

## GROUP 3 PUMP DEVICE

### 1. REMOVAL AND INSTALL

#### 1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (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.**

- (4) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

· Hydraulic tank quantity : 96 l (25.4 U.S. gal)

- (5) Remove socket bolts (11) and disconnect hoses (1,2).

- (6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10).

- (7) Remove socket bolts (12) and disconnect pump suction pipe (4).

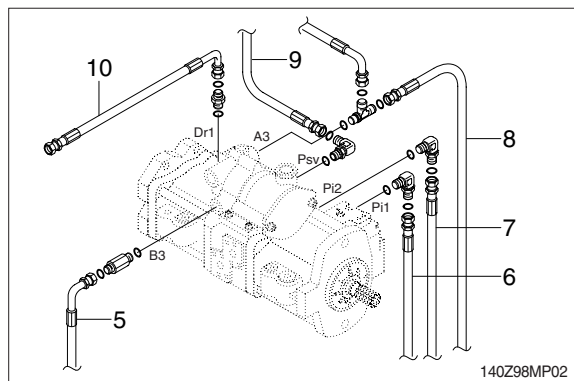
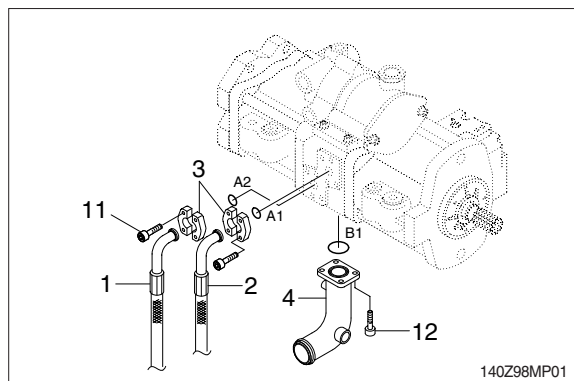
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (8) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 90 kg (200 lb)

※ Pull out the pump assembly from housing.

When removing the pump assembly, check that all the hoses have been disconnected.

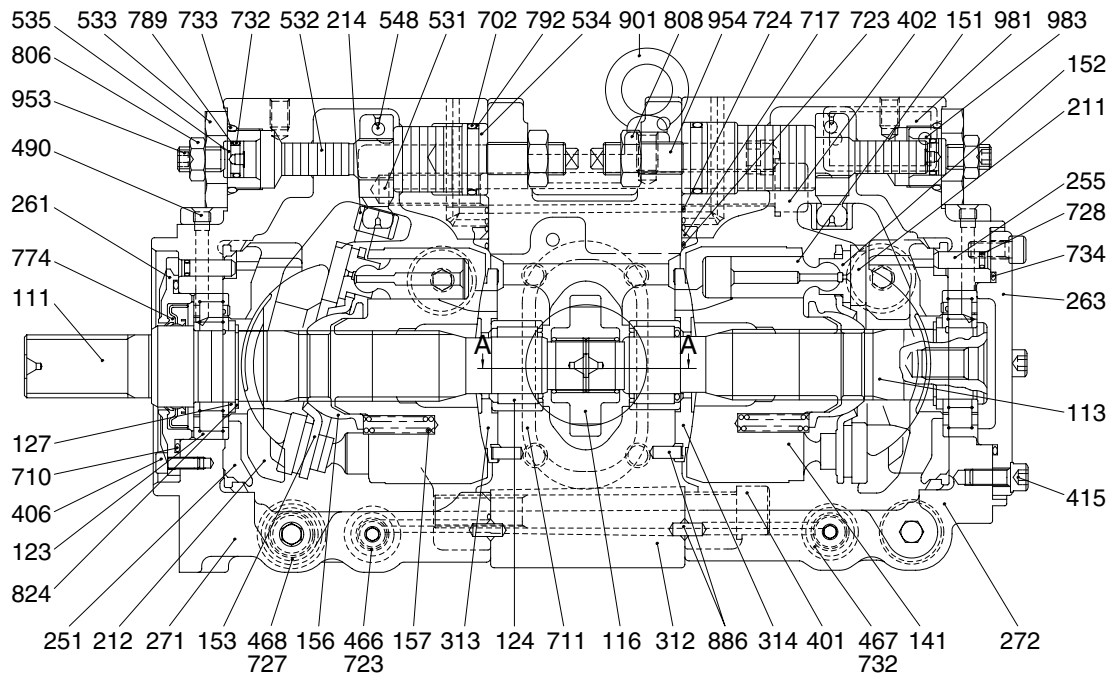


## 2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Remove the suction strainer and clean it.
- (3) Replace return filter with new one.
- (4) Remove breather and clean it.
- (5) After adding oil to the hydraulic tank to the specified level.
- (6) Bleed the air from the hydraulic pump.
  - ① Remove the air vent plug (2EA).
  - ② Tighten plug lightly.
  - ③ Start the engine, run at low idling, and check oil come out from plug.
  - ④ Tighten plug.
- (7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.
- (8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

## 2. MAIN PUMP (1/3)

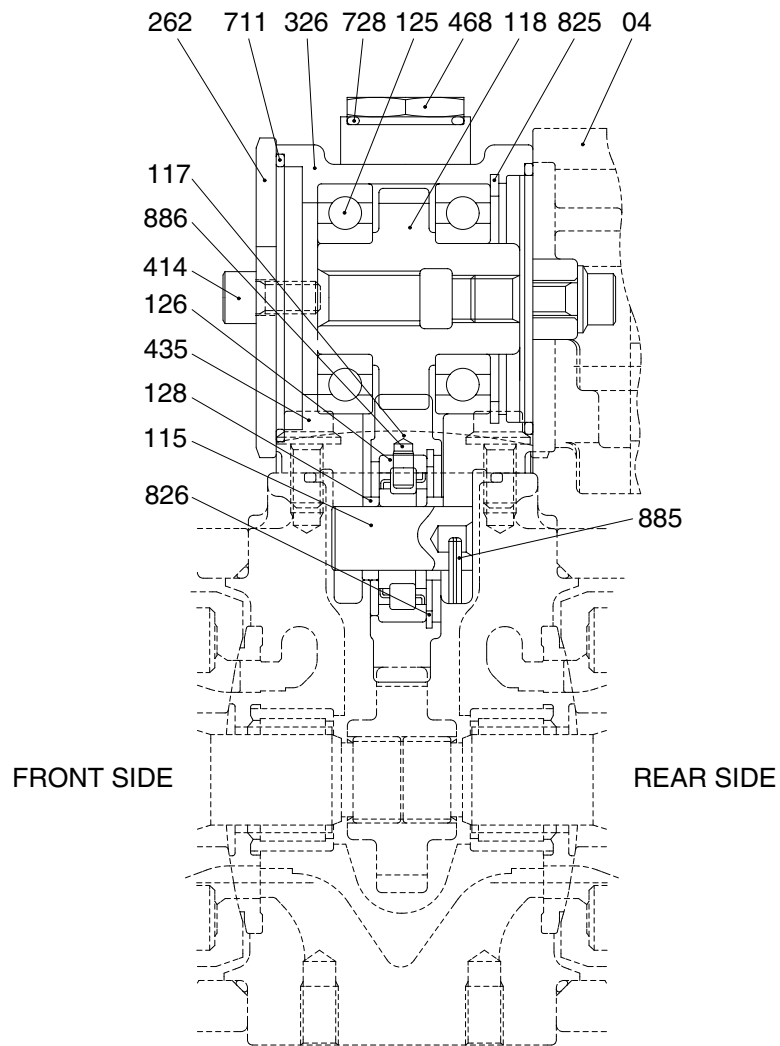
### 1) STRUCTURE



140Z92MP02

111	Drive shaft (F)	272	Pump casing (R)	711	O-ring
113	Drive shaft (R)	312	Valve block	717	O-ring
116	1st Gear	313	Valve plate (R)	723	O-ring
123	Roller bearing	314	Valve plate (L)	724	O-ring
124	Needle bearing	401	Hexagon socket bolt	728	O-ring
127	Bearing spacer	402	Hexagon socket bolt	732	O-ring
141	Cylinder block	406	Hexagon socket bolt	733	O-ring
151	Piston	415	Hexagon socket bolt	734	O-ring
152	Shoe	466	Plug	774	Oil seal
153	Set plate	467	plug	789	Back up ring
156	Bushing	468	Plug	792	Back up ring
157	Cylinder spring	490	Plug	806	Nut
211	Shoe plate	531	Tilting pin	808	Hexagon head nut
212	Swash plate	532	Servo piston	824	Snap ring
214	Bushing	533	Plug	886	Spring pin
251	Support	534	Stopper (L)	901	Eye bolt
255	Lock pin	535	Stopper (S)	953	Set screw
261	Seal cover (F)	548	Pin	954	Set screw
263	Seal cover (R)	702	O-ring	981	Plate
271	Pump casing (F)	710	O-ring	983	Pin

## MAIN PUMP (2/3)



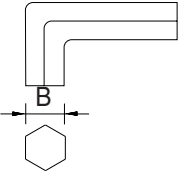
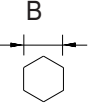
140Z92MP03

04	Gear pump	128	Bearing spacer	711	O-ring
115	Shaft	262	Cover	728	O-ring
117	Gear No. 2	326	Gear case	825	Retainer ring
118	Gear No. 3	414	Hexagon socket bolt	826	Retainer ring
125	Ball bearing	435	Flange socket bolt	885	Spring pin
126	Roller bearing	468	Plug	886	Pin

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

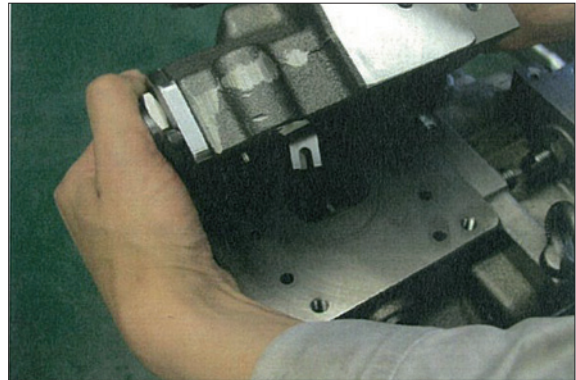
Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	ROH/VP/UNF plug (PF screw)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/8	-	M10
	6	M 8	BP-1/4	PF-1/4	M12, M14
	8	M10	BP-3/8	PF-3/8	M16, M18
	10	M12	BP-1/2	PF-1/2	M20
	14	M16, M18	BP-3/4	PF-3/4	-
	17	M20, M22	BP-1	PF-1	-
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon bolt	Hexagon nut	VP plug (PF screw)	
	19	M12	M12	PF-1/4	
	24	M16	M16	-	
	27	M18	M18	PF-1/2	
	30	M20	M20	-	
	41	-	-	-	PF-1
Adjustable angle wrench		Medium size, 1 set			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		Steel bar of key material approx. 10 × 8 × 200			
Torque wrench		Capable of tightening with the specified torques			

**(2) Tightening torque**

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
PT Plug (material : S45C) ※ Wind a seal tape 1.5 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S45C)	PF 1/4	3.0	21.7	0.24	6
	PF 3/8	7.55	54.6	0.31	8
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

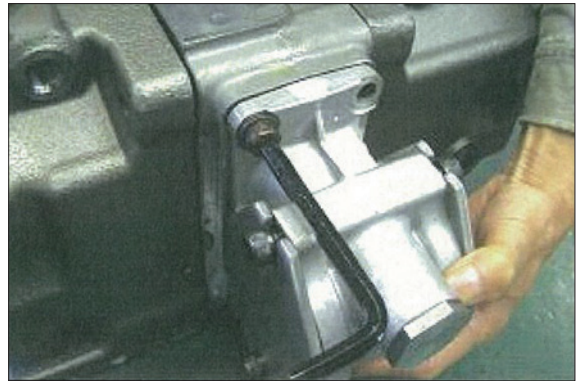
### 3) DISASSEMBLY

- (1) Select place suitable to disassembling.
  - ※ Select clean place.
  - ※ Spread rubber sheet, cloth or so on overhaul workbench top to prevent parts from being damaged.
- (2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.
- (3) Remove drain port plug (468) and drain oil pump casing (271, 272).
- (4) Remove hexagon socket head bolts (412, 413) and remove regulator.



140Z98MP11

- (5) Place pump horizontally on workbench with its regulator fitting surface down, and remove flange socket (435) and remove PTO unit (05).
  - ※ Be careful about the attaching direction of the PTO unit (05).
  - ※ Before bringing regulator fitting surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



140Z98MP12

- (6) In case the pump is provided without the PTO unit (05), remove the cover (326) with the hexagon socket head cap screws (414).



140Z98MP13

- (7) Remove flange socket (435) and remove gear pump (04).



140Z98MP14

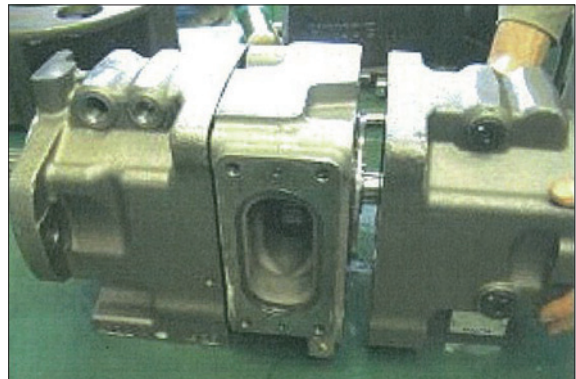
- (8) Loosen hexagon socket head bolt (401) which tighten pump casing (271, 272) and valve block (312).



140Z98MP15

- (9) Place pump horizontally on workbench with its regulator fitting surface down, and separate pump casing (271,272) from valve block (312).

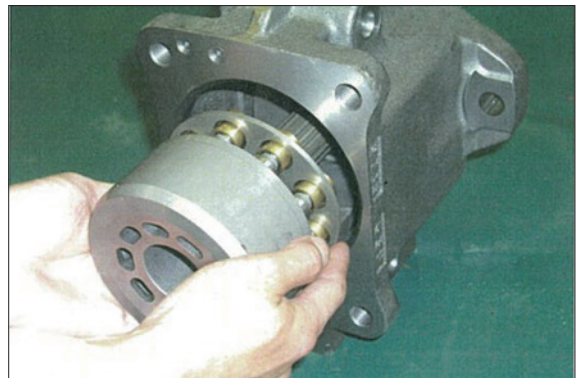
- ※ Remove 1st gear (116) when separating pump casing from valve block (312) too.



140Z98MP16

- (10) Pull out cylinder (141), pistons (151), set screw (153), spherical bush (156) and cylinder springs (157) simultaneously from pump casing (271, 272) straightly over drive shaft (111, 113).

- ※ Take care not to damage sliding surface of cylinder (141), spherical bush (156), shoes (152), swash plate (212), etc.

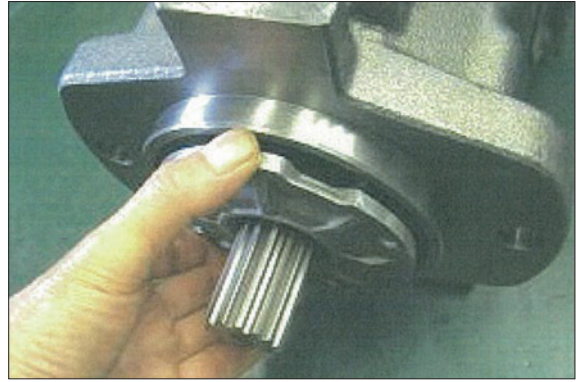


140Z98MP17

(11) Remove hexagon socket head bolts (406) and then seal cover (F, 261).

※ In the case removing it is difficult, and hooking pull thin rod into notch, and the cover can be removed easily.

※ Since oil seal is fitted on seal cover (F) (261), take care not to damage it at removing the cover.



140Z98MP18

(12) Tapping shaft ends of drive shaft (111, 113) lightly with plastic hammer, remove it from pump casing (271, 272).



140Z98MP19

(13) Remove shoe plate (211) and swash plate (212) from pump casing (271, 272).



140Z98MP20

(14) Insert thin steel bar into the hole and remove the lock pin (255) from pump casing (271, 272).

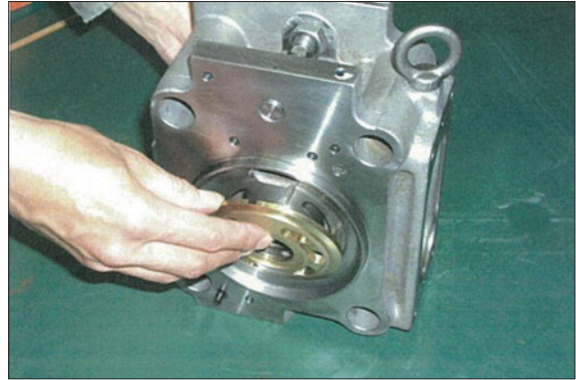
※ When holding with thin steel bar, do not confuse the unlocking hole with the arc shaped oil passage.



140Z98MP21

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

※ These may be removed in Work 8.



140Z98MP22

If necessary, remove stopper (L) (534), Qmin. plug (533), servo piston (532) and tilting pin (531) from pump casing (271, 272), and needle bearing (124) from valve block.

- ※ When removing tilting pin, use a protector to prevent pin head from being damaged.
- ※ Since lock tight is applied to fitting areas of tilting pin (531) and servo piston (532), take care not to damage servo piston (532).
- ※ Do not remove needle bearing (124) as far as possible, except the case that considered to be out of its life span.
- ※ Do not loosen hexagon nuts of valve block (312) and Qmin. plug (533).  
If loosened, flow setting will be changed.

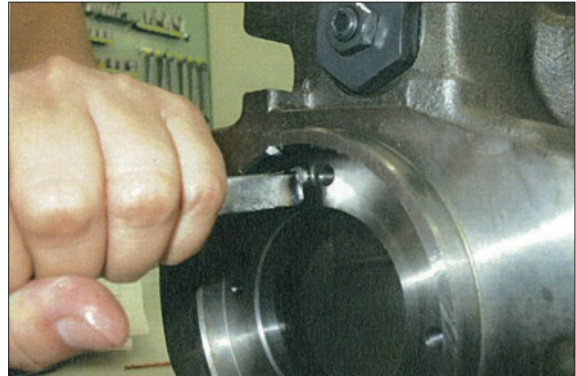
#### 4) ASSEMBLY

(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

- ① Do not fail to repair the parts damaged during disassembling, and repair replacement parts in advance.
- ② Clean each part fully with cleaning oil and dry it with compressed air.
- ③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.
- ④ In principle, replace seal parts, such as O-rings, oil seals, etc.
- ⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.
- ⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

(2) Insert the lock pin (255) after the swash plate support (251) into the pump casing (271, 272), and fit the lock pin (255) into the hole of the swash plate support (251).

- ※ In case the servo piston, tilting pin, stopper (L), stopper (S), and Qmin. plug have been removed, attached then to the pump casing in advance.
- ※ In the tightening work of the servo piston and the tilting pin, use the tool not to damaged the head of the tilting pin and the feed back pin. Besides, apply loctite (of medium strength) to the thread portion.



140Z98MP23

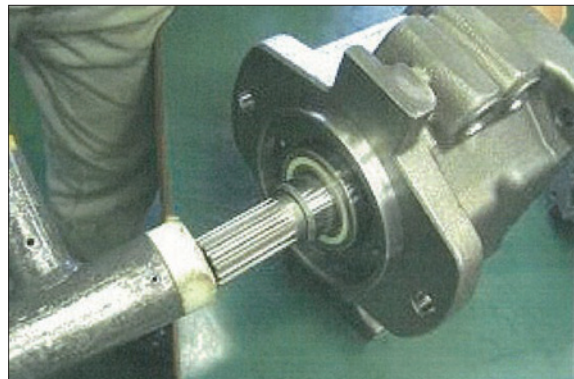
(3) Fit tilting bush (214) of swash plate (212) to tilting pin (531), and fit swash plate (212) with shoe plate (211) to swash plate support (251) correctly.

- ※ Confirm with fingers of both hands that swash plate can be removed smoothly.
- ※ Apply grease to sliding sections of swash plate (212) and swash plate support (251), and drive shaft (111, 113) can be fitted easily.
- ※ Take care not to damage shoe plate (211) surface.



140Z98MP24

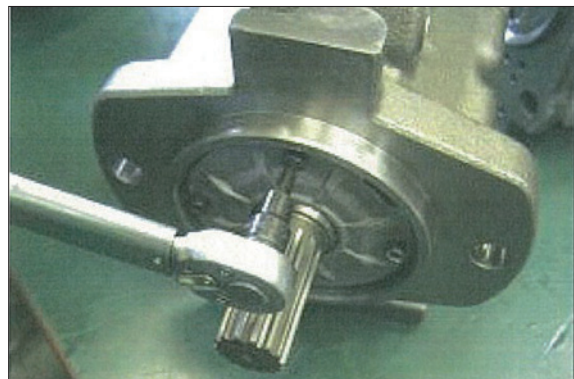
(4) To pump casing (271, 272), fit drive shaft (111, 113) set with bearing (123), bearing spacer (127) and stop ring (824).



140Z98MP25

(5) In assemble of front pump, assemble seal cover (F) (261) to pump casing (271) and fix it with hexagon socket head bolt (406).

- ※ Apply grease lightly to oil seal in seal cover (F) (261).
- ※ For assemble oil seal (774), taking full care not to damage it.



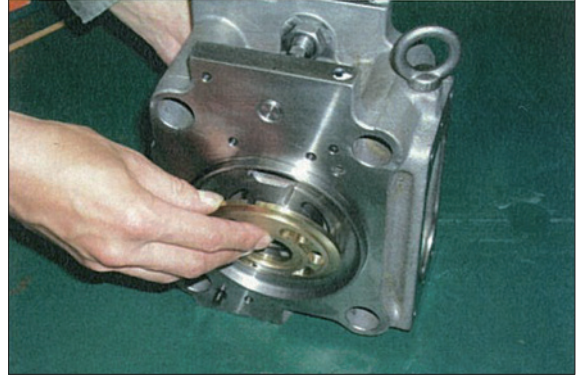
140Z98MP26

(6) Assemble piston cylinder subassembly [cylinder (141), piston subassembly (151, 152), set plate (153), spherical bush (156) and cylinder spring (157)]. Fitting spline phases of cylinder, spherical bush (156) and drive shaft (111, 113), insert piston cylinder subassembly into pump casing (271, 272).



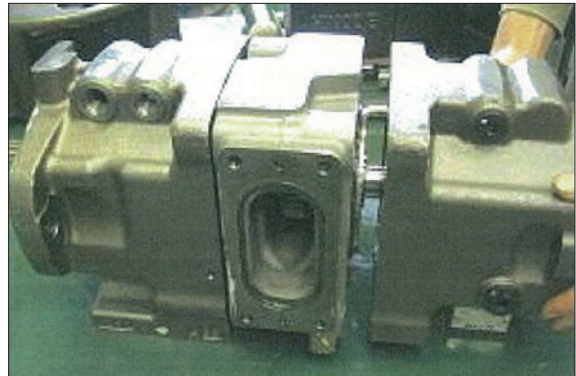
140Z98MP27

- (7) Fit valve plate (313, 314) to valve block (312), spring pin (886) into pin hole.  
※ Take care not to mistake suction/delivery direction of valve plate (312).



140Z98MP28

- (8) Place pump horizontally on workbench with its regulator fitting surface down, and attach pump casing (271, 272) to valve block (312). Fit 1st gear (116) simultaneously.  
※ Before bringing regulator fitting surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.  
※ Take care not to mistake direction of valve block (312). [Clockwise rotation (viewed from input shaft side)]. Fit the valve block (312) with suction flange left when regulator side below, viewed from front side.



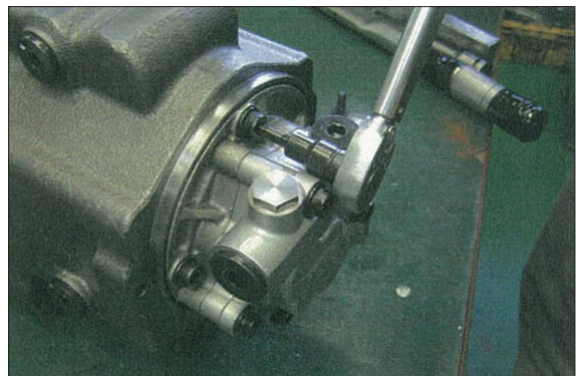
140Z98MP29

- (9) Fix valve block (312) to pump casing (271, 272) with hexagon socket head bolts (401).



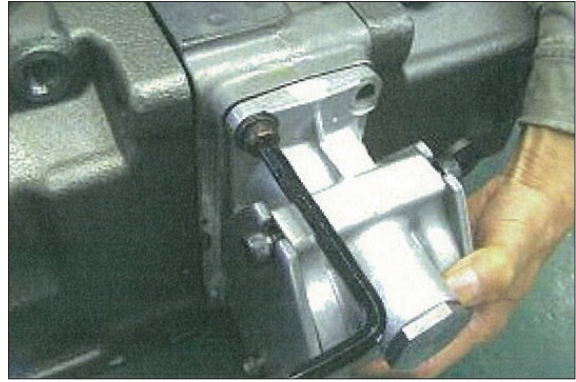
140Z98MP30

- (10) Fit gear pump (04) to pump casing (272) with hexagon socket head bolts (435).



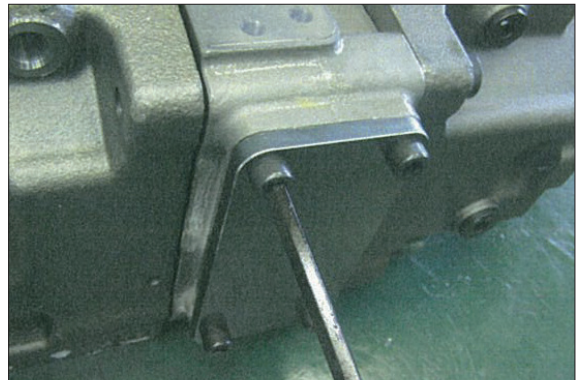
140Z98MP31

- (11) Attach the PTO unit (05) by fastening the flange socket (435) to the valve block (312).



140Z98MP32

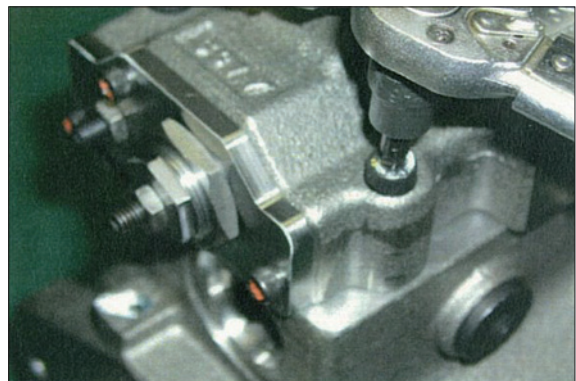
- (12) In case the pump is not provided with the PTO unit (05), attach the cover (326) with the hexagon socket head cap screw (414).



140Z98MP33

- (13) Putting feedback lever (611) of regulator into feedback pin (548) of tilting pin (531), fit regulator with hexagon socket head bolt (415).

※ Take care not to mix up regulator of front pump and that of rear pump.

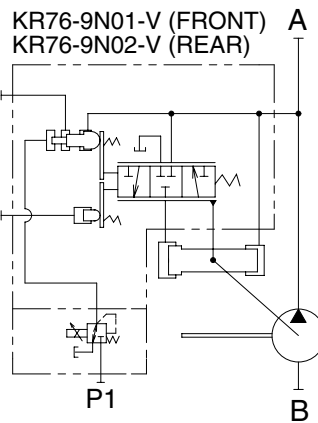
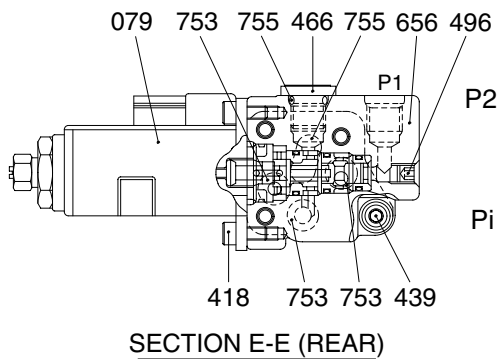
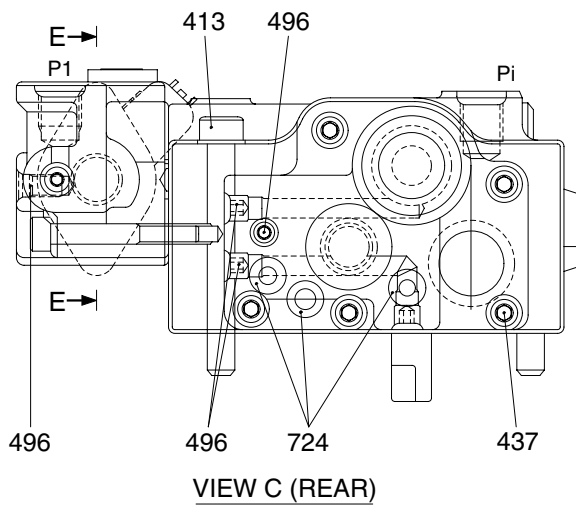
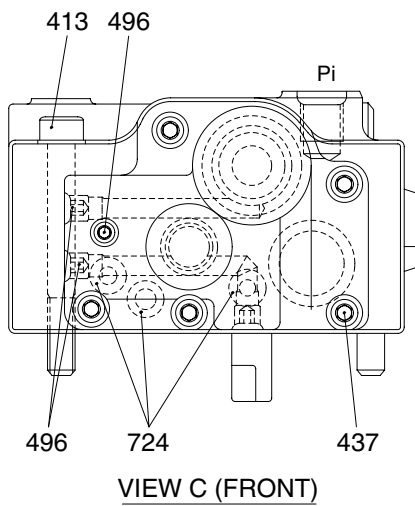
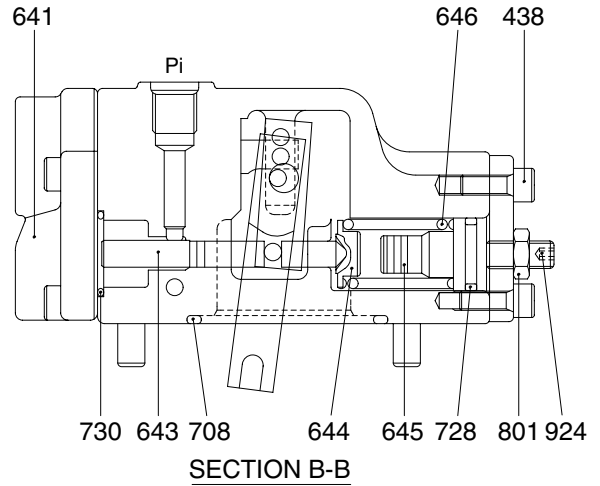
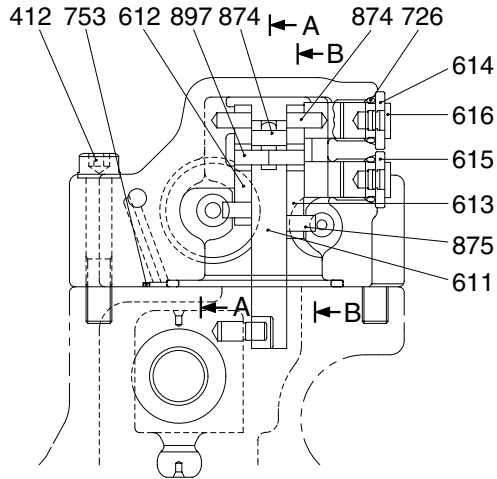


140Z98MP34

- (14) Fit drain port plug (468).  
This is the end of reassembling procedures.

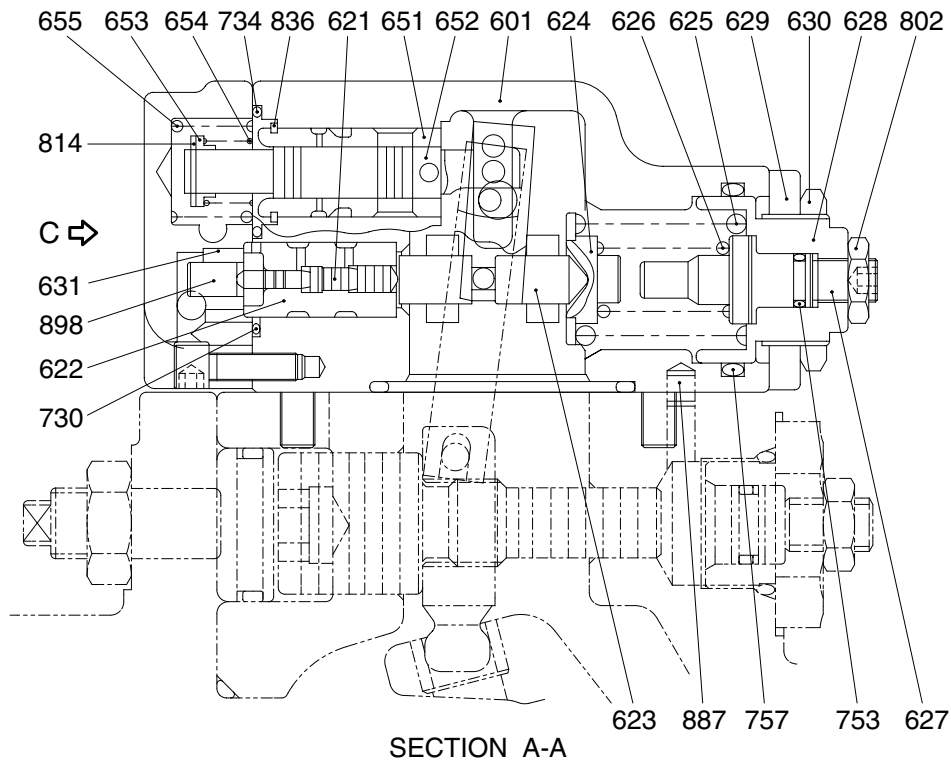
### 3. REGULATOR

#### 1) STRUCTURE (1/2)



140Z92MP04

## REGULATOR (3/3)



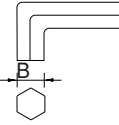

140Z92MP05

079	EPPR valve assembly	624	Spring seat (C)	708	O-ring
412	Hexagon socket screw	625	Outer spring	724	O-ring
413	Hexagon socket screw	626	Inner spring	725	O-ring
418	Hexagon socket screw	627	Adjust stem (C)	728	O-ring
437	Hexagon socket screw	628	Adjust screw (C)	730	O-ring
438	Hexagon socket screw	629	Cover (C)	734	O-ring
439	Hexagon socket screw	630	Lock nut	753	O-ring
466	Plug	631	Sleeve, Pf	755	O-ring
496	Plug	641	Pilot cover	757	O-ring
601	Casing	643	Pilot piston	801	Nut
611	Feed back lever	644	Spring seat (Q)	802	Nut
612	Lever (1)	645	Adjust stem (Q)	814	Snap ring
613	Lever (2)	646	Pilot spring	836	Snap ring
614	Center plug	651	Sleeve	874	Pin
615	Adjust plug	652	Spool	875	Pin
616	Plug	653	Spring seat	887	Pin
621	Compensator piston	654	Return spring	897	Pin
622	Piston case	655	Set spring	898	Pin
623	Compensator rod	656	Block cover	924	Set screw

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M5	BP-1/16	-	M 8
	5	M6	BP-1/8	-	M10
	6	M8	BP-1/4	PO-1/4	M12, M14
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon head bolt	Hexagon nut	VP plug (PF thread)	
	6	M 8	M 8	-	
Adjustable angle wrench		Small size, Max 36 mm			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		4 × 100 mm			
Torque wrench		Capable of tightening with the specified torques			
Pincers		-			
Bolt		M4, Length : 50 mm			

**(2) Tightening torque**

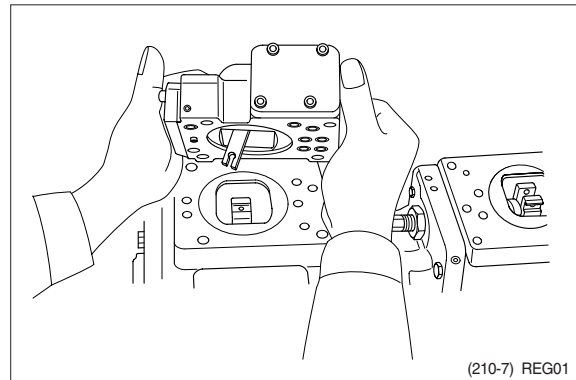
Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S35C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

### 3) DISASSEMBLY

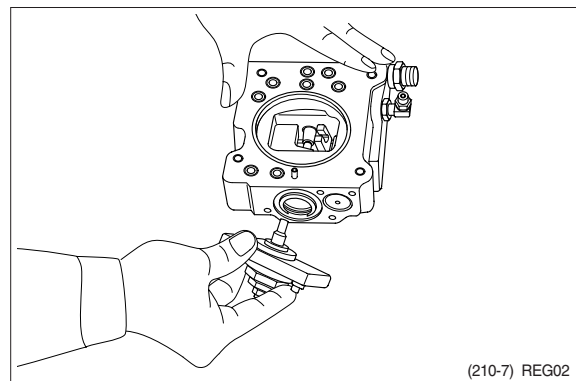
Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

For this reason, replacement of a regulator assembly is recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

- (1) Choose a place for disassembly.
  - ※ Choose a clean place.
  - ※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.
- (2) Remove dust, rust, etc. from surfaces of regulator with clean oil.
- (3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.
  - ※ Take care not to lose O-ring.



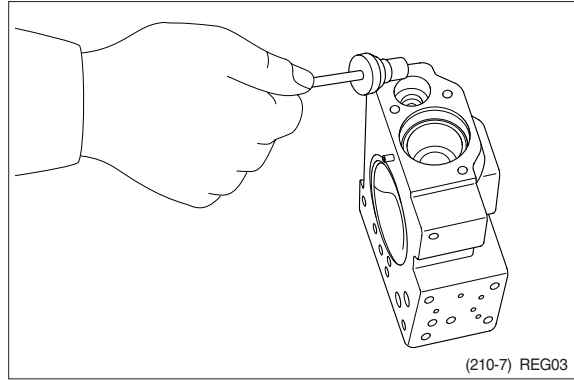
- (4) Remove hexagon socket head screw (438) and remove cover (C,629)
  - ※ Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
  - ※ Do not loosen these screws and nuts. If they are loosened, adjusted pressure-flow setting will vary.



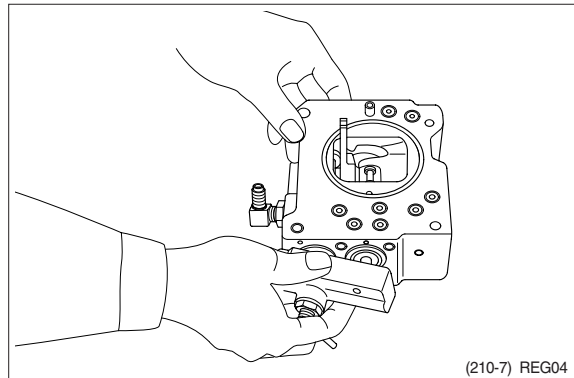
- (5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.

Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

- ※ Adjusting ring (Q,645) can easily be drawn out with M4 bolt.

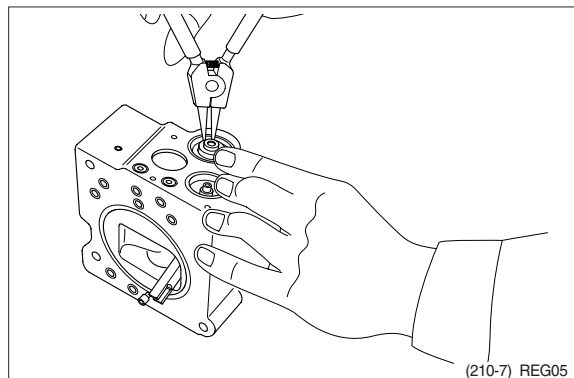


- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641). After removing pilot cover, take out set spring (655) from pilot section.



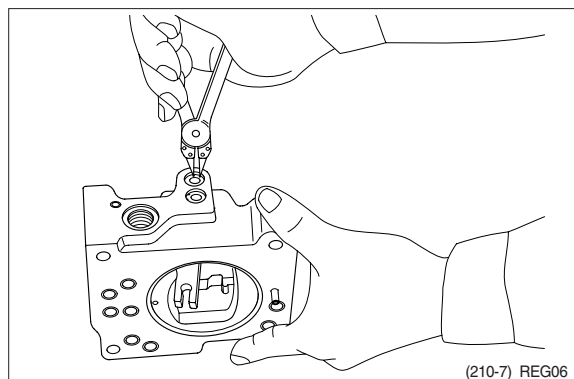
- (7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).

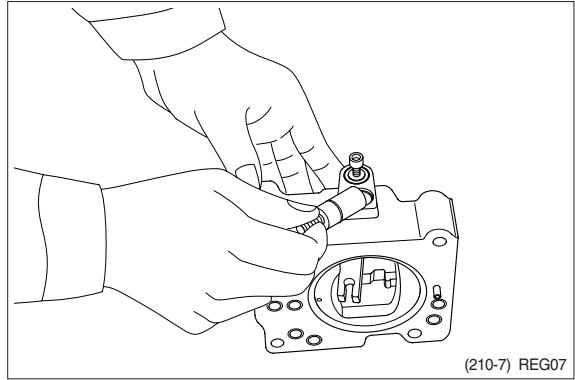
- ※ Sleeve (651) is fitted with snap ring (836).
- ※ When removing snap ring (814), return spring (654) may pop out. Take care not to lose it.



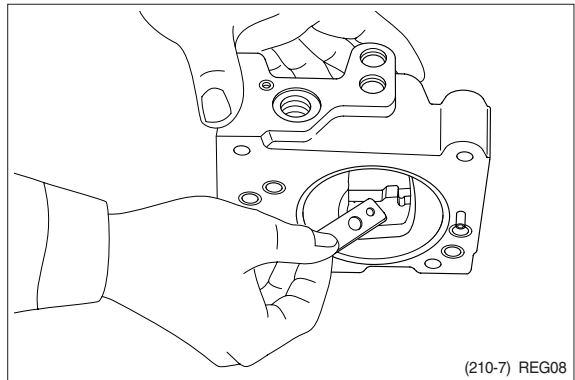
- (8) Remove prevention plug (616) and take out center plug (614) and adjusting plug (615).

- ※ Center plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.

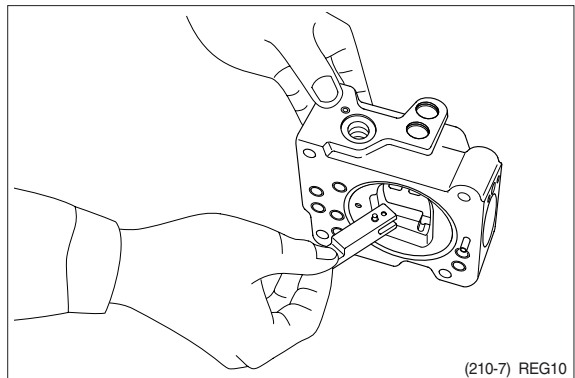
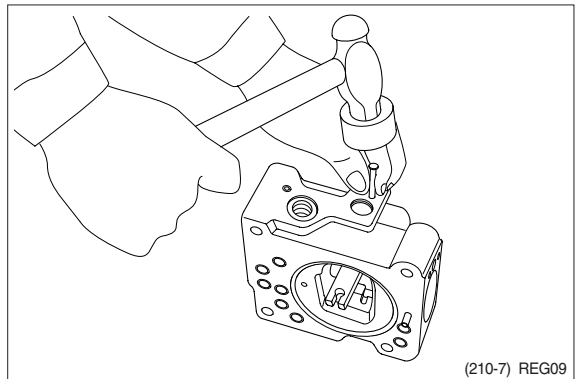




- (9) Remove lever (2, 613). Do not draw out pin (875).  
※ Work will be promoted by using pincers or so on.



- (10) Draw out pin (874) and remove feedback lever (611).  
Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever (1, 612).



- (11) Remove lever (1, 612). Do not draw out pin (875).
  - (12) Draw out pilot piston (643) and spool (652).
  - (13) Draw out piston case (622), compensating piston (621) and compensating rod (623).
- ※ Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

This completes disassembly.

#### 4) ASSEMBLY

(1) For assembly, reverse disassembly procedures, but pay attention to the following items.

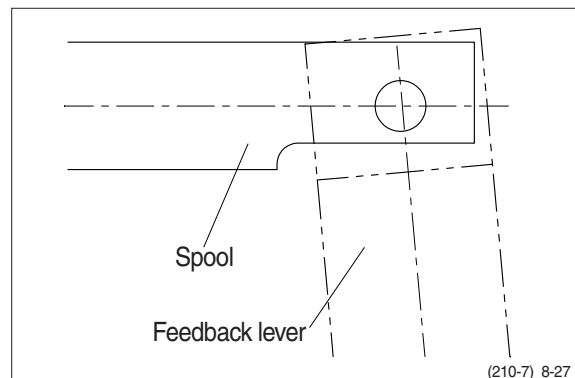
- ① Always repair parts that were scored at disassembly.
- ② Get replacement parts ready beforehand.  
Mixing of foreign matter will cause malfunction.  
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.
- ③ Always tighten bolts, plugs, etc. to their specified torques.
- ④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.
- ⑤ Replace seals such as O-ring with new ones as a rule.

(2) Put compensating rod (623) into compensating hole of casing (601).

(3) Put pin force-fitted in lever (1, 612) into groove of compensating rod and fit lever (1) to pin force-fitted in casing.

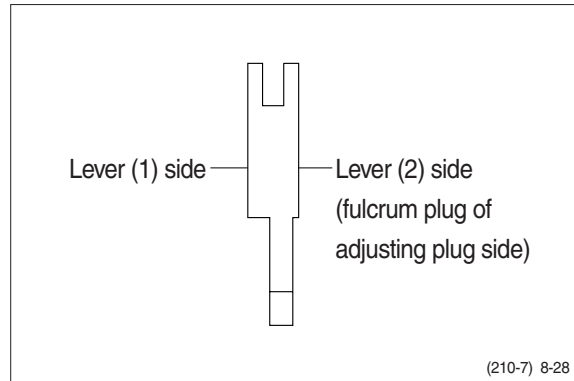
(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

- ※ Confirm that spool and sleeve slide smoothly in casing without binding.
- ※ Pay attention to orientation of spool.



(5) Fit feedback lever (611), matching its pin hole with pin hole in spool.  
Then insert pin (874).

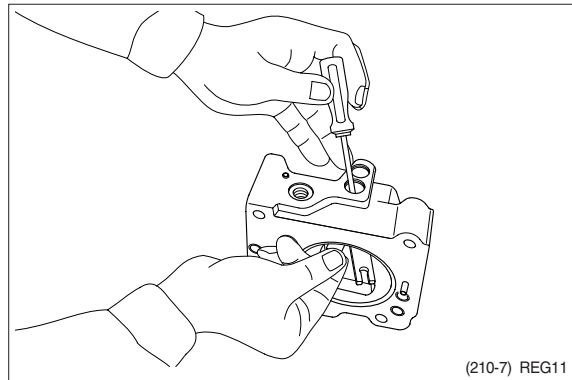
- ※ Insert pin in feedback lever a little to ease operation.
- ※ Take care not to mistake direction of feedback lever.



(6) Put pilot piston (643) into pilot hole of casing.

- ※ Confirm that pilot piston slides smoothly without binding.

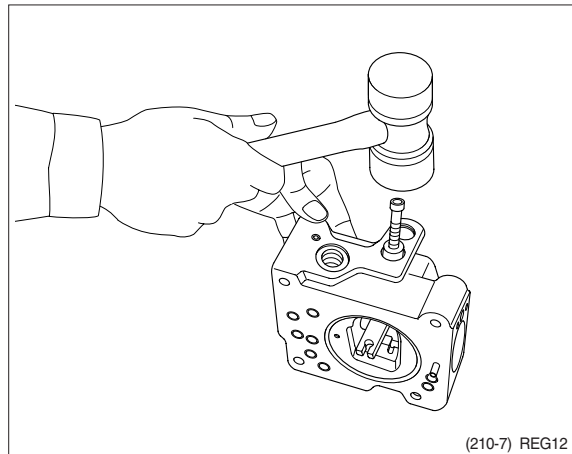
(7) Put pin force-fitted in lever (2, 613) into groove of pilot piston.  
Then fix lever (2).



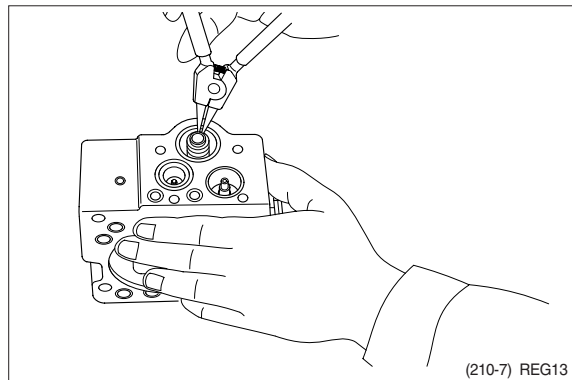
(8) Fit center plug (614) so that pin force-fitted in center plug (614) can be put into pin hole of lever (2).  
Then install prevention plug (858).

(9) Insert adjusting plug (615) and fit locking ring.

- ※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.  
At this point in time move feedback lever to confirm that it has no large play and is free from binding.

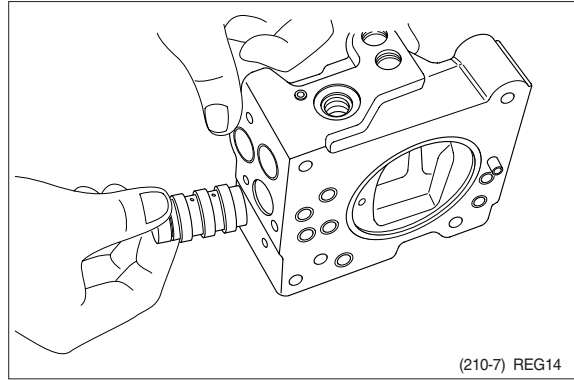


(10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



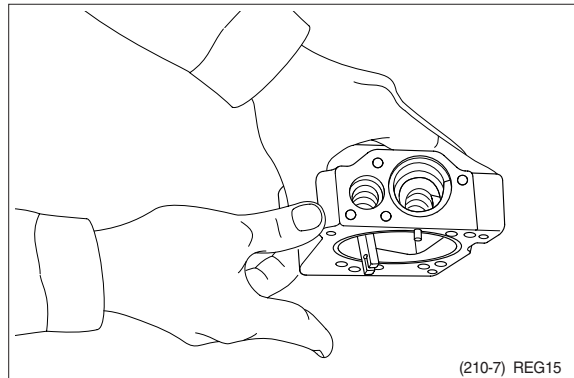
- (11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.

Fit pilot cover (641) and tighten it with hexagonal socket head screws (437, 438).



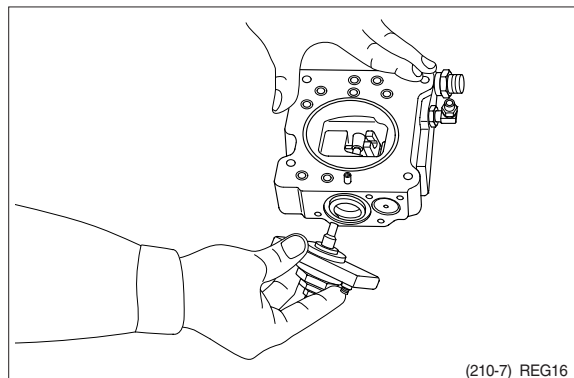
- (12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole. Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

※ When fitting spring seat, take care not to mistake direction of spring seat.



- (13) Install cover (C, 629) fitted with adjusting screws (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

Then tighten them with hexagonal socket head screws (438).



This completes assembly.