(2) Gear pump (for pilot)

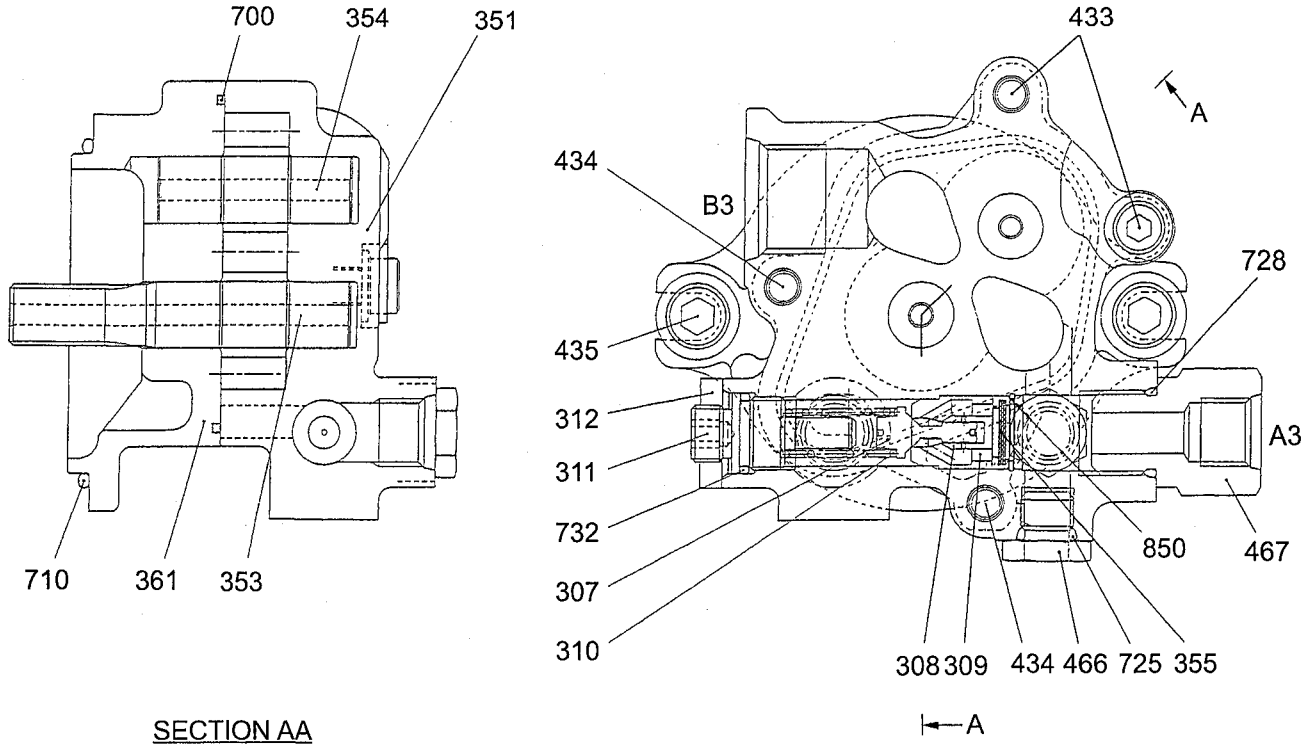


Fig. 1-2 Structure of gear pump (for pilot)

Table 1-2

TIGHTENING TORQUE kgf·m (lbf·ft)	No.	NAME	Q'TY	TIGHTENING TORQUE kgf·m (lbf·ft)	No.	NAME	Q'TY
	307	POPPET	1	1.7 (12)	433	FLANGE SOCKET ; M8 X 40	2
	308	SEAT	1	1.7 (12)	434	FLANGE SOCKET ; M8 X 55	2
	309	RING	1	3.4 (25)	435	FLANGE SOCKET ; M10 X 35	2
	310	SPRING	1	1.6 (12)	466	VP PLUG ; PF1/4	2
	311	ADJUSTING SCREW	1	5.4 (39)	467	ADAPTER ; PF1/2-PF3/8	1
3 (22)	312	LOCK NUT ; M14	1		700	RING	1
	351	GEAR CASE	1		710	O-RING ; 1B G80	1
	353	DRIVE GEAR	1		725	O-RING ; 1B P11	2
	354	DRIVEN GEAR	1		728	O-RING ; 1B P18	1
	355	FILTER	1		732	O-RING ; 1B P16	1
	361	FRONT CASE	1		850	SNAP RING	1

1.1.2 DISASSEMBLY AND ASSEMBLY OF MAIN PUMP

(1) Tools

The following list shows the tools required for remove and install.

Table 1-3

Tool name	Dimension
Allen wrench	Opposing flats 4,5,6,8,14mm
Eye wrench Socket wrench Wrench with double heads (single head)	Opposing flats 19, 27mm
Adjust wrench	Medium size 1pc.
Screw driver	Flat-bladed screw driver 1pc.
Hammer	Plastic hammer 1pc.
Plier	For snap ring
Steel bar	Steel bar for key Approx.10 X 8 X 200mm (0.40" X 0.31" X 0.79")
Torque wrench	One that may be fastened to specified torque

(2) Disassembling procedure

1) Selecting a place for disassembly.

- Choose a clean place.
- Spread rubber sheet or cloth on work bench to protect parts from damaging.

2) Cleaning

Remove dust and rust, etc. on pump surface with wash oil.

3) Drain oil

Drain out the oil in the pump casing by removing drain port plug (467), (468).

: 27 mm

- Drain out the oil from the plug of the front pump and the rear pump.

4) Removing regulator and PTO gear casing

Remove the socket bolts [415 (See Fig.1-20), 435 (See Fig.1-34.)]. Then remove the regulator and the PTO gear casing.

: 6 mm, 8 mm

- Regarding the disassembly of the regulator, refer to article of Regulator.
- Regarding the disassembly of the PTO gear casing, refer to article of PTO Gear Casing.

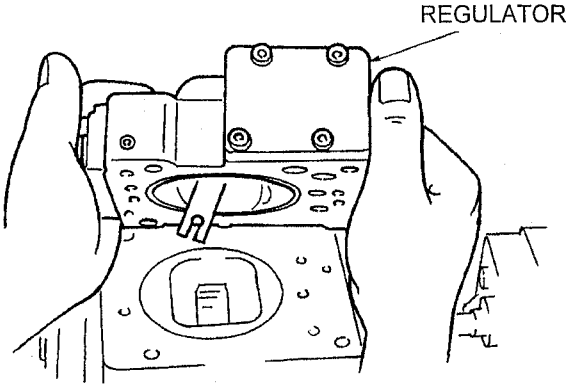


Fig. 1-3 Remove regulator

5) Remove socket bolt (401)
Loosen socket bolts (401) that fasten swash plate support (251), pump casing (271) and valve block (312).
: 14 mm

6) Disassembling the pump casing and the valve block
Place the pump level on a work bench with its mounting surface of the regulator facing down. Then separate pump casing (271) and valve block (312).

- When facing the mounting surface of the regulator down, place a rubber board on a work bench so as not to score the mounting surface.
- When the pump casing has been separated from the valve block, draw out the 1st gear at the same time.

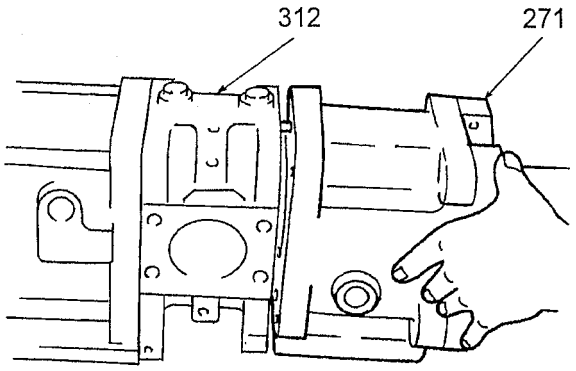


Fig. 1-4 Disassembling the pump casing (271) and the valve block (312)

7) Drawing out the cylinder assy
Draw out cylinder (141) out of pump casing (271) in parallel to shaft (111). At the same time draw out piston (151), plate (153), spherical bushing (156) and cylinder spring (157).

- Use care so as not to score the sliding surface of the cylinder, spherical bushing, shoe and the swash plate .

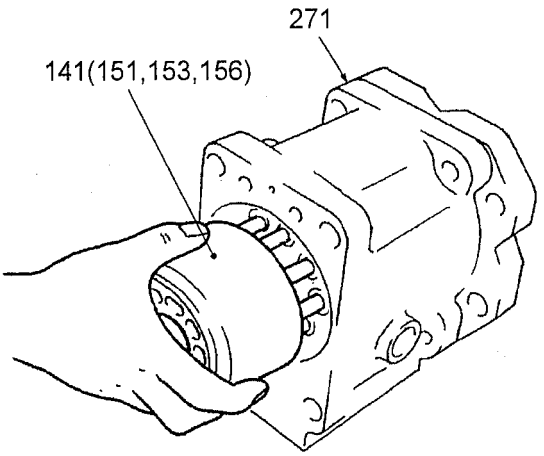


Fig. 1-5 Drawing out the cylinder assy

8) Remove seal cover (F)
Remove socket bolt (406) and seal cover F (261).
: 5 mm

- The seal cover (F) may be drawn out with ease if it is taken out by tightening bolts in the tapped holes (M6 tap) of the seal cover (F).
- An oil seal is fitted to seal cover (F). Therefore, use care so as not to score the oil seal.

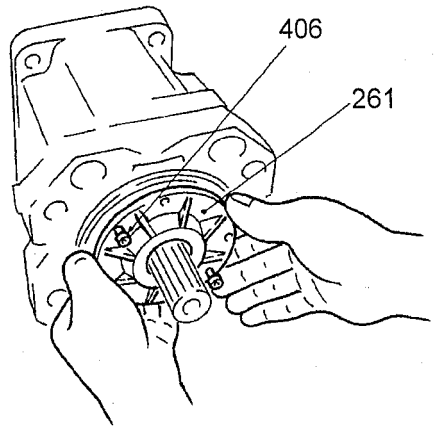


Fig. 1-6 Removing seal cover F (261)

9) Remove seal cover (R)
Remove socket bolt (406) and seal cover R (262).
: 5 mm

10) Separating the swash plate support and the pump casing
Knock lightly on the mounting flange of swash plate support (251) from the pump casing (271) side and separate the swash plate support from the pump casing.

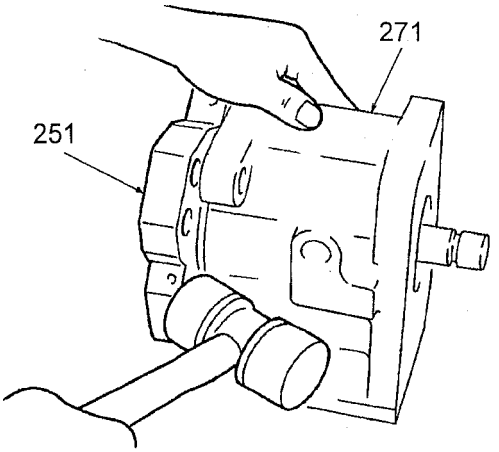


Fig. 1-7 Separating the swash plate (251) support and the pump casing (271)

11) Remove shoe and swash plate
Draw out shoe plate (211) and swash plate (212) from pump casing (271).

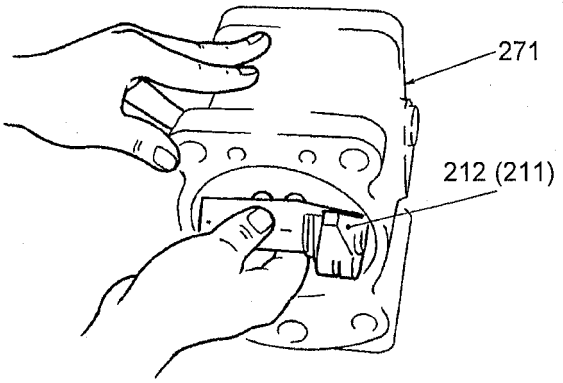


Fig. 1-8 Removing shoe (211) and swash plate (212)

12) Drawing out the shaft
Tap lightly the shaft end (111, 113) by means of a plastic hammer and draw out the shaft from the swash plate support.

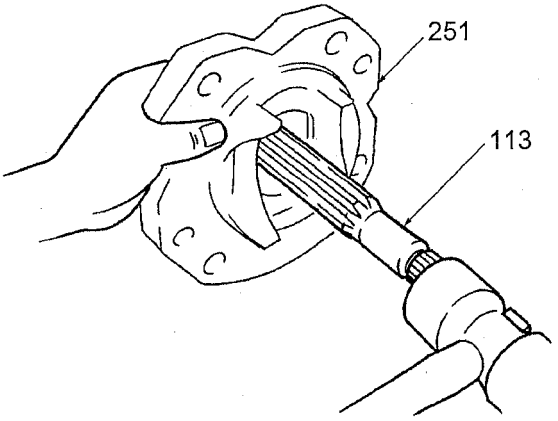


Fig. 1-9 Drawing out the shaft (111), (113)

13) Remove valve plate

Remove valve plate (313, 314) from valve block (312).

- The valve plate may come off during the operation under 6).

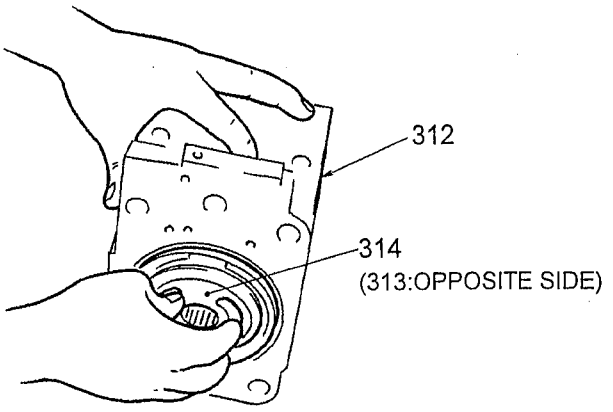


Fig. 1-10 Removing valve plates (313), (314)

14) Remove other parts

If necessary, remove stopper (L) (534), stopper (S) (535), servo piston (532) and tilting pin (531) from pump casing (271), and remove needle bearing (124) from valve block (312).

- When removing the tilting pin, use care so as not to score the head of the tilting pin, using a jig.
- It is hard to separate the tilting pin from the servo piston in some cases as Locktite is coated on the mating part between them. Use care so as not to score the servo piston by applying unreasonable force.
- Do not draw out needle bearings except when their service life has ended..
- Do not loosen hex nuts (808) of valve block (312) and swash plate support (251). A set flow rate changes.

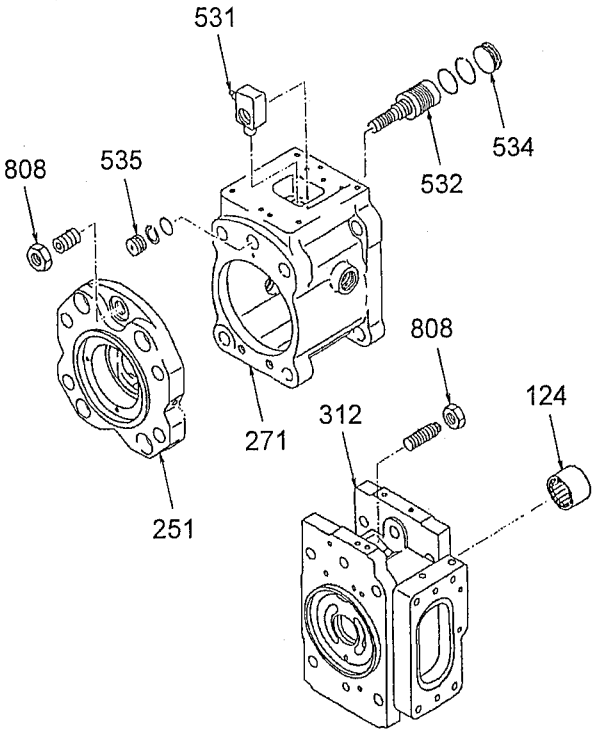


Fig. 1-11 Removing other parts

(8) Installing procedure

1) Preacutions to be exercised in installation

Assembly is a reverse order of disassembly, but notice the following.

1. Repair scored parts at disassembly. Get replacements ready beforehand.
2. Wash parts sufficiently in cleaning oil and dry them with jet air.
3. Do not forget to coat the sliding areas and bearings with clean hydraulic oil.
4. In principle, replace sealing parts such as O rings and oil seals.
5. Tighten socket bolts and plugs to specified torques in this manual, using a torque wrench.
6. Do not mix up front pump parts with rear pump parts.

2) Installing swash plate support

Attach swash plate support (251) to pump casing (271) by tapping the swash plate support lightly with a plastic hammer.

- When the servo piston, the tilting pin, the stopper (L) and the stopper (S) have been removed, install them to the pump casing beforehand.
- When tightening servo piston and tilting pin, use a jig so as not to damage the head of the tilting pin and feedback pin.

  Coat the screwed part with Locktite #262.

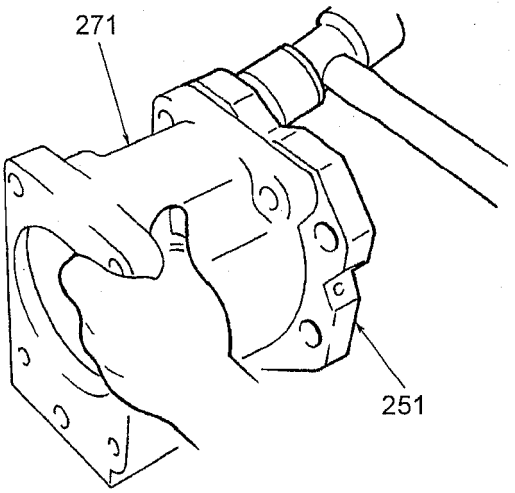


Fig. 1-12 Installing swash plate support (251)

3) Installing swash plate

Place the pump casing with its mounting surface of the regulator facing down, insert the tilting bushing of the swash plate into tilting pin (531), and fit swash plate (212) to swash plate support (251) properly.

- Confirm by the fingers of your both hands that swash plate moves smoothly.
- The shaft be installed easily if grease is applied to the sliding parts of swash plate and swash plate support.

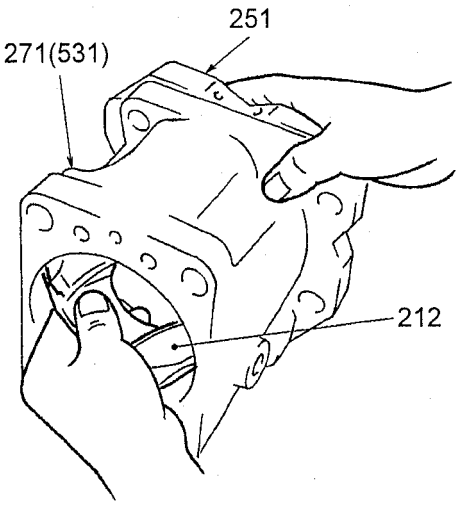


Fig. 1-13 Installing swash plate (212)

4) Installing shaft

Install shaft (111) fitted with bearing (123), bearing spacer (127) and snap ring (824), to swash plate support (251).

- Do not knock on the shaft with a hammer or something.
- Fix the bearing by lightly tapping the outer race of it by means of a plastic hammer and set it exactly to the end by using a steel rod and others.

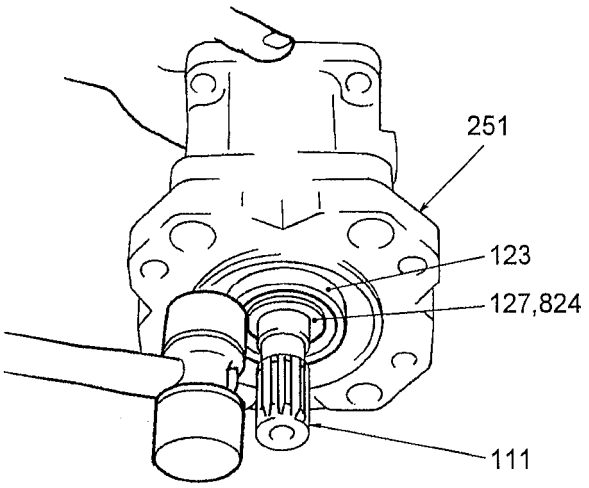


Fig. 1-14 Installing shaft (111)

5) Installing seal cover

Assemble seal cover (F) (261) to pump casing (271) and fix it with socket bolts (406).

: 5 mm

Tightening torque : 1.2 kgf·m (8.7 lbf·ft)

- Coat the oil seal in seal cover (F) with a thin film of grease.
- Handle the oil seal with sufficient care so it is not scored.
- Fit seal cover (R) (262) the same way as above.

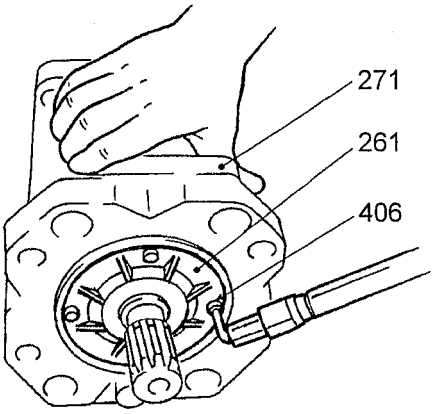


Fig. 1-15 Installing seal cover F (261)

6) Inserting piston cylinder sub

Assemble the piston cylinder sub [cylinder block (141), piston (151), shoe (152), plate (153), spherical bushing (156) and cylinder spring (157)].

Align the spherical bushing with the cylinder spline and insert them into the pump casing.

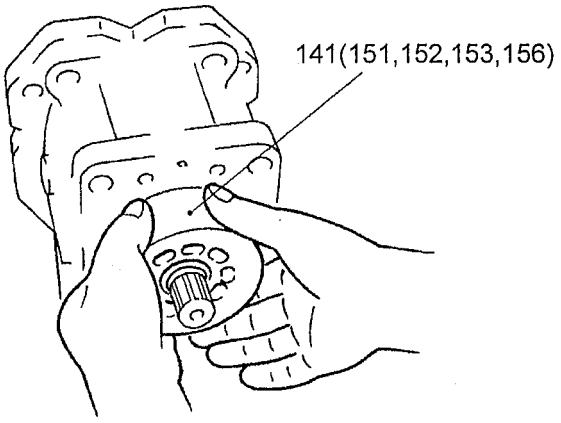


Fig. 1-16 Inserting piston cylinder sub

7) Installing valve plate
Install valve plate (313), (314) to valve block (312) by aligning pin.

- Do not mistake the suction and delivery sides of the valve plate.

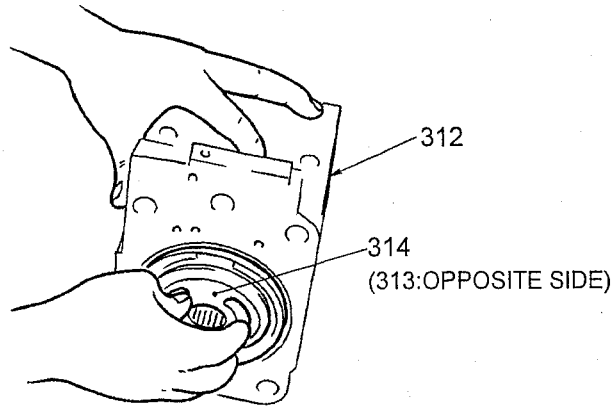


Fig. 1-17 Installing valve plates (313), (314)

8) Installing valve block
Install valve block (312) to pump casing (271) and fasten them together with socket bolts (401).
: 14 mm
Tightening torque : 24 kgf·m (170 lbf·ft)

- Work will be promoted if assembly is started from the rear pump.
- Exercise care so as not to mistake the direction of the valve block (312). (Install it so the regulator comes up as seen from the front side and the suction flange comes on the right.)
- Insert the 1st gear into the valve block beforehand and connect it with the spline of the shaft.

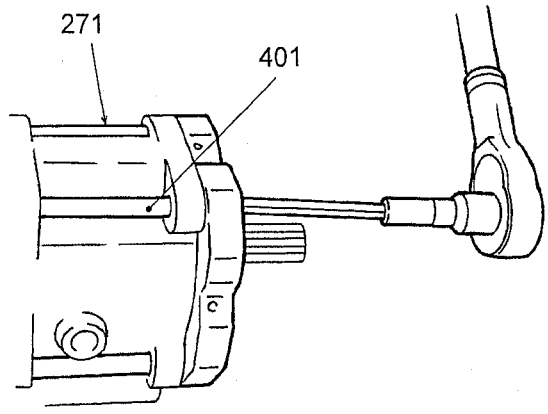


Fig. 1-18 Installing valve block (312)

9) Installing regulator and PTO gear casing
Pinch feedback pin of tilting pin in feedback lever of the regulator and PTO gear casing, install the regulator and fasten socket bolt.
Refer to [415 (See Fig.1-20.), 435[See Fig.1-34.)].

Socket bolt (415) ..... For regulator
: 6mm,
Tightening torque : 3.0 kgf·m (22 lbf·ft)
Socket bolt (435)..... For PTO gear casing
: 8mm,
Tightening torque : 3.4 kgf·m (25 lbf·ft)

- Do not mistake the front regulator for the rear regulator.

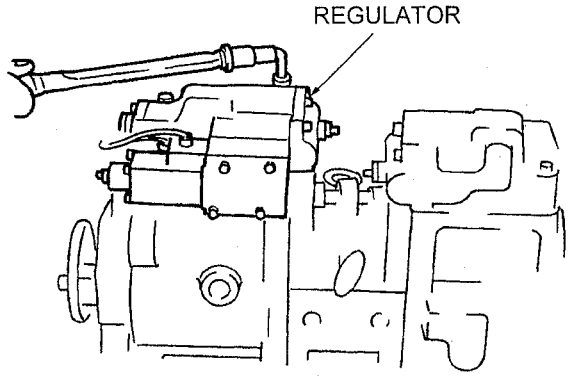


Fig. 1-19 Installing regulator and PTO gear casing

10) Installing drain port plug
The work is complete when drain port VP plugs (467), (468) have been set.
: 27 mm,
Tightening torque : 11 kgf·m (80 lbf·ft)

1.1.3 MAINTENANCE STANDARDS

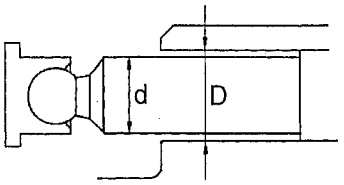
(1) Replacement standards for abrasive parts

Replace or readjust parts that exeed the following standards of wear.

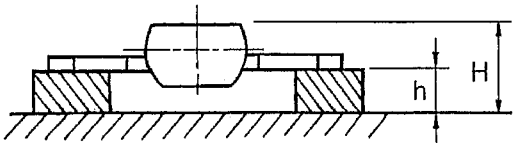
However, always replace such parts that show excessive damage on appearance.

Unit : mm (in)

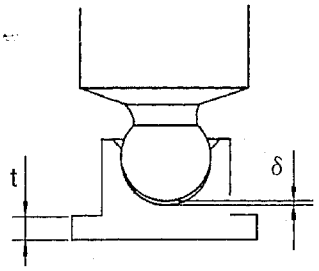
Part name and inspection item	Standard dimension	Recommended value for replacement	Remedy
Clearance between piston and cylinder bore (D–d)	0.028 (0.0011")	0.056 (0.0022")	Replace piston or cylinder.
Gap between piston and caulked part of shoe (δ)	0~0.1 (0.004")	0.3 (0.012")	Replace piston shoe assy.
Thickness of shoe (t)	3.9 (0.154")	3.7 (0.146")	Replace piston shoe assy.
Free height of cylinder spring (L)	31.3 (1.23")	30.2 (1.19")	Replace cylinder spring .
Combined height of retainer plate and spherical bushing (H–h)	10.5 (0.413")	9.8 (0.386")	Replace a set of spherical bushing or retainer plate.



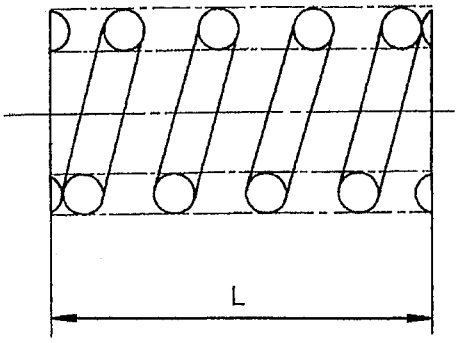
Clearance between piston and cylinder bore: D—d



Combination of retainer plate and spherical bushing Height=H—h



Gap between piston and shoe : δ
thickness of shoe: t



Free height of cylinder spring: L

(2) Repair standards for cylinder, valve plate and swash plate (shoe plate face)

Valve plate (sliding section) Swash plate (shoe plate face) Cylinder (sliding section) Roughness of each surface	Surface roughness requiring correction	3-Z
	Standard surface roughness (correction value)	Less than 0.4Z (lapping)

1.1.4 TROUBLESHOOTING

(1) Locating causes of troubles

The pump is usually fitted with a regulator, auxiliary valves and auxiliary pumps, and this makes fault location extremely difficult. However, faults would be found out easily if the following check items were attended to.

1) Inspecting the filter and drain oil

Inspect the filter element to check for abnormal contaminations. Some metallic particles will be deposited on it as the shoe and the cylinder wear off. In case metallic particles are found in large quantity, the elements may be damaged. In that case check the drain oil in the pump casing as well.

2) Checking for abnormal vibration and sound

Check that the pump does not vibrate and make an abnormal sound.

Check that the hunting of the regulator and the attached valve's relief valve are of regular frequency. In case vibration and sound are abnormal, the pump may be making a cavitation or internally broken.

3) When two pumps are used

In case two single pumps or motors are used or when a double pump is used. change pump pipelines. This will make clear that the pumps are faulty or the circuit after the pumps is faulty.

4) Pressure measurements

If the problem is related to control functions, avoid disassembling the pumps carelessly, but look for causes by measuring pressures.

(2) Troubleshooting

1) Overloading to engine

Cause	Remedy	Remarks
1. Revolution and pressure are higher than set values.	1) Set pressure to specified value.	
2. Regulator torque is set higher than normal.	2) Readjust regulator.	2) Refer to Regulator Manual.
3. Pump's internal parts are seized or broken.	3) Replace damaged parts.	3) Check filter and drain oil to see if abnormal wear particles are present.
4. Regulator is piped incorrectly.	4) Pipe regulator correctly.	

(2) Pump's oil flow rate is extremely low and delivery pressure is not available.

Cause	Remedy	Remark
1. Regulator is out of order	1) Repair regulator.	1) Refer to Regulator Manual.
2. Pump's internal parts are seized or broken.	2) Replace damaged parts.	2) Check filter and drain oil.
3. Attached pump is out of order.	3) Replace damaged parts.	3) Remove attached pump and check shaft joint.
4. Attached valve is out of order.	4) Check attached valve. Particularly poppet, seat and spring.	4) Refer to Manual for Attached Valve.
5. Regulator is piped incorrectly.	5) Pipe correctly.	

(3) Abnormal Sound and Vibration

Cause	Remedy	Remark
1. Cavitation	1) Prevent cavitation. Check that hydraulic oil is not clouded.	1-1) The boost pressure is low. 1-2) The attached pump is in trouble. 1-3) The suction pipe is inhaling air. 1-4) The suction resistance is high.
2. Caulked part of shoe is broken.	2) Replace piston shoe and shoe plate.	
3. Cylinder is cracked	3) Replace cylinder.	
4. Pump is installed improperly.	4) Correct installation.	
5. Regulator is hunting.	5) Repair regulator,	5) See Regulator Manual.
6. Relief valve in attached valve is hunting.	6) Repair attached valve.	6) See the Manual for Attached Valve.