm^2
Overload relief pressure	
For Arm	200 kg/cm^2
Spool type	
For boom, propelling motor and arm	D
For swing motor	Z

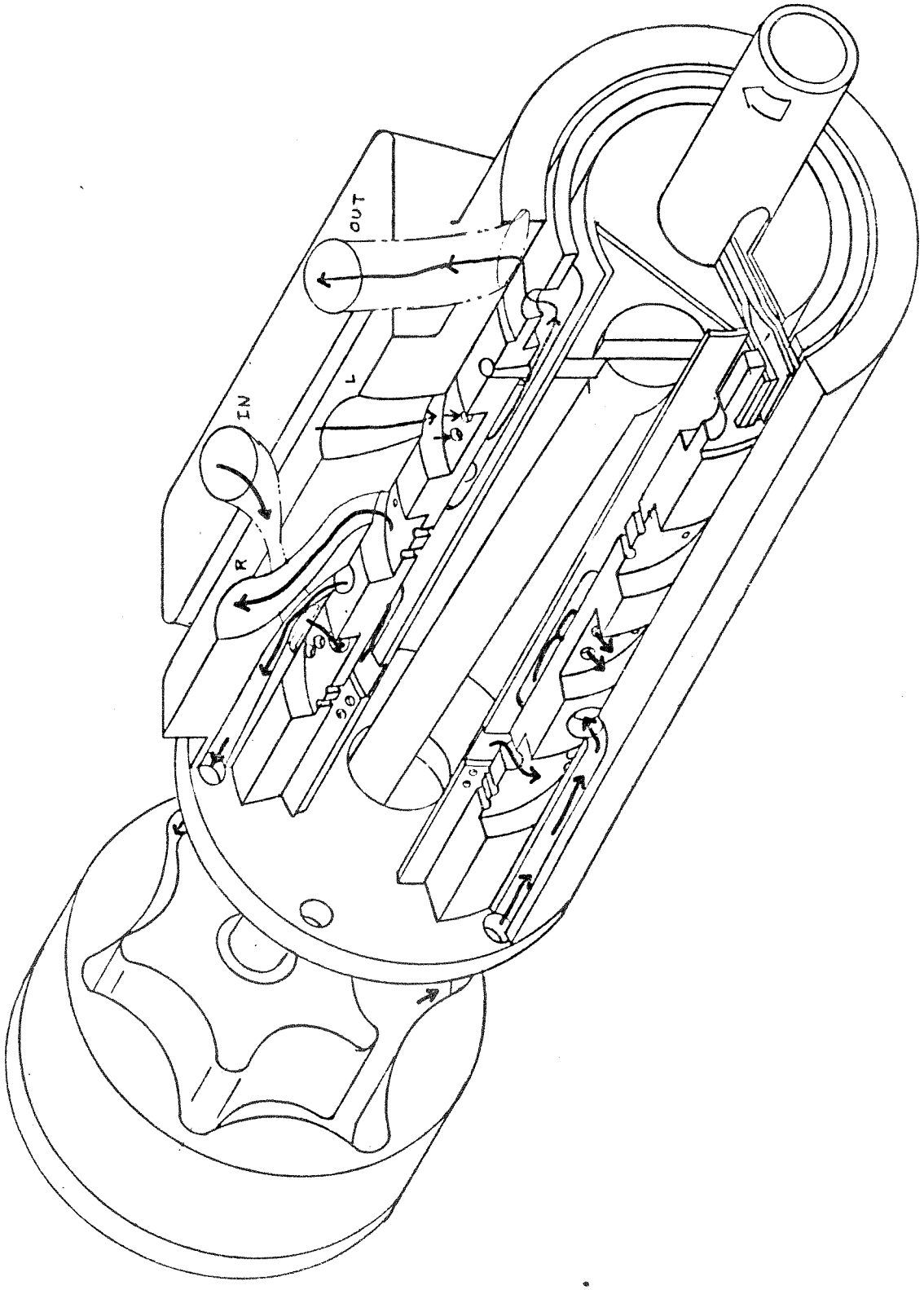


Fig. 7-6 STEERING TO RIGHT

4) Construction

A) Relay Valve

The relay valve is operated by oil from the master cylinder and is regulated by the brake pedal depending on which way the pedal is depressed. The valve consists of a piston, diaphragm and poppet valve.

B) Pewer Cylinder

The cylinder consists of a piston, a piston rod and a piston. A sectional view of the cylinder is shown below.

C) Hydraulic Cylinder

The cylinder consists of a piston and a ball check valve.

D) Check Valve

The check valve is installed vertically in such a manner that it is held on the seat by its own weight and the tension of a valve spring under normal condition. When negative pressure occurs in the negative side of this valve, even if slightly, the valve is lifted up away from the valve seat.

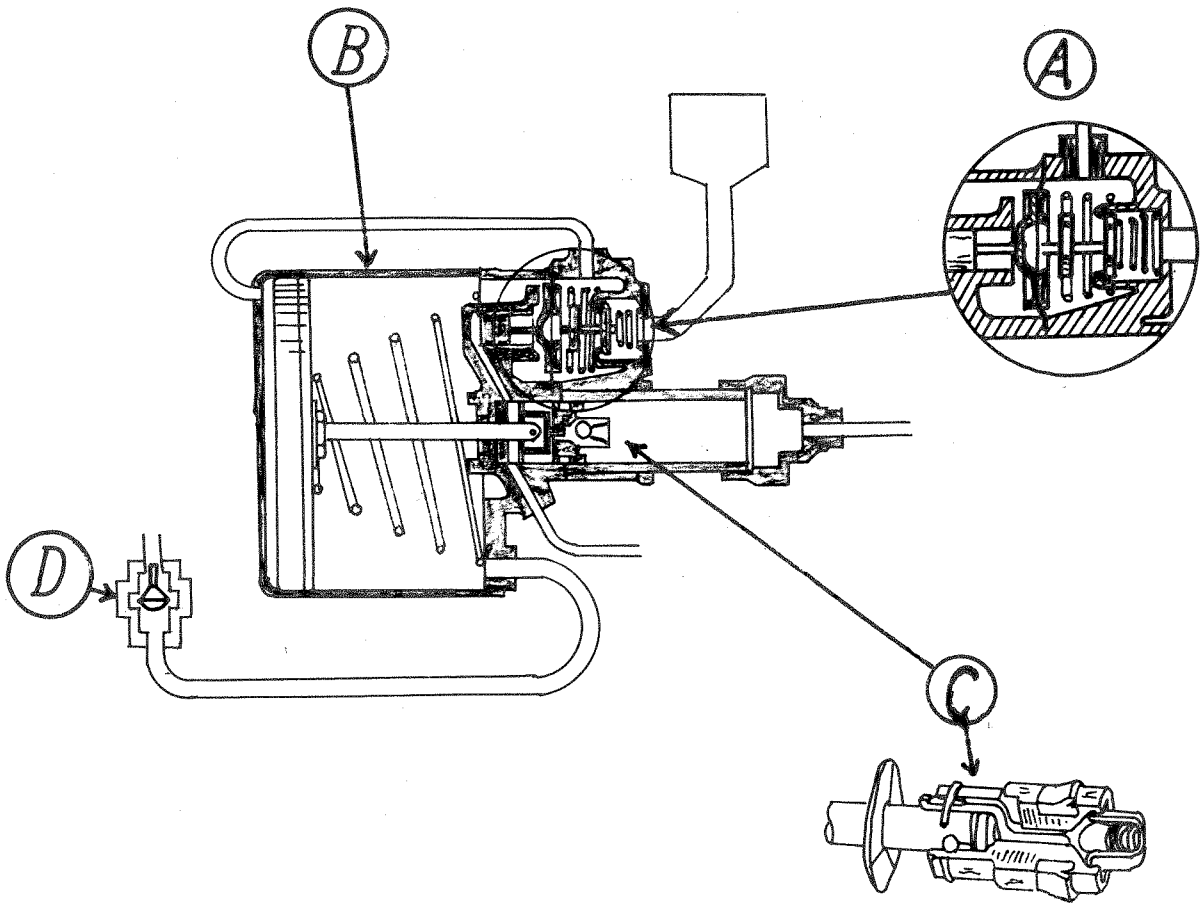


Fig. 8-5

5) Diassembling and Reassembling

See SUPLEMENT-2

9. OUTRIGGER, PARKING BRAKE AND RAM CYLINDER

9.1 GENERAL

The outrigger circuit is interlocking with the ram cylinder circuit and parking circuit, and it is so designed that, when the outriggers have been extended, the ram cylinder is fixed and the parking brake is applied (See Fig. 9-1).

When travelling, raise to outriggers until they contact the respective stoppers and be sure to fix the ram cylinder applying pressure and release the parking brake. (See Fig. 9-2, and if the machine is run with the parking brake kept applied, the brake may be burnt to malfunction.)

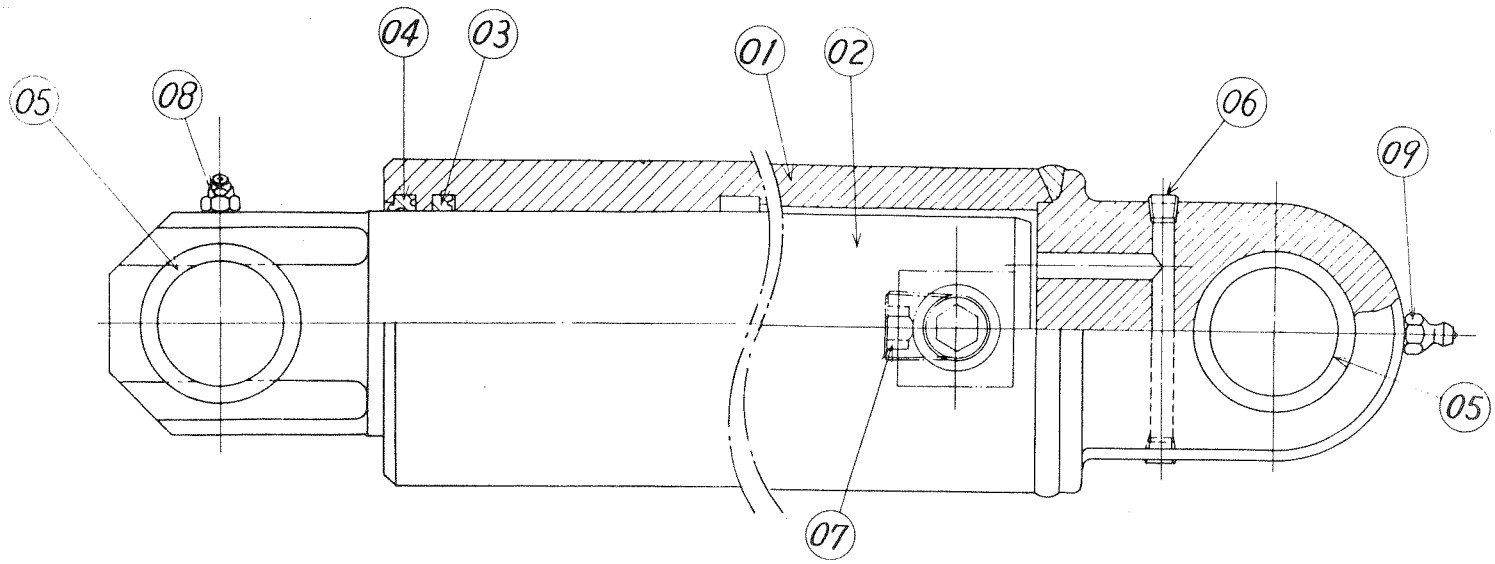


Fig. 9-6

Item	Part No.	Part Name	Q'ty	Serial No.
	4504588	Ram Cylinder	1	0101 ∿ 0230
	4513562	Ram Cylinder	1	0231 ∿
01	4508038	. Cylinder Tube	1	0101 ∿
02	4508039	. Rod	1	0101 ∿
03	4508040	. U-Ring	1	0101 ∿ 0230
	4031965	. U-Ring	1	0231 ∿
04	4508041	. Wiper Ring	1	0101 ∿
05	4508042	. Bushing	2	
06	4508043	. Plug	2	
07	4508044	. Plug	1	
08	4508045	. Fitting	1	
09	4508046	. Fitting	1	

11. LINE FILTER (FULL-FLOW FILTER)

The full-flow system polishes the entire supply of oil each time it circulates in the hydraulic system. Fig. 11-1 shows a cross section of a full-flow filter used in the hydraulic system of a Hitachi hydraulic excavator.

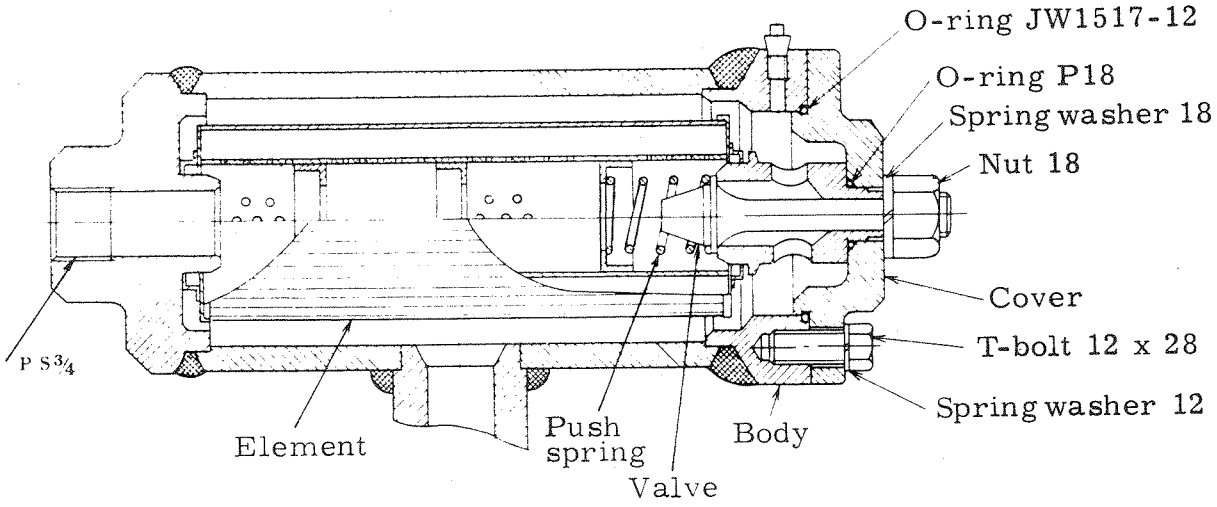


Fig. 11-1 Cross Section of Full-Flow Filter

Its filtering element is capable of removing dirt particles larger than 10 μ. This filter is designed to allow oil to enter the outer screen to assure 1) high filtering efficiency for reverse flow, 2) easy inspection, 3) long element life (because the difference in pressure across the element applies compressive load to it), and 4) easy cleaning. To prevent the pressure from building up so high that it might damage the filter element or starve one of the hydraulic components, a relief valve is built in this filter system to bypass oil around the filter. When the relief valve opens, dirty oil pours into the hydraulic system. Unless the filter is cleaned immediately, dirt particles in the oil will step up wear in the hydraulic components and the pump inlet screen will continue to plug until pump starvation occurs.

Se-quence	Procedure	Required tools
2	Assemble the ball bearings (122) and the drive shaft (111) carrying stop ring (825) in the bearing casing. Rotate the drive shaft to cause its spline to engage with that of the cylinder.	
3	After installing the drive shaft in position, insert the O-ring (719) into the bearing casing groove, and while paying attention to the oil seal, assemble the front cover to the bearing casing.	Hexagonal wrench key (6 mm) Clamping torque: 2 to 3 kg-m
4	Assemble the motor casing to the bearing casing by placing the motor casing nameplate over the bottom of the swash plate part of the bearing casing. If their relative position is other than this, assembly cannot be accomplished.	Hexagonal wrench key (10 mm) Clamping torque: 7 to 8 kg-m
5	Assemble the valve plate (313) to the valve cover (312). Pay attention to the pin hole for positioning the dowel pin (887).	
6	Assemble the valve cover to the motor casing by laying the latter on its side, and by directing the former toward the side. If bearings do not readily fit into position, strike them with a wooden mallet until the dowel pin (887) came in position. Uniformly tighten the six mounting bolts (424, 426). Be sure to mount the O-ring (716). Note: Two of dowel pins (887) are used on the valve plate (313) fitting with the valve cover (312) and on the valve cover (312) positioning with the motor casing (272) respectively.	Hexagonal wrench key (10 mm)

MEMO

(5)

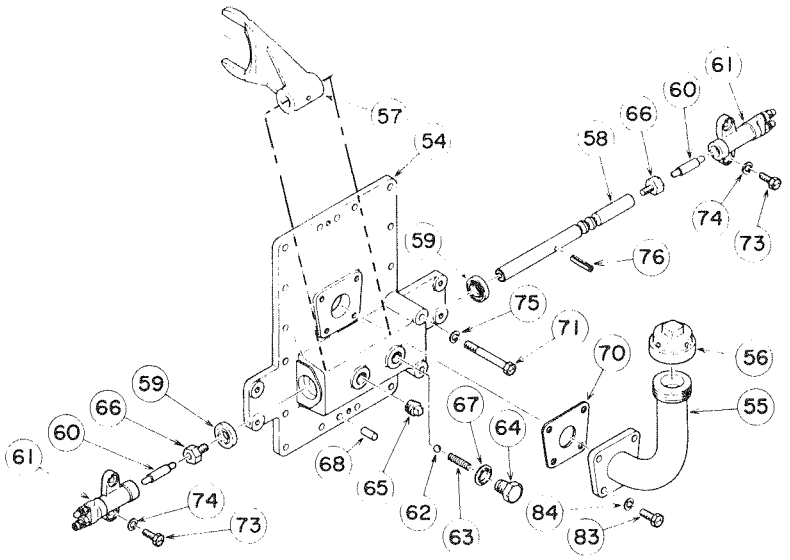


Fig. 15-7 Cover

Se-quence	Procedure	Required Tools
1	Take out the clutch cylinder (61), the rod (60) and the bolts (66) from the cover (54).	Spanner-8
2	Take out the shout (55) from the cover.	Spanner-10
3	Remove the spring pin (76) and the shaft (58) from the cover. Take out the fork (57) from the cover.	Pliers

17. SUPPLEMENT-1

HOW TO USE ORBIT ROLL

Disassembly and Reassembly

ii) In order to reassemble the O-ring to the front side of the spool, use a special tool (part number X1203-209). Refer to the explanation in 2) Reassembly.

iii) When the spool and sleeve assembly are to be inserted into the housing, cover the top of the spool with protection cap so that the O-ring may not be damaged. Pull out this protection cap from the front side after reassembly of the spool and sleeve assembly.

iv) Since the washer for the cap screw plays a role as seal to prevent leakage, be sure to replace it with a new one after disassembly.

2) Reassembly

i) Insert the spool into the sleeve. (Apply a small amount of clean lubricating oil and insert in a gradual manner turning it slowly.)

ii) Align the groove of the spool with that of the sleeve, and using the spring inserting tool (part number X1203-204) insert the spring into the grooves.

iii) Insert the cross pin into the hole of the sleeve assembly and into that of the spool.

iv) Install the bearing assembly to the spool and sleeve assembly. Ring, bearing race, needle bearing and craft washer must be assembled in this order, and chamfered face of the bearing race and the needle bearing must be set on the opposite side.

v) Coat the O-ring with grease and set up the king-ring and the O-ring. Then attach this O-ring to the spindle of the special tool (part number X1203-209) to make a sub-assembly as illustrated in photo 25.

vi) Insert the spindle into the bushing of this special tool till the top of the spindle comes into touch with the stopper. (Refer to photo 26.)

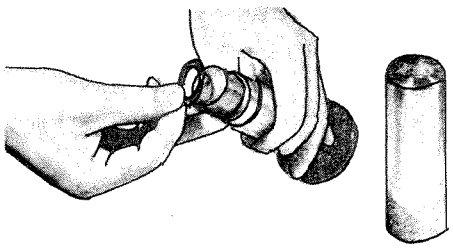


Photo 25

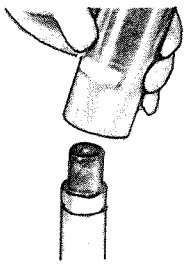


Photo 26

b. Assembly

1) End Plate

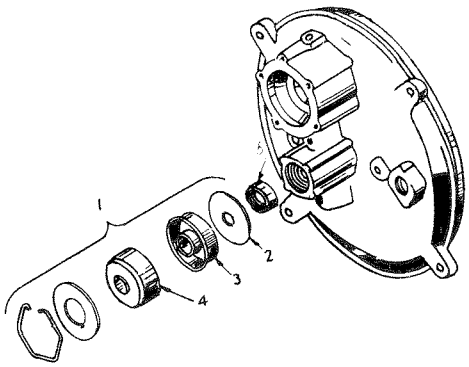


Fig. 5

Press the oil seal (5) into place in the end plate with the sealing lip facing toward the hydraulic cylinder. Do not drive. Install the push rod seals (2), (3) and (4) in the center hole in the dirction as shown. Secure with the snap ring and stop washer.

2) Valve Fitting and Relay Valve Piston (Figs. 6 and 7)

Enter the stop washer (2) in the valve fitting (3) and secure with the retaining ring (1). Use the tool"Clamp Holder" (910-10050" to facilitate the operation.

Dip the piston cups (5) in clean oil to provide initial lubrication. Insert the cups in the piston (6) following the direction given in Fig. 7. Use the tools "Piston Cup Installer" (910-20000 and 910-20010) to install. If these tools are not immediately available, expand the cups by fingers.

*(1) When not equipped with the outlet valve in the cylinder, install the cups in the same direction. (Fig. 7)

When equipped with the outlet valve, install the cups in the reverse direction to each other as per the instruction given in Fig. 7.

After installing the C-washer (8), squeeze the ends to prevent the cups from working out of position during operation.

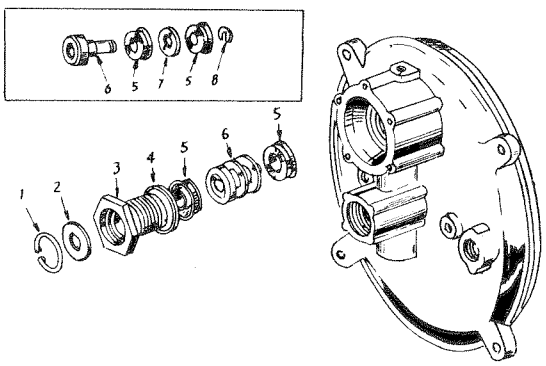


Fig. 6

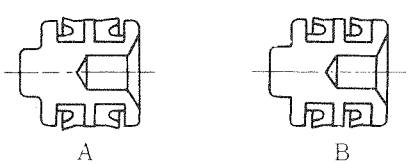


Fig. 7