

GROUP 3 PUMP DEVICE

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 : 250 l

(4) Remove bolts(16) and disconnect pipe (1,2).

(5) Disconnect pilot line hoses(4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14).

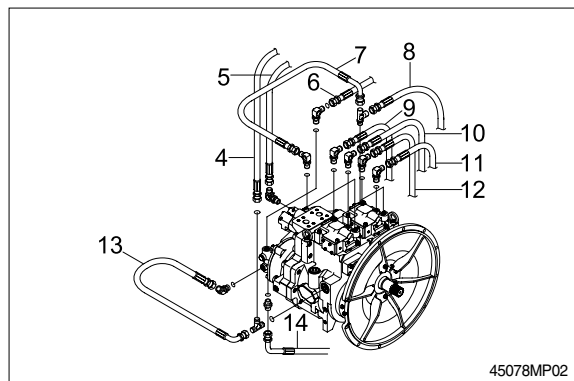
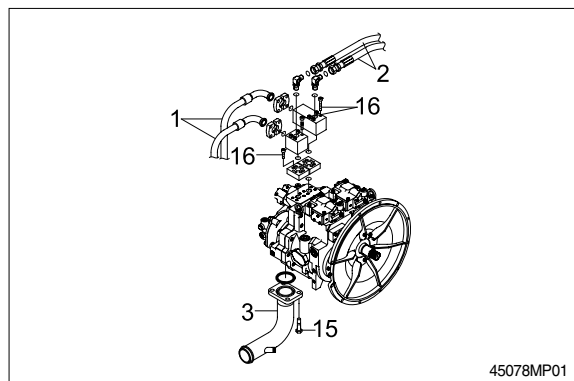
(6) Remove bolts(15) and disconnect pump suction tube (3).

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

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

· Weight : 240kg(530lb)

※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.

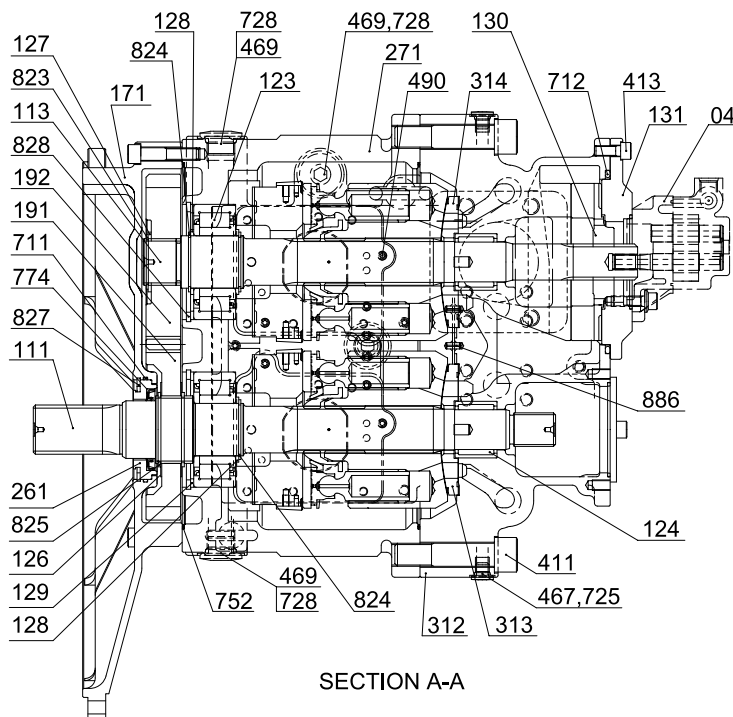
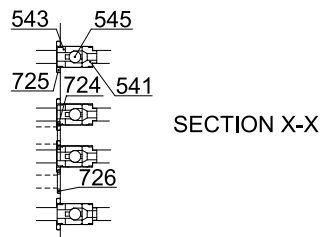
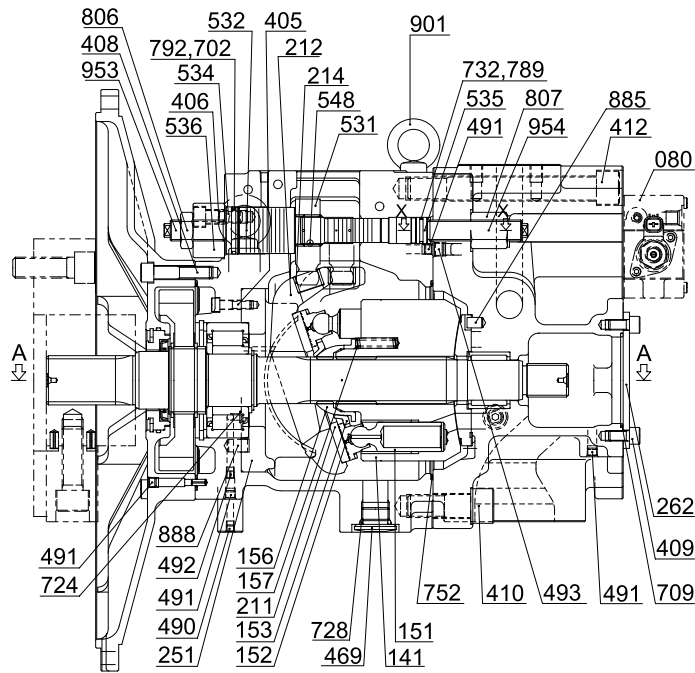


2) INSTALL

- (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.

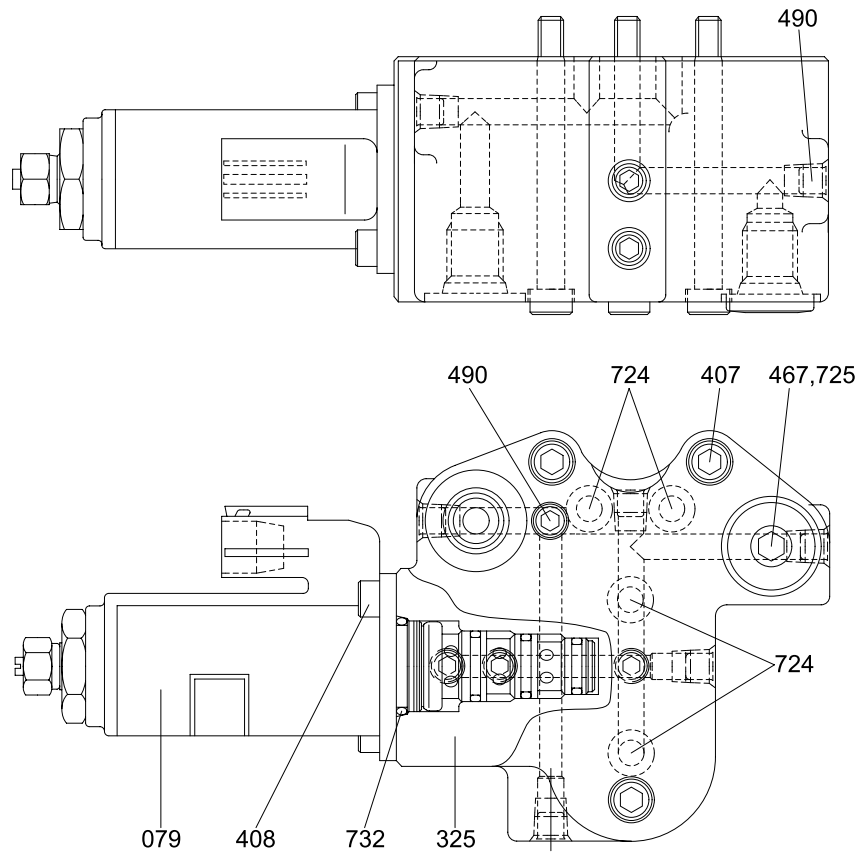
2. MAIN PUMP(1/2)

1) STRUCTURE



| | | | | | |
|-----|-------------------------------------|-----|---------------------|-----|-----------------|
| 04 | Gear pump | 262 | Cover | 548 | Feed back pin |
| 080 | Proportional reducing valve assy | 271 | Pump casing | 702 | O-ring |
| 111 | Drive shaft | 312 | Valve cover | 709 | O-ring |
| 113 | Driven shaft | 313 | Valve plate(R) | 711 | O-ring |
| 123 | Roller bearing | 314 | Valve plate(L) | 712 | O-ring |
| 124 | Needle bearing | 405 | Hexagon socket bolt | 724 | O-ring |
| 126 | Spacer | 406 | Hexagon socket bolt | 725 | O-ring |
| 127 | Spacer | 408 | Hexagon socket bolt | 726 | O-ring |
| 128 | Bearing spacer | 409 | Hexagon socket bolt | 728 | O-ring |
| 129 | Bearing spacer | 410 | Hexagon socket bolt | 732 | O-ring |
| 130 | Booster | 411 | Hexagon socket bolt | 752 | Seat packing |
| 131 | Booster cover | 412 | Hexagon socket bolt | 774 | Oil seal |
| 141 | Cylinder block | 413 | Hexagon socket bolt | 789 | Back up ring |
| 151 | Piston | 467 | Plug | 792 | Back up ring |
| 152 | Shoe | 469 | Plug | 806 | Nut |
| 153 | Plate | 490 | Plug | 807 | Nut |
| 156 | Bushing | 491 | Plug | 823 | Snap ring |
| 157 | Cylinder spring | 492 | Restrictor | 824 | Snap ring |
| 171 | Front casing | 493 | Plug | 825 | Snap ring |
| 191 | Drive gear | 531 | Tilting pin | 827 | Snap ring |
| 192 | Driven gear | 532 | Servo piston | 828 | Snap ring |
| 211 | Shoe plate | 534 | Stopper(L) | 885 | Valve plate pin |
| 212 | Swash plate | 535 | Stopper(S) | 886 | Spring pin |
| 214 | Tilting bushing bushing | 536 | Servo cover | 888 | Pin |
| 251 | Swash plate support | 541 | Seat | 901 | Eye bolt |
| 261 | Front cover | 543 | Stopper | 953 | Set screw |
| | | 545 | Steel ball | 954 | Set screw |

MAIN PUMP(2/2)



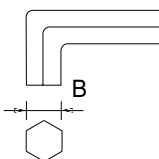

45070MP04

| | | | | | |
|-----|-----------------------------|-----|---------------|-----|--------|
| 079 | Proportional reducing valve | 408 | Hexagon screw | 724 | O-ring |
| 325 | Valve casing | 467 | Plug | 725 | O-ring |
| 407 | Hexagon screw | 490 | Plug | 732 | O-ring |

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 | | | |
|---|--|-------------------------------|---------------------|-------------------------------|--------------|
| Allen wrench  | B | Hexagon socket head cap screw | PT plug (PT thread) | PO plug (PF thread) | Servo piston |
| | 4 | M 5 | BP-1/16 | - | - |
| | 5 | M 6 | BP-1/ 8 | - | - |
| | 6 | M 8 | BP-1/ 4 | PF-1/4 | - |
| | 8 | M10 | BP-3/ 8 | PF-3/8 | - |
| | 10 | M12 | BP-1/2 | PF-1/2 | - |
| | 14 | M16, M18 | BP-3/4 | PF-3/4 | - |
| | 17 | M20, M22 | BP-1 | PF-1 | M30 |
| Double ring spanner, socket wrench, double(Single) open end spanner  | - | Hexagon head screw | Hexagon nut | Hexagon socket head set screw | |
| | 10 | M6 | M6 | - | |
| | 13 | M8 | M8 | M20 | |
| | 30 | M20 | M20 | - | |
| 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, TSR200, TRR200 | | | | |
| Steel bar | Steel bar of key material approx. 10×8×200 | | | | |
| Torque wrench | Capable of tightening with the specified torques | | | | |
| Seal tape | For BP-1/4 | | | | |

(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 | 115.7 | 0.47 | 12 |
| | M16 | 24.0 | 173.6 | 0.55 | 14 |
| | M18 | 34.0 | 245.9 | 0.55 | 14 |
| | M20 | 44.0 | 318.3 | 0.67 | 17 |
| | M22 | 64.0 | 462.9 | 0.67 | 17 |
| PT plug(Material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug | PT 1/16 | 0.7 | 5.1 | 0.16 | 4 |
| | PT 1/ 8 | 1.05 | 7.59 | 0.20 | 5 |
| | PT 1/ 4 | 1.75 | 12.66 | 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 1/ 2 | 10.0 | 72.3 | 0.39 | 10 |
| | PF 3/ 4 | 15.0 | 108.5 | 0.55 | 14 |
| | PF 1 | 19.0 | 137.4 | 0.67 | 17 |
| | PF 1 1/4 | 27.0 | 195.3 | 0.67 | 17 |
| | PF 1 1/2 | 28.0 | 202.5 | 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.
 - ※ Fix pump casing(271) by using thread 2-M10 × 16 in disassembling.



45078MP28

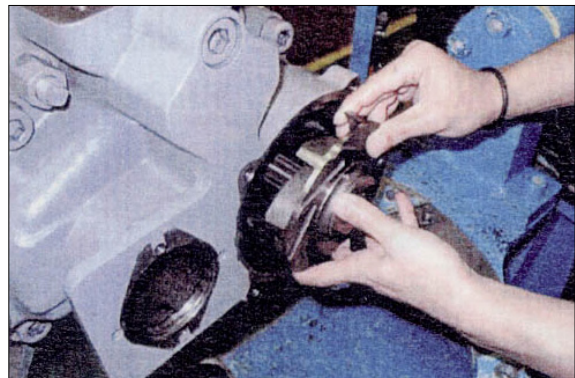
- (2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.
- (3) Remove outlet port plug(469, lower part of pump casing) and let the oil out of pump casing.
 - ※ In order to be let the oil out of pump casing easily, remove oil filling port plug(469, upper part of pump casing).

- (4) Remove hexagon socket head cap screws(412, 413) and remove regulators.
 - ※ In order to avoid mixing up regulator of drive shaft side with that of driven shaft side, mark each of them.



45078MP29

- (5) Remove gear pump, booster cover(131), booster(130), and cover(262).



45078MP23

(6) Loosen hexagon socket head cap screws(410, 411, 412) which tighten valve cover(312).

※ Remove regulators before starting this work.

(7) Place pump horizontally on workbench and separate pump casing(271) and valve cover(312).

※ Crane valve cover(312) at this work because it is heavy(about 60kgf).

※ There are two spring pins for fixing position between pump casing(271) and valve cover(312). Since they have a tight fit, remove valve cover(312) upright with respect to drive shaft(111) and driven shaft(113), while lightly tapping the valve cover(312) with a plastic hammer.

※ Take care not to damage fitting surfaces between pump casing(271) and valve cover(312). Take care not to drop valve plates(313, 314), check valve subassemblies(541, 543, 545), O-rings (724, 725, 726) and seat packing(752) in removing valve cover(312).



45078MP03

(8) If necessary, remove needle bearings (124) from valve cover(312).

※ Do not remove needle bearings as far as possible, except when it is considered to be out of its life span.

※ Do not loosen hexagon nut(807) of the valve cover. If loosened, flow setting will be changed.

(9) Pull cylinders out of pump casing(271) straightly over drive shaft(111) and driven shaft(113). Pull out also pistons(151), set plate(153), spherical bush(156) and cylinder springs(157) simultaneously.

- ※ Take care not to damage sliding surfaces of cylinder, spherical bush, shoes, swash plate, and so on.



45078MP04

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



45078MP05

(11) If necessary, remove stopper(L, 534), stopper(S, 535), servo piston(532), tilting pin(531), and servo cover(536), from pump casing(271).

- ※ In 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 and servo piston, take care not to damage servo piston.
- ※ Do not loosen hexagon nut(806) on servo cover(536). If loosened, flow setting will be changed.

(12) Remove snap ring(827) and front cover(261) from front casing(171).

- ※ A groove is provided on the outer circumference of front cover straight with respect to drive shaft(111) by placing a minus type screwdriver in the groove.
- ※ Since oil seal(774) is fitted on front cover(261), take care not to damage it in removing.



45078MP06

(13) Loosen hexagon socket head cap screws(408) which tighten front casing(271)

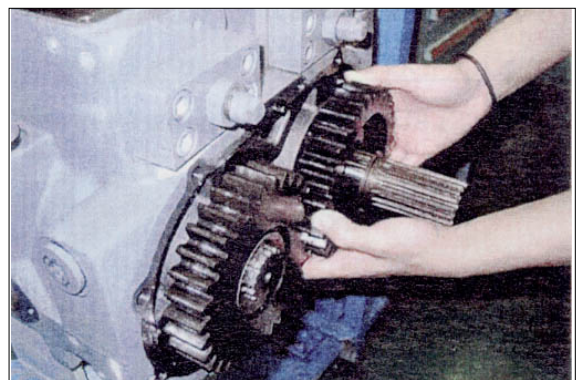
(14) Separate front casing(171) and pump casing(271).

- ※ Take care of front casing not to fall because it is heavy(about 32kgf).
- ※ There are two spring pins(886) for fixing position between front casing(171) and pump casing(271). Tapping lightly with a plastic hammer, remove front casing(171) perpendicular to drive shaft(111) because they are fitted firmly. When removing, take care not to damage oil seal sliding surface of drive shaft(111).
- ※ Take care not to damage fitting surfaces between front casing(171) and pump casing(271).



45078MP07

(15) Remove snap rings(823, 825), bearing spacers(126, 127), drive gear(191), and driven gear(192).



45078MP24

- (16) Remove snap ring(828) and bearing spacer(129) and take out drive shaft(111) and driven shaft(113) tapping lightly ends of them.



45078MP08

- (17) If necessary, remove snap rings(824, 825), bearing spacer(128), and roller bearing(123) from drive shaft(111) and driven shaft(113).

- ※ Do not remove roller bearing as far as possible, except when it is considered to be out of its life span. Use a specified jig in removing because roller bearing is shrinkage fitted to shaft.

- (18) Loosen hexagon socket head cap screws(405) which tighten swash plate supports(251) and pump casing(271).

- ※ Adhesive(No.1305N of threebond make) is applied to hexagon socket head cap screws(405).

- (19) Remove swash plate supports(251) from pump casing(271).



45078MP09

- ※ 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 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 surfaces, bearings, etc. before assembling them.
- ④ In principle, replace seal parts, such as O-rings, oil seals, etc.
- ⑤ Apply grease to O-rings, seat packing, and check valves in assembling them because they tend to come off.
- ⑥ In case of parallel type pump, rotating directions of drive shaft and driven shaft are different. Take care not to mix up parts of the drive shaft side with those of the driven shaft side.
- ⑦ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with specified torques in this maintenance manual.

(2) Select place suitable to assembling.

- ※ Select clean place.
- ※ Spread rubber sheet, cloth or so on overhaul workbench top to prevent parts from being damaged.
- ※ Fix pump casing(271) by using thread 2-M10×16 in assembling.



45078MP10

(3) Fit swash plates(251) to pump casing (271) and fix them with hexagon socket head cap screws(405).

- ※ There are O-rings(724) on the matching surface in contact with pump casing(271).
- ※ Fix them with grease so they do not come off.
- ※ Positioning pin(888) is placed on the pump casing(271) side. Adjust it so it enters the groove of swash plate support(251) and fix it.
- ※ Fit swash plate support(251) so it enters straight, while tapping it lightly.
- ※ Apply adhesive(No.1305N of three bond make) to hexagon socket head cap screws.



45078MP11



45078MP12

(4) To pump casing(271), fit drive shaft(111) set and driven shaft(113) set with roller bearing(123), bearing spacer(128), and snap rings(824, 825). Then fix them with snap rings(828).

- ※ Direct the sharp edge side of snap rings(824, 825) to the outside.
- ※ Do not tap shafts with hammer or so on.
- ※ Assemble them into pump casing tapping outer race of bearing lightly with plastic hammer. Fit them fully using steel bar or so on.
- ※ Both side of snap rings(828) are burnished.



45078MP13

(5) Fit drive gear(191), driven gear(192), and bearing spacers(126, 127) to drive shaft(111) and driven shaft(113). Then fix them with snap rings(823, 825).

- ※ Confirm the attaching direction of drive gear before fitting.
- ※ Direct the sharp edge of snap rings(823, 825) to the outside.



45078MP14

(6) Fit front casing(171) to pump casing(271) and fix them with hexagon socket head cap screws(408).

- ※ Take care of front casing not to fall because it is heavy(about 32kgf).
- ※ There are two spring pins(886) for fixing position between front casing(171) and pump casing(271). Always fit spring pins (886) to the pump casing(271) side.
- ※ Fit front casing(171) to pump casing(271) perpendicular to drive shaft(111), while tapping it lightly because spring pin(886) has a tight fit. When fitting, take care not to damage oil seal sliding surface of drive shaft(111).
- ※ Take care not to damage fitting surfaces of front casing(171) and pump casing(271).
- ※ Apply grease to seat packing(752) because it tends to come off.



45078MP15



45078MP16

(7) Fit front cover(261) to front casing(171) and fix them with snap ring(827).

- ※ Apply grease lightly to oil seal in front cover.
- ※ Assembling oil seal, take full care not to damage it.
- ※ Direct the sharp edge of snap ring(827) to the outside.



45078MP06

(8) Place pump casing(271) horizontally. Fit servo piston(532), tilting pin(531), stopper(L, 534), and stopper(S, 535) to pump casing. Then fit servo cover(536) to pump casing and fix them with hexagon socket head cap screws(406).

- ※ Fix pump casing(271) by using thread 2-M10×16 in assembling.
- ※ In tightening servo piston(532) and tilting pin(531), use a protector to prevent tilting pin head and feedback pin from being damaged. In addition apply adhesive (No.1305N of threebond make) to their threaded sections.

(9) Fit tilting bush(214) of swash plate(212) to tilting pin(531) and fit swash plate to swash plate support(251) correctly.

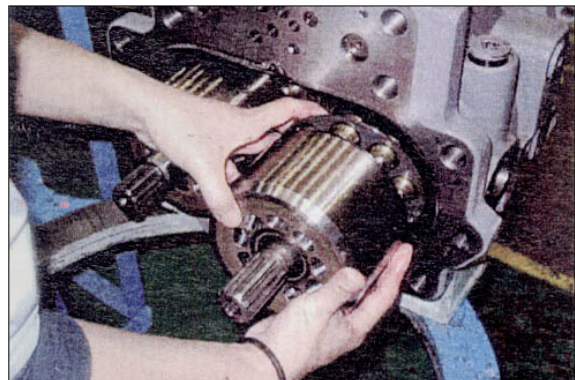
- ※ Take care not to mix up parts of drive shaft side with those of driven shaft side.
- ※ Even after fitting, swash plate(212) comes off from swash plate support(251), in some cases. They do not come off easily if grease is applied to the sliding surfaces.
- ※ Confirm with fingers of both hands that swash plate can be moved smoothly.



45078MP17

(10) Assemble piston cylinder subassembly [cylinder(141), piston subassembly(151, 152), set plate(153), spherical bush(156), cylinder spring(157)]. Fit spline phases of spherical bush and cylinder and insert piston cylinder subassembly into pump casing with respect to drive shaft(111) and driven shaft(113).

- ※ Take care not to mix up parts of drive shaft side with those of driven shaft side.
- ※ Confirm that swash plate(212) is not off from swash plate support(251) and from tilting pin(531), before inserting them.



45078MP25

(11) Fit valve plates(313, 314) to valve cover, entering valve plate pin(885) into pin hole.

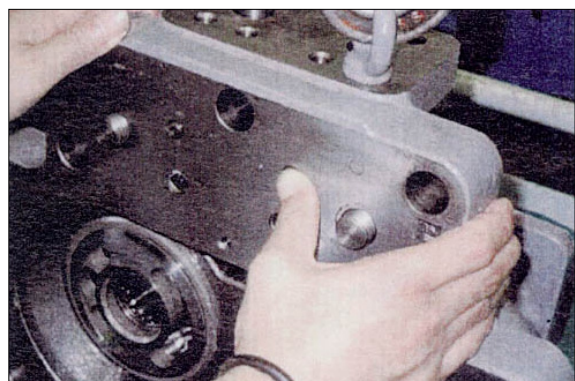
- ※ Take care not to mistake suction/delivery directions of valve plate.
- ※ Apply grease to matching surface in contact with valve cover(312) because valve plates(313, 314) tend to come off.



45078MP18

(12) Insert check valve subassemblies(541, 543, 545) and needle bearings to valve cover(312).

- ※ Insert check valve subassemblies into valve cover in correct order.
- ※ Since check valve subassembly tends to come off, apply grease to matching part of valve cover(312).



45078MP26

(13) Fit O-ring(724, 725, 726) and seat packing(752) to the matching surface of pump casing(271) in contact with valve cover(312).

- ※ Since O-rings and seat packing tend to come off, apply grease to matching surface.



45078MP19

(14) Fit valve cover(312) to pump casing(271) and tighten them with hexagon socket head cap screws(410, 411, 412).

- ※ Crane valve cover(312) at this work because it is heavy(about 60kgf).
- ※ Confirm that swash plate(212) is not off from swash plate support(251) and tilting pin(531) before fitting.
- ※ Needle bearings(124) are located on the valve cover(312) side place the valve cover with care. In order to protect needle bearing, cover drive shaft(111) and driven shaft(113) with specified cover shown in attached dwgs 3 and 4.
- ※ When fitting, take care as valve plates(313, 314) check valve subassemblies(541, 543, 545), O-rings (724, 725, 726), and seat packing(752) may come off in some cases.
- ※ There are two spring pins(886) for fixing position between pump casing(271) and valve cover(312). Since spring pin(886) has a tight fit, fit valve cover(312) upright to drive shaft(111) and driven shaft(113), while tapping it with a plastic hammer.
- ※ Take care not to damage fitting surfaces between valve cover(312) and pump casing(271).

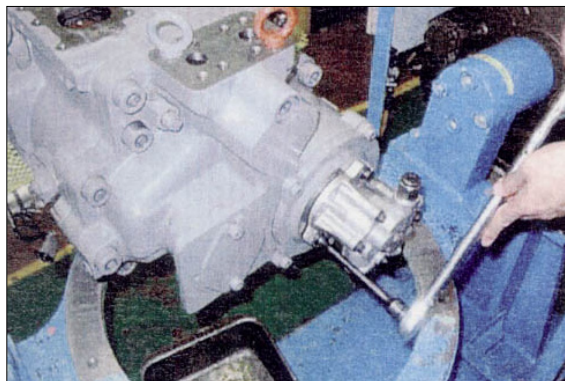


45078MP20



45078MP21

(15) Fit booster(130), booster cover(131) cover(262) and gear pump.



45078MP27

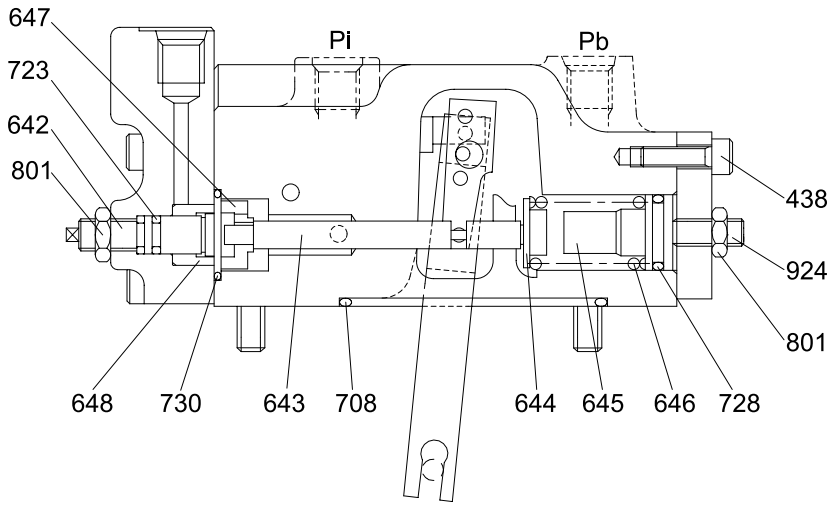
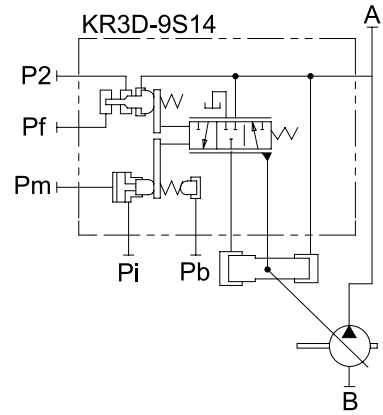
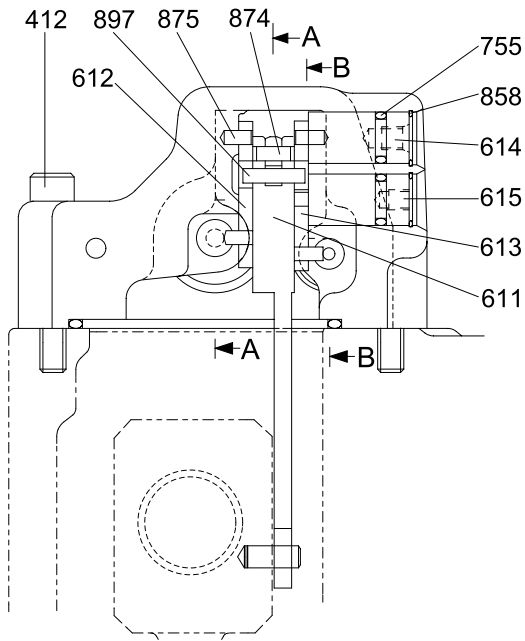
(16) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head cap screws(412, 413).

※ Since the regulators on the drive shaft side and the driven shaft side are set at different pressure and flow values, take care not to mistake one for another.

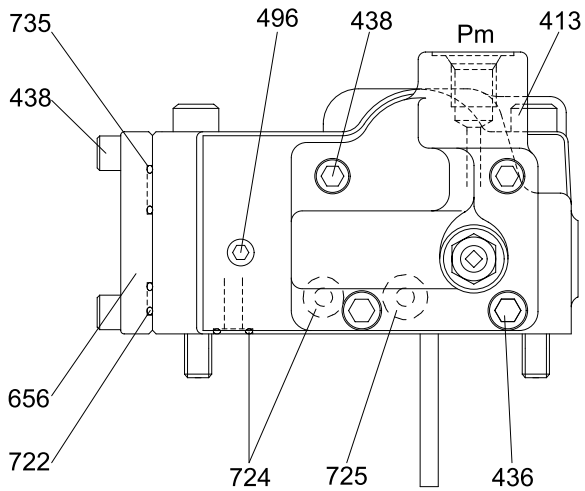


45078MP22

5) REGULATOR(1/2)



SECTION B-B

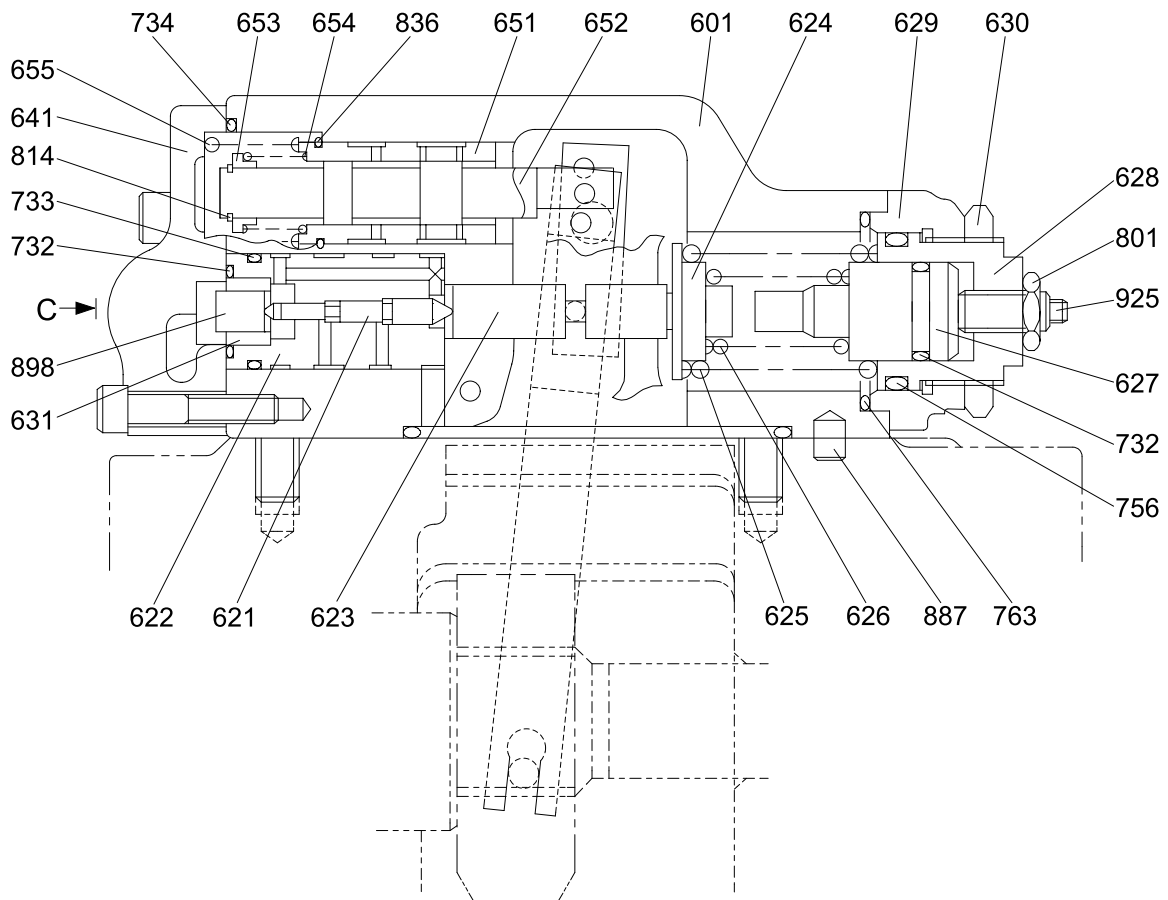


VIEW C

45070RG01

| Port | Port name | port size |
|------|--------------------|-------------|
| Pb | Back pressuye port | PF 1/4 - 15 |
| Pi | Pilot port | PF 1/4 - 15 |
| Pm | Qmax cut port | PF 1/4 - 15 |

REGULATOR(2/2)



SECTION A-A

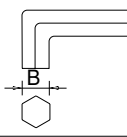

45070RG02

| | | |
|--------------------------|-----------------------|----------------------|
| 412 Hexagon socket screw | 631 Sleeve, pf | 730 O-ring |
| 413 Hexagon socket screw | 641 Pilot cover | 732 O-ring |
| 436 Hexagon socket screw | 642 Adjust screw(QMC) | 733 O-ring |
| 438 Hexagon socket screw | 643 Pilot piston | 734 O-ring |
| 496 Plug | 644 Spring seat(Q) | 735 O-ring |
| 601 Casing | 645 Adjust stem(Q) | 755 O-ring |
| 611 Feed back lever | 646 Pilot spring | 756 O-ring |
| 612 Lever(1) | 647 Stopper | 763 O-ring |
| 613 Lever(2) | 648 Piston(QMC) | 801 Nut |
| 614 Center plug | 651 Sleeve | 814 Snap ring |
| 615 Adjust plug | 652 Spool | 836 Snap ring |
| 621 Compensator piston | 653 Spring seat | 858 Snap ring |
| 622 Piston case | 654 Return spring | 874 Spring pin |
| 623 Compensator rod | 655 Set spring | 875 Pin |
| 624 Spring seat(C) | 656 Block cover | 887 Pin |
| 625 Outer spring | 708 O-ring | 897 Pin |
| 626 Inner spring | 722 O-ring | 898 Pin |
| 627 Adjust stem(C) | 723 O-ring | 924 Set screw |
| 628 Adjust screw(C) | 724 O-ring | 925 Adjust screw(QI) |
| 629 Cover(C) | 725 O-ring | |
| 630 Lock nut | 728 O-ring | |

6) 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 | M 5 | BP-1/16 | - | M 8 |
| | 5 | M 6 | BP-1/8 | - | M10 |
| | 6 | M 8 | 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 36mm | | | |
| Screw driver | | Minus type screw driver, Medium size, 2 sets | | | |
| Hammer | | Plastic hammer, 1 set | | | |
| Pliers | | For snap ring, TSR-160 | | | |
| Steel bar | | 4 × 100mm | | | |
| Torque wrench | | Capable of tightening with the specified torques | | | |
| Pincers | | - | | | |
| Bolt | | M4, Length : 50mm | | | |

(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(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 Plut(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.

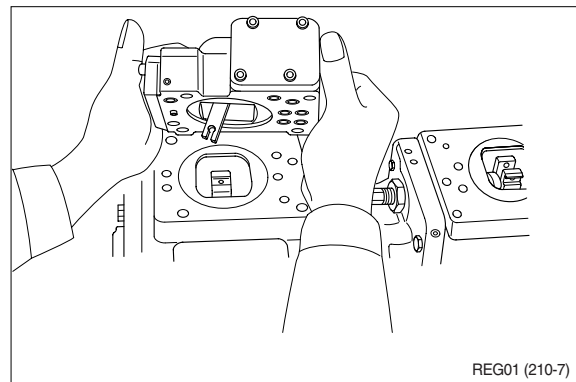
(1) Choose a place for disassembly.

- ※ 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.

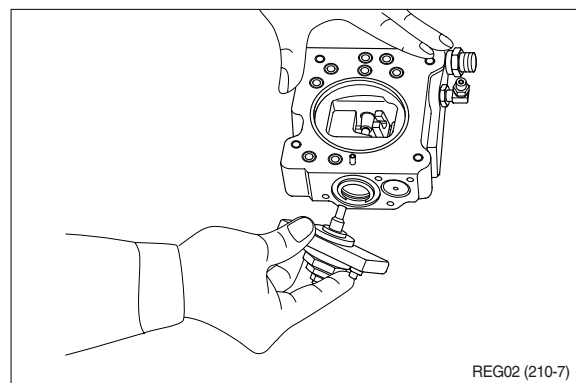
- ※ Take care not to lose O-ring.



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

- ※ Cover(C) is fitted with adjusting screw (C,QI) (628, 925), adjusting ring(C, 627), lock nut(630), hexagon nut(801) and adjusting screw(924).

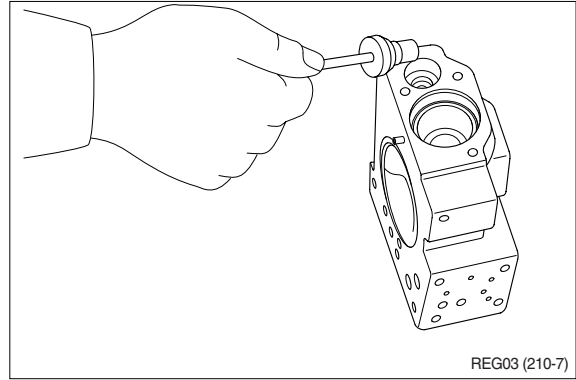
Do not loosen these screws and nuts.
If they are loosened, adjusted pressure-flow setting will vary.



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

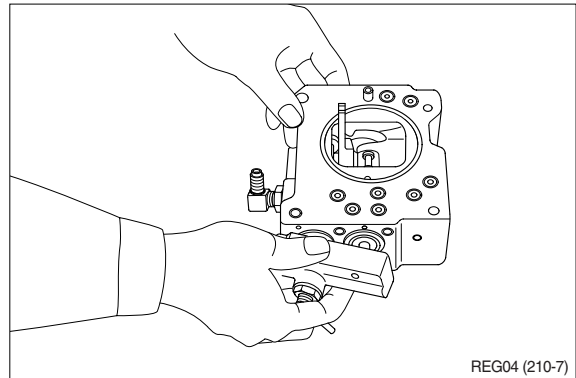
Then draw out adjusting ring(Q, 645), pilot spring(646) and spring seat(644) from pilot section.

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



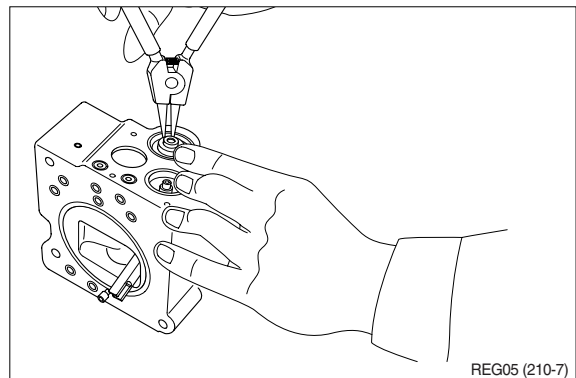
- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover(641).

After removing pilot cover, take out set spring(655) from pilot section.



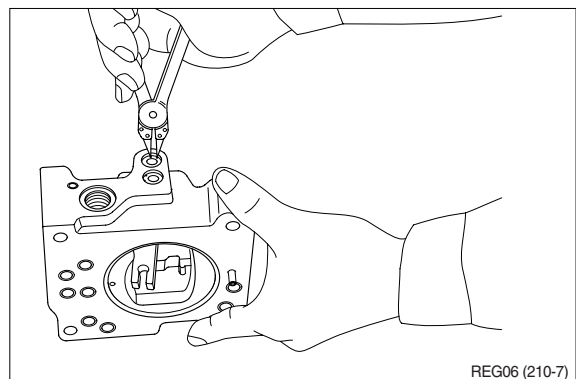
- (7) Remove snap ring(814) and take out spring seat(653), return spring(654) and sleeve(651).

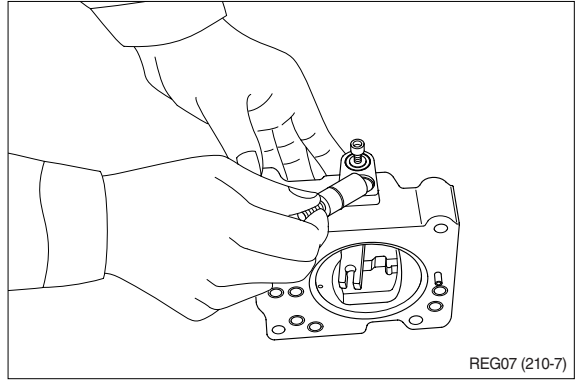
- ※ Sleeve(651) is fitted with snap ring(836).
- ※ When removing snap ring(814), return spring(654) may pop out. Take care not to lose it.



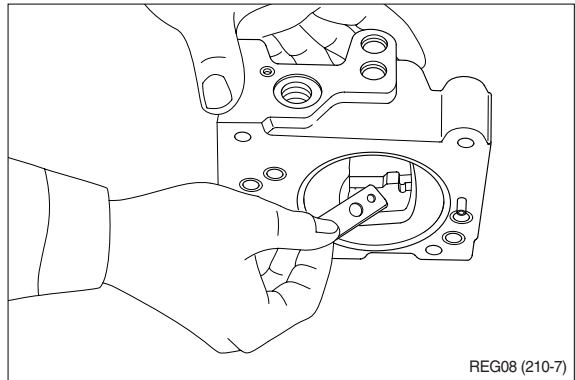
- (8) Remove locking ring(858) and take out fulcrum plug(614) and adjusting plug (615).

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

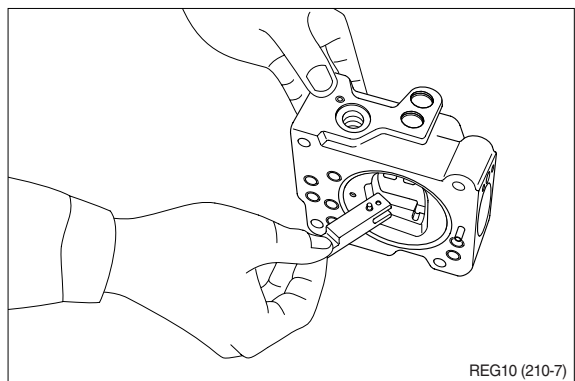
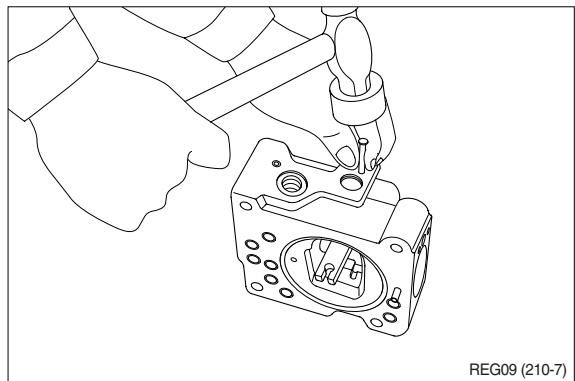




- (9) Remove lever(2, 613). Do not draw out pin(875).
※ Work will be promoted by using pincers or so on.



- (10) Draw out pin(874) and remove feedback lever(611).
Push out pin(874, 4mm 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

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.

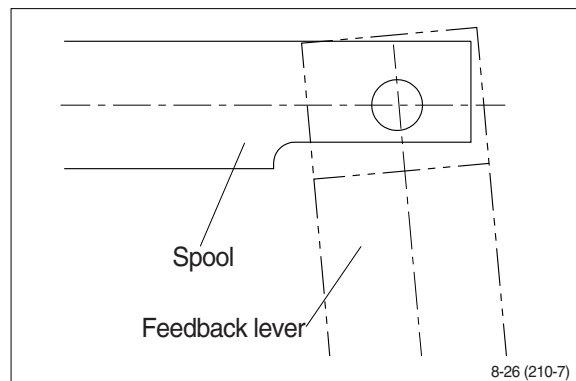
(2) Put compensating rod(623) into compensating hole of casing(601).

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

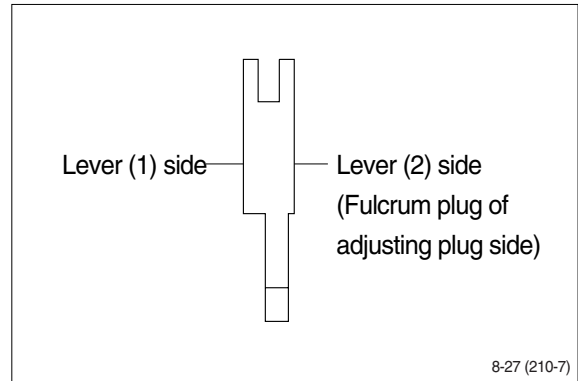
(4) Fit spool(652) and sleeve(651) into hole in spool of casing.

※ Confirm that spool and sleeve slide smoothly in casing without binding.

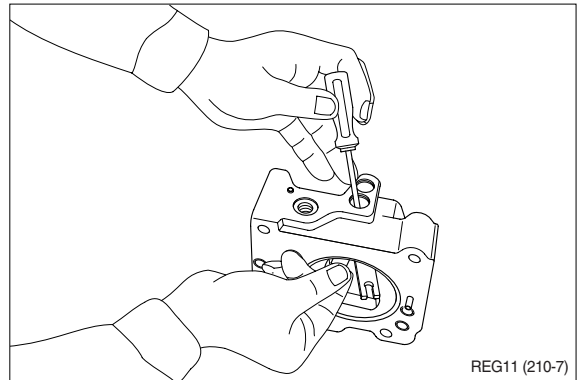
※ Pay attention to orientation of spool.



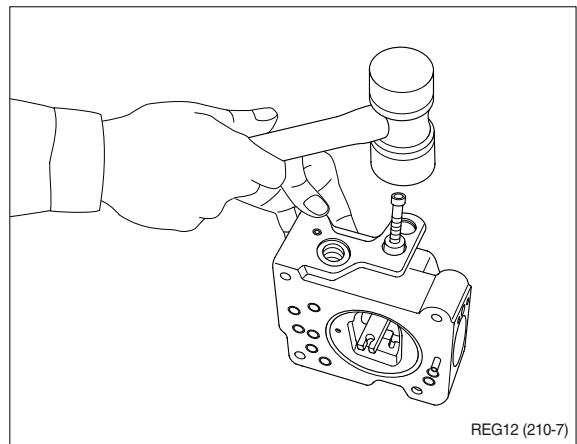
- (5) Fit feedback lever(611), matching its pin hole with pin hole in spool.
Then insert pin(874).
- ※ Insert pin in feedback lever a little to ease operation.
 - ※ Take care not to mistake direction of feedback lever.



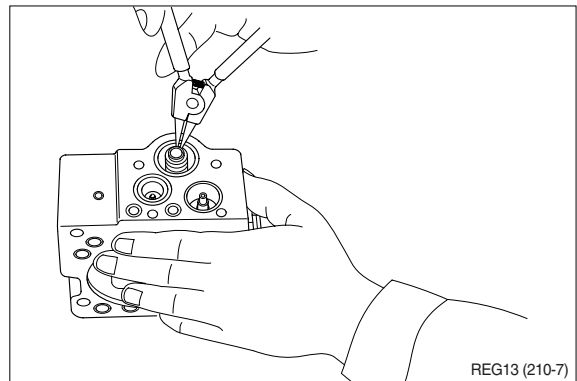
- (6) Put pilot piston(643) into pilot hole of casing.
- ※ Confirm that pilot piston slides smoothly without binding.
- (7) Put pin force-fitted in lever(2, 613) into groove of pilot piston.
Then fix lever(2).



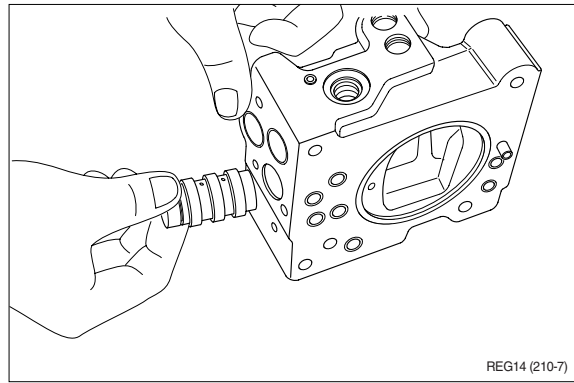
- (8) Fit fulcrum plug(614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever(2).
Then fix locking ring(858).
- (9) Insert adjusting plug(615) and fit locking ring.
- ※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
- At this point in time move feedback lever to confirm that it has no large play and is free from binding.



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

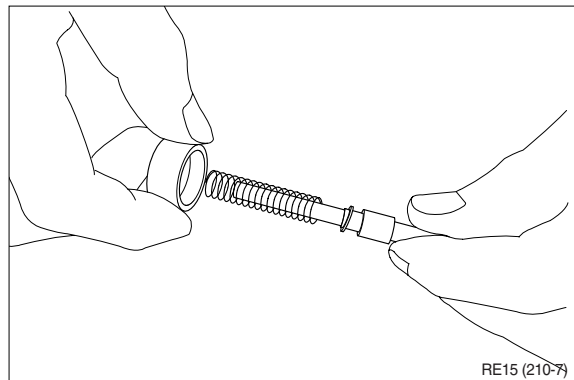


- (11) Fit set spring(655) to spool hole and put compensating piston(621) and piston case(622) into compensating hole.
Fit pilot cover(641) and tighten it with hexagonal socket head screws(436, 438).



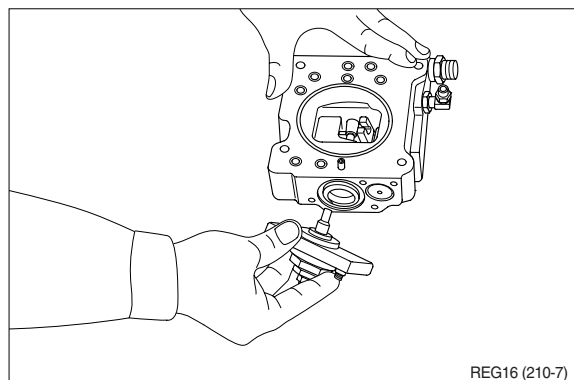
- (12) Put spring seat(644), pilot spring(646) and adjusting ring(Q, 645) into pilot hole.
Then fix spring seat(624), inner spring (626) and outer spring(625) into compensating hole.

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



- (13) Install cover(C, 629) fitted with adjusting screws(628, 925), 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.

GROUP 3 PUMP DEVICE(#0464~)

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 : 250 l

(4) Remove socket bolts(5) and disconnect hose (1,2).

(5) Disconnect pilot line hoses(4, 5, 6, 7, 8, 9, 10, 11).

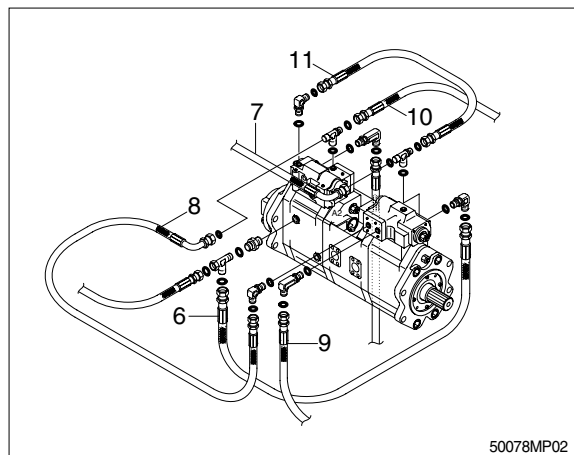
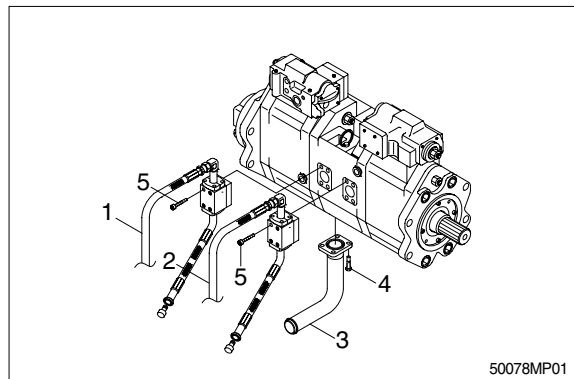
(6) Remove bolts(4) and disconnect pump suction tube (3).

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

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

· Weight : 180kg(400lb)

※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.

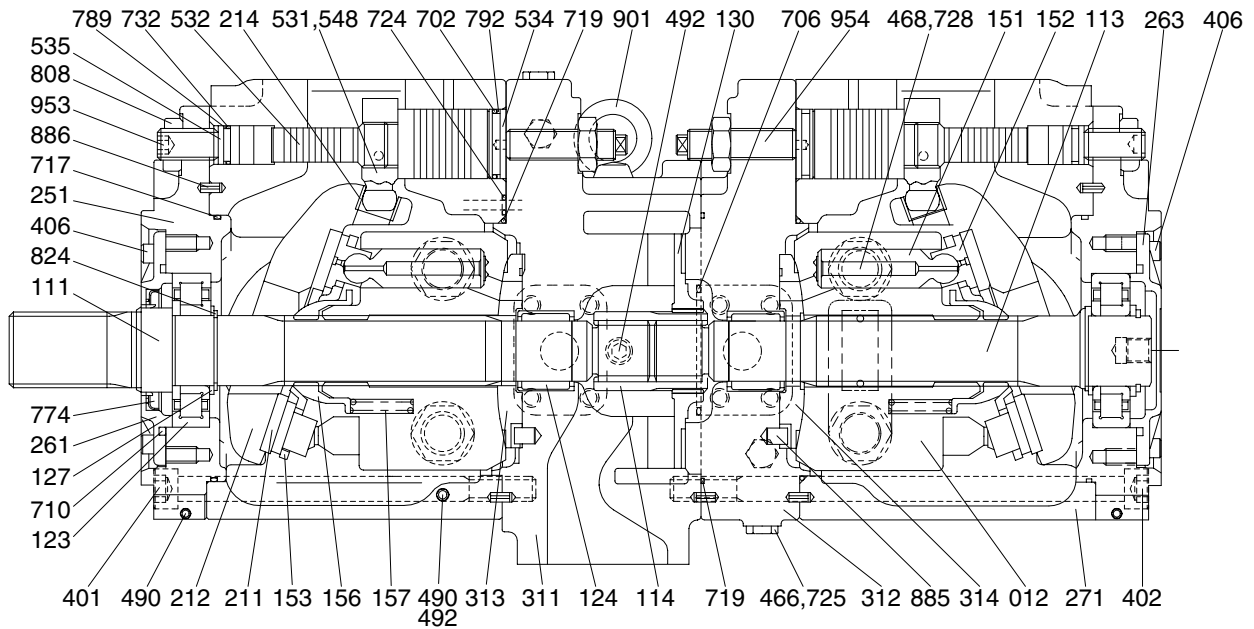


2) INSTALL

- (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



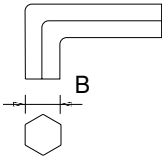

470072MP02

| | | | | | |
|-----|-----------------|-----|---------------------|-----|------------------|
| 012 | Cylinder block | 271 | Pump casing | 710 | O-ring |
| 111 | Drive shaft(F) | 311 | Valve cover(F) | 717 | O-ring |
| 113 | Driven shaft(R) | 312 | Valve cover(R) | 719 | O-ring |
| 114 | Coupling | 313 | Valve plate(R) | 724 | O-ring |
| 123 | Roller bearing | 314 | Valve plate(L) | 725 | O-ring |
| 124 | Needle bearing | 401 | Hexagon socket bolt | 728 | O-ring |
| 127 | Spacer | 402 | Hexagon socket bolt | 732 | O-ring |
| 130 | Booster | 406 | Hexagon socket bolt | 774 | Oil seal |
| 151 | Piston | 466 | VP Plug | 789 | Back up ring |
| 152 | Shoe | 468 | VP Plug | 792 | Back up ring |
| 153 | Plate | 490 | VP Plug | 808 | Hexagon head nut |
| 156 | Bushing | 492 | VP Plug | 824 | Snap ring |
| 157 | Cylinder spring | 531 | Tilting pin | 885 | Pin |
| 211 | Shoe plate | 532 | Servo piston | 886 | Spring pin |
| 212 | Swash plate | 534 | Stopper(L) | 901 | Eye bolt |
| 214 | Bushing | 535 | Stopper(S) | 953 | Set screw |
| 251 | Support plate | 548 | Feed back pin | 954 | Set screw |
| 261 | Seal cover(F) | 702 | O-ring | | |
| 263 | Seal cover(R) | 706 | O-ring | | |

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

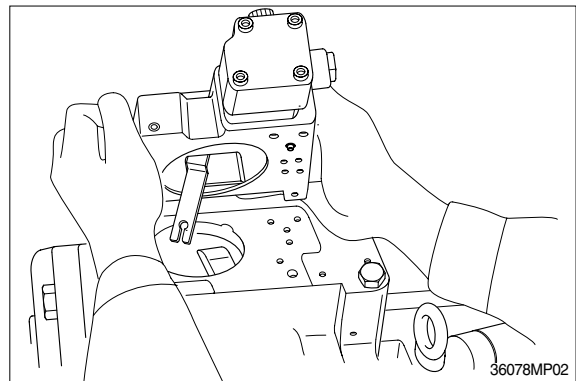
| Tool name & size | Part name | | | | |
|--|--|--------------------------|---------------------|---------------------|------------------------------|
| Allen wrench  | B | Hexagon socket head bolt | PT plug (PT thread) | PO plug (PF thread) | Hexagon socket head setscrew |
| | 4 | M 5 | BP-1/16 | - | M 8 |
| | 5 | M 6 | BP1/ 8 | - | M10 |
| | 6 | M 8 | BP-1/ 4 | PO-1/4 | M12, M14 |
| | 8 | M10 | BP-3/ 8 | PO-3/8 | M16, M18 |
| | 17 | M20, M22 | BP-1 | PO-1, 1 1/4, 1 1/2 | - |
| Double ring spanner, socket wrench, double(Single) open end spanner  | - | Hexagon head bolt | Hexagon head bolt | VP plug (PF thread) | |
| | 19 | M12 | M12 | VP-1/4 | |
| | 24 | M16 | M16 | - | |
| | 27 | M18 | M18 | VP-1/2 | |
| | 30 | M20 | M20 | - | |
| | 36 | - | - | VP-3/4 | |
| 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 | 115.7 | 0.47 | 12 |
| | M16 | 24.0 | 173.6 | 0.55 | 14 |
| | M18 | 34.0 | 245.9 | 0.55 | 14 |
| | M20 | 44.0 | 318.3 | 0.67 | 17 |
| | M22 | 64.0 | 462.9 | 0.67 | 17 |
| PT plug(Material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug | PT 1/16 | 0.7 | 5.1 | 0.16 | 4 |
| | PT 1/ 8 | 1.05 | 7.59 | 0.20 | 5 |
| | PT 1/ 4 | 1.75 | 12.66 | 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 1/ 2 | 10.0 | 72.3 | 0.39 | 10 |
| | PF 3/ 4 | 15.0 | 108.5 | 0.55 | 14 |
| | PF 1 | 19.0 | 137.4 | 0.67 | 17 |
| | PF 1 1/4 | 27.0 | 195.3 | 0.67 | 17 |
| | PF 1 1/2 | 28.0 | 202.5 | 0.67 | 17 |

3) DISASSEMBLY

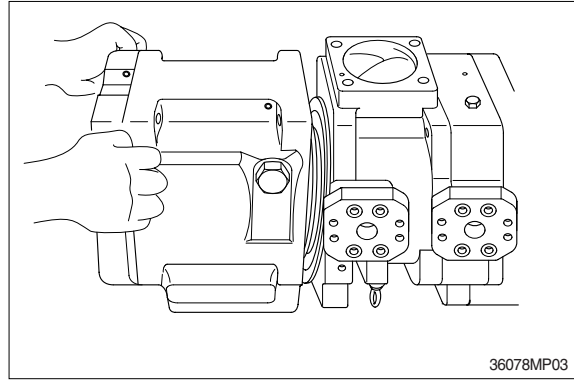
- (1) Select place suitable to disassembling.
 - ※ Select clean place.
 - ※ Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.
- (2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.
- (3) Remove drain port plug(468) and let oil out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



- (5) Loosen hexagon socket head bolts(401) which tighten swash plate support(251), pump casing(271) and valve cover(F, 311).
 - ※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.
- (6) Loosen hexagon socket head bolts(402) which tighten swash plate support(251), pump casing(271) and valve cover(R, 312).

(7) Place pump horizontally on workbench with its regulator-fitting surface down, and separate pump casing(271) from valve cover(F, 311).

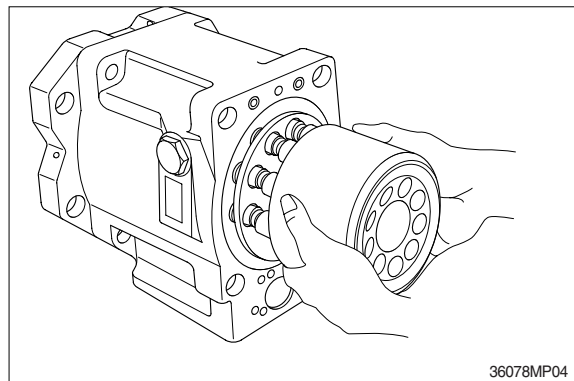
- ※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



(8) Separate valve cover(F, 311) from valve cover(R, 312) and pull out booster(130), spline coupling(114).

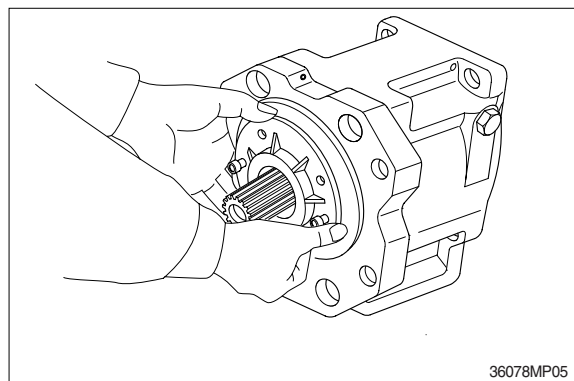
(9) Separate valve cover(R, 312) from pump casing and then pull out the cylinder block(012) of pump casing(271) straightly over drive shaft(R, 113). Pull out also pistons(151), set plate(153), spherical bush(156) and cylinder springs (157) simultaneously.

- ※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.

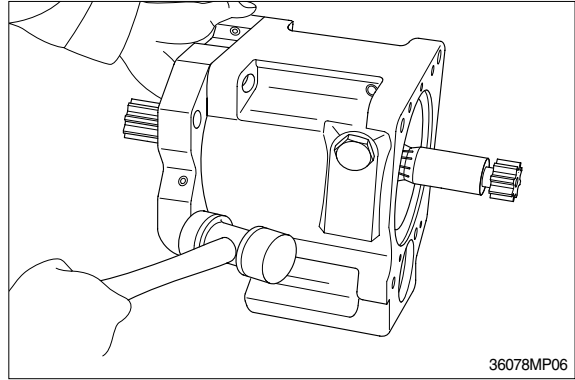


(10) Remove hexagon socket head bolts(406) and then seal cover(F, 261).

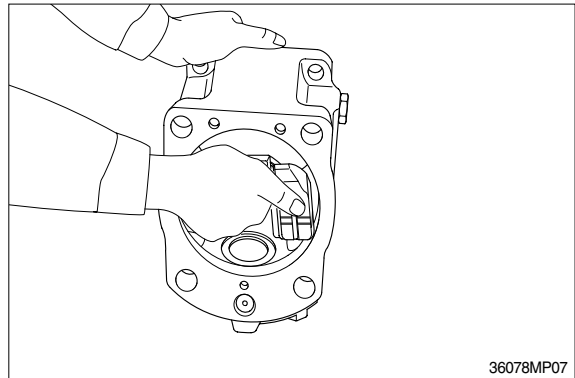
- ※ Fit bolt into pulling-out tapped hole of seal cover(F), and cover can be removed easily.
- ※ Since oil seal is fitted on seal cover(F), take care not to damage it when removing cover.



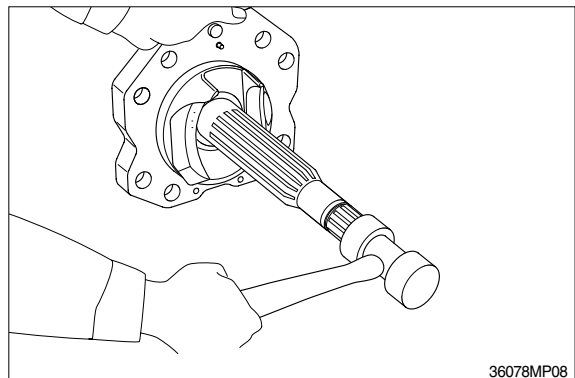
(11) Tapping lightly fitting flange section of swash plate support(251) on its pump casing side, separate swash plate support from pump casing.



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

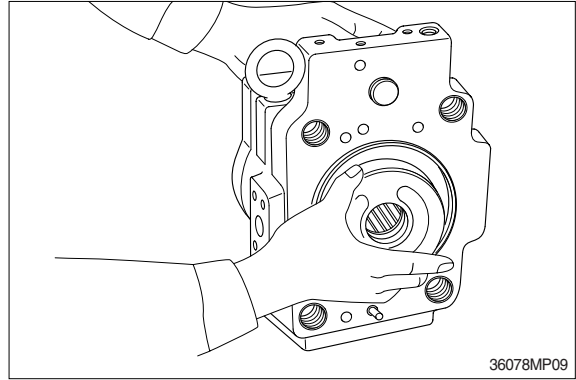


(13) Tapping lightly shaft ends of drive shafts(111, 113) with plastic hammer, take out drive shafts from swash plate supports.



(14) Remove valve plates(313, 314) from valve cover(311, 312).

- ※ These may be removed in work 7, 9.



(15) If necessary, remove stopper (L, 534), stopper(S, 535), servo piston(532) and tilting pin(531) from pump casing(271), and needle bearing(124) from valve cover(311, 312).

- ※ In removing tilting pin, use a protector to prevent pin head from being damaged.
- ※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.
- ※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.
- ※ Do not loosen hexagon nuts of valve cover and swash plate support.
If loosened, flow setting will be changed.

(16) This is the end of disassembling procedures.

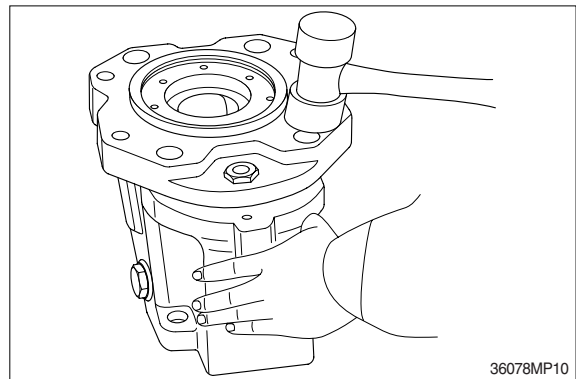
4) ASSEMBLY

(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 8-11, 12.
- ⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

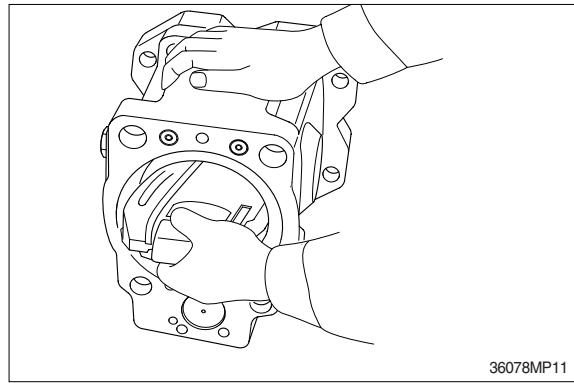
(2) Fit swash plate support(251) to pump casing(271), tapping the former lightly with a hammer.

- ※ After servo piston, tilting pin, stopper(L) and stopper(S) are removed, fit them soon to pump casing in advance for reassembling.
- ※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite(Medium strength) to their threaded sections.



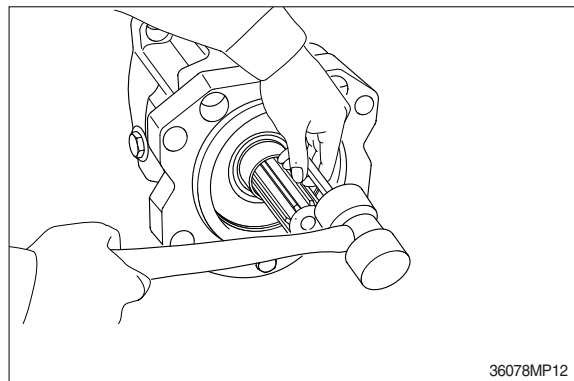
(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin(531) and fit swash plate (212) to swash plate support(251) correctly.

- ※ Confirm with fingers of both hands that swash plate can be removed smoothly.
- ※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



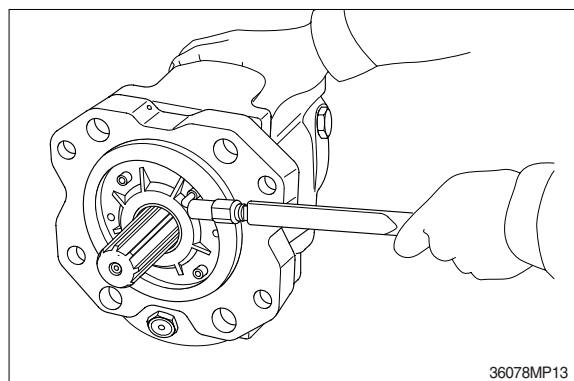
(4) To swash plate support(251), fit drive shaft(111) set with bearing(123), bearing spacer(127) and snap ring(824).

- ※ Do not tap drive shaft with hammer or so on.
 - ※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.
- Fit them fully, using steel bar or so on.

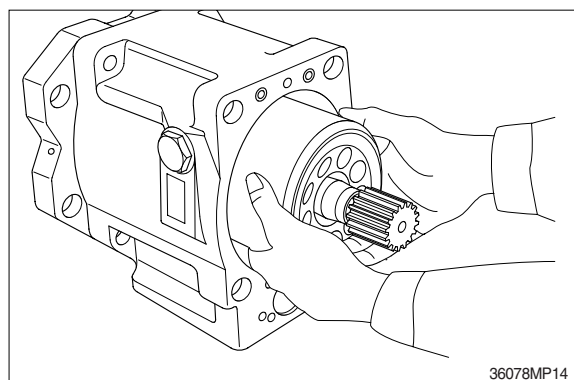


(5) Assemble seal cover(F, 261) to pump casing(271) and fix it with hexagon socket head bolts(406).

- ※ Apply grease lightly to oil seal in seal cover(F).
- ※ Assemble oil seal, taking full care not to damage it.
- ※ For tandem type pump, fit rear cover(263) and seal cover(262) similarly.

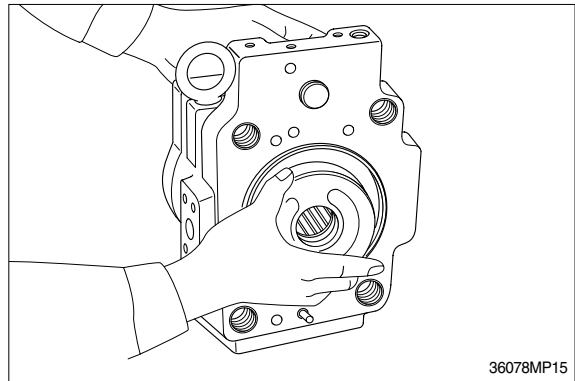


(6) Assemble piston cylinder subassembly [cylinder block(012), piston subassembly (151, 152), set plate(153), spherical bushing(156) and cylinder spring (157)]. Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing(271).



(7) Fit valve plate(313) to valve cover(F, 311), and fit valve plate(314) to valve cover(R, 312), entering pin into pin hole.

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



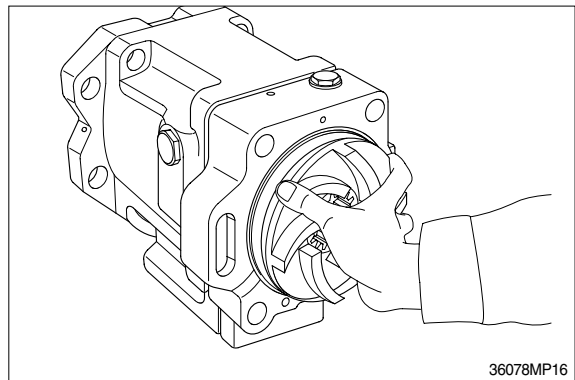
(8) Fit valve block(R, 312) to pump casing (271) and fit spline coupling(114) and booster(130) to shaft(R, 113).

※ Take care not to mistake direction of valve cover.

Fit valve cover with regulator up and with delivery flange left, viewed from front side.

※ Take care not to mistake direction of booster(130).

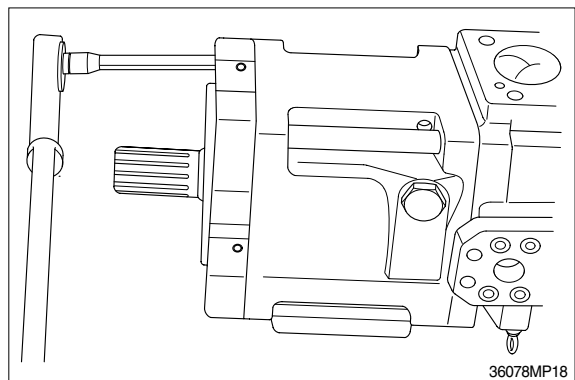
(Refer to the sectional drawing)



(9) Fit valve cover(F, 311) to valve cover(R) and tighten hexagon socket head bolts(402).

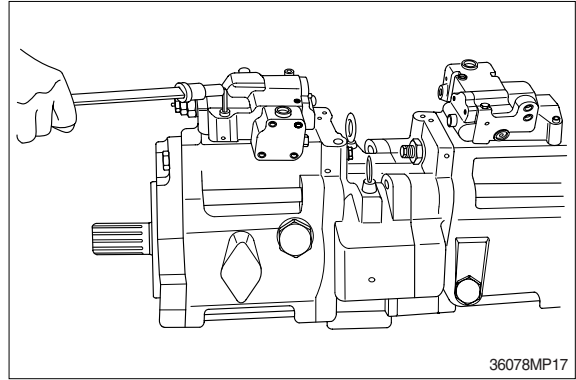
(10) Fit pump casing(271) with shaft(F, 111) to valve cover(F, 311) and tighten hexagon socket head bolts(401).

※ Mate spline phases of shaft(F) and spline coupling, with shaft(F) been rotating.



(11) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts(412,413).

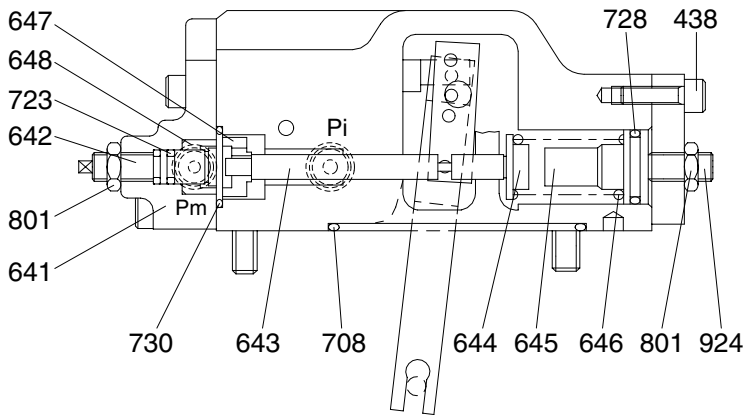
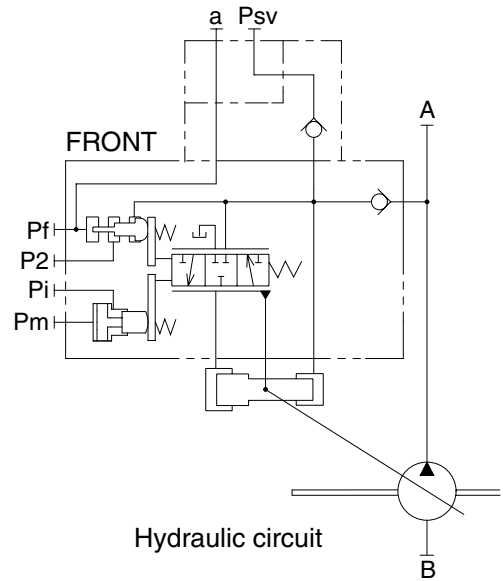
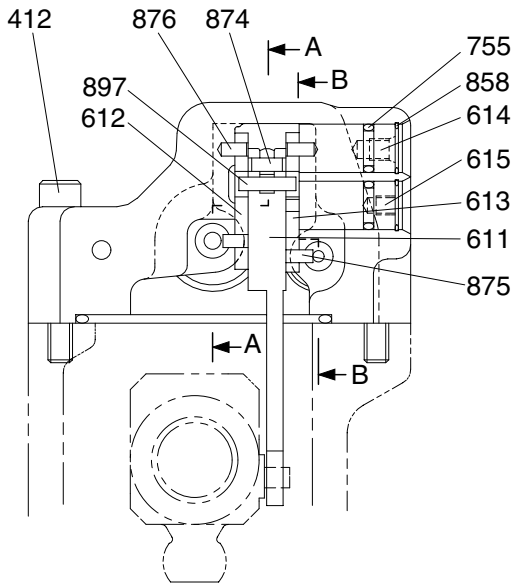
※ Take care not to mistake regulator of front pump for that of rear pump.



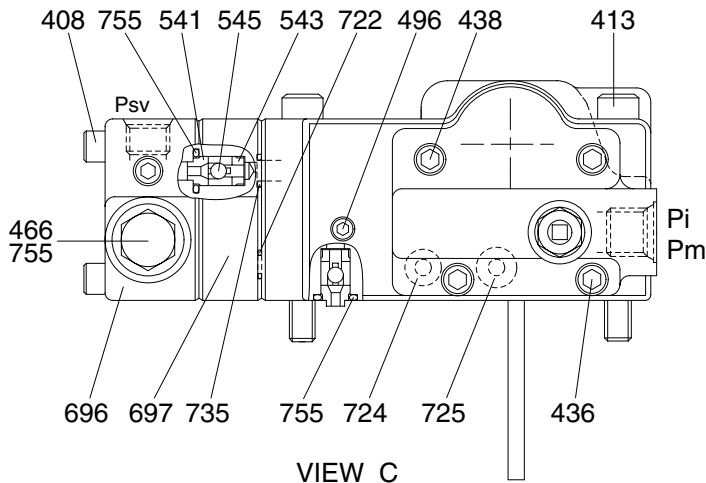
(12) Fit drain port plug(468).

This is the end of reassembling procedures.

5) REGULATOR(1/2)



SECTION B-B

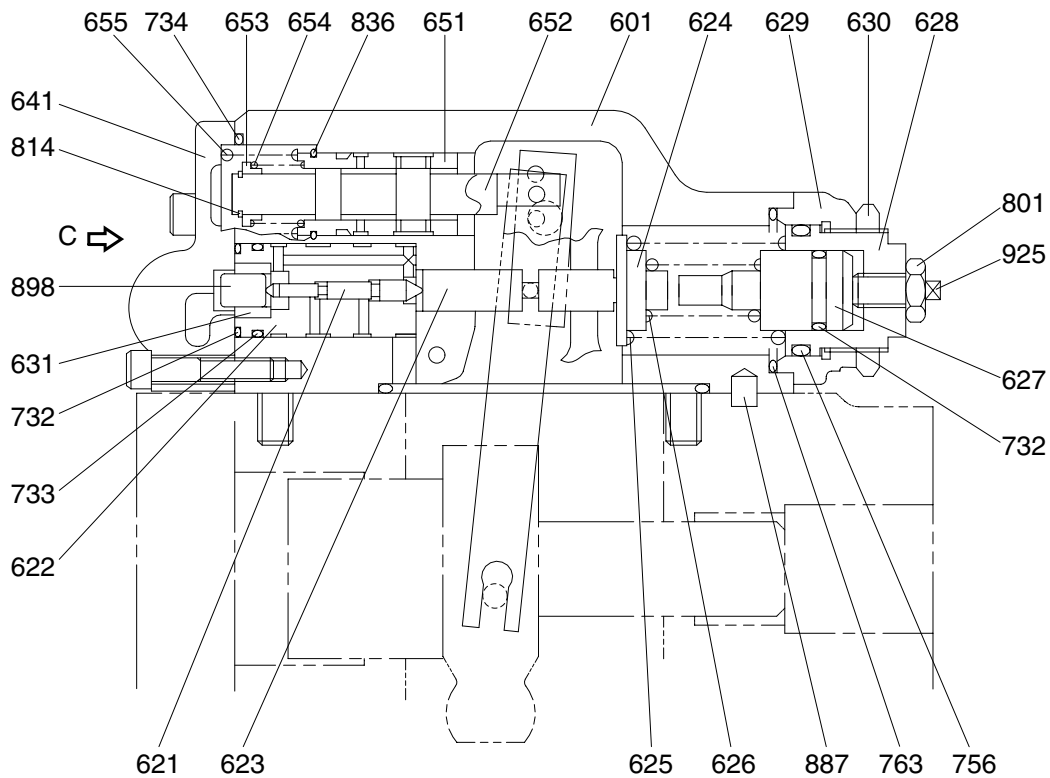


VIEW C

470072RG01

| Port | Port name | Port size |
|------|-------------------------|-------------|
| Pi | Pilot port | PF 1/4 - 15 |
| Psv | Servo assist port | PF 1/4 - 15 |
| P2 | Companion delivery port | - |
| Pf | Powershift port | - |
| a | Gauge port | PF 1/4 - 15 |

REGULATOR(2/2)



SECTION A-A

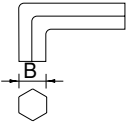

470072RG02

| | | |
|--------------------------|-----------------------|----------------------|
| 408 Hexagon socket screw | 628 Adjust screw(C) | 725 O-ring |
| 412 Hexagon socket screw | 629 Cover(C) | 728 O-ring |
| 413 Hexagon socket screw | 630 Lock nut | 730 O-ring |
| 436 Hexagon socket screw | 631 Sleeve, pf | 732 O-ring |
| 438 Hexagon socket screw | 641 Pilot cover | 733 O-ring |
| 466 Plug | 642 Adjust screw(QMC) | 734 O-ring |
| 496 Plug | 643 Pilot piston | 735 O-ring |
| 541 Seat | 644 Spring seat(Q) | 755 O-ring |
| 543 Stopper | 645 Adjust stem(Q) | 756 O-ring |
| 545 Steel ball | 646 Pilot spring | 763 O-ring |
| 601 Casing | 647 Stopper | 801 Nut |
| 611 Feed back lever | 648 Piston(QMC) | 814 Snap ring |
| 612 Lever(1) | 651 Sleeve | 836 Snap ring |
| 613 Lever(2) | 652 Spool(A) | 858 Snap ring |
| 614 Center plug | 653 Spring seat | 874 Spring pin |
| 615 Adjust plug | 654 Return spring | 875 Pin |
| 621 Compensator piston | 655 Set spring | 876 Pin |
| 622 Piston case | 696 Port cover | 878 Pin |
| 623 Compensator rod | 697 Check valve plate | 887 Pin |
| 624 Spring seat(C) | 708 O-ring | 897 Pin |
| 625 Outer spring | 722 O-ring | 898 Pin |
| 626 Inner spring | 723 O-ring | 924 Set screw |
| 627 Adjust stem(C) | 724 O-ring | 925 Adjust screw(QI) |

6) 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 | M 5 | BP-1/16 | - | M 8 |
| | 5 | M 6 | BP-1/8 | - | M10 |
| | 6 | M 8 | 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 36mm | | | |
| Screw driver | | Minus type screw driver, Medium size, 2 sets | | | |
| Hammer | | Plastic hammer, 1 set | | | |
| Pliers | | For snap ring, TSR-160 | | | |
| Steel bar | | 4 × 100mm | | | |
| Torque wrench | | Capable of tightening with the specified torques | | | |
| Pincers | | - | | | |
| Bolt | | M4, Length : 50mm | | | |

(2) Tightening torque

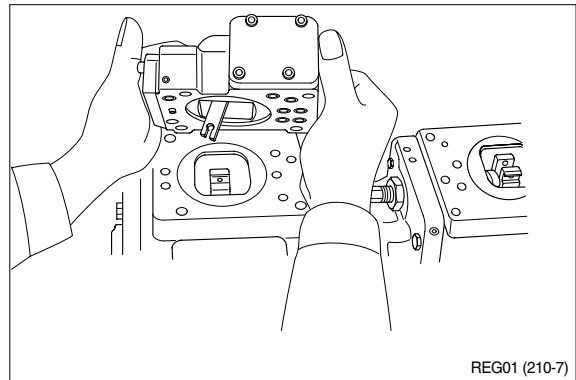
| Part name | Bolt size | Torque | | Wrench size | |
|---|-----------|---------|----------|-------------|----|
| | | kgf · m | lbf · ft | in | mm |
| Hexagon socket head bolt Material : SCM435) | M 5 | 0.7 | 5.1 | 0.16 | 4 |
| | M 6 | 1.2 | 8.7 | 0.20 | 5 |
| | M 8 | 3.0 | 21.7 | 0.24 | 6 |
| | M10 | 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(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 Plut(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

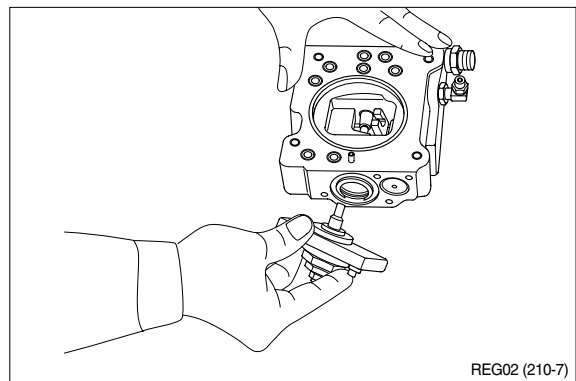
Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

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.



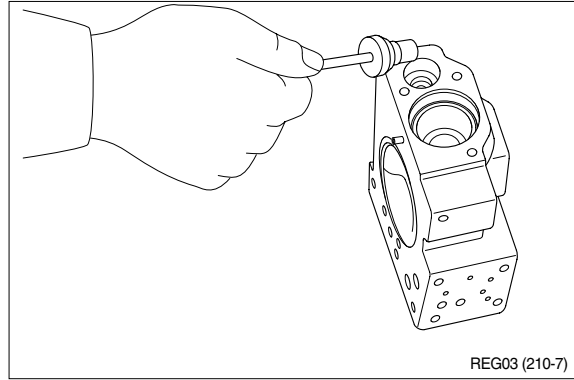
- (4) Remove hexagon socket head screw (438) and remove cover(C,629)
 - ※ Cover(C) is fitted with adjusting screw (C,QI) (628, 925), adjusting ring(C, 627), lock nut(630), hexagon nut(801) and adjusting screw(924).
Do not loosen these screws and nuts.
If they are loosened, adjusted pressure-flow setting 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.

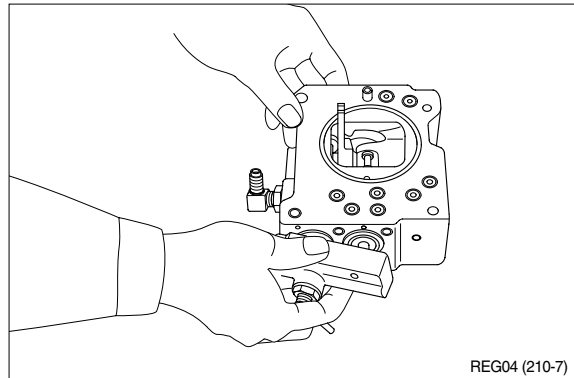
Then draw out adjusting ring(Q, 645), pilot spring(646) and spring seat(644) from pilot section.

※ 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.

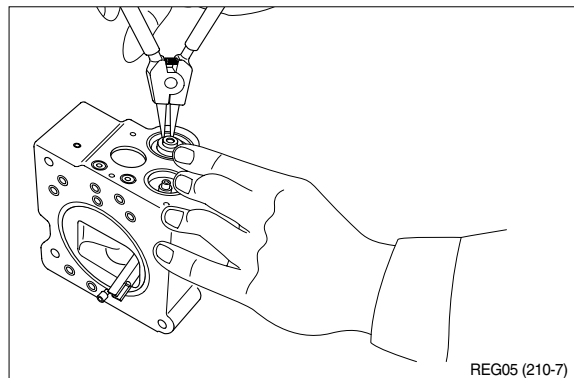


(7) Remove snap ring(814) and take out spring seat(653), return spring(654) and sleeve(651).

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

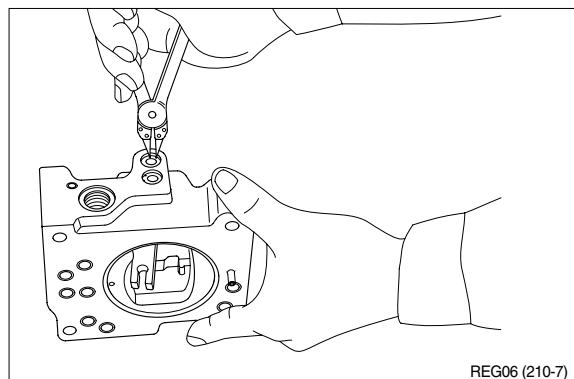
※ When removing snap ring(814), return spring(654) may pop out.

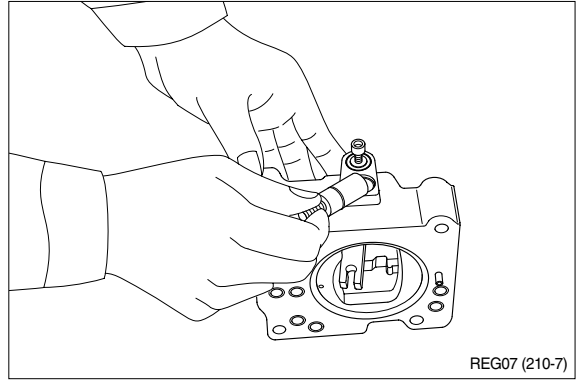
Take care not to lose it.



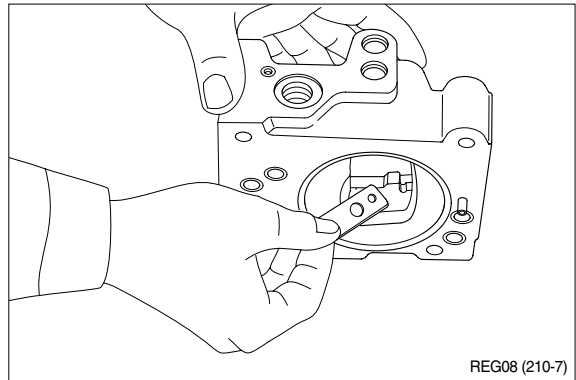
(8) Remove locking ring(858) and take out fulcrum plug(614) and adjusting plug (615).

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

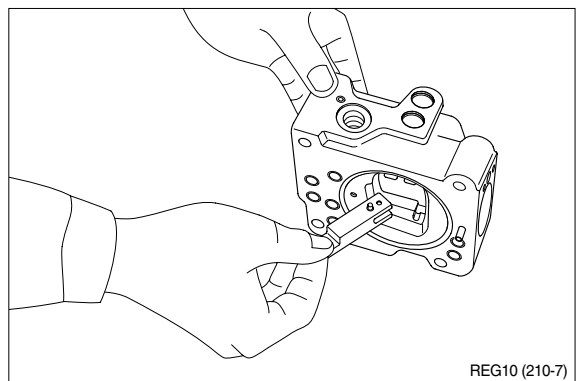
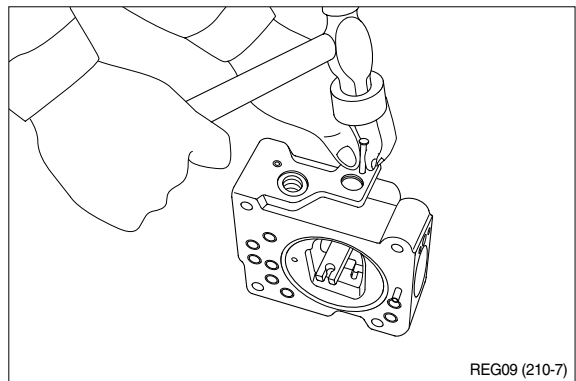




- (9) Remove lever(2, 613). Do not draw out pin(875).
※ Work will be promoted by using pincers or so on.



- (10) Draw out pin(874) and remove feedback lever(611).
Push out pin(874, 4mm 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

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.

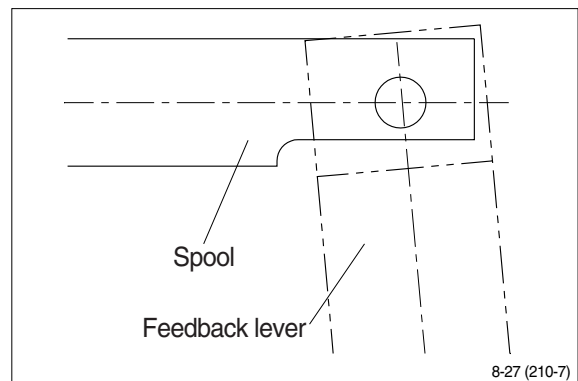
(2) Put compensating rod(623) into compensating hole of casing(601).

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

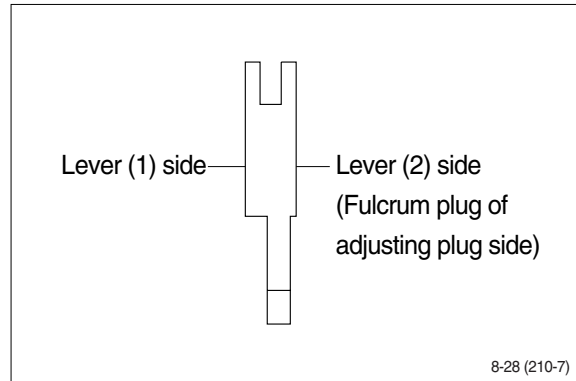
(4) Fit spool(652) and sleeve(651) into hole in spool of casing.

※ Confirm that spool and sleeve slide smoothly in casing without binding.

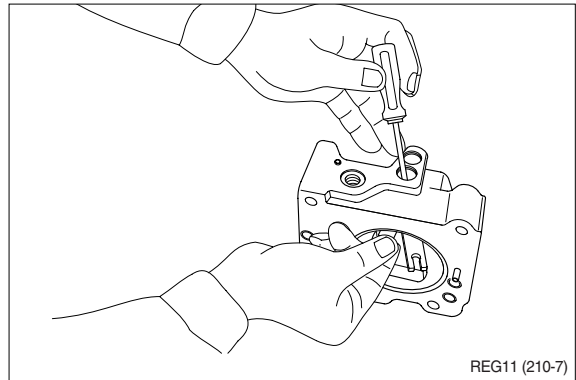
※ Pay attention to orientation of spool.



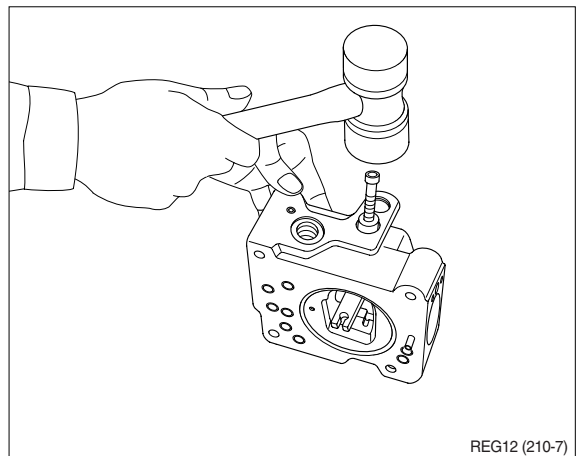
- (5) Fit feedback lever(611), matching its pin hole with pin hole in spool.
Then insert pin(874).
- ※ Insert pin in feedback lever a little to ease operation.
 - ※ Take care not to mistake direction of feedback lever.



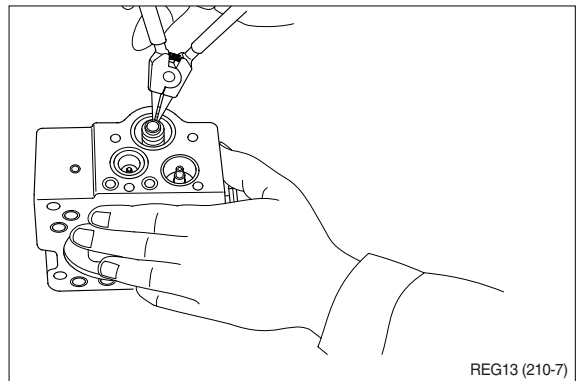
- (6) Put pilot piston(643) into pilot hole of casing.
- ※ Confirm that pilot piston slides smoothly without binding.
- (7) Put pin force-fitted in lever(2, 613) into groove of pilot piston.
Then fix lever(2).



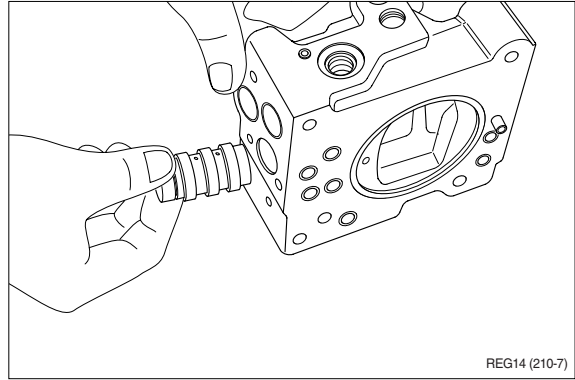
- (8) Fit fulcrum plug(614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever(2).
Then fix locking ring(858).
- (9) Insert adjusting plug(615) and fit locking ring.
- ※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
- At this point in time move feedback lever to confirm that it has no large play and is free from binding.



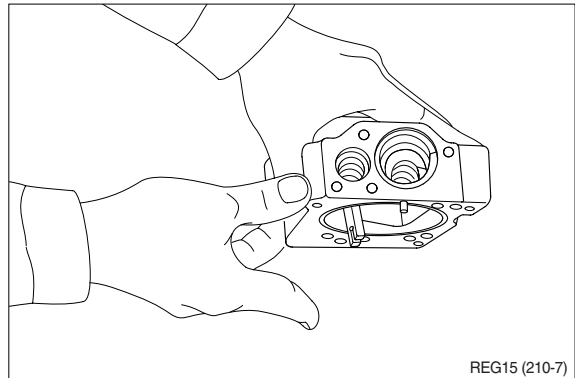
- (10) Fit return spring(654) and spring seat (653) into spool hole and attach snap ring (814).



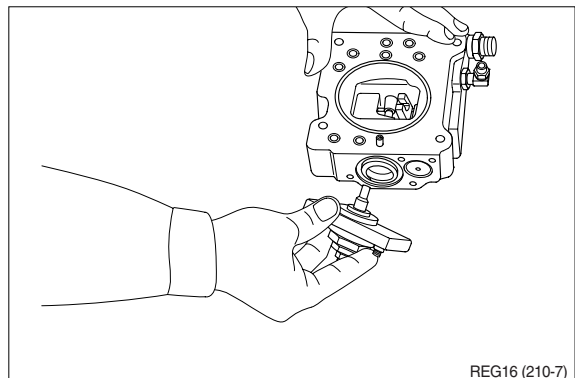
- (11) Fit set spring(655) to spool hole and put compensating piston(621) and piston case(622) into compensating hole.
Fit pilot cover(641) and tighten it with hexagonal socket head screws(436, 438).



- (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, 925), 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.