GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL

1) REMOVAL

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

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

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

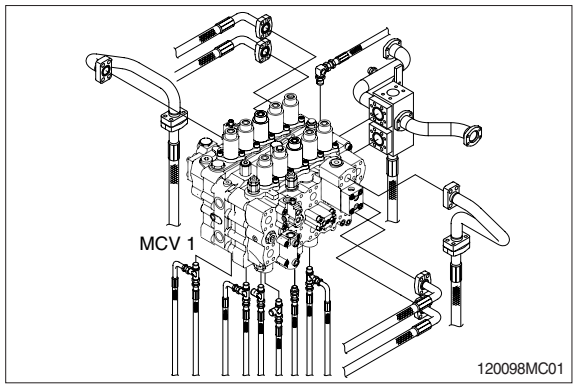
(5) Remove bolts and disconnect pipe.

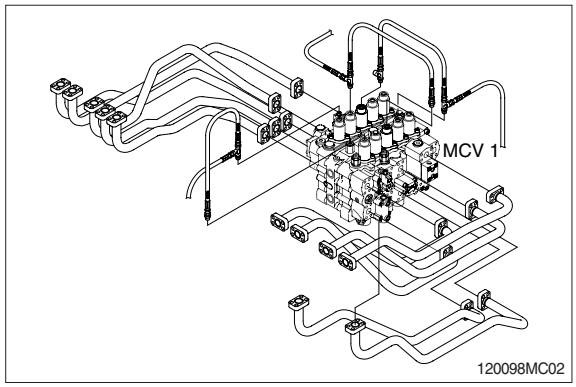
(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt.
- MCV 1 weight : 450 kg (990 lb)
- MCV 2 weight : 160 kg (350 lb)

(9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.



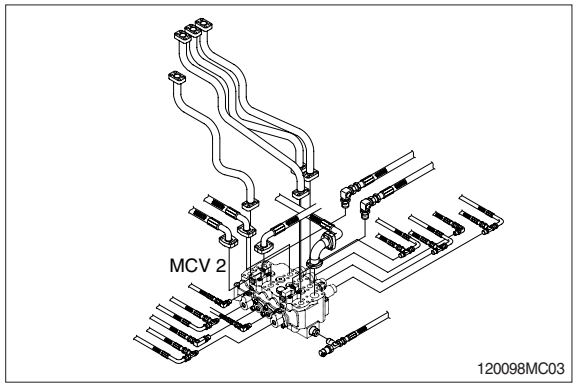


2) INSTALL

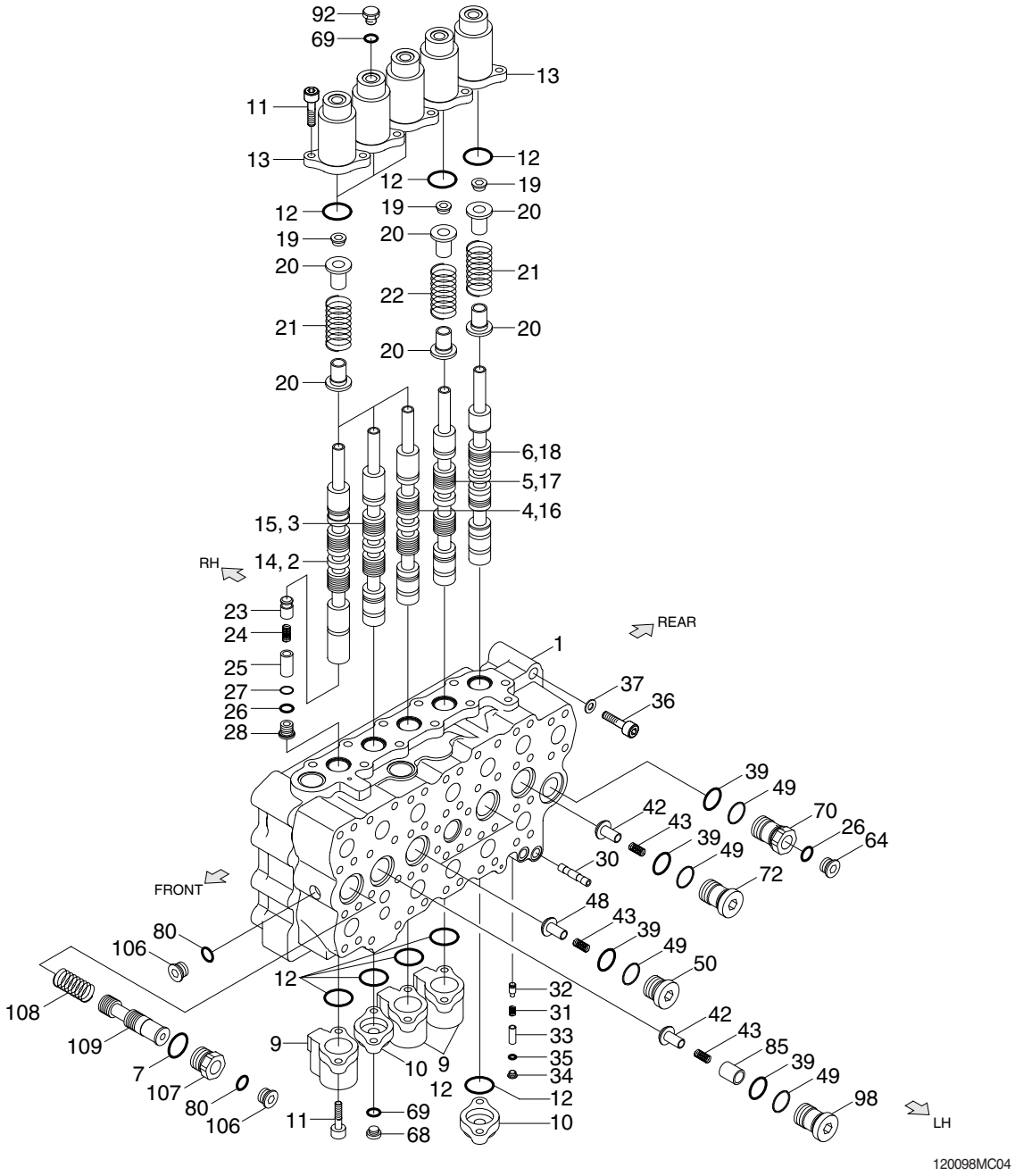
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from below items.
① Cylinder (boom, arm, bucket)
② Swing motor
③ Travel motor
※ See each item removal and install.

(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



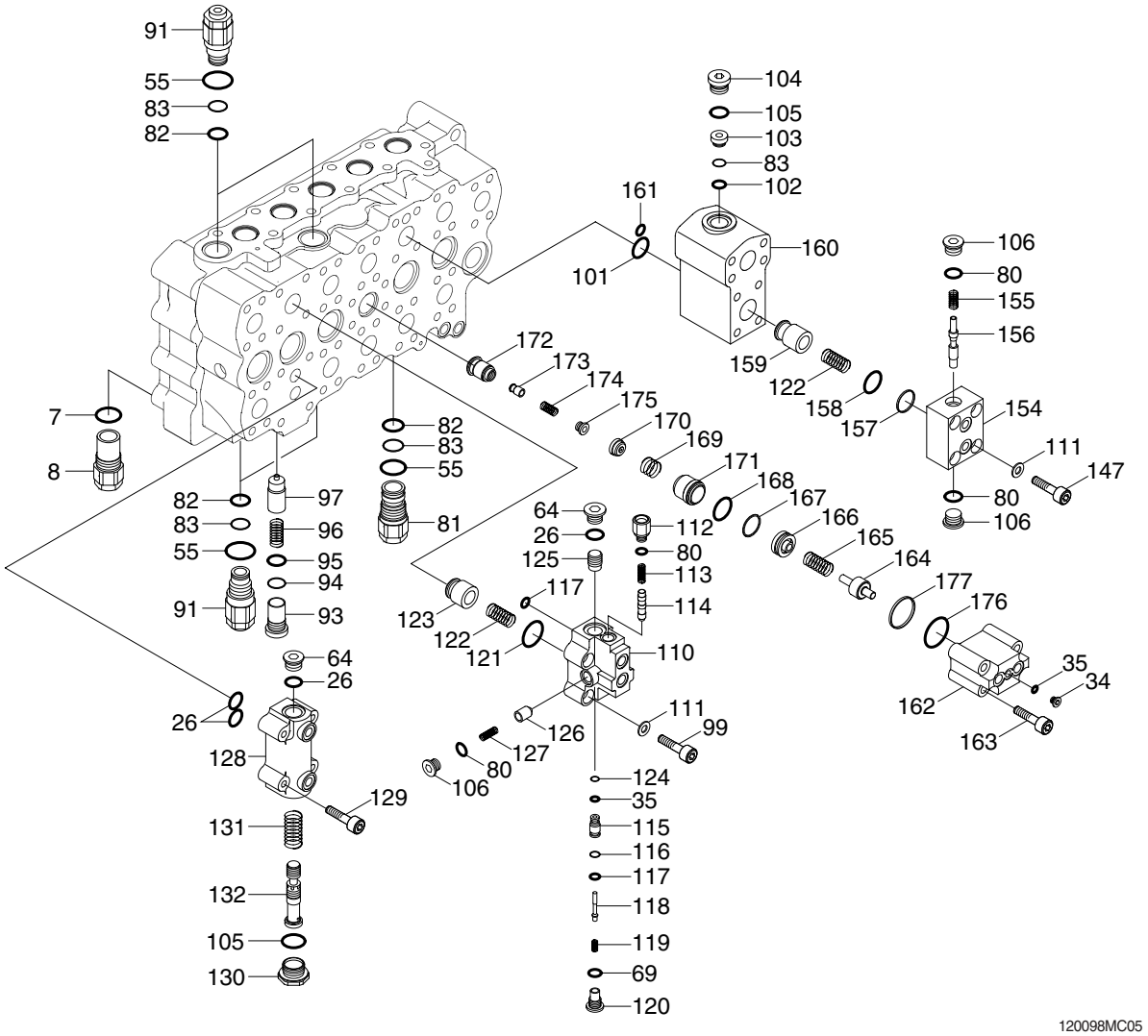
2. STRUCTURE (MCV 1, 1/5)



120098MC04

1	Housing	16	Plunger	31	Spring	68	Cap
2	Plunger assy	17	Plunger	32	Check	69	O-ring
3	Plunger assy	18	Plunger	33	Spacer	70	Cap
4	Plunger assy	19	Cap	34	Cap	72	Cap
5	Plunger assy	20	Spring guide	35	O-ring	80	O-ring
6	Plunger assy	21	Spring	36	Socket bolt	85	Cap
7	O-ring	22	Spring	37	Washer	92	Plug
9	Cover	23	Check	39	O-ring	98	Cap
10	Cover	24	Spring	42	Check	106	Cap
11	Socket bolt	25	Spacer	43	Spring	107	Cap
12	O-ring	26	O-ring	48	Check	108	Spring
13	Cover	27	Back up ring	49	Back up ring	109	Spool
14	Plunger	28	Cap	50	Cap		
15	Plunger	30	Orifice	64	Cap		

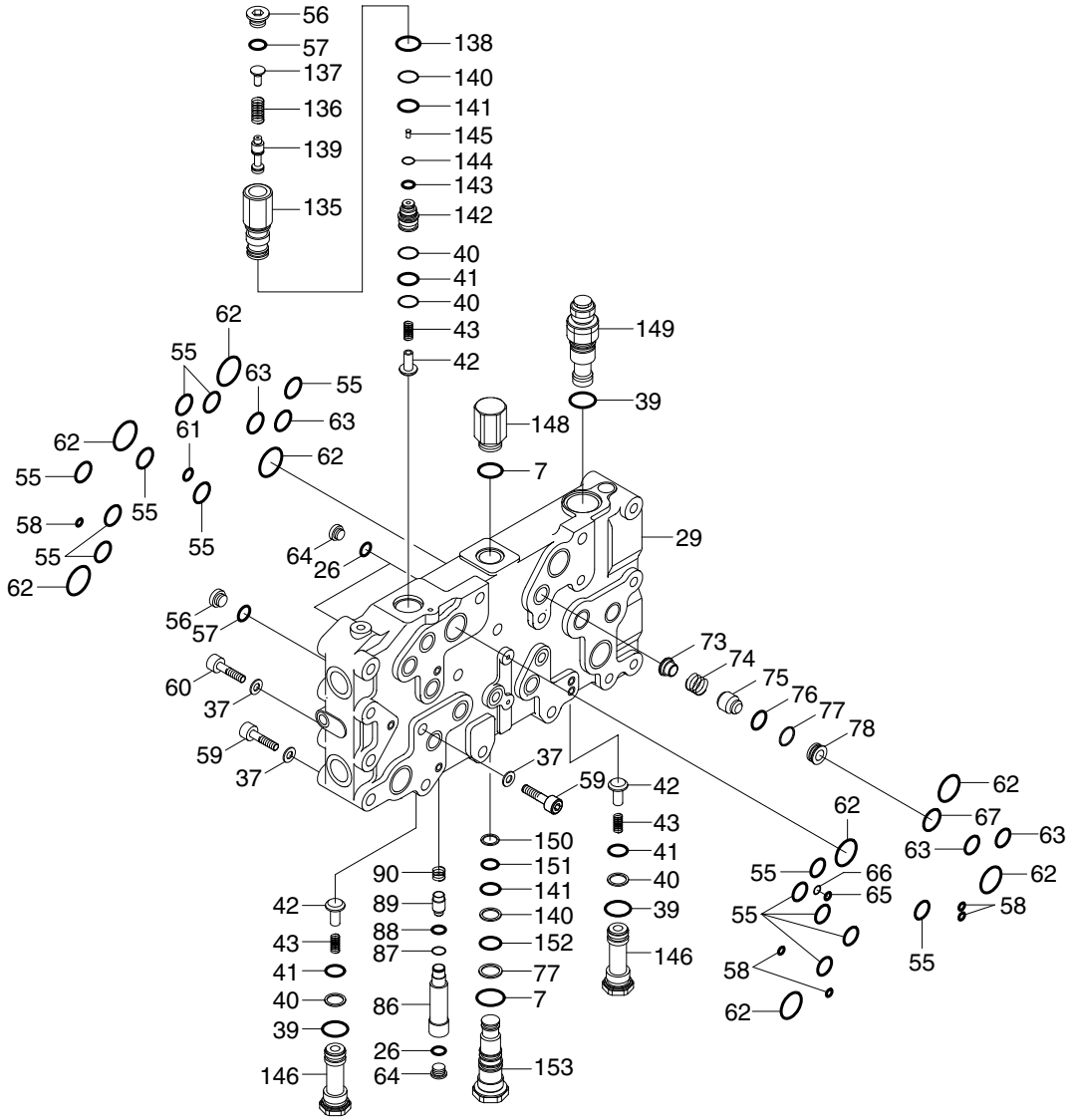
STRUCTURE (MCV1, 2/5)



120098MC05

7	O-ring	101	O-ring	122	Spring	160	Mainfold
8	Foot relief valve assy	102	O-ring	123	Poppet	161	O-ring
26	O-ring	103	Plug	124	Back up ring	162	Cover
34	Cap	104	Cap	125	Piston	163	Socket bolt
35	O-ring	105	O-ring	126	Check	164	Pisotn
55	O-ring	106	Cap	127	Spring	165	Spring
64	Cap	110	Cover assy	128	Cover	166	Plate
69	O-ring	111	Lock washer	129	Socket bolt	167	Back up ring
80	O-ring	112	Cap	130	Cap	168	O-ring
81	Make up assy	113	Spring	131	Spring	169	Spring
82	O-ring	114	Piston	132	Spool	170	Spring guide
83	Back up ring	115	Sleeve	147	Socket bolt	171	Sleeve
91	Overload relief valve	116	Back up ring	154	Cover	172	Poppet
93	Cap	117	O-ring	155	Spring	173	Check
94	Back up ring	118	Poppet	156	Spool	174	Spring
95	O-ring	119	Spring	157	Back up ring	175	Cap
96	Spring	120	Cap	158	O-ring	176	O-ring
97	Check	121	O-ring	159	Poppet	177	Back up ring
99	Socket bolt						

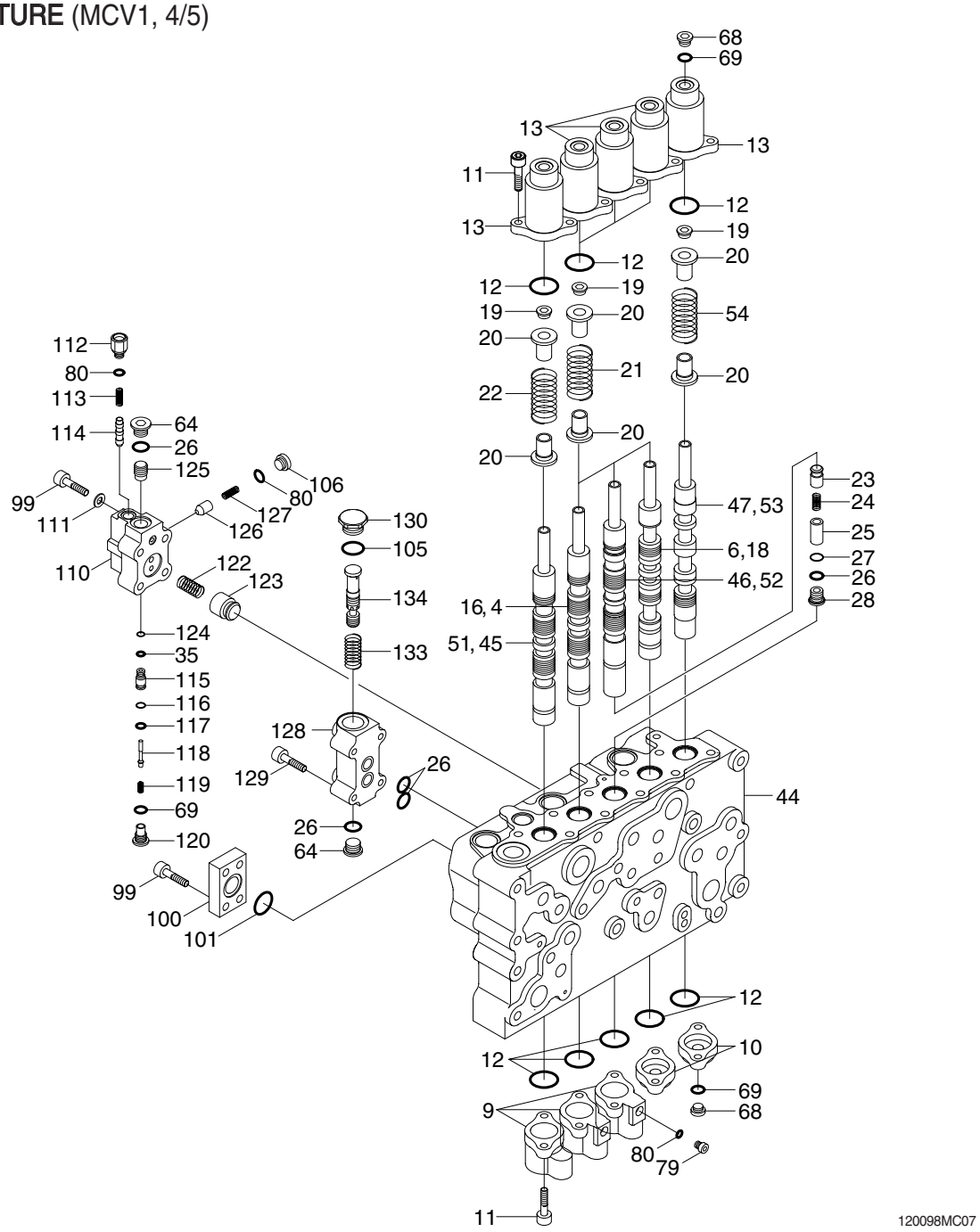
STRUCTURE (MCV1, 3/5)



120098MC06

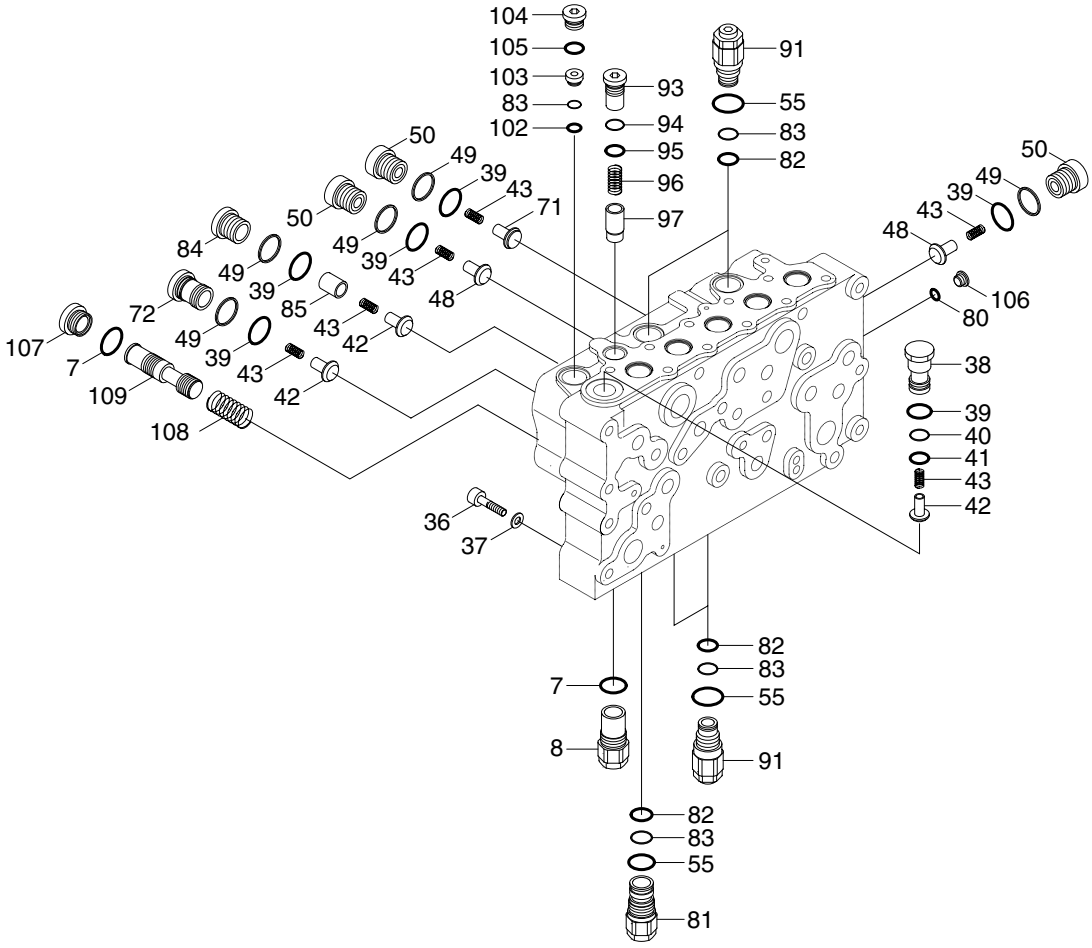
7	O-ring	59	Socket bolt	77	Back up ring	141	O-ring
26	O-ring	60	Socket bolt	78	Seat	142	Sleeve
29	Manifold	61	O-ring	86	Cap	143	O-ring
37	Washer	62	O-ring	87	Back up ring	144	Back up ring
39	O-ring	63	O-ring	88	O-ring	145	Pisotn
40	Back up ring	64	Cap	89	Check	146	Cap
41	O-ring	65	O-ring	90	Spring	148	Boost check valve
42	Check	66	Back up ring	135	Sleeve	149	Main relief valve assy
43	Spring	67	O-ring	136	Spring	150	Back up ring
55	O-ring	73	Spring guide	137	Spring	151	O-ring
56	Cap	74	Spring	138	O-ring	152	O-ring
57	O-ring	75	Check	139	Spool	153	Cap
58	O-ring	76	O-ring	140	Back up ring		

STRUCTURE (MCV1, 4/5)



4	Plunger assy	25	Spacer	69	O-ring	117	O-ring
6	Plunger assy	26	O-ring	79	Plug	118	Poppet
9	Cover	27	Back up ring	80	O-ring	119	Spring
10	Cover	28	Cap	99	Socket bolt	120	Cap
11	Socket bolt	35	O-ring	100	Flange	122	Spring
12	O-ring	44	Housing	101	O-ring	123	Poppet
13	Cover	45	Plunger assy	105	O-ring	124	Back up ring
16	Plunger	46	Plunger assy	106	Cap	125	Piston
18	Plunger	47	Plunger assy	110	Cover assy	126	Check
19	Plunger cap	51	Plunger	111	Lock washer	127	Spring
20	Spring guide	52	Plunger	112	Cap	128	Cover
21	Spring	53	Plunger	113	Spring	129	Socket bolt
22	Spring	54	Spring	114	Piston	130	Cap
23	Check	64	Cap	115	Sleeve	133	Spring
24	Spring	68	Cap	116	Back up ring	134	Spool

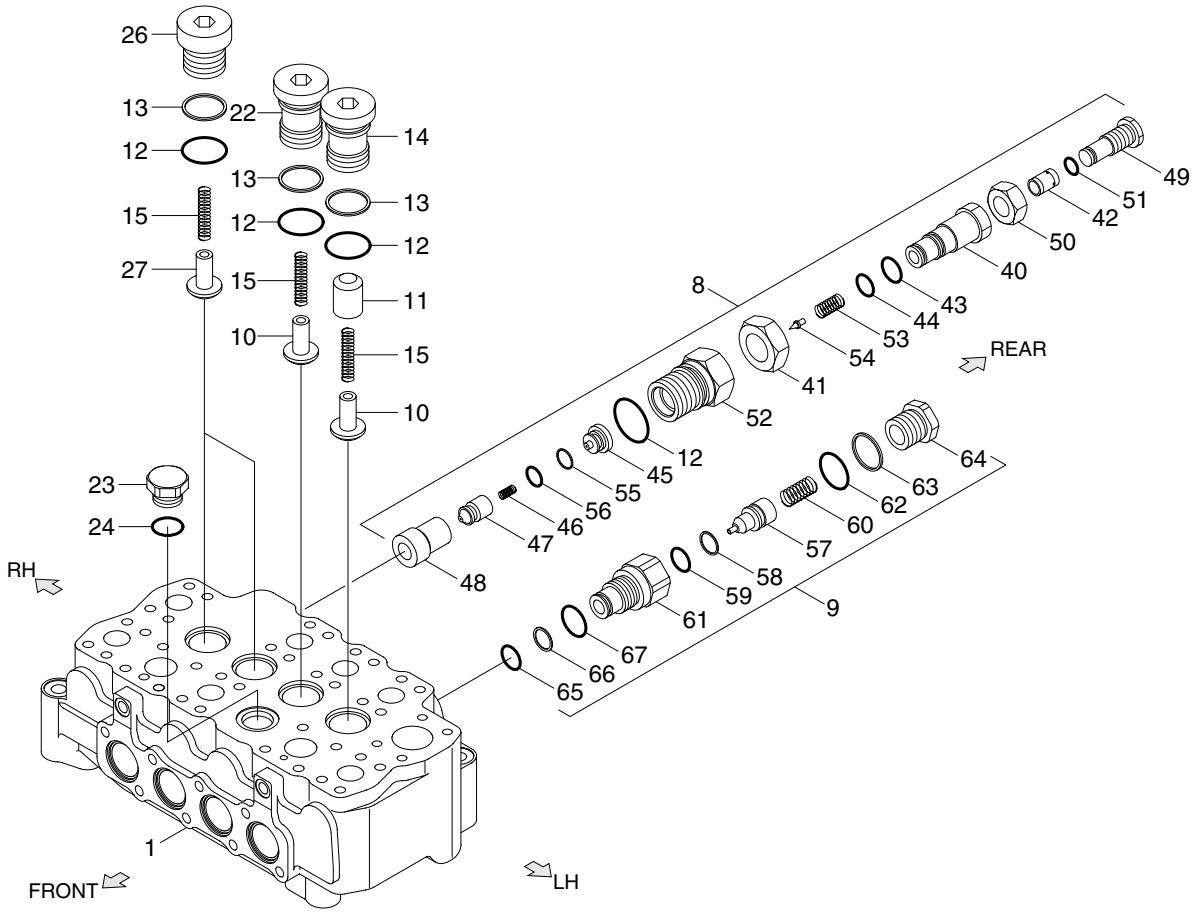
STRUCTURE (MCV1, 5/5)



120098MC08

7	O-ring	50	Cap	94	Back up ring
8	Foot relief valve assy	55	O-ring	95	O-ring
36	Socket bolt	71	Check	96	Spring
37	Washer	72	Cap	97	Check
38	Cap	80	O-ring	102	O-ring
39	O-ring	81	Make up assy	103	Plug
40	Back up ring	82	O-ring	104	Cap
41	O-ring	83	Back up ring	105	O-ring
42	Check	84	Cap	106	Cap
43	Spring	85	Check	107	Cap
48	Check	91	Overload relief valve	108	Spring
49	Back up ring	93	Cap	109	Spool

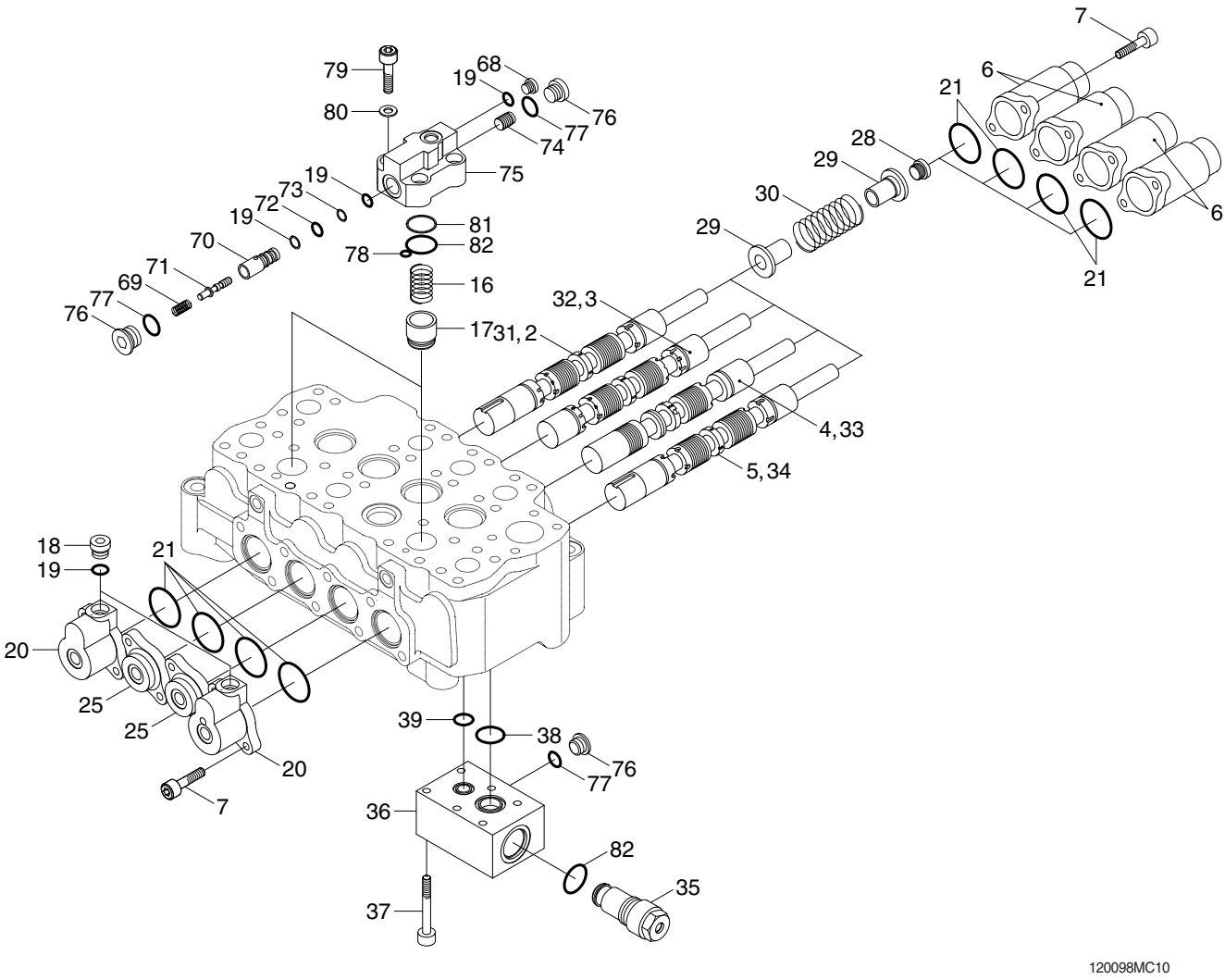
STRUCTURE (MCV2, 1/2)



120098MC09

1	Housing	40	Sleeve	54	Pilot poppet
8	Main relief valve assy	41	Hex nut	55	Back up ring
9	Make up assy	42	Piston	56	O-ring
10	Check	43	O-ring	57	Poppet
11	Check	44	O-ring	58	Back up ring
12	O-ring	45	Pilot sheet	59	O-ring
13	Back up ring	46	Spring	60	Spring
14	Cap	47	Poppet	61	Relief sleeve
15	Spring	48	Sleeve	62	O-ring
22	Cap	49	Adjust screw	63	Back up ring
23	Cap	50	Hex nut	64	Cap
24	O-ring	51	O-ring	65	O-ring
26	Cap	52	Cap	66	Back up ring
27	Check	53	Spring	67	O-ring

STRUCTURE (MCV2, 2/2)



120098MC10

2	Plunger assy	29	Spring guide	70	Sleeve
3	Plunger assy	30	Spring	71	Poppet
4	Plunger assy	31	Plunger	72	O-ring
5	Plunger assy	32	Plunger	73	Back up ring
6	Cover	33	Plunger	74	Piston
7	Socket bolt	34	Plunger	75	Cover
16	Spring	35	Foot relief valve assy	76	Cap
17	Poppet	36	Manifold	77	O-ring
18	Plug	37	Socket bolt	78	O-ring
19	O-ring	38	O-ring	79	Socket bolt
20	Cover	39	O-ring	80	Lock washer
21	O-ring	68	Cap	81	Back up ring
25	Cover	69	Spring	82	O-ring
28	Cap				

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) Hydraulic machinery precisely. Please make disassembly and assembly have a small gap at a place without the dust.

(2) When remove it from an actual machine, wash a plumbing part and a plug, and dust and water do not enter.

(3) Examine a structure figure before work, and prepare a part depending on a purpose. In addition, prepare by a parts list beforehand because there is a part of the need to change in sub-assembly.

(4) Disassembly

① Handle the components carefully not to drop them or bump them with each other as they are mode with precision.
② Do not force the work by hitting or twisting as burred or damaged component may not be assembled or result in oil leakage or low performance.
③ When disassembled, tag the components for identification so that they can be reassembled correctly.
④ Once disassembled, O-ring and back-up rings are usually not to be used again. (Remove them using a wire with its end made like a shoehorn. Be careful not to damage the slot)
⑤ If the components are left disassembled or half-disassembled, they may get rust from moisture or dust. If the work has to be interrupted, take care to prevent rust and dust.

(5) Assembly

① Take the same precautions as for disassembly.
② When assembling the components, remove any metal chips or foreign objects and check them for any burrs or dents. Remove nurrs and dents with oil-stone, if any.
③ O-rings and back-up rings are to be replaced with new ones, as a rule.
④ When installing O-ring and back-up rings, be careful not to damage them. (Apply a little amount of grease for smoothness)
⑤ Tighten the bolts and caps with specified torque.

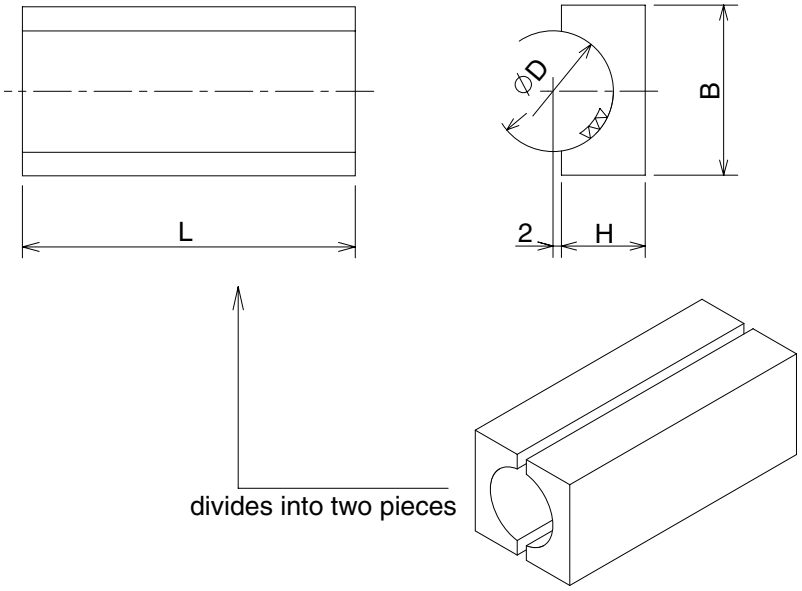
2) TOOLS

(1) Before disassembling the control valve, prepare the following tools beforehand.

① **Holder**

Item	ø D	L	B	H
Main plunger	36	90	50	25
Priority valve poppet assy	25	30	35	20

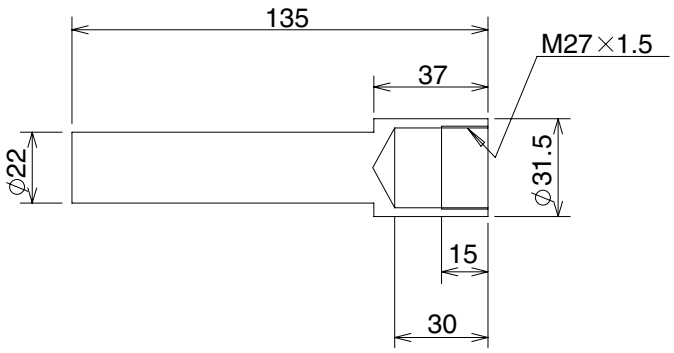
※ Material : Brass



120098MC11

② Arm regeneration valves sleeve pull out device

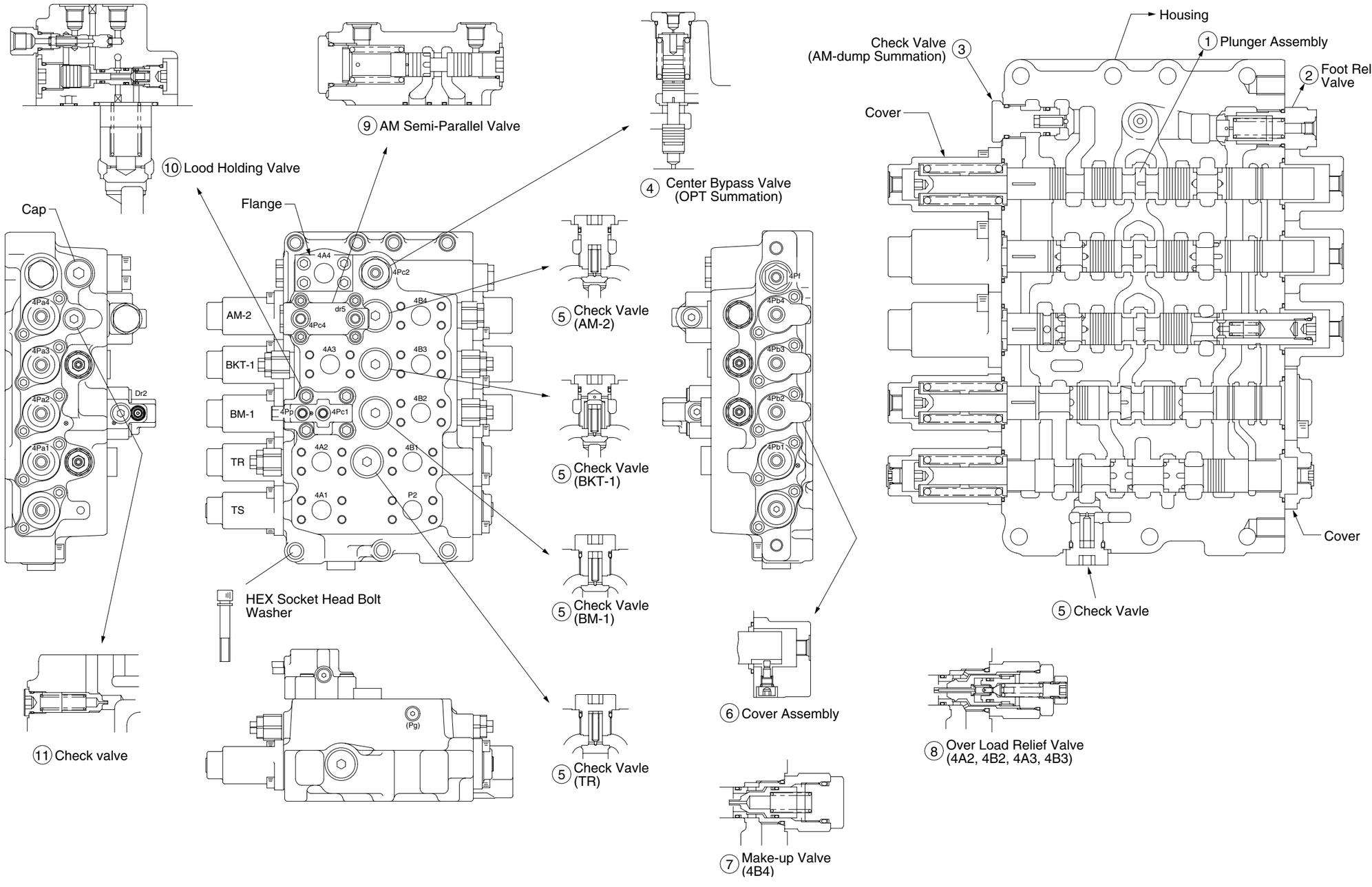
※ Material : Steel



120098MC12

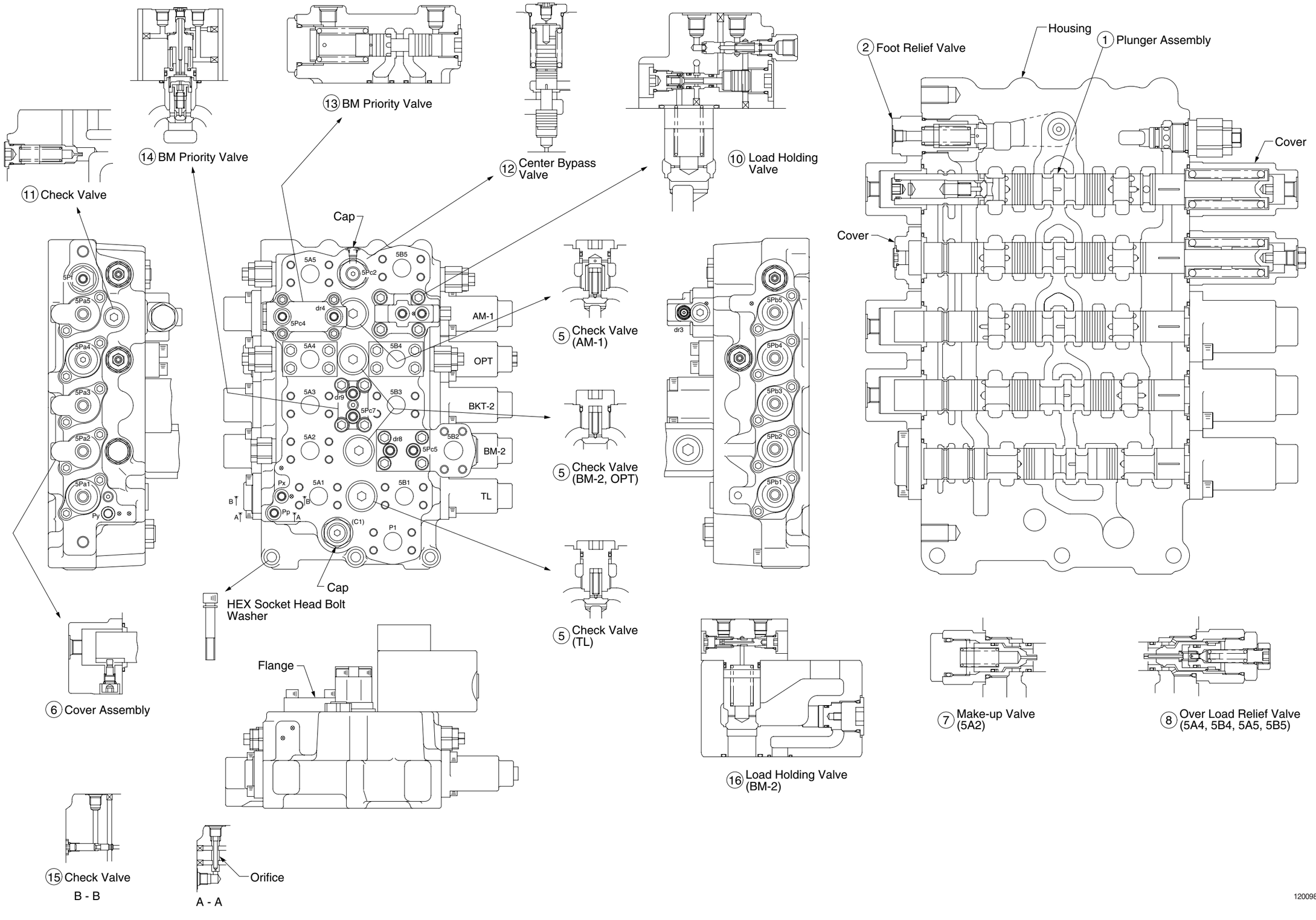
3) MOUNTING AND DISMOUNTING VALVES

· **Straight travel side valve** (MCV 1)

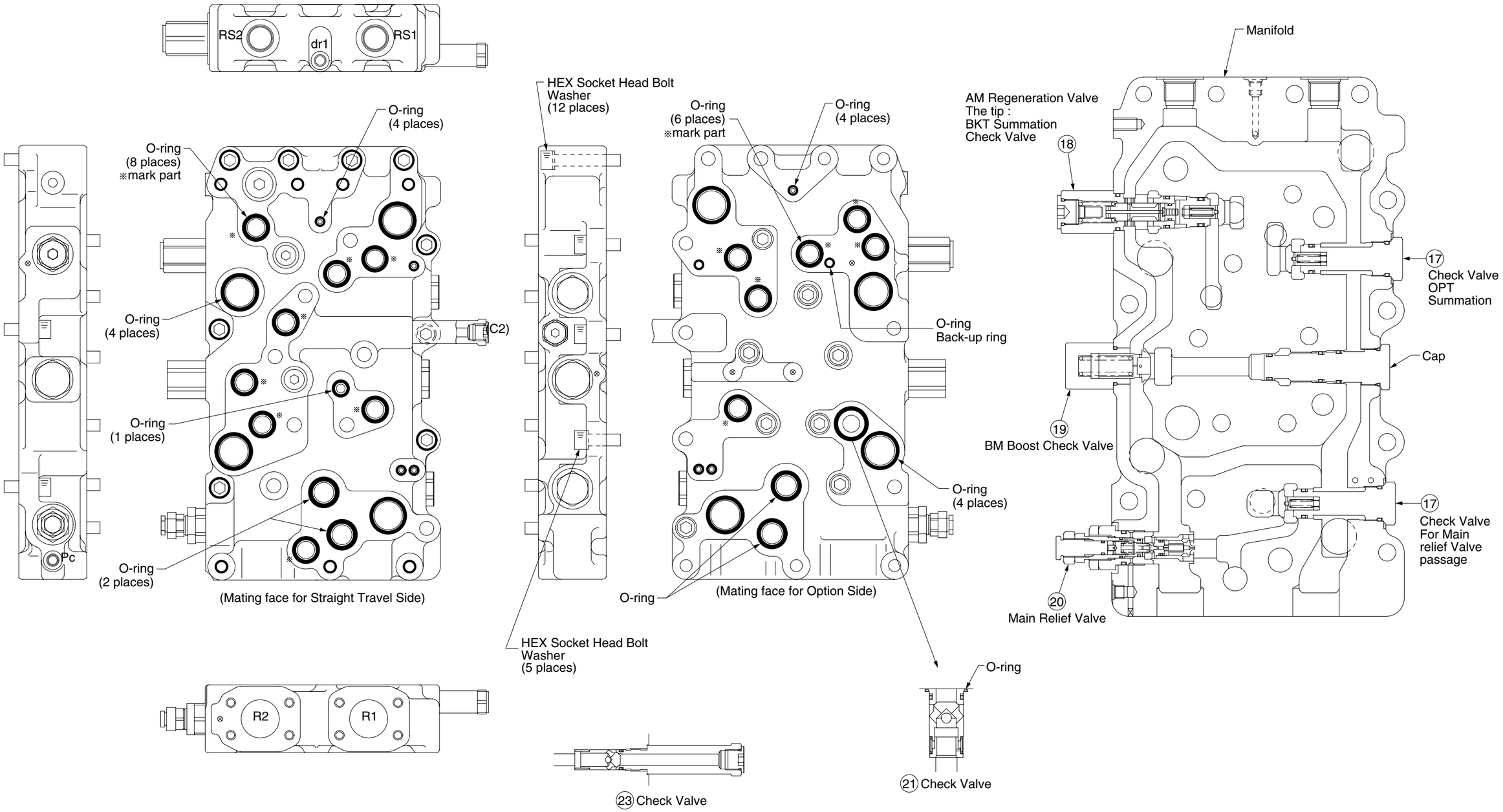


120098MC13

· **Option side valve** (MCV 1)

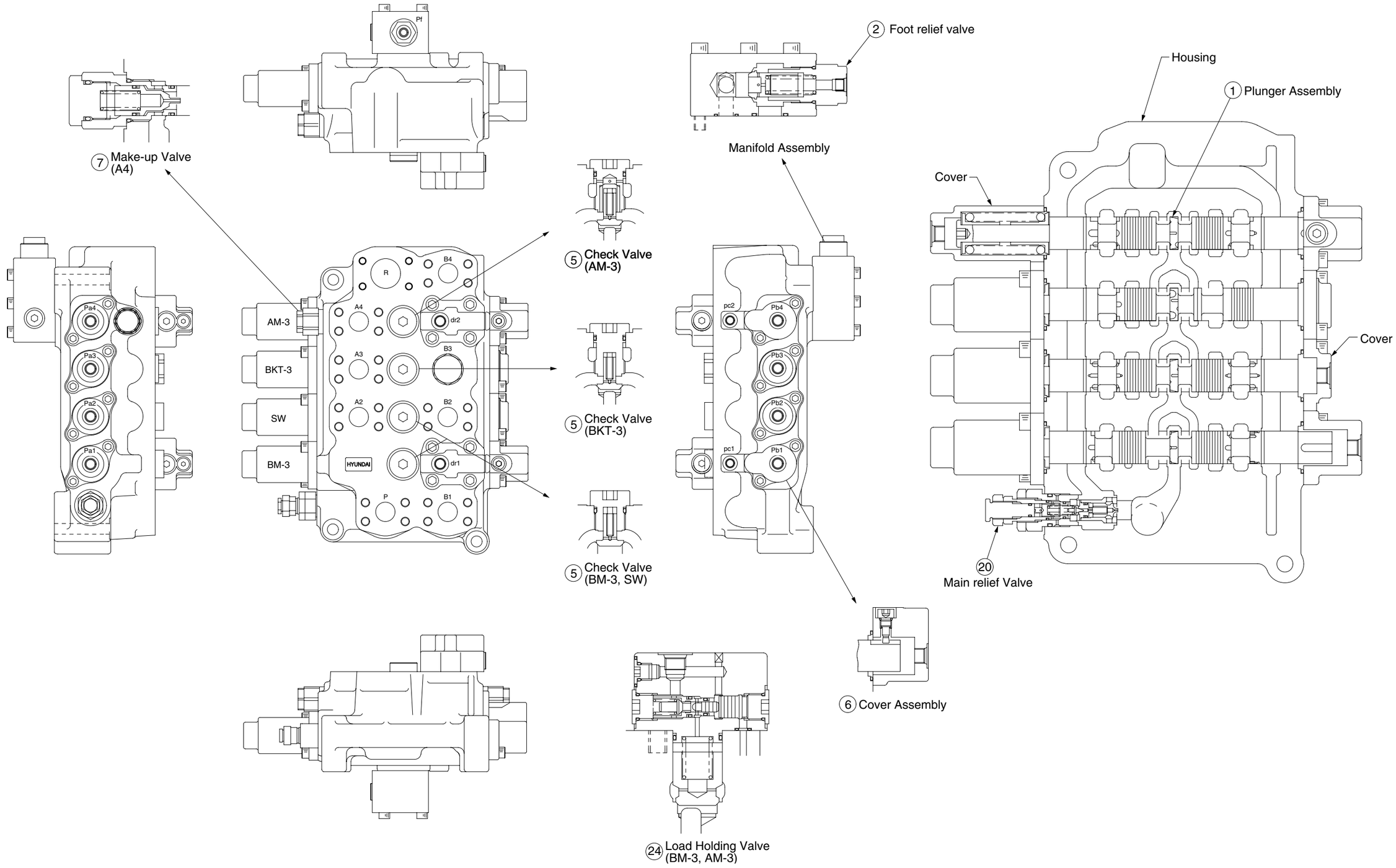


· **Manifold assembly** (MCV 1)



120098MC15

· **Swing side valve** (MCV 2)



120098MC16

(1) Main plunger

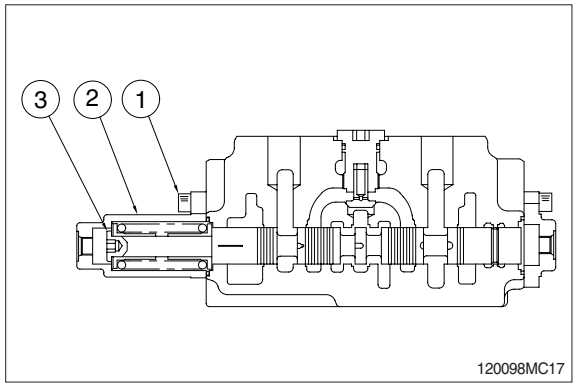
※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

① Remove hexagon socket bolts (1) then remove cover (2).

※ Hexagon socket bolt
Width across flat : 10 mm
Tightening torque : 10 kgf · m (72.3 lbf · ft)

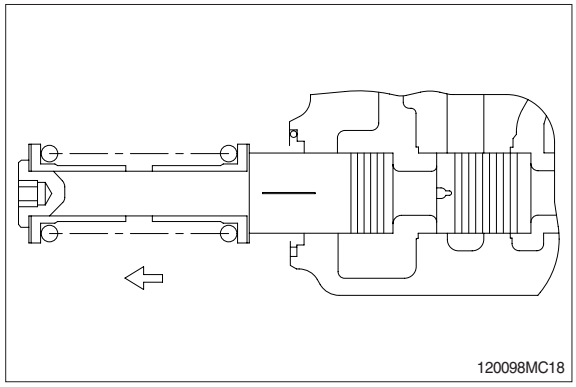
※ When reassembly
Install cover (2) after making sure that O-ring is placed on the edge of the valve hole.



② Pull out plunger sub-assembly.

※ Do not pull out the plunger all at once. Pull slowly while confirming the fitness with the housing hole.

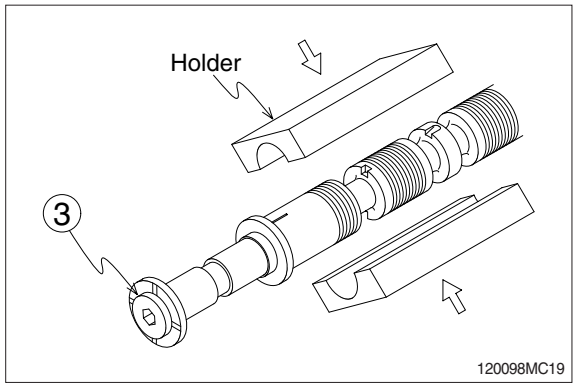
※ When reassembly
AM, BM, and BKT match the key groove of the cover.



③ Place the plunger between holders and loosen the plunger cap (3) by using vise.

· Plunger cap
Width across flat : 10 mm
Tightening torque : 10 kgf · m
(72.3 lbf · ft)

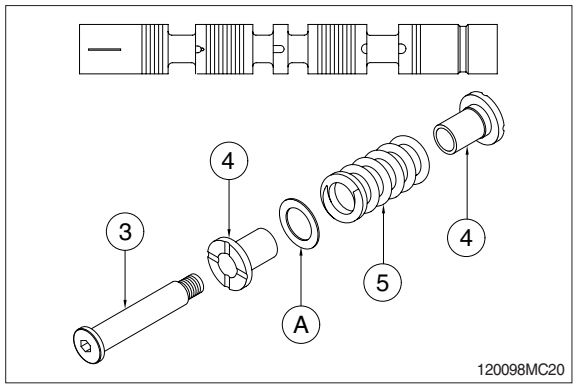
※ Put the plunger between the holders and clamp them by a vise after degreasing the plunger and holders as a special tool.



④ Remove the plunger cap (3), spring guide (4), spring (5).

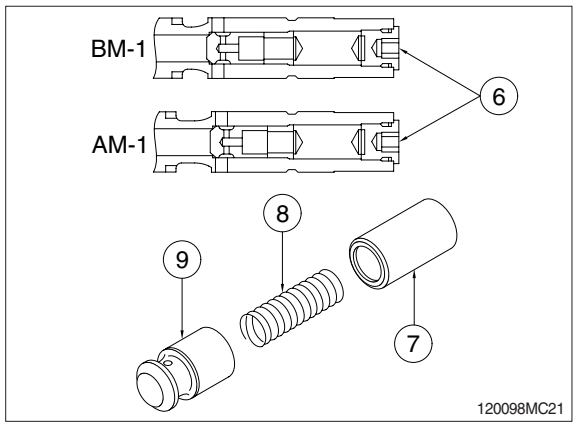
※ Spring is different according to the plunger.

※ AM-2 plunger only.
The spacer (A) is built in.



⑤ BM-1, AM-1 plunger only.
Remove cap (6), spacer (7), spring (8), and check (9).

· Cap
Width across flat : 10 mm
Tightening torque : 8.2 kgf · m
(59.3 lbf · ft)



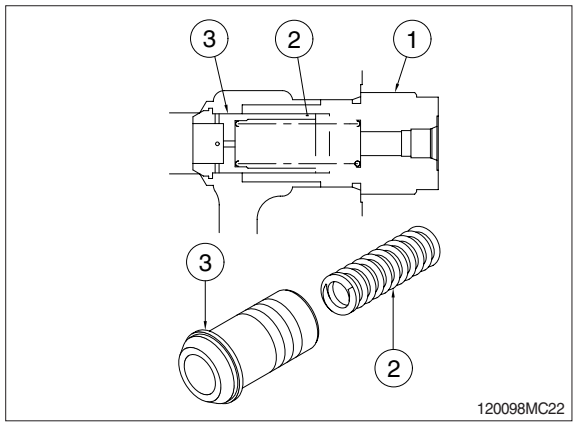
(2) Foot relief valve

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

① Remove cap (1) and pull out spring (2) and poppet (3).

· Cap
Width across flat : 36 mm
Tightening torque : 25.5 kgf · m
(184 lbf · ft)



(3) Check valve (Arm dump summation)

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

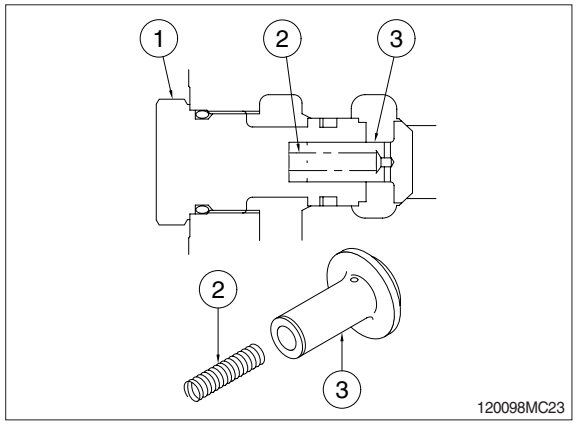
① Remove cap (1) and pull out spring (2) and check (3).

· Cap

Width across flat : 41 mm

Tightening torque : 18.4 kgf · m

(133 lbf · ft)



(4) Center bypass valve (Opt summation)

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

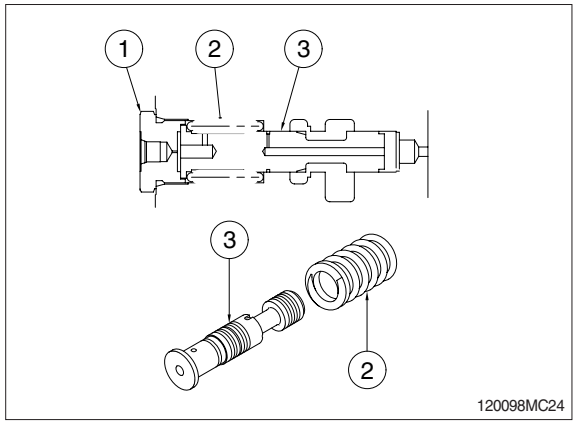
① Remove cap (1) and pull out spool (3) and spring (2).

· Cap

Width across flat : 46 mm

Tightening torque : 25.5 kgf · m

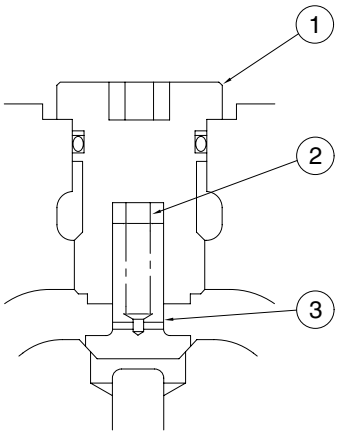
(184 lbf · ft)



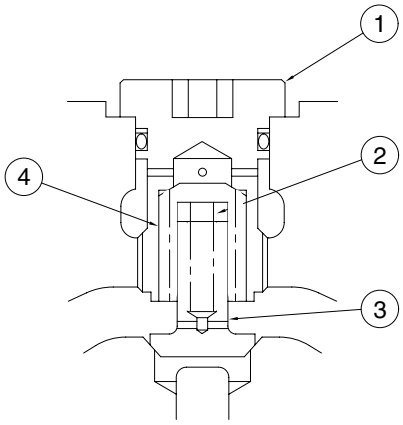
(5) Check valve

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

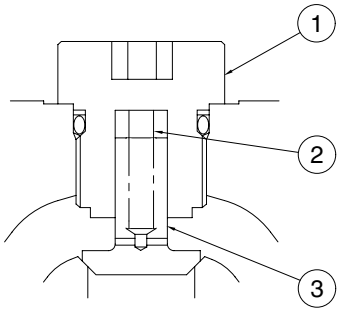


AM-2L, TL, BKT-3



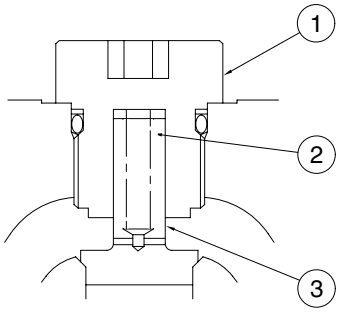
BKT-1, AM-1, AM-3

CAP : The squeezing diameter is different



BM-1, BM-2, BM-3

SW, OPT, OTHER



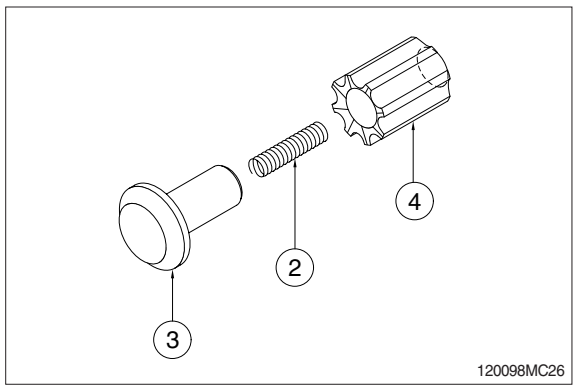
(TR) CHECK : Outer orifice

120098MC25

· It explains with BKT-1.

① Remove cap (1) and pull out check (4), spring (2) and check (3).

· Cap
Width across flat : 14 mm
Tightening torque : 35.7 kgf · m
(258 lbf · ft)



120098MC26

(6) Cover assy

※ Reassembly in the reverse order to disassembly.

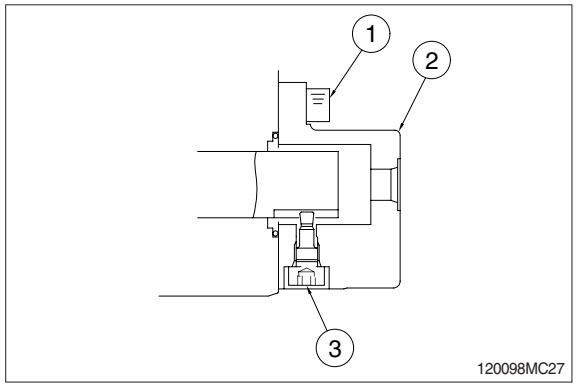
※ Attach an identification tag immediately after disassembly.

① Remove hexagon socket bolts (1) then remove cover assy (2).

※ Hexagon socket bolt
Width across flat : 10 mm
Tightening torque : 10 kgf · m (72.3 lbf · ft)

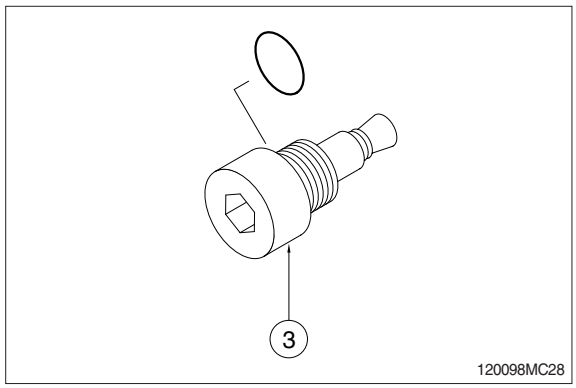
※ When reassembly
Install cover (2) after making sure that O-ring is placed on the edge of the valve hole.

The direction of the installation of the cover is noted.



② Remove plug (3).

· Plug
Width across flat : 8 mm
Tightening torque : 8.2 kgf · m
(59.3 lbf · ft)



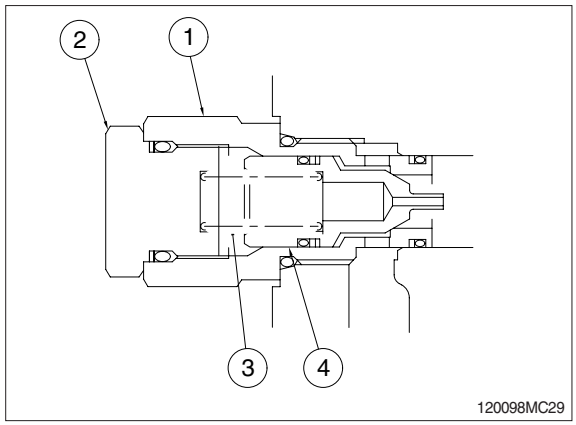
(7) Make up valve

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

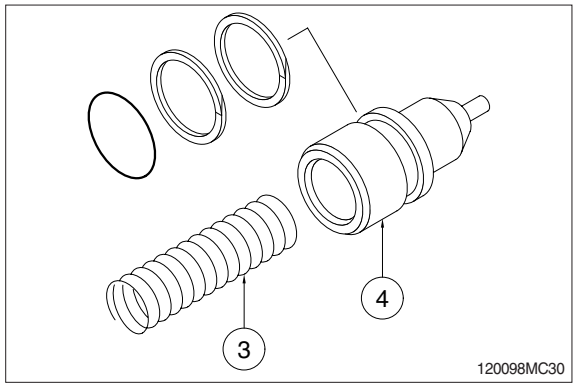
① Loosen sleeve (1) and remove make-up valve.

· Sleeve
Width across flat : 41 mm
Tightening torque : 10 kgf · m
(72.3 lbf · ft)



② Remove cap (2) and pull out spring (3) and poppet (4).

· Cap
Width across flat : 36 mm
Tightening torque : 10 kgf · m
(72.3 lbf · ft)



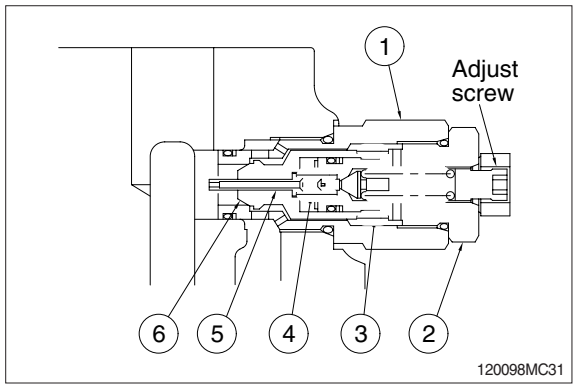
(8) Overload relief valve

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

① Loosen sleeve (1) and remove relief valve.

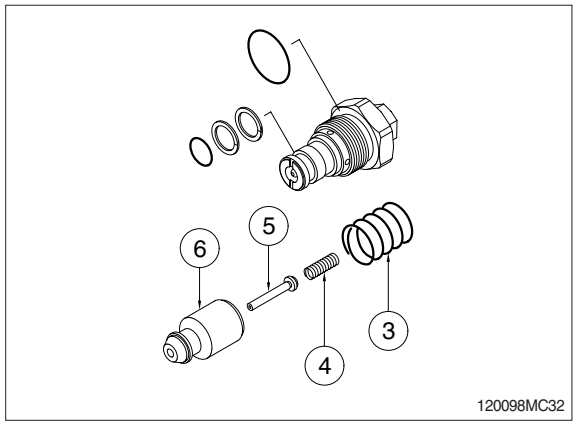
· Sleeve
Width across flat : 41 mm
Tightening torque : 10 kgf · m
(72.3 lbf · ft)



② Loosen and remove relief seat (2) sub-assembly and remove spring (3), (4), piston (5) and main poppet (6).

· Relief sleeve
Width across flat : 36 mm
Tightening torque : 10 kgf · m
(72.3 lbf · ft)

※ Do not disassemble adjusting screw.
It's impossible to readjust setting pressure exactly on the machine.



(9) Arm semi para valve

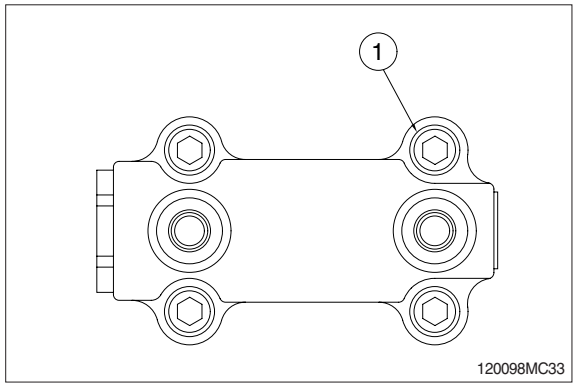
※ Reassembly in the reverse order to disassembly.

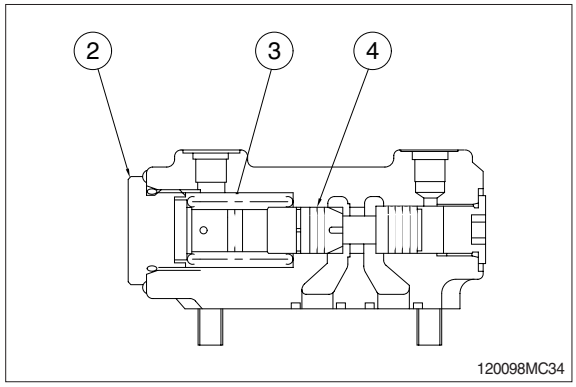
※ Attach an identification tag immediately after disassembly.

① Loosen hexagon socket bolts (1) and remove cover assembly.

- Hexagon socket bolt
  Width across flat : 8 mm
  Tightening torque : 6.12 kgf · m
  (44.3 lbf · ft)

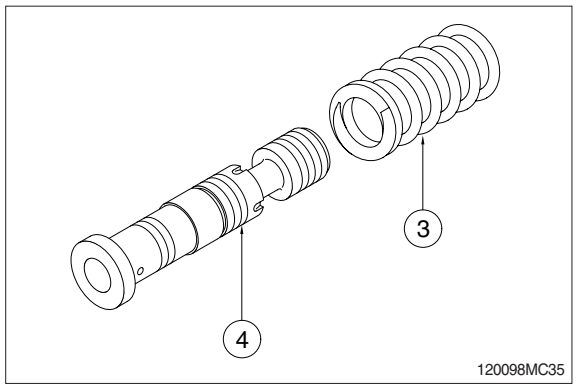
※ When reassembly
Install cover assy after making sure that O-ring is placed on the edge of the cover hole.





② Remove cap (2) and pull out spool (4) and spring (3).

- Cap
  Width across flat : 41 mm
  Tightening torque : 10 kgf · m
  (72.3 lbf · ft)



(10) Holding valve (Arm 1, Boom 1)

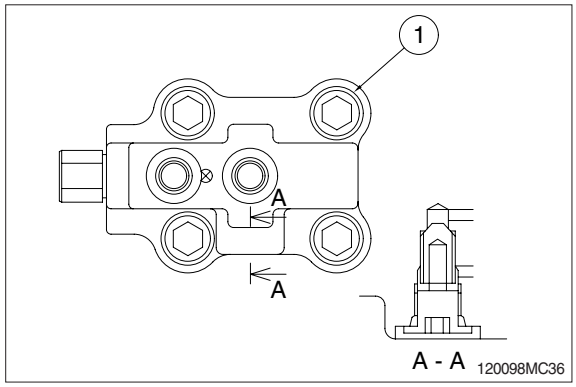
※ Reassembly in the reverse order to disassembly.

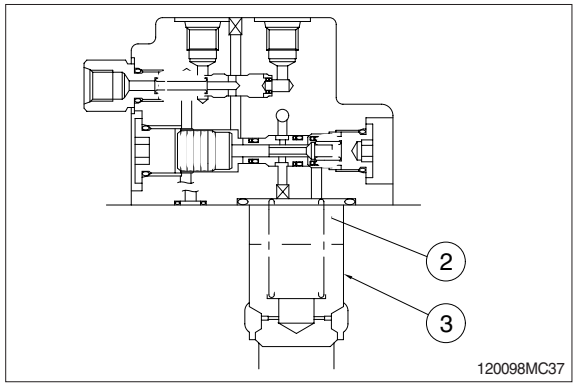
※ Attach an identification tag immediately after disassembly.

① Loosen hexagon socket bolts (1) and remove cover assembly.

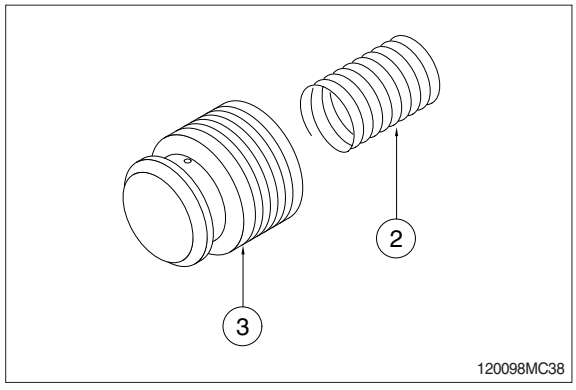
· Hexagon socket bolt
Width across flat : 12 mm
Tightening torque : 18.4 kgf · m
(133 lbf · ft)

※ When reassembly
Install cover assy after making sure that O-ring is placed on the edge of the cover hole.





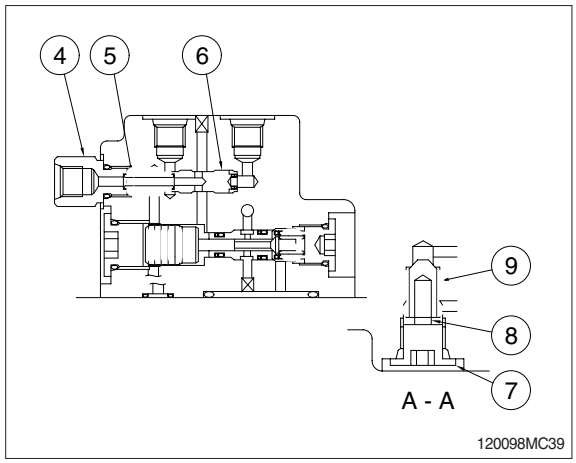
② Remove spring (2) and poppet (3).

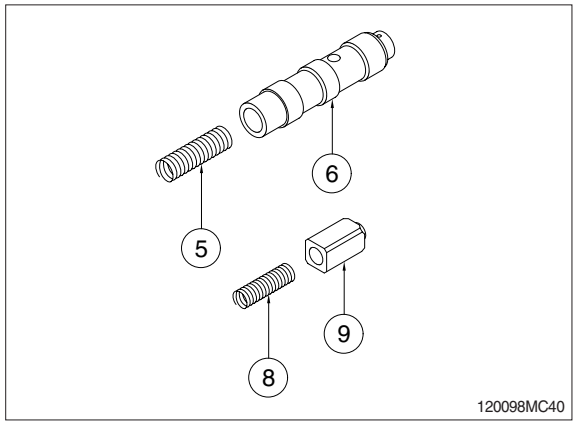


③ Cover assembly

a. Remove cap (4) and pull out spring (5), and piston (6).
- Cap
  Width across flat : 19 mm
  Tightening torque : 3.1 kgf · m
  (22.4 lbf · ft)

b. Remove cap (7) and pull out spring (8), and check (9).
- Cap
  Width across flat : 6 mm
  Tightening torque : 3.1 kgf · m
  (22.4 lbf · ft)

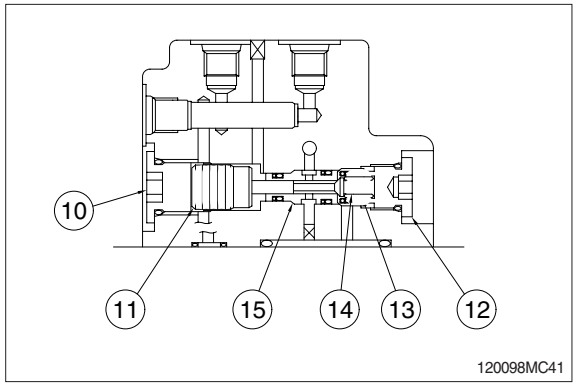


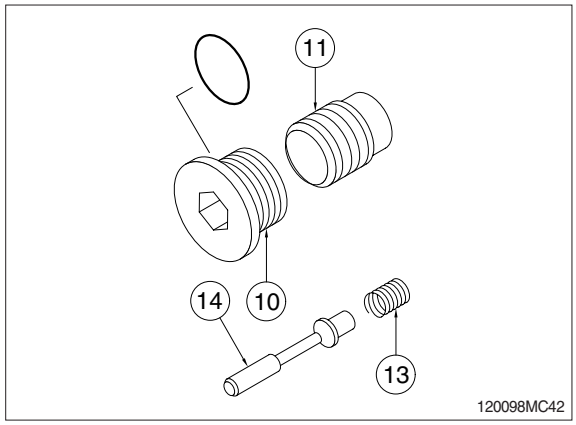


c. Remove cap (10) and piston (11).
- Cap
  Width across flat : 10 mm
  Tightening torque : 6.1 kgf · m
  (44.1 lbf · ft)

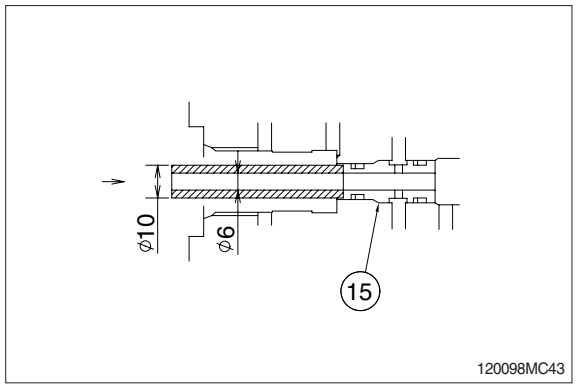
d. Remove cap (12) and pull out spring (13), and poppet (14).
- Cap
  Width across flat : 8 mm
  Tightening torque : 5.1 kgf · m
  (36.9 lbf · ft)

※ There is a case where the poppet cannot be taken by the seat edge.





e. It begins to beat the sleeve with the pipe lightly.



(11) Check valve (Arm semi para, Boom priority)

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

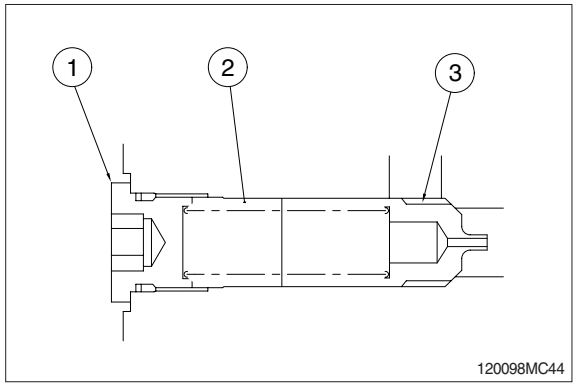
① Remove cap (1) and pull out spring (2), and check (3).

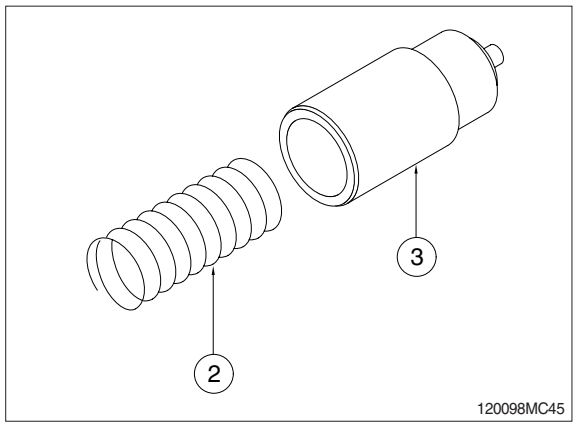
· Cap

Width across flat : 12 mm

Tightening torque : 15.3 kgf · m

(111 lbf · ft)

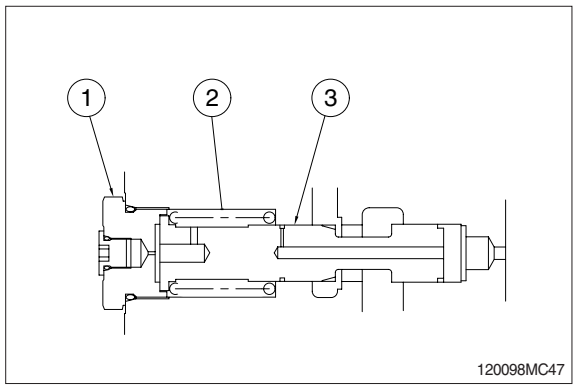


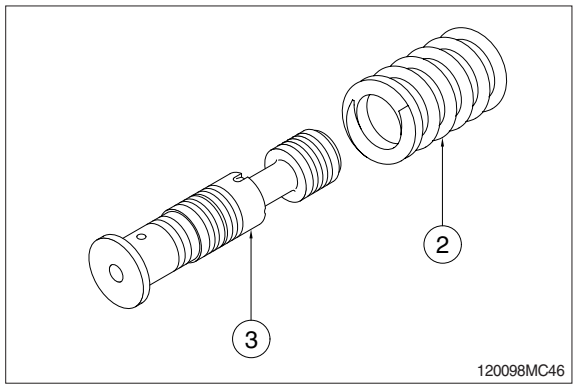


(12) Center bypass valve

※ Reassembly in the reverse order to disassembly.
※ Attach an identification tag immediately after disassembly.

① Remove cap (1) and pull out spool (3), and spring (2).
- Cap
  Width across flat : 46 mm
  Tightening torque : 25.5 kgf · m
  (184.4 lbf · ft)



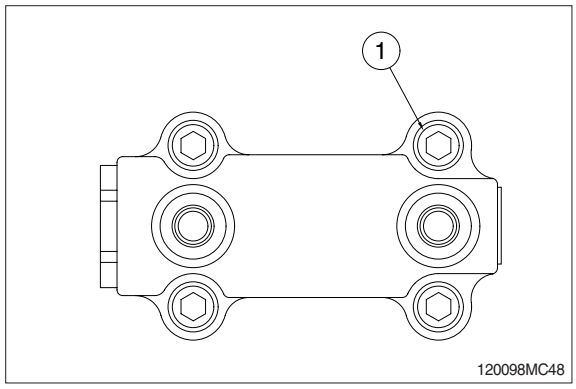


(13) Boom priority valve 1

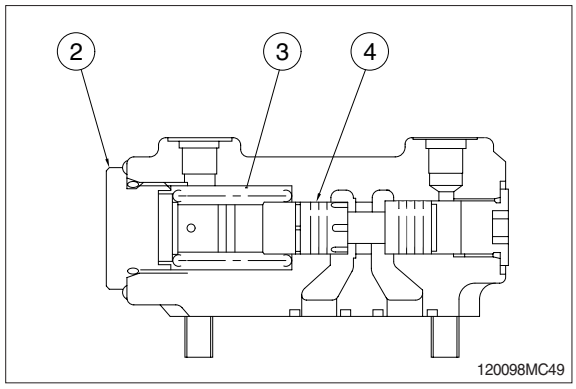
※ Reassembly in the reverse order to disassembly.
※ Attach an identification tag immediately after disassembly.

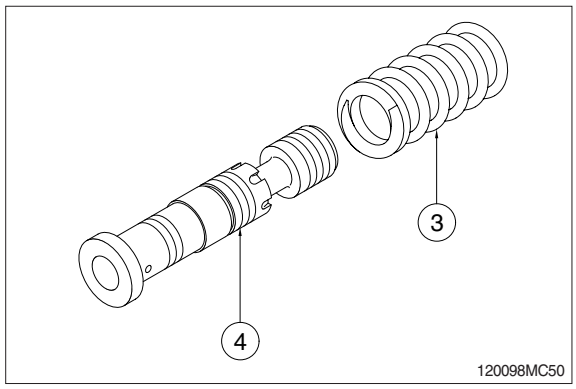
① Loosen hexagon socket bolts (1) and remove cover assembly.
- Hexagon socket bolt
  Width across flat : 8 mm
  Tightening torque : 6.1 kgf · m
  (44.1 lbf · ft)

※ When reassembly
Install cover assy after making sure that O-ring is placed on the edge of the cover hole.



② Remove cap (2) and pull out spool (4), and spring (3).
- Cap
  Width across flat : 41 mm
  Tightening torque : 10 kgf · m
  (72.3 lbf · ft)





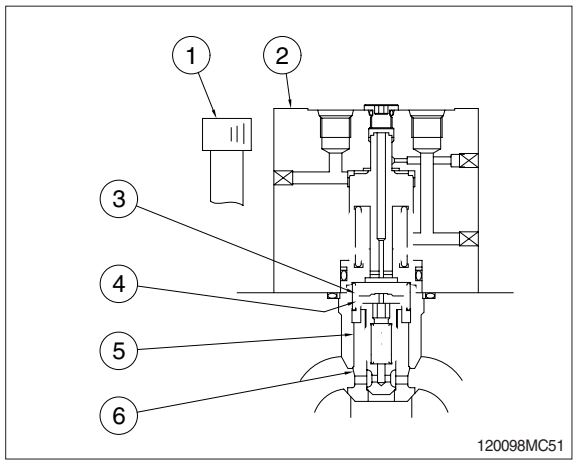
(14) Boom priority valve 2

※ Reassembly in the reverse order to disassembly.

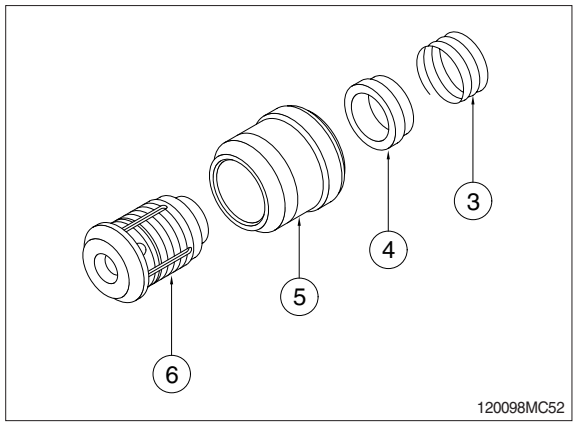
※ Attach an identification tag immediately after disassembly.

① Loosen hexagon socket bolts (1) and remove cover assembly (2).
- Hexagon socket bolt
  Width across flat : 12 mm
  Tightening torque : 18.4 kgf · m
  (133 lbf · ft)

※ When reassembly
Install cover assy (2) after making sure that O-ring and back-up ring is placed on the edge of the valve hole.



② Remove spring (3), spring guide (4), sleeve (5) and poppet sub-assembly (6).

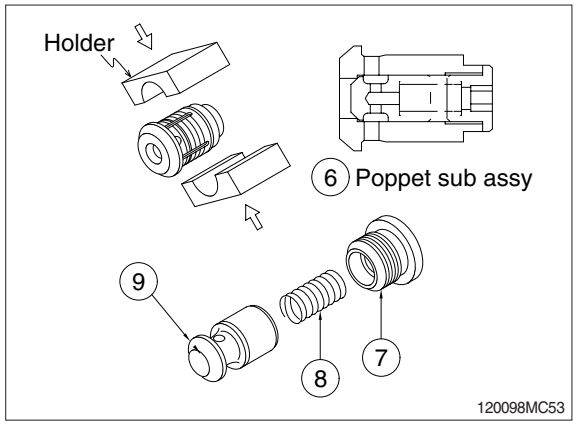


③ Place the poppet between holders and loosen the cap (7) by using vise.

Remove cap (7), spring (8) and check (9).

· Cap
Width across flat : 6 mm
Tightening torque : 3.6 kgf · m
(26 lbf · ft)

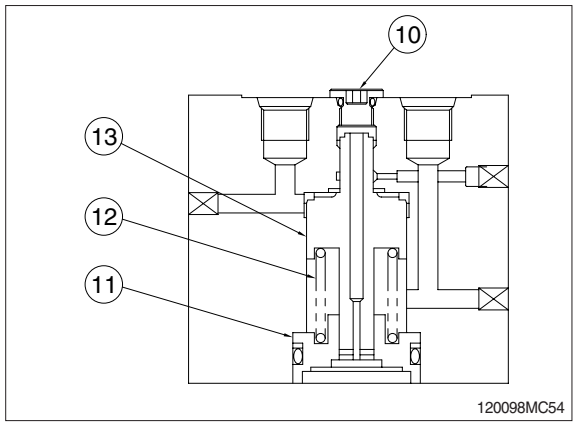
※ Put the poppet between the holders and clamp them by a vise after degreasing the poppet and holders as a special tool.

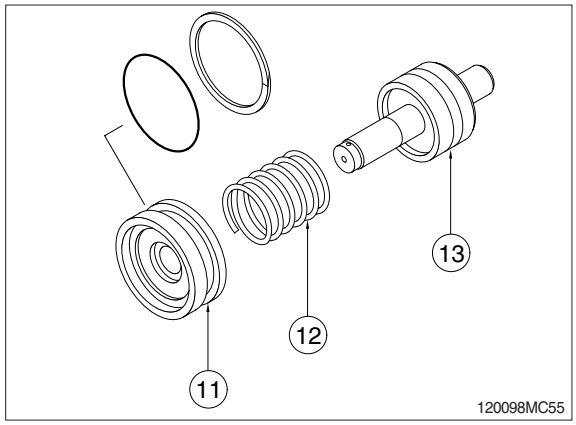


④ Cap (10) removed and a plate (11) is extracted by the press.
Remove spring (12) and piston (13).

· Cap
Width across flat : 5 mm
Tightening torque : 21 kgf · m
(14.5 lbf · ft)

※ It takes care that to not fly, when a plate (11) with spring anti-power separates.





(15) Check valve (Travel straight)

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

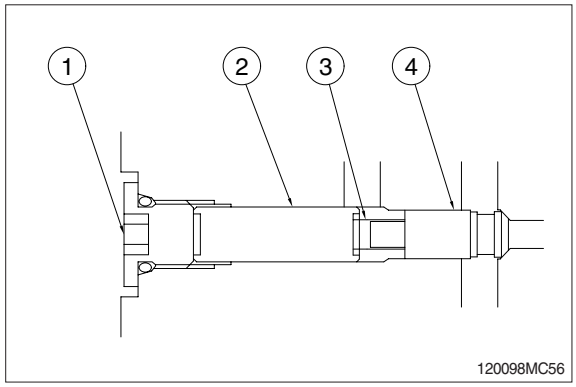
① Remove cap (1) and and pull out spacer (2), spring (3) and check (4).

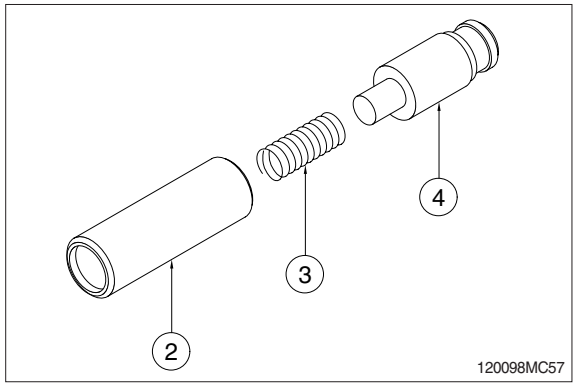
· Cap

Width across flat : 5 mm

Tightening torque : 21 kgf · m

(14.5 lbf · ft)





(16) Load holding valve (Boom 2)

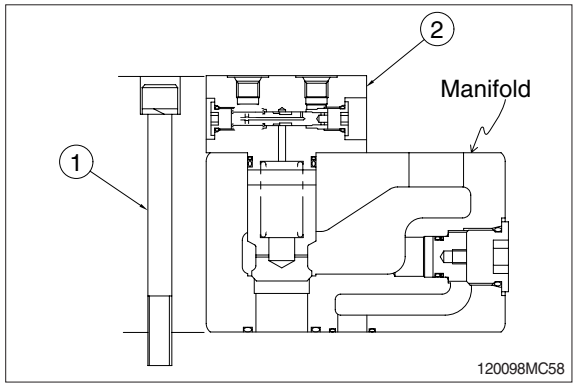
※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

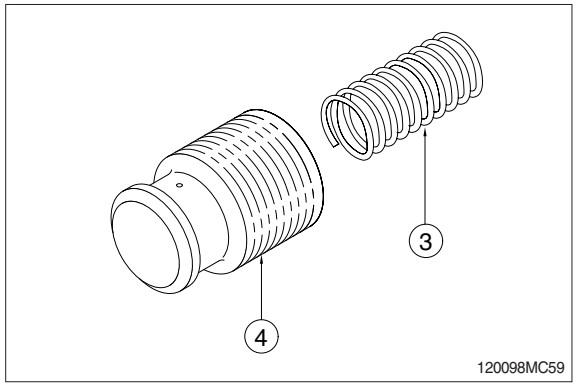
① Loosen hexagon socket bolts (1) and remove cover assembly.

· Hexagon socket bolt
Width across flat : 12 mm
Tightening torque : 18.6 kgf · m
(134.5 lbf · ft)

※ When reassembly
Install cover assy after making sure that O-ring is placed on the edge of the cover hole.



② Remove spring (3) and poppet (4).



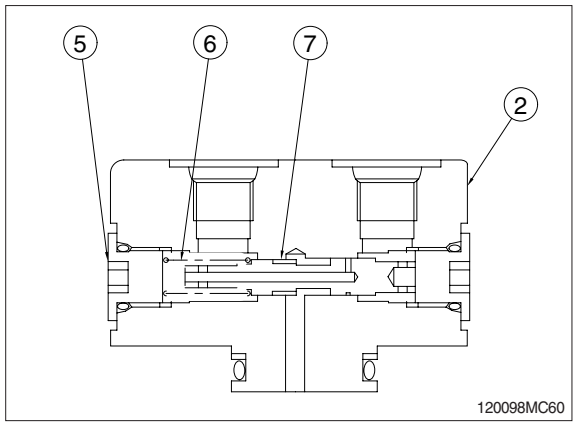
③ Cover assembly

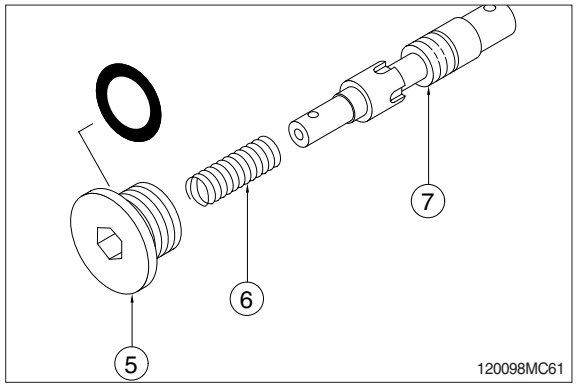
Remove cap (5) and pull out spring (6), and spool (7).

· Cap

Width across flat : 6 mm

Tightening torque : 3.1 kgf · m (22.4 lbf · ft)





(17) Check valve (Opt summation, main relief valve passage)

※ Reassembly in the reverse order to disassembly.

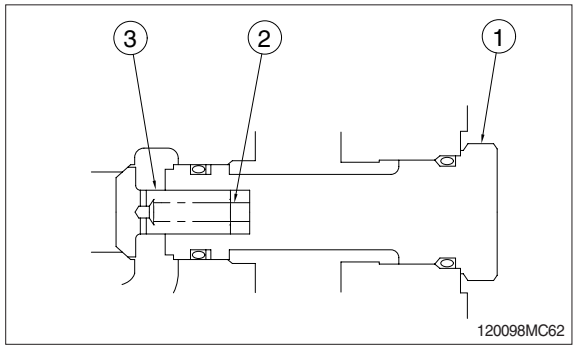
※ Attach an identification tag immediately after disassembly.

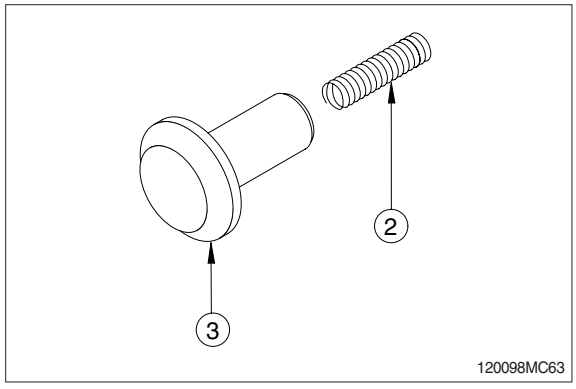
① Remove cap (1) and pull out spool (2) and check (3).

· Cap

Width across flat : 41 mm

Tightening torque : 18.4 kgf · m (133 lbf · ft)





(18) Arm regeneration valve

※ Reassembly in the reverse order to disassembly.

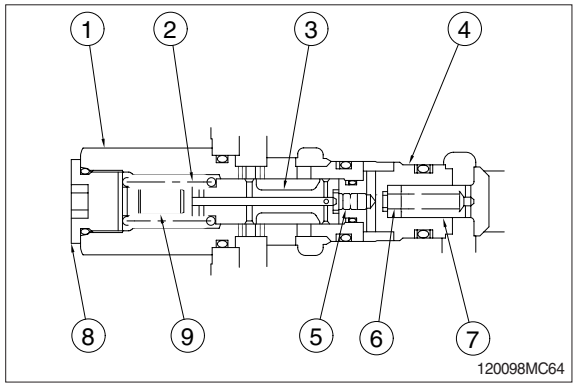
※ Attach an identification tag immediately after disassembly.

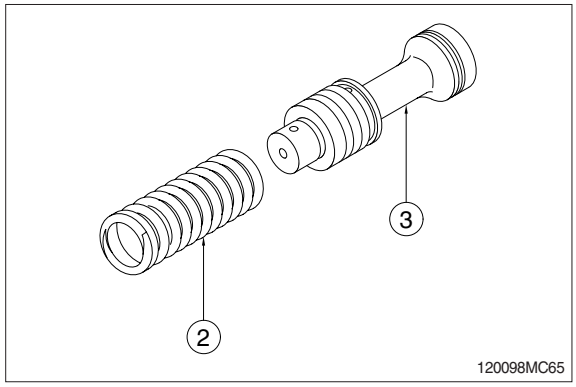
① Remove cap (1) and pull out spring (2) and spool (3).

· Cap

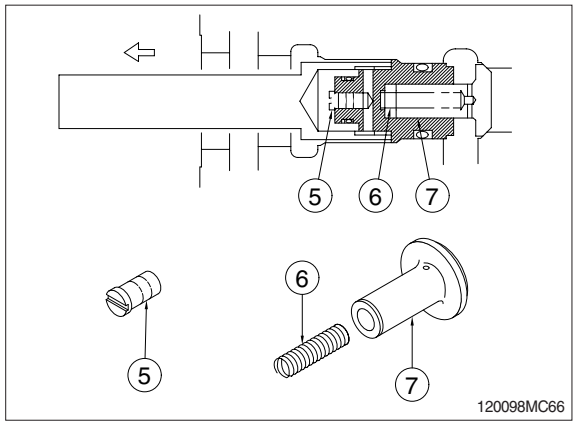
Width across flat : 41 mm

Tightening torque : 18.4 kgf · m (133 lbf · ft)





② Sleeve (4) is pull out with a special tool. Remove piston (5), spring (6) and check (7).

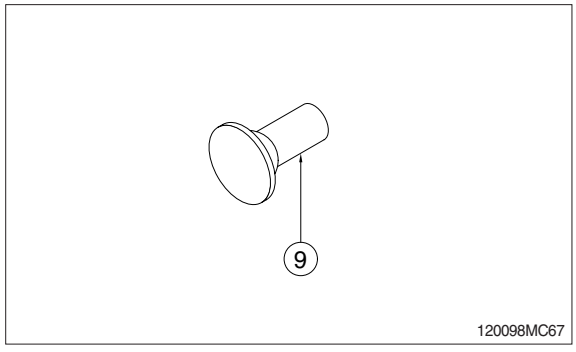


③ Remove cap (8) and pull out spring guide (9).

· Cap

Width across flat : 12 mm

Tightening torque : 10 kgf · m (72.3 lbf · ft)



(19) Boom boost check valve

※ Reassembly in the reverse order to disassembly.

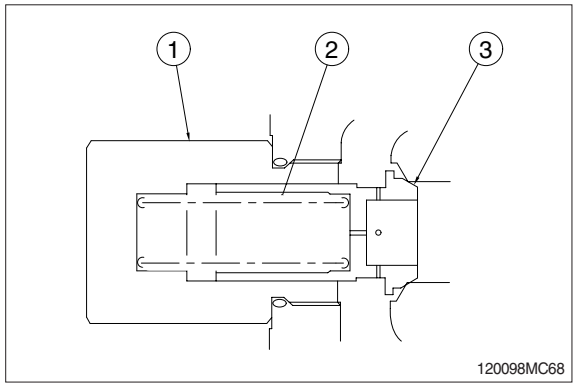
※ Attach an identification tag immediately after disassembly.

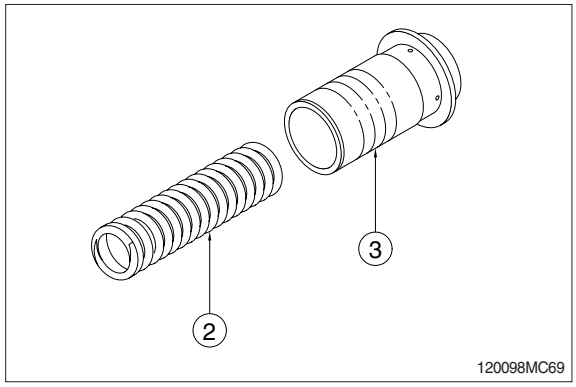
① Remove cap (1) and pull out spring (2) and poppet (3).

· Cap

Width across flat : 46 mm

Tightening torque : 18.4 kgf · m (133 lbf · ft)

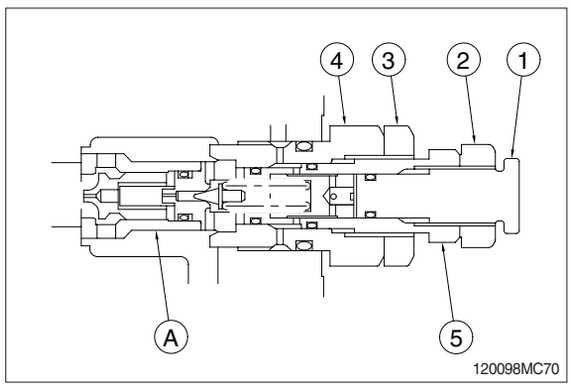




(20) Main relief valve

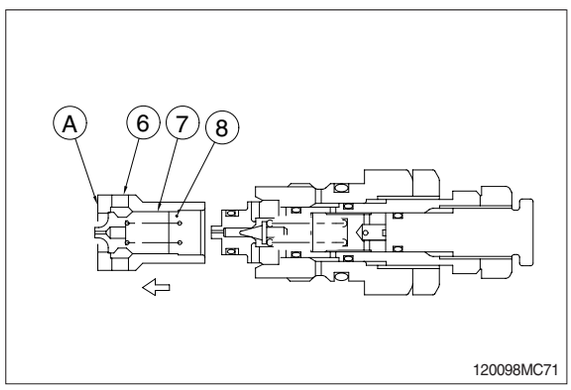
· **Disassembly**

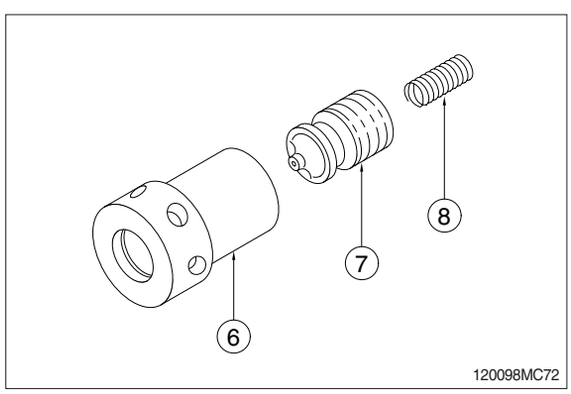
① Loosen nut (2) while holding adjusting screw (1).
② Loosen nut (3) while holding cap (4).
③ Remove main relief valve from valve body.



④ Pull out main poppet sub assy (A) and remove main poppet (7) and spring (8) from sleeve (6).

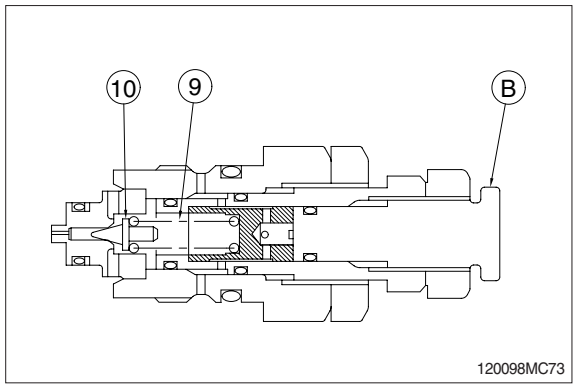
Width across flat
1 Adjust screw : 22 mm
2 Hexagon nut : 30 mm
3 Hexagon nut : 41 mm
4 Cap : 41 mm
5 Sleeve : 27 mm

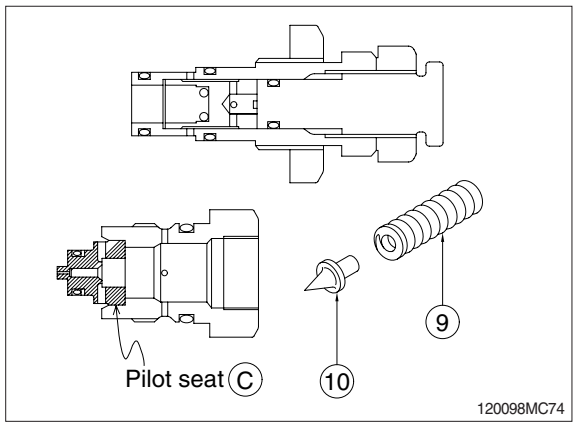




⑤ Remove adjusting sub-assy (B) then remove spring (9) and pilot poppet (10).

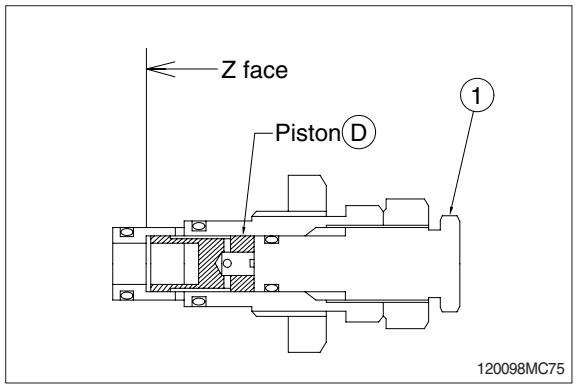
※ Do not disassembly pilot seat (C). (Press fitting)



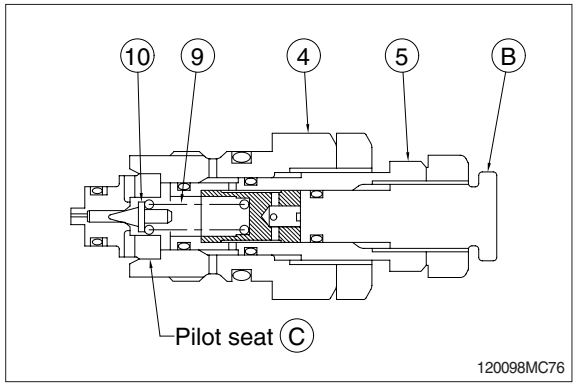


· **Reassembly**

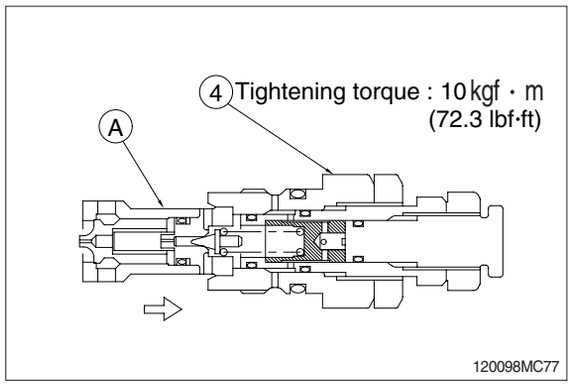
① Screw low pressure adjusting screw (1) until piston (D) touches "Z" face, in this position, relief setting pressure is high level.



② Install pilot poppet (10), spring (9) and adjusting screw sub-assy (B).
Set adjusting screw sub-assy (B) temporarily in the position that pilot poppet (10) contacts to pilot seat (C). Then pressure adjusting spring (9) begins to be effective.



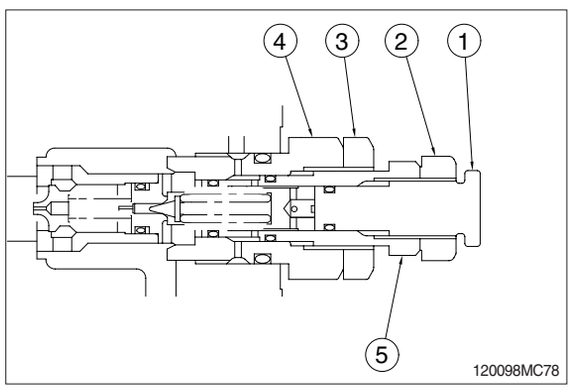
③ Assemble main poppet sub-assy (A), and install the main relief valve which is set temporarily in main body.
Tighten cap (4) with a torque wrench.



· **Resetting relief pressure**

① **High pressure**
Set the prescribed pressure correctly adjusting sleeve (5), while reading the pressure gauge. Tighten lock nut (3) with torque wrench holding sleeve (5).

※ One quarter turn of sleeve (5) equals about 4.5 MPa.



② **Low pressure**
Set the prescribed pressure correctly adjusting screw (1), while reading the pressure gauge. Tighten lock nut (2) with torque wrench holding adjusting screw (1).

※ One quarter turn of adjusting screw (1) equals about 4.5 MPa.

Tightening torque
1 Adjust screw : -
2 Hexagon nut : 6.1 kgf · m (44.1 lbf · ft)
3 Hexagon nut : 10 kgf · m (72.3 lbf · ft)
4 Cap : 10 kgf · m (72.3 lbf · ft)
5 Sleeve : -

(21) Check valve (Boom up summation)

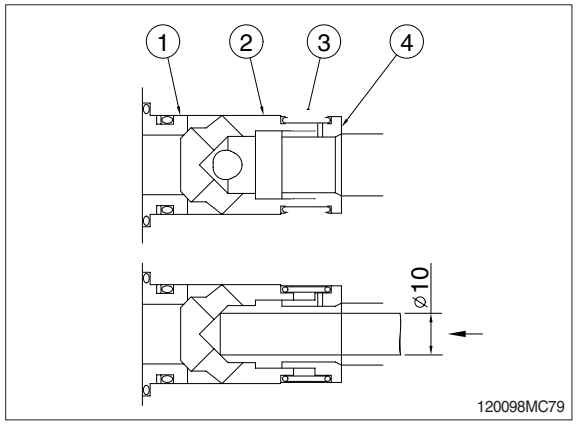
※ Reassembly in the reverse order to disassembly.

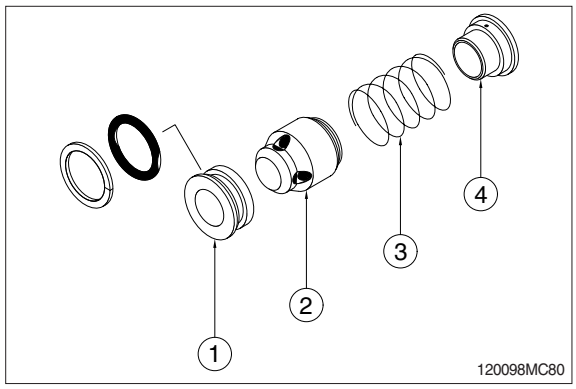
※ Attach an identification tag immediately after disassembly.

※ There is a necessity for separating housing and manifold. (refer to page 8-66)

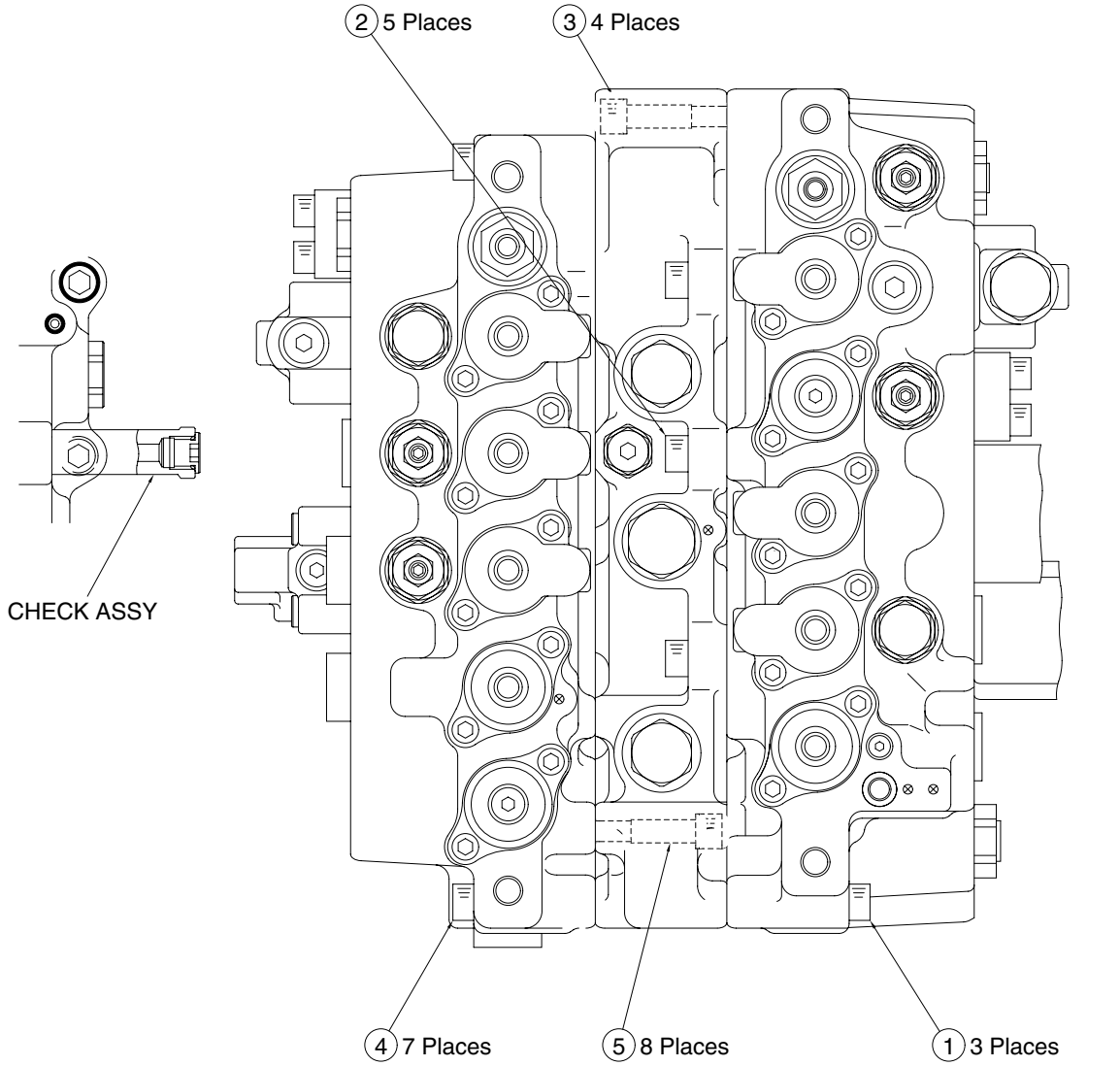
① It begins to beat the check with the pipe lightly.

Remove seat (1), check (2), spring (3) and spring guide (4).





(22) Separation/union of valve



① Separation

1-1. Loosen hexagon socket bolts (1), (2), (3) and remove OPT side valve.

1-2. Loosen hexagon socket bolts (4), (5) and remove TS side valve.

· Hexagon socket bolt

Width across flat : 14 mm

※ Remove check assemble of the manifold earlier. (refer to page 8-67)

② Union

2-1. Installation respect is made smooth.

2-2. United at TS side valve earlier.

2-3. United at OPT side valve.

· Hexagon socket bolt

Tightening torque : 25.5 kgf · m (184.4 lbf · ft)

※ Install valve assy after making sure that O-ring is placed on the edge of the manifold hole.

(23) Check valve (Boom summation)

※ Reassembly in the reverse order to disassembly.

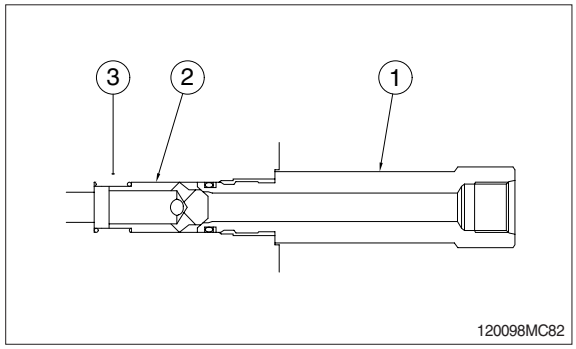
※ Attach an identification tag immediately after disassembly.

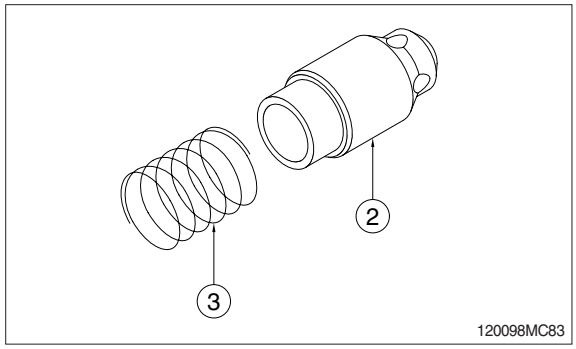
① Remove cap (1) and pull out check (2) and spring (3).

· Cap

Width across flat : 32 mm

Tightening torque : 10 kgf · m (72.3 lbf · ft)





(24) Load holding valve (Arm 3, Boom 3)

※ Reassembly in the reverse order to disassembly.

※ Attach an identification tag immediately after disassembly.

① Loosen hexagon socket bolts (1) and remove cover assembly (2).

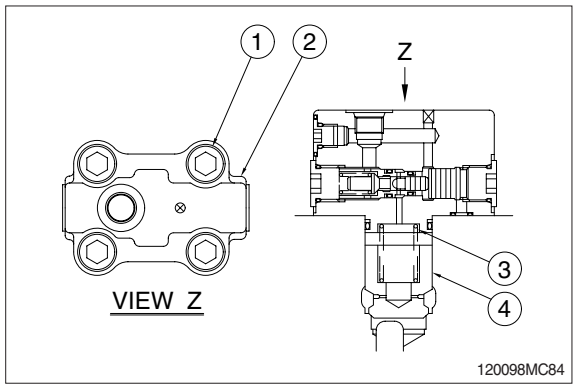
· Hexagon socket bolt

Width across flat : 12 mm

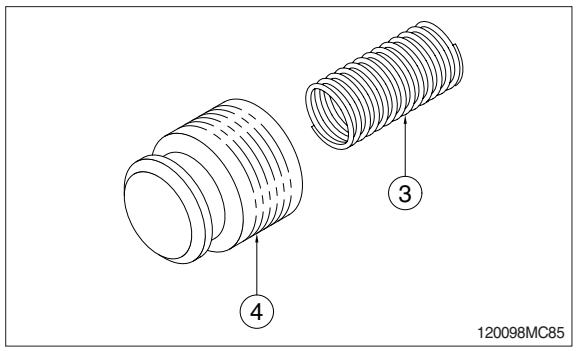
Tightening torque : 18.4 kgf · m (133 lbf · ft)

※ When reassembly

Install cover assy after making sure that O-ring is placed on the edge of the cover hole.



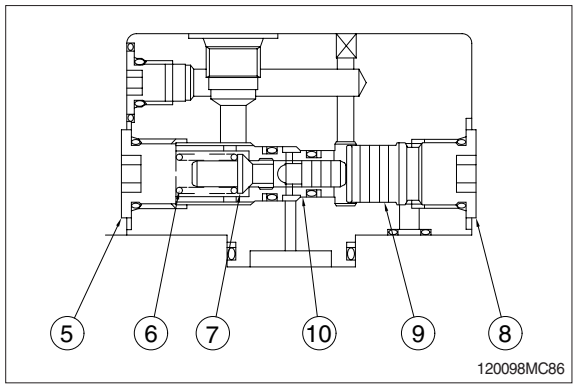
② Remove spring (3) and poppet (4).



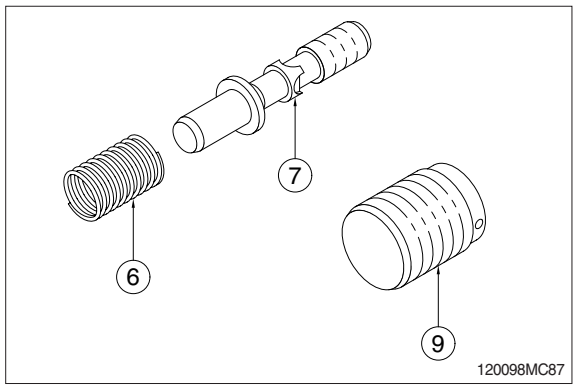
③ Cover assembly

a. Remove cap (5) and pull out spring (6), and poppet (7).
   · Cap
   Width across flat : 10 mm
   Tightening torque : 5.1 kgf · m
   (36.9 lbf · ft)

※ There is a case where the poppet cannot be taken by the seat edge.



b. Remove cap (8) and piston (9).
   · Cap
   Width across flat : 10 mm
   Tightening torque : 5.1 kgf · m
   (36.9 lbf · ft)



c. It begins to beat the sleeve with the pipe lightly.