

GROUP 6 TRAVEL DEVICE (up to #0306)

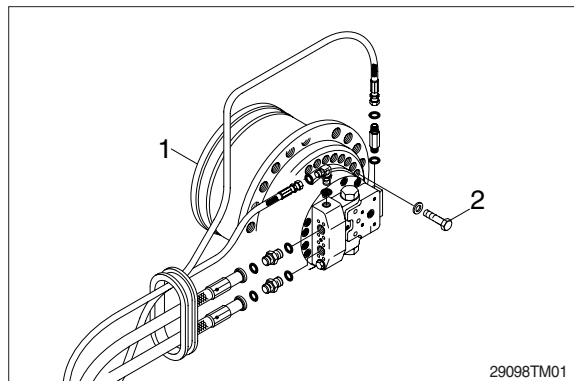
1. REMOVAL AND INSTALL

1) REMOVAL

- (1) Swing the work equipment 90° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ Escaping fluid under pressure can penetrate the skin causing serious injury.

- ※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.
 - (5) Remove the cover.
 - (6) Remove the hose.
 - ※ Fit blind plugs to the disconnected hoses.
 - (7) Remove the bolts and the sprocket.
 - (8) Sling travel device assembly (1).
 - (9) Remove the mounting bolts (2), then remove the travel device assembly.
 - Weight : 400 kg (880 lb)

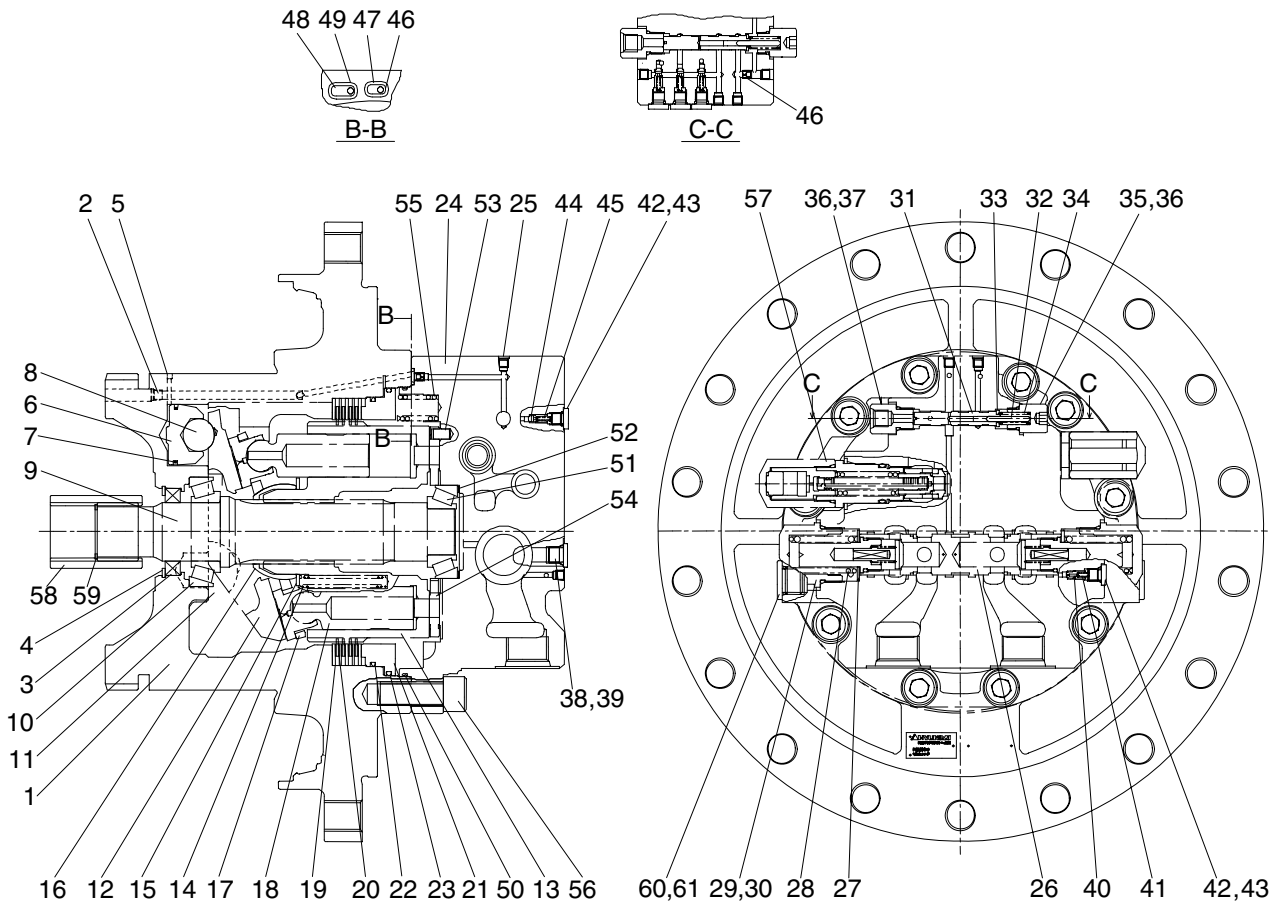


2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel motor.
 - ① Remove the air vent plug.
 - ② Pour in hydraulic oil until it overflows from the port.
 - ③ Tighten plug lightly.
 - ④ Start the engine, run at low idling, and check oil come out from plug.
 - ⑤ Tighten plug fully.
- (3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

1) STRUCTURE

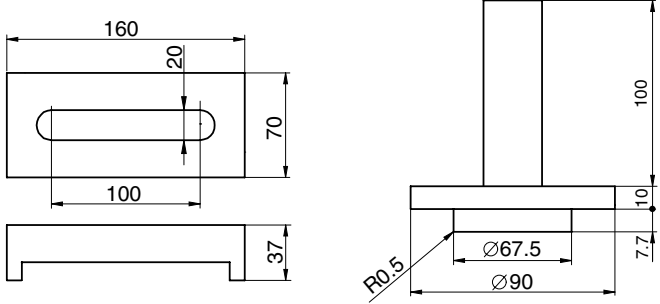
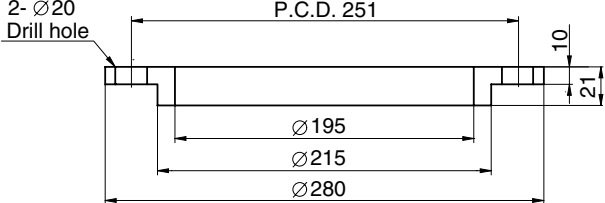
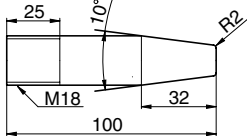
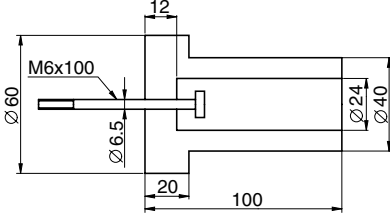
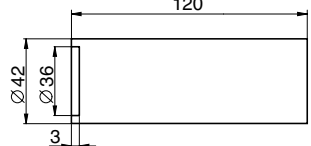


29092TM03

1	Casing	22	D-ring	43	O-ring
2	Plug	23	D-ring	44	Check valve
3	Oil seal	24	Rear cover	45	Check valve spring
4	Retaining ring	25	Plug	46	Restrictor
5	Expander plug	26	Spool ass'y	47	O-ring
6	Shifter piston	27	Spring holder	48	Restrictor
7	Piston seal	28	Spring	49	O-ring
8	Steel ball	29	Plug	50	O-ring
9	Shaft	30	O-ring	51	Bearing
10	Bearing	31	Pilot valve spool	52	Shim
11	Pivot	32	Pin	53	Parallel pin
12	Swash plate	33	Spring holder	54	Valve plate
13	Cylinder block	34	Spring	55	Brake spring
14	Cylinder spring	35	Pilot valve plug	56	Hexagon socket head bolt
15	Spring holder	36	O-ring	57	Overload relief valve
16	Ball joint	37	Connector	58	Coupling
17	Shoe retainer	38	Plug	59	Retaining ring
18	Piston ass'y	39	O-ring	60	Plug
19	Separating plate	40	Restrictor	61	O-ring
20	Friction plate	41	Restrictor spring		
21	Brake piston	42	Plug		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Description	Specification
Hexagon wrench	Width across flat 5, 6, 8, 10, 14 mm
Snap ring prier	For shaft \varnothing 60 ~ 80 mm
Snap ring prier	For bore \varnothing 32 ~ 58 mm
Plastic hammer	1 piece
Screw driver	Minus (-), medium size, 2 pieces
Torque wrench	10 kgf · m (72.3 lbf · ft), 33 kgf · m (238.6 lbf · ft), 45 kgf · m (325.4 lbf · ft)
Gear (bearing) puller	Work size : Dia 75 × Width 45 can be handled
Mount metal (2 pieces) Jig for inserting oil seal	 <p style="text-align: center;">Mount metal Jig for inserting oil seal</p>
Jig for inserting brake piston	
Guide pin for rear cover (2 pieces)	
Jig for pulling out brake piston (2 pieces)	
Jig for inserting rear bearing	
Others	Seal tape, kerosene, grease, hydraulic oil, compressed air, waists etc.

(2) Tightening torque

Item	Part name	Size	Torque	
			kgf · m	lbf · ft
29	Plug	M 42	45~47	325~340
35	Plug (pilot valve)	PF 3/8	5.0~6.0	36~43.4
37	Connector (pilot valve)	PF 3/8	5.0~6.0	36~43.4
38	Plug	PF 1/4	3.0±0.3	21.6±21.1
42	Plug	PF 1/8	1.5±0.1	10.8±1.0
56	Hexagon socket head bolt	M 18	33±3.3	238.6±23.8
57	Overload relief valve	M 27	10~12	72.3~86.7
60	Plug	PF 1/2	10±1.0	72.3±7.2

3. DISASSEMBLING

1) GENERAL INSTRUCTIONS

- ▲ Combustibles such as white kerosene are used for washing parts.**
These combustibles are easily ignited, and could result in fire or injury.
Be very careful when using.
 - ▲ Internal parts are coated with hydraulic fluid during disassembling and are slippery.**
If a part slips out of your hand and falls, it could result in bodily injury or could damage the part.
Be very careful when handling.
- (1) Generally, hydraulic equipment is precisely manufactured and clearances between each parts are very narrow. Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather. Tools and kerosene to wash parts should also be clean and handled with great care.
 - (2) When motor is removed from the host machine, wash around the ports sufficiently and put the plugs so that no dust and/or water may invade. Take off these plugs just before the piping works when re-attach it to the host machine.
 - (3) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in advance.
 - (4) The piston can be inserted to whichever cylinder block for the initial assembling.
However, their combination should not be changed if they are once used. To reuse them, put the matching mark on both pistons and cylinder block before disassembling.
- ▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

2) DISASSEMBLING TRAVEL MOTOR

(1) Removing accessory valves

Before disassembling motor, remove accessory valves.

- ※ According to disassembling purpose, select the valves to be removed.

However, you cannot disassemble the motor without removing overload relief valve (57).

▲ There is dread of the burn, disassemble motor after cooling it to ambient temperature.

- ① Remove M42 plug (29) and O-ring (30).
- ② Remove spring (28), spring holder (27) and spool assy (26).

- ※ Put the matching mark on both spool assy (26) and rear cover (24) so that spool assy (26) should not be reversed on re-assembling.

It is impossible to disassemble this spool assy (26) further because spool assy (26) is fixed by adhesive.

- ③ Remove plug (42), O-ring (43), check restrictor spring (41) and restrictor (40).

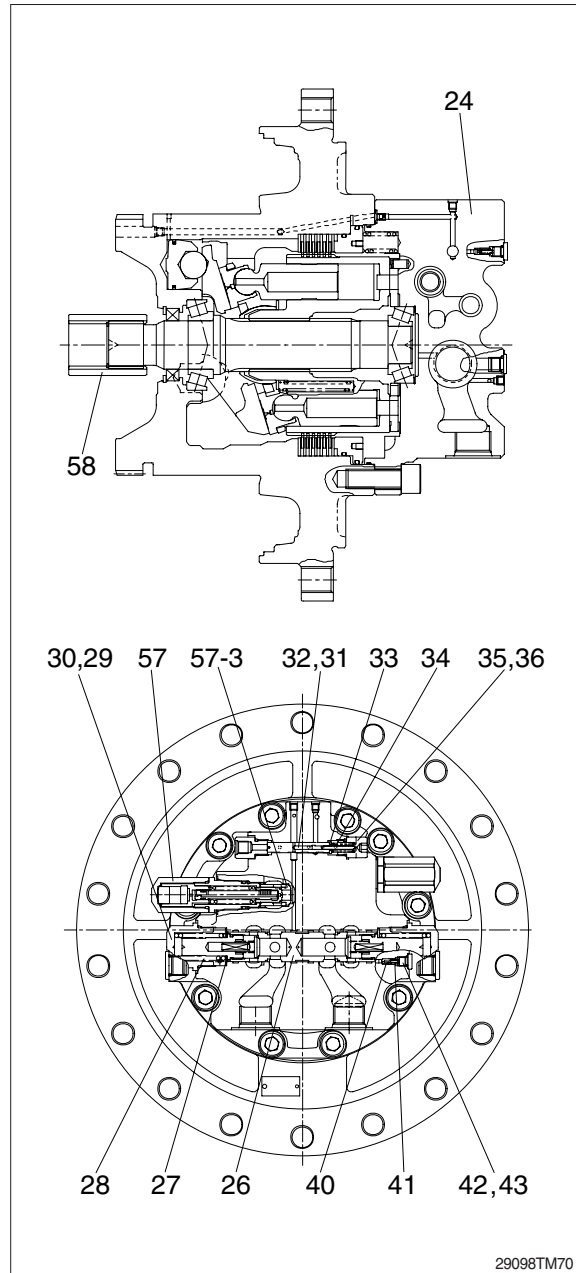
- ④ Remove overload relief valves (57).

- ※ When removing overload relief valve (57), valve seat (57-3) easily comes off, so take great care not to fall into the rear cover (24) or lose.

- ⑤ Remove pilot valve plug (35) and then, remove O-ring (36), pilot valve spring (34), spring holder (33), pilot valve spool (31) and pin (32).

- ⑥ Remove coupling (58).

▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.



(2) Disassembling motor

- ① Place the motor with the shaft horizontal, remove hexagon socket head bolts M18×50 (56) of rear cover (24) leaving two on diagonally upper and lower position.
- ② Install two guide pins diagonally into rear cover (24).
(Purpose: Prevention of falling rear cover)
- ③ Loosen slowly and simultaneously the remaining two hexagon socket head bolts M18 x 50 (56).
- ④ Remove rear cover (24) and brake springs (55) taking care cylinder block (13) is not coming out stuck with rear cover (24).

▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

※ Do not fall, at this moment, valve plate (54), brake springs (55), outer race of rear bearing (51) and/or O-rings (50), (47), (49).

※ There are shims (52) under the outer race of rear bearing (51). Take a great care not to lose.

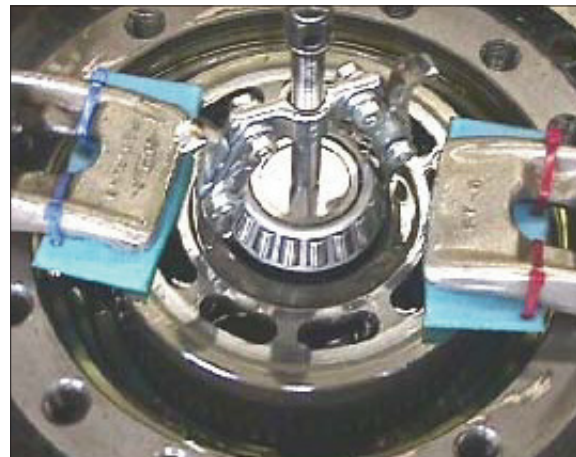
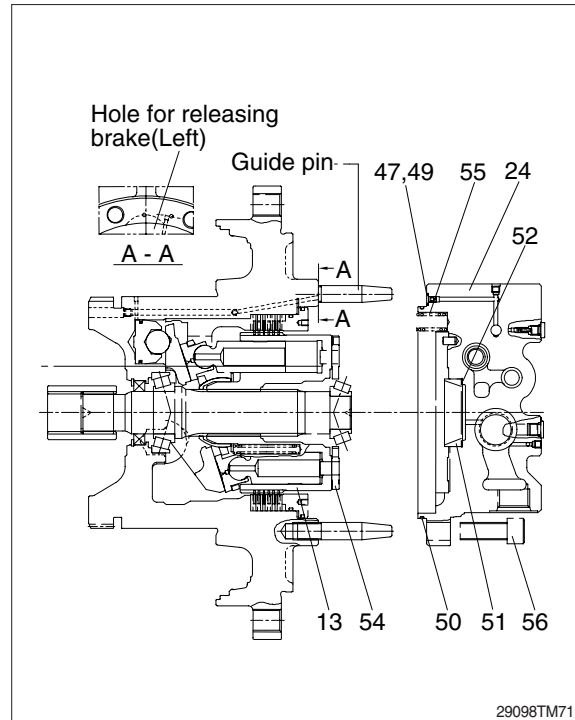
- ⑤ Remove valve plate (54) without pulling out cylinder block (13).

※ Put the matching mark on both valve plate (54) and rear cover (24) so that valve plate (54) should not be reversed on re-assembling.

- ⑥ Using removed hexagon socket head bolts M18 x 50 (56), fasten two mount metals so as to push in cylinder block (13) without damaging it then inner race of rear bearing (51) comes out.

※ Put a rubber plate between mount metal and cylinder block (13) to protect its sliding surface.

- ⑦ Put two fingers of gear (bearing) puller under the inner race of rear bearing (51) and remove the race.



- ⑧ Attaching a hand on brake piston (21), supply plant air through oil hole for releasing brake and push out the piston (21).

▲ Be aware of brake piston (21) popping out.

- ※ In case of using jig for pulling out brake piston (21), install jigs to M6 thread (2 places) of brake piston (21) and pull out brake piston (21).

- ⑨ Put as a mark on a piston assy (18) such as a paper pipe and put a matching mark on cylinder block (13) so that they can be re-assembled at the same position as before.

- ⑩ Remove rotary group (cylinder block (13), spring holder (15), nine piston assys (18), shoe retainer (17), ball joint (16) and cylinder spring (14)) as an assembly.

▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

- ⑪ Remove separating plates (19) and friction plates (20).

- ⑫ Remove nine piston assys (18), shoe retainer (17) and ball joint (16) from rotary group simultaneously.

- ⑬ Remove spring holder (15) and cylinder springs (14).

- ※ Put piston assys (18) into the cylinder block (13) matching the matching mark with shoe retainer (17) as if assembled.

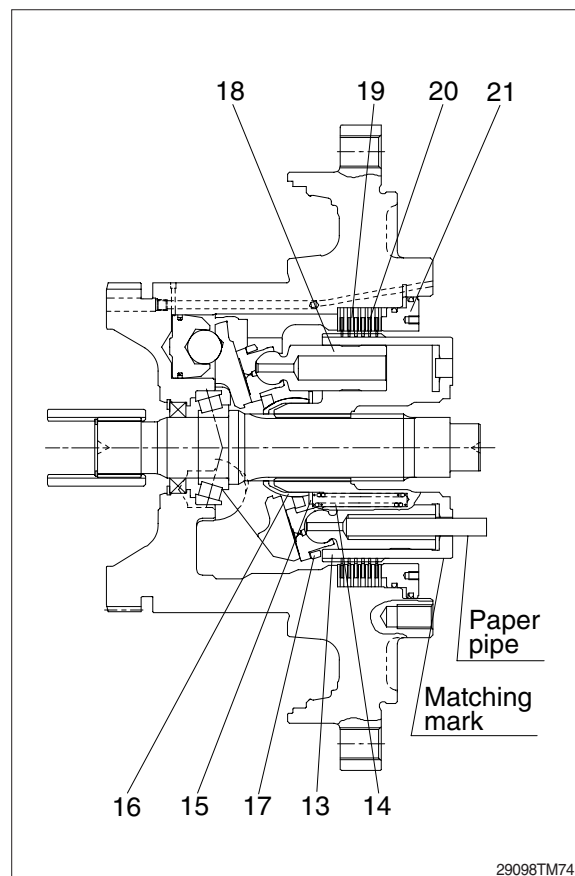
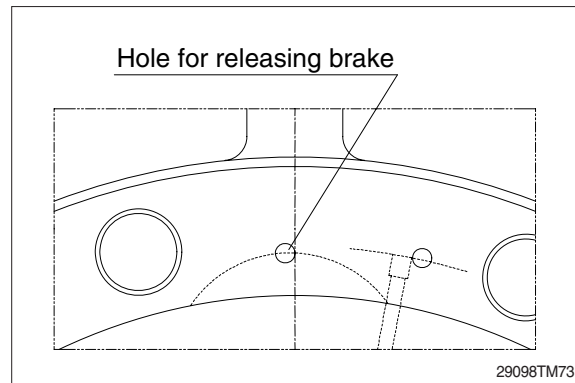
The purpose is to put piston assys (18) in the same bore of cylinder block (13) as before when reassembled.

- ※ Take care not to scratch sliding surfaces. Do not reuse damaged ones.

- ※ It is impossible to disassemble piston and shoe because they are calked together.

- ※ Above disassembling is mentioned as a motor only and naturally can be applied to the motor with reduction gears.

The situation is rather easier for with reduction gears because the shaft is rather restricted by a gear to move.



- ⑭ Remove swash plate (12).
- ⑮ Do not detach shifter piston assy (6), (7), (8).

If it needs to detach, attach a hand on shifter piston and supply plant air through the hole shown in figure and push it out.

- ▲ **Be aware of shifter piston (6) popping out.**

- ⑯ Shaft (9) can come out now.
- ⑰ If front bearing (10) happens to be changed, remove inner races and outer races using bearing puller if needed and exchange to new ones as an assembly.

- ※ When changing bearings (10), (51), shaft(9), casing(1) or rear cover (24), it affects the clearance of the bearings.

Therefore, shim (52) should be adjusted. Shim (52) adjustment should be performed by measuring correctly the clearance for shim and change shim that meets the clearance.

Other jigs and tools are needed to measure and decide the thickness of the shim.

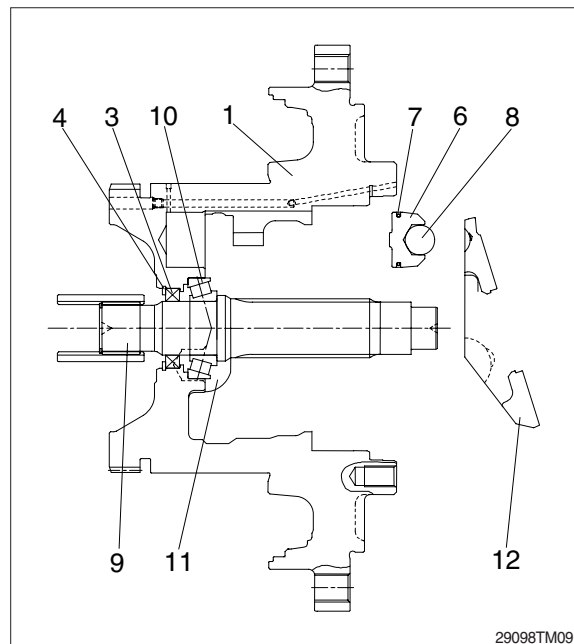
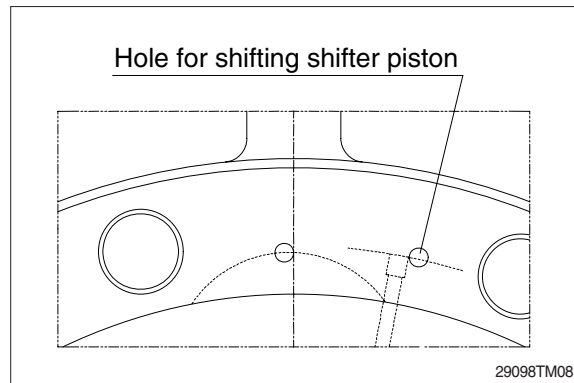
Please contact dealers for them if necessary.

- ※ Do not remove pivots (11).
- If it needs to disassemble them, put matching mark on pivots (11) with swash plate (12).

- ※ Never detach oil seal (3) only for the purpose of inspecting it.

If disassembled, remove retaining ring (4) first and remove oil seal (3).

Never fail to replace oil seal (3) with new one.



⑱ Deciding shim (52) thickness for tapered roller bearings.

※ This work should be done only when you have changed bearings (10), (51), shaft (9), casing (1) or rear cover (24).

a. Measure the assembling width “E”

※ Take care not to incline shaft (9).

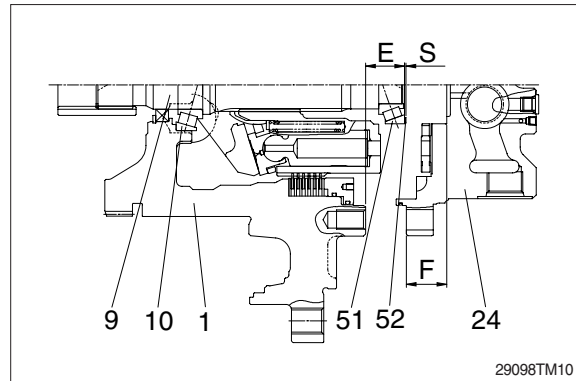
b. Measure the depth “F” of rear cover (24)

※ Measure them at crossed 4 places on the circuit, then calculate their mean value.

c. When thickness of shim (52) to be used is placed as “S”, the clearance “Y” can be calculated as follows:

$$Y = F - (E + S)$$

d. Select one or two shim (52) so as the clearance “Y” to come to 0-0.1mm (clearance) on this unit.



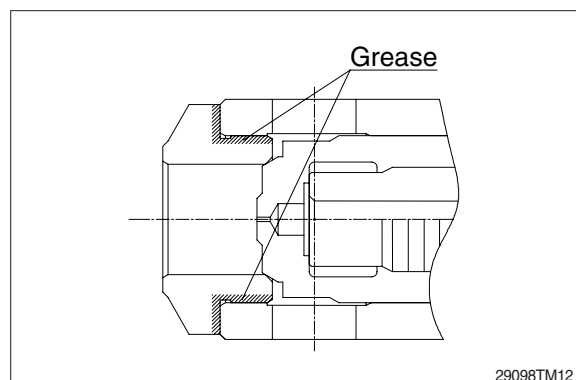
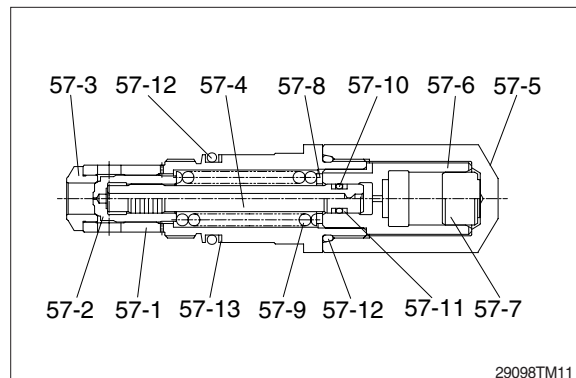
(3) Disassembling overload relief valve

※ As a rule, overload relief valve (57) should be handled as one service part. If there are any trouble on overload relief valve (57), replace as an assembly.

※ Valve seat (57-3) is fitted in bore of socket (57-1) at clearance fit.

When removing overload relief valve (57), valve seat (57-3) easily comes off, so take great care not to lose.

When assembling overload relief valve (57) to rear cover (24), apply grease sufficiently on engagement part not to drop valve seat (57-3).



4. REASSEMBLING

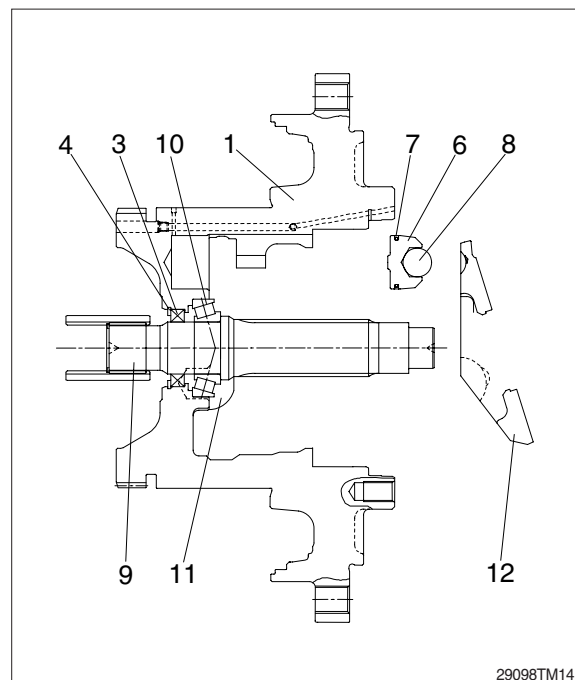
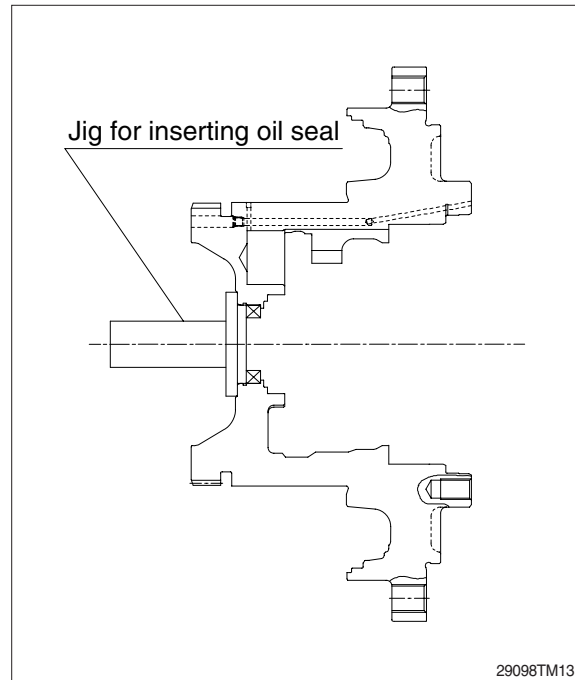
1) GENERAL INSTRUCTIONS

- (1) Wash each parts sufficiently with kerosene, and blow them by plant air.
 - (2) Assemble sliding parts after coating clean hydraulic oil on them.
- ▲ **Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.**

2) ASSEMBLING MOTOR

- (1) Coat outer surface of oil seal (3) and inner face of casing (1) with grease. Using jig, rightly and evenly press in the oil seal (3) into casing (1).
- (2) Fix oil seal (3) by retaining ring (4).
- (3) Put the outer race of bearing (10) on casing (1) (this fit is loose), and press the inner race on shaft (9) (this fit is tight).
 - ※ It is easier to fit inner race if the inner race is heated or boiled under 100 degrees centigrade.
 - Never over heat!
- ▲ **Take great care not to burn.**
- (4) Insert shaft (9) into casing (1) after coating grease on the contact surface to oil seal (3) lip.
- (5) Put shifter piston assy (6), (7), (8) into casing (1).
 - ※ Insert shifter piston assy not to incline.
 - ※ When inserting shifter piston assy, apply grease sufficiently on piston seal (7) and take a great care not to cut piston seal (7).
- (6) Insert pivots (11) into the casing (1).

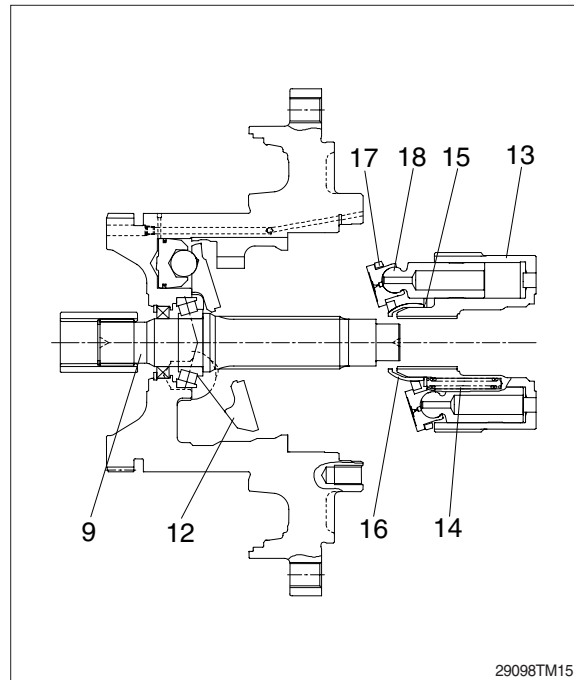
Take care to match the matching mark with casing (1) and also to coincide the direction of sliding trace on sphere surface with those contact trace on swash plate (12) if the motor was operated a certain hours.
- (7) Apply grease sufficiently on three spherical recess of swash plate (12) and assemble it in casing (1).



- (8) Insert piston assys (18), shoe retainer (17), ball joint (16), spring holder (15), cylinder spring (14) on to cylinder block (13) as shown and then insert the whole assembly to shaft (9).

▲ Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

- ※ Piston assys (18) should be inserted into the same bore as before disassembling.
- (9) Rightly knock in the inner race of rear bearing (51) to the rear end of shaft (9) by using jig (A1) and plastic hammer (A2).
- (10) Install all the separating plates (19) and friction plates (20) alternately between casing (1) and cylinder block (13) adjusting on the notches and splines. Separating plates (19) comes both first and last.



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- (11) Insert brake piston (21) into casing (1) using inserting jig (B) after attaching D-rings (22), (23) to brake piston (21).

- ※ Apply grease sufficiently on D-rings (22), (23).

- ※ Insert brake piston (21) by using inserting jig not to incline.

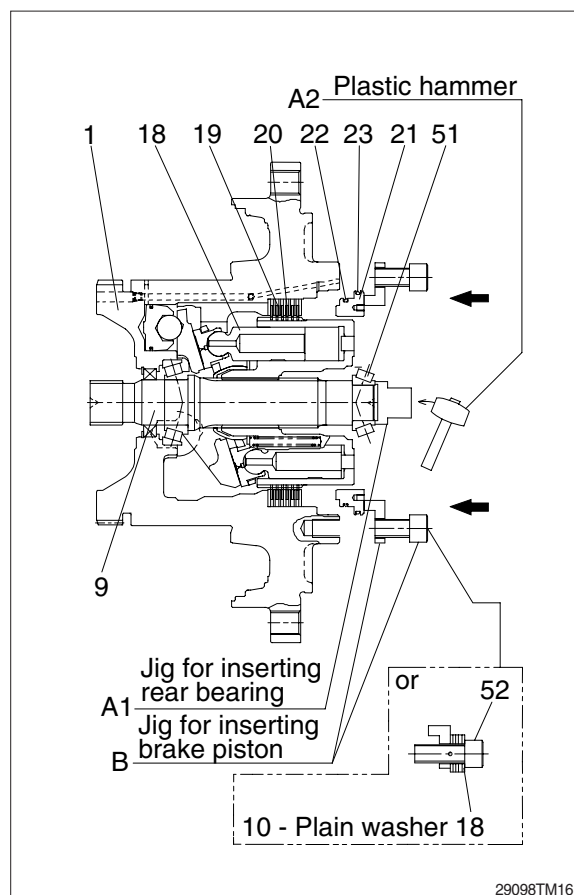
Two kinds of D-rings are used on brake piston (21). The larger one (23) is first inserted into the hole, then the smaller one (22) enters.

It is impossible to see how the smaller ring goes into the hole. Therefore, never push it forcibly into the hole.

Otherwise, it may be scraped off by the edge of the hole of casing (1).

- ※ When changing bearings (10), (51), shaft (9), casing (1) or rear cover (24), it affects the clearance of the bearings. Therefore, shim (52) should be adjusted.

Refer to “Deciding shim (52) thickness for tapered roller bearings” (page 8-84) and decide shim (52) thickness.



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(12) Install two guide pins diagonally on casing (1). (Purpose: Guide for installing rear cover)

(13) Lay down rear cover (24) to mount valve plate (54) coinciding matching mark made prior to disassembling and also place brake springs (55) with ample grease to be attached to rear cover (24) while assembling.

Also set shim (52), outer race of rear bearing (51) and O-rings (50), (47), (49) on rear cover (24).

(14) Insert rear cover (24) to casing (1) along the guide pin, and install two hexagon socket head bolts M18 x 50 (56) diagonally upper and lower position and tight them to assemble rear cover (24) parallelly.

Then, install the rest of hexagon socket head bolts M18 x 50 (56) and remove guide pin and install two the remainder.

▲ Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

※ When removing outer race of rear bearing (51), install shim (52) without fail.

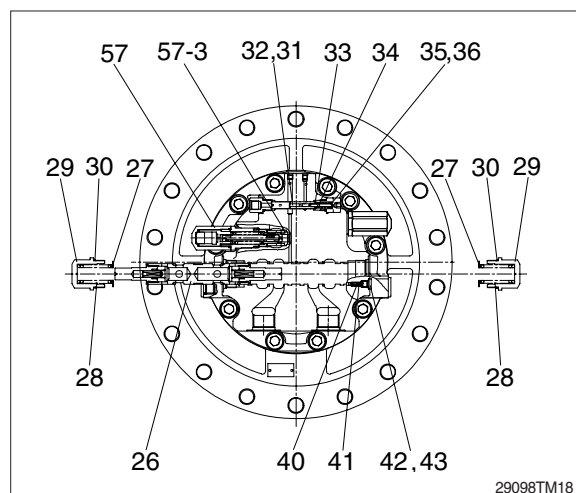
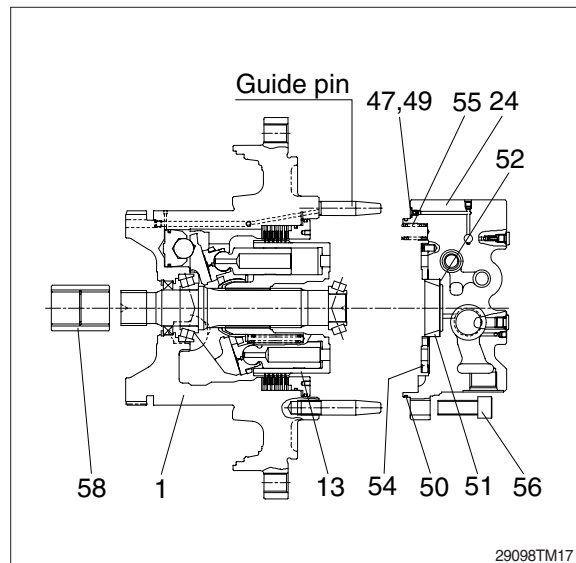
Confirm that O-rings (47), (49), (50) are installed to rear cover (24).

※ Tightening torque of hexagon socket head bolt M18 x 50 (56) is 33 kgf·m (238.6 lbf·ft) without removing rust preventive agent on the threads.

(15) Assemble coupling (58).

(16) Assemble spring (34), spring holder (33), pilot valve spool (31) and pin (32) to rear cover (24), and then install pilot valve plug (35) with O-ring (36).

※ Tightening torque of pilot valve plug (35) is 5.0~6.0 kgf·m (36.1~43.3 lbf·ft).



(17) Assemble overload relief valves (57).

- ※ Valve seat (57-3) is fitted in bore of socket (57-1) at clearance fit.

When assembling overload relief valve (57) to rear cover (24), valve seat (57-3) easily comes off, so take great care not to lose and apply grease sufficiently on engagement part not to drop valve seat (57-3).

- ※ Tightening torque of overload relief valve (57) is 10.0~12.0 kgf·m (72.3~86.8 lbf·ft)

(18) Assemble restrictor (40) and restrictor spring (41) to rear cover (24), and then install PF 1/8 plug (42) with O-ring (43).

- ※ Tightening torque of PF 1/8 plug (42) is 1.5 kgf·m (10.8 lbf·ft) .

- ※ In case of assembling NEW restrictor (40), fit valve seat of restrictor (40) with rear cover (24).

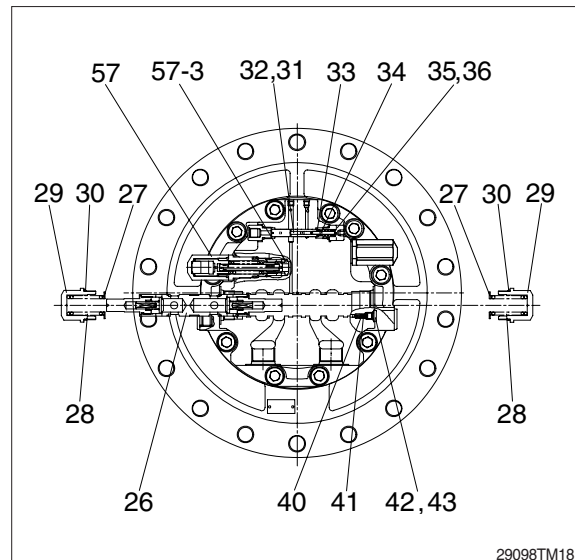
(After inserting restrictor (40) to rear cover (24), knock restrictor (40) slightly by hammer.)

(19) Inserting spool assy (26) to rear cover (24) coinciding matching mark made prior to disassembling, and then assemble spring holder (27) and spring (28).

- ※ Spool assy (26) is unsymmetry. Insert spool assy (26) in an appropriate direction.

(20) Assemble M42 plug (29) with O-ring (30).

- ※ Tightening torque of M42 plug (29) is 45.0~47.0 kgf·m (325.4~340 lbf·ft).



3) INITIAL PRE-CONDITIONING OPERATION

(1) Drain charge

Fill up hydraulic oil in the motor casing after assembling.

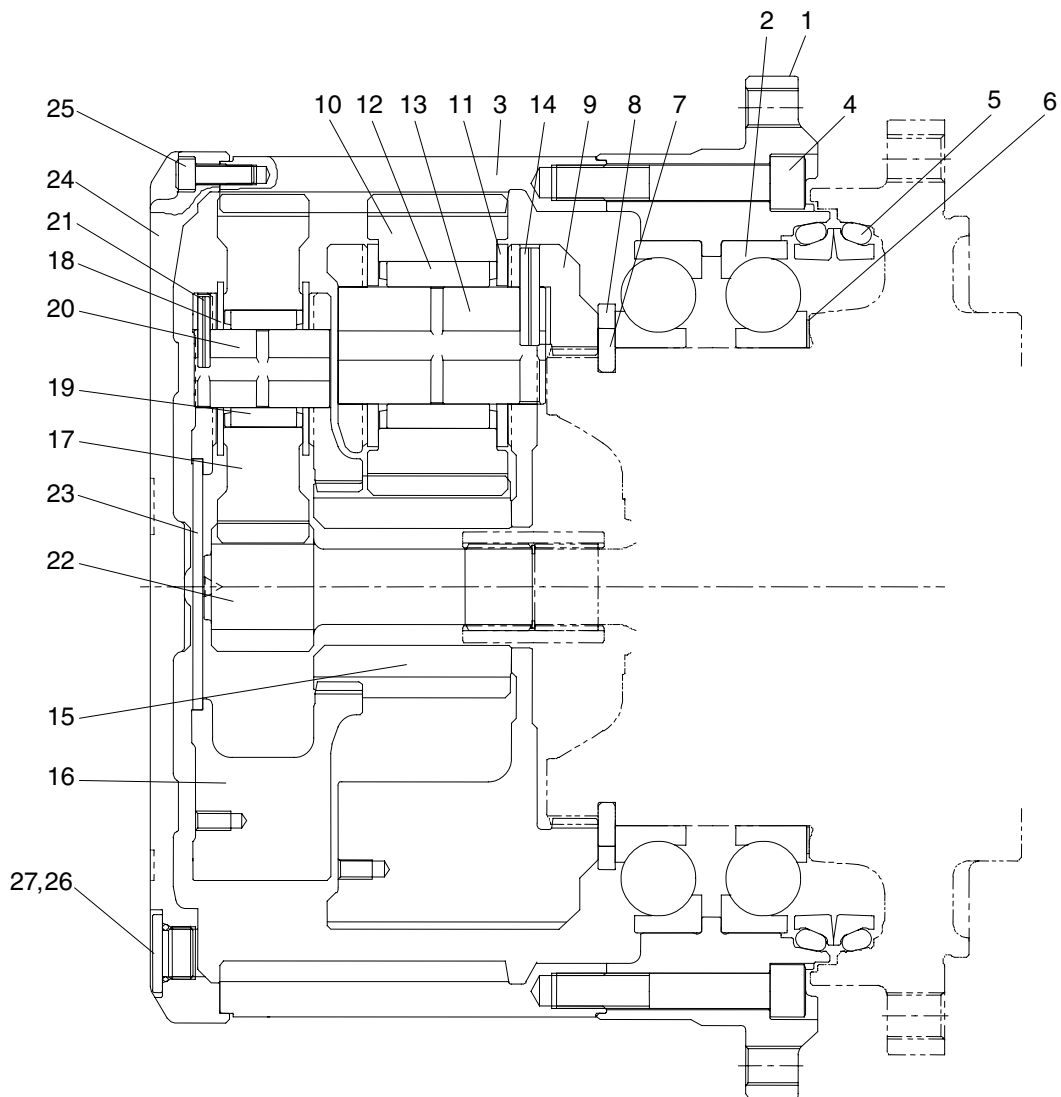
This motor has two drain ports (PF1/2). Bleed air in motor casing from un-piping port (upper side).

(2) Initial pre-conditioning operation

Operate the motor 5 minutes at low speed mode and low-idle, check if there are abnormal noise or leak of oil.

5. TRAVEL REDUCTION GEAR

1) STRUCTURE

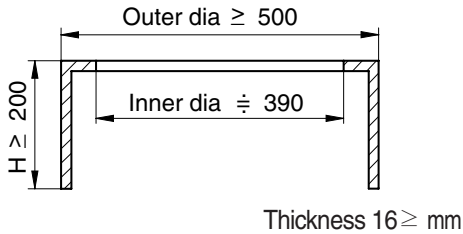


29092TM02

1	Housing	10	Planetary gear 2	19	Needle bearing
2	Bearing	11	Thrust washer 2	20	Carrier pin 1
3	Ring gear	12	Needle bearing	21	Spring pin
4	Hexagon socket head bolt	13	Carrier pin 2	22	Sun gear 1
5	Floating seal	14	Spring pin	23	Thrust plate
6	Shim	15	Sun gear 2	24	Cover
7	Lock washer	16	Carrier 1	25	Hexagon socket head bolt
8	Support ring	17	Planetary gear 1	26	Plug
9	Carrier 2	18	Thrust washer 1	27	O-ring

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Description	Specification
Torque wrench	For 38.5 kgf · m (278 lbf · ft)
Hexagon socket wrench	Width across flats 8, 14 mm
Work stand	 <p>Outer dia ≥ 500 Inner dia $\cong 390$ H ≥ 200 Thickness $16 \geq \text{mm}$</p>
Micro depth gauge	0~15 mm
Vernier caliper	0~150 mm
Knocking pin	For knocking in spring pins item 7 and 15 $\phi 5.5 \times 80$, $\phi 9.5 \times 60$
Eye bolt	M10 and M20 (or equiv. hooks) each 3 pcs
Others small items	Kerosene as cleaner, solvent, gear oil, grease, Loctite No. 242 and No. 515, seal tape, waists etc.
Vertical press and jigs	To press in angular bearings and to assemble its lock washers. (press capacity 3 ton)

(2) Tightening torque

Item	Part name	Size	Torque	
			kgf · m	lbf · ft
4	Socket head bolt	M18 × 110	38.5 ± 3.85	278.4 ± 27.8
25	Socket head bolt	M10 × 30	7 ± 0.7	50.6 ± 5.0
26	Taper plug	PF 3/4	14.9 ± 1.5	107 ± 10.8

6. DISASSEMBLING

1) GENERAL INSTRUCTIONS

- ▲ Combustibles such as white kerosene are used for washing parts. These combustibles are easily ignited, and could result in fire or injury.
Be very careful when using.**
 - ▲ Internal parts are coated with gear oil during disassembly and are slippery. If a part slips off from your hand and falls, it could result in bodily injury or could damage the part.
Be very careful when handling.**
- (1) Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather.
Tools and kerosene to wash parts should also be clean and handled with great care.
- (2) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a sub-assembly.
Consult with the parts manual in advance.
- ▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

2) DISASSEMBLING PROCEDURES

※ Figure in () shown after the part name corresponds to the number on structure drawing.

(1) Preparation for disassembling

① The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit sufficiently and dry it.

▲ **There is dread of the burn, disassemble reduction unit after cooling it to ambient temperature.**

② Loosen taper screw plug G3/4 (26) of drain and fill port and drain oil from reduction gears.

▲ **While oil is still hot, inside of the unit may be pressurized. Take care of the hot oil gushing out of the unit when loosening the plug.**

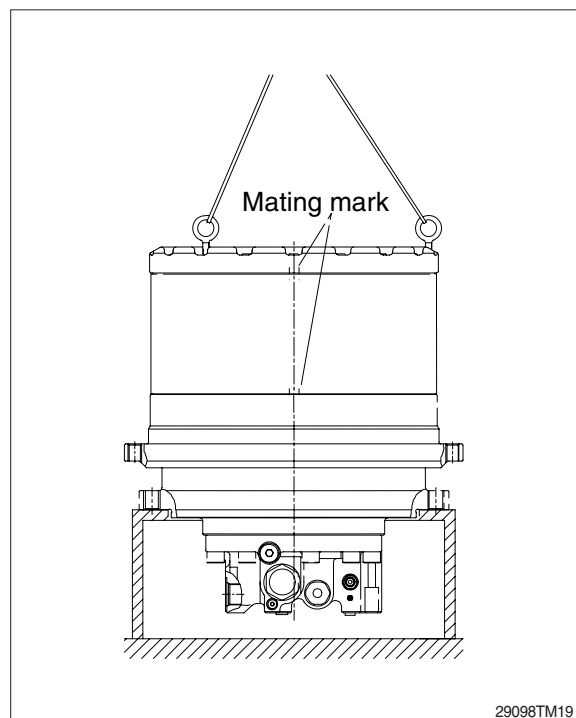
③ Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.

(2) Setting reduction unit (or whole propelling unit) on work stand

① Remove hexagon socket head bolts M10 ×30 (25) at 3 places from cover (24) almost equally apart each other, then install M10 eye bolts.
Lift up the unit using them and place it on work stand with cover (24) upward.

▲ **Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

※ Lift the parts up horizontally.



29098TM19

(3) Removing cover

- ① Remove the rest of hexagon socket head bolts M10×30 (25) that secure cover (24).



29098TM20

- ② As the cover (24) is adhered to ring gear (3), remove cover (24) by lightly hammering slantwise upward by wooden bar aiming at projection of cover (24).

- ▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.



29098TM21

(4) Removing carrier 1 assy

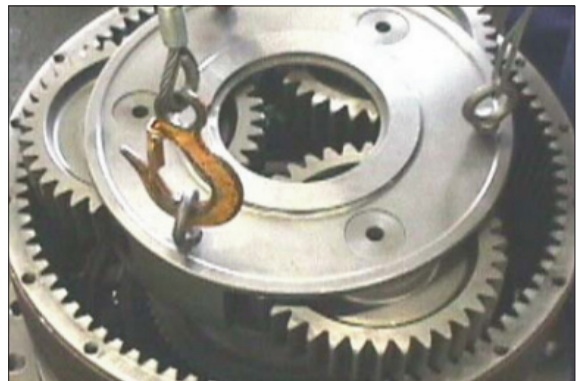
- ① Remove thrust plate (23).
- ② Screw three M10 eye bolts in carrier 1 (16) and lift up and remove carrier 1 as sub-assy (16), (17), (18), (19), (20), (21).

- ▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

※ Lift the parts up horizontally.

- ③ Remove sun gear 1 (22).

- ▲ Take great care not to pinch your hand between gears while disassembling.



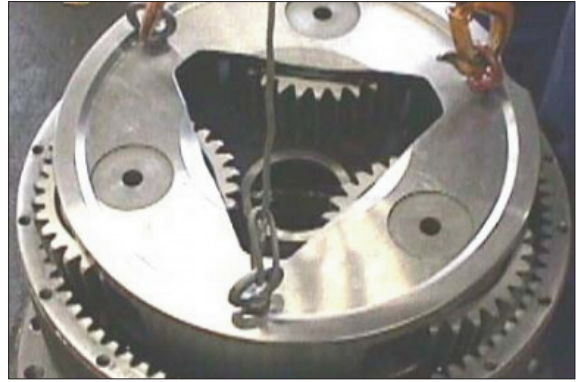
29098TM22

(5) Removing carrier 2 assy

- ① Remove sun gear 2 (15).
- ② Screw three M10 eye bolts in carrier 2 (9) and lift up and remove carrier 2 as sub-assy (9), (10), (11), (12), (13), (14).

⚠ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

※ Lift the parts up horizontally.



29098TM23

(6) Disassembling housing assy

- ① Remove support ring (8).



29098TM24

- ② Take off lock washers (7) by tapping on screw driver or on similar tool placed at parting surface of them.

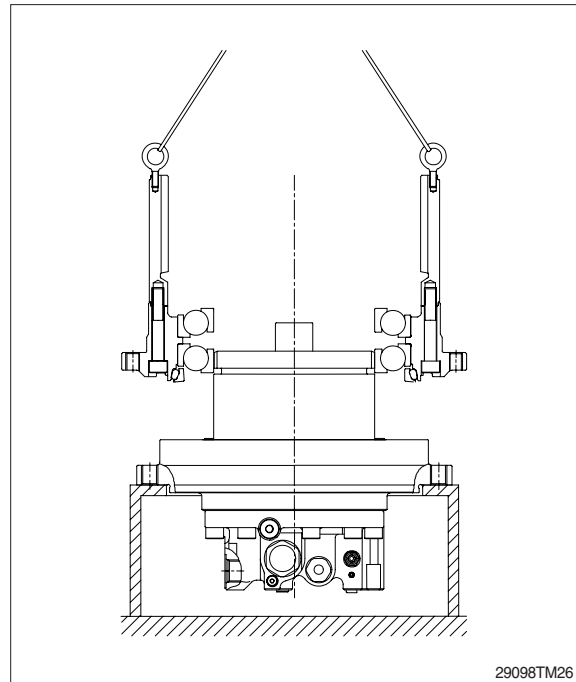


29098TM25

- ③ Screw three M10 eye bolts in ring gear (3) almost equally apart each other, then lift it up horizontally and remove housing assy including ring gear (3), housing (1), angular bearing (2), a piece of floating seal (5) and hexagon socket head bolts M18×110 (4) together.

▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

- ※ Lift the parts up horizontally.
- ※ If it is difficult to remove housing assy, lift up housing assy and press end face of motor casing slowly by press machine.
- ※ Take care not to damage the spline of casing and the motor shaft.

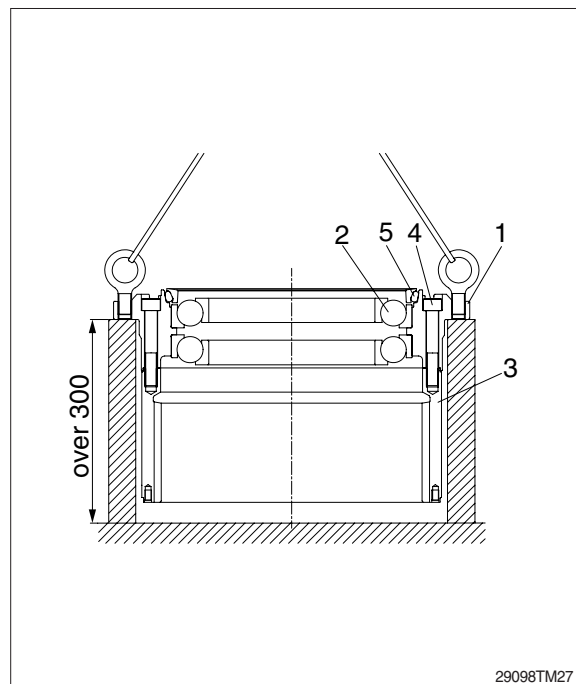


(7) Disassembling housing assy

- ① Screw three M20 eye bolts in housing (1) almost equally apart each other. Lift up the housing assy and place it on work stand with housing (1) upward. Put a mating mark outside of housing (1) and ring gear (3).

▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

- ※ Lift the parts up horizontally.
- ② Remove floating seal (5) from housing (1).
- ③ Remove hexagon socket head bolts M18×110 (4), leaving two of them diagonally.
- ④ Loosen the rest two hexagon socket head bolts M18×110 (4) and tap lightly the head of them then ring gear (3) can be easily removed from housing (1).



▲ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

- ※ Take care not to damage the sliding surface of floating seal (5) or its O-ring.
- ※ Bearings (2) have been tightly press fitted in housing (1). Don't remove the bearings (2) unless otherwise their exchange is needed.
In case bearings (2) removed, don't re-use them.
New bearings (2) should be used and shim (6) adjusting be required.

(8) Removing floating seal

- ① Remove a piece of floating seal (5) of motor side.



29098TM28

(9) Disassembling carrier 1 Assy

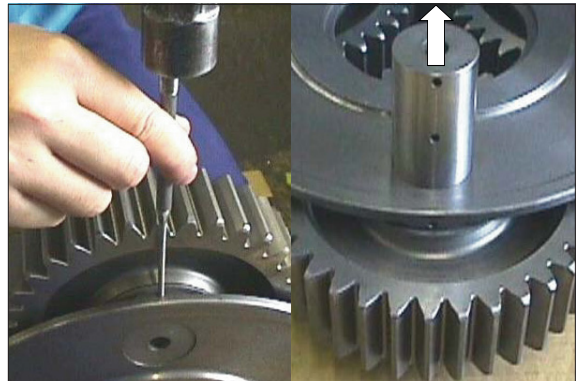
- ※ When carrier pins 1 (20) are to be re-used, mark each pin with its mated hole of carrier 1 (16) to assure the same combination as before.

- ① Knock spring pins 6×36 (21) fully into carrier pins 1 (20) by using knocking pin (Ø5.5).
- ② Tap carrier pins 1 (20) out from carrier 1 (16).
- ③ Remove thrust washers 1 (18), planetary gears 1 (17) and needle bearings (19).

▲ Take great care not to pinch your hand between gears and carrier 1 (16) while disassembling.

- ④ Knock out spring pins 6×36 (21) from carrier pins 1 (20) for re-assembly by using knocking pin (Ø5.5).

- ※ When carrier pin 1 (20) or planetary gear 1 (17) is needed to be exchanged, three pins or three gears should be all exchanged.



29098TM29/30



29098TM31/32

(10) Disassembling carrier 2 assy

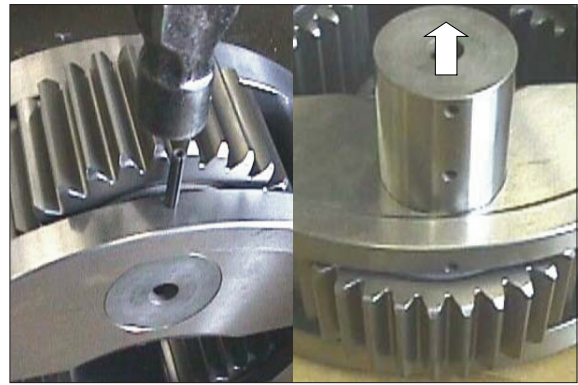
※ When carrier pins 2 (13) are to be re-used, mark each pin with its mated hole of carrier 2 (9) to assure the same combination as before.

- ① Knock spring pins 10×50 (14) fully into carrier pins 2 (13) by using knocking pin (∅9.5).
- ② Tap carrier pins 2 (13) out from carrier 2 (9).
- ③ Remove thrust washers 2 (11), planetary gears 2 (10) and needle bearings (12).

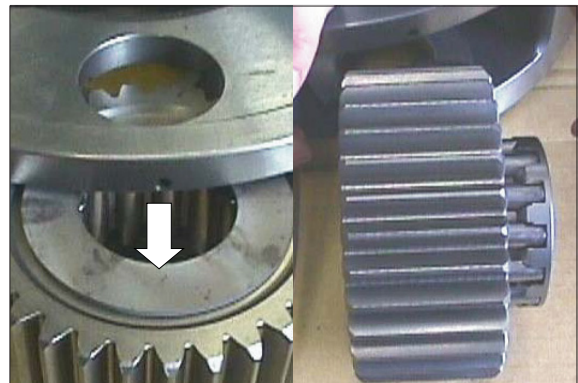
※ Take great care not to pinch your hand between gears and carrier 2 (9) while disassembling.

- ④ Knock out spring pins 10×50 (14) from carrier pins 2 (13) for re-assembly by using knocking pin (∅9.5).

※ When carrier pin 2 (13) or planetary gear 2 (10) is needed to be exchanged, three pins or three gears should be all exchanged.



29098TM33/34



29098TM35/36

7. ASSEMBLING

1) General instructions

- (1) Clean every part by kerosene and dry them by air blow. Surfaces to be applied by loctite must be degreased by solvent.
- (2) Check every parts for any abnormal.
- (3) Each hexagon socket head bolt should be used with Loctite #242 applied on its threads.
- (4) Apply gear oil slightly on each part before assembling.
- (5) Remove the refuse of loctite #242 in thread holes by tap and degrease by solvent.

▲ Take great care not to pinch your hand between parts while assembling nor let fall parts on your foot while lifting them.

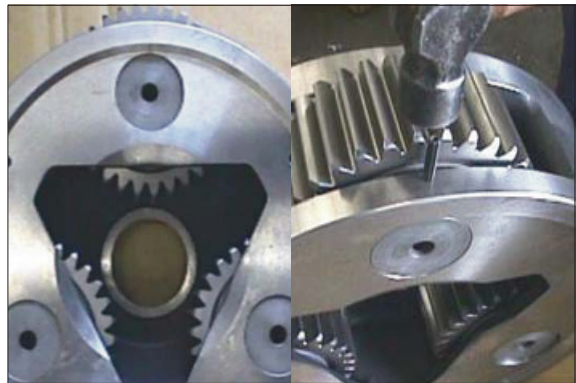
2) ASSEMBLING PROCEDURES

(1) Assembling carrier 2 assy

- ① Install planetary gears 2 (10), needle bearings (12) and thrust washer 2 (11) into carrier 2 (9).

▲ Take great care not to pinch your hand between gears and carrier 2 (9) while assembling.

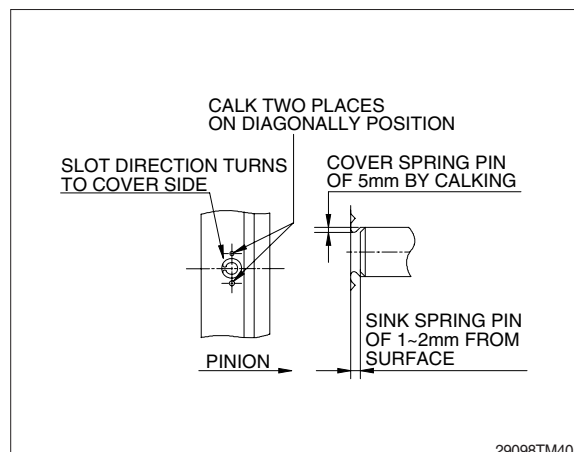
- ② Install carrier pins 2 (13) into carrier 2 (9) where the holes for spring pins 10 x 50 (14) are to be in line with those of carrier 2 (9).
- ③ Install spring pins 10×50 (14) into carrier 2 (9) and at the same time into carrier pins 2 (13). (sink spring pins of 1 - 2 mm from surface by using knocking pin (Ø9.5)
- ④ Calk carrier 2 (9) on diagonally position to prevent spring pin 10×50 (14) from coming out.



29098TM37/38



29098TM39



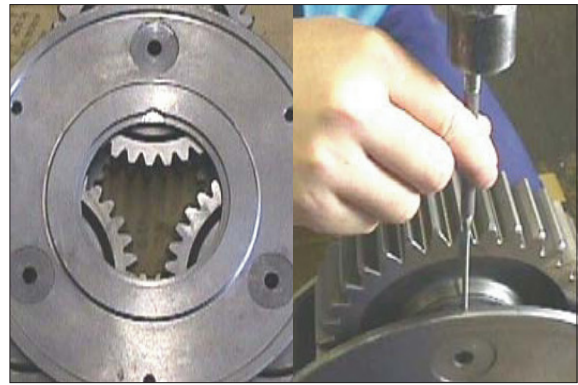
29098TM40

(2) Assembling carrier 1 assy

- ① Install planetary gears 1 (17), needle bearings (19) and thrust washers 1 (18) into carrier 1 (16).

▲ Take great care not to pinch your hand between gears and carrier 1 (16) while assembling.

- ② Install carrier pins 1 (20) into carrier 1 (16) where the holes for spring pins are to be in line with those of carrier 1 (16).
- ③ Install spring pins 6×36 (21) into carrier 1 (16) and at the same time into carrier pins 1 (20). (sink spring pins of 1 - 2 mm from surface by using knocking pin (Ø5.5))
- ④ Calk carrier 1 (16) on diagonally position to prevent spring pin 6×36 (21) from coming out.



29098TM41/42



29098TM43

(3) Installing main bearing and floating seal

- ① Install main bearing (2) to inner surface of housing (1) by using press machine.
- ② Install a piece of floating seal (5) on motor casing and also install another piece of floating seal (5) on housing (1).

※ Clean the groove for floating seals (5) to eliminate oil, dust, paint or other foreign material.

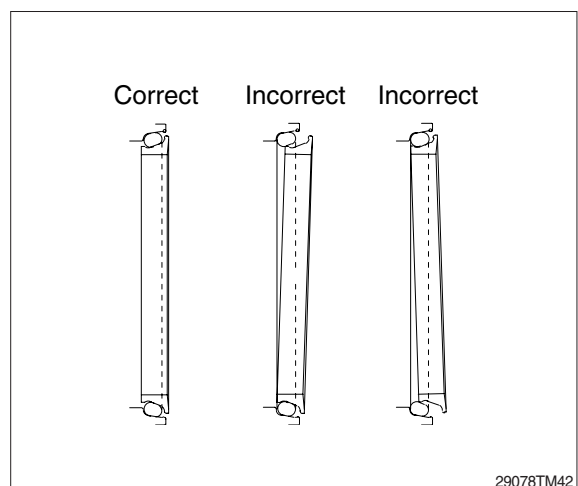
※ Apply gear oil slightly on sliding surfaces of floating seals (5) before assembling but keep strictly dry on O-rings and on its grooves.

※ Confirm that O-ring of floating seals (5) are not twisted and those are correctly installed. i.e. parallel as shown each other between housing (1) and motor casing after assembled.

It is recommended to use jig to install floating seal.



29098TM44



29078TM42

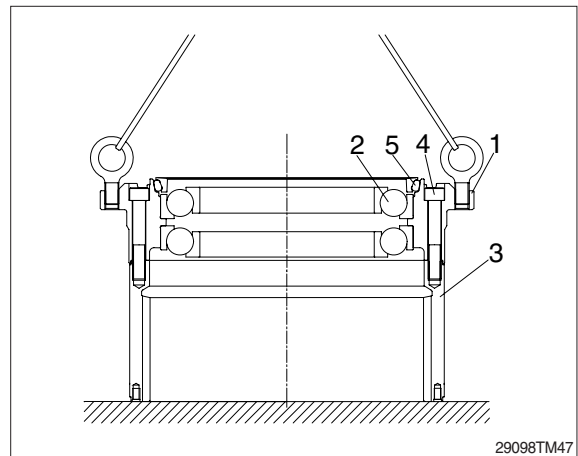
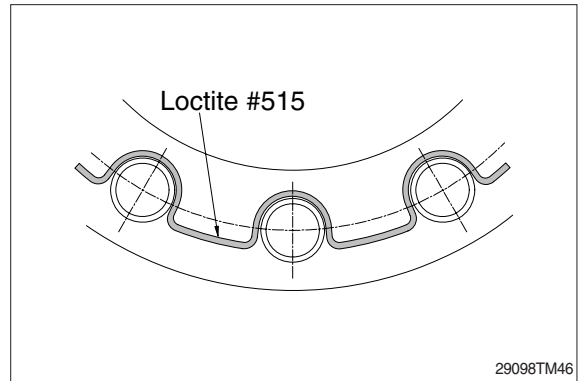
(4) Assembling housing assy

- ① Apply loctite #515 on mating surfaces of housing (1) or ring gear (3) without a gap.
- ② Install three M20 eye bolts equally apart on housing (1).

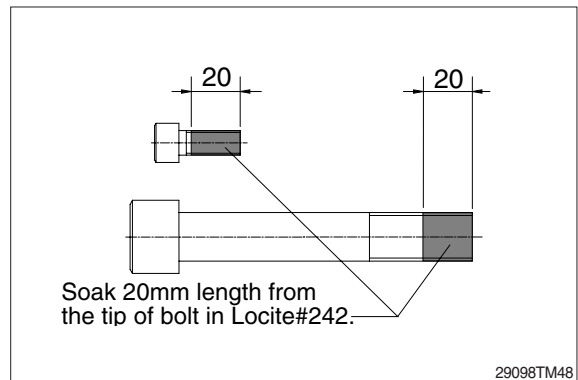
Using the eye bolts, hang the housing (1) by wire rope and place it on ring gear (3), coinciding mating marks.

▲ Take great care not to pinch your hand between parts while assembling nor let fall parts on your foot while lifting them. Lift the parts up horizontally.

- ③ After applying Loctite #242 on the threads of 25 pieces of hexagon socket head bolts M18×110 (4), tighten them with torque wrench.



※ Tightening torque of hex. socket head bolt M18×110 (4) is 38.5 ± 3.85 kgf·m (278.5 ± 27.8 lbf·ft) without removing rust preventive agent on the threads.



(5) Deciding shim thickness for angular bearings

※ This work should be done only when you have to change motor casing, housing (1), bearings (2) or lock washers (7).

Unless otherwise use the same shim (6) as before.

① Fit in two bearings (2) on housing (1) pressing their outer laces.

② Press inner laces of two bearings (2) lightly and evenly, measure the assembling width "A" of inner laces.

※ When measuring the assembling width "A", rotate bearings (2) at least 5 times and become the width "A" stably.

③ Measure the motor side assembling width "B" for bearings (2).

④ Measure the groove width "C" of motor casing.

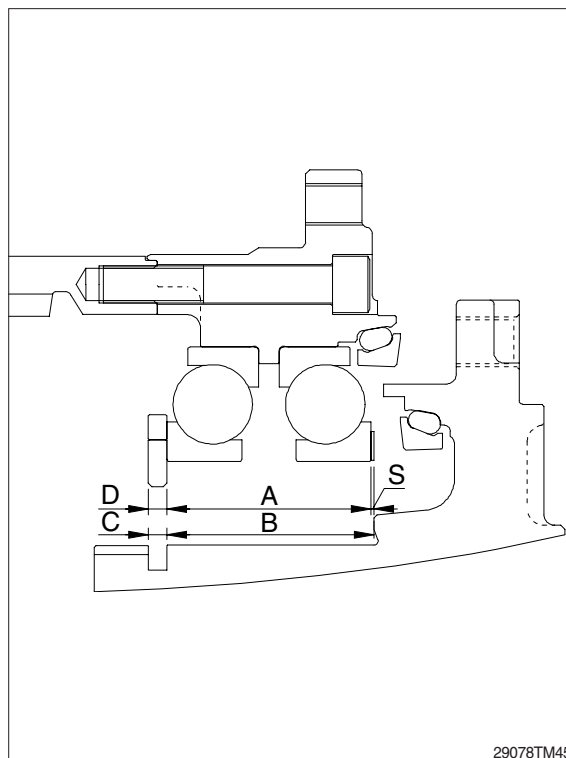
⑤ Measure the thickness "D" of lock washers (7).

※ Measure them at 4 places evenly apart on the circumferences then calculate and use those mean values. Measure them to the accuracy of 0.01 mm.

⑥ When thickness of shim (6) to be used is placed as "S", the clearance "X" can be calculated as follows :

$$X = (B + C) - (A + D + S)$$

⑦ Select a shim (6) so as the clearance X to come to -0.08 mm (interference) - +0.02 mm (clearance) on this unit.



(6) Installing housing assy

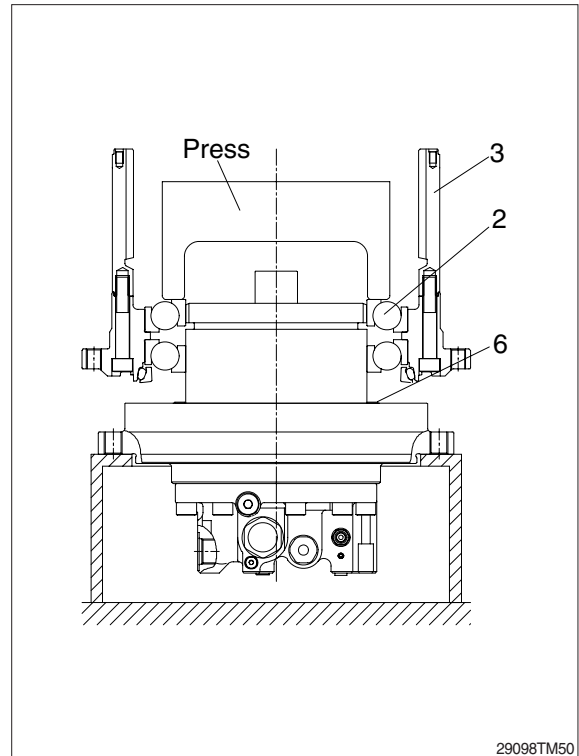
- ① Place motor on work stand with the shaft upward, and put the selected shim (6) (Refer to “Deciding shim thickness for angular bearing” on page 8-101) on the bearing mating surface of motor casing.

▲ Take great care not to pinch your hand between parts while assembling nor let fall parts on your foot while lifting them. Lift the parts up horizontally.

- ② Install three M10 eye bolts on ring gear (3) almost equally apart and lift it up. Descend it concentric with motor and put bearings (2) on housing (1) into motor casing. Use press machine and press inner lace of bearing (2) into full depth.

▲ Take great care not to pinch your hand between parts while assembling nor let fall parts on your foot while lifting them.

※ Lift the parts up horizontally.



- ③ While pressing inner lace of bearing (2), install lock washers (7) into groove.



- ④ Install support ring (8) over outside of lock washers (7).



(7) Assembling carrier 2 assy

- ① Install three M10 eye bolts equally apart on carrier 2 (9).

Using the eye bolts, hang the carrier 2 assy by wire rope and place three planetary gears 2 (10) as shown on figure TM75, put carrier 2 assy into ring gear (3) and mesh the splines to those of motor.

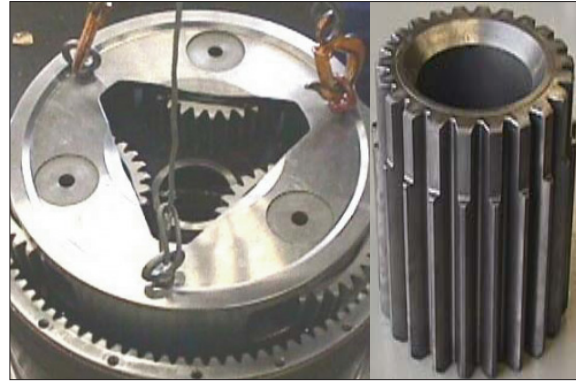
⚠ Take great care not to pinch your hand between parts while assembling nor let fall parts on your foot while lifting them.

※ Lift the parts up horizontally.

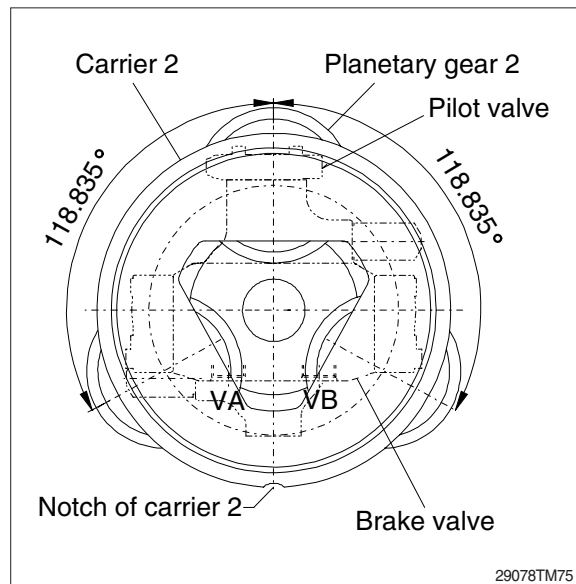
- ② Insert and mesh sun gear 2 (15) on center.

⚠ Take great care not to pinch your hand between gears while assembling.

※ Positioning carrier 2 assy as figure TM75 is important to obtain better lubrication.



29098TM53/54



29078TM75

(8) Assembling carrier 1 assy

- ① Install three M10 eye bolts equally apart on carrier 1 (16).

Using the eye bolts, hang the carrier 1 assy by wire rope and place it in ring gear (3), rotate planetary gears 1 (17) by hand and adjust carrier 1 (16) to mesh with sun gear 2 (15).

▲ Take great care not to pinch your hand between parts while assembling nor let fall parts on your foot while lifting them.

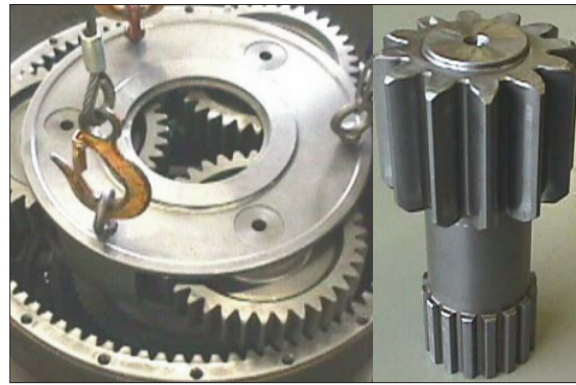
※ Lift the parts up horizontally.

- ② Making sure that coupling is on the shaft end, install sun gear 1 (22) on center.

▲ Take great care not to pinch your hand between gears while assembling.

- ③ Place thrust plate (23) on carrier 1 (16).

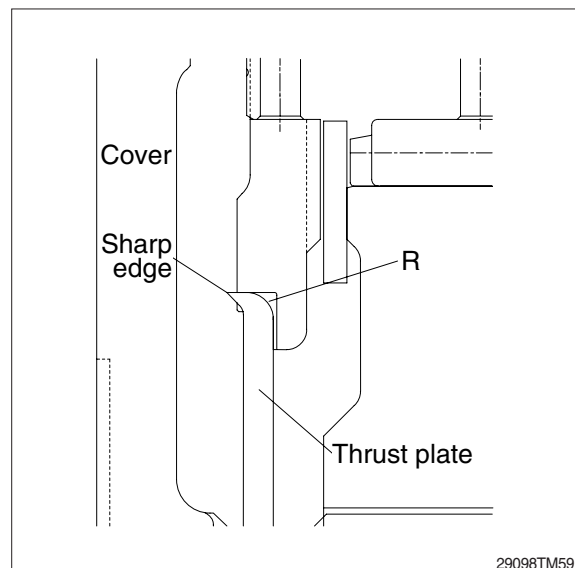
※ Face sharp edged side to cover (24).



29098TM56/57



29098TM58



29098TM59

(9) Installing cover

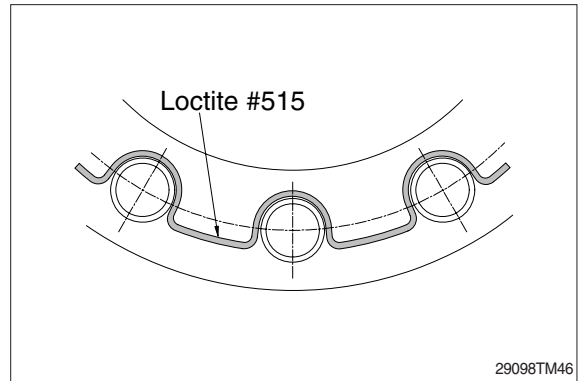
※ Gear oil can be filled before installing cover (24) if you can measure prescribed volume of oil.

① Apply Loctite #515 on mating surfaces of cover (24) or ring gear (3) and install cover (24) on ring gear (3).

▲ **Take great care not to pinch your hand between parts while assembling nor let fall parts on your foot while lifting them.**

② After applying Loctite #242 on the threads of 18 pieces of hexagon socket head bolts M10 x 30 (25), tighten them with torque wrench.

※ Tightening torque of hex. socket head bolt M10 x 30 (25) is 7.0 ± 0.7 kgf·m (50.6 ± 5.0 lbf·ft) without removing rust preventive agent on the threads.



(10) Filling gear oil

① Fill gear oil (SAE #90 API class GL-4 or GL-5, 9.5 liters) from two PF 3/4 ports.

② Tighten taper screw plugs (26).

※ Tightening torque of taper screw plug (26) is 15 ± 1.5 kgf·m (108.4 ± 10.8 lbf·ft).

