

YANMAR

SERVICE MANUAL

EXCAVATOR

Vi012

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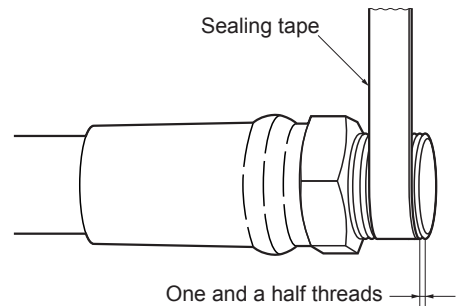


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1. GENERAL CAUTIONS FOR MAINTENANCE WORK

- (6) Keep the parts apt to be damaged by water or oil apart from the oily or wet parts.
e.g.: Electrical parts, rubber parts, V-belts, etc.
- (7) Use the jig for press-fitting the bearings, bushes and oil seals. When using a hammer, use a pad block.
- (8) Clean the joint surface of all parts and keep them free from dust.
- (9) Wind the sealing tape securely, leaving a space of one or two threads from the tip of the male screw. The tape should have an overlap of about 10 mm.



1-5 Cautions for Removal and Installation of Hydraulic Equipment

- (1) Check that the hydraulic oil temperature is low enough.
- (2) Release air from the hydraulic tank to prevent the hydraulic oil from flowing out.
- (3) Be sure to plug open the ends of hydraulic components to prevent dust from entering.
- (4) Be sure to wipe hydraulic oil from the hydraulic components so that it will not be mistaken for an oil leak.
- (5) Take care not to damage the plating on the cylinder rod.
- (6) Remove or install cylinders with rods fully retracted.
- (7) Be sure to release air after installing the hydraulic cylinders.
 - Run the engine at a low speed. Extend and retract the cylinders 4 to 5 times up to 50 to 100 mm from the end of the stroke. Then, fully extend and retract.
- (8) Be sure to pressurize the hydraulic tank after installing the hydraulic components (in the case of the sealed hydraulic tank). Otherwise, hydraulic pumps might suffer cavitation and their life will be shortened.
 - To pressurize the hydraulic tank, fully extend each cylinder and tighten the oil filter port plugs.

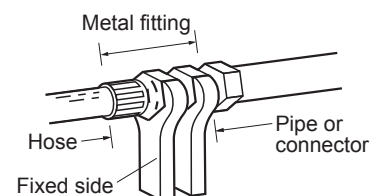
1-6 Cautions for Removal and Installation of Hydraulic Piping

- (1) Installation of hydraulic hose

Take care not to twist the hoses. (Judge whether or not the hose is twisted by the hose mark.) For hoses with a metal fitting, use two wrenches to prevent twisting.

Use one to fix the hose, and the other to tighten the fitting to the specified tightening torque. Carefully check that the hoses do not come in contact after tightening. If any contact is found, correct it or use tubes.

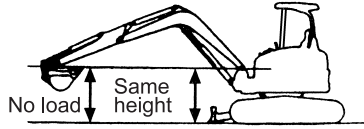
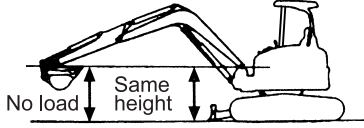
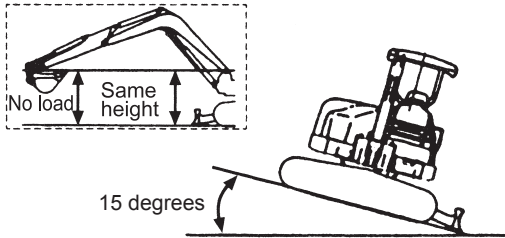
- (2) When installing hoses, first tighten to the specified torque and then loosen them a little. Then retighten to the specified torque.
 - Break in the installed parts before tightening (except those using seal tapes).
- (3) When installing pipes, turn the nuts more 1/4 to 1/2 turn after they reach the sharp torque rise point.
- (4) When installing or removing hoses, use two wrenches, one to fasten the hose and the other to tighten or loosen the hose to prevent twisting.
- (5) Check for oil leakage by applying max. pressure 5 to 6 times after attaching hydraulic hoses or pipes.



2. TECHNICAL DATA

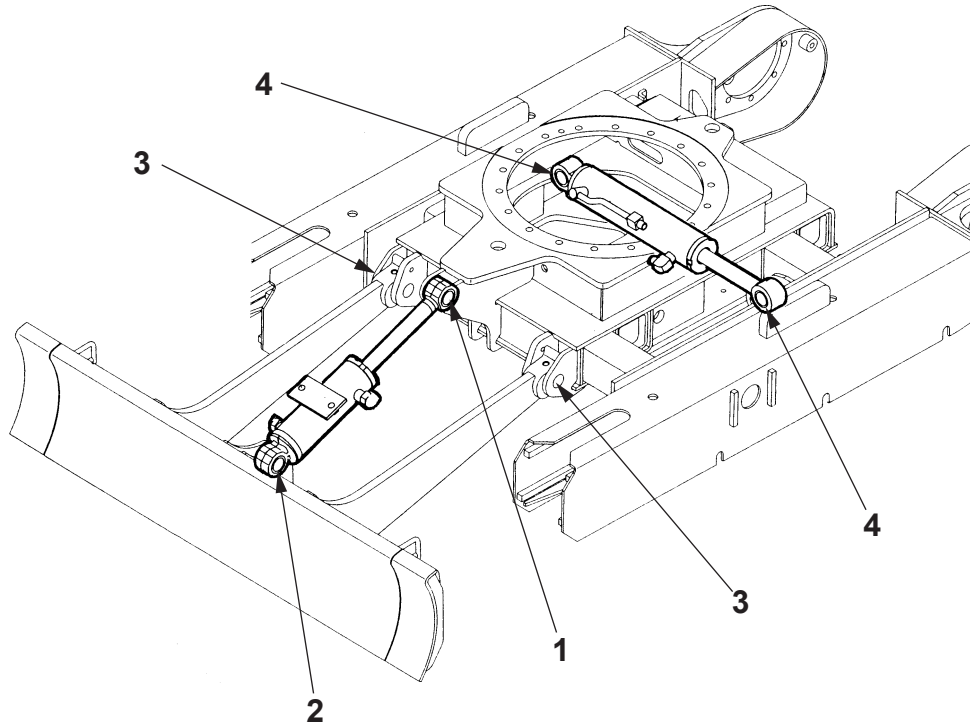
Item	Unit	ViO12
Electrical equipment		
Boom light	V-W	12-27
Room lamp (for cabin)	V-W	-
Wiper motor (for cabin)	V-W	-
Cabin heater (for cabin)	V-W	-

3. SERVICING STANDARDS

Applicable model			ViO12	
Item	Measuring condition	Unit	Standard	Allowance
Machine performance				
Swing drift at stopping	<p>Machine position</p>  <ul style="list-style-type: none"> • Engine : rated speed • Hydraulic oil temp. : 50 to 60 °C • Site : Firm, flat ground • Make the boom and bucket pins the same height. • Make match marks on the outer race and the inner race of the swing bearing (or the track frame). • Measure shifted distance between both marks after making one turn with no load. 	mm or degrees	80 or less, 20 or less	120 30
Swing time	<p>Machine position</p>  <ul style="list-style-type: none"> • Engine : rated speed • Hydraulic oil temp. : 50 to 60 °C • Site : Firm, flat ground • Make one idling turn with no load, then measure the time necessary to make 5 turns. 	sec. / 5 turns	30,9	35,5
Swing drift	<p>Machine position</p>  <ul style="list-style-type: none"> • Engine : stopped • Hydraulic oil temp. : 50 to 60 °C • Make the boom and bucket pins the same height. • Park the machine on a slope with an inclination of 15 degrees and turn the upperstructure 90 degrees to the crawler. • Make match marks on the outer race and the inner race of the swing bearing (or the track frame). • Measure shifted distance or angle between both marks after 5 min. 	mm	(at engine stop)	0
			(at engine operating)	P 60 (P 15 degrees)

3. SERVICING STANDARDS

3-6-2 Blade Moving Device



[Unit : mm]

No.	Applicable model : ViO12	Standard	Wear limit	
	Measuring point		Pin	Bore of bush or hole
1	Blade cylinder, rod	Ø25	-0,5	+0,5
2	Blade cylinder, bottom	Ø25		
3	Blade fulcrum	Ø25		
4	Track gauge change cylinder	Ø33		

Note : Allowable clearance between pin and bore of bush or hole is 1 mm.

3-6-3 Bucket Teeth

[Unit : mm]

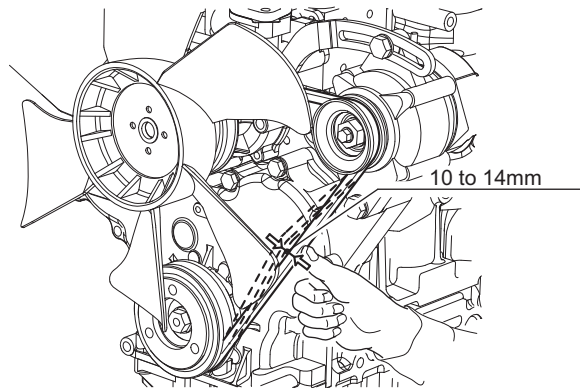
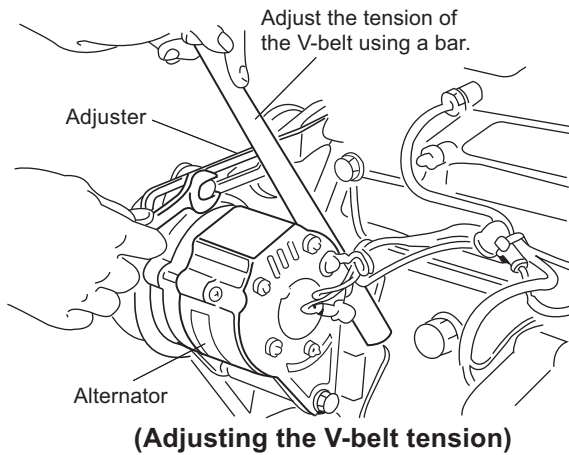
Measuring point	Standard	Wear limit	Measure
	133	103	Replace

4. ENGINE

4-2-3 Checking the V-belt Tension

Push the center of the V-belt between the alternator and the cooling water pump with a finger. If the slack is 10 to 14 mm, the V-belt tension is proper.

If not, adjust the V-belt tension using the adjuster at the alternator.



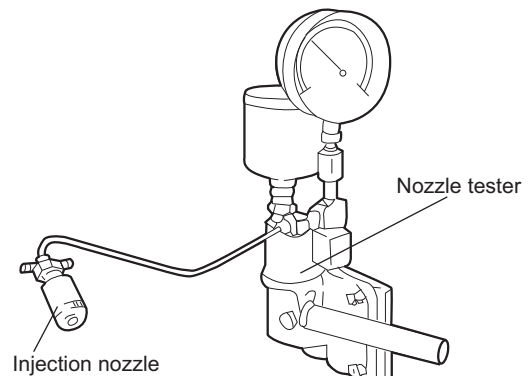
4-2-4 Checking the Fuel Injection Valve

1) Measuring the Fuel Injection Pressure

Note :

Thoroughly remove carbon deposits from the injection nozzle hole before the measurement.

- (1) Connect the fuel injection valve to the high pressure pipe of the nozzle tester.
- (2) While pumping the lever of the nozzle tester slowly, read the pressure gauge on the nozzle tester the moment the nozzle starts fuel injection.
(For the fuel injection pressure, refer to Section "2-1 Specifications".)
- (3) If the measured fuel injection pressure is lower than the specified value, replace the pressure adjusting shim with a thicker one.



(Measuring the fuel injection pressure with a nozzle tester)

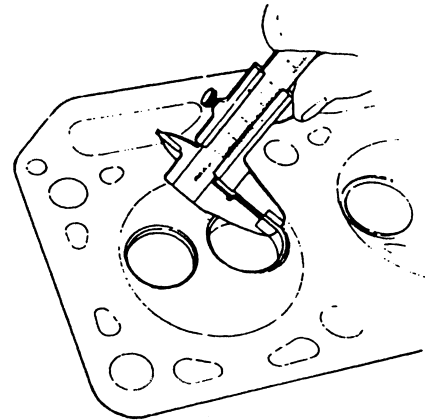
Types of pressure adjusting shim thickness mm	Fuel injection pressure adjustment
0.1 0.2 0.3 0.4 0.5	The injection pressure will change by approximately 7-10 kgf/cm ² for every 0.1 mm shim thickness.

4. ENGINE

(2) Width and angle of the valve seat

Remove carbon deposits from the seat surface. Measure the seat width and angle using vernier calipers and an angle gauge respectively.

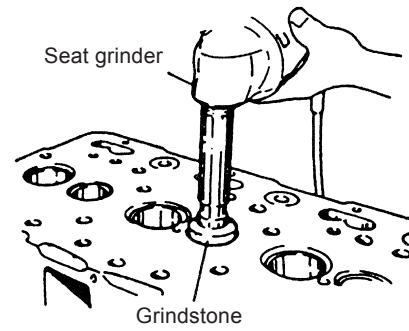
		Standard	Wear limit
Valve seat width	Intake	Refer to Section "3-2 1) Nominal and Allowable Values".	
	Exhaust		
Valve seat angle	Intake		
	Exhaust		



(Measuring the valve seat width)

[Valve seat correction procedure]

- (1) If the seat surface is worn or roughened slightly, lap the seat surface to a smooth state with a valve compound mixed with oil.
- (2) If the seat surface is worn or roughened excessively, correct the seat surface using a seat grinder or a seat cutter, and finish it according to the above step (1).

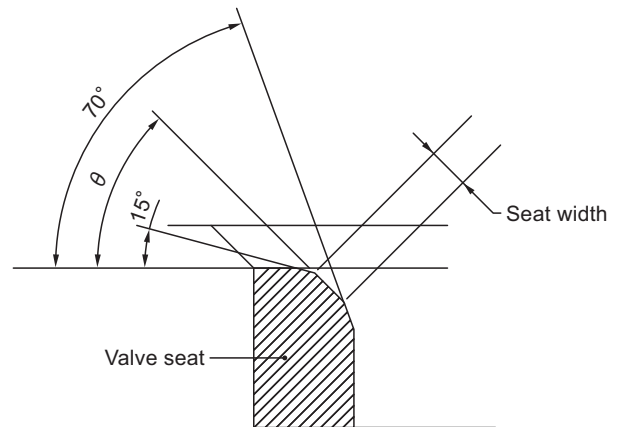


[Procedure for using seat grinder and seat cutter]

- (1) Correct the roughened seat surface with a seat grinder or a seat cutter.

Seat grindstone	Angle θ (degrees)
Intake valve	30
Exhaust valve	45

- (2) When the seat width is enlarged from the initial value, correct it by grinding the seat surface with a 70 degrees seat grinder or a seat cutter. Then, grind the seat surface with a 15 degrees grinder so that the seat width should be the standard value.



(Valve seat correction angle)

Note :

When using a seat cutter, apply pressure evenly taking care not to cut the seat surface unevenly.

- (3) Knead a valve compound with oil and finish the valve seat by lapping with the compound.

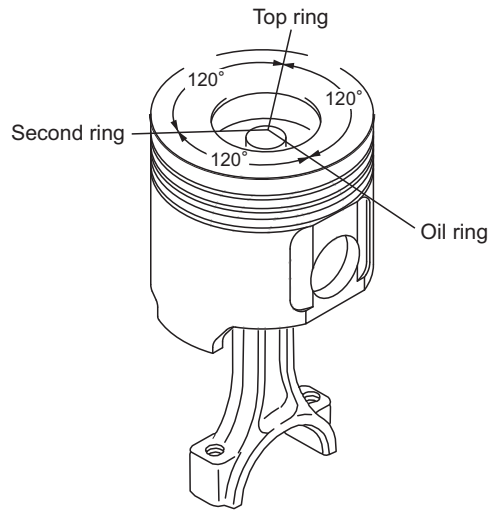
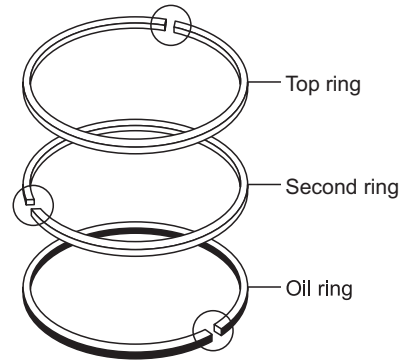
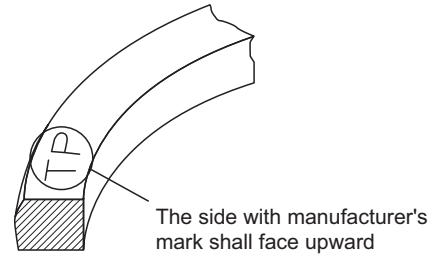
Note :

If any valve requires correction, be sure to measure the oil clearance between the valve stem outside dia. and the valve guide inside dia. If the oil clearance exceeds the wear limit, replace the valve or the valve guide before correcting the valve seat surface. (For the oil clearance between the valve and the valve guide, refer to the subsection 3 in this section.)

4. ENGINE

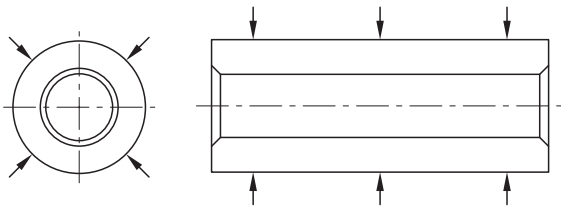
5) Installation of Piston Rings

- Using a piston ring replacer, fit the piston ring into the ring groove, with the manufacturer's mark near the end of the piston ring facing upward (to the combustion chamber side). After fitting the piston ring, check that the piston ring moves smoothly. Be sure to place the end gaps of the top rings in the position not at right angle to the piston pin.
- After fitting all the piston rings, shift the end gaps of them at 120 degrees intervals, so that they are not aligned along the piston. Apply lubricating oil to the piston pin before inserting it into the piston.



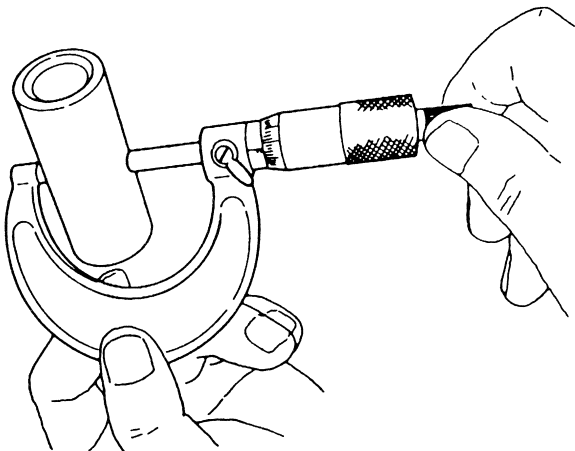
6) Measuring the Outside Diameter and Bush Hole Inside Diameter of the Piston Pin

Measure the outside diameter and bush hole inside diameter of the piston pin. Replace the piston pin if one or both of the measured values exceed the wear limit. Apply lubricating oil to the piston pin before inserting it into the piston.

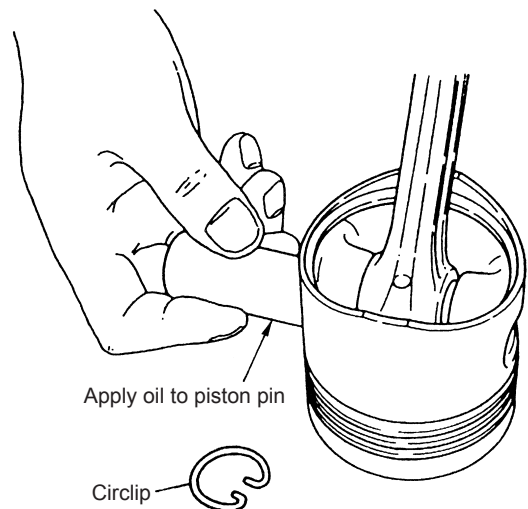


(Measuring points of the piston pin) outside diameter

		Standard	Wear limit
Piston pin	Outside dia.	Refer to Section "3-2 1) Nominal and Allowable Values".	
	Bush hole inside dia.		
	Oil clearance		



(Measuring the piston pin outside diameter)



4. ENGINE

4-4 Precautions for Reassembly

Reassemble the engine components in the reverse order of the disassembly procedure. Follow the precautions below particularly before and during the reassembly.

1) Cleaning the Components

Clean the cylinder block, the cylinder head, the crank shaft, and the cam shaft carefully so that they are free from chips, dust, sand, and other foreign matter.

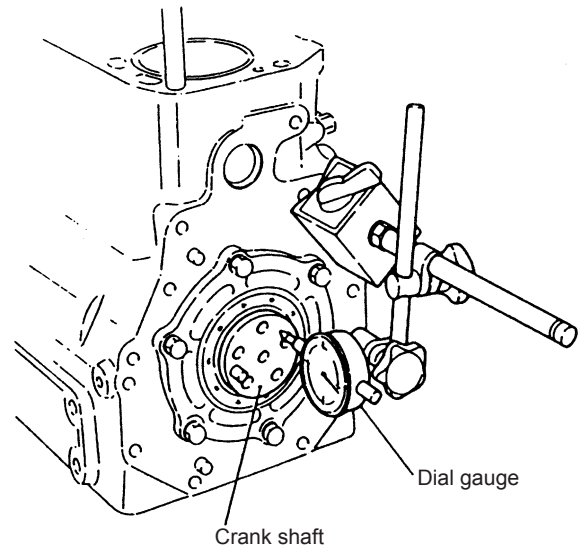
2) Parts to be Replaced in Reassembly

Be sure to replace the following parts with new ones in reassembly.

- (1) Valve stem seal
- (2) Head gasket packing
- (3) Nozzle protector of the fuel injection valve
- (4) All of the copper packings, O-rings and gasket packings.

3) Measuring the Side Gap Around the Crank Shaft

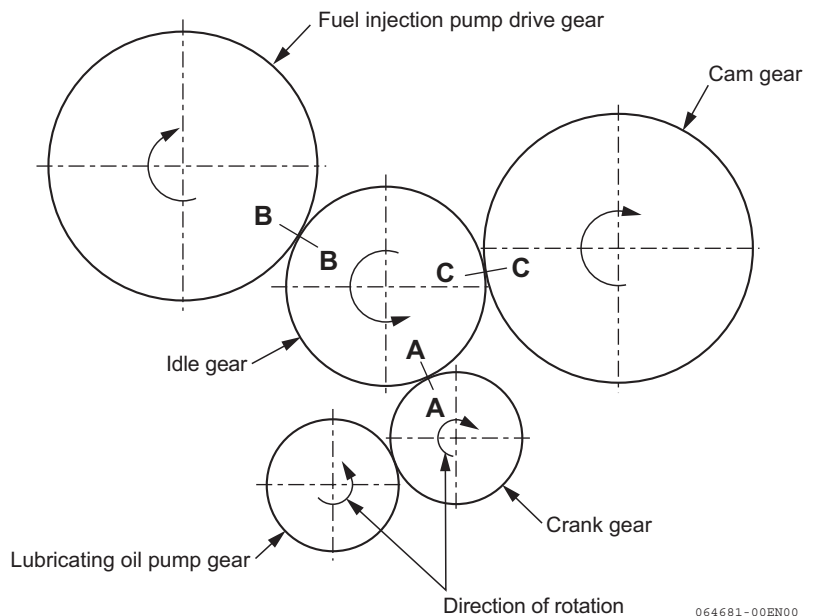
Apply a dial gauge to the end of the crank shaft. Press the crank shaft to each of the right and left sides in the axial direction to measure the side gap. Alternatively, insert a thickness gauge directly into the clearance between the reference thrust metal and the thrust surface of the crank shaft to measure the side gap. If the measured value exceeds the wear limit, replace the thrust metal with a new one.



Side gap	Refer to Section "3-2 1) Nominal and Allowable Values".
----------	---

4) Gear Train

After installing all the gears, check that the match marks A, B and C on the idle gear are aligned with those on the crank gear, the fuel injection pump drive gear and camshaft gear respectively, as shown below.



064681-00EN00

5. ELECTRIC SYSTEM

5-2 Monitor and Alarm Systems

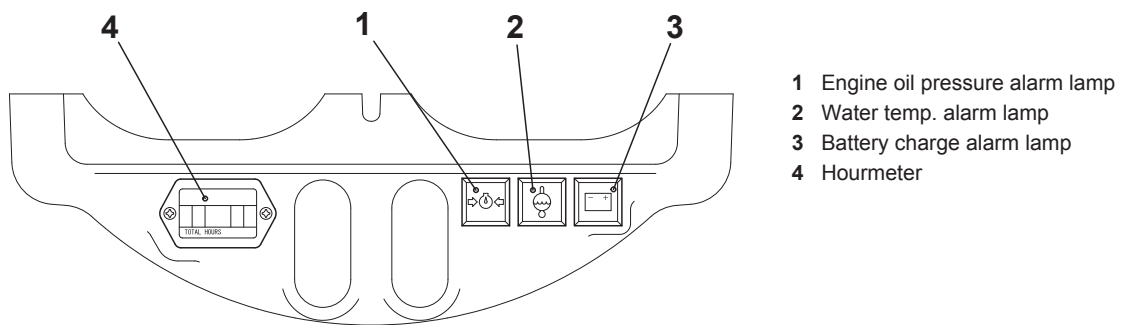
For safer machine operation, the operator needs to have a clear understanding of the machine's condition. However, it is difficult for the operator to keep an eye on every aspect of the machine he/she is operating.

Therefore, alarms and a meter are provided to warn the operator of any trouble of the machine at the early stage.

Note :

The monitors do not give a full assurance of the machine's condition. The indications shown on them should be used as a guide for daily check and periodic maintenance according to the Operation & Maintenance Manual.

5-2-1 Part Name



5-2-2 Performances of Alarm Sensors

- All the lamps should be off while the engine is running.
- The engine oil pressure and battery charge alarm lamps should light when the engine is stopped.
- The buzzer should sound when the engine oil pressure alarm lamp lights while the engine is running.

5. ELECTRIC SYSTEM

5-4-3 Battery Charge

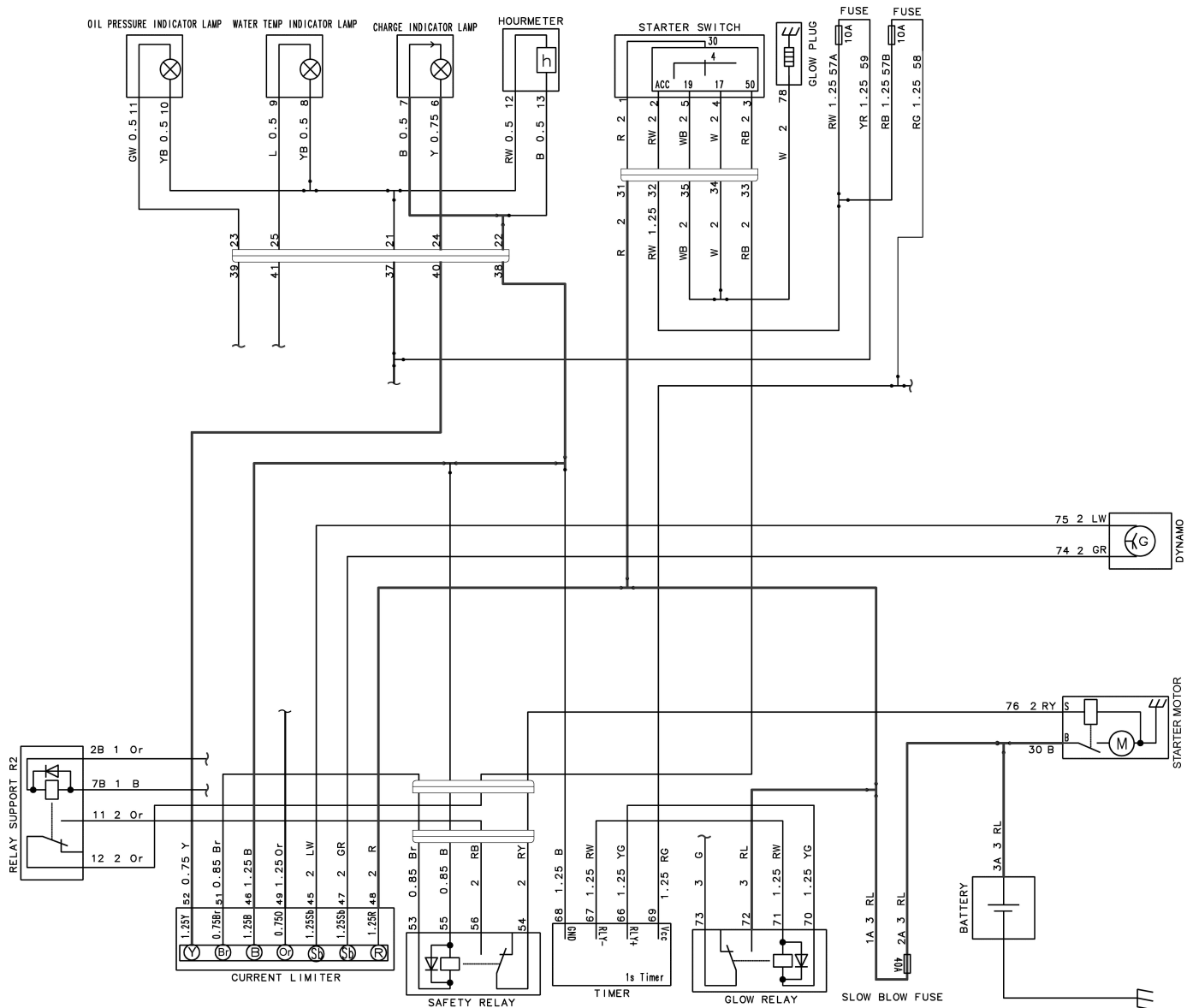
The electric current produced by the dynamo flows through the current limiter, the starter switch and the slow blow fuse to the battery positive terminal, to charge the battery. A circuit is provided to connect the current limiter terminal Y to the battery charge alarm lamp, and the lamp is off when the battery is normally charged.

- An electric current flows from the dynamo terminals **G1** and **G2** through the both current limiter terminals **Sb** and then **R**, and the slow blow fuse to the battery positive terminal, to charge the battery.
- When the voltage generated by the dynamo is normal, no electric current flows from the current limiter terminal **Y** to the battery charge alarm lamp, so that the lamp is off.

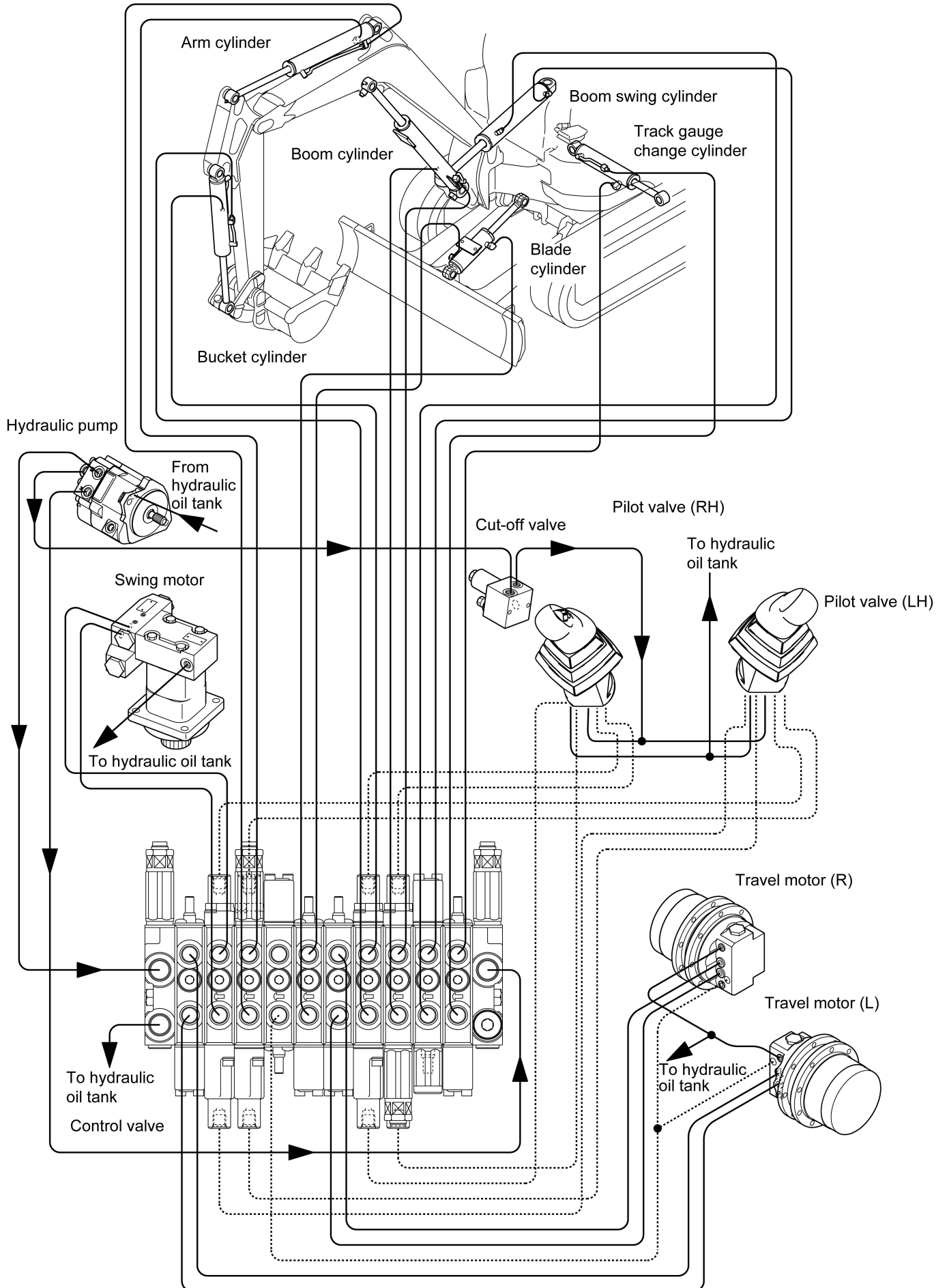
5-4-4 Failure in Battery Charge

When a failure occurs in the battery charging circuit, the battery charge alarm lamp lights.

- When abnormal (low) voltage is generated by the dynamo, the circuit in the current limiter allows an electric current to flow between the current limiter terminal **Y** and the battery charge alarm lamp in the lamp unit, so that the lamp lights.
- If the battery charge alarm lamp is on when the voltage generated by the dynamo is normal, the current limiter may be defective.



6. HYDRAULIC SYSTEM



6. HYDRAULIC SYSTEM

6-3-3 Bucket

1) Bucket "Curl"

(1) Pilot oil flow

When the bucket control lever is moved to the left to curl the bucket, the oil from the pilot pump P3 flows through the port A of the cut-off valve and the port 4 of the pilot valve (RH) to the port a4 of the bucket section to move its spool.

(2) Oil flow from hydraulic pump

The oil from the piston pump P1 flows through the port P1 of the inlet section and the port A4 of the bucket section to BKI of the bucket cylinder to extend its cylinder rod.

The return oil from BKO of the bucket cylinder flows back to the hydraulic oil tank through the port B4 of the bucket section, the port T of the control valve and the return filter.

2) Bucket "Dump"

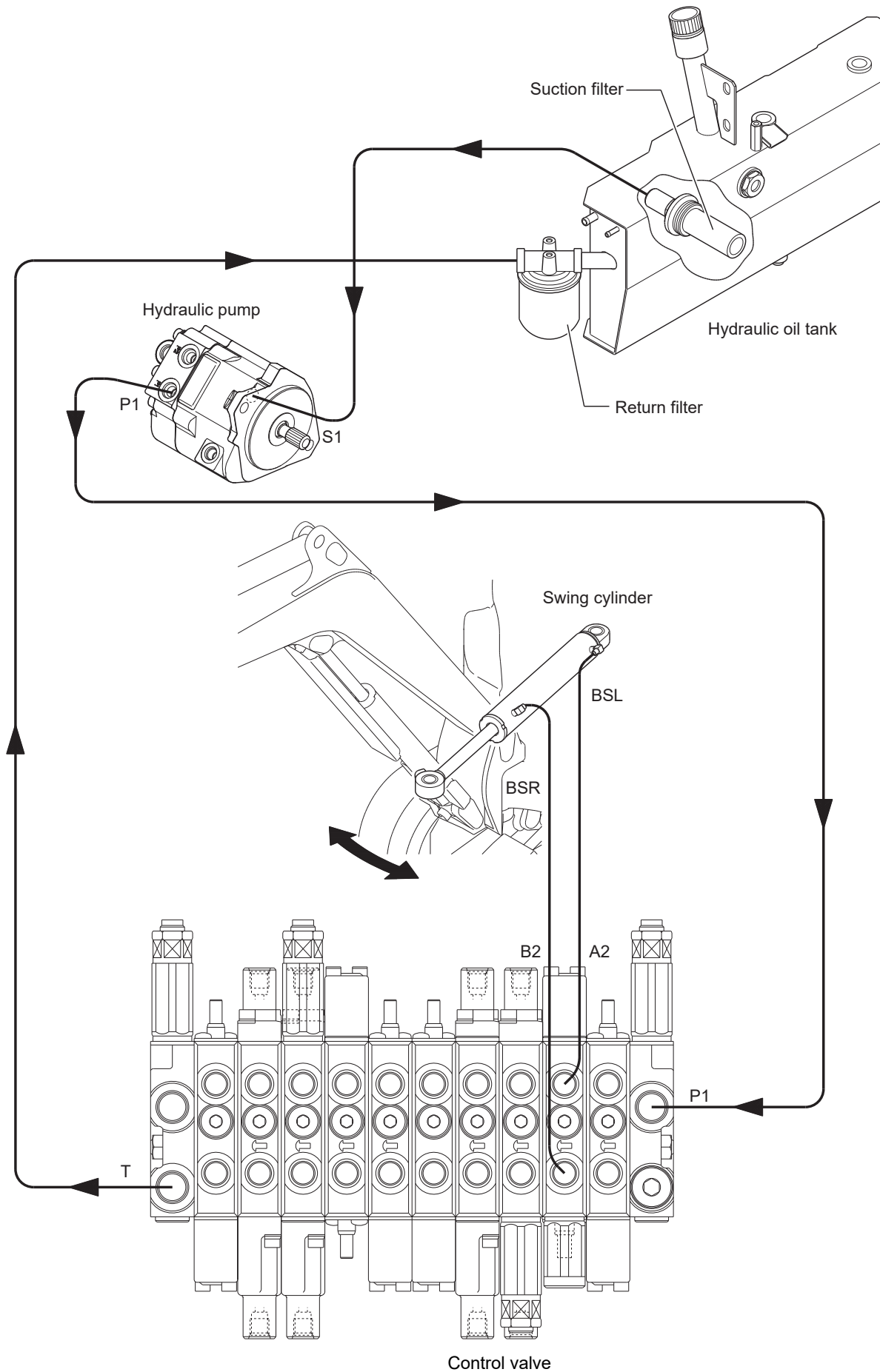
(1) Pilot oil flow

When the bucket control lever is moved to the right to dump the bucket, the oil from the pilot pump P3 flows through the port A of the cut-off valve and the port 2 of the pilot valve (RH) to the port b4 of the bucket section to move its spool.

(2) Oil flow from hydraulic pump

The oil flows in the opposite direction to the oil flow in the bucket curl operation with regard to the bucket cylinder.

6. HYDRAULIC SYSTEM



6. HYDRAULIC SYSTEM

6-3-8 Track Gauge Change

The track gauge change lever is connected to the spool of the control valve through linkage.

1) Widening

When the track gauge change lever is pushed forward to widen the track gauge, the spool of the track gauge change section is pulled.

Oil Flow from Hydraulic Pump

The oil from the piston pump P1 flows to the bottom side (W) of the track gauge change cylinder through the port P1 of the inlet section, the port B1 of the track gauge change section and the port B of the swivel joint to extend its cylinder rod, widening the track gauge.

The return oil from the rod side (N) of the track gauge change cylinder flows back to the hydraulic oil tank through the port A of the swivel joint, the port A1 of the track gauge change section, the port T of the control valve and the return filter.

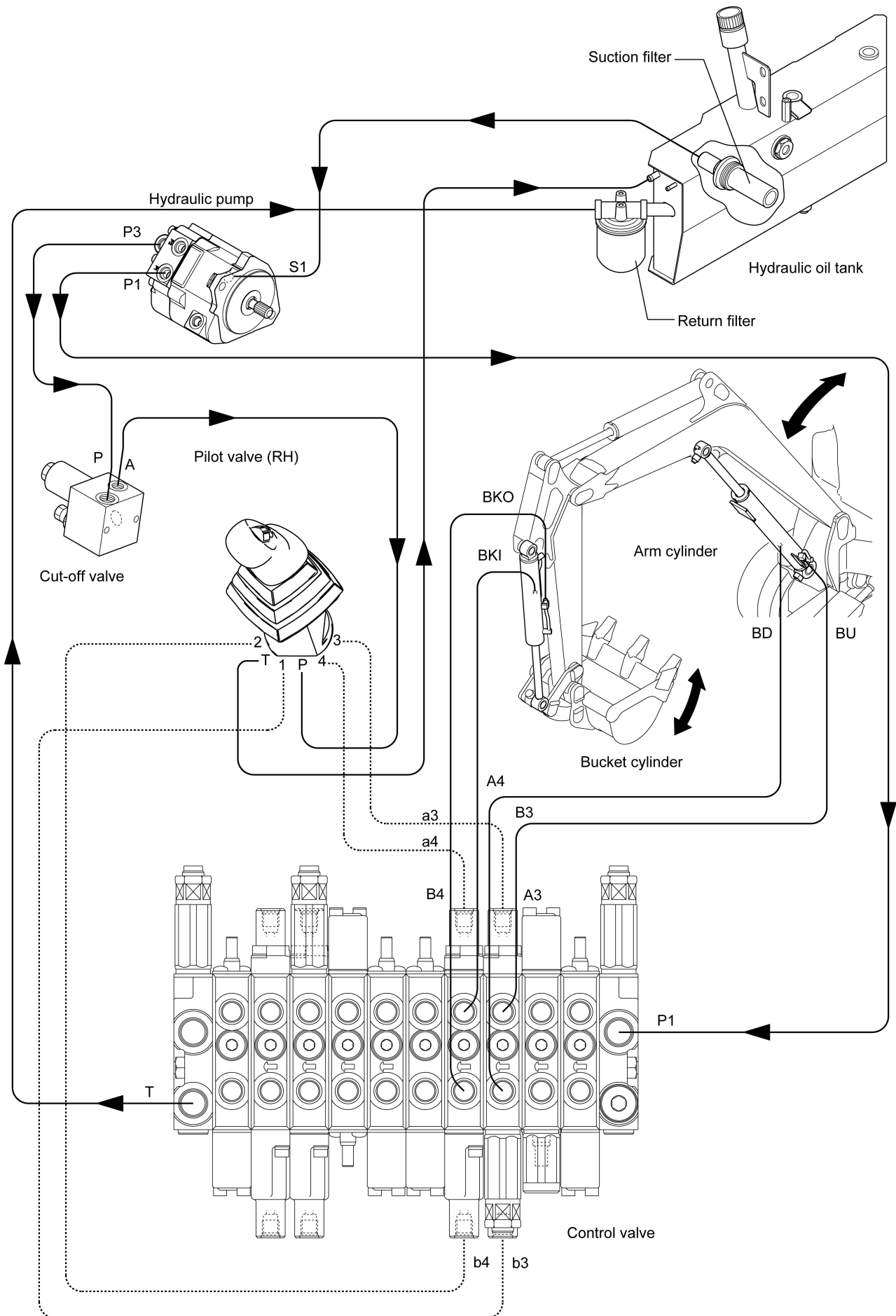
2) Narrowing

When the track gauge change lever is pulled back to narrow the track gauge, the spool of the track gauge change section is pressed.

Oil Flow from Hydraulic Pump

The oil flows in the opposite direction to the oil flow in the track gauge widening operation with regard to the track gauge change cylinder.

6. HYDRAULIC SYSTEM

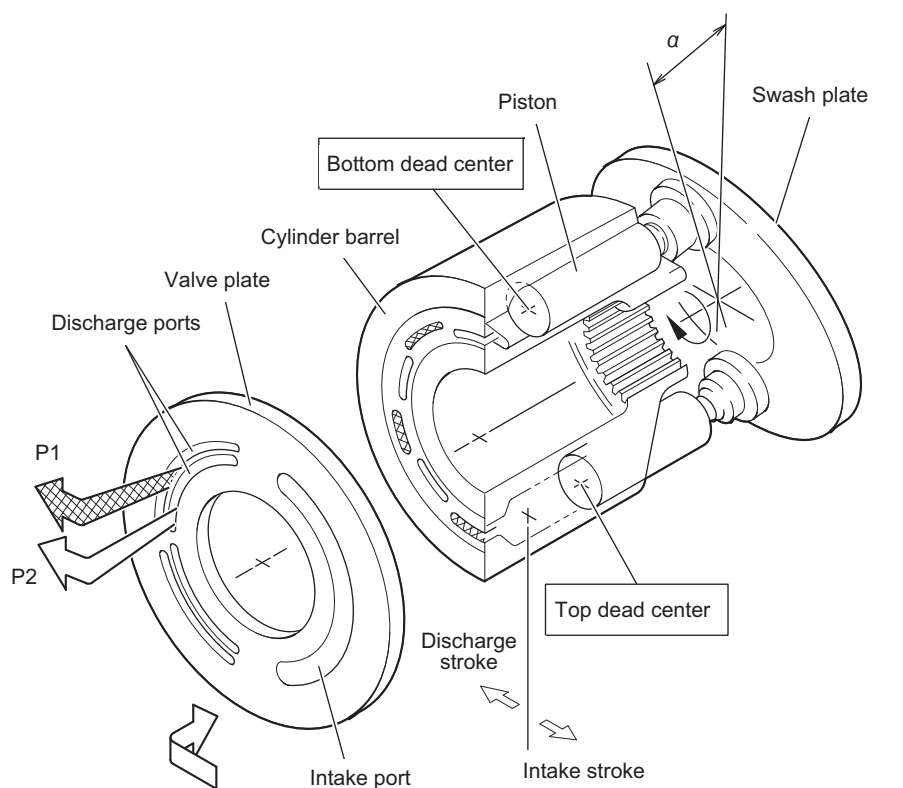


6. HYDRAULIC SYSTEM

2. Theory of operation

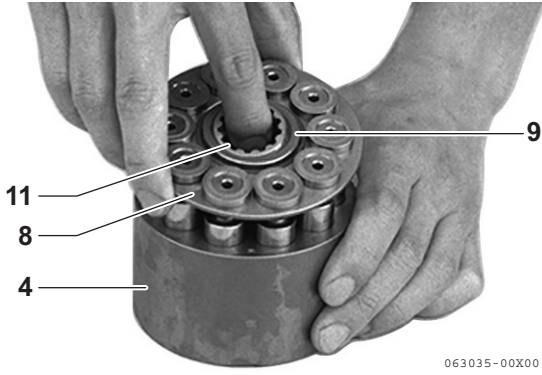
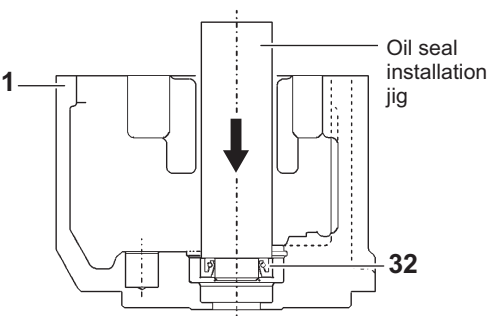
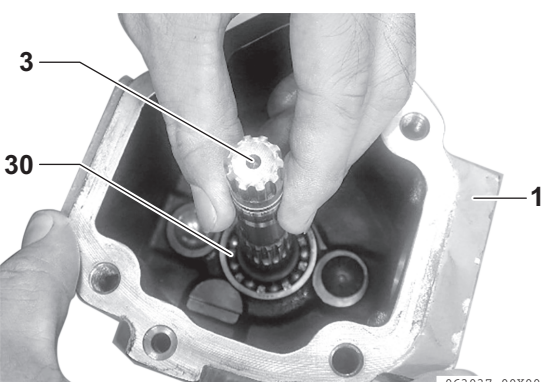
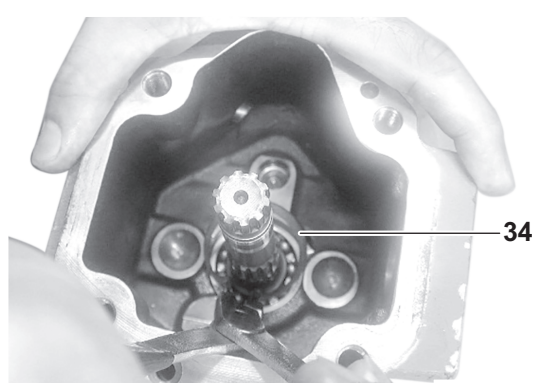
1) Pump function

- The cylinder barrel, which is splined to the drive shaft, revolves with the shaft.
- The pistons installed into the cylinder barrel, following the sliding surface of the swash plate, make a reciprocating motion, which causes the volume of the plunger to change, thereby enabling the intake and discharge pumping operations.
- As the plunger moves from the bottom dead center to the top dead center, the volume of it is increased and oil flowing from the intake port runs through the valve plate into the cylinder barrel. (Intake stroke)
- As the plunger moves from the top dead center to the bottom dead center, the volume of it is reduced, the oil in the cylinder barrel is discharged to the discharge port. (Discharge stroke)
- By changing the inclination of the swash plate sliding surface, the plunger stroke is changed and thus the displacement of the plunger can be changed.
- Oil taken in from the inner ports of the cylinder barrel is discharged from the inner discharge ports of the valve plate.
- Oil taken in from the outer ports of the cylinder barrel is discharged from the outer discharge ports of the valve plate.
- Oil discharged from the outer (inner) discharge port of the valve plate flows to P1 (P2) port of the pump assembly.



6. HYDRAULIC SYSTEM

4) Reassembly

Procedure	
<p>(1) Install needles 11, barrel holder 9 and shoe holder 8 with piston and shoe assemblies in order in cylinder barrel 4.</p>	 <p>063035-00X00</p>
<p>(2) Install oil seal 32 in body S 1.</p> <p>Note : New oil seal 32 must be installed. Slightly apply grease on lip and outside of it and lightly drive it into body S 1 with installation jig and hammer.</p>	 <p>063036-00EN00</p>
<p>(3) Install shaft 3 with ball bearing 30 in body S 1.</p> <p>Note : Be careful not to damage lip of oil seal 32 when installing shaft 3.</p>	 <p>063037-00X00</p>
<p>(4) Install snap ring 42 34 to hold ball bearing 30.</p>	 <p>063038-00X00</p>

6. HYDRAULIC SYSTEM

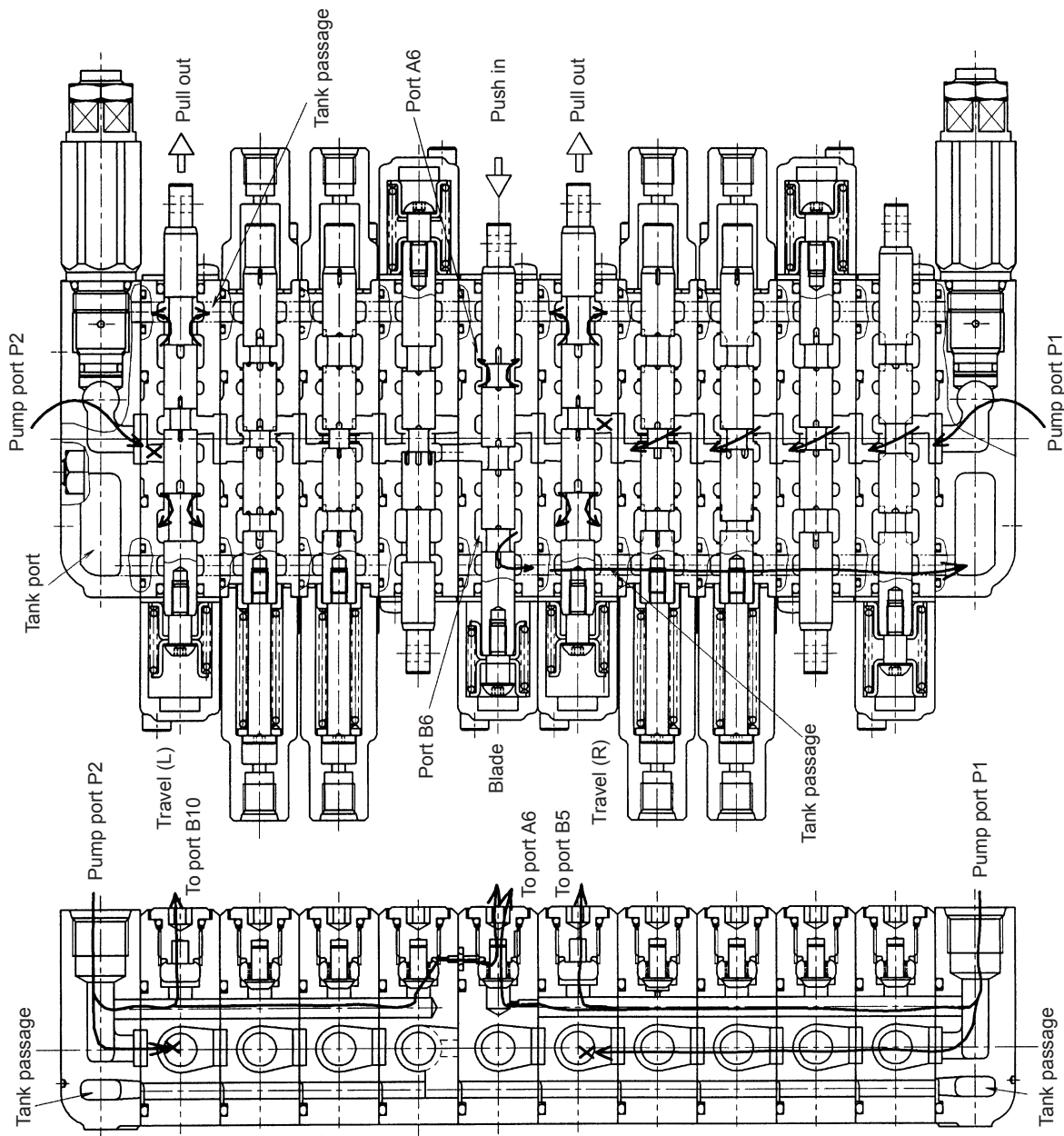
5) Simultaneous Operation of Blade and Travel

When the both travel spools are pulled out and the blade spool is pushed in, the oil from the port P1 and that from the port P2 flow to the travel section ports B5 and B10 respectively, while some of each oil flow is regulated to a specified quantity through the throttle and the specified quantity of oil flows to the blade section. These divided oil flows which have come into the blade section are combined after passing through the load check valve, and the combined oil flows to the port A6.

The return oil from the port B6 returns to the tank through the tank passage.

The blade section is supplied with the same specified quantity of divided oil from the ports P1 and P2 ; therefore, the both travel sections are also supplied with the same quantity of oil. Thus, the machine can travel without deviation even when the blade is operated during traveling.

When the travel spools are pushed in and the blade spool is pulled out, the oil from the port P1 and that from the port P2 flow to the travel section ports A5 and A10 respectively and the specified quantity of divided oil flows through the blade section to the port B6. Then, the oil returns from the port A6 to the tank through the tank passage.



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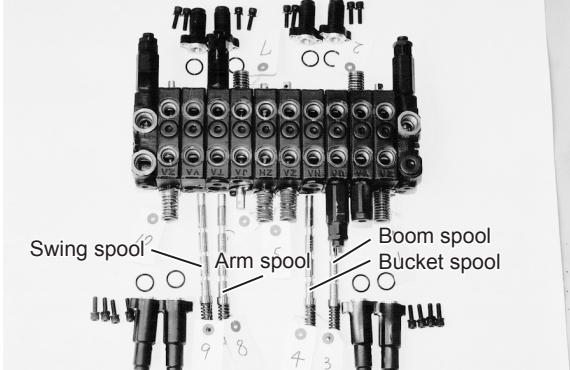
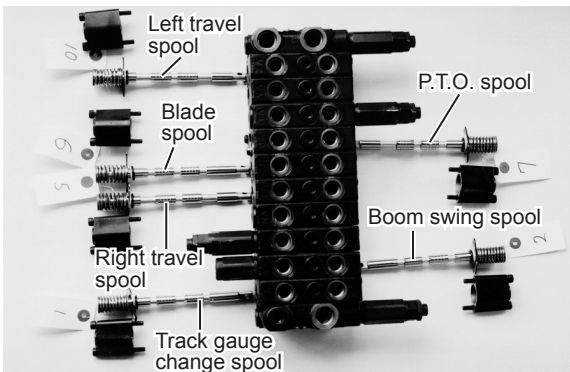
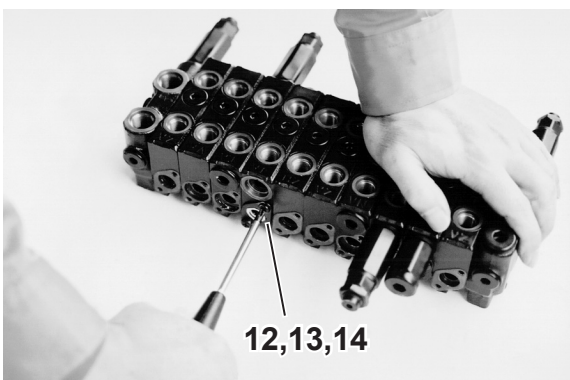
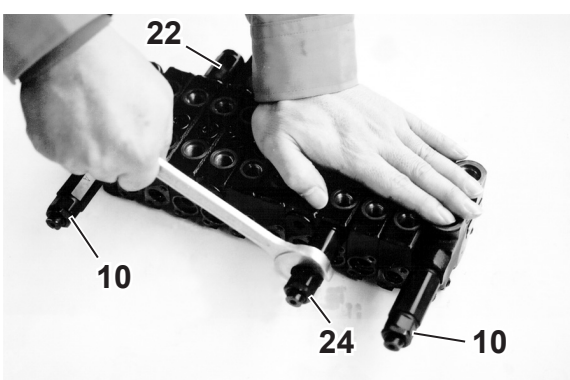
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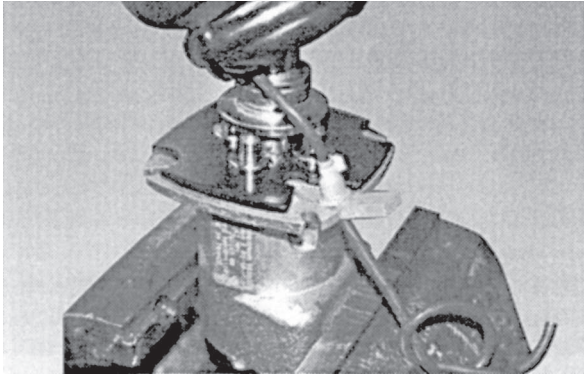

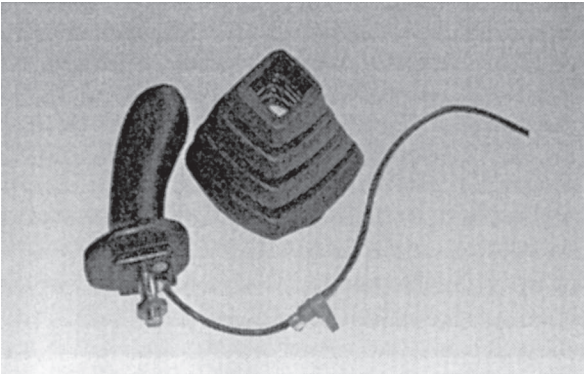
6. HYDRAULIC SYSTEM

Procedure	
<p>(4) Remove the boom spool, the bucket spool, the arm spool and the swing spool.</p>	
<p>(5) Remove the boom swing spool, the right travel spool, the blade spool, the P.T.O. spool, the left travel spool and the track gauge change spool.</p>	
<p>(6) Remove the seal plates 14, the backup rings 13 and the O-rings 12 on the spool link side.</p>	
<p>(7) Remove the system relief valves 10, the circuit relief valves 24 and the anti-cavitation valve 22.</p> <p>Note : Make matchmarks on the valves and the control valve body before removing the valves.</p>	

6. HYDRAULIC SYSTEM

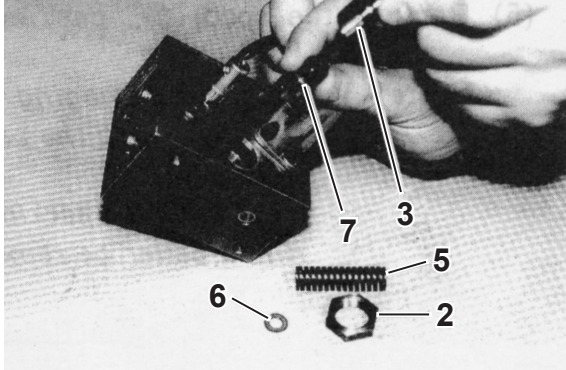
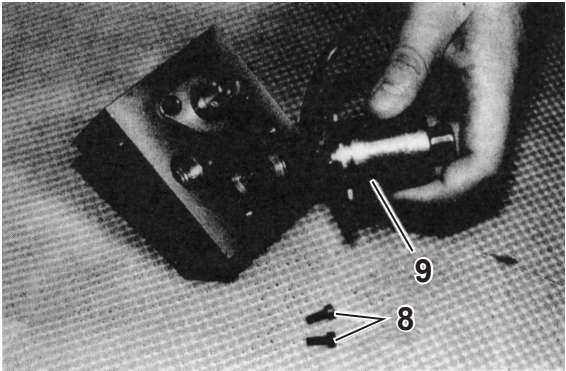
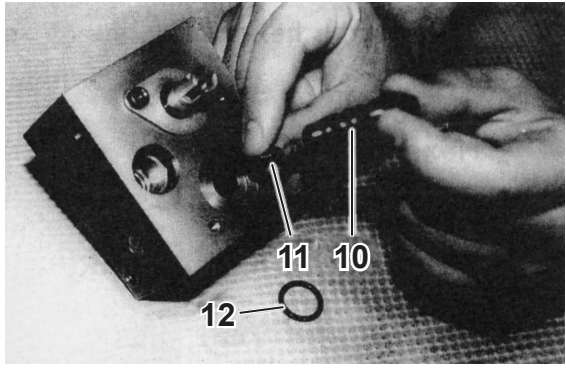
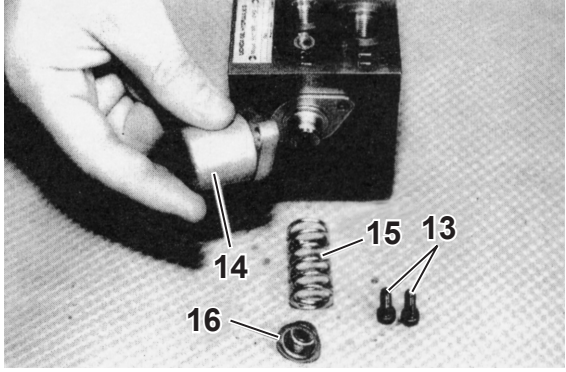
5. Pilot Control Unit Repair Procedures

1) Boot or Handle Replacement

Procedure	
<p>Preliminary operations Remove the pilot control unit from the machine's arm rest of free the unit by unscrewing the 4 screws fixing the plate in order to release the electrical cable. Hold the pilot control unit using a vice or a vice-grip wrench (clamp onto the body above the arm rest, 65 opening).</p> <p>Note : <i>The pilot control unit does not need to be removed from the machine to release the cable. However, it is recommended to lift the control unit by undoing the 4 fixing screws on the arm rest.</i> <i>It is unnecessary to remove the units without electrical functions.</i></p> <p> Machine off :</p> <ul style="list-style-type: none">- place all of the machine's equipment connected to the pilot control unit in neutral position,- release stored pressure by operating all of the pilot unit's control valves by moving the handle in all directions. <p>Handle removal Lift and turn the boot inside out. Remove the grommet from its emplacement to free the cable. Loosen the handle mounting nut (19 mm open-end wrench). Reassembly : torque : 30 ± 3 N·m Unscrew and remove the handle.</p>	 
<p>Boot replacement Remove the faulty boot and replace it with a new boot. Replace the handle following the disassembly instructions in reverse order.</p>	

6. HYDRAULIC SYSTEM

3) Disassembly

Procedure	
<p>(1) Relief valve Remove the hexagon nut 2, adjusting screw 3 and O-ring 4, and take out the spring 5, shim 6 and spool 7. Wrench : 14, 24</p> <p>Note : <i>The pressure is already set. Avoid disassembling if not necessary.</i></p>	
<p>(2) Solenoid-operated directional control valve Remove the hexagon socket head screws 8 and solenoid 9. Hexagon bar wrench : 3</p> <p>Note : <i>Take care not to drop the push rod into the solenoid.</i></p>	
<p>(3) Remove the spool 10, spring 11 and O-ring 12.</p>	
<p>(4) Manual directional control valve Remove the hexagon socket head screws 13, cover 14, spring 15 and spring seat 16. Hexagon bar wrench : 4</p>	


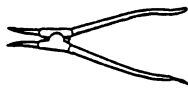

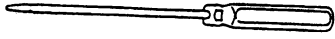
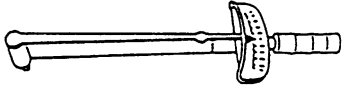
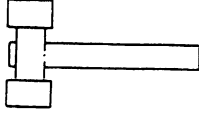

6. HYDRAULIC SYSTEM

3. Disassembly and reassembly

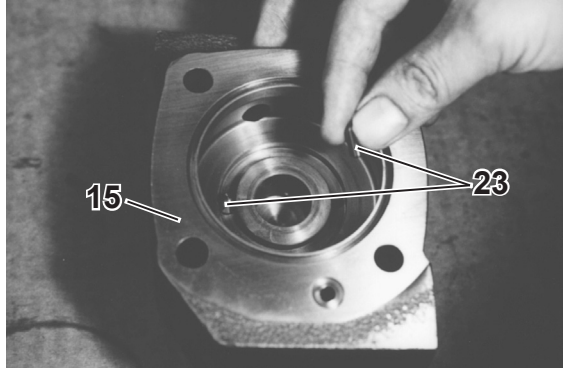
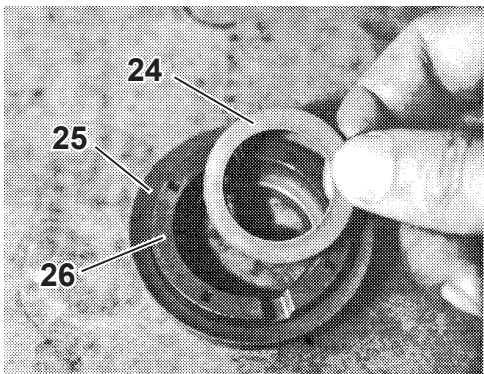
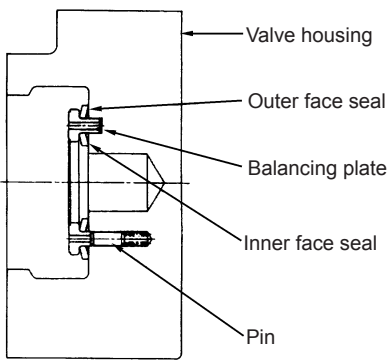
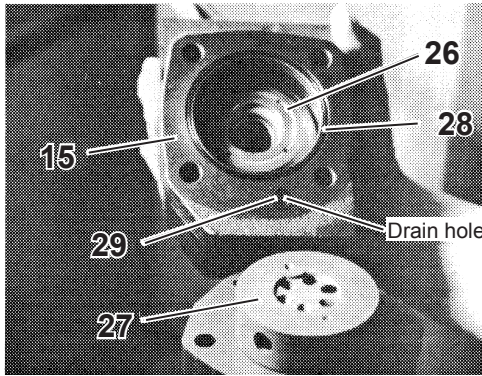
1) Precautions for disassembly and reassembly

- (1) Since the parts of the hydraulic equipment are precision-made for tight clearances, be sure to perform disassembly and reassembly in a clean place that is free from dust.
- (2) Prepare clean tools and treated oil, and handle the parts carefully.
- (3) First clean the external surface of the removed assemblies.
- (4) Before beginning disassembly, review the drawings of the internal structure and prepare the required parts according to the purpose and extent of the disassembly.
- (5) In principle, replace the removed seals and rings with new ones. Since some replacement parts are available only as subassemblies, refer to the parts catalog to prepare the necessary subassemblies in advance.
- (6) Handling of O-rings
 - [1] Lubricate the O-rings and the O-ring fitting seats with clean grease or hydraulic oil.
 - [2] The O-rings may not be damaged in handling or distorted by heat.
 - [3] Do not extend any O-rings with such great force as to permanently deform them.
 - [4] Avoid rolling the O-rings when fitting them. A distorted O-ring may not return to its original shape, and therefore, may cause oil leakage.

2) Tools for disassembly and reassembly

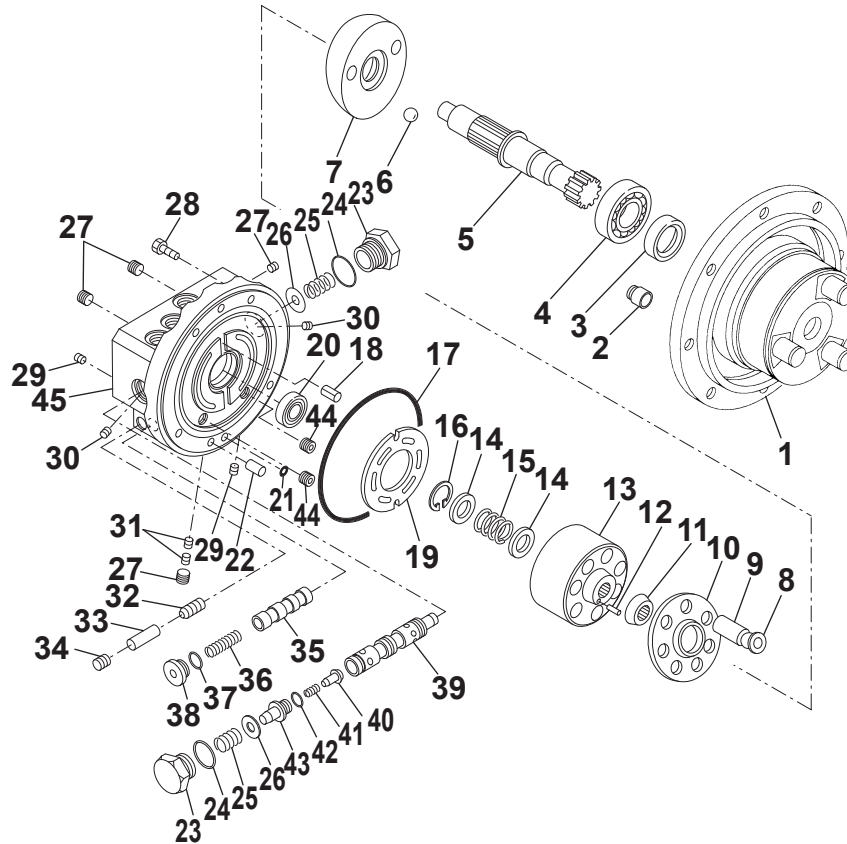
Tool	Appearance	Remarks	Tool	Appearance	Remarks
Square socket		36 mm	Retaining pliers		35 mm for external snap ring
Monkey wrench			Screwdriver		
Torque wrench		Capacity : 34.3 to 117.7 N·m	Plastic hammer		
Socket		Width across flats : 35 mm	Press		Approx. 3 ton

6. HYDRAULIC SYSTEM

Procedure	
<p>(13) Install springs 22 and pins 23 into valve housing 15.</p>	
<p>(14) Install inner face seal 24 and outer face seal 25 to balancing plate 26.</p>	
<p>(15) With the notches of balancing plate 26 fitted with pins 23, install balancing plate 26 into valve housing 15.</p>	
<p>(16) Install O-rings 28 and 29 to valve housing 15, and then, install valve housing 15 onto valve 27.</p> <p>Notes :</p> <p>a) Install the valve housing onto the valve while pressing balancing plate 26 with a thin rod such as a screwdriver inserted into the port hole in the valve housing, to prevent the balancing plate from coming off.</p> <p>b) Align the drain holes in the valve housing and the valve plate.</p>	

6. HYDRAULIC SYSTEM

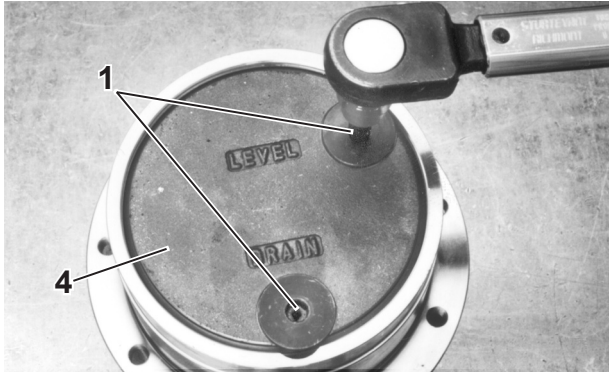
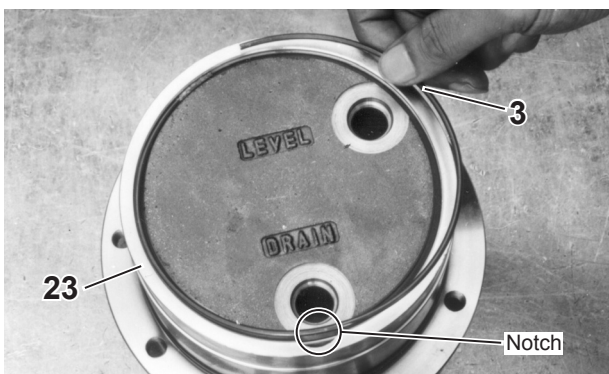
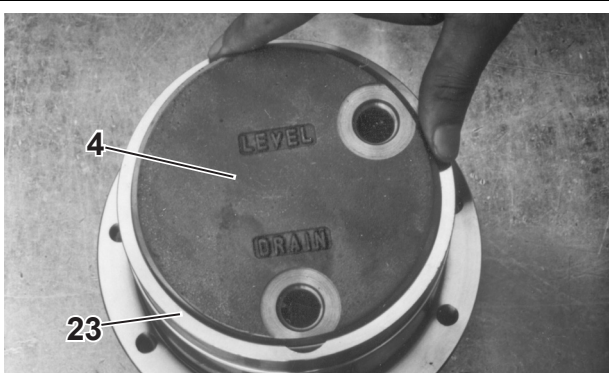

3) Exploded View and Component Parts (Motor Section and Valve Section)



No.	Part	Q'ty	No.	Part	Q'ty
1	Body 2	1	24	O-ring 1BP18	2
2	Control piston	1	25	Spring V2	2
3	Oil seal	1	26	Ring	2
4	Bearing 6004	1	27	Plug 1 / 16	4
5	Shaft	1	28	Hexagon socket head bolt	7
6	Ball	2	29	Plug	6
7	Swash plate	1	30	Choke 0.4	2
8	Shoe	7	31	Choke 0.5	2
9	Piston	7	32	Shuttle spool	1
10	Shoe holder	1	33	Pin	2
11	Barrel holder	1	34	Plug 1 / 16	2
12	Pin	3	35	High-speed spool	1
13	Cylinder barrel	1	36	Spring V3	1
14	Retainer	2	37	O-ring 1BP14	2
15	Spring C	1	38	Plug	2
16	Internal snap ring 28	1	39	Spool	1
17	O-ring 1B105	1	40	Check valve	2
18	Spring pin	1	41	Spring V1	2
19	Valve plate	1	42	O-ring 1A10	2
20	Bearing 6201	1	43	Spring guide	2
21	O-ring 1BP6	1	44	Plug 1 / 8	2
22	Pin 6 × 14	1	45	Body 1	1
23	Plug	2			

6. HYDRAULIC SYSTEM

4)-6 Disassembly of Reduction Gear Section

Procedure	
<p>(1) Remove plugs 1 from cover 4 and drain the lubricating oil. Width across flats : 5 mm</p>	
<p>(2) Put a screwdriver or the like in the notch of body 23 to remove O-snap ring 3.</p>	
<p>(3) Remove cover 4 from body 23.</p>	
<p>(4) Remove O-ring 5 from body 23.</p>	

6. HYDRAULIC SYSTEM

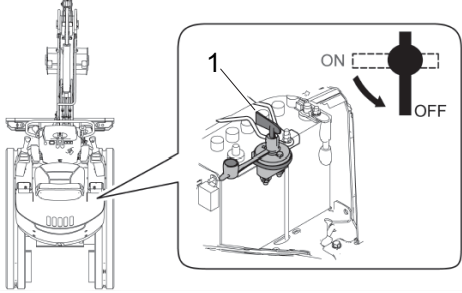
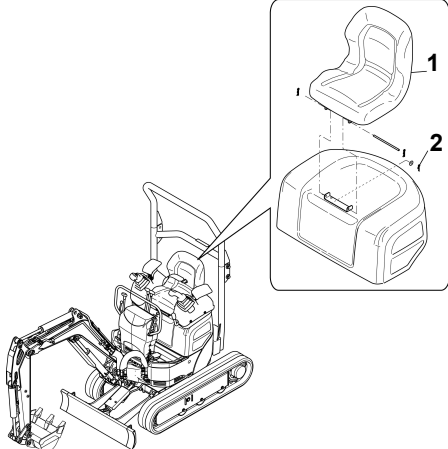
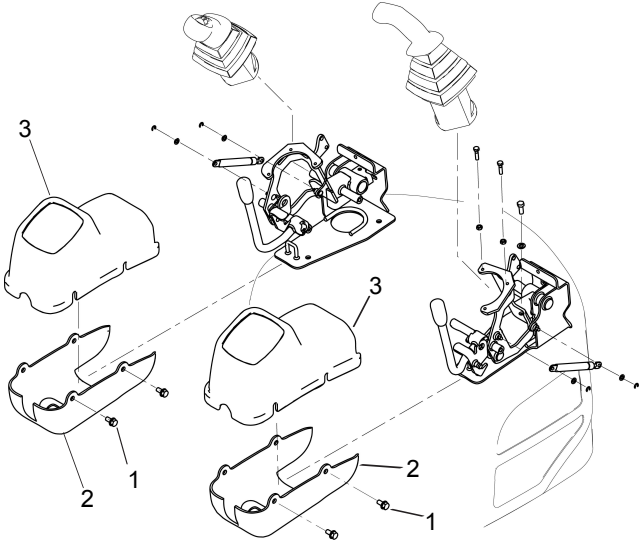
5. Troubleshooting

Trouble	Cause	Measure
1. Motor does not rotate.	1) Malfunction of any hydraulic equipment other than travel motor	Check the inlet pressure of the motor. Then, check and repair or replace the other equipment.
	2) Malfunction of hydraulic motor (1) Pressure oil leakage due to excessively worn sliding portion of internal part	Replace the excessively worn part.
	(2) Broken internal part	Replace the broken part or kit.
	3) Malfunction of counterbalance valve (Improper stroke of counterbalance valve) (1) Foreign matter caught in the valve (2) Clogged choke	Remove the foreign matter, and repair or replace the damaged part. Clean the choke.
	4) Malfunction of reduction gear (1) Broken internal part	Replace the broken part or kit.
2. Travel speed is low or machine cannot travel straight.	1) Malfunction of any hydraulic equipment other than travel motor	Check and repair or replace the equipment.
	2) Malfunction of hydraulic motor (1) Lowered volumetric efficiency due to excessive worn	Replace the excessively worn part in the sliding section.
3. Motor does not stop or takes time to stop.	1) Malfunction of counterbalance valve (Counterbalance valve does not return normally.) (1) Foreign matter caught in the valve (2) Clogged choke	Remove the foreign matter, and repair or replace the damaged part. Clean the choke.
	(3) Broken spring	Replace the spring.
4. Oil leakage.	1) Damaged O-ring	Replace the O-ring.
	2) Flaw in sealing surface of O-ring	Repair the sealing surface or replace the O-ring.
	3) Broken oil seal	Replace the oil seal.
	4) Excessively worn mechanical seal	Replace the floating seat and the seal ring.
	5) Loosened bolt or plug	Retighten the bolt or the plug.
5. Machine slips excessively on a slope.	1) Excessive oil leakage from hydraulic motor	Replace the excessively worn part in the sliding section.
	2) Excessive oil leakage from counterbalance valve	Replace the excessively worn part in the sliding section.

7. ADJUSTMENT AND REPAIR

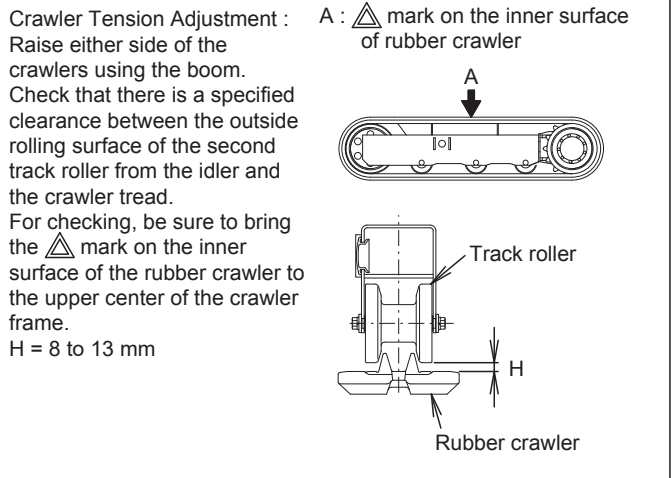
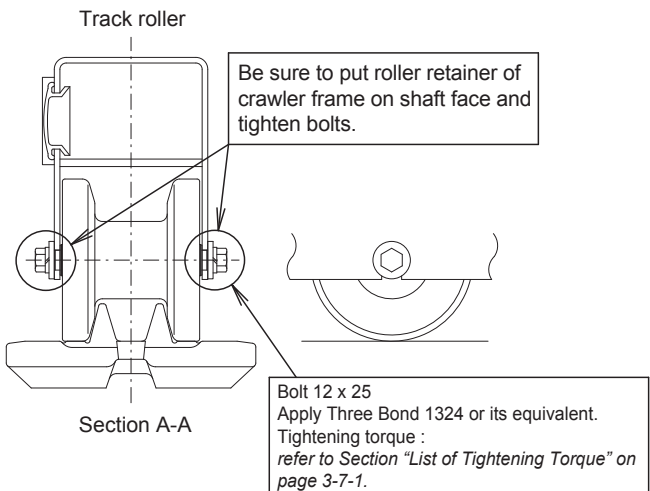
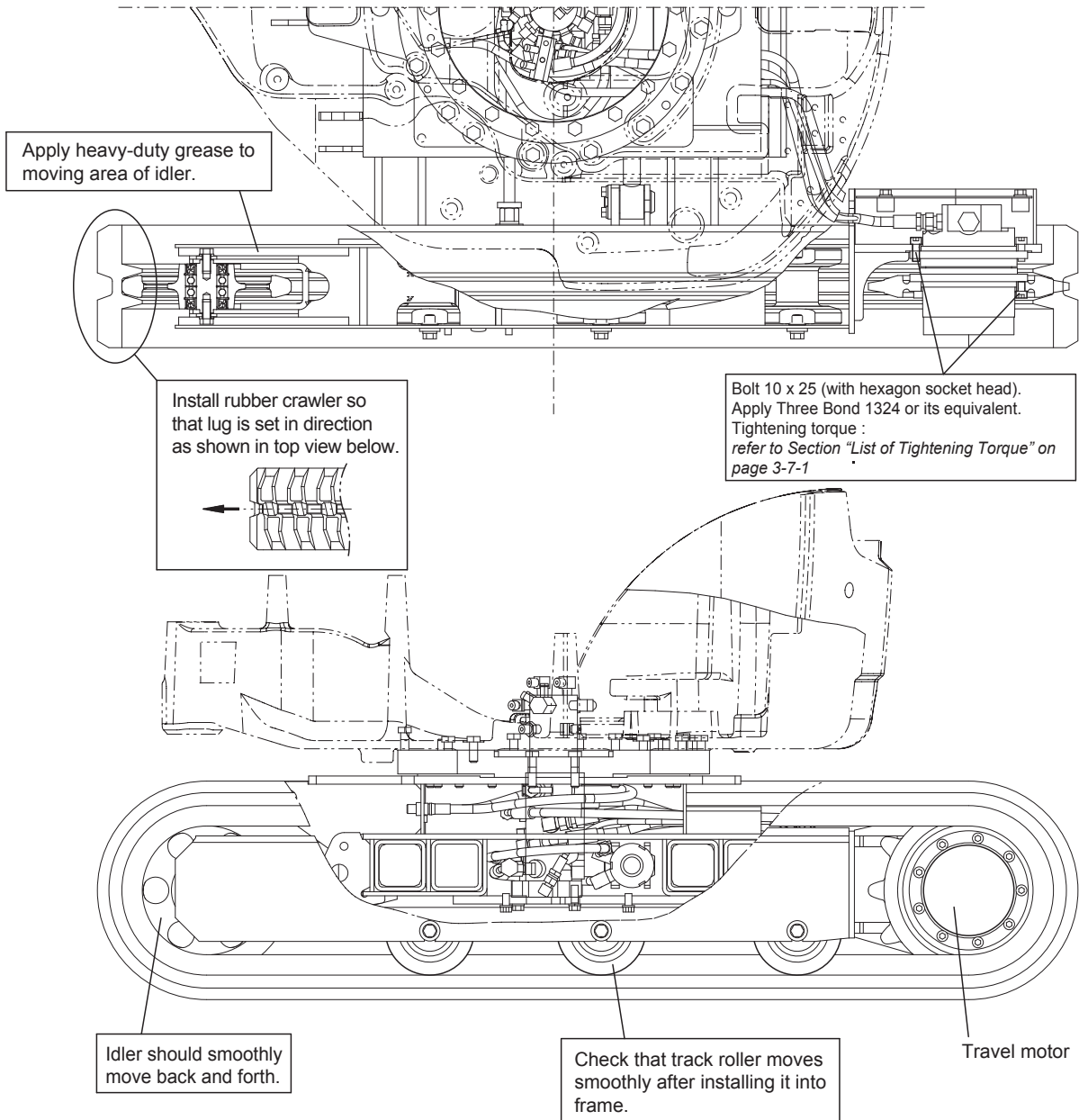
7-1-2 Removal and Reinstallation of Starter Motor

1) Removal

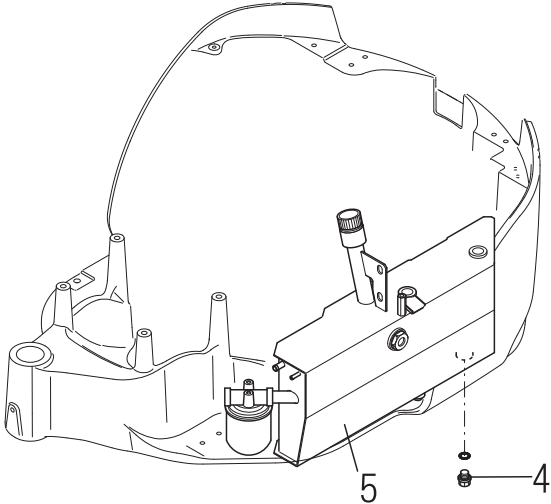
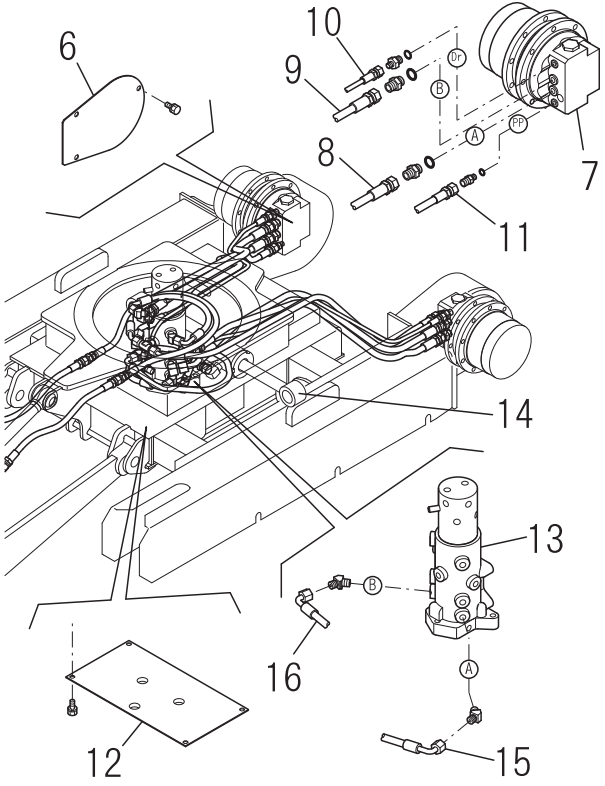
Procedure	
<p>(1) Open the engine hood and turn the main switch 1 to the OFF position to disconnect the battery of the machine.</p> <p>Note : Place a MAINTENANCE IN PROGRESS label on the machine.</p>	
<p>(2) Remove the operator's seat 1 by removing pins 2 and open the engine hood.</p>	
<p>(3) Remove the bolts 1 retaining the lower covers 2 and the upper covers 3 (L and R) from the engine hood.</p> <p>(4) Disconnect the electric harness from the joystick R.</p> <p>(5) Remove three bolts M6x20 retaining the joystick and pilot valve element on the bracket.</p>	

7. ADJUSTMENT AND REPAIR

7-2-2 Points of Reassembly



7. ADJUSTMENT AND REPAIR

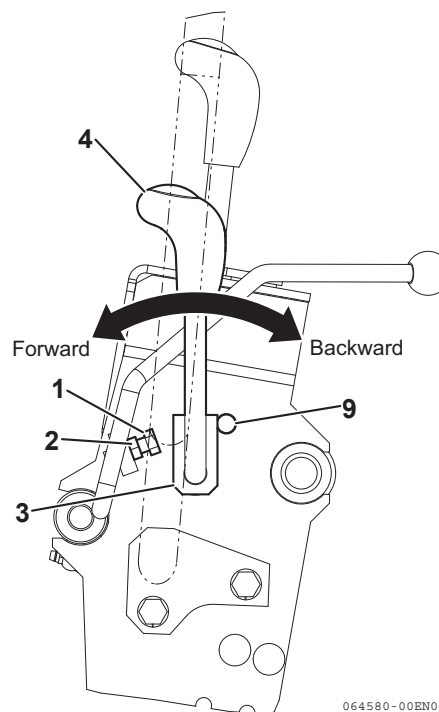
Procedure			
<p>(5) Remove the drain plug 4 from the hydraulic oil tank 5 and drain the hydraulic oil.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Hydraulic oil quantity</td> <td style="padding: 2px;">7,4 L (in tank)</td> </tr> </table> <p>Warning : Put a container under the hydraulic oil drain plug.</p>	Hydraulic oil quantity	7,4 L (in tank)	
Hydraulic oil quantity	7,4 L (in tank)		
<p>(6) Remove the motor cover 6, and then remove the hydraulic hoses from the travel motor 7.</p> <ul style="list-style-type: none"> • Hose 8 (swivel joint to travel motor A) • Hose 9 (swivel joint to travel motor B) • Hose 10 (swivel joint to travel motor Dr) • Hose 11 (swivel joint to travel motor PP) <p>Note : Mark the hydraulic hoses to identify their respective fitting positions.</p> <p>(7) Remove the under cover (SJ) 12.</p> <p>(8) Disconnect the hoses for the track gauge change cylinder 14 from the hub of the swivel joint 13.</p> <ul style="list-style-type: none"> • Hose 15 (swivel joint A to track gauge change cylinder rod) • Hose 16 (swivel joint B to track gauge change cylinder bottom) 			

7. ADJUSTMENT AND REPAIR

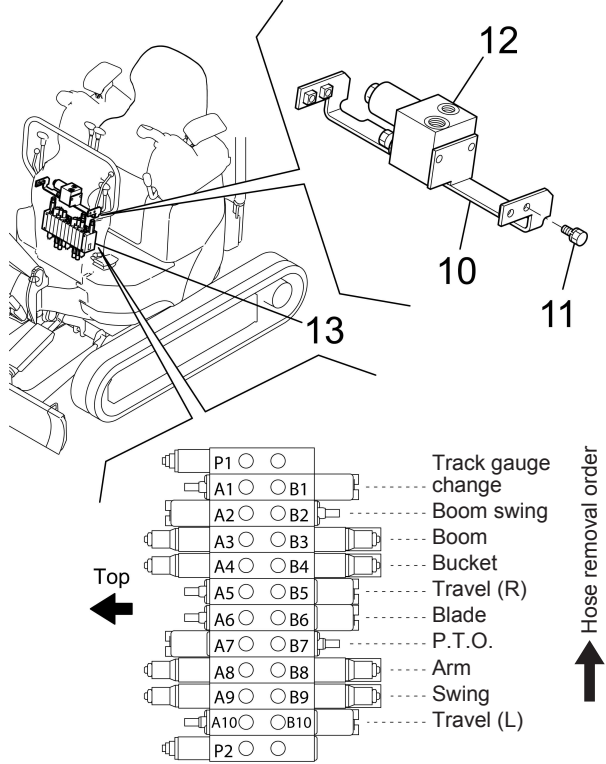
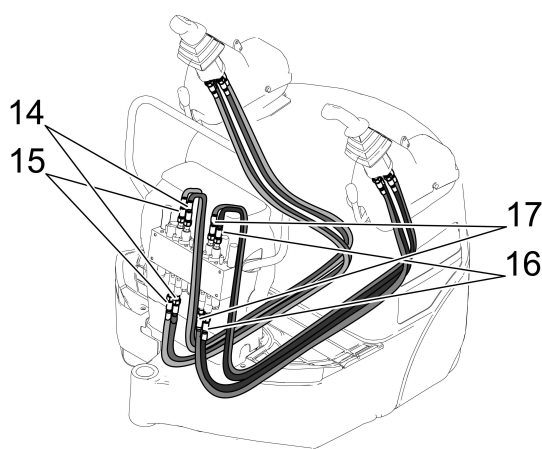
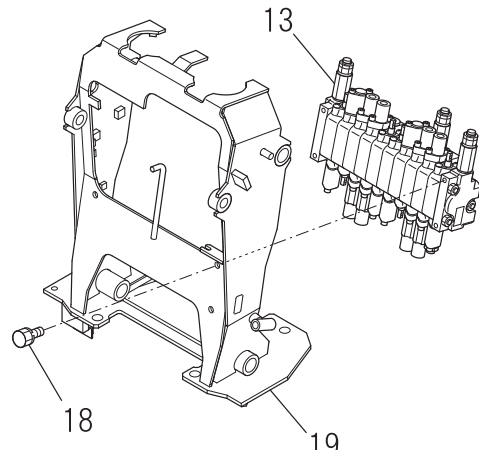
7-3-6 Adjustment of Accelerator Lever

1) Adjustment of Low Idling Speed

- (1) Loosen the nut **2** to screw in the stopper bolt **1** and move the accelerator lever **4** fully forward.
- (2) Make sure the low idling speed (1225 to 1275 rpm) when the regulator handle **7** of the fuel injection pump touches the adjust bolt **6**.
- (3) If the engine speed is not within the above range, turn the adjust bolt **6** to adjust the stroke of the regulator handle **7**.
- (4) Loosen the stopper bolt **1** of the accelerator lever **4** until the head of the stopper bolt **1** touches the accelerator arm **3** and tighten the nut **2** to lock the stopper bolt **1**.



7. ADJUSTMENT AND REPAIR

Procedure																																					
<p>(7) Remove the mounting bolts 11 from the valve stay 10 and remove the valve stay 10 with the cut-off valve 12 installed.</p> <p>(8) Disconnect the hydraulic hoses from the connectors of the control valve 13.</p> <p>Notes :</p> <ul style="list-style-type: none"> • Mark the removed hoses to identify their respective fitting positions. • Remove all the hydraulic hoses in order of section arrangement of the control valve from the inlet section (P2 and T) side, as indicated by the arrow. 	 <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">P1 ○ ○</td> <td style="text-align: center;">○ ○</td> <td>Track gauge change</td> </tr> <tr> <td style="text-align: center;">A1 ○ ○</td> <td style="text-align: center;">○ B1</td> <td>Boom swing</td> </tr> <tr> <td style="text-align: center;">A2 ○ ○</td> <td style="text-align: center;">○ B2</td> <td>Boom</td> </tr> <tr> <td style="text-align: center;">A3 ○ ○</td> <td style="text-align: center;">○ B3</td> <td>Bucket</td> </tr> <tr> <td style="text-align: center;">A4 ○ ○</td> <td style="text-align: center;">○ B4</td> <td>Travel (R)</td> </tr> <tr> <td style="text-align: center;">A5 ○ ○</td> <td style="text-align: center;">○ B5</td> <td>Blade</td> </tr> <tr> <td style="text-align: center;">A6 ○ ○</td> <td style="text-align: center;">○ B6</td> <td>P.T.O.</td> </tr> <tr> <td style="text-align: center;">A7 ○ ○</td> <td style="text-align: center;">○ B7</td> <td>Arm</td> </tr> <tr> <td style="text-align: center;">A8 ○ ○</td> <td style="text-align: center;">○ B8</td> <td>Swing</td> </tr> <tr> <td style="text-align: center;">A9 ○ ○</td> <td style="text-align: center;">○ B9</td> <td>Swing</td> </tr> <tr> <td style="text-align: center;">A10 ○ ○</td> <td style="text-align: center;">○ B10</td> <td>Travel (L)</td> </tr> <tr> <td style="text-align: center;">P2 ○ ○</td> <td style="text-align: center;">○ ○</td> <td></td> </tr> </table>	P1 ○ ○	○ ○	Track gauge change	A1 ○ ○	○ B1	Boom swing	A2 ○ ○	○ B2	Boom	A3 ○ ○	○ B3	Bucket	A4 ○ ○	○ B4	Travel (R)	A5 ○ ○	○ B5	Blade	A6 ○ ○	○ B6	P.T.O.	A7 ○ ○	○ B7	Arm	A8 ○ ○	○ B8	Swing	A9 ○ ○	○ B9	Swing	A10 ○ ○	○ B10	Travel (L)	P2 ○ ○	○ ○	
P1 ○ ○	○ ○	Track gauge change																																			
A1 ○ ○	○ B1	Boom swing																																			
A2 ○ ○	○ B2	Boom																																			
A3 ○ ○	○ B3	Bucket																																			
A4 ○ ○	○ B4	Travel (R)																																			
A5 ○ ○	○ B5	Blade																																			
A6 ○ ○	○ B6	P.T.O.																																			
A7 ○ ○	○ B7	Arm																																			
A8 ○ ○	○ B8	Swing																																			
A9 ○ ○	○ B9	Swing																																			
A10 ○ ○	○ B10	Travel (L)																																			
P2 ○ ○	○ ○																																				
<p>(9) Remove the pilot hoses from the connectors of the control valve.</p> <ul style="list-style-type: none"> • Pilot hoses 14 [pilot valve (RH) to bucket section] • Pilot hoses 15 [pilot valve (RH) to boom section] • Pilot hoses 16 [pilot valve (LH) to swing section] • Pilot hoses 17 [pilot valve (LH) to arm section] 																																					
<p>(10) Remove the mounting bolts 18 and remove the control valve 13 from the valve support 19.</p>																																					

7. ADJUSTMENT AND REPAIR

3) Precautions for Handling and Storing Seals

- (1) Seals are packed in the package that is suitable for storage.
- (2) Do not leave seals outside the packages.
- (3) For storing, put seals in the packages and place them in a dark and cool place (in a parts box or cardboard box) under 40°C to avoid direct sunlight. If the storage condition is proper, they can be stored for four or five years.
- (4) Do not put anything on swivel seals, or they may be distorted.

4) How to Fit Seals (for Inner Side)

• Fitting

- (1) Use lithium soap base multipurpose grease (cone penetration No.1 or No.2).
- (2) To fit a swivel seal, make it heart-shaped as shown in the figures at the right and press one end of it into the groove. Then, fit the whole swivel seal, pressing it with your finger (Figs. 1 and 2).
- (3) When using a jig for fitting swivel seals, use a jig with round edges to avoid damaging the seals. (Fig. 3)
- (4) If the swivel seal is distorted after fitted, correct the distortion with a jig before assembly. (Fig. 4)

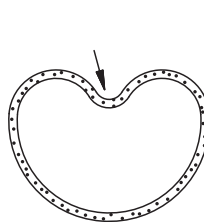


Fig. 1

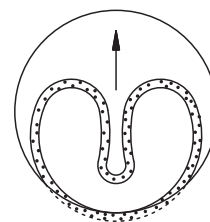


Fig. 2

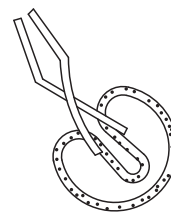


Fig. 3

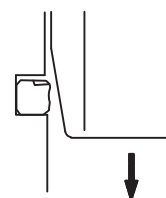


Fig. 4

5) Repair and Replacement of Parts

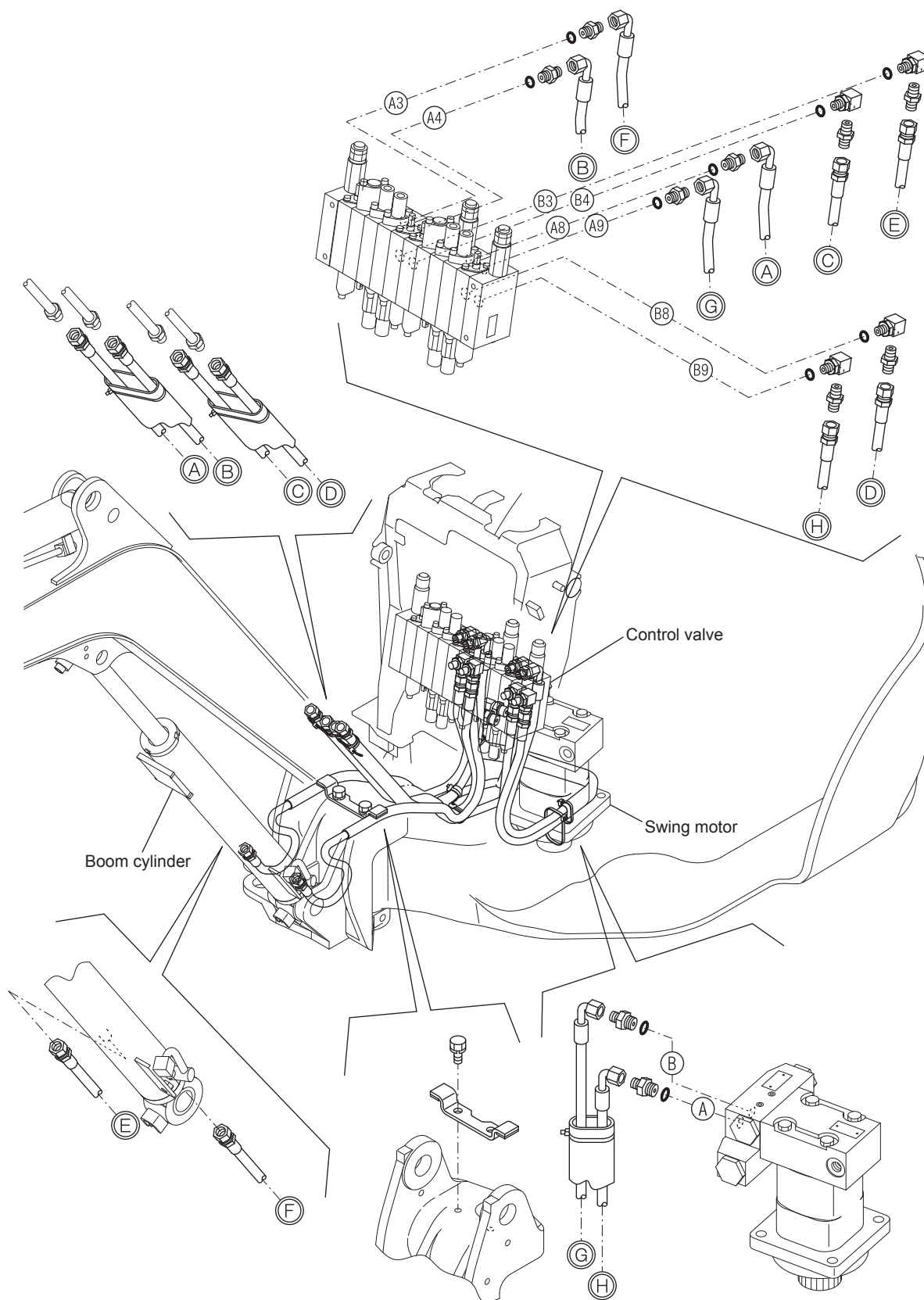
- (1) Disassemble and reassemble the swivel joint at a place free from dust.
- (2) Completely remove the contamination, foreign matter (sludge), etc. from the removed parts.
- (3) Check the seal surface of the shaft for flaws and nicks. Repair or replace the shaft when necessary.
- (4) Replace the shaft if it is worn.
- (5) Replace all seals in reassembly.

7. ADJUSTMENT AND REPAIR

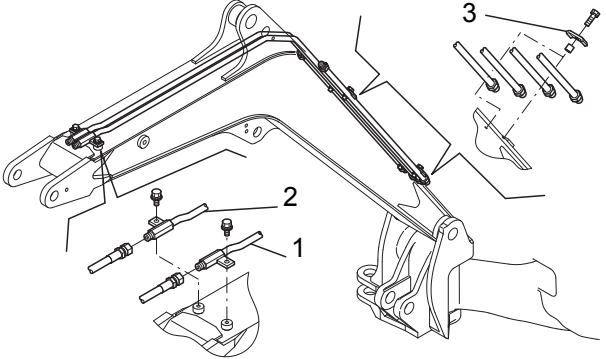
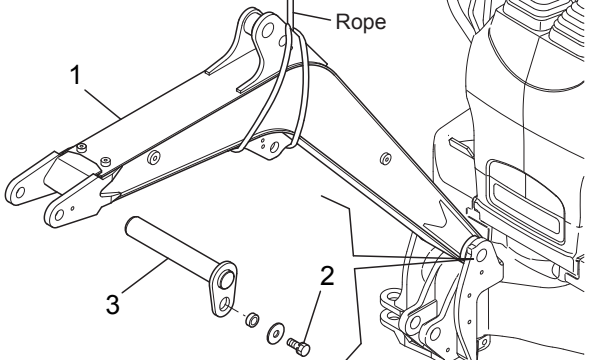
2) Upperstructure

(Control valve ↔ Swing motor)

(Control valve ↔ Boom cylinder)



7. ADJUSTMENT AND REPAIR

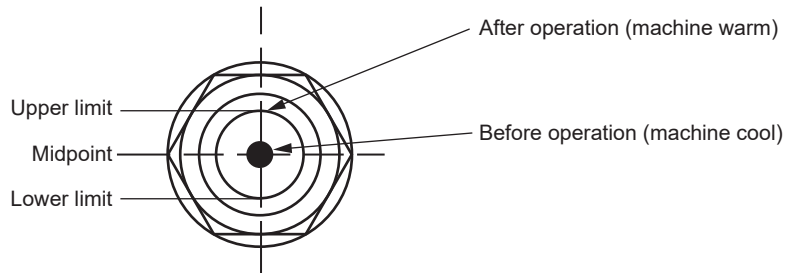
Procedure	
<p>(8) Remove the mounting bolts for the bucket L tube 1 and the bucket R tube 2.</p> <p>(9) Remove the plates 3 and remove the tubes.</p>	 <p>The diagram illustrates the removal of mounting bolts and plates from the bucket tubes. It shows two views: a side view of the bucket assembly and a top-down view of the mounting bolts. The bolts are labeled 1 and 2, and the plates are labeled 3. The bolts are shown being removed from the tubes, and the plates are shown being removed from the tubes.</p>
<p>(10) After roping the boom 1, remove the bolt 2 (M10) and pull out the pin 3. Then remove the boom 1.</p> <p>Notes :</p> <ul style="list-style-type: none">• Remove the boom using a lifting device.• Take care that the hoses do not catch on any other parts.	 <p>The diagram illustrates the removal of the boom after roping. It shows a side view of the boom assembly with a rope attached to the boom. The boom is labeled 1, the rope is labeled Rope, the bolt is labeled 2, and the pin is labeled 3. The bolt and pin are shown being removed from the boom, and the boom is shown being lifted away from the assembly.</p>

10. TROUBLESHOOTING

10-1-7 Fluctuation in Oil Level of Hydraulic Oil Tank Due to Temperature Change

Phenomenon

The oil level of the hydraulic oil tank varies between before operation (the machine is cool) and after operation (the machine is warm).

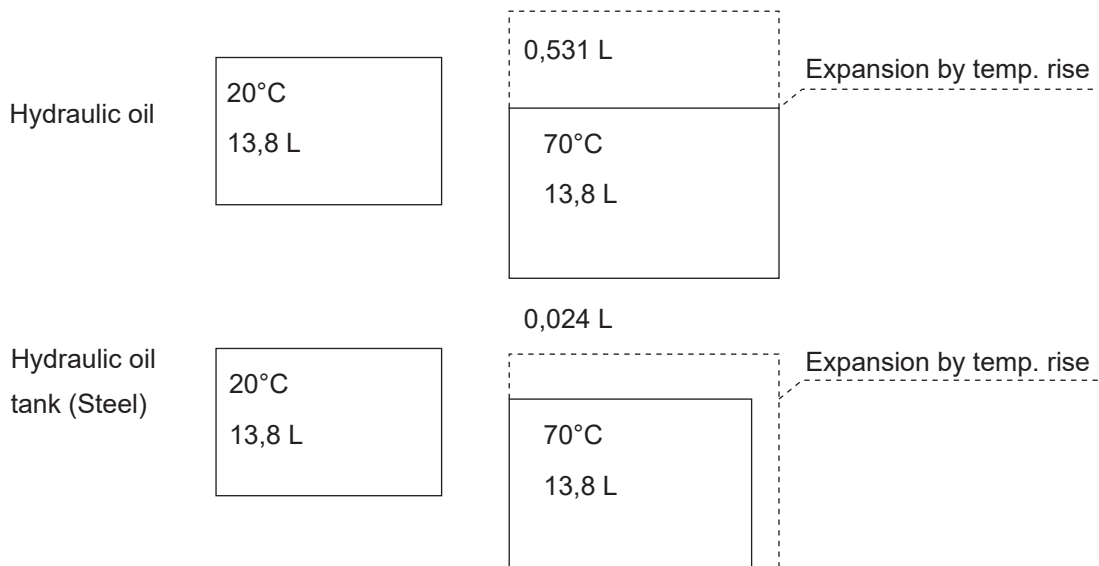


Reason

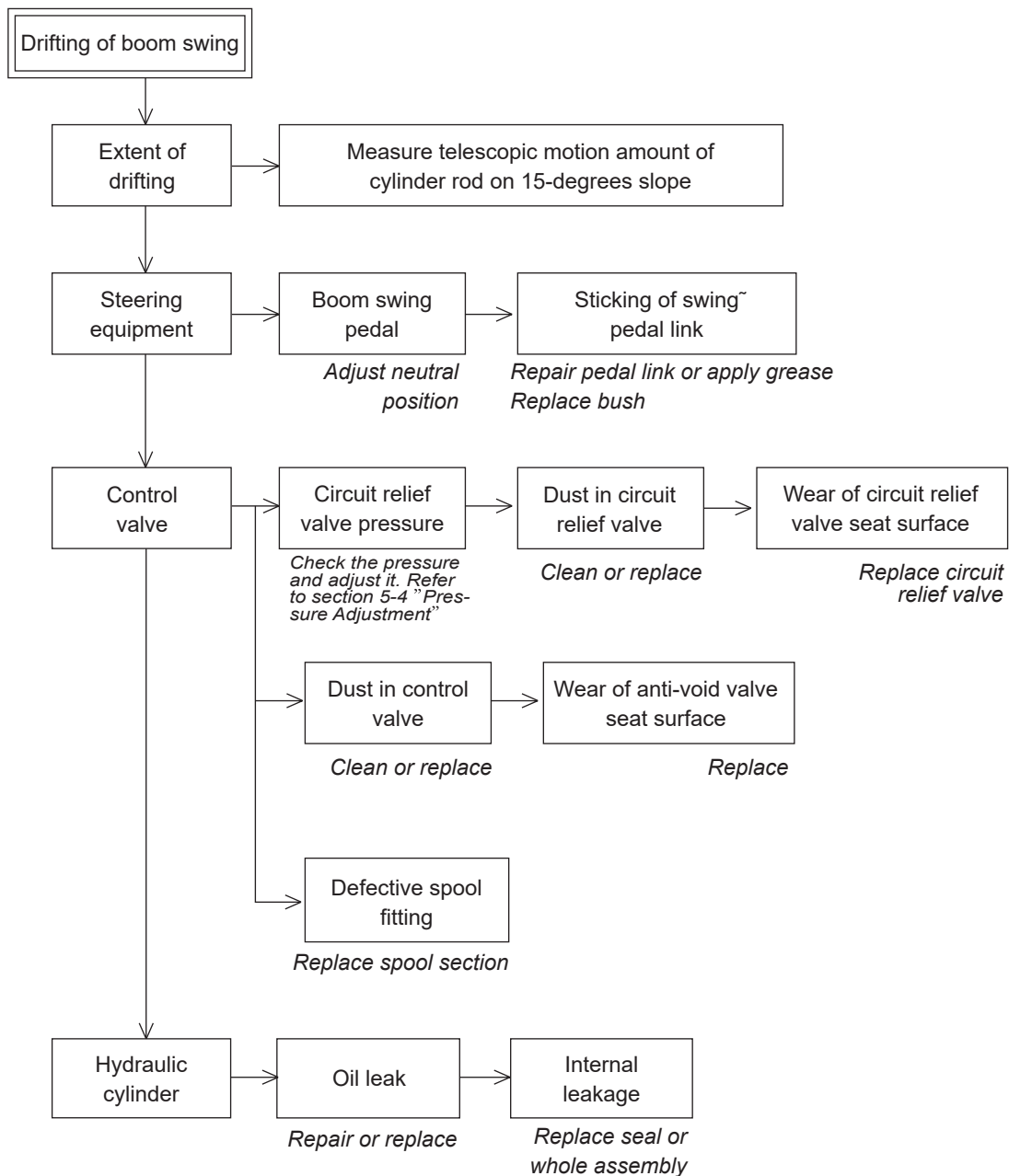
The oil level changes because the thermal expansion factor of oil is far larger (about 20 times) than that of steel.

1. Linear thermal expansion factor of steel : 11.7×10^{-6}
2. Cubical thermal expansion factor of steel : 3.51×10^{-5}
3. Cubical thermal expansion factor of hydraulic oil : 7.7×10^{-4}

(Example)



10. TROUBLESHOOTING

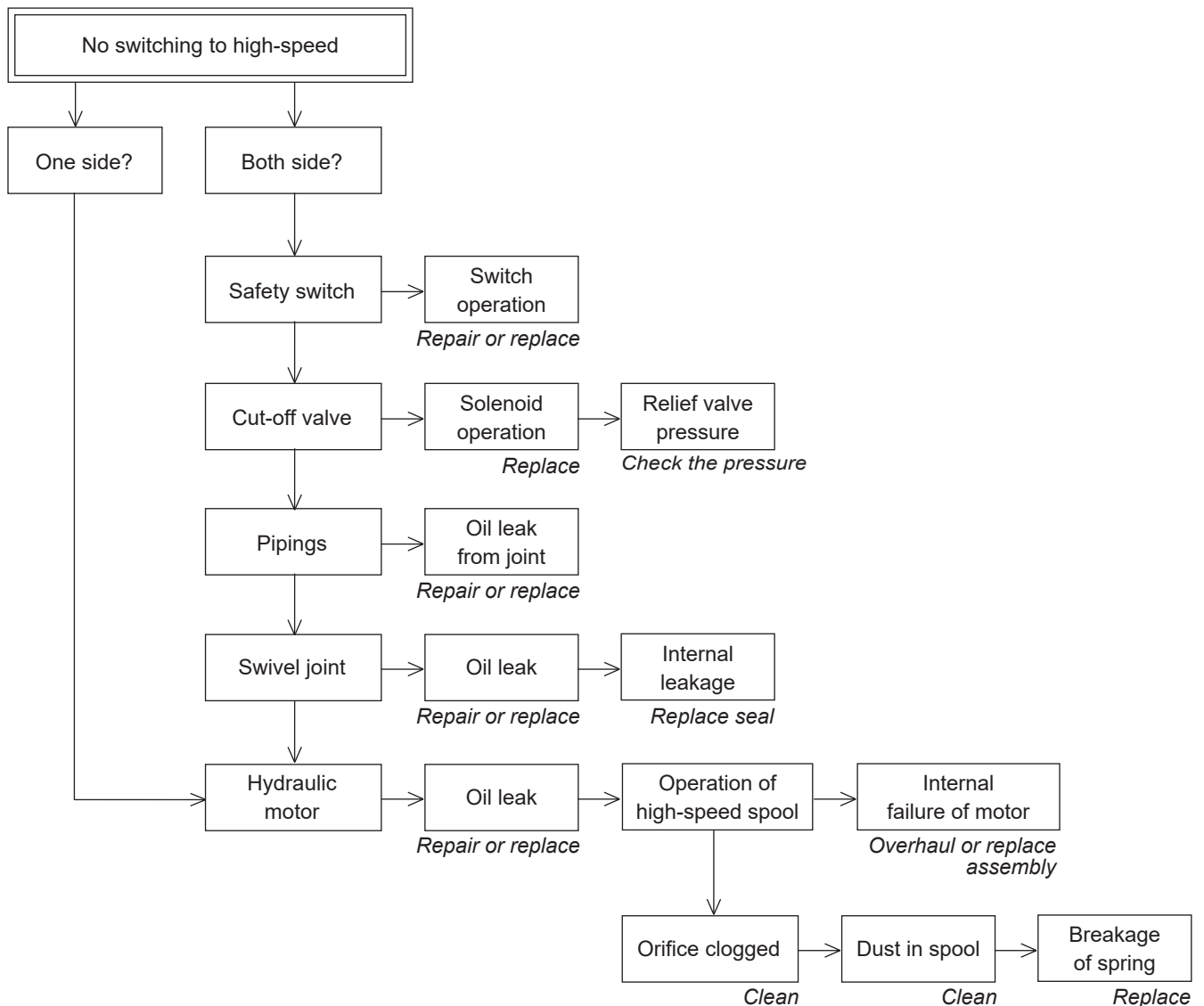


Inspection procedure

Switch the hose with the hose of the other circuit using the control valve.

- [1] No boom swing drifting : Control valve is faulty.
- [2] Boom swing drifting : Hydraulic cylinder is faulty.

10. TROUBLESHOOTING



Note :

When the oil temp. is still very low, switching to high-speed may not be made immediately when treading on the high-speed pedal. This problem disappears as the oil temperature rises.
 (Refer to Section "10-1-7 Time Lag on Travel Speed Switching".)

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