FIATALLIS®

FX130

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Service Manual

FX130
HYDRAULIC EXCAVATOR SERVICE MANUAL

FEATURES OF THIS MANUAL

1. CONSTRUCTION

This manual is divided into eleven sections. The section names and its contents are as below. To fully use this service manual, understand how it is organized. Spend a minute reading this now and save many minutes of searching later.

Section 1

HOW TO USE

In the begging, read this section for effective use of this manual.

Section 2

SPECIFICATIONS

Specifications of machine and components and general service data are given in this section.

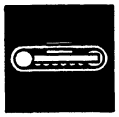
Section 3

GENERAL

Use this section not only as a reference guide to maintenance or repair but also as a text-book to train new personnel.

Section 4

SUPERSTRUCTURE



Section 5

UNDERCARRIAGE

Section 6

FRONT-END ATTACHMENTS

Refer to each of these sections according to the component you need to know.

Section 7

HYDRAULIC SYSTEM

Section 8

PNEUMATIC SYSTEM

Delete this section for not using pheumatic system.

Section 9

ELECTRICAL SYSTEM

Refer to each of these sections according to the system you need to know.

HYDRAULIC SYSTEM

This machine has adopted an "optimum hydraulic system (OHS)" which facilitates the speeding up of the actuators, swing operation and a variety of combined operations required of an hydraulic shovel. A large-capacity safety valve is provided in the control valve, with many additional safety valves on each hydraulic circuit to prevent over pressure and clogging of filters and consequent damage to the hydraulic system and components. The travel parking brake is so designed that it is put ON and OFF automatically by the travel motor drive pressure. It is released by operating the travel drive lever, and is applied when hand pressure is released. The swing parking brake is interlocked with the swing lever and is put ON and OFF automatically. It is released by operating the swing lever, and is applied automatically after putting back the lever in hold position. The lock brake operating upperstructure swing system is interlocked with swing control lever operation and is put ON/OFF automatically. It is released by operating the travel control lever and is applied again putting the lever in hold position. This machine is equipped with an accumulator which allows to move the front-end attachment for some time after the engine has stopped. As it contains high pressure gas, the accumulator must never be separated from the machine, dismantled or thrown into a fire. All the hydraulic components, including the pump and main control valve have been adjusted at the time of factory delivery. Do not dismantle these components nor tamper with the adjustment screws; once dismantled, they are no longer readjustable. In case of any abnormality, contact the nearest Service Center.

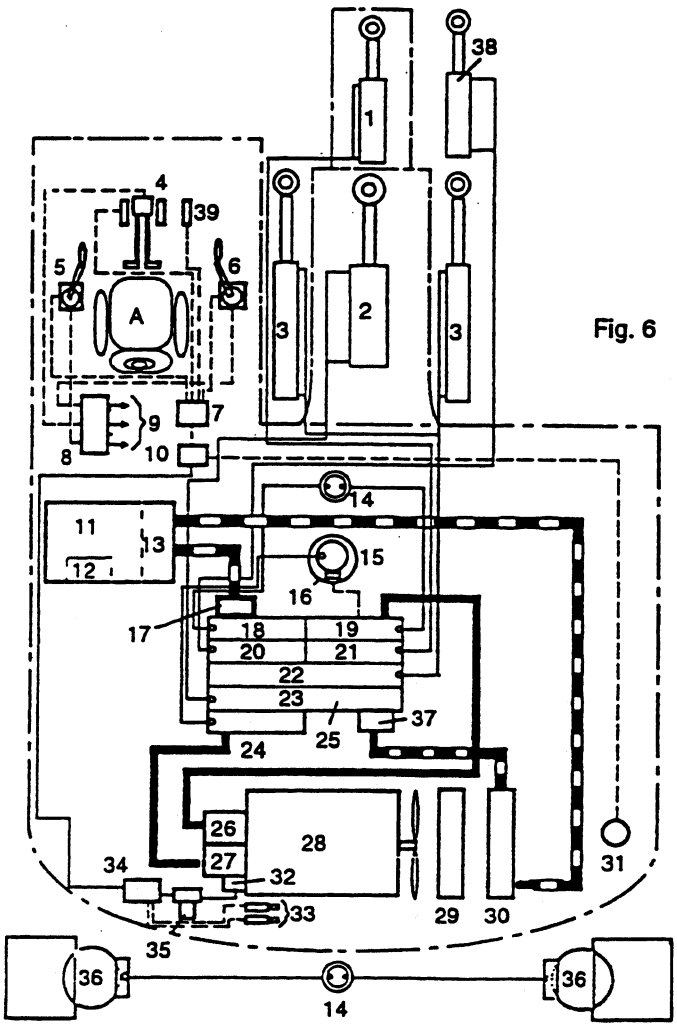


Fig. 6

A) Operator's compartment
1) Bucket cylinder
2) Arm (dipper) cylinder
3) Lifting boom cylinders
4) Travel drive pilot valve
5) Left pilot valve
6) Right pilot valve
7) Control neutralizer valve
8) Anti-shock valve
9) To main control valve
10) Check valve
11) Hydraulic oil tank
12) Suction strainer
13) Full flow filter
14) Rotary distributor
15) Swing motor
16) Parking brake selection valve
17) By-pass check valve
18) Travel drive (left track)
19) Travel drive (right track)
20) Positioning arm
21) Bucket
22) Boom
23) Arm (dipper)
24) Swing
25) Main control valve
26) Front pump
27) Rear pump
28) Engine
29) Radiator
30) Hydraulic oil cooler
31) Accumulator
32) Pilot control pump
33) Mode selection cylinder
34) Solenoid valve
35) Pilot control system filter
36) Travel drive motor
37) Restriction valve
38) Posit. cylinder (triple articulation version)
39) Posit. control pedal (triple articulation version)

1. CONSTRUCTION

1 SUPERSTRUCTURE

- The superstructure consists of six main components.
  They are the main frame, engine, fuel and hydraulic tank, hydraulic system components and the counter weight.
- The main frame is a welded structure which holds the engine, the hydraulic system components, the fuel and hydraulic tank, the operator's cab and so on.
- The counter weight is bolted to the rear of the frame to balance the machine.
- The frame is bolted to the outer race of the swing bearing.
  The swing bearing is mounted on the undercarriage.

2 UNDERCARRIAGE

- The undercarriage is a tractor type, which supports the superstructure and front-end attachments through the swing bearing.
  The track frame is an all welded, stress-relieved structure.
- The front idler, track spring, track adjuster, rollers and travel unit are fixed to the track frame. Lifetime-lubricated track rollers, idlers and sprocket with floating seals. Track shoes of induction-hardened rolled alloy with triple grousers.

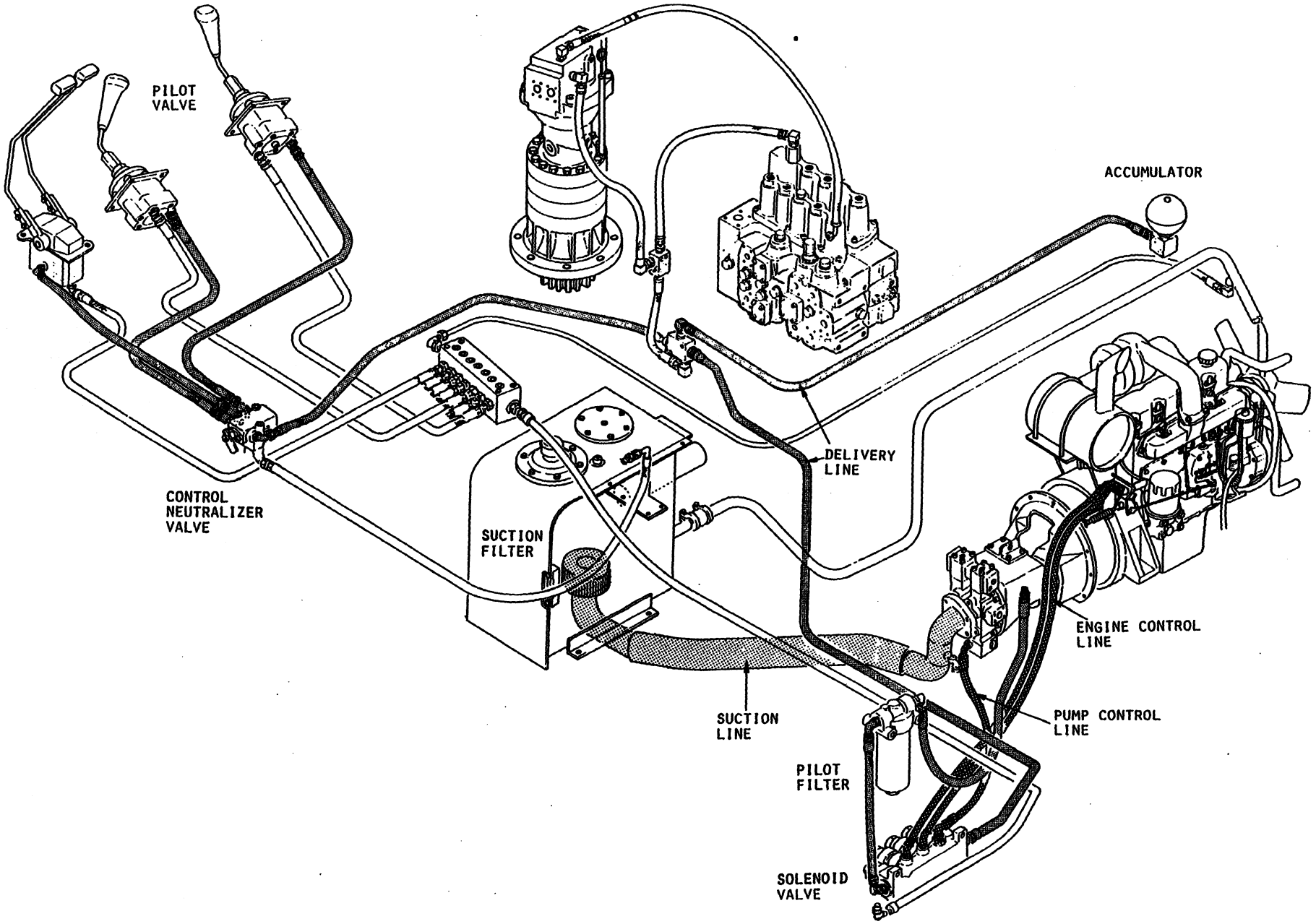
3 FRONT-END ATTACHMENT

The front-end attachment mainly consists of six components.
They are the boom, arm, bucket, 2 boom cylinders, arm cylinder and bucket cylinder.

4 HYDRAULIC SYSTEM

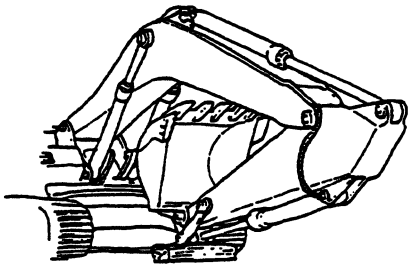
- All operations of both the front-end attachments and main body are hydraulically powered.
- Hydraulic system mainly consists of five circuit.
  They are the pump suction line, delivery line, return line, drain line and pilot line.
- The oil from the hydraulic tank flows to the three pumps (front, rear and pilot pump) through the pump suction line.
- The hydraulic pumps are the heart of the hydraulic system and creates the oil flow which supplied to all of the circuit through the delivery and pilot line.
- Discharged oil from the control valve goes to the hydraulic tank through the return line.
- Internal leakage from the motors and brake valves are necessary because they act as lubrication.
  Leaked oil is returned to the hydraulic tank through the drain line.

HYDRAULIC SYSTEM



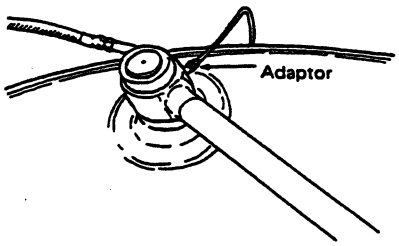
1.2 FRONT ATTACHMENT

1.2.1 Removal of front attachment ass'y

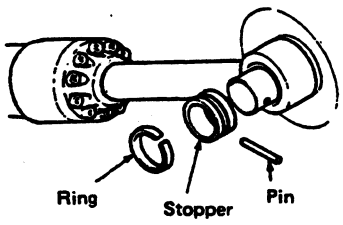


1 Place the excavator on level ground.
Lower bucket to the ground.
Stop the engine.
Remove the air breezer cap, and drain the air in the oil tank.

2 Disconnect lubrication hoses at adapters from boom cylinder rod ends.

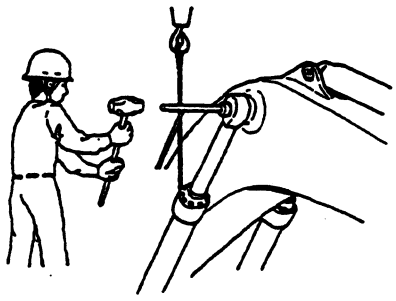


3 Remove rings, pins and stoppers of the pin connecting with boom cylinder rod ends and boom.

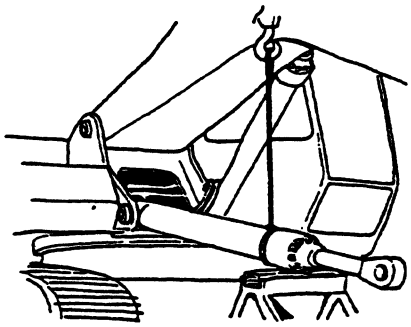


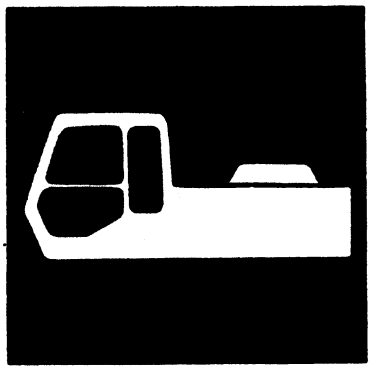
4 Fasten sling to boom cylinder.

Push pin far enough to remove cylinder rod with hummer.



5 Lower right boom cylinder to put it on stand.
Fasten sling to other (left) boom cylinder.
Push pin in other direction to remove other (left) boom cylinder.
Lower other (left) boom cylinder.





Section 4 SUPERSTRUCTURE

CONTENTS

O/P: OPERATIONAL PRINCIPLE

Continued on next page

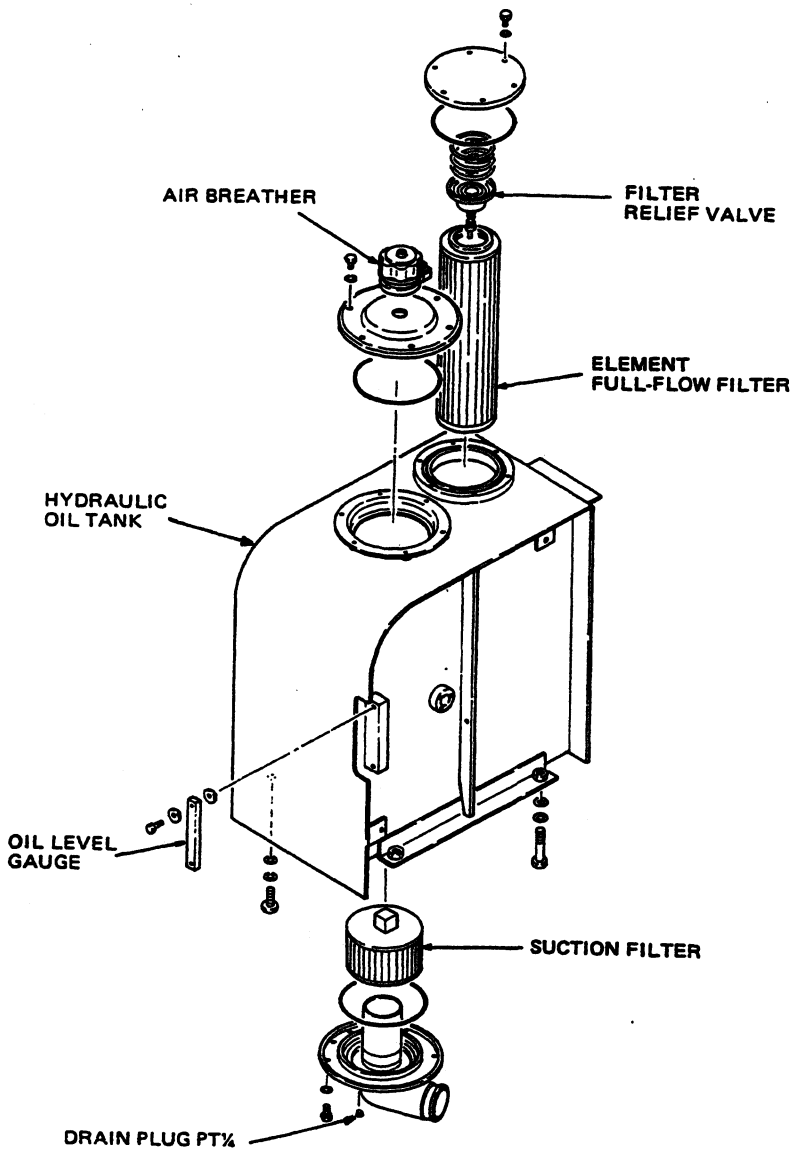
3. HYDRAULIC OIL TANK

3.1 CONSTRUCTION & FUNCTION

3.1.1 OIL TANK

The oil tank acts as both a reservoir and an oil conditioner. Its functions are to dissipate heat from the oil, to separate out air from the oil and remove contaminants.

A full-flow filter and a suction filter are provided in the hydraulic oil tank. They catch and remove dust and dirt particles from the oil.



5.3 SPECIFICATIONS

5.3.1 SWING REDUCTION DEVICE

. Type	Two stage planetary gear type.
. Reduction ratio	15.8
. Amount of gear oil	approx. 32 ℓ

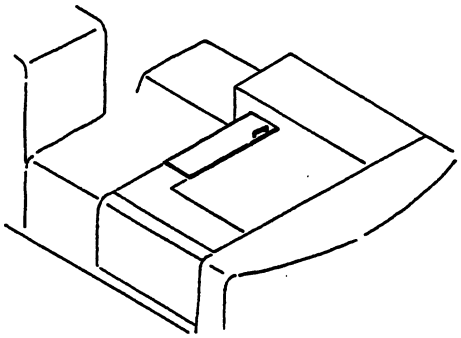
5.3.2 SWING MOTOR

. Type	Swash plate type axial piston motor
. Displacement	39.1 cm^3 /rev
. Max. flow rate	110 ℓ/min. (Max. pump displacement)
. Max. rotation speed	1350 rpm
. Output torque	36.9 kgf.m (362 N-m) at 260 kgf/cm^2 (25506) Kpa)
. Relief set pressure	260 kgf/cm^2
. Parking brake release pressure	15 kgf/cm^2

10.2 MAINTENANCE STANDARD

10.2.1 REMOVAL & INSTALLATION

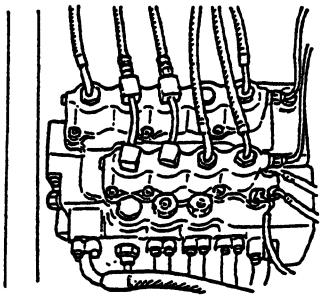
(1) REMOVE CONTROL VALVE



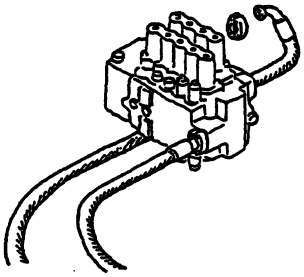
1 Remove cover

2 Remove pilot hoses from the control valve.

Note: Put matching number or tag on the hoses and control valve.

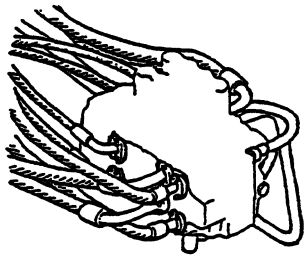


3 Remove pump delivery hoses from the control valve.



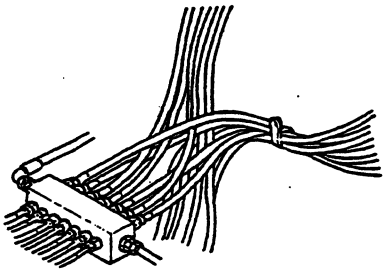
4 Remove acutator's hoses from the control valve.

Note: Put matching number or tag on the hoses and control valve.



5 Remove pilot hoses of control valve bottom side from the shockless valve.

Note: Put matching number or tag on the hoses and shockless valve.

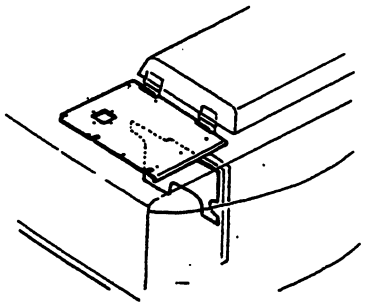


6 Replenish the hydraulic oil into the tank.

Note: Remove an air vent plug on the pump to release the air in the pump.

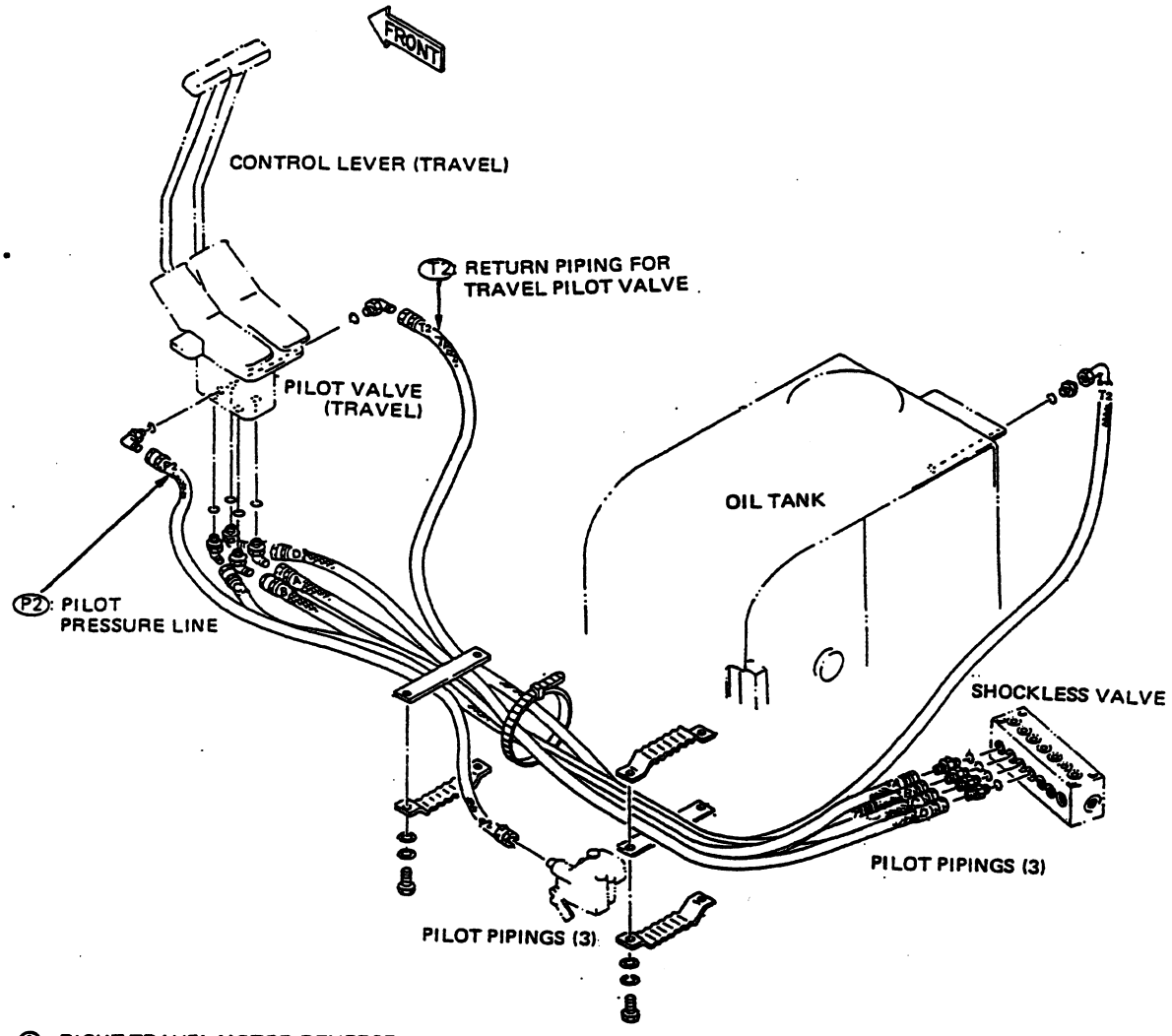
7 Install cover.

Tightening torque: 9 kgf.m, 65 ft.lbs

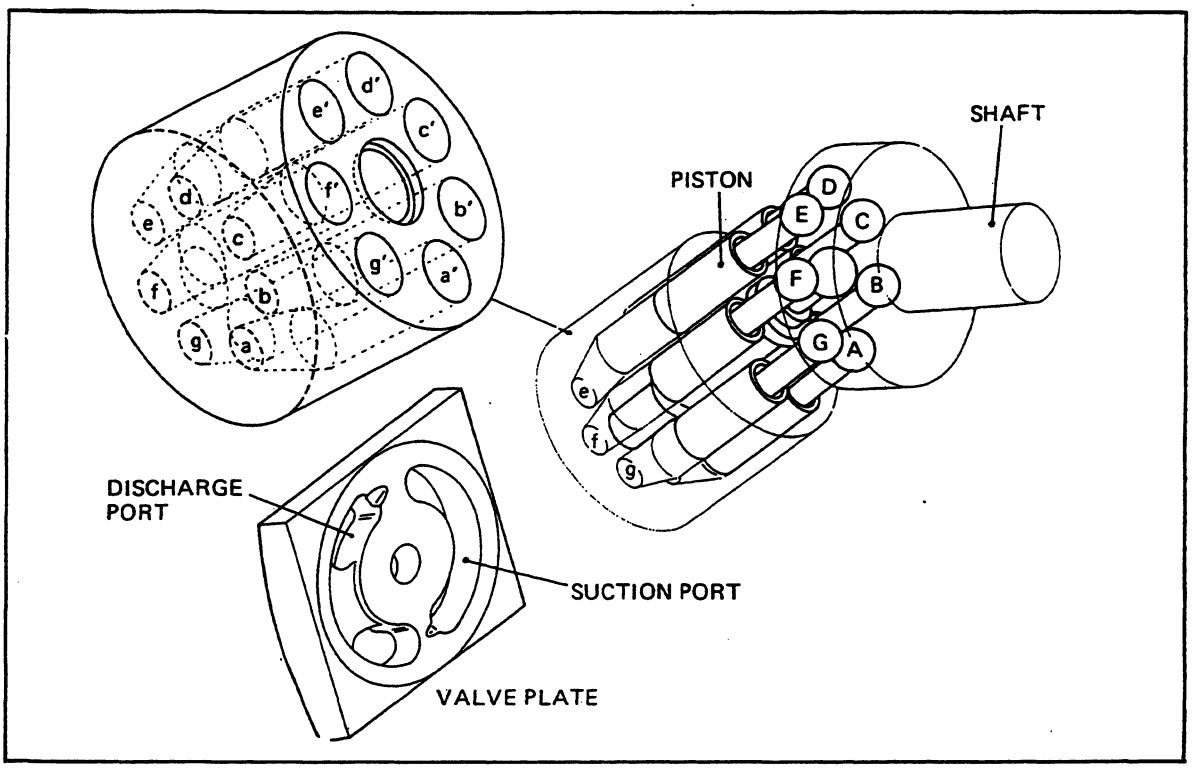


15.1.4 PILOT PIPING (4)

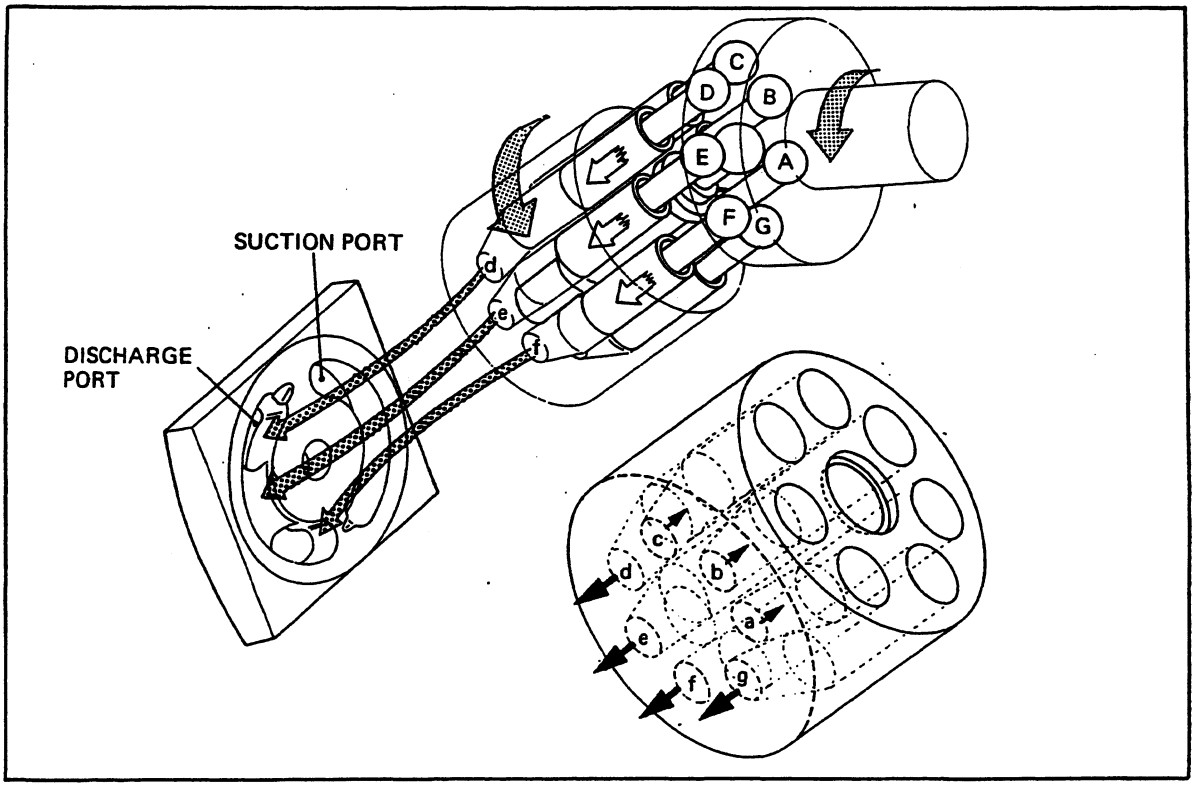
Pilot piping (4) consists of travel pilot valve piping and piping from pilot valve to shockless valve.



Ⓐ: RIGHT TRAVEL MOTOR REVERSE
Ⓑ: LEFT TRAVEL MOTOR REVERSE
Ⓒ: LEFT TRAVEL MOTOR FORWARD
Ⓓ: RIGHT TRAVEL MOTOR FORWARD



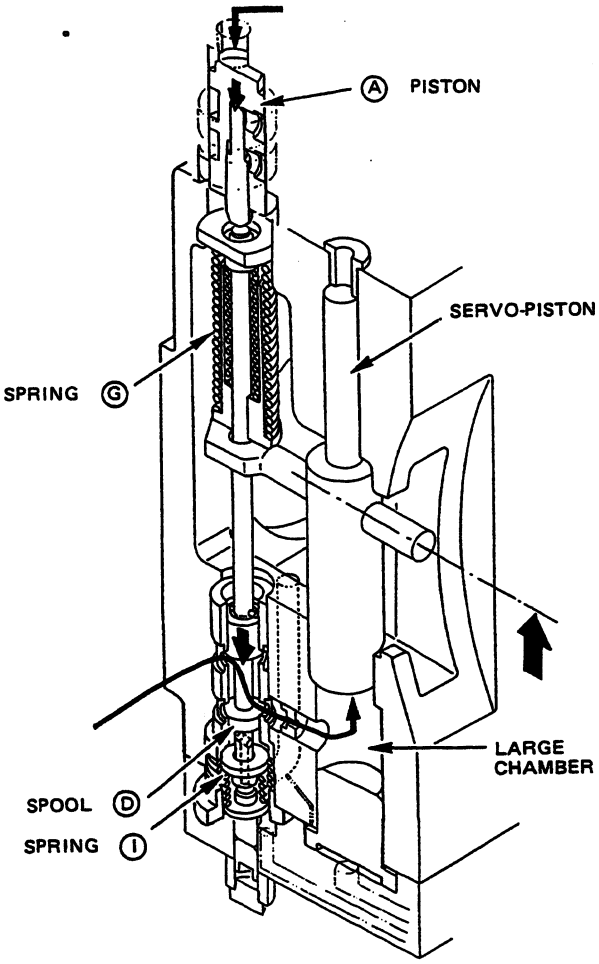
After the cylinder block is rotated on the valve plate surface slightly, piston (D) begins to move in the direction of the valve plate, and the oil is forced out through the discharge port until the piston reaches its stroke-end.

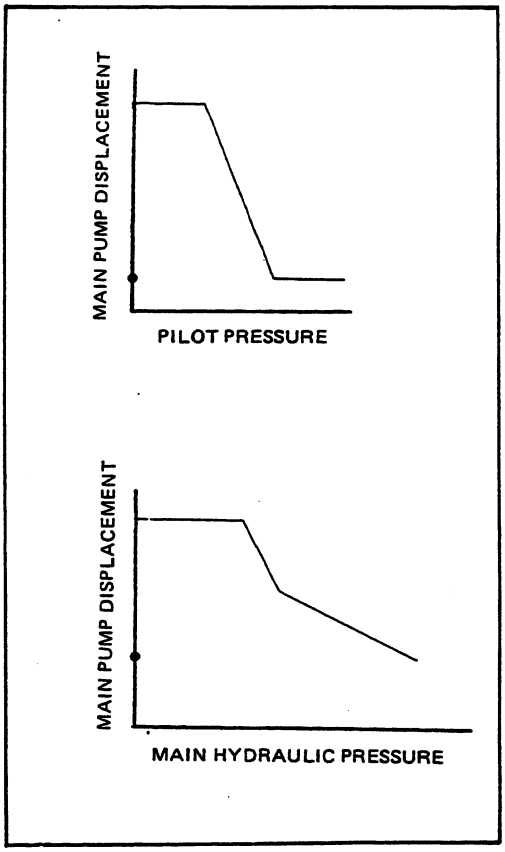


3.8 MINIMUM DISPLACEMENT

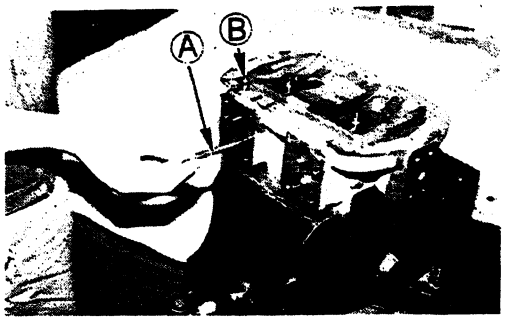
Here the control lever has just been returned to neutral. Pilot pressure reaches its maximum value. This increased pilot pressure acts on piston Ⓐ pushing it to its extreme lower position. This movement causes the spool Ⓓ to move to the downward, and opens the passage between the large cahmber and the servo-pressure line again, allowing the servo-pressure oil to flow to the large chamber.

The servo-piston is moved to extreme upper position and coming into contact with the stopper. Now the cylinder block has reached its minimum inclination angle, so pump displacement is also at its minimum value.



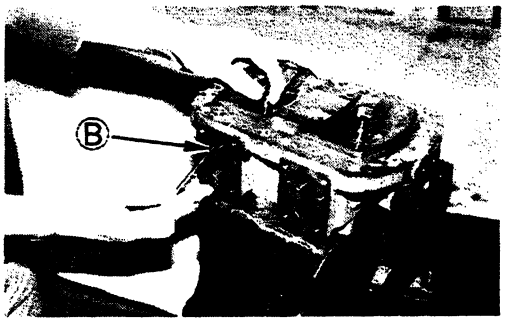


19 Remove rod Ⓐ and sleeve Ⓑ.

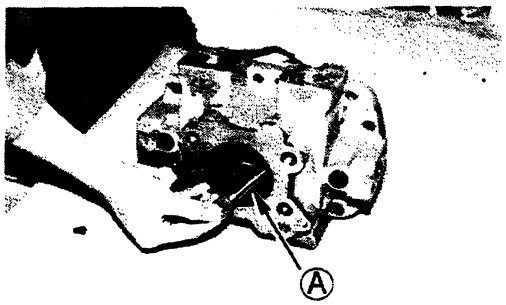


20 To remove another side control part, use this same procedure.

21 Remove two socket screws (B).

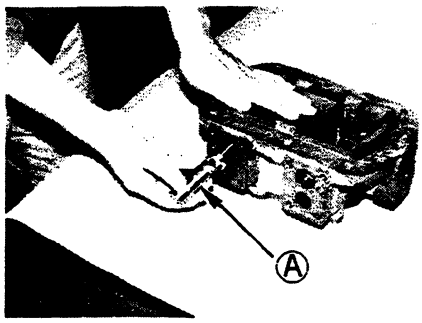


22 Remove rod Ⓐ from suction port.

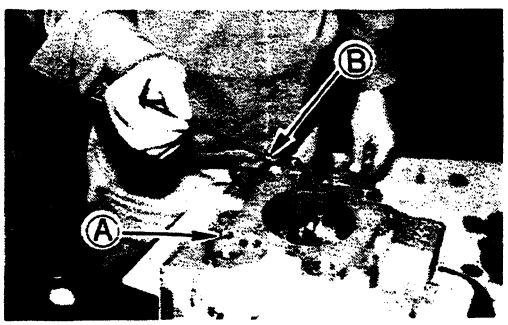


23 Remove piston Ⓐ.

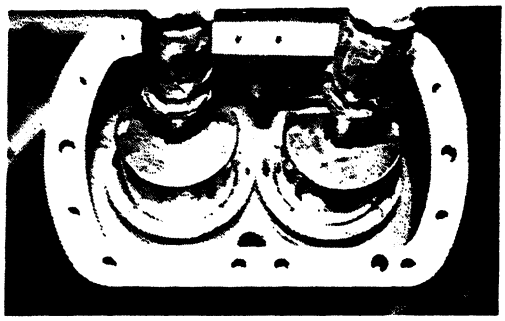
24 To remove another side piston, use this same procedure.



25 Remove plug Ⓐ on each holes.
Remove restriction(B) by 100 mm long allen wrench.



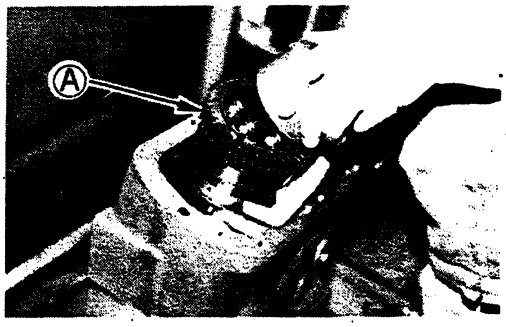
7 Warm the rotary group inserting hole of housing about 85°C by a heater.



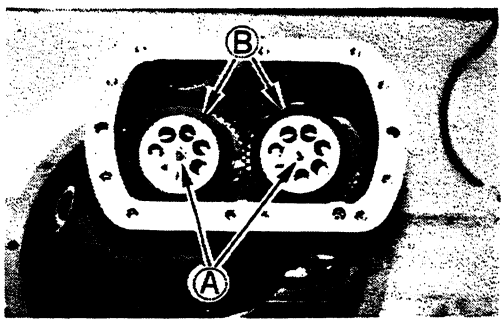
8 Install rear pump rotary group Ⓐ.

Note: Apply hydraulic oil to each rotary group inserting holes of the housing.

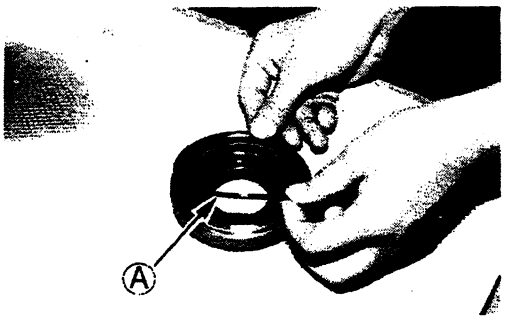
9 Install front pump rotary group Ⓐ.



Set 2 socket bolts Ⓐ (M5 x 30) with rubber disc not to drop cylinder block Ⓑ.

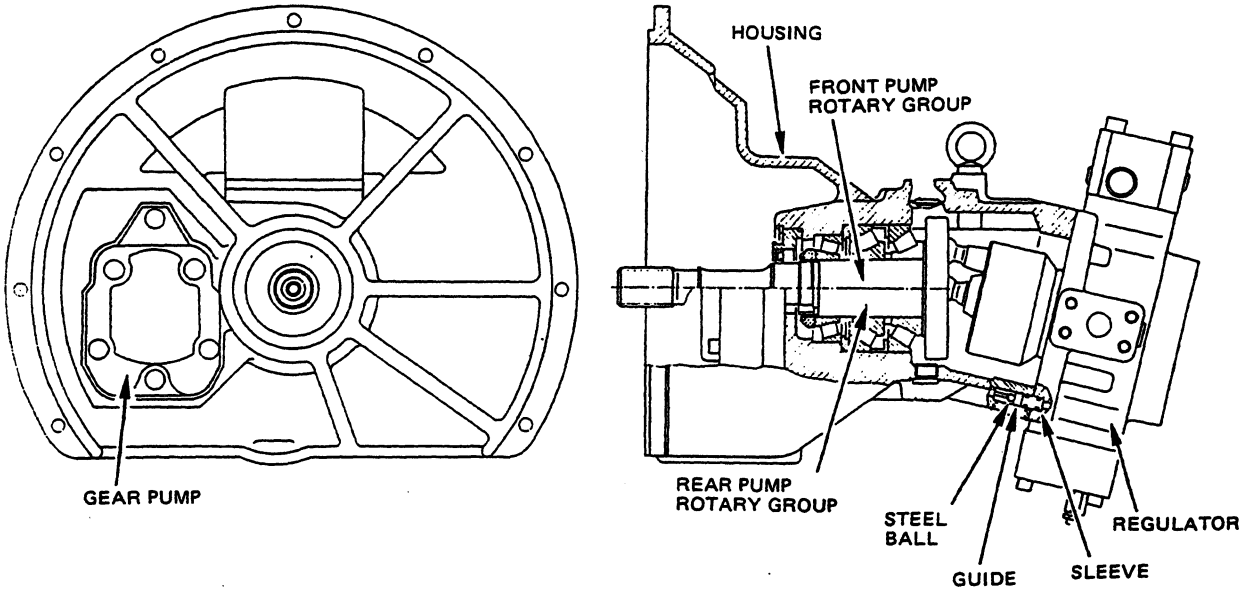


10 Install O-ring Ⓐ on the seal cover.

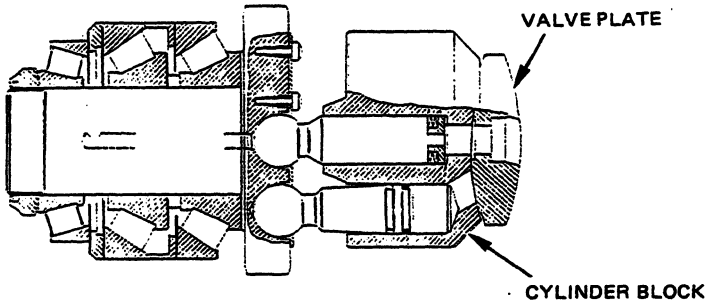


3. PARTS LIST

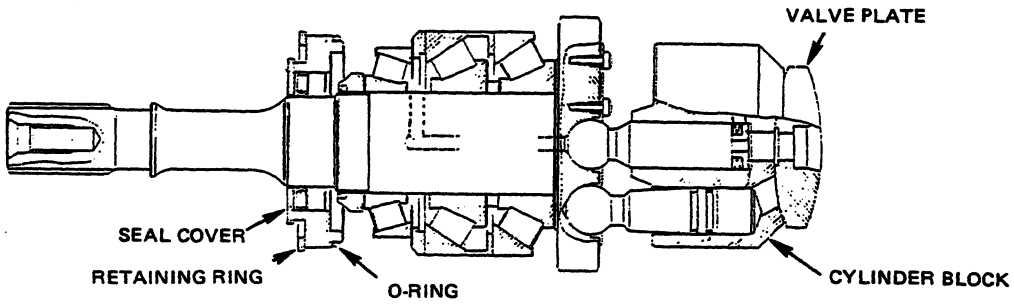
1. PUMP ASSEMBLY



2. REAR PUMP ROTARY GROUP



3. FRONT PUMP ROTARY GROUP



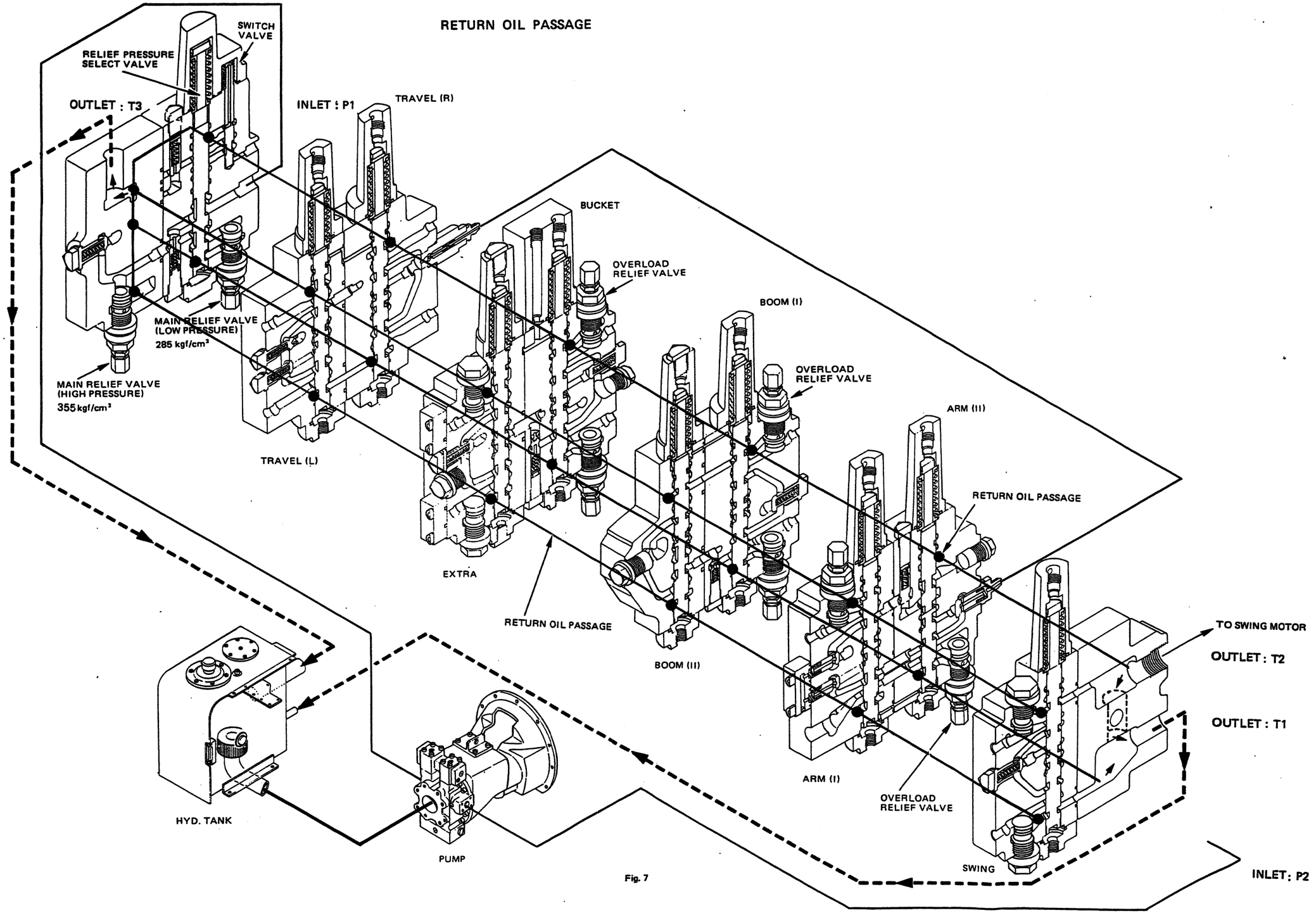

RETURN OIL PASSAGE
SWITCH VALVE
RELIEF PRESSURE SELECT VALVE
OUTLET : T3
INLET : P1
TRAVEL (R)
BUCKET
OVERLOAD RELIEF VALVE
BOOM (I)
MAIN RELIEF VALVE (LOW PRESSURE)
285 kgf/cm²
OVERLOAD RELIEF VALVE
ARM (II)
MAIN RELIEF VALVE (HIGH PRESSURE)
355 kgf/cm²
TRAVEL (L)
RETURN OIL PASSAGE
EXTRA
RETURN OIL PASSAGE
BOOM (II)
TO SWING MOTOR
OUTLET : T2
OUTLET : T1
ARM (I)
OVERLOAD RELIEF VALVE
SWING
INLET : P2
HYD. TANK
PUMP

Fig. 7

2-5 SWITCH VALVE

When the spool except travel is moved, the pilot oil from the pilot pump is closed by its spool. Consequently, the pilot pressure of pilot INLET "Pp"of the switch valve is raised and its spool is moved. And the oil flow from the front pump "P1" is changed from the right block to the left block of the travel (L) section, and the machine straight travelling.

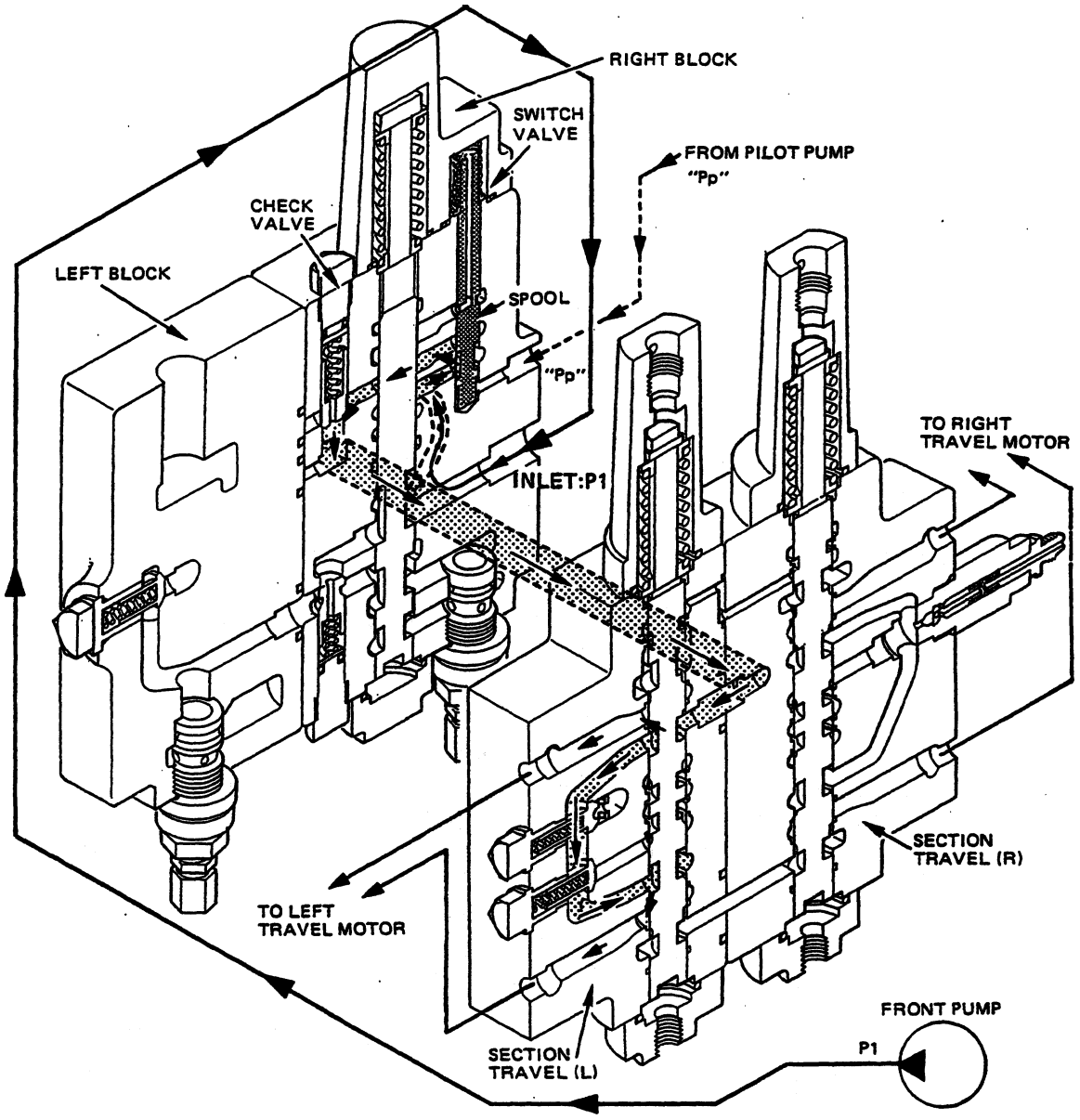
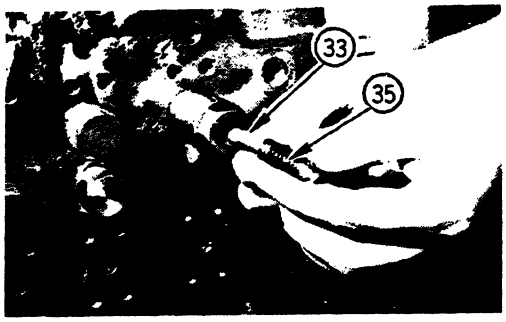


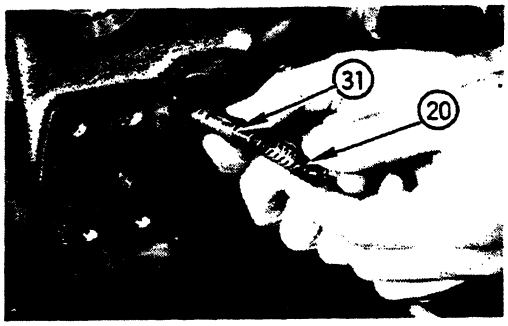
Fig. 17

21 Remove valve (33) and spring (35).

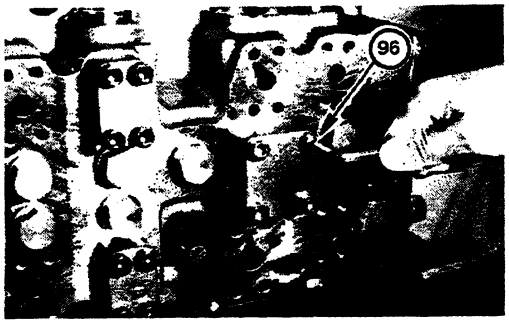


22 CHECK VALVE (For arm II)
Remove adapter (32).

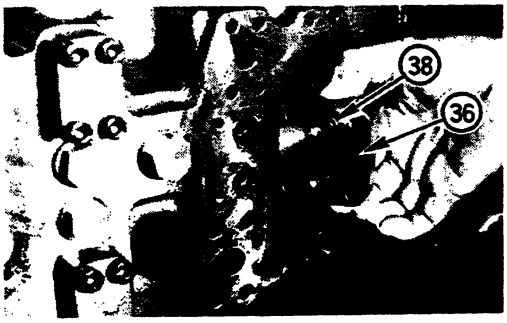
23 Remove spring (20) and valve (31).



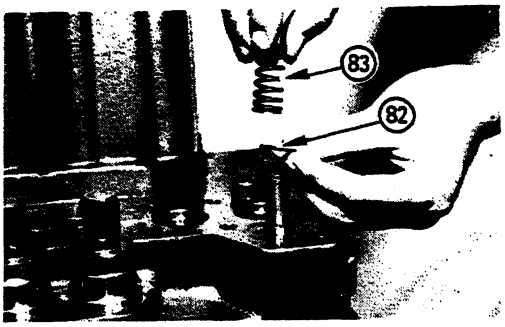
24 CHECK VALVE (For arm I)
Remove socket bolts (96).



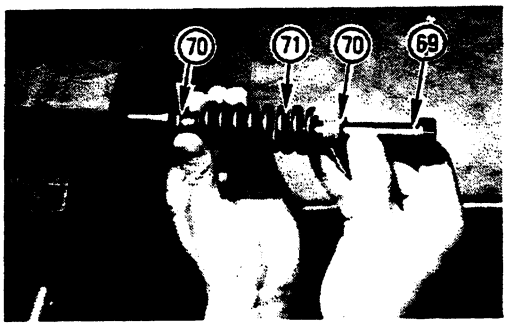
25 Remove plate (36) and O-ring (38).



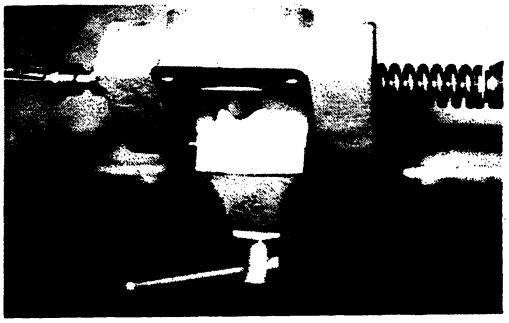
11 Install spring (83) and washer (82).



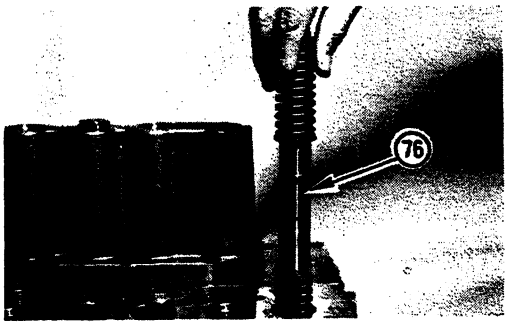
12 SPOOL
Install washers (70), spring (71) and bolt (69).



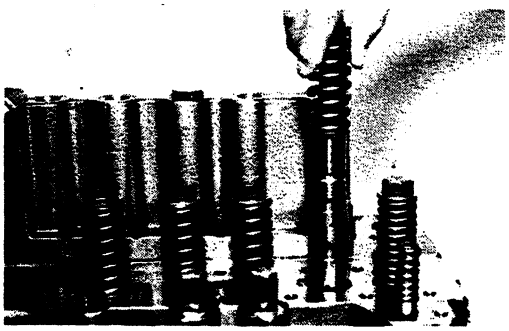
13 Tighten the bolt.



14 Install spool assembly (76).

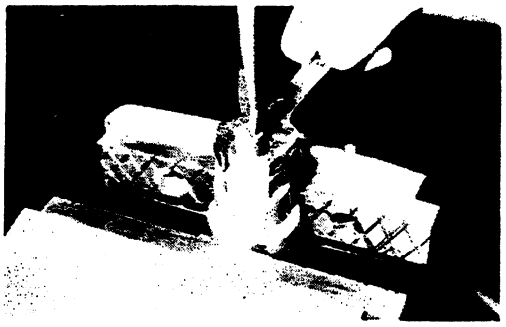


15 Install spool assemblies (64), (63), (62) and (61).



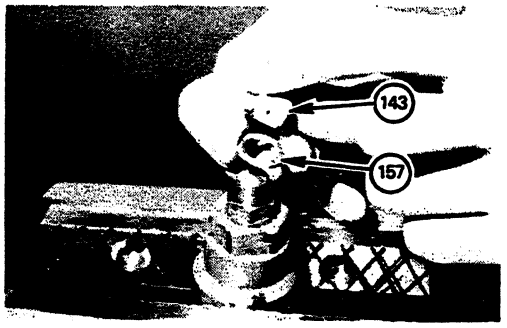
61 Tighten the nut by using a screw driver and a spanner.

Tightening torque: 1.6 ∿ 2.0 kgf.m
(12 ∿ 15 ft.lbs)



62 Install nut (143) and washer (157) into the adjusting screw.

Tightening torque: 2.0 ∿ 2.4 kgf.m
(15 ∿ 18 ft.lbs)



2 OVERLOAD RELIEF VALVE

Item	Parts name	Q'ty
140	Housing	1
141	O-ring	1
142	Back-up ring	1
143	Nut	1
144	Nut	1
145	Adjusting screw	1
146	Spring	1

Item	Parts name	Q'ty
147	Poppet	1
148	Retaining ring	1
149	Retainer	1
150	Seat 1	1
151	Spring	1
152	Valve cartridge	1
153	Seat 1	

Item	Parts name	Q'ty
154	Poppet	1
155	O-ring	1
156	Back-up-ring	1
157	Washer	2
158	Spring	1
157	O-ring	

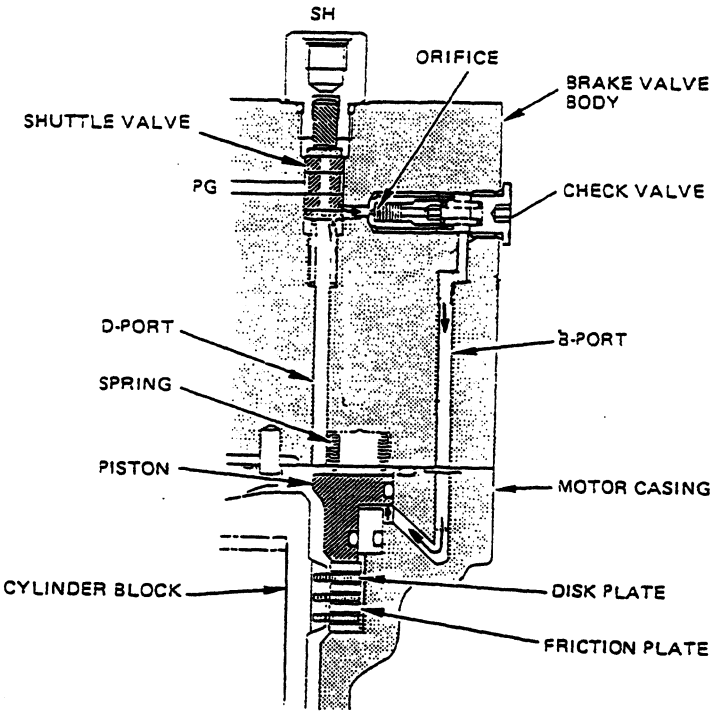
MAIN RELIEF VALVE

Item	Parts name	Q'ty
170	Housing	1
171	O-ring	
172	Back-up ring	
173	O-ring	
174	Nut	
175	Nut	
176	Adjusting screw	

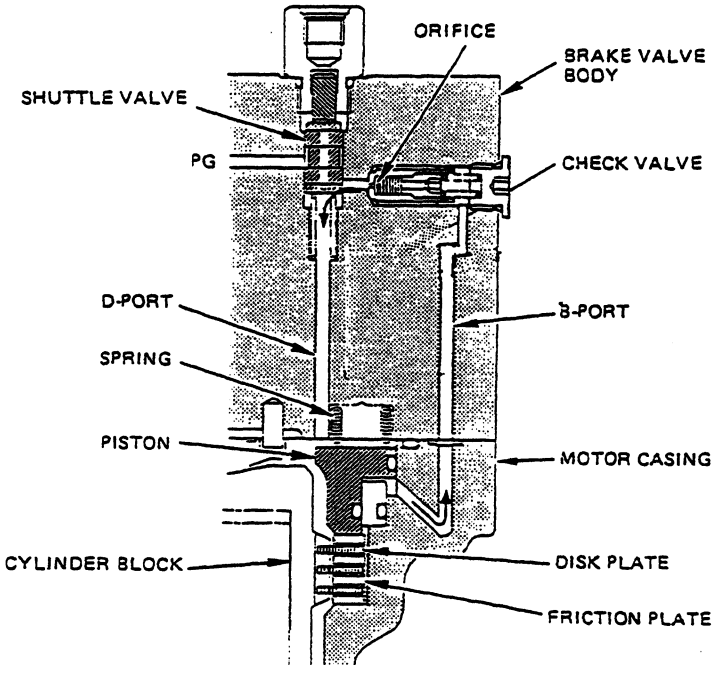
Item	Parts name	Q'ty
177	Spring	
178	Poppet	
179	Ring	
180	Seat	
181	Valve cartridge	
182	Seat	
183	Poppet	

Item	Parts name	Q'ty
184	Spring	
185	Back-up ring	
186	O-ring	
187	Washer	
188	O-ring	

In the lever operation, the brake release pressure (SH) pushes shuttle valve down-ward, and pilot pressure (PG) is applied to B-port through the check valve to move the piston to the up-ward against the force of spring, thus releasing the brake force.



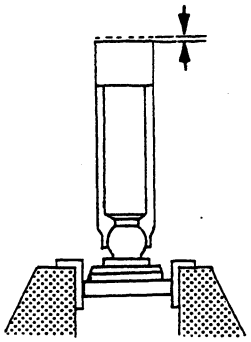
When the control lever is returned to neutral position, the shuttle valve returns upper. Then, the brake piston is moved down-by spring force and the return oil from the chamber B flows back to D-port through the orifice, at this time, the orifice works to make a time lag for 4 second.



2. INSPECTION

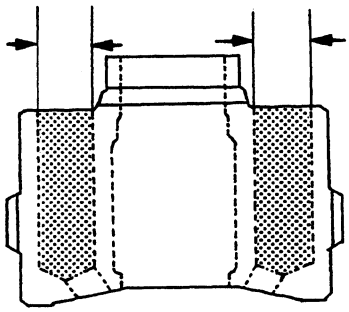
1 Move the piston up and down to measure the clearance between the piston and the shoe.

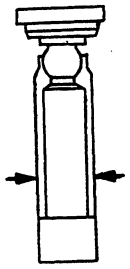
Standard	Limit of use
Max. 0.15 mm	0.4 mm



2 Measure between cylinder bore and piston diameter.

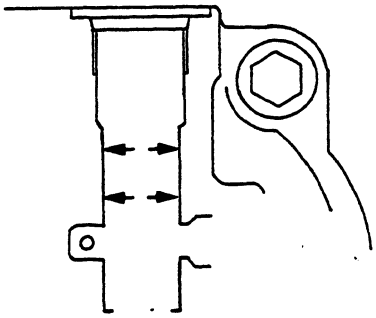
Standard clearance	Limit of use
Max. 0.025 mm	0.04 mm

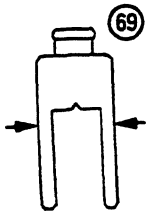




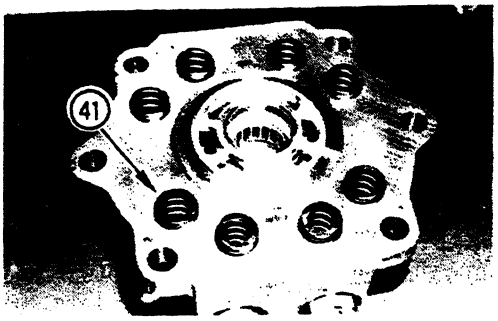
3 Measure between shockless piston (69) and piston bore of the brake valve body.

Standard clearance	Limit of use
Max. 0.017 mm	0.04 mm

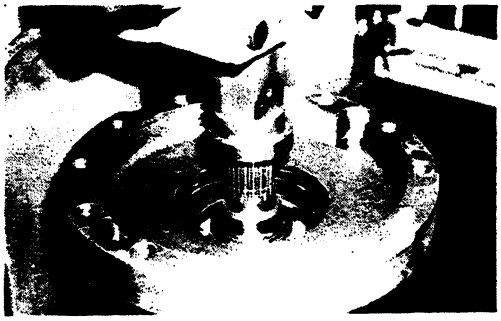




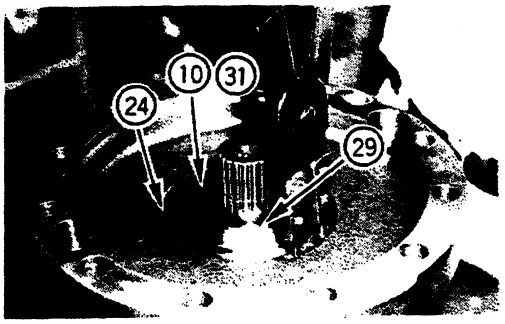
27 Install springs (41) into the body.



28 Press-fit the shaft sub-assembly to the case (01) by using a press.



29 Apply a grease to the seal cover (10), seal lip (29) and O-ring (31), then install seal cover sub-assembly and retaining ring (24) to the case.

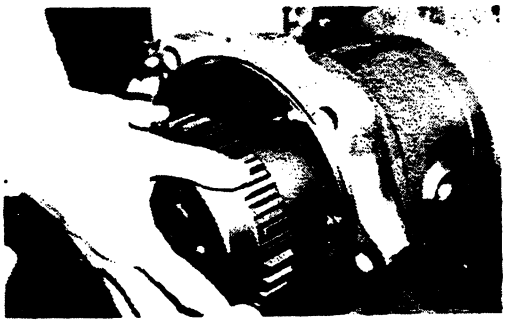


30 Install thrust plate (09) to the case.

Note: Turn the chamfered part to the case side.

31 Install cylinder block sub-assembly into the case.

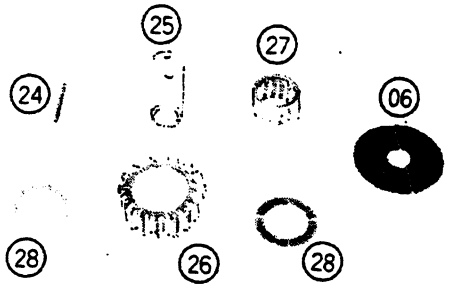
Note: Push the assembly slowly lest the piston, retainer holder, etc.



2. ASSEMBLY

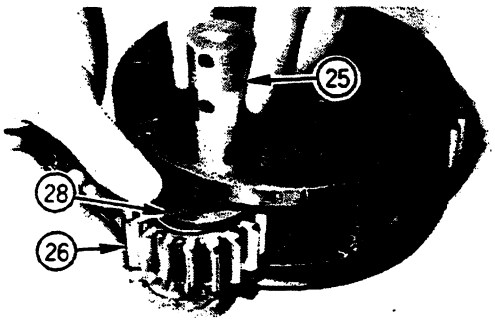
Note : Before assembly, clean all internal parts using clean oil and dried by air. No foreign material should be remain inside the reduction device.

1 Install needle bearing (27) in planetary gear (26).

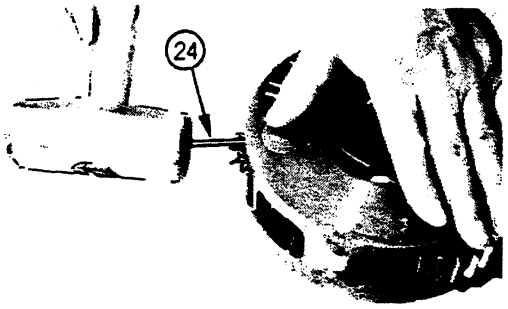


2 Install thrust plate (04) in carrier (05).

3 Install planetary gear (26) and thrust plates (28) with the oil grooves of thrust platetes toward the planetary gear. Install pin (25) aligning the hole in pin with hole in carrier.



4 Tap spring pin (24) into the hole of carrier. The slit of spring pin should be toward the upside of carrier.



2-3. CONTROL RANGE (C-D)

When the pusher is pushed down, the balance spring is compressed and its force "F_1" is transmitted to the spool, connecting the ports "IN" to "OUT" to release the pilot pressure out of delivery port, as shown in Fig. 11. This delivery pressure is applied to the piston in the spool, and pushes the spool up until it is balanced with the force F_1. Consequently, the delivery pressure "P_2" (secondary pressure) is varied in proportion to the compressed force "F_1" of the spring.

When the force "F_1" is balanced with "F_2", the spool is positioned at both ports; "IN" and "T". Therefore, both ports are blocked and disconnected from the port "OUT".

NOTE: The piston in the spool is provided to decrease received pressure for the spool.

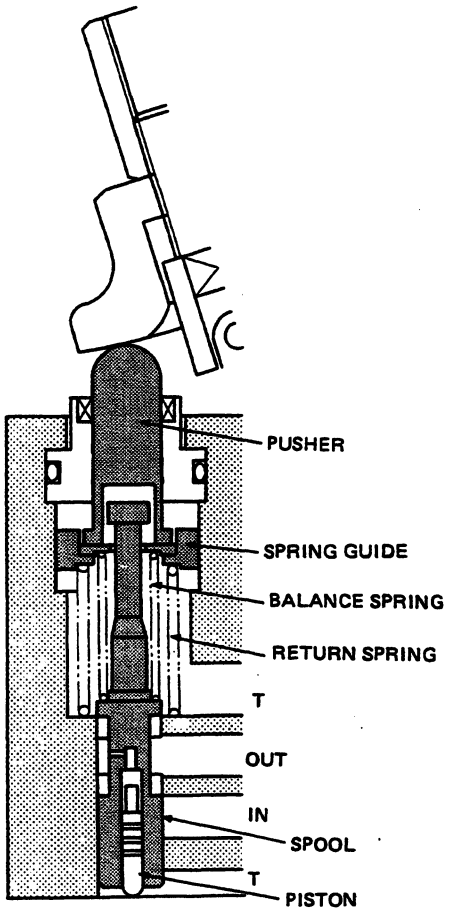


Fig. 10

The above operation range is shown in Fig. 13.

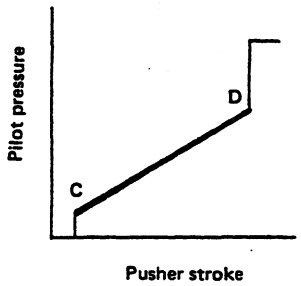


Fig. 13

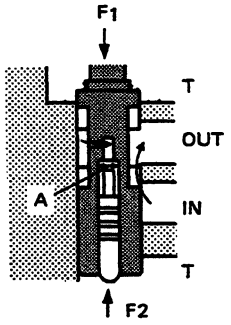


Fig. 11

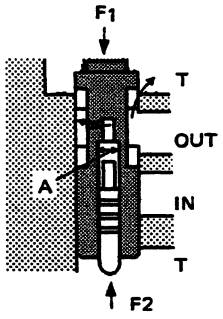
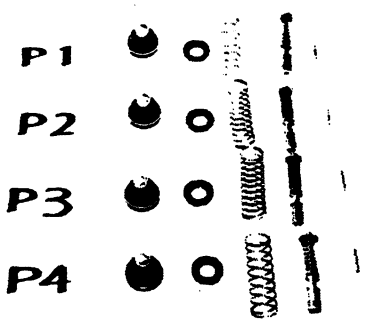


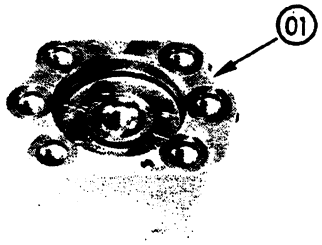
Fig. 12

2. ASSEMBLY

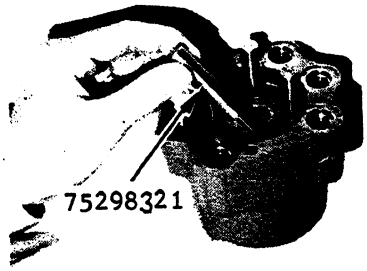
1 Clean all parts and apply clean hydraulic oil to all internal parts.



2 Put casing (01) on the workbench.

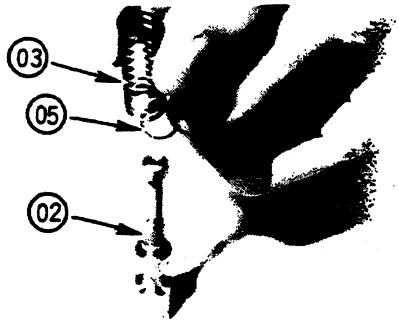


3 Install the special tools (75298321)into four holes in the casing.



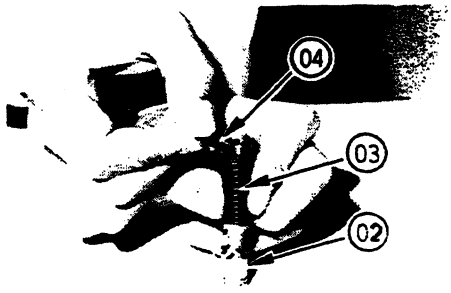
4 Install shim (05) and spring (03) into spool (02).

Note: Number of shim are decided at performance test, don't loose them.



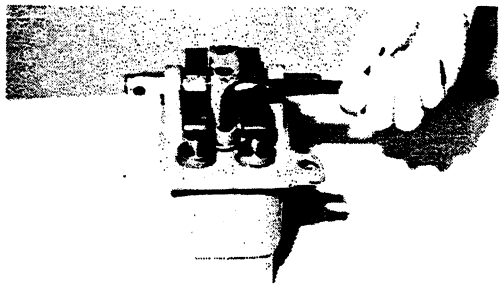
5 Press spring (03) and install spacer (04) between spool (02) and spring (03).

Note: Spacer has both sides, face the spring seat side to the spring.

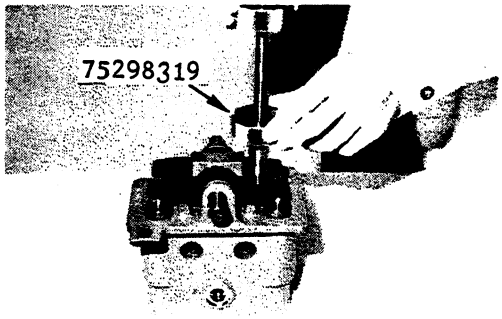


HV TYPE PILOT VALVE (FOR TRAVEL)

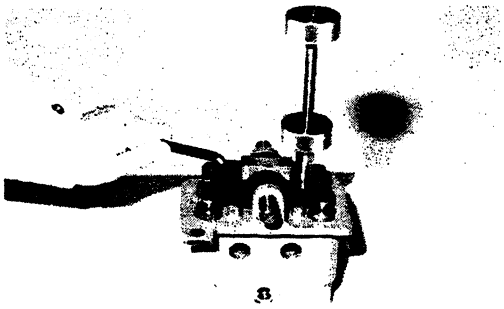
10 Put the pilot valve assembly on the workbench.
Remove socket bolt (14) from the casing.



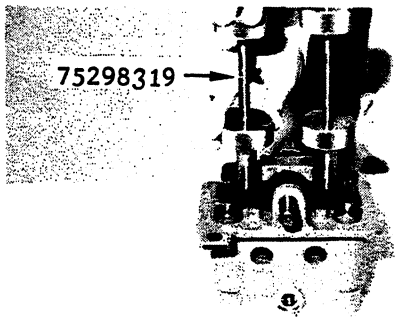
11 Install a special tool (75298319)into the casing.



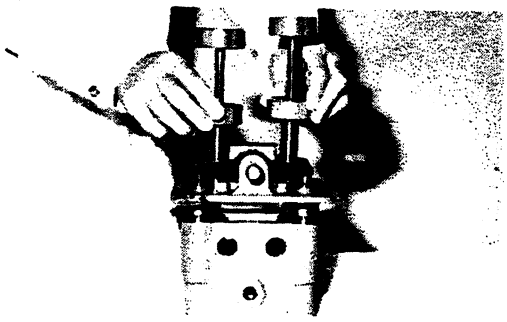
12 Remove the other socket bolt (14) from the casing.



13 Install the special tool (75298319) into the casing.

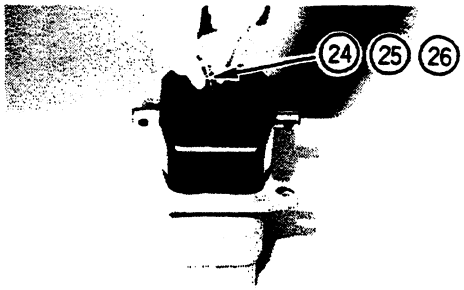


14 Loosen both special tools (75298319) gradually, until it has lost spring force.



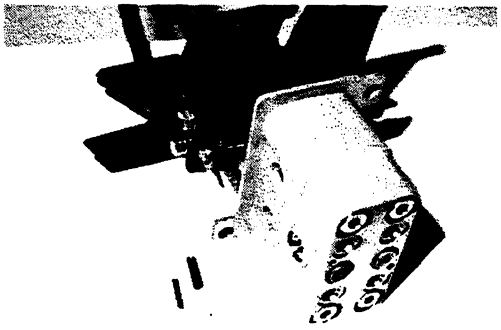
HV TYPE PILOT VALVE (FOR TRAVEL)

31 Install bolt (24), plain washer (25) and spring washer (26).



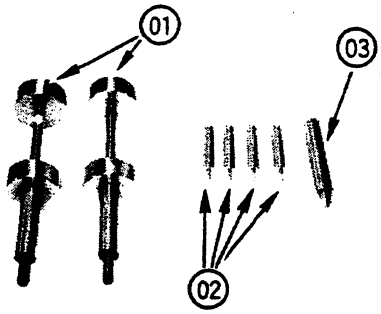
32 Install both right and left levers.

33 Install two spring pins.



3. SPECIAL TOOLS

(01) 75298319
(02) 75298321
(03) 75298322



ST-NUMBER	TOOL NAME	Q'ty	USE
75298319	Valve holder ass'y	2	to remove and install holder
75298321	Holder removing guide	4	to keep straight the spool
75298322	Bushing driving guide	1	to install the bushing

SHOCKLESS VALVE

Item	Part name	Q'ty	Item	Part name	Q'ty
01	Spring	14	12A	Spool	1
02	Plug	7	12B	Ring	1
03	Spring	6	12C	Orifice	1
04	Plug	6	13	Spool ass'y	1
05	Name-Plate	1	13A	Spool	1
06	Plug	7	13B	Ring	1
07	Screw drive	2	13C	Restriction	1
08	O-ring	6	14	Filter ass'y	6
09	O-ring	14	14A	Filter	1
10	O-ring	6	14B	Valve seat	1
11	Spool ass'y	4	15	Body ass'y	1
11A	Spool	1	15A	Body	1
11B	Ring	1	15B	Seal	1
11C	Orifice	1	15C	Seal	1
12	Spool ass'y	2	15D	Steel ball	12

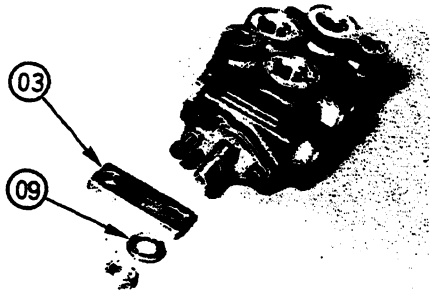
CONTROL NEUTRALIZER VALVE

1. DISASSEMBLY

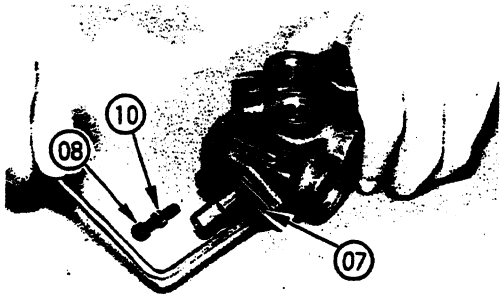
NOTE: Before disassembling clean the all parts.

1 Remove nut (11)

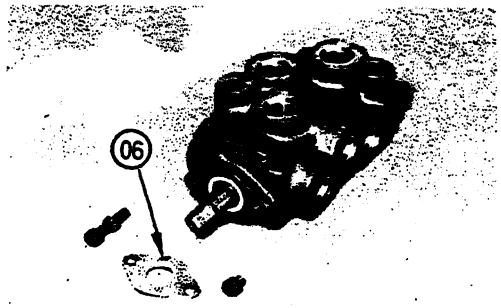
2 Remove spring washer (09) and lever (03).



3 Loosen nut (10) and remove bolt (07) and (08).



4 Remove seal plate (06).



2.2 SOLENOID VALVE (N/O: Normal open type)

This valve is provided to operate pump regulator.

a. Neutral position

When no electrical instruction is given, the valve is in neutral.
In this condition, pilot pressure oil from pilot pump flows to the pump regulator.

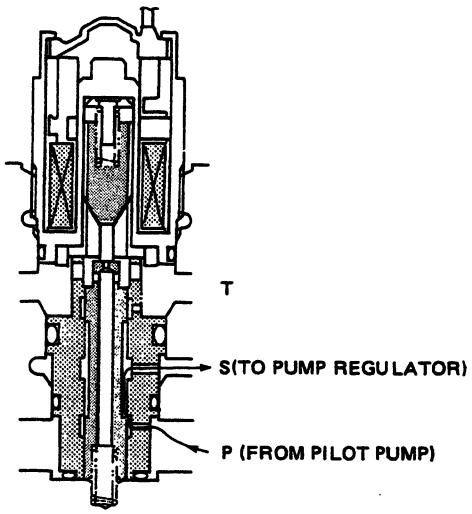


Fig. 4

b. Working position

When an electrical instruction is given, the spool move to the downward. Pilot pressure line from pilot pump is cut, and allows the pilot pressure oil in port S to flow to the tank.

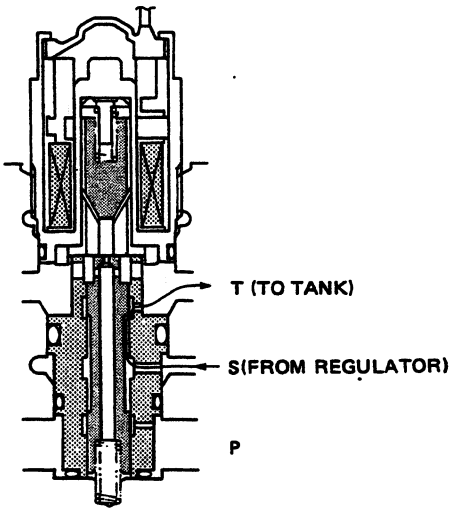
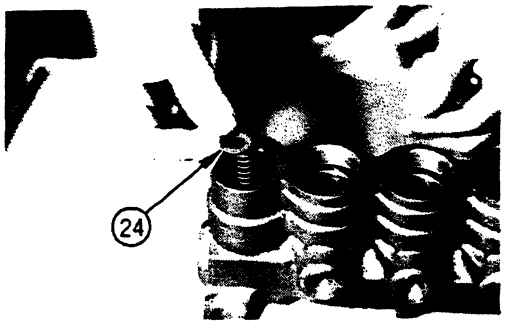


Fig. 5

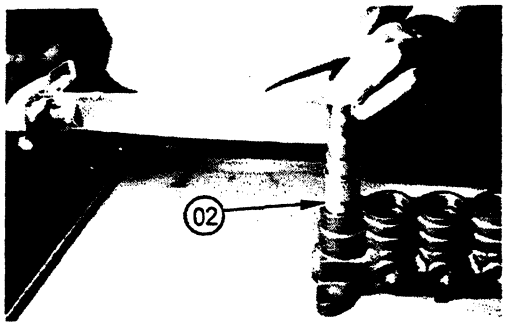
5 Install shim (24).

Note: Number of shim are decided at performance test, don't loose them.

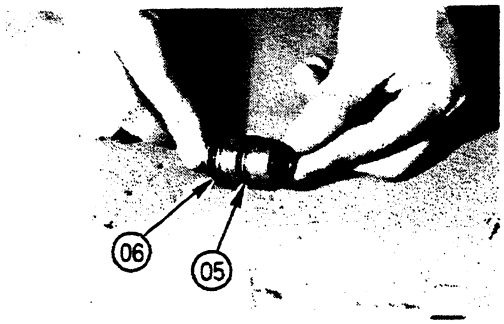


6 Install plug (02).

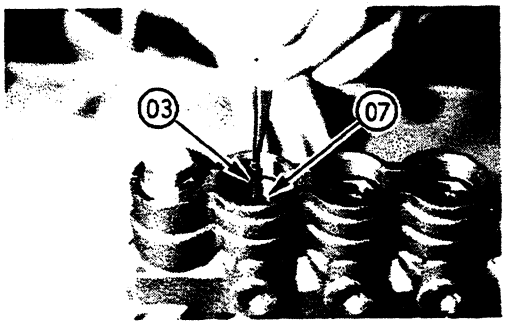
Tighten torgue: 5 kg.m (36.17 ft. lbs)



7 Install O-ring(04), (05) and (06) into body (07).

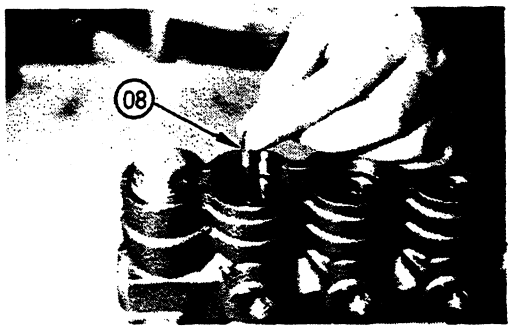


8 Install body (07) and spring (03).



9 Install spool (08) and (09).

Note: Install spool refer to port number.



UNDERCARRIAGE

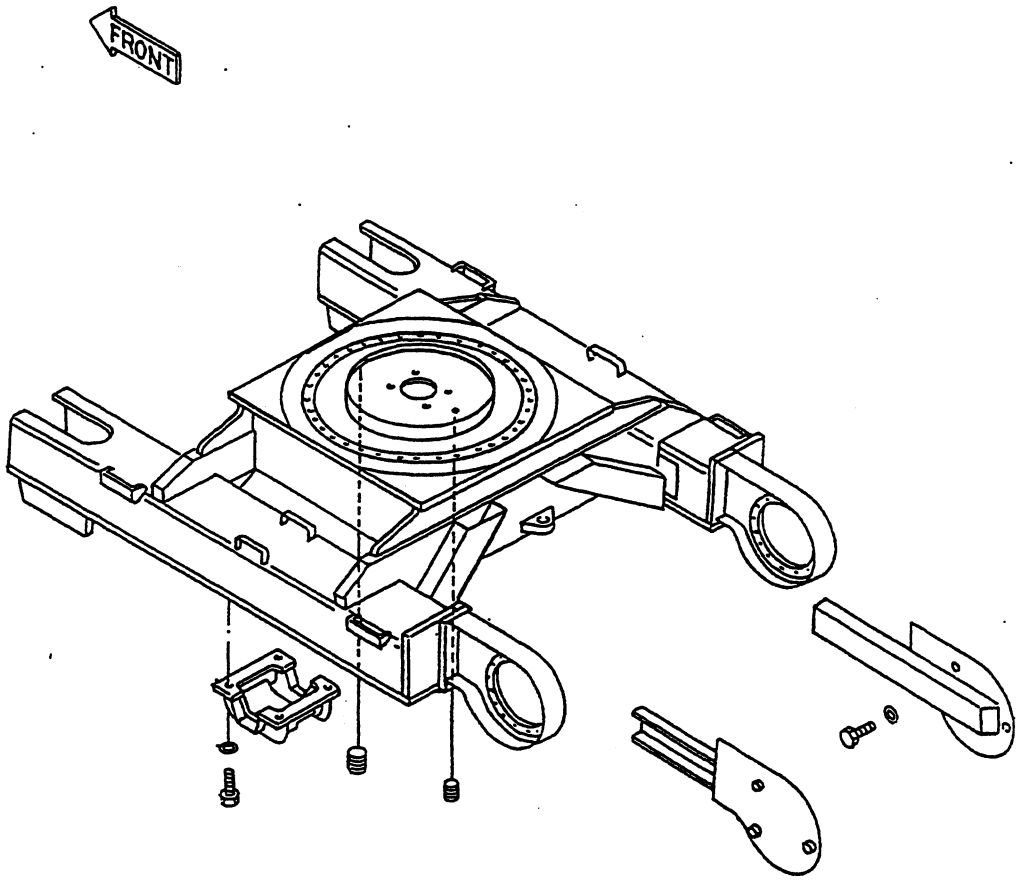
1. TRACK FRAME

1.1 CONSTRUCTION & FUNCTION

The track frame is a welded one-construction and composed of center frame, right and left side frames.

The center frame has a centralized hole for the pipings to improve the reliability. The side frame is made so that the mud can be easily eliminated.

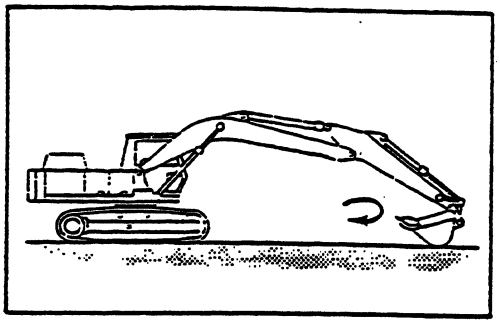
The swing bearing and the center joint are provided on the center frame, the lower rollers and the center guards are under the side frames, the upper rollers are on the side frames, the front idlers are at the front of the side frames and the travel devices are at the rear of the side frames.



3.2 MAINTENANCE

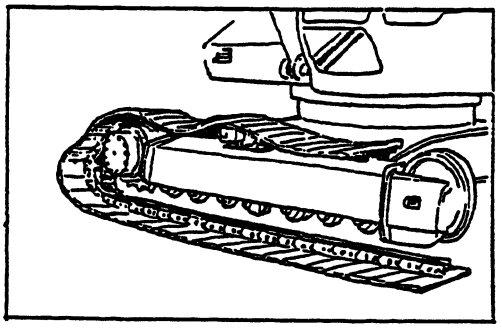
3.2.1 REMOVAL & INSTALLATION

REMOVAL

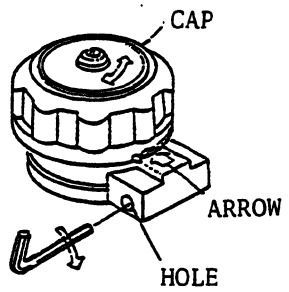


1 Place unit on level ground. Swing the superstructure so that the operator's cab side is travel device side as shown.

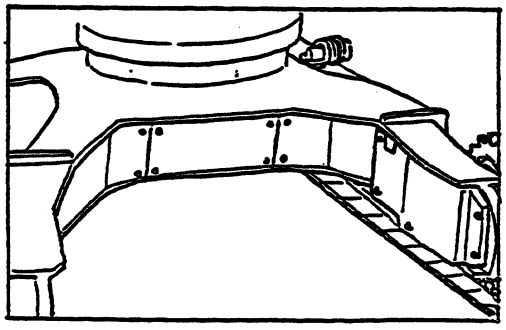
2 Disconnect track link.



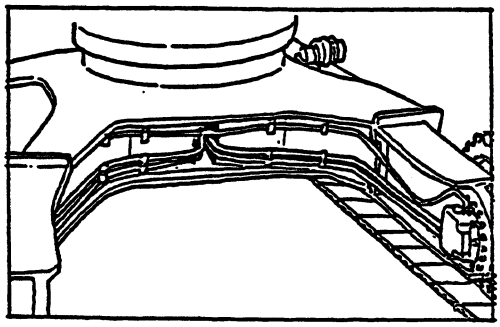
3 Stop the engine and operate the control lever for releasing pressure in the hydraulic system.
Remove the air breather cap and release the air from the hydraulic tank.



4 Remove the piping covers.



5 Remove clamps

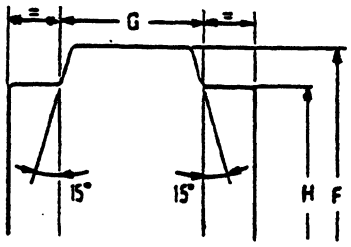


WARNING

Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 2 bar (30 psi) according to local or national requirements.

4 For reassebly, reverse the disassembly operation sequence.
Fit back the idler wheel, (01) taking the necessary precautions for the assembly of lip seals (03) and O-rings (07).

Amout of oil: 0,3 kg
Grade: SAE 30.

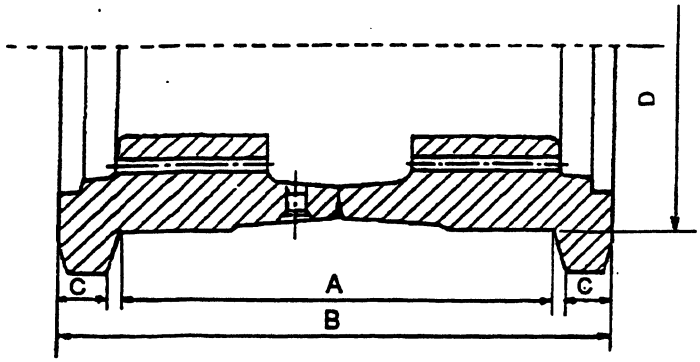


Idler wheel

Reference	F	G	H
NOMINAL DIMENSION (mm)	588	70	536

5.2.4 MAINTENANCE STANDARD

ROLLER



ND = Nominal Dimension
RL = Recommended Service Limit
LU = Limit of Use

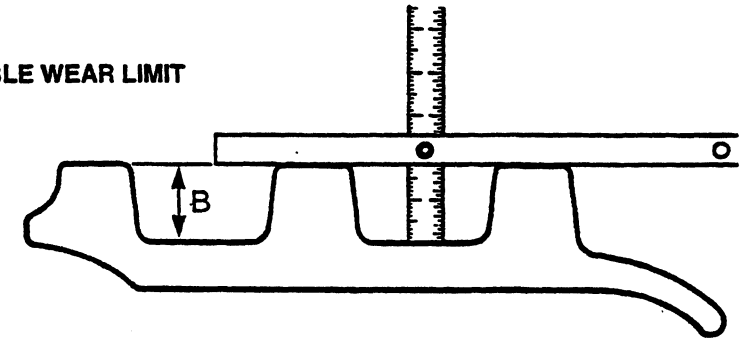
Unit: mm

Mark	ND	RL	LU	Remedy
A	143	147	150	Replace
B	195	-	-	Buildup or Replace
C	-	-		"
D	155	151.5	149	"

(3) SHOES WEAR LIMIT

Wear
The most important wear is the relative height of the grouser to the top of the shoe plate. A depth gauge is used to measure this.

SHOES ALLOWABLE WEAR LIMIT



Measurement of grouser height

Grouser Height	New		Wear percentage							
			25%		50%		75%		100%	
	mm	in	mm	in	mm	in	mm	in	mm	in
B	25.3	1.00	22	0,85	19	0,75	15	0,59	11	0,43

Note: As well as showing the maximum allowable wear (i.e. 100 percent), intermediate wear limits are also shown to help the user evaluate the approximate life of the components not completely worn out.
The 75 percent wear limits is useful as a reference for partial overhaul such as pin and bush turning, rebuilding, etc.

Structure (Fig. 4)

Seven pistons (1) of axial piston motor are provided on one cylinder block (4), parallel to cylindrical plane. Cylinder block (4) rotates together with output shaft (2) when the pistons reciprocate.
Seven pistons (1) are installed on spherical joints. Cylinder block (4) is slanted against output shaft (2). Fixed valve plate (3) is in contact with the end of the cylinder block (4). The angle of inclination of cylinder block (4) is 40°. Therefore, the torque of motor is prefixed. (see fig. 9).

Operation (Fig. 4)

When oil flows into the L.H. ports and out of the R.H. ports in valve plate (3), the oil pressure is applied to the rear sides of pistons (1) leading to the L.H. ports, and output shaft (2) rotates clockwise.
In this case, pistons (1) rotate clockwise together with cylinder block (4) at the same speed as output shaft (2), while sliding in cylinder block (4).
Then, when piston (1) reaches the uppermost point, this piston cylinder connects to the ports on the outlet side in valve plate (3).
When pistons (1) reach the outlet ports, the pressure on the piston back sides is relieved, eliminating the force on output shaft (2).
Then pistons (1) are rotated by output shaft (2) and allowed to slide through cylinder block (4). The oil on the piston back sides is drained to the tank. The above mentioned movements are followed by all seven pistons (1) and output shaft (2) rotates clockwise.
If the oil inlet and outlet ports are used in the reverse way the above movements are made oppositely, causing output shaft (2) to rotate counterclockwise.

1) Piston
2) Output shaft
3) Plate
4) Cylinder block

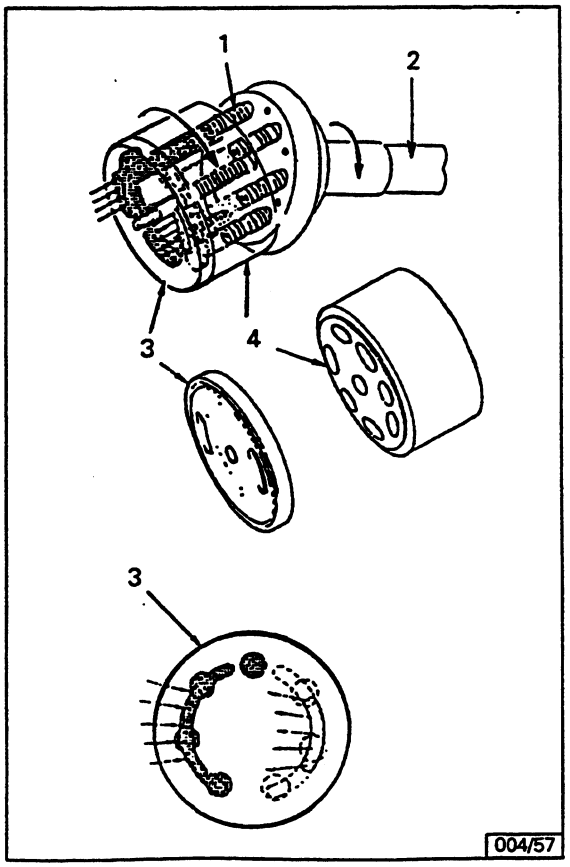
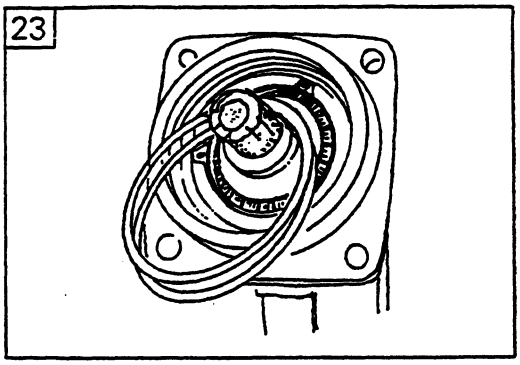
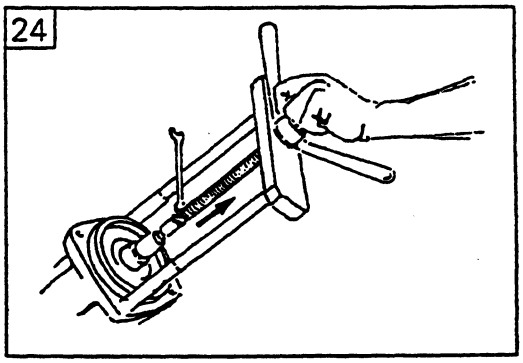


Fig. 4

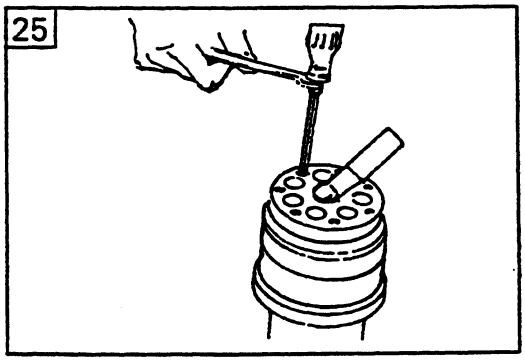
Remove shim.



Remove rotary group with extractor. (See fig. 50).



Remove retaining plate. The screws are held by loctite.



I. DISASSEMBLY

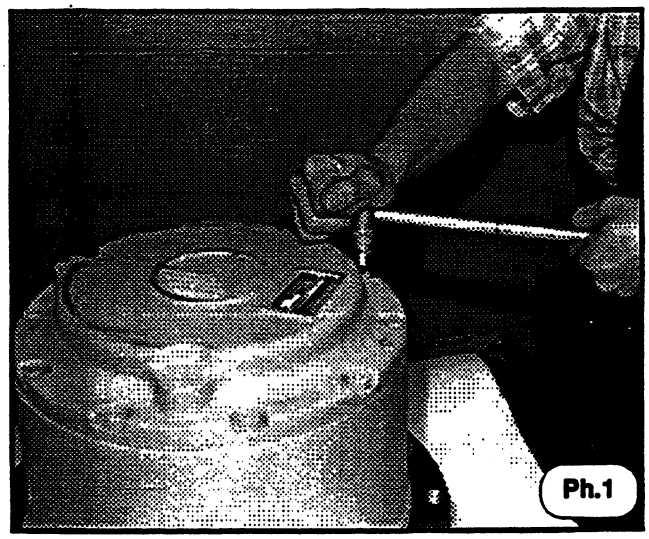


FOTO 1

DOPO AVER SVUOTATO L'OLIO LUBRIFICANTE DAL RIDUTTORE SECONDO QUANTO DESCRITTO AL PARAGRAFO 3.2, SVITARE LE 10 VITI TCEI M10x25 (POS.16), CLASSE DI RESISTENZA 12.9

PHOTO 1

AFTER HAVING EMPTIED THE LUBRICANT OIL FROM THE GEARBOX ACCORDING TO THE RULES AS AT PARAGRAPH 3.2, UNSCREW THE 10 SCREWS TCEI M10x25 (POS.16), RESISTANCE CLASS 12.9

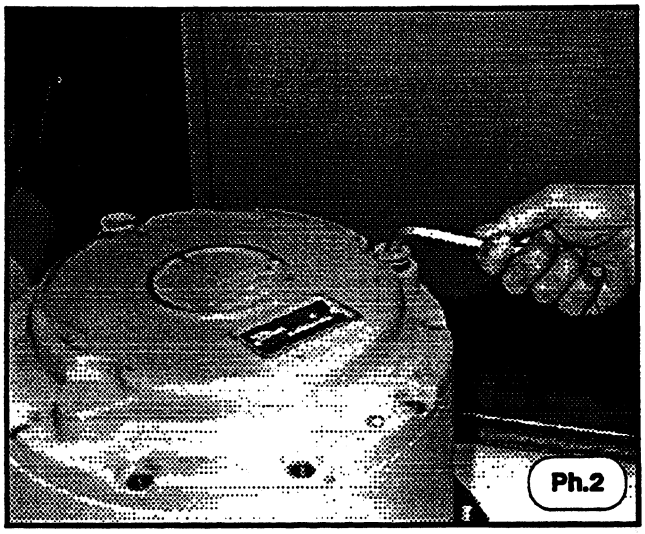


FOTO 2

SVITARE I 2 TAPPI M22x1,5 (POS.21), SITUATI SUL COPERCHIO DI CHIUSURA DEL RIDUTTORE (POS.17)

PHOTO 2

UNSCREW THE 2 PLUGS M22x1.5 (POS.21), PLACED ON THE CLOSING COVER OF THE GEARBOX (POS.17)

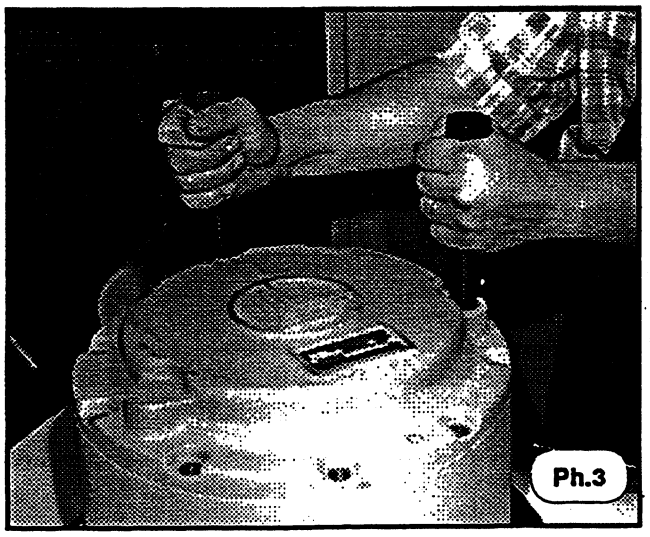


FOTO 3

SFILARE IL COPERCHIO DI CHIUSURA (POS.17) UTILIZZANDO COME ESTRATTORI 2 VITI M22x1,5 AVVITATE NEI FORI DEI TAPPI OLIO

PHOTO 3

REMOVE THE CLOSING COVER (POS.17) BY USING AS EXTRACTORS 2 SCREWS M22x1.5 TIGHTENED TO THE OIL PLUGS HOLES

1.2 CONTROLLO TENUTA FRONTALE

PUO' ESSERE NECESSARIO IN CASO DI PER-DITE OLIO, DOVER PROWEDERE AL CONTROLLO, E ALLA EVENTUALE SOSTITUZIONE, DELLA TENUTA FRONTALE (POS.5)
OCCORRE IN QUESTO CASO AVERE IL RIDUTTORE SMONTATO DALLA MACCHINA

1.2 FRONT SEALING CONTROL

IN CASE OF OIL LEACKAGES IT CAN BE NECESSARY TO PROVIDE FOR THE CONTROL AND EVENTUAL REPLACEMENT OF THE FRONT SEALING (POS.5).
IN THIS CASE IT IS NECESSARY TO HAVE THE GEARBOX DISASSEMBLED FROM THE MACHINE

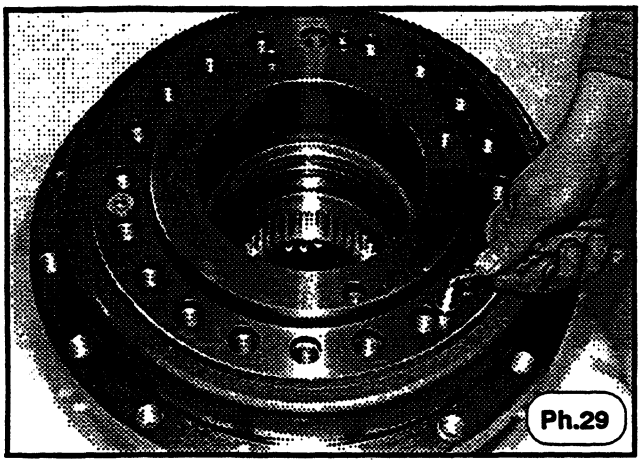


FOTO 29
SVITARE LE 3 VITI TSPEI M10x25 (POS.2), CLASSE DI RESISTENZA 10.9

PHOTO 29
UNSCREW THE 3 SCREWS TSPEI M10x25 (POS.2), RESISTANCE CLASS 10.9

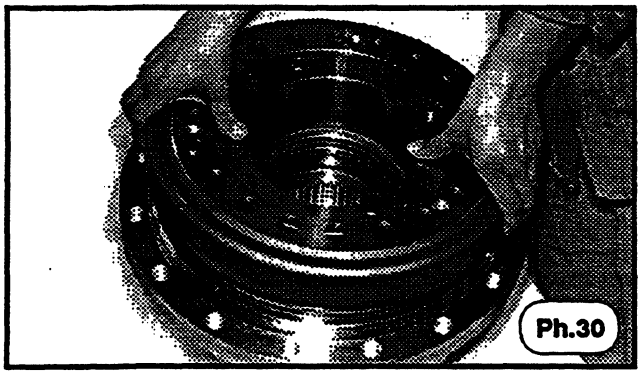


FOTO 30
SFILARE IL COPERCHIO (POS.4)

PHOTO 30
EXTRACT THE COVER (POS.4)

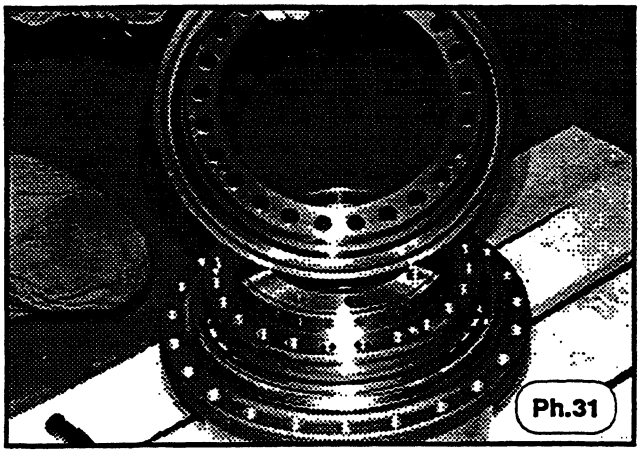


FOTO 31
E' POSSIBILE ORA CONTROLLARE LA TENUTA FRONTALE (POS.5)

PHOTO 31
NOW IT IS POSSIBLE TO CHECK THE FRONTAL SEALING (POS.5)

NOTA

LO SMONTAGGIO DEL RIDUTTORE TERMINA CON QUST'ULTIMA OPERAZIONE: TUTTI I PARTICOLARI SONO ORA A DISPOSIZIONE PER LE VERIFICHE NECESSARIE

NOTE

THE GEARBOX DISASSEMBLYI ENDS WITH THE ABOVE OPERATION: ALL ITEMS ARE NOW AVAILABLE FOR THE NECESSARY VERIFICATIONS

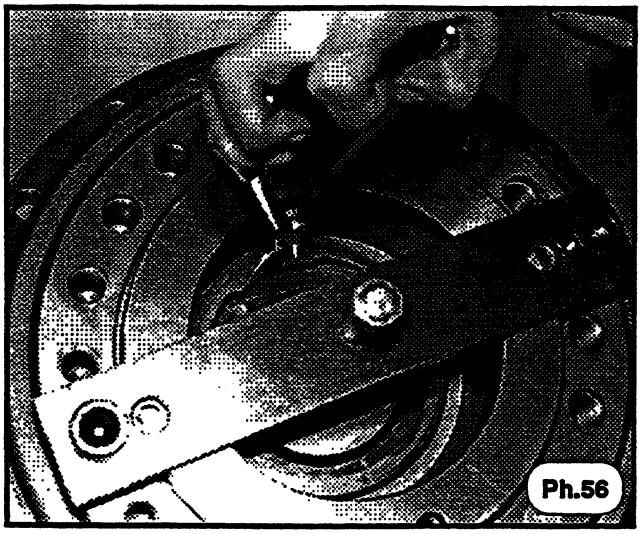

Ph.56

FOTO 56
MONTARE L'ANELLO ELASTICO (POS.36)

PHOTO 56
MOUNT THE CIRCLIP (POS.36)

NOTA
PER VERIFICARE IL CORRETTO ASSEMBLAGGIO DEL GRUPPO FRENO, E' NECESSARIO EFFETTUARE UNA PROVA DI TENUTA DELLE GUARNIZIONI.
COLLEGARE IL FORO DI COMANDO FRENO AD UNA POMPA E SBLOCCARE IL FRENO IMMETTENDO OLIO IN PRESSIONE. CON L'AUSILIO DI UN MANOMETRO VERIFICARE CHE LA PRESSIONE NON DIMINUISCA (VEDI FIG.4). IN CASO CONTRARIO LE GUARNIZIONI DI TENUTA DEL FRENO PERDONO OLIO ED E' NECESSARIO RISMONTARE IL GRUPPO FRENO E PROVVEDERE ALLA LORO SOSTITUZIONE

DATI DI PROVA : PRESSIONE OLIO = 150 bar
DURATA DELLA PROVA = 3 min.

NOTE
IN ORDER TO VERIFY THE CORRECT ASSEMBLY OF THE BRAKE GROUP, IT IS NECESSARY TO CARRY OUT A SEALING TEST OF THE SEAL RINGS.

CONNECT THE BRAKE COMMAND HOLE TO A PUMP AND UNBLOCK THE BRAKE BY PUTTING OIL IN PRESSURE. BY MEANS OF A MANOMETER VERIFY THAT THE PRESSURE DOES NOT DECREASE (SEE FIG.4). ON THE CONTRARY, THE SEAL RINGS OF THE BRAKE LOOSE OIL AND IT IS NECESSARY TO REASSEMBLE THE BRAKE GROUP AND PROVIDE FOR THEIR REPLACEMENT

TEST DATA : OIL PRESSURE = 150 bar
DURATING TEST = 3 min.

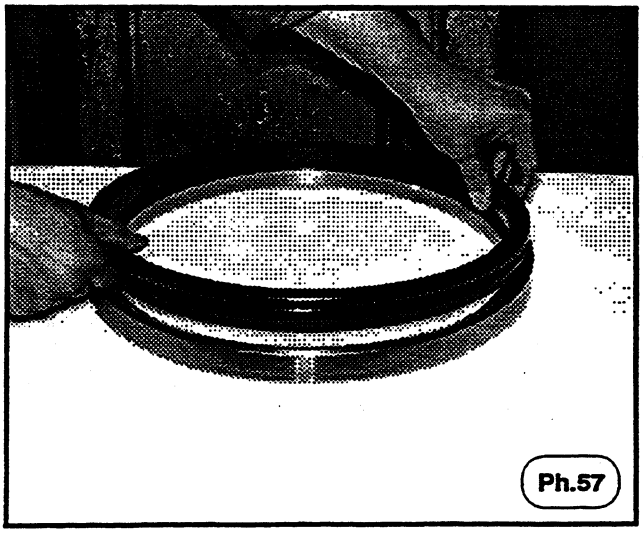
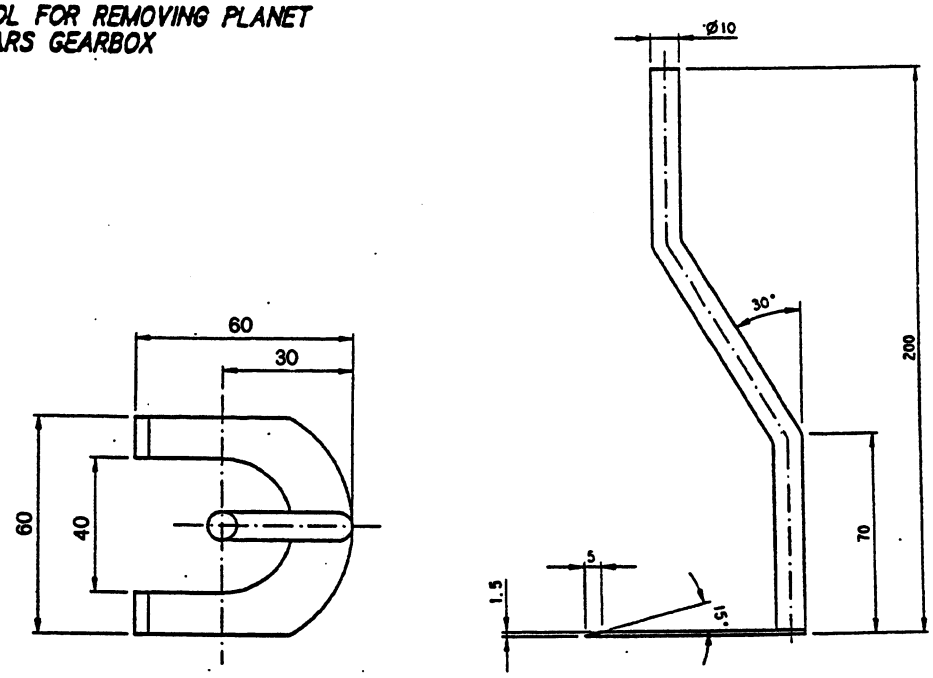

Ph.57

FOTO 57
MONTARE UNA SEMITENUTA FRONTALE (POS.5) SULL'APPOSITO ATTREZZO (VEDI DIS. 75301333)

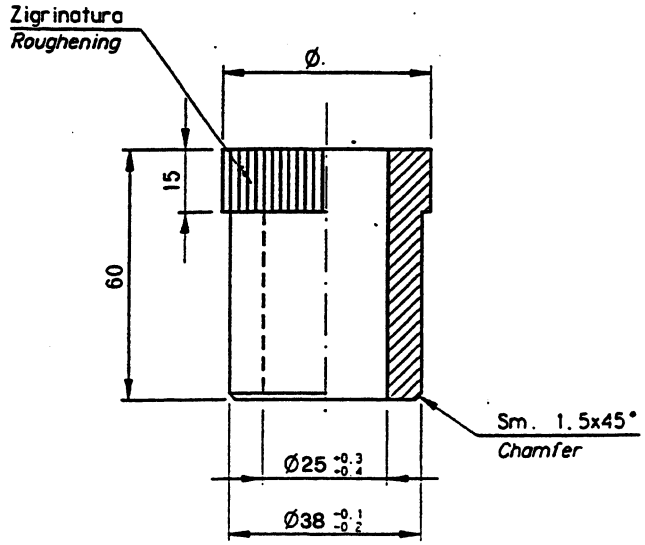
PHOTO 57
MOUNT A FRONTAL HALF SEALING (POS.5) ON THE PROPER TOOL (SEE DRAWING 75301333)

TOOL FOR REMOVING PLANET GEARS GEARBOX



75301353

BUSH GUIDE FOR FITTING THE PLANET

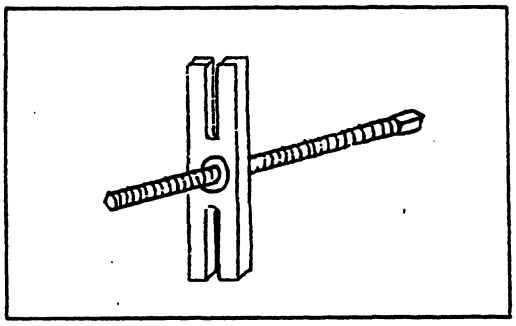


75301352

3. SPECIAL TOOLS

ST-Number	Tool Name	Q'ty	Use
75298324	Puller	1	To remove body from spindle

75298324



3.2 MAINTENANCE STANDARD

ADJUSTED THE BUCKET CLEARANCE

(1) Check the bucket clearance "a". If necessary adjust the shim as follows.

(2) Adjustment of bucket linkage (standard bucket)

This machine has a bucket adjustment system to take up play in the linkage. When play in the linkage increases, remove shims as explained below. This will allow the bush ④ to move to the right and take up the clearance "a" between the bush and the arm boss.

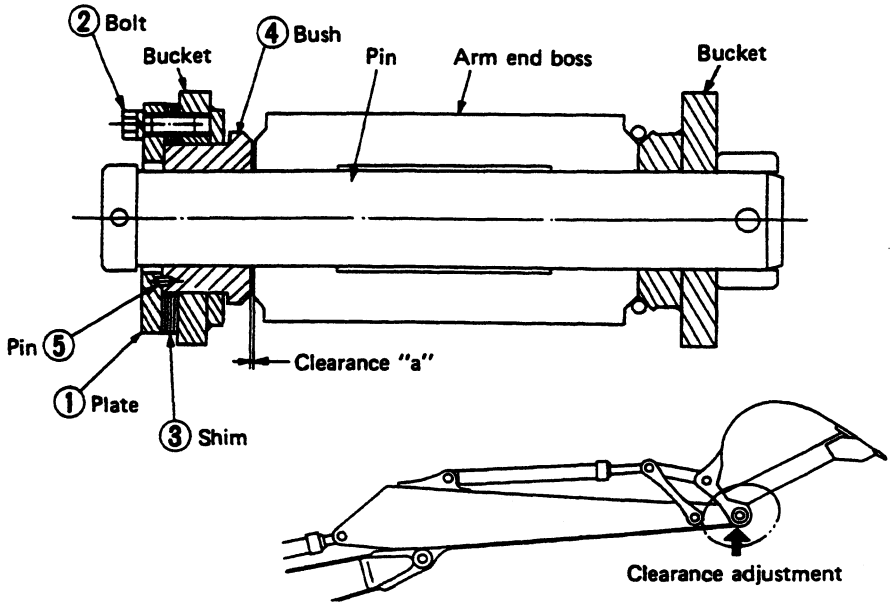
(i) Remove bolt ② and plate ① .

(ii) Remove shims ③ according to the clearance "a".

(iii) Fit plat ① to pin ⑤ and tighten bolt ②

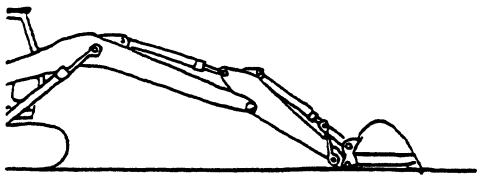
NOTES:

Bucket clearance "a" should not be adjusted below 0.5 mm.

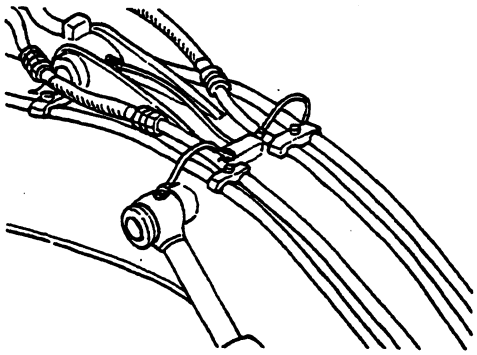


(5) REMOVE BOOM CYLINDER

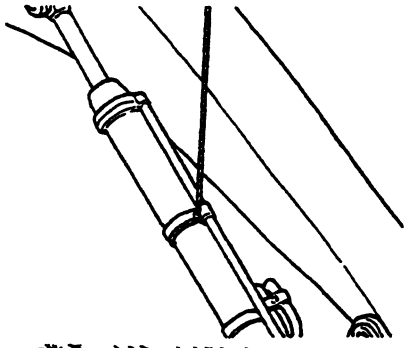
1 Place the unit on level ground.



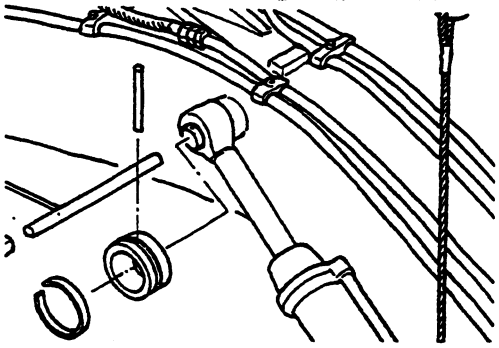
2 Remove lubricate piping from the boom cylinders.



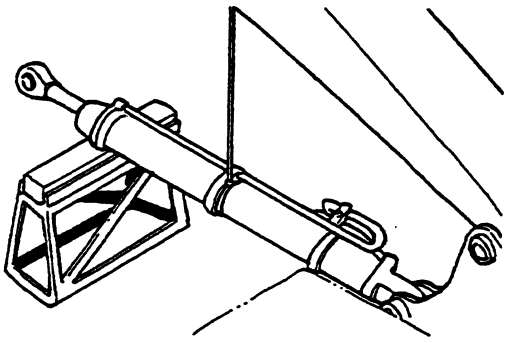
3 Hoist boom cylinder.



4 Remove ring and stopper pin, then, push out pin with bar and hammer.

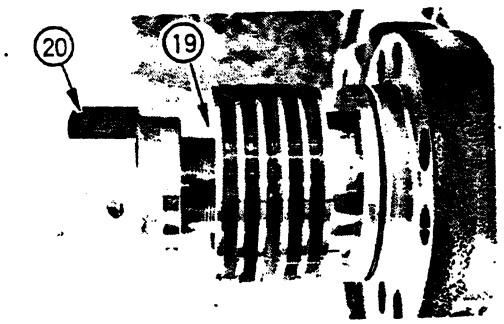


5 Lower boom cylinder to put it on stand. Push pin in other direction and lower cylinder.

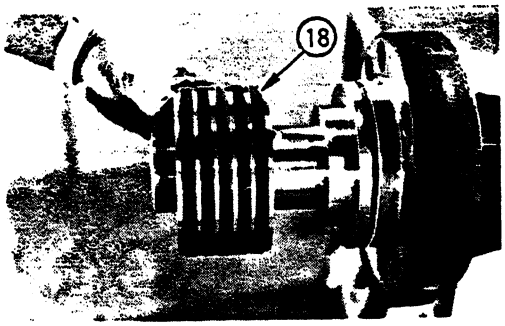


CYLINDER

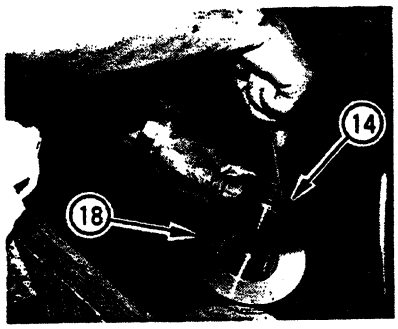
10 Remove piston nut (20) and shim from rod (19).



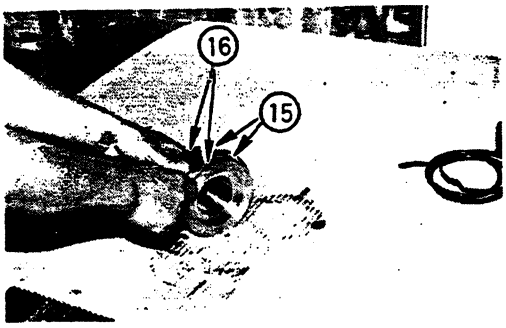
11 Remove piston (18) from the rod.



12 Cut seal ring (14) on the piston (18).

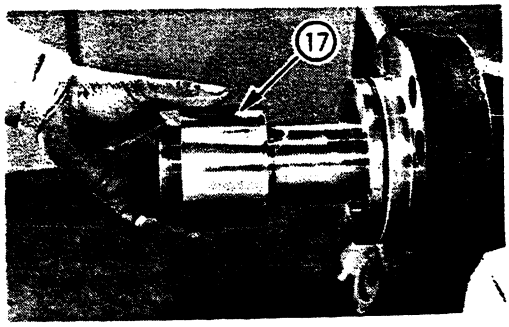


13 Remove the four slide rings (15) (16) from the piston.



14 Remove the brake bushing (17) from the rod.

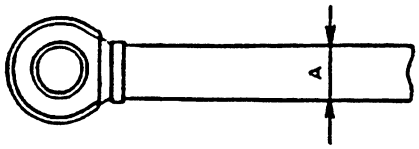
Note: The bucket cylinder has no brake bushing (17).



CYLINDER

MAINTENANCE STANDARD

Rod

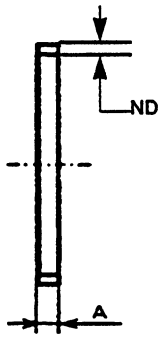


ND: NOMINAL DIMENSIONS
LU: LIMIT OF USE

Unit: mm

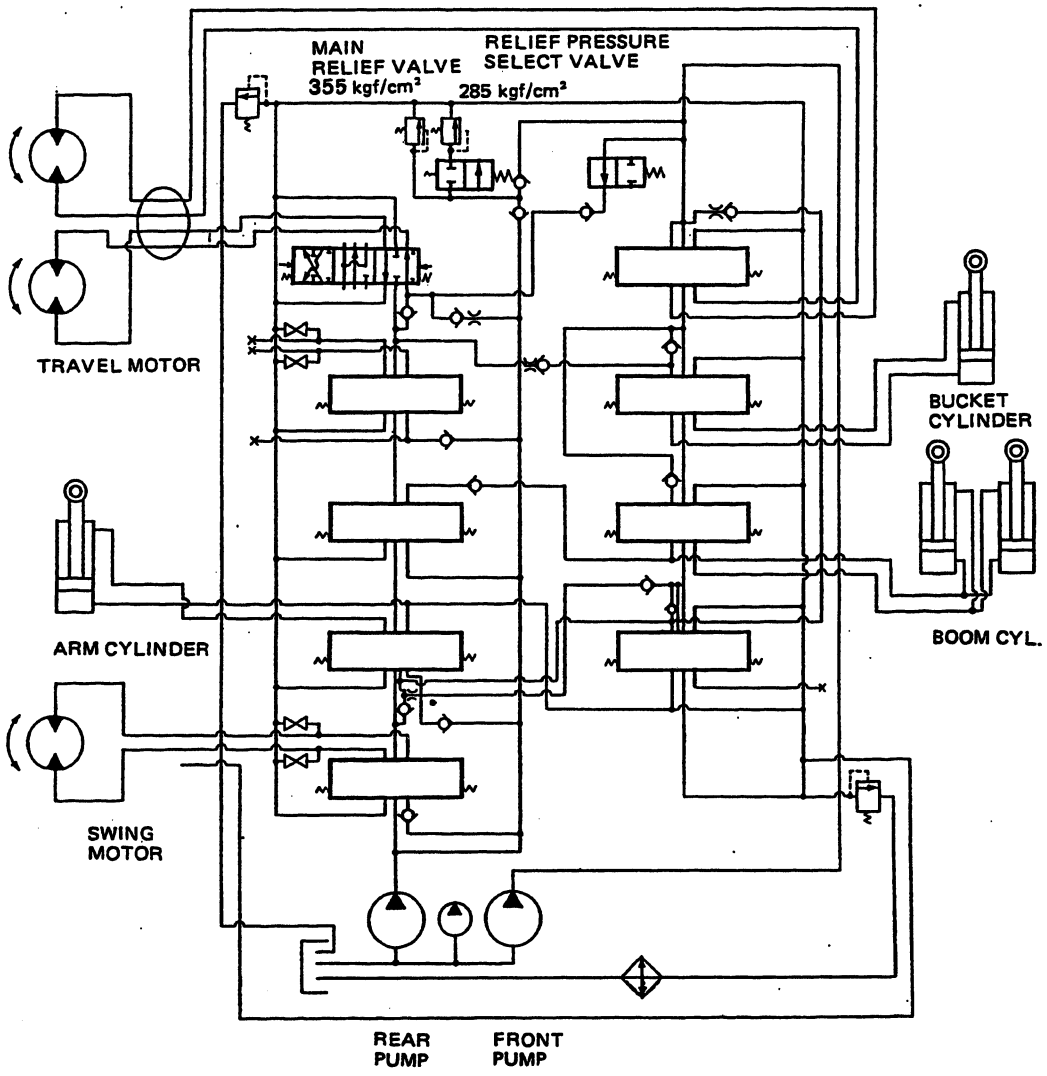
Cilindri	ND (A)	LU	Remedy
Boom	65	-0,023	Replace or plate with chromium
Arm	80		
Bucket	70		

PISTON SLIDE RING

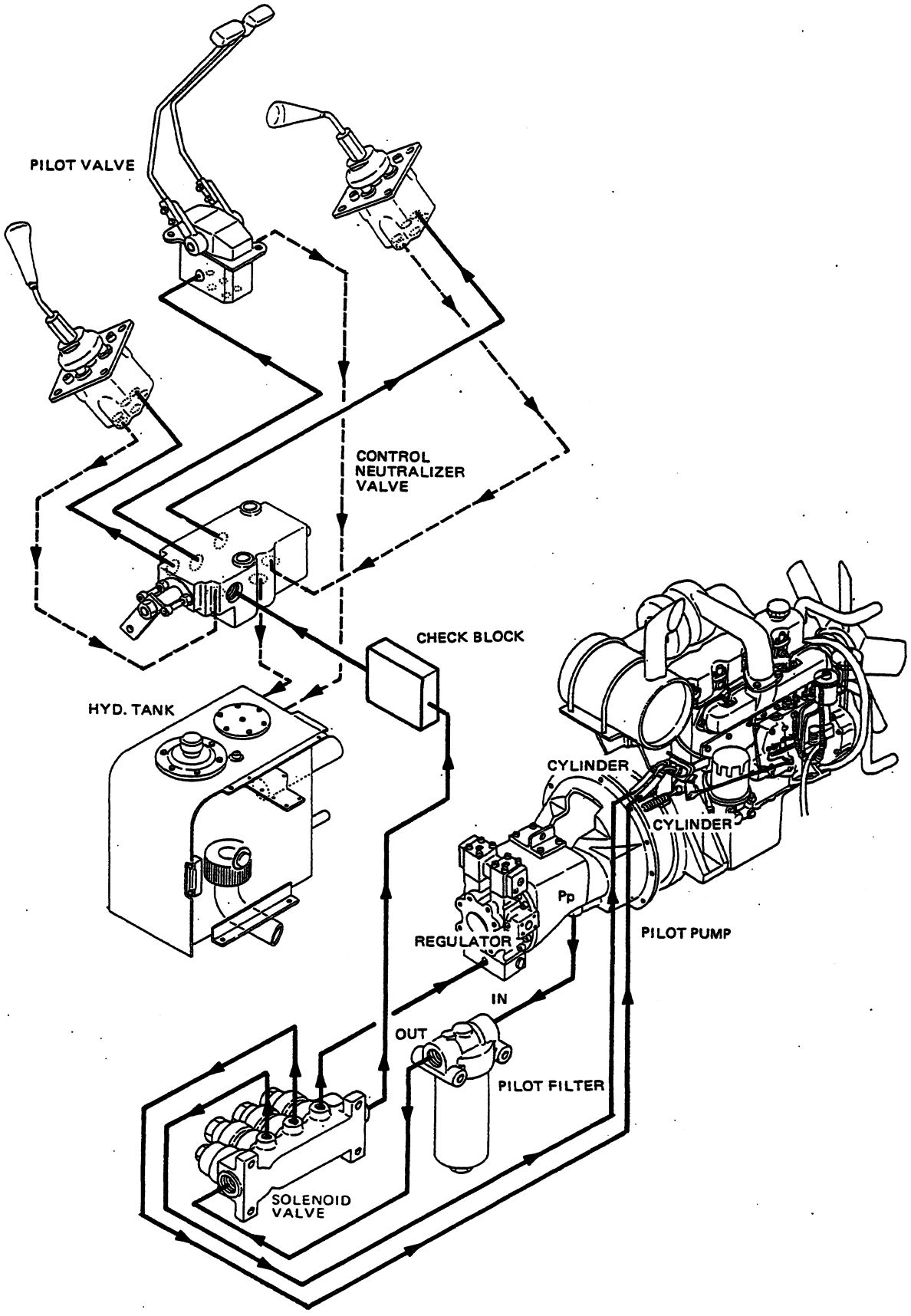


Unit: mm

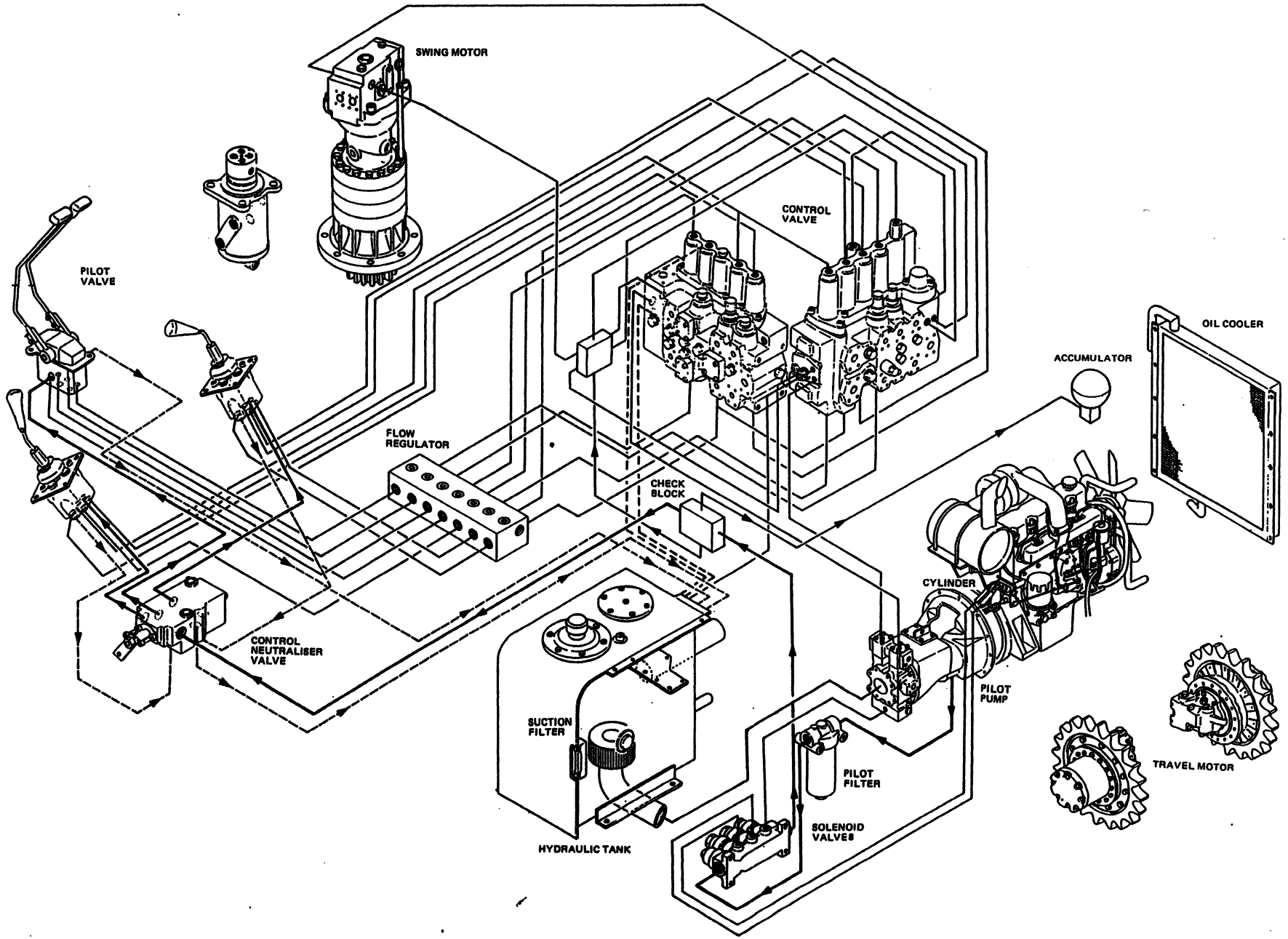
	ND	LU	Remedy
A	2.42 ~ 2.48	2.37	Replace


MAIN
RELIEF VALVE
355 kgf/cm²
RELIEF PRESSURE
SELECT VALVE
285 kgf/cm²
TRAVEL MOTOR
BUCKET
CYLINDER
ARM CYLINDER
BOOM CYL.
SWING
MOTOR
REAR
PUMP
FRONT
PUMP

HYDRAULIC SYSTEM



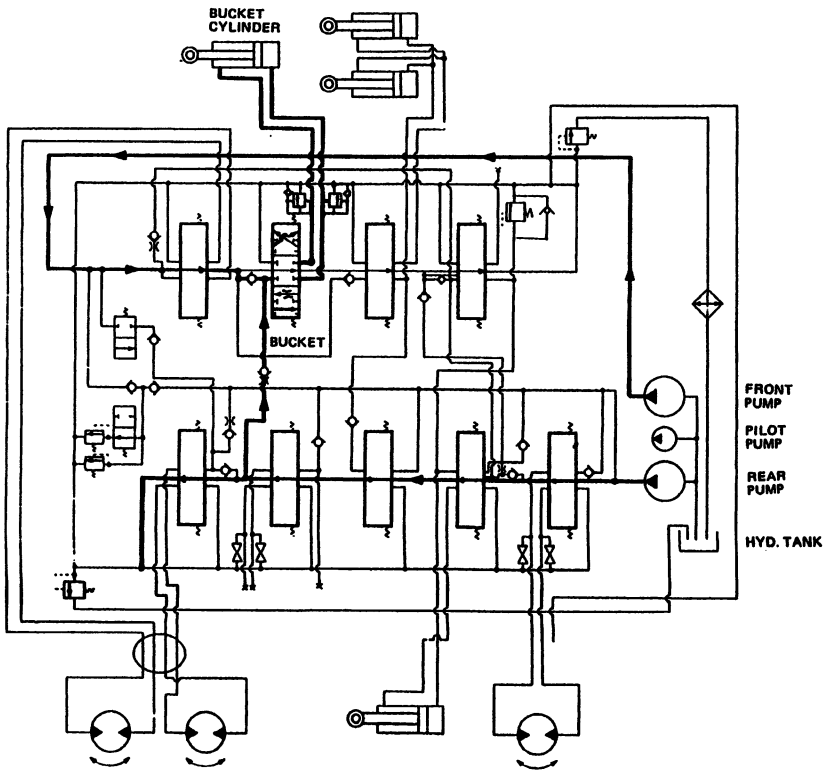
HYDRAULIC SYSTEM

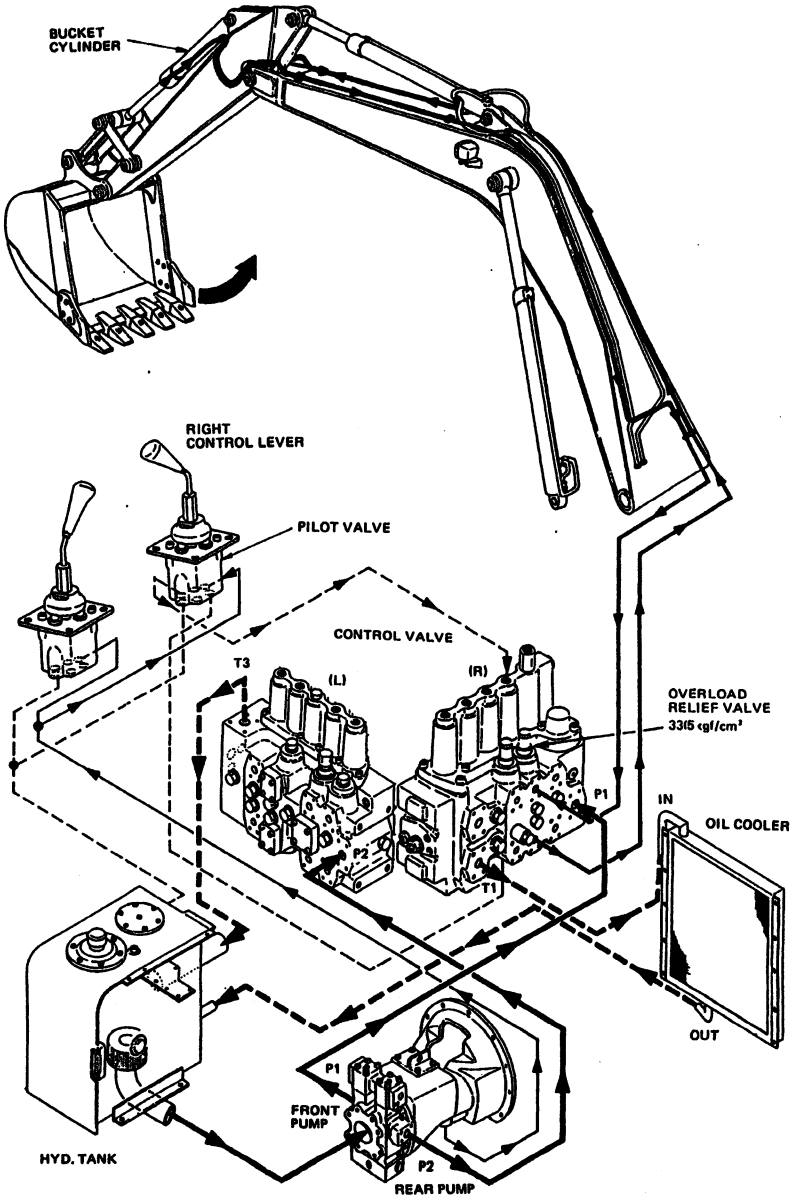


4.5 BUCKET CIRCUIT OPERATION

When the right control lever manually placed in the bucket roll-in (out) position. Then the oil from pilot pump through the pilot valve to bucket section of the control valve. Here, the spool position is moved to bucket roll-in (roll-out) posit-on.

The oil flows from front pump through bucket section of the control valve to the bottom end (rod-end) of the bucket cylinder and roll-in (roll-out) the bucket. The return oil flows from bucket cylinder through the bucket section of the control valve returned to the tank. Cavitation and excessive pressure in the bucket cylinder circuit is prevented by a overload relief and make-up valve for the bucket section of the control valve.





5. COMBINED OPERATION

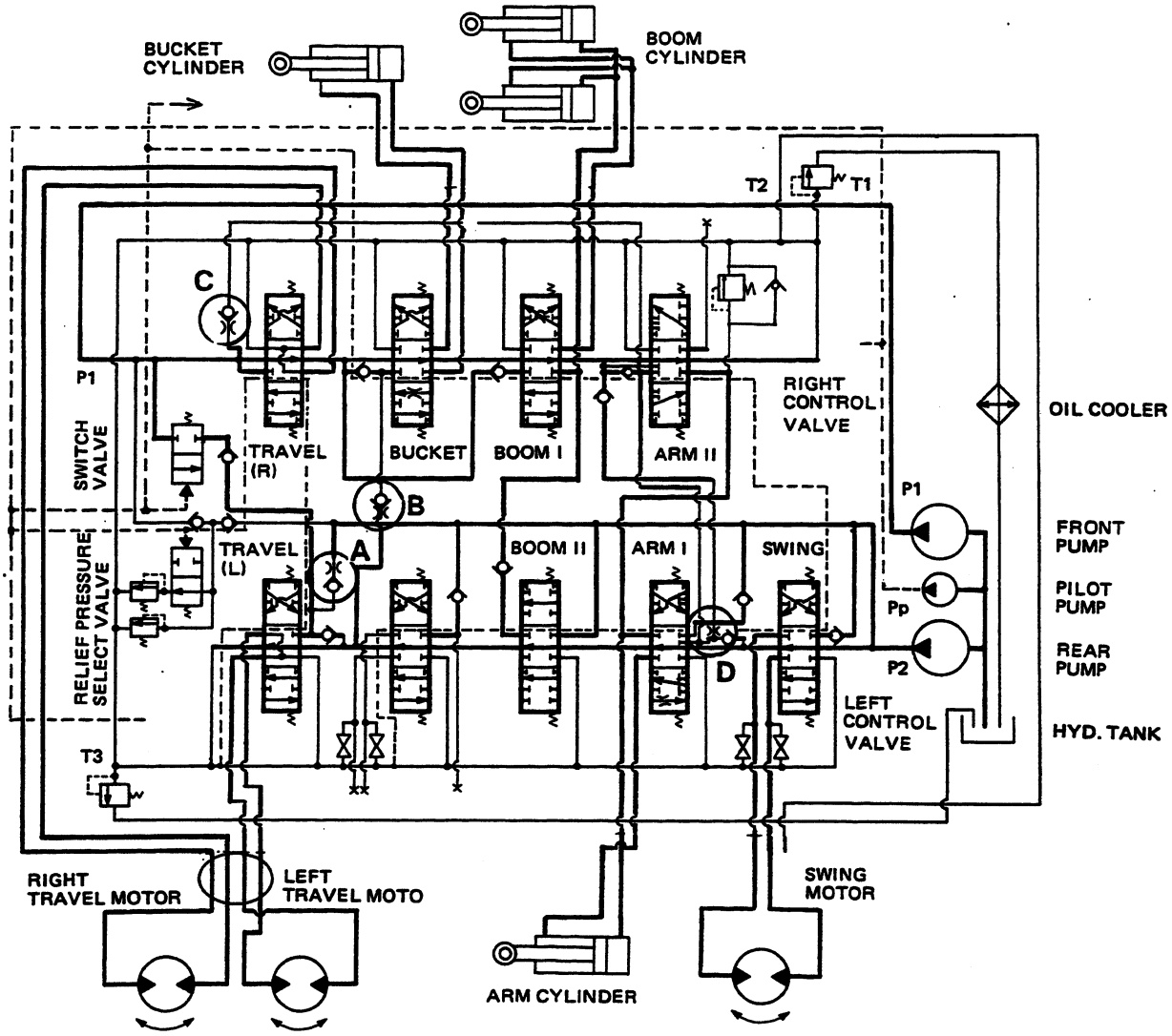
5.1 OUTLINE

In case operation, the oil flows from both main pumps through the neutral oil passage, parallel oil passage, bypass oil passage and confluence oil passage. Then the oil is supplied to each actuator and function them. Check valves and orifices (A, B, C, D) are provided with on these flow passage. These control the oil flows from the pump corresponding to the each actuator's state of functioning and smooth the combined operation.

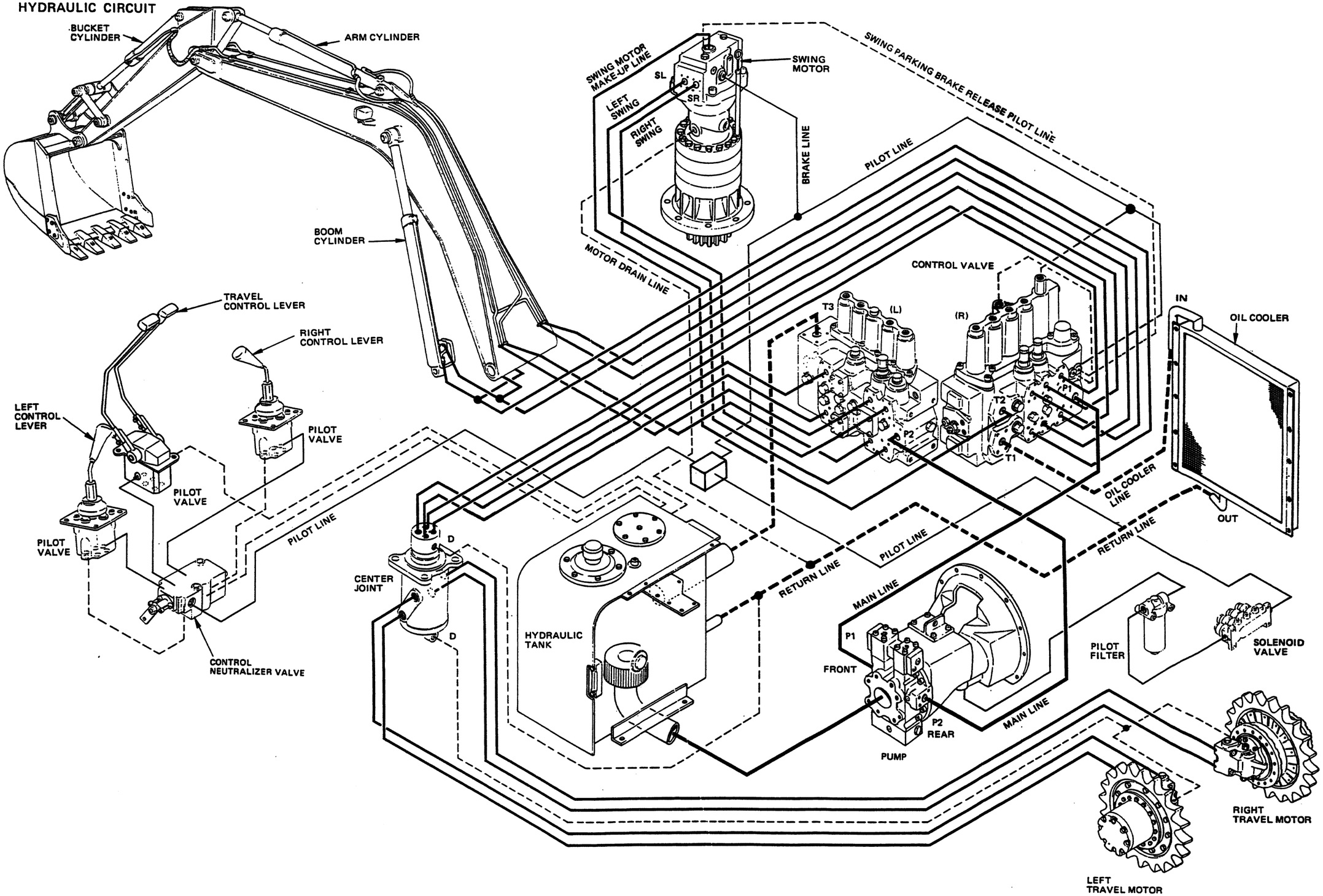
SWITCH VALVE

This switch valve is provided in the control valve.

When the spool except travel is moved, the pilot oil from the pilot pump is closed by its spool. Consequently, the pilot pressure port of the switch valve rised and its spool is moved. And the oil flows from the front pump is changed from the right block to the left block of the travel section (L), and the machine straight travelling.

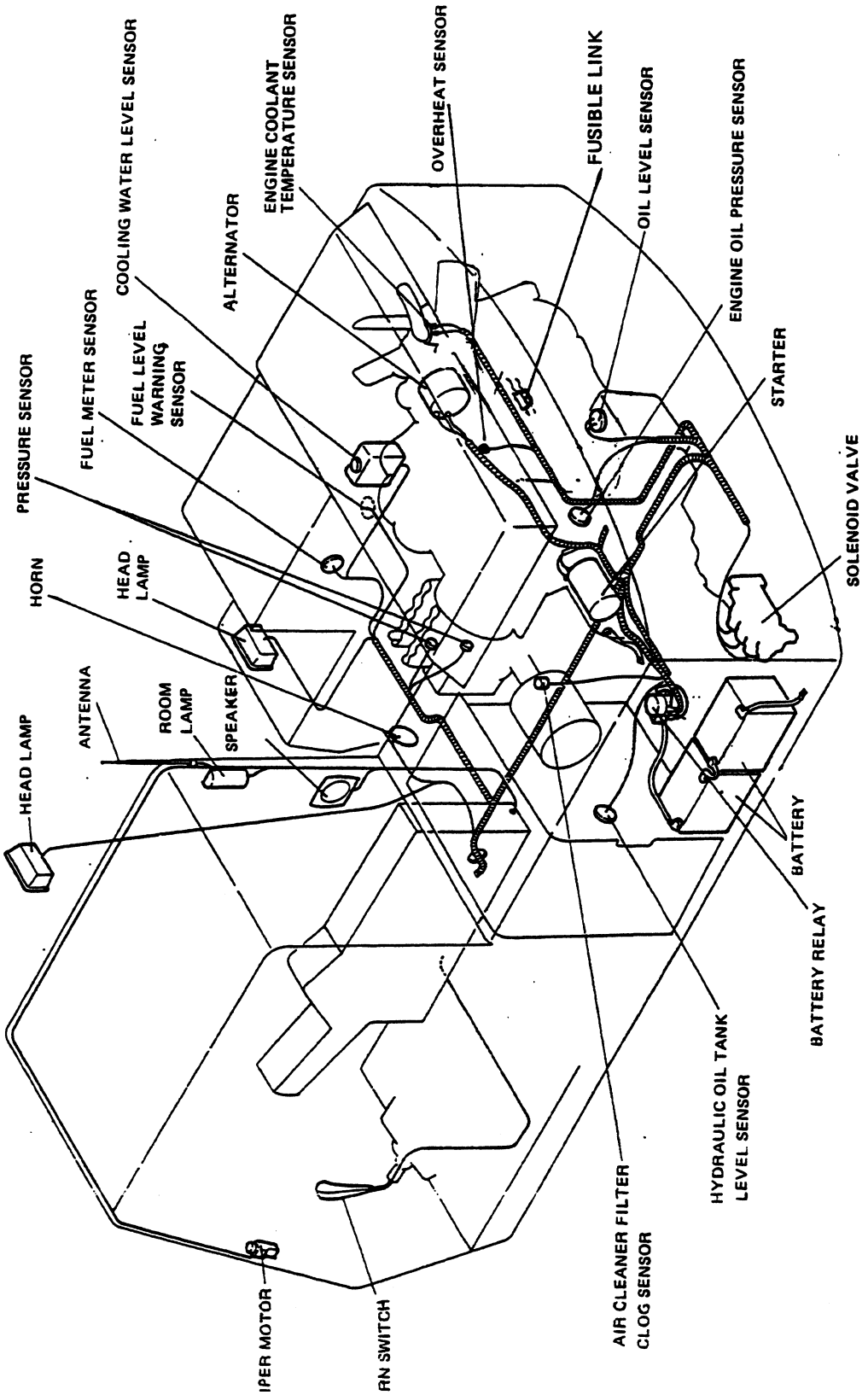


HYDRAULIC CIRCUIT



1. CONSTRUCTION OF ELECTRICAL SYSTEM

(1) Arrangement of Equipment



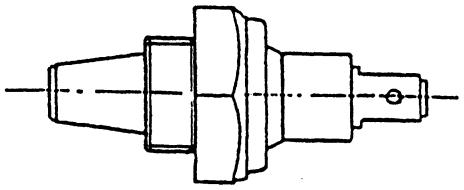
° When the engine is stopped, it is normal that all warning lamps go out except the engine oil pressure warning lamp and battery charge warning lamp.
° While the engine is running, it is normal that all red lamps go out.
° When starting the engine, it is normal that all lamps light.

o When the buzzer stop switch is pushed about one second, the buzzer does not sound even though the switch is released.
Since the buzzer function is automatically resetted the switch is released the buzzer sounds, if a abnormality occurs again.

4. FUNCTION OF SENSORS AND RELAYS

(1) Engine oil pressure sensor (pressure switch)

As soon as engine oil pressure goes up, the oil pressure sensor turns OFF, shutting off the engine oil warning lamp.
As soon as engine oil pressure goes down, the sensor turns ON, lighting the warning lamp.

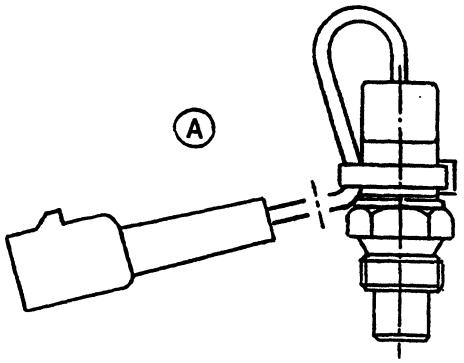


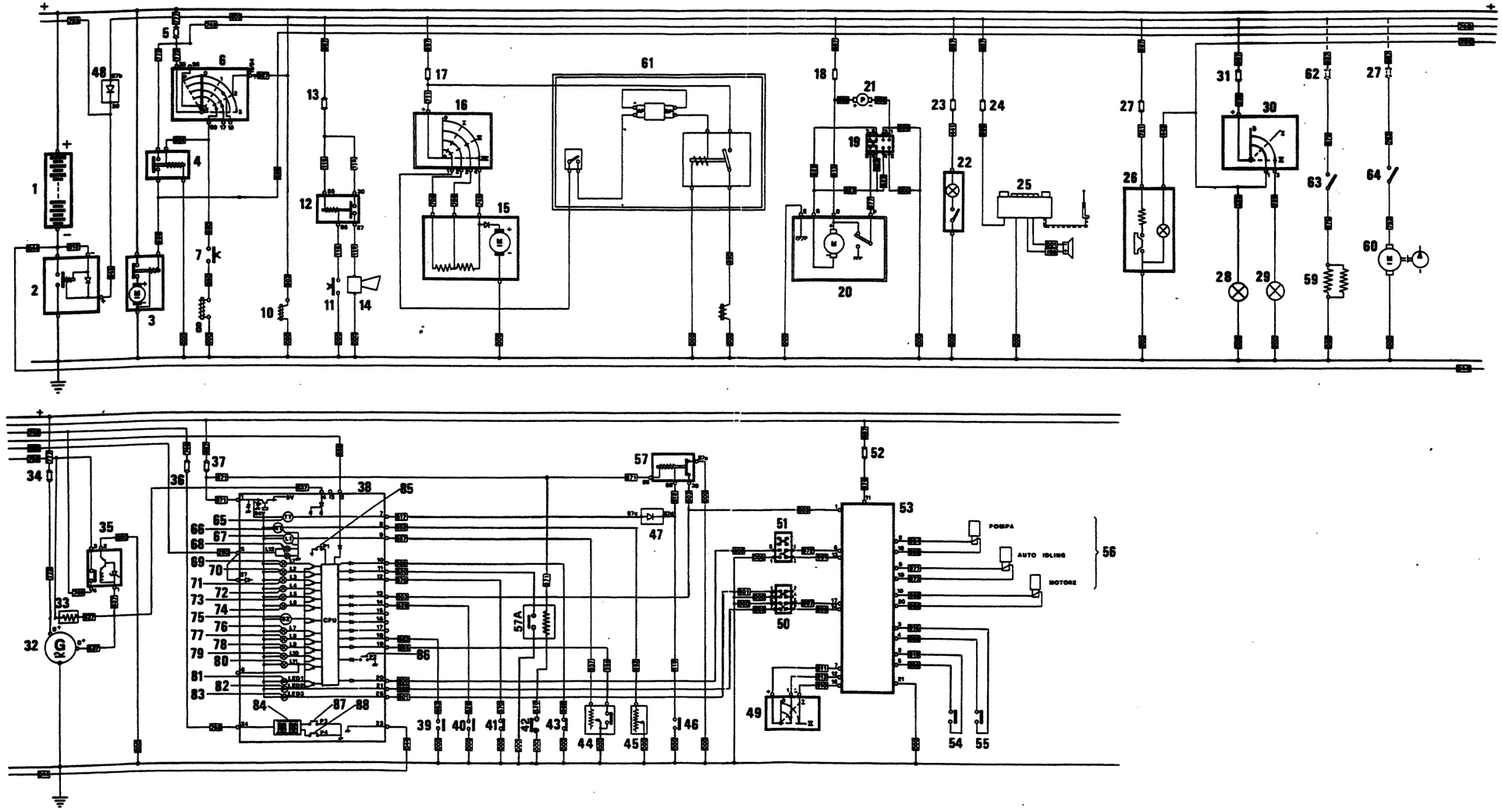
A. Engine oil pressure sensor o motore

(3) Overheat sensor

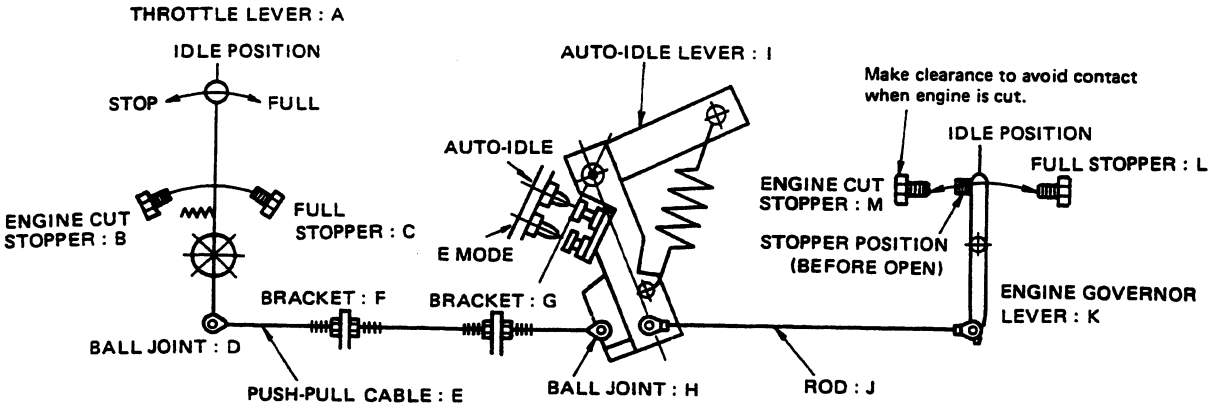
When engine cooling water is overheated, the overheat sensor turns ON to light the engine overheat warning lamp.

A. Engine coolant temperature sensor

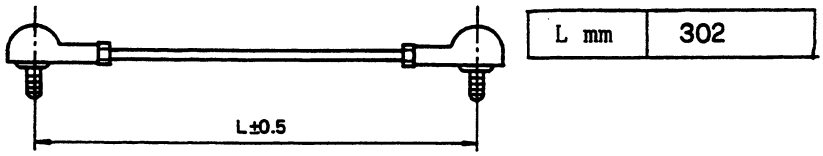



POMPA
AUTO IDLING
MOTORE
CPU

2. ASSEMBLY AND ADJUSTMENT OF AUTO-IDLE DEVICE



(1) Adjust the length of the rod J at L ± 0.5 mm



(2) Install the rod J between the governor lever and the auto-idle lever.

(3) Install the cable E between the slottle lever A and the auto-idle lever I. Install the cable in the following procedures:

1 Turn the governor lever to the idle position.

2 Install the cable in the order of: Ball joint D → Bracket F → Bracket G → Ball joint H.

Cautions

o The ball joint H should be fixed with the auto-idle lever so that the cable is pulled slightly (to keep the idle speed from lowering).

o To turn the throttle lever to the idle position, at first turn it to cut the engine, and put it back until it stops.

(4) Loosen the stopper bolt C, turn the throttle lever to "FULL" little by little, and turn the governor lever to make it contact with the full stopper.

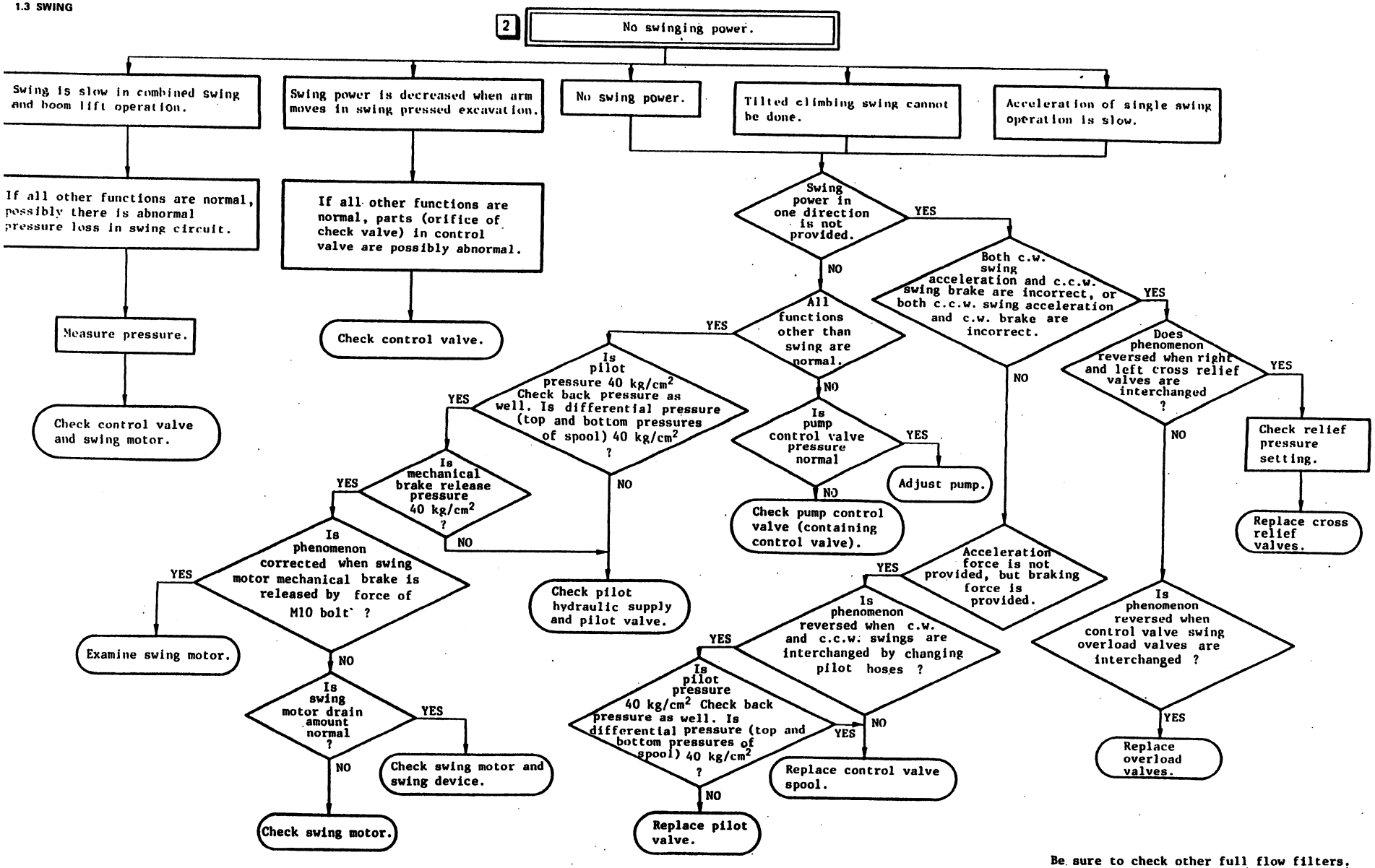
(5) Adjust the full stopper C while keeping the governor lever K contact with the stopper L. The adjustment should be made so that the clearance between the throttle lever and the stopper bolt becomes 0.5 mm when the throttle lever is in the FULL position.

(6) Turn the throttle lever to the STOP position, and make adjustments so that the engine cut stopper bolt comes in contact with the throttle lever.

DIAGNOSE MALFUNCTIONS

MALFUNCTIONS PHENOMENA

1.3 SWING



Be sure to check other full flow filters.

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DIAGNOSE MALFUNCTIONS

2.3 Monitor

14

Maloperation of fuel lamp

Lamp is not turned on despite pointer of fuel gauge indicating "E" point.

Is lamp turned on when checking for burn-out of filament ?

No → Exchange bulb

Yes

Remove harness from connector (male/female terminal) of float switch at lower portion of fuel tank, ground terminal at harness side.

Is lamp turned on ?

Yes → Replace float switch

No

Check continuity between terminal of lead wire of float switch and body (E).

Is continuity obtained ?

No → Replace float switch

Yes

Reconnect float switch lead wire to place, remove 12-pole connector and check continuity between No.19 terminal at harness side and body (E).

Is continuity obtained ?

Yes → Gauge panel defective

No → Harness defective (disconnection) (Between No.19 terminal of gauge panel and float switch)

Lamp is turned ON despite fuel tank being filled fully with fuel.

Remove harness from connector (male/female terminal) of float switch at lower portion of fuel tank.

Is lamp turned off ?

Yes → Replace float switch

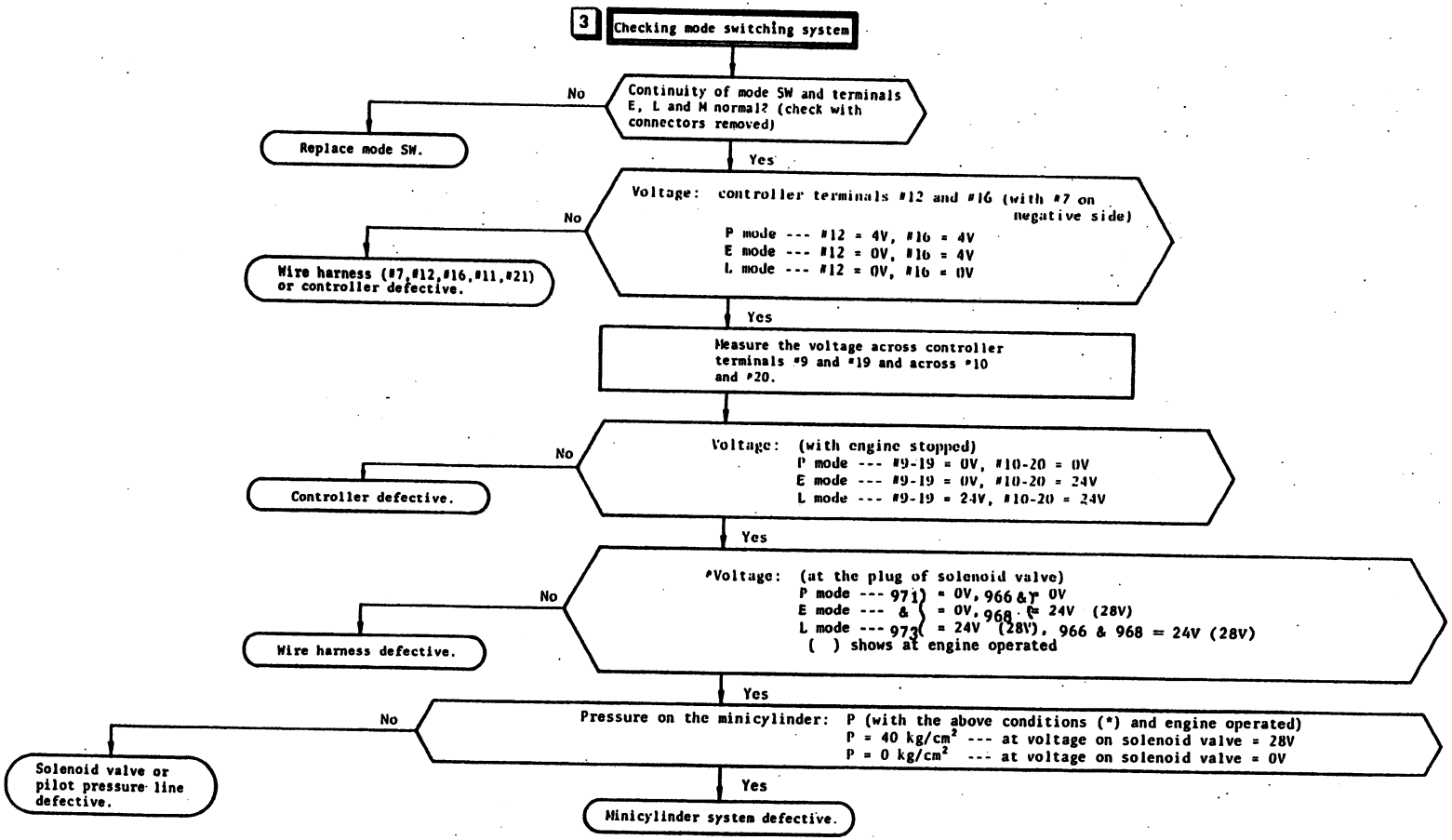
No

Remove 12-pole connector of gauge panel

Is lamp turned off ?

Yes → Harness defective (short) (Across No.19 terminal of gauge panel and float switch)

No → Gauge panel defective


3
Checking mode switching system
Continuity of mode SW and terminals E, L and M normal? (check with connectors removed)
No
Replace mode SW.
Yes
Voltage: controller terminals #12 and #16 (with #7 on negative side)
P mode --- #12 = 4V, #16 = 4V
E mode --- #12 = 0V, #16 = 4V
L mode --- #12 = 0V, #16 = 0V
No
Wire harness (#7,#12,#16,#11,#21) or controller defective.
Yes
Measure the voltage across controller terminals #9 and #19 and across #10 and #20.
Voltage: (with engine stopped)
P mode --- #9-19 = 0V, #10-20 = 0V
E mode --- #9-19 = 0V, #10-20 = 24V
L mode --- #9-19 = 24V, #10-20 = 24V
No
Controller defective.
Yes
*Voltage: (at the plug of solenoid valve)
P mode --- 971 = 0V, 966 & 968 = 0V
E mode --- 971 = 0V, 966 & 968 = 24V (28V)
L mode --- 971 = 24V (28V), 966 & 968 = 24V (28V)
( ) shows at engine operated
No
Wire harness defective.
Yes
Pressure on the minicylinder: P (with the above conditions (*) and engine operated)
P = 40 kg/cm² --- at voltage on solenoid valve = 28V
P = 0 kg/cm² --- at voltage on solenoid valve = 0V
No
Solenoid valve or pilot pressure line defective.
Yes
Minicylinder system defective.

EXCAVATOR PERFORMANCE TEST

5 System pressure relief condition engine speed.

❶ Switch selection

Mode selector switch ..... P

Auto-idle switch ..... OFF

❷ Start and run the engine at fast idle.

❸ Hold the bucket lever and arm lever to the roll-in, and read the engine speed when the system pressure is relieved.

(3) Judgement

1 Engine speed

		Standard	Recommended to service	Limit of use
Unloaded low idle		850±50		
Unloaded fast idle	P mode	2350±50		
	E mode	2050±100		
Auto-idle condition		1400$^{+150}_{-100}$		
System pressure relief condition		2200±50		

2 ❶ There mustn't be a hunting of more than 50 rpm at the low idle.

❷ Be sure that auto-idling operation performs well.

2.2 COMPRESSION PRESSURE

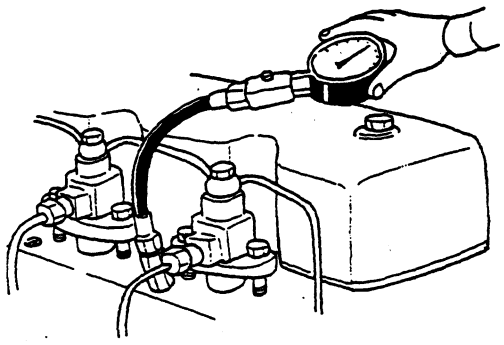
Note:
- **Judge the degree of engine output drop by measuring the cylinder compression pressure.**
- **Before begining check, insure that battery is fully charged, valve clearance is correct and glow plugs are is thoroughly cleaned.**

(1) Measurement preparation

❶ Make sure that the engine is not warmed up.

❷ Remove all return pipe and fuel injection piping.

❸ Attach a gauge and adapter to the injector mounting hole.



EXCAVATOR PERFORMANCE TEST

(2) Measurement

❶ Set the arm to the roll-out and the bucket to the roll-in, hold the bottom face of the bucket to the same height of boom foot pin, and read the indicated value of the dial gauge (h1).

❷ Jack up the front idler by about 50cm and read the indicated value (h2) of the dial gauge.

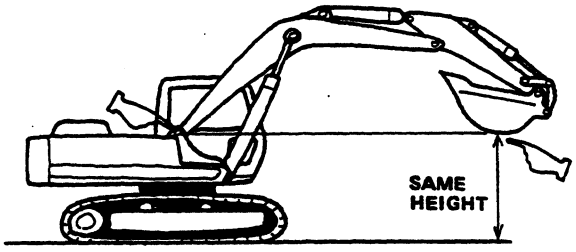
❸ Determine the opening amount (H) for the swing bearing from the two indicated values.

$H = h_2 - h_1$

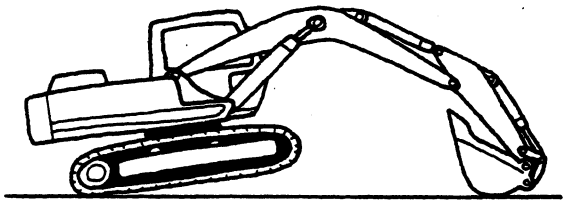
(3) Judgement

Unit: mm

Standard	Limit of use
Less than 1.1	3.7



(h_1) MEASUREMENT



(h_2) MEASUREMENT

3. MAIN RELIEF VALVE

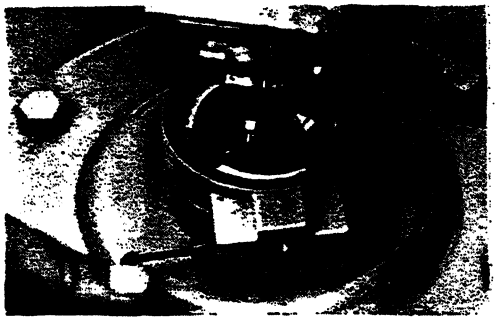
3.1 SPECIFICATION & JUDGEMENT

Unit:kgf/cm^2(MPa)

Main relief valve	Standard	Recommended service limit	Limit of use
For front use	285±10 (28±0.98)	Max. 295 (29) Min. 248 (24.3)	Max. 295 (29) Min. 235 (23.1)
For travel use	355±10 (34.8±0.98)	Max. 360 (35.3) Min. 288 (28.2)	Max. 360 (35.3) Min. 274 (26.9)

3.2 MEASUREMENT

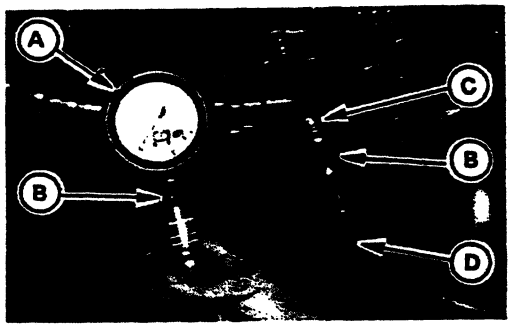
1 Stop the engine.
Release the air pressure from the hydraulic tank.

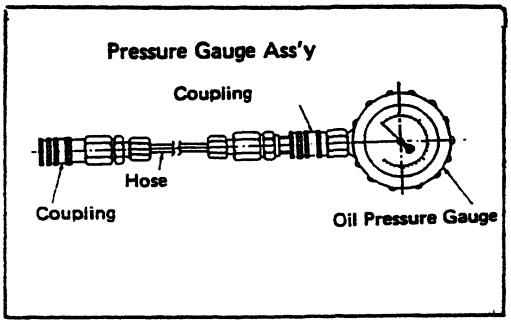


2 Connect the 0 to 400 kgf/cm^2 (0 to 40 MPa) pressure gauge assembly to the front pump test port.

Note: Use nipples to make the connections.

Ⓐ Pressure gauge
Ⓑ Coupling
Ⓒ Nipple
Ⓓ Hose

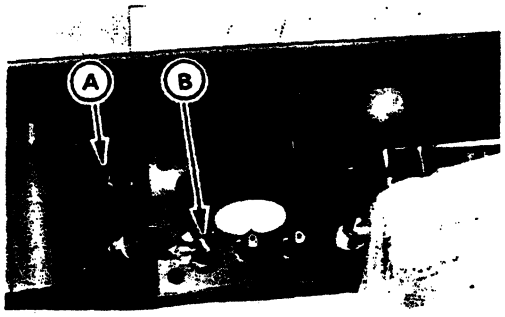




8 ❶ Turn mode switch Ⓑ to P mode and auto-idling switch Ⓐ "OFF".

❷ Start and run the engine at fast idle. Check oil leakage from the connections.

Important: **Before starting the engine be sure the flow meter loading valve is open until it stops.**



9 **Setting load pressure**

❶ Fast test

- **Front pump:**

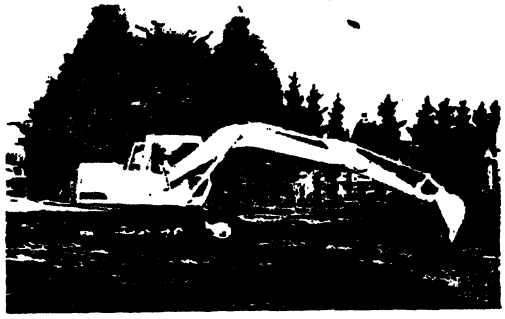
  No-load, 100, 140, 170, 250, 300 kgf/cm^2

- **Rear pump:**

  Set the front attachment as shown in the photo, and grasp earth by the bucket securely.

  Operate and hold swing control lever slowly.

CAUTION: **Undercarriage will turn if it does not grasp earth securely.**



❷ Second test

- **Front pump:**

  No-load, 100, 140, 170, 250, 300 kgf/cm^2

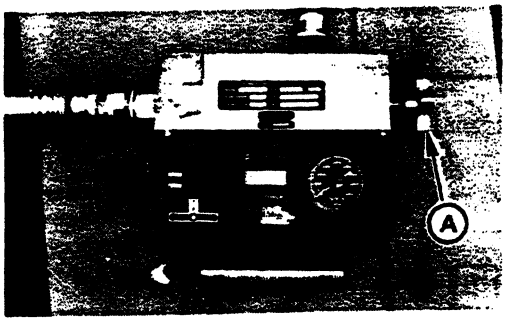
- **Rear pump:**

  No-load

10 ❶ Slowly close portable tester loading valve Ⓐ just enough to get the above load pressure.

If necessary, adjust engine rpm.

❷ Read the pump flow indications on flow meter, the pressure indications each pressure gauges and engine rpm.



7.2.2 REAR SIDE PUMP

Prepare with the same manner in the FRONT SIDE PUMP TEST steps 1, 2, 4, 5, 6, 7 and 8.

3 Disconnect rear side main pump outlet hose Ⓓ at pump discharge ports and the plug from each main pump pressure measuring ports being tested.