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1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This service manual mainly contains the necessary technical information for operations performed in a service workshop.

For ease of understanding, the manual is divided into the following sections.

SECTION 1 GENERAL

This section explains the safety hints and gives the specification of the machine and major components.

SECTION 2 STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

SECTION 3 HYDRAULIC SYSTEM

This section explains the hydraulic circuit, single and combined operation.

SECTION 4 ELECTRICAL SYSTEM

This section explains the electrical circuit, monitoring system and each component. It serves not only to give an understanding electrical system, but also serves as reference material for trouble shooting.

SECTION 5 MECHATRONICS SYSTEM

This section explains the computer aided power optimization system and each component.

SECTION 6 TROUBLESHOOTING

This section explains the troubleshooting charts correlating problems to causes.

SECTION 7 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

SECTION 8 DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

SECTION 9 COMPONENT MOUNTING TORQUE

This section shows bolt specifications and standard torque values needed when mounting components to the machine.

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your HYUNDAI distributor for the latest information.

2. HOW TO READ THE SERVICE MANUAL

Distribution and updating

Any additions, amendments or other changes will be sent to HYUNDAI distributors.
Get the most up-to-date information before you start any work.

Filing method

1. See the page number on the bottom of the page.
   File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1
   2 - 3
   - Item number(2. Structure and Function)
   - Consecutive page number for each item.
3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.
   10 - 4
   10 - 4 - 1
   10 - 4 - 2 } Added pages
   10 - 5

Revised edition mark(①②③…)

When a manual is revised, an edition mark is recorded on the bottom outside corner of the pages.

Revisions

Revised pages are shown at the list of revised pages on the between the contents page and section 1 page.

Symbols

So that the shop manual can be of ample practical use, important places for safety and quality are marked with the following symbols.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing the work.
		Extra special safety precautions are necessary when performing the work because it is under internal pressure.
※	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.

3. CONVERSION TABLE

Method of using the Conversion Table

The Conversion Table in this section is provided to enable simple conversion of figures. For details of the method of using the Conversion Table, see the example given below.

Example

1. **Method of using the Conversion Table to convert from millimeters to inches**

   Convert 55mm into inches.

   (1) Locate the number 50in the vertical column at the left side, take this as ⓐ, then draw a horizontal line from ⓐ.

   (2) Locate the number 5in the row across the top, take this as ⓑ, then draw a perpendicular line down from ⓑ.

   (3) Take the point where the two lines cross as ⓒ. This point ⓒ gives the value when converting from millimeters to inches. Therefore, 55mm = 2.165 inches.

2. Convert 550mm into inches.

   (1) The number 550 does not appear in the table, so divide by 10(Move the decimal point one place to the left) to convert it to 55mm.

   (2) Carry out the same procedure as above to convert 55mm to 2.165 inches.

   (3) The original value(550mm) was divided by 10, so multiply 2.165 inches by 10(Move the decimal point one place to the right) to return to the original value.
   This gives 550mm = 21.65 inches.

Millimeters to inches

1mm = 0.03937 in

	0	1	2	3	4	5 ⓑ	6	7	8	9
0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
ⓐ 50	1.969	2.008	2.047	2.087	2.126	ⓒ 2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Millimeters to inches

1mm = 0.03937in

	0	1	2	3	4	5	6	7	8	9
0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1kg = 2.2046lb

	0	1	2	3	4	5	6	7	8	9
0		2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.5.	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liter to U.S. Gallon

1 l = 0.2642 U.S.Gal

	0	1	2	3	4	5	6	7	8	9
0		0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.6076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.631	25.625	25.889	26.153

Liter to U.K. Gallon

1 l = 0.21997 U.K.Gal

	0	1	2	3	4	5	6	7	8	9
0		0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.969	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

	0	1	2	3	4	5	6	7	8	9
		7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	396.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	10005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kgf/cm² to lbf/in²

$1kgf / cm^2 = 14.2233lbf / in^2$

	0	1	2	3	4	5	6	7	8	9
		14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1010	1024	1038	1053	1067	1081	1095	1109	1124
80	1138	1152	1166	1181	1195	1209	1223	1237	1252	1266
90	1280	1294	1309	1323	1337	1351	1365	1380	1394	1408
100	1422	1437	1451	1465	1479	1493	1508	1522	1536	1550
110	1565	1579	1593	1607	1621	1636	1650	1664	1678	1693
120	1707	1721	1735	1749	1764	1778	1792	1806	1821	1835
130	1849	2863	1877	1892	1906	1920	1934	1949	1963	1977
140	1991	2005	2020	2034	2048	2062	2077	2091	2105	2119
150	2134	2148	2162	2176	2190	2205	2219	2233	2247	2262
160	2276	2290	2304	2318	2333	2347	2361	2375	2389	2404
170	2418	2432	2446	2460	2475	2489	2503	2518	2532	2546
180	2560	2574	2589	5603	2617	2631	2646	2660	2674	2688
200	2845	2859	2873	2887	2901	2916	2930	2944	2958	2973
210	2987	3001	3015	3030	3044	3058	3072	3086	3101	3115
220	3129	3143	3158	3172	3186	3200	3214	3229	3243	3257
230	3271	3286	3300	3314	3328	3343	3357	3371	3385	3399
240	3414	3428	3442	3456	3470	3485	3499	3513	3527	3542

TEMPERATURE

Fahrenheit-Centigrade Conversion.

A simple way to convert a fahrenheit temperature reading into a centigrade temperature reading or vice verse is to enter the accompanying table in the center or boldface column of figures.

These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

˚C		˚F	˚C		˚F	˚C		˚F	˚C		˚F
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	114.8	27.2	81	117.8
-37.2	-35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	93	199.4
-23.9	-11	12.2	-4.4	24	75.2	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	77.0	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	78.8	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	80.6	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	82.4	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	84.2	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	35	95.0	21.1	70	158.0	51.7	125	257.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	172	347.0

SECTION 1 GENERAL

SECTION 1 GENERAL

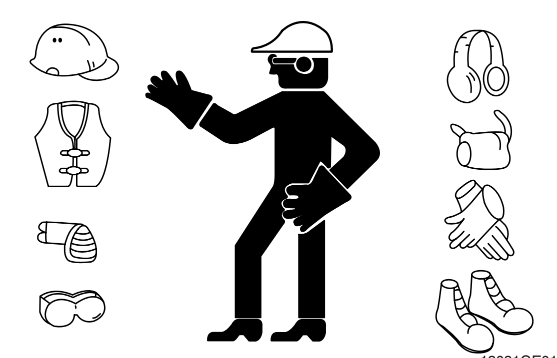
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

Unsafe work practices are dangerous. Understand service procedure before doing work; Do not attempt shortcuts.

WEAR PROTECTIVE CLOTHING

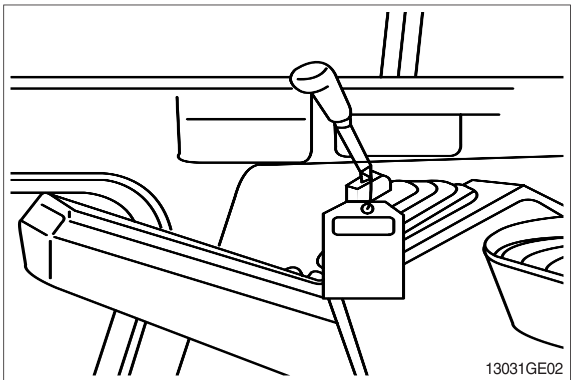
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

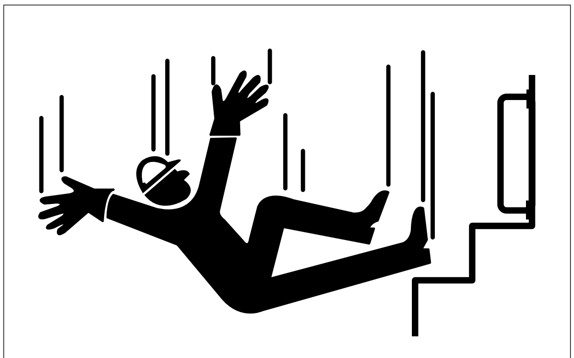
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「Do Not Operate」 tag on the right side control lever.



13031GE02

USE HANDHOLDS AND STEPS

Falling is one of the major causes of personal injury.
When you get on and off the machine, always maintain a three point contact with the steps and handrails and face the machine. Do not use any controls as handholds.
Never jump on or off the machine. Never mount or dismount a moving machine.
Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.



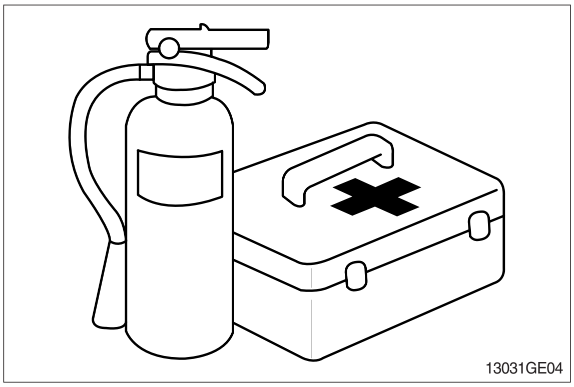
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

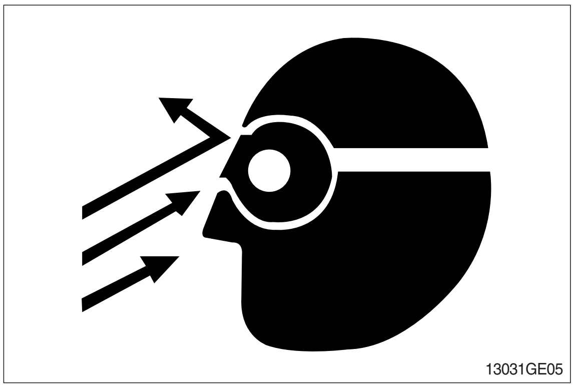
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.

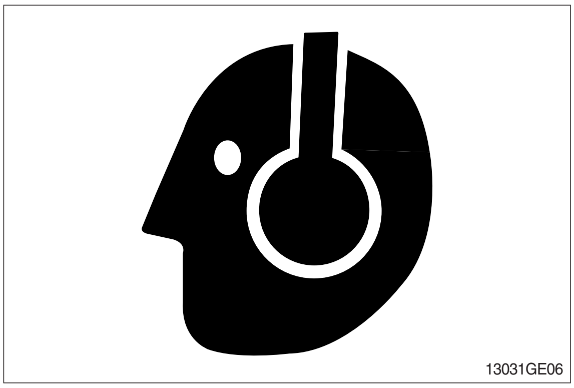


13031GE05

PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

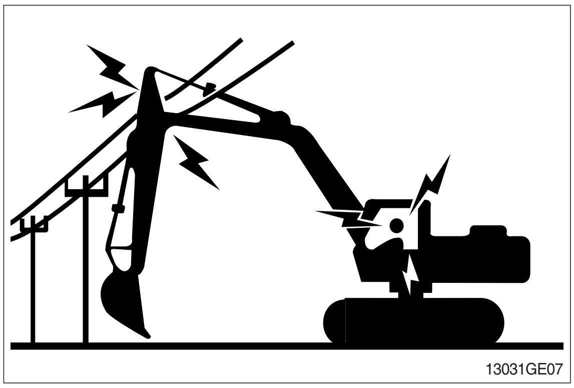


13031GE06

AVOID POWER LINES

Serious injury or death can result from contact with electric lines.

Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.

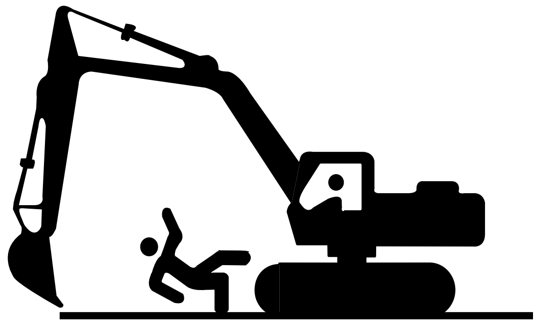


13031GE07

KEEP RIDERS OFF EXCAVATOR

Only allow the operator on the excavator. Keep riders off.

Riders on excavator are subject to injury such as being struck by foreign objects and being thrown off the excavator. Riders also obstruct the operator's view resulting in the excavator being operated in an unsafe manner.



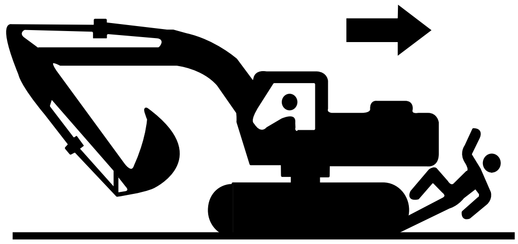
13031GE08

MOVE AND OPERATE MACHINE SAFELY

Bystanders can be run over. Know the location of bystanders before moving, swinging, or operating the machine.

Always keep the travel alarm in working condition. It warns people when the excavator starts to move.

Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.

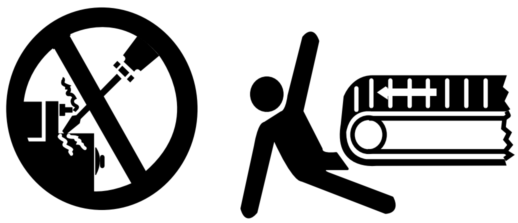


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

Avoid possible injury machine damage. Do not start engine by shorting across starter terminals.

NEVER start engine while standing on ground. Start engine only from operator's seat.



13031GE26

PARK MACHINE SAFELY

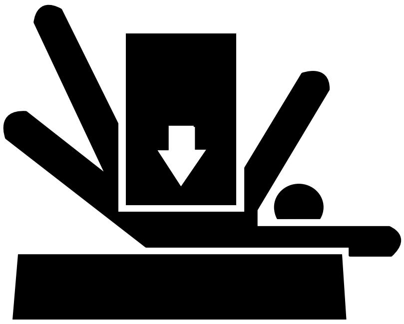
Before working on the machine:

- Park machine on a level surface.
- Lower bucket to the ground.
- Turn auto idle switch off.
- Run engine at 1/2 speed without load for 2 minutes.
- Turn key switch to OFF to stop engine. Remove key from switch.
- Move pilot control shutoff lever to locked position.
- Allow engine to cool.

SUPPORT MACHINE PROPERLY

Always lower the attachment or implement to the ground before you work on the machine. If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

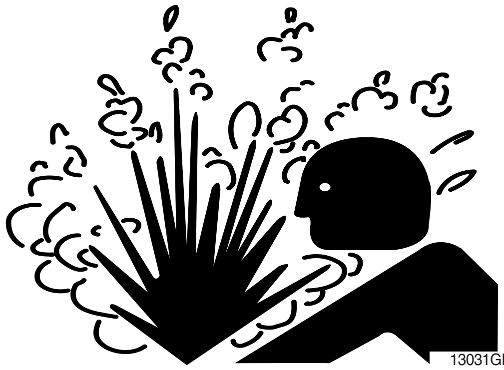


13031GE10

SERVICE COOLING SYSTEM SAFELY

Explosive release of fluids from pressurized cooling system can cause serious burns.

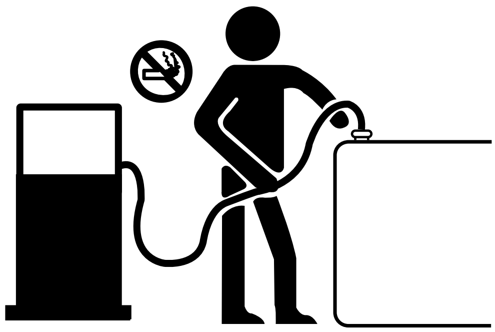
Shut off engine. Only remove filler cap when cool enough to touch with bare hands.



13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

Handle fuel with care; It is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.
Fill fuel tank outdoors.



13031GE12

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

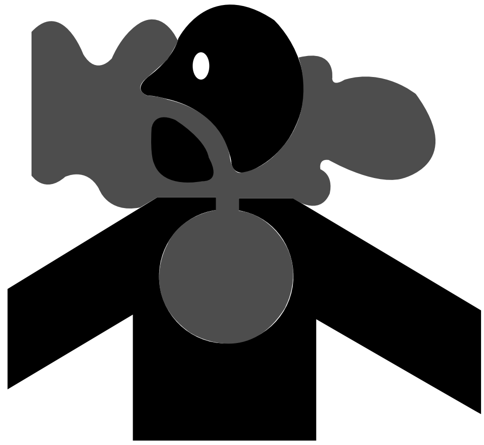
Do not store oily rags; They can ignite and burn spontaneously.

13031GE13

BEWARE OF EXHAUST FUMES

Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.

If you must operate in a building, be positive there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

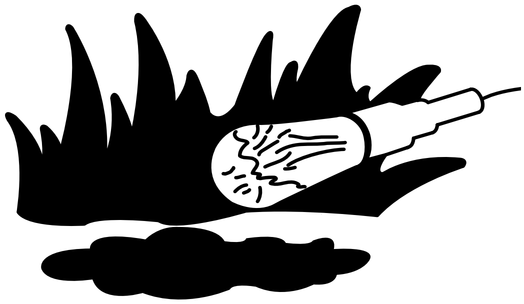
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

ILLUMINATE WORK AREA SAFELY

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

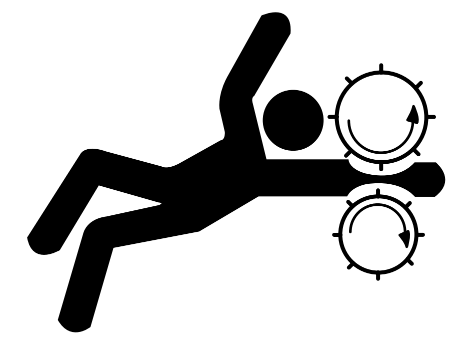


13031GE15

SERVICE MACHINE SAFELY

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

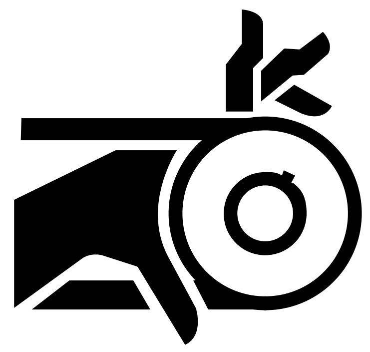


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

To prevent accidents, use care when working around rotating parts.



13031GE17

AVOID HIGH PRESSURE FLUIDS

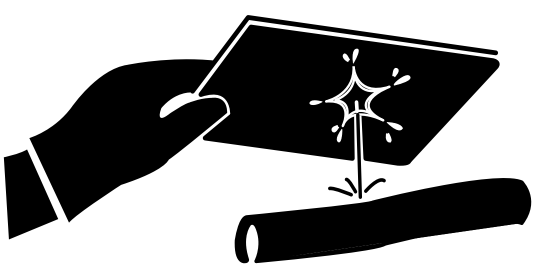
Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.

Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.

13031GE20

PREVENT BATTERY EXPLOSIONS

Keep sparks, lighted matches, and flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; It may explode. Warm battery to 16˚C (60˚F).

13031GE21

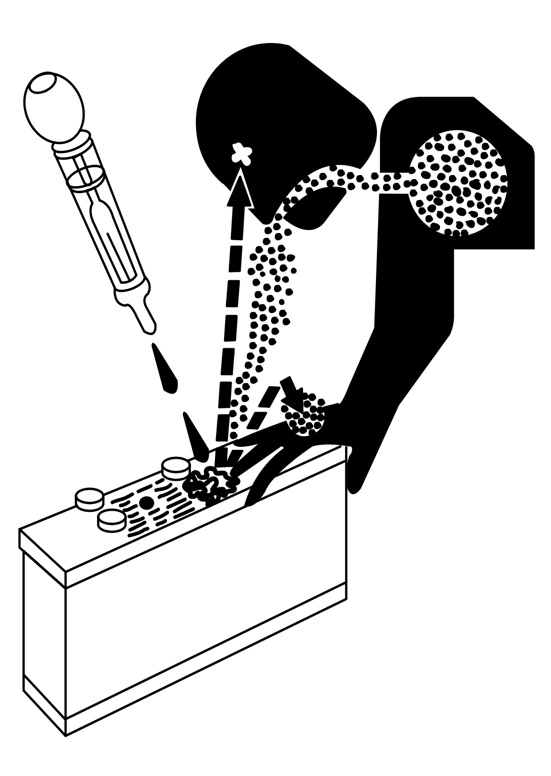
PREVENT ACID BURNS

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

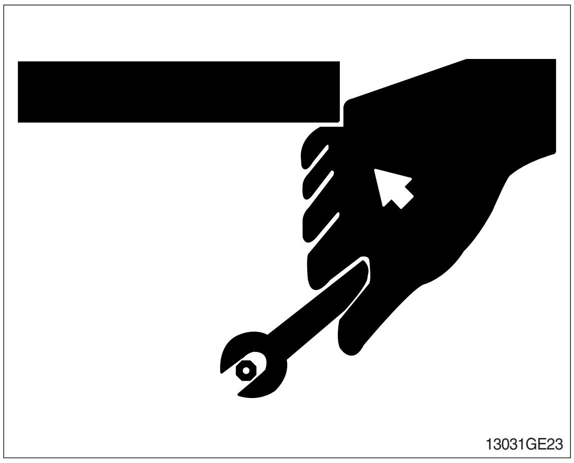
If you spill acid on yourself:
1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10-15 minutes. Get medical attention immediately.

If acid is swallowed:
1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.



13031GE22

USE TOOLS PROPERLY



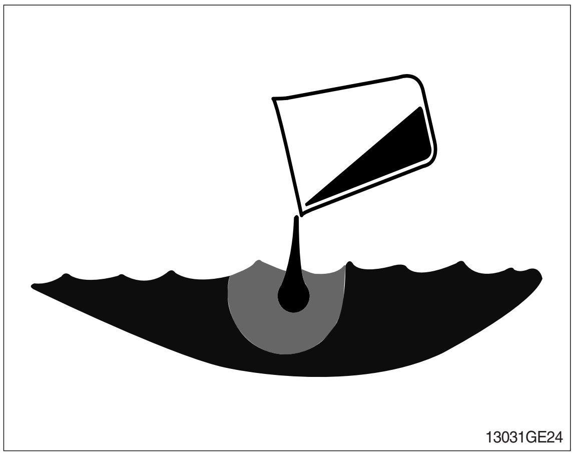
Use tools appropriate to the work. Makeshift tools, parts, and procedures can create safety hazards.

Use power tools only to loosen threaded tools and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only recommended replacement parts.(aee Parts catalogue.)

DISPOSE OF FLUIDS PROPERLY

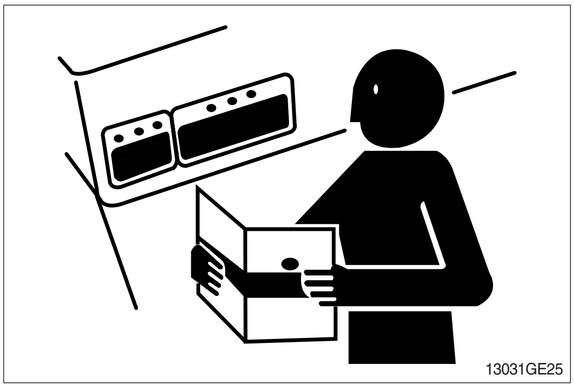


Improperly disposing of fluids can harm the environment and ecology. Before draining any fluids, find out the proper way to dispose of waste from your local environmental agency.

Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.

REPLACE SAFETY SIGNS



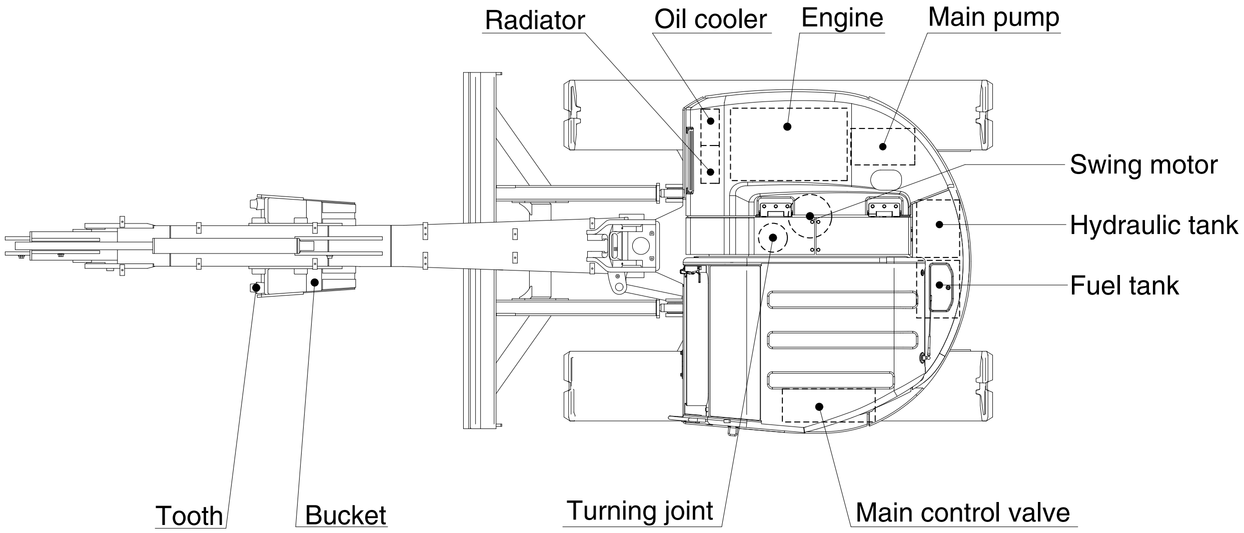
Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

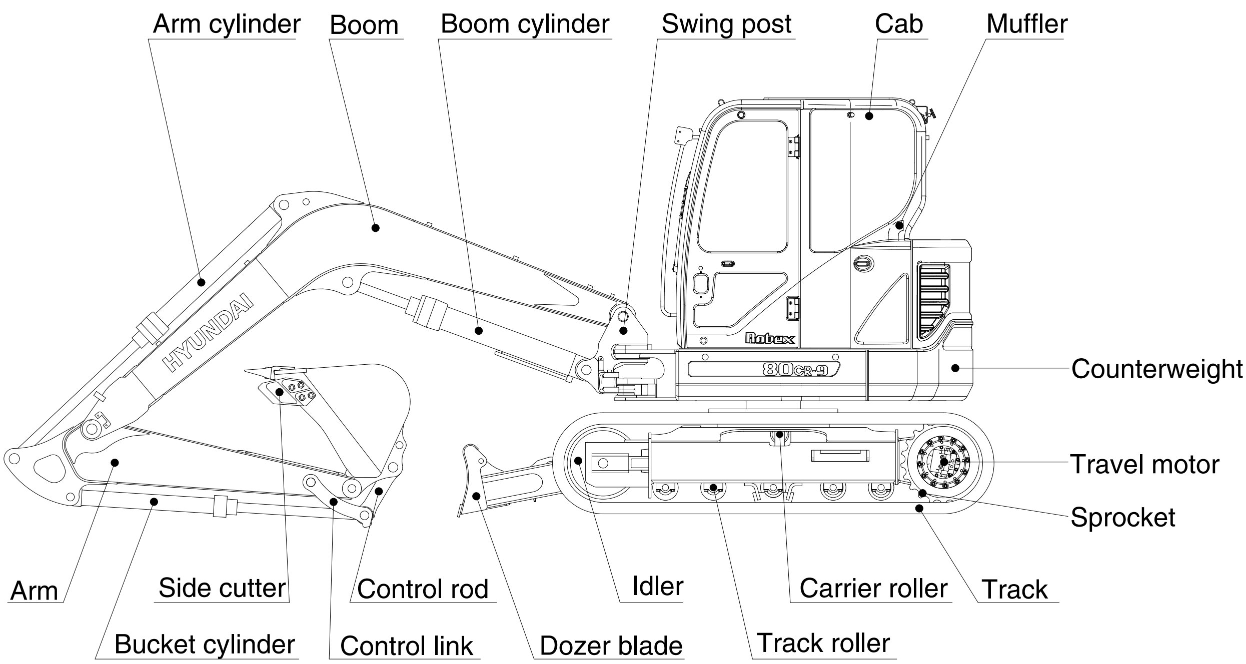
LIVE WITH SAFETY

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

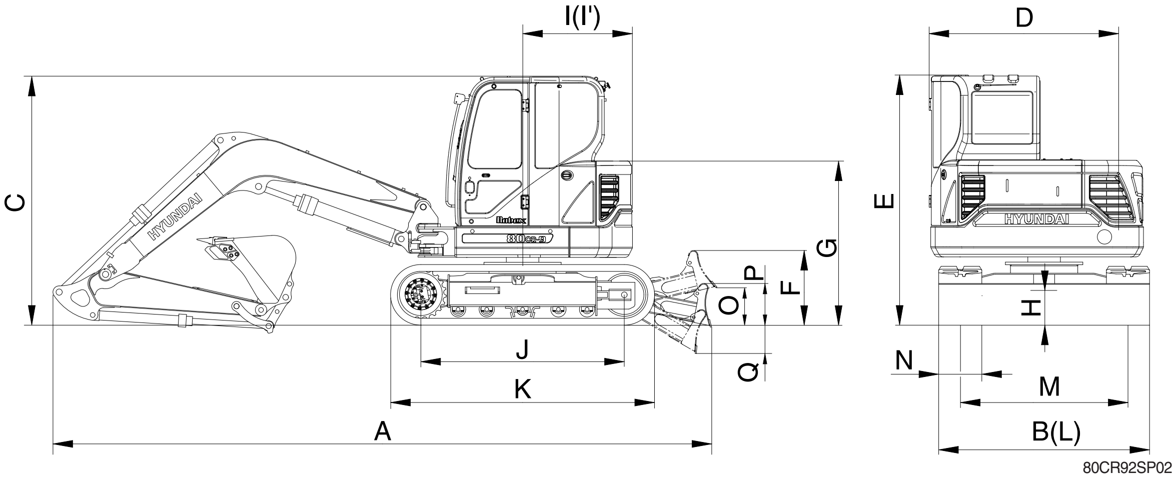




80CR92SP01

2. SPECIFICATIONS

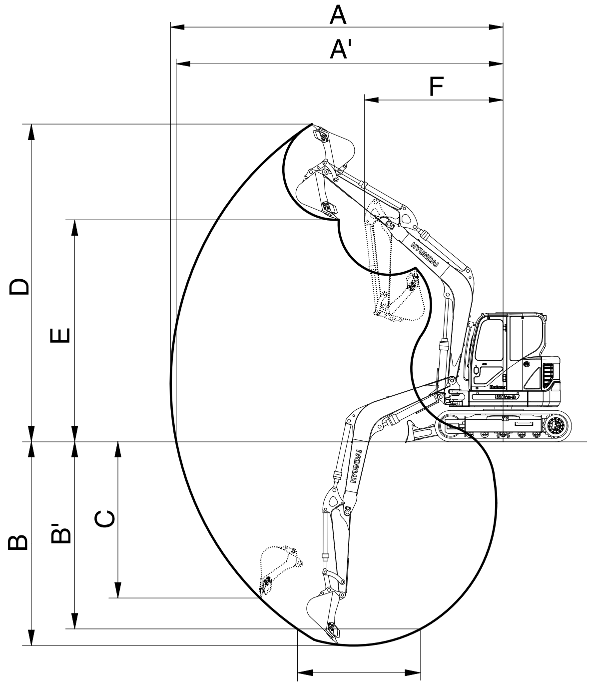
1) 3.4 m (11' 2") MONO BOOM, 1.67 m (5' 6") ARM WITH BOOM SWING SYSTEM



Description		Unit	Specification
Operating weight		kg (lb)	8200 (18080)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.28 (0.25)
Overall length	A	mm (ft-in)	6170 (20' 3")
Overall width, with 450 mm shoe	B		2300 (7' 7")
Overall height	C		2640 (8' 8")
Superstructure width	D		2220 (7' 3")
Overall height of cab	E		2640 (8' 8")
Ground clearance of counterweight	F		740 (2' 5")
Engine cover height	G		1750 (5' 9")
Minimum ground clearance	H		360 (1' 2")
Rear-end distance	I		1280 (4' 2")
Rear-end swing radius	I'		1280 (4' 2")
Distance between tumblers	J		2200 (7' 3")
Undercarriage length	K		2790 (9' 2")
Undercarriage width	L		2300 (7' 7")
Track gauge	M		1850 (6' 1")
Track shoe width, standard	N		450 (1' 6")
Height of blade	O		460 (1' 6")
Ground clearance of blade up	P		400 (1' 4")
Depth of blade down	Q		280 (0' 11")
Travel speed (Low/high)		km/hr (mph)	2.8/4.3 (1.7/2.7)
Swing speed		rpm	9.6
Gradeability		Degree (%)	30 (58)
Ground pressure (450 mm shoe)		kgf/cm^2 (psi)	0.39 (5.55)
Max traction force		kg (lb)	7400 (16310)

3. WORKING RANGE

1) 3.4 m (11' 2") MONO BOOM



80CR92SP03

Description		1.67 m (5' 6") Arm
Max digging reach	A	6960 mm (22'10")
Max digging reach on ground	A'	6820 mm (22' 5")
Max digging depth	B	4140 mm (13' 7")
Max digging depth (8ft level)	B'	3780 mm (12' 5)
Max vertical wall digging depth	C	3570 mm (11' 9")
Max digging height	D	6740 mm (22' 1")
Max dumping height	E	4730 mm (15' 6")
Min swing radius	F	2500 mm (8' 2")
Boom swing radius (left/right)		70˚/60˚
Bucket digging force	SAE	48.4 kN
		4940 kgf
		10890 lbf
	ISO	55.9 kN
		5700 kgf
		12570 lbf
Arm crowd force	SAE	40.3 kN
		4110 kgf
		9060 lbf
	ISO	42.2 kN
		4300 kgf
		9480 lbf

4. WEIGHT

Item	kg	lb
Upperstructure assembly	4090	9020
Main frame weld assembly	720	1590
Engine assembly	270	600
Main pump assembly	60	130
Main control valve assembly	40	90
Swing motor assembly	80	170
Hydraulic oil tank assembly	75	165
Fuel tank assembly	70	155
Boom swing post	260	570
Counterweight	930	2050
Cab assembly	330	730
Lower chassis assembly	2940	6480
Track frame weld assembly	990	2180
Swing bearing	140	310
Travel motor assembly	85	190
Turning joint	30	60
Track recoil spring	110	240
Idler	130	290
Carrier roller	20	40
Track roller	160	360
Track-chain assembly (450 mm standard triple grouser shoe)	830	1830
Dozer blade assembly	320	700
Front attachment assembly (3.4 m boom,1.67 m arm, 0.28 m^3 SAE heaped bucket)	1170	2580
3.4 m boom assembly	420	930
1.67 m arm assembly	180	400
0.28 m^3 SAE heaped bucket	230	510
Boom cylinder assembly	110	240
Arm cylinder assembly	90	200
Bucket cylinder assembly	60	130
Dozer cylinder assembly	80	180
Bucket control link assembly	80	180
Boom swing cylinder assembly	70	150

5. LIFTING CAPACITIES

1) 3.4 m (11' 2") boom, 1.67m (5' 6") arm equipped with 0.28 m^3 (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade up with 930 kg (2050 lb) counterweight.

Load point height		Load radius						At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		Capacity		Reach
										m (ft)
4.5 m	kg					*1550	1480	*1470	1040	5.47
(15.0 ft)	lb					*3420	3260	*3240	2290	(17.9)
3.0 m	kg					*1740	1430	*1530	780	6.23
(10.0 ft)	lb					*3840	3150	*3370	1720	(20.4)
1.5 m	kg			*4050	2510	*2260	1320	*1620	700	6.45
(5.0 ft)	lb			*8930	5530	*4980	2910	*3570	1540	(21.2)
Ground	kg			*4830	2320	*2650	1230	*1710	740	6.20
Line	lb			*10650	5110	*5840	2710	*3770	1630	(20.3)
-1.5 m	kg	*4730	*4730	*4410	2320	*2550	1210	*1760	940	5.38
(-5.0 ft)	lb	*10430	*10430	*9720	5110	*5620	2670	*3880	2070	(17.7)
-3.0 m	kg			*2810	2430					
(-10.0 ft)	lb			*6190	5360					

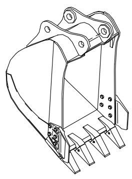
2) 3.4 m (11' 2") boom, 1.67 m (5' 6") arm equipped with 0.28 m^3 (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade down with 930 kg (2050 lb) counterweight.

Load point height		Load radius						At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		Capacity		Reach
										m (ft)
4.5 m	kg					*1550	1380	1110	970	5.47
(15.0 ft)	lb					*3420	3040	2450	2140	(17.9)
3.0 m	kg					1540	1340	840	730	6.23
(10.0 ft)	lb					3400	2950	1850	1610	(20.4)
1.5 m	kg			2770	2320	1430	1230	760	650	6.45
(5.0 ft)	lb			6110	5110	3150	2710	1680	1430	(21.2)
Ground	kg			2570	2140	1330	1140	790	680	6.20
Line	lb			5670	4720	2930	2510	1740	1500	(20.3)
-1.5m	kg	*4730	*4730	2670	2140	1310	1120	1010	870	5.38
(-5.0 ft)	lb	*10430	*10430	5670	4720	2890	2470	2230	1920	(17.7)
-3.0 m	kg			2690	2250					
(-10.0 ft)	lb			5930	4960					

Note
1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity of the ROBEX series does not exceed 75 % of tipping load with the machine on firm, level ground or 87 % of full hydraulic capacity.
3. The load point is a hook located on the back of the bucket.
4. *indicates load limited by hydraulic capacity.

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET



0.28 m^3 SAE heaped bucket

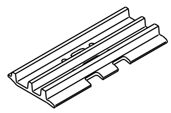
Capacity		Width		Weight	Recommendation
					3.4 m (11' 2") Mono boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.67 m arm (5' 6")
0.28 m^3 (0.37 yd^3)	0.25 m^3 (0.33 yd^3)	730 mm (28.7")	810 mm (31.9")	230 kg (510 lb)	Applicable for materials with density of 1600 kg/m^3 (2700 lb/yd^3) or less

7. UNDERCARRIAGE

1) TRACKS

X-leg type center frame is integrally welded with reinforced box-section track frames. The design includes dry tracks, lubricated rollers, idlers, sprockets, hydraulic track adjusters with shock absorbing springs and assembled track-type tractor shoes with triple grousers.

2) TYPES OF SHOES

Model	Shapes		Triple grouser	
				
R80CR-9	Shoe width	mm (in)	450 (18)	600 (24)
	Operating weight	kg (lb)	8200 (18080)	8360 (18430)
	Ground pressure	kgf/cm^2 (psi)	0.39 (5.55)	0.30 (4.27)
	Overall width	mm (ft-in)	2300 (7' 7")	2390 (7' 10")

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	1 EA
Track rollers	5 EA
Track shoes	39 EA

4) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

※ Table 1

Track shoe	Specification	Category
450 mm triple grouser	Standard	A
600 mm triple grouser	Option	A

※ Table 2

Category	Applications	Precautions
A	Rocky ground, river beds, normal soil	· Travel at low speed on rough ground with large obstacles such as boulders or fallen trees

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Yanmar 4TNV98-ZVHYB
Type	4-cycle diesel engine, low emission
Cooling method	Water cooling
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	98 × 110 mm (3.86" × 4.33")
Piston displacement	3319 cc (203 cu in)
Compression ratio	18.5:1
Rated gross horse power (SAE J1995)	60.4 Hp at 2100 rpm (45.0 kW at 2100 rpm)
Maximum torque at 1350 rpm	24.5 kgf · m (177 lbf · ft)
Engine oil quantity	11.6 ℓ (3.1 U.S. gal)
Dry weight	270 kg (595 lb)
High idling speed	2250 ± 50 rpm
Low idling speed	1050 ± 50 rpm
Rated fuel consumption	174.4 g/Hp · hr at 2100 rpm
Starting motor	12 V-3 kW
Alternator	12 V-80 A
Battery	1 × 12 V × 100 Ah

2) MAIN PUMP (P1, P2)

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 36 cc/rev
Maximum pressure	280 kgf/cm^2 (3980 psi)
Rated oil flow	2 × 72 ℓ/min (2 × 19 U.S.gpm)
Rated speed	2000 rpm

3) PISTON PUMP (P3)

Item	Specification
Type	Fixed displacement axis piston pump
Capacity	28 cc/rev
Maximum pressure	230 kgf/cm^2 (3270 psi)
Rated oil flow	56 ℓ/min (14.8 U.S.gpm)

4) GEAR PUMP (P4)

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	8.9 cc/rev
Maximum pressure	35 kgf/cm^2 (500 psi)
Rated oil flow	17.8 ℓ/min (4.7 U.S.gpm/3.7 U.K.gpm)

5) MAIN CONTROL VALVE

Item	Specification
Type	12 spools sectional inline
Operating method	Hydraulic pilot system
Main relief valve pressure	280 kgf/cm^2 (3980psi)
Overload relief valve pressure	310 kgf/cm^2 (4410psi)

6) SWING MOTOR (machine serial No.: -#1002)

Item	Specification
Type	Axial piston motor
Capacity	39 cc/rev
Relief pressure	230 kgf/cm^2 (3270 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	14 kgf · m (101 lbf · ft)
Brake release pressure	20~40 kgf/cm^2 (280~570 psi)
Reduction gear type	2 - stage planetary

SWING MOTOR (machine serial No.: #1003-)

Item	Specification
Type	Axial piston motor
Capacity	43.4 cc/rev
Relief pressure	230 kgf/cm^2 (3270 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	17 kgf · m (123 lbf · ft)
Brake release pressure	25~50 kgf/cm^2 (356~711 psi)
Reduction gear type	2 - stage planetary

7) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	280 kgf/cm^2 (3980 psi)
Reduction gear type	2 stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	Less then 9 kgf/cm^2 (128 psi)
Braking torque	8.4 kgf · m (61 lbf · ft)

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø 115 × ø 70 × 850 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø 100 × ø 65 × 873 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø 85 × ø 55 × 685 mm
	Cushion	Extend only
Dozer cylinder	Bore dia × Rod dia × Stroke	ø 130 × ø 70 × 152 mm
	Cushion	-
Boom swing cylinder	Bore dia × Rod dia × Stroke	ø 110 × ø 60 × 744 mm
	Cushion	-

※ Discoloration of cylinder rod can occur when the friction reduction additive of lubrication oil spreads on the rod surface.

※ Discoloration does not cause any harmful effect on the cylinder performance.

9) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
R80CR-9	Standard	450 mm (18")	0.35 kgf/cm^2 (4.98 psi)	38	2300 mm (7' 7")
	Option	600 mm (24")	0.27 kgf/cm^2 (3.84 psi)	38	2390 mm (7' 10")

10) BUCKET

Item		Capacity		Tooth quantity	Width	
		SAE heaped	CECE heaped		Without side cutter	With side cutter
R80CR-9	STD	0.28 m^3 (0.37yd^3)	0.25 m^3 (0.33yd^3)	4	730 mm (28.7")	810 mm (31.9")

9. RECOMMENDED OILS

Use only oils listed below. Do not mix different brand oil.
Please use HYUNDAI genuine oil and grease.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature ℃ (℉) -20 (-4), -10 (14), 0 (32), 10 (50), 20 (68), 30 (86), 40 (104)
Engine oil pan	Engine oil	11.6 (3.1)	SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive (-#1002)	Gear oil	1.5 (0.4)	SAE 80W-90
Final drive	Gear oil	1.2×2 (0.32×2)	SAE 80W-90
Swing drive (-#1002)	Grease	3.3 (0.87)	NLGI NO.1 NLGI NO.2
Hydraulic tank	Hydraulic oil	Tank : 71 (18.8) System : 120 (31.7)	ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel	120 (31.7)	ASTM D975 NO.1 ASTM D975 NO.2
Fitting (Grease nipple)	Grease	As required	NLGI NO.1 NLGI NO.2
Radiator (Reservoir tank)	Mixture of antifreeze and water 50 : 50	11 (2.9)	Ethylene glycol base permanent type

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material

SECTION 2 STRUCTURE AND FUNCTION

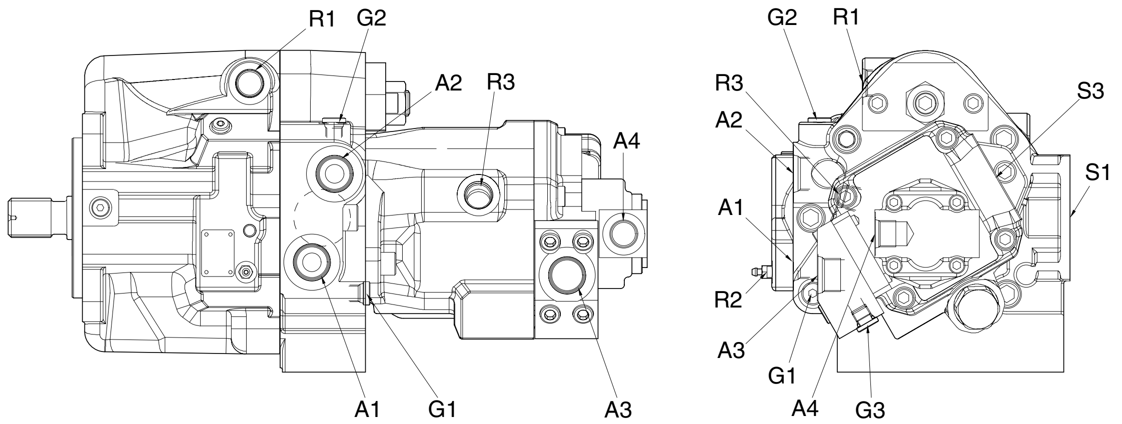
GROUP 1 HYDRAULIC PUMP

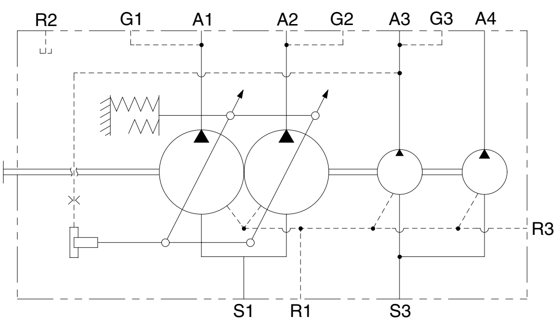
1. GENERAL

This is a variable displacement double-piston pump for discharge with equal displacements from one cylinder block. This pump is so compact as to appear a single pump though this is actually a double pump.

Because this pump has one swash plate, the tilting angle is the same for two pumps. Tilting of the pump changes in response to the total pressure of P1 + P2. Namely, the output is controlled to the constant value so that the relationship between the discharge pressure and flow rate Q becomes constant, (P1 + P2) × Q =Constant.

The third pump and pilot pump can be connected to the same shaft via a coupling.





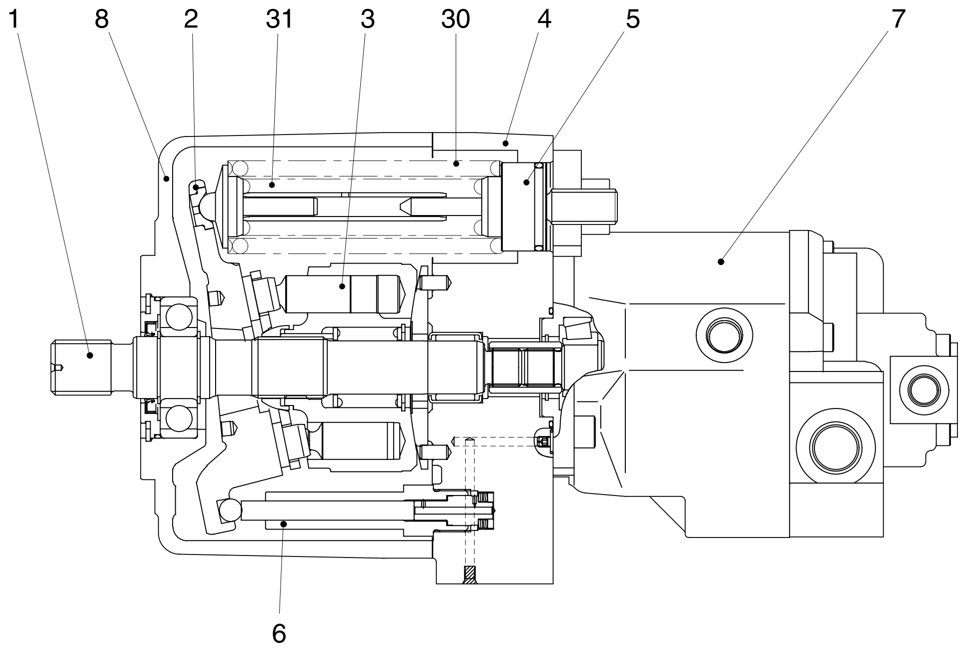
Hydraulic circuit

80CR92MP01

Description of the ports

Port	Name	Bore
S1	Suction port	SAE 2 (standard)
S3	Suction port	SAE 1 1/4 (standard)
A1, A2	Discharge port	PF 3/4
A3	Discharge port	PF 3/4
A4	Discharge port	PF 1/2
R1	Drain port	PF 1/2
R2	Air bleeder port	M10 × 1.0 (with bleeder valve)
R3	Drain port	PF 1/2
G1, G2, G3	Gauge port	PF 1/4 with quick coupler

2. PRINCIPAL COMPONENTS AND FUNCTIONS



80CR92MP02

1	Drive shaft	6	Control piston
2	Hanger	7	Piston pump
3	Rotary group	8	Housing
4	Cover	30	Spring
5	Spring seat	31	Spring

SPECIFICATIONS

- Capacity : 2×36+28+8.9 cc/rev
- Rated oil flow : 2×72+56+17.8 ℓ/min
- Rated pressure : 2×280+230+35 kgf/cm²

1) PISTON PUMP

This is a variable displacement double-piston pump for discharge with two equal displacements from one cylinder block. Because this is one rotary group, there is only one suction port.

The oil is divided into two equal flows by the control plate in the cover and directed to two discharge ports provided in the cover.

The oil pressure caused by the discharge pressure acts on the hanger and tilts the hanger by overcoming the spring force.

Since the piston stroke changes according to the tilting angle of the hanger, the flow can be changed.

The third pump and pilot pump can be connected to the same shaft via a coupling.

2) PRINCIPLE OF OPERATION

(1) Function of pump

Displacement q (cm^2)

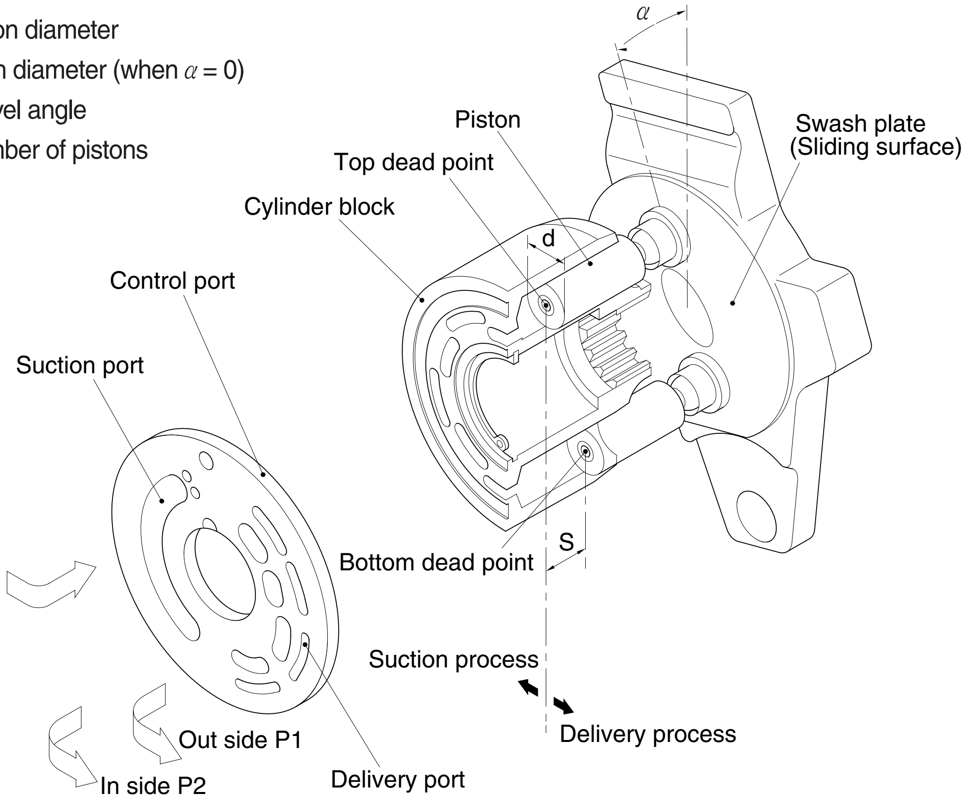
$q= \pi \times d^2/4 \times D \tan\alpha \times Z/2$

d : Piston diameter

D : Pitch diameter (when $\alpha = 0$)

α : Swivel angle

Z : Number of pistons



80CR92MP03

The cylinder block is connected via spline and can rotate together with the drive shaft.

The piston assembled into the cylinder block performs reciprocal operation while following the swash plate on the hanger.

The piston moves in a direction to increase the displacement during a stroke from the top to the bottom dead points. The oil flows from the suction port via a cover into the cylinder block (suction process).

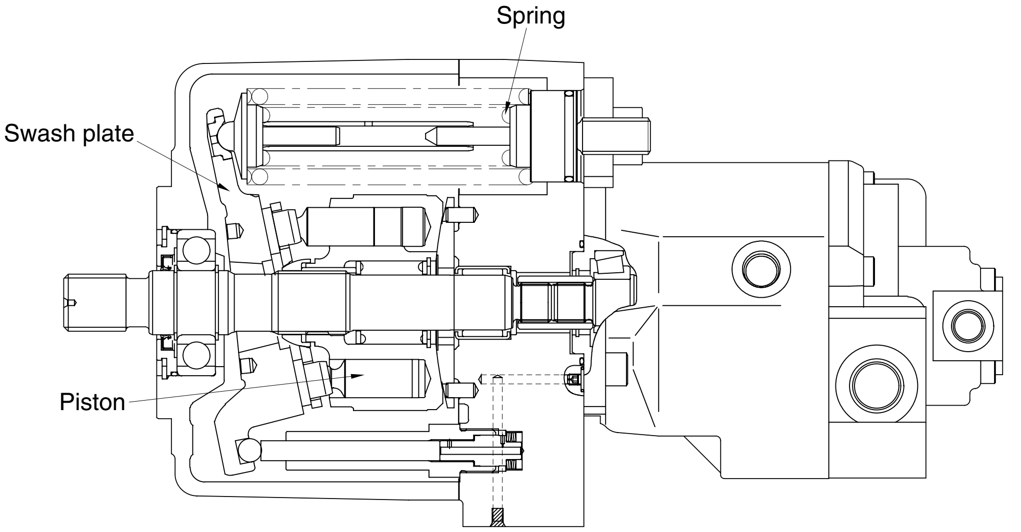
During a stroke from the bottom to the top dead points, the piston moves in a direction to decrease the displacement. The oil is discharged to the discharge port (discharge process).

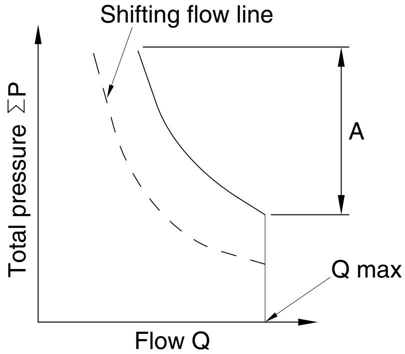
Charging the tilting of the hanger can be change the displacement.

The oil sucked through the port in the cylinder block is discharged from the discharge port on the inside of the control plate.

The oil sucked through the port on the outside of the cylinder block is discharged from the discharge port on the outside of the port plate.

2) CONTROL FUNCTIONS





80CR92MP04

The delivery pressure P1 and P2 are directed to the piston which slides on the swash plate, and acts on the swash plate.

The spring is provided to act against the delivery pressure.

When the oil pressure via piston acting on the swash plate is less than the installation load of the spring, the swash plate is fixed to the maximum tilting position.

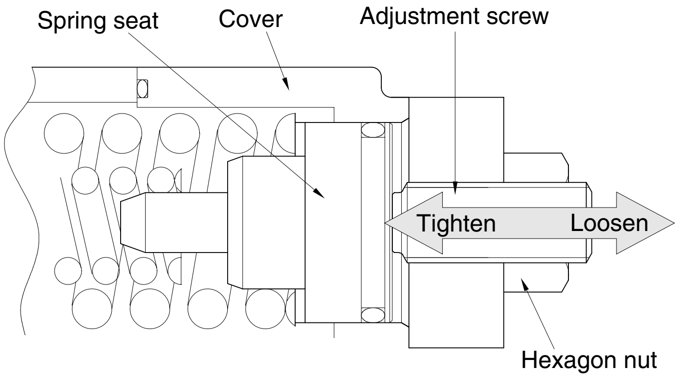
When the oil pressure via piston acting on the swash plate exceeds the installation load of the spring, the swash plate is tilted and kept tilted at a position where the oil pressure is balanced with the spring force (region A in above figure).

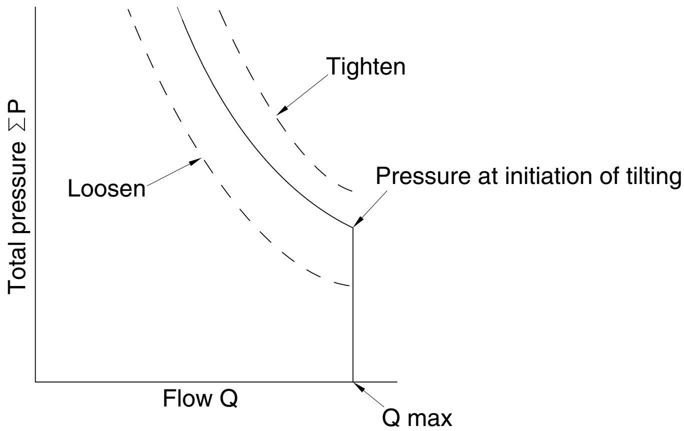
When the P3 oil pressure acts on the shift piston, the control shifting line is shifted.

3) ADJUSTMENT PROCEDURE OF SETTING TORQUE

(1) Loosen the hexagonal nut.

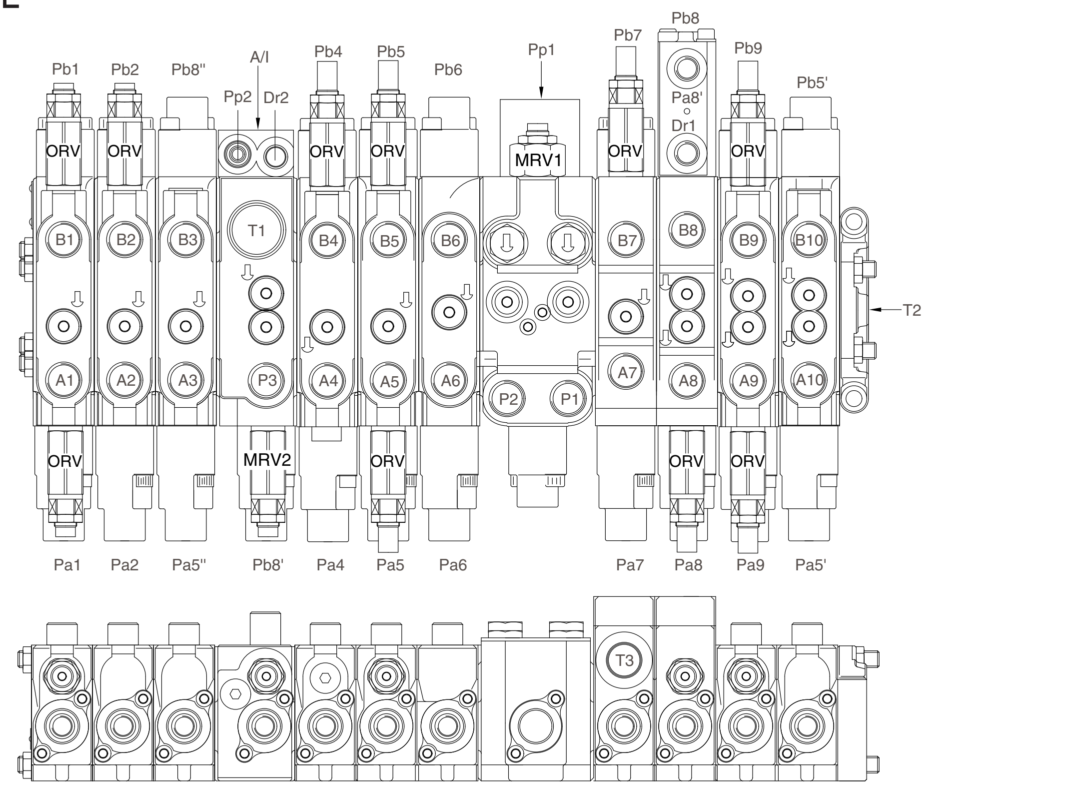
(2) Tighten or loosen the adjusting screw to set the power shifting line.





80CR92MP05

1. OUTLINE

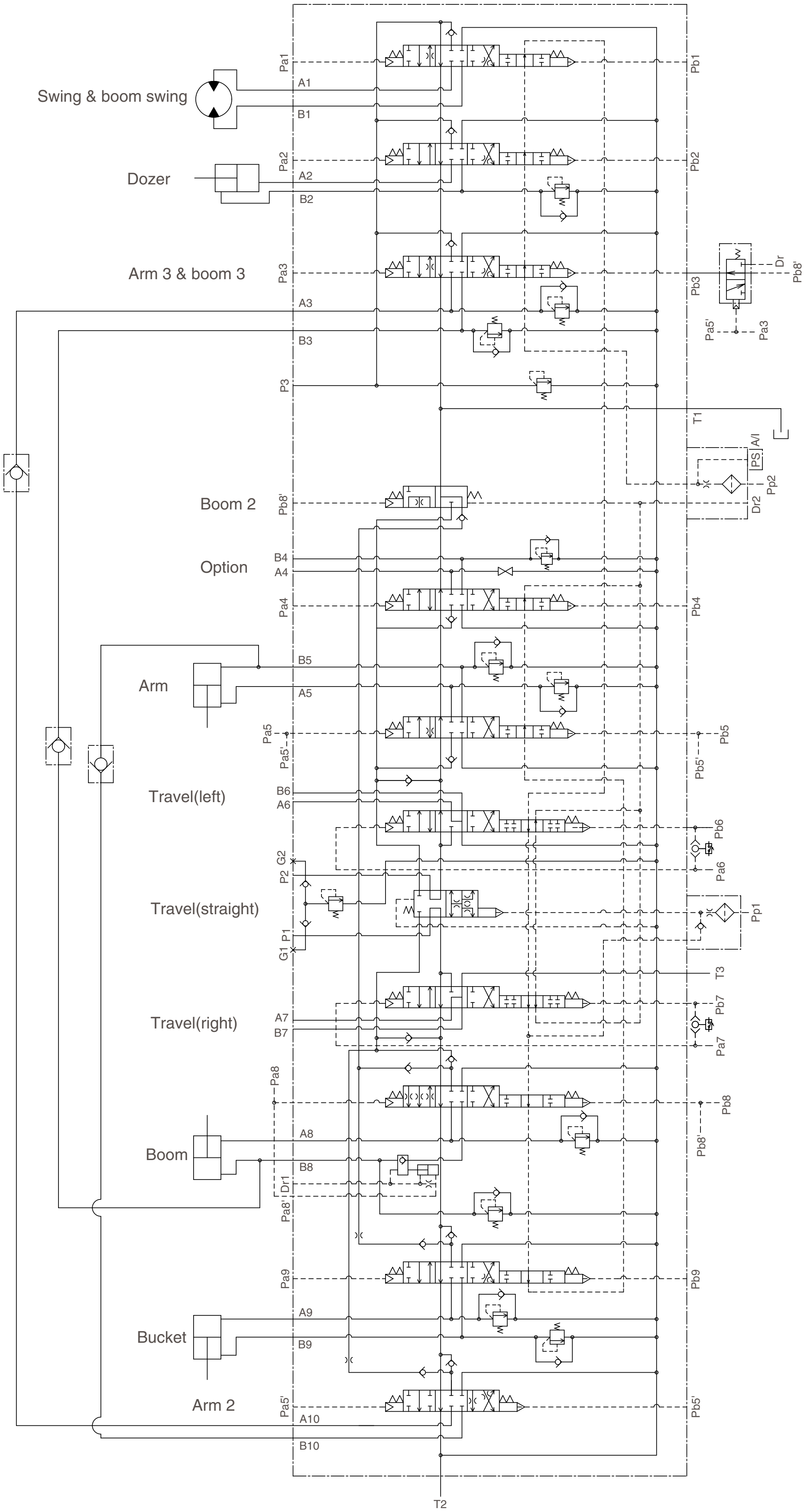


80CR92MC01

Mark	Port name	Port size	Tightening torque
P1	P 1 inlet port	PF 1/2	6.0~7.0 kgf · m
P2	P 2 inlet port		
P3	P 3 inlet & boom 2 port		
T1	P 3 & boom 2 tank port	PF1	10~12 kgf · m
T2	End cover tank port	PF 1/2	6.0~7.0 kgf · m
T3	Travel tank port		
A1	Swing & boom swing port		
B1			
A2	Dozer port		
B2			
A3	Arm 3 & boom 3 port		
B3			
A4	Option port		
B4			
A5	Arm port		
B5			
A6	Travel port (left)		
B6			
A7	Travel port (right)		
B7			
A8	Boom port		
B8			
A9	Bucket port		
B9			
A10	Arm 2 port		
B10			

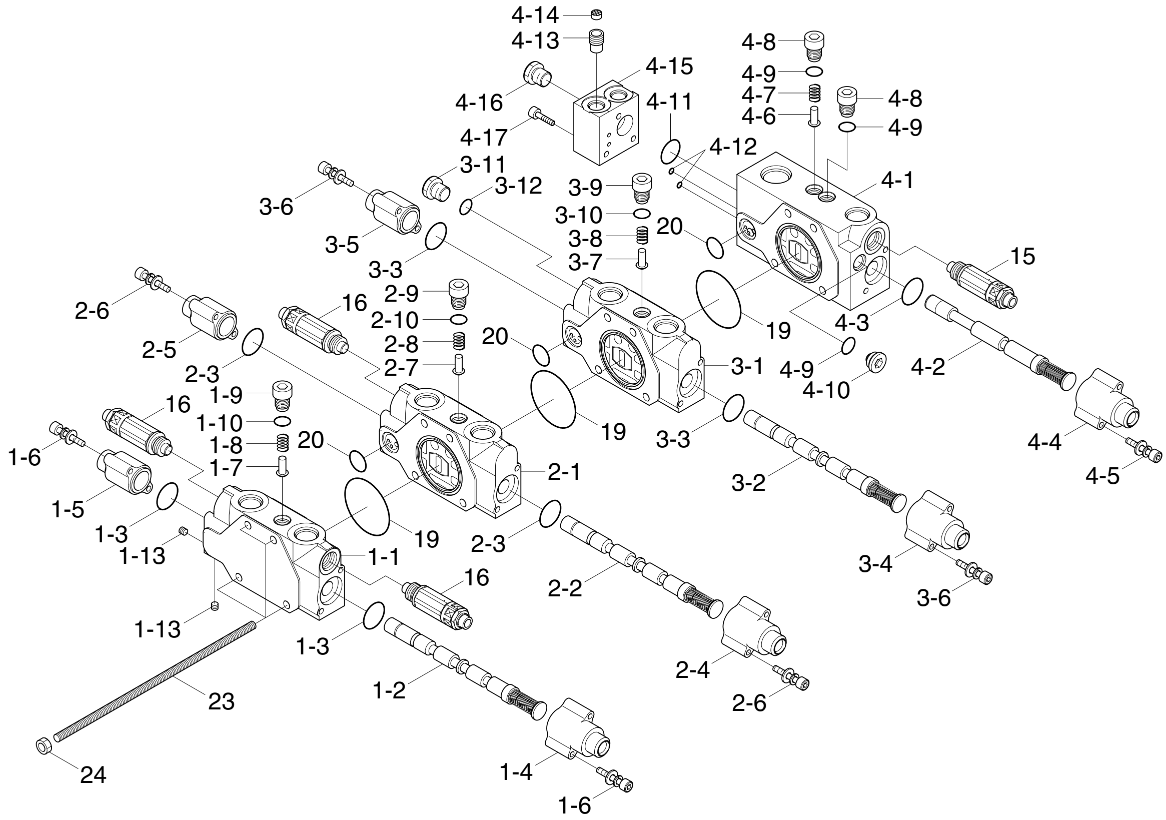
Mark	Port name	Port size	Tightening torque
Pa1	Swing & boom swing pilot port	PF 1/4	2.5~3.0 kgf · m
Pb1			
Pa2	Dozer pilot port		
Pb2			
Pa3	Arm 3 & boom 3 pilot port		
Pb3			
Pb8'	P 3 inlet & boom 2 pilot port		
Pa4	Service pilot port		
Pb4			
Pa5	Arm pilot port		
Pb5			
Pa6	Travel pilot port (left)		
Pb6			
Pa7	Travel pilot port (right)		
Pb7			
Pa8	Boom pilot port		
Pb8			
Pa9	Bucket pilot port		
Pb9			
Pa5'	Arm 2 pilot port		
Pb5'			
Pp1	P1, P2 & straight travel pilot port		
Pp2	P3 & boom 2 pilot port		
Dr2	P3 & boom 2 drain port		
A/I	Auto idle pilot port		
Pa8'	Boom lock valve release pilot port		
Dr1	Boom lock valve drain port		

2. HYDRAULIC CIRCUIT



80CR92MC06

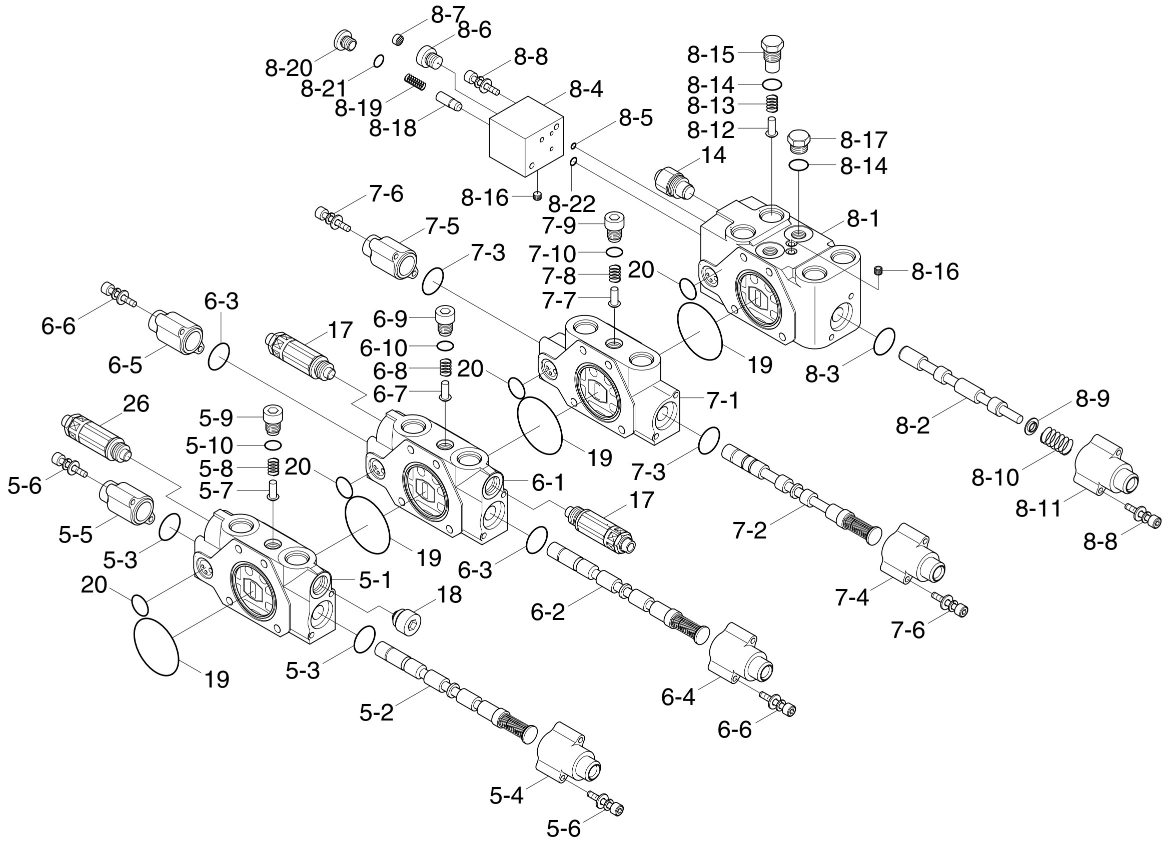
3. STRUCTURE (1/4)



80CR92MC02

1	Swing block	2-8	Spring	4-4	Pilot cover
1-1	Work body	2-9	Check valve plug	4-5	Socket bolt
1-2	Swing spool assy	2-10	O-ring	4-6	Check valve poppet
1-3	O-ring	3	Boom swing block	4-7	Spring
1-4	Pilot cover	3-1	Work body	4-8	Check valve plug
1-5	Pilot cover	3-2	Boom swing spool assy	4-9	O-ring
1-6	Socket bolt	3-3	O-ring	4-10	Plug
1-7	Poppet	3-4	Pilot cover	4-11	O-ring
1-8	Spring	3-5	Pilot cover	4-12	O-ring
1-9	Check valve plug	3-6	Socket bolt	4-13	Orifice
1-10	O-ring	3-7	Poppet	4-14	Coin type filter
1-13	Plug	3-8	Spring	4-15	Pilot body
2	Dozer block	3-9	Check valve plug	4-16	Plug
2-1	Work body	3-10	O-ring	4-17	Socket bolt
2-2	Dozer spool assy	3-11	Plug	15	Relief valve
2-3	O-ring	3-12	O-ring	16	Relief valve
2-4	Pilot cover	4	Boom 2 block	19	O-ring
2-5	Pilot cover	4-1	Work body	20	O-ring
2-6	Socket bolt	4-2	Boom 2 spool assy	23	Tie bolt
2-7	Poppet	4-3	O-ring	24	Hexagon nut

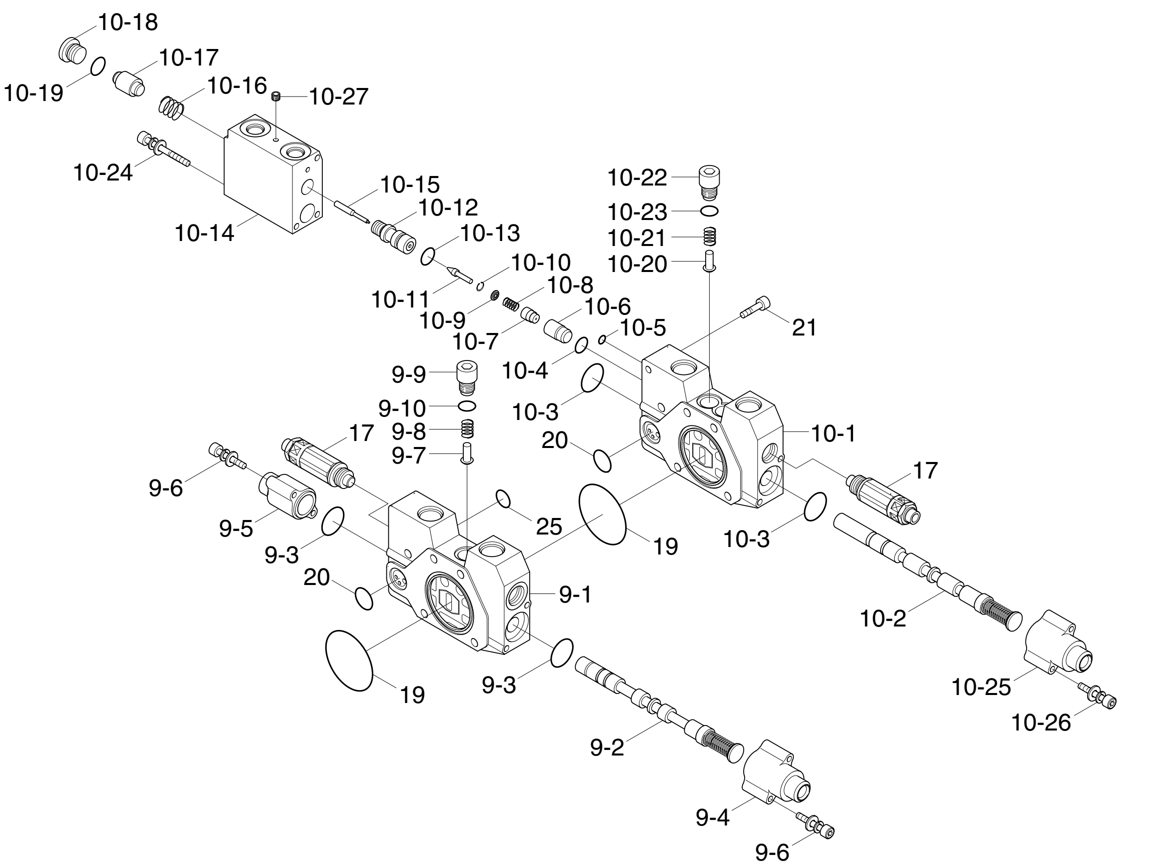
STRUCTURE (2/4)



80CR92MC03

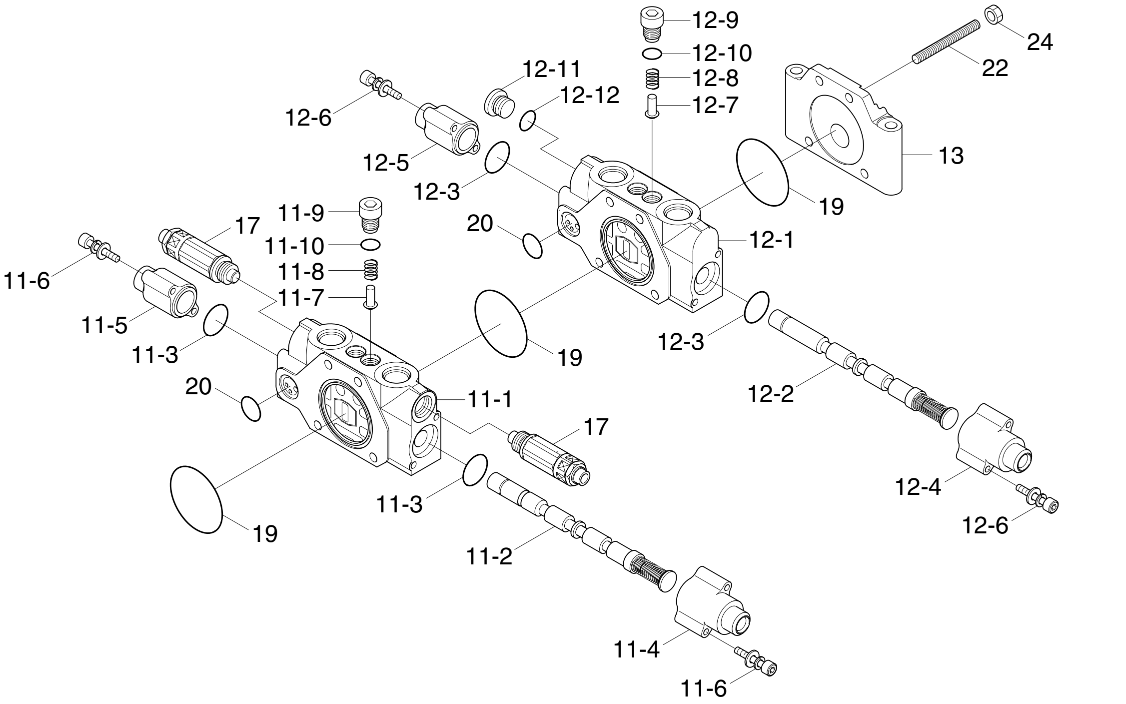
5	Service block
5-1	Work body
5-2	Service spool assy
5-3	O-ring
5-4	Pilot cover
5-5	Pilot cover
5-6	Socket bolt
5-7	Poppet
5-8	Spring
5-9	Check valve plug
5-10	O-ring
6	Arm block
6-1	Work body
6-2	Arm spool assy
6-3	O-ring
6-4	Pilot cover
6-5	Pilot cover
6-6	Socket bolt
6-7	Poppet
6-8	Spring
6-9	Check valve plug
6-10	O-ring
7	Left travel block
7-1	Work body
7-2	Travel spool assy
7-3	O-ring
7-4	Pilot cover
7-5	Pilot cover
7-6	Socket bolt
7-7	Check valve poppet
7-8	Spring
7-9	Check valve plug
7-10	O-ring
8	Straight travel block
8-1	Work body
8-2	Travel spool assy
8-3	O-ring
8-4	Pilot body
8-5	O-ring
8-6	Orifice
8-7	Coin type filter
8-8	Socket bolt
8-9	Spring seat
8-10	Spring
8-11	Pilot cover
8-12	Check valve poppet
8-13	Check valve spring
8-14	O-ring
8-15	Check valve plug
8-16	Plug
8-17	Plug
8-18	Check valve
8-19	Check valve spring
8-20	Plug
8-21	O-ring
8-22	O-ring
14	Main relief valve
17	Relief valve
18	Plug
19	O-ring
20	O-ring
26	Relief valve

STRUCTURE (3/4)



9	Right travel block	10-4	O-ring	10-19	O-ring
9-1	Work body	10-5	O-ring	10-20	Poppet
9-2	Travel spool assy	10-6	Lock valve	10-21	Spring
9-3	O-ring	10-7	Lock restrictor	10-22	Check valve plug
9-4	Pilot cover	10-8	Holder spring	10-23	O-ring
9-5	Pilot cover	10-9	Holder spring	10-24	Socket bolt
9-6	Socket bolt	10-10	Retaining ring	10-25	Pilot cover
9-7	Check valve plug	10-11	Poppet	10-26	Socket bolt
9-8	Spring	10-12	Piston guide	10-27	Plug
9-9	Check valve plug	10-13	O-ring	17	Relief valve
9-10	O-ring	10-14	Pilot cover	19	O-ring
10	Boom block	10-15	Piston	20	O-ring
10-1	Work body	10-16	Lock valve spring	21	Socket bolt
10-2	Boom spool assy	10-17	Piston	25	O-ring
10-3	O-ring	10-18	Plug		

STRUCTURE (4/4)



11	Bucket block	11-10	O-ring	12-9	Check valve plug
11-1	Work body	12	Arm 2 block	12-10	O-ring
11-2	Bucket spool assy	12-1	Work body	12-11	Plug
11-3	O-ring	12-2	Arm 2 spool assy	12-12	O-ring
11-4	Pilot cover	12-3	O-ring	13	End cover
11-5	Pilot cover	12-4	Pilot cover	17	Reliefvalve
11-6	Socket bolt	12-5	Pilot cover	19	O-ring
11-7	Poppet	12-6	Socket bolt	20	O-ring
11-8	Spring	12-7	Poppet	22	Tie bolt
11-9	Check valve plug	12-8	Spring	24	Hexagon nut

GROUP 3 SWING DEVICE

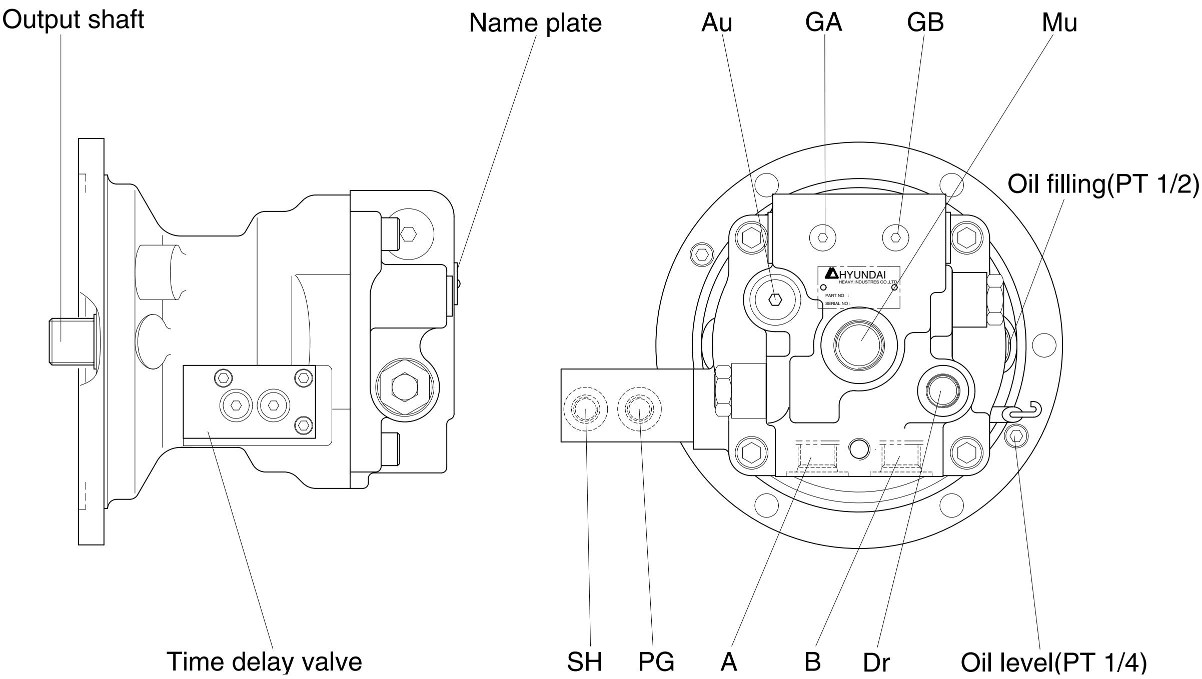
■ TYPE 1

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

1) SWING MOTOR

Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.



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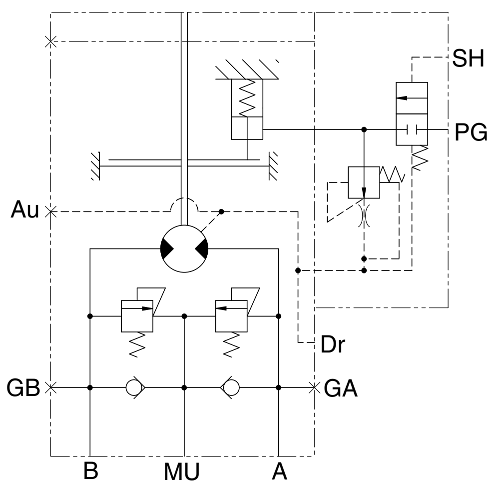
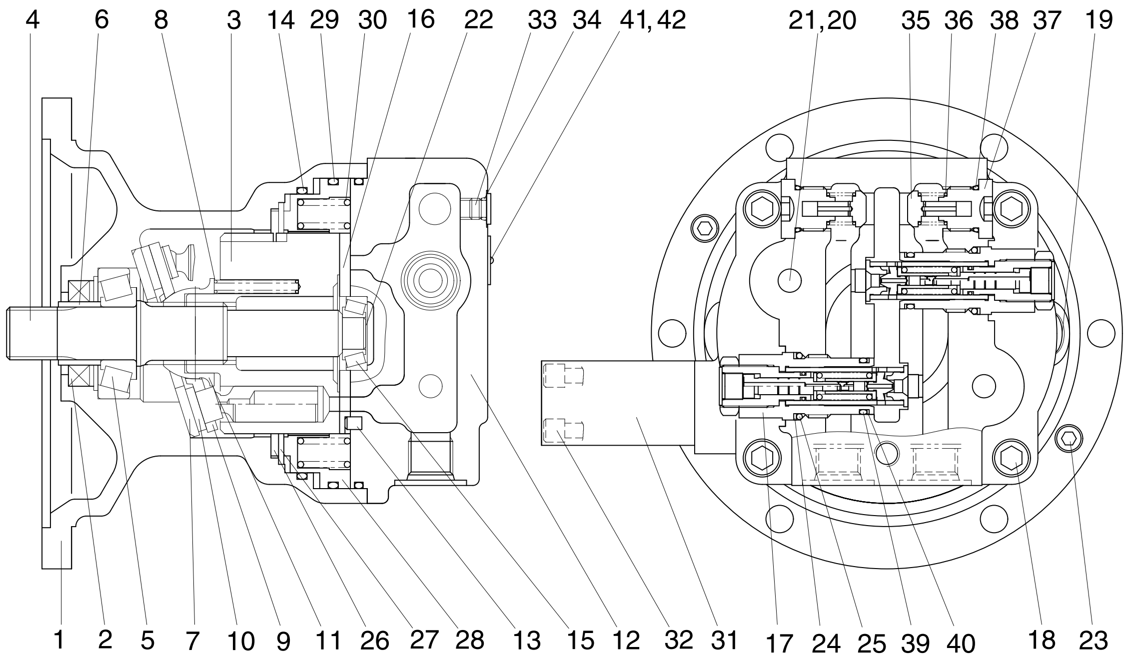


Hydraulic circuit

Port	Port name	Port size
A	Main port	PF 1/2
B	Main port	PF 1/2
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
GA,GB	Gauge port	PF 1/4
Au	Air vent port	PF 3/8

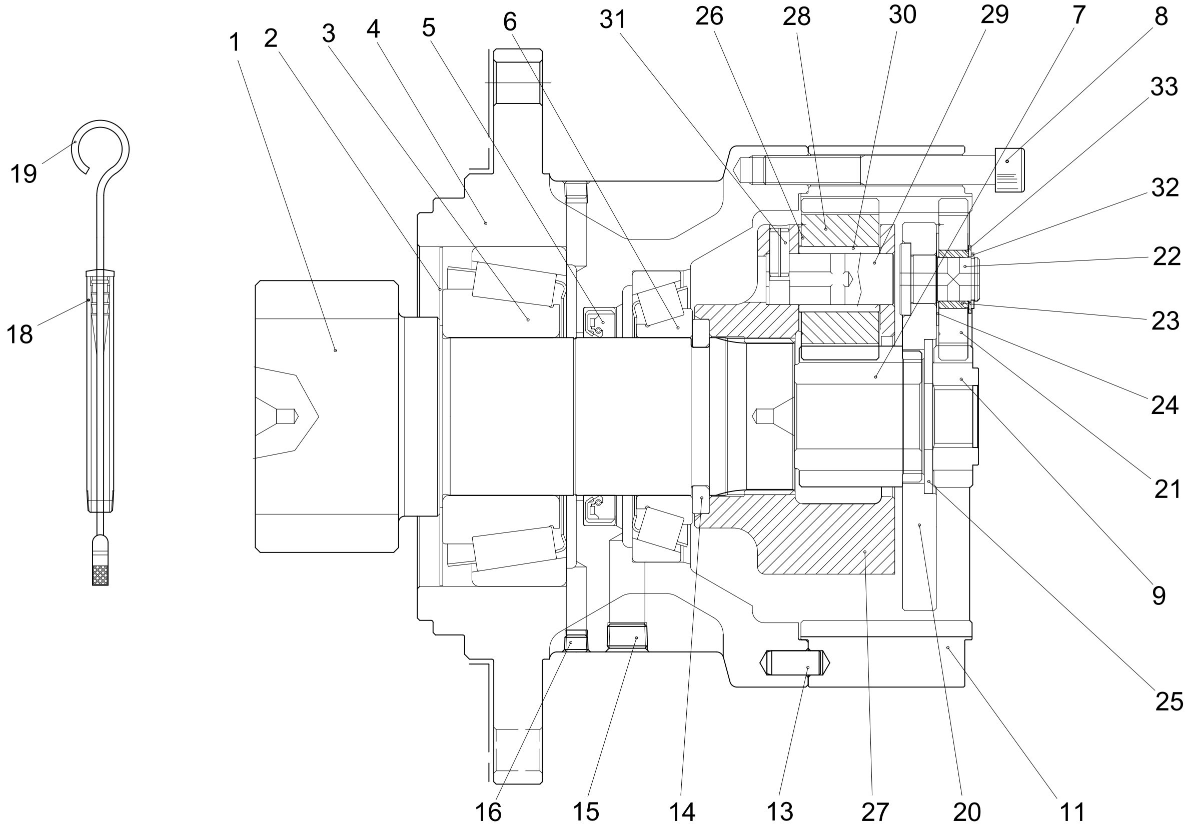
80CR92SM05



7072SM01

1	Body	15	Taper bearing	29	O-ring
2	Oil seal	16	Valve plate	30	Spring
3	Cylinder block	17	Relief valve assy	31	Time delay valve
4	Shaft	18	Socket bolt	32	Socket bolt
5	Taper bearing	19	Plug	33	Plug
6	Bushing	20	Plug	34	O-ring
7	Shoe plate	21	O-ring	35	Valve
8	Spring	22	Shim	36	Spring
9	Set plate	23	Plug	37	Plug
10	Piston shoe assy	24	Back up ring	38	O-ring
11	Ball guide	25	O-ring	39	O-ring
12	Rear cover	26	Friction plate	40	Back up ring
13	Pin	27	Plate	41	Name plate
14	O-ring	28	Parking piston	42	Rivet

2) REDUCTION GEAR



7072SM04

1	Shaft	12	Carrier assy 2	23	Bushing 1
2	Bearing cover	13	Dowel pin	24	Thrust washer 1
3	Taper roller bearing	14	Collar	25	Thrust washer 3
4	Case	15	Plug	26	Thrust washer 2
5	Oil seal	16	Plug	27	Carrier assy 2
6	Taper roller bearing	17	Cover	28	Planet gear 2
7	Sun gear 2	18	Pipe	29	Pin 2
8	Socket bolt	19	Level gauge	30	Bushing 2
9	Sun gear 1	20	Carrier assy 1	31	Spring pin
10	Carrier assy 1	21	Planet gear 1	32	Snap ring
11	Ring gear	22	Pin 1	33	Thrust washer 4

2. FUNCTION

1) ROTARY PART

When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force F1 perpendicular to swash plate(7) and force F2 perpendicular to cylinder center.

Being transferred to the cylinder block(3) through piston, force F2 causes rotational moment at surroundings of cylinder.

Since cylinder block has 9 equidistantly arrayed pistons, rotational torque is transmitted to cylinder shaft in order by several pistons connected to the inlet port of high pressurized oil. When the direction of oil flow is reversed, rotational direction of cylinder is also reversed. Output torque is given by the equation.

$$T = \frac{p \times q}{2\pi},\ q=Z \cdot A \cdot PCD \cdot \tan\theta,\quad F1 = \frac{F}{\cos\theta},\ F_2=F\tan\theta,\quad S=PCD \times \tan\theta$$

Where p : Effective difference of pressure (kgf/cm^2)

q : Displacement (cc/rev)

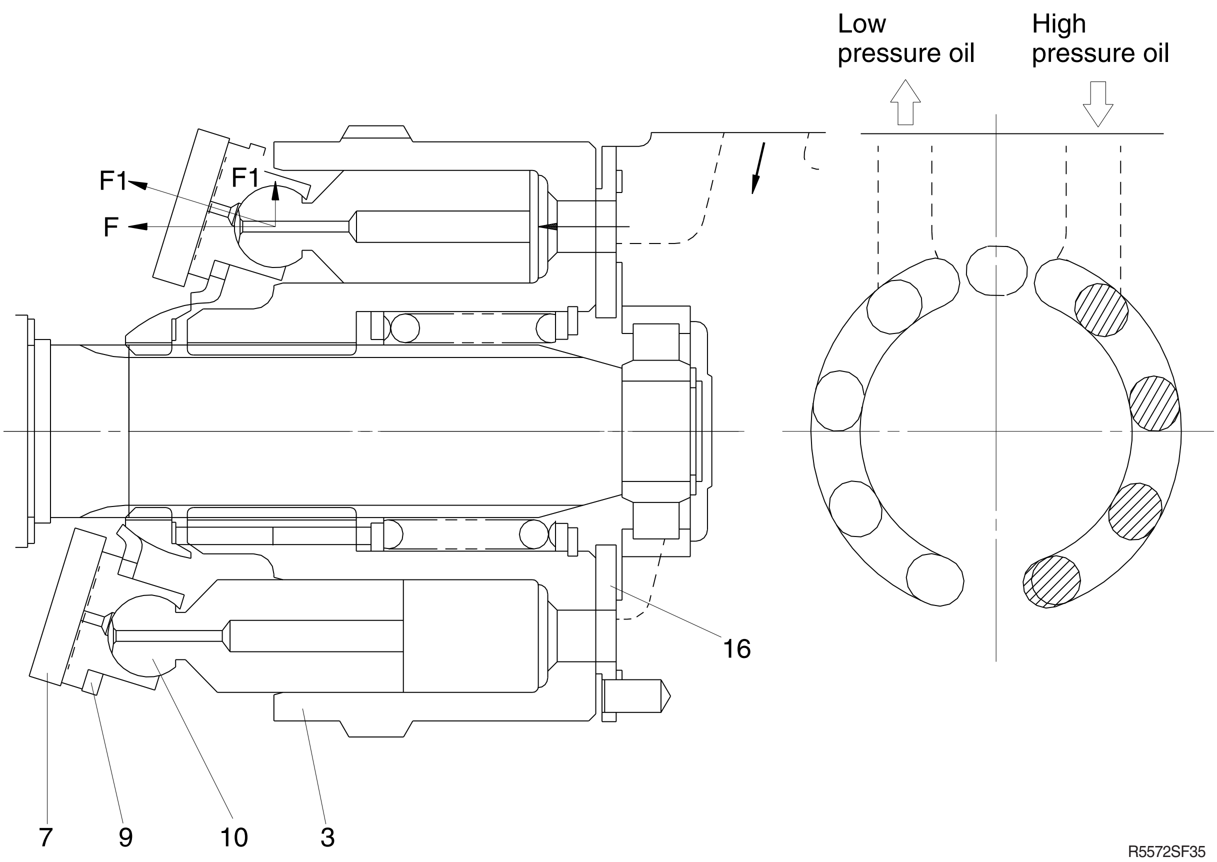
T : Output torque (kgf · cm)

Z : Piston number (9EA)

A : Piston area (cm^2)

θ : Tilting angle of swash plate (degree)

S : Piston stroke (cm)



2) MAKE UP VALVE

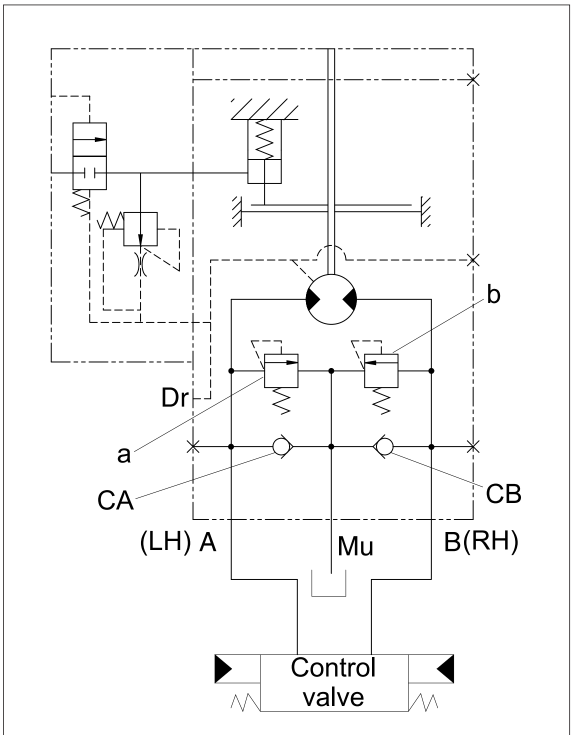
(1) Outline

The safety valve portion consists of a check valve and safety valve.

(2) Function

When the swing is stopped, the output circuit of the motor continues to rotate because of inertia. For this reason, the pressure at the output side of the motor becomes abnormality high, and this will damage the motor. To prevent this, the oil causing the abnormal hydraulic pressure is allowed to escape from the outlet port (high-pressure side) of the motor to port Mu, thereby preventing damage to the motor.

Compared with a counterbalance valve, there is no closed-in pressure generated at the outlet port side when slowing down the swing speed. This means that there is no vibration when slowing down, so the ease of swing control is improved.



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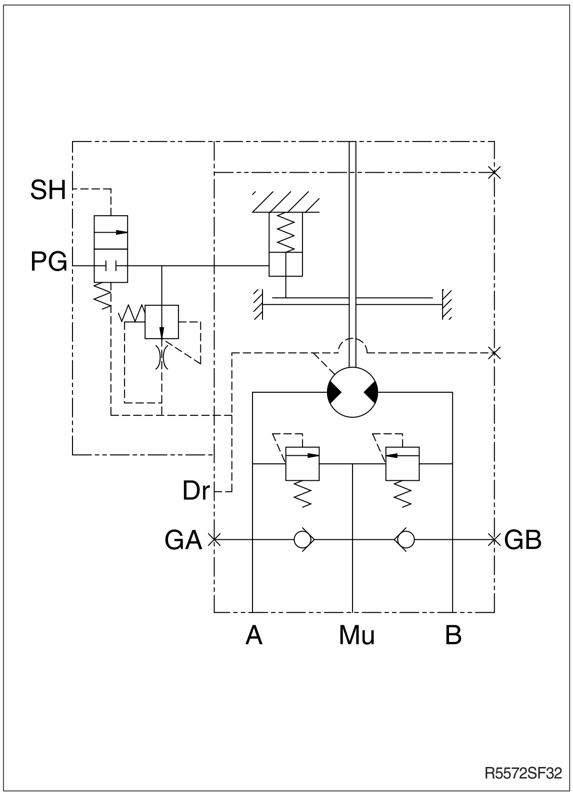
(3) Operation

① **When starting swing**

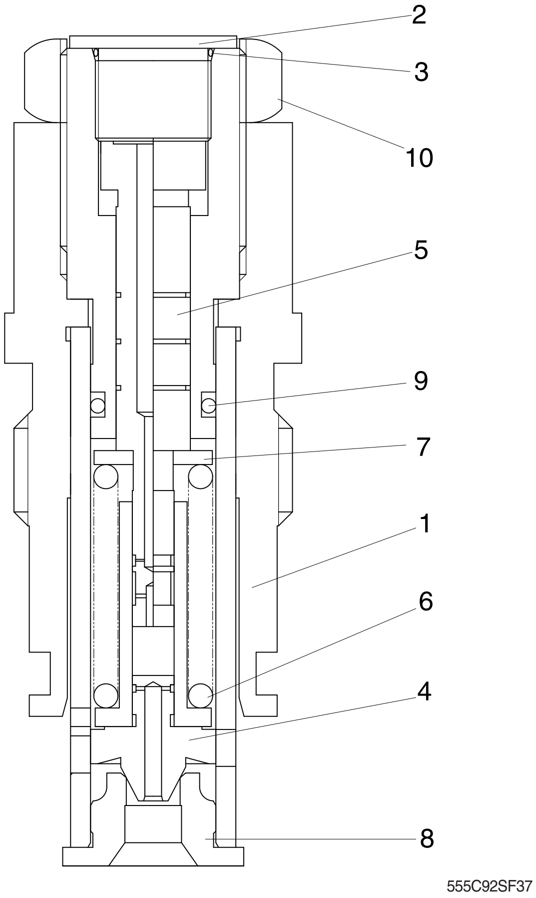
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port B. Because of this, the pressure at port B rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port of the motor passes from port A through the control valve and returns to the tank.

② When stopping swing

- When the swing control lever is returned to neutral, no pressurized oil is supplied from the pump to port B.
  The return circuit to the tank is closed by the control valve. So the oil from the outlet port of the motor increases in pressure at port A. Resistance to the rotation of the motor is created, and the brake starts to act.
- The pressure at port A rises to the set pressure of make up valve a, and in this way, a high brake torque acts on the motor, and the motor stops.
- When make up valve a is being actuated, the relief oil from make up valve a and the oil from port Mu pass through check valve CB and are supplied to port B. This prevents cavitation from forming at port B.



3) RELIEF VALVE



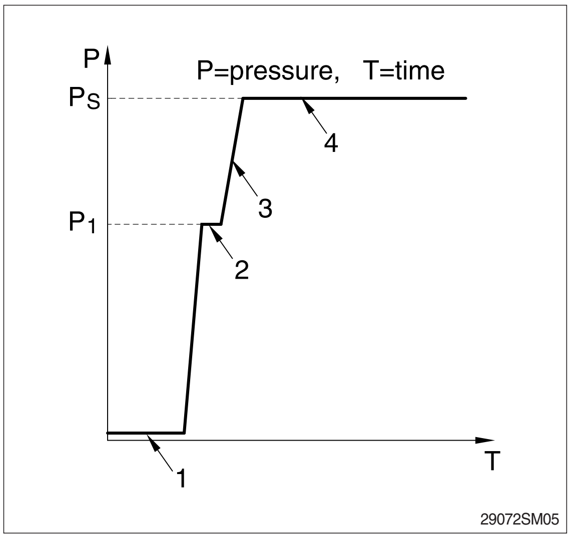
1	Body
2	Plug
3	O-ring
4	Plunger
5	Piston
6	Spring
7	Spring seat
8	Seat
9	O-ring
10	Nut

(1) Construction of relief valve

The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(2) Function of relief valve

Figure illustrates how the pressure acting on the relief valve is related to its rising process. Here is given the function, referring to the figure following page.

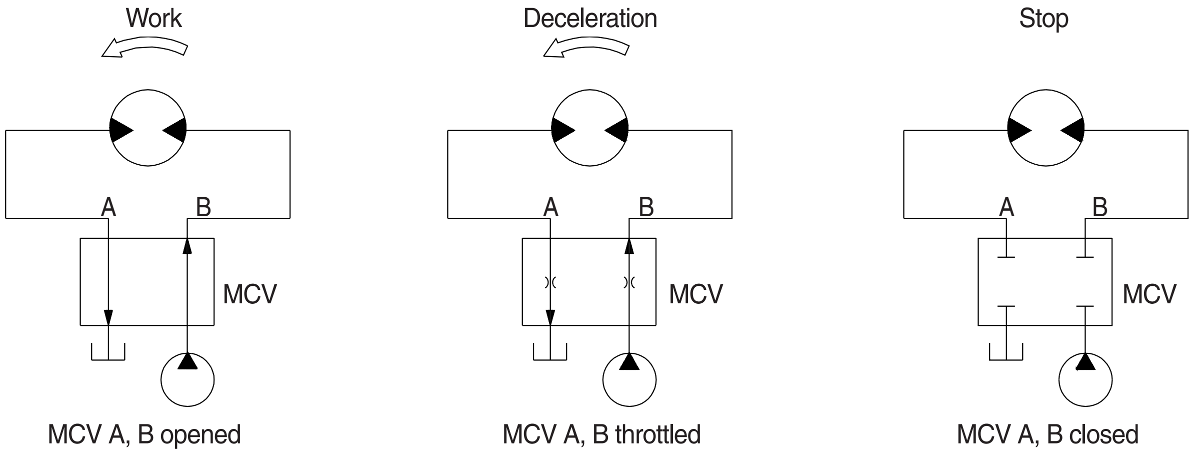


4) BRAKE SYSTEM

(1) Control valve swing brake system

This is the brake system to stop the swing motion of the excavator during operation.

In this system, the hydraulic circuit is throttled by the swing control valve, and the resistance created by this throttling works as a brake force to slow down the swing motion.



210-7 2-48(1)

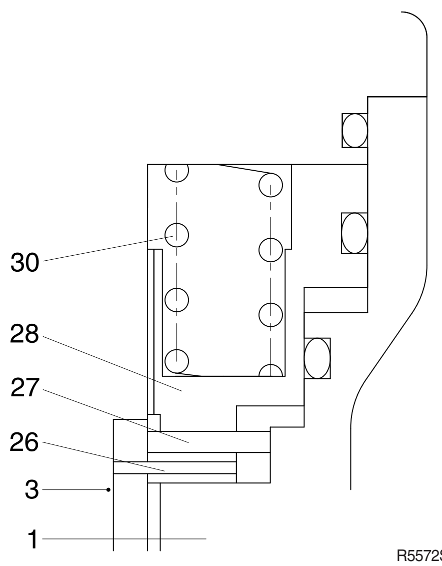
(2) Mechanical swing parking brake system

The mechanical swing parking brake system is installed to prevent the upper structure from swinging downhill because of its own weight when the excavator is parked on a slope since it completely eliminates the hydraulic drift of swing motion while the excavator is on a slop, work can be done more easily and safely.

① Brake assembly

Circumferential rotation of separate plate (27) is constrained by the groove located at casing (1). When housing is pressed down by brake spring (30) through friction plate (26), separate plate (27) and brake piston (28), friction force occurs there.

Cylinder (3) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



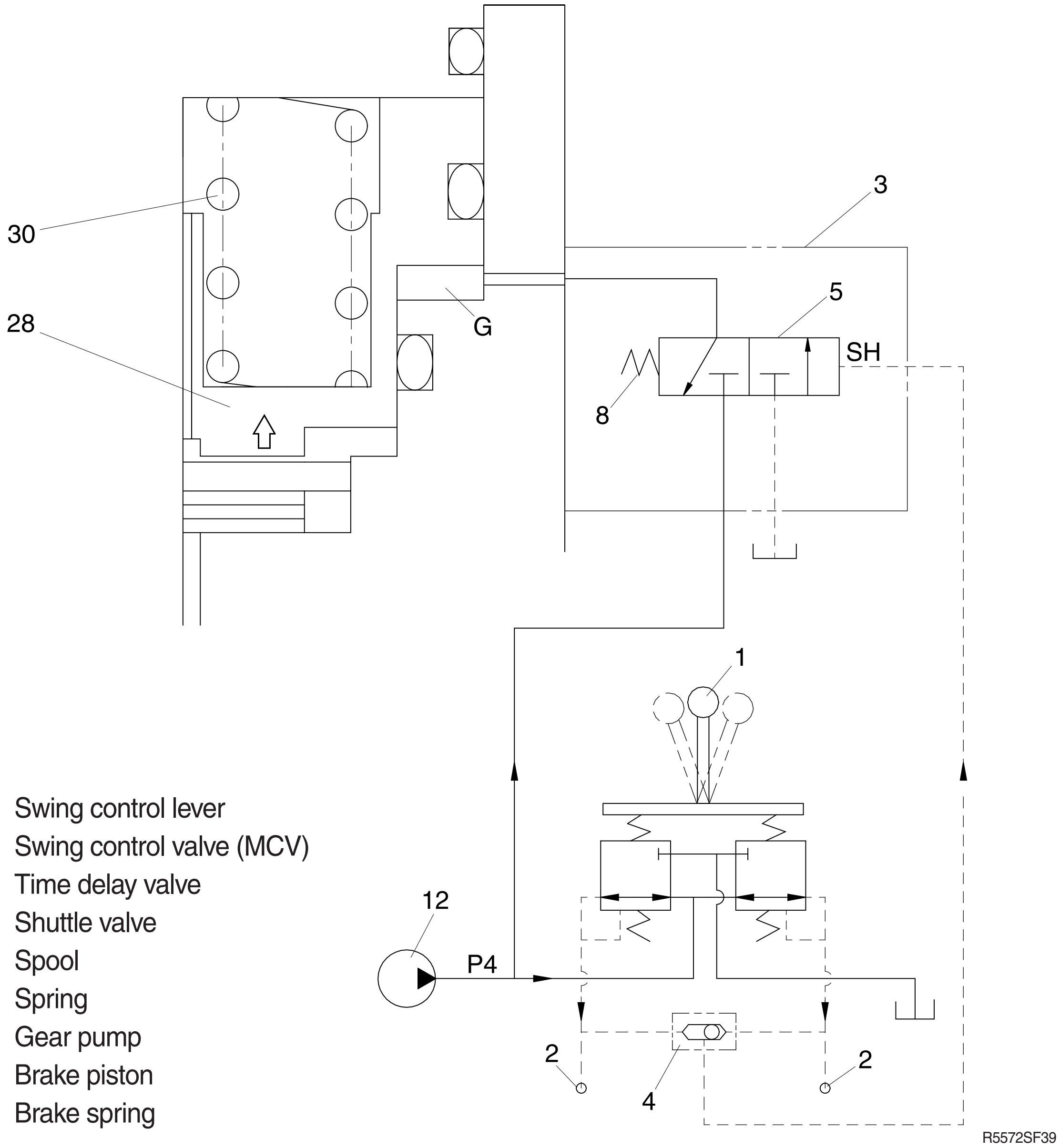
R5572SF38

1	Casing	27	Separate plate
3	Cylinder	28	Brake piston
26	Friction plate	30	Brake spring

② Operating principle

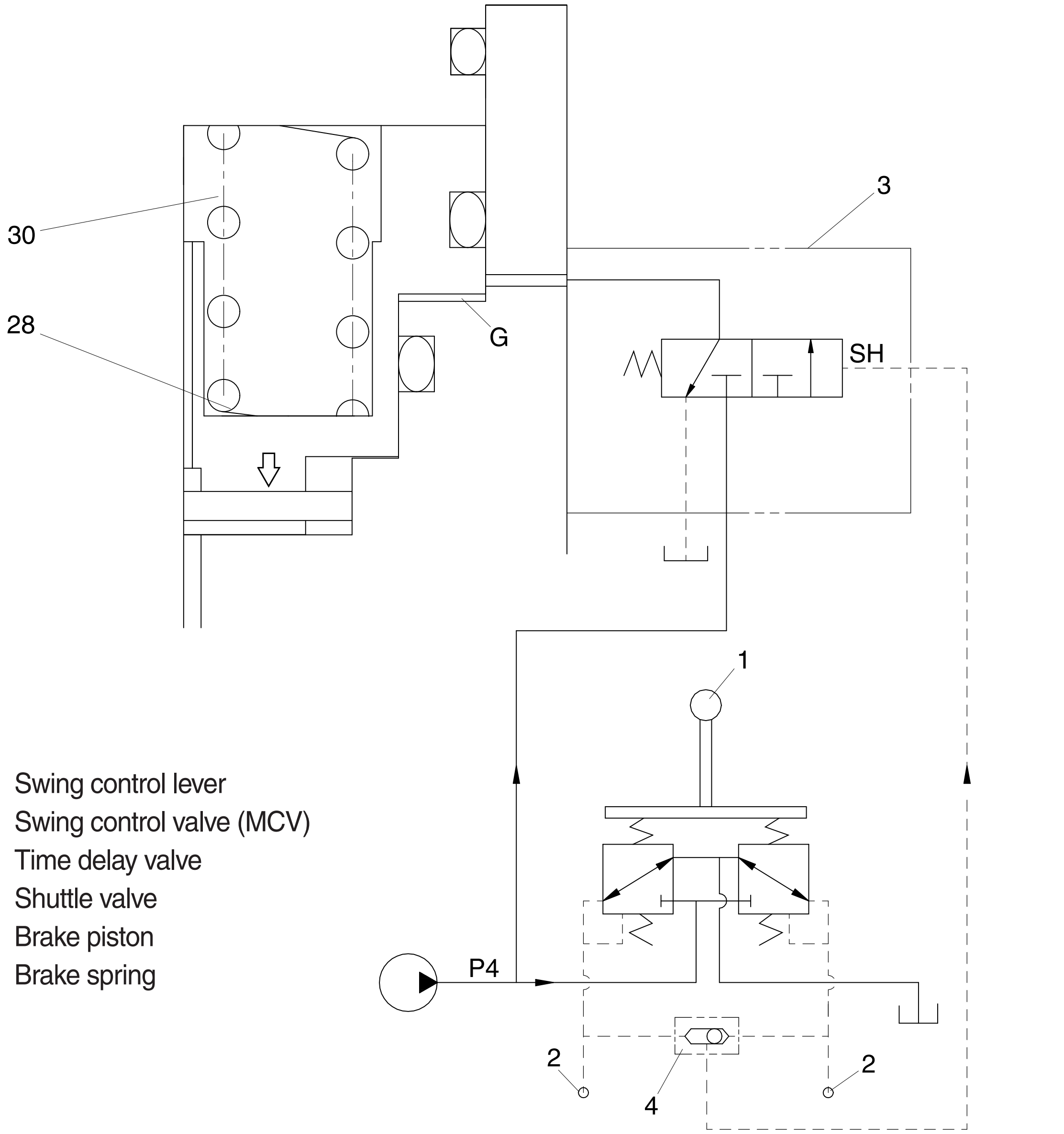
a. When the swing control lever (1) is set to the swing position, the pilot oil go to the swing control valve (2) and to SH of the time delay valve (3) via the shuttle valve (4), this pressure move spool (5) to the leftward against the force of the spring (8), so pilot pump charged oil (P4) goes to the chamber G.

   This pressure is applied to move the piston (28) to the upward against the force of the spring (30). Thus, it releases the brake force.



1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
5 Spool
8 Spring
12 Gear pump
28 Brake piston
30 Brake spring

b. When the swing control lever (1) is set the neutral position, the time delay valve (3) shifts the neutral position and the pilot oil blocked chamber G.
Then, the piston (28) is moved lower by spring (30) force and the return oil from the chamber G is drain.



1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
28 Brake piston
30 Brake spring

R5572SF40

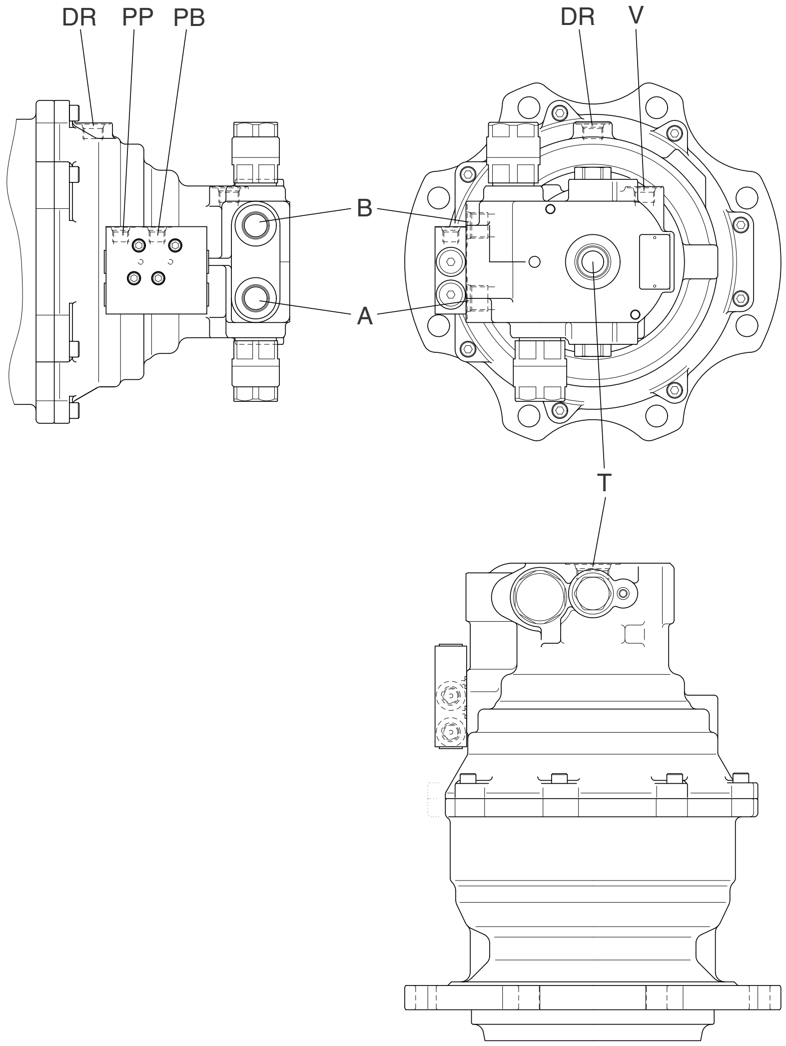
■ TYPE 2

1. STRUCTURE

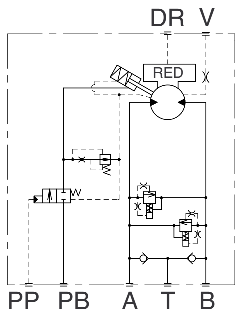
Swing device consists swing motor and swing reduction gear.

1) SWING MOTOR

Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.



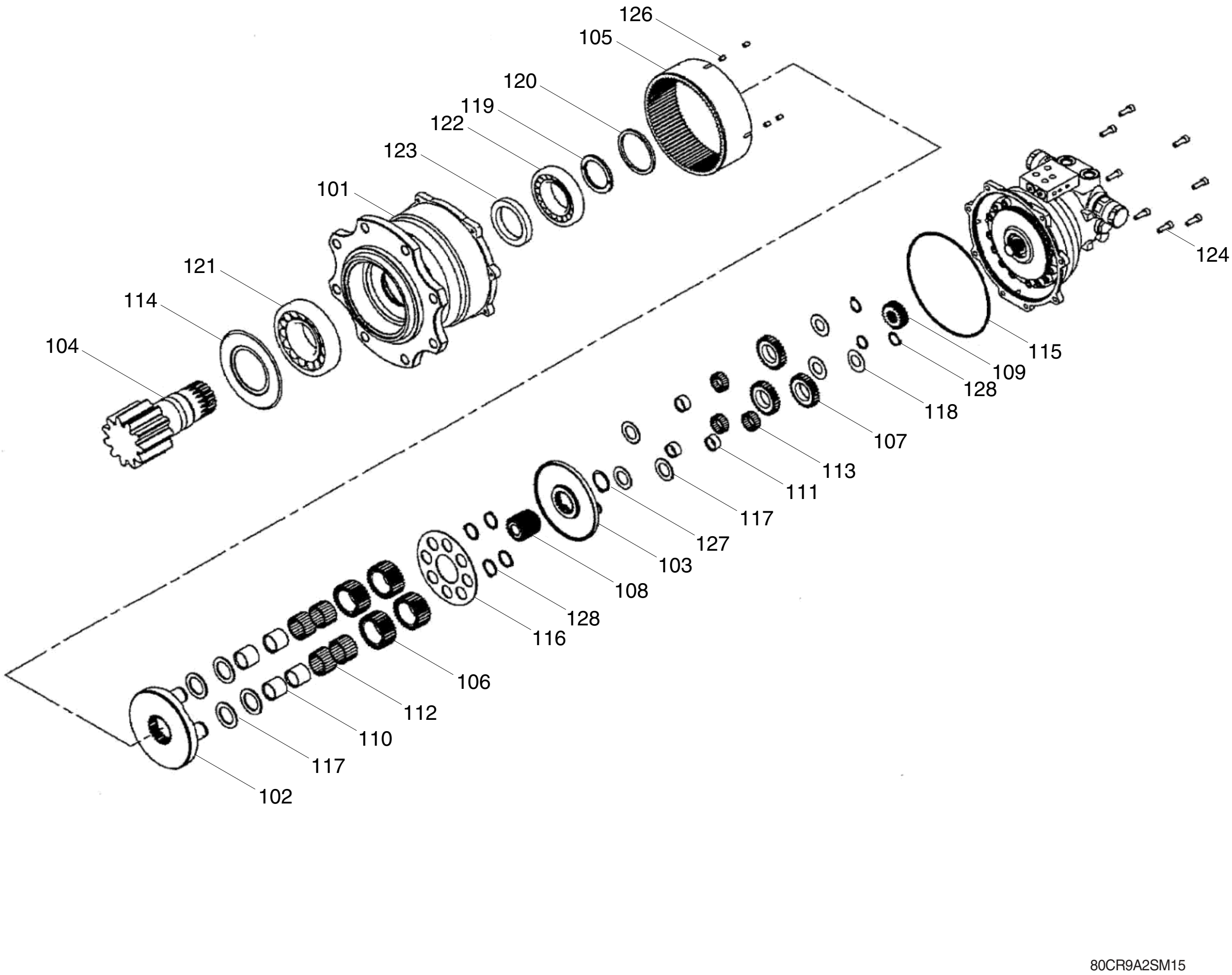
Port	Port name	Port size
A	Main port	PF 1/2
B	Main port	PF 1/2
DR	Drain port	PF 3/8
T	Make up port	PF 3/4
PB	Brake release stand by port	PF 1/4
PP	Brake release pilot port	PF 1/4
V	Air vent port	PF 3/8



HYDRAULIC CIRCUIT

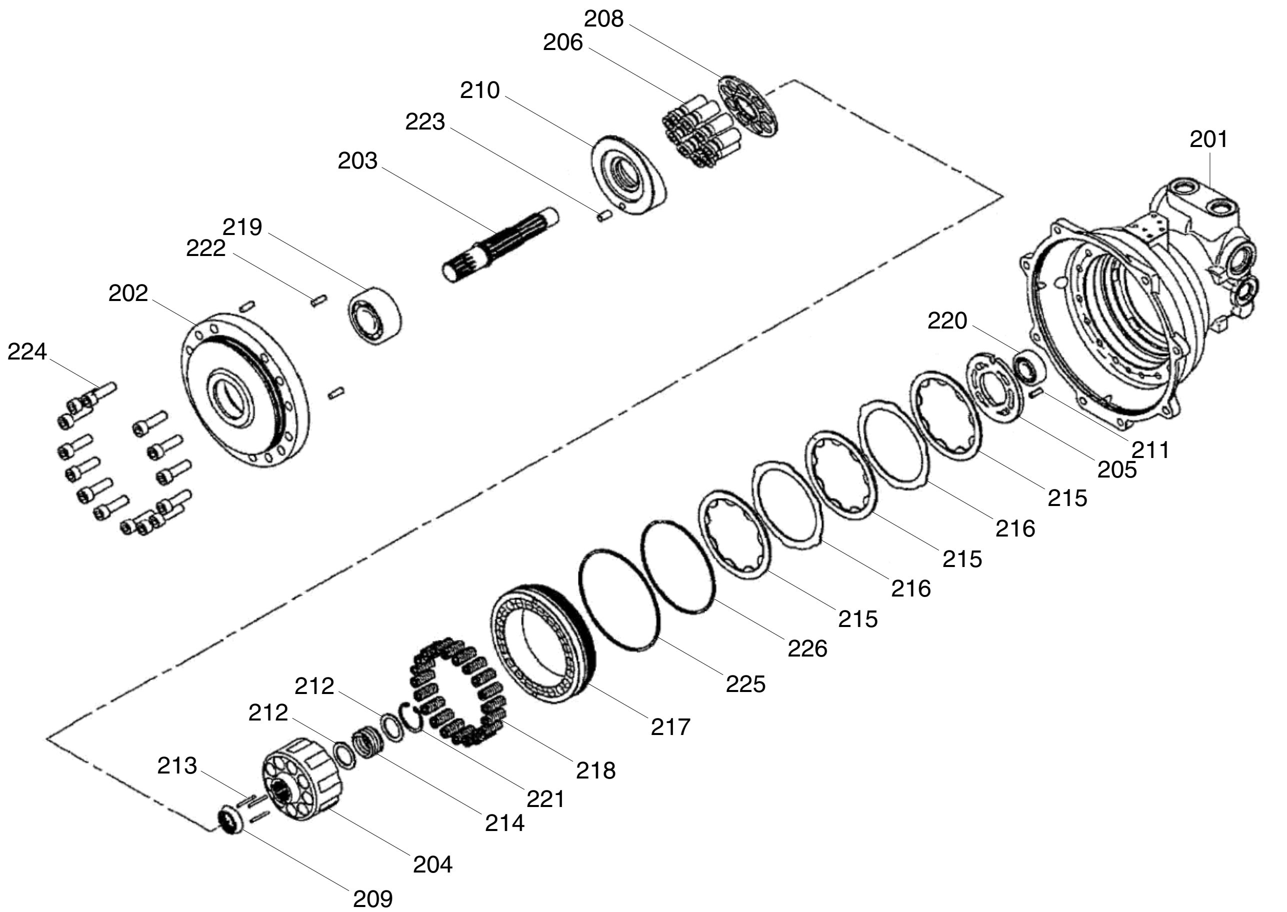
80CR9A2SM01

2) COMPONENTS (1/3)



101	Body	110	Ring 1	119	Preload collar
102	Carrier 1	111	Ring 2	120	Ring
103	Carrier 2	112	Needle	121	Bearing
104	Pinion shaft	113	Needle	122	Bearing
105	Internal gear	114	Ring seal	123	Oil seal
106	Gear B1	115	O-ring	124	Screw
107	Gear B2	116	Thrust plate	126	Bushing pin
108	Gear S1	117	Thrust washer 1	127	Snap ring
109	Gear S2	118	Thrust washer 2	128	Snap ring

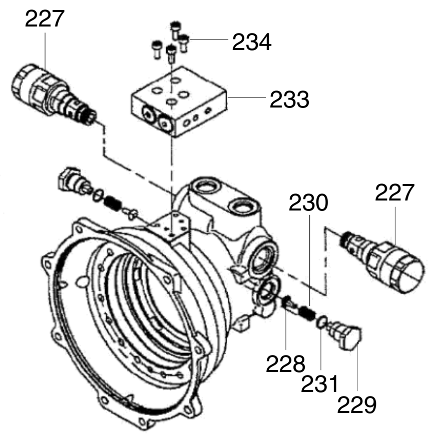
COMPONENTS (2/3)



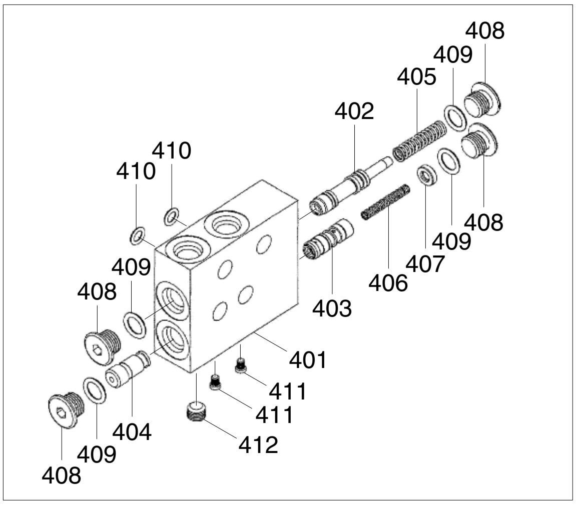
80CR9A2SM16

201	Body H	211	Spring pin	220	Bearing
202	Plate S	212	Retainer	221	Snap ring
203	Shaft	213	Pin	222	Pin
204	Cylinder barrel	214	Spring C	223	Pin
205	Valve plate	215	Disk plate	224	Screw
206	Piston assy	216	Steel plate	225	O-ring
208	Shoe holder	217	Brake piston	226	O-ring
209	Barrel holder	218	Spring B		
210	Swash plate	219	Bearing		

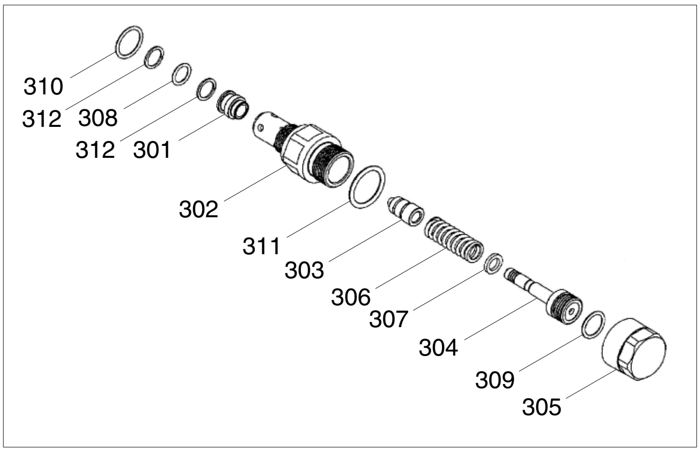
COMPONENTS (3/3)



DETAIL ITEM 233



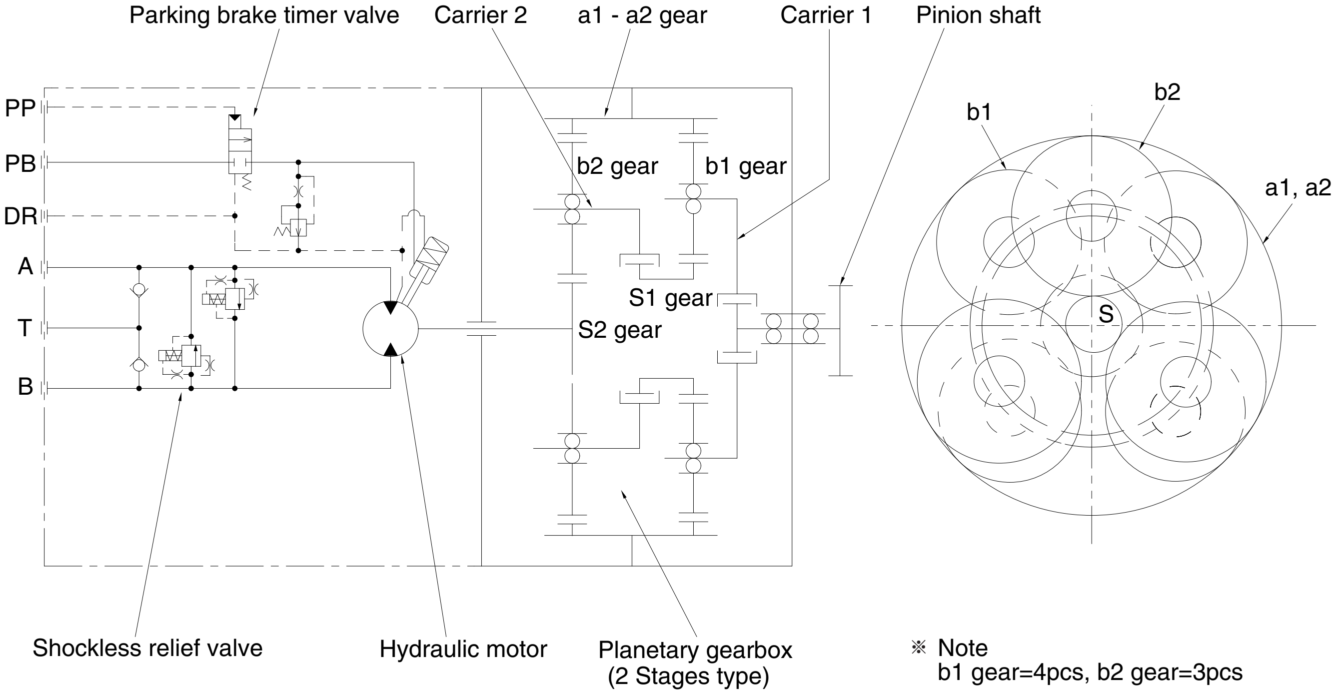
DETAIL ITEM 227



80CR9A2SM16-1

227	Relief valve	305	Cap	404	Stopper
228	Check valve	306	Spring	405	Spring
229	Plug	307	Spacer	406	Spring
230	Spring	308	O-ring	407	Spring holder
231	O-ring	309	O-ring	408	Plug
233	P/brake timer valve	310	O-ring	409	O-ring
234	Screw	311	O-ring	410	O-ring
301	Seat	312	Back-up ring	411	Metal plug
302	Retainer	401	Body	412	Plug
303	Poppet	402	Spool		
304	Piston	403	Piston		

2. OPERATION PRINCIPLE



※ Note
b1 gear=4pcs, b2 gear=3pcs

80CR9A2SM02

3. OPERATION

The swing motor consists of a planetary gear speed reducer, a hydraulic motor and the hydraulic valves.

1) REDUCTION GEAR SECTION

(1) Function

The speed reducer of swing motor is a simple planetary gear type with two stages. The high output speed of the hydraulic motor is reduced to low speed with high torque and obtaining the pinion shaft rotation.

(2) Operation

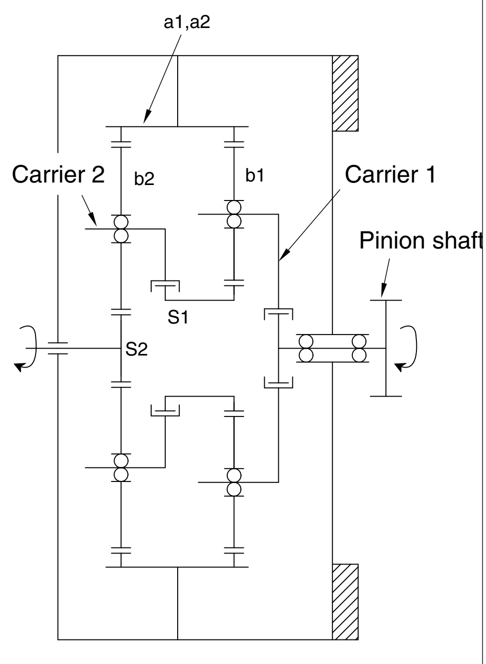
The s2 gear is attached to the hydraulic motor shaft, and the s2 output speed is reduced between the gears (s2, b2, a2).

This reduced output speed is transmitted to the s1 gear and the speed is reduced again between the gears (s1, b1, a1), and it is transmitted to the pinion shaft, and drives the machine.

The gear ratio of two stages simple planetary speed reducer is calculated using the following formula.

$$R = \frac{Zs1}{Zs1+Za1} \times \frac{Zs2}{Zs2+Za2}$$

※ Z ** : Number of gear teeth.



R27Z92SM03

2) HYDRAULIC MOTOR SECTION

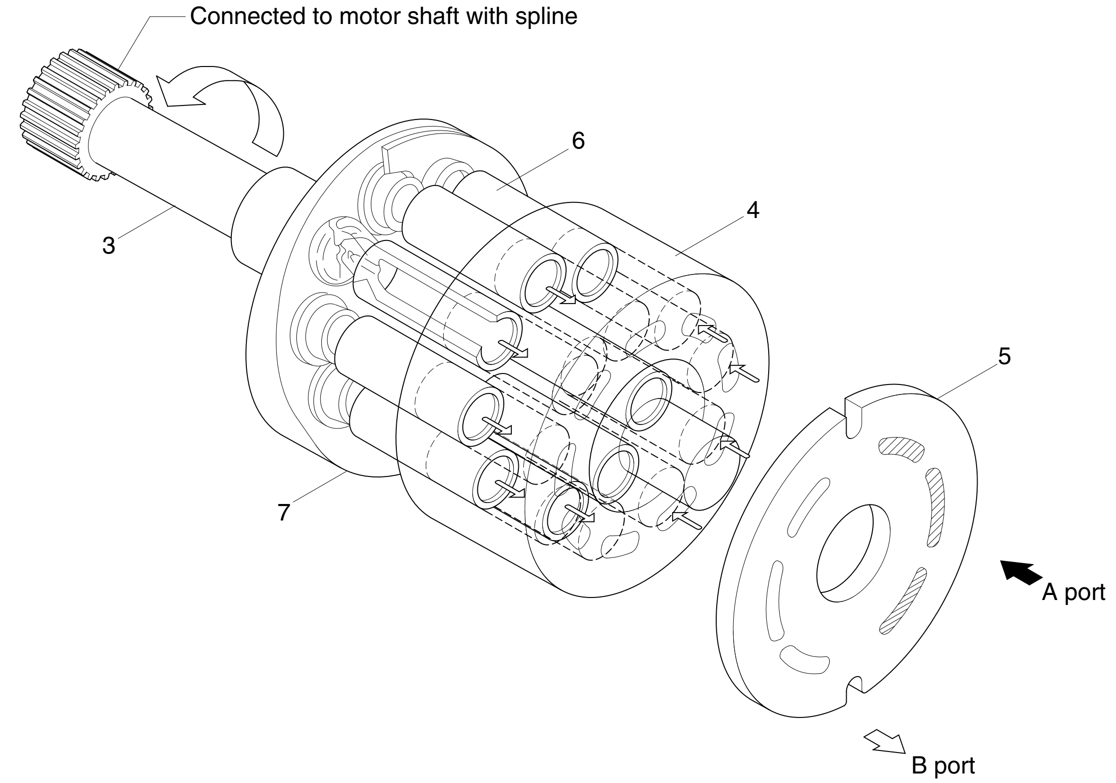
(1) Function

This hydraulic motor is an axial piston type, and changes the hydraulic energy supplied from the pump to the rotary motion.

(2) Structure

Through a hydraulic valve, the pressurized oil is supplied to the valve plate (5). When the pressurized oil is supplied to the A port, this pressurized oil pushes the piston (6) in the cylinder barrel (4). This pushing force is changed to the rotational power by the swash plate (7) and transmitted to the shaft (3) which is connected to the cylinder barrel (4) with the spline. The return flow from the cylinder port is going out through the B port of the valve plate (5).

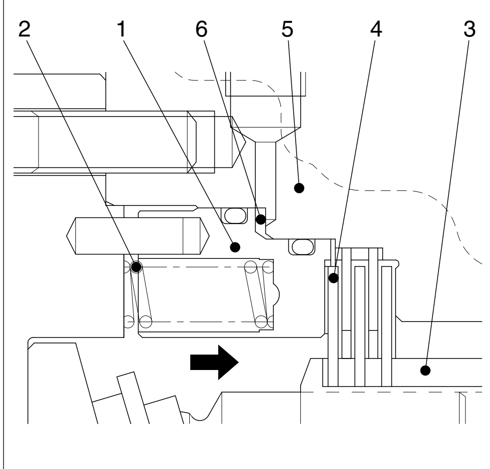
To reverse rotation, pressurized oil is supplied to the B port and returning oil exits through the A port.



R27Z92SM04

(3) Parking brake

The parking brake fixes the output shaft of hydraulic motor mechanically while the wheel motor is stopped.



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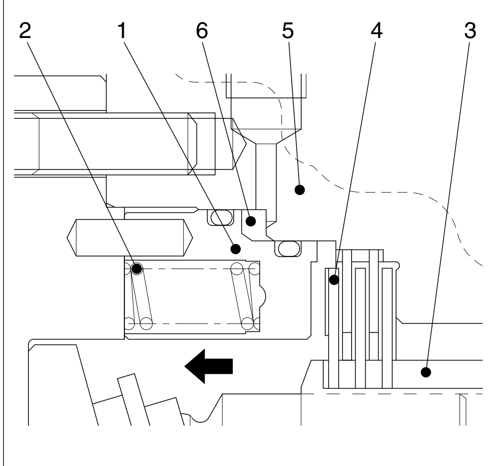
① At the brake releasing pressure OFF

When brake releasing pressure is not supplied, the brake piston (1) is pressed in the direction (shown as arrow) by the spring (2). Then the disk plate (4) which is fixed to the cylinder barrel (3) is held between the body H (5) and the brake piston (1). As a result, with the friction of these parts, the cylinder barrel (3) and the hydraulic motor are unable to rotate.



80CR9A2SM06

② At the brake releasing pressure ON

When brake releasing pressure is supplied, the oil is lead to chamber (6).

Then the brake piston (1) is moved to the direction (shown as arrow) against the force of spring (2). As a result, the disk plate (4) is released from the friction, and the cylinder barrel (3) can be rotated.

3) HYDRAULIC VALVE SECTION

(1) Shockless relief valve

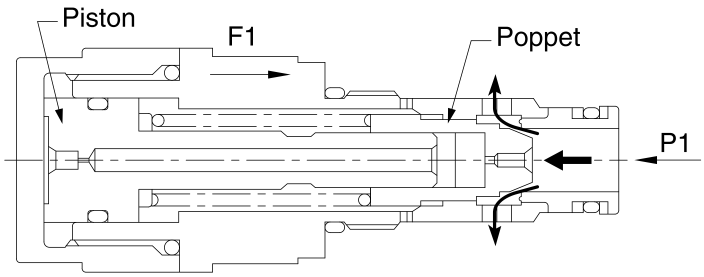
The shockless relief valve consists of the direct relief valve (poppet) and the piston for changing the spring force with two stages.

When the hydraulic motor is stopped, even after closing IN and OUT port of the hydraulic motor, the motor tries to run with inertia. Motor works as like a pump, and the pressure (brake pressure) is made on the OUT port side. The shockless relief valve releases this brake pressure with two stages of operation. This makes the shock smooth, and prevents the motor being damaged.

It also makes the start of the motor smooth.

① First stage

When the P1 pressure is going up, the poppet opens due to the pressure of the spring force F1.



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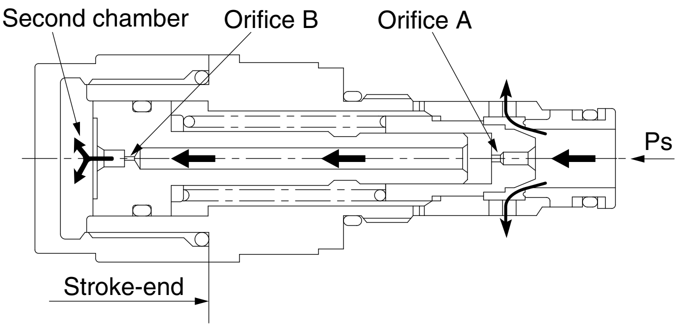
② Second stage

When P1 pressure enters the second chamber through the orifice A and B, the piston moves to its stroke-end. With this action, the spring is compressed, the spring force becomes stronger, and the P1 pressure is increased to the setting pressure Ps.



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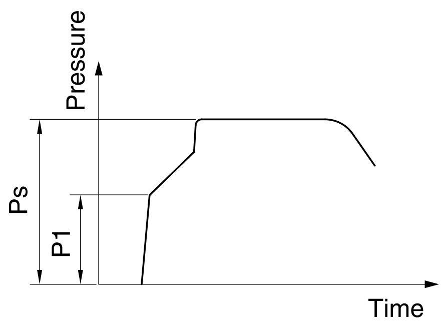


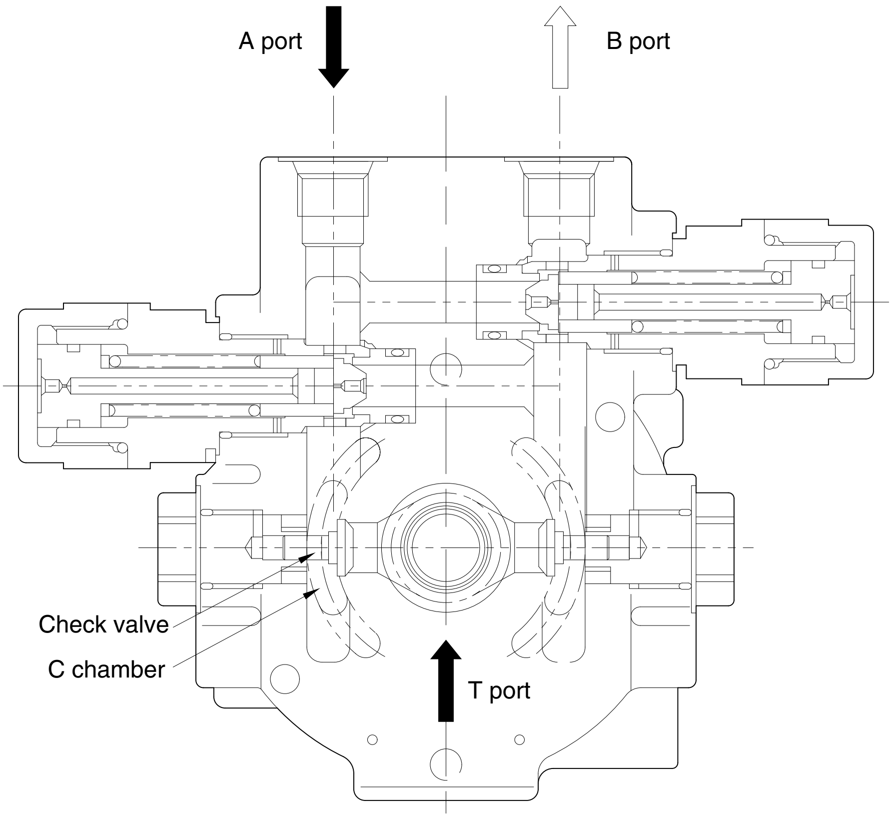
80CR9A2SM09

With the above two stages of operation, the motor starts and stops smoothly.

(2) Check valve

When the swing motor is decelerated by operating the control valve, it continues to be moved by the inertia of the machine. Then, it works as pump, and the pressure of C chamber tends to become negative. However, when B port pressure is below cracking pressure of the relief valve, all flow in A port goes out from B port through the motor.

Therefore, if C chamber can get flow only from the control valve, the flow will not be enough to prevent the negative pressure; as a result, cavitation could occur. The check valve works to supply the flow from T port to C chamber and prevents cavitation.



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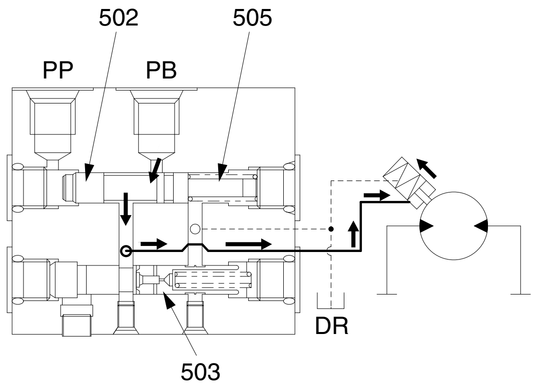
(3) P/B timer valve

P/B timer valve delays the parking brake activating for a period of time until the swing motor stops to prevent the hydraulic motor being damaged.

① When the parking brake is released

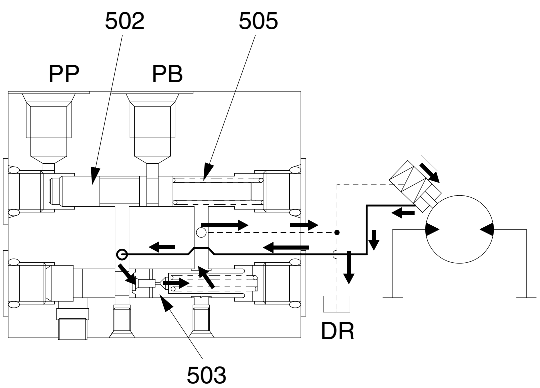
Brake pilot pressure is supplied to the PP port. The spool (502) is moved to the position against the force of the spring (505). Then, the oil is led to the parking brake section through the path (shown as arrow in figure), and it releases the parking brake.



80CR9A2SM30

② When the parking brake is activated

Brake pilot pressure in PP port is shut off. The spool (502) is returned to the position by the force of the spring (505), and the brake releasing pressure to the parking brake section is shut off by spool (502). Then the oil in the parking brake section is pushed back to DR port through the path (shown as arrow in figure) by the force of the springs in the parking brake section, but it is choked by the orifice in the piston (503), and is gradually dumped to DR port. As a result, brake activation is delayed.



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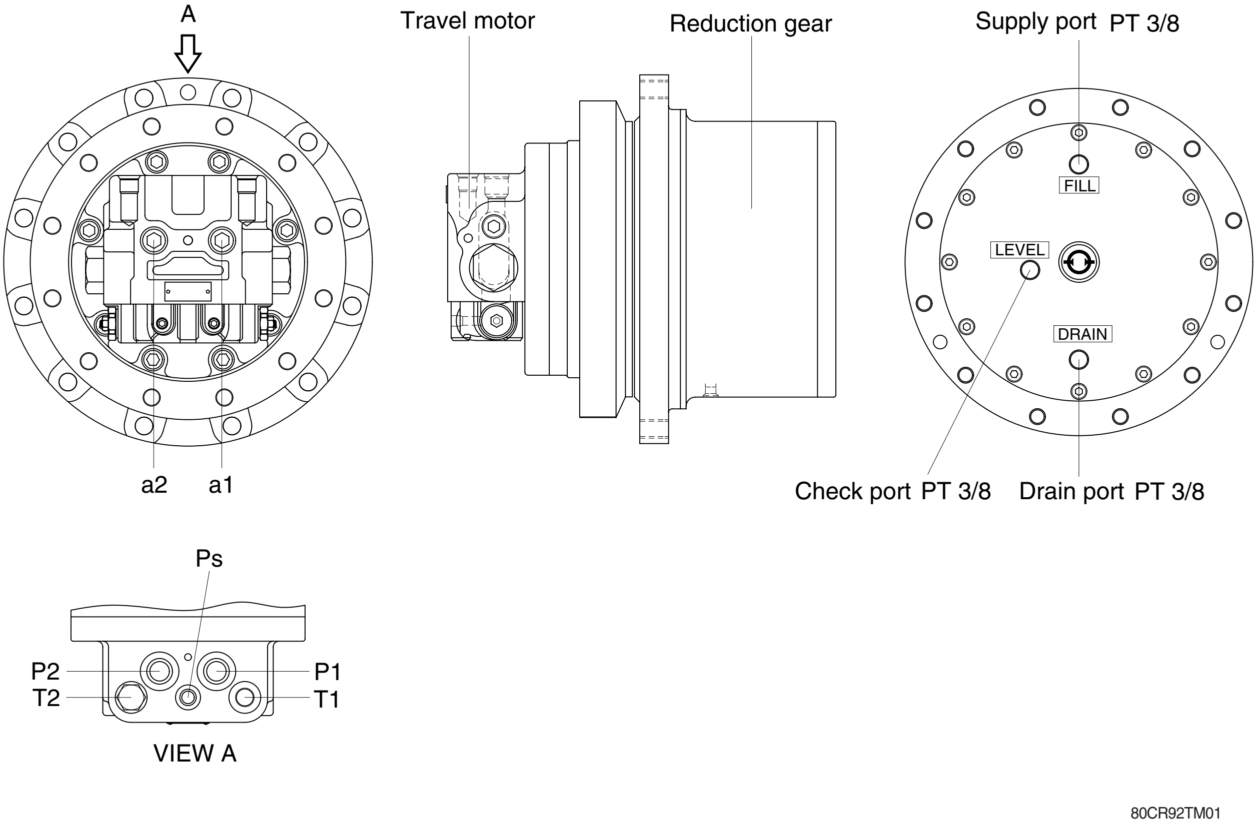
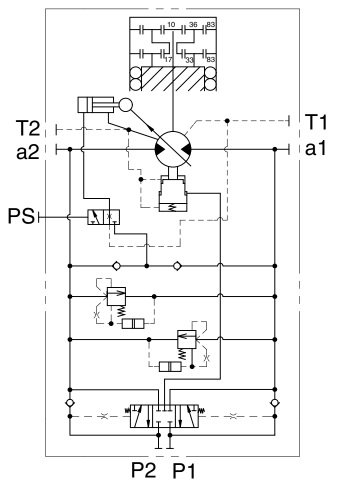
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.

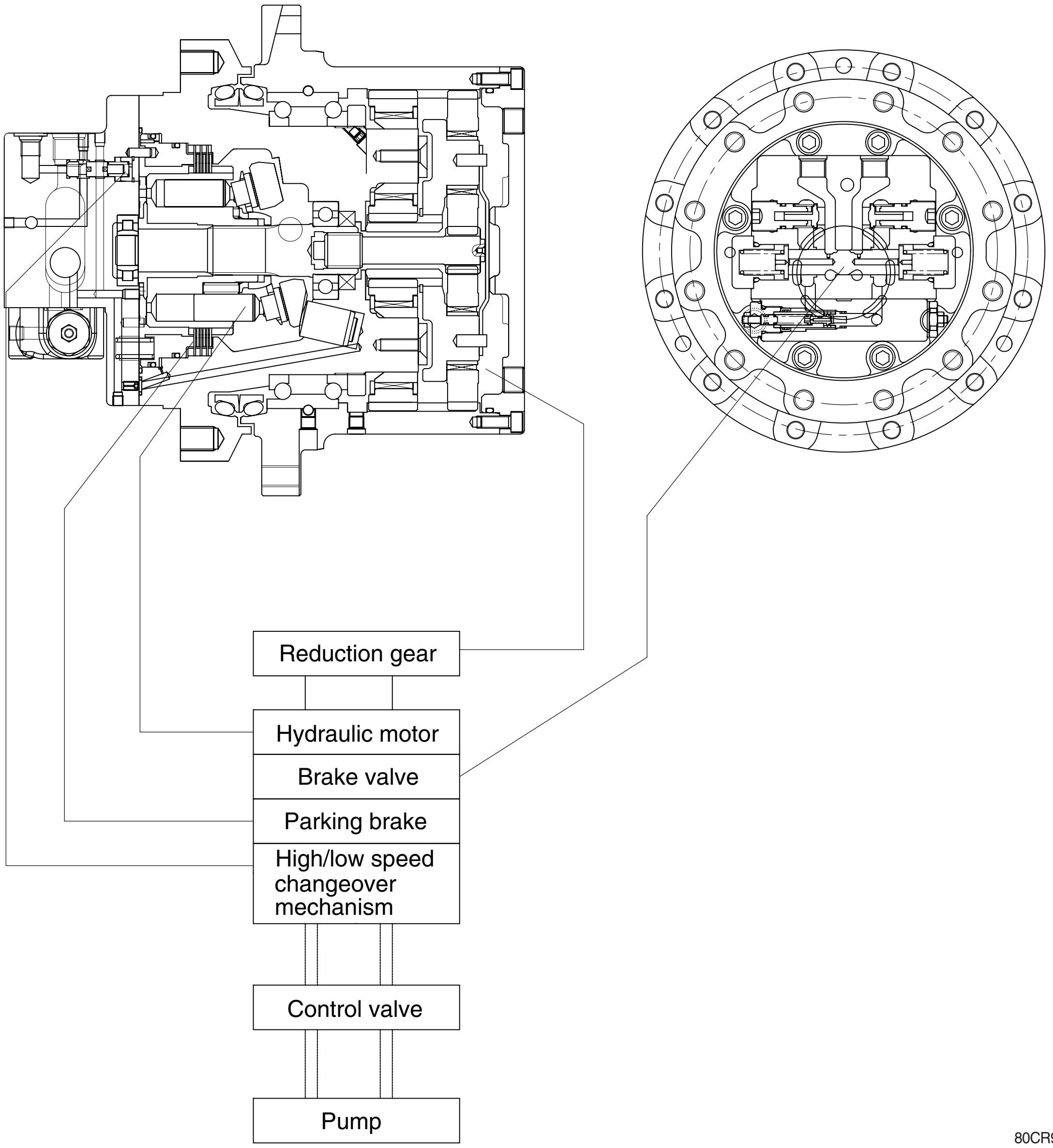




Hydraulic circuit

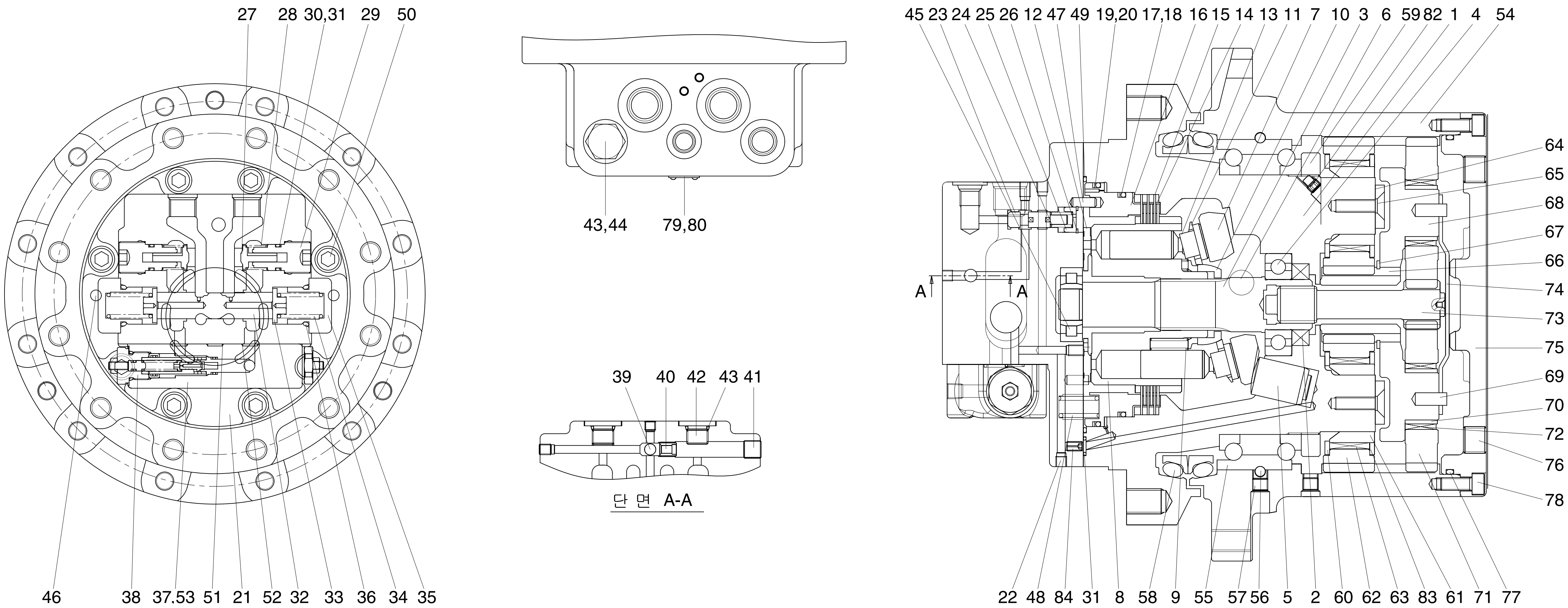
Port	Port name	Port size
P1	Main port	PF 1/2
P2	Main port	PF 1/2
a1,a2	Gauge port	PT 1/4
T1,T2	Drain port	PF 3/8
Ps	2 speed control port	PF 1/4

1) BASIC STRUCTURE



80CR92TM02

2) STRUCTURE



80CR92TM03

1	Shaft casing	15	Parking plate	29	Plug	43	O-ring	58	Floating seal	72	Needle bearing
2	Oil seal	16	Parking piston	30	O-ring	44	Plug	59	Nut	73	Drive gear
3	Shaft	17	O-ring	31	Back up ring	45	Ball bearing	60	Washer	74	Thrust plate
4	Bearing	18	Back up ring	32	Main spool	46	Parallel pin	61	Collar	75	Ring gear cover
5	Swash piston	19	O-ring	33	Spring seat	47	Parallel pin	62	Planetary gear	76	Plug
6	Swash steel ball	20	Back up ring	34	Spring	48	Spring	63	Needle bearing	77	O-ring
7	Swash plate	21	Rear cover	35	Plug	50	Wrench bolt	64	Plate	78	Wrench bolt
8	Cylinder block	22	Plug	36	O-ring	51	O-ring	65	Bolt	79	Name plate
9	Spring	23	Spool	37	Relief valve assy	52	O-ring	66	Sun gear	80	Rivet
10	Ball guide	24	Spring	38	Relief valve assy	53	Wrench bolt	67	Snap ring	82	Set screw
11	Set plate	25	Stopper	39	Steel ball	54	Ring gear	68	Carrier	83	Washer
12	Valve plate	26	Snap ring	40	Check seat	55	Angular bearing	69	Spring pin	84	Plug
13	Piston	27	Check	41	Plug	56	Steel ball	70	Collar		
14	Friction plate	28	Spring	42	Plug	57	Plug	71	Planetary gear		

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder (8) through valve casing of motor (21), and valve plate (12).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston (13).

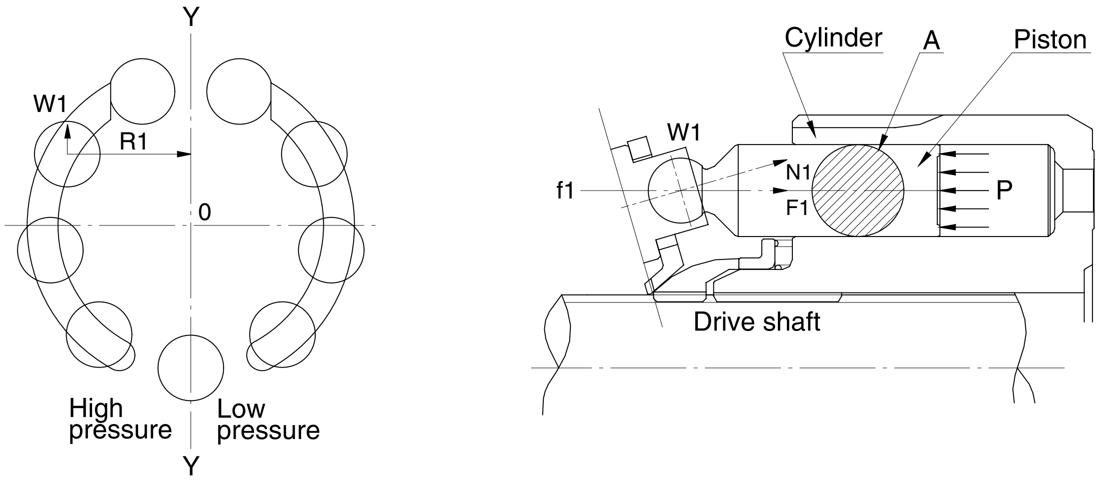
The high hydraulic can generate the force, F1 = P×A (P : Supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the swash plate (7) of a tilt angle, α .

W1 generates torque, T = W1+R1, for Y-Y line connected by the upper and lower sides of piston as following pictures.

The sum of torque (ΣW1×R1), generated from each piston (4~5pieces) on the side of a high hydraulic, generates the turning force.

This torque transfers the turning force to a cylinder (8) through a piston; because a cylinder is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



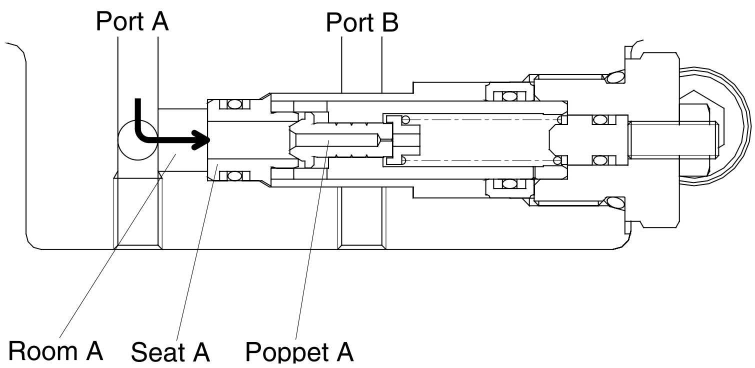
5592TM03

2) WORKING OF RELIEF VALVE

Relief valve carries on two functions of followings.

(1) It standardizes a pressure in case of driving a hydraulic motor ; bypasses and extra oil in a motor inlet related to acceleration of an inertia to an outlet.

(2) In case of an inertia stopped, it forces an equipment stopped, according to generating the pressure of a brake on the projected side.
Room A is always connected with port A of a motor. If the pressure of port is increased, press poppet B. And if it is higher than the setting pressure of a spring, the oil of an hydraulic flows from room A to port B, because poppet A is detached from the contact surface of seat A.



80CR92TM05

3) WORKING OF BRAKE

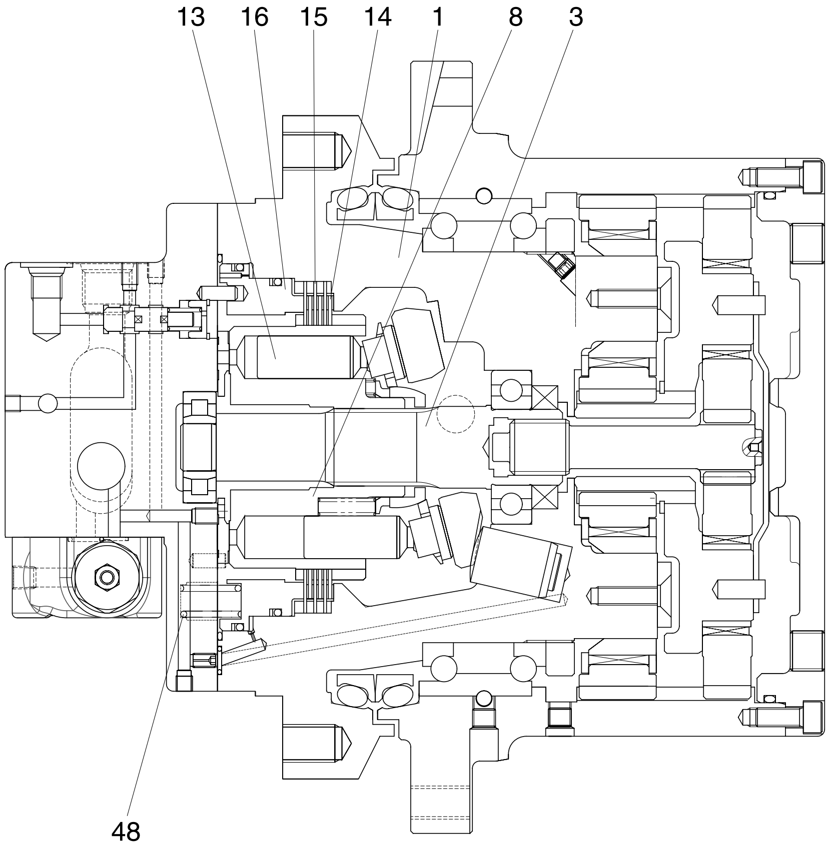
Brake operates the pressure supplied through spool (simultaneous peripheral operation online) installed in valve casing (21) to the part of parking piston (16) and releases a brake.

When the pressure does not work, the brake always runs.

The force of a brake is generated by the frictional force among a plate (15), brake piston (16) and a cylinder block (8) that is connected through spline which are fixed by shaft casing (1) with friction plate (14).

When a pressure does not work on the part of piston, brake spring presses brake piston; oil in a brake room flows into the drain of a motor through an orifice; in that time, brake piston compresses a frictional plate (14) and a detached plate in the middle of shaft casing and brake piston according to the force springs (48); finally, it makes a frictional force.

This frictional force helps the brake fixing a turning axis (3) connected by a cylinder and spline operated.



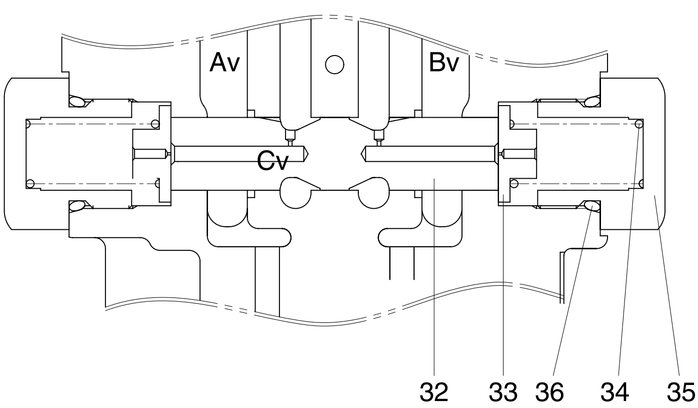
80CR92TM06

4) COUNTERBALANCE VALVE

Av port is connected into a hydraulic pump and Bv port is into a tank. Hydraulic pump supplying oil is come into Av → Cv room. In accordance with spring force (34) that is working on the spool's side it moves to the spool (32) on the right side which is medium position and that time motor is turning.

When the spool (32) is come back to the medium position that time hydraulic motor is stopped.

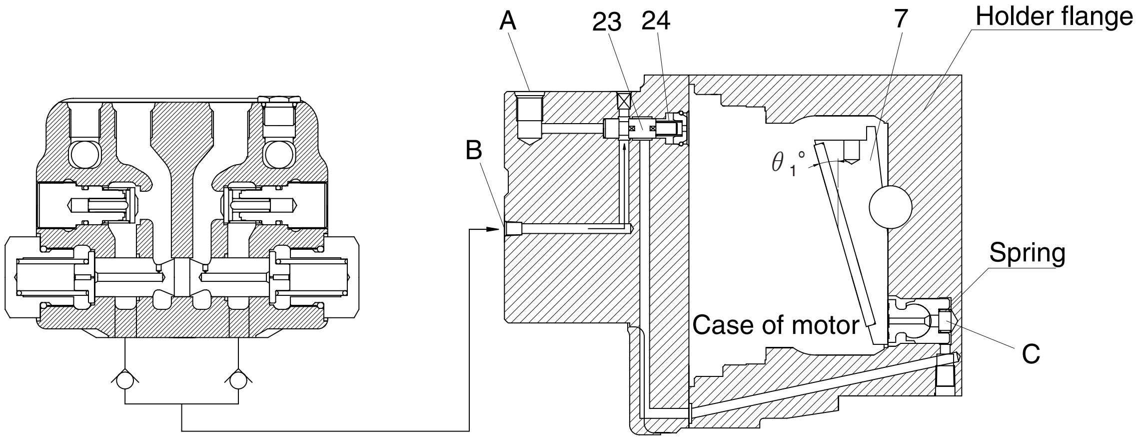
In accordance with spool's returning speed and shape control the working oil that is returning from hydraulic motor smoothly stopping the motor.



80CR92TM07

4) HIGH/LOW SPEED CHANGEOVER MECHANISM

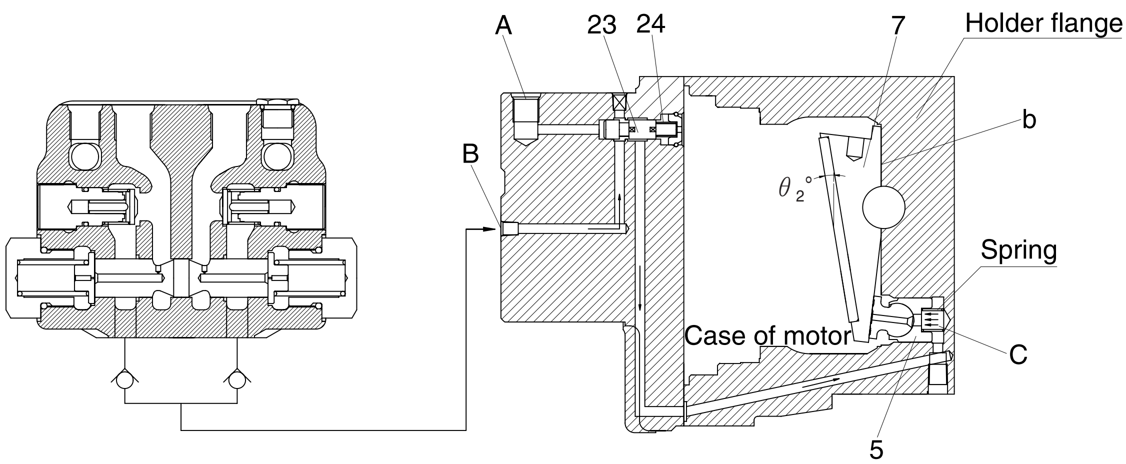
(1) At low speed-at pilot pressure of less than 10 kgf/cm² (0.98 Mpa)



80CR92TM08

When no pilot pressure is supplied from port (A) at a pressure of 10 kgf/cm² (0.98 Mpa) or less, spool (23) is pressed toward the left by the force of spring (24), the pressurized oil supply port B is shut off, and oil in chamber (C) is released into the motor case via spool (23).
Consequently, swash plate (7) is tilted at a maximum angle ($\theta_1°$) and the piston displacement of hydraulic motor becomes maximum, thus leading to low-speed rotation.

(2) At high speed-at pilot pressure of 10 kgf/cm² (0.98 Mpa) or more



80CR92TM09

When a pilot pressure is supplied from port (A) at a pressure of 10 kgf/cm² (0.98 Mpa) or more, the pressure overcomes the force of spring (24) and spool (23) is pressed toward the right. The pressurized oil at supply port (B) is then introduced into chamber (C) via spool (23).
Piston (5) pushes up swash plate (7) until it touches side (b) of the holder flange.
At this time, swash plate (7) is tilted at a minimum angle ($\theta_2°$) and the piston displacement of hydraulic motor becomes maximum, thus leading to high-speed rotation.

2. REDUCTION GEAR

1) FUNCTION

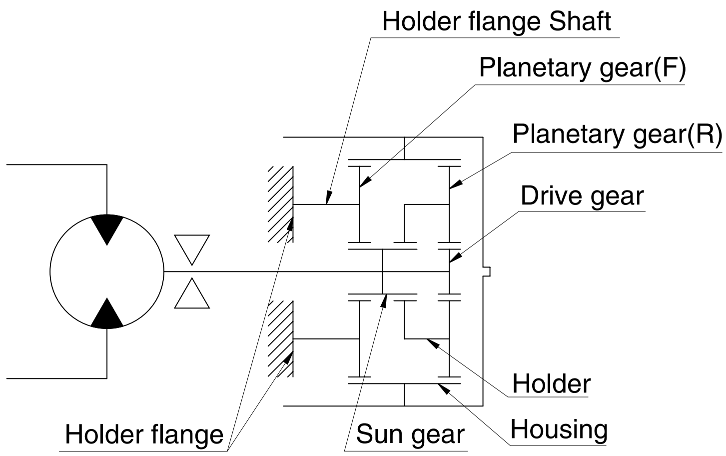
The reduction gear unit consists of a combination of simple planetaly gear mechanism.

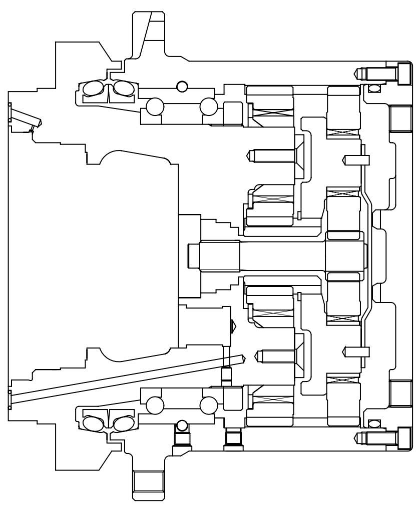
This mechanism reduce the high speed rotation from the hydraulic motor and convert it into low speed, high torque to rotate the hub (or case), which in turn rotates the sprocket.

2) OPERATING PRINCIPLE

Shaft → Drive gear → Planetary Gear R → Housing

→ Holder → Sun gear → Planetary Gear F →Rotation of Housing





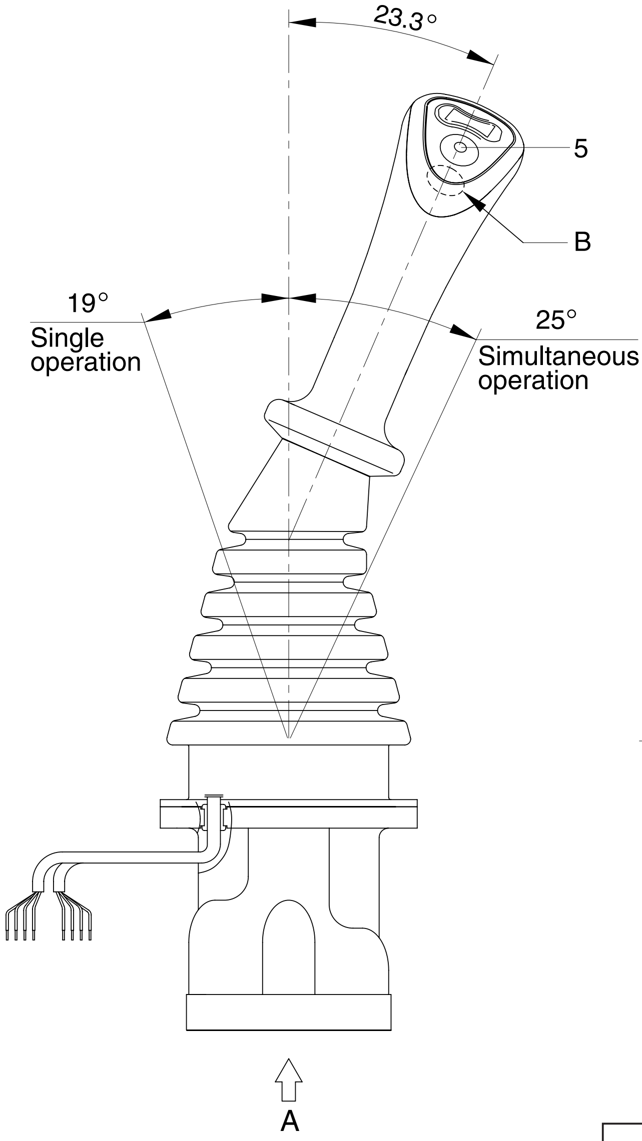
5592TM07

Reduction ratio = (Housing Teeth/Drive Gear Teeth + 1)
×(Housing Teeth/Sun Gear Teeth + 1) - 1.

GROUP 5 RCV LEVER

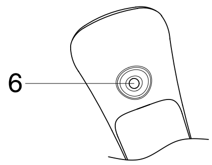
1. STRUCTURE

The casing has the oil inlet port P (primary pressure) and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.

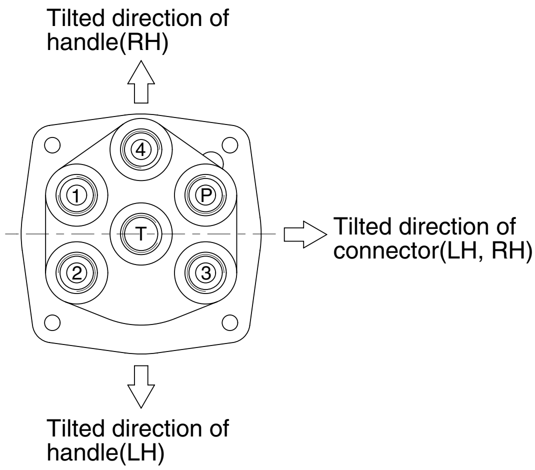


Switches

No.	LH	RH
5	One touch decel	Horn
6	-	Breaker

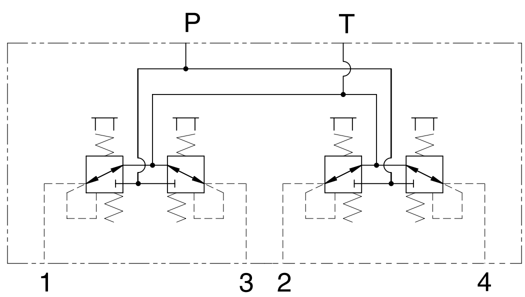


DETAIL B



VIEW A

21092RL01



Hydraulic circuit

Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	
2	Arm in port	Boom down port	
3	Right swing port	Bucket in port	
4	Arm out port	Boom up port	

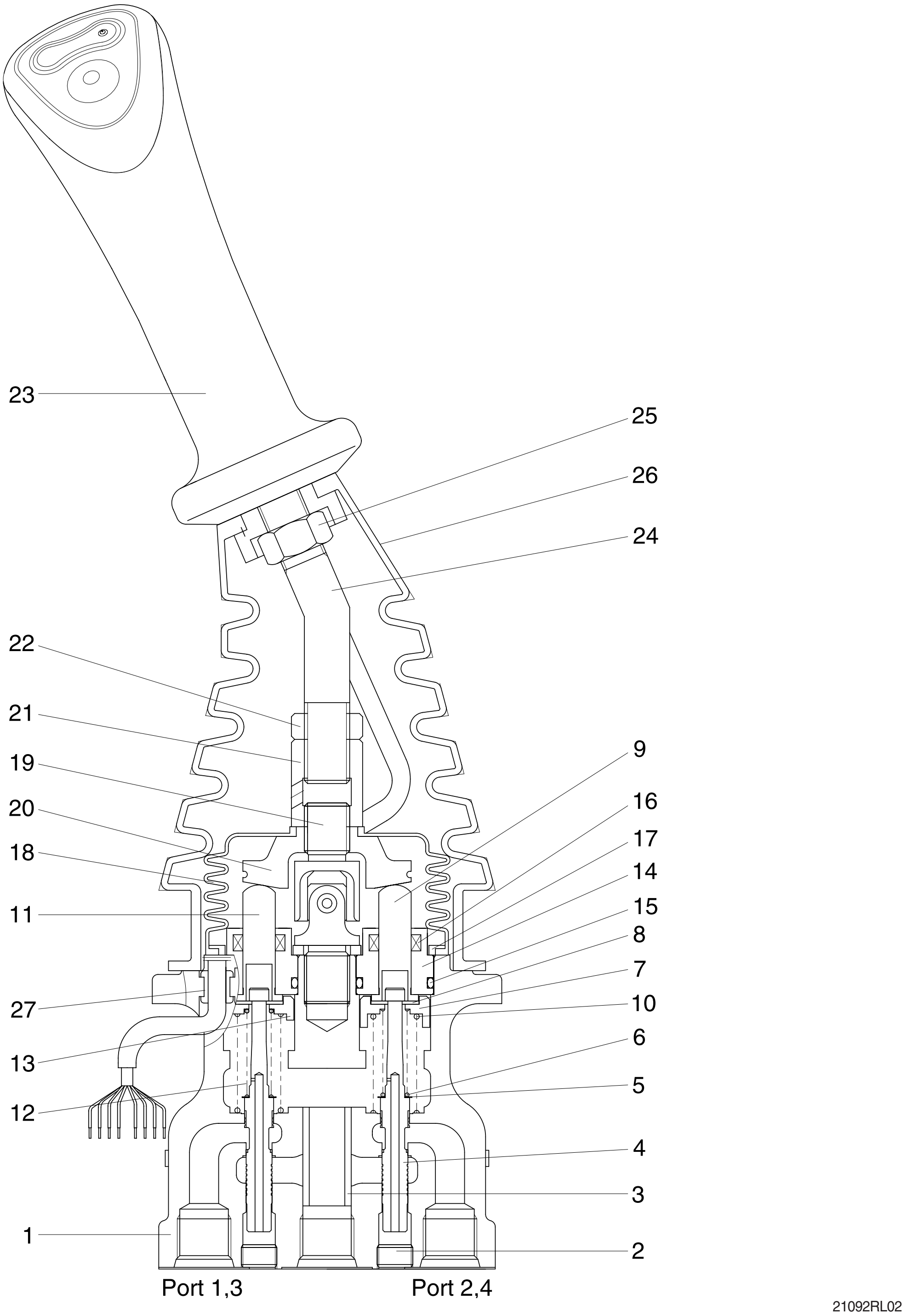
CROSS SECTION

The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (4), spring (6) for setting secondary pressure, return spring (10), stopper (8), spring seat (7, 13) and shim (5). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (9, 11) by the return spring.

When the push rod is pushed down by tilting the handle, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.

CROSS SECTION



1	Case	8	Stopper	15	O-ring	22	Lock nut
2	Plug	9	Push rod	16	Rod seal	23	Handle assembly
3	Bushing	10	Spring	17	Plate	24	Handle bar
4	Spool	11	Push rod	18	Boot	25	Nut
5	Shim	12	Spring	19	Joint assembly	26	Boot
6	Spring	13	Spring seat	20	Swash plate	27	Bushing
7	Spring seat	14	Plug	21	Adjusting nut		

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve that controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

(1) Inlet port (P) where oil is supplied from hydraulic pump.

(2) Output ports (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.

(3) Tank port (T) necessary to control the above output pressure.

(4) Spool to connect output port to inlet port or tank port.

(5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (4) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (9,11) is inserted and can slide in the plug (14).

For the purpose of changing the displacement of the push rod through the swash plate (20) and adjusting nut (21) are provided the handle (23) that can be tilted in any direction around the fulcrum of the universal joint (19) center.

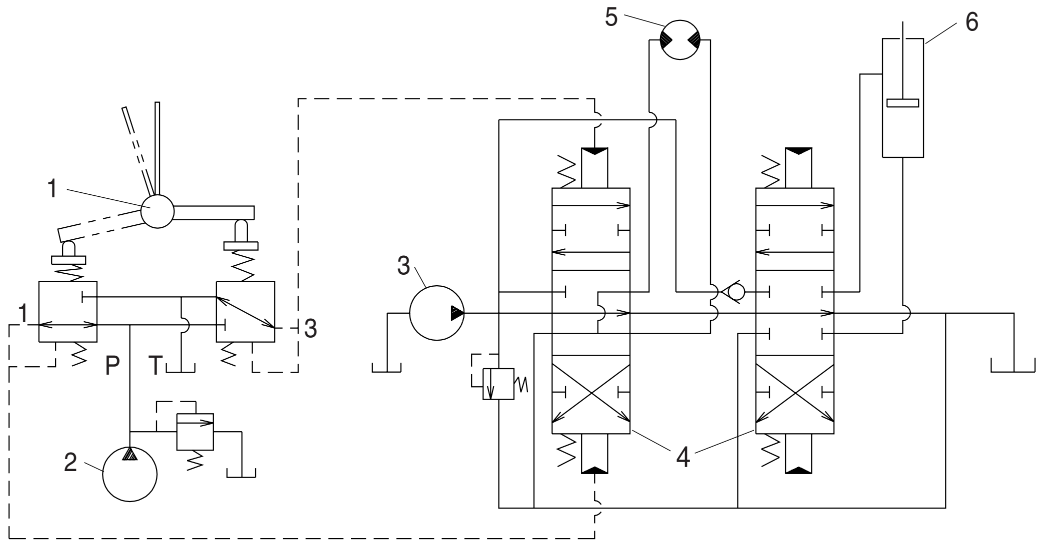
The spring (10) works on the case (1) and spring seat (7, 13) and tries to return the push rod (9,11) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

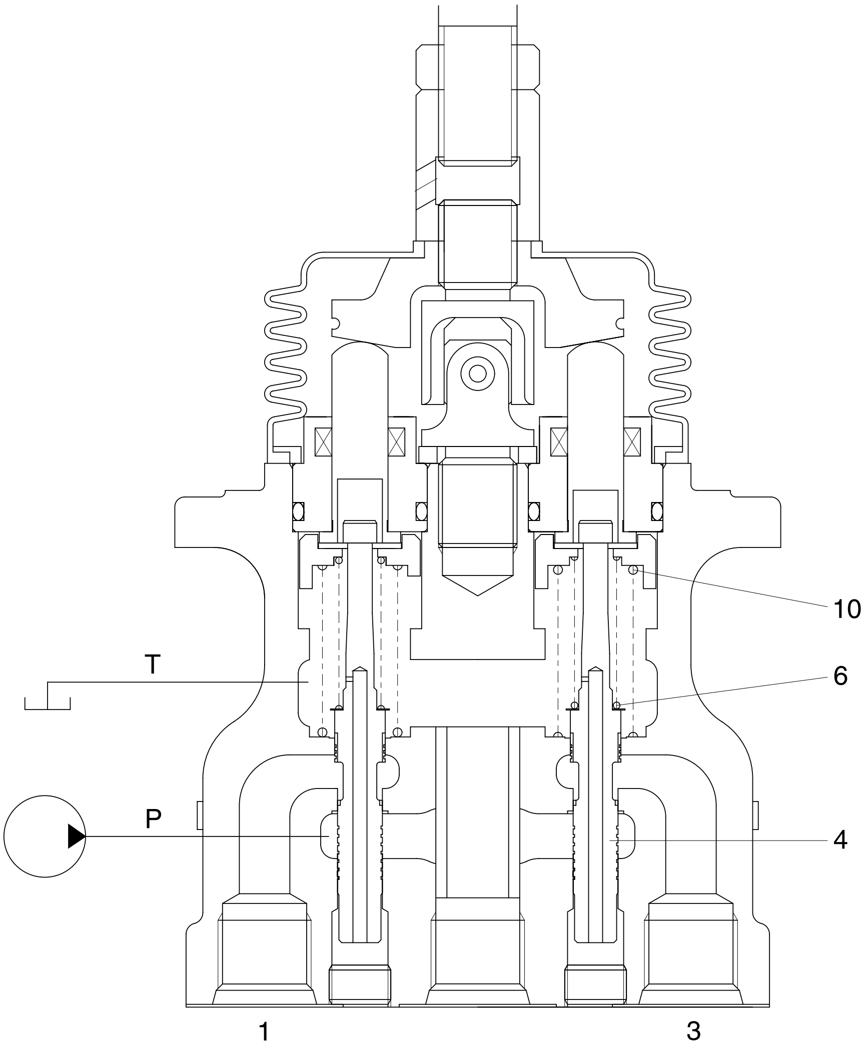
The diagram shown below is the typical application example of the pilot valve.



2-70

1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

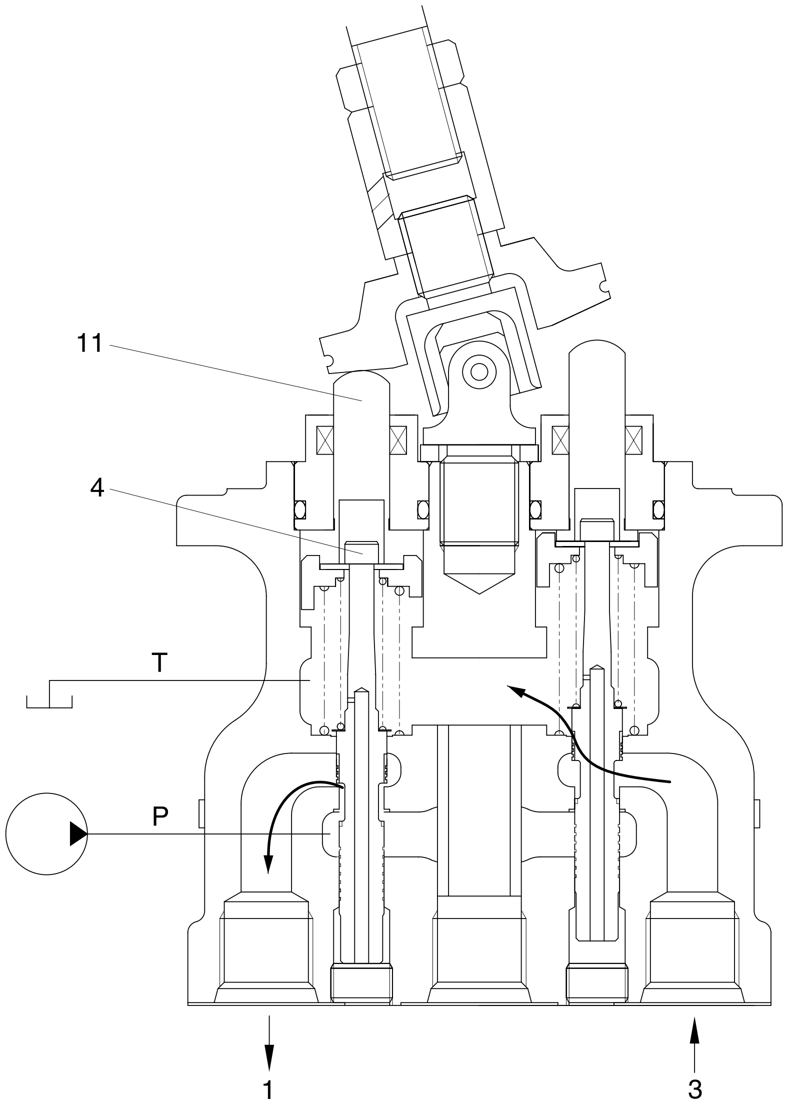
(1) Case where handle is in neutral position



21092RL03

The force of the spring (6) that determines the output pressure of the pilot valve is not applied to the spool (4). Therefore, the spool is pushed up by the spring (10) to the position of port (1, 3) in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where handle is tilted

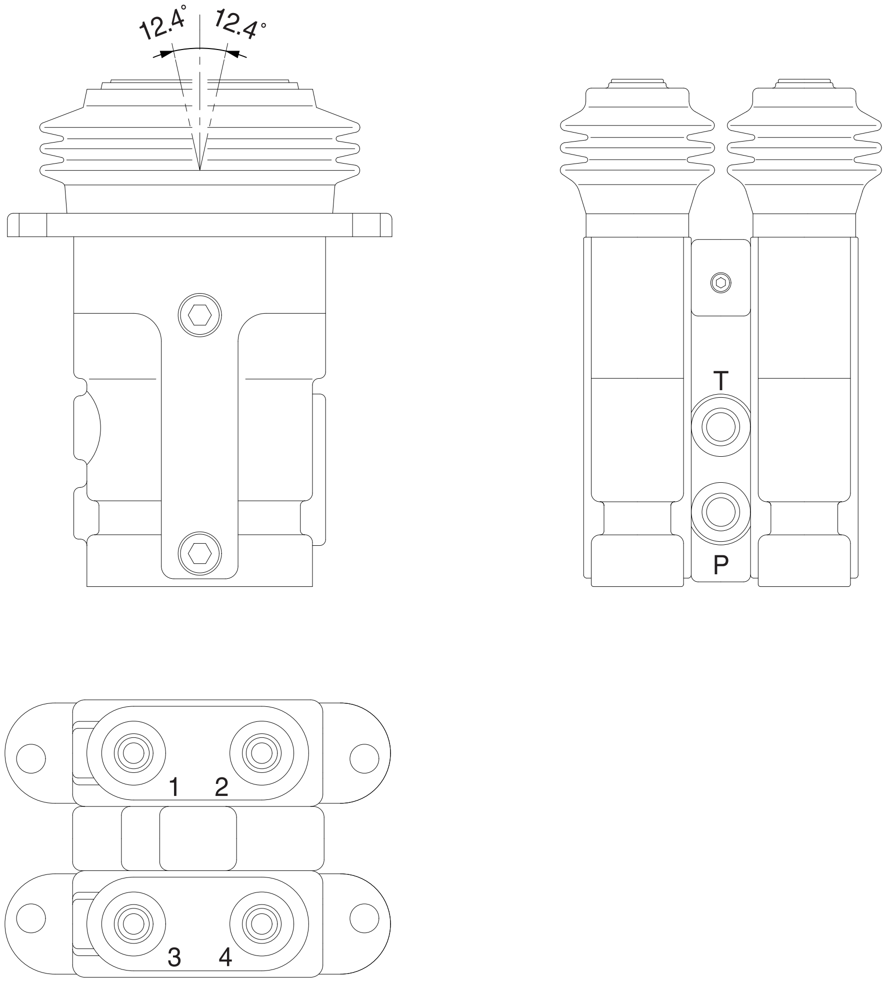


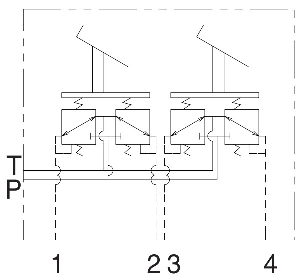
When the push rod (11) is stroked, the spool (4) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (1). If it decreases lower than the set pressure, port P is connected with port (1) and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

GROUP 6 RCV PEDAL

1. STRUCTURE

The casing (Spacer) has the oil inlet port P (Primary pressure), and the oil outlet port T (Tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.





Hydraulic circuit

Port	Port	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Travel (LH, Forward)	
2	Travel (LH, Backward)	
3	Travel (RH, Forward)	
4	Travel (RH, Backward)	

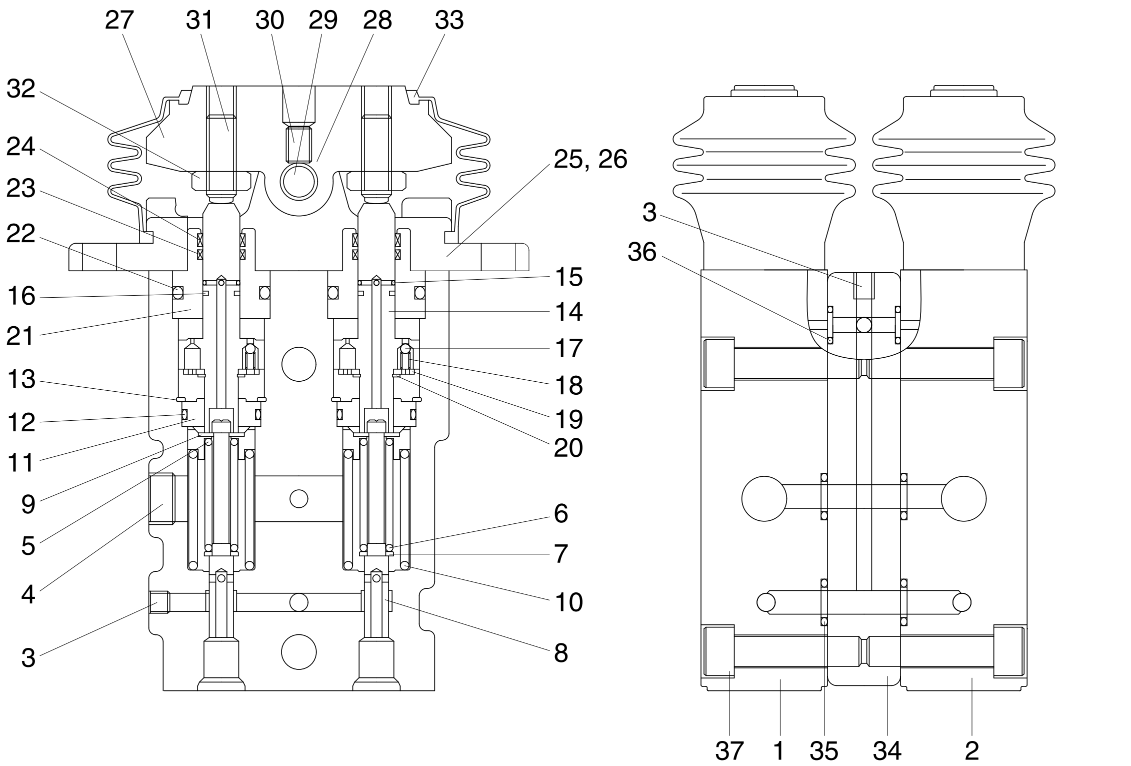
14072SF73

CROSS SECTION

The construction of the RCV pedal is shown in the below drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (8), spring (6) for setting secondary pressure, return spring (10), stopper (9), and spring seat (7). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 19 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (14) by the return spring.

When the push rod is pushed down by tilting pedal, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.



14072SF70

1	Body (1)	14	Push rod	27	Cam
2	Body (2)	15	Spring pin	28	Bushing
3	Plug	16	Seal	29	Cam shaft
4	Plug	17	Steel ball	30	Set screw
5	Spring seat	18	Spring	31	Set screw
6	Spring	19	Plate	32	Nut
7	Spring seat	20	Snap ring	33	Bellows
8	Spool	21	Plug	34	Space
9	Stopper	22	O-ring	35	O-ring
10	Spring	23	Rod seal	36	O-ring
11	Rod guide	24	Dust seal	37	Bolt
12	O-ring	25	Cover		
13	Snap ring	26	Bolt		

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

(1) Inlet port (P) where oil is supplied from hydraulic pump.

(2) Output port (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.

(3) Tank port (T) necessary to control the above output pressure.

(4) Spool to connect output port to inlet port tank port.

(5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (14) is inserted and can slide in the plug (21).

For the purpose of changing th displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

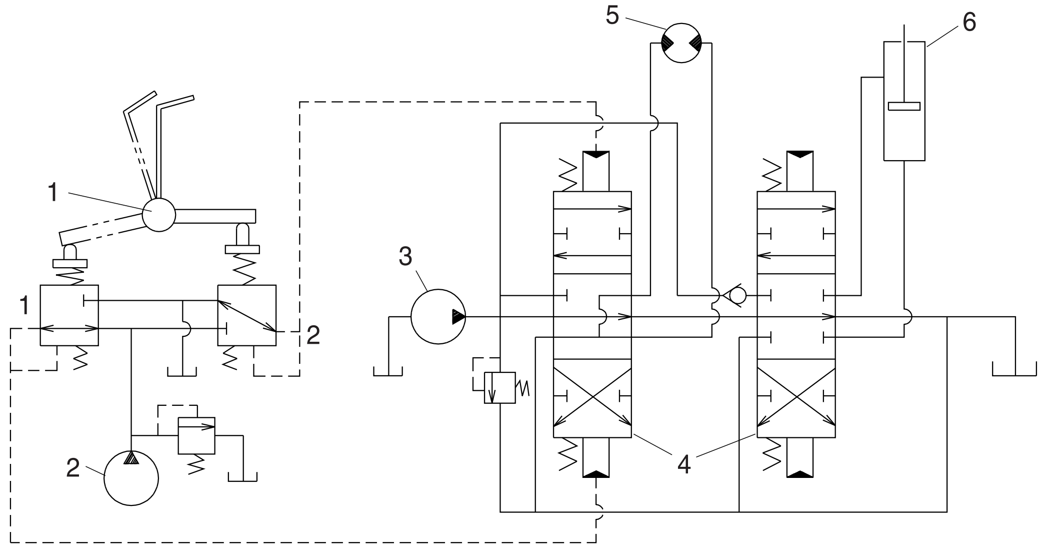
The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below ant the attached operation explanation drawing.

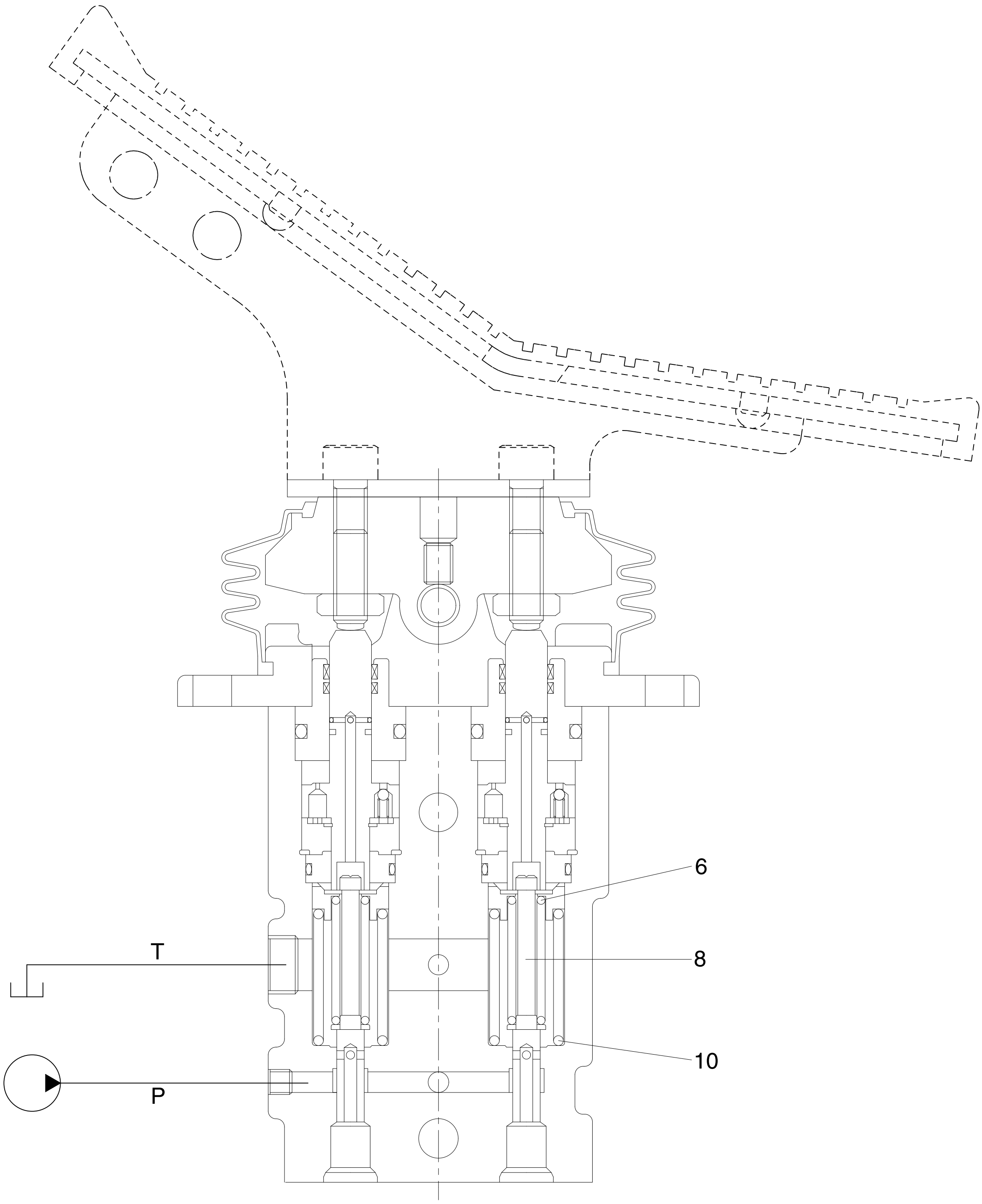
The diagram shown below is the typical application example of the pilot valve.



2-76

1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

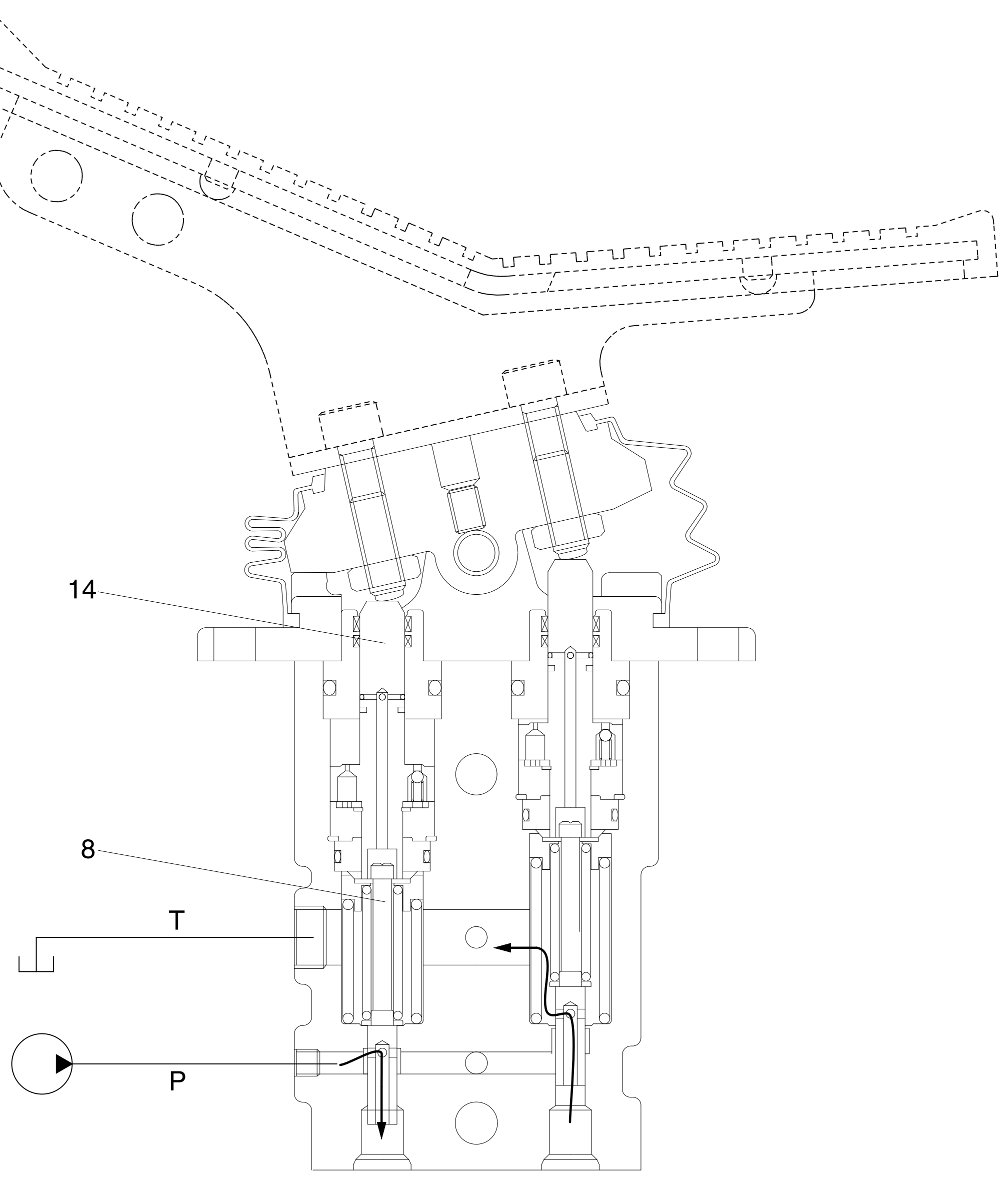
(1) Case where handle is in neutral position



14072SF74

The force of the spring (6) that determines the output pressure of the pilot valve is not applied to the spool (8). Therefore, the spool is pushed up by the spring (10) to the position of port 2 in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where handle is tilted

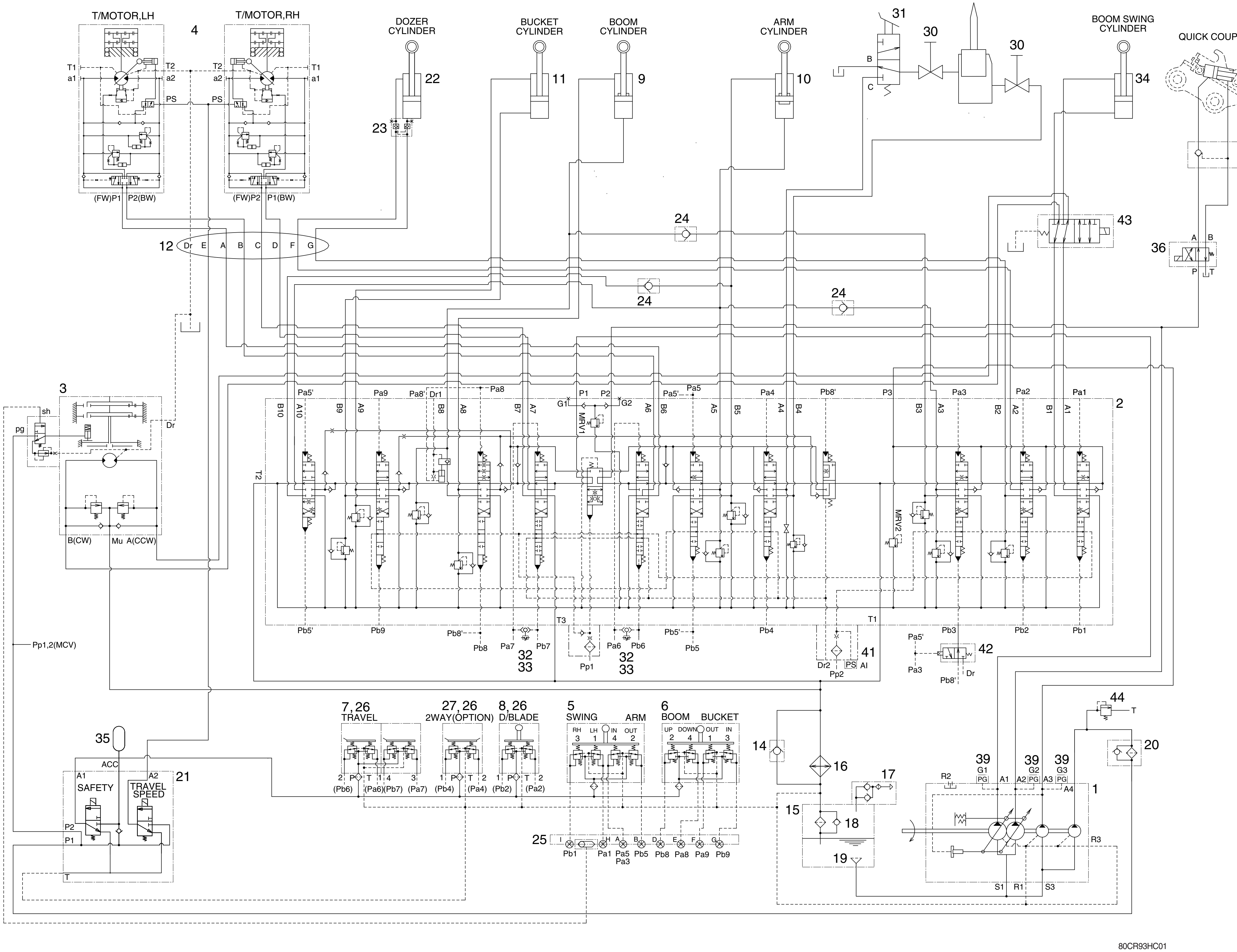


14072SF75

When the push rod (14) is stroked, the spool (8) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.

SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT

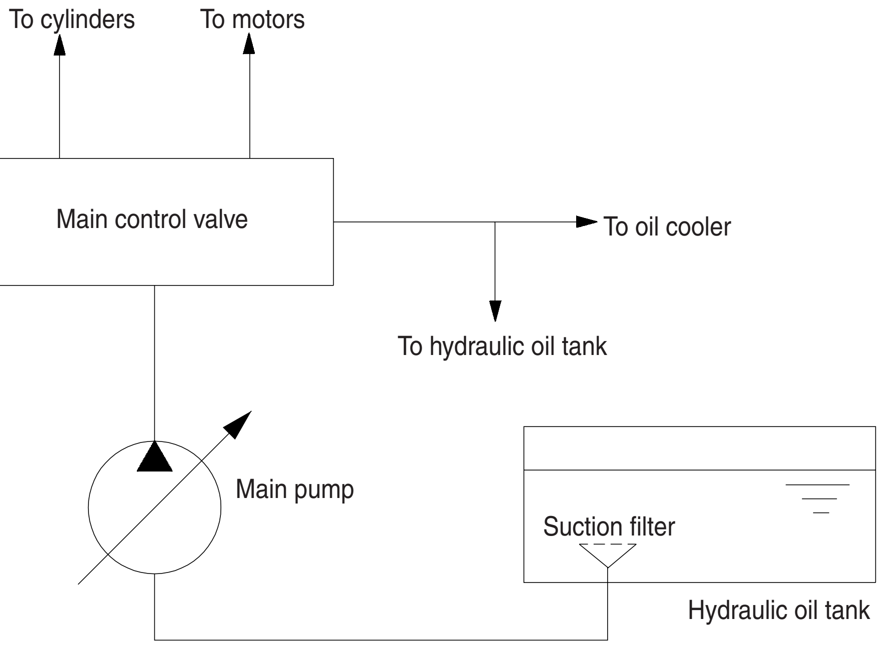


1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever(LH)
6 RCV lever(RH)
7 RCV pedal
8 RCV dozer
9 Boom cylinder
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Bypass valve
19 Strainer
20 Pilot filter
21 Solenoid valve
22 Dozer cylinder
23 Check valve
24 Check valve
25 Terminal
26 Last guard filter
27 2-Way pedal
30 Stop valve
31 Selector valve
32 Pressure switch
33 Shuttle valve
34 Boom swing cylinder
35 Accumulator
36 Solenoid valve
39 Coupling screw
41 Pressure sensor
42 Selector valve
43 Selector valve
44 Relief valve

GROUP 2 MAIN CIRCUIT

The main hydraulic circuit consists of suction circuit, delivery circuit, return circuit and drain circuit.
The hydraulic system consists of one main pump, one control valve, one swing motor, four cylinders and two travel motors.
The swash plate type variable displacement axial piston pump is used as the main pump and is driven by the engine at ratio 1.0 of engine speed.

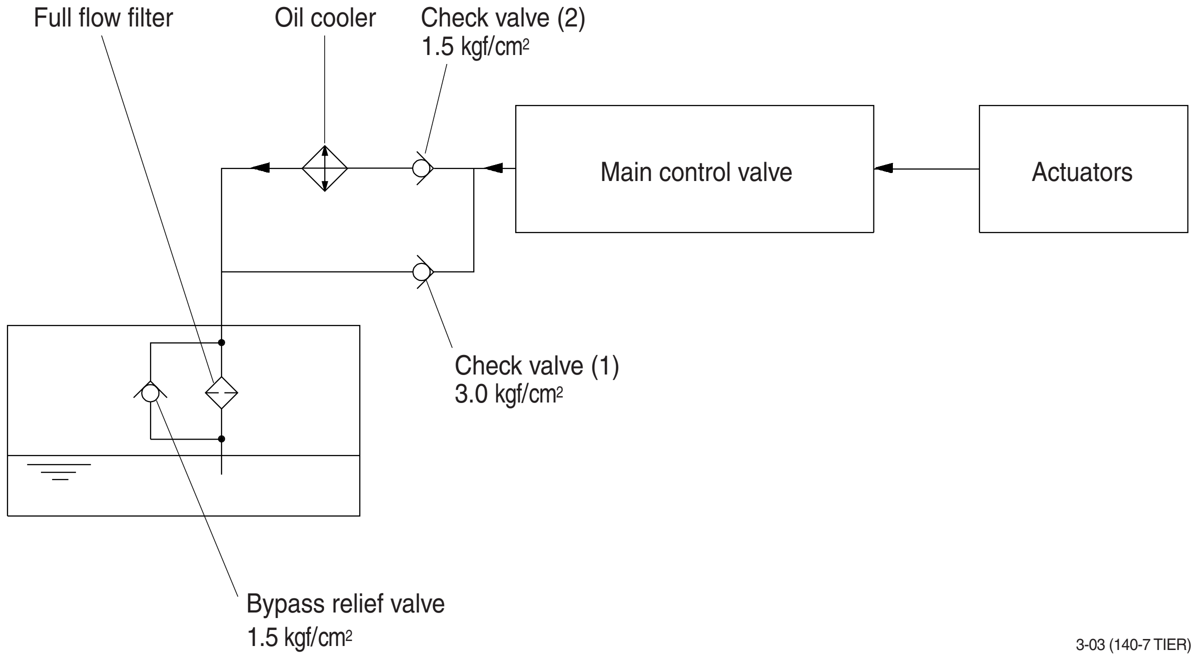
1. SUCTION AND DELIVERY CIRCUIT



3-02 (140-7 TIER)

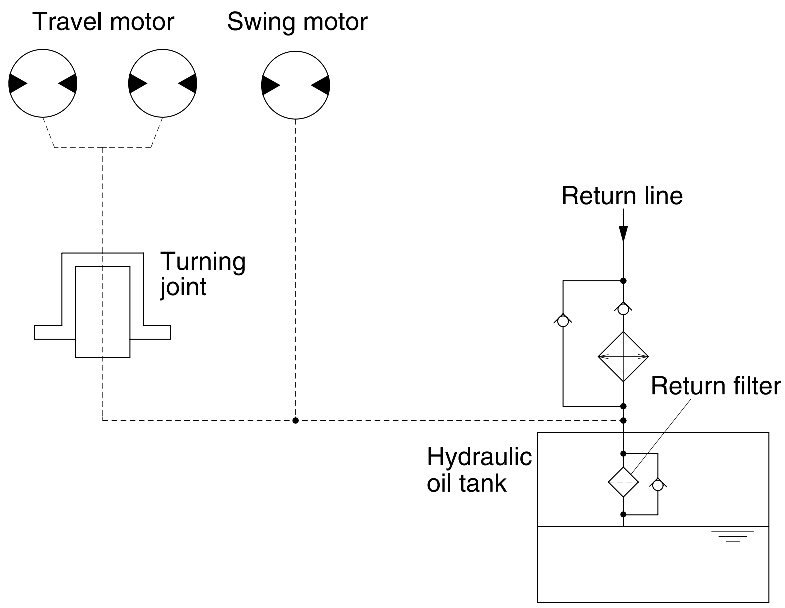
The pumps receive oil from the hydraulic tank through a suction filter. The discharged oil from the pump flows into the control valve and goes out the tank ports.
The oil discharged from the main pump flows to the actuators through the control valve.
The control valve controls the hydraulic functions.
The return oil from the actuators flows to the hydraulic tank through the control valve and the oil cooler.

2. RETURN CIRCUIT



All oil returned from each actuator returns to the hydraulic tank through the control valve.
The bypass check valves are provided in the return circuit.
The setting pressure of bypass check valves are 1.5 kgf/cm^2 (21 psi) and 3.0 kgf/cm^2 (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.
When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. When the oil pressure exceeds 3.0 kgf/cm^2 (43 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).
The full-flow filter and bypass relief valve are provided in the hydraulic tank.
The oil returned from right and left side of control valve is combined and filtered by the full-flow filter. A bypass relief valve is provided in the full-flow filter.
When the filter element is clogged, the bypass relief valve opens at 1.5 kgf/cm^2 (21 psi) differential pressure.

3. DRAIN CIRCUIT



R5573CI02

Besides internal leaks from the motors and main pump, the oil for lubrication circulates.

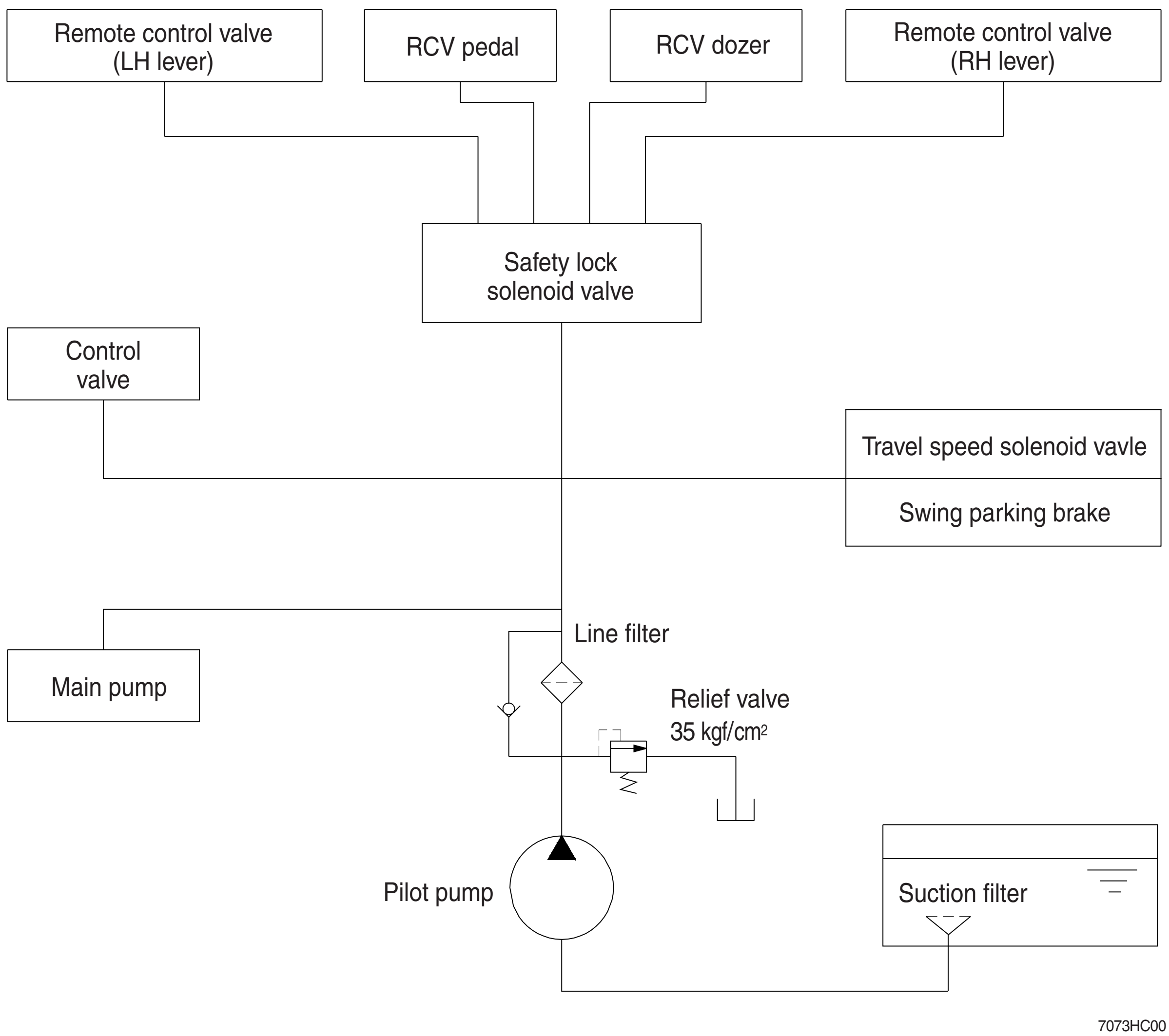
1) TRAVEL MOTOR DRAIN CIRCUIT

Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and return to the hydraulic tank after being filtered by return filter.

2) SWING MOTOR DRAIN CIRCUIT

Oil leaked from the swing motor returns to the hydraulic tank passing through a return filter with oil drained from the travel circuit .

GROUP 3 PILOT CIRCUIT

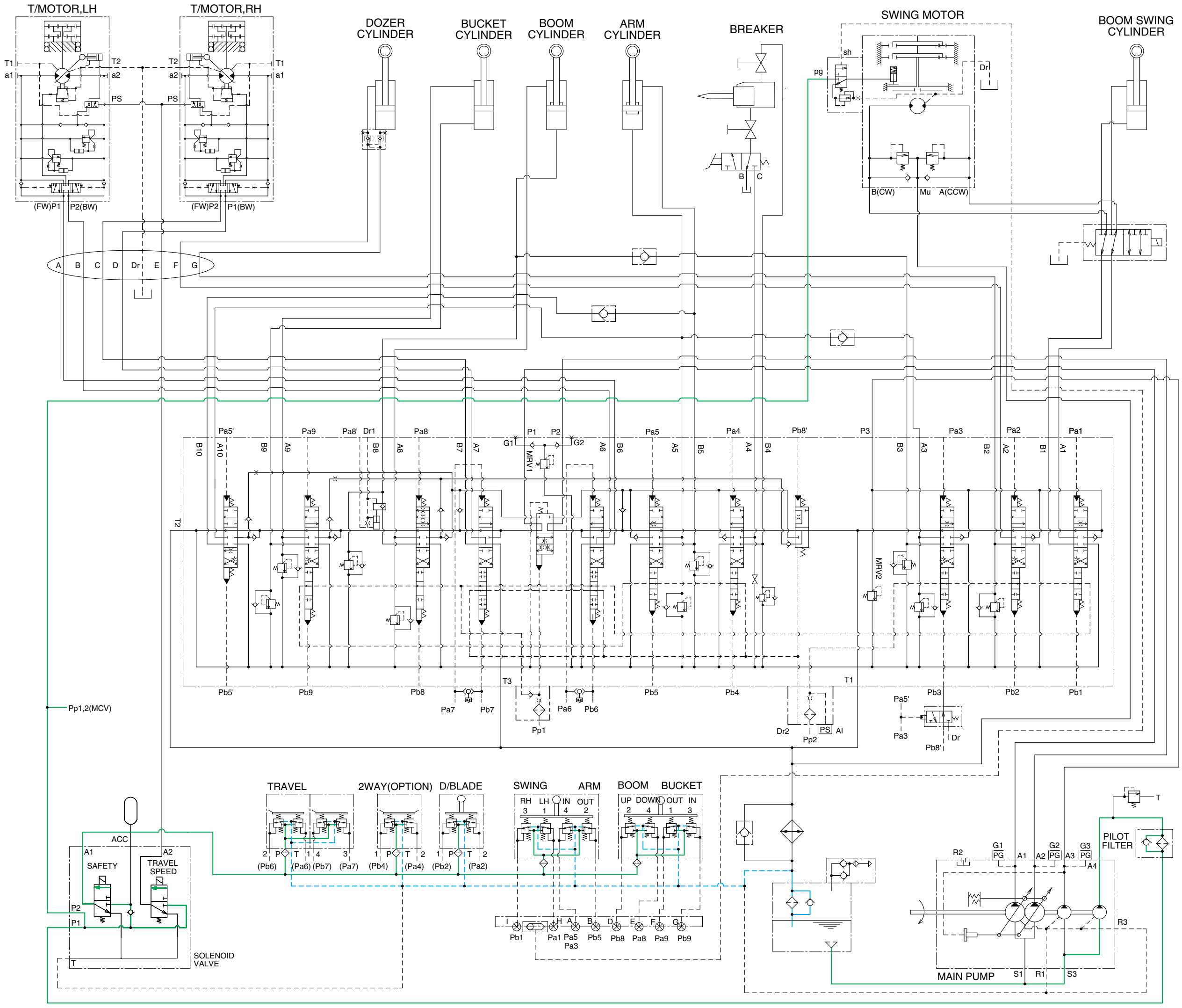


The pilot circuit consists of suction circuit, delivery circuit and return circuit.

The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction filter.

The discharged oil from the pilot pump flows to the remote control valve through line filter, solenoid valve assemblies, swing parking brake, main control valve and safety lock solenoid valve.

1. SUCTION, DELIVERY AND RETURN CIRCUIT



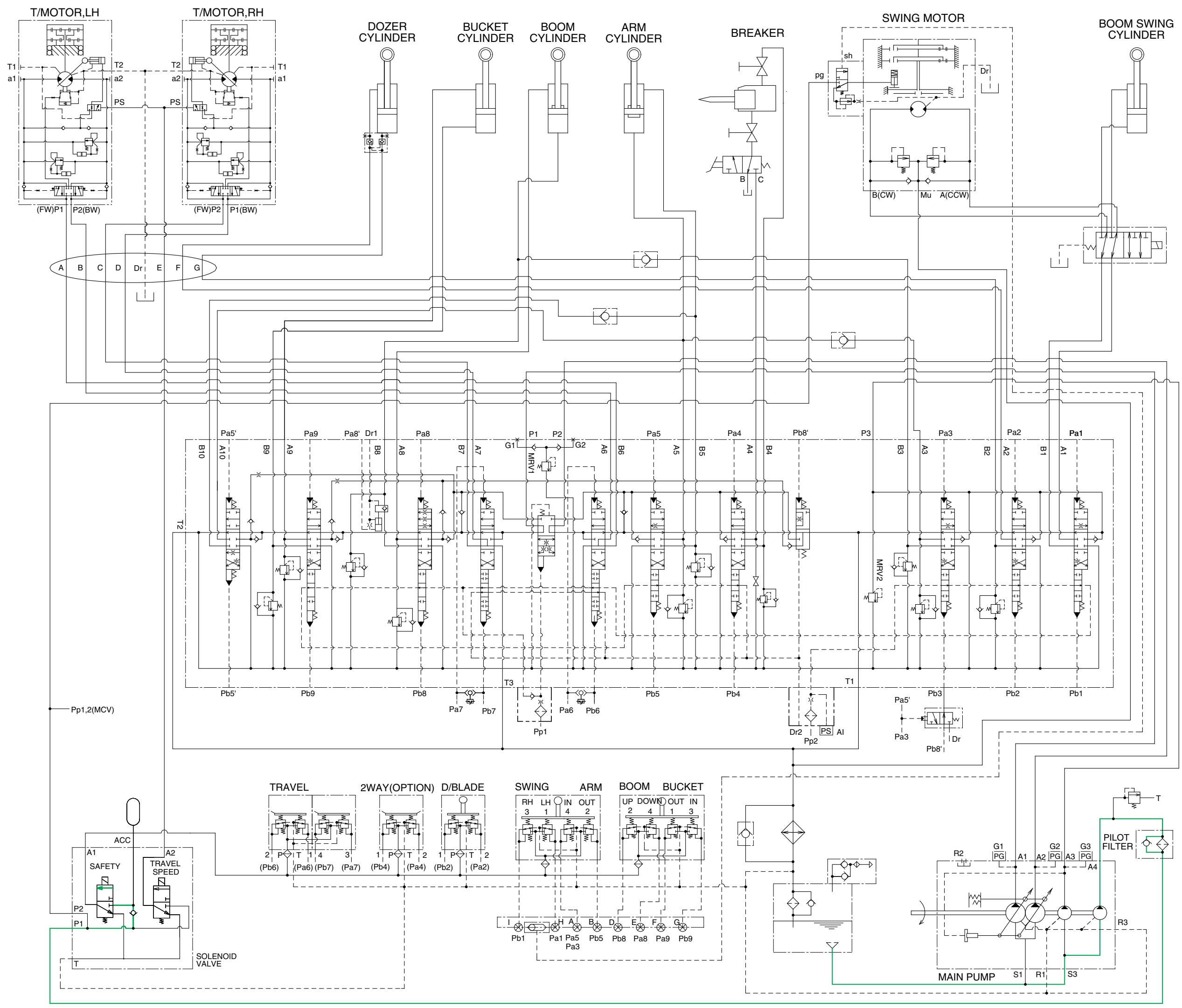
80CR93HC02

The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

The oil filtered by line filter flows remote control valve through safety solenoid valve.

The return oil flow into the hydraulic tank.

2. SAFETY VALVE (SAFETY LEVER)

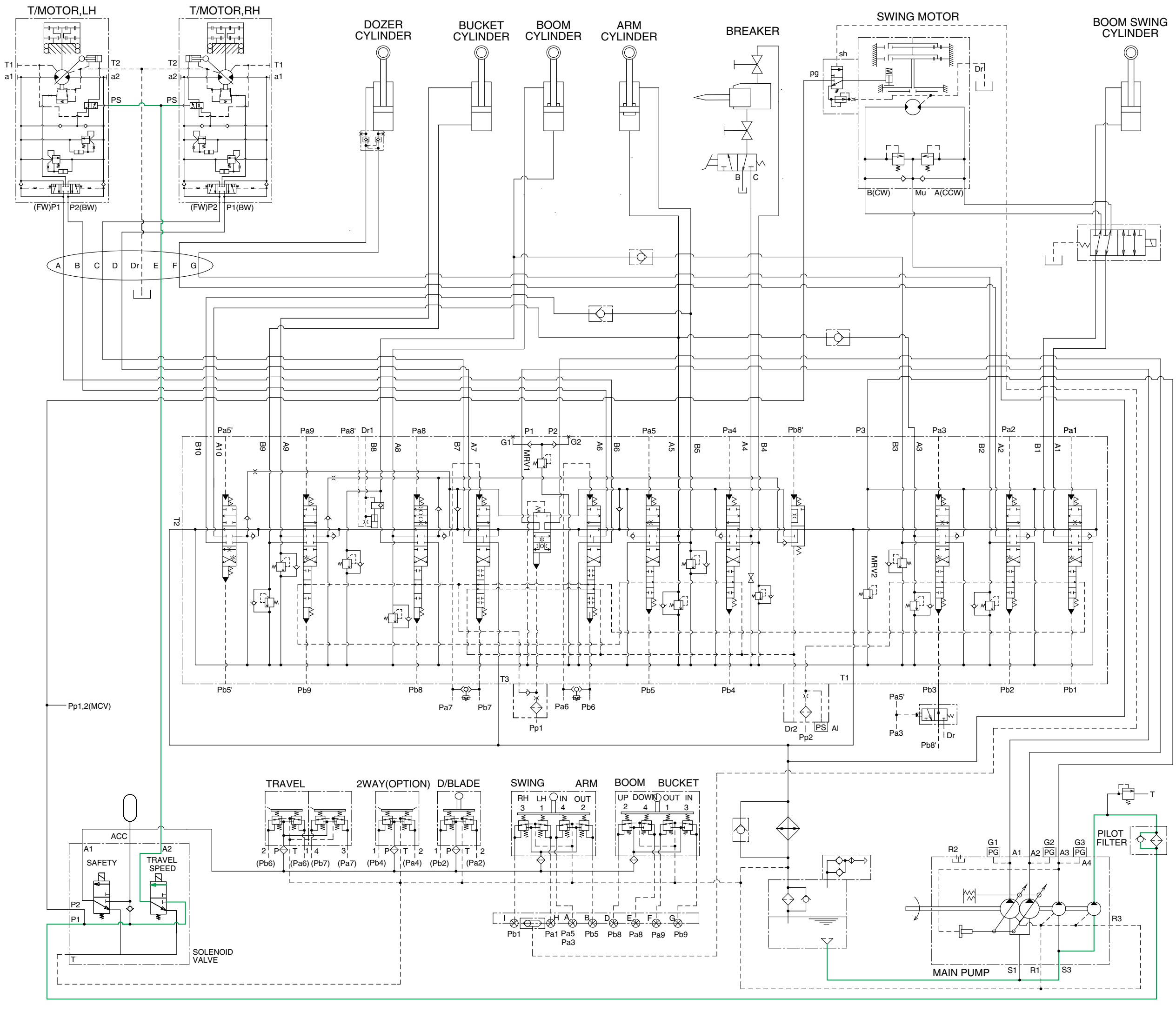


80CR93HC03

When the lever of the safety solenoid valve is moved downward, oil flows into the remote control valve through solenoid valve and line filter.

When the lever of the safety solenoid valve is moved upward, oil does not flow into the remote control valve, because of the blocked port.

3. TRAVEL SPEED CONTROL SYSTEM



80CR93HC04

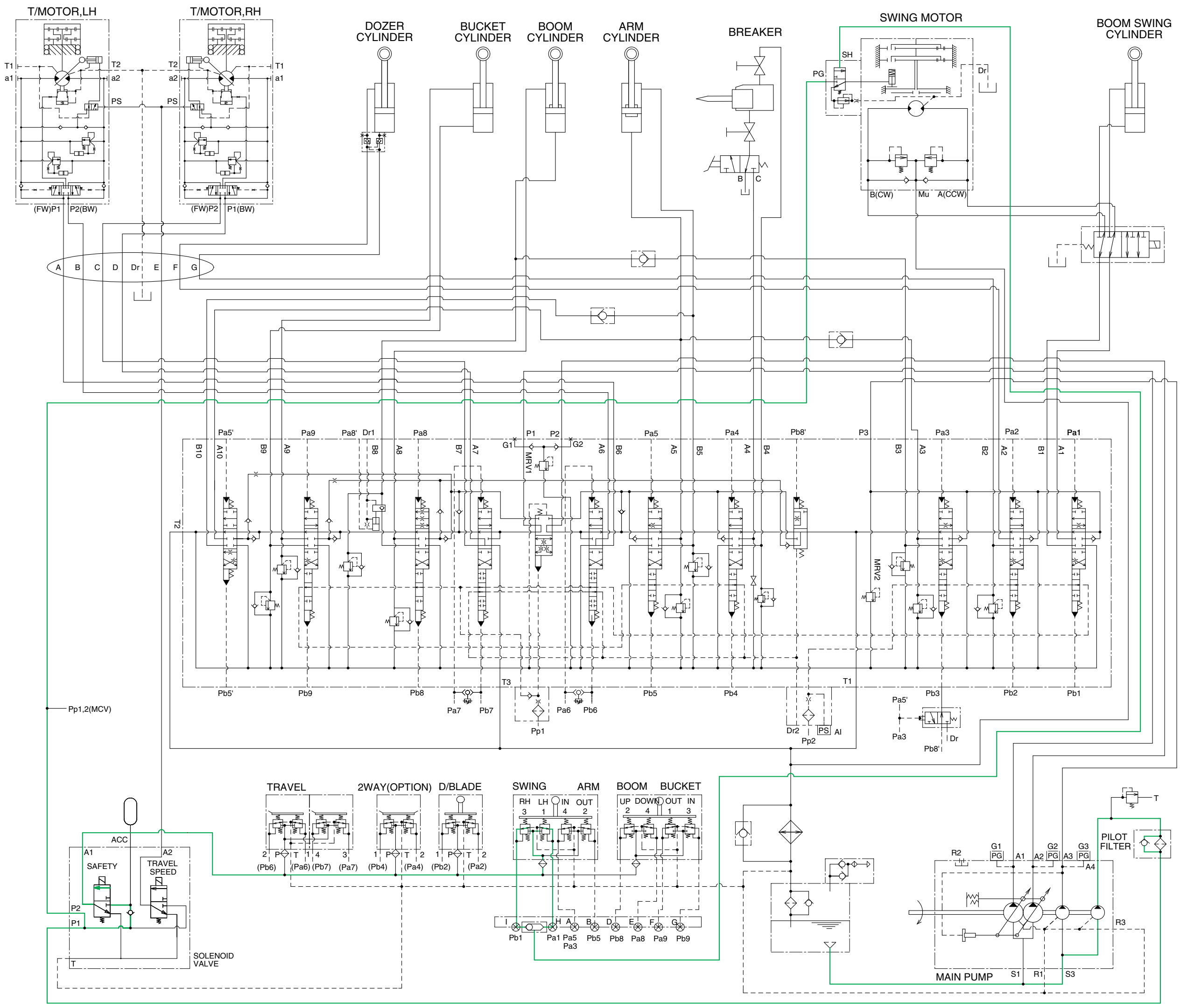
When the travel speed switch is pushed, the travel speed solenoid valve is actuated and the discharged oil from the pilot pump flows to the PS port of pilot valve in the travel motors.

As a result, the control piston is pushed by the main oil flow, thus the displacement is minimized.

When the travel speed switch is pushed once more, the travel speed solenoid valve is return to original position by the force of spring, the hydraulic oil of PS port returns to the hydraulic tank.

As a result, the control piston is returned by the main oil flow, thus the displacement is maximized.

4. SWING PARKING BRAKE RELEASE



80CR93HC05

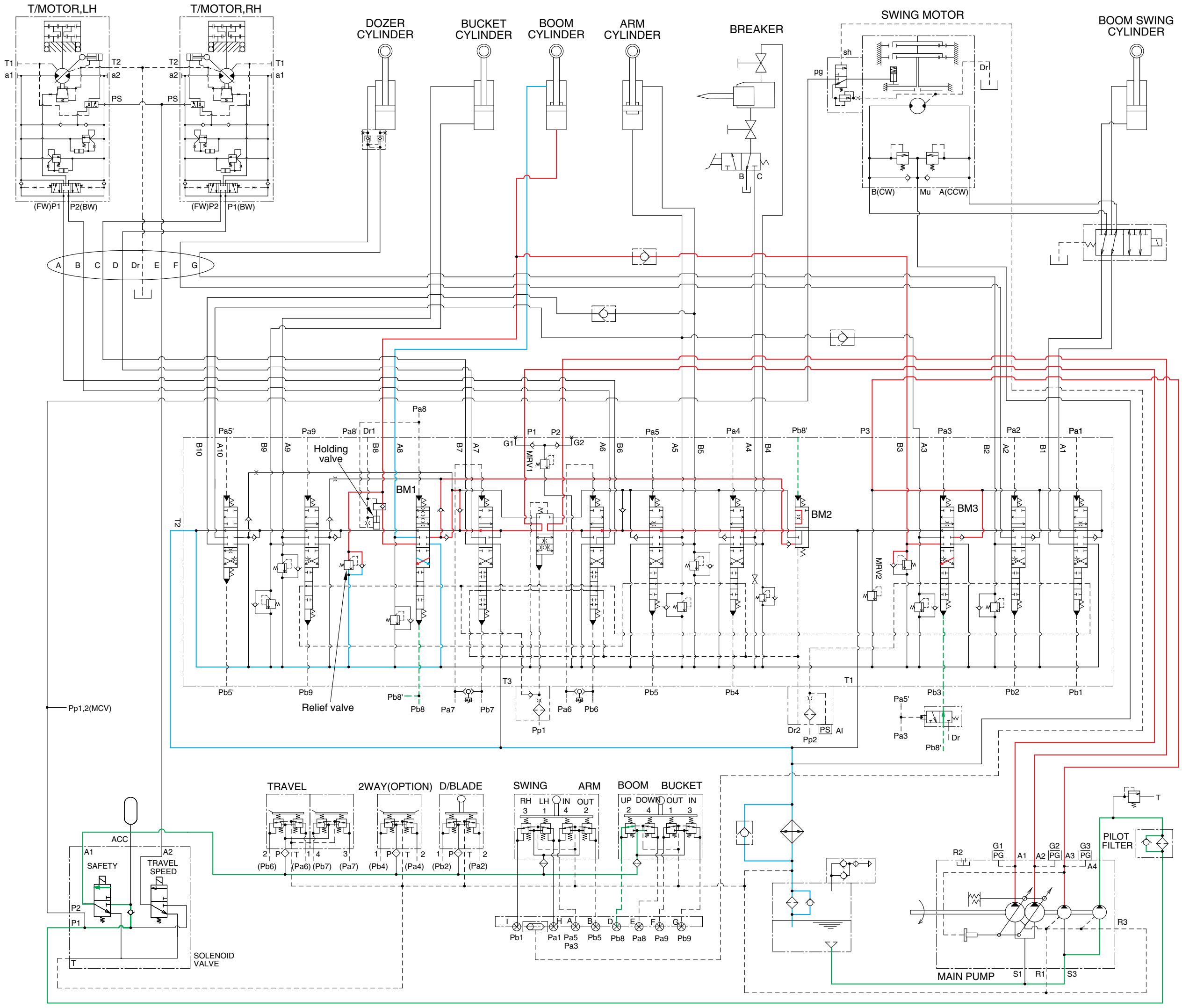
When the swing control lever is tilted, the pilot oil flow into SH port of shuttle valve, this pressure move spool so, discharged oil from pilot valve flow into PG port.

This pressure is applied to swing motor disc, thus the brake is released.

When the swing control lever is set in the neutral position, oil in the swing motor disc cylinder is drained, thus the brake is applied.

GROUP 4 SINGLE OPERATION

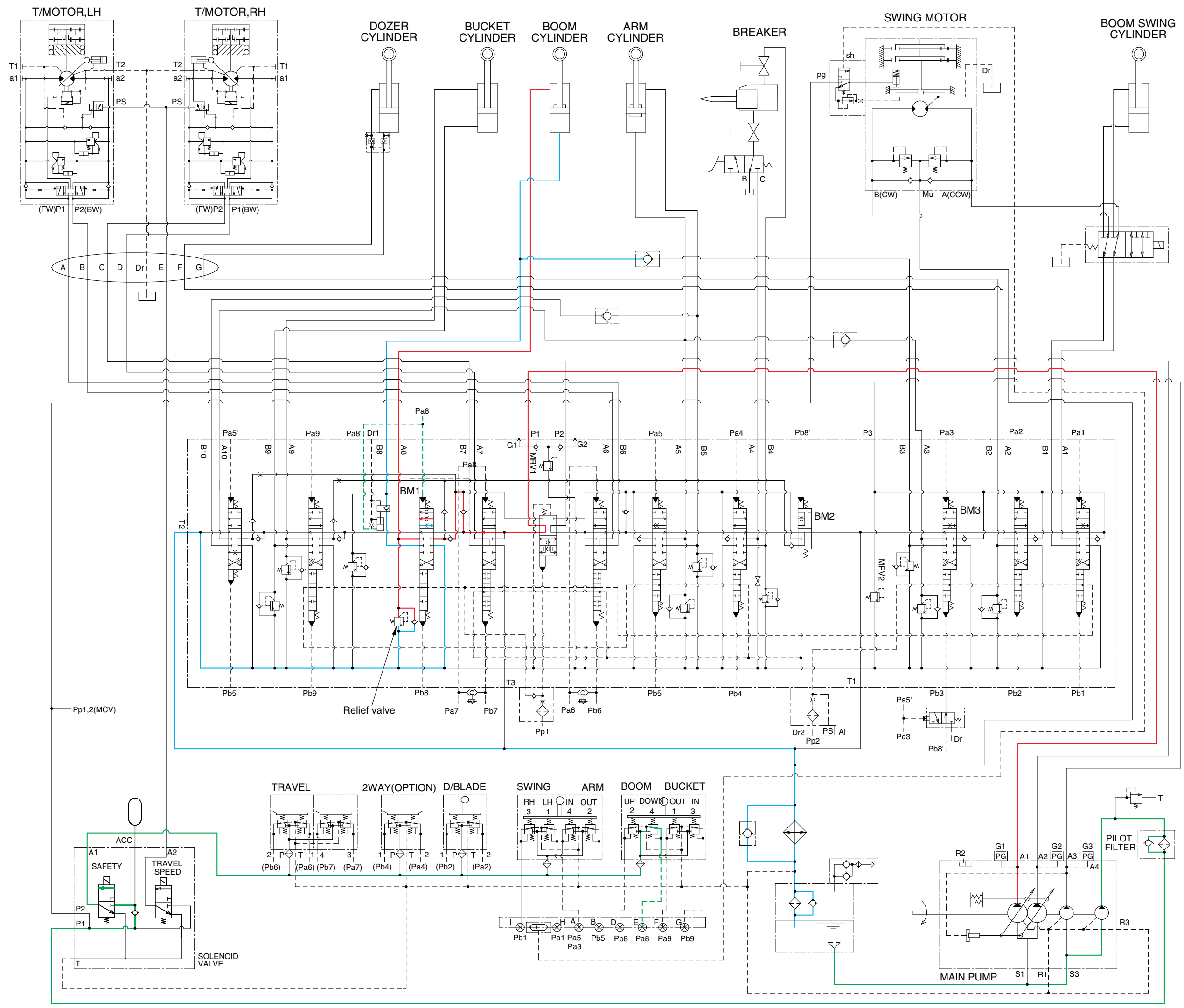
1. BOOM UP OPERATION



80CR93HC06

When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure from the remote control valve.
The oil from the A1, A2 and A3 pump flows into the main control valve and then goes to the large chamber of boom cylinders. At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder bottom end circuit is prevented by relief valve. When the boom is up and the control lever is returned to neutral position, the circuit for the holding pressure at the bottom end of the boom cylinder is closed by the boom holding valve. This prevents the hydraulic drift of boom cylinder.

2. BOOM DOWN OPERATION



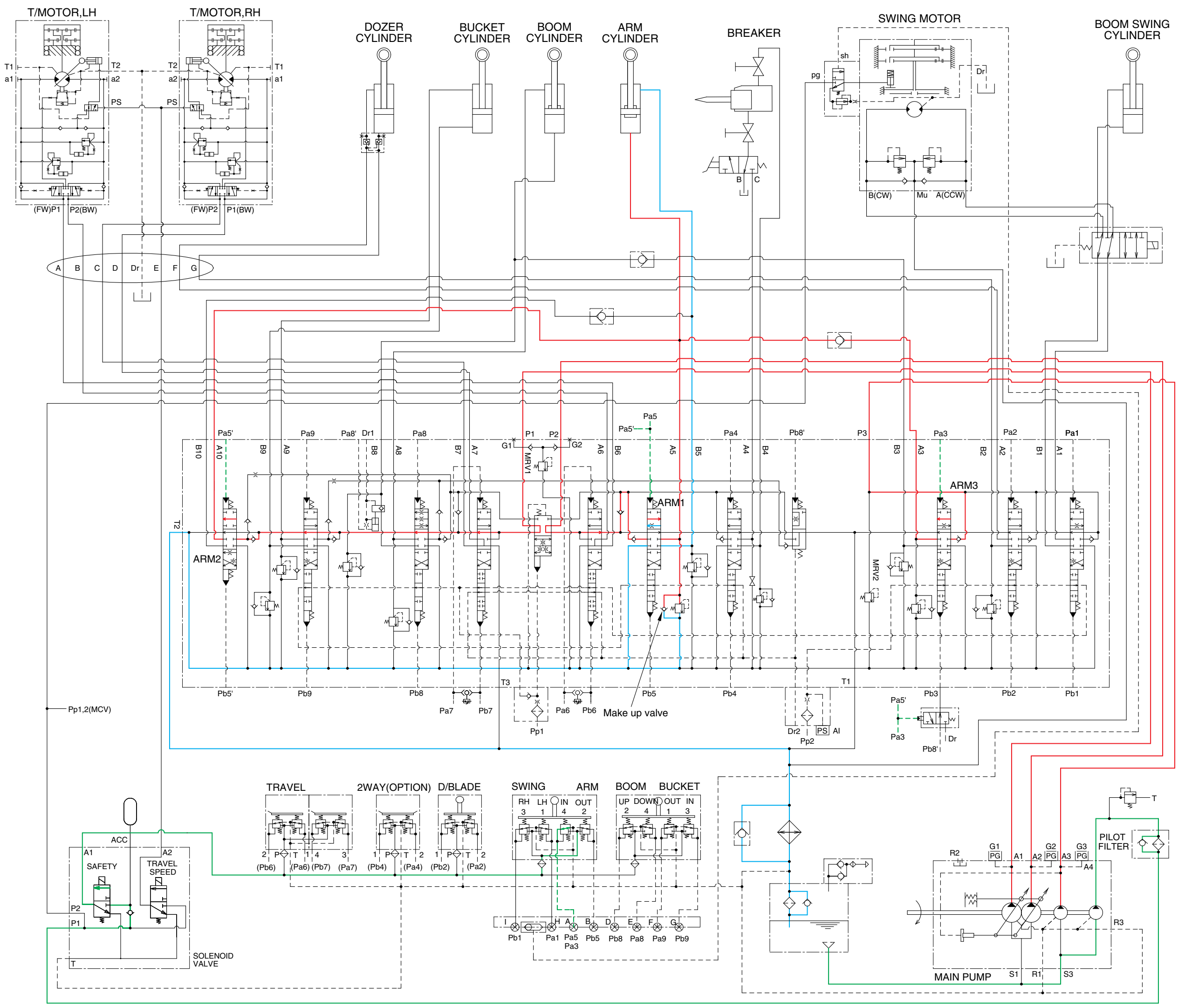
80CR93HC07

When the right control lever is pushed forward, the boom spools in the main control valve are moved to the down position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom spool in the main control valve.

The excessive pressure in the boom cylinder rod end circuit is prevented by the relief valve.

3. ARM ROLL IN OPERATION



80CR93HC08

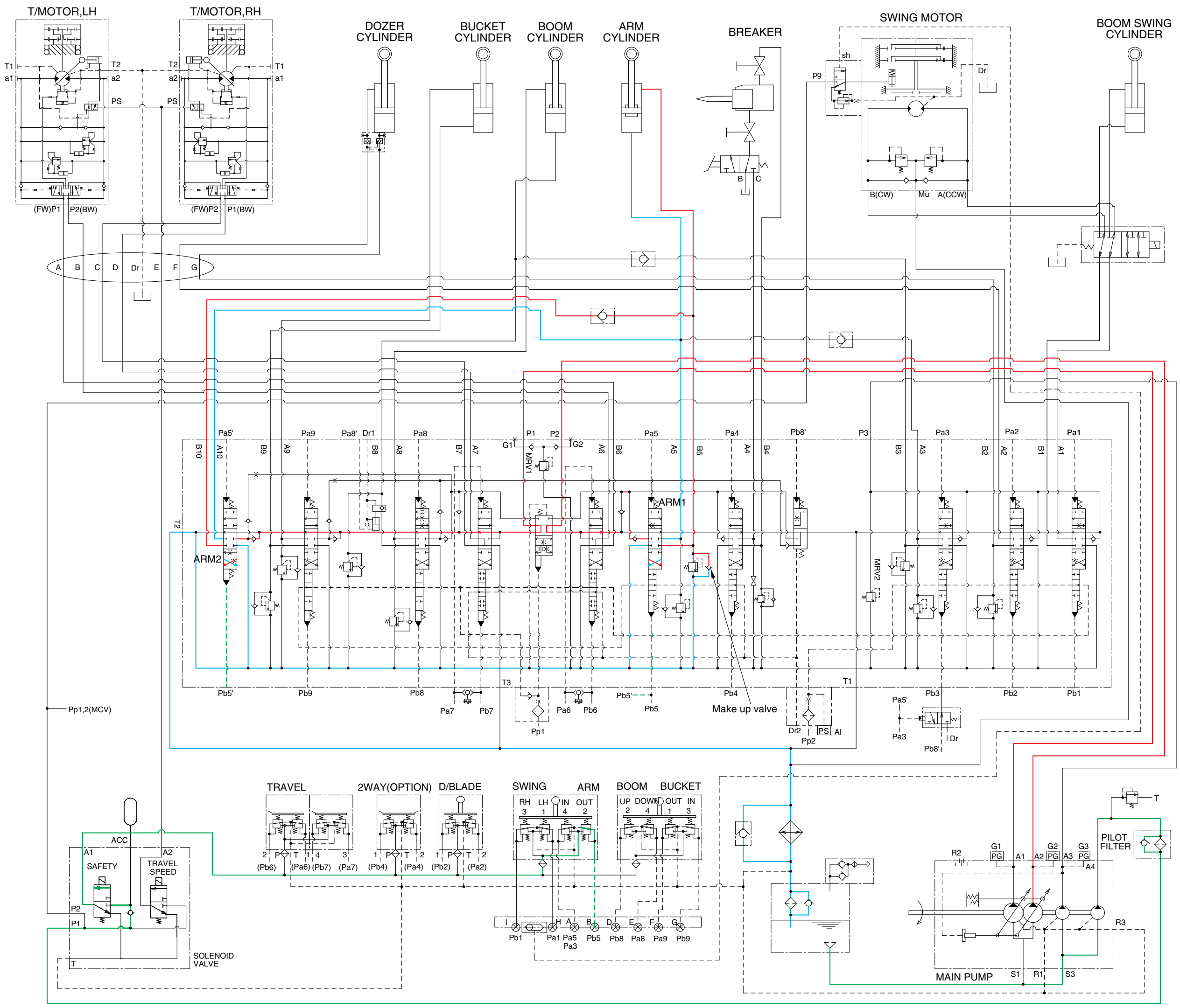
When the left control lever is pulled back, the arm spools in the main control valve are moved the to roll in position by the pilot oil pressure from the remote control valve.

The oil from the A1, A2 and A3 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm spool in the main control valve. When this happens, the arm rolls in.

The cavitation which will happen to the bottom of the arm cylinder is also prevented by the make-up valve in the main control valve.

4. ARM ROLL OUT OPERATION



80CR93HC09

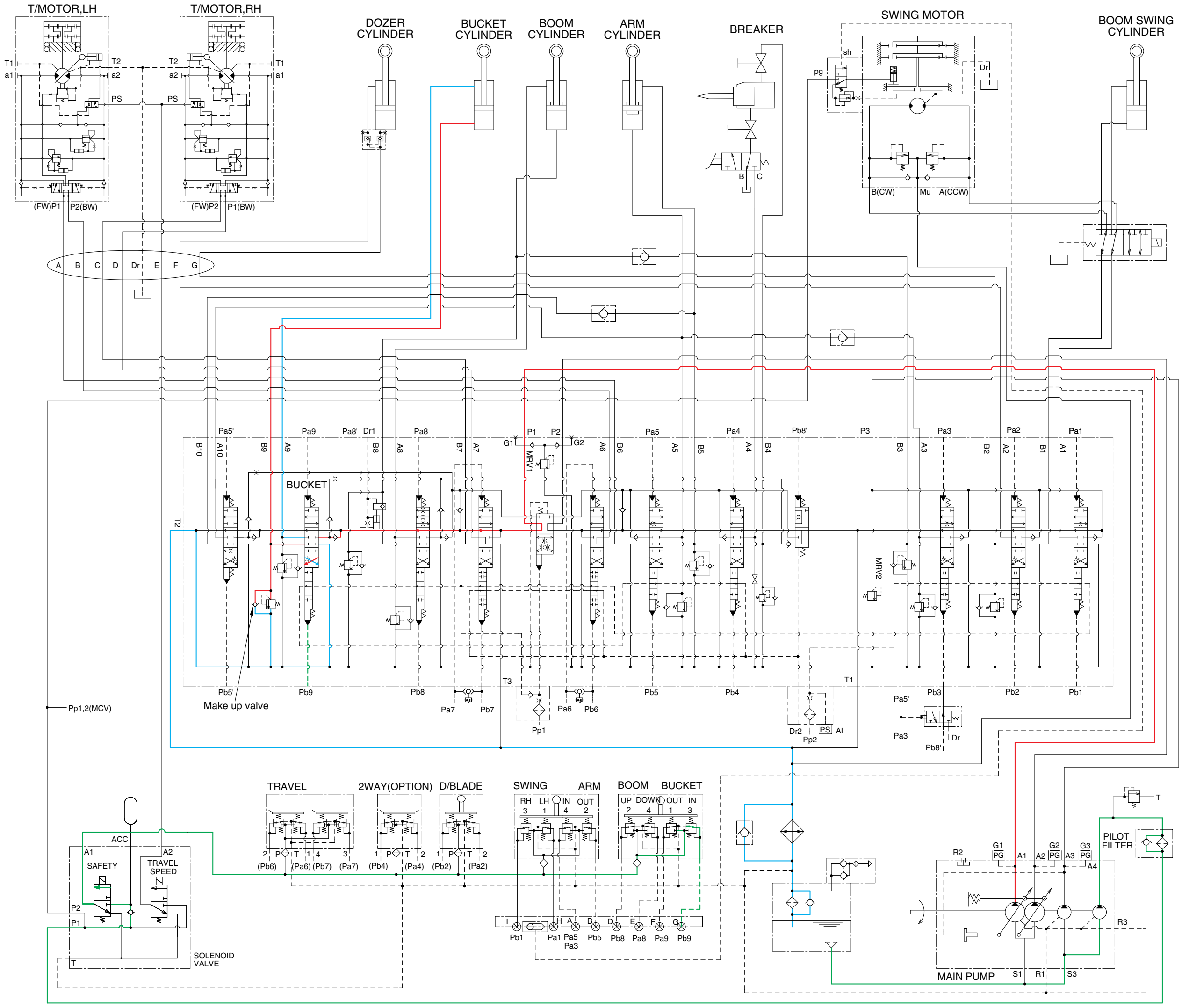
When the left control lever is pushed forward, the arm spool in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pump flows into the main control valve and then goes to the small chamber of arm cylinder.

At the same time, the oil from the large chamber of arm cylinder returns to the hydraulic oil tank through the arm spool in the main control valve. When this happens, the arm rolls out.

The cavitation which will happen to the rod of the arm cylinder is also prevented by the make-up valve in the main control valve.

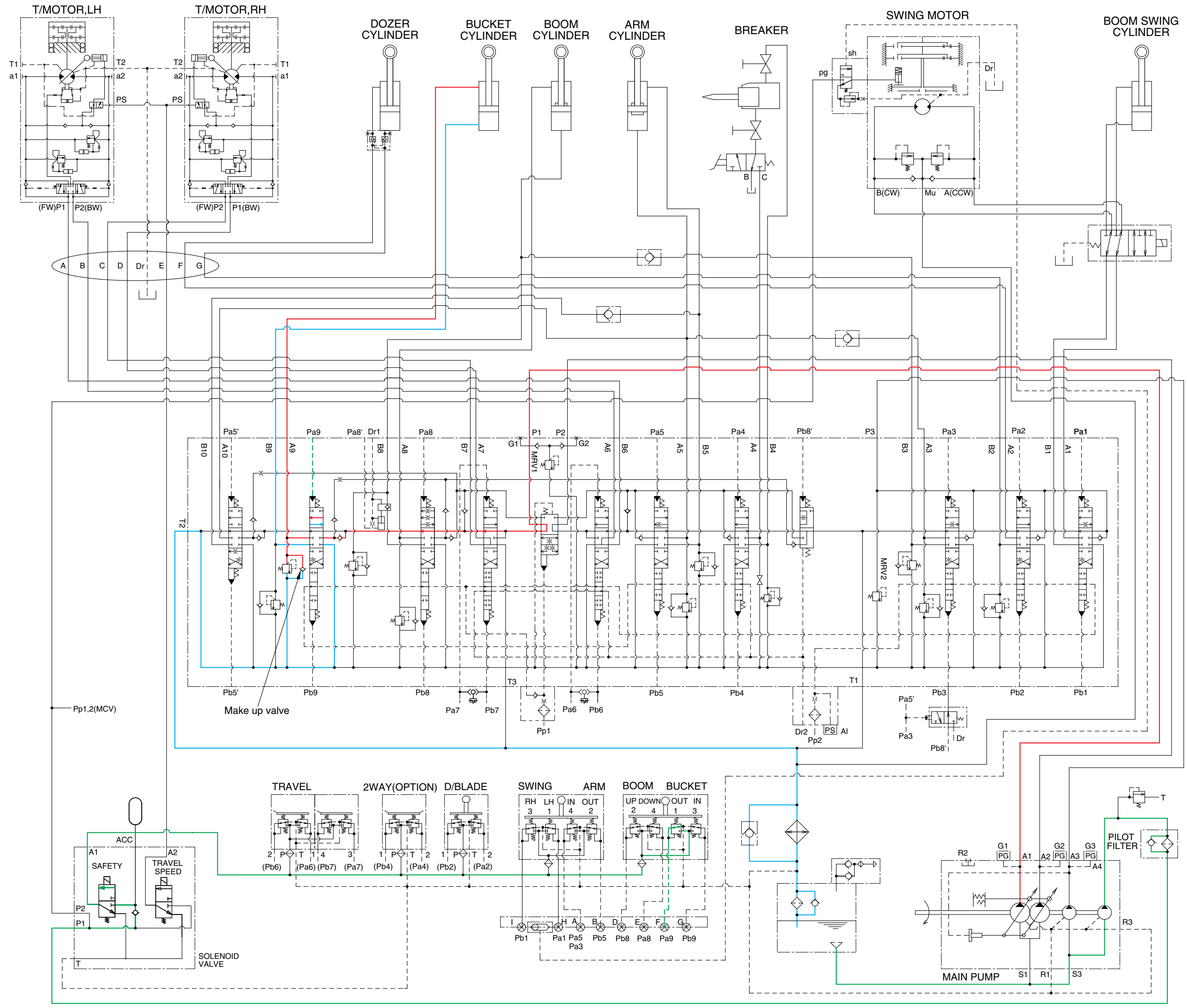
5. BUCKET ROLL IN OPERATION



80CR93HC10

When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.
The oil from the A1 pump flows into the main control valve and then goes to the large chamber of bucket cylinder.
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.
The cavitation which will happen to the bottom of the bucket cylinder is also prevented by the make-up valve in the main control valve.

6. BUCKET ROLL OUT OPERATION



80CR93HC11

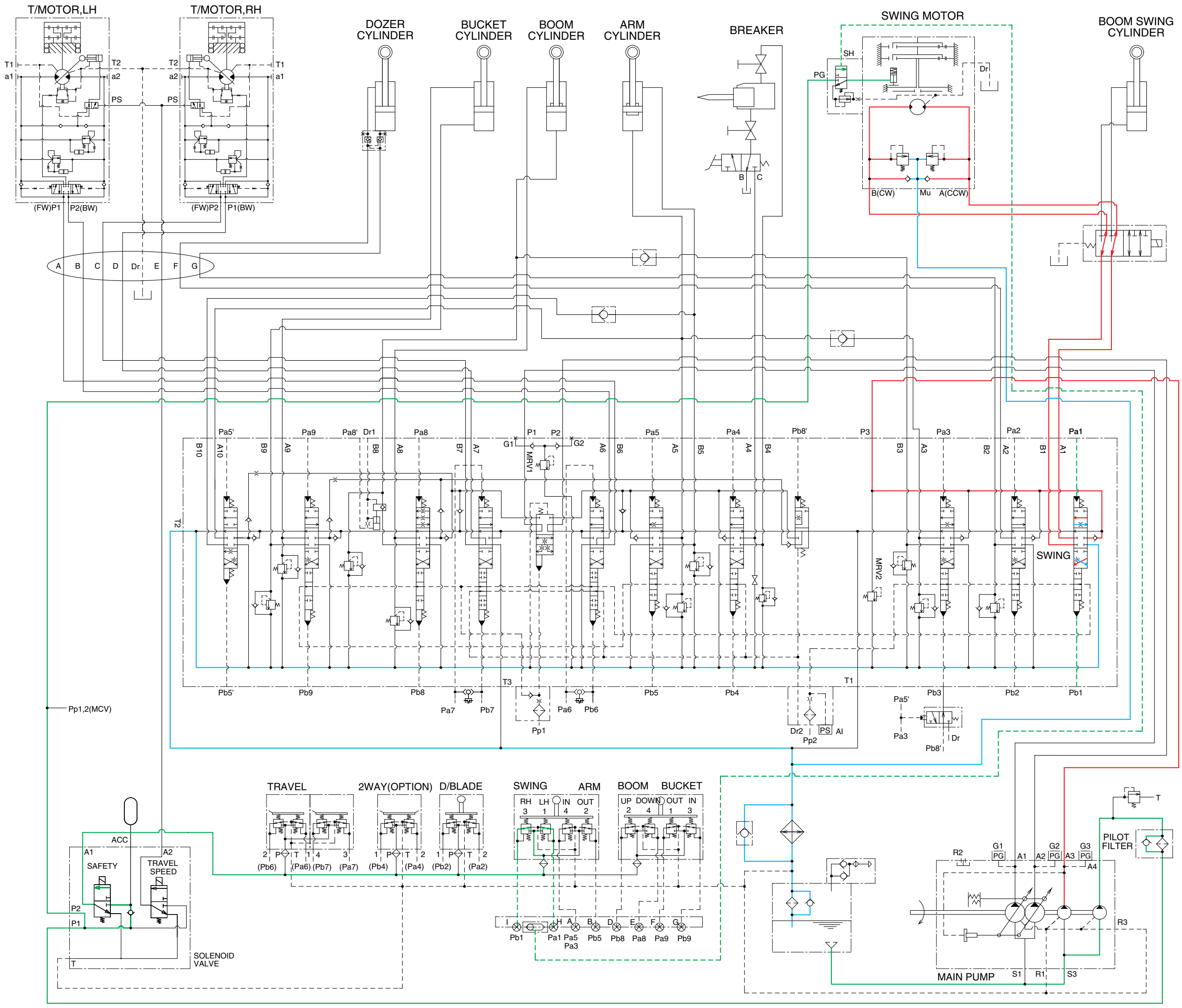
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

The cavitation which will happen to the rod of the bucket cylinder is also prevented by the make-up valve in the main control valve.

7. SWING OPERATION



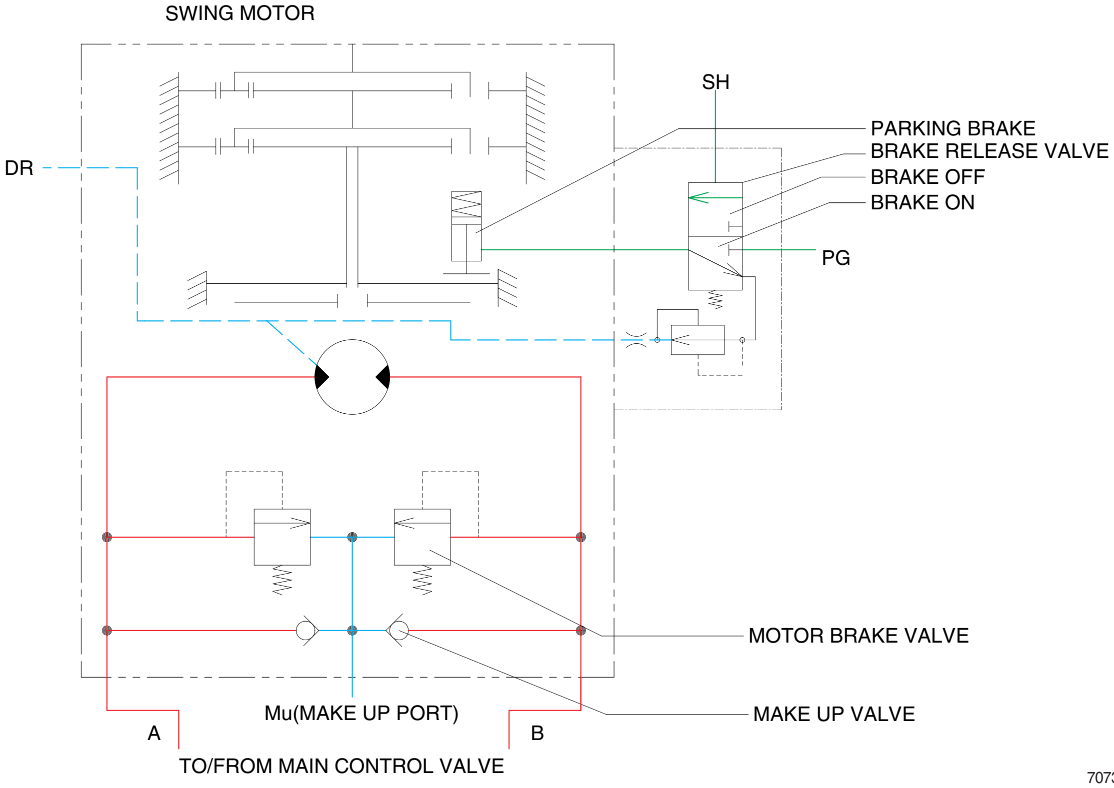
80CR93HC12

When the left control lever is pushed left or right, the swing spool in the main control valve is moved to the left or right swing position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the main control valve and then goes to the swing motor.

At the same time, the return oil from the swing motor returns to the hydraulic oil tank through the swing spool in the main control valve. When this happens, the superstructure swings to the left or right. The swing parking brake, make up valve and the overload relief valve are provided in the swing motors. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

SWING CIRCUIT OPERATION



7073HC30

1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation.

2) MAKE UP VALVE

The make up valves prevent cavitation by supplying return oil to the vacuum side of the motor.

3) PARKING BRAKE

In case that the parking, of the machine at slope is required during operation, there is the danger of involuntary swing caused by the self weight of the machine. The brake is connected to prevent this involuntary swing.

PARKING BRAKE "OFF" OPERATION

The parking brake is released by the pilot pressure oil from the pilot pump.

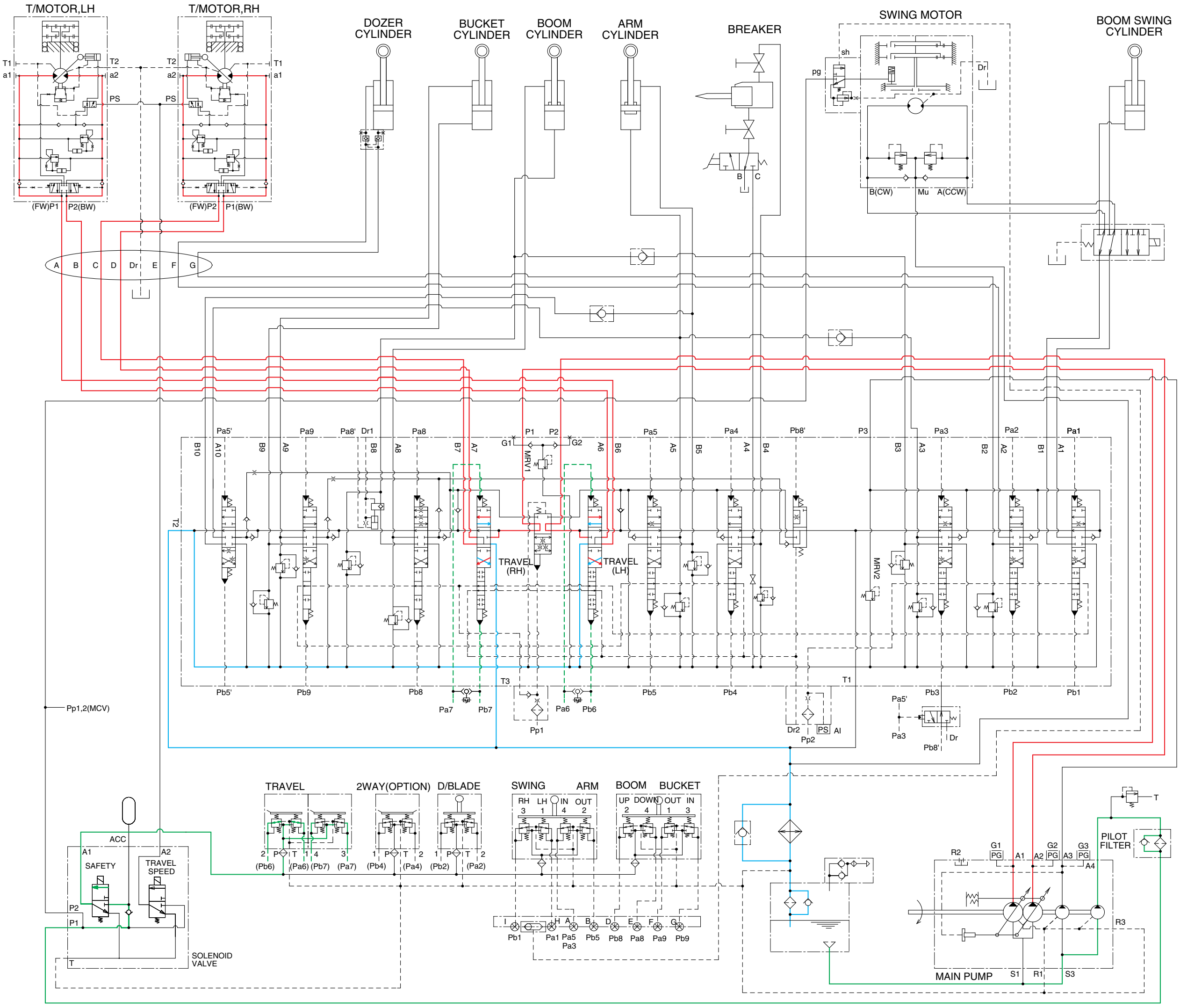
When the left control lever placed in the swing position, the pilot pressure at the shuttle valve is transferred to the brake release valve and the brake release valve is change over. Then the pilot pressure lift the brake piston and release the parking brake.

PARKING BRAKE "ON" OPERATION

When the control lever placed in the neutral position, the pressure of the pilot oil passage down.

Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the tank. And the brake is set to 'ON".

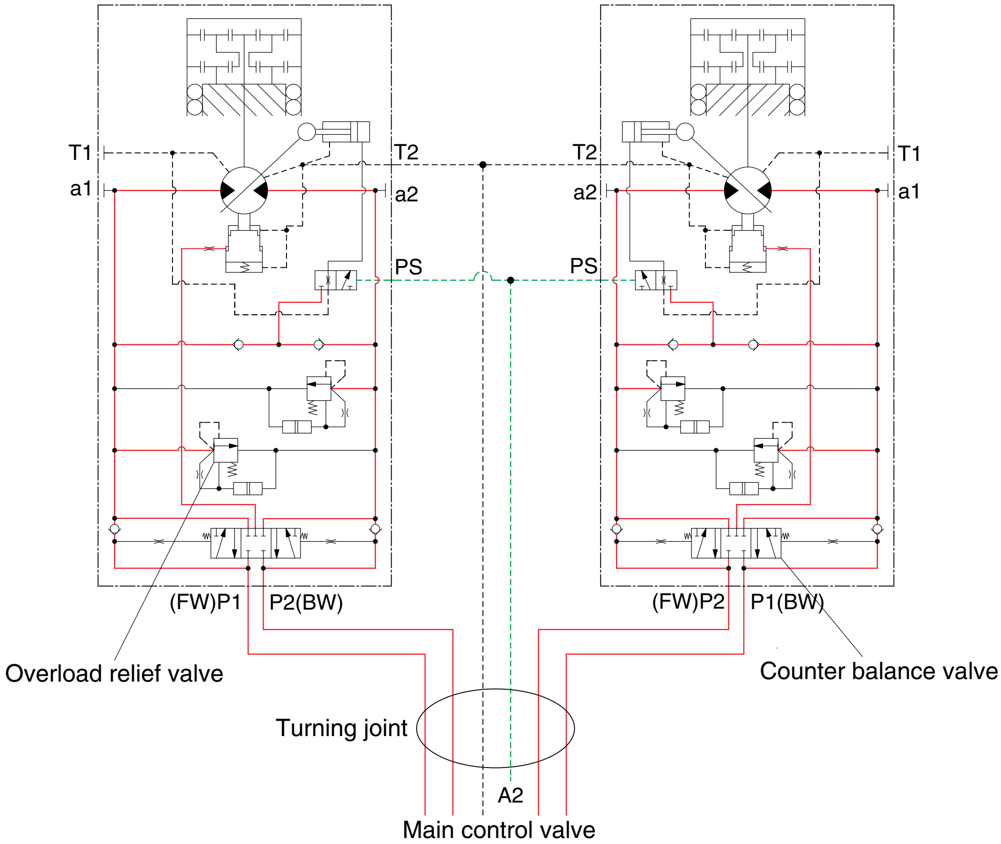
8. TRAVEL FORWARD AND REVERSE OPERATION



80CR93HC14

When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by the link. The oil from the both pumps (A1, A2) flows into the main control valve and then goes to the both travel motors through the turning joint. The return oil from both travel motors returns to the hydraulic oil tank through the turning joint and the travel spools in the main control valve. When this happens, the machine moves to the forward or reverse.

TRAVEL CIRCUIT OPERATION



80CR93HC15

Valves are provided on travel motors to offer the following functions.

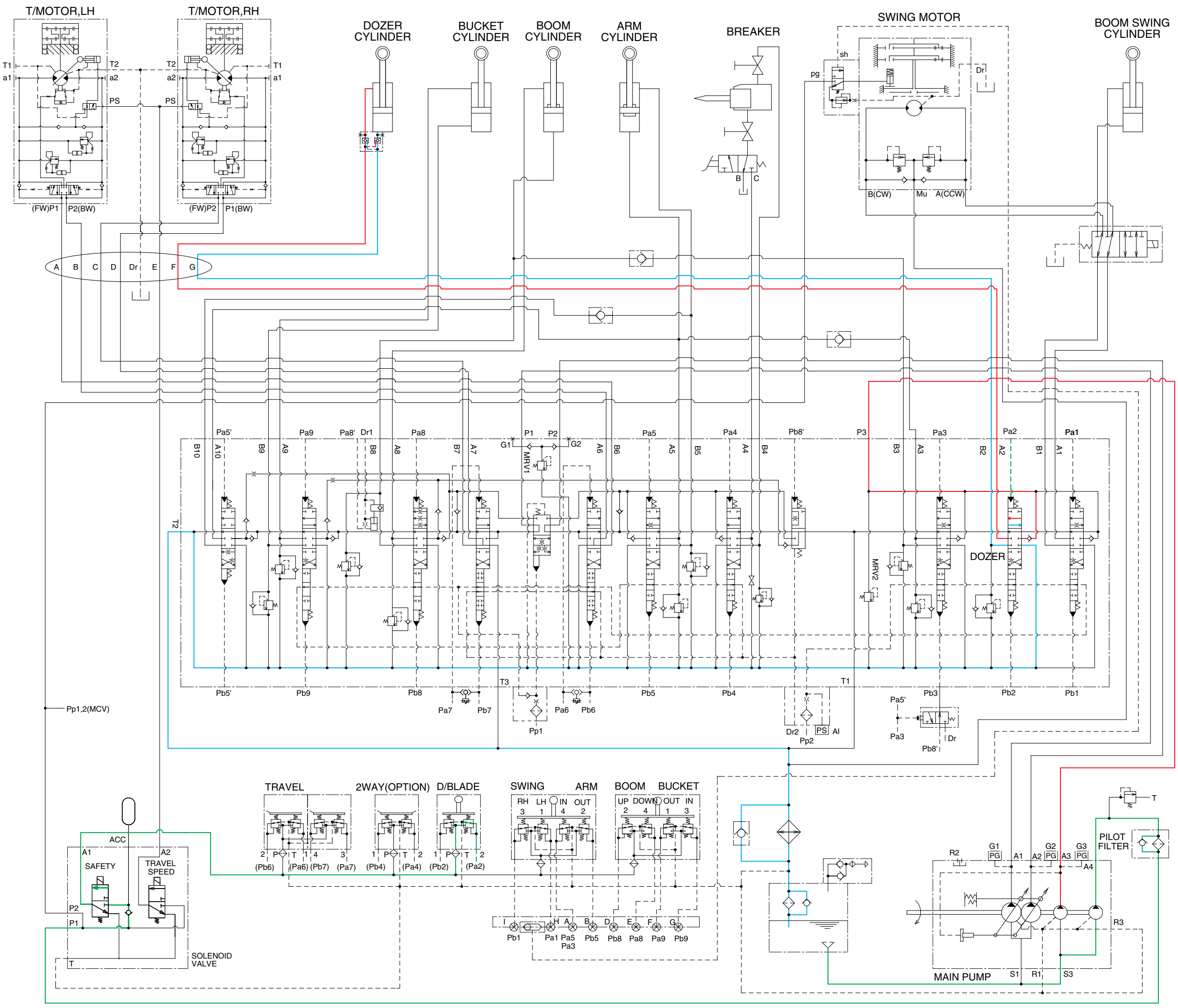
1) COUNTER BALANCE VALVE

When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 280 kgf/cm^2 to prevent high pressure generated at at time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

9. DOZER UP OPERATION



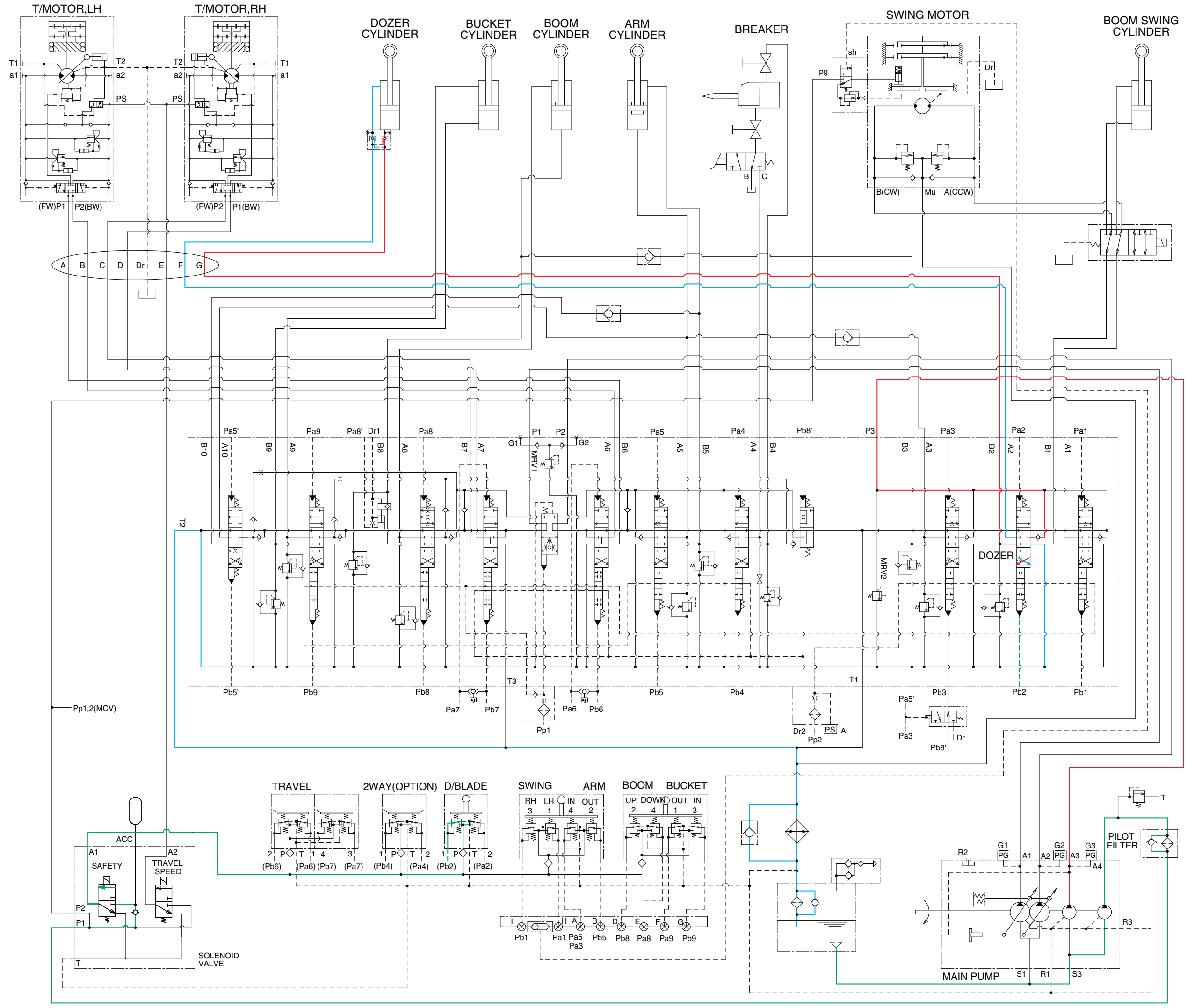
80CR93HC16

When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the main control valve and then goes to the small chamber of dozer cylinders.

At the same time, the oil from the large chamber of dozer cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer goes up.

10. DOZER DOWN OPERATION



80CR93HC17

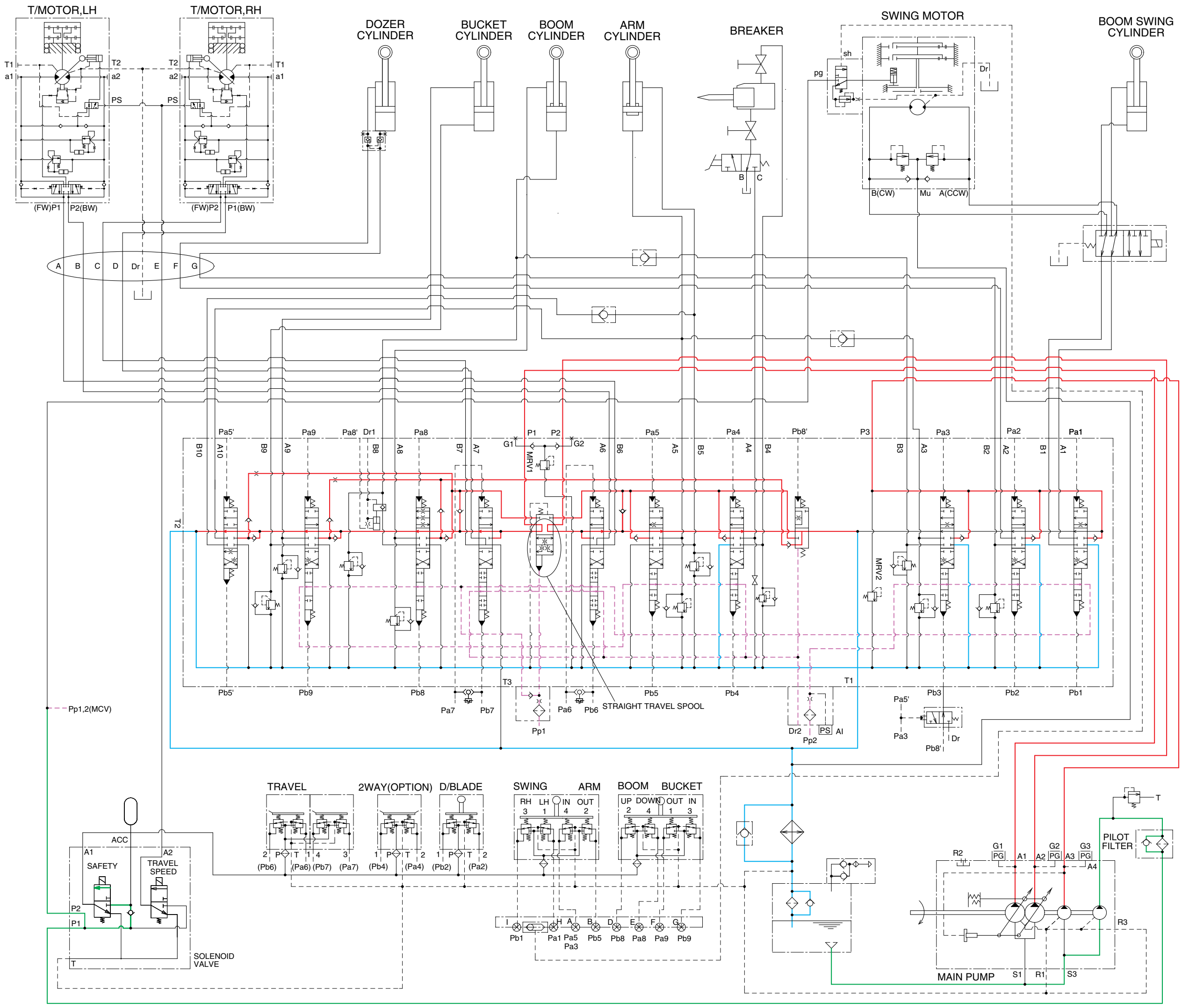
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the main control valve and then goes to the large chamber of dozer cylinders.

At the same time, the oil from the small chamber of dozer cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer blade is down.

GROUP 5 COMBINED OPERATION

1. OUTLINE



80CR93HC21

The oil from the A1, A2, A3 pump flows through the neutral oil passage, bypass oil passage and confluence oil passage in the main control valve. Then the oil goes to each actuator and operates them. Check valves and orifices are located on these oil passage in the main control valve. These control the oil from the main pumps so as to correspond to the operation of each actuator and smooth the combined operation.

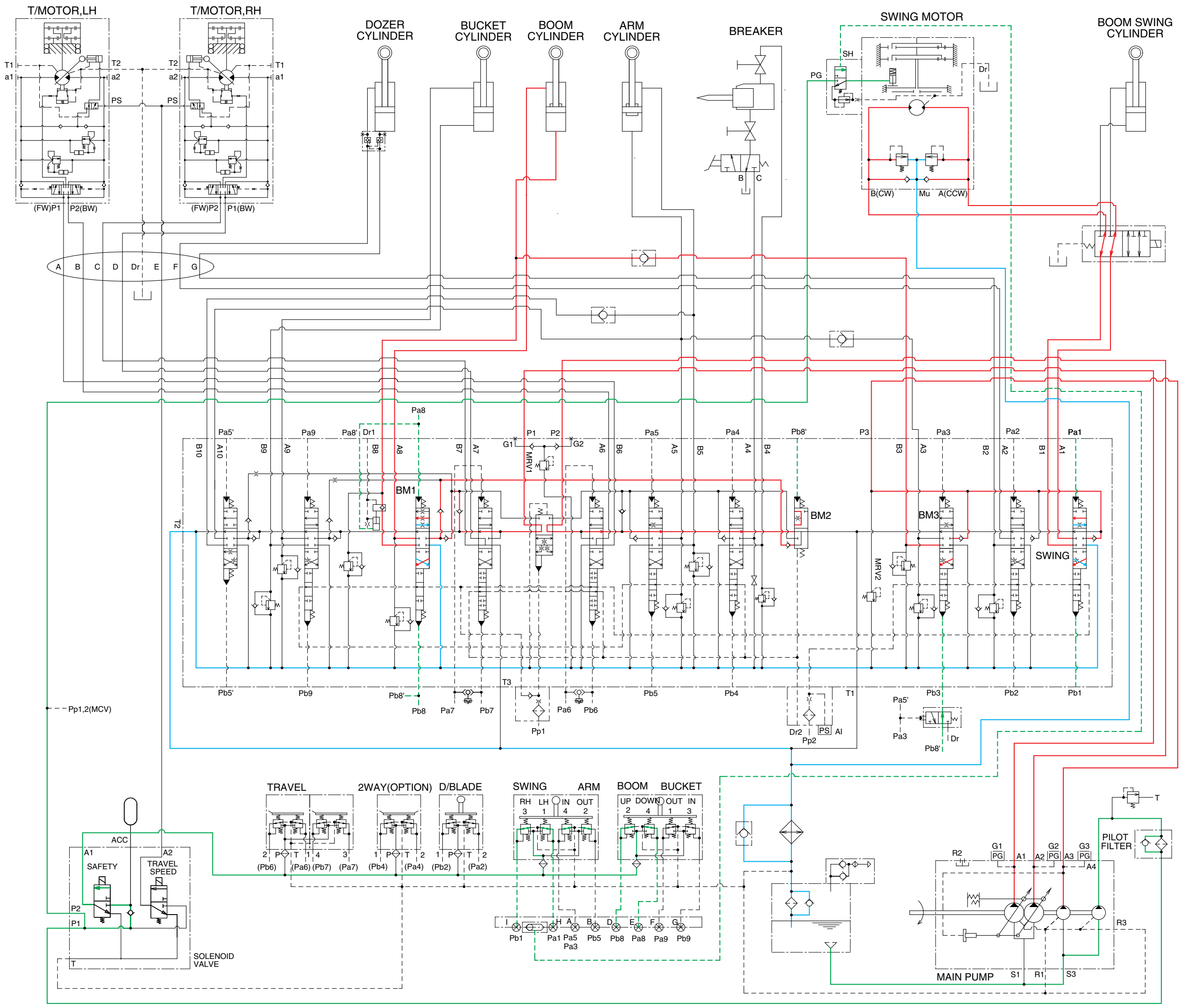
STRAIGHT TRAVEL SPOOL

This straight travel spool for straight travel is provided in the main control valve.

If any actuator is operated when traveling, the straight travel spool is pushed to the up by the pilot oil pressure.

Consequently, the left and right travel oil supply passage are connected, and equivalent amount of oil flows into the left and right travel motors. This keeps the straight travel.

2. COMBINED SWING AND BOOM OPERATION



80CR93HC22

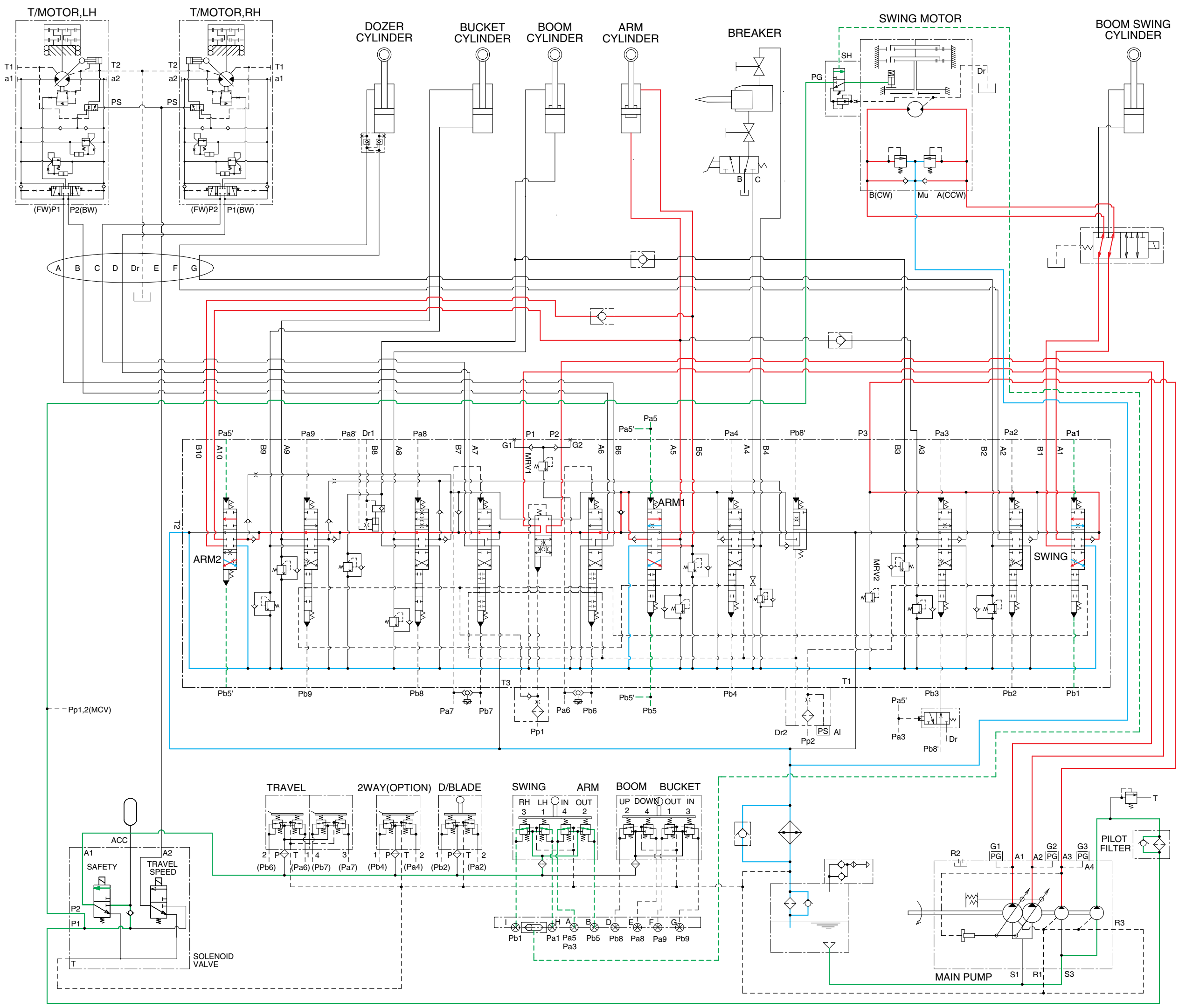
When the swing and boom functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1, A2 and A3 pump flows into the boom cylinder through boom 1, boom 2 and boom 3 spool.

The oil from the A3 pump flows into the swing motor through the swing spool.

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



80CR93HC23

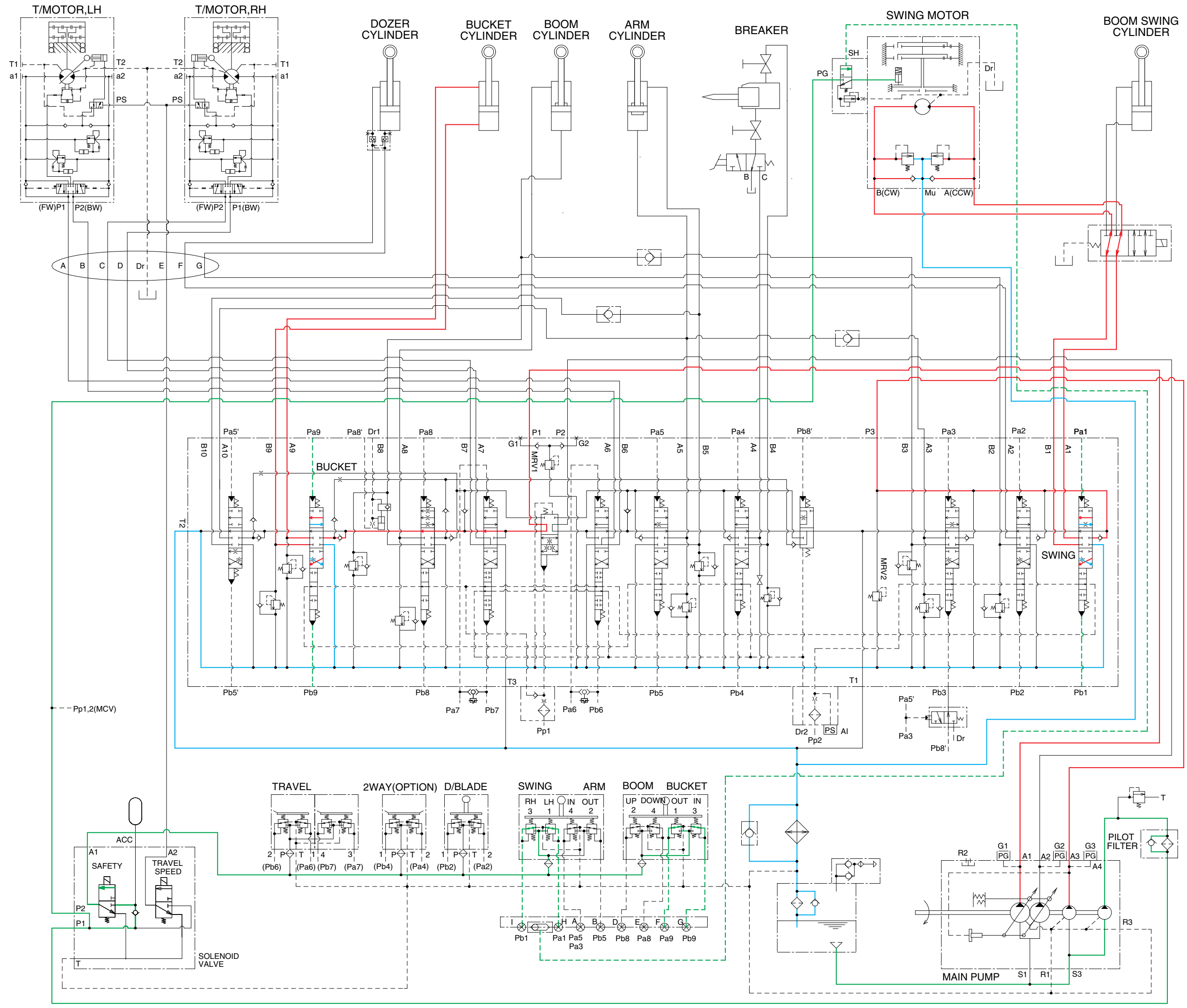
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the swing motor through swing spool.

The oil from the A1 and A2 pump flows into the arm cylinder through the arm and arm 2 spool.

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



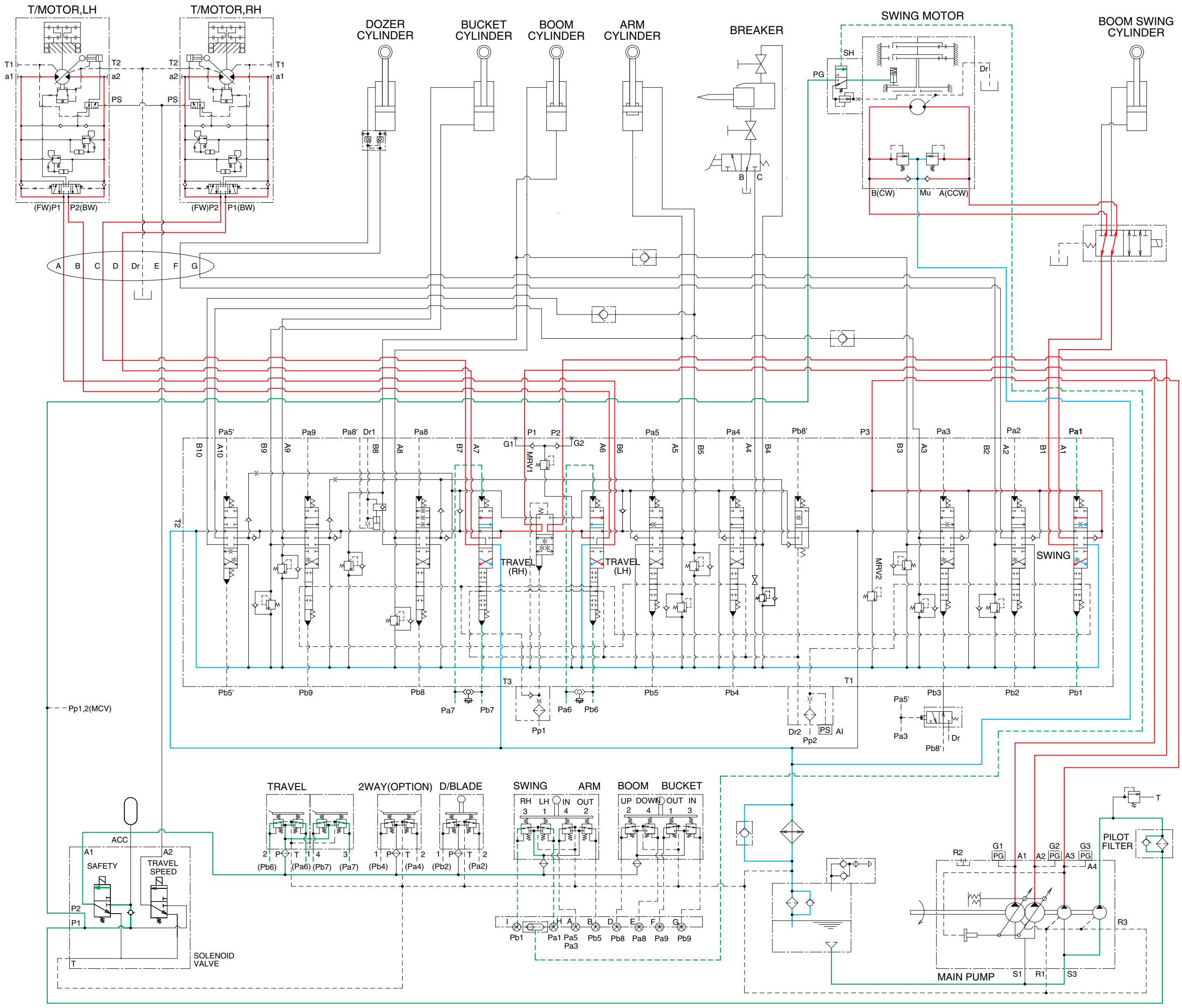
80CR93HC24

When the swing and bucket functions are operated, simultaneously the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the swing motor through the swing spool.

The oil from the A1 pump flows into the bucket cylinder through the bucket spool.

5. COMBINED SWING AND TRAVEL OPERATION



80CR93HC26

When the swing and travel functions are operated, simultaneously the swing spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the travel levers.

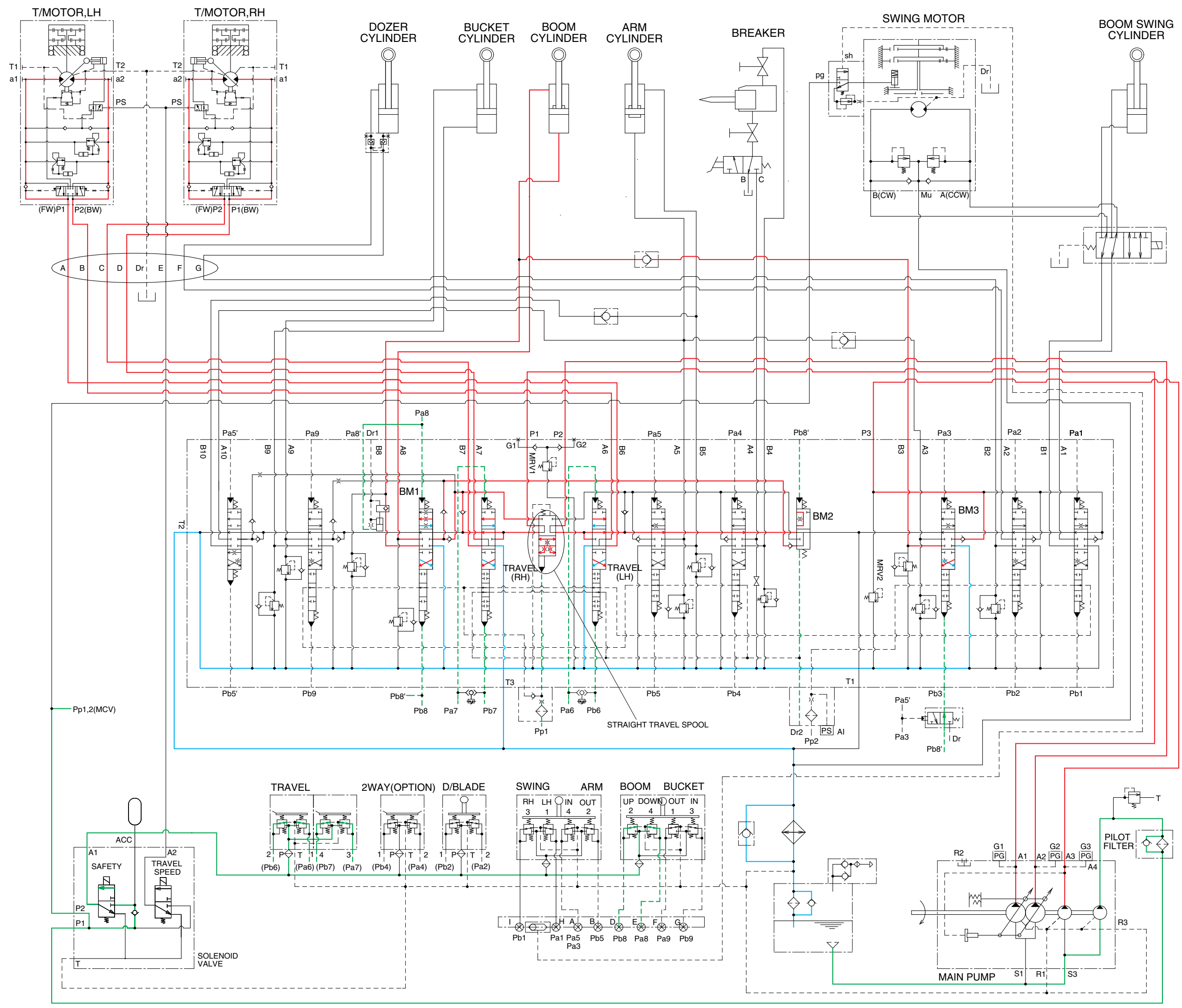
The oil from the A3 pump flows into the swing motor through the swing spool.

The oil from the A2 pump flows into the travel motor through the LH travel spool.

The oil from the A1 pump flows into the travel motor through RH travel spool.

The superstructure swings and the machine travels straight.

6. COMBINED BOOM AND TRAVEL OPERATION



80CR93HC27

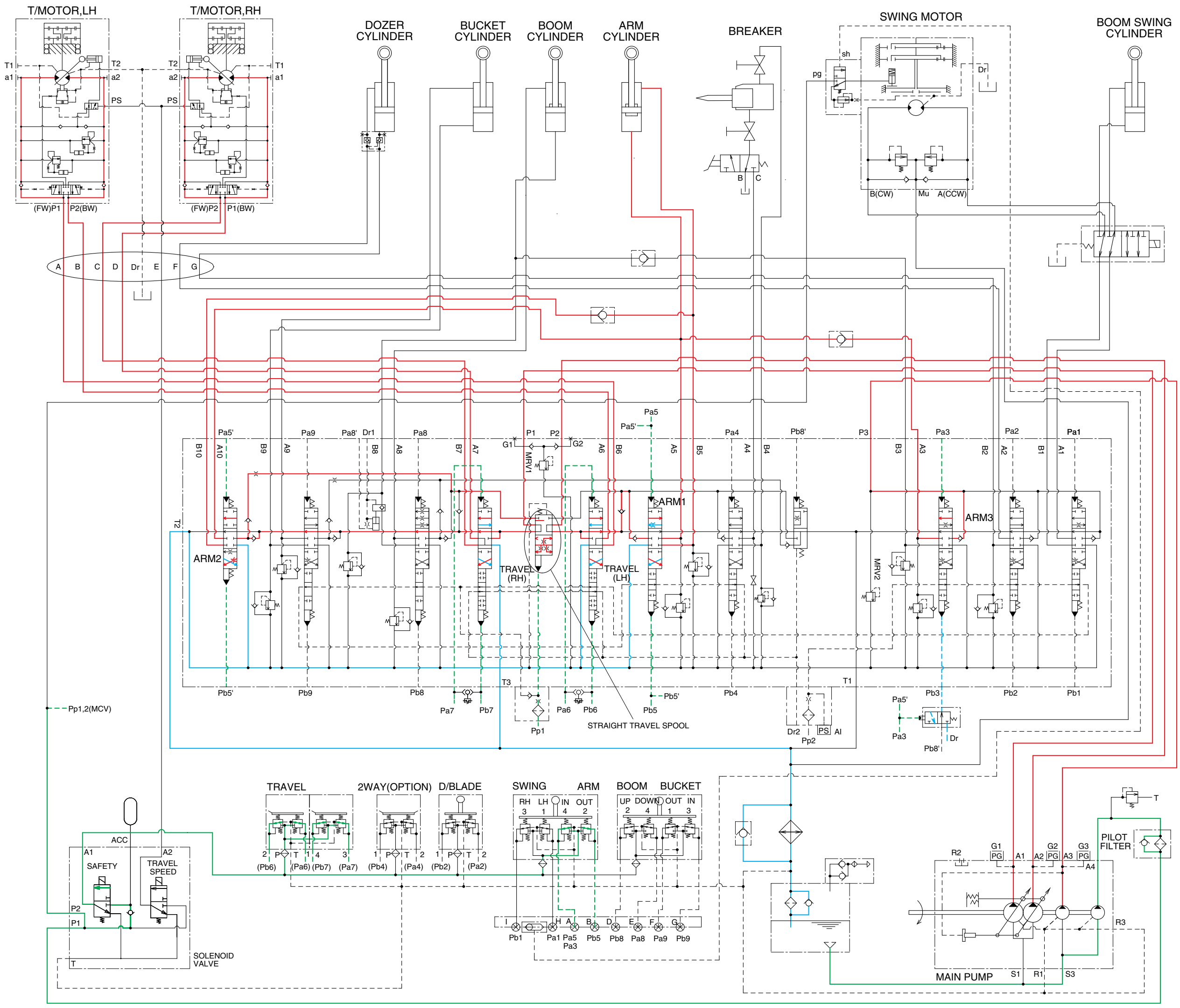
When the boom and travel functions are operated, simultaneously the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the straight travel spool is pushed to the up by the oil pressure from pilot pump.

The oil from the A1 and A2 pumps flows into the boom cylinders and the travel motors through boom 1, boom 2, travel LH and travel RH spools via the straight travel spool.

The A3 pump flows into the boom cylinder through boom 3 spool.

The boom is operated and the machine travels straight.

7. COMBINED ARM AND TRAVEL OPERATION



80CR93HC28

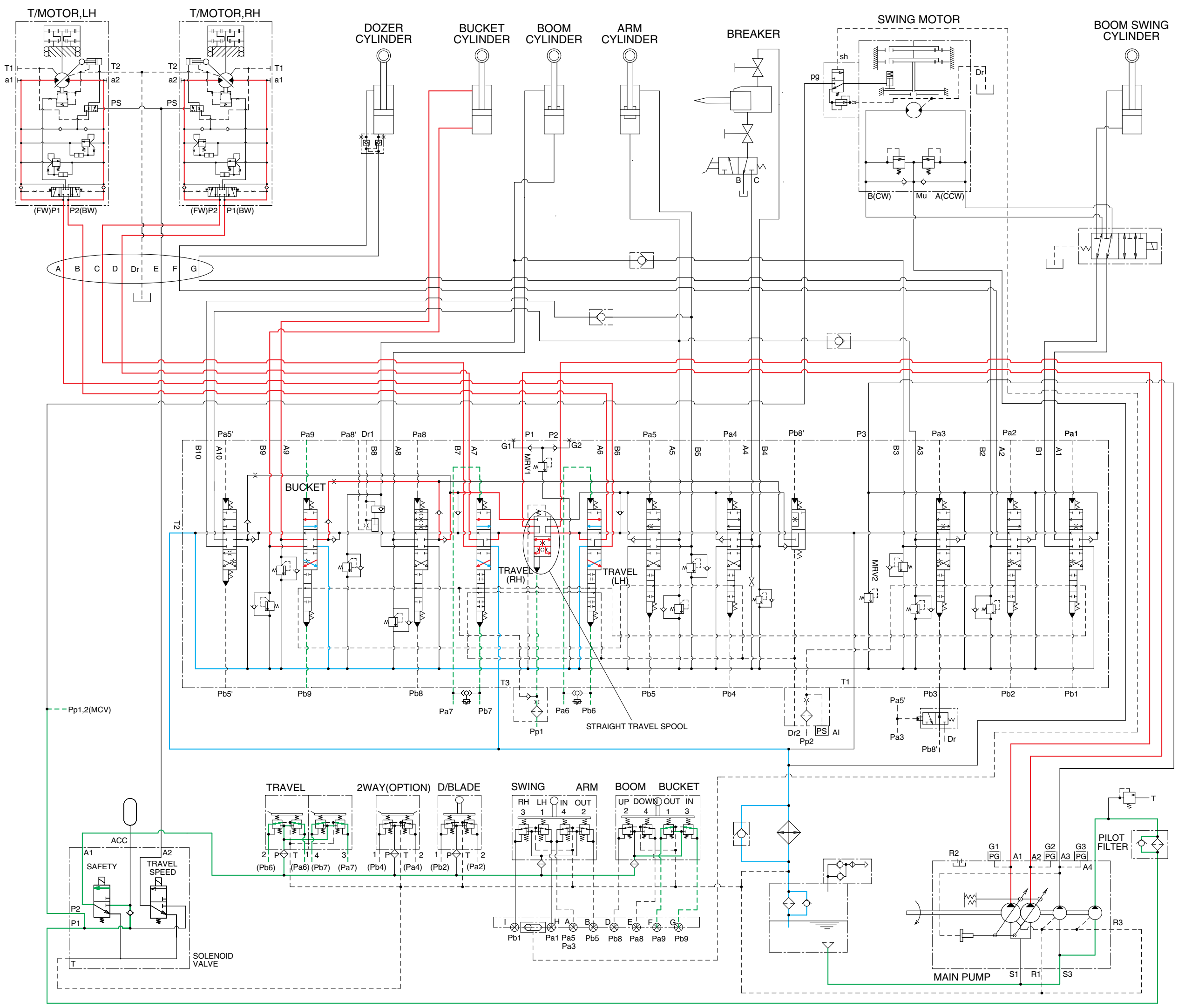
When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the straight travel spool is pushed to the up by the oil pressure from pilot pump.

The oil from the A1 and A2 pumps flows into the travel motors and the arm cylinder through travel spools and arm spools via the straight travel spool.

At the same time, the oil from the A3 pump flows into the arm cylinder through the arm 3 spool via the selector valve.

The arm is operated and the machine travels straight.

8. COMBINED BUCKET AND TRAVEL OPERATION



80CR93HC29

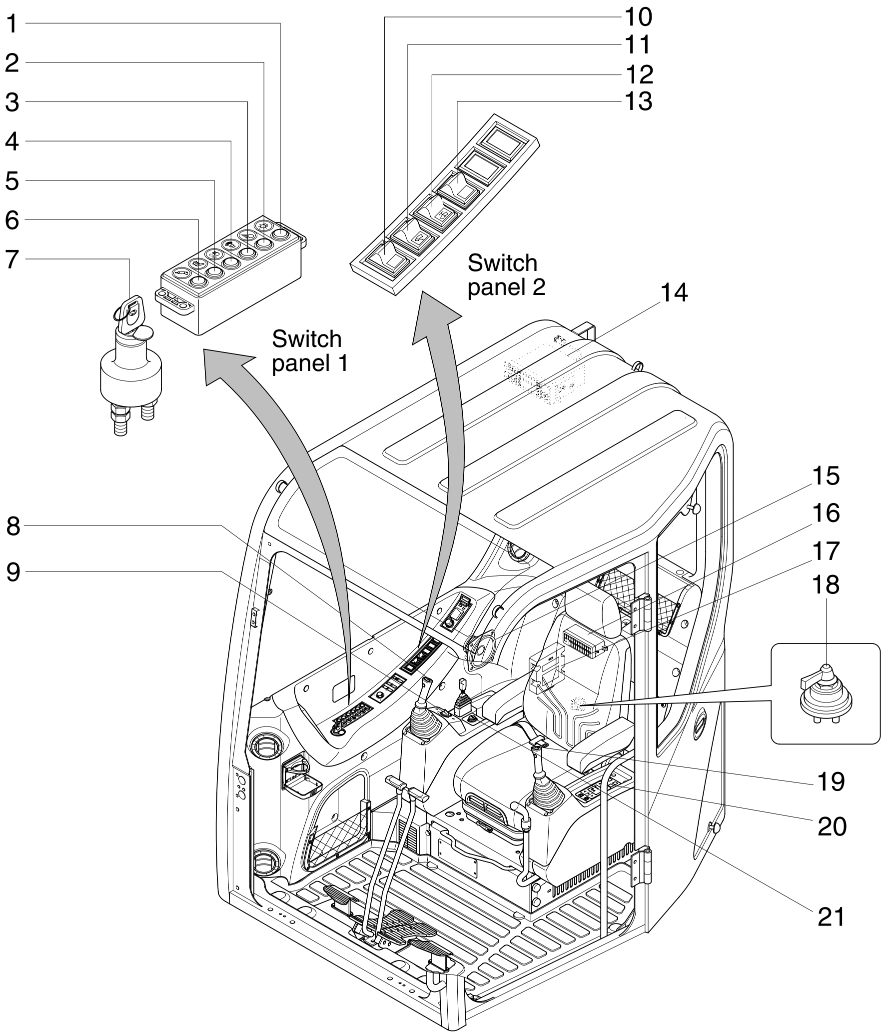
When the bucket and travel functions are operated, simultaneously the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve, and the straight travel spool is pushed to the up by the oil pressure from pilot pump. The oil from the A1 and A2 pumps flows into the travel motors and the bucket cylinder through the travel spools and the bucket spool via the straight travel spool.
The bucket is operated and the machine travels straight.

SECTION 4 ELECTRICAL SYSTEM

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

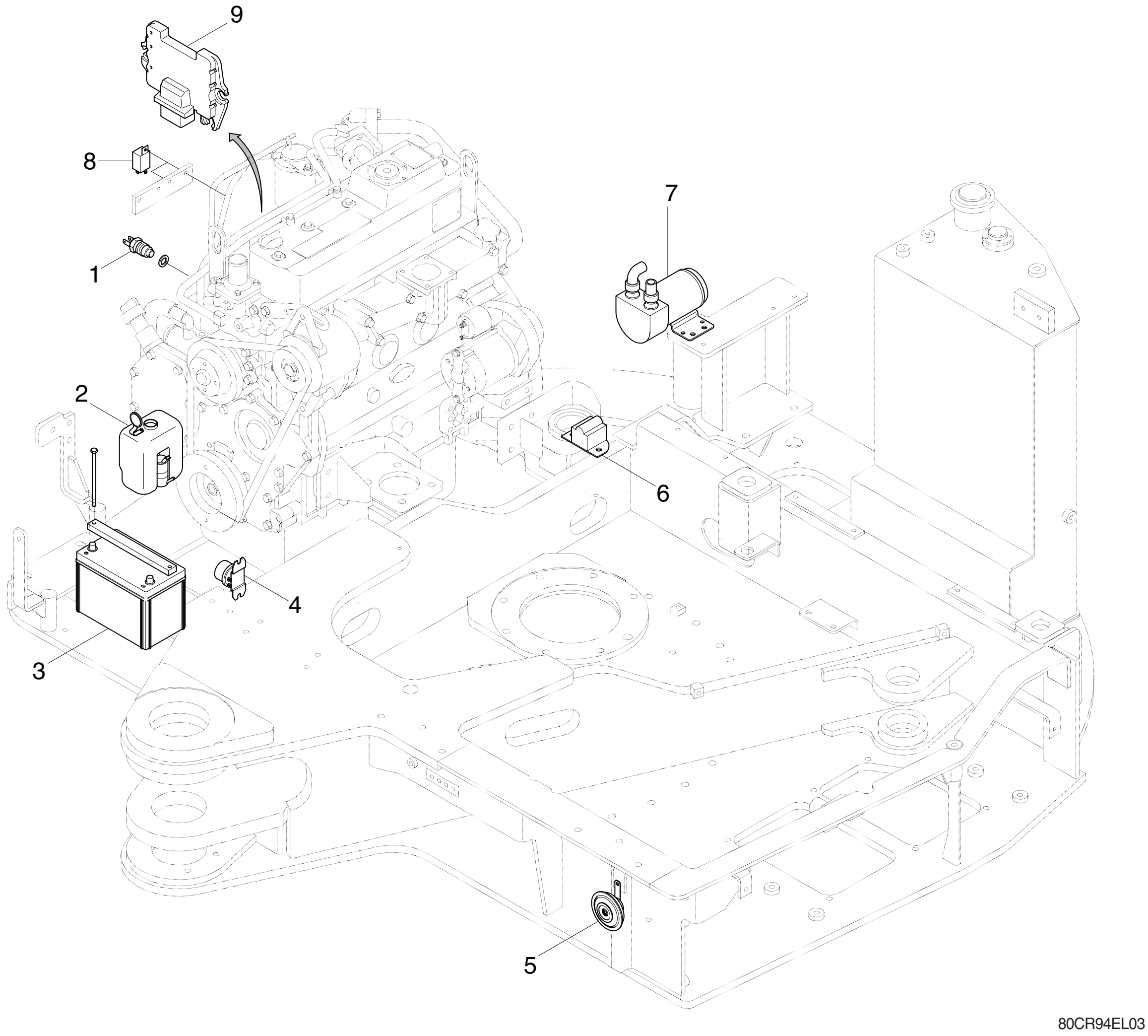
1. LOCATION 1



80CR94EL02

1	Head light switch	8	Breaker operation switch	15	Speaker
2	Work light switch	9	Accel dial switch	16	Fuse box
3	Travel alarm switch	10	Quick clamp switch	17	Machine control unit
4	Cab light switch	11	Wiper switch	18	Master switch
5	Beacon switch	12	Washer switch	19	Horn switch
6	Breaker selection switch	13	Boom offset switch	20	Aircon & heater controller
7	Start switch	14	Radio & MP3 player	21	Cigar lighter

2. LOCATION 2



1	Water temp sender	6	Back buzzer
2	Washer tank assy	7	Fuel filler pump
3	Battery	8	Power relay
4	Battery relay	9	Engine control module
5	Horn		

GROUP 2 MONITORING SYSTEM

1. OUTLINE

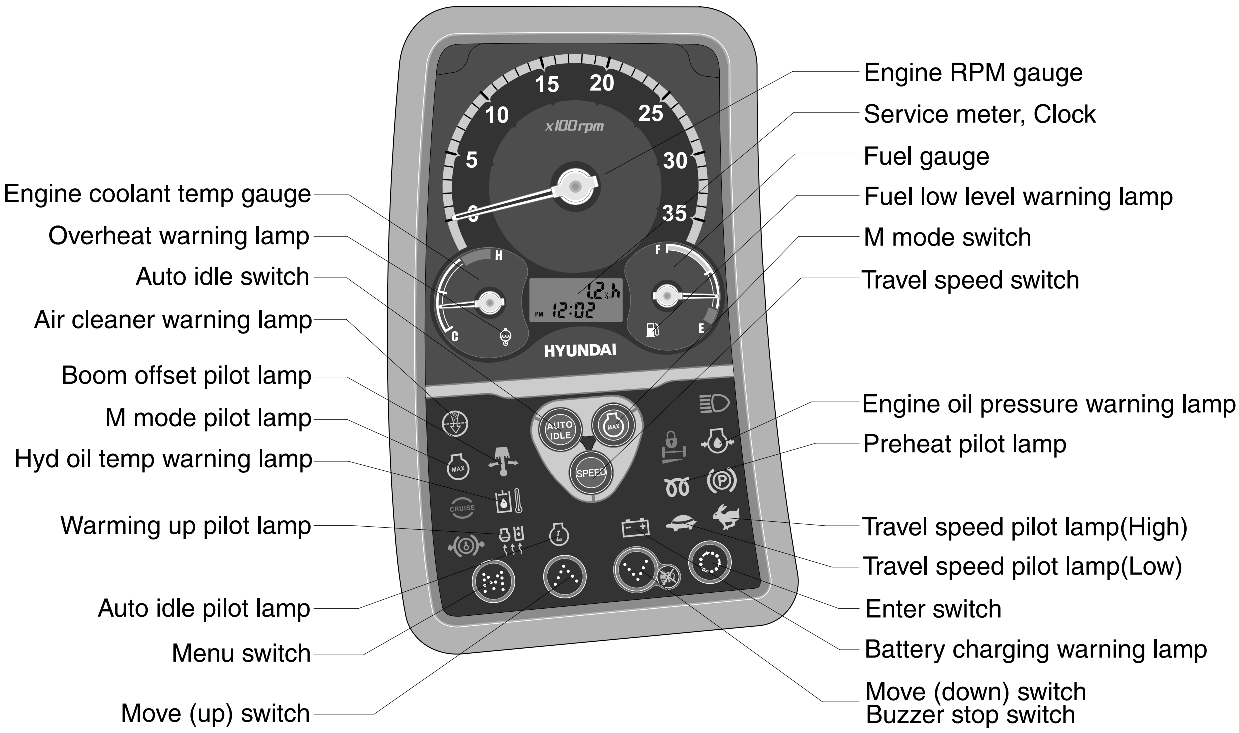
Monitoring system consists of the monitor part and switch part.

The monitor part gives warnings when any abnormality occurs in the machine and informs the condition of the machine.

Various select switches are built into the monitor panel, which act as the control portion of the machine control system.

2. CLUSTER

1) MONITOR PANEL



5593CD02

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor initial 6 seconds

a. All lamps light up.

b. Buzzer sound.

② Check monitor after 3 seconds : Indicate machine condition

a. Tachometer : 0 rpm

b. Fuel gauge : Pointed at appropriate level

c. Engine coolant temperature gauge : Pointed at appropriate level

d. Warning lamp

※ During start key ON the engine oil pressure lamp and battery charging lamp go on, but it is not abnormal.

※ When engine coolant temperature below 30˚C, the warming up lamp lights up and then operating the preheat switch.

(2) Start of engine

① Check machine condition

a. Tachometer pointed at present rpm

b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF

c. Travel speed pilot lamp : Low (turtle)

② When abnormal condition

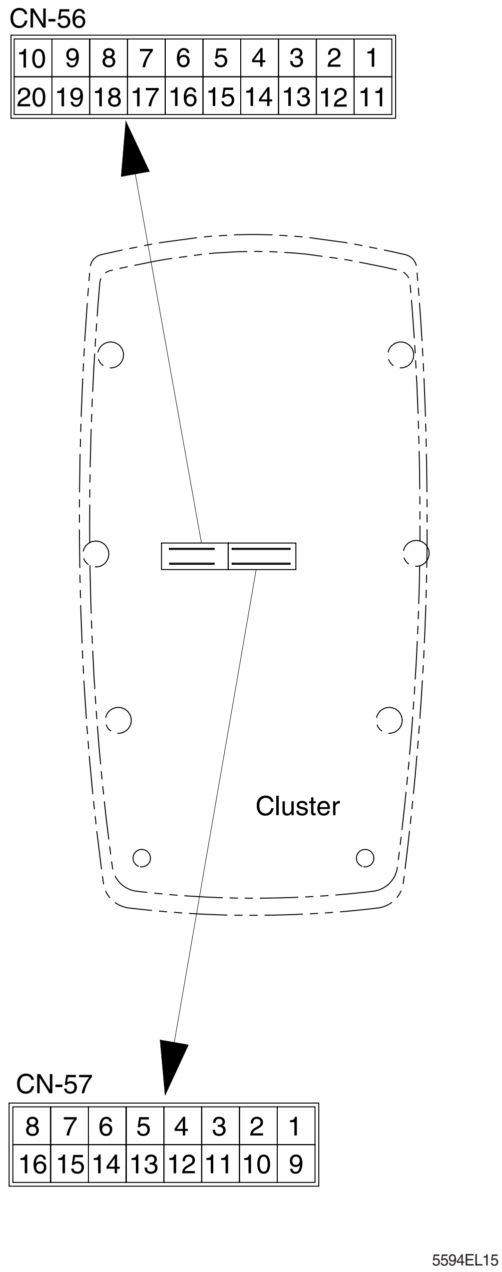
a. The lamp lights up and the buzzer sounds.

b. If BUZZER STOP switch is pressed, buzzer sound is canceled but the lamp light up until normal condition.

3. CLUSTER CONNECTOR

1) CN-56 CONNECTOR

No.	Signal	Input/ Output
1	Null	-
2	Null	-
3	Alternator signal	Input
4	Over heat signal	Input
5	Tacho signal	Input
6	Null	-
7	Null	-
8	Travel relay	Output
9	Power 12V	-
10	Power IG 12V	-
11	Null	-
12	Illumination	Input
13	Null	-
14	Null	-
15	Fuel level sender	Input
16	Hyd oil temp sendor	Input
17	Water temp sender	Input
18	GND	-
19	GND	-
20	GND	-



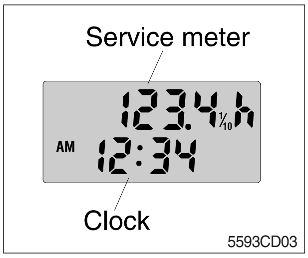
2) CN-57 CONNECTOR

No.	Signal	Input/ Output
1	Null	-
2	Engine oil pressure switch	Input
3	Air cleaner signal	-
4	Boom swing signal	-
5	Null	-
6	Null	-
7	Null	-
8	Null	-
9	Program dump	-
10	Null	-
11	COM-GND	Input
12	RS232-RX	Input
13	RS232-TX	Output
14	RS485-RX	Input
15	RS485-TX	Output
16	Pre heat signal	Input

4. CLUSTER FUNCTION

1) GAUGES AND DISPLAYS

(1) LCD display



① **Service meter** : This meter shows the total operation hours of the machine.

※ Always ensure the operating condition of the meter during the machine operation.

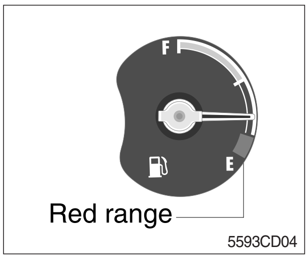
※ The last unit 4 1/10 indicates 1/10 of 4 hours.

(for example : 1 1/10 indicates 6 minutes)

② **Clock** : This displays the current time.

※ Refer to the "menu switch" for the setting time/ESL switch.

(2) Fuel gauge

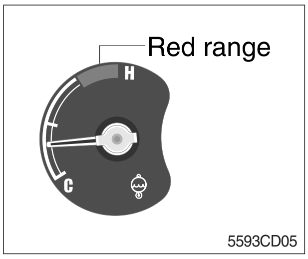


① This gauge indicates the amount of fuel in the fuel tank.

② Fill the fuel when the red range or warning lamp blinks.

※ **If the gauge indicate the red range or warning lamp ON. Even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

(3) Engine coolant temperature gauge

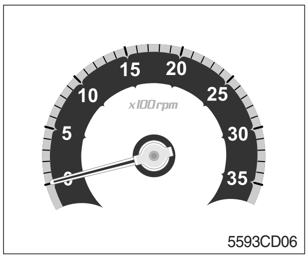


① This indicates the temperature of coolant.

② When the red range pointed or warning lamp blinks, engine do not abruptly stop but run it at medium speed to allow it to cool gradually, then stop it.
Check the radiator and engine.

※ **If the engine is stopped without cooled down running, the temperature of engine parts will rise suddenly, this could cause severe engine trouble.**

(4) Engine rpm gauge



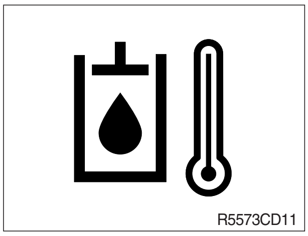
① This gauge displays the number of engine revolutions per minute.

2) WARNING AND PILOT LAMPS

(1) Fuel low level warning lamp

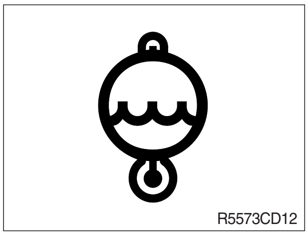
① This lamp blinks and the buzzer sounds when the level of fuel is below 17 ℓ (4.5 U.S. gal).
② Fill the fuel immediately when the lamp blinks.

(2) Hydraulic oil temperature warning lamp



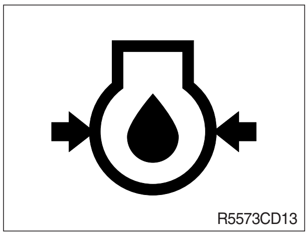
① This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 105˚C (221˚F).
② Check the hydraulic oil level when the lamp blinks.
③ Check for debris between oil cooler and radiator.

(3) Overheat warning lamp



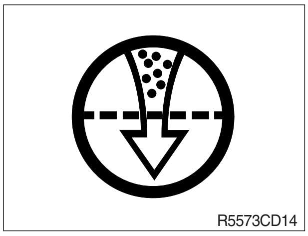
① This lamp blinks and the buzzer sounds when the temperature of coolant is over the normal temperature 110˚C (230˚F).
② Check the cooling system when the lamp blinks.

(4) Engine oil pressure warning lamp



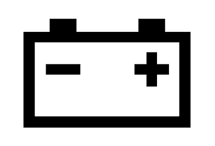
① This lamp blinks and the buzzer sounds after starting the engine because of the low oil pressure.
② If the lamp blinks during engine operation, shut OFF engine immediately. Check oil level.

(5) Air cleaner warning lamp



① This lamp blinks and the buzzer sounds when the filter of air cleaner is clogged.
② Check the filter and clean or replace it.

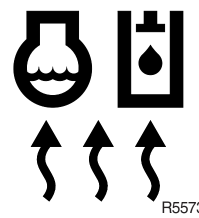
(6) Battery charging warning lamp



R5573CD16

① This lamp blinks and the buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
② Check the battery charging circuit when this lamp blinks during engine operation.

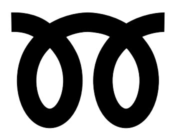
(7) Warming up pilot lamp



R5573CD18

① This lamp is turned ON when the coolant temperature is below 30˚C (86˚F).
② The automatic warming up is cancelled when the engine coolant temperature is above 30˚C, or when 10 minutes have passed since starting.

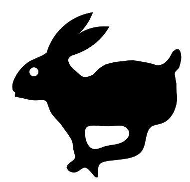
(8) Preheat pilot lamp



R5573CD19

① When engine preheating switch is turned ON, pilot lamp cames ON.
② Refer to the preheating switch for details.

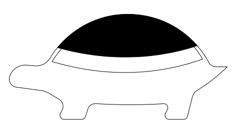
(9) Travel speed pilot lamp (high)



R5573CD20

① When this lamp turned ON, the machine travel high speed.
② Refer to the travel speed select switch for details.

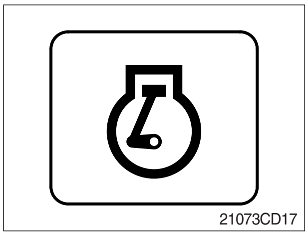
(10) Travel speed pilot lamp (low)



R5573CD21

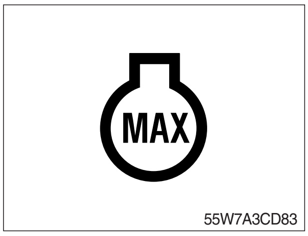
① When this lamp turned ON, the machine travel low speed.
② Refer to the travel speed select switch for details.

(11) Auto idel pilot lamp



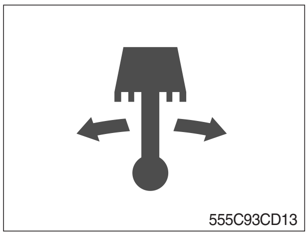
① If the control lever and pedal are not moved for several seconds with auto idle switch pressed, the indicator illuminates and engine speed is decelerated.
② If the auto idle switch is pressed once more or the control lever or pedal is moved, the indicator turns off and the number of engine revolution is turned to the previous condition.

(12) M mode pilot lamp



① This lamp is ON when the M mode switch is pressed.
② Engine is operated with a maximum speed.

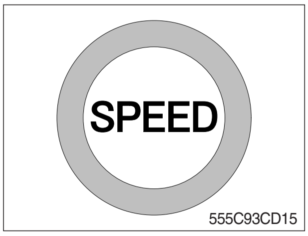
(13) Boom offset pilot lamp



① This lamp is ON when the boom offset switch is pressed.

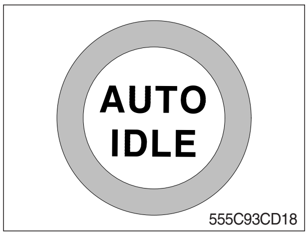
3) SWITCHES

(1) Travel speed control switch



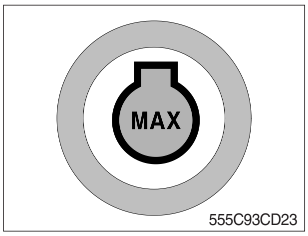
① This switch is to control the travel speed which is changed to high speed (rabbit mark) by pressing the switch and low speed (turtle mark) by pressing it again.

(2) Auto idle switch



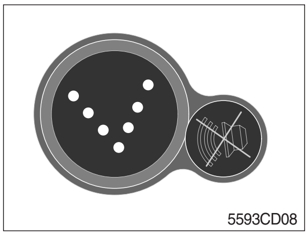
① This switch is used to actuate or cancel the auto idle function.
② When the switch actuated and all control levers and pedals are at neutral position, engine speed will be lowered automatically to save fuel consumption.

(3) M mode switch



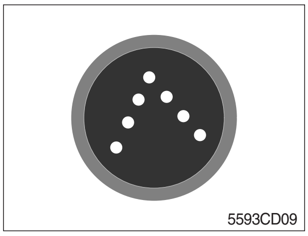
① This switch is used to maximum power.
② When this switch is pressed, the M mode pilot lamp is ON or OFF.

(4) Move (down) & buzzer stop switch



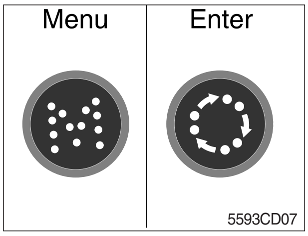
① When the starting switch is turned ON first, normally the alarm buzzer sounds for 6 seconds during lamp check operation.
② The lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press this switch and buzzer stops, but the lamp lights until the problem is cleared.
③ This switch is used to move down or decrease input value.
※ Refer to page 4-11.

(5) Move (up) switch



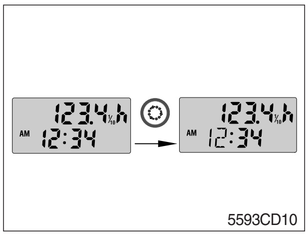
① This switch is used to move up or increase input value.
※ Refer to page 4-11.

(6) Menu and enter switch

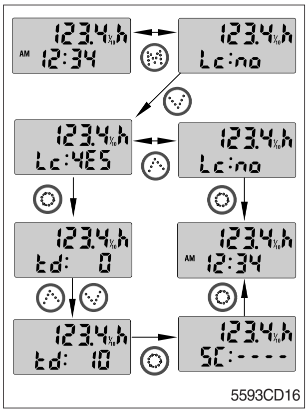


5593CD07

① These switches are used to set time or set ESL (Engine Start Limit) function.
- The Enter button ( ) is used to select a function.
- The Menu button ( ) is used to select a menu or return to the time display menu.


5593CD10

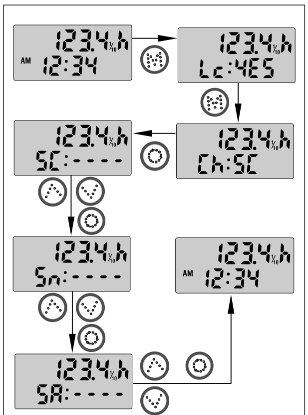
② **Setting time**
- Press Enter button ( ) to set time, then the screen will be changed to a display for time setting as a following picture and time cipher will blink.
- **Set hours** : When the cipher for hour blinks, press up ( ) or down ( ) button and set the hour.
- **Set minutes**: When the cipher for minute blinks, press up ( ) or down ( ) button and set the minute.


5593CD16

③ **Set ESL** (Engine Start Limit) **function**
- Press Menu button ( ), the display is changed from the time display menu to ESL function menu.
- Select YES or NO by Move button (,) and set the ESL function by the Enter button ( ).
  · YES : ESL function is activated.
  · NO : ESL function is cancelled.

④ **Set the interval time**
- Select ESL function to YES and press the Enter button ( ), then the display is changed to the interval time set menu.
- Set the interval time by move button (,) and press the Enter button ( ).
- You can finish setting the interval time by inputting the password and pressing the Enter button ( ) once more.
- Interval times : 5 kinds (0, 10, 30, 60 minutes, 1day)

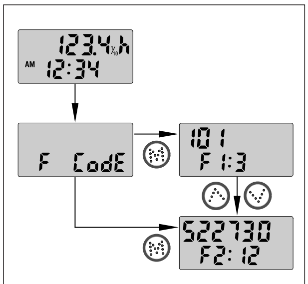
※ **If the ESL function is set to YES, the password is required when a operator starting engine first.**
But the operator can restart the engine within the interval time period without inputting the password.



5593CD18

⑤ Change password

- Select ESL function to YES and press the Menu button ( ), the display is shifted to the password change menu.
  · Input a new password (Sn : - - - -) after enter the current password successfully (SC : - - - -).
  · Push enter ( ) button for a second to finish the setting after the new password is entered once again (SA : - - - -).
  · When the setting is done, the display will blink 3 times and return to the time display screen.



5593CD14A

⑥ Check machine and engine diagnostic codes

- If the F : Code is displayed on the LCD display, you can check faults of the machine and/or engine.
- The machine fault code is displayed by pressing the Menu button ( ) and the engine fault code is displayed by pressing the Menu button ( ) once more.
- Other fault codes can be displayed by using the Move up/down button (,).

※ **Refer to the following pages for the fault codes.**

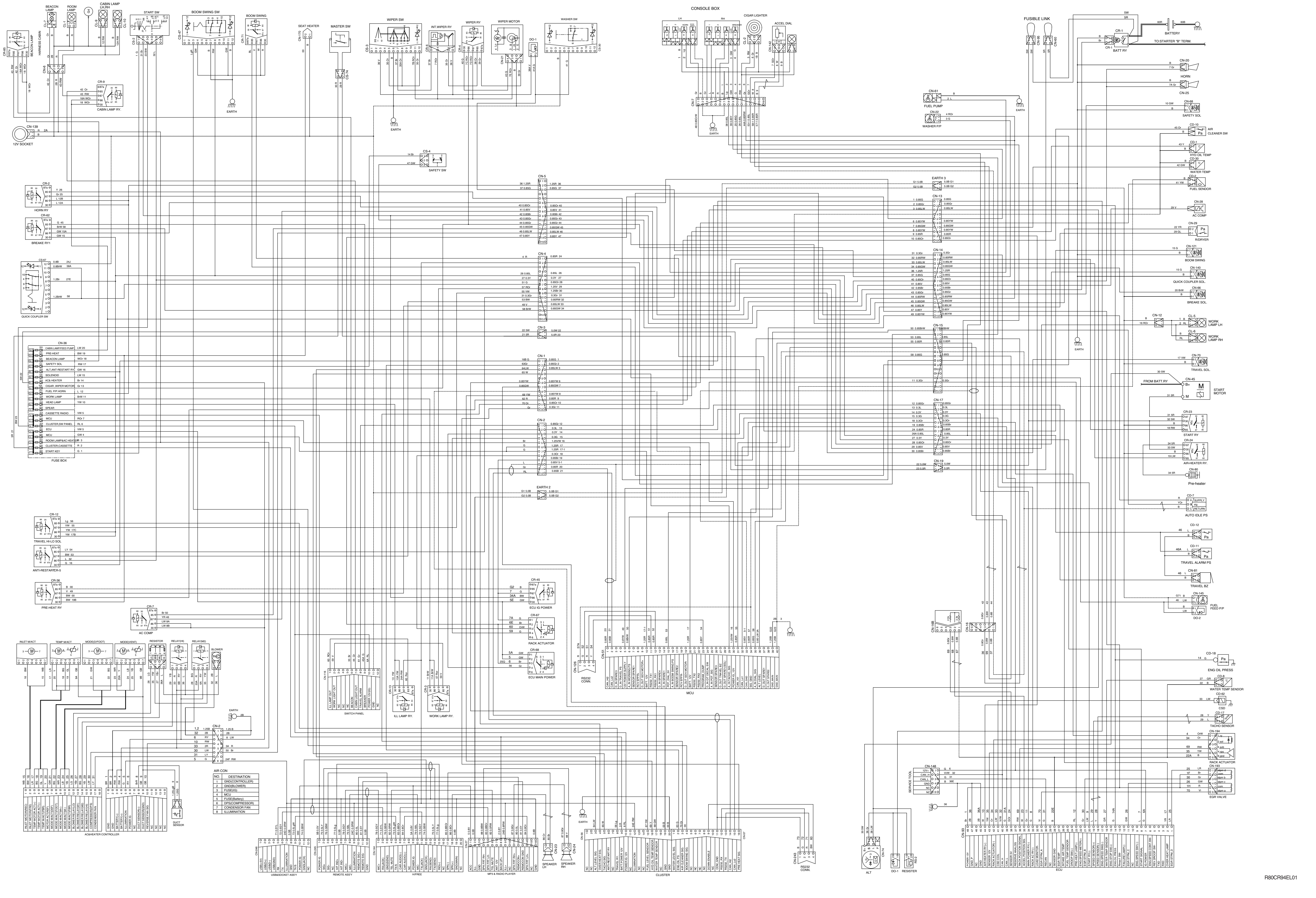
⑦ Machine fault code

Fault code HCESPN	Fault code FMI	Description
105	0	Working pressure sensor data above normal range (or open circuit)
	1	Working pressure sensor data below normal range
	2	Working pressure sensor data error
	4	Working pressure sensor circuit - voltage below normal, or shorted to low source
	14	Working pressure sensor circuit - special instructions
	16	Working pressure sensor circuit - voltage valid but above normal operational range
	18	Working pressure sensor circuit - voltage valid but below normal operational range
167	4	Travel speed solenoid circuit - voltage below normal, or shorted to low source (or open circuit)
	6	Travel speed solenoid circuit - current above normal
503	0	Brake pressure sensor data above normal range (or open circuit)
	1	Brake pressure sensor data below normal range
	2	Brake pressure sensor data error
	4	Brake pressure sensor data - voltage below normal, or shorted to low source
	16	Brake pressure sensor data - voltage valid but above normal operational range
	18	Brake pressure sensor data - voltage valid but below normal operational range
505	0	Working brake pressure sensor data above normal range (or open circuit)
	1	Working brake pressure sensor data below normal range
	2	Working brake pressure sensor data error
	4	Working brake pressure sensor circuit - voltage below normal, or shorted to low source
	16	Working brake pressure sensor circuit - voltage valid but above normal operational range
	18	Working brake pressure sensor circuit - voltage valid but below normal operational range
525	4	Ram lock solenoid circuit - voltage below normal, or shorted to low source (or open circuit)
	6	Ram lock solenoid circuit - current above normal
530	0	Travel fwd pilot pressure sensor data above normal range (or open circuit)
	1	Travel fwd pilot pressure sensor data below normal range
	2	Travel fwd pilot pressure sensor data error
	4	Travel fwd pilot pressure sensor circuit - voltage below normal, or shorted to low source
	14	Travel fwd pilot pressure sensor circuit - special instructions
	16	Travel fwd pilot pressure sensor circuit - voltage valid but above normal operational range
	18	Travel fwd pilot pressure sensor circuit - voltage valid but below normal operational range
701	4	Hour meter circuit - voltage below normal, or shorted to low source
705	0	MCU input voltage high
	1	MCU input voltage low
707	1	Alternator node I voltage low (or open circuit)
714	3	Acc. dial circuit - voltage above normal, or shorted to high source (or open circuit)
	4	Acc. dial circuit - voltage below normal, or shorted to low source
830	12	MCU internal memory error
840	2	Cluster communication data error
841	2	ECM communication data error
850	2	RMCU communication data error

⑧ Engine fault code

Fault code		Description
YANMAR SPN	FMI	
1210	4	Engine fuel rack position sensor : shorted to low source
	3	Engine fuel rack position sensor : shorted to high source
91	4	Accelerator pedal position sensor “A” : shorted to low source
	3	Accelerator pedal position sensor “A” : shorted to high source
	2	Accelerator pedal position sensor “A” : intermittent fault
	1	Accelerator pedal position sensor “A” : below normal operational range (SAE J1843)
	0	Accelerator pedal position sensor “A” : above normal operational range (SAE J1843)
	15	Accelerator pedal position sensor “A” : not available (SAE J1843)
29	4	Accelerator pedal position sensor “B” : shorted to low source
	3	Accelerator pedal position sensor “B” : shorted to high source
	2	Accelerator pedal position sensor “B” : intermittent fault
	1	Accelerator pedal position sensor “B” : below normal operational range (SAE J1843)
	0	Accelerator pedal position sensor “B” : above normal operational range (SAE J1843)
	8	Accelerator pedal position sensor “B” : communication fault
	15	Accelerator pedal position sensor “B” : not available (SAE J1843)
108	4	Barometric pressure sensor : shorted to low source
	3	Barometric pressure sensor : shorted to high source
	2	Barometric pressure sensor : intermittent fault
1136	4	E-ECU internal temperature sensor : shorted to low source
	3	E-ECU internal temperature sensor : shorted to high source
	2	E-ECU internal temperature sensor : intermittent fault
	0	E-ECU internal temperature : too high
110	4	Engine coolant temperature sensor : shorted to low source
	3	Engine coolant temperature sensor : shorted to high source
	2	Engine coolant temperature sensor : intermittent fault
	0	Engine coolant temperature : too high
1079	4	Sensor 5V : shorted to low source
	3	Sensor 5V : shorted to high source
	2	Sensor 5V : intermittent fault
158	1	E-ECU system voltage : too low
	0	E-ECU system voltage : too high
1078	4	Engine fuel injection pump speed sensor : shorted to low source
522402	4	Auxiliary speed sensor : shorted to low source
522241	4	Engine fuel rack actuator relay : open circuit
	3	Engine fuel rack actuator relay : short circuit
	7	Engine fuel rack actuator relay : mechanical malfunction
	2	Engine fuel rack actuator relay : intermittent fault
522243	4	Air heater relay : open circuit
	3	Air heater relay : short circuit
	2	Air heater relay : intermittent fault

Fault code		Description
YANMAR SPN	FMI	
522242	4	Cold start device : open circuit
	3	Cold start device : short circuit
	2	Cold start device : intermittent fault
522251	4	EGR stepping motor “A” : open circuit
	3	EGR stepping motor “A” : short circuit
522252	4	EGR stepping motor “B” : open circuit
	3	EGR stepping motor “B” : short circuit
522253	4	EGR stepping motor “C” : open circuit
	3	EGR stepping motor “C” : short circuit
522254	4	EGR stepping motor “D” : open circuit
	3	EGR stepping motor “D” : short circuit
100	4	Oil pressure switch : shorted to low source
	1	Oil pressure : too low
167	4	Battery charge switch : shorted to low source
	1	Battery charge : charge warning
522314	0	Engine coolant temperature : abnormal temperature
522323	0	Air cleaner : mechanical malfunction
522329	0	Oily water separator : mechanical malfunction
190	0	Engine speed : over speed condition
638	4	Engine fuel rack actuator : shorted to low source
	3	Engine fuel rack actuator : shorted to high source
	7	Engine fuel rack actuator : mechanical malfunction
639	12	High speed CAN communication : communication fault
630	2	E-ECU internal fault : EEPROM check sum error (data set 2)
	12	E-ECU internal fault : EEPROM error
628	12	E-ECU internal fault : flashROM check sum error (main software)
	2	E-ECU internal fault : flashROM check sum error (data set 1)
	2	E-ECU internal fault : flashROM check sum error (data set 2)
1485	4	E-ECU main relay : shorted to low source
522727	12	E-ECU internal fault : cyclic redundancy check of sub-CPU error
	12	E-ECU internal fault : acknowledgement of sub-CPU error
	12	E-ECU internal fault : communication with sub-CPU error
522728	12	E-ECU internal fault : engine map data version error
522730	12	Immobilizer : CAN communication fault
	8	Immobilizer : pulse communication fault
1202	2	Immobilizer : system fault



MEMORANDUM

1. POWER CIRCUIT

The negative terminal of battery is grounded to the machine chassis.

When the start switch is in the OFF position, the current flows from the positive battery terminal as shown below.

1) OPERATING FLOW

Battery → Battery relay (CR-1) → Fusible link (CN-60) → I/conn [CN-3 (2)] → Master switch [CS-74]

→ Fuse box [No.1] → Start switch [CS-2 (1)]
→ Fuse box [No.2] → MP3 & Radio player [CN-27 (8)]
→ Cluster [CN-56 (9)]
→ Switch panel [CN-115 (10)]
→ Fuse box [No.3] → I/conn [CN-2 (5)] → AC & Heater controller
→ I/conn [CN-6 (3)] → Room lamp [CL-1 (2)]
→ 12V socket [CN-139 (2)]
→ Fuse box [No.4] → I/conn [CN-2 (7)] → DC motor controller [CN-51 (10)]
→ I/conn [CN-2 (6)] → DC motor controller [CN-51 (20)]

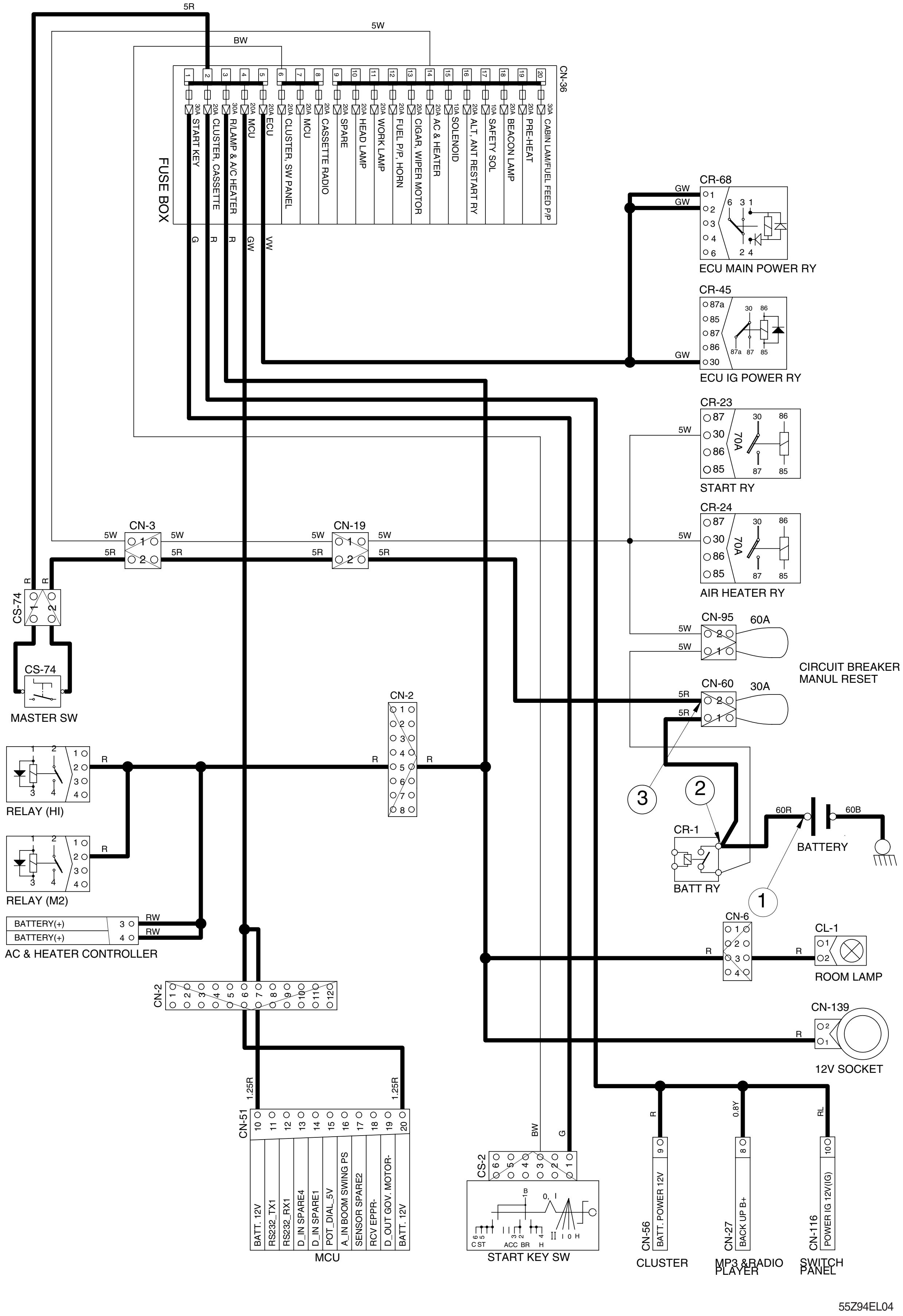
※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (battery) ② - GND (battery relay) ③ - GND (fusible link)	10~12.5V

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Fusible link [CN-60]
→ I/conn [CN-3 (2)] → Master switch [CS-74] → Fuse box No.1 → Start key [CS-2 (1)]

※ Start switch : ON

→ Start switch ON [CS-2 (2)] → ECU IG power relay [CR-45 (86)]
→ I/conn [CN-5 (9)] →
Battery relay [CR-1]:Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2 (3)] → Fuse box (all power is supplied with electric component)

※ Start switch : START

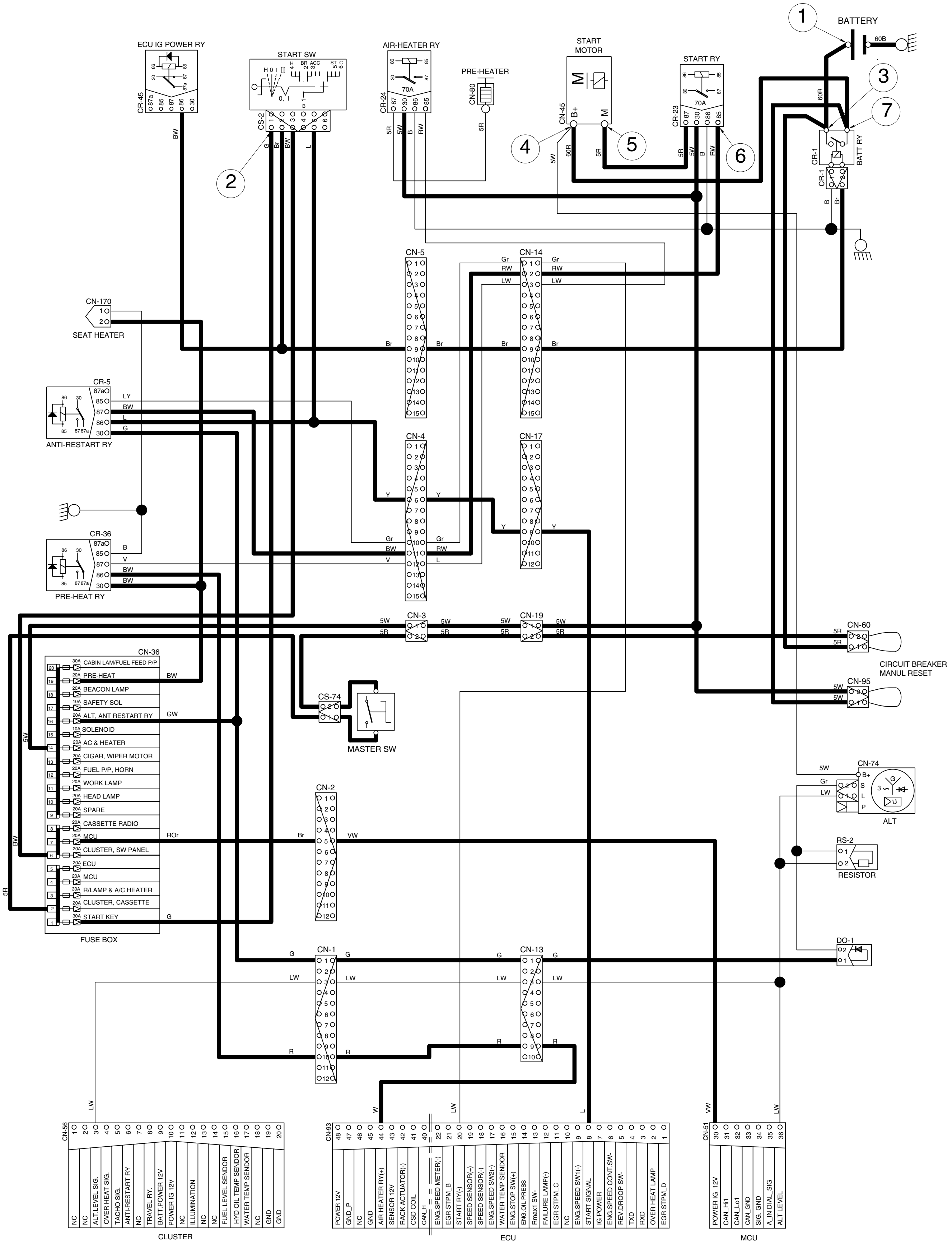
Start switch START [CS-2 (5)] → Anti-restart relay [CR-5 (86) → (87)] → I/conn [CN-4 (11)]
→ Start relay [CR-23 (C2) → (2)] → Starter motor operating
→ I/conn [CN-4 (6)] → ECU [CN-93 (8)]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① - GND (battery) ② - GND (start key) ③ - GND (battery relay M4) ④ - GND (starter B^+) ⑤ - GND (starter M) ⑥ - GND (start relay) ⑦ - GND (battery relay M8)	10~12.5V

※ GND : Ground

STARTING CIRCUIT



55Z94EL05

3. CHARGING CIRCUIT

When the starter is activated and the engine is started, the operator releases the key switch to the ON position.

Charging current generated by operating alternator flows into the battery through the Battery relay (CR-1).

The current also flows from alternator to each electrical component and controller through the fuse box.

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-1 (3)] → Cluster [CN-56 (3)] → Cluster warning lamp
→ Governor DC motor controller [CN-51 (36)]

(2) Charging flow

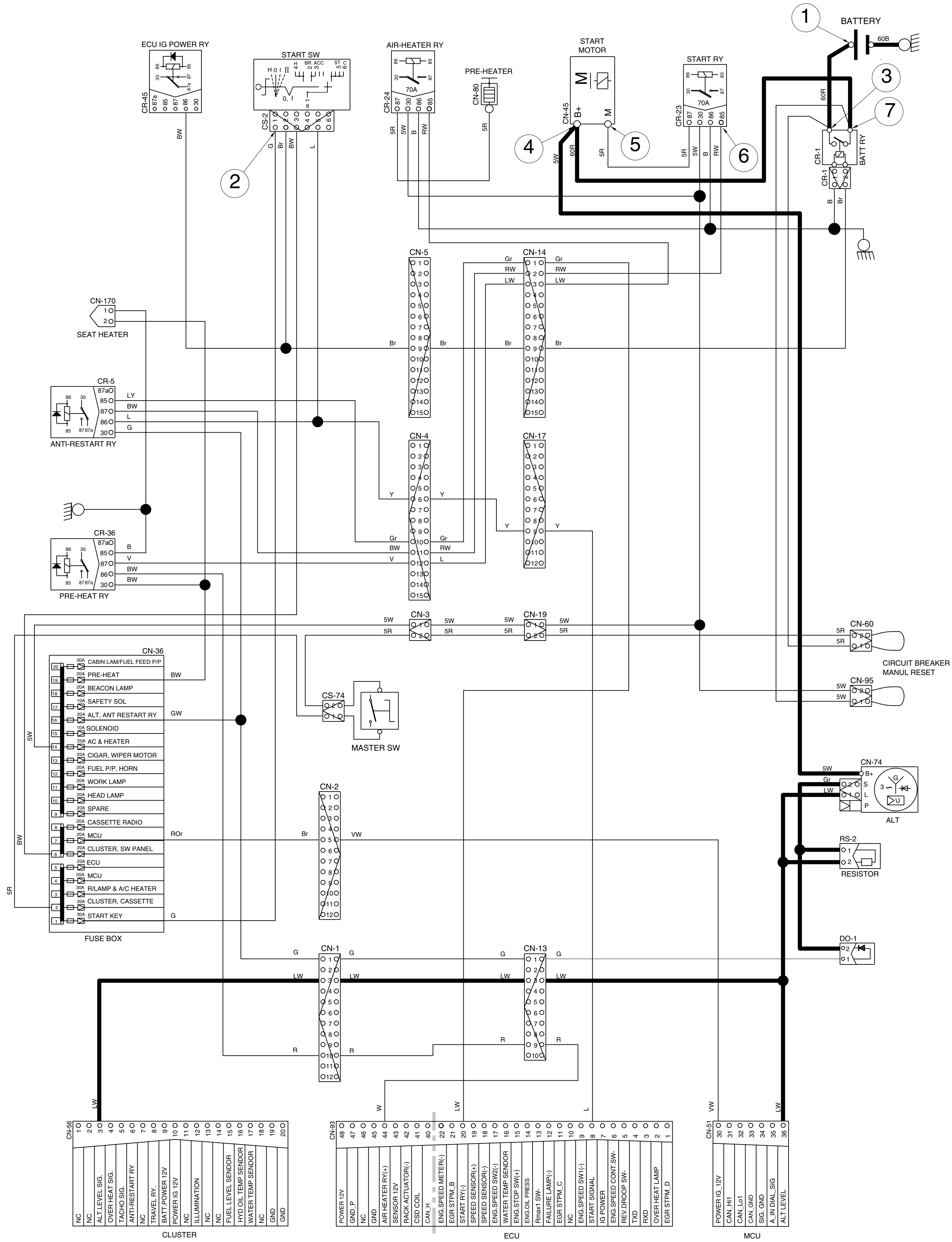
Alternator "B^+" terminal → Battery relay → Battery (+) terminal

2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① - GND (battery voltage) ② - GND (battery relay) ③ - GND (alternator B^+ terminal) ④ - GND (alternator L terminal) ⑤ - GND (cluster)	10~12.5V

※ GND : Ground

CHARGING CIRCUIT



55Z94EL06

4. HEAD AND WORK LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.10) → Head lamp relay [CR-13 (86) → (85)] → Switch panel [CN-116 (1)]
Fuse box (No.11) → Work lamp relay [CR-3 (86) → (85)] → Switch panel [CN-116 (2)]

(1) Head lamp switch ON

Head lamp switch ON [CN-116(1)] → Head lamp relay [CR-13 (85) → (87)]

- → I/conn [CN-4 (2)] → Head lamp ON [CL-3, 4 (2)]
- → I/conn [CN-5 (1)] → I/conn [CN-7 (11)] → Cigar lighter [CL-2 (1)]
- → Remote controller illumination ON [CN-245 (9)]
- → MP3 & Radio player illumination ON [CN-27 (9)]
- → USB & Socket illumination ON [CN-246 (7)
- → Cluster illumination ON [CN-56 (12)]
- → I/conn [CN-2 (8)] → AC/Heater controller illumination ON

(2) Work lamp switch ON

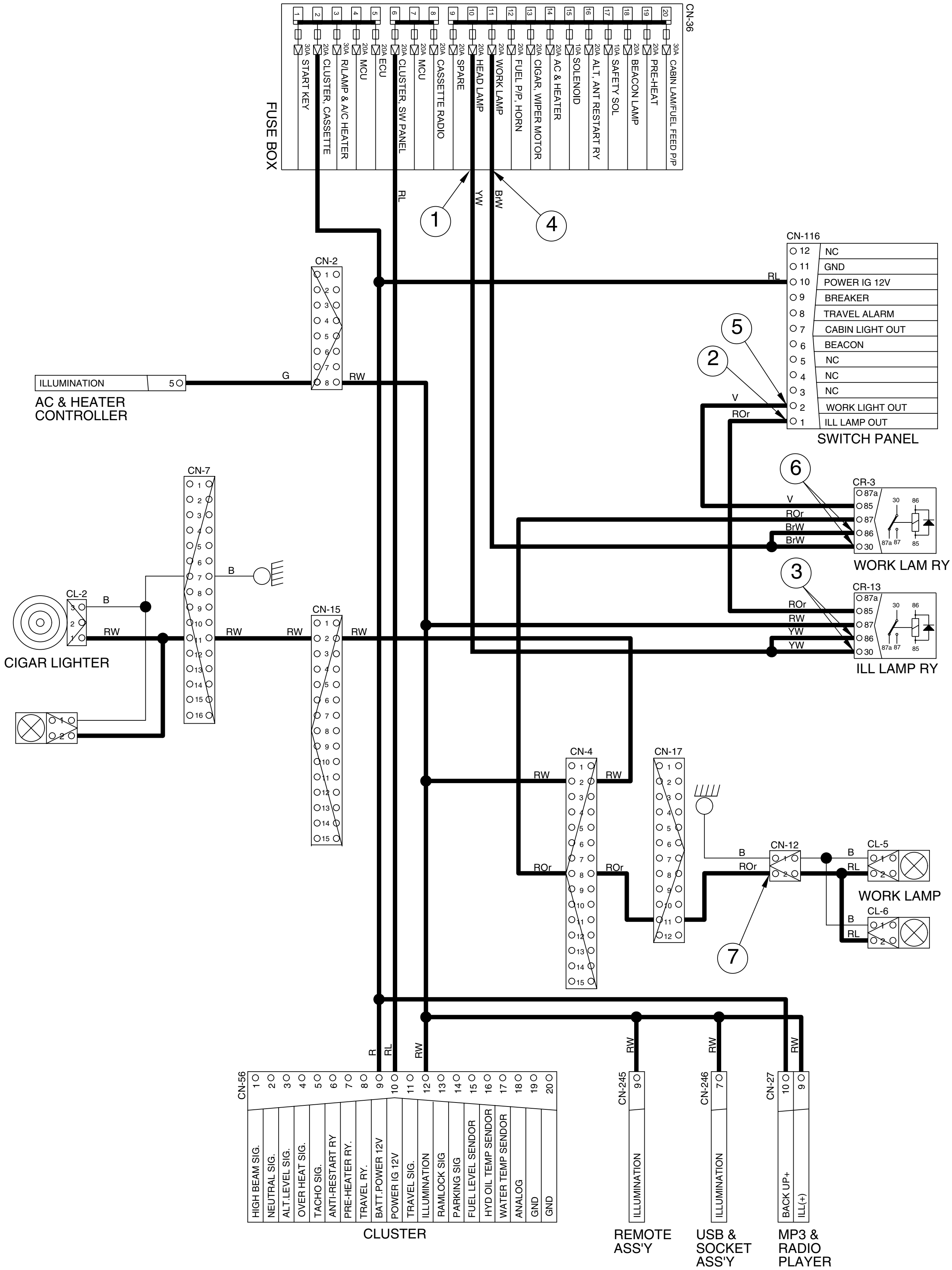
Work light switch ON [CN-116 (2)] → Work lamp [CR-3 (85) → (87)] → I/conn [CN-4 (8)]
I/conn [CN-12 (2)] → Work lamp ON [CL-5 (2)]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (head light)	10~12.5V
STOP	ON	⑤ - GND (fuse box) ⑥ - GND (switch power input) ⑦ - GND (switch power output) ⑧ - GND (work light)	10~12.5V

※ GND : Ground

HEAD AND WORK LAMP CIRCUIT



55Z94EL07

5. BEACON LAMP AND CAB LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.18) → Beacon lamp relay [CR-85(30) → (85)] → Switch panel [CN-116 (6)]
Fuse box (No.20) → Cab lamp relay [CR-9 (30) → (85)] → Switch panel [CN-116 (7)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-116 (6)] → Beacon lamp relay [CR-85 (87)] → I/conn [CN-6 (1)]
→ Beacon lamp ON [CL-7]

(2) Cab lamp switch ON

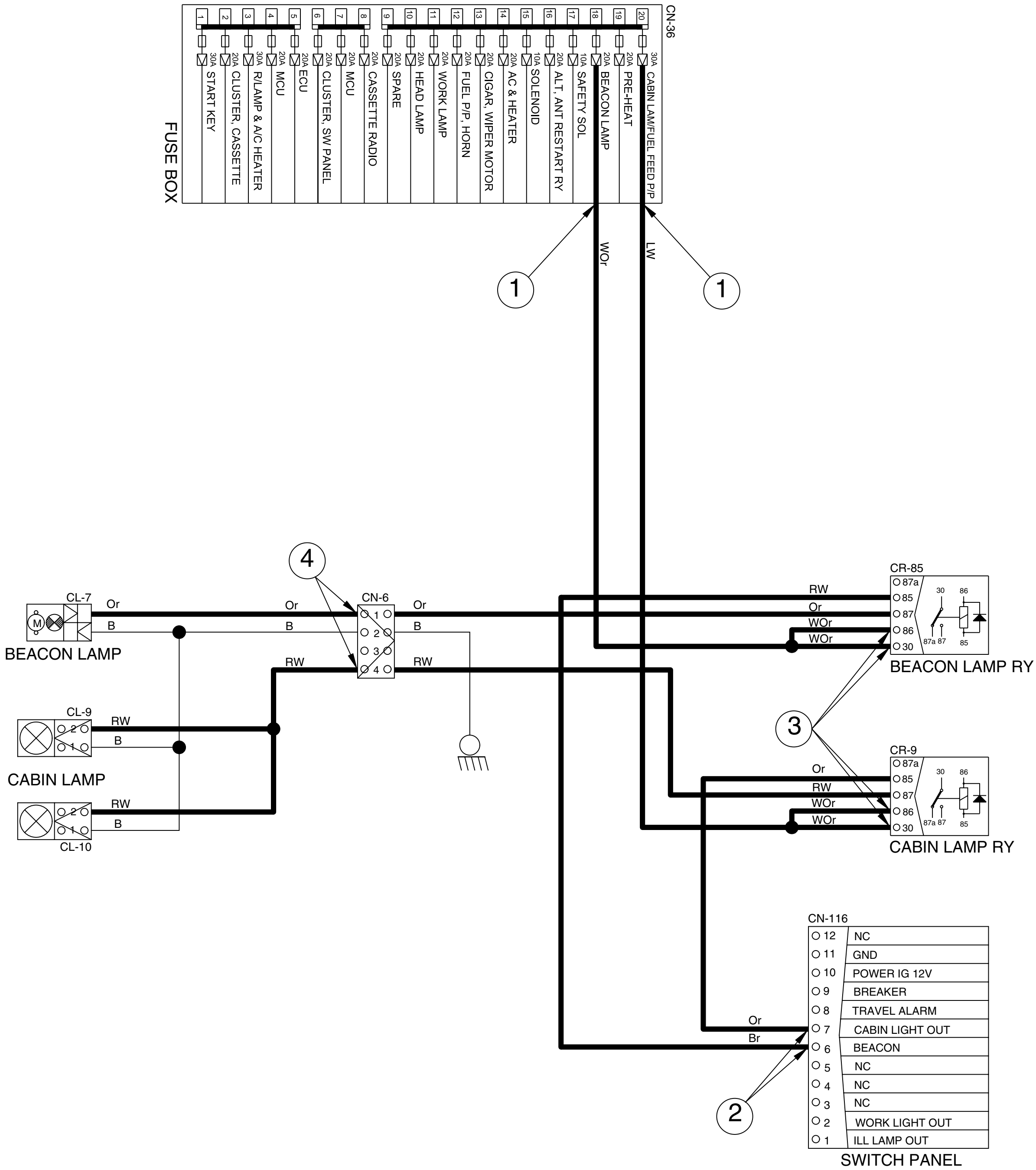
Cab lamp switch ON [CN-116 (7)] → Cab lamp relay [CR-9 (87)] → I/conn [CN-6 (4)]
→ Cab lamp ON [CL-9, 10]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (beacon & cab lamp)	10~12.5V

※ GND : Ground

BEACON LAMP CIRCUIT



55Z94EL08

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.13) → Wiper relay [CR-4 (86)]
→ Int wiper relay [CR-6 (4)]
→ Wiper switch [CS-3 (11)]
→ Wiper motor [CN-21 (3)]
→ I/conn [CN-5 (11)] → I/conn [CN-14 (11)] → Washer pump [CN-22 (2)]

(2) Wipe switch ON : 1st step (low speed)

Wiper switch ON [CS-3 (8)→(7)] → Int wiper relay [CR-6 (6)→(3)] → Wiper relay [CR-4 (85)→(30)]
→ Washer motor operating [CN-21 (4)]

(3) Wiper switch ON : 2nd step (washer)

Wiper switch ON [CS-3 (7)] → Int wiper relay [CR-6 (1)] → Washer switch [CS-30 (6)]
→ Wiper relay [CR-4 (85) → (30)]
→ Wiper motor operating[CN-21(1)]

Washer switch ON [CS-30 (6)] → I/conn [CN-5 (3)] → Washer pump operating [CN-22 (1)]

(4) Auto parking (when switch OFF)

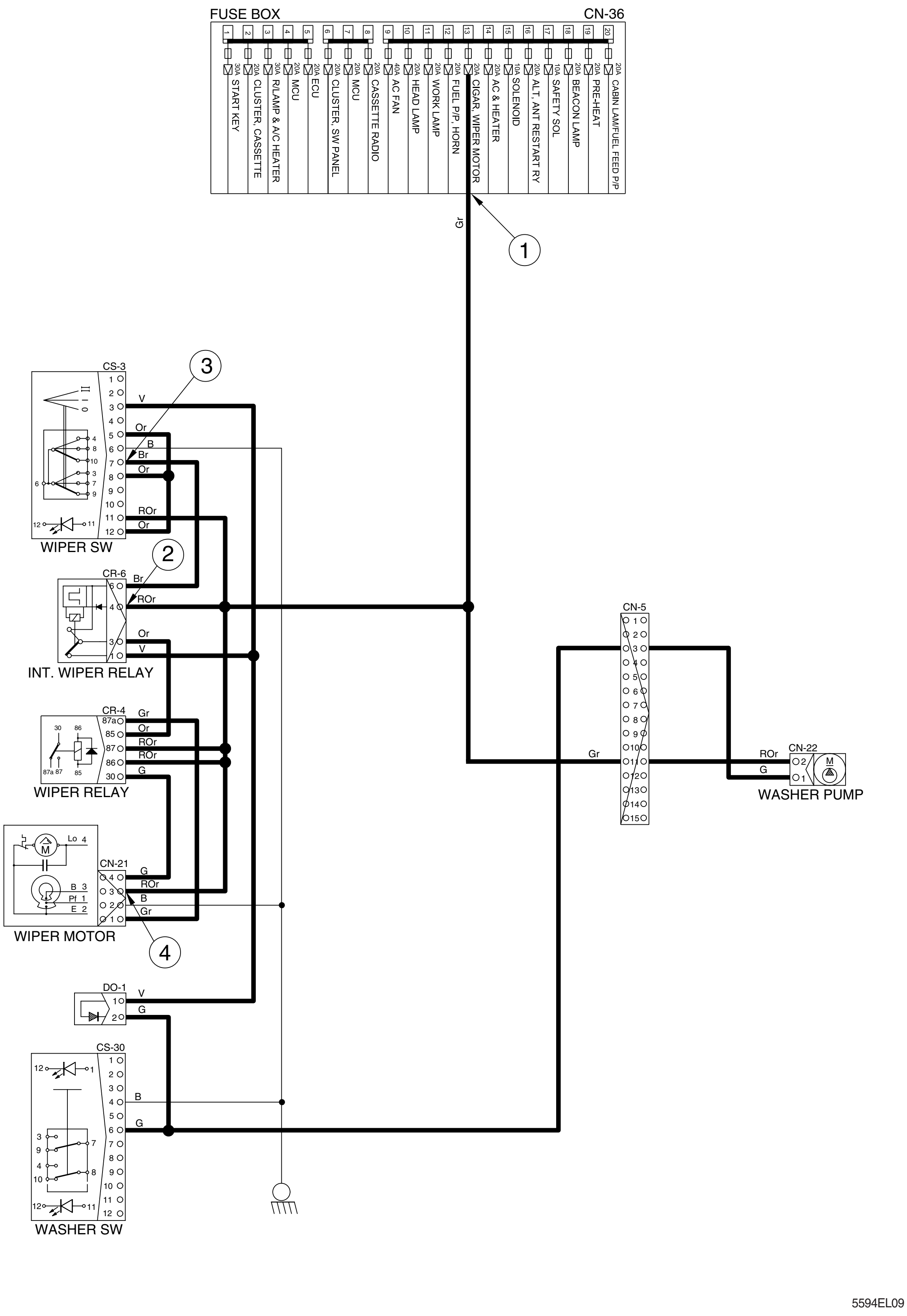
Switch OFF → Wiper motor [CN-21 (1)] → Wiper switch [CS-3 (5)→(8)] → Int wiper relay [CR-6 (6)→(3)]
→ Wiper relay [CR-4 (85) → (30)] → Wiper motor [CN-21 (4)]
→ Wiper motor parking position by wiper motor controller

2) CHECK POINT

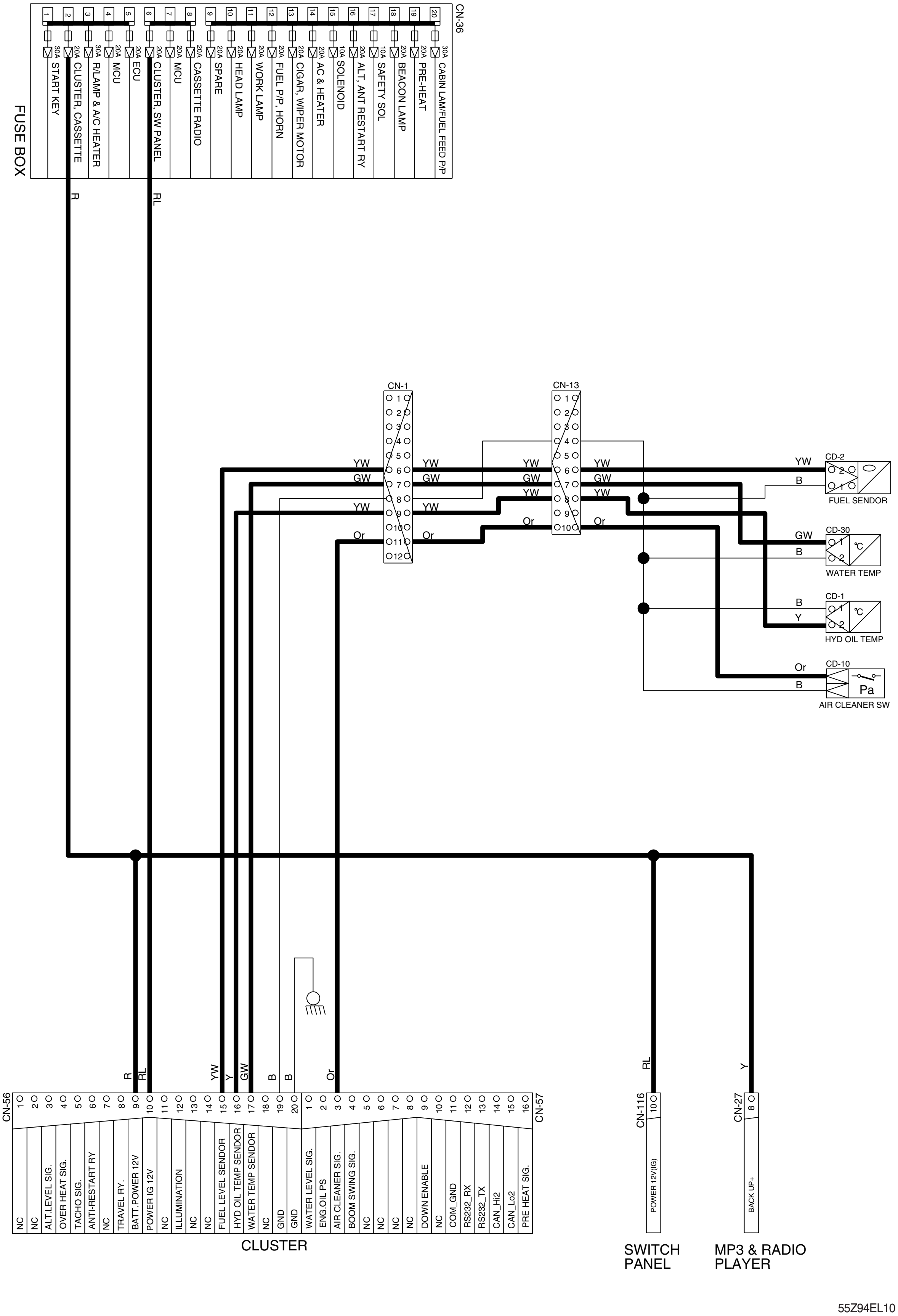
Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (wiper motor)	10~12.5V

※ GND : Ground

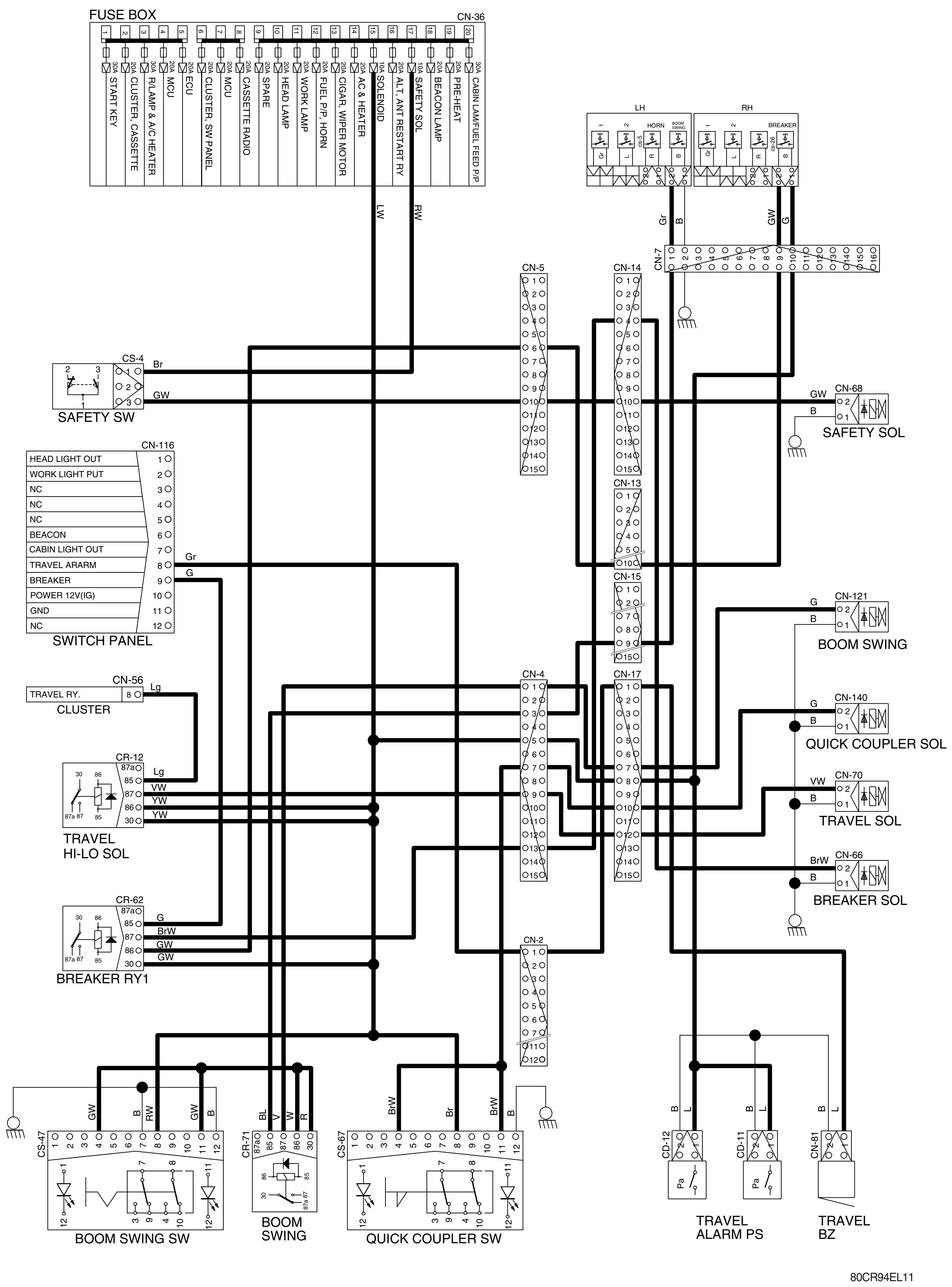
WIPER AND WASHER CIRCUIT



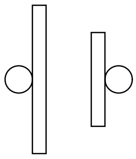
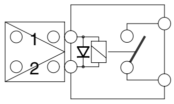
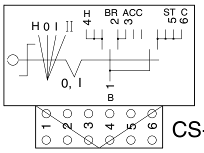
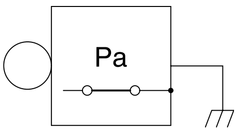
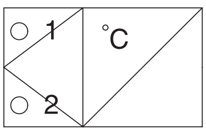
MONITORING CIRCUIT

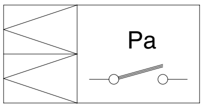
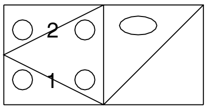
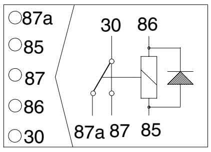
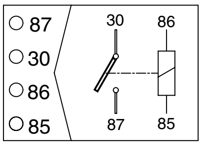
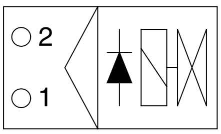
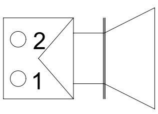


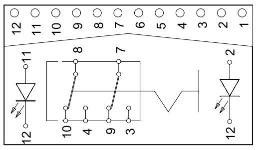
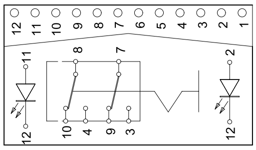
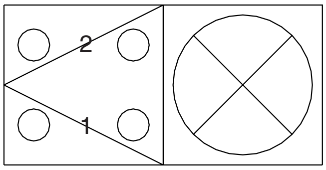
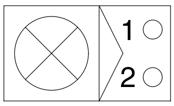
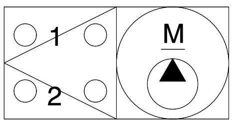
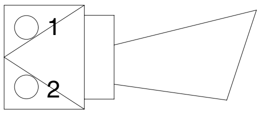
ELECTRIC CIRCUIT FOR HYDRAULIC

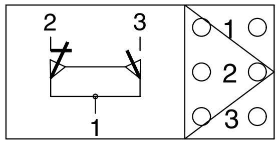
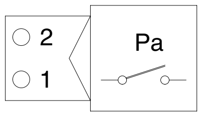
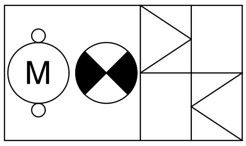
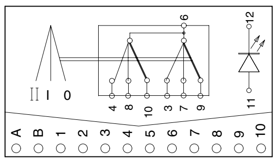
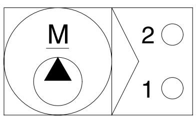
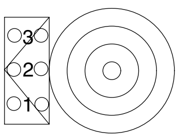


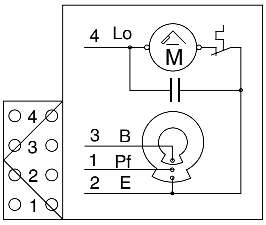
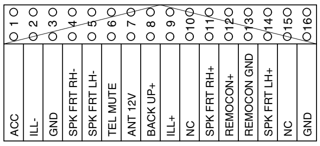
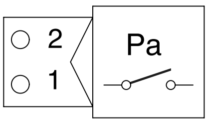
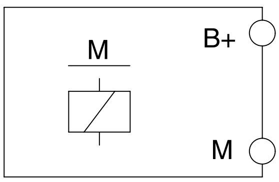
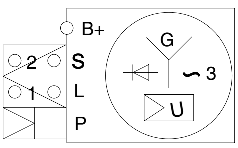
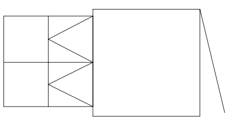
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

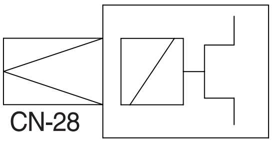
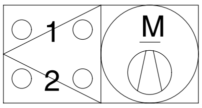
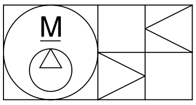
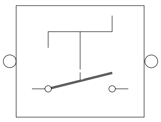
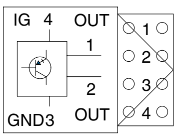
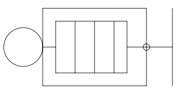
Part name	Symbol	Specification	Check
Battery		12V × 100Ah	※ Check specific gravity 1.280 over : over charged 1.280 ~ 1.250 : normal 1.250 below : recharging
Battery relay	 CR-1	Rated load : 12V 100A (continuity) 1000A (30 second)	※ Check coil resistance Normal : about 12 Ω ※ Check contact Normal : ∞ Ω
Start key	 CS-2	12V	※Check contact OFF : ∞ Ω (for each terminal) ON : 0 Ω (for terminal 1-3 and 1-2) START : 0 Ω (for terminal 1-5)
Pressure switch (for engine oil)	 CD-18	0.5 kgf/cm^2 (N.C TYPE)	※ Check resistance Normal : 0 Ω (CLOSE)
Hydraulic oil, coolant temperature sensor	 CD-1 CD-8	0.5 kgf/cm^2 (N.C TYPE)	※ Check resistance 50°C : 804 Ω 80°C : 310 Ω 100°C : 180 Ω

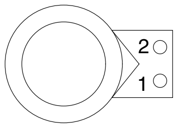
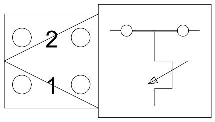
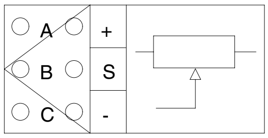
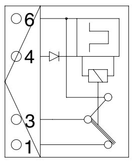
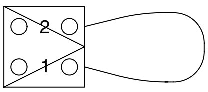
Part name	Symbol	Specification	Check
Air cleaner pressure switch	 CD-10	Pressure: 635mmH$_2$O (N.O TYPE)	※ Check contact Normal : ∞ Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 100 Ω Low : 500 Ω Empty warning :700 Ω
Relay	 CR-2 CR-3 CR-4 CR-5 CR-7 CR-9 CR-12 CR-13 CR-36 CR-45 CR-62 CR-71 CR-85	12V 20A	※ Check resistance Normal : about 200 Ω (for terminal 85-86) : 0 Ω (for terminal 30-87a) : ∞ Ω (for terminal 30-87)
Relay	 CR-23 CR-24	12V 70A	※ Rated coil current 1.2±0.3A
Solenoid valve	 CN-66 CN-68 CN-70 CN-121 CN-140	12V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	4 Ω 20W	※Check resistance Normal : 4 Ω

Part name	Symbol	Specification	Check
Boom swing switch	 CS-47	12V 16A	※ Check contact Normal OFF - ∞ Ω (for terminal 1-5,2-6) - 0 Ω (for terminal 5-7,6-8)
Quick clamp switch	 CS-67	12V 16A	※ Check contact Normal OFF - ∞ Ω (for terminal 1-5,2-6) - 0 Ω (for terminal 5-7,6-8)
Work, cab lamp	 CL-5 CL-6 CL-9 CL-10	12V 65W (H3 TYPE)	※ Check disconnection Normal : 1.2 Ω
Room lamp	 CL-1	12V 10W	※ Check disconnection Normal : a few Ω
Fuel filler pump	 CN-145	12V 20A 35 l /min	※Check operation Supply power (for terminal 1) : 12V
Horn	 CN-20 CN-25	12V	100±5dB

Part name	Symbol	Specification	Check
Safety switch	 CS-4	Micro	※ Check contact Normal : 0 Ω (for terminal A-B) : ∞ Ω (for terminal A-C) Operating : ∞ Ω (for terminal A-B) : 0 Ω (for terminal A-C)
Pressure switch	 CD-11 CD-12	10bar (N.C type)	※ Check contact Normal : 0.1 Ω
Beacon lamp	 CL-7	12V (Strobe type)	※ Check disconnection Normal : a few Ω
Wiper switch	 CS-3	12V 16A	※Check contact Normal : ∞ Ω
Washer pump	 CN-22	12V 3.8A	※Check contact Normal : 3 Ω (for terminal 1-2)
Cigar lighter	 CL-2	12V 10A 1.4W	※Check coil resistance Normal : about 1MΩ ※ Check contact Normal : ∞ Ω Operating time : 5~15sec

Part name	Symbol	Specification	Check
Wiper motor	 CN-21	12V 3A	※Check contact Normal : 6 Ω (for terminal 2-6)
Radio & MP3 player	 CN-27	24V 2A	※ Check voltage 20 ~ 25V (for terminal 1-3, 3-8)
Receiver dryer	 CN-29	12V	※ Check contact Normal : 0 Ω
Starter	 CN-45	12V × 3kW	※ Check contact Normal : 0.1 Ω
Alternator	 CN-74	12V 80A	※ Check contact Normal : 0 Ω (for terminal B^+-1) Normal : 24 ~ 27.5V
Travel buzzer	 CN-81	12V 0.5A	※ Check contact Normal : 5.2 Ω

Part name	Symbol	Specification	Check
Compressor	 CN-28	12V 79W	-
Blower fan motor	 CN-83	12V 9.5A	※ Check resistance 2.5 Ω (for terminal 1-2)
Fuel feed pump	 CN-61	12V	-
Master switch		12V 1000A	-
Timer		12V	-
Preheater	 CN-80	12V 42A 500W	-

Part name	Symbol	Specification	Check
12V socket	 CN-139	12V 120W	-
Duct sensor		1˚C OFF 4˚C ON	※ Check resistance Normal : 0 Ω (for terminal 1-2) the atmosphere temp : over 4˚C
Accel dial	 CN-142	-	※ Check resistance Normal : about 5k Ω (for terminal A-C) ※ Check voltage Normal : about 5V (for terminal A-C) : 2~4.5V (for terminal C-B)
Int wiper relay	 CR-6	12V 12A	-
Fusible link	 CN-60 CN-95	12V, 30A (CN-65) 12V, 60A (CN-95)	-

GROUP 5 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	12	Cabin room harness - Main harness	S816-012002	174663-2
CN-2	AMP	12	Aircon harness - Cabin room harness	S816-012002	174663-2
CN-3	YAZAKI	2	Fusible link - Fuse box	S813-030201	S813-130201
CN-4	AMP	15	Cabin room harness - Main harness	2-85262-1	368301-1
CN-5	AMP	15	Cabin room harness - Main harness	2-85262-1	368301-1
CN-6	DEUTSCH	4	Cabin harness - Cabin room lamp harness	DT06-4S-EP06	DT04-4P-E005
CN-7	KET	20	Console harness - Main harness	MG610240	-
CN-8	AMP	12	Cabin harness	S816-012002	-
CN-12	AMP	2	Boom harness - Work lamp harness	-	S816-102002
CN-13	AMP	10	Bottom harness	174655-2	-
CN-14	AMP	15	Bottom harness	2-85262-1	-
CN-15	AMP	15	Bottom harness	-	368301-1
CN-17	AMP	12	Bottom harness	-	174663-2
CN-19	YAZAKI	2	Bottom harness	-	S813-130201
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	12	Wiper harness	S816-012002	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	2	Speaker LH	MG610070	-
CN-24	KET	2	Speaker RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27	-	16	Cassette radio	PK145-16017	-
CN-28	AMP	1	Air-con comp	S810-001202	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse box	21L7-00250	-
CN-45	TERM	1	Starter	ST710246-2	-
CN-48	AMP	40	MCU	DRC26-40SA	-
CN-51	DEUTSCH	40	Governor DC motor controller	DRC26-40SA	S816-103002
CN-55	AMP	2	Travel alarm PS	S816-002002	S816-102002
CN-56	AMP	20	Cluster	175967-2	-
CN-57	AMP	16	Cluster	175966-2	-
CN-60	YAZAKI	2	Fusible link	-	7122-4125-50
CN-61	TERM	1	Fuel filler pump	S822-014000	S822-114000
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel HI-LO solenoid	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-74	KET	2	Alternator	ST710285-2	-
CN-76	KET	6	DC motor	MG640515-4	-
CN-79	YAZAKI	3	Fuel cut-off solenoid	S813-060300	-
CN-80	AMP	1	Pre heater	ST710384-2	-
CN-81	DEUTSCH	2	Travel buzzer	DT06-2S-EP06	DT04-2P-E005
CN-83	AMP	2	Air-con fan	MG640188-5	-
CN-92	KET	1	Anti-restart relay	S814-001100	-
CN-95	YAZAKI	2	Fusible link	-	S813-130201
CN-116	AMP	12	Switch panel	368542-1	-
CN-126			RS232 connector		
CN-139	AMP	2	12V socket	S810-002202	-
CN-140	DEUTSCH	2	Quick coupler	DT06-2S-EP06	DT04-2P-E005
CN-142	DEUTSCH	3	Accel dial	DT06-3S-EP06	-
CN-144	AMP	2	Handsfree	S810-002202	-
CN-145	KET	2	Fuel feed pump	7123-6423-30	-
CN-148			Service tool		
CN-170	PACKARD	2	Seat heat switch	12162017	-
CN-243			RS232 connector		
CN-245	AMP	12	Remote controller assy	368542-1	-
CN-246	AMP	12	USB & Socket assy	174045-2	-
CN-258	KET	1	Aircon comp power	MG640944-5	MG650943-5
CN-263	DEUTSCH	2	Aircon comp relay	DT06-2S-EP06	DT04-2P-E005
· LAMP					
CL-1	KET	2	Room lamp	MG610392	-
CL-2	AMP	3	Cigar light	S810-003202	-
CL-3	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-4	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-5	DEUTSCH	2	Work lamp	DT06-2S-EP06	-
CL-6	DEUTSCH	2	Work lamp	DT06-2S-EP06	
CL-7	-	1	Beacon lamp	-	S822-114000
CL-9	DEUTSCH	2	Cabin lamp	DT06-2S-EP06	-
CL-10	DEUTSCH	1	Cabin lamp	DT06-2S-EP06	-
· RELAY					
CR-1	AMP	2	Battery relay	S816-002002	S816-102002
CR-2	AMP	4	Horn relay	S810-004002	-
CR-5	AMP	4	Anti-restart relay	S810-004002	-
CR-6	KET	6	Int wiper relay	S810-006002	-
CR-12	AMP	4	Travel relay	S810-004002	-
CR-23	KET	2	Start relay	S814-002001	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-24	KET	2	Air heater relay	S814-002001	-
CR-33	AMP	4	Air-con fan relay	S810-004002	-
CR-36	AMP	4	Pre-heater relay	S810-004002	-
CR-45			ECU IG connector		
CR-47	KET	2	Fuel cut-off relay	S814-002001	-
CR-50	KET	4	Timer relay	MG610047-5	-
CR-67	Sumitomo Denso	6	ECU main power	6020-6161	
CR-68	Sumitomo Denso	6	Rack actuator	6020-6161	
· SENDER					
CD-1	AMP	2	Hydraulic temp sender	85202-1	-
CD-2	AMP	2	Fuel sender	-	S816-102002
CD-7	DEUTSCH	3	Auto idle pressure switch	DT06-3S-EP06	-
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-11	-	2	Travel pressure switch	MG640795	-
CD-12	-	2	Travel pressure switch	MG640795	-
CD-18	AMP	1	Engine oil pressure	ST710345-1	-
CD-30	AMP	2	Water temp	85202-1	-
CD-45	-	2	WIF sensor	-	S816-102003
DO-1	-	2	Diode	21EA-50570	-
DO-2	-	2	Diode	21EA-50570	-
DO-3	-	2	Diode	21EA-50570	-
· SWITCH					
CS-2	KET	6	Start key switch	S814-006000	-
CS-3	SWF	12	Wiper switch	585790	-
CS-4	AMP	3	Safety switch	S816-003002	-
CS-5	-	1	Horn-LH switch	-	DT04-2P-E005
CS-26	DEUTSCH	2	Breaker switch	DT06-2S-EP06	-
CS-30	SWF	12	Wiper washer	585790	-
CS-47	SWF	12	Boom swing switch	585790	-
CS-67	SWF	12	Quick coupler switch	589790	-
CS-74	YAZAKI	2	Master switch	S813-030201	S813-130201
CS-99	SWF	12	Auto idle switch	589790	-

2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

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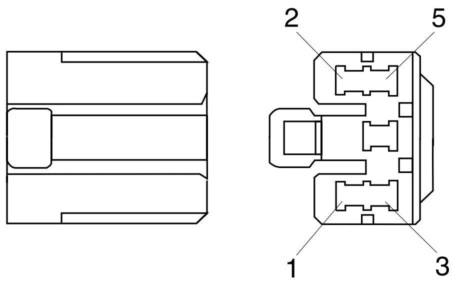
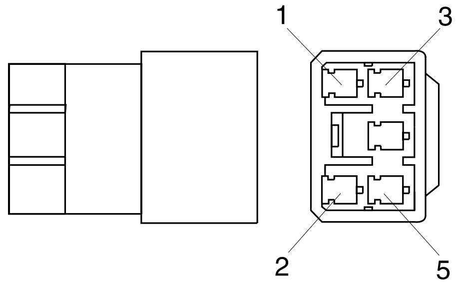
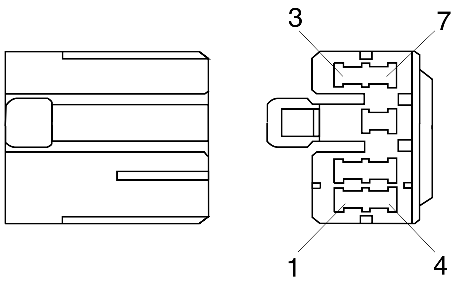
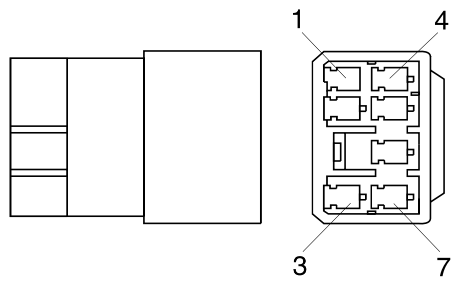
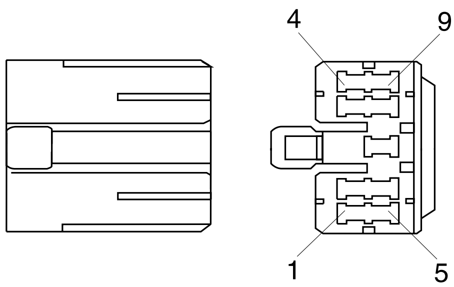
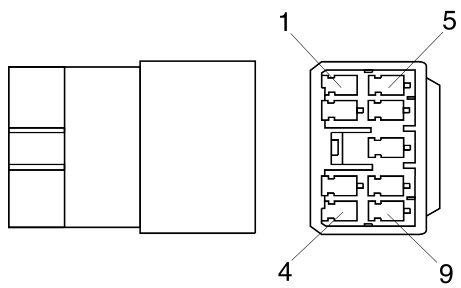
<tr><th>No. of pin</th><th>Receptacle connector (female)</th><th>Plug connector (male)</th></tr>
<tr><td>5</td><td>

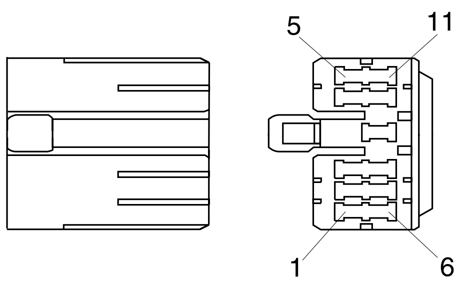
S811-005002</td><td>

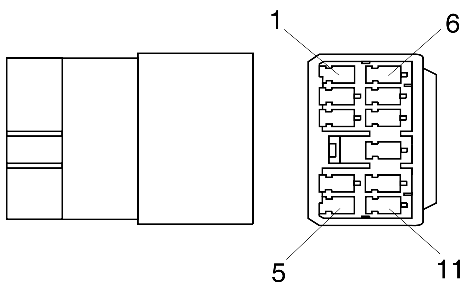
S811-105002</td></tr>
<tr><td>7</td><td>

S811-007002</td><td>

S811-107002</td></tr>
<tr><td>9</td><td>

S811-009002</td><td>

S811-109002</td></tr>
<tr><td>11</td><td>

S811-011002</td><td>

S811-111002</td></tr>
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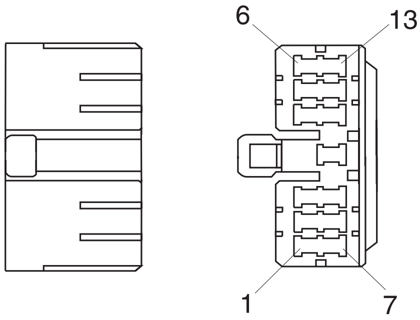
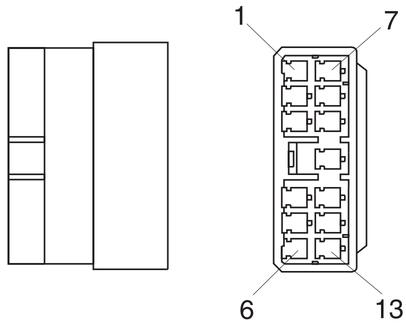
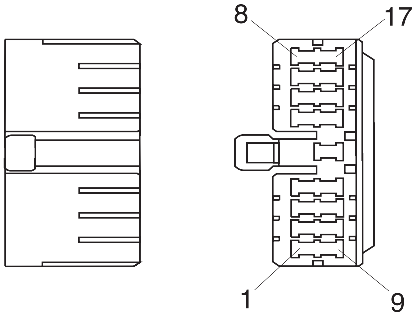
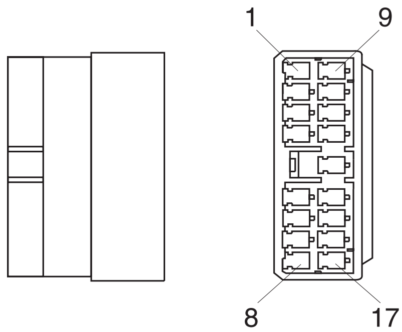
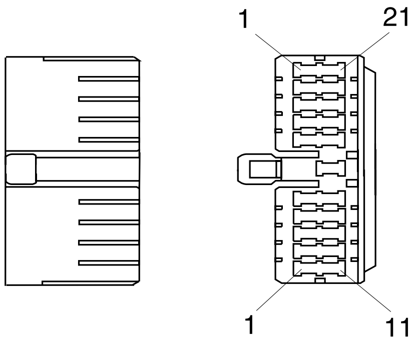
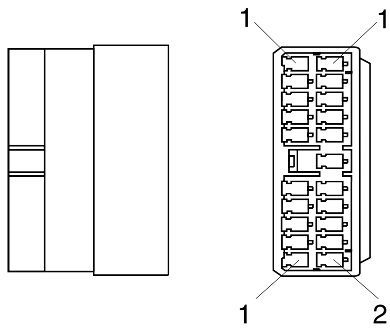
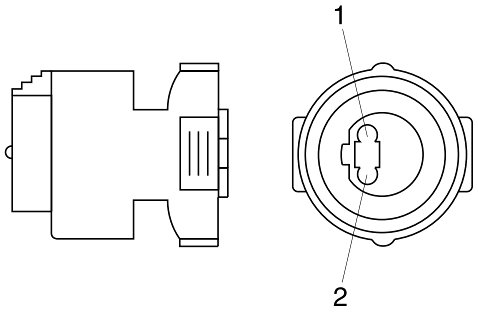
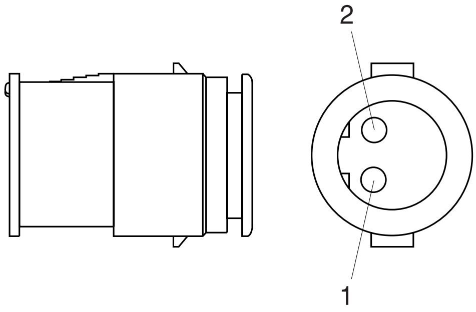
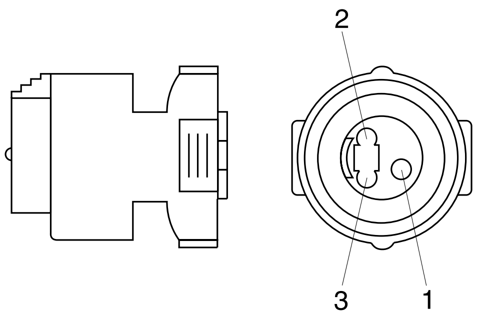
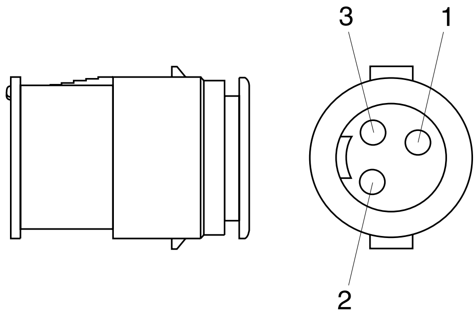
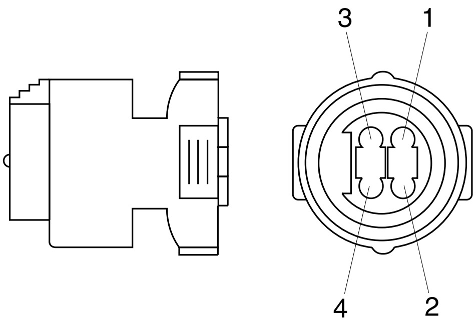
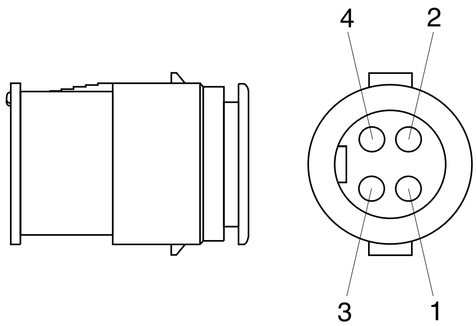
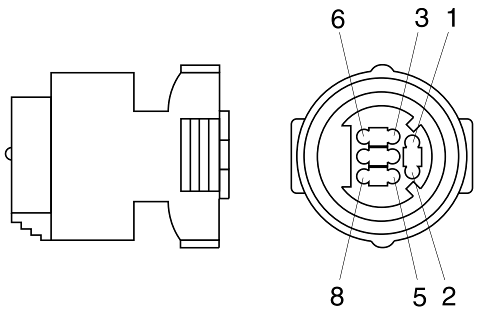
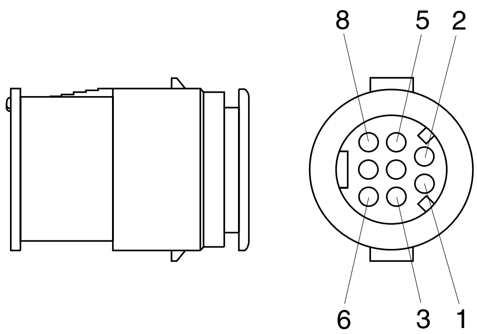
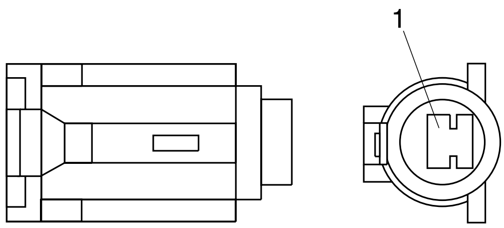
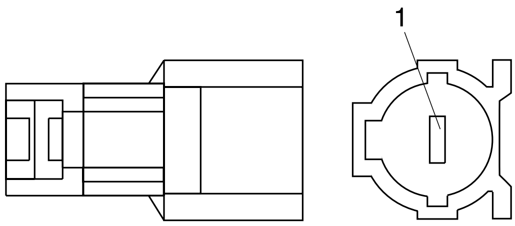
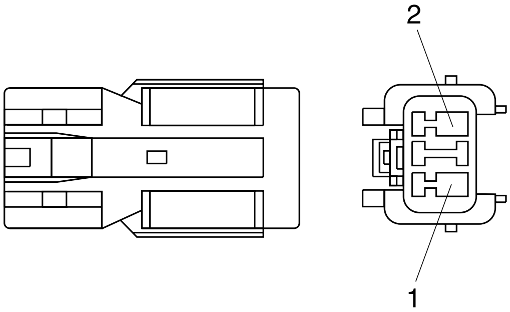
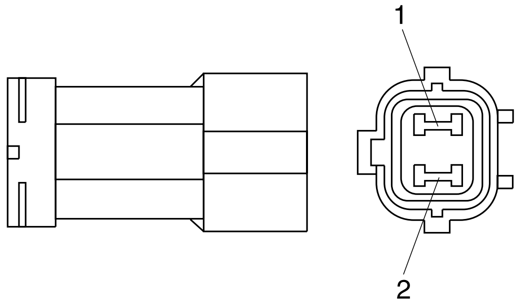
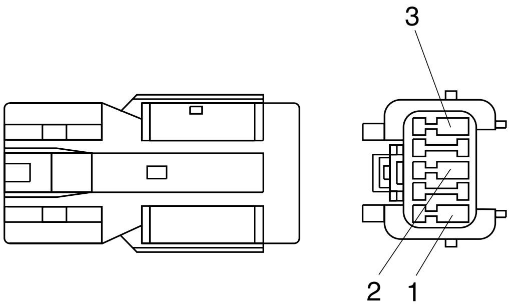
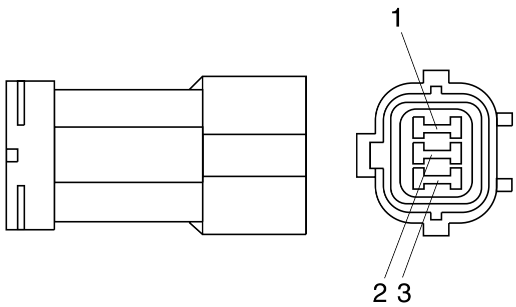
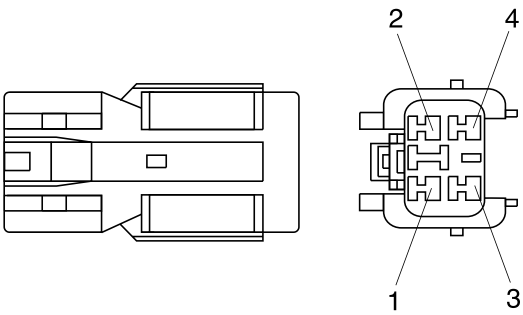
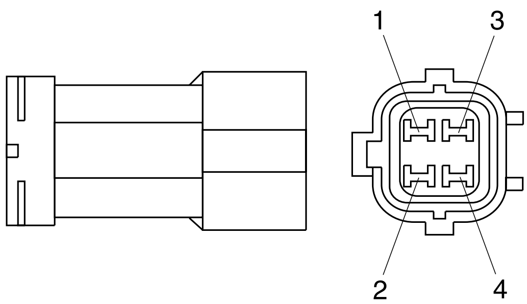
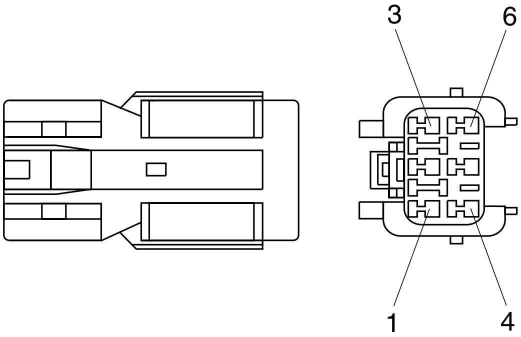
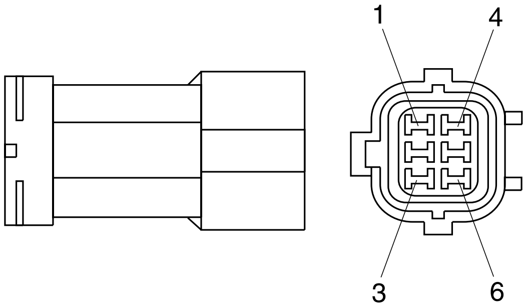
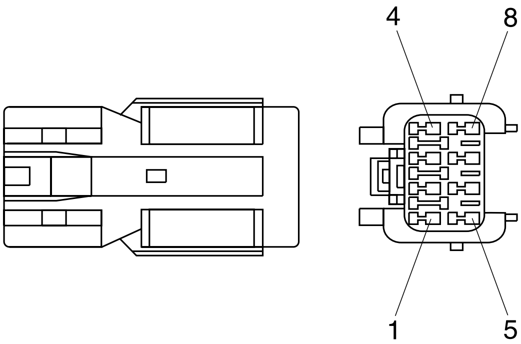
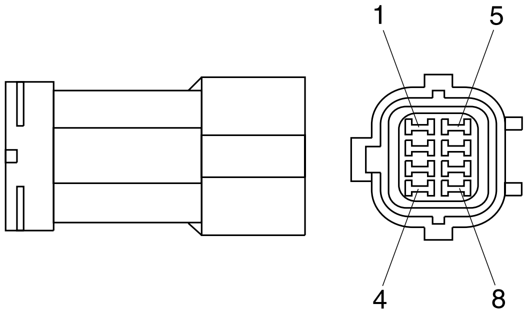
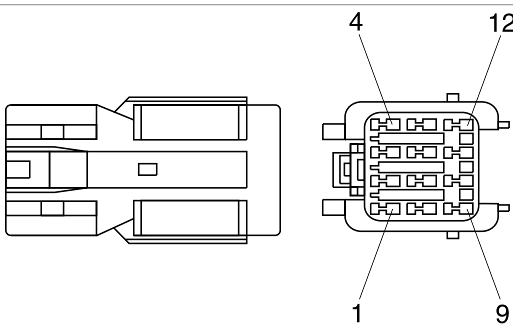
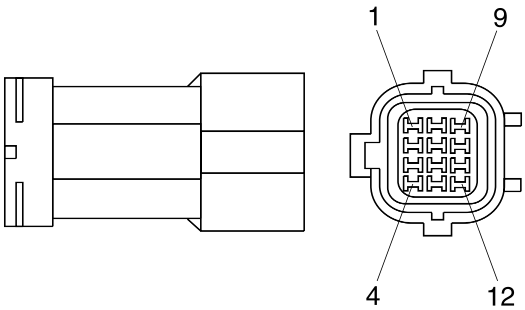
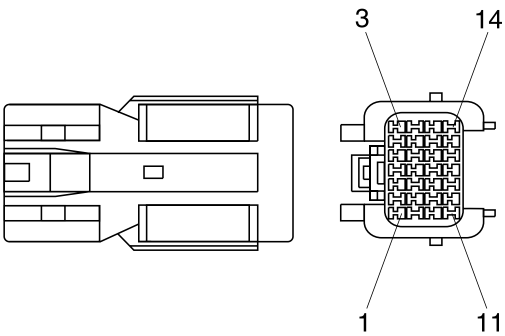
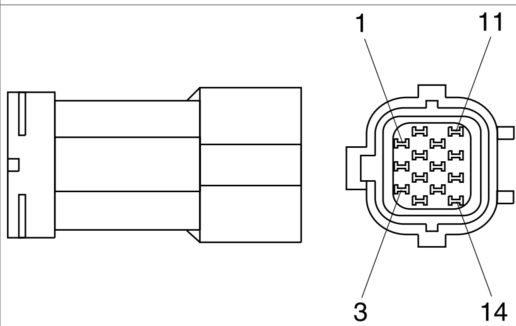
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

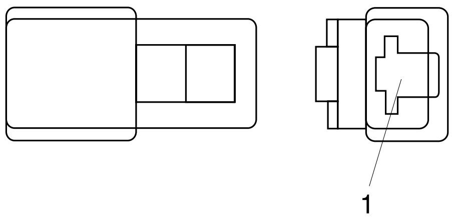
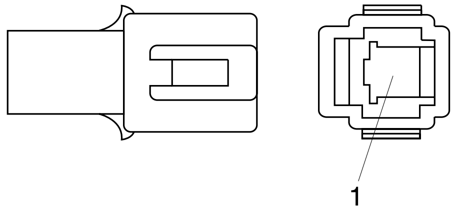
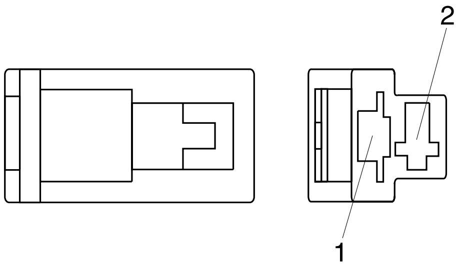
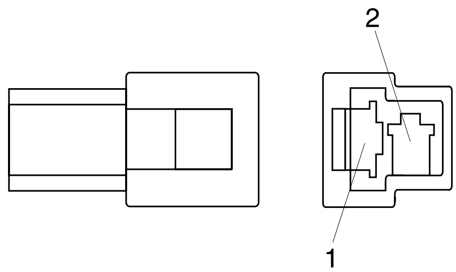
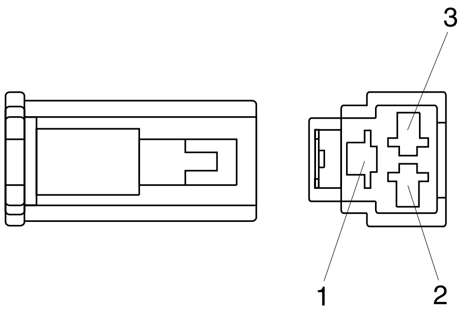
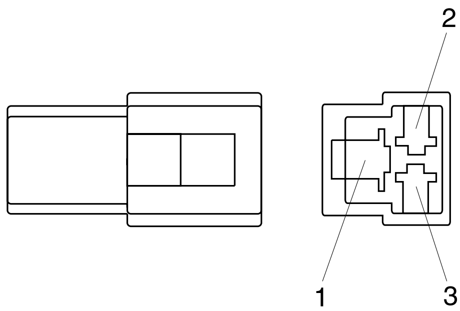
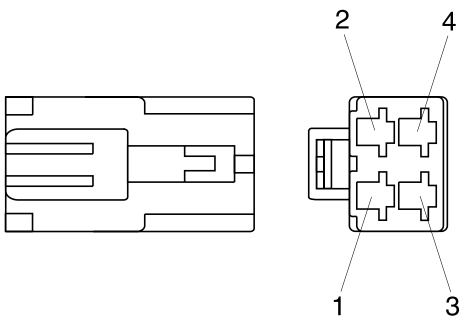
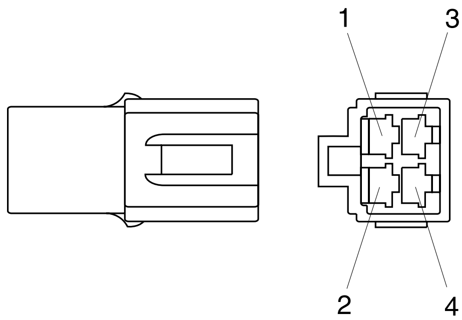
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

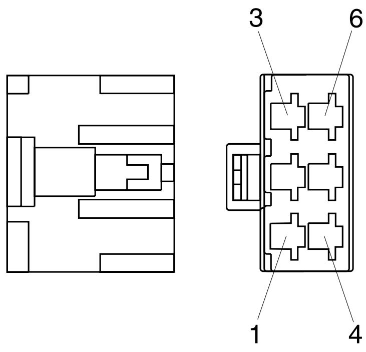
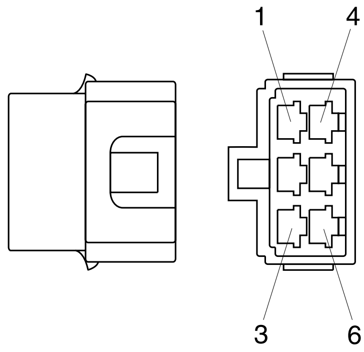
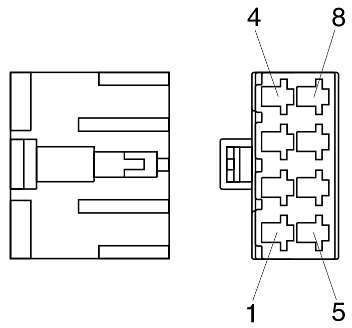
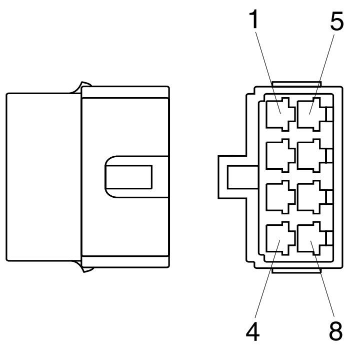
3) SWP TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S814-001000	 S814-101000
2	 S814-002000	 S814-102000
3	 S814-003000	 S814-103000
4	 S814-004000	 S814-104000

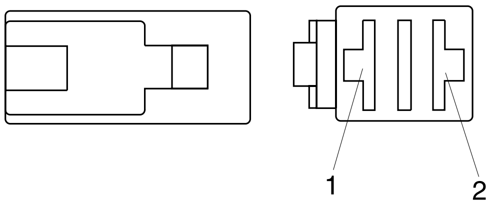
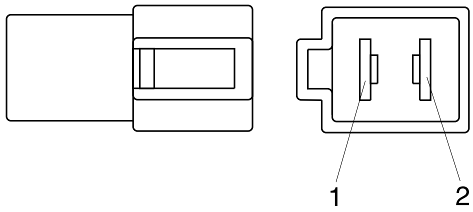
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

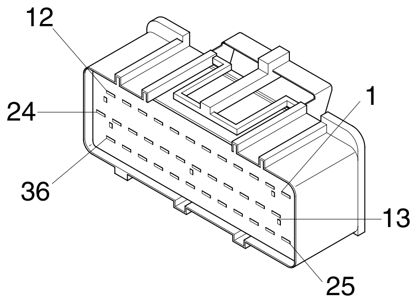
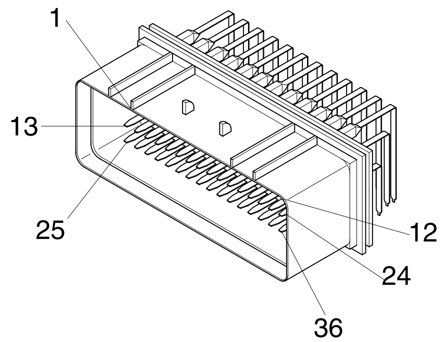
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S810-006202	 S810-106202
8	 S810-008202	 S810-108202

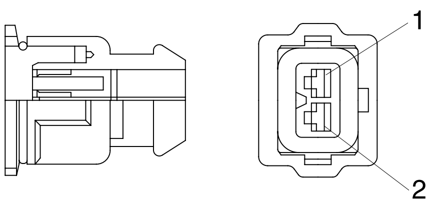
5) 375 FASTEN TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S810-002402	 S810-102402

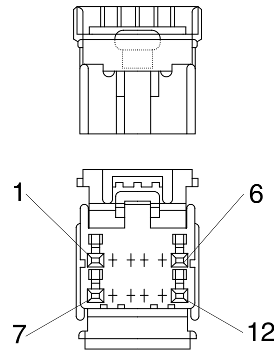
6) AMP ECONOSEAL CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
36	 344111-1	 344108-1

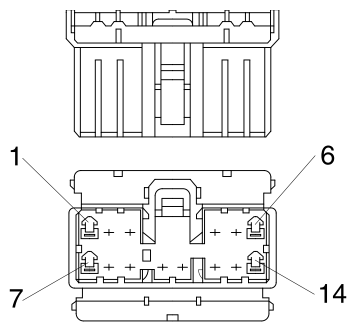
7) AMP TIMER CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	 85202-1	

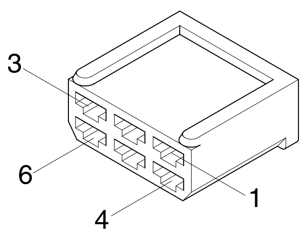
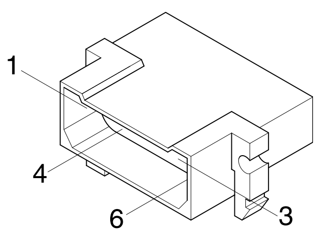
8) AMP 040 MULTILOCK CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
12	 174045-2	

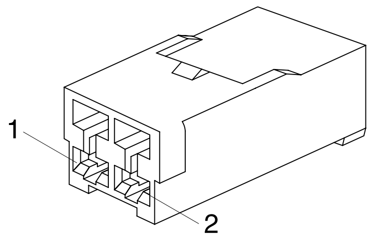
9) AMP 070 MULTILOCK CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
14	 173852	

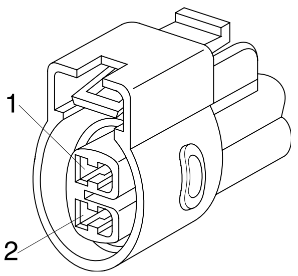
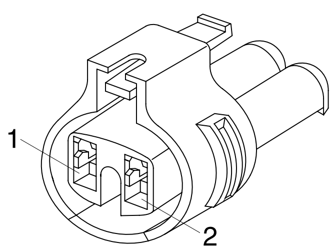
10) AMP FASTIN - FASTON CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
6	 925276-0	 480003-9

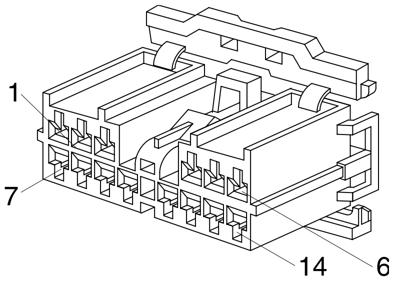
11) KET 090 CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
6	 MG610070	

12) KET 090 WP CONNECTORS

No. of pin	Receptacle connector (female)	Plug connector (male)
2	 MG640605	
2	 MG640795	

13) KET SDL CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
14	 MG610406	

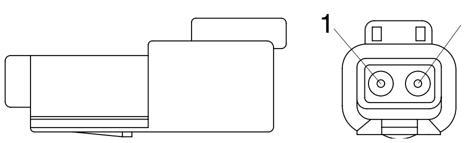
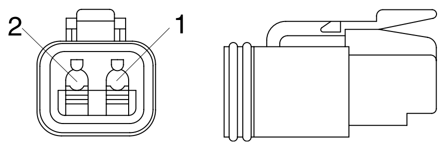
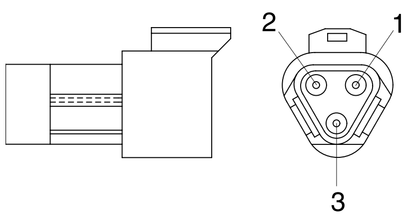
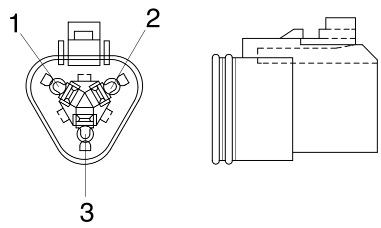
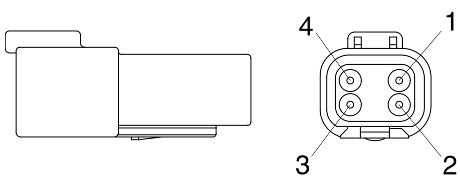
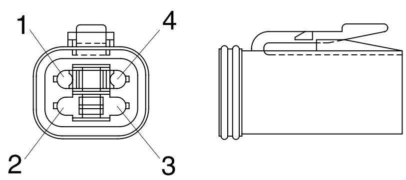
14) DEUTSCH DT CONNECTORS

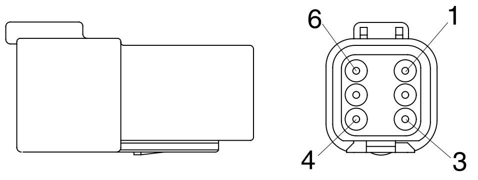
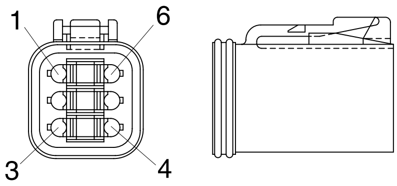
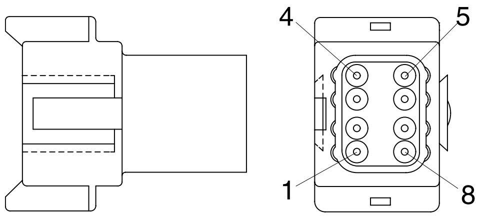
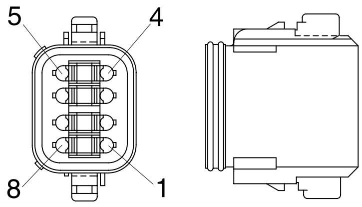
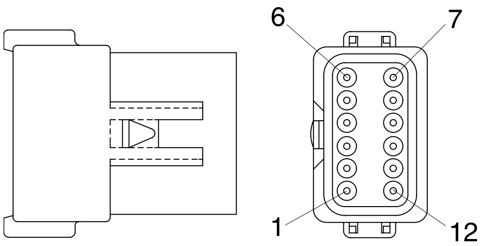
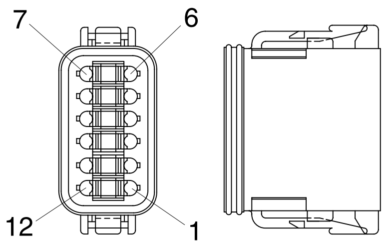
DT 06 - 3S - ★★★★

- ★★★★ : Modifications (see below)
- 3S : Number of contacts (P : Pin, S : Socket)
- 06 : 04 : Receptacle, 06 : Plug
- DT : Deutsch connectors

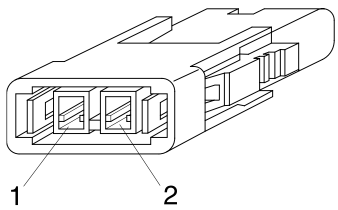
※ Modification

E003 : Standard end cap - gray
E004 : Color of connector to be black
E005 : Combination - E004 & E003
EP04 : End cap
EP06 : Combination P012 & EP04
P012 : Front seal enhancement - connectors color to black for 2, 3, 4 & 6pin

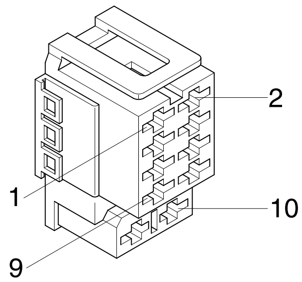
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT06-2P
3	 DT06-3S	 DT06-3P
4	 DT06-4S	 DT06-4P

No. of pin	Receptacle connector (female)	Plug connector (male)
6	 DT06-6S	 DT06-6P
8	 DT06-8S	 DT06-8P
12	 DT06-12S	 DT06-12P

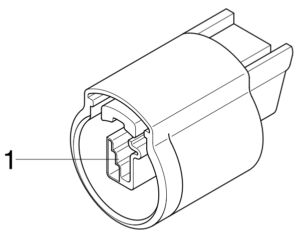
15) MOLEX 2CKTS CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	 35215-0200	

16) ITT SWF CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

17) MWP NMWP CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
1	 NMWP01F-B	

SECTION 5 TROUBLESHOOTING

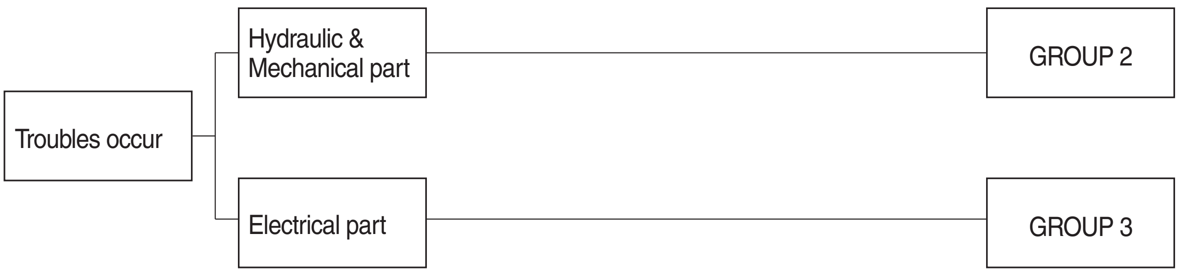
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

When a trouble is occurred in the machine, this section will help an operator to maintain the machine with easy.

The trouble of machine is parted Hydraulic & Mechanical system and Electrical system system.

At each system part, an operator can check the machine according to the troubleshooting process diagram.

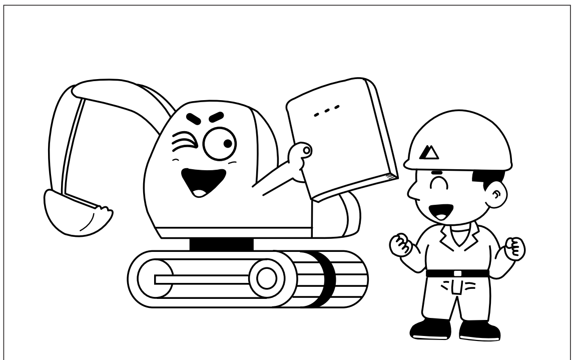


2. DIAGNOSING PROCEDURE

To carry out troubleshooting efficiently, the following steps must be observed.

STEP 1. Study the machine system

Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.

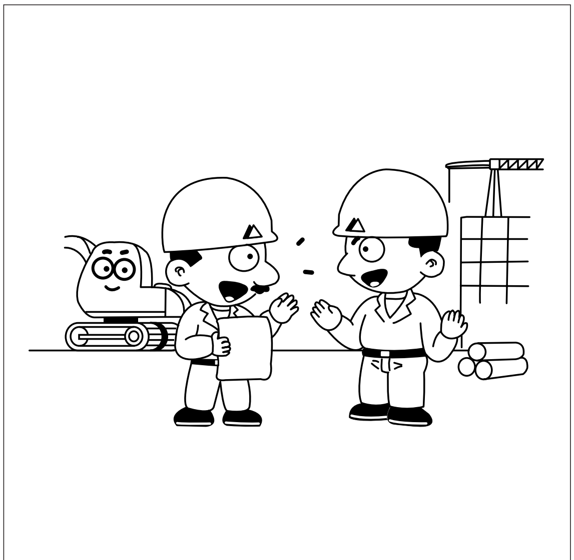


13031SH02

STEP 2. Ask the operator

Before inspecting, get the full story of malfunctions from a witness --- the operator.

1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously? If so, which parts were repaired before.

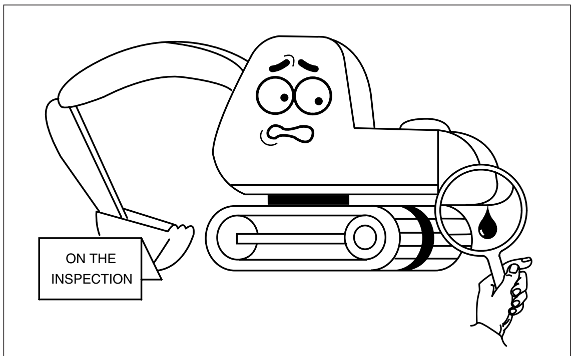


13031SH03

STEP 3. Inspect the machine

Before starting troubleshooting, check the machine for the daily maintenance points as shown in the operator's manual.

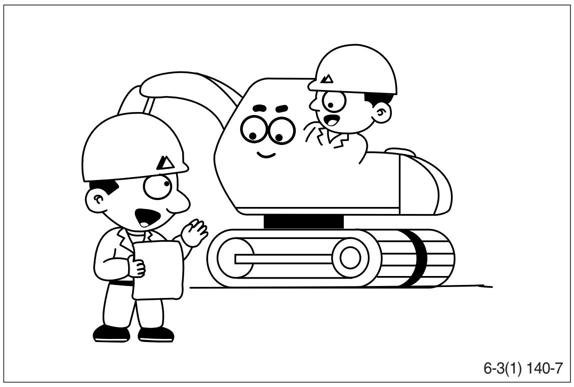
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



6-2(3) 140-7

STEP 4. Inspect the trouble actually on the machine

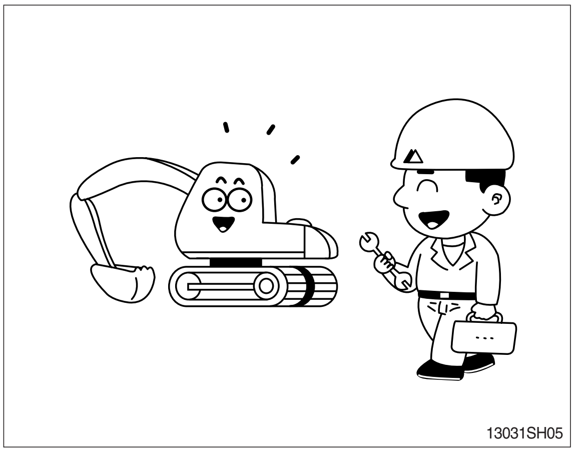
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



6-3(1) 140-7

STEP 5. Perform troubleshooting

According to where the trouble parts are located, hydraulic & mechanical system part or electrical system part or mechatronics system part, perform troubleshooting the machine refer to the each system part's troubleshooting process diagram.

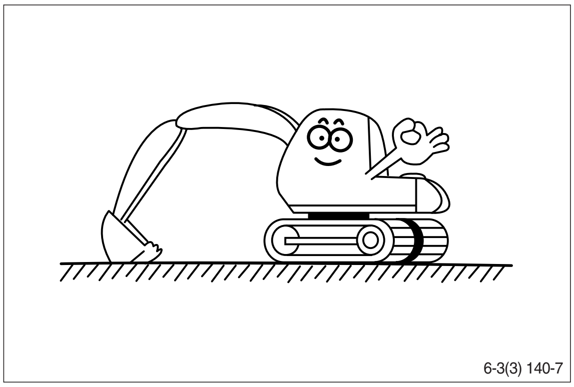


13031SH05

STEP 6. Trace a cause

Before reaching a conclusion, check the most suspectible causes again. Try to trace what the real cause of the trouble is.

Make a plan of the appropriate repairing procedure to avoid consequential malfunctions.



6-3(3) 140-7

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

(1) If even a minor fault is left intact and operation is continued, a fatal failure may be caused, entailing a large sum of expenses and long hours of restoration.
Therefore when even a small trouble occurs, do not rely on your intuition and experience, but look for the cause based on the troubleshooting principle and perform maintenance and adjustment to prevent major failure from occurring. Keep in mind that a fault results from a combination of different causes.

(2) The following lists up commonly occurring faults and possible causes with this machine. For the troubleshooting of the engine, refer to the coming troubleshooting and repair.

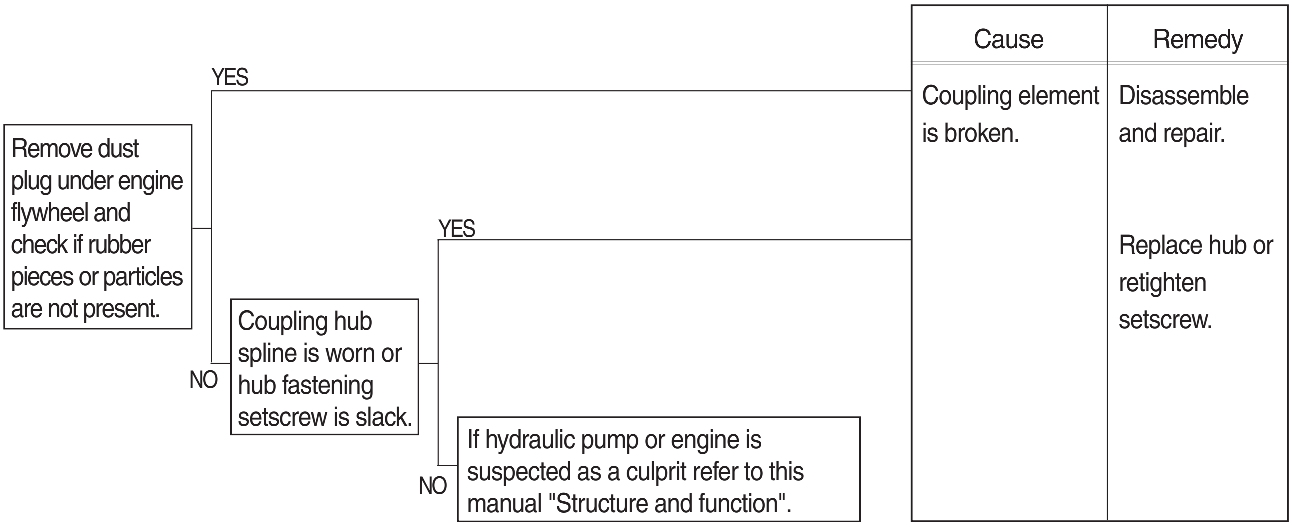
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(4) Ask user or operator the following.
① Was there any strange thing about machine before failure occurred?
② Under what conditions did the failure occur?
③ Have any repairs been carried out before the failure?

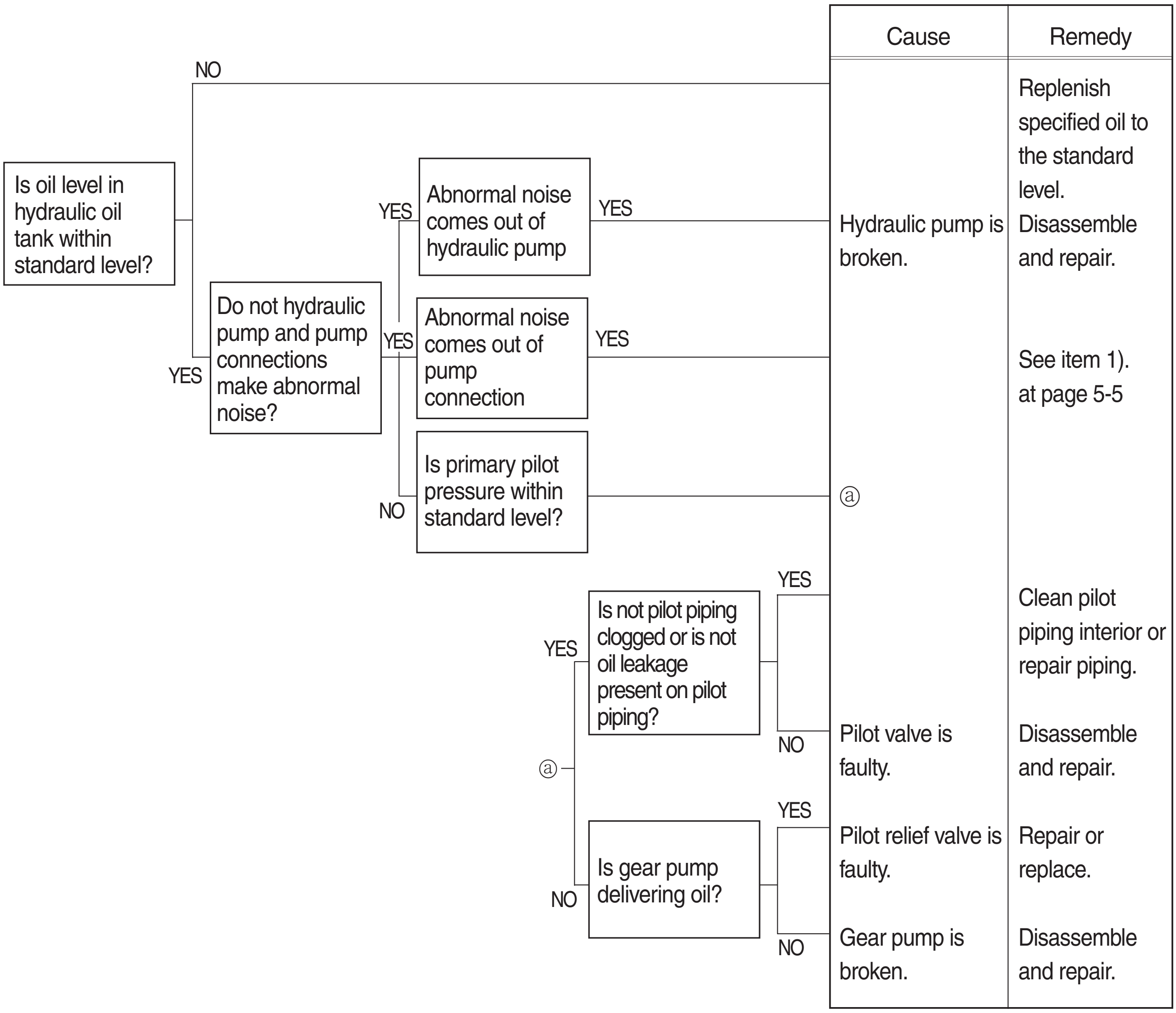
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



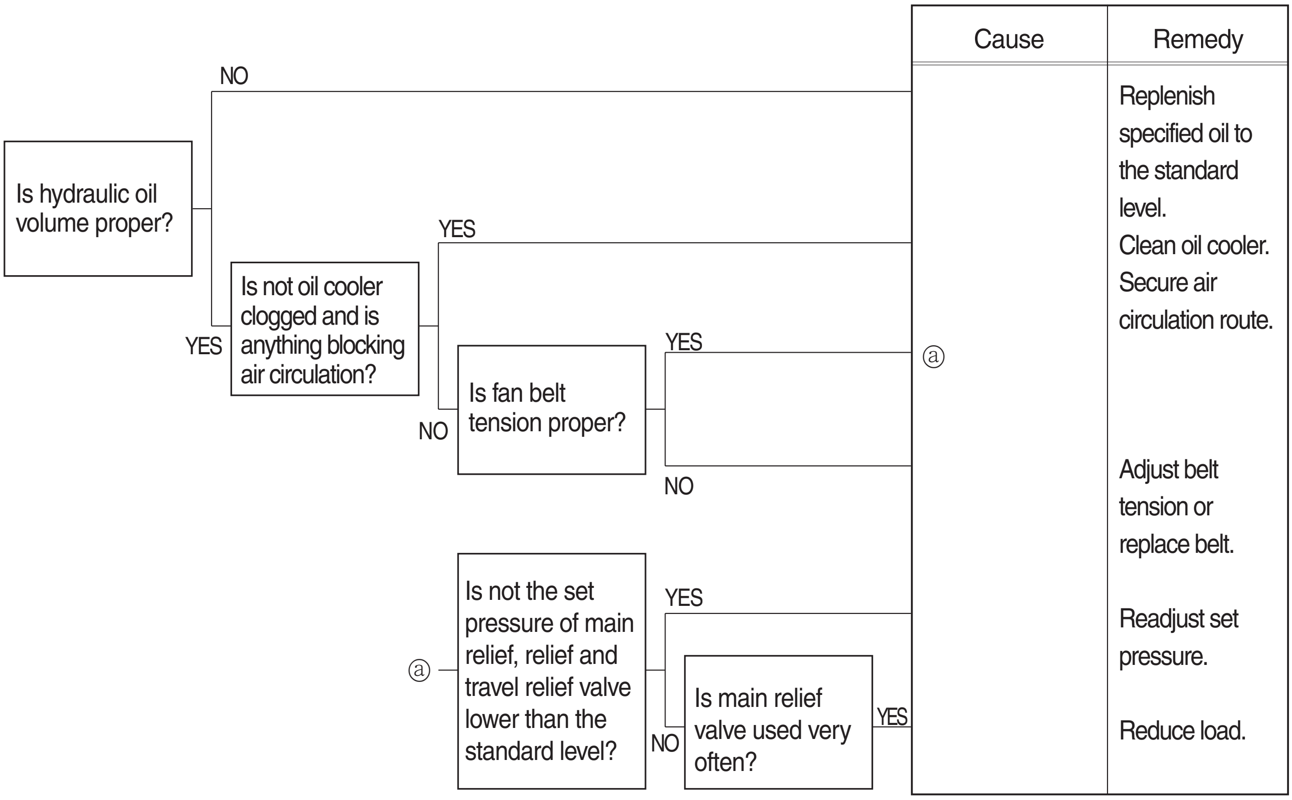
2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



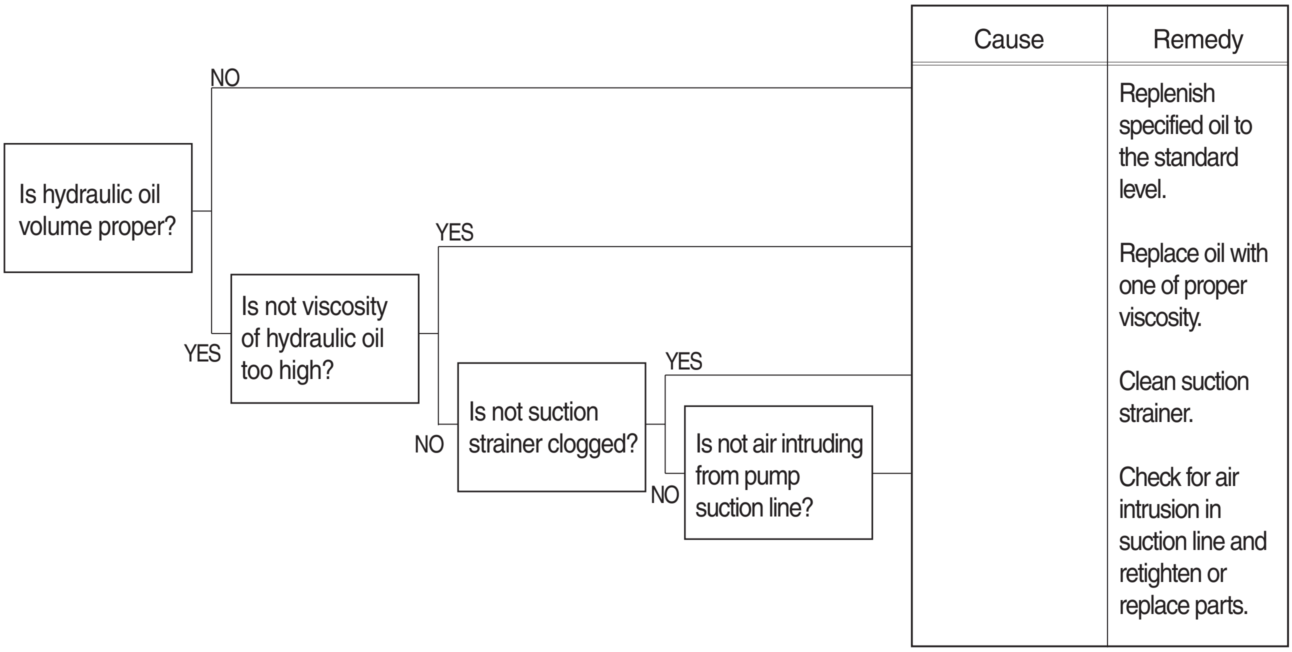
3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

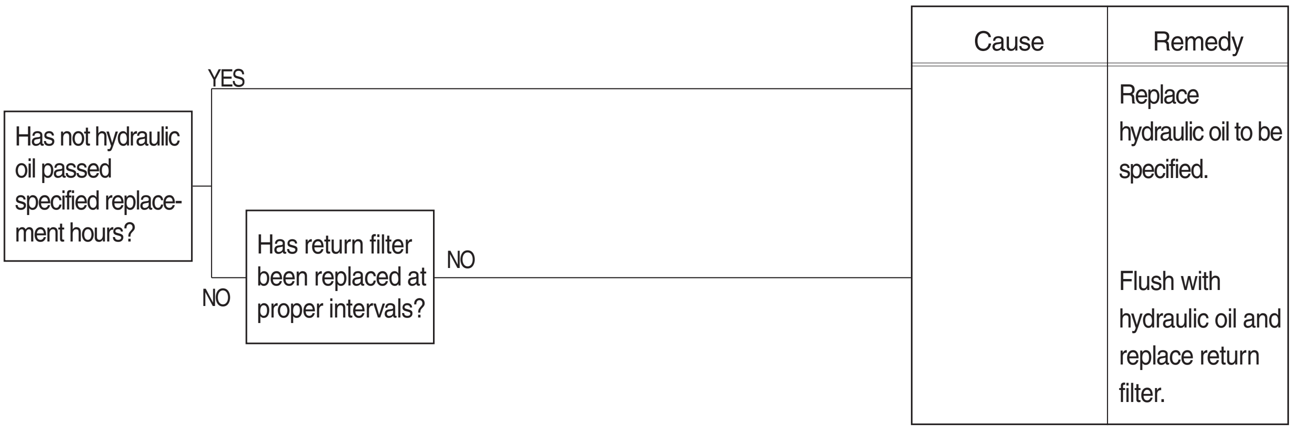
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

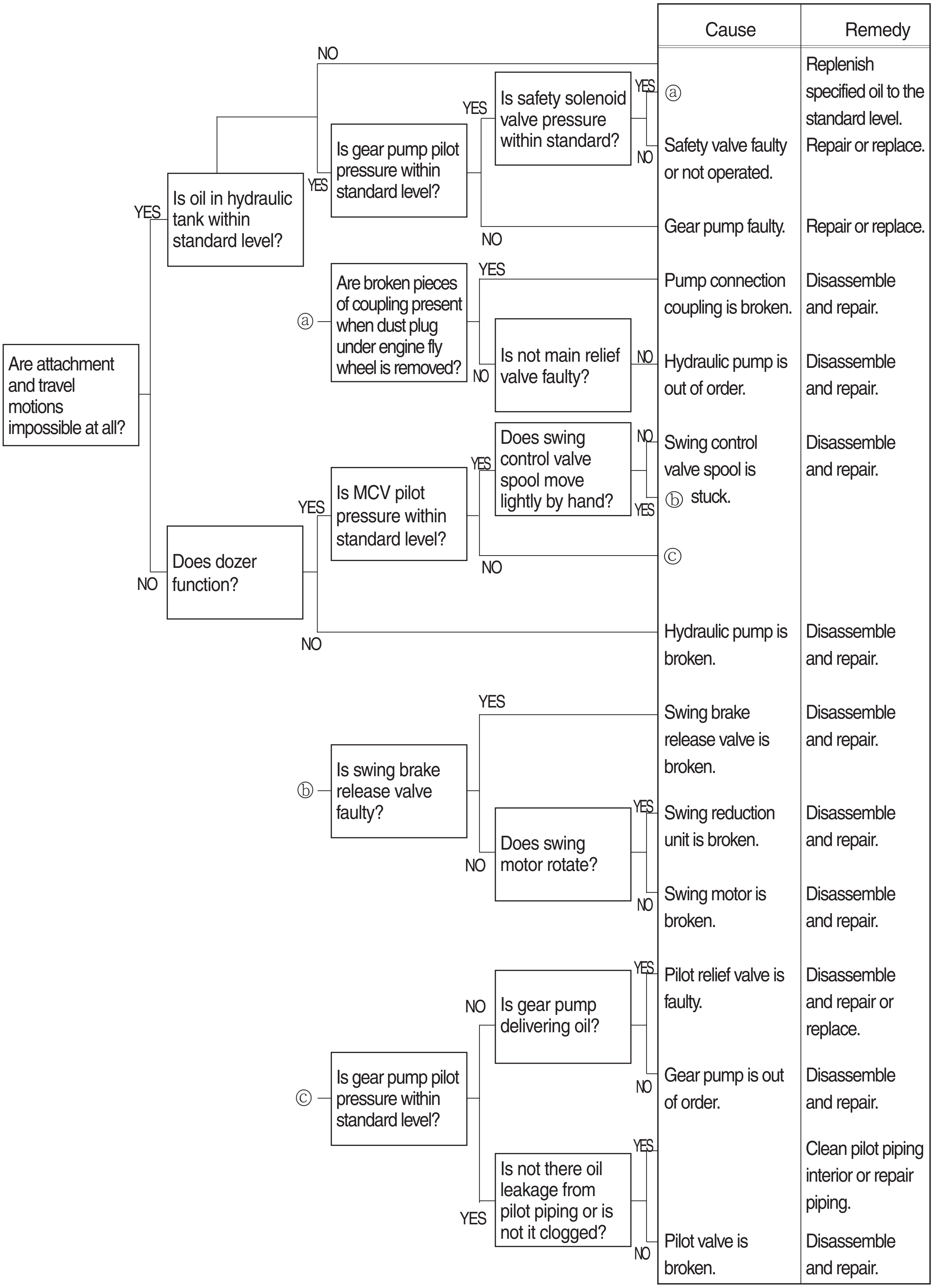


4) HYDRAULIC OIL IS CONTAMINATED

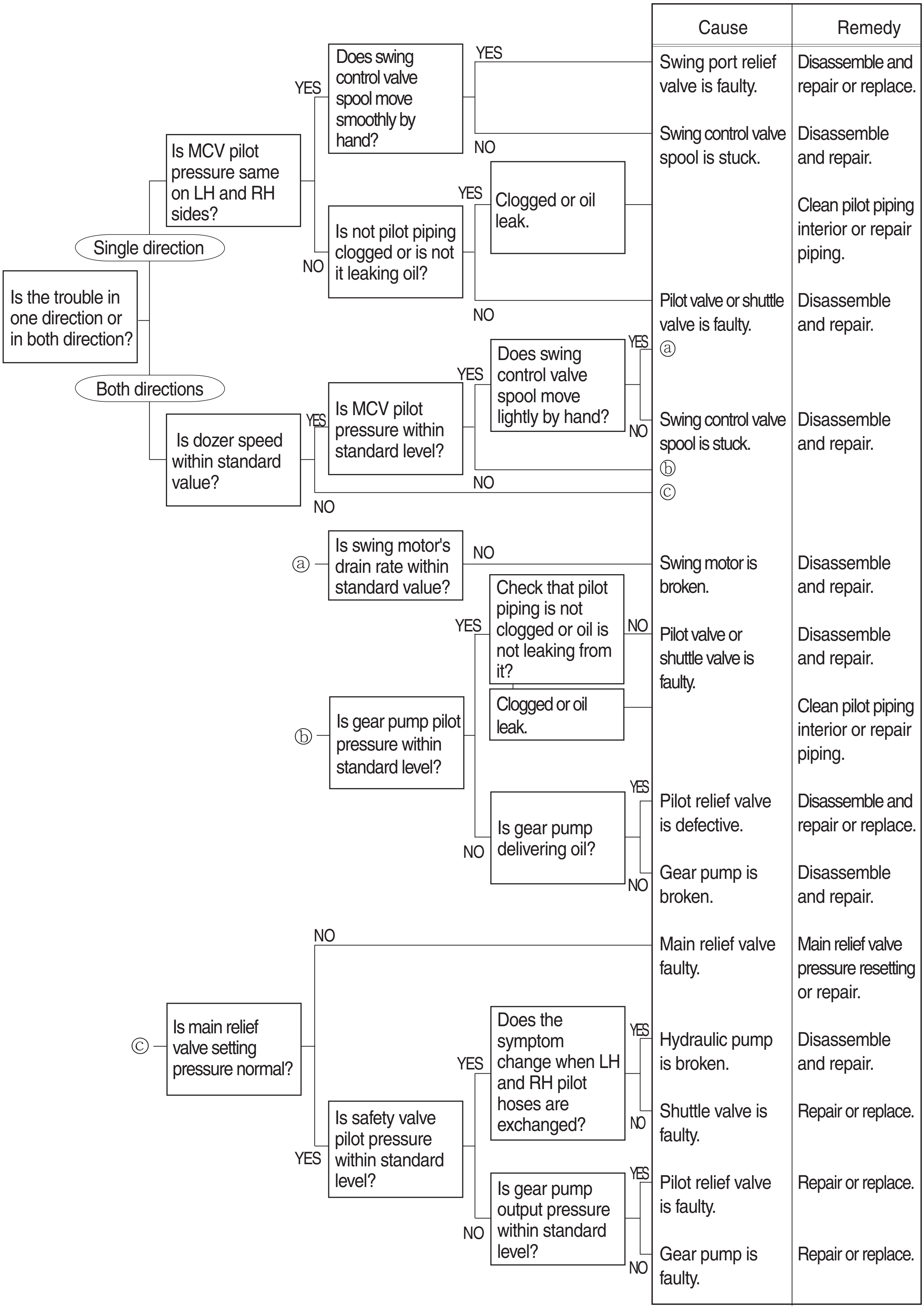


4. SWING SYSTEM

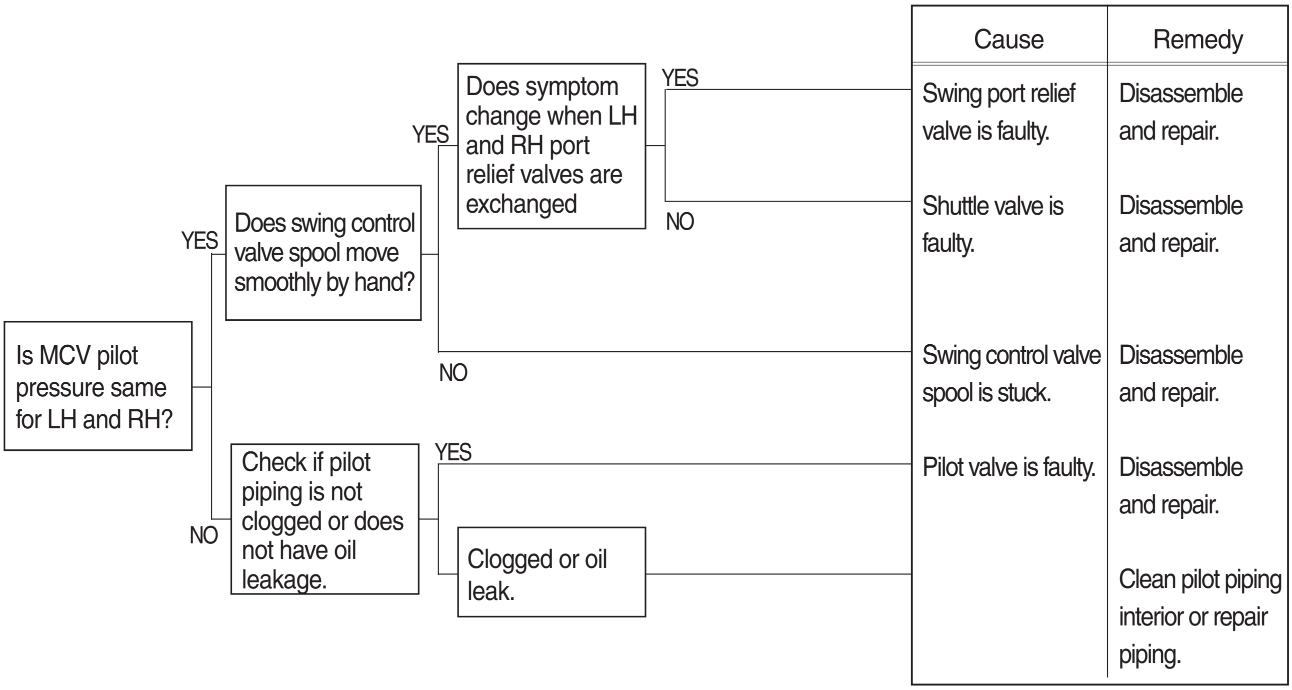
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



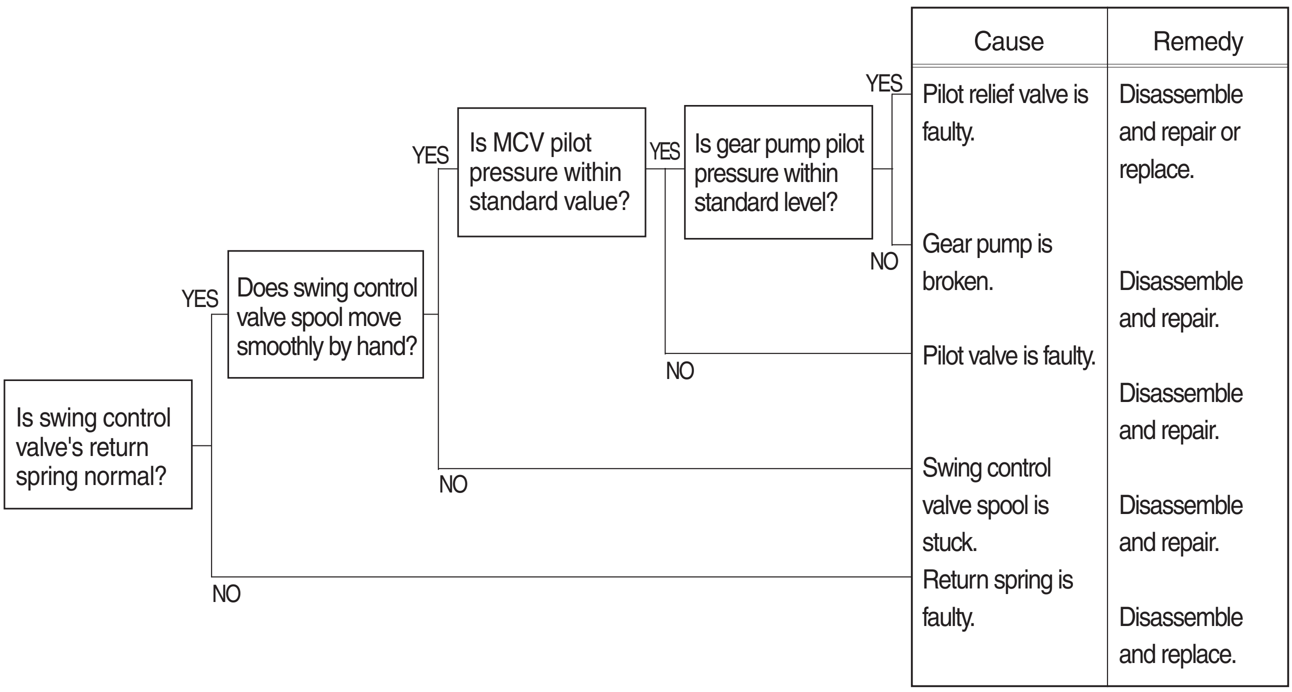
2) SWING SPEED IS LOW



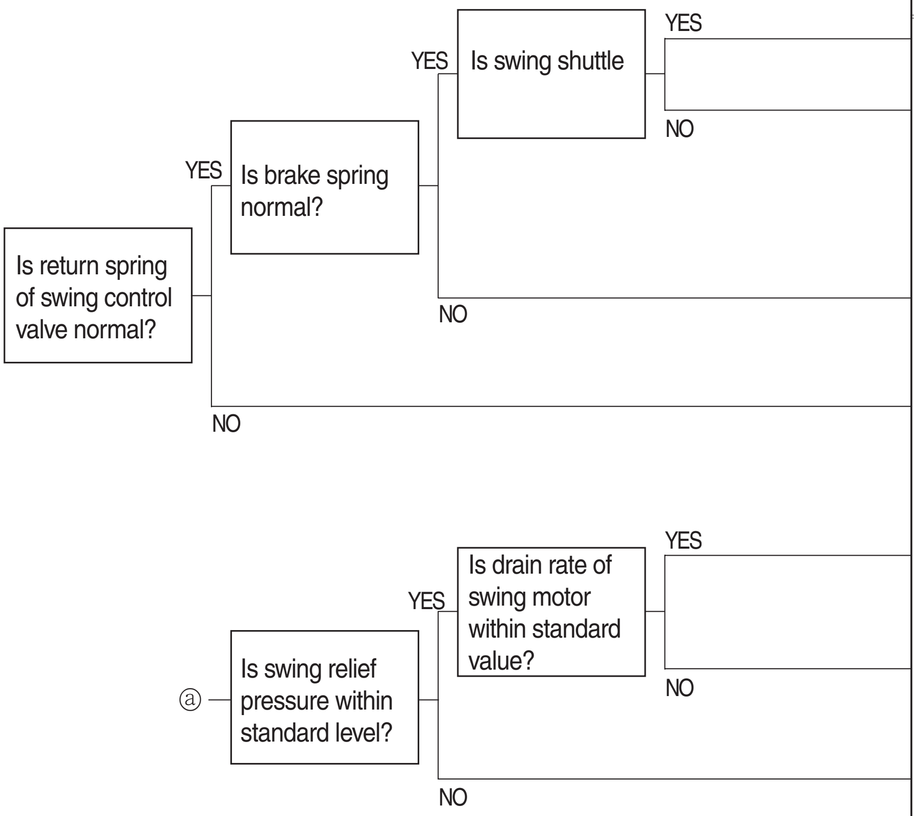
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP



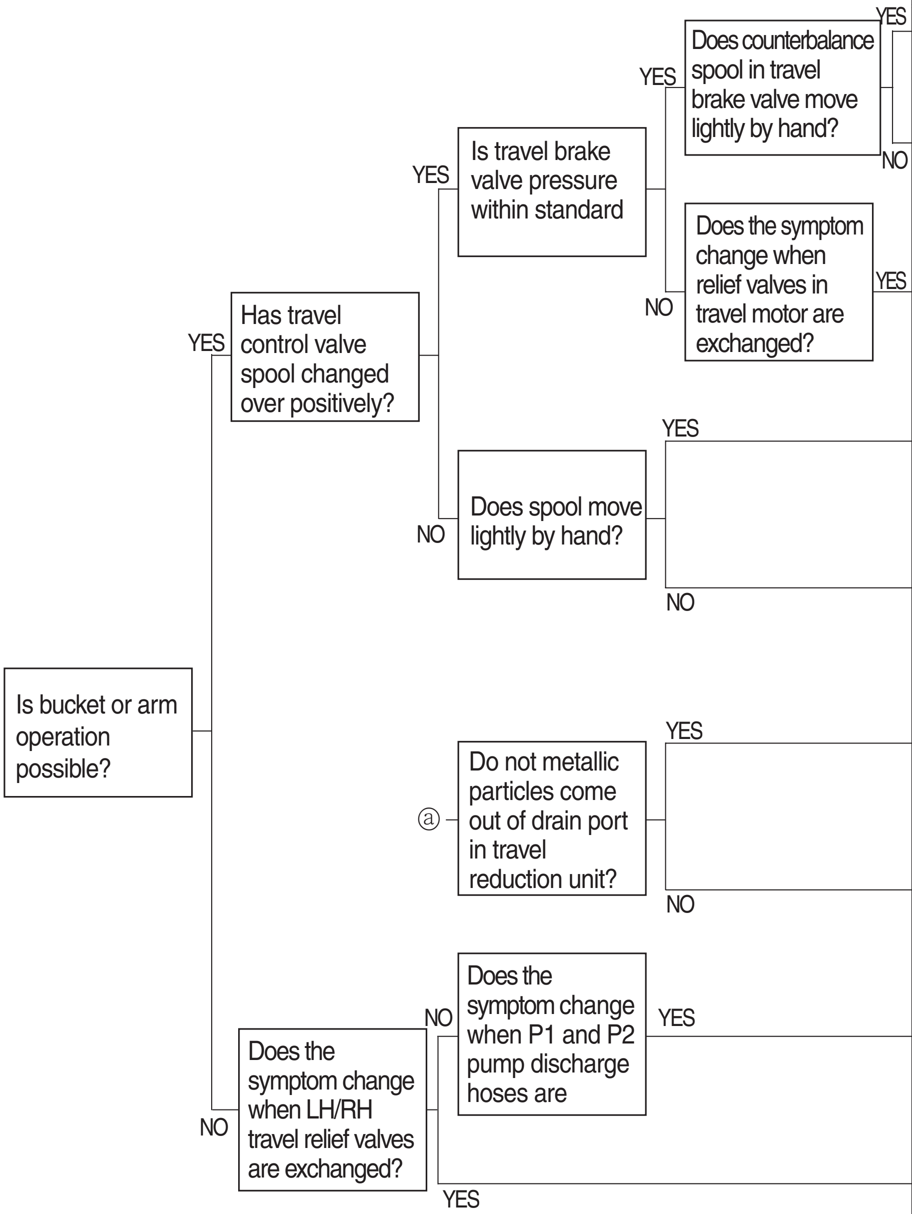
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
	Adjust swing relief valve pressure or replace swing relief valve.

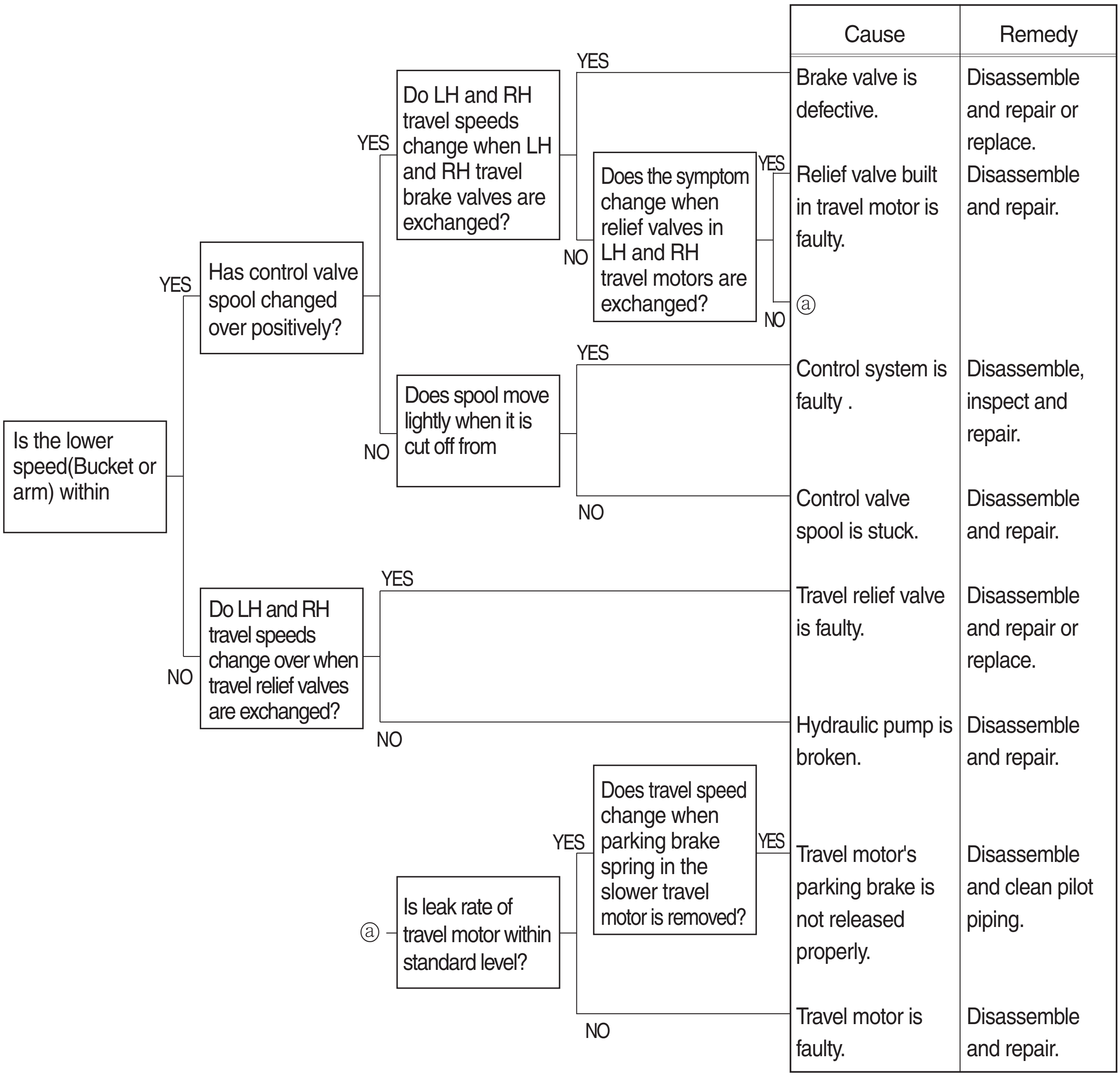
5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



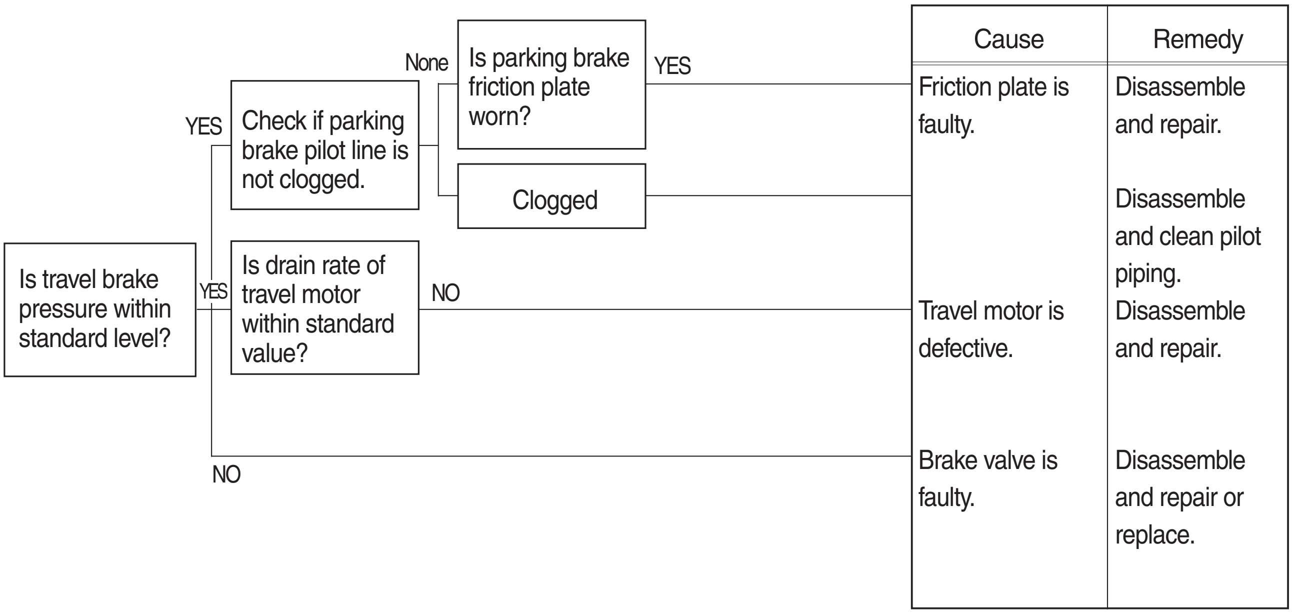
Cause	Remedy
ⓐ	
Counter spool in travel brake valve is stuck.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
Control system is defective.	Disassemble inspect and repair.
Travel control valve spool is stuck.	Disassemble and repair.
Travel reduction unit is faulty.	Disassemble and repair.
Travel motor is out of order.	Disassemble and repair.
Hydraulic pump is broken.	Disassemble and repair.
Travel relief valves are faulty.	Disassemble and repair or replace.

2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

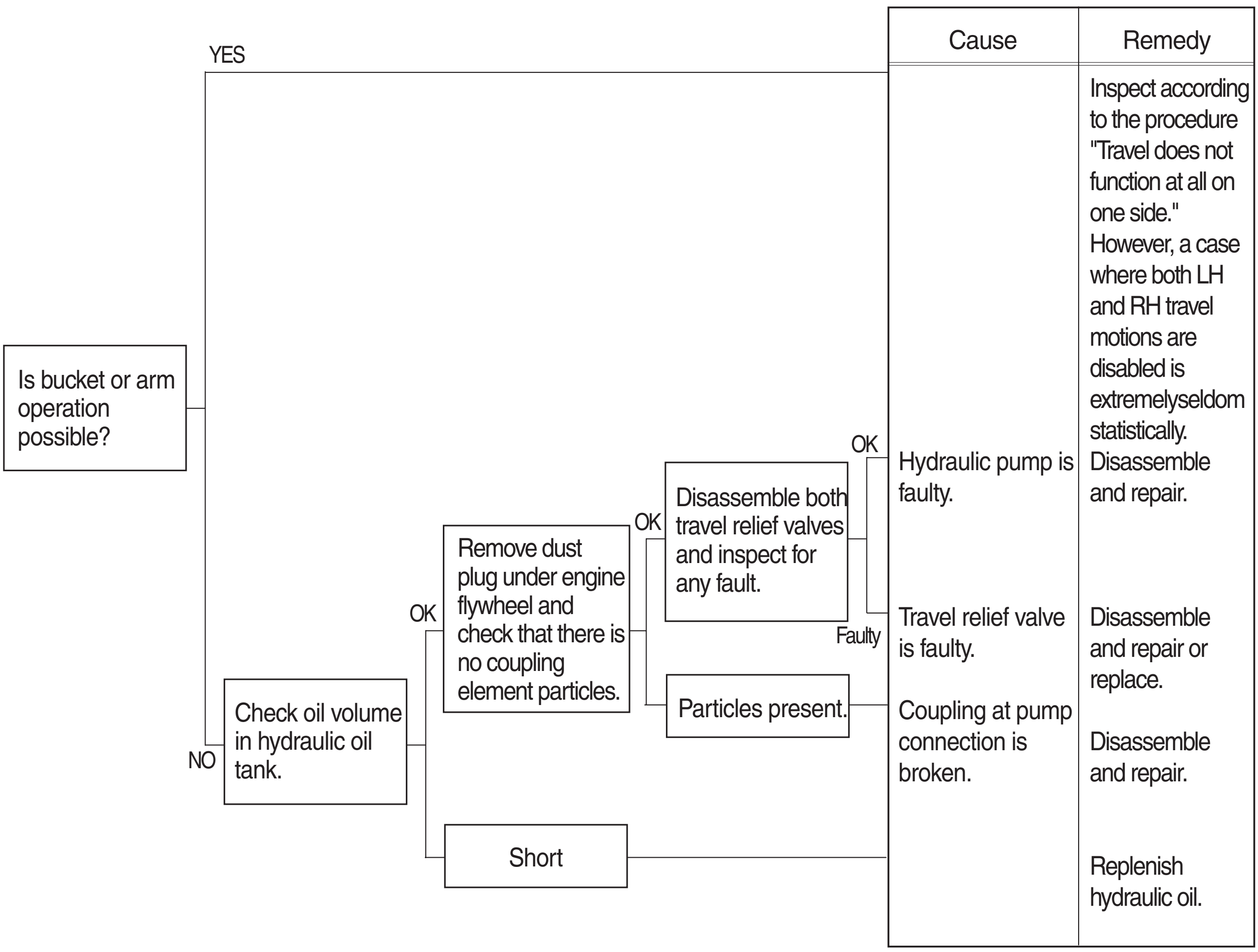


3) MACHINE DOES NOT STOP ON A SLOPE

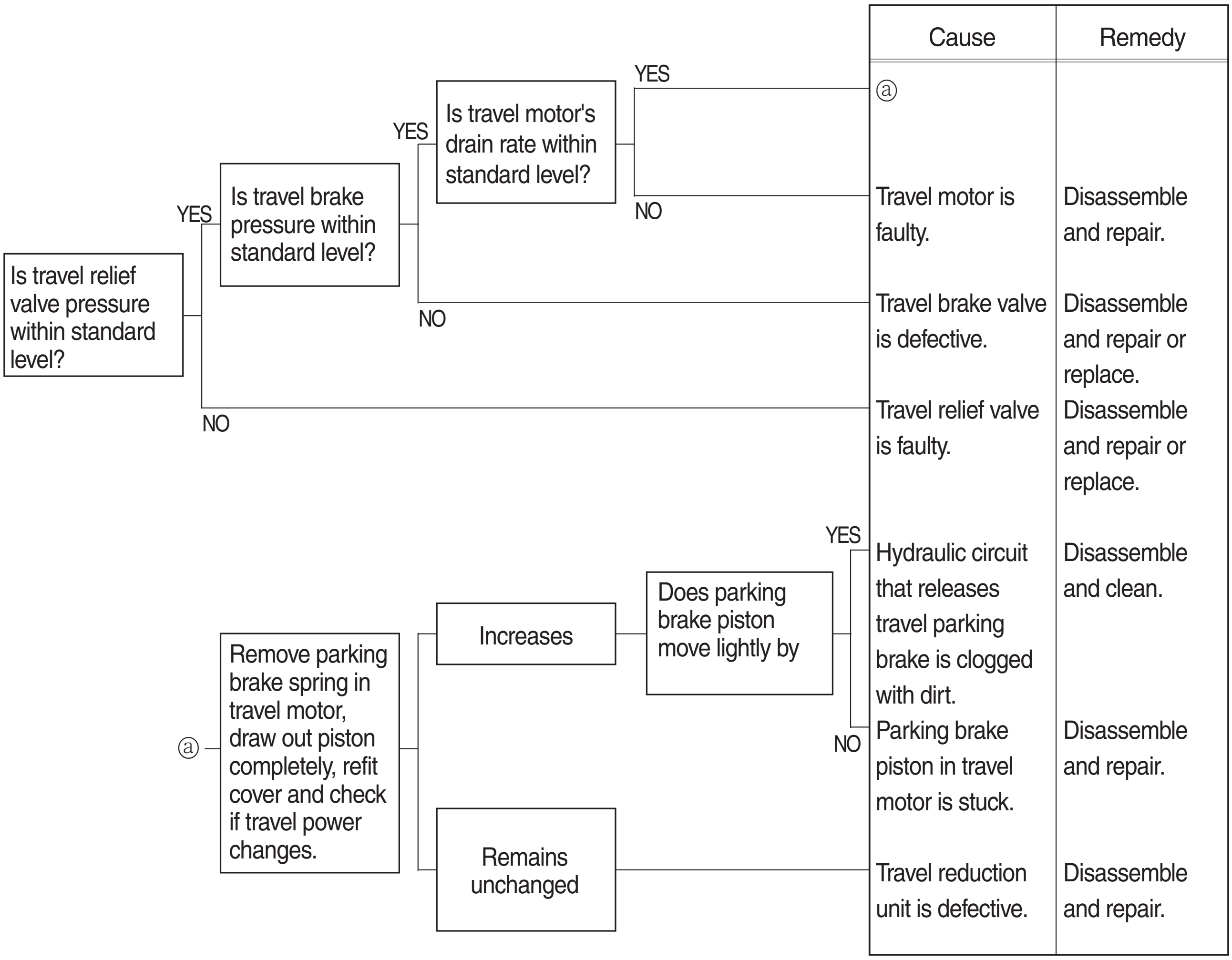
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

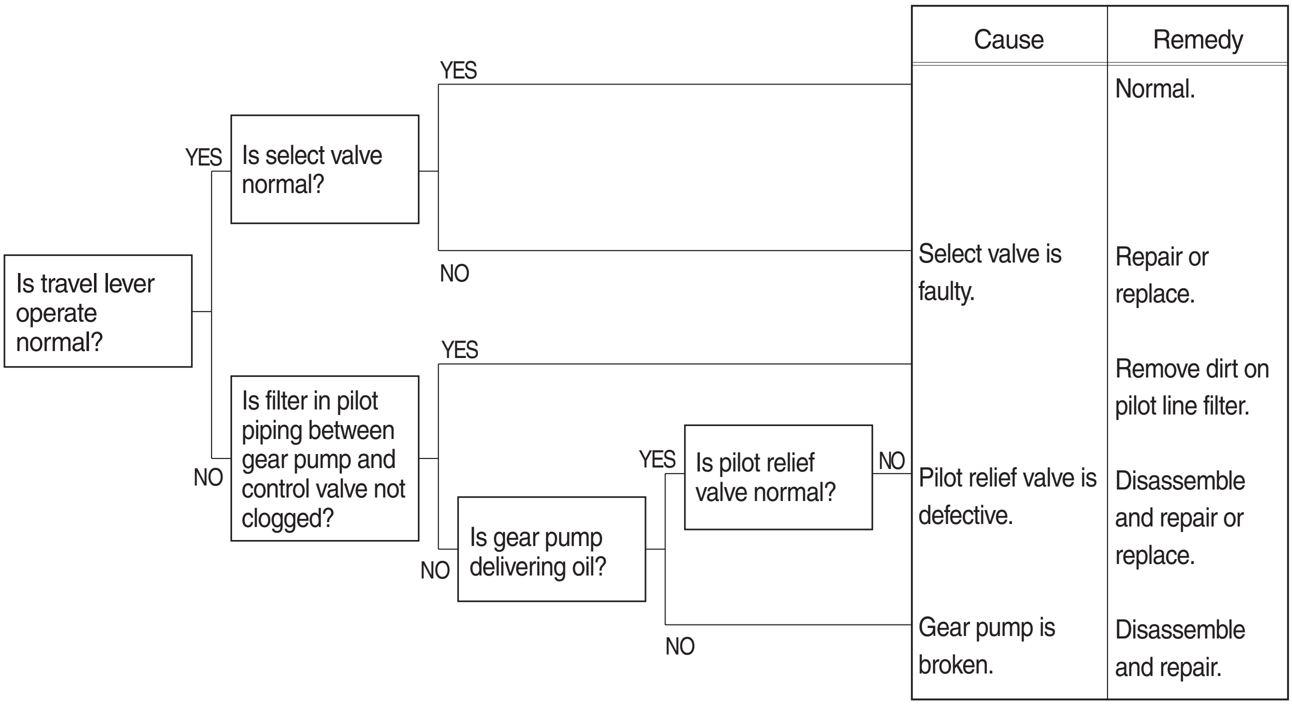


5) TRAVEL ACTION IS POWERLESS (travel only)



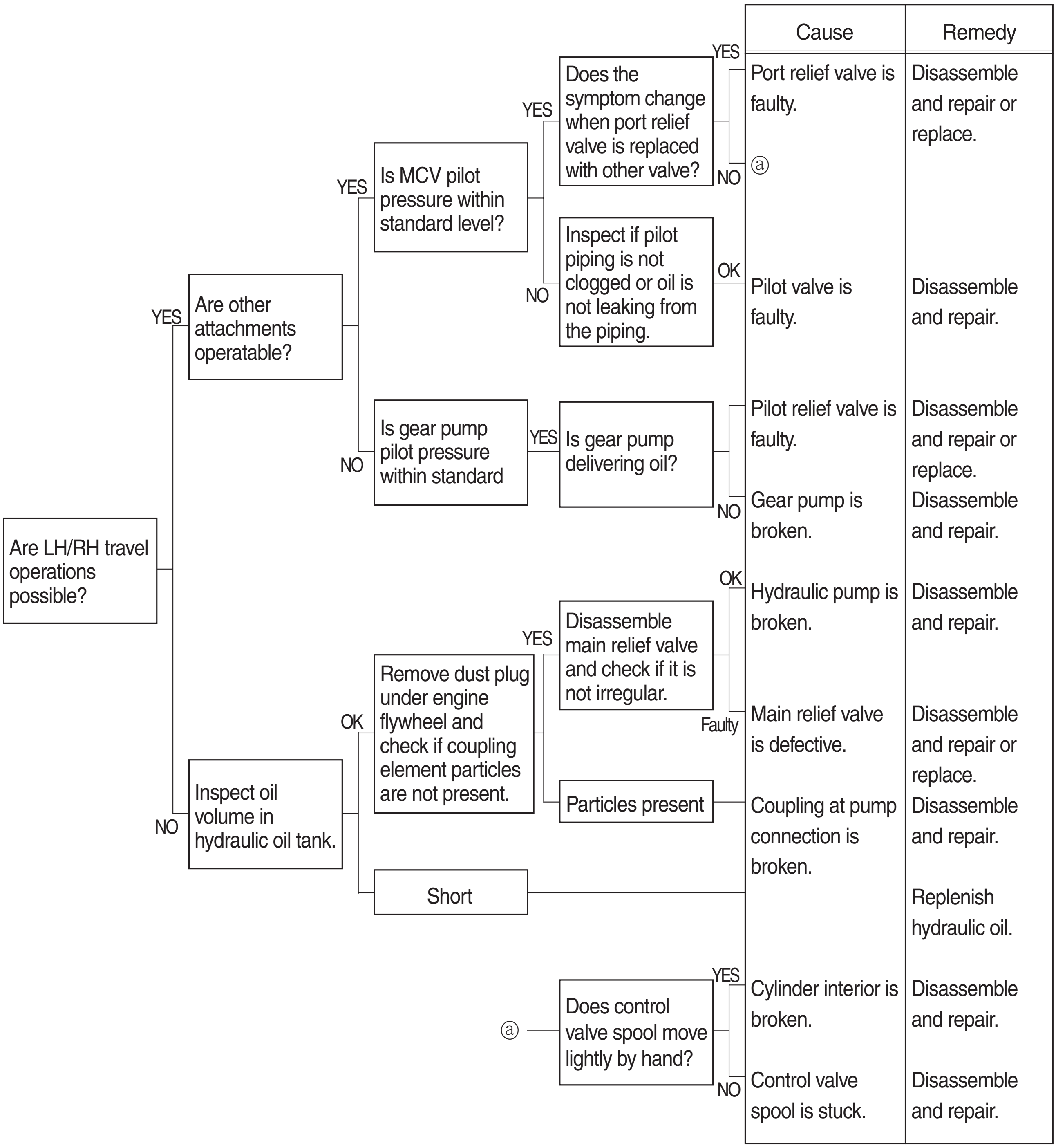
6) MACHINE RUNS RECKLESSLY ON A SLOPE

7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME

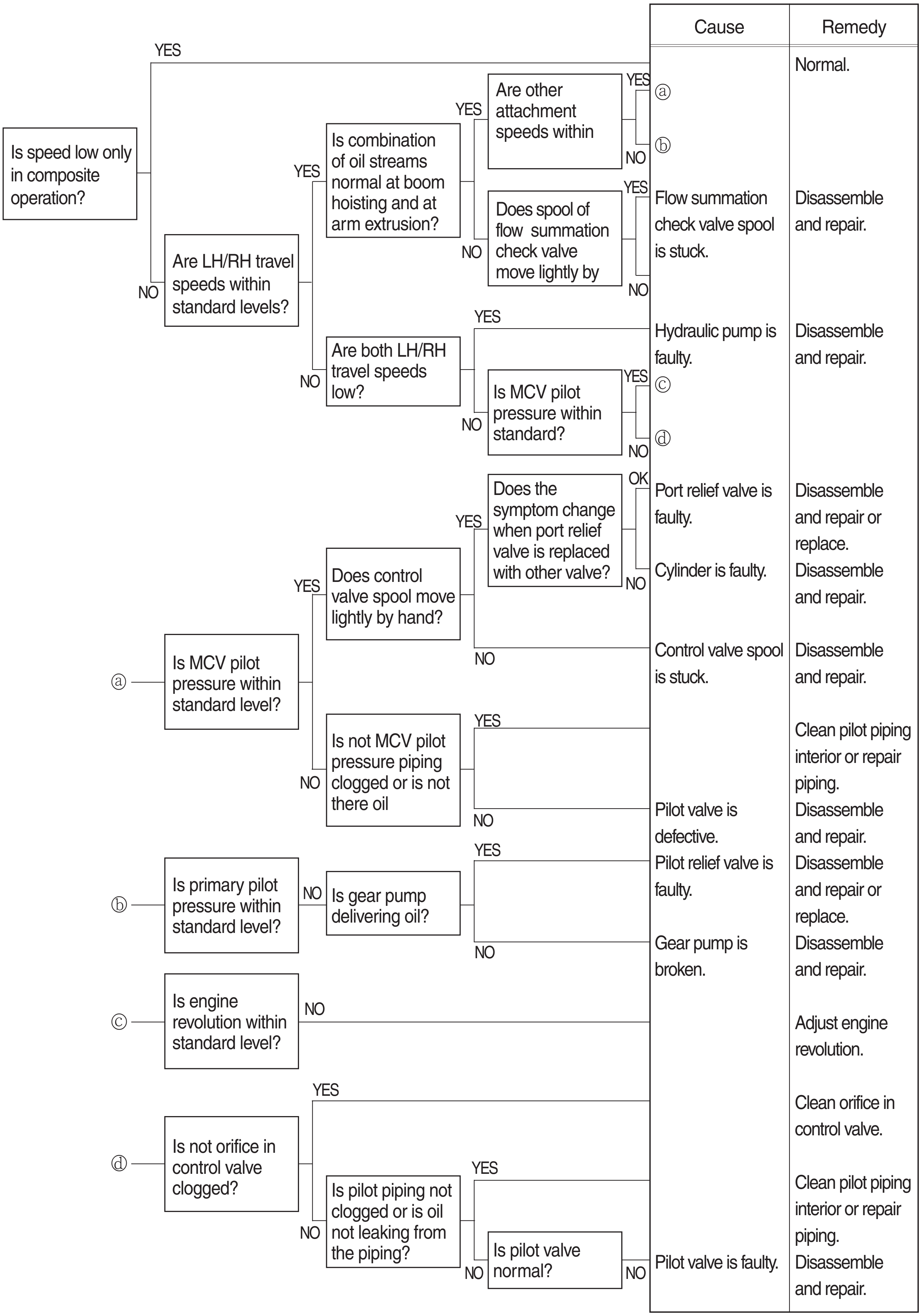


6. ATTACHMENT SYSTEM

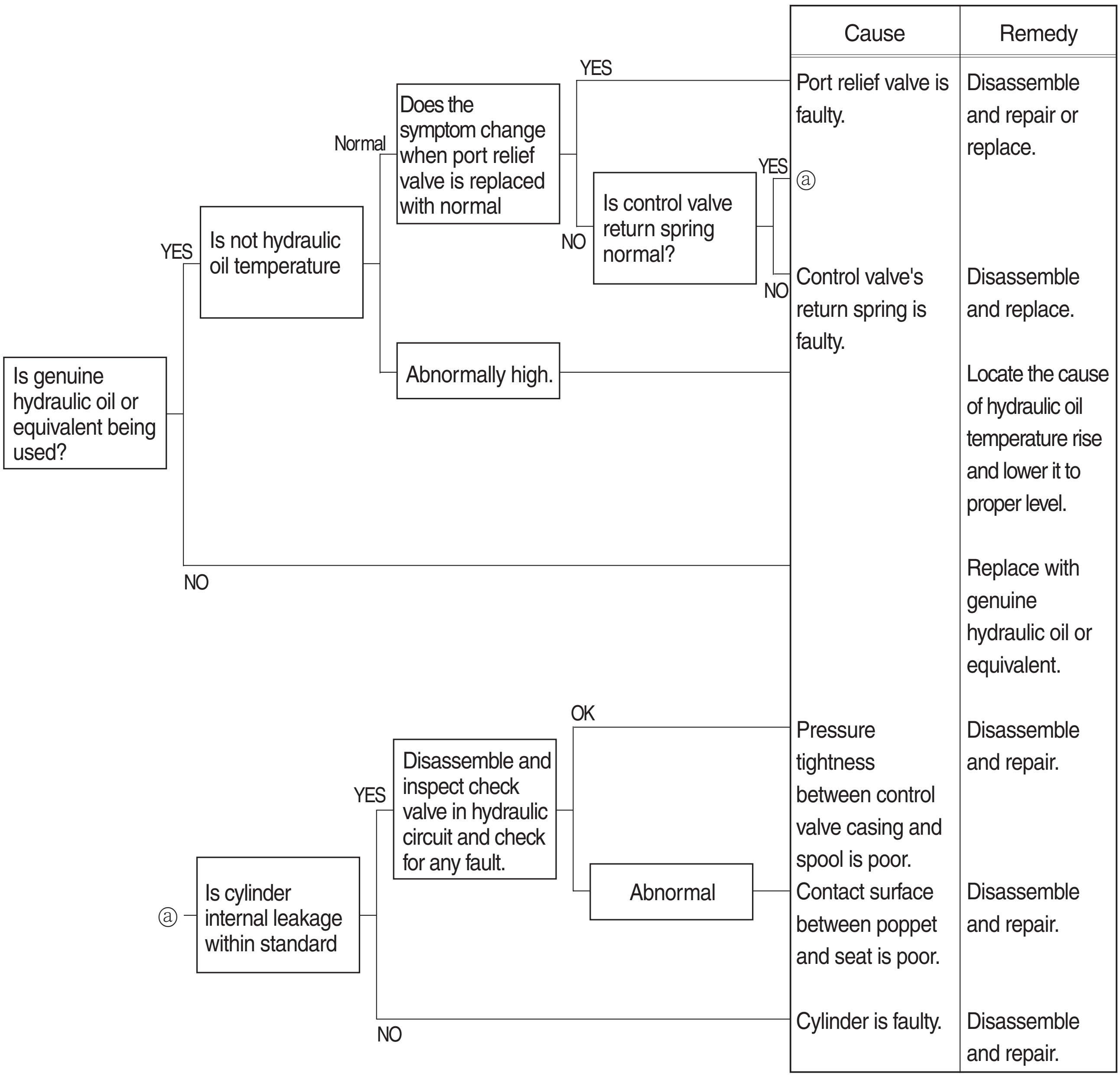
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



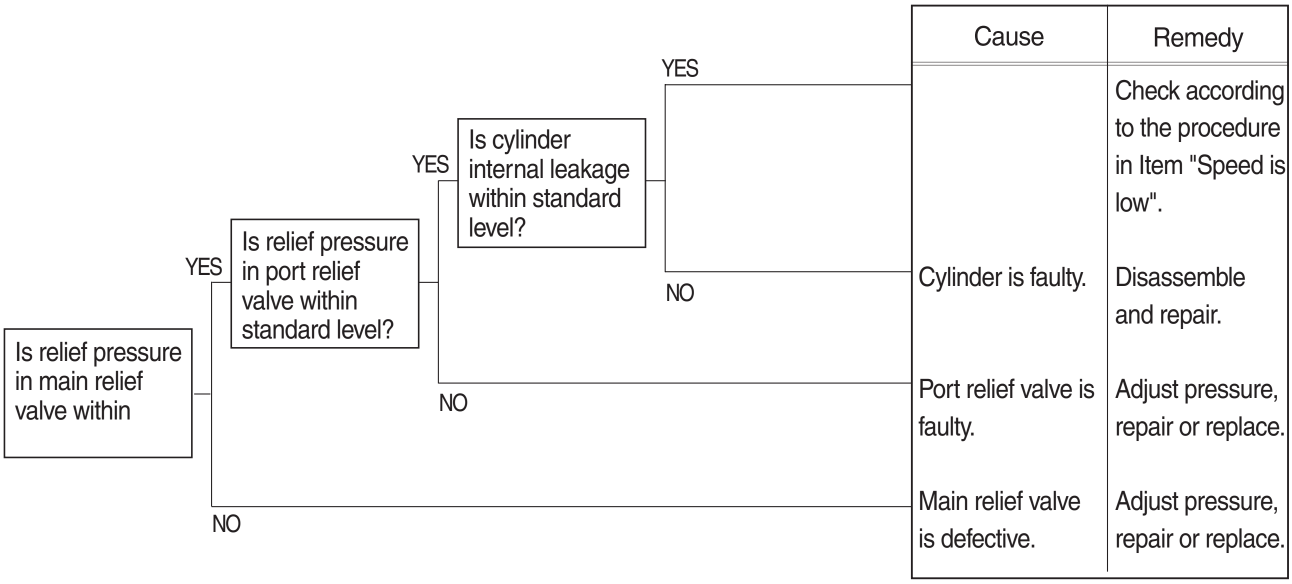
2) BOOM, ARM OR BUCKET SPEED IS LOW



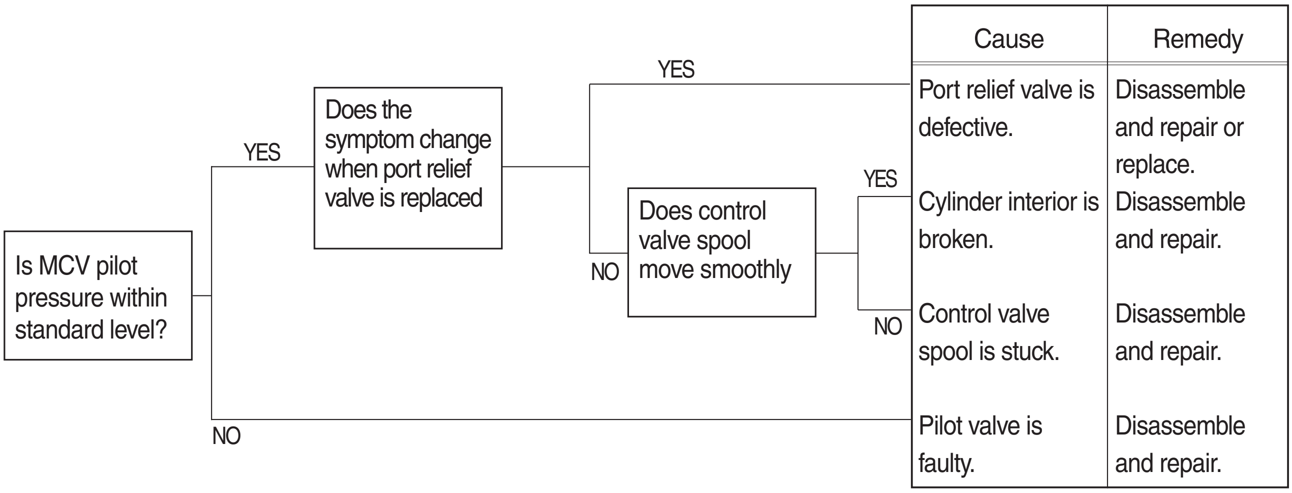
3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE

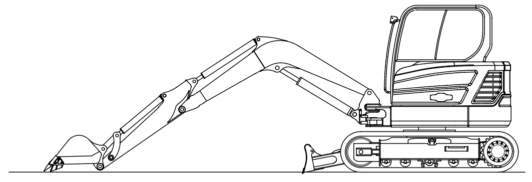


6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

Check	Result	Cause	Remedy
Is boom foot pin greased sufficiently?	YES		Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
	NO	Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is in a grown state, correct it by paper lapping or with an oil stone.

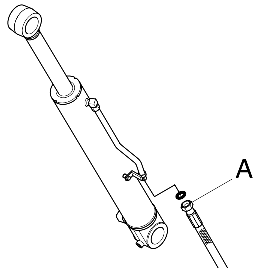
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

1. Lower the bucket teeth to the ground with bucket cylinder fully retracted and arm cylinder rod retracted almost in full.



80CR95BY01

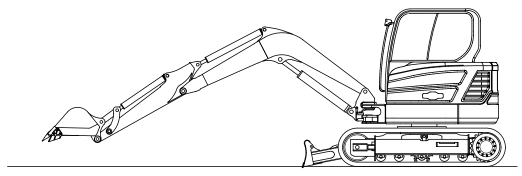
2. Disconnect hose(A) from rod side of boom cylinder and drain oil from cylinders and hose.(Put cups on piping and hose ends)



R5575BY02

3. Raise bucket OFF the ground by retracting the arm cylinder rod.

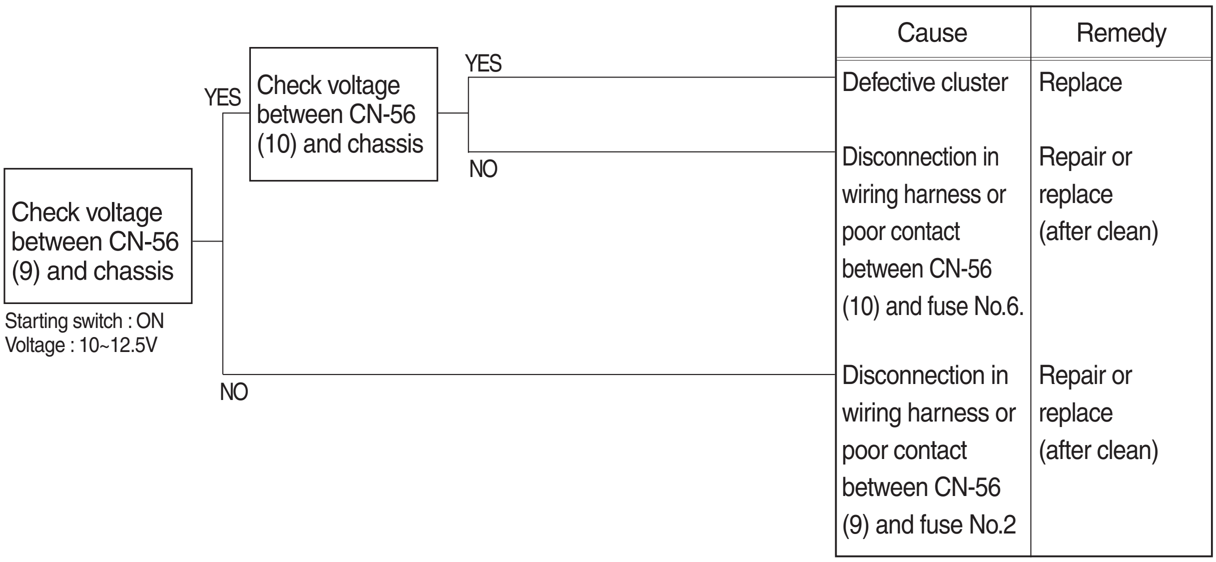
   If oil leaks from piping side and boom cylinder rod is retracted there is an internal leak in the cylinder.
   If no oil leaks from piping side and boom cylinder rod is retracted, there is an internal leak in the control valve.



80CR95BY03

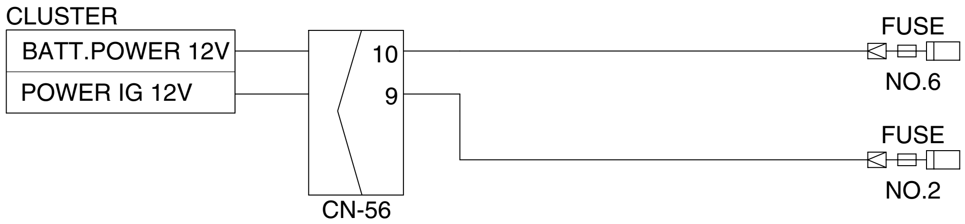
1. WHEN STARTING SWITCH IS TURNED ON, MONITOR PANEL DISPLAY DOES NOT APPEAR

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.2 and No.5.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check voltage

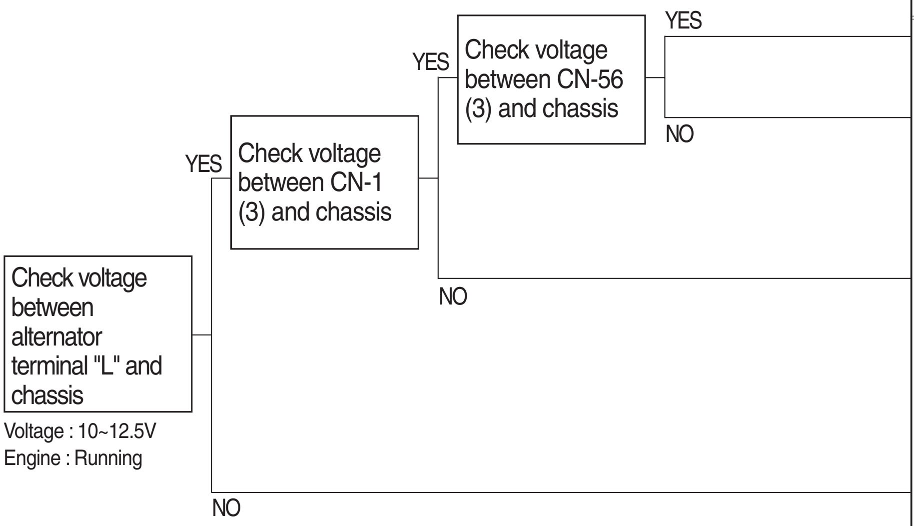
YES	10 ~ 12.5V
NO	0V



55Z95TS01

2. BATTERY CHARGING WARNING LAMP LIGHTS UP (starting switch : ON)

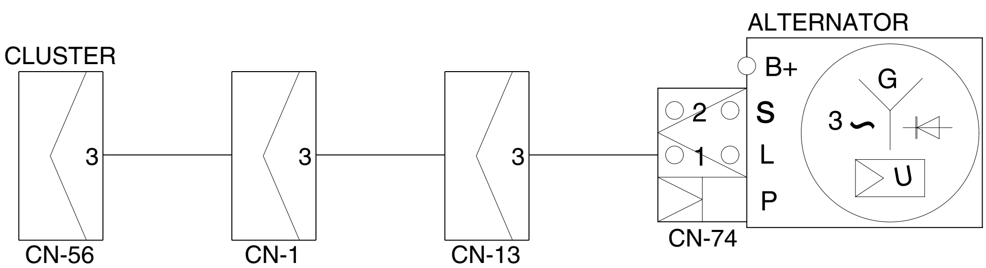
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56(3) -CN1(3)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-1(3)-alternator terminal "L"	Repair or replace (after clean)
Defective alternator	Replace

Check voltage

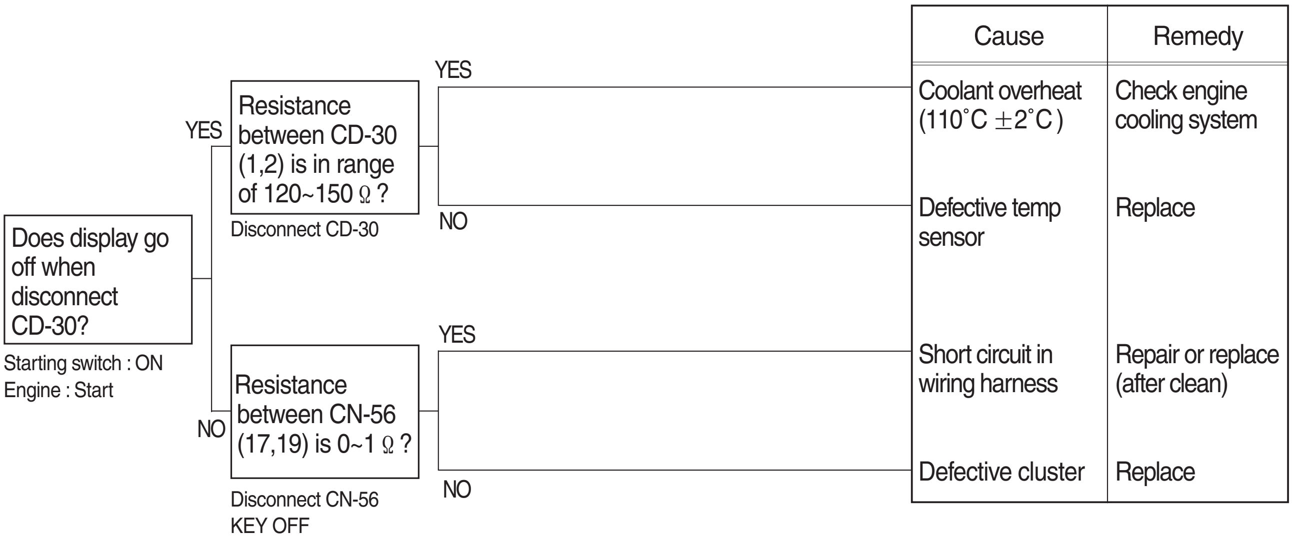
YES	10 ~ 12.5V
NO	0V

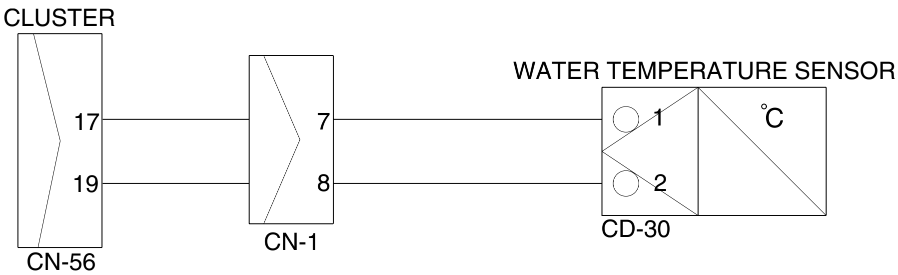


55Z95TS02

3. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

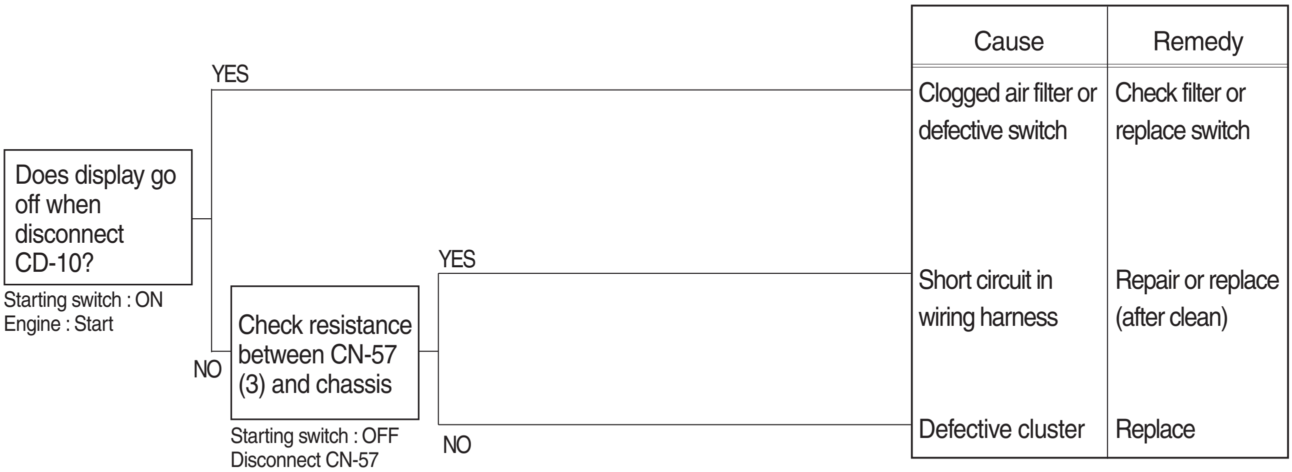




5595TS03

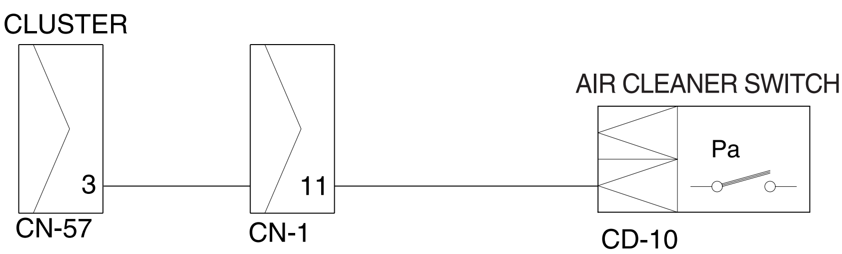
4. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check resistance

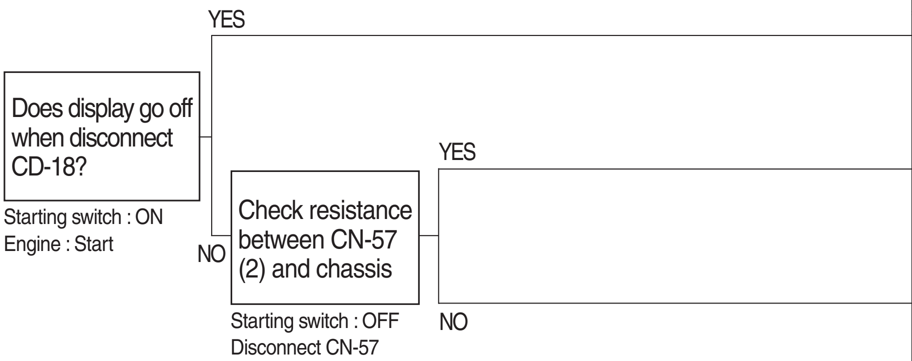
YES	MAX 1Ω
NO	MIN 1M Ω



555C95TS13

5. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

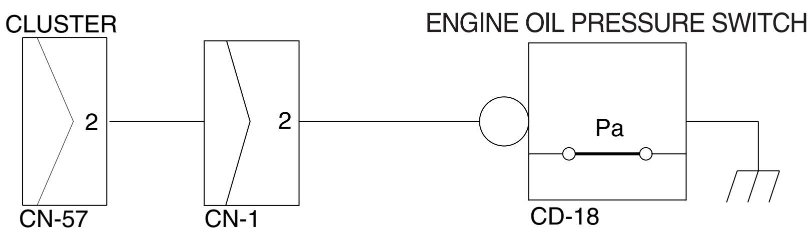
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Engine oil leakage, or defective switch	Check engine oil level or replace switch
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-57 (2)-CD-18	Repair or replace (after clean)

Check resistance

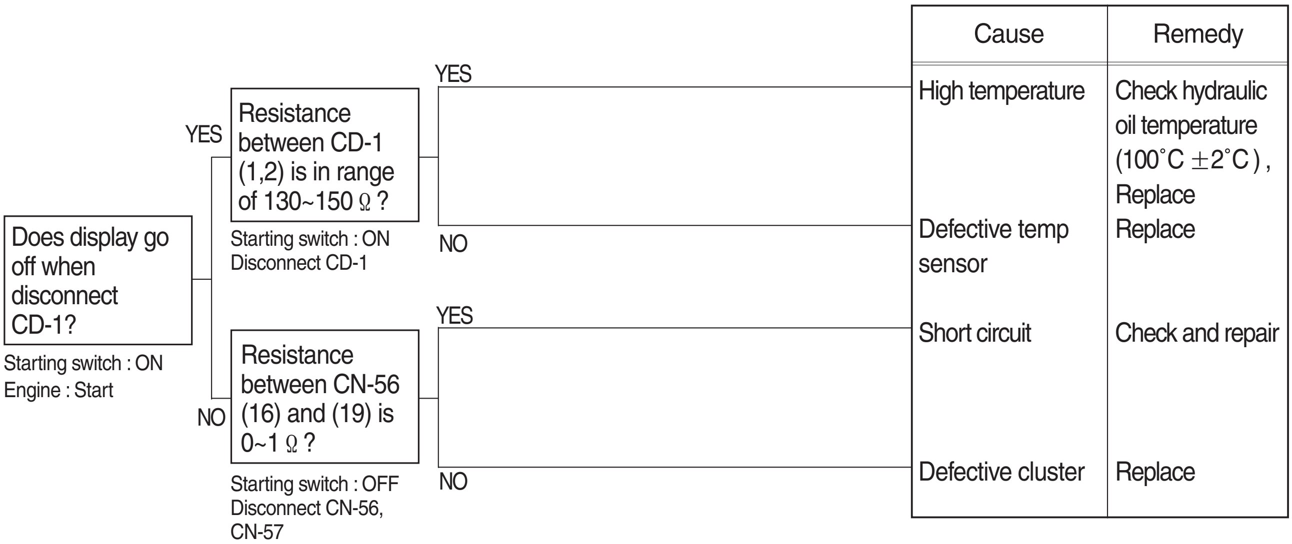
YES	MAX 1Ω
NO	MIN 1MΩ

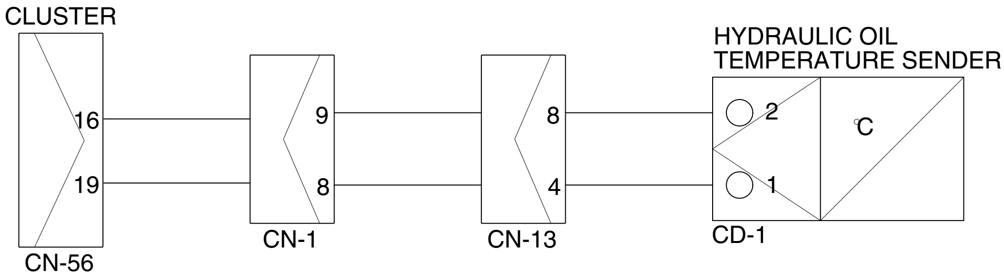


555C95TS14

6. WHEN HYDRAULIC OIL TEMPERATURE WARNING LAMP LIGHTS UP (engine is started)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

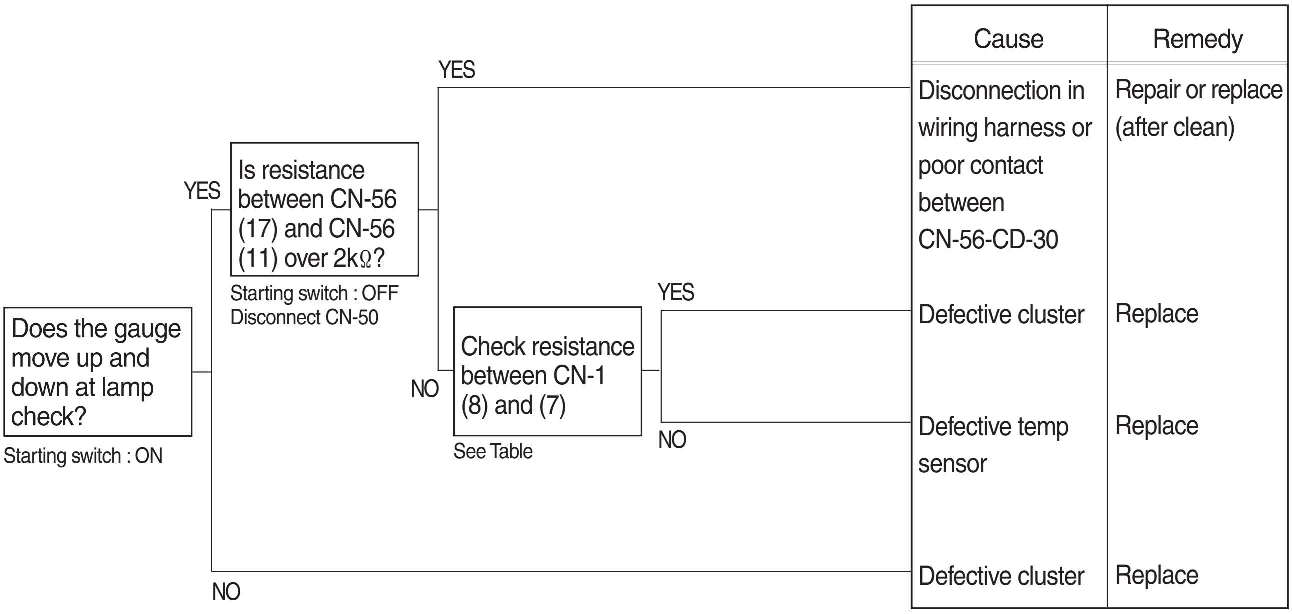


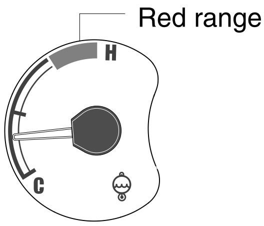


55Z95TS15

7. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

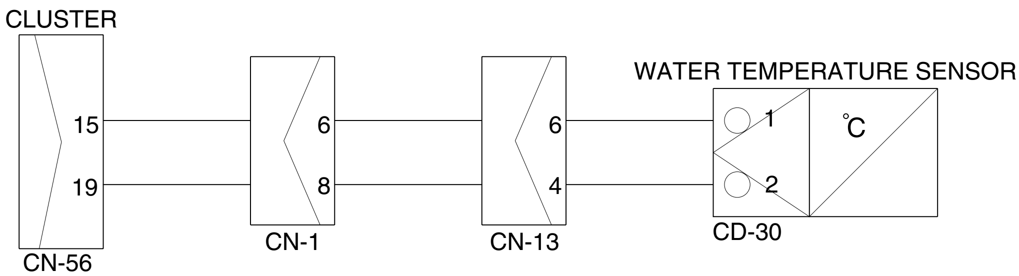
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

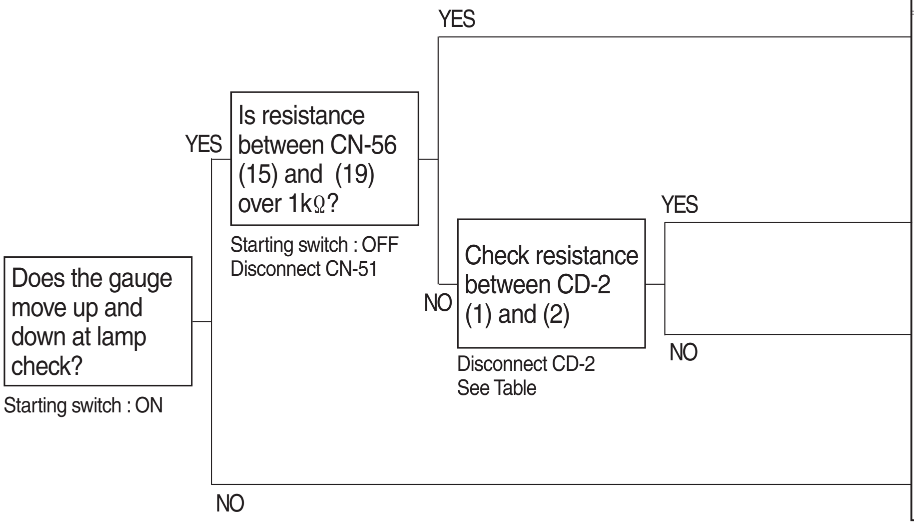
Item \ Temperature	40˚C	85~110˚C	115˚C (red range)
Unit Resistance(Ω)	1170~	270~130	~124
Tolerance(%)	±5	-8~0	±5



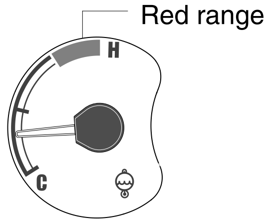
55Z95TS03

8. WHEN FUEL GAUGE DOES NOT OPERATE (check warning lamp ON/OFF)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

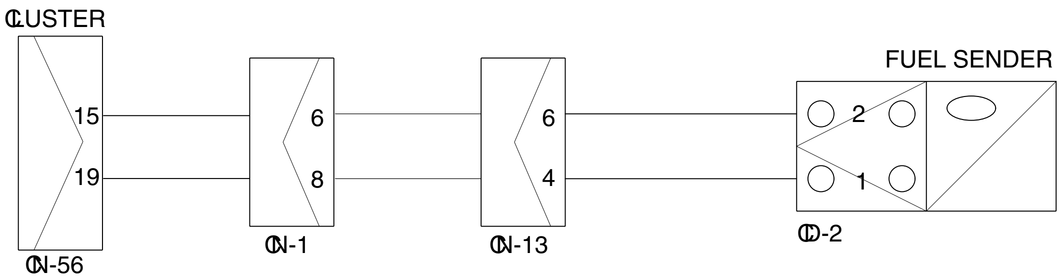


Cause	Remedy
Disconnection in wiring harness	Check and repair
Defective cluster	Replace
Defective fuel sensor	Replace
Defective cluster	Replace



Check Table

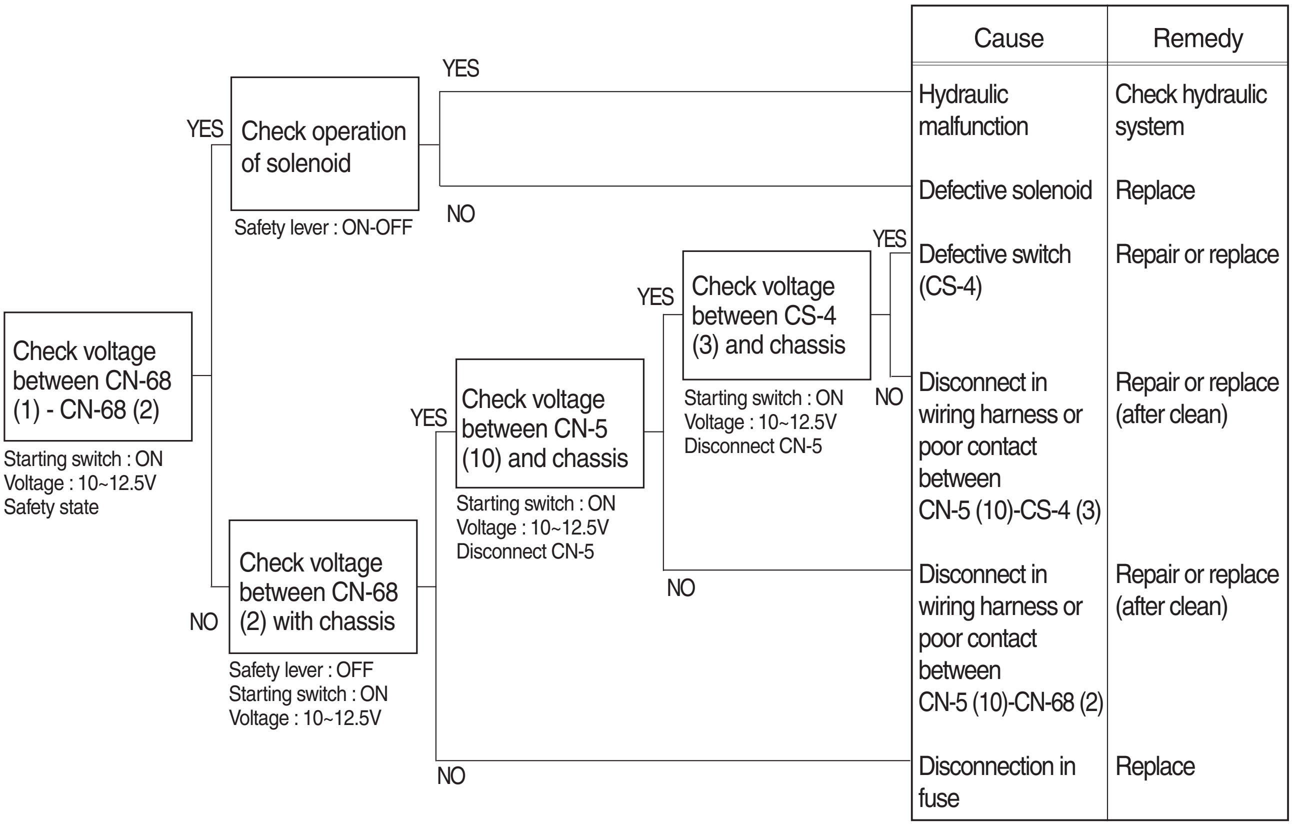
Item \ Level	Empty	1/2	Full
Unit Resistance (Ω)	700	300	~100
Tolerance (%)	±5	±8	±5

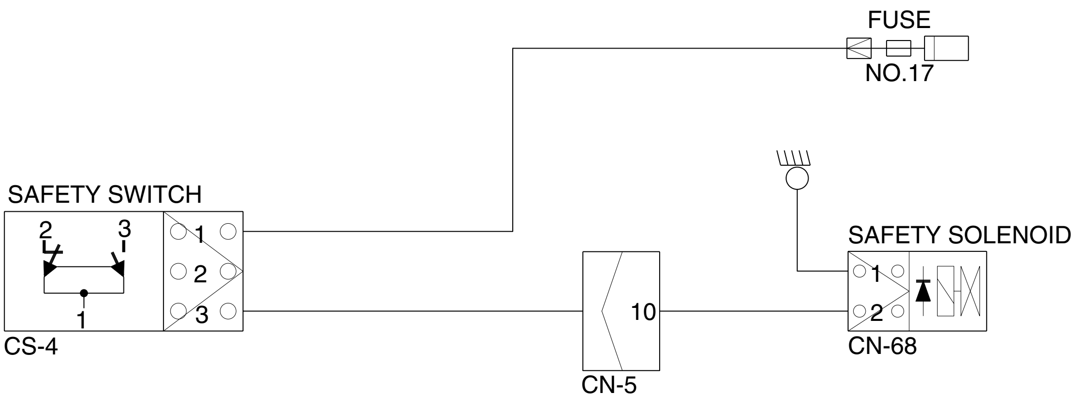


55Z95TS16

9. WHEN SAFETY SOLENOID DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.14.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

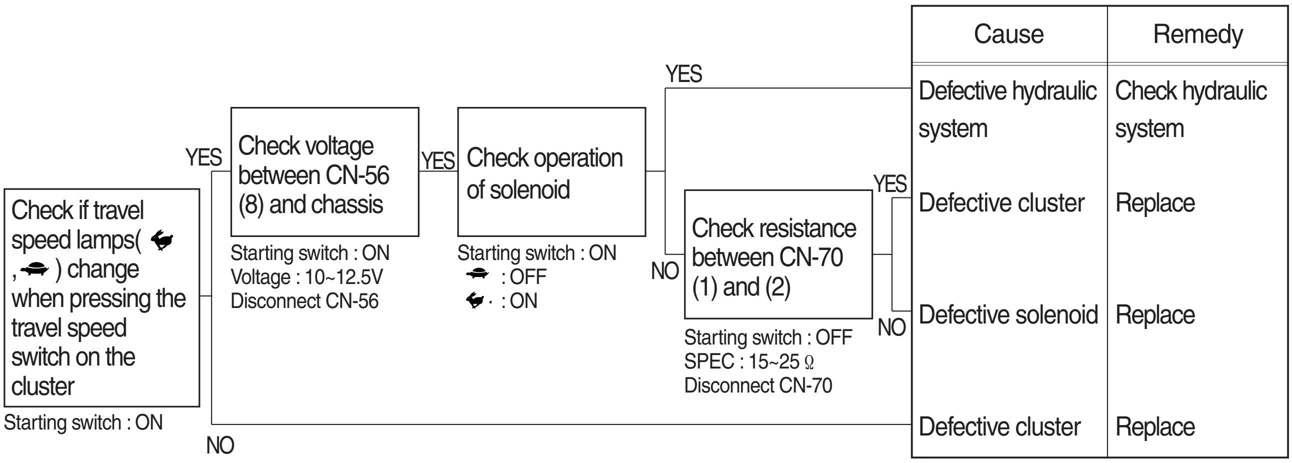


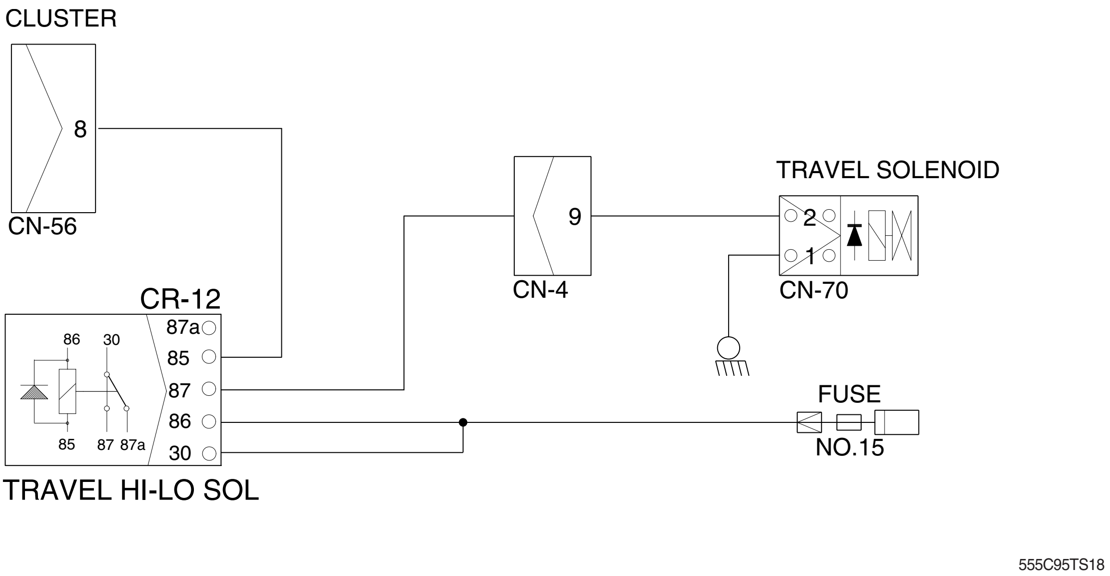


555C95TS17

10. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE

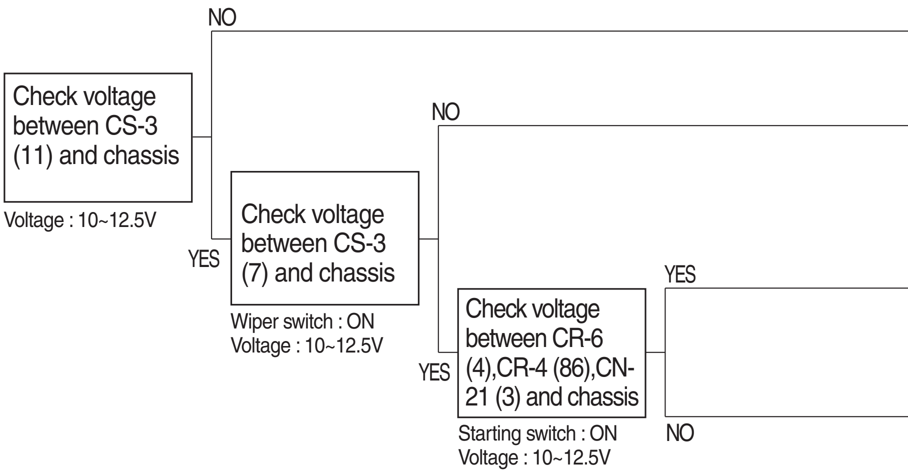
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.15.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



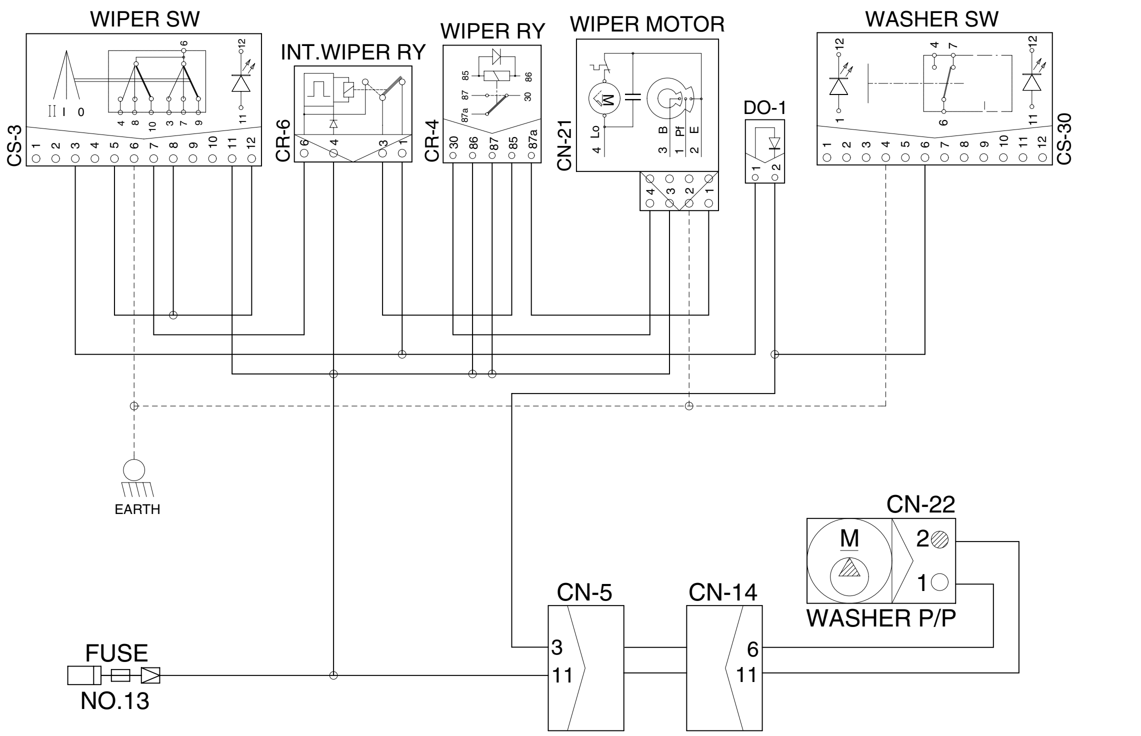


11. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No.13 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

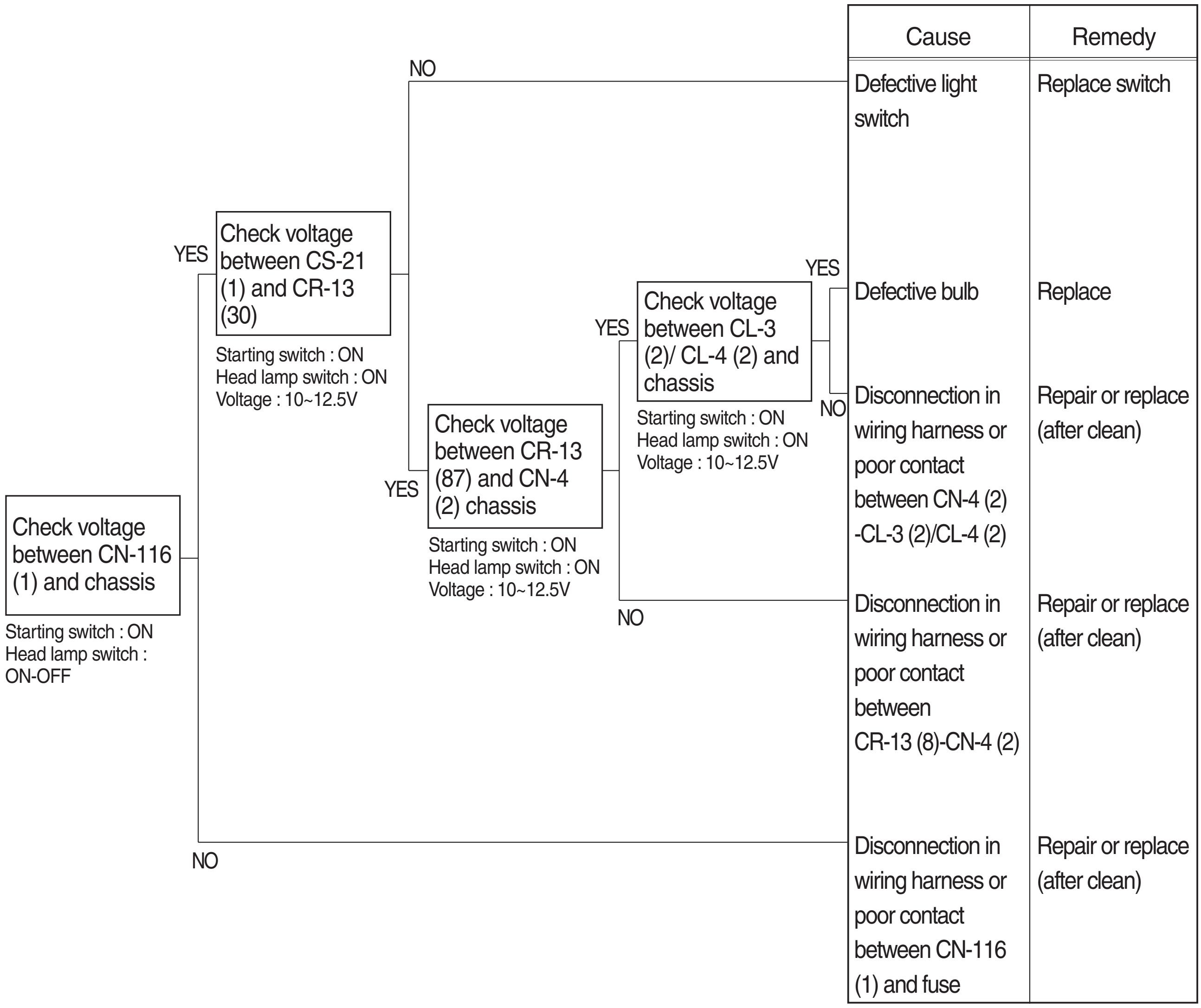


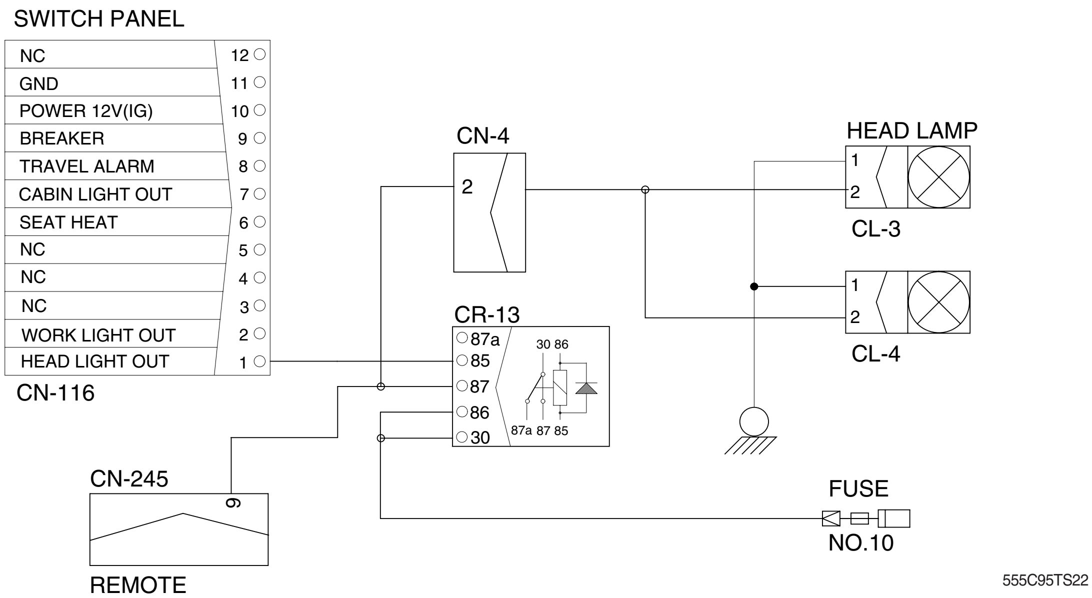
Cause	Remedy
Recheck fuse	Replace
Defective wiper switch	Replace
Defective Int wiper relay, wiper relay, wiper motor	Replace
Recheck fuse	Replace



12. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

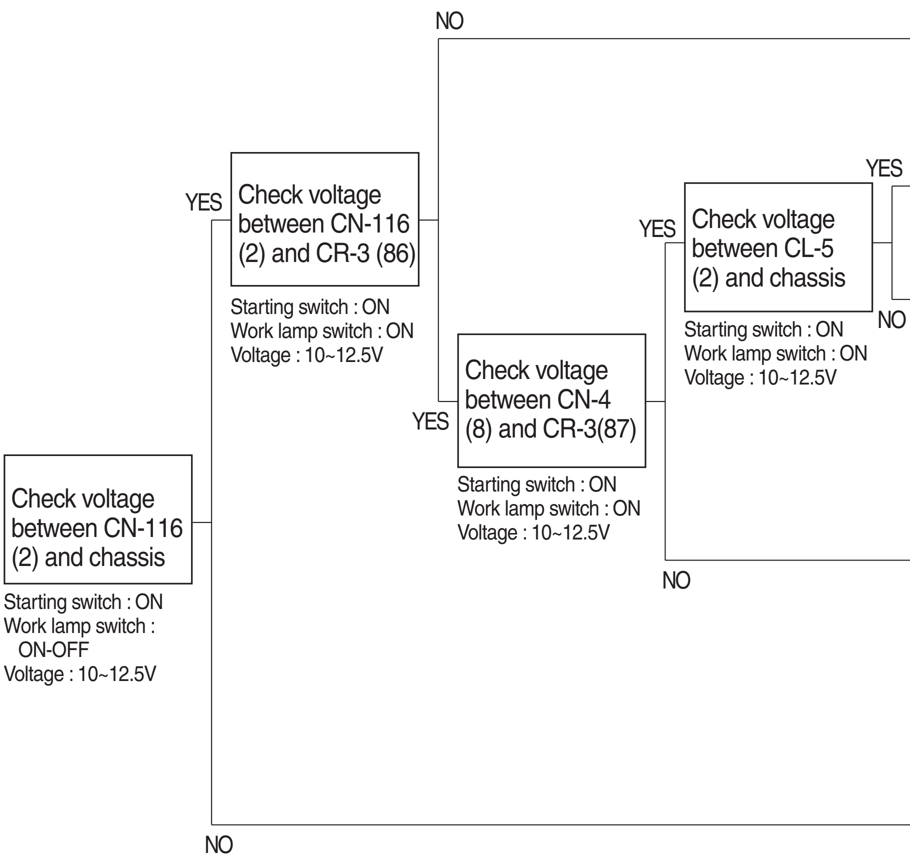
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.10.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



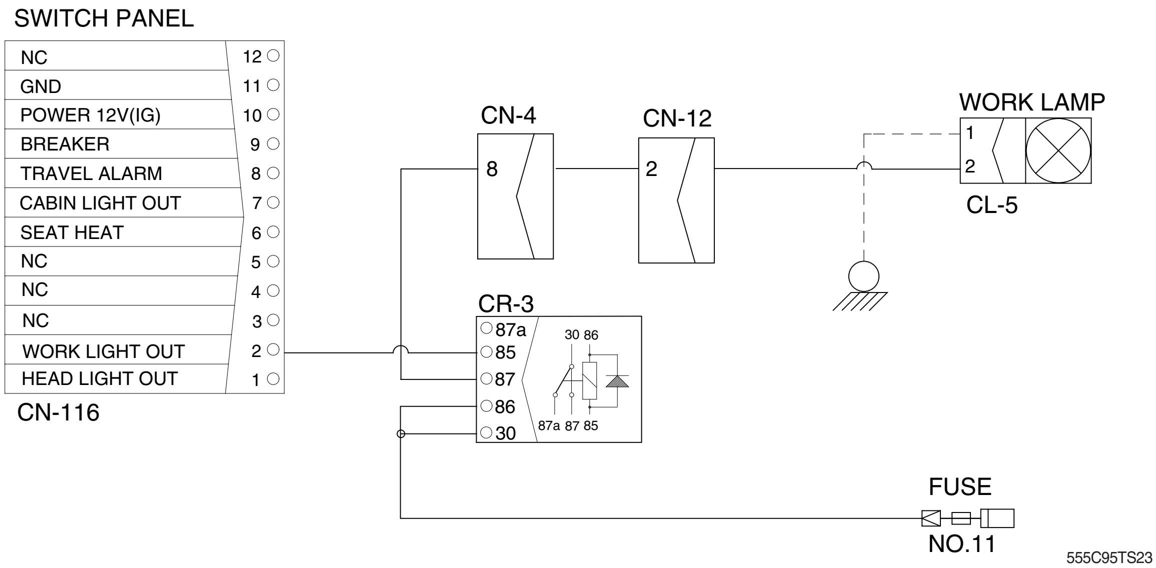


13. WHEN STARTING SWITCH IS TURNED ON, WORK LAMP DOES NOT LIGHTS UP

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.11.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

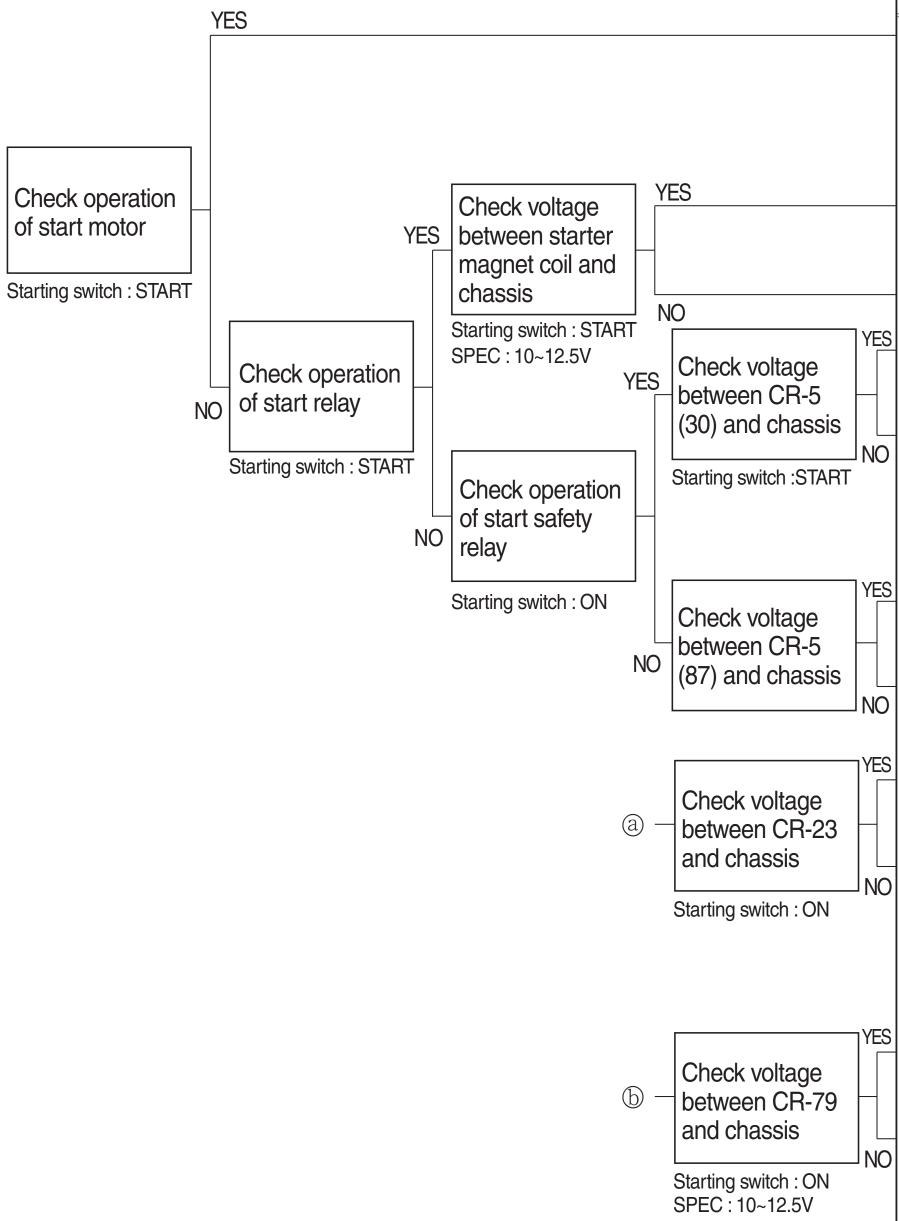


Cause	Remedy
Defective light switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-4 (8) and CL-5 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (2)-CN-4 (8)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (2) and fuse	Repair or replace (after clean)

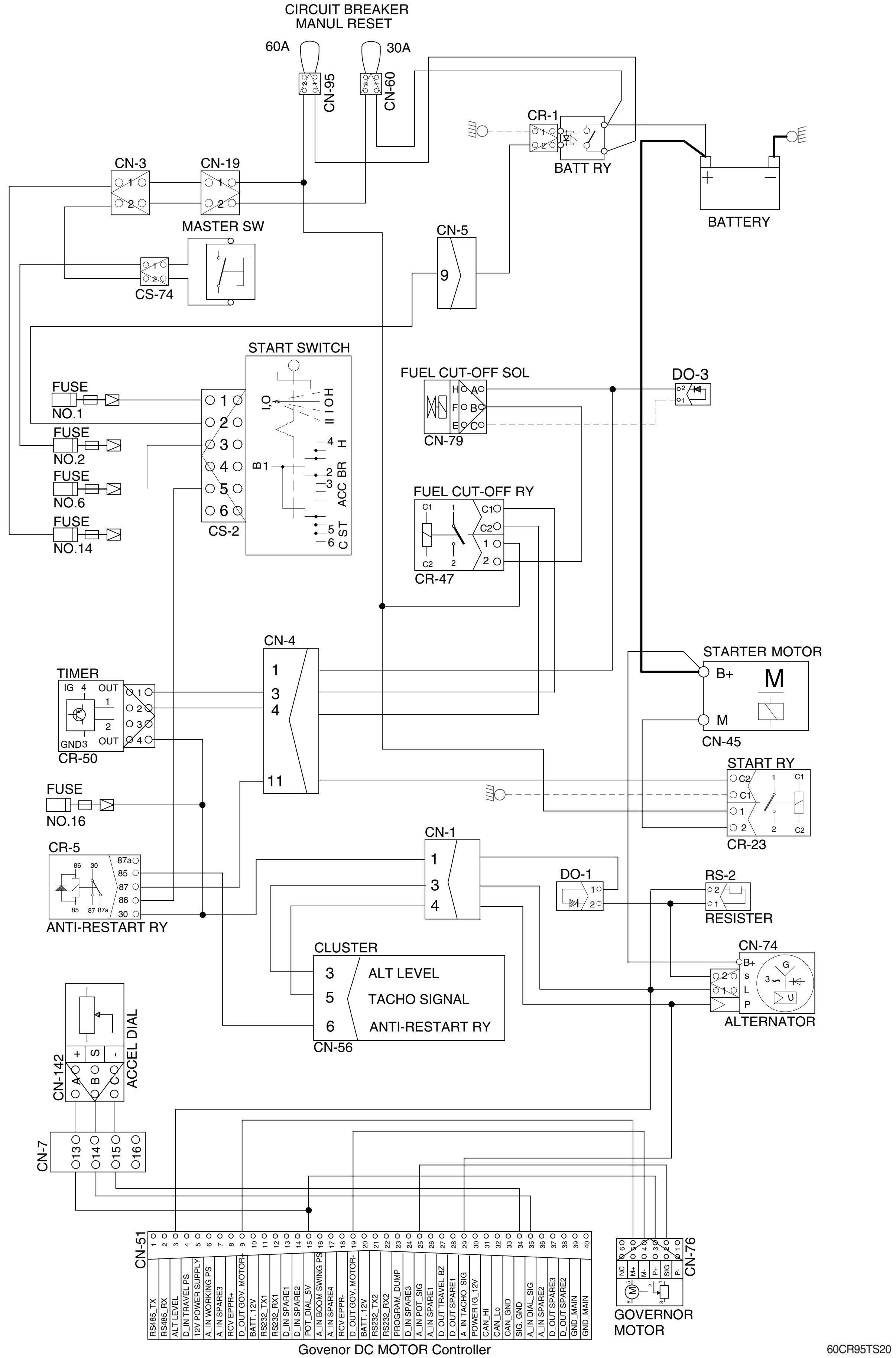


14. WHEN ENGINE DOES NOT START

- Check supply of the power at engine stop solenoid while starting switch is ON.
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

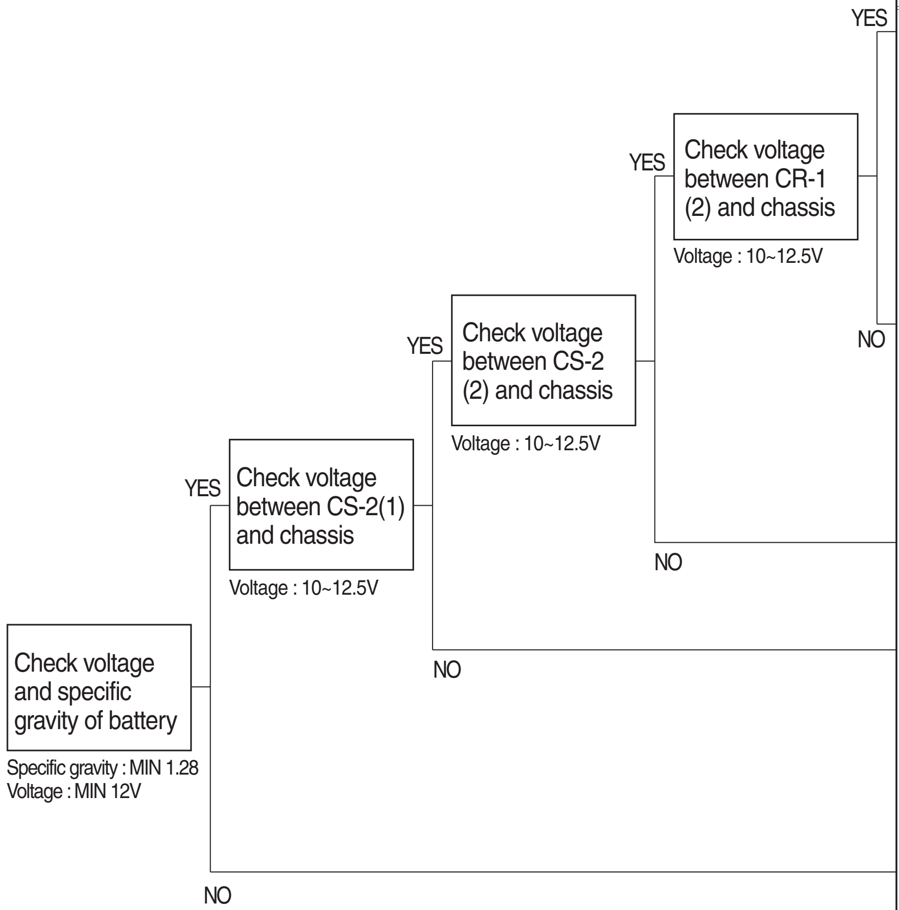


Cause	Remedy
Defective battery	Check engine system charge or replace (after checking specific gravity of battery)
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CR-5 (87) and CN-4(11)	Repair or replace (after clean)
Defective relay	Replace
ⓑ	
Defective relay	Replace
Disconnection in wiring harness or poor contact between CR-5 (87)-CR-23 (2)	Repair or replace (after clean)
Defective fuel cut-off solenoid	Replace
Disconnection in wiring harness or between CN-79-CR-23(2)	Repair or replace (after clean)

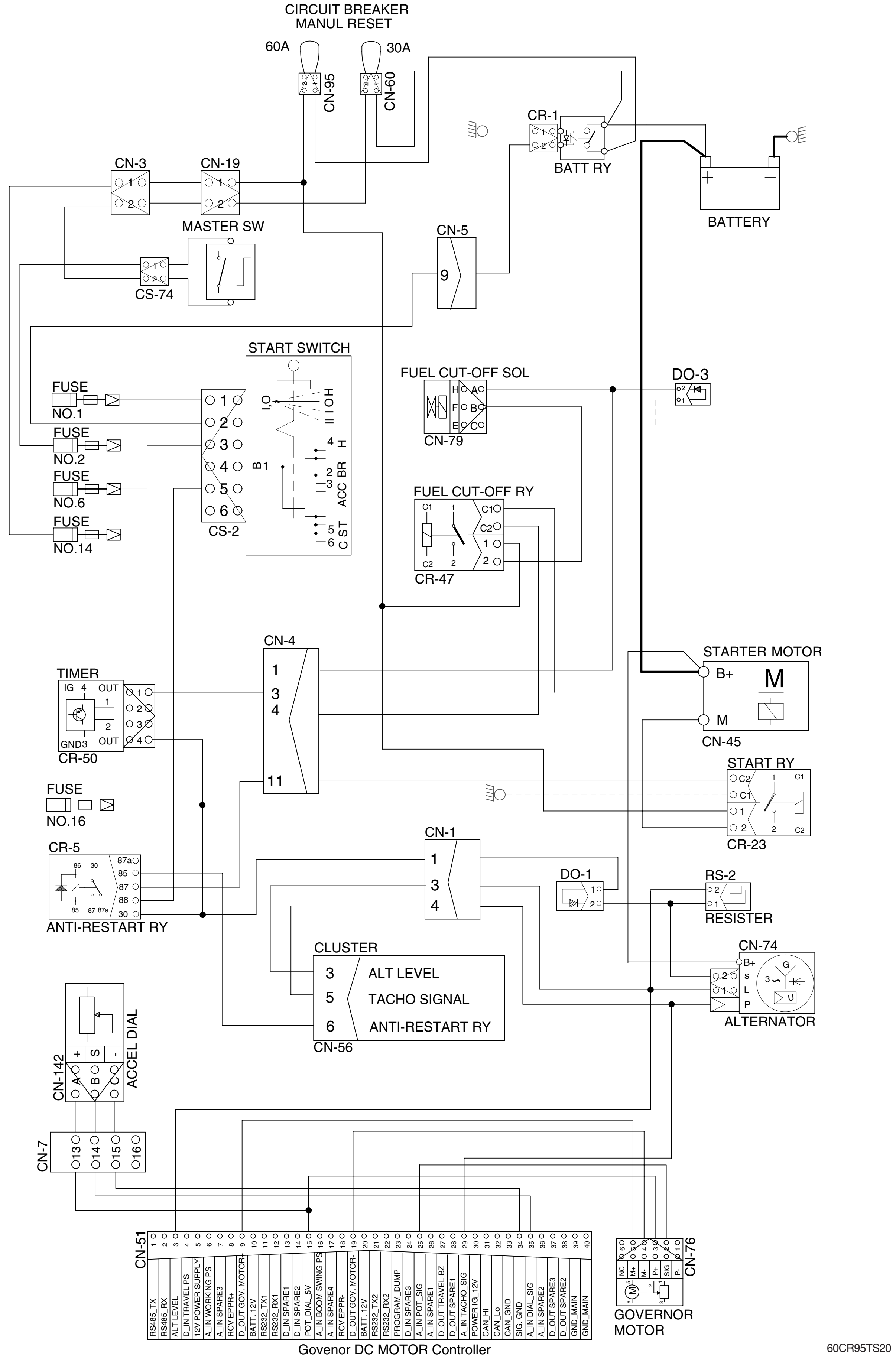


15. WHEN STARTING SWITCH ON DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and master switch ON.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Disconnection in wiring harness or poor contact between CN-5 (9)-CR-1 (2) or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2 (2)-CN-5 (9)	Replace
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2 (1)-fuse No.1	Replace
Battery capacity too low	Charge or replace (after clean)



SECTION 6 MAINTENANCE STANDARD

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check:

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets Hyundai spec.

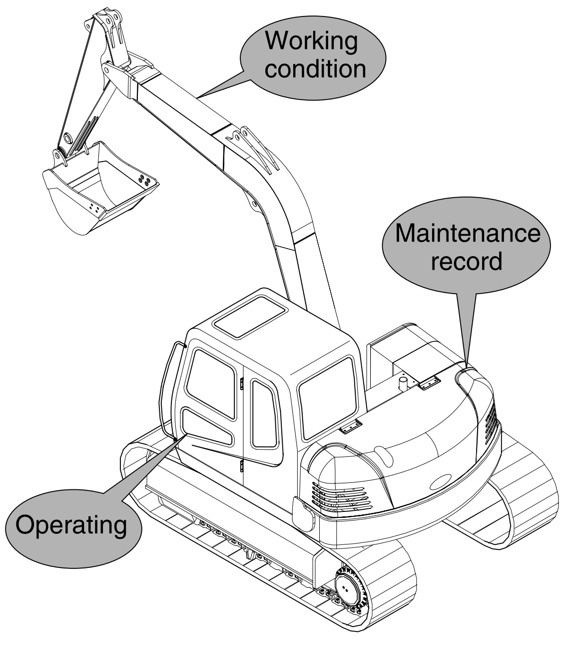
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done (by referring to the "Service Limits" in this manual).

3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.

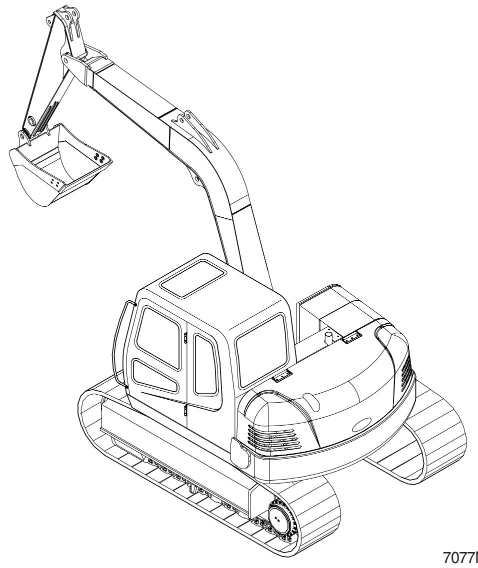


7077MS01

2. TERMINOLOGY

1) STANDARD

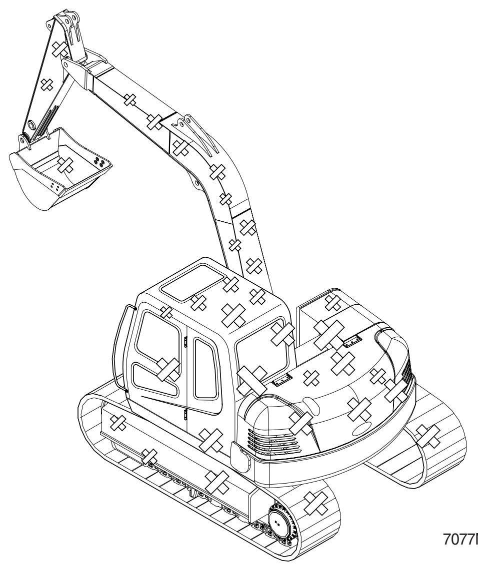
Specifications applied to the brand-new machine, components and parts.



7077MS02

2) SERVICE LIMIT

The lowest acceptable performance level. When the performance level of the machine falls below this level, the machine must be removed from work and repaired. Necessary parts and components must be replaced.



7077MS03

3. OPERATION FOR PERFORMANCE TESTS

1) Observe the following rules in order to carry out performance tests accurately and safely.

(1) The machine

Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(2) Test area

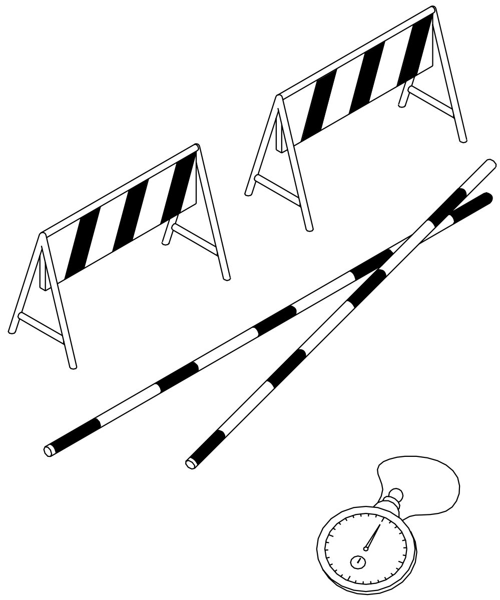
① Select a hard, flat surface.
② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.
③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(3) Precautions

① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.
② Operate the machine carefully and always give first priority to safety.
③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements

① Accurately calibrate test instruments in advance to obtain correct data.
② Carry out tests under the exact test conditions prescribed for each test item.
③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



7-3 (140-7)

2) ENGINE SPEED

(1) Measure the engine speed at the maximum RPM.

※ The engine speed must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.

(2) Preparation and measurement

① Warm up the machine, until the engine coolant temperature reaches 50˚C or more, and the hydraulic oil is 50±5˚C.

② Set the M mode at the cluster

③ Measure the engine RPM.

(3) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remark
R80CR-9	Low idle	1000±50	
	High idle	2100±50	M mode

3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 20m test track.

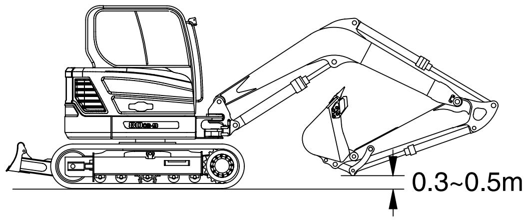
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Prepare a flat and solid test track 20m in length, with extra length of 3 to 5m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC04

(3) Measurement

① Measure both the low and high speeds of the machine.

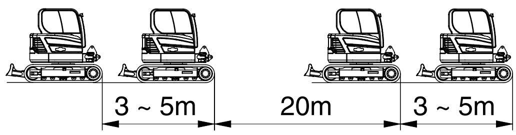
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the time required to travel 20m.

⑤ After measuring the forward travel speed, turn the upperstructure 180° and measure the reverse travel speed.

⑥ Repeat steps ④ and ⑤ three times in each direction and calculate the average values.



80CR96MC05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
R80CR-9	1 Speed	26.5±2.0	33	
	2 Speed	17.2±1.0	22	

4) TRACK REVOLUTION SPEED

(1) Measure the track revolution cycle time with the track raised off ground.

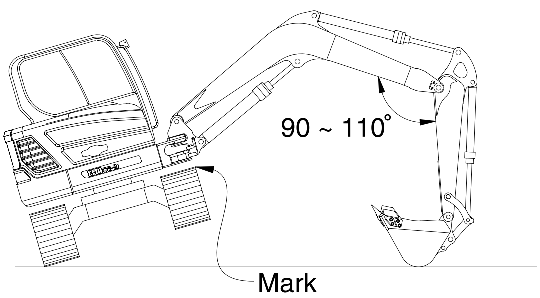
(2) Preparation

① Adjust the tension of both side tracks to be equal.

② On the track to be measured, mark one shoe with chalk.

③ Swing the upperstructure 90˚ and lower the bucket to raise the track off ground. Keep the boom-arm angle between 90 to 110˚ as shown. Place blocks under machine frame.

④ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC06

(3) Measurement

① Select the following switch positions.

・ Travel mode switch : 1 or 2 speed

② Operate the travel control lever of the raised track in full forward and reverse.

③ Rotate 1 turn, then measure time taken for next 3 revolutions.

④ Raise the other side of machine and repeat the procedure.

⑤ Repeat steps ③ and ④ three times and calculate the average values.

(4) Evaluation

The revolution cycle time of each track should meet the following specifications.

Unit : Seconds / 3 revolutions

Model	Travel speed	Standard	Maximum allowable
R80CR-9	1 Speed	23.2±1.5	29
	2 Speed	15.1±1.5	18.9

5) TRAVEL DEVIATION

(1) Measure the deviation by the tracks from a 20m straight line.

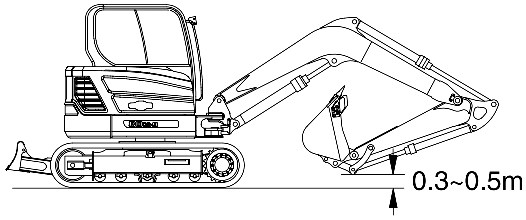
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 20m in length, with extra length of 3 to 5m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC04

(3) Measurement

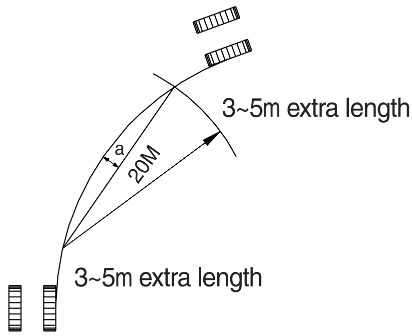
① Measure the amount of mistracking at high and low travel speeds.

② Start traveling the machine in the acceleration zone with the travel levers at full stroke.

③ Measure the distance between a straight 20m line and the track made by the machine. (dimension a)

④ After measuring the tracking in forward travel, turn the upperstructure 180˚ and measure that in reverse travel.

⑤ Repeat steps ③ and ④ three times and calculate the average values.



7-7(2) 140-7

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20m

Model	Standard	Maximum allowable	Remarks
R80CR-9	200 below	240	

6) SWING SPEED

(1) Measure the time required to swing three complete turns.

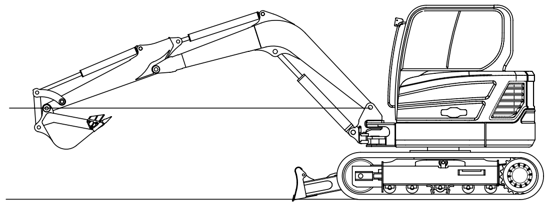
(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC07

(3) Measurement

① Operate swing control lever fully.

② Swing 1 turn and measure time taken to swing next 2 revolutions.

③ Repeat steps ① and ② three time and calculate the average values.

(4) Evaluation

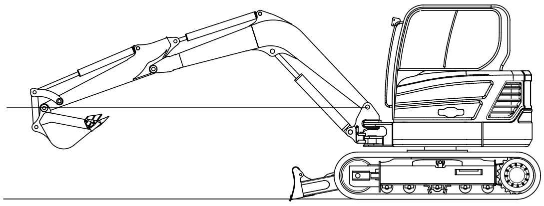
The time required for 2 swings should meet the following specifications.

Unit : Seconds / 2 revolutions

Model	Standard	Maximum allowable	Remarks
R80CR-9	13.6±1.0	17	

7) SWING FUNCTION DRIFT CHECK

(1) Measure the swing drift on the bearing outer circumference when stopping after a 360˚ full speed swing.



80CR96MC07

(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.

⑤ Swing the upperstructure 360˚.

⑥ Keep the hydraulic oil temperature at 50±5˚C.

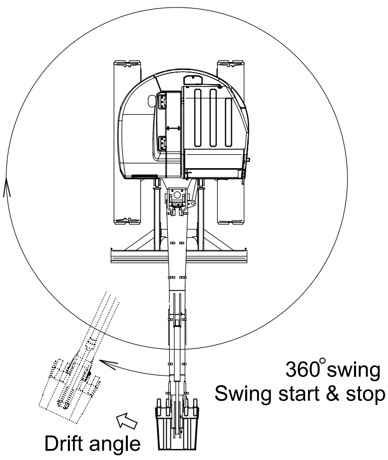
(3) Measurement

① Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360˚.

② Measure the distance between the two marks.

③ Align the marks again, swing 360˚, then test the opposite direction.

④ Repeat steps ② and ③ three times each and calculate the average values.



80CR96MC08

(4) Evaluation

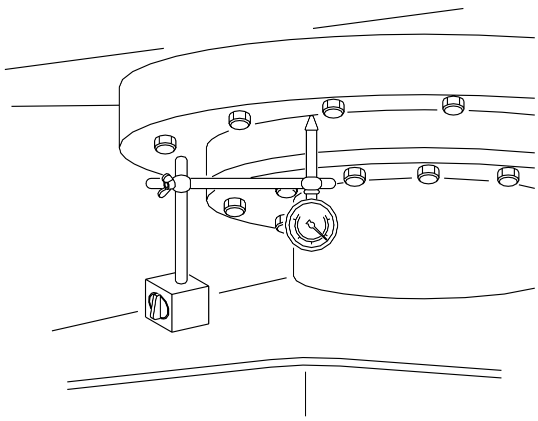
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remarks
R80CR-9	90 below	127.6	

8) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



7-10(1) 140-7

(2) Preparation

① Check swing bearing mounting cap screws for loosening.

② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.

③ Install a dial gauge on the track frame as shown, using a magnetic base.

④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.

⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.

⑥ Bucket should be empty.

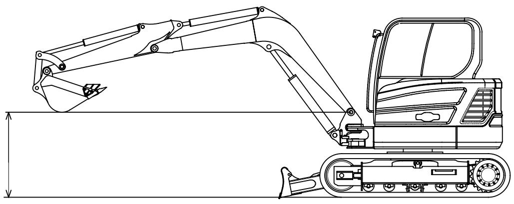
(3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).

② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).

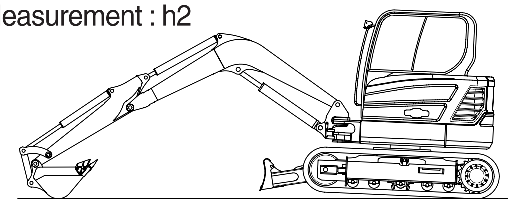
③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1

Measurement : h1



80CR96MC09

Measurement : h2



80CR96MC10

(4) Evaluation
The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
R80CR-9	0.5 ~ 1.5	3.0	

9) HYDRAULIC CYLINDER CYCLE TIME

(1) Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

(2) Preparation

① To measure the cycle time of the boom cylinders:
With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.

② To measure the cycle time of the arm cylinder.
With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5m above the ground.

③ To measure the cycle time of the bucket cylinder.
The empty bucket should be positioned at midstroke between roll-in and roll-out, so that the sideplate edges are vertical to the ground.

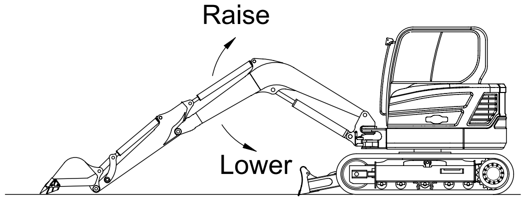
④ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

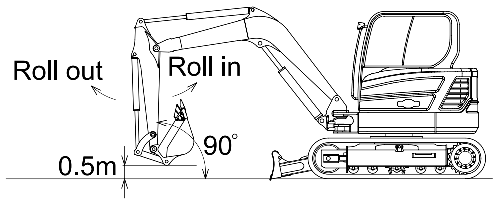
① To measure cylinder cycle times.

- Boom cylinders.
Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.
- Arm cylinder.
Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

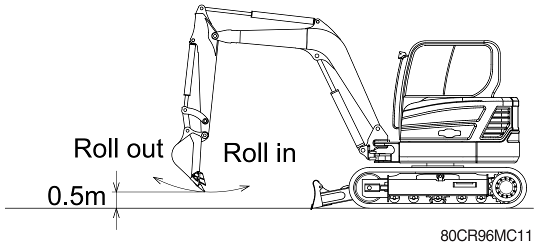
Boom cylinder



Arm cylinder



Bucket cylinder



- Bucket cylinders
  Measure the time it takes to roll in the bucket, and the time it takes to roll out the bucket. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.
- Repeat each measurement 3 times and calculate the average values.

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds

Model	Function	Standard	Maximum allowable	Remarks
R80CR-9	Boom raise	3.0±0.4	3.6	
	Boom lower	2.8±0.4	3.4	
	Arm in	2.8±0.4	3.4	
	Arm out	2.8±0.3	3.2	
	Bucket load	3.4±0.4	4.0	
	Bucket dump	2.1±0.3	2.5	
	Dozer up (raise)	1.5±0.3	1.8	
	Dozer down (lower)	1.7±0.3	2.0	

10) DIG FUNCTION DRIFT CHECK

(1) Measure dig function drift, which can be caused by oil leakage in the control valve and boom, standard arm, and standard bucket cylinders, with the loaded bucket.
When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to purge air.

(2) Preparation

① Load bucket fully. Instead of loading the bucket, weight (W) of the following specification can be used.

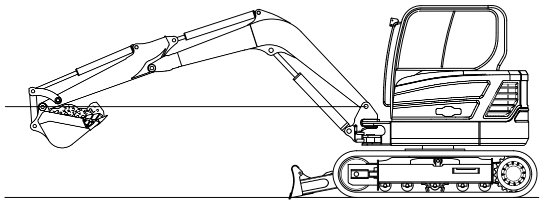
· $W = M^3 \times 1.5$
Where :
M^3 = Bucket heaped capacity (m^3)
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30mm extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30mm retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC12

(3) Measurement

① Stop the engine.

② Five minutes after the engine has been stopped, measure the changes in the positions of the boom, arm and bucket cylinders.

③ Repeat step ② three times and calculate the average values.

(4) The measured drift should be within the following specifications.

Unit : mm / 5min

Model	Drift to be measured	Standard	Maximum allowable	Remarks
R80CR-9	Boom cylinder	10 below	20	
	Arm cylinder	20 below	30	
	Bucket cylinder	40 below	50	

11) CONTROL LEVER OPERATING FORCE

(1) Use a spring scale to measure the maximum resistance of each control lever at the middle of the grip.

(2) Preparation

① Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Start the engine.
② Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.
③ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.
④ Repeat steps ② and ③ three times and calculate the average values.

(4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
R80CR-9	Boom lever	1.6 or below	2.0	
	Arm lever	1.6 or below	2.0	
	Bucket lever	1.6 or below	2.0	
	Swing lever	1.6 or below	2.0	
	Travel lever	2.1 or below	3.15	

12) CONTROL LEVER STROKE

(1) Measure each lever stroke at the lever top using a ruler.

※ When the lever has play, take a half of this value and add it to the measured stroke.

(2) Preparation

Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Stop the engine.

② Measure each lever stroke at the lever top from neutral to the stroke end using a ruler.

③ Repeat step ② three times and calculate the average values.

(4) Evaluation

The measured drift should be within the following specifications.

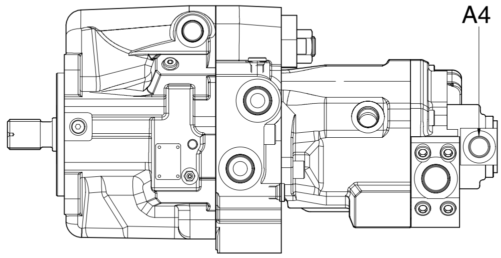
Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
R80CR-9	Boom lever	87±10	109	
	Arm lever	87±10	109	
	Bucket lever	87±10	109	
	Swing lever	87±10	109	
	Travel lever	142±10	178	

13) PILOT PRIMARY PRESSURE

(1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ Loosen and remove plug on the pilot pump delivery port (A4) and connect pressure gauge.
④ Start the engine and check for oil leakage from the port.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC13

(2) Measurement

① Measure the primary pilot pressure in the M mode.

(3) Evaluation

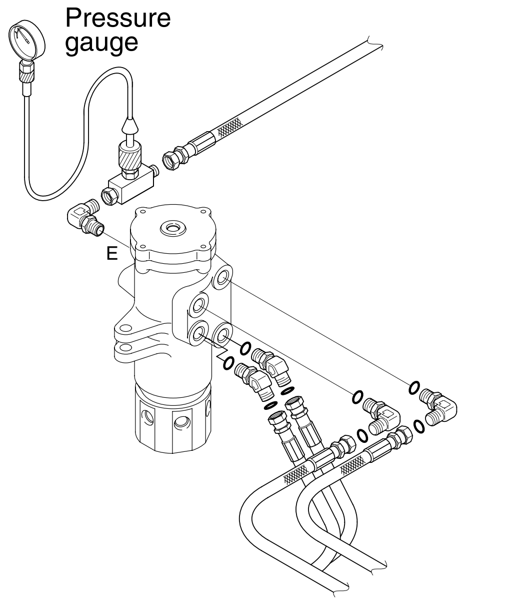
The average measured pressure should meet the following specifications:

Unit : kgf / cm^2

Model	Standard	Remarks
R80CR-9	35±5	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation



80CR96MC14

① Stop the engine.
② Push the pressure release button to bleed air.
③ To measure the speed selecting pressure: Install a connector and pressure gauge assembly to turning joint E port as shown.
④ Start the engine and check for on leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

① Select the following switch positions.
Travel mode switch : 1 speed
2 speed
② Measure the travel speed selecting pressure in the Hi or Lo mode.
③ Lower the bucket to the ground to raise the track off the ground. Operate the travel lever at full stroke and measure the fast speed pressure.
④ Repeat steps ② and ③ three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
R80CR-9	1 Speed	0	-	
	2 Speed	35±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

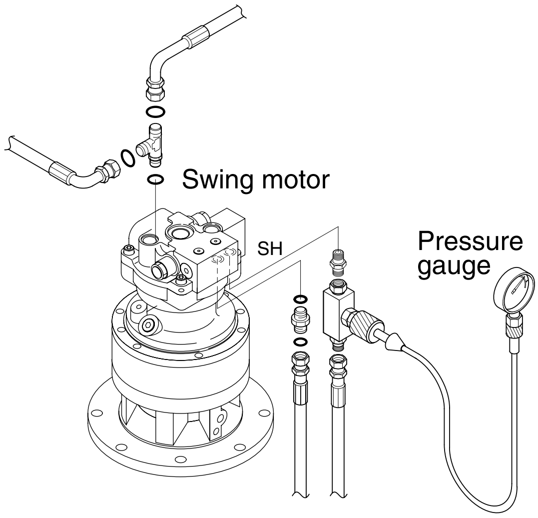
① Stop the engine.

② Push the pressure release button to bleed air.

③ Install a connector and pressure gauge assembly to swing motor SH port, as shown.

④ Start the engine and check for oil leakage from the adapter.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC15

(2) Measurement

① Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.

② Repeat three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Description	Standard	Remarks
R80CR-9	Brake disengaged	20~40	
	Brake applied	0	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

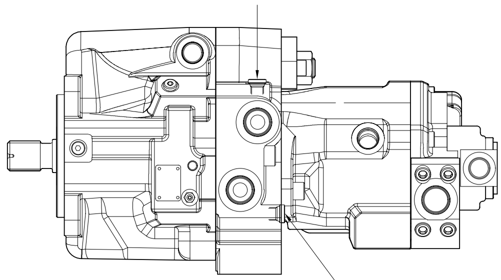
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the main pump pressure. Install a connector and pressure gauge assembly main pump gauge port (G1, G2) as shown.

④ Start the engine and check for oil leakage from the port.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC17

(2) Measurement

① Measure the main pump delivery pressure at high idle.

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
R80CR-9	High idle	20±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

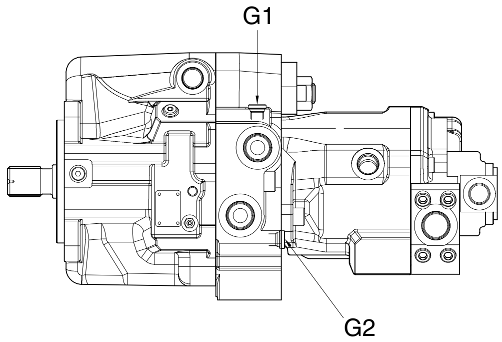
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the system relief pressure. Install a connector and pressure gauge assembly main pump gauge port, as shown.

④ Start the engine and check for oil leakage from the port.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC17

(2) Measurement

① Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

② In the swing function, place bucket against an immovable object and measure the relief pressure.

③ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Function to be tested	Standard
R80CR-9	Boom, Arm, Bucket	310±10
	Travel	280±10
	Swing	230±10

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP

Before inspection, wash the parts well and dry them completely.

Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.

Replace the seal also when any remarkable deformation and damage are found.

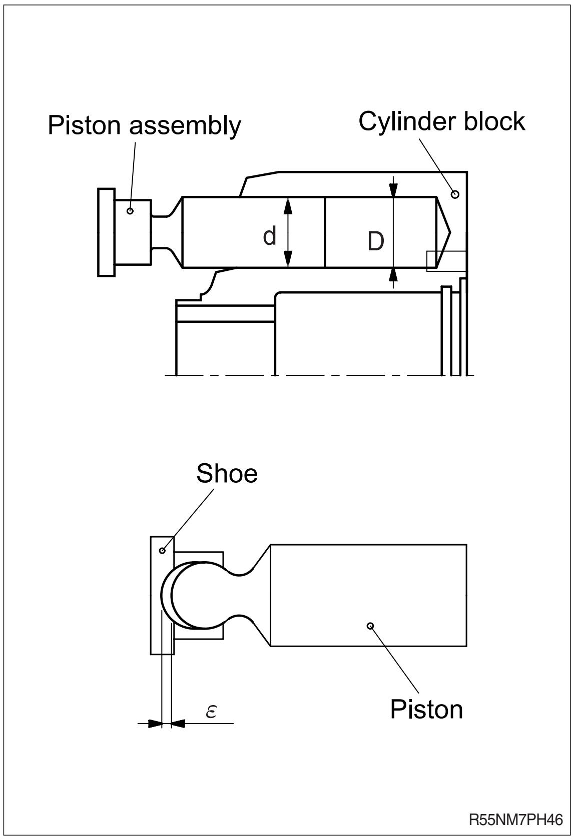
1) PISTON ASSEMBLY AND CYLINDER BLOCK

(1) Check the appearance visually.
No damage, scouring, abnormal wear (particularly, in the slide portion) should be found.

(2) Check the clearance between the piston outside dia and cylinder block inside dia.
D-d $\leq$ 0.050 mm

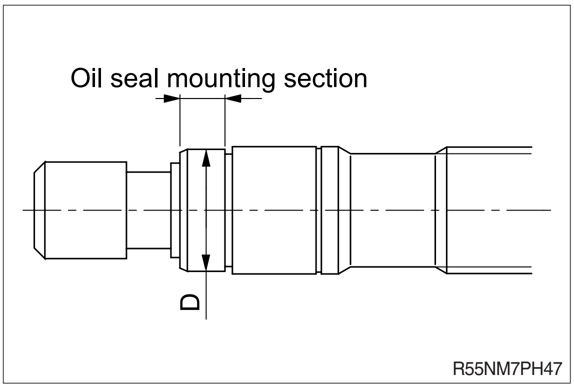
2) PISTON SHOE AND PISTON

(1) Check the axial play of the piston and piston shoe.
$\varepsilon \leq$ 0.2 mm



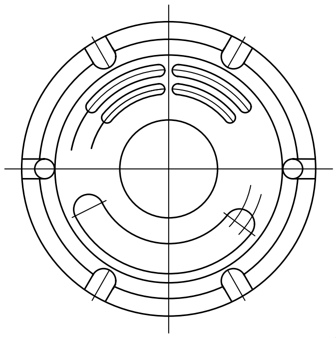
3) SHAFT

(1) Check the wear amount of the oil seal mounting section.
Wear mount $\leq$ 0.025 mm



4) CONTROL PLATE

(1) Check the slide surface for any damage. When the damage is large, replace the plate with new one.

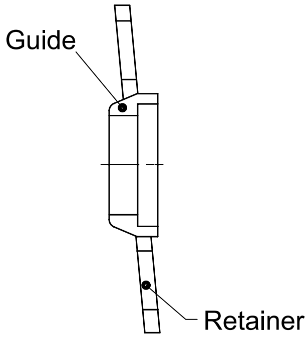


R55NM7PH48

5) GUIDE AND RETAINER

(1) Check for scouring or stepped wear. If this can not be corrected, replace the guide and retainer with new full-set.

(2) Fine scouring or damage can be corrected with lapping. Carry out thorough washing after lapping.



R55NM7PH49

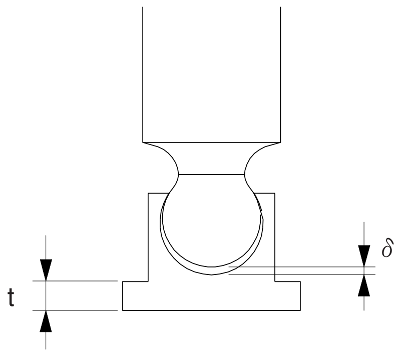
2. MAIN CONTROL VALVE

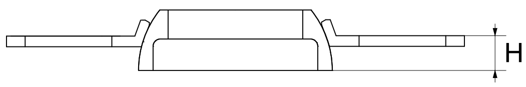
Part name	Inspection item	Criteria & measure
Block	· Existence of scratch, rusting or corrosion.	· In case of damage in following section, replace part. - Sliding sections of casing fore and spool, especially land sections applied with holded pressure. - Seal pocket section where spool is inserted. - Seal section of port where O-ring contacts. - Seal section of each relief valve for main, travel, and port. - Other damages that may damage normal functions.
Spool	· Existence of scratch, gnawing, rusting or corrosion. · O-ring seal sections at both ends. · Insert spool in casing hole, rotate and reciprocate it.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of poppet or spring · Insert poppet into casing and function it.	· Correction or replacement when sealing is incomplete. · Normal when it can function lightly without being caught.
Around spring	· Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage. · Rusting, corrosion or deformation of seal plate.	· Correction or replacement. · Correction or replacement.
Main relief valve & port relief valve	· External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · Abnormal spring. · O-rings, back up rings and seals.	· Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement. · 100% replacement in general.

3. SWING DEVICE

1) WEARING PARTS

Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.020	0.045	Replace piston or cylinder block
Play between piston and shoe caulking section (δ)	0	0.3	Replace assembly of piston and shoe
Thickness of shoe (t)	4	3.8	Replace assembly of piston and shoe
Combined height of set plate and guide (H)	17.4	17	Replace set of set plate and guide
Thickness of friction plate	3.6	3.2	Replace

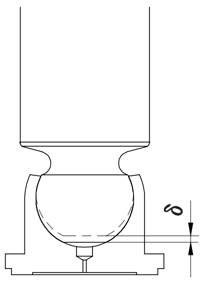
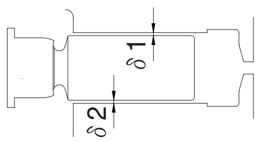
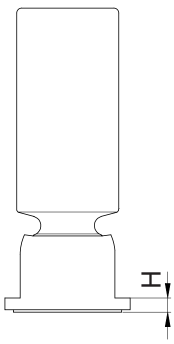
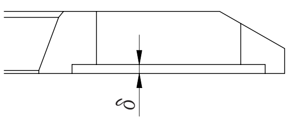


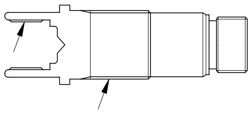


2) SLIDING PARTS

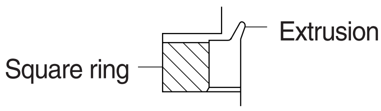
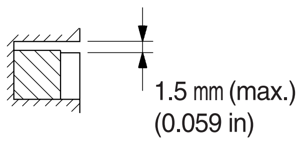
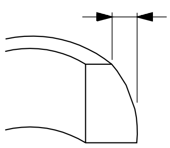
Part name	Standard roughness	Remark
Shoe	0.8S	
Shoe plate	0.8S	
Cylinder block	6.3S	
Valve plate	0.8S	

4. TRAVEL DEVICE

Part name	Check point	Standard dimension	Maximum allowable value (criteria)	Remedy
Piston assy (13) 	Play between piston and slipper	δ = 0.1 mm	δ < 0.5 mm	Replace 9 sets of piston assy
Piston assy (B) and cylinder block (8) 	Clearance/diameter between piston diameter and cylinder bore ($\delta 1 + \delta 2$)	0.03 mm	< 0.07 mm	Replace the set of 1 cylinder barrel and 9 piston assys
Slipper 	Height of the plate	Height H 5 mm	Height H < 4.6 mm	Replace 9 sets of piston assy
Retainer (11) 	Wear		Wear depth δ < 0.2mm	Replace
Swash plate (7)	Condition of sliding surface	Roughness < Ra 0.2μ m	Roughness < Ra 1.6μ m	Replace

Part name	Check point	Standard dimension	Maximum allowable value (criteria)	Remedy
Shaft (3) 	Spline sections (connected to cylinder barrel, and bear part)	-	No abnormality such as crack, chipping, nonuniformly wear-ing out, etc.	Replace
Bearings (4), (45), (63), (72)	Rolling surface	-	No flaking or other abnormal damage on the rolling surf-ace	Replace
Oil seal (2)	Seal lip	-	No damage or partial wear	Replace
O-rings, Back-up rings	-	-	-	In reassembling, they should be replaced with new ones even if no abnormality is det-ected.
Cylinder block (8)	Condition of the surface sliding with valve plate	Roughness < Ra 0.2μ m	Roughness < Ra 0.8μ m	Replace the set of cylinder barrel and valve plate
Valve plate (12)	Condition of sliding surface	Roughness < Ra 0.4μ m	Roughness < Ra 1.6μ m	Replace the set of cyli-nder barrel and valve plate

5. TURNING JOINT

Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination.	Replace
		· Damaged more than 0.1 mm (0.0039 in) in depth.	Smooth with oilstone.
	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Smooth
Cover	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Replace
Seal set	-	· Extruded excessively from seal groove square ring. 	Replace
	-	· Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring. 	Replace
	-	· Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in) 	Replace

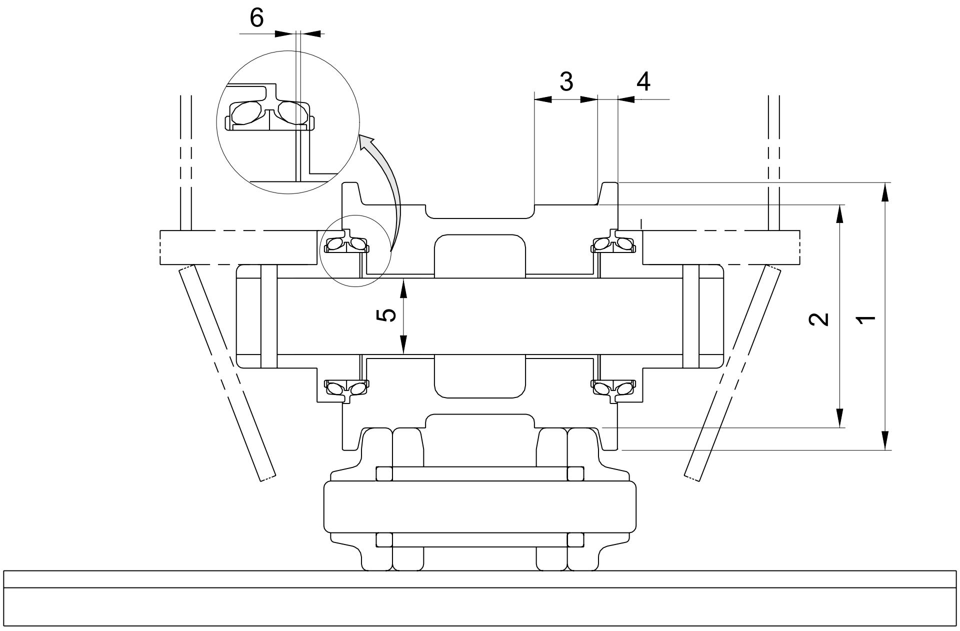
6. CYLINDER

Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal. · Rust is not present on plating. · Scratches are not present.	· Replace or replate · Replace or replate · Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK

1) TRACK ROLLER

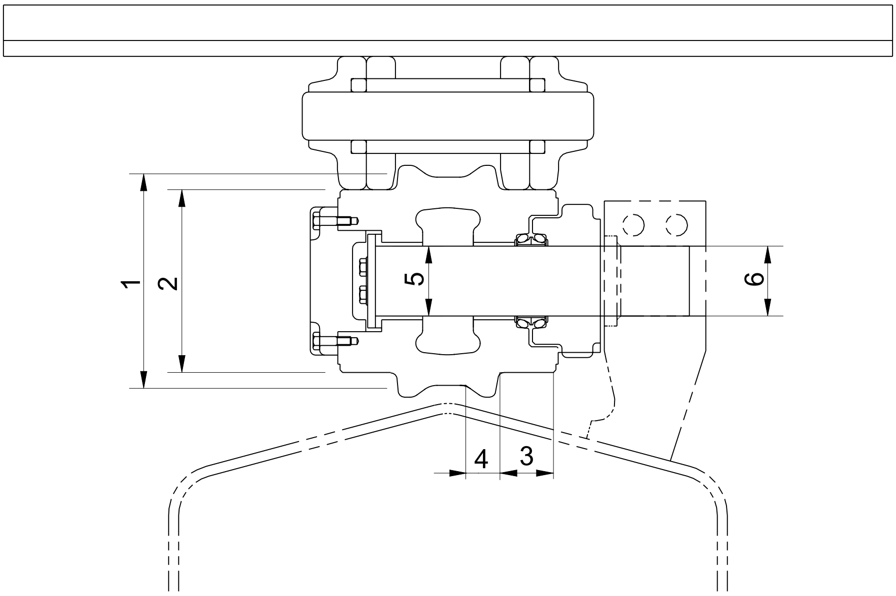


80CR96MC21

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		ø 149		-		
2	Outside diameter of tread	ø 125		ø 115		
3	Width of tread	35		40		
4	Width of flange	13		-		
5	Clearance between shaft and bushing	Standard size & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		ø 40 0 -0.03	ø 40 +0.3 +0.25	0.25 to 0.33	2.0	
6	Side clearance of roller (both side)	Standard clearance		Clearance limit		Replace
		0.3~0.9		2.0		

2) CARRIER ROLLER

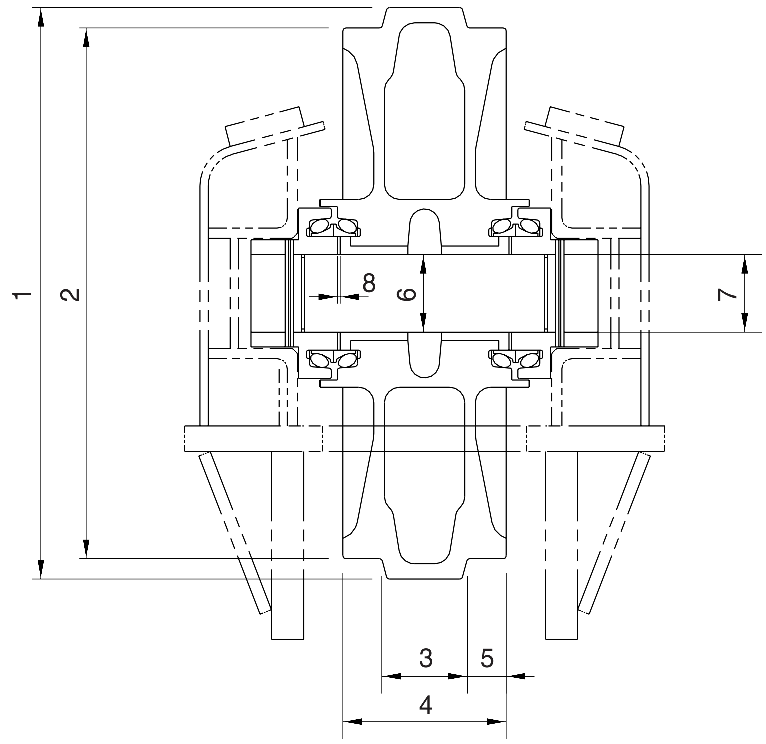


80CR96MC20

Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="2">ø 115</td><td colspan="2">-</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">ø 95</td><td colspan="2">ø 85</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">31</td><td colspan="2">35</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">11</td><td colspan="2">-</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="5">Replace bushing or shaft</td></tr>
<tr><td>Shaft</td><td>Bushing</td></tr>
<tr><td>ø 38 $^{0}_{-0.03}$</td><td>ø 38 $^{+0.35}_{+0.3}$</td><td>0.3 ~ 0.38</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Clearance between shaft and support</td><td>Shaft</td><td>Support</td><td rowspan="2">0.3 ~ 0.6</td><td rowspan="2">1.2</td></tr>
<tr><td>ø 38 $^{-0.2}_{-0.3}$</td><td>ø 38 $^{+0.3}_{+0.1}$</td></tr>
</table>

3) IDLER



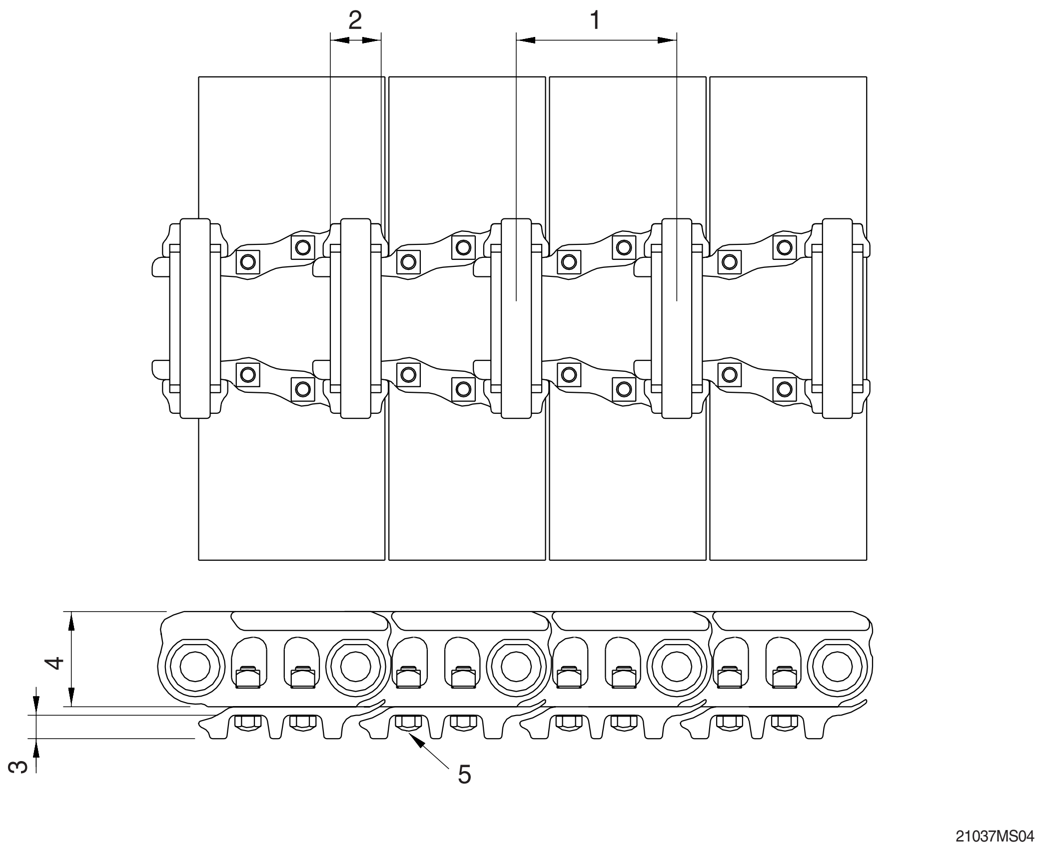
21037MS03

Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of protrusion</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="6">Rebuild or replace</td></tr>
<tr><td colspan="2">ø 440</td><td colspan="2">-</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">ø 410</td><td colspan="2">ø 400</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="2">40</td><td colspan="2">-</td></tr>
<tr><td>4</td><td>Total width</td><td colspan="2">100</td><td colspan="2">-</td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="2">30</td><td colspan="2">35</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Bushing</td></tr>
<tr><td>ø 60 $^{0}_{-0.03}$</td><td>ø 60.3 $^{+0.08}_{+0.03}$</td><td>0.33~0.41</td><td>2.0</td></tr>
<tr><td>7</td><td>Clearance between shaft and support</td><td>ø 60 $^{0}_{-0.03}$</td><td>ø 60 $^{+0.07}_{+0.03}$</td><td>0.03~0.1</td><td>1.2</td><td>Replace</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Side clearance of idler (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace bushing</td></tr>
<tr><td colspan="2">0.35~1.3</td><td colspan="2">2.0</td></tr>
</table>

4) TRACK

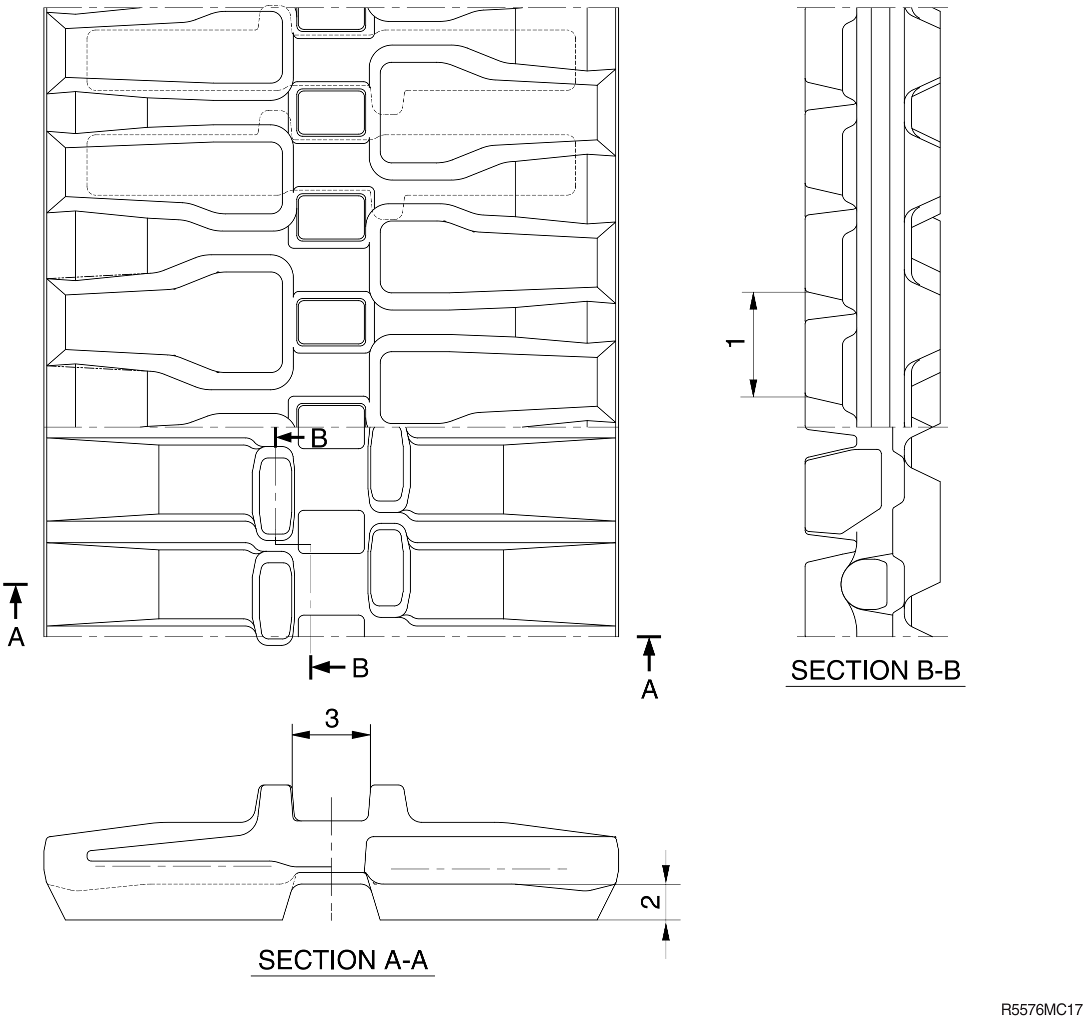
(1) Steel track



Unit : ㎜

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		154	158.3	
2	Outside diameter of bushing	ø 41.3	ø 34.3	Rebuild or replace
3	Height of grouser	20	10	
4	Height of link	74	66	
5	Tightening torque	Initial tightening torque : 25.5 ± 2.5 kgf · m		Retighten

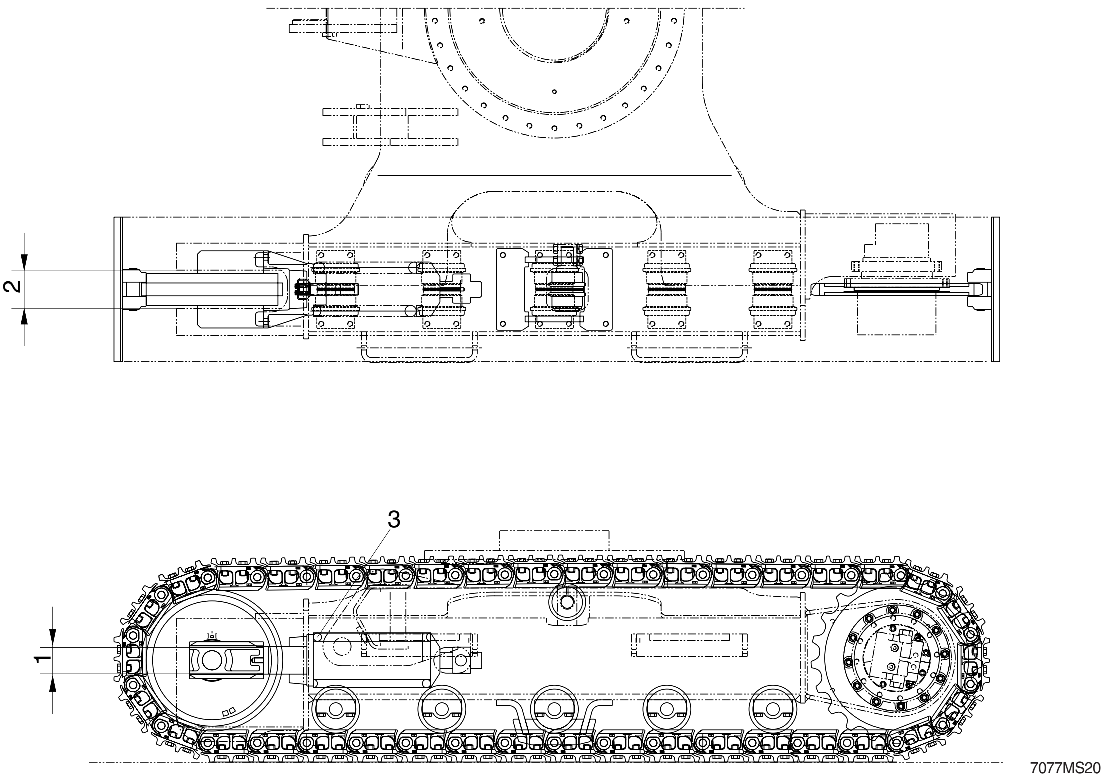
(2) Rubber shoe spec



Unit : mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Link pitch	83.5	±1.0	87	Replace
2	Height of grouser	30	-	5	
3	Width of link	52	-	70	

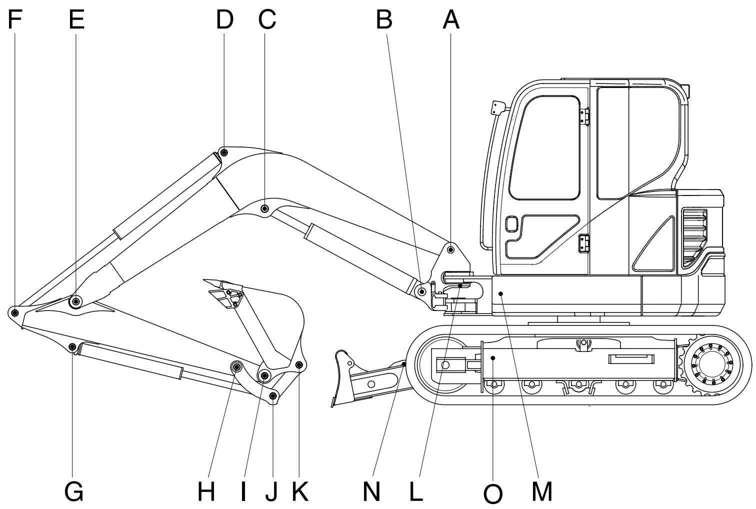
5) TRACK FRAME AND RECOIL SPRING



Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Vertical width of idler guide</td><td></td><td colspan="2">Standard size</td><td>Tolerance</td><td>Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td>Track frame</td><td colspan="2">92</td><td>+2
0</td><td>96</td></tr>
<tr><td>Idler support</td><td colspan="2">90</td><td>-0
-1.5</td><td>87</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Horizontal width of idler guide</td><td>Track frame</td><td colspan="2">172</td><td>+2
0</td><td>176</td></tr>
<tr><td>Idler support</td><td colspan="2">170</td><td>-</td><td>168</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Recoil spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="3">Replace</td></tr>
<tr><td>Free length</td><td>Installation length</td><td>Installation load</td><td>Free length</td><td>Installation load</td></tr>
<tr><td>ø 170×370</td><td>320</td><td>5,083 kg</td><td>-</td><td>4,174 kg</td></tr>
</table>

2. WORK EQUIPMENT



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Unit : ㎜

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom rear	65	64	63.5	65.5	66	Replace
B	Boom cylinder head	65	64	63.5	65.5	66	〃
C	Boom cylinder rod	65	64	63.5	65.5	66	〃
D	Arm cylinder head	65	64	63.5	65.5	66	〃
E	Boom front	65	64	63.5	65.5	66	〃
F	Arm cylinder rod	65	64	63.5	65.5	66	〃
G	Bucket cylinder head	50	49	48.5	50.5	51	〃
H	Arm link	55	54	53.5	55.5	56	〃
I	Bucket and arm link	55	54	53.5	55.5	56	〃
J	Bucket cylinder rod	55	54	53.5	55.5	56	〃
K	Bucket link	55	54	53.5	55.5	56	〃
L	Boom swing post	110	109	108.5	110.5	111	〃
M	Boom swing cylinder	65	64	63.5	65.5	66	〃
N	Blade cylinder	65	64	63.5	65.5	66	〃
O	Blade and frame link	55	54	53.5	55.5	56	〃

SECTION 7 DISASSEMBLY AND ASSEMBLY

SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

1) Lower the work equipment completely to the ground.
   If the coolant contains antifreeze, dispose of it correctly.

2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.

3) When draining oil, prepare a container of adequate size to catch the oil.

4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.

5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.

6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.

7) Check the number and thickness of the shims, and keep in a safe place.

8) When raising components, be sure to use lifting equipment of ample strength.

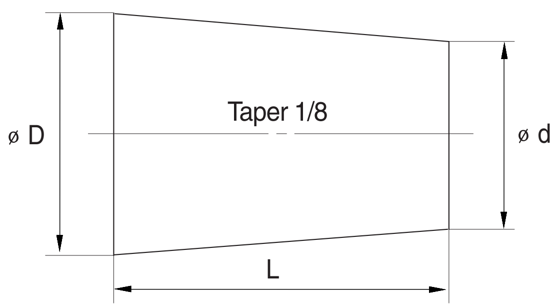
9) When using forcing screws to remove any components, tighten the forcing screws alternately.

10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.

12) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Dimensions		
	D	d	L
06	6	5	8
08	8	6.5	11
10	10	8.5	12
12	12	10	15
14	14	11.5	18
16	16	13.5	20
18	18	15	22
20	20	17	25
22	22	18.5	28
24	24	20	30
27	27	22.5	34



2. INSTALL WORK

1) Tighten all bolts and nuts(Sleeve nuts) to the specified torque.

2) Install the hoses without twisting or interference.

3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.

4) Bend the cotter pin or lock plate securely.

5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.

6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.

7) Clean all parts, and correct any damage, dents, burrs, or rust.

8) Coat rotating parts and sliding parts with engine oil.

9) When press fitting parts, coat the surface with antifriction compound(LM-P).

10) After installing snap rings, check that the snap ring is fitted securely in the ring groove(Check that the snap ring moves in the direction of rotation).

11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.

12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.

13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:

(1) Start the engine and run at low idling.

(2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100㎜ before the end of the stroke.

(3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)

(4) After completing this operation, raise the engine speed to the normal operating condition.

※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment.

※ Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

3. COMPLETING WORK

1) If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

2) If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

3) If the piping or hydraulic equipment, such as hydraulic cylinders, pumps, or motors, have been removed for repair, always bleed the air from the system after reassembling the parts.

4) Add the specified amount of grease(Molybdenum disulphied grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket)	M10 × 1.5	7±1.5	50.6±10.9
2		Engine mounting bolt (bracket-frame)	M16 × 2.0	30±4.5	217±32.5
3		Radiator mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
4		Coupling mounting bolt	M14 × 2.0	14±1.0	101±7.2
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	12±1.0	86.8±7.2
6		Main control valve mounting bolt	M 8 × 1.25	3.4±0.7	24.6±5.0
7		Fuel tank mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
8		Hydraulic oil tank mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
9		Turning joint mounting bolt, nut	M12 × 1.75	12.3±1.3	89±9.4
10	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
11		Swing bearing upper mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
12		Swing bearing lower mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
13		Travel motor mounting bolt	M16 × 2.0	23±2.5	166±18.1
14	Under carriage	Sprocket mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
15		Carrier roller mounting bolt, nut	M16 × 2.0	29.7±3.0	215±21.7
16		Track roller mounting bolt	M14 × 2.0	19.6±2.0	142±14.5
17		Track tension cylinder mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
18		Track shoe mounting bolt, nut	M14 × 1.5	25.5±2.5	184±18.1
19	Others	Counter weight mounting bolt	M27 × 3.0	140±15	1013±108
20		Cab mounting bolt, nut	M12 × 1.75	12.2±1.3	88.2±9.4
21		Operator's seat mounting bolt	M 8 × 1.25	1.17±0.5	8.5±3.6

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · ft
M 8 × 1.0	2.2 ~ 3.4	15.9 ~ 24.6	3.0 ~ 4.4	21.7 ~ 31.8
M10 × 1.2	4.5 ~ 6.7	32.5 ~ 48.5	5.9 ~ 8.9	42.7 ~ 64.4
M12 × 1.25	7.8 ~ 11.6	56.4 ~ 83.9	10.6 ~ 16.0	76.7 ~ 116
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 131	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 195	26.6 ~ 36.0	192 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 391	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 516	70.7 ~ 95.7	511 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 665	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1339	182 ~ 248	1314 ~ 1796
M36 × 3.0	192 ~ 260	1390 ~ 1880	262 ~ 354	1894 ~ 2562

2) PIPE AND HOSE (FLARE type)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

3) PIPE AND HOSE (ORFS type)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130
1-7/16-12	41	21	152
1-11/16-12	50	35	253

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

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.**

13031GE18

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

· Hydraulic tank quantity : 71 l (18.8 U.S.gal)

(5) Disconnect hydraulic hoses (11, 12, 13, 17, 18).

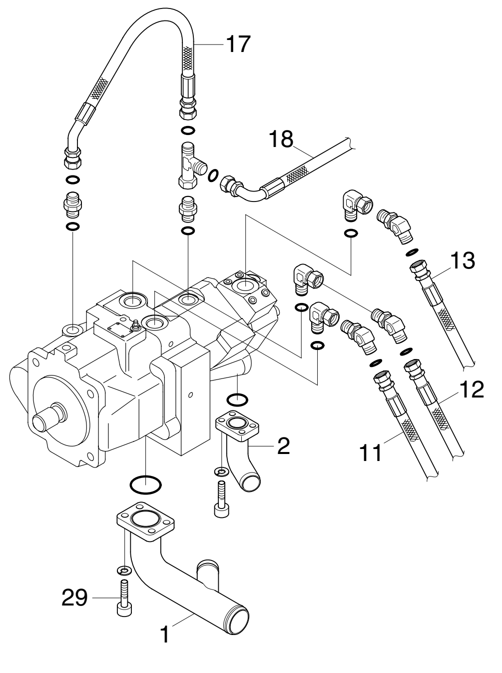
(6) Remove bolts (29) and disconnect pump suction pipe (1, 2).

※ When pump suction pipe 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 : 60 kg (70 lb)

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



80CR97DA01

2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

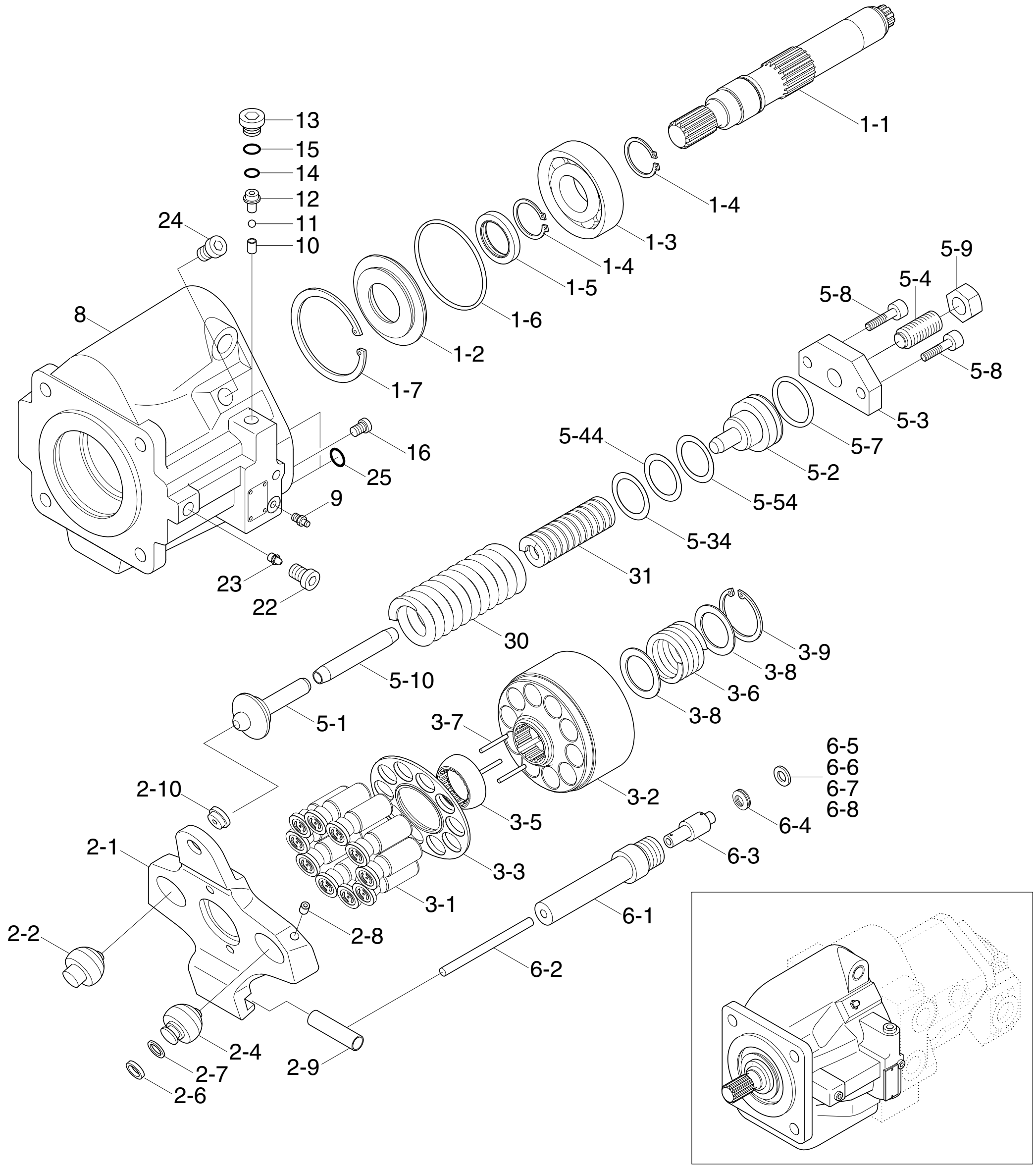
(6) Bleed the air from the hydraulic pump.
① Loosen the air vent plug.
② Start the engine, run at low idling, and check oil come out from plug.
③ Tighten plug.

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

(8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. MAIN PUMP

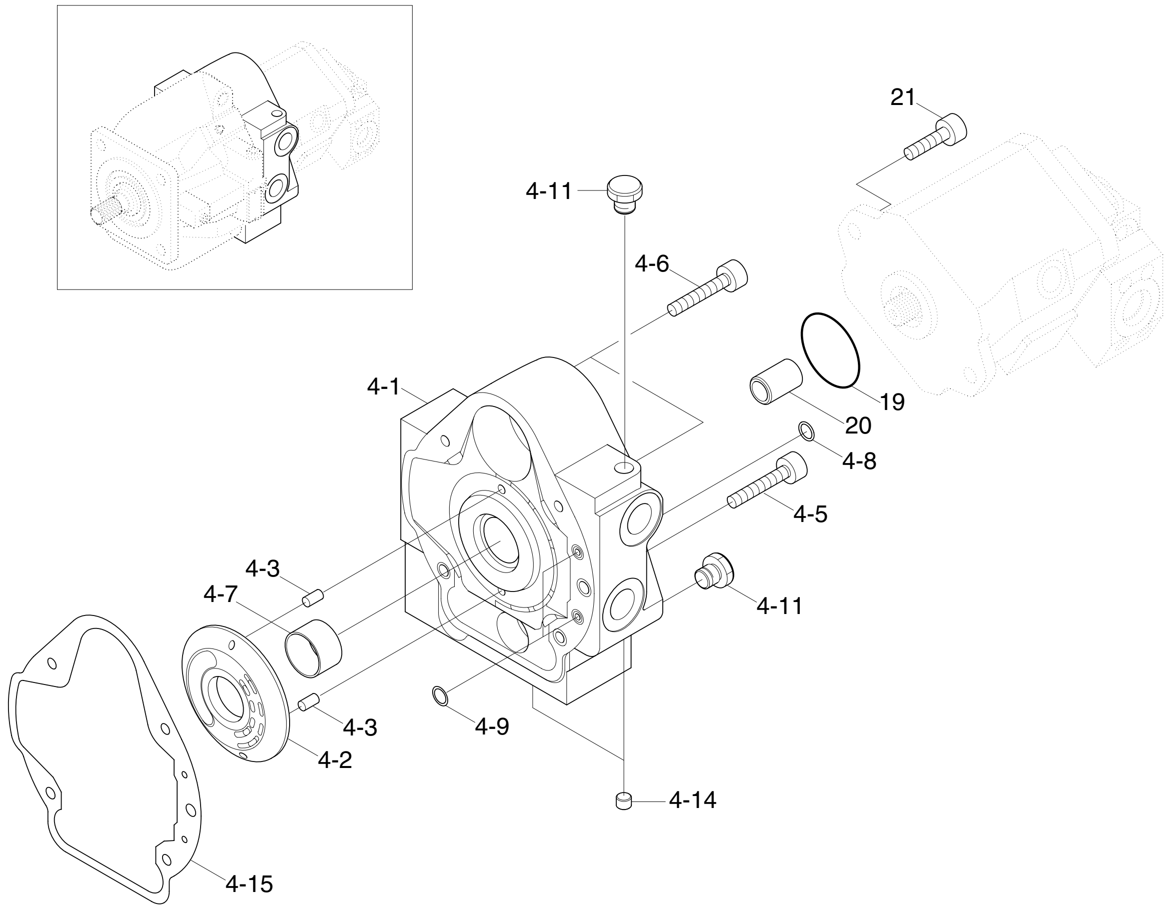
1) STRUCTURE (1/3)



80CR97MP100

1	Shaft assy	2-10	Bushing	5-8	Bolt	8	Housing
1-1	Shaft	3	Rotary group	5-9	Nut	9	Air vent valve
1-2	Seal retainer	3-1	Piston	5-10	Guide	10	Bushing
1-3	Bearing	3-2	Cylinder block	5-34	Shim (0.3T)	11	Steel ball
1-4	Retaining ring	3-3	Retainer	5-44	Shim (0.5T)	12	Plug
1-5	Oil seal	3-5	Guide	5-54	Shim (1.0T)	13	Plug
1-6	O-ring	3-6	Spring	6	Control piston assy	14	Packing
1-7	Retaining ring	3-7	Parallel pin	6-1	Cylinder	15	Shim
2	Swash plate assy	3-8	Spring seat	6-2	Piston	16	Plug
2-1	Swash plate	3-9	Retaining ring	6-3	Piston	22	Plug assy
2-2	Guide	5	Spring seat assy	6-4	Spring	23	Orifice
2-4	Guide	5-1	Spring seat	6-5	Spacer	24	Plug
2-6	O-ring	5-2	Spring seat	6-6	Spacer	25	Square ring
2-7	Back up ring	5-3	Cover	6-7	Spacer	30	Spring
2-8	D/Break off pin	5-4	Adjust screw	6-8	Spacer	31	Spring
2-9	Pin	5-7	O-ring				

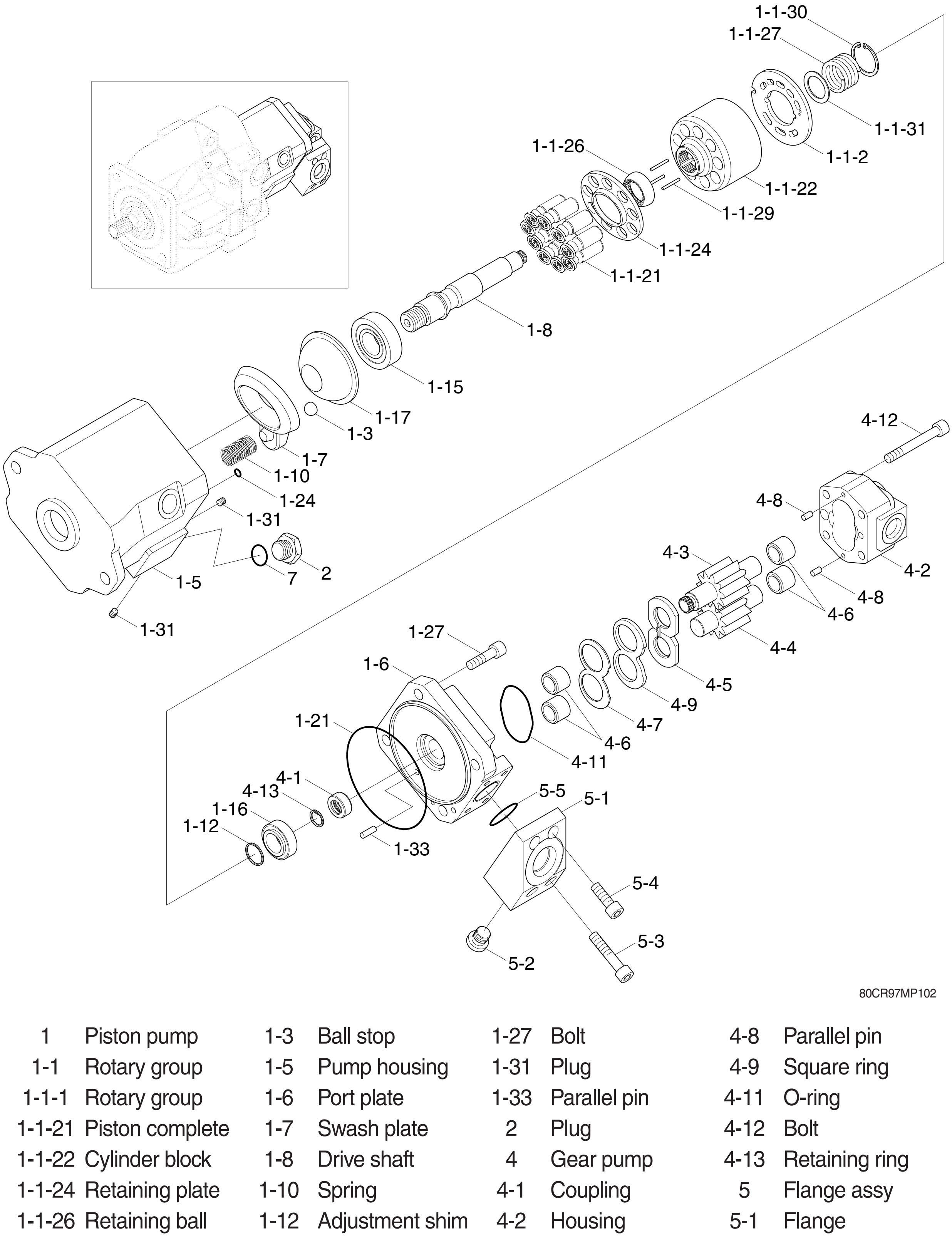
STRUCTURE (2/3)



80CR97MP101

4	Port plate assy	4-6	Screw	4-14	Plug
4-1	Cover	4-7	Bearing	4-15	Packing
4-2	Control plate	4-8	O-ring	19	O-ring
4-3	Parallel pin	4-9	Square ring	20	Coupling
4-5	Screw	4-11	Plug	21	Screw

STRUCTURE (3/3)



1	Piston pump	1-3	Ball stop	1-27	Bolt	4-8	Parallel pin
1-1	Rotary group	1-5	Pump housing	1-31	Plug	4-9	Square ring
1-1-1	Rotary group	1-6	Port plate	1-33	Parallel pin	4-11	O-ring
1-1-21	Piston complete	1-7	Swash plate	2	Plug	4-12	Bolt
1-1-22	Cylinder block	1-8	Drive shaft	4	Gear pump	4-13	Retaining ring
1-1-24	Retaining plate	1-10	Spring	4-1	Coupling	5	Flange assy
1-1-26	Retaining ball	1-12	Adjustment shim	4-2	Housing	5-1	Flange
1-1-27	Spring	1-15	Bearing	4-3	Drive gear	5-2	Plug
1-1-29	Pin	1-16	Bearing	4-4	Idle gear	5-3	Screw
1-1-30	V-ring	1-17	Cradle shell	4-5	Thrust plate	5-4	Screw
1-1-31	Backup plate	1-21	O-ring	4-6	Metal	5-5	O-ring
1-1-2	Control plate	1-24	Square ring	4-7	Back up ring	7	O-ring

3. DISASSEMBLY AND ASSEMBLY

1) NECESSARY TOOLS AND JIGS

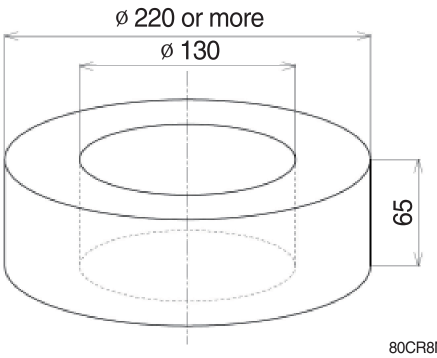
The following tools and jigs are necessary to disassemble and assemble the pump.

(1) Tools

Name	Size (nominal)	Quantity
Hexagon socket screw key	6, 8, 10, 12	One each
Spanner	27, 32	One each
Screw driver for slotted-head screws	Medium size	2
Plastic hammer	Medium size	1
Pliers for retaining ring	For bore use (retaining ring for 80)	1
Grease	-	Small amount
Adhesive	Three bond #1305	Small amount

(2) Jigs

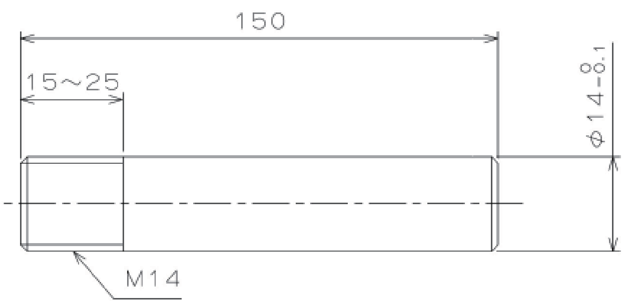
Disassemble table



80CR8MP01

※ This is a plate to stand the pump facing downward.
A square block may be used if the shaft does not contact.

Guide bolt for disassemble and assemble port plate



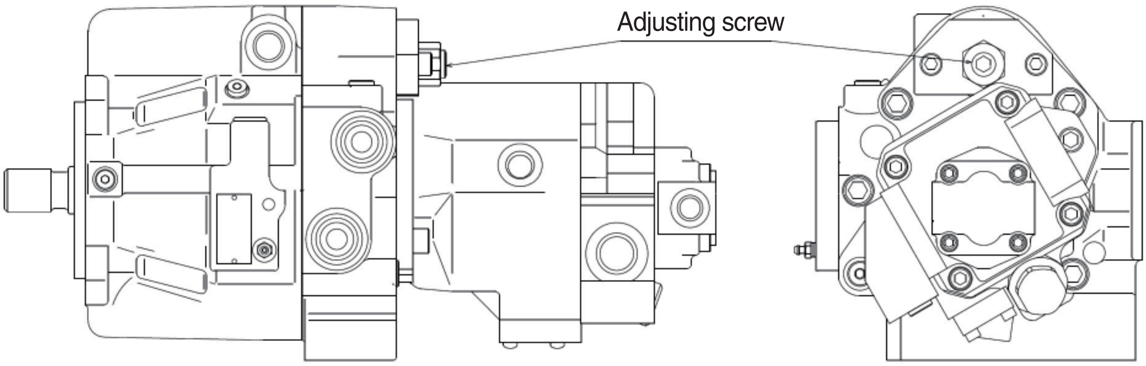
Stud bolt can be possible

80CR8MP02

2) CAUTIONS DURING DISASSEMBLING AND ASSEMBLING

(1) Cautions for disassembling

① Do not loosen adjusting screw unless absolutely necessary.
② Take utmost care during disassembly not to knock or drop each part.
③ Special attention is necessary for disassemble port plate, because spring load is very high.



80CR8MP03

(2) Cautions for assembling

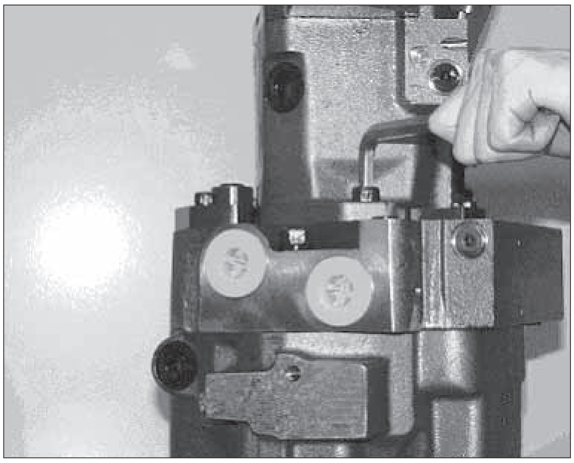
① Wash each part thoroughly.
② During assembling, take utmost care not to damage the part or allow foreign materials to enter.
③ Special attention is necessary for assemble port plate, because spring load is very high.
④ As a rule, the O-ring and oil seal should not be reused.
⑤ Apply the grease for each sliding surfaces.
⑥ In our assembly work, the torque wrench is used to control the torque.
Be sure to use the torque wrench.

3) DISASSEMBLING PROCEDURE (main pump)

(1) Disassembling the rear pump.

① Remove the hexagon socket head cap screws and plain washers.
(M12×30, 2 pieces)
Hexagon socket screw key
(Hexagon side distance : 10 mm)

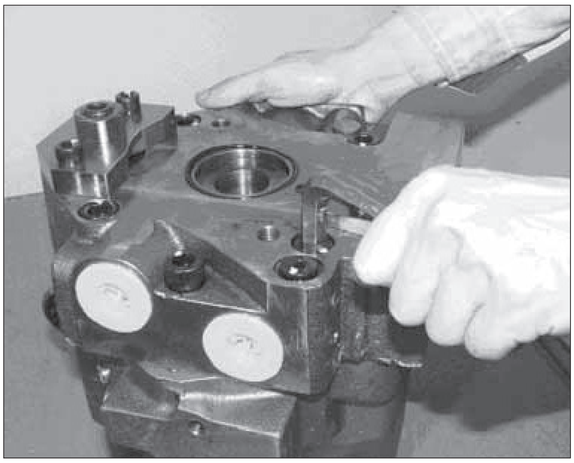
② Coupling on the port plate side are detached at the same time.



80CR8MP04

(2) Remove the port plate.

① Remove hexagon socket head cap screws.
(M14×70, 4 pieces and M14×65, 1 piece)
Hexagon socket screw key
(Hexagon side distance : 12 mm)

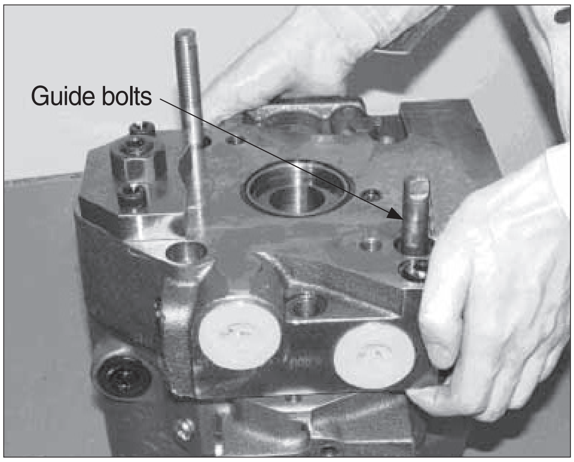


80CR8MP05

② Install the guide bolts to the port plate.

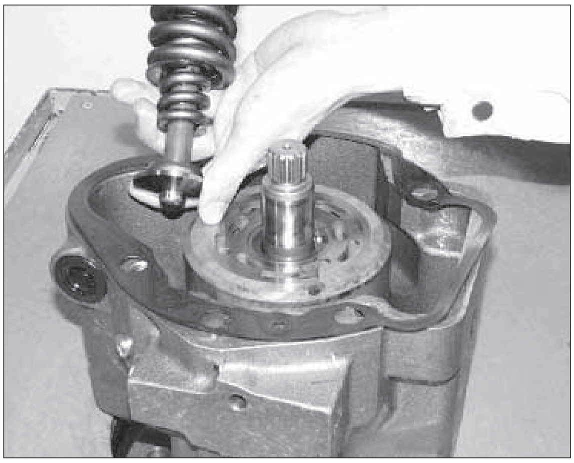
Be careful because control plate and control piston are on the backside of port plate.

When port plate doesn't come off easily, you can use a plastic hammer lightly.



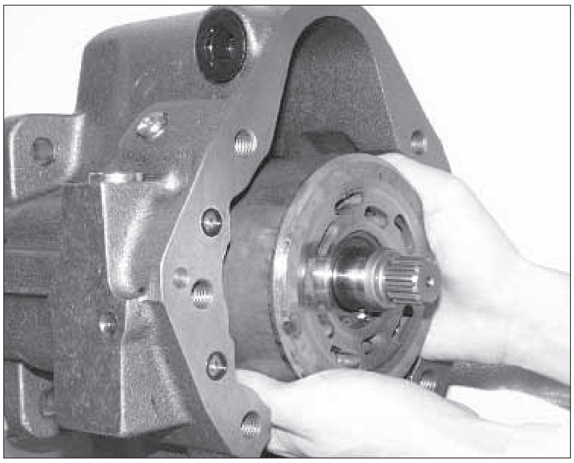
80CR8MP06

(3) Remove the inside parts.
Remove the gasket, control springs (inner and outer), guide, and spring seat.



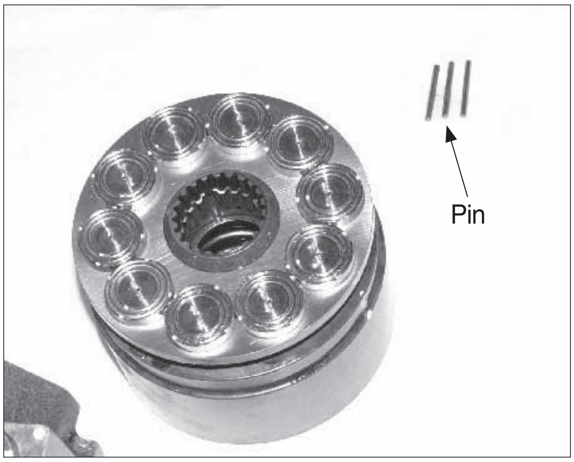
80CR8MP07

(4) Remove rotary group.
① Push down sideways the pump.
② Take out the rotary group with both hands holding retaining plate and piston assembly.



80CR8MP08

③ The parallel pins (ø3×30, 3 pieces) may remain in the housing, when removing the rotary group.
Please take out the parallel pins when they were left in the housing.

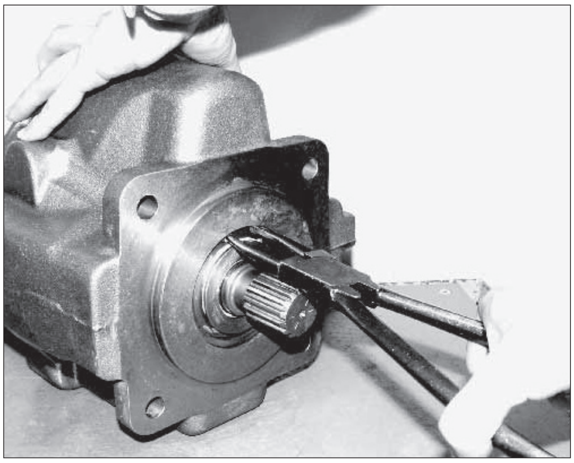


80CR8MP09

(5) Remove the shaft.

① Remove the retaining ring.
(For bore use ; 80)

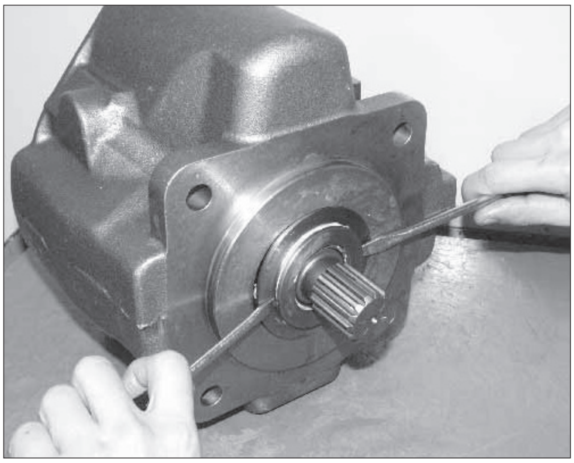
Pliers for retaining rings
(For bore use ; retaining ring for 80)



80CR8MP10

② Remove the shaft seal case and O-ring behind the seal case.

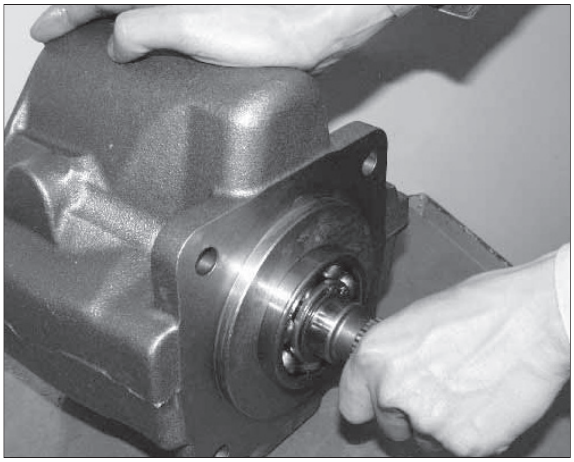
Screwdrivers for slotted-head screws (medium size)



80CR8MP11

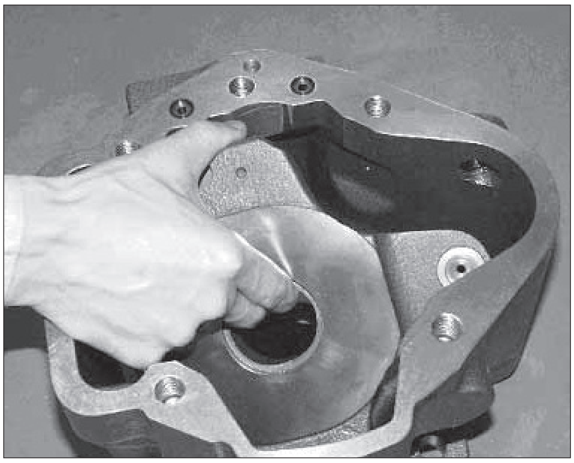
③ Remove the shaft.

When the shaft doesn't come off easily, you can use a plastic hammer and hit a shaft end of backside lightly.



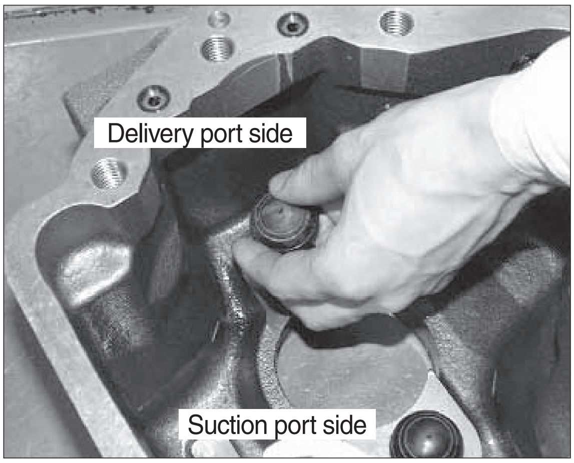
80CR8MP12

(6) Remove the swash plate.



80CR8MP13

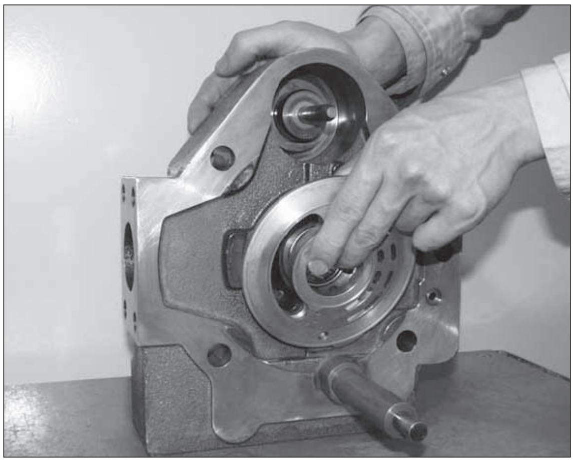
(7) Disassemble the ball guide.



80CR8MP14

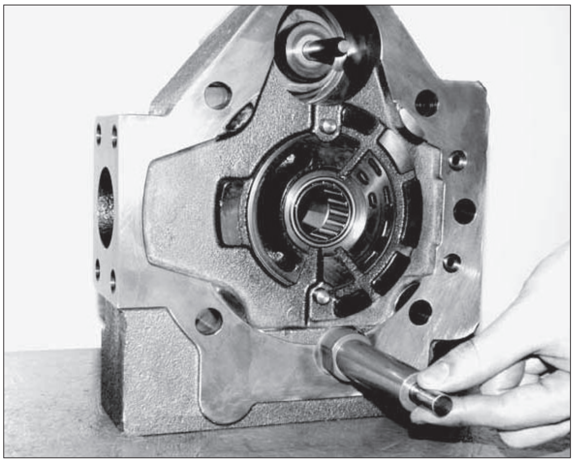
(8) Disassemble the port plate.

① Remove the control plate.



80CR8MP15

② Remove the control piston assembly.
Remove the piston.

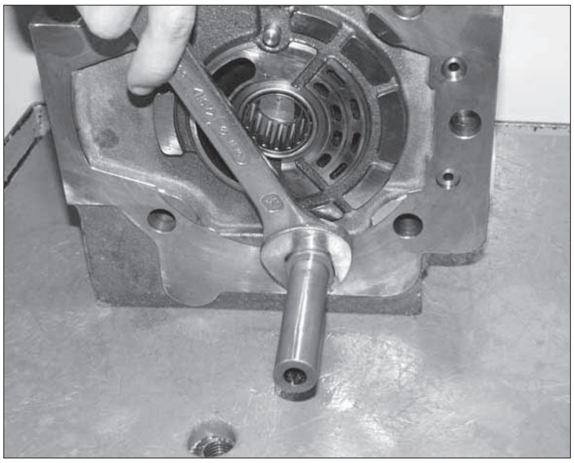


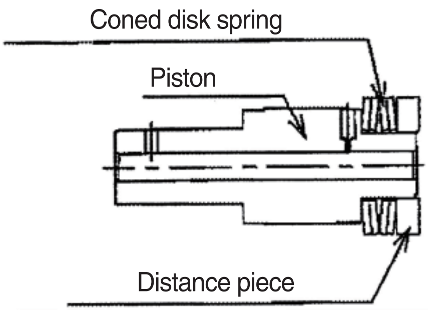
80CR8MP16

③ Remove the cylinder.

· Spanner (27 mm)

Be careful because piston and coned disk spring and distance piece are in the port plate.





80CR8MP18

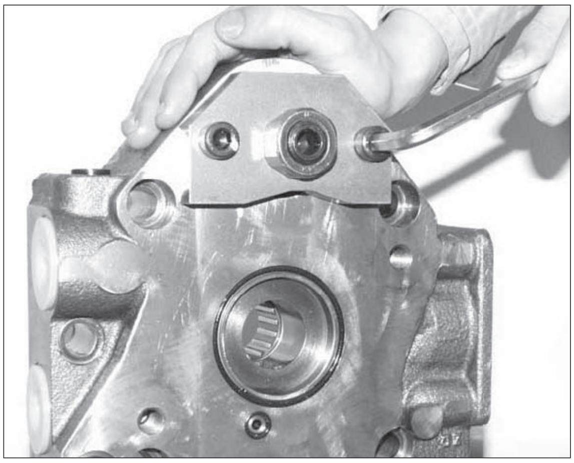
80CR8MP17

④ Remove the spring seat assembly.

※ Only when it is necessary
(The setting changes if the hexagonal nut is loosened.)

Remove the hexagon socket head cap screws.
(M10×30, 2 pieces)
Hexagon socket screw key
(Hexagon side distance : 8 mm)

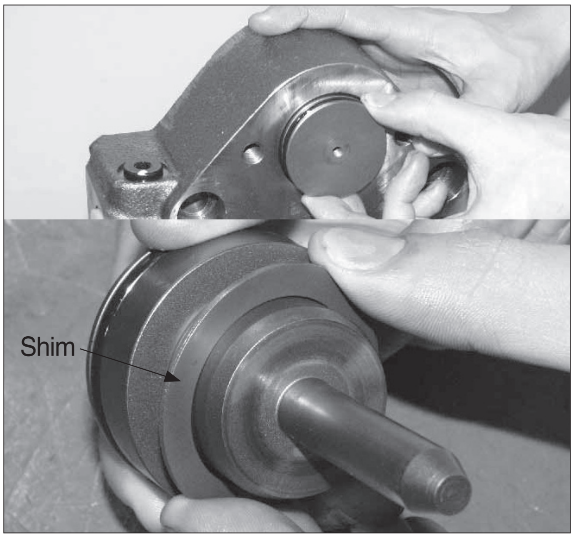
Only when it is necessary



80CR8MP19

⑤ Remove the spring seat.

Be careful because shim might attach to the spring seat.

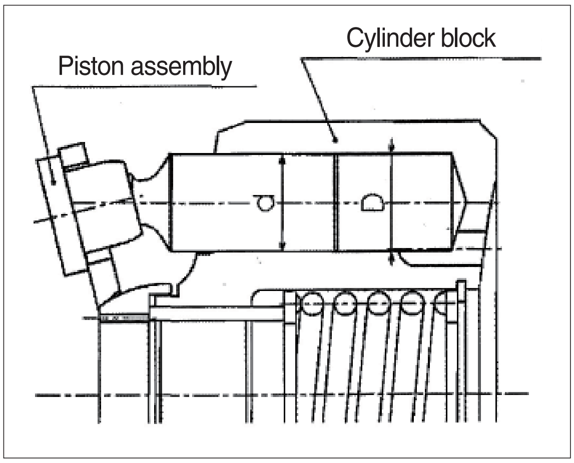


80CR8MP20

4) MAINTENANCE AND SERVICE STANDARD FOR THE MAIN PUMP

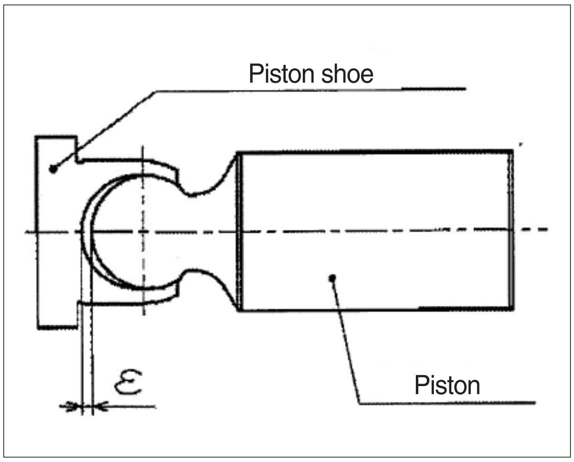
Before inspection wash the parts well and dry them completely.
Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.
Replace the seal also when any remarkable deformation and damage are found.

(1) Piston assembly and cylinder block
- Check the appearance visualy.
  No damage souring abnormal wear (particularly in the side potion) should be found.
- Check the clearance between the piston outside dia and the cylinder block inside dia.
  D-d $\leq$ 0.06 mm



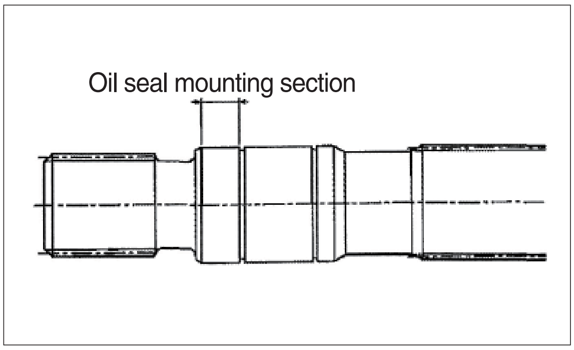
80CR8MP21

(2) Piston shoe and piston
- Check the piston shoe.
  $\varepsilon \leq$ 0.2 mm



80CR8MP22

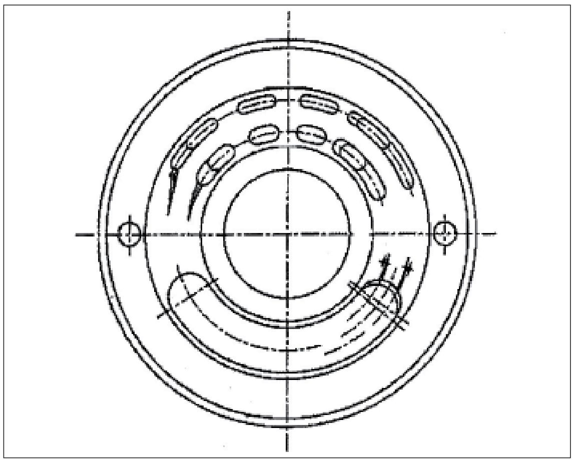
(3) Shaft
- Check the wear amount of the oil seal mounting section.
  Wear amount $\leq$ 0.025 mm



80CR8MP23

(4) Control plate

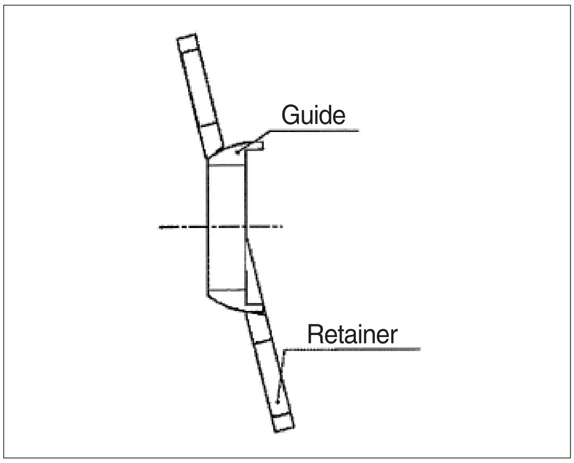
- Check the slide surface for any damage.
  When the damage is large replace the control plate with new one.



80CR8MP24

(5) Guide and retainer

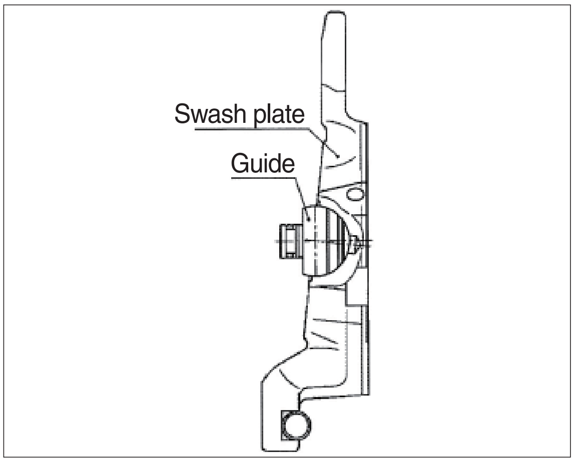
- Check for scouring or stepped wear.
  If this can not be corrected replace the guide and the retainer as a set.
- Fine scouring or damage can be corrected with lapping.
  Carry out through washing after lapping.



80CR8MP25

(6) Guide and swash plate

- Check for scouring or stepped wear.
  If this can not be corrected replace the guide and the swash plate as a set.

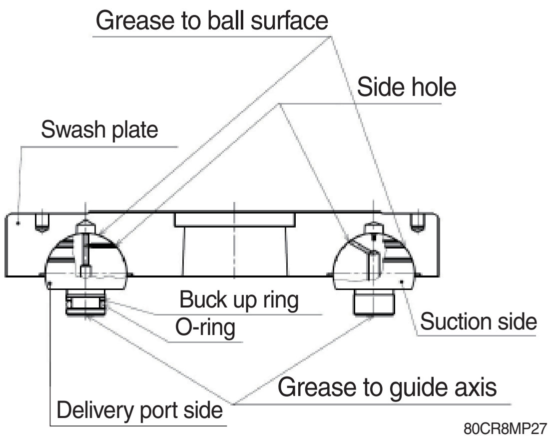


80CR8MP26

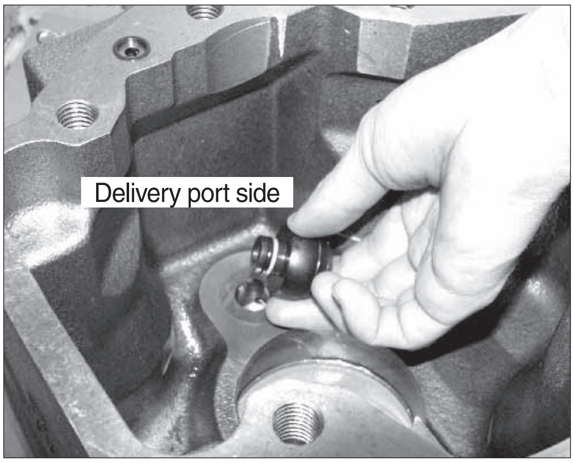
5) ASSEMBLING PROCEDURE (main pump)

(1) Assemble the swash plate

① Assemble the ball guides to housing.
Check the position of O-ring and backup ring.
Apply the grease to the guide axis for the dropout prevention.

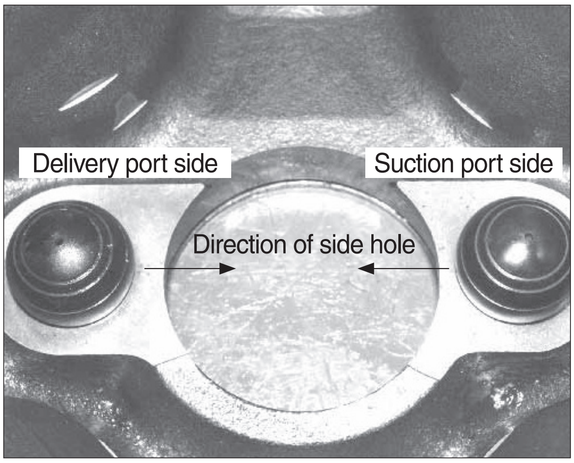


80CR8MP27



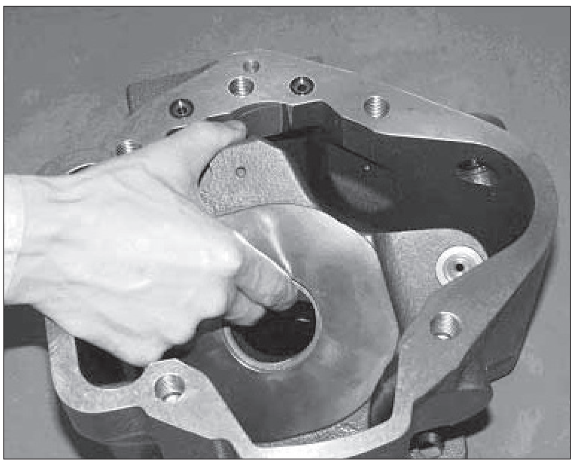
80CR8MP28

② Fix the position of side holes and apply grease to the whole of ball surfaces.



80CR8MP29

③ Install the swash plate.

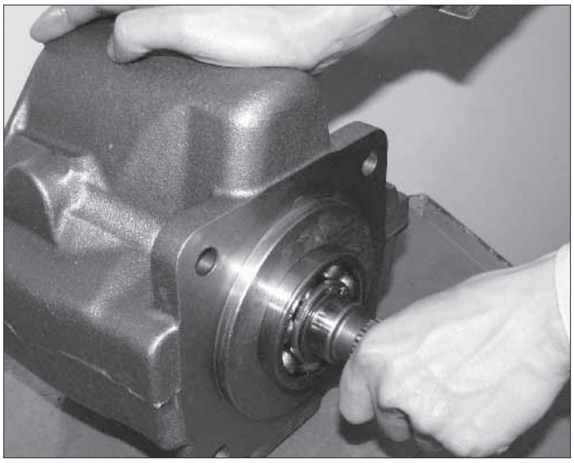


80CR8MP30

(2) Assemble the shaft

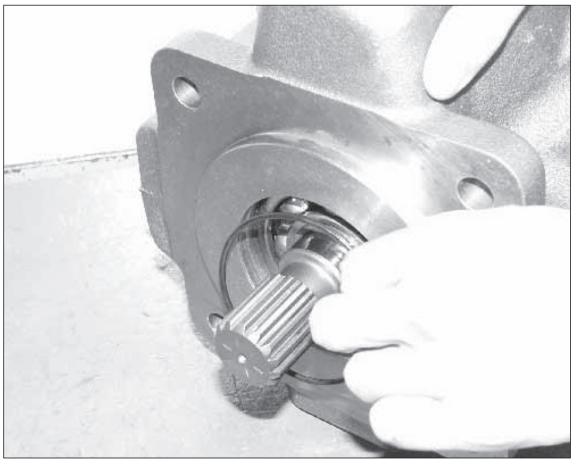
① Install the shaft into the housing with taking care not to drop swash plate out. Fix the bearing outer ring firmly into the housing hole.

When the shaft doesn't build in easily, you can use a plastic hammer and hit a shaft end of front side lightly.



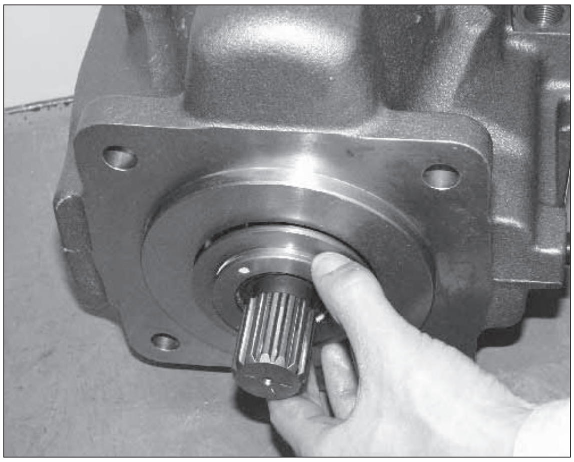
80CR8MP31

② Apply the grease to O-ring and assemble it.



80CR8MP32

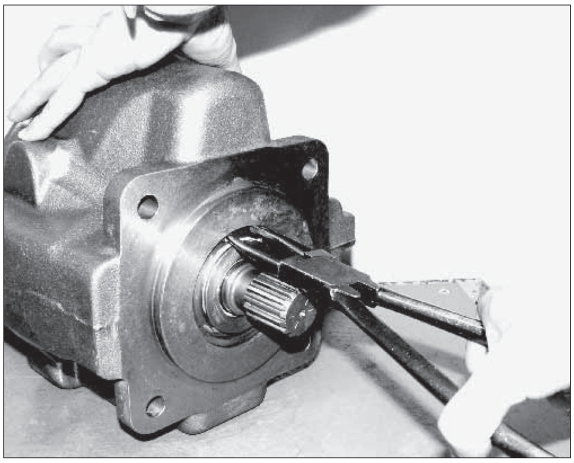
③ Install the oil seal case into the shaft. Apply grease to the oil seal lip beforehand.
Be careful not to damage shaft seal with spline.



80CR8MP33

④ Assemble the retaining ring.
(For bore use ; 80)

Pliers for retaining rings
(For bore use ; retaining ring for 80)



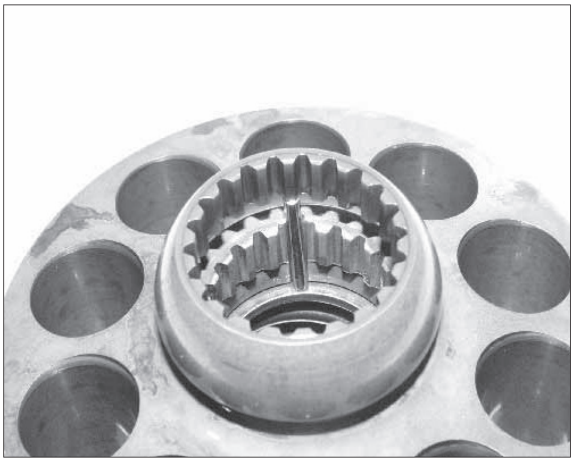
80CR8MP34

(3) Assemble the rotary group.

① Apply the grease to the parallel pins (ø 3×30, 3 pieces) and install them to the ditch part of spline.

80CR8MP35

② Apply the grease to the surface of retaining ball and assemble it on the pins.

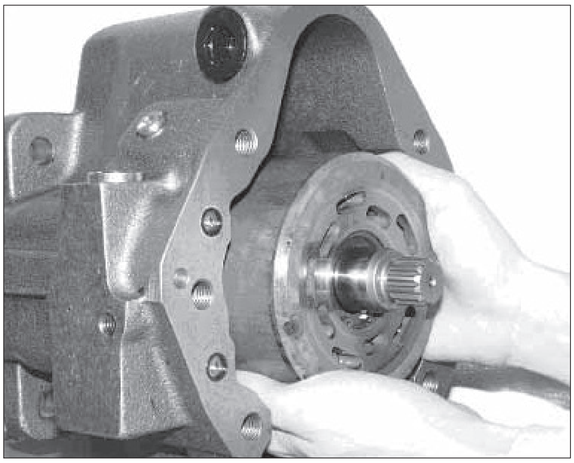


80CR8MP36

③ Apply the grease to the end part of the shoes and assemble the piston assembly into the hole of retaining plate and cylinder block.

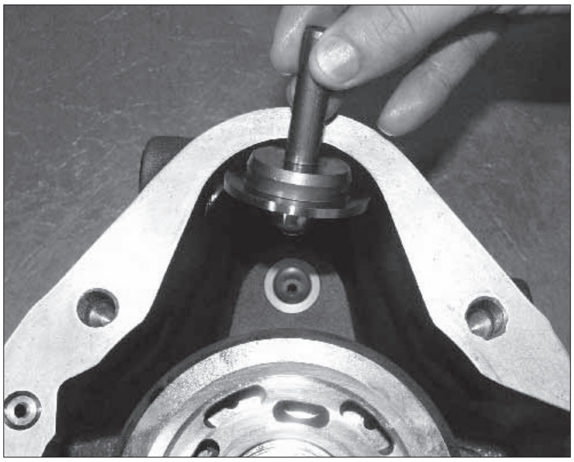
80CR8MP37

(4) Install the rotary group.
(Along the shaft spline)



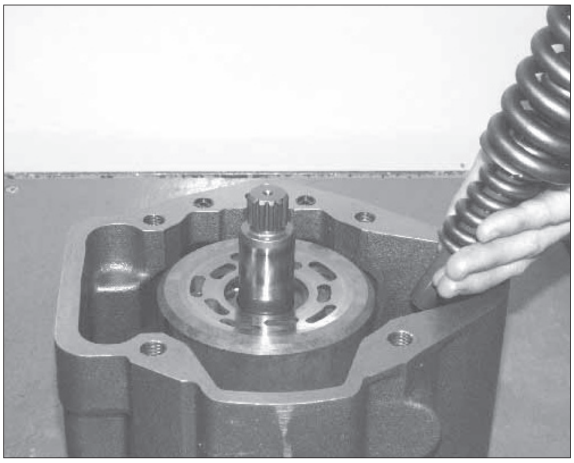
80CR8MP38

(5) Assemble the spring seat assembly.
① Apply the grease to the ball surface of spring seat and assemble it.



80CR8MP39

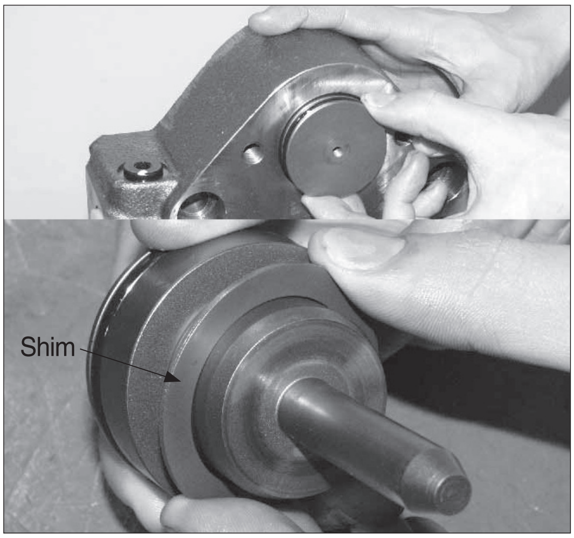
② Assemble the springs (inner and outer) and the guide.



80CR8MP40

③ Install the spring seat into the port plate.

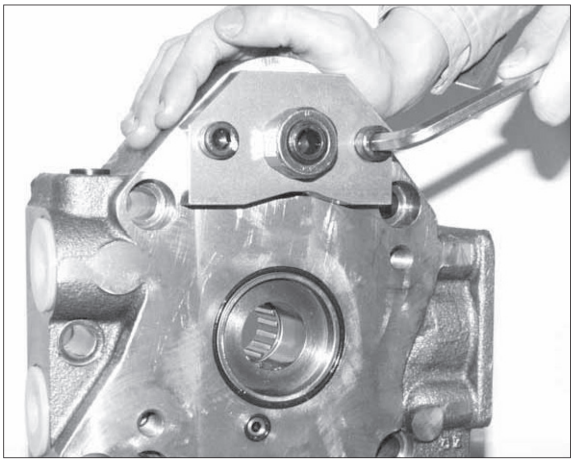
Apply grease to the shim for dropout prevention when shim has attached to the spring seat.



80CR8MP20

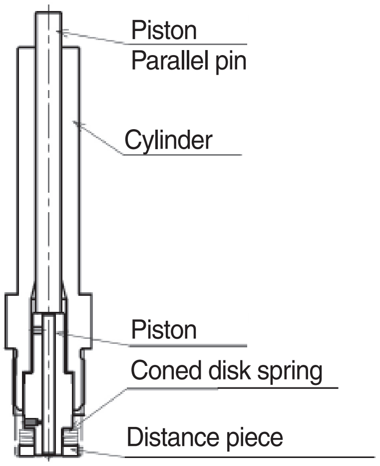
④ Assemble the cover.
Fix the hexagon socket head cap screws. (M10×30, 2 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 mm)
Tightening torque : 6.3±0.7 kgf · m
(45.6±5.2 lbf · ft)

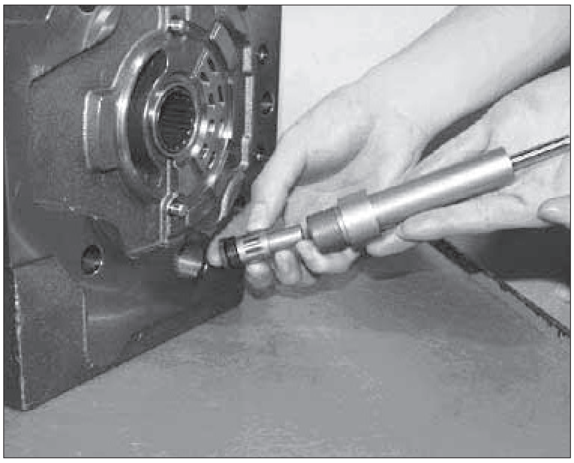


80CR8MP41

(6) Assemble the control piston assembly.



80CR8MP43



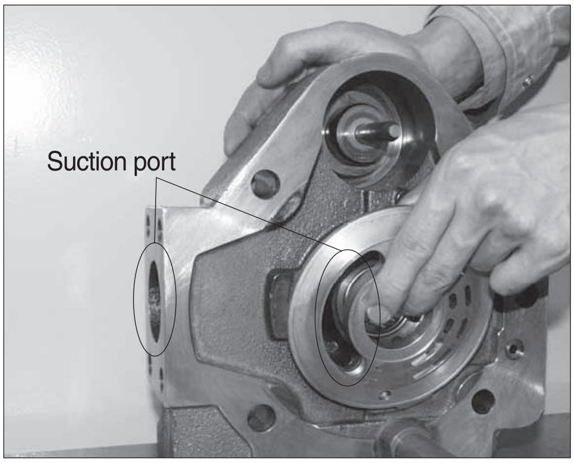
80CR8MP42

Apply three bond #1305 to the thread of the cylinder.
Spanner (27 mm)
Tightening torque : 14.5±1.4 kgf · m
(105±10.3 lbf · ft)

(7) Assemble the control plate.

① Apply the grease between port plate and control plate for dropout prevention and assemble the control plate to the port plate.

② Apply the grease to the operating surface of control plate.

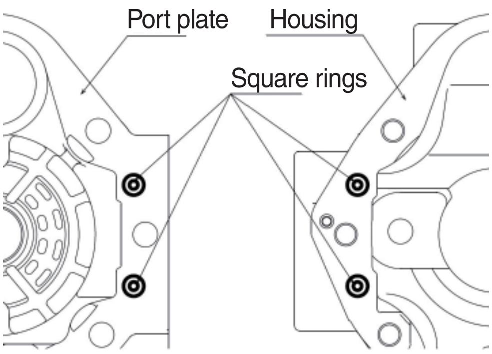


80CR8MP44

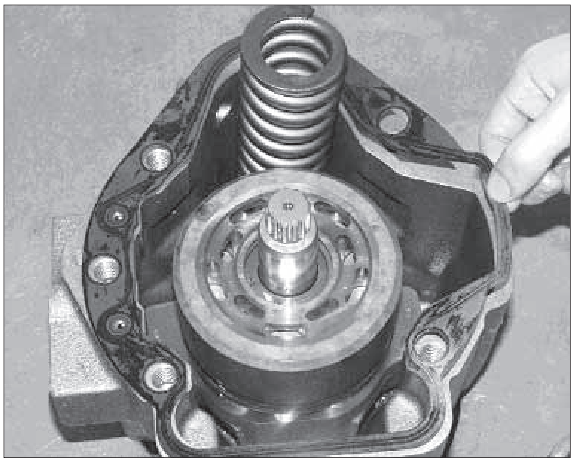
(8) Assemble the port plate assembly.

① Assemble the square rings to the housing side and port plate side (each 2 pieces).

② Assemble the gasket on the housing surface.



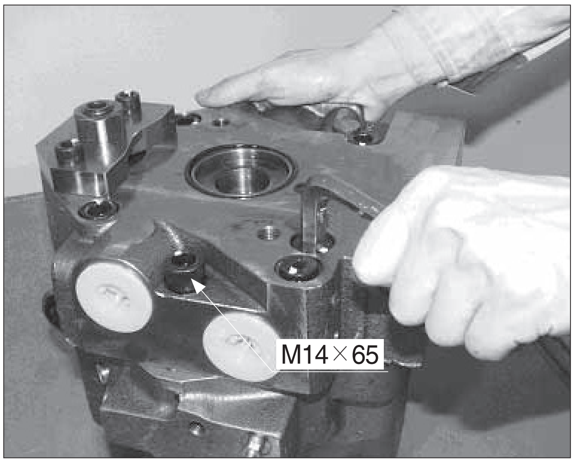
80CR8MP46



80CR8MP45

③ Fix the port plate with the hexagon socket head cap screw.
(M14×70, 4 pieces)
(M14×65, 1 pieces)

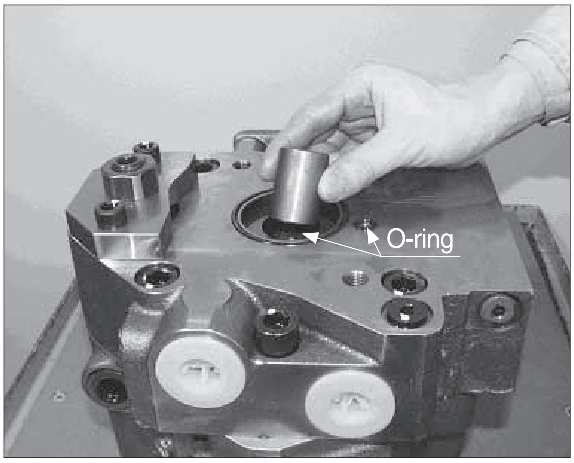
Hexagon socket screw key
(Hexagon side distance : 12 mm)
Tightening torque : 16.8±1.5 kgf · m
(122±11.1 lbf · ft)



80CR8MP47

(9) Assemble the rear pump.
Install the coupling.

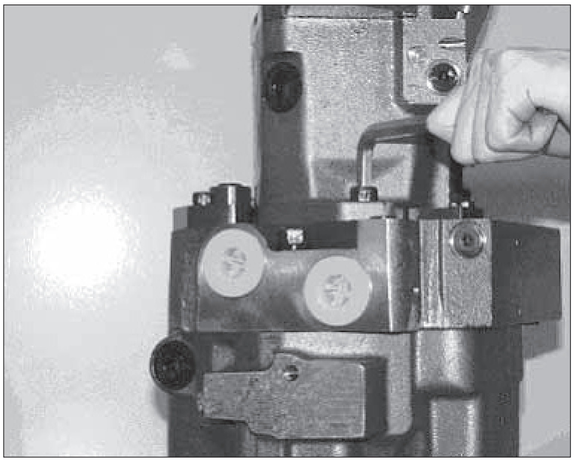
Confirm the O-rings.



80CR8MP48

① Fix the rear pump with the hexagon socket head cap screws.
(M12×30, 2 pieces)

Hexagon socket screw key
(Hexagon side distance : 10 mm)
Tightening torque : 11.2±1.2 kgf · m
(81.1±8.9 lbf · ft)



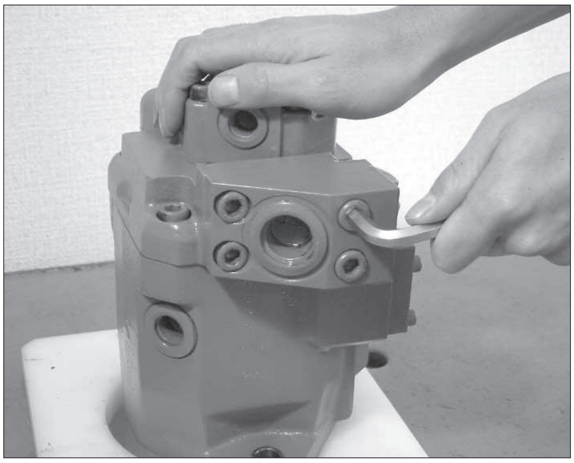
80CR8MP49

6) DISASSEMBLING PROCEDURE (rear pump)

(1) Remove the flange.

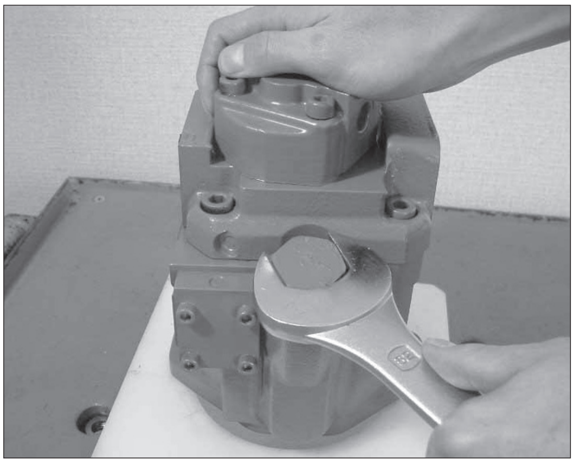
Remove the hexagon socket head cap screws.
(M10×45, 2 pieces, M10×20, 2 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 mm)



80CR8MP50

(2) Remove the plug.
Spanner (32 mm)

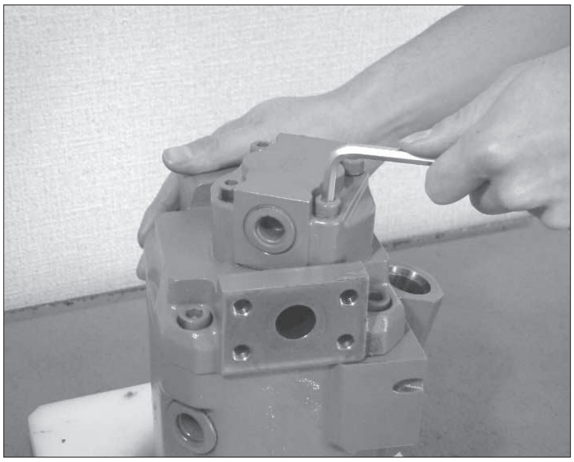


80CR8MP51

(3) Remove the gear pump.

Remove the hexagon socket head cap screws.
(M8×50, 4 pieces)

Hexagon socket screw key
(Hexagon side distance : 6 mm)

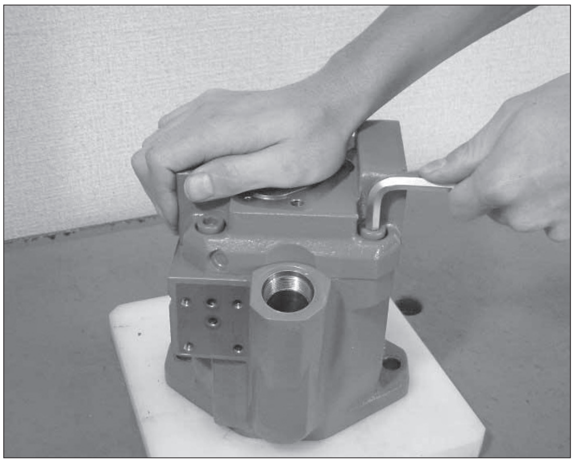


80CR8MP52

(4) Remove the port plate.

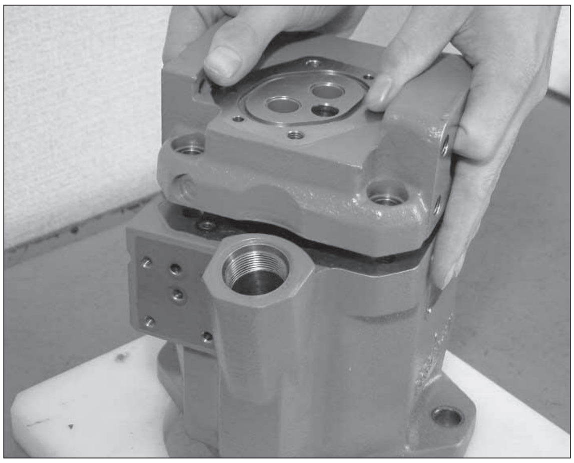
① Remove the hexagon socket head cap screws.
(M10×30, 4 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 mm)



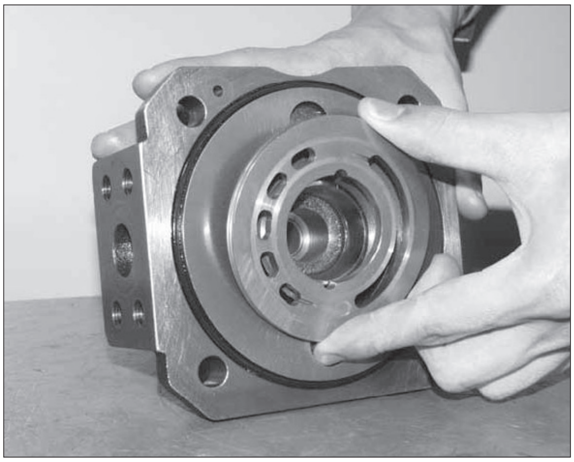
80CR8MP53

② Remove the port plate.



80CR8MP54

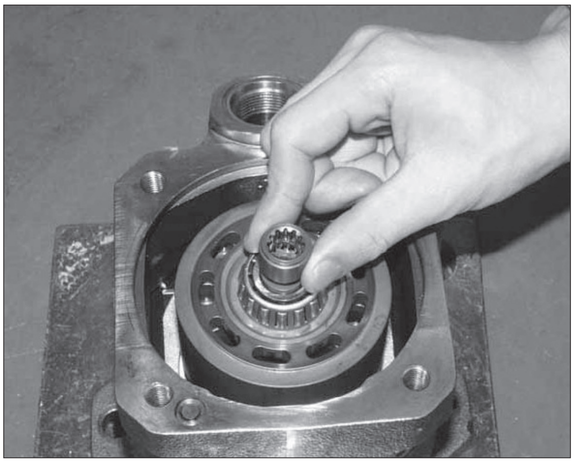
③ Remove the control plate from the port plate.



80CR8MP55

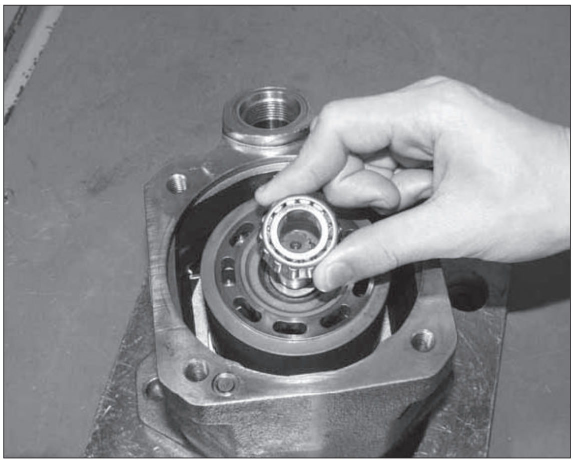
(5) Remove the parts from the pump housing.

① Remove the coupling.



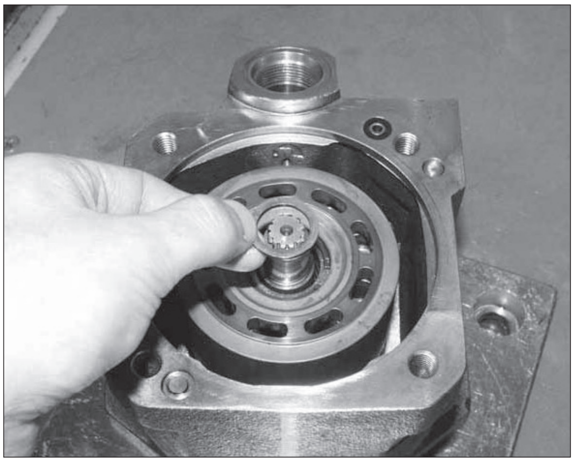
80CR8MP56

② Remove the bearing.



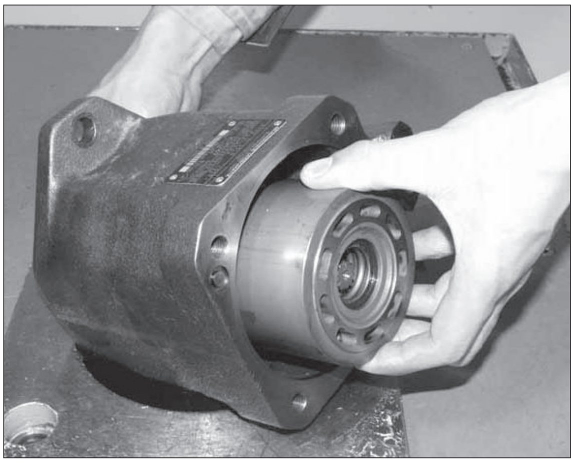
80CR8MP57

③ Remove the shim.



80CR8MP58

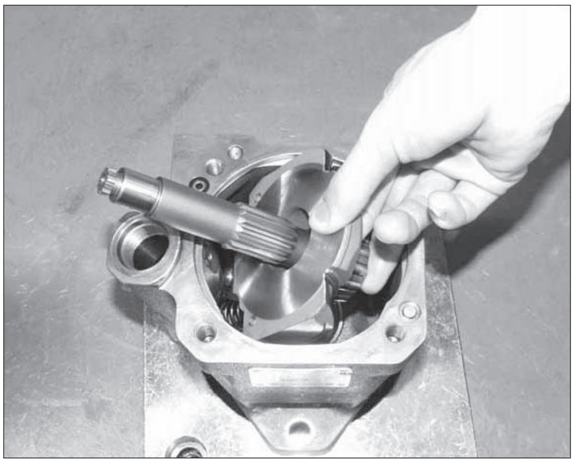
④ Remove the rotary group.



80CR8MP59

⑤ Remove the swash plate and the drive shaft.

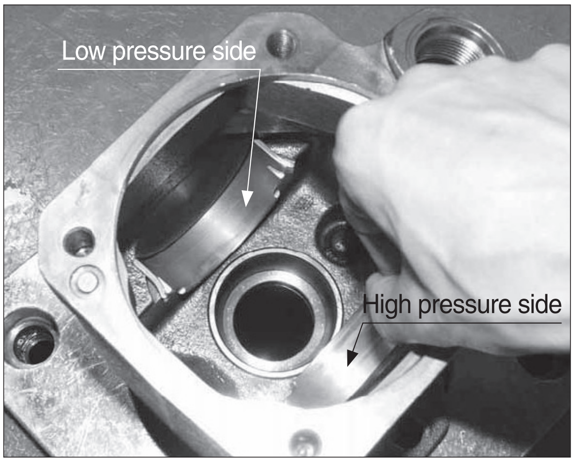
Note the spring that is on the back side of the swash plate.



80CR8MP60

⑥ Remove the cradle shells.

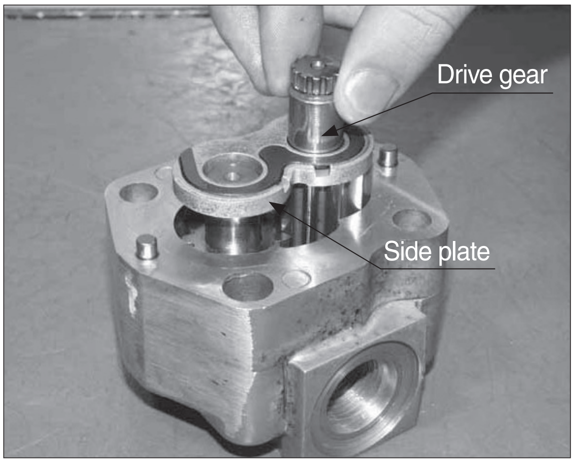
Mark the cradle shells so that it should not make a mistake in the position of a low-pressure side and a high-pressure side.



80CR8MP61

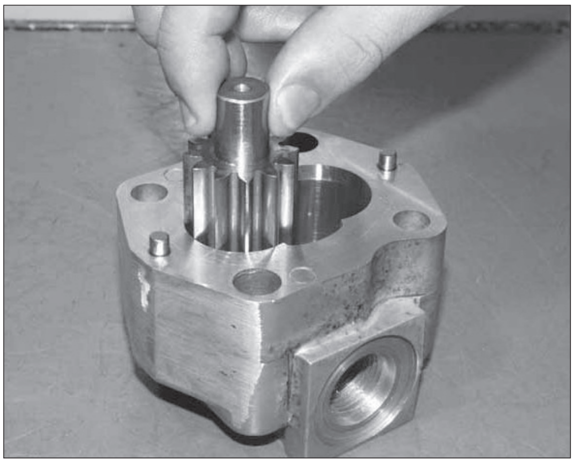
(4) Disassemble the gear pump.

① Remove the drive gear and the side plate.



80CR8MP62

② Remove the idle gear.

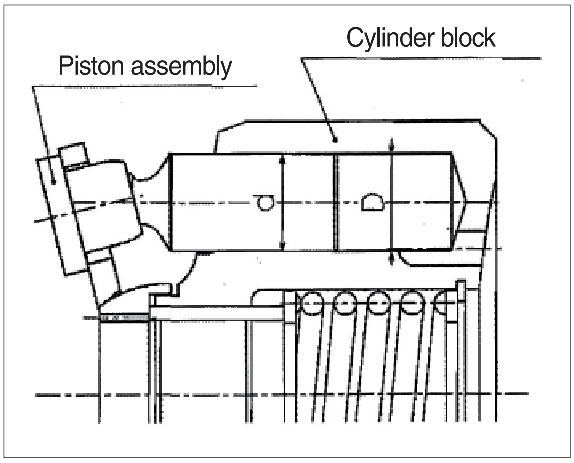


80CR8MP63

7) MAINTENANCE AND SERVICE STANDARD FOR THE REAR PUMP

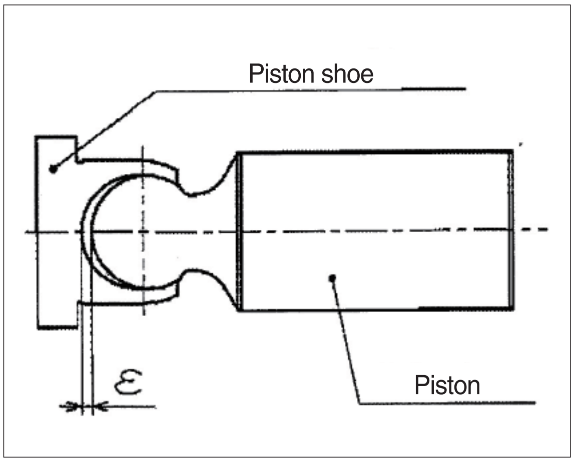
Before inspection wash the parts well and dry them completely.
Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.
Replace the seal also when any remarkable deformation and damage are found.

(1) Piston assembly and cylinder block
- Check the appearance visualy.
  No damage souring abnormal wear (particularly in the side potion) should be found.
- Check the clearance between the piston outside dia and the cylinder block inside dia.
  D-d $\leq$ 0.06 mm



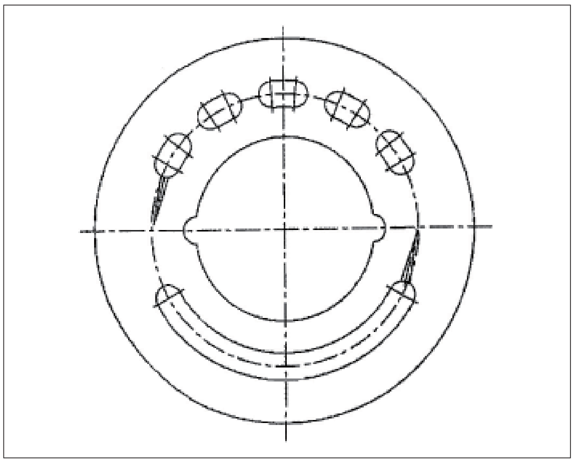
80CR8MP21

(2) Piston shoe and piston
- Check the piston shoe.
  $\varepsilon \leq$ 0.2 mm



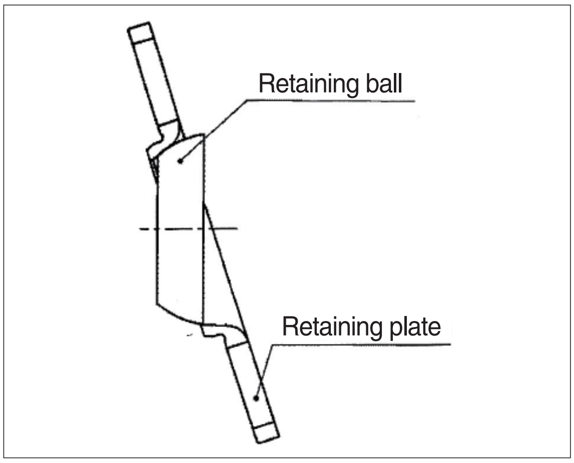
80CR8MP22

(3) Control plate
- Check the slide surface for any damage.
  When the damage is large replace the control plate with new one.



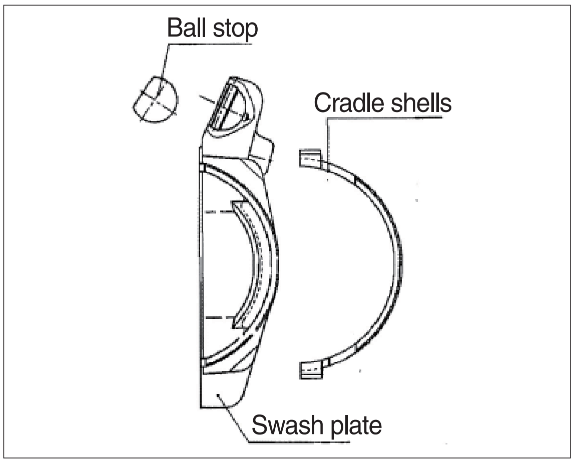
80CR8MP64

(4) Retaining ball and retaining plate
   - Check for scouring or stepped wear.
     If this can not be corrected replace the retaining ball and the retaining plate as a set.
   - Fine scouring or damage can be corrected with lapping.
     Carry out through washing after lapping.



80CR8MP65

(5) Swash plate and ball stop and cradle shells
   - Check for scouring or stepped wear.
     If this can not be corrected replace the swash plate and the ball stop and the cradle shells as a set.



80CR8MP66

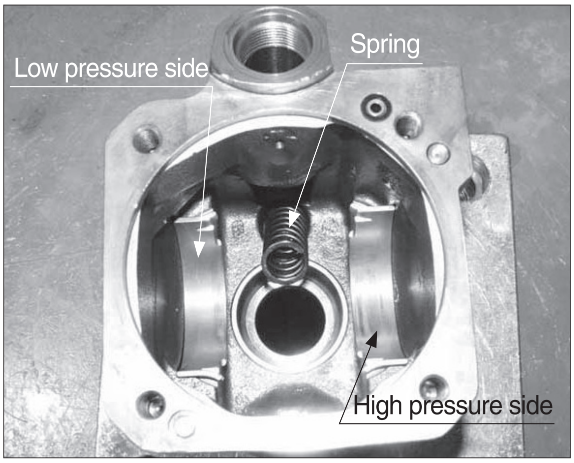
8) ASSEMBLING PROCEDURE (rear pump)

(1) Assemble the swash plate and the drive shaft.

① Assemble the cradle shells.

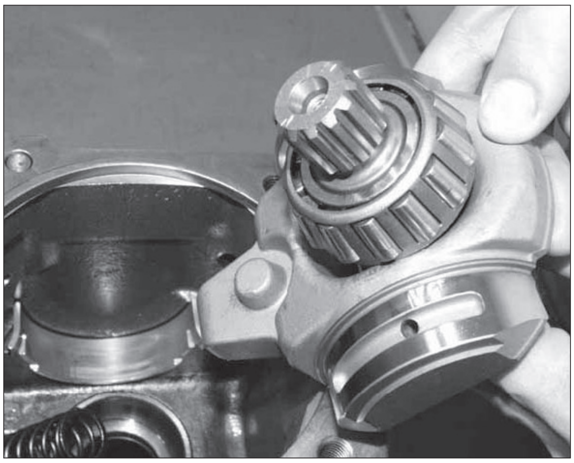
Note the mark of the low-pressure side and the high-pressure side if you use the disassembled parts again.

② Assemble the spring.

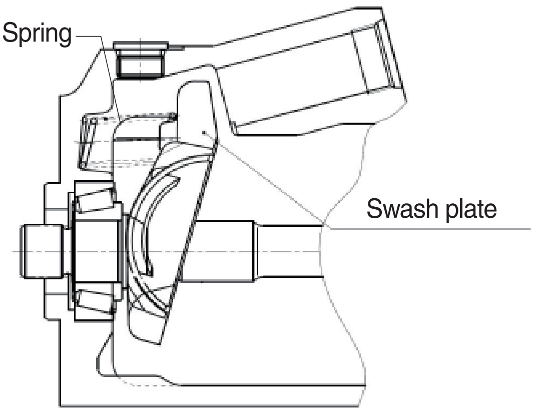


80CR8MP67

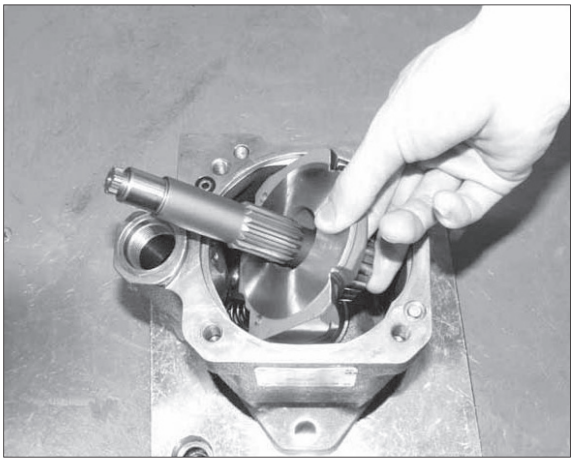
③ Assemble the swash plate with the drive shaft.



80CR8MP68



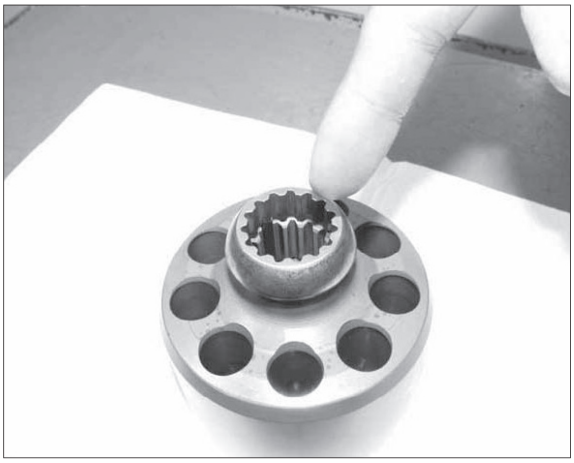
80CR8MP69



80CR8MP70

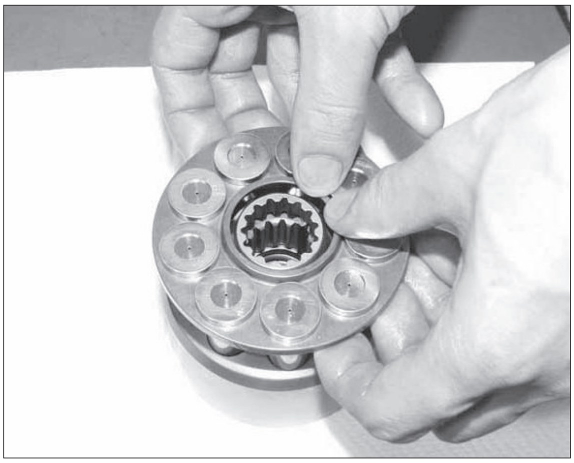
(2) Assemble the rotary group.

① Apply the grease to the surface of retaining ball and assemble it along the cylinder block spline.



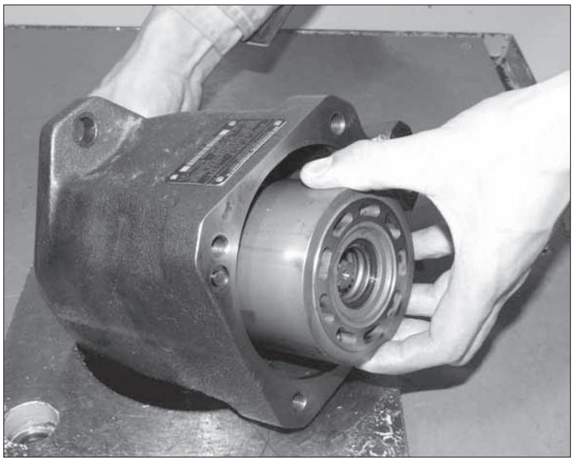
80CR8MP71

② Apply the grease to the end part of the shoes and assemble the piston complete into the hole of retaining plate and cylinder block.



80CR8MP72

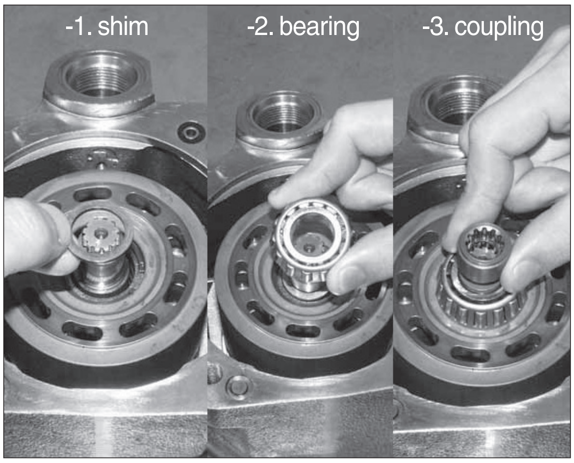
(3) Install the rotary group.
(Along the shaft spline)



80CR8MP73

(4) Assemble the shim and the bearing and the coupling

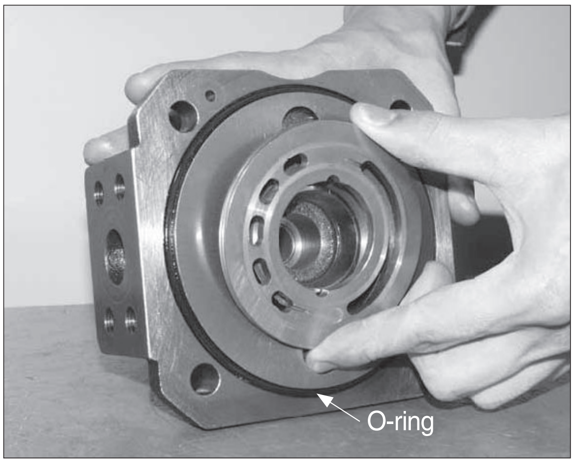
① Assemble the shim to the drive shaft.
② Assemble the bearing on the shim.
③ Assemble the coupling to the drive shaft.



80CR8MP74

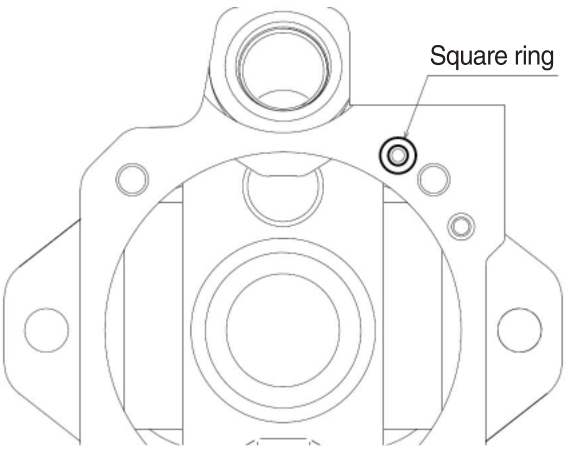
(5) Apply the grease between port plate and control plate for dropout prevention and assemble the control plate to the port plate.

Confirm the O-ring.

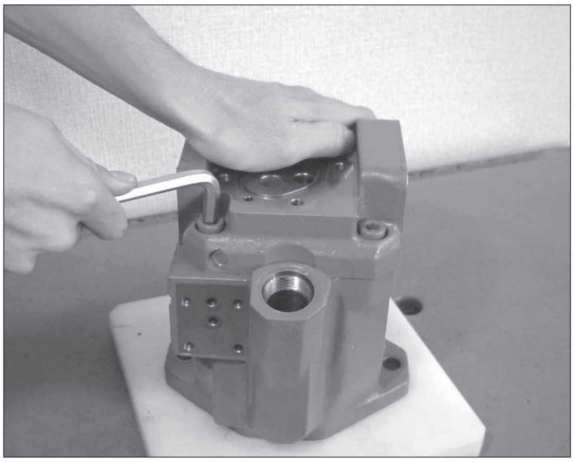


80CR8MP75

(6) Assemble the port plate.
Confirm the square ring.



80CR8MP76



80CR8MP77

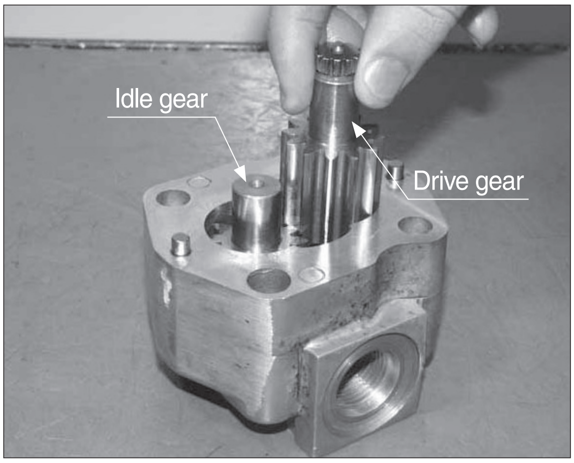
(M10×30, 4 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 mm)

Tightening torque : 6.3±0.71 kgf · m
(45.7±5.2 lbf · ft)

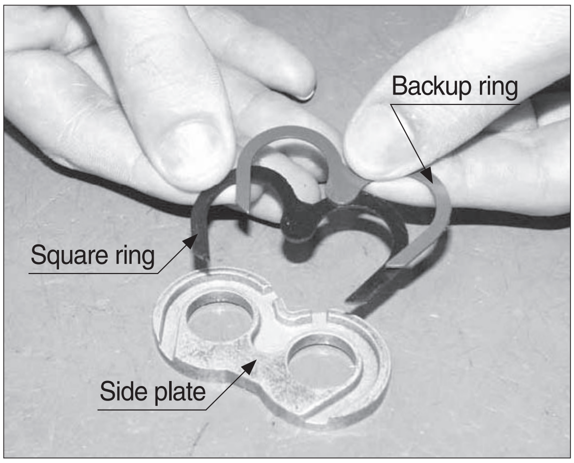
(7) Assemble the gear pump.

① Install the drive gear and the idle gear.



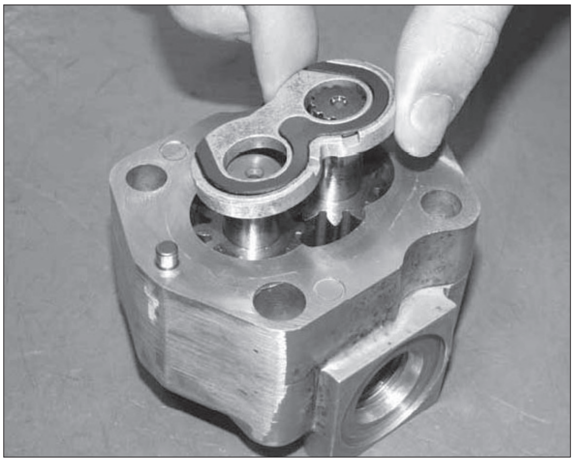
80CR8MP78

② Apply the grease to the square ring and the backup ring for dropout prevention and install the rings into the side plate.



80CR8MP79

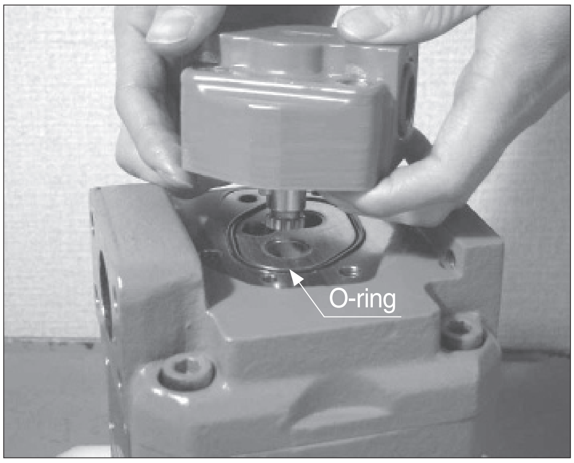
③ Apply the grease to the side plate for dropout prevention and assemble it.



80CR8MP80

(8) Assemble the gear pump on the port plate.

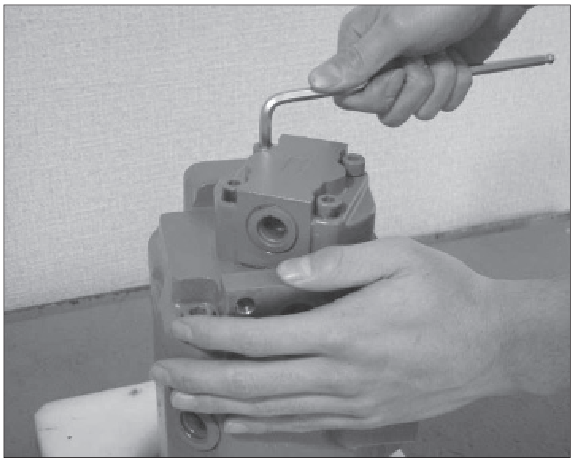
Confirm the O-ring.



80CR8MP81

Hexagon socket head cap screws
(M8×50, 4 pieces)

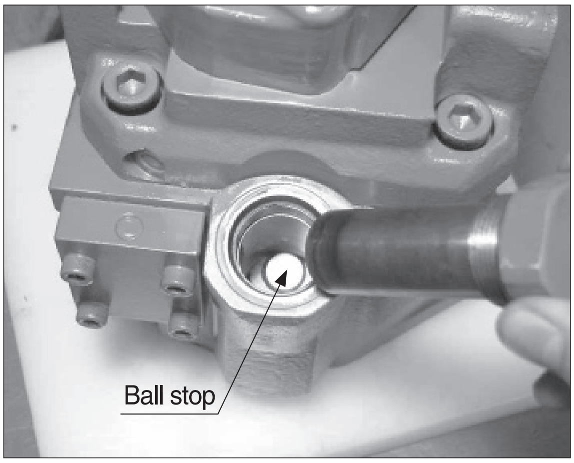
Hexagon socket screw key
(Hexagon side distance : 6 mm)
Tightening torque : 3.26±0.31 kgf · m
(23.6±2.2 lbf · ft)



80CR8MP82

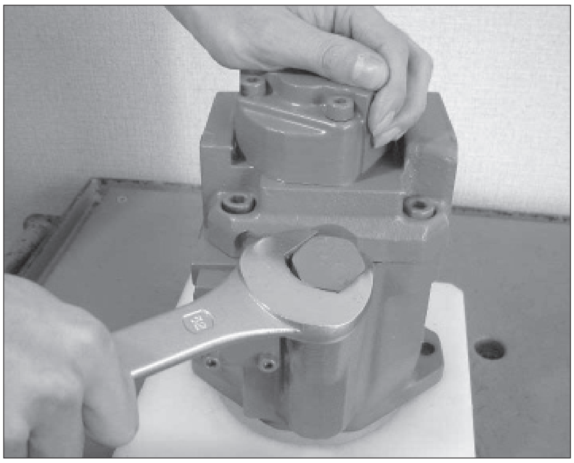
(9) Assemble the plug.

Confirm that the planar section of the ball stop is upward.



80CR8MP83

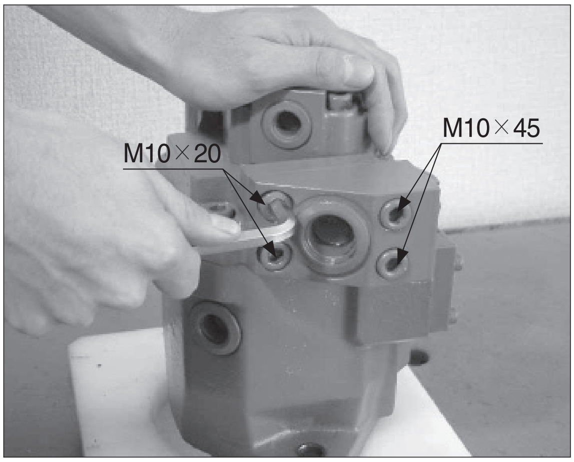
Spanner (32 mm)
Tightening torque : 15.3 kgf · m (111 lbf · ft)



80CR8MP84

(10) Assemble the flange.
Hexagon socket head cap screws
(M10×45, 2 pieces, M10×20, 2 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 mm)
Tightening torque : 6.3±0.7 kgf · m
(45.6±5.2 lbf · ft)



80CR8MP85

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

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.

13031GE18

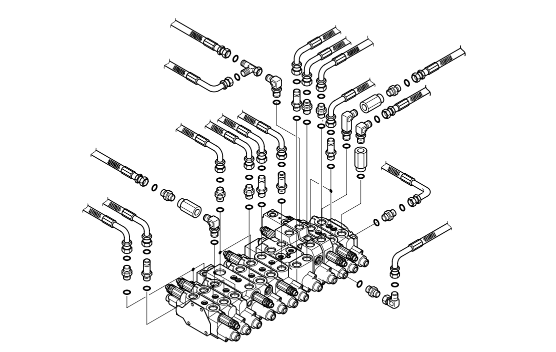
(4) Disconnect hydraulic hose.

(5) Disconnect pilot line hoses.

(6) Remove links.

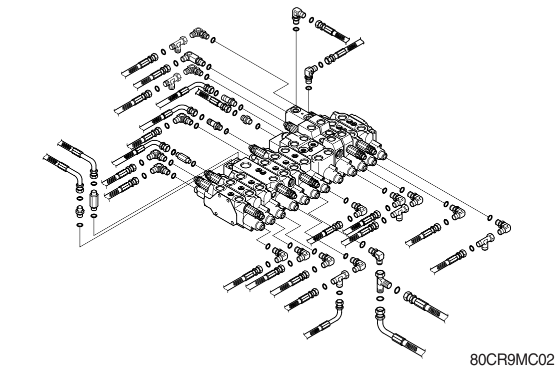
(7) Sling the control valve assembly and remove the control valve mounting bolt.

· Weight : 40 ㎏ (90 ℔)



80CR9MC01

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



80CR9MC02

2) INSTALL

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

(2) Bleed the air from below items.

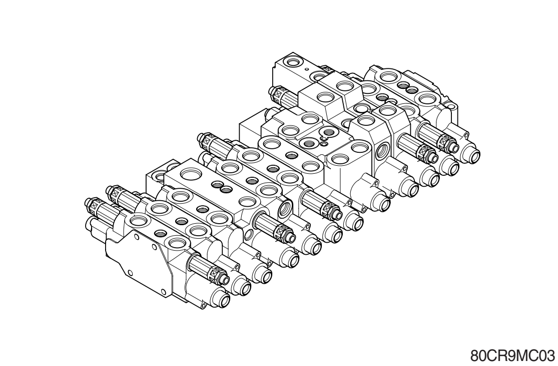
① Cylinder (boom, arm, bucket)

② Swing motor

③ Travel motor

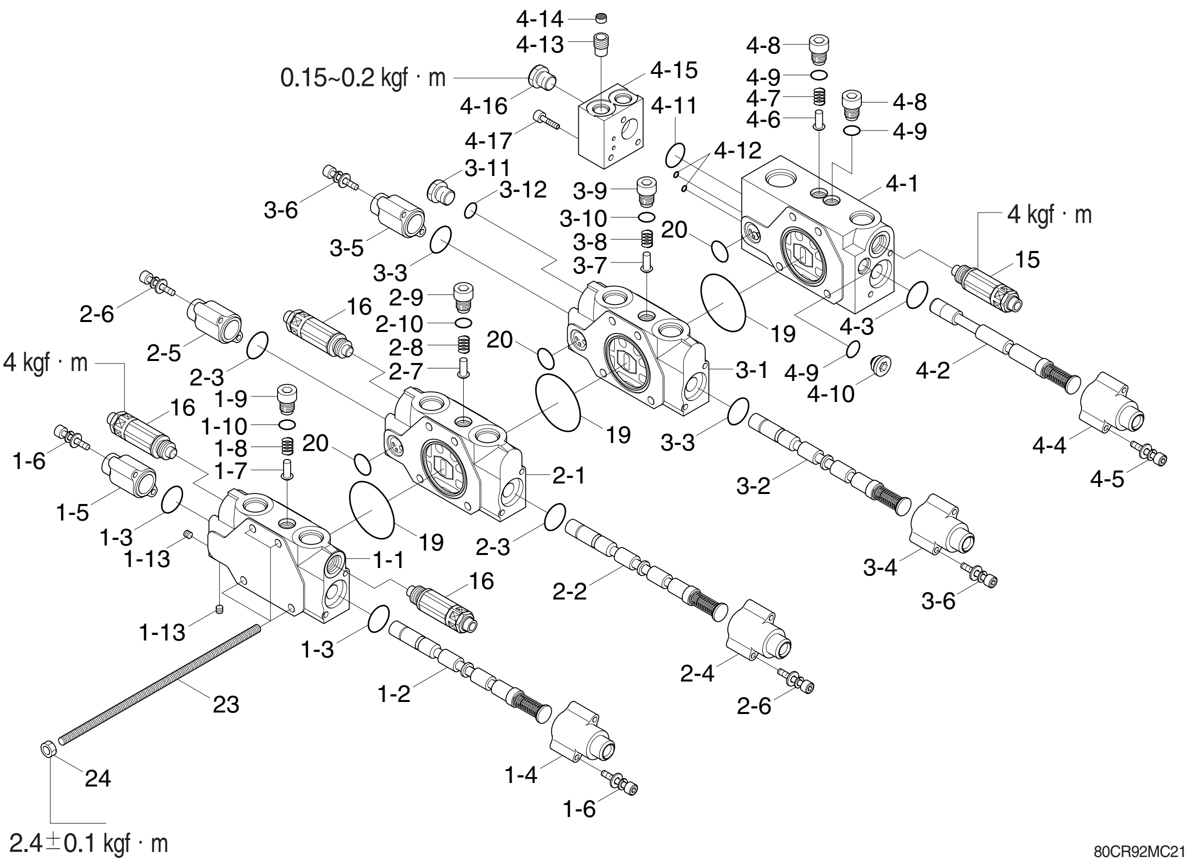
※ See each item removal and install.

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



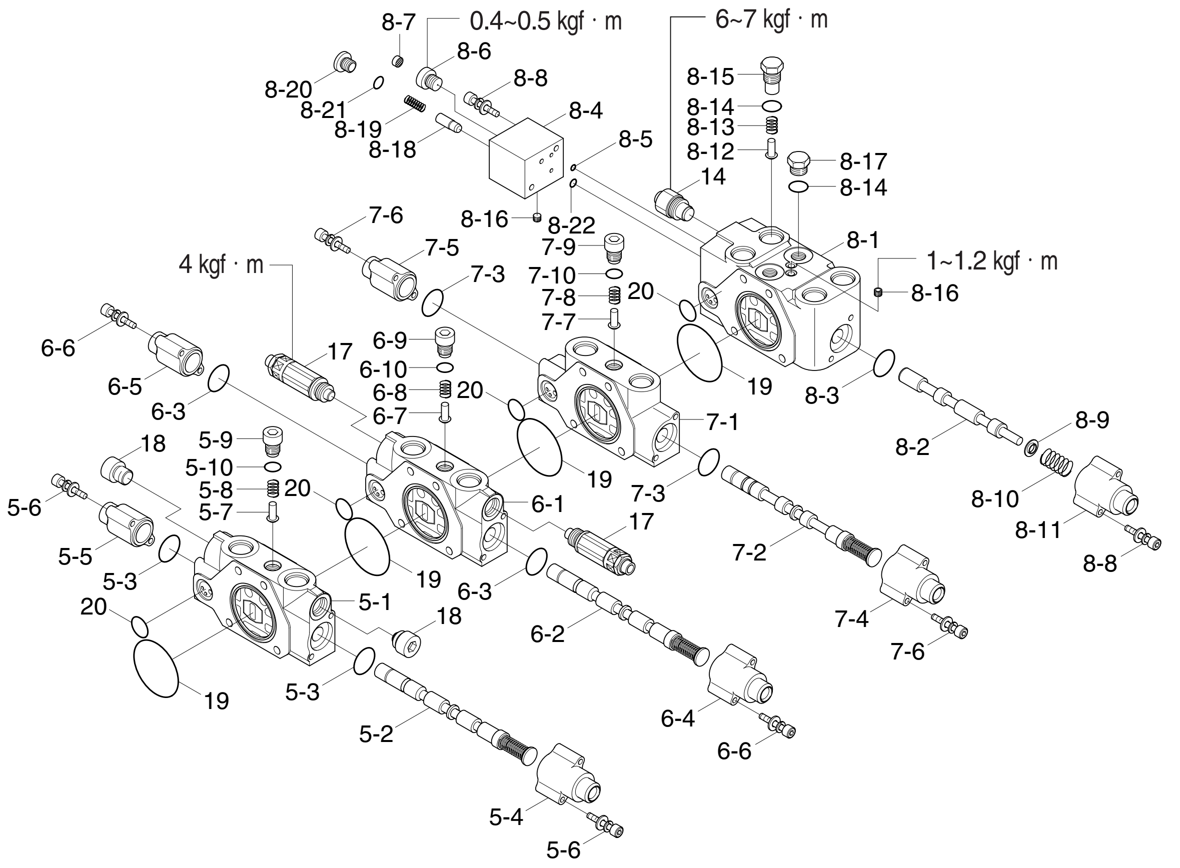
80CR9MC03

2. STRUCTURE (1/4)



1	Swing block	2-8	Spring	4-4	Pilot cover
1-1	Work body	2-9	Check valve plug	4-5	Socket bolt
1-2	Swing spool assy	2-10	O-ring	4-6	Check valve poppet
1-3	O-ring	3	Boom swing block	4-7	Spring
1-4	Pilot cover	3-1	Work body	4-8	Check valve plug
1-5	Pilot cover	3-2	Boom swing spool assy	4-9	O-ring
1-6	Socket bolt	3-3	O-ring	4-10	Plug
1-7	Poppet	3-4	Pilot cover	4-11	O-ring
1-8	Spring	3-5	Pilot cover	4-12	O-ring
1-9	Check valve plug	3-6	Socket bolt	4-13	Orifice
1-10	O-ring	3-7	Poppet	4-14	Coin type filter
1-13	Plug	3-8	Spring	4-15	Pilot body
2	Dozer block	3-9	Check valve plug	4-16	Plug
2-1	Work body	3-10	O-ring	4-17	Socket bolt
2-2	Dozer spool assy	3-11	Plug	15	Relief valve
2-3	O-ring	3-12	O-ring	16	Relief valve
2-4	Pilot cover	4	Boom 2 block	19	O-ring
2-5	Pilot cover	4-1	Work body	20	O-ring
2-6	Socket bolt	4-2	Boom 2 spool assy	23	Tie bolt
2-7	Poppet	4-3	O-ring	24	Hexagon nut

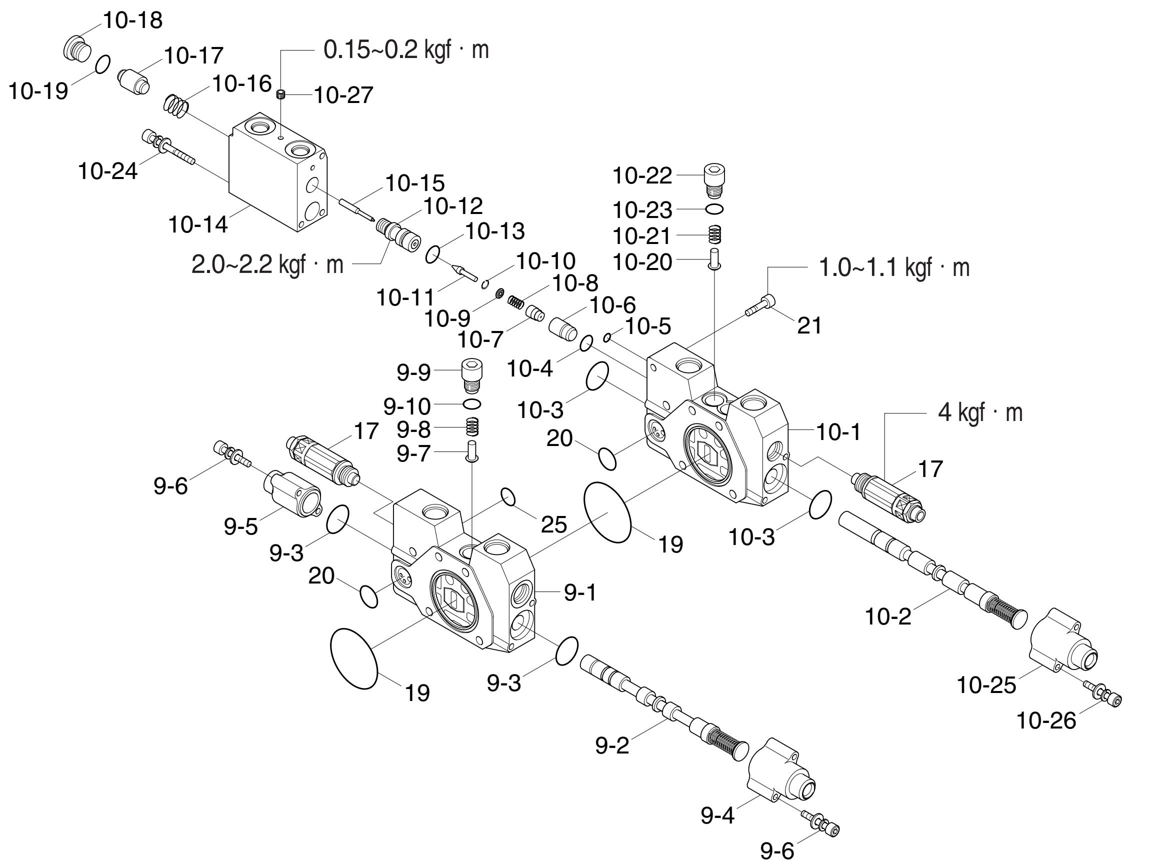
STRUCTURE (2/4)



80CR92MC31

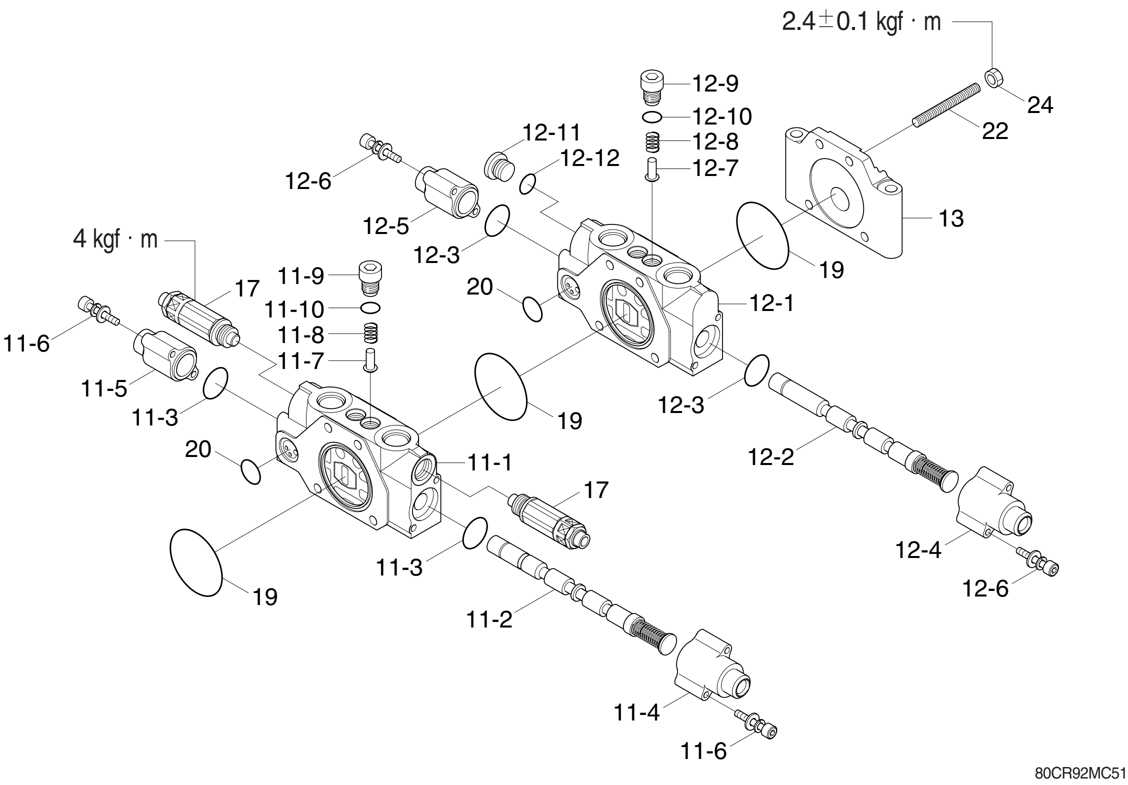
5	Service block	6-10	O-ring	8-8	Socket bolt
5-1	Work body	7	Left travel block	8-9	Spring seat
5-2	Service spool assy	7-1	Work body	8-10	Spring
5-3	O-ring	7-2	Travel spool assy	8-11	Pilot cover
5-4	Pilot cover	7-3	O-ring	8-12	Check valve poppet
5-5	Pilot cover	7-4	Pilot cover	8-13	Check valve spring
5-6	Socket bolt	7-5	Pilot cover	8-14	O-ring
5-7	Poppet	7-6	Socket bolt	8-15	Check valve plug
5-8	Spring	7-7	Check valve poppet	8-16	Plug
5-9	Check valve plug	7-8	Spring	8-17	Plug
5-10	O-ring	7-9	Check valve plug	8-18	Check valve
6	Arm block	7-10	O-ring	8-19	Check valve spring
6-1	Work body	8	Straight travel block	8-20	Plug
6-2	Arm spool assy	8-1	Work body	8-21	O-ring
6-3	O-ring	8-2	Travel spool assy	8-22	O-ring
6-4	Pilot cover	8-3	O-ring	14	Main relief valve
6-5	Pilot cover	8-4	Pilot body	17	Relief valve
6-6	Socket bolt	8-5	O-ring	18	Plug
6-7	Poppet	8-6	Orifice	19	O-ring
6-8	Spring	8-7	Coin type filter	20	O-ring
6-9	Check valve plug				

STRUCTURE (3/4)



9	Right travel block	10-4	O-ring	10-19	O-ring
9-1	Work body	10-5	O-ring	10-20	Poppet
9-2	Travel spool assy	10-6	Lock valve	10-21	Spring
9-3	O-ring	10-7	Lock restrictor	10-22	Check valve plug
9-4	Pilot cover	10-8	Holder spring	10-23	O-ring
9-5	Pilot cover	10-9	Holder spring	10-24	Socket bolt
9-6	Socket bolt	10-10	Retaining ring	10-25	Pilot cover
9-7	Check valve plug	10-11	Poppet	10-26	Socket bolt
9-8	Spring	10-12	Piston guide	10-27	Plug
9-9	Check valve plug	10-13	O-ring	17	Relief valve
9-10	O-ring	10-14	Pilot cover	19	O-ring
10	Boom block	10-15	Piston	20	O-ring
10-1	Work body	10-16	Lock valve spring	21	Socket bolt
10-2	Boom spool assy	10-17	Piston	25	O-ring
10-3	O-ring	10-18	Plug		

STRUCTURE (4/4)



11	Bucket block	11-10	O-ring	12-9	Check valve plug
11-1	Work body	12	Arm 2 block	12-10	O-ring
11-2	Bucket spool assy	12-1	Work body	12-11	Plug
11-3	O-ring	12-2	Arm 2 spool assy	12-12	O-ring
11-4	Pilot cover	12-3	O-ring	13	End cover
11-5	Pilot cover	12-4	Pilot cover	17	Relief valve
11-6	Socket bolt	12-5	Pilot cover	19	O-ring
11-7	Poppet	12-6	Socket bolt	20	O-ring
11-8	Spring	12-7	Poppet	22	Tie bolt
11-9	Check valve plug	12-8	Spring	24	Hexagon nut

3. DISASSEMBLY

1) PRECAUTIONS FOR DISASSEMBLY

(1) Since hydraulic devices are all machined precisely with clearances being very little, carry out the disassembly and assembly work at a clean place and make sure to prevent the device from being entered with dust, sand, and the like.

(2) Before disassembly work, prepare necessary material such as the structural drawing for control valve to fully understand the structure and others.

(3) When removing the control valve from the machine, put a dustproof cap on each port and then clean the outside of assembly after checking the installation of caps.
Furthermore, prepare a suitable workbench with clean paper or rubber mat on it for the work.

(4) Since there is a possibility of rust when the disassembled parts are left, apply anti-corrosive oil to the parts and seal them.

(5) Hold the control valve body when carrying or moving. Especially, do not hold the exposed spool after removing a pilot cover from the control valve.

(6) Do not hit the control valve even if it does not move smoothly.

(7) It is recommend carrying out various tests (relief valve setting, leak test, internal pressure loss check, etc.) after the disassembly and assembly of the control valve, which requires a hydraulic test device.
Accordingly, when the disassembly might be possible technically but the test and/or adjustment might be impossible, do not carry out the work.

⚠ Before removing the pipes, attach suitable indications on them to be able to locate their positions later. If there is a mistake in piping between the ports, unintentional movement could result in an accident.

⚠ Falling or hitting the control valve could bend the spool, which could result in an accident.

⚠ If foreign matter enters each port, there could be a control valve malfunction, resulting in an accident.

⚠ Since the load side port could hold an empty weight or enclosed pressure, release the inside pressure before loosening the piping.
There could be a fall of attachments or a jet of high-temperature hydraulic fluid.

⚠ The control valve becomes high temperature after operating the machine; after checking that the temperature becomes low, start the work.

⚠ The control valve has complicated connections and seals through the internal passages, which means that there could be enclosed pressure, resulting in an oil jet after disassembly.
Ware safety goggles during disassembly work because there could be a blow off of parts if they are caught.

2) NECESSARY TOOLS AND OTHERS

(1) Before disassembling the control valve, prepare the following tools.
The tools below are used to disassemble this control valve only; tools for disassembling the port fittings are not included.

Name of tool	Quantity	Size (mm)
Hexagonal wrench	Each 1	4, 5, 6, 8 and 10
Screw wrench	Each 1	13, 19, 21, 22 and 30
Socket wrench	Each 1	13, 19, 21, 22 and 30
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~ 14.5 lbf · ft)
Torque wrench	1	2.0 ~ 12.0 kgf · m (14.5 ~ 86.8 lbf · ft)
Magnet	1	-
Pliers	1	-
Slotted screwdriver	1	-
Tweezers	1	-

Prepare clean wash oil, hydraulic fluid, grease, tag paper, marker pen and others before work.

3) DISASSEMBLY OF EACH PART

Before disassembly work, check that there is no dust on the outside of the control valve and then place it on a workbench with actuator ports facing upward.

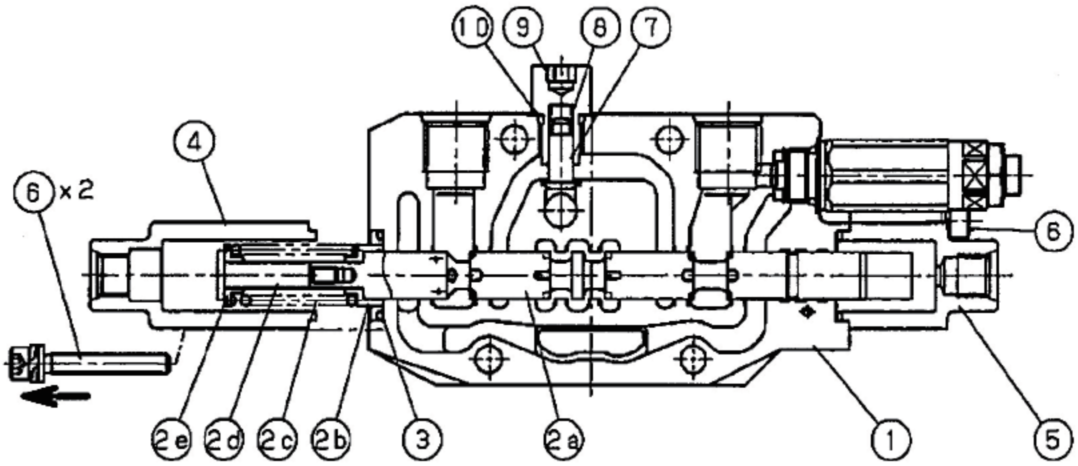
The numbers in (   ) in the explanation and in ○ in the figures show reference numbers in the parts table in the specifications and drawings.

(1) Spool draw-out procedures

■ Except P1, P2 inlet & straight travel block

Taking the dozer spool as an example, the draw-out procedures are as follows.

① Remove 2 hex socket head bolt with washer (⑥) with 5 ㎜ hexagonal wrench.
② Remove pilot cover (④).
③ With a spring in the dozer spool exposed, pull out spool assy from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
④ The other spools can also be pulled out in the same manner.
· At this time, check O-ring (③) is on the bottom of body side flange.



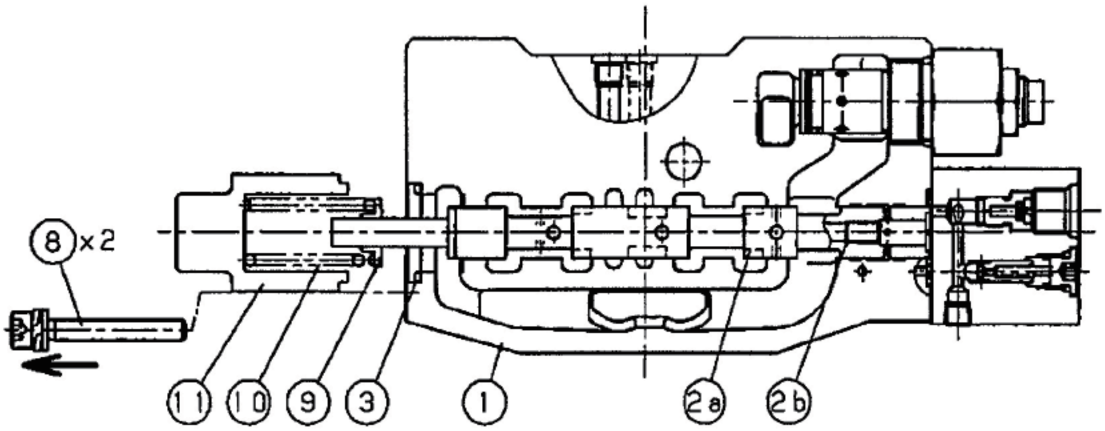
80CR97MCV01

1	Work body	2d	End spool	6	Hex socket head bolt with washer
2	Dozer spool assy	2e	Spring seat	7	Check valve poppet
2a	Dozer spool	3	O-ring	8	Check valve spring
2b	Spring seat	4	Pilot cover	9	Check valve plug
2c	Spring	5	Pilot cover	10	O-ring

■ P1, P2 inlet & straight travel block

The draw-out procedures for the straight travel spool are as follows.

① Remove 2 hex socket head bolt with washer (⑧) with 5 ㎜ hexagonal wrench.
② Remove pilot cover (⑪).
③ With spring and the end of straight travel spool exposed from spool sleeve, pull out spring at first, and pull out spool from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
 · At this time, check O-ring (③) is on the bottom of body side flange.



80CR97MCV02

1	Work body	8	Hex socket head bolt with washer
2	Straight travel spool assy	9	Spring seat
2a	Straight travel spool	10	Spring
2b	Plug	11	Pilot cover
3	O-ring		

(2) Check valve disassembly procedures

■ Standard type check valve (see figure 4)

① Hold the control valve body at workbench or hold it by two or more people.

② Loosen and remove check valve plug (⑨) at the center of the control valve upper surface with 8 mm hexagonal wrench.
When it is hard to loosen the plug because O-ring (⑩) bites the screw, do not loosen forcibly, refasten it once and then try to loosen again.

③ From the hole where check valve plug has been removed, remove check valve spring (⑧) and check valve (⑦) with tweezers or magnet.

· The numbers in figure 4 are the same as those in the P1, P2 inlet & straight travel block in the specifications and drawings.
· Except for the P1, P2 inlet & straight travel block the shape of check valve is different, however, they can be disassembled in the same manner.
· The numbers in figure 5 are the same as those in the P3 inlet & boom 2 block in the specifications and drawings.
· The numbers in figure 6 are the same as those in the dozer block in the specifications and drawings.

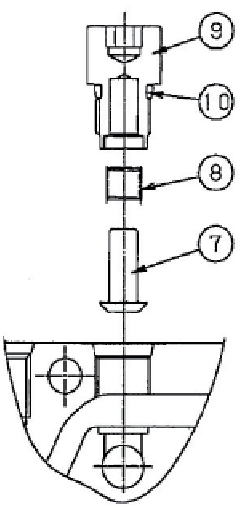


Figure 4. Check valve
(P1, P2 inlet & straight travel)

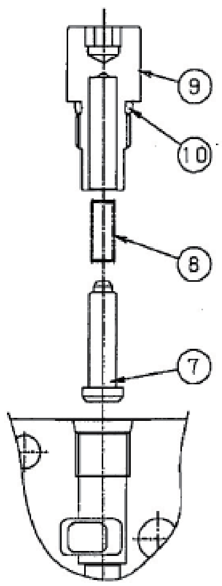


Figure 5. Check valve
(P3 inlet & boom 2, travel)

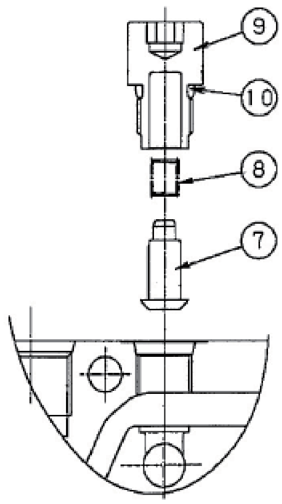


Figure 6. Check valve
(Swing & boom swing, dozer, arm 3 & boom 3, service, arm, boom, bucket, arm 2)

80CR97MCV03

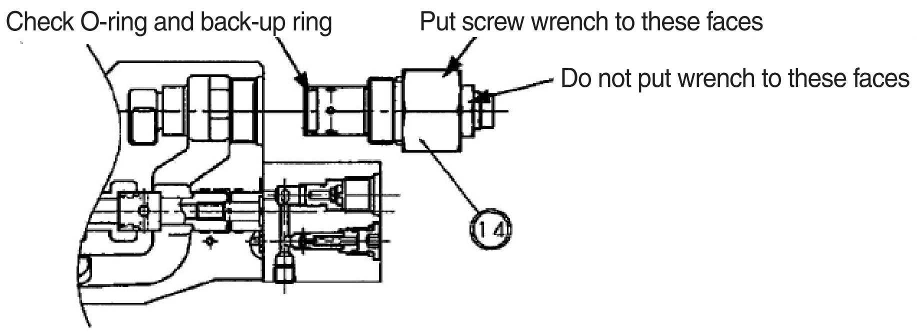
(3) Accessory valve removal procedures

※ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace the accessory valve as assy if any malfunction occurs.

■ Removing main relief valve (MRV1) : see page 2-9 and 7-44

① Loosen and remove main relief valve (⑭) with 30 ㎜ screw wrench or socket wrench.
· Put screw wrench (or socket wrench) to 30 ㎜ hexagonal part of pressure regulating body.
· Check O-ring and back-up ring are on the part of main relief valve seat.

※ Do not put 19 mm screw wrench to the lock nut part when removing.
Only lock nut is loosened to change the main relief valve setting, which could result in the degradation in performance or damage.



80CR97MCV04

■ Removing relief valve (MRV2, ORV) : see page 2-9

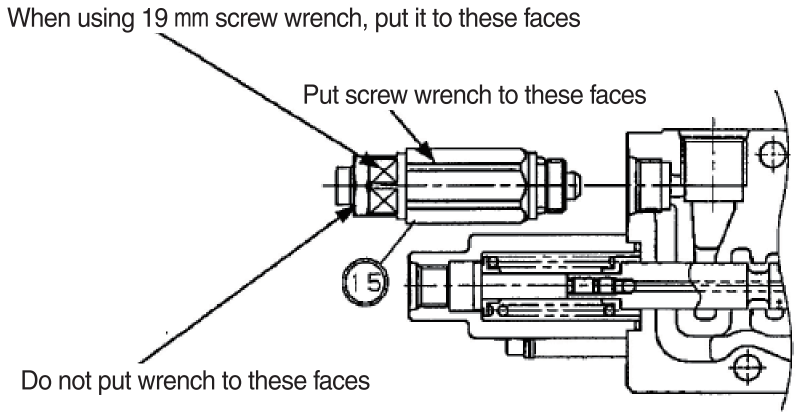
Taking relief valve in the P3 inlet & boom 2 block as an example, the removal procedures are as follows.

① Loosen and remove relief valve (⑮) with 22 ㎜ screw wrench or socket wrench.

· Put screw wrench (or socket wrench) to 22 ㎜ hexagonal part of pressure regulating body.

· If there is no 22 ㎜ screw wrench (or socket wrench), it is also possible to loosen and remove by putting 19 ㎜ screw wrench to the hexagonal part as shown in the below.

※ If using 19 mm screw wrench to remove, do not put it to the lock nut part.
Only lock nut is loosened to change the relief valve setting, which could result in the degradation in performance or damage.



80CR97MCV05

※ Removing accessoory valve causes the seat to be exposed.
Flaws of the seat causes leakage from the inside cylinder port, which makes the holding capacity of attachment worse.
When storing it, be careful not to damage the seat.

(4) Block disassembly procedures

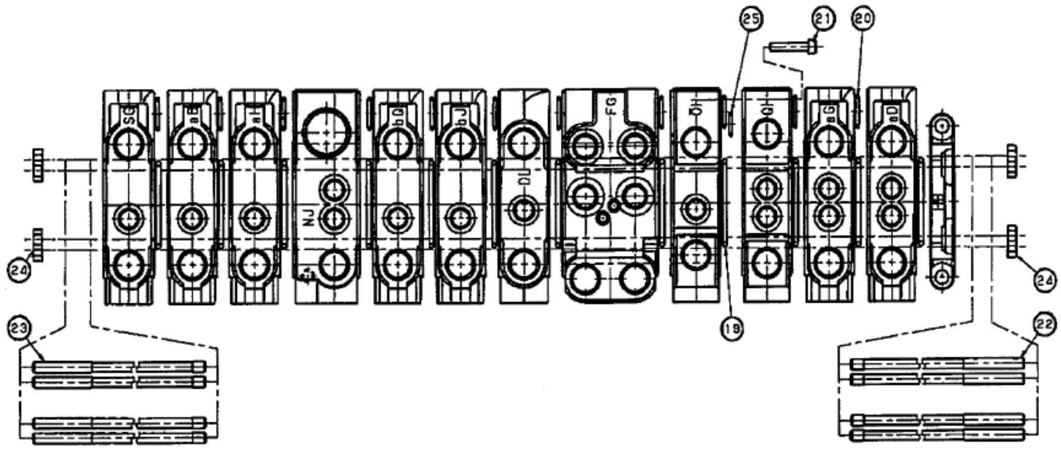
① Loosen and remove hexagonal socket head bolt (㉑) assembled in the body QH with 5 ㎜ hexagonal wrench.

② Loosen and remove 8 M8 hexagonal nut (㉔) for assembling block on the both side of control valve with 13 ㎜ screw wrench or socket wrench.

③ When 8 tie bolt (㉒, ㉓) are loosen and pulled out from the control valve side, each block can be removed.

· Be careful not to drop or lose various O-ring (⑲,⑳,㉕) installed on the matching surfaces for each block.

· Do not disassemble 2 plugs installed in the body SG except in cases of absolute necessity since they are used as drill holes for making passages.



80CR97MCV06

(5) Precautions after disassembly

※ For the parts already removed in the work, store and/or transport them with attention on flaws and dirt.

When carrying out another work, storage, or transportation with the parts removed condition, apply caps or plastic tape to the holes from which the parts have been taken out, protecting the holes from being entered with dust or the like.

4. ASSEMBLY

1) PRECAUTIONS FOR ASSEMBLY

(1) Be careful that the unevenness of fastening torque and the contamination of dust during assembly work could result in malfunction.
In addition, observe fastening torque values specified in the specifications and drawings.

(2) During assembly work, compare valves with control valve structural drawing and check the number of parts whether there is any improper assembly and/or the omission of parts.

(3) For the parts to be used in assembly, dip in fluid oil as need arises to reassemble after washing well in washing oil and being dried.

(4) After cleaning and degreasing the surface sufficiently, apply loctite to 2 threads of the screw from the tip. (Too much loctite could result in malfunction after squeezing out)

(5) For the part to be attached or assembled with two or more bolts and nuts, fastening them evenly and alternately for several times, not once with the specified torque.
The unevenness of fastening torque could result in the leakage of hydraulic fluid too the outside and/or malfunctions.

2) PRECAUTIONS FOR ASSEMBLING SEAL PARTS

(1) All seals are to be renewed at assembly.

(2) Check seals for defects in molding and flaws in handling.
Do not use the seal with defect and/or flaw.

(3) The seals used on sliding surfaces and the places to be installed with seals are to be applied with grease or hydraulic fluid for sufficient lubrication where not specially noted.

(4) Do not make seals longer up to permanent deformation.

(5) O-ring is not to be twisted during assembly.
Kinked O-ring could cause oil leakage after installation because kinks are hard to restored.

3) NECESSARY TOOLS AND OTHERS

Before assembling the control valve, prepare the following tools.
The tools below are used to assemble this control valve only; tools for assembling the port fittings are not included.

Name of tool	Quantity	Size (mm)
Hexagonal wrench	Each 1	4, 5, 6, 8 and 10
Screw wrench	Each 1	13, 19, 21, 22 and 30
Socket wrench	Each 1	13, 19, 21, 22 and 30
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~ 14.5 lbf · ft)
Torque wrench	1	2.0 ~ 12.0 kgf · m (14.5 ~ 86.8 lbf · ft)
Magnet	1	-
Pliers	1	-
Slotted screwdriver	1	-
Tweezers	1	-

Prepare clean wash oil, hydraulic fluid, grease, loctite #242 and others before work.

4) ASSEMBLING WORK

※ The numbers in (   ) in the explanation and in ○ in the figures show reference numbers in the parts table in the specifications and drawings.

※ For the fastening torque values for screws, see the 2-9 and 7-43~46.

(1) Assembling block (see figure 10 and 11)

① On a surface plate with clean rubber plates on it, place blocks with actuator port surface facing upward in the order shown in "Orders of assembling bodies" on the next page.

※ Check the matching surfaces in each block for dust or the like, and check whether O-ring shown in the specifications and drawings are surely put in each groove for O-ring.
Kinked O-ring could cause the leakage of hydraulic fluid to the outside due to the malfunction of sealing performance.
If O-ring are not installed surely in O-ring grooves, there would be the nip of O-ring, resulting in the leakage of hydraulic fluid to the outside when assembling the bodies.

② Put and fasten 8 tie bolt (㉒, ㉓) through the bodies from the side of control valve, and fasten 8 M8 hexagon nut (㉔) to the bolts **by hand**.

③ Check that all the body surfaces are in alignment in this condition.
If not, make all the body surfaces in alignment by hitting them with plastic hammers or the like.
Before aligning the bottom surfaces, remove the rubber plates and others that have been laid at ①.
However, check that there is no dust or no unevenness on the surface from which the above rubber plates have been removed.

※ Do not hit hard when using a plastic hammer.
Hard hitting could cause displacements in the portion that has been ailgned.
Check the alignment with a flat plate or the like after aligning.
If there is large displacement in any block, bad connection between internal passages could cause a malfunction.
If any seal position overlaps the passage, there could be the leakage of hydraulic fluid to the outside.

④ After checking that the surfaces are in alignment, fasten 8 M8 hexagon nut (㉔) that have been put on in ② with the torque specified in the specifications and drawings with 13 ㎜ socket wrench.

※ Fasten 8 M8 hexagon nut evenly and little by little in several times.
Uneven fastening makes the body assy curve easily, which could result in leakage or malfunction after installation on the machine.
If you find any curve in the body assy, it is necessary to reassemble or to correct it by pressing machine or the like.

⑤ Finally, fasten hex socket head bolt (㉔) located between the body QH and body OH with a specified torque with 5 ㎜ hexagonal wrench.

Orders of assembling blocks

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
ID	SG	aB	aH	NJ	bQ	bJ	DL	FG	OH	QH	aG	aD	HB

※ Identifications (ID) are engraved on the top (actuator port side) of the block.

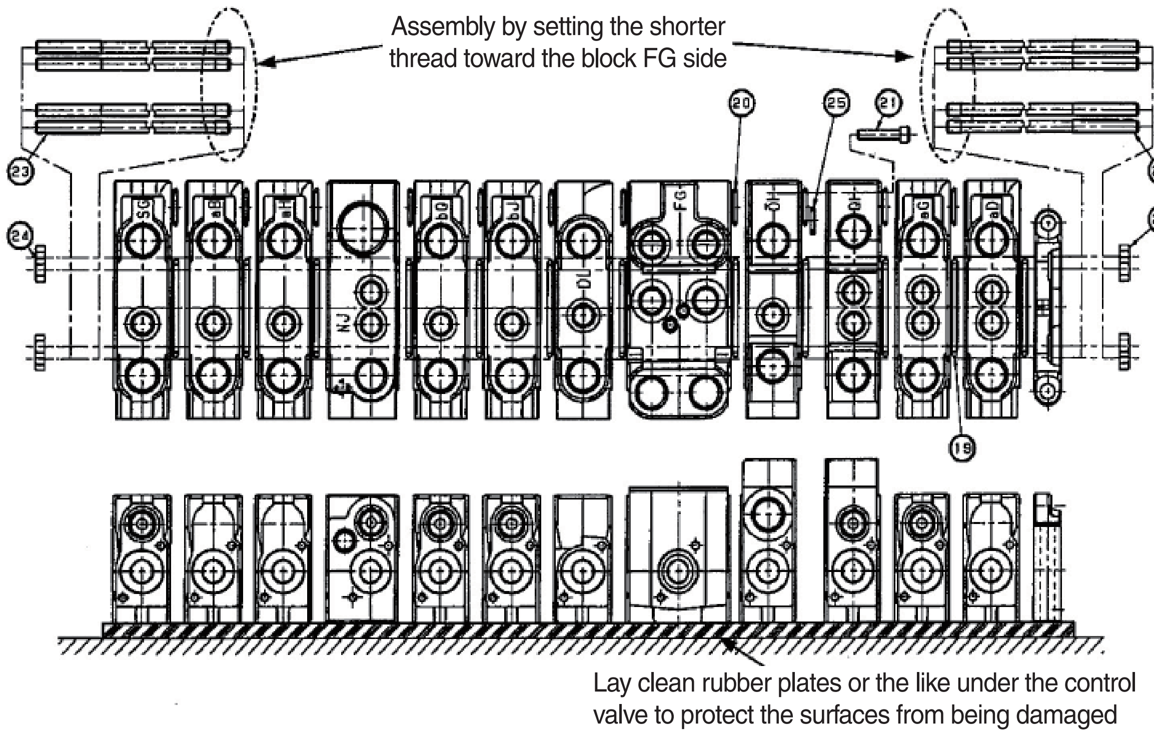


Figure 10. Block assy

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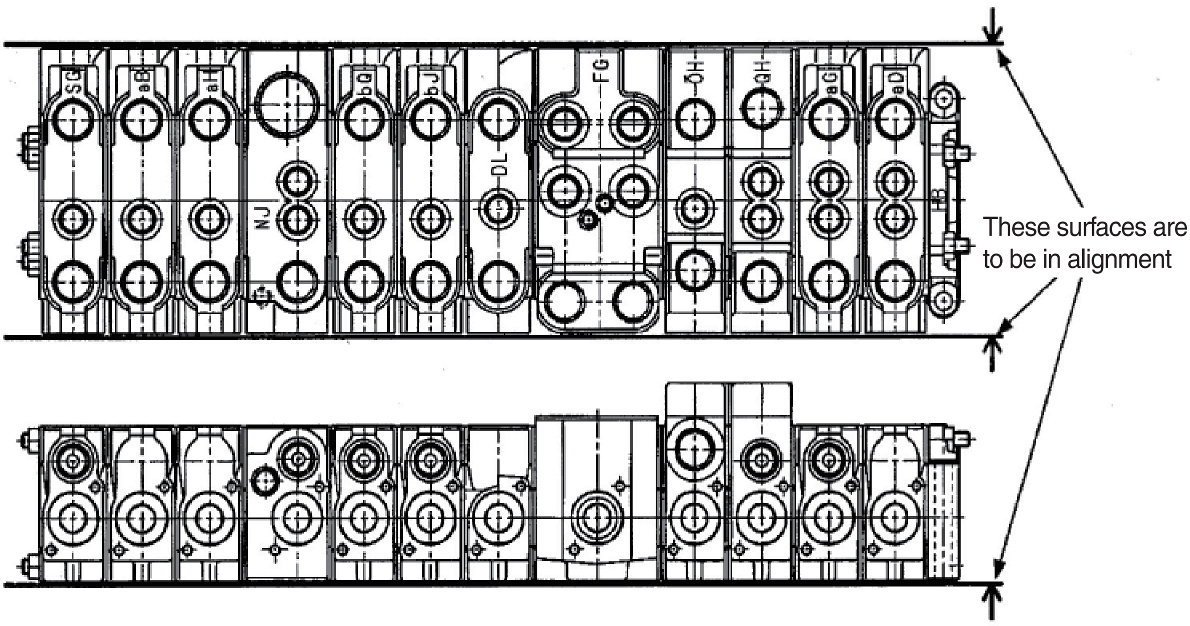


Figure 11. Block assy (after assembly)

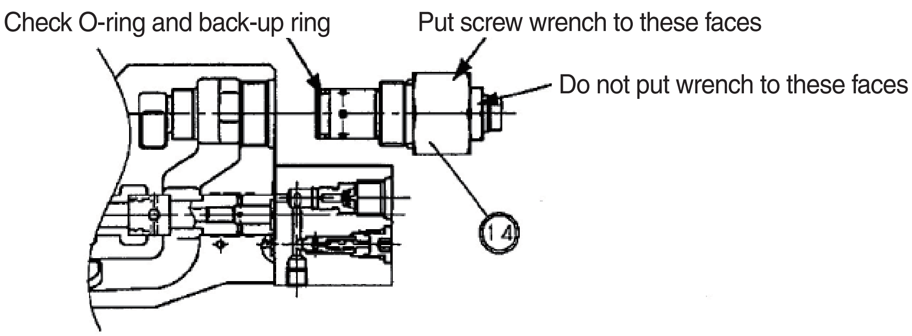
80CR97MCV08

(2) Accessory valve installing procedures

※ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace in assy if any malfunction occurs.

■ Installing main relief valve (MRV1) : see page 2-9 and 7-44

① Fasten main relief valve (⑭) with specified torque with 30 mm screw wrench (or socket wrench).
· Put screw wrench (or socket wrench) to 30 mm hexagonal part of pressure regulating body.
· Check O-ring and back-up ring are on the part of main relief valve seat.



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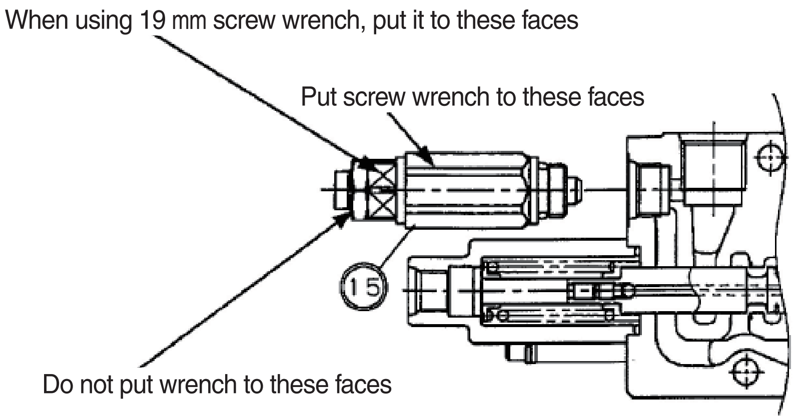
■ Installing relief valve (MRV2, ORV) : see page 2-9

① Fasten relief valve (⑮) with specified torque with 22 ㎜ screw wrench (or socket wrench).

· Put screw wrench (or socket wrench) to 22 ㎜ hexagonal part of pressure regulating body.

· If there is no 22 ㎜ screw wrench (or socket wrench), it is also possible to fasten with 19 ㎜ screw wrench to the hexagonal part as shown in the below.



80CR97MCV10

※ Be careful not to damage the seat of socket that sticks out above the tip when installing relief valve to the body.
If the seat is damaged, there could be internal leakage, resulting in the malfunction of holding attachment.
Do not put 19 mm screw wrench to the lock nut part when installing.
Lock nut truns with adjustable screw free turning, resulting in the degradation in performance or damage.

(3) Check valve assembly procedures

■ Standard type check valve (see figure 14)

① Hold the control valve body at workbench or hold it by two or more people.
② Assemble check valve (⑦) and check valve spring (⑧) in sequence at the center of control valve top surface.
Then, set check valve (⑦) vertically. (Check that the check valve is in nearly at the center of hole)
③ Check that O-ring (⑩) is securely installed with check valve plug (⑨) and then screw it into the part where check valve has been assembled.
④ Fasten check valve plug (⑨) with specified torque with 8 mm hexagonal wrench.

· The other check valves can be assembled in the same manner, use suitable parts in the drawing. (see figure 15 and 16)
If assembly is mistaken, check valve could not function or there could be damage.

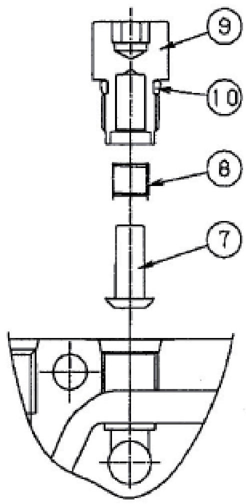


Figure 14. Check valve
(P1, P2 inlet & straight travel)

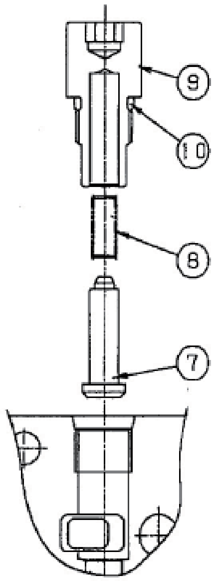


Figure 15. Check valve
(P3 inlet & boom 2, travel)

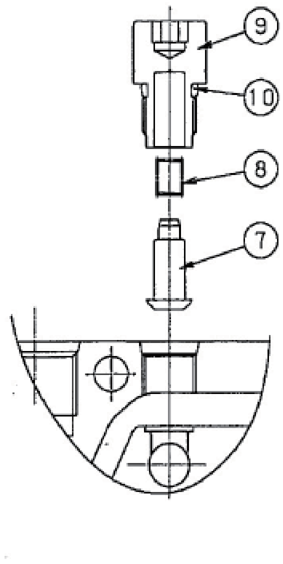


Figure 16. Check valve
(Swing & boom swing, dozer, arm 3 & boom 3, service, arm, boom, bucket, arm 2)

80CR97MCV11

(4) Spool installing procedures

■ Except P1, P2 inlet & straight travel block

Taking the dozer spool as an example, the installing procedures are as follows.

① After checking whether there is no dust or the like in the spool sleeves of the body and/or spool assy and O-ring (③) is securely installed with that the flange bottom of the body, insert the dozer spool assy into spool sleeve of the body with attention on the position and direction.

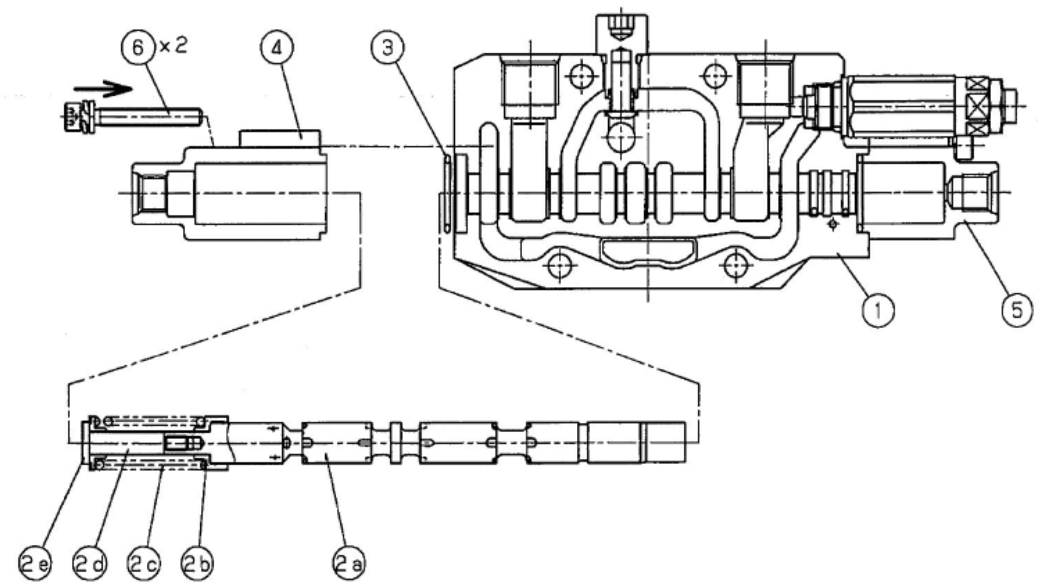
· Then, apply little hydraulic fluid to spool before the insertion.

※ Carefully insert spool assy into the spool sleeve horizontally.
If it is hard to insert, forcible insertion could cause impressions on spool sleeves and/or spools, resulting in malfunction.
If you feel any feeling of wrongness such as catches or strong resistance, pull it out once to check whether there is the adhesion of dust or the development of flaw or burr.
If there are flaws or burns, there could be malfunction so that replace body and spool in set.

· When there is no feeling of wrongness, move it slowly several times to check the movement and no feeling of wrongness again.

② Press pilot cover (④) in a direction from the spring side of spool assy to the flange of the body.
Fasten 2 hex socket head bolt with washer (⑥) with specified torque with 5 mm hexagonal wrench.

③ The other spools can be assembled in the same manner.



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■ P1, P2 inlet & straight travel block

The installing procedures for the staight travel spool is as follows.

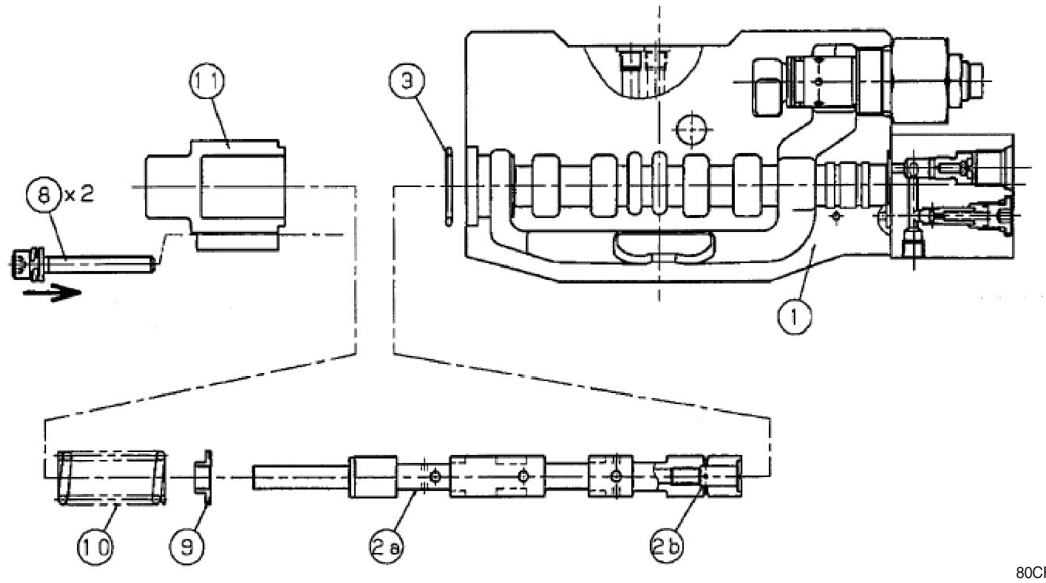
① Assemble spring seat (⑨) and spring (⑩) at the end of spool.

② After checking whether there is no dust or the like in the spool sleeves of the body any/or spool and O-ring (③) is securely installed with that the flange bottm of the body, insert the straight travel spool with spring into spool sleeves of the body with attention on the position and direction.

· Then, apply little hydraulic fluid to spool before the insertion.

⚠ Carefully insert the straight travel spool into the spool sleeve horizontally.
If it is hard to insert, forcible insertion could cause impressions on spool sleeves and/or spools, resulting in internal leakage.
If you feel any feeling of wrongness such as catches or strong resistance, pull it out once to check whether there is the adhesion of dust or the development of flaw or burr.
If there are flaws or burns, there could be internal leakage so that replace body and spool in set.

③ Press pilot cover (⑪) in a direction from the spring side of spool assy to the flange of the body. Fasten 2 hexagon socket head bolt with washer (⑧) with specified torque with 5 mm hexagonal wrench.



80CR97MCV13

5. MAINTENANCE STANDARD

1) PARTS CHECK

Name	Inspection item	Criterion and treatment
Work body	Presence of scratch, rust, corrosion	Replace it if any of the followings is damaged · Sliding parts for spool, especially lands with holding pressure · Body flanges receiving spool · Seal parts contacting with O-ring in ports · Seats in relief and overload relief valves · Damage spoiling normal functions
Spool	Presence of scratch, scuff, rust, corrosion Insert spool into body and stroke it with turning	Replace it if scratch is on outer sliding part Replace or correct it if spool does not move smoothly
Check valve (Load check valve)	Damage to check valve or check valve spring Insert check valve into check valve plug to operate	Replace or correct it if flaw or dent is on seat Smooth moving without scratch is normal Replace it if not
Spring and related parts	Rust, corrosion, deformation, breakage in return spring seat, plug, cover	Replace it if there is non-smooth operation or heavy damage
Sealing of spools	Hardened, deformed, or damaged O-ring	Replace it
Relief valve	Rust in appearance Matching surface of valve seat Abnormality in spring O-ring, back-up ring	Replace it Replace it if there is flaw or dent Replace it 100% replacement in principle

6. PROBLEM CAUSES AND MEASURES

※ If any abnormal condition is found, check whether control valve itself fails or there is problem in pump, cylinder, motor, or hydraulic circuit. For this check, it is necessary to measure pilot pressure, pump discharge pressure, and load pressure. Observe the above disassembly and assembly procedures even if any part is disassembled or inspected.
※ Be careful of dust proofing. Dust is very harmful to hydraulic devices.
※ Carefully handle moving movable parts. Correct it with oilstone or replace it even if there is a minor flaw. Clean it sufficiently after correction.
※ Protect the seal surface of O-ring from being damaged. The damage could cause oil leakage.

1) CONTROL VALVE

Phenomenon	Possible causes	Treatment
No movement in each attachment. Slow operation (Power shortage) or slow response	Operation failure in relief valve · Dust between regulating valve and seat★ · Dust between regulating valve seats★ · Stick of regulating valve★ · Breakage or fatigue of spring★ · Loosened adjustable screw	Measure relief valve pressure · Replacement in assy★ · Replacement in assy★ · Replacement in assy★ · Replacement in assy★ · Readjust and fasten lock nut with specified torque · Disassemble and clean it
	Dust between body and spool, or stick	Replace body and spool if damage is big
Cylinder's empty weight falling in neutral is big	Execssive gap between block and spool	Replace spool
	Spool is not returned to neutral completely · Dust storage between body and spool, or stick · Breakage or fatigue of spring	Measure pilot secondary pressure · Disassemble and clean, or replace body and spool in set for stick · Replace spring
	Operation failure in relief valve (ORV) (see 5. Maintenance standard)	Measure relief valve pressure (ORV) (see 5. Maintenance standard)
	Operation failure in lock valve · Dust between lock valves or needle valve seats · Stick of lock valve or needle valve · Orifice clogging in lock valve	Replace lock valve assy (including lock valve body)
When operating to rise cylinder at starting operation, it lowers	Operation failure in load check valve · Dust between load check valve and body · Stick in load check valve · Breakage or fatigue of spring	· Disassemble and clean Replace body and load check valve if damage is big · Disassemble and clean Replace body and load check valve if damage is big · Replace spring

For problem with ★ mark, must replace relief valve in assy.

2) RELIEF VALVE

Relief valve is the most important part for performance and safety, and is very difficult to readjust the setting at a place except maintenance shops with adequate equipment.

Replace in assy if any of the following malfunctions occurs.

Treatments here are only for reference, and the replacement in assy is in principle.

Phenomenon	Possible causes	Treatment
Pressure cannot rise	Any pressure regulating valve, regulating valve, or piston in relief valves has stuck to keep opening, or dust presents on any seat in relief valves	· Check whether foreign matter has been stored in matching parts in relief valves · Each part is to be slid freely · Clean all parts completely
Relief pressure is unstable	Each regulating valve in relief valves is damaged Piston has stuck in pressure regulating valve	· Replace damaged parts · Clean all parts completely · Remove flaws from surface
Relief pressure is out of setting range	Attrition by dust Lock nut and adjustable screw are loosened Breakage or fatigue of spring Operation failure in relief valve (MRV and ORV)	Disassemble and clean Regurate pressure Replace spring Measure pressures of relief valve (MRV and ORV)
Oil leakage	Damage in each seat Attrition in O-ring Stick of each part due to dust	Replace damaged or attrition part Check each part moves smoothly, and reassemble Check that there is no scratch, dent, or foreign matter, and reassemble

GROUP 5 SWING DEVICE

■ TYPE 1

1. REMOVAL AND INSTALL OF MOTOR

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) Disconnect hose assembly (2, 3).

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

(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (9).

※ Motor device weight : 23 kg (51 lb)

(7) Remove the swing motor assembly.

※ When removing the swing motor 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 the swing motor.

① Remove the air vent plug.

② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

④ Start the engine, run at low idling and check oil come out from plug.

⑤ Tighten plug fully.

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

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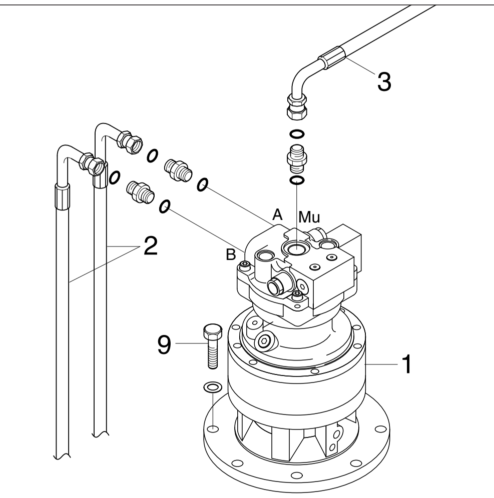

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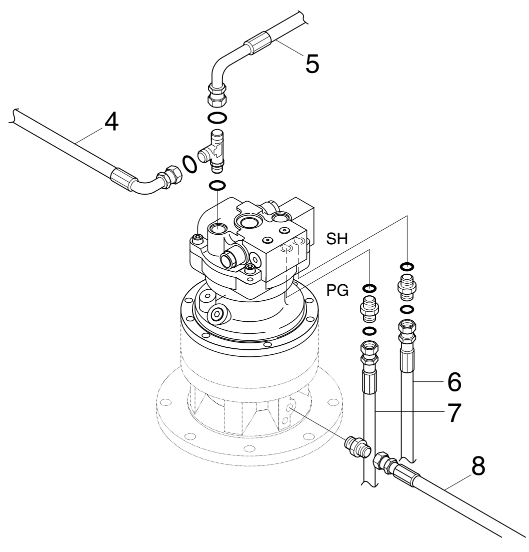

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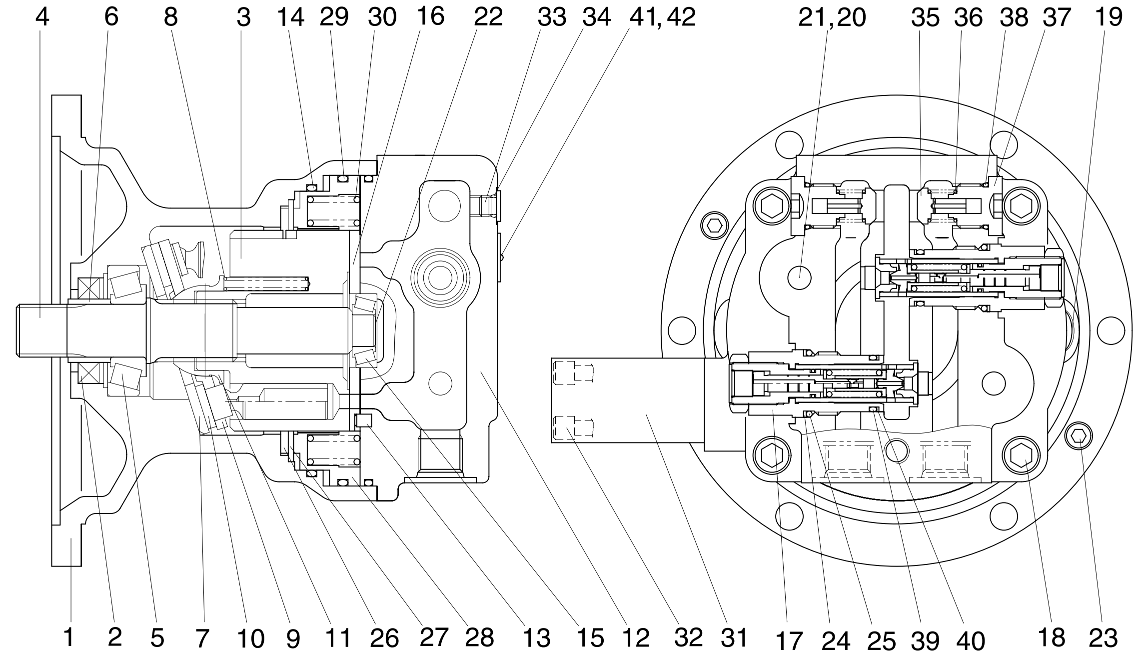
2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



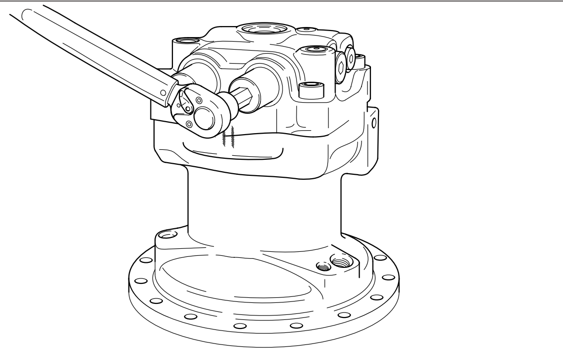
7072SM01

1	Body	15	Taper bearing	29	O-ring
2	Oil seal	16	Valve plate	30	Spring
3	Cylinder block	17	Relief valve assy	31	Time delay valve
4	Shaft	18	Socket bolt	32	Socket bolt
5	Taper bearing	19	Plug	33	Plug
6	Bushing	20	Plug	34	O-ring
7	Shoe plate	21	O-ring	35	Valve
8	Spring	22	Shim	36	Spring
9	Set plate	23	Plug	37	Plug
10	Piston shoe assy	24	Back up ring	38	O-ring
11	Ball guide	25	O-ring	39	O-ring
12	Rear cover	26	Friction plate	40	Back up ring
13	Pin	27	Plate	41	Name plate
14	O-ring	28	Parking piston	42	Rivet

2) DISASSEMBLY

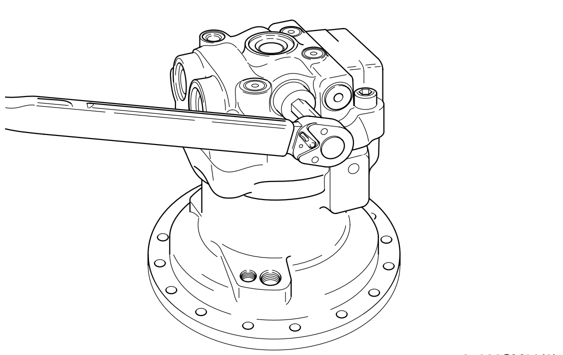
(1) Removal of relief valve assembly
Remove cap of relief valve assembly (17) with 14 ㎜ hexagonal wrench.

※ Assemble removed relief valve assembly (17) to original state when reassembling.



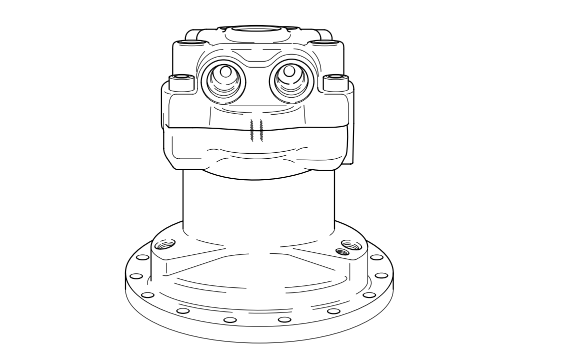
25038SM02(1)

(2) Removal of make up valve and bypass valve assembly
Loosen plug (37) with 14 ㎜ hexagonal wrench, and remove check valve (35) and spring (36).



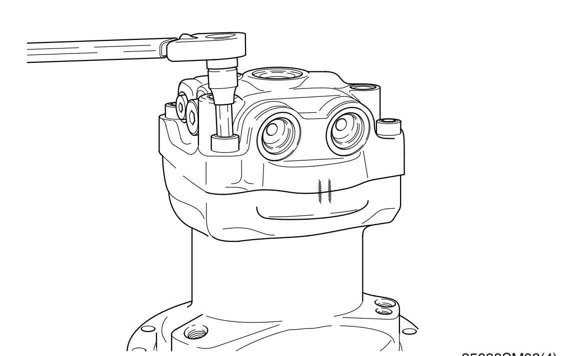
25038SM02(2)

(3) Marking at swing motor
Before disassembling motor, make a matching mark between cover (12) and housing (1) for easy reassembling.



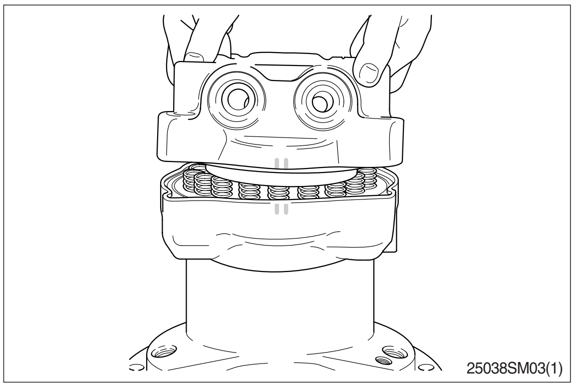
25038SM02(3)

(4) Remove mounting bolts of cover
Loosen hexagon socket bolt (18) with 12 ㎜ hexagonal wrench.



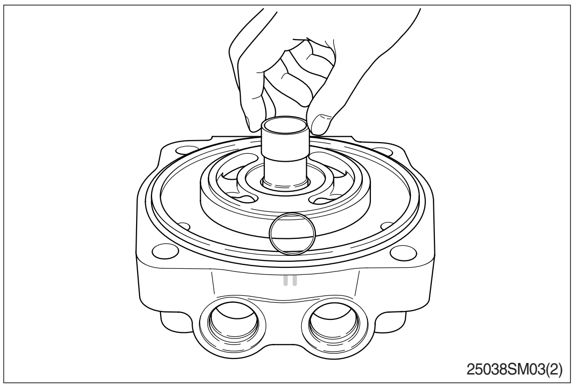
25038SM02(4)

(5) Removal of cover assembly
Place shaft of motor assembly to downward and take cover (12) out.



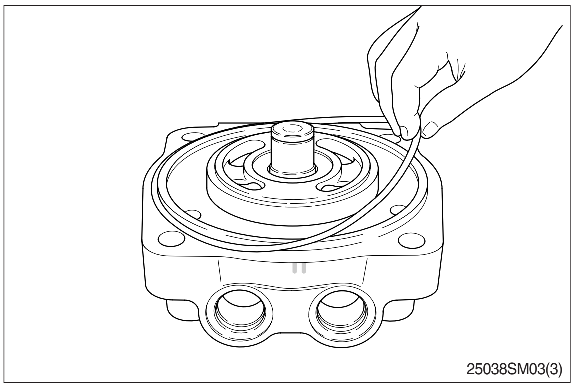
25038SM03(1)

(6) Remove shim (22) remove inner race of needle bearing (15) by bearing puller.



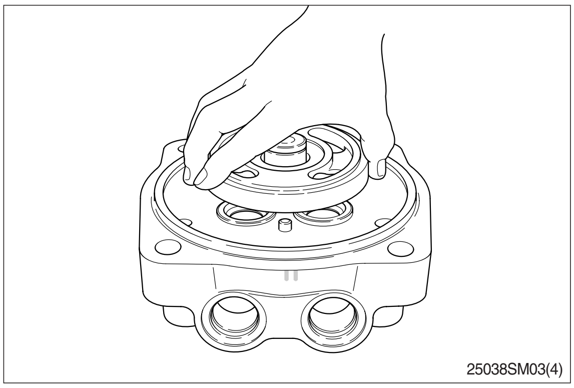
25038SM03(2)

(7) Remove O-ring (29) from cover.



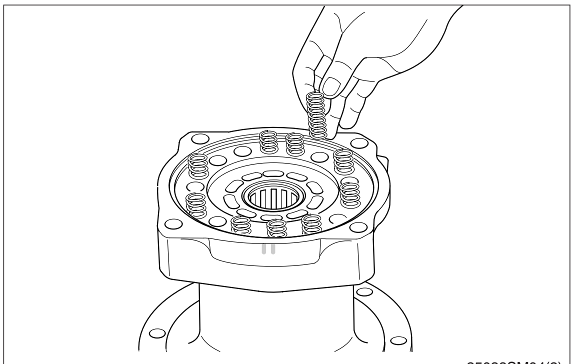
25038SM03(3)

(8) Remove balance plate
Valve plate (16) is adhered on end surface of cylinder (3) by oil viscosity. Take off balance plate (16) with hands.
Assembling method of balance plate (16) depends on cover (12).
(Band groove and round groove of high · low pressure transmission area)
Before removing, check and record location of balance plate (16) to prevent misassembling.



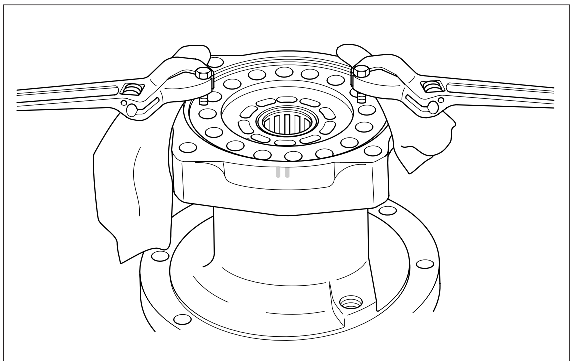
25038SM03(4)

(9) Removal of spring (30, brake area)
Remove spring (30) from piston (28).
Check and record original position of each spring (30) for correct assembling.



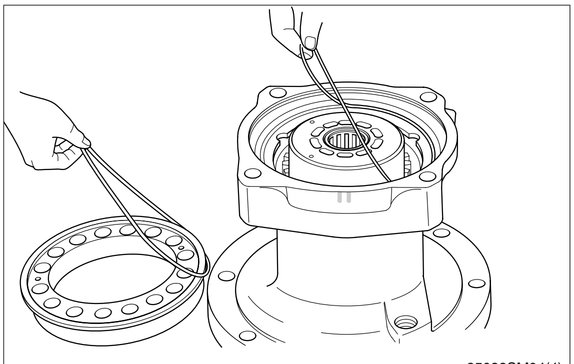
25038SM04(2)

(10) Removal of brake piston
When removing piston (28) from housing (1), there is a sliding resistance against tightening of O-rings (14,29). Use tap hole on piston (28) as shown in the picture.



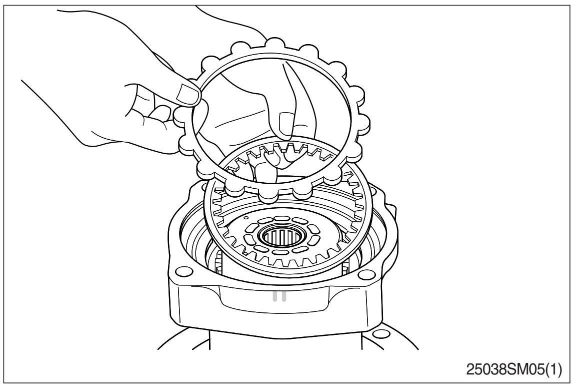
25038SM04(3)

(11) Remove O-rings (14, 29) from piston (28) and housing (1).



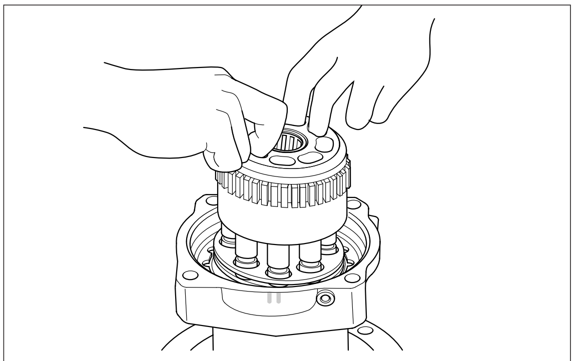
25038SM04(4)

(12) Remove friction plate (26) and lining plate (27) from housing (1).

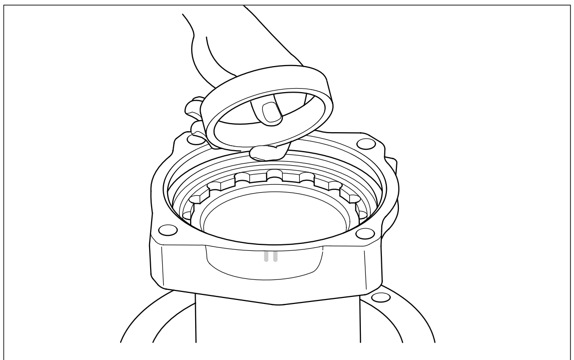


25038SM05(1)

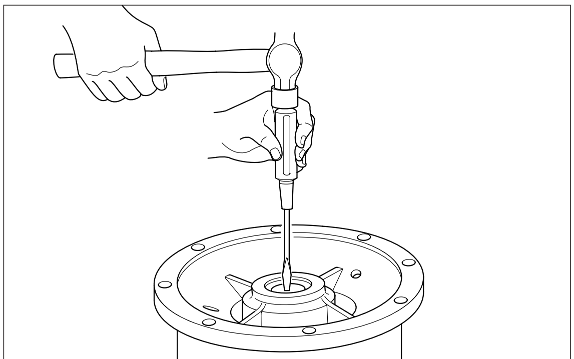
(13) Removal of cylinder assembly
Holding end of cylinder assembly (3) with hand, draw out cylinder assembly from housing.
※ Oil seal (2) and outer race of taper roller bearing (15) are left inside of housing.
※ End surface of cylinder (3) is sliding face . So, protect the surface with a scrap of cloth against damage.
※ Make a matching mark on piston hole of cylinder (3) and piston assembly (10) to fit piston into the same hole when reassembling.


25038SM05(2)

(14) Separate outer race of taper roller bearing (5) from housing.

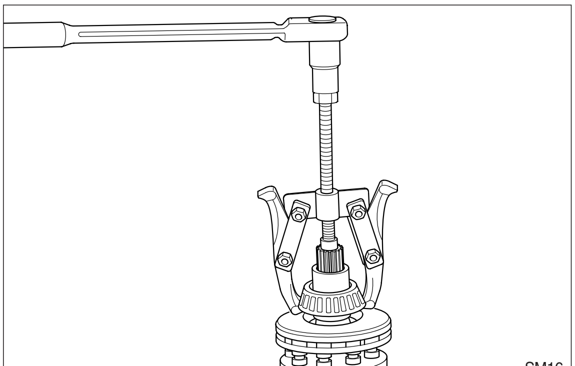

25038SM05(3)

(15) Removal of oil seal
Remove oil seal (2) from housing (1) with driver and hammer.
※ Do not reuse oil seal after removal.


25038SM05(4)

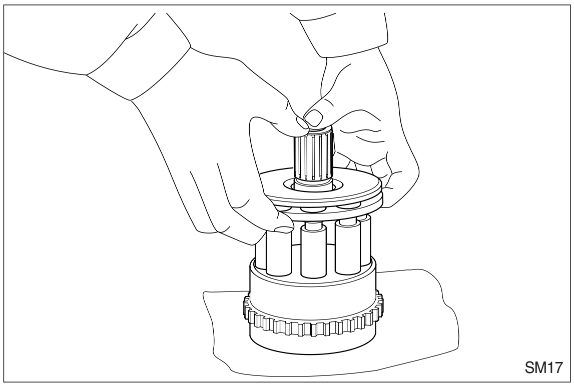
(16) Disassembly of cylinder assembly

① Removal of inner race of taper roller bearing (5).
Lift out cylinder block (3) with 2 inner race of roller bearing (5) by applying gear puller at the end of spline in the cylinder.



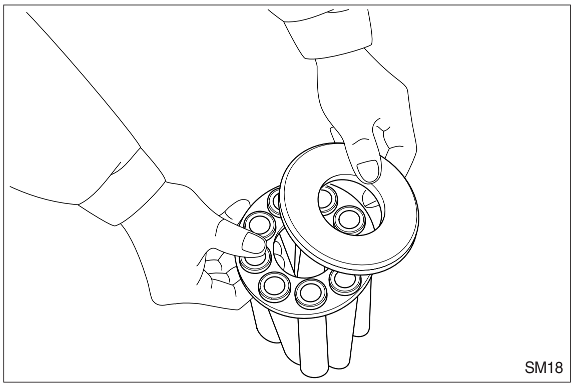
SM16

② Separate shoe plate (7), piston assembly (10), set plate (9) from cylinder block (3).



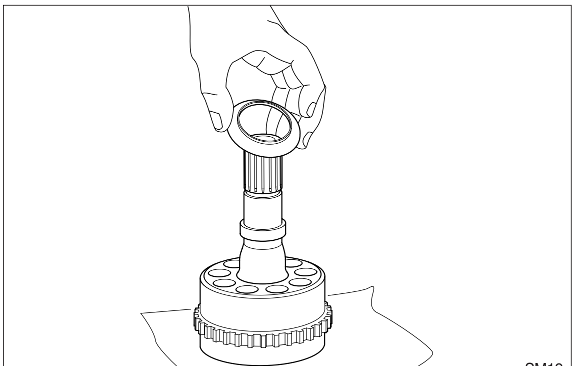
SM17

③ Get shoe plate (7) slide on sliding face of piston assembly (10) and remove it.
※ Be cautious not to damage on sliding face of cam plate.



SM18

④ Remove ball guide (11) from cylinder block (3).



SM19

This completes disassembly.

3) ASSEMBLY

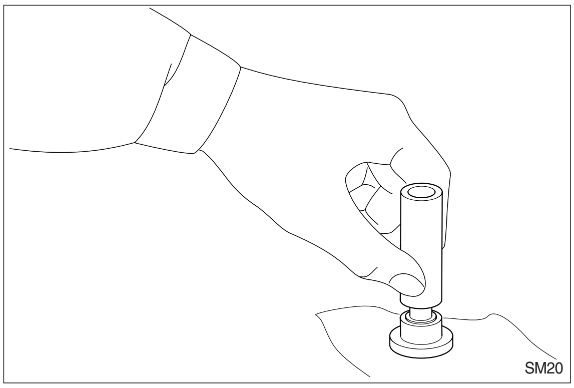
(1) Preparation

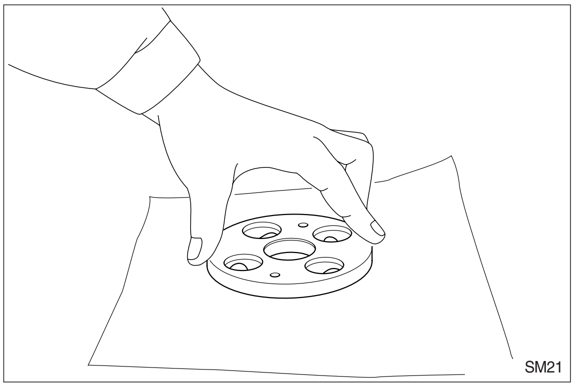
Before reassembling, perform below procedure.

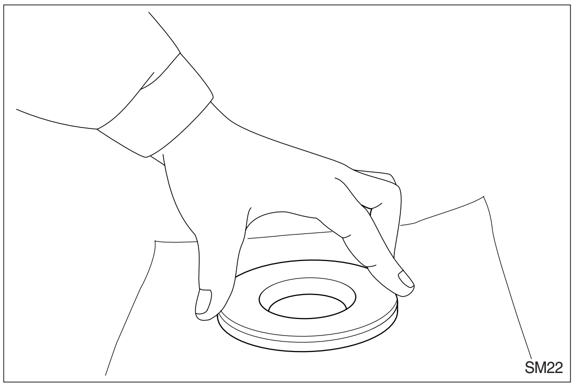
① Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.

② Replace seal with new one.

③ Grind sliding face of piston assembly (10), balance plate (16) and shoe plate (7) with sandpaper #2000.


SM20


SM21

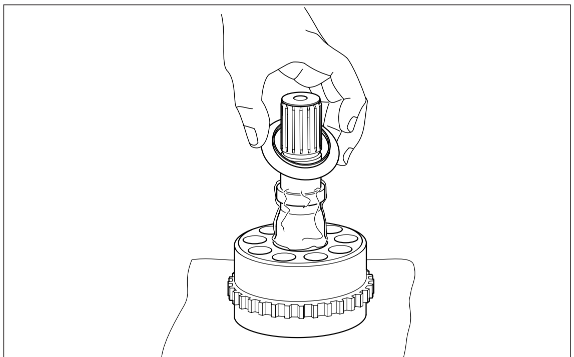

SM22

④ When assembling, lubricate with specified clean hydraulic oil.

⑤ When assembling piston assembly (10) to piston hole of cylinder block (3), check matching mark between them.

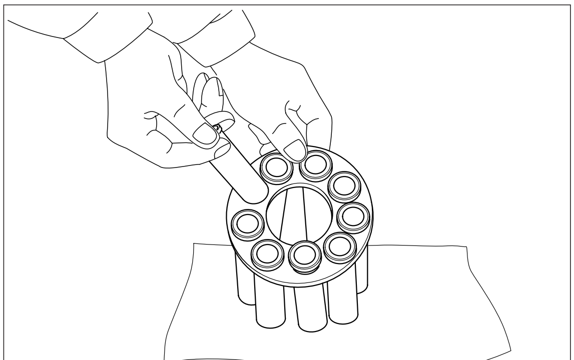
(2) Cylinder assembly

① Lubricate grease on round area (Contacting area withball guide (11)) of cylinder block (3) and assemble spring (4).



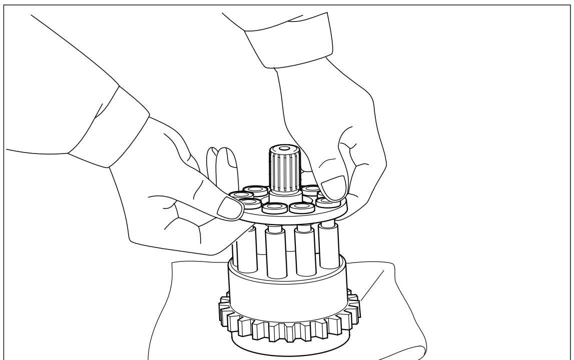
SM23

② Insert piston assembly (10) in hole of set plate (9).



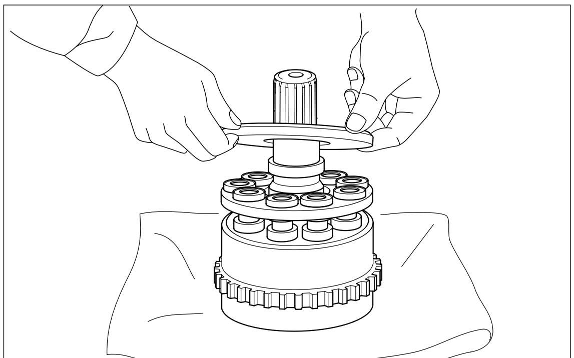
SM24

③ Assemble piston assembly (10) and set plate (9) to cylinder block (3). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder block (3).



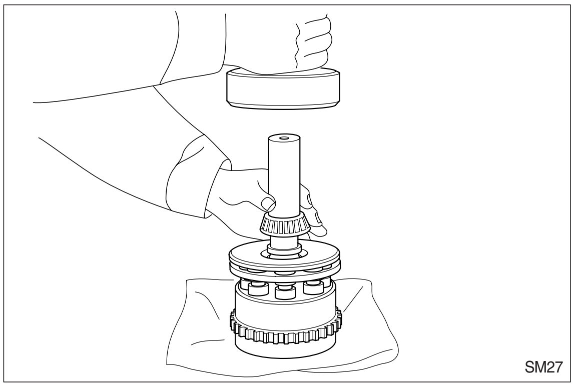
SM25

④ Lubricate specified hydraulic oil on shoe sliding face of piston assembly (10) and assemble shoe plate (7).



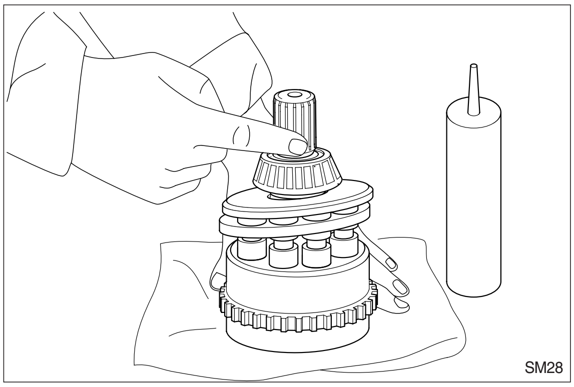
SM26

⑤ Assemble inner race of taper roller bearing (5) to cylinder block (3).



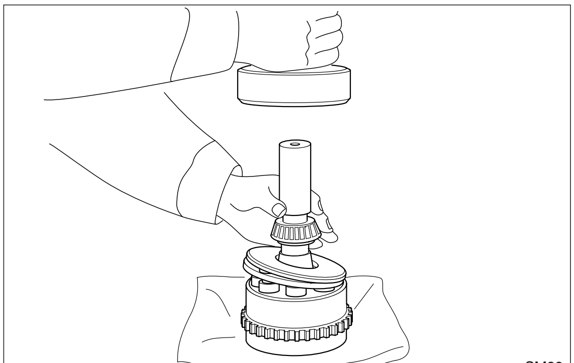
SM27

⑥ Apply loctite to bearing mounting area of inner race of cylinder block (3) lightly.



SM28

⑦ Assemble bushing (6) to cylinder block (3).

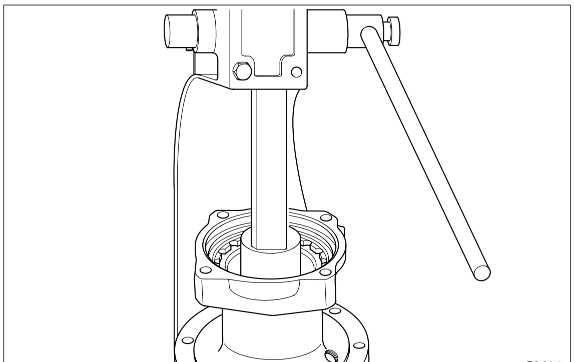


SM29

(3) Oil seal

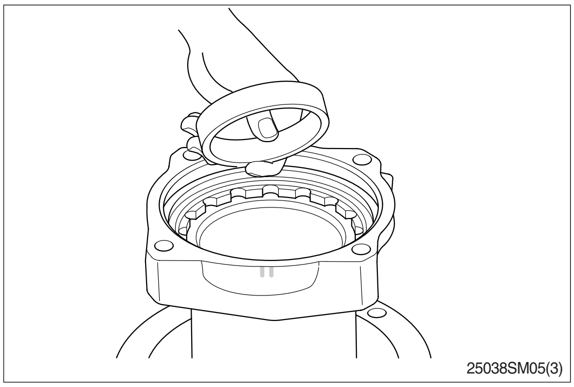
Apply three bond of white color on outer surface of oil seal (2) and assemble and insert it.

※ Before assembling, lubricate lip of oil seal with grease.



SM30

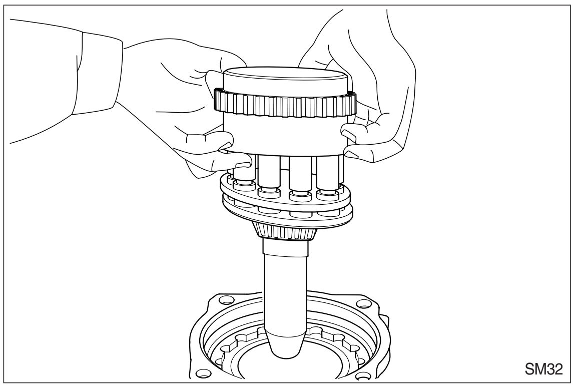
(4) Assemble outer race of taper roller bearing (5) to motor housing (1).



(5) Cylinder assembly

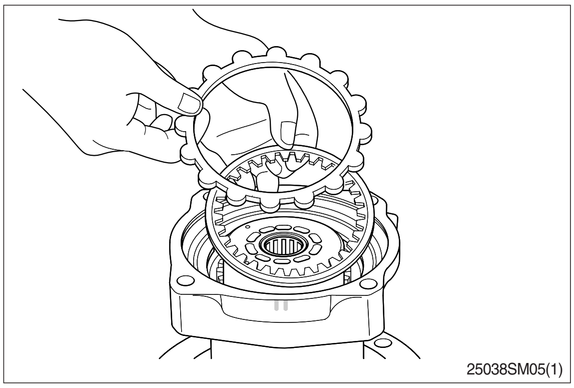
Hold end of cylinder assembly(3) with hands and assemble cylinder assembly to housing(1). Be careful to prevent damage of seal by spline of shaft.

※ When assemble cylinder assembly, spline shaft of cylinder is protruded from end of housing, therefore put pads with length 30~50mm under bottom of housing.



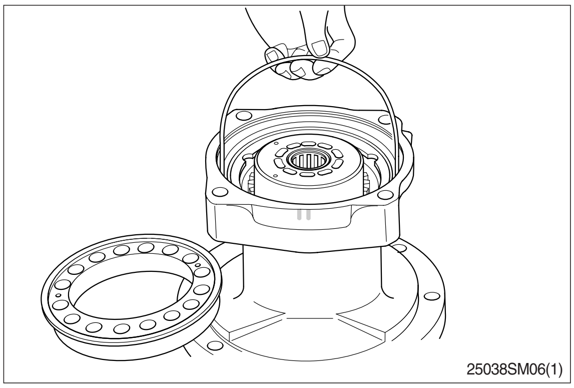
(6) Assemble friction plate (26) and lining plate (27).

※ Lubricate specified hydraulic oil on each side.



(7) Insert O-rings (14,29) into housing (1) and piston (28).

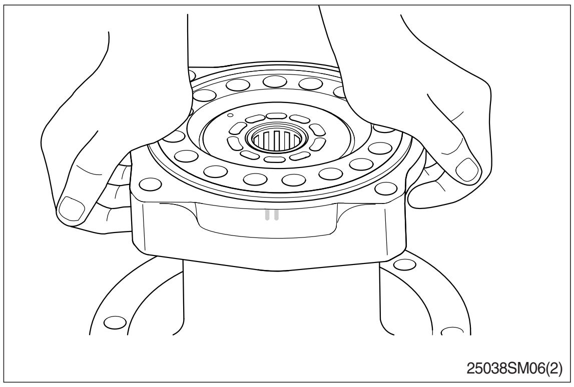
※ Lubricate O-ring with grease.



(8) **Brake piston**

Lubricate specified hydraulic oil on outer sliding face of piston (28) and assemble brake piston to housing (1).

※ It is too tight to assemble piston (10) because O-rings (14,29) are fitted, therefore it is recommended to push piston (28) horizontally by hands at once.

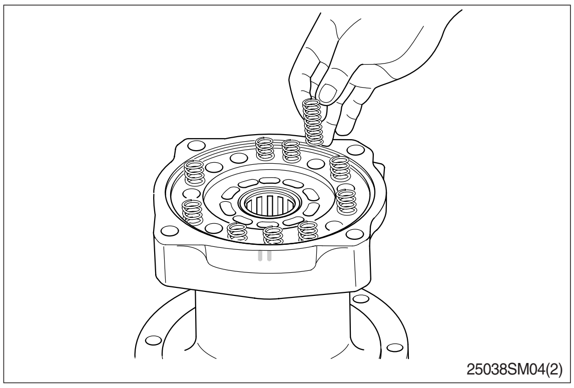


25038SM06(2)

(9) **Spring** (30, brake unit)

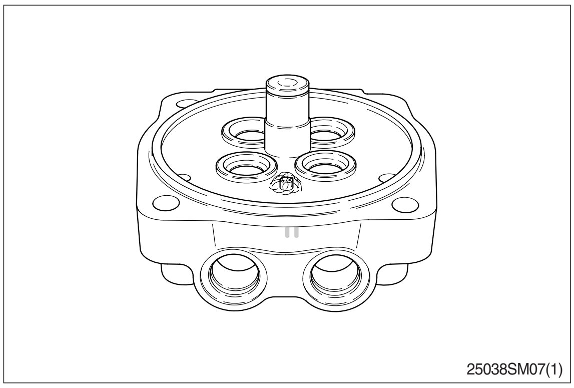
Assemble spring (30) to piston (28) of brake unit.

※ Insert spring (30) into original position.



25038SM04(2)

(10) Lubricate locating pin for antirotation of valve plate (16) of cover (12) with grease sufficiently and install locating pin to housing.

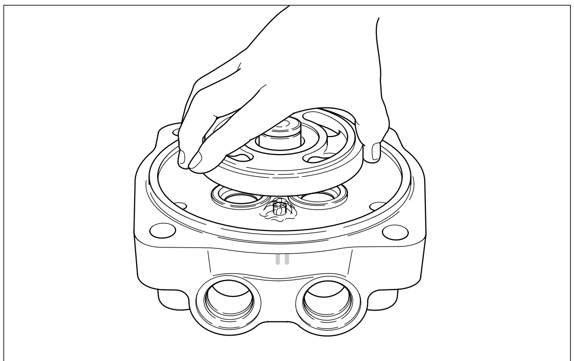


25038SM07(1)

(11) **Balance plate**

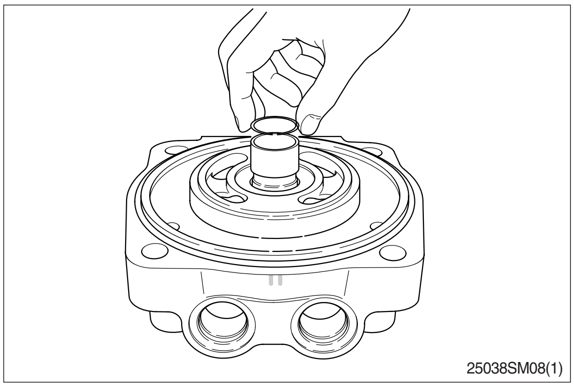
Assemble valve plate (16) to cover (12).

※ Be cautious of assembling direction.

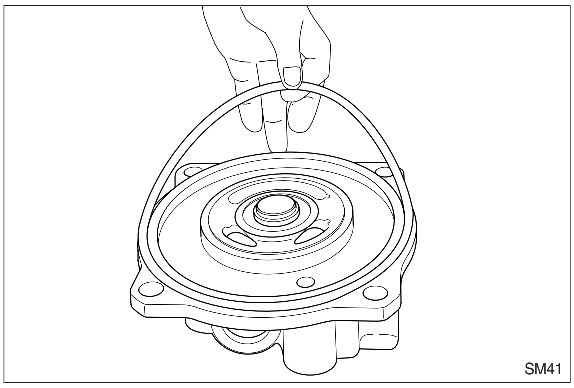


25038SM07(2)

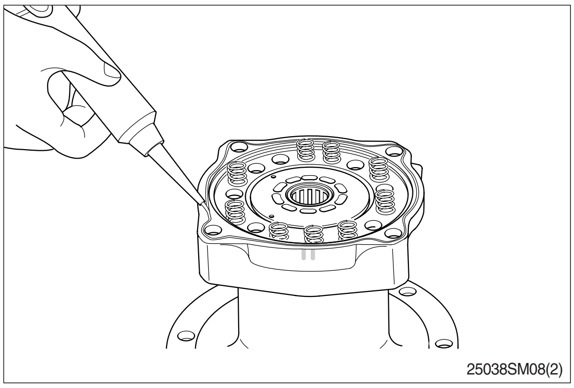
(12) Assemble inner race of needle bearing (15) and shim (22) to cover (12).



(13) Assemble O-ring (29) to cover (12).
※ Lubricate O-ring with grease.



(14) Apply three bond of white color to distinguish oil leakage from remaining oil in bolt hole of cover (12).

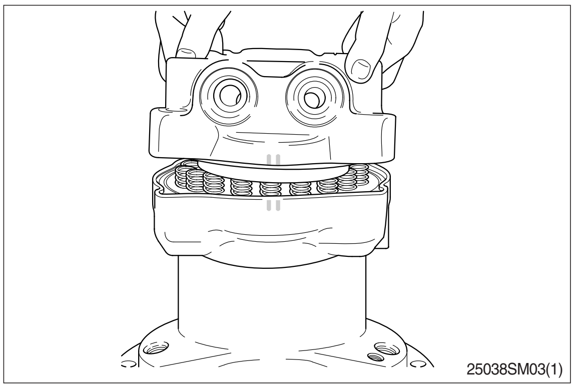


(15) Cover

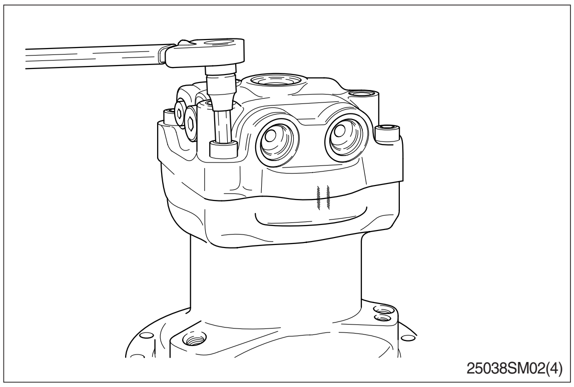
Assemble cover (12) and valve plate (16) to housing (1) lightly, holding them up with hands.

※ When assembling, be careful not to detach valve plate (16) and bushing (6) from cover (12).

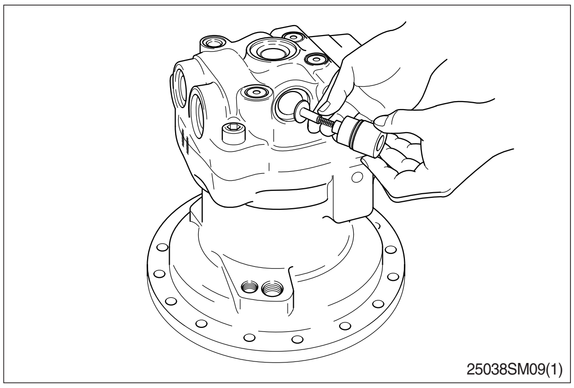
※ Fit matching marks on housing (1) and cover (12) made before disassembling.



(16) Tighten cover (12) and housing (1) with 12 mm hexagonal socket bolt (18).
- Tightening torque : 16 kgf · m (116 lbf · ft)

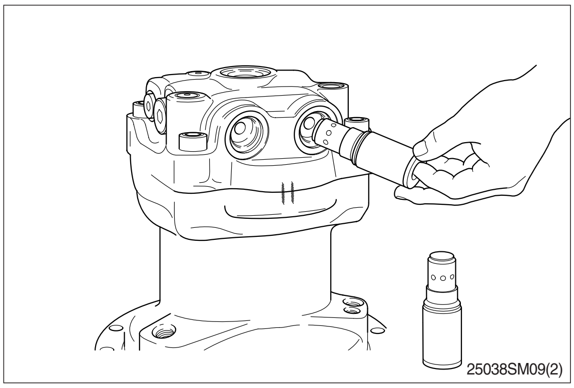

25038SM02(4)

(17) Make up valve
Assemble check(35) and spring(36) to cover(12) and tighten plug(37) with 14 mm hexagonal socket bolt.
- Tightening torque : 14 kgf · m (101 lbf · ft)


25038SM09(1)

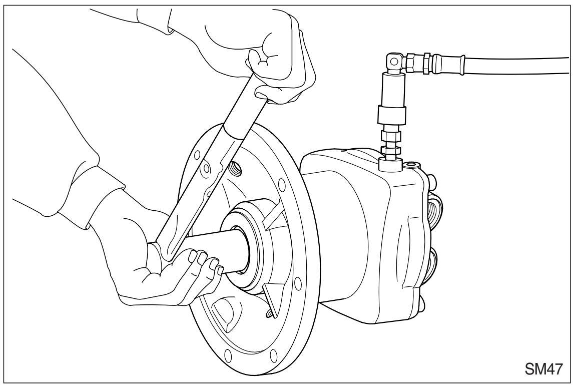
(18) Relief assembly
Assemble relief valve assembly(17) to cover(12) with 14mm hexagonal socket bolt.
- Tightening torque : 8 kgf · m (58 lbf · ft)

※ Be cautious of assembling method.


25038SM09(2)

(19) Check of assembly
Load pilot pressure of 20 kgf/cm^2 to brake release port after opening inlet and outlet port.
Check if output shaft is rotated smoothly around torque of 0.5~1 kgf · m.
If not rotated, disassemble and check.

This completes assembly.


SM47

3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

(1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.

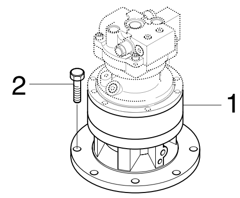
(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 45 kg (99 lb)

13031GE18

2) INSTALL

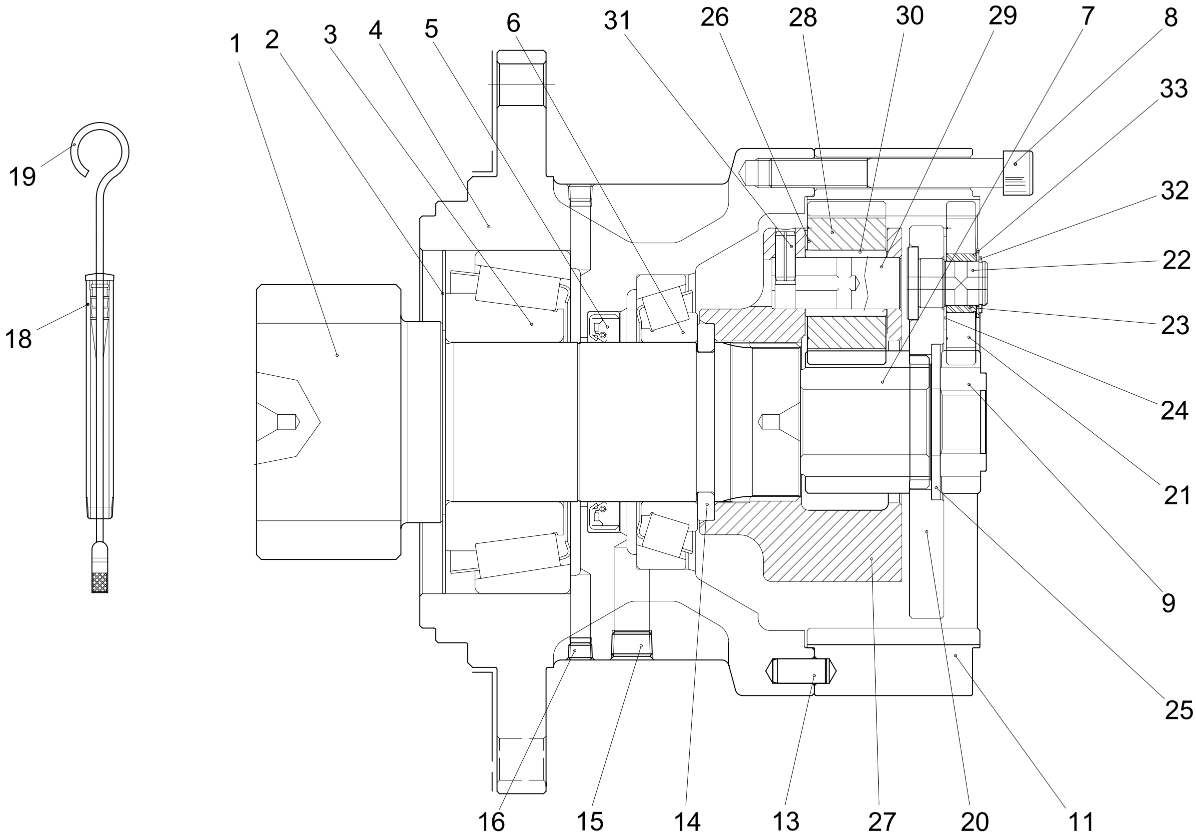
(1) Carry out installation in the reverse order to removal.
· Tightening torque : 10.5 kgf · m (76 lbf · ft)



R5577SM03

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

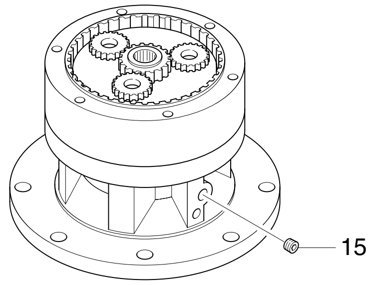


7072SM04

1	Shaft	12	Carrier assy 2	23	Bushing 1
2	Bearing cover	13	Dowel pin	24	Thrust washer 1
3	Taper roller bearing	14	Collar	25	Thrust washer 3
4	Case	15	Plug	26	Thrust washer 2
5	Oil seal	16	Plug	27	Carrier assy 2
6	Taper roller bearing	17	Cover	28	Planet gear 2
7	Sun gear 2	18	Pipe	29	Pin 2
8	Socket bolt	19	Level gauge	30	Bushing 2
9	Sun gear 1	20	Carrier assy 1	31	Spring pin
10	Carrier assy 1	21	Planet gear 1	32	Snap ring
11	Ring gear	22	Pin 1	33	Thrust washer 4

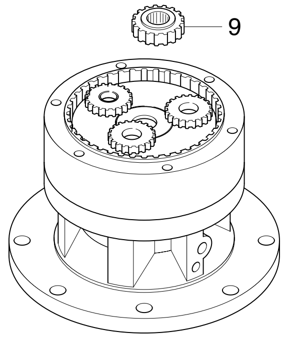
2) DISASSEMBLY

(1) Remove the plug (15) and drain out gear oil.



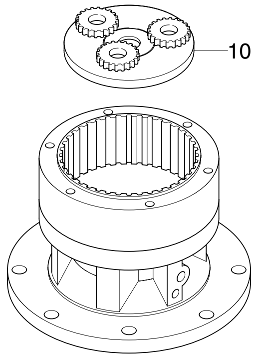
R5577SM04

(2) Remove the No.1 sun gear (9).



R5577SM05

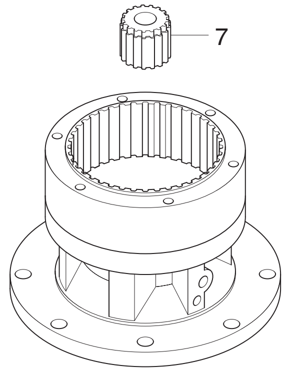
(3) Remove the No.1 carrier sub-assembly (10) using the jig.



R5577SM06

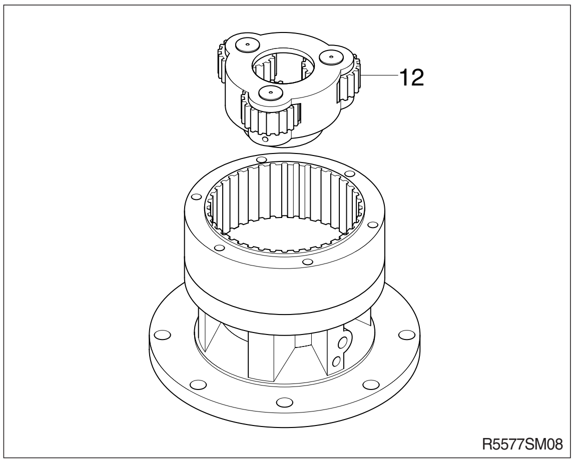
(4) Remove the No.2 sun gear (7).

※ Pay attention to ensure the gear is not damaged during disassembling.

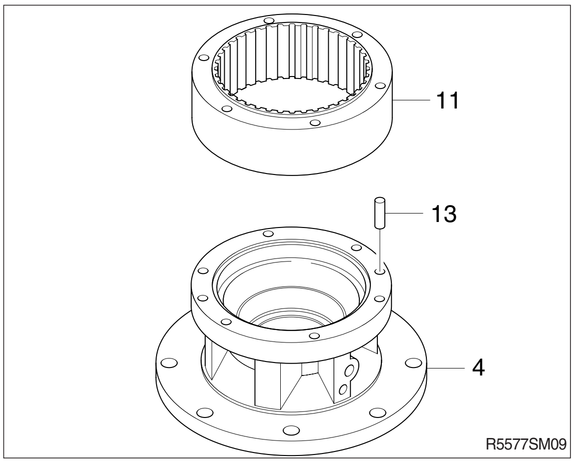


R5577SM07

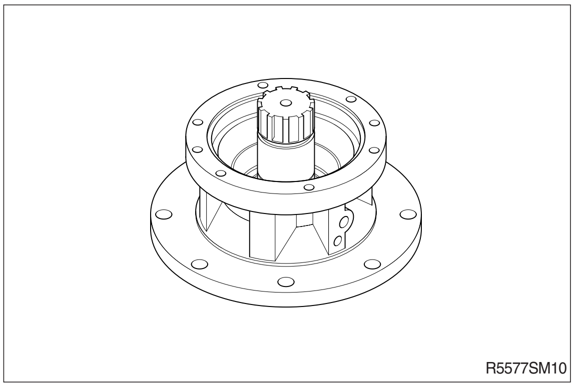
(5) Remove the No.2 carrier sub assembly (12).



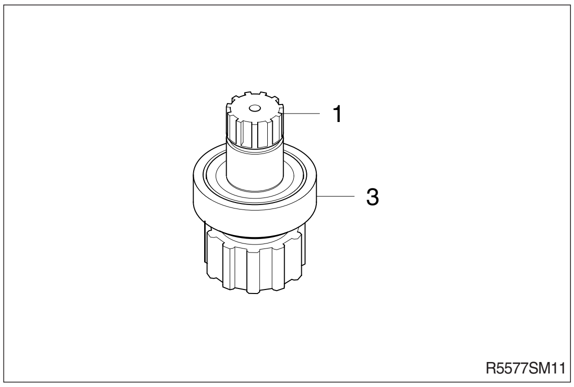
(6) Remove the ring gear by the removal groove between the ring gear (11) and casing (4) by using jig.
Full out the knock pin (13).
Do not need to remove the knock pin (13) if it is not worn or damaged.



(7) Put it on the working table with the drive shaft up.

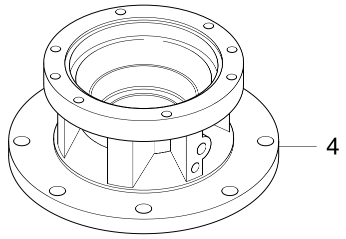


(8) Disassemble the drive shaft (1) with bearing (3) by using jig.



3) ASSEMBLING SWING REDUCTION GEAR

(1) Place the case (4) on the reversing machine having the flange side of the case up.

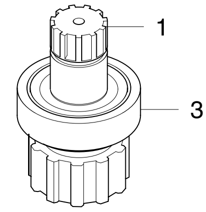


R5577SM12

(2) Install shaft assembly (1) into case (4).

※ Be sure to clean the case before install, using washing machine with the temperature of 80°C

※ Do not install shaft assembly by force.

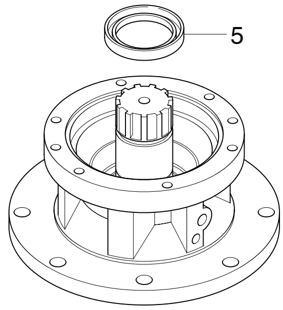


R5577SM11

(3) Reverse case and press to insert oil seal (5) by using pressing jig after spreading grease oil around the outside ring of the seal and bearing.

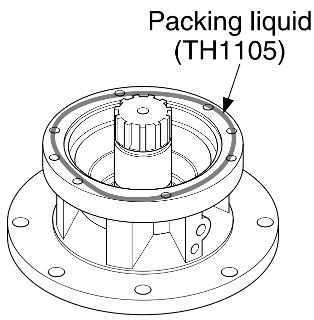
Coat grease oil slightly on the lip surface to prevent any scratch when installing.

※ Be sure to check by eye that the oil seal is seated completely after being installed.



R5577SM13

(4) Clean the assembling surface of case and spread packing liquid (TH1105) as shown in figure.

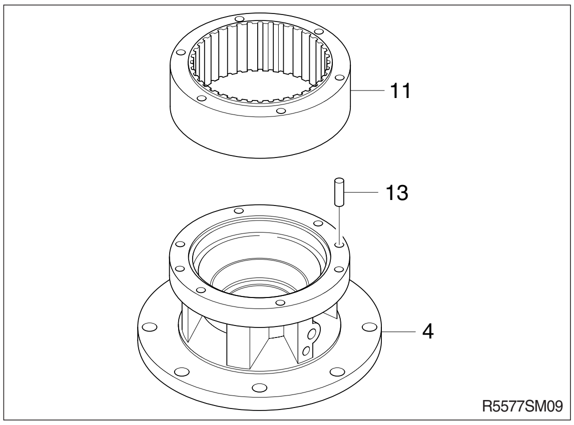


R5577SM14

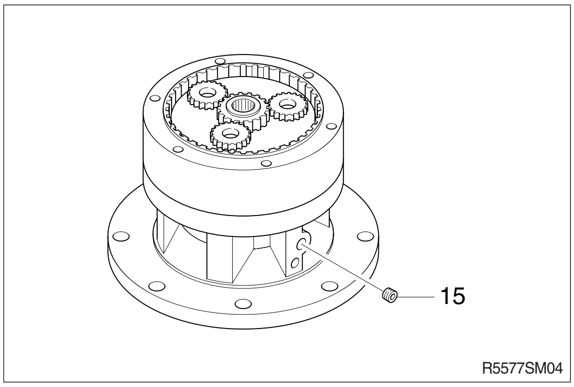
(5) Place ring gear (11) on the case by matching it with knock pin (13) hole.

(6) Insert 2 knock pins (13) by using jig.

※ Be sure to check the hole location of oil gage before inserting.

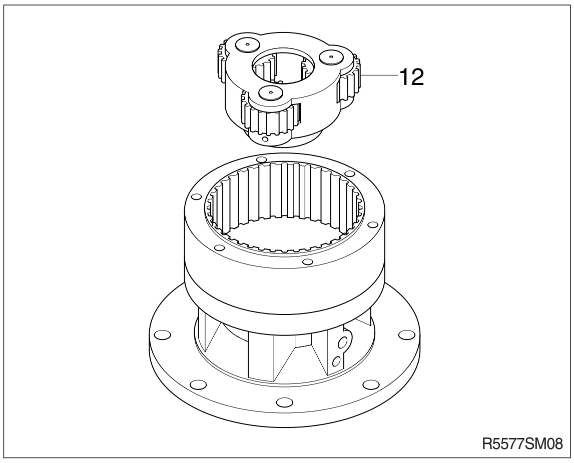


(7) Screw drain plug into drain plug (15) after winding sealing tape.



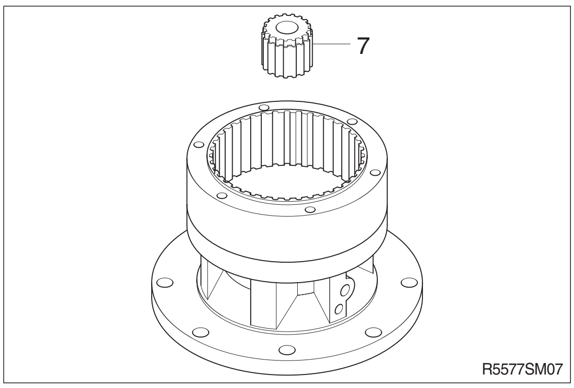
(8) Mount No.2 carrier assembly (12) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



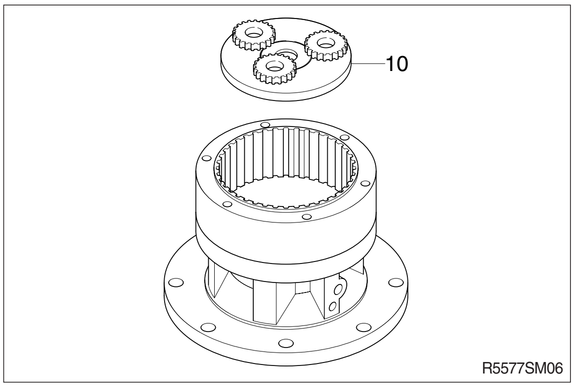
(9) Install No.2 sun gear (7).

※ Be sure to check the direction of sun gear (7) when assembling.

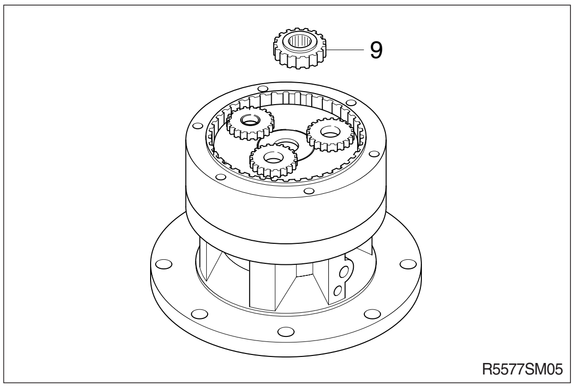


(10) Mount No.1 carrier assembly (10) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



(11) Assemble No.1 sun gear (9).



■ TYPE 2

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) Disconnect hose assembly (12, 13).

(5) Disconnect pilot line hoses (15, 29, 32, 33).

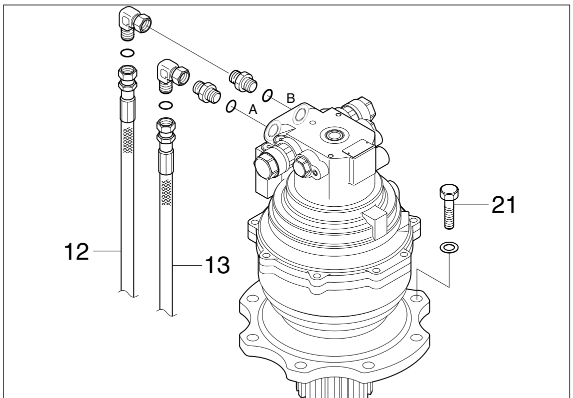
(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (21).

※ Motor device weight : 80 kg (176 lb)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.


13031GE18



80CR9A7SM101

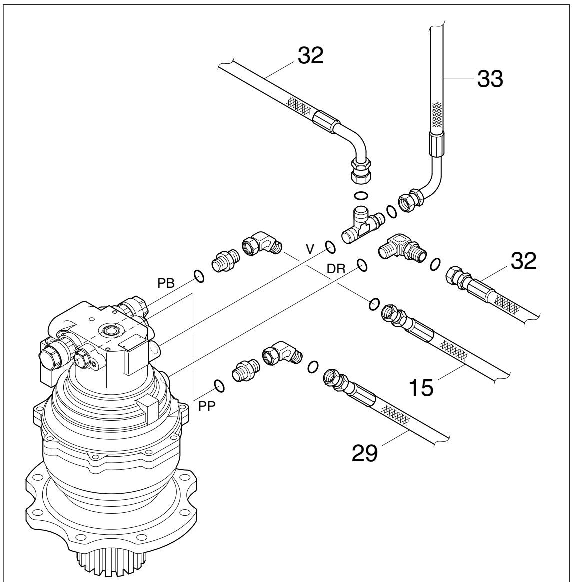
2) INSTALL

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

(2) Bleed the air from the swing motor.

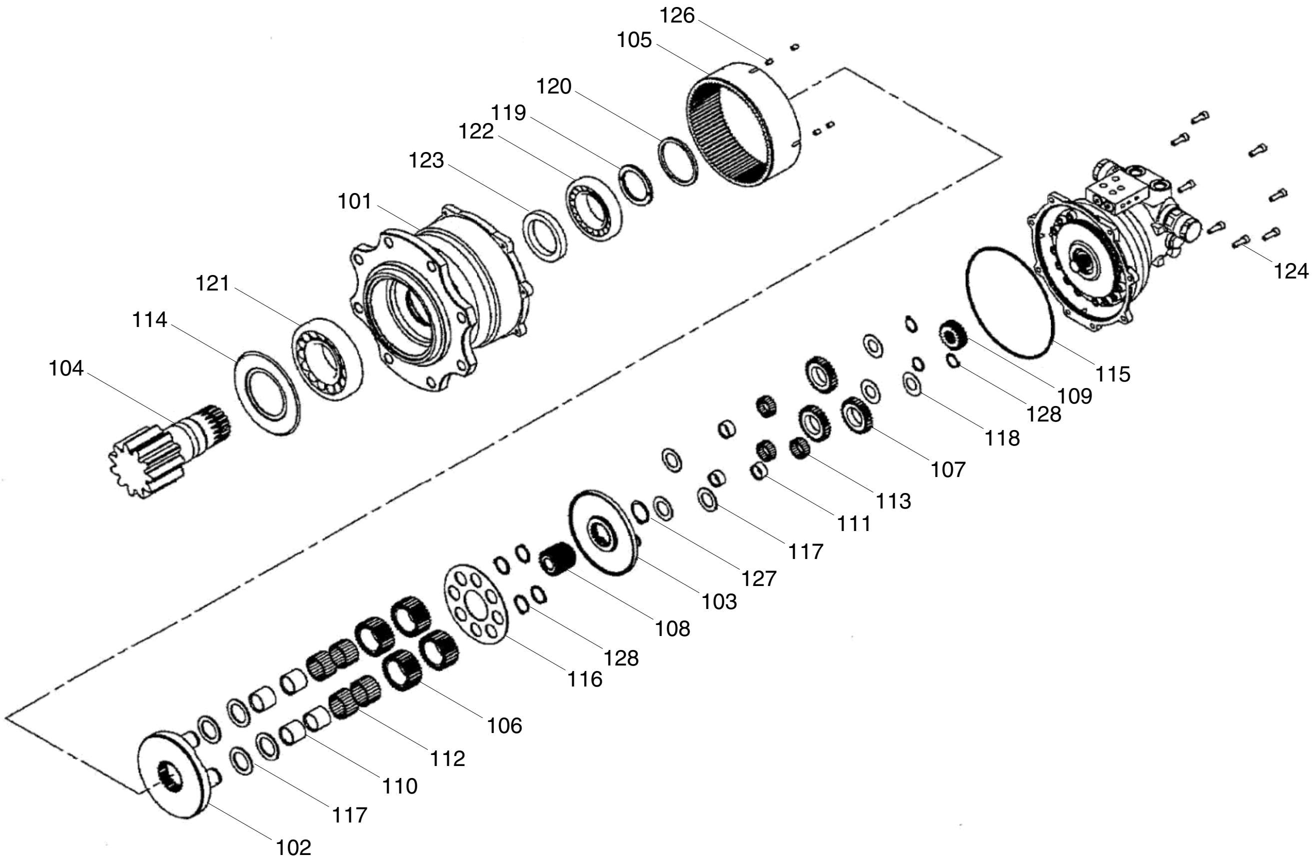
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling and check oil come out from plug.
⑤ Tighten plug fully.

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



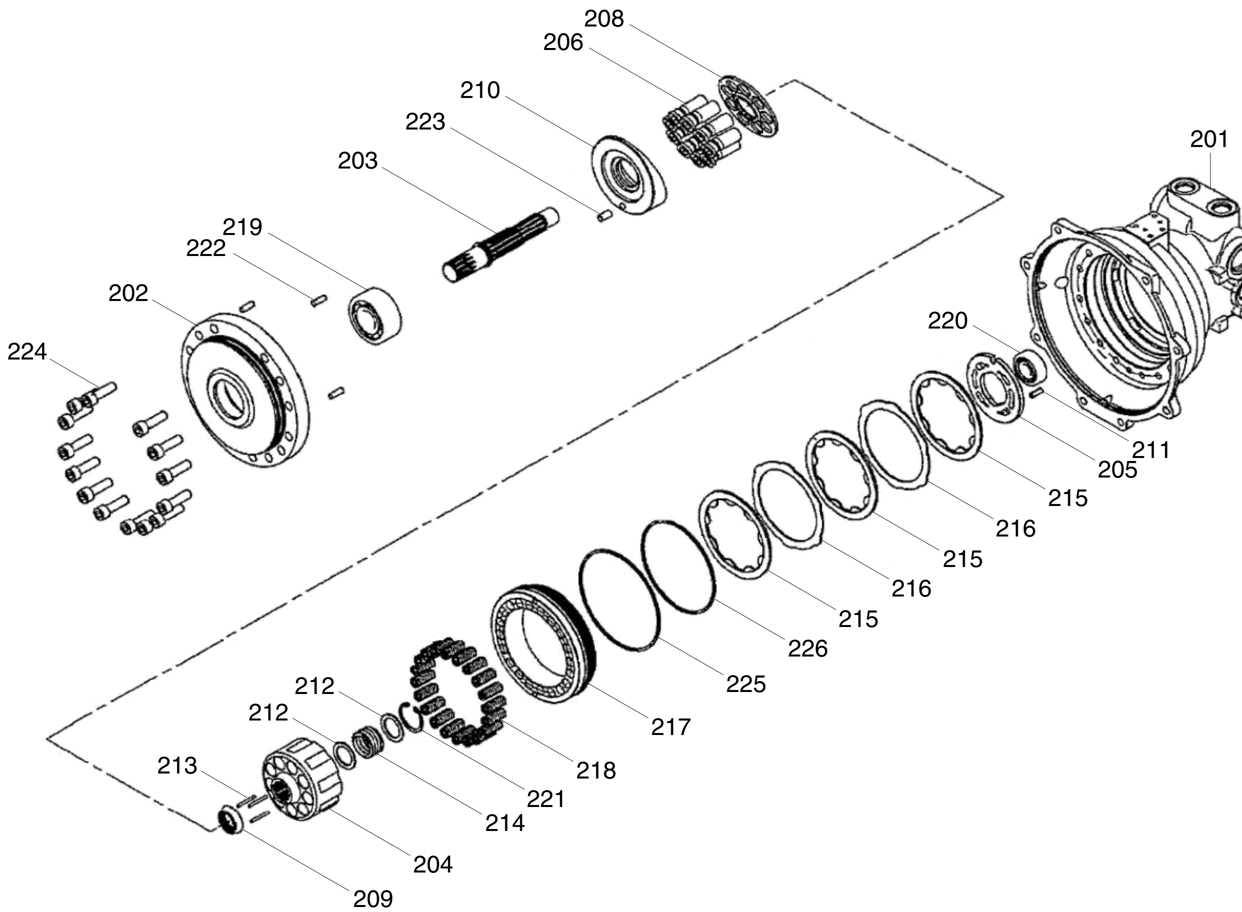
80CR9A7SM102

2) COMPONENTS (1/3)



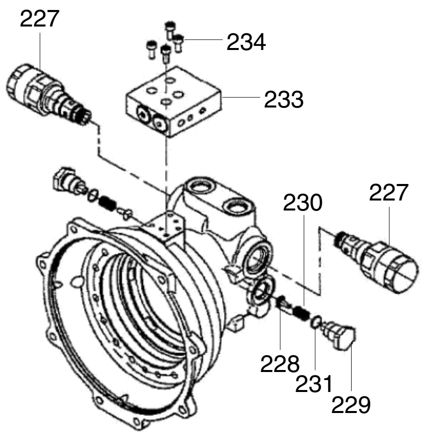
101	Body	110	Ring 1	119	Preload collar
102	Carrier 1	111	Ring 2	120	Ring
103	Carrier 2	112	Needle	121	Bearing
104	Pinion shaft	113	Needle	122	Bearing
105	Internal gear	114	Ring seal	123	Oil seal
106	Gear B1	115	O-ring	124	Screw
107	Gear B2	116	Thrust plate	126	Bushing pin
108	Gear S1	117	Thrust washer 1	127	Snap ring
109	Gear S2	118	Thrust washer 2	128	Snap ring

COMPONENTS (2/3)

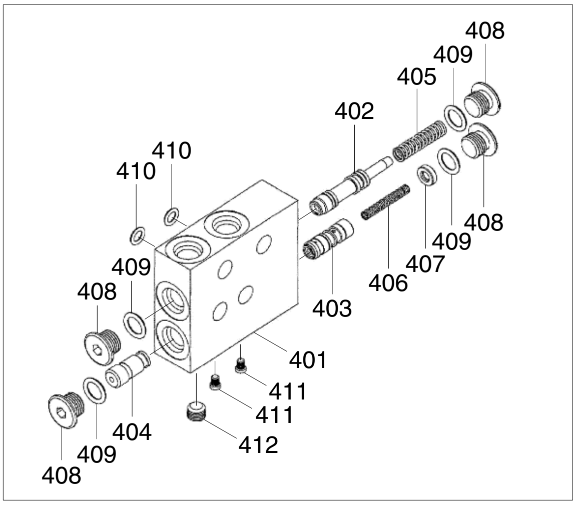


201	Body H	211	Spring pin	220	Bearing
202	Plate S	212	Retainer	221	Snap ring
203	Shaft	213	Pin	222	Pin
204	Cylinder barrel	214	Spring C	223	Pin
205	Valve plate	215	Disk plate	224	Screw
206	Piston assy	216	Steel plate	225	O-ring
208	Shoe holder	217	Brake piston	226	O-ring
209	Barrel holder	218	Spring B		
210	Swash plate	219	Bearing		

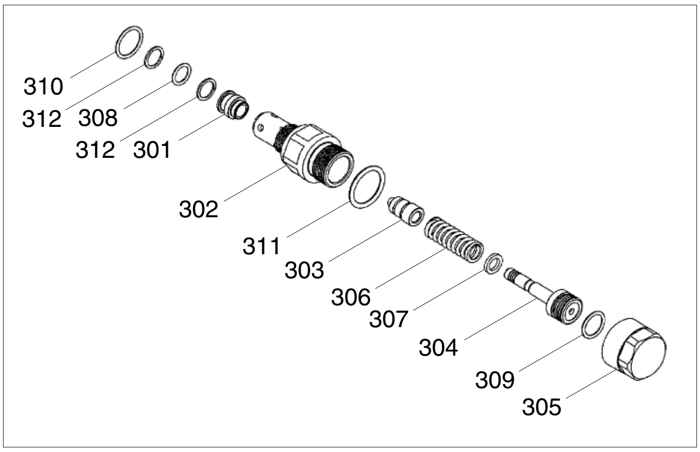
COMPONENTS (3/3)



DETAIL ITEM 233



DETAIL ITEM 227



80CR9A2SM16-1

227	Relief valve	305	Cap	404	Stopper
228	Check valve	306	Spring	405	Spring
229	Plug	307	Spacer	406	Spring
230	Spring	308	O-ring	407	Spring holder
231	O-ring	309	O-ring	408	Plug
233	P/brake timer valve	310	O-ring	409	O-ring
234	Screw	311	O-ring	410	O-ring
301	Seat	312	Back-up ring	411	Metal plug
302	Retainer	401	Body	412	Plug
303	Poppet	402	Spool		
304	Piston	403	Piston		

2) GENERAL ATTENTION

Please pay attention following points.

(1) Working should be done at the clean place and pay attention not to attach dust, paint cake and water. And prepare the clean box to put into the disassembled parts.

(2) Before disassembling, clean up the dust which is attached to the outside of the swing motor and take out paint which is attached to the binding parts by the wire brush.

(3) To make the original position when assembling, make a marking before disassembling.

(4) Give special care to protect parts from damage.

(5) Wash parts with washing oil sufficiently.

(6) Check parts whether there is friction loss or seize and take out burr with sand paper.

(7) Change the seals and snap rings to new ones.

3) DISASSEMBLY AND ASSEMBLY PROCEDURE

As the swing motor composes 2 blocks (hydraulic motor and reduction gear), explain each block disassembly and assembly procedure.

And please refer to the page 7-67~69.

4) TOOLS FOR DISASSEMBLY AND ASSEMBLY

No.	Tool	
1 2	Preset type hand torque wrench	45 N (JIS B4650) 90 N (JIS B4650)
3 4 5	Hexagon bar bit for above wrench	Two-plane width 5 Two-plane width 6 Two-plane width 8
6	Single purpose type hand torque	T = 12±0.6 kgf · m (86.8±4.4 lbf · ft) Two-plane 27 T = 22.5±2.5 kgf · m (163±18.1 lbf · ft) Two-plane 41
7 8 9	Hexagon bar wrench	Two-plane width 5 Two-plane width 6 Two-plane width 8
10	Spanner	Two-plane width 27 Two-plane width 41
11	Minus driver	Width 6~10
12 13 14	Snap ring pliers	ø 35 for hole ø 30 for shaft ø 48 for shaft
15	Hammer	-
16	Plastic hammer	-
17 18 19 20 21	Other	Grease (oil designated hydraulic oil) Wire brush Sand paper Anti-loose adhesive (three bond #1305)

3. DISASSEMBLY

1) HYDRAULIC MOTOR

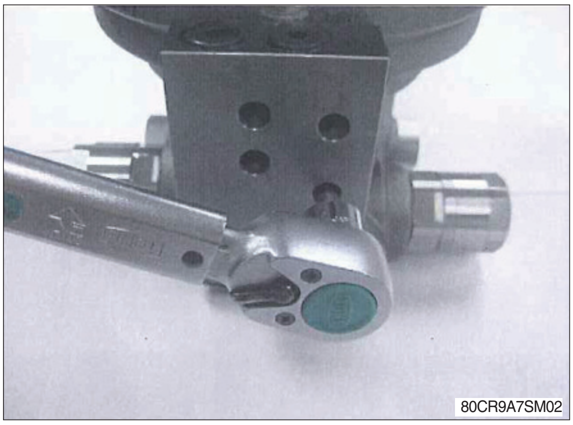
(1) Loose the hexagon socket head cap bolts (124), and take out the hydraulic motor assembly from the reduction gear body.

· Tools required :
Hexagon bar wrench : 6 ㎜

※ When taking out the hydraulic motor assembly from the reduction gear body, the drain port should be open.
When it is difficult to take out, insert the minus driver into the binding face to the body. If a part of the binding the surface becomes convex by the driver, take out the burr completely.

(2) Loose the hexagon socket head cap bolts (234), and take out the timer valve (233) from the hydraulic motor assembly.

· Tools required :
Hexagon bar wrench : 5 ㎜



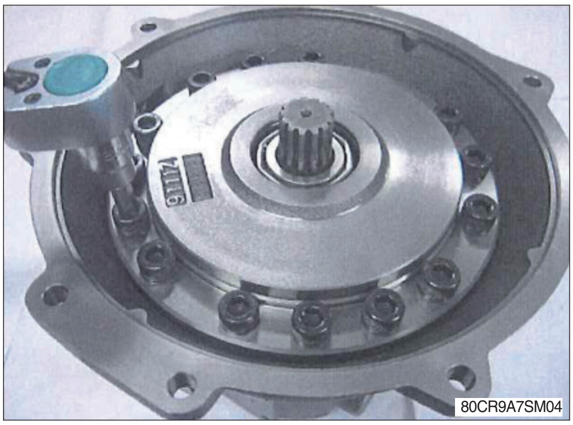
(3) Take out the relief valve assembly (227).

· Tools required :
Spanner : 41 ㎜

※ Do not disassemble the relief valve assembly, unless it is necessary.

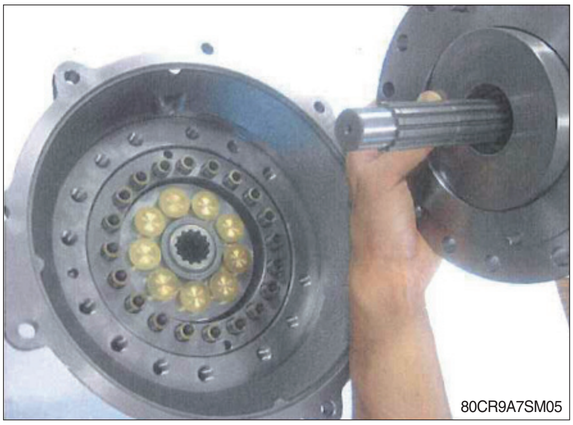
(4) Loose the hexagon socket head cap bolts (224), and take out it.

· Tools required :
Hexagon bar wrench : 8 mm


80CR9A7SM04

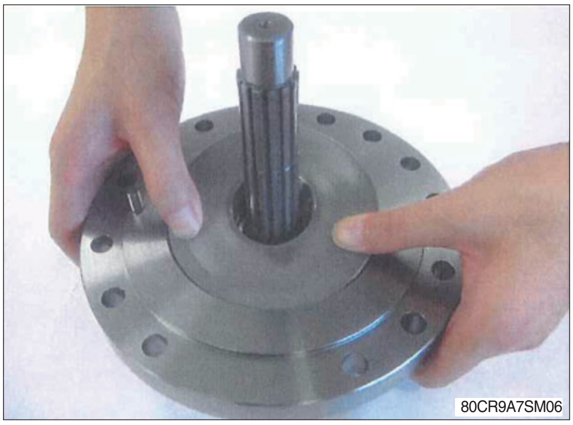
(5) Take out the plate S (202).

※ Pay attention not to drop off swash plate (210).


80CR9A7SM05

(6) Take out the swash plate (210) and the shaft kit from the plate S (202).

※ When it is difficult to take out the shaft, hit the opposite side slightly by the plastic hammer.
As the bearing (216) is pressed into the shaft, do not disassemble unless it is necessary to change the bearing.


80CR9A7SM06

(7) Take out the spring B (218) from the brake piston (217).
· Spring B (218) : 20 pcs


80CR9A7SM07

(8) Take out the parallel pin (222) from the plate S (202).

· Parallel pin (222) : 3 pcs

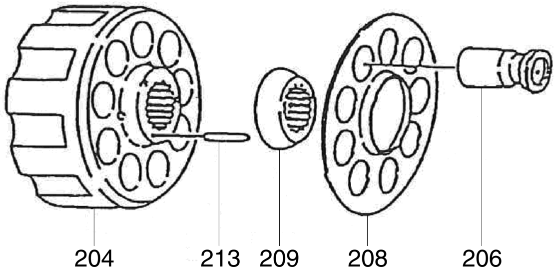
80CR9A7SM08

(9) Take out the cylinder barrel kit.

※ Pay attention not to lose parts, which are scattered easily.
There is a possibility to stay valve plate (205) on bottom face of cylinder barrel. Pay attention not to drop off it.

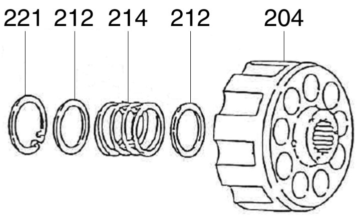
80CR9A7SM09

(10) Take out the piston assemblies (206), the shoe (208), the barrel holder (209) and the pin (213).

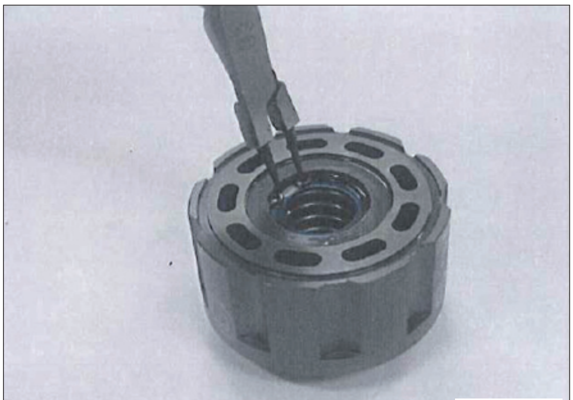


80CR9A7SM10

(11) Take out the snap ring (221), the retainer (212) and the spring C (214).
· Tools required :
Snap ring plier : ø 35 for hole



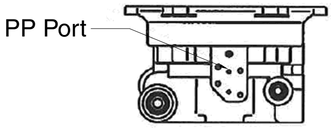
80CR9A7SM11-1



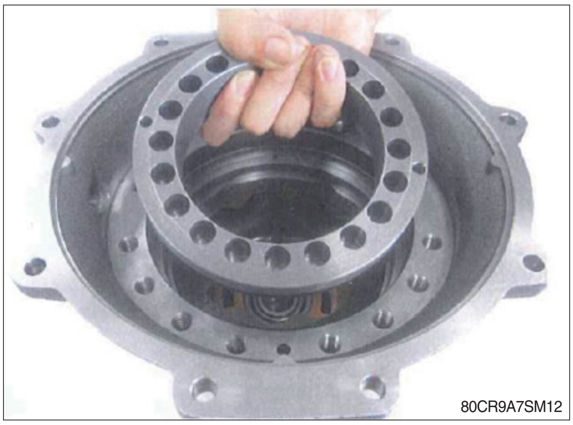
80CR9A7SM11

(12) Take out the brake piston (217) and the O-ring (225, 226) from body H (201).

※ Blow in air from PP port little by little to remove brake piston.
Pay attention not to come off it suddenly.



80CR9A7SM12-1



80CR9A7SM12

(13) Take out the disk plate (215), and the steel plate (216).
- Disk plate (215) : 3 pcs
- Steel plate (216) : 2 pcs

80CR9A7SM13

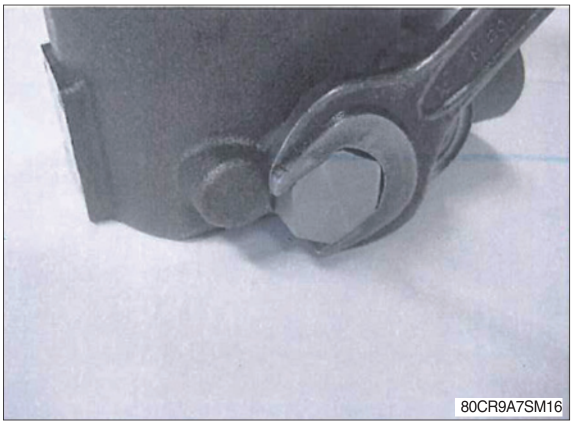
80CR9A7SM14

(14) Take out the valve plate (205).

80CR9A7SM15

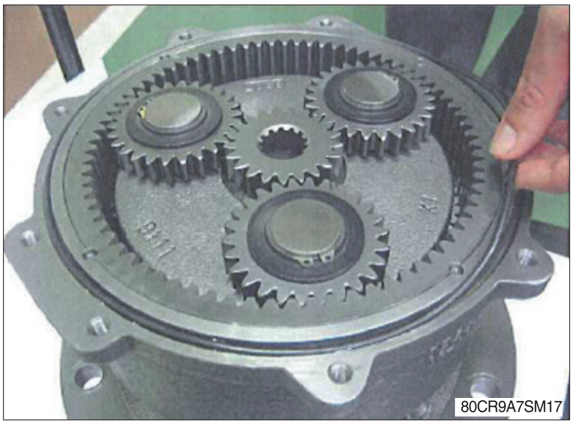
(15) Loose the plug (229), and take out the check valve (228) and the spring (230). (2 locations)

· Tools required :
Spanner : 27 mm

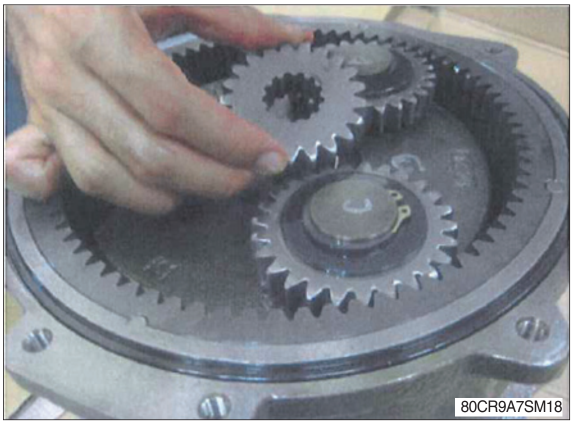

80CR9A7SM16

2) REDUCTION GEAR

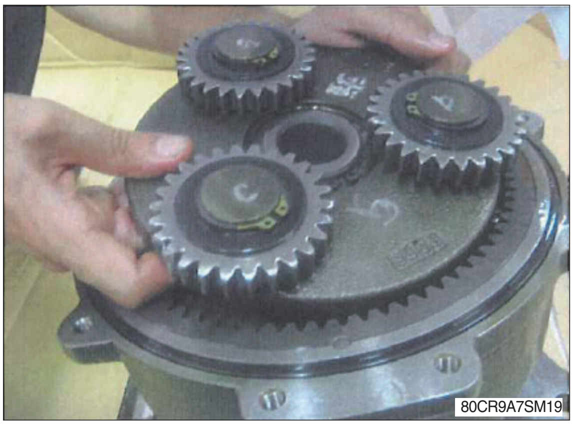
(1) Take out the O-ring (115).


80CR9A7SM17

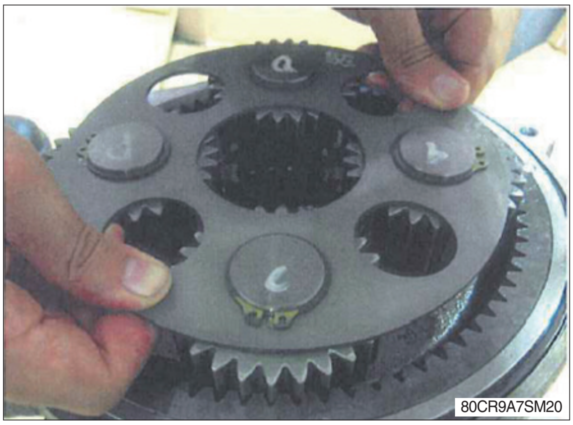
(2) Take out the S2 gear (109).


80CR9A7SM18

(3) Take out the carrier 2 kit.


80CR9A7SM19

(4) Take out the carrier 1 kit.



80CR9A7SM20

(5) Take out the snap ring (128), the thrust washer (118), the b2 gears (107) and the needles 2 (113) from the carrier 2 kit.

80CR9A7SM21

(6) Take out the snap ring (128), and the S1 gear (108) from the carrier 2 kit.

80CR9A7SM22

(7) Take out the ring 2 (111) and thrust washers (117) from the carrier 2 kit.


80CR9A7SM23

(8) Take out the snap ring (128) and the thrust plate 1 (116) from the carrier 1 kit.


80CR9A7SM24

(9) Take out the b1 gears (106) and needles (112) from the carrier 1 kit.


80CR9A7SM25

(10) Take out the rings 1 (110) and the thrust washers (117) from the carrier 1 kit.


80CR9A7SM26

4. ASSEMBLY

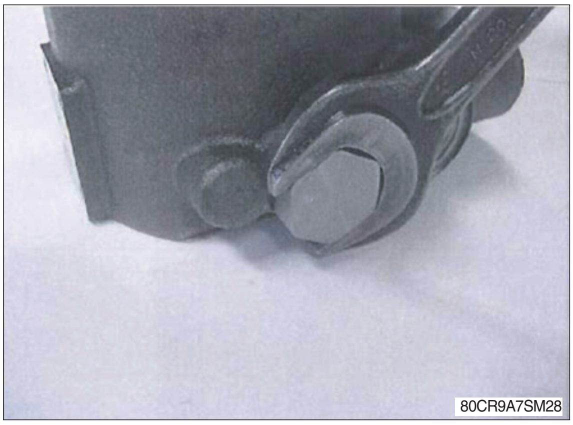
1) HYDRAULIC MOTOR SECTION

(1) Press-fit the bearing (220) and spring pin (211) into the body H (201).

80CR9A7SM27

(2) Insert the 2 check valves (228) (1 pc/side), springs (230) (1pc/side) and plug (229) (1pc/side) with O-ring (231) in that order into the body H (201). (2 locations)

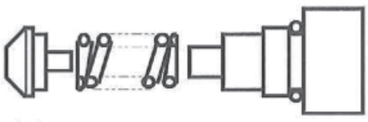
· Tools required :
Spanner : 27 mm
Torque wrench



80CR9A7SM28

※ Apply grease slightly to the O-ring and assemble to pay attention not biting the seals.

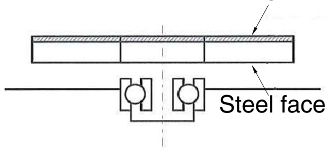
· Plug tightening torque :
12±0.6 kgf · m (86.8±4.34 lbf · ft)



80CR9A7SM28-1

(3) Place the valve plate (205) onto the body H (201).

※ The steel face of the valve plate should be downside and assemble.



80CR9A7SM29-1

80CR9A7SM29

(4) Assemble the disk plate (215) and steel plate (216).

※ Number of parts count on installing

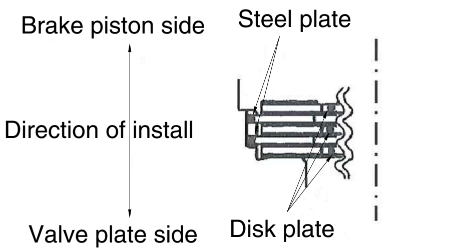
· Disc plate : three

· Steel plate : two

※ Please assemble exact number of parts and exact order. (refer the below drawing)

※ Please install disc plate ditch wih accuracy in order to install cylinder barrel assy into it on (9), see the page 7-81.

80CR9A7SM30



80CR9A7SM31-1

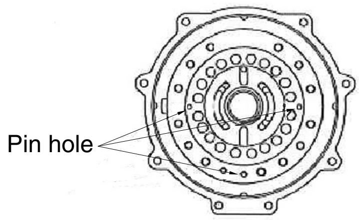
80CR9A7SM31

(5) Make the brake piston assembly which placed O-rings (225, 226) on brake piston (217), and place it onto the body H (201).

Place the brake piston assembly onto plate S placed 3 pins, then place it onto the body H as matched pin hole position. After that, press-fit it by tightening hexagon bolts little by little.
Check no pushed out, scratches and dust on O-ring at this time.
To preven the brake piston assembly falling off, apply grease on plate S.
Take out the plate S after placed brake piston assembly.

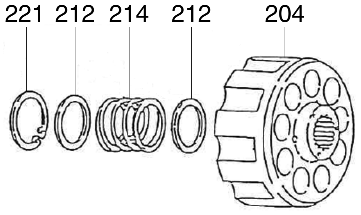
※ Pay attention to jam seal parts, install them applying grease on O-rings.

80CR9A7SM32

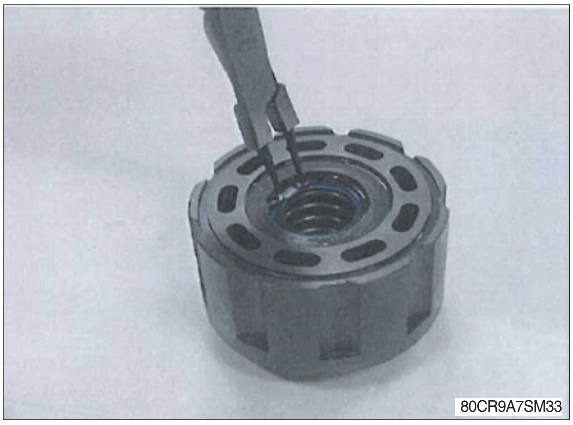


80CR9A7SM32-1

(6) Place the retainer (212), spring C (214) and retainer (212) in that order into the cylinder barrel (204), and then secure them with the snap ring (221).
  · Tools required :
  Snap ring plier : ø 28 for hole



80CR9A7SM11-1

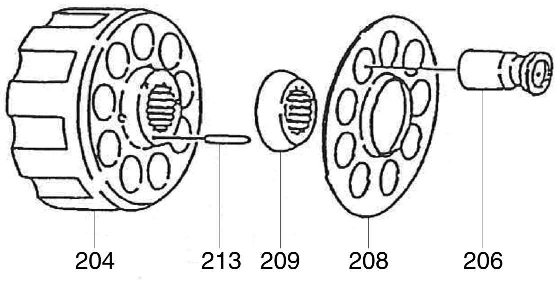


80CR9A7SM33

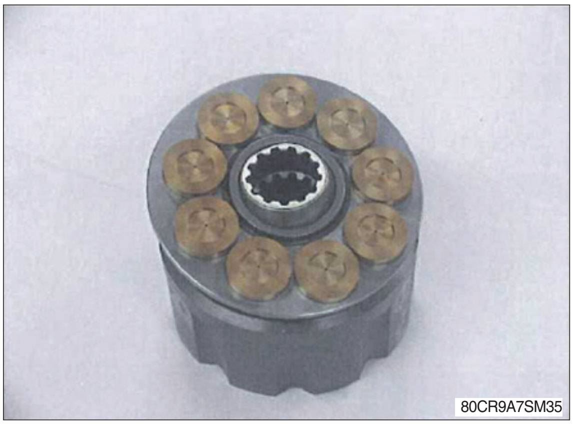
(7) Make the shoe holder assembly which has the 9 piston assemblies (206) placed on the shoe holder (208).

80CR9A7SM34

(8) Place the 3 pins (213), barrel holder (209) and the shoe holder assembly onto the cylinder barrel (204) to make up a cylinder barrel assembly.



80CR9A7SM10



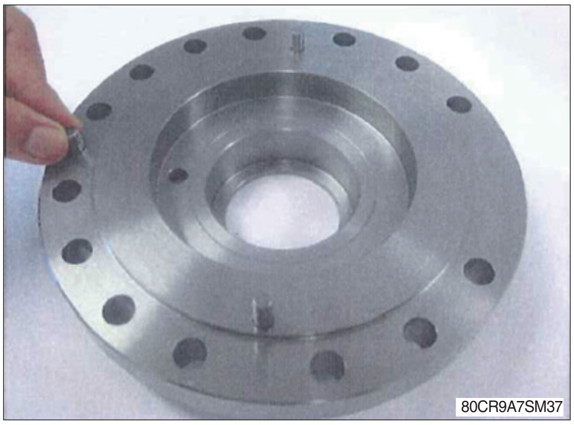
80CR9A7SM35

(9) Insert cylinder barrel assembly along ditch of disk plate into body H (201).

80CR9A7SM36

(10) Place the parallel pins (222) into the plate S (202).

· Parallel pin (222) : 3 pcs



80CR9A7SM37

(11) Insert the spring B (218) into the brake piston (217).

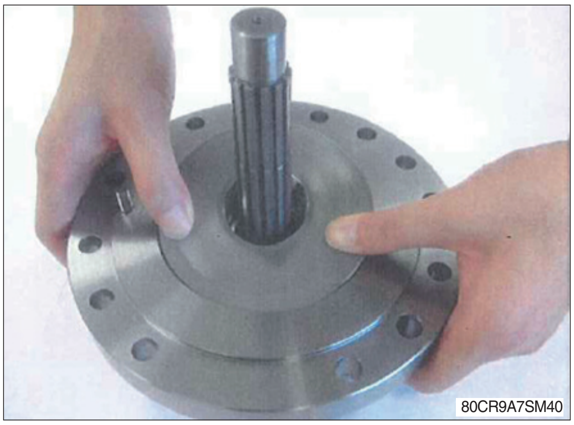
· Spring B (218) : 20 pcs

80CR9A7SM38

(12) Press-fit bearing (219) with shaft (203).

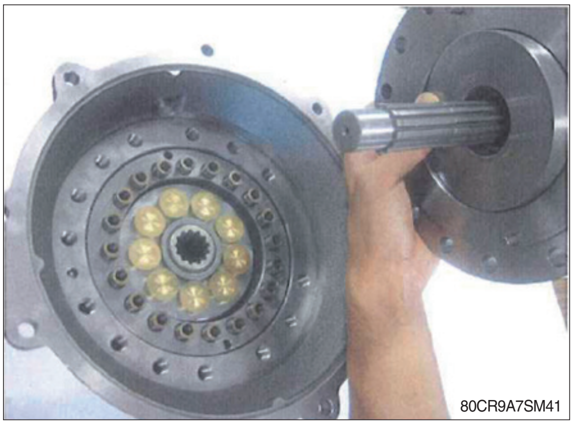
80CR9A7SM39

(13) Place the shaft kit and the swash plate (210) into the plate S (202).



80CR9A7SM40

(14) Join the body H (201) and the plate S (202).

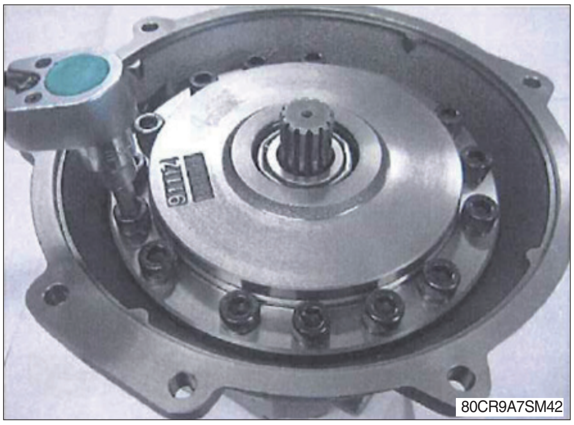


80CR9A7SM41

(15) Bolt the plate S (202) together with the 14 hexagon socket head cap bolts (224).

· Tools required :
Hexagon bar wrench : 8 mm
Torque wrench

· Bolt tightening torque :
6 ± 0.3 kgf · m (43.4 ± 2.17 lbf · ft)

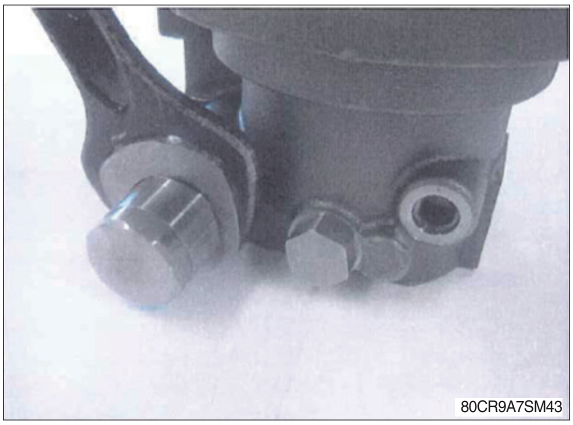


80CR9A7SM42

(16) Screw up the relief valve assembly. (both side)

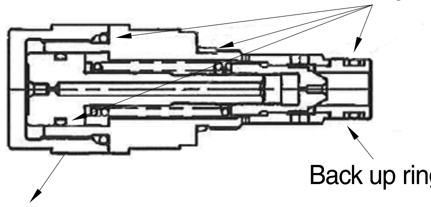
· Tools required :
Spanner : 41 mm
Torque wrench

· Plug tightening torque :
22.5±2.5 kgf · m (163±18.1 lbf · ft)



80CR9A7SM43

※ Once the relief valve is disassembled, replace the O-ring and the back up ring in the below, and screw the cap with the following torque.

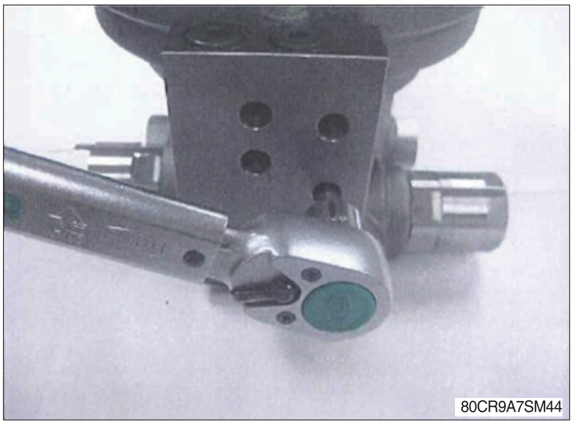


80CR9A7SM43-1

(17) Screw up the timer valve.

· Tools required :
Hexagon bar wrench : 5 mm
Torque wrench

· Plug tightening torque :
1.2±0.1 kgf · m (8.7±0.72 lbf · ft)



80CR9A7SM44

2) REDUCTION GEAR SECTION

(1) Place the ring (110) (1 pc/pin) and the thrust washer (117) (1 pc/pin) in that order onto the pins of the carrier 1 (102). (4 locations)

80CR9A7SM45

(2) Place the b1 gear (106) (1 pc/pin) and the 92 needles 1 (112) (24 pcs/pin) in that order onto the 4 pins of the carrier 1 (102). (4 locations)

80CR9A7SM46

(3) Place the thrust plate (116) and the 4 snap rings (128) (1 pc/pin) to make up a carrier 1 kit.

· Tools required :

Snap ring plier : ø 30 for shaft

※ Pay attention to the direction of the snap ring. The edge side should be uppermost. Pay attention not to open the snap ring too much.

The snap ring which was opened too much should lose tension and be replaced.

80CR9A7SM47

(4) Place the thrust washer (117) (1 pc/pin) and the ring 2 (111) (1 pc/pin) in that order onto the pin of the carrier 2 (103). (3 locations)


80CR9A7SM48

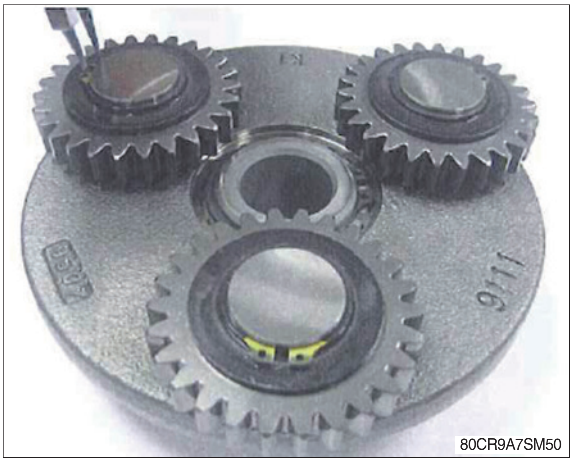
(5) Place the S1 gear (108) onto the carrer 2 (103) to make up a carrier 2 kit.
· Tools required :
Snap ring plier : ø 48 for shaft

※ Pay attention to the direction of the snap ring. The edge side should be uppermost.
Pay attention not to open the snap ring too much.
The snap ring which was opened too much should lose tension and be replaced.

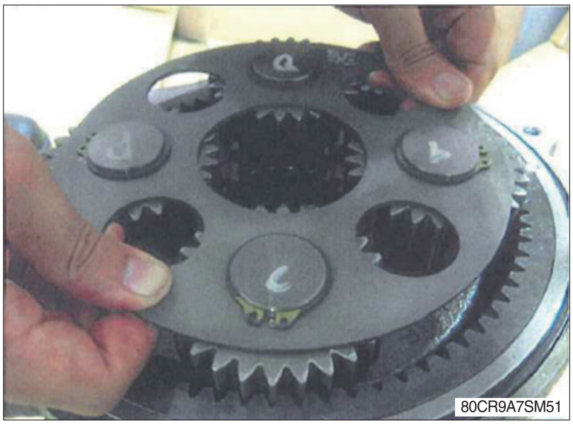

80CR9A7SM49

(6) Place the b2 gears (107) (1 pc/pin), the 72 needle (113) (24 pcs/pin), and the snap ring (128) in that order onto the pin of the carrier 2 (103). (3 locations)
· Tools required :
Snap ring plier : ø 30 for shaft

※ Pay attention to the direction of the snap ring. The edge side should be uppermost.
Pay attention not to open the snap ring too much.
The snap ring which was opened too much should lose tension and be replaced.

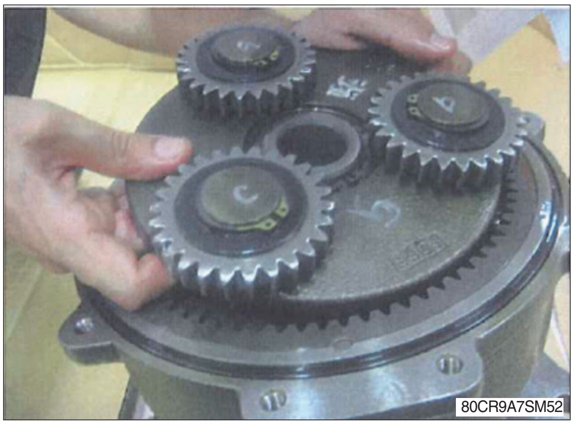

80CR9A7SM50

(7) Place the carrier 1 assembly into the body (101) align spline of carrier to the pinion shaft (104).



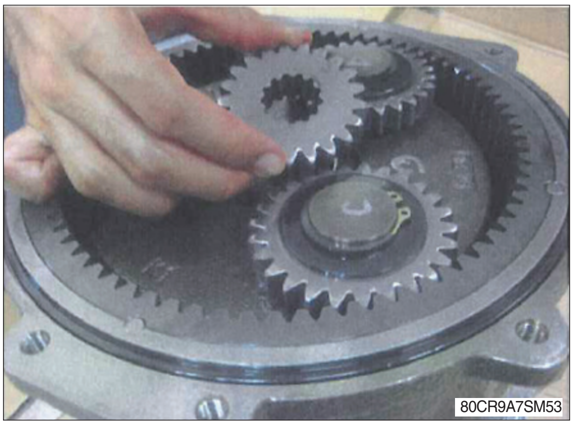
80CR9A7SM51

(8) Place the carrier 2 assembly into the body (101) align spline of S1 gear (108) to the b1 gear (106).



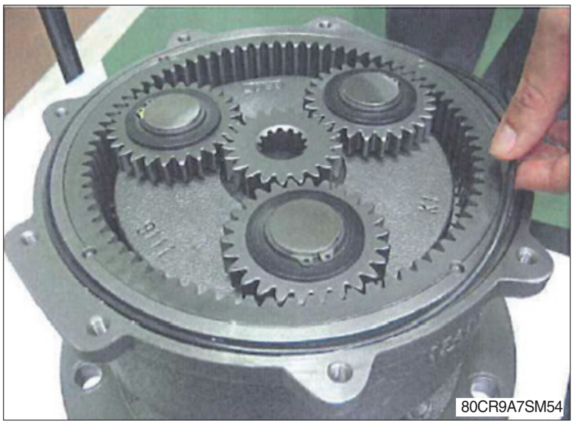
80CR9A7SM52

(9) Place the S2 gear (109) into the carrier 2 assembly.



80CR9A7SM53

(10) Place the O-ring (115) onto the body (101).



80CR9A7SM54

(11) Fill body (101) with hydraulic oil.

※ Oil : ISO VG 46 or equivalent
Oil amount : 2 to 3 mm below top of the B2 gear.
Wipe oil off flange surface if it is spilled.

(12) Join the hydraulic motor and the body, and then bolt them together with the hexagon socket head cap bolts (124).

· Tools required :
Hexagon bar wrench : 6 mm
Torque wrench

※ Align the shaft of the motor to the S2 gear.
Apply anti-loose adhesive to the screws.

· Plug tightening torque :
3±0.3 kgf · m (21.7±2.17 lbf · ft)

GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

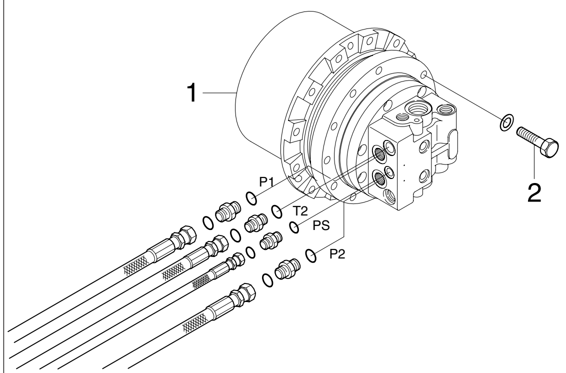
(1) Swing the work equipment 90° and lower it completely to the ground.

(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.**



555K7TM01

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hose.

※ **Fit blind plugs to the disconnected hoses.**

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly(1).

(9) Remove the mounting bolts(2), then remove the travel device assembly.
· Weight : 85 kg (190 lb)

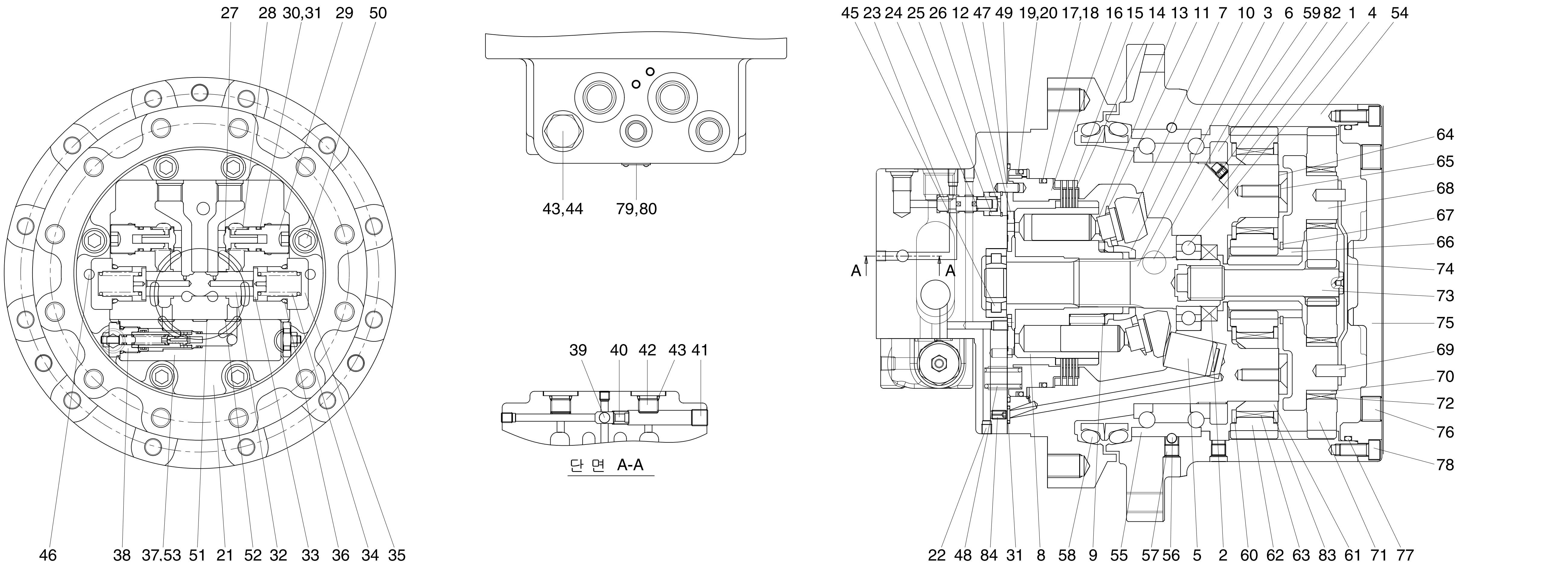
2) INSTALL

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

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

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

2) STRUCTURE



80CR92TM03

1	Shaft casing	15	Parking plate	29	Plug	43	O-ring	58	Floating seal	72	Needle bearing
2	Oil seal	16	Parking piston	30	O-ring	44	Plug	59	Nut	73	Drive gear
3	Shaft	17	O-ring	31	Back up ring	45	Ball bearing	60	Washer	74	Thrust plate
4	Bearing	18	Back up ring	32	Main spool	46	Parallel pin	61	Collar	75	Ring gear cover
5	Swash piston	19	O-ring	33	Spring seat	47	Parallel pin	62	Planetary gear	76	Plug
6	Swash steel ball	20	Back up ring	34	Spring	48	Spring	63	Needle bearing	77	O-ring
7	Swash plate	21	Rear cover	35	Plug	50	Wrench bolt	64	Plate	78	Wrench bolt
8	Cylinder block	22	Plug	36	O-ring	51	O-ring	65	Bolt	79	Name plate
9	Spring	23	Spool	37	Relief valve assy	52	O-ring	66	Sun gear	80	Rivet
10	Ball guide	24	Spring	38	Relief valve assy	53	Wrench bolt	67	Snap ring	82	Set screw
11	Set plate	25	Stopper	39	Steel ball	54	Ring gear	68	Carrier	83	Washer
12	Valve plate	26	Snap ring	40	Check seat	55	Angular bearing	69	Spring pin	84	Plug
13	Piston	27	Check	41	Plug	56	Steel ball	70	Collar		
14	Friction plate	28	Spring	42	Plug	57	Plug	71	Planetary gear		

3) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name of tools	Size	Name of applied parts
Hexagonal L-wrench	2.5	Orifice (84)
	4	Plug (22)
	6	Plug (41), wrench bolt (65, 78)
	8	Plug (76)
	-	Plug (29, 42, 44)
Socket wrench / spanner	27	Plug (35), Relief valve assembly (38)
Snap-ring plier (for holes, axis)		Snap ring (26, 67)
Solder hammer		Bearing (4), Pin (46, 47), Oil seal (2)
Torque wrench		Size : 500, 3000
Jig for assembling oil seal		Oil seal (2)
Induction heating apparatus for bearing		Bearing (4)

(2) Tightening torque

No.	Name	Size	Torque
			kgf · m
22	Plug	NPT 1/16	0.7~1.1
29	Plug	M24	5
41	Plug	PT 1/4	5
50	Wrench bolt	M12×35L	10
76	Plug	PT 3/8	8.5
65, 78	Wrench bolt	M8×20L	10

2. DISASSEMBLY

1) GENERAL PRECAUTIONS

(1) Select a clean place for disassembling.
Spread a rubber plate on a working table in order to prohibit the damage of parts.

(2) Clean a deceleration equipment and a motor part, washing out dirt and unnecessary substances.

(3) Without any damage of O-ring, oil seal, the adhered surface of other seals, a gear, a pin, the adhered surface of other bearings, and the surface of moisturized copper, treat each parts.

(4) Numbers written in the parenthesis, ( ), next to the name of a part represent the part numbers of a previous page.

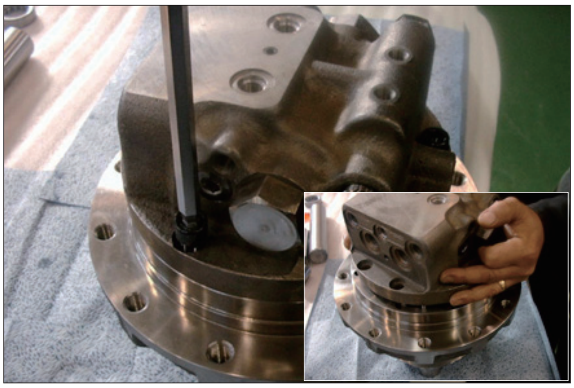
(5) The side of a pipe in a motor can be written as a rear side ; the side of out-put as a front side.

(6) In case of bonding bolts, combine a standard torque by torque wrench after spraying loctite 262 on the tab parts. (It can be dealt as assembling NPTF screws and an acceleration equipment.)

2) DISASSEMBLING

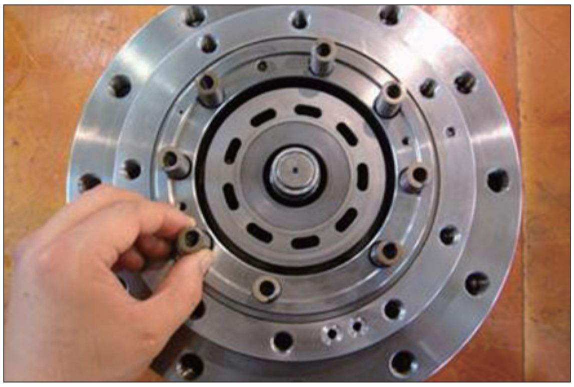
(1) Motor unit

① Put the motor assembly on the assemble table.
Using L-Wrench, disassemble wrench bolt (50)-8EA and so respectively disassemble shaft casing assembly and rear cover assembly.



7078TM01/01A

② Disassemble spring (48)-8EA From shaft casing (1).

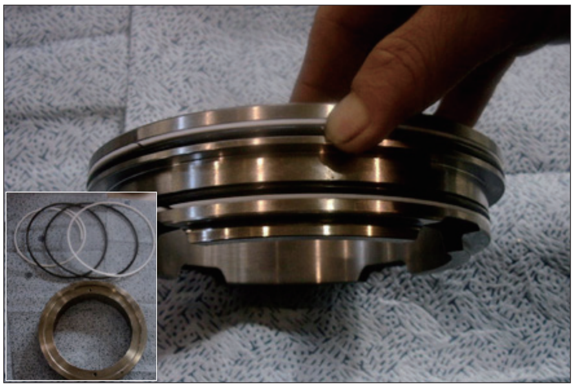


7078TM02

③ Using jig, disassemble parking piston (16) from shaft casing (1).

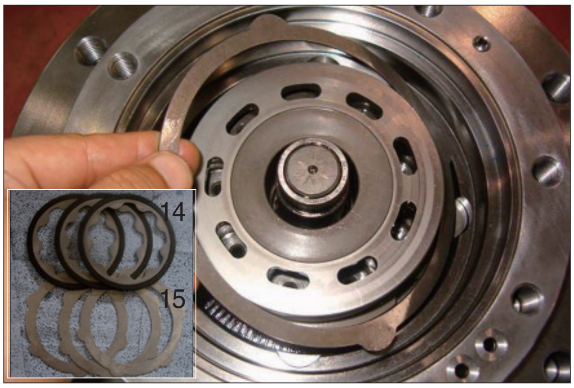
7078TM03

④ Disassemble O-ring (17, 19) and back up ring (18, 20) from parking piston (16)



7078TM04/04A

⑤ Respectively in order friction plate (14), parking plate (15) disassemble from shaft casing (1).



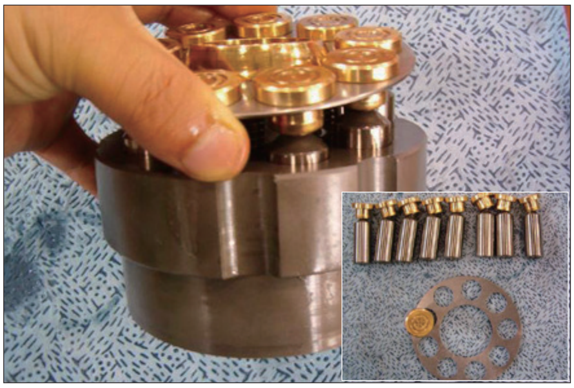
7078TM05/05A

⑥ Disassemble cylinder block assembly (8) from shaft casing (1).

7078TM06

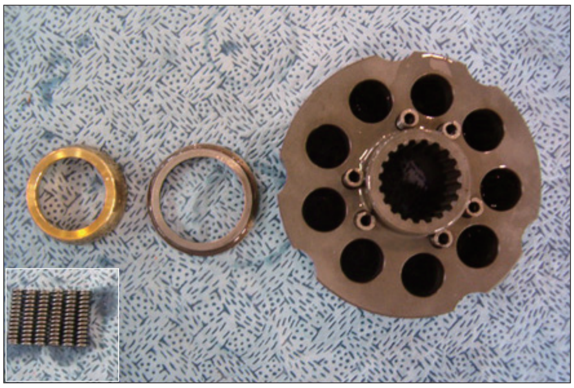
(2) Cylinder block

① Disassemble set plate (11), piston assembly (13) from cylinder block assembly.



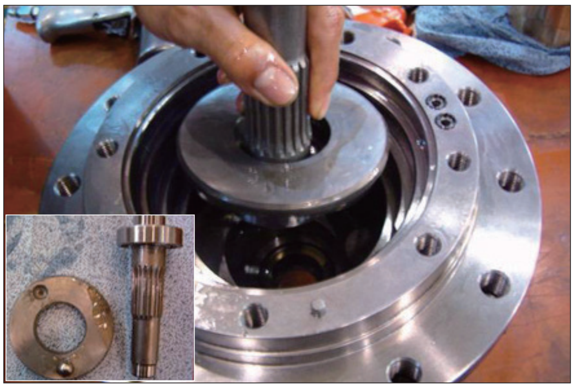
7078TM07/07A

② Disassembling in order cylinder block (8), ball guide (10) and spring (9).



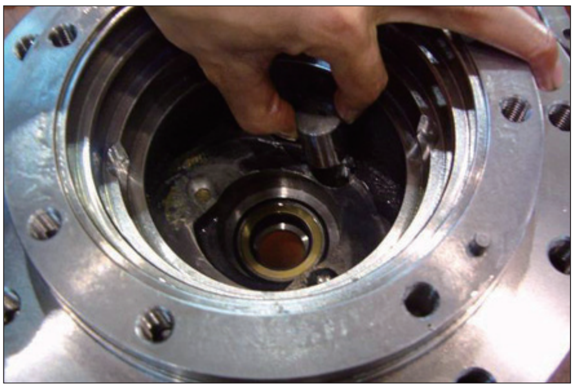
7078TM08/08A

③ Disassembling swash plate (7) and shaft (3) from shaft casing (1).



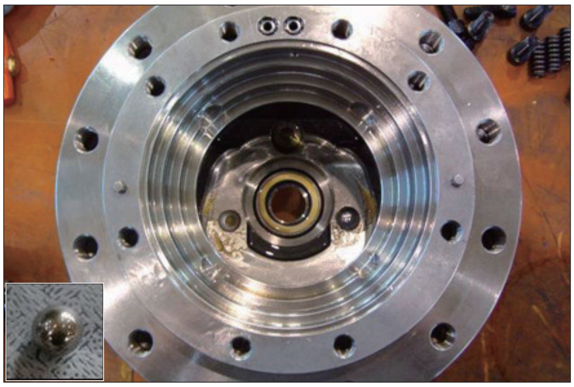
7078TM09/09A

④ Disassembling swash piston (5) from shaft casing (1).



7078TM10

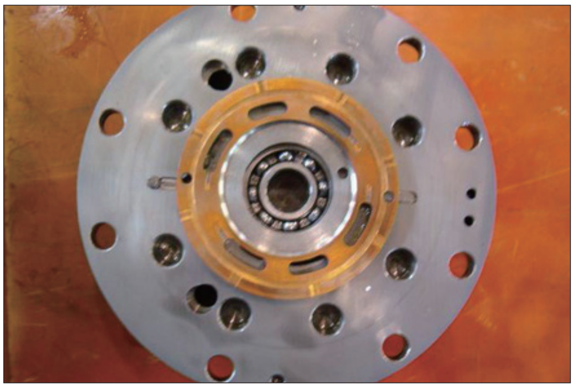
⑤ Disassembling steel ball (6) from shaft casing (1).



7078TM11/11A

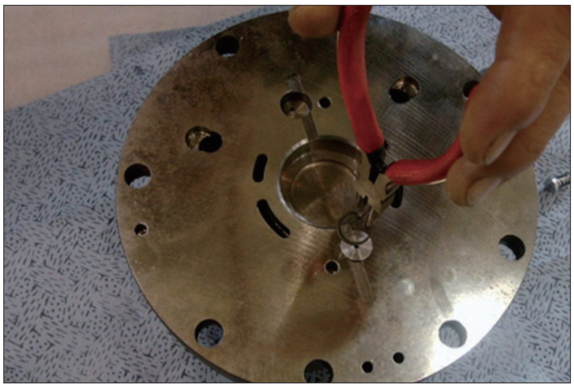
(3) Rear cover

① Disassembling valve plate (12) from rear cover (21).



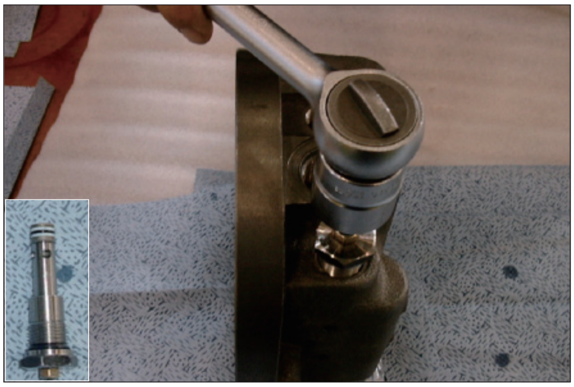
7078TM12

② Using plier jig, disassembling in order snap ring (26), stopper (25), spring (24), spool (23) from rear cover (21).



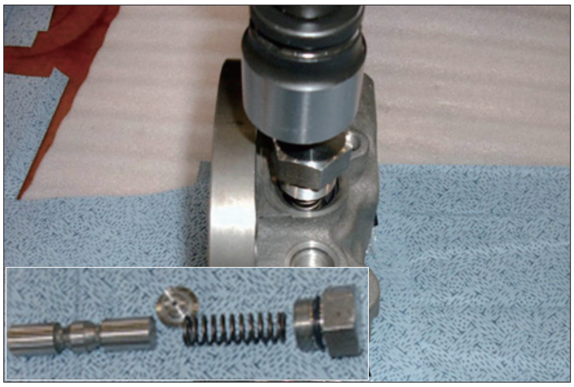
7078TM13

③ Using L-wrench, disassembling relief valve assembly (38) from rear cover (21).



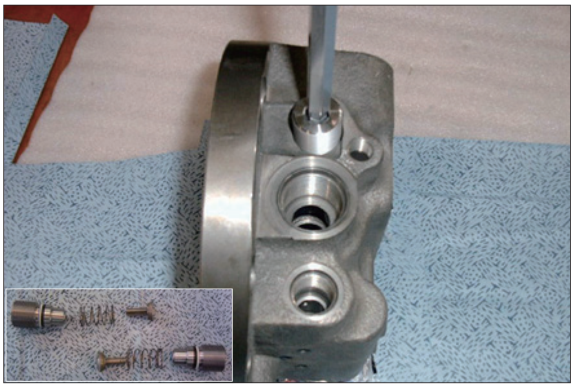
555K7TM14/14A

④ Using torque wrench, disassembling plug (35) in order O-ring (36), spring 34), spring seat (33), main spool (32) from rear cover (21).



7078TM15/15A

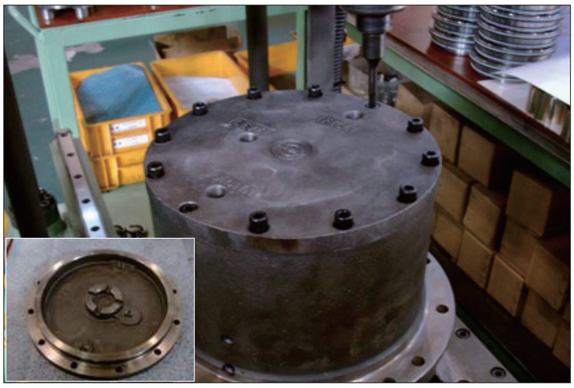
⑤ Using L-wrench, disassembling plug (29) in order O-ring (30), back up ring (31), spring (28) and check (27) from rear cover (21).



7078TM16/16A

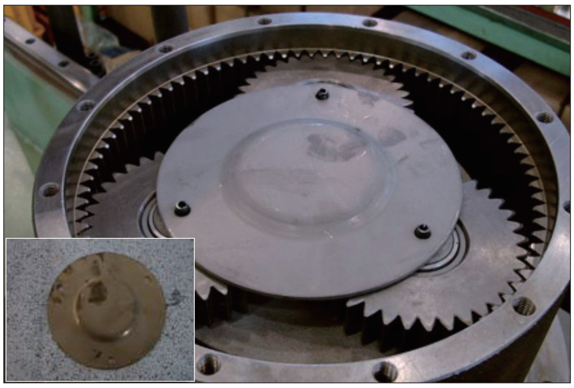
(4) Reduction gear

① Using L-wrench, disassembling wrench bolt (78) and then ring gear cover (75), O-ring (77) from ring gear (54).



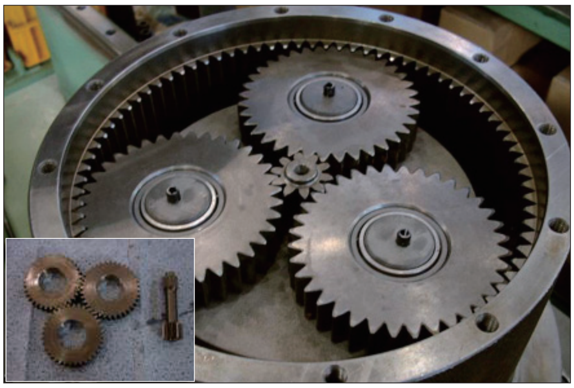
7078TM17/17A

② Disassembling thrust plate (74) from ring gear (54).



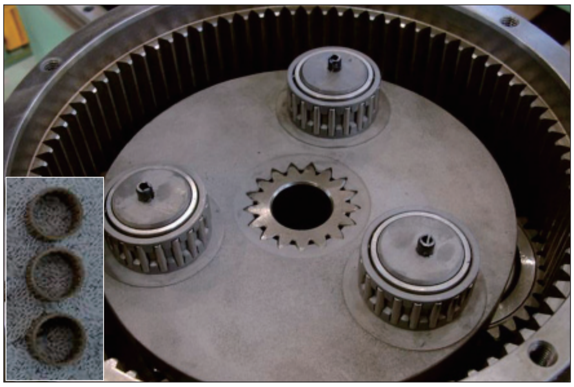
7078TM18/18A

③ Disassembling in order planetary gear (71), drive gear (73) from ring gear (54).



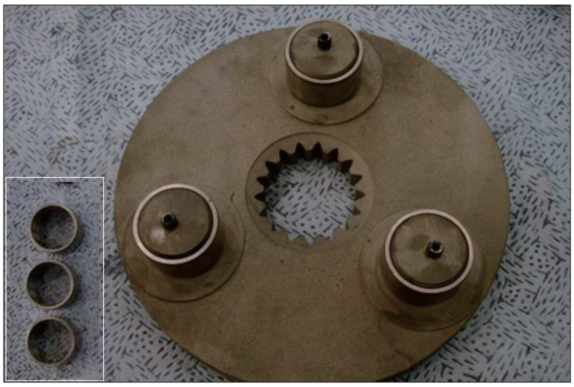
7078TM19/19A

④ Disassembling needle bearing (72) from ring gear (54).



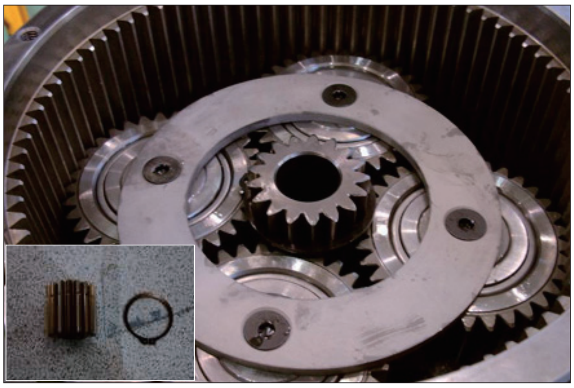
7078TM20/20A

⑤ Disassembling in order collar (70), carrier (68) from ring gear (54).



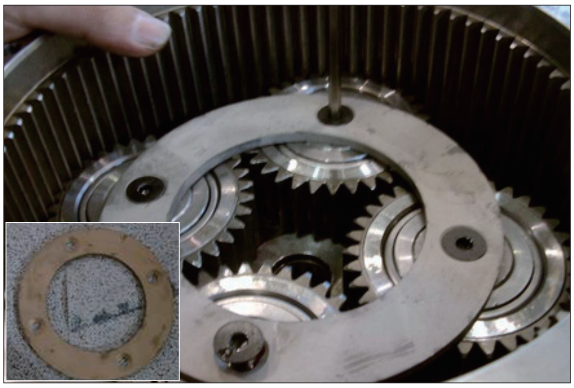
7078TM21/21A

⑥ Disassembling sun gear (66) from ring gear (54) and then disassembling snap ring (67) with plier jig.



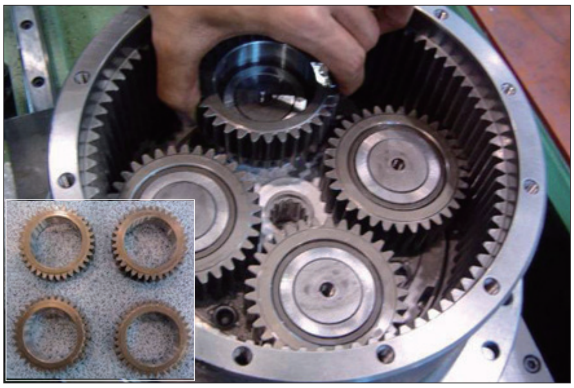
7078TM22/22A

⑦ Using L-wrench, disassembling plate head bolt (65)-4EA from ring gear (54) and then disassembling plate (64).



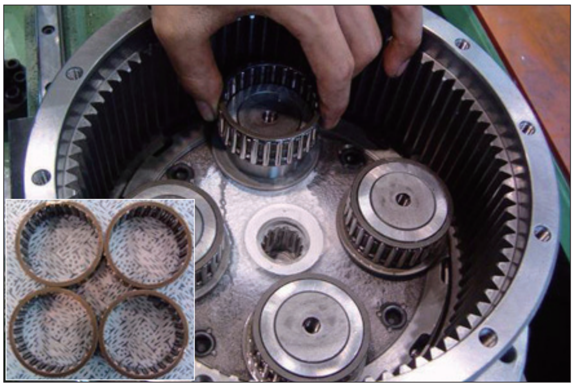
7078TM23/23A

⑧ Disassembling planetary gear (62)-4EA from ring gear (54).



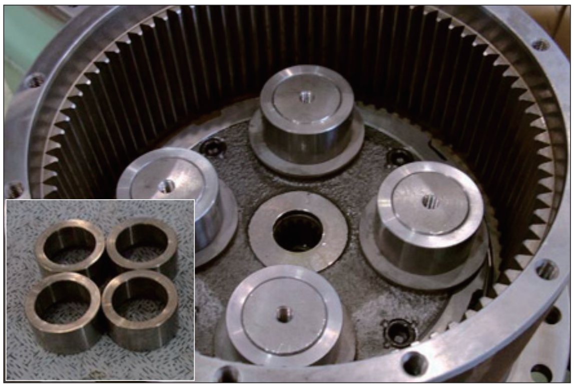
7078TM24/24A

⑨ Disassembling needle bearing (63)-4EA from ring gear (54).



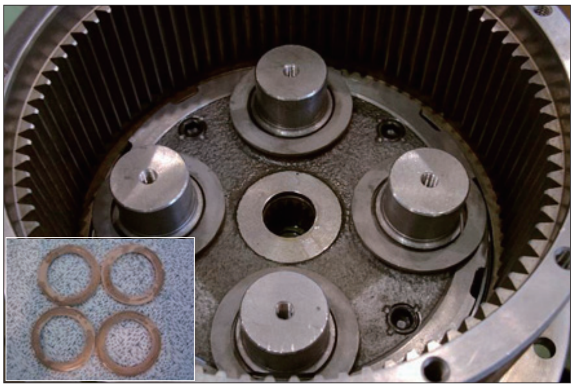
7078TM25/25A

⑩ Disassembling collar (61)-4EA from ring gear (54).



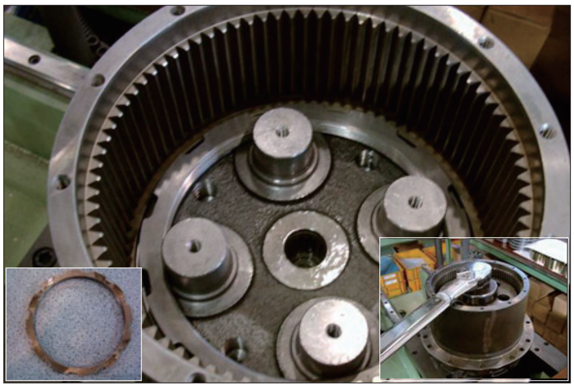
7078TM26/26A

⑪ Disassembling washer (60)-4EA from ring gear (54).



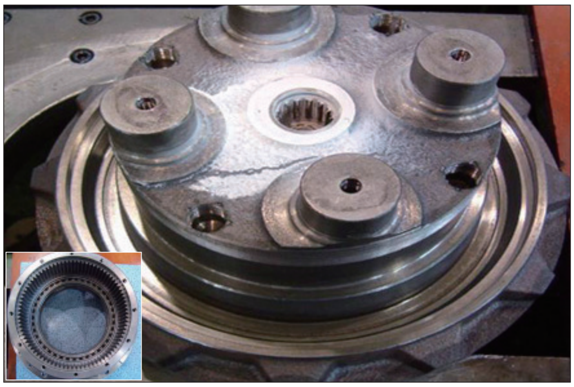
7078TM27/27A

⑫ Using jig, disassembling nut (59) when inner pressed state with L-wrench bolt from ring gear (54).



7078TM28/28A/B

⑬ Put the reduction gear on the assembling jig and then disassembling ring gear (54).



7078TM29/29A

3. ASSEMBLY

1) GENERAL SUGGESTIONS

(1) After washing each parts cleanly, dry it with compressed air.
Provided that you do not wash friction plate with treated oil.

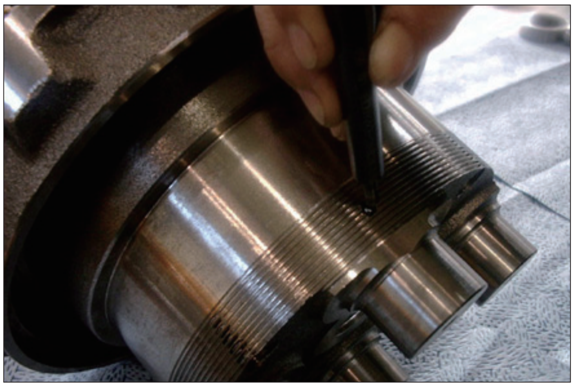
(2) In bonding each part, fasten bond torque.

(3) When using a hammer, do not forget to use a plastic hammer.

2) ASSEMBLING

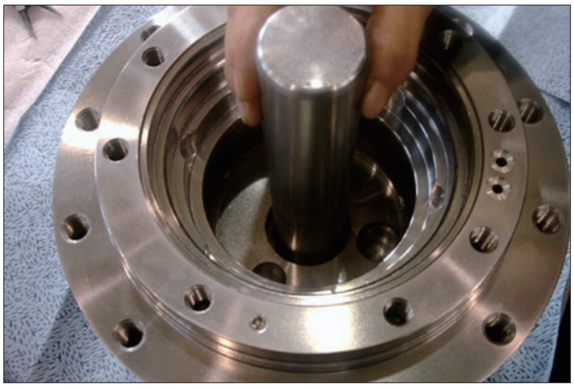
(1) Sub of turning axis

① Using a jig, insert the steel ball (56) to the shaft casing (1) and then assemble plug (57).



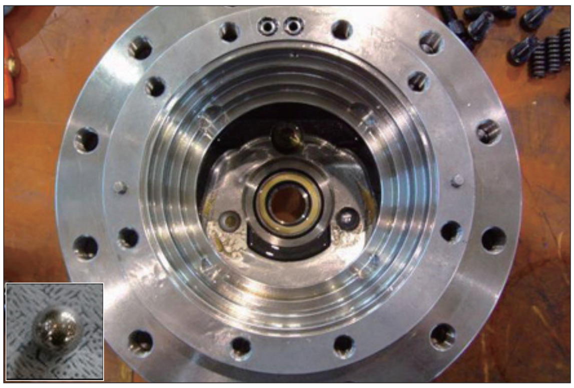
7078TM51

② Using a jig, assemble oil seal (2) to the shaft casing (1) and then inserting with solid hammer.



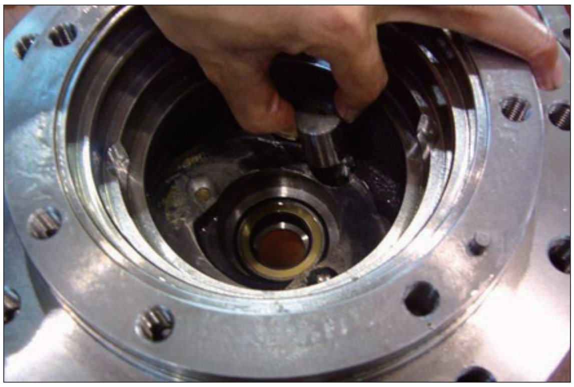
7078TM52

③ Assemble swash steel ball (6) to the shaft casing (1) with grease.

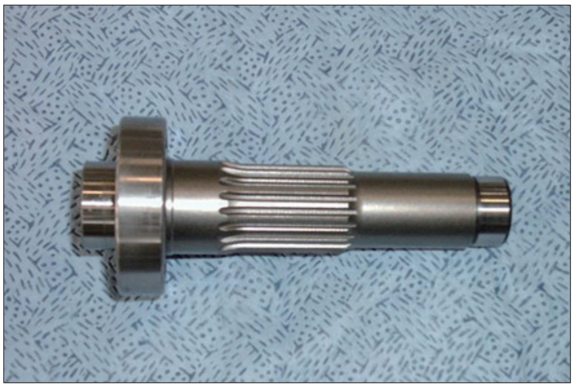


7078TM53/11A

④ Assemble swash piston (5) to the shaft casing (1).


7078TM54

⑤ Heat pressing bearing to the shaft (3).

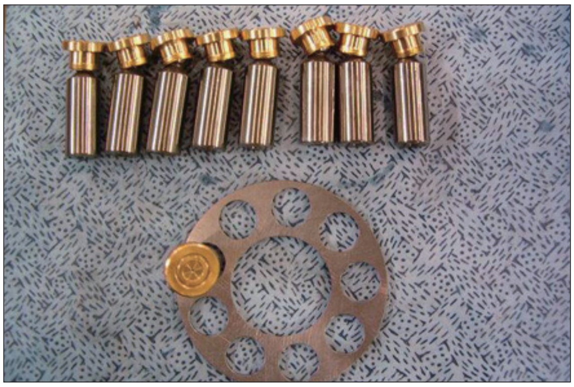

7078TM55

⑥ Assemble bearing and heat pressed shaft (3) to the shaft casing (1).

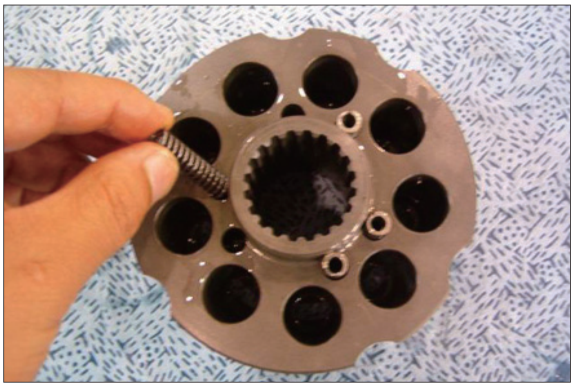

7078TM56

(2) Cylinder block sub assembly

① Assemble piston assembly (13) to the set plate (11, 9 set).

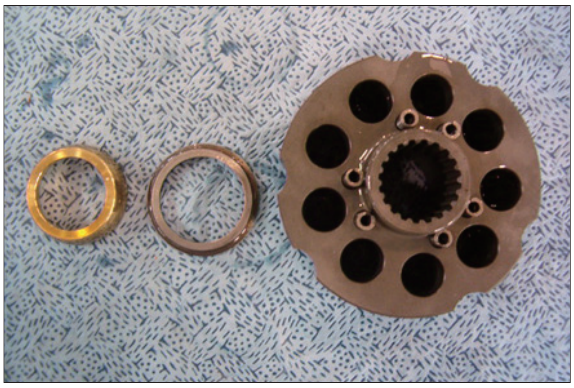

7078TM57

② Assemble spring (9) to the cylinder block (8, 6 set).



7078TM58

③ Assemble ball guide (10) to the cylinder block (8).



7078TM08/08A

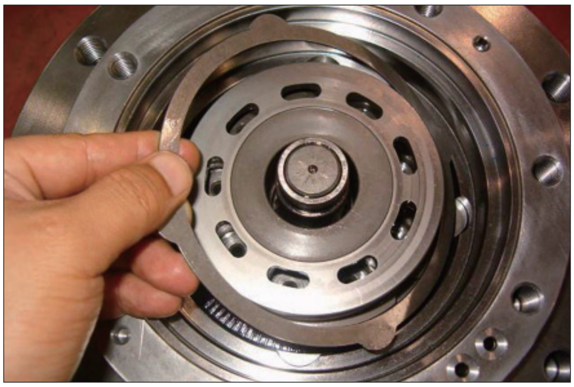
④ Assemble sub-assembled piston (11, 13) to the cylinder block (8).

7078TM60

⑤ Assemble cylinder block (8) to the shaft casing (1).

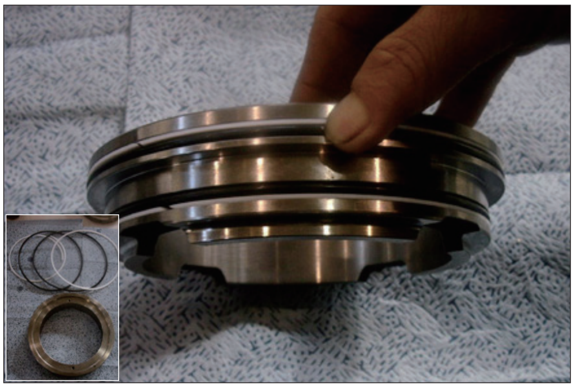
7078TM06

⑥ Assembling friction plate (14), parking plate (15) (respectively 3EA assembling) to the shaft casing (1).



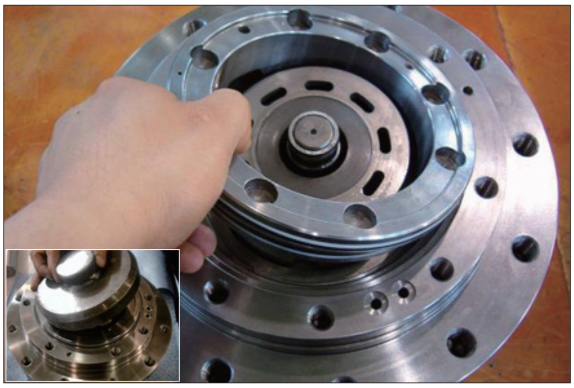
7078TM05

⑦ Assembling back up ring (18), O-ring (17, 19), back up ring (20) to the parking piston (16).



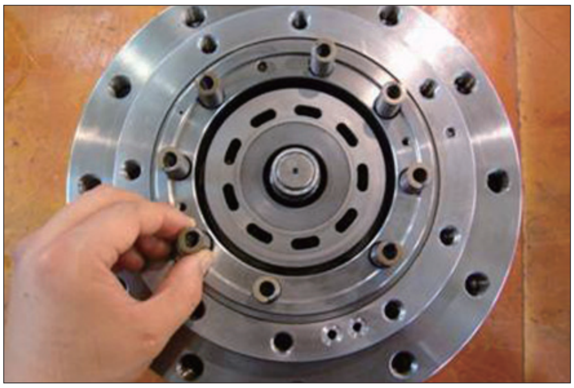
7078TM04/04A

⑧ Using a jig, insert the parking piston to the shaft casing (1) and assemble.



7078TM64/64A

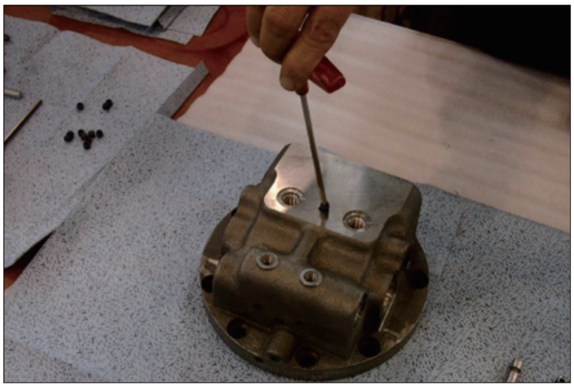
⑨ Assemble spring (48) to the shaft casing (1) and then assemble O-ring (49).



7078TM02

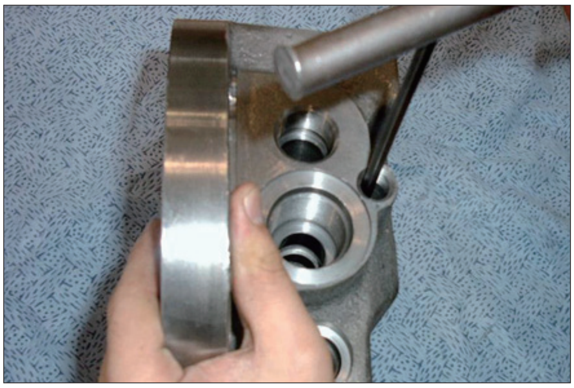
(3) Rear cover assembly

① Using a L-Wrench, assemble plug (22) 10EA to the rear cover (21).



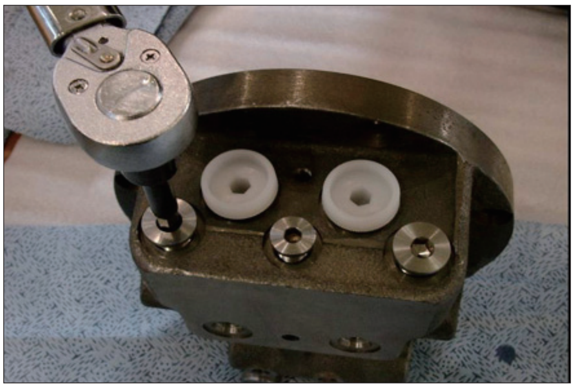
7078TM66

② Assemble in order steel ball (39), check-seat (40) and plug (41) to the rear cover (21).



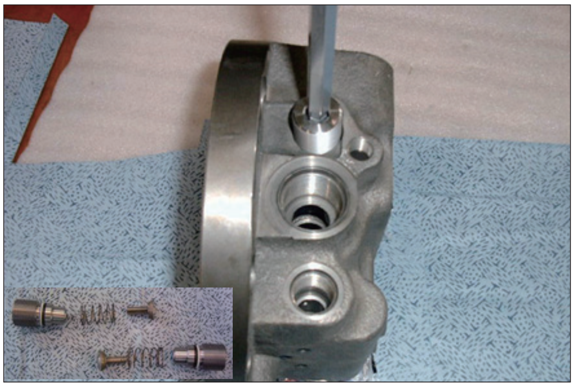
7078TM67

③ Assemble plug (42, 44), O-ring (43) to the rear cover (21).



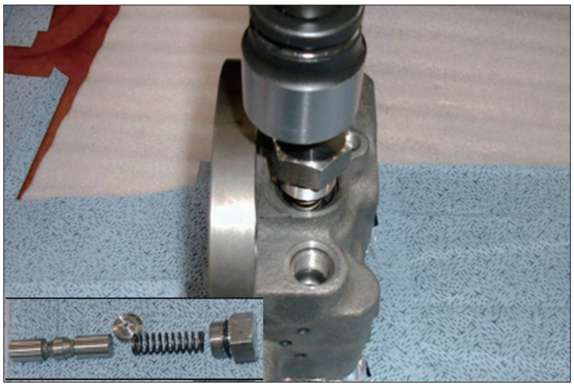
7078TM68

④ Assemble check (27), spring (28) to rear cover (21) and assemble back up ring (31), O-ring (30) to the plug (29) after then using L-Wrench.



7078TM16/16A

⑤ Insert main spool (32), spring-seat (33), spring (34) to the rear cover (21) and assemble plug (35) with L-wrench.

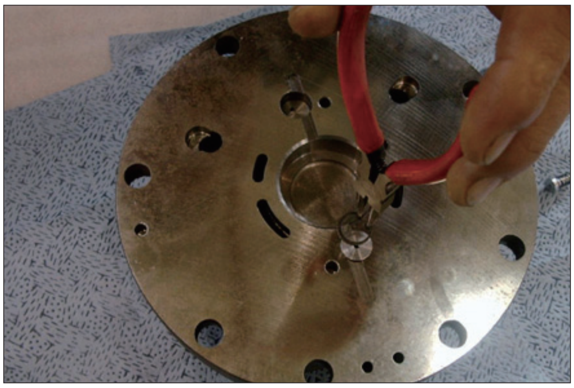


7078TM15/15A

⑥ Assemble relief valve assembly (38) (with left-right symmetry) to the rear cover (21) and then tighten with a torque wrench.

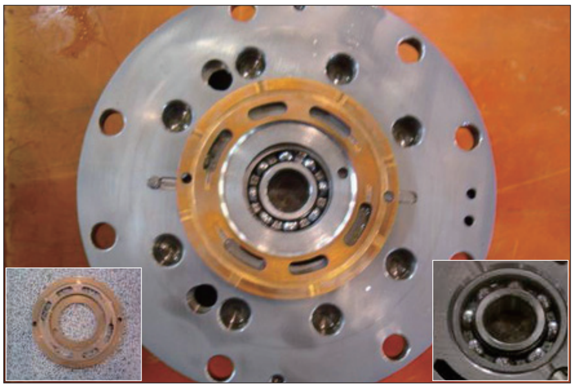
7078TM71

⑦ Using a plier jig, assemble snap ring (26), stopper (25), spring (24), spool (23) to the rear cover.



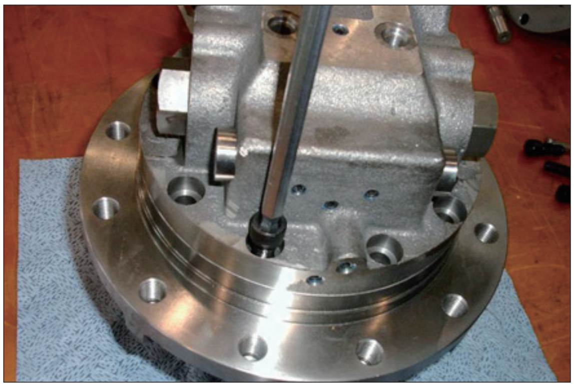
7078TM13

⑧ Assemble roller bearing (45), pin (46) and valve plate (12) to the rear cover (21).



7078TM12/73/73A

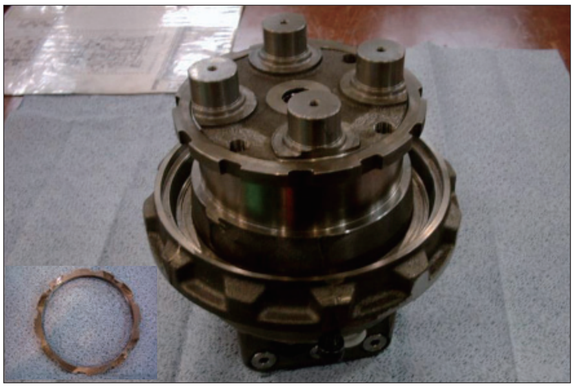
⑨ Combine rear cover assembly and shaft casing assembly with bolt (50).



7078TM74

(4) Travel reduction gear

① Before assembling nut (59) to the motor. Eliminate burr and alien substances ready for assembling.

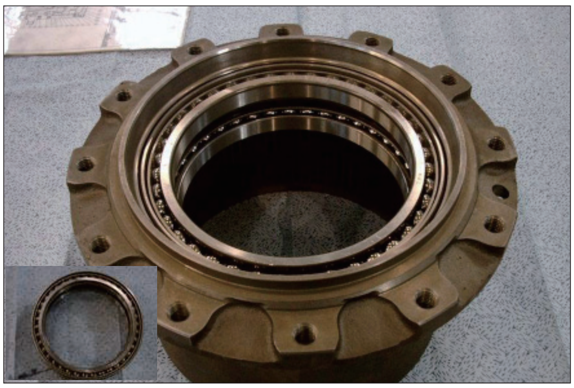


7078TM77/28A

② Insert ring gear (54) to the spray washing M/C and heat 69˚C ~70˚C one minute.

7078TM78

③ Assembling angular bearing (55) to the ring gear (54).

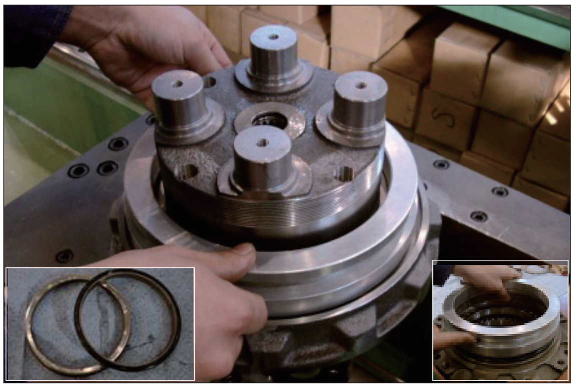


7078TM79/79A

④ Insert steel ball (56) 105EA to the ring gear (54) with a jig after assembling plug (57) 2EA with L-Wrench.

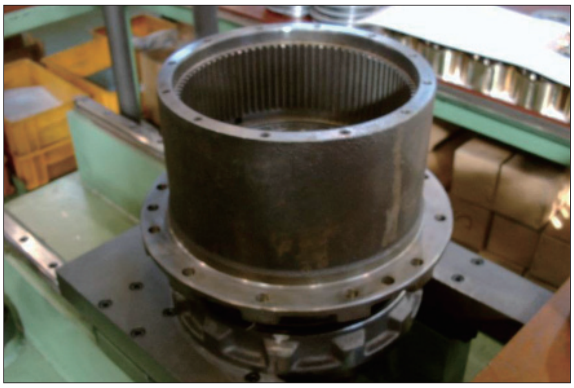
7078TM80/80A

⑤ Assemble floating seal (58) to ring gear (54) and motor part with a jig.



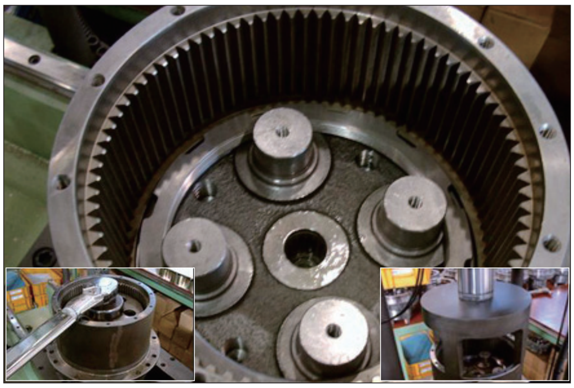
7078TM81/81A/82

⑥ Upset the ring gear (54) and assemble with motor.



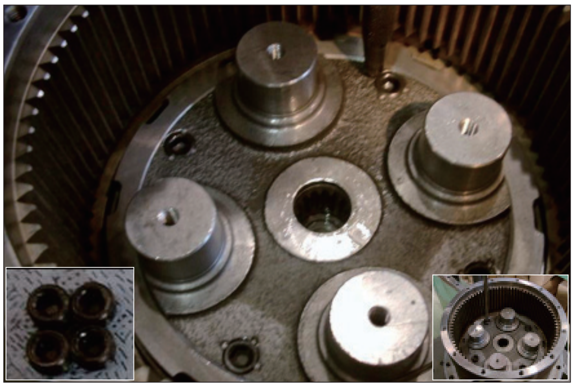
7078TM83

⑦ Combine nut (59) to the ring gear (54) and pressing use a jig and then assembling with torque-wrench.



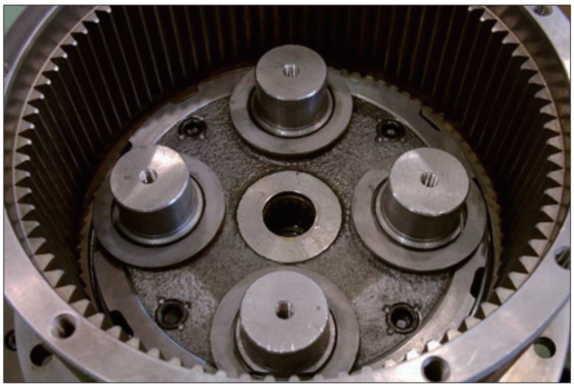
7078TM28/28B/28C

⑧ Using a L-wrench, assembling plug-4EA to the ring gear (54) and then cocking by a jig.



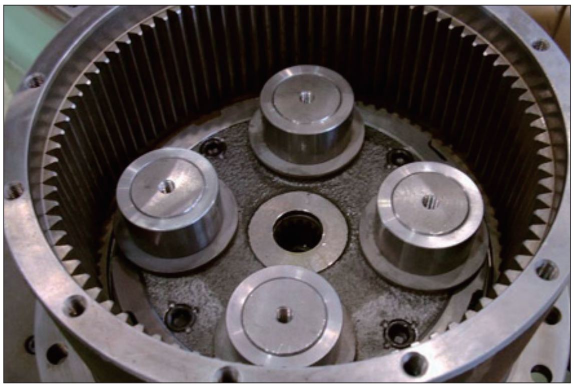
7078TM84/84A/85

⑨ Assemble washer (60)-4EA the ring gear (54).



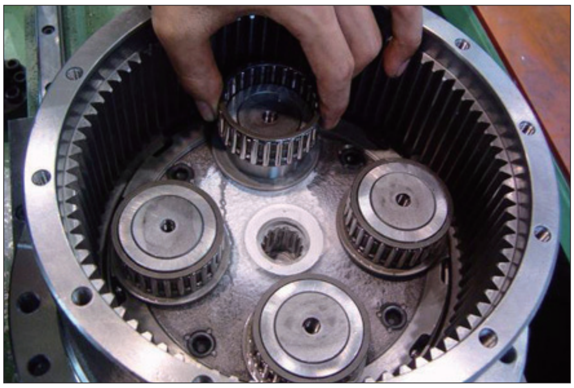
7078TM27

⑩ Assemble collar (61)-4EA to the ring gear (54).



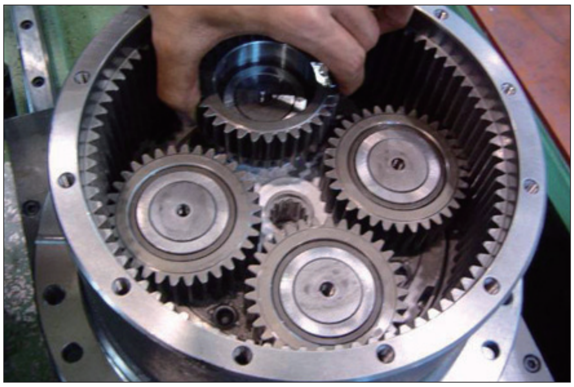
7078TM26

⑪ Assemble needle bearing (63)-4EA to the ring gear (54).



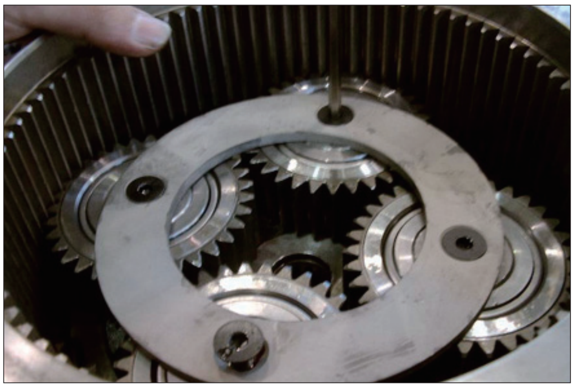
7078TM25

⑫ Assemble planetary gear (62)-4EA to the ring gear (54).



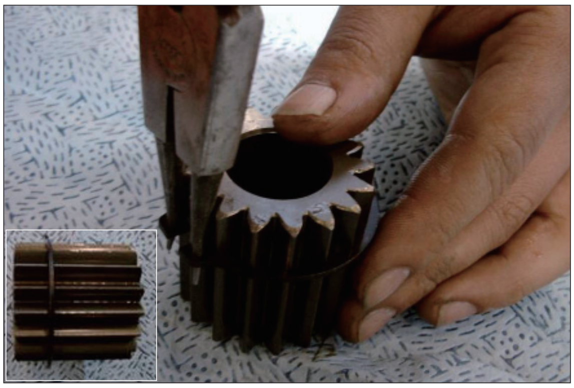
7078TM24

⑬ Assemble plate (64)-1EA to the ring gear (54) and then combine plate head bolt (65)-4EA with L-wrench.
(after paste loctite and then combine the plate head bolt).



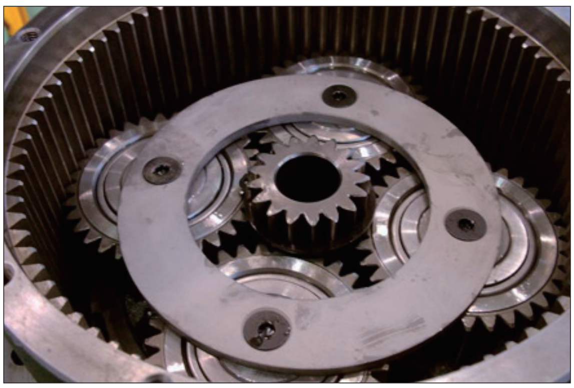
7078TM23

⑭ Assembling snap ring (67) to the sun gear (66) with a plier jig.



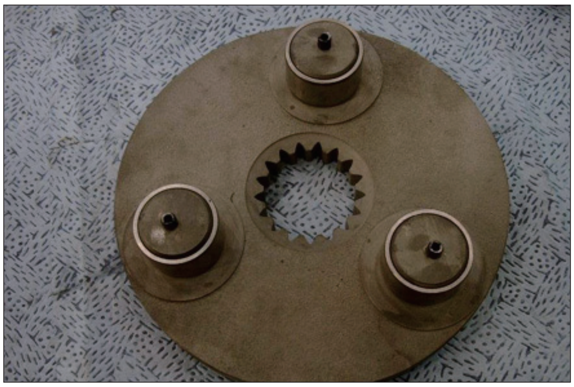
7078TM86/86A

⑮ Assemble sun gear with snap ring assembly to the ring gear (54).



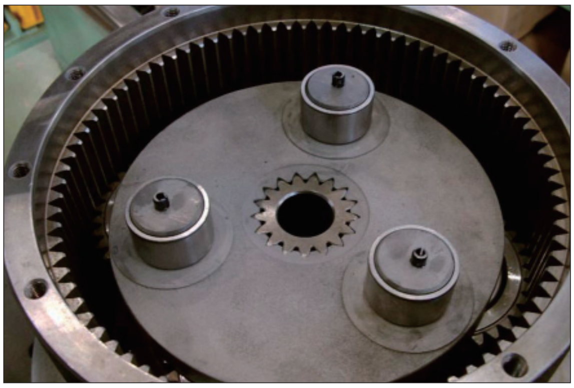
7078TM22

⑯ Assemble in order collar (70), spring pin (69) to the carrier (68).



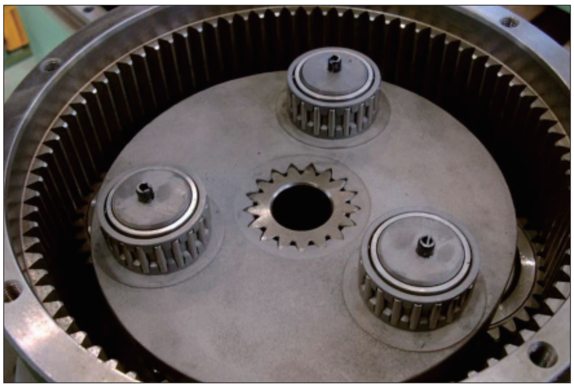
7078TM21

⑰ Assemble carrier sub assembly to the ring gear (54).



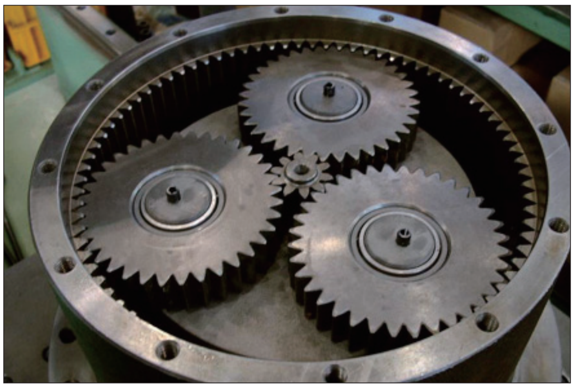
7078TM87

⑱ Assemble needle bearing (72)-3EA to the ring gear (54).



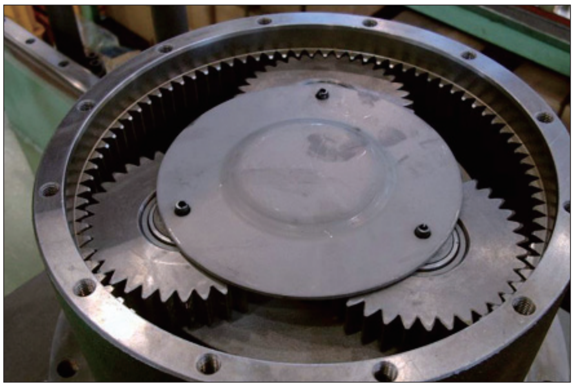
7078TM20

⑲ Assemble in order planetary gear (71), drive gear (73) to the ring gear (54).



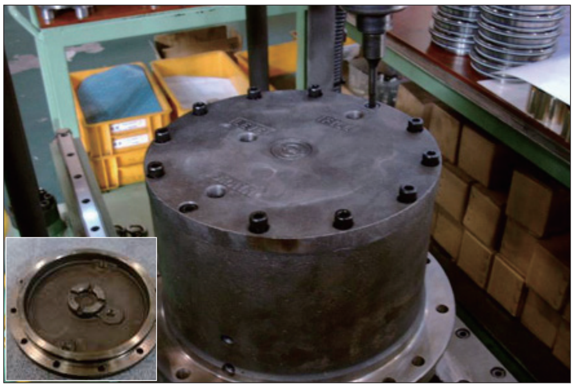
7078TM19

⑳ Assemble thrust plate (74) to the ring gear (54).



7078TM18

㉑ Assemble in order ring gear cover (75) with O-ring (77) and then assemble wrench bolt (78) with torque-wrench.



7078TM17/17A

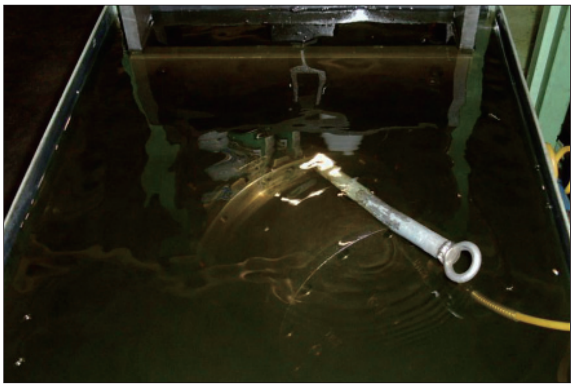
㉒ Roll the tarpon tape to the ring gear (54) and then combine with L-wrench(after test of drain part water pressure and capacity and then assemble plug PT3/8 form).

7078TM88

(5) Test

① Motor water pressure test

-Check the oil leak for one minute by appearance test at air pressure 5 kgf/cm^2.



7078TM89

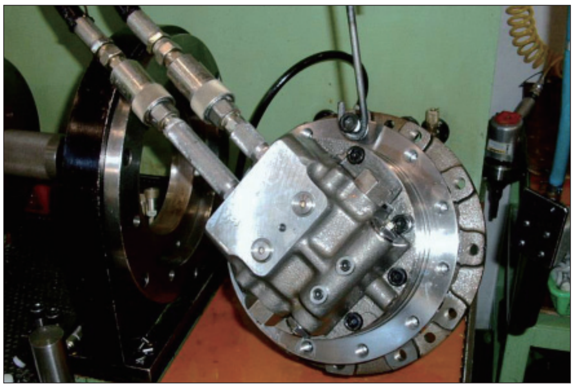
② Performance test

-Pour the gear oil (80W-90) by beaker at the reduction gear.

7078TM90

③ Test bench mounting

-Partially performance test by mounting motor test bench.



7078TM91

GROUP 7 RCV LEVER

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.**

13031GE18

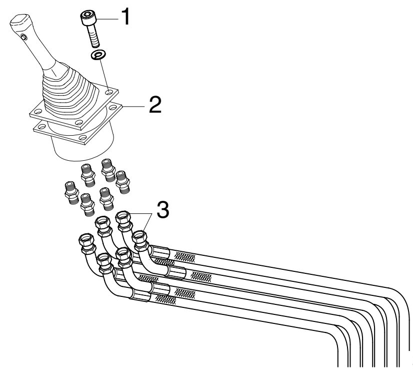
(4) Loosen the socket bolt (1).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ **When removing the pilot valve assembly, check that all the hoses have been disconnected.**



21078DA06

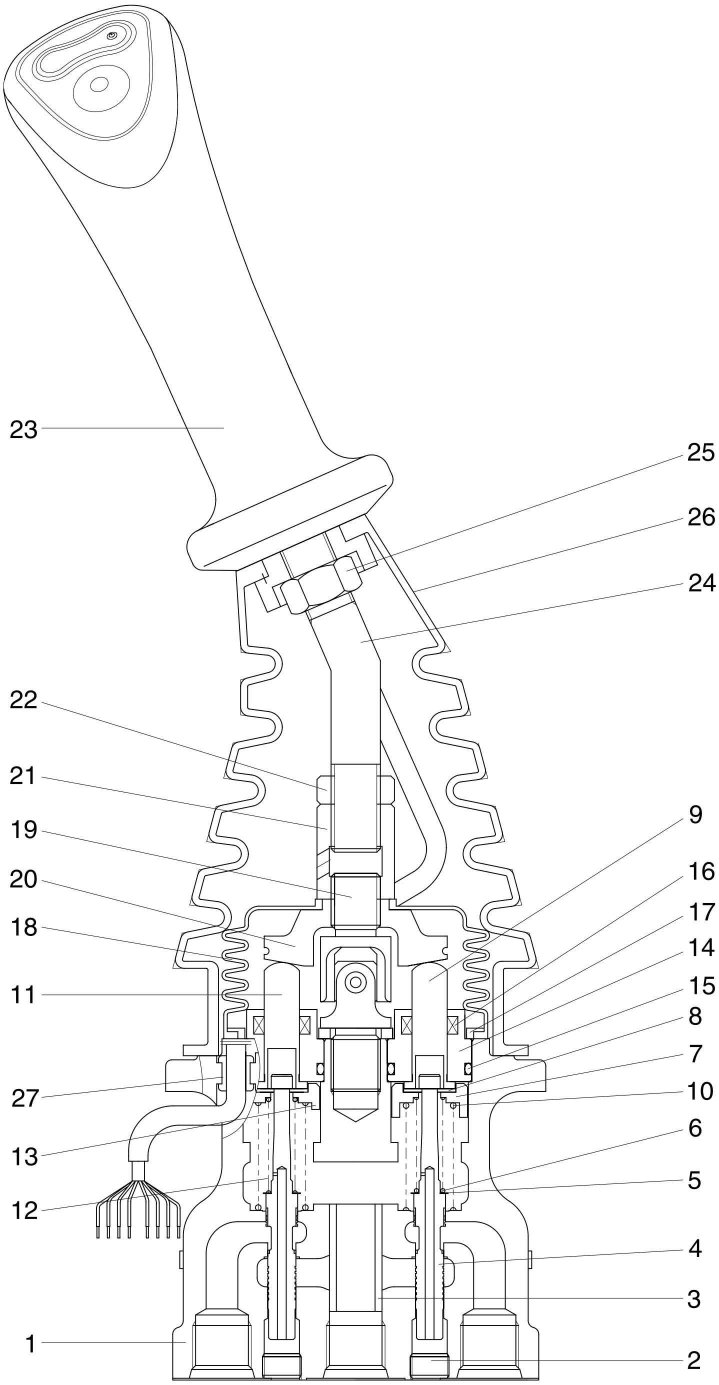
2) INSTALL

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

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

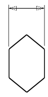
1) STRUCTURE



1	Case	8	Stopper	15	O-ring	22	Lock nut
2	Plug	9	Push rod	16	Rod seal	23	Handle assembly
3	Bushing	10	Spring	17	Plate	24	Handle bar
4	Spool	11	Push rod	18	Boot	25	Nut
5	Shim	12	Spring	19	Joint assembly	26	Boot
6	Spring	13	Spring seat	20	Swash plate	27	Bushing
7	Spring seat	14	Plug	21	Adjusting nut		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	B 
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Plug	2	PT 1/8	3.0	21.7
Joint	18	M14	3.5	25.3
Swash plate	19	M14	5.0±0.35	36.2±2.5
Adjusting nut	20	M14	5.0±0.35	36.2±2.5
Lock nut	21	M14	5.0±0.35	36.2±2.5
Screw	29	M 3	0.05	0.36

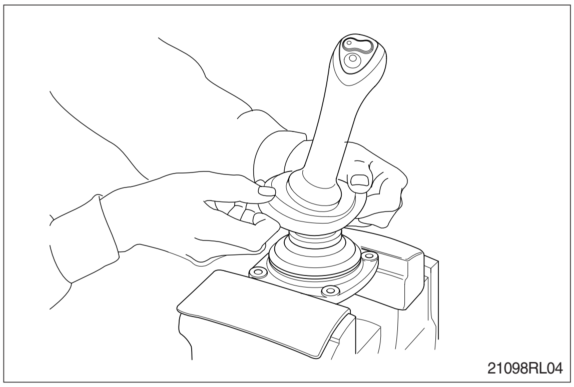
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

※ Put blind plugs into all ports

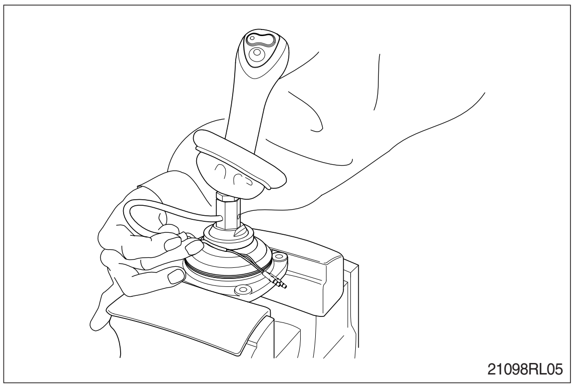
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (26) from case (1) and take it out upwards.



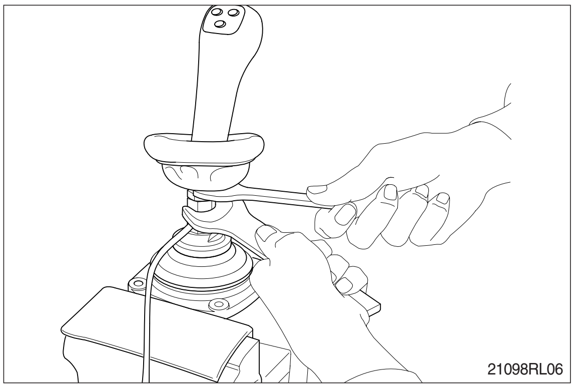
21098RL04

※ For valve with switch, remove cord also through hole of casing.



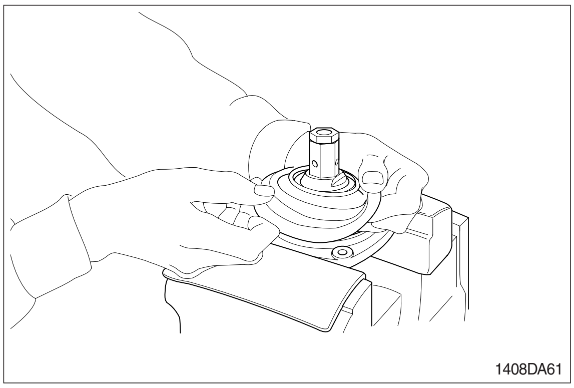
21098RL05

(4) Loosen lock nut (22) and adjusting nut (21) with spanners on them respectively, and take out handle section as one body.



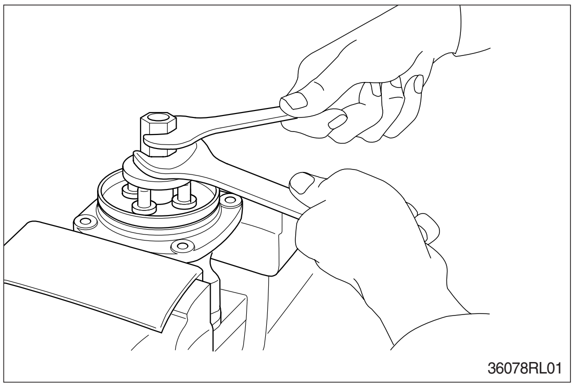
21098RL06

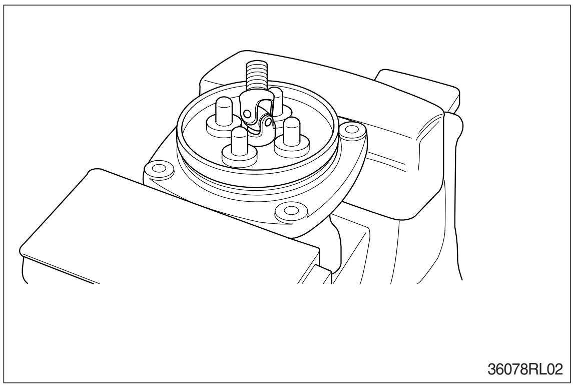
(5) Remove the boot (18).



1408DA61

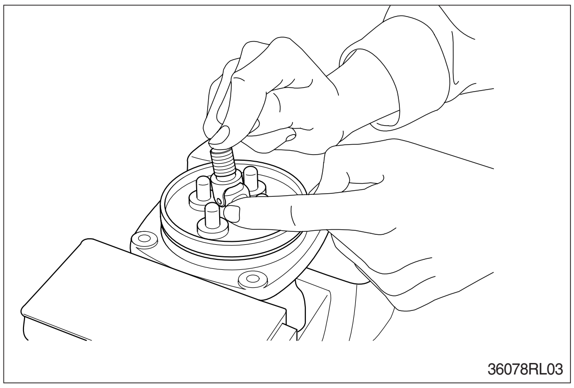
(6) Loosen adjusting nut (21) and plate (20) with spanners on them respectively, and remove them.

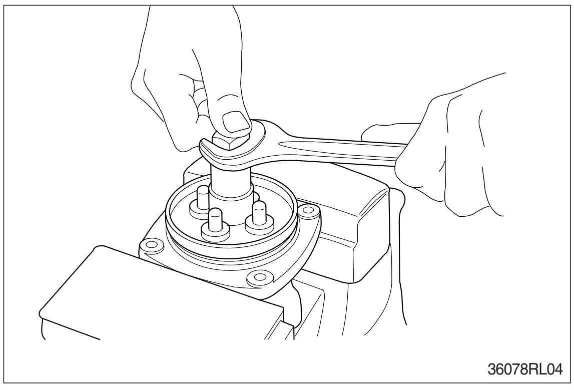




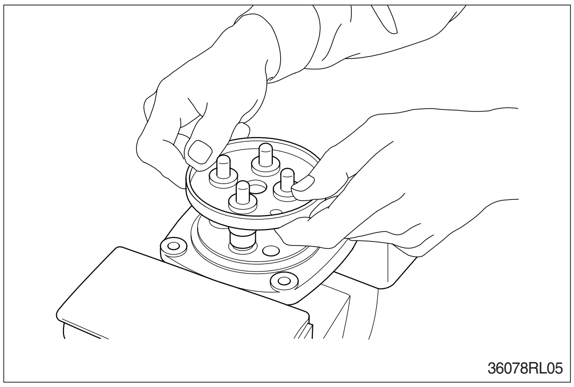
(7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

※ When return spring (10) is strong in force, plate (17), plug (14) and push rod (11) will come up on loosening joint.
Pay attention to this.





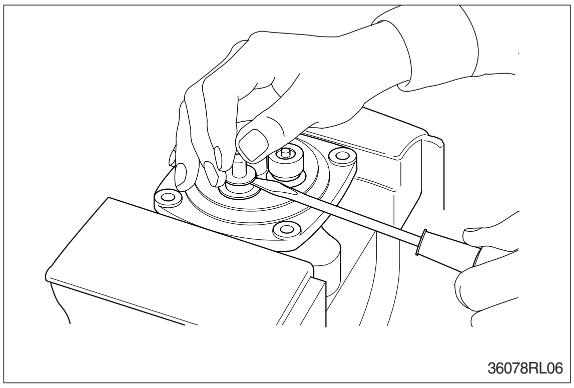
(8) Remove plate (17).



(9) When return spring (10) is weak in force, plug (14) stays in casing because of sliding resistance of O-ring.

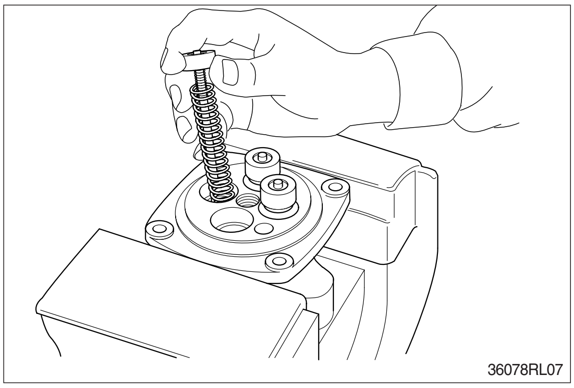
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (10) force.
Pay attention to this.

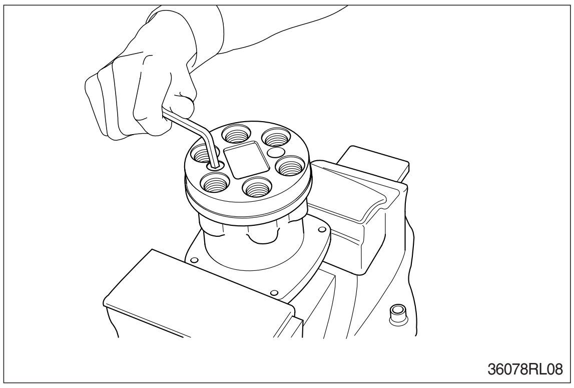


(10) Remove reducing valve subassembly and return spring (10) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



(11) Loosen hexagon socket head plug (2) with hexagon socket screw key.

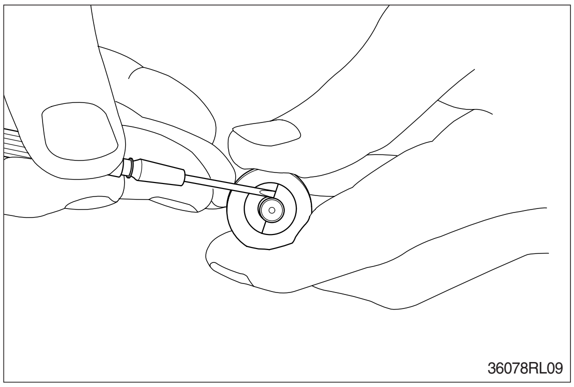


(12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper (8) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

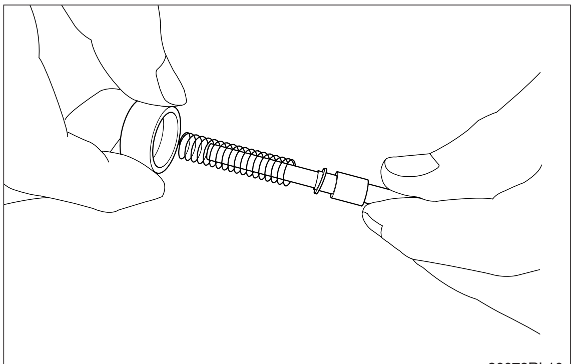
※ Record original position of spring seat (7).

※ Do not push down spring seat more than 6 mm.

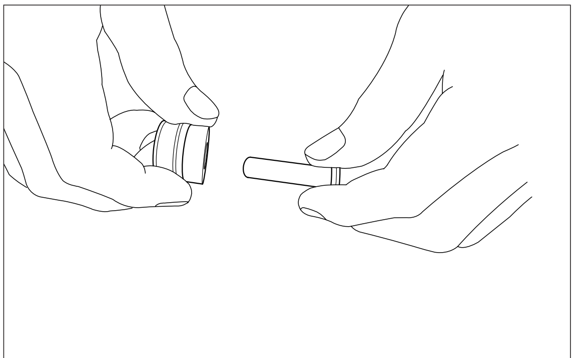

36078RL09

(13) Separate spool (4), spring seat (7), spring (6) and shim (5) individually.

※ Until being assembled, they should be handled as one subassembly group.

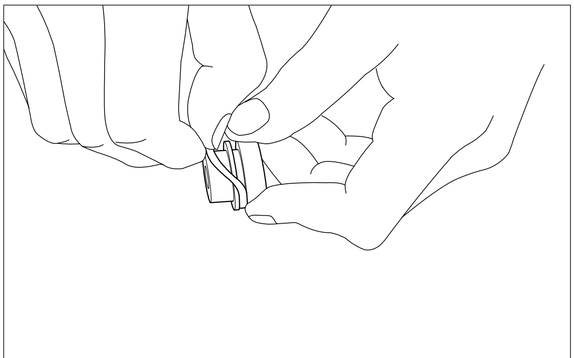

36078RL10

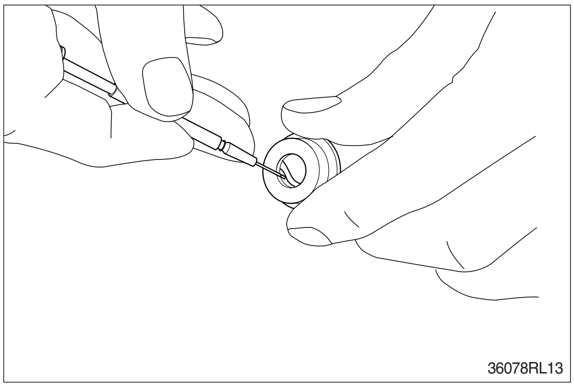
(14) Take push rod (14) out of plug (11).


36078RL11

(15) Remove O-ring (15) and seal (16) from plug (14).

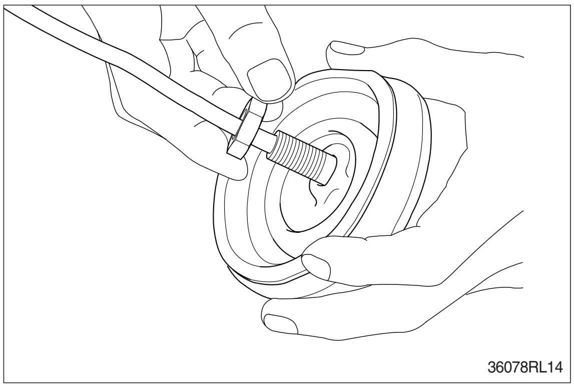
Use small minus screwdriver or so on to remove this seal.


36078RL12

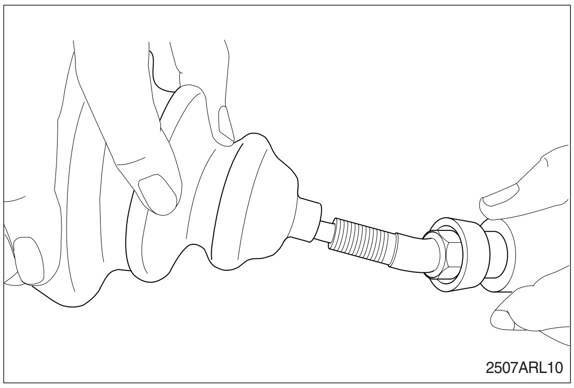


36078RL13

(16) Remove lock nut (22) and then boot (26).



36078RL14



2507ARL10

(17) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

(18) Rust prevention of parts.

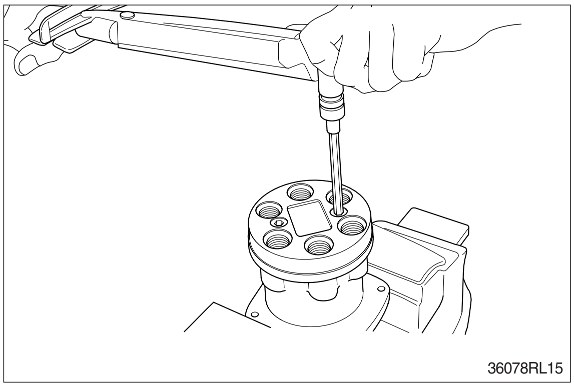
Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

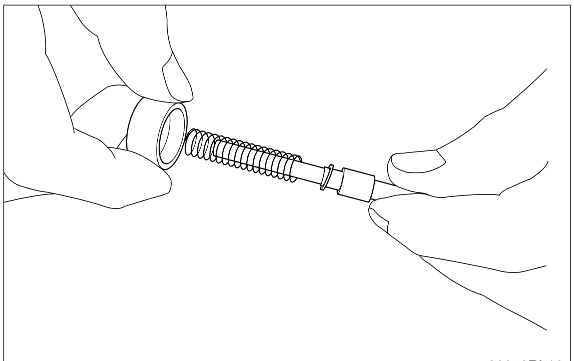
(1) Tighten hexagon socket head plug (2) to the specified torque.

※ Tighten two bolts alternately and slowly.



36078RL15

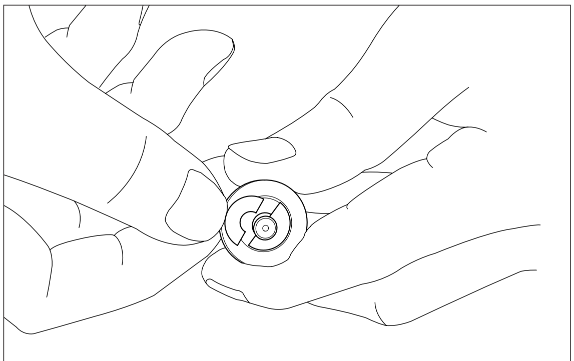
(2) Put shim (5), springs (6) and spring seat (7) onto spool (4) in this order.



36078RL16

(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (8) on spring seat without piling them on.

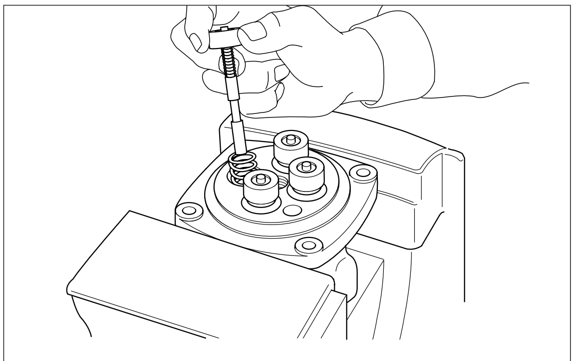
※ Assemble stopper (8) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6 mm.



36078RL17

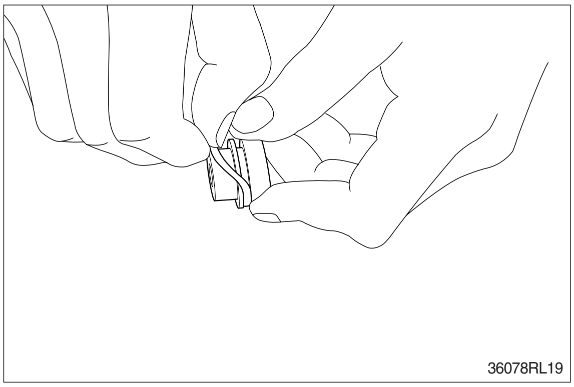
(4) Assemble spring (10) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



36078RL18

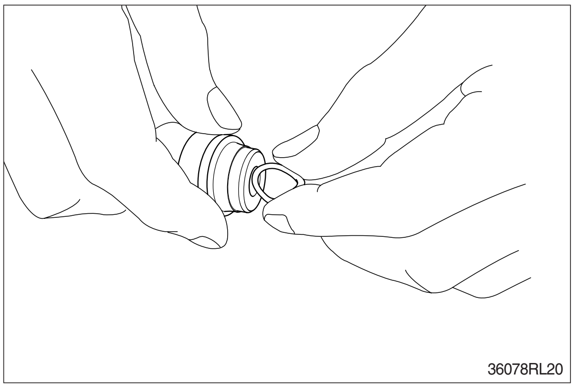
(5) Assemble O-ring (15) onto plug (14).



36078RL19

(6) Assemble seal (16) to plug (14).

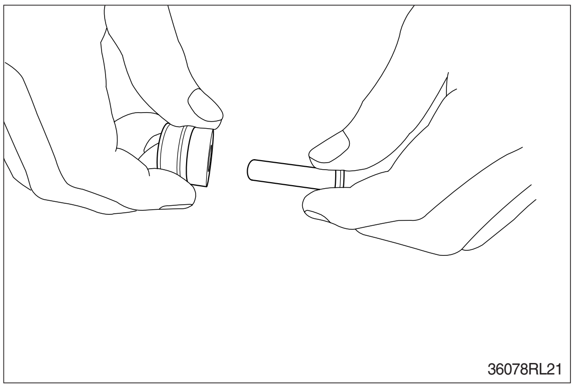
※ Assemble seal in such lip direction as shown below.



36078RL20

(7) Assemble push rod (11) to plug (14).

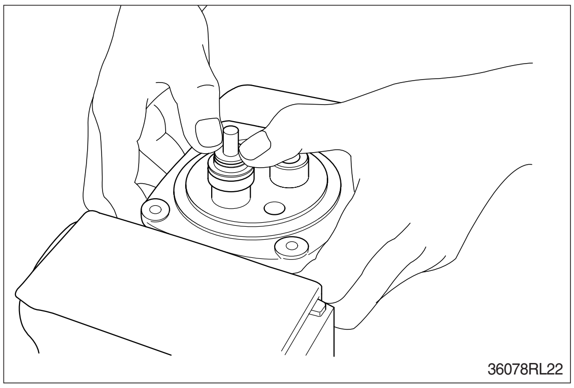
※ Apply working oil on push-rod surface.



36078RL21

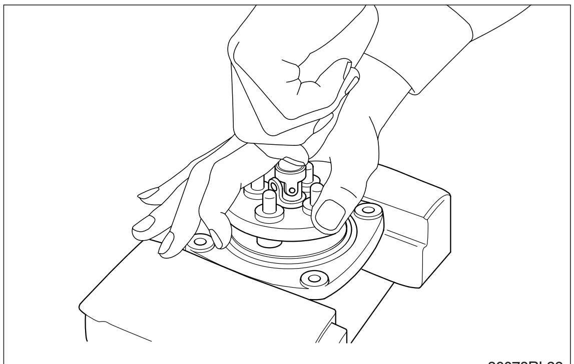
(8) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



36078RL22

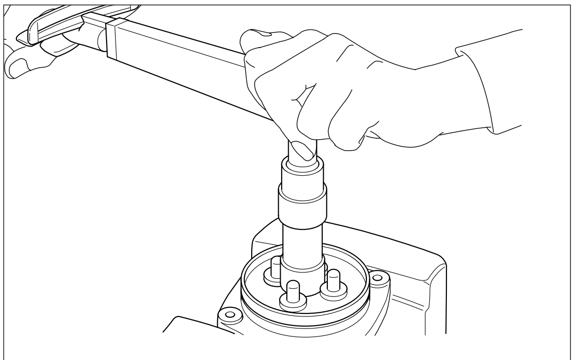
(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (17), and tighten joint (19) temporarily.



36078RL23

(10) Fit plate (17).

(11) Tighten joint (19) with the specified torque to casing, utilizing jig.

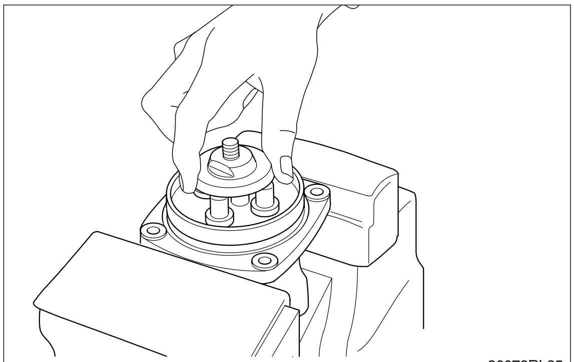


36078RL24

(12) Assemble plate (20) to joint (19).

※ Screw it to position that it contacts with 4 push rods evenly.

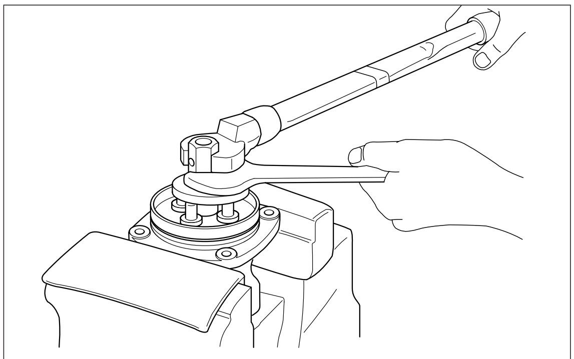
※ Do not screw it over.



36078RL25

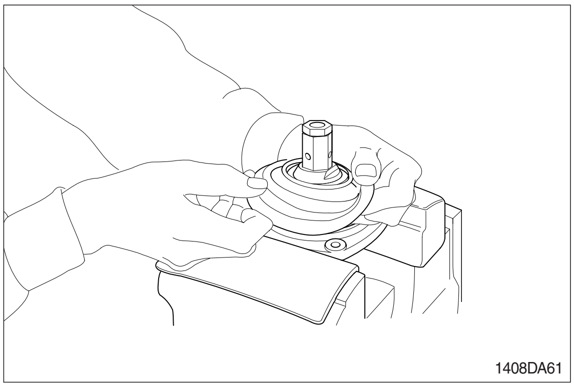
(13) Assemble adjusting nut (21), apply spanner to width across flat of swash plate (20) to fix it, and tighten adjusting nut to the specified torque.

※ During tightening, do not change position of disk.



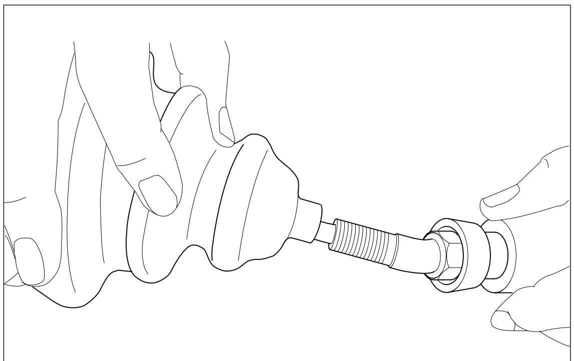
36078RL26

(14) Fit boot (18) to plate.

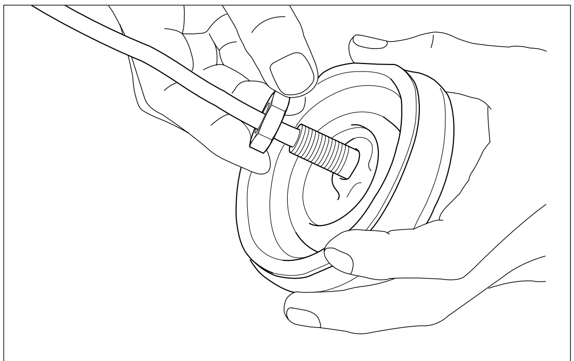


1408DA61

(15) Fit boot (26) and lock nut (22), and handle subassembly is assembled completely.

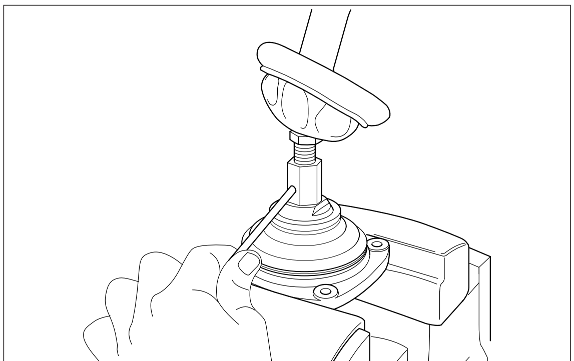


2507ARL10



36078RL27

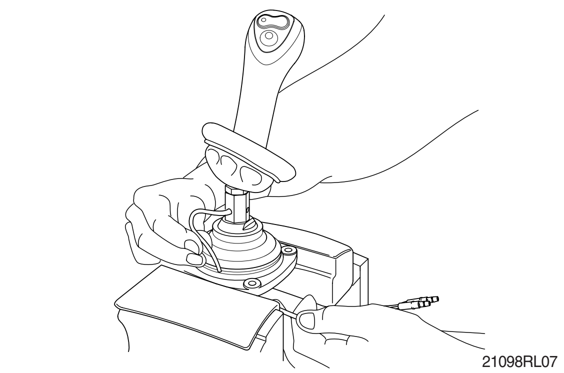
(16) Pull out cord and tube through adjusting nut hole provided in direction 60˚ to 120˚ from casing hole.



1408DA66

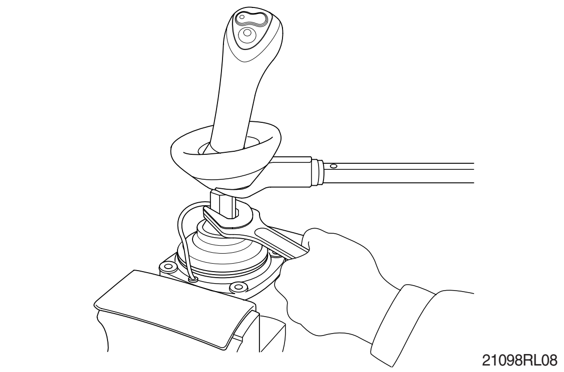
(17) Assemble bushing (27) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.



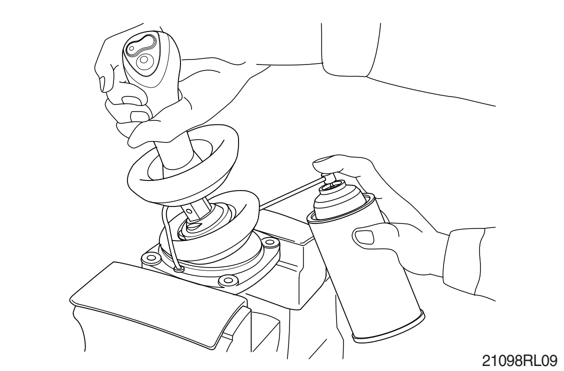
21098RL07

(18) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



21098RL08

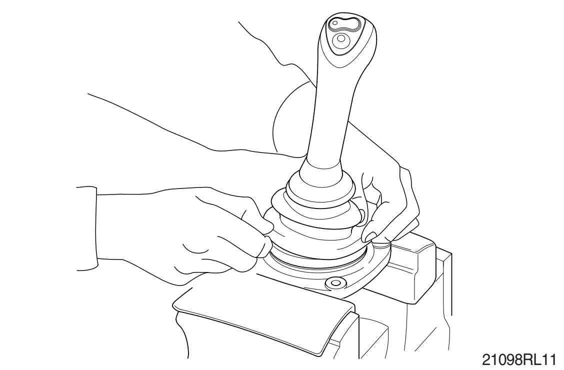
(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



21098RL09

(20) Assemble lower end of bellows to casing.

(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



21098RL11

GROUP 8 TURNING JOINT

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.**

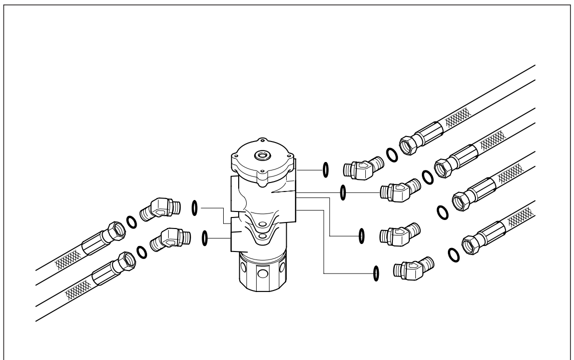
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.


13031GE18

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

- Weight : 30 kg (70 lb)
- Tightening torque : 12.3 ± 1.3 kgf · m (88.9 ± 9.4 lbf · ft)


R5572TJ01

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

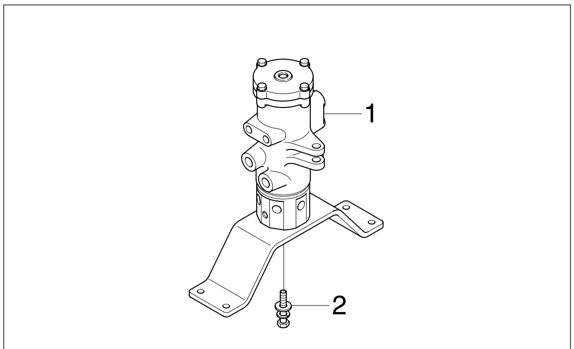
2) INSTALL

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

※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

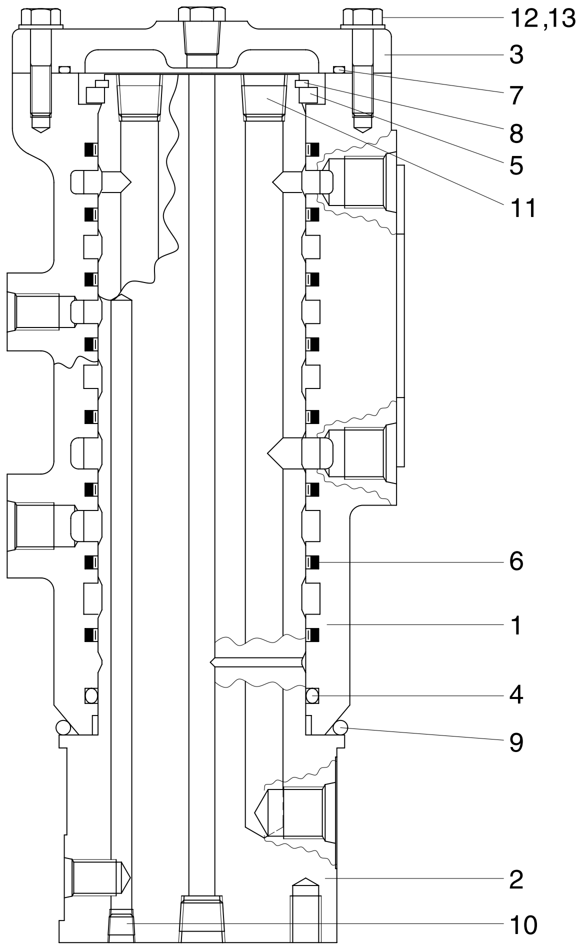
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



R5577TJ02

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



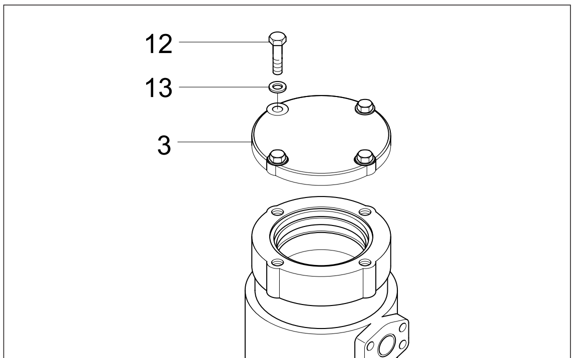
555K7TJ03

1	Hub	6	Slipper seal	10	Plug
2	Shaft	7	O-ring	11	Plug
3	Cover	8	Retainer ring	12	Hexagon bolt
4	O-ring	9	O-ring	13	Spring washer
5	Ring				

2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

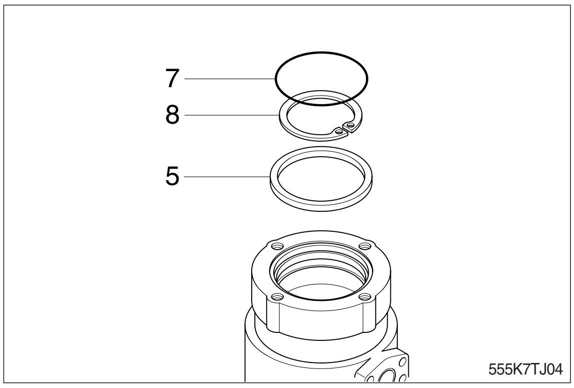
(1) Remove bolts (12), washer (13) and cover (3).



R55NM7TJ02

(2) Remove O-ring (7).

(3) Remove retainer ring (8) and ring (5).

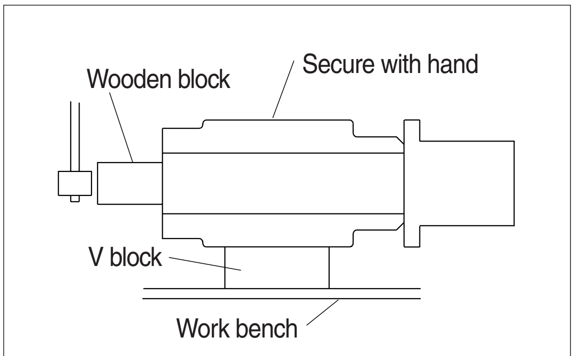


555K7TJ04

(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

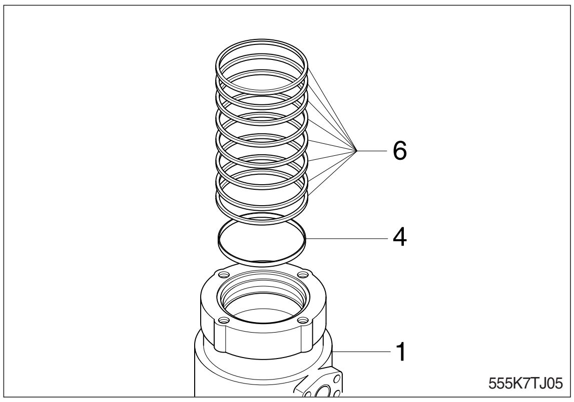
※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



8-141(3) 210-7

(5) Remove eight slipper seals (6) and O-ring (4) from hub (1).



555K7TJ05

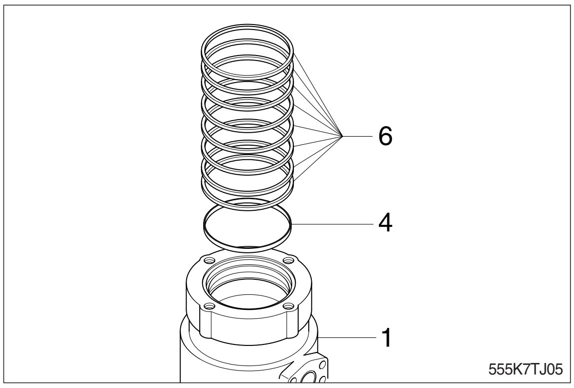
3) ASSEMBLY

※ Clean all parts.

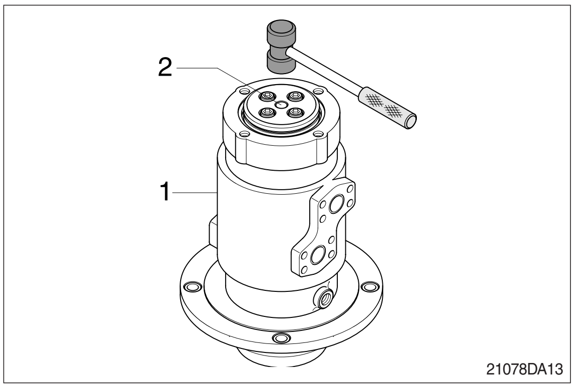
※ As a general rule, replace oil seals and O-ring.

※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix eight slipper seal (6) and O-ring (4) to hub (1).

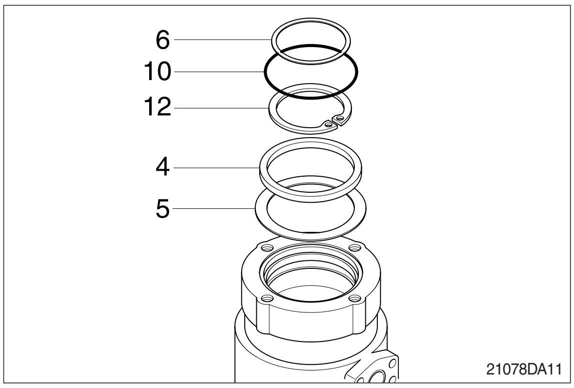


(2) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.

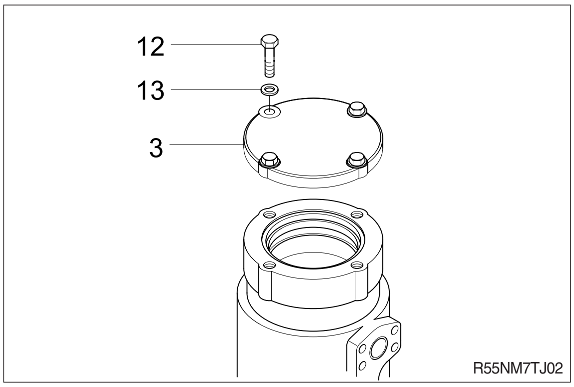


(3) Ring (5) and retainer ring (8) to shaft (2).

(4) Fit O-ring (7) to hub (1).



(5) Install cover (3) to body (1) and tighten bolts (12) with washer (13).



GROUP 9 BOOM, ARM AND BUCKET CYLINDERS

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

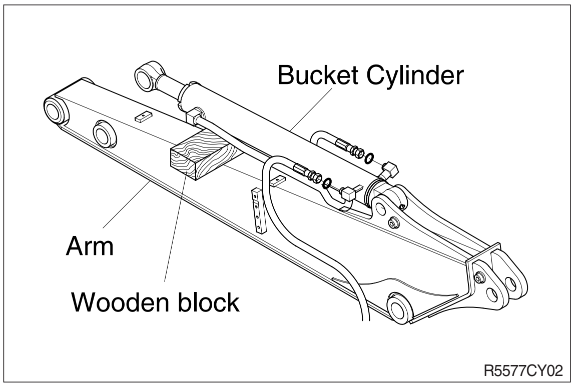
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

13031GE18

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank. Escaping fluid under pressure can penetrate the skin causing serious injury.

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

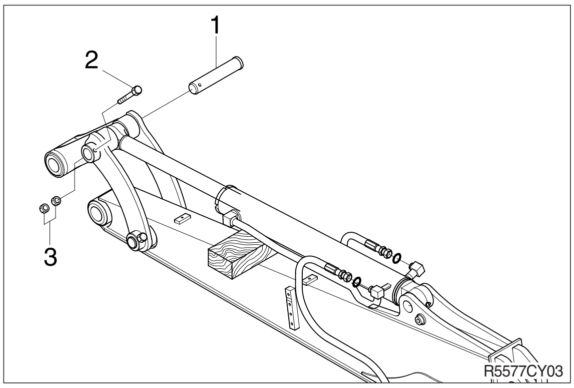
① Set block between bucket cylinder and arm.



R5577CY02

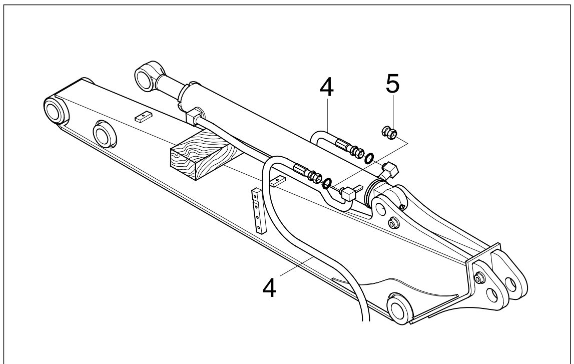
② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



R5577CY03

③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.

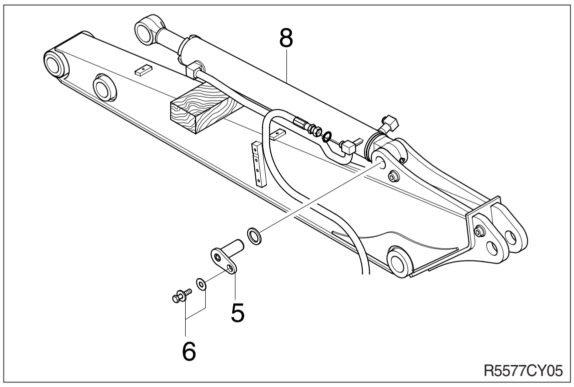


R5577CY04

④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

· Weight : 60 ㎏ (130 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the bucket cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) ARM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

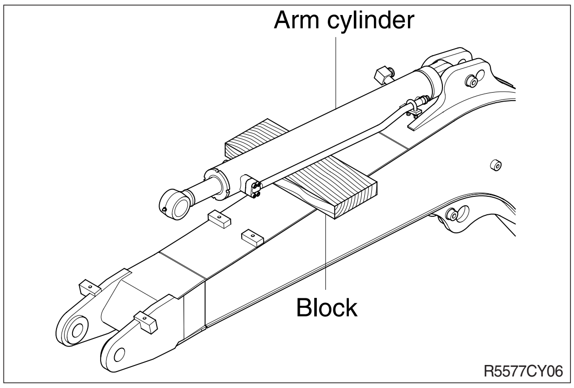
⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

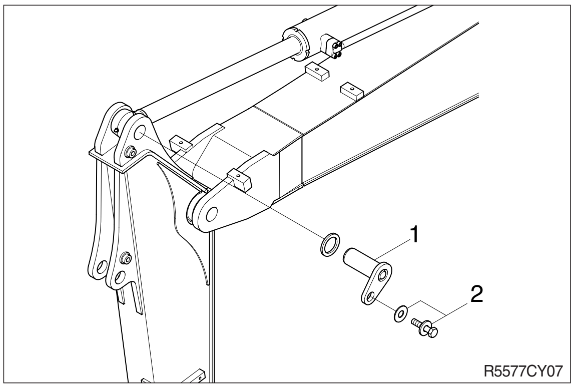
① Set block between arm cylinder and boom.


13031GE18



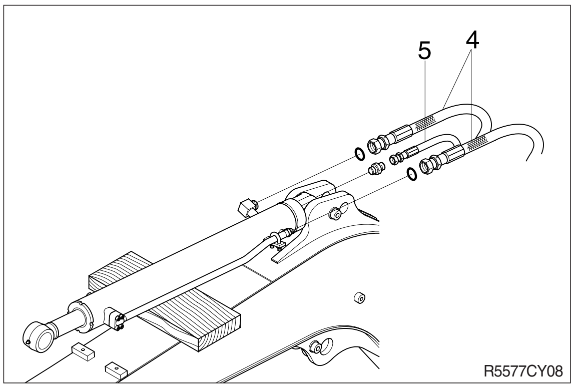
R5577CY06

② Remove bolt (2) and pull out pin (1).
※ Tie the rod with wire to prevent it from coming out.



R5577CY07

③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.
④ Disconnect greasing pipings (5).

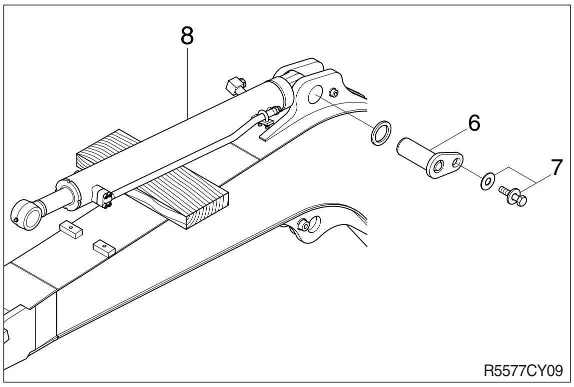


R5577CY08

⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

· Weight : 90 ㎏ (200 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

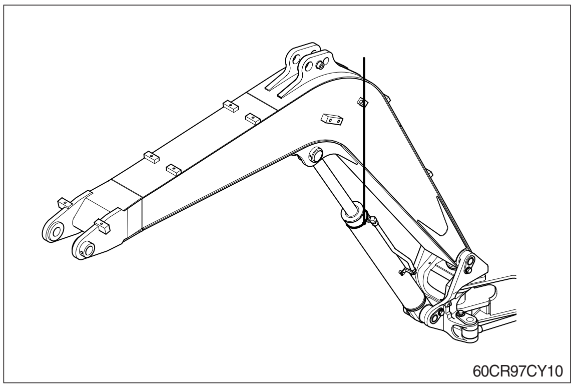

13031GE18

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

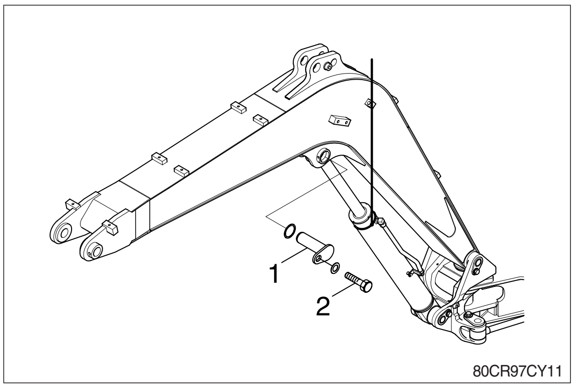
⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Disconnect greasing hoses.
② Sling boom cylinder assembly.

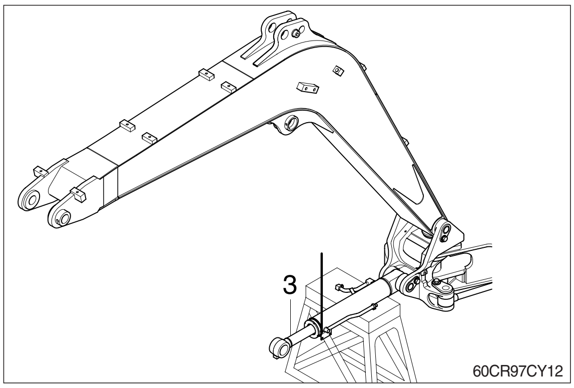

60CR97CY10

③ Remove bolt (2) and pull out pin (1).
※ Tie the rod with wire to prevent it from coming out.



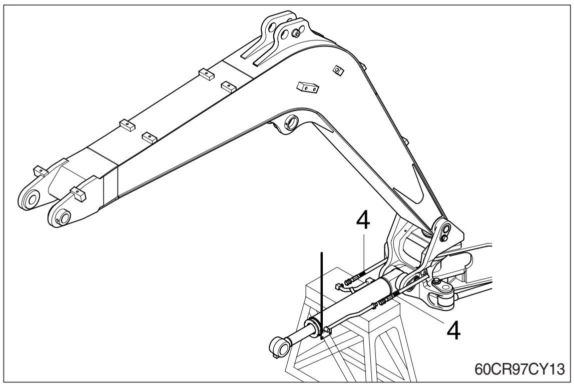
80CR97CY11

④ Lower the boom cylinder assembly (3) on a stand.



60CR97CY12

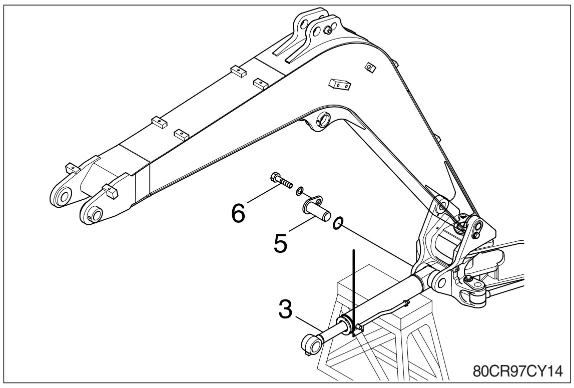
⑤ Disconnect boom cylinder hoses (4) and put plugs on cylinder pipe.



⑥ Remove bolt (6) and pull out pin (5).

⑦ Remove boom cylinder assembly (3).

· Weight : 110 ㎏ (240 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

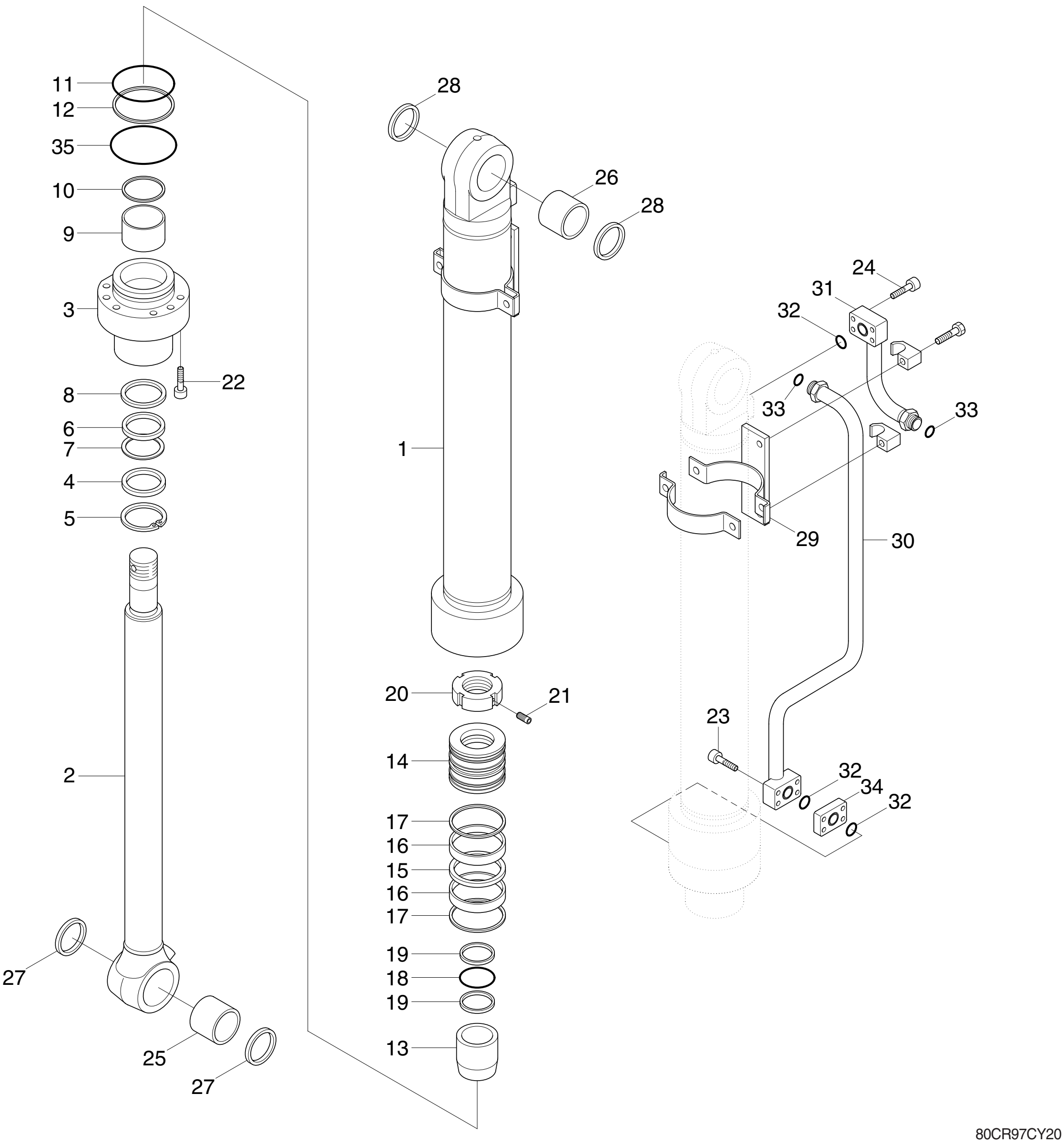
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

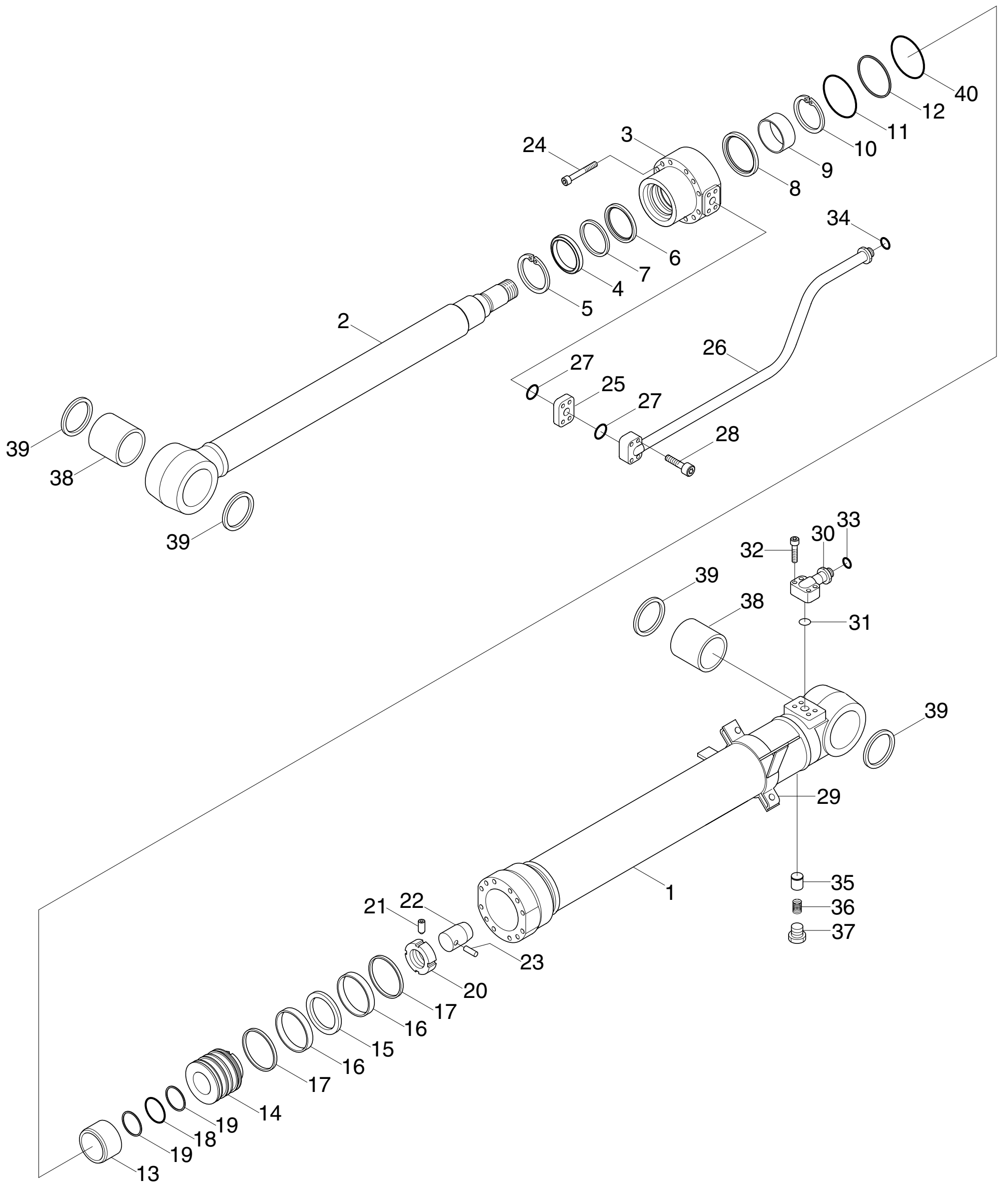
1) STRUCTURE

(1) Bucket cylinder



1	Tube assy	13	Cushing ring	25	Pin bushing
2	Rod assy	14	Piston	26	Pin bushing
3	Gland	15	Piston seal	27	Dust seal
4	Dust wiper	16	Wear ring	28	Dust seal
5	Retaining ring	17	Dust ring	29	Band assy
6	Rod seal	18	O-ring	30	Pipe assy
7	Back up ring	19	Back up ring	31	Pipe assy-B
8	Buffer ring	20	Lock nut	32	O-ring
9	Bushing	21	Set screw	33	O-ring
10	Retaining ring	22	Socket bolt	34	Flange
11	O-ring	23	Socket bolt	35	O-ring
12	Back up ring	24	Socket bolt		

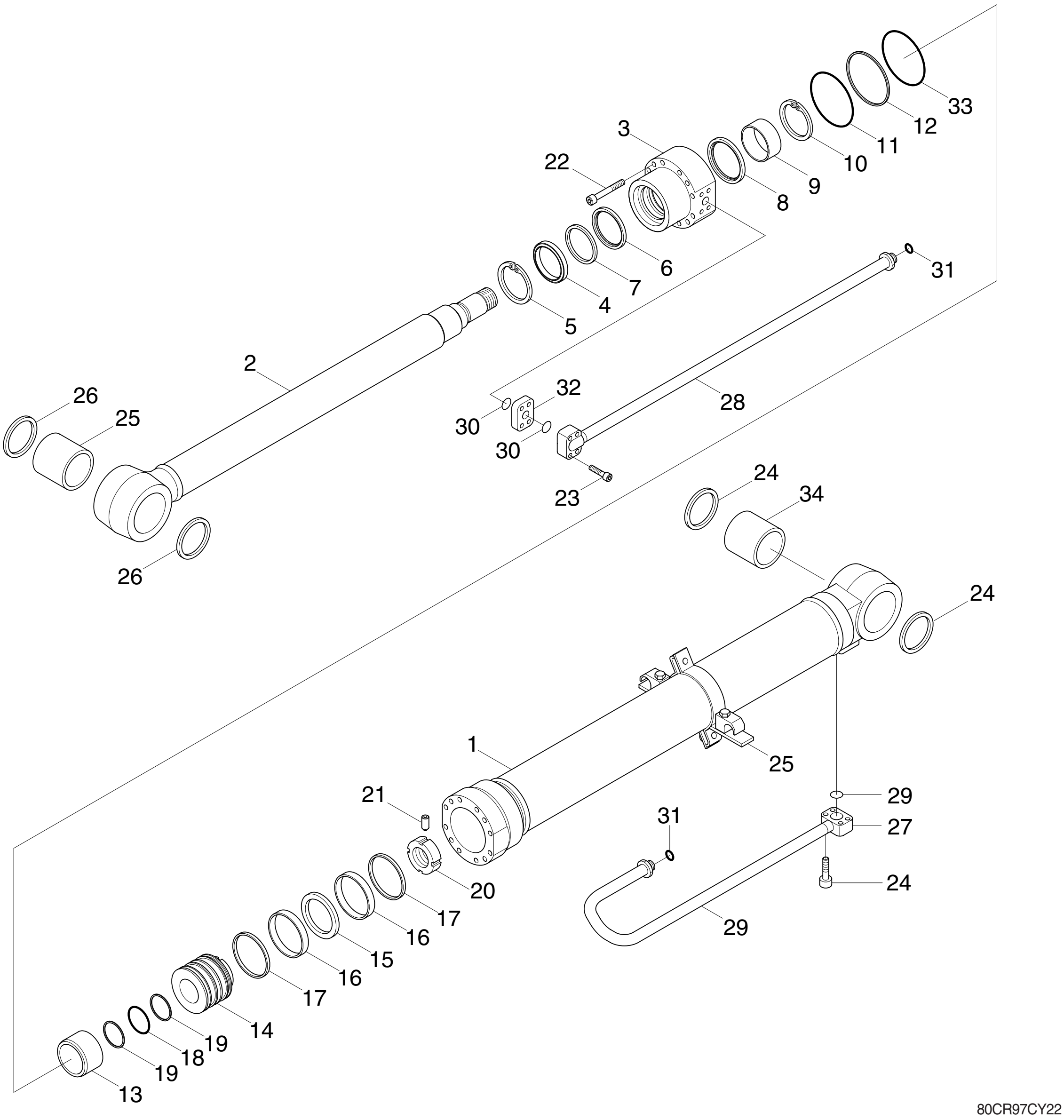
(2) Arm cylinder



80CR97CY21

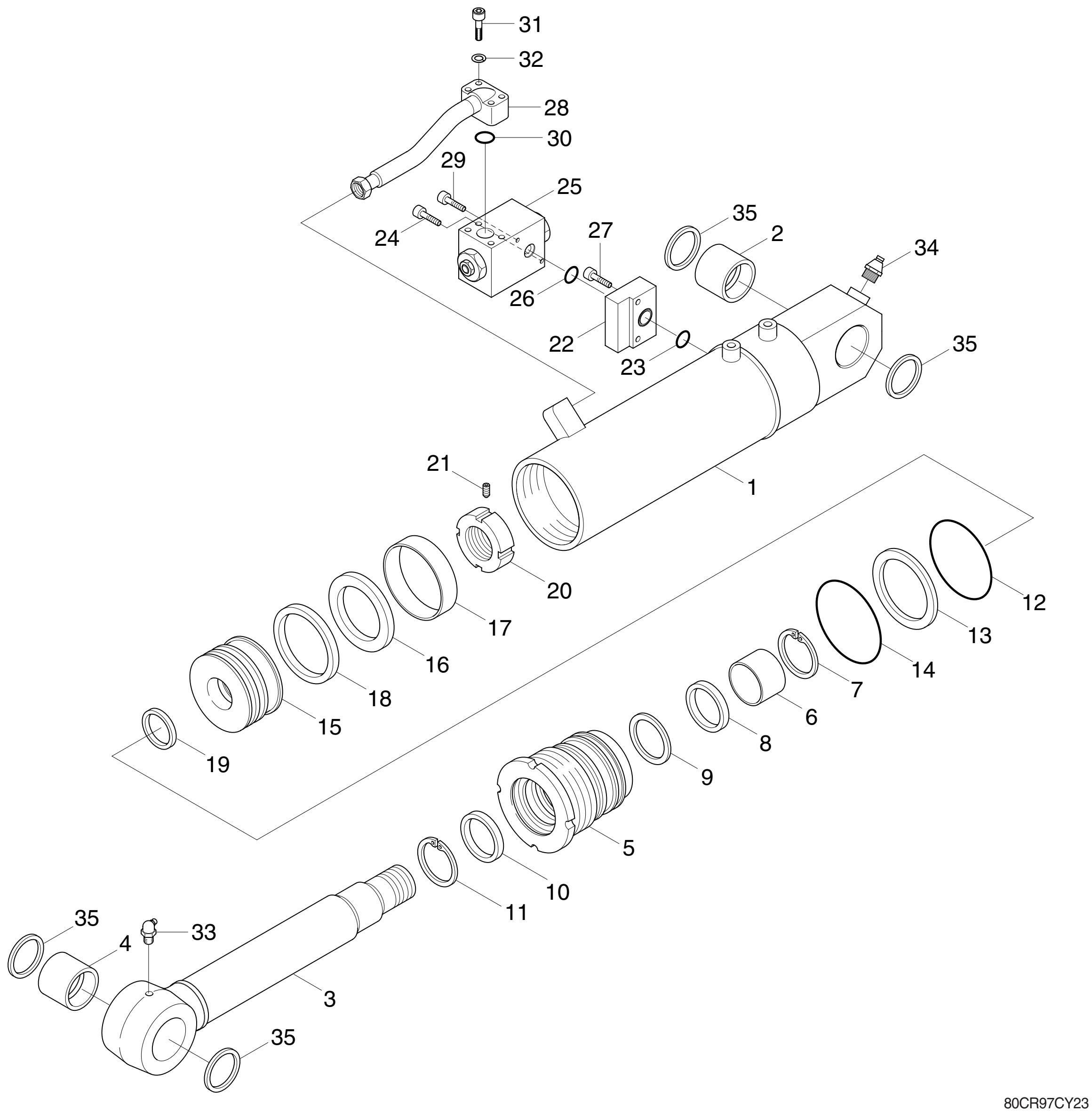
1	Tube assy	15	Piston seal	29	Band assy
2	Rod assy	16	Wear ring	30	Pipe assy-B
3	Gland	17	Dust ring	31	O-ring
4	Dust wiper	18	O-ring	32	Socket bolt
5	Retaining ring	19	Back up ring	33	O-ring
6	Rod seal	20	Lock nut	34	O-ring
7	Back up ring	21	Set screw	35	Check valve
8	Buffer ring	22	Plunger	36	Coil spring
9	Dry bearing	23	Parallel pin	37	Plug
10	Retaining ring	24	Socket bolt	38	Pin bushing
11	O-ring	25	Flange	39	O-ring
12	Back up ring	26	Pipe assy-R	40	O-ring
13	Cushing ring	27	O-ring		
14	Piston	28	Socket bolt		

(3) Boom cylinder



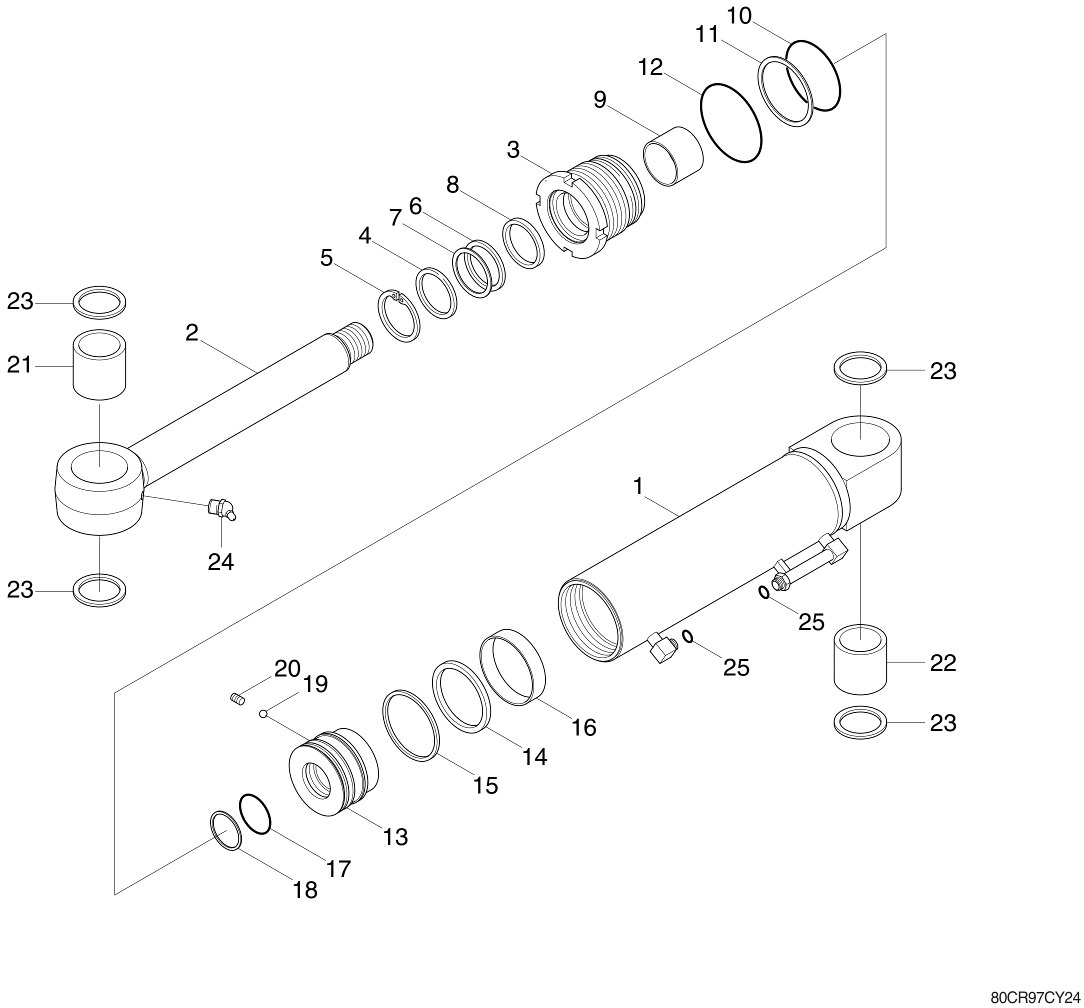
1	Tube assy	12	Back up ring	23	Socket bolt
2	Rod assy	13	Cushing ring	24	Socket bolt
3	Gland	14	Piston	25	Pin bush
4	Dust wiper	15	Piston seal	26	Dust seal
5	Retaining ring	16	Wear ring	27	Band assy
6	Rod seal	17	Dust ring	28	Pipe assy-R
7	Back up ring	18	O-ring	29	Pipe assy-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Bushing	20	Lock nut	31	O-ring
10	Retaining ring	21	Set screw	32	Flange
11	O-ring	22	Socket bolt	33	O-ring

(4) Dozer cylinder



1	Tube assy
2	Pin bushing
3	Gland
4	Pin bushing
5	Rod cover
6	Rod bush
7	Retaining ring
8	Buffer seal
9	U-packing
10	Dust wiper
11	Retaining ring
12	O-ring
13	Back up ring
14	O-ring
15	Piston
16	Piston seal
17	Wear ring
18	Dust ring
19	O-ring
20	Piston nut
21	Set screw
22	Spacer
23	O-ring
24	Hex socket bolt
25	Check valve
26	O-ring
27	Hex socket bolt
28	Pipe assy
29	Hex socket bolt
30	O-ring
31	Hex socket bolt
32	Spring washer
33	Grease nipple
34	Grease nipple
35	Pin wiper

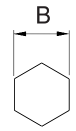
(5) Boom swing cylinder



1	Tube assy	10	O-ring	19	Steel ball
2	Rod assy	11	Back up ring	20	Set screw
3	Rod assy	12	O-ring	21	Pin bushing
4	Dust wiper	13	Piston	22	Grease nipple
5	Retaining ring	14	Piston seal	23	Dust seal
6	Rod seal	15	Dust ring	24	Grease nipple
7	Back up ring	16	Wear ring	25	O-ring
8	Buffer ring	17	O-ring		
9	Du bushing	18	Back up ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name	Specification	
Allen wrench	8	
	10	
Spanner	M22	
Hook spanner	Suitable size	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Gland mounting bolt (socket head bolt)	Boom cylinder	22	M14×2.0	15±1.5	108±10.8
	Arm cylinder	24	M14×2.0	15±1.5	108±10.8
	Bucket cylinder	22	M12×1.75	9.4±1.0	68±7.2
Gland	Dozer cylinder	5	M135×2.0	75±7.5	540±54
	Boom swing cylinder	3	M115×2.0	92±9.2	665±66.5
Lock	Boom cylinder	20	M50×2.0	130±13	940±94
	Arm cylinder	20	M42×2.0	75±7.5	540±54
	Bucket cylinder	20	M39×2.0	75±7.5	540±54
	Dozer cylinder	20	M55×2.0	130±13	940±94
Piston	Boom cylinder	14	M60×3.0	75±7.5	540±54
	Arm cylinder	14	M55×2.0	60±6.0	434±43.4
	Bucket cylinder	14	M48×2.0	50±5.0	362±36.2
	Dozer cylinder	15	M65×3.0	75±7.5	540±54
	Boom swing	13	M50×2.0	125±12.5	904±90.4

3) DISASSEMBLY

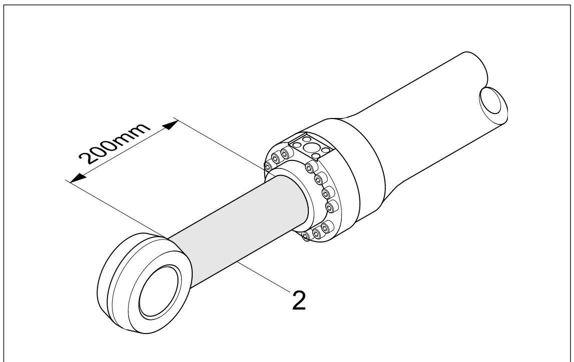
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

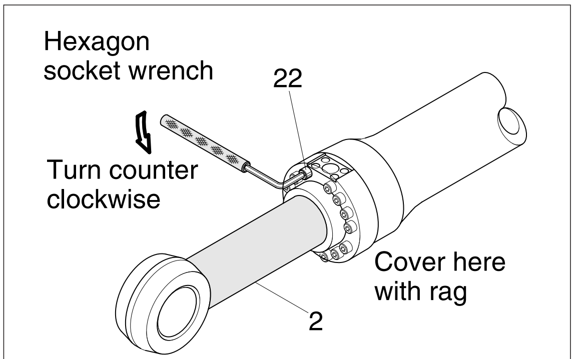
② Pull out rod assembly (2) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



1408DA110

③ Loosen and remove socket bolts (22) of the gland in sequence.

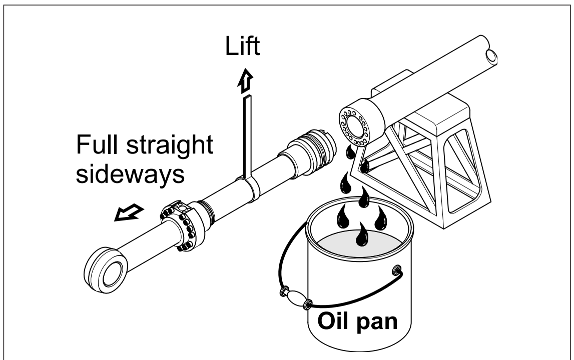
※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



7078CY21

④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.

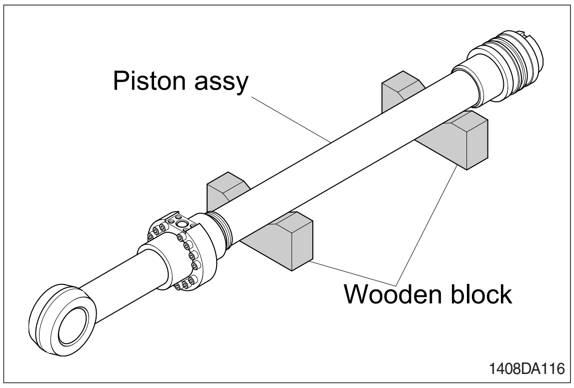


1408DA113

Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.

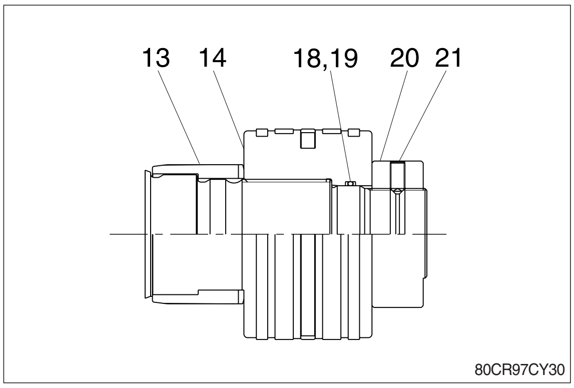


(2) Remove piston and rod cover

① Remove screw (21).
Remove lock nut (20).

※ Since lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock nut (20).

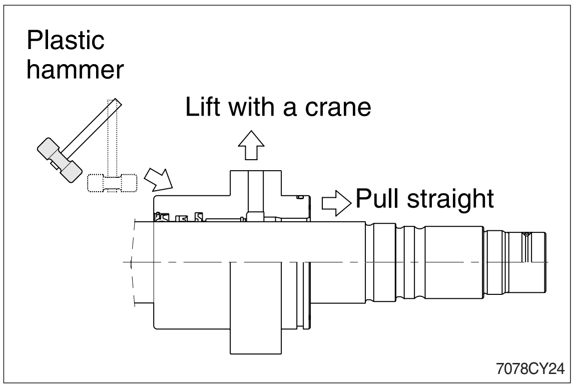
② Remove piston assembly (14), back up ring (19), and O-ring (18).



③ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.
Exercise care so as not to damage the lip of rod bushing (9) and packing (4, 5, 6, 7, 8) by the threads of rod assembly (2).

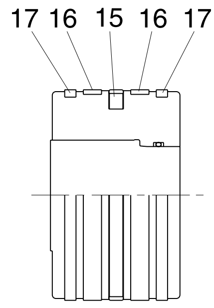


(3) Disassemble the piston assembly

① Remove wear ring (16).

② Remove dust ring (17) and piston seal (15).

※ Exercise care in this operation not to damage the grooves.



80CR97CY31

(4) Disassemble gland assembly

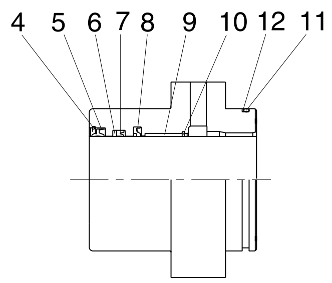
① Remove back up ring (12) and O-ring (11).

② Remove snap ring (5), dust wiper (4).

③ Remove back up ring (7), rod seal (6) and buffer ring (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.



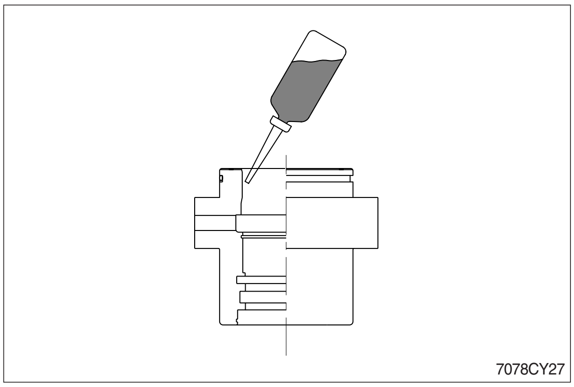
80CR97CY32

4) ASSEMBLY

(1) Assemble cylinder head assembly

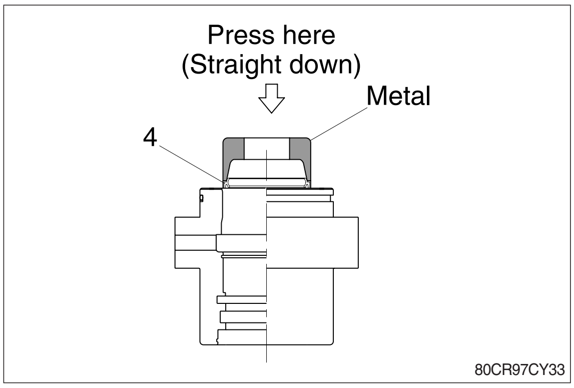
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland (3) with hydraulic oil.



② Coat dust wiper (4) with grease and fit dust wiper (4) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

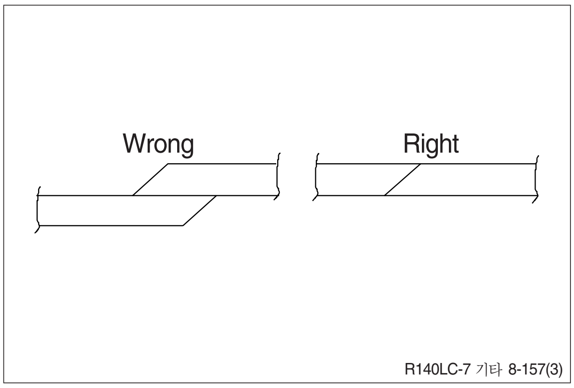
③ Fit snap ring (5) to the stop face.



④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

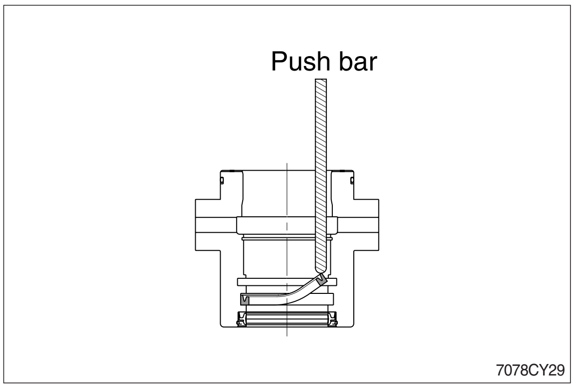
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until one side of it is inserted into groove.

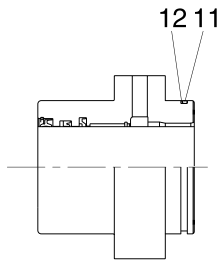


※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



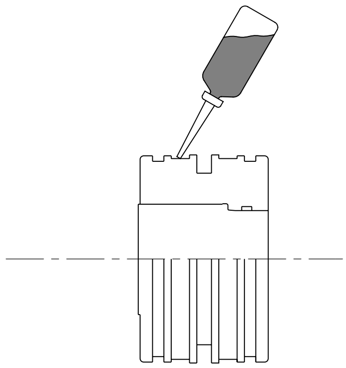
⑤ Fit back up ring (12) to gland (3).
※ Put the backup ring in the warm water of 30~50˚C.
⑥ Fit O-ring (11) to gland (3).



7078CY30

(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.
① Coat the outer face of piston (14) with hydraulic oil.



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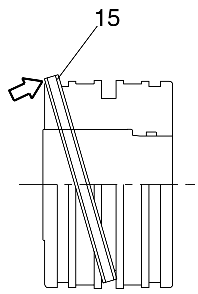
② Fit piston seal (15) to piston.
※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.
※ After assembling the piston seal, press its outer diameter to fit in.



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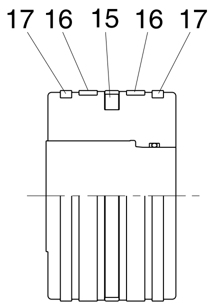
③ Fit wear ring (16) and dust ring (17) to piston (14).



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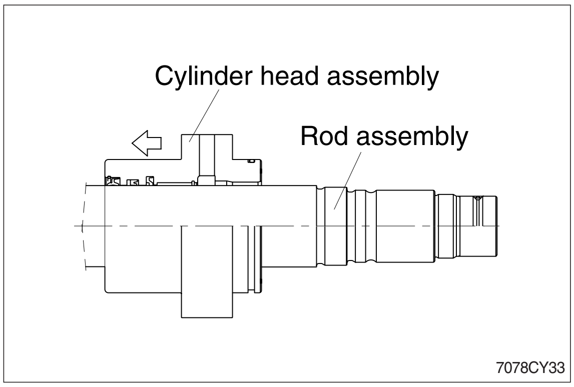
(3) Install piston and cylinder head

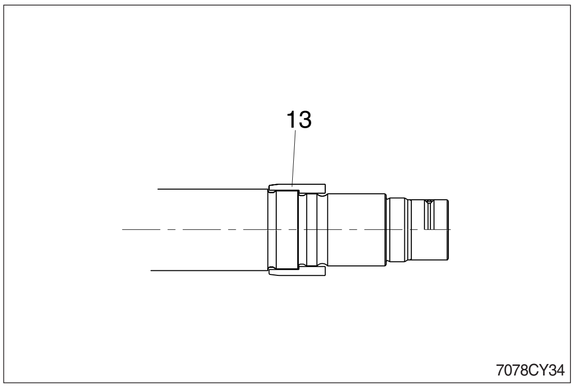
① Fix the rod assembly to the work bench.

② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



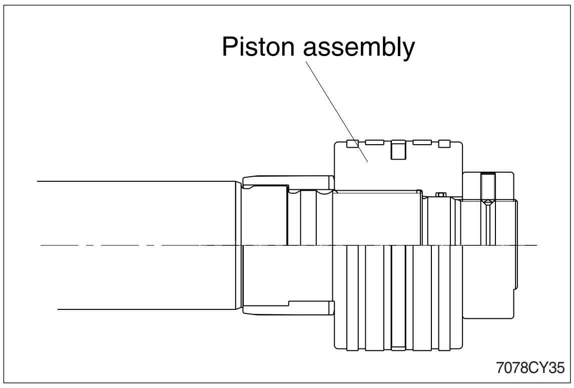
④ Insert cushion ring (13) to rod assembly. Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque :

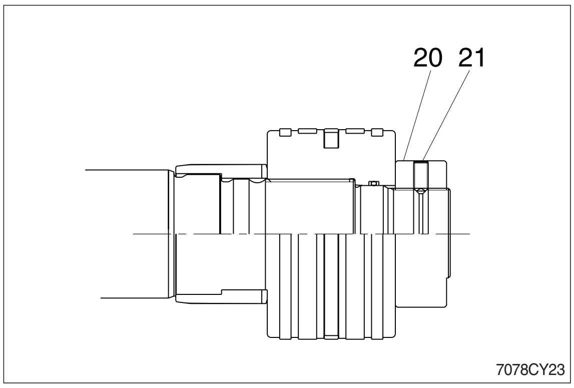
Item		kgf · m	lbf · ft
Boom	14	75±7.5	540±54
Arm	14	60±6.0	434±43
Bucket	14	50±5.0	362±36
Dozer	15	75±7.5	540±54
Boom swing	13	125±12.5	904±90



⑥ Fit lock nut (20) to piston and screw (21).

· Tightening torque :

Item		kgf · m	lbf · ft
Boom	20	130±13	940±94
Arm	20	75±7.5	542±54
Bucket	20	75±7.5	542±54
Dozer	20	130±13	940±94



(3) Overall assemble

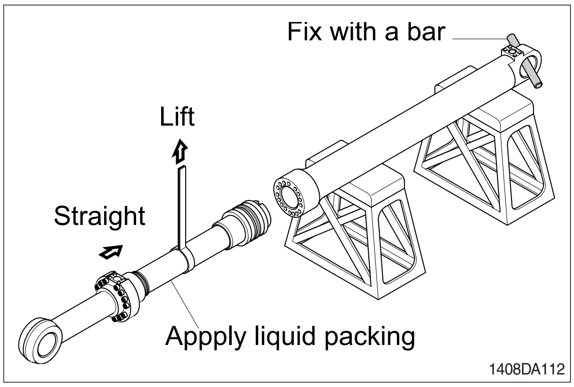
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

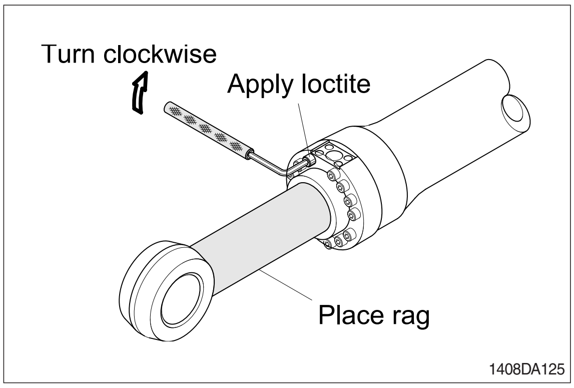
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

※ Refer to the table of tightening torque.





1. TRACK LINK

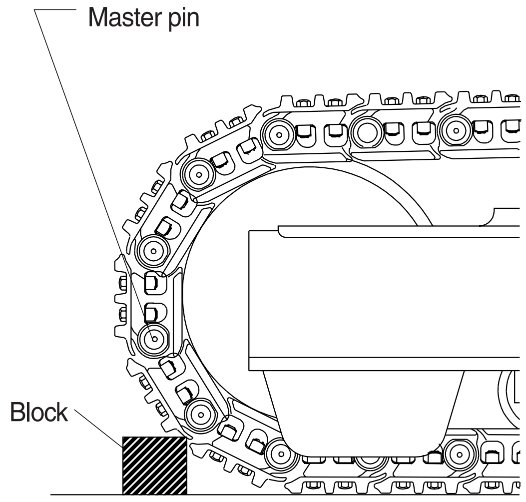
1) REMOVAL

(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

(3) Push out master pin by using a suitable tool.



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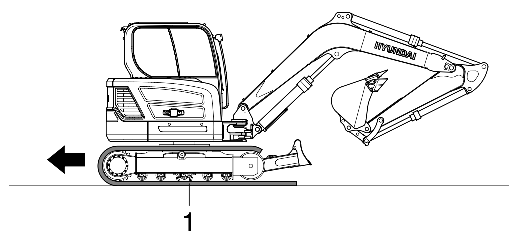
(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.

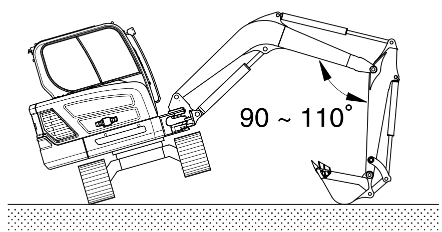


55Z97TR01

2) INSTALL

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

※ Adjust the tension of the track link.

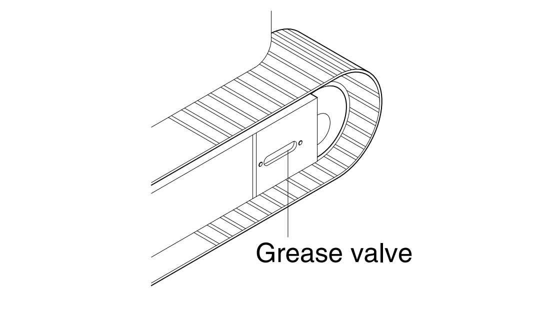


55Z97TR02

2. CARRIER ROLLER

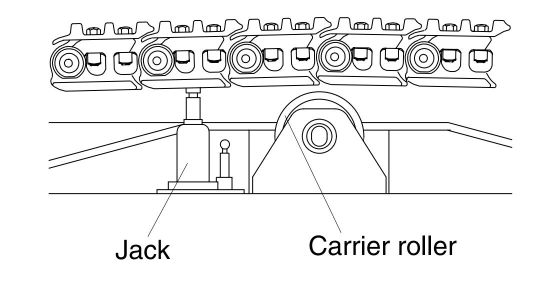
1) REMOVAL

(1) Loosen tension of the track link.



R5577TR05

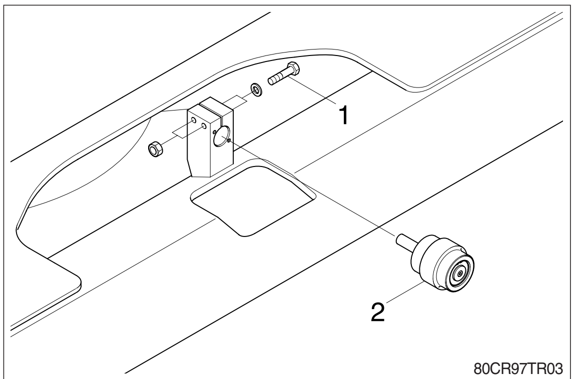
(2) Jack up the track link height enough to permit carrier roller removal.



R5577TR04

(3) Remove bolt (1) at both side.

(4) Remove carrier roller (2).
 · Weight : 10 kg (20 lb)



80CR97TR03

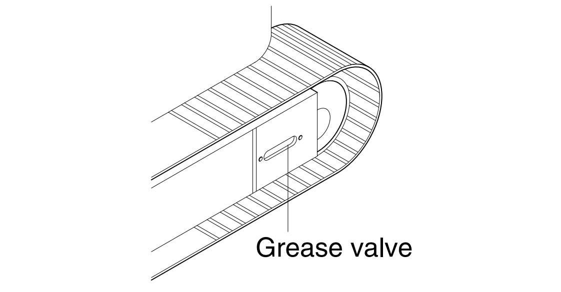
2) INSTALL

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

3. TRACK ROLLER

1) REMOVAL

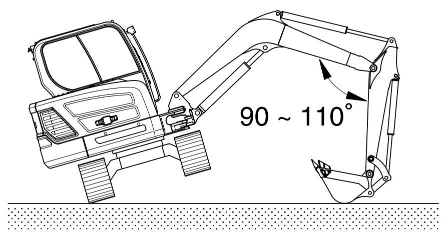
(1) Loosen tension of the track link.



R5577TR05

(2) Using the work equipment, push up track frame on side which is to be removed.

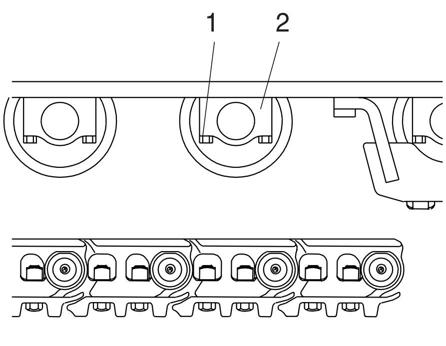
※ After jack up the machine, set a block under the unit.



55Z97TR02

(3) Remove the mounting bolt (1) and draw out the track roller (3).

· Weight : 16 ㎏ (36 ℔)



8-163(3)

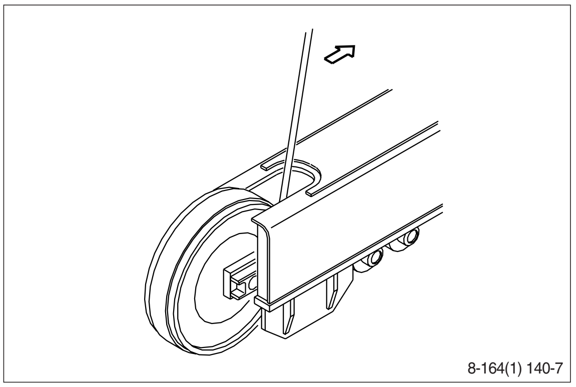
2) INSTALL

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

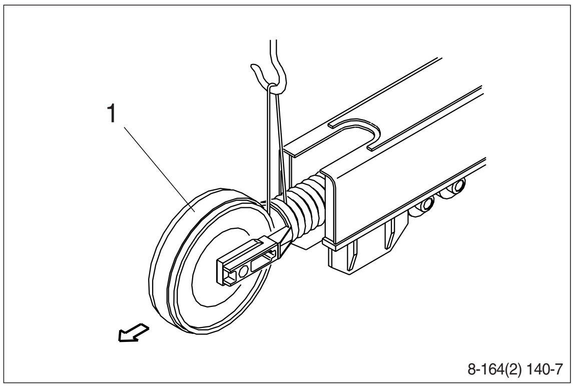
4. IDLER AND RECOIL SPRING

1) REMOVAL

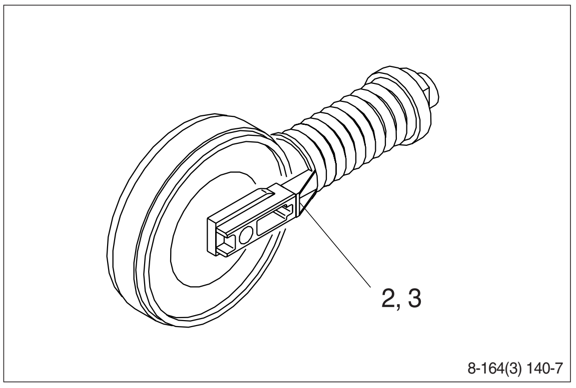
(1) Remove the track link.
For detail, see removal of track link.



(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 110 kg (240 lb)

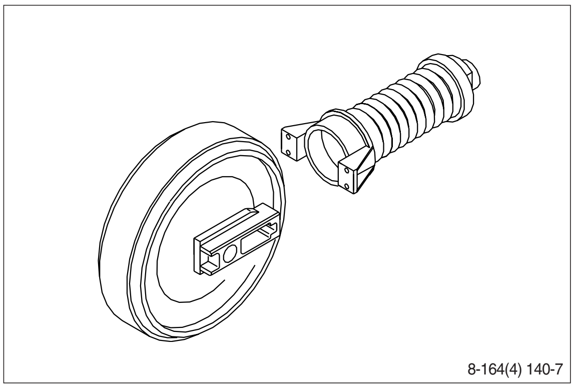


(3) Remove the bolts (2), washers (3) and separate idler from recoil spring.



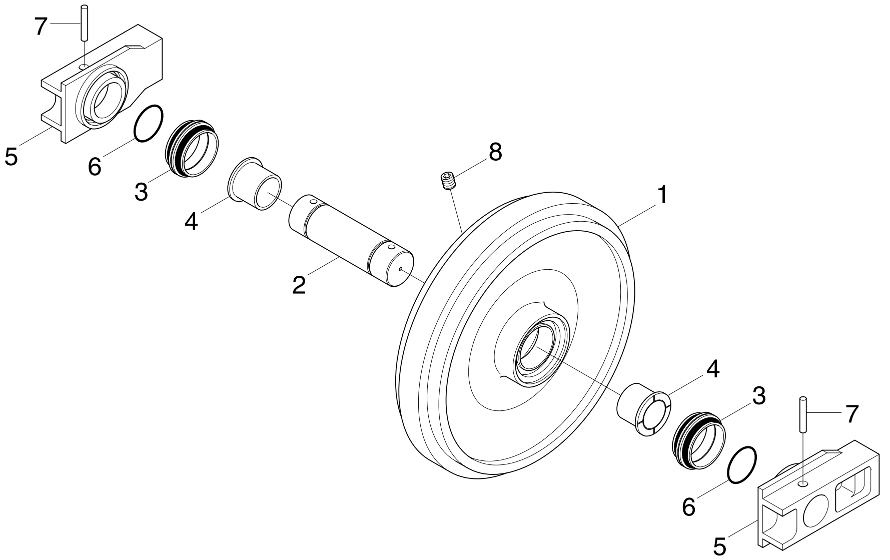
2) INSTALL

(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



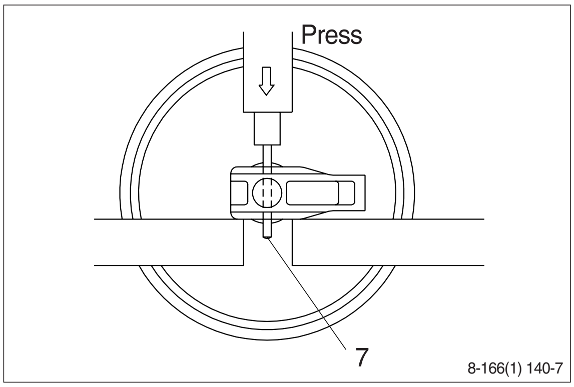
80CR97ID30

1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Bracket	8	Plug
3	Seal assembly	6	O-ring		

(2) Disassembly

① Remove plug and drain oil.

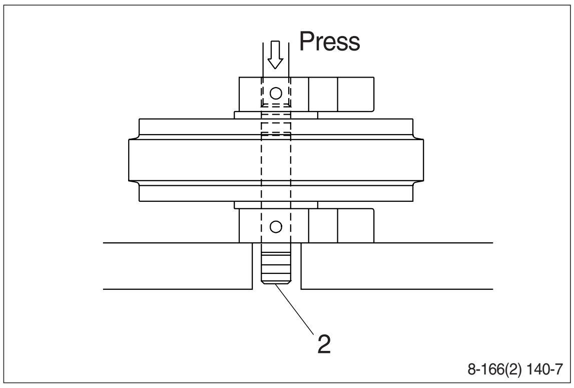
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

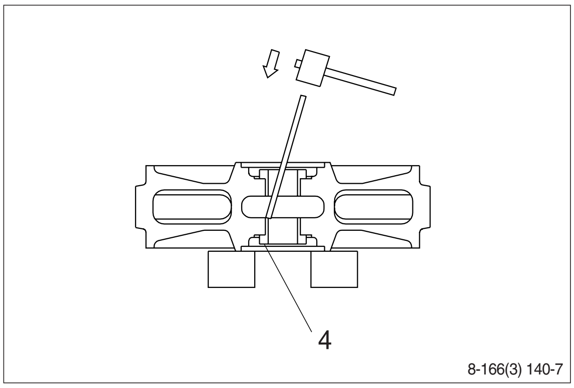
④ Remove seal (3) from idler (1) and bracket (5).

⑤ Remove O-ring (6) from shaft.



⑥ Remove the bushing (4) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

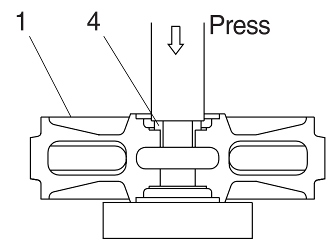


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

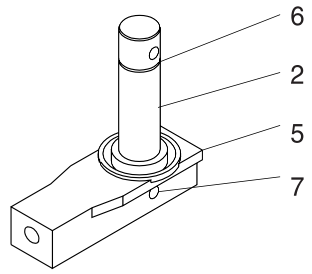
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1) 140-7

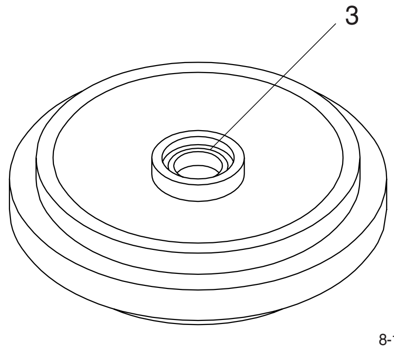
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



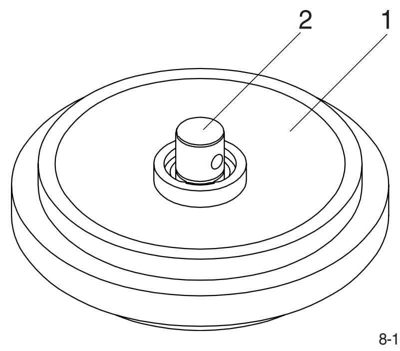
8-167(2) 140-7

④ Install seal (3) to shell (1) and bracket (5).



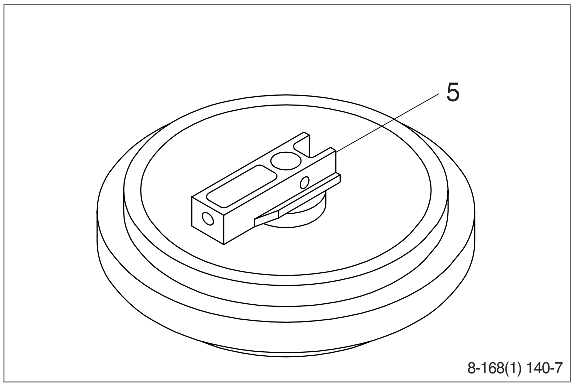
8-167(3) 140-7

⑤ Install shaft (2) to shell (1).

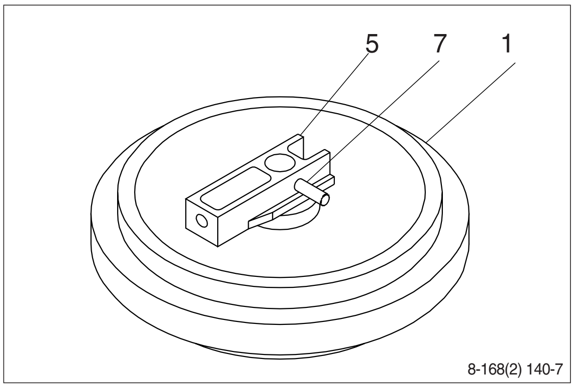


8-167(4) 140-7

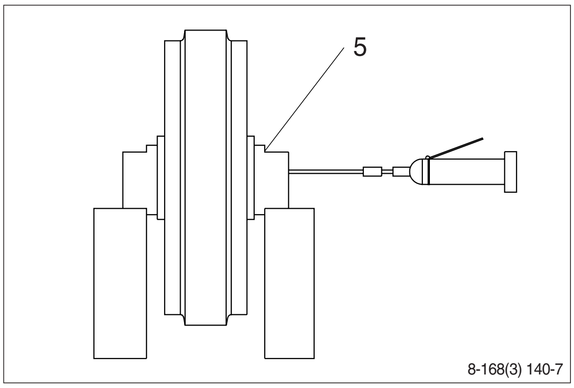
⑥ Install bracket (5) attached with seal (3).



⑦ Knock in the spring pin (7) with a hammer.

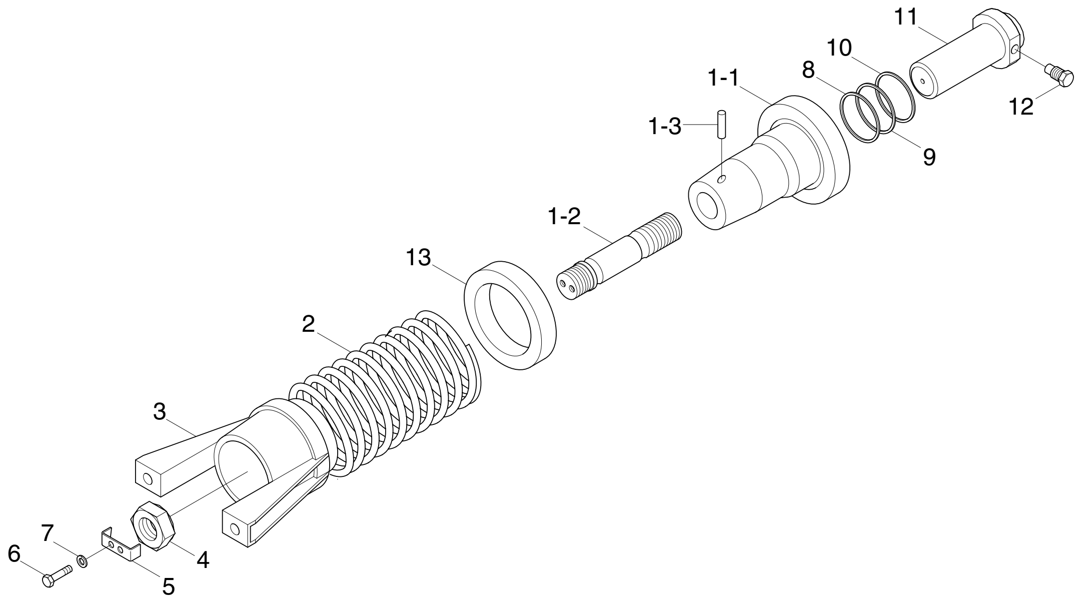


⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



80CR97ID31

1-1	Body	4	Lock nut	9	Back up ring
1-2	Tie bar	5	Lock plate	10	Dust seal
1-3	Spring pin	6	Bolt	11	Rod assembly
2	Spring	7	Spring washer	12	Grease valve
3	Bracket	8	Rod seal	13	Spacer

(2) Disassembly

① Apply pressure on spring (2) with a press.

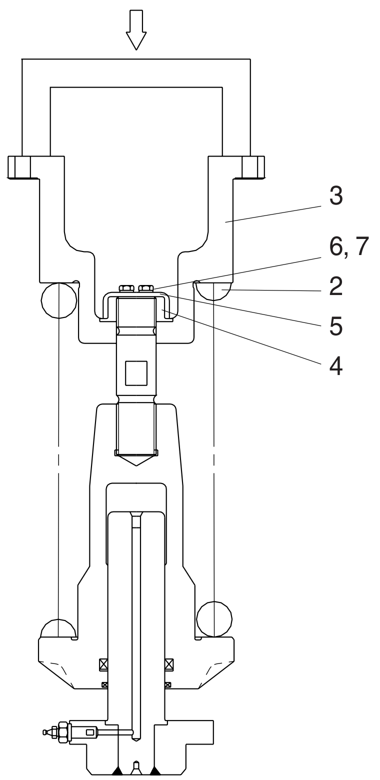
※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

· Spring set load : 5083 ㎏ (11210 ㏈)

② Remove bolt (6), spring washer (7) and lock plate (5).

③ Remove lock nut (4).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

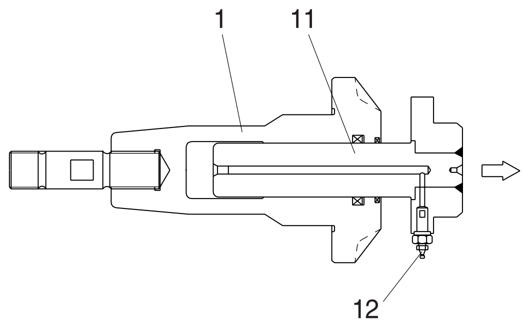
④ Lighten the press load slowly and remove bracket (3) and spring (2).



R210UCG2(1)

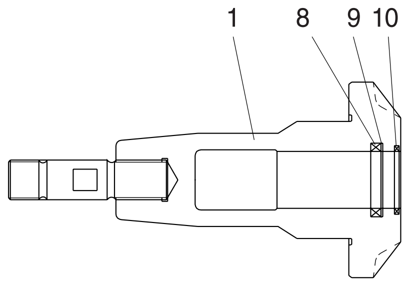
⑤ Remove rod (11) from body (1-1).

⑥ Remove grease valve (12) from rod (11).



R210UCG2(2)

⑦ Remove rod seal (8), back up ring (9) and dust seal (10).

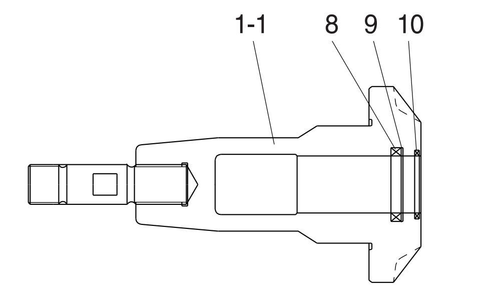


R210UCG2(3)

(3) Assembly

Install dust seal (10), back up ring (9) and rod seal (8) to body (1-1).

※ When installing dust seal (10) and rod seal (8), take full care so as not to damage the lip.

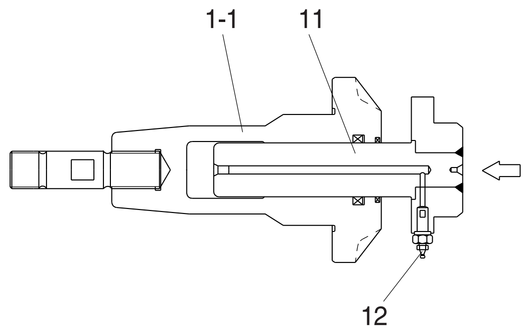


R210UCG2(3)

② Pour grease into body (1-1), then push in rod (11) by hand.
After take grease out of grease valve mounting hole, let air out.

※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve (12) to rod (11).
·Tightening torque : 13±1.0 kgf·m
(94±7.2 lbf·ft)



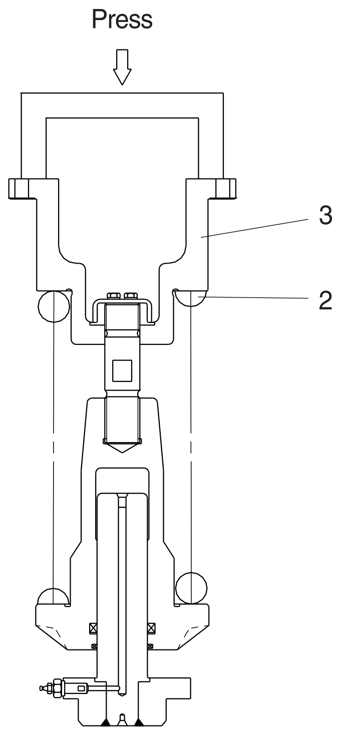
R210UCG2(4)

④ Install spring (2) and bracket (3) to body (1-1).

⑤ Apply pressure to spring (2) with a press and tighten lock nut (4).

※ Apply sealant before assembling.

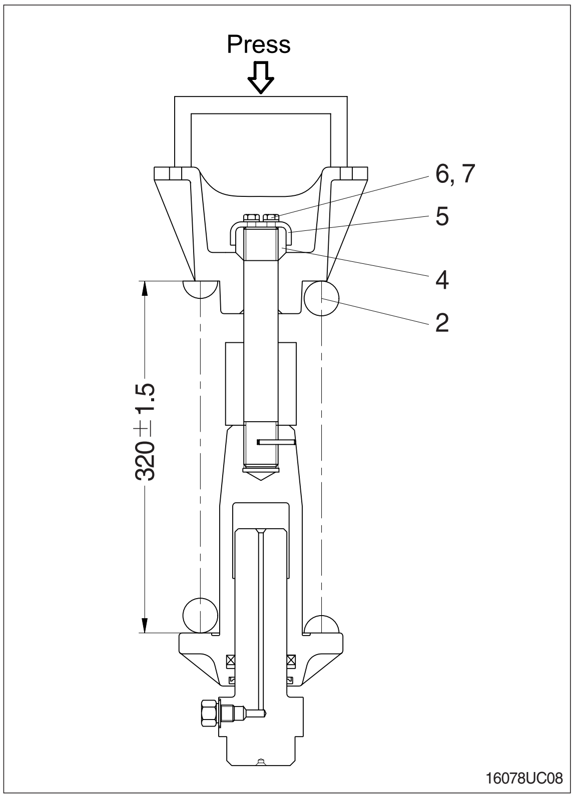
※ During the operation, pay attention specially to prevent the press from slipping out.



R210UCG2(5)

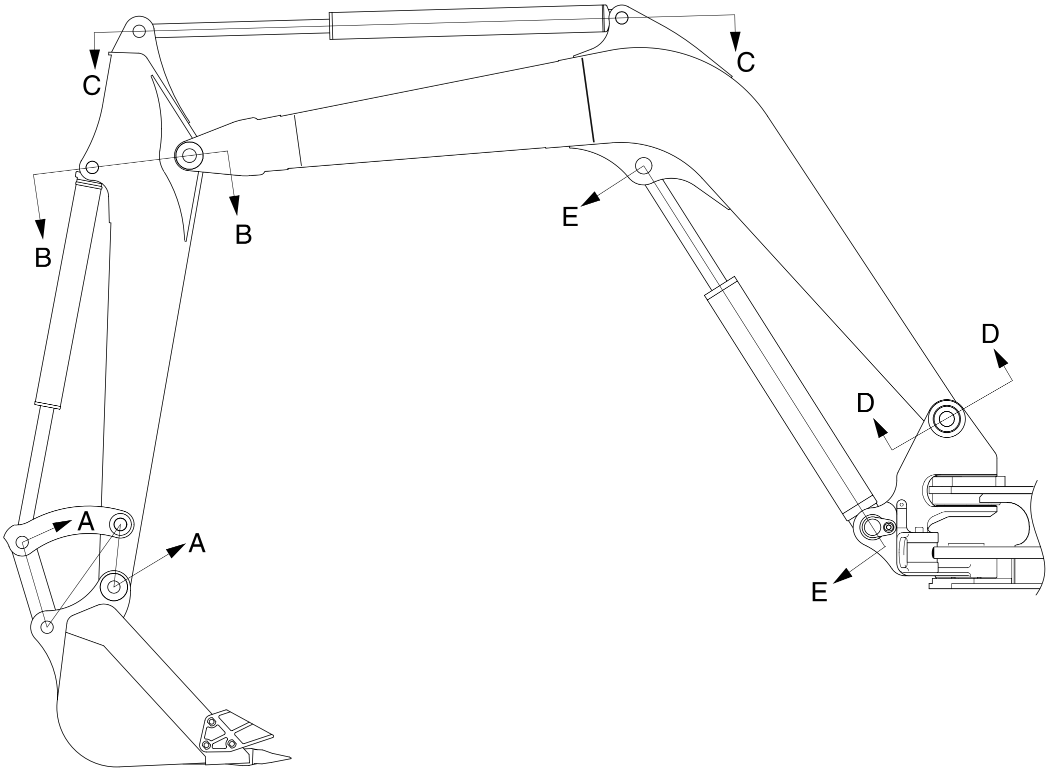
⑥ Lighten the press load and confirm the set length of spring (2).

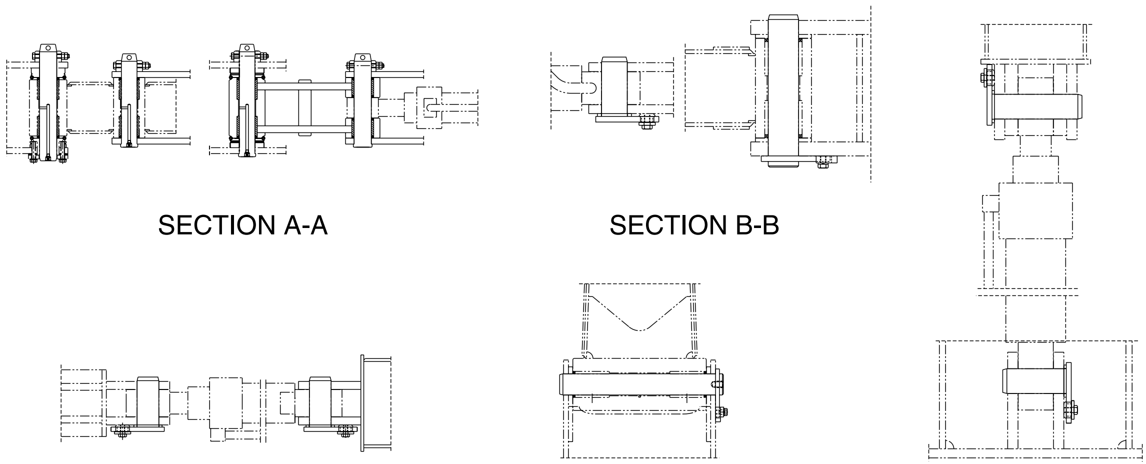
⑦ After the setting of spring (2), install lock plate (5), spring washer (7) and bolt (6).



GROUP 11 WORK EQUIPMENT

1. STRUCTURE





SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

SECTION E-E

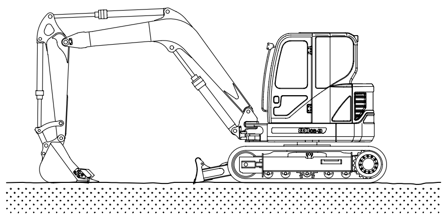
80CR97AT01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

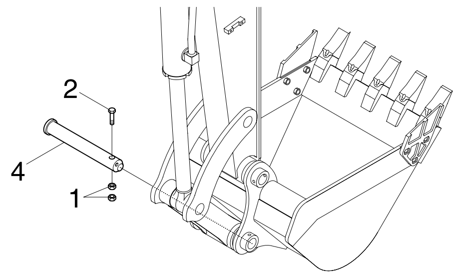
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



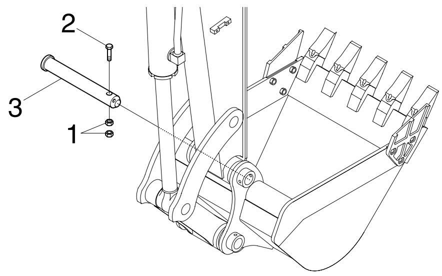
80CR97AT02

② Remove nut (1), bolt (2) and draw out the pin (4).



R5577AT13

③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly.
· Weight : 230 ㎏ (510 ℔)



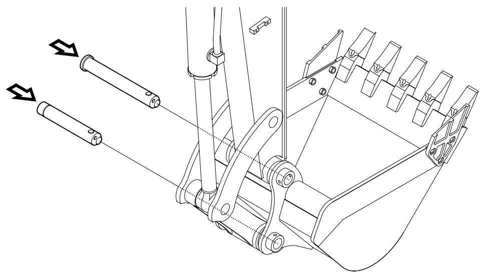
R5577AT04

(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Adjust the bucket clearance.
For detail, see operation manual.



R5577AT03

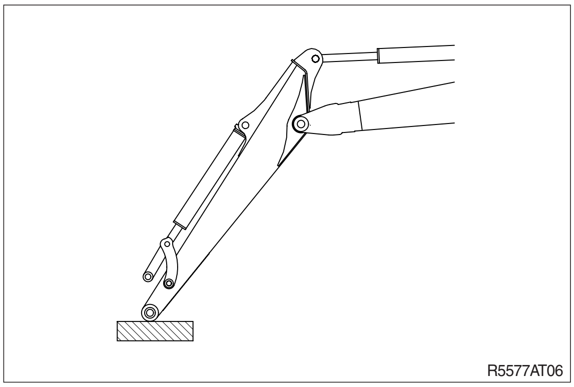
2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

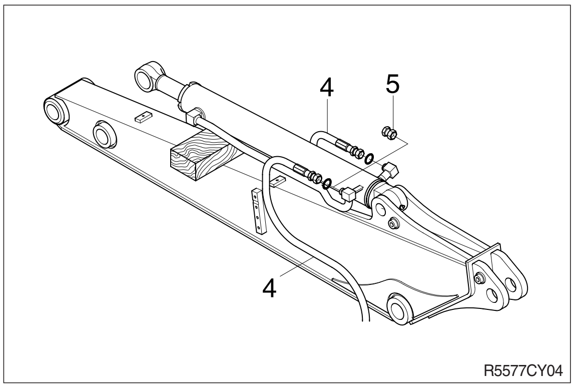
⚠ **Escaping fluid under pressure can penetrated the skin causing serious injury.**

① Remove bucket assembly.
For details, see removal of bucket assembly.



② Disconnect bucket cylinder hose (4).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**



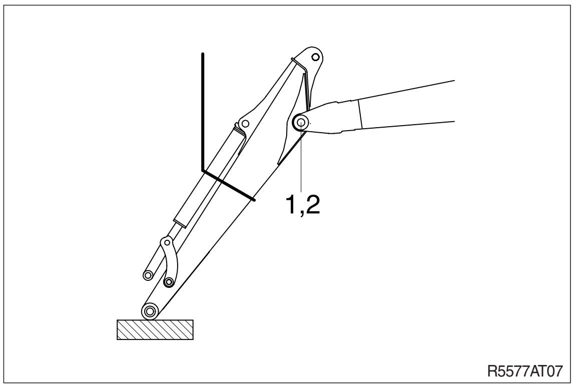
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

※ Tie the rod with wire to prevent it from coming out.

④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly.
· Weight : 180 ㎏ (400 ℔)

※ When lifting the arm assembly, always lift the center of gravity.



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

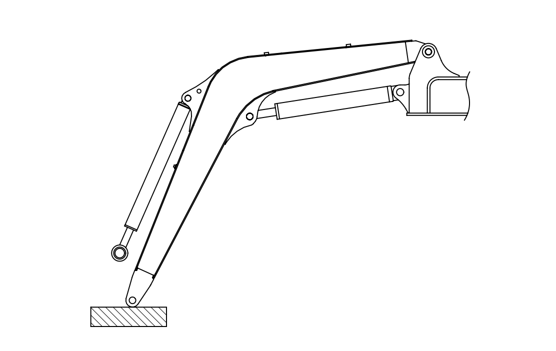
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

① Remove arm and bucket assembly.

② For details, see removal of arm and bucket assembly.
Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.



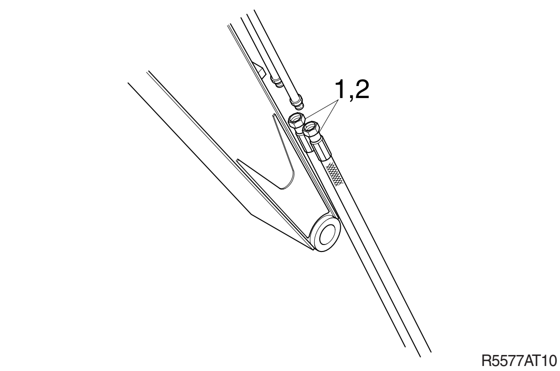
R5577AT08

③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hos e(1).

※ When the hose are disconnected, oil may spurt out.

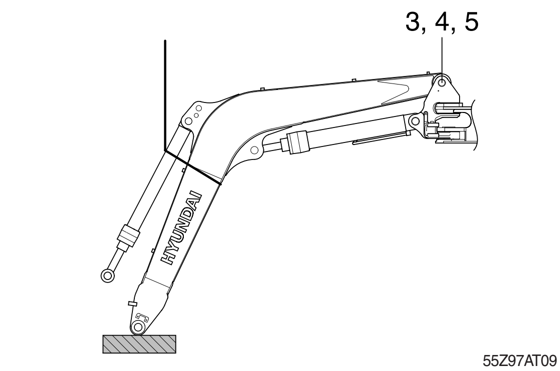
⑤ Sling boom assembly (3).



R5577AT10

⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly.
· Weight : 420 ㎏ (930 ㏈)

※ When lifting the boom assembly always lift the center of gravity.



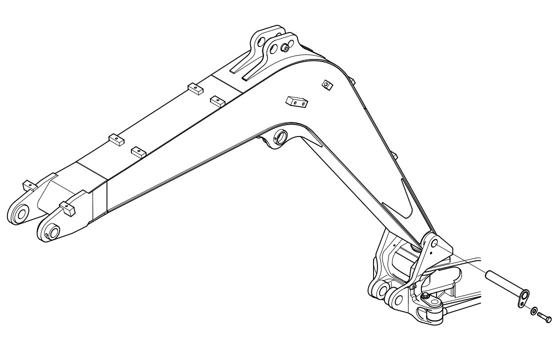
55Z97AT09

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

※ Bleed the air from the cylinder.



55Z97AT12

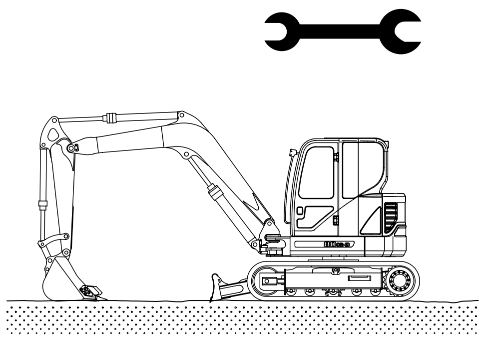
SECTION 8 COMPONENT MOUNTING TORQUE

GROUP 1 INTRODUCTION GUIDE

1. This section shows bolt specifications and standard torque values needed when mounting components to the machine.
2. Use genuine Hyundai spare parts.
   We expressly point out that Hyundai will not accept any responsibility for defects resulted from non-genuine parts.
   In such cases Hyundai cannot assume liability for any damage.

※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.

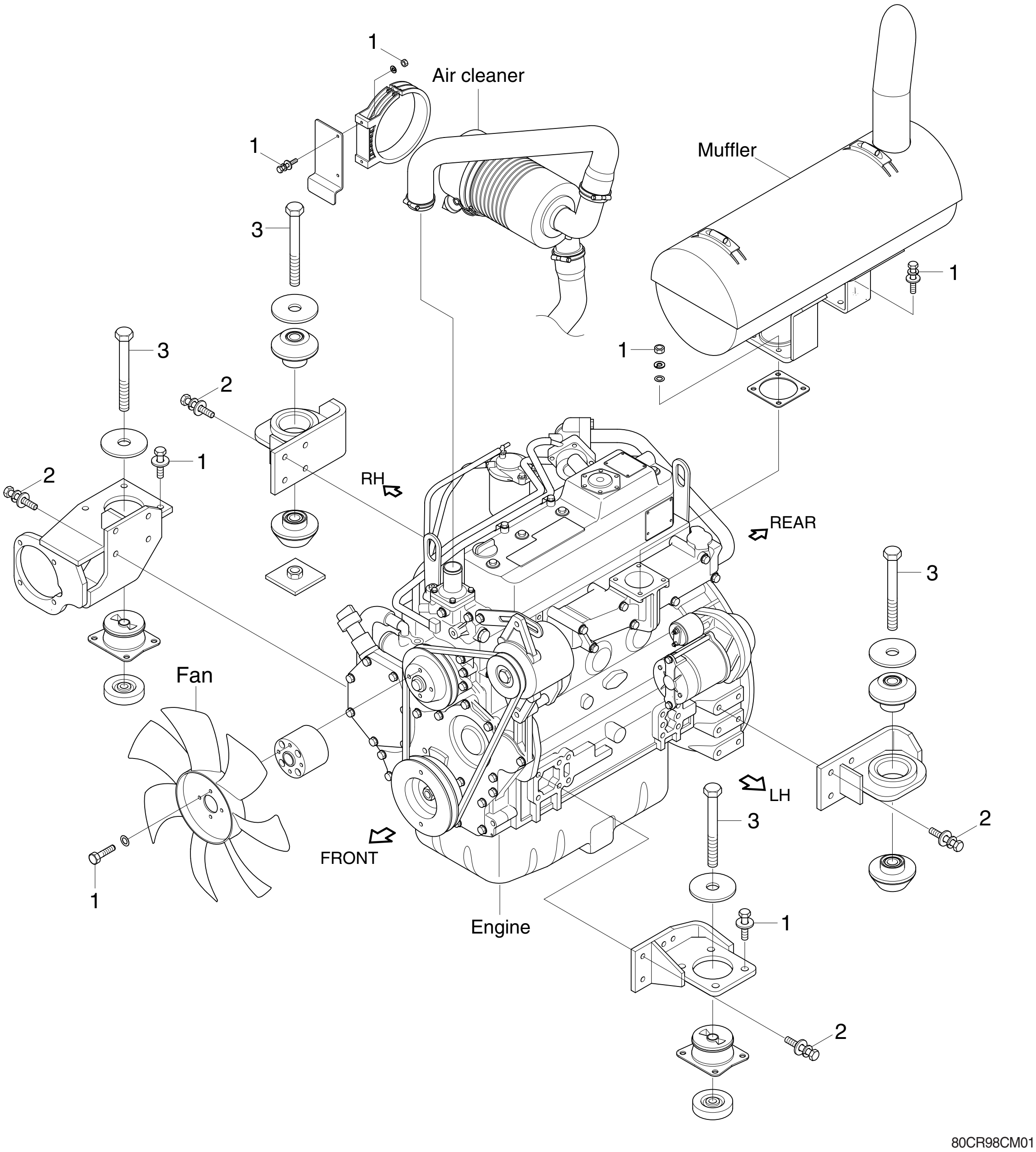
※ Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.



80CR98CM20

GROUP 2 ENGINE SYSTEM

1. ENGINE AND ACCESSORIES MOUNTING

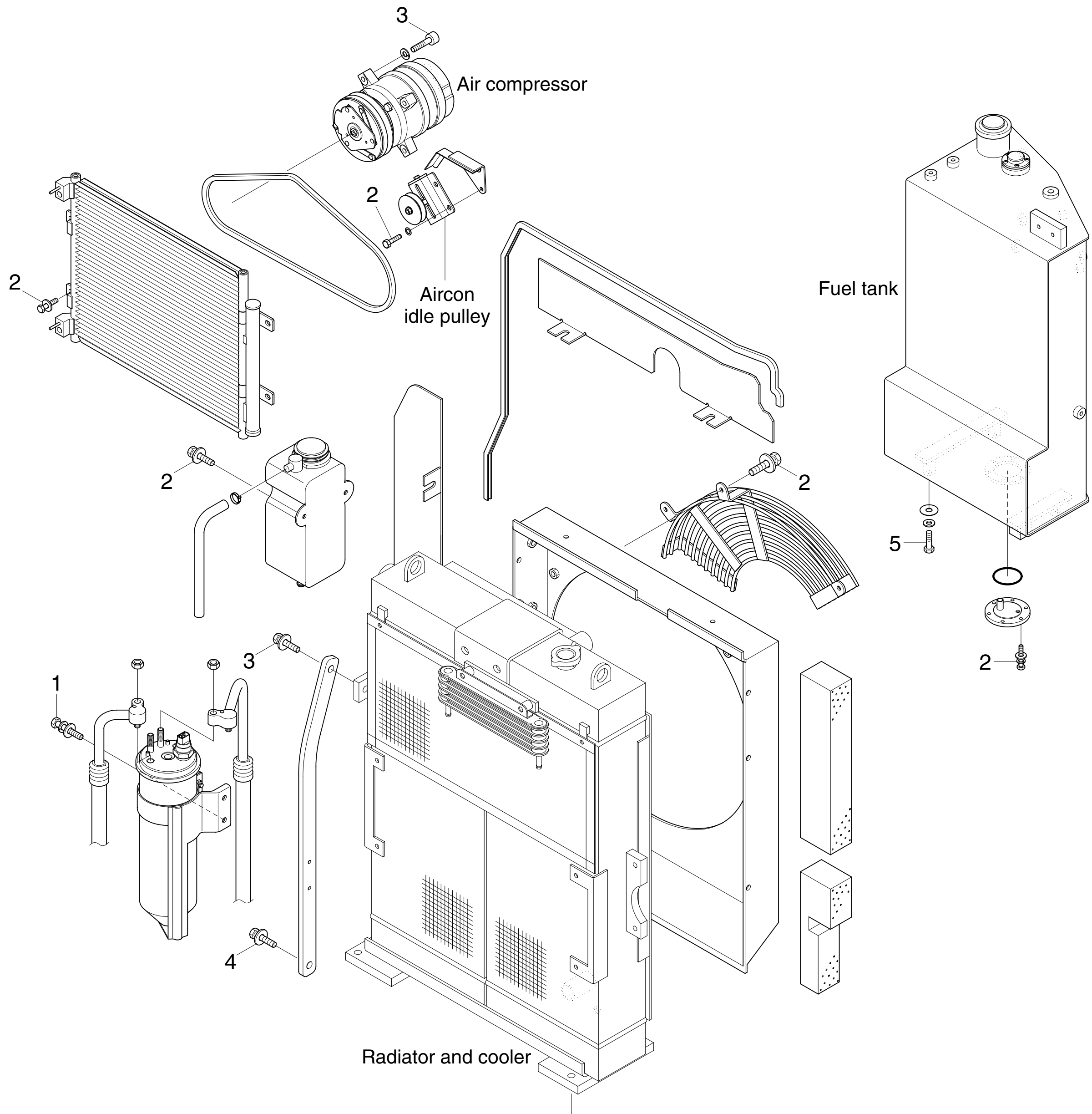


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.0	49.9±7.2

Item	Size	kgf · m	lbf · ft
3	M16×2.0	25±2.5	181±18

2. COOLING SYSTEM AND FUEL TANK MOUNTING



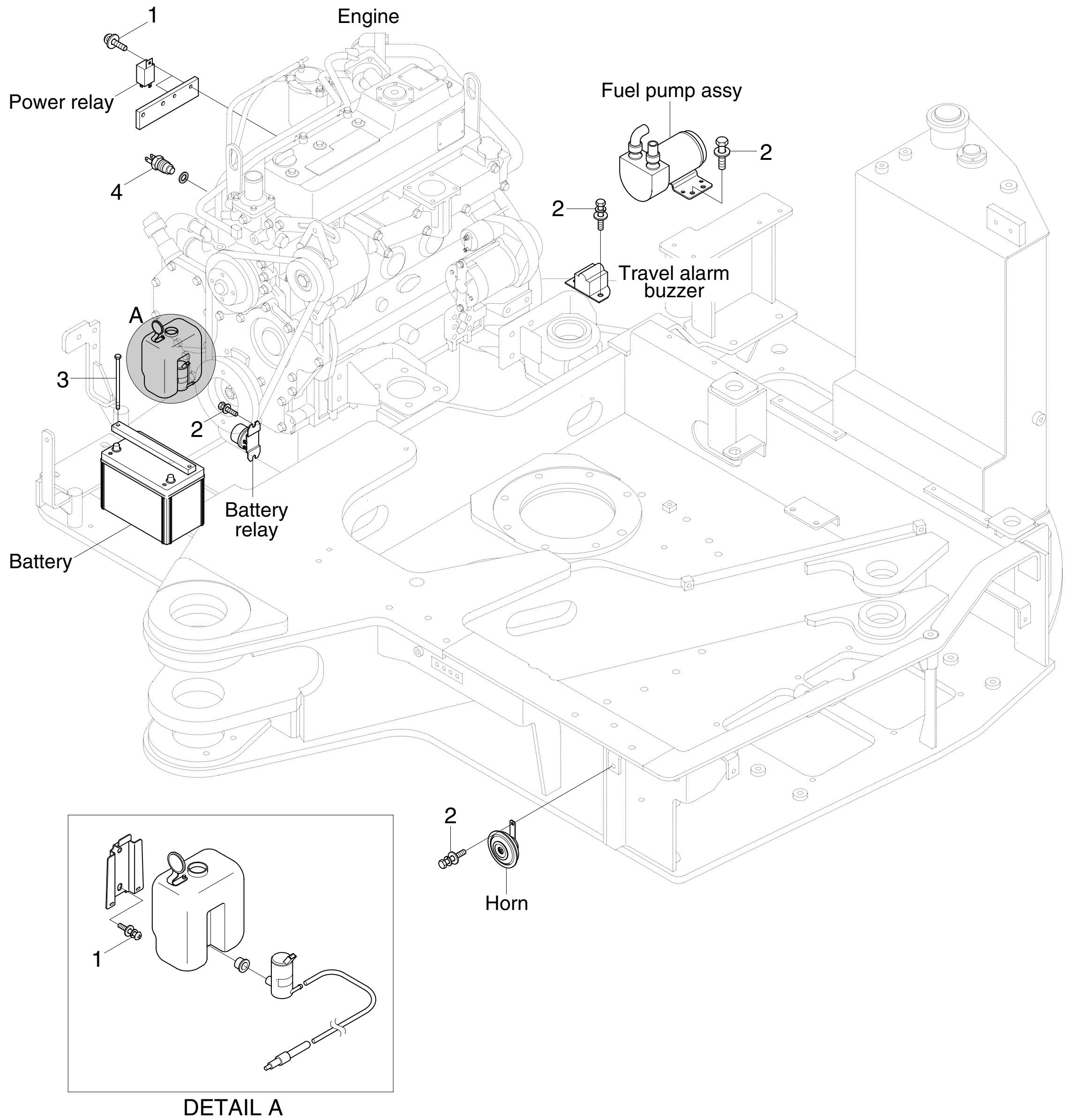
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.25	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
4	M12×1.75	12.8±3.0	92.6±21.7
5	M16×2.0	25±2.5	181±18.1

GROUP 3 ELECTRIC SYSTEM

1. ELECTRIC COMPONENTS MOUNTING 1



80CR98CM03

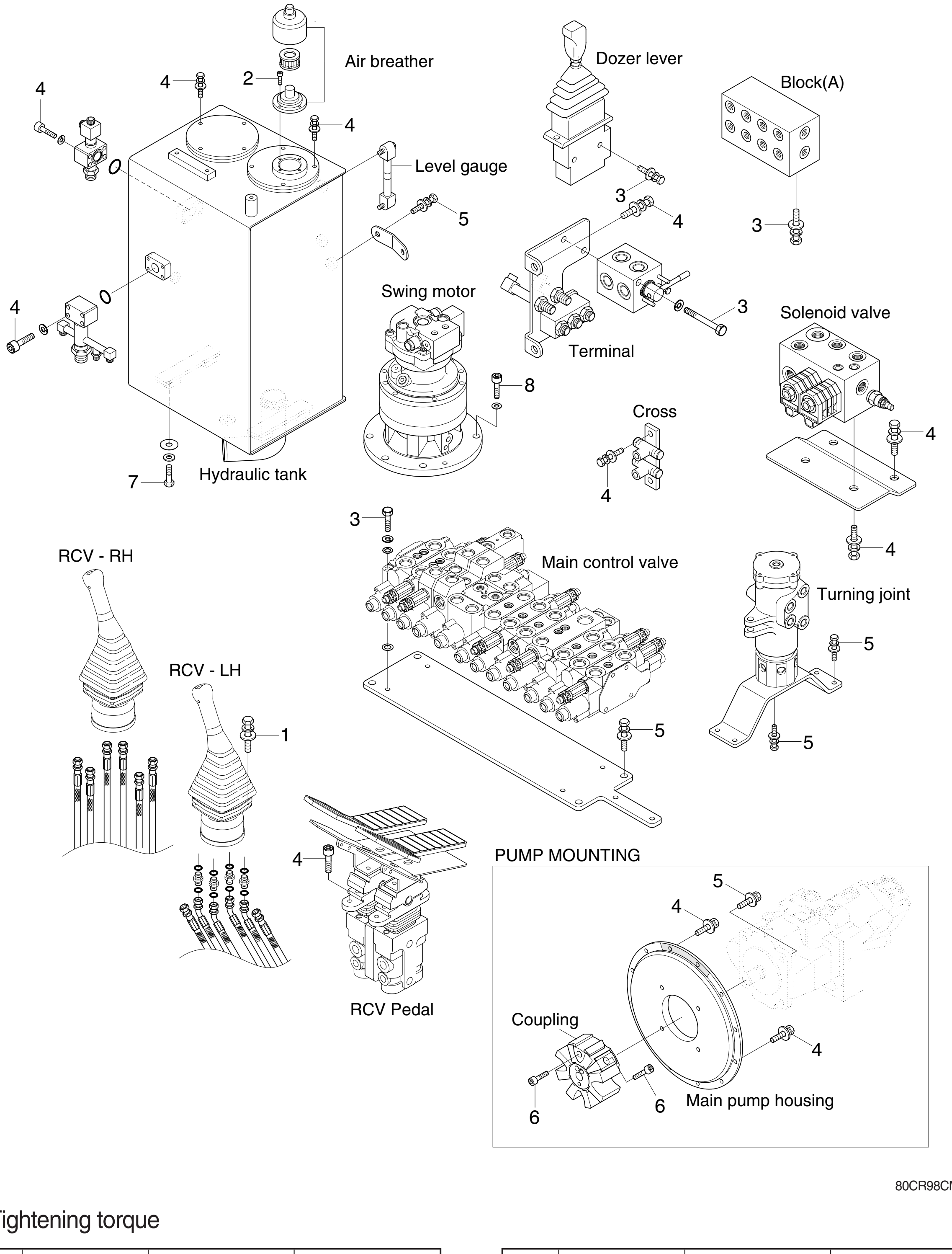
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1
4	-	2.0±0.2	14.5±1.4

GROUP 4 HYDRAULIC SYSTEM

1. HYDRAULIC COMPONENTS MOUNTING 1



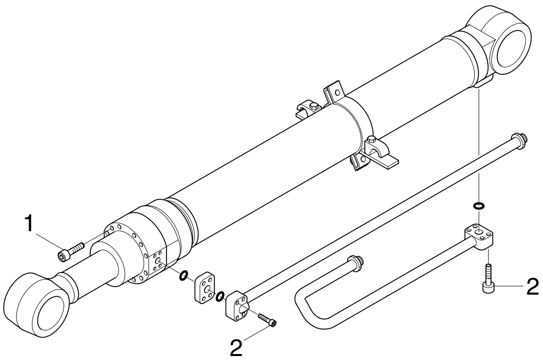
80CR98CM05

· Tightening torque

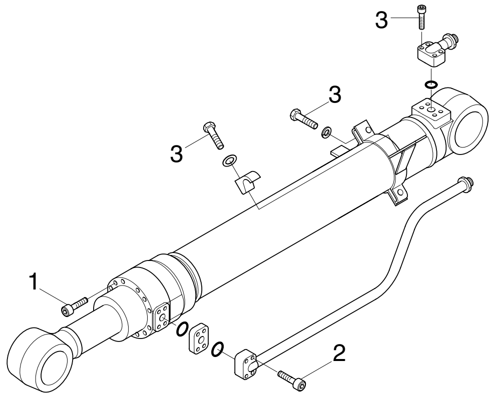
Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 6×1.0	1.44±0.3	10.4±2.2
3	M 8×1.25	2.5±0.5	18.1±3.6
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.2±1.3	88.2±9.4
6	M14×2.0	14.0±1.0	101±7.2
7	M16×2.0	25.0±2.5	118±18.1
8	M16×2.0	29.7±4.5	215±33.0

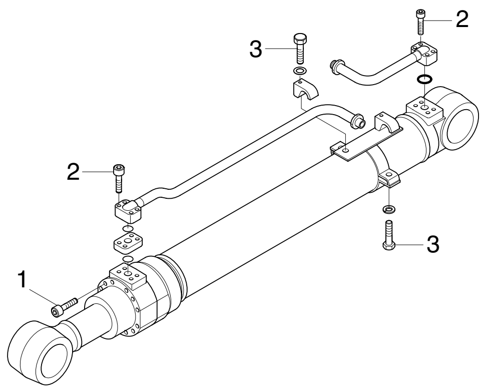
2. HYDRAULIC COMPONENTS MOUNTING 2



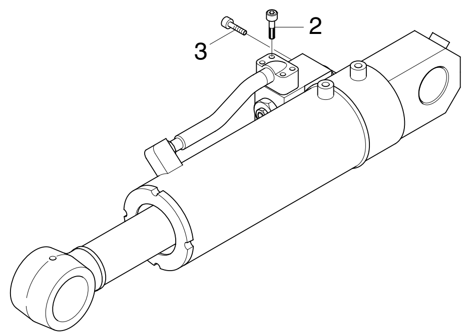
BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER



DOZER CYLINDER

80CR98CM06

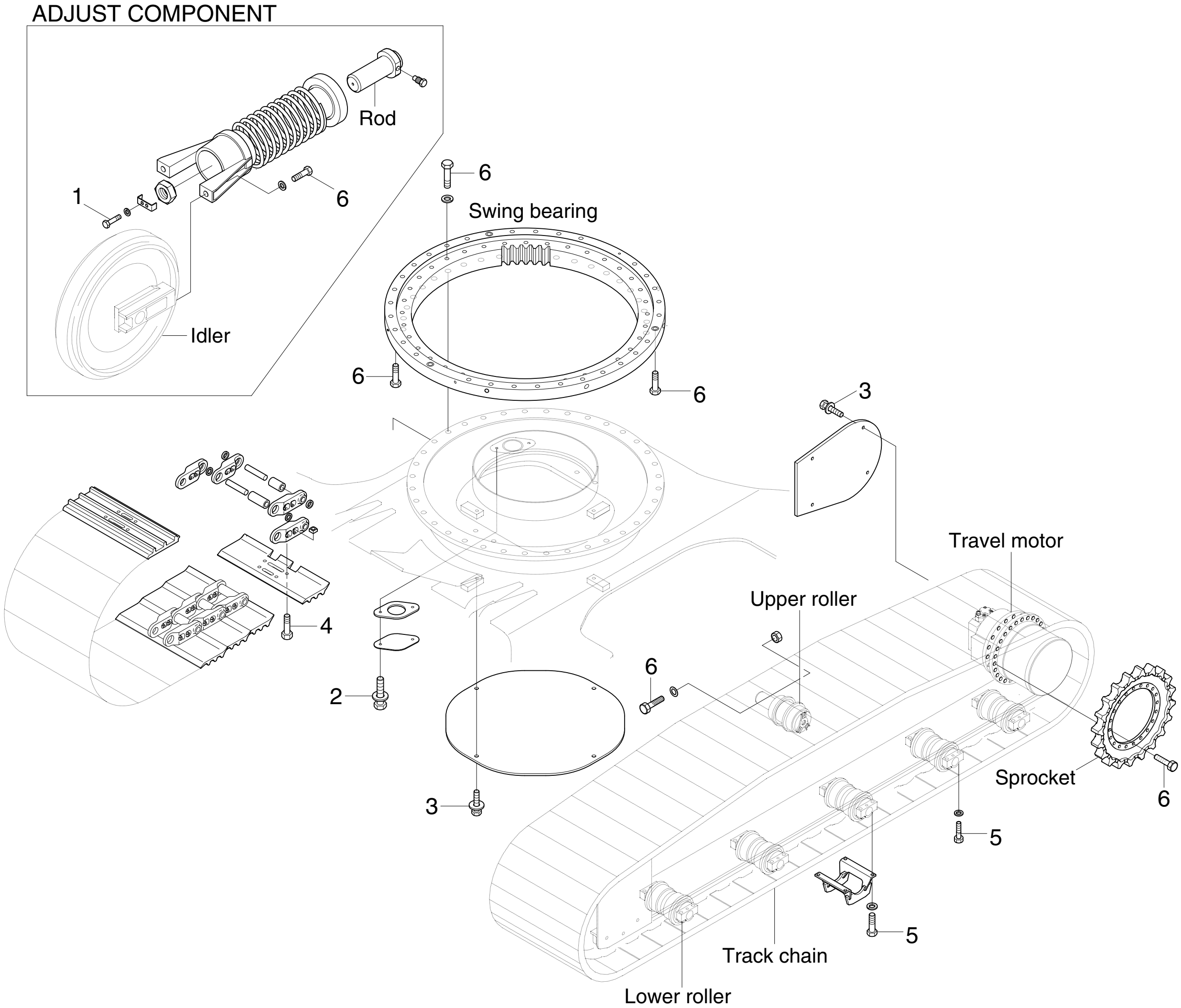
· Tightening torque

Gland mounting bolt (1)

Item	Size	kgf · m	lbf · ft
Boom cylinder	M14	15±1.5	108±10.8
Arm cylinder	M14	15±1.5	108±10.8
Bucket cylinder	M12	9.4±1.0	68±7.2

Item	Size	kgf · m	lbf · ft
2	M8×1.25	2.7±0.3	19.5±2.2
3	M10×1.5	3.2±0.3	23.1±2.2

GROUP 5 UNDERCARRIAGE



80CR98CM08

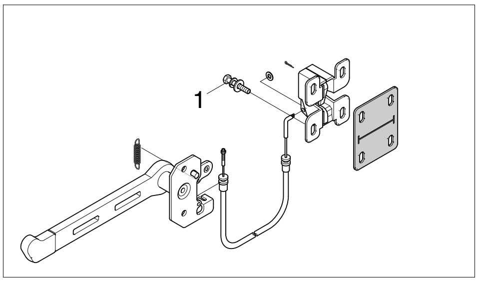
· Tightening torque

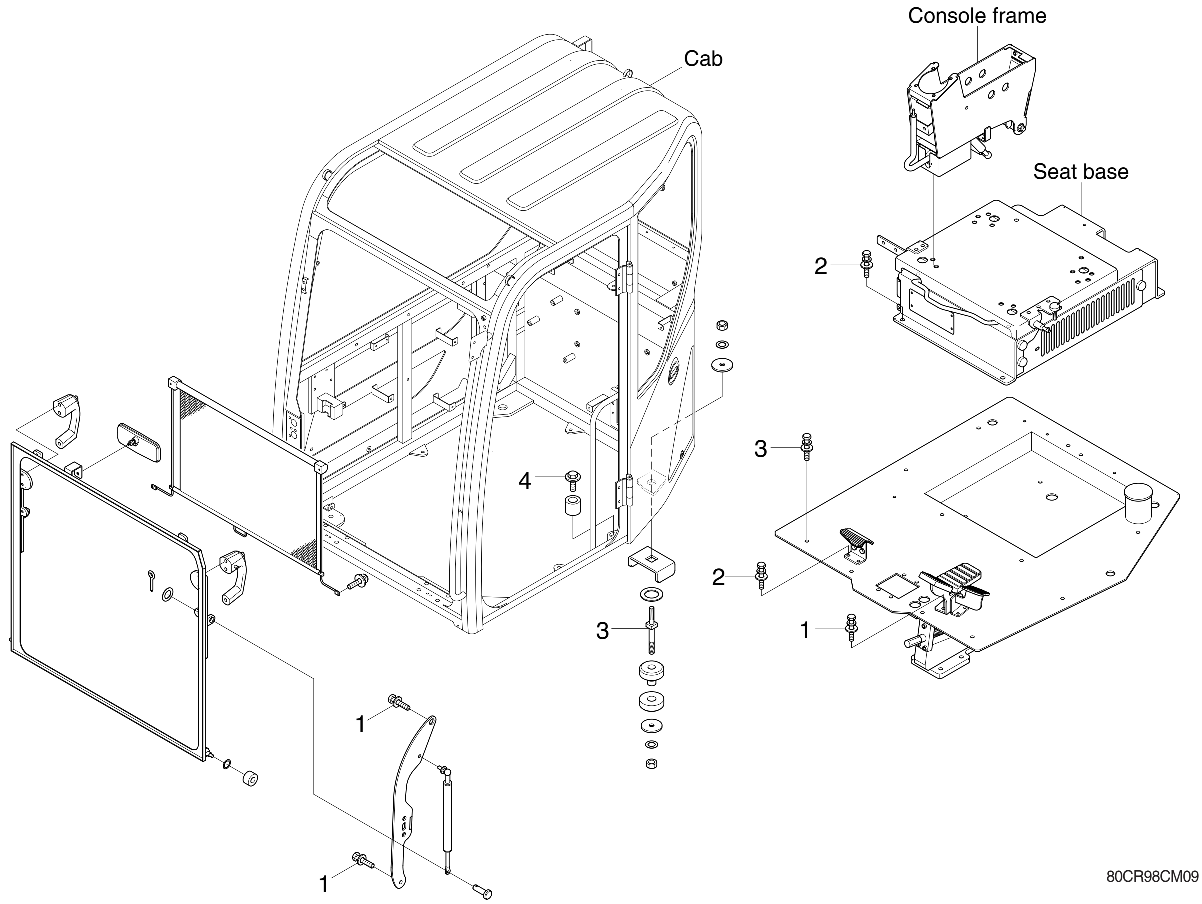
Item	Size	kgf · m	lbf · ft
1	M8 × 1.25	3.4 ± 0.5	24.6 ± 3.6
2	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
3	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7

Item	Size	kgf · m	lbf · ft
4	M14 × 1.5	25.5 ± 2.5	184 ± 18.1
5	M14 × 2.0	19.6 ± 2.0	142 ± 14.5
6	M16 × 2.0	29.7 ± 4.3	215 ± 31.1

GROUP 6 STRUCTURE

1. CAB AND ACCESSORIES MOUNTING



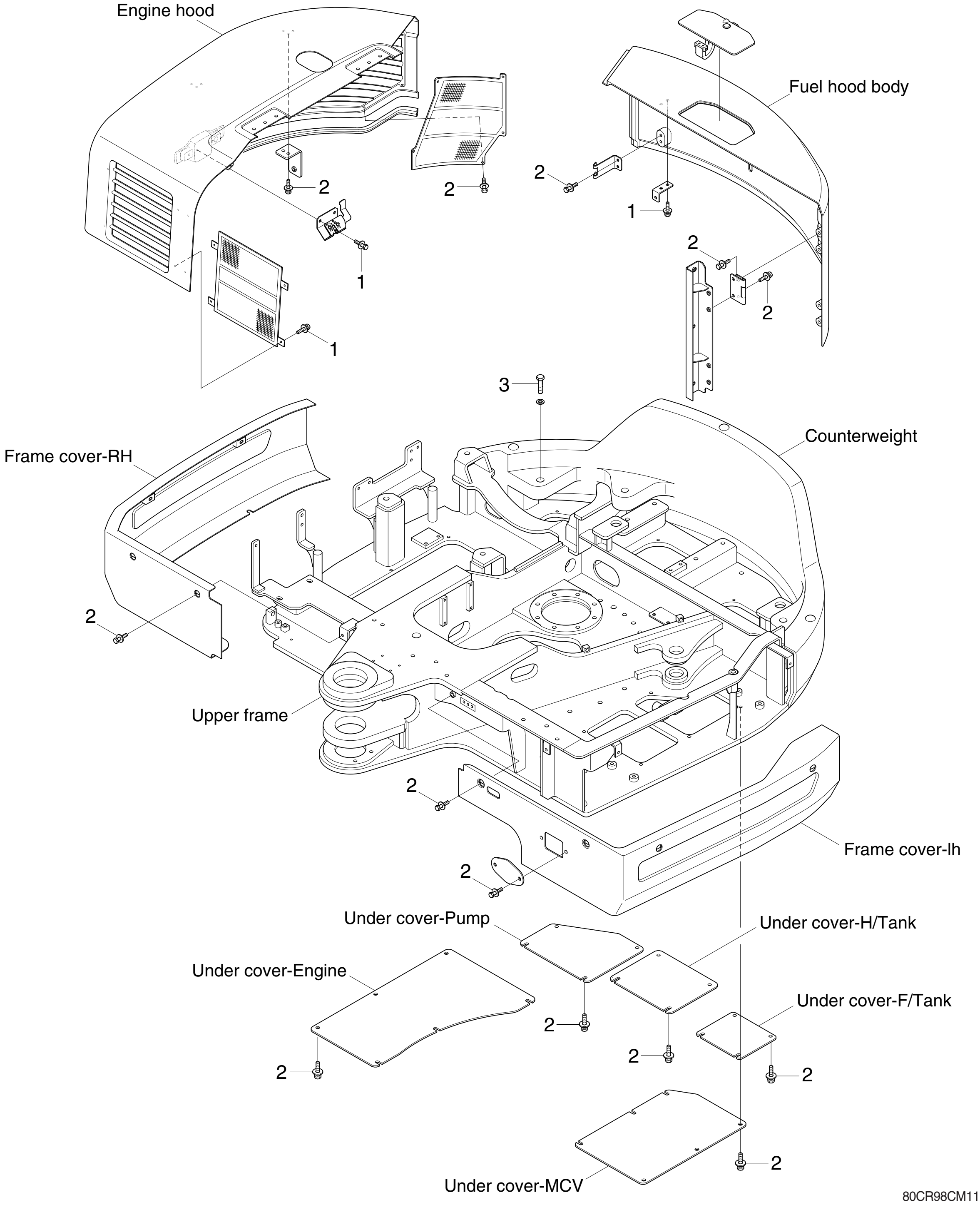


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	4.7±0.9	34.0±6.5

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M16×2.0	29.7±4.5	215±32.5

2. COWLING MOUNTING

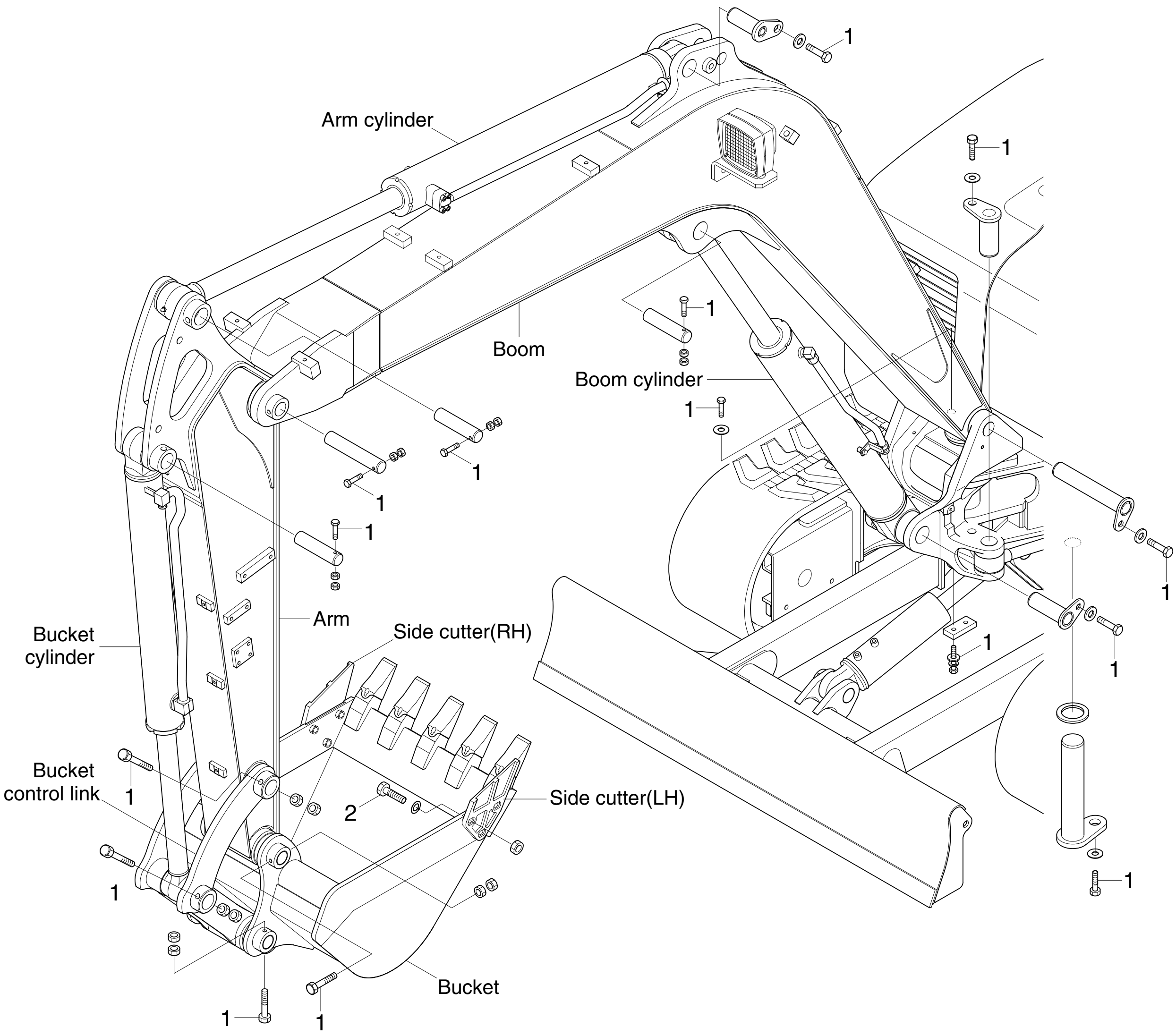


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M27×3.0	140±15	1013±108

GROUP 7 WORK EQUIPMENT



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7

Item	Size	kgf · m	lbf · ft
2	M20 × 2.5	57.9 ± 8.7	419 ± 62.9