1. REMOVAL AND INSTALL

1) REMOVAL

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

(2) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

· Hydraulic tank quantity : 670 ℓ

(4) Remove the wirings for the pressure sensors and so on.

(5) Remove socket bolts (1) and disconnect hose (3).

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

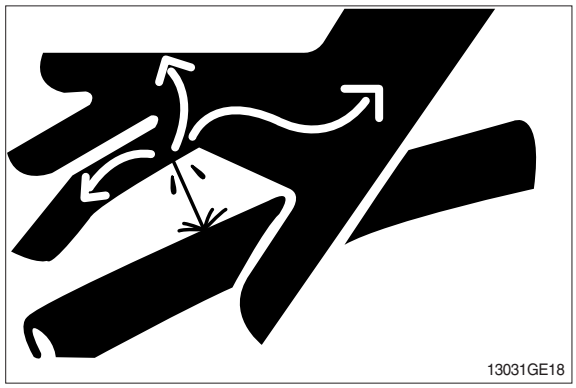
(7) Remove bolts (4) and disconnect pump suction tube (2).

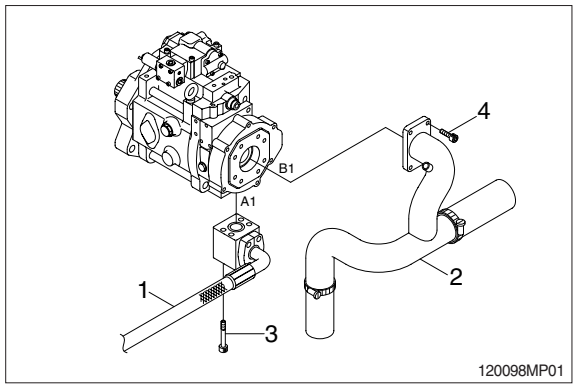
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

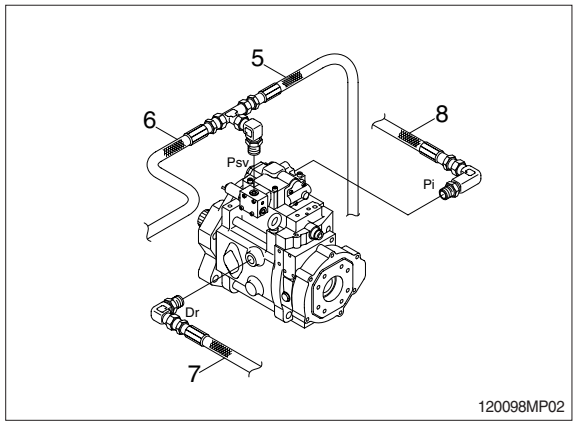
(8) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 160 kg × 3 (360 lb × 3)

※ 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 the return filter with a new one.

(4) Remove breather and clean it.

(5) After adding oil to the hydraulic tank to the specified level.

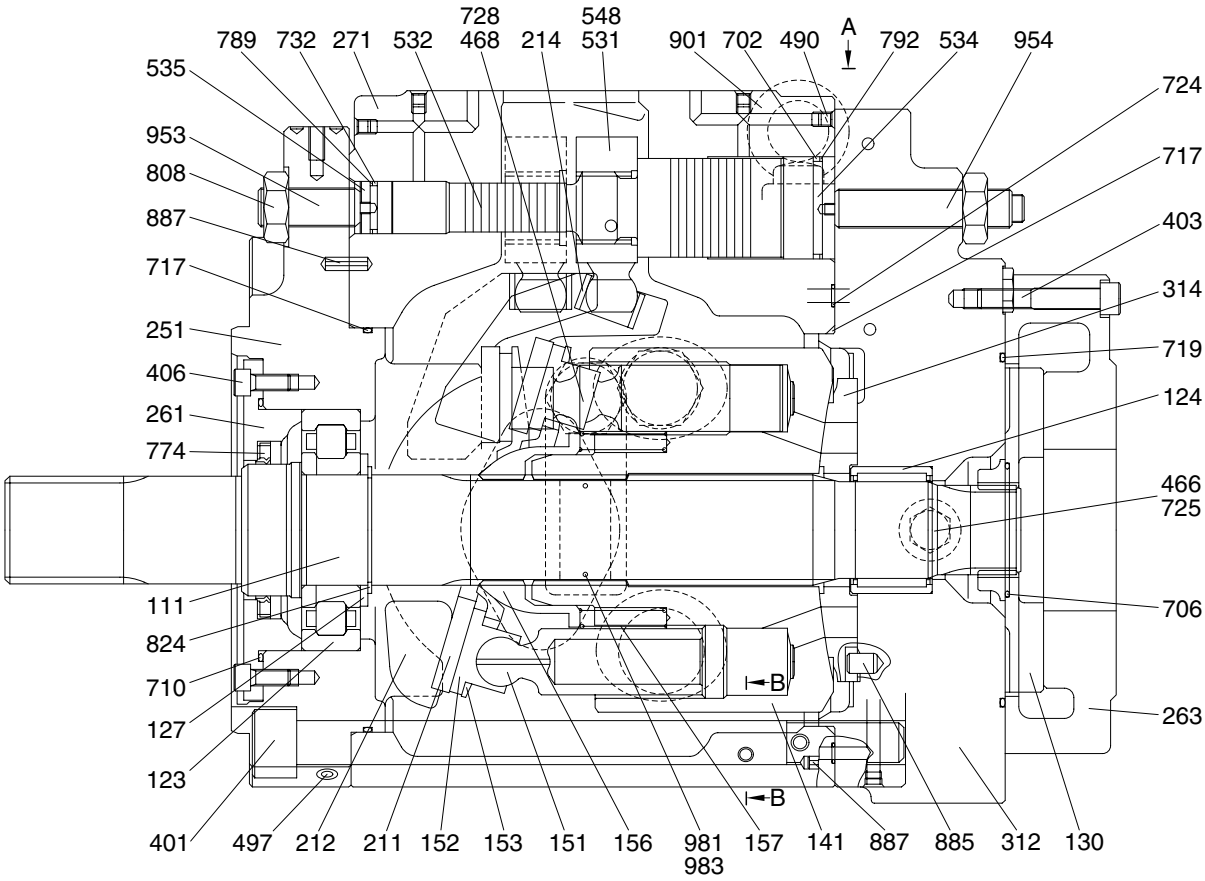
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA)
② Tighten plug lightly
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

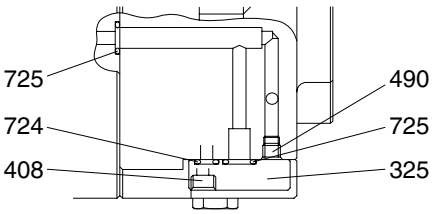
(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

(8) Confirmed the hydraulic oil level and check the hydraulic oil leaks or not.

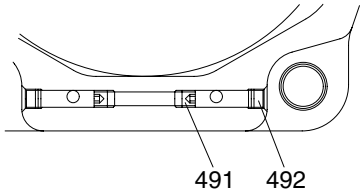
2. MAIN PUMP (1/2)

1) STRUCTURE





VIEW A



SECTION B -B

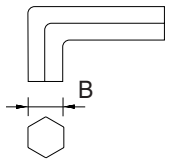
120092MP02

111	Drive shaft	261	Front cover	492	Plug	728	O-ring
113	Roller bearing	263	Booster cover	497	Plug	732	O-ring
114	Needle bearing	271	Pump casing	531	Tilting pin	774	Oil seal
123	Spacer	312	Valve cover	532	Servo piston	789	Back up ring
130	Booster	314	Valve plate (F)	534	Stopper (L)	792	Back up ring
141	Cylinder block	325	Cover	535	Stopper (S)	808	Nut
151	Piston	401	Screw	548	Feed back pin	824	Snap ring
152	Shoe	403	Hexagon screw	702	O-ring	885	Pin
153	Set plate	406	Hexagon screw	706	O-ring	887	Spring pin
156	Bushing	408	Screw	710	O-ring	901	Eye bolt
157	Cylinder spring	466	Plug	717	O-ring	953	Set screw
211	Shoe plate	468	Plug	719	O-ring	954	Set screw
212	Swash plate	490	Plug	724	O-ring	981	Name plate
214	Steel bearing	491	Restrictor	725	O-ring	983	Pin
251	Support						

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="4">Part name</th></tr>
<tr><td rowspan="8">Allen wrench
 
</td><td>B</td><td>Hexagon socket head bolt</td><td>PT plug (PT thread)</td><td>PO plug (PF thread)</td><td>Hexagon socket head setscrew</td></tr>
<tr><td>4</td><td>M 5</td><td>BP-1/16</td><td>-</td><td>M 8</td></tr>
<tr><td>5</td><td>M 6</td><td>BP1/ 8</td><td>-</td><td>M10</td></tr>
<tr><td>6</td><td>M 8</td><td>BP-1/4</td><td>PO-1/4</td><td>M12, M14</td></tr>
<tr><td>8</td><td>M10</td><td>BP-3/8</td><td>PO-3/8</td><td>M16, M18</td></tr>
<tr><td>10</td><td>M12</td><td>BP-1/2</td><td>PO-1/2</td><td>M20</td></tr>
<tr><td>17</td><td>M20, M22</td><td>BP-1</td><td>PO-1</td><td>-</td></tr>
<tr><td>22</td><td>M30</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="6">Double ring spanner, socket wrench, double (single) open end spanner
 
</td><td>-</td><td colspan="2">Hexagon head bolt</td><td>Hexagon head bolt</td><td>VP plug (PF thread)</td></tr>
<tr><td>19</td><td colspan="2">M12</td><td>M12</td><td>VP-1/4</td></tr>
<tr><td>30</td><td colspan="2">M20</td><td>M20</td><td>-</td></tr>
<tr><td>36</td><td colspan="2">-</td><td>-</td><td>VP-3/4</td></tr>
<tr><td>46</td><td colspan="2">M30</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="4">Medium size 1 set, Small size 1 set</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="4">Flat-blade screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="4">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="4">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="4">Steel bar of key material approx. 10 × 8 × 200</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="4">Capable of tightening with the specified torques</td></tr>
</table>

(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
	M22	45.0	325	0.67	17
PT plug (material : S45C) ※ Wind a seal tape 1.5 to 2 turns round the plug	PT 1/16	1.1	8.0	0.16	4
	PT 1/ 8	1.2	8.7	0.20	5
	PT 1/ 4	2.2	16	0.24	6
VP plug (material : SS400)	PF 1/ 4	3.7	26.8	0.75	19
	PF 3/ 8	7.5	54.2	0.87	22
	PF 1/ 2	11.2	81.0	1.06	27
	PF 3/ 4	17.3	125.0	1.42	36
ROH plug ※ PF 3/8 or less : S45C More than PF 1/2 : SCM435	PF 1/ 4	3.7	26.8	0.75	19
	PF 3/ 8	7.5	54.2	0.87	22
	PF 1/ 2	11.2	81.0	1.06	27
	PF 3/ 4	17.3	125.0	1.42	36

3) DISASSEMBLY

(1) Select place suitable to disassembling.

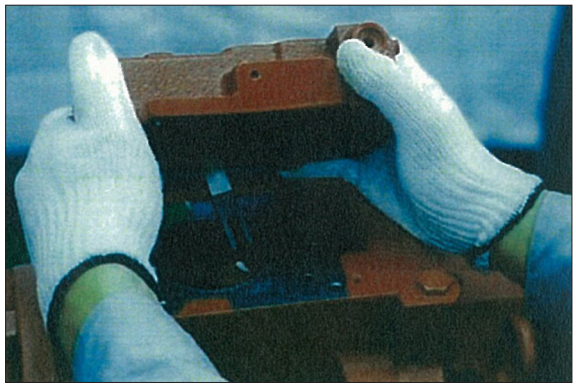
※ Select clean place.

※ Spread rubber sheet, cloth or so on 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 from pump casing (271).

(4) Remove hexagon socket head bolts (412, 413) and remove regulator.



120098MP04

(5) Remove hexagon socket head bolts (403) which tighten booster cover (263), valve cover (L, 312) and remove booster (130).

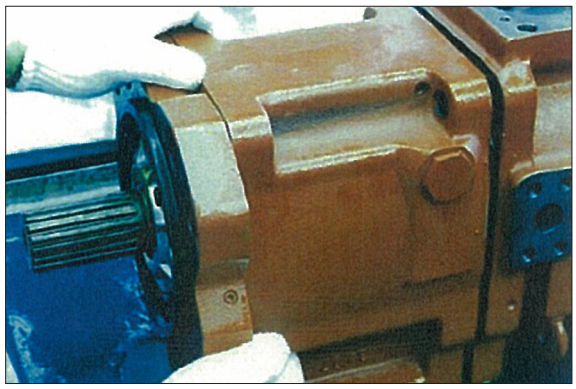
(6) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve cover (L, 312).

※ Do not remove hexagon socket head bolts (401).

(7) Place pump horizontally on workbench with its regulator-fitting surface down, and remove hexagon socket bolts (401).

※ Before bringing regulator fitting surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.

(8) Separate pump casing (271) from valve cover (L) (312).



120098MP05

(9) Pull out cylinder block (141), piston subassembly (011), set plate (153), spherical bush (158) and cylinder springs (157) simultaneously from pump casing (271) straightly over drive shaft (111).

※ Take care not to damage silding surfaces of cylinder block (141), spherical bush (156), shoes (152), swash plate (212), etc.

※ Take care not to damage drive shaft (111).

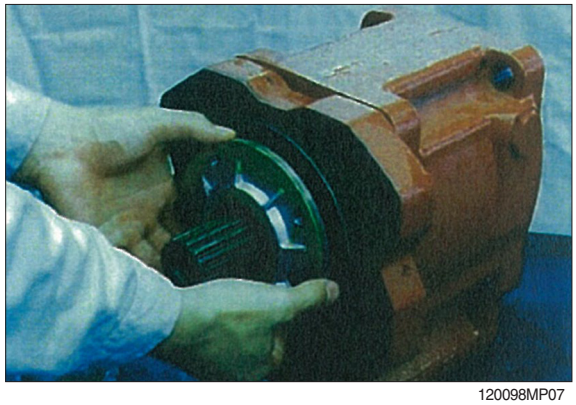
120098MP06

(10) Remove hexagon socket head bolts (406) and then remove front cover (261).

※ Front cover can be easily removed by screwing M8 bolts into threads on the front cover.

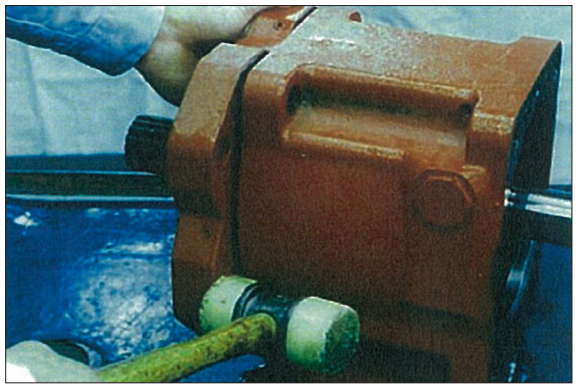
※ Since oil seal is fitted on front cover (261), take care not to damage it at removing the cover.

※ Remove dust of the input spline part and prevent it from adhering to oil seal.



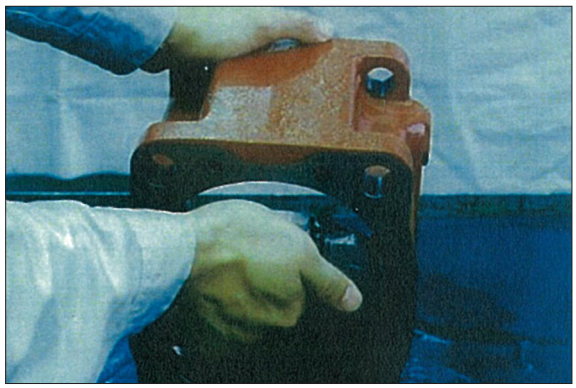
120098MP07

(11) Tap the mounting flange portion of the swash plate support (251) lightly from the pump casing side, and separate the swash plate support and the pump casing.



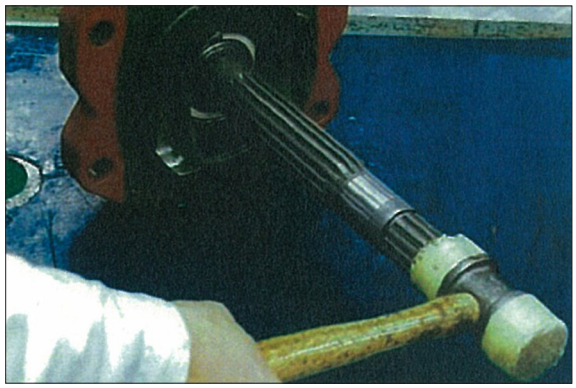
120098MP08

(12) Remove shoe plate (211) and swash plate (212) from pump casing (271).



120098MP09

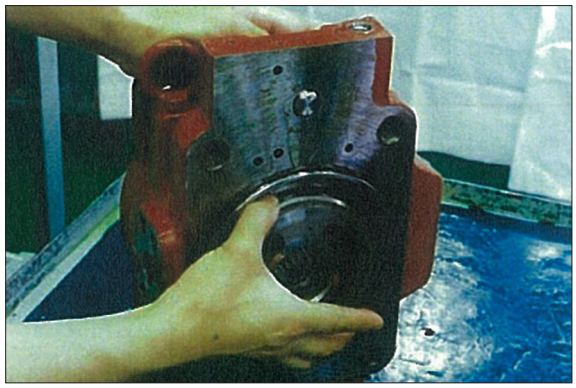
(13) Tapping shaft end of drive shaft (111) lightly with plastic hammer, remove it from the swash plate support (251).



120098MP10

(14) Remove valve plates (314) from valve cover (L, 312).

※ These may be removed in work 8.



120098MP11

(15) 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 cover (312).

※ When removing tilting pin, use a protector to prevent pin head from being damaged.

※ Since adhesive (No. 1305N of threebond make) 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) unless it is considered to be out of its life span.

※ Do not loosen hexagon nuts of valve cover (312) and swash plate support (251).
If loosened, flow setting will be changed.

(16) This is the end of disassembling procedures.

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 prepare 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.

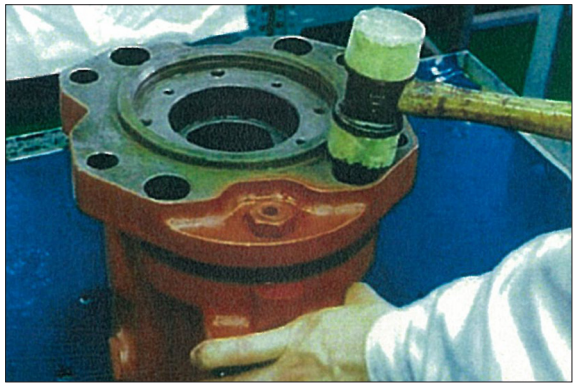
④ In principle, replace seal parts, such as O-rings, oil seals, etc.

⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-10, 11.

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

※ In case the servo piston, tilting pin, stopper (L), and stopper (S) have been removed, attach them to the pump casing in advance.

※ In the tightening work of the servo piston and the tilting pin, use the tool not to damage the head of the tilting pin and the feed back pin. Besides, apply adhesive (No. 1305N of threebond make) to the thread portion.



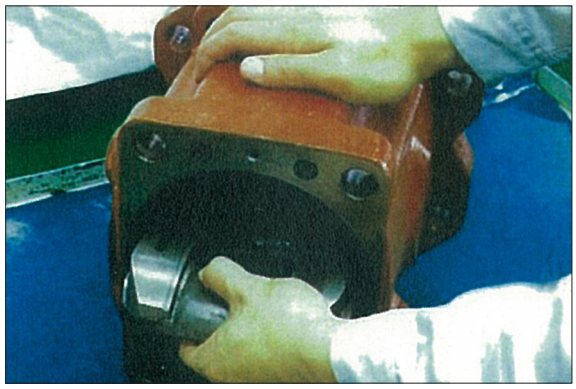
120098MP12

(3) Attach the shoe plate (211) to the swash plate (212). Place the pump casing with its regulator-mounting face directed downward, attach the tilting bush of the swash plate to the tilting pin (531), and properly attach the swash plate and shoe plate ot the swash plate support (251).

※ Confirm with fingers of both hands that swash plate can be moved smoothly.

※ Apply grease to sliding sections of swash plate (212) and swash plate support (251), and drive shaft (111) can be fitted easily.

※ Take care not to damage shoe plate (211) surface.



120098MP13

(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

※ Do not tap drive shaft (111) with hammer or so on.

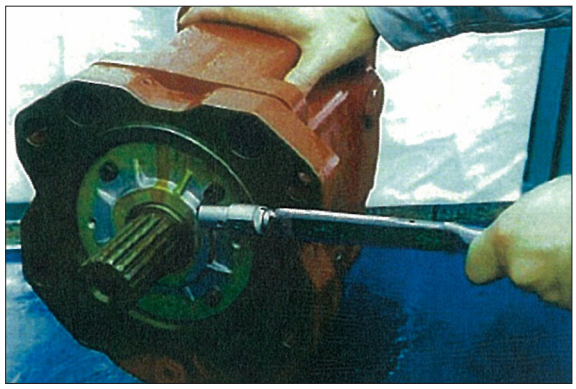
※ Tapping outer race of bearing lightly with plastic hammer, etc. Fit them fully, using steel care not to damage it.

120098MP14

(5) Assemble front cover (F, 261) to swash plate support (251) and fix it with hexagon socket head bolts (406).

※ Apply grease lightly to oil seal in front cover (261).

※ Assemble front cover with great care not to damage the oil seal.

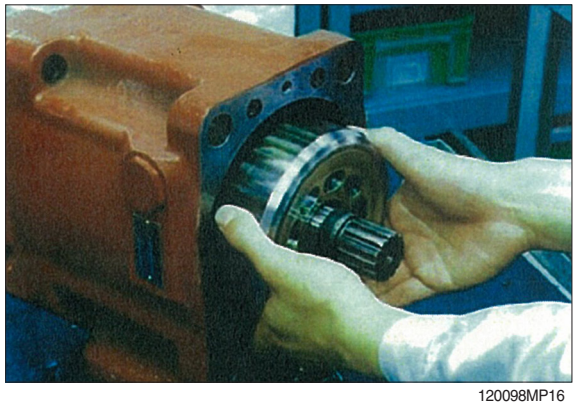


120098MP15

(6) Insert the piston cylinder subassembly 〔cylinder block (141), piston subassembly (011), set plate (153), spherical bushing (156) and cylinder spring (157)〕 into pump casing (271) with phasing splines on cylinder, spherical bush (156) and drive shaft (111).

※ Take care not to damage drive shaft (111).

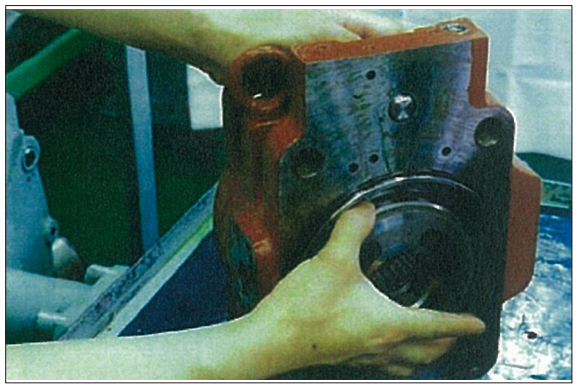
※ Confirm that swash plate has not come off.



120098MP16

(7) Fit valve plate (L, 314) to valve cover (L, 312), locating pin (885) into pin hole.

※ Take care not to mistake suction / delivery directions of valve plate (314).

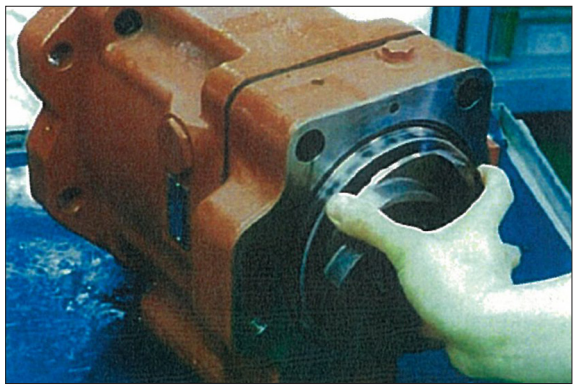


120098MP17

(8) Fit valve block (312) to pump casing (271) with hexagon socket head bolts (401).

※ Before bringing regulator fitting surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.

※ Take care not to damage needle bearing (124).

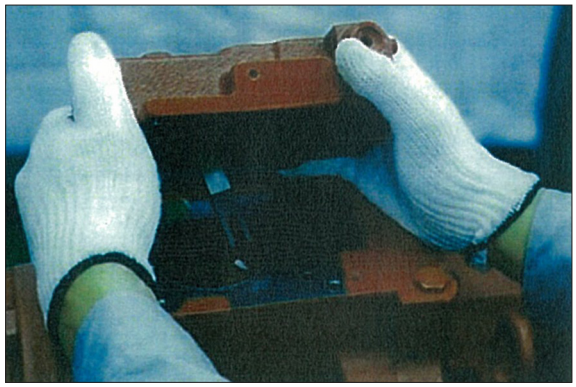


120098MP18

(9) Assemble booster (130) to drive shaft (111) and fit booster cover (263) with hexagon socket head bolts (403).

※ Take care not to mistake direction of booster.

(10) Putting feedback lever of regulator into feedback pin (548) of tilting pin (531), fit regulator with hexagon socket head bolts.

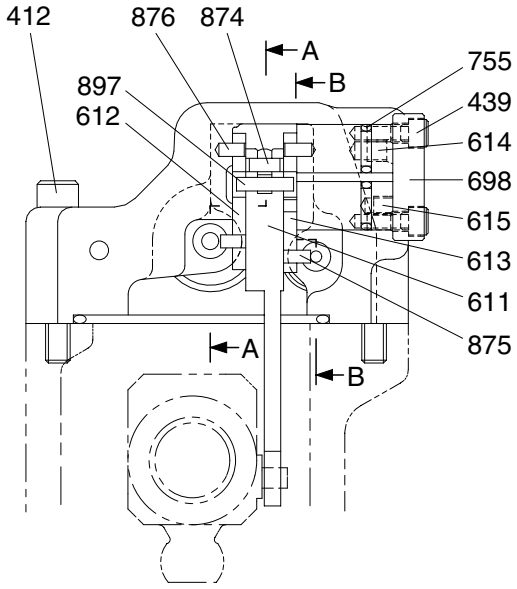


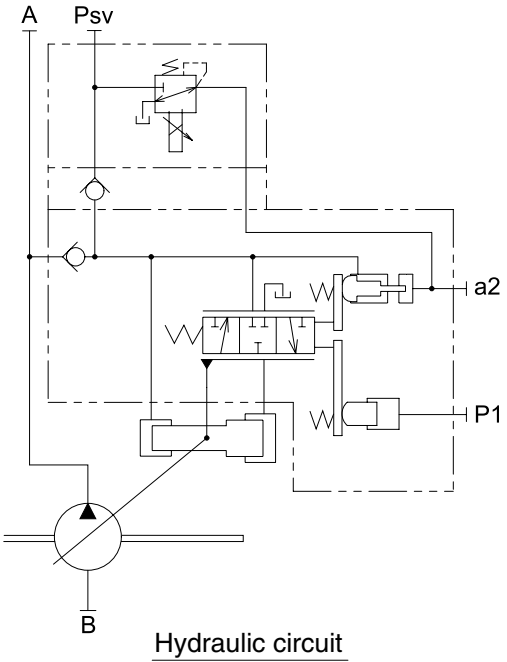
120098MP19

(11) Fit drain port plug (468) to pump casing (271).

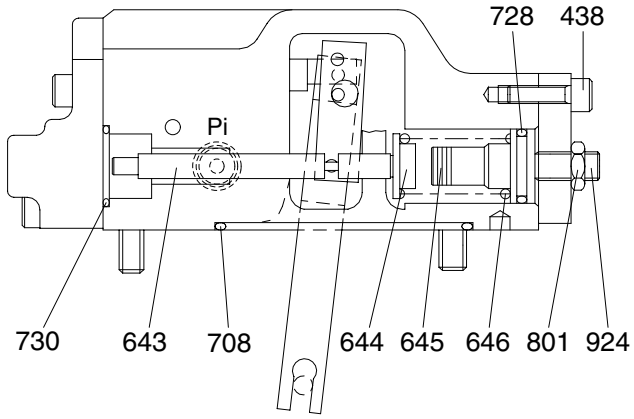
This is the end of reassembling procedure.

5) REGULATOR (1/2)

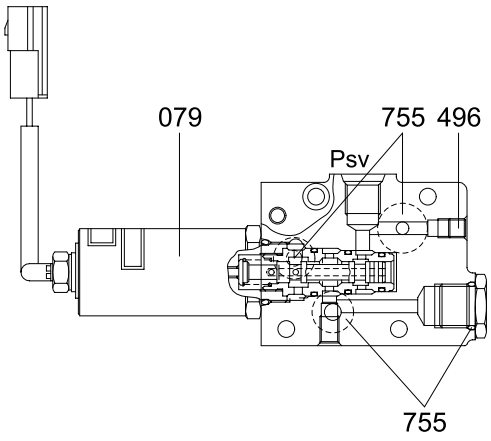




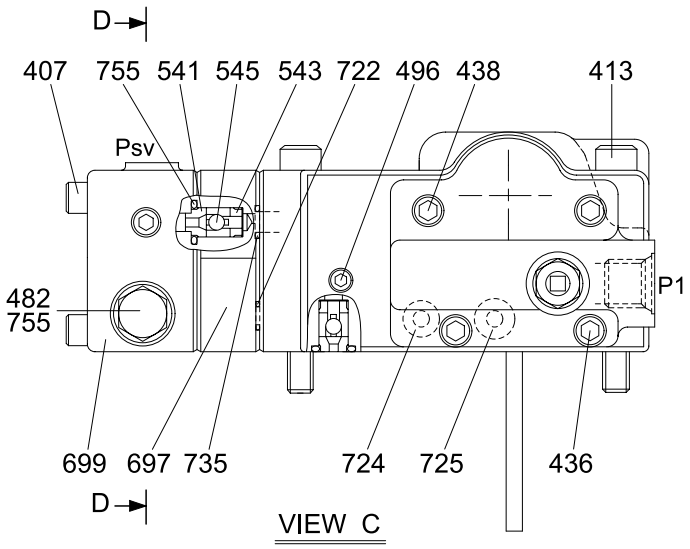
Hydraulic circuit



SECTION B-B



SECTION D-D

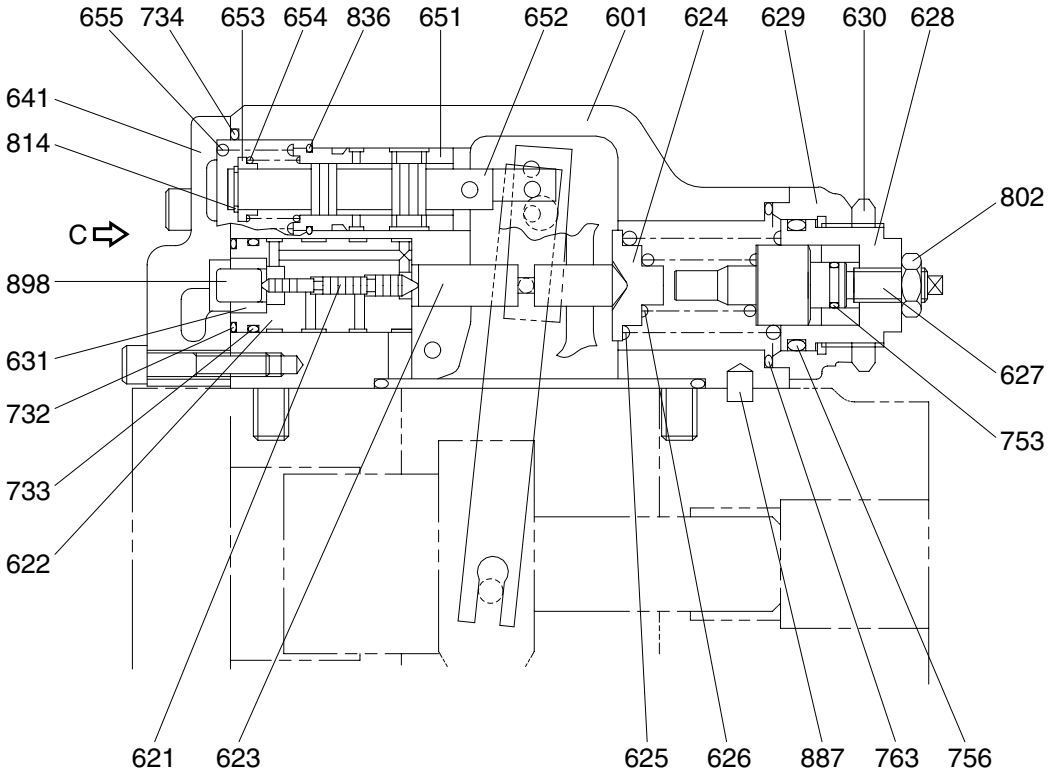


VIEW C

Port	Port name	Port size
P1	Pilot port	PF 1/4 - 15
Psv	Servo assist port	PF 1/4 - 13
a2	Sensor port	PF 1/4 - 13

120092RG01

REGULATOR(2/2)



SECTION A-A

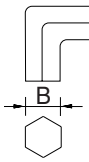
120092RG02

079	EPPR valve	626	Inner spring	725	O-ring
407	Hexagon socket screw	627	Adjust stem (C)	728	O-ring
412	Hexagon socket screw	628	Adjust screw (C)	730	O-ring
413	Hexagon socket screw	629	Cover (C)	732	O-ring
436	Hexagon socket screw	630	Lock nut	733	O-ring
438	Hexagon socket screw	631	Sleeve	734	O-ring
439	Hexagon socket screw	641	Pilot cover	735	O-ring
466	Plug	643	Pilot piston	753	O-ring
496	Plug	644	Spring seat (Q)	755	O-ring
541	Seat	645	Adjust stem (Q)	756	O-ring
543	Stopper	646	Pilot spring	763	O-ring
545	Steel ball	651	Sleeve	801	Nut
601	Casing	652	Spool	802	Nut
611	Feed back lever	653	Spring seat	814	Snap ring
612	Lever (1)	654	Return spring	836	Snap ring
613	Lever (2)	655	Set spring	874	Pin
614	Center plug	697	Plate	875	Pin
615	Adjust plug	698	Cover	876	Pin
621	Compensator piston	699	Casing	887	Pin
622	Piston case	708	O-ring	897	Pin
623	Compensator rod	722	O-ring	898	Pin
624	Spring seat (C)	724	O-ring	924	Set screw
625	Valve casing				

6) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

<table>
<tr><td colspan="2">Tool name & size</td><td colspan="4">Part name</td></tr>
<tr><td>Name</td><td>B</td><td>Hexagon socket head bolt</td><td>PT plug (PT thread)</td><td>PO plug (PF thread)</td><td>Hexagon socket head setscrew</td></tr>
<tr><td rowspan="3">Allen wrench  </td><td>4</td><td>M 5</td><td>BP-1/16</td><td>-</td><td>M 8</td></tr>
<tr><td>5</td><td>M 6</td><td>BP1/ 8</td><td>-</td><td>M10</td></tr>
<tr><td>6</td><td>M 8</td><td>BP-1/ 4</td><td>PO-1/4</td><td>M12, M14</td></tr>
<tr><td rowspan="2">Double ring spanner, socket wrench, double (single) open end spanner  </td><td>-</td><td colspan="2">Hexagon head bolt</td><td>Hexagon nut</td><td>VP plug (PF thread)</td></tr>
<tr><td>6</td><td colspan="2">M 8</td><td>M 8</td><td>-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="4">Small size, Max 36 mm</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="4">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="4">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="4">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="4">4×100 mm</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="4">Capable of tightening with the specified torques</td></tr>
<tr><td colspan="2">Pincers</td><td colspan="4">-</td></tr>
<tr><td colspan="2">Bolt</td><td colspan="4">M4, Length : 50 mm</td></tr>
</table>

(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 Plut (Materal : 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 Plut (Materal : 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.

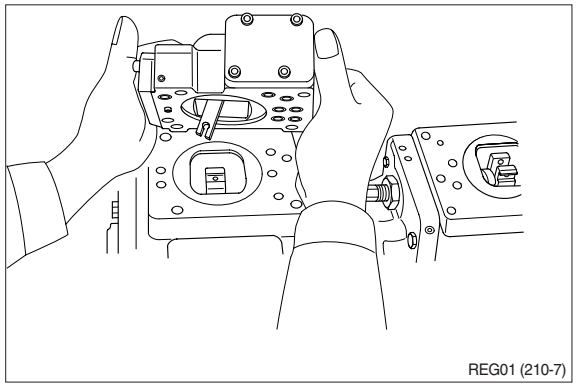
※ Choose a clean place.

※ 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.



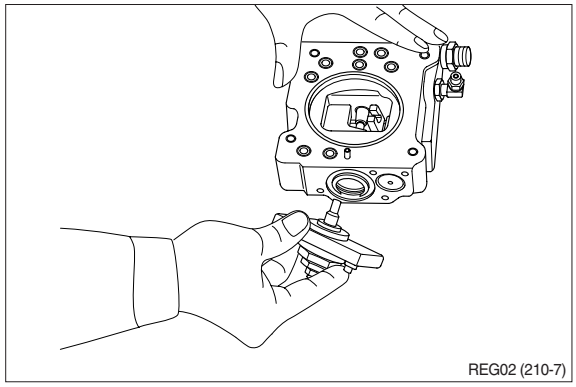
REG01 (210-7)

(4) Remove hexagon socket head screw (438) and remove cover (C,629)

※ Cover (C) is fitted with adjusting screw (C,QI) (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

Do not loosen these screws and nuts.

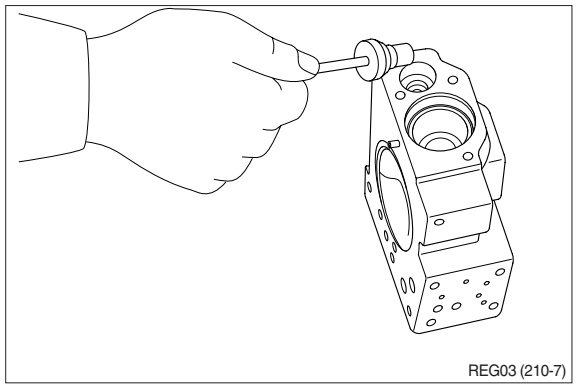
If they are loosened, adjusted pressure-flow setting will vary.



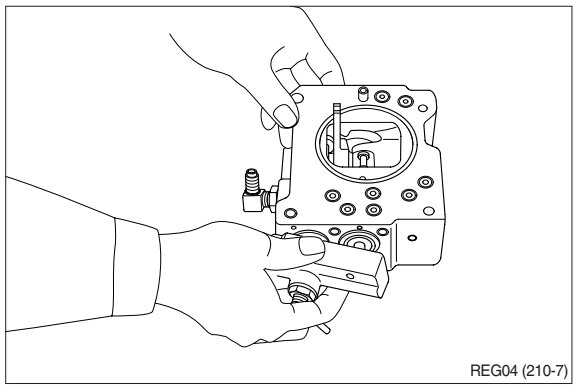
REG02 (210-7)

(5) After removing cover (C, 629) subassemb-ly, 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.


REG03 (210-7)

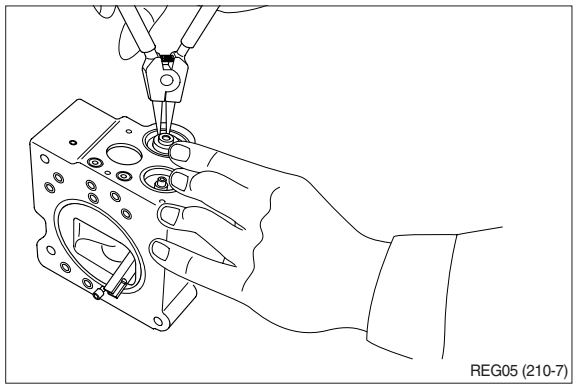
(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.


REG04 (210-7)

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

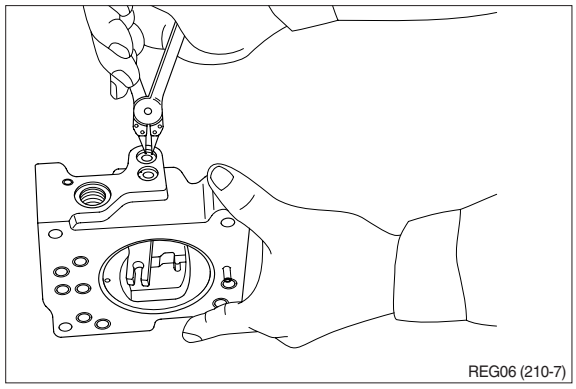
※ Sleeve (651) is fitted with snap ring (836).

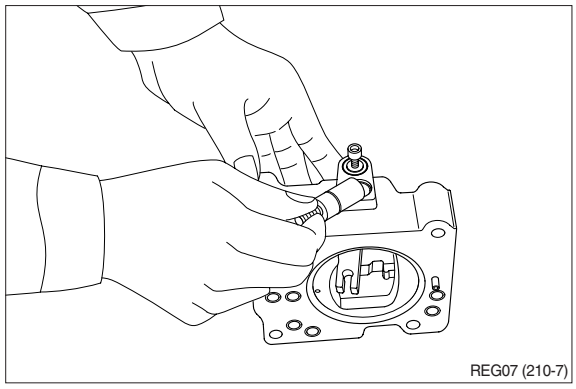
※ When removing snap ring (814), return spring (654) may pop out.
Take care not to lose it.


REG05 (210-7)

(8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

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

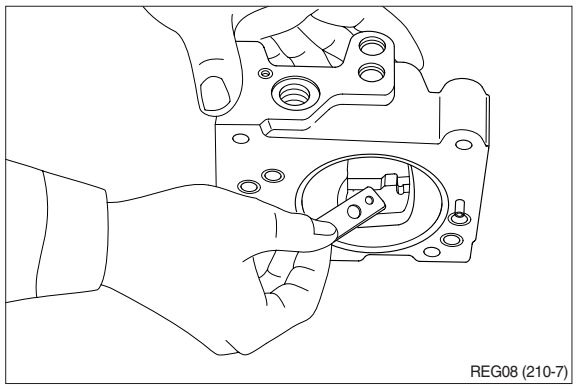

REG06 (210-7)



REG07 (210-7)

(9) Remove lever 2 (613). Do not draw out pin (875).

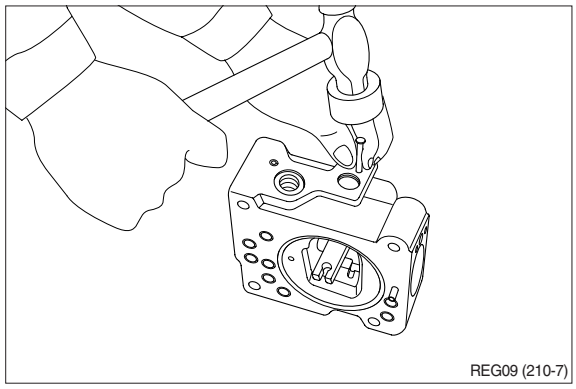
※ Work will be promoted by using pincers or so on.



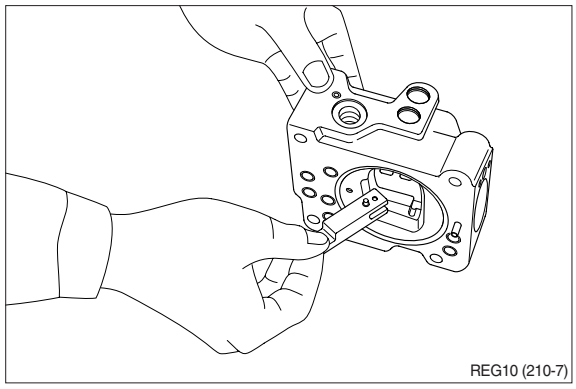
REG08 (210-7)

(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).



REG09 (210-7)



REG10 (210-7)

(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

③ them in clean place.

Always tighten bolts, plugs, etc. to their

④ specified torques.

Do not fail to coat sliding surfaces with

⑤ clean hydraulic oil before assembly.

Replace seals such as O-ring with new ones as a rule.

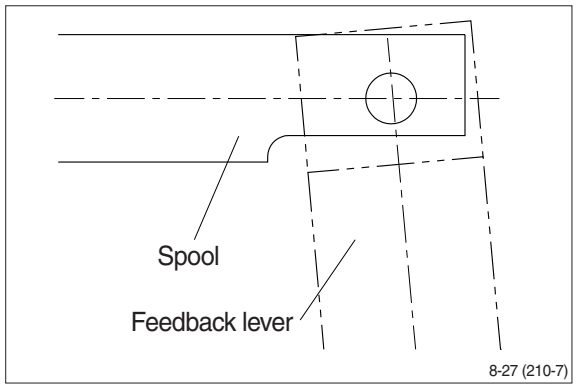
(2) Put compensating rod (623) into compensating hole of casing (601).

(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.

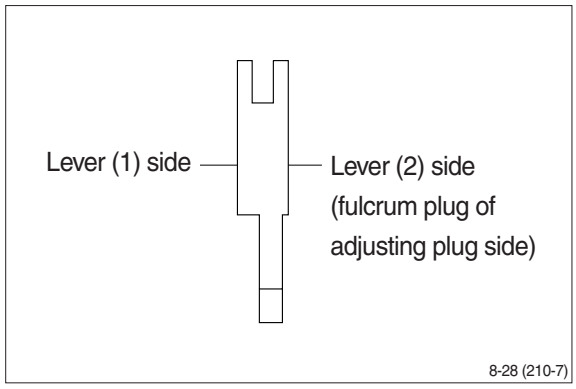
※ Pay attention to orientation of spool.



(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.

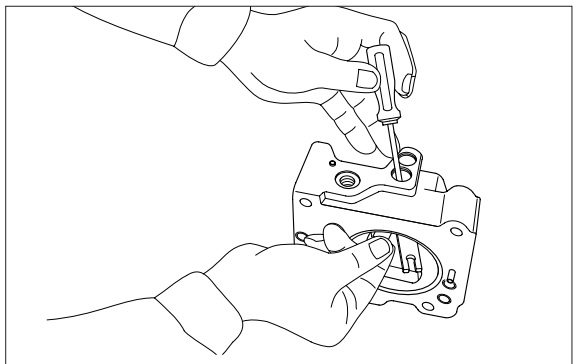


8-28 (210-7)

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

※ Confirm that pilot piston slides smoothly without binding.

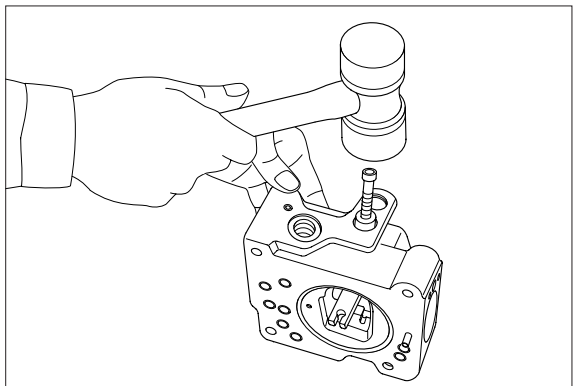
(7) Put pin force-fitted in lever 2 (613) into groove of pilot piston.
Then fix lever (2).


REG11 (210-7)

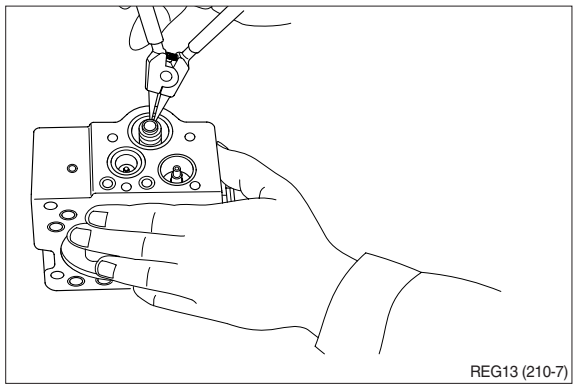
(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever 2.
Then fix locking ring (858).

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

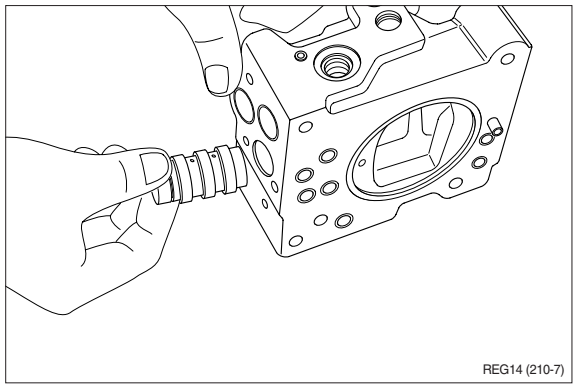
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.


REG12 (210-7)

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

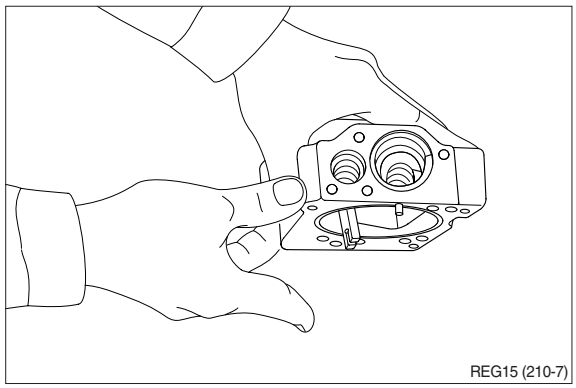

REG13 (210-7)

(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 (436, 438).


REG14 (210-7)

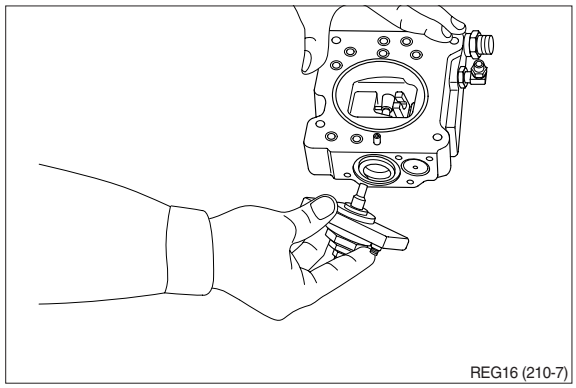
(12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole.
Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

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


REG15 (210-7)

(13) Install cover (C, 629) fitted with adjusting screws (628, 925), adjusting ring (C, 627), lock nut (630), hexagon nut (802) and adjusting screw (924).
Then tighten them with hexagonal socket head screws (438).

This completes assembly.


REG16 (210-7)