1. GENERAL CAUTIONS FOR MAINTENANCE WORK

1. General Cautions for Maintenance Work

1-1 Correct Work

Correct work means the quickest possible completion of according to the correct procedures and the specified standards.

It is important when conducting certain operations always to bear in mind the equipment, tools, gauges, materials, oil and grease, etc. that you must have ready, as well as items to be checked, adjusted, or disassembled, and cautions to watch out for.

1-2 Safety Precautions

(1) Never attempt servicing while engine is running or immediately after stopping operation.
(2) Wear work cloths, safety shoes and helmet.
(3) Check the equipment and tools before use. Especially, be sure to check the crane, lifting equipment and tools.
(4) When working together with other persons, allocate everyone's share of job, arrange the signals and act in concert with the other persons.
(5) The operation of the crane and slinging work must be performed by qualified persons.
(6) Do not enter or pass under the raised load.
(7) Lift and support the massive parts by crane before removing the installation bolts.
(8) Disconnect cables from battery before repairing the electric system.
(9) Remove the battery when welding the machine.

1-3 Preparations

(1) Check the service record of the machine. (That is, check how many months or hours the machine has been used since the preceding overhaul, what was the trouble then and what parts were replaced.)
(2) Have all servicing tools ready, i.e., tools, measuring devices (which have received periodic maintenance), containers, oil & grease, etc.
(3) Have the service literature (operation manual, parts catalog, etc.) ready.

1-4 Cautions for Disassembly and Reassembly

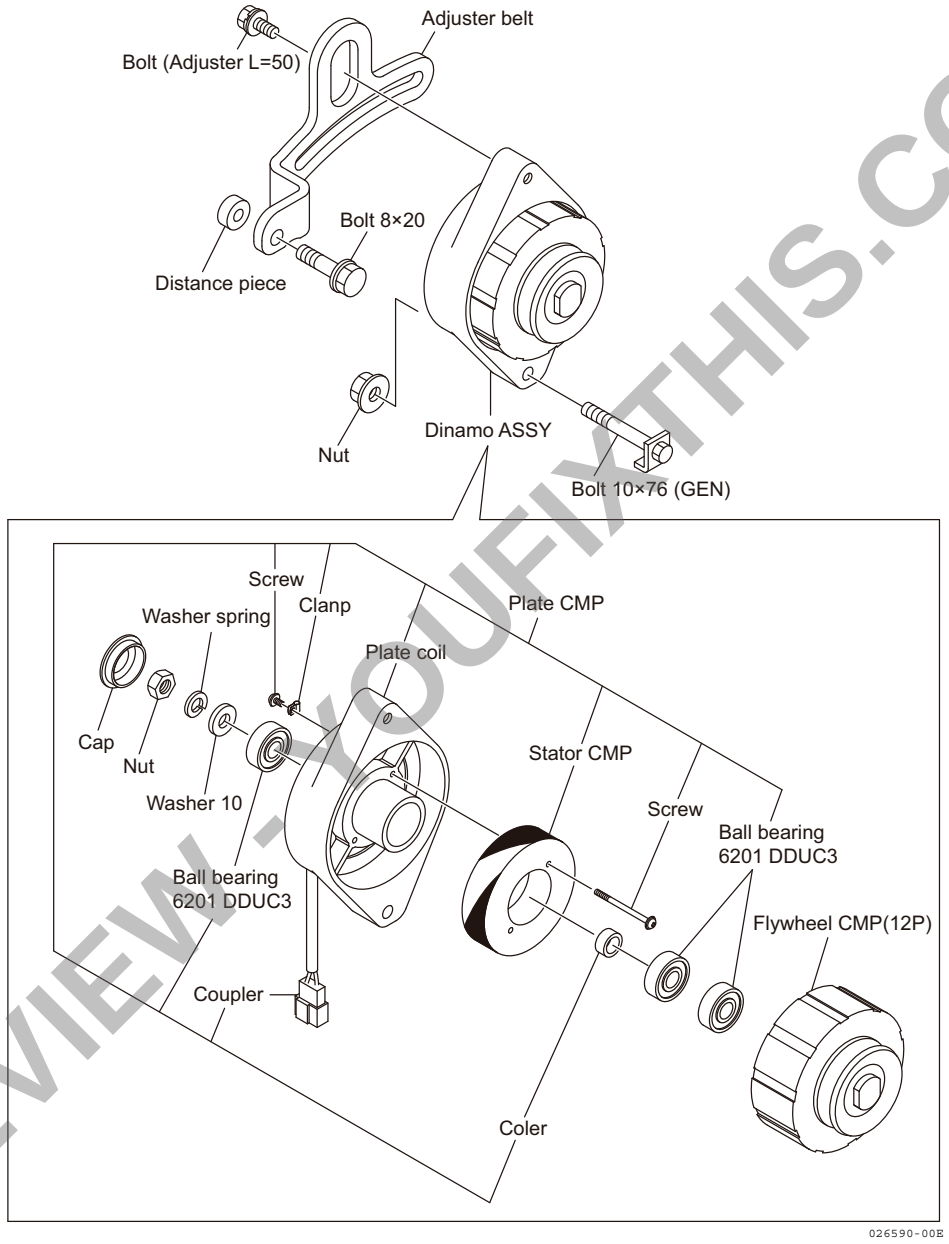
(1) Clean the machine before disassembly.
(2) Check and record the condition of the machine before disassembly :
- Model, machine number, operation hours
- Reasons for repair, history of repair
- Contamination of filters
- Fuel and oil condition
- Damage to parts, etc.

(3) Place alignment marks on the necessary parts to facilitate reassembly.
(4) Clean all the removed parts and new replacement parts and put them in order.
(5) Use new seals, split pins, etc. for reassembly.

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Components



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5-3-8 Track Gauge Change

The track gauge change lever is connected to the spool of the track gauge change section through a rod.

1) Widening of Track Gauge

When the track gauge change lever is pressed outside 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 P2 flows to the port B5 of the track gauge change cylinder through the port P2 of the inlet section, the port B5 of the track gauge change section and the port B of the swivel joint to extend its cylinder rod, widening the track gauge.

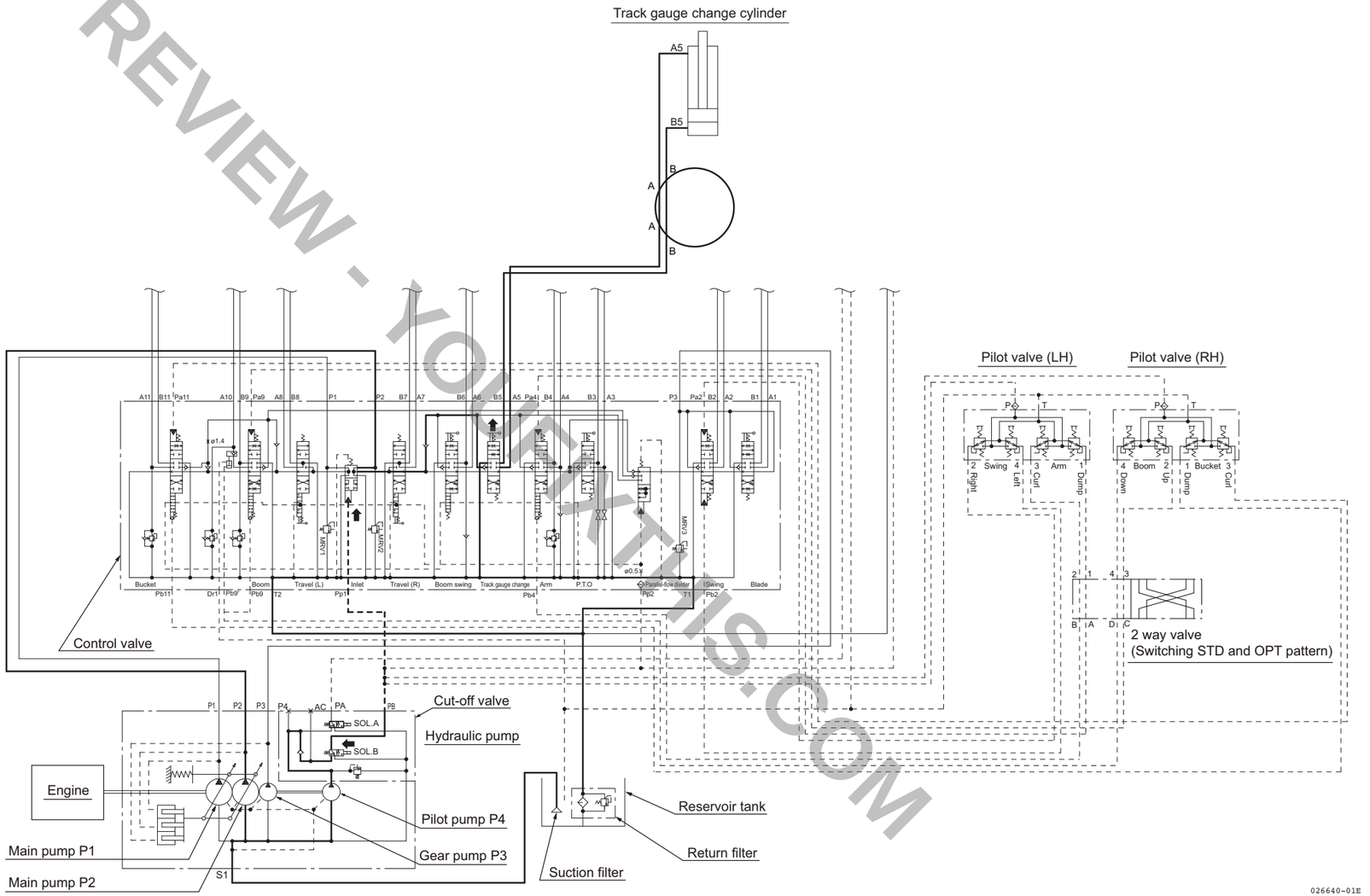
The return oil from the port A5 of the track gauge change cylinder flows back to the hydraulic oil tank through the port A of the swivel joint, the port A5 of the track gauge change section and the ports T1 and T2 of the control valve.

2) Narrowing of Track Gauge

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

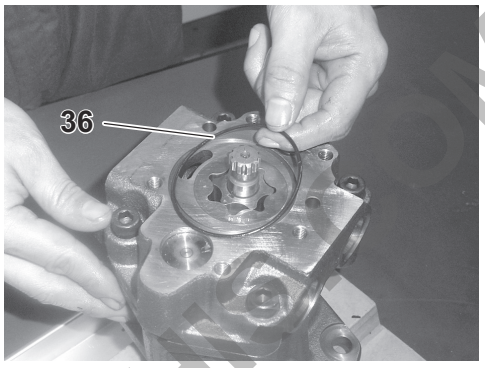
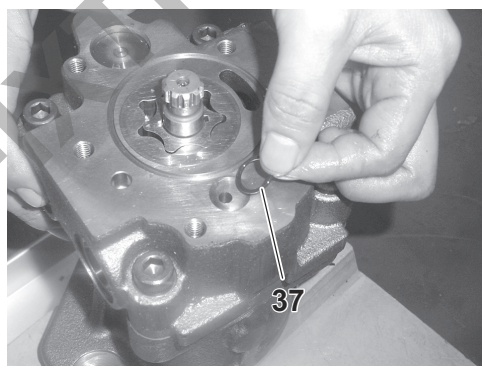
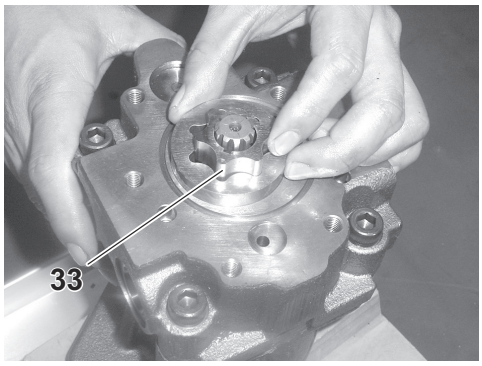
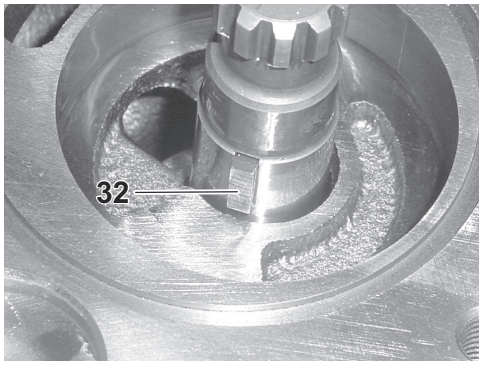
Oil Flow from Hydraulic Pump

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.



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Procedure	
(7) Remove the O-rings 36 and 37.	 
(8) Remove the rotor SET 33 to remove the key 32.	 

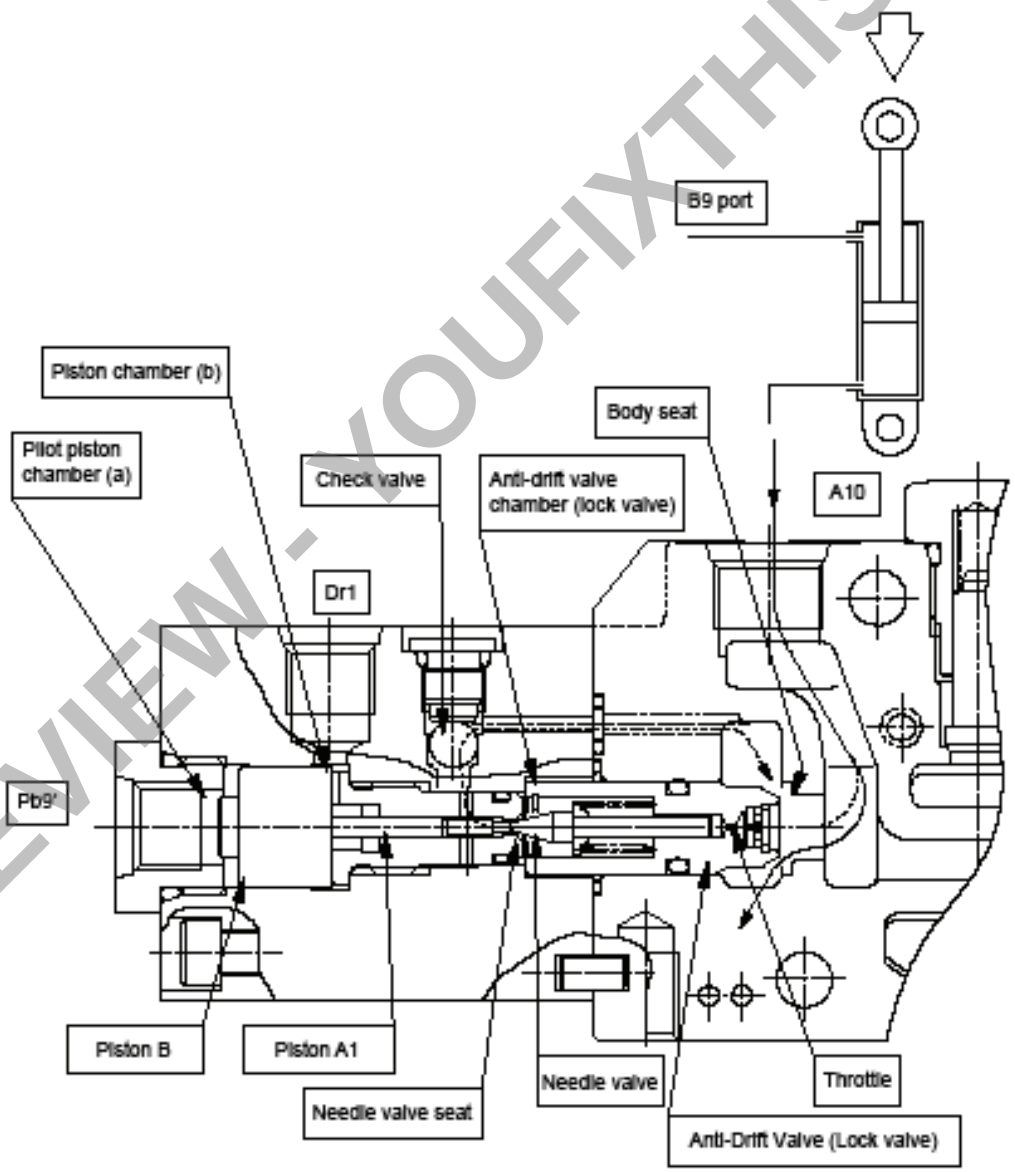
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(2) Releasing (boom down)

When the pilot oil flows to the pilot port Pb9' for release of the anti-drift valve, the pilot pressure moves the piston B to the right, and it presses the needle valve to open via the piston A1. At that time, the return oil from the boom cylinder flows through the orifice of the anti-drift valve, the anti-drift valve chamber, the needle valve seat, and check valve to the downstream chamber of the anti-drift valve (the boom section).

The downstream chamber connects to the return oil passage according to a boom spool movement and the pressure in the anti-drift valve chamber decreases as the needle valve has been opened, and the return oil from the boom cylinder has opened the anti-drift valve so that the return oil from the boom cylinder flows to the return oil passage through the notch in the boom spool, and the boom cylinder can retract.



Anti-Drift Valve Operation releasing (boom down)

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11)Blade Operation

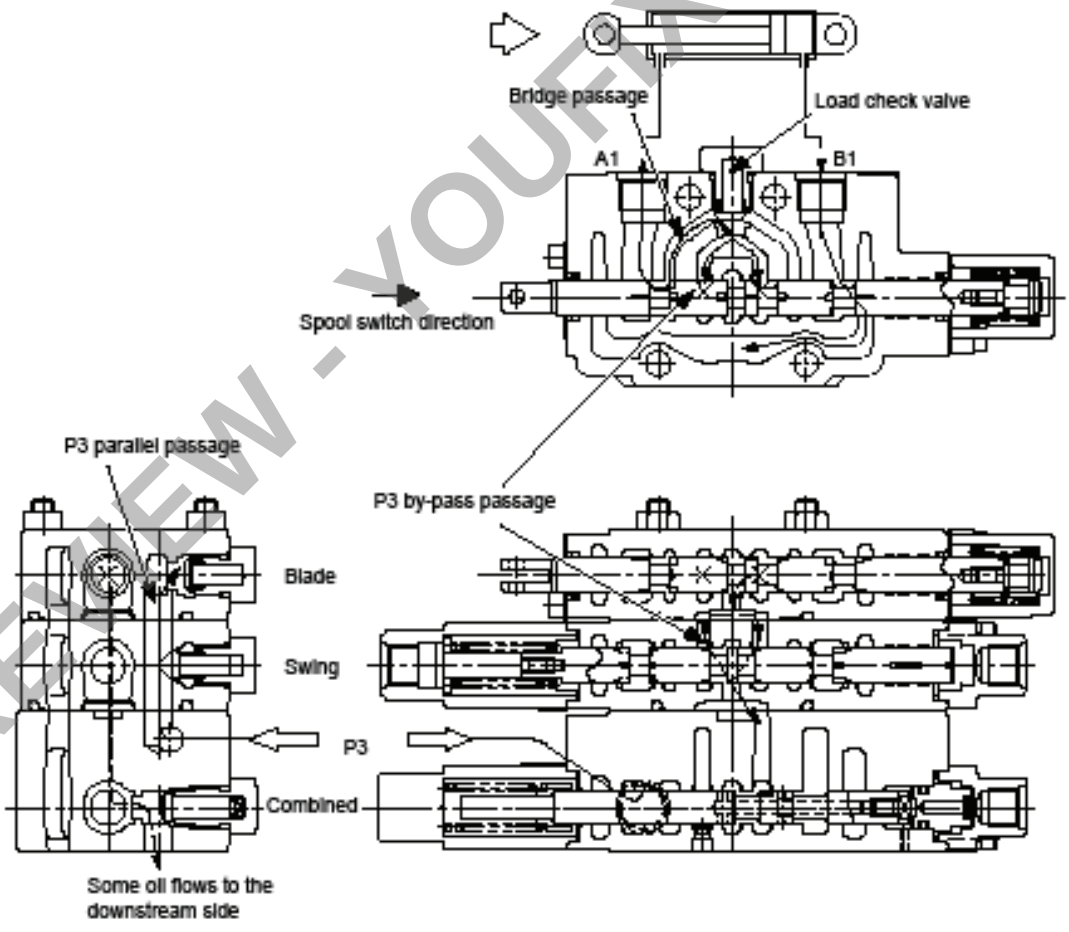
(1) Blade up operation

When the blade lever is pulled back to raise the blade, the spool of the blade section is pressed.

The P3 bypass passage is blocked by the blade spool as the spool has been moved, so that the oil from the port P3 flows to the parallel passage of the blade section. When the by-pass passage is blocked by the blade spool, a part of oil flows out to the by-pass passage through the notches on the spool. The passage between the port A1 and the bridge passage is opened as the blade spool has been moved, so that the oil flowed to the parallel passage flows through the load check valve in the blade section and the bridge passage to the port A1 and is fed to the rod end of the blade cylinder.

Meanwhile, the return oil from the bottom end of the blade cylinder flows to the return oil passage, which is opened to the tank passage as the spool has been moved through the port B1 and the notch in the blade spool.

Thus, the blade cylinder is retracted to raise the blade.



Blade up operation

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3-3) Removal Procedure of Accessory Valve

(1) Removal of port relief valve and main relief valve (refer to the below figure)

Remove the port relief valve by using a 22mm wrench or socket wrench.

- Apply the wrench (socket wrench) to the 22mm hexagon portion of the pressure regulating body.
- When there is no 22mm wrench (socket wrench), a 19mm wrench can be used to remove the hexagon portion as indicated in the following figure.

[Note]

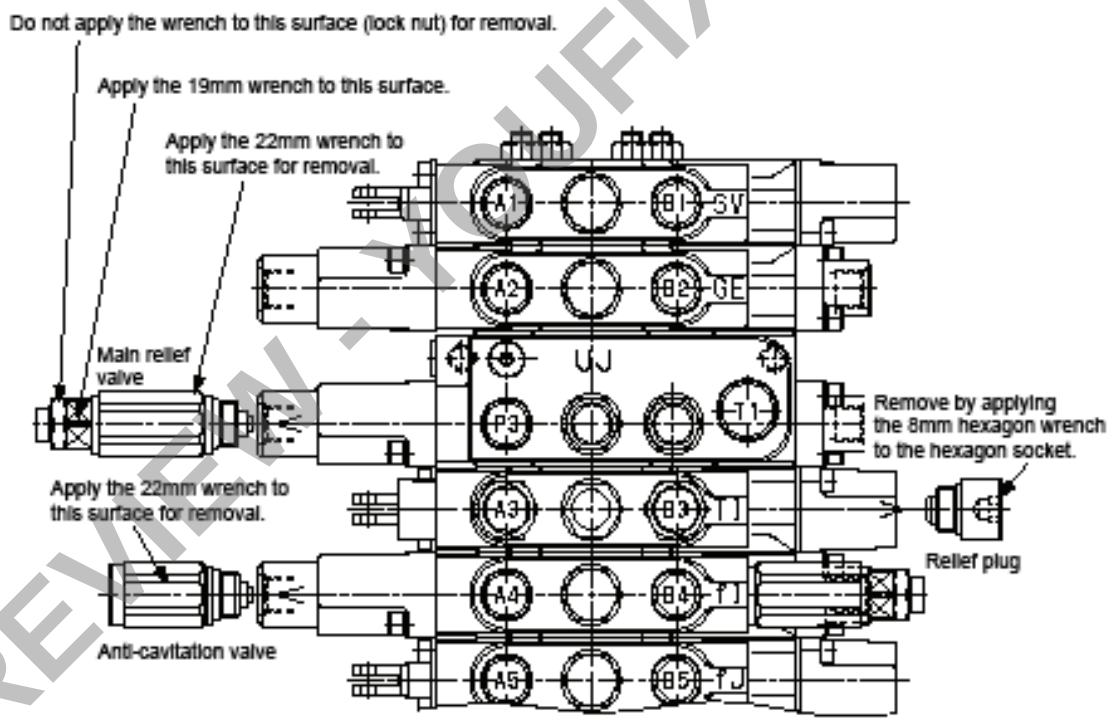
Do not remove by applying a 19mm wrench to the lock nut portion. Only the lock nut portion is loosened, resulting in performance deterioration and breakage caused by the changes in the set value of the relief valve.

(2) Removal of anti-cavitation valve (refer to the below figure)

Similar to the port relief valve, remove the anti-cavitation valve by using a 22mm wrench or socket wrench.

(3) Removal of relief plug (refer to the below figure)

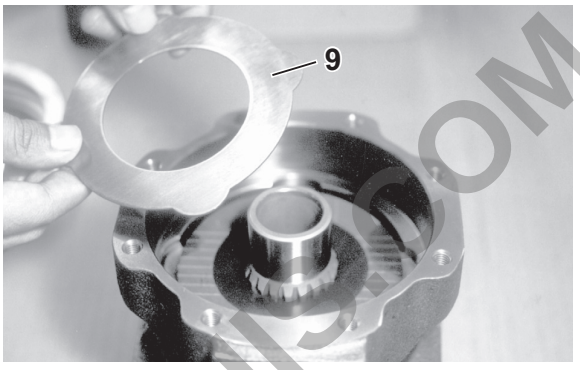
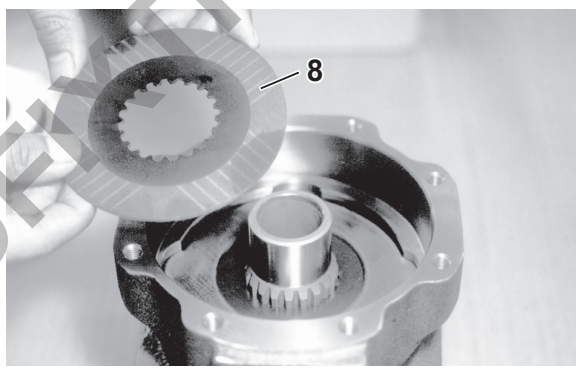
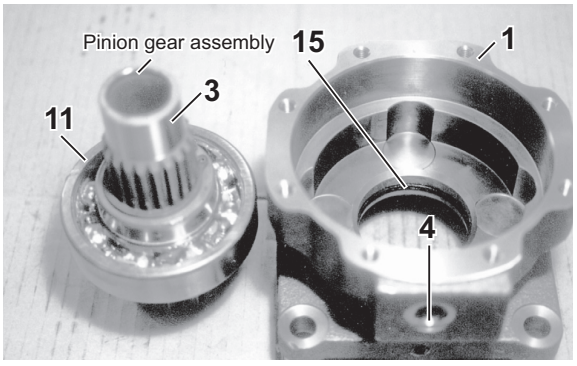
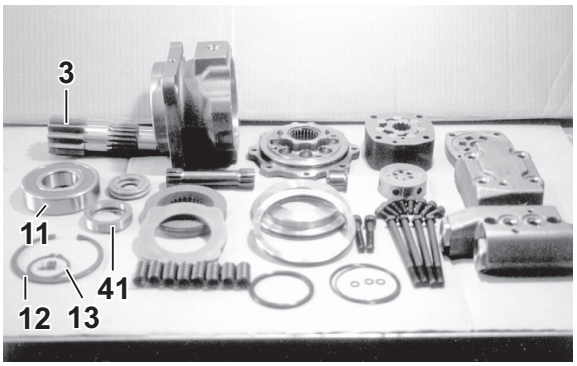
Remove the relief plug by using a 8mm hexagon wrench.



Removal of accessory valve

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Procedure	
(9) Remove one of the steel plates **9**.	
(10) Remove one of the friction plates **8**. Alternately remove the rest of the steel plates **9** and the friction plates **8**.	
(11) Remove the internal snap ring **12** to remove the pinion gear assembly such as the bearing from the bearing housing **1**. Remove the blind plug **4** and the X-ring **15** from the bearing housing **1**.	
(12) Remove the external snap ring **13** from the pinion gear **3** to remove the collar **7** and the front bearing **11**. ***Note :*** *Do not remove them, if not required.*	

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7-3-5 Adjustment of Boom Swing Pedal

1) Setting Pedal Level

Remove the step and side cover L.

(1) Loosen the nut 2 of the cable 1.

(2) Adjust the cable 1 so that the pedal will be level.

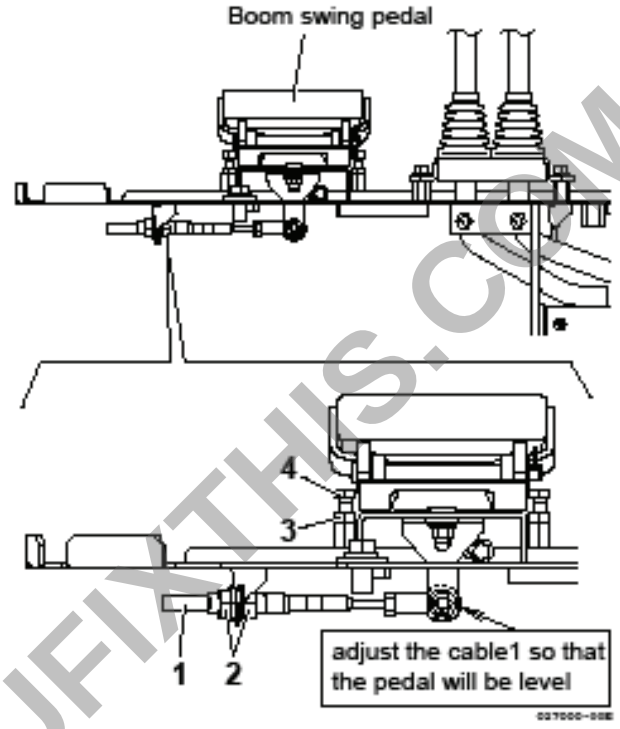
(3) Tighten the nut 2 of the cable 1.

2) Adjustment of Stopper Bolts (For Right and Left Boom Swing)

(1) Loosen the lock nuts 3 and screw in the stopper bolts 4 so that they will not touch the boom swing pedal.

(2) Move the boom swing pedal to its stroke end, and loosen the stopper bolt 4 until the bolt head touches the pedal (for each stopper bolt).

(3) Loosen the stopper bolt 4 half-turn further and tighten the lock nut 3 to fix it.



7-3-6 Adjustment of Blade Lever

Remove the step, the side cover R, the indicator box and cover plate, and then remove the pilot valve (RH).

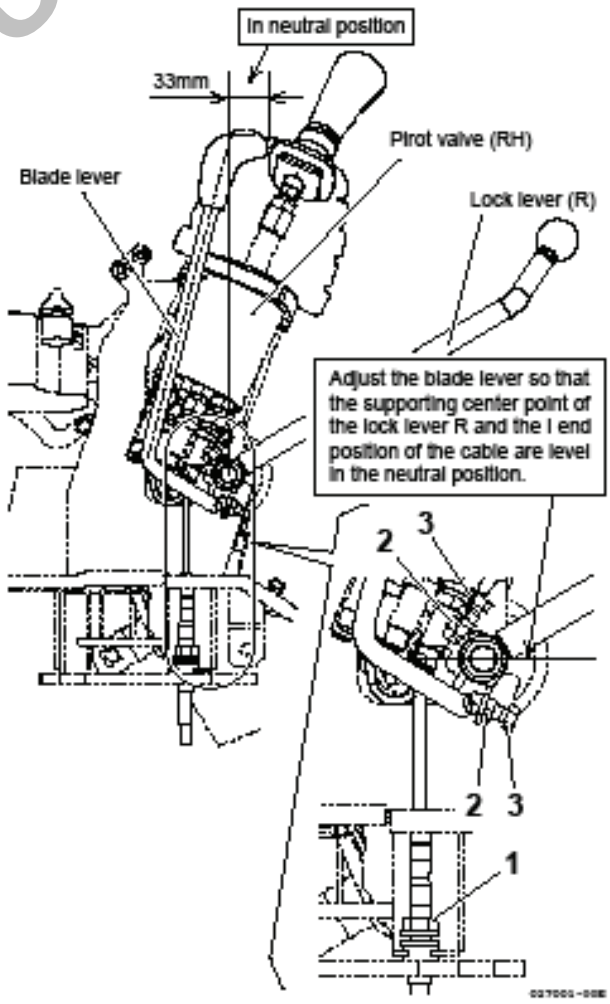
(1) Loosen the nut 1 and adjust the blade lever so that the supporting center point of the lock lever R and the I end position of the cable are level in the neutral position.

(2) Adjustment of stopper bolts 3 (for the blade up and down)

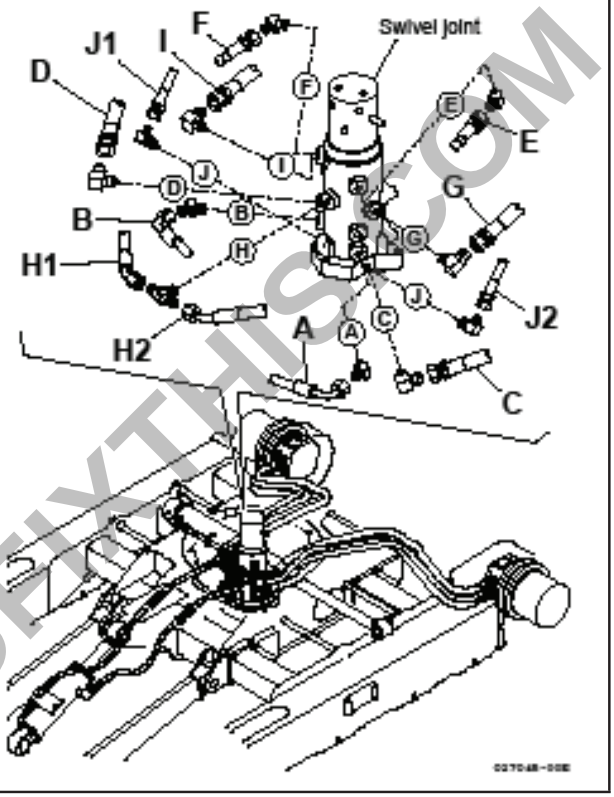
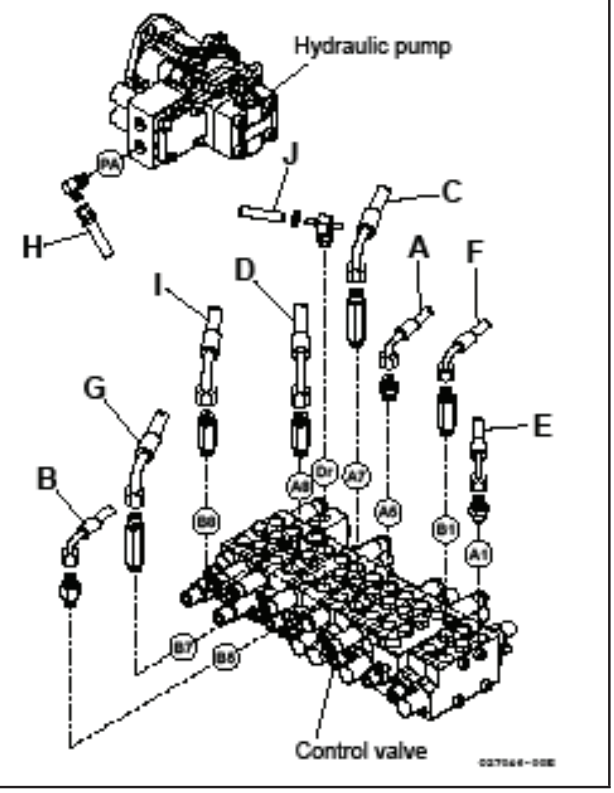
[1] Loosen the lock nuts 2 and loosen the stopper bolts 3 so that they will not touch the blade lever.

[2] Move the blade lever to its stroke end, and tighten the stopper bolt 3 until the bolt end touches the blade lever (for each stopper bolt).

[3] Tighten the stopper bolt 3 half-turn further and tighten the lock nut 2 to fix it.



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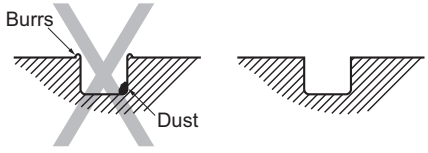
Procedure	
(7) Remove the hydraulic hoses from the swivel hub of the swivel joint. I : For travel motor (R) (forward) D : For travel motor (R) (reverse) J1 : For travel motor (R) (drain) F: For blade cylinder (bottom side) H1 : For high-speed (R) H2 : For high-speed (L) B : For track gauge change cylinder (bottom side) A : For track gauge change cylinder (rod side) E : For blade cylinder (rod side) C : For travel motor (L) (reverse) J2 : For travel motor (L) (drain) G : For travel motor (L) (forward) ***Notes :*** • *Remove the hydraulic hoses from the swivel hub in bottom-to-top order.* • *Mark the removed hoses to identify their respective fitting positions.* (8) Remove the mounting bolts for the swivel joint.	
(9) Remove the hydraulic hoses from the control valve. A : For track gauge change cylinder (rod side) C : For travel motor (L) (reverse) I : For travel motor (R) (forward) E : For blade cylinder (rod side) D : For travel motor (R) (reverse) F : For blade cylinder (bottom side) G : For travel motor (L) (forward) B : For track gauge change cylinder (bottom side) J : For travel motor (L and R) (drain) ***Note :*** *Mark the removed hoses to identify their respective fitting positions.* (10) Remove the hydraulic hose from the pump. H : For high-speed (L and R) (11) Take down the swivel joint (with the hydraulic hoses connected to the swivel shaft) to the lower center frame and remove it.	

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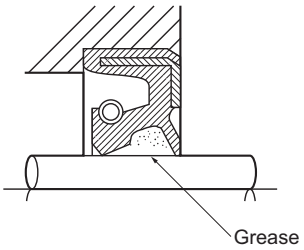
1-7 Cautions for Handling Seals

(1) Clean out grooves of O-rings. Remove burrs or dust if any.



(2) Take care not to twist O-rings. Correct by your finger if it is twisted.
(3) Take care not to damage seals when inserting.
(4) Handling of floating seals :
- Completely wipe off all the oil from the O-ring and housing after detaching the floating seals.
- Before installing, apply a little gear oil to the matching face of the housing.
- Turn the seals two or three times after installation to break them in.

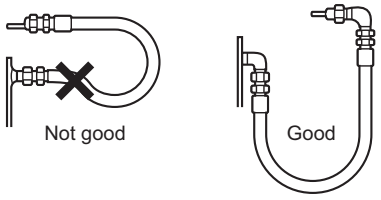
(5) Apply grease to the lip of the oil seals to prevent wear.



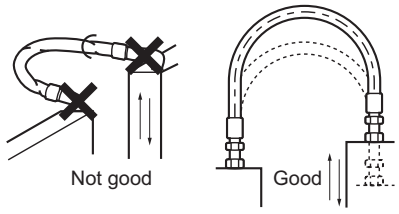
1-8 Correct Installation of Hydraulic Hose

In order to mount the hydraulic hose most effectively and economically, observe the following cautions.

(1) When a hose is used at the minimum bending radius, use elbows to avoid sharp bending.



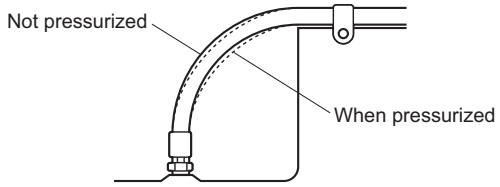
(2) To prevent twisting, the hose should be bent in the same direction as it moves.



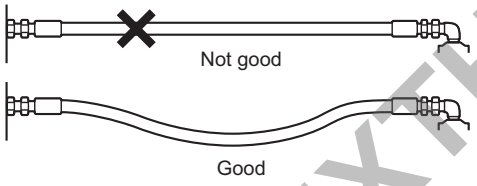
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(3) When the hose is pressurized, the hose length varies slightly at the bend. Allow this change to occur and do not try to fasten the bend.



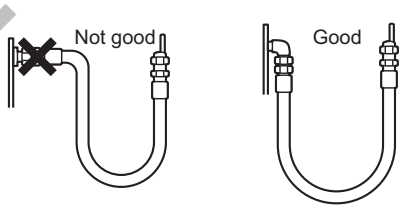
(4) It is necessary for the hose to have ample slackness for elongation and contraction, because its length will change by +2 % to -4 % when used at high pressure.



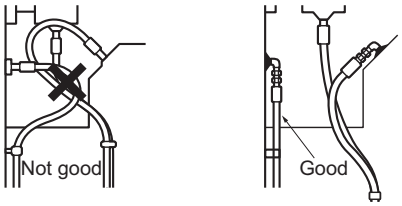
(5) Use the proper adapters, not pipes, in order to reduce the number and length of joints and improve the external appearance.



(6) Use an elbow to prevent excessive twisting or bending of the hose.



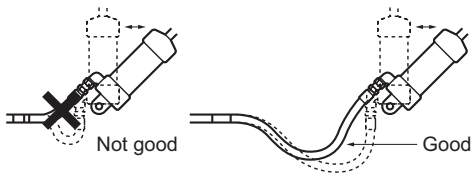
(7) Use adapters to make the hose as straight as possible. The outside appearance can be improved by avoiding the use of hoses that are too long.



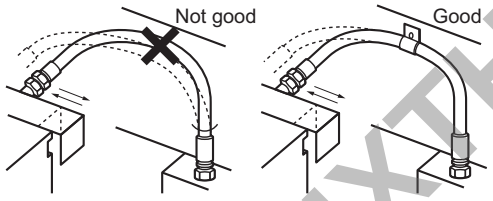
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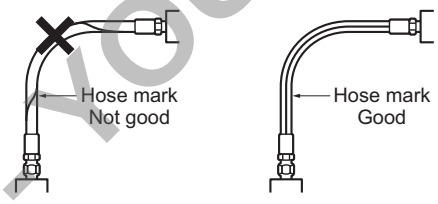
(8) The hose should be slightly longer than is absolutely necessary. The extra allows smoother movement of the hose and prevents sharp bending.



(9) When a bent hose is attached to two different planes, fix as shown in the diagram to prevent twisting.



(10) Use the marking on the hose as a guide to prevent twisting during installation.
Twisting of metal fitting with union nuts should be with a wrench on the hexagonal parts.

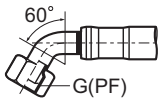
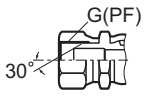
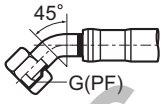
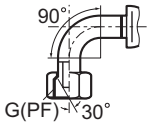


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4) Combination of Fitting

Code No.	Fitting type
1	A·B
3	A·E
4	B·B
5	B·C
6	B·E
7	B·D

A		Taper pipe thread R (PT)	D		60 degrees bent type. Straight pipe thread G (PF) with male 30 degrees seat
B		Straight pipe thread G (PF) with male 30 degrees seat	E		45 degrees bent type. Straight pipe thread G (PF) with male 30 degrees seat
C		90 degrees bent type. Straight pipe thread G (PF) with male 30 degrees seat			

(Example) Part code 2 3 2 0 2 – 0 3 0 8 5 5

- Rubber hose, high pressure type
- SAE J517, 100R2
- Nominal dia., 3 / 8"
- Hose length, 33.5 in. (85 cm)
- Straight pipe thread G (PF) with male 30 degrees seat and 90 degrees bent type.
- Straight pipe thread G (PF) with male 30 degrees seat

List of pipe threads	
Symbol	Name
G (PF)	Straight pipe thread
R (PT)	Male taper pipe thread
Rc (PT)	Female taper pipe thread

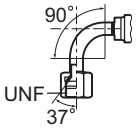
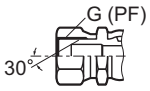
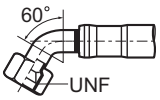
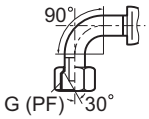
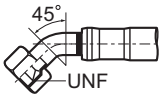
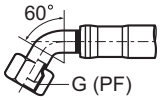
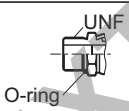
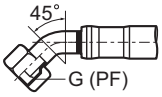
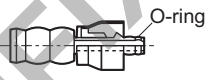
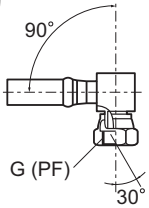
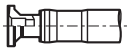
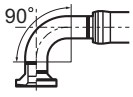
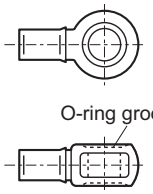
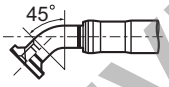
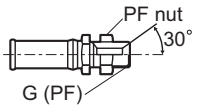
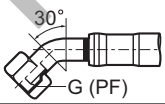
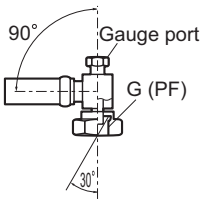
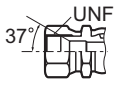
Note :

All the hoses with fittings other than those listed above are special parts.

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5 Combination of fitting

Fitting type	Code	Fitting type	Code
 Taper pipe thread R (PT)	A	 90 degrees bent type. UNF thread with female 37 degrees seat	P
 Straight pipe thread G (PF) with male 30 degrees seat	B	 60 degrees bent type. UNF thread with female 37 degrees seat	Q
 90 degrees bent type. Straight pipe thread G (PF) with male 30 degrees seat	C	 45 degrees bent type. UNF thread with female 37 degrees seat	R
 60 degrees bent type. Straight pipe thread G (PF) with male 30 degrees seat	D	 UNF, thread with O-ring groove	S
 45 degrees bent type. Straight pipe thread G (PF) with male 30 degrees seat	E	 One-touch fitting (male)	T
 Straight pipe thread G (PF) with male 30 degrees seat	F	 90 degrees elbow straight pipe thread male 30 degrees seat	V
 O-ring flange type	G		
 90 degrees bent O-ring flange type	H	 Eyejoint with O-ring groove	W
 45 degrees bent O-ring flange type	J		
 Straight pipe thread, female 30 degrees seat with O-ring groove	K	 Straight pipe thread with jam nut female 30 degrees seat	X
 30 degrees bent type. Straight pipe thread G (PF) with male 30 degrees seat	L	 90 degrees elbow straight pipe thread with gauge port plug male 30 degrees seat	Z
 Taper pipe thread NPTF	M		
 UNF, thread with female 37 degrees seat	N	Without fitting	Y

Note :
According to the combination of bending or elbow fittings, some hoses require drawings or original hoses to locally manufacture.

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1-10 Air Release of Hydraulic Equipment

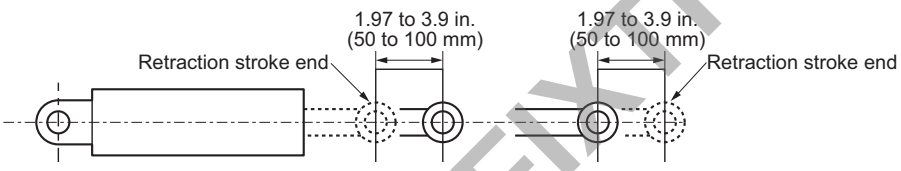
When operating the machine after disassembly or parts replacement of the hydraulic equipment, piping, etc., be sure to release air from the hydraulic system. This is necessary to prevent seizure and cavitation of the hydraulic equipment. If the air is left in the hydraulic system, the air is compressed or expanded depending on the load, having an adverse effect on the smooth operation of the hydraulic equipment and shortening the service life.

1. Air Release of Each Hydraulic Component

Run the engine at medium speed and activate the respective circuits for about 10 to 15 minutes.

2. Air Release of Hydraulic Cylinders

1) Set the Engine Speed at Low Idling Range.
2) Extend and Retract the Cylinder Up to 1.97 to 3.9 in. (50 to 100 mm) from Each Stroke End Slowly 4 or 5 Times.



Note :

The extension and retraction stroke is up to 1.97 in. (50 mm) from each stroke end for the blade cylinder.

3) Then, Fully Extend and Retract the Cylinder 3 or 4 Times.

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FORWARD

This service manual outlines procedures for construction machinery servicing. It contains specifications, servicing instructions and handling cautions. To obtain the maximum life and performance from construction machinery, read this manual carefully and follow instructions.

Please note that all dimensions and numerical values in this manual are for service reference, and not inspection standards. Descriptions and specifications in this manual are subject to change without notice due to design improvements, etc.

⚠ WARNING

California
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

⚠ WARNING

California
Proposition 65 Warning

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm.
Wash hands after handling.

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