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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

   - 2 : Item number(2. Structure and Function)
   - 3 : 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/cm^2 to lbf/in^2

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

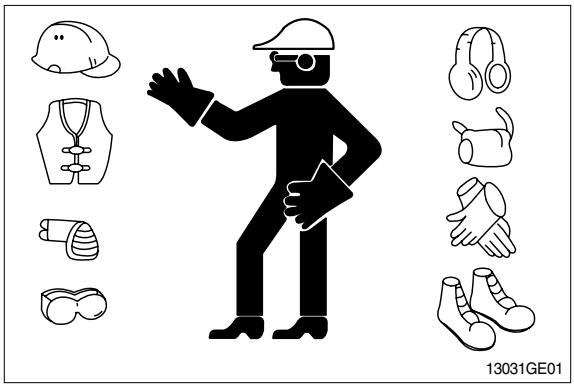
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

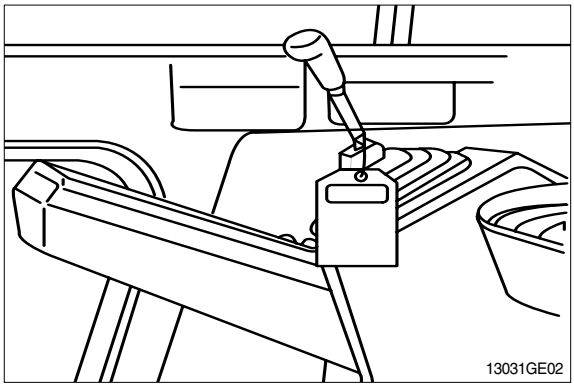
WEAR PROTECTIVE CLOTHING

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



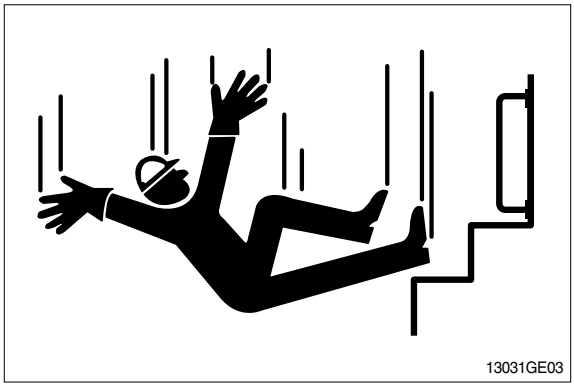
WARN OTHERS OF SERVICE WORK

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.



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.

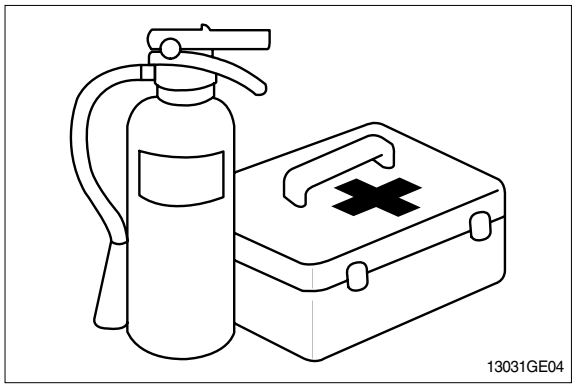


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

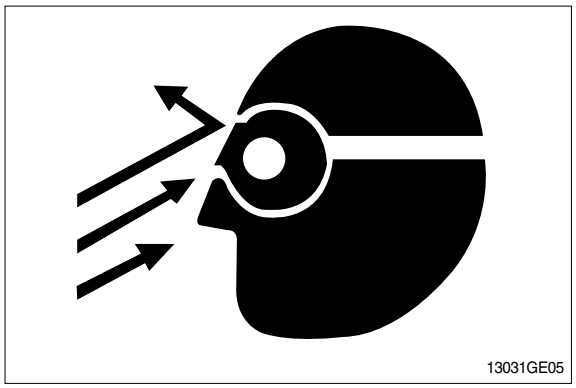
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

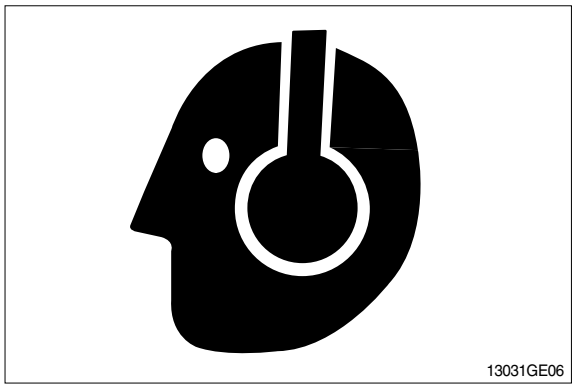
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

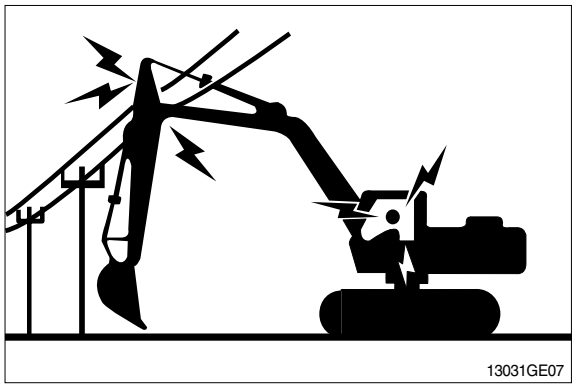
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

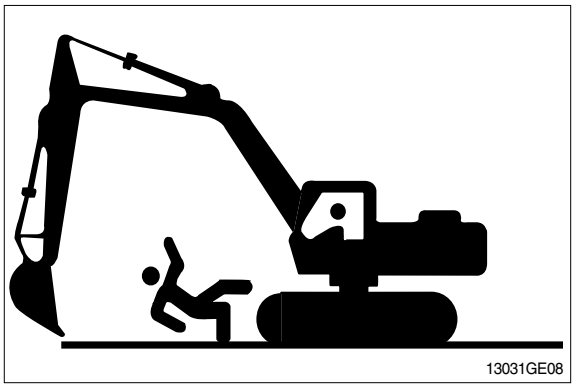
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



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.

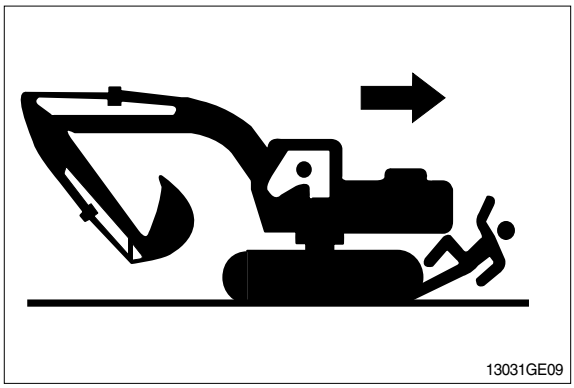

13031GE08

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.

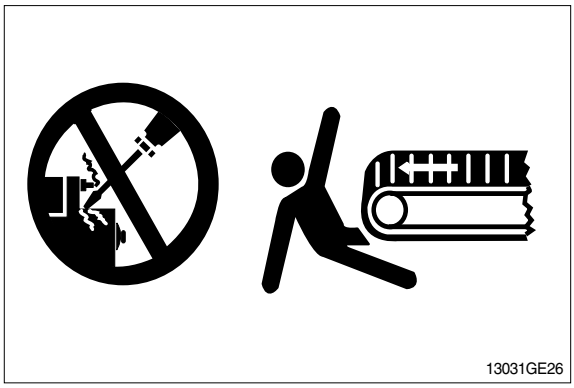
Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.


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

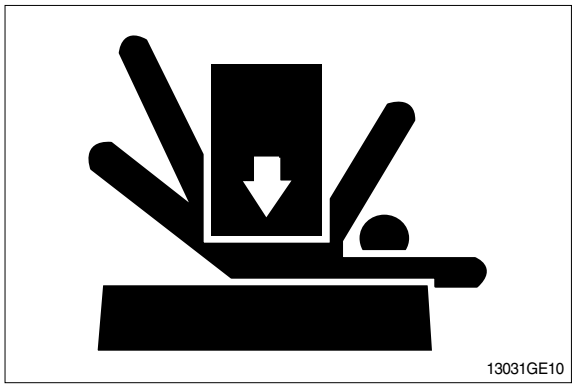
Before working on the machine:

- 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.

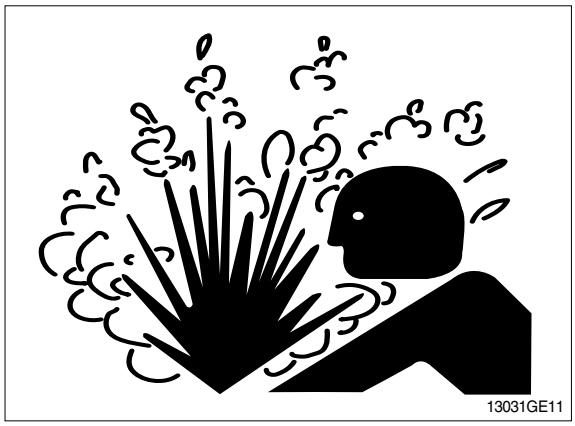
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



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.



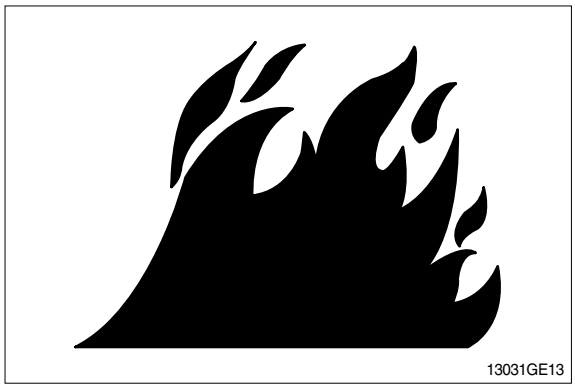
HANDLE FLUIDS SAFELY-AVOID FIRES

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.

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

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

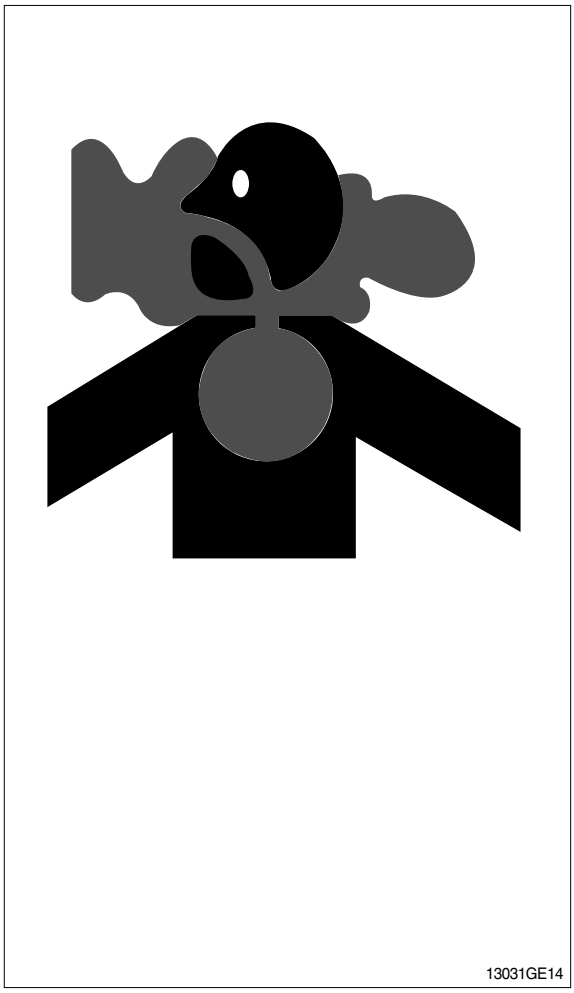
Do not store oily rags; They can ignite and burn spontaneously.



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.



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.

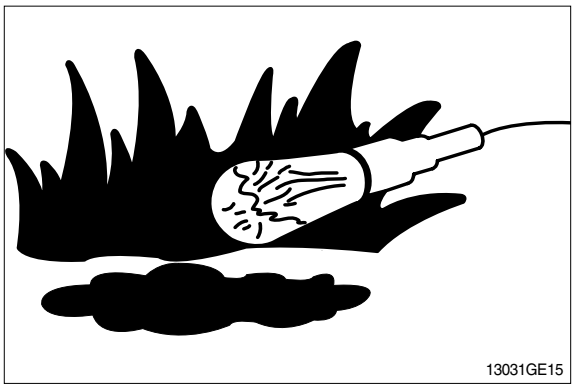
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

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

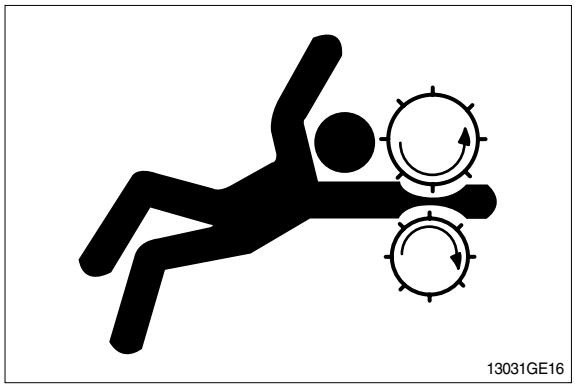
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



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.

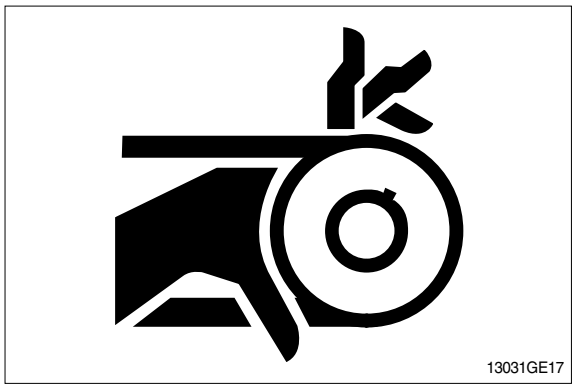
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



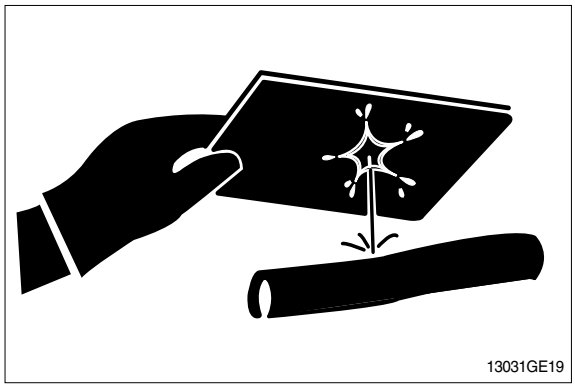
AVOID HIGH PRESSURE FLUIDS

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.



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.

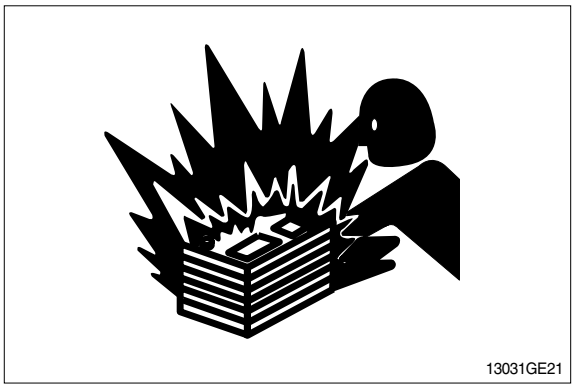
Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.

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).



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:

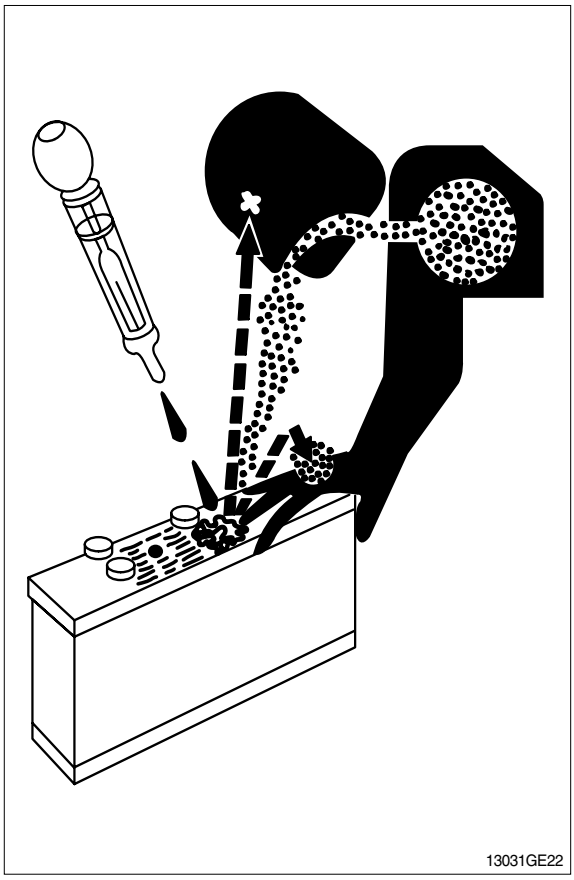
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

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.



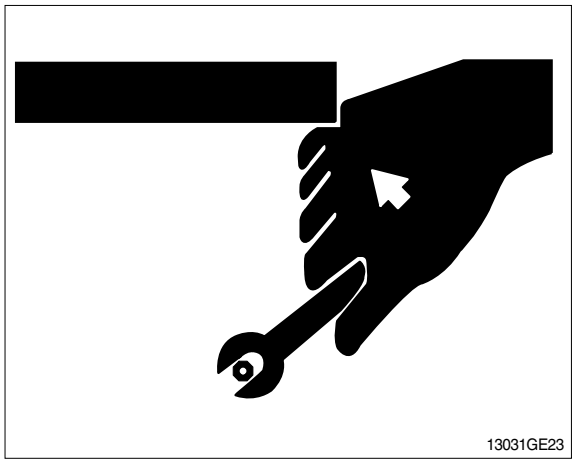
USE TOOLS PROPERLY

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.(See Parts catalogue.)

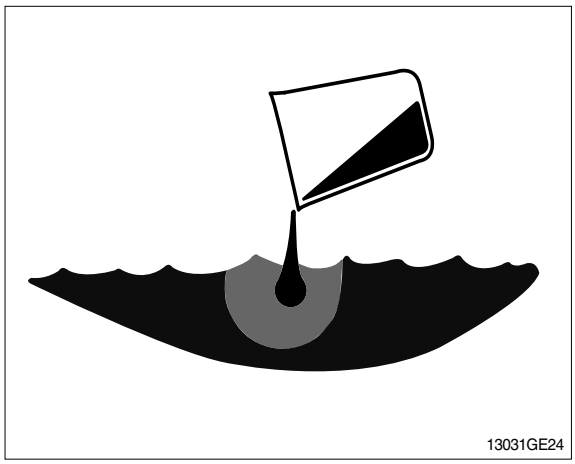


DISPOSE OF FLUIDS PROPERLY

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.

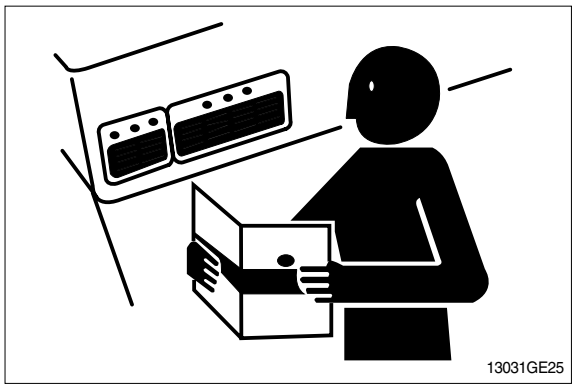
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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.

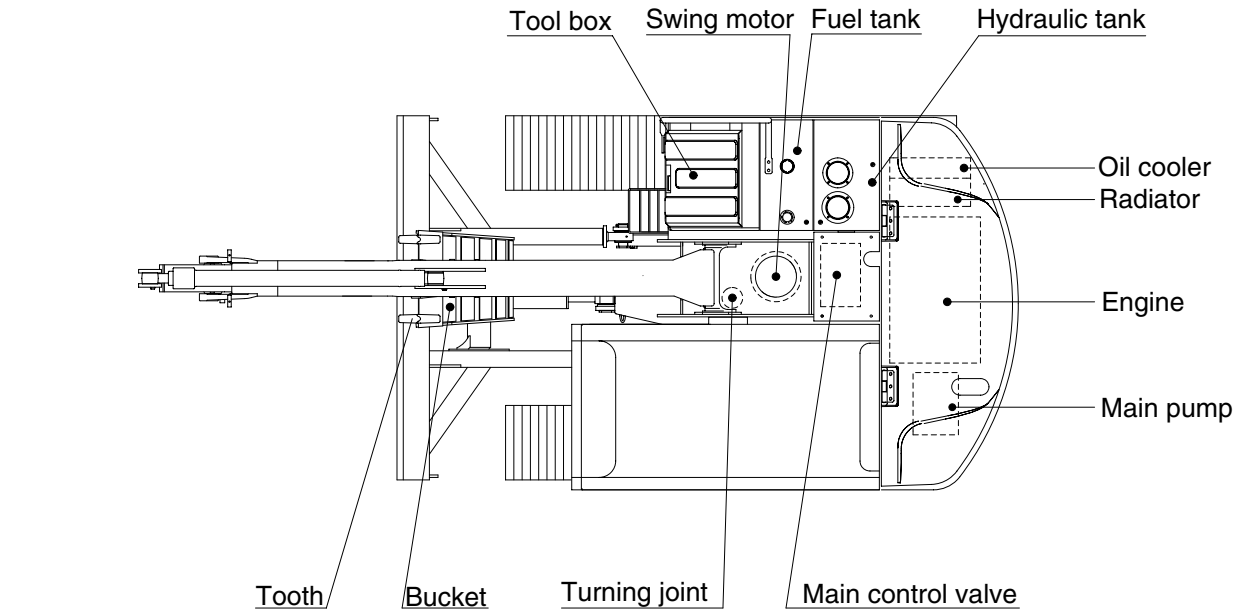


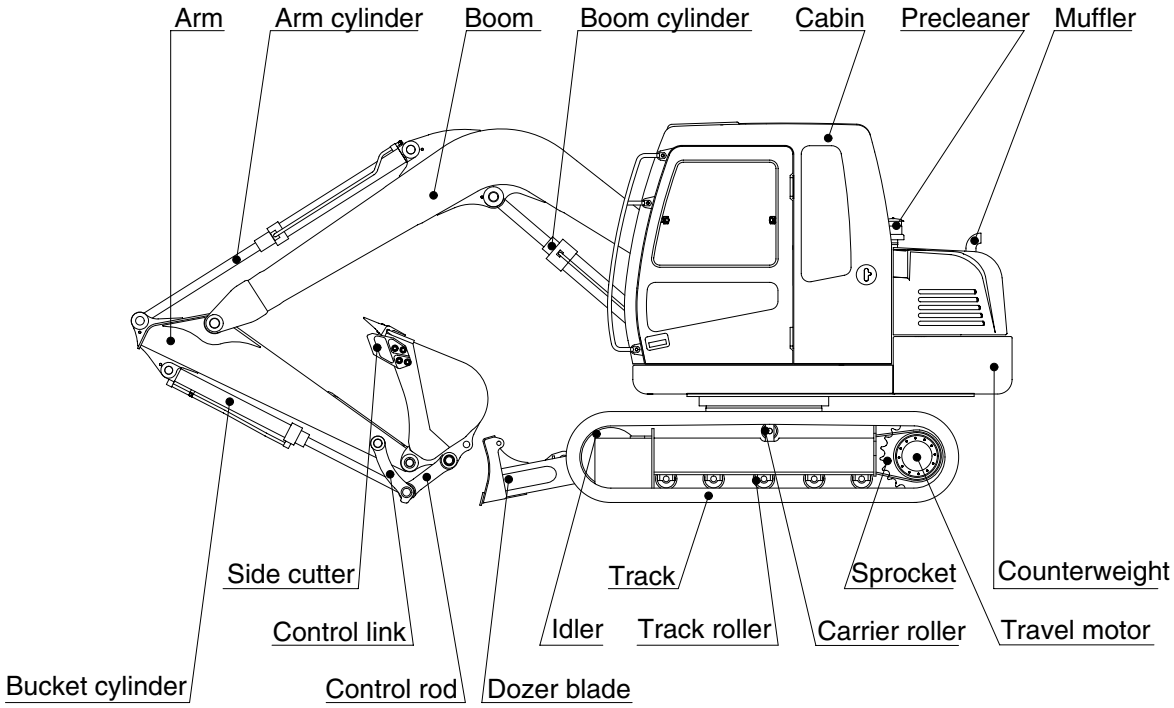
LIVE WITH SAFETY

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



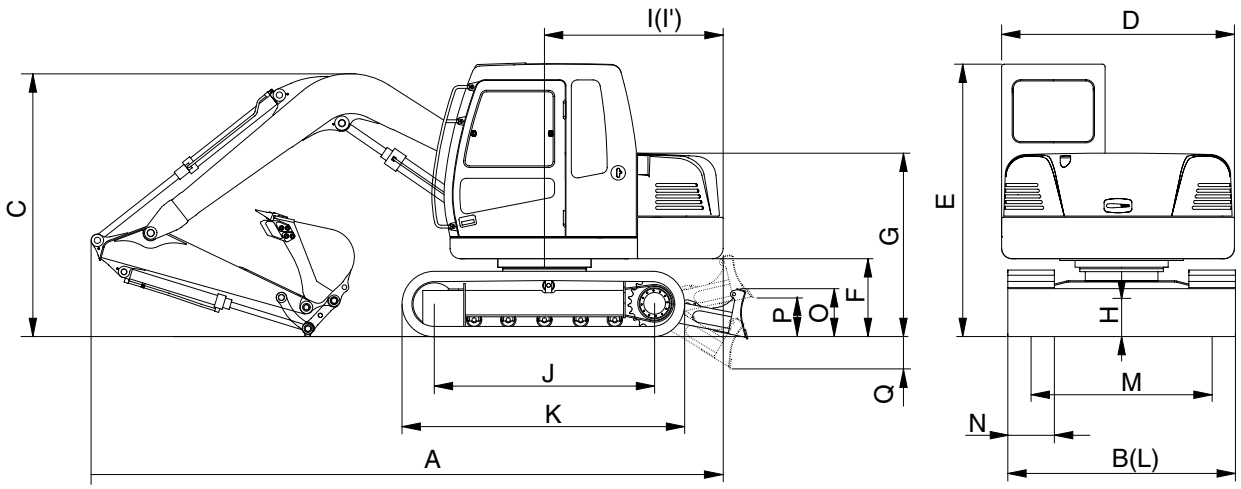


7072SP01

2. SPECIFICATIONS

1) R80

(1) 3.7m(12' 2") MONO BOOM, 1.67m(5' 6") ARM AND FRONT DOZER BLADE

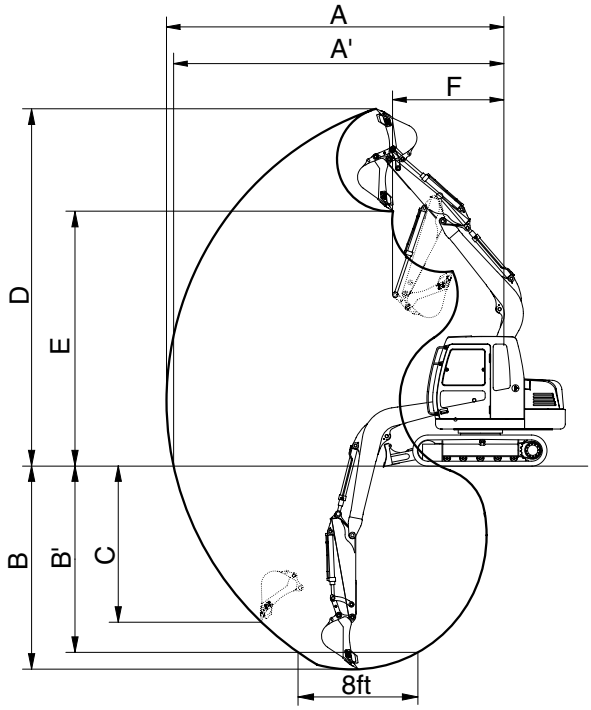


Description		Unit	Specification
Operating weight		kg(lb)	7900(17555)
Bucket capacity(SAE heaped), standard		$m^3(yd^3)$	0.28(0.25)
Overall length	A	mm(ft-in)	6325(20' 9")
Overall width, with 450mm shoe	B		2260(7' 5")
Overall height of boom	C		2605(8' 7")
Superstructure width	D		2250(7' 5")
Overall height	E		2650(8' 8")
Ground clearance of counterweight	F		755(2' 6")
Engine cover height	G		1775(5' 10")
Minimum ground clearance	H		360(1' 2")
Rear-end distance	I		1727(5' 8")
Rear-end swing radius	I'		1750(5' 9")
Distance between tumblers	J		2130(6' 12")
Undercarriage length	K		2724(8' 11")
Undercarriage width	L		2200(7' 3")
Track gauge	M		1750(5' 9")
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)	3.3/4.6(2.1/2.9)
Swing speed		rpm	12.0
Gradeability		Degree(%)	30(58)
Ground pressure(450mm shoe)		$kgf/cm^2(psi)$	0.37(5.26)

3. WORKING RANGE

1) R80

(1) 3.7m(12' 2") MONO BOOM



7072SP03

Description		1.67m(5' 6") Arm
Max digging reach	A	6330mm (20' 9")
Max digging reach on ground	A'	6190mm (20' 4")
Max digging depth	B	4150mm (13' 7")
Max digging depth (8ft level)	B'	3810mm (12' 6")
Max vertical wall digging depth	C	3200mm (10' 6")
Max digging height	D	7260mm (23'10")
Max dumping height	E	5170mm (17' 0")
Min swing radius	F	1750mm (5' 9")
Bucket digging force	SAE	44.1 kN
		4500 kgf
		9920 lbf
	ISO	51.0 kN
		5200 kgf
		11460 lbf
Arm digging force	SAE	38.2 kN
		3900 kgf
		8600 lbf
	ISO	39.2 kN
		4000 kgf
		8820 lbf

4. WEIGHT

1) R80

Item	kg	lb
Upperstructure assembly	3750	8270
Main frame weld assembly	820	1810
Engine assembly	550	1120
Main pump assembly	50	110
Main control valve assembly	60	130
Swing motor assembly	80	170
Hydraulic oil tank assembly	120	260
Fuel tank assembly	80	170
Counterweight	540	1190
Cab assembly	310	680
Lower chassis assembly	2820	6220
Track frame weld assembly	980	2160
Swing bearing	140	310
Travel motor assembly	90	200
Turning joint	30	60
Track recoil spring(2EA)	120	260
Idler(2EA)	130	290
Sprocket(2EA)	50	110
Carrier roller(2EA)	20	40
Track roller(10EA)	160	360
Track-chain assembly(450㎜ standard triple grouser shoe, 2EA)	810	1790
Dozer blade assembly	330	730
Front attachment assembly(3.7m boom, 1.67m arm, 0.32m^3 SAE heaped bucket)	1230	2710
3.7m boom assembly	490	1080
1.67m arm assembly	200	440
0.32m^3 SAE heaped bucket	245	540
Boom cylinder assembly	120	260
Arm cylinder assembly	80	180
Bucket cylinder assembly	50	110
Dozer blade cylinder	50	110
Bucket control link assembly	60	130

5. LIFTING CAPACITIES

1) ROBEX 80

(1) 3.7m (12' 2") boom, 1.67m (5' 6") arm equipped with 0.32m³ (SAE heaped) bucket and 450mm (18") triple grouser shoe and dozer blade up with400kg (890lb) counterweight.

Load point height		Load radius						At max. reach		
		1.5m(5ft)		3.0m(10ft)		4.5m(15ft)		Capacity		Reach
										m(ft)
4.5m (15.0ft)	kg			*1800	*1800			1130	1020	5.06
	lb			*3970	*3970			2490	2250	(16.6)
3.0m (10.0ft)	kg	*3890	*3890	*2370	*2370	1350	1220	850	760	5.75
	lb	*8580	*8580	*5220	*5220	2980	2690	1870	1680	(18.9)
1.5m (5.0ft)	kg			2490	2190	1260	1130	760	680	5.95
	lb			5490	4830	2780	2490	1680	1500	(19.5)
Ground Line	kg			2300	2000	1180	1060	800	720	5.70
	lb			5070	4410	2600	2340	1760	1590	(18.7)
-1.5m (-5.0ft)	kg	*4810	*4810	2260	1970	1170	1040	1030	920	4.93
	lb	*10600	*10600	4980	4340	2580	2290	2270	2030	(16.2)
-3.0m (-10.0ft)	kg	*4000	*4000	*2360	2060					
	lb	*8820	*8820	*5200	4540					

(2) 3.7m (12' 2") boom, 1.67m (5' 6") arm equipped with 0.32m³ (SAE heaped) bucket and 450mm (18") triple grouser shoe and dozer blade down with 400kg (890lb) counterweight.

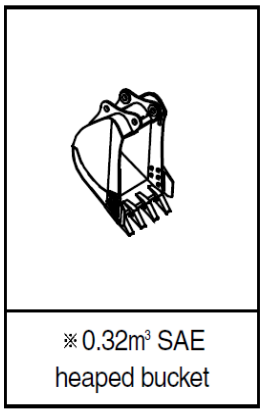
Load point height		Load radius						At max. reach		
		1.5m(5ft)		3.0m(10ft)		4.5m(15ft)		Capacity		Reach
										m(ft)
4.5m (15.0ft)	kg			*1800	*1800			*1680	1090	5.06
	lb			*3970	*3970			*3700	2400	(16.6)
3.0m (10.0ft)	kg	*3890	*3890	*2370	*2370	*1930	1300	*1710	820	5.75
	lb	*8580	*8580	*5220	*5220	*4250	2870	*3770	1810	(18.9)
1.5m (5.0ft)	kg			*3330	2350	*2230	1210	*1760	740	5.95
	lb			*7340	5180	*4920	2670	*3880	1630	(19.5)
Ground Line	kg			*3820	2160	*2430	1140	*1810	770	5.70
	lb			*8420	4760	*5360	2510	*3990	1700	(18.7)
-1.5m (-5.0ft)	kg	*4810	*4810	*3580	2130	*2230	1120	*1790	990	4.93
	lb	*10600	*10600	*7890	4700	*4920	2470	*3950	2180	(16.2)
-3.0m (-10.0ft)	kg	*4000	*4000	*2360	2220					
	lb	*8820	*8820	*5200	4980					

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

1) GENERAL BUCKET



※ 0.32m³ SAE heaped bucket

Capacity		Width		Weight	Recommendation
					3.7m (12' 2") Mono boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.67m arm (5' 6")
※ 0.32m³ (0.42yd³)	0.28m³ (0.37yd³)	670mm (26.4")	750mm (29.5")	230kg (510lb)	

※ : Standard bucket

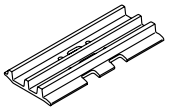
Applicable for materials with density of 2000kg/m³ (3370lb/yd³) or less

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	
				
R80-7	Shoe width	mm(in)	450(18)	600(24)
	Operating weight	kg(lb)	7800(17196)	7960(17550)
	Ground pressure	kgf/cm²(psi)	0.37(5.26)	0.28(3.98)
	Overall width	mm(ft-in)	2260(7' 5")	2350(7' 9")

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	1EA
Track rollers	5EA
Track shoes	38EA

4) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

※ **Table 1**

Track shoe	Specification	Category
450mm triple grouser	Standard	A
600mm 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	KOEL 4R1040NA
Type	4-cycle diesel engine
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	105 ×120mm(4.13" ×4.72")
Piston displacement	4160cc(254cu in)
Compression ratio	18:1
Rated gross horse power(SAE J1995)	76Hp at 2200rpm(57kW at 2200rpm)
Maximum torque at 1400rpm	29.6kgf·m(214lbf·ft)
Engine oil quantity	11.5 ℓ (3.0U.S. gal)
Dry weight	500kg(584lb)
High idling speed	2400 ±50rpm
Low idling speed	1000 ±50rpm
Rated fuel consumption	167g/Hp·hr at 2200rpm
Starting motor	Lucas 24V-4.5kW
Alternator	Lucas 24V, 55A
Battery	2 ×12V ×68AH

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 ×36cc/rev
Maximum pressure	280kgf/cm^2 (3983psi)
Rated oil flow	2 ×75.6 ℓ/min (2 ×20U.S.gpm)
Rated speed	1950rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	8.9cc/rev
Maximum pressure	35kgf/cm^2(500psi)
Rated oil flow	18.2 ℓ/min(4.8U.S.gpm/4.0U.K.gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	11 spools mono-block
Operating method	Hydraulic pilot system
Main relief valve pressure	280kgf/cm^2(3980psi)
Overload relief valve pressure	310kgf/cm^2(4410psi)

5) SWING MOTOR

Item	Specification
Type	Axial piston motor
Capacity	43cc/rev
Relief pressure	190kgf/cm^2(2702psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	14kgf · m^2(101lbf · ft)
Brake release pressure	20~40kgf/cm^2(284~569psi)
Reduction gear type	2 - stage planetary
Swing speed	12.0 rpm

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	300kgf/cm^2(4270psi)
Reduction gear type	2 stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	Less than 9kgf/cm^{22}(128psi)
Braking torque	8.4kgf · m^2(61lbf · ft)

7) REMOTE CONTROL VALVE

Item		Specification
Type		Pressure reducing type
Operating pressure	Minimum	5kgf/cm² (71psi)
	Maximum	20kgf/cm² (284psi)
Push rod stroke	Lever	6.5/8.5mm (0.26/0.34in)

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø115 × ø70 × 980mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø95 × ø60 × 860mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø85 × ø55 × 665mm
	Cushion	Extend only
Dozer cylinder	Bore dia × Rod dia × Stroke	ø110 × ø65 × 152mm
	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
R80	Standard	450mm(18")	0.37kgf/cm²(5.26psi)	38	2260mm(7' 5")
	Option	600mm(24")	0.28kgf/cm²(3.98psi)	38	2350mm(7' 9")

10) BUCKET

Item		Capacity		Tooth quantity	Width	
		SAE heaped	CECE heaped		Without side cutter	With side cutter
R80	STD	0.32m³(0.42yd³)	0.25m³(0.33yd³)	4	725mm(28.5")	740mm(29.1")

9. RECOMMENDED OILS

Use only oils listed below or equivalent.
Do not mix different brand oil.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature C° (F°) -20 (-4) / -10 (14) / 0 (32) / 10 (50) / 20 (68) / 30 (86) / 40 (104)
Engine oil pan	Engine oil	11.5(3.04)	SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Gear oil	1.5(0.4)	SAE 85W-140
Final drive	Gear oil	1.2 × 2 (0.32 × 2)	SAE 85W-140
Swing drive	Grease	0.2kg(0.4lb)	NLGI NO.1 NLGI NO.2
Hydraulic tank	Hydraulic oil	Tank:75(19.8) System: 130(34.3)	ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel	135(35.7)	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	20(5.3)	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

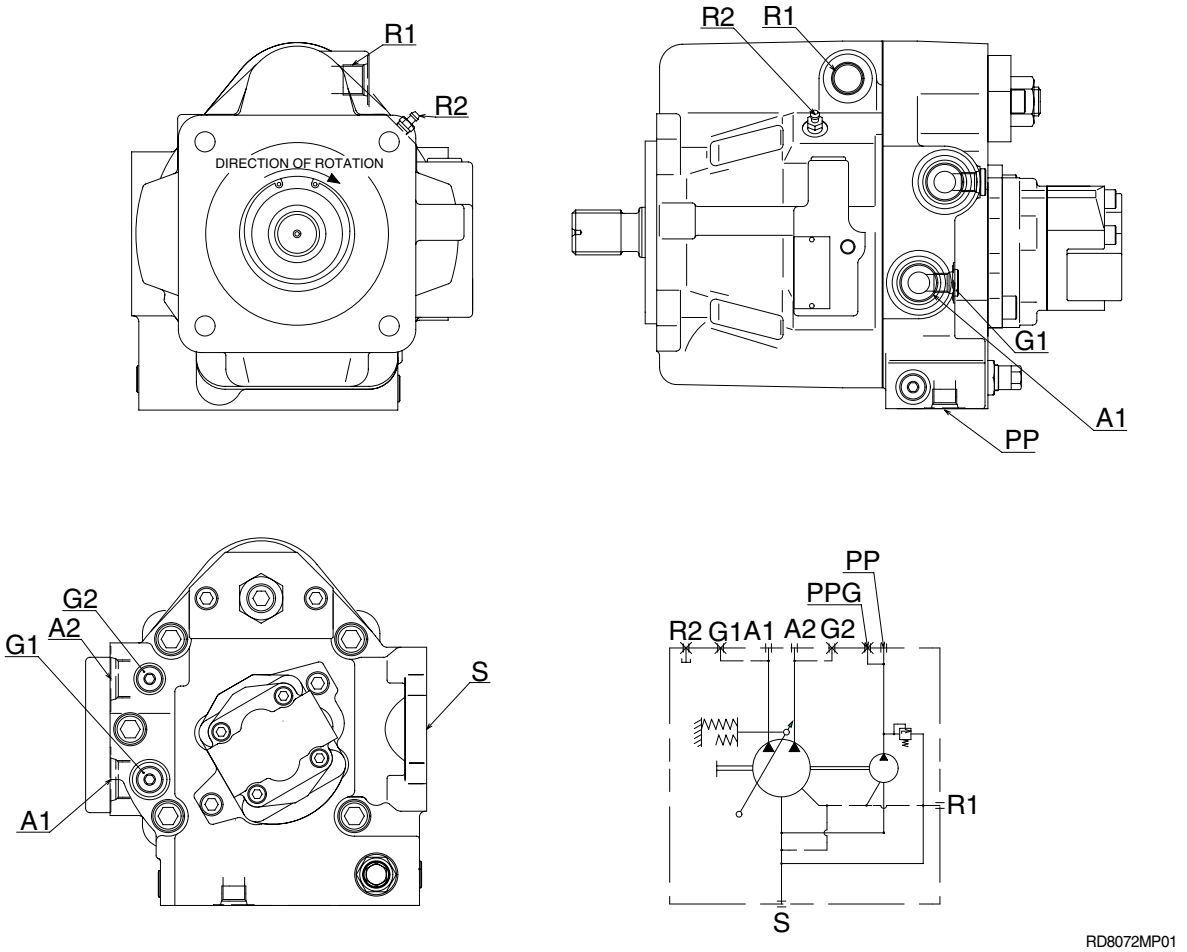
GROUP 1 HYDRAULIC PUMP

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.

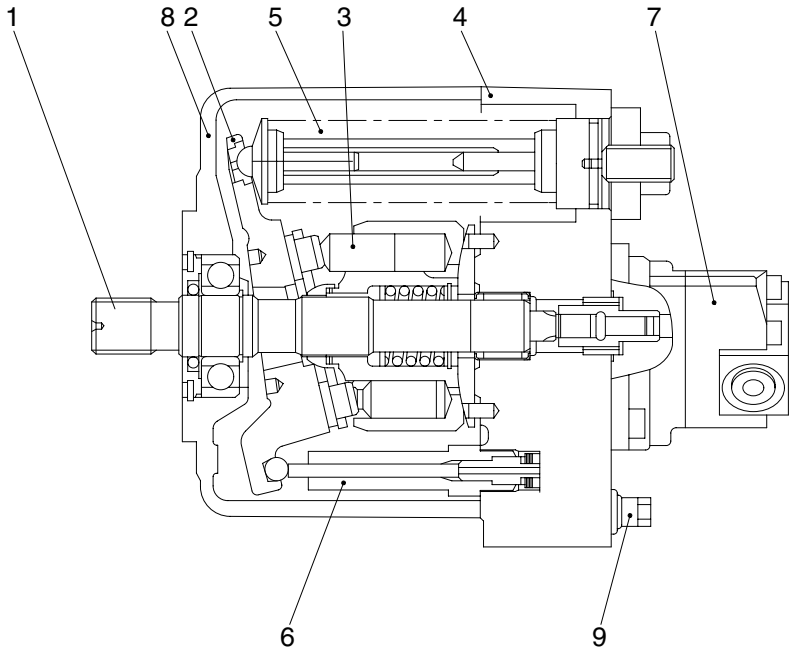


RD8072MP01

Description of the ports

Port	Name	Bore
S	Suction port	SAE 2 1/2 (Standard)
A1, A2	Discharge port	PF 3/4
PP	Pilot port	G 3/8
G1, G2	Gauge port	PF 1/4 With quick coupler
R1	Drain port	G 1/2
R2	Air bleeder port	With bleeder valve (M10×1.0)

2. PRINCIPAL COMPONENTS AND FUNCTIONS



7072MP03

1 Shaft assembly
2 Swash plate assembly
3 Rotary group
4 Cover assembly
5 Control spring assembly
6 Control piston assembly
7 Gear pump
8 Housing
9 Relief valve

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 discharge pressure directed to the control piston 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 simultaneous tilting angle constant-output control method is employed.

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

1) PRINCIPLE OF OPERATION

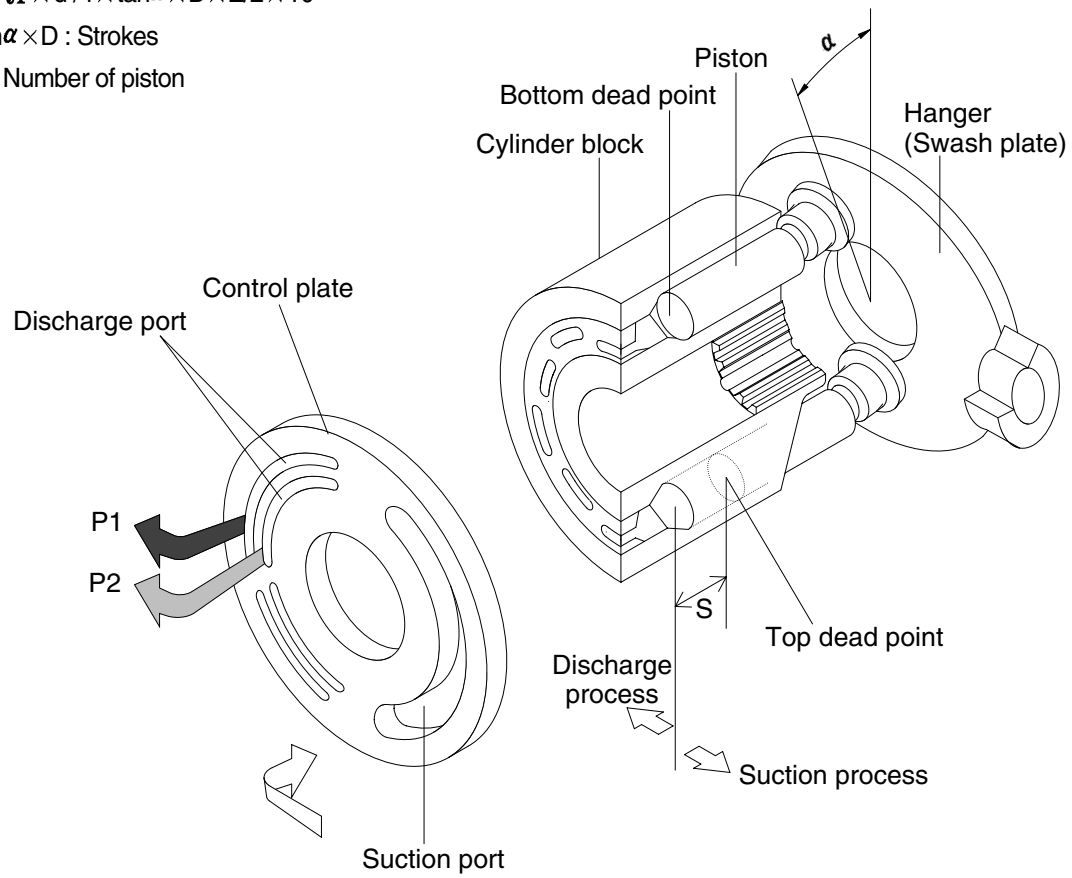
(1) Function of pump

Displacement q(cm^3)

$q = \pi \times d^2/4 \times \tan\alpha \times D \times Z/2 \times 10^{-3}$

$\tan\alpha \times D$: Strokes

Z : Number of piston



7072MP05

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 lower to the upper dead points. The oil flows from the suction port via a port plate into the cylinder block(suction process).

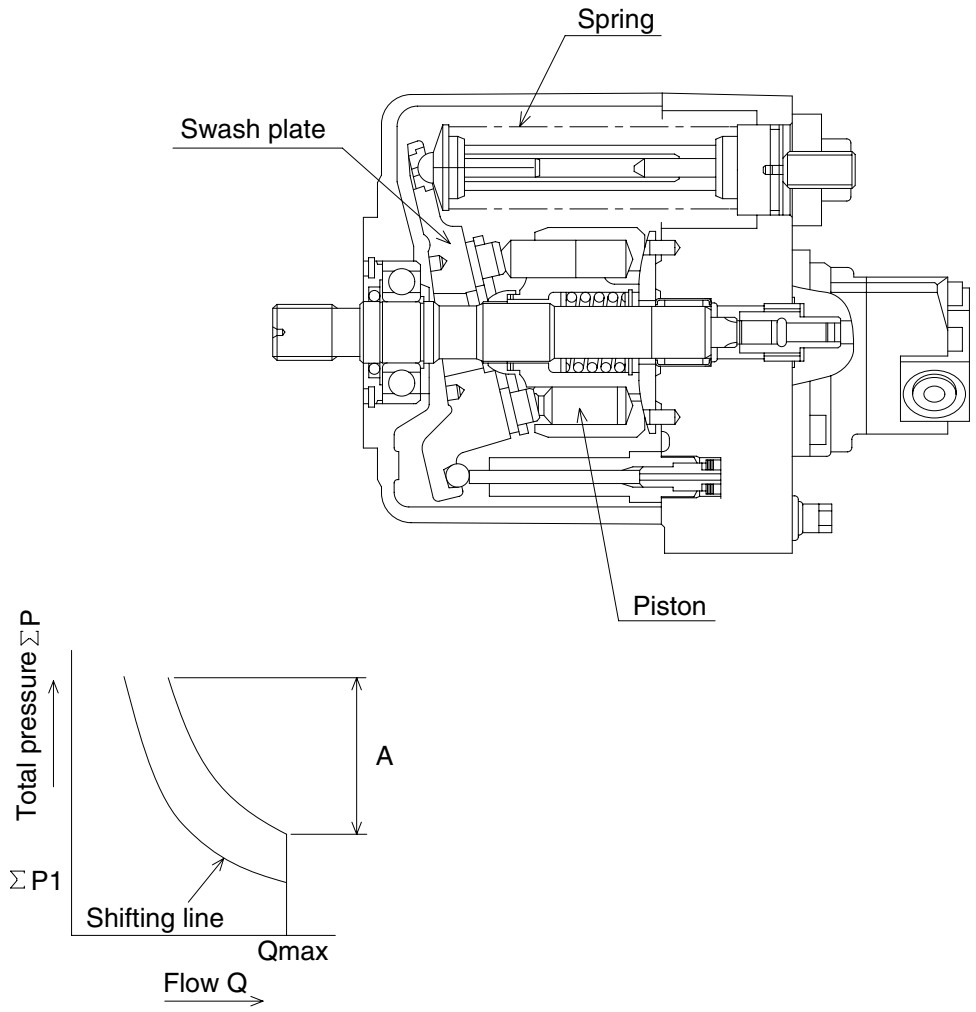
During a stroke from the upper to the lower dead points, the piston moves in a direction to decrease the displacement. The oil is discharged to the discharge port(discharge process).

The displacement can be changed by changing the tilting of the hanger(swash plate).

The oil sucked through the port in the cylinder block is discharged from the discharge port in the port 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



7072MP04

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.

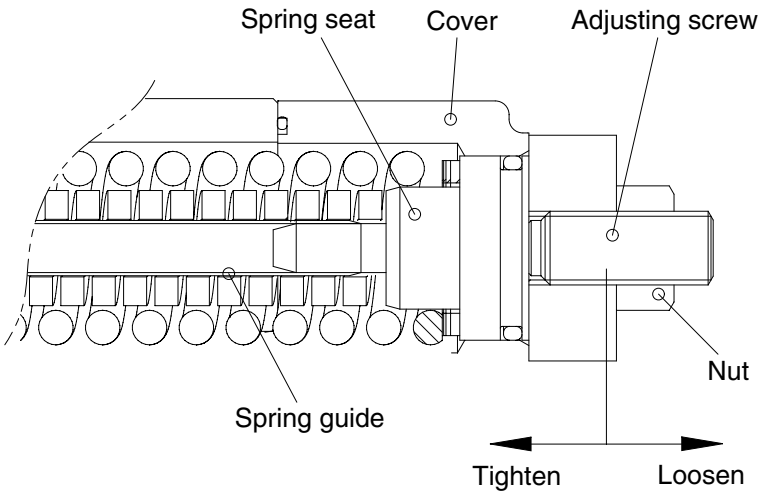
When the oil pressure via piston acting on the swash plate is less than the installation load of the spring the swash plate is fixed to the maximum tilting position.

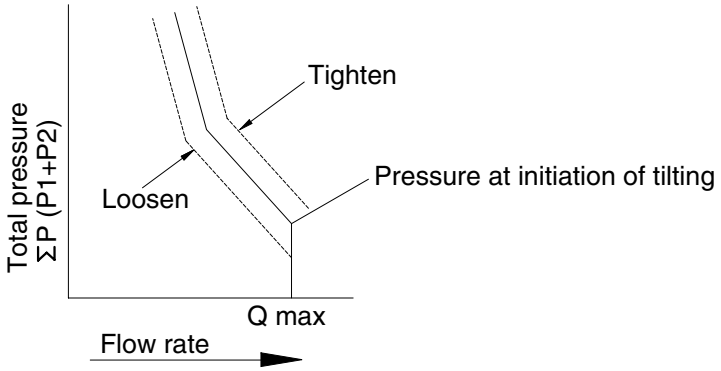
When the oil pressure via piston acting on the swash plate exceeds the installation load of the spring the swash plate is tilted and kept tilted at a position where the oil pressure is balanced with the spring force.(Region A in above figure)

3) CONTROL / ADJUSTMENT PROCEDURE

(1) Loosen the hexagonal nut.

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





7072MP06

3. ADJUSTMENT

This hydraulic pump has been set and inspected according to your specified input power and control. Readjustment of all the adjusting portions may lead to the loss of functions specified for each control and the pump proper may be excluded from the scope of guarantee. Never attempt operating the adjusting screw, etc.

4. INSTALLATION

(1) Install the pump so that the input shaft becomes horizontal.
(2) Install the pump in a position lower than the lowest oil level in the tank to allow continuous flow of the oil into the pump.
(3) Since the pump is installed directly to the diesel engine, always use a flexible hose. Install the suction pipe firmly to prevent suction of an air.
(4) Use the high-pressure type flexible hoses for the discharge ports A1~A2.
(5) After installation, fill the pump housing with the hydraulic oil.
(6) Do not direct the external drain piping from within the oil.

5. DRIVE

(1) Use a flexible coupling for connection to the motor.
(2) Insert the coupling firmly onto the input shaft. Do not hammer the coupling during insertion.
(3) The input shaft must rotate clockwise when viewed from the shaft end.

6. HYDRAULIC OIL

The hydraulic oil to be used must be a general petroleum, hydraulic oil or wear-resistant hydraulic oil (ISO 3448, VG 32~56 or equivalent).
The applicable viscosity range is as follows :

Maximum allowable viscosity : 1000 mm^2/s
Minimum allowable viscosity : 10 mm^2/s
Recommended viscosity range : 15 ~ 150 mm^2/s

7. STARTING PROCEDURE

※ Before start up, check the following points and observe the cautions :

(1) Check if the tank has been washed clean.
(2) Check if the piping is clean and installed in such a manner as to prevent stress on the pump.
(3) Check if the piping is connected correctly according to the piping (circuit) diagram.
(4) Check if the joint and flange are correctly tightened.
(5) Check if the joint between the motor and pump is correctly installed.
(6) Check if the motor rotation direction agrees with the pump rotation direction.
(7) Check if the specific hydraulic oil is supplied though the filter and filled in the tank to the specified position of the oil level gallge.
(8) Check if the filter has the specified filtration accuracy (10 ㎛ or less).
(9) Check if the filter has been installed correctly relative to the flowt direction.
(10) Check if the pump housing is filled with oil.
(11) Check if the control valve is set to the bypass position.
(12) Start the motor. If necessary, carry out warm-up operation at low speed.
(13) Check, without any load on the system, if the actuator operates correctly.

(14) When the motor has reached the operation speed, check the operation while applying the load to the actuator.
(15) Check the monitoring or measuring instrument if installed.
(16) Check the noise level.
(17) Check the oil level in the tank. Supply the oil. If required.
(18) Check the setting of the pressure control valve while applying the load to the actuator.
(19) Check the parts for any leakage.
(20) Stop the motor.
(21) Retighten all the bolts and plugs even when they have proved to by free from Leakage.
(Be sure to remove the pressure from the circuit before retightening.)
(22) Check the oil level in the tank.
(23) Check if the pump and actuator function correctly.
(24) Irregular operation of the actuator indicates that an air is left still in the circuit. When the air is bleeded completely from the circuit, all the parts operates smoothly without any irregular movement and there is no bubble in the oil of the tank.
(25) Check the oil temperature.
(26) Stop the motor.
(27) Check the filter if the element is fouled.
(28) If the element is heavily fouled, carry out flashing in the circuit.

※ To prevent damage to the pump, be sure to observe the following cautions during the operation which may allow entry of the actuator, hydraulic oil change, etc :
(1) After oil supply, fill the pump housing with the hydraulic oil.
(2) Start the pump with the speed of 1000 rpm or less and take care not to allow the oil level to lower below the specified level of the oil level gauge.
(3) When bleeding an air from the hydraulic circuit, keep the motor speed at 1000 rpm or less. Operate each actuator for three or more cycles and carry out idling for 5 minutes or more.

8. MAINTENANCE

The maintenance of this hydraulic pump is limited mainly to the tank, in particular, the hydraulic oil change.
Since the maintenance interval varies depending on respective operation and use conditions, the cautions described below for the users should be for reference only.

(1) Checking the filter

① Every day for the initial period after start up.
② Once a week when the operation becomes stable.
③ Once a month when the operation hours exceed about 100 hours.

※ When any part of the hydraulic system is changed (e.g., assembling of an additional part, change and repair of the piping), check the filter newly as in the case of startup.

(2) Changing the filter

① After startup
② After 500 hours of operation
③ Every 500 hours of operation after that, and each time the hydraulic oil is changed or the failure occurs. If any abnormal fouling of the filter is observed during daily check up to the first filter change after startup, find out the cause.
In this case, do not extend the check and filter change intervals to 500 hours.

※ The paper filter can not be cleaned. Change the filter as a whole.

(3) Changing the hydraulic oil

① After 2000 hours of operation.

② Every 2000 hours of operation or once a year after that.

The change interval may have to be shortened depending on the degree of fouling and the thermal load condition of the hydraulic oil.

If the hydraulic oil is not appropriate and need be changed, pay attention to the following points :

Be sure to control the oil temperature below the highest temperature and above the lowest temperature during operation in winter and summer.

Pay attention to the following points during change of the hydraulic oil :

- Change the hydraulic oil as a whole quantity.
- Do not allow dust to mix into the circuit.
- Clean the tank inside.
- Supply the oil through the filter.

(4) Checking for the oil leakage

① Daily during the initial period after startup.

② Once a week when the operation becomes stable.

(5) Checking the temperature

① Monitor the temperature continuously.

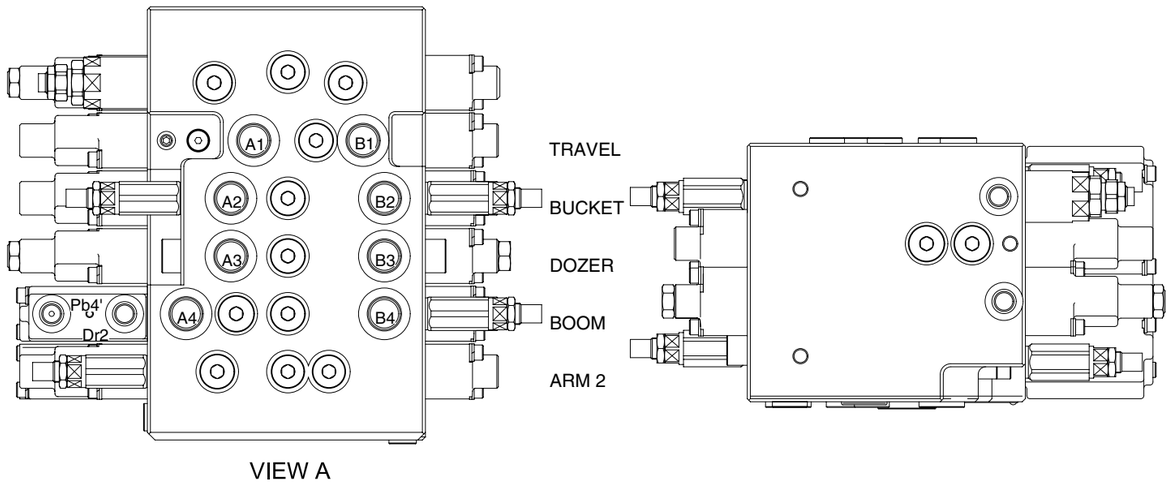
② When the viscosity is above the allowable value because of low hydraulic oil temperature, warm-up operation is necessary.

Start the motor with the speed set to about one half of the rated speed, then operate the actuator under the load for a short period.

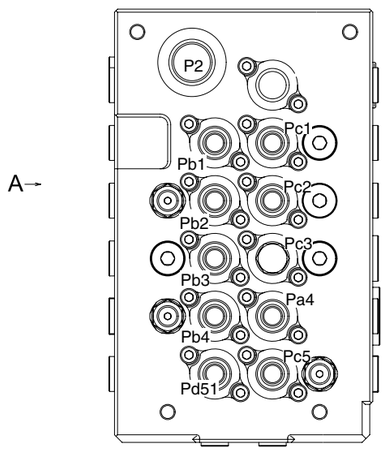
When the oil temperature is below the allowable ambient temperature, it is necessary to preheat the oil tank before start of the motor.

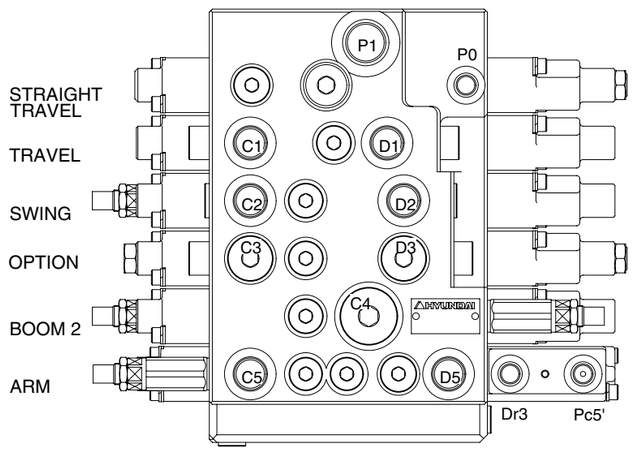
Take care not to allow the hydraulic oil temperature to exceed +90° C

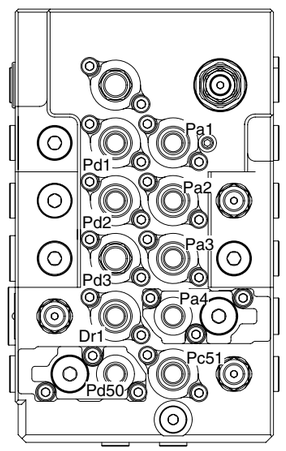
1. STRUCTURE

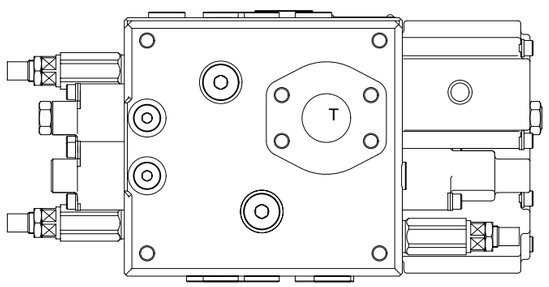


VIEW A





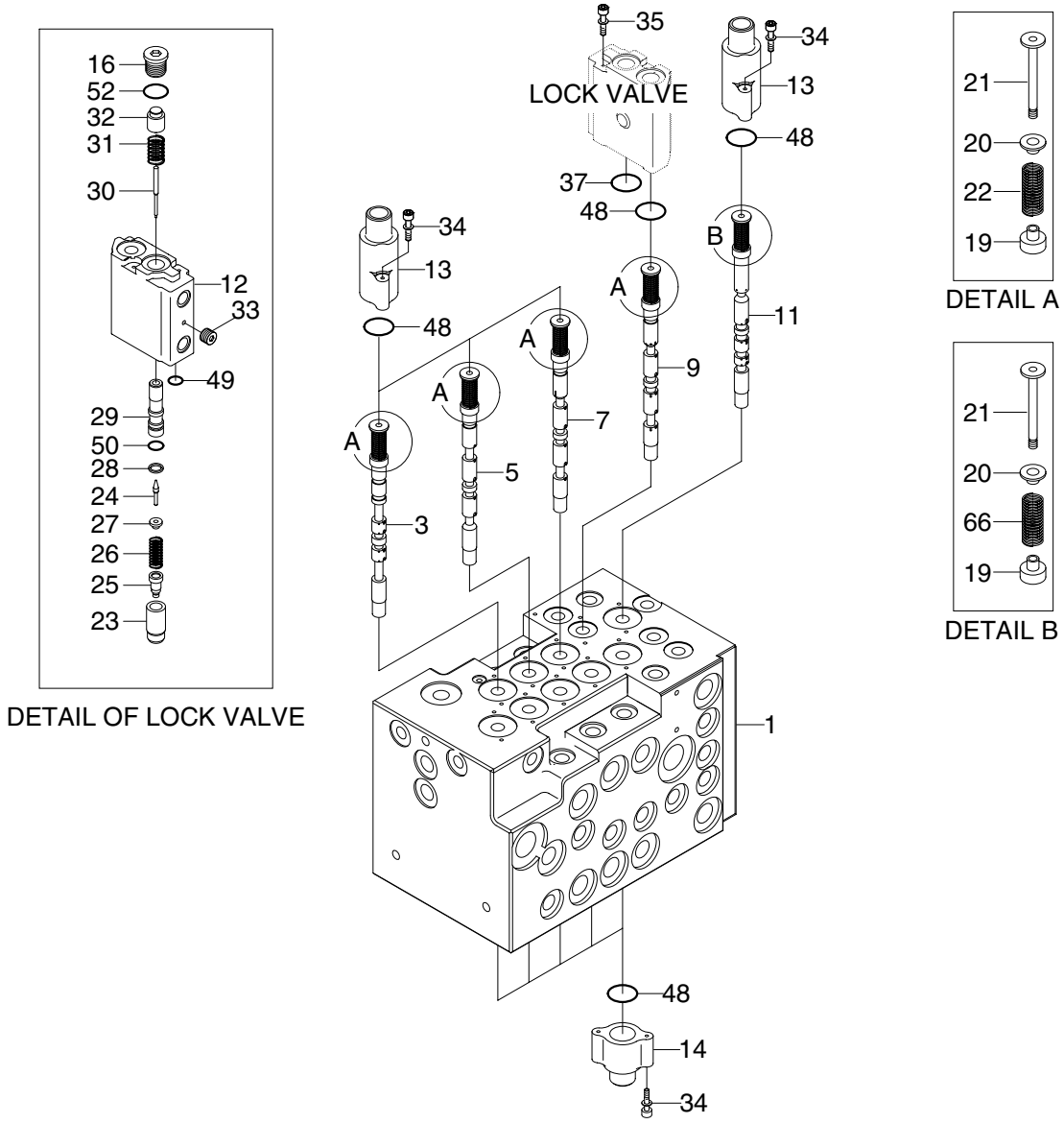




Mark	Port name	Port size	Tightening torque
Rs	Make up for swing motor	G1/4	2.5~3kgf · m (18.1~21.7lbf · ft)
Pa1	Travel left pilot port(FW)		
Pb1	Travel left pilot port(BW)		
Pc1	Travel right pilot port(BW)		
Pd1	Travel right pilot port(FW)		
Pa2	Bucket in pilot port		
Pb2	Bucket out pilot port		
Pc2	Swing pilot port(RH)		
Pd2	Swing pilot port(LH)		
Pc3	Option pilot port		
Pd3	Option pilot port		
Pa40	Boom up pilot port		
Pa41	Boom up confluence pilot port		
Pb4	Boom down pilot port		
Pb4'	Lock valve pilot port(Boom)		
Pc50	Arm in pilot port		
Pc51	Arm in confluence pilot port		
Pc5'	Lock valve pilot port(Arm)		
Pd50	Arm out pilot port		
Pd51	Arm out confluence pilot port		
PO	Pilot pressure port		
Dr1	Drain port		
Dr2	Drain port		
Dr3	Drain port		
A1	Travel motor right side port(FW)	G1/2	6~7kgf · m (43.4~50.6lbf · ft)
B1	Travel motor right side port(BW)		
C1	Travel motor left side port(BW)		
D1	Travel motor left side port(FW)		
A2	Bucket head side port		
B2	Option port		
C2	Swing motor port(LH)		
D2	Swing motor port(RH)		
A3	Dozer up port		
B3	Dozer down port		
C3	Bucket rod side port		
D3	Option port		
A4	Boom head side port		
B4	Boom rod side port		
C5	Arm head side port		
D5	Arm rod side port		
P1	Pump port(P1 side)	G3/4	8~9kgf · m (57.9~65.1lbf · ft)
P2	Pump port(P2 side)		
T1	Return port	SAE3000, 1 1/4 (M10)	5.5~8.3kgf · m (39.8~60.0lbf · ft)

7072MCV30

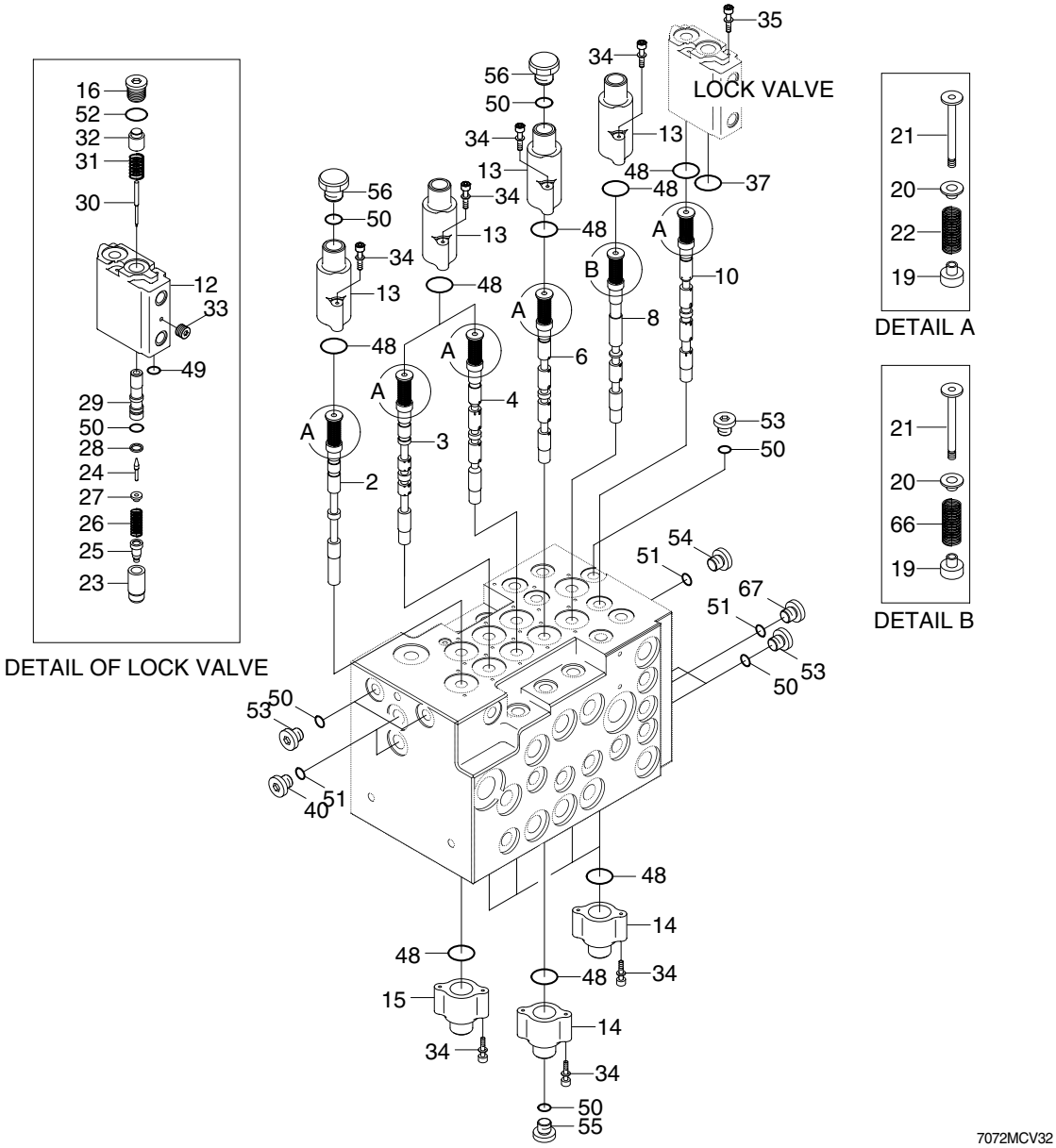
1) Structure(1/4)



7072MCV31

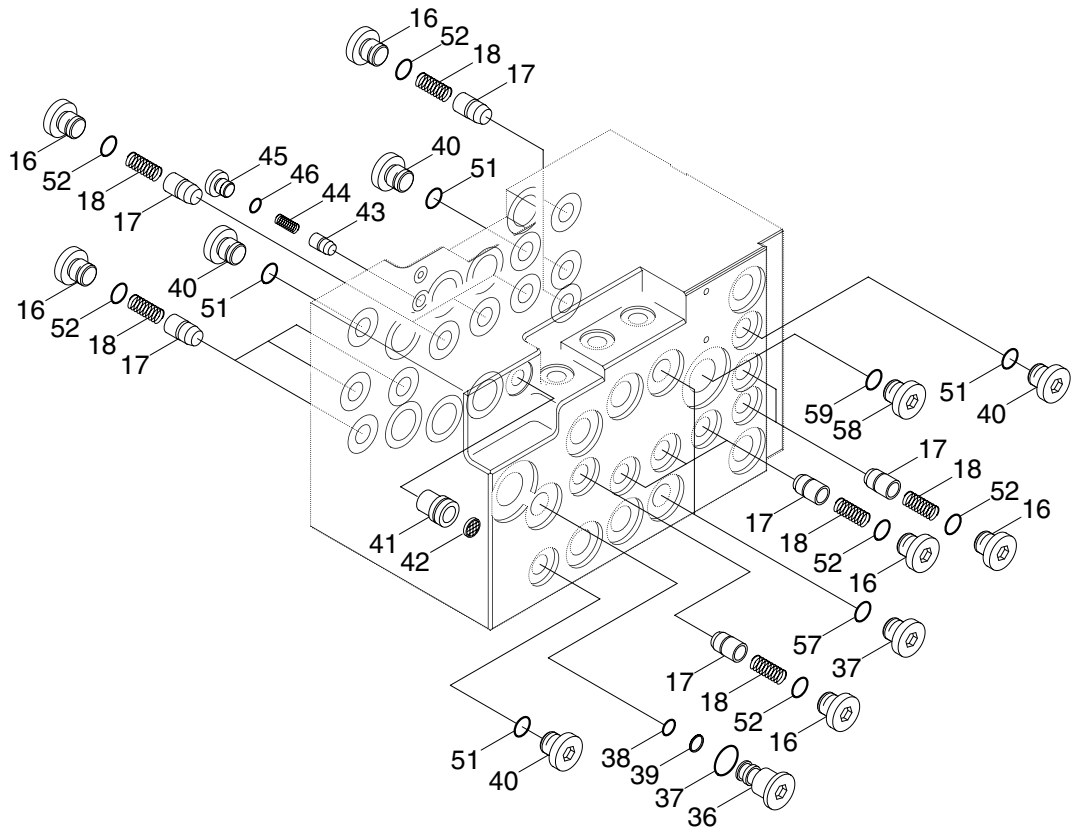
1	Body	20	Spring holder	31	Lock valve spring
3	Spool-Travel(LH)	21	Spool end	32	Piston
5	Spool-Swing	22	Spring	33	Plug
7	Spool-Option	23	Lock valve	34	Socket head bolt
9	Spool-Boom 2	24	Poppet	35	Socket head bolt
11	Spool-Arm	25	Lock valve restrictor	37	O-ring
12	Pilot-Cover	26	Lock valve spring	48	O-ring
13	Pilot-Cover	27	Spring holder	49	O-ring
14	Pilot-Cover	28	Retaining ring	50	O-ring
16	Plug	29	Piston guide	52	O-ring
19	Spring holder	30	Piston	66	Spring

2) Structure(2/4)



2	Spool-Travel straight	23	Lock valve	40	Plug
4	Spool-Travel(RH)	24	Poppet	48	O-ring
6	Spool-Dozer	25	Lock valve restrictor	49	O-ring
8	Spool-Boom	26	Lock valve spring	50	O-ring
10	Spool-Arm 2	27	Spring holder	51	O-ring
12	Pilot-Cover	28	Retaining ring	52	O-ring
13	Pilot-Cover	29	Piston guide	53	Plug
14	Pilot-Cover	30	Piston	54	Restrictor plug
15	Pilot-Cover	31	Lock valve spring	55	Plug
16	Plug	32	Piston	56	Plug
19	Spring holder	33	Plug	66	Spring
20	Spring holder	34	Socket head bolt	67	Restrictor plug
21	Spool end	35	Socket head bolt		
22	Spring	37	O-ring		

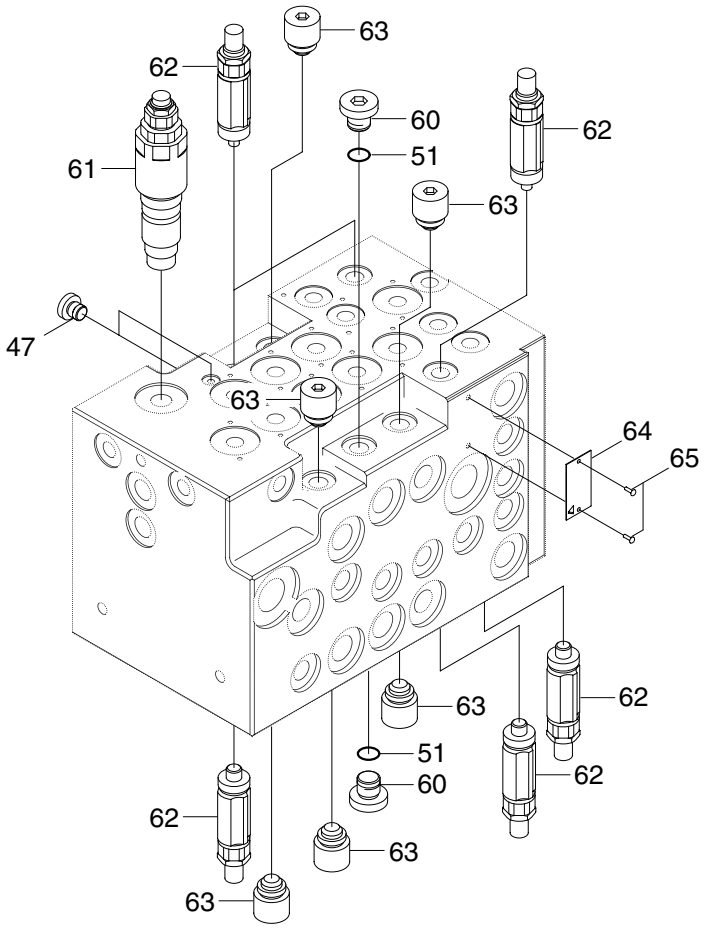
3) Structure(3/4)



7072MCV33

16	Plug	40	Plug	51	O-ring
17	Check valve	41	Restrictor plug	52	O-ring
18	Check valve spring	42	Coin type filter	57	Plug
36	Plug	43	Check valve	58	Plug
37	O-ring	44	Check valve spring	59	O-ring
38	O-ring	45	Plug		
39	Back up ring	46	O-ring		

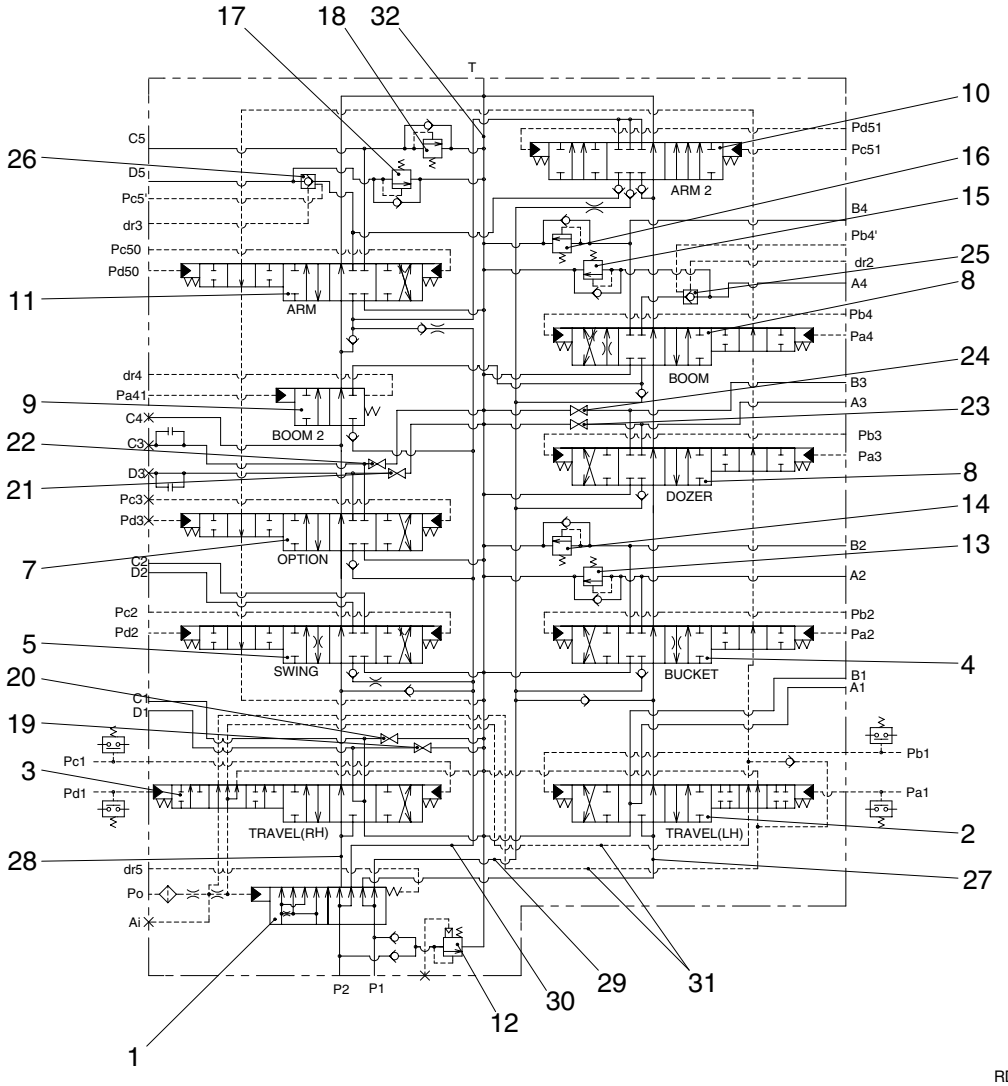
4) Structure(4/4)



7072MCV34

47 Plug
48 O-ring
51 O-ring
60 Plug
61 Main relief valve
62 Overload relief valve
63 Relief valve plug
64 Name plate
65 Pin

2. HYDRAULIC CIRCUIT DIAGRAM



Ref. No.	Description	Ref. No.	Description
1	Spool - Straight travel	17	Overload relief valve
2	Spool - Tavel left	18	Overload relief valve
3	Spool - Tavel right	19	Relief plug
4	Spool - Bucket	20	Relief plug
5	Spool - Swing	21	Relief plug
6	Spool - Dozer	22	Relief plug
7	Spool - Option	23	Relief plug
8	Spool - Boom	24	Relief plug
9	Spool - Boom2	25	Boom lock valve
10	Spool - Arm2	26	Arm lock valve
11	Spool - Arm	27	By - Pass(P1)
12	Main relief valve	28	By - Pass(P2)
13	Overload relief valve	29	Parallel passage(P1)
14	Overload relief valve	30	Parallel passage(P2)
15	Overload relief valve	31	Pilot signal passage
16	Overload relief valve	32	Tank passage

3. FUNCTION

1) CONTROL VALVE

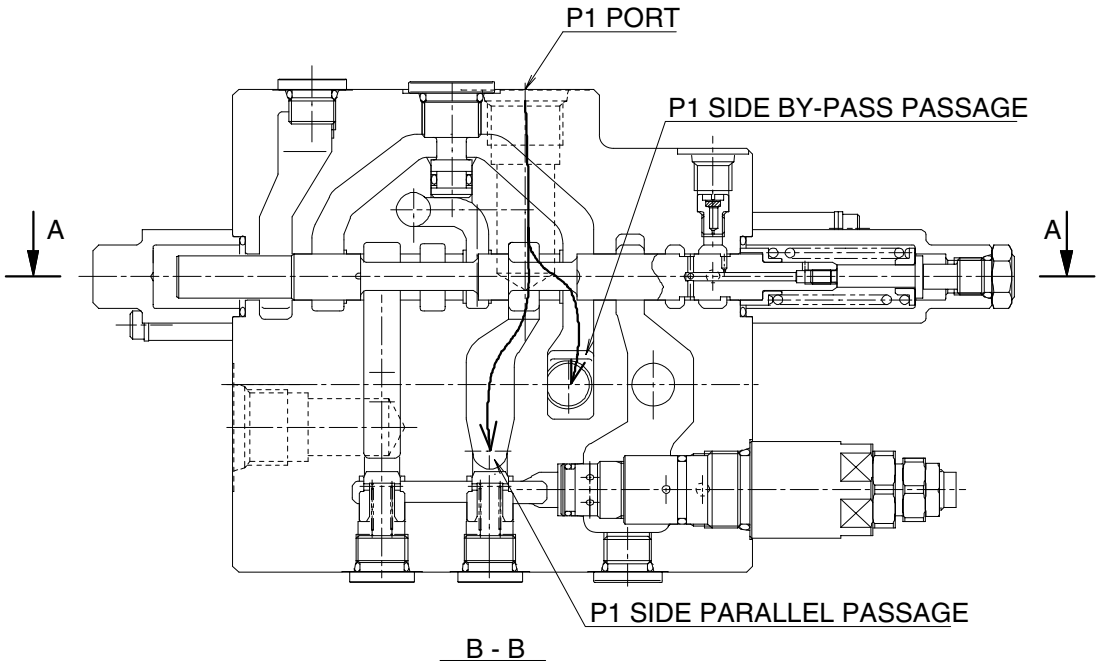
(1) Neutral

P1 : The oil from the pump flows into the control valve through the port P1, P1 and also into the left travel spool portion via the travel straight spool land.
As by-pass(P1) is not closed by the spool at the spool in neutral, the oil go through the by-pass of each spool of left travel → bucket → dozer → boom → arm2, and flows out the tank passage through the passage of the discharge portion body.

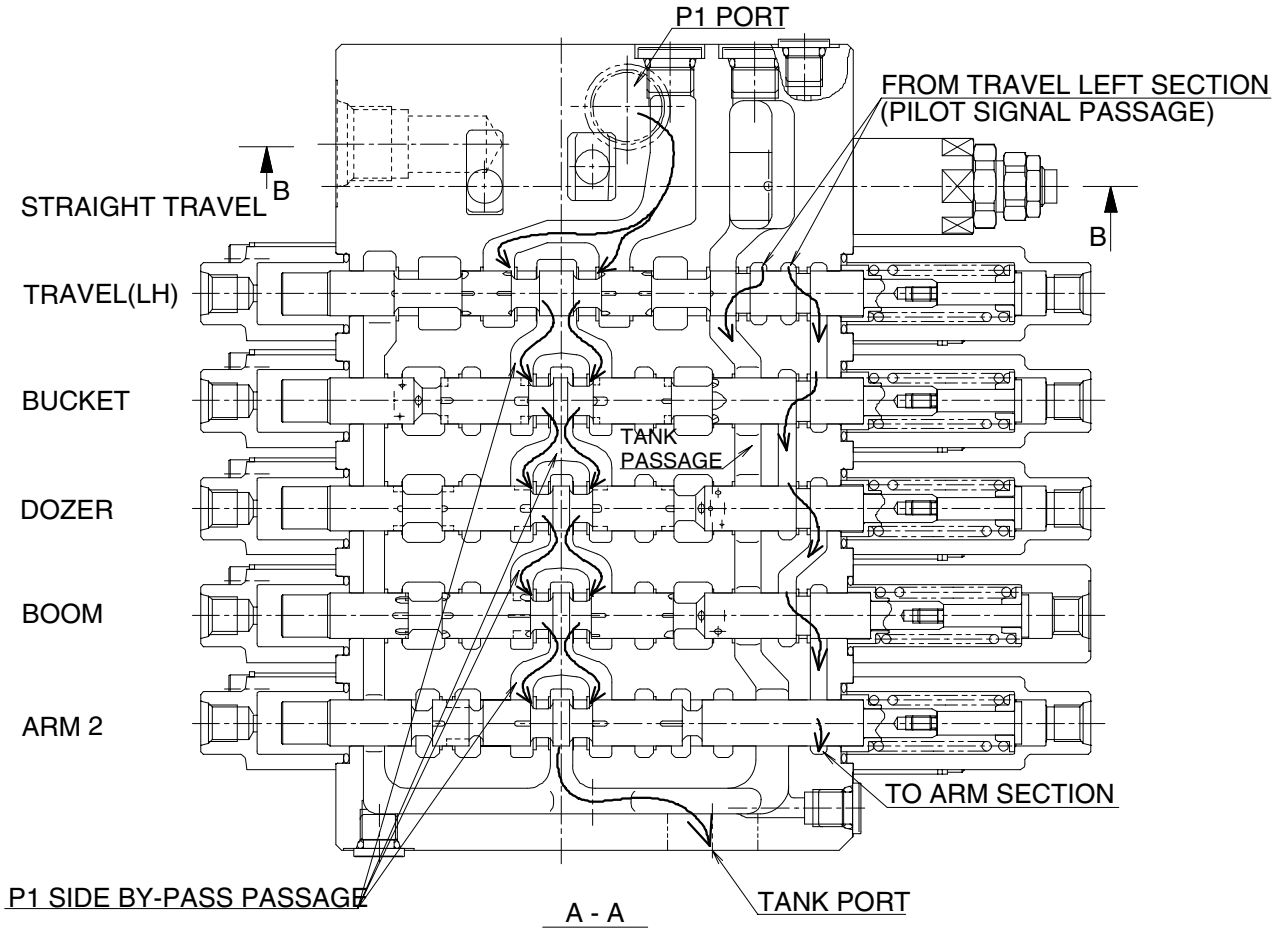
P2 : The oil from the pump flows into the control valve through the port P2, P2 and also into the right travel spool portion via the travel straight spool land.
As by-pass(P2) is not closed by the spool at the spool in neutral, the oil go through the by-pass of each spool of right travel → swing → option → boom2 → arm, and flows out the tank passage through the passage of the discharge portion body.

P0 : The oil from the pump flows into the control valve through the port P0, and further into the pilot signal passage via the filter and orifice in the supply portion.
At the spool neutral, it flows from travel spool(LH/RH) portion to the tank passage through the passage in the travel spool(LH/RH).
Accordingly, the pilot signal passage pressure comes to be equal to the tank pressure, and the also the receiving pressure on the travel straight spool stays to be unswitched.

At neutral(P1)

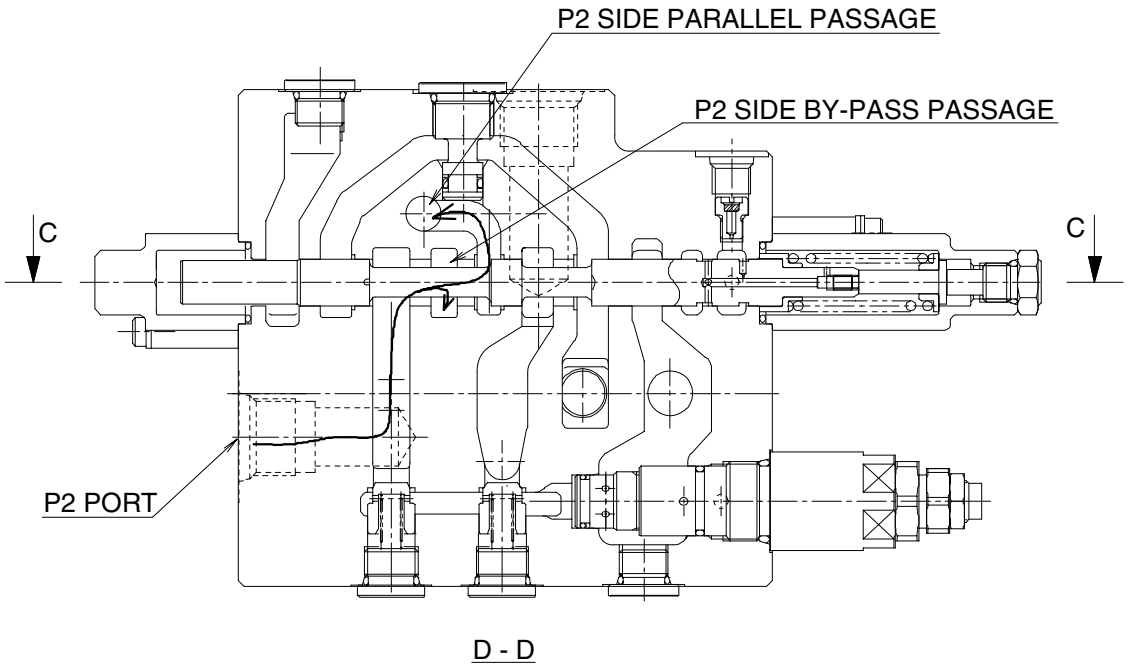


7072MCV02

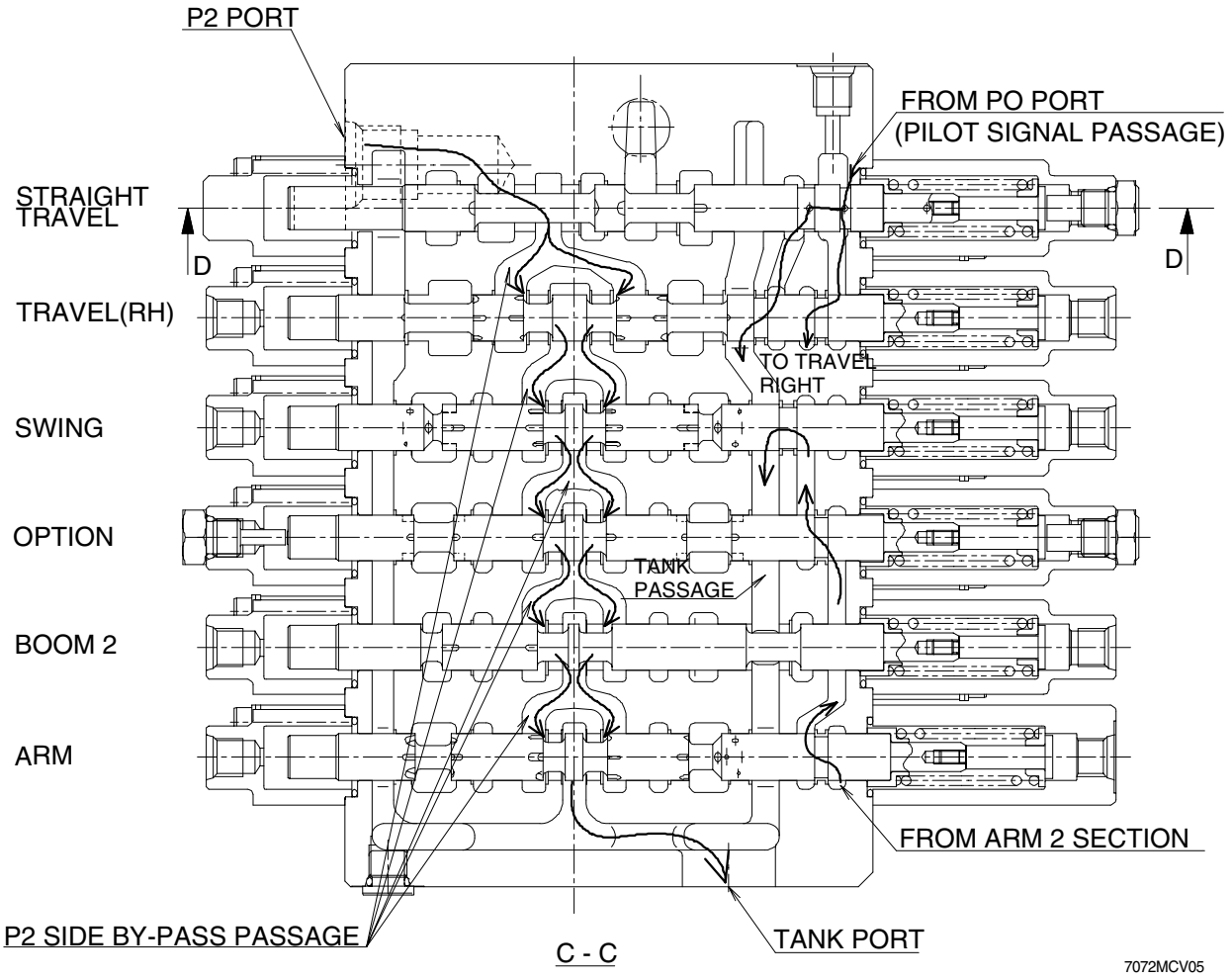


7072MCV03

At neutral(P2)



7072MCV04



7072MCV05

(2) Operating of each section

Here, it represents and the operation of the boom(raise) and arm(dump & crowd) section is explained.

① Boom raise operation

With the boom raise operation, the pilot secondary pressure enters into the Pa40 port, and moves the spool for the boom operation. And with the movement of the spool, as the by-pass circuit is cut at the boom switching section, the oil is received through the P1 port flows into the parallel circuit on the boom switching section.

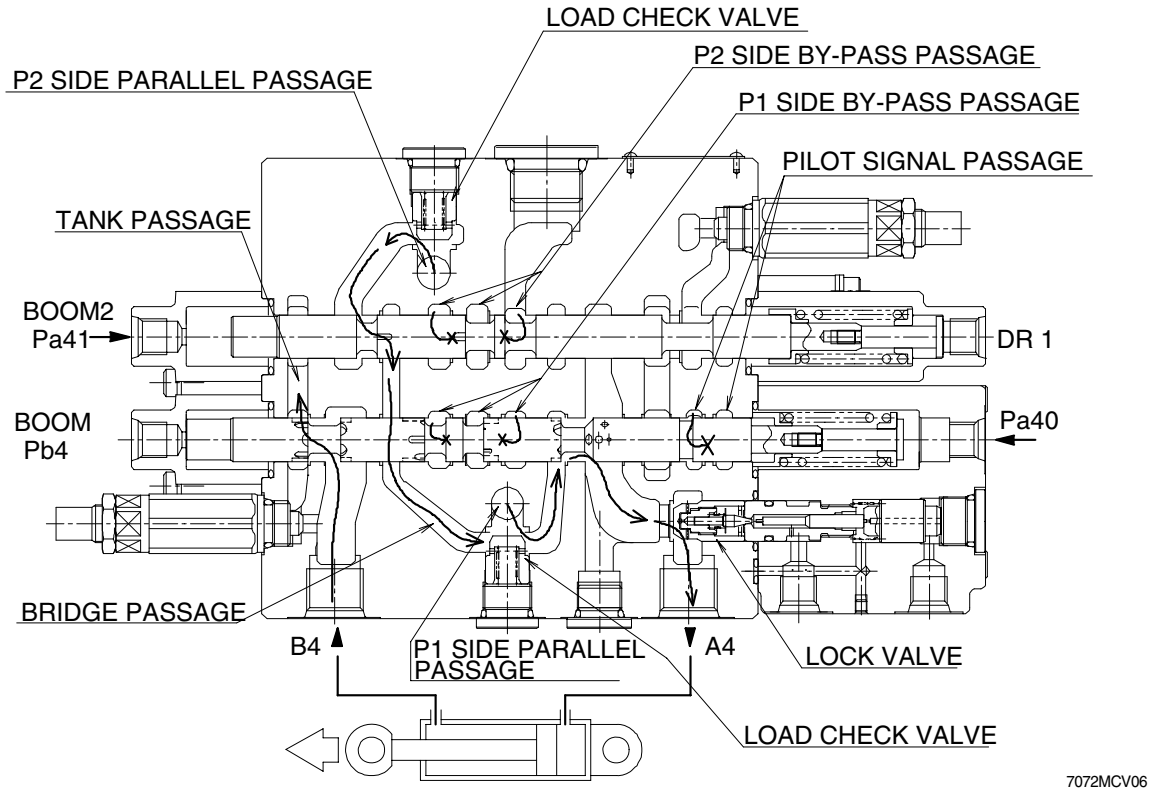
With the movement of the spool, as the circuit from the passage leading to the boom lock valve section to the bridge passage is opened, the oil entered in the parallel circuit passes through the load check valve on the boom switching section and flows into the A4 port through the bridge passage and open the boom lock valve(free flow) and is fed into the boom cylinder head side.

Moreover, secondary pilot pressure enters into Pa41 port of boom2 spool simultaneously, and moves boom2 spool. And with the movement of the boom2 spool, as the by-pass(P2) circuit is cut at the boom2 switching section, the oil received through the P2 port flows into the P2 parallel circuit on the boom2 switching section. The oil which flowed into P2 parallel passage in the boom2 parallel circuit on the boom2 switching section. The oil which flowed into P2 parallel passage in the boom2 section flows into the bridge passage of the boom section from the land of boom2 spool released by shift of boom2 spool. And P2 oil is fed into the boom cylinder head side.

On the other hand, the return oil from the boom cylinder rod side flows into the B4 port, and with the movement of the spool the oil flows out into the tank passage.

The oil from the port P0 flows to the pilot signal passage through the orifice.

So the oil in the pilot signal passage flows from the travel section to the tank passage, the pilot signal pressure becomes to equal to the tank pressure, therefore the travel straight spool is not switched.



Arm crowd operation

② With the arm crowd operation, the pilot secondary pressure enters into the Pc50 port, and moves the spool for the arm operation. And with the movement of the spool, as the by-pass circuit is cut at the arm switching section, the oil received through the P2 port flows into the parallel circuit on the arm switching section.

With the movement of the spool, as the circuit from the passage leading to the bridge passage is opened, the oil entered in the parallel circuit passes through the load check valve on the arm switching section and flows into the D5 port through the bridge passage and is fed into the arm cylinder rod side.

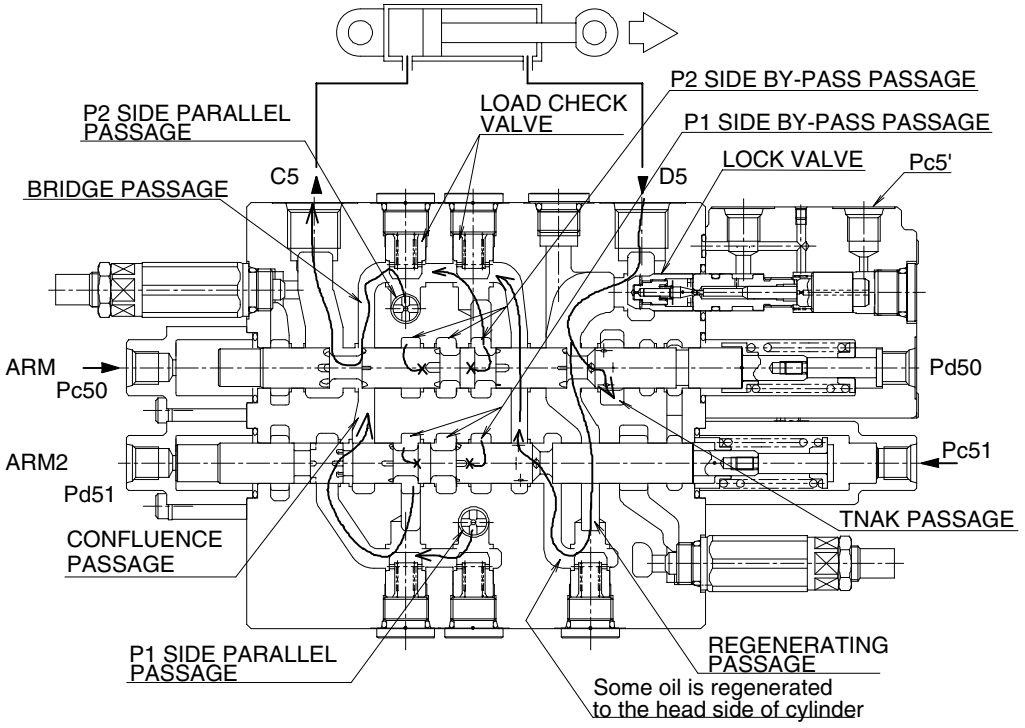
Moreover, secondary pilot pressure enters into Pc51 port of arm2 spool simultaneously, and moves arm2 spool. And with the movement of the arm2 spool, as the by-pass(P1) circuit is cut at the arm2 switching section, the oil received through the P1 port flows into the arm confluence passage through the check valve in the arm2 switching section. The oil which flowed into arm confluence passage in the arm2 section flows into the bridge passage of the arm section from the land of arm2 spool released by shift of arm2 spool. And P1 oil is fed into the arm cylinder head side.

On the other hand, secondary pilot pressure enters into Pc5', port of arm lock valve simultaneously, so arm lock valve is released.(Refer to "ACTUATION OF LOCK VALVE, RELEASING" page(2-23). And the return oil from the arm cylinder rod side flows into the D5 port, and with the movement of the spool some of the oil flows out into the tank passage through the meter-out orifice of the arm spool.

The rest of the oil flows to the bridge passage through the regenerating check valve, regenerating land of the arm2 spool and into the port C5. Accordingly, in this case, the arm cylinder extends the rod to start crowding, and further, the supply flow to the arm cylinder increased by the regeneration by which the cylinder moves faster.

The oil from the port P0 flows to the pilot signal passage through the orifice.

So the oil in the pilot signal passage flows from the travel section to the tank passage, the pilot signal pressure becomes to equal to the tank pressure, therefore the travel straight spool is not switched.



③ Arm dump operation

With the arm dump operation, the pilot secondary pressure enters into the Pd50 port, and moves the spool for the arm operation. And with the movement of the spool, as the by-pass circuit is cut at the arm switching section, the oil received through the P2 port flows into the parallel circuit on the arm switching section.

With the movement of the spool, as the circuit from the passage leading to the arm lock valve section to the bridge passage is opened, the oil entered in the parallel circuit passes through the load check valve on the arm switching section and flows into the C5 port through the bridge passage and open the arm lock valve(free flow) and is fed into the arm cylinder rod side.

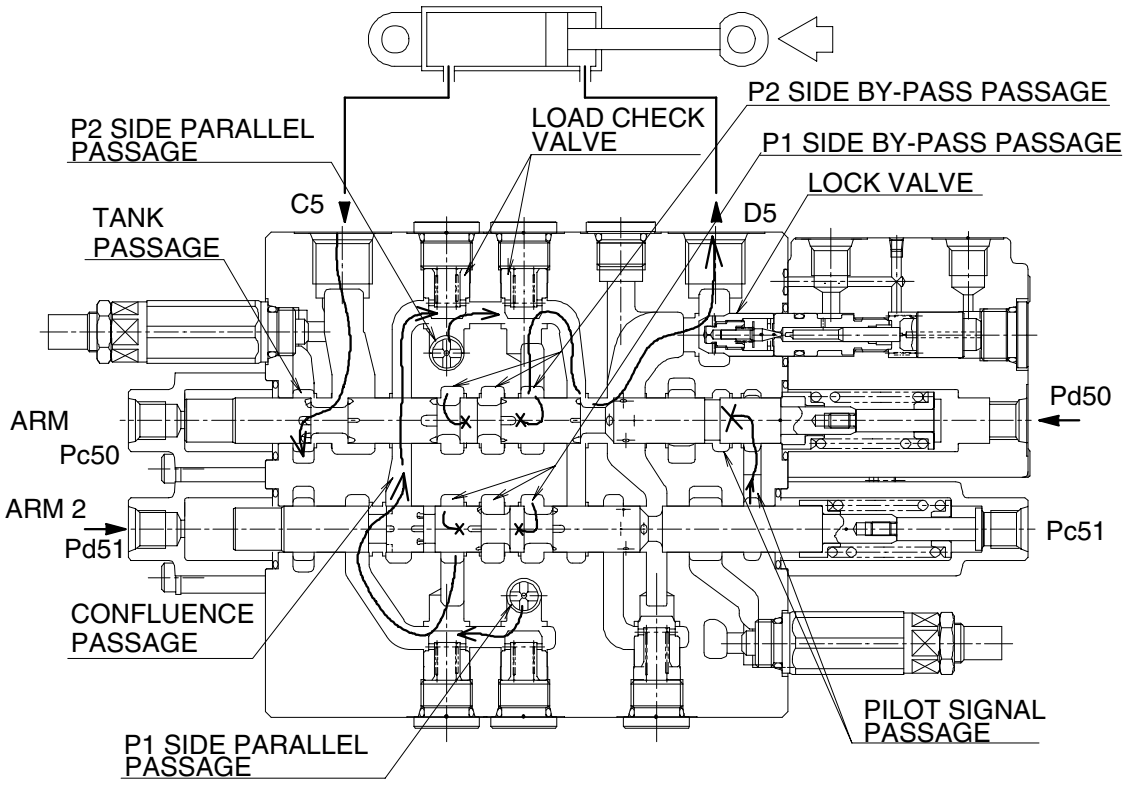
Moreover, secondary pilot pressure enters into Pd51 port of arm2 spool simultaneously, and moves arm2 spool. And with the movement of the arm2 spool, as the by-pass(P1) circuit is cut at the arm2 switching section, the oil received through the P1 port flows into the arm confluence passage through the check valve in the arm2 switching section. The oil which flowed into arm confluence passage in the arm2 section flows into the bridge passage of the arm section from the land of arm2 spool released by shift of arm2 spool. And P1 oil is fed into the arm cylinder rod side.

On the other hand, the return oil from the arm cylinder head side flows into the C5 port, and with the movement of the spool the oil flows out into the tank passage.

The oil from the port P0 flows to the pilot signal passage through the orifice.

So the oil in the pilot signal passage flows from the travel section to the tank passage, the pilot signal pressure becomes to equal to the tank pressure, therefore the travel straight spool is not switched.

Also about other switching sections(travel, swing, bucket, etc.), there is only no spool like a boom2 or an arm2, and an operation is the same.



7072MCV08

(3) Travel straight function

Straight-travel valve is the valve for keeping traveling straight, when boom, arm, bucket, swing, dozer, or option is operated at the time of traveling.

When any of the both travels and arm, boom, bucket, swing, dozer, or option is switched at the state of the pilot pressure supplied in the port P0, the pilot signal passage is closed from the tank passage, and the pilot pressure comes to act in the pilot passage.

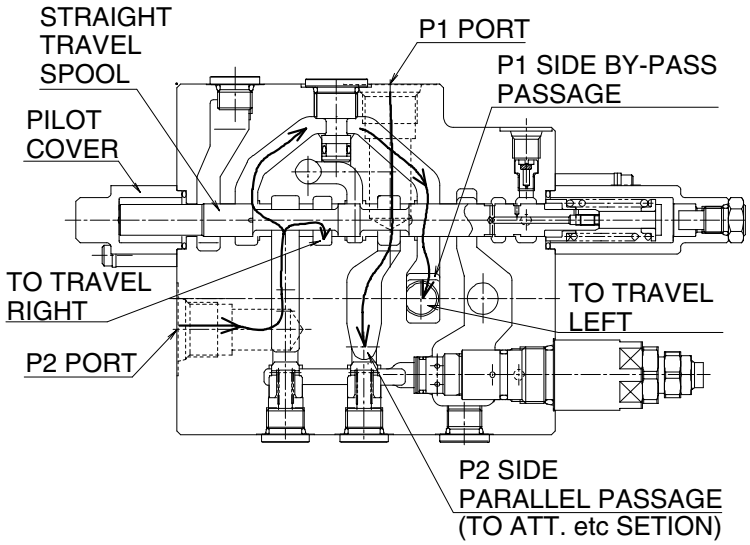
Therefore, the pilot pressure acts in the spring room of the straight travel spool, and the spool against the spring moves until to contact to the pilot cover of the opposite side.

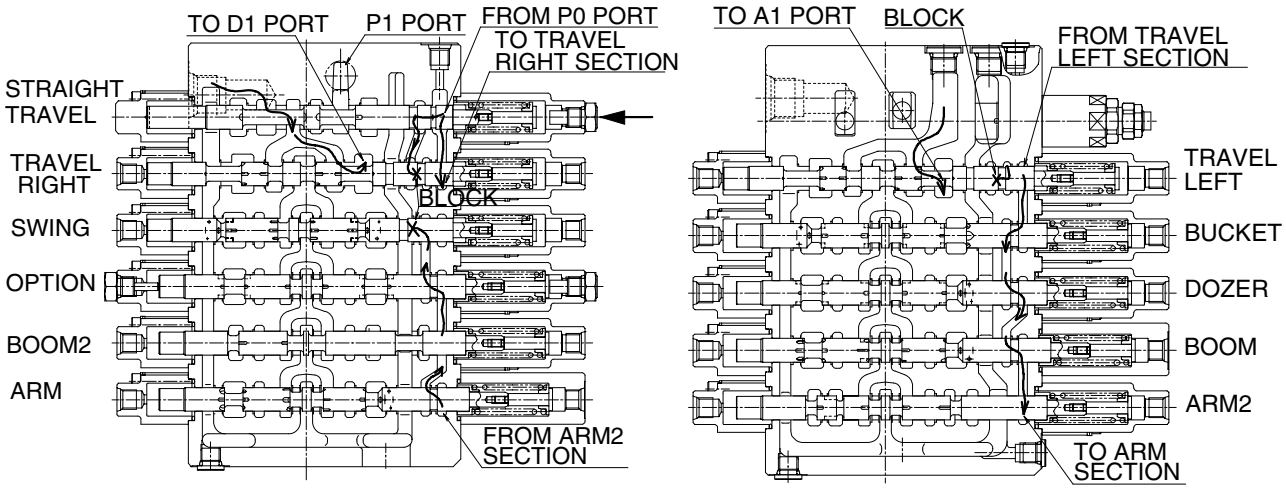
When the straight travel spool is switched, the oil pressure from P1 is led to the each attachment switching section through the P1 and P2 parallel passage.

On the other hand, the oil from P2 is supplied to the both travel section through P1 and P2 bypass passage.

Therefore, when attachments(boom or arm...etc.) is switched at the time of both travels, since the oil of P2 mainly flows to both travels, and the oil of P1 mainly flows to attachments, it can keep traveling straight.

The following figure expresses the state when operating the both travels and the swing section as reference.





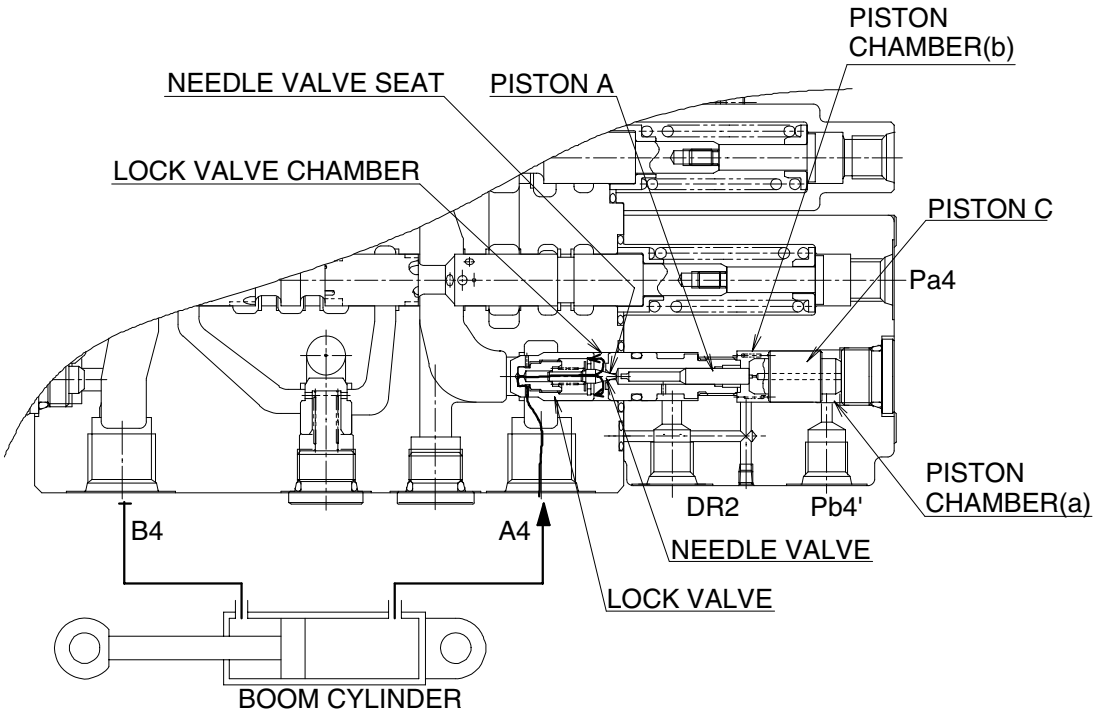
7072MCV09A~C

2) ACTUATION OF LOCK VALVE(BOOM AND ARM)

(1) Holding

In the condition where the spool for booms on the neutral position, pilot piston chamber(A) is connected to the drain passage through pilot port(Pb4') used to release the lock valve, and piston chamber(b) is also connected to the drain passage through drain port(DR2).

Therefore, piston(C) must be held in the condition shown in the figure. Then the retaining pressure of the boom cylinder acts on the lock valve chamber as shown in the figure, and pushes the needle valve against the seat section, preventing the leakage on the boom cylinder head side. Consequently the movement of the boom cylinder due to the leakage is also prevented.



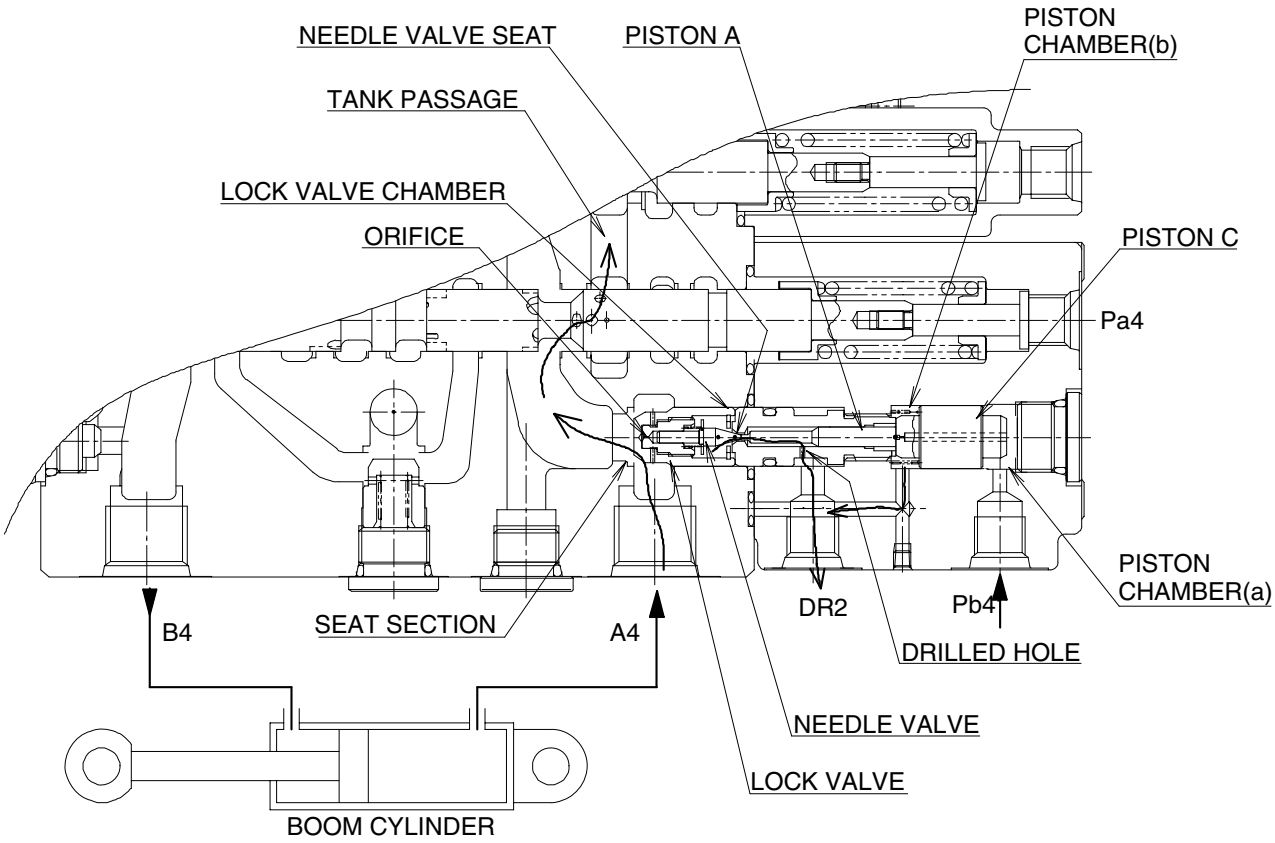
7072MCV10

(2) Releasing

When the pilot pressure acts on pilot port(Pb4') for releasing of lock valve, piston(C) moves leftward, and pushes and opens the needle valve through piston(A).

Then the return oil from the boom cylinder flows through the orifice of the lock valve, lock valve chamber and drilled hole, and flows into the tank passage through the notch of the spool for boom.

The pressure of the lock valve chamber lowers because the needle valve opens and the return oil from the boom cylinder opens the lock valve. Consequently the return oil from the boom cylinder flows into the tank passage through the notch of the spool for boom.



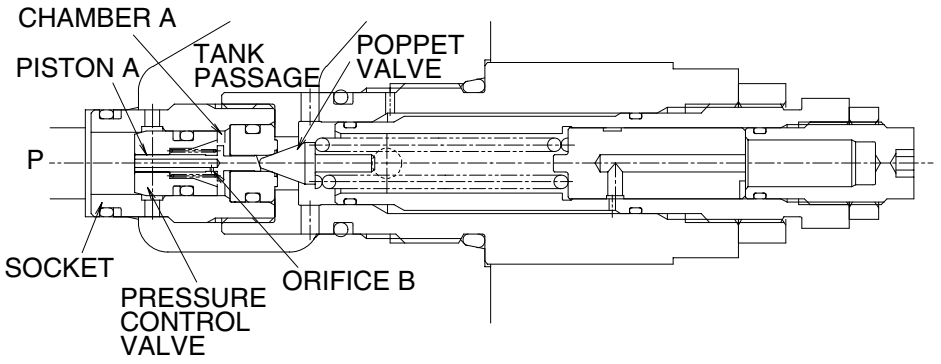
7072MCV11

2) ACTUATION OF RELIEF VALVE

(1) Main relief valve

① Relief function

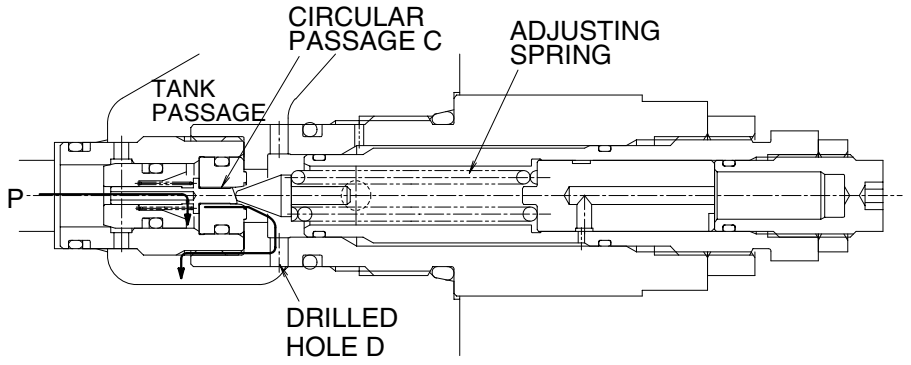
The pressure passes through the inside of piston placed in the pressure control valve(parent valve) and orifice B and is led to chamber A, while the pressure control valve is seated on the socket also on the body securely.



7072MCV12

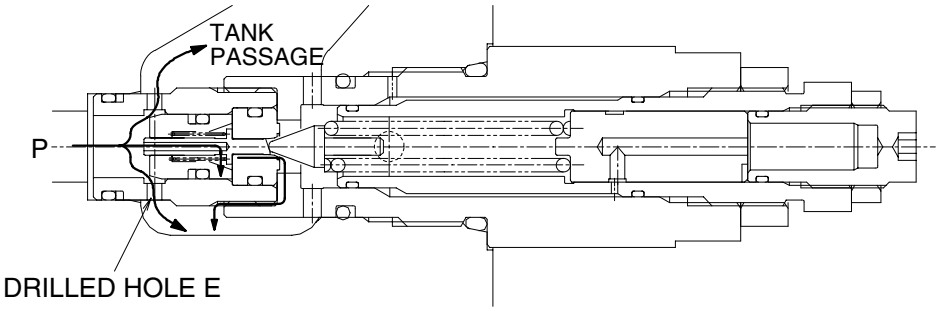
When the pressure of port P reaches to the set pressure by spring, poppet valve leaves from the seat.

The oil flows through inside of piston A → orifice B → chamber A → circular passage C → drilled hole D and outer side socket, and flows out to the tank passage.



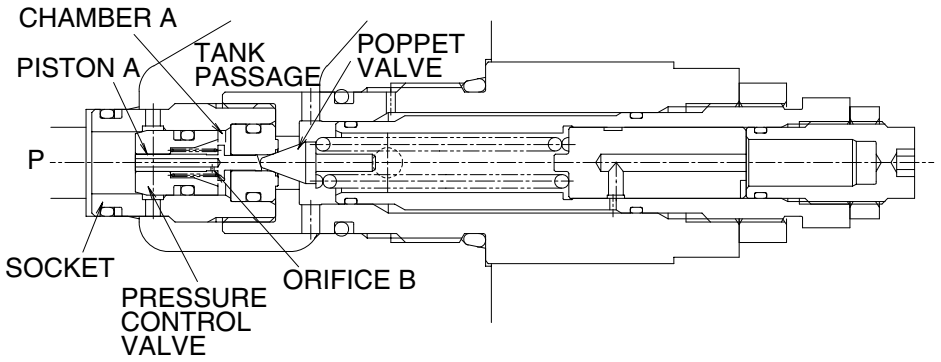
7072MCV13

As the pressure in chamber A drops by unseating of poppet valve, pressure control valve leaves from the seat, by which the oil in port P flows out to the tank passage through drilled hole E.



7072MCV14

When the pressure in port P falls to the set pressure by spring, poppet valve is re-seated by the spring, and the pressure in chamber A comes to equal to the port P, by which pressure control valve is re-seated on socket returning to the initial situation.

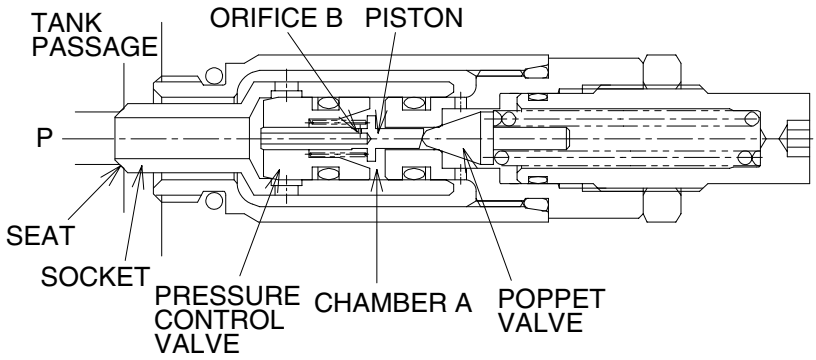


7072MCV12

(2) Overload relief valve

① Relief function

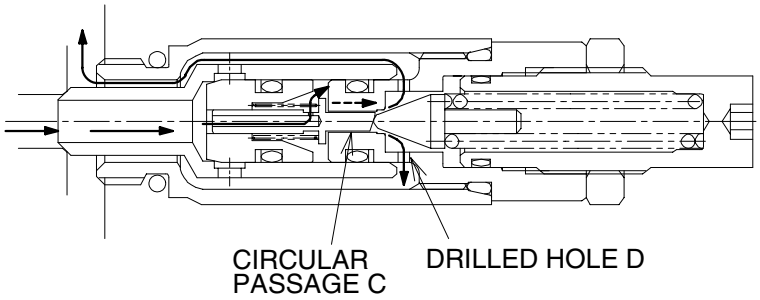
The pressure passes through the inside of piston in the pressure control valve(main valve) and orifice B and is led to chamber A, while the poppet valve is seated on the socket also on the body securely.



7072MCV16

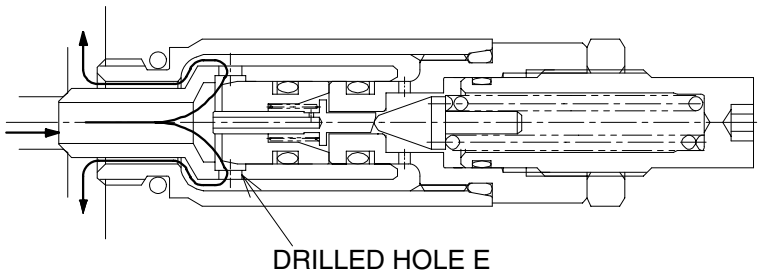
Then the pressure of port P reaches to the set pressure by spring, poppet valve leaves from the seat.

The oil flows through inside of piston → orifice B → chamber A → circular passage C → drilled hole D and outer side socket, and flows out to the tank passage.



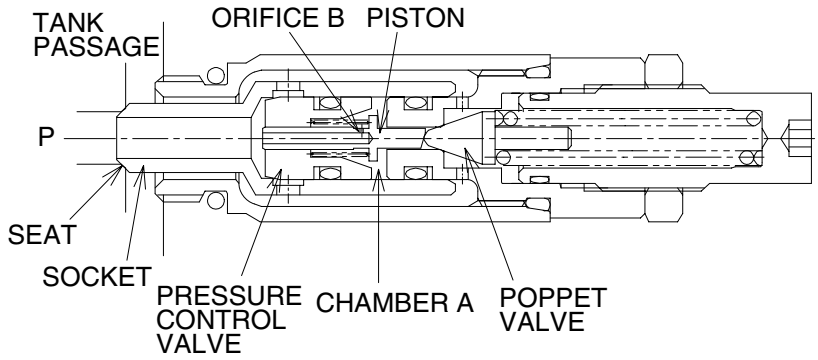
7072MCV17

As the pressure in chamber A drops by unseating of poppet valve, pressure control valve leaves from the seat, by which the oil in port P flows out to the tank passage through drilled hole E.



7072MCV18

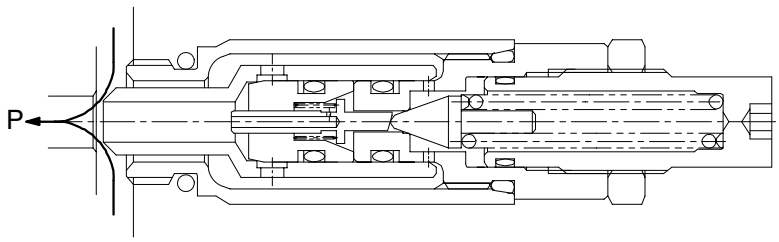
When the pressure in port P falls to the set pressure by spring, poppet valve is re-seated by the spring, and the pressure in chamber A comes to equal to the port P, by which pressure control valve is re-seated on socket returning to the initial situation.



7072MCV16

② Suction function

When the negative pressure is generated in port P, this valve supplies the oil from the tank passage. When the pressure in port P is less than the tank passage pressure, the push-up force acts on socket, by which socket is left from the seat, and the oil flows from the tank passage to port P.



7072MCV19

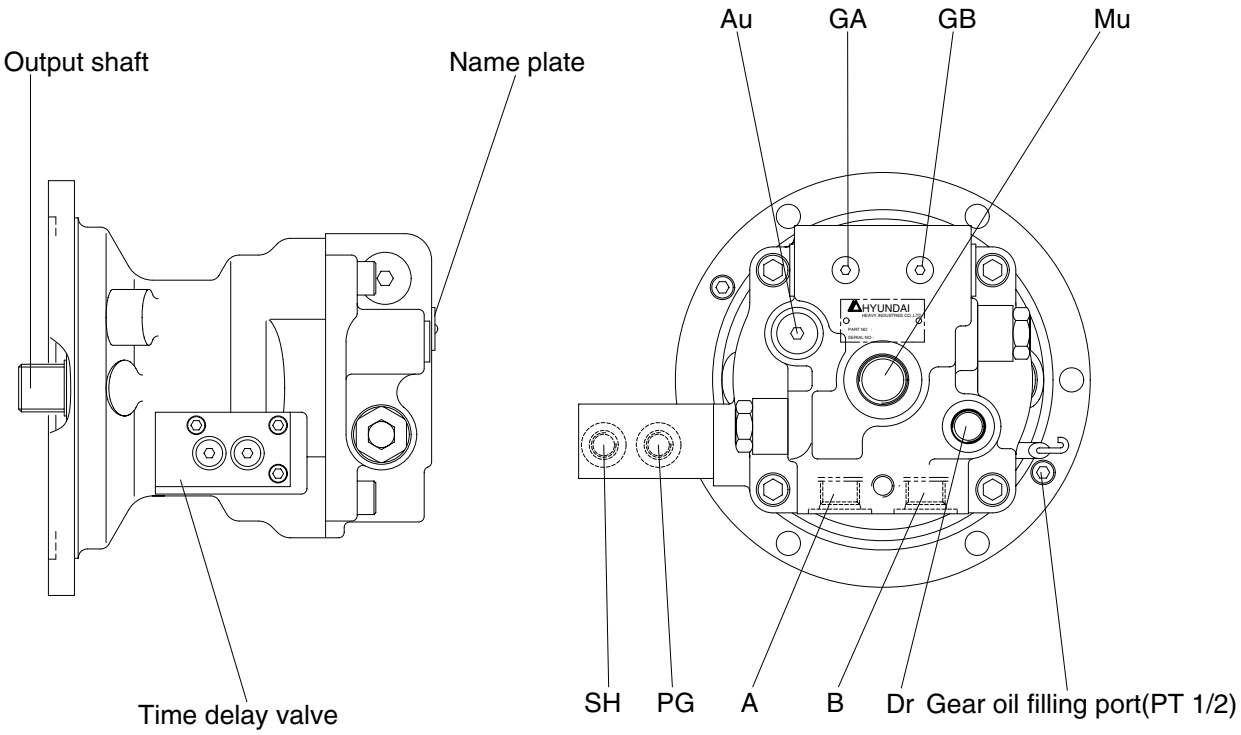
GROUP 3 SWING DEVICE

1. STRUCTURE

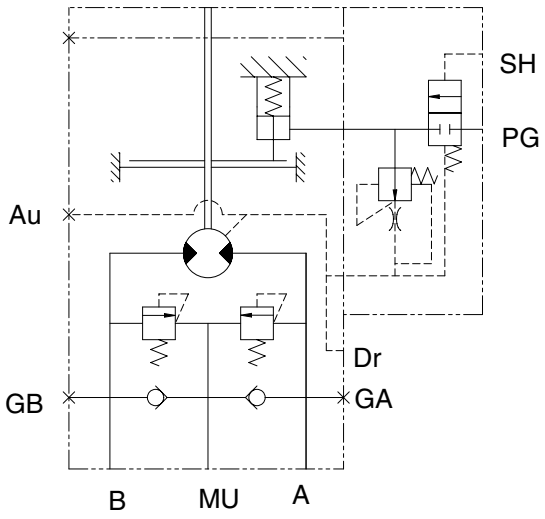
Swing device consists swing motor and swing reduction gear.

1) SWING MOTOR

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



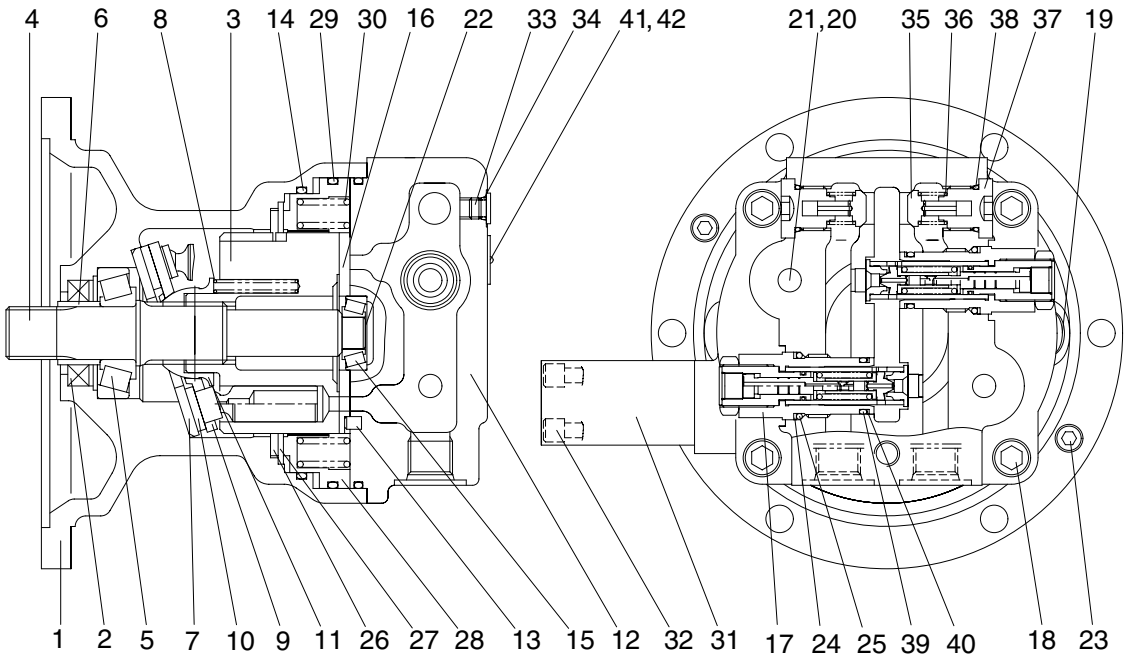
7072SM02



7072SM03

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 port	PF 1/4
SH	Brake pilot port	PF 1/4
GA,GB	Gage port	PF 1/4
Au	Air vent port	PF 3/8

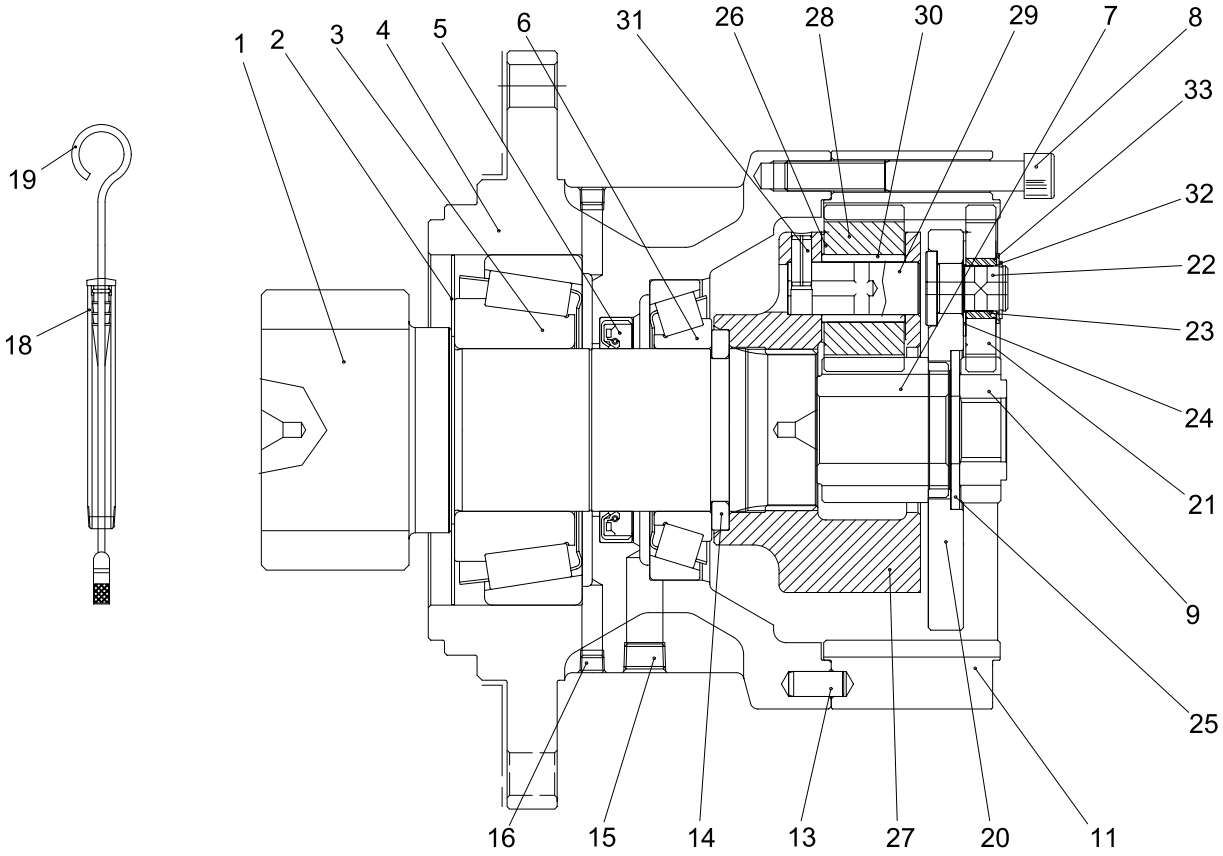
(1) Structure of swing motor



7072SM01

1	Body	15	Taper bearing	29	O-ring
2	Oil seal	16	Valve plate	30	Spring
3	Cylinder block	17	Relief valve assembly	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	Drive shaft	13	Dowel pin	24	Thrust washer No.1
2	Bearing cover	14	Collar	25	Thrust washer No.3
3	Taper roller bearing	15	Plug	26	Thrust washer No.2
4	Case	16	Plug	27	Carrier No.2
5	Oil seal	18	Pipe	28	Planet gear No.2
6	Taper roller bearing	19	Level gauge	29	Pin No.2
7	Sun gear No.2	20	Carrier No.1	30	Bush No.2
8	Socket bolt	21	Planet gear No.1	31	Spring pin
9	Sun gear No.1	22	Pin No.1	32	Snap ring
11	Ring gear	23	Bush No.1	33	Thrust washer No.4

2. FUNCTION

1) ROTARY PART

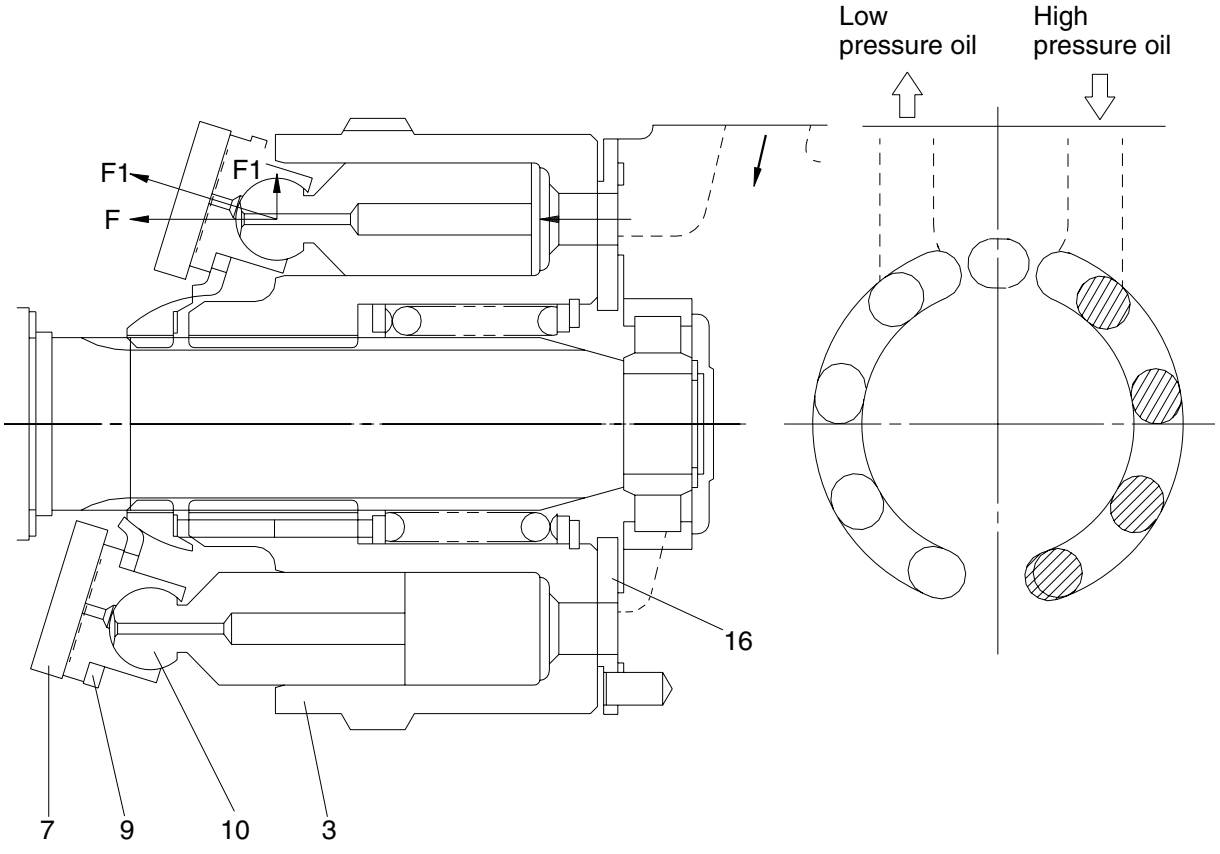
When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force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

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

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)

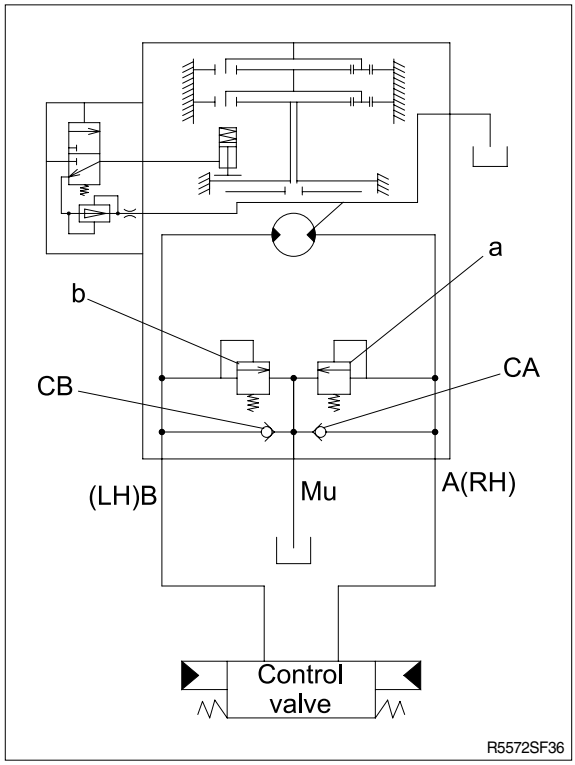


R5572SF35

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.

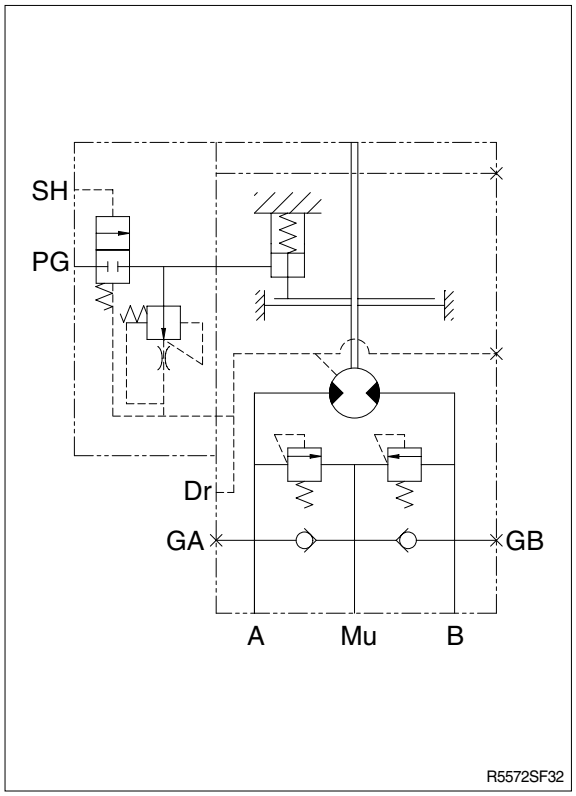
(3) Operation

① When starting swing

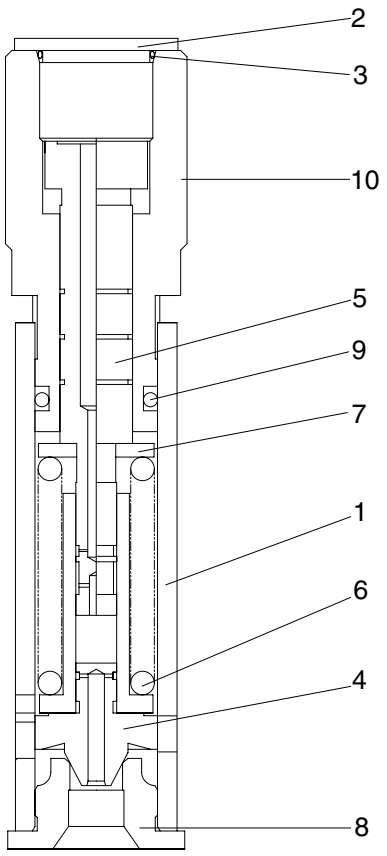
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port **B**. Because of this, the pressure at port **B** rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet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



R5572SF37

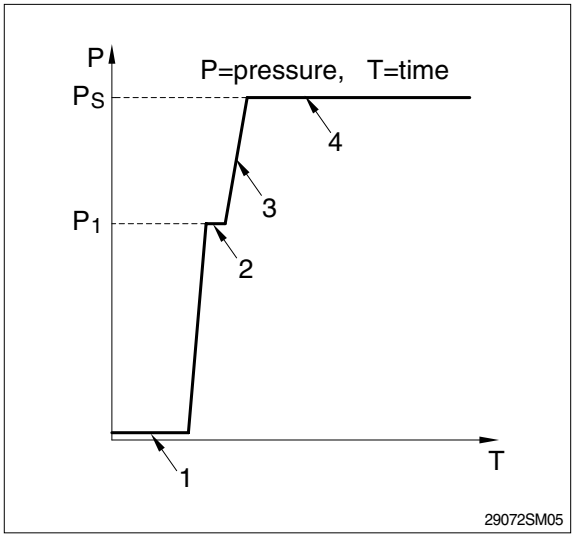
1 Body
2 Plug
3 O-ring
4 Plunger
5 Piston
6 Spring
7 Spring seat
8 Seat
9 O-ring
10 Nut

(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.

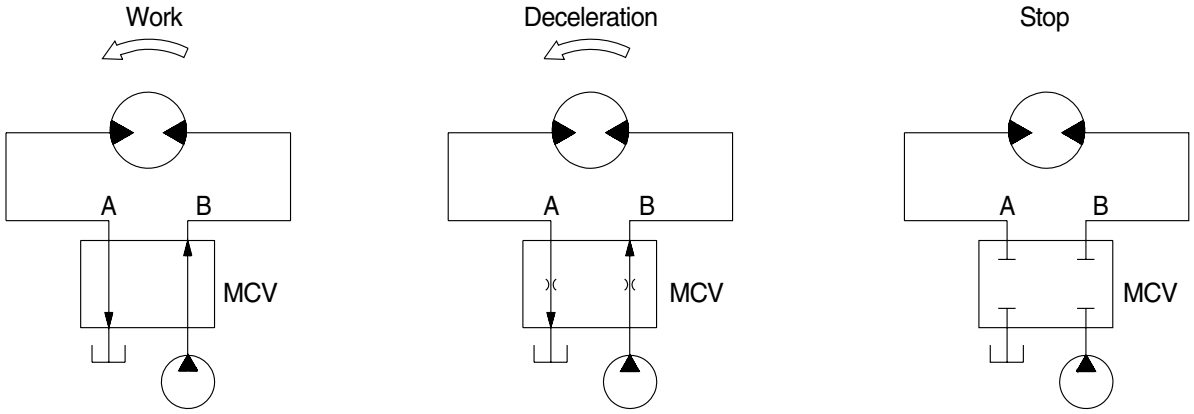


4) BRAKE SYSTEM

(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)

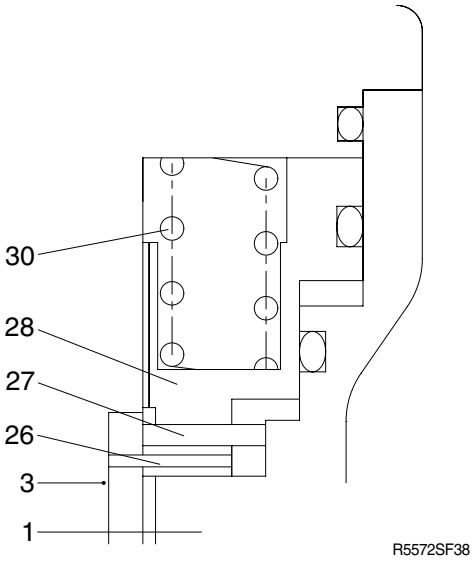
(2) Mechanical swing parking brake system

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.



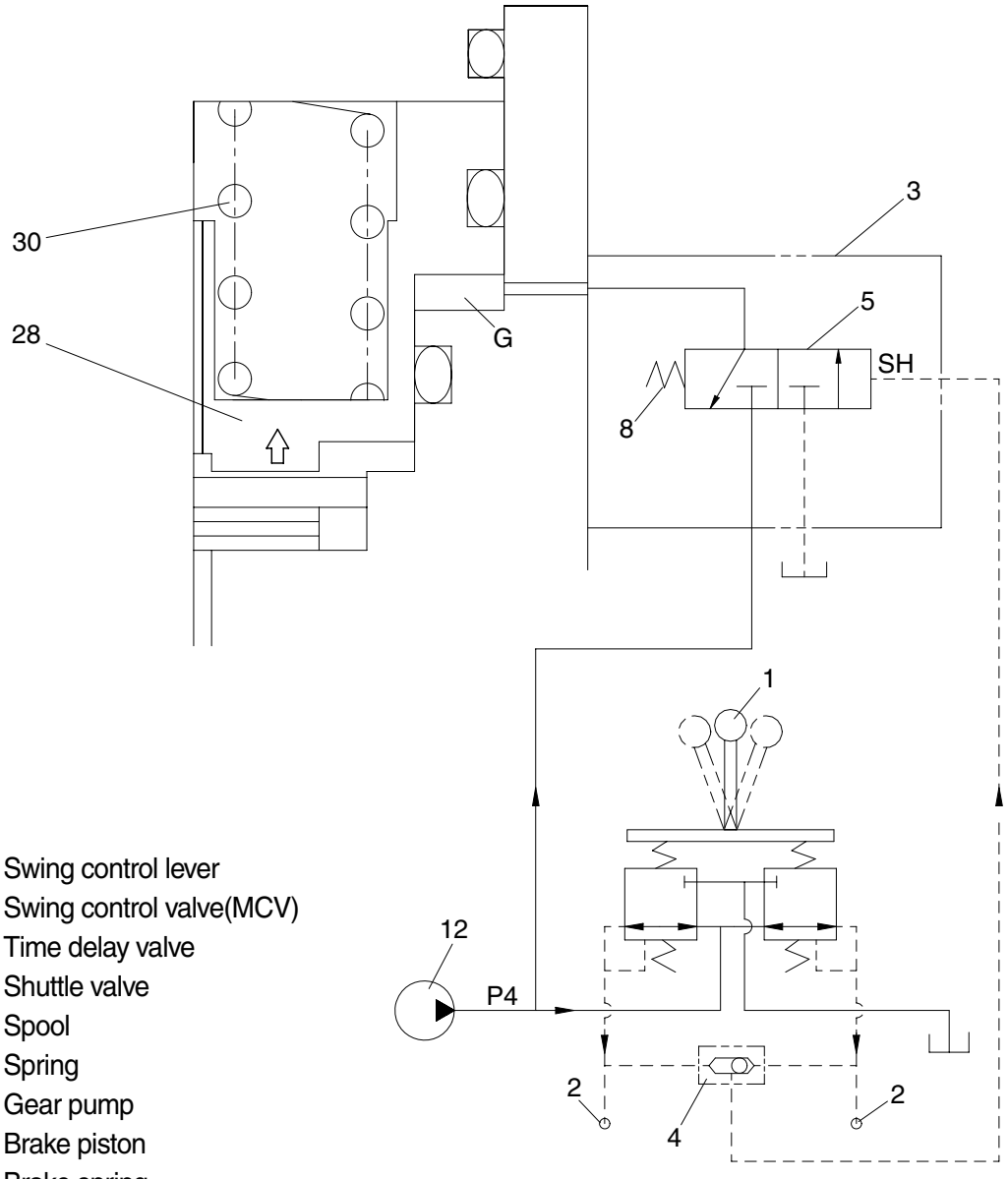
R5572SF38

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.

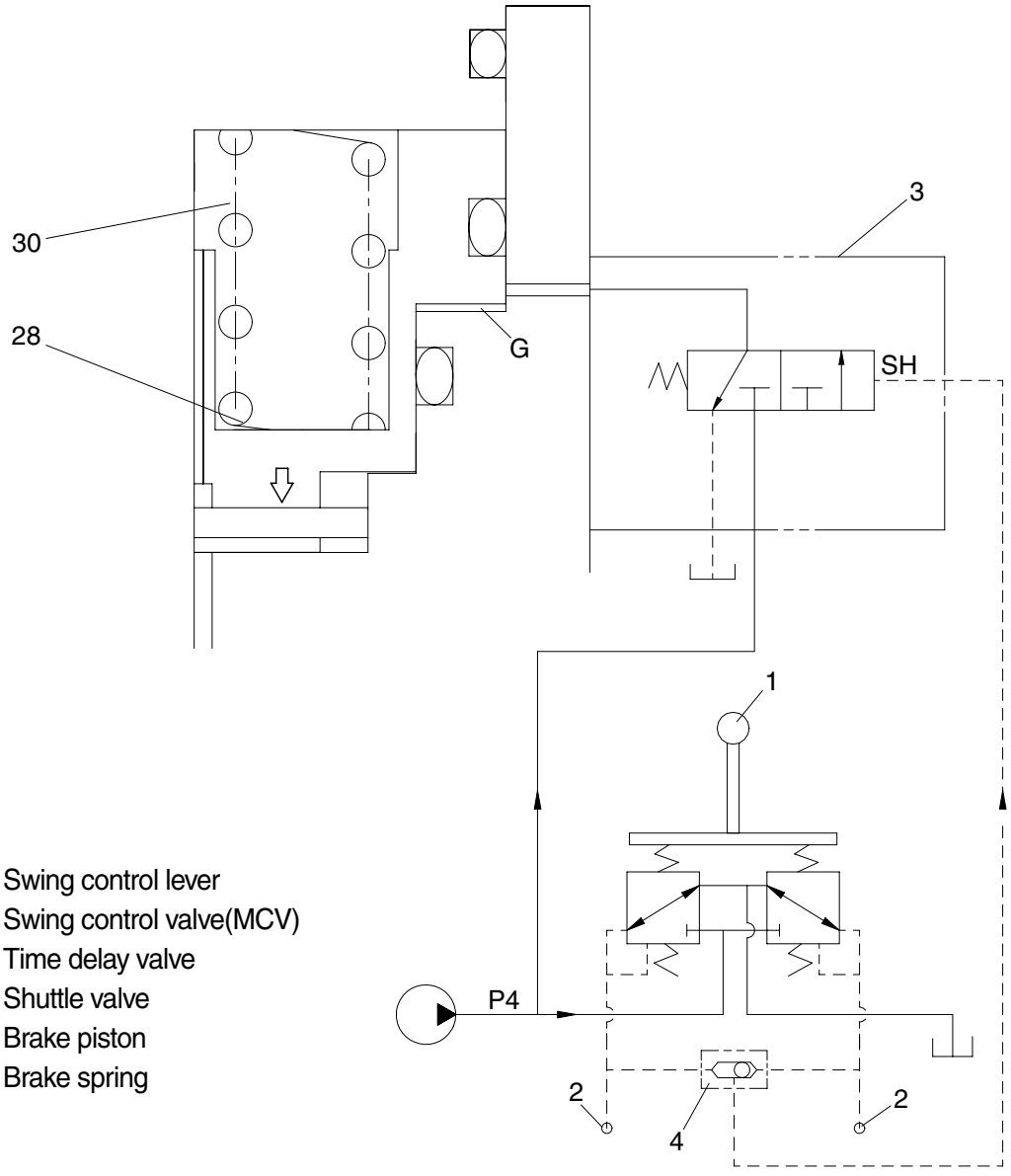
This pressure is applied to move the piston(28) to the upward against the force of the spring(30). Thus, it releases the brake force.



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

R5572SF39

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

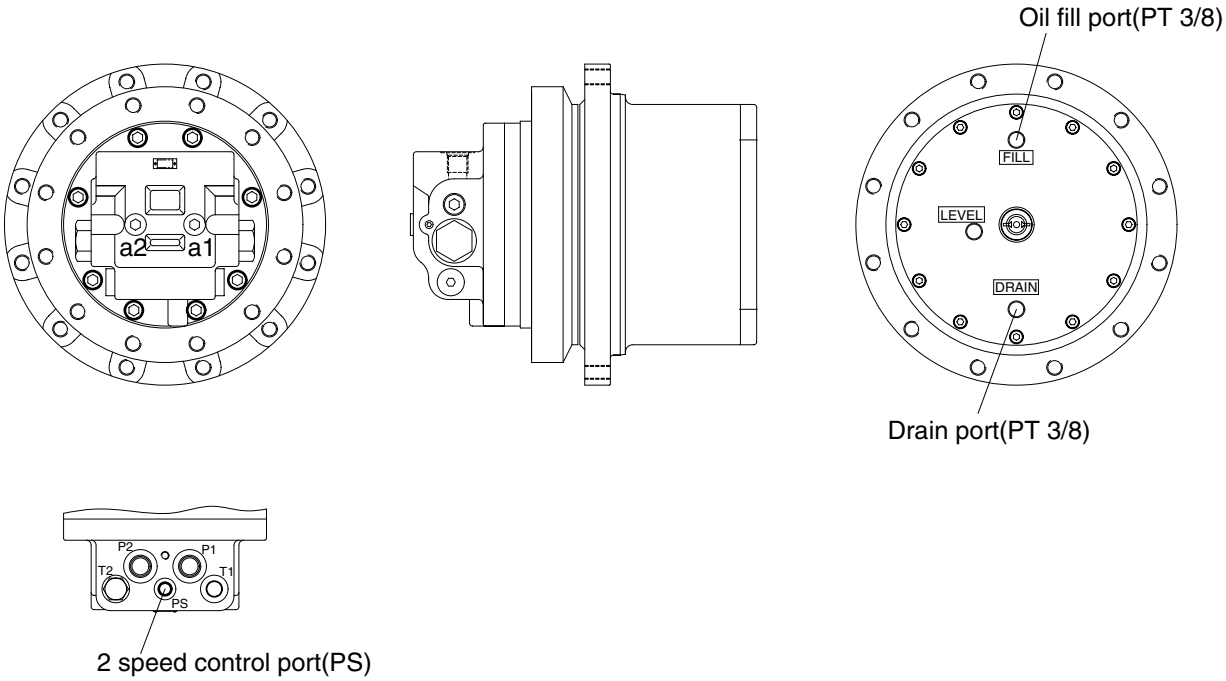
R5572SF40

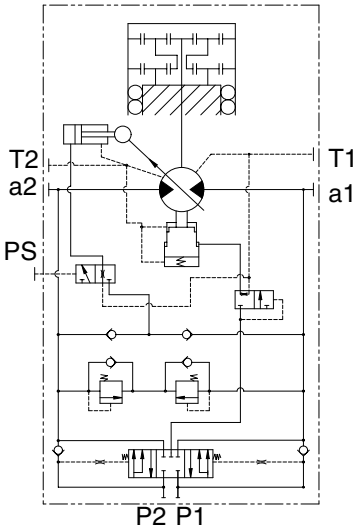
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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

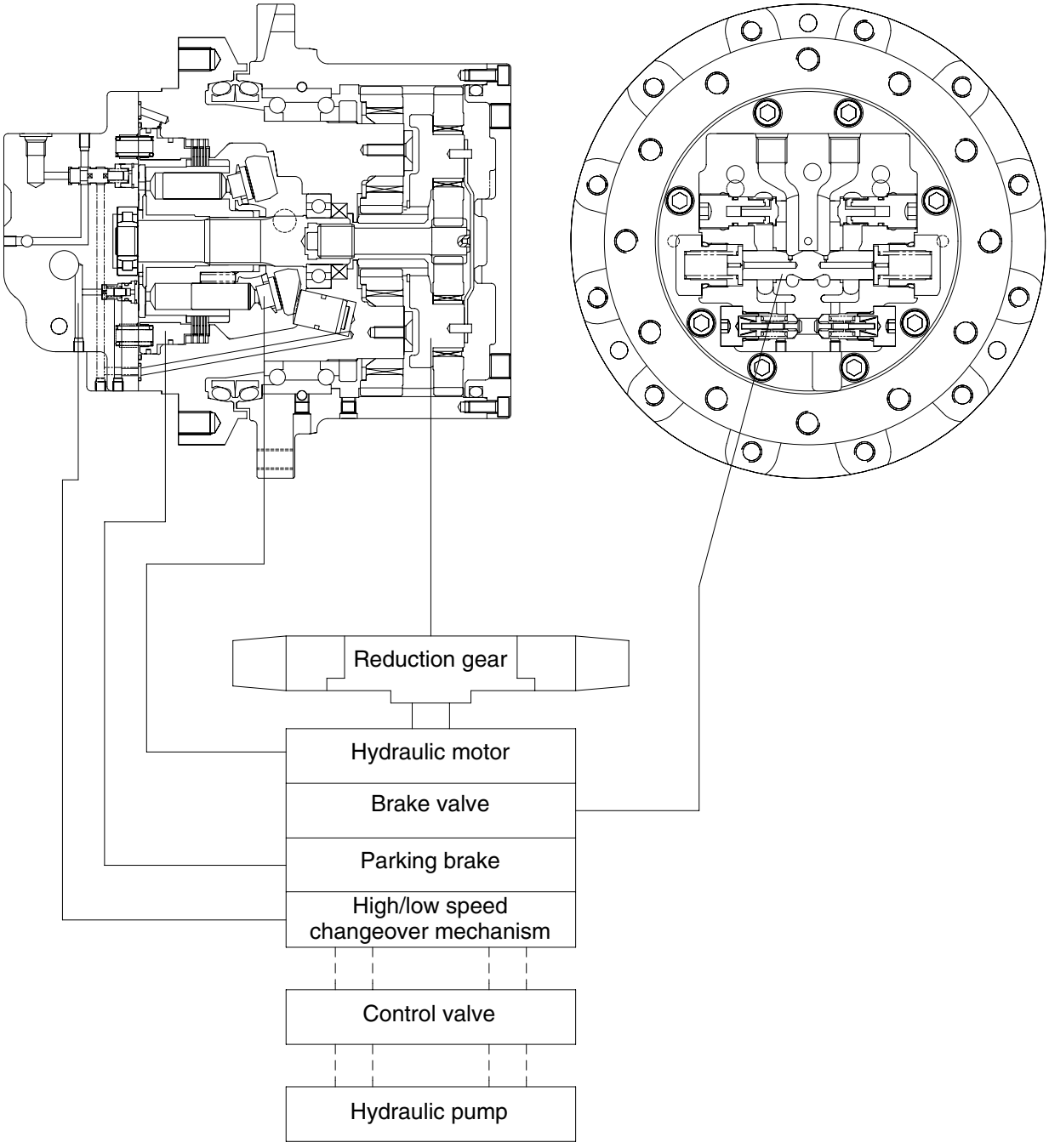




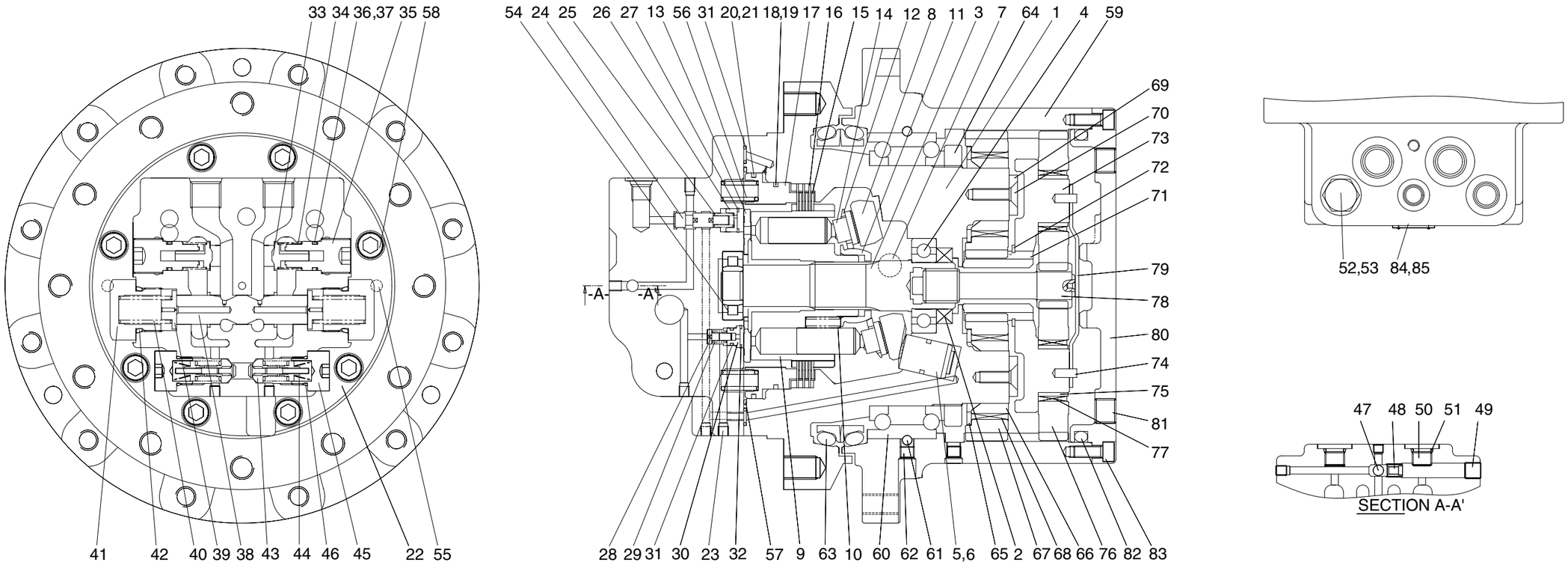
Port	Port name	Port size
P1	Main port	PF 1/2
P2	Main port	PF 1/2
a1, a2	Gauge port	PT 1/4
T1, T2	Drain port	PF 3/8
PS	2 speed control port	PF 1/4

7072TM01

1) BASIC STRUCTURE



7072TM03



7072TM02

1	Shaft casing	16	Parking plate	31	O-ring	45	Plug	59	Ring gear	73	Carrier
2	Oil seal	17	Parking piston	32	Snap ring	46	O-ring	60	Angular bearing	74	Spring pin
3	Shaft	18	O-ring	33	Check	47	Steel ball	61	Steel ball	75	Collar
4	Bearing	19	Back up ring	34	Spring	48	Check seat	62	Plug	76	Planetary gear(B)
5	Swash piston	20	O-ring	35	Plug	49	Plug	63	Floating seal	77	Needle bearing
6	Piston ring	21	Back up ring	36	O-ring	50	Plug	64	Nut	78	Drive gear
7	Swash steel ball	22	Rear cover	37	Back up ring	51	O-ring	65	Washer	79	Thrust plate
8	Swash plate	23	Plug	38	Main spool	52	Roller bearing	66	Collar	80	Ring gear cover
9	Cylinder block	24	Spool	39	Spring seat	53	O-ring	67	Planetary gear(A)	81	Plug
10	Spring	25	Spring	40	Spring	54	Hex plug	68	Needle bearing	82	O-ring
11	Ball guide	26	Stopper	41	Plug	55	Parallel pin	69	Plate	83	Wrench bolt
12	Set plate	27	Snap ring	42	O-ring	56	Spring	70	Bolt	84	Name plate
13	Valve plate	28	Check	43	Relief valve assembly	57	O-ring	71	Sun gear	85	Rivet
14	Piston assembly	29	Spring	44	Spring	58	Wrench bolt	72	Snap ring	86	Seal kit
15	Friction plate	30	Seat								

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder(9) through valve casing of motor(22), and valve plate(13).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston(14).

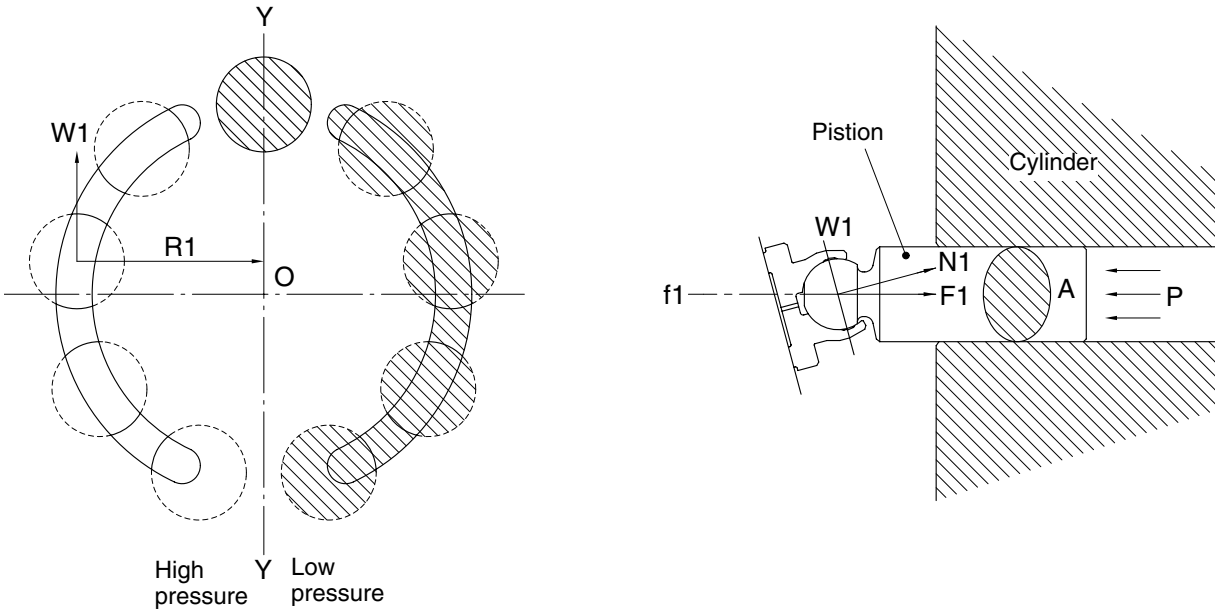
The high hydraulic can generate the force, F1 = P $\times$A(P : Supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate(8) 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 $\times$ 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(9) through a piston; because a cylinder is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



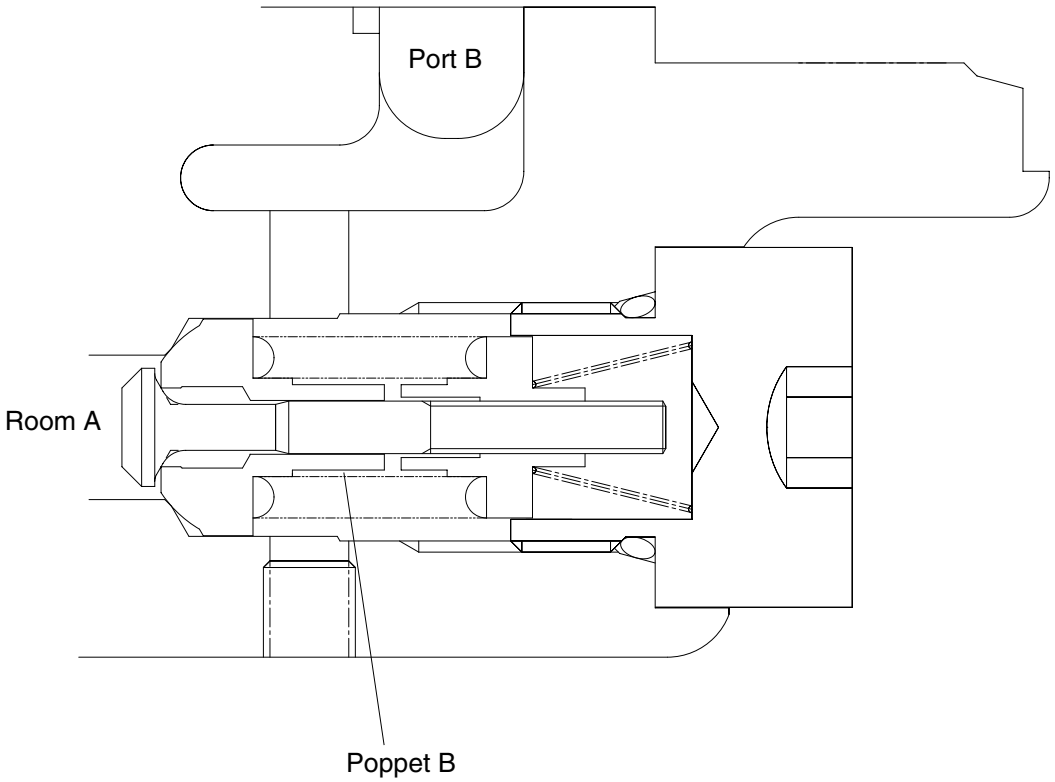
21078TM05

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.

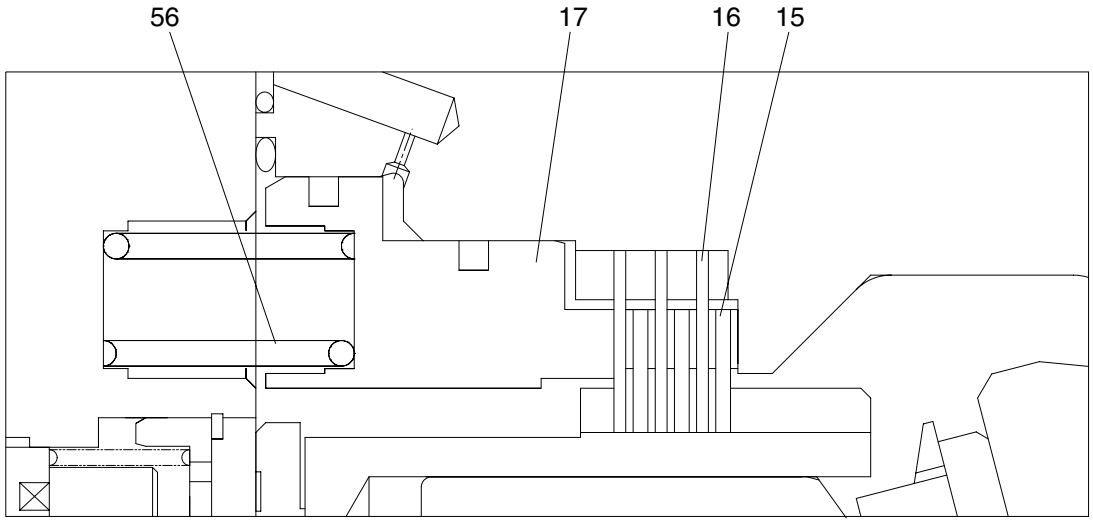
(2) In case of an inertia stopped, it forces an equipment stopped, according to generating the pressure of a brake on the projected side.
Room A is always connected with port A of a motor. If the pressure of port is increased, press poppet B. And if it is higher than the setting pressure of a spring,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



7072TM04

3) WORKING OF BRAKE

Brake operates the pressure supplied through SPOOL(simultaneous peripheral operation online) installed in rear cover(22) to the part of parking piston(17) 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(16), brake piston(17) and a cylinder block(9) connected through spline which are fixed by shaft casing(1) with friction plate(15).
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(15) and a detached plate in the middle of shaft casing and brake piston according to the force plate springs(56); finally, it makes a frictional force.
This frictional force helps the brake fixing a turning axis(3) connected by a cylinder and spline operated.



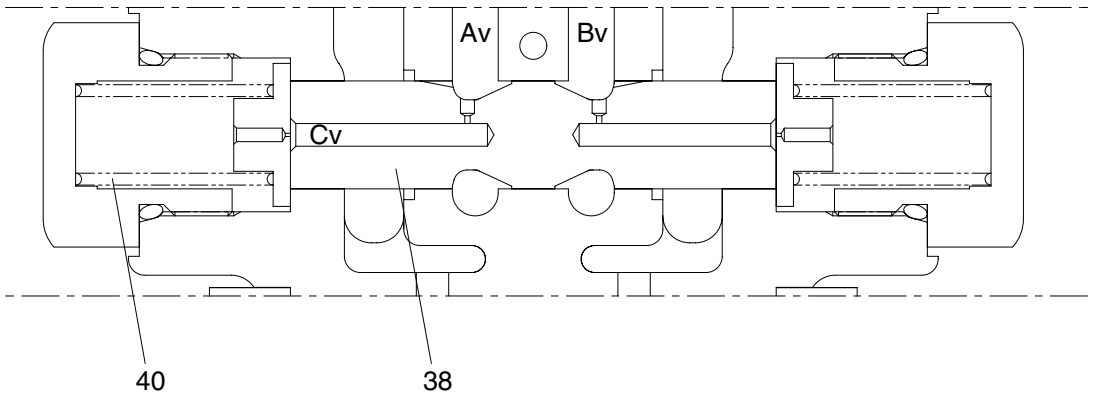
7072TM05

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(40) that is working on the spool's side it moves to the SPOOL(38) on the right side which is medium position and that time MOTOR is turning.

When the SPOOL(38) 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.

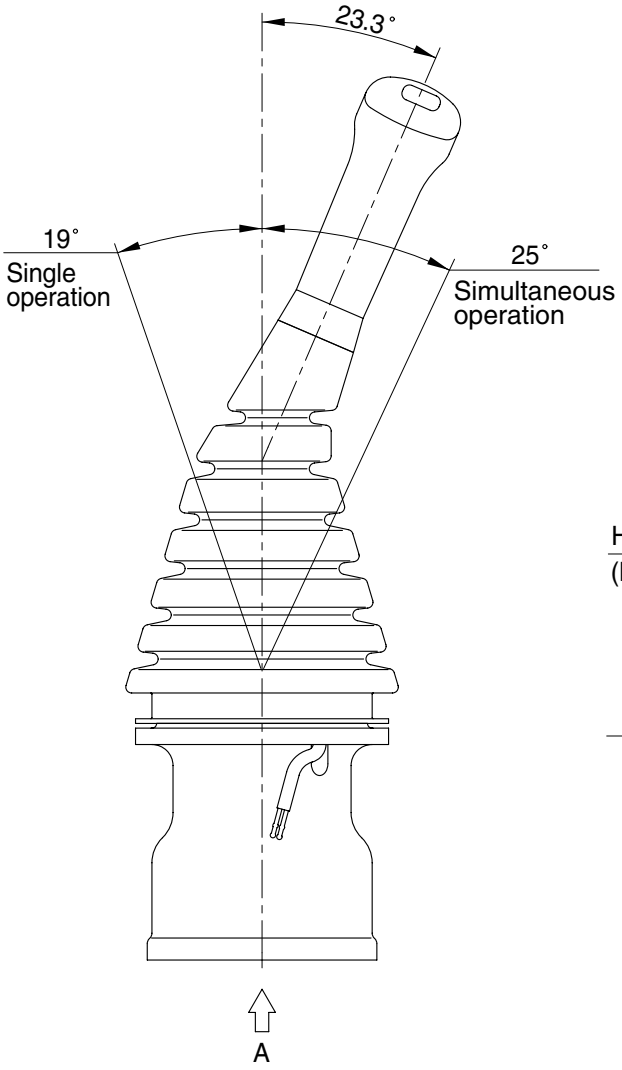


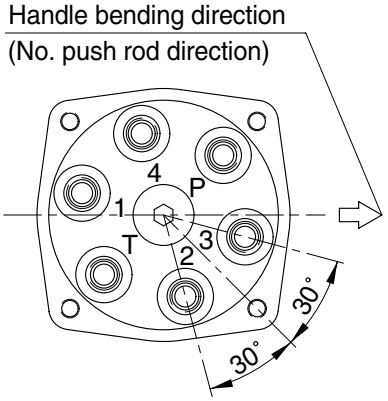
7072TM06

GROUP 5 RCV LEVER

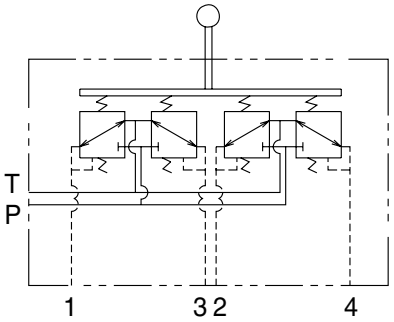
1. STRUCTURE

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.





VIEW A



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	

25032RL01

CROSS SECTION

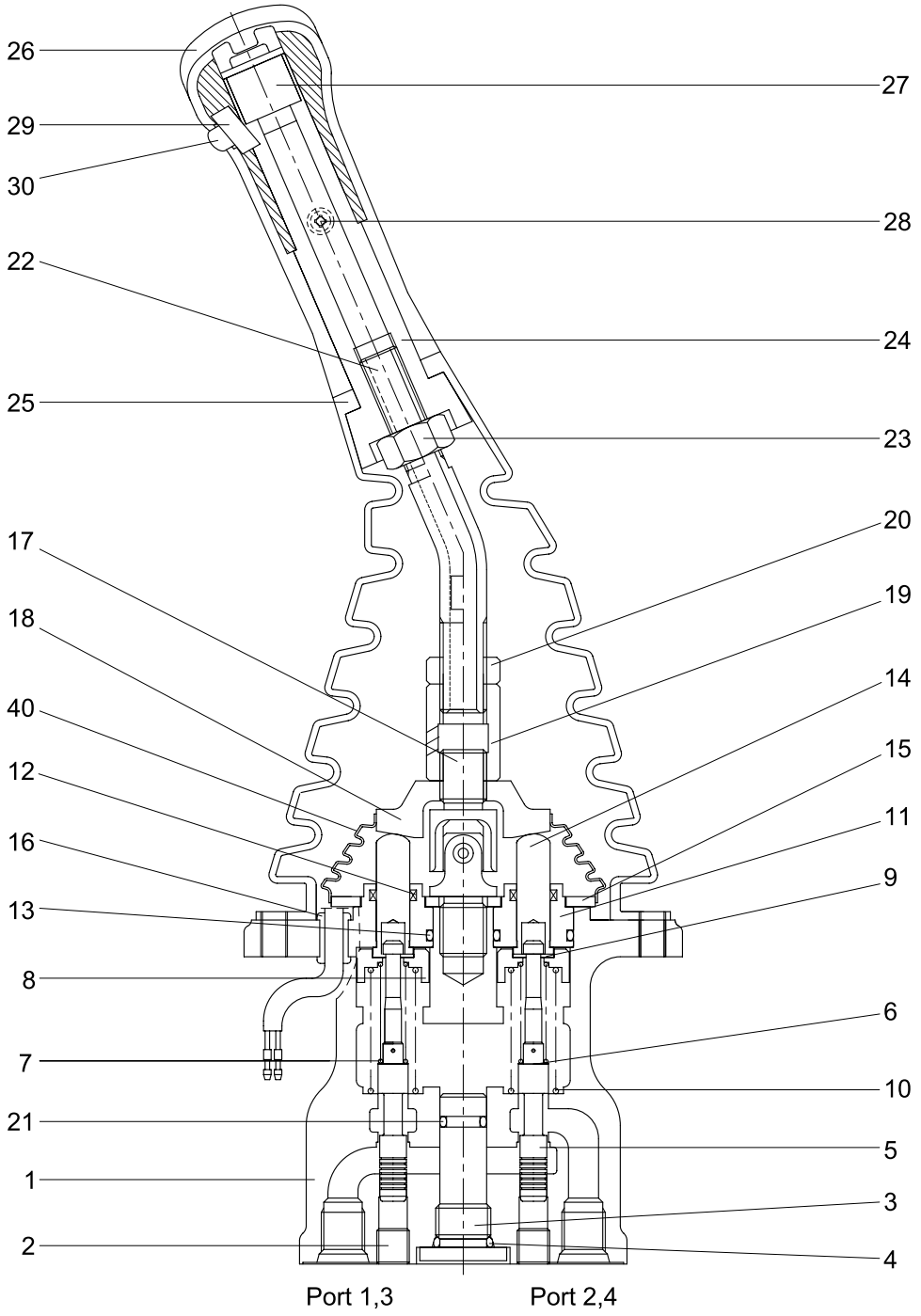
The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool(5), spring(7) for setting secondary pressure, return spring(10), stopper(9), spring seat(8) and shim(6). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5kgf/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 the handle, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.

1	Case	12	Rod seal	22	Handle connector
2	Plug	13	O-ring	23	Nut
3	Plug	14	Push rod	24	Insert
4	O-ring	15	Plate	25	Boot
5	Spool	16	Bushing	26	Handle
6	Shim	17	Joint assembly	27	Switch assembly
7	Spring	18	Swash plate	28	Screw
8	Spring seat	19	Adjusting nut	29	Switch assembly
9	Stopper	20	Lock nut	30	Switch cover
10	Spring	21	O-ring	40	Boot
11	Plug				

CROSS SECTION



14072SF80

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(5) 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(7) 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(11).

For the purpose of changing the displacement of the push rod through the switch plate(19) and adjusting nut(20) are provided the handle(27) that can be tilted in any direction around the fulcrum of the universal joint(18) center.

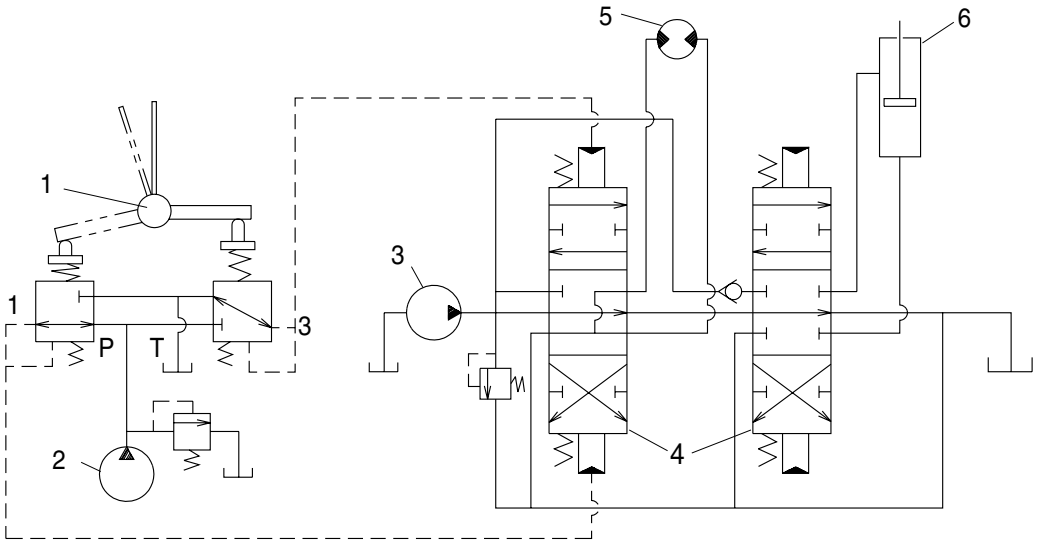
The spring(10) works on the case(1) and spring seat(8) and tries to return the push rod(14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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 and the attached operation explanation drawing.

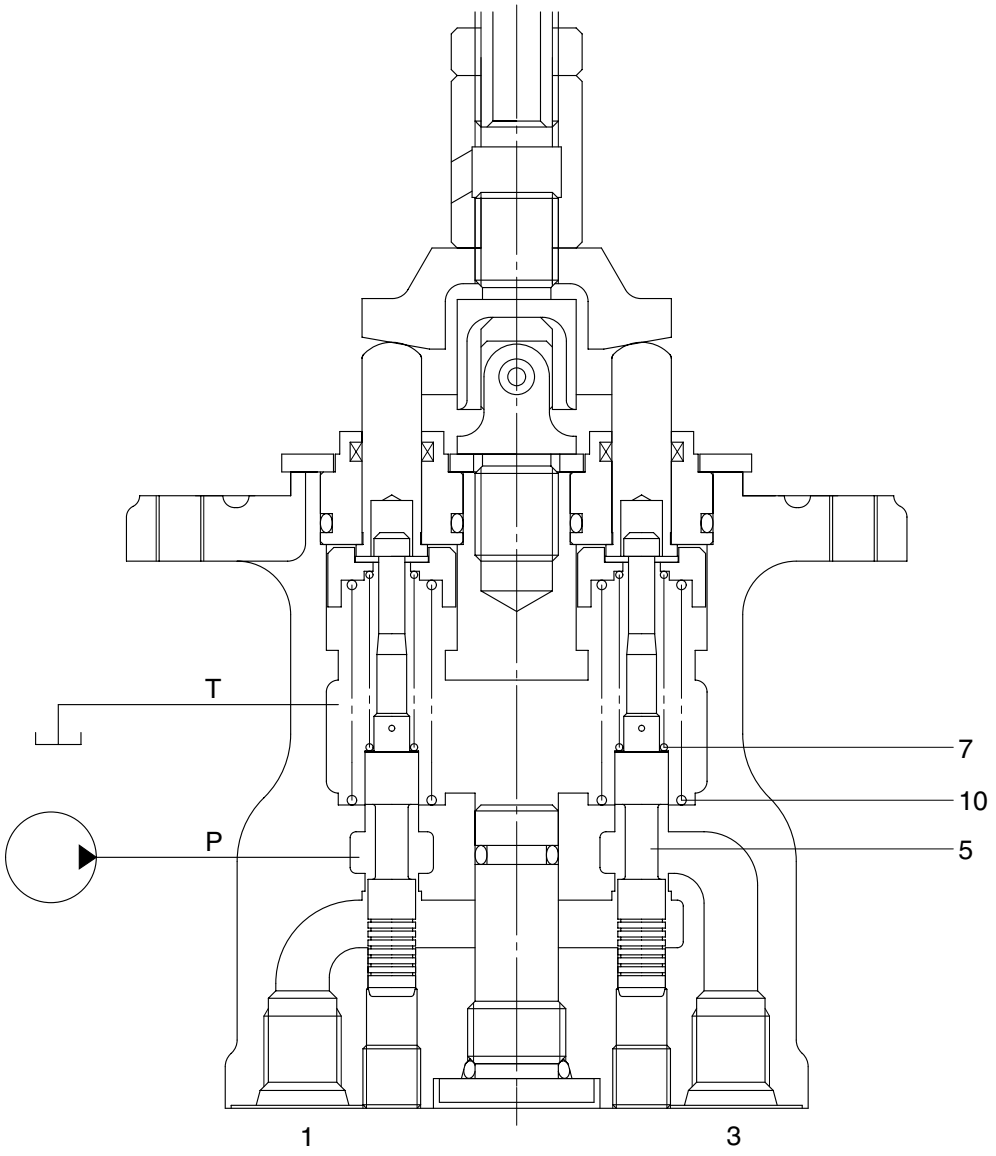
The diagram shown below is the typical application example of the pilot valve.



140LC-7 기타2-70

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

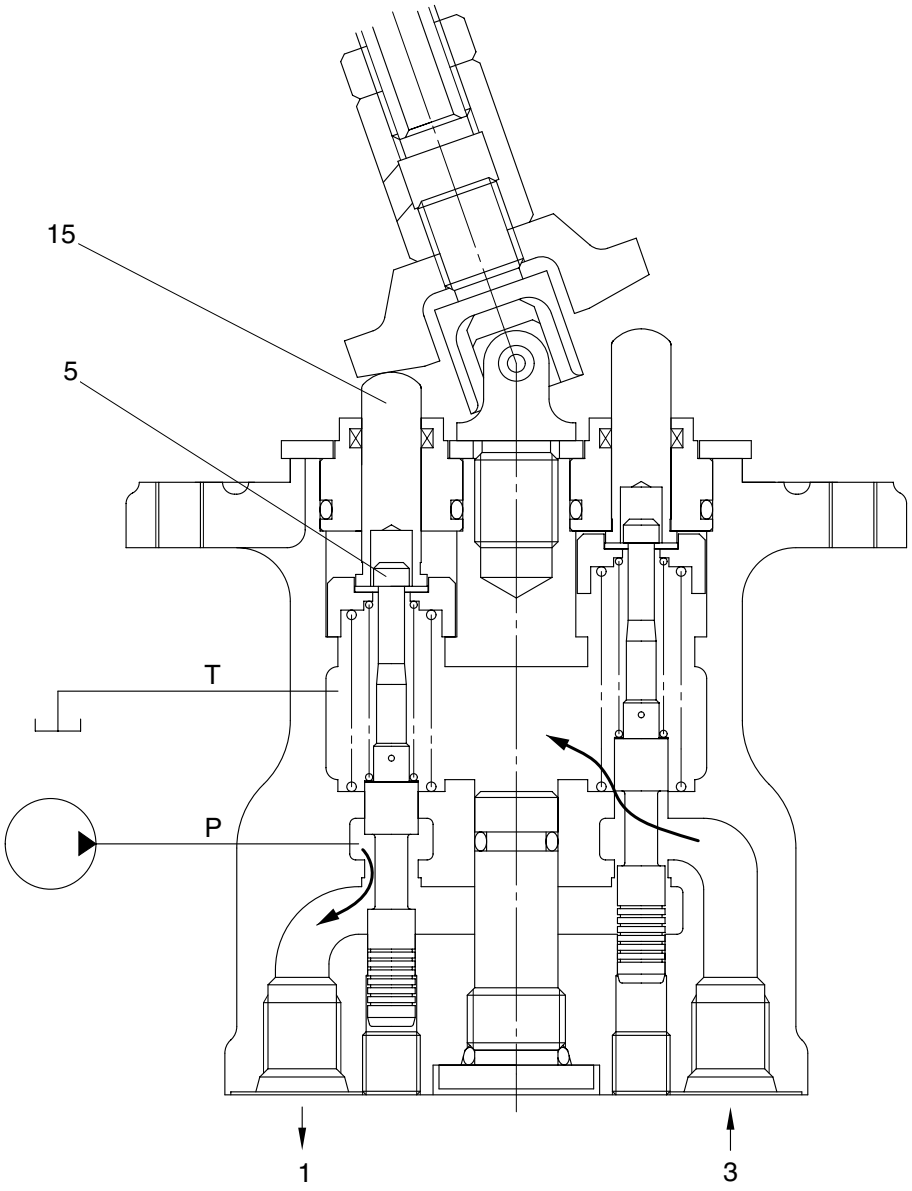
(1) Case where handle is in neutral position



25032RL03

The force of the spring(7) that determines the output pressure of the pilot valve is not applied to the spool(5). 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



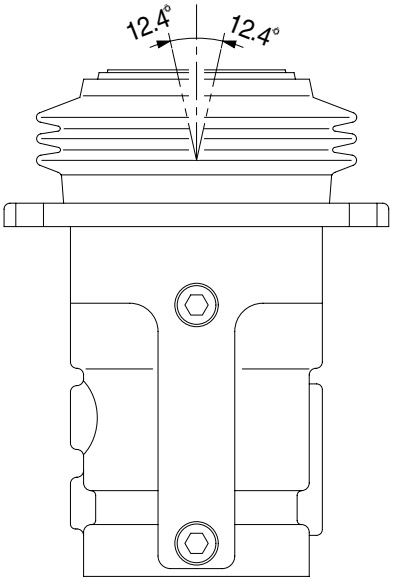
25032RL04

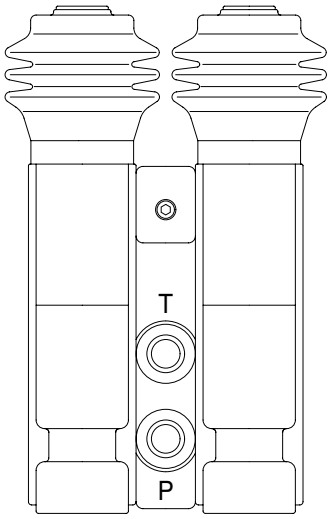
When the push rod(14) is stroked, the spool(5) moves downwards.
Then port P is connected with port(1) and the oil supplied from the pilot pump flows through port(1) to generate the pressure.
When the pressure at port(1) increases to the value corresponding to the spring force set by tilting the handle, 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.

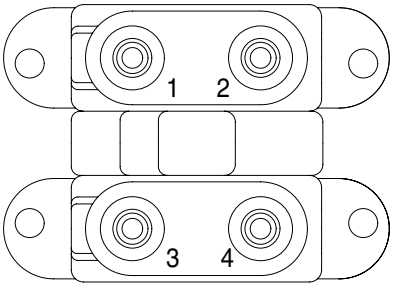
GROUP 6 RCV PEDAL

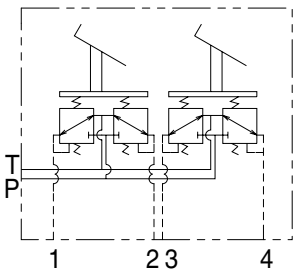
1. STRUCTURE

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)	

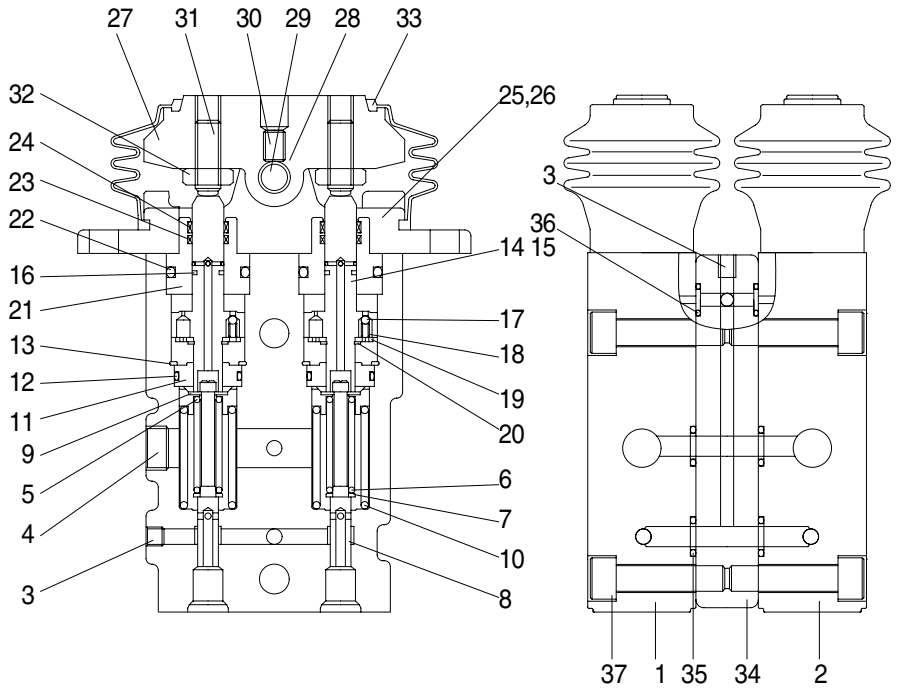
14072SF73

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

2. FUNCTION

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.

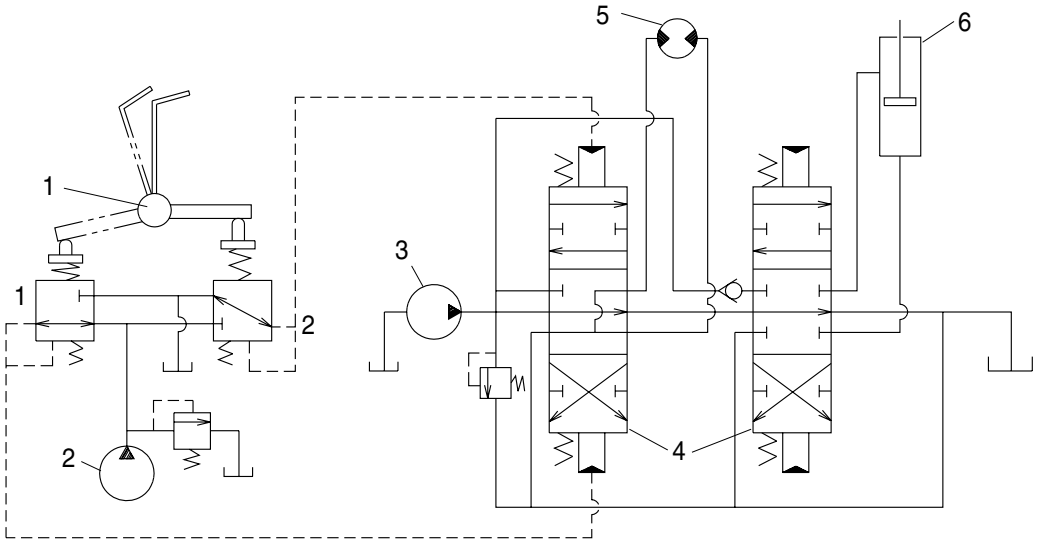
The spring(10) works on the casing(1) and spring seat(7) and tries to return the push rod(14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

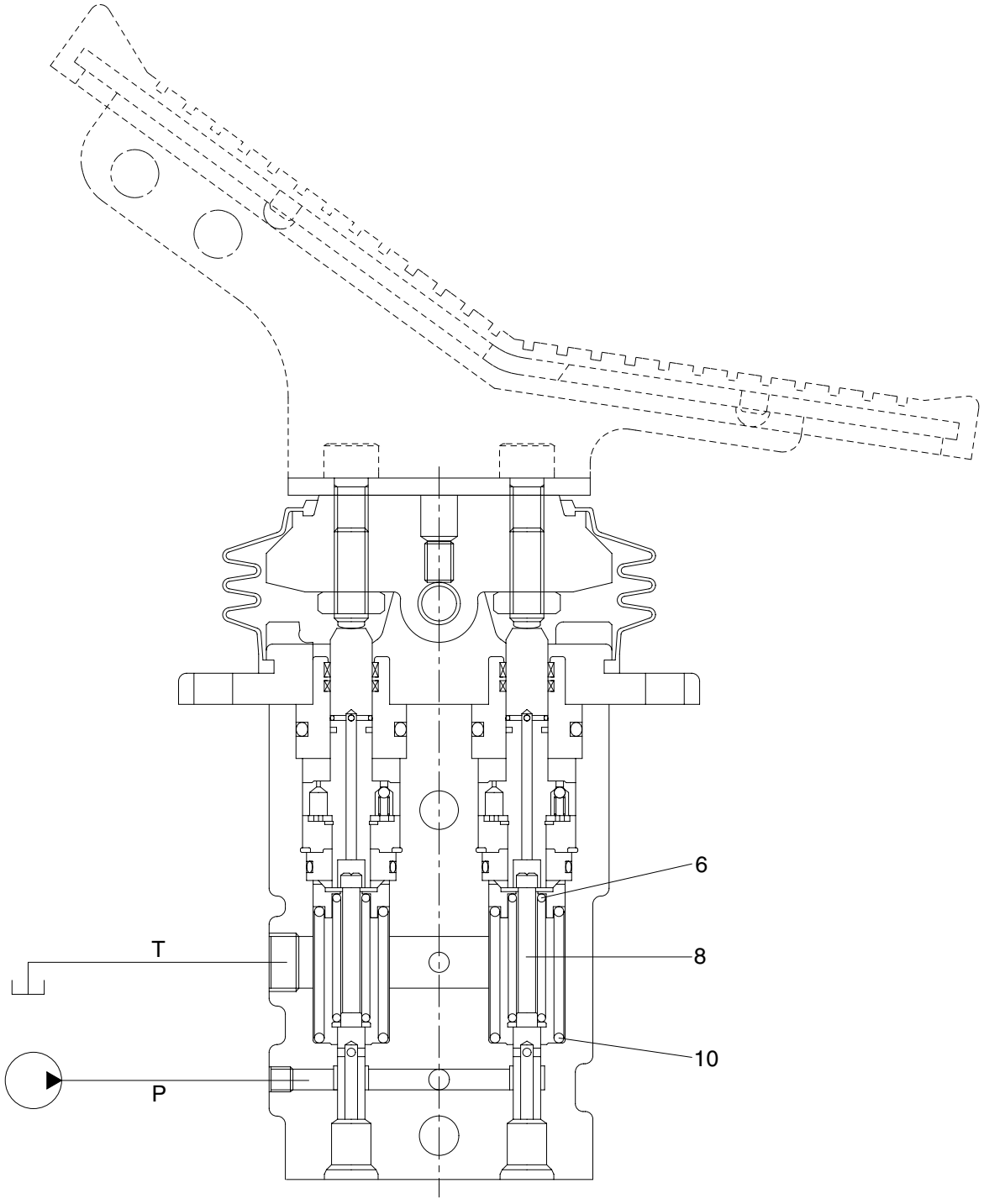
The diagram shown below is the typical application example of the pilot valve.



140LC-7 기타2-76

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

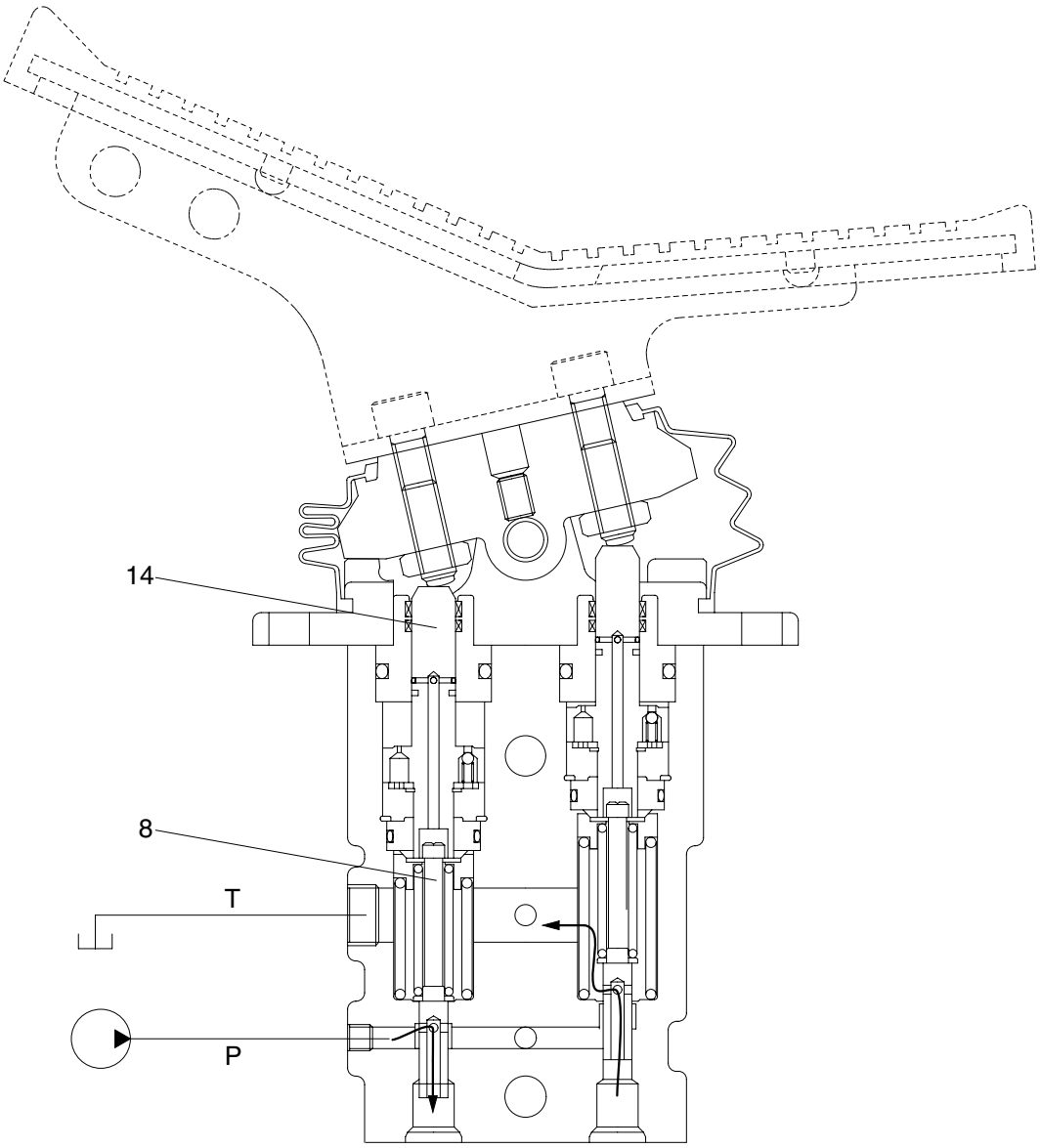
(1) Case where pedal is in neutral position



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 pedal is tilted

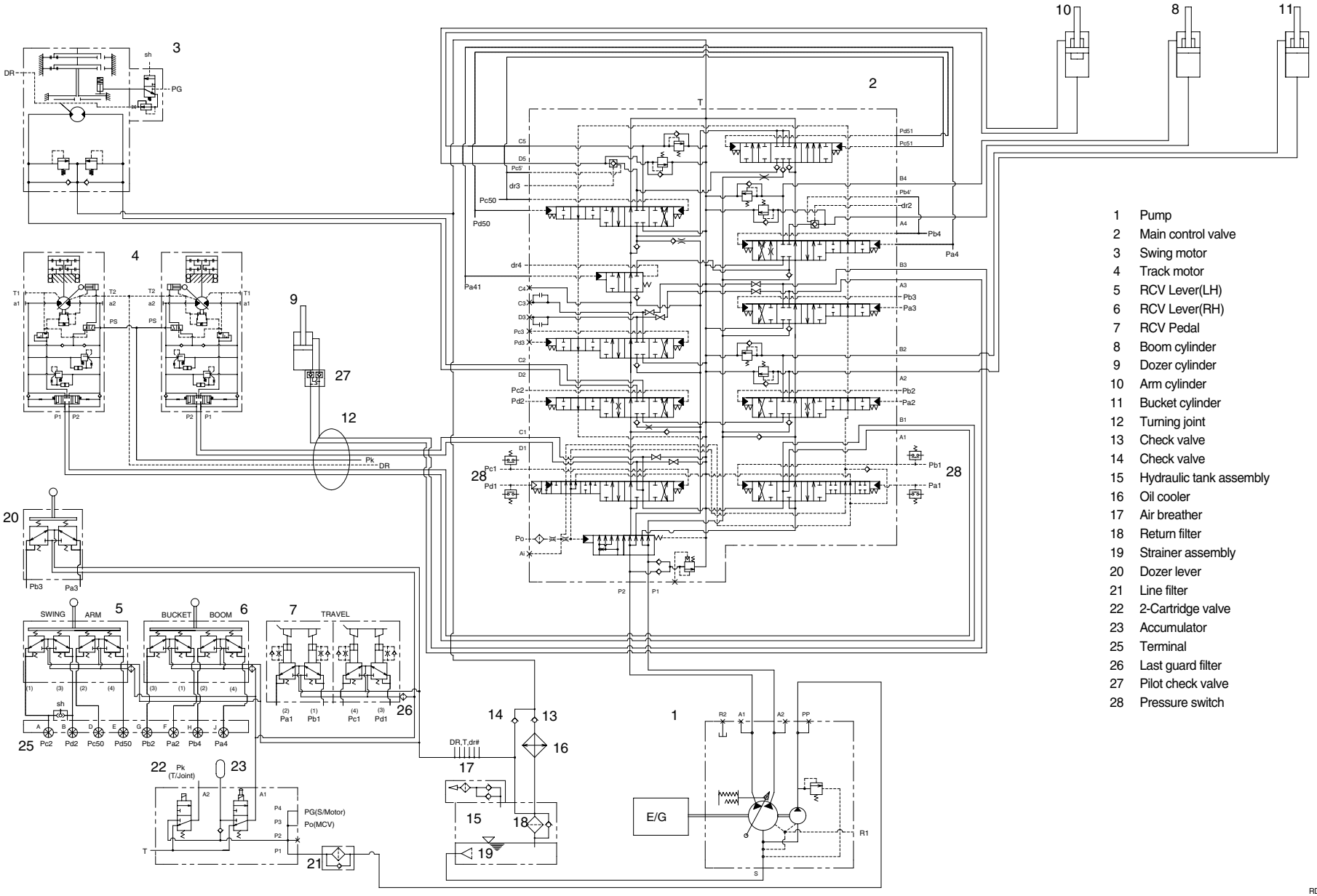


14072SF75

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

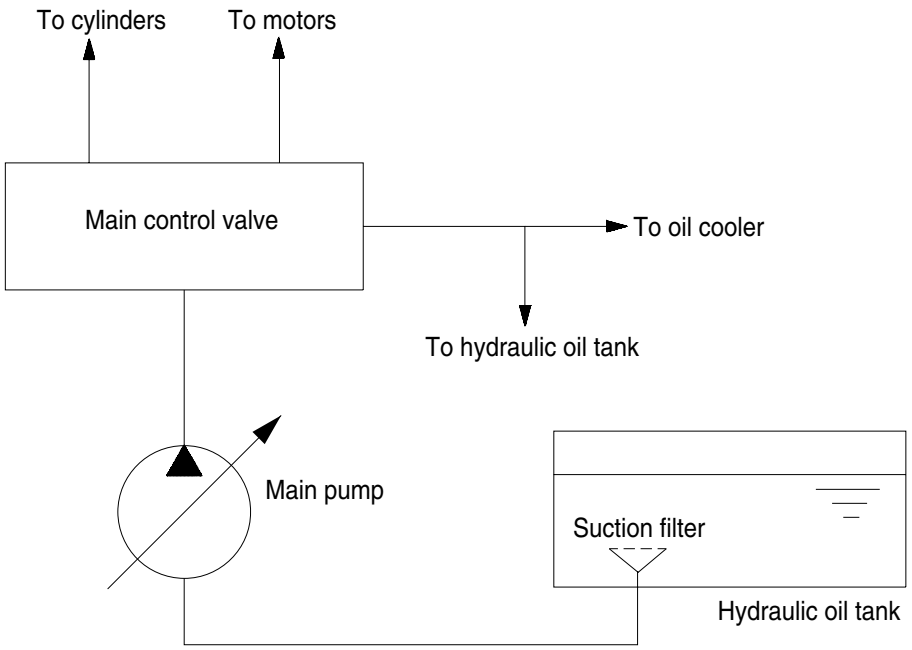
GROUP 1 HYDRAULIC CIRCUIT



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.

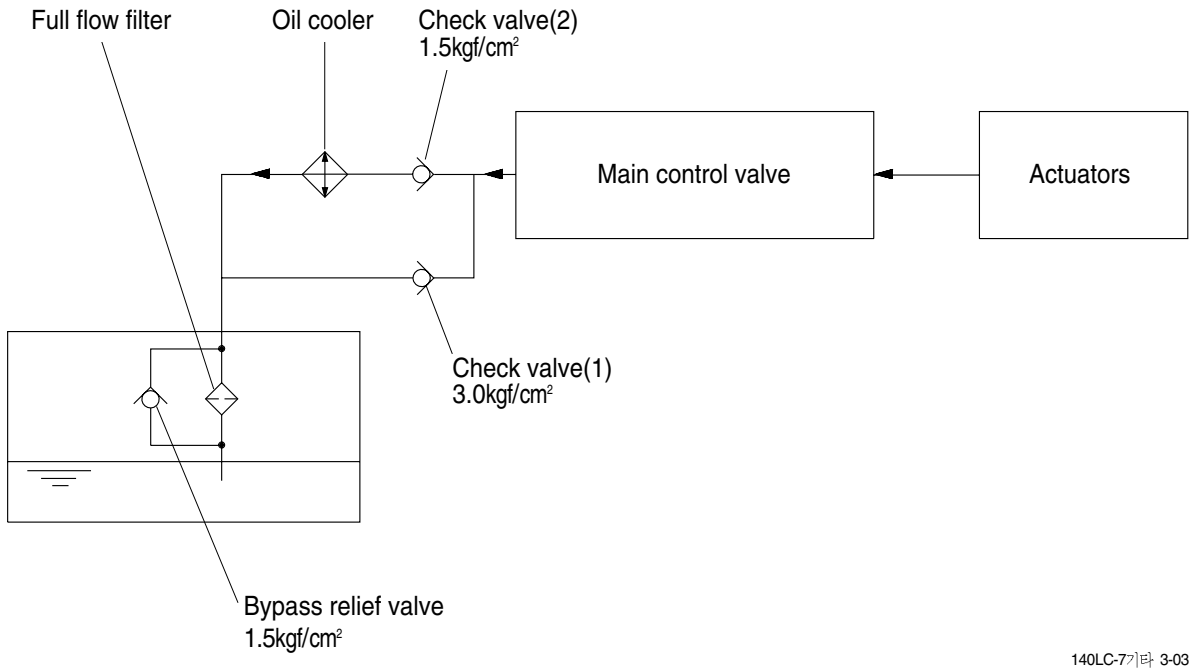
1. SUCTION AND DELIVERY CIRCUIT



140LC-7기타 3-02

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.

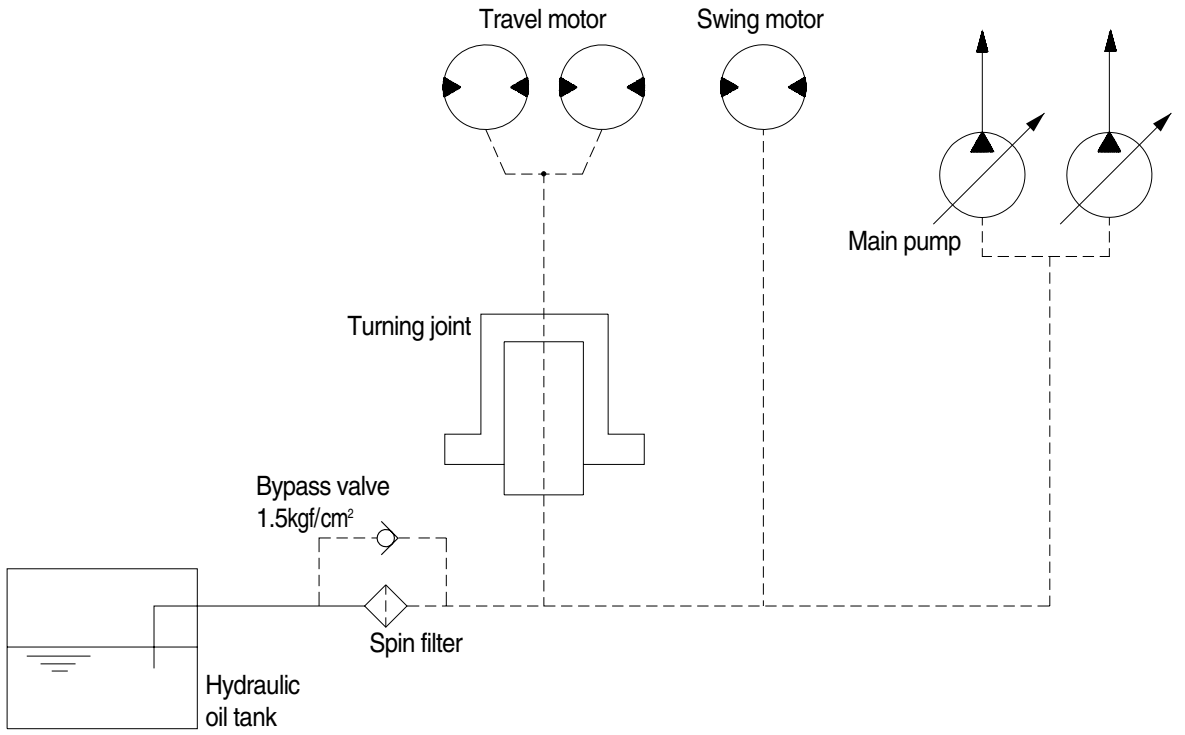
2. RETURN CIRCUIT



140LC-7기타 3-03

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 1.5kgf/cm²(21psi) and 3.0kgf/cm²(43psi). 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 3.0kgf/cm²(43psi), 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 1.5kgf/cm²(21psi) differential pressure.

3. DRAIN CIRCUIT



140LC-7기타 3-04

Besides internal leaks from the motors and main pump, the oil for lubrication circulates. These oil have to be fed to the hydraulic tank passing through spin filter.
When the drain oil pressure exceed 1.5kgf/cm²(21psi), the oil returns to the hydraulic tank directly.

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 spin filter.

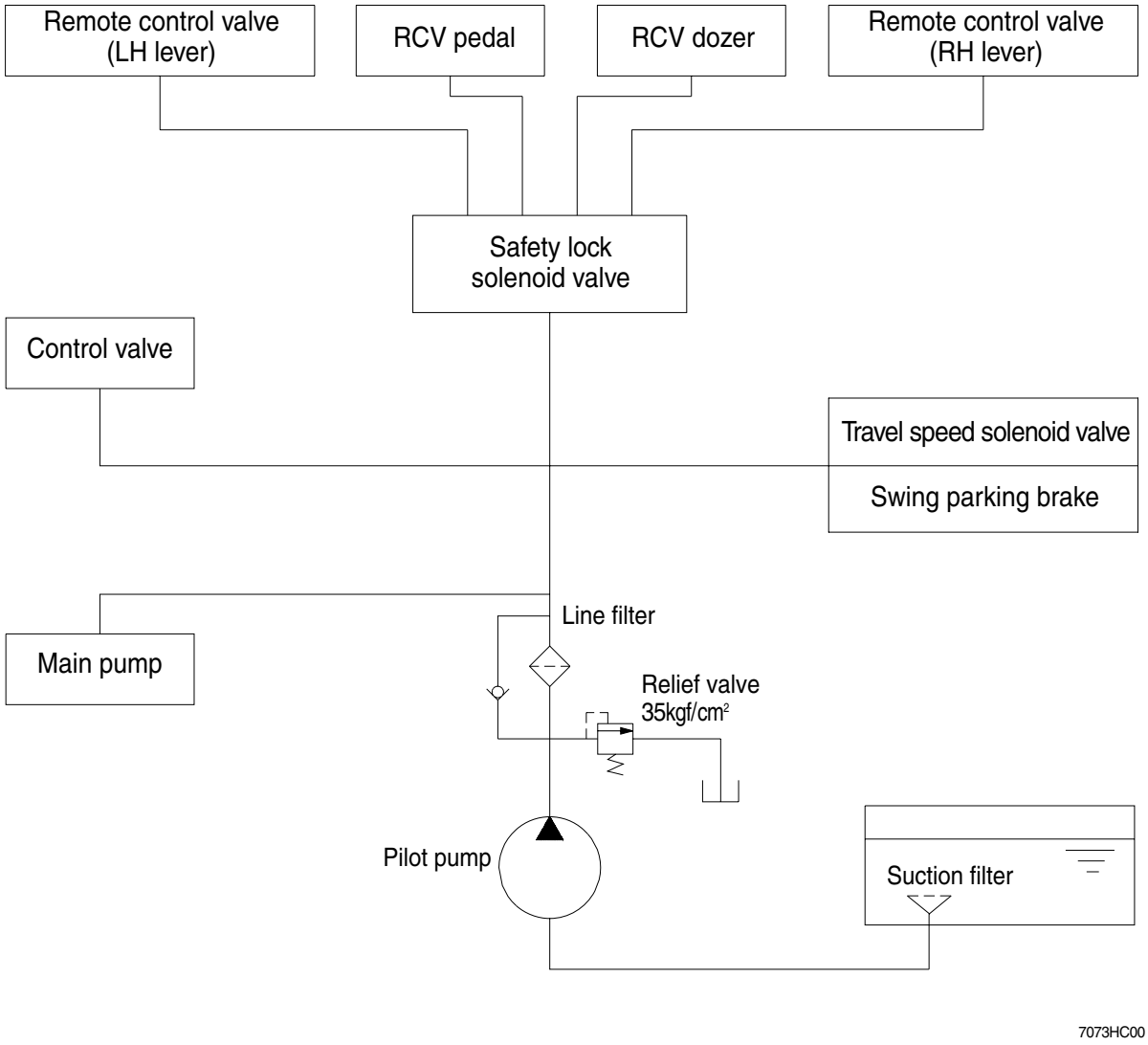
2) SWING MOTOR DRAIN CIRCUIT

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

3) MAIN PUMP DRAIN CIRCUIT

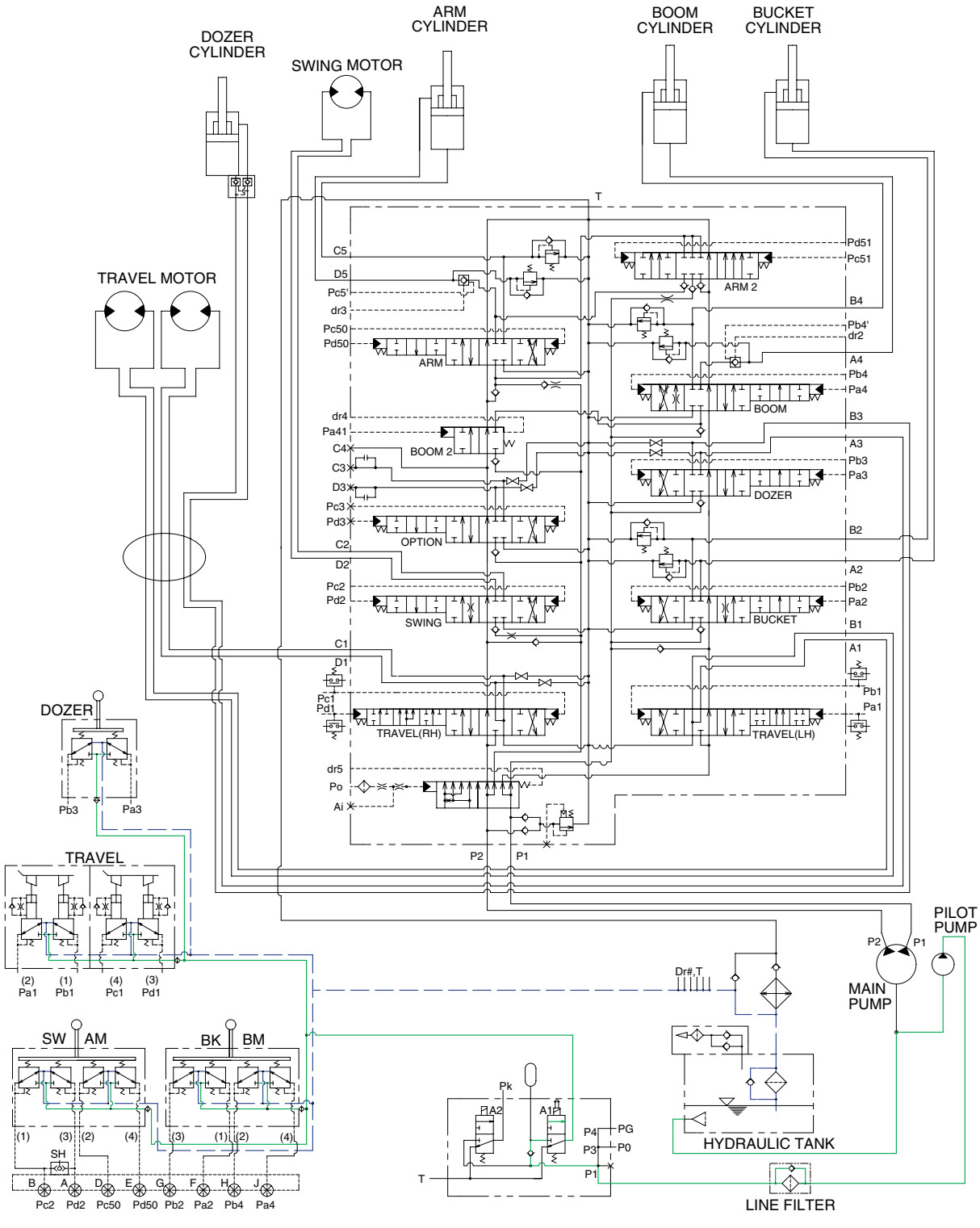
Oil leaked from main pump returns to the hydraulic tank passing through spin filter.

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, travel speed solenoid valve, swing parking brake, main control valve and safety lock solenoid valve.

1. SUCTION, DELIVERY AND RETURN CIRCUIT



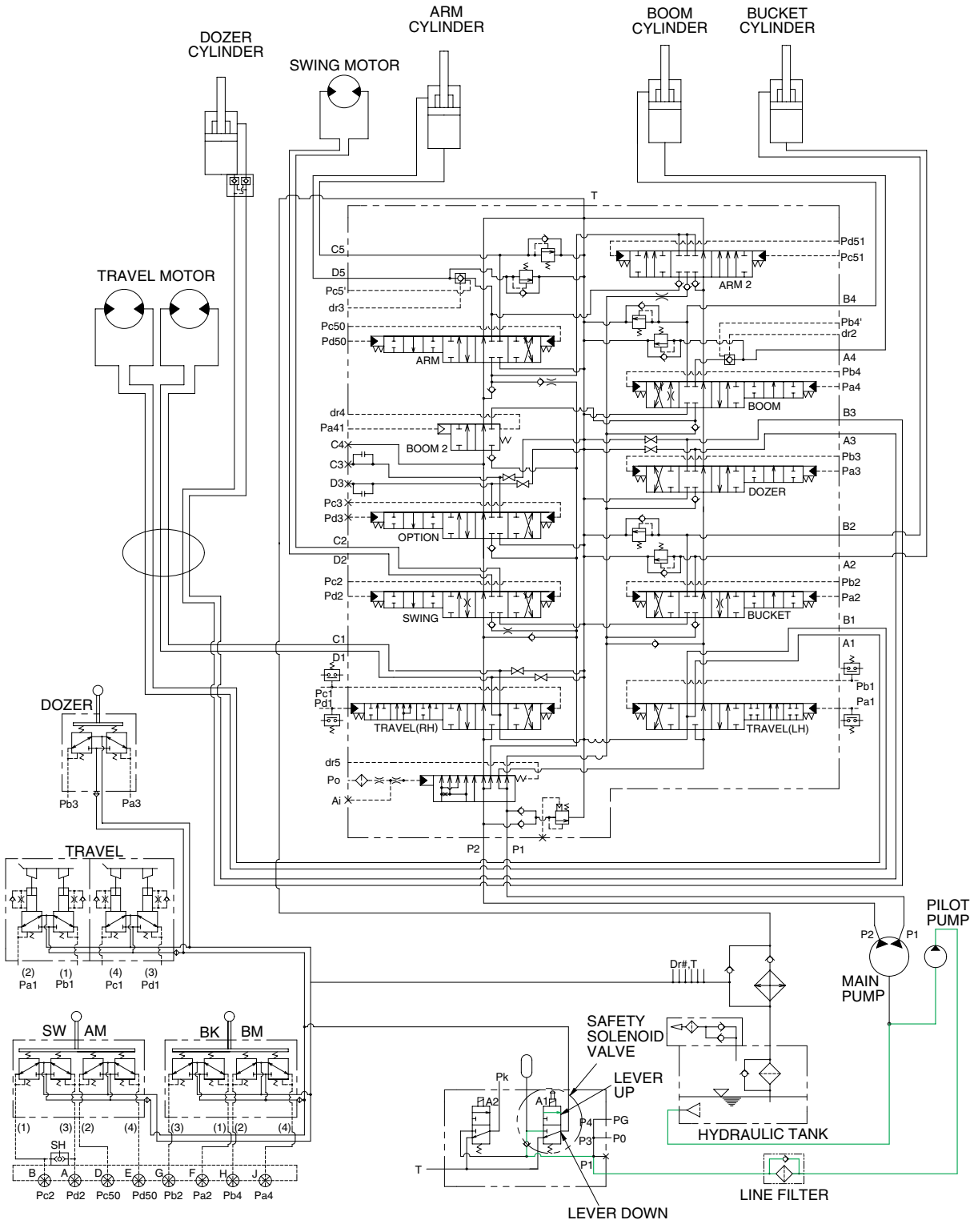
RD8073HC02

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)

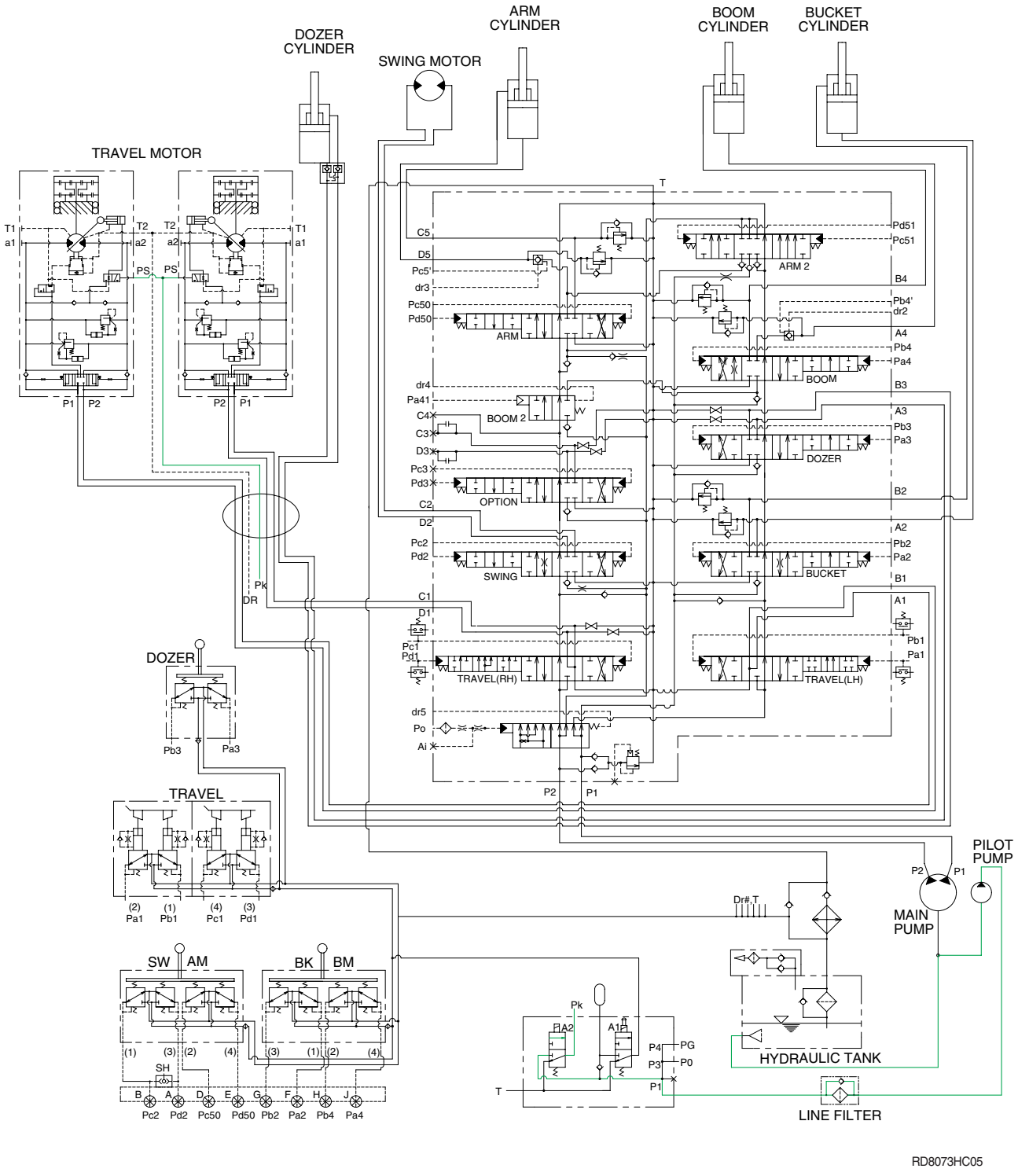


RD8073HC03

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

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

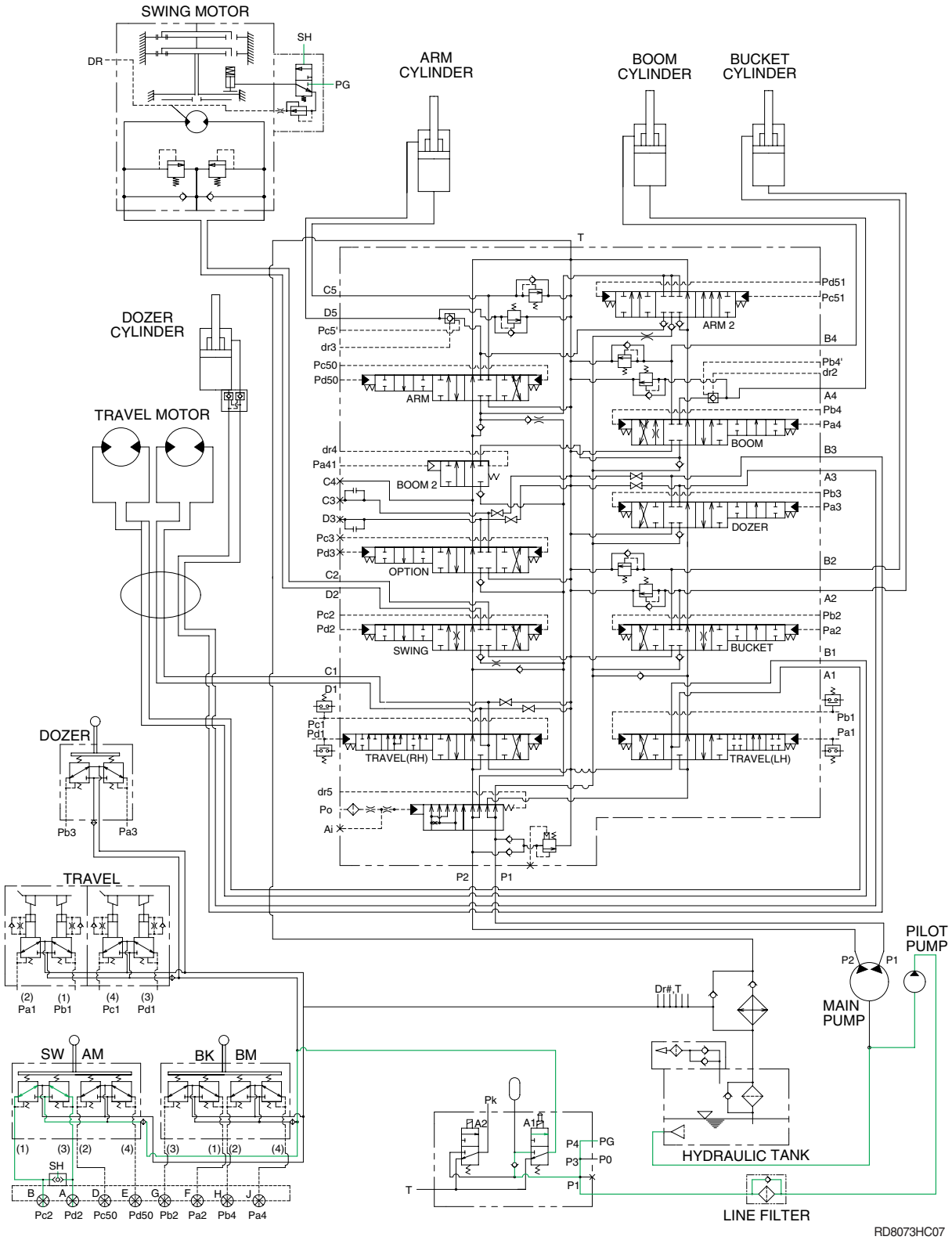
3. TRAVEL SPEED CONTROL SYSTEM



RD8073HC05

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 Pk 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 Pk port retums 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



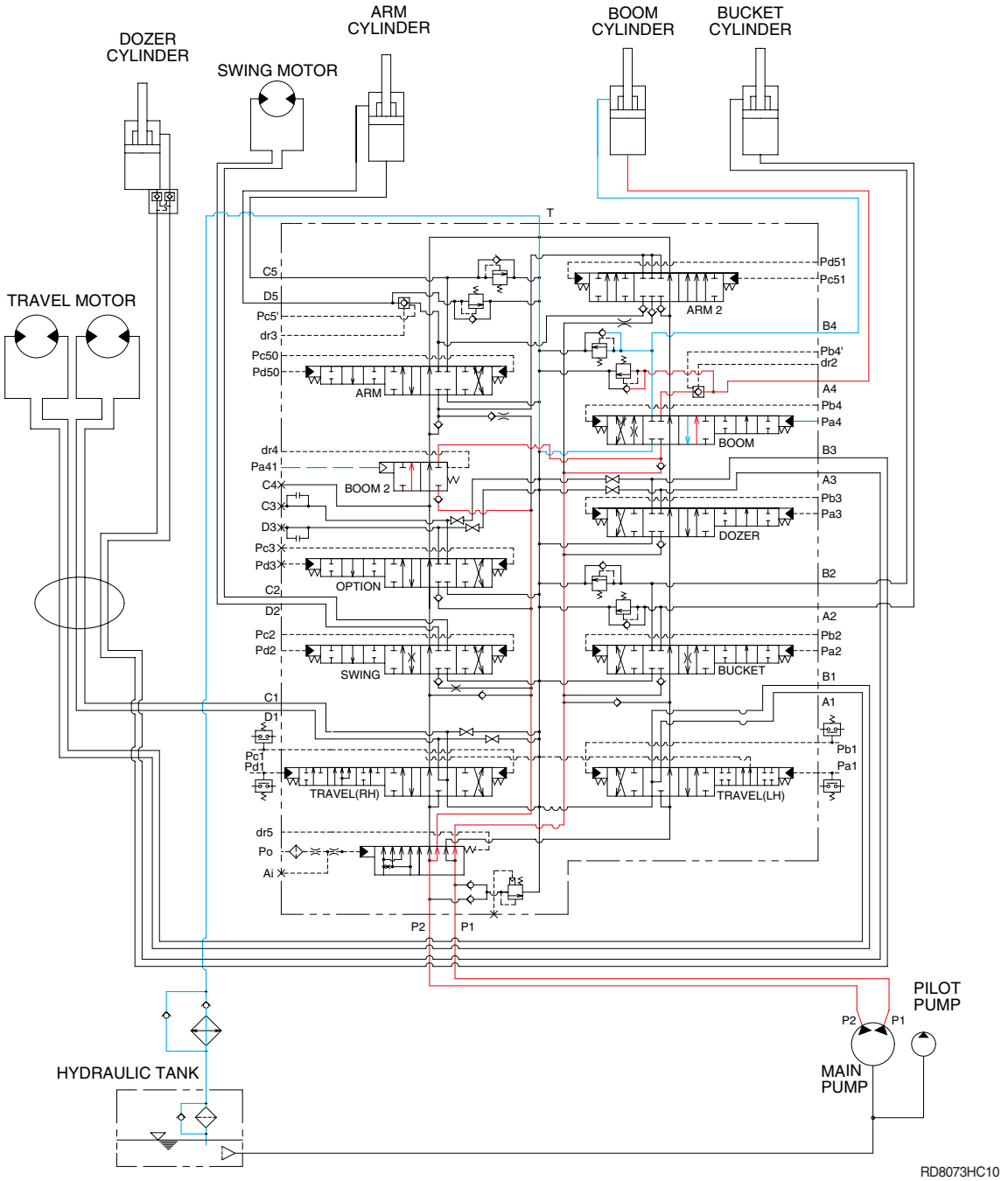
When the swing control lever is tilted, the pilot oil flow into SH port of shuttle valve, this pressure move spool so, discharged oil from pilot valve flow into PG port.

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



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 P1 and P2 pump flows into the main control valve and then goes to the large chamber of boom cylinders.

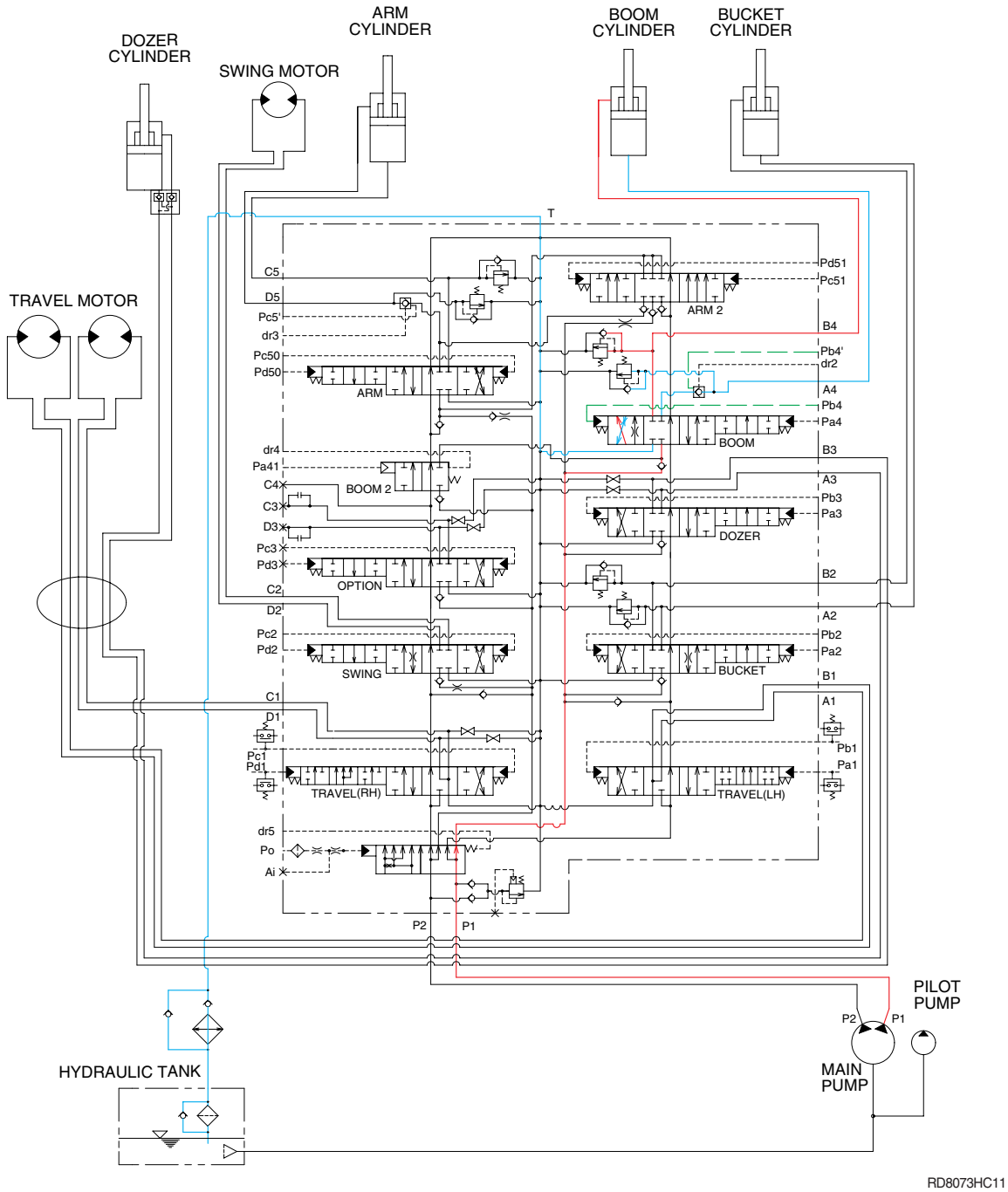
At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up.

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



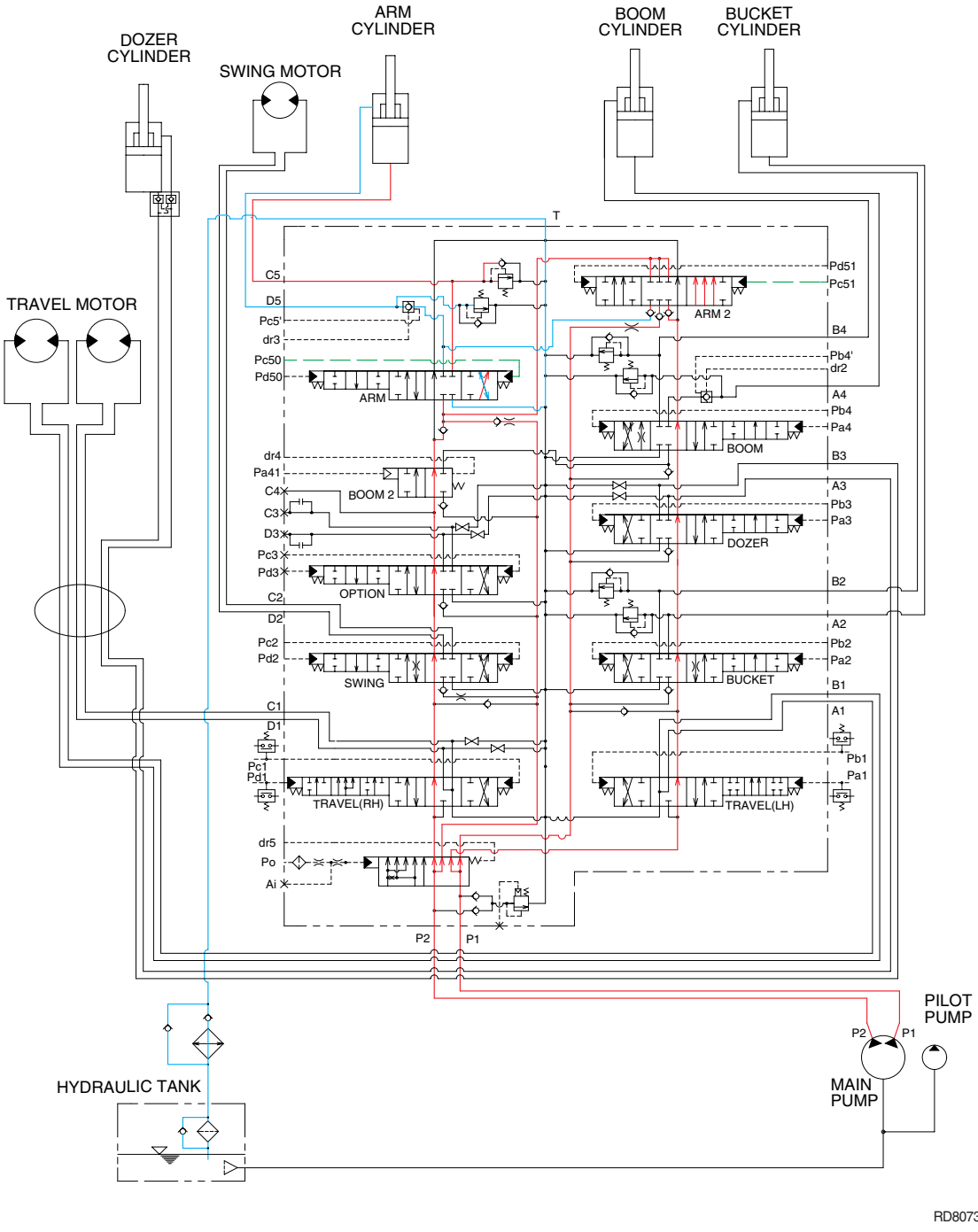
When the right control lever is pushed forward, the boom spools in the main control valve are moved to the down position by the pilot oil pressure from the remote control valve.

The oil from the P1 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.

When the down speed of boom is faster, the oil returned from the large chamber of boom cylinder combines with the oil from the front pump, and flows into the small chamber of the cylinder.

This prevents cylinder cavitation by the negative pressure when the front pump flow can not match the boom down speed. And the excessive pressure in the boom cylinder rod end circuit is prevented by the relief valve.

3. ARM ROLL IN OPERATION



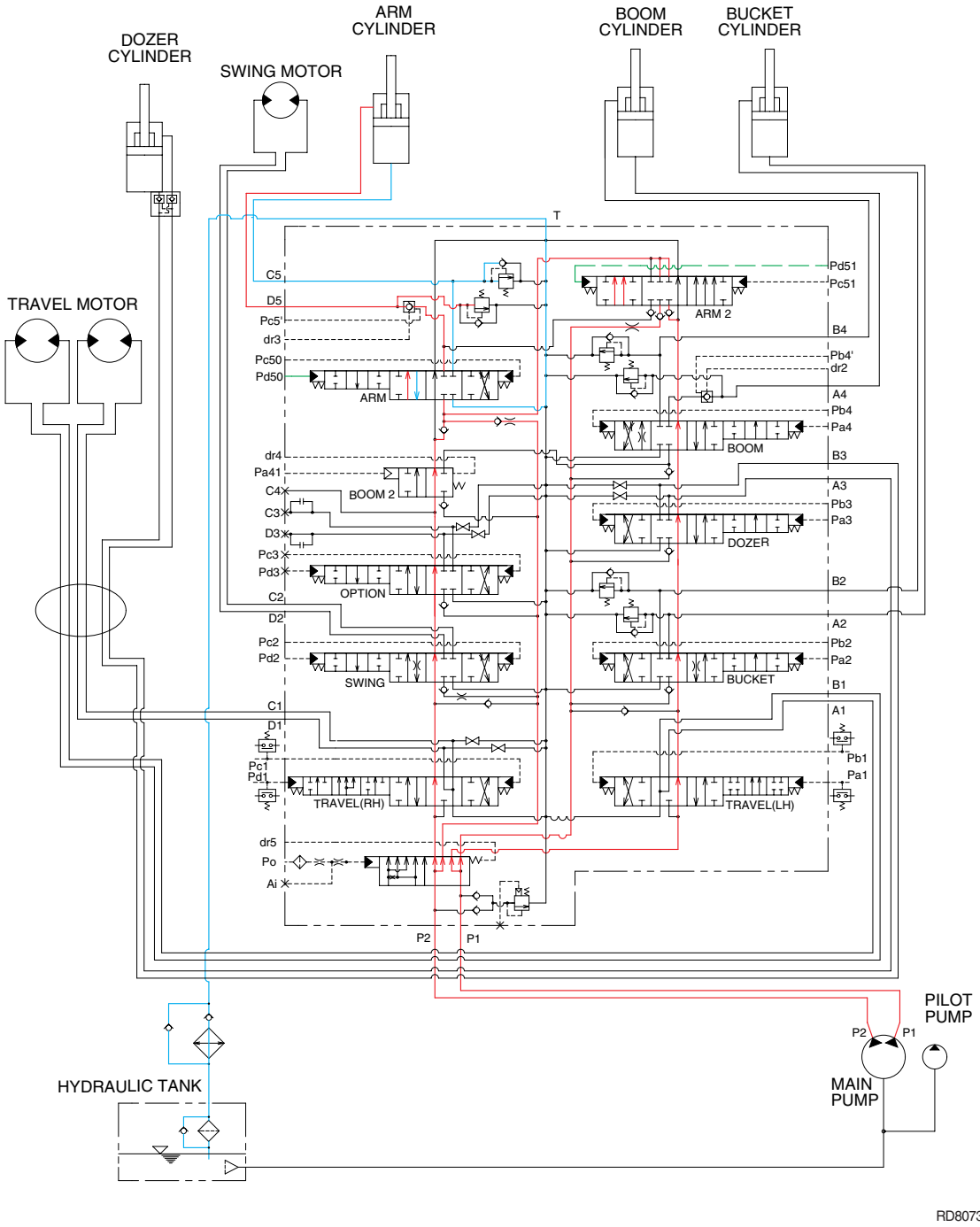
When the left control lever is pulled back, the arm spools in the main control valve are moved the to roll in position by the pilot oil pressure from the remote control valve.

The oil from the P1 and P2 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



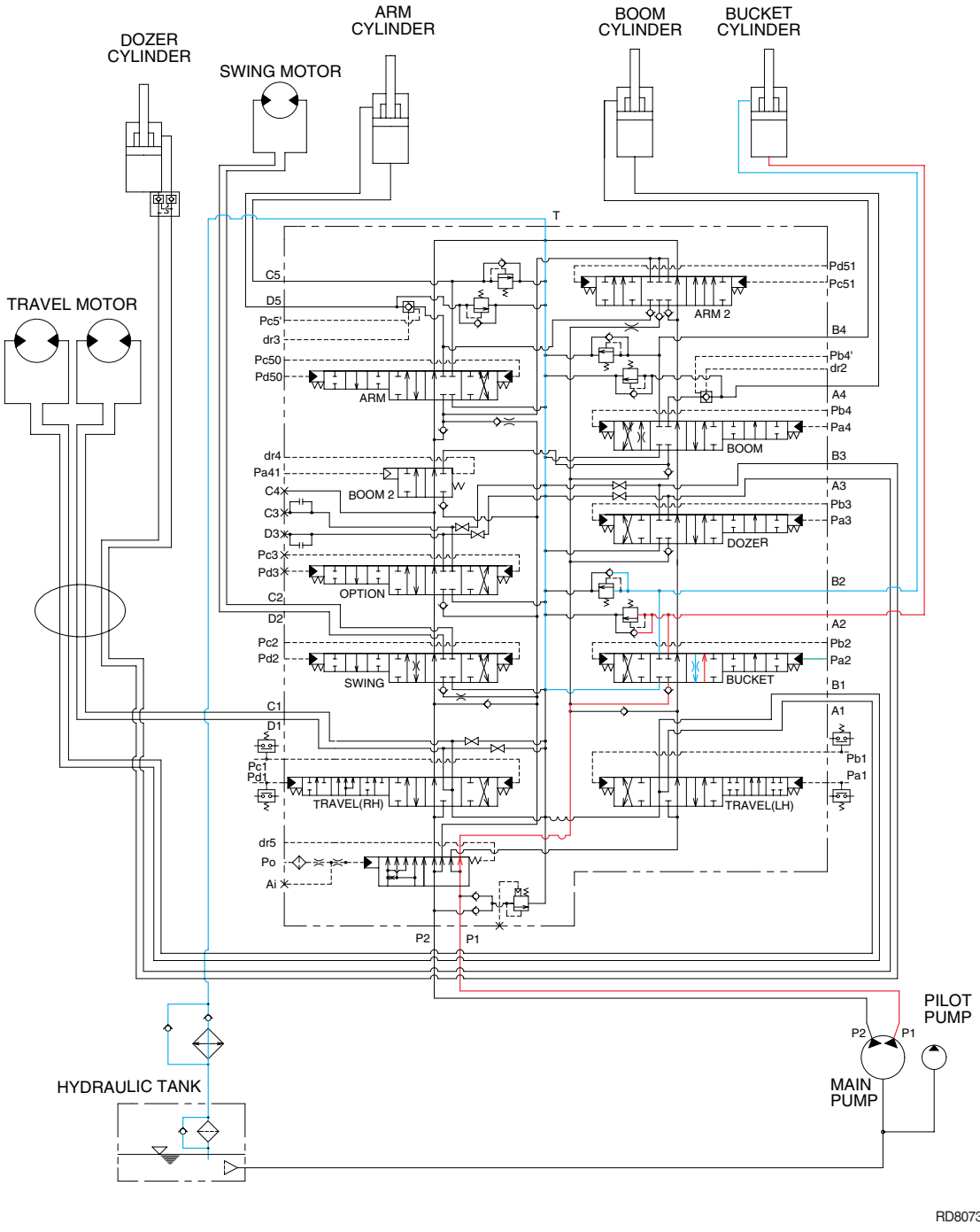
When the left control lever is pushed forward, the arm spool in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the P1 and P2 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



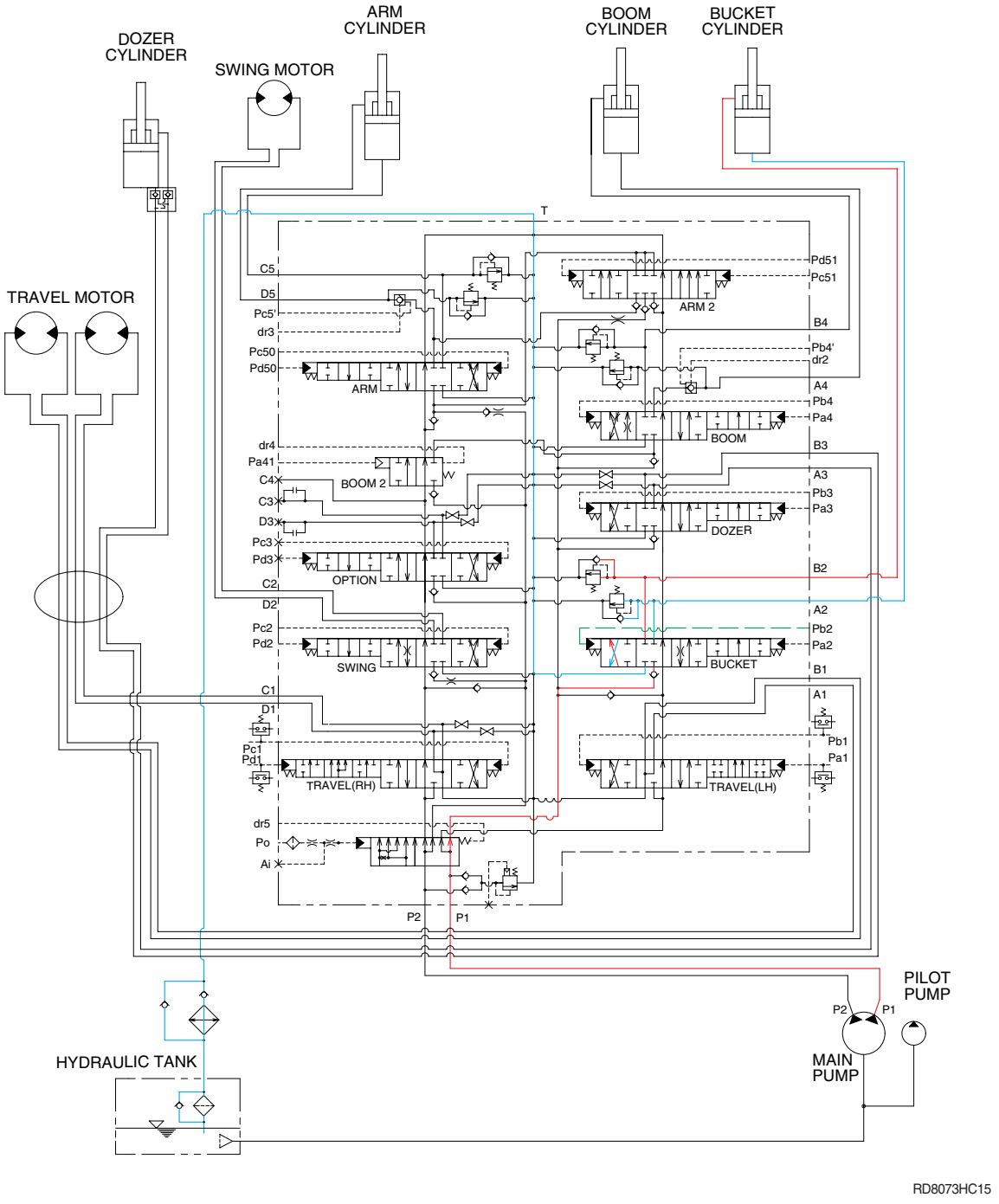
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

The oil from the P1 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 boom 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



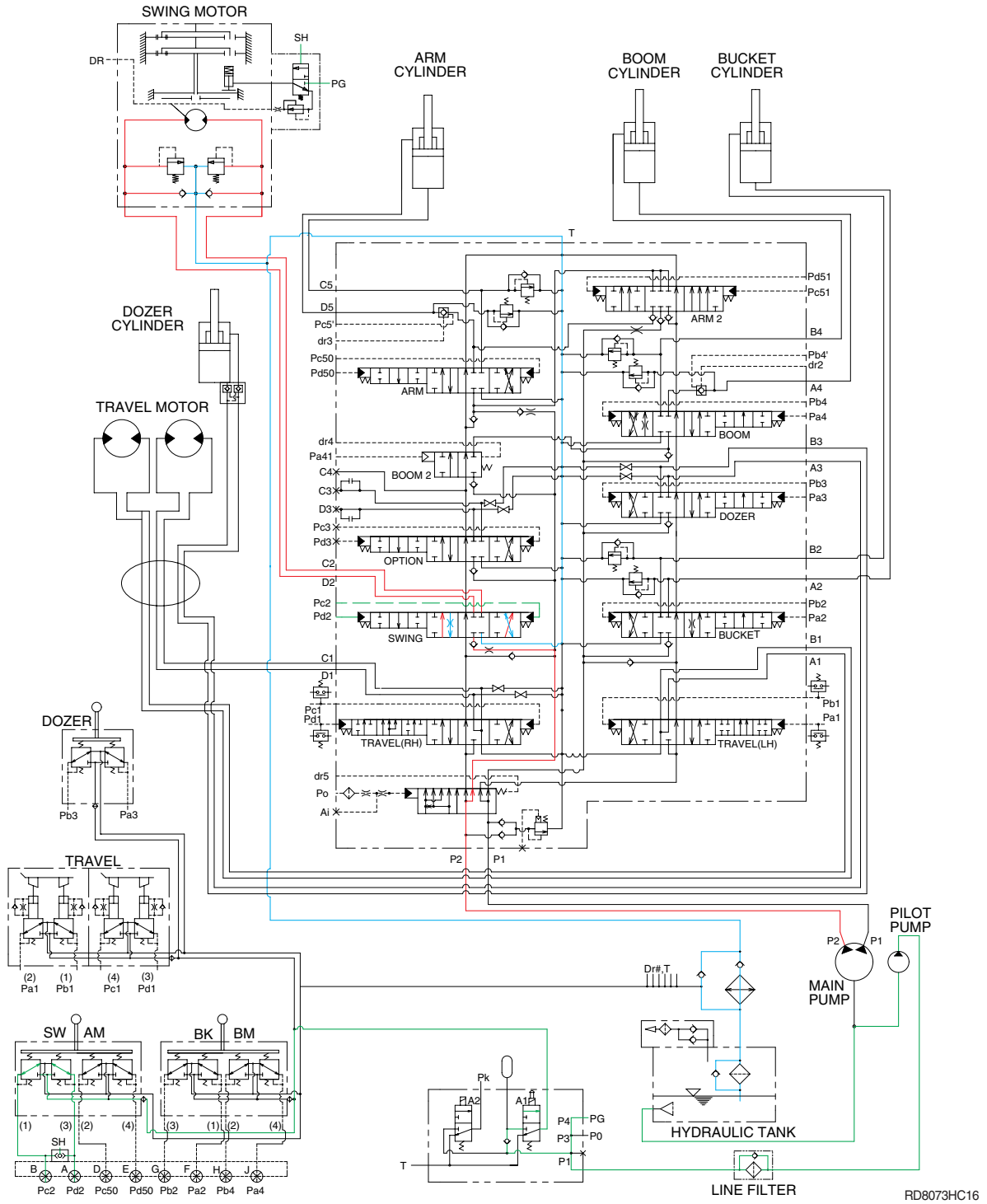
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the P1 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 retums 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



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.

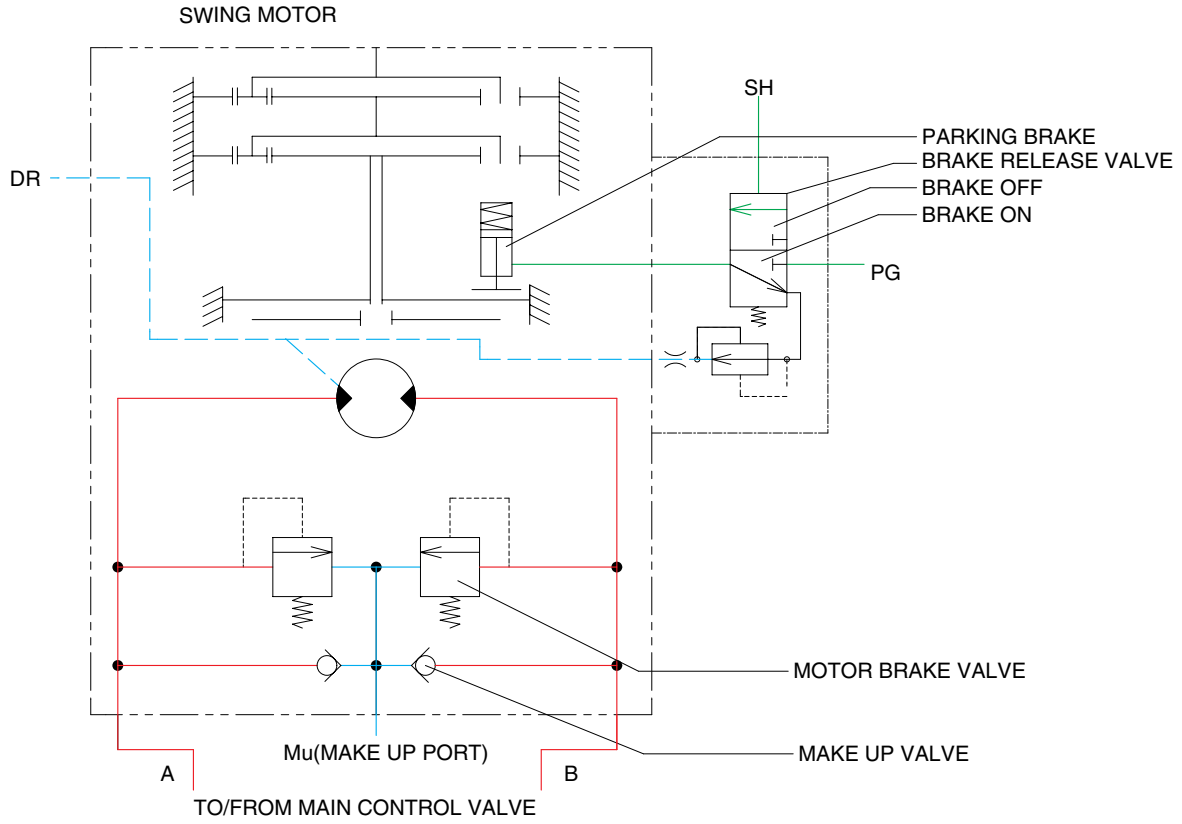
The oil from the P2 pump flows into the main control valve and then goes to the swing motor.

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



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.

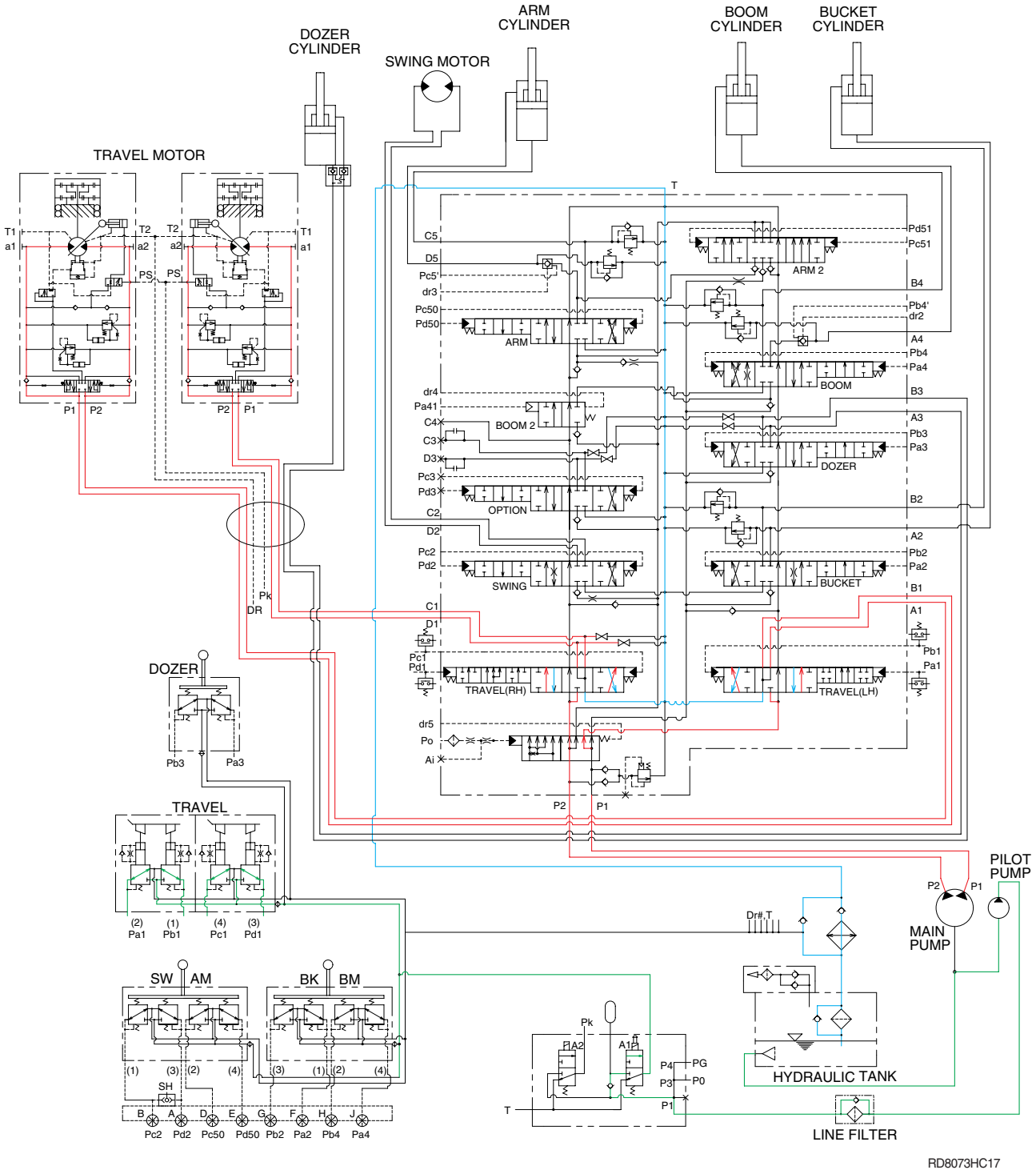
PARKING BRAKE "ON" OPERATION

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".

BYPASS VALVE

This bypass valve absorbs shocks produced as swing motion stops and reduced oscillation cause

8. TRAVEL FORWARD AND REVERSE OPERATION



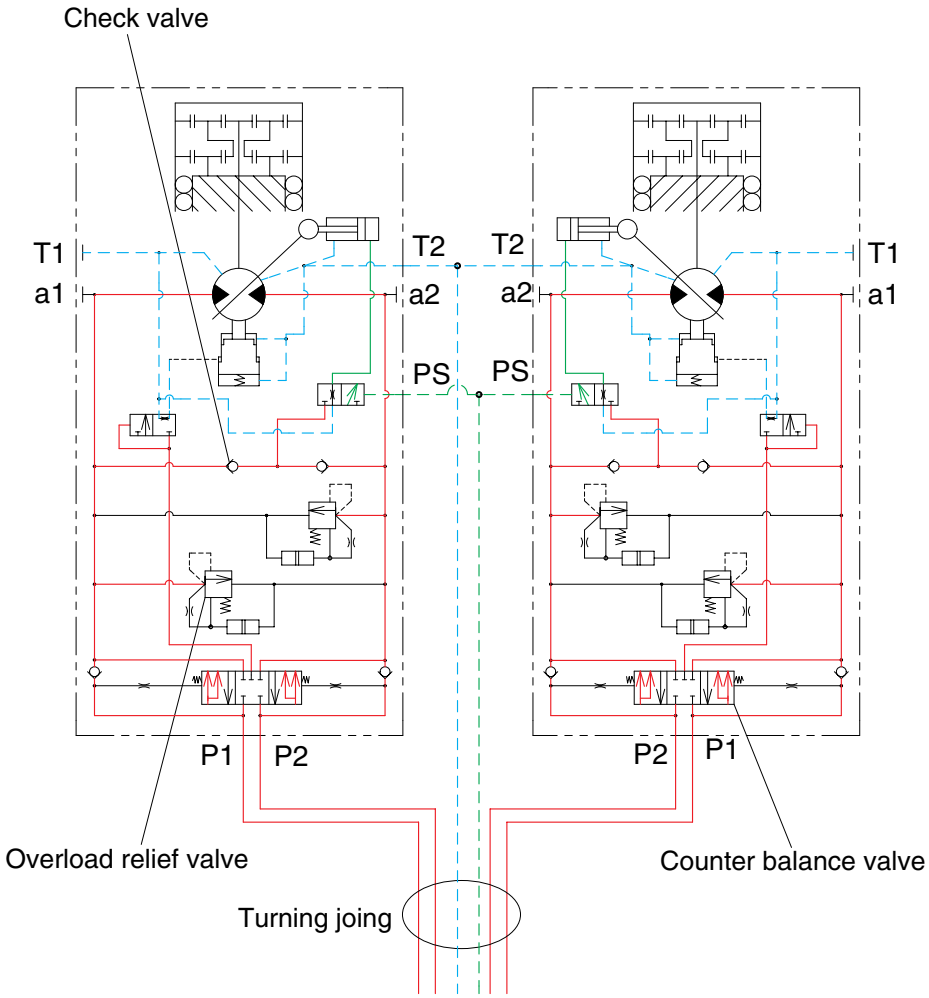
When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by the pilot oil pressure from the remote control valve.

The oil from the both pumps 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



7073HC31

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

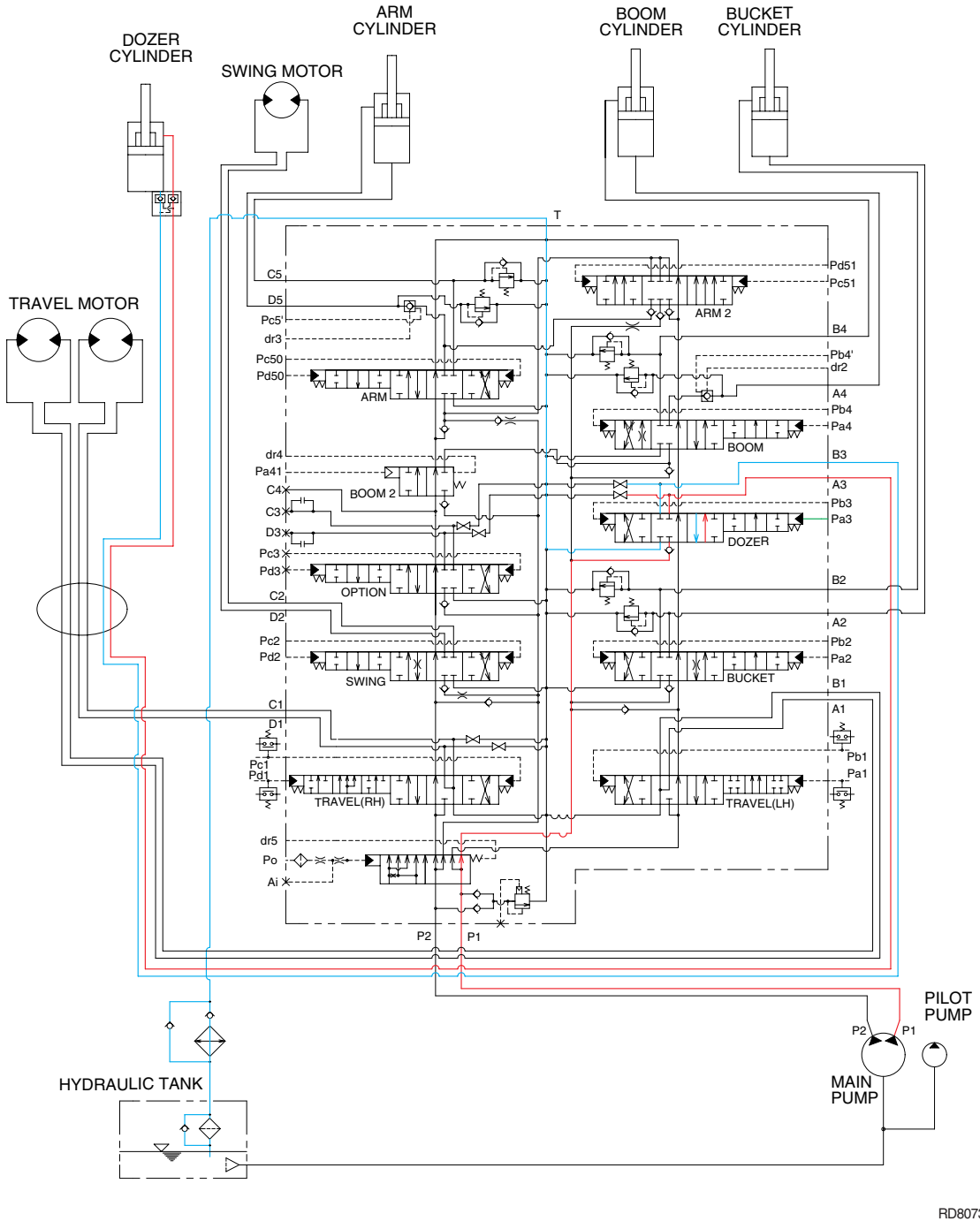
1) COUNTER BALANCE VALVE

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 365kgf/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

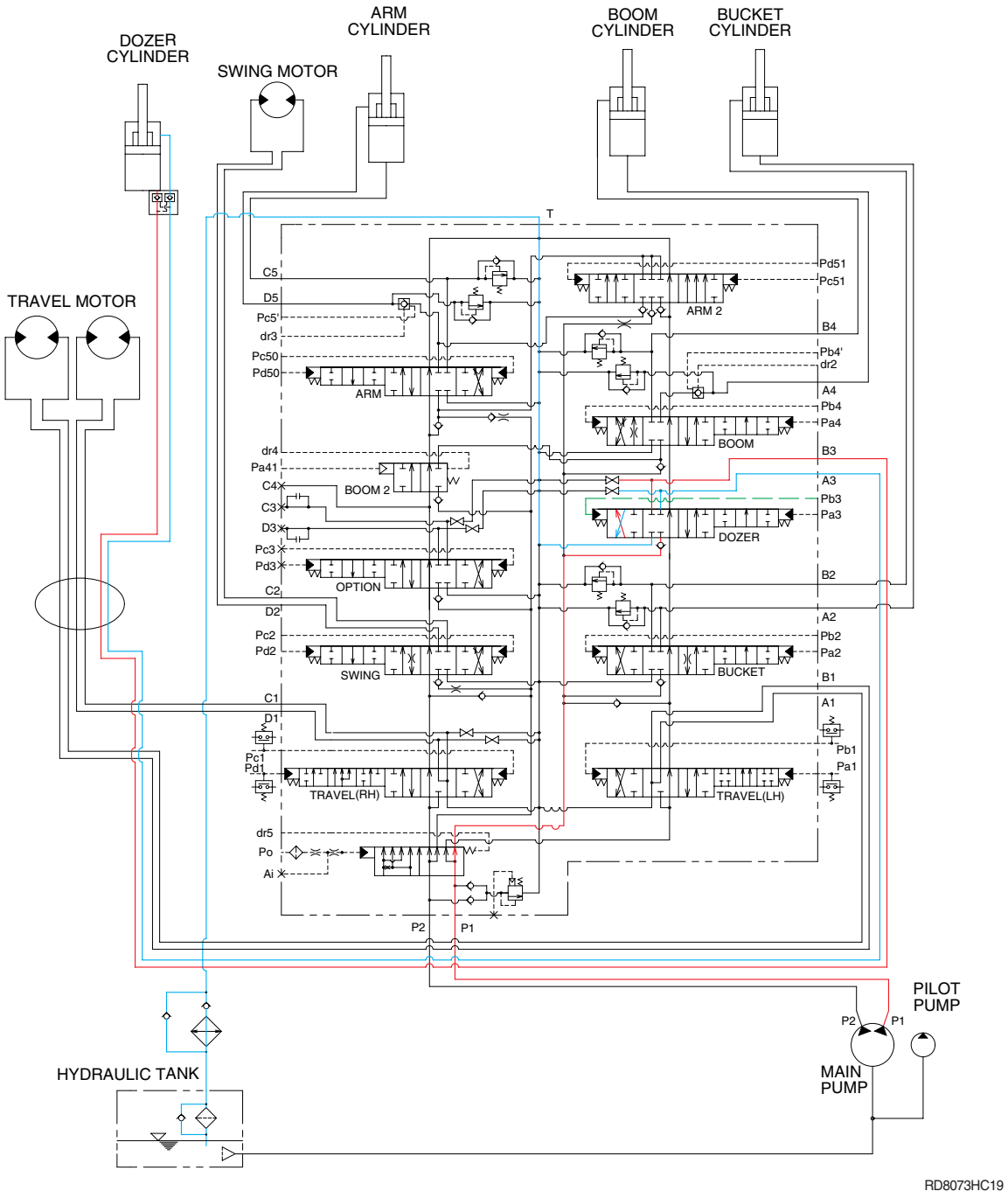


When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.

The oil from the P2 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



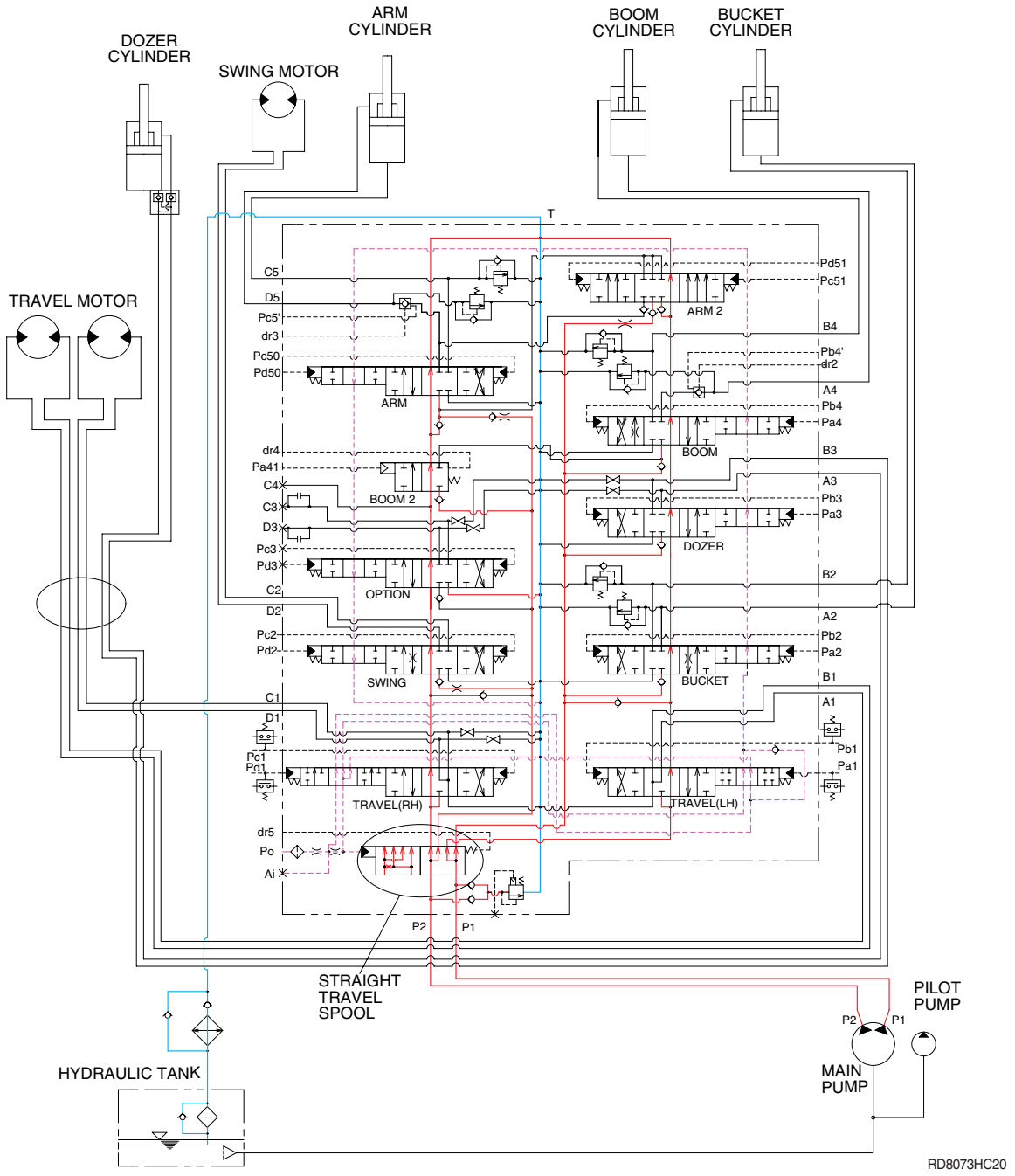
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

The oil from the P2 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



The oil from the P1 and P2 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.

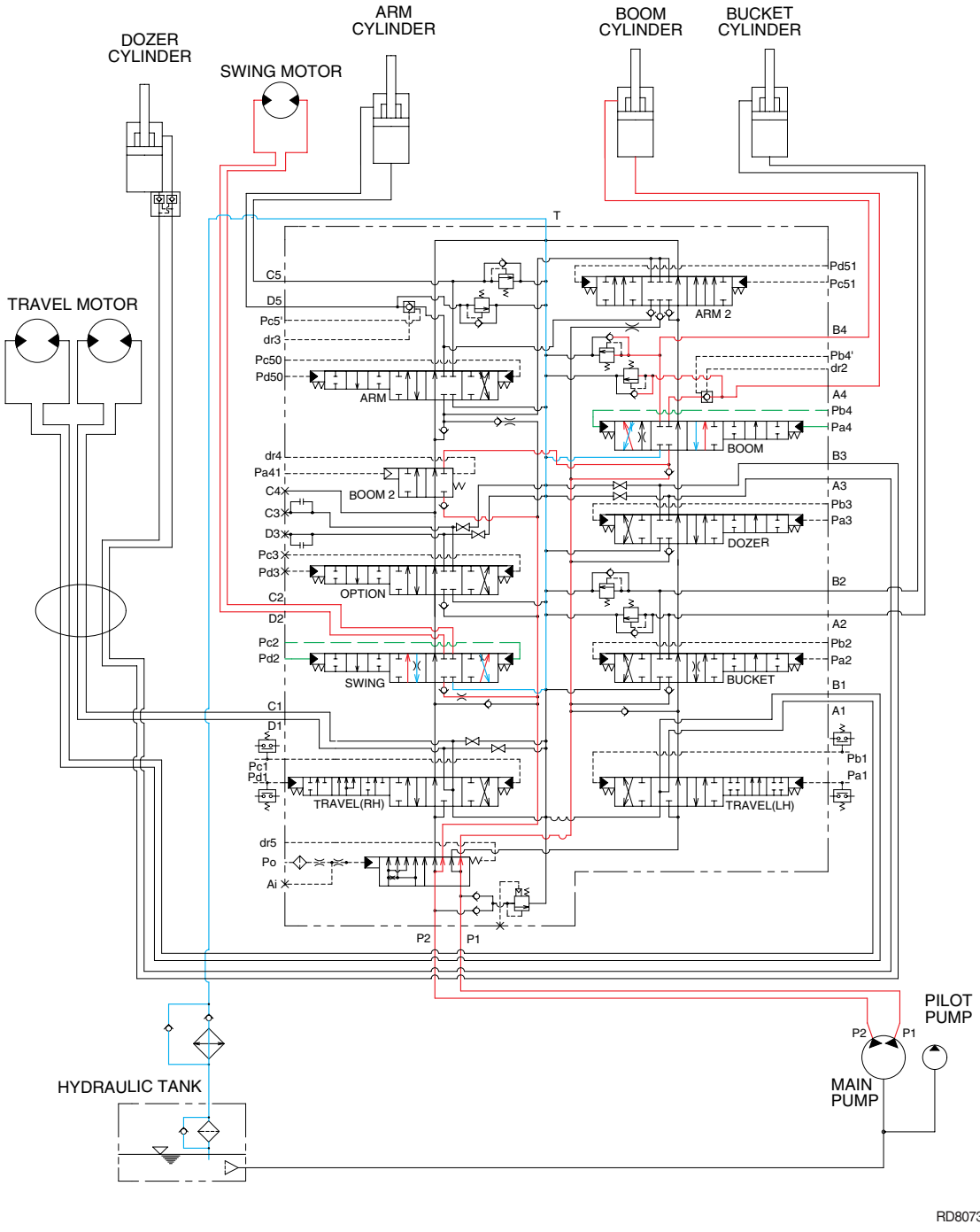
STRAIGHT TRAVEL SPOOL

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 right 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



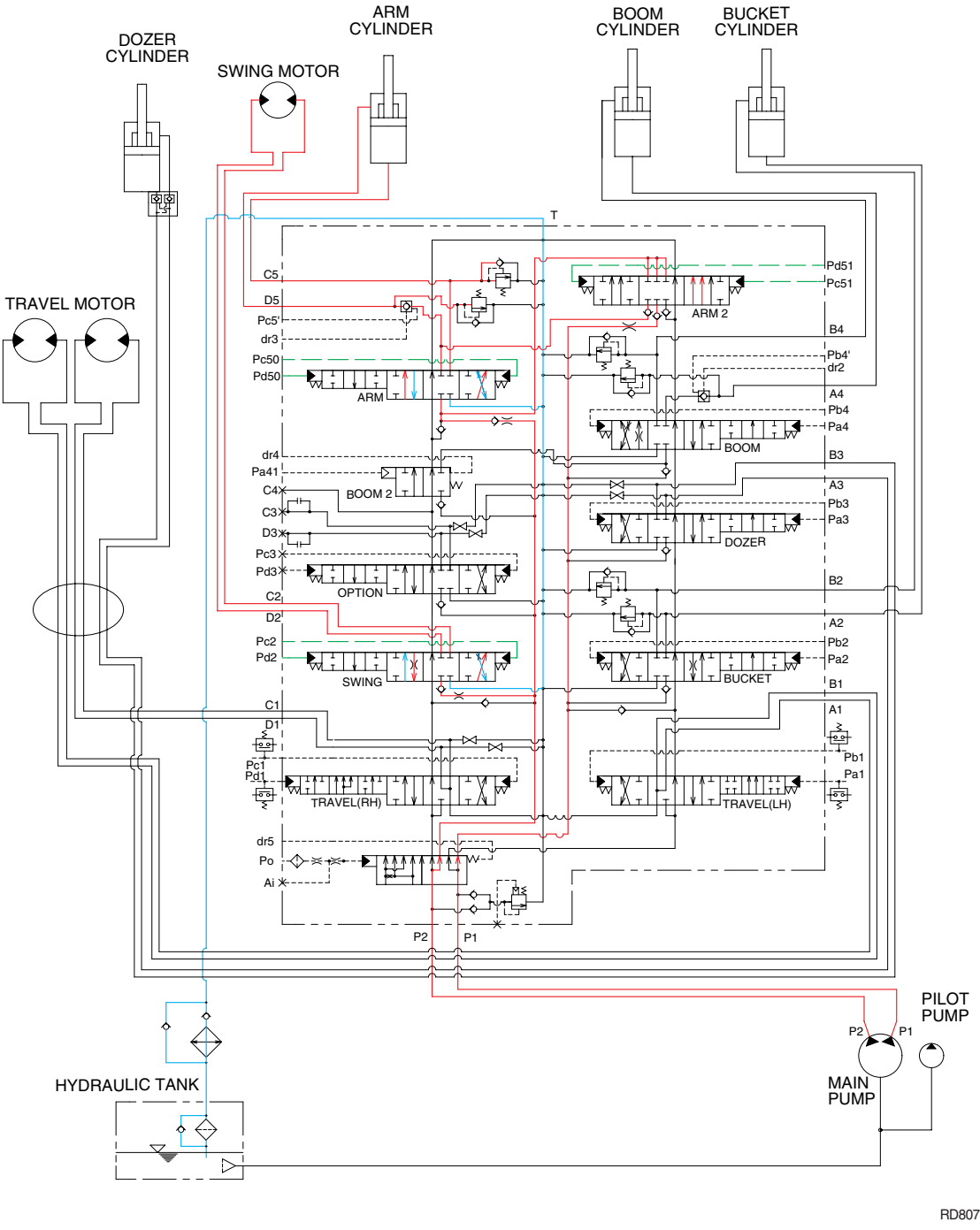
When the swing and boom functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the P2 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

The oil from the P1 pump flows into the boom cylinders through the boom 1 spool.

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



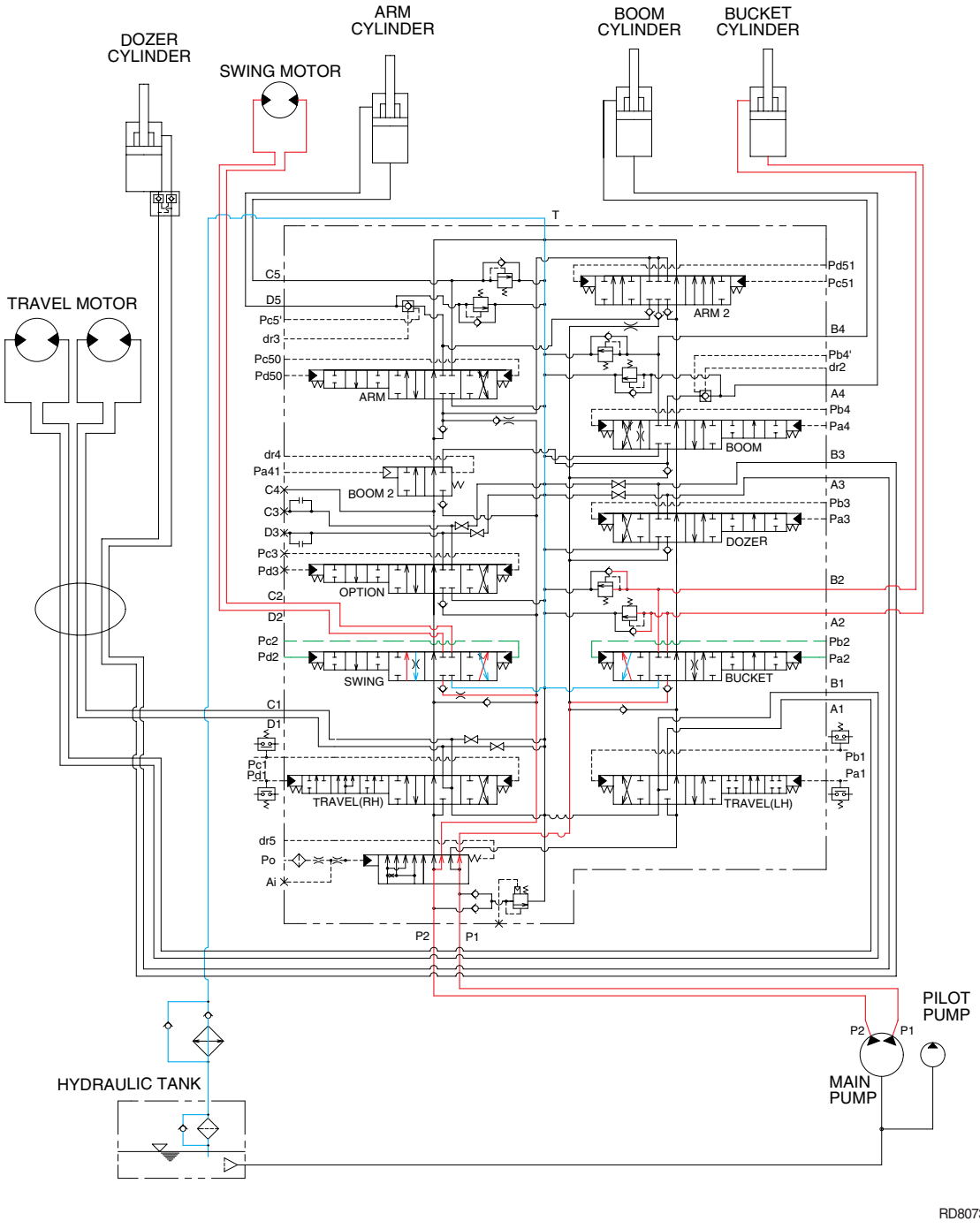
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the P2 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

The oil from the P1 pump flows into the arm cylinder through the arm 2 spool.

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION

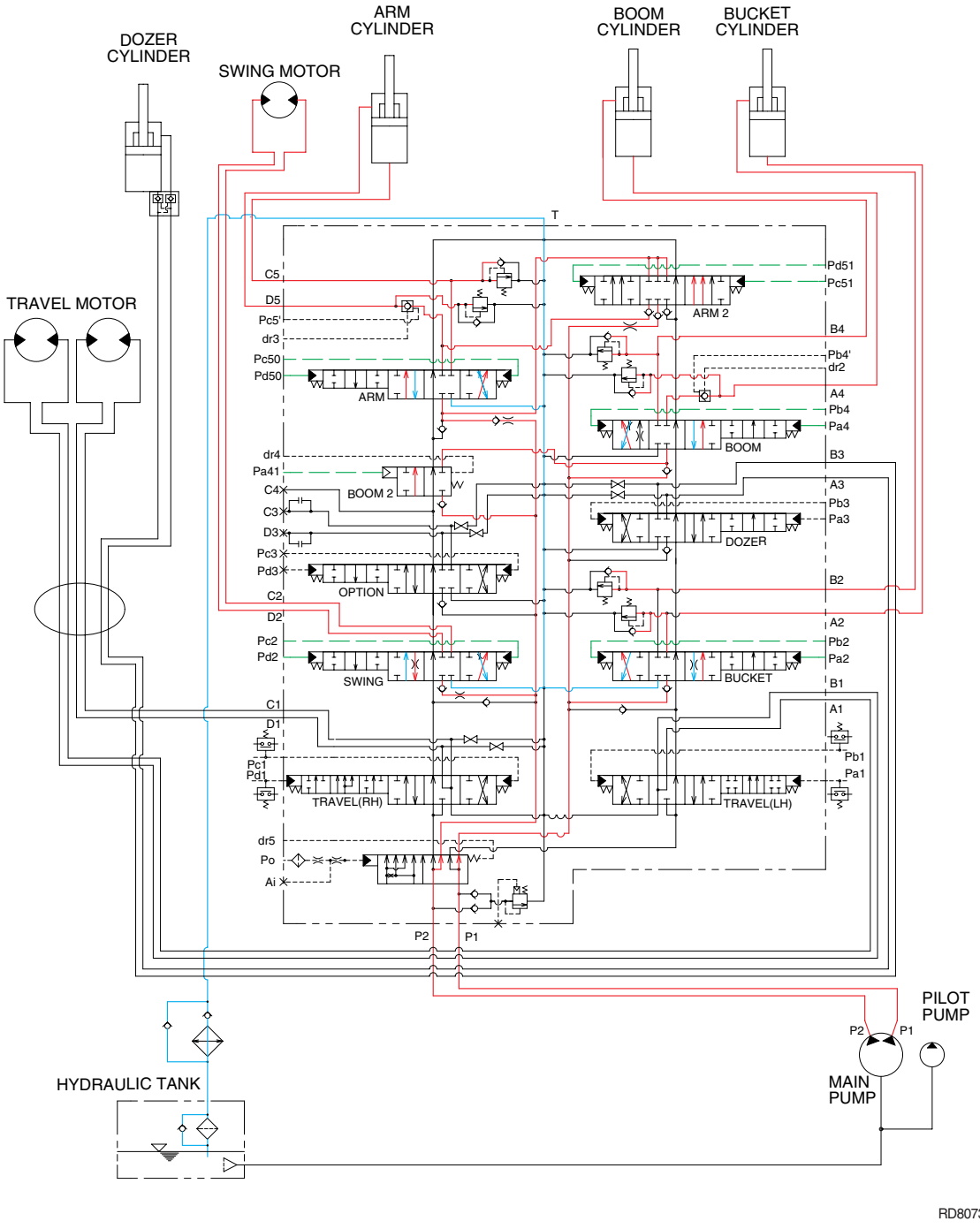


When the swing and bucket functions are operated, simultaneously the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the P2 pump flows into the swing motor through the swing spool.

The oil from the P1 pump flows into the bucket cylinder through the bucket spool.

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION



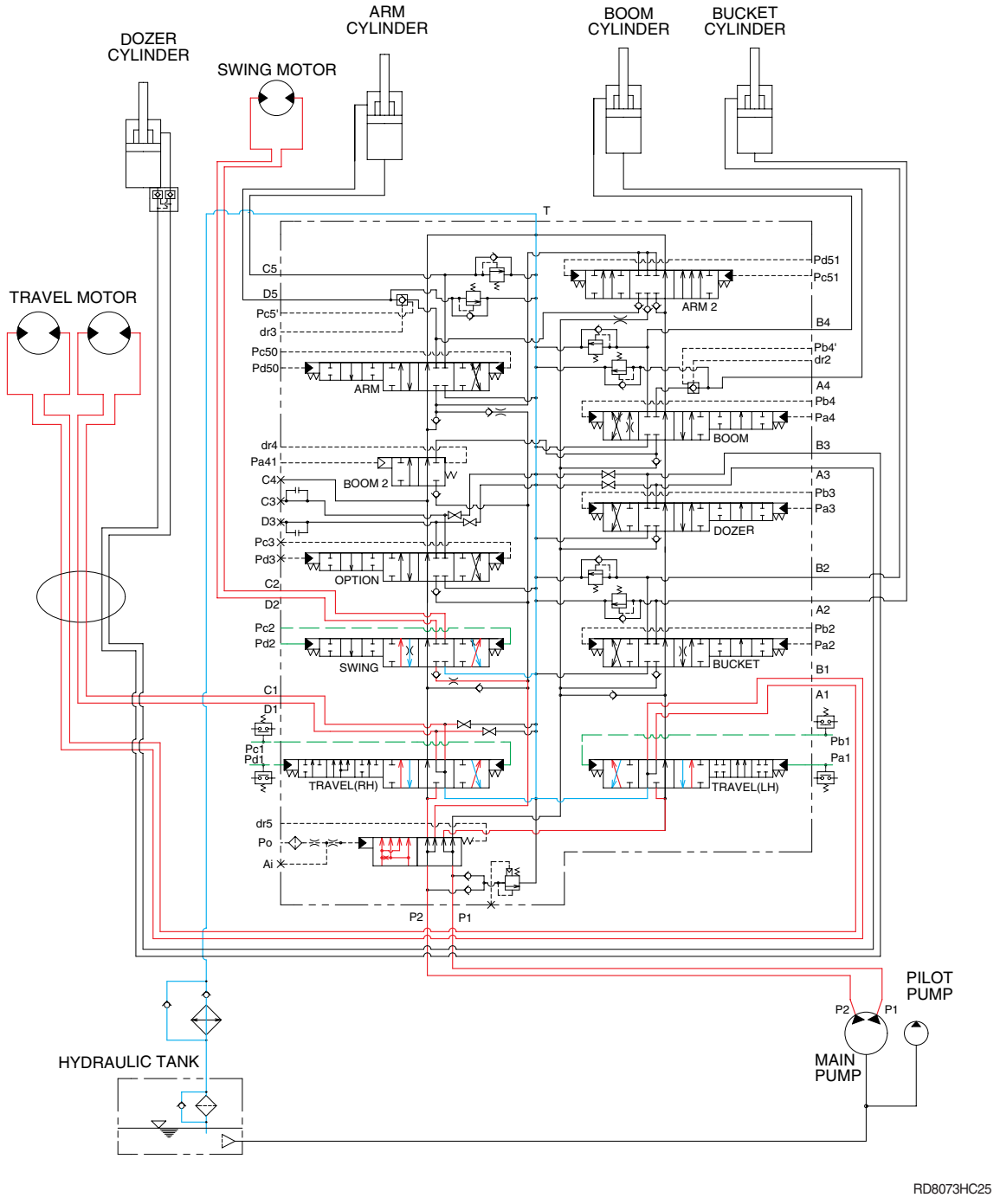
When the swing, boom, arm and bucket functions are operated, simultaneously each spool in the main control valve is moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the P2 pump flows into the swing motor, boom cylinders and arm cylinder through the swing spool, boom 2 spool, arm 1 spool, and the parallel and confluence oil passage.

The oil from the P1 pump flows into the boom cylinders, arm cylinder and bucket cylinder through the boom 1 spool, arm 2 spool, bucket spool and the parallel and confluence oil passage.

The superstructure swings and the boom, arm and bucket are operated.

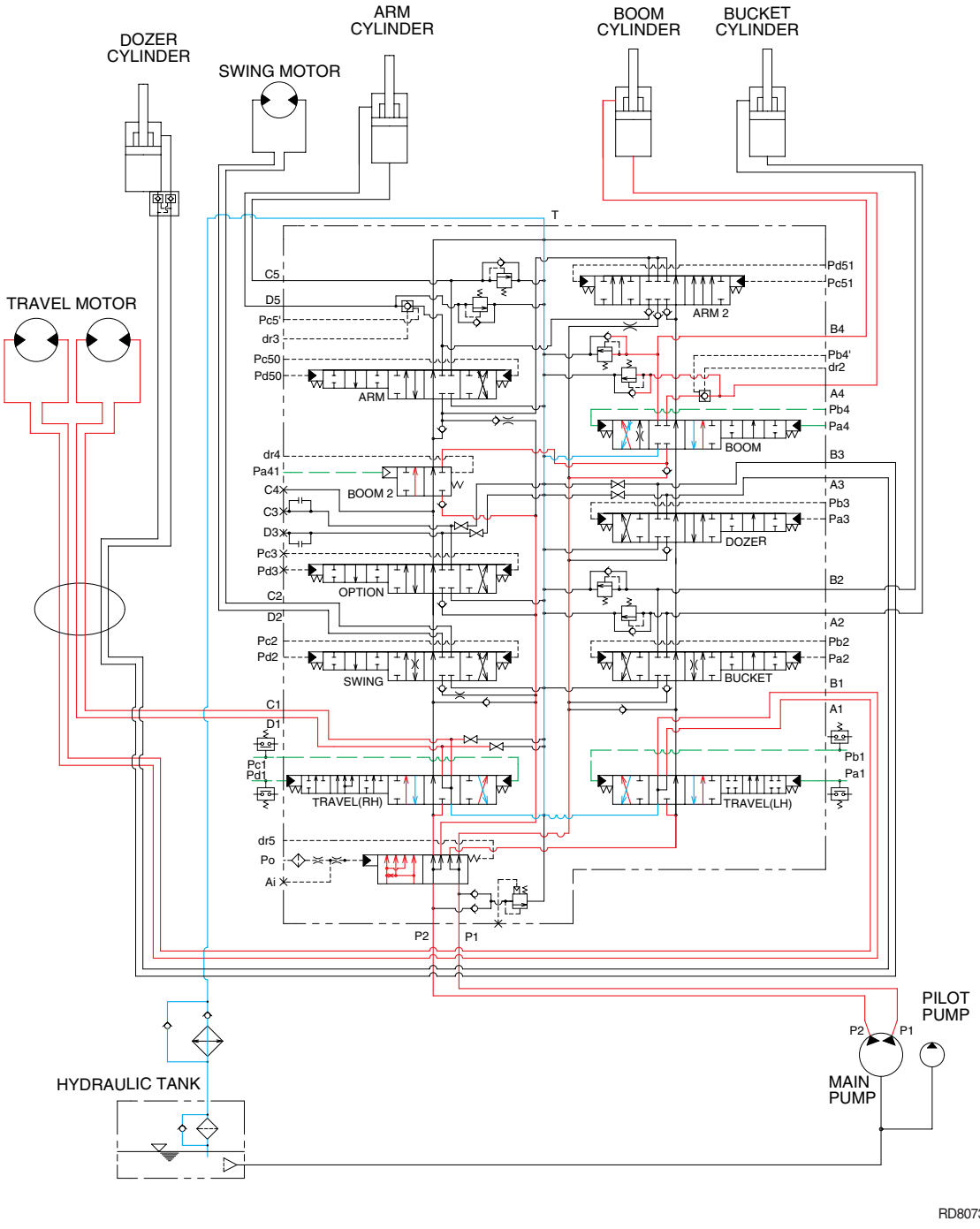
6. COMBINED SWING AND TRAVEL OPERATION



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 straight travel spool is pushed to the left by the pilot oil pressure from the pilot pump. The oil from the P1 pump flows into the swing motor through the swing spool. The oil from the P2 pump flows into the travel motor through the RH travel spool and the LH travel spool via the straight travel spool.

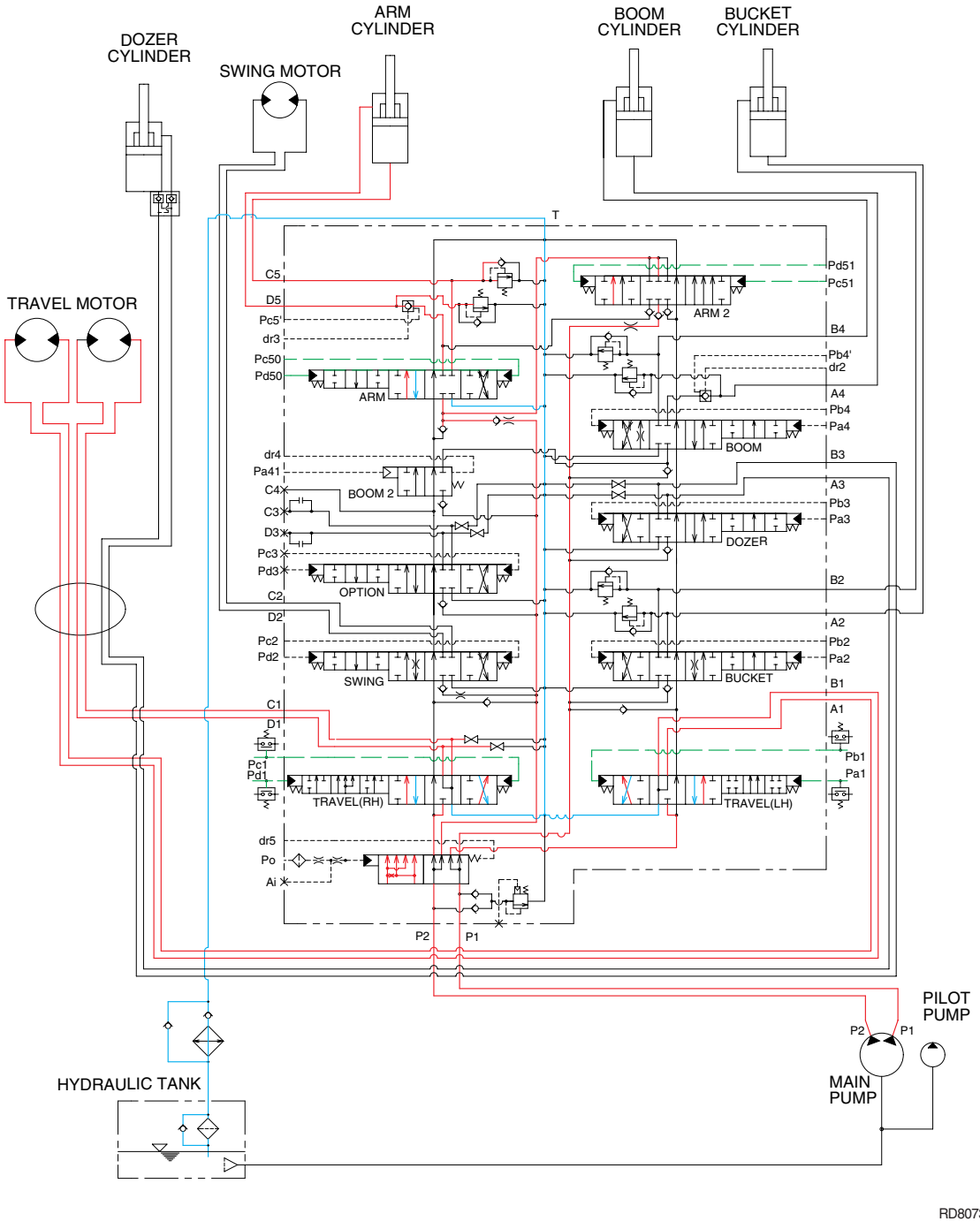
The superstructure swings and the machine travels straight.

7. COMBINED BOOM AND TRAVEL OPERATION



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 left by the oil pressure from pilot pump.
The oil from the P1 pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence oil passage in case boom up operation. The oil from the P2 pump flows into the travel motors through the RH travel spool and the LH travel spool via the straight travel spool.

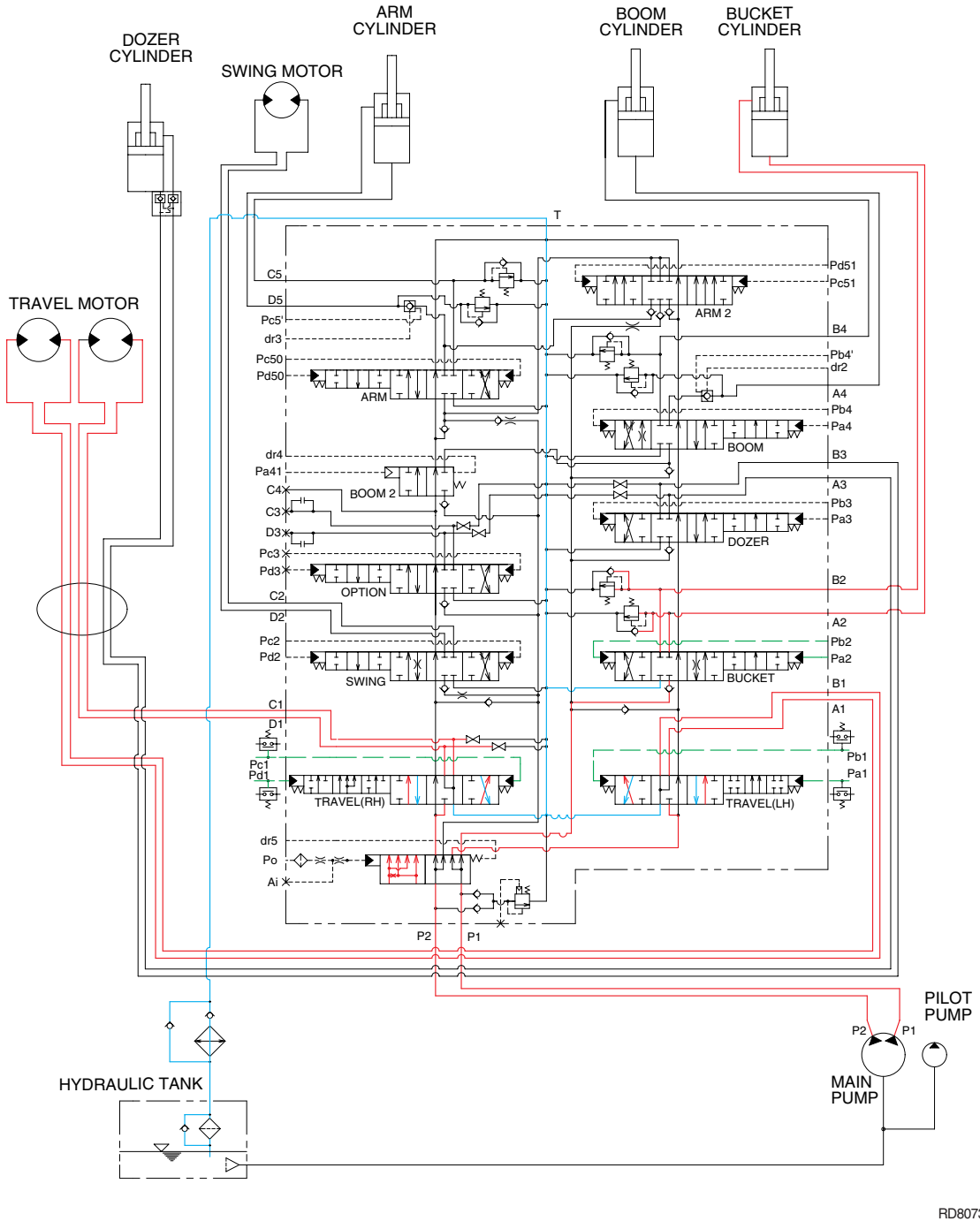
8. COMBINED ARM AND TRAVEL OPERATION



RD8073HC27

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 left by the oil pressure from pilot pump.
The oil from the P1 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage. The oil from the P2 pump flows into the travel motors through the RH travel spool and the LH travel spool via the straight travel spool.
The arm is operated and the machine travels straight.

9. COMBINED BUCKET AND TRAVEL OPERATION



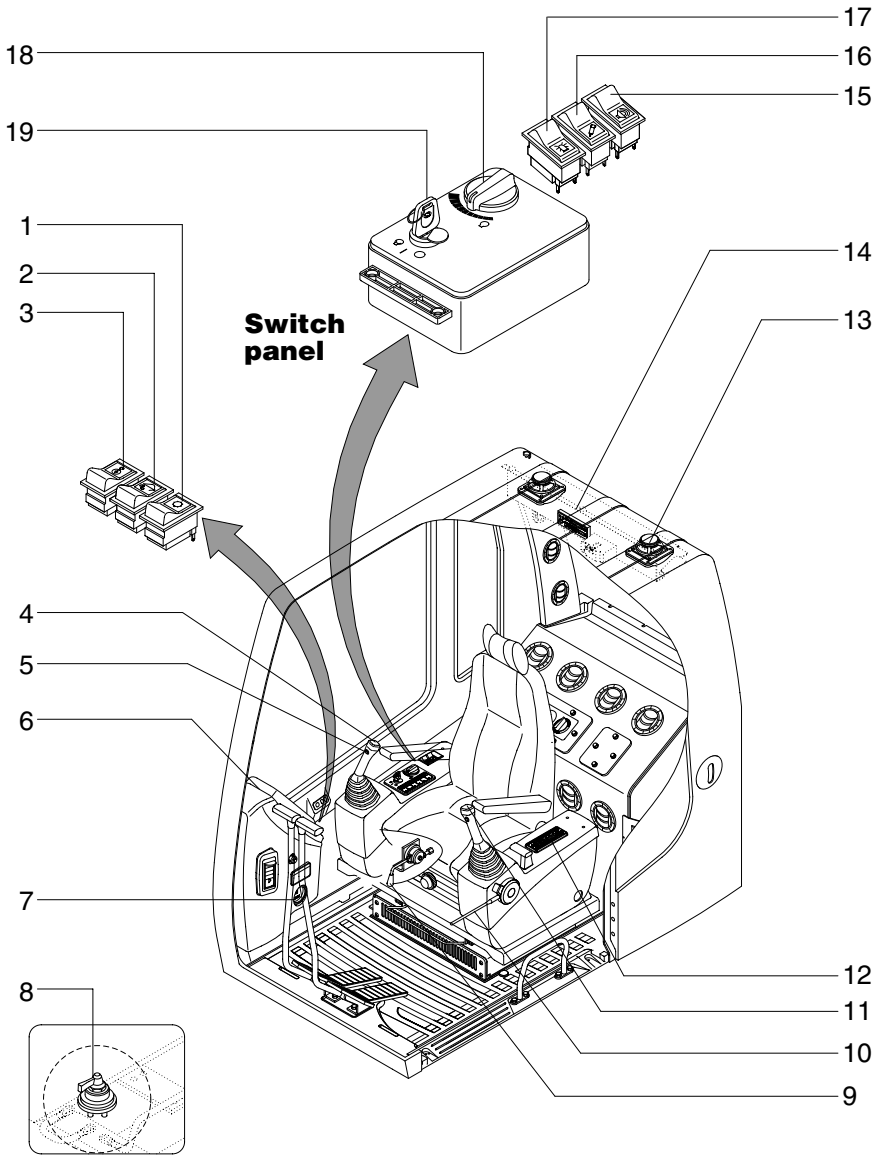
When the bucket and travel functions are operated, simultaneously the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve, and the straight travel spool is pushed to the left by the oil pressure from pilot pump. The oil from the P1 pump flows into the bucket cylinder through the bucket spool via the confluence oil passage. The oil from the P2 pump flows into the travel motors through the RH travel spool and the LH travel spool via the straight travel spool of the control valve.
The bucket is operated and the machine travels straight.

SECTION 4 ELECTRICAL SYSTEM

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

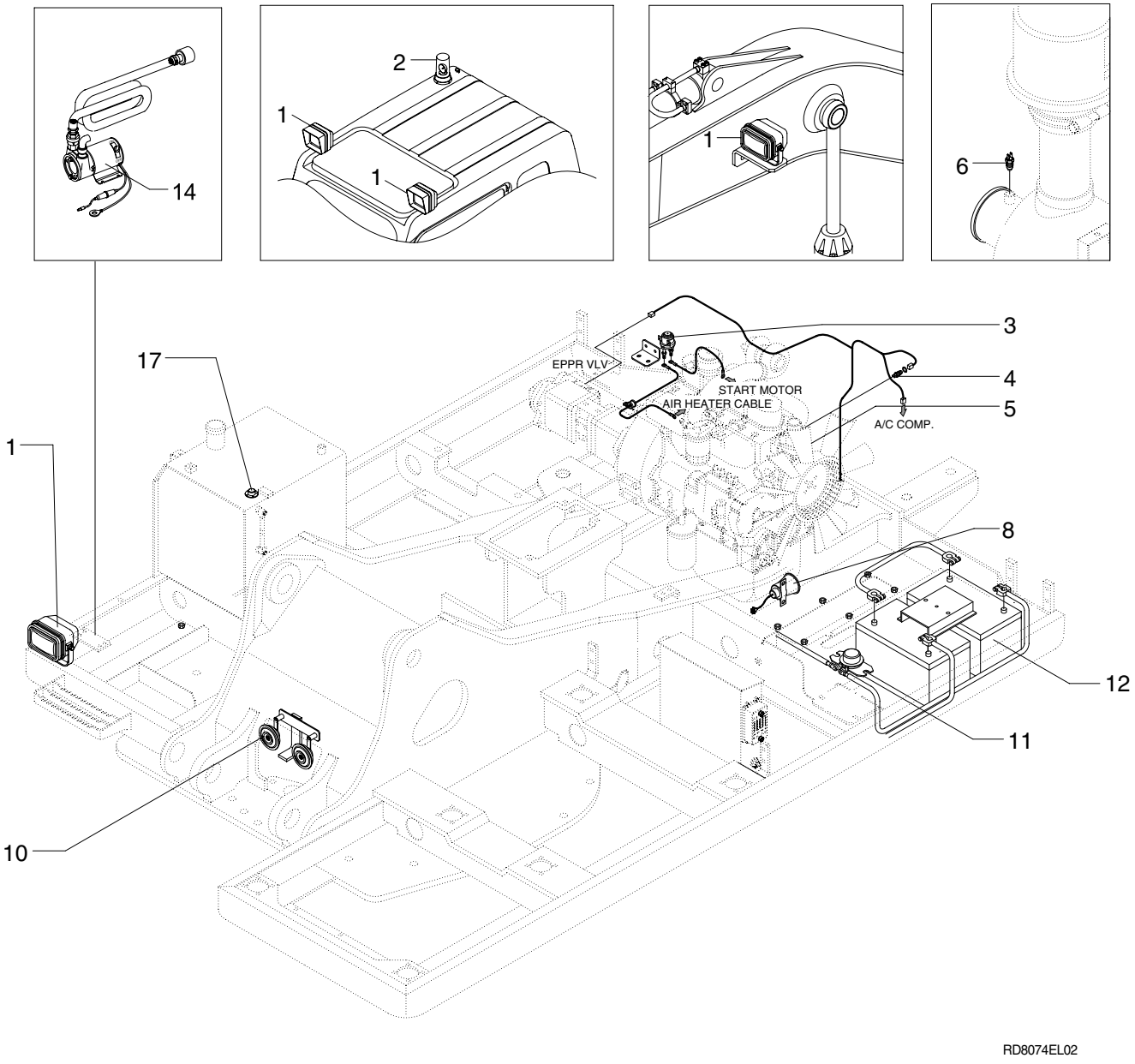
1. LOCATION 1



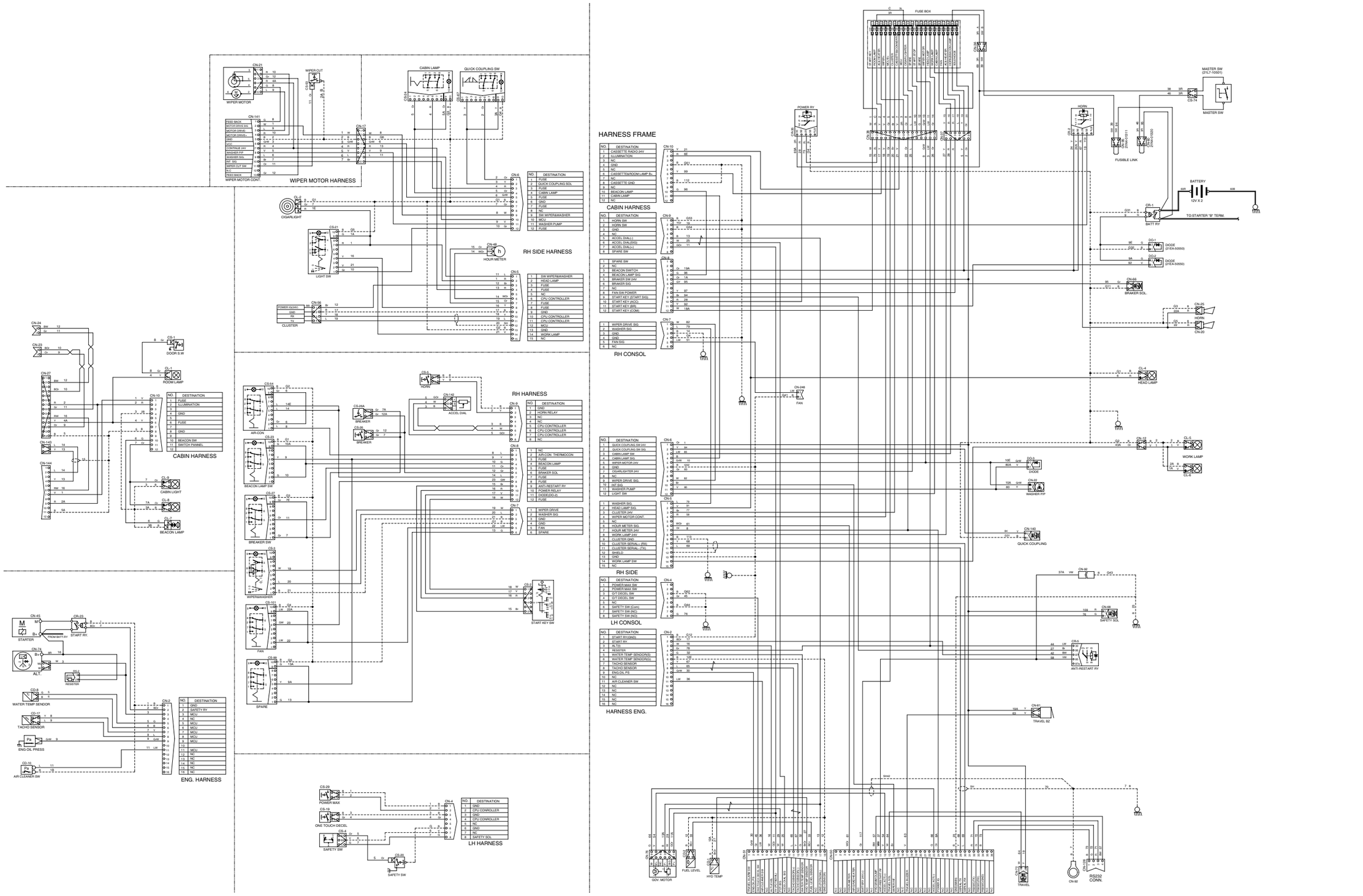
RD8074EL01

1	Main light switch	8	Master switch	14	Cassette radio
2	Quick coupling switch	9	Emergency engine acceleration lever	15	Travel alarm stop switch
3	Overload switch			16	Breaker selection switch
4	Horn switch	10	Safety lever	17	Beacon switch
5	Breaker operation switch	11	One touch decel switch	18	Accel dial
6	Cluster	12	Air-con switch	19	Start switch
7	Hour meter	13	Speaker		

2. LOCATION 2



1	Lamp	7	Alternator	13	Master switch
2	Beacon lamp	8	Travel alarm buzzer	14	Fuel filler pump
3	Heater relay	9	Washer pump	15	Relays
4	Start relay	10	Horn	16	CPU controller
5	Temp sender	11	Battery relay	17	Fuel sender
6	Air cleaner switch	12	Battery		


WIPER MOTOR HARNESS
RH SIDE HARNESS
RH HARNESS
CABIN HARNESS
ENG. HARNESS
HARNESS FRAME
CABIN HARNESS
RH CONSOL
RH SIDE
LH CONSOL
HARNESS ENG.
LH HARNESS
MCU(Machine Control Unit)
WIPER MOTOR
CIGAR/LIGHT
LIGHT SW
HOUR METER
CLUSTER
AIR-CON
BEACON LAMP SW
BREAKER SW
WIPER&WASHER
FAN
SPARE
HORN
ACCEL DIAL
BREAKER
DOOR S.W
ROOM LAMP
CABIN LIGHT
BEACON LAMP
STARTER
ALT.
START RY.
WATER TEMP SENSOR
TACHO SENSOR
ENG OIL PRESS
AIR CLEANER SW
POWER MAX
ONE TOUCH DECEL
SAFETY SW
START KEY SW
POWER RY
FUSE BOX
FUSIBLE LINK
MASTER SW
BATTERY
12V X 2
TO STARTER "B" TERM.
BATT RY
DIODE
BRAKER SOL
HORN
HEAD LAMP
WORK LAMP
DIODE
WASHER P/P
QUICK COUPLING
SAFETY SOL
ANTI-RESTART RY
TRAVEL
RS232 CONN.
FAN
GOV. MOTOR
FUEL LEVEL
HYD TEMP

RD8074EL00

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 → Fusible link [CN-60] → Master switch [CS-74] →

- → Power relay [CR-35(30)]
- → Fuse box [No.1] → I/conn [CN-38(1)] → I/conn [CN-8(12)] → Start switch [CS-2(1)]
- → Fuse box [No.2] → I/conn [CN-38(3)] → I/conn [CN-10(6)] → Room lamp [CL-1(2)]
  Cassette radio [CN-27(11)]
- → Fuse box [No.3] → I/conn [CN-38(8)] → I/conn [CN-11(4)] → AC & Heater controller [Battery(+)]
  I/conn [CN-11(5)] → Relay[Hi, M2]
- → Fuse box [No.4] → I/conn [CN-38(4)] → I/conn [CN - 5(4)] → I/conn [CN -17(5)]
  → Wiper motor Controller [CN-141(5)]
  Wiper motor [CN-21(4)]
- → Fuse box [No.5] → I/conn [CN-38(5)] → CPU controller [CN-50(7)]

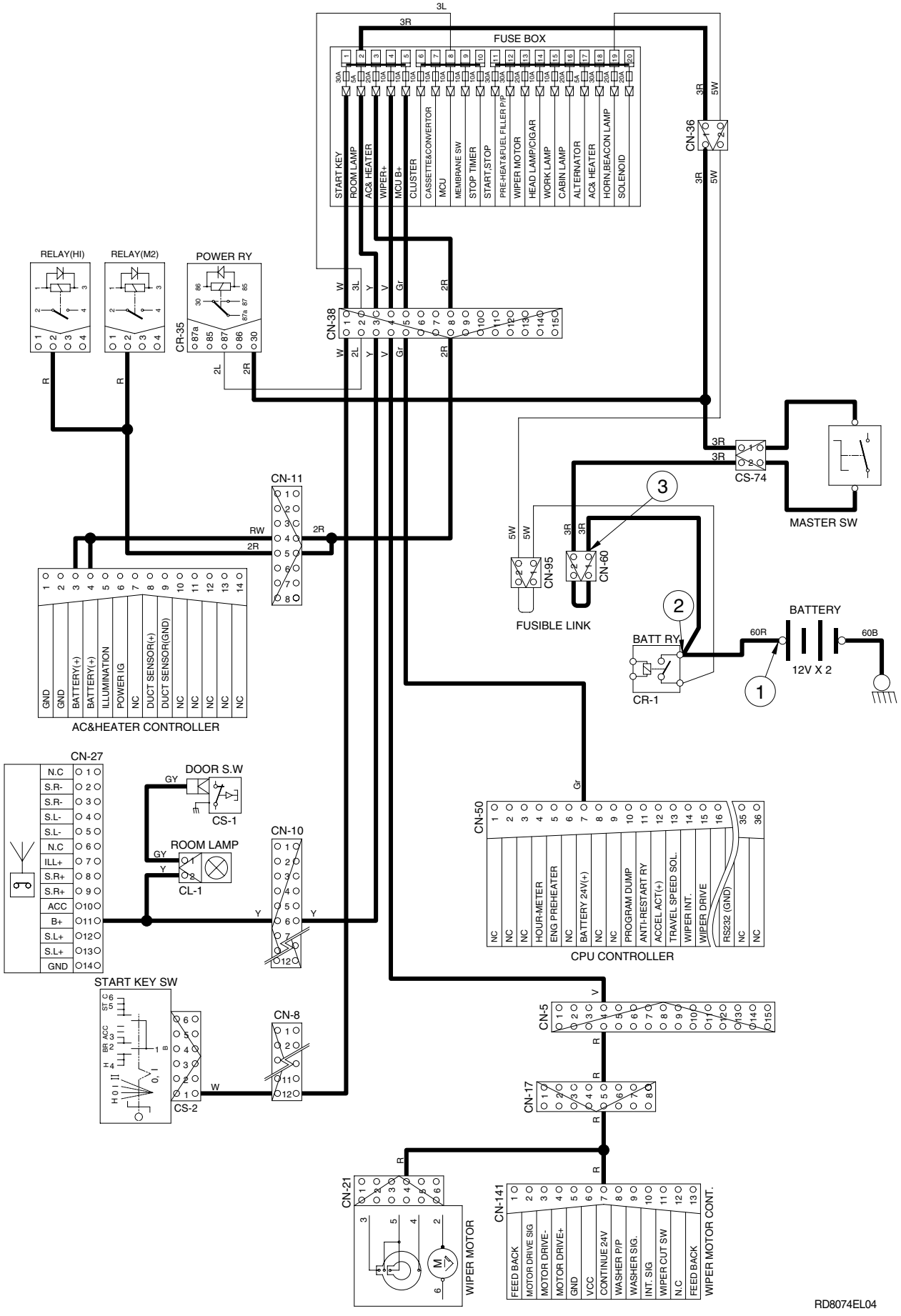
※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (Battery 2 EA) ② - GND (Battery 2 EA) ③ - GND (Fusible link)	20~25V 20~25V 20~25V

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery(+) terminal → Battery relay[CR-1] → Fusible link[CN-60] → Master switch [CS-74] → Fuse box No.1 → I/conn [CN-38(1)] → I/conn [CN-8(12)] → Start key [CS-2(1)]

※ Start switch : ON

→ Start switch ON [CS-2(2)] → I/conn [CN-8(11)] → Diode[DO-2] → Battery relay [CR-1]:Battery relay operating(All power is supplied with the electric component)

→ Start switch ON [CS-2(3)] → I/conn [CN-8(10)] → Power relay [CR-35(86)→(87)] → Fuse box No.8

※ Start switch : START

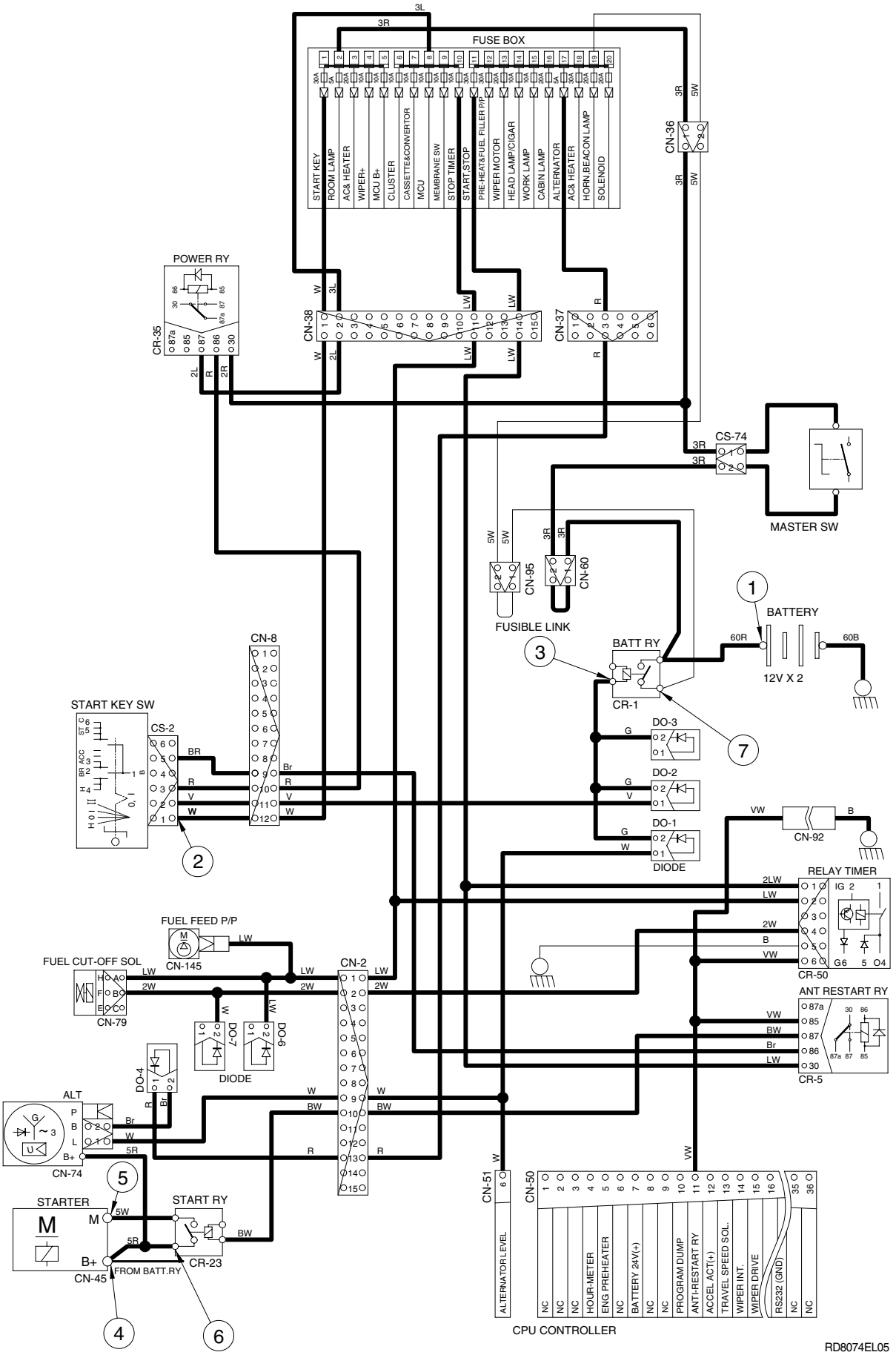
Start switch START[CS-2(5)] → I/conn[CN-8(9)] → Anti-restart relay [CR-5(86)→(87)] → I/conn [CN-2(10)] → Start relay [CR-23]

2) CHECK POINT

OEngine	Start switch	Check point	Voltage
Operating	Start	① - GND (Battery) ② - GND (Start key) ③ - GND (Battery relay M4) ④ - GND (Starter B ㅁ) ⑤ - GND (Starter M) ⑥ - GND (Start relay) ⑦ - GND (Battery relay M8)	20 ~ 25V

※ GND : Ground

STARTING CIRCUIT



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 [CN-74(1)] → I/conn [CN-2(9)] → CPU Controller [CN-51(6)] →
Cluster warning lamp (Via serial interface)

(2) Charging flow

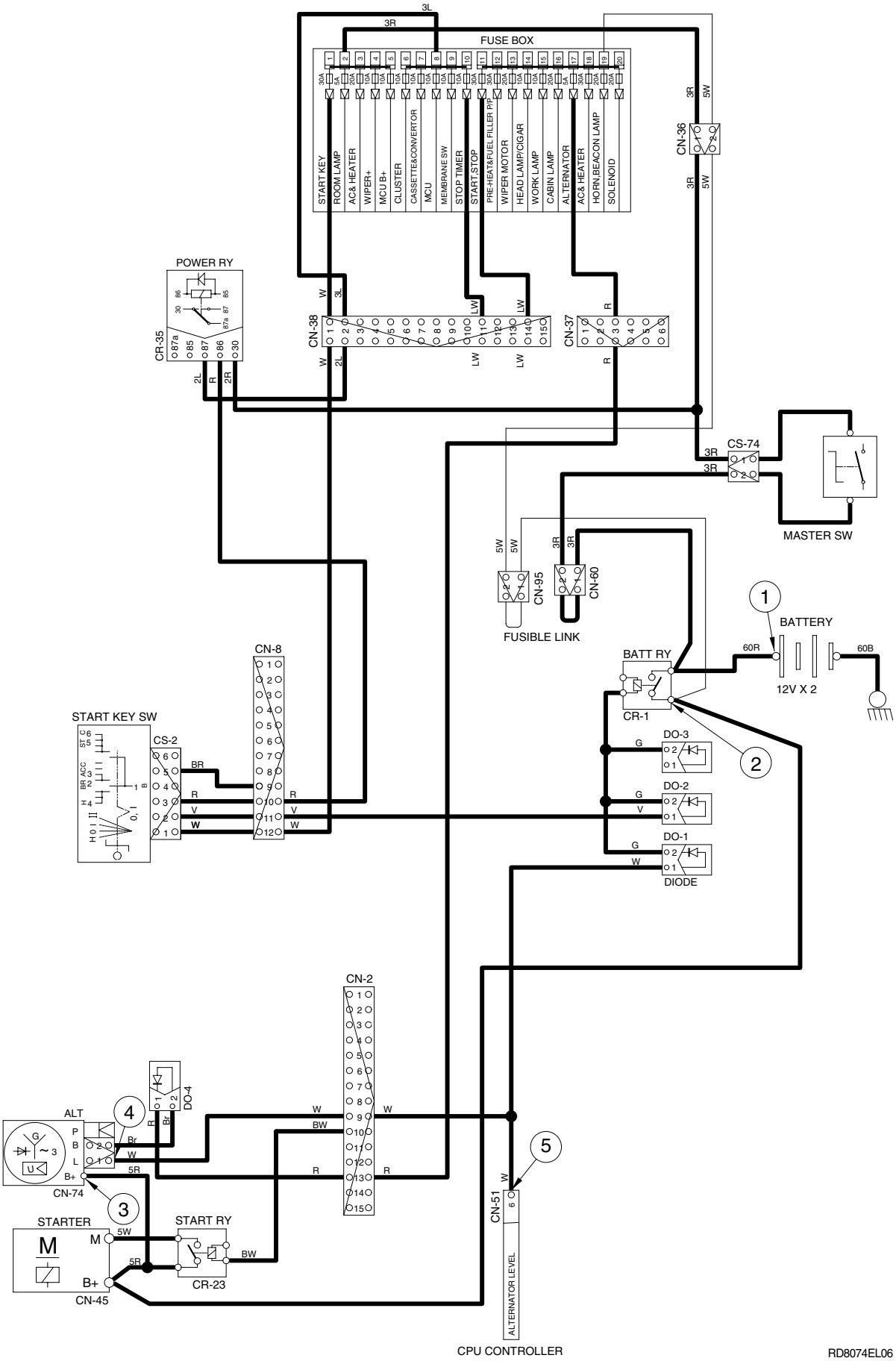
Alternator "B^+" terminal → Battery relay → Battery(+) terminal
Fusible link → Fuse box

2) CHECK POINT

Engine	Start switch	Check point	Voltage
ON	ON	① - GND (Battery voltage) ② - GND (Battery relay) ③ - GND (Alternator B □terminal) ④ - GND (Alternator I terminal) ⑤ - GND (CPU)	20~27V

※ GND : Ground

CHARGING CIRCUIT



4. HEAD LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.14) → I/conn[CN-38(15)] → I/conn[CN-7(7) → Membrance switch[CN-116(9)]
I/conn[CN-6(7)] → Cigar light[CL-2]

※ When lamp switch ON

Membrance switch[CN-116(1)] → I/conn[CN-7(1)]

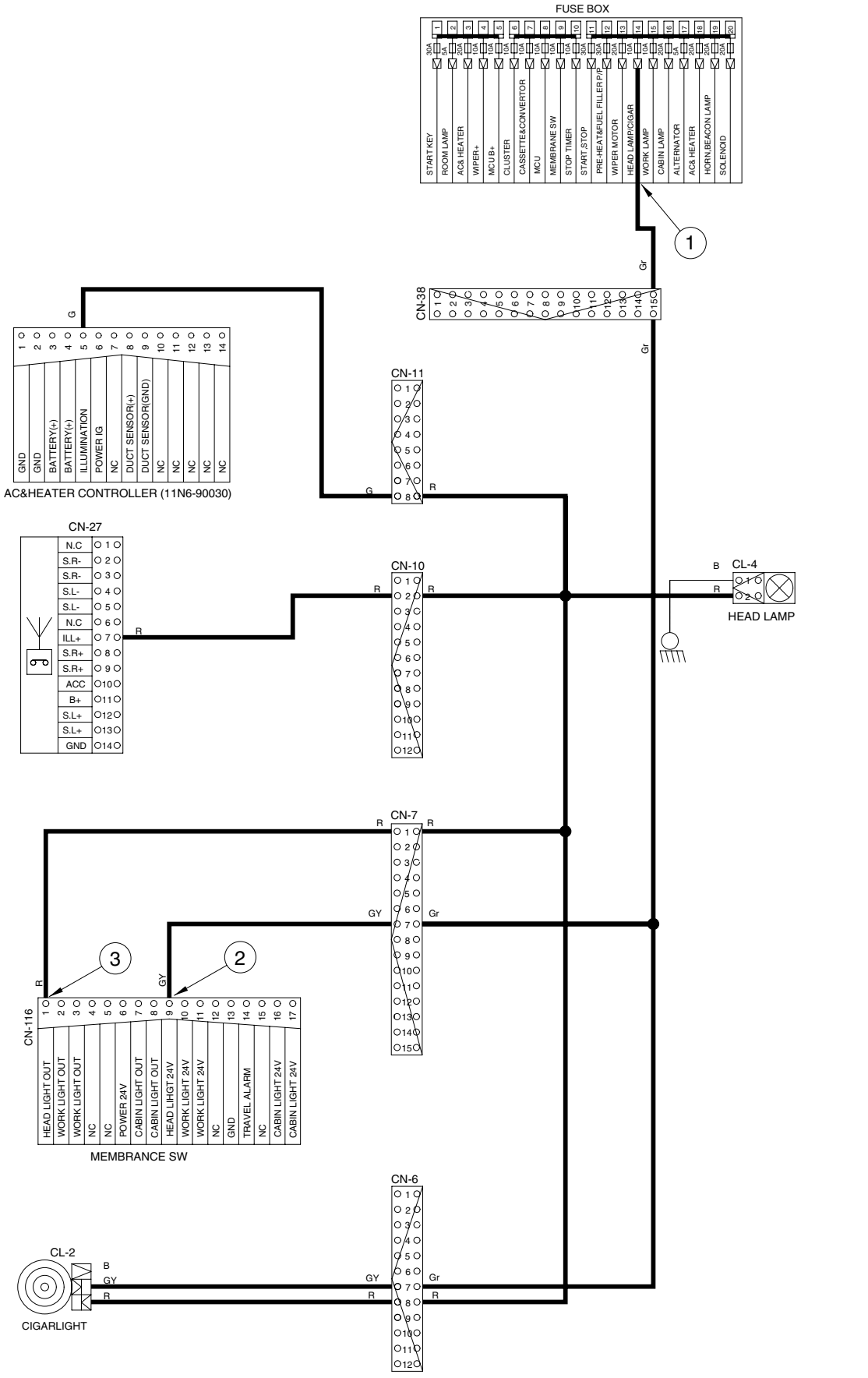
- I/conn [CN-10(2)] → Cassette radio illumination [CN-27(7)]
- I/conn [CN-11(8)] → AC & Heater controller illumination
- Head lamp [CL-4(2)] : Head lamp ON
- I/conn[CN-6(8)] → Cigarlight [CL-2]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
STOP	ON	① - GND (Fuse box) ② - GND (Switch power input) ③ - GND (Switch power output)	20~25V

※ GND : Ground

HEAD LAMP CIRCUIT



7074EL07

5. WORK LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.15) → I/conn[CN-37(1)] → I/conn［CN-7(8)］→ Membrance switch[CN-116(10, 11)]

※ When work lamp switch ON

Work lamp switch ON［CN-116(2, 3)］→ I/conn [CN-7(2)] → I/conn[CN-12(2)] →

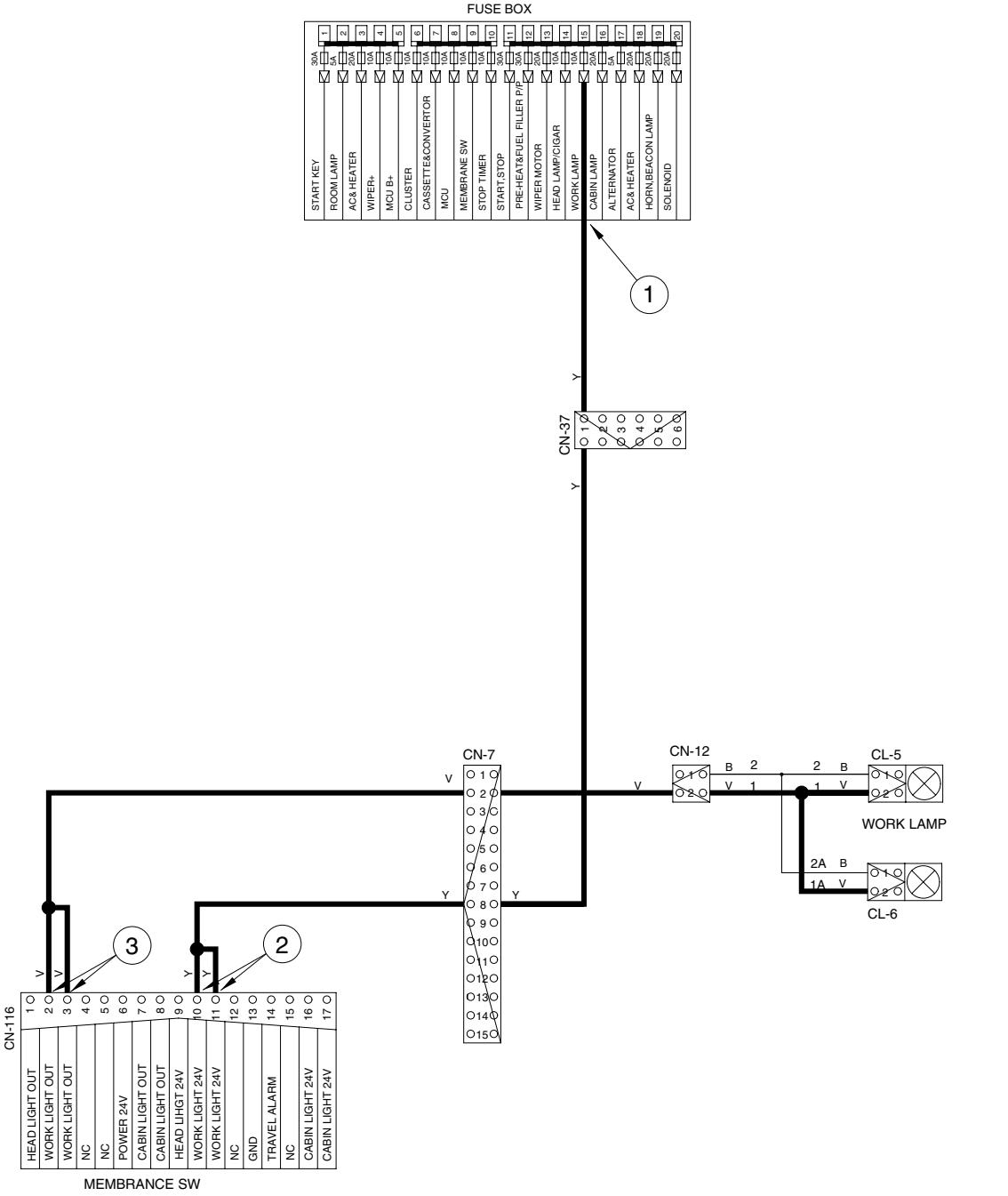
Work lamp ON [CL-5(2), CL-6(2)]

2) CHECK POINT

Engine	Key switch	Check point	VoltagOe
STOP	ON	① - GND (Fuse box) ② - GND (Light switch input) ③ - GND (Light switch output) ④ - GND (Work lamp)	20~25V

※ GND : Ground

WORK LAMP CIRCUIT



7074EL08

6. CAB LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.16) → I/conn[CN-37(2)] → I/conn[CN-7(8)] →Membrance switch[CN-116(16, 17)]

※ When Lamp switch ON

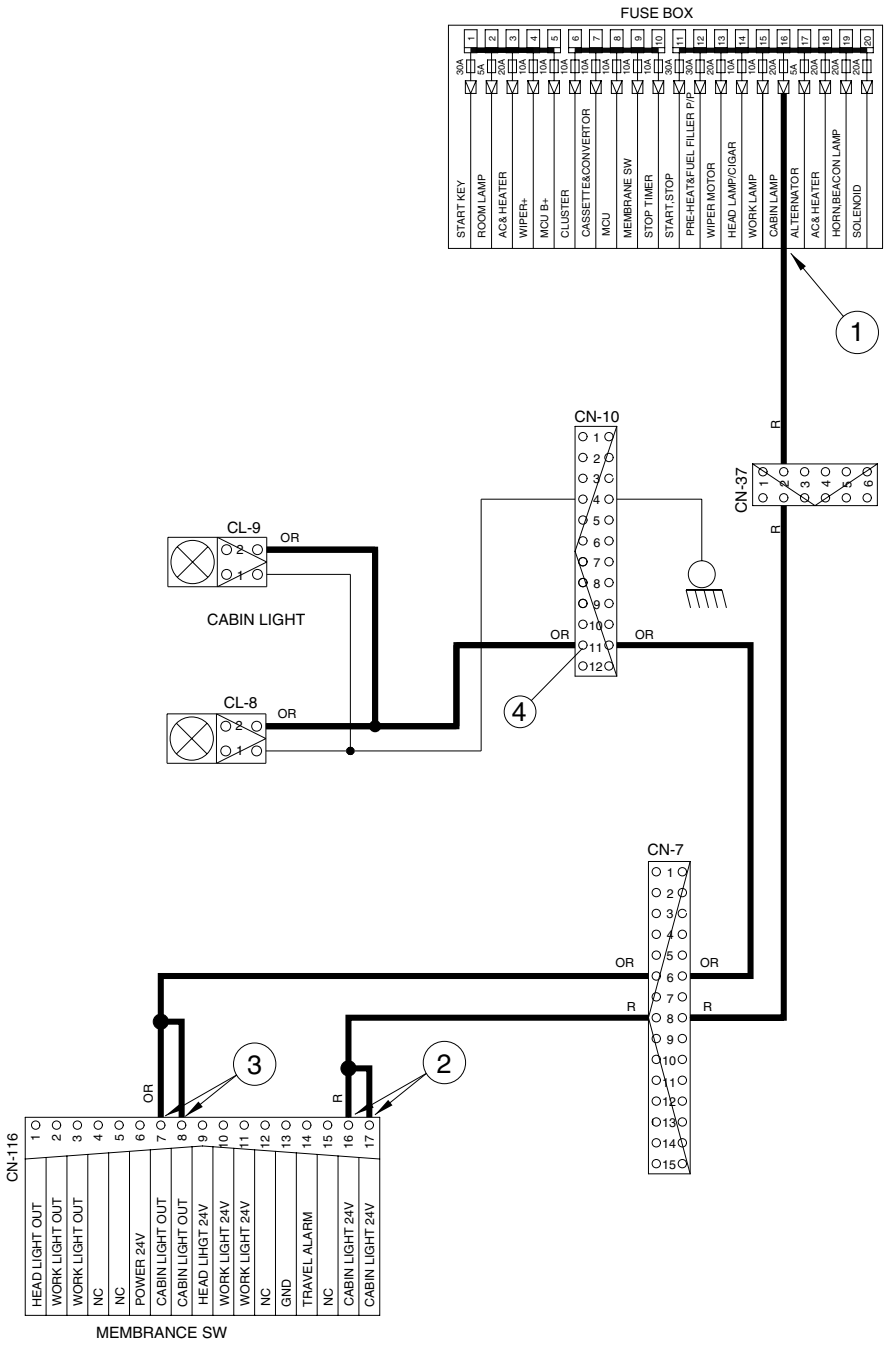
Lamp switch ON [CN-116(7, 8)] → I/conn [CN-7(6)] → I/conn [CN-10(11)] →
Cab light ON [CL-8(2), CL-9(2)]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (Fuse box) ② - GND (Light switch input) ③ - GND (Light switch output) ④ - GND (Cab lamp)	20 ~ 25V

※ GND : Ground

CAB LAMP CIRCUIT



7074EL09

7. BEACON LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.19) → I/conn[CN-37(5)] → I/conn [CN-8(3)] → Beacon lamp switch [CS-23(6)]

※ When lamp switch ON

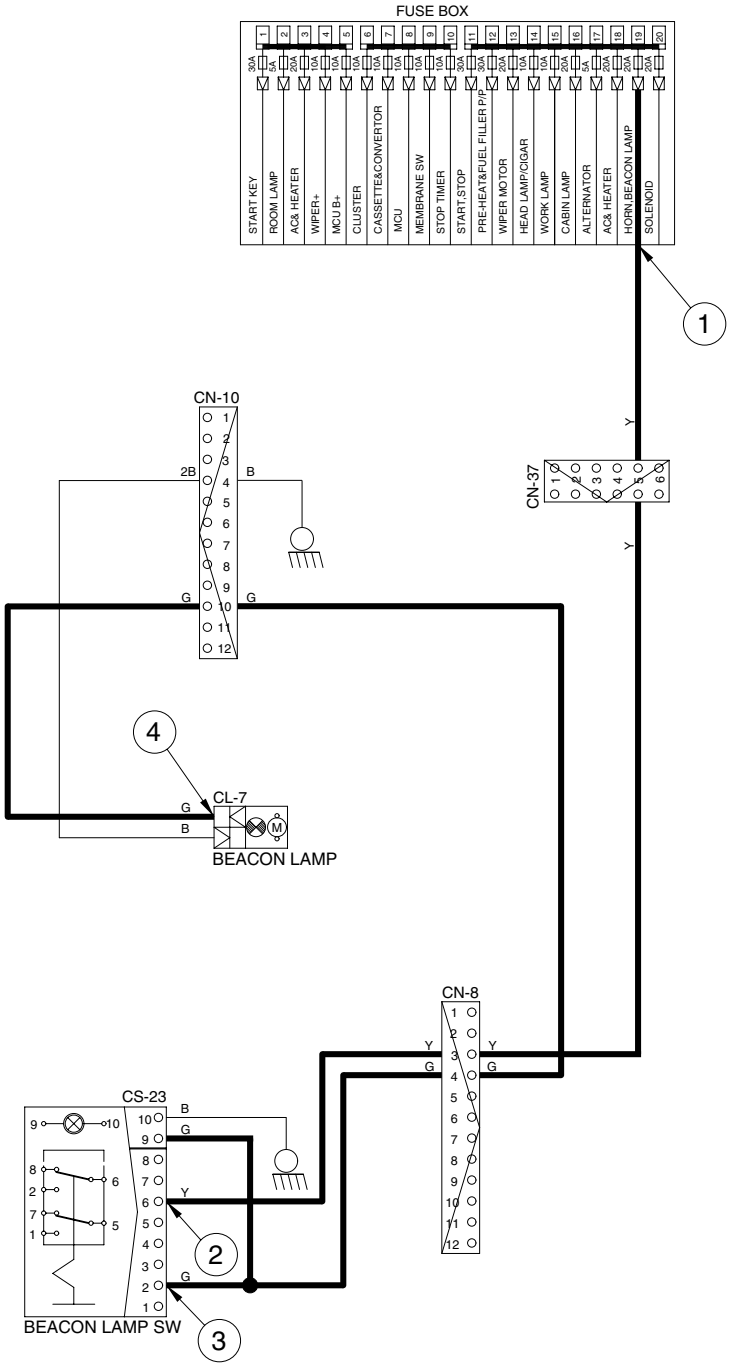
Beacon lamp switch ON [CS-23(2)] → Switch Indicator lamp ON [CS-23(9)]
I/conn [CN-8(4)] → I/conn [CN-10(10)]
→ Beacon lamp ON [CL-7]

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 lamp)	20~25V

※ GND : Ground

BEACON LAMP CIRCUIT



7074EL10

8. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.5) → I/conn[CN-38(6)] → I/conn [CN-5(3)] → Cluster[CN-56(1)]

Fuse box (No.4) → I/conn[CN-37(4)] → I/conn [CN-5(4)] → I/conn [CN-17(5)]
→ Wiper motor controller [CN-141(7)]
Wiper motor [CN-21(4)]

Fuse box (No.13) → I/conn[CN-37(13)] → I/conn [CN-6(5)] → I/conn [CN-17(4)] →
Wiper motor controller [CN-141(6)]
→ Washer pump [CN-22(2)]

(2) Wiper switch ON(Intermittent)

Wiper switch ON [CN-50(14)] → I/conn[CN-6(10)] → I/conn[CN-17(8)] →
Wiper motor controller [CN-141(10) → (3)] → Wiper motor intermittently operating [CN-21(6)]

(3) Wiper switch ON

Wiper switch ON [CN-50(15)] → I/conn [CN-6(9)] → I/conn[CN-17(2)] →
Wiper motor controller [CN-141(2) → (4)] → Wiper motor operating [CN-21(2)]

(4) Washer switch ON

Washer switch ON [CN-50(16)] → I/conn [CN-5(1)] → I/conn [CN-17(7)] →
→ Wiper motor controller [CN-141(9) → (8)] → I/conn [CN-17(6)] → I/conn [CN-6(11)]
→ Washer operating [CN-22(1)]
Wiper switch ON [CN-50(15)] → I/conn [CN-6(9)] → I/conn[CN-17(2)] →
Wiper motor controller [CN-141(2) → (4)] → Wiper motor operating [CN-21(2)]

(5) Auto parking(When switch OFF)

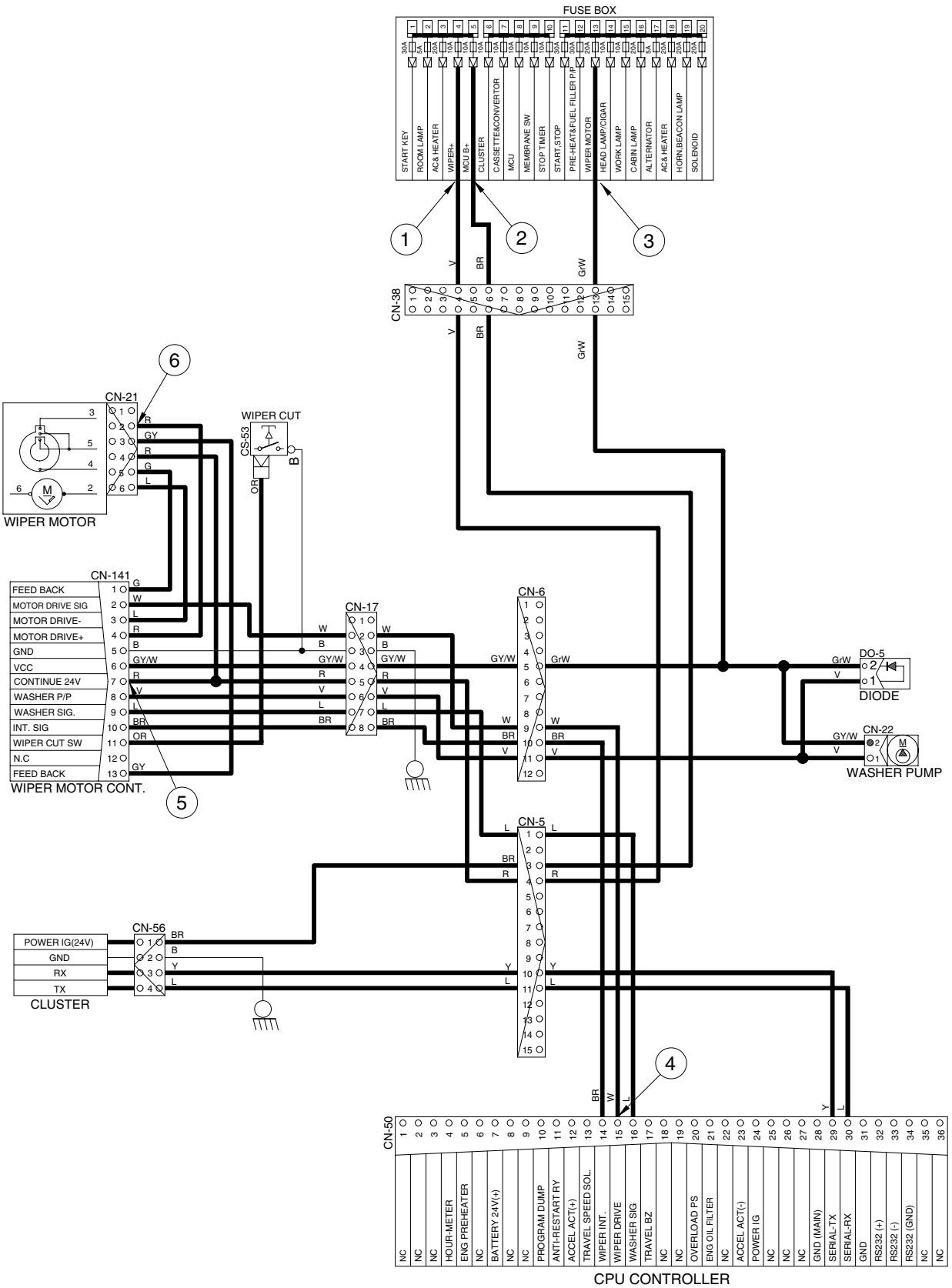
Switch OFF [CN-50(15)] → Wiper motor parking position by wiper motor controller

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND(Fuse box) ② - GND(Switch power input)	24V
		③ - GND(Switch power output) ④ - GND(Wiper Power input)	0~5V
		⑤ - GND(Wiper power output)	24V
		⑥ - GND(Wiper motor)	0 or 24V

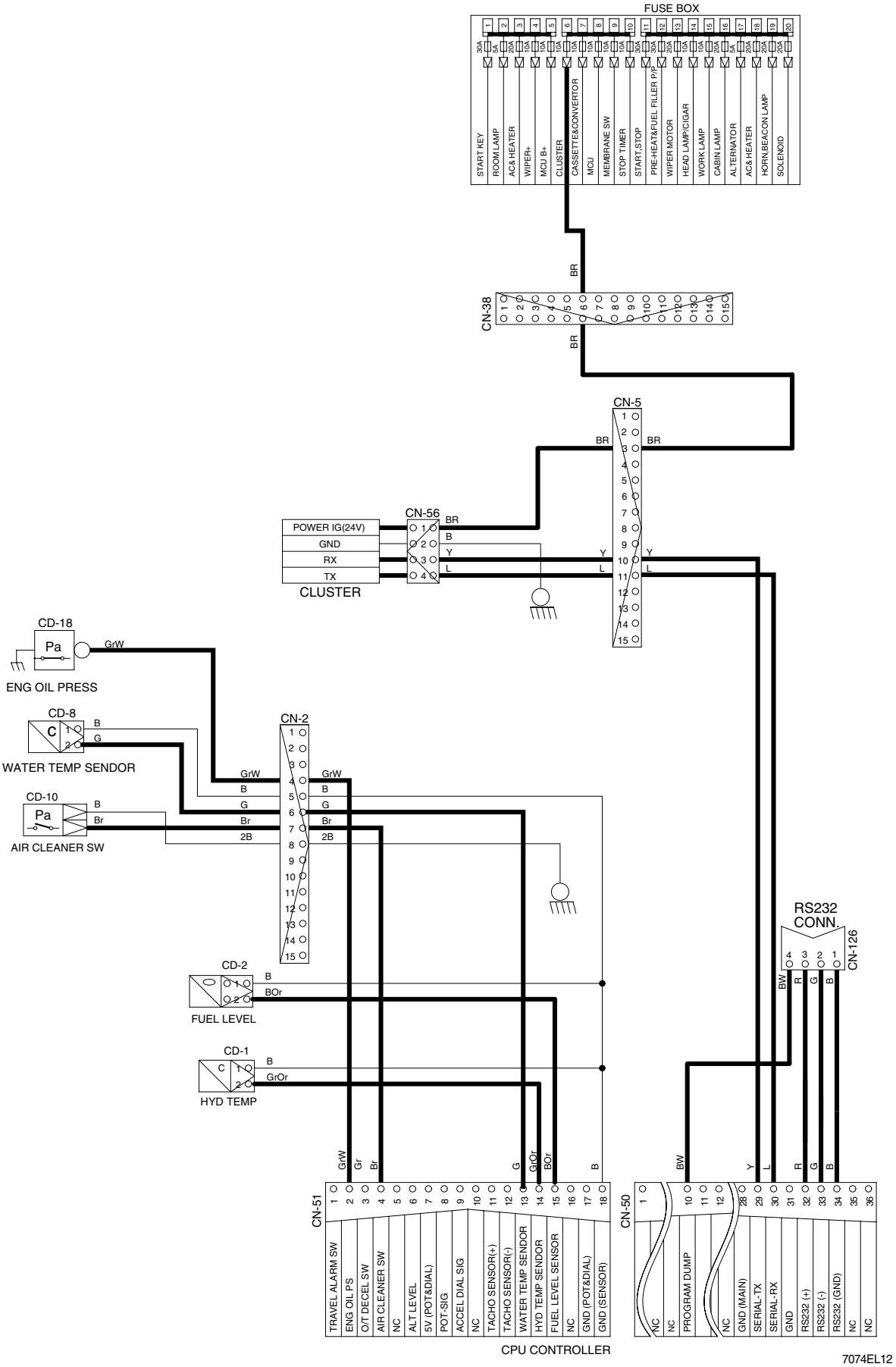
※ GND : Ground

WIPER AND WASHER CIRCUIT

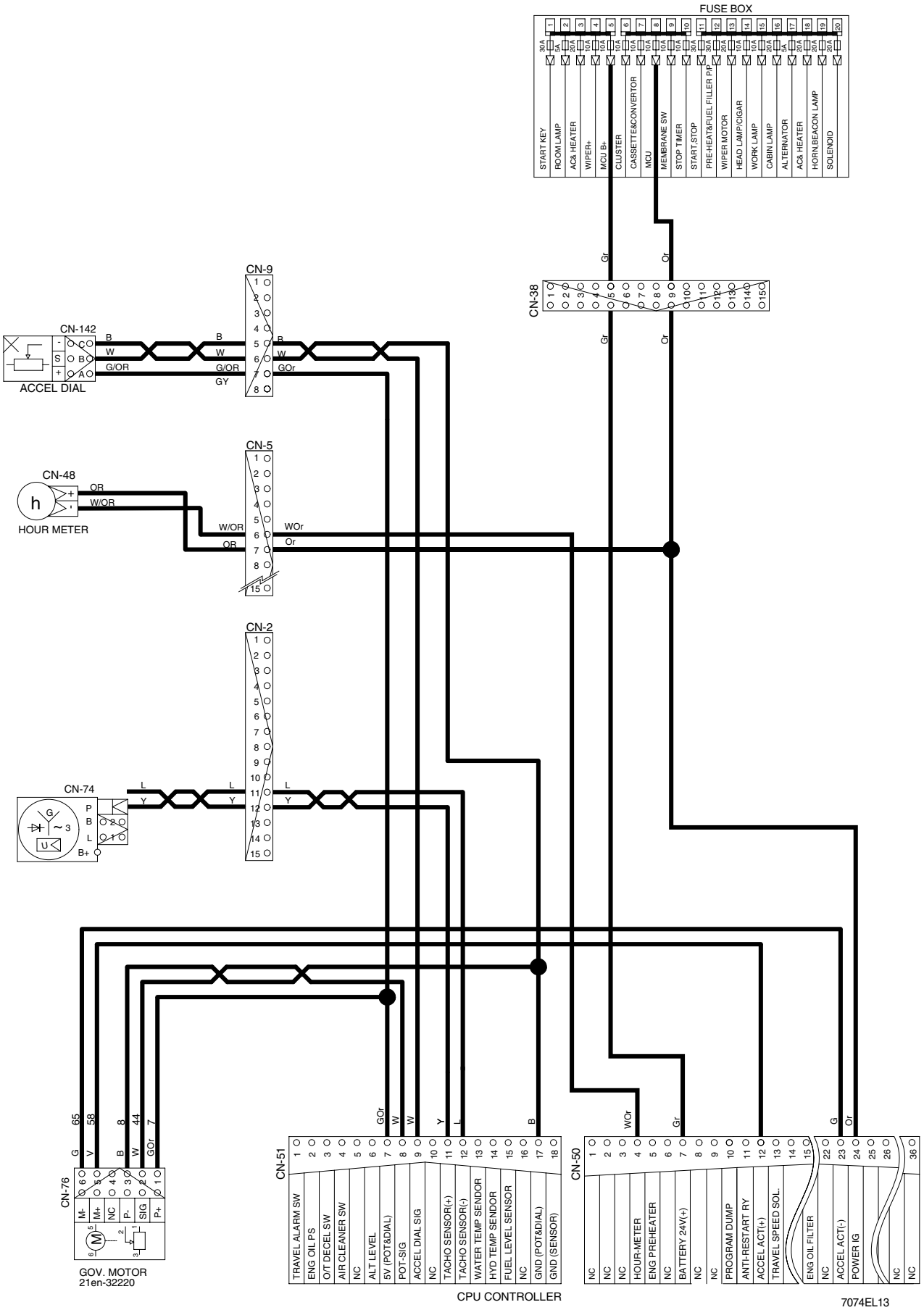


7074EL11

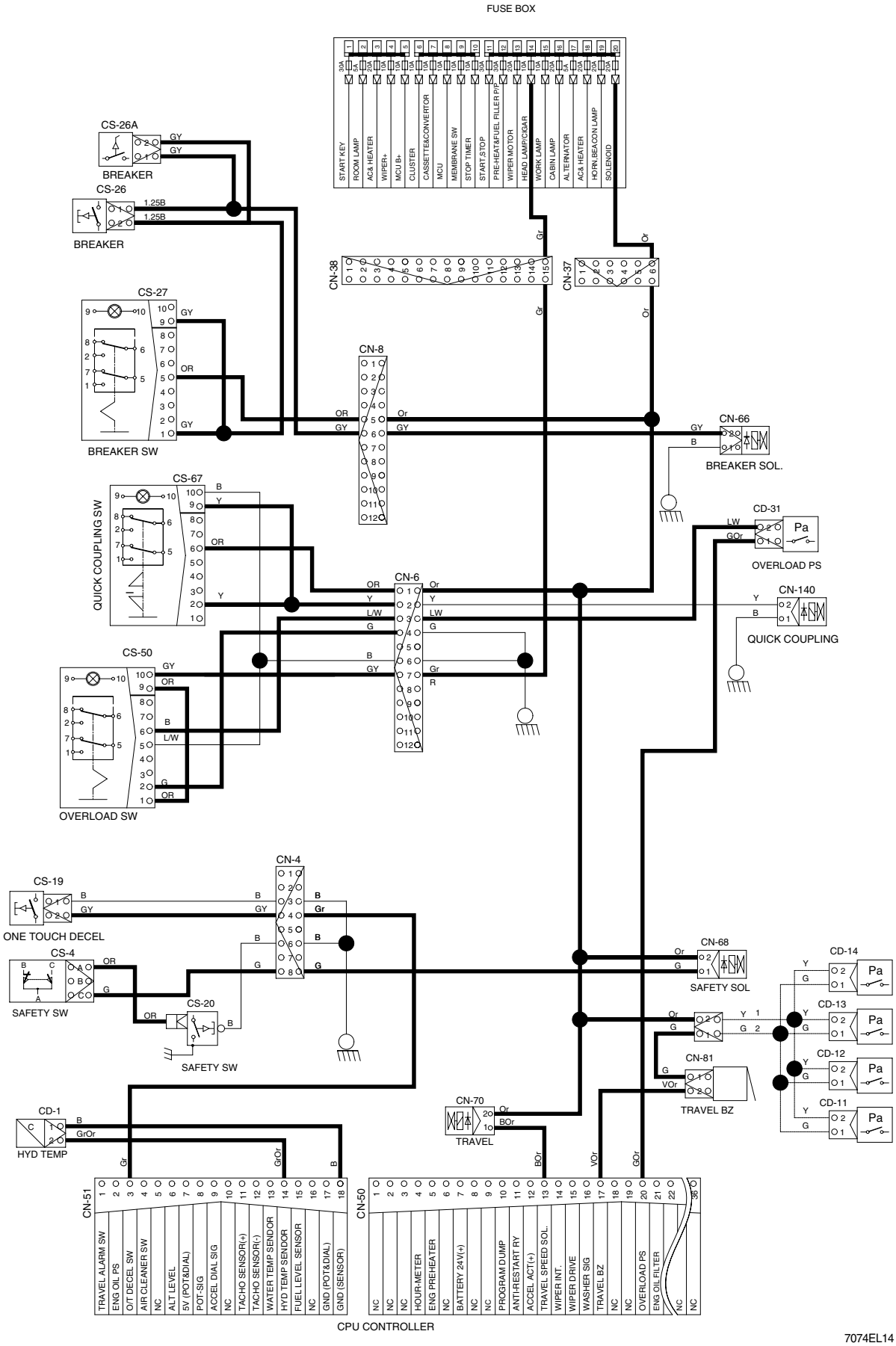
CONTROLLER CIRCUIT



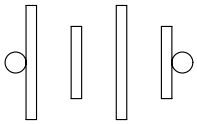
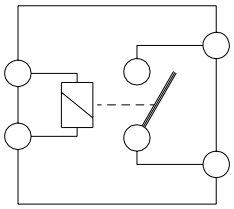
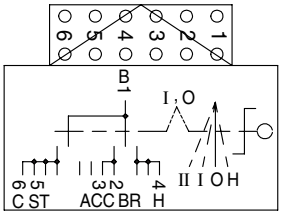
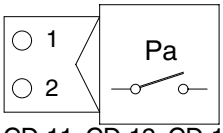
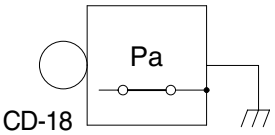
MONITORING CIRCUIT

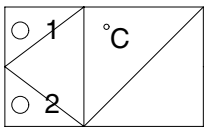
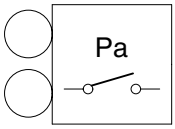
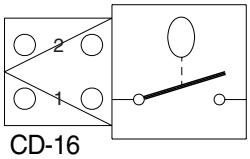
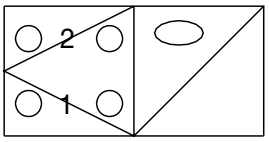
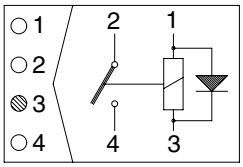
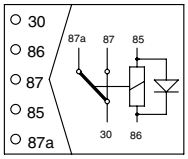


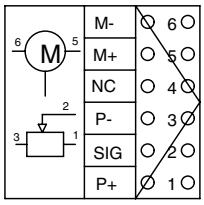
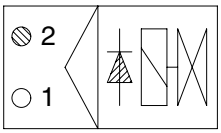
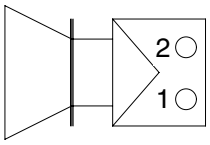
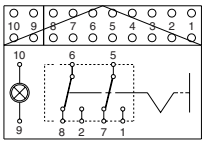
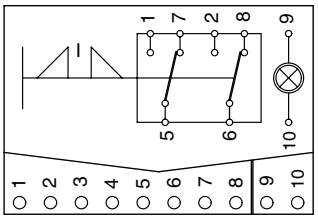
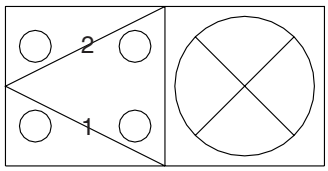
ELECTRIC CIRCUIT FOR HYDRAULIC

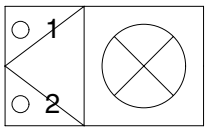
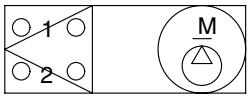
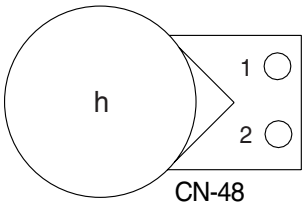
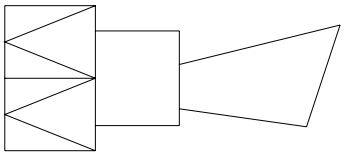
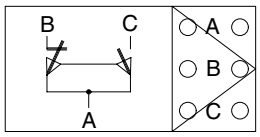
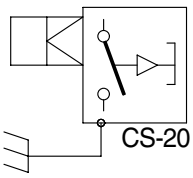


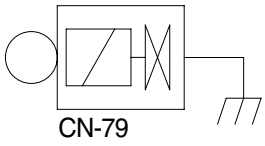
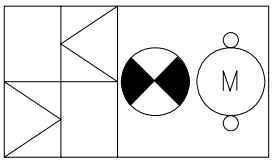
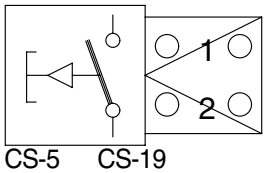
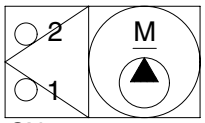
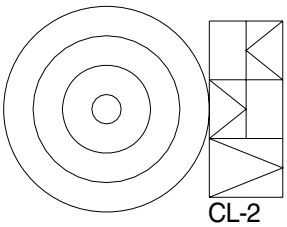
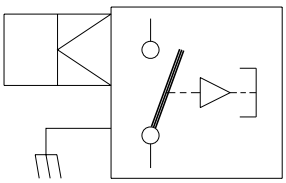
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

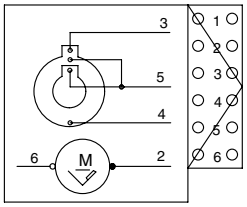
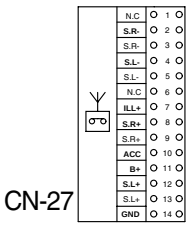
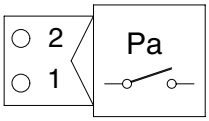
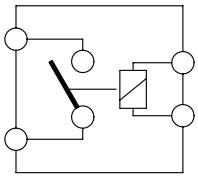
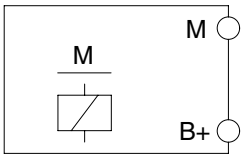
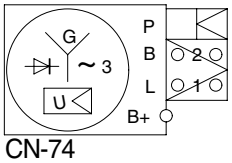
Part name	Symbol	Specification	Check
Battery		12V × 68Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A(continuity) 1000A(30second)	※ Check coil resistance (M4 to M4) Normal : About 50 Ω ※ Check contact Normal : ∞ Ω
Start key	 CS-2	24V 40A	※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 overload)	 CD-11, CD-12, CD-13 CD-14, CD-31	3 ~ 6 kgf/cm² (N.O TYPE)	※ Check contact Normal : ∞(OPEN)
Pressure switch (For engine oil)	 CD-18	0.5 kgf/cm² (N.C TYPE)	※ Check resistance Normal : 0 Ω (CLOSE)

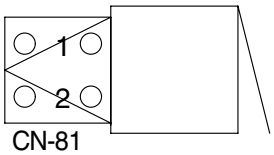
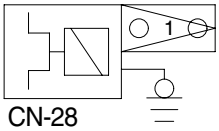
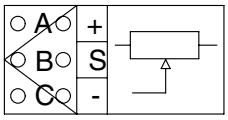
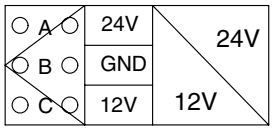
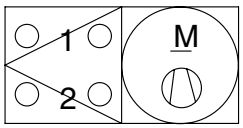
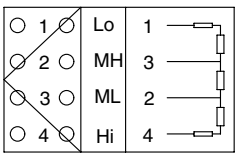
Part name	Symbol	Specification	Check
Temperature sensor (Coolant, hydraulic)	 CD-1, CD-8	-	※ Check resistance 50°C : 804 Ω 80°C : 310 Ω 100°C : 180 Ω
Air cleaner pressure switch	 CD-10	Pressure: 635mmH_2O (N.O TYPE)	※ Check contact Normal : ∞ Ω
Coolant level sensor	 CD-16	24V 0.5A	※ Check contact High level : ∞ Ω Low level : 0 Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 50 Ω 6/12 : 350 Ω 11/12 : 100 Ω 5/12 : 400 Ω 10/12 : 150 Ω 4/12 : 450 Ω 9/12 : 200 Ω 3/12 : 500 Ω 8/12 : 250 Ω 2/12 : 550 Ω 7/12 : 300 Ω 1/12 : 600 Ω Empty warning :700 Ω
Aircon relay	 HI, M2	24V 20A	※ Check resistance Normal : About 200 Ω (For terminal 1-3) : 0 Ω (For terminal 2-4)
Relay	 CR-2 CR-33 CR-5 CR-35 CR-7 CR-36	24V 16A	※ Check resistance Normal : About 160 Ω (For terminal 85-86) : 0 Ω (For terminal 30-87a) : ∞ Ω (For terminal 30-87)

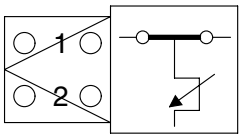
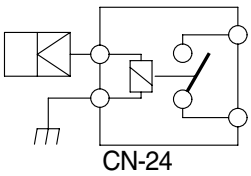
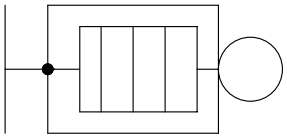
Part name	Symbol	Specification	Check
Accel actuator	 CN-76	-	※ Check resistance Normal : 1-2 Ω (For terminal 5-6) 0.8-1.2kΩ (For terminal 1-3)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-140	24V 1A	※ Check resistance Normal : 15~25 Ω (For terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	4 Ω 20W	※Check resistance Normal : 4 Ω
Switch (Looking type)	 CS-23, CS-24, CS-27, CS-54	24V 8A	※ Check contact Normal ON - 0 Ω (For terminal 1-5,2-6) - ∞ Ω (For terminal 5-7,6-8) OFF - ∞ Ω (For terminal 1-5,2-6) - 0 Ω (For terminal 5-7,6-8)
Switch	 CS-67	24V 8A	※ Check contact Normal ON - 0 Ω (For terminal 1-5,2-6) - ∞ Ω (For terminal 5-7,6-8) OFF - ∞ Ω (For terminal 1-5,2-6) - 0 Ω (For terminal 5-7,6-8)
Lamp	 CL-4, CL-5, CL-6, CL-8, CL-9	24V 70W (H3 TYPE)	※ Check disconnection Normal : 1.2 Ω

Part name	Symbol	Specification	Check
Room lamp	 CL-1	24V 10W	※ Check disconnection Nomal : A few Ω
Fuel filler pump	 CN-61	24V 10A 35 ℓ/min	※ Check resistance Normal : 1.0 Ω
Hour meter	 CN-48	16V ~ 32V	※ Check operation · Supply powe(24V) to terminal No. 2 and connect terminal No. 1 and ground.
Horn	 CN-20 CN-25	DC 22.0 ~ 28.0V 2A	※ Check operation · Supply powe(24V) to each terminal and connect ground.
Safety switch 1	 CS-4	24V 15A (N.C TYPE)	※ 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)
Safety switch 2	 CS-20	24V (N.C TYPE)	※ Check contact Normal : 0 Ω (one pin to ground)

Part name	Symbol	Specification	Check
Fuel cut-off	 CN-79	24V	※ Check resistance Normal : 15~25 Ω
Beacon lamp	 CL-7	24V 70W	※ Check disconnection Normal : 1.1 Ω
Switch (One touch decel, Breaker, Horn)	 CS-5 CS-19 CS-26 CS-29	24V 6A	※Check contact Normal : ∞ Ω
Washer pump	 CN-22	24V 3.8A	※Check contact Normal : 10.7 Ω (For terminal 1-2)
Cigar lighter	 CL-2	24V 5A 1.4W	※Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞ Ω Operating time : 5~15sec
Switch (Door, Safety, Wiper cut)	 CS-1, CS-20, CS-53	24V 2W	※Check resistance Normal : About 5MΩ

Part name	Symbol	Specification	Check
Wiper motor	 CN-21	24V 2A	※Check contact Normal : 7 Ω (For terminal 2-6)
Cassette radio	 CN-27	24V 2A	※ Check voltage 20 ~ 25V (For terminal 10-14,11-14)
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : 0 Ω
Start relay	 CR-23	24V 300A	※ Check contact Normal : 0.94 Ω (For terminal 1-2)
Starter	 CN-45	Delco Remy 28MT 24V	※ Check contact Normal : 0.1 Ω
Alternator	 CN-74	24V 60A	※ Check contact Normal : 0 Ω (For terminal B ⊏1) Normal : 24 ~ 27.5V

Part name	Symbol	Specification	Check
Travel alarm	 CN-81	24V 0.5A	※ Check contact Normal : 5.2 Ω
Aircon compressor	 CN-28	24V 79W	※ Check contact Normal : 13.4 Ω
Accel dial	 CN-142	-	※ Check resistance Normal : About 5KΩ (For terminal A-C) ※ Check valtage Normal : About 5V (For terminal A-C) : 2 ~ 4.5V (For terminal C-B)
DC/DC Converter	 CN-138	12V 3A	24V(A-B) 12V(B-C)
Blower motor		24V 9.5A	※ Check resistance 2.5 Ω (For terminal 1-2)
Resistor		-	※ Check resistance 1.12 Ω (For terminal 4-2) 2.07 Ω (For terminal 2-3) 3.17 Ω (For terminal 3-1)

Part name	Symbol	Specification	Check
Duct sensor (Switch)		1°C OFF 4°C ON	※ Check resistance : 0 Ω (For terminal 1-2, the atmosphere temp : over 4°C)
Preheater relay		24V 200A	※ Check contact Normal : 0.94 Ω (For terminal 1-GND)
Preheater		24V 200A	※ Check resistance : 0.25 ~ 0.12 Ω

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

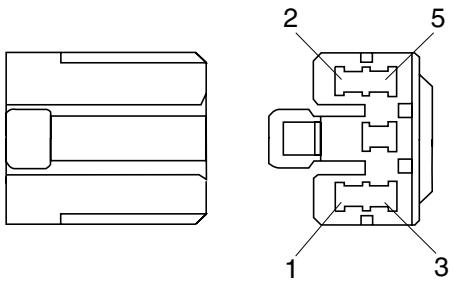
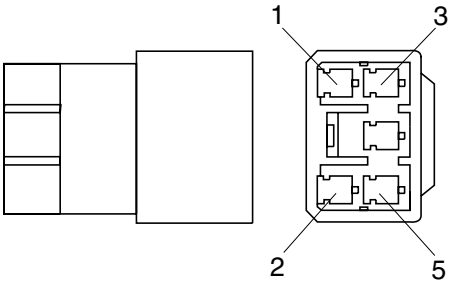
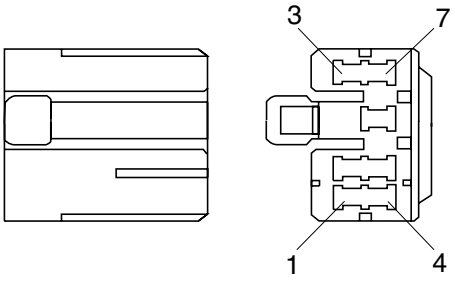
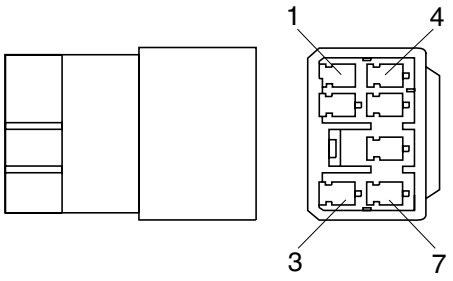
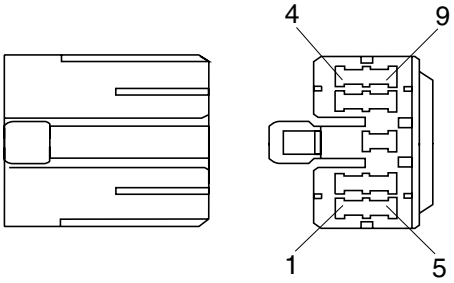
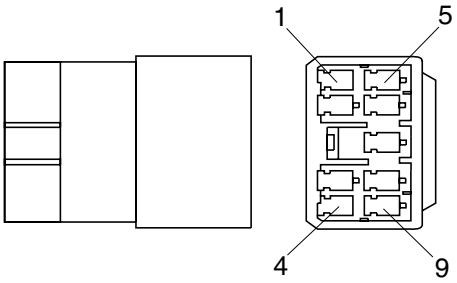
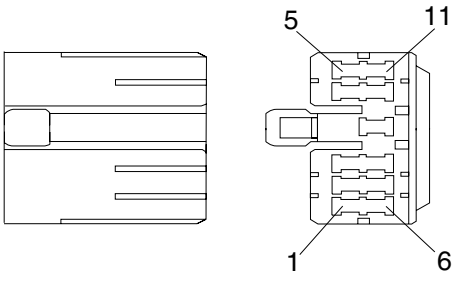
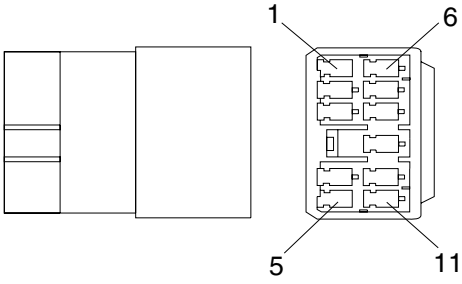
Connectorn umber	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-2	AMP	15	Engine harness	2-85262-1	368301-1
CN-4	AMP	8	LH console wire harness	S816-008002	S816-108002
CN-5	AMP	15	RH side harness	2-85262-1	368301-1
CN-6	AMP	12	RH side harness	S816-012002	S816-112002
CN-7	AMP	15	RH console wire harness	2-85262-1	368301-1
CN-8	AMP	12	RH console wire harness	S816-012002	S816-112002
CN-9	AMP	8	RH console wire harness	S816-008002	S816-108002
CN-10	DEUTSCH	12	Cab harness	DT06-12S	DT04-12P
CN-11	DEUTSCH	8	LH console wire harness	DT06-8S	-
CN-12	KET	2	Work lamp harness	MG640188-4	-
CN-17	DEUTSCH	8	Wipe harness	DT06-8S	DT04-8P
CN-20	MOLEX	2	Horn	36825-0211	-
CN-21	AMP	6	Wiper motor	925276-0	-
CN-22	-	2	Washer tank	MG640605	-
CN-23	KET	2	LH speaker	MG610070	7322-1520
CN-24	KET	2	RH speaker	MG610070	7322-1520
CN-25	MOLEX	2	Horn	36825-0211	-
CN-27	AMP	14	Cassette radio	173852	AMP14P
CN-28	-	1	Air-con comp	MWP-01F-B	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	3	Fuse box	S813-030200	S813-130200
CN-37	-	6	Fuse box	S816-006002	S816-106002
CN-38	AMP	15	Fuse box	2-85262-1	368301-1
CN-45	RING TERM	1	Starter	S820-308000	-
CN-48	-	2	Hour meter	S810-002202	-
CN-50	AMP	36	CPU	3441111-1	-
CN-51	AMP	36	CPU	3441111-1	-
CN-55	AMP	2	Travel alarm pressure switch	S816-002002	S816-102002
CN-56	DEUTSCH	4	Cluster	-	DT04-4P
CN-60	-	2	Fusible link	-	7122-4125-50
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	DT01-2P-P012
CN-66	DEUTSCH	2	Breaker solenoid valve	DT06-2S-EP06	DT04-2P-E005
CN-68	DEUTSCH	2	Safety solenoid valve	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel speed solenoid valve	DT06-2S-EP06	-
CN-74	KET	2	Alternator	MG640188-4	-
CN-76	DEUTSCH	6	Accel actuator	DT06-6S-EP06	-
CN-79	RING TERM	1	Fuel cut-off solenoid	S813-060300	-
CN-81	DEUTSCH	2	Travel buzzer	DT06-2S-EP06	DP04-2P-E005

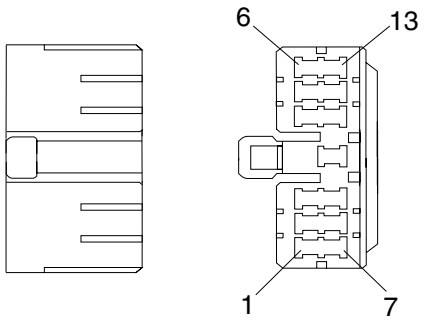
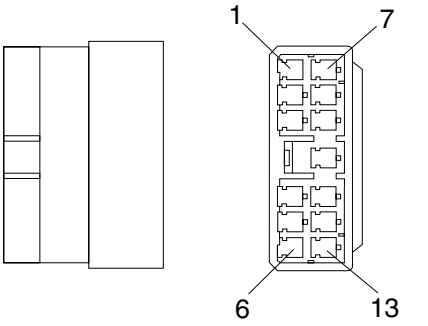
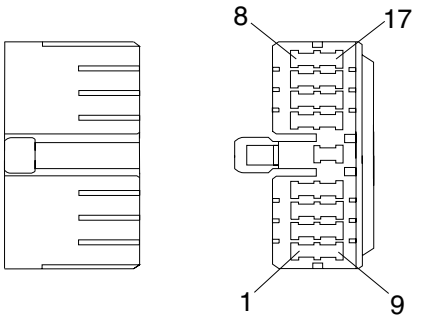
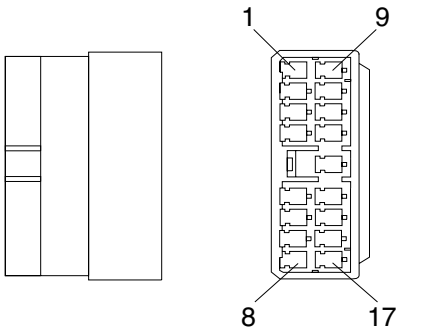
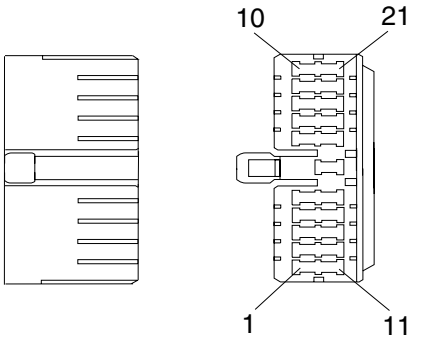
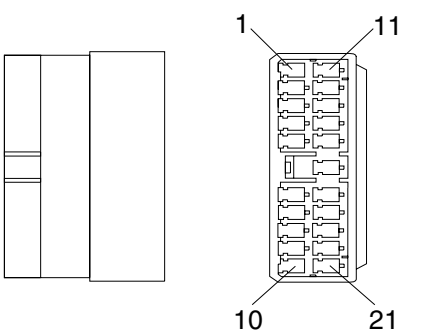
Connectorn umber	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-83	KET	4	AC Fan	MG651092	-
CN-92	AMP	1	Safety	S814-101100	S814-001100
CN-95	KET	2	Fusible link	-	S813-130200
CN-125	-	4	GPS	S816-004002	S816-104002
CN-126	DEUTSCH	4	RS232C connector	DT06-4S-P012	DT04-4P-E004
CN-138	DEUTSCH	3	DC/DC converter	DT06-3S	DT04-3P
CN-139	DEUTSCH	2	12V Socket	-	DT04-2P
CN-140	DEUTSCH	2	Quick coupling	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor control unit	172498-1	-
CN-142	DEUTSCH	3	Accel dial	DT06-3S	-
CN-143	KET	14	Cassette radio	MG610406	-
CN-144	AMP	12	Remocon	174045-2	-
CN-145	-	2	Fuel feed pump	7123-6423-30	-
RELAY					
CR-1	RING TERM	1	Battery relay	S820-104002	-
CR-3	-	4	Work lamp relay	S820-104000	-
CR-23	-	2	Start relay	S820-104000	-
CR-24	-	1	Pre-heater relay	S822-014000	-
CR-43	-	4	Engine stop relay	S810-004202	-
SWITCH					
CS-1	CB104	1	Door switch	S822-014004	-
CS-2	-	6	Start key switch	S814-006000	-
CS-4	DEUTSCH	6	Safety switch	DT06-3S	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P
CS-19	DEUTSCH	2	One touch decel	DT06-2S	DT04-2P
CS-20	AMP	1	Safety switch	S822-014002	-
CS-21	SWF	10	Main light switch	SWF593757	-
CS-23	SWF	10	Beacon lamp switch	SWF593757	-
CS-24	SWF	10	Overload switch	SWF593757	-
CS-26	DEUTSCH	2	Breaker switch	SWF593757	-
CS-27	SWF	10	Breaker switch	SWF593757	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-54	SWF	10	Travel alarm	SWF593757	-
CS-67	SWF	10	Quick coupling switch	SWF593757	-
LAMP					
CL-1	KET	2	Cab room lamp	MG610392	-
CL-2	-	1	Cigar light	S822-014002	-
CL-4	DEUTSCH	2	Head lamp	-	DT04-2P-E005
CL-5	DEUTSCH	2	Work lamp-LH	-	DT04-2P
CL-6	DEUTSCH	2	Work lamp-RH	-	DT04-2P
CL-7	CB104	1	Beacon lamp	S822-014004	-

Connectorn umber	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CL-8	DEUTSCH	2	LH cabin light	-	DT04-2P
CL-9	DEUTSCH	2	RH cabin light	-	DT04-2P
SENDER					
CD-1	AMP	2	Hydraulic Temp sender	963040-3	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-8	-	2	Water temp sender	85202-1	-
CD-10	RING TERM	1	Air cleaner switch	S820-104002	-
CD-11	AMP	2	Travel alarm pressure switch	S816-102002	-
CD-12	AMP	2	Travel alarm pressure switch	S816-102002	-
CD-13	AMP	2	Travel alarm pressure switch	S816-102002	-
CD-14	AMP	2	Travel alarm pressure switch	S816-102002	-
CD-16	-	2	Water level	S814-002100	-
CD-17	-	2	Tacho sensor	S814-002001	-
CD-18	RING TERM	1	Engine oil pressure switch	S819-010122	-
CD-31	DEUTSCH	2	Overload pressure switch	DT06-2S-EP06	-

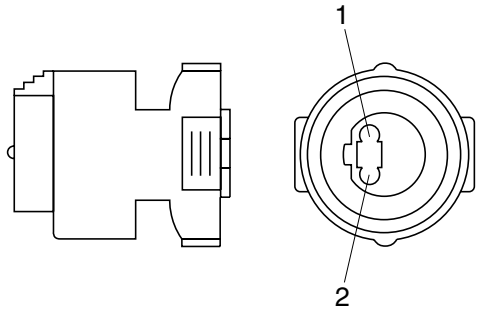
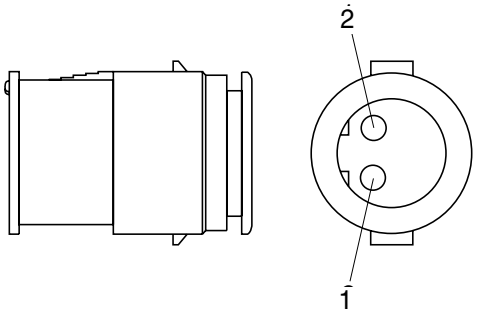
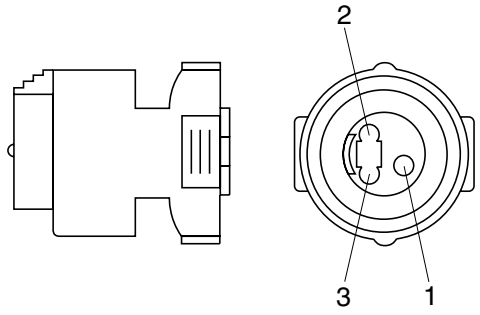
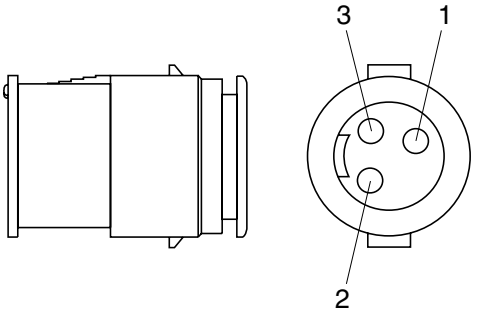
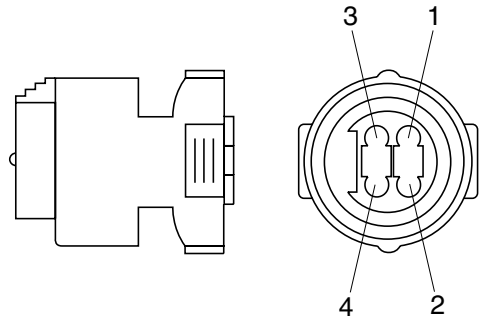
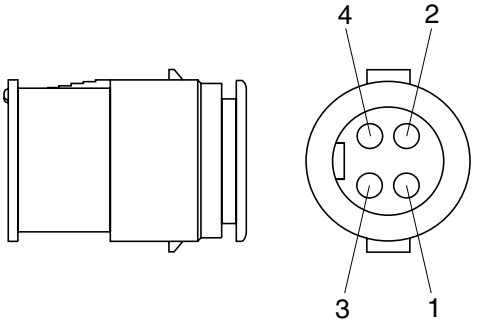
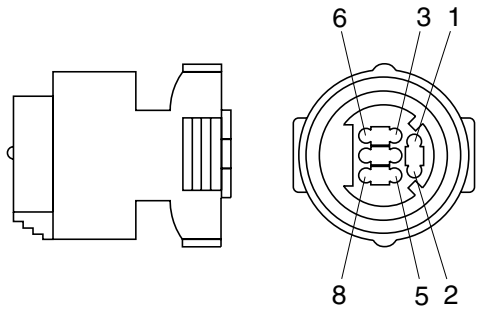
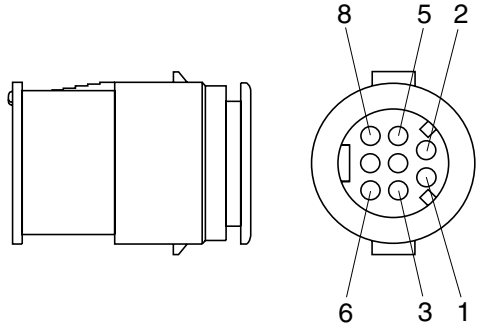
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

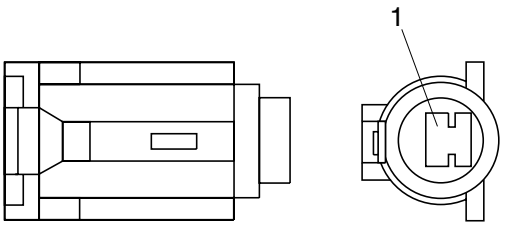
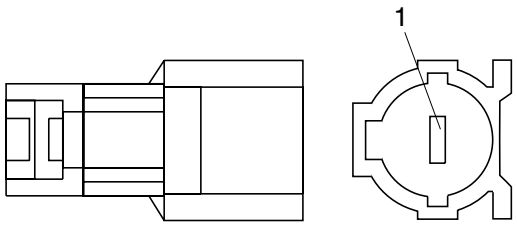
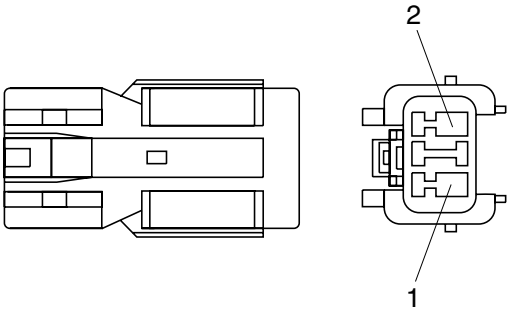
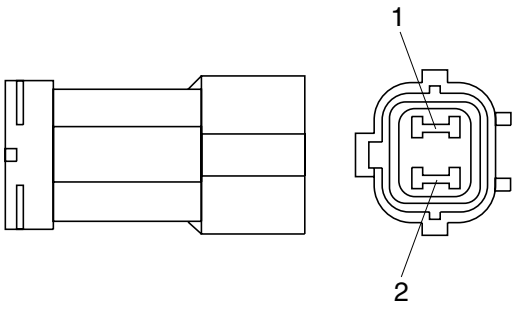
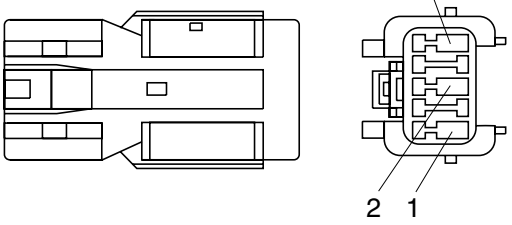
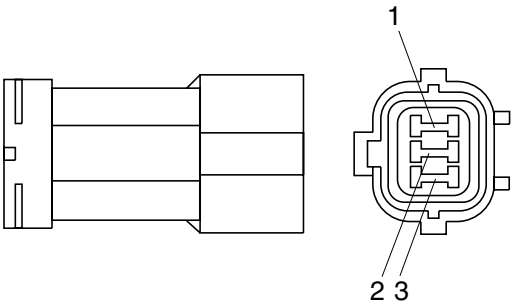
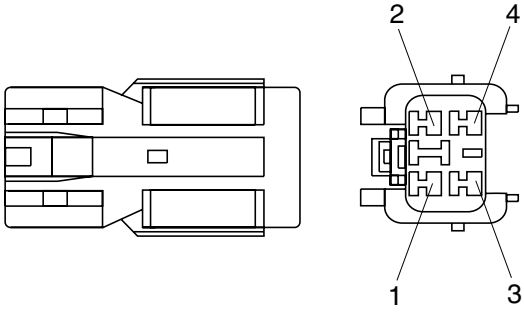
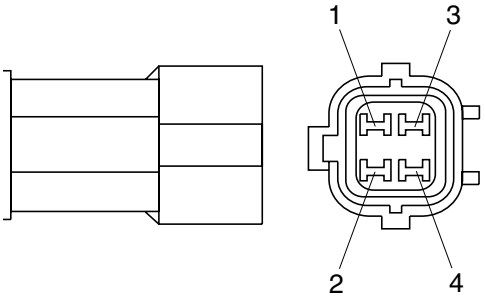
No. of pin	Receptacle connector(Female)	Plug connector(Male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

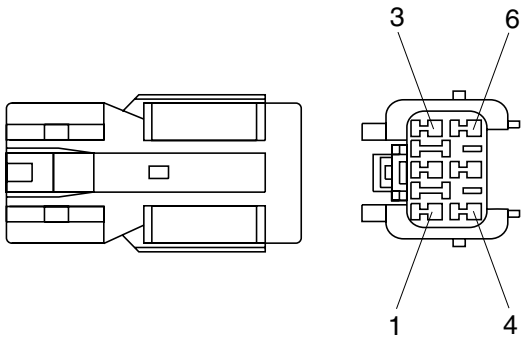
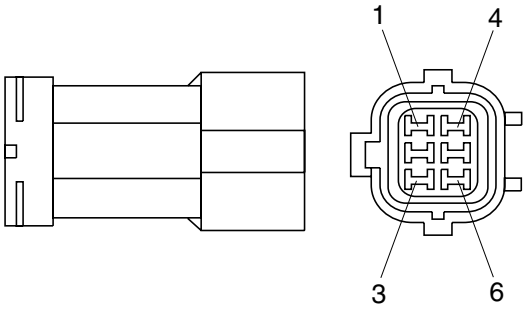
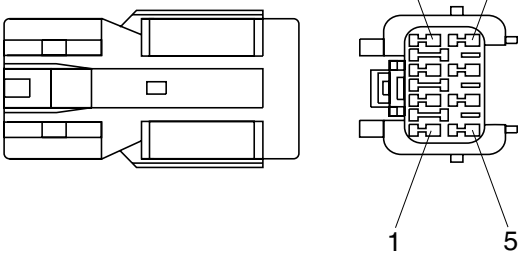
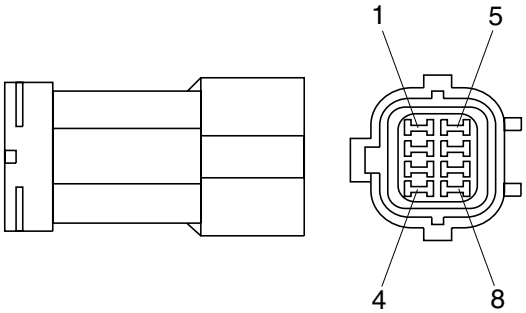
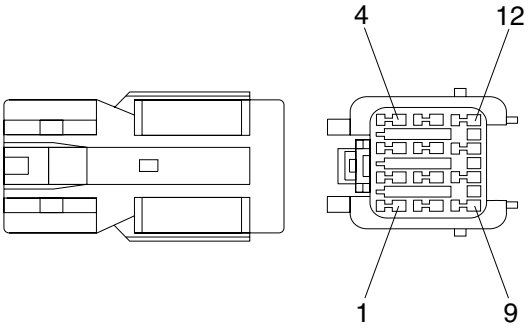
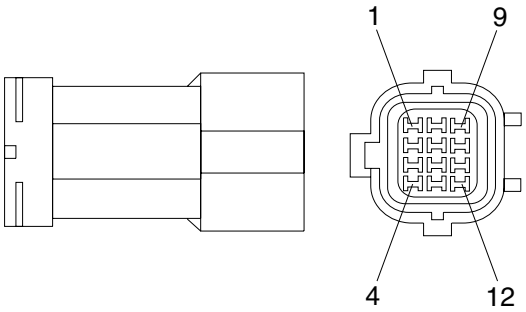
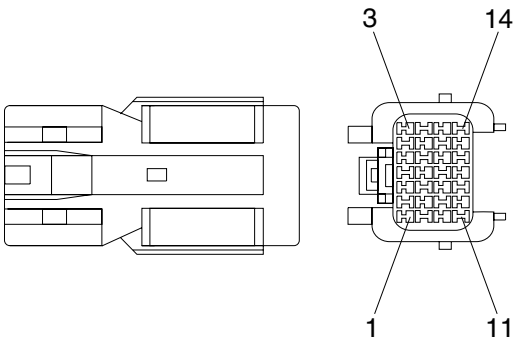
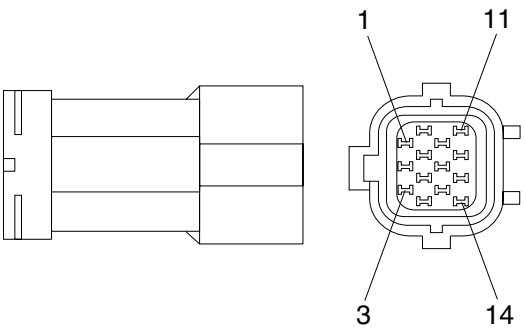
No. of pin	Receptacle connector(Female)	Plug connector(Male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

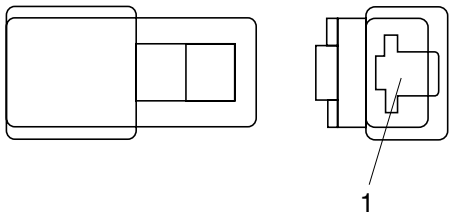
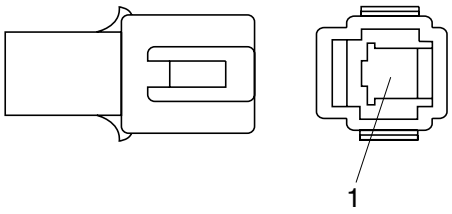
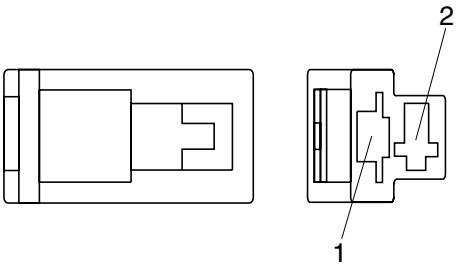
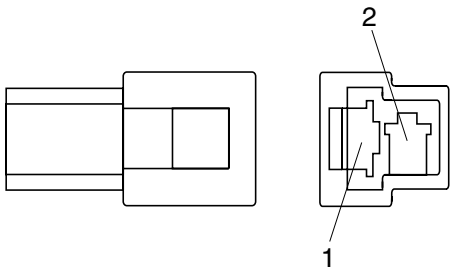
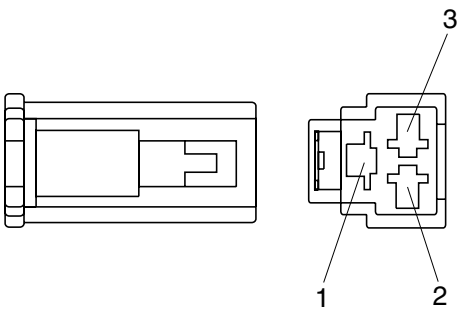
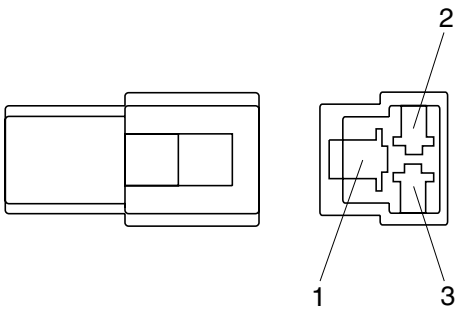
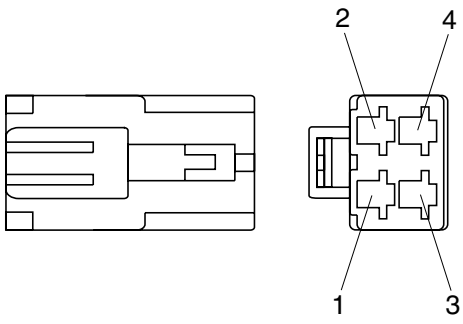
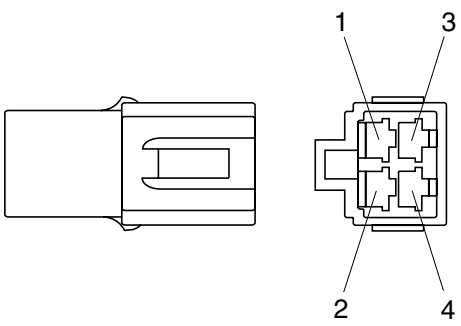
No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

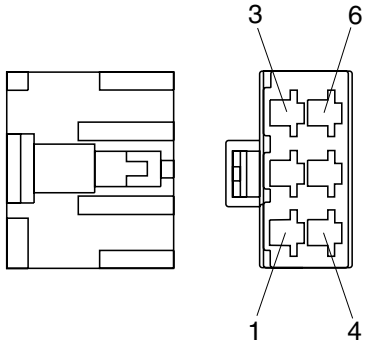
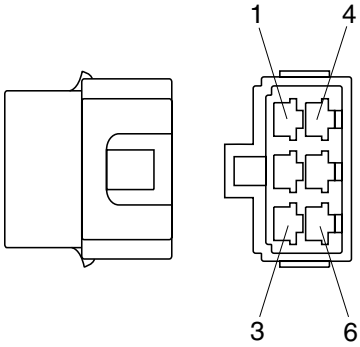
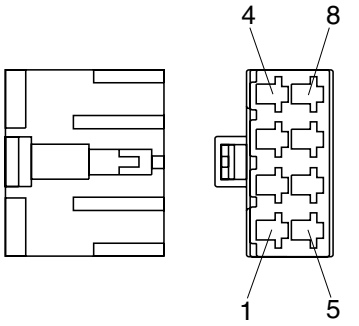
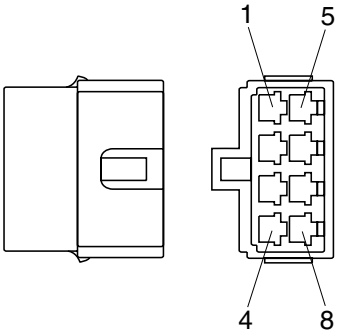
3) SWP TYPE CONNECTOR

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

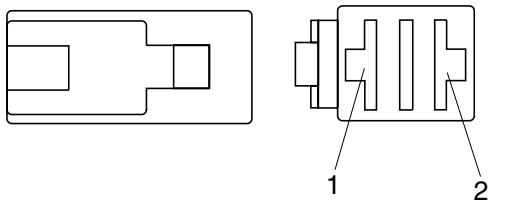
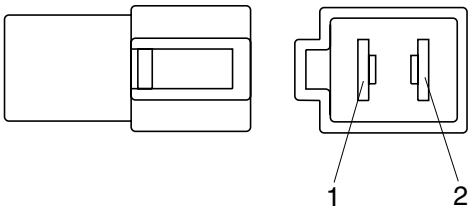
No. of pin	Receptacle connector(Female)	Plug connector(Male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

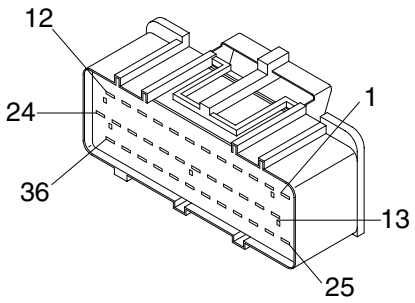
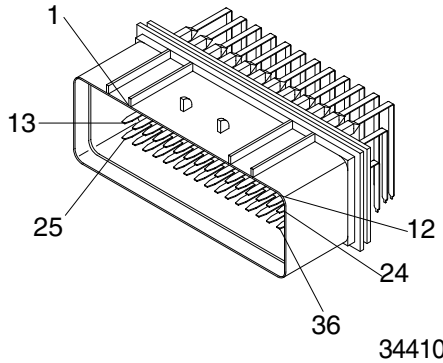
No. of pin	Receptacle connector(Female)	Plug connector(Male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

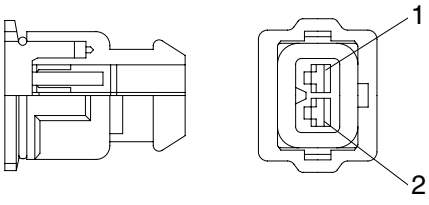
5) 375 FASTEN TYPE CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 S810-002402	 S810-102402

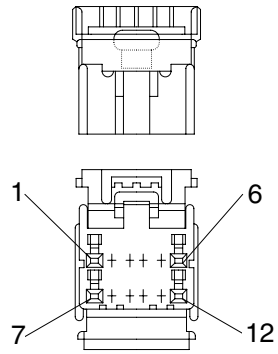
6) AMP ECONOSEAL CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
36	 344111-1	 344108-1

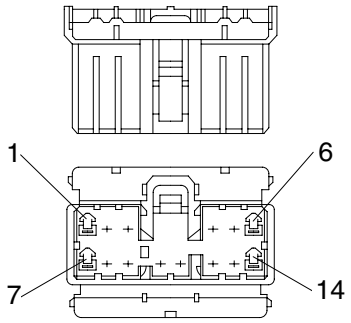
7) AMP TIMER CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 85202-1	

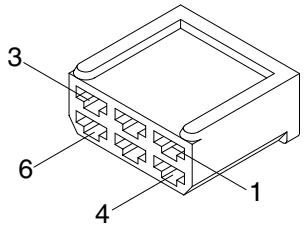
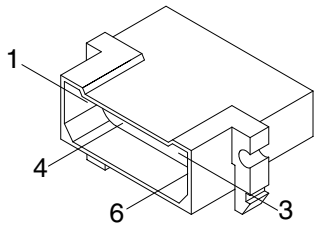
8) AMP 040 MULTILOCK CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
12	 174045-2	

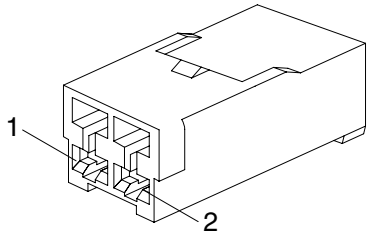
9) AMP 070 MULTILOCK CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
14	 173852	

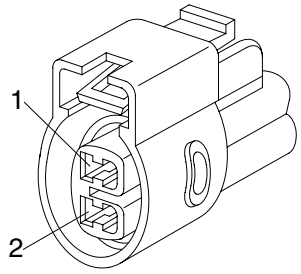
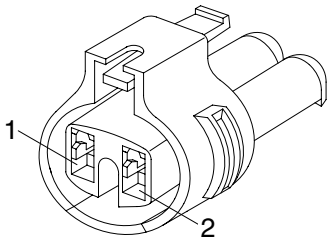
10) AMP FASTIN - FASTON CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
6	 925276-0	 480003-9

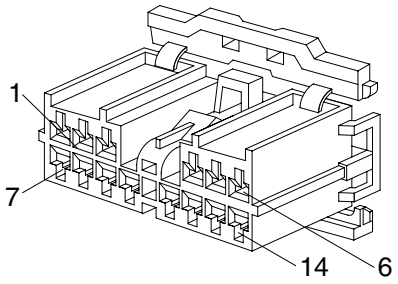
11) KET 090 CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 MG610070	

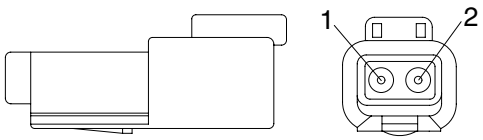
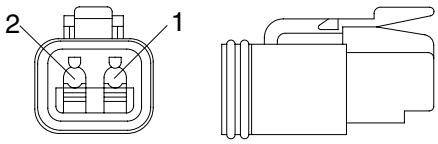
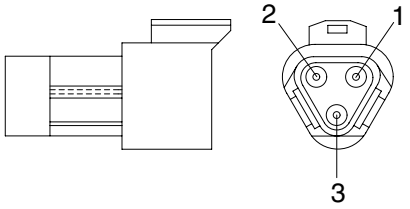
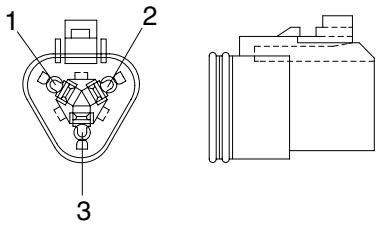
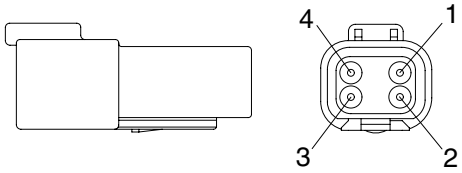
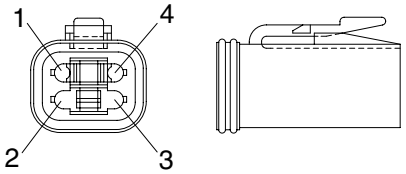
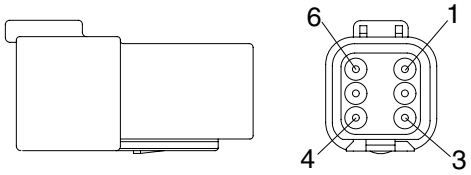
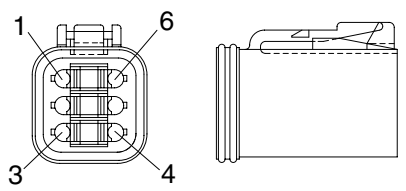
12) KET 090 WP CONNECTORS

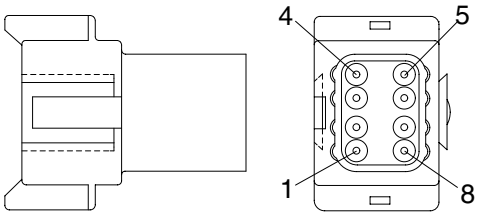
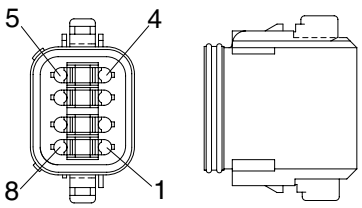
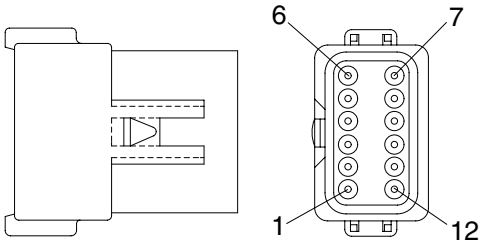
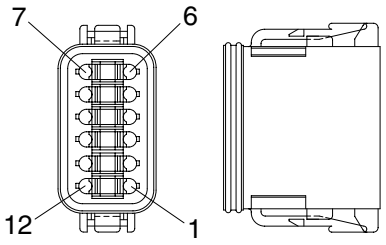
No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 MG640605	
2	 MG640795	

12) KET SDL CONNECTOR

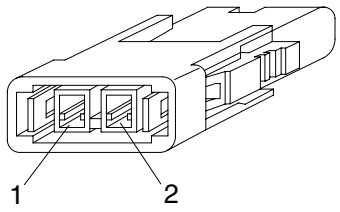
No. of pin	Receptacle connector(Female)	Plug connector(Male)
14	 MG610406	

13) DEUTSCH DT CONNECTORS

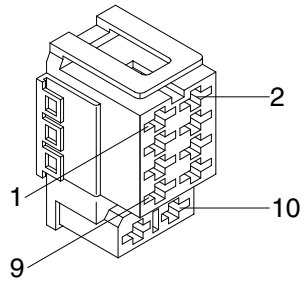
No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 DT06-2S	 DT06-2P
3	 DT06-3S	 DT06-3P
4	 DT06-4S	 DT06-4P
6	 DT06-6S	 DT06-6P

No. of pin	Receptacle connector(Female)	Plug connector(Male)
8	 DT06-8S	 DT06-8P
12	 DT06-12S	 DT06-12P

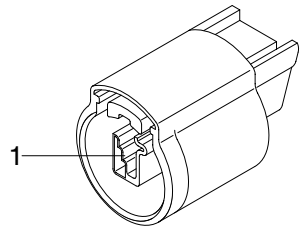
14) MOLEX 2CKTS CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 35215-0200	

15) ITT SWF CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
10	 SWF593757	

16) MWP NMWP CONNECTOR

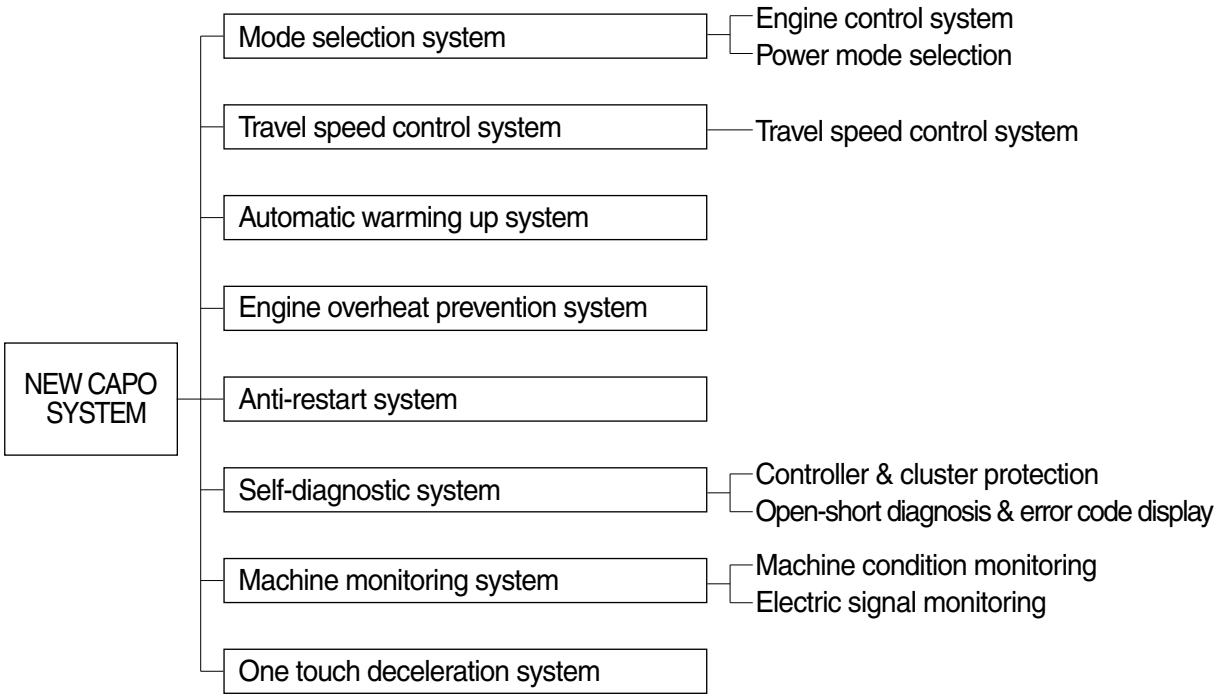
No. of pin	Receptacle connector(Female)	Plug connector(Male)
1	 NMWP01F-B	

SECTION 5 MECHATRONICS SYSTEM

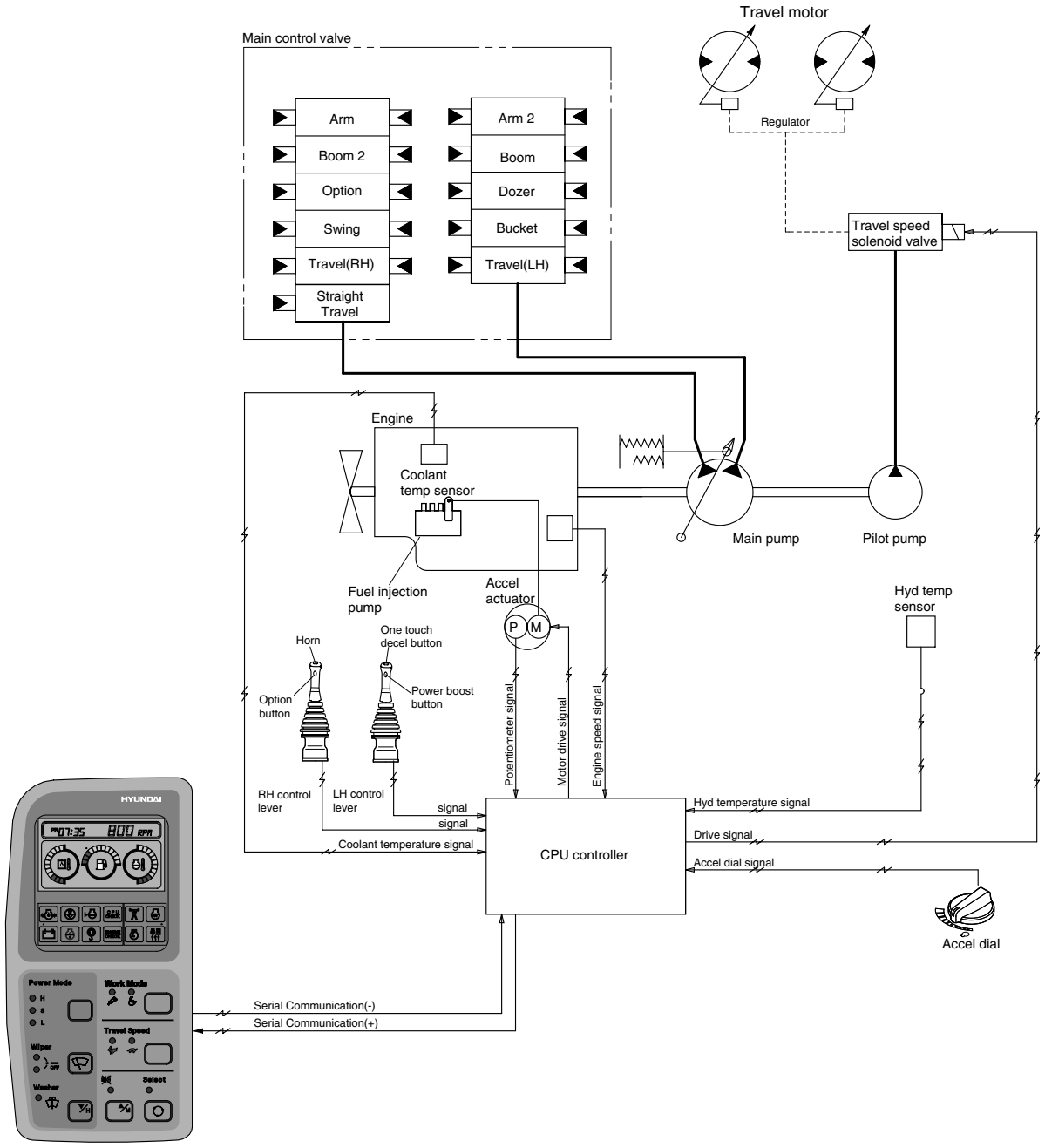
SECTION 5 MECHATRONICS SYSTEM

GROUP 1 OUTLINE

The NEW CAPO(Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, one touch deceleration etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc.
It consists of a CPU controller, a cluster, an accel actuator, and other components. The CPU controller, and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.



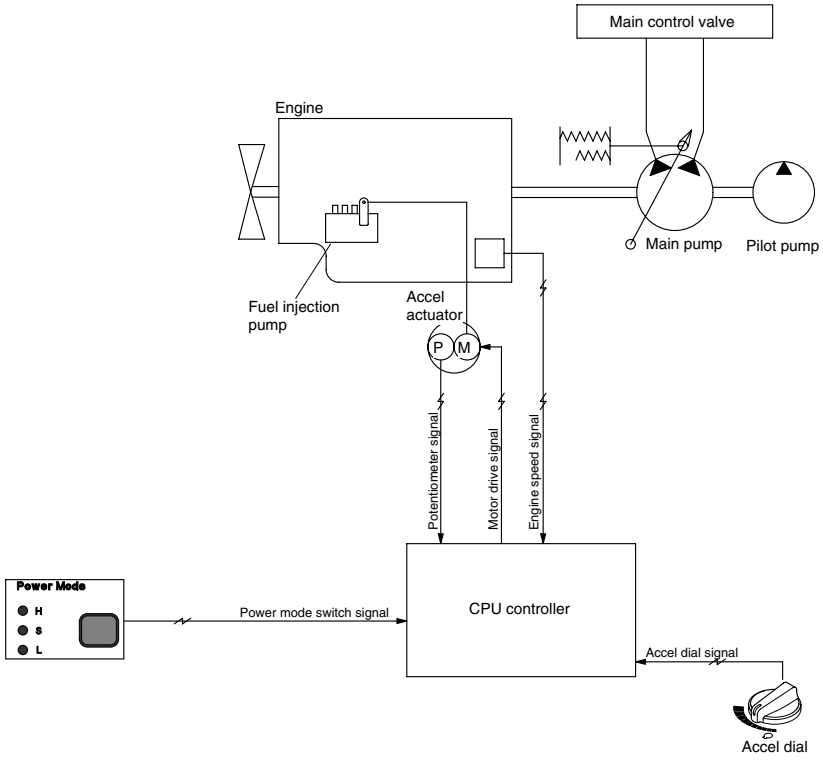
SYSTEM DIAGRAM



RD8075MS01

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



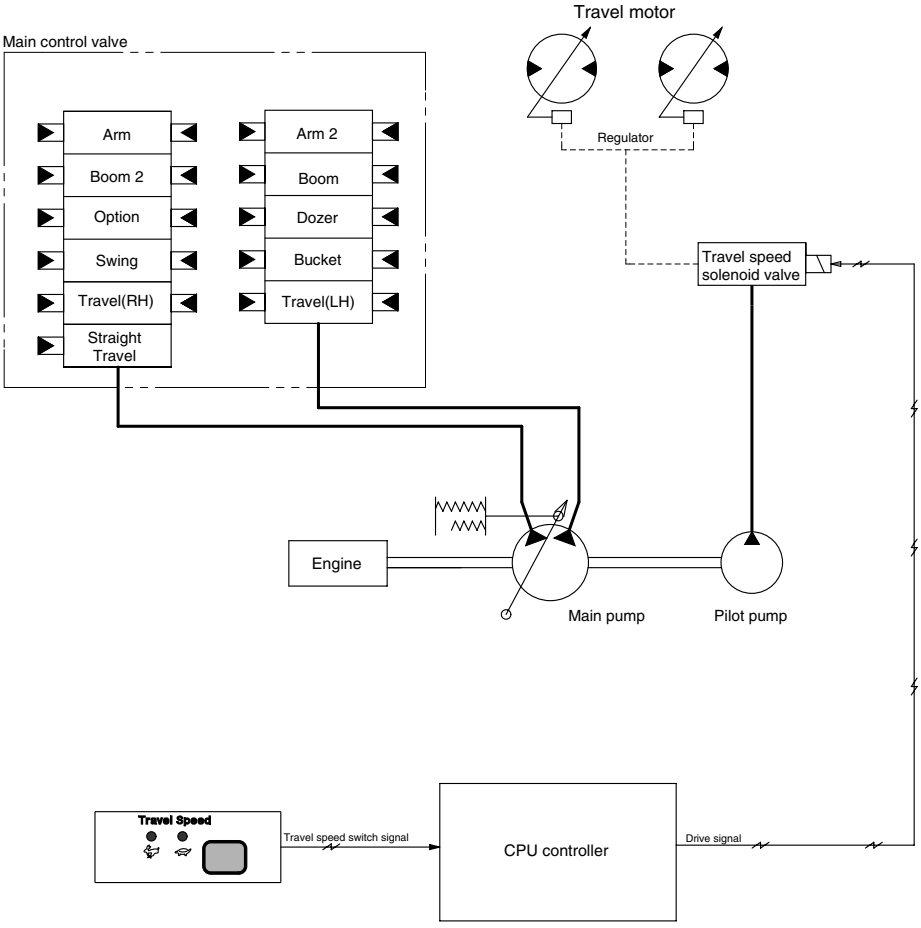
7075MS02

Mode selection system(Micro computer based engine mutual control system) optimizes the engine performance.

The combination of 3 power modes(H, S, L) and accel dial position(10 set) makes it possible to use the engine power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

Mode	Application	Power set (%)	Engine rpm
H	High power	100	2050±50
S	Standard power	85	1850±50
L	Light power	70	1750±50
One touch decel	Engine quick deceleration	-	1000±100
KEY START	Key switch start position	-	1000±100

GROUP 3 TRAVEL SPEED CONTROL SYSTEM



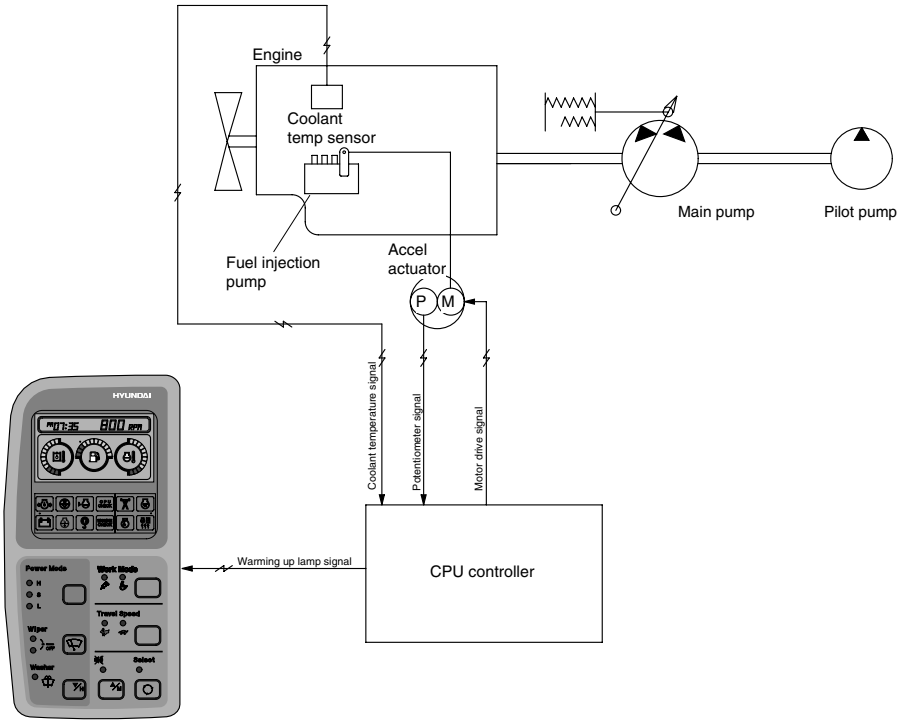
7075MS04

Travel speed can be switched manually by pressing the travel speed switch on the cluster.

Speed	Travel speed solenoid valve	Lamp on cluster	Operation
Lo	OFF	Turtle	Low speed, high driving torque in the travel motor
Hi	ON	Rabbit	High speed, low driving torque in the travel motor

※ Default : Turtle(Lo)

GROUP 4 AUTOMATIC WARMING UP FUNCTION



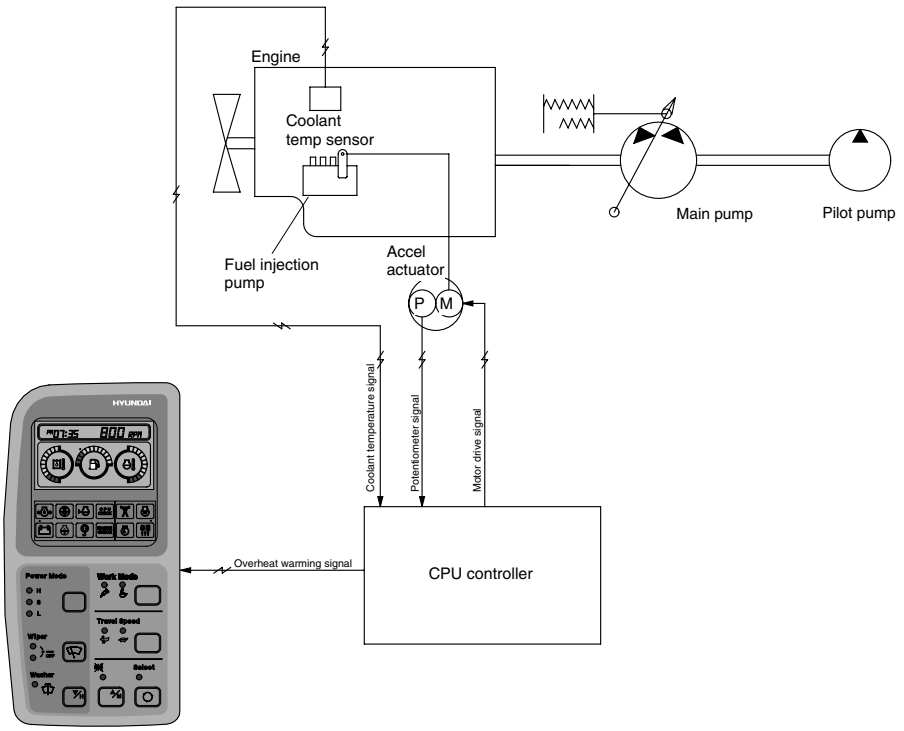
RD8075MS05

1. CPU controller reads engine coolant temperature through the temperature sensor, and if the coolant temperature is less than 30°C, it increases the engine speed from key start rpm to 1200rpm.
2. In case of the coolant temperature increases up to 30°C, the engine speed is decreased to key start speed. And if an operator changes mode set during the warming up function, the CPU controller cancels the automatic warming up function.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : Less than 30°C(After engine run) - Accel dial position is under **3**	- Mode : Default(**S** mode) - Warming up time : 10 minutes(Max) - Warming up lamp : ON
Canceled	- Coolant temperature : Above 30°C - Warming up time : Above 10 minutes - Changed mode set by operator - Increase engine speed by rotating accel dial clockwise ※ If any of the above conditions is applicable, the automatic warming up function is canceled	- Default mode - Default mode - Changed mode
Warming up lamp	- Coolant temperature : Above 30°C	- Warming up lamp : OFF

GROUP 5 ENGINE OVERHEAT PREVENTION FUNCTION



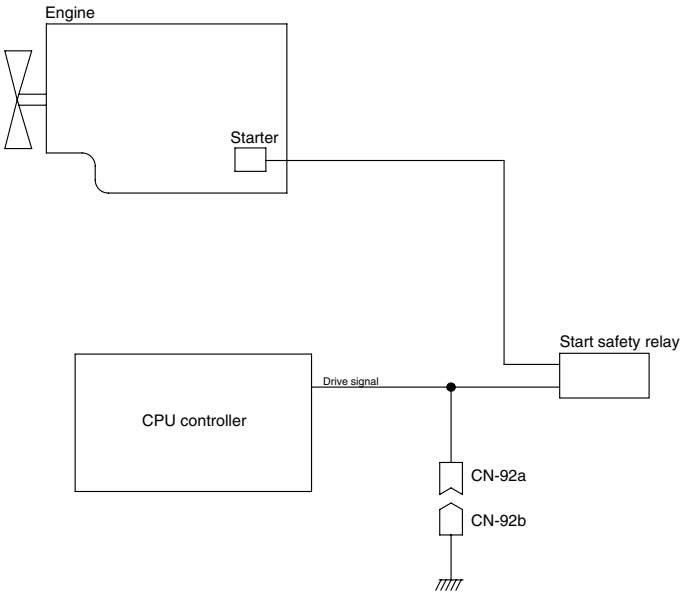
RD8075MS06

1. CPU controller reads engine coolant temperature through the temperature sensor and when the engine coolant boils up to 110℃, it sends overheat warning signal to the cluster and decrease the engine speed same as accel dial **7** position.
2. If the coolant temperature drops less than 100℃, the CPU controller returns the mode to the mode set before. And if mode set is changed during the function, the CPU controller cancels the function. Even if the overheat prevention function is canceled by mode change, the overheat warning lamp turns OFF only when the coolant temperature is less than 100℃.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : Above 110℃ - Accel dial set : Above **8**	- Engine rpm drop to accel dial 7 position - Overheat warning lamp & buzzer : ON
Canceled	- Coolant temperature : Less than 100℃ - Changed mode set by operator ※ If any of the above conditions is applicable, engine overheat prevention function is canceled	- Return to the mode and accel dial set before - Hold on the changed set
Overheat warning lamp	- Coolant temperature : Less than 100℃	- Overheat warning lamp : OFF

GROUP 6 ANTI-RESTART SYSTEM



21075MS10

1. ANTI-RESTART FUNCTION

After 10 seconds from the engine starts to run, CPU controller turns off the start safety relay to protect the starter from inadvertent restarting.

2. When a replacement or taking-off of the CPU controller is needed, connect CN-92a and CN-92b to ensure the engine start without the CPU controller.

GROUP 7 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

When any abnormality occurs in the NEW CAPO system caused by electric parts malfunction and by open or short circuit, the CPU controller diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

The current or recorded error codes are displayed at the error display mode selected by touching **SELECT** switch 2 times while pressing **BUZZER STOP** switch.

2. CURRENT ERROR DISPLAY

Cluster displays **Co : Err** and makes buzzer sound itself to warn the communication error when communication problem caused by wire-cut or malfunction of the CPU controller occurs.

Cluster displays real time error codes received from CPU controller through communication. In case of no problem it displays **CHECK Er : 00**.

If there are more than 2 error codes, each one can be displayed by pressing ▲ and ▼ switch respectively.

Examples :

1) Communication Error

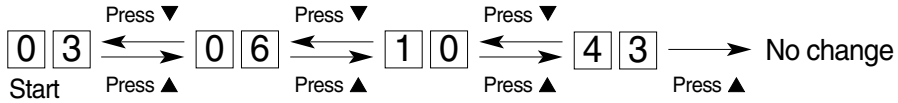
Co : Err & Buzzer sound

2) No problem

CHECK Er : 0 0

3) 4 Error codes(03, 06, 10, 43) display

CHECK Er : 0 3

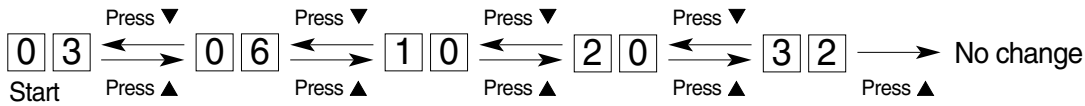


3. RECORDED ERROR DISPLAY

The recorded error can be displayed only when the key switch is at ON position.

Examples : 5 Recorded error codes(03, 06, 10, 20, 32) display

TIME Er : 0 3



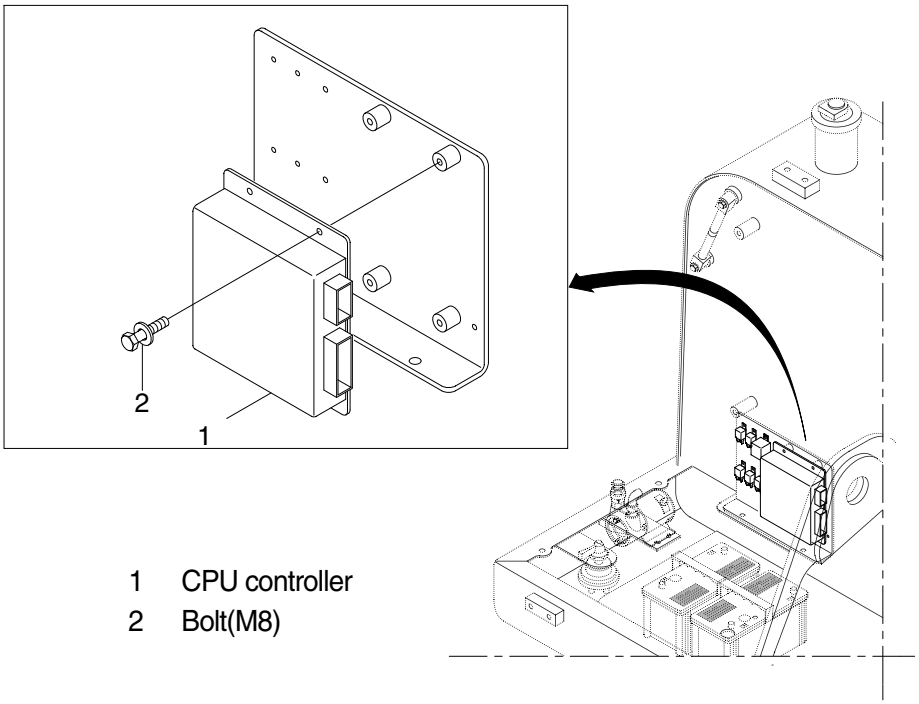
4. DELETE ALL RECORDED ERROR CODES

Select recorded error(**TIME Er**) display and press engine and select switch at the same time for 2 seconds or more. Cluster display changes to **TIME Er : 00**, which shows that CPU controller deleted all the recorded error codes in the memory.

5. ERROR CODES TABLE

Fault code No.	Description
00	No error
01	Short circuit in accel actuator motor system
02	Potentiometer circuit is shorted to Vcc(5V) or battery +
05	Short circuit in travel speed solenoid system
10	Short circuit in hour-meter system
11	Accel dial circuit is shorted to Vcc(5V) or battery +
16	Accel actuator motor circuit is open or shorted to ground
17	Potentiometer circuit is open or shorted to ground
20	Travel speed solenoid circuit is open or shorted to ground
25	Hour-meter circuit is open or shorted to ground
26	Accel dial circuit is open or shorted to ground
31	Engine preheater circuit is open or shorted to ground
33	Alternator circuit is open or shorted to ground
34	Actuator input voltage is below 18V
35	Actuator input voltage is over 38V
36	Communication error with cluster
37	Engine speed sensor circuit is open or shorted to ground
41	Hydraulic oil temperature sensor circuit is shorted to ground
42	Fuel level sensor circuit is shorted to ground
43	Coolant temperature sensor circuit is shorted to ground
45	Hydraulic oil temperature sensor circuit is open or shorted to battery +
46	Fuel level sensor circuit is open or shorted to battery +
47	Coolant temperature sensor circuit is open or shorted to battery +
49	Engine preheater circuit is shorted to battery +

1. CPU CONTROLLER MOUNTING



1 CPU controller
2 Bolt(M8)

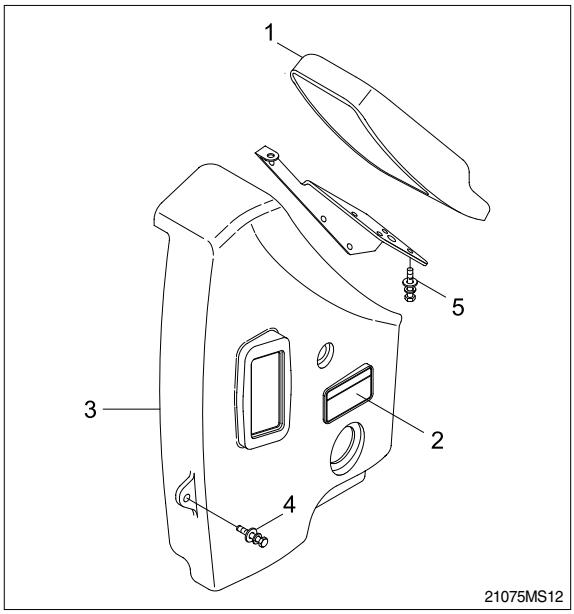
7075MS12

2. CPU CONTROLLER ASSEMBLY

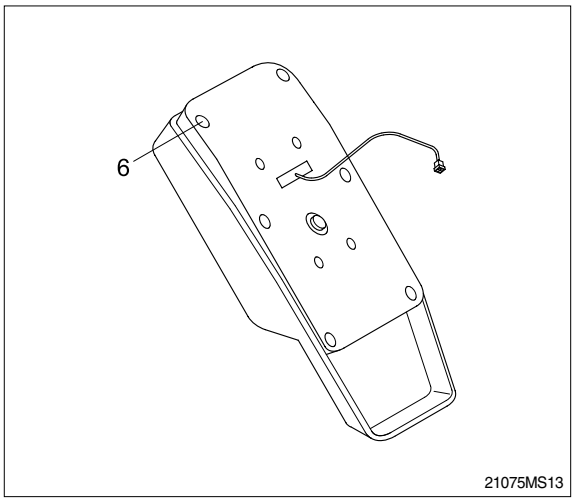
1) Disconnect 2 connectors from CPU controller.
2) Remove four pieces of bolt(2).
3) Remove 6 pieces of screw and open the cover of CPU controller.
4) Inspection : Check PCB(Printed Circuit Board)
   (1) If any damage is found, replace CPU controller assembly.
   (2) If not, but CAPO system does not work please report it to HHI dealer or A/S department.

3. EXCHANGE METHOD OF THE ROM

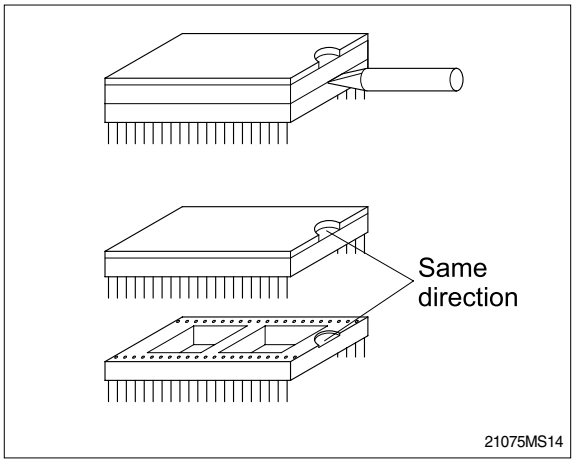
1) Disassemble the ash tray(2).
2) Disassemble the wiper motor cover(3).
3) Disassemble the cluster(1).



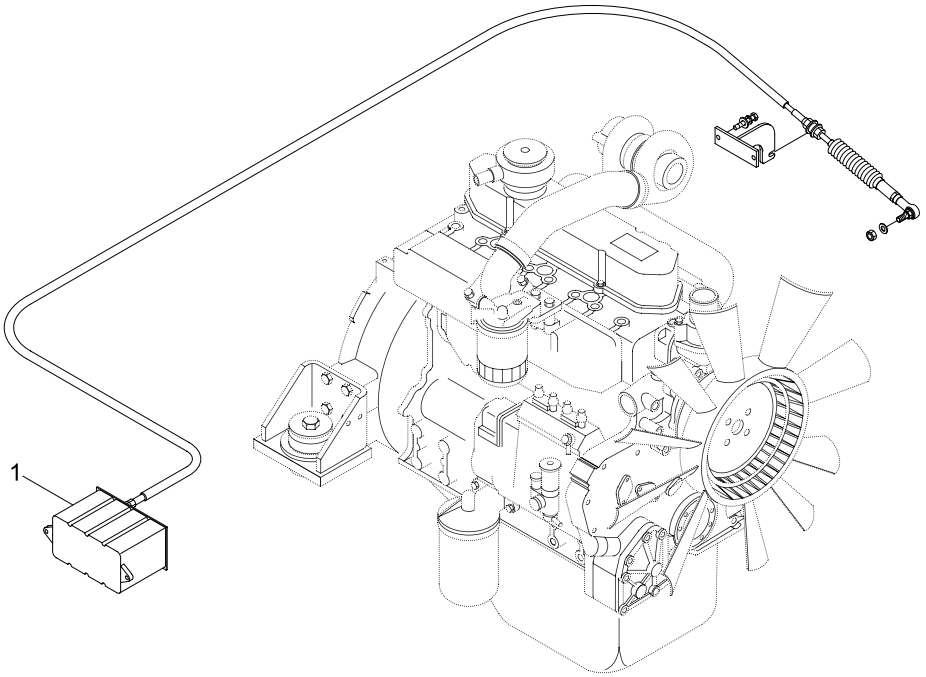
4) Loosen the screws(6EA) located back of the cluster.
5) Then you can open the upper case of the cluster easily.



6) Install the new ROM.(Be careful of direction and assmelbe the cluster in the reverse order to removal).



4. ENGINE ACCEL ACTUATOR

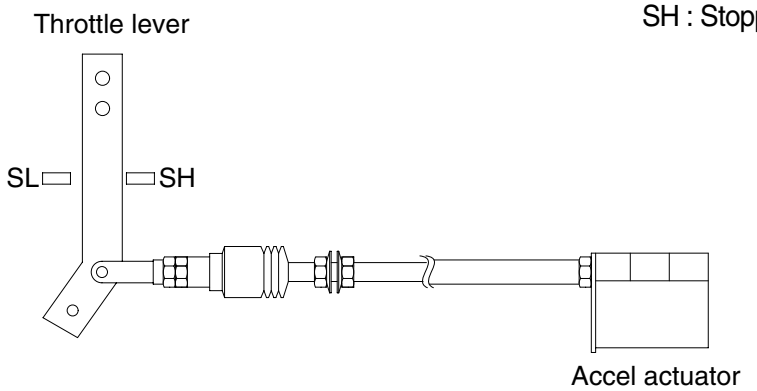


1 Accel actuator

RD8075MS07

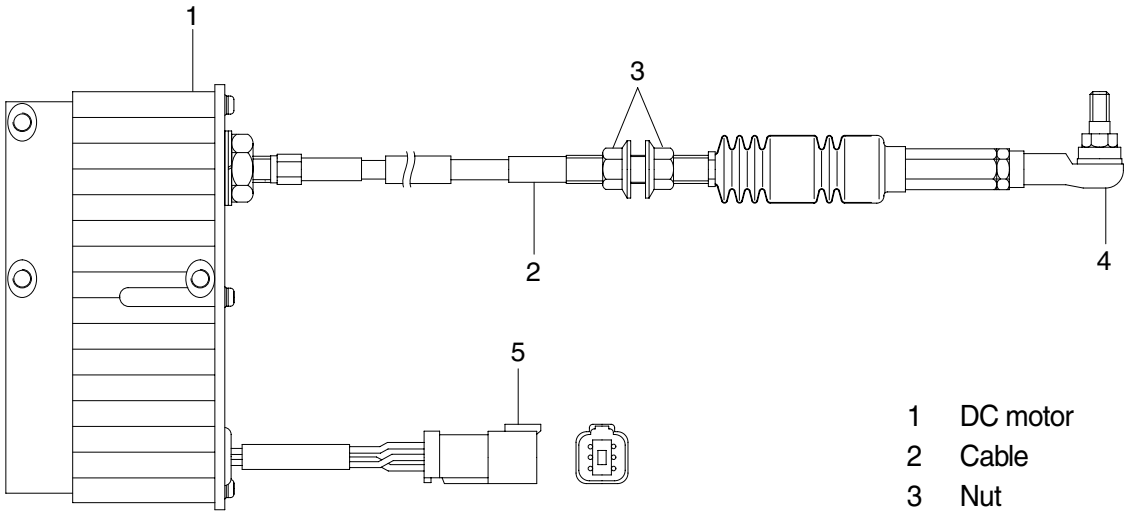
1) ENGINE THROTTLE LEVER

SL : Stopper, low idle
SH : Stopper, high idle



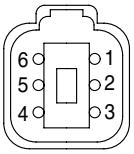
11075MS08

2) ACCEL ACTUATOR



1 DC motor
2 Cable
3 Nut
4 Ball joint
5 Connector

RD8075MS09

Connector		
Type		6P, female
Line color & description	1	White(Potentiometer 5V)
	2	Blue(Potentiometer SIG)
	3	Black(Potentiometer GND)
	4	-
	5	Green(Motor+)
	6	Yellow(Motor -)
Inspection		Check resistance Spec : 1~2 Ω (Between No.5-6) 0.8~1.2kΩ (Between No.1-3)

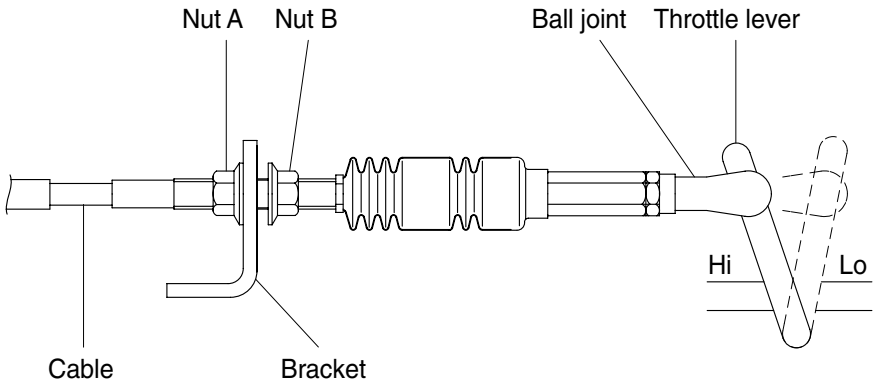
3) ACCEL ACTUATOR CABLE SETTING PROCEDURE

(1) Key ON

① Set the engine control dial max position and the one touch decel switch OFF.
② Connect the ball joint of cable to engine throttle lever.
③ Pull the cable to high stopper and put nut **A** edge to yoke of the bracket.
※ Make throttle lever not contact to the edge of high stopper.

(2) Key START

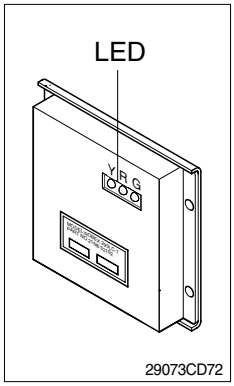
④ Confirm if the engine speed on cluster is same as each mode specification.
⑤ If the engine speed displayed on cluster is highter than each mode specification, then turn the nut
⑥ **A** to counter clockwise and make the engine speed same to each mode specification.
If the engine speed displayed on cluster is lower than each mode specification, then turn the nut
⑦ **A** to clockwise and make the engine speed same to each mode specification.
Turn nut **B** to clockwise and fix the cable to bracket.



130W5MS05

Mode	RPM
H	2050±50
S	1850±50
L	1750±50
Key start(one touch decel)	1000±100

5. CPU CONTROLLER



(1) To match the engine torque with the pump absorption torque, CPU controller varies EPPR valve output pressure, which control pump discharge amount whenever feedbacked engine speed drops under the reference rpm of each mode set.

(2) Three LED lamps on the CPU controller display as below.

LED lamp	Trouble	Service
G is turned ON	Normal	-
R is turned ON	Trouble on CPU	· Change the controller
G and Y are turned ON	Trouble on serial communication line	· Check if serial communication lines between controller and cluster are disconnected
Three LED are turned OFF	Trouble on CPU controller power	· Check if the input power wire (24V, GND) of controller is disconnected · Check the fuse

G : green, R : red, Y : yellow

GROUP 9 MONITORING SYSTEM

1. OUTLINE

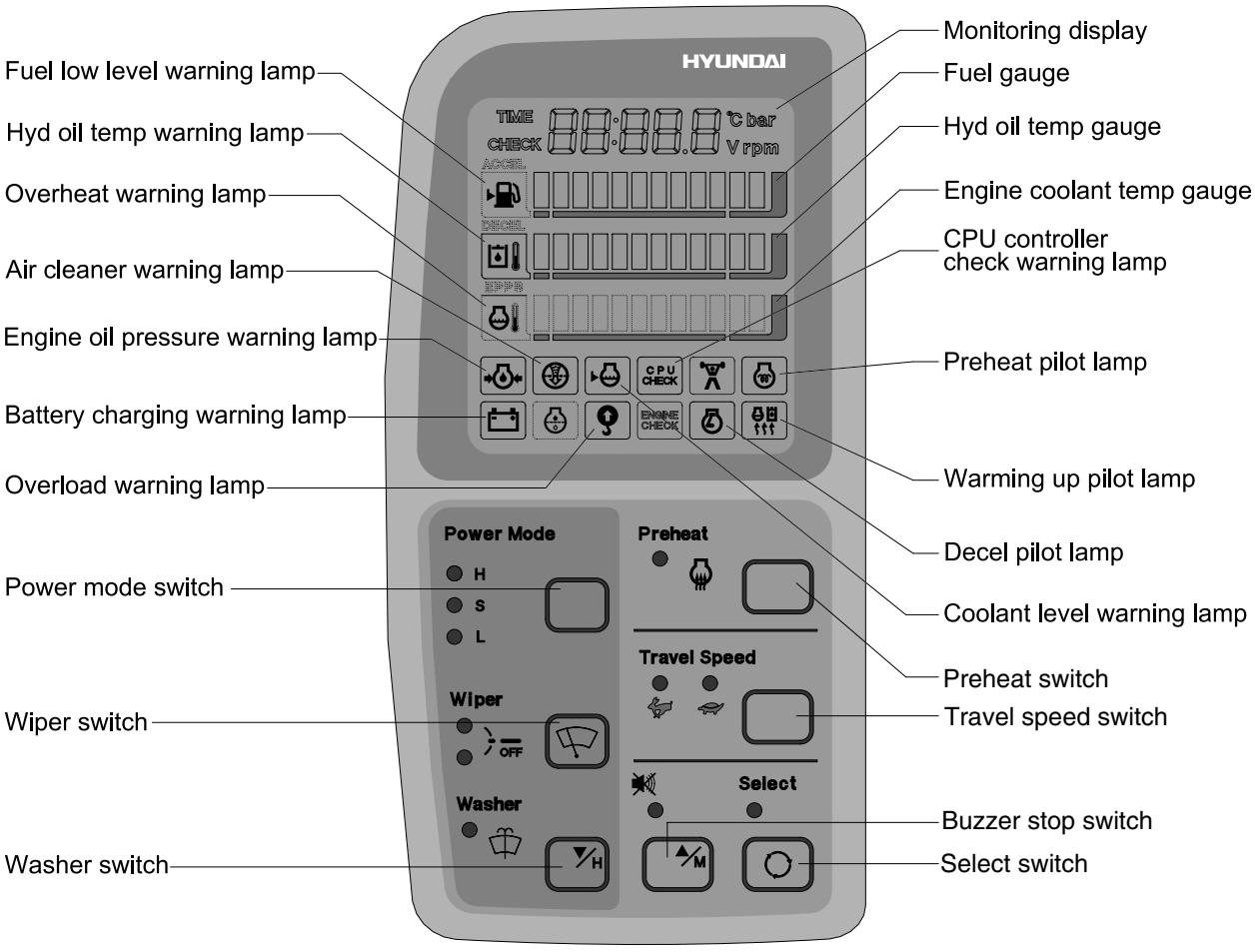
Monitoring system consists of the monitor part and switch part.

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



7075MS11

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor initial 5 seconds

a. All lamps light up.
b. Buzzer sound.

② Check monitor after 5 seconds : Indicate cluster version and machine condition

a. Cluster program version : CL : 2.0 ← Indicates program version 2.0 for 2 seconds.
b. Tachometer : 0rpm
c. Fuel gauge : All light up below appropriate level
d. Hydraulic temperature : All light up below appropriate level
e. Engine coolant temperature gauge : All light up below appropriate level
f. 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.

③ Indicating lamp state

a. Power mode selection : S mode
b. Preheat : No LED ON
c. Wiper : No LED ON
d. Washer : No LED ON
e. Travel speed pilot lamp : Low(Turtle)

(2) Start of engine

① Check machine condition

a. Tachometer indicates at present rpm
b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF

c. Preheat : No LED ON
d. Power mode selection : S mode
e. Wiper : No LED ON
f. Washer : No LED ON
g. Travel speed pilot lamp : Low(Turtle)

② When warming up operation

a. Warming up lamp : ON
b. 10 seconds after engine started, engine speed increases to1200rpm

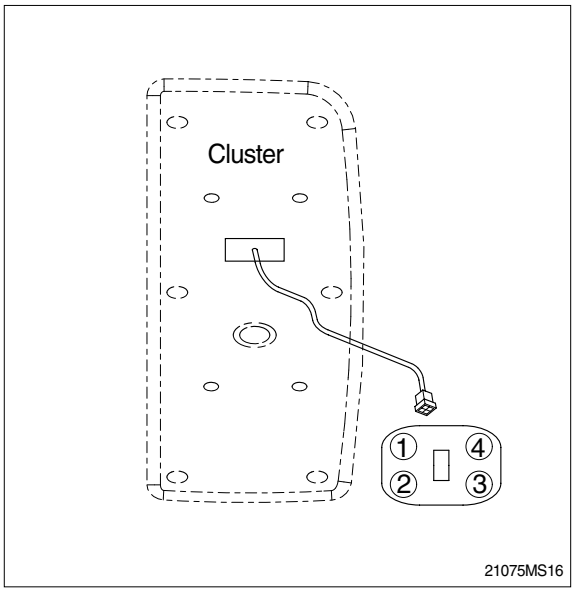
※ Others same as above ①.

③ 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.

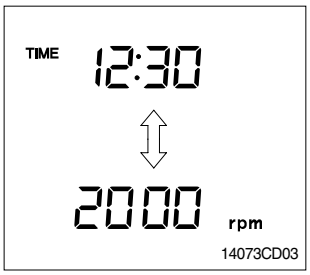
3. CLUSTER CONNECTOR

No.	Signal	Input / Output
1	Power IG(24V)	Input(20~32V)
2	GND	Input(0V)
3	Serial-(RX)	Input(Vpp=12V)
4	Serial+(TX)	Output(Vpp=4V)



4. CLUSTER FUNCTION

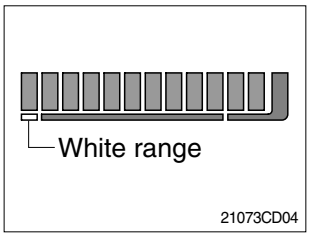
1) MONITORING DISPLAY



① This displays the current time and machine information such as engine rpm, coolant/hydraulic oil temperature, hydraulic oil pressure and also error codes.

※ **Refer to the page 5-24 for details.**

2) FUEL GAUGE

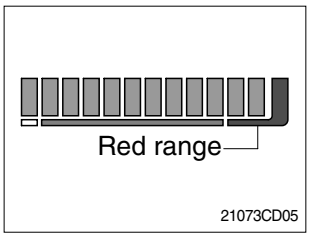


① This gauge indicates the amount of fuel in the fuel tank.

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

※ **If the gauge illuminates the white range or warning lamp blinks 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) HYDRAULIC OIL TEMPERATURE GAUGE



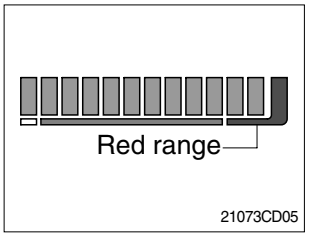
① This indicates the temperature of coolant.
- White range : 30℃(86°F) below
- Green range : 30-105 ℃(86-221°F)
- Red range : 105℃(221℉) above

② The green range illuminates when operating.

③ Keep idling engine at low speed until the green range illuminates, before operation of machine.

④ When the red range illuminates, reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

4) ENGINE COOLANT TEMPERATURE GAUGE



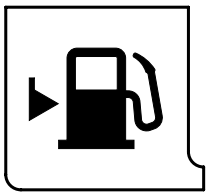
① This indicates the temperature of coolant.
- White range : 30℃(86°F) below
- Green range : 30-105 ℃(86-221°F)
- Red range : 105℃(221℉) above

② The green range illuminates when operating.

③ Keep idling engine at low speed until the green range illuminates, before operation of machine.

④ When the red range illuminates, turn OFF the engine, check the radiator and engine.

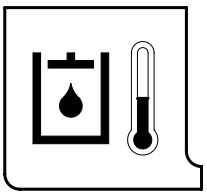
5) FUEL LOW LEVEL WARNING LAMP



21073CD04A

① This lamp blinks and the buzzer sounds when the level of fuel is below 21.5 ℓ (5.7U.S. gal).
② Fill the fuel immediately when the lamp blinks.

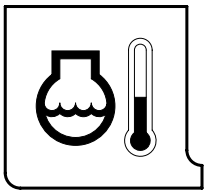
6) HYDRAULIC OIL TEMPERATURE WARNING LAMP



21073CD05A

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.

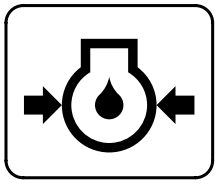
7) OVERHEAT WARNING LAMP



21073CD06A

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

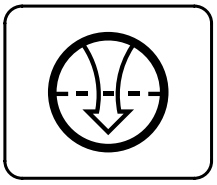
8) ENGINE OIL PRESSURE WARNING LAMP



21073CD07

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

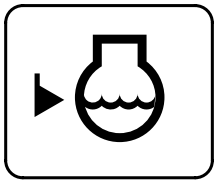
9) AIR CLEANER WARNING LAMP



21073CD08

① This lamp is operated by the vacuum caused inside when the filter of air cleaner is clogged which supply air to the engine.
② Check the filter and clean or replace it when the lamp blinks.

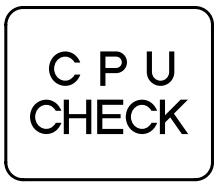
10) COOLANT LEVEL WARNING LAMP



21073CD09

① This lamp blinks and the buzzer sounds when the coolant is below LOW in the reservoir tank of radiator.
② Check the reservoir tank when the lamp blinks.

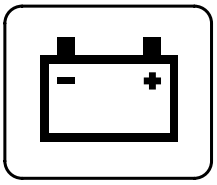
11) CPU CONTROLLER CHECK WARNING LAMP



21073CD10

① Communication problem with CPU controller makes the lamp blinks and the buzzer sounds.
② With lamp blinks all of the lamp on the cluster LCD will be OFF.

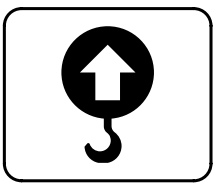
12) BATTERY CHARGING WARNING LAMP



21073CD13

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.

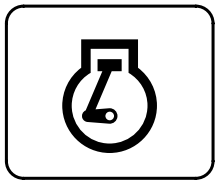
13) OVERLOAD WARNING LAMP



21073CD15

① When the machine is overload, the overload warning lamp blinks during the overload switch ON.

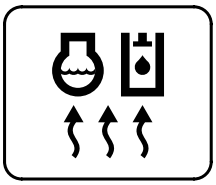
14) ONE TOUCH DECEL PILOT LAMP



21073CD17

① Operating auto decel or one touch decel makes the lamp ON.
② The lamp will be ON when pushing one touch decel switch on the LH RCV lever.

15) WARMING UP PILOT LAMP

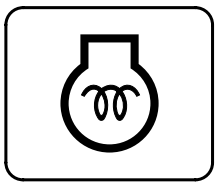


21073CD18

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.

16) PREHEAT PILOT LAMP

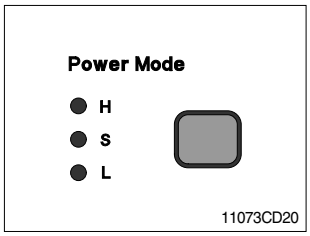


21073CD12

① This lamp is turned ON when the preheating function is actuated in cold weather.

② Start the engine as this lamp is OFF.

17) POWER MODE SWITCH

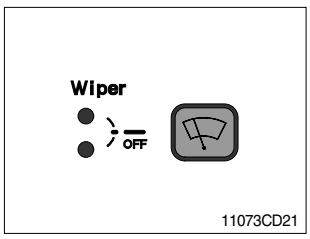


11073CD20

① This switch is to select the machine power mode, which shifts from high power work to standard power work and light power work in a raw by pressing the switch.

- **H** : This is used for high power work
- **S** : This is used for standard power work
- **L** : This is used for light power work

18) WIPER SWITCH



11073CD21

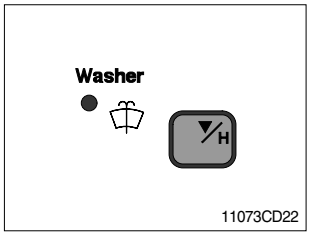
① This switch is used to operate wiper.

- Press the switch once to operate wiper.
- Press the switch once more to intermittently operate wiper low speed.
- Press the switch more than one second to turn off wiper.

※ **Wiper motor doesn't operate with front sliding door open.**

※ **If wiper does not operate with the switch in the ON position, turn the switch off immediately. Check the cause. If the switch remains ON, it can result in motor failure.**

19) WASHER SWITCH

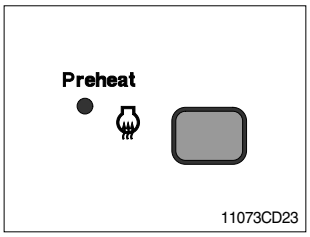


11073CD22

① The washer liquid is sprayed and the wiper is operated only while pressing this switch.

② The indicator lamp is turned ON when operating this switch.

20) PREHEAT SWITCH

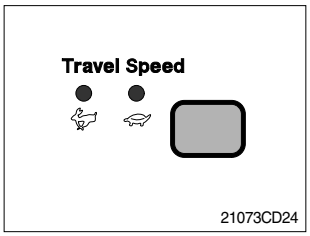


① This switch is used for starting the engine in cold weather.
If pressed, grid heater is activated to get easier engine starting.

※ **Never hold the push button switch in for more than 30 seconds, as this can damage the grid heater.**

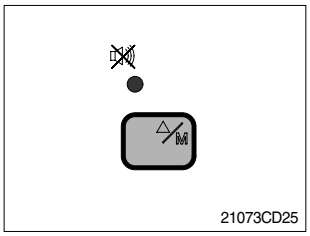
② The indicator lamp is turned ON when operating this switch.

21) 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 again.

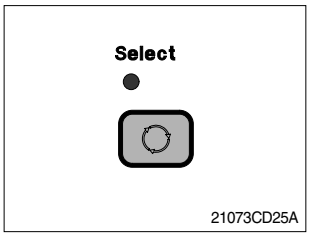
22) BUZZER STOP SWITCH



① When the starting switch is turned ON first, normally the alarm buzzer sounds for 5 seconds during lamp check operation.

② The red lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press this switch and buzzer stops, but the red lamp lights until the problem is cleared.

23) SELECT SWITCH



① This switch is used to select the monitor display function.

※ **Refer to the page 5-24 for details.**

② If the switch is pressed for 3 seconds in time display mode, it is selected time adjusting function, as below.
- Hour by auto decel switch
- Minute by buzzer stop switch.

③ After time set, the switch is pressed, it is returned clock.

5. MONITORING DISPLAY

1) OUTLINE

Information of machine performance as monitored by the CPU controller can be displayed on the cluster when the operator selects a display mode by touching **SELECT** switch alone or with **BUZZER STOP** switch on the cluster as below.

Display group	How to select display mode		Name	Display on the cluster
	Group selection	Display mode selection		
Group 0 (Default)	Way 1 Key switch **ON** or **START** Way 2 Touch **WASHER** switch while pressing **BUZZER STOP** at group 1~4.	Initial	Engine rpm	1750 rpm
		Touch **SELECT** 1 time	Time	TIME 12:30
		Touch **SELECT** 2 times	CPU model & version	08:C 1.0
Group 1 (Volt, temp, EPPR press, version)	Touch **SELECT** switch **once** while pressing **BUZZER STOP.** In this group **SELECT** LED **ON**	Default	Battery voltage(V)	b:24.8v
		Touch **SELECT** 1 time	Potentiometer voltage(V)	Po: 2.5v
		Touch **SELECT** 2 times	Accel dial voltage(V)	dL: 3.8v
		Touch **SELECT** 3 times	Hydraulic oil temperature(℃)	Hd: 105℃
		Touch **SELECT** 4 times	Coolant temperature(℃)	Ct: 107℃
Group 2 (Error code)	Touch **SELECT** switch **twice** while pressing **BUZZER STOP.** In this group **BUZZER STOP** LED blinks	Default	Current error	CHECK Er: 03
		Touch **SELECT** 1 time	Recorded error (Only key switch ON)	TIME Er: 03
		Press down(▼) & **SELECT** at the same time	Recorded error deletion (Only key switch ON)	TIME Er: 00
Group 3 (Switch input)	Touch **SELECT** switch **3 times** while pressing **BUZZER STOP.** In this group **SELECT** LED blinks at 0.5sec interval	Default	One touch decel switch	od:on or oFF
		Touch **SELECT** 1 time	Preheat switch	PH:on or oFF
		Touch **SELECT** 2 times	Overload pressure switch	o l:on or oFF
Group 4 (Output)	Touch **SELECT** switch **4 times** while pressing **BUZZER STOP.** In this group **SELECT** LED blinks at 1sec interval	Default	Hourmeter	Ho:on or oFF
		Touch **SELECT** 1 time	Neutral relay (Anti-restart relay)	nr:on or oFF
		Touch **SELECT** 2 times	Travel speed solenoid	SS:on or oFF
		Touch **SELECT** 3 times	Preheat relay	PR:on or oFF

※ By touching **SELECT** switch once while pressing **BUZZER STOP**, display group shifts.
Example : Group 0 → 1 → 2 → 3 → 4 → 0

2) DESCRIPTION OF MONITORING DISPLAY

Group	Display	Name	Description
Group 0	2200 rpm	Engine speed	It displays current engine speed detected by engine speed sensor from 500 to 3000rpm. Range : 500~3000rpm by 10rpm
	TIME 12 : 30	Time	It displays current time(12 is hour and 30 is minute) Range : Hour(1~12), minute(00~59)
	08 : C1.0	Model and CPU program version	It shows that machine model(R80-7) and the program version of the CPU controller is 1.0. Version display range : 0.0~9.9 by 0.1
Group 1	b24 : 8V	Battery voltage	It shows that battery power of 24.8V is supplied into CPU controller. Range : 00.0~48.0V by 0.1V
	Po : 2.5V	Potentiometer voltage	It shows that potentiometer signal voltage is 2.5V. Range : 0.0~5.0V by 0.1V
	dL : 3.8V	Accel dial voltage	It shows that accel dial signal voltage is 3.8V. Range : 0.0~5.0V by 0.1V
	Hd : 50°C	Hydraulic oil temperature	It shows that hydraulic oil temperature detected by temperature sensor is 50℃. Range : 0~150℃ by 1℃
	Ct : 85°C	Coolant temperature	It shows that coolant oil temperature detected by temperature sensor is 50℃. Range : 0~150℃ by 1℃
Group 2	CHECK Er : 01	Current error	It shows that current error of 01(Short circuit in accel actuator motor system) is diagnosed by self diagnosis system in the CPU controller. If more than 2 errors, when pressing ▼ or ▲ switch, other error codes show. Range : 00~58
	TIME Er : 03	Recorded error	It shows recorded error code of 03 which is diagnosed before. If more than 2 error codes, when pressing ▼ or ▲ switch, other error codes show. Range : 00~58
	TIME Er : 00	Recorded error deletion	It shows all recorded error codes are removed in the CPU controller memory.

Group	Display	Name	Description
Group 3	od : on or oFF	One touch decel switch	od : on Shows that one touch decel switch is pressed. od : oFF Shows that one touch decel switch is released.
	PH : on or oFF	Preheat switch	PH : on Shows that preheat switch is pressed. PH : oFF Shows that preheat switch is released.
	ol : on or oFF	Overload pressure switch	ol : on Shows that overload pressure switch is turned ON. ol : oFF Shows that overload pressure switch is turned OFF.
Group 4	Ho : on or oFF	Hourmeter	Ho : on Shows that hourmeter is activated by CPU controller. Ho : oFF Shows that hourmeter is turned off.
	nr : on or oFF	Neutral relay (Anti-restart relay)	nr : on Shows that neutral relay for anti-restarting function is activated(Engine start is possible). nr : oFF Shows that neutral relay is turned off to disable the engine restart.
	ts : on or oFF	Travel speed solenoid	ts : on Shows that travel speed solenoid is activated (High speed). ts : oFF Shows that travel speed solenoid is released (Low speed).
	PR : on or oFF	Preheat relay	PR : on Shows that preheat relay is activated. PR : oFF Shows that preheat relay is released.

■ MONITORING SYSTEM

1. OUTLINE

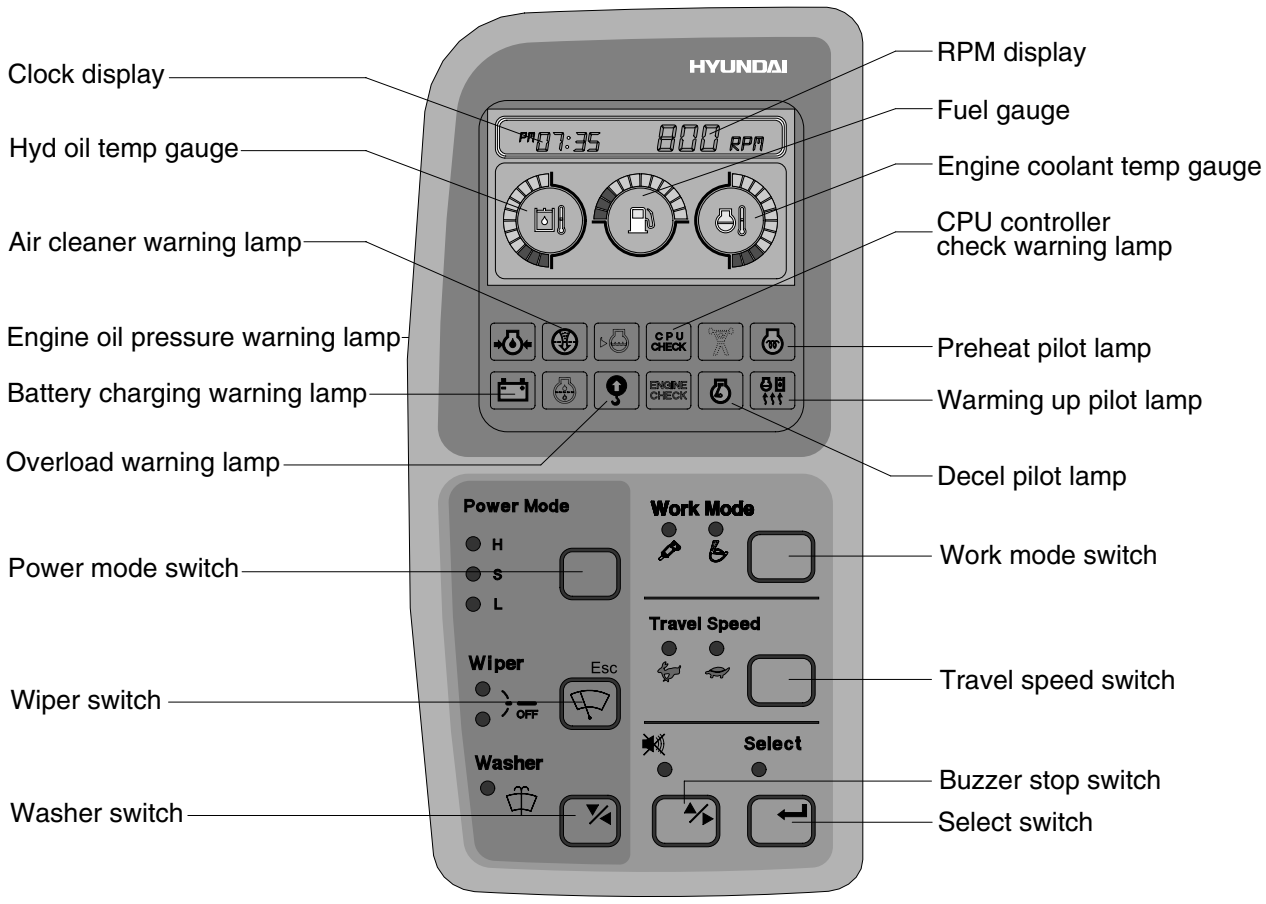
Monitoring system consists of the monitor part and switch part.

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



RD8075MS08

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor initial 5 seconds

a. All lamps light up.
b. Buzzer sound.

② Check monitor after 5 seconds : Indicate cluster version and machine condition

a. Cluster program version : 「1.00」 ← Indicates program version 「1.00」 for 5 seconds.
b. Tachometer : 0rpm
c. Fuel gauge : All light up below appropriate level
d. Hydraulic temperature : All light up below appropriate level
e. Engine coolant temperature gauge : All light up below appropriate level
f. 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.

③ Indicating lamp state

a. Power mode selection : S mode
b. Preheat : No LED ON
c. Wiper : No LED ON
d. Washer : No LED ON
e. Travel speed pilot lamp : Low(Turtle)

(2) Start of engine

① Check machine condition

a. Tachometer indicates at present rpm
b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF

c. Preheat : No LED ON
d. Power mode selection : S mode
e. Wiper : No LED ON
f. Washer : No LED ON
g. Travel speed pilot lamp : Low(Turtle)

② When warming up operation

a. Warming up lamp : ON
b. 10 seconds after engine started, engine speed increases to1200rpm

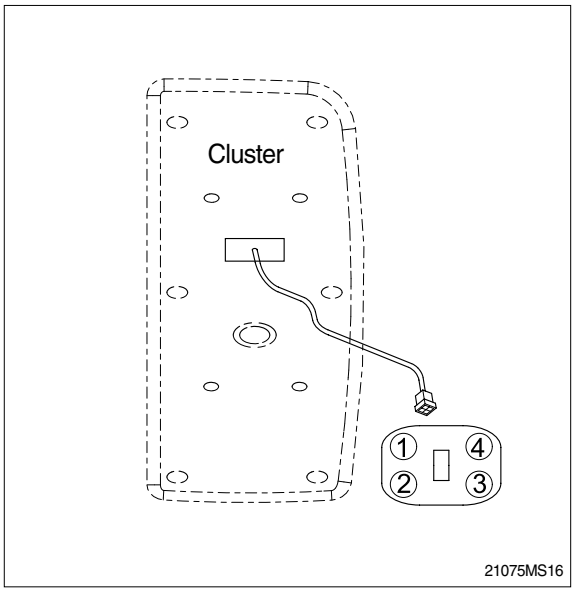
※ Others same as above ①.

③ 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

No.	Signal	Input / Output
1	Power IG(24V)	Input(20~32V)
2	GND	Input(0V)
3	Serial-(RX)	Input(Vpp=12V)
4	Serial+(TX)	Output(Vpp=4V)



4. LCD main operation display

Default screen

1607A3CD02A

Option screen

1607A3CD02B

1 Time display
2 RPM display
3 Hydraulic oil temperature gauge
4 Fuel level gauge
5 Engine coolant temperature gauge

1) Time display

1607A3CD02C

① This displays the current time.

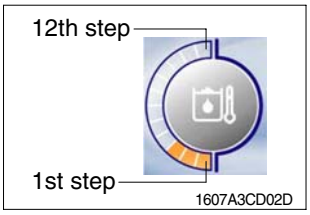
※ **Refer to the page 5-34 to set time for details.**

2) RPM display

1607A3CD02C

① This displays the engine rpm.

3) Hydraulic oil temperature gauge



1607A3CD02D

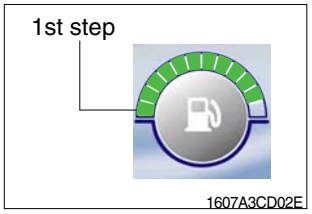
① This gauge indicates the temperature of hydraulic oil in 12 step gauge.
- 1st step : Below 30℃(86°F)
- 2nd~10th step : 30-105 °C(86-221°F)
- 11th~12th step : Above 105℃(221°F)

② The gauge between 2nd and 10th steps illuminates when operating.

③ Keep idling engine at low speed until the gauge between 2nd and 10th steps illuminates, before operation of machine.

④ When the gauge of 11th and 12th steps illuminates, reduce the load on the system. If the gauge stays in the 11th~12th steps, stop the machine and check the cause of the problem.

4) Fuel level gauge



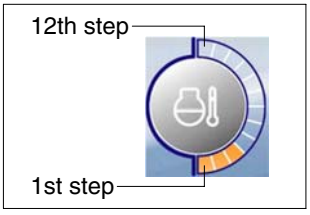
1607A3CD02E

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

② Fill the fuel when the 1st step or fuel icon blinks in red.

※ **If the gauge illuminates the 1st step or fuel icon blinks in red 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.**

5) Engine coolant temperature gauge



1607A3CD02F

① This gauge indicates the temperature of coolant in 12 step gauge.
- 1st step : Below 30℃(86°F)
- 2nd~10th step : 30-105 °C(86-221°F)
- 11th~12th step : Above 105℃(221°F)

② The gauge between 2nd and 10th steps illuminates when operating.

③ Keep idling engine at low speed until the gauge between 2nd and 10th steps illuminates, before operation of machine.

④ When the gauge of 11th and 12th steps illuminates, turn OFF the engine, check the radiator and engine.

5. Warning of main operation screen

1) Warning display

(1) Engine coolant temperature


- This lamp blinks and the buzzer sounds when the temperature of coolant is over the normal temperature 105℃(221°F) .
- Check the cooling system when the lamp blinks.

(2) Fuel level


- This lamp blinks and the buzzer sounds when the level of fuel is below 28 ℓ (7.4U.S. gal).
- Fill the fuel immediately when the lamp blinks.

(3) Hydraulic oil temperature


- This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 105 ℃(221 °F) .
- Check the hydraulic oil level when the lamp blinks.
- Check for debris between oil cooler and radiator.

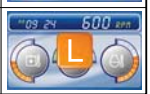
(4) All gauge


- This lamp blinks and the buzzer sounds when the all gauge is abnormal.
- Check the each system when the lamp blinks.

(5) Communication error

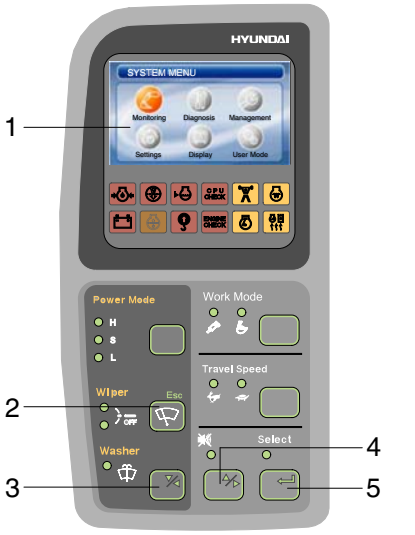
- Communication problem between MCU controller and cluster makes the lamp blinks and the buzzer sounds.
- Check if any fuse for MCU burnt off.
  If not check the communication line between them.

2) Pop-up icon display

No	Switch	Selected mode	Display
1	Power mode switch	High power work mode	
		Standard power work mode	
		Light power work mode	

No	Switch	Selected mode	Display
2	Travel speed control switch	Low speed	
		High speed	

3) LCD



RD8075MS10

1 : LCD

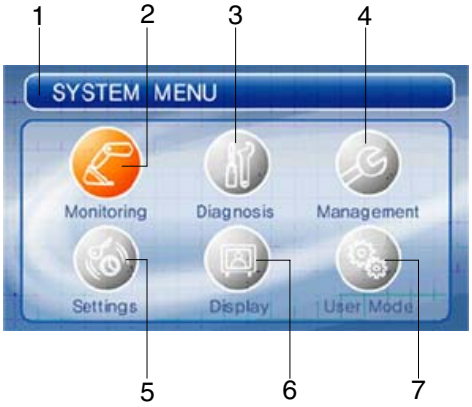
2 Esc : Escape,
Return to the previous menu

3 : Down/Left Direction

4 : Up/Right Direction

5 : Select(Enter)
Activate the currently chosen item

(1) Main menu



2507A4OP94

1 SYSTEM MENU : Menu information

2 : Monitoring
- Equipment, Switch, Output

3 : Diagnosis
- Current error, Recorded error

4 : Maintenance

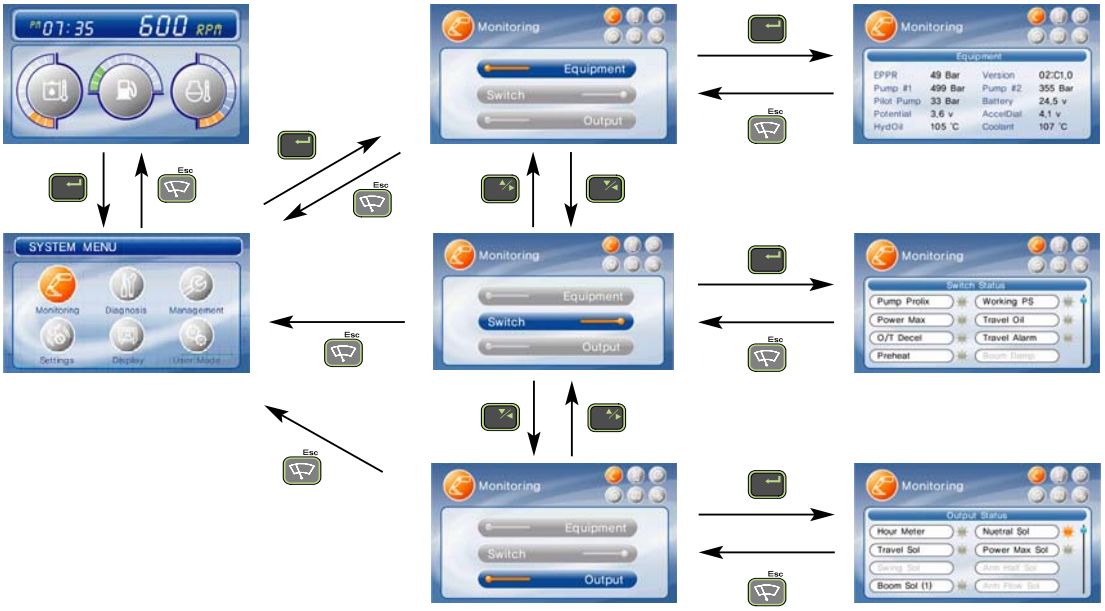
5 : Settings
- Time set, Dual mode
- System lock(Reserved)

6 : Display
- Operation skin, Brightness, Language

7 : User mode(null)

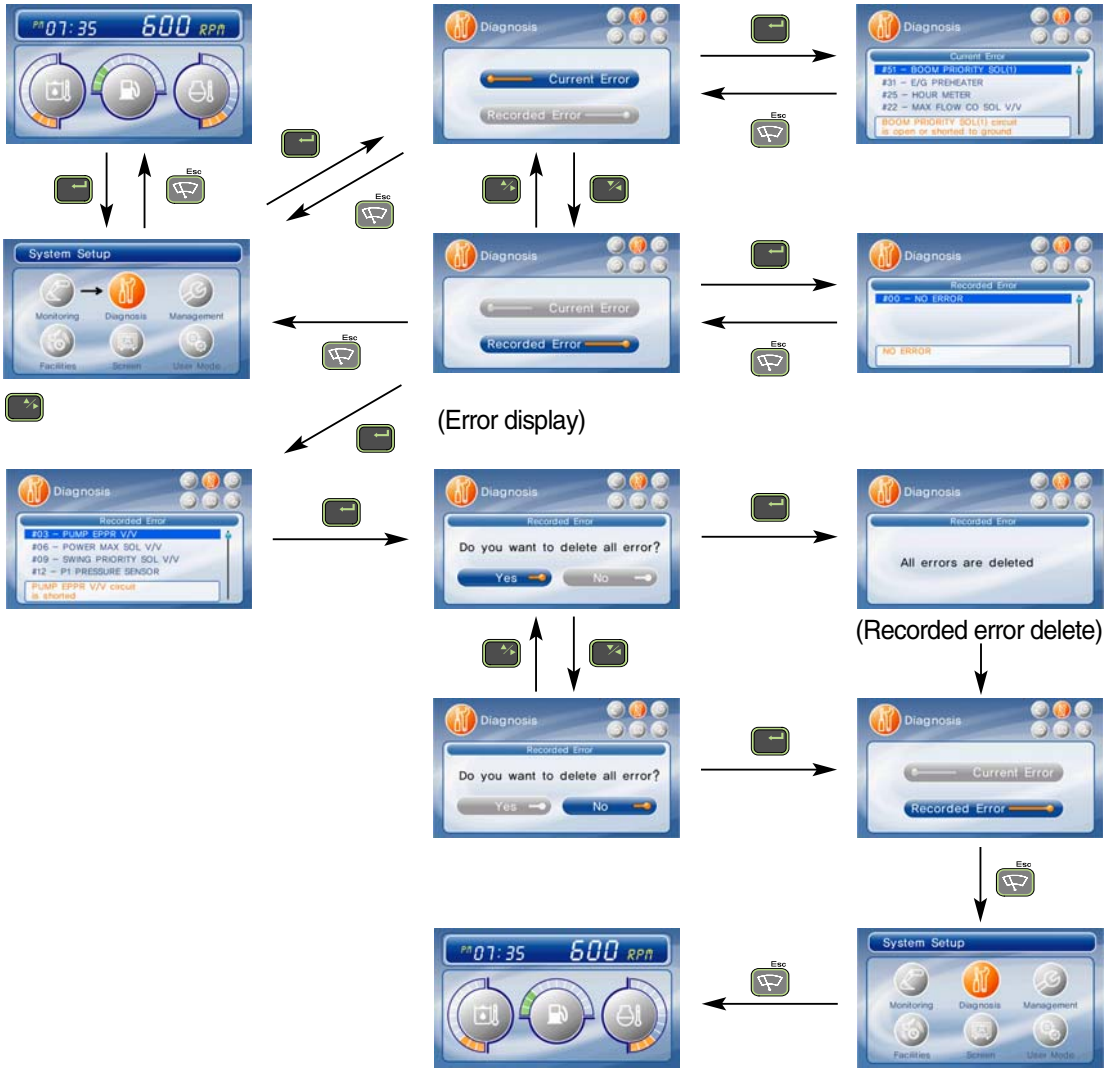
(2) Display map

① Monitoring



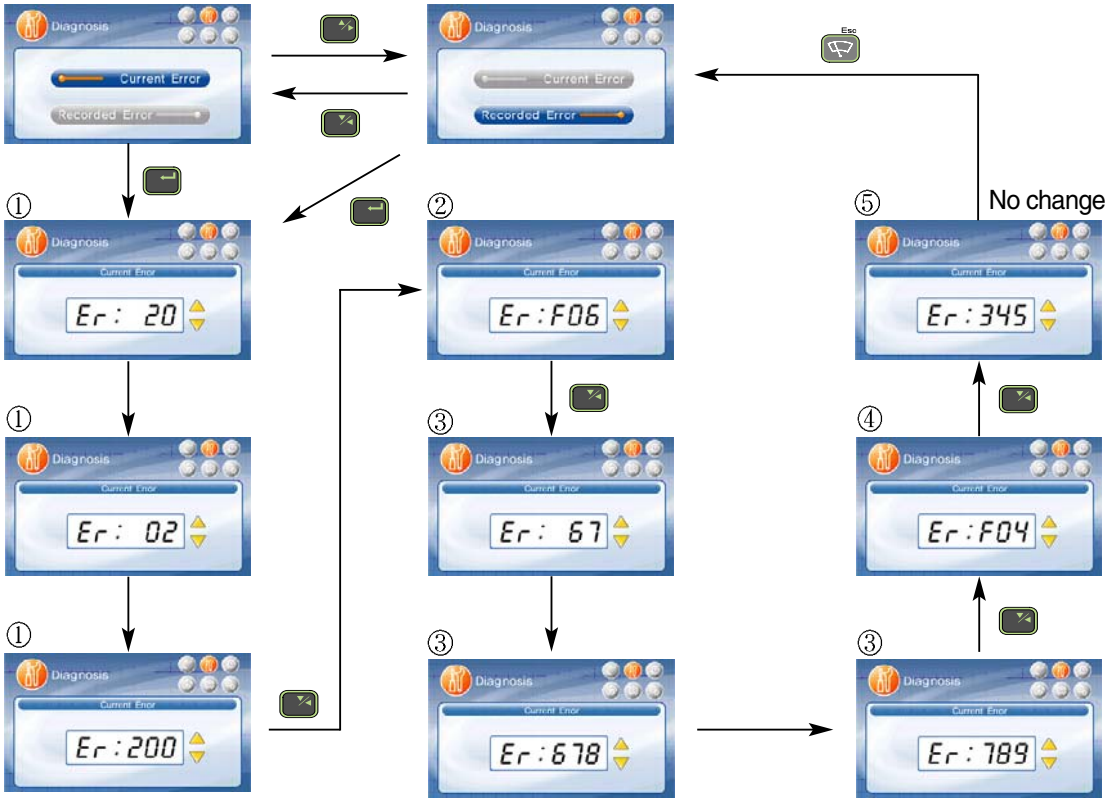
② Diagnosis

a. Protocol type 1

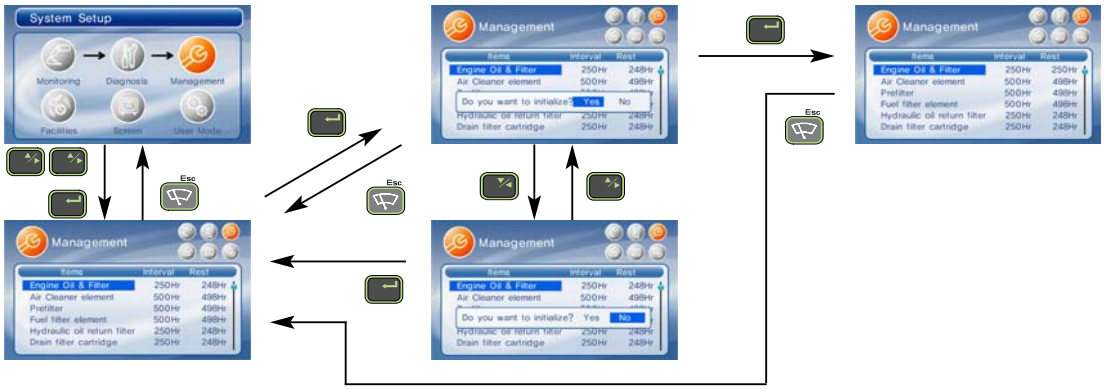


b. Protocol type 2

- If there are more than 2 error codes, each one can be displayed by pressing or switch respectively.
- 3 error codes (①SPN200200, ②FMI06, ③SPN6789, ④FMI04, ⑤345) display.



③ Maintenance



④ Setting

a. Time set

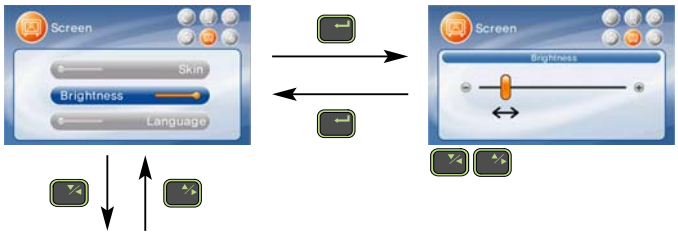
b. System lock - Reserved

c. Dual mode
- Changing the MCU mode

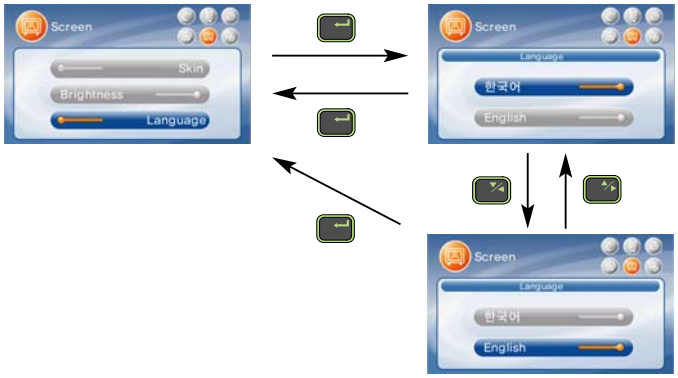
⑤ Display

a. Operation skin

b. Brightness

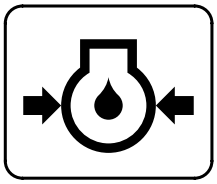


c. Language



4) Warning and pilot lamp

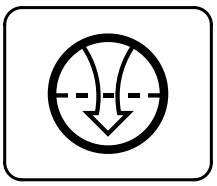
(1) Engine oil pressure warning lamp



21073CD07

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.

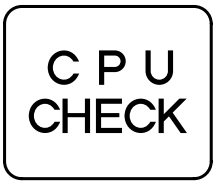
(2) Air cleaner warning lamp



21073CD08

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.

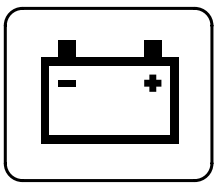
(3) MCU controller check warning lamp



21073CD10

① If any fault code is received from MCU controller, this lamp blinks and the buzzer sounds.
② Check the communication line between MCU controller and cluster.

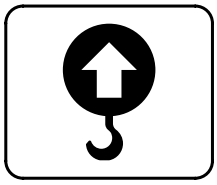
(4) Battery charging warning lamp



21073CD13

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.

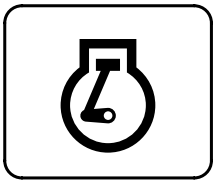
(5) Overload warning lamp



21073CD15

① When the machine is overload, the overload warning lamp blinks during the overload switch is ON.

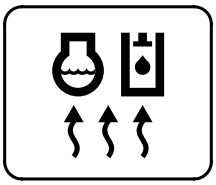
(6) Decel pilot lamp



21073CD17

① Operating auto decel or one touch decel makes the lamp ON.
② The lamp will be ON when pushing one touch decel switch on the LH RCV lever.

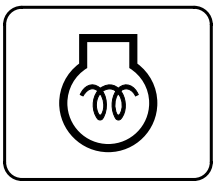
(7) Warming up pilot lamp



21073CD18

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.

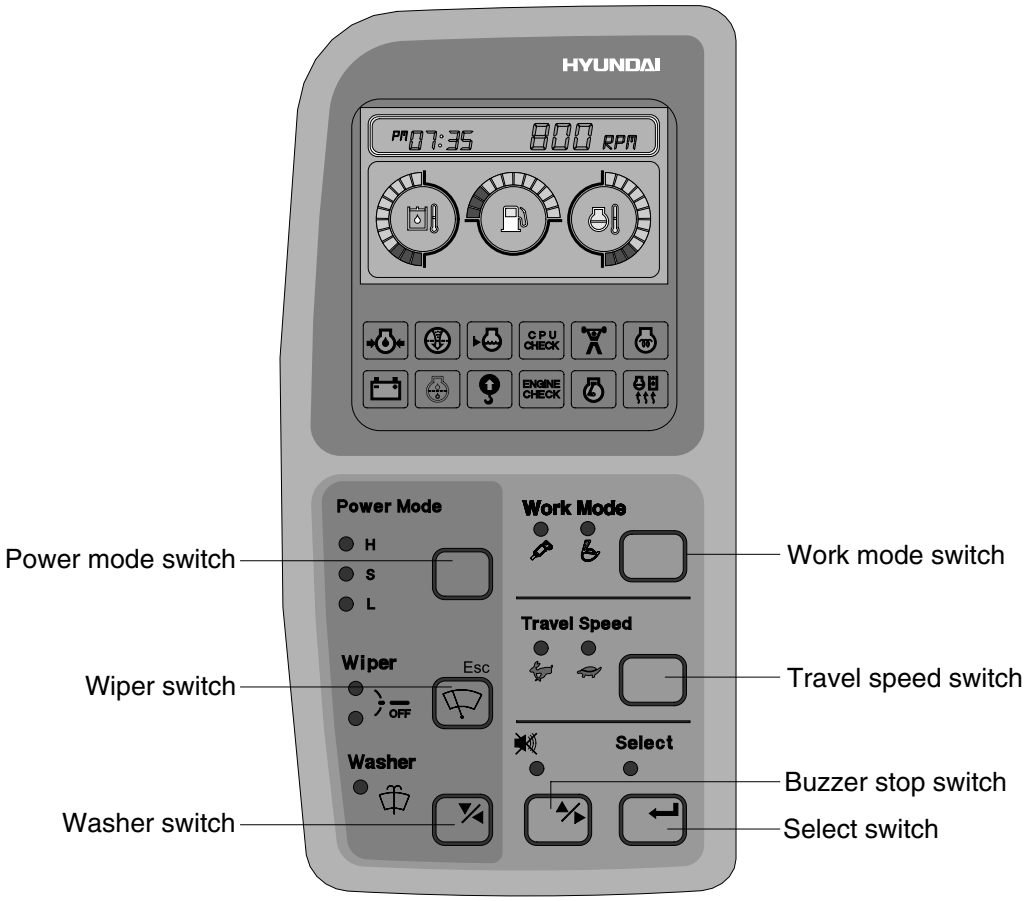
(8) Preheat pilot lamp



21073CD12

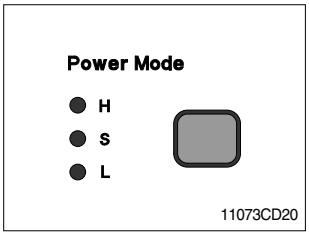
① Turning the start key switch ON position starts preheating in cold weather.
② Start the engine as this lamp is OFF.

5) SWITCH PANEL



RD8075MS11

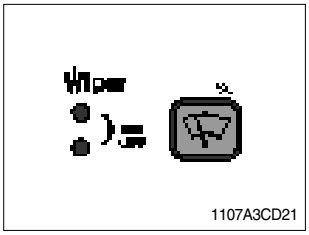
(1) Power mode switch



① This switch is to select the machine power mode, which shifts from high power work to standard power work and light power work in a raw by pressing the switch.

- **H** : High power work mode
- **S** : Standard power work mode
- **L** : Light power work mode

(2) Wiper mode switch



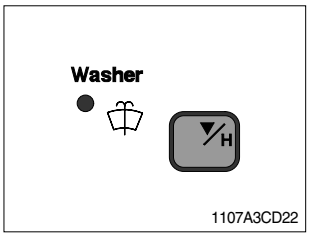
① This switch is used to operate wiper.

- Press the switch once to operate wiper.
- Press the switch once more to intermittently operate wiper low speed.
- Press the switch once more to turn off wiper.

※ **Wiper motor doesn't operate with front sliding door open.**

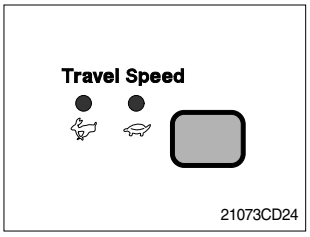
※ **If wiper does not operate with the start switch in the ON position, turn the switch off immediately. Check the cause. If the switch remains ON, it can result in motor failure.**

(3) Washer switch



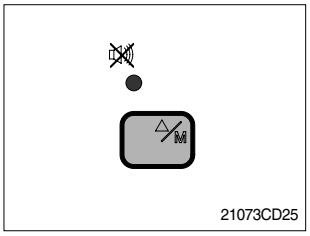
① The washer liquid is sprayed and the wiper is operated only while pressing this switch.
② The indicator lamp is turned ON when operating this switch.

(4) Travel speed control switch



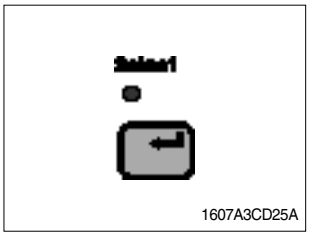
① This switch is to control the travel speed which is changed to high speed(Rabbit mark) by pressing the switch and low speed(Turtle mark) by pressing it again.

(5) Buzzer stop switch



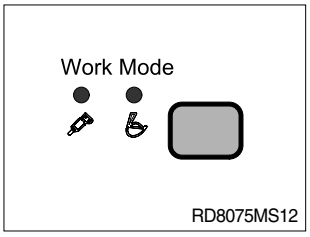
① When the starting switch is turned ON first, normally the alarm buzzer sounds for 2 seconds during lamp check operation.
② The red lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press this switch and buzzer stops, but the red lamp lights until the problem is cleared.

(6) Select switch



① This switch is used to enter main menu and sub menu for LCD.
※ **Refer to the page 5-32 for details.**

(7) Work mode switch



① This switch is to select the machine operation mode, which shifts from general operation mode to breaker mode by pressing the switch.
- : General work mode
- : Breaker operation mode

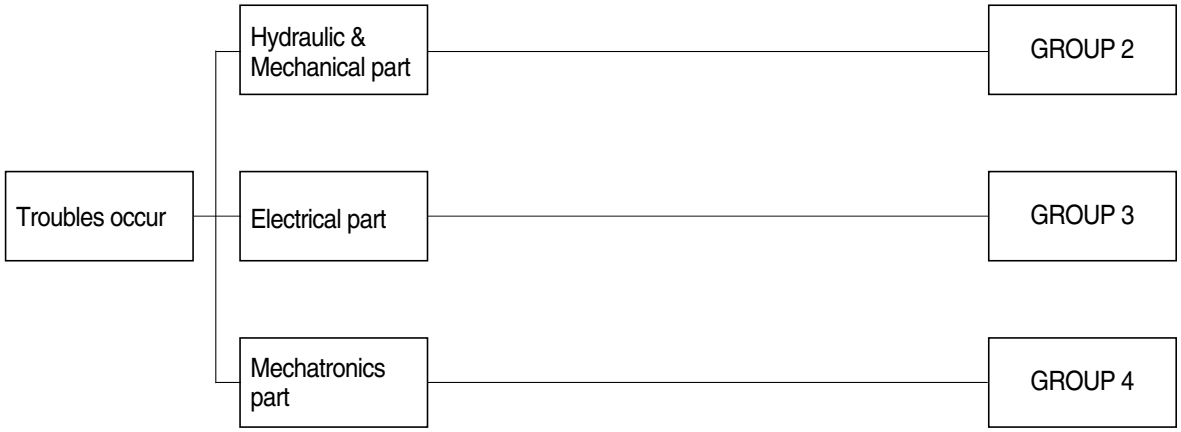
SECTION 6 TROUBLESHOOTING

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

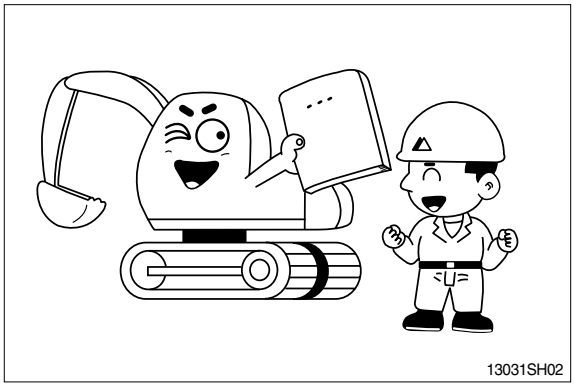


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

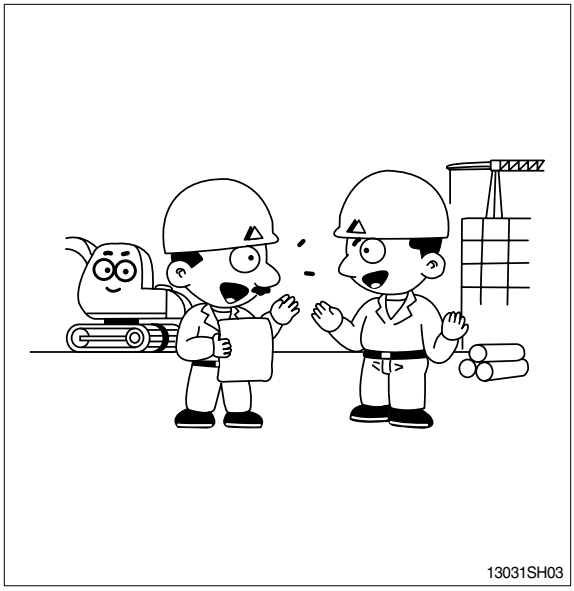
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.



STEP 2. Ask the operator

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

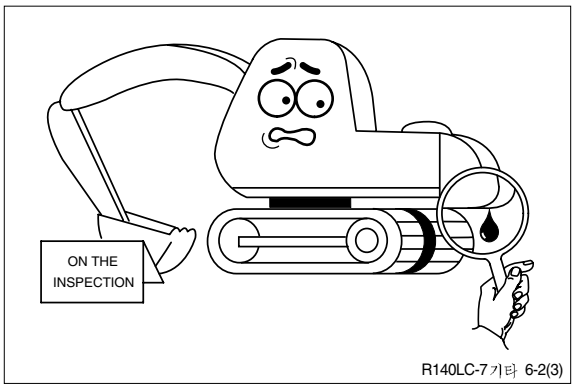
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously?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



STEP 3. Inspect the machine

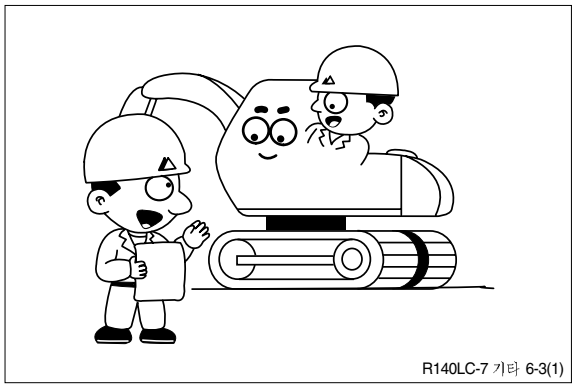
Before starting troubleshooting, check the machine for the daily maintenance points as shown in the operator's manual.

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.



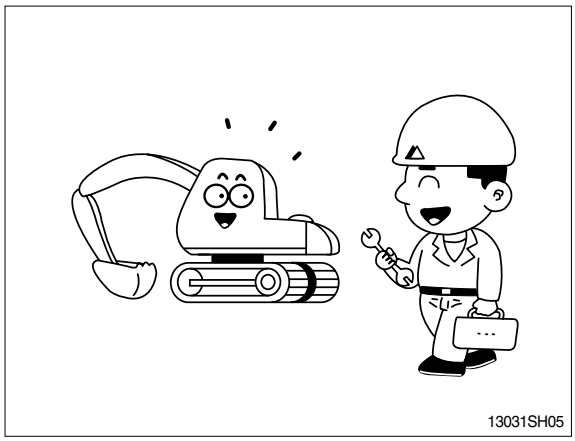
STEP 4. Inspect the trouble actually on the machine

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.


R140LC-7 기타 6-3(1)

STEP 5. Perform troubleshooting

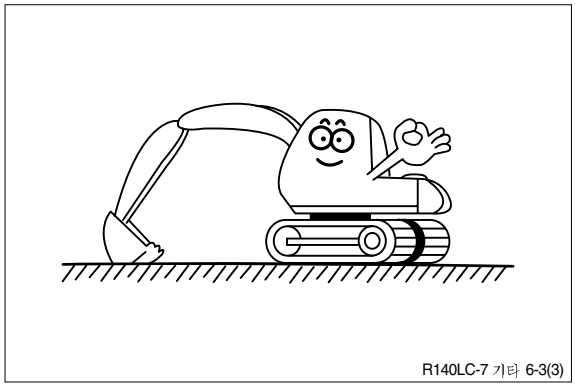
According to where the trouble parts are located, hydraulic & mechanical system part or electrical system part or mechatronics system part, perform troubleshooting the machine refer to the each system part's troubleshooting process diagram.


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.


R140LC-7 기타 6-3(3)

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.

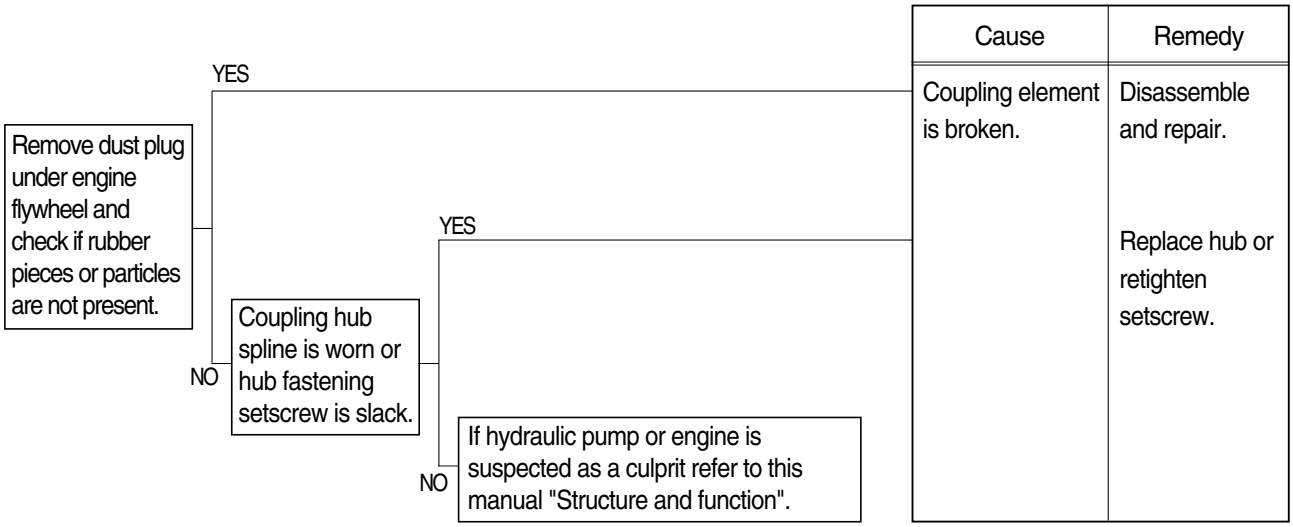
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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.

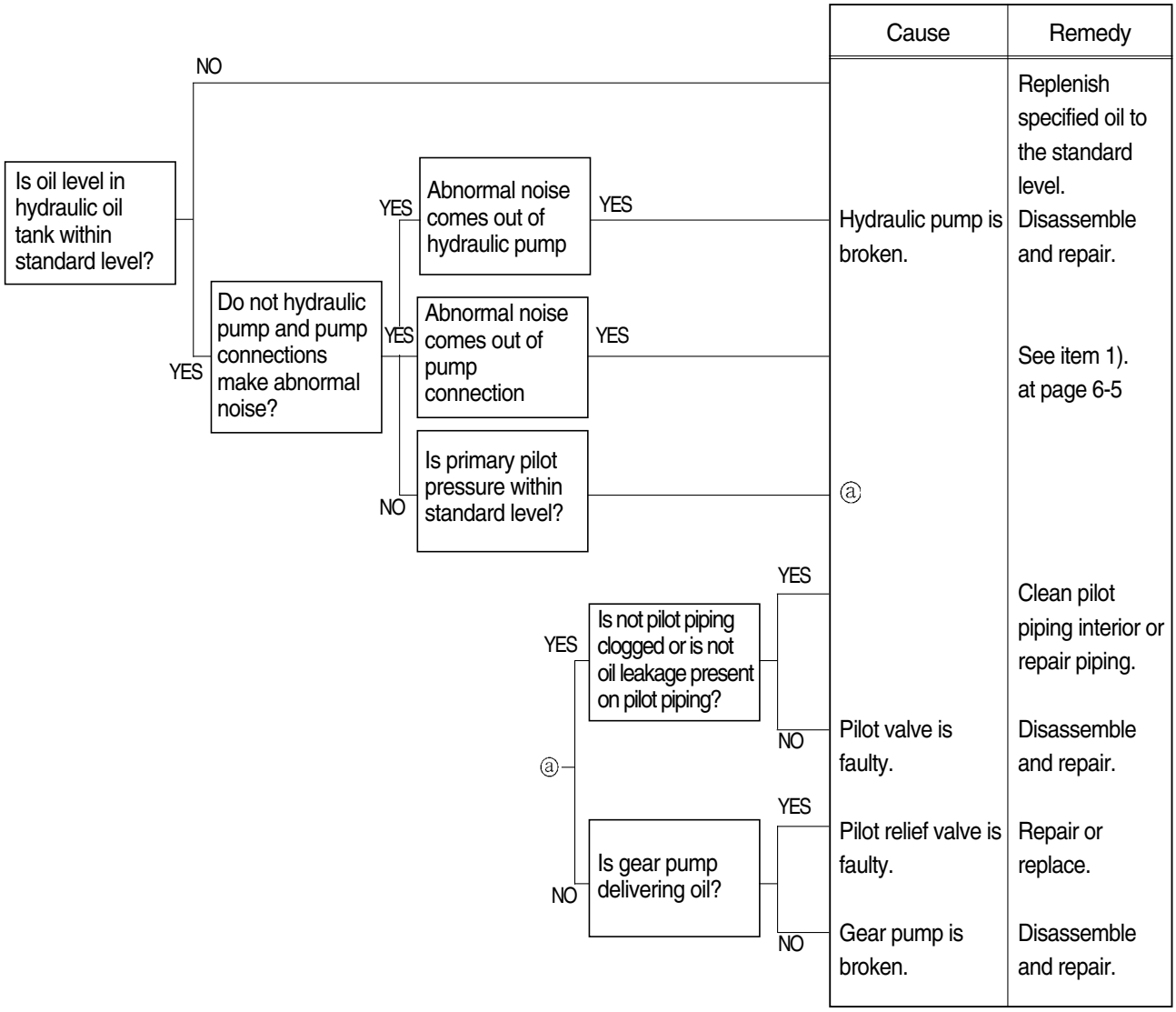
2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



Cause	Remedy
Coupling element is broken.	Disassemble and repair.
	Replace hub or retighten setscrew.

2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

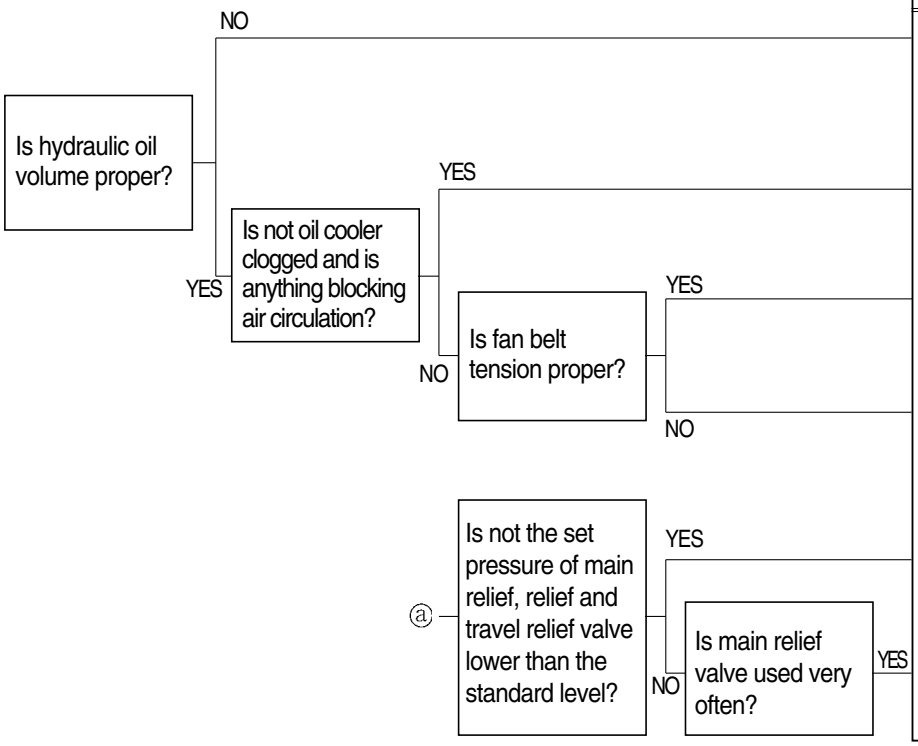


3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

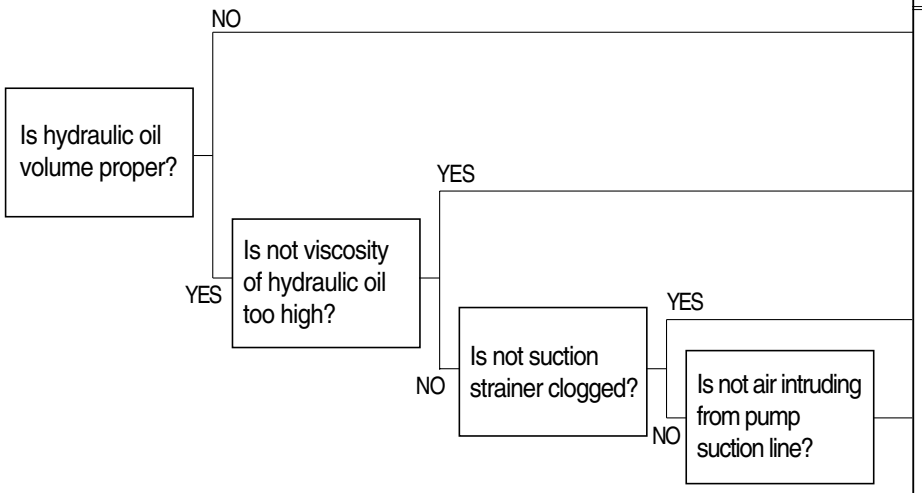
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



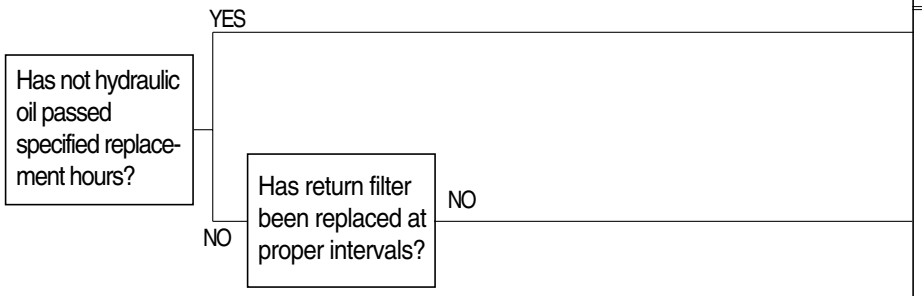
Cause	Remedy
ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Secure air circulation route. Adjust belt tension or replace belt. Readjust set pressure. Reduce load.

3) CAVITATION OCCURS WITH PUMP



Cause	Remedy
	Replenish specified oil to the standard level. Replace oil with one of proper viscosity. Clean suction strainer. Check for air intrusion in suction line and retighten or replace parts.

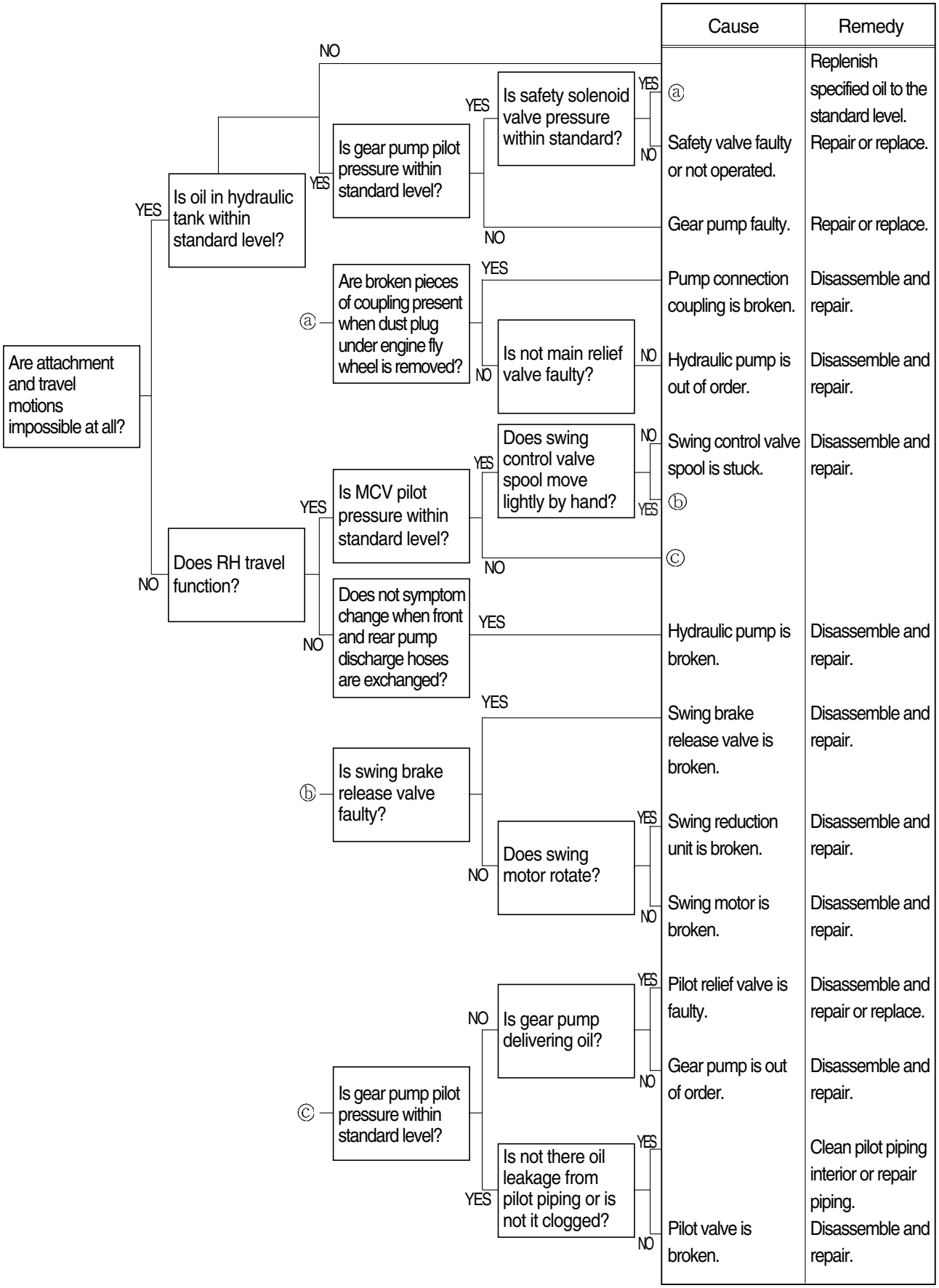
4) HYDRAULIC OIL IS CONTAMINATED



Cause	Remedy
	Replace hydraulic oil to be specified. Flush with hydraulic oil and replace return filter.

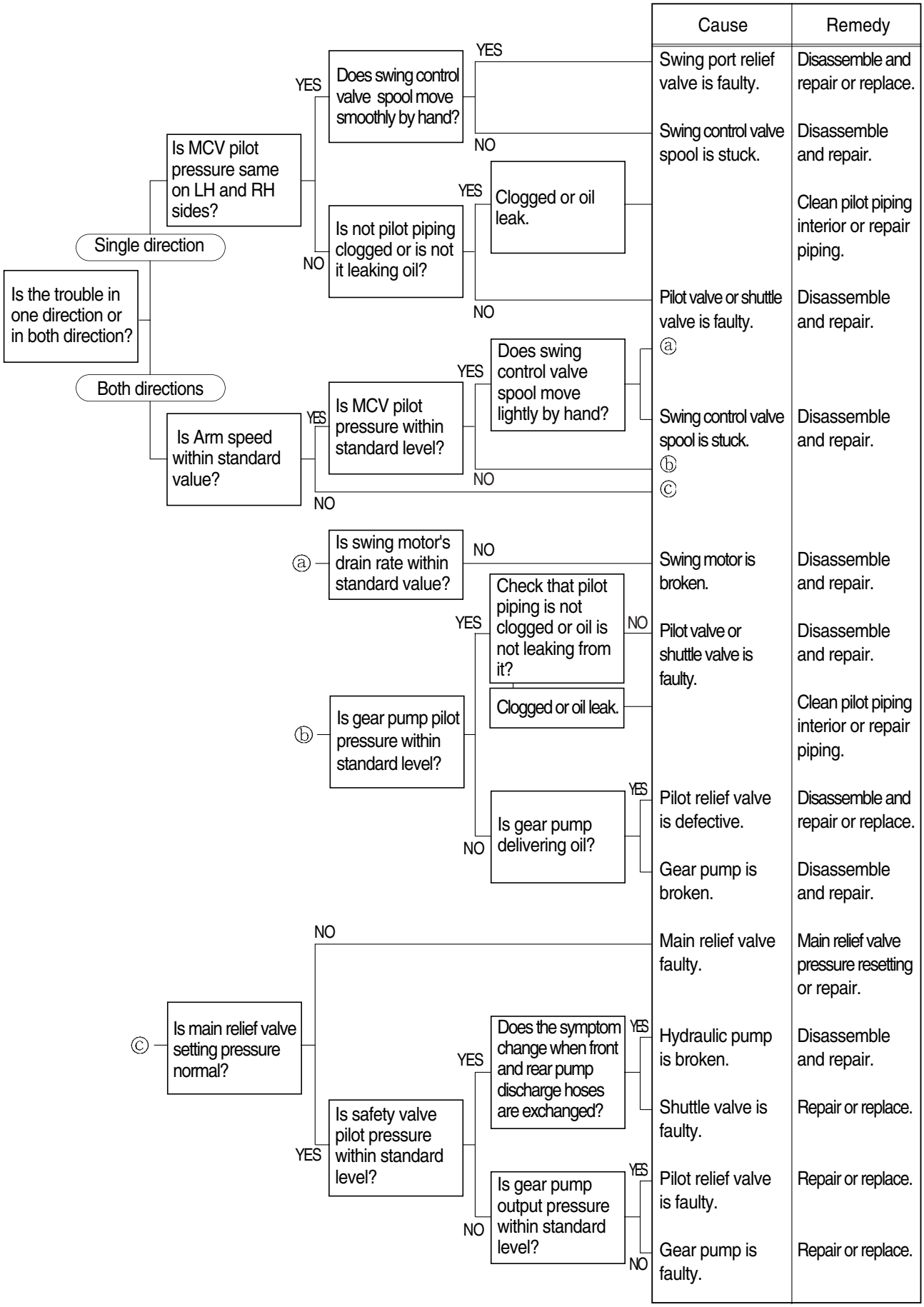
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

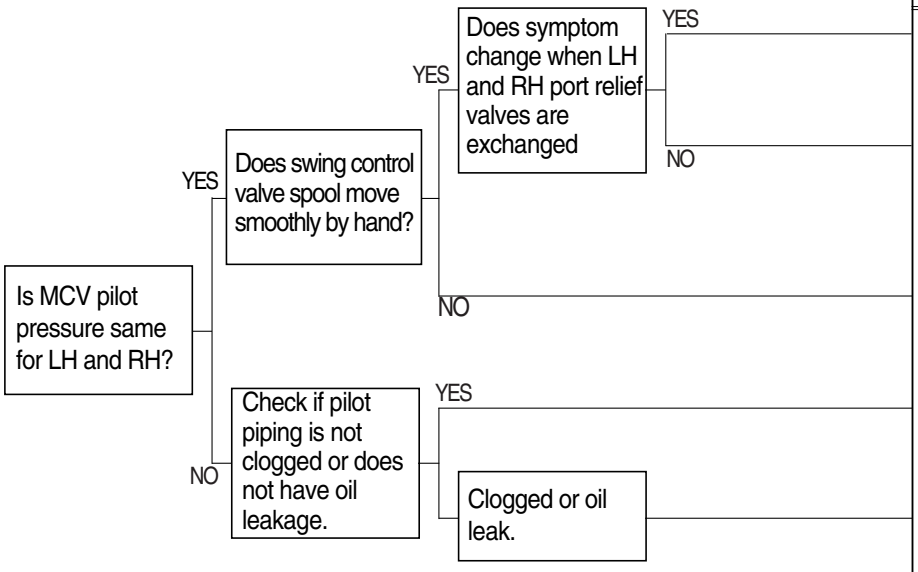


Cause	Remedy
ⓐ Safety valve faulty or not operated.	Replenish specified oil to the standard level. Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
ⓑ	
ⓒ	
Hydraulic pump is broken.	Disassemble and repair.
Swing brake release valve is broken.	Disassemble and repair.
Swing reduction unit is broken.	Disassemble and repair.
Swing motor is broken.	Disassemble and repair.
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is out of order.	Disassemble and repair.
	Clean pilot piping interior or repair piping.
Pilot valve is broken.	Disassemble and repair.

2) SWING SPEED IS LOW

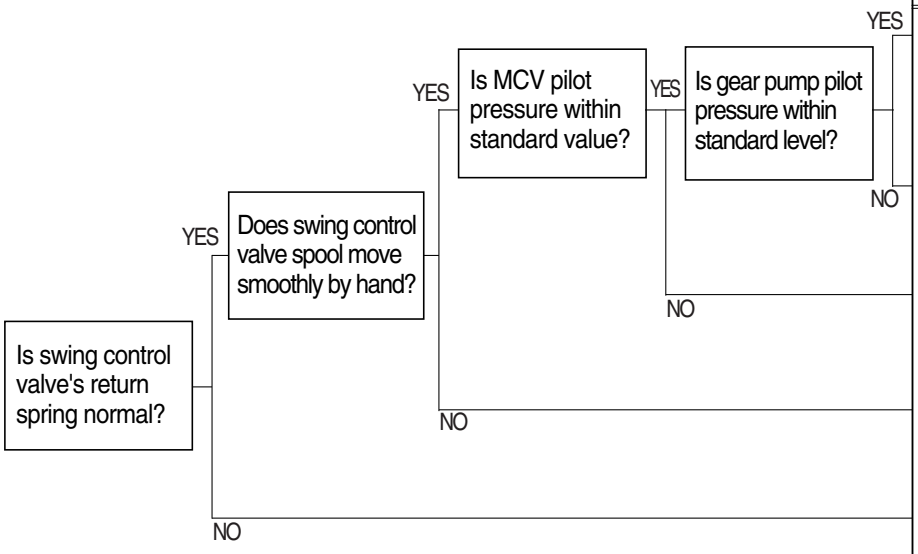


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



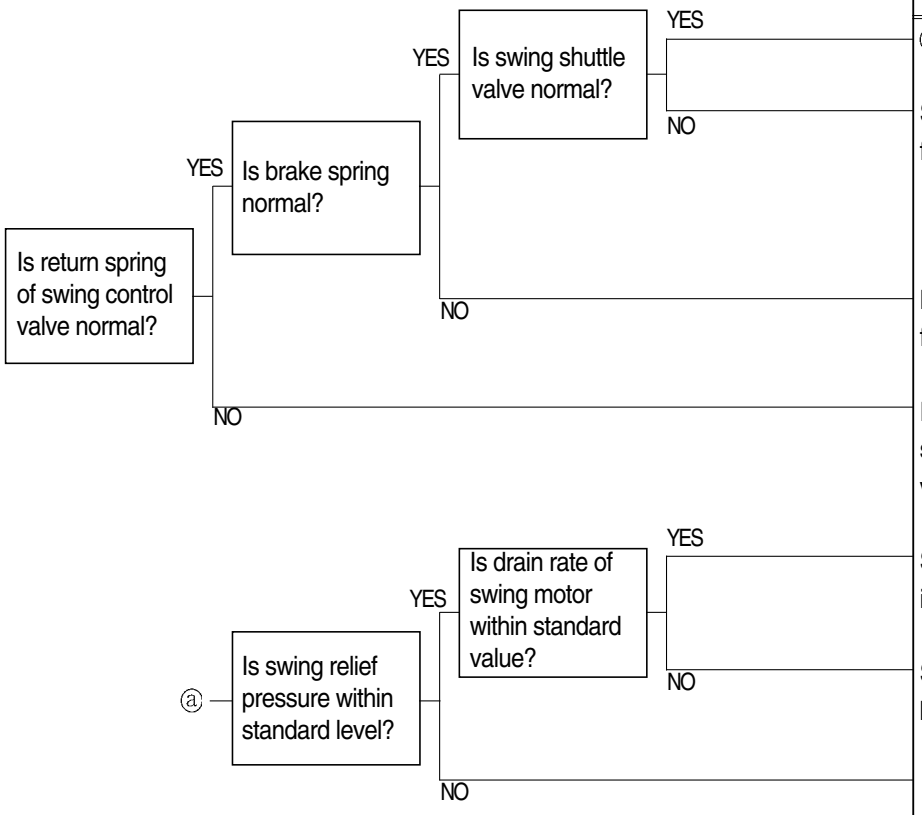
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



Cause	Remedy
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Return spring is faulty.	Disassemble and replace.

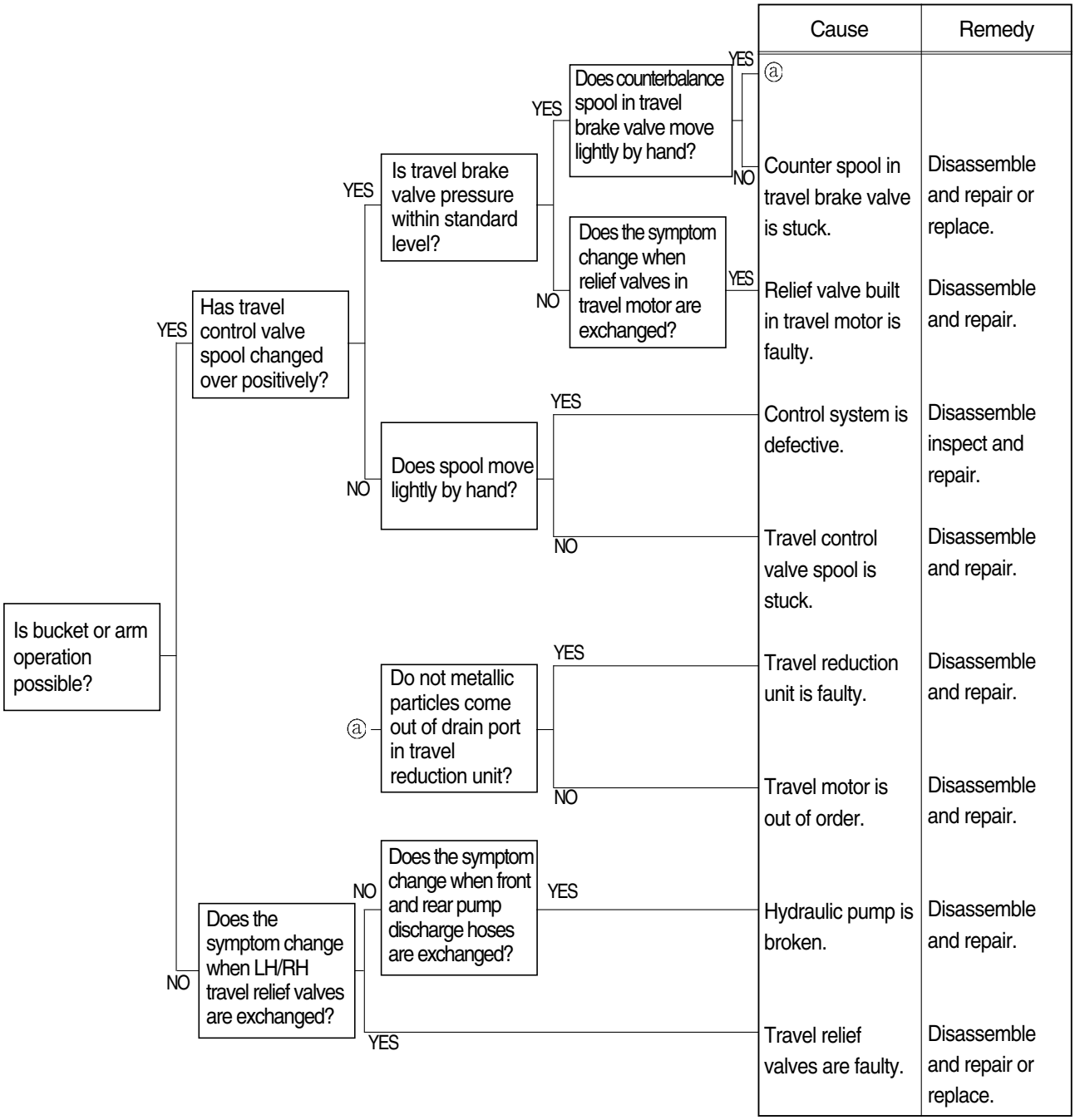
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



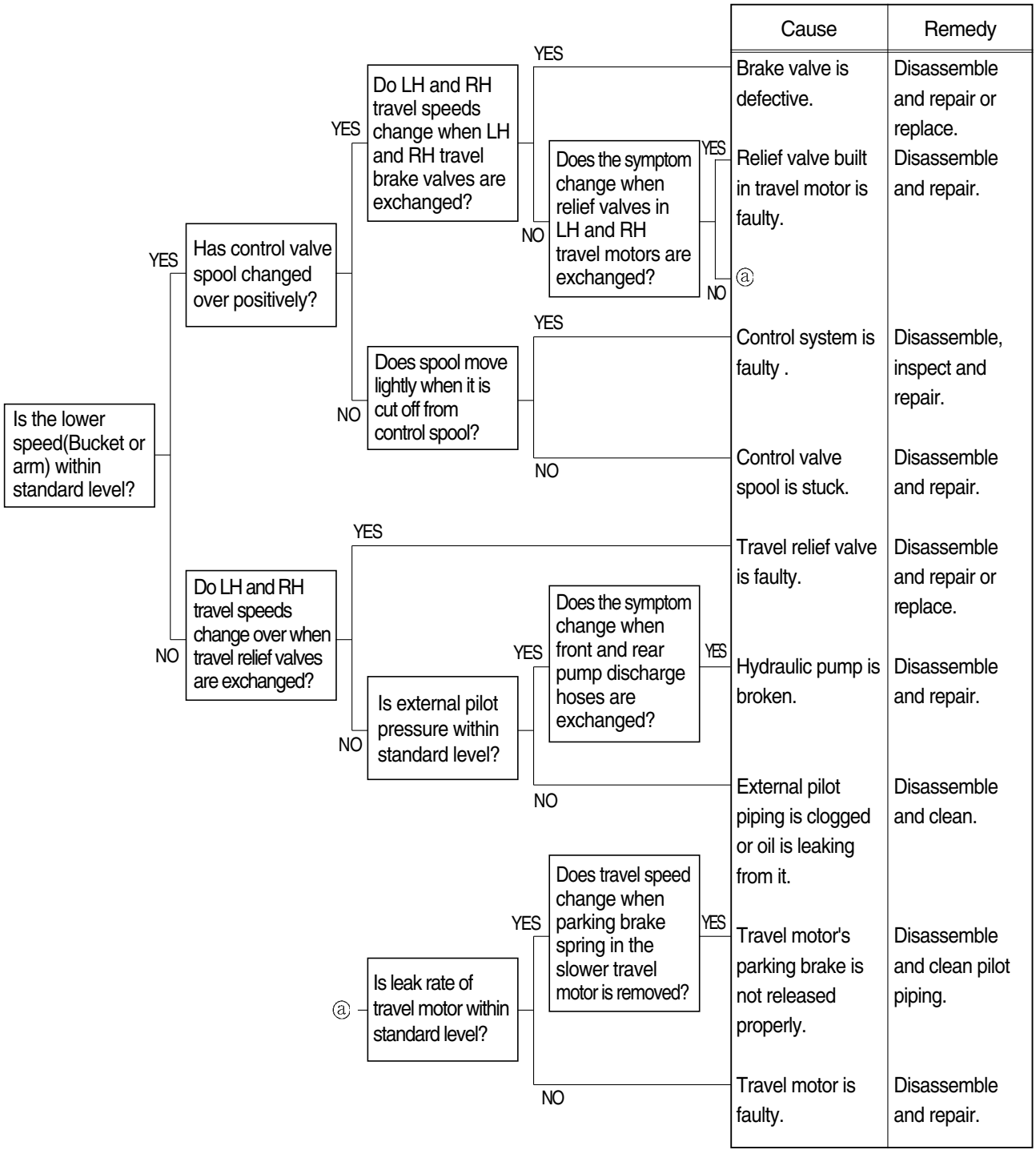
Cause	Remedy
ⓐ Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
	Adjust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

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

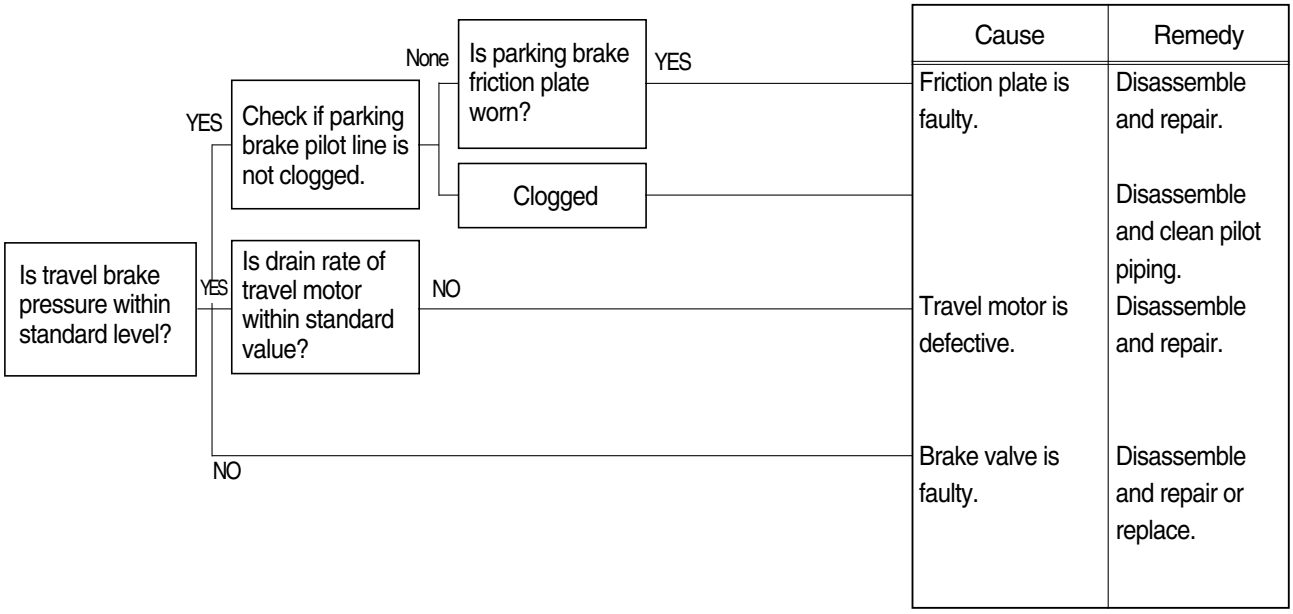


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



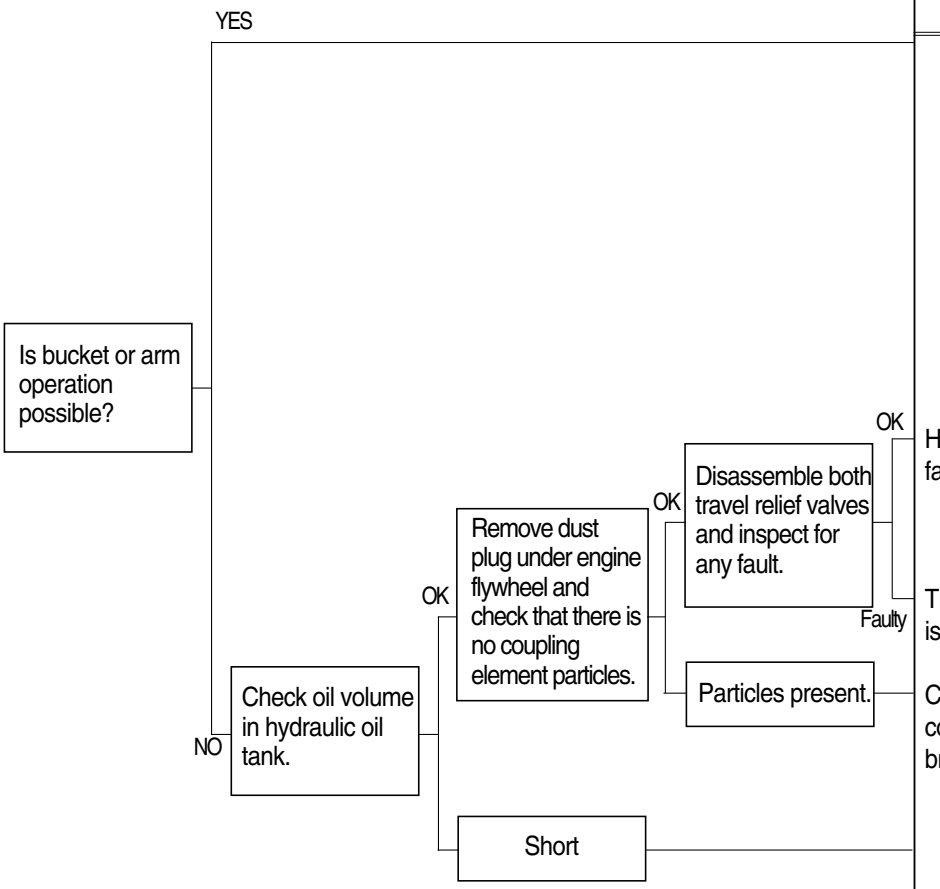
3) MACHINE DOES NOT STOP ON A SLOPE

Machine is pulled forward as sprocket rotates during digging operation.



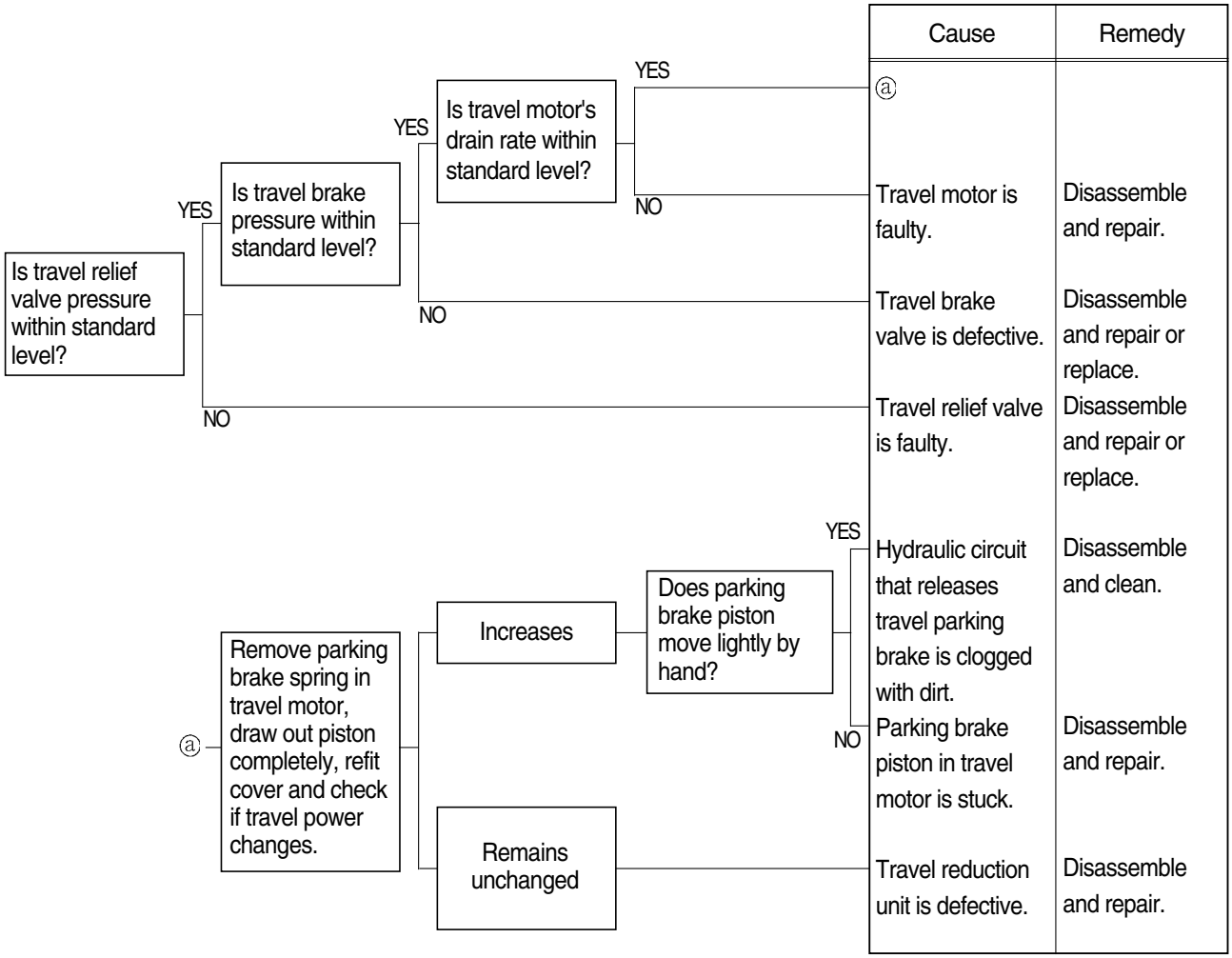
Cause	Remedy
Friction plate is faulty.	Disassemble and repair.
Clogged	Disassemble and clean pilot piping.
Travel motor is defective.	Disassemble and repair.
Brake valve is faulty.	Disassemble and repair or replace.

4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



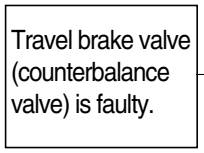
Cause	Remedy
	Inspect according to the procedure "Travel does not function at all on one side." However, a case where both LH and RH travel motions are disabled is extremelyseldom statistically.
Hydraulic pump is faulty.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Coupling at pump connection is broken.	Disassemble and repair.
	Replenish hydraulic oil.

5) TRAVEL ACTION IS POWERLESS(Travel only)



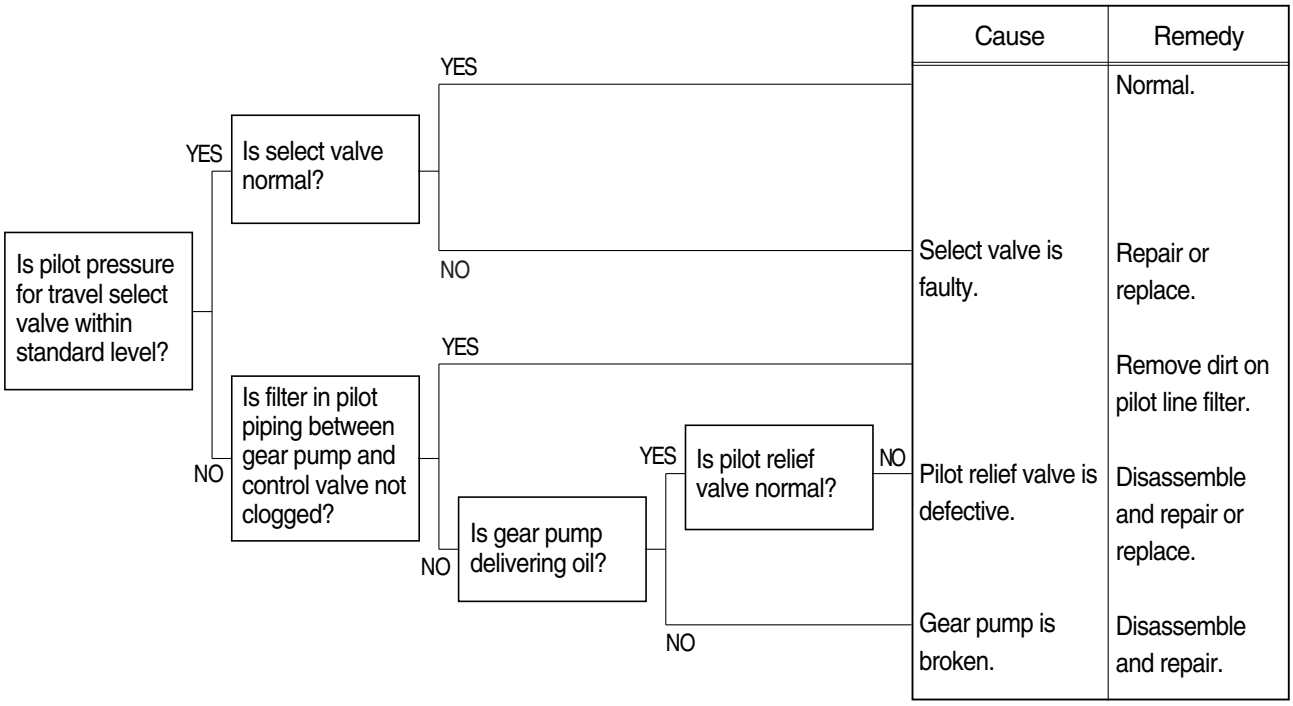
Cause	Remedy
ⓐ	
Travel motor is faulty.	Disassemble and repair.
Travel brake valve is defective.	Disassemble and repair or replace.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic circuit that releases travel parking brake is clogged with dirt.	Disassemble and clean.
Parking brake piston in travel motor is stuck.	Disassemble and repair.
Travel reduction unit is defective.	Disassemble and repair.

6) MACHINE RUNS RECKLESSLY ON A SLOPE



Cause	Remedy
	Disassemble and repair or replace.

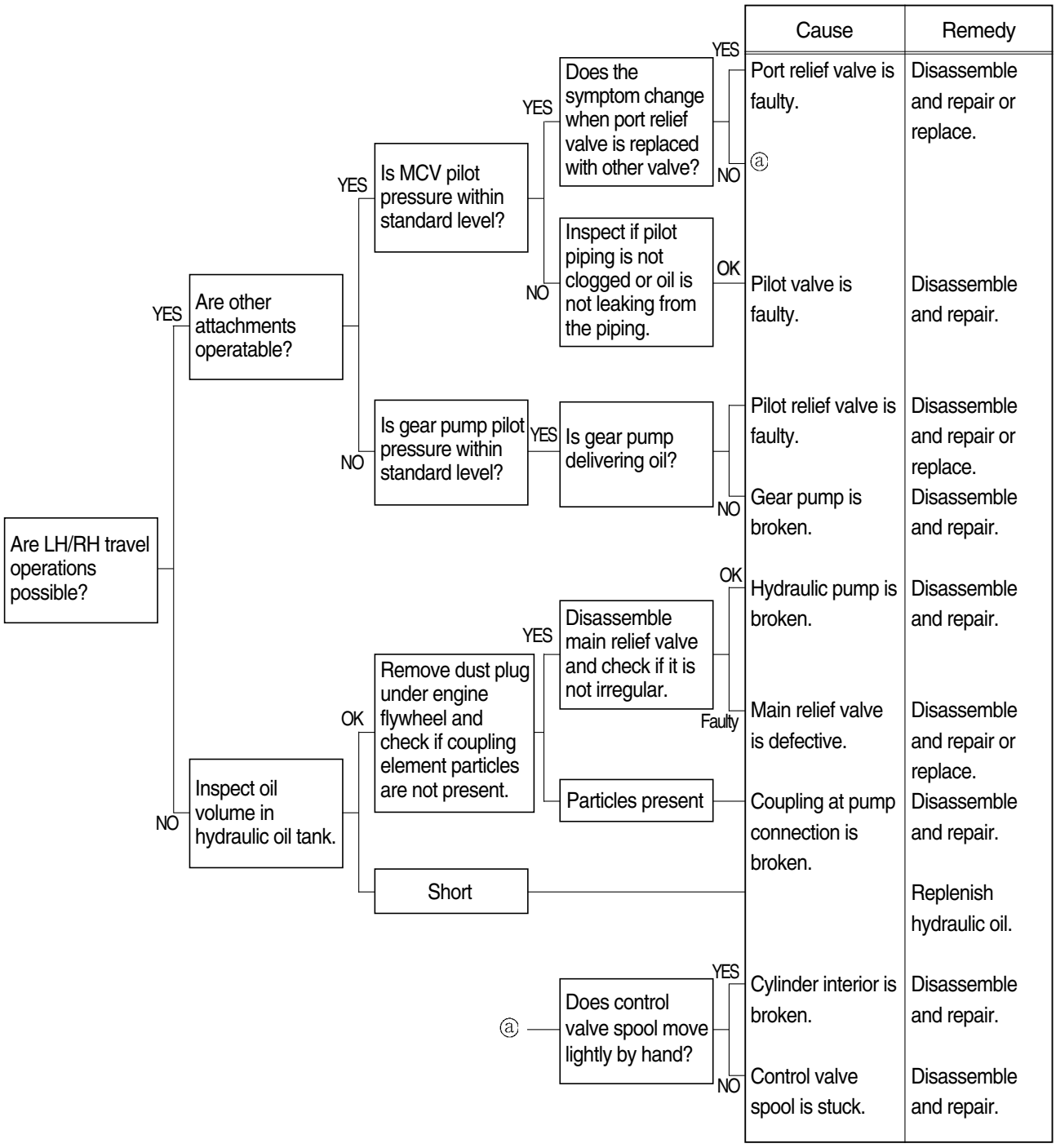
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



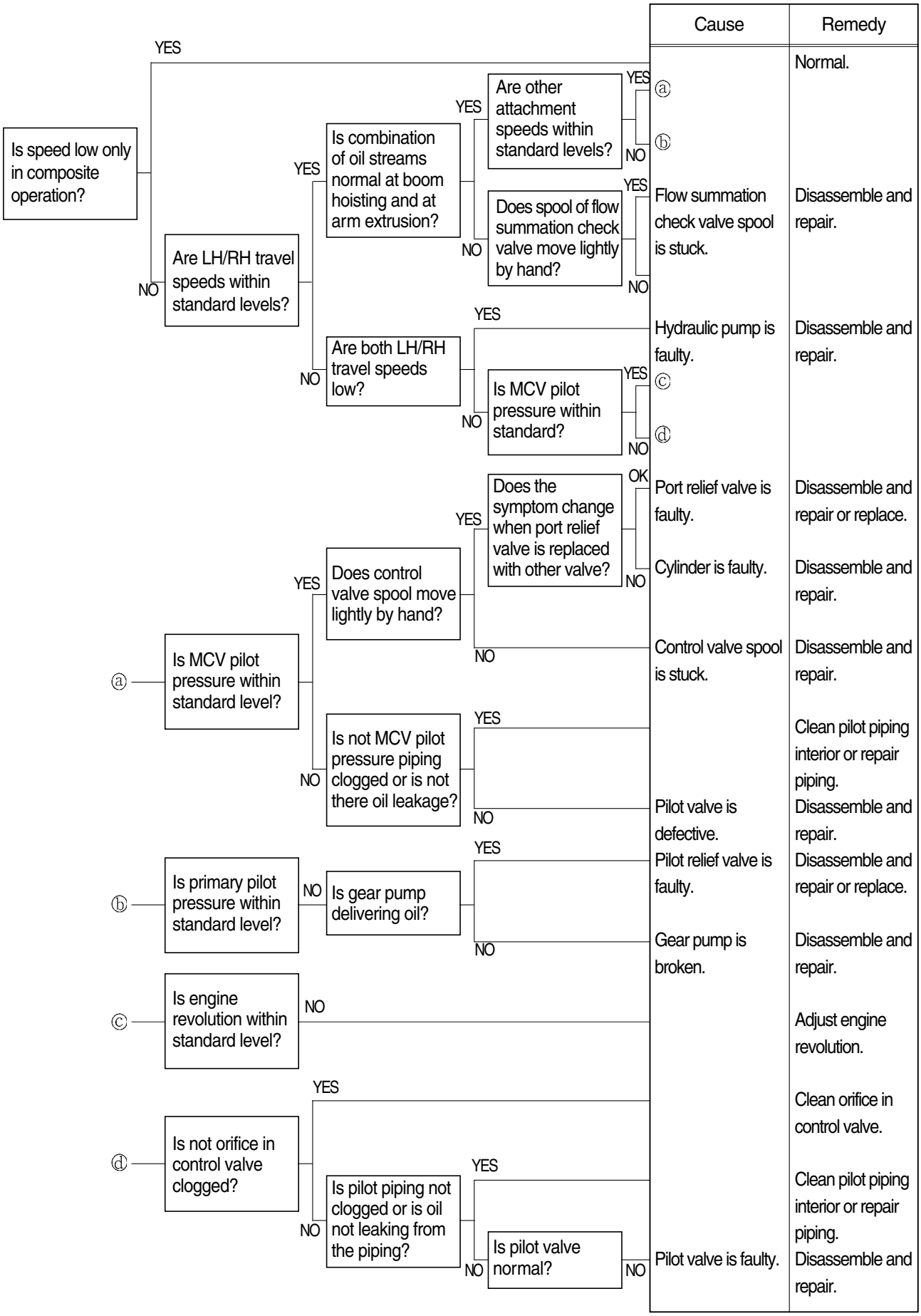
Cause	Remedy
	Normal.
Select valve is faulty.	Repair or replace.
	Remove dirt on pilot line filter.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

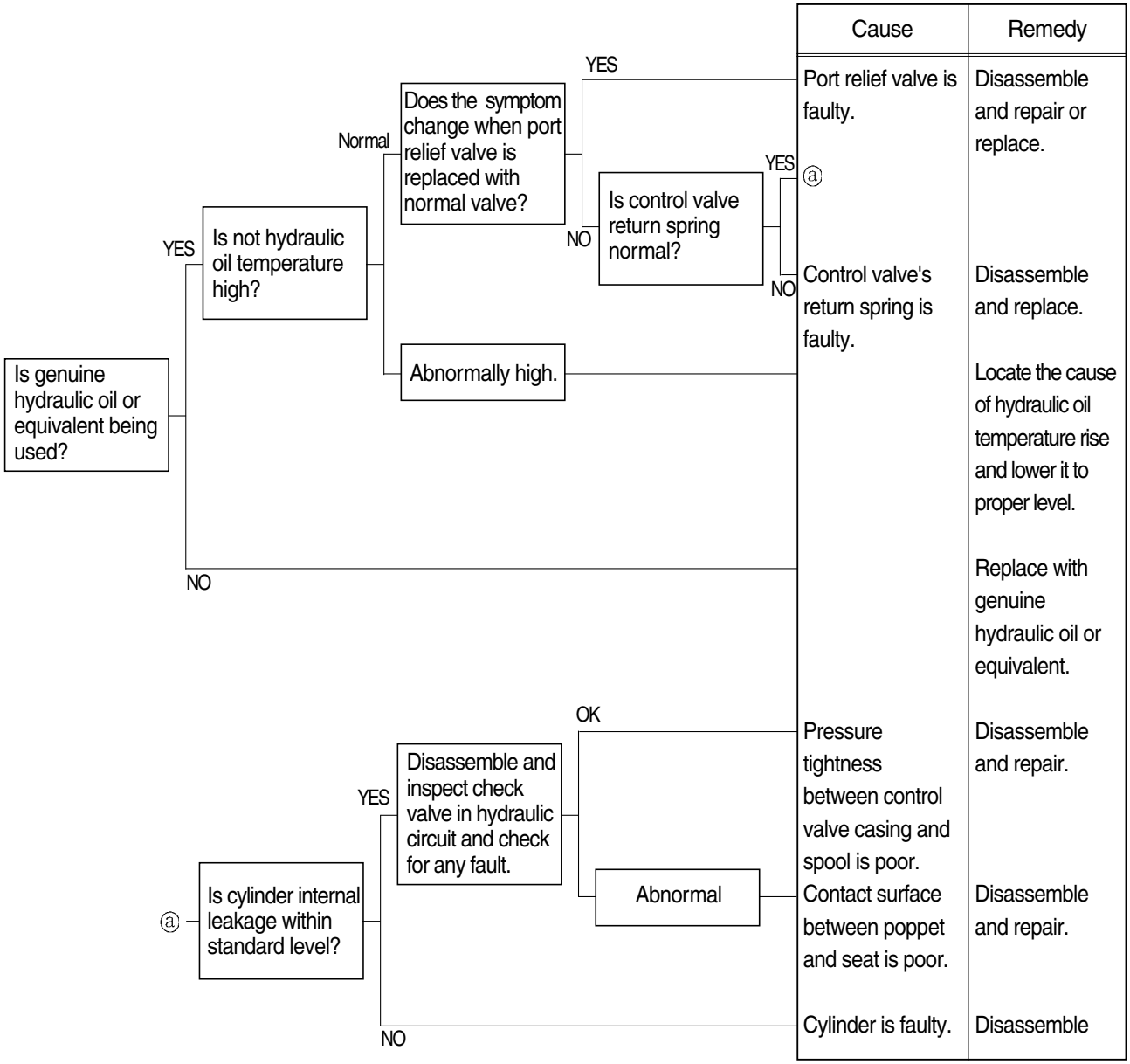
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

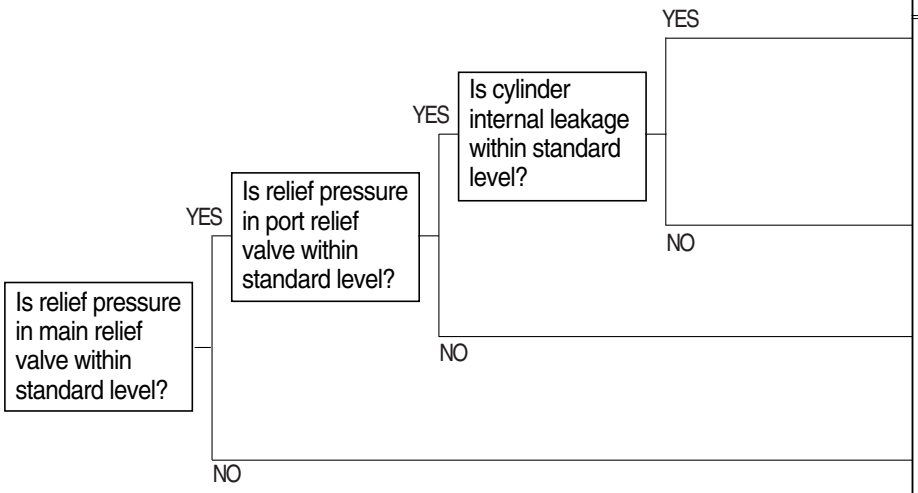


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



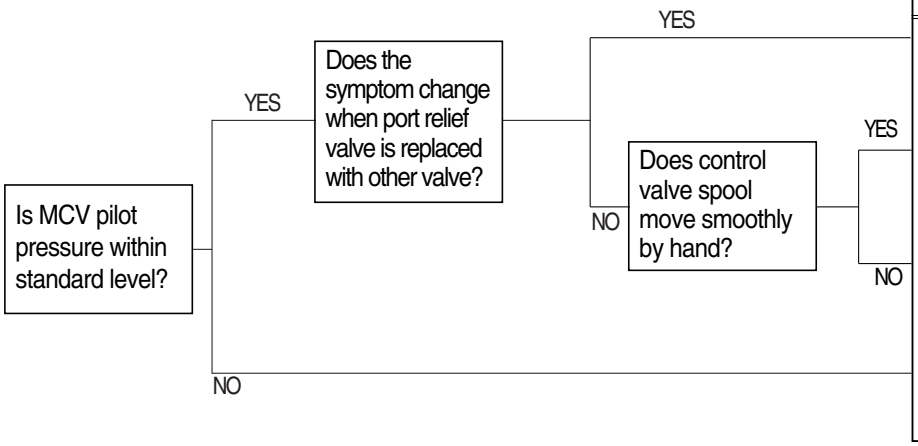
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between control valve casing and spool is poor.	Disassemble and repair.
Contact surface between poppet and seat is poor.	Disassemble and repair.
Cylinder is faulty.	Disassemble

4) BOOM, ARM OR BUCKET POWER IS WEAK



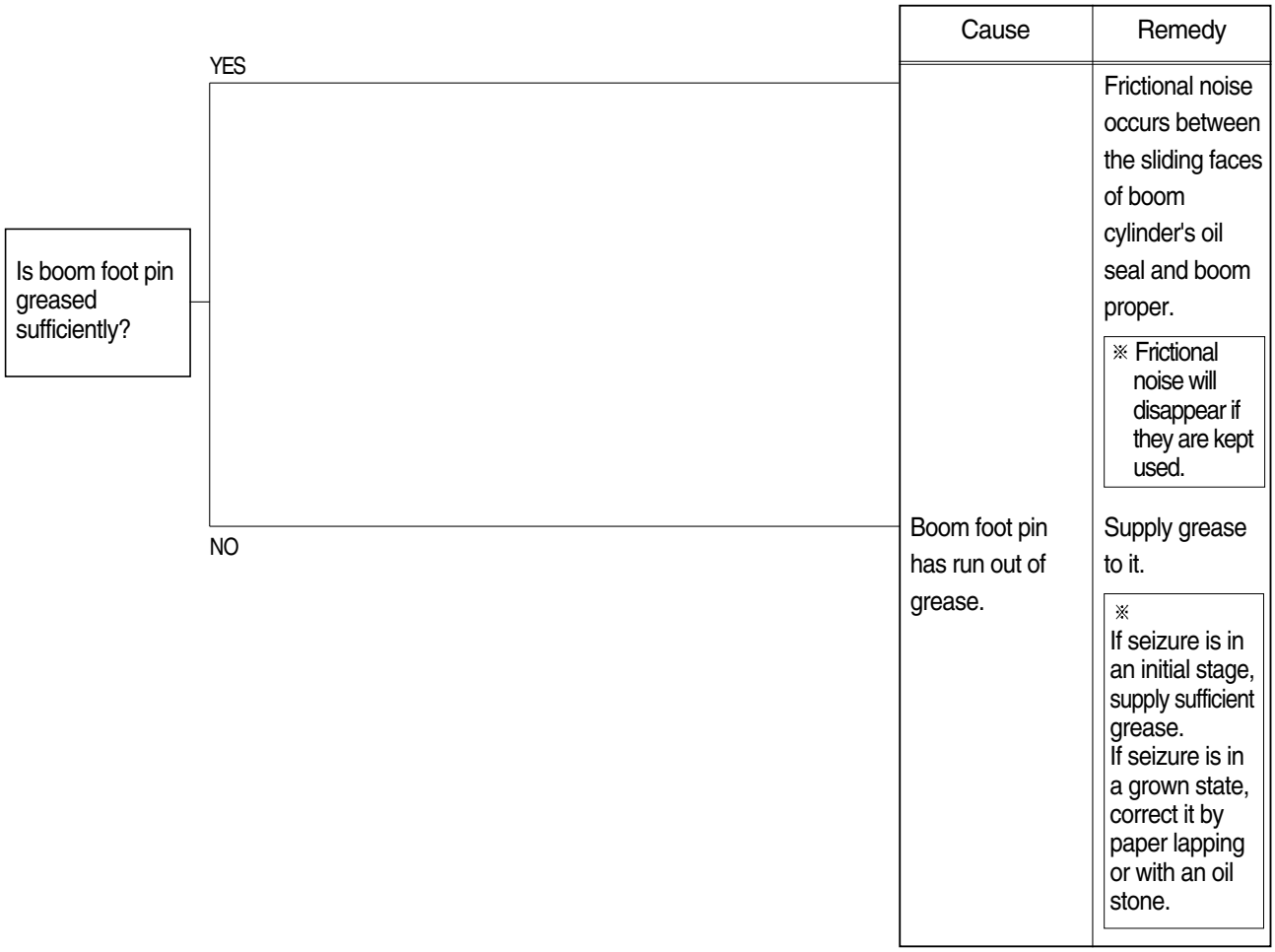
Cause	Remedy
Cylinder is faulty.	Check according to the procedure in Item "Speed is low". Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



Cause	Remedy
Port relief valve is defective.	Disassemble and repair or replace.
Cylinder interior is broken.	Disassemble and repair.
Control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.

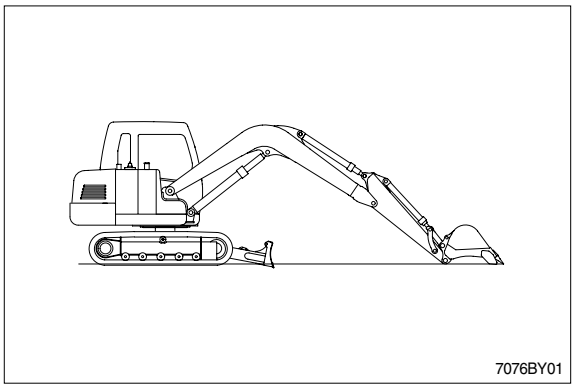
6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED



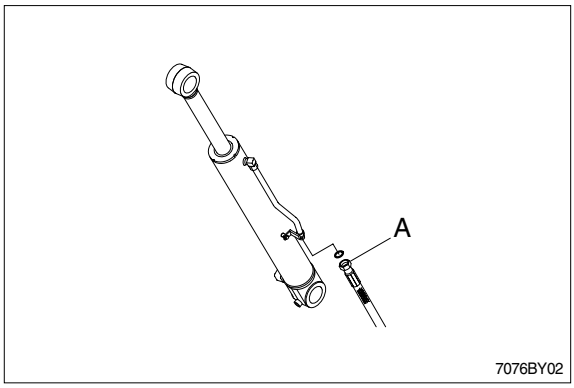
Cause	Remedy
	Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is 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.

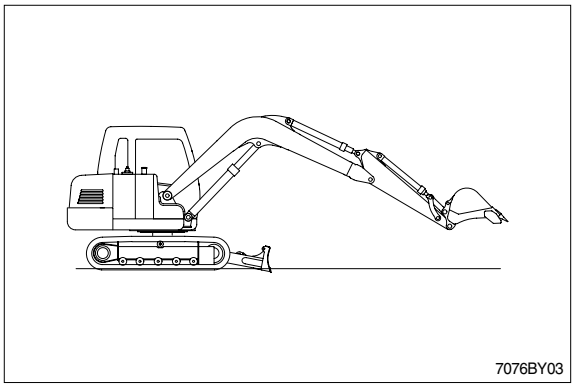


2. Disconnect hose(A) from rod side of boom cylinder and drain oil from cylinders and hose.(Put cups on piping and hose ends)



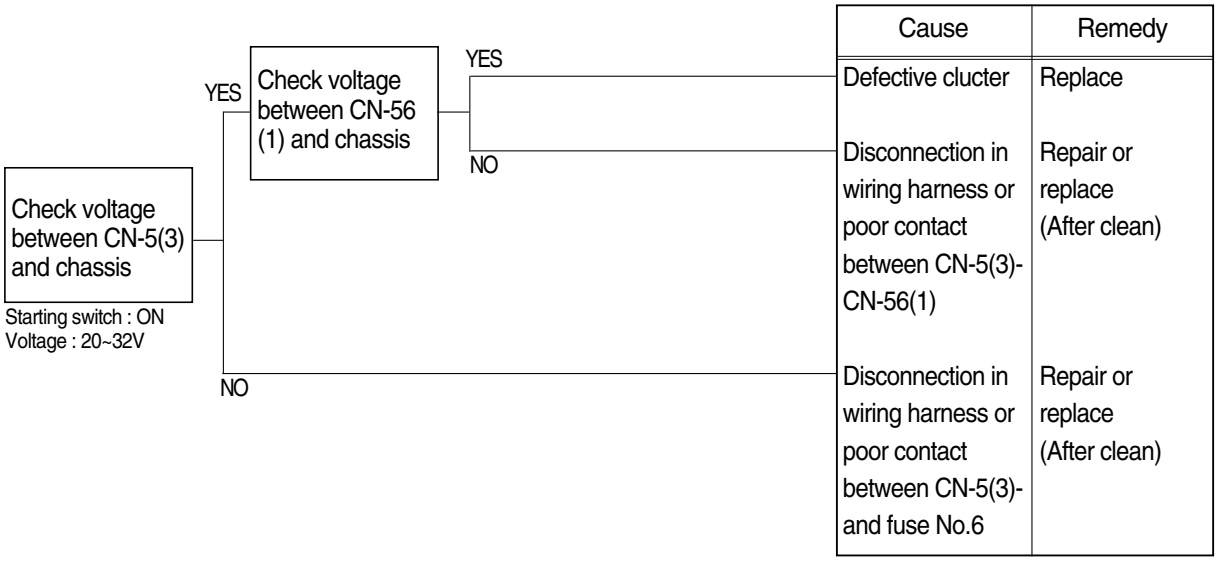
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

   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.

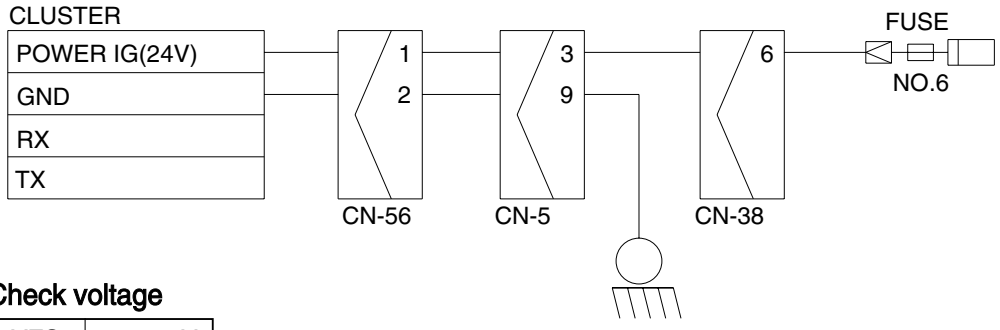


1. WHEN STARTING SWITCH IS TURNED ON, MONITOR PANEL DISPLAY DOES NOT APPEAR

- 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.6.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective clucter	Replace
Disconnection in wiring harness or poor contact between CN-5(3)-CN-56(1)	Repair or replace (After clean)
Disconnection in wiring harness or poor contact between CN-5(3)- and fuse No.6	Repair or replace (After clean)



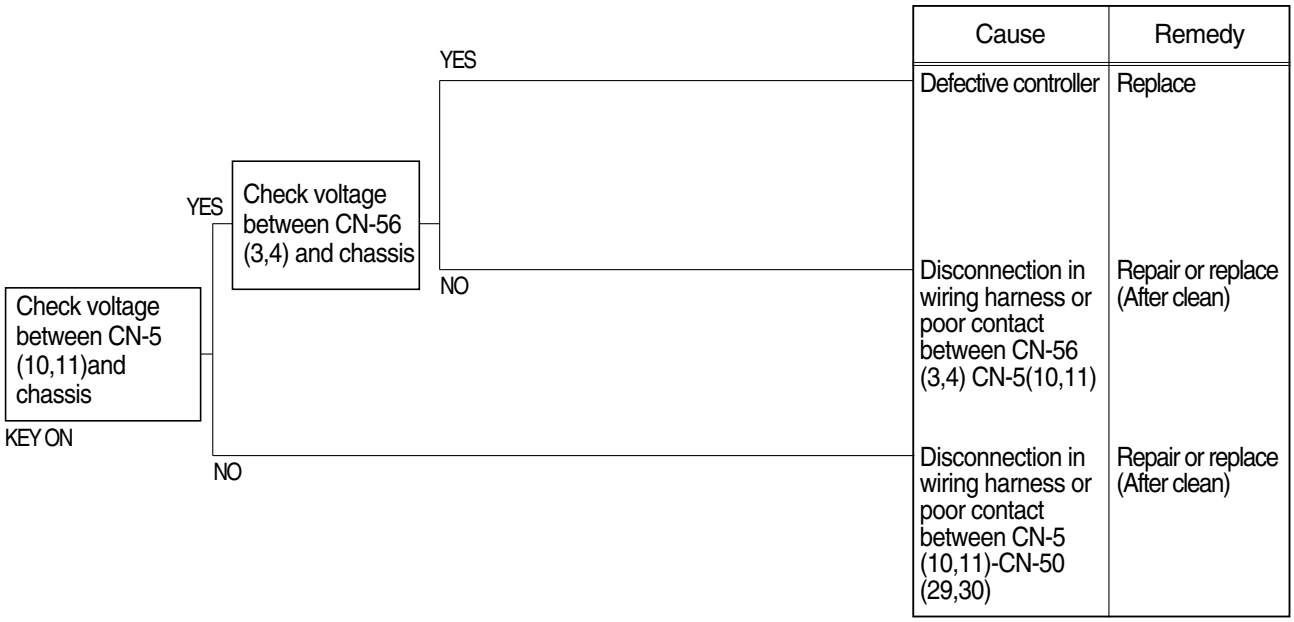
Check voltage

YES	20 ~ 30V
NO	0V

7076TS20

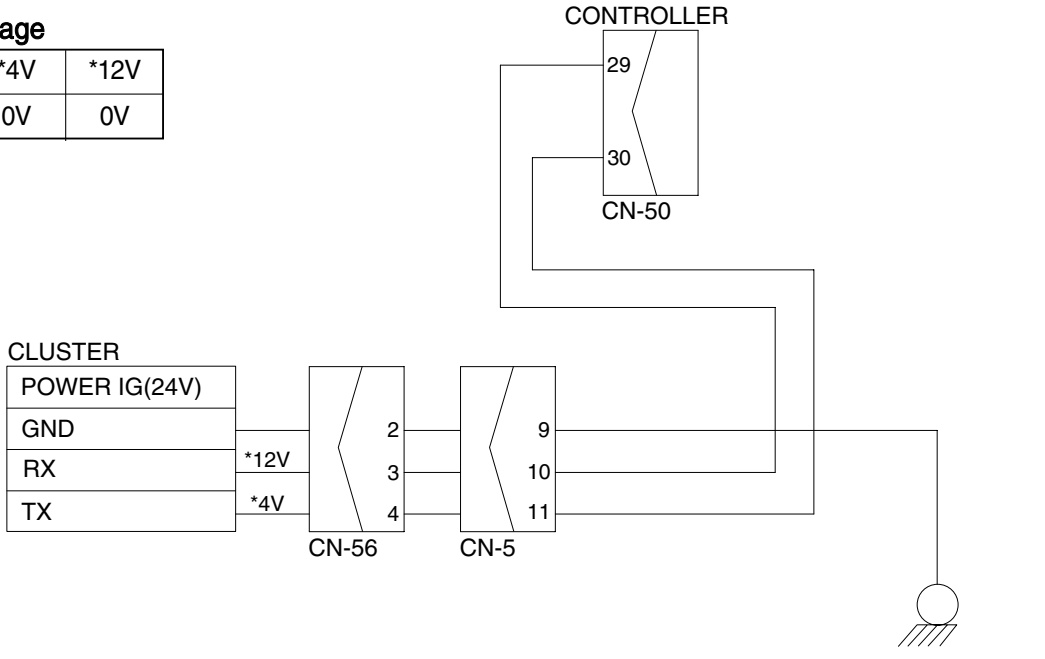
2. COMMUNICATION ERROR "Co : Err" FLASHES ON THE CLUSTER

- 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 voltage

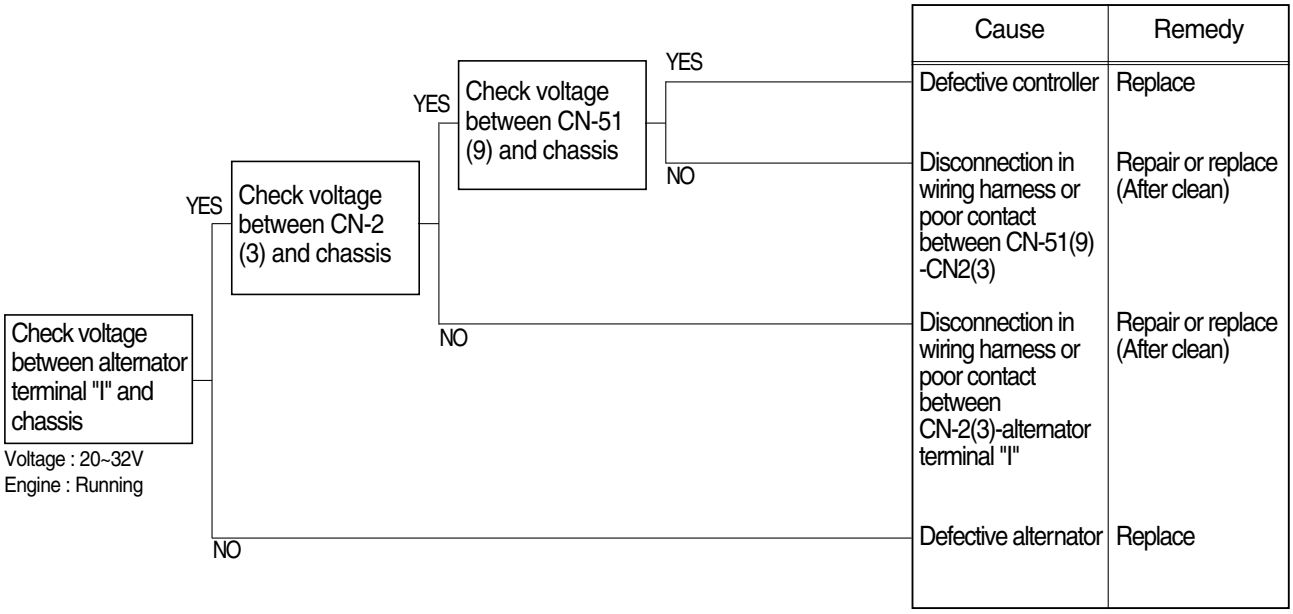
YES	*4V	*12V
NO	0V	0V



29076ES02

3. BATTERY CHARGING WARNING LAMP LIGHTS UP(Starting switch : ON)

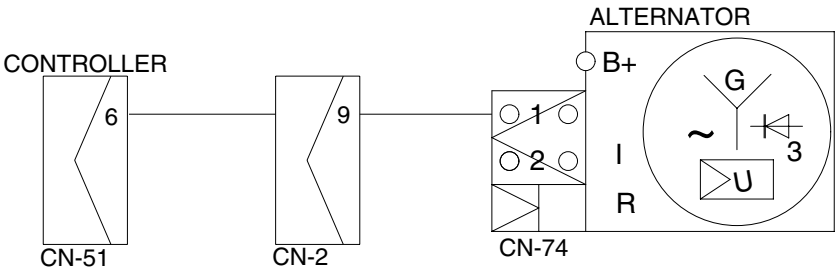
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective controller	Replace
Disconnection in wiring harness or poor contact between CN-51(9) -CN2(3)	Repair or replace (After clean)
Disconnection in wiring harness or poor contact between CN-2(3)-alternator terminal "I"	Repair or replace (After clean)
Defective alternator	Replace

Check voltage

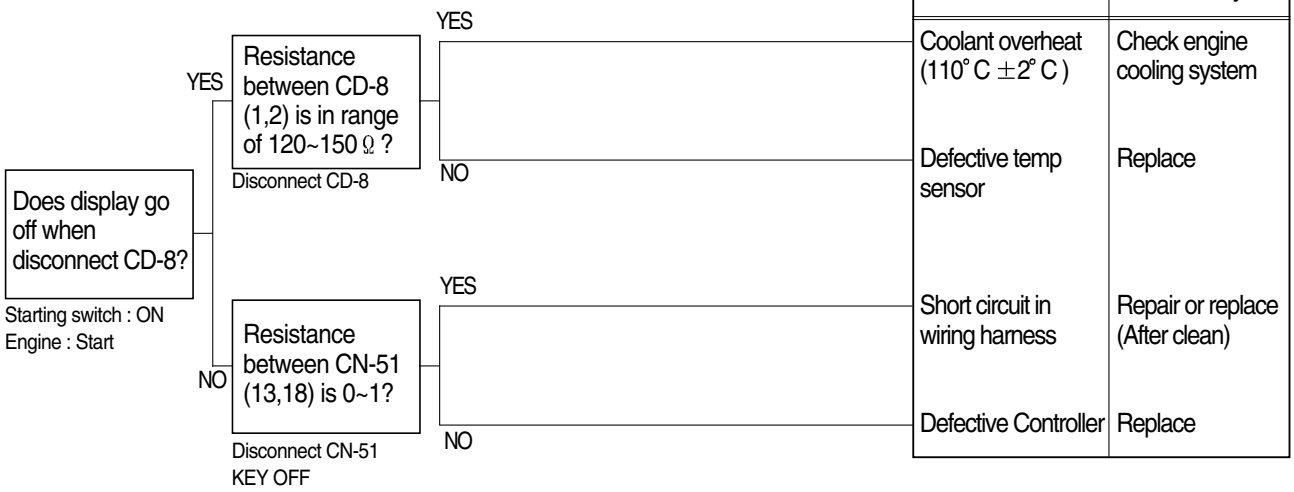
YES	20 ~ 32V
NO	0V

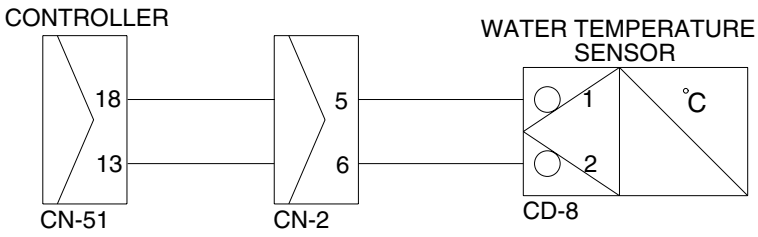


7076TS21

4. 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.

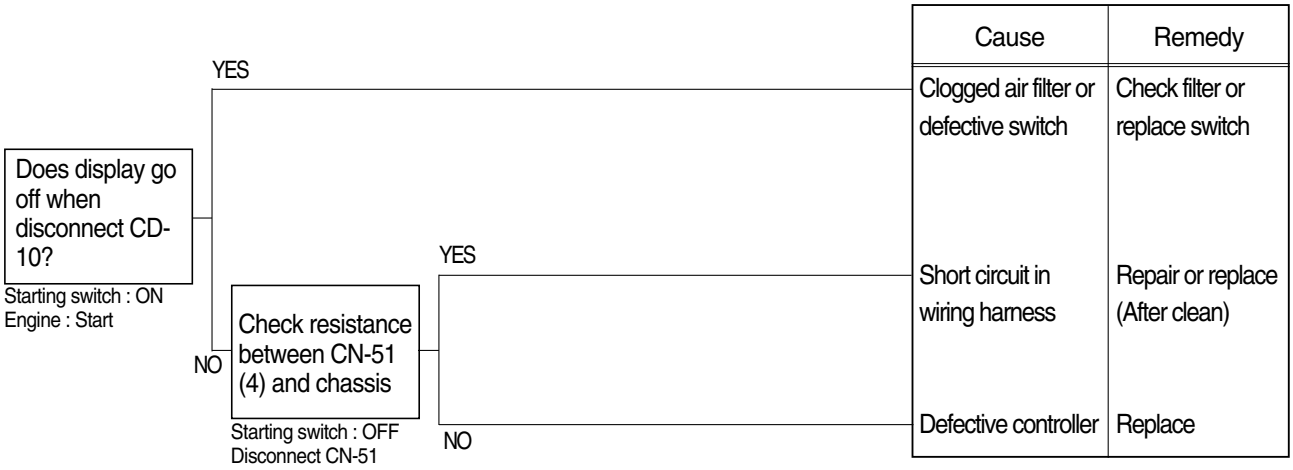




7076TS22

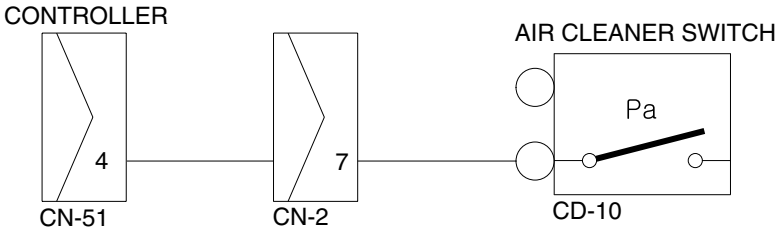
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP(Engine is started)

- 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

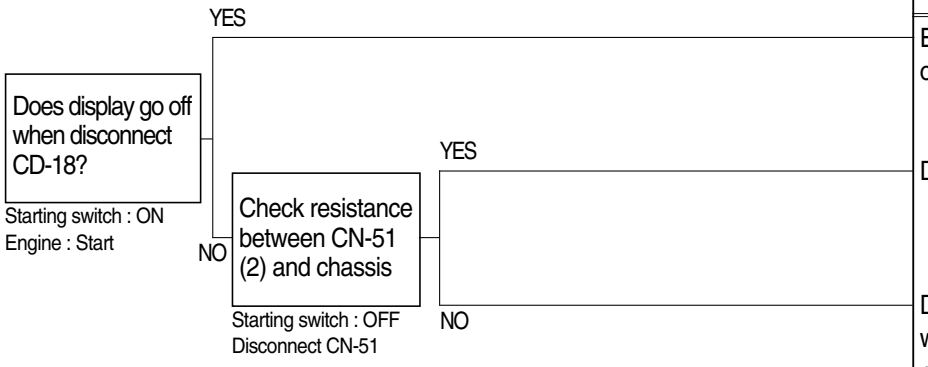
YES	MAX 1Ω
NO	MIN 1M Ω



7076TS23

6. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (Engine is started)

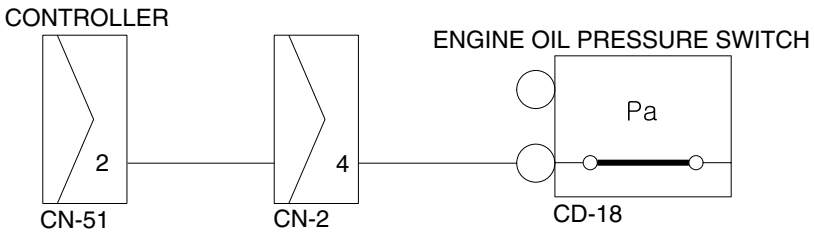
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Engine oil leakage, or defective switch	Check engine oil level or replace switch
Defective controller	Replace
Disconnection in wiring harness or poor contact between CN-51(2)-CD-18	Repair or replace (After clean)

Check resistance

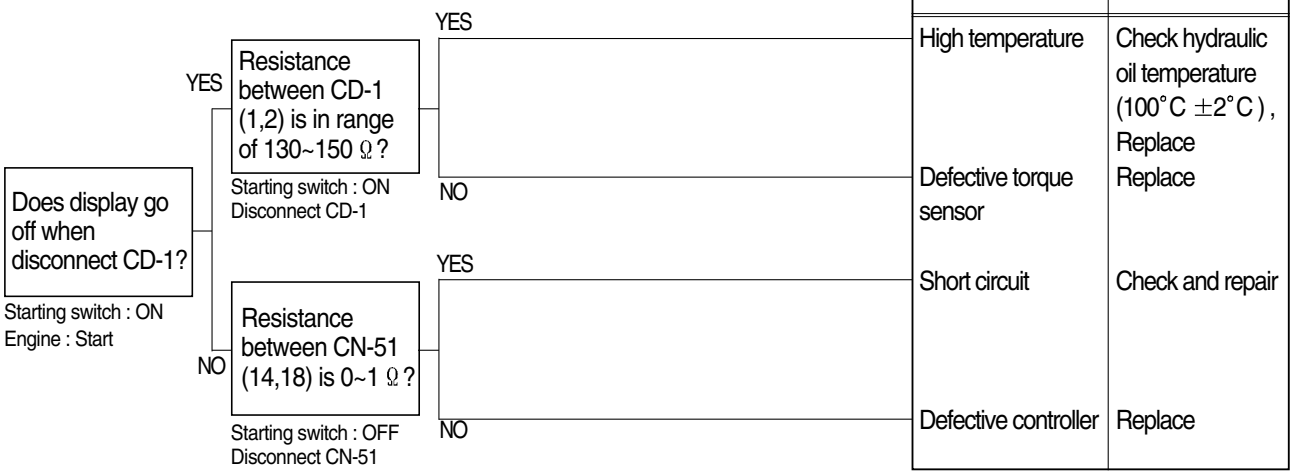
YES	MAX 1Ω
NO	MIN 1MΩ

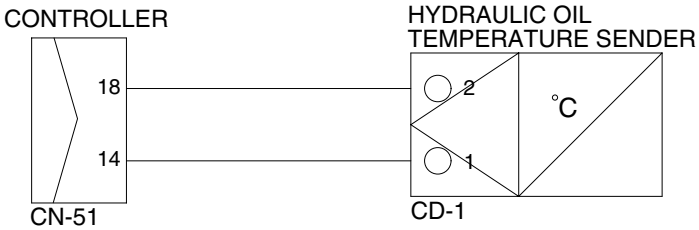


7076TS24

7. 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.

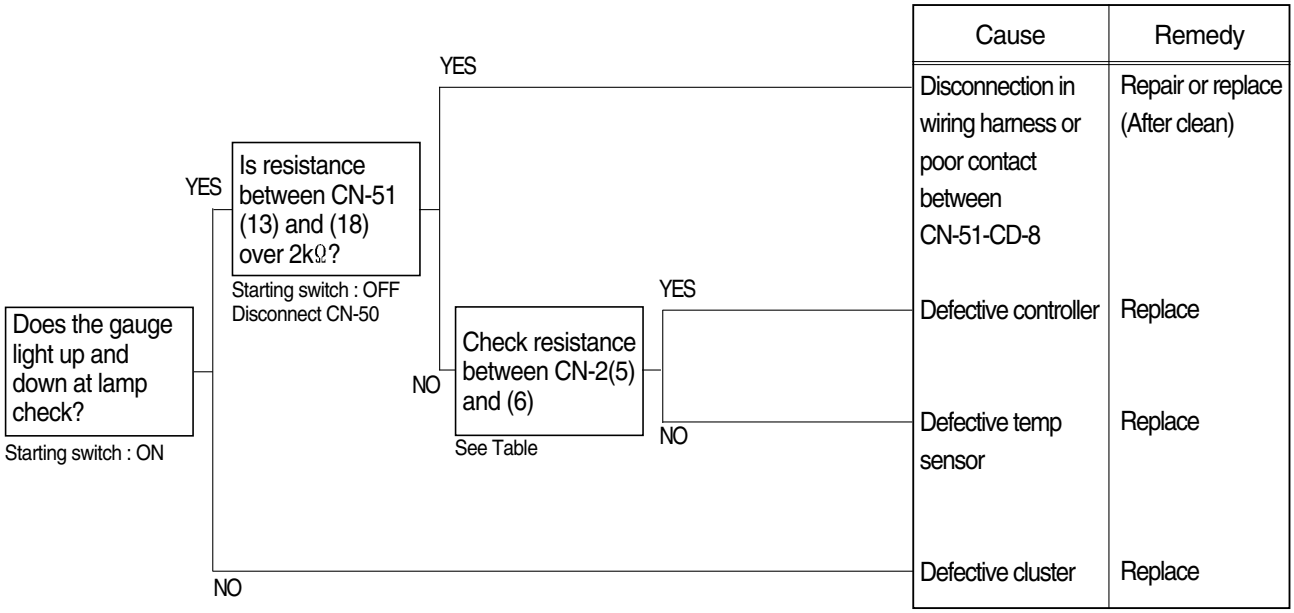




7076TS25

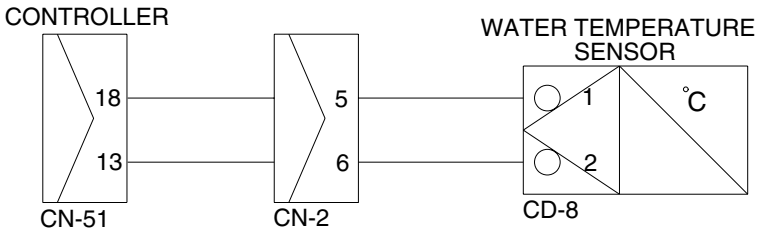
8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

- 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

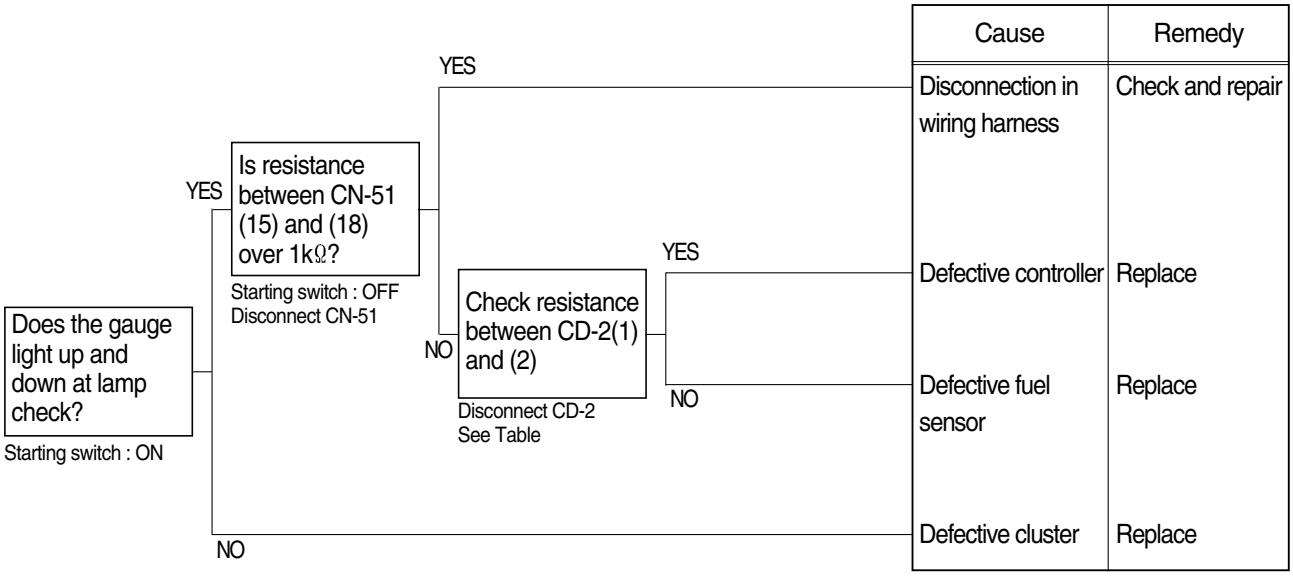
Item \ Temperature	White range (~29℃)	Green range (30~105℃)	Red range (105℃ ~)
Unit Resistance(Ω)	1646~	1645~158	~139
Tolerance(%)	±20	±20	±20

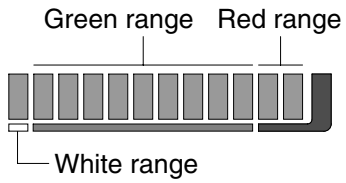


7076TS22

9. WHEN FUEL GAUGE DOES NOT OPERATE(Check warning lamp ON/OFF)

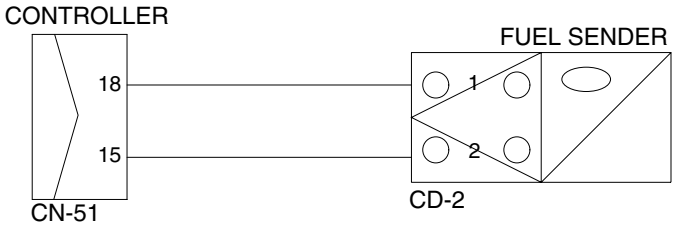
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

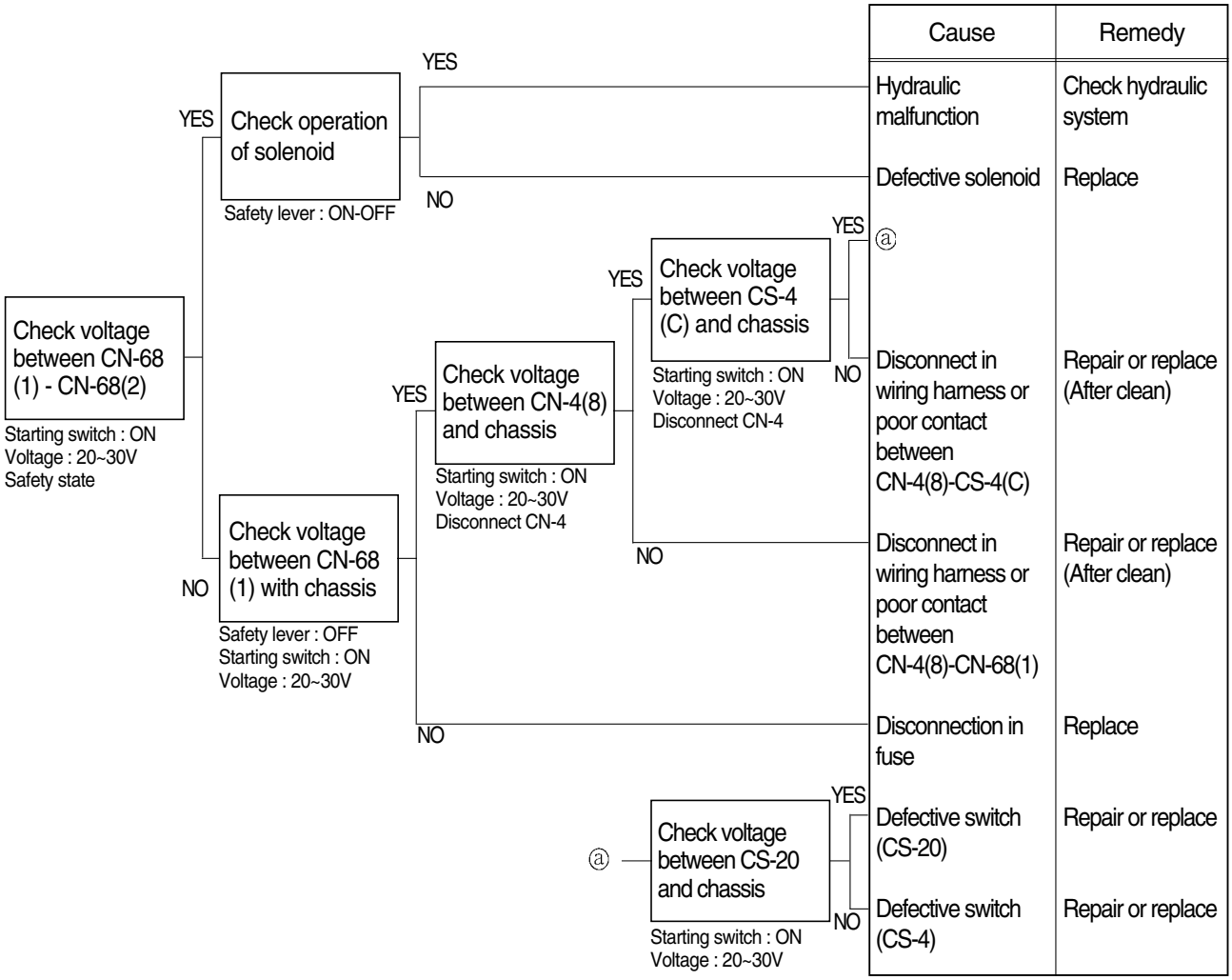
Item \ Level	White range	Green range	Red range
Unit Resistance(Ω)	700~601	600~101	~100
Tolerance(%)	±5	±5	±5

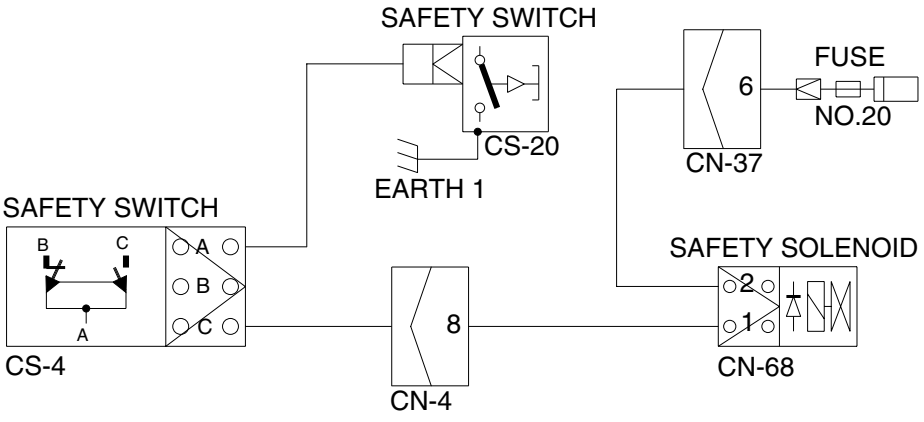


7076TS26

10. 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.20.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

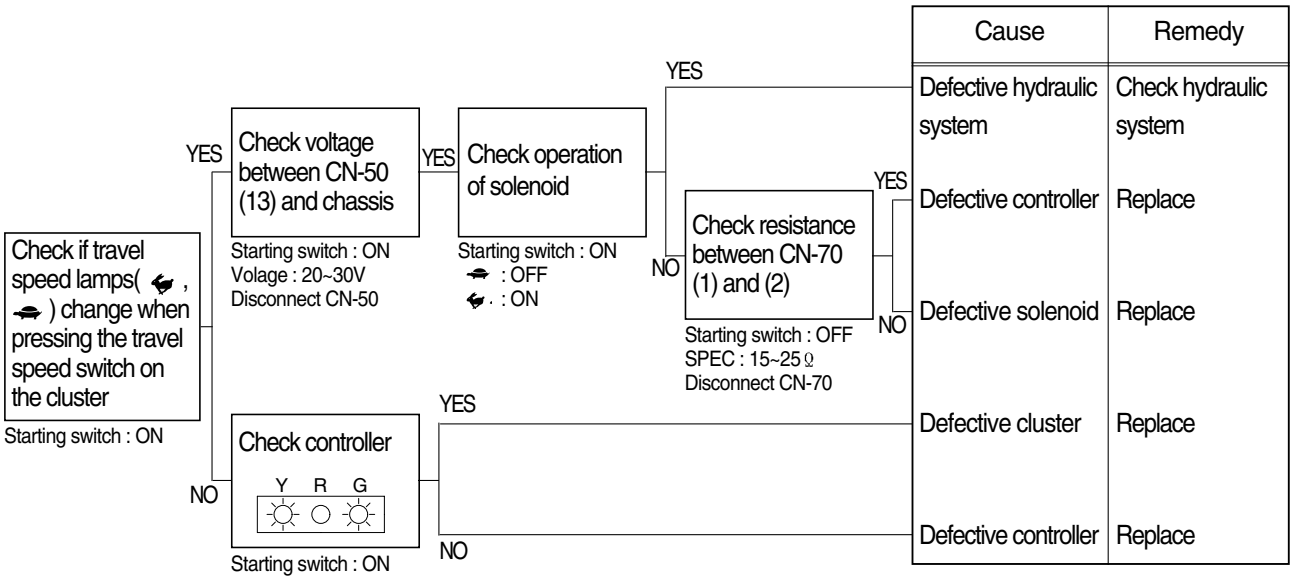


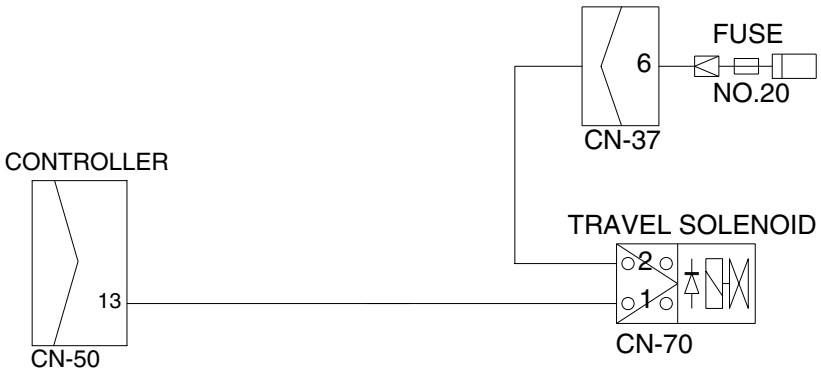


7076TS27

11. 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.22 .
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

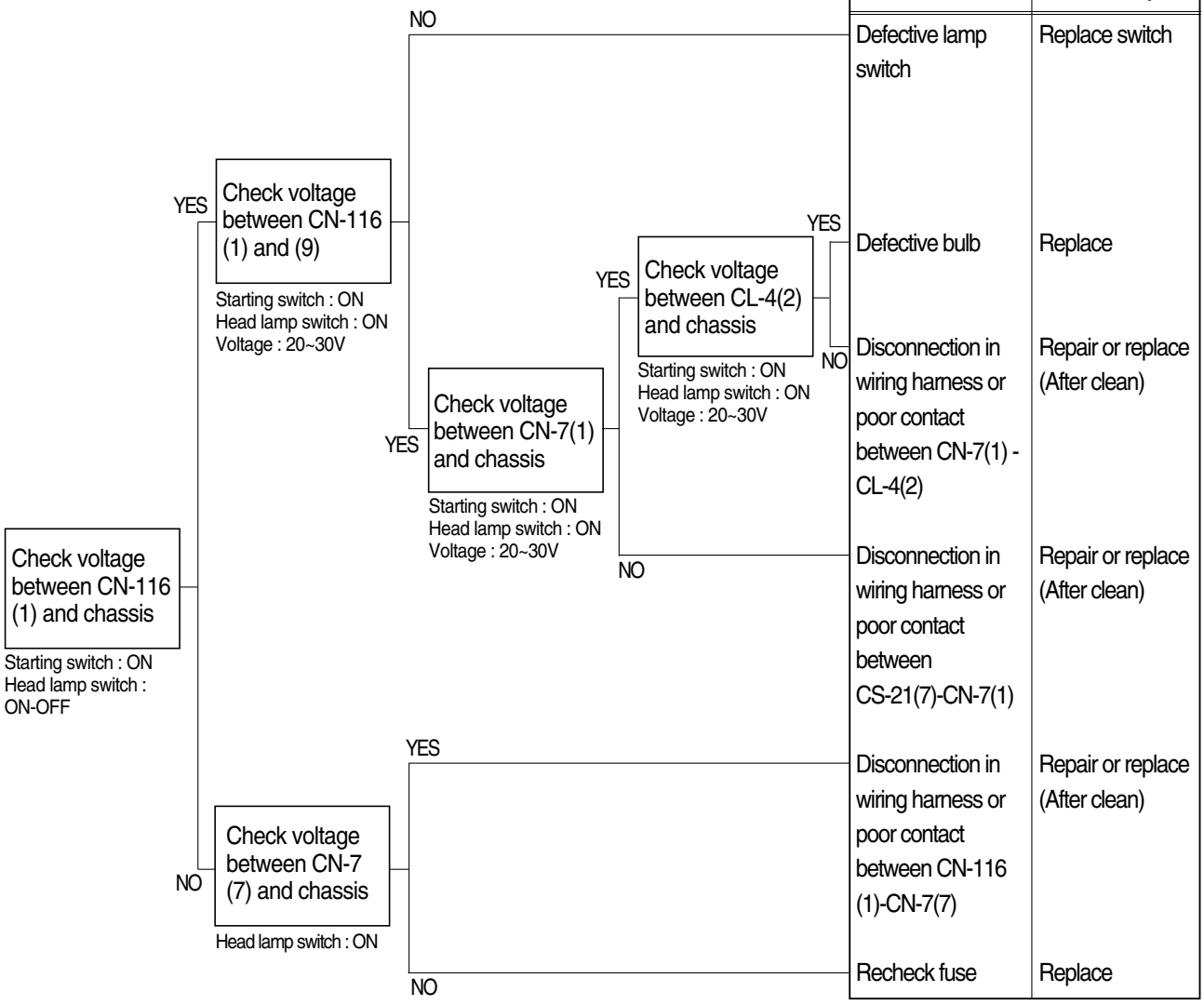


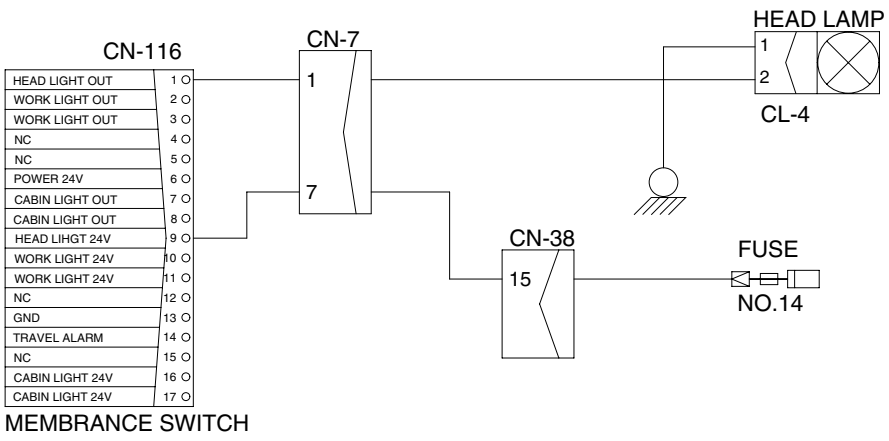


7076TS28

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.14.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

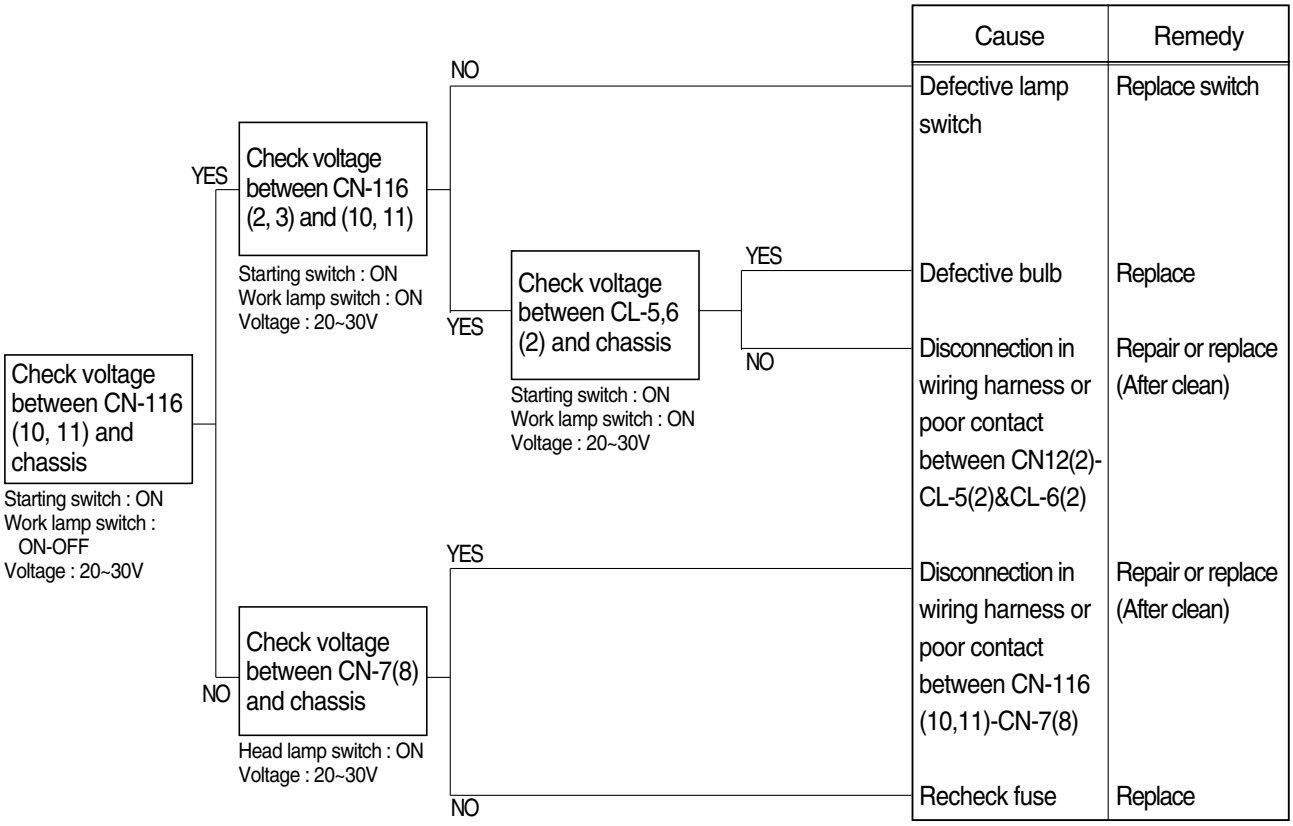




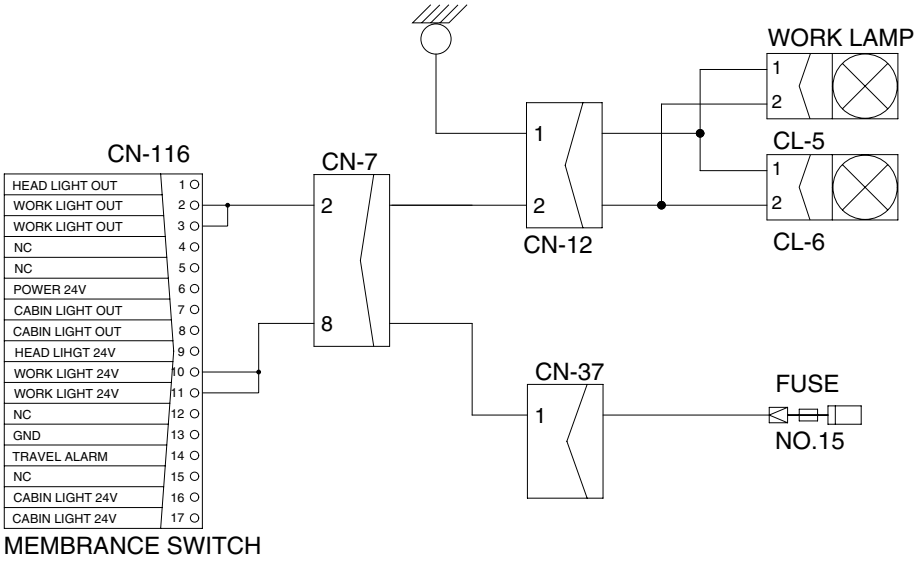
7076TS29

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.15.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



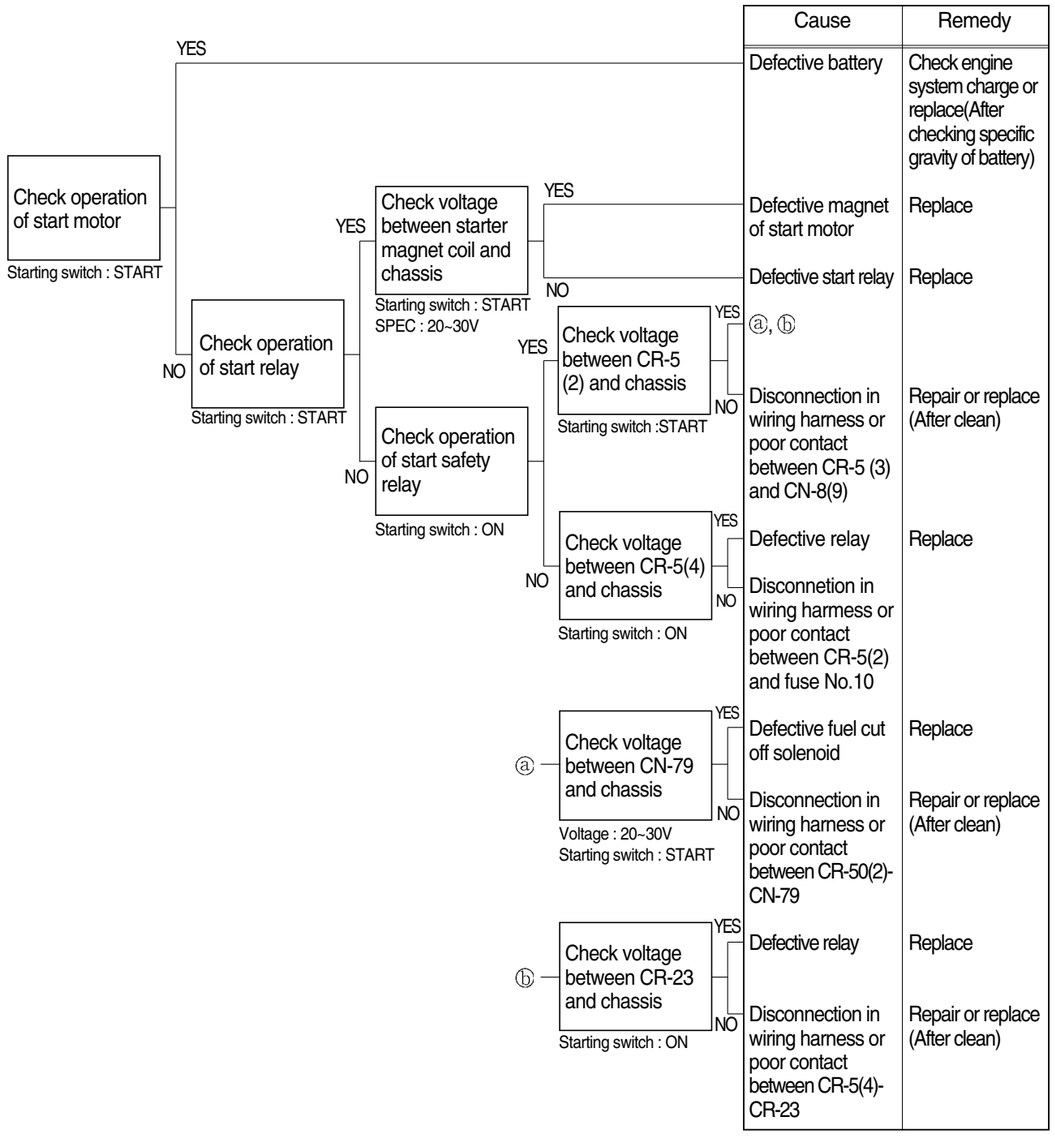
Cause	Remedy
Defective lamp switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN12(2)-CL-5(2)&CL-6(2)	Repair or replace (After clean)
Disconnection in wiring harness or poor contact between CN-116 (10,11)-CN-7(8)	Repair or replace (After clean)
Recheck fuse	Replace

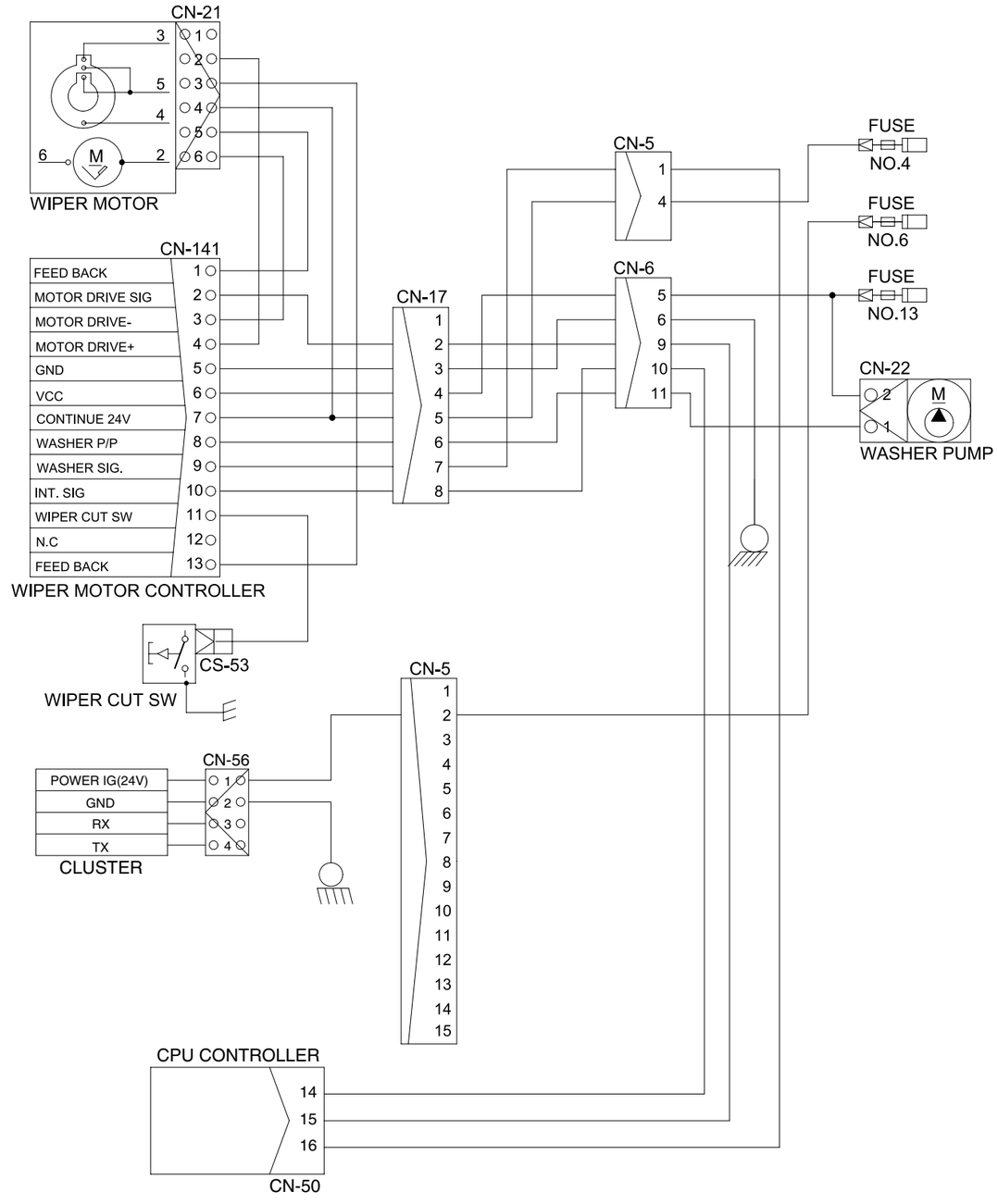


7076TS30

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.

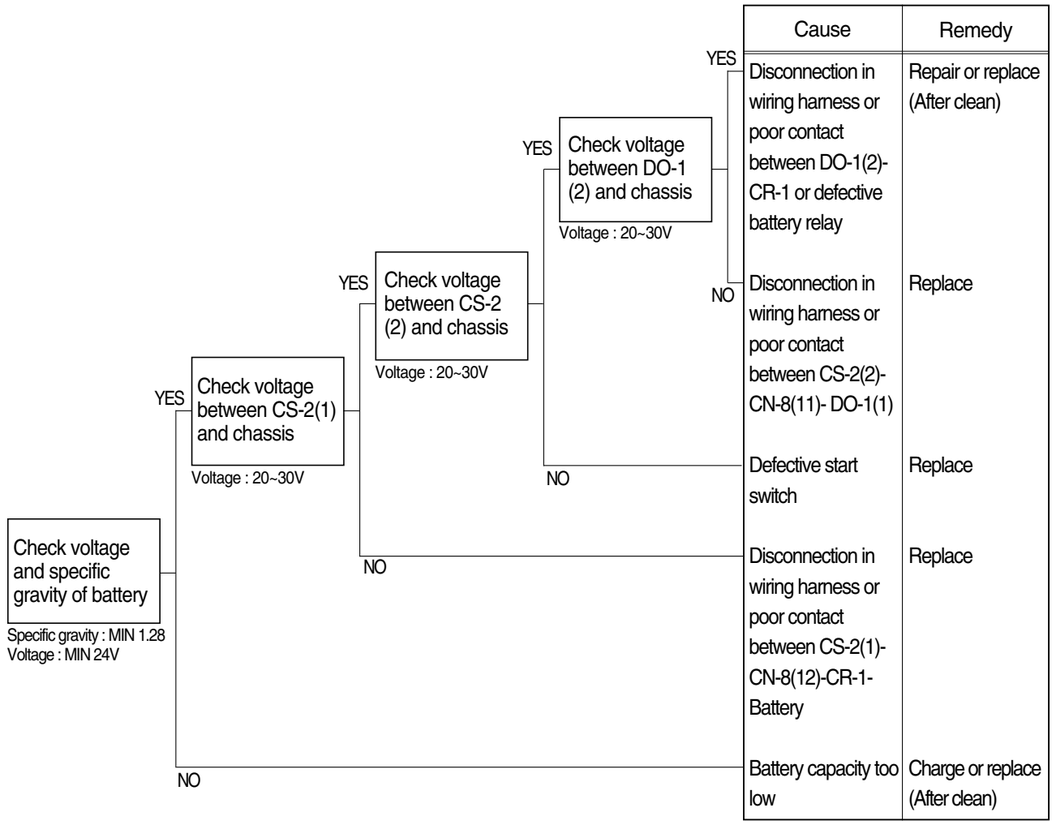




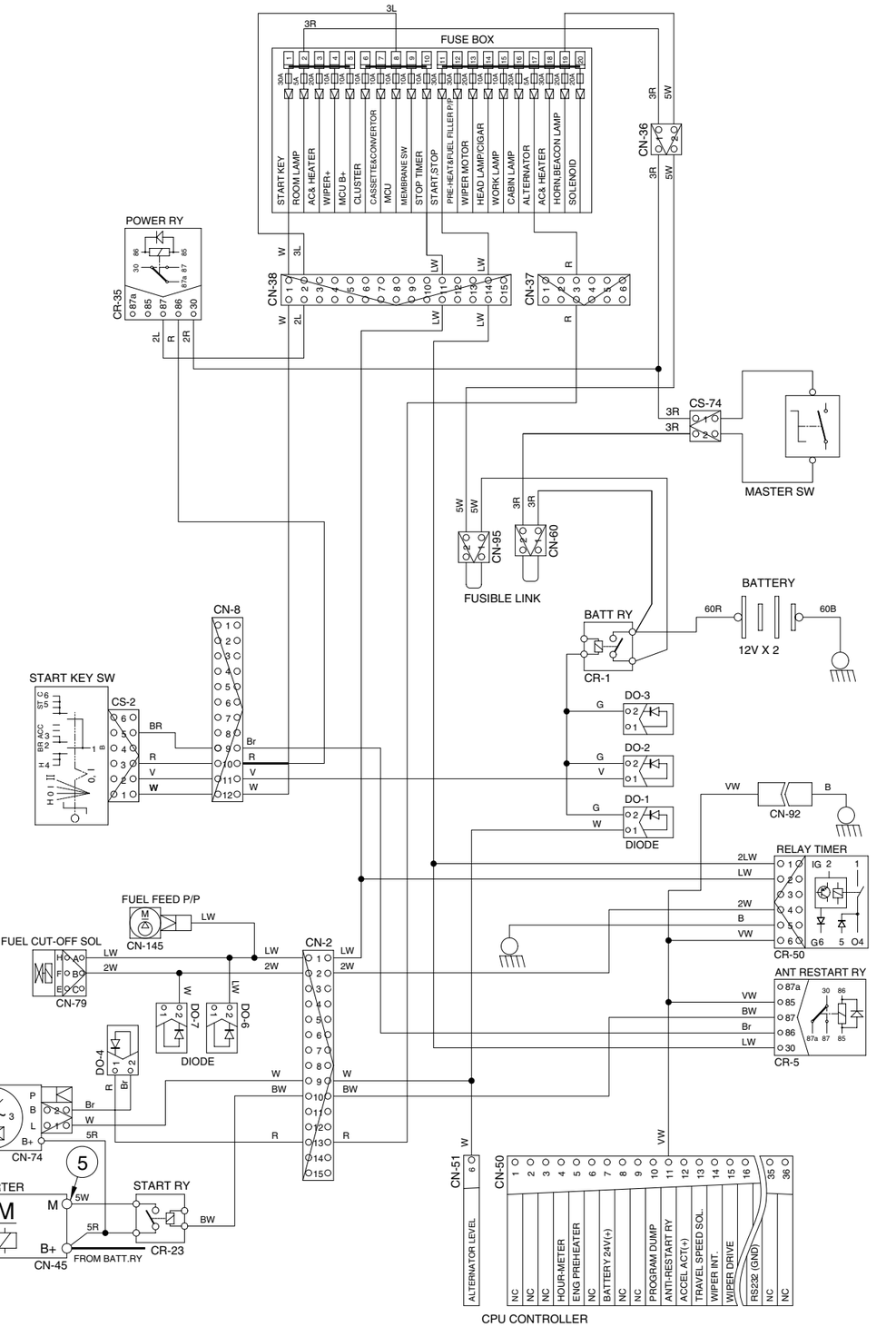
7076TS31

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.



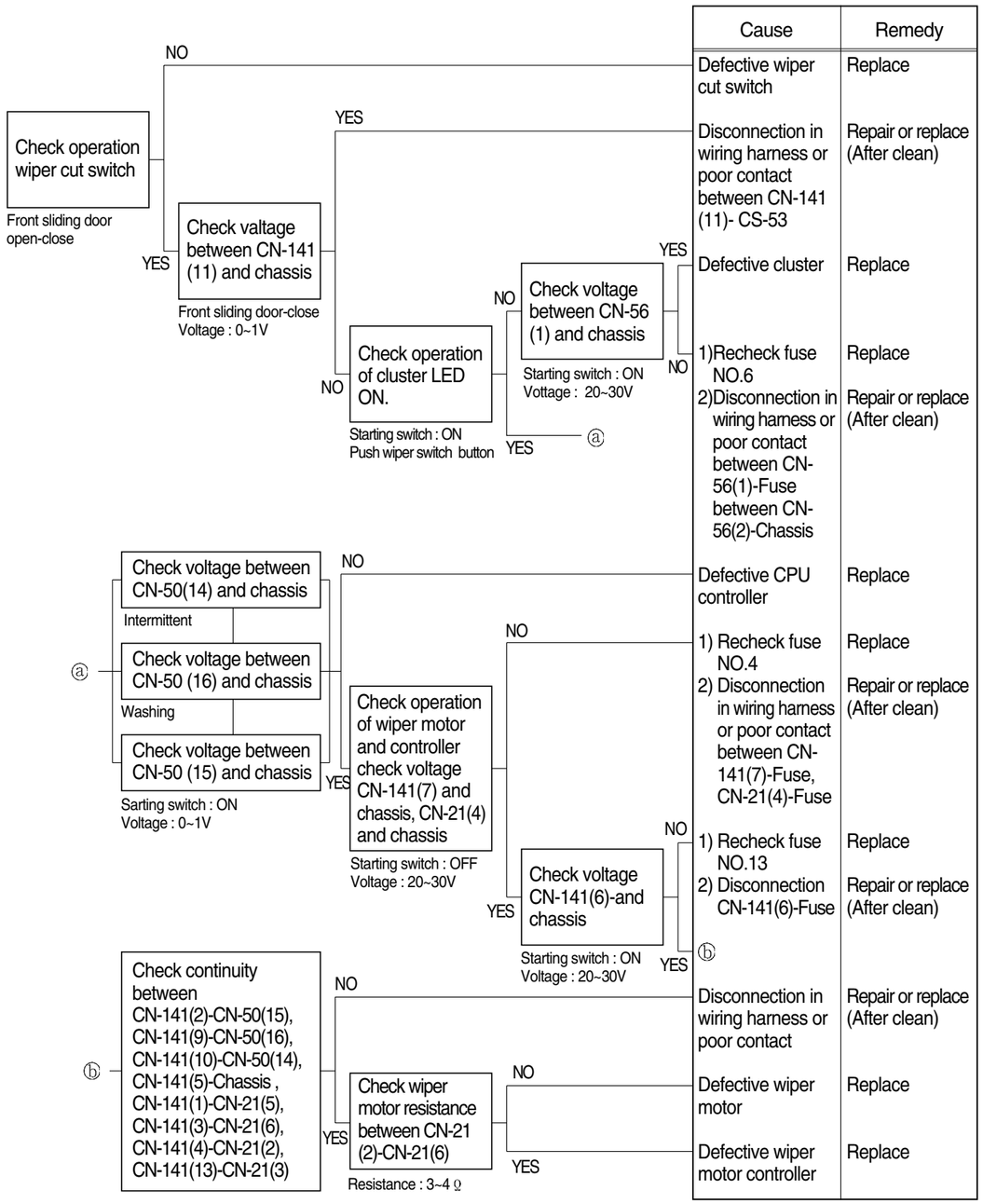
Cause	Remedy
Disconnection in wiring harness or poor contact between DO-1(2)-CR-1 or defective battery relay	Repair or replace (After clean)
Disconnection in wiring harness or poor contact between CS-2(2)-CN-8(11)- DO-1(1)	Replace
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2(1)-CN-8(12)-CR-1-Battery	Replace
Battery capacity too low	Charge or replace (After clean)



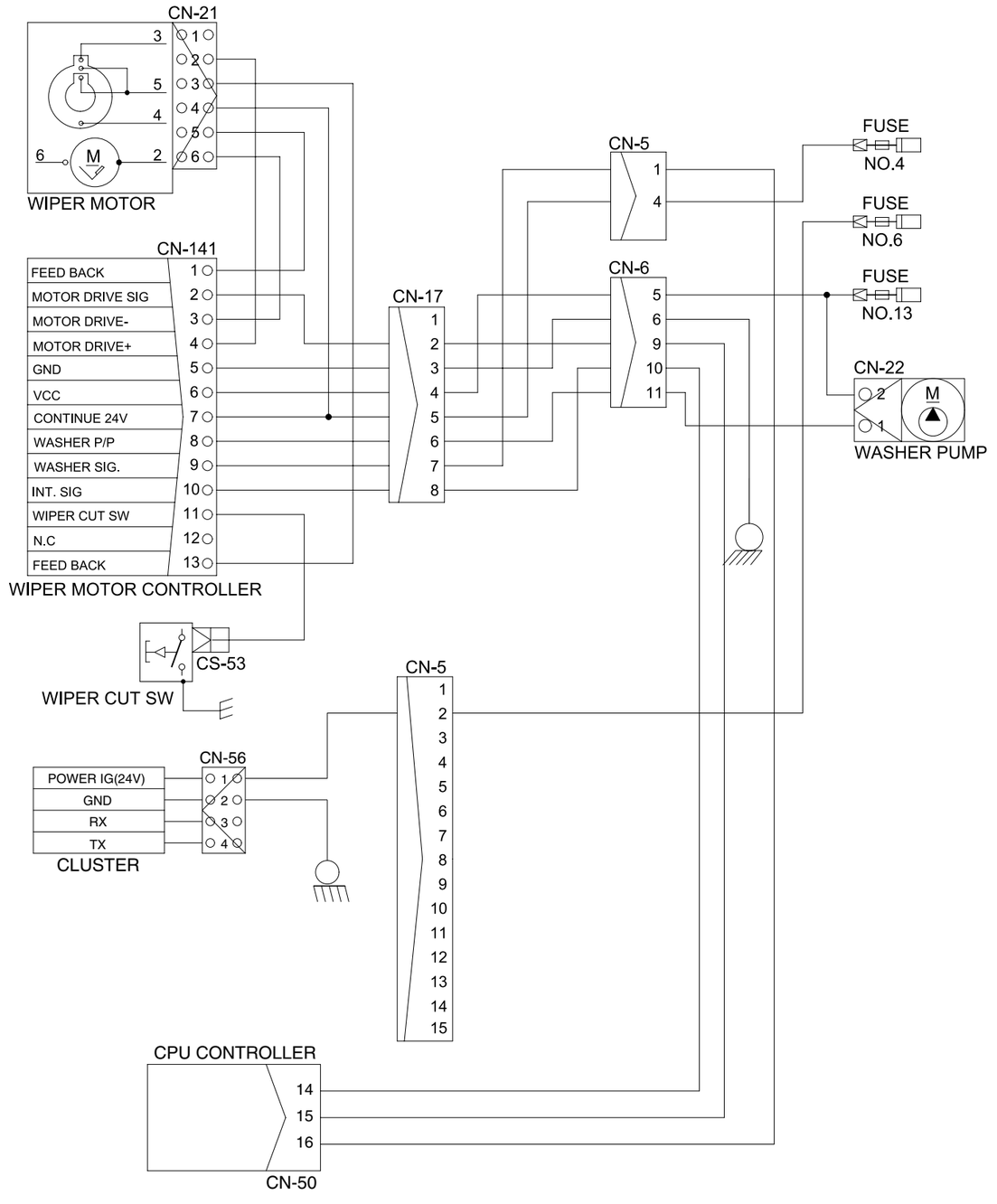
RD8076TS31

16. 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.4, 6 and 13 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective wiper cut switch	Replace
Disconnection in wiring harness or poor contact between CN-141 (11)- CS-53	Repair or replace (After clean)
Defective cluster	Replace
1)Recheck fuse NO.6	Replace
2)Disconnection in wiring harness or poor contact between CN-56(1)-Fuse between CN-56(2)-Chassis	Repair or replace (After clean)
Defective CPU controller	Replace
1) Recheck fuse NO.4	Replace
2) Disconnection in wiring harness or poor contact between CN-141(7)-Fuse, CN-21(4)-Fuse	Repair or replace (After clean)
1) Recheck fuse NO.13	Replace
2) Disconnection CN-141(6)-Fuse	Repair or replace (After clean)
Disconnection in wiring harness or poor contact	Repair or replace (After clean)
Defective wiper motor	Replace
Defective wiper motor controller	Replace

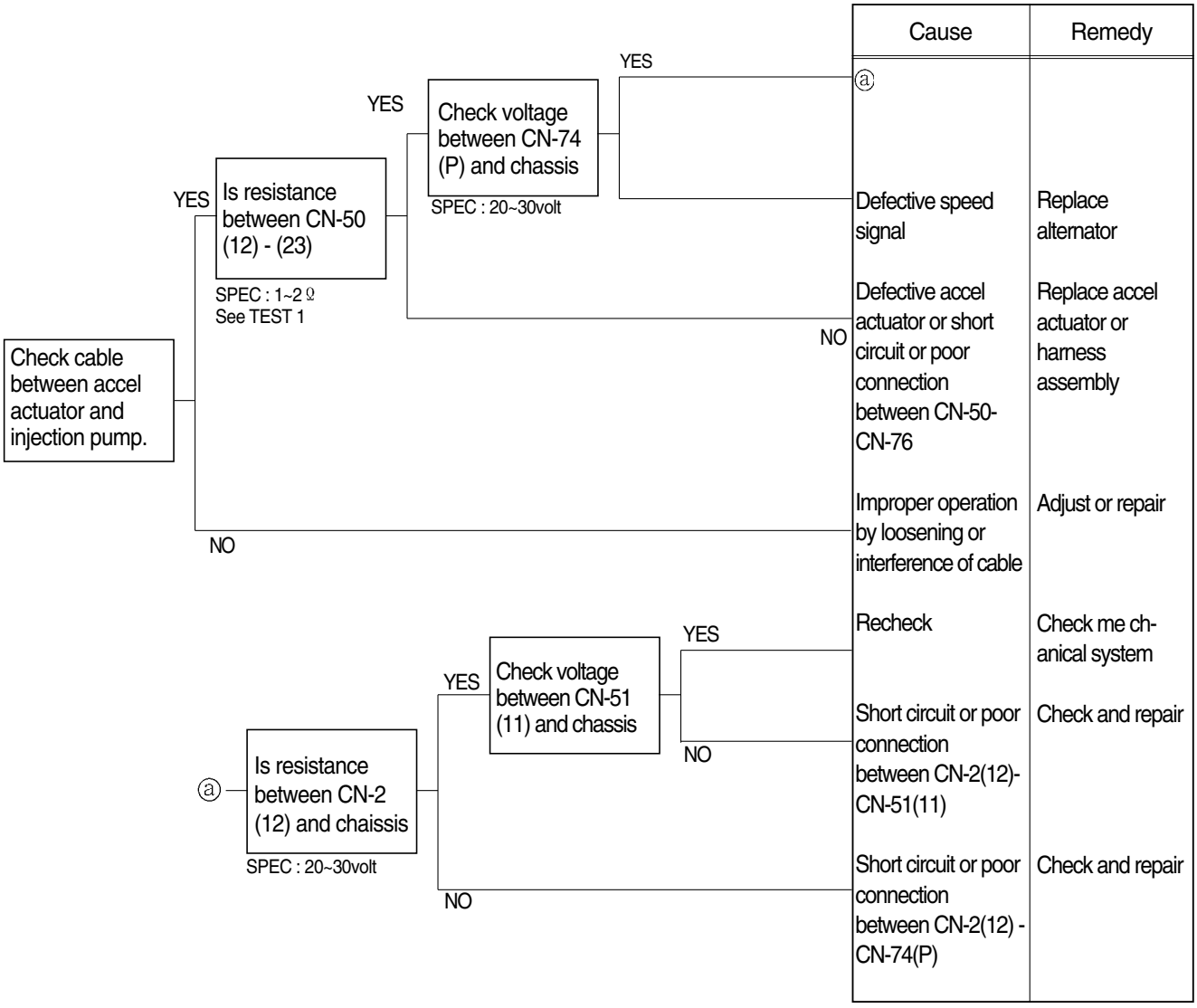


7076TS37

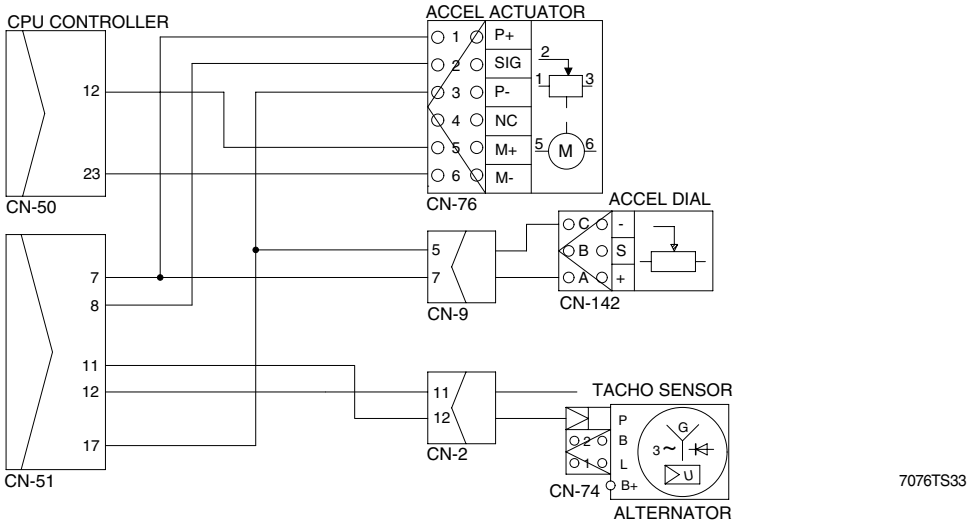
1. SLOW ACTION OF ENGINE SPEED CHANGE WHEN CHANGE THE MODE

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



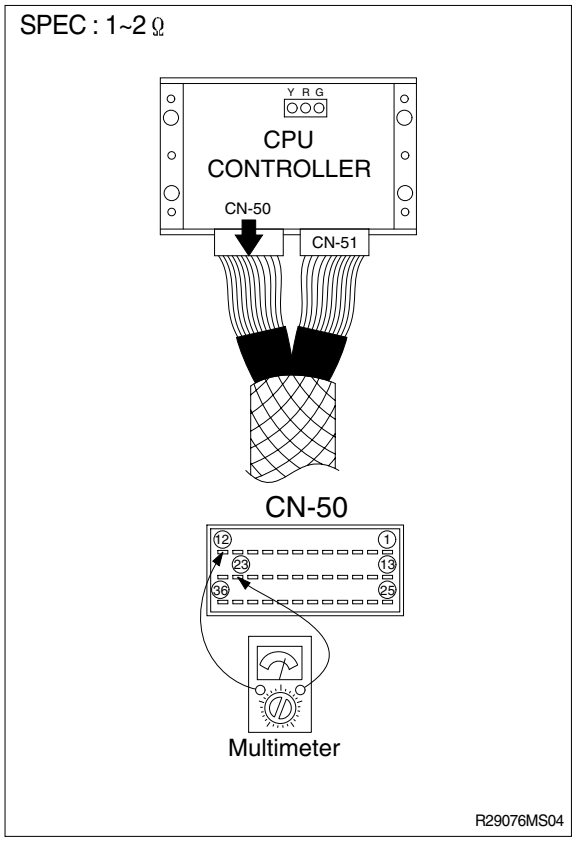
2) TEST PROCEDURE

(1) **Test 1 :** Check resistance.

① Starting key OFF.

② Disconnect connector CN-50 from CPU controller.

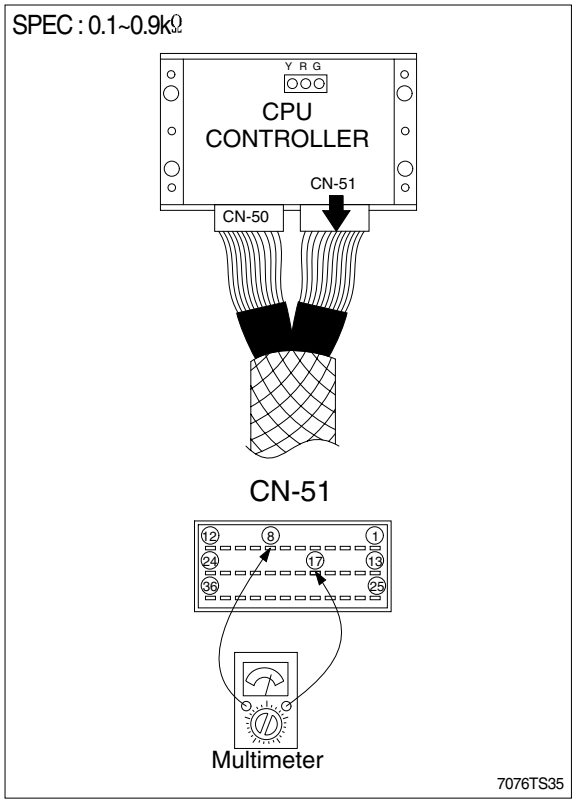
③ Check resistance between CN-50(12)-(23) as figure.



(2) **Test 2 :** Check voltage and resistance.

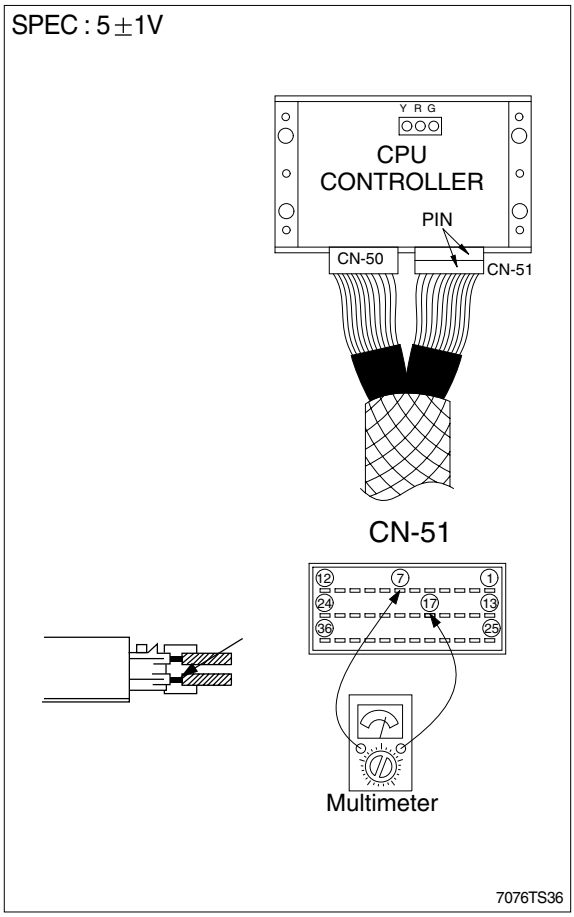
① Check resistance between CN-51(8)-(17).

- Starting key OFF.
- Disconnect connector CN-51 from CPU controller.
- Check resistance value with multimeter as figure.



② Check voltage between CN-51(7) and CN-51(17).

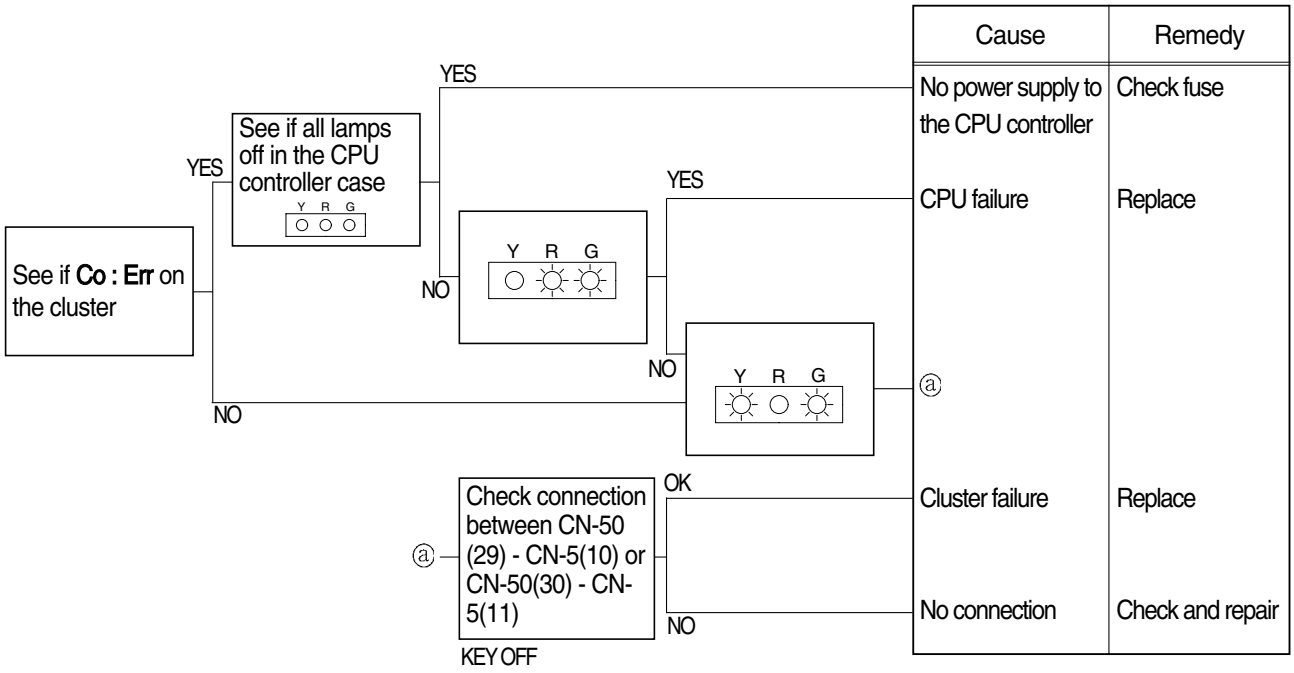
- Prepare 2 pieces of thin sharp pin, steel or copper.
- Starting key ON.
- Insert prepared pins to rear side of connectors : One pin to CN-51(17)
  Other pin to CN-51(7)
- Check voltage.



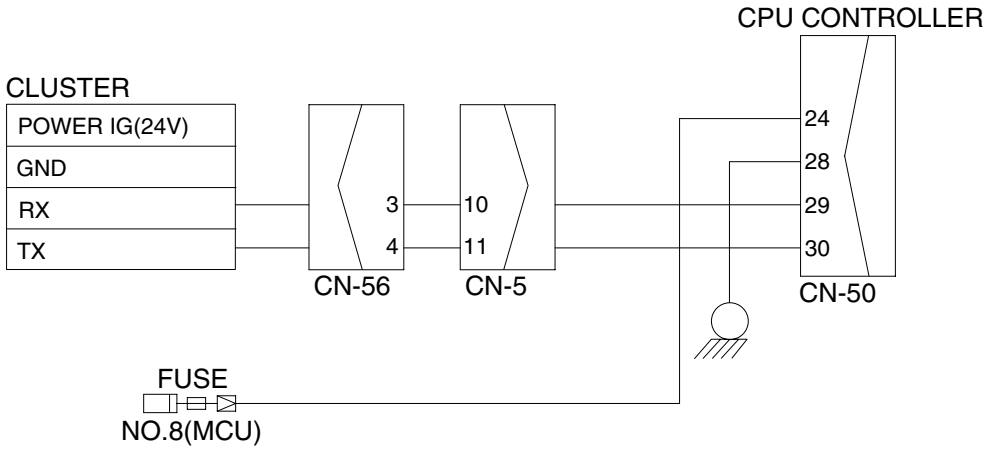
2. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



7076TS34

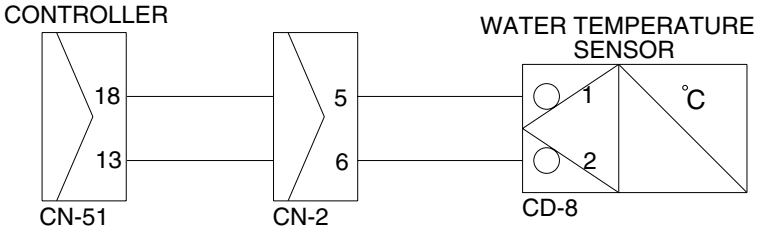
3. MALFUNCTION OF WARMING UP

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE

Cause	Remedy
Defective cluster or CPU controller or CD-8(Sensor)	Repair or Replace
Poor connection between CN-51(13) - CD-8(2)	Repair
Poor connection between CN-51(18) - CD-8(1)	Repair

Wiring diagram



7076TS22

SECTION 7 MAINTENANCE STANDARD

SECTION 7 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**.

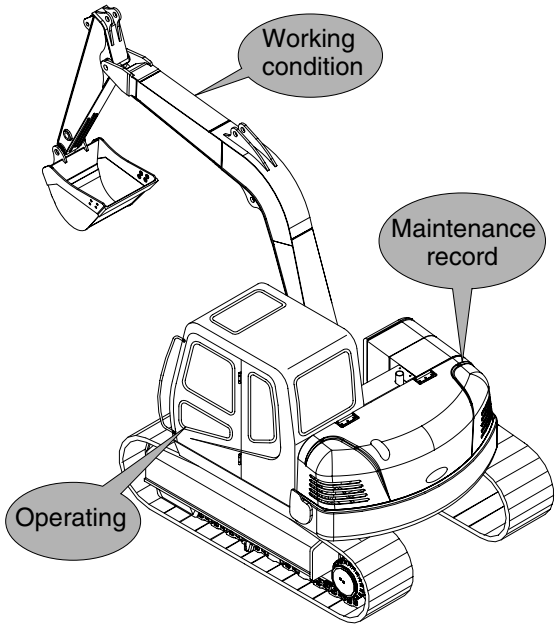
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

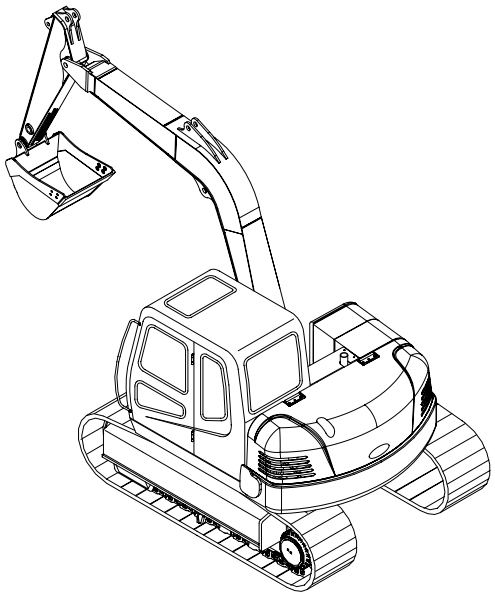


7077MS01

2. TERMINOLOGY

1) STANDARD

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

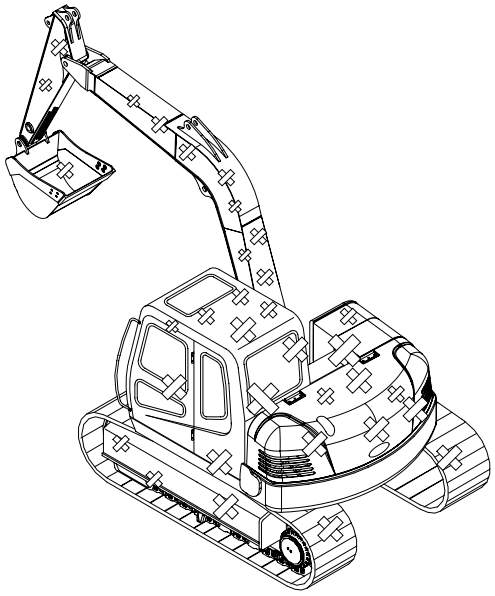


7077MS02

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.

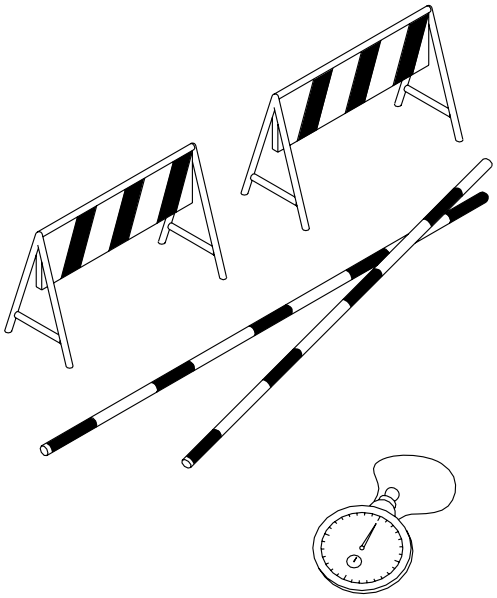
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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.



140LC-7 기타 7-3

2) ENGINE SPEED

(1) Measure the engine speed at each power mode

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

(2) Preparation

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 accel dial at 10(Max) position.
③ Push the H-mode switch and confirm that the fuel injection pump governor lever comes into contact with the high-idle stopper.
④ Measure the engine RPM.

(3) Measurement

① Start the engine. The engine will run at start idle speed. Measure engine speed with a tachometer.
② Measure and record the engine speed at each mode(H, S, L).
③ Select the H-mode.
④ Lightly operate the bucket control lever a few times, then return the control lever to neutral. Select one touch decel ON.
⑤ Measure and record the auto deceleration speed.

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
R80	Start/one touch idle	1050±100	One touch decel
	H mode	2200±50	
	S mode	2050±50	
	L mode	1900±50	

Condition : Set the accel dial at 10(Max) position.

3) TRAVEL SPEED

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

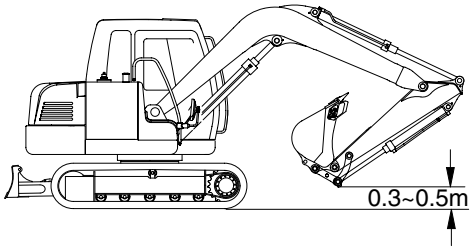
(2) Preparation

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℃.



7077MS04

(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, then select the following switch positions.

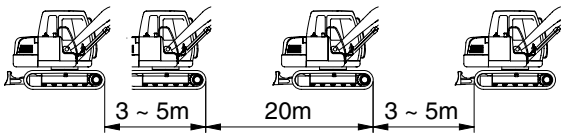
- Mode selector : H mode

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.



7077MS05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
R80	1 Speed	25.7±2.0	32.1	Steel track
	2 Speed	15.7±1.0	19.6	Steel track

4) TRACK REVOLUTION SPEED

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

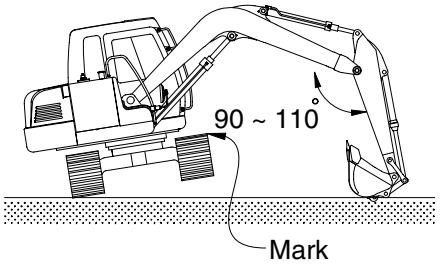
(2) Preparation

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.



7078DA99

(3) Measurement

① Select the following switch positions.

- Travel mode switch : 1 or 2 speed
- Mode selector : H mode

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	Remarks
R80	1 Speed	22.6±2.0	28.3	Steel track
	2 Speed	13.7±1.0	17.1	Steel track

5) TRAVEL DEVIATION

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

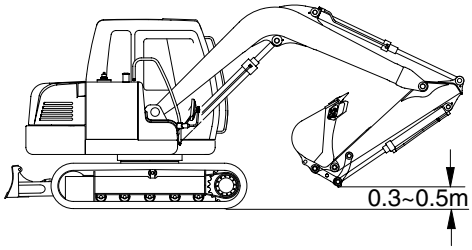
(2) Preparation

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℃.



7077MS04

(3) Measurement

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

② Before beginning each test, select the following switch positions.

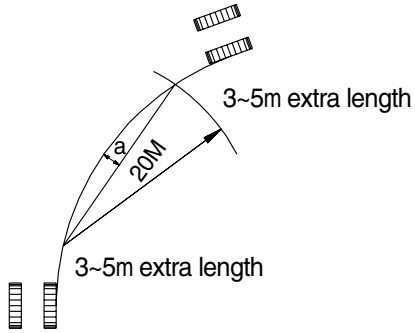
· Mode selector : H mode

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

④ Measure the distance between a straight 20m line and the track made by the machine.(Dimension a)

⑤ After measuring the tracking in forward travel, turn the upperstructure 180° and measure that in reverse travel.

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



140LC-7 기타 7-7(2)

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20m

Model	Standard	Maximum allowable	Remarks
R80	200 below	240	

6) SWING SPEED

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

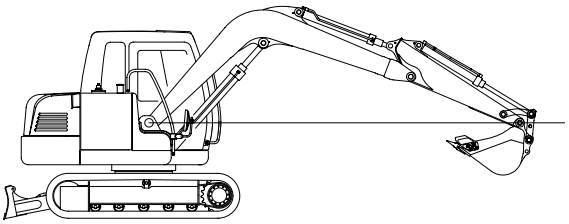
(2) Preparation

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.



7077MS07

(3) Measurement

① Select the following switch positions.

· Mode selector : H mode

② Operate swing control lever fully.

③ Swing 1 turn and measure time taken to swing next 3 revolutions.

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

(4) Evaluation

The time required for 3 swings should meet the following specifications.

Unit : Seconds / 3 revolutions

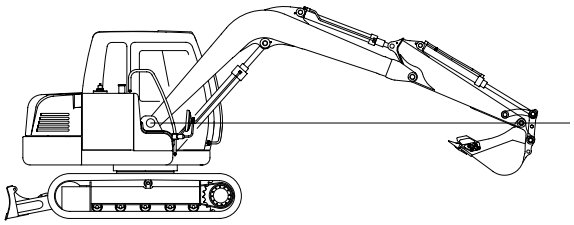
Model	Standard	Maximum allowable	Remark
R80	15.8±1.5	19.8	

7) SWING FUNCTION DRIFT CHECK

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

(2) Preparation

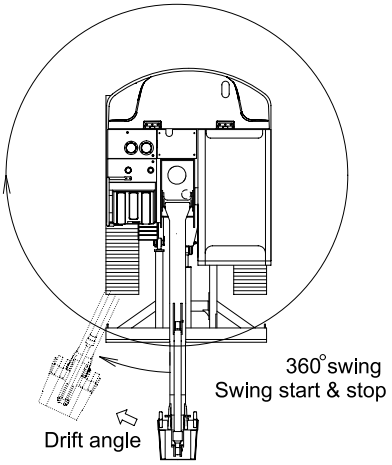
① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. 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℃.



7077MS07

(3) Measurement

① Conduct this test in the H mode.
② Select the following switch positions.
· Mode selector : H mode
③ 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°
④ Measure the distance between the two marks.
⑤ Align the marks again, swing 360°, then test the opposite direction.
⑥ Repeat steps ④ and ⑤ three times each and calculate the average values.



7077MS08

(4) Evaluation

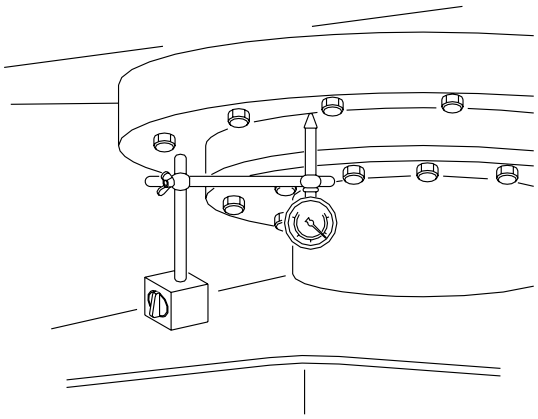
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Mode select switch	Standard	Maximum allowable	Remarks
R80	H mode	90 below	157.5	

8) SWING BEARING PLAY

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



140LC-7 기타 7-10(1)

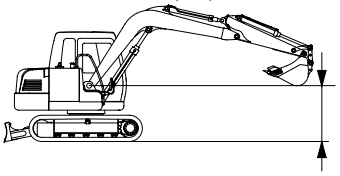
(2) Preparation

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.

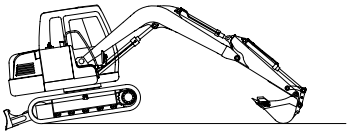
(3) Measurement

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)



Measurement : (h2)



7077MS09

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
R80	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.

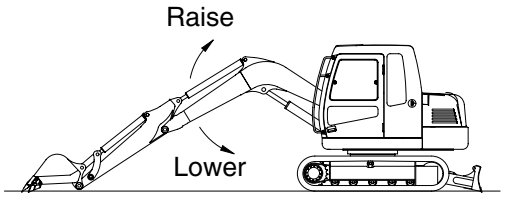
④ Keep the hydraulic oil temperature at 50±5℃.

(3) Measurement

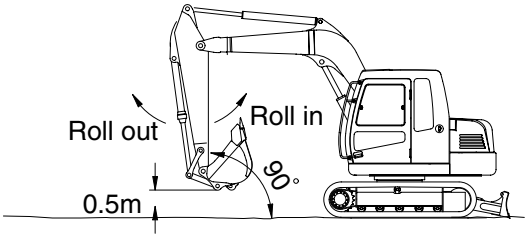
① Select the following switch positions.
- Mode selector : H mode

② 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.

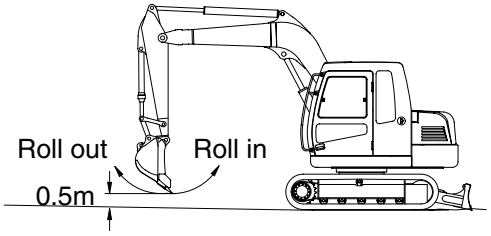
Boom cylinder



Arm cylinder



Bucket cylinder



7077MS10

- 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
R80	Boom raise	3.1±0.4	3.9	
	Boom lower	3.8±0.4	4.6	
	Arm in	2.6±0.4	3.3	
	Arm out	2.2±0.3	3.0	
	Bucket load	3.2±0.4	3.8	
	Bucket dump	2.1±0.3	2.5	
	Dozer up	1.2±0.3	1.8	
	Dozer down	1.5±0.3	2.1	

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)

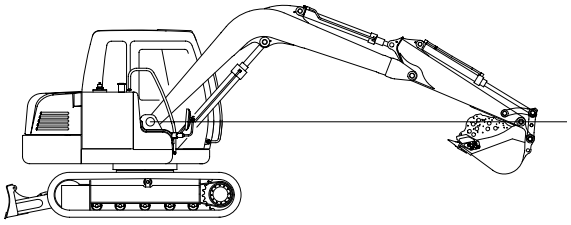
1.5 = Soil specific gravity

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

③ Position the bucket cylinder with the rod 20 to 30㎜ 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℃.



7077MS11

(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
R80	Boom cylinder	10 below	20	
	Arm cylinder	10 below	20	
	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℃.

(3) Measurement

① Start the engine.
② Select the following switch positions.
· Mode selector : H mode
③ Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.
④ 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.
⑤ Repeat steps ③ and ④ 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
R80	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.

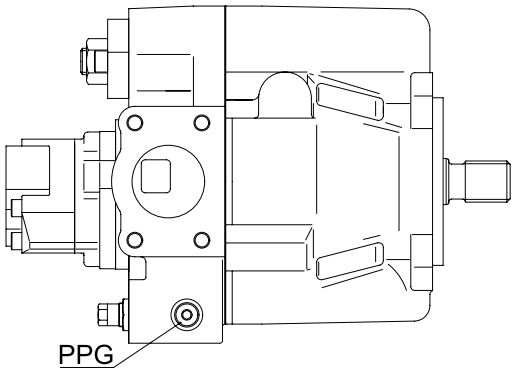
Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
R80	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 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.



7077MS12

(2) Measurement

① Select the following switch positions.
· Engine rpm : 2100rpm
② Measure the primary pilot pressure in the H mode.

(3) Evaluation

The average measured pressure should meet the following specifications:

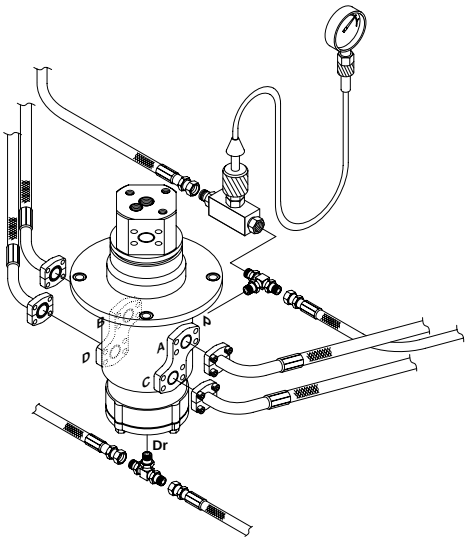
Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
R80	2100rpm	35±5	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation

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
④ assembly to turning joint P port as shown. Start the engine and check for on leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5℃.



21077MS13

(2) Measurement

① Select the following switch positions.
Travel mode switch : 1 speed
2 speed
· Mode selector : H mode
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 / cm²

Model	Travel speed mode	Standard	Maximum allowable	Remarks
R80	1 Speed	0	-	
	2 Speed	35±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

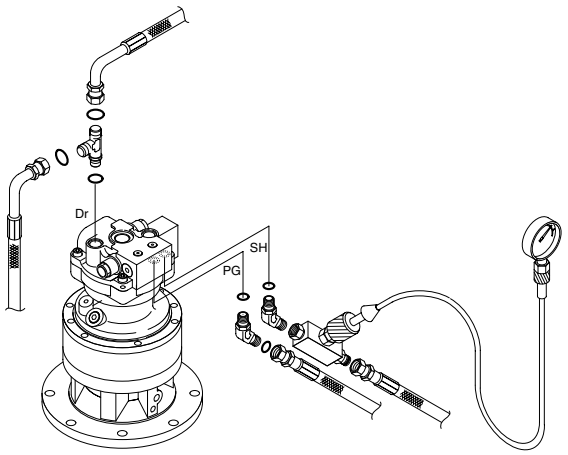
① Stop the engine.

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.



7077MS14

(2) Measurement

① Select the following switch positions.

· Mode selector : H mode

② 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.

Repeat step ② 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	Allowable limits	Remarks
R80	Brake disengaged	35	20~40	
	Brake applied	0	-	

16) SYSTEM PRESSURE RELIEF SETTING

(1) Preparation

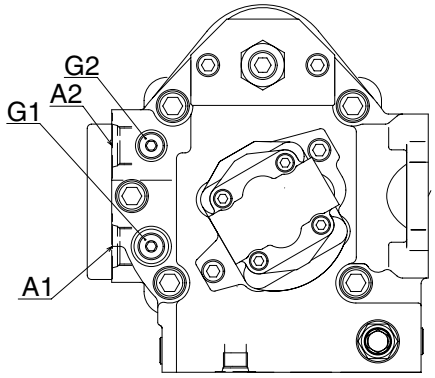
① Stop the engine.

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℃.



7077MS13

(2) Measurement

① Select the following switch positions.

· Mode selector : H mode

② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

③ In the swing function, place bucket against an immovable object and measure the relief pressure.

④ 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 / cm²

Model	Function to be tested	Standard	Port relief seting
R80	Boom, Arm, Bucket	280±10	310±10
	Travel	280±10	-
	Swing	210±10	-

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.

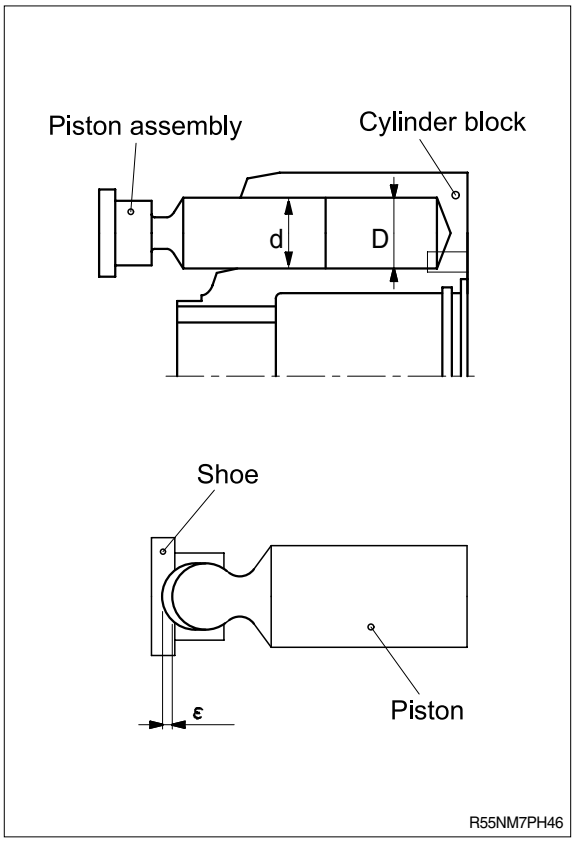
1) PISTON ASSEMBLY AND CYLINDER BLOCK

(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 $\leq$ 0.060mm

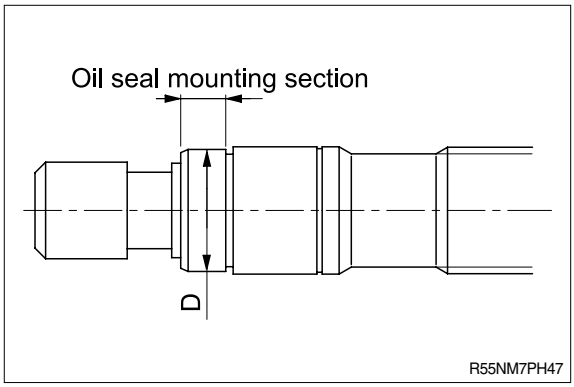
2) PISTON SHOE AND PISTON

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



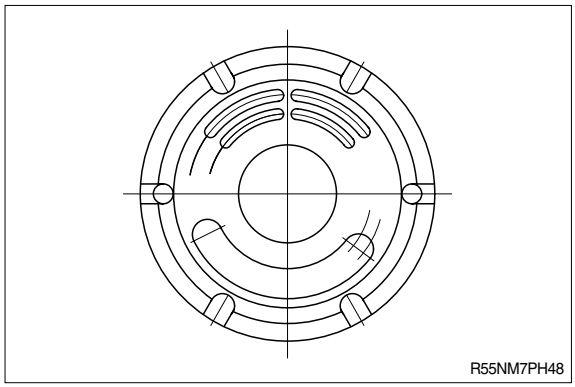
3) SHAFT

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



4) CONTROL PLATE

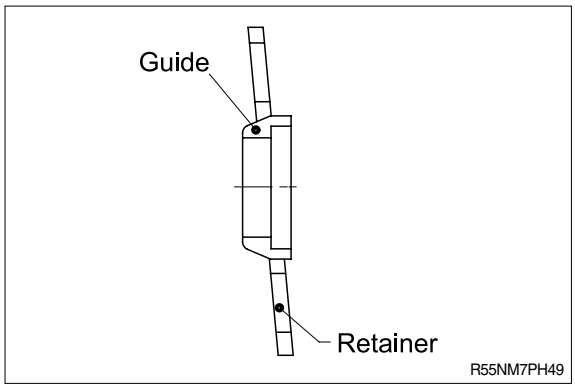
(1) Check the slide surface for any damage. When the damage is large, replace the plate with new one.



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.



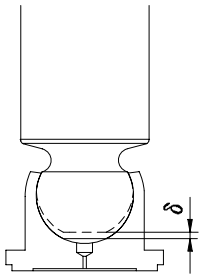
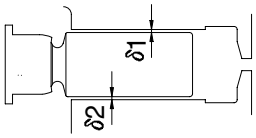
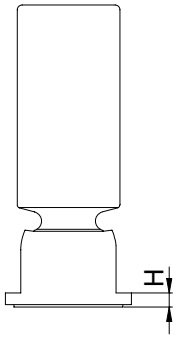
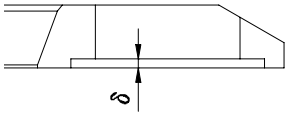
2. MAIN CONTROL VALVE

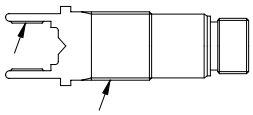
Part name	Inspection item	Criteria & measure
Switching section	· Existence of scratch, rust and corrosion.	· Replace it when there is flaw on the following section. - Sliding section against the spool, especially land section where the hold pressure is borne. - Seal pocket section where the spool is placed in or flange section. - Seat section of relief valve and overload relief valve. - Failure it may cause malfunction, etc.
Spool	· Existence of scratch, rust and corrosion. · Insert spool in the hole of the switching section, stroke it while rotating.	· Replace it when there is scratch on the preipheral sliding surface · In case the spool is not smooth, repair or replace it.
Load check valve	· Damage of load check valve and spring. · Insert load check valve in plug and experimentally operate it.	· In case there are flaws and scratches on the seat section, repair or replace it. · When it moves smoothly, normal but if it moves unsmoothly, replace it.
Around spring	· Rust, corrosion, deformation and breakage of spring, spring seat, plug, and cover.	· Replace it when the movement is unsmooth or there is damage causing poor durability.
Around of seal of spool	· Hardenig, deformation and flaw of O-ring.	· Exchange · Replace.
Main relief valve Overload relief valve	· Rust on outer surface. · Contact surface of valve seat. · Spring in abnormal condition. · O-ring, back-up ring.	· In case there are flaw and dent, replace it. · Replace. · Replace all parts, as a genaral rule.

3. SWING DEVICE

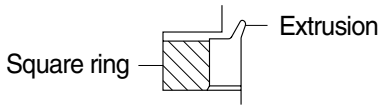
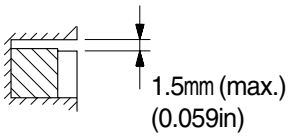
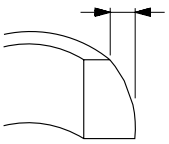
Part name	Inspection item	Remedy
Shoe of piston assembly	· Sliding surface has a damage. · Sliding surface depression(⌐¬) dimension less than 0.45㎜ or has a large damage.	· Lapping · Replace parts or motor
Piston of piston assembly	· Sliding surface has a seizure(Even though small).	· Replace motor
Piston hole of cylinder assembly	· Sliding surface has a seizure. · Sliding surface has a damage.	· Replace motor · Replace motor
Taper roller bearing Needle bearing Roller bearing	· In case 3000hour operation. · Rolling surface has a damage.	· Replace · Replace

4. TRAVEL DEVICE

Part name	Check point	Standard dimension	Maximum allowable value (Criteria)	Remedy
Piston assy(7) 	Play between piston and slipper	δ = 0.1mm	δ < 0.5mm	Replace 9 sets of piston assy
Piston assy(7) and cylinder barrel (3) 	Clearance/diameter between piston diameter and cylinder bore (δ 1 + δ 2)	0.03mm	< 0.07mm	Replace the set of 1 cylinder barrel and 9 piston assys
Slipper(7-2) 	Height of the plate	Height H 5mm	Height H < 4.6mm	Replace 9 sets of piston assy
Retainer(5) 	Wear		Wear depth δ < 0.2mm	Replace
Cam(6)	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(2) 	Spline sections(connected to cylinder barrel, and bear part)	-	No abnormality such as crack, chipping, nonuniformly wear-ing out, etc.	Replace
Bearings(1-3), (1-8), (1-13), (11), (12)	Rolling surface	-	No flaking or other abnormal damage on the rolling surface	Replace
Oil seal(13)	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 detected.
Cylinder barrel(3)	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(8)	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

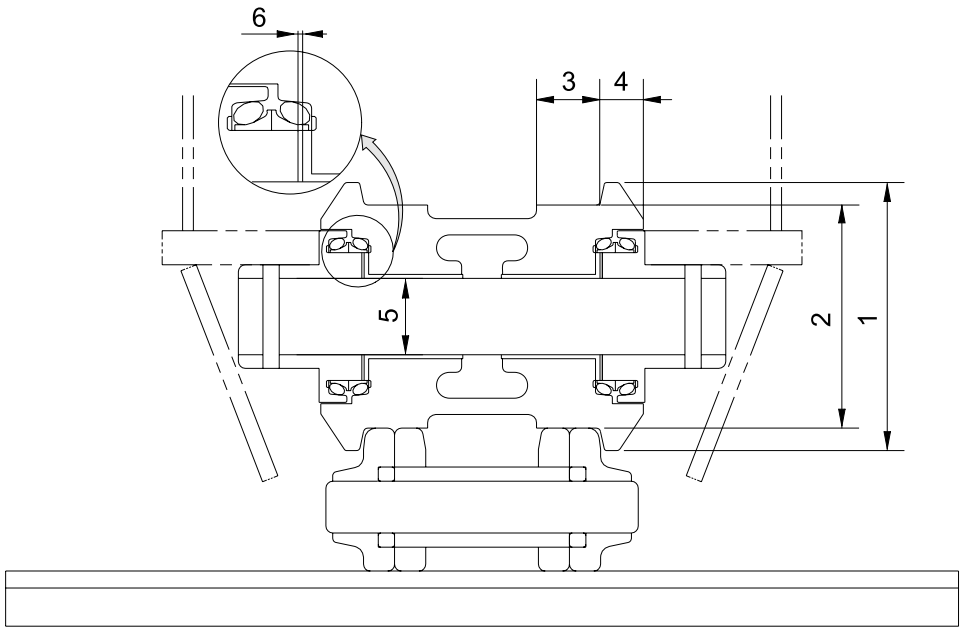
Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1mm (0.0039in) in depth due to seizure contamination.	Replace
		· Damaged more than 0.1mm(0.0039in) in depth.	Smooth with oilstone.
	Sliding surface with thrust plate.	· Worn more than 0.5mm(0.02in) or abnormality.	Replace
		· Worn less than 0.5mm(0.02in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5mm)(0.02in).	Smooth
Cover	Sliding surface with thrust plate.	· Worn more than 0.5mm(0.02in) or abnormality.	Replace
		· Worn less than 0.5mm(0.02in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5mm)(0.02in).	Replace
Seal set	-	· Extruded excessively from seal groove square ring. 	Replace
	-	· Slipper ring 1.5mm(0.059in) narrower than seal groove, or narrower than back ring. 	Replace
	-	· Worn more than 0.5mm(0.02in) ~ 1.5mm(MAX.) (0.059in) 	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.	· Replace or replate
		· Rust is not present on plating.	· Replace or replate
		· Scratches are not present.	· 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

1. TRACK

1) TRACK ROLLER

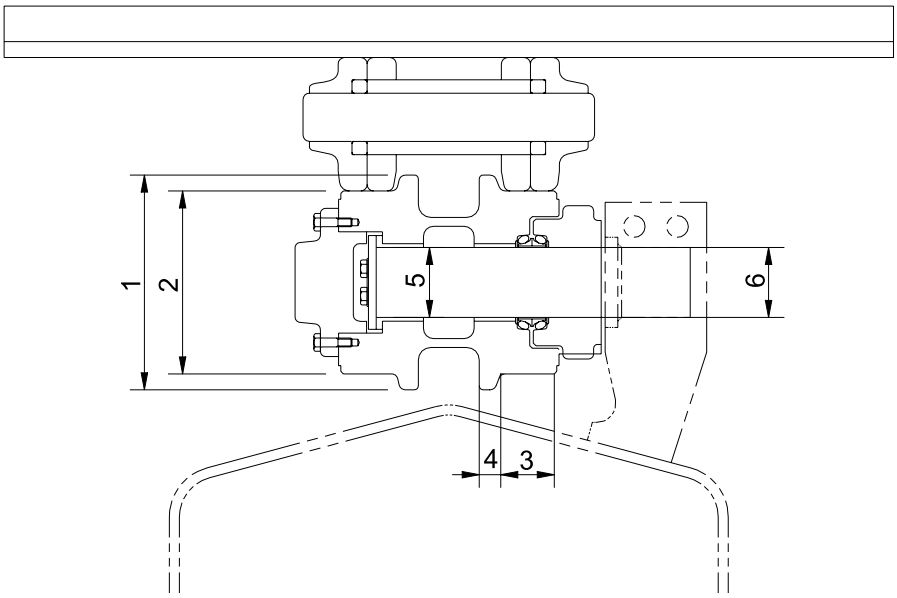


7077MS15

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	bushing			
		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

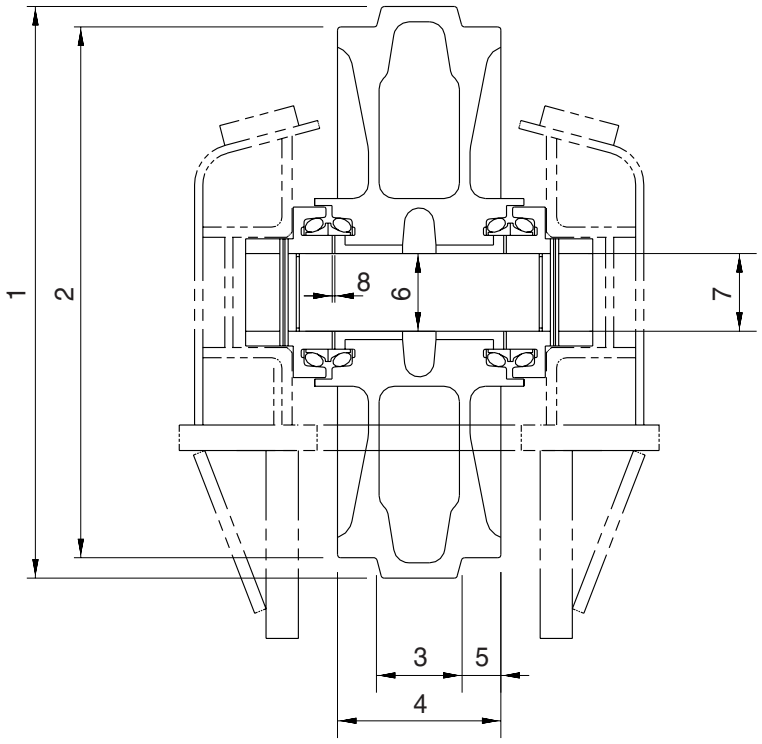


32077MS02

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		ø 115		-		
2	Outside diameter of tread	ø 95		ø 85		
3	Width of tread	31		35		
4	Width of flange	11		-		
5	Clearance between shaft and bushing	Standard size & Tolerance		Standard clearance	Clearance limit	Replace bushing or shaft
		Shaft	Bushing			
		ø 38 0 / - 0.03	ø 38 +0.35 / +0.3	0.3 ~ 0.38	2.0	
6	Clearame between shaft and support	Shaft	Support	0.3 ~ 0.6	1.2	
		ø 38 - 0.2 / - 0.3	ø 38 +0.3 / +0.1			

3) IDLER



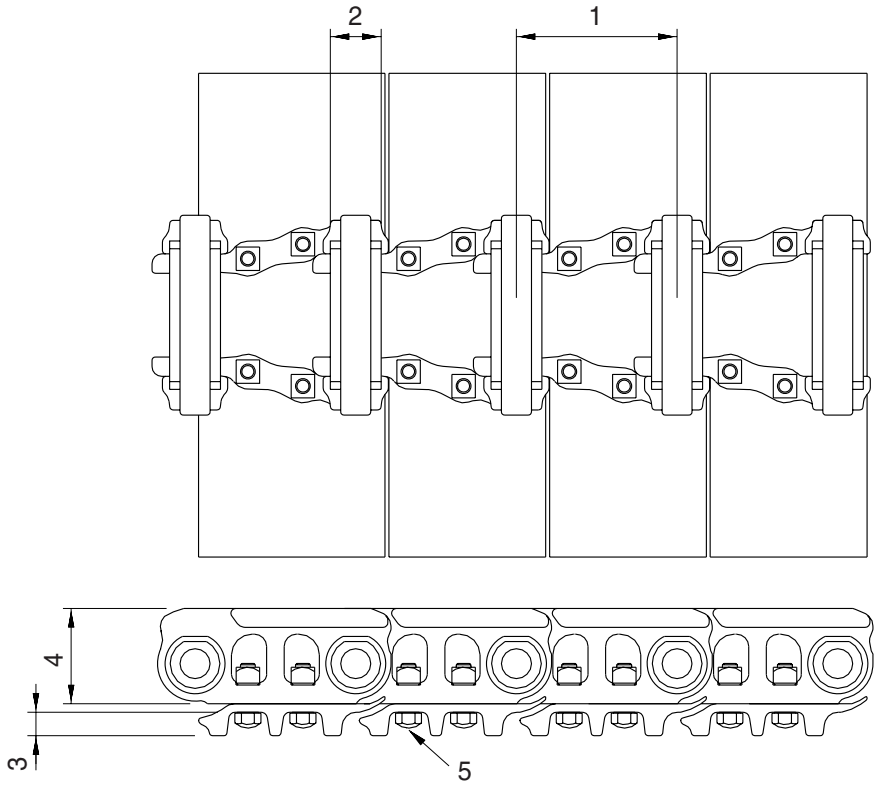
21037MS03

Unit : mm

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

4) TRACK

(1) Steel track

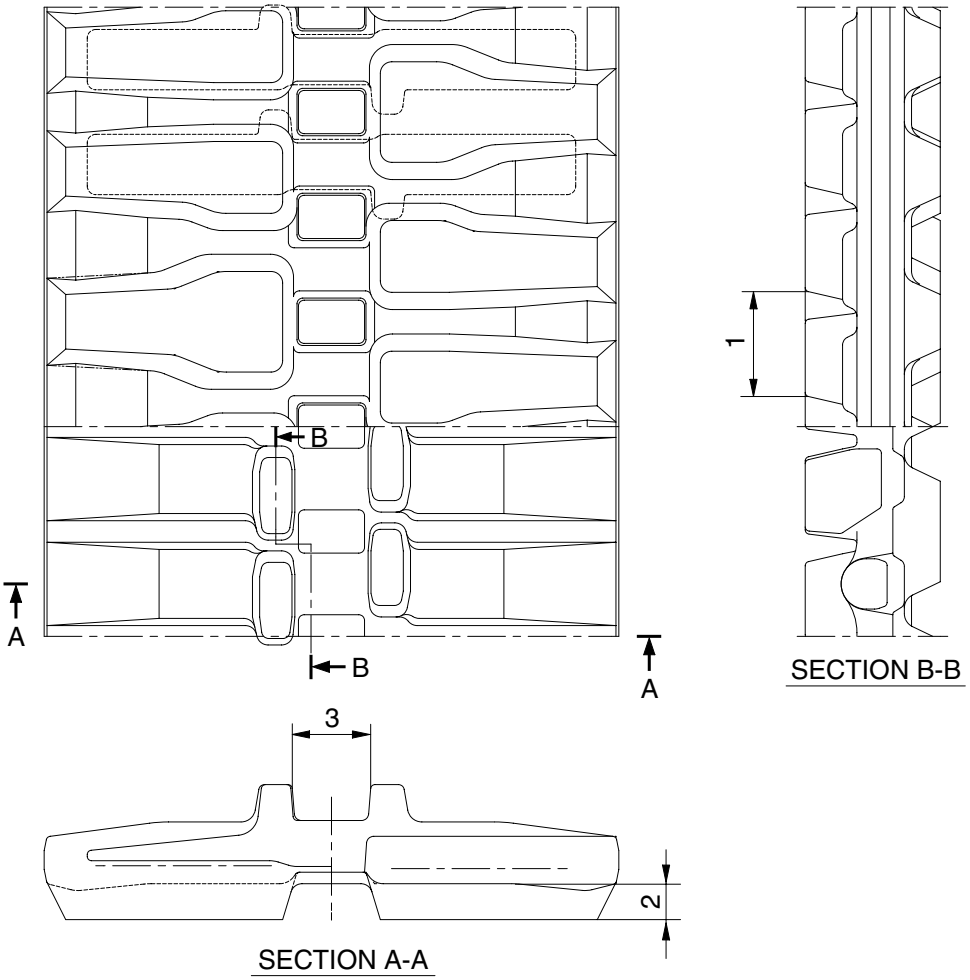


21037MS04

Unit : mm

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		154	158.3	
2	Outside diameter of bushing	ø41.26	ø34.26	Rebuild or replace
3	Height of grouser	20	10	
4	Height of link	74	66	
5	Tightening torgue	Initial tightening torque : 25.5±2.5kgf · m		Retighten

(2) Rubber shoe spec

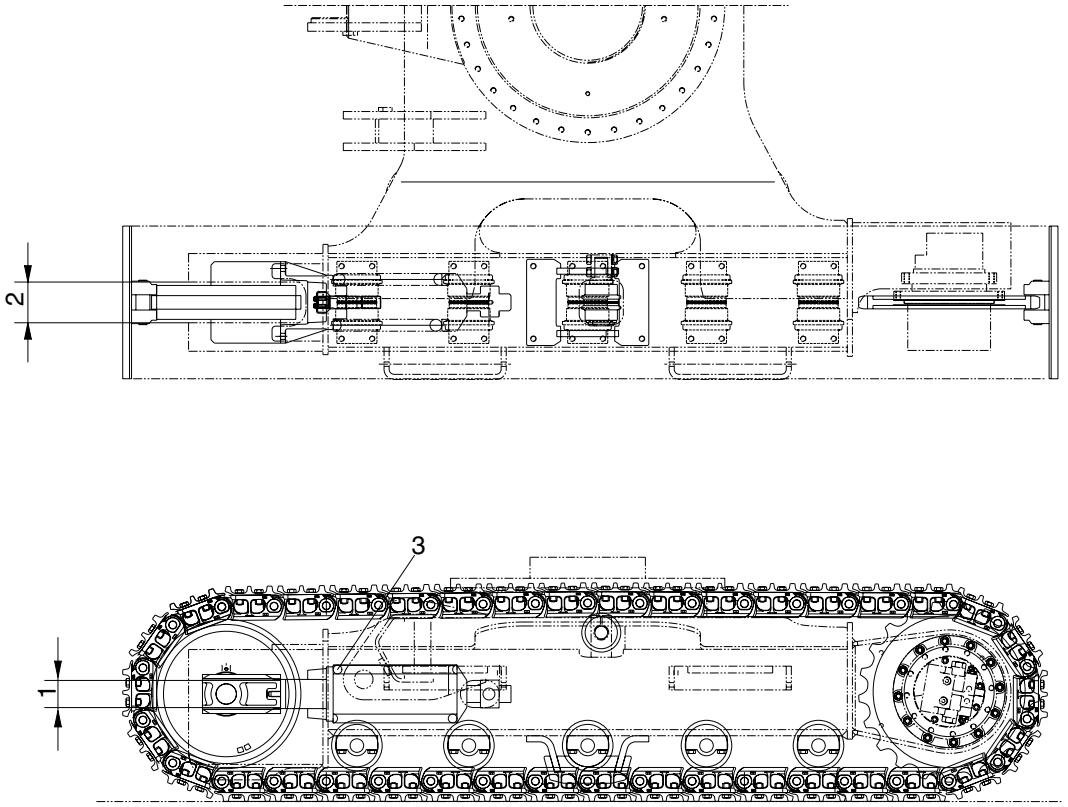


R5576MC17

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

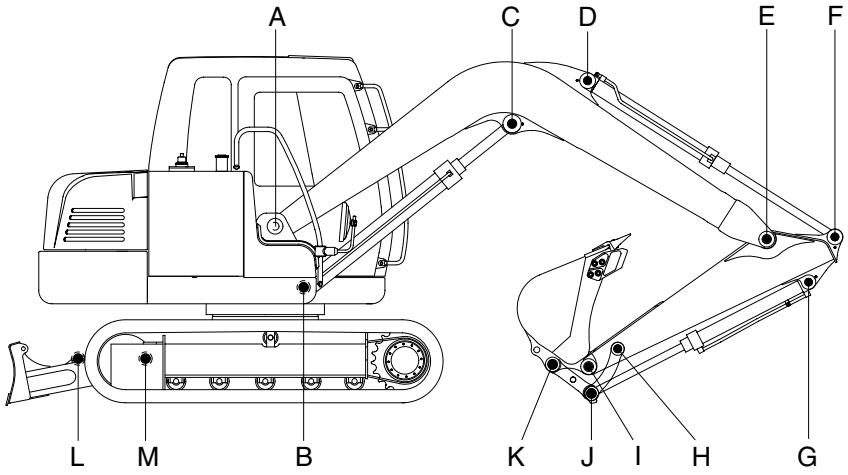


7077MS20

Unit : mm

No.	Check item	Criteria					Remedy
1	Vertical width of idler guide		Standard size	Tolerance	Repair limit		Rebuild or replace
		Track frame	92	+2 0	96		
		Idler support	90	-0 -1.5	87		
2	Horizontal width of idler guide	Track frame	172	+2 0	176		
		Idler support	170	-	168		
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		ø170×370	320	5,083kg	-	4,174kg	

2. WORK EQUIPMENT



7077MS16

Unit : mm

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	Dozer cylinder	65	64	63.5	65.5	66	〃
M	Dozer and frame	55	54	53.5	55.5	56	〃

SECTION 8 DISASSEMBLY AND ASSEMBLY

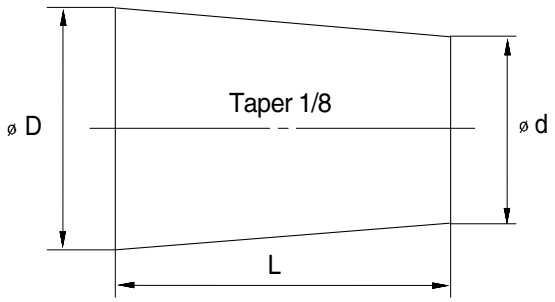
SECTION 8 DISASSEMBLY AND ASSEMBLY

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	25±0.5	181±3.6
3		Radiator mounting bolt, nut	M12 × 1.75	12.2±1.3	88.2±9.4
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	M10 × 1.5	6.9±1.4	49.9±10.1
7		Fuel tank mounting bolt	M16 × 2.0	25±2.5	181±18.1
8		Hydraulic oil tank mounting bolt	M16 × 2.0	25±2.5	181±18.1
9		Turning joint mounting bolt, nut	M12 × 1.75	12.3±1.3	88.2±9.4
10	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±3.2	215±23.1
11		Swing bearing upper mounting bolt	M16 × 2.0	29.7±5	215±36.2
12		Swing bearing lower mounting bolt	M16 × 2.0	29.7±5	215±36.2
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±4.5	215±32.5
15		Carrier roller mounting bolt, nut	M16 × 2.0	29.7±4.5	215±32.5
16		Track roller mounting bolt	M14 × 2.0	19.6±2.5	142±18
17		Track tension cylinder mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
18		Track shoe mounting bolt, nut	M14 × 1.5	25.5±2.5	184±18.1
19	Others	Counter weight mounting bolt	M20 × 2.5	57.8±6.4	418±46.3
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±0.1	8.5±0.7

※ For tightening torque of engine and hydraulic components, see each component disassembly and assembly.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT - Coarse thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · 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	2.73 ~ 4.12	19.7 ~ 29.8
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 ~ 79.5	9.8 ~ 15.8	71 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 167
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 ~ 343
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	350 ~ 457	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.5	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1655
M36 × 4.0	174 ~ 236	1261 ~ 1703	250 ~ 310	1808 ~ 2242

2) BOLT AND NUT - Fine thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8 × 1.0	2.17 ~ 3.37	15.7 ~ 24.3	3.04 ~ 4.44	22.0 ~ 32.0
M10 × 1.25	4.46 ~ 6.66	32.3 ~ 48.2	5.93 ~ 8.93	42.9 ~ 64.6
M12 × 1.25	7.78 ~ 11.58	76.3 ~ 83.7	10.6 ~ 16.0	76.6 ~ 115
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 130	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 194	26.6 ~ 36.0	193 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 390	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 515	70.7 ~ 95.7	512 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 664	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1338	182 ~ 248	1314 ~ 1795
M36 × 3.0	192 ~ 260	1389 ~ 1879	262 ~ 354	1893 ~ 2561

3) PIPE AND HOSE

Thread size	Width across flat(mm)	kgf · m	lbf · ft
1/4"	19	3	21.7
3/8"	22	4	28.9
1/2"	27	5	36.2
3/4"	36	12	86.8
1"	41	14	101

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	6	43.4
3/4"	36	13	94.0
1"	41	15	109

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

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

- Hydraulic tank quantity : 75 ℓ

(5) Disconnect hoses(4) and remove connectors(3).

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

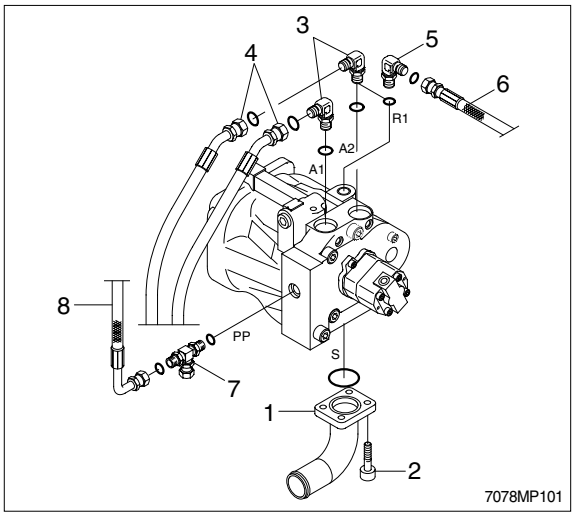
(7) Remove socket bolts(2) and disconnect pump suction tube(1).

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

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

- Weight : 50kg(110lb)

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



2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

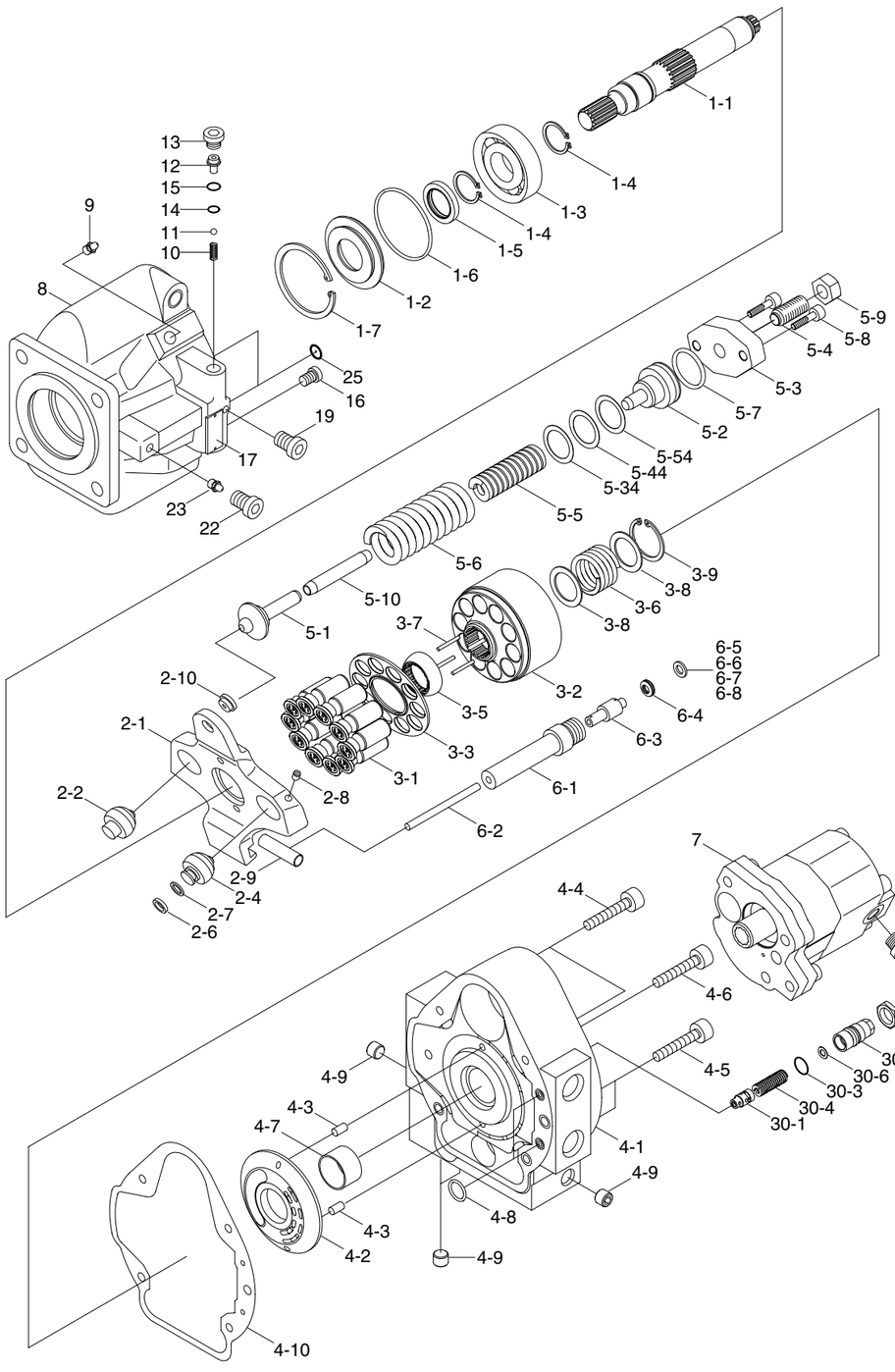
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug(1EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

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

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

2. MAIN PUMP(1/2)

1) STRUCTURE



1	Shaft assembly	5-5	Spring
1-1	Shaft	5-6	Spring
1-2	Seal retainer	5-7	O-ring
1-3	Bearing	5-8	Bolt
1-4	Retaining ring	5-9	Nut
1-5	Oil seal	5-10	Guide
1-6	O-ring	5-34	Shim
1-7	Retaining ring	5-44	Shim
2	Swash plate assembly	5-54	Shim
2-1	Hanger	6	Control spring assembly
2-2	Guide	6-1	Cylinder
2-4	Guide	6-2	Piston
2-6	O-ring	6-3	Piston
2-7	Back up ring	6-4	Plate spring
2-8	Plug	6-5	Spacer
2-9	Pin	6-6	Spacer
2-10	Bush	6-7	Spacer
3	Rotary group	6-8	Spacer
3-1	Piston	7	Gear pump
3-2	Cylinder block	8	Housing
3-3	Retainer	9	Air vent valve
3-5	Guide	10	Bush
3-6	Spring	11	Steel ball
3-7	Parallel pin	12	Plug
3-8	Spring spacer	13	Plug
3-9	Retaining ring	14	Packing
4	Port plate assembly	15	Shim
4-1	Cover	16	Plug
4-2	Control plate	17	Name plate assembly
4-3	Parallel pin	18	Plug
4-4	Bolt	19	Plug
4-5	Bolt	22	Plug assembly
4-6	Bolt	23	Orifice
4-7	Bearing	25	Square ring
4-8	Square ring	30	Relief valve
4-9	Plug	30-1	Spool
4-10	Packing	30-2	Adjust screw
5	Control spring assembly	30-3	O-ring
5-1	Spring spacer	30-4	Spring
5-2	Spring spacer	30-5	Nut
5-3	Cover	30-6	Shim
5-4	Adjust screw		

7078MP102

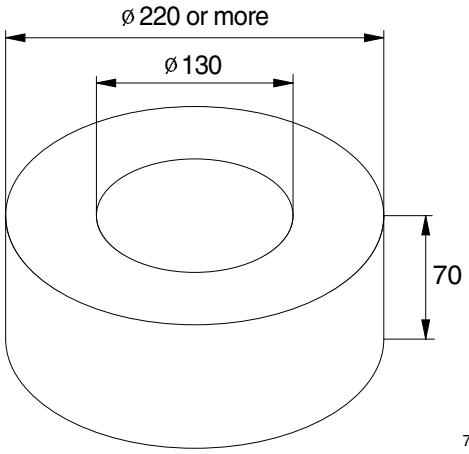
2) NECESSARY TOOLS AND JIGS

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

(1) Tools

Name	Size(nominal)
Hexagon socket screw keys	6, 8, 10, 12㎜
Spanner	14, 17, 24, 27
Screwdrivers for slotted-head screws	Middle
Pliers for retaining rings	Bore use 80
Grease	-
Adhesive	Three Bond #1305
Plastic hammer	Medium size

(2) Jigs



This is a table to stand the pump facing downward

3) CAUTIONS DURING DISASSEMBLING AND ASSEMBLING

(1) Cautions for disassembling

① Never attempt operating the adjusting screws unless absolutely necessary.
② Take utmost care during disassembly not to knock or drop each part.

(2) Cautions for assembling

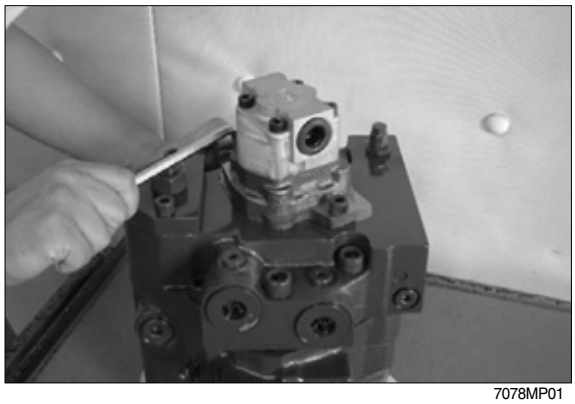
① Wash each part thoroughly.
② During assembling take utmost care not to damage the part or allow foreign materials to enter.
③ As a rule the O-ring and oil seal should not be reused.
④ In our assembly work the torque wrench is used to control the torque.
Be sure to use the torque wrench.

3. DISASSEMBLING

1) DISASSEMBLING THE GEAR PUMP

(1) Remove the hexagon socket head cap screws. (M10×25, 2pcs)
L-wrench(8)

(2) Remove the coupling and bush.

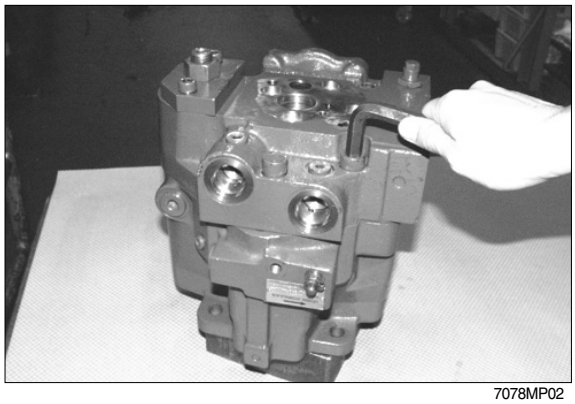


7078MP01

2) DISASSEMBLING THE MAIN PUMP

(1) Removing of the cover

① Remove the hexagon socket head cap screws.
(M14×40, 2 pieces)
(M14×65, 2 pieces)
(M14×75, 1 pieces)
L-wrench(12)

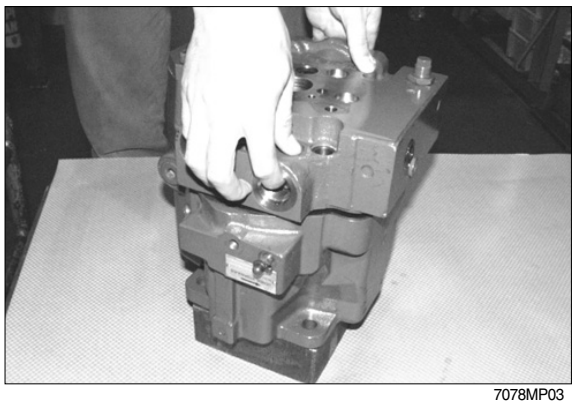


7078MP02

② Removing the cover.

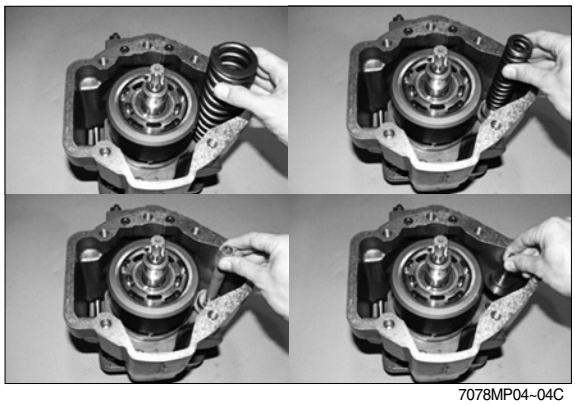
※ Be careful because the control plate is provided to the backside.

※ When the cover is difficult to remove, knock lightly with a plastic hammer.



7078MP03

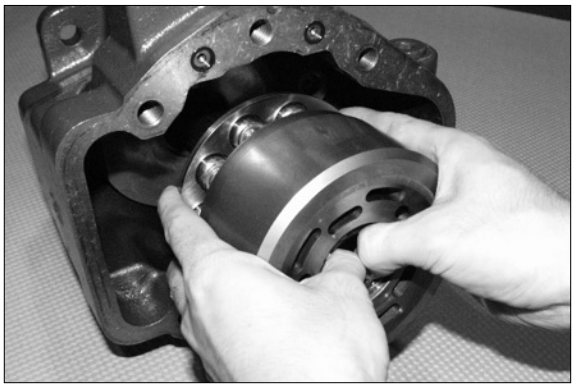
③ Removing of the spring and the guide and the spring seat.



7078MP04~04C

(2) Removing of the rotary group

① Lay the pump on the side and take out the rotary group from the shaft.



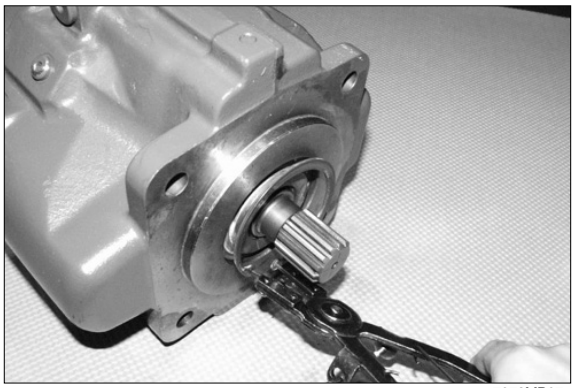
7078MP05

② 3 Parallel pins may remain in the housing when removing rotary group.
Please take out 3 parallel pins when they were left in the housing.

7078MP06

(3) Removing of the shaft

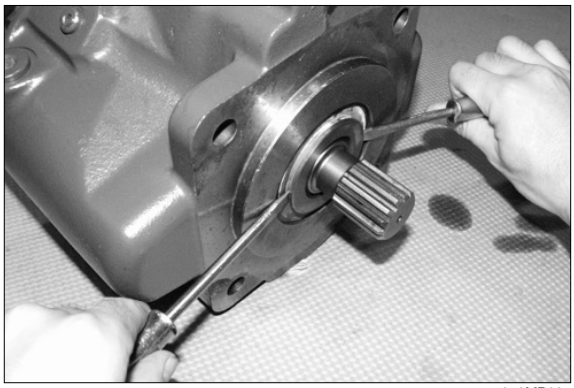
① Removing the retaining ring.
(Pliers for retaining rings, Bore use 80)



7078MP07

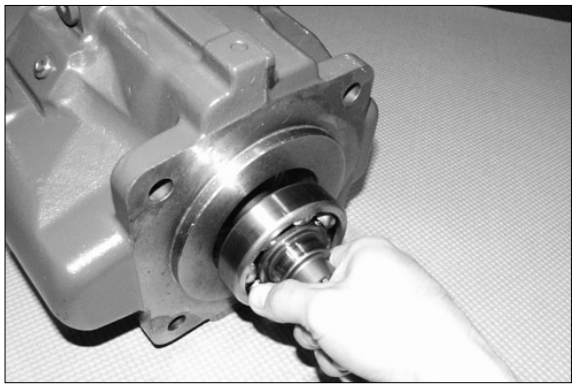
② Removing the oil seal case.
(Two screwdrivers)

③ Remove the O-ring.



7078MP08

④ Remove the shaft

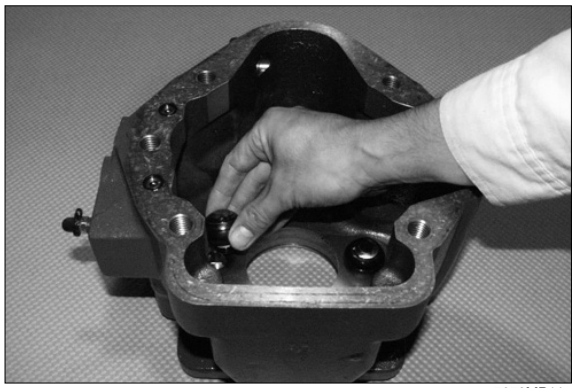


7078MP09

⑤ Removing the swash plate.

7078MP10

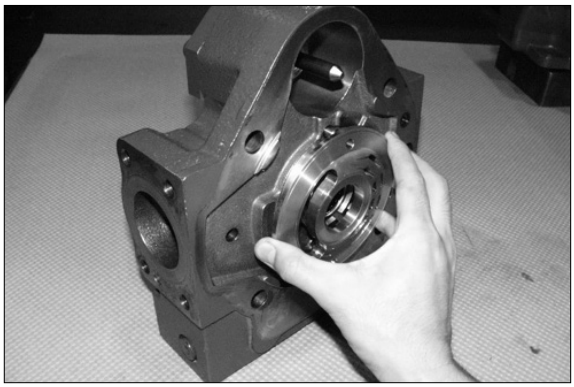
⑥ Removing the guides.



7078MP11

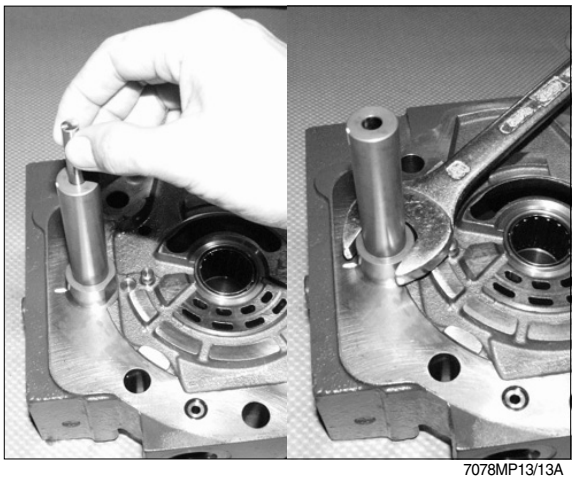
(4) Disassembling of the cover

① Removing the control plate.



7078MP12

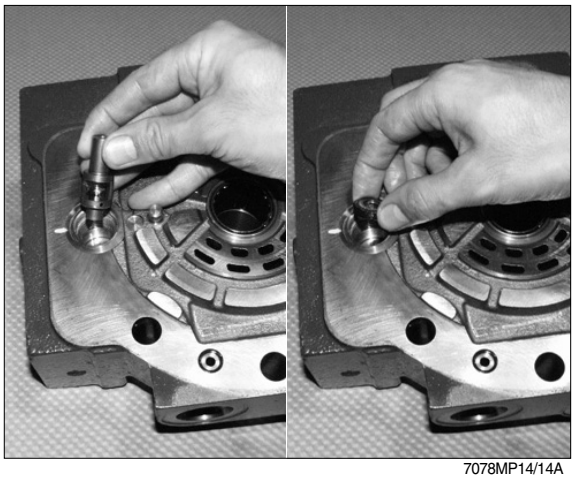
② Remove the piston and cylinder.
Spanner (27)



7078MP13/13A

③ Remove the piston.

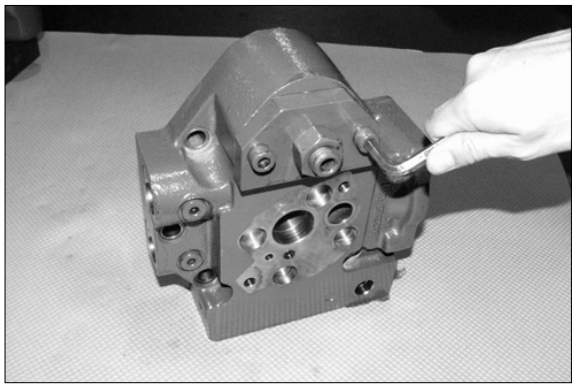
④ Remove the coned disk springs and distance piece.



7078MP14/14A

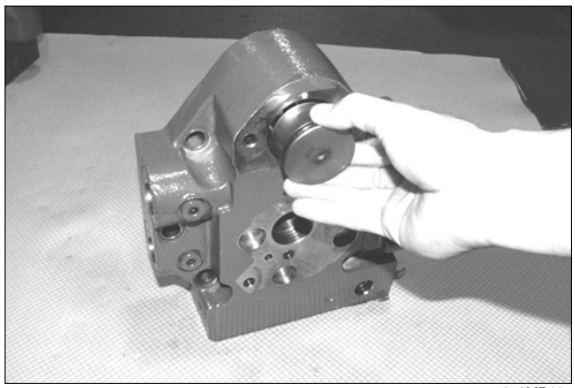
(5) Removing the cover

① Remove the hexagon socket head cap screws. (M10 × 30, 2 pieces)
L-wrench(8)



7078MP15

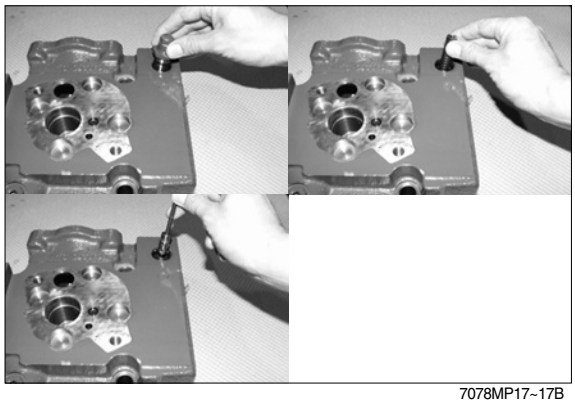
② Remove the spring seat.



7078MP16

③ Removing the relief valve.
Removing the hexagon nut.
Since the pressure has been set, this assembly must be made only when necessary.
Spanner (24)

④ Remove the adjusting screw.
Be careful because the shim is inserted.
Spanner (14)

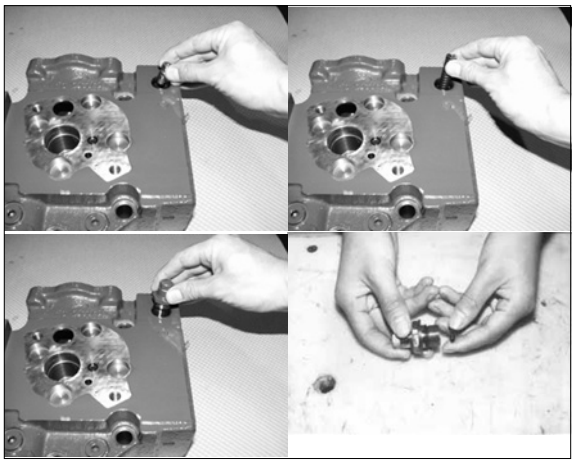


7078MP17~17B

⑤ Remove the spring and spool.

4. ASSEMBLING

(1) Assembling of the cover



7078MP18~18C

① Assembling the relief valve.

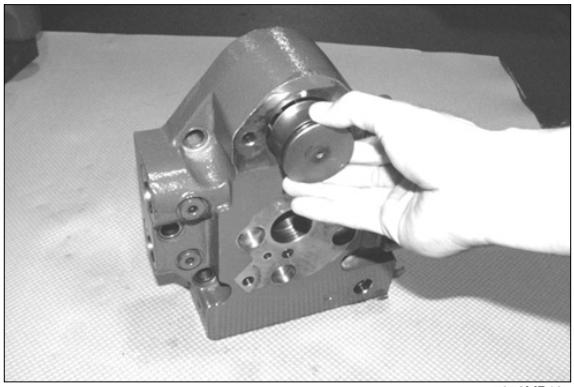
② Install the spool and spring.

③ Install the shim into the adjusting screw.

Tighten the hexagonal nut.
After assembling, set the pressure and tighten the nuts.

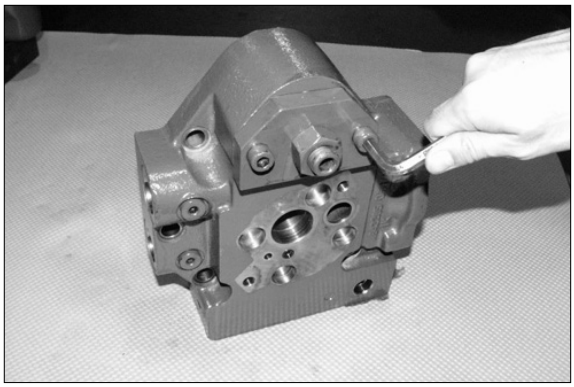
Tightening torque 9.8N · m(7.2lbf · ft)
Spanner(24)
Spanner(14)

④ Install the spring seat into the cover.



7078MP19

(2) Assemble the cover



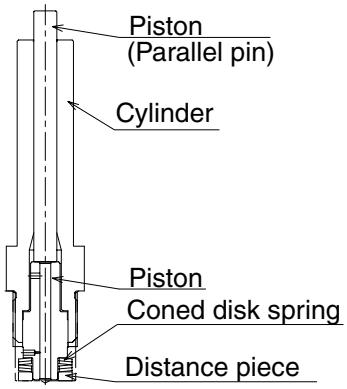
7078MP20

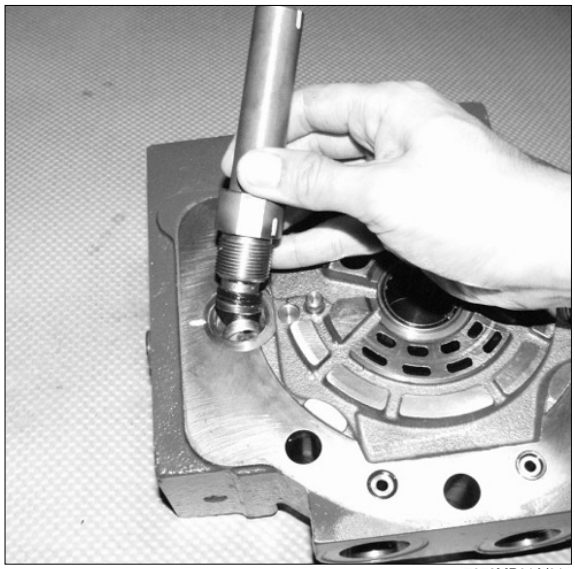
① Fix the hexagon socket head cap screws. (M10×30, 2 pieces)

L-wrench(8)
· Tightening torque 55~69N · m
(41~51lbf · ft)

② Assemble the control piston.

※ Apply three bond #1305 to the thread of the cylinder.





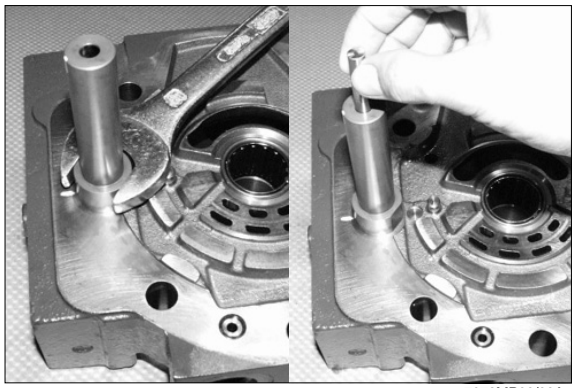
7078MP21A/21

③ Assemble the control piston.

Spanner (27)

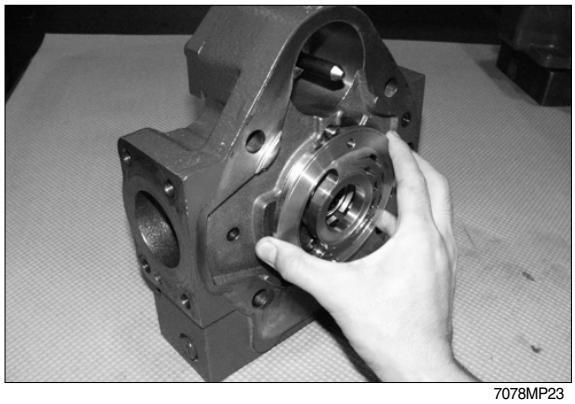
· Tightening torque 126~157N · m
(93~116lbf · ft)

④ Install the piston.



7078MP22/22A

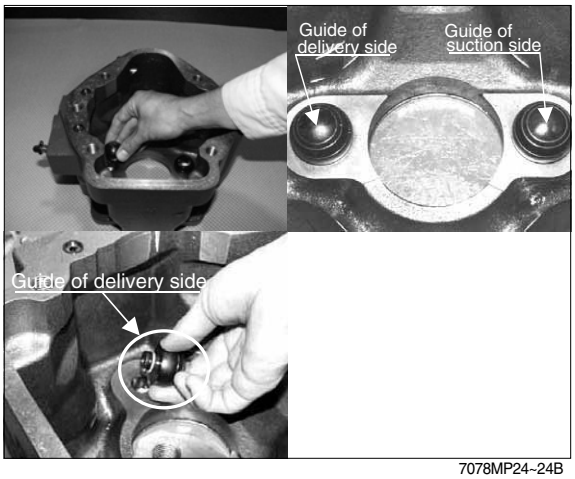
⑤ Apply grease to the back side of the control plate.
(To prevent dislodgement)
And assemble it to the cover while matching knock holes.



7078MP23

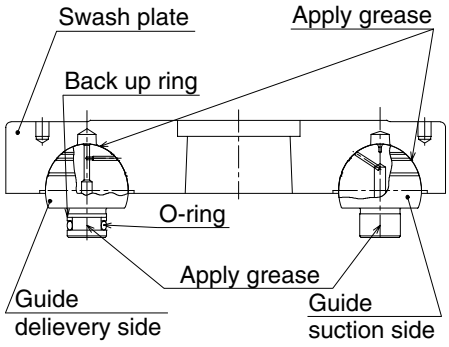
(3) Assembling of the swash plate

① Install the guides into the housing.



7078MP24~24B

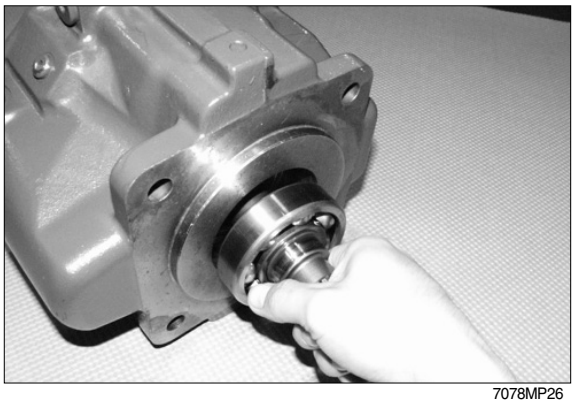
② Install the swash plate into the housing.



7078MP25A/25

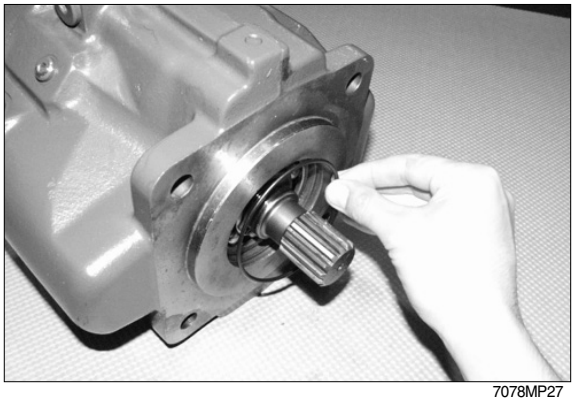
(4) Assembling of the shaft

① Install the shaft into the housing.
Fix the bearing outer ring firmly into the housing hole.



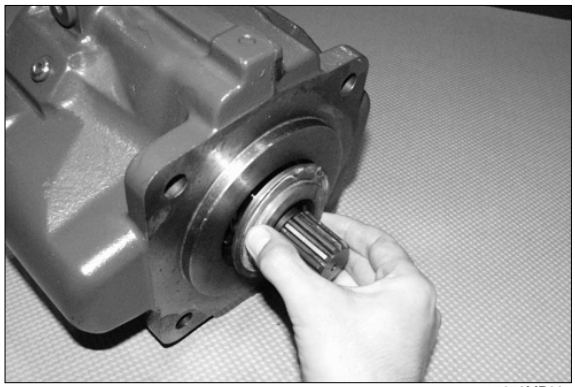
7078MP26

② Apply grease to the O-ring for assembling.



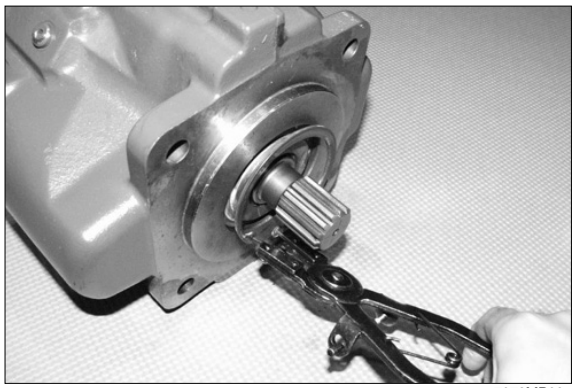
7078MP27

③ Install the oil seal case into the shaft.
Apply grease to the oil seal lip beforehand.



7078MP28

④ Install the retaining ring to fix the shaft.
(Pliers for retaining rings, bore use 80)



7078MP29

(5) Assembling of the rotary group

① Apply grease to 3 parallel pins.
Install 3 parallel pins into the cylinder block.

7078MP30

② Apply grease to the guide.
Install the guide on 3 parallel pins

7078MP30A

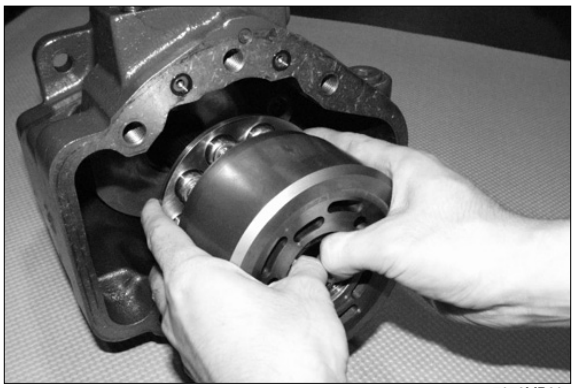
③ Install the piston(10 pistons) into the retainer.

④ Apply grease to the piston.
Install the piston and the retainer into the hole of cylinder block.

7078MP31

⑤ Install the rotary group into the housing. (Along the shaft spline)

⑥ Apply grease to slide surface of the piston shoe and to the slide surface of the cylinder block relative to the control plate.

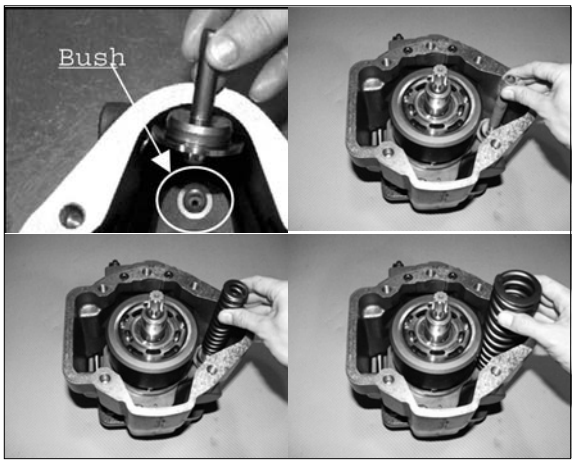


7078MP32

(5) Assembling of the spring seat

① Apply grease to the spherical portion of the spring seat.
Install the spring seat into the bush.

② Install the spring guide and springs into the housing.



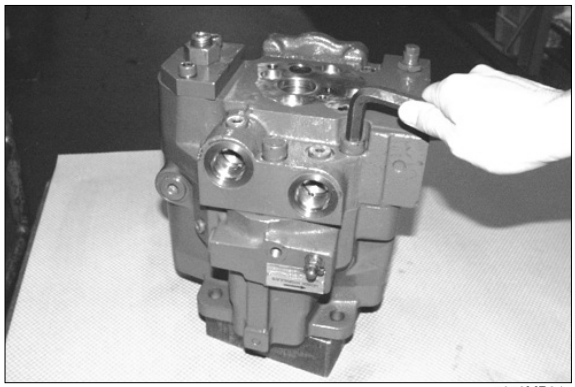
7078MP33~33C

③ Install the packing.

7078MP34

④ Join together housing and cover.
Fix the hexagon socket head cap screws.
(M14×40, 2 pieces)
(M14×65, 2 pieces)
(M14×75, 1 pieces)

L-wrench(12)
· Tightening torque 150~180N · m
(111~133lbf · ft)

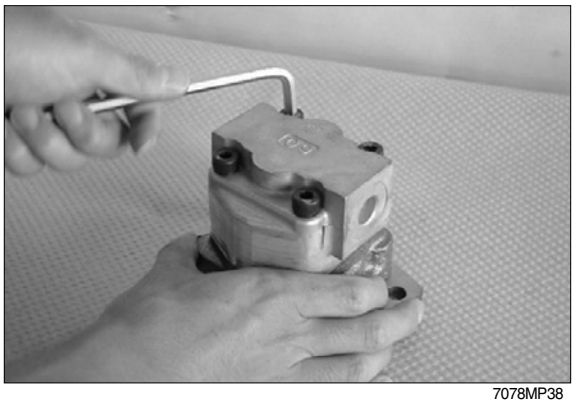


7078MP34

5. DISASSEMBLING

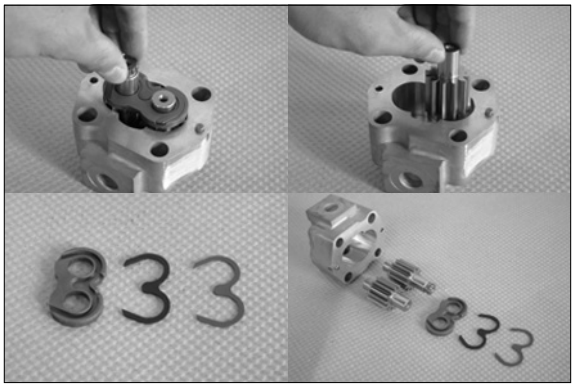
(1) Disassembling the gear pump

① Remove the hexagon socket head cap screws. (M8×50, 4pcs)



7078MP38

② Remove the side plate, backup ring, square ring and gears while pulling out the drive gear and idle gear.



7078MP39~39C

③ Removing the front frame.

Remove the hexagon head bolts, (M10×2, 4pcs)

Spanner (17)

7078MP40

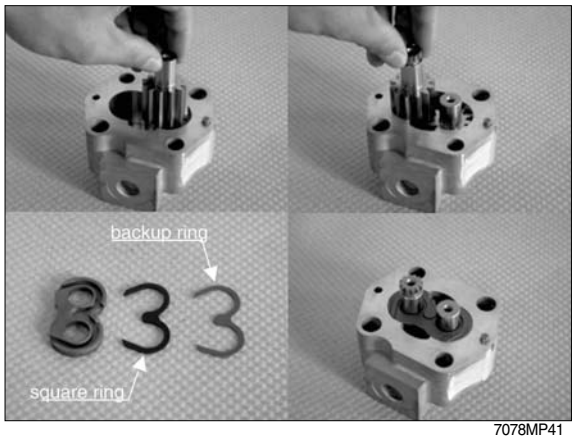
6. ASSEMBLING

(1) Assembling the gear pump

① Assemble the idle and drive gear into the housing.

② Assemble the side plate assy.
Apply grease to the square ring and backup ring to prevent dislodgment and assemble them in this order.

③ Assembled in side plate assy.
Above into the housing.



7078MP41

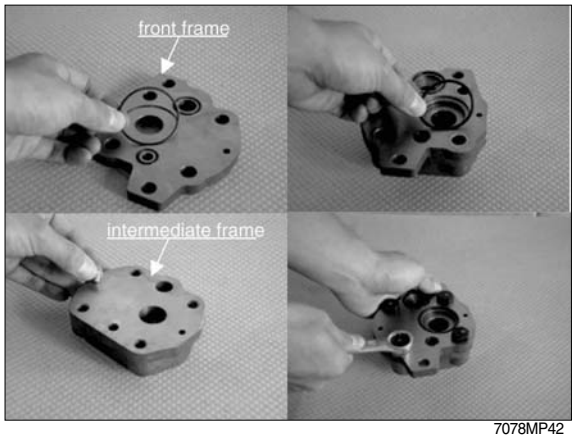
④ Assemble the front frame.

⑤ Install the O-rings into the front frame.

⑥ Install the two parallel pins into the front frame.

⑦ Join together intermediate frame.
Fix the hexagon head bolts,
(M10×25, 4pcs)

Spanner (17)
· Tightening torque 59N · m (44lbf · ft)



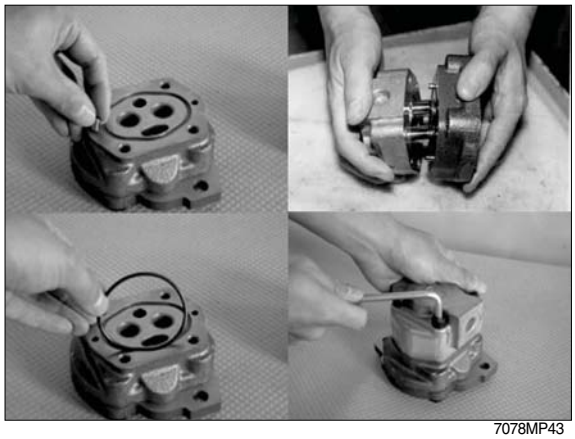
7078MP42

⑧ Assemble the intermediate frame.

⑨ Install two parallel pins and O-ring.

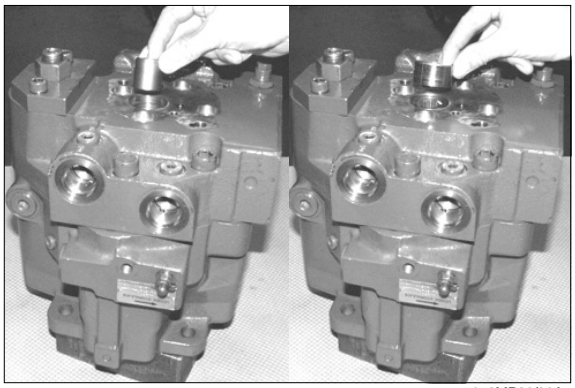
Fix the hexagon socket head cap screws.
(M8×50, 4pcs)

L-wrench(6)
· Tightening torque 29.4N · m (21.4lbf · ft)


7078MP43

(2) Assembling the gear pump

① Install the coupling to the shaft end of the main pump.

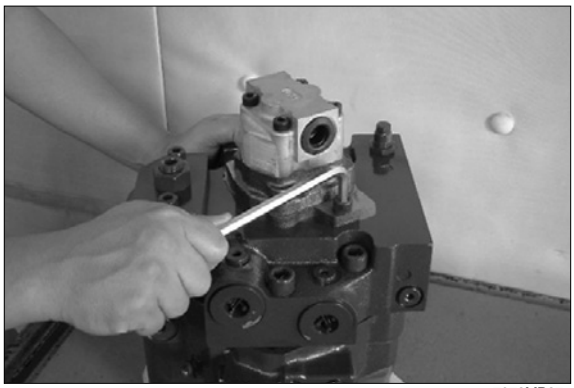


7078MP36/36A

② Fix the gear pump with the hexagon socket head cap screws.
(M10×25, 2 pieces)

L-wrench(8)

· Tightening torque 55~69N · m
(40~50lbf · ft)



7078MP37

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) Remove bolts and disconnect pipe.

(5) Disconnect pilot line hoses.

(6) Disconnect pilot piping.

(7) Sling the control valve assembly and remove the control valve mounting bolt.
· Weight : 60kg(130lb)

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

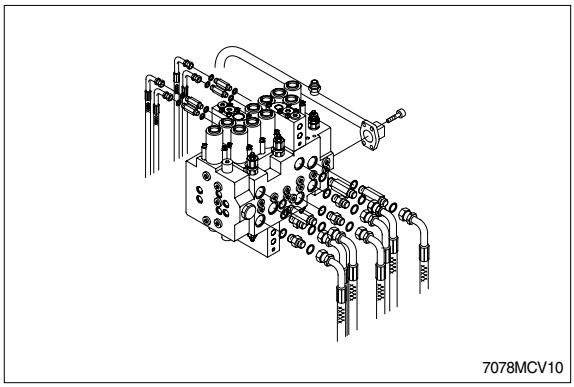
2) INSTALL

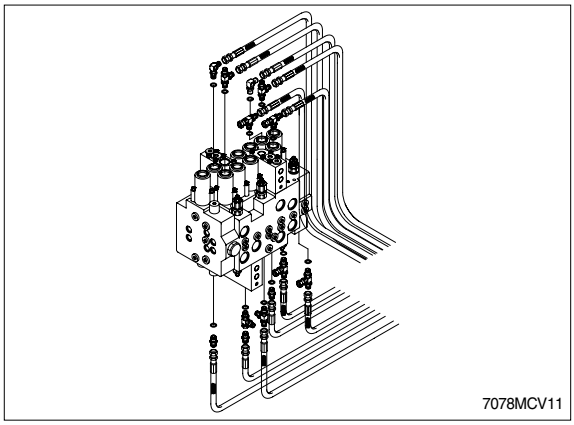
(1) Carry out installation in the reverse order to removal.

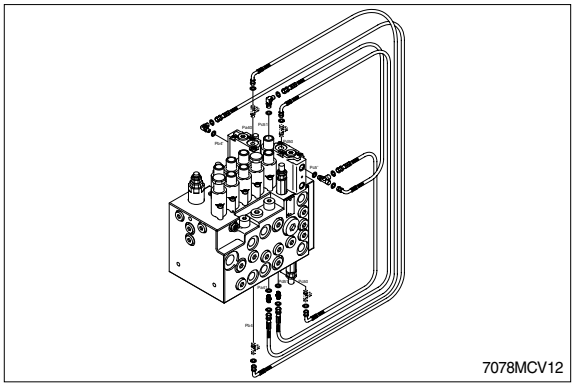
(2) Bleed the air from below items.
① Cylinder(Boom, arm, bucket)
② Swing motor
③ Travel motor
※ See each item removal and install.

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

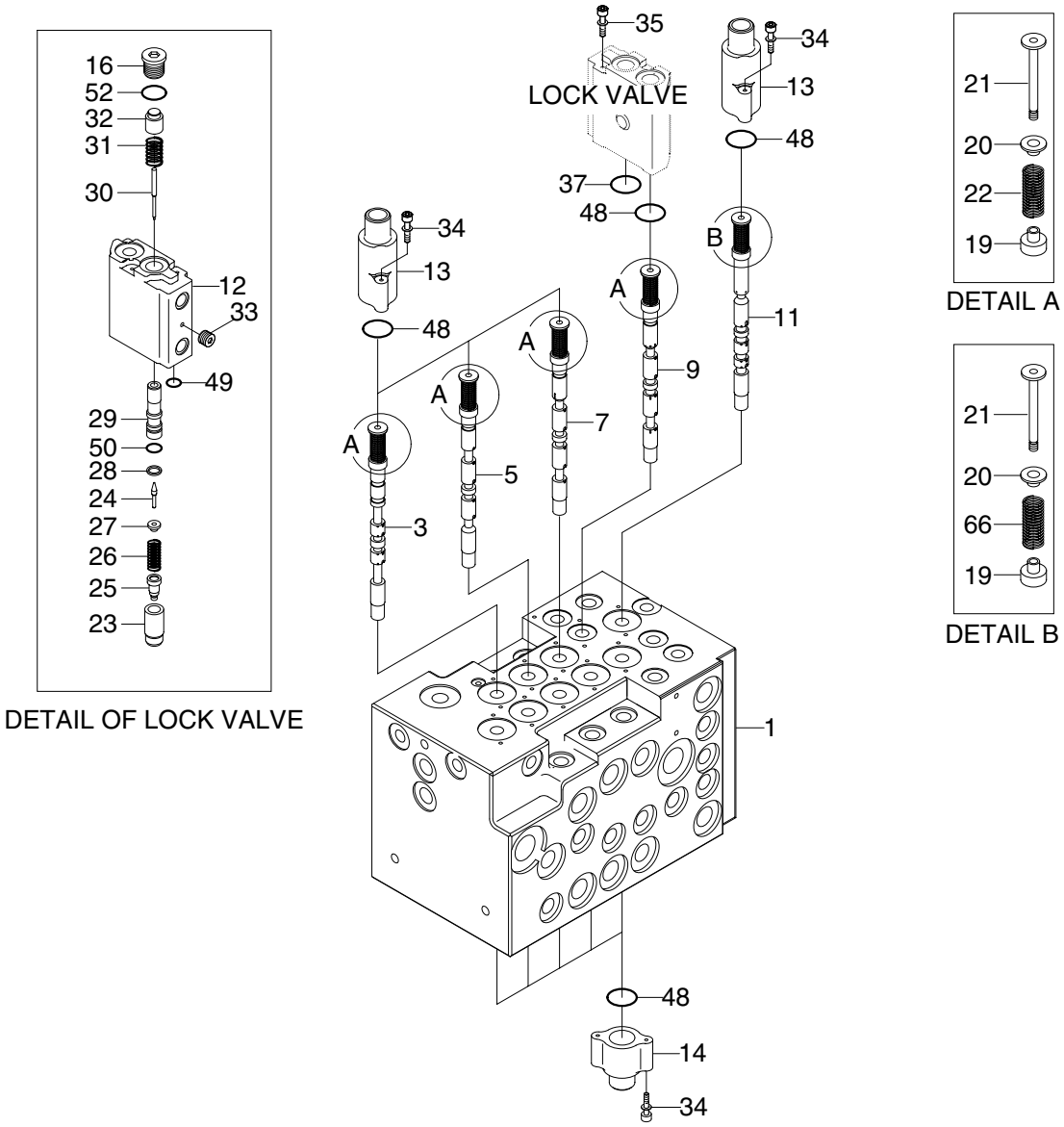

13031GE18


7078MCV10


7078MCV11


7078MCV12

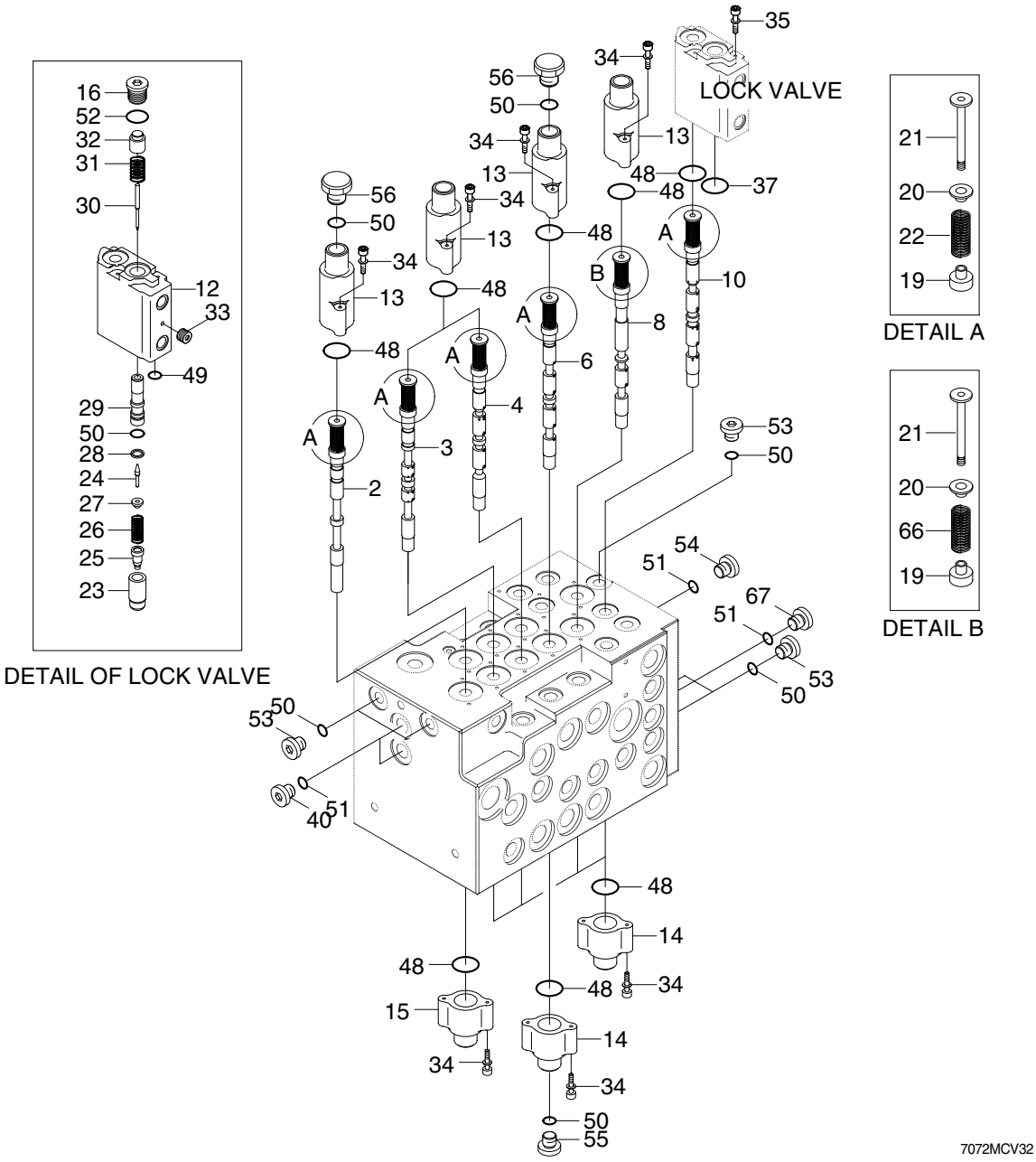
2. STRUCTURE(1/4)



7072MCV31

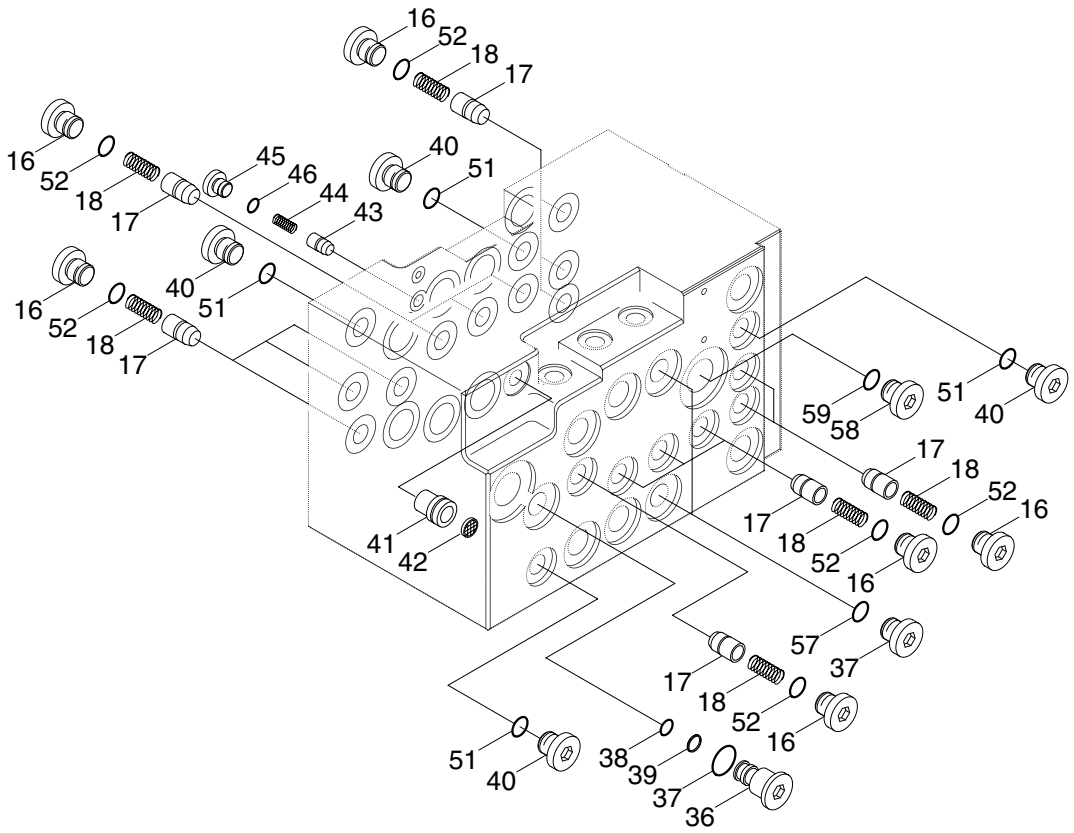
1	Body	20	Spring holder	31	Lock valve spring
3	Spool-Travel(LH)	21	Spool end	32	Piston
5	Spool-Swing	22	Spring	33	Plug
7	Spool-Option	23	Lock valve	34	Socket head bolt
9	Spool-Boom 2	24	Poppet	35	Socket head bolt
11	Spool-Arm	25	Lock valve restrictor	37	O-ring
12	Pilot-Cover	26	Lock valve spring	48	O-ring
13	Pilot-Cover	27	Spring holder	49	O-ring
14	Pilot-Cover	28	Retaining ring	50	O-ring
16	Plug	29	Piston guide	52	O-ring
19	Spring holder	30	Piston	66	Spring

STRUCTURE(2/4)



2	Spool-Travel straight	23	Lock valve	40	Plug
4	Spool-Travel(RH)	24	Poppet	48	O-ring
6	Spool-Dozer	25	Lock valve restrictor	49	O-ring
8	Spool-Boom	26	Lock valve spring	50	O-ring
10	Spool-Arm 2	27	Spring holder	51	O-ring
12	Pilot-Cover	28	Retaining ring	52	O-ring
13	Pilot-Cover	29	Piston guide	53	Plug
14	Pilot-Cover	30	Piston	54	Restrictor plug
15	Pilot-Cover	31	Lock valve spring	55	Plug
16	Plug	32	Piston	56	Plug
19	Spring holder	33	Plug	66	Spring
20	Spring holder	34	Socket head bolt	67	Restrictor plug
21	Spool end	35	Socket head bolt		
22	Spring	37	O-ring		

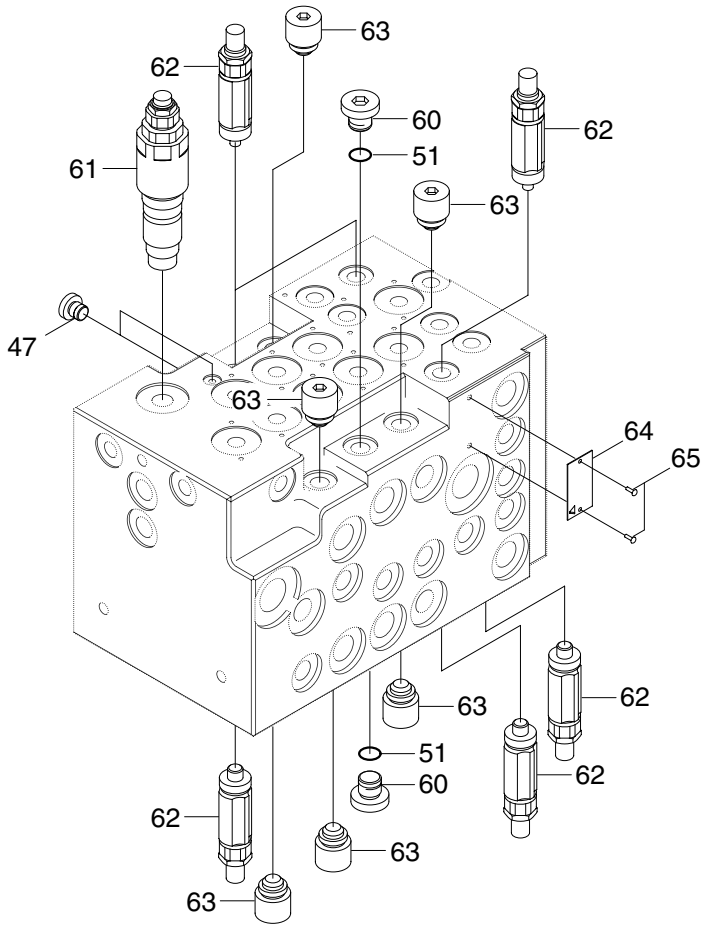
STRUCTURE(3/4)



7072MCV33

16	Plug	40	Plug	51	O-ring
17	Check valve	41	Restrictor plug	52	O-ring
18	Check valve spring	42	Coin type filter	57	Plug
36	Plug	43	Check valve	58	Plug
37	O-ring	44	Check valve spring	59	O-ring
38	O-ring	45	Plug		
39	Back up ring	46	O-ring		

STRUCTURE(4/4)



7072MCV34

47 Plug
48 O-ring
51 O-ring
60 Plug
61 Main relief valve
62 Overload relief valve
63 Relief valve plug
64 Name plate
65 Pin

3. DISASSEMBLY AND ASSEBLY

1) GENERAL CAUTIONS

Disassembling and assembling should be executed in maker's factory in principle. And, when be obliged to do them for some unavoidable reason, they must be executed in a factory of having enough skill for hydraulic equipment with keeping following cautions.

(1) As hydraulic equipments, not only this valve are constructed precisely with very small clearances, disassembling and assembling must be carefully done in a clean place with preventing dusts and contaminants from entering.

(2) When removing the control valve from the machine, install caps on every ports, and wash the outside of the assembly with confirming the existence of caps before disassembling.
Prepare a suitable table and some clean papers or rubber mat on the table for disassembling.

(3) For carrying the control valve, never hold with spool caps portion of switching portion, and carefully treat the valves.

(4) Do not tap the valve even if the spool movement is not smooth.

(5) Several tests for such as relief characteristics, leakage, overload relief valve setting and flow resistance are required after re-assembling, and the hydraulic test equipments for those tests are needed.
Therefore, do not disassemble what cannot perform test adjustment, even if it can disassemble.
Prepare clean washing solvent, hydraulic oil and grease in advance.

2) TOOLS

Prepare following tools for disassembling the control valve.

Mark	Name	Qty	Description
1	Vise	1	
2	Pads	1	
3	Allen key wrench	Each 1	4mm, 6mm, 8mm
4	Spaner	Each 1	13mm, 19mm, 22mm, 32mm
5	Socket wrench	Each 1	13mm, 19mm
6	Tweezer	1	
7	Magnet	1	
8	Plier	1	
9	Torque wrench		Suitable for each torque or adjustable one

3) REMOVING SPOOL

(1) The case of the section without lock valve

Instruction for removing the travel spool(for instance) is follows :

Remove two cap screws by 5mm allen key wrench, then remove pilot cover.

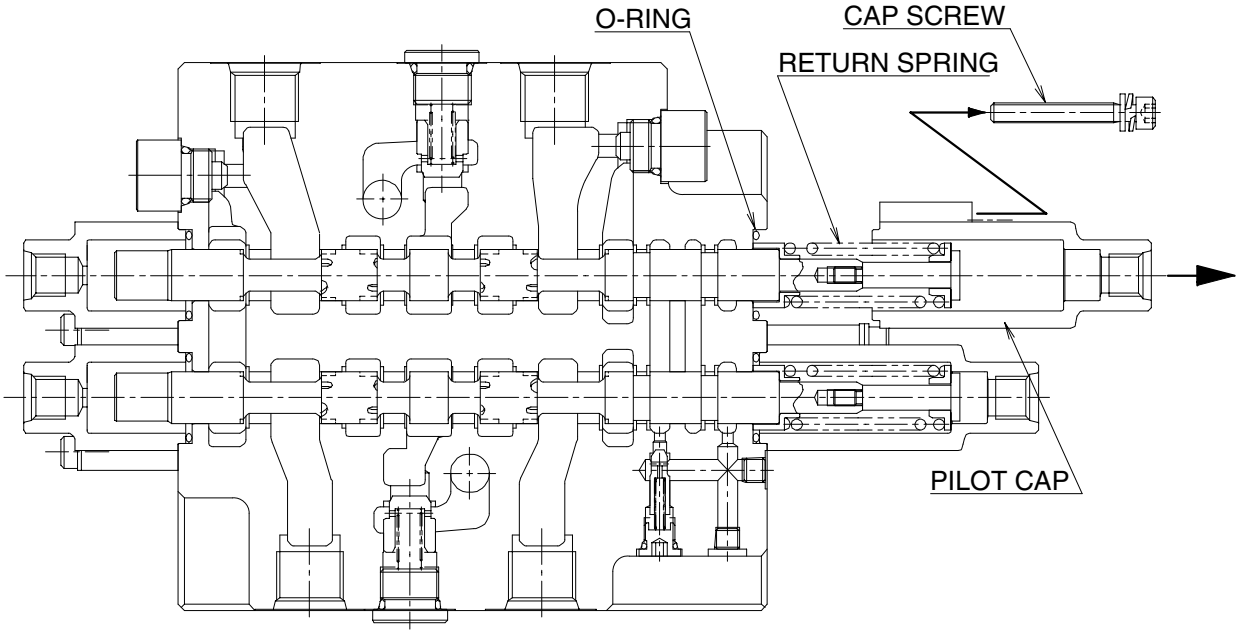
As the return spring portion of travel spool comes out, pull the spring straight slowly, by which spool assembly is removed.

Other spools(no lock valve type) can be removed in the same manner.

At this time confirm whether O-ring on the bottom of pilot cover mounting flange at body side has not fallen off.

※ In the case of spool replace, do not disassemble of a spool by any cases.
Please replace by spool assembly.

※ Please attach using a tag etc. in the case of two or more kinds of spool replace, and understand a position.



7078MCV01

(2) The case of the section with lock valve(boom and arm)

Instruction for removing the boom spool(for instance) is follows :

Remove three cap screws by 5㎜ allen key wrench. Then remove pilot cover with piston guide, piston A, piston C, and spring of lock valve A.

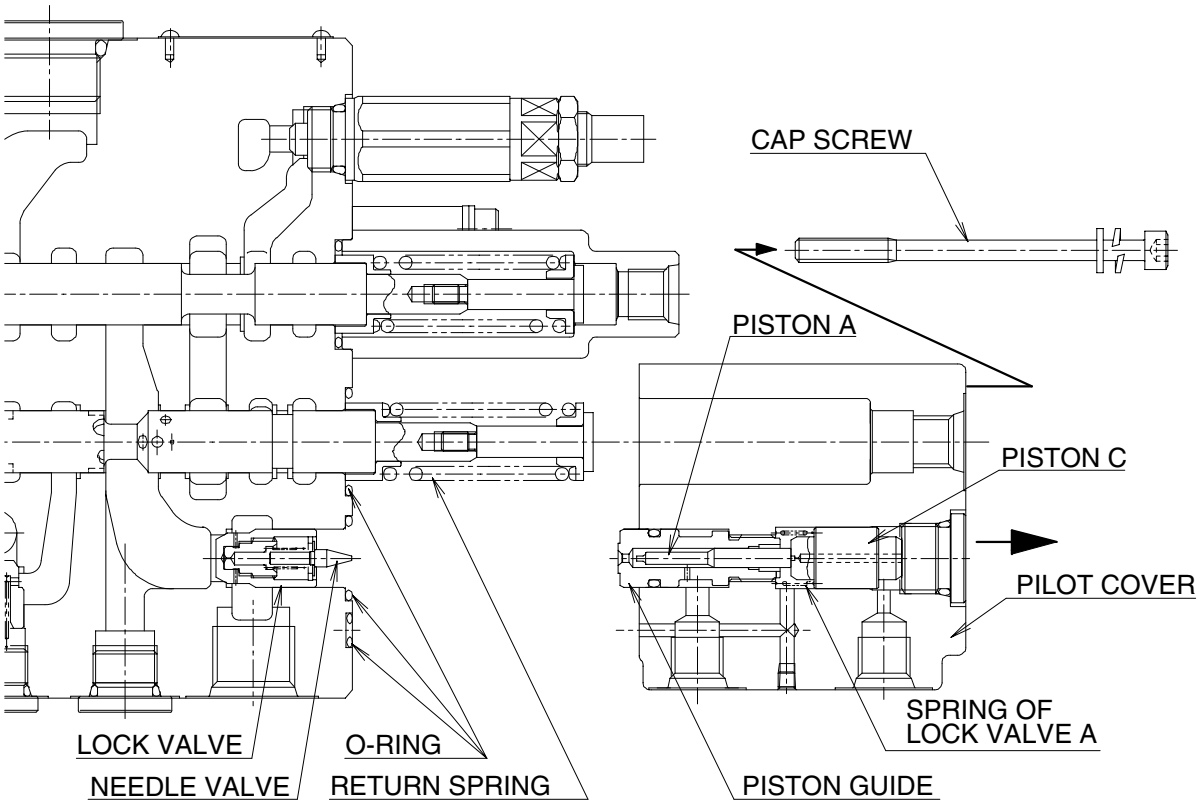
※ At this time, be careful for O-ring on the bottom of pilot cover mounting flange at body side and needle valve not to separate, and remove the pilot cover.

As the spring portion of the boom spool comes out, pull the spring straight slowly, by which spool assembly is removed.

※ Please treat it carefully so that a crack is not attached to the piston guide part exposed from the bottom of pilot cover.

※ In the case of spool replace, do not disassemble of a spool by any cases.

Please replace by spool assembly.



7078MCV02

4) REMOVING LOCK VALVE

First, a pilot cover is removed like a previous page.

※ Since it is easy to separate from needle valve, please remove and keep it.
Next, the pilot cover is fixed by vice, and the plug is loosened and removed by the 8mm allen wrench.

※ Please fix the sides other than a port side by vice.

※ Please treat it carefully so that a crack is not attached to the piston guide part exposed from the bottom of pilot cover.

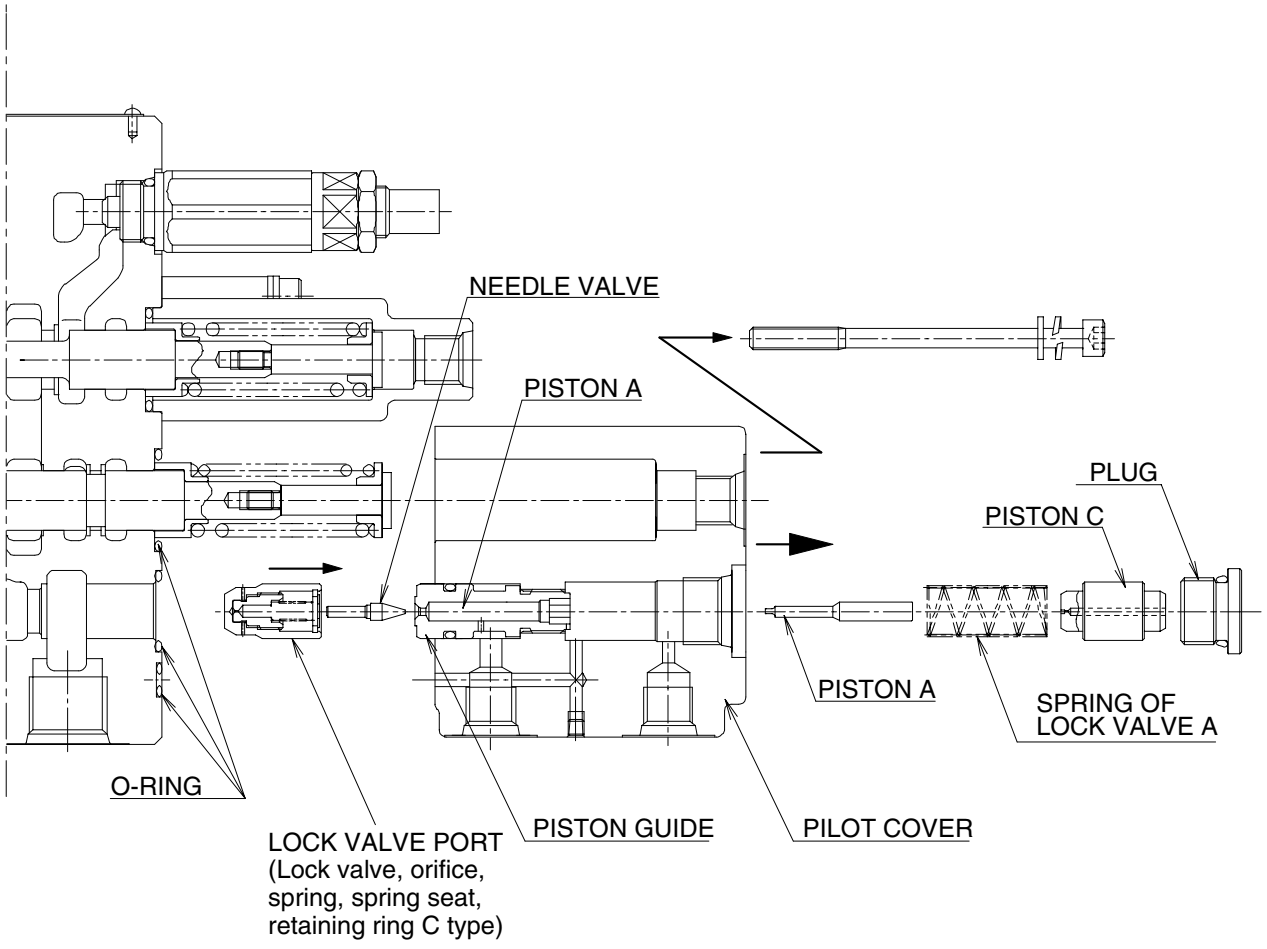
From the hole which is removed the plug, piston C, spring of lock valve A, and piston A can be extracted using tweezers or a magnet.

※ The diretion where piston C had put should be known.

※ Do not disassemble the piston guide. When fault arises, please replace for a pilot cover by the set.

Next, the locke valve part(lock valve, orifice of lock valve, spring of lock valve B, spring seat, retaining ring C-type) is removed from the body by the set using a magnet.

※ Do not disassemble the lock valve port. When fault arises, please replace by the set.



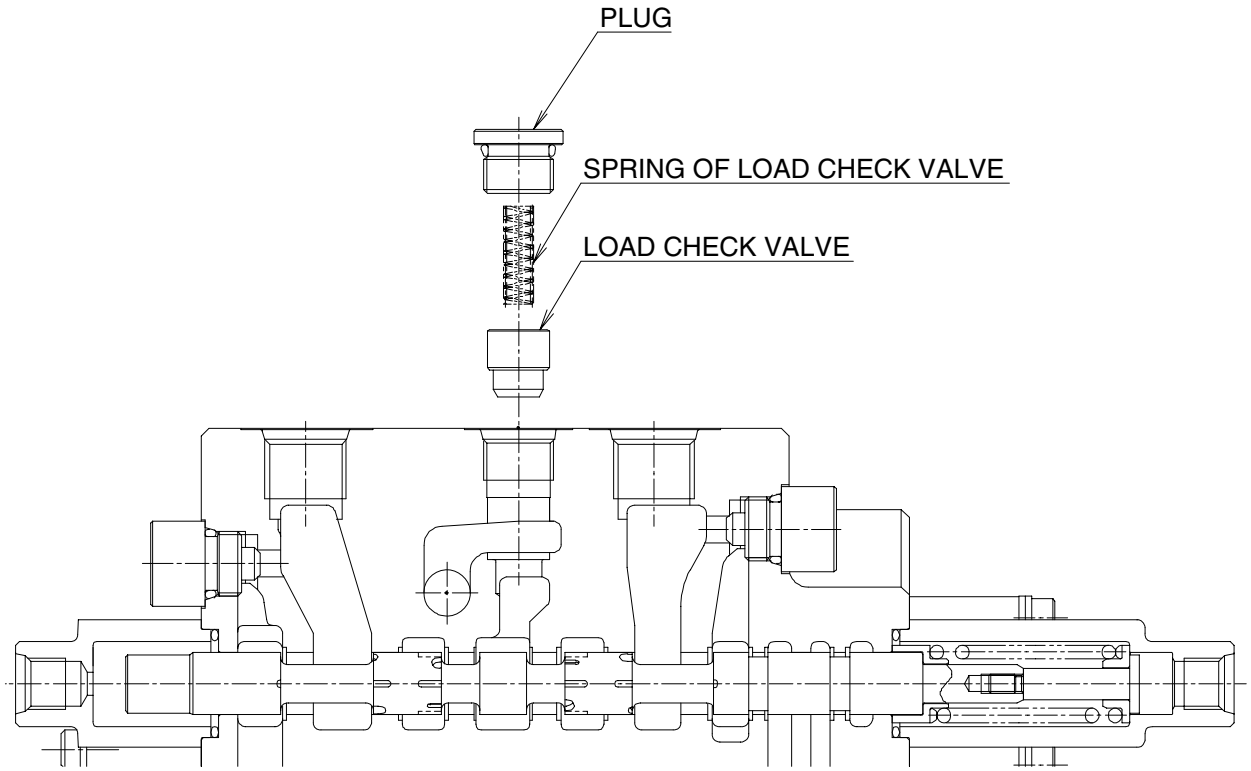
7078MCV03

5) REMOVING LOAD CHECK VALVE

First, the valve body is fixed and it is made not to move.

A plug is removed using a 8㎜ allen wrench.

Next, spring of load check valve and load check valve are extracted using tweezers or a magnet.



7078MCV04

6) REMOVING MAIN RELIEF VALVE AND OVERLOAD RELIEF VALVE

First, the main valve body is fixed and it is made not to move.

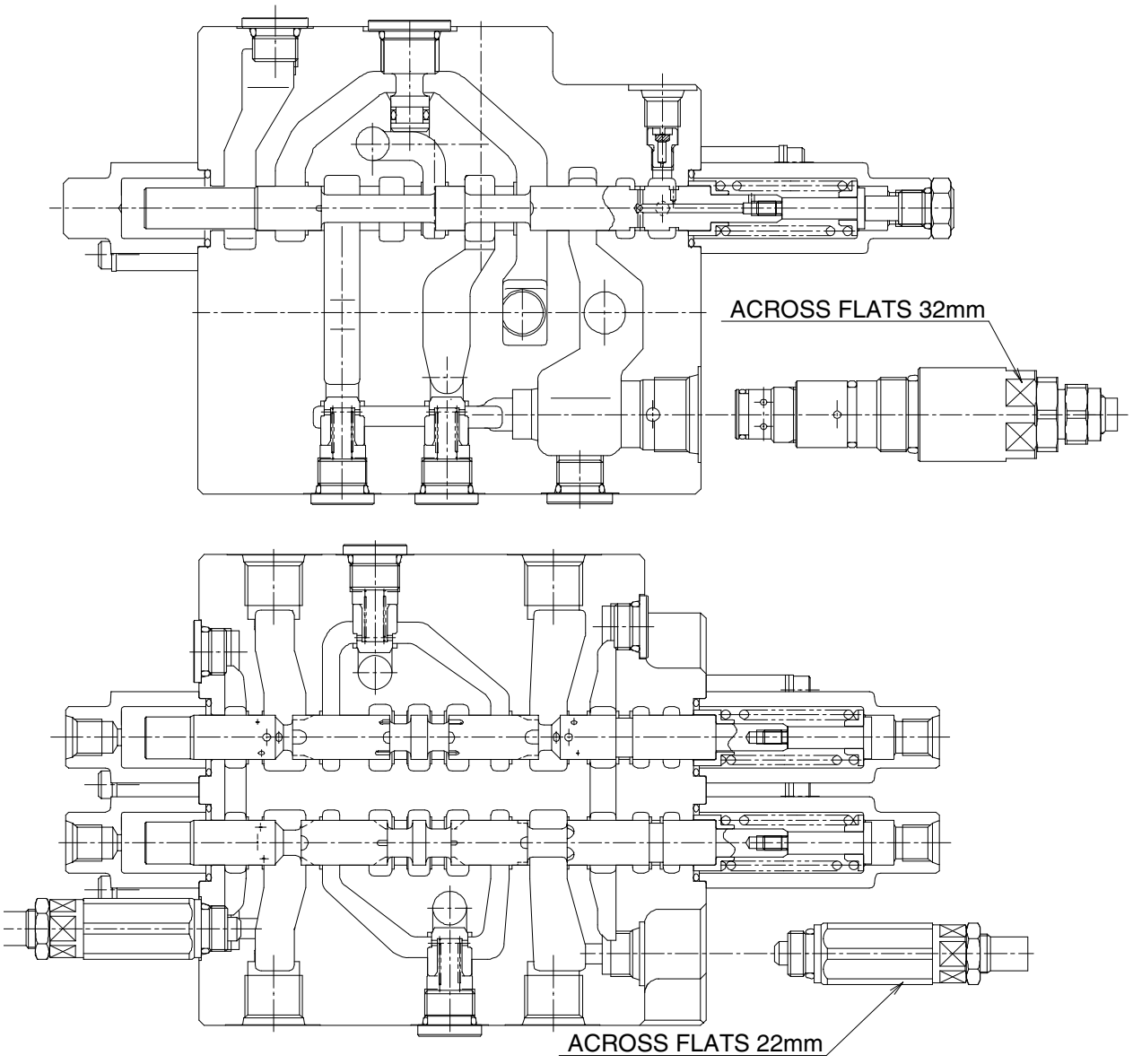
Next, a 32mm spanner is hooked on hex. portion(across flats 32㎜) of main relief valve, and it is loosened and removed.

And, a 22mm spanner is hooked on hex. portion(across flats 22mm) of overload relief valve, and it is loosened and removed.

※ **Do not remove the main relief valve using the hexagon width portion 19, 22 or 27㎜.**
Do not remove the overload relief valve using the hexagon width portion 19㎜.

※ **Please treat it carefully so that a crack is not attached to the seat part of removed main relief valve and overload relief valve.**

※ **As the main relief valve and overload relief valve are one of the most important components on the function and safety, and also, it is difficult to re-set the pressure, so replace them by assembly if any deficiency is found.**



7078MCV05

7) ASSEMBLING

(1) As the description on assembly is sentence only, refer to clause for disassembly for figures.

(2) Cautions when assembling

① The unevenness of tightening torque and the contaminant during assembly may cause a failure. And observe the tightening torque specified in the description.

② When assembling, check up on the valve construction drawing, identify the number of part, and pay attention that there is no installation error and omission of part, etc.

③ When you assemble, please wash all parts by pure cleaning liquid, and immerse them in hydraulic oil as required, and assemble them.

④ Before applying loctite, clean and degrease the surface sufficiently, and apply it to two threads. (Overapplication may cause a malfunction due to the squeezing out)

⑤ For re-assembling, basically use only bland new seals for all portions.

(3) Cautions when fitting seals

① For re-assembling, basically use only bland new seals for all portions.

② Pay attention to seals that they are free from deformation and flaw coming about when handling them.

③ Apply grease or hydraulic oil to the seals and seal fitting section to make the sliding smooth, unless otherwise specified.

④ Do not stretch the seals until it will be changed permanently.

⑤ Pay attention not to roll the O-ring when fitting. Because it is difficult for the twisted O-ring to be restored naturally after fitting, and it may cause oil leakage.

(4) Installation of main relief valve and overload relief valve

The main body is fixed, and install main relief valve and overload relief valve on each port, and tighten them with regulation torque.

- Main relief valve : Tightening torque = 59~69N · m(6.0~7.0kgf · m)
- Overload relief valve : Tightening torque = 39~49N · m(4.0~5.0kgf · m)

※ Keep regulation torque at tightening, if not, distortion of body or oil leakage may be generated.

(5) Instllation of spool assembly

Confirm whether dusts etc. are not sticking on the spool and spool cavity in the body. Also confirm whether O-rings are securely installed on the bottom of the body flanges. (2 places, front and back of the body)

Insert each spool assembly into each spool cavity of the body confirming the position and direction.

Prior to insert, apply small amount of hydraulic oil on spool.

※ Even if insert of spools is not easy, do not press them in force. It may bring some deficiencies in function.

Push and pull spools several times by hand and confirm that they move without excessive resistance or slip-sticking. If any of them does not move smoothly, replace spool assembly or the valve assembly.

Following above, install pilot cover to the body flange securely from the spring side of spool assy and install bolts on the body with the regulation tightening torque.

After confirming existence of O-ring on opposite side of the body flange, install pilot cover to the flange securely, and install bolts on the body with regulation tightening torque.

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).

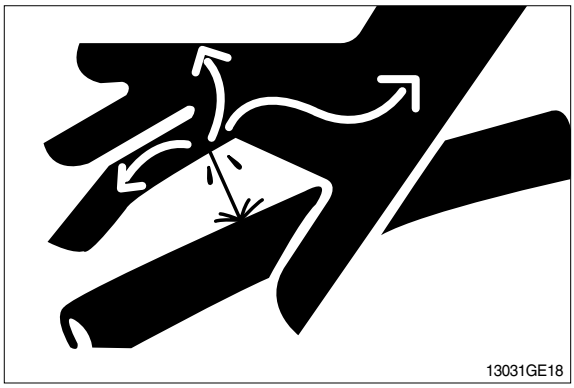
(5) Disconnect pilot line hoses(4, 5, 6, 7, 8).

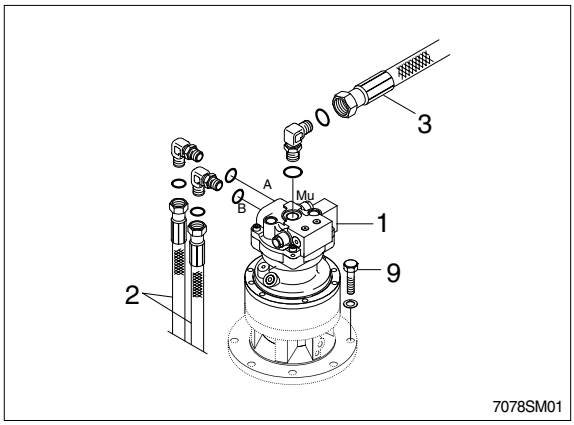
(6) Sling the swing motor assembly(1) and remove the swing motor mounting bolts (9).

※ Motor device weight : 23kg(51lb)

(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.

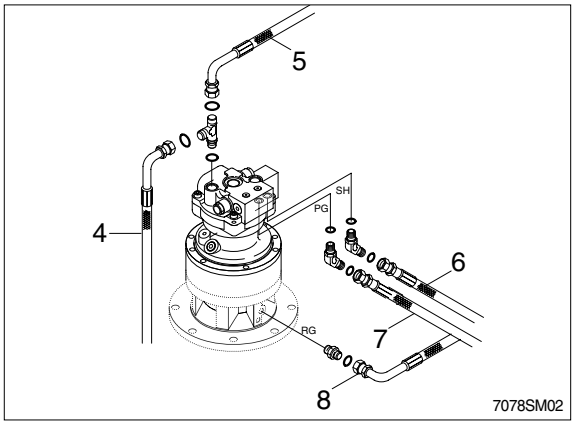
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

④ Start the engine, run at low idling and check oil come out from plug.

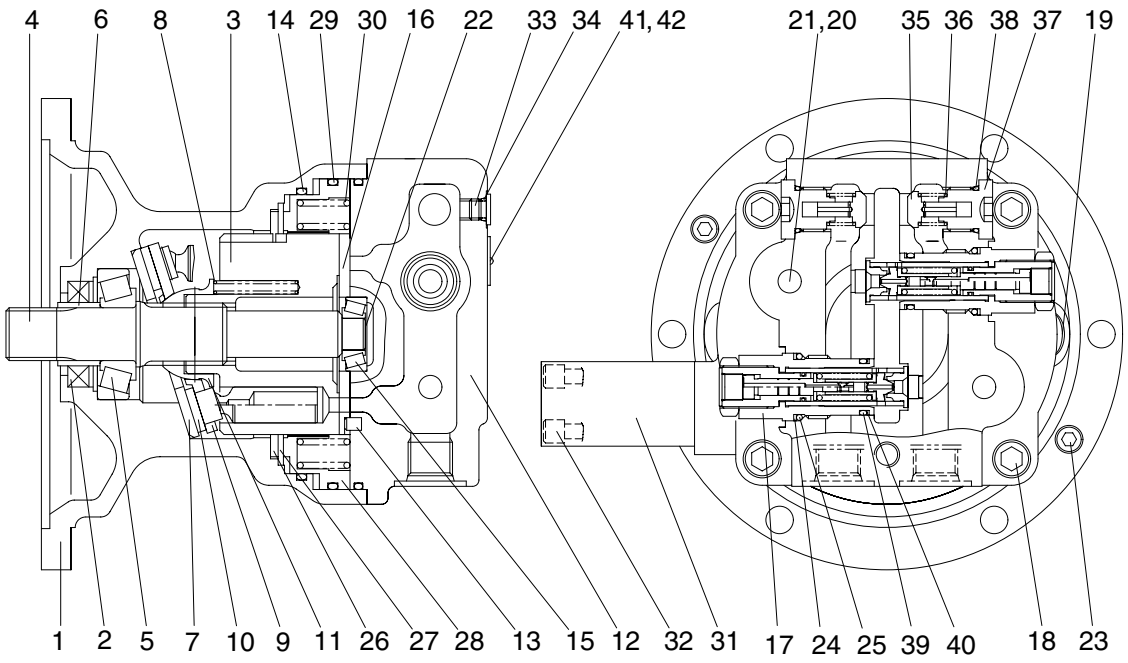
⑤ Tighten plug fully.

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



2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



7072SM01

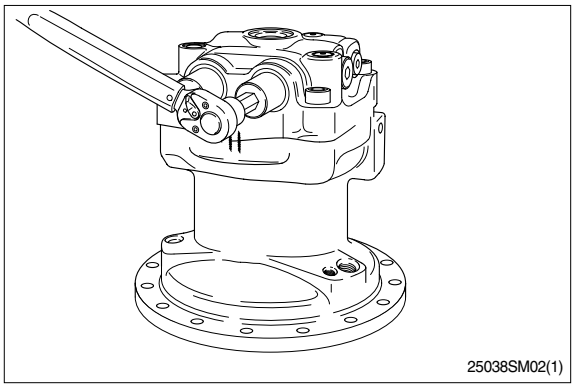
1	Body	15	Taper bearing	29	O-ring
2	Oil seal	16	Valve plate	30	Spring
3	Cylinder block	17	Relief valve assembly	31	Time delay valve
4	Shaft	18	Socket bolt	32	Socket bolt
5	Taper bearing	19	Plug	33	Plug
6	Bushing	20	Plug	34	O-ring
7	Shoe plate	21	O-ring	35	Valve
8	Spring	22	Shim	36	Spring
9	Set plate	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

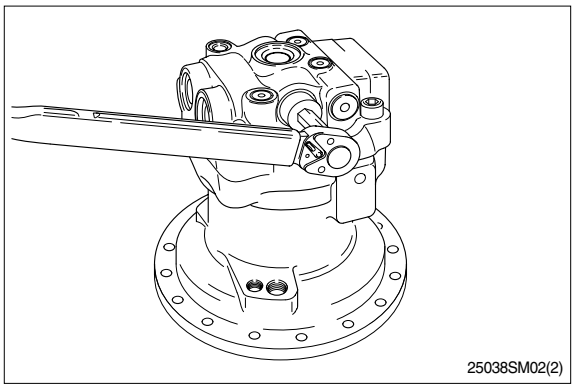
Remove cap of relief valve assembly(17) with 14㎜ hexagonal wrench.

※ Assemble removed relief valve assembly (17) to original state when reassembling.



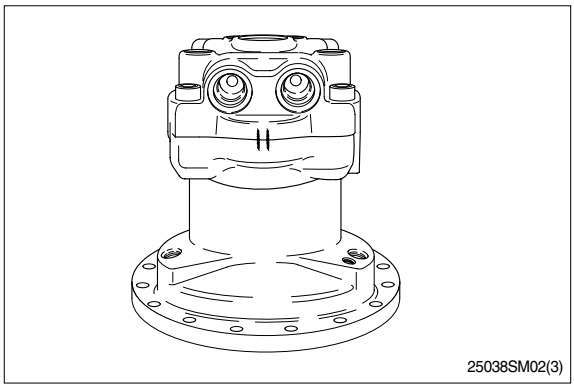
(2) Removal of make up valve and bypass valve assembly

Loosen plug(37) with 14㎜ hexagonal wrench, and remove check valve(35) and spring(36).



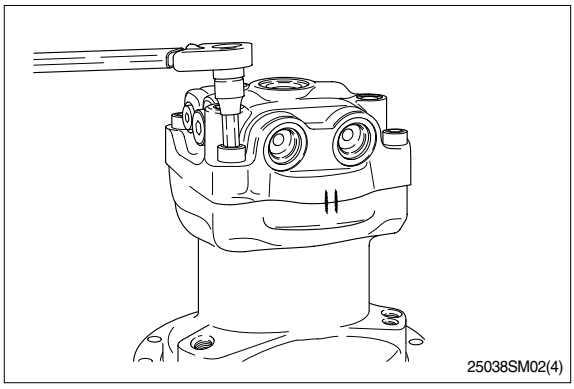
(3) Marking at swing motor

Before disassembling motor, make a matching mark between cover(12) and housing(1) for easy reassembling.



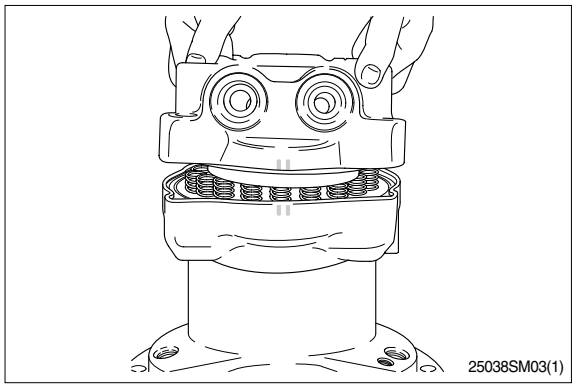
(4) Remove mounting bolts of cover

Loosen hexagon socket bolt(18) with 12㎜ hexagonal wrench.

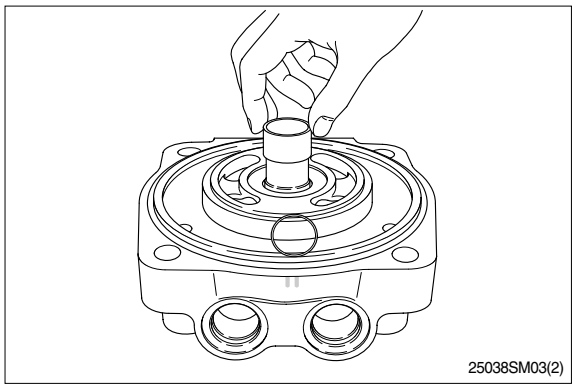


(5) Removal of cover assembly

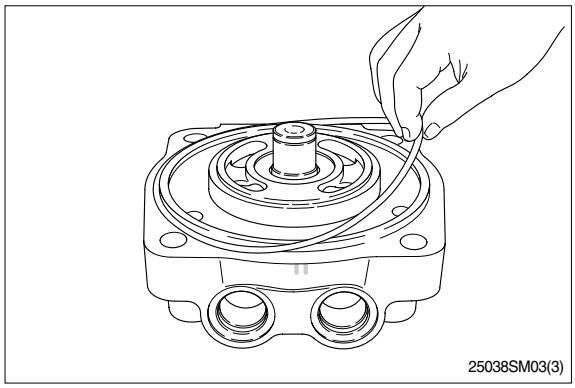
Place shaft of motor assembly to downward and take cover(12) out.



(6) Remove shim(22) remove inner race of needle bearing(15) by bearing puller.



(7) Remove O-ring(29) from cover.



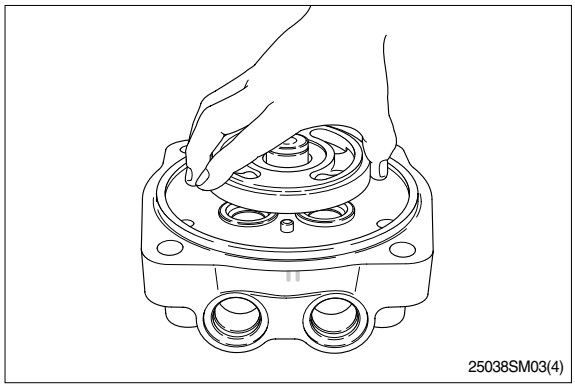
(8) Remove balance plate

Valve plate(16) is adhered on end surface of cylinder(3) by oil viscosity. Take off balance plate(16) with hands.

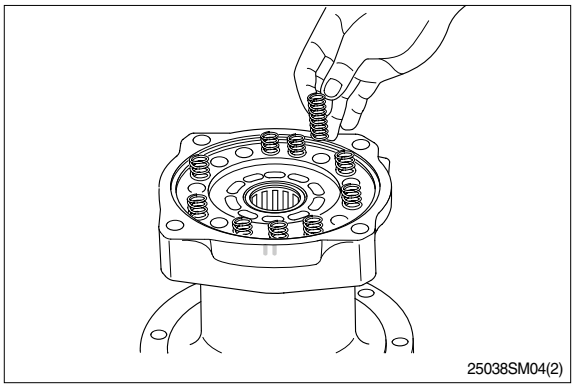
Assembling method of balance plate(16) depends on cover(12).

(Band groove and round groove of high · low pressure transmission area)

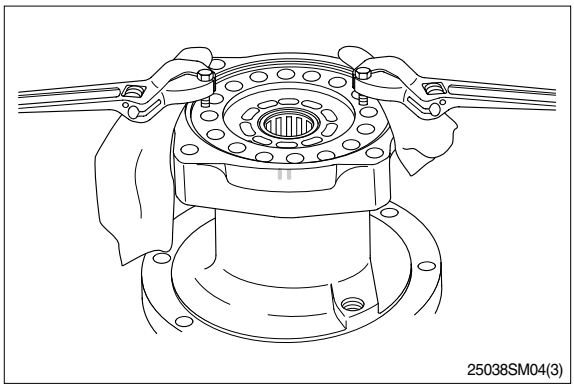
Before removing, check and record location of balance plate(16) to prevent misassembling.



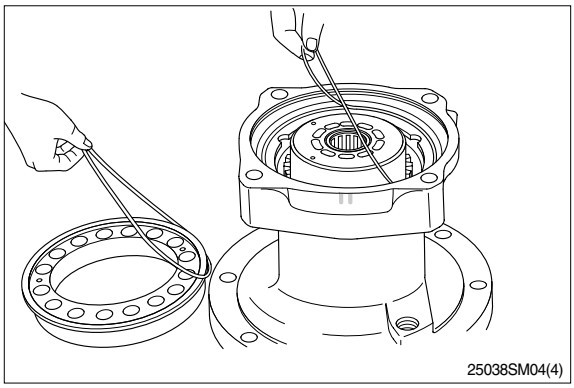
(9) Removal of spring(30, brake area)
Remove spring(30) from piston(28).
Check and record original position of each spring(30) for correct assembling.


25038SM04(2)

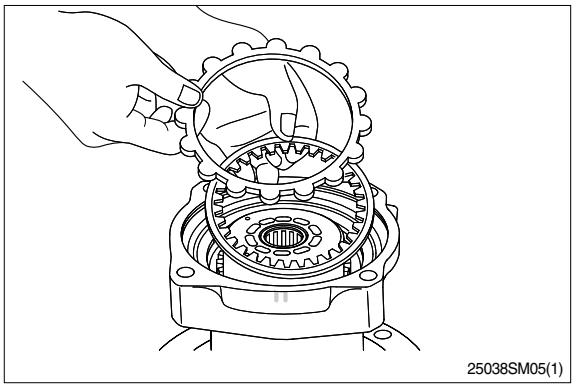
(10) Removal of brake piston
When removing piston(28) from housing (1), there is a sliding resistance against tightening of O-rings(14,29). Use tap hole on piston(28) as shown in the picture.


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)

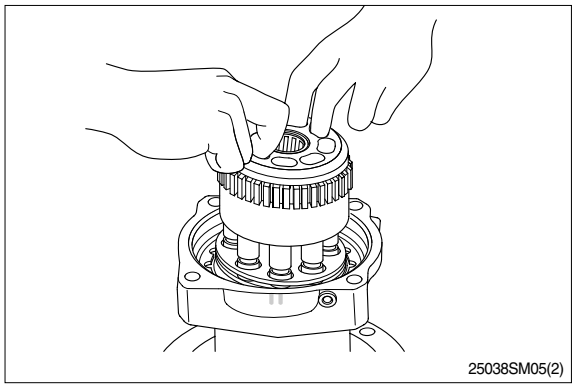
(13) Removal of cylinder assembly

Holding end of cylinder assembly(3) with hand, draw out cylinder assembly from housing.

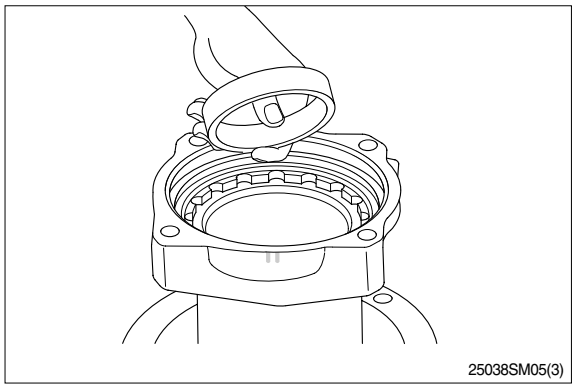
※ Oil seal(2) and outer race of taper roller bearing(15) are left inside of housing.

※ 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.



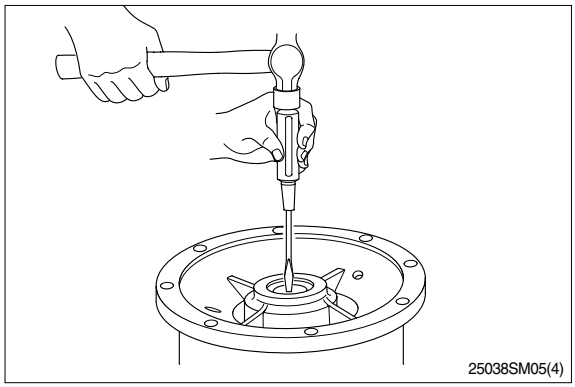
(14) Separate outer race of taper roller bearing(5) from housing.



(15) Removal of oil seal

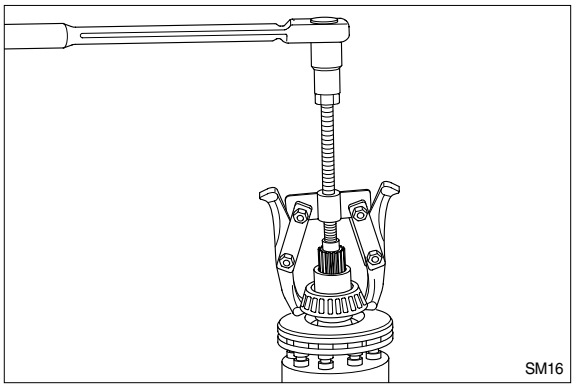
Remove oil seal(2) from housing(1) with driver and hammer.

※ Do not reuse oil seal after removal.

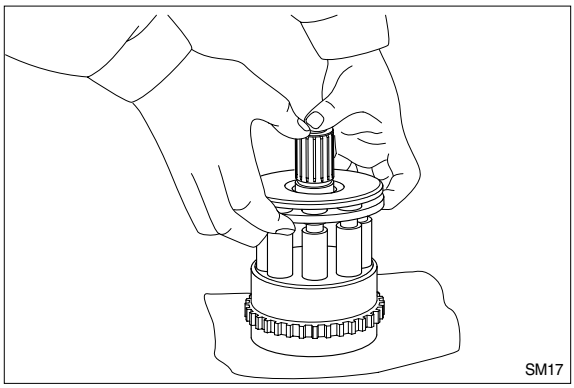


(16) Disassembly of cylinder assembly

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.

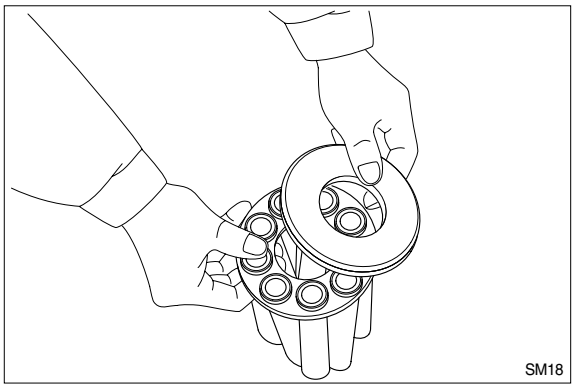

SM16

② Separate shoe plate(7), piston assembly (10), set plate(9) from cylinder block(3).

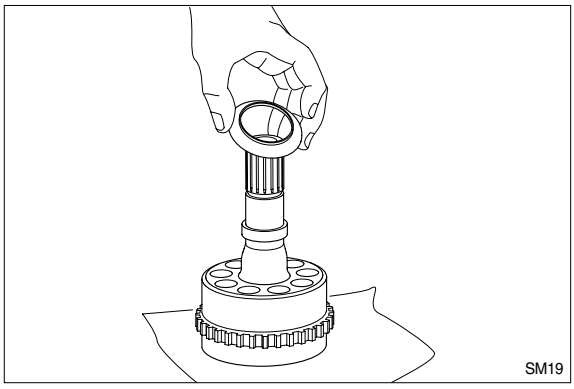

SM17

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

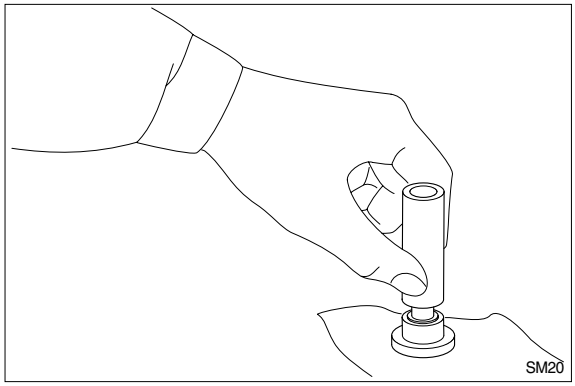
(1) Preparation

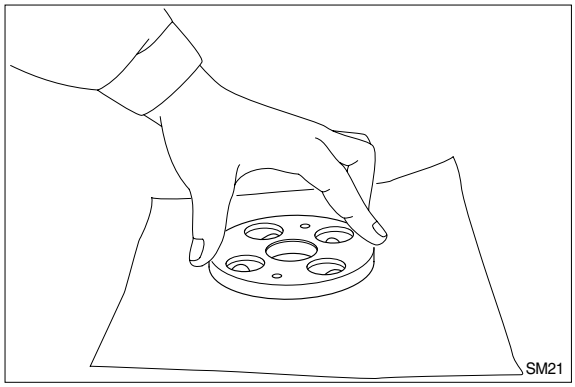
Before reassembling, perform below procedure.

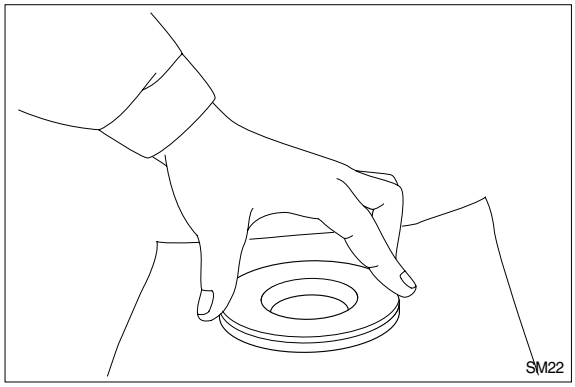
① Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.

② Replace seal with new one.

③ Grind sliding face of piston assembly(10), balance plate(16) and shoe plate(7) with sandpaper #2000.





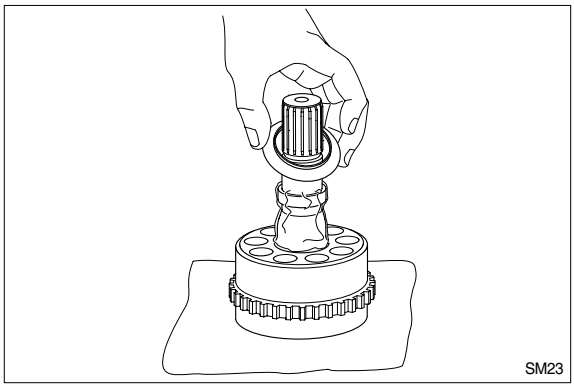


④ When assembling, lubricate with specified clean hydraulic oil.

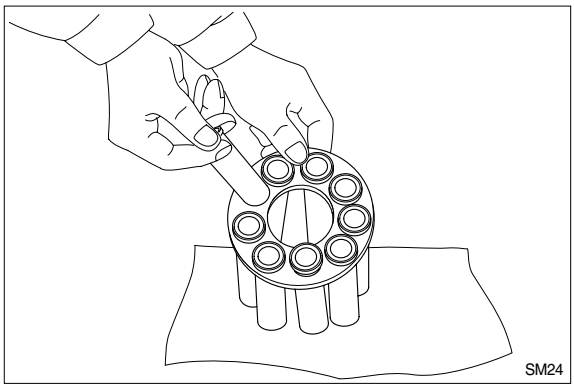
⑤ When assembling piston assembly(10) to piston hole of cylinder block(3), check matching mark between them.

(2) Cylinder assembly

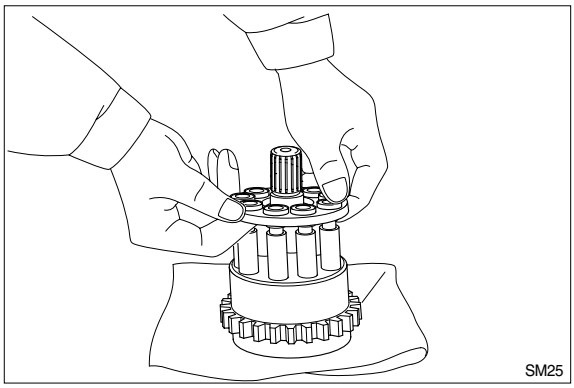
① Lubricate grease on round area (Contacting area withball guide(11)) of cylinder block(3) and assemble spring(4).



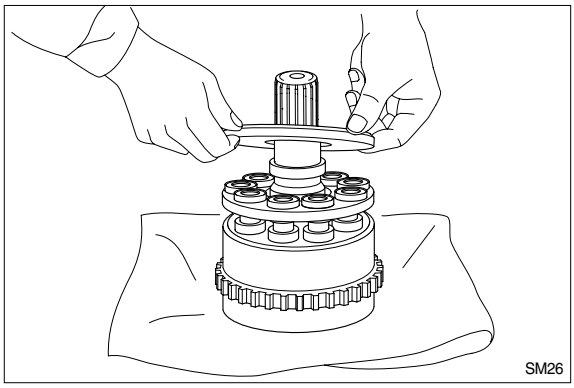
② Insert piston assembly(10) in hole of set plate(9).



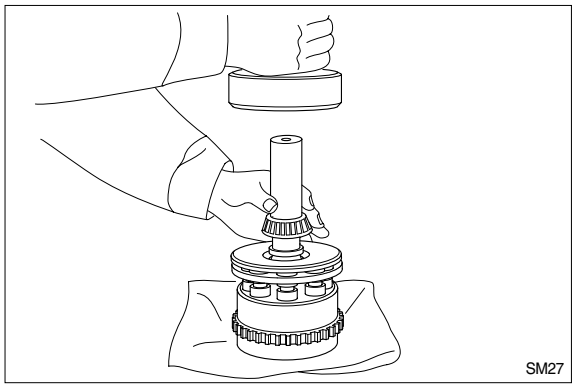
③ Assemble piston assembly(10) and set plate(9) to cylinder block(3). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder block(3).



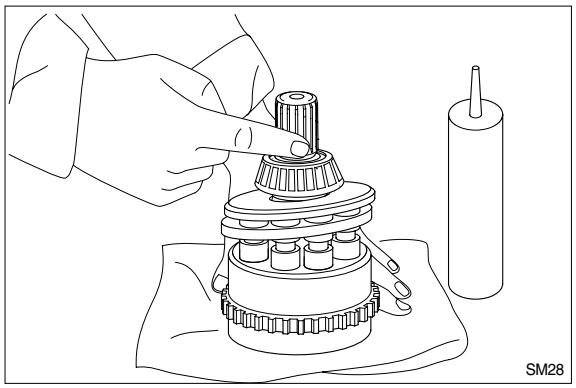
④ Lubricate specified hydraulic oil on shoe sliding face of piston assembly(10) and assemble shoe plate(7).



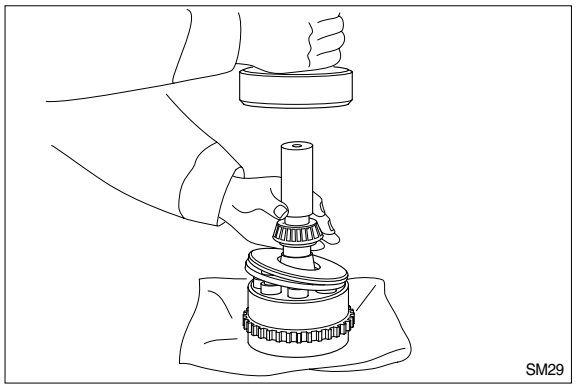
⑤ Assemble inner race of taper roller bearing(5) to cylinder block(3).



⑥ Apply loctite to bearing mounting area of inner race of cylinder block(3) lightly.



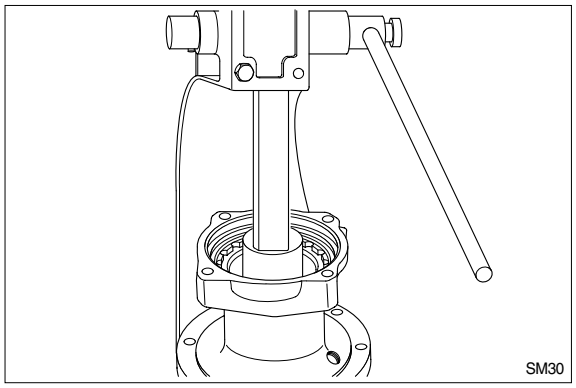
⑦ Assemble bushing(6) to cylinder block(3).



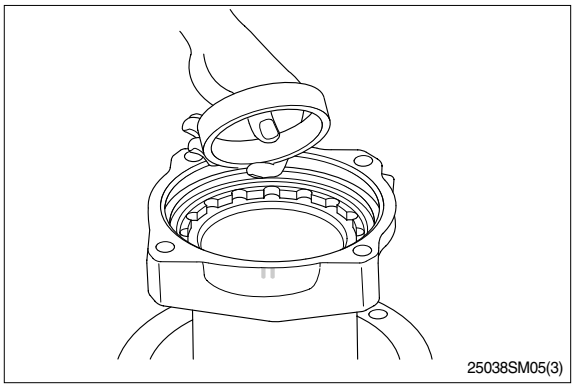
(3) Oil seal

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.



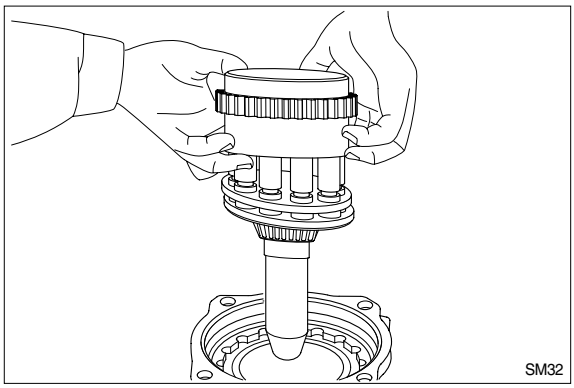
(4) Assemble outer race of taper roller bearing(5) to motor housing(1).



(5) Cylinder assembly

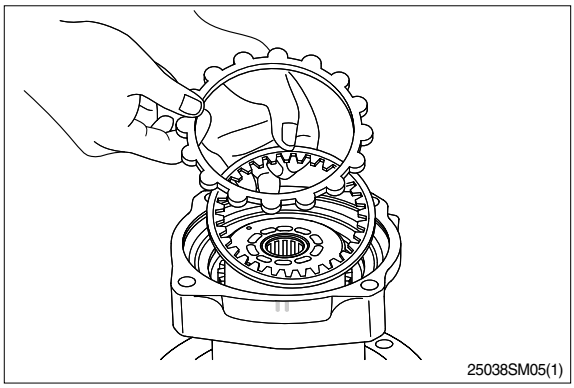
Hold end of cylinder assembly(3) with hands and assemble cylinder assembly to housing(1). Be careful to prevent damage of seal by spline of shaft.

※ When assemble cylinder assembly, spline shaft of cylinder is protruded from end of housing, therefore put pads with length 30~50㎜ under bottom of housing.



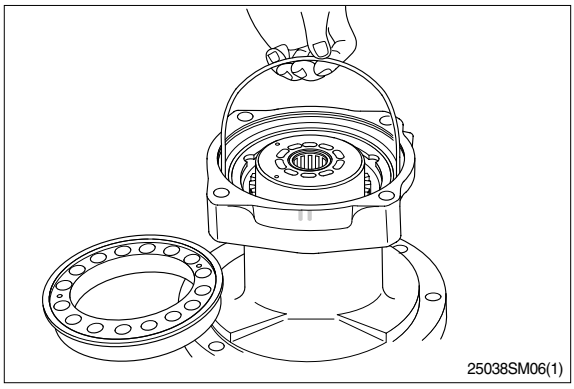
(6) Assemble friction plate(26) and lining
※ plate(27).

Lubricate specified hydraulic oil on each side.



(7) Insert O-rings(14,29) into housing(1) and piston(28).

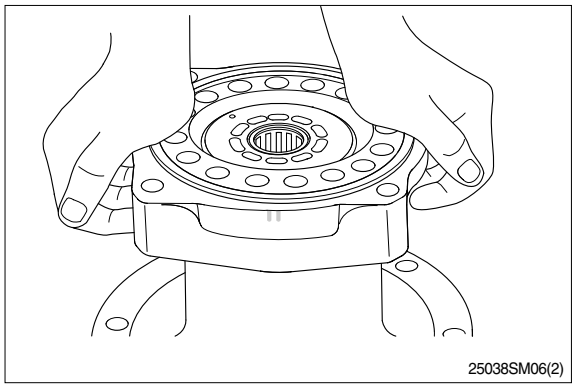
※ Lubricate O-ring with grease.



(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.

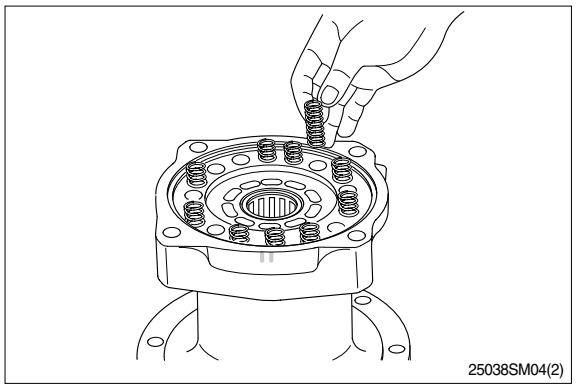


25038SM06(2)

(9) Spring(30, brake unit)

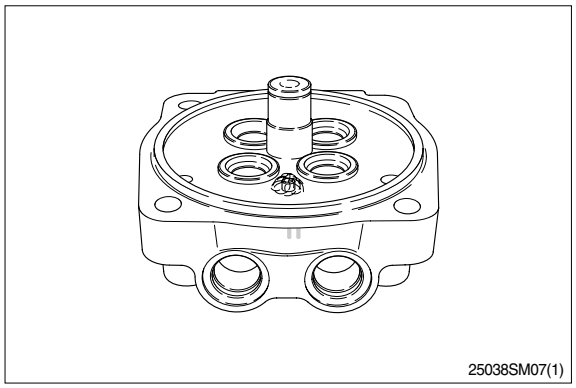
Assemble spring(30) to piston(28) of brake unit.

※ 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.

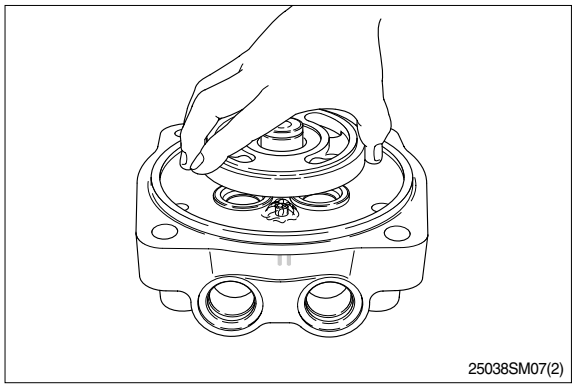


25038SM07(1)

(11) Balance plate

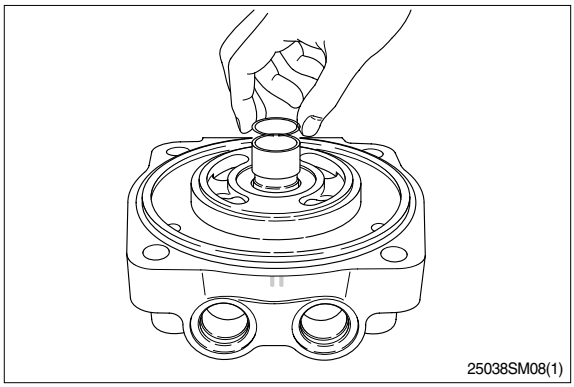
Assemble valve plate(16) to cover(12).

※ Be cautious of assembling direction.



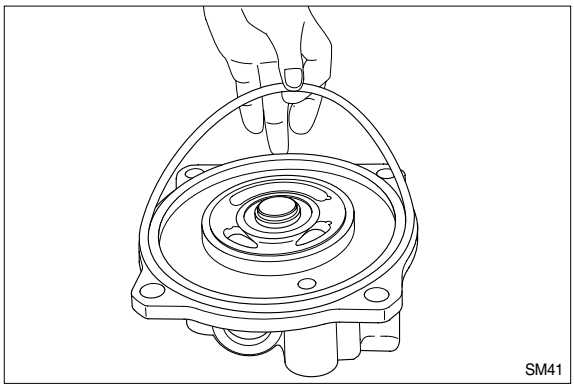
25038SM07(2)

(12) Assemble inner race of needle bearing (15) and shim(22) to cover(12).

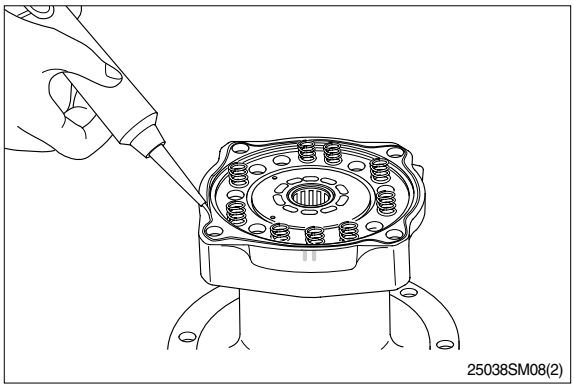


(13) Assemble O-ring(29) to cover(12).

※ 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).

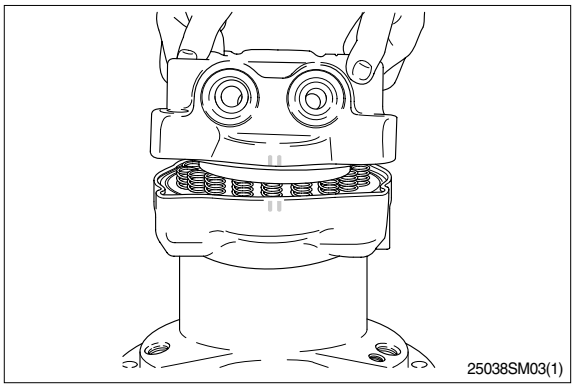


(15) Cover

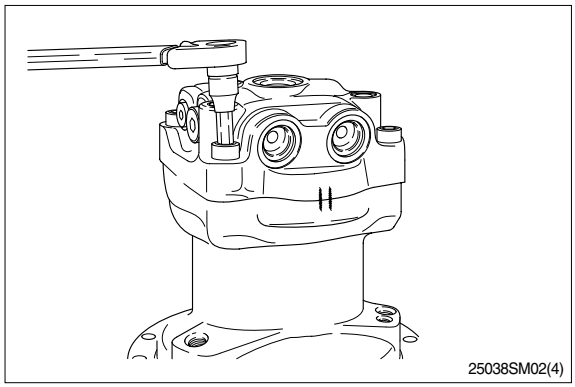
Assemble cover(12) and valve plate(16) to housing(1) lightly, holding them up with hands.

※ When assembling, be careful not to detach valve plate(16) from cover(30).

※ Fit matching marks on housing(1) and cover(12) made before disassembling.

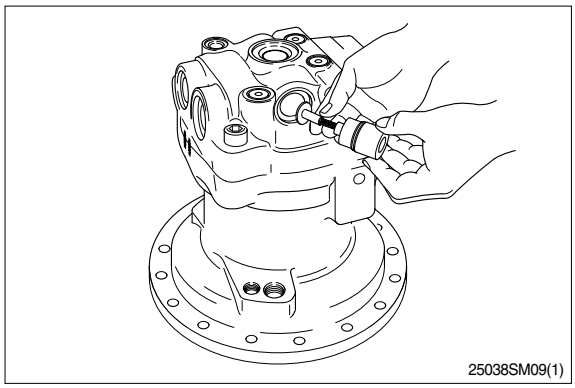


(16) Tighten cover(12) and housing(1) with 12㎜ hexagonal socket bolt(18).
· Tightening torque : 16kgf · m(116lbf · ft)


25038SM02(4)

(17) Make up valve

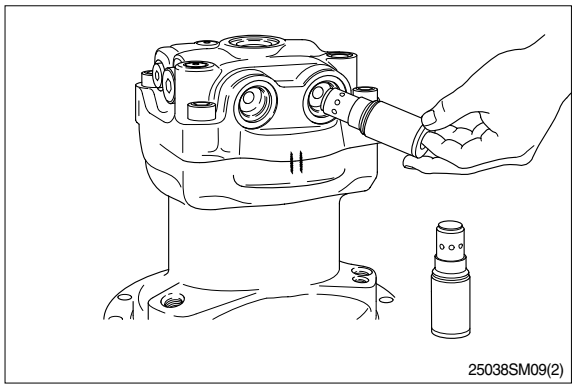
Assemble check(35) and spring(36) to cover(12) and tighten plug(37) with 14㎜ hexagonal socket bolt.
· Tightening torque : 14kgf · m(101lbf · ft)


25038SM09(1)

(18) Relief assembly

Assemble relief valve assembly(17) to cover(12) with 14㎜ hexagonal socket bolt.
· Tightening torque : 8kgf · m(58lbf · ft)

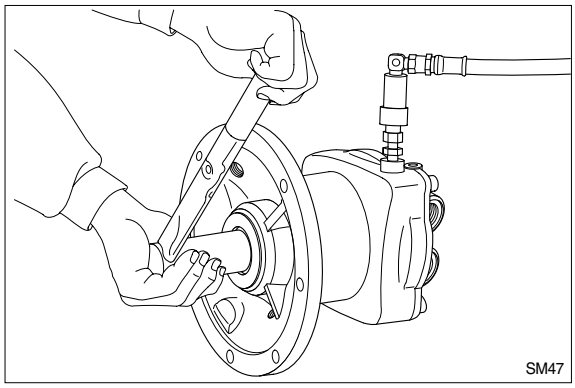
※ Be cautious of assembling method.


25038SM09(2)

(19) Check of assembly

Load pilot pressure of 20kgf/㎠ to brake release port after opening inlet and outlet port.
Check if output shaft is rotated smoothly around torque of 0.5~1kgf · m.
If not rotated, disassemble and check.

This completes assembly.


SM47

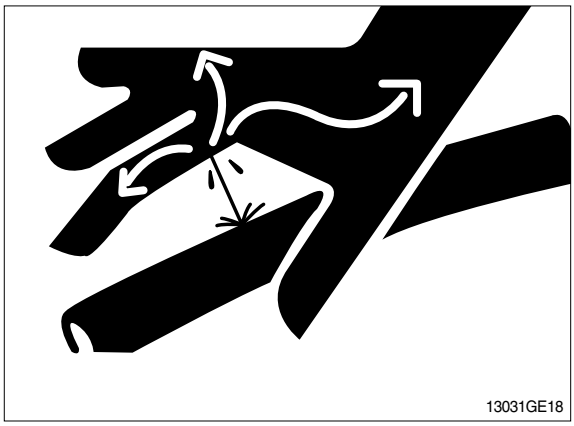
3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

(1) Remove the swing motor assembly.
For details, see **removal of swing motor assembly**.

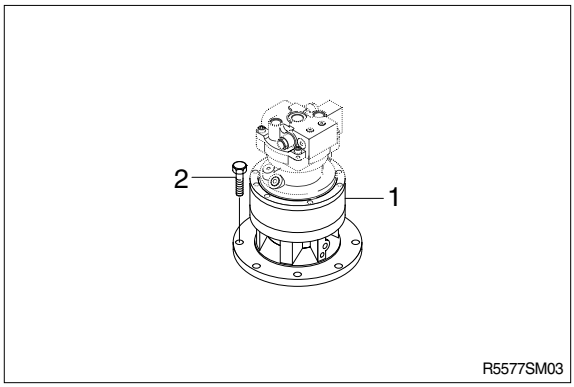
(2) Sling reduction gear assembly(1) and remove mounting bolts(2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 45kg (99lb)



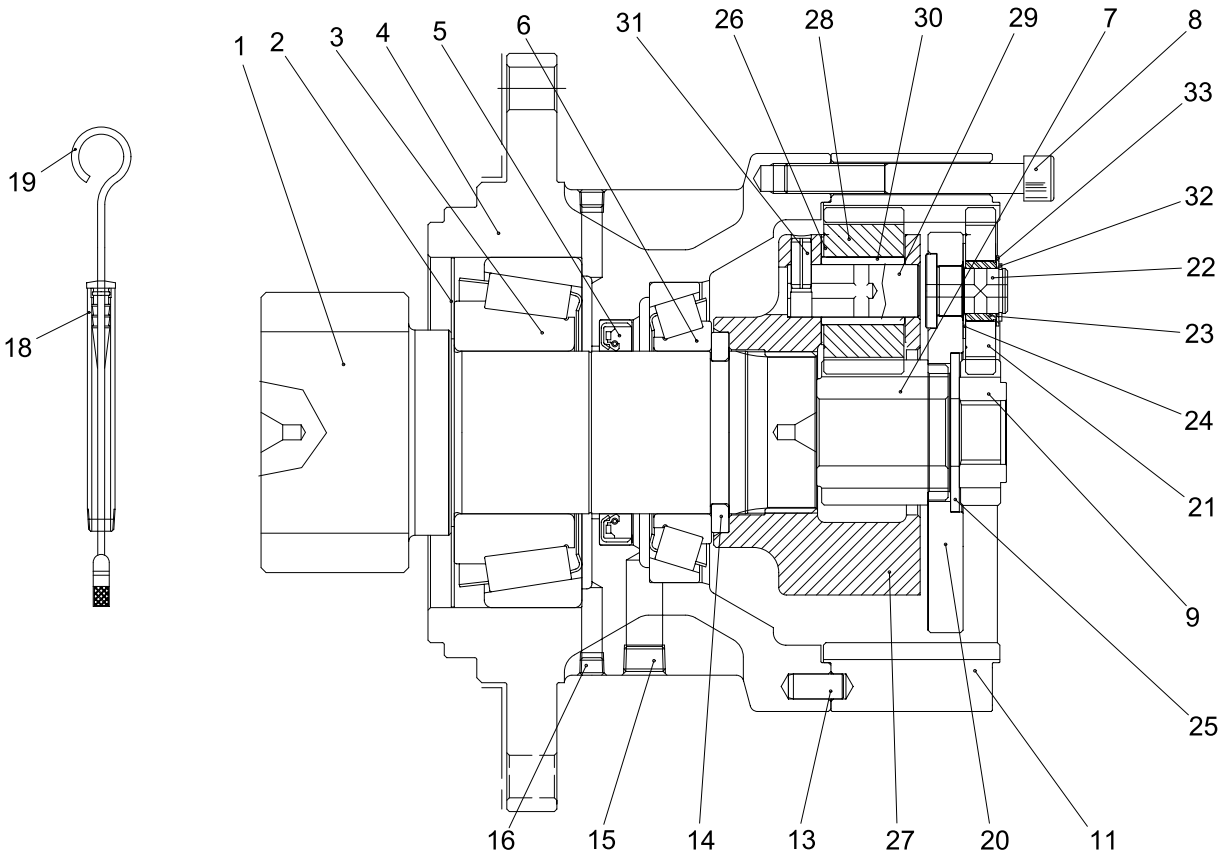
2) INSTALL

(1) Carry out installation in the reverse order to removal.
· Tightening torque : 29.7±3.2 (215±23.1lbf · ft)



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

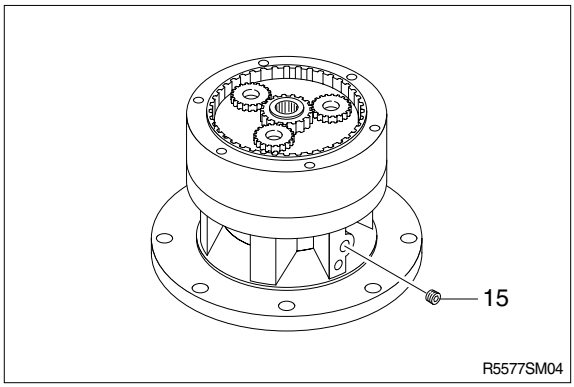


7072SM04

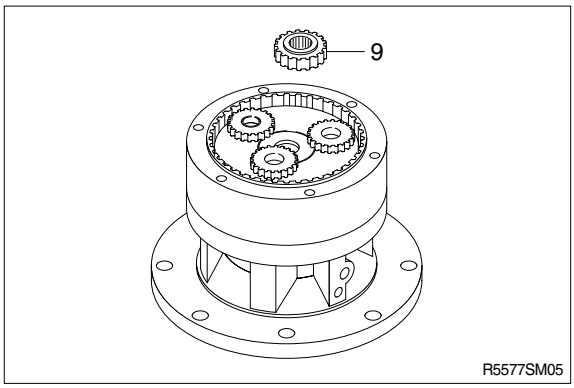
1	Drive shaft	13	Dowel pin	24	Thrust washer No.1
2	Bearing cover	14	Collar	25	Thrust washer No.3
3	Taper roller bearing	15	Plug	26	Thrust washer No.2
4	Case	16	Plug	27	Carrier No.2
5	Oil seal	18	Pipe	28	Planet gear No.2
6	Taper roller bearing	19	Level gauge	29	Pin No.2
7	Sun gear No.2	20	Carrier No.1	30	Bush No.2
8	Socket bolt	21	Planet gear No.1	31	Spring pin
9	Sun gear No.1	22	Pin No.1	32	Snap ring
11	Ring gear	23	Bush No.1	33	Thrust washer No.4

2) DISASSEMBLY

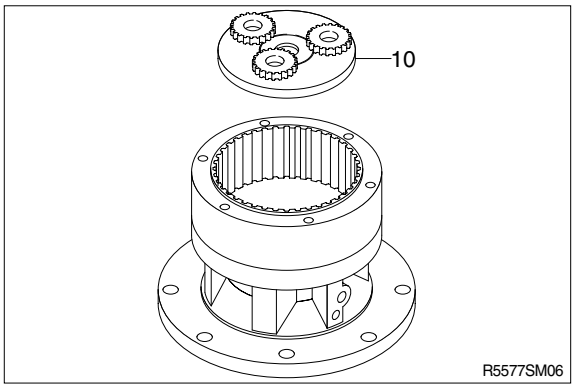
(1) Remove the plug(15) and drain out gear oil.



(2) Remove the No.1 sun gear(9).

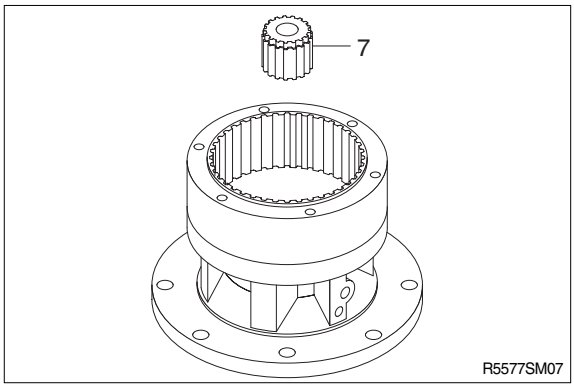


(3) Remove the No.1 carrier sub-assembly (10) using the jig.

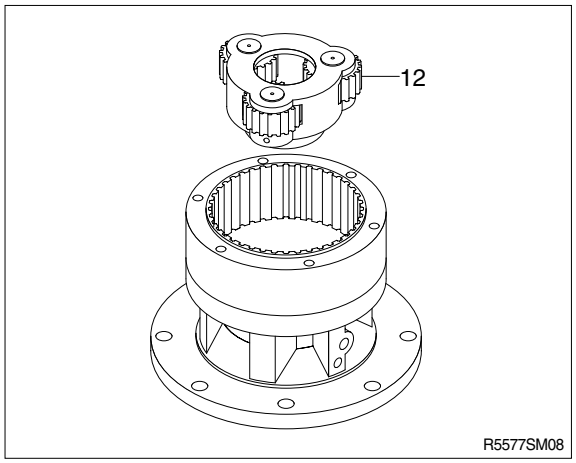


(4) Remove the No.2 sun gear(7).

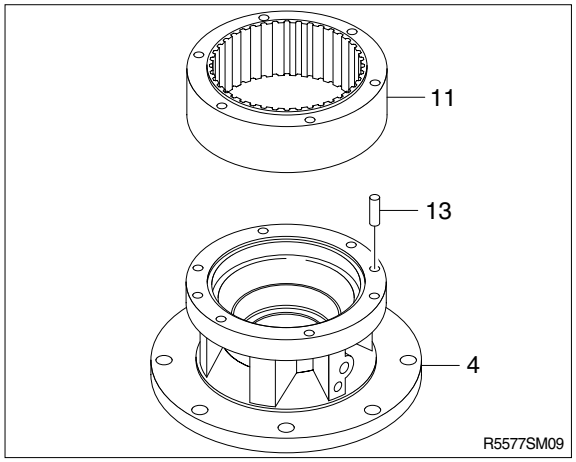
※ Pay attention to ensure the gear is not damaged during disassembling.



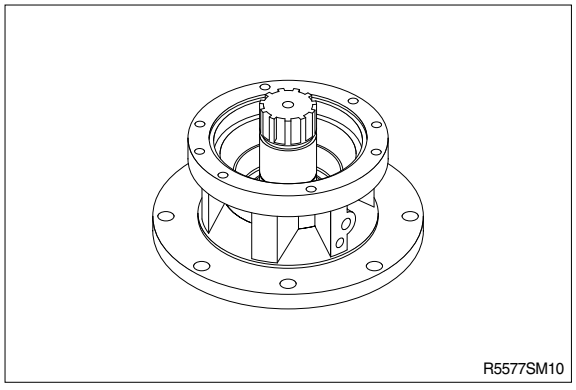
(5) Remove the No.2 carrier sub assembly (12).



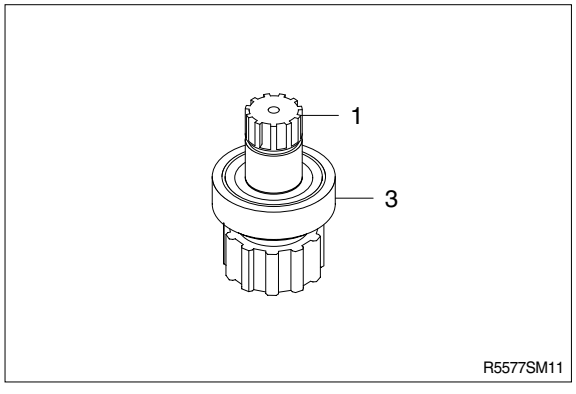
(6) Remove the ring gear by the removal groove between the ring gear(11) and casing(4) by using jig.
Full out the knock pin(13).
Do not need to remove the knock pin(13) if it is not worn or damaged.



(7) Put it on the working table with the drive shaft up.

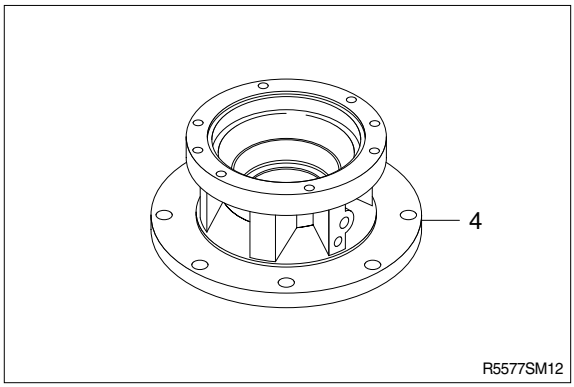


(8) Disassemble the drive shaft(1) with bearing(3) by using jig.



3) ASSEMBLING SWING REDUCTION GEAR

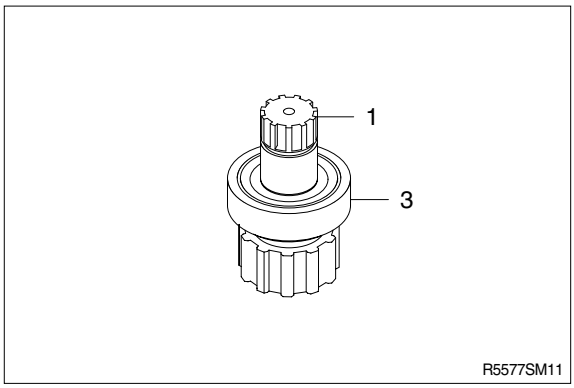
(1) Place the case(4) on the reversing machine having the flange side of the case up.



(2) Install shaft assembly(1) into case(4).

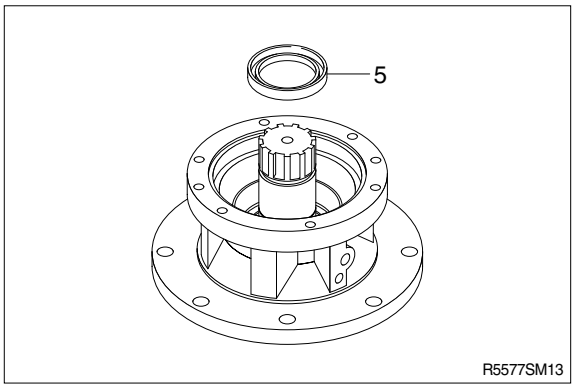
※ Be sure to clean the case before install, using washing machine with the temperature of 80°C.

※ Do not install shaft assembly by force.

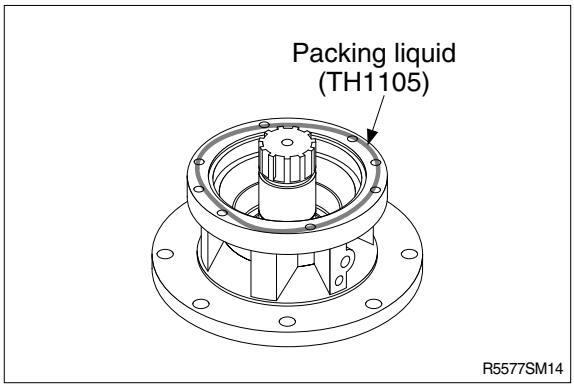


(3) Reverse case and press to insert oil seal(5) by using pressing jig after spreading grease oil around the outside ring of the seal and bearing.
Coat grease oil slightly on the lip surface to prevent any scratch when installing.

※ Be sure to check by eye that the oil seal is seated completely after being installed.



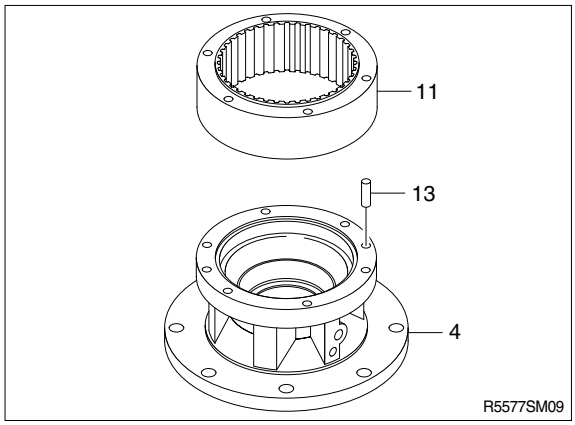
(4) Clean the assembling surface of case and spread packing liquid(TH1105) as shown in figure.



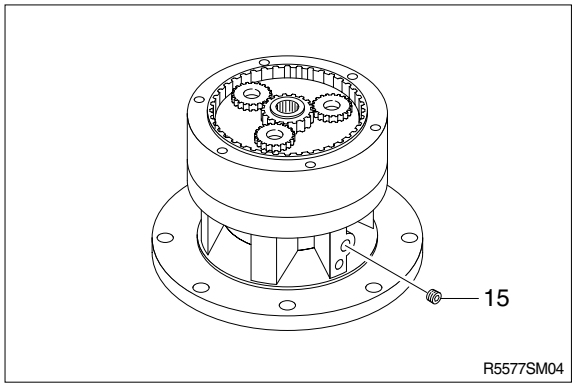
(5) Place ring gear on the case by matching it with knock pin hole.

(6) Insert 2 knock pins by using jig.

※ Be sure to check the hole location of oil gage before inserting.

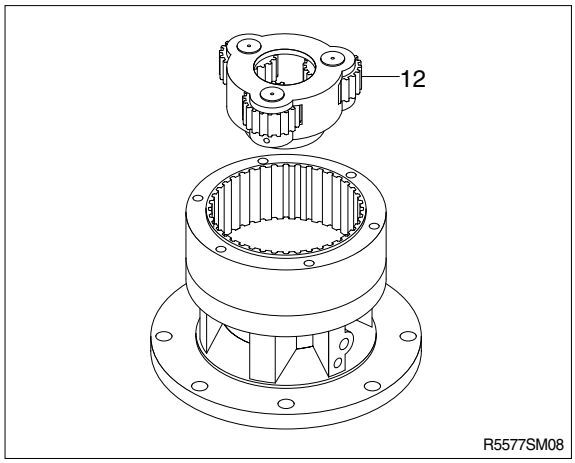


(7) Screw drain plug into drain plug(15) after winding sealing tape.



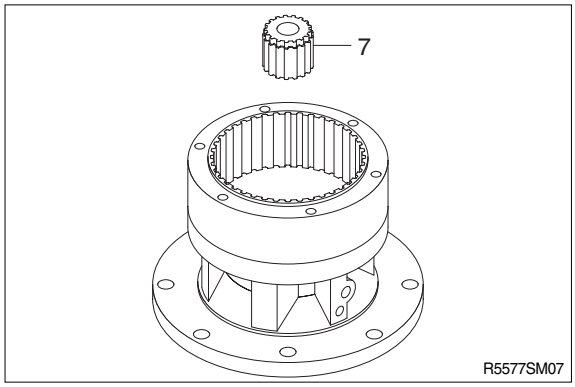
(8) Mount No.2 carrier assembly(12) in the case sub assembly and install bolts into 2 TAP holes(M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



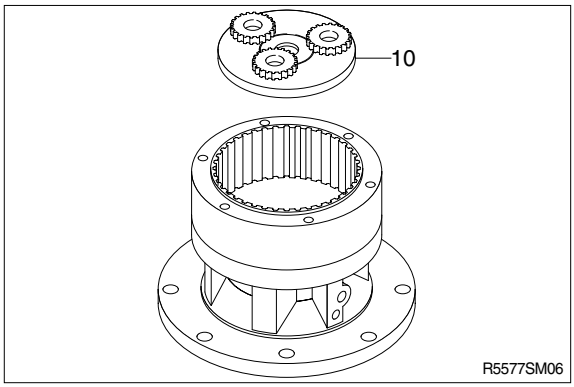
(9) Install No.2 sun gear(7).

※ Be sure to check the direction of sun gear(7) when assembling.

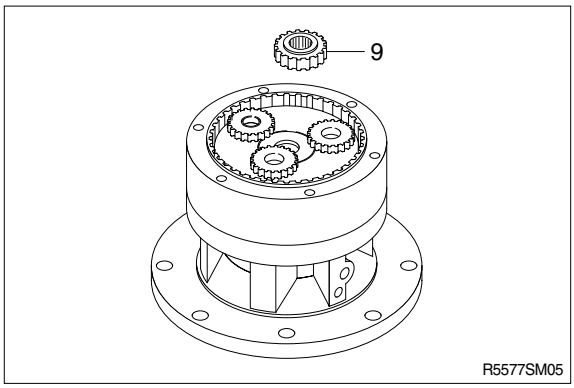


(10) Mount No.1 carrier assembly(10) in the case sub assembly and install bolts into 2 TAP holes(M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



(11) Assemble No.1 sun gear(9).



1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90° and lower it completely to the ground.

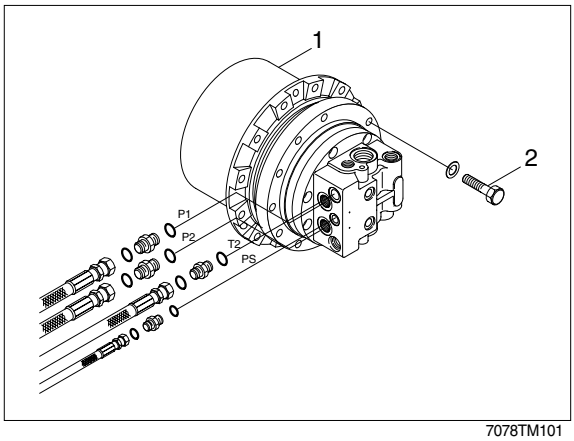
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(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.

(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 : 80kg(180lb)

2) INSTALL

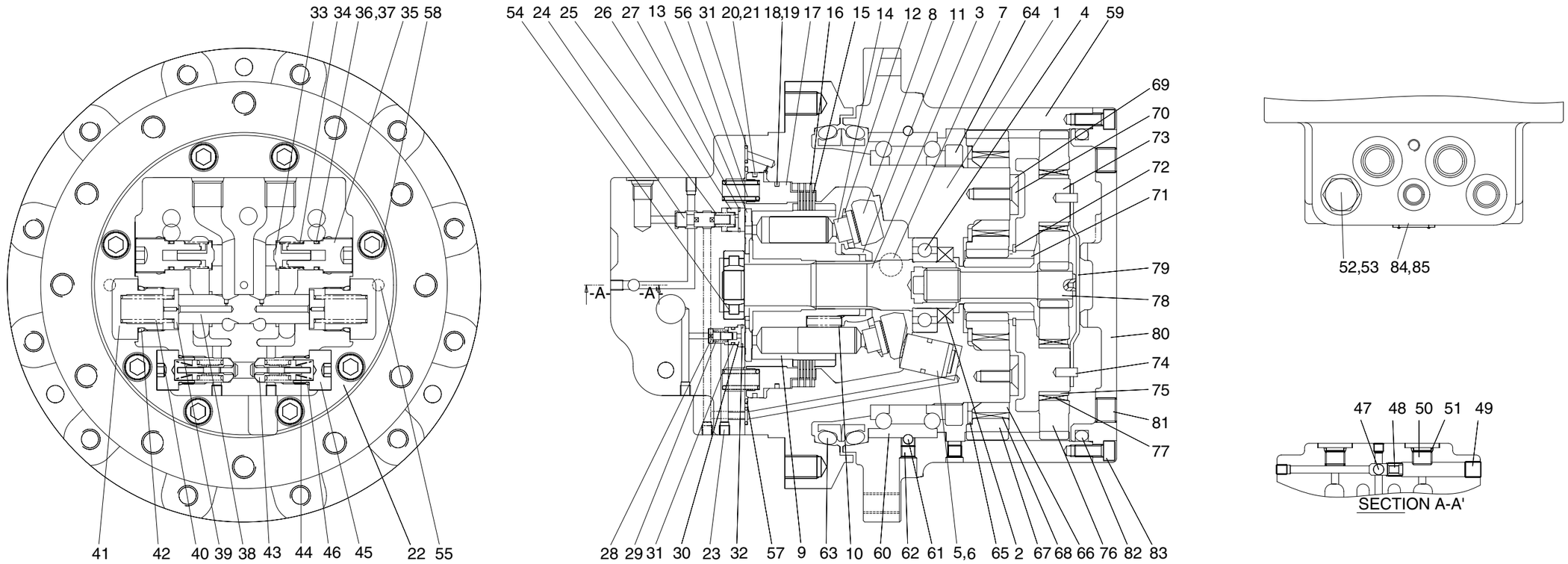
(1) Carry out installation in the reverse order to removal.

(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. TRAVEL MOTOR

2) STRUCTURE



7072TM02

1	Shaft casing	16	Parking plate	31	O-ring	45	Plug	59	Ring gear	73	Carrier
2	Oil seal	17	Parking piston	32	Snap ring	46	O-ring	60	Angular bearing	74	Spring pin
3	Shaft	18	O-ring	33	Check	47	Steel ball	61	Steel ball	75	Collar
4	Bearing	19	Back up ring	34	Spring	48	Check seat	62	Plug	76	Planetary gear(B)
5	Swash piston	20	O-ring	35	Plug	49	Plug	63	Floating seal	77	Needle bearing
6	Piston ring	21	Back up ring	36	O-ring	50	Plug	64	Nut	78	Drive gear
7	Swash steel ball	22	Rear cover	37	Back up ring	51	O-ring	65	Washer	79	Thrust plate
8	Swash plate	23	Plug	38	Main spool	52	Roller bearing	66	Collar	80	Ring gear cover
9	Cylinder block	24	Spool	39	Spring seat	53	O-ring	67	Planetary gear(A)	81	Plug
10	Spring	25	Spring	40	Spring	54	Hex plug	68	Needle bearing	82	O-ring
11	Ball guide	26	Stopper	41	Plug	55	Parallel pin	69	Plate	83	Wrench bolt
12	Set plate	27	Snap ring	42	O-ring	56	Spring	70	Bolt	84	Name plate
13	Valve plate	28	Check	43	Relief valve assembly	57	O-ring	71	Sun gear	85	Rivet
14	Piston assembly	29	Spring	44	Spring	58	Wrench bolt	72	Snap ring	86	Seal kit
15	Friction plate	30	Seat								

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name of tools	Size	Name of applied parts
Hexagonal L-wrench	4	Plug(23)
	6	Plug(49), wrench bolt(70, 83)
	8	Plug(81)
	-	Reliefp valve assembly(46)
	-	Plug(38, 52, 50)
Socket wrench / spanner	27	Plug(41)
Snap-ring plier(for holes, axis)		Snap ring(27, 32, 72)
Solder hammer		Bearing(4), Pin(55, 74), 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	lbf · ft
23	Plug	NPT 1/16	0.7~1.1	5.1~7.9
49	Plug	PT 1/4	5	36.2
81	Plug	PT 3/8	8.5	61.5
58	Wrench bolt	M12×35L	10	72.3
70, 83	Wrench bolt	M8×20L	10	72.3

3. 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.

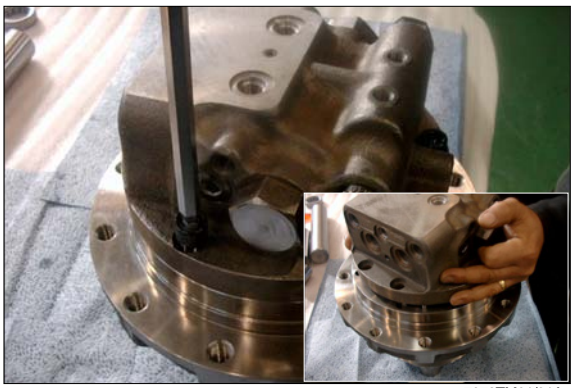
(5) The side of a pipe in a motor can be written as a rear side ; the side of out-put as a front side.

(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

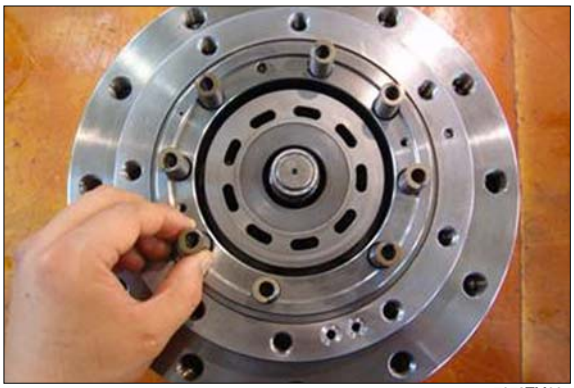
(1) Motor unit

① Put the motor assembly on the assemble table.
Using L-Wrench, disassemble wrench bolt(58)-8EA and so respectively disassemble shaft casing assembly and rear cover assembly.



7078TM01/01A

② Disassemble spring(56)-8EA From shaft casing(1).



7078TM02

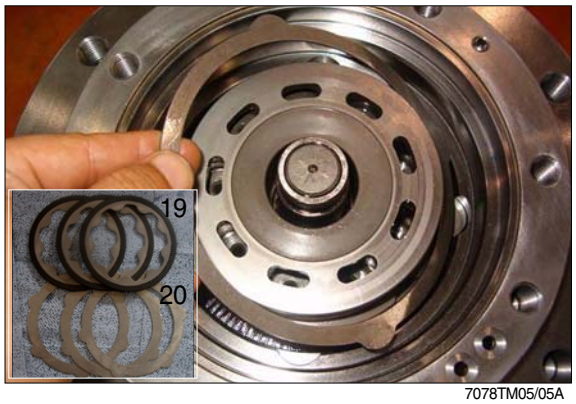
③ Using jig, disassemble parking piston(17) from shaft casing(1).

7078TM03

④ Disassemble O-ring(18, 20) and back up ring(19, 21) from parking piston(17)

7078TM04/04A

⑤ Respectively in order friction plate (15), parking plate(16) disassemble from shaft casing(1).



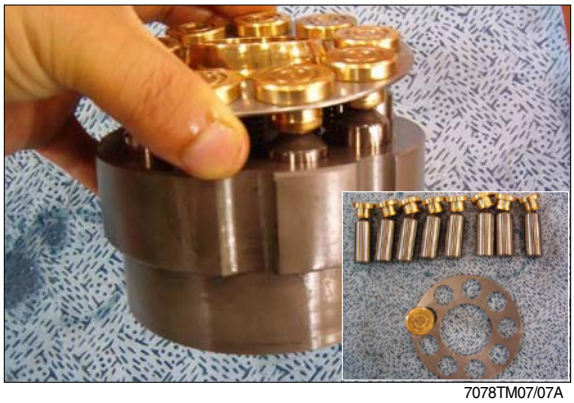
7078TM05/05A

⑥ Disassemble cylinder block assembly(9) from shaft casing(1).

7078TM06

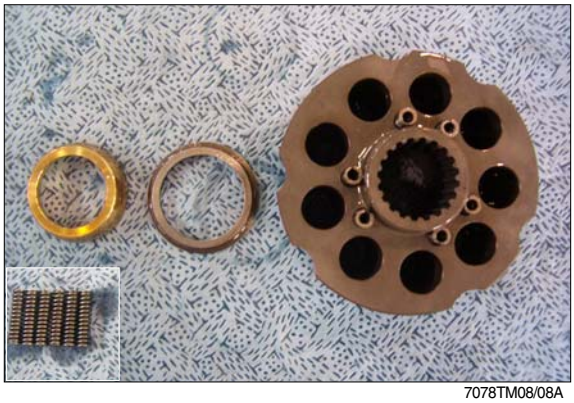
(2) Cylinder block

① Disassemble set plate(12), piston assembly(14) from cylinder block assembly.



7078TM07/07A

② Disassembling in order cylinder block(9), ball guide(11) and spring(10).

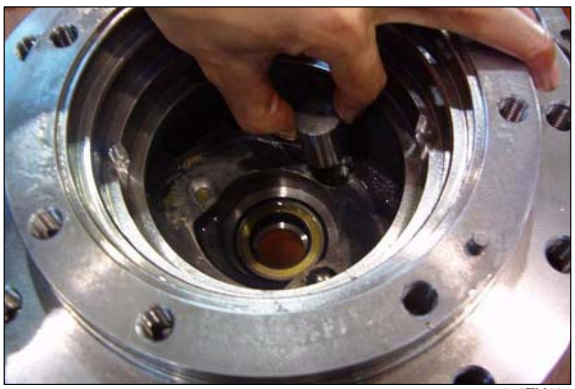


7078TM08/08A

③ Disassembling swash plate(8) and shaft(3) from shaft casing(1).

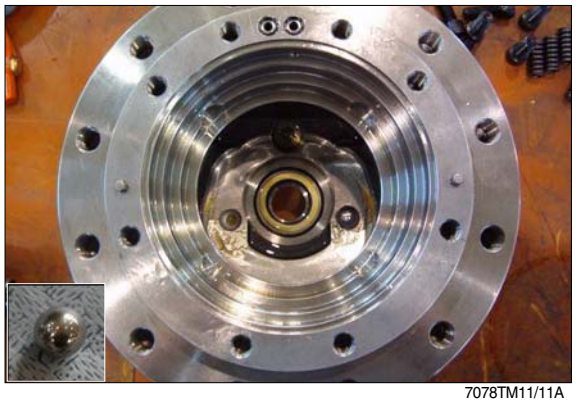
7078TM09/09A

④ Disassembling swash piston(5) from shaft casing(1).



7078TM10

⑤ Disassembling steel ball(7) from shaft casing(1).



7078TM11/11A

(3) Rear cover

① Disassembling valve plate(13) from rear cover(22).

7078TM12

② Using plier jig, disassembling in order snap ring(27), stopper(26), spring(25), spool(24) from rear cover(22) and then disassembling snap ring(32), seat(30), spring(29), check(28) same procedure.

7078TM13

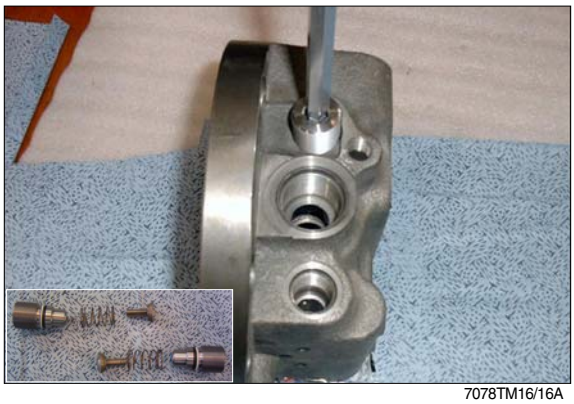
③ Using L-wrench, disassembling plug(45) from rear cover(22) and then relief valve assembly(43) (left, right is symmetry).

7078TM14/14A

④ Using torque wrench, disassembling plug (41) in order O-ring(42), spring(40), spring seat(39), main spool(38) from rear cover(22).

7078TM15/15A

⑤ Using L-wrench, disassembling plug(35) in order O-ring(36), back up ring(37), spring(34) and check(32) from rear cover(22).



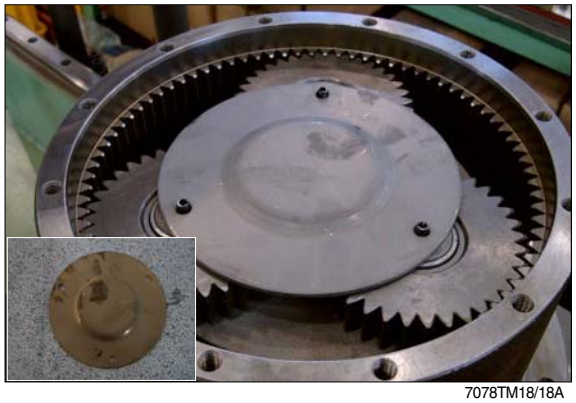
7078TM16/16A

(4) Reduction gear

① Using L-wrench, disassembling wrench bolt(83) and then ring gear cover(80), O-ring(82) from ring gear(59).

7078TM17/17A

② Disassembling thrust plate(79) from ring gear(59).

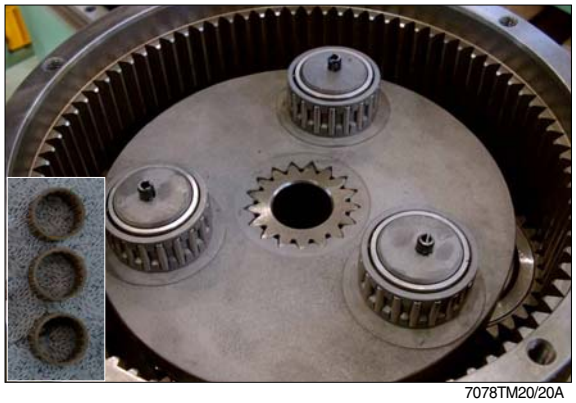


7078TM18/18A

③ Disassembling in order planetary gear(76), drive gear(78) from ring gear(59).

7078TM19/19A

④ Disassembling needle bearing(77) from ring gear(59).

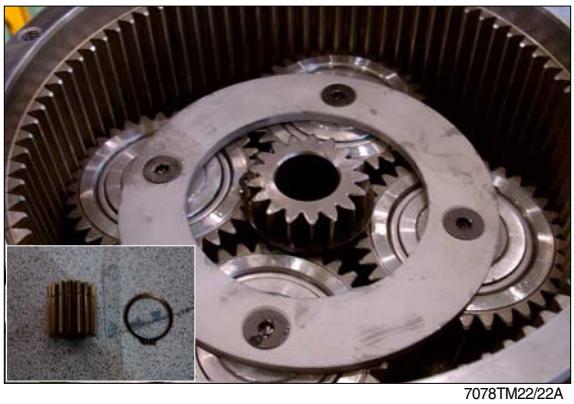


7078TM20/20A

⑤ Disassembling in order collor(75), carrier(73) from ring gear(59).

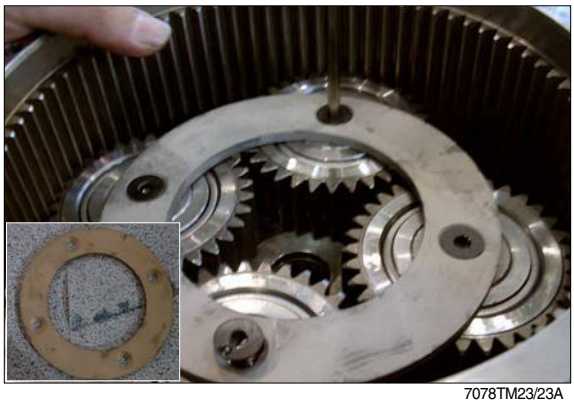
7078TM21/21A

⑥ Disassembling sun gear(71) from ring gear(59) and then disassembling snap ring(72) with plier jig.



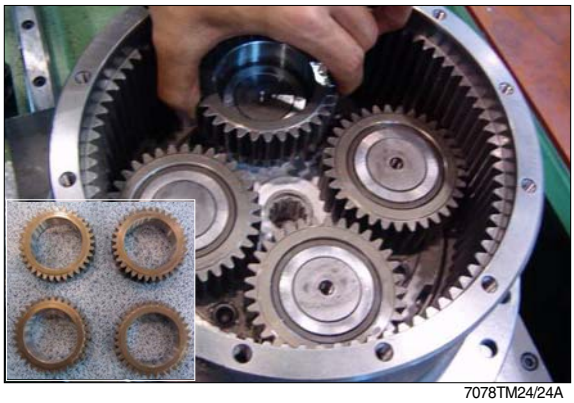
7078TM22/22A

⑦ Using L-wrench, disassembling plate head bolt(70)-4EA from ring gear(59) and then disassembling plate(69).



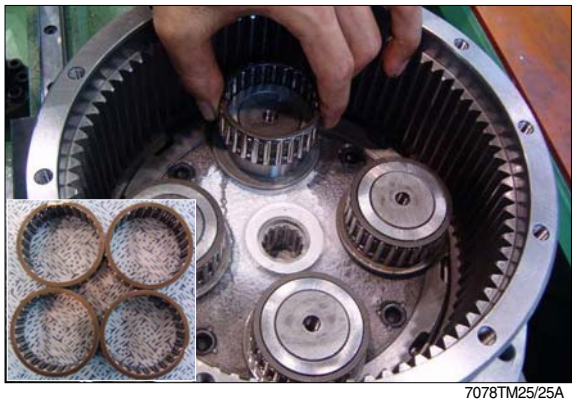
7078TM23/23A

⑧ Disassembling planetary gear(67)-4EA from ring gear(59).



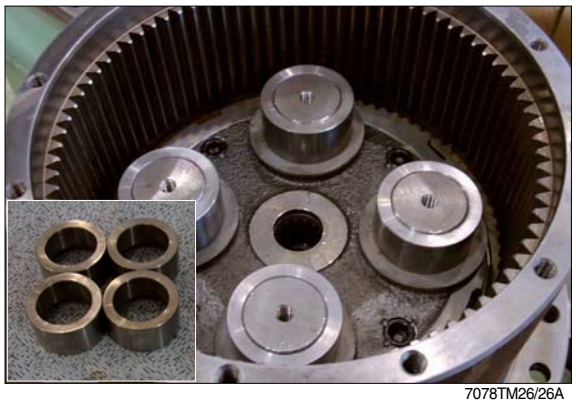
7078TM24/24A

⑨ Disassembling needle bearing(68)-4EA from ring gear(59).



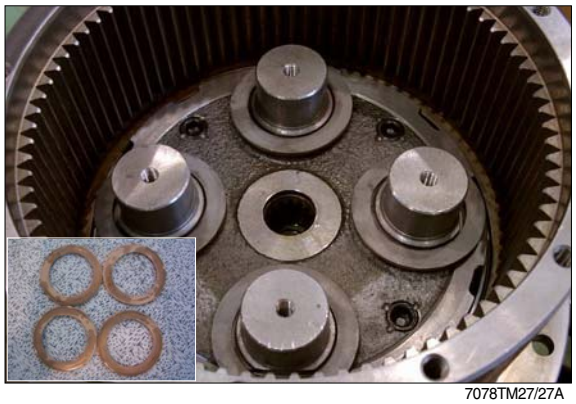
7078TM25/25A

⑩ Disassembling collar(66)-4EA from ring gear(59).



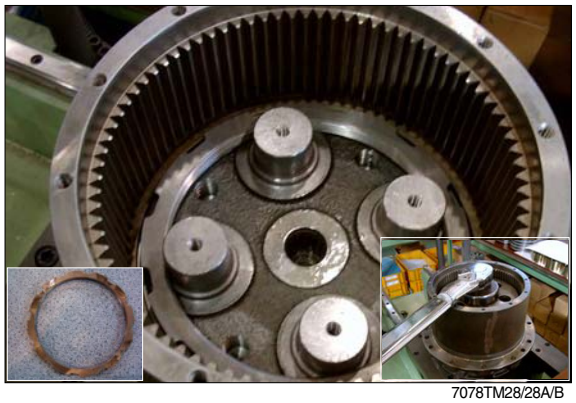
7078TM26/26A

⑪ Disassembling washer(65)-4EA from ring gear(59).



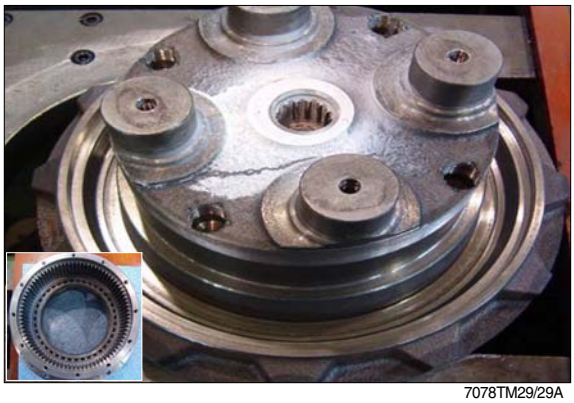
7078TM27/27A

⑫ Using jig, disassembling nut(64) when inner pressed state with L-wrench bolt from ring gear(59).



7078TM28/28A/B

⑬ Put the reduction gear on the assembling jig and then disassembling ring gear(59).



7078TM29/29A

4. 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(61) to the shaft casing(1) and then assemble plug(62).

7078TM51

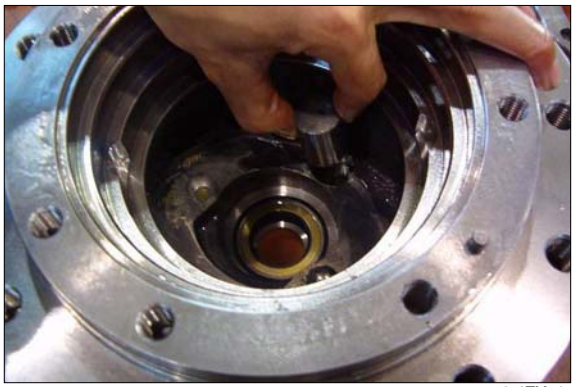
② Using a jig, assemble oil seal(2) to the shaft casing(1) and then inserting with solid hammer.

7078TM52

③ Assemble swash steel ball(7) 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).

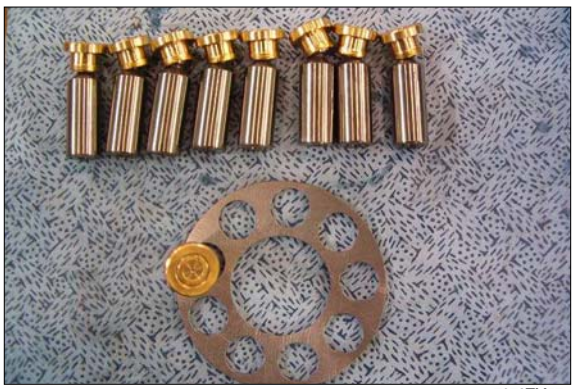
7078TM55

⑥ Assemble bearing and heat pressed shaft(3) to the shaft casing(1).

7078TM56

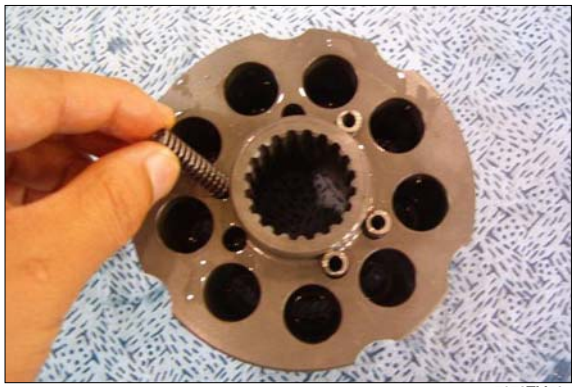
(2) Cylinder block sub assembly

① Assemble piston assembly(14) to the set plate(12, 9 set).



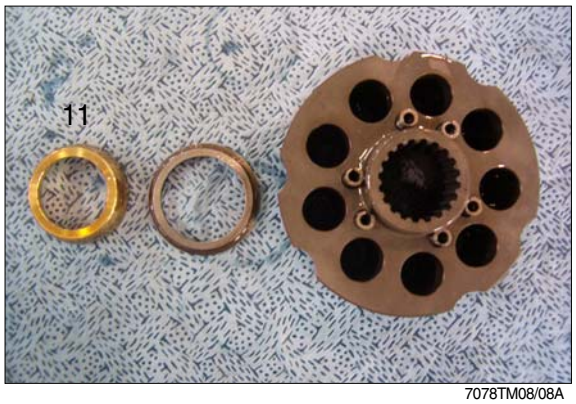
7078TM57

② Assemble spring(10) to the cylinder block(9, 6 set).



7078TM58

③ Assemble ball guide(11) to the cylinder block(9).



7078TM08/08A

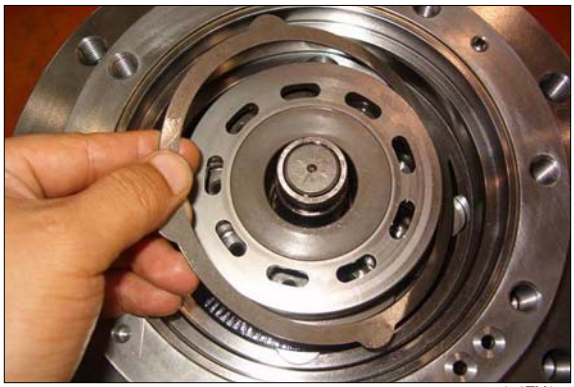
④ Assemble sub-assembled piston(12,14) to the cylinder block(9).

7078TM60

⑤ Assemble cylinder block(10) to the shaft casing(1).

7078TM06

⑥ Assembling friction plate(15), parking plate(16)(respectively 3EA assembling) to the shaft assing(1).



7078TM05

⑦ Assembling back up ring(19), O-ring(18, 20), back up ring(21) to the parking piston(17).

7078TM04/04A

⑧ Using a jig, insert the parking piston to the shaft casing(1) and assemble.

7078TM64/64A

⑨ Assemble spring(56) to the shaft casing(1) and then assemble O-ring(57).

7078TM02

(3) Rear cover assembly

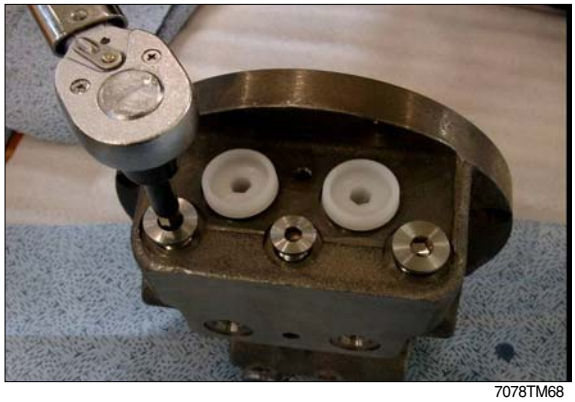
① Using a L-Wrench, assemble plug(23) 10EA to the rear cover(22).

7078TM66

② Assemble in order steel ball(47), check-seat(48) and plug(49) to the rear cover (22).

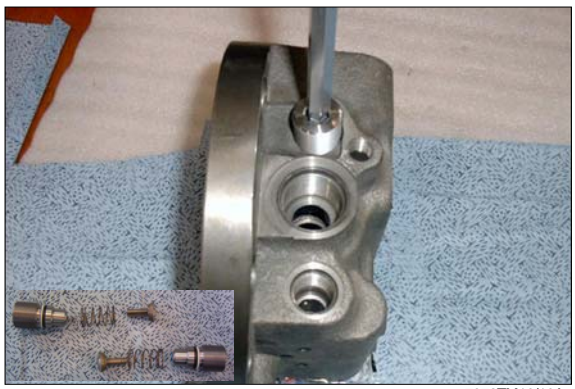
7078TM67

③ Assemble plug(50, 52), O-ring(51, 53) to the rear cover(22).



7078TM68

④ Assemble check(33), spring(34) to rear cover(22) and assemble back up ring(37), O-ring(36) to the plug(35) after then using L-Wrench.



7078TM16/16A

⑤ Insert main spool(38), spring-seat(39), spring(40) to the rear cover(22) and assemble plug(41) with L-wrench.

7078TM15/15A

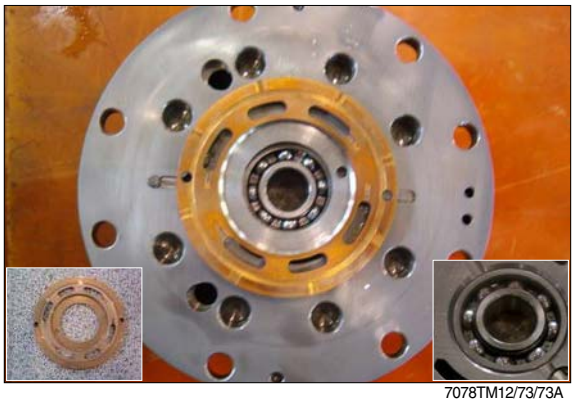
⑥ Assemble relief valve assembly(43)(with left-ringt symmetry) to the rear cover(22) and then insert spring(44) and assemble plug(45) with torque-wrench.

7078TM71/14A

⑦ Using a plier jig, assemble snap ring(27), stopper(26), spring(25), spool(24) to the rear cover.
Same method assemble snap ring(32), seat(30), spring(29) and check(28).

7078TM13

⑧ Assemble roller bearing(54), pin(55) and valve plate(56) to the rear cover(22).



7078TM12/73/73A

⑨ Combine rear cover assembly and shaft casing assembly with bolt(58).

7078TM74

(4) Travel reduction gear

① Before assembling nut(64) to the motor. Eliminate burr and alien substances ready for assembling.

7078TM77/28A

② Insert ring gear(59) to the spray washing M/C and heat 69℃~70℃ one minute.

7078TM78

③ Assembling angular bearing(60) to the ring gear(59).

7078TM79/79A

④ Insert steel ball(61) 105EA to the ring gear(59) with a jig after assembling plug(62) 2EA with L-Wrench.

7078TM80/80A

⑤ Assemble floating seal(63) to ring gear(59) and motor part with a jig.

7078TM81/81A/82

⑥ Upset the ring gear(59) and assemble with motor.

7078TM83

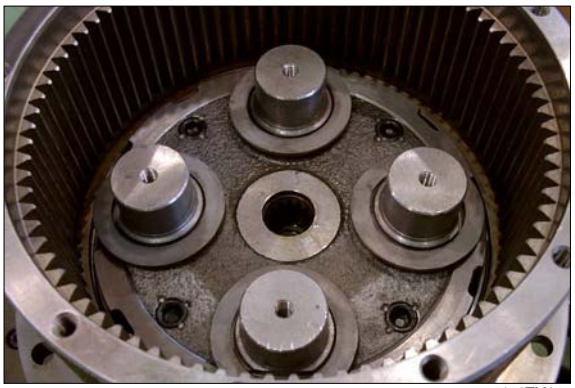
⑦ Combine nut(64) to the ring gear(59) and pressing use a jig and then assembling with torque-wrench.

7078TM28/28B/28C

⑧ Using a L-wrench, assembling plug-4EA to the ring gear(59) and then cocking by a jig.

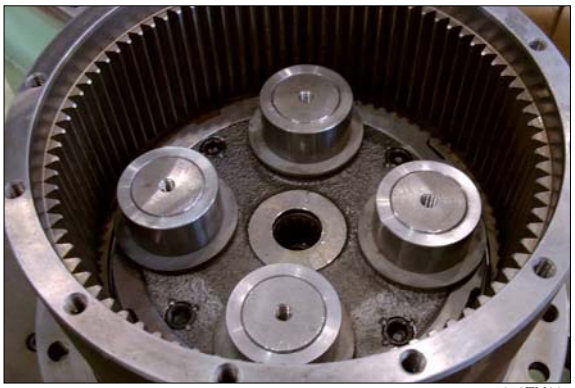
7078TM84/84A/85

⑨ Assemble washer(65)-4EA the ring gear(59).



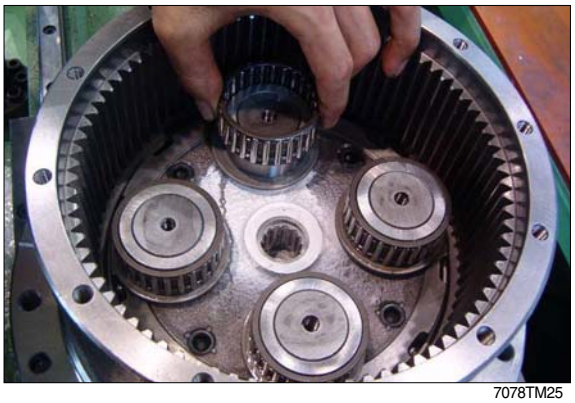
7078TM27

⑩ Assemble collar(66)-4EA to the ring gear(59).



7078TM26

⑪ Assemble needle bearing(68)-4EA to the ring gear(59).

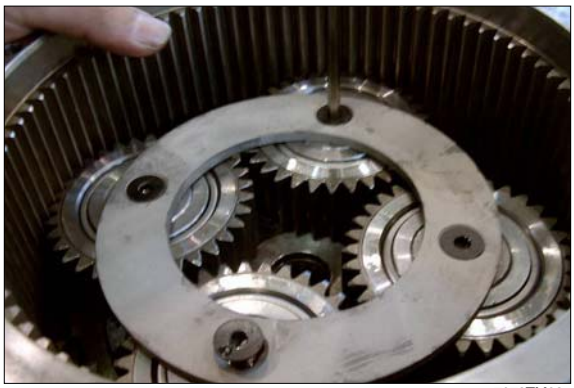


7078TM25

⑫ Assemble planetary gear(67)-4EA to the ring gear(59).

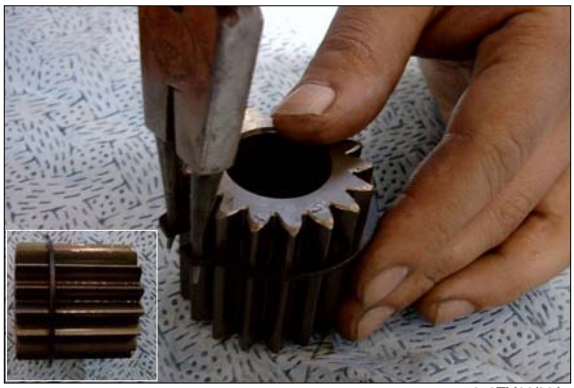
7078TM24

⑬ Assemble plate(69)-1EA to the ring gear(59) and then combine plate head bolt(70)-4EA with L-wrench.
(after paste loctite and then combine the plate head bolt).



7078TM23

⑭ Assembling snap ring(72) to the sun gear(71) with a plier jig.



7078TM86/86A

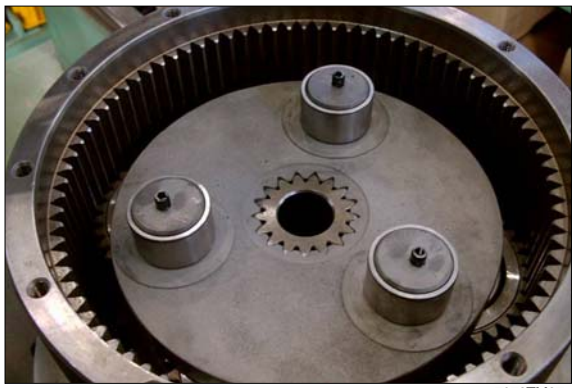
⑮ Assemble sun gear with snap ring assembly to the ring gear(59).

7078TM22

□ Assemble in order collor(75), spring pin(74) to the carrier(73).

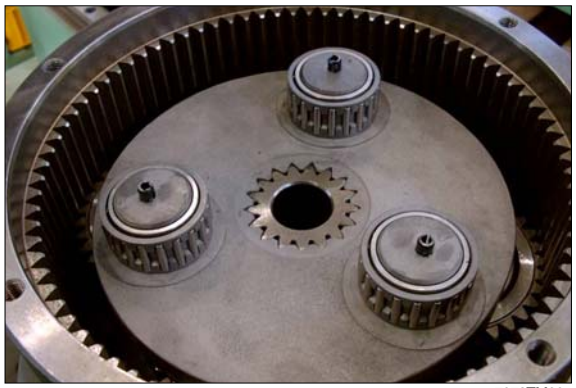
7078TM21

□ Assemble carrier sub assembly to the ring gear(59).



7078TM87

□ Assemble needle bearing(77)-3EA to the ring gear(59).



7078TM20

□ Assemble in order planetary gear(76), drive gear(78) to the ring gear(59).

7078TM19

□ Assemble thrust plate(79) to the ring gear(59).

7078TM18

Assemble in order ring gear cover(80) with O-ring(82) and then assemble wrench bolt(83) with torque-wrench.

7078TM17/17A

Roll the tapron tape to the ring gear(59) 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 5kgf/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

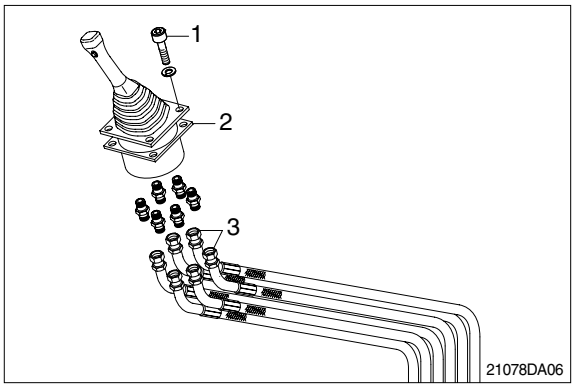
1) REMOVAL

(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.



(4) Loosen the socket bolt(2).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses(3).

(7) Remove the pilot valve assembly(1).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.

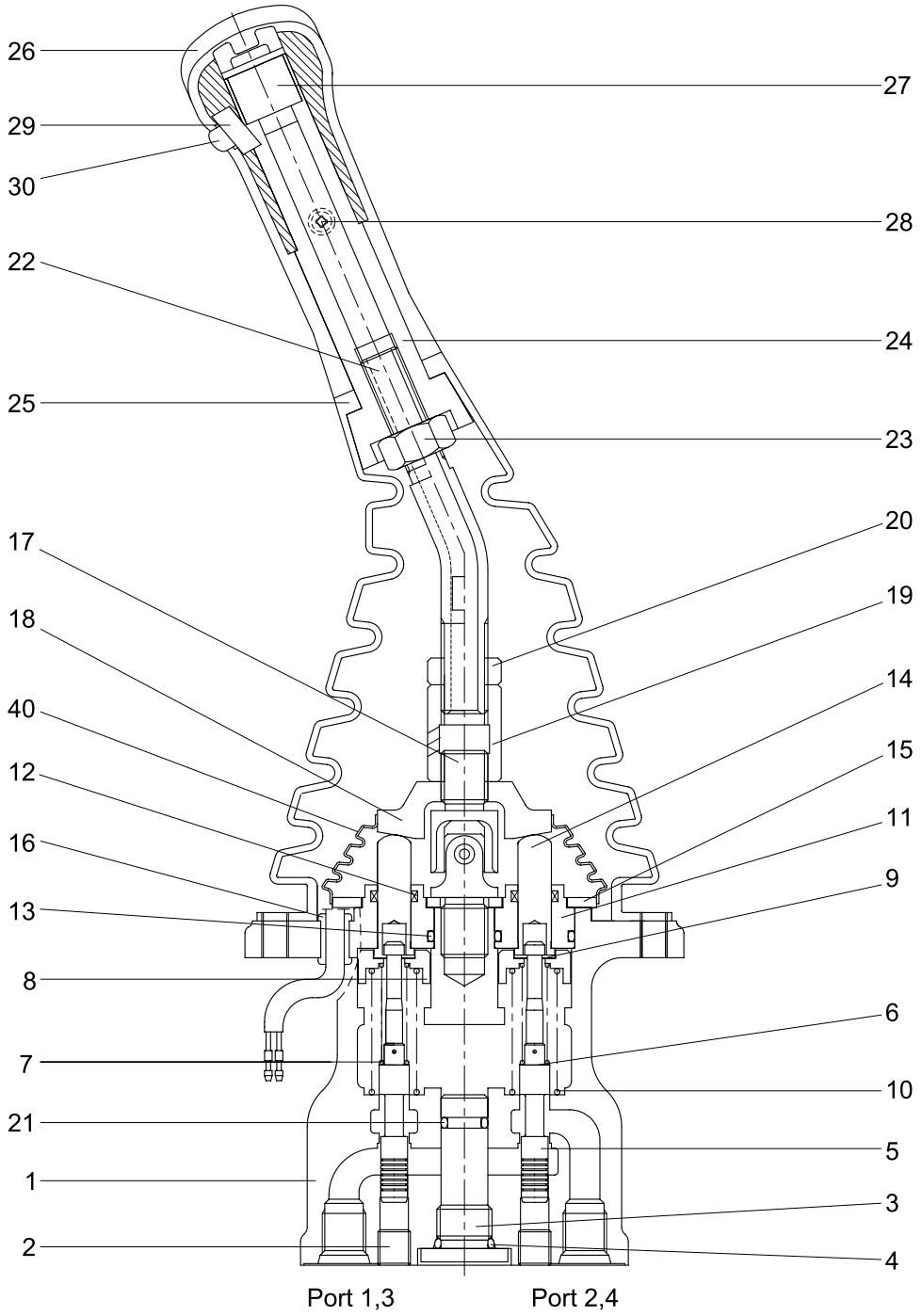
2) INSTALL

(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

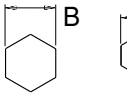


14072SF80

1	Case	12	Rod seal	22	Handle connector
2	Plug	13	O-ring	23	Nut
3	Plug	14	Push rod	24	Insert
4	O-ring	15	Plate	25	Boot
5	Spool	16	Bushing	26	Handle
6	Shim	17	Joint assembly	27	Switch assembly
7	Spring	18	Swash plate	28	Screw
8	Spring seat	19	Adjusting nut	29	Switch assembly
9	Stopper	20	Lock nut	30	Switch cover
10	Spring	21	O-ring	40	Boot
11	Plug				

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
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

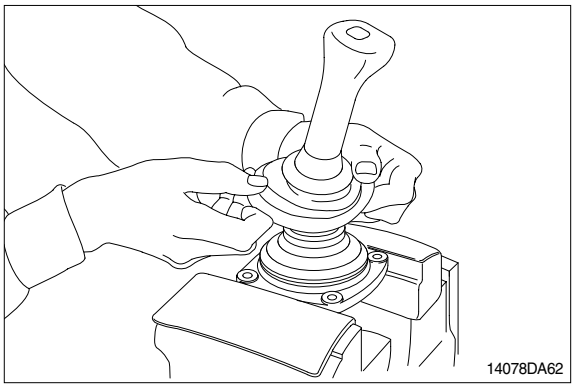
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

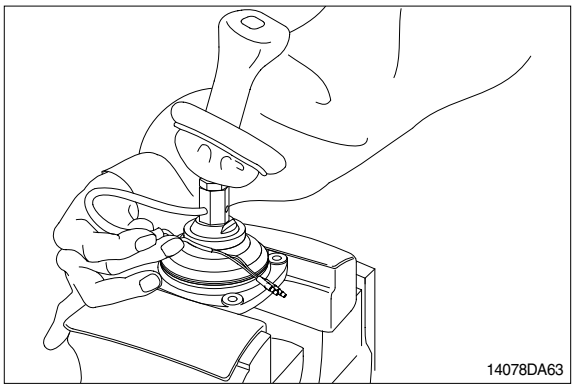
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper(or lead) sheets.

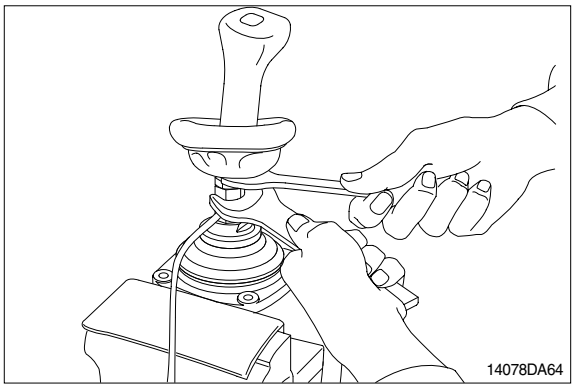
(3) Remove end of boot(26) from case(1) and take it out upwards.



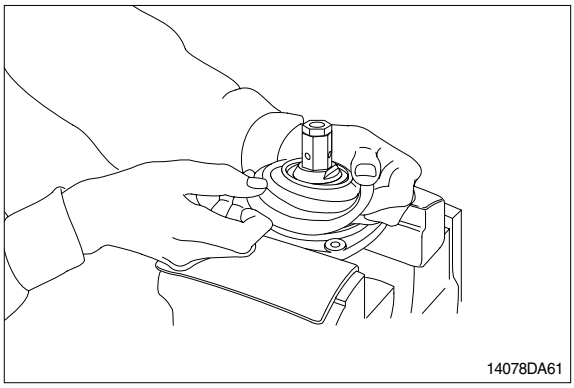
※ For valve with switch, remove cord also through hole of casing.



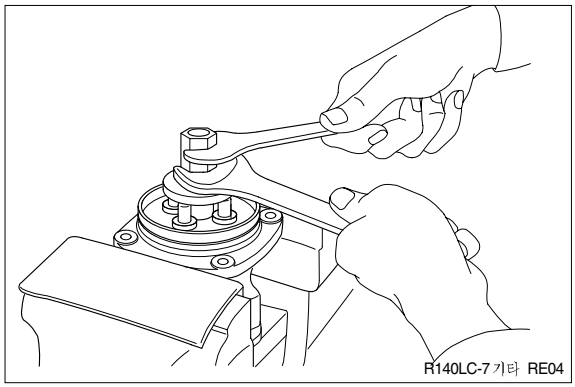
(4) Loosen lock nut(21) and adjusting nut(20) with spanners on them respectively, and take out handle section as one body.

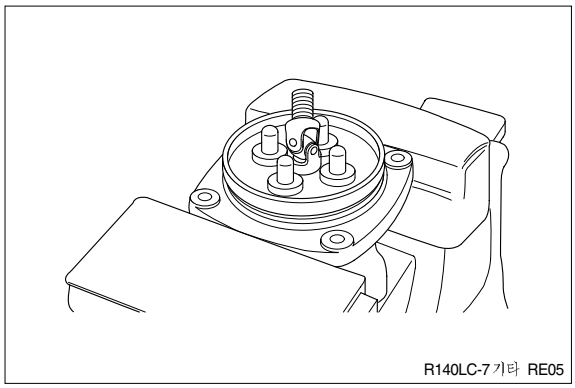


(5) Remove the boot(40)



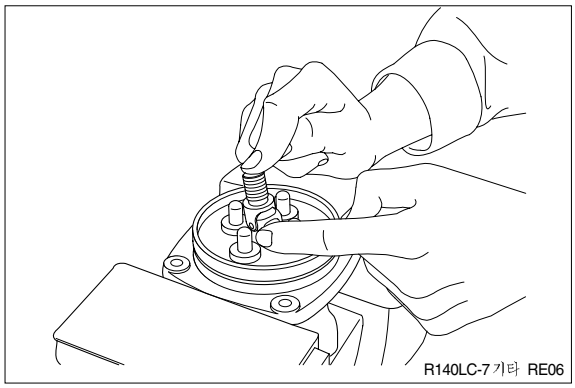
(6) Loosen adjusting nut(20) and plate(19) with spanners on them respectively, and remove them.

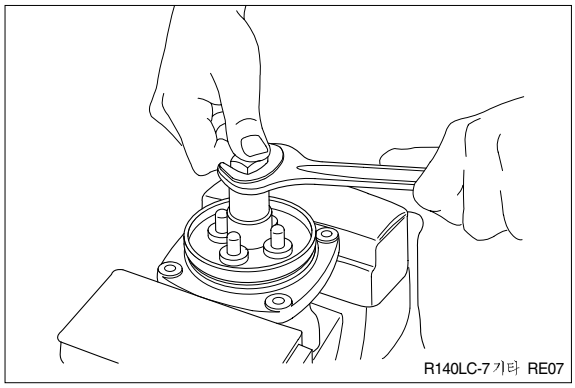




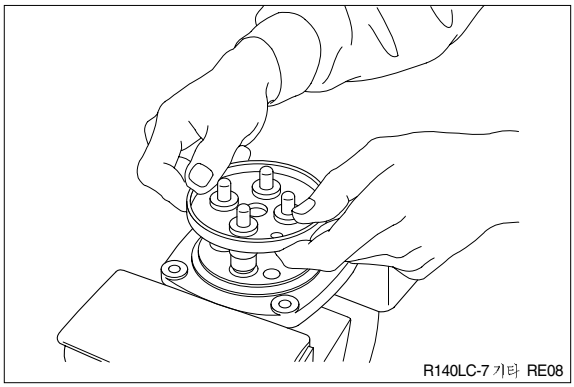
(7) Turn joint anticlockwise to loosen it, utilizing jig(Special tool).

※ When return spring(10) is strong in force, plate(16), plug(11) and push rod(14, 15) will come up on loosening joint.
Pay attention to this.





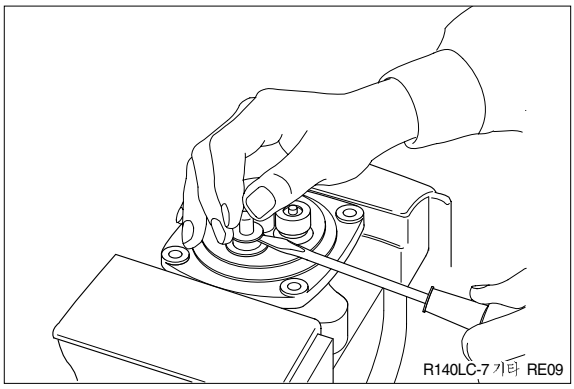
(8) Remove plate(16).



(9) When return spring(10) is weak in force, plug(11) stays in casing because of sliding resistance of O-ring.

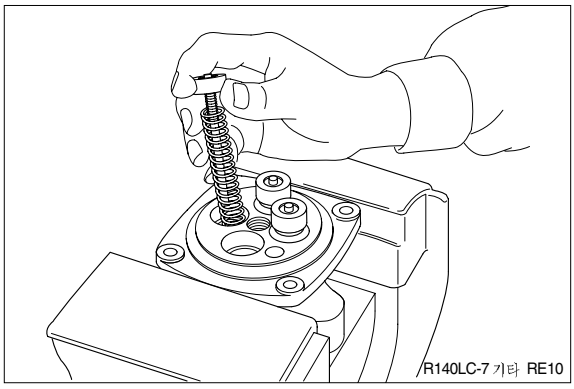
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring(10) force.
Pay attention to this.

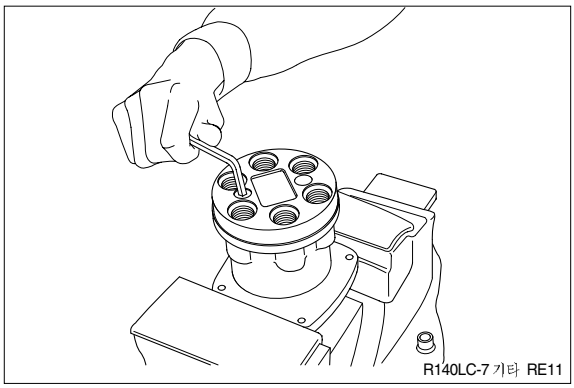


(10) Remove reducing valve subassembly and return spring(10) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



(11) Loosen hexagon socket head plug(2) with hexagon socket screw key.

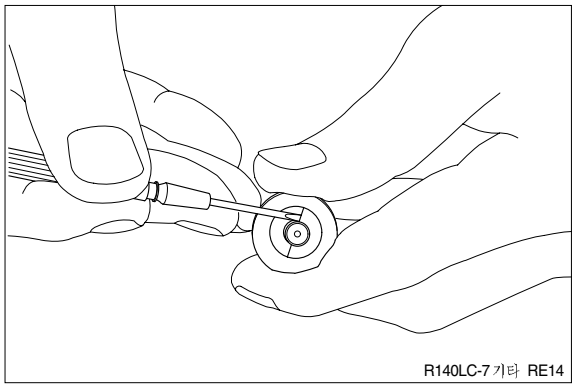


(12) For disassembling reducing valve section, stand it vertically with spool(5) bottom placed on flat workbench. Push down spring seat(8, 31) and remove two pieces of semicircular stopper(9) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

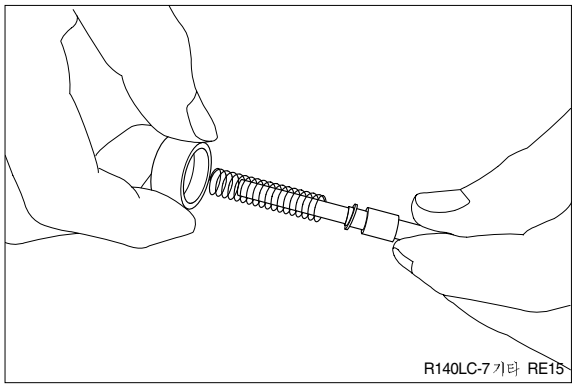
※ Record original position of spring seat(8, 31).

※ Do not push down spring seat more than 6㎜.

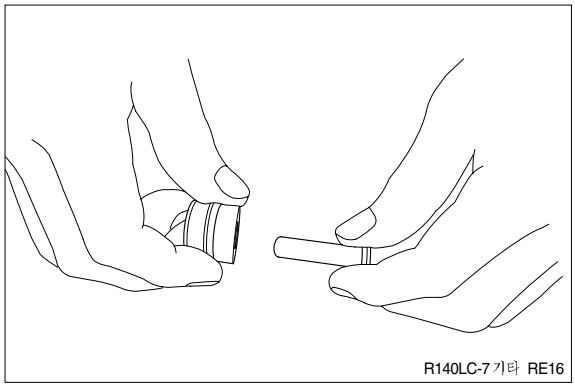

R140LC-7 기타 RE14

(13) Separate spool(5), spring seat(8, 31), spring(7, 30) and shim(6) individually.

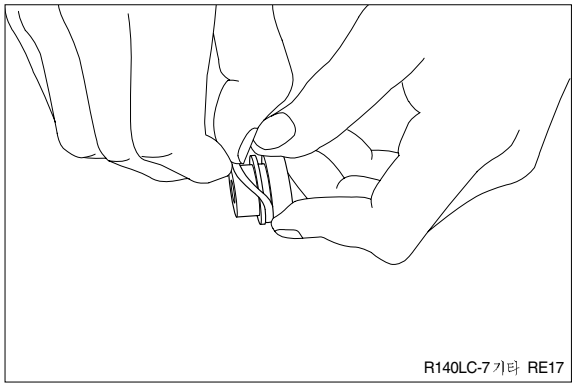
※ Until being assembled, they should be handled as one subassembly group.

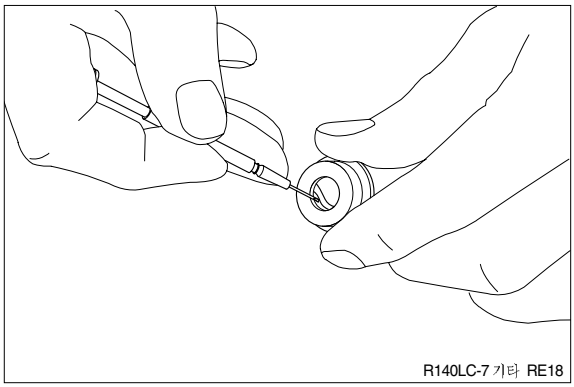

R140LC-7 기타 RE15

(14) Take push rod(14, 15) out of plug(11).

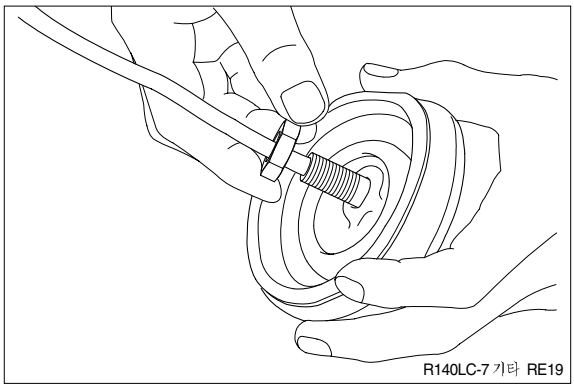

R140LC-7 기타 RE16

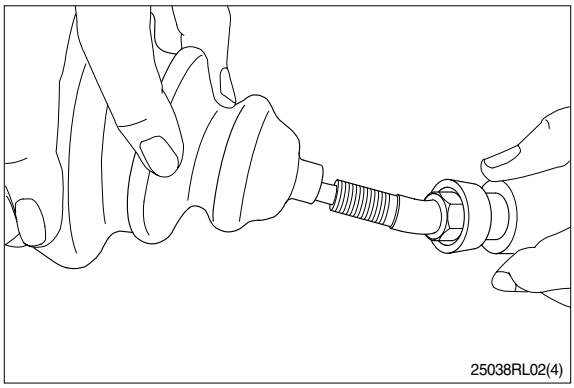
(15) Remove O-ring(13) and seal(12) from plug(11).
Use small minus screwdriver or so on to remove this seal.


R140LC-7 기타 RE17



(16) Remove lock nut(21) and then boot(26).





(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

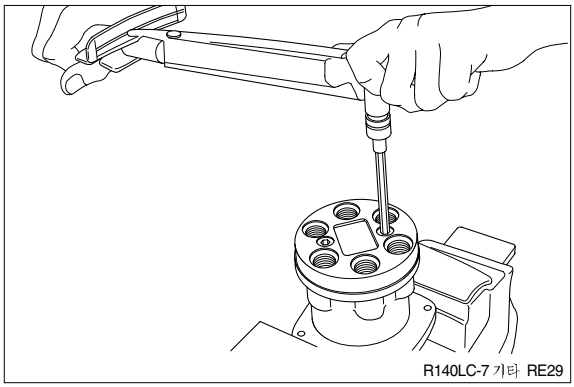
Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

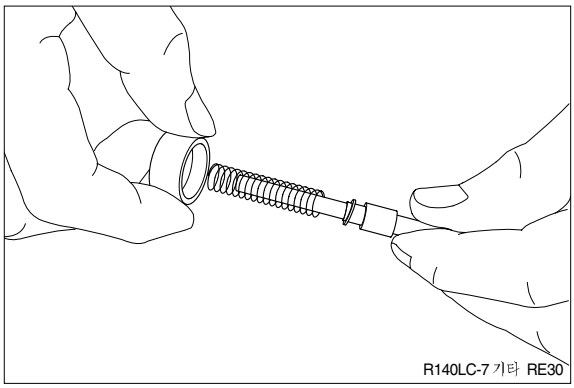
4) ASSEMBLY

(1) Tighten hexagon socket head plug(2) to the specified torque.

※ Tighten two bolts alternately and slowly.

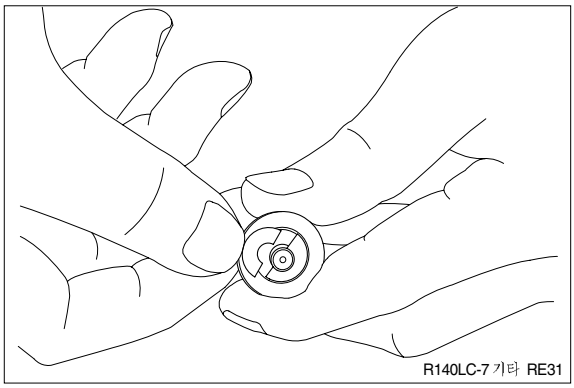


(2) Put shim(6), springs(7, 30) and spring seat(8, 31) onto spool(5) in this order.



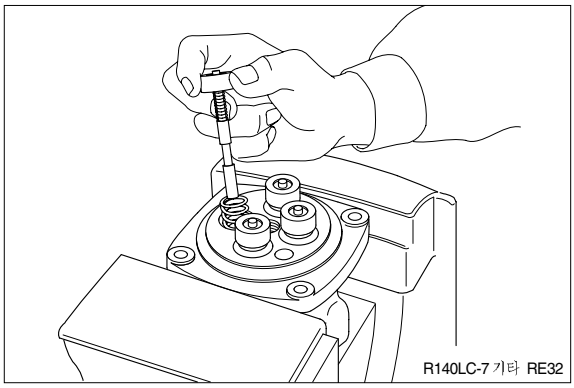
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper(9) on spring seat without piling them on.

※ Assemble stopper(9) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.

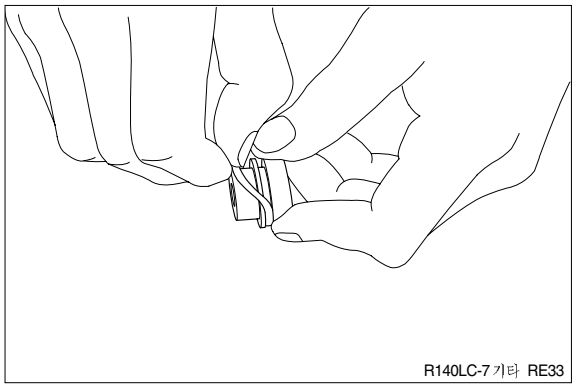


(4) Assemble spring(10) into casing.
Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

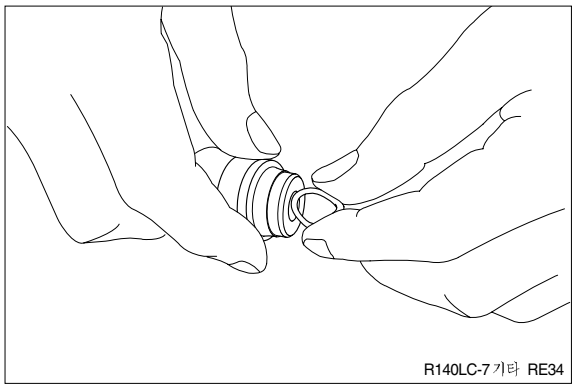


(5) Assemble O-ring(13) onto plug(11).



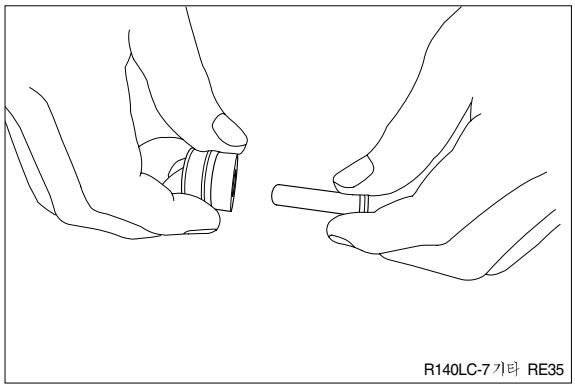
(6) Assemble seal(12) to plug(11).

※ Assemble seal in such lip direction as shown below.



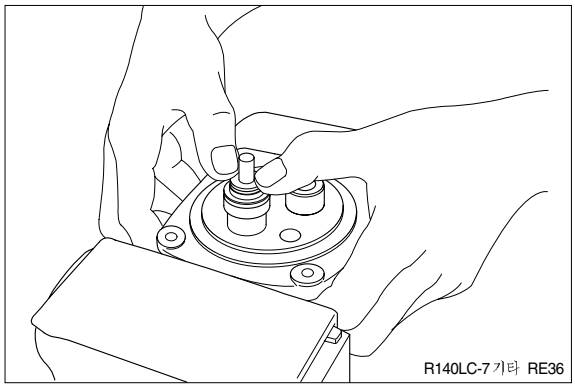
(7) Assemble push rod(14, 15) to plug(11).

※ Apply working oil on push-rod surface.

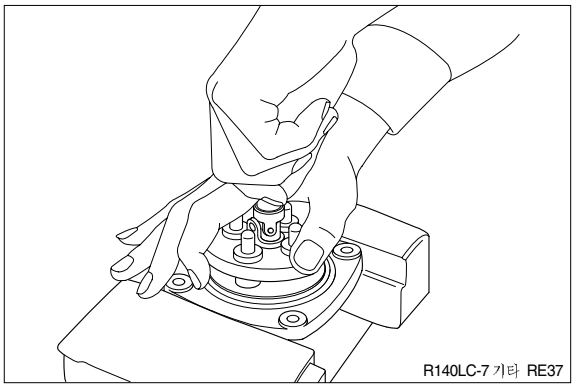


(8) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

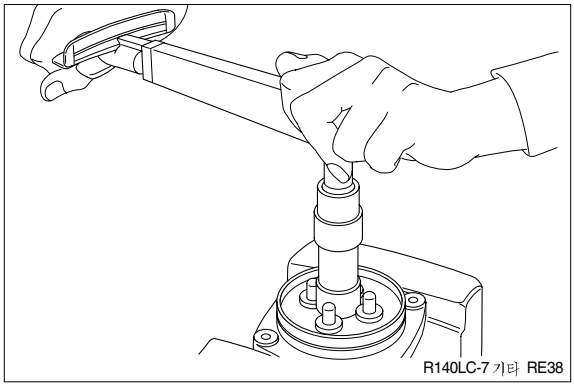


(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate(16), and tighten joint(18) temporarily.



(10) Fit plate(16).

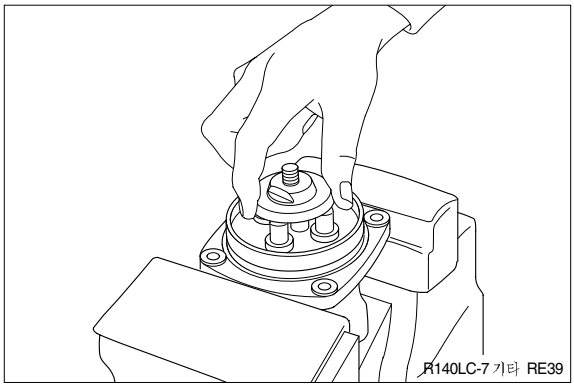
(11) Tighten joint(18) with the specified torque to casing, utilizing jig.



(12) Assemble plate(19) to joint(18).

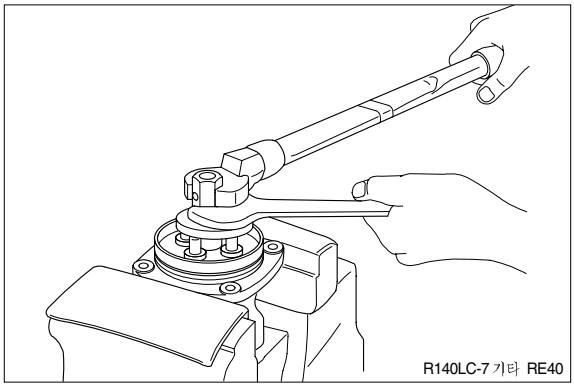
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

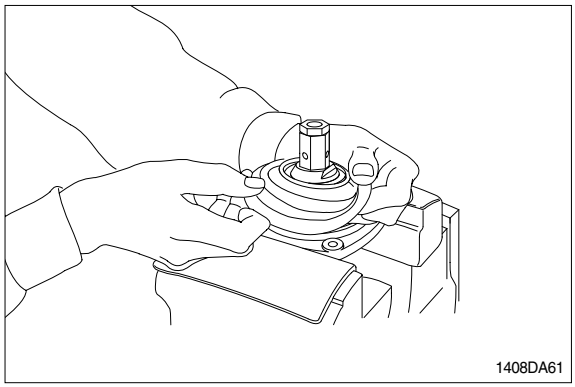


(13) Assemble adjusting nut(20), apply spanner to width across flat of plate(19) to fix it, and tighten adjusting nut to the specified torque.

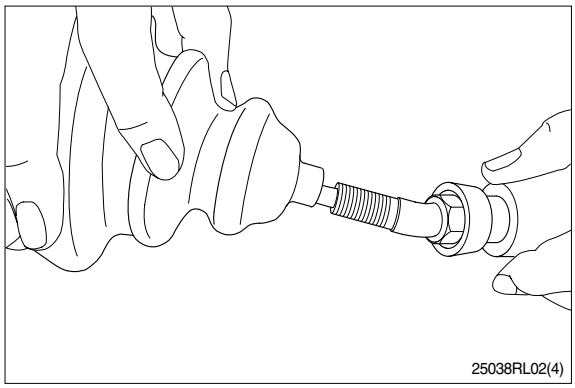
※ During tightening, do not change position of disk.

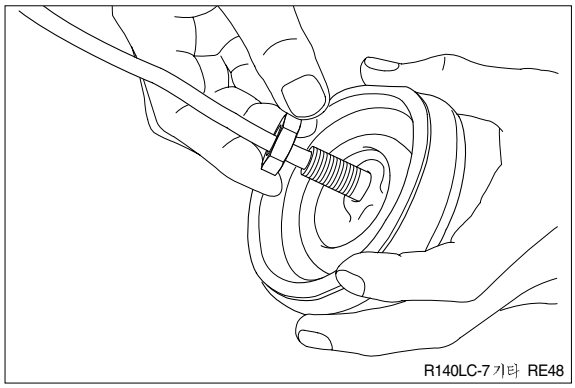


(14) Fit boot(40) to plate.

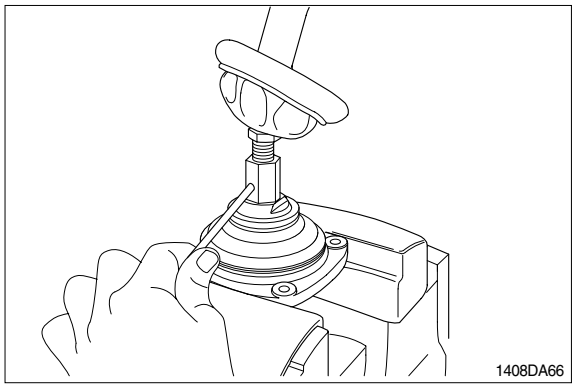


(15) Fit boot(26) and lock nut(21), and handle subassembly is assembled completely.



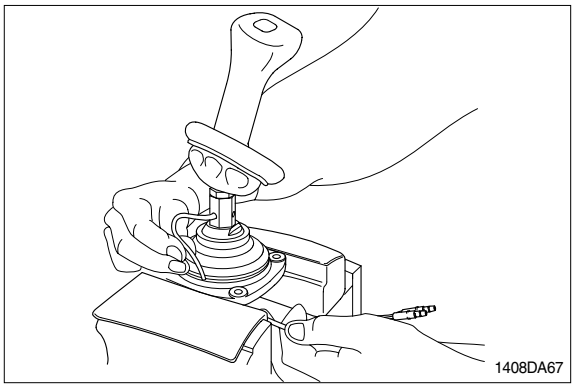


(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.

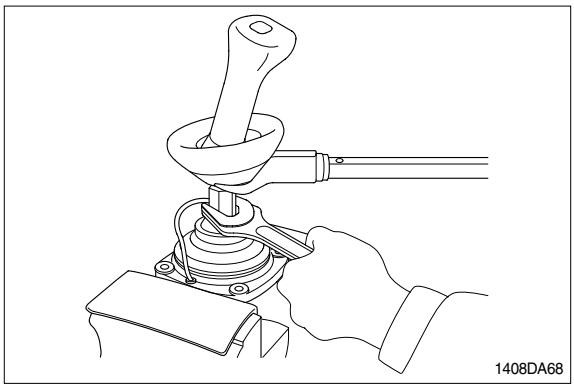


(17) Assemble bushing(17) to plate and pass cord and tube through it.

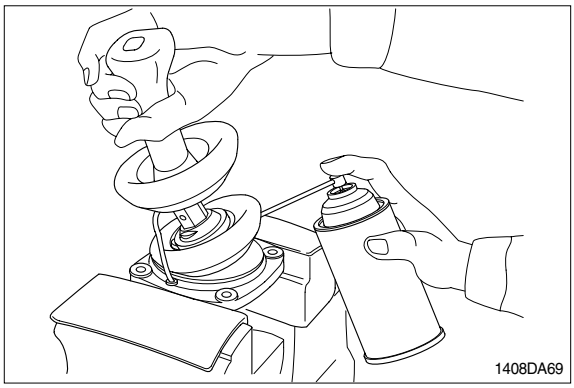
※ Provide margin necessary to operation.



(18) Determine handle direction, tighten lock nut(21) to specified torque to fix handle.

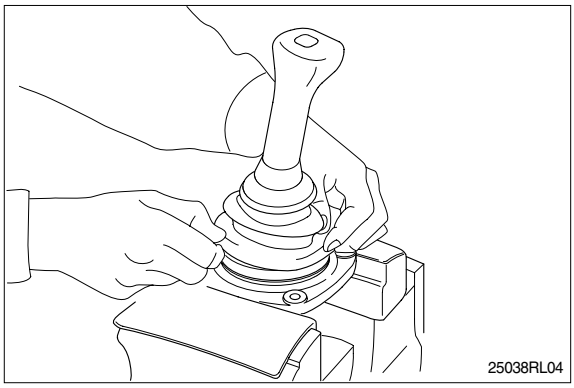


(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(20) Assemble lower end of bellows to casing.

(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



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.

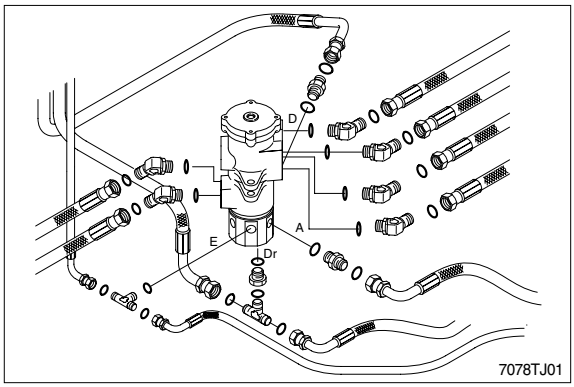
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt(2).
- Weight : 30kg(70lb)
- Tightening torque : 12.3 ± 1.3kgf · m (88.2 ± 9.4lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.



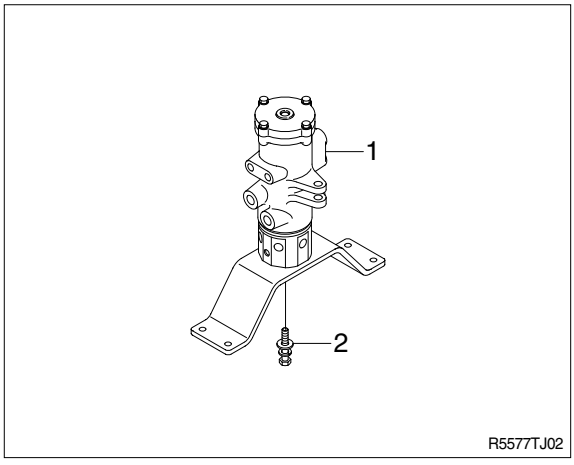
2) INSTALL

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

※ Take care of turning joint direction.

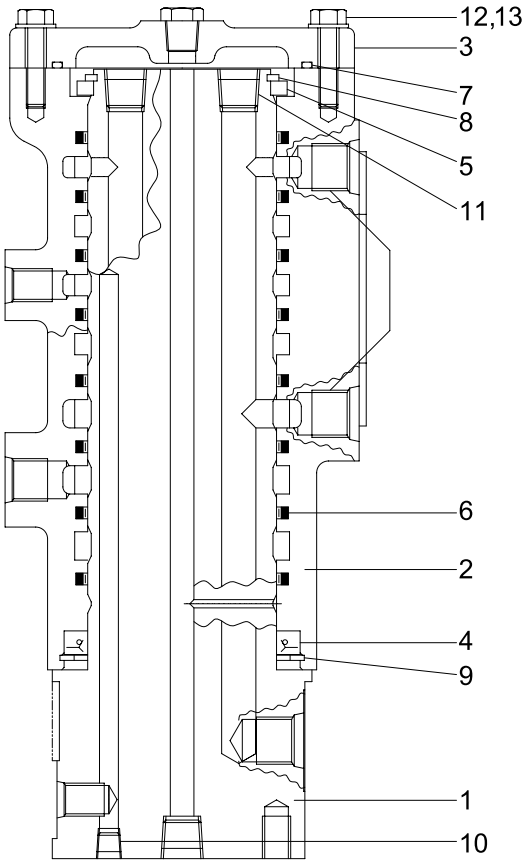
※ Assemble hoses to their original positions.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



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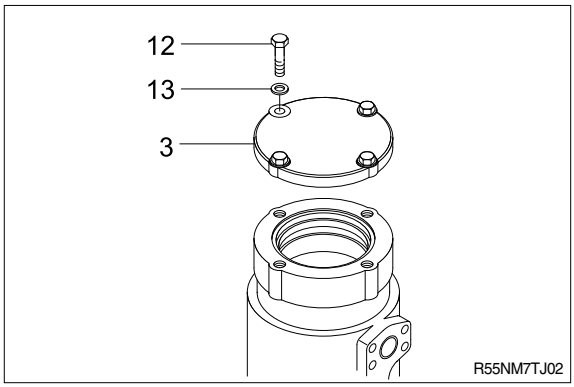
1	Hub	6	Slipper seal	10	Plug
2	Shaft	7	O-ring	11	Plug
3	Cover	8	Retainer ring	12	Hexagon bolt
4	Oil seal	9	Retainer ring	13	Spring washer
5	Ring				

2) DISASSEMBLY

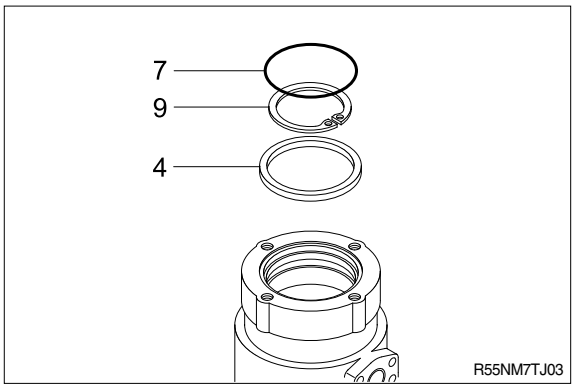
※ Before the disassembly, clean the turning joint.

(1) Remove bolts(12), washer(13) and cover(3).



(2) Remove O-ring(7).

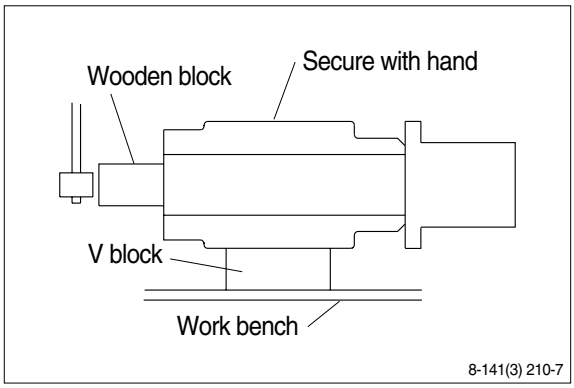
(3) Remove retainer ring(9) and spacer(4).



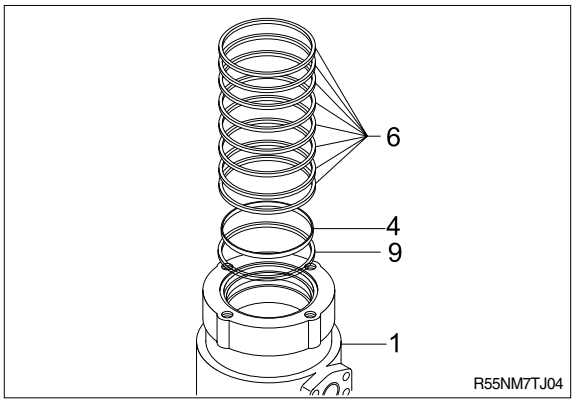
(4) Place hub(1) on a V-block and by using a wood buffer at the shaft end, hit out shaft(2) to about 1/2 from the body with a hammer.

※ 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).



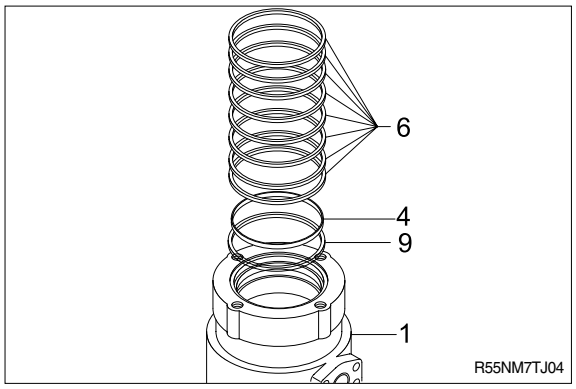
(5) Remove eight slipper seals(6) and oil seal(4), retainer ring(9) from hub(1).



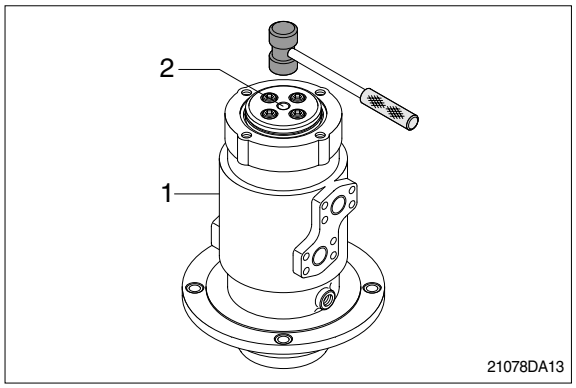
3) ASSEMBLY

※ 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 oil seal(4), retainer ring(9) to hub(1).

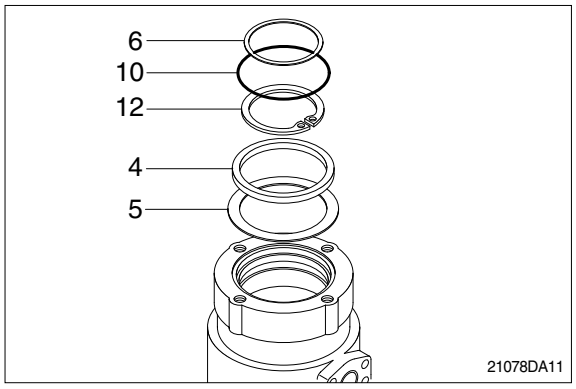


(2) Set shaft(2) on block, tap hub(1) with a plastic hammer to install.

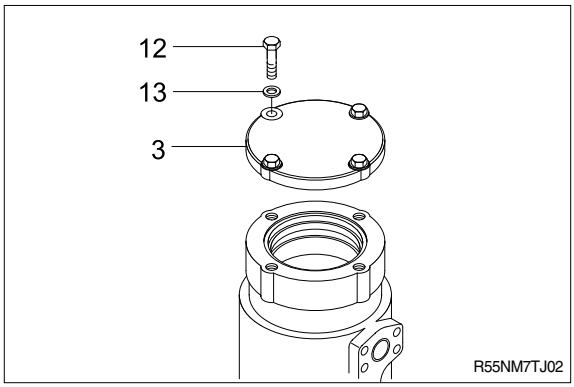


(3) Fit spacer(4) and retainer ring(9) to shaft(2).

(4) Fit O-ring(7) to hub(1).



(5) Install cover(3) to body(1) and tighten bolts(12).
- Tightening torque : 12.3±1.3kgf · m
(88.2±9.4lbf · ft)



GROUP 9 BOOM, ARM AND BUCKET CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

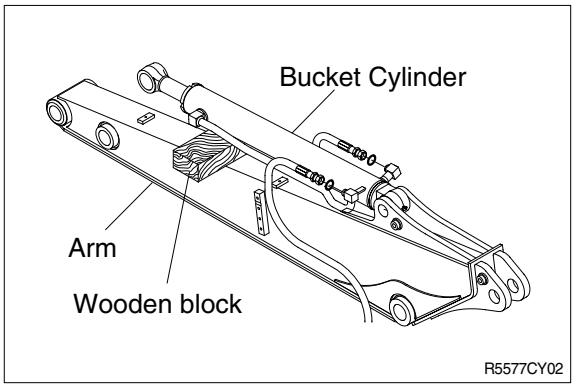
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

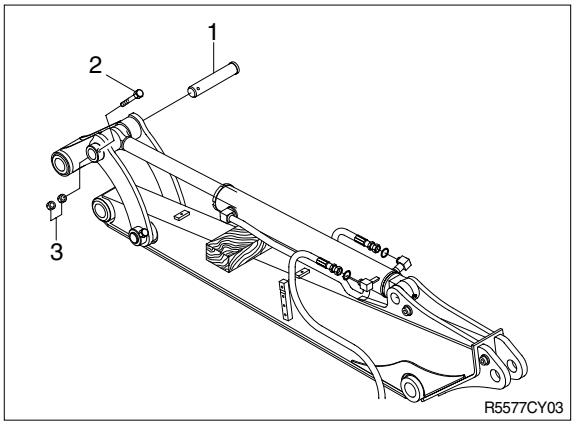
※ Escaping fluid under pressure can penetrate the skin causing serious injury.
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

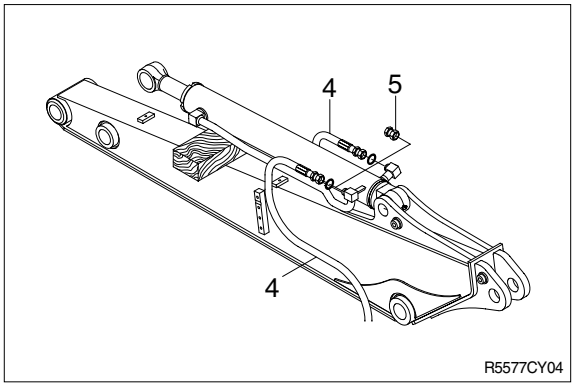


② Remove bolt(2), nut(3) and pull out pin (1).

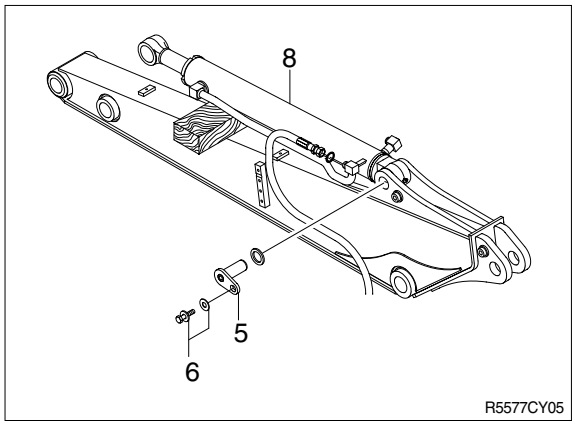
※ Tie the rod with wire to prevent it from coming out.



③ Disconnect bucket cylinder hoses(4) and put plugs(5) on cylinder pipe.



④ Sling bucket cylinder assembly(8) and remove bolt(6) then pull out pin (5).
⑤ Remove bucket cylinder assembly(8).
· Weight : 50kg(110lb)



(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

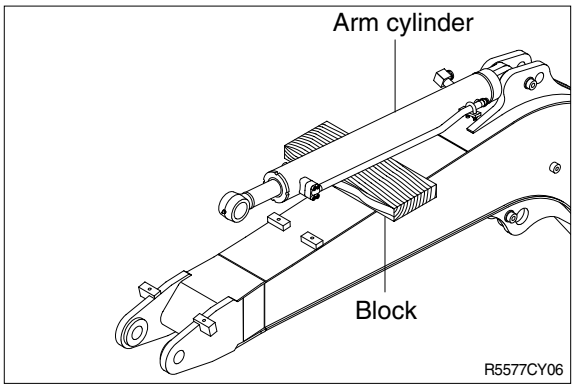
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.

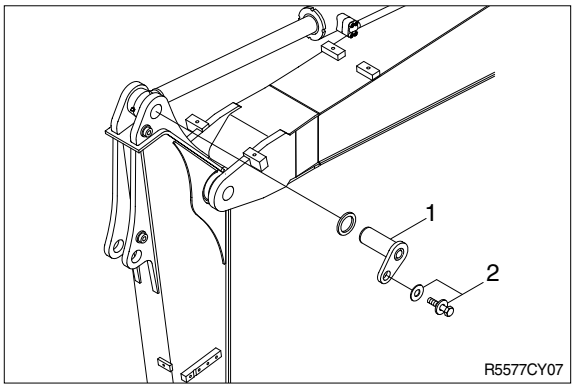
※ Escaping fluid under pressure can penetrate the skin causing serious injury.
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



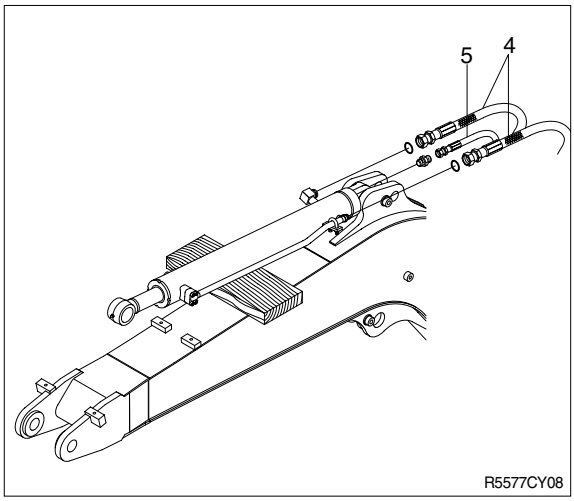
② Remove bolt(2) and pull out pin(1).

※ Tie the rod with wire to prevent it from coming out.



③ Disconnect arm cylinder hoses(3) and put plugs on cylinder pipe.

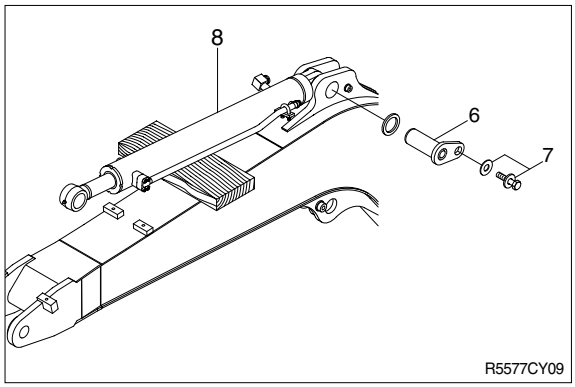
④ Disconnect greasing pipings(4).



⑤ Sling arm assembly(7) and remove bolt (6) then pull out pin(5).

⑥ Remove arm cylinder assembly(7).

· Weight : 80kg(180lb)



(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

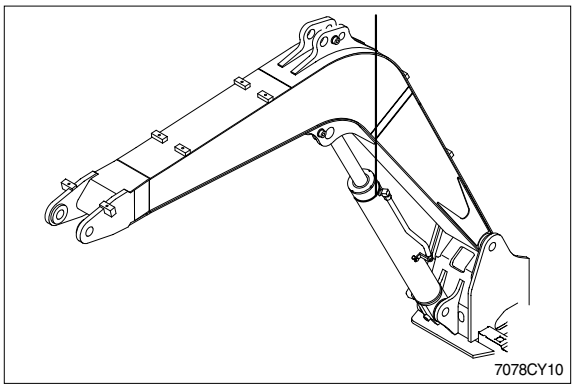
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

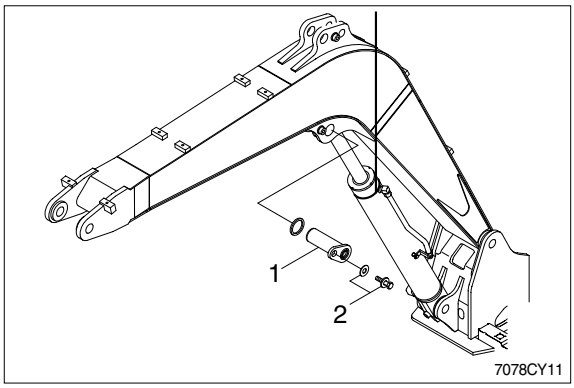
※ Escaping fluid under pressure can penetrate the skin causing serious injury.
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Sling boom cylinder assembly.

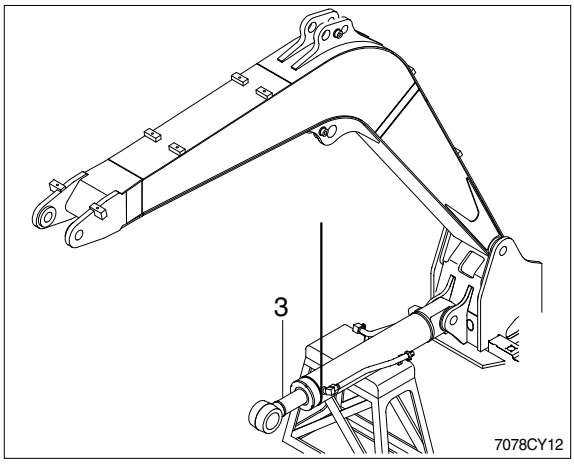


② Remove bolt(2), pull out pin(1).

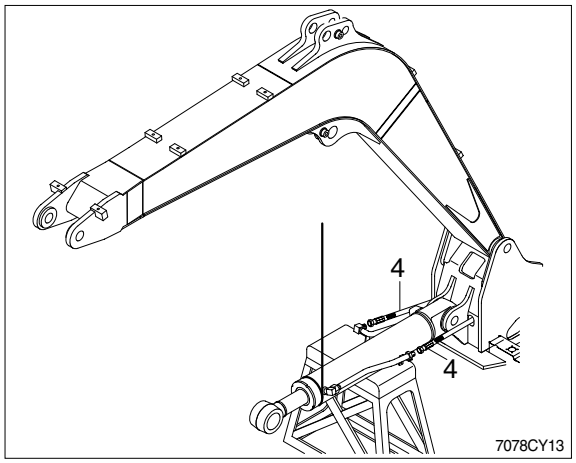
※ Tie the rod with wire to prevent it from coming out.



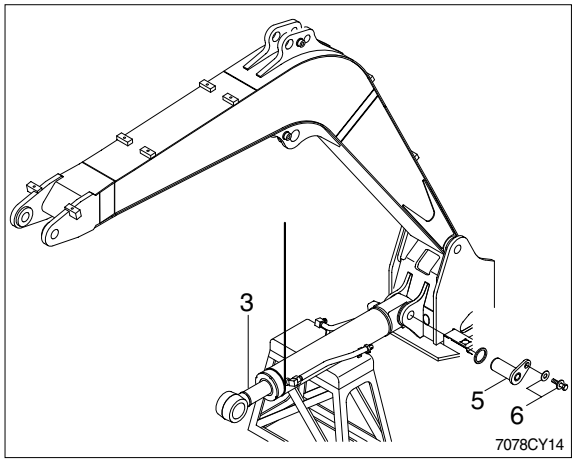
③ Lower the boom cylinder assembly(3) on a stand.



④ Disconnect boom cylinder hoses(4) and put plugs on cylinder pipe.



⑤ Remove bolt(6) and pull out pin(5).
⑥ Remove boom cylinder assembly(6).
· Weight : 120kg(260lb)



(2) Install

① Carry out installation in the reverse order to removal.

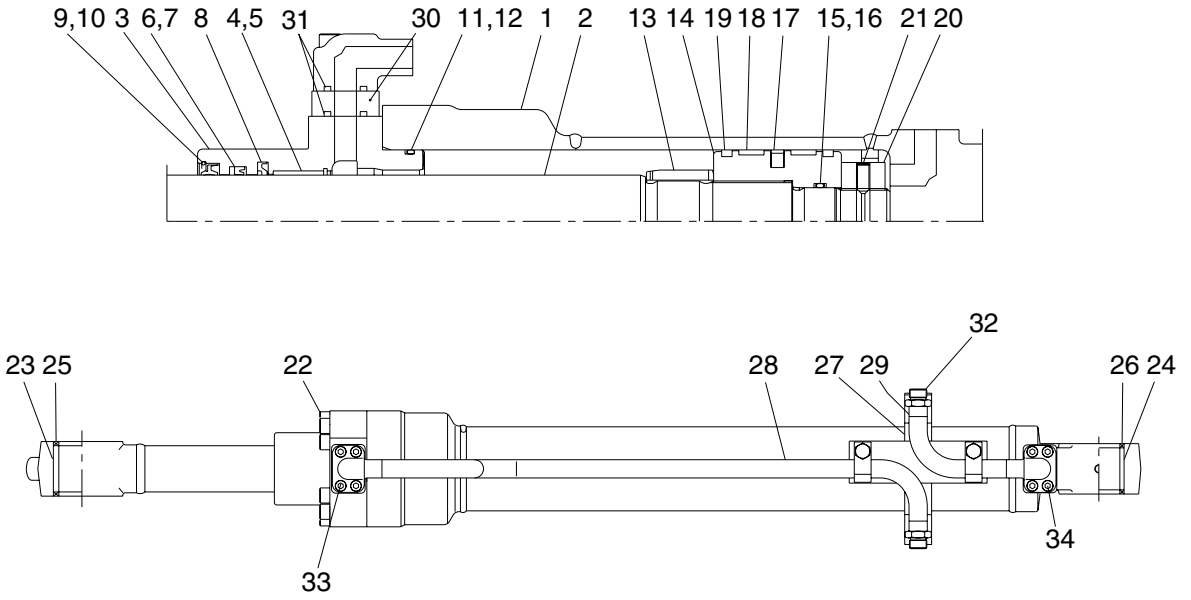
⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ 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



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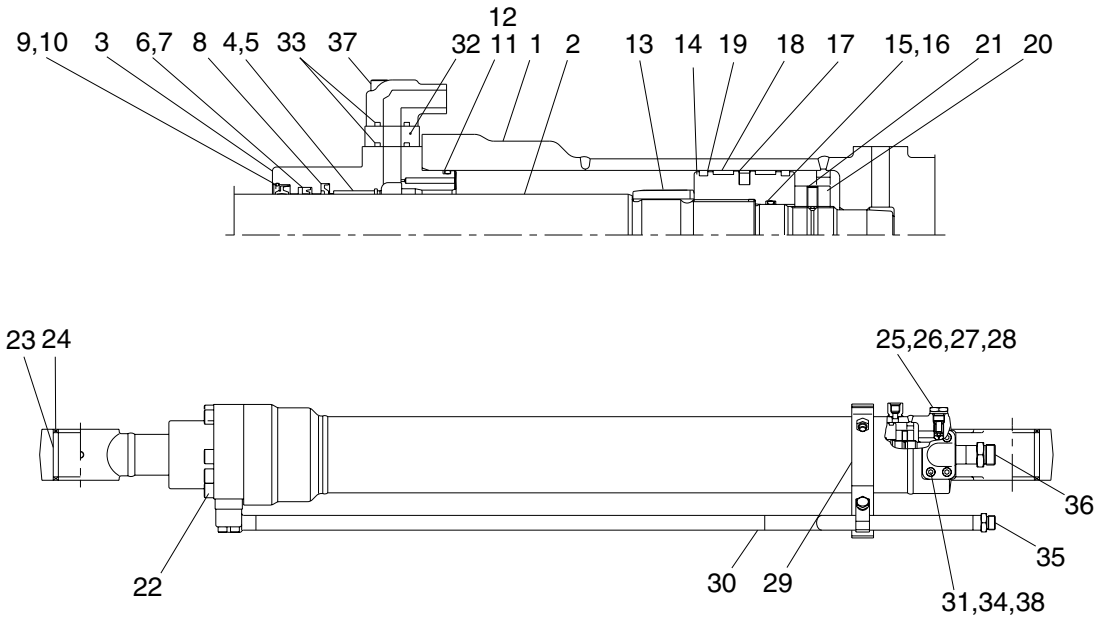
1	Tube assembly	13	Cushion ring	24	Pin bush
2	Rod assembly	14	Piston	25	Dust seal
3	Gland	15	O-ring	26	Dust seal
4	DD2 bush	16	Back up ring	27	Band assembly
5	Snap ring	17	Piston seal	28	Pipe assembly(R)
6	Rod seal	18	Wear ring	29	Pipe assembly(B)
7	Back up ring	19	Dust ring	30	Flange
8	Buffer ring	20	Lock nut	31	O-ring
9	Dust wiper	21	Screw	32	O-ring
10	Snap ring	22	Hexagon socket head bolt	33	Hexagon socket head bolt
11	O-ring	23	Pin bush	34	Hexagon socket head bolt
12	Back up ring				

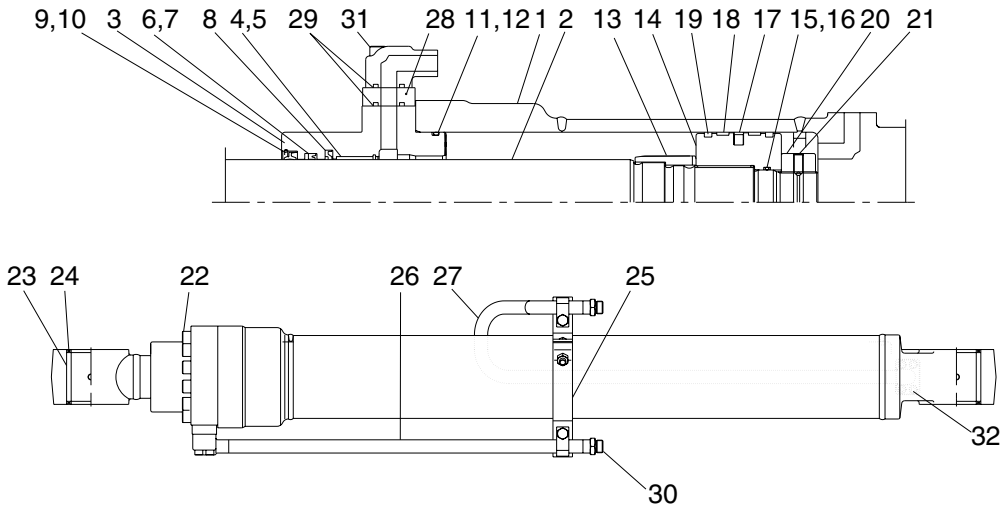
(2) Arm cylinder



7078CY02

1	Tube assembly	14	Piston	27	O-ring
2	Rod assembly	15	O-ring	28	Plug
3	Gland	16	Back up ring	29	Band assembly
4	DD2 Bush	17	Piston seal	30	Pipe assembly(R)
5	Snap ring	18	Wear ring	31	Pipe assembly(L)
6	Rod seal	19	Dust ring	32	Flange
7	Back up ring	20	Lock nut	33	O-ring
8	Buffer ring	21	Screw	34	O-ring
9	Dust wiper	22	Hexagon socket head bolt	35	O-ring
10	Snap ring	23	Pin bush	36	O-ring
11	O-ring	24	Dust seal	37	Hexagon socket head bolt
12	Back up ring	25	Check valve	38	Hexagon socket head bolt
13	Cushion ring	26	Coil spring		

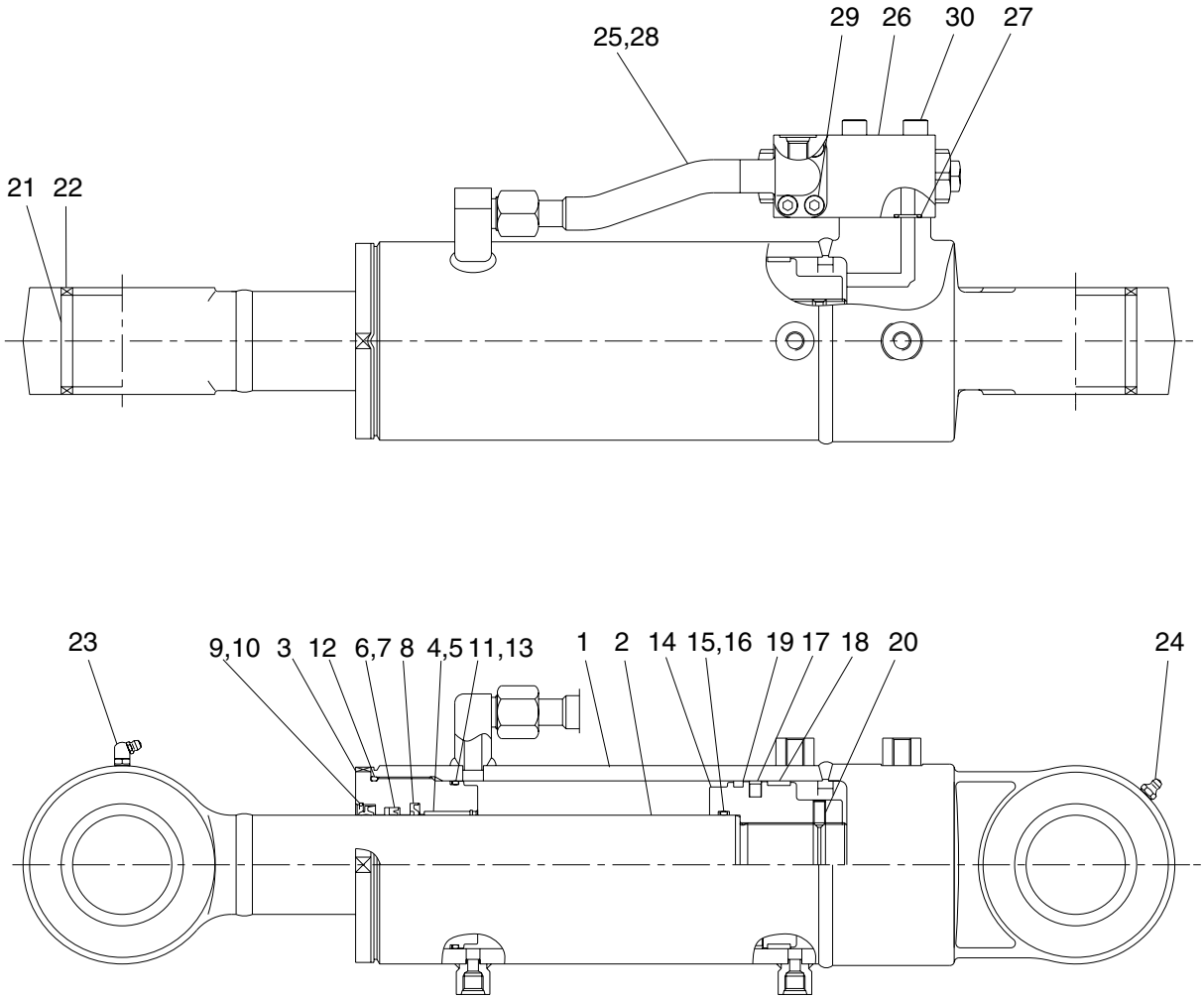
(3) Boom cylinder



7078CY01

1	Tube assembly	12	Back up ring	23	Pin bush
2	Rod assembly	13	Cushion ring	24	Dust seal
3	Gland	14	Piston	25	Band assembly
4	DD2 bush	15	O-ring	26	Pipe assembly(R, LH/RH)
5	Snapring	16	Back up ring	27	Pipe assembly(L, LH/RH)
6	Rod seal	17	Piston seal	28	Flange
7	Back up ring	18	Wear ring	29	O-ring
8	Buffer ring	19	Dust ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon head bolt
10	Snap ring	21	Screw	32	Hexagon head bolt
11	O-ring	22	Hexagon socket head bolt		

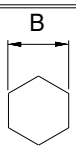
(4) Dozer cylinder



1	Tube assembly	11	O-ring	21	Pin bush
2	Rod assembly	12	O-ring	22	Dust seal
3	Gland	13	Buck-up ring	23	Grease nipple
4	Du bushing	14	Piston	24	Grease nipple
5	Snap ring	15	O-ring	25	Pipe assy-R
6	Rod seal	16	Back up ring	26	Double check valve
7	Buck-up ring	17	Piston seal	27	O-ring
8	Bufter ring	18	Wear ring	28	O-ring
9	Dust wiper	19	Dust ring	29	Hexagon socket head bolt
10	Snap ring	20	Screw	30	Hexagon socket head bolt

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	B	Remark
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, Gland mounting bolt (Socket head bolt)	Boom cylinder	22	M14×2.0	15±1.5	109±11
	Arm cylinder	22	M14×2.0	15±1.5	109±11
	Bucket cylinder	22	M12×1.75	9.4±1	68±7
	Dozer cylinder	3	M115×2.0	70±7.0	510±51
Lock nut	Boom cylinder	20	M50×2.0	190±19	1375±138
	Arm cylinder	20	M42×2.0	180±18	1302±130
	Bucket cylinder	20	M39×2.0	170±17	1230±123
Piston	Boom cylinder	14	M60×3.0	100±10	723±72
	Arm cylinder	14	M52×3.0	150±15	1085±109
	Bucket cylinder	14	M48×2.0	100±10	723±72
	Dozer cylinder	14	M55×2.0	140±14	1013±101

3) DISASSEMBLY

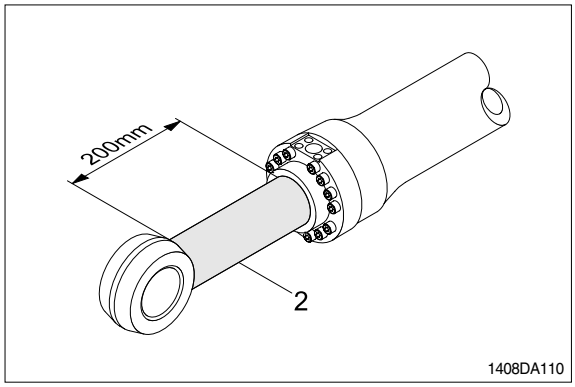
(1) Remove cylinder head and piston rod

※ **Procedures are based on the bucket cylinder.**

① Hold the clevis section of the tube in a vise.

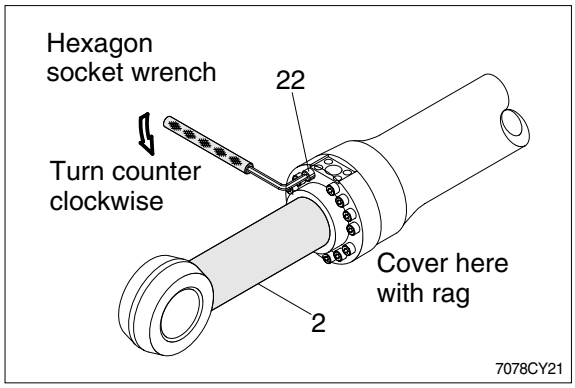
※ **Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.**

② Pull out rod assembly(2) about 200㎜ (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



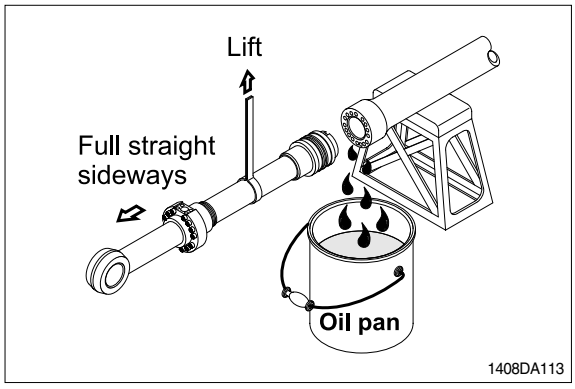
③ Loosen and remove socket bolts(22) of the gland in sequence.

※ Cover the extracted rod assembly(2) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly together from tube assembly(1).

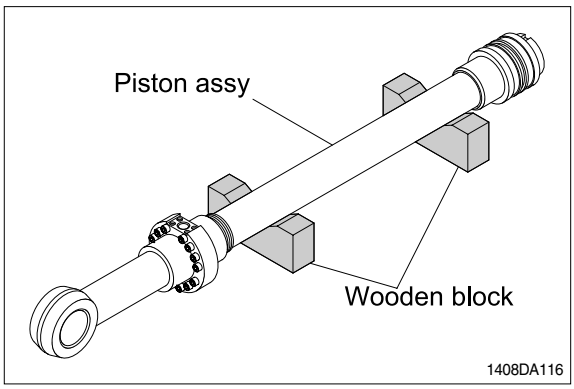
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly(2) with a crane or some means and draw it out. However, when rod assembly(2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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.



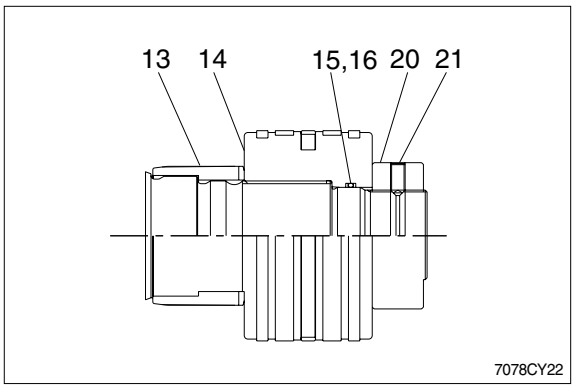
(2) Remove piston and cylinder head

① Remove screw(21).

② 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).

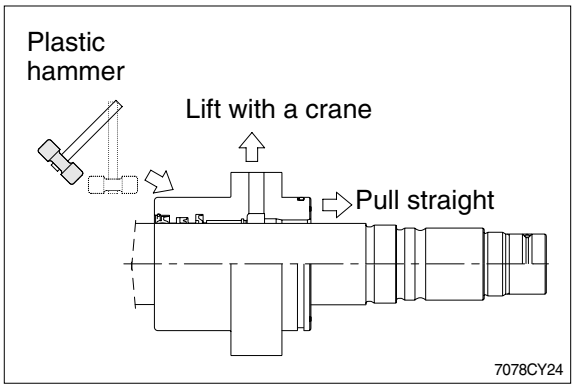
③ Remove piston assembly(14), back up ring(16), and O-ring(15).



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(4) and packing (5,6,7,8,9,10) by the threads of rod assembly(2).

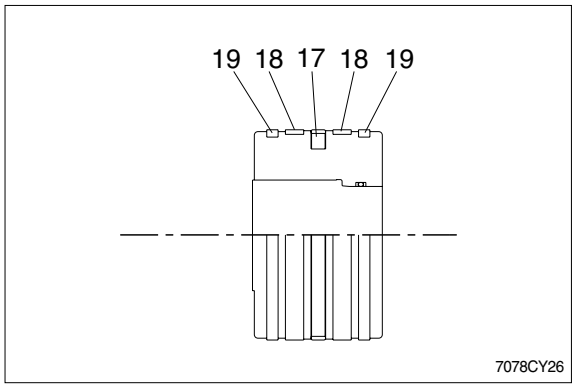


(3) Disassemble the piston assembly

① Remove wear ring(18).

② Remove dust ring(19) and piston seal (17).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

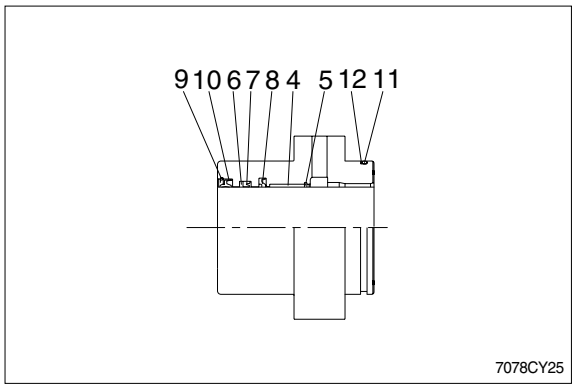
① Remove back up ring(11) and O-ring (12).

② Remove snap ring(10), dust wiper(9).

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.

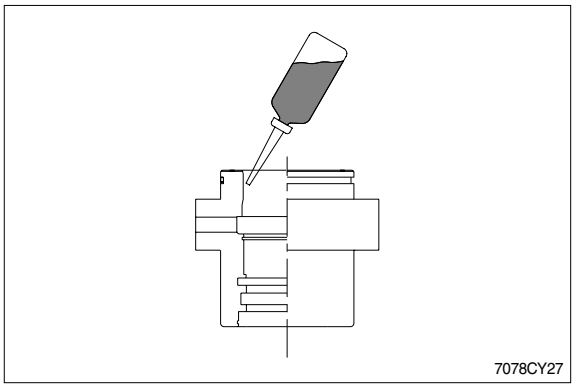


3) ASSEMBLY

(1) Assemble cylinder head assembly

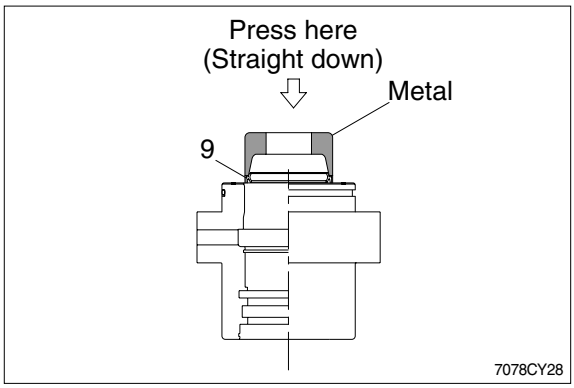
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland(3) with hydraulic oil.



② Coat dust wiper(9) with grease and fit dust wiper(9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

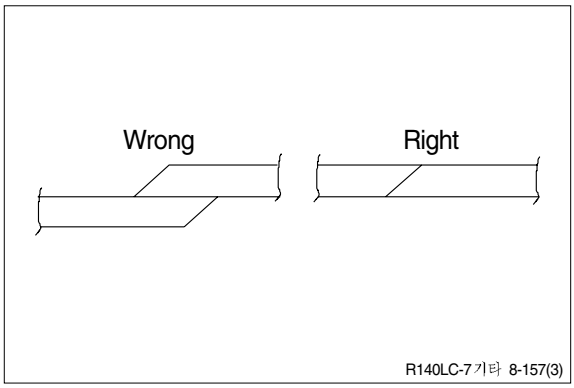
③ Fit snap ring(10) to the stop face.



④ Fit back up ring(7), rod seal(6) and buffer ring(8) to corresponding grooves, in that order.

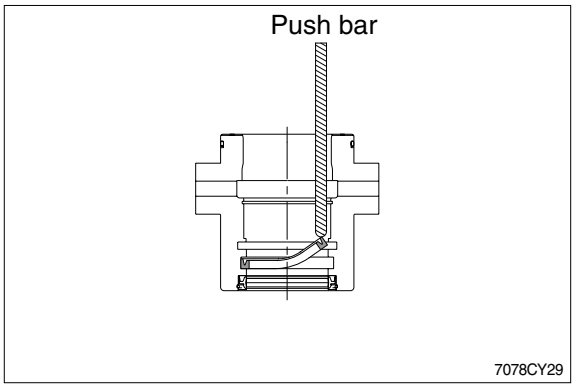
※ Coat each packing with hydraulic oil before fitting it.

※ 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.

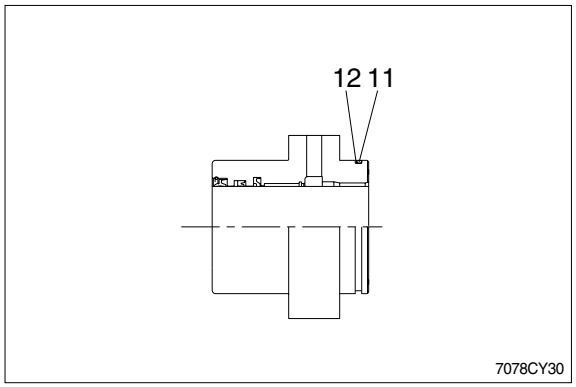
※ Fitting rod seal(6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring(12) to gland(3).

※ Put the backup ring in the warm water of 30~50℃.

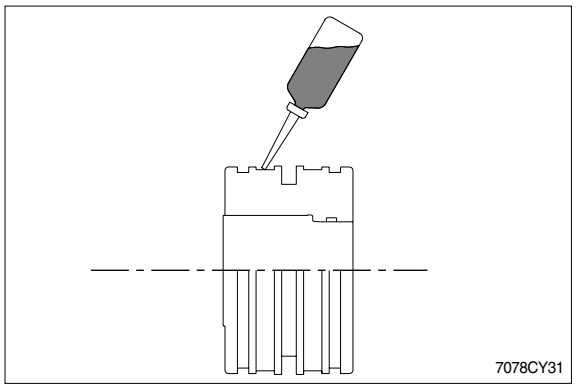
⑥ Fit O-ring(11) to gland(3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

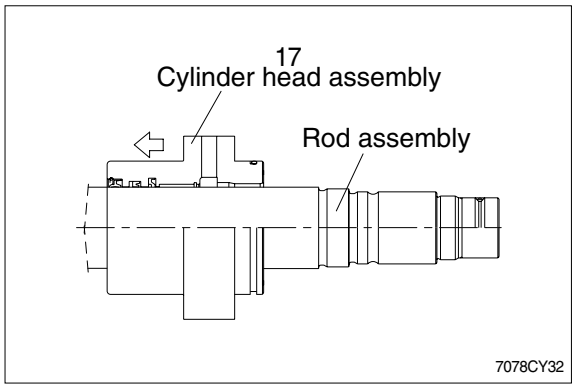
① Coat the outer face of piston(14) with hydraulic oil.



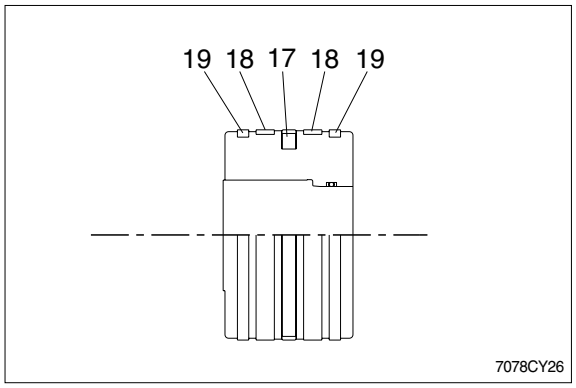
② Fit piston seal(17) to piston.

※ Put the piston seal in the warm water of 60~100℃ for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



③ Fit wear ring(18) and dust ring(19) to piston(14).

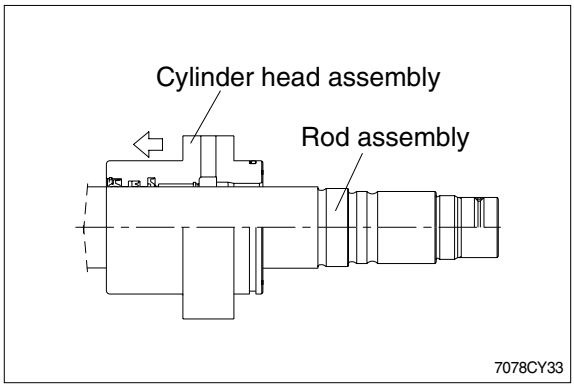


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

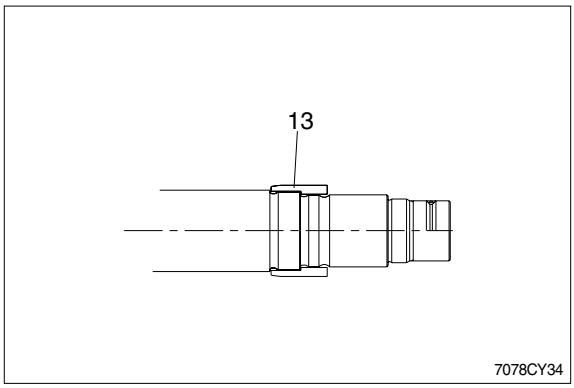
② Apply hydraulic oil to the outer surface of rod assembly(2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring(13) to rod assembly.

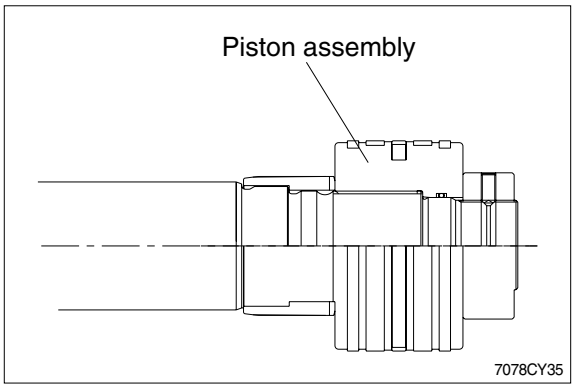
※ Note that cushion ring(13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque :

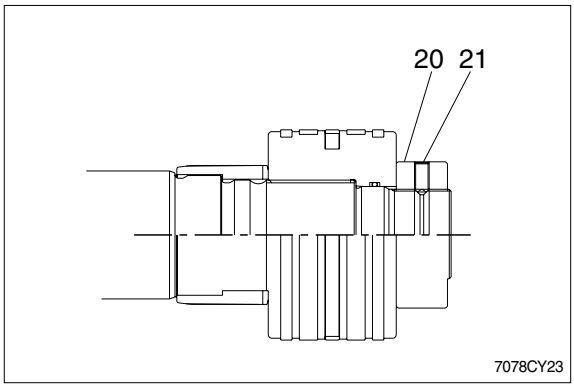
Item		kgf · m	lbf · ft
Boom	14	100±10	723±72
Arm	14	150±15	1085±109
Bucket	14	100±10	723±72
Dozer	14	140±14	1013±101



⑥ Fit lock nut(20) to piston and screw(21).

· Tightening torque :

Item		kgf · m	lbf · ft
Boom	20	190±19	1375±138
Arm	20	180±18	1302±130
Bucket	20	170±17	1230±123



(4) Overall assemble

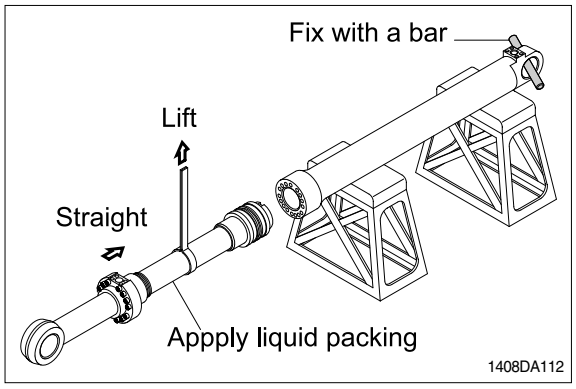
① Place a V-block on a rigid work bench. Mount the tube assembly(1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

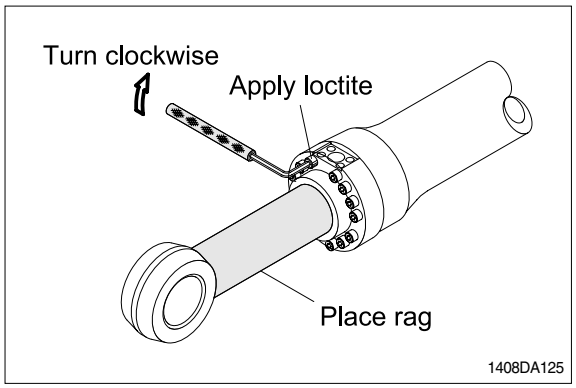
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ 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

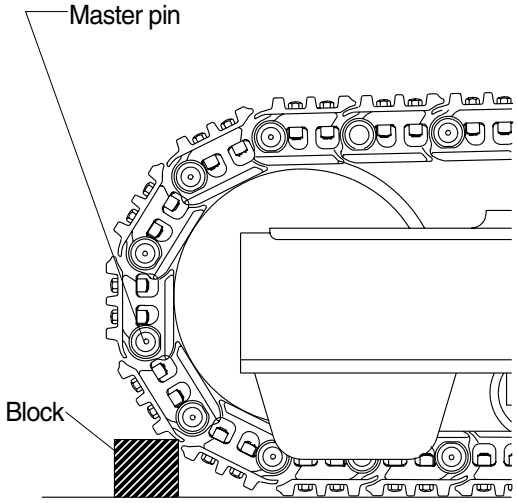
1) REMOVAL

(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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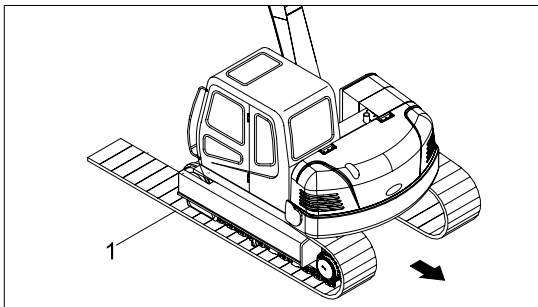
(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ 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.



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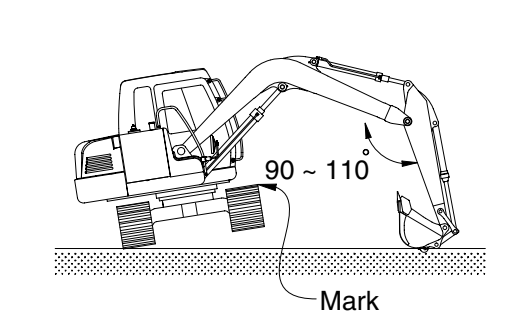
2) INSTALL

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

※ Adjust the tension of the track link.



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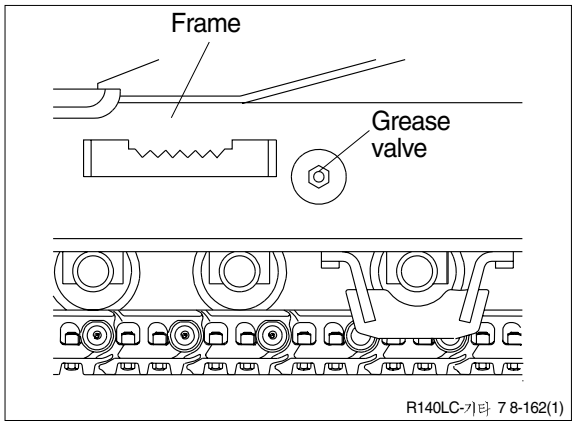
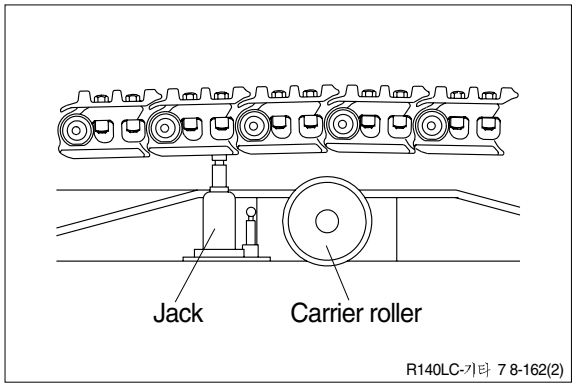
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.

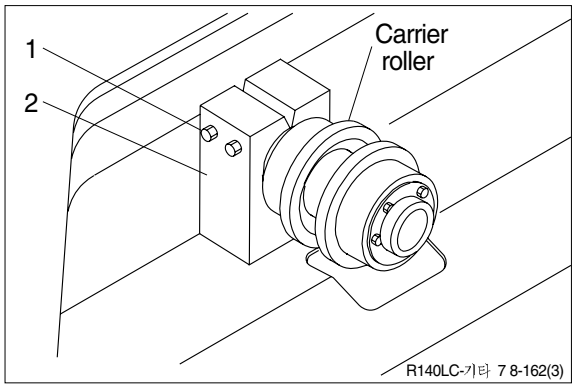


(2) Jack up the track link height enough to permit carrier roller removal.



(3) Loosen the lock nut (1).

(4) Open bracket(2) with a screwdriver, push out from inside, and remove carrier roller assembly.
- Weight : 13kg(29lb)



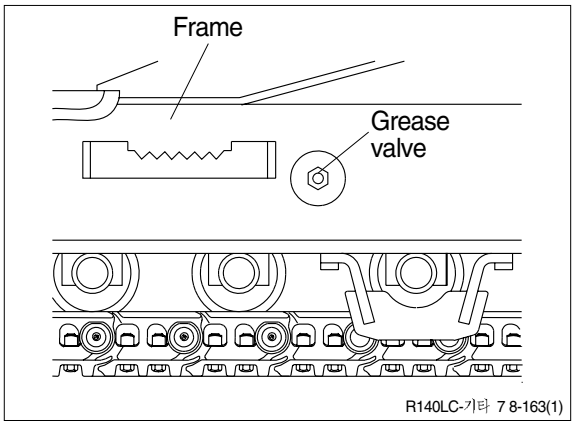
2) INSTALL

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

3. TRACK ROLLER

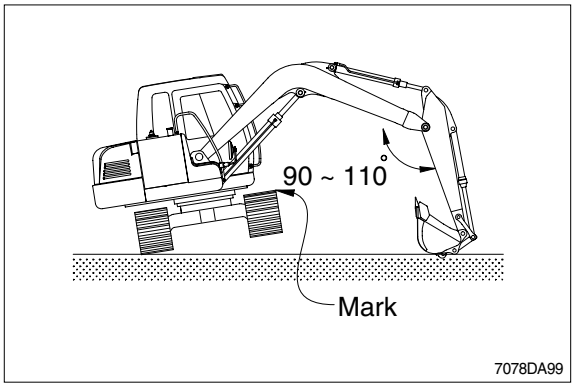
1) REMOVAL

(1) Loosen tension of the track link.



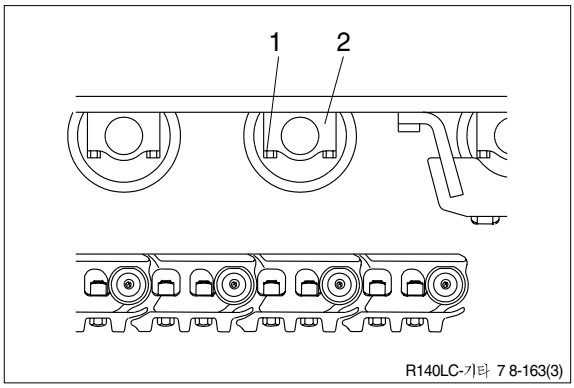
(2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt(1) and draw out the track roller(2).

· Weight : 16kg(36lb)



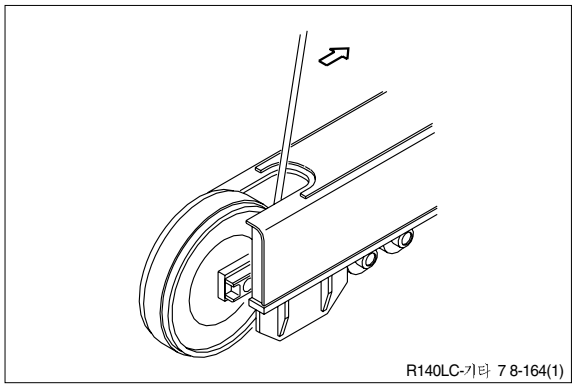
2) INSTALL

(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**.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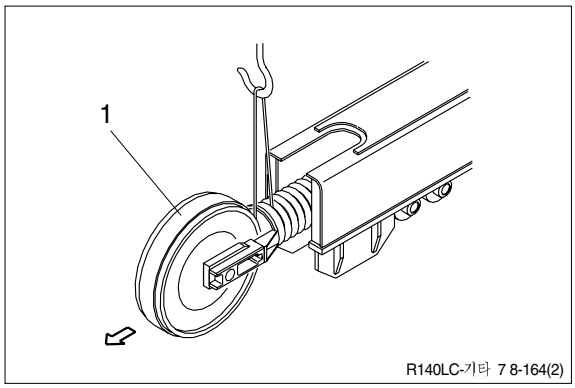
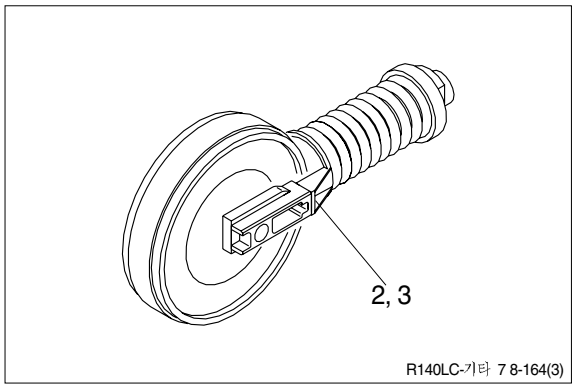
(2) Sling the recoil spring(1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 120kg(265lb)



R140LC-기타 7 8-164(2)

(3) Remove the bolts(2), washers(3) and separate ilder from recoil spring.

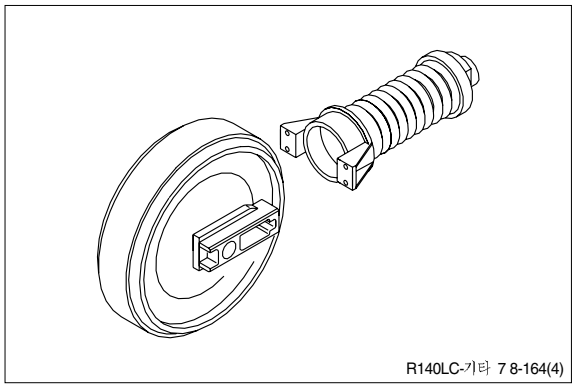


R140LC-기타 7 8-164(3)

2) INSTALL

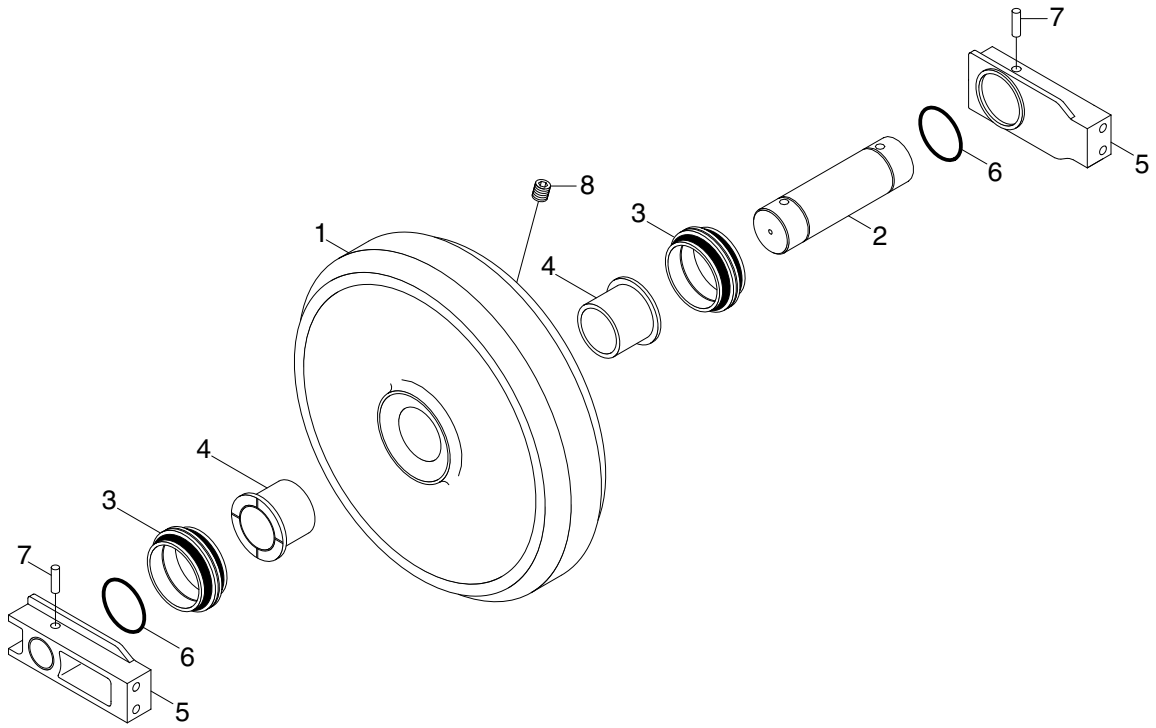
(1) Carry out installation in the reverse order to removal.

※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.


R140LC-기타 7 8-164(4)

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



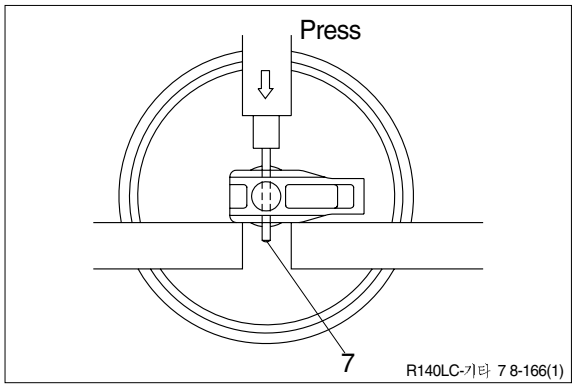
21078DA43

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.

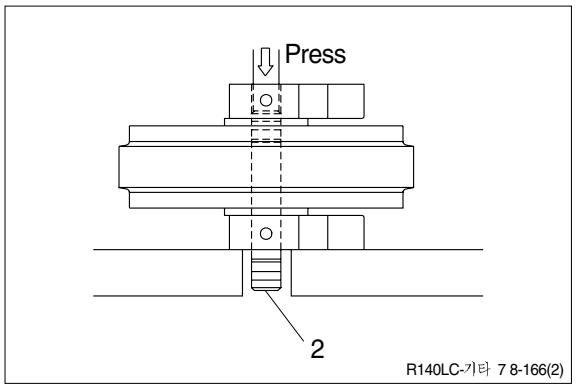
② Draw out the spring pin(7), using a press.



③ Pull out the shaft(2) with a press.

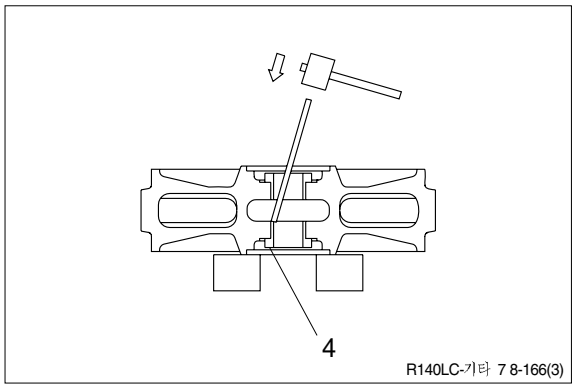
④ Remove seal(3) from idler(1) and bracket (5).

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.

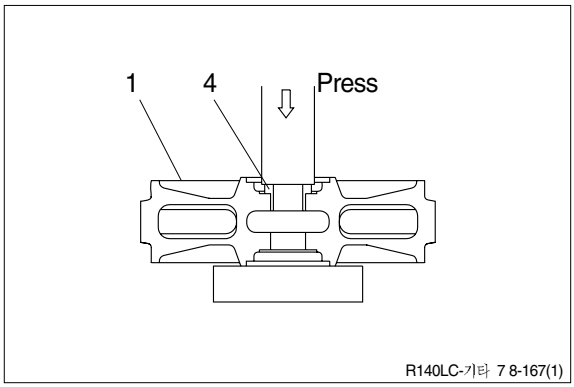


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

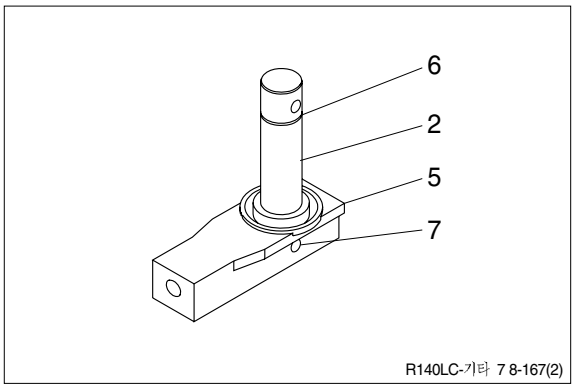
① Cool up bushing(4) fully by some dry ice and press it into shell(1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



R140LC-기타 7 8-167(1)

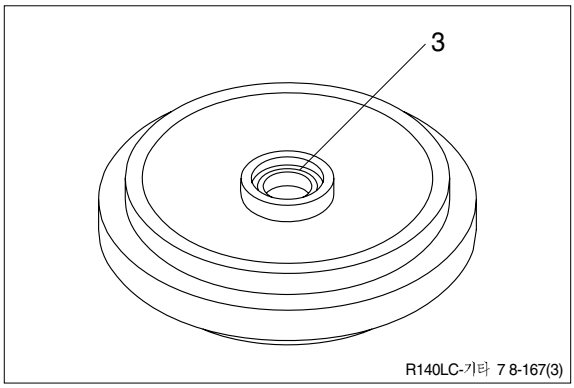
② Coat O-ring(6) with grease thinly, and install it to shaft(2).

③ Insert shaft(2) into bracket(5) and drive in the spring pin(7).



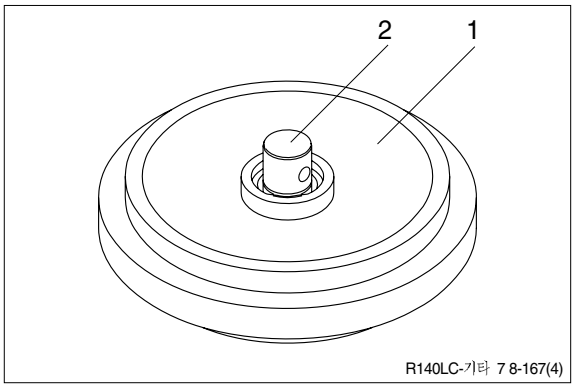
R140LC-기타 7 8-167(2)

④ Install seal(3) to shell(1) and bracket(5).



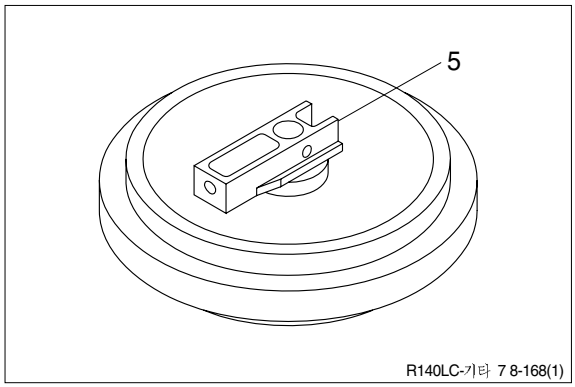
R140LC-기타 7 8-167(3)

⑤ Install shaft(2) to shell(1).

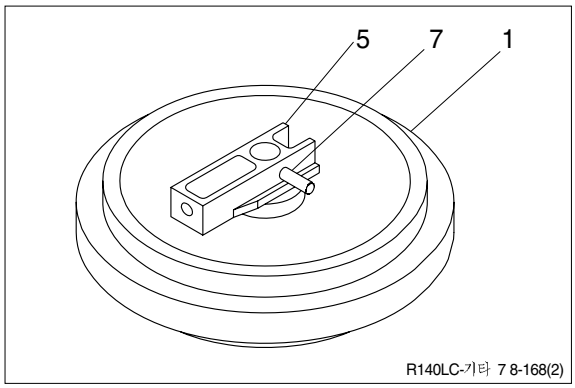


R140LC-기타 7 8-167(4)

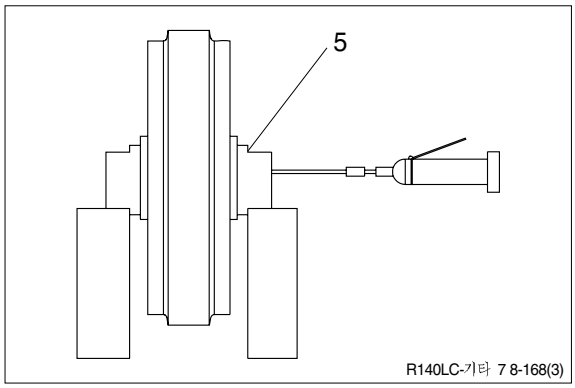
⑥ Install bracket(5) attached with seal(3).



⑦ Knock in the spring pin(7) with a hammer.

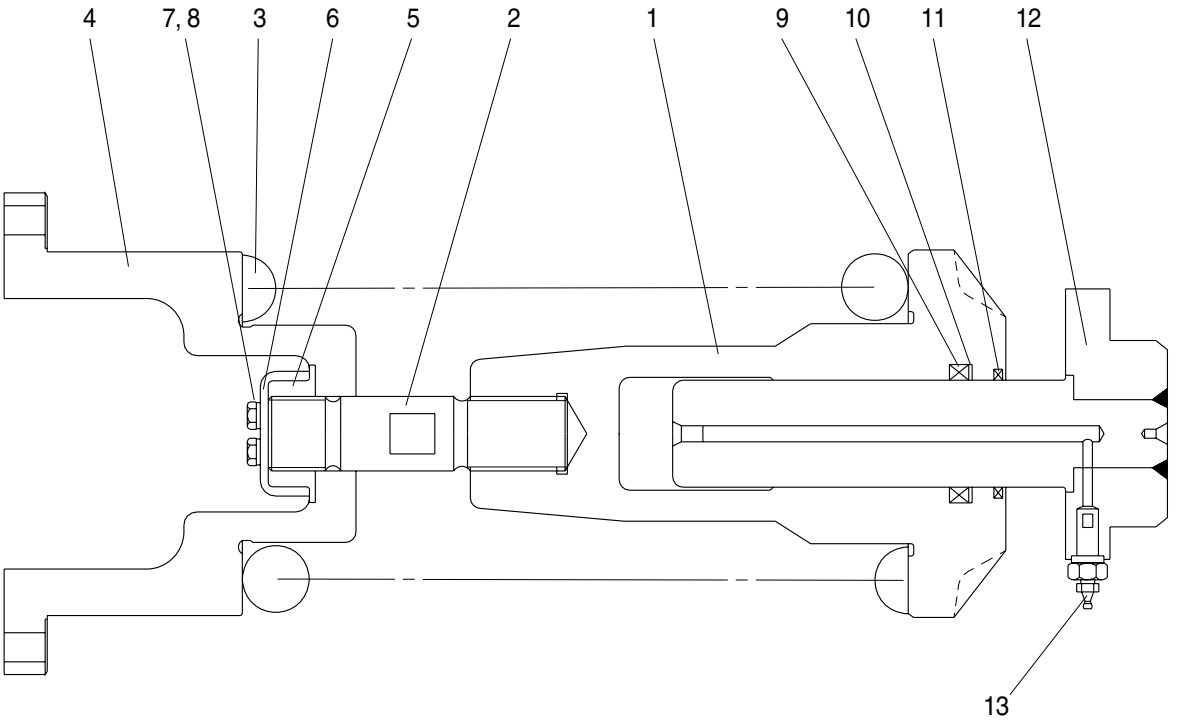


⑧ Lay bracket(5) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



1	Body	6	Lock plate	11	Dust seal
2	Tie bar	7	Bolt	12	Rod assembly
3	Spring	8	Spring washer	13	Grease valve
4	Bracket	9	Rod seal		
5	Lock nut	10	Back up ring		

(2) Disassembly

① Apply pressure on spring(3) with a press.

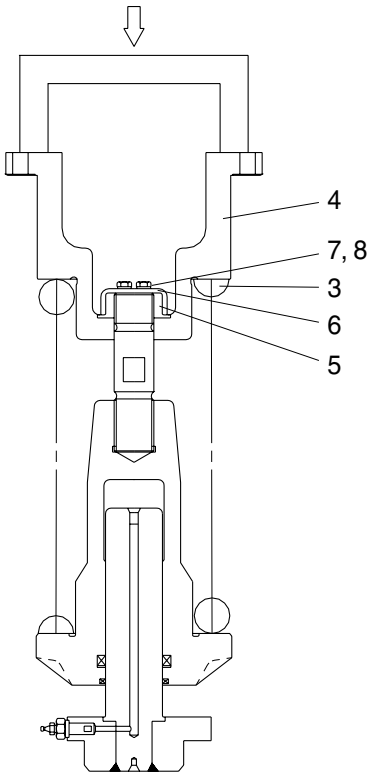
※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

· Spring set load : 5083kg(11206lb)

② Remove bolt(7), spring washer(8) and lock plate(6).

③ Remove lock nut(5).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

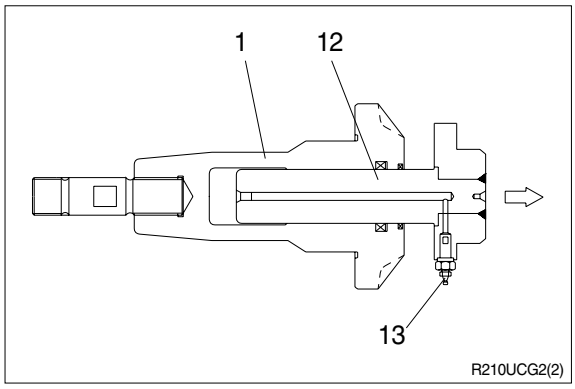
④ Lighten the press load slowly and remove bracket(4) and spring(3).



R210UCG2(1)

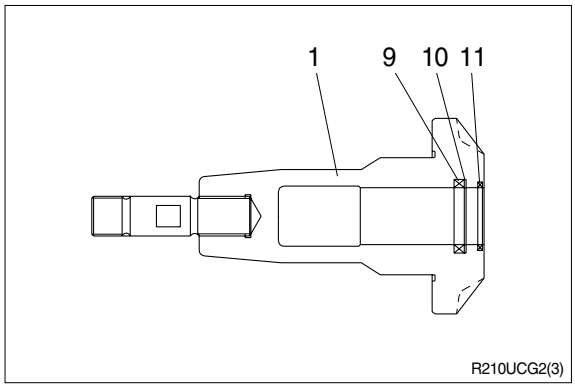
⑤ Remove rod(12) from body(1).

⑥ Remove grease valve(13) from rod(12).



R210UCG2(2)

⑦ Remove rod seal(9), back up ring(10) and dust seal(11).

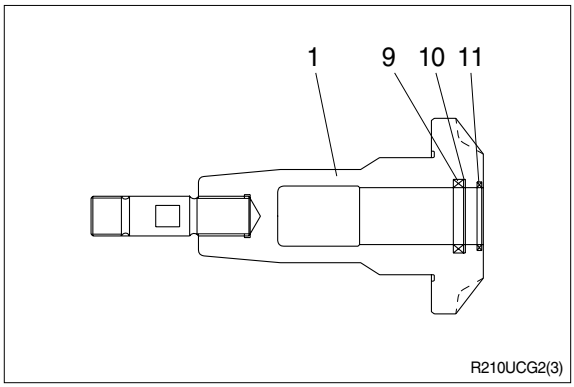


R210UCG2(3)

(3) Assembly

① Install dust seal(11), back up ring(10) and rod seal(9) to body(1).

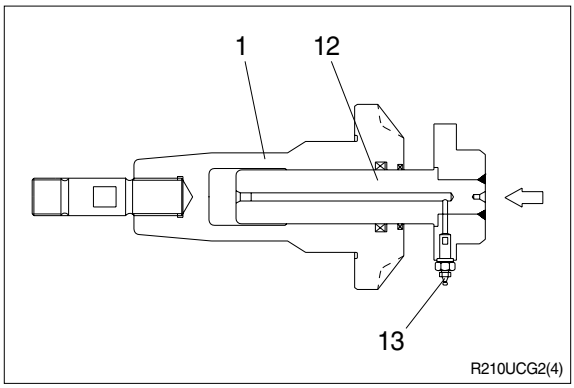
※ When installing dust seal(11) and rod seal(9), take full care so as not to damage the lip.



② Pour grease into body(1), then push in rod(12) 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(13) to rod(12).
· Tightening torque : 10±1kg · m
(72.4±7.2lb · ft)

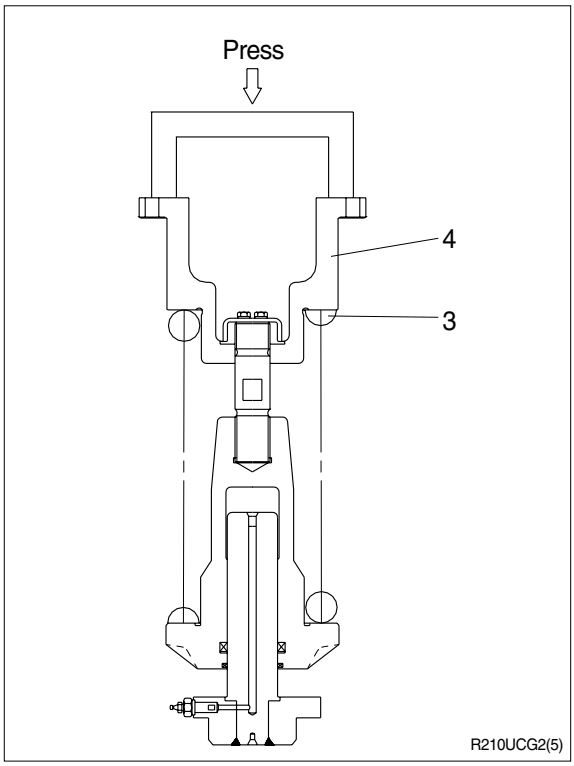


④ Install spring(3) and bracket(4) to body (1).

⑤ Apply pressure to spring(3) with a press and tighten lock nut(5).

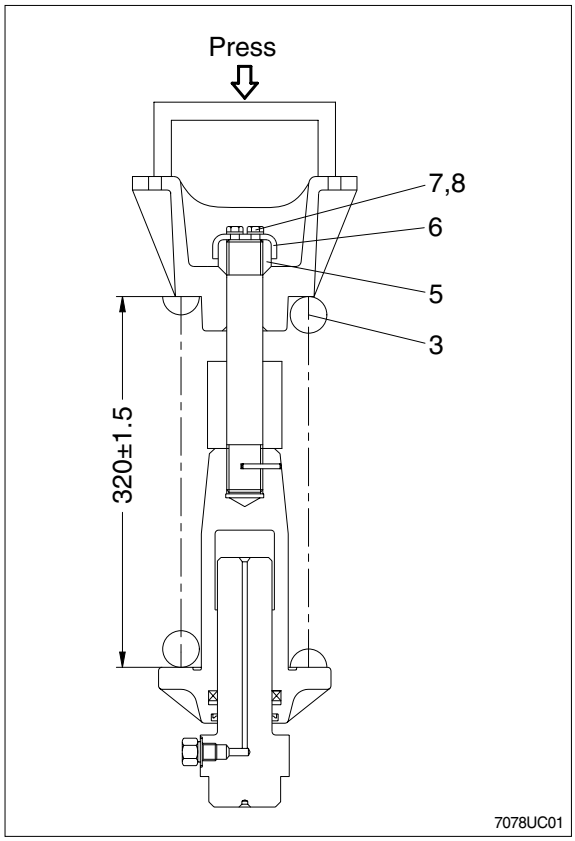
※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.

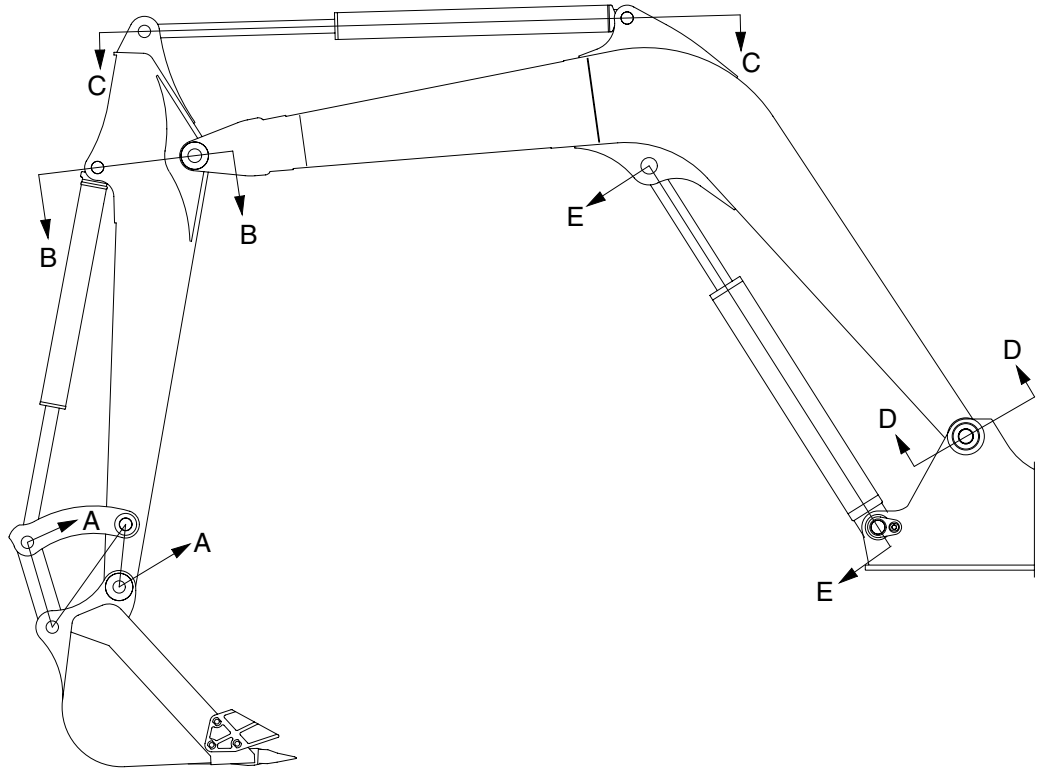


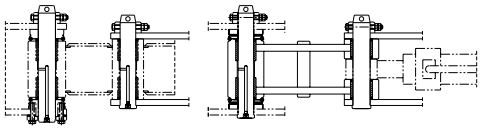
⑥ Lighten the press load and confirm the set length of spring(3).

⑦ After the setting of spring(3), install lock plate(6), spring washer(8) and bolt(7).

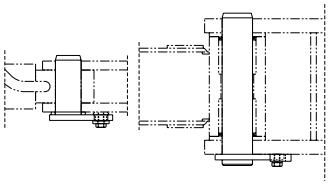


1. STRUCTURE

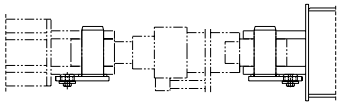




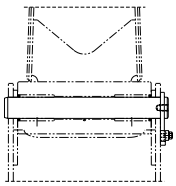
SECTION A-A



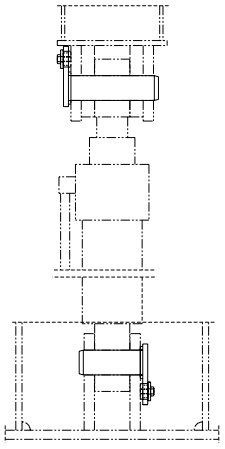
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

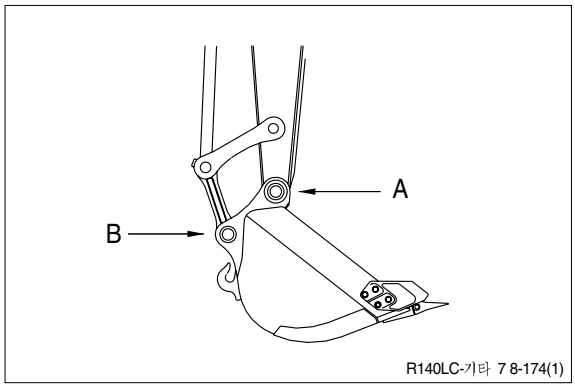
7078AT01

2. REMOVAL AND INSTALL

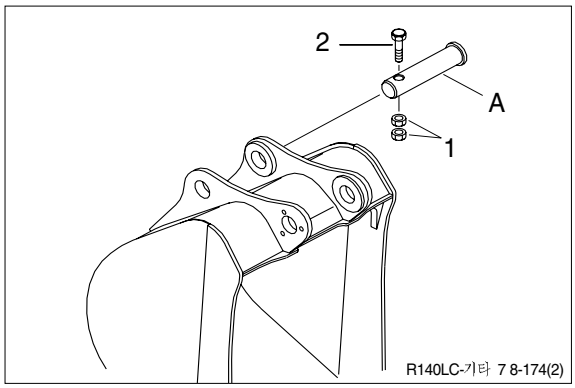
1) BUCKET ASSEMBLY

(1) Removal

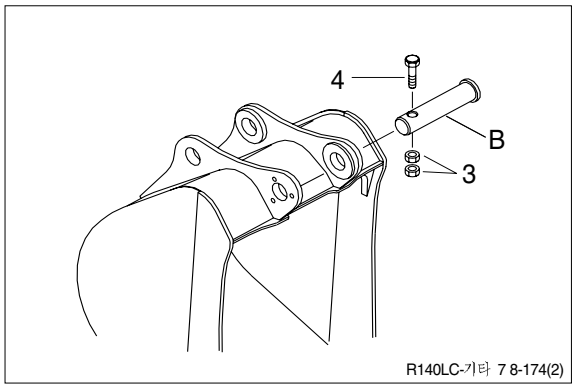
① Lower the work equipment completely to ground with back of bucket facing down.



② Remove nut(1), bolt(2) and draw out the pin(A).



③ Remove nut(3), bolt(4) and draw out the pin(B).

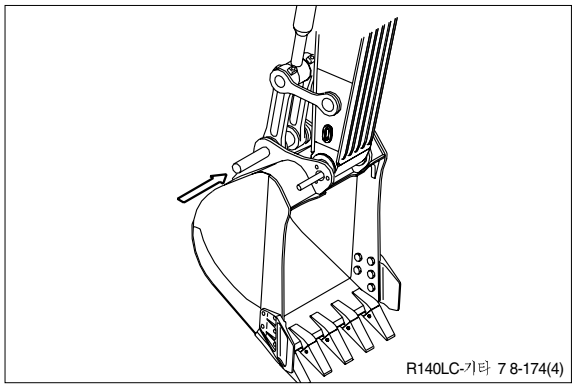


(2) Install

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**.



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(1).

⚠ Fit blind plugs(5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

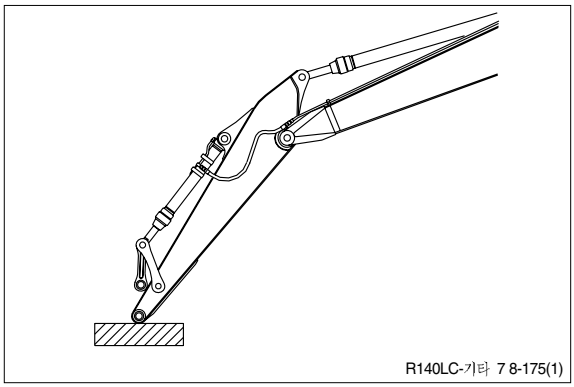
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

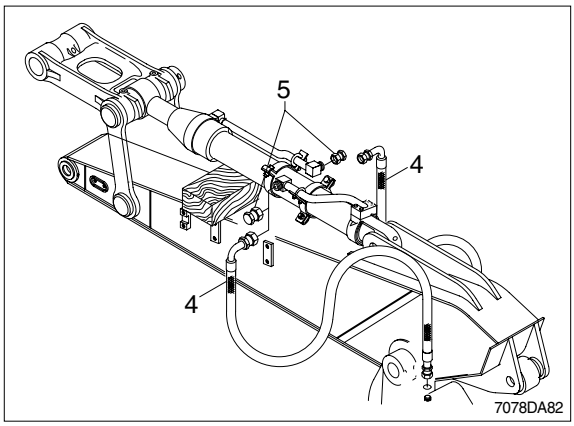
※ Tie the rod with wire to prevent it from coming out.

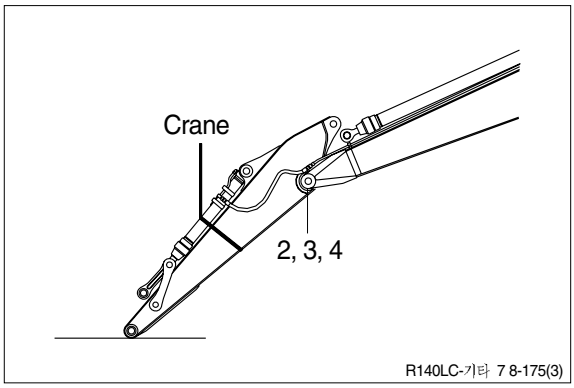
④ For details, see **removal of arm cylinder assembly**.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt(2), plate(3) and pull out the pin(4) then remove the arm assembly.
· Weight : 250kg(550lb)

※ When lifting the arm assembly, always lift the center of gravity.


R140LC-기타 7 8-175(1)





(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

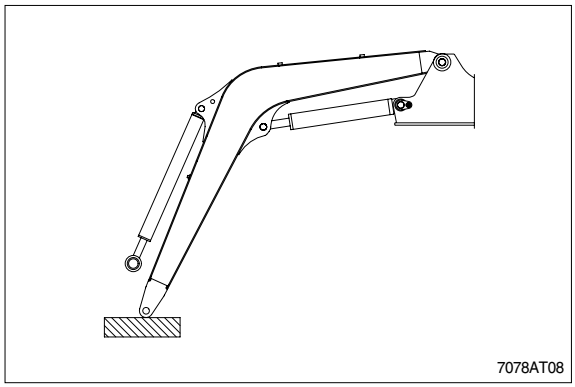
※ Bleed the air from the cylinder.

3) BOOM ASSEMBLY

(1) Removal

① Remove arm and bucket assembly.
For details, see **removal of arm and bucket assembly**.

② Remove boom cylinder assembly from boom.
For details, see **removal of boom cylinder assembly**.

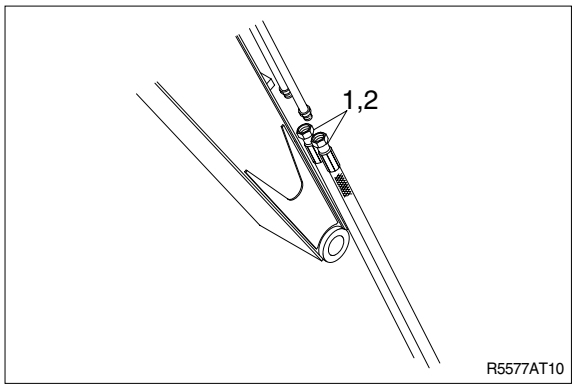


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose(2) and arm cylinder hose(1).

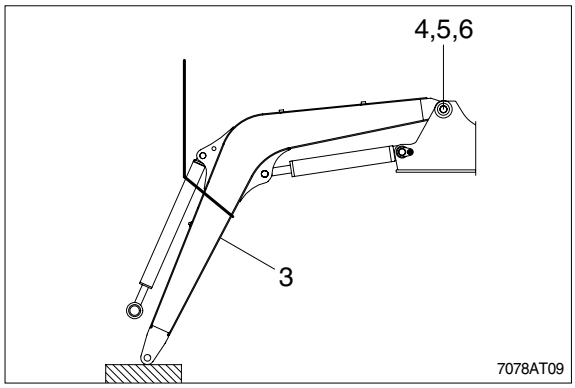
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly(3).



⑥ Remove bolt(4), plate(5) and pull out the pin(6) then remove boom assembly.
· Weight :570kg(1260lb)

※ When lifting the boom assembly always lift the center of gravity.

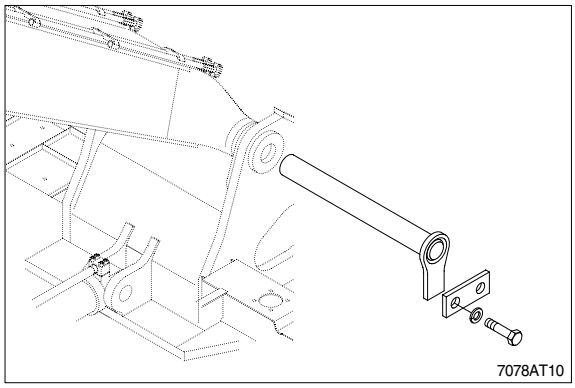


(2) Install

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.



SECTION 9 COMPONENT MOUNTING TORQUE

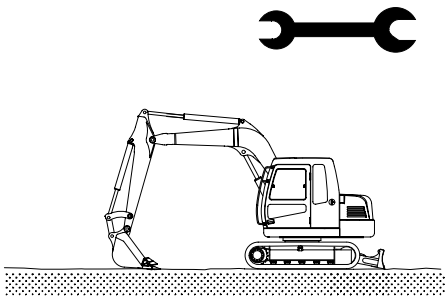
SECTION 9 COMPONENT MOUNTING TORQUE

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.**

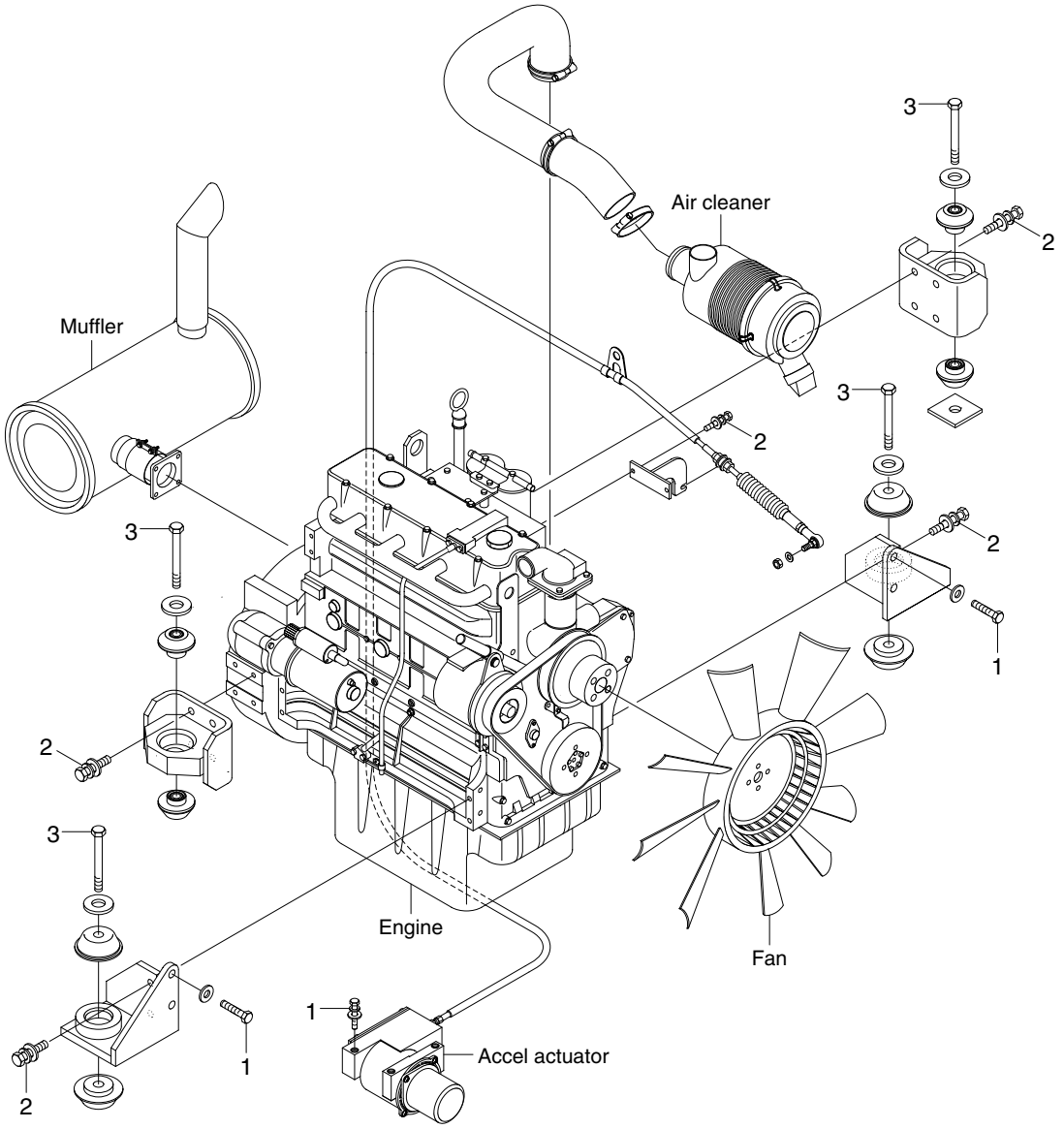
※ **Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.**



7079CM14

GROUP 2 ENGINE SYSTEM

1. ENGINE AND ACCESSORIES MOUNTING

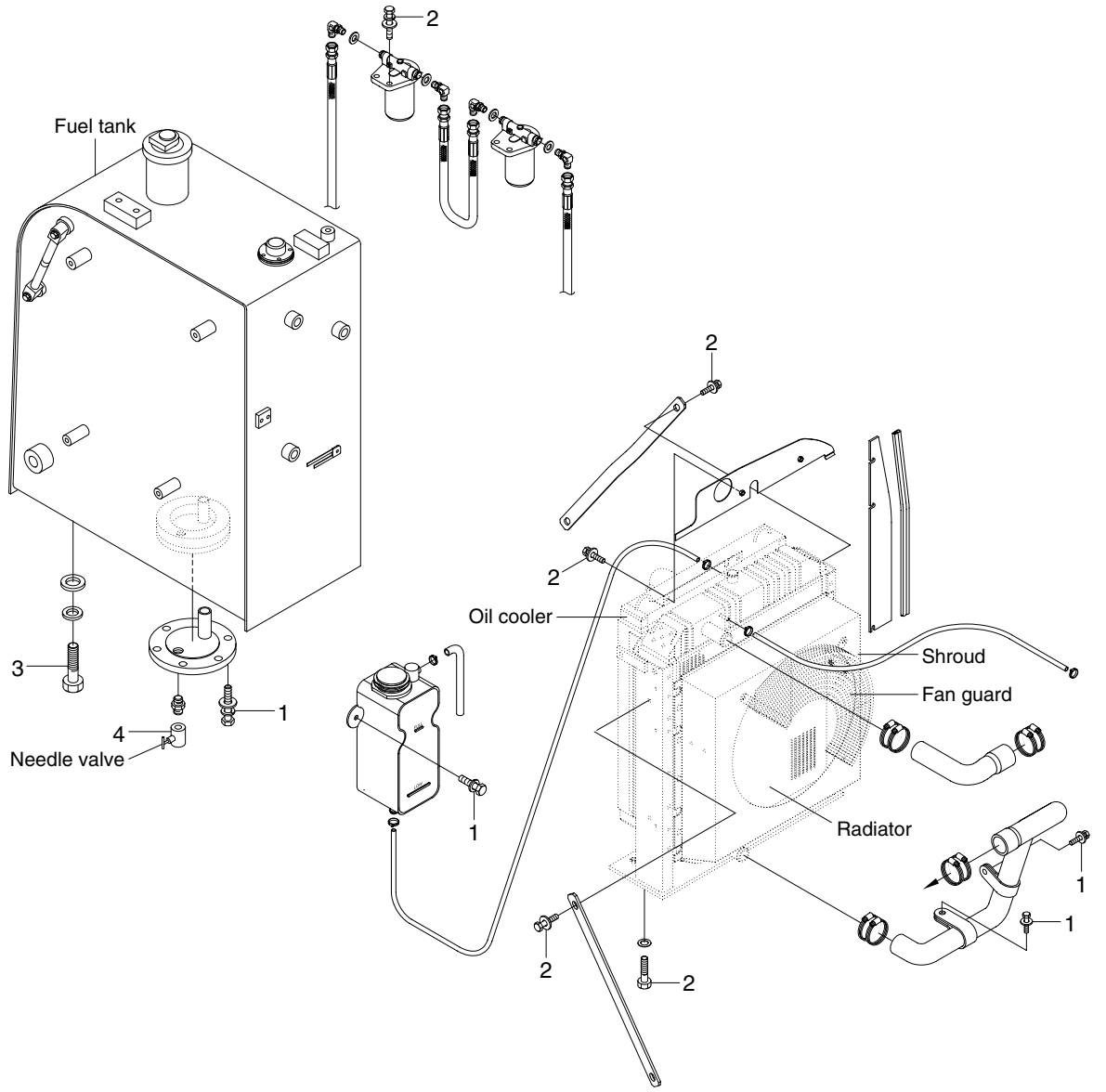


· Tightening torque

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±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M 16×2.0	25±0.5	181±19
-	-	-	-

2. COOLING SYSTEM AND FUEL TANK MOUNTING



RD8079CM02

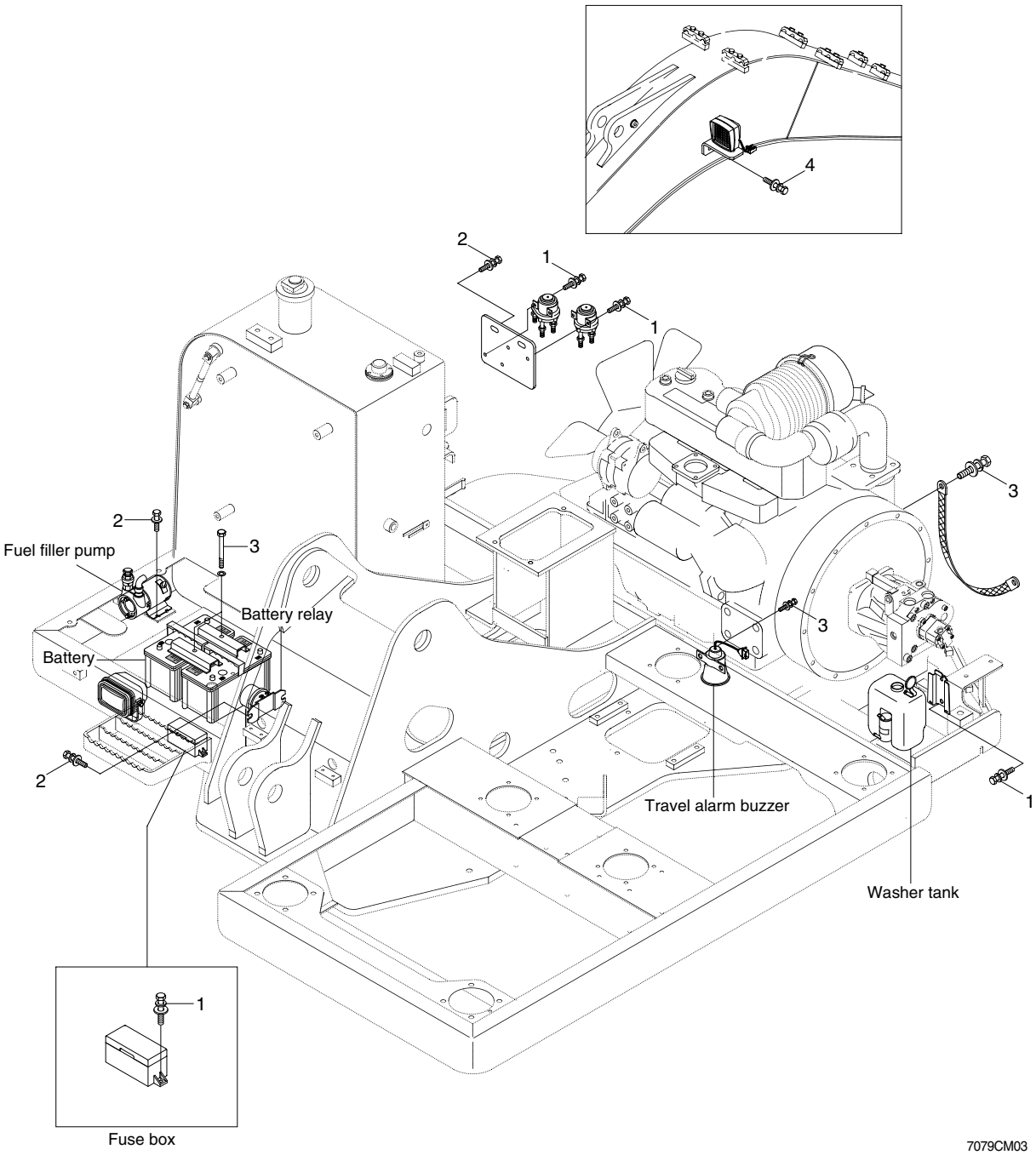
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8 ×1.25	2.5±0.5	18.1 ±3.6
2	M12×1.75	12.2±1.3	88.2±9.4

Item	Size	kgf · m	lbf · ft
3	M 16×2.0	29.7±4.5	215±36.2
4	-	2.3±0.6	16.6±4.3

GROUP 3 ELECTRIC SYSTEM

1. ELECTRIC COMPONENTS MOUNTING 1

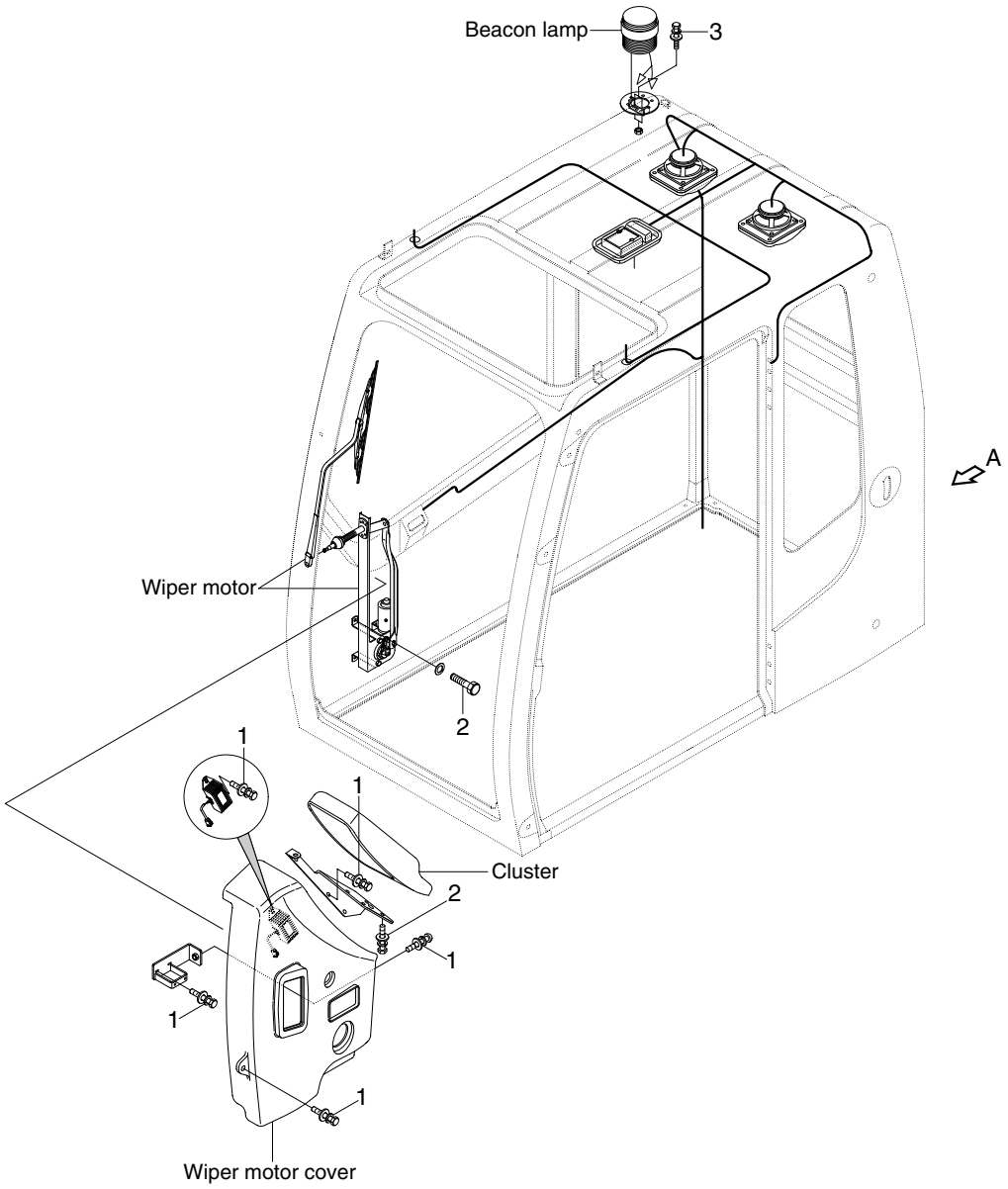


· Tightening torque

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	M 10 ×1.5	6.9±1.4	49.9±10.1
4	M 12 ×1.75	12.8±3.0	92.6±21.7

2. ELECTRIC COMPONENTS MOUNTING 2



7079CM04

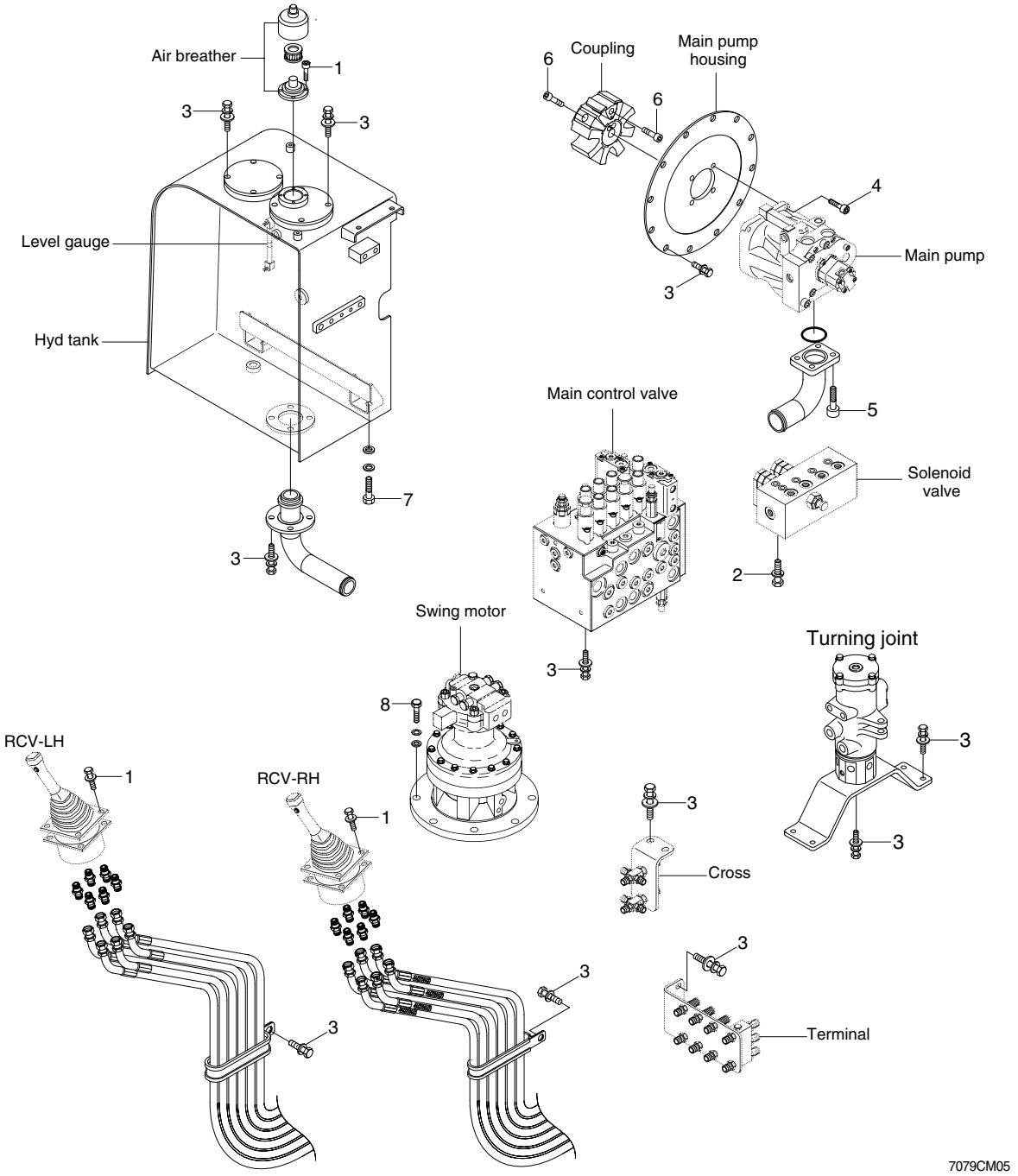
· Tightening torque

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
-	-	-	-

GROUP 4 HYDRAULIC SYSTEM

1. HYDRAULIC COMPONENTS MOUNTING 1

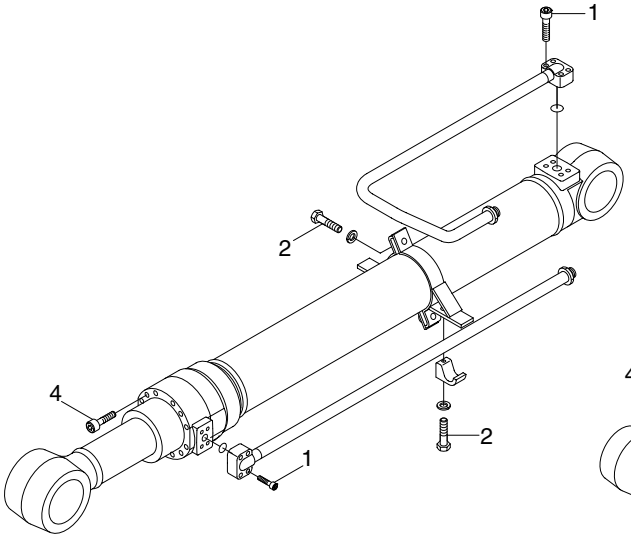


· Tightening torque

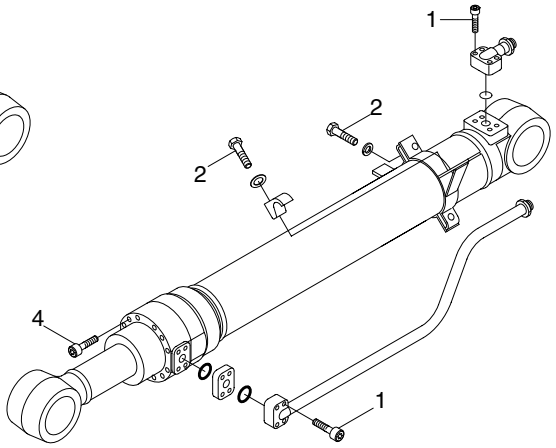
Item	Size	kgf · m	lbf · ft
1	M 6 ×1.0	1.44±0.3	10.4±2.2
2	M 8 ×1.25	2.5 ±0.5	18.1±3.6
3	M 10×1.5	6.9 ±1.4	49.9±10.1
4	M 12×1.75	12±1	86.8±7.2

Item	Size	kgf · m	lbf · ft
5	M 12×1.75	12.8±3.0	92.6±21.7
6	M 14×2.0	14±1	101±7.2
7	M 16×2.0	25±2.5	181±18.1
8	M 16×2.0	29.6±3.2	214 ±23.1

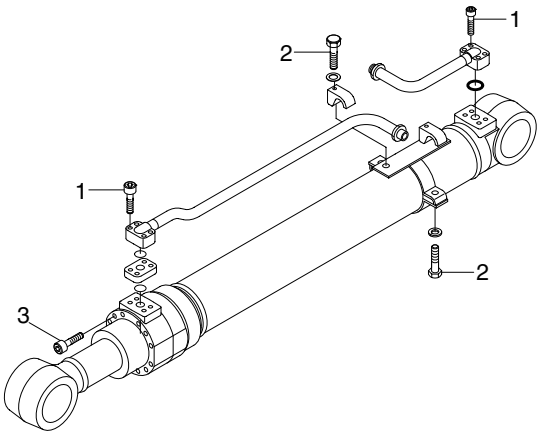
2. HYDRAULIC COMPONENTS MOUNTING 2



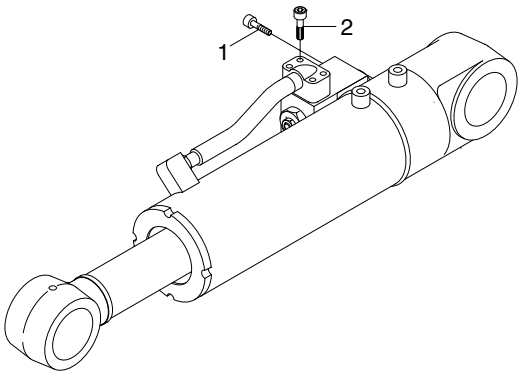
BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER



DOZER CYLINDER

7079CM07

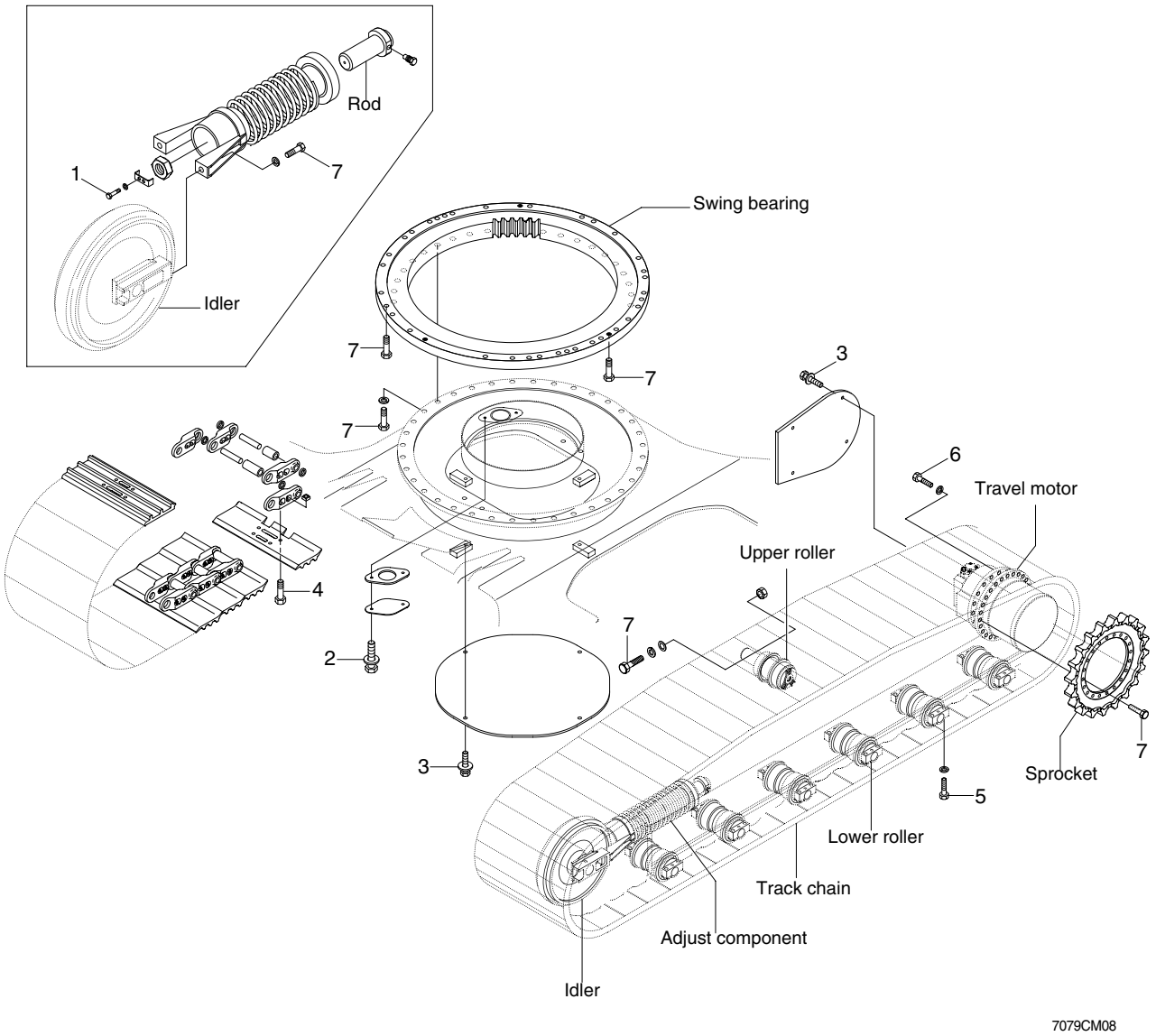
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.7±0.3	19.6±2.2
2	M10×1.5	3.2±0.3	23.1±2.2

Item	Size	kgf · m	lbf · ft
3	M12×1.75	9.4±1	68±7.2
4	M14×2.0	15±1.5	108±10.8

GROUP 5 UNDERCARRIAGE

ADJUST COMPONENT



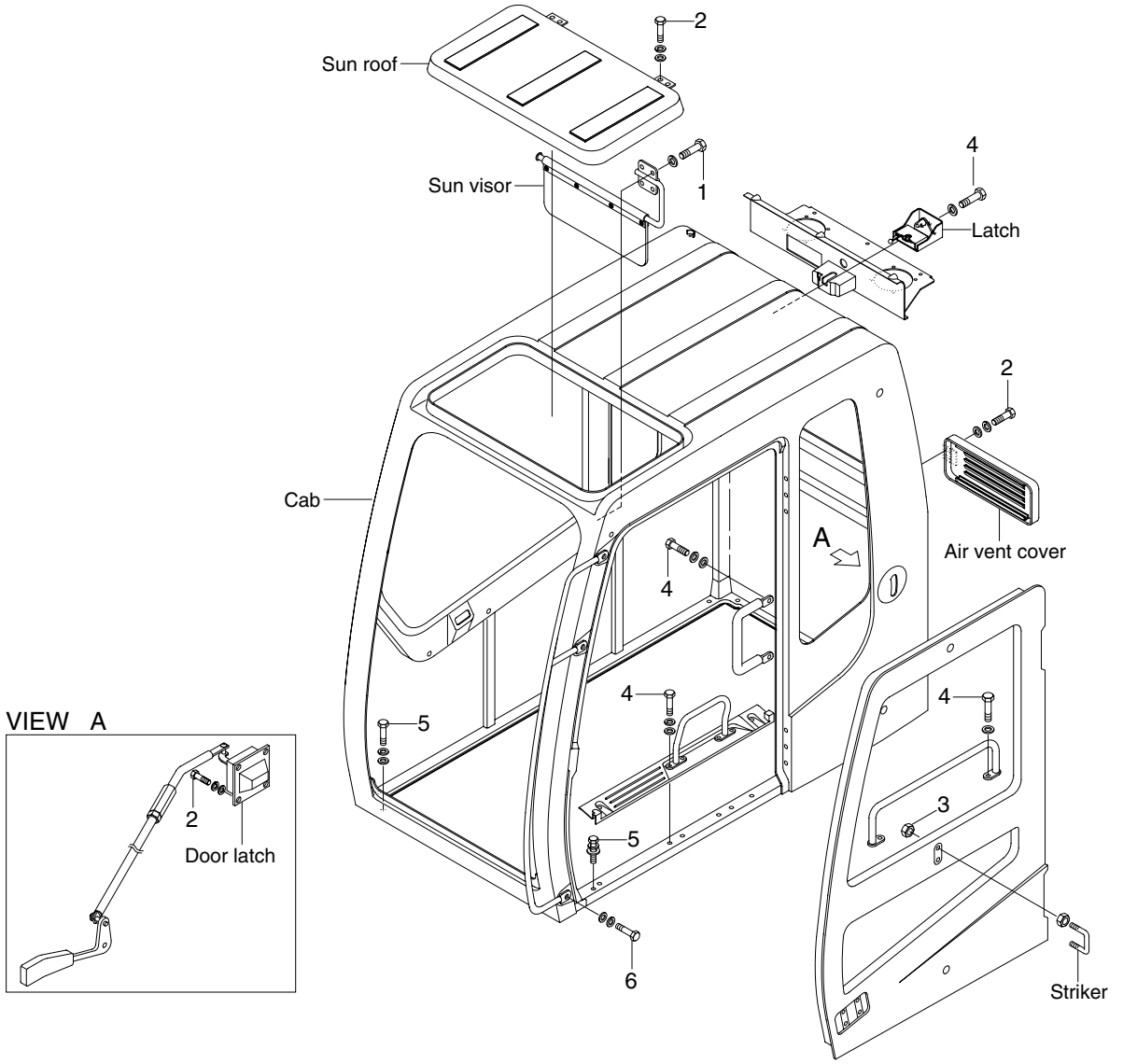
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	3.4±0.5	24.6±3.6
2	M10×1.5	6.9±1.4	49.9±10.1
3	M12×1.75	12.3±1.3	88.2±9.4
4	M14×1.5	25.5±2.5	184±18

Item	Size	kgf · m	lbf · ft
5	M14×2.0	19.6±2.5	142±18
6	M16×2.0	23±2.5	166±18.1
7	M16×2.0	29.7±4.7	215±32.5
-	-	-	-

GROUP 6 STRUCTURE

1. CAB AND ACCESSORIES MOUNTING



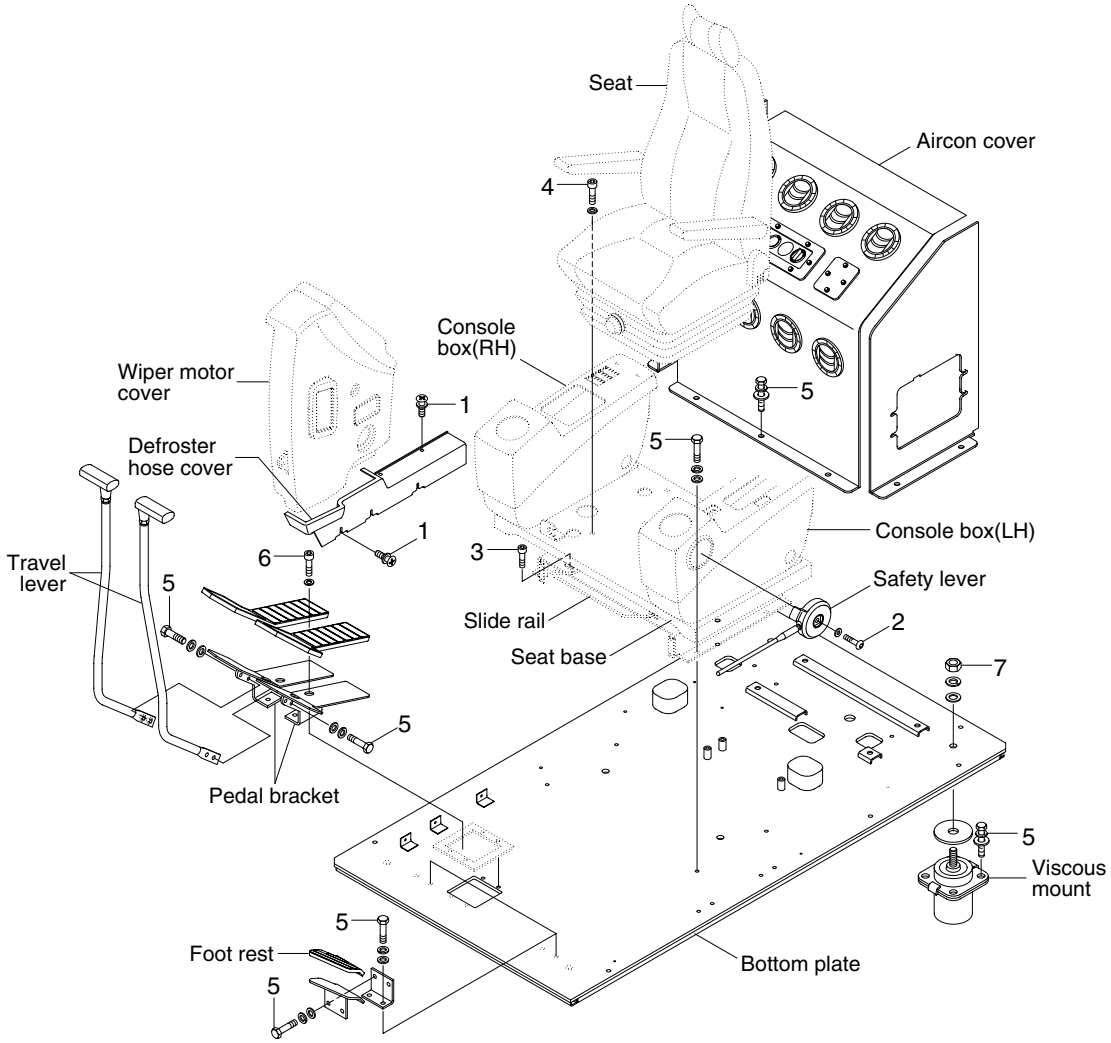
11079CM09

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6 × 1.0	0.49 ± 0.1	3.5 ± 0.7
2	M 8 × 1.25	2.5 ± 0.5	18.1 ± 3.6
3	M10 × 1.5	4.7 ± 0.9	34 ± 6.5

Item	Size	kgf · m	lbf · ft
4	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
5	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
6	M16 × 2.0	29.7 ± 4.5	215 ± 32.5

2. CAB INTERIOR MOUNTING



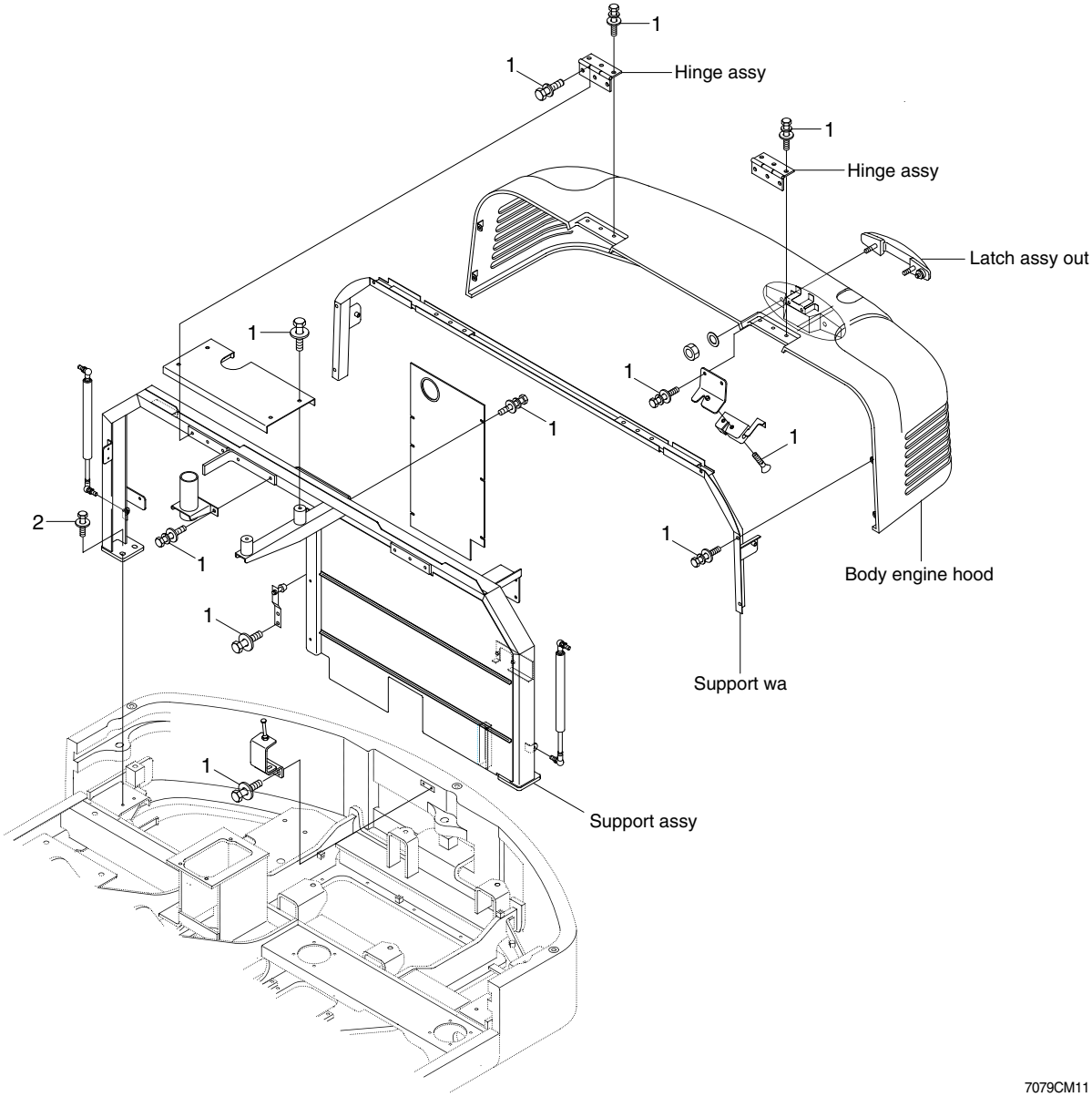
RD8079CM10

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	0.49±0.1	3.5±0.7
2	M 6×1.0	1.05±0.2	7.6±1.4
3	M 8×1.25	3.43±0.7	24.8±5.1
4	M 8×1.25	4.05±0.8	29.3±5.8

Item	Size	kgf · m	lbf · ft
5	M10×1.5	6.9±1.4	49.9±10.1
6	M10×1.5	8.27±1.7	59.8±12.3
7	M16×2.0	29.7±4.5	215±32.5
-	-	-	-

3. COWLING MOUNTING



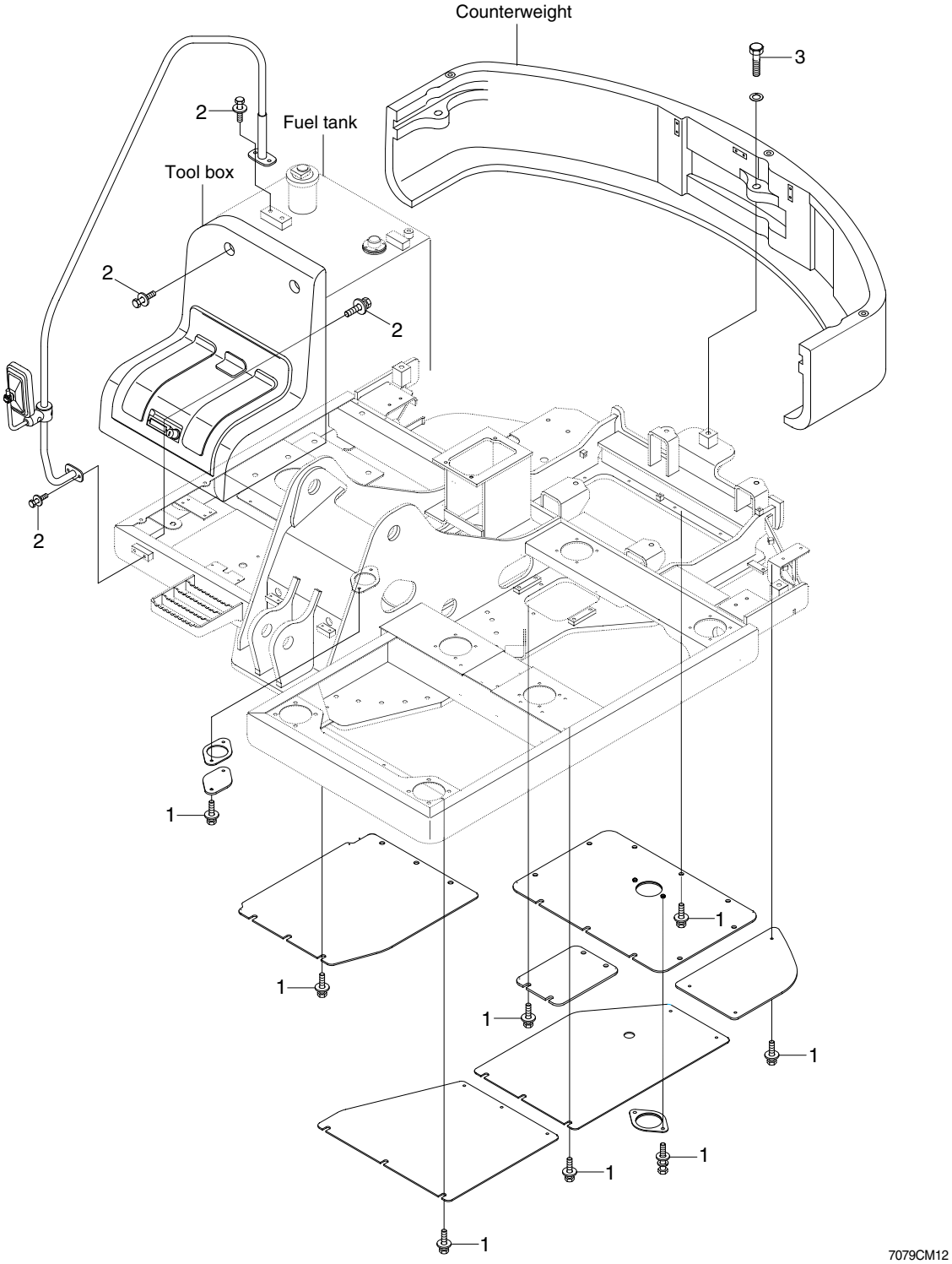
7079CM11

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
2	M12×1.75	12.8±3.0	92.6±21.7

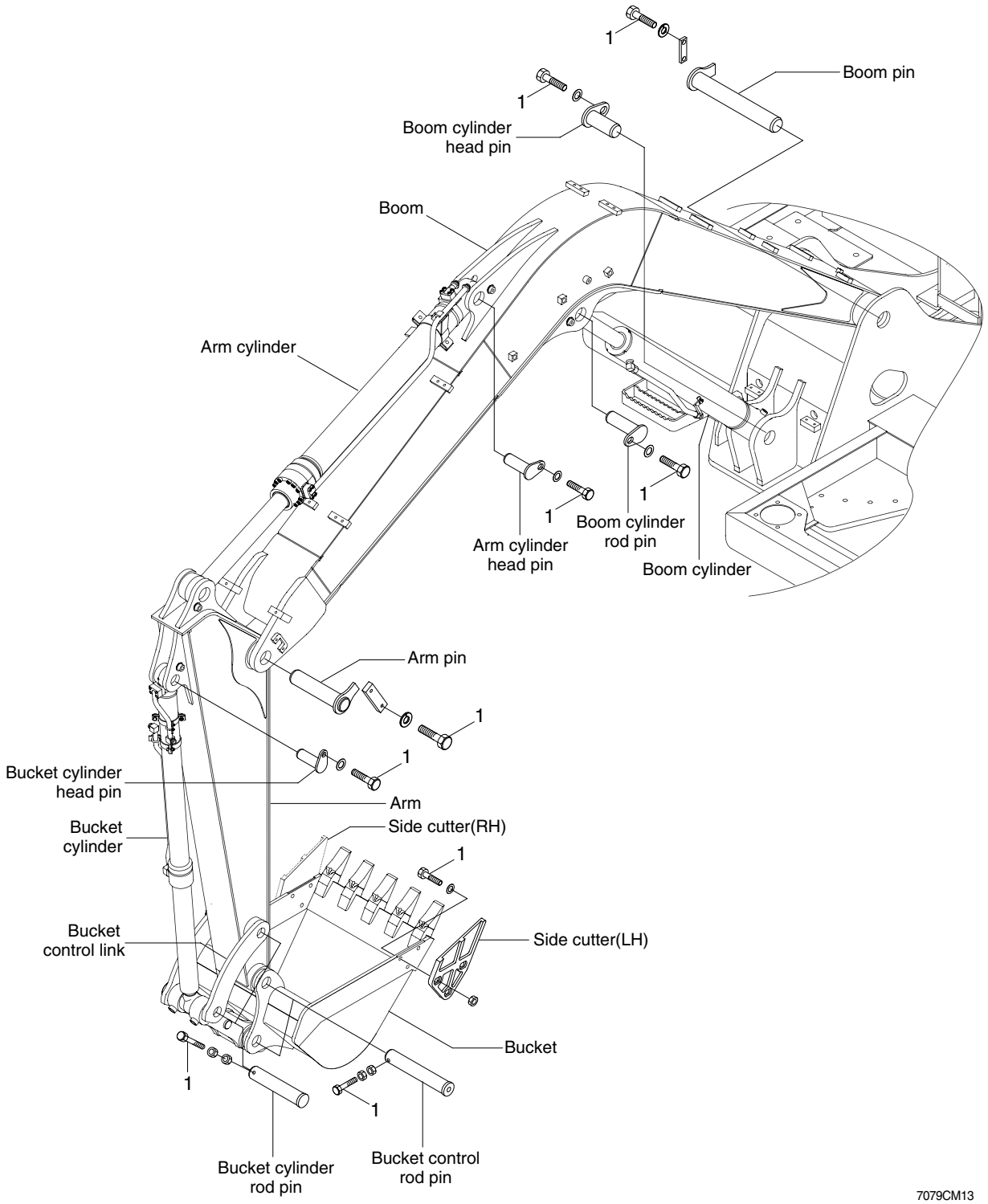
4. COUNTERWEIGHT AND COVERS MOUNTING



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
3	M20×2.5	57.8±6.4	418±46.3
-	-	-	-



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M12×1.75	12.8±3.0	92.6±21.7