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SECTION 6 MAINTENANCE STANDARD

SECTION 7 DISASSEMBLY AND ASSEMBLY

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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

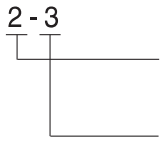
Distribution and updating

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



Item number(2. Structure and Function)

Consecutive page number for each item.

3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.

10 - 4
10 - 4 - 1
10 - 4 - 2 ┐ Added pages
10 - 5

Revised edition mark(①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

   Convert 55mm into inches.

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

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

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

2. Convert 550mm into inches.

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

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

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

Millimeters to inches

1mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

Kilogram to Pound

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 l = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 l = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

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

kgf/cm² to lbf/in²

1kgf / cm² = 14.2233lbf / in²

	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

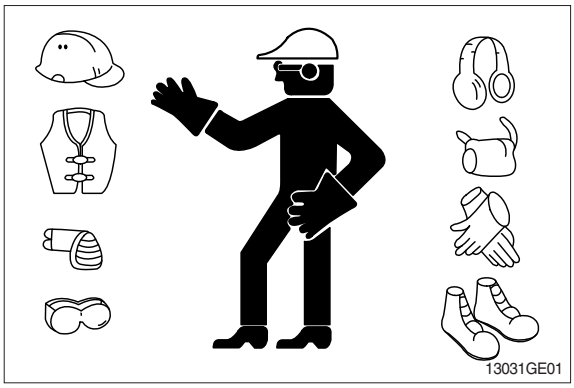
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

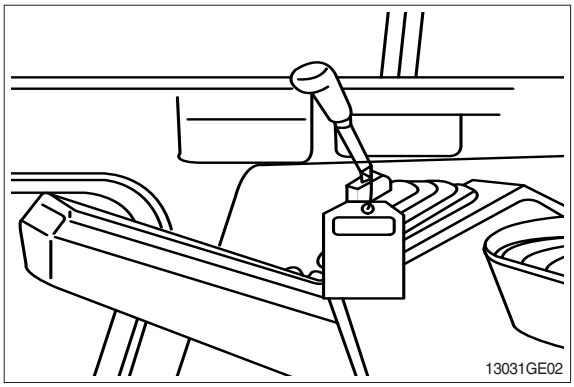
WEAR PROTECTIVE CLOTHING

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



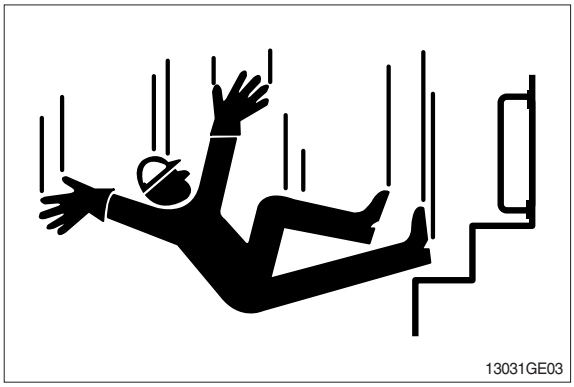
WARN OTHERS OF SERVICE WORK

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.

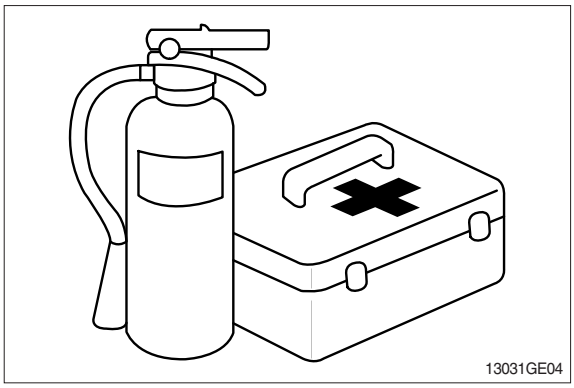


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

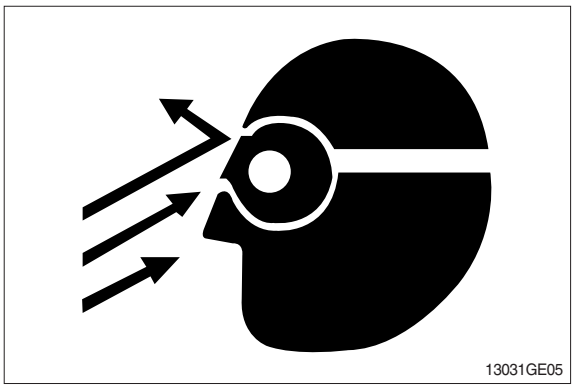
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

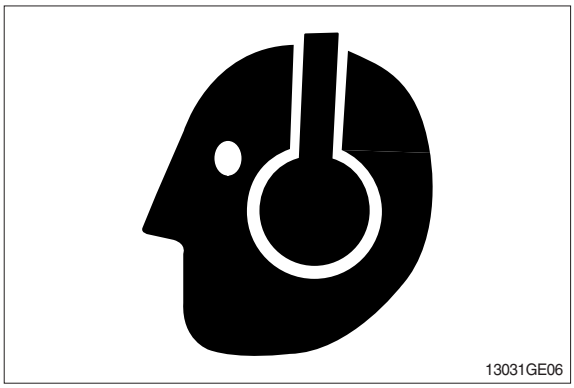
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

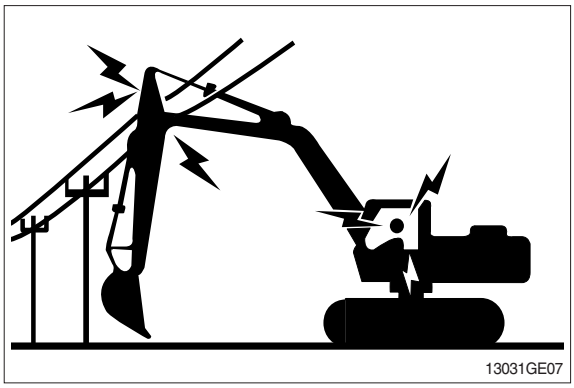
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

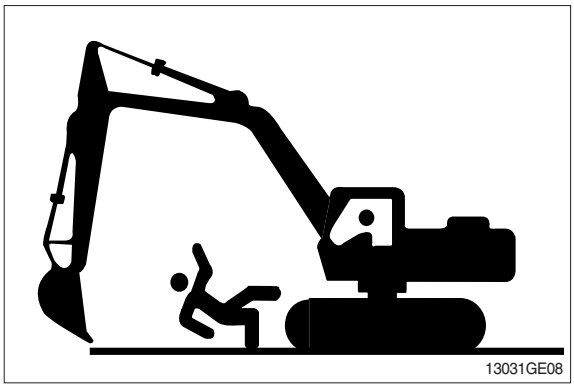
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



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.

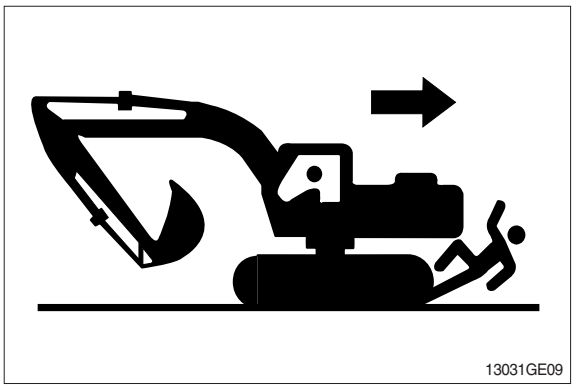

13031GE08

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

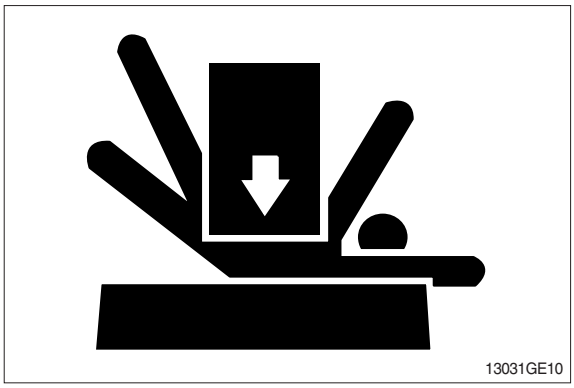
Before working on the machine:

- 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.

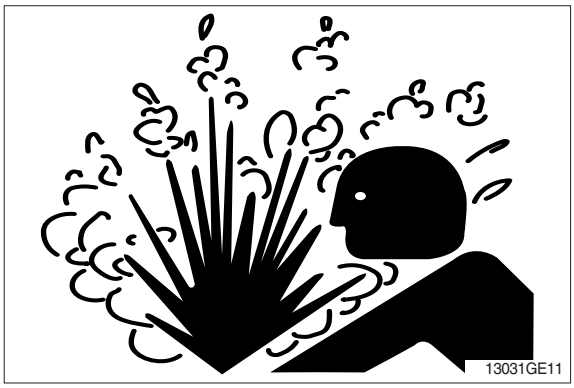
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



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.



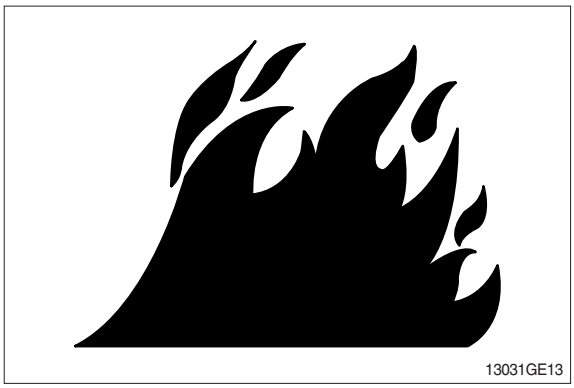
HANDLE FLUIDS SAFELY-AVOID FIRES

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.

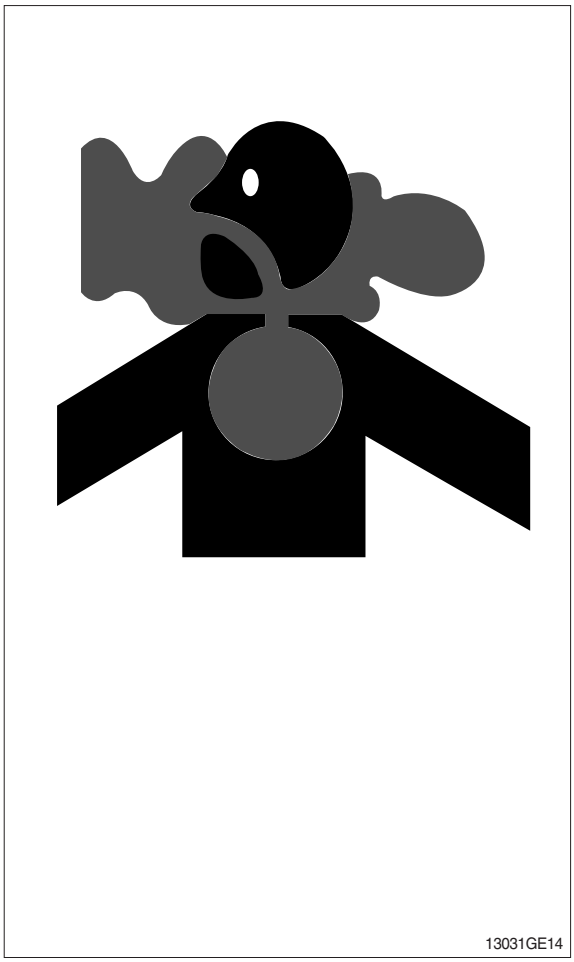
Do not store oily rags; They can ignite and burn spontaneously.



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.

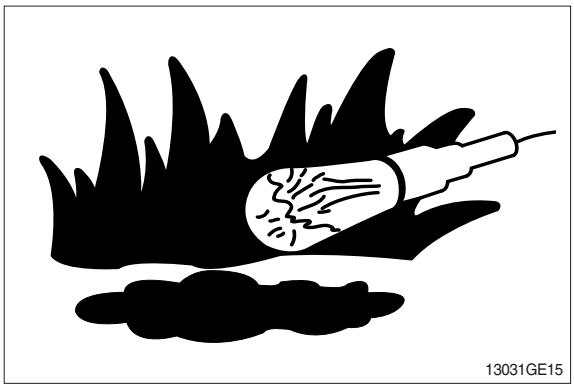
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

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

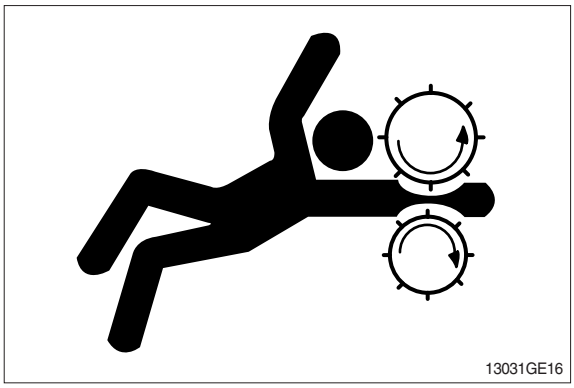
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



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.

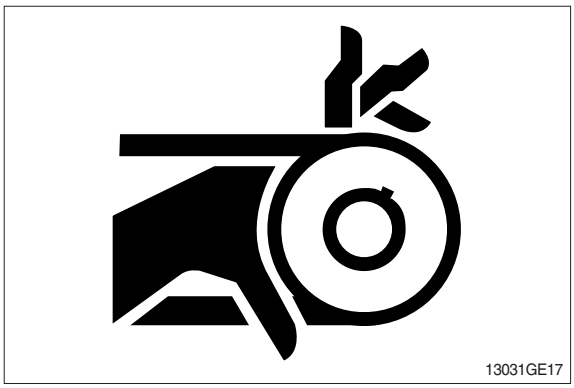
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



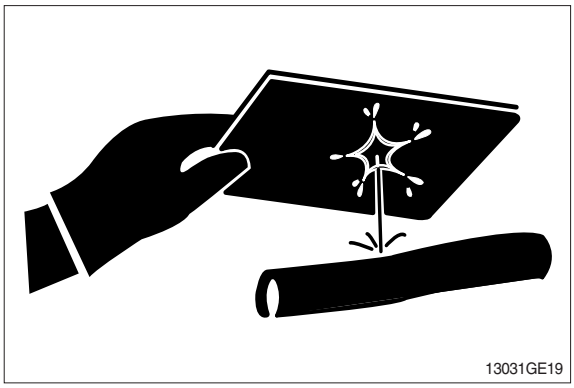
AVOID HIGH PRESSURE FLUIDS

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.

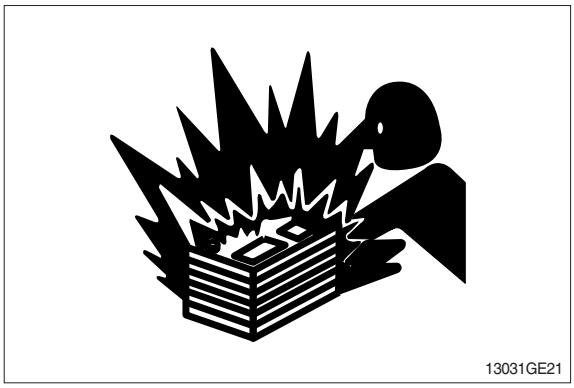
Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.

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:

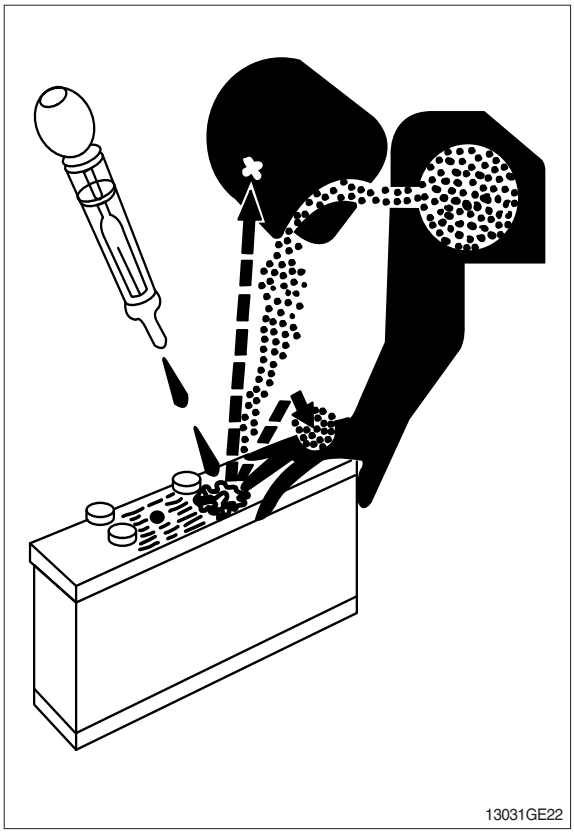
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

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.



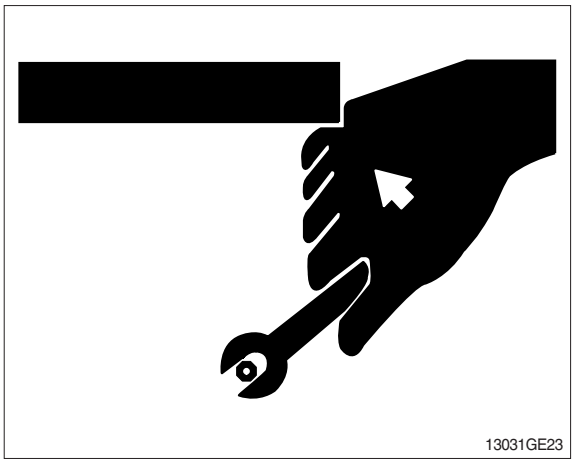
USE TOOLS PROPERLY

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.(aee Parts catalogue.)

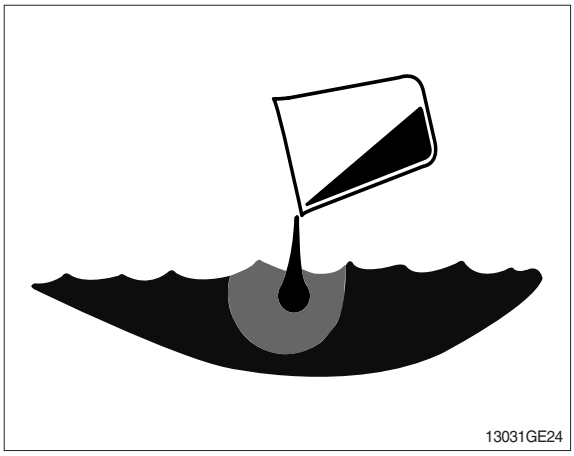

13031GE23

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.

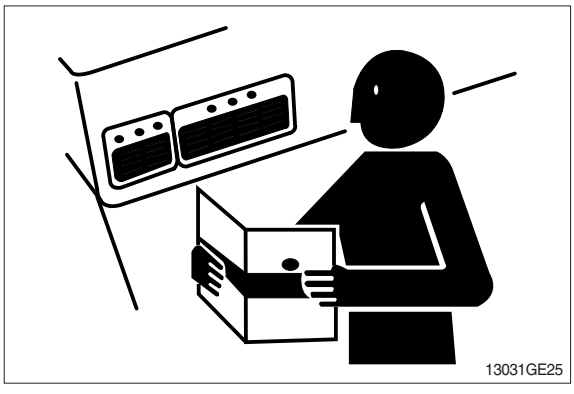
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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.


13031GE24

REPLACE SAFETY SIGNS

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

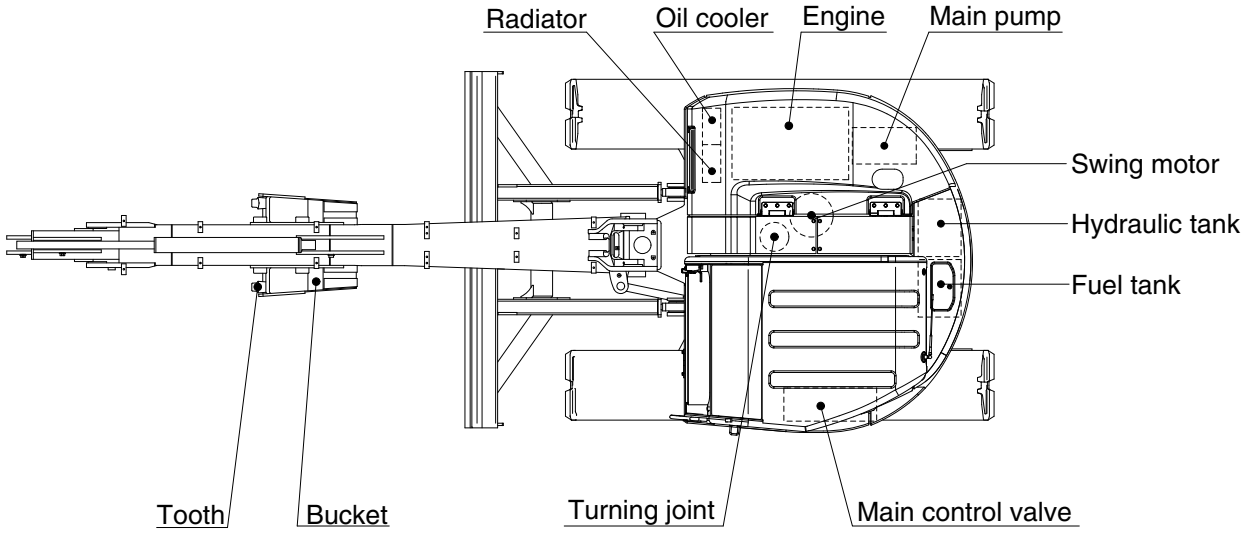

13031GE25

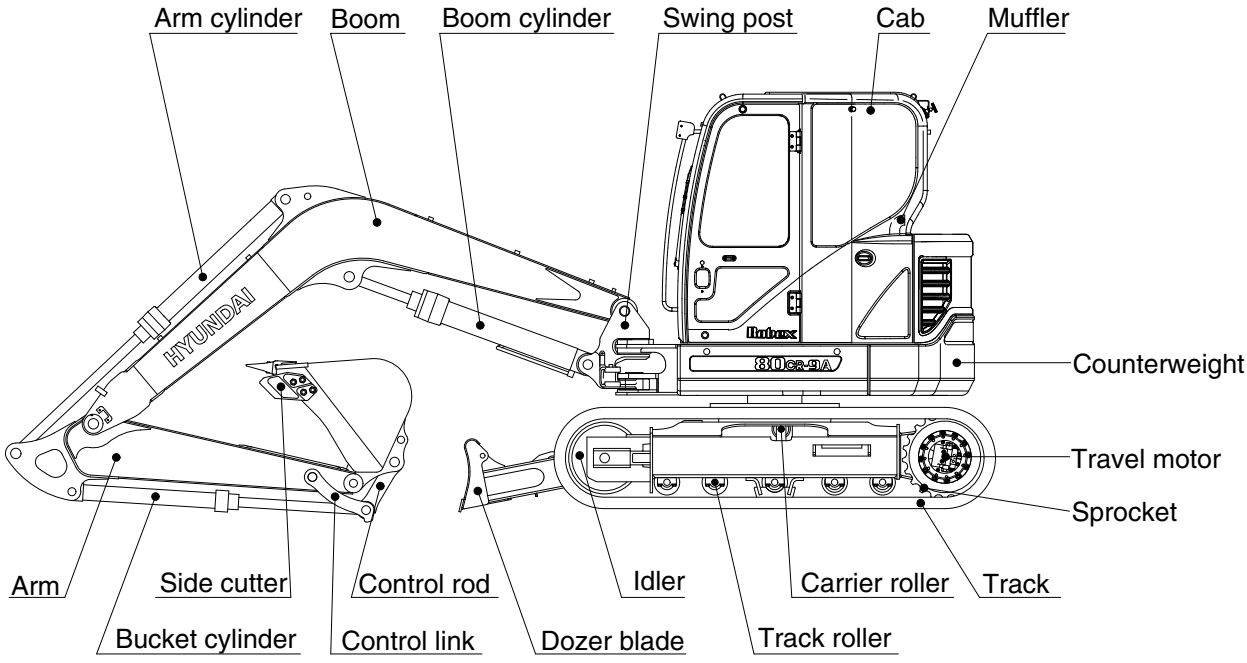
LIVE WITH SAFETY

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

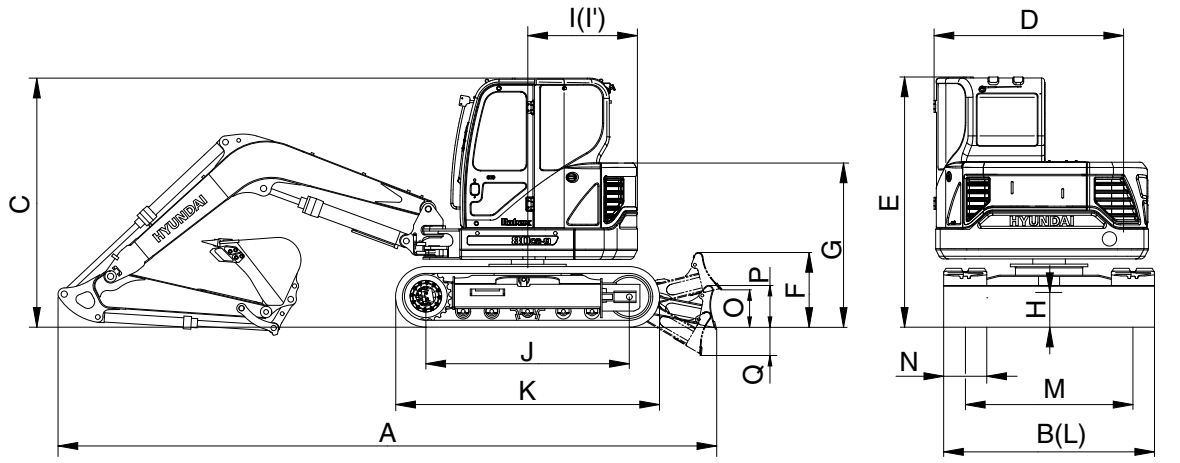




80CR9A2SP01

2. SPECIFICATIONS

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

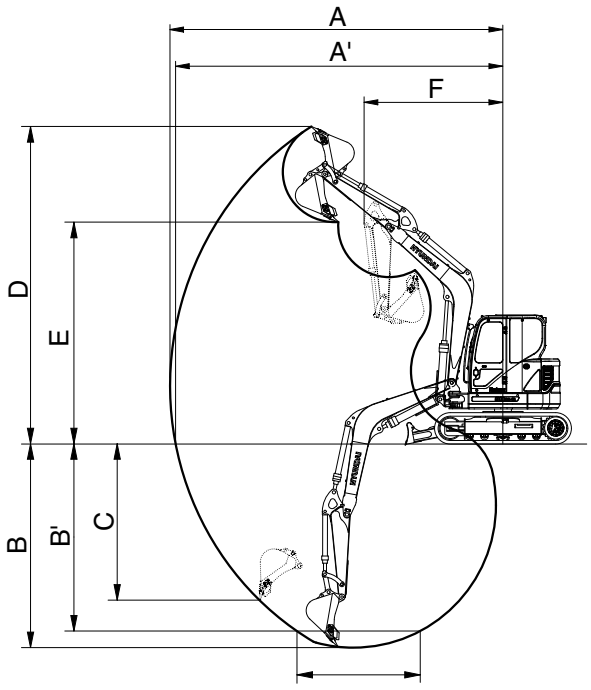


80CR92SP02

Description		Unit	Specification
Operating weight		kg (lb)	8350 (18410)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.28 (0.25)
Overall length	A	mm (ft-in)	6170 (20' 3")
Overall width, with 450 mm shoe	B		2300 (7' 7")
Overall height	C		2640 (8' 8")
Superstructure width	D		2220 (7' 3")
Overall height of cab	E		2640 (8' 8")
Ground clearance of counterweight	F		740 (2' 5")
Engine cover height	G		1750 (5' 9")
Minimum ground clearance	H		360 (1' 2")
Rear-end distance	I		1280 (4' 2")
Rear-end swing radius	I'		1280 (4' 2")
Distance between tumblers	J		2200 (7' 3")
Undercarriage length	K		2790 (9' 2")
Undercarriage width	L		2300 (7' 7")
Track gauge	M		1850 (6' 1")
Track shoe width, standard	N		450 (1' 6")
Height of blade	O		460 (1' 6")
Ground clearance of blade up	P		400 (1' 4")
Depth of blade down	Q		280 (0' 11")
Travel speed (Low/high)		km/hr (mph)	2.8/4.6 (1.7/2.9)
Swing speed		rpm	9.1
Gradeability		Degree (%)	30 (58)
Ground pressure (450 mm shoe)		kgf/cm^2 (psi)	0.39 (5.55)
Max traction force		kg (lb)	7400 (16310)

3. WORKING RANGE

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



80CR92SP03

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

4. WEIGHT

Item	kg	lb
Upperstructure assembly	4090	9020
Main frame weld assembly	720	1590
Engine assembly	270	600
Main pump assembly	60	130
Main control valve assembly	40	90
Swing motor assembly	80	170
Hydraulic oil tank assembly	75	165
Fuel tank assembly	70	155
Boom swing post	260	570
Counterweight	930	2050
Cab assembly	380	840
Lower chassis assembly	2940	6480
Track frame weld assembly	990	2180
Swing bearing	140	310
Travel motor assembly	85	190
Turning joint	30	60
Track recoil spring (2EA)	110	240
Idler (2EA)	130	290
Carrier roller (2EA)	16	35
Track roller (10EA)	160	360
Track-chain assembly (450 ㎜ standard triple grouser shoe, 2EA)	810	1790
Dozer blade assembly	320	700
Front attachment assembly (3.4 m boom,1.67 m arm, 0.28 m^3 SAE heaped bucket)	1170	2580
3.4 m boom assembly	420	930
1.67 m arm assembly	180	400
0.28 m^3 SAE heaped bucket	230	510
Boom cylinder assembly	110	240
Arm cylinder assembly	90	200
Bucket cylinder assembly	60	130
Dozer cylinder assembly	80	180
Bucket control link assembly	80	180
Boom swing cylinder assembly	70	150

5. LIFTING CAPACITIES

1) 3.4 m (11' 2") boom, 1.67 m (5' 6") arm equipped with 0.28 m³ (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade up with 930 kg (2050 lb) counterweight.

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

2) 3.4 m (11' 2") boom, 1.67 m (5' 6") arm equipped with 0.28 m³ (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade up with 930 kg (2050 lb) counterweight.

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

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

3) 3.4 m (11' 2") boom, 2.2 m (7' 3") arm equipped with 0.28 m³ (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade down with 930 kg (2050 lb) counterweight.

Load point height		Load radius								At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20 ft)		Capacity		Reach
												m (ft)
4.5 m	kg					*1180	*1180			*950	*950	5.54
(15.0 ft)	lb					*2600	*2600			*2090	*2090	(18.2)
3.0 m	kg					*1410	*1410	*1400	850	*900	770	6.27
(10.0 ft)	lb					*3110	*3110	*3090	1870	*1980	1700	(20.6)
1.5 m	kg			*3300	2650	*1970	1350	*1570	800	*960	680	6.52
(5.0 ft)	lb			*7280	5840	*4340	2980	*3460	1760	*2120	1500	(21.4)
Ground	kg	*1300	*1300	*4600	2340	*2470	1230	*1730	760	*1130	680	6.37
Line	lb	*2870	*2870	*10140	5160	*5450	2710	*3810	1680	*2490	1500	(20.9)
-1.5 m	kg	*3020	*3020	*4570	2290	*2570	1180			*1560	800	5.76
(-5.0 ft)	lb	*6660	*6660	*10080	5050	*5670	2600			*3440	1760	(18.9)
-3.0 m	kg	*5280	*5280	*3500	2370					*1870	1240	4.49
(-10.0 ft)	lb	*11640	*11640	*7720	5220					*4120	2730	(14.7)

4) 3.4 m (11' 2") boom, 2.2 m (7' 3") arm equipped with 0.28 m³ (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade up with 930 kg (2050 lb) counterweight.

Load point height		Load radius								At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20 ft)		Capacity		Reach
												m (ft)
4.5 m	kg					*1180	*1180			*950	920	5.54
(15.0 ft)	lb					*2600	*2600			*2090	2030	(18.2)
3.0 m	kg					*1410	1350	840	760	760	690	6.27
(10.0 ft)	lb					*3110	2980	1850	1680	1680	1520	(20.6)
1.5 m	kg			2720	2390	1350	1220	800	720	670	600	6.52
(5.0 ft)	lb			6000	5270	2980	2690	1760	1590	1480	1320	(21.4)
Ground	kg	*1300	*1300	2400	2090	1230	1100	750	680	670	610	6.37
Line	lb	*2870	*2870	5290	4610	2710	2430	1650	1500	1480	1340	(20.9)
-1.5 m	kg	*3020	*3020	2350	2040	1180	1050			790	710	5.76
(-5.0 ft)	lb	*6660	*6660	5180	4500	2600	2310			1740	1570	(18.9)
-3.0 m	kg	*5280	*5280	2430	2120					1240	1110	4.49
(-10.0 ft)	lb	*11640	*11640	5360	4670					2730	2450	(14.7)

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.

5) 3.4 m (11' 2") boom, 2.2 m (7' 3") arm equipped with 0.28 m³ (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade down with 1330 kg (2930 lb) counterweight.

Load point height		Load radius								At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20 ft)		Capacity		Reach
												m (ft)
4.5 m	kg					*1180	*1180			*950	*950	5.54
(15.0 ft)	lb					*2600	*2600			*2090	*2090	(18.2)
3.0 m	kg					*1410	*1410	*1400	990	*900	900	6.27
(10.0 ft)	lb					*3110	*3110	*3090	2180	*1980	1980	(20.6)
1.5 m	kg			*3300	3000	*1970	1550	*1570	940	*960	800	6.52
(5.0 ft)	lb			*7280	6610	*4340	3420	*3460	2070	*2120	1760	(21.4)
Ground	kg	*1300	*1300	*4600	2690	*2470	1430	*1730	900	*1130	810	6.37
Line	lb	*2870	*2870	*10140	5930	*5450	3150	*3810	1980	*2490	1790	(20.9)
-1.5 m	kg	*3020	*3020	*4570	2640	*2570	1380			*1560	950	5.76
(-5.0 ft)	lb	*6660	*6660	*10080	5820	*5670	3040			*3440	2090	(18.9)
-3.0 m	kg	*5280	*5280	*3500	2720					*1870	1440	4.49
(-10.0 ft)	lb	*11640	*11640	*7720	6000					*4120	3170	(14.7)

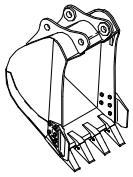
6) 3.4 m (11' 2") boom, 2.2 m (7' 3") arm equipped with 0.28 m³ (SAE heaped) bucket and 450 mm (18") triple grouser shoe and dozer blade up with 1330 kg (2930 lb) counterweight.

Load point height		Load radius								At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20 ft)		Capacity		Reach
												m (ft)
4.5 m	kg					*1180	*1180			*950	*950	5.54
(15.0 ft)	lb					*2600	*2600			*2090	*2090	(18.2)
3.0 m	kg					*1410	*1410	990	900	900	820	6.27
(10.0 ft)	lb					*3110	*3110	2180	1980	1980	1810	(20.6)
1.5 m	kg			3100	2720	1560	1410	940	850	800	720	6.52
(5.0 ft)	lb			6830	6000	3440	3110	2070	1870	1760	1590	(21.4)
Ground	kg	*1300	*1300	2780	2420	1440	1290	900	810	810	730	6.37
Line	lb	*2870	*2870	6130	5340	3170	2840	1980	1790	1790	1610	(20.9)
-1.5 m	kg	*3020	*3020	2730	2370	1390	1240			950	850	5.76
(-5.0 ft)	lb	*6660	*6660	6020	5220	3060	2730			2090	1870	(18.9)
-3.0 m	kg	*5280	*5280	2810	2450					1450	1300	4.49
(-10.0 ft)	lb	*11640	*11640	6190	5400					3200	2870	(14.7)

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

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET



0.28 m^3 SAE heaped bucket

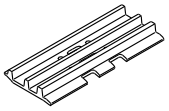
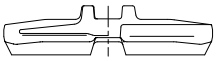
Capacity		Width		Weight	Recommendation
					3.4 m (11' 2") Mono boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.67 m arm (5' 6")
0.28 m^3 (0.37 yd^3)	0.25 m^3 (0.33 yd^3)	730 mm (28.7")	810 mm (31.9")	230 kg (510 lb)	Applicable for materials with density of 1600 kg/m^3 (2700 lb/yd^3)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

7. UNDERCARRIAGE

1) TRACKS

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

2) TYPES OF SHOES

Model	Shapes		Triple grouser		Rubber track
					
R80CR-9A	Shoe width	mm (in)	450 (18)	600 (24)	450 (18)
	Operating weight	kg (lb)	8350 (18410)	8510 (18760)	8250 (18190)
	Ground pressure	kgf/cm^2 (psi)	0.39 (5.55)	0.29 (4.12)	0.38 (5.40)
	Overall width	mm (ft-in)	2300 (7' 7")	2390 (7' 10")	2300 (7' 7")

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

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

4) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

※ Table 1

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

※ Table 2

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

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Yanmar 4TNV98C
Type	4-cycle diesel engine, low emission
Cooling method	Water cooling
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	98 × 110 mm (3.86" × 4.33")
Piston displacement	3319 cc (203 cu in)
Compression ratio	18:1
Rated gross horse power (SAE J1995)	66.9 Hp at 2400 rpm (49.9 kW at 2400 rpm)
Maximum torque at 1560 rpm	24.0 kgf · m (173.6 lbf · ft)
Engine oil quantity	11.6 ℓ (3.1 U.S. gal)
Dry weight	270 kg (595 lb)
High idling speed	2550 ± 50 rpm
Low idling speed	1000 ± 50 rpm
Rated fuel consumption	170 g/Hp · hr at 2100 rpm
Starting motor	12 V-3 kW
Alternator	12 V-60 A
Battery	1 × 12 V × 100 Ah

2) MAIN PUMP (P1, P2)

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 36 cc/rev
Maximum pressure	280 kgf/cm^2 (3980 psi)
Rated oil flow	2 × 68.4 ℓ /min (2 × 18.1 U.S.gpm)
Rated speed	1900 rpm

3) PISTON PUMP (P3)

Item	Specification
Type	Fixed displacement axis piston pump
Capacity	28 cc/rev
Maximum pressure	230 kgf/cm^2 (3270 psi)
Rated oil flow	53 ℓ /min (14 U.S.gpm)

4) GEAR PUMP (P4)

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	8.9 cc/rev
Maximum pressure	35 kgf/cm^2 (500 psi)
Rated oil flow	16.9 ℓ /min (4.5 U.S.gpm/3.7 U.K.gpm)

5) MAIN CONTROL VALVE

Item	Specification
Type	12 spools sectional inline
Operating method	Hydraulic pilot system
Main relief valve pressure P1, P2 / P3	280 kgf/cm^2 (3980psi) / 230 kgf/cm^2 (3270psi)
Overload relief valve pressure	310 kgf/cm^2 (4410psi)

6) SWING MOTOR

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

7) TRAVEL MOTOR

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

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø 115 × ø 70 × 850 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø 100 × ø 65 × 870 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø 85 × ø 55 × 685 mm
	Cushion	Extend only
Dozer cylinder	Bore dia × Rod dia × Stroke	ø 130 × ø 70 × 152 mm
	Cushion	-
Boom swing cylinder	Bore dia × Rod dia × Stroke	ø 110 × ø 60 × 744 mm
	Cushion	-

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

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

9) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
R80CR-9A	Steel	450 mm (18")	0.39 kgf/cm^2 (5.55 psi)	39	2300 mm (7' 7")
		600 mm (24")	0.29 kgf/cm^2 (4.12 psi)	39	2390 mm (7' 10")
	Rubber	450 mm (18")	0.38 kgf/cm^2 (5.40 psi)	-	2300 mm (7' 7")

10) BUCKET

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

2) RECOMMENDED OILS

HYUNDAI genuine lubricating oils have been developed to offer the best performance and service life for your equipment. These oils have been tested according to the specifications of HYUNDAI and, therefore, will meet the highest safety and quality requirements.

We recommend that you use only HYUNDAI genuine lubricating oils and grease officially approved by HYUNDAI.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature °C(°F) -50 (-58) -30 (-22) -20 (-4) -10 (14) 0 (32) 10 (50) 20 (68) 30 (86) 40 (104)
Engine oil pan	Engine oil	11.6 (3.1)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Grease	0.2 (0.1)	★NLGI NO.1 NLGI NO.2
Final drive	Gear oil	1.2×2 (0.3×2)	★SAE 75W-90 SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank; 71 (18.8) System; 120 (31.7)	★ISO VG 15 ISO VG 32 ISO VG 46, HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	120 (31.7)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (reservoir tank)	Mixture of antifreeze and water 50 : 50	11 (2.9)	Ethylene glycol base permanent type ★Ethylene glycol base permanent type (60 : 40)

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

★ : Cold region
Russia, CIS, Mongolia

★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm

★2 : Soft water
City water or distilled water

★3 : Hyundai Bio Hydraulic Oil
- For more information, contact HYUNDAI dealers.

※ Using any lubricating oils other than HYUNDAI genuine products may lead to a deterioration of performance and cause damage to major components.

※ Do not mix HYUNDAI genuine oil with any other lubricating oil as it may result in damage to the systems of major components.

※ Do not use any engine oil other than that specified above, as it may clog the diesel particulate filter(DPF).

※ For HYUNDAI genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact HYUNDAI dealers.

SECTION 2 STRUCTURE AND FUNCTION

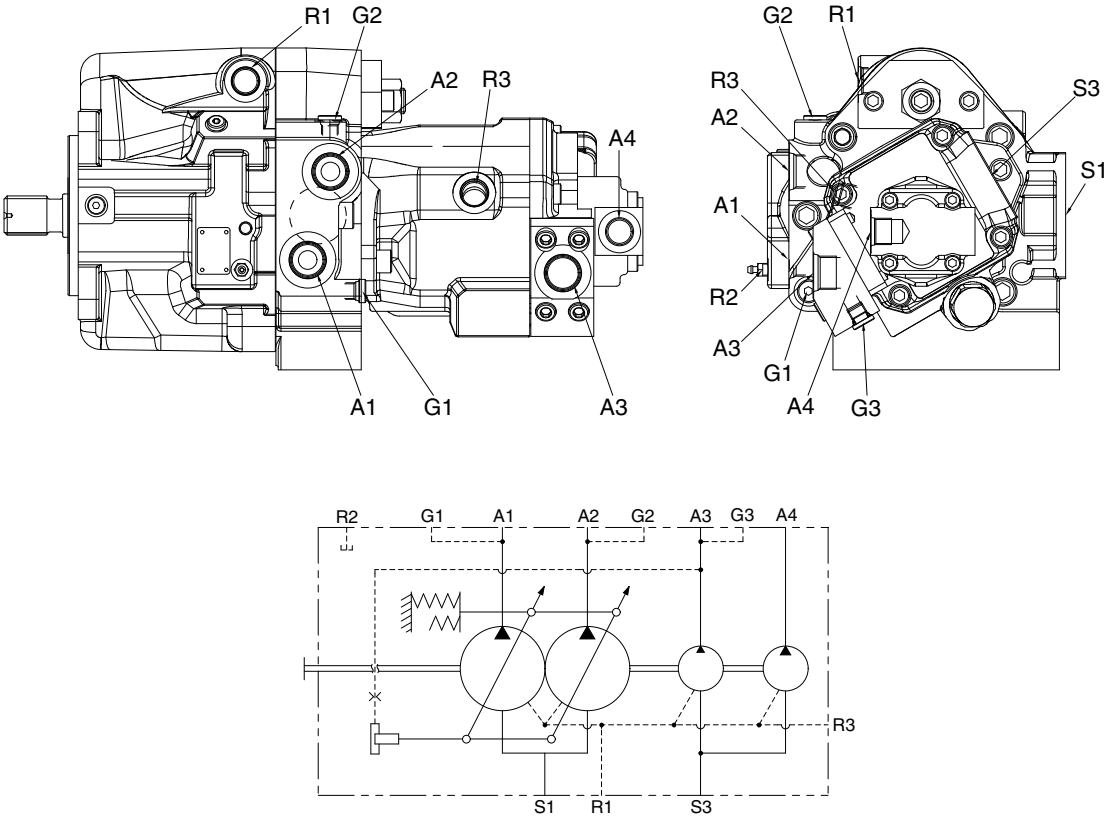
GROUP 1 HYDRAULIC PUMP

1. GENERAL

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

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

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



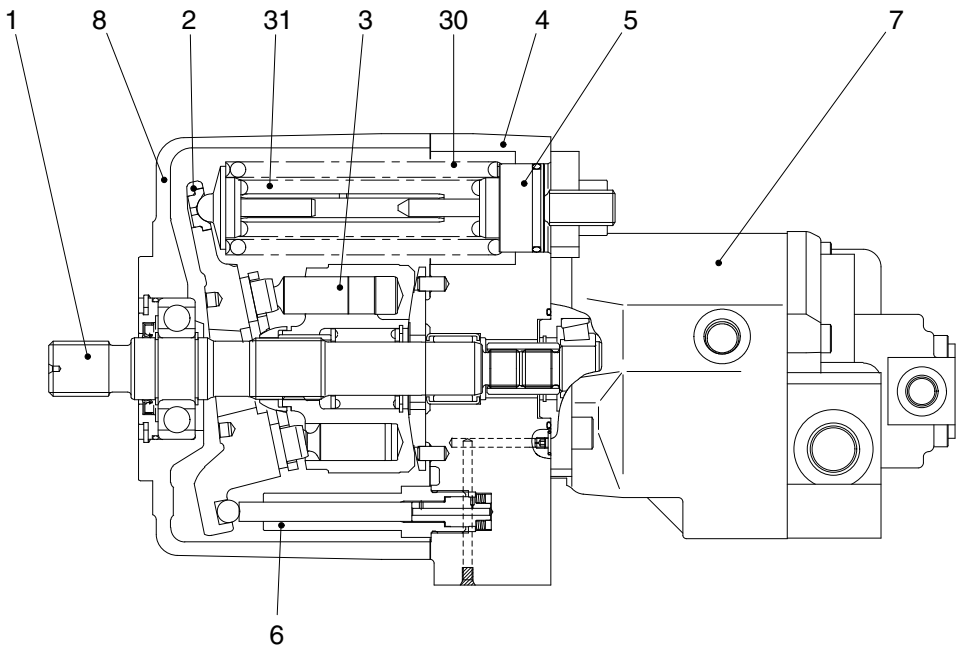
Hydraulic circuit

80CR92MP01

Description of the ports

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

2. PRINCIPAL COMPONENTS AND FUNCTIONS



80CR92MP02

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

SPECIFICATIONS

- Capacity : 2 × 36+28+8.9 cc/rev
- Rated oil flow : 2 × 68.4+53+16.9 ℓ /min
- Maximum pressure : 2 × 280+230+35 kgf/cm^2

1) PISTON PUMP

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

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

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

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

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

2) PRINCIPLE OF OPERATION

(1) Function of pump

Displacement q (cm^3)

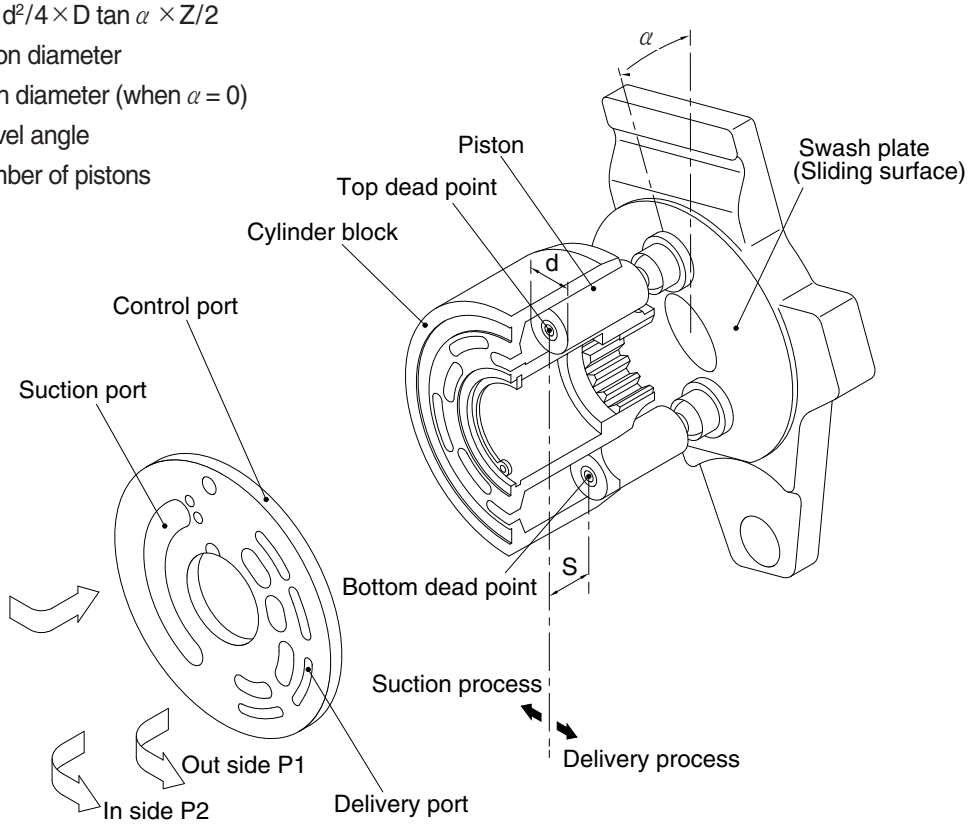
$q = \pi \times d^2/4 \times D \tan\alpha \times Z/2$

d : Piston diameter

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

α : Swivel angle

Z : Number of pistons



80CR92MP03

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

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

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

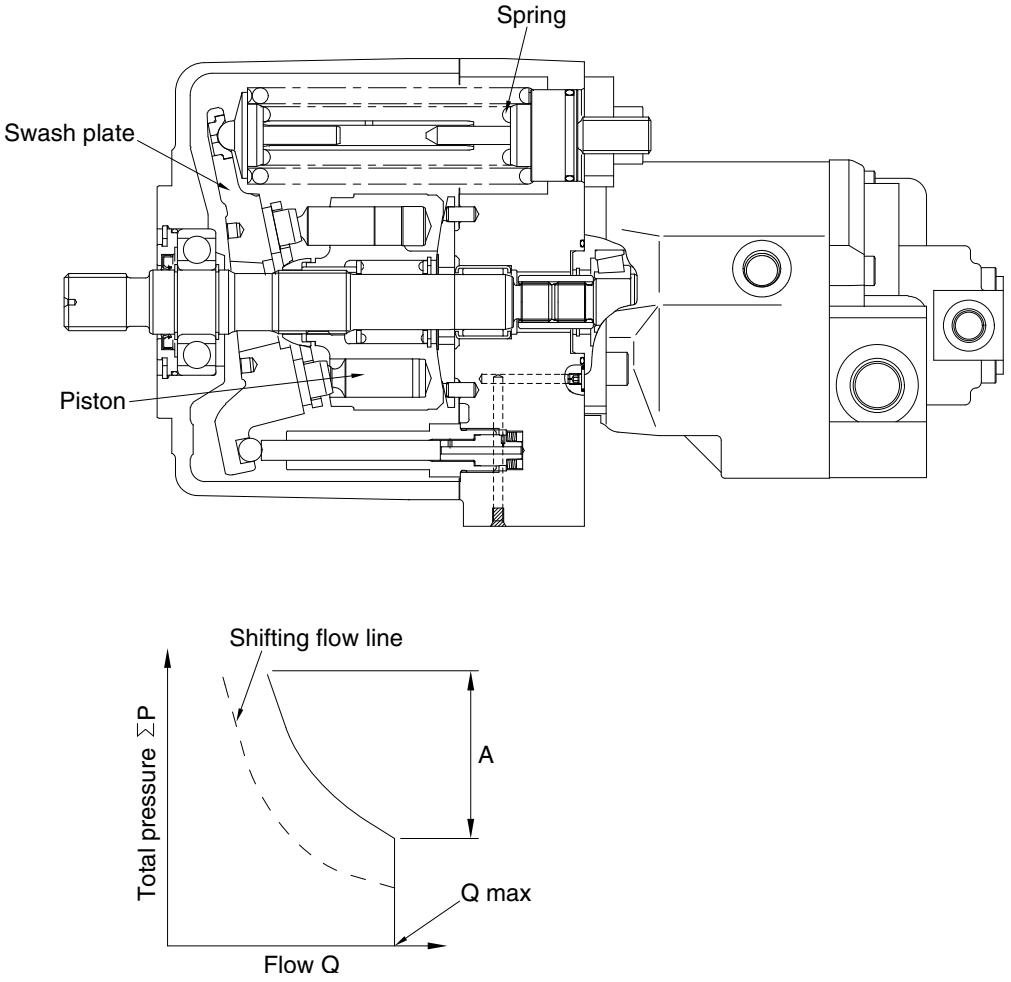
During a stroke from the bottom to the top dead points, the piston moves in a direction to decrease the displacement. The oil is discharged to the discharge port (discharge process).

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

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

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

2) CONTROL FUNCTIONS



80CR92MP04

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

The spring is provided to act against the delivery pressure.

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

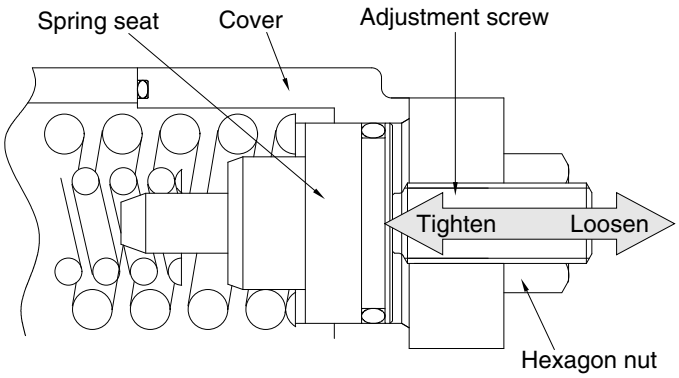
When the oil pressure via piston acting on the swash plate exceeds the installation load of the spring, the swash plate is tilted and kept tilted at a position where the oil pressure is balanced with the spring force (region A in above figure).

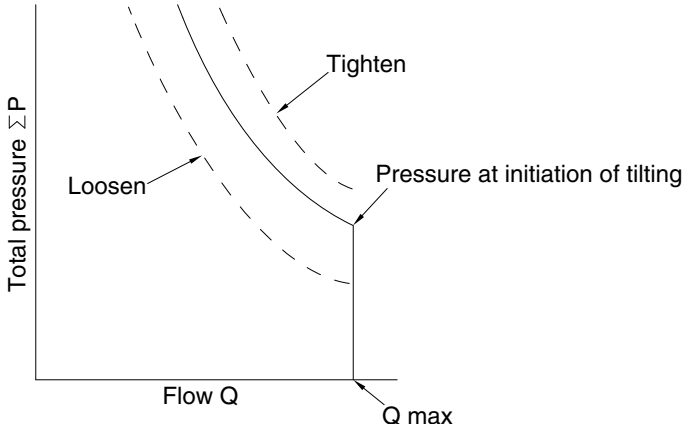
When the P3 oil pressure acts on the shift piston, the control shifting line is shifted.

3) ADJUSTMENT PROCEDURE OF SETTING TORQUE

(1) Loosen the hexagonal nut.

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

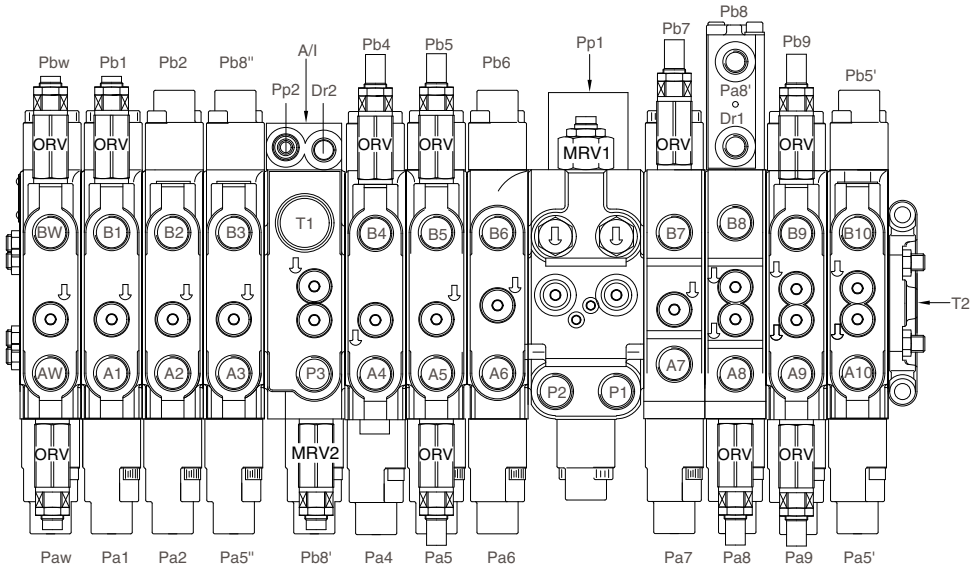




80CR92MP05

GROUP 2 MAIN CONTROL VALVE

1. OUTLINE

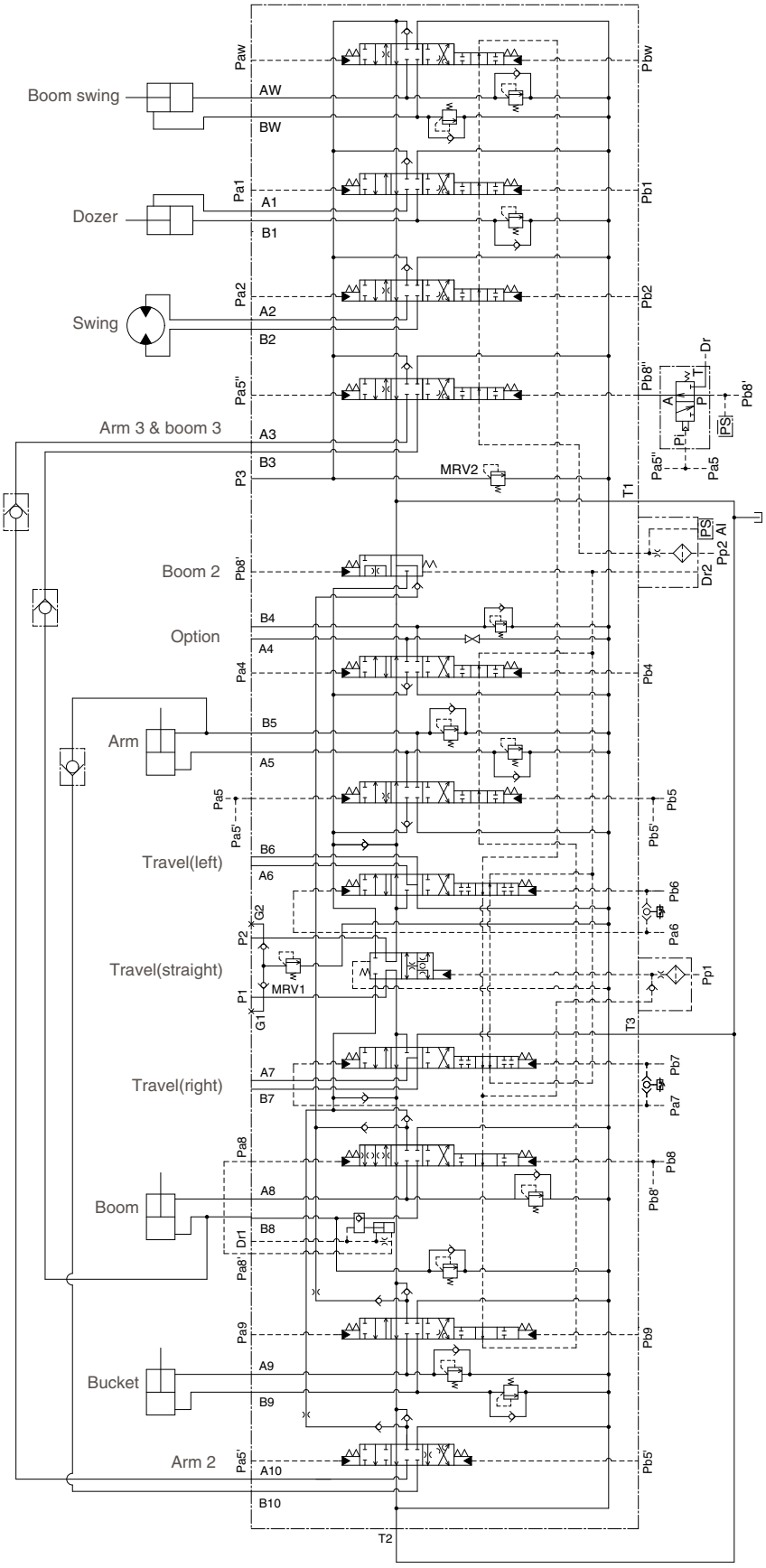


80CR9A2MC01

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

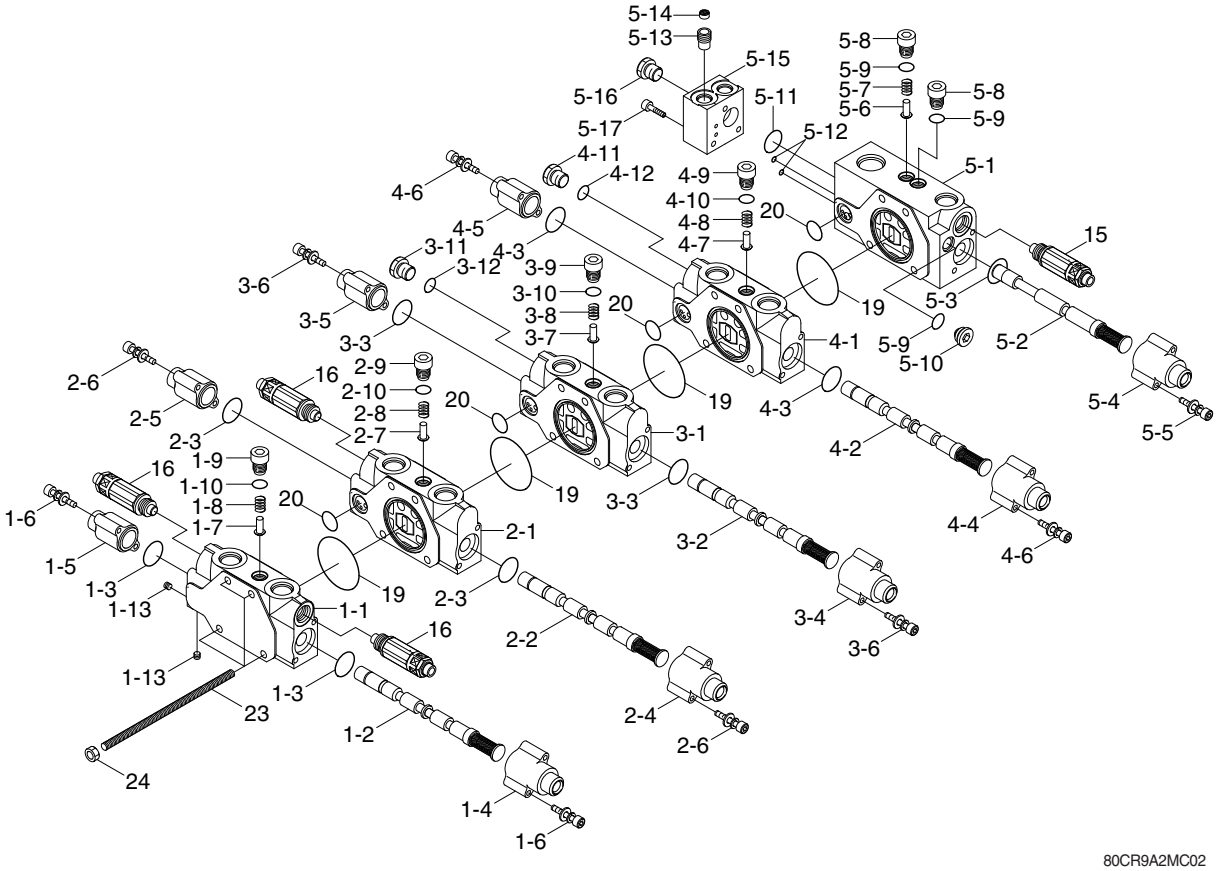
Mark	Port name	Port size	Tightening torque
Pa1	Dozer pilot port	PF 1/4	2.5~3.0 kgf · m
Pb1			
Pa2	Swing pilot port		
Pb2			
Pa3	Arm 3 & boom 3 pilot port		
Pb3			
Pb8'	P 3 inlet & boom 2 pilot port		
Pa4	Option pilot port		
Pb4			
Pa5	Arm pilot port		
Pb5			
Pa6	Travel pilot port (left)		
Pb6			
Pa7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

2. HYDRAULIC CIRCUIT



80CR9A2MC06

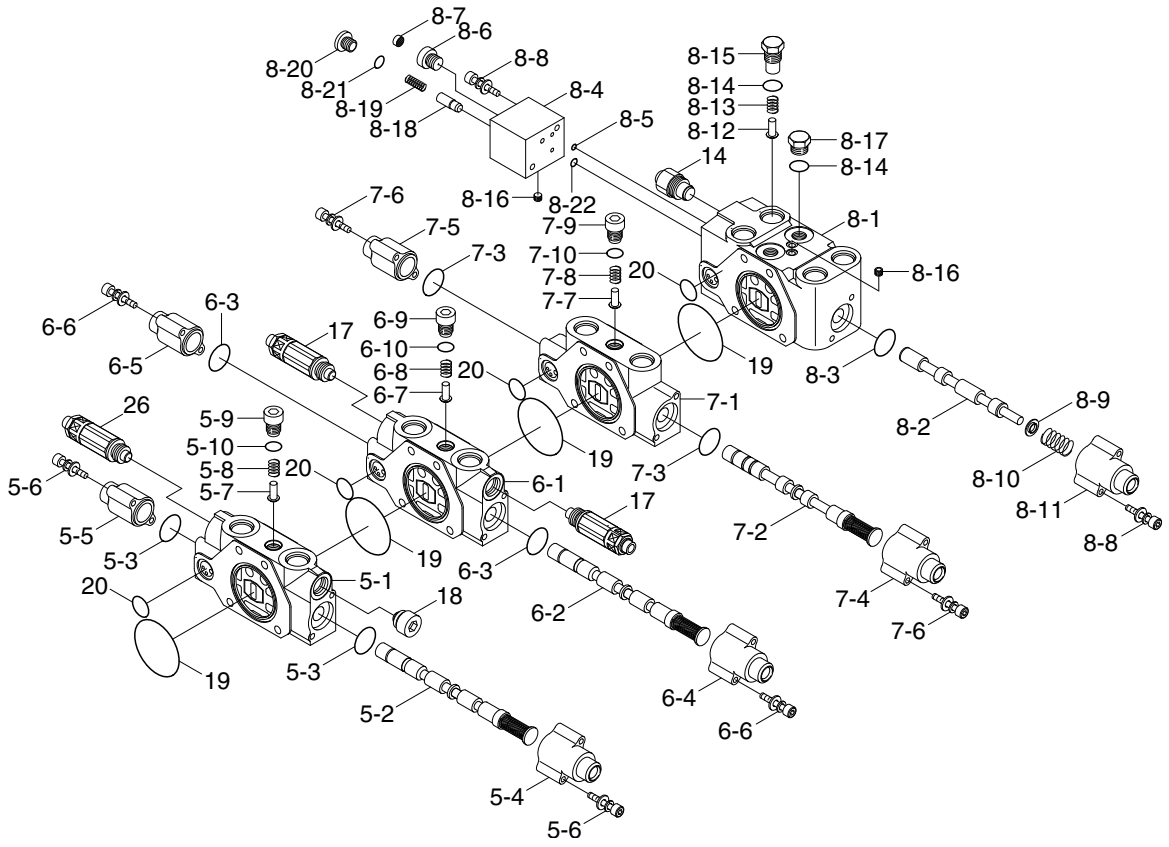
3. STRUCTURE (1/4)



80CR9A2MC02

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

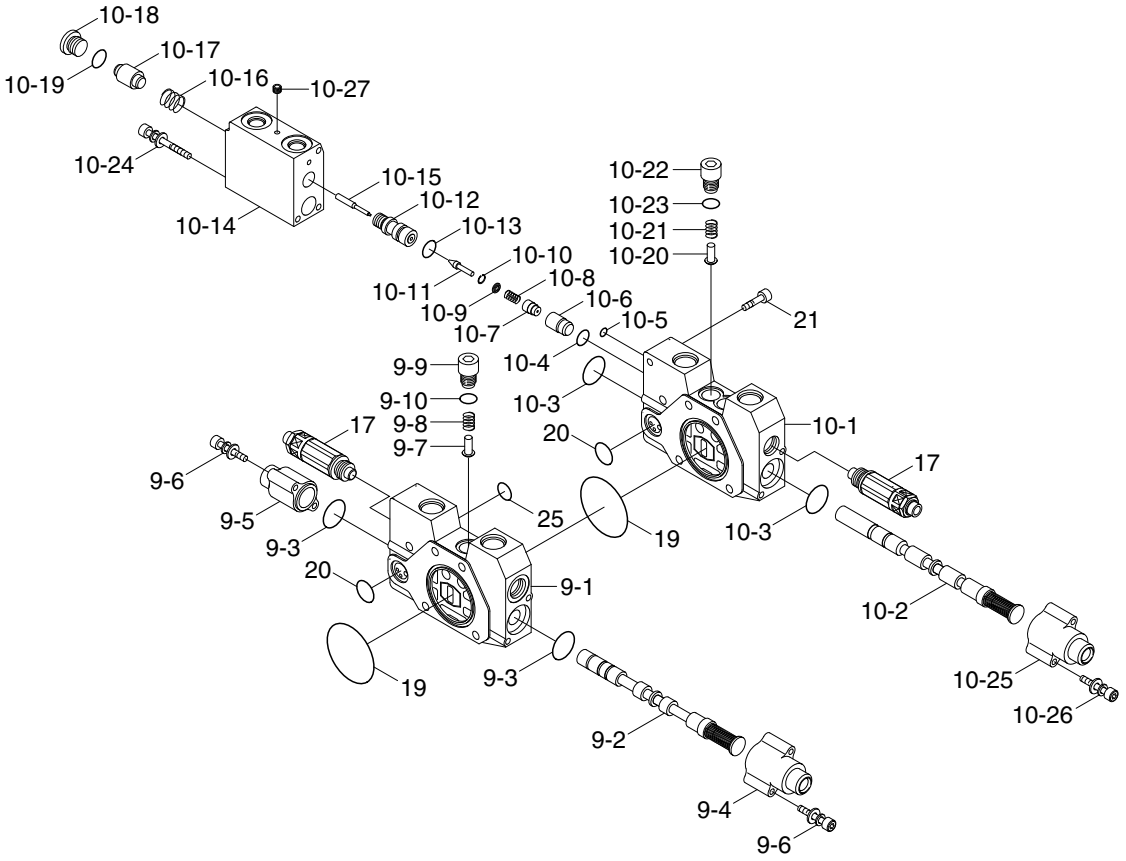
STRUCTURE (2/4)



80CR92MC03

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

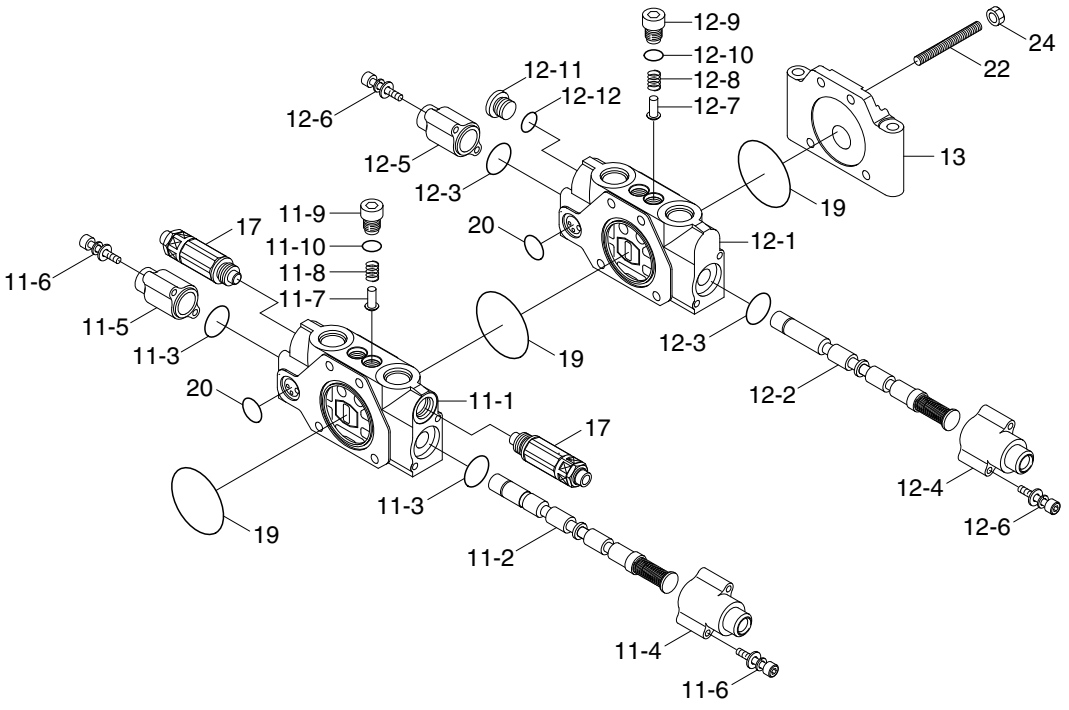
STRUCTURE (3/4)



80CR92MC04

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

STRUCTURE (4/4)



80CR92MC05

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

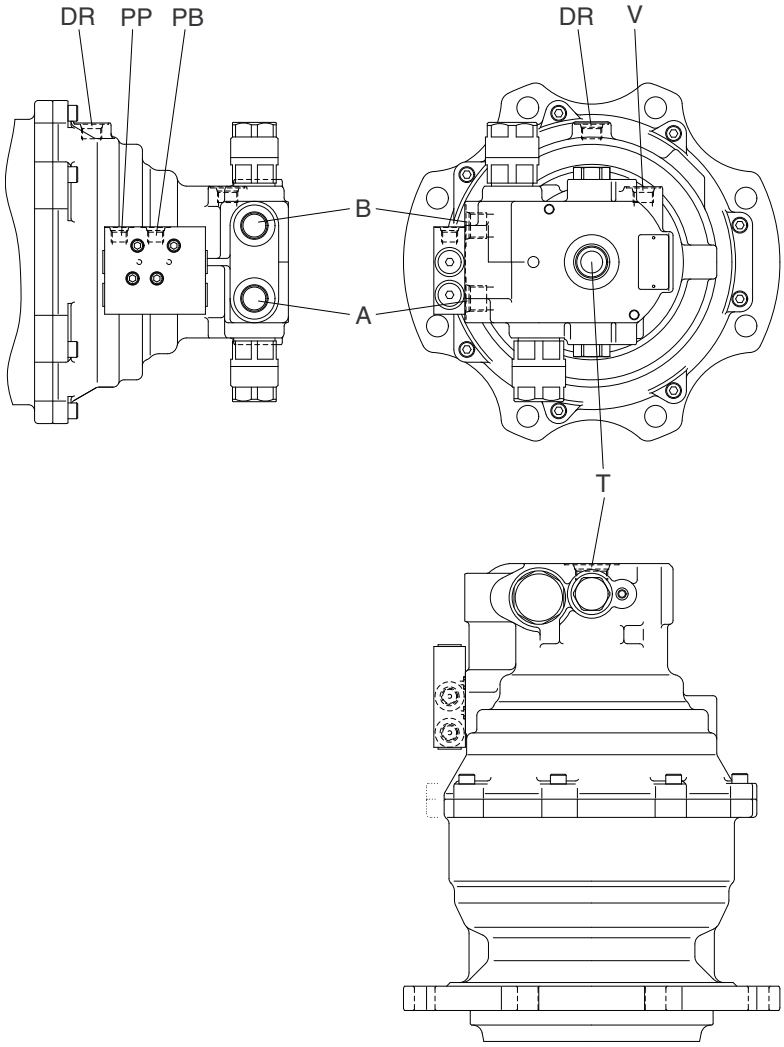
GROUP 3 SWING DEVICE

1. STRUCTURE

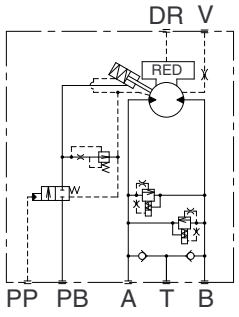
Swing device consists swing motor and swing reduction gear.

1) SWING MOTOR

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



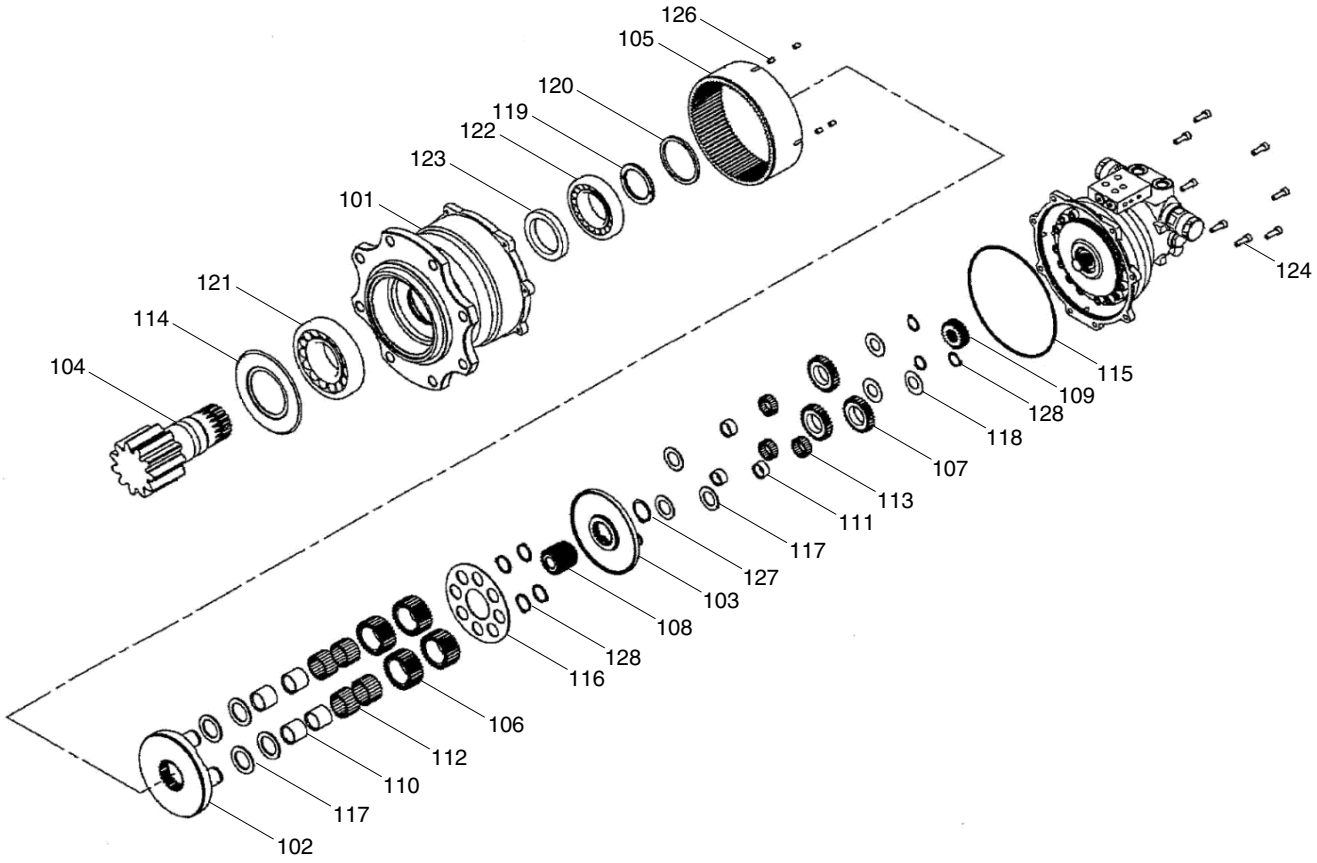
Port	Port name	Port size
A	Main port	PF 1/2
B	Main port	PF 1/2
DR	Drain port	PF 3/8
T	Make up port	PF 3/4
PB	Brake release stand by port	PF 1/4
PP	Brake release pilot port	PF 1/4
V	Air vent port	PF 3/8



HYDRAULIC CIRCUIT

80CR9A2SM01

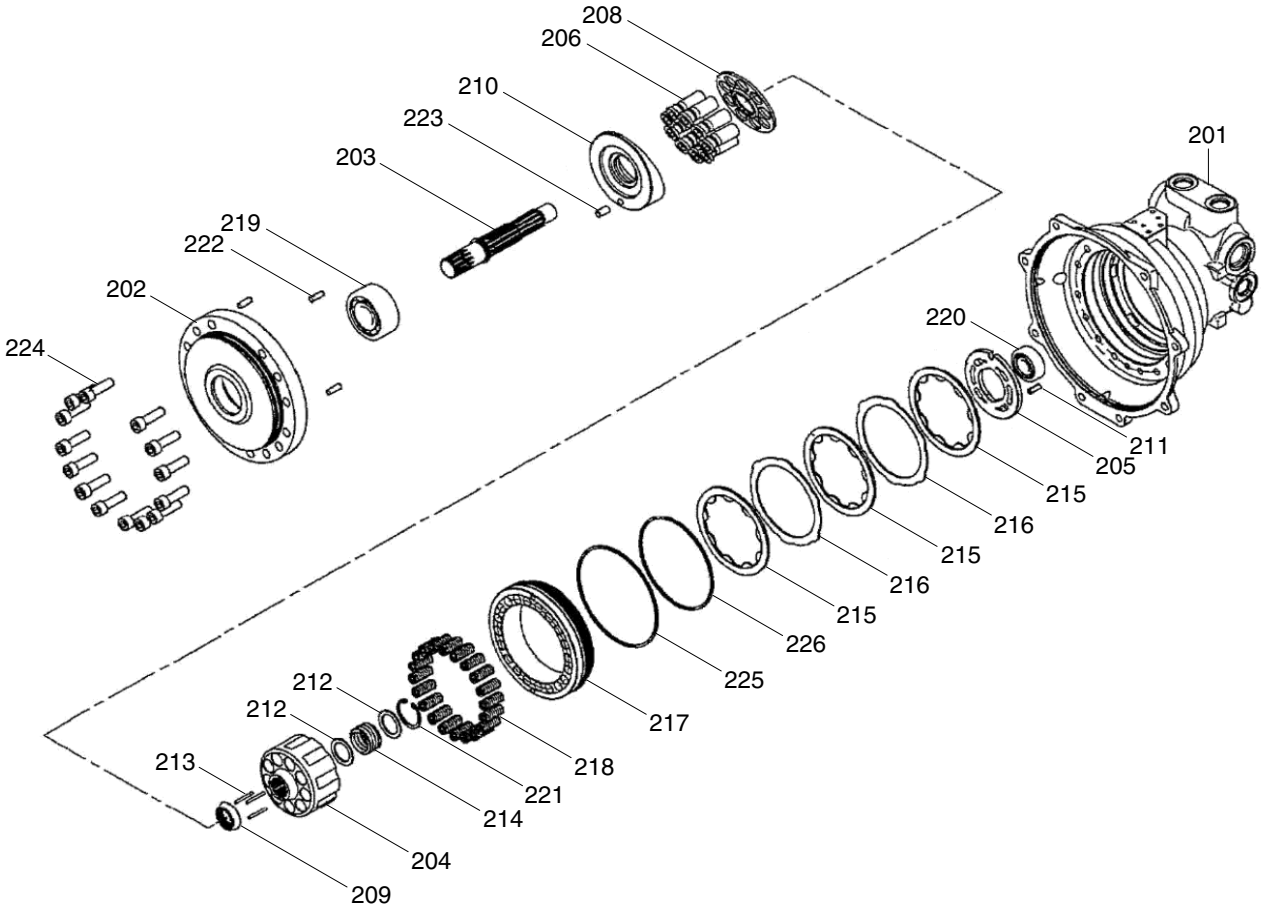
2) COMPONENTS (1/3)



80CR9A2SM15

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

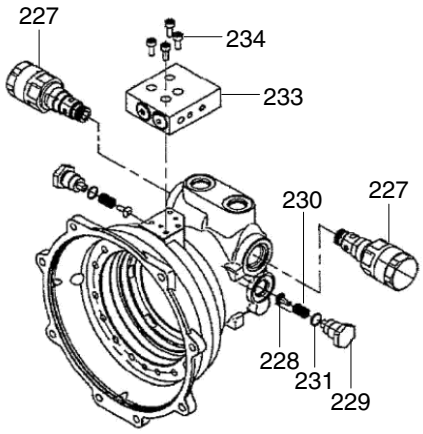
COMPONENTS (2/3)



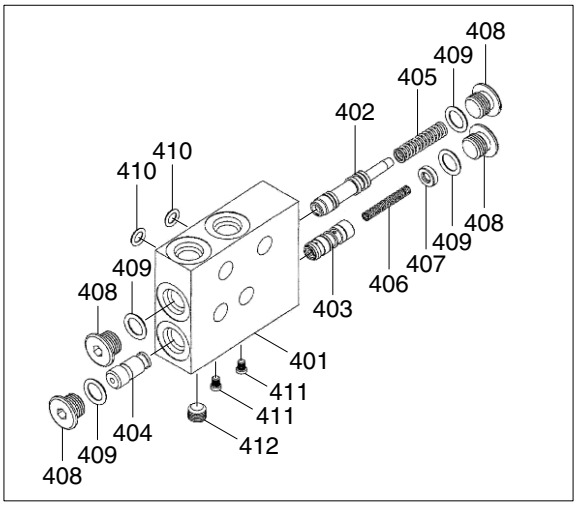
80CR9A2SM16

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

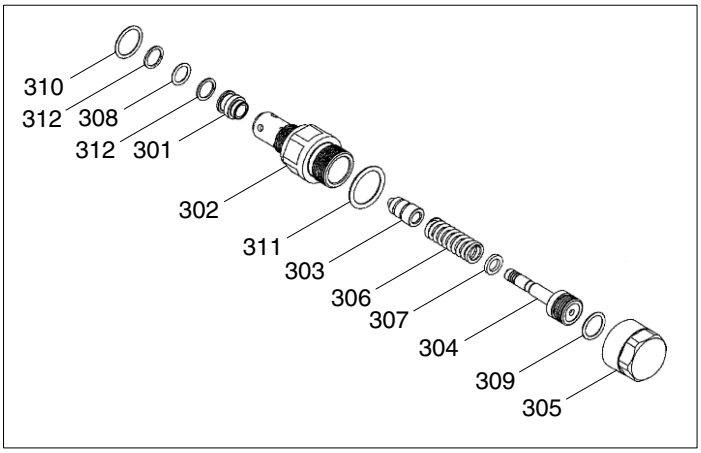
COMPONENTS (3/3)



DETAIL ITEM 233



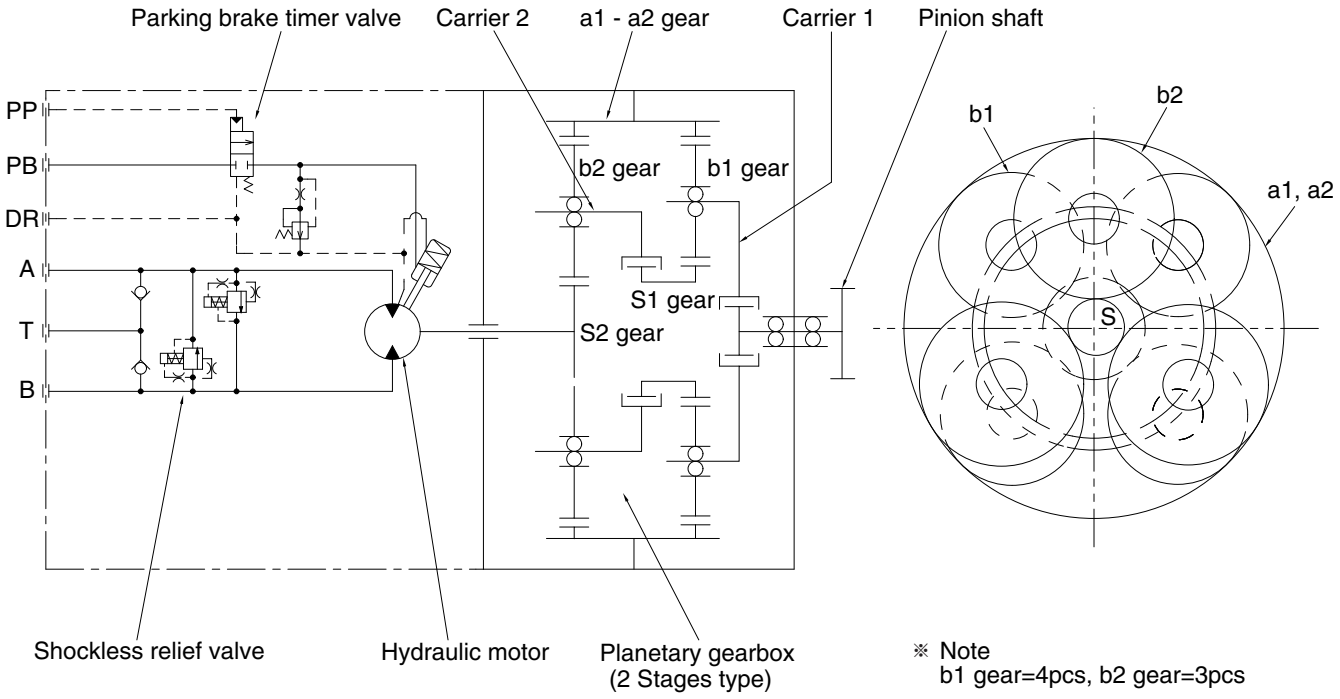
DETAIL ITEM 227



80CR9A2SM16-1

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

2. OPERATION PRINCIPLE



3. OPERATION

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

1) REDUCTION GEAR SECTION

(1) Function

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

(2) Operation

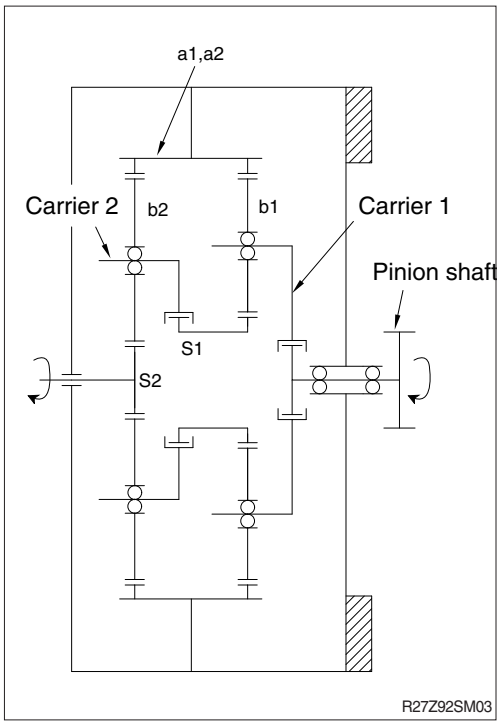
The s2 gear is attached to the hydraulic motor shaft, and the s2 output speed is reduced between the gears (s2, b2, a2).

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

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

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

※ Z ** : Number of gear teeth.



2) HYDRAULIC MOTOR SECTION

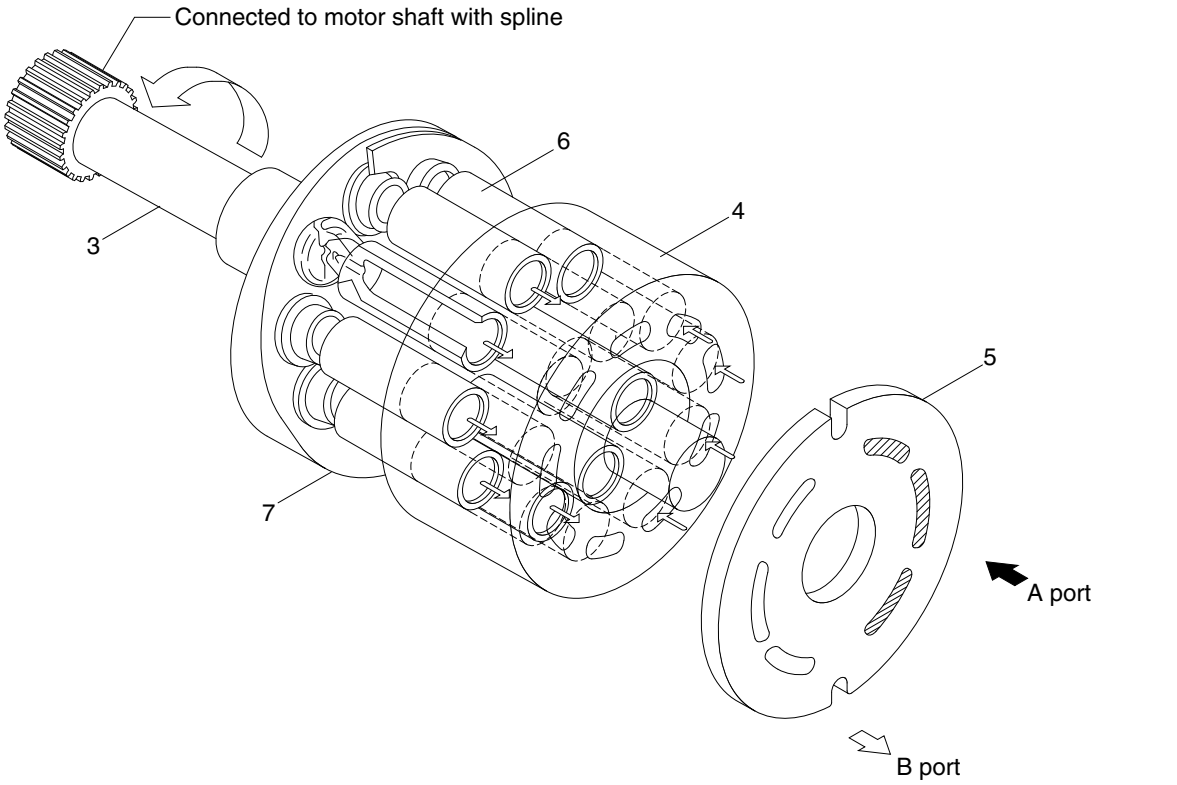
(1) Function

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

(2) Structure

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

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



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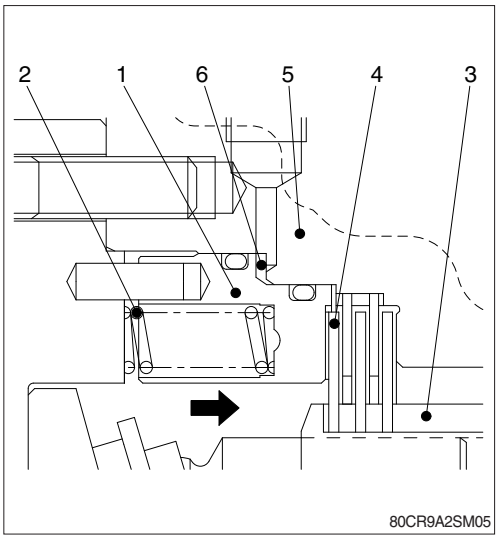
(3) Parking brake

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

① At the brake releasing pressure OFF

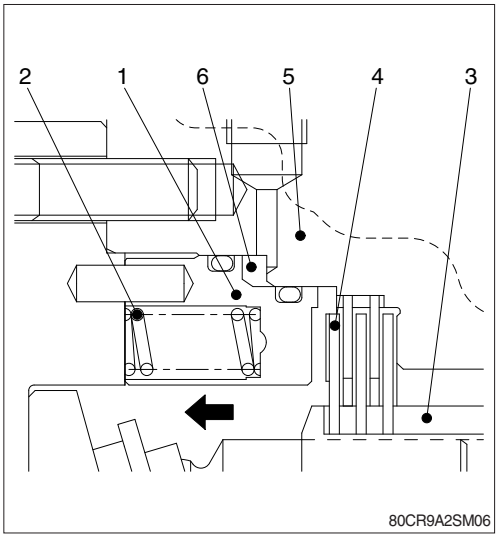
When brake releasing pressure is not supplied, the brake piston (1) is pressed in the direction (shown as arrow) by the spring (2). Then the disk plate (4) which is fixed to the cylinder barrel (3) is held between the body H (5) and the brake piston (1). As a result, with the friction of these parts,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



② At the brake releasing pressure ON

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

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



3) HYDRAULIC VALVE SECTION

(1) Shockless relief valve

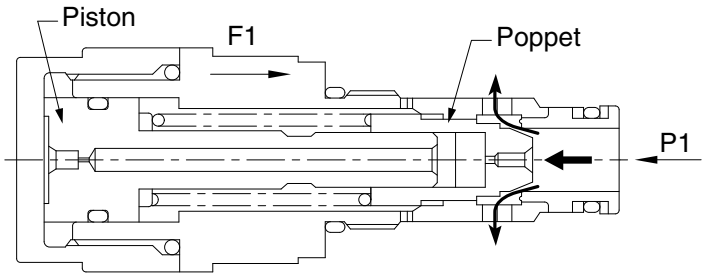
The shockless relief valve consists of the direct relief valve (poppet) and the piston for changing the spring force with two stages.

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

It also makes the start of the motor smooth.

① First stage

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



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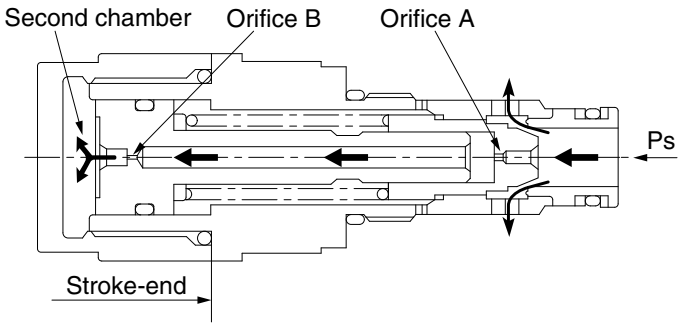
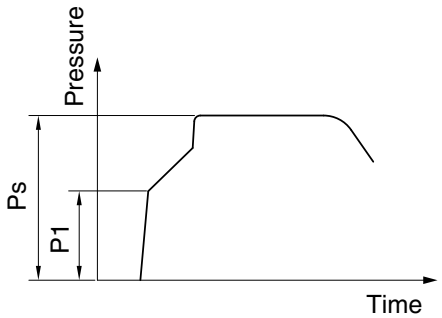
② Second stage

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



80CR9A2SM08



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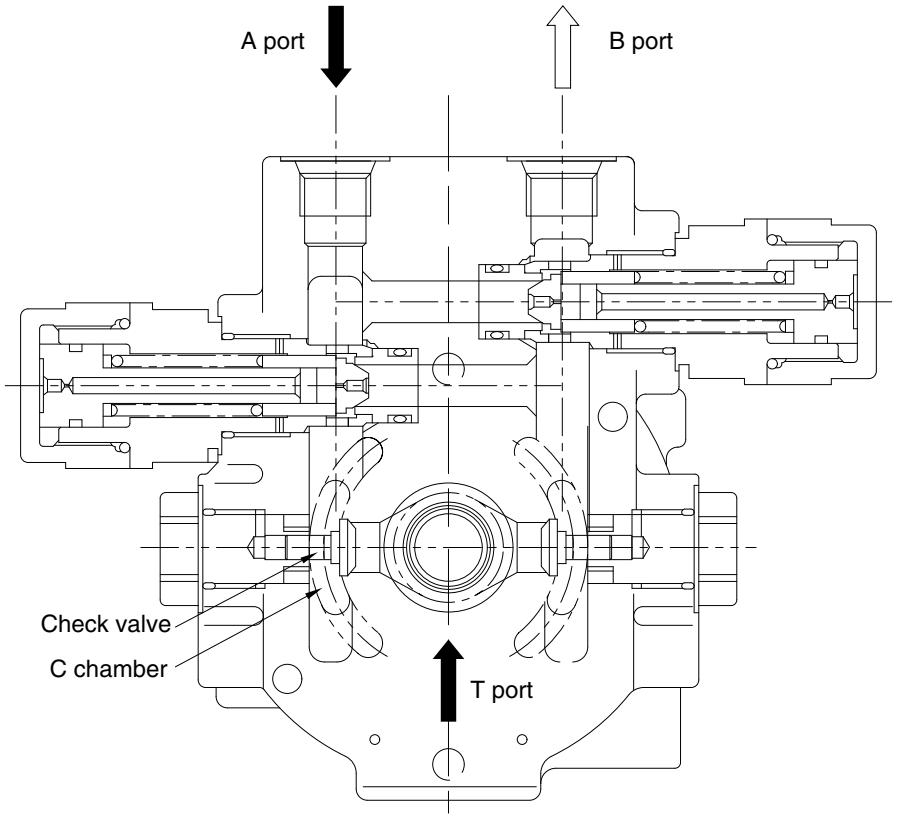
With the above two stages of operation, the motor starts and stops smoothly.

(2) Check valve

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

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



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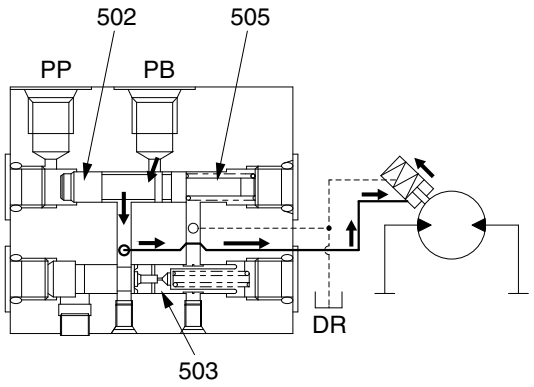
(3) P/B timer valve

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

① When the parking brake is released

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



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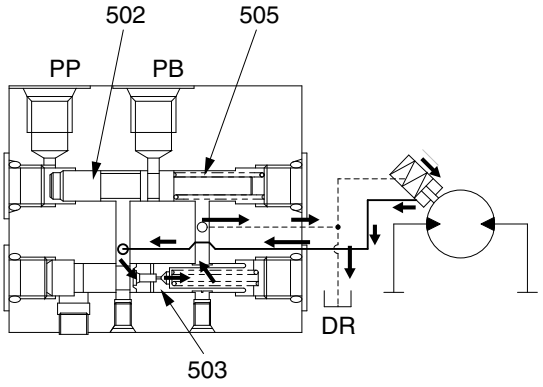
② When the parking brake is activated

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



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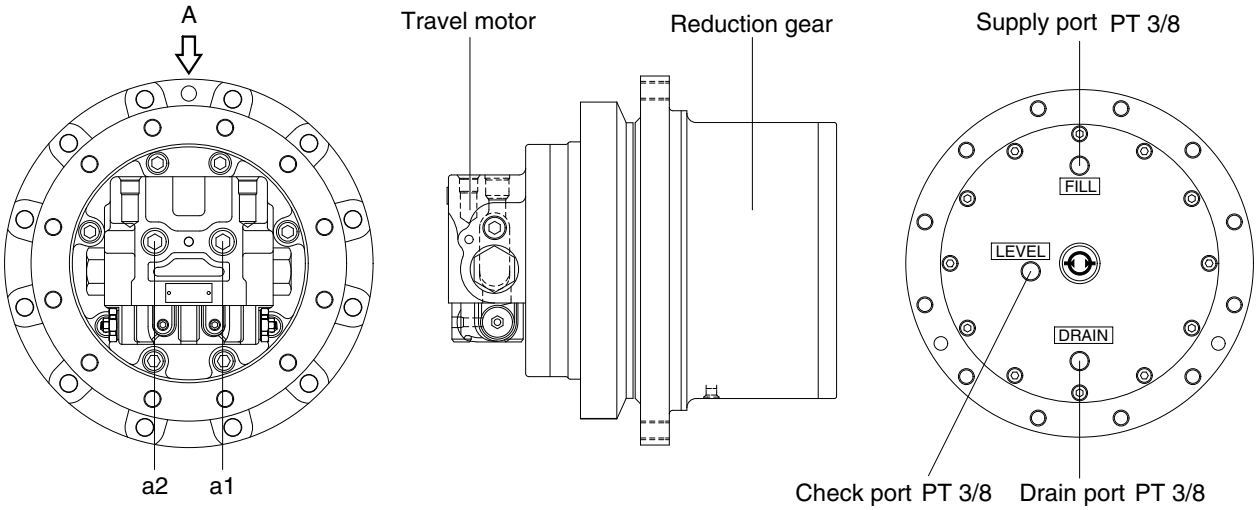
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



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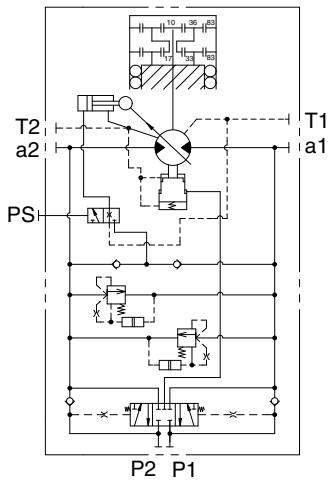
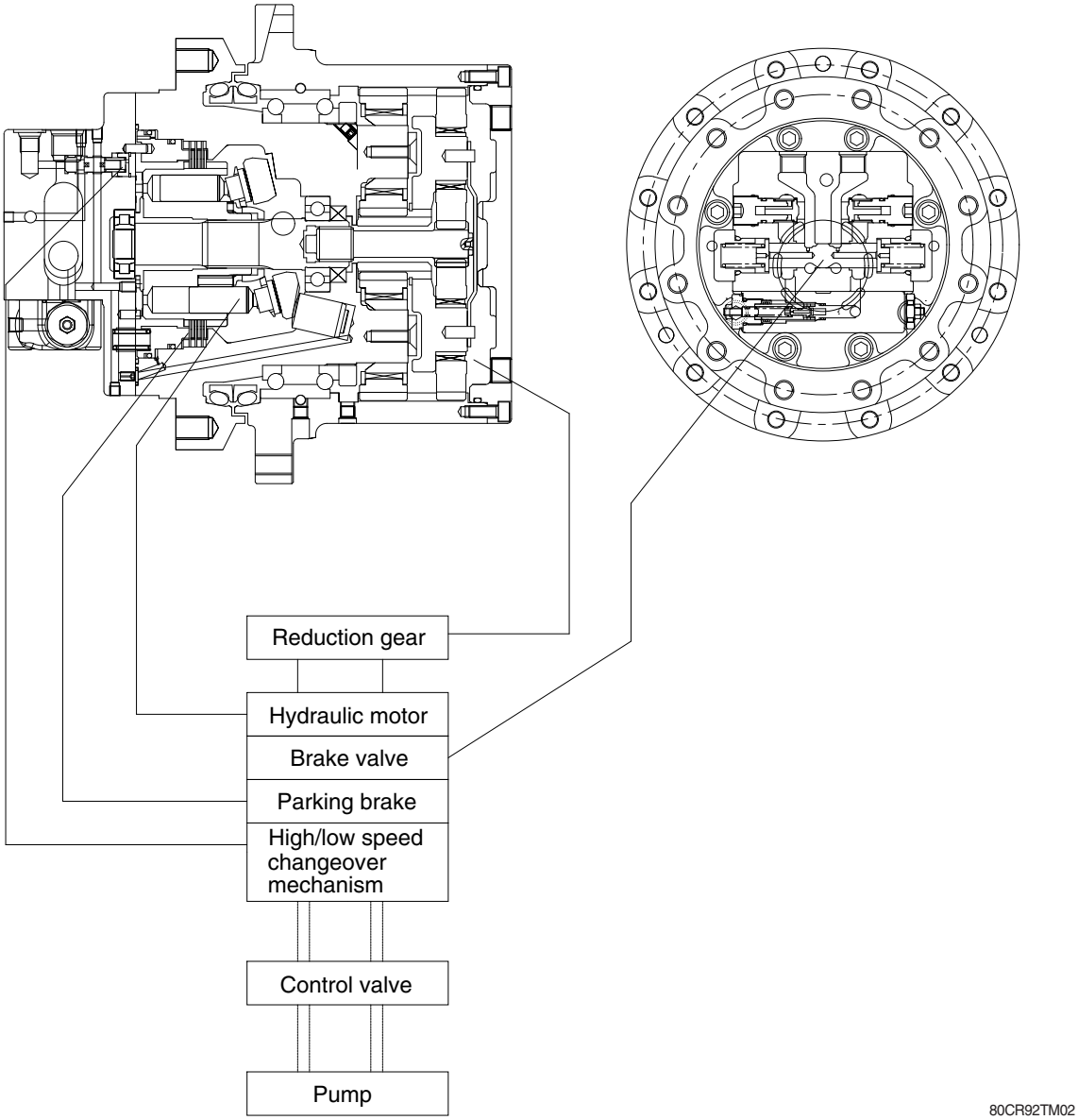


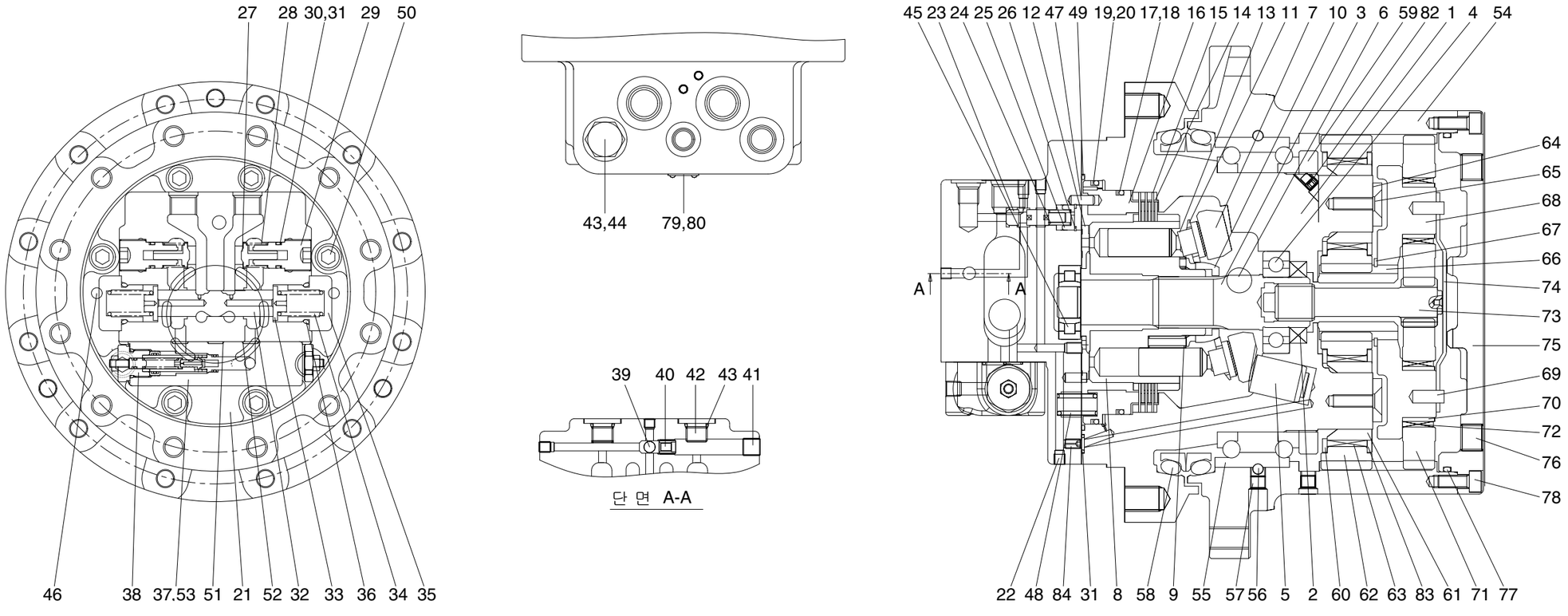
Hydraulic circuit

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

1) BASIC STRUCTURE



2) STRUCTURE



80CR92TM03

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

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

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

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

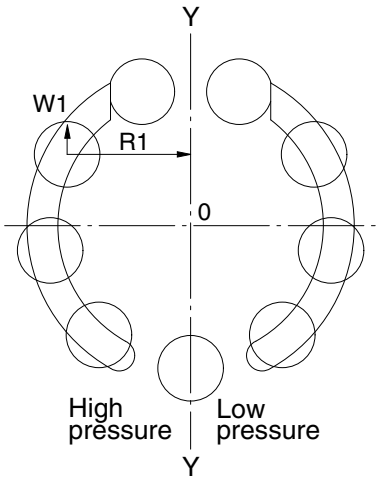
The high hydraulic can generate the force, F1 = P × A (P : Supplied pressure, A : water pressure area), like following pictures, working on a piston.

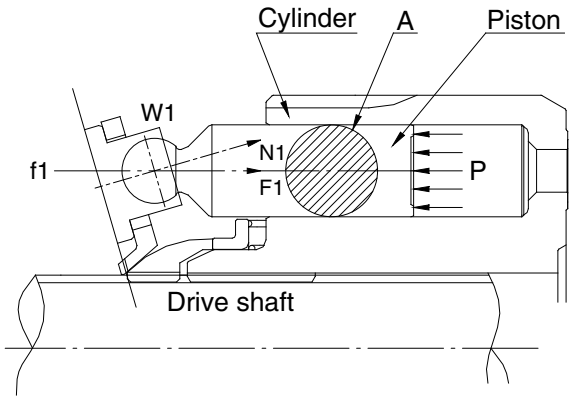
This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the swash plate (7) of a tilt angle, α .

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

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

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





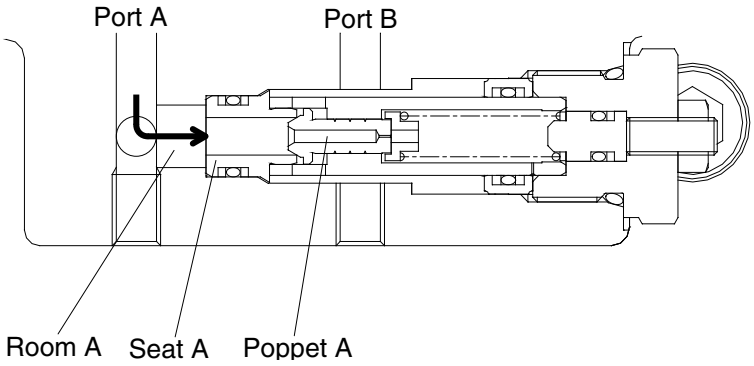
5592TM03

2) WORKING OF RELIEF VALVE

Relief valve carries on two functions of followings.

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

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



80CR92TM05

3) WORKING OF BRAKE

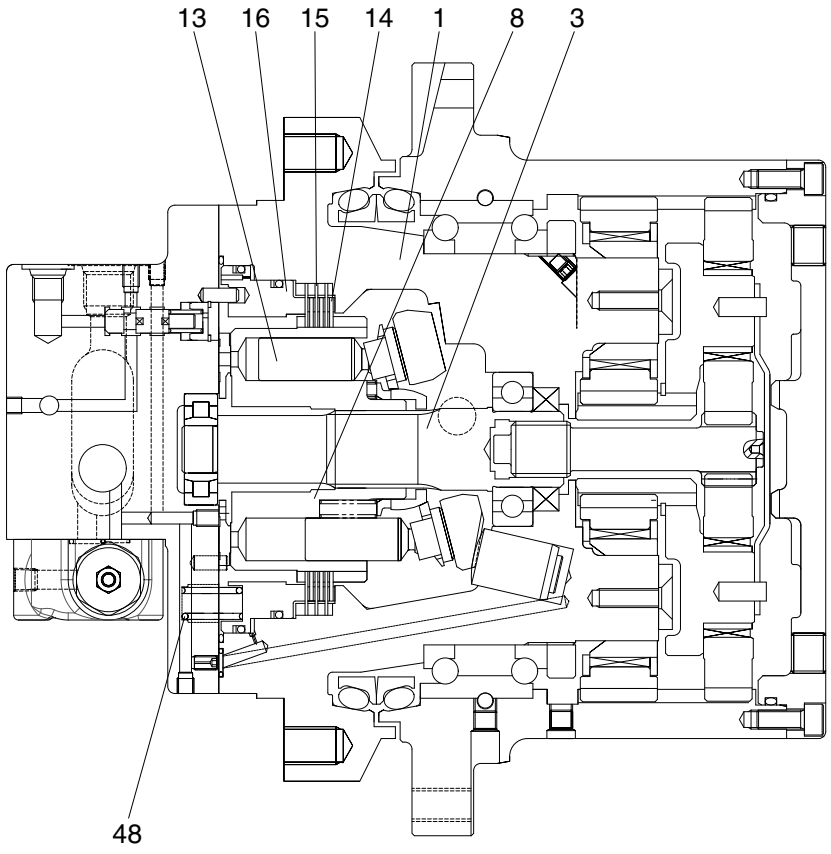
Brake operates the pressure supplied through spool (simultaneous peripheral operation online) installed in valve casing (21) to the part of parking piston (16) and releases a brake.

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

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

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

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



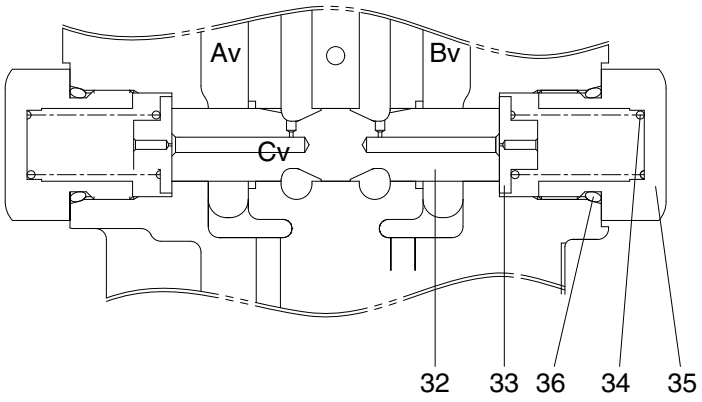
80CR92TM06

4) COUNTERBALANCE VALVE

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

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

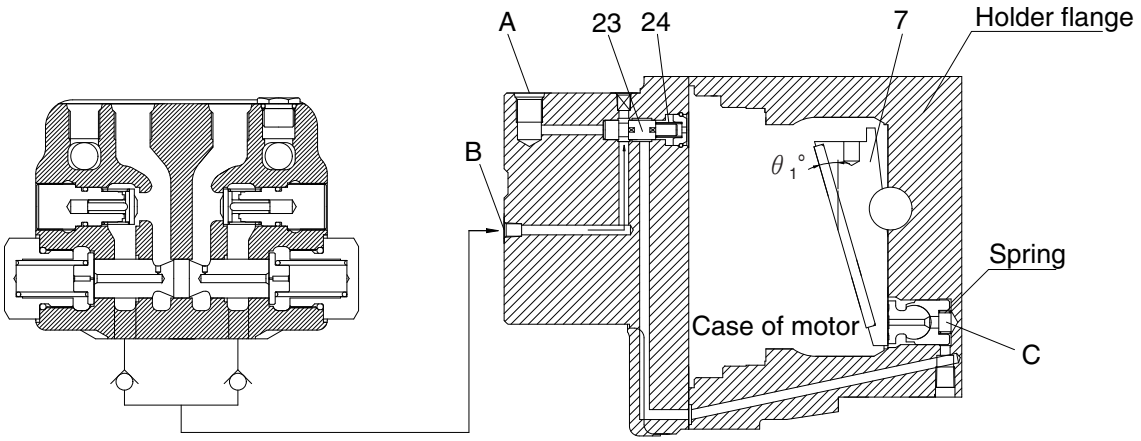
In accordance with spool's returning speed and shape control the working oil that is returning from hydraulic motor smoothly stopping the motor.



80CR92TM07

4) HIGH/LOW SPEED CHANGEOVER MECHANISM

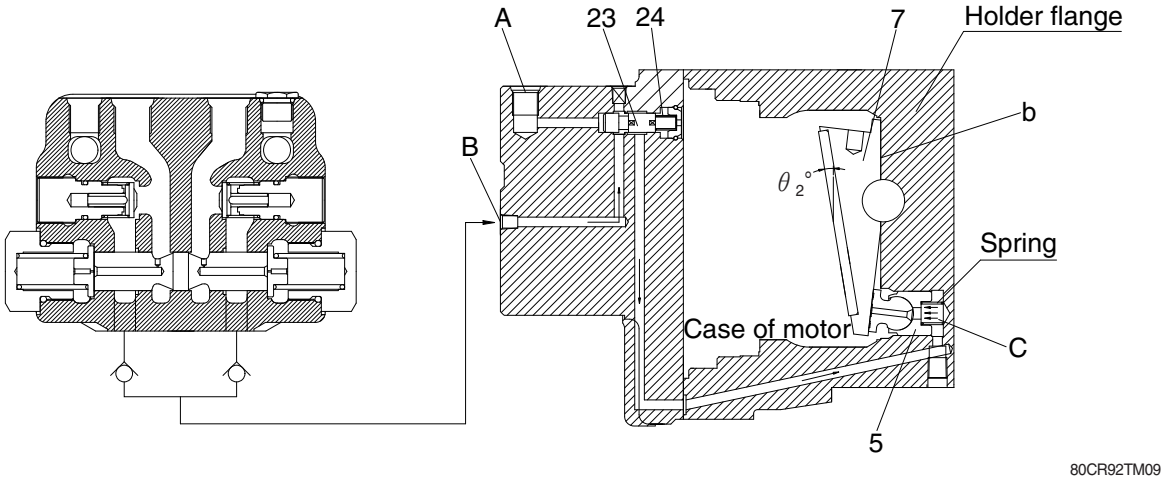
(1) At low speed-at pilot pressure of less than 10 kgf/cm² (0.98 Mpa)



When no pilot pressure is supplied from port (A) at a pressure of 10 kgf/cm² (0.98 Mpa) or less, spool (23) is pressed toward the left by the force of spring (24), the pressurized oil supply port B is shut off, and oil in chamber (C) is released into the motor case via spool (23).

Consequently, swash plate (7) is tilted at a maximum angle (θ_1°) and the piston displacement of hydraulic motor becomes maximum, thus leading to low-speed rotation.

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



When a pilot pressure is supplied from port (A) at a pressure of 10 kgf/cm² (0.98 Mpa) or more, the pressure overcomes the force of spring (24) and spool (23) is pressed toward the right. The pressurized oil at supply port (B) is then introduced into chamber (C) via spool (23).

Piston (5) pushes up swash plate (7) until it touches side (b) of the holder flange.

At this time, swash plate (7) is tilted at a minimum angle (θ_2°) and the piston displacement of hydraulic motor becomes maximum, thus leading to high-speed rotation.

2. REDUCTION GEAR

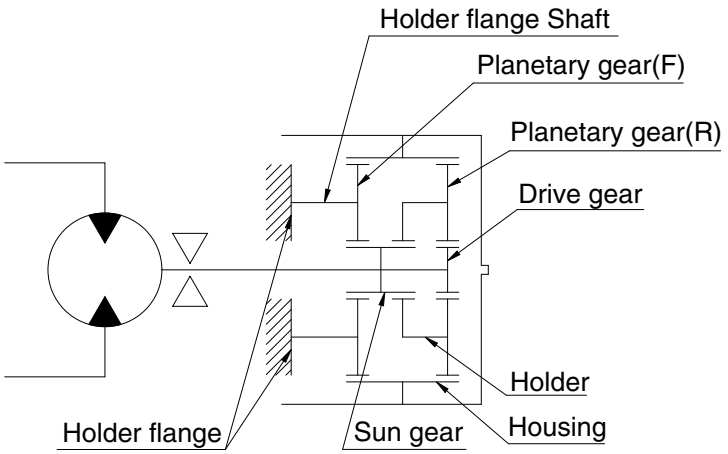
1) FUNCTION

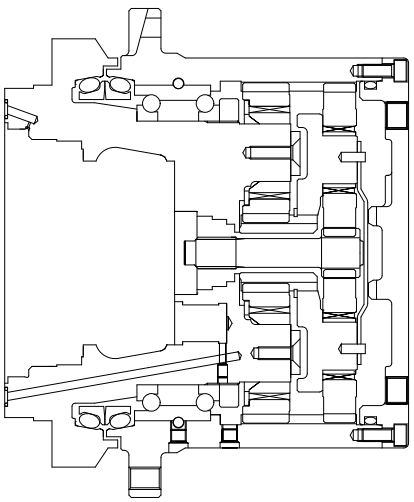
The reduction gear unit consists of a combination of simple planetaly gear mechanism.

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

2) OPERATING PRINCIPLE

Shaft → Drive gear → Planetary Gear R → Housing
→ Holder → Sun gear → Planetary Gear F →Rotation of Housing





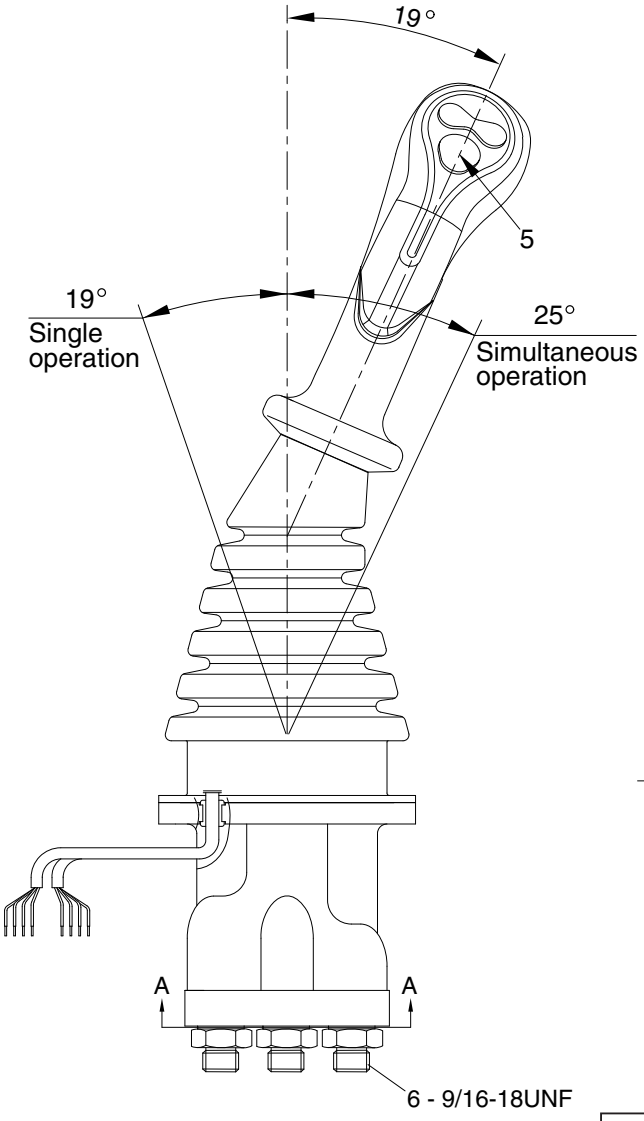
5592TM07

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

GROUP 5 RCV LEVER

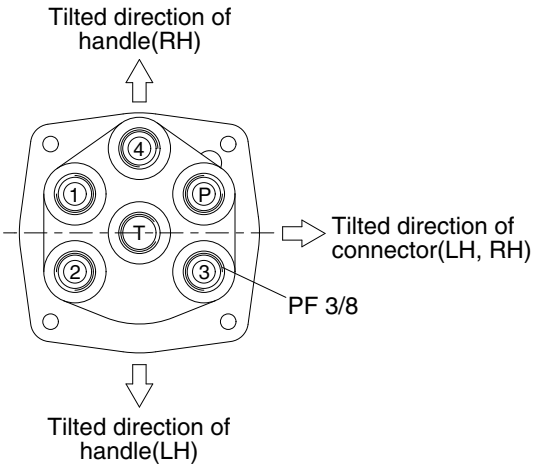
1. STRUCTURE

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



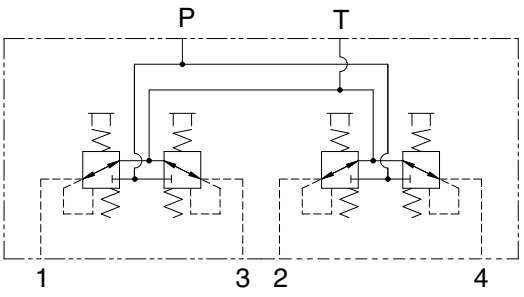
Switches

No.	LH	RH
5	Horn	Breaker



VIEW A

559A2RL01



Hydraulic circuit

Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 3/8
T	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	
2	Arm in port	Boom down port	
3	Right swing port	Bucket in port	
4	Arm out port	Boom up port	

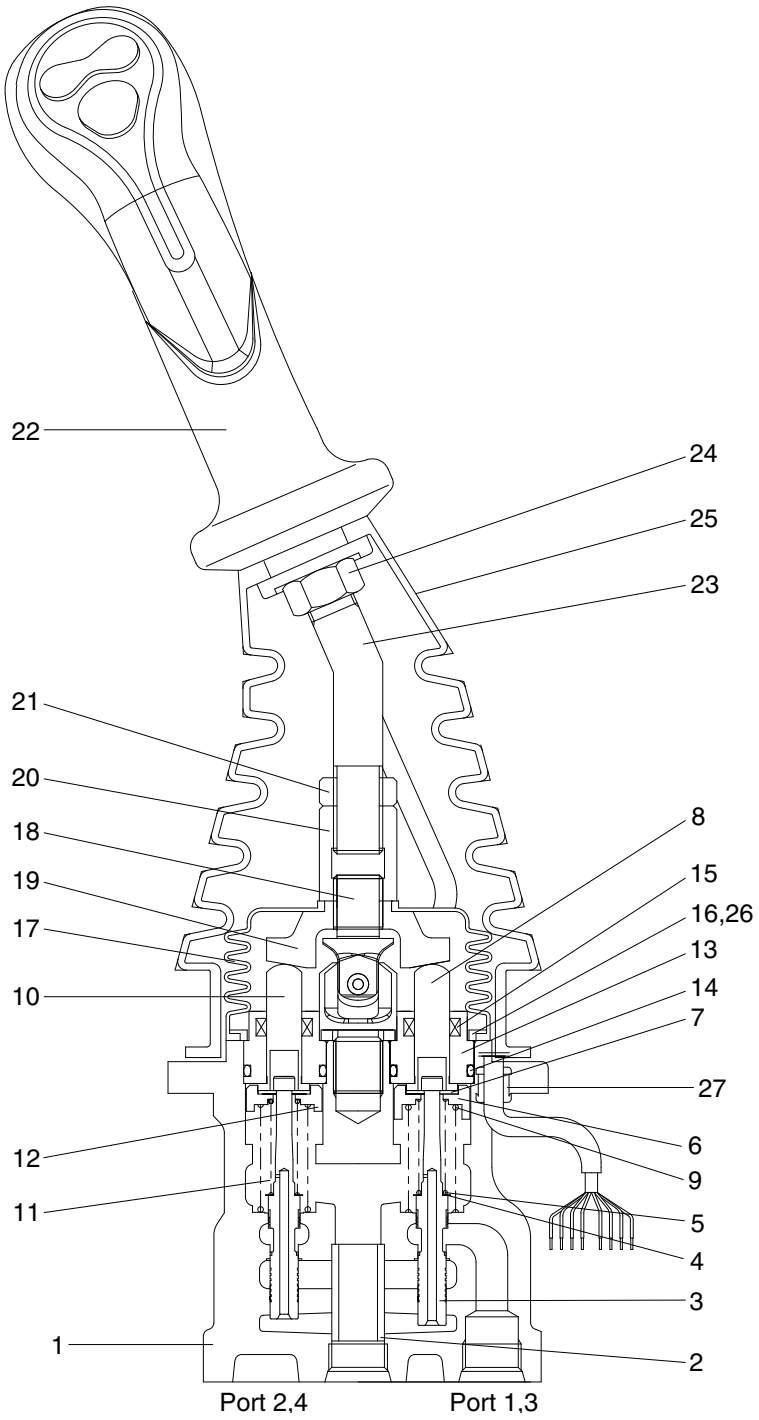
CROSS SECTION

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

The pressure reducing section is composed of the spool (3), spring (5) for setting secondary pressure, spring (9), stopper (7), spring seat (6, 12) and shim (4). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (8, 10) by the return spring.

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

CROSS SECTION



60W9S2RL02

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (3) 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 (5) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (8,10) is inserted and can slide in the plug (13).

For the purpose of changing the displacement of the push rod through the swash plate (19) and adjusting nut (20) are provided the handle (22) that can be tilted in any direction around the fulcrum of the universal joint (18) center.

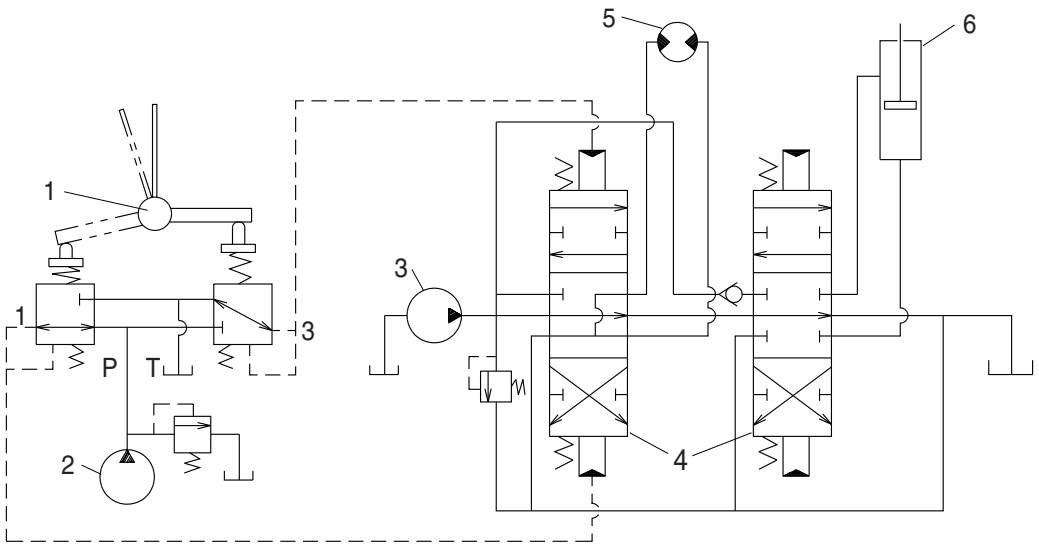
The spring (9) works on the case (1) and spring seat (6, 12) and tries to return the push rod (8,10) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

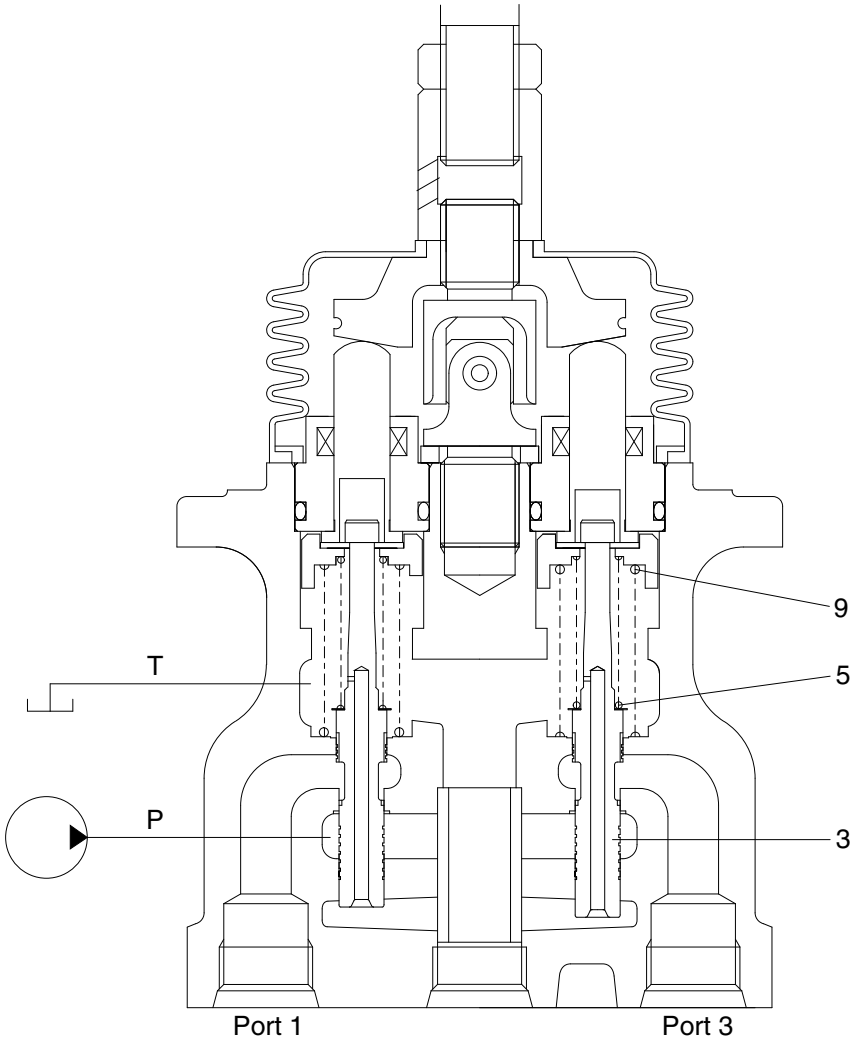
The diagram shown below is the typical application example of the pilot valve.



2-70

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

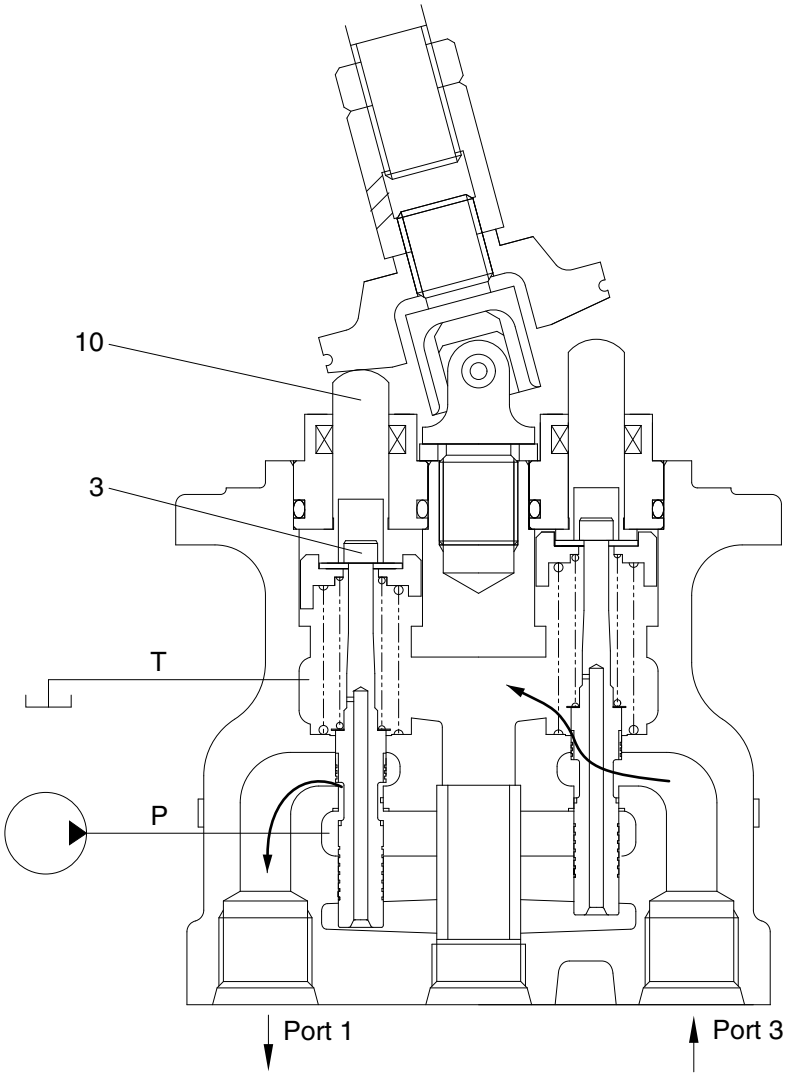
(1) Case where handle is in neutral position



60W9S2RL03

The force of the spring (5) that determines the output pressure of the pilot valve is not applied to the spool (3). Therefore, the spool is pushed up by the spring (9) 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



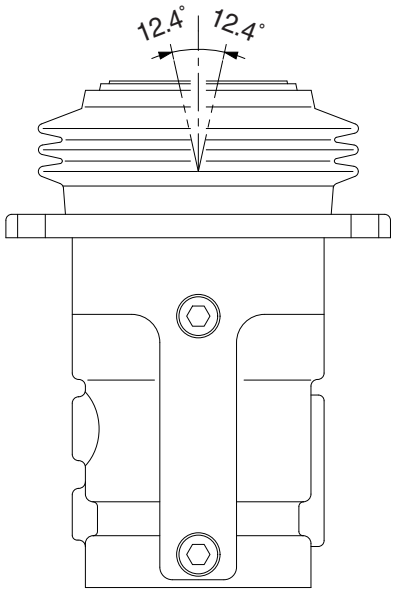
60W9S2RL04

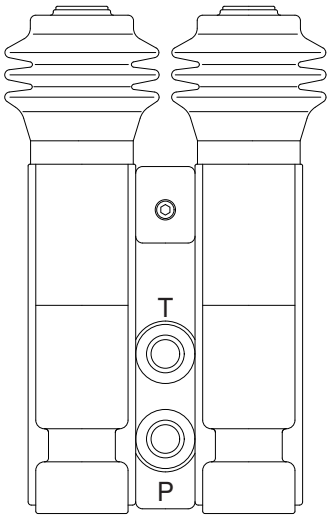
When the push rod (10) is stroked, the spool (3) moves downwards.
Then port P is connected with port 1 and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

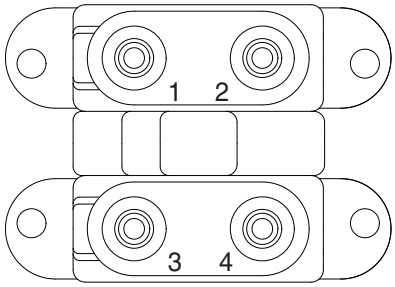
GROUP 6 RCV PEDAL

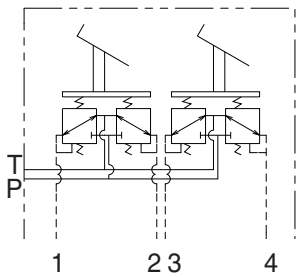
1. STRUCTURE

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









Hydraulic circuit

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

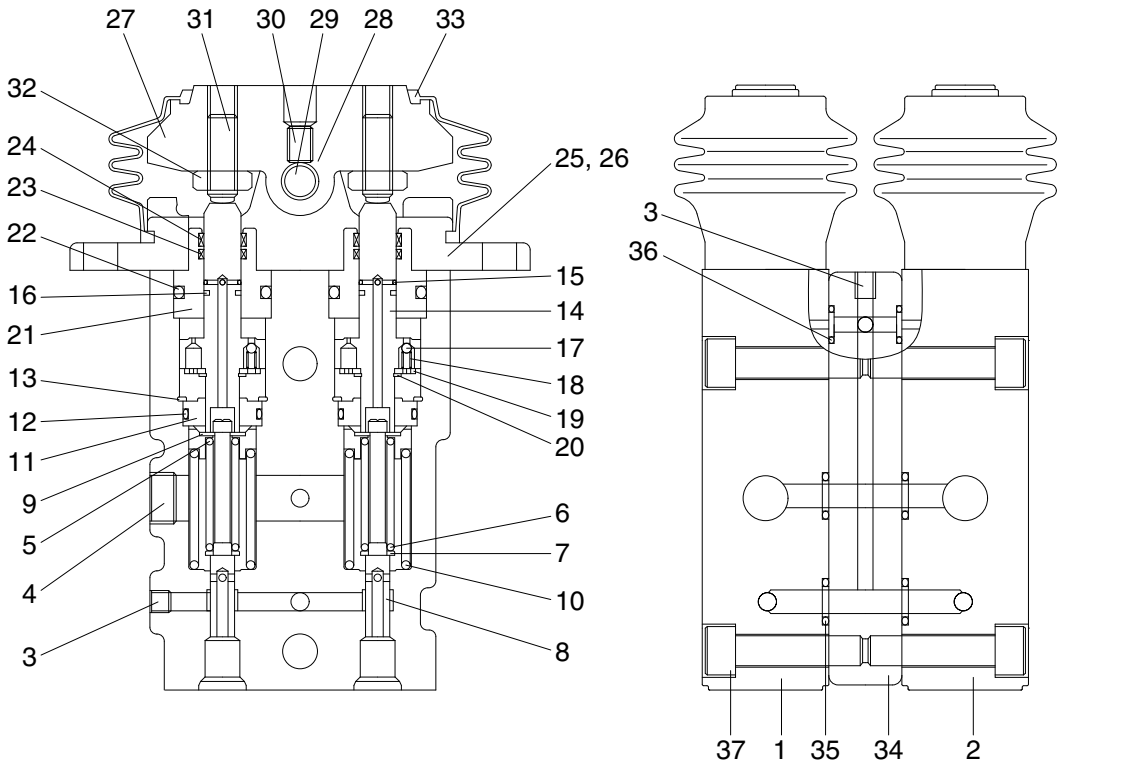
14072SF73

CROSS SECTION

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

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

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



14072SF70

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

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

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

The change the deflection of this spring, the push rod (14) is inserted and can slide in the plug (21). For the purpose of changing th displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

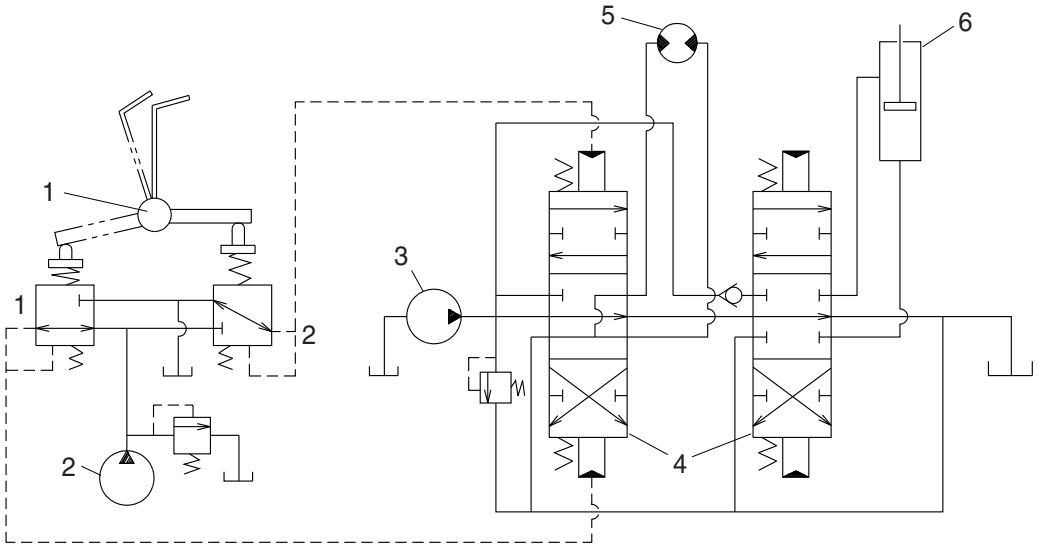
The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

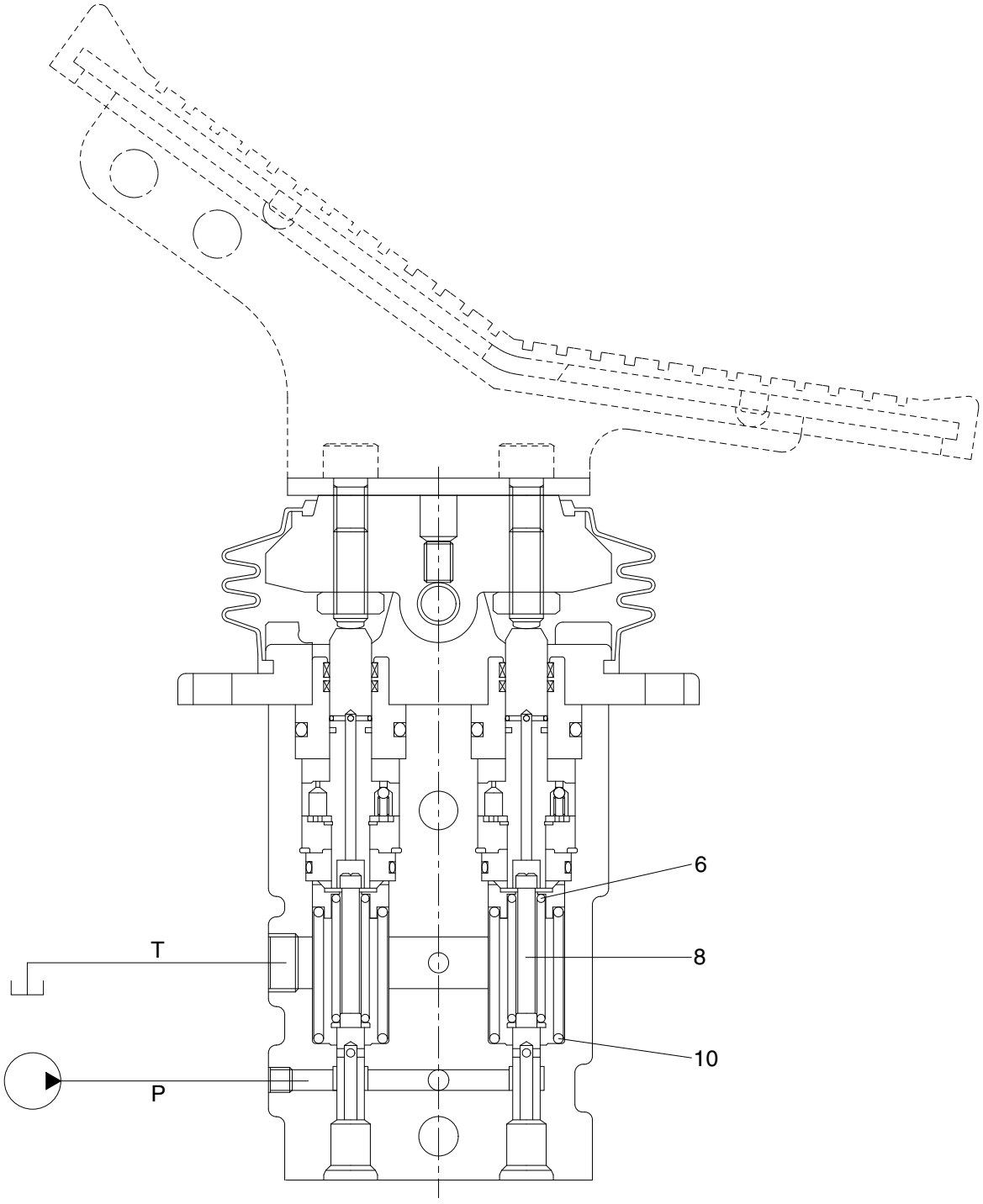
The diagram shown below is the typical application example of the pilot valve.



2-76

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

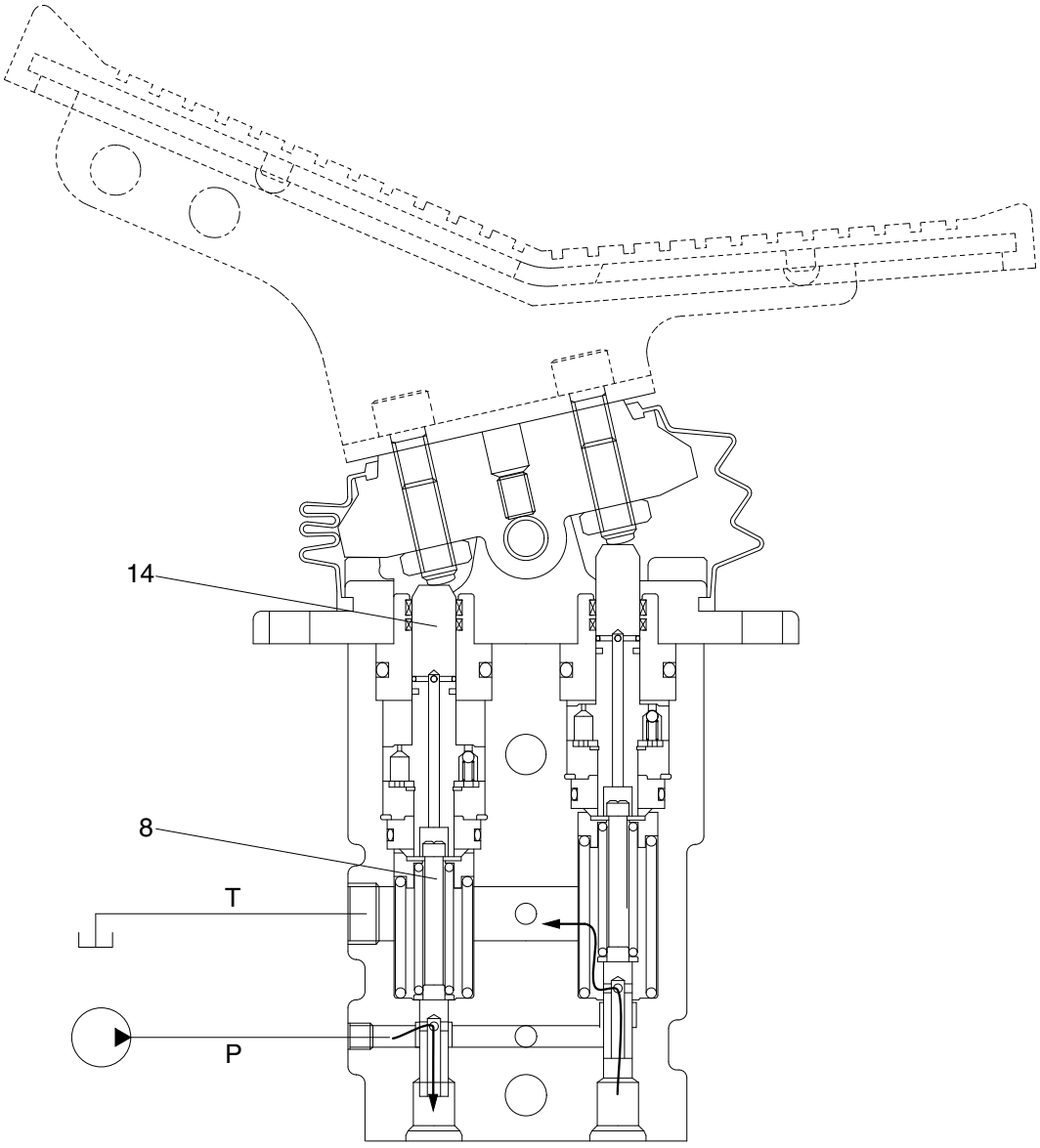
(1) Case where handle is in neutral position



14072SF74

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

(2) Case where handle is tilted

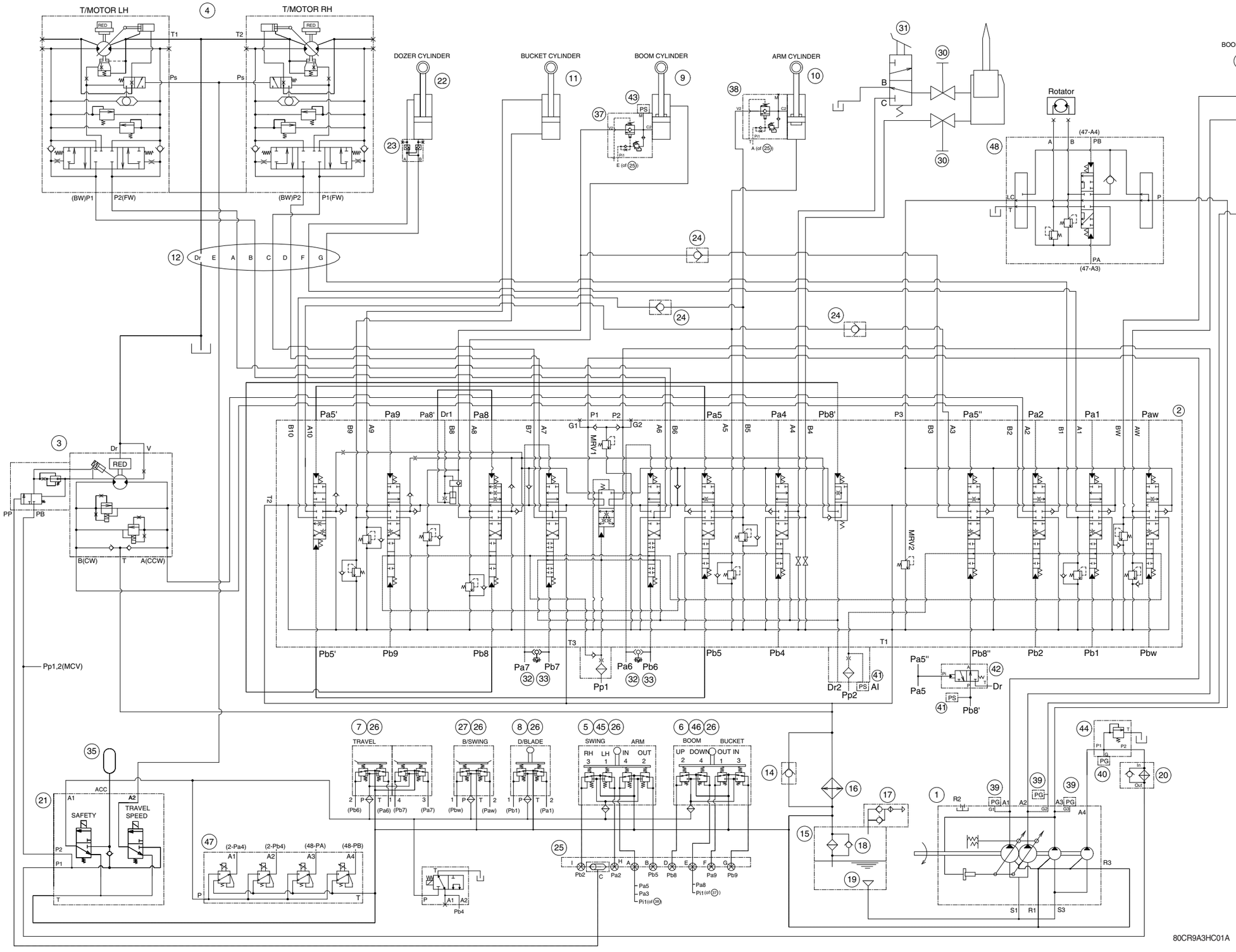


14072SF75

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

SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT

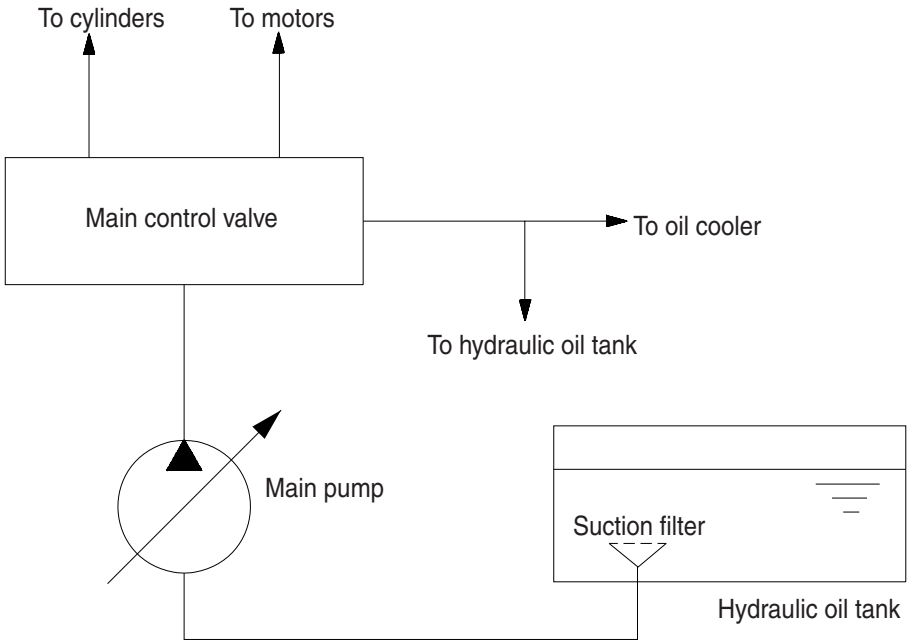


1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever(LH)
6 RCV lever(RH)
7 RCV pedal(travel)
8 RCV dozer
9 Boom cylinder
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Bypass valve
19 Strainer
20 Pilot filter
21 Solenoid valve
22 Dozer cylinder
23 Check valve
24 Check valve
25 Terminal
26 Last guard filter
27 Boom swing pedal
30 Stop valve
31 Selector valve
32 Pressure switch
33 Shuttle valve
34 Boom swing cylinder
35 Accumulator
36 Solenoid valve
37 Safety lock valve
38 Safety lock valve
39 Coupling screw
40 Coupling screw
41 Pressure sensor
42 Selector valve
43 Pressure sensor
44 Relief valve
47 4-EPPR valve
48 Selector valve

GROUP 2 MAIN CIRCUIT

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

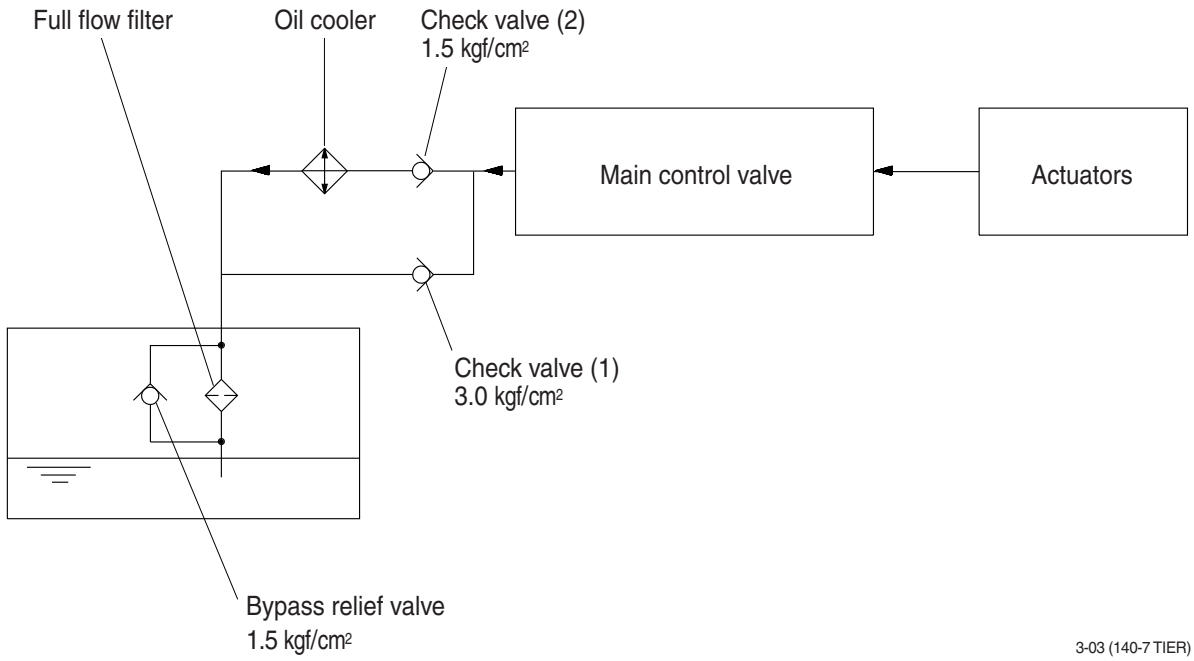
1. SUCTION AND DELIVERY CIRCUIT



3-02 (140-7 TIER)

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

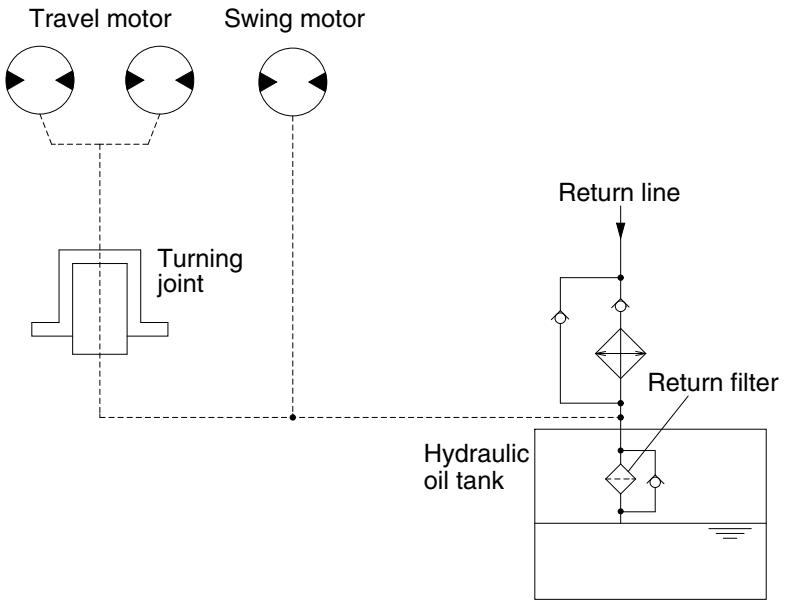
2. RETURN CIRCUIT



3-03 (140-7 TIER)

All oil returned from each actuator returns to the hydraulic tank through the control valve.
The bypass check valves are provided in the return circuit.
The setting pressure of bypass check valves are 1.5 kgf/cm2 (21 psi) and 3.0 kgf/cm2 (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.
When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. When the oil pressure exceeds 3.0 kgf/cm2 (43 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).
The full-flow filter and bypass relief valve are provided in the hydraulic tank.
The oil returned from right and left side of control valve is combined and filtered by the full-flow filter. A bypass relief valve is provided in the full-flow filter.
When the filter element is clogged, the bypass relief valve opens at 1.5 kgf/cm2 (21 psi) differential pressure.

3. DRAIN CIRCUIT



R5573CI02

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

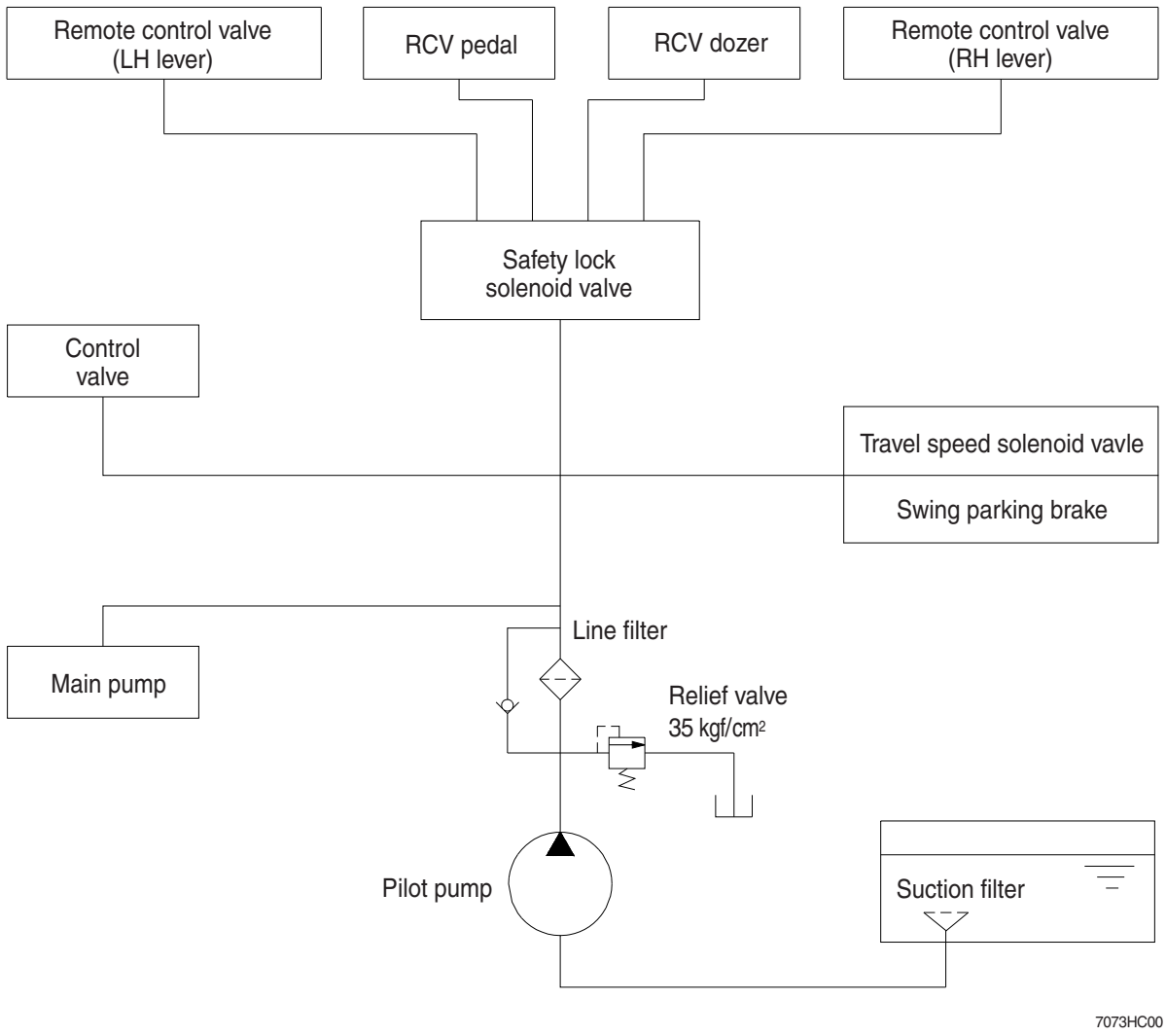
1) TRAVEL MOTOR DRAIN CIRCUIT

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

2) SWING MOTOR DRAIN CIRCUIT

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

GROUP 3 PILOT CIRCUIT

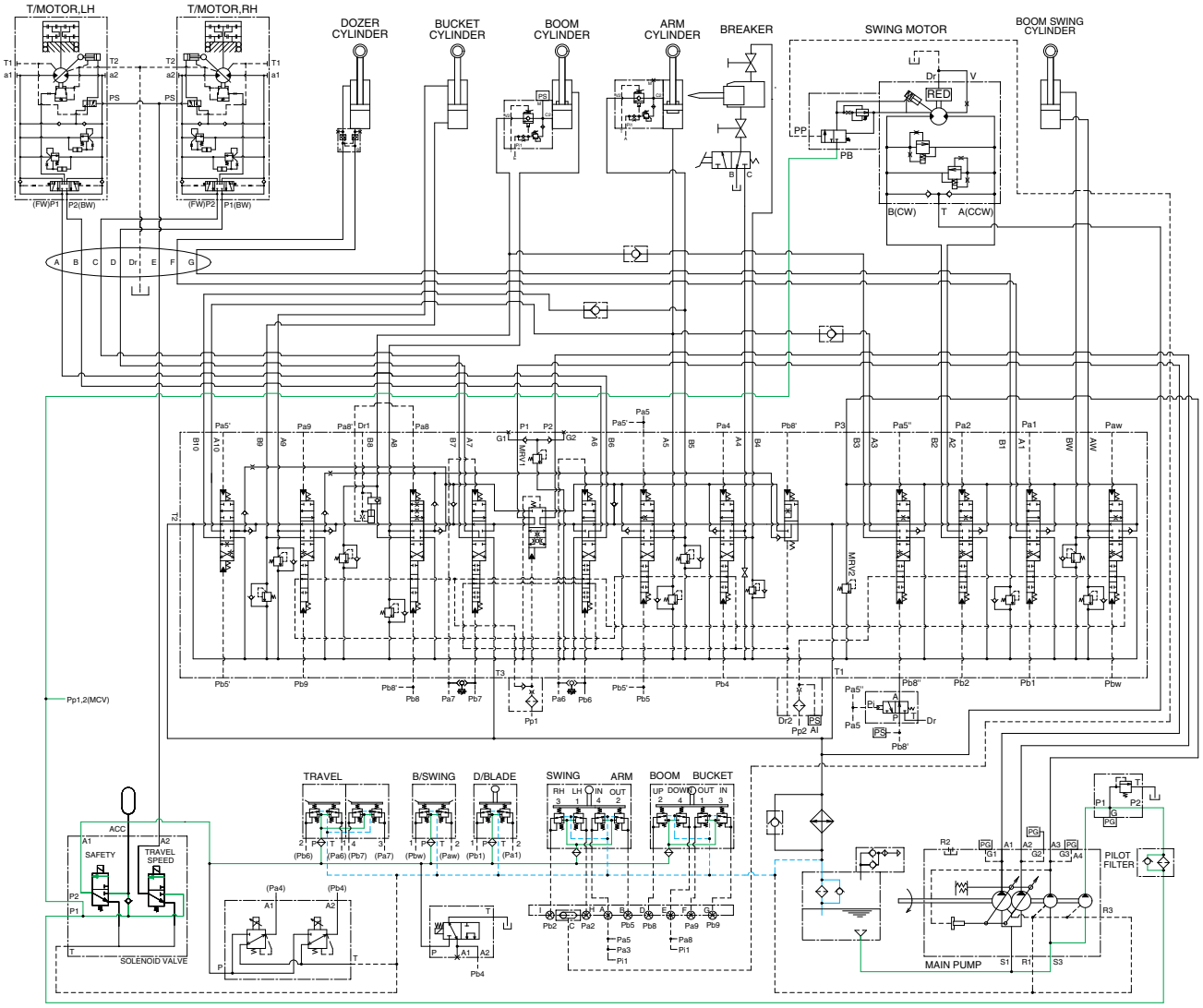


The pilot circuit consists of suction circuit, delivery circuit and return circuit.

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

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

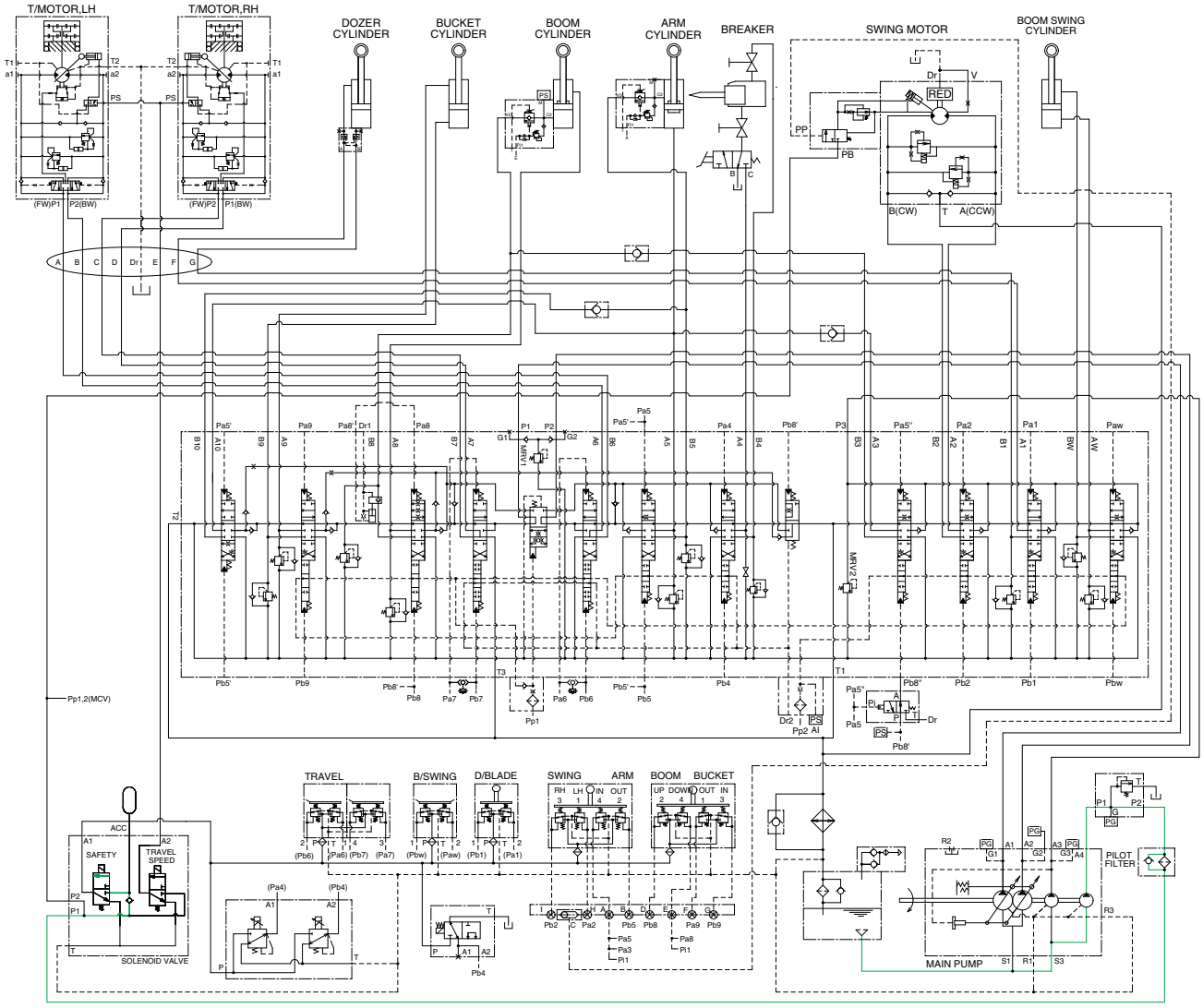
1. SUCTION, DELIVERY AND RETURN CIRCUIT



80CR9A3HC02

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)

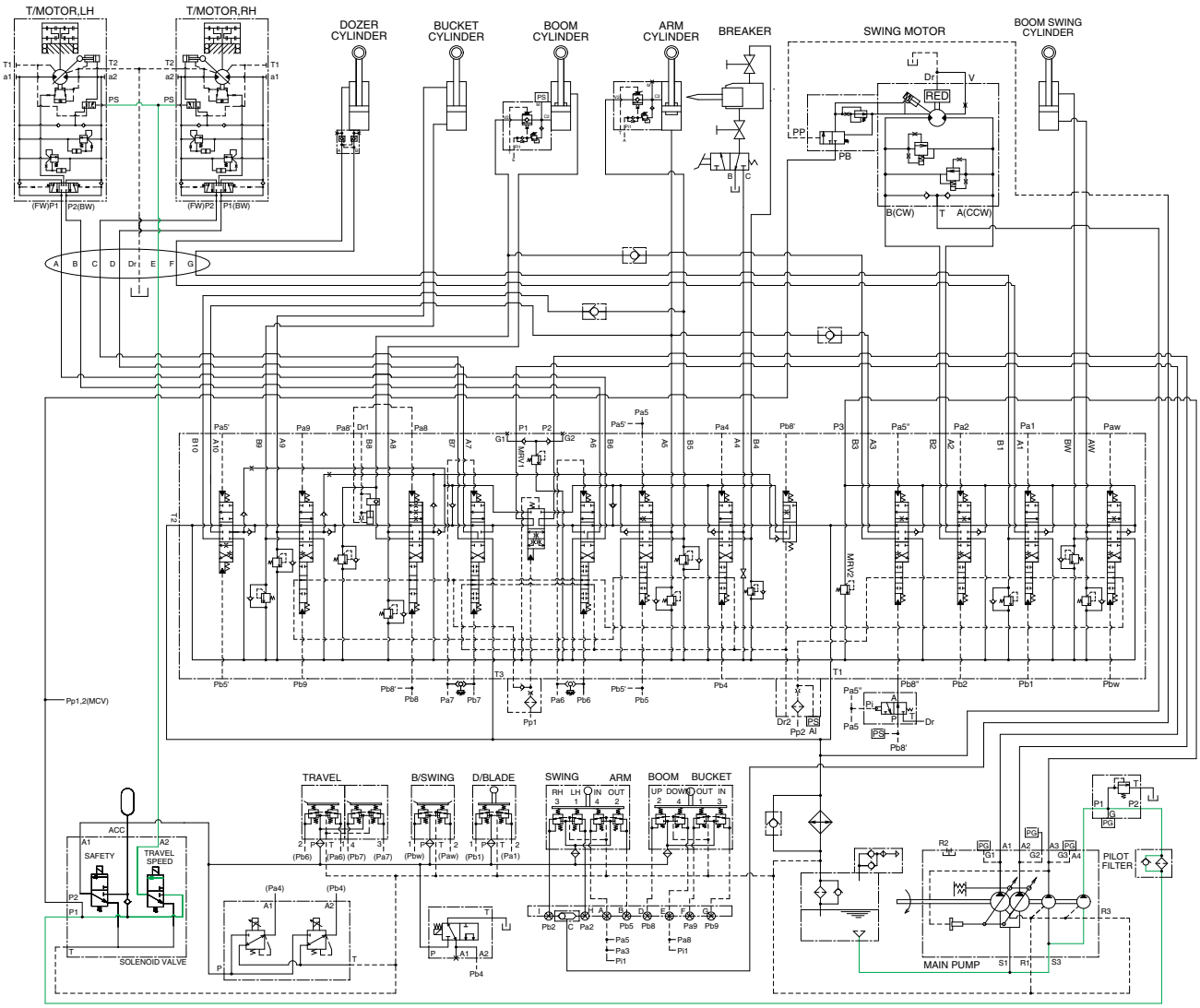


80CR9A3HC03

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

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

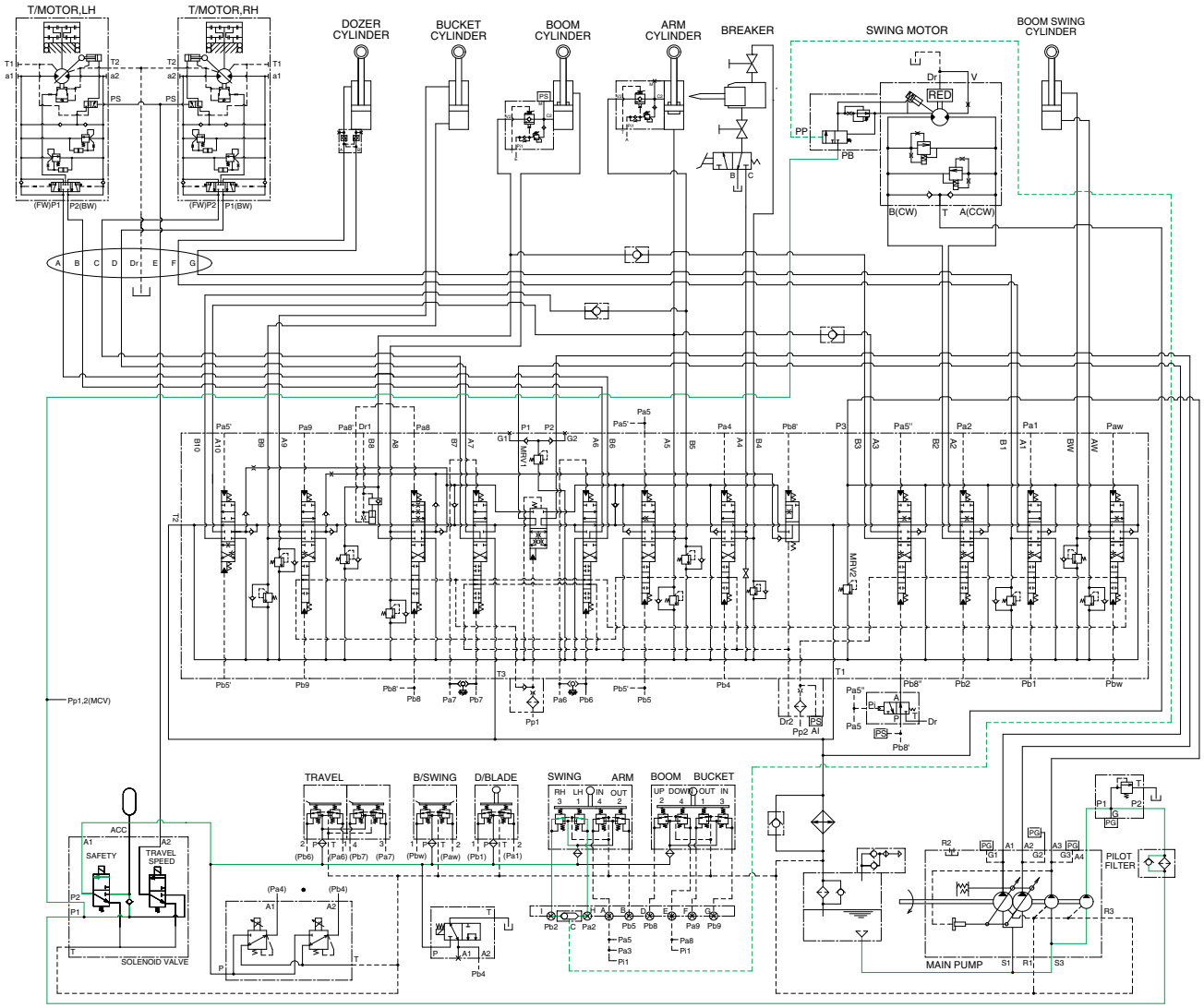
3. TRAVEL SPEED CONTROL SYSTEM



80CR9A3HC04

When the travel speed switch is pushed, the travel speed solenoid valve is actuated and the discharged oil from the pilot pump flows to the PS port of pilot valve in the travel motors.
As a result, the control piston is pushed by the main oil flow, thus the displacement is minimized.
When the travel speed switch is pushed once more, the travel speed solenoid valve is return to original position by the force of spring, the hydraulic oil of PS port returns to the hydraulic tank.
As a result, the control piston is returned by the main oil flow, thus the displacement is maximized.

4. SWING PARKING BRAKE RELEASE

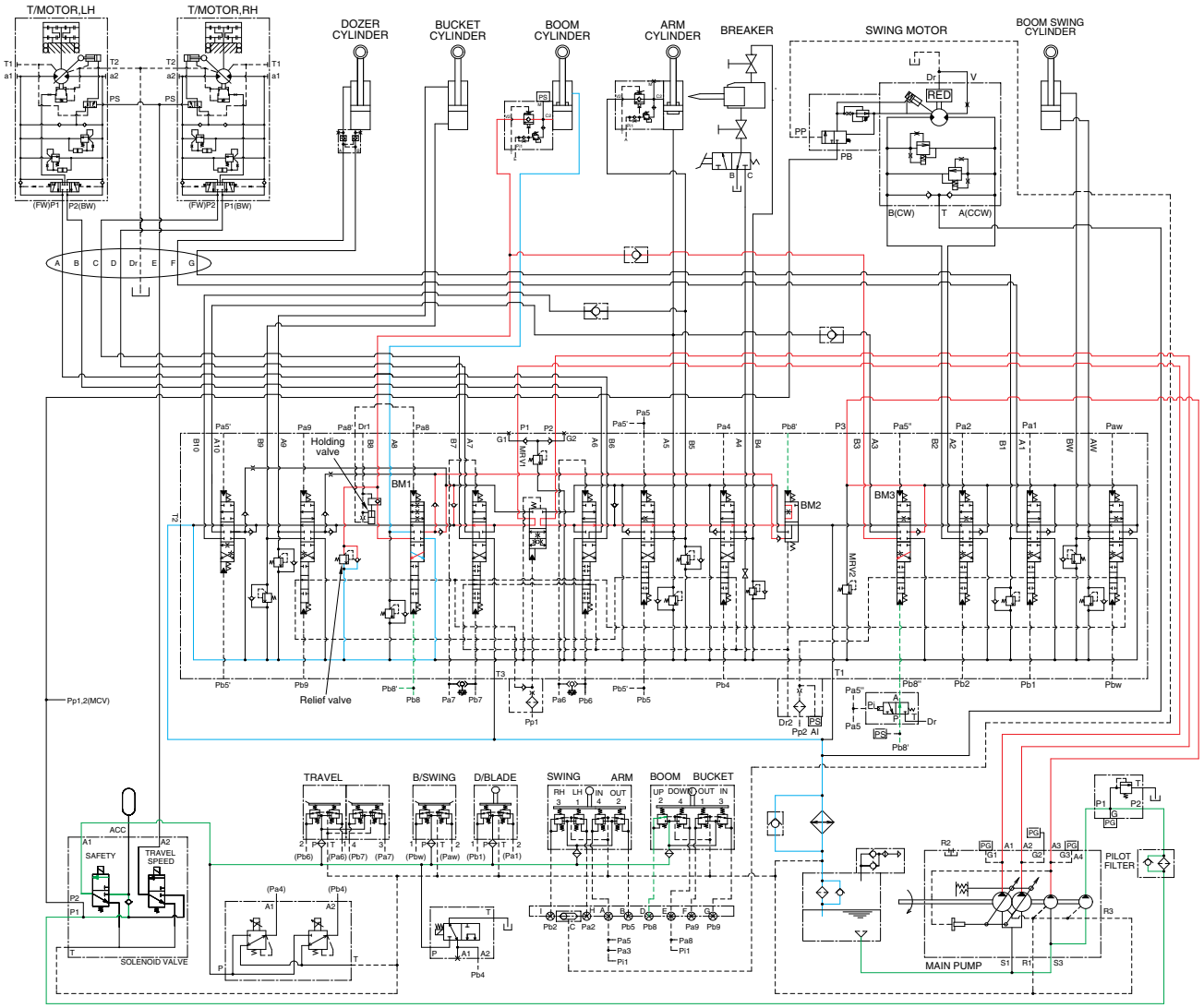


80CR9A3HC05

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

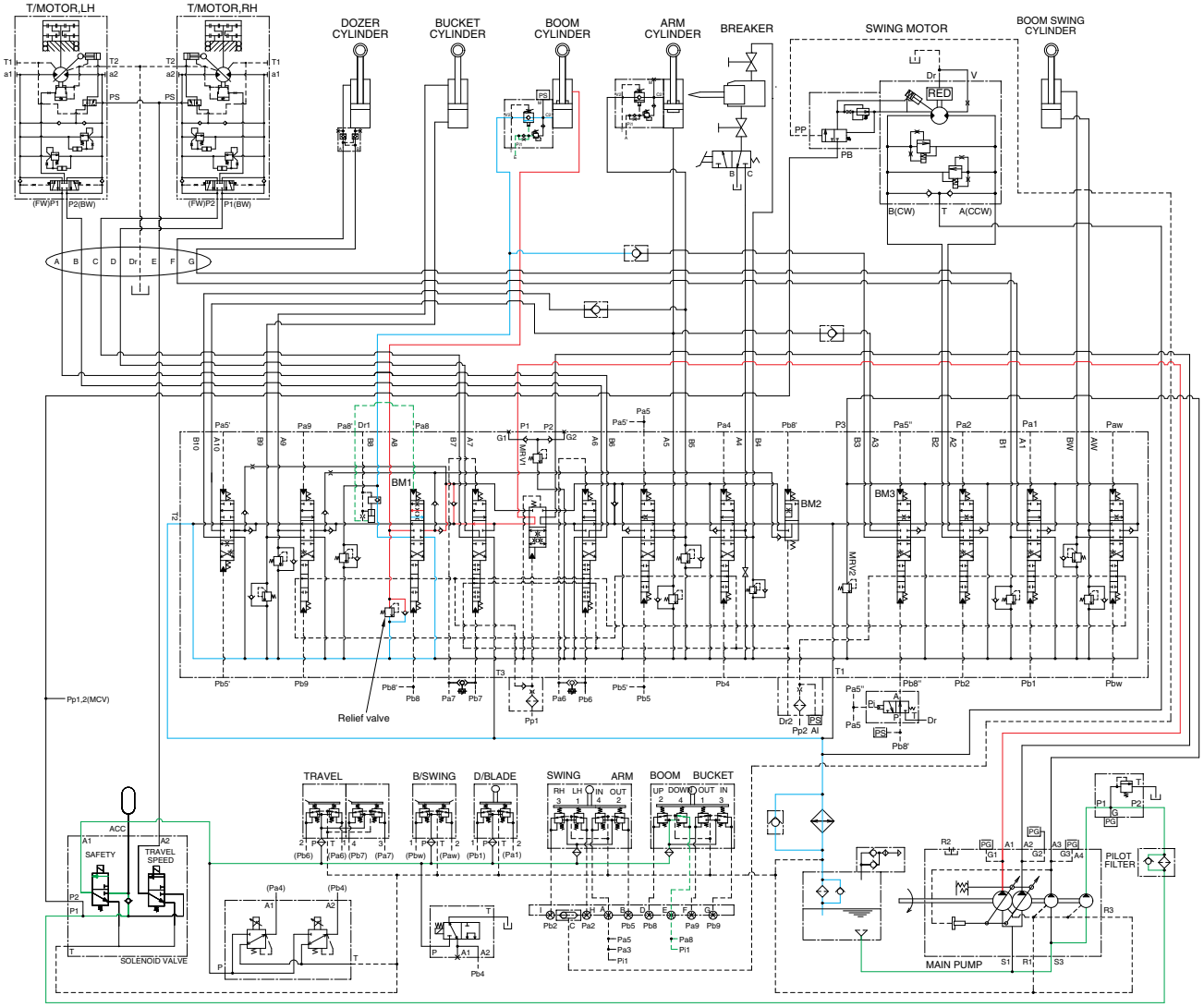


80CR9A3HC06

When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure from the remote control valve.

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

2. BOOM DOWN OPERATION



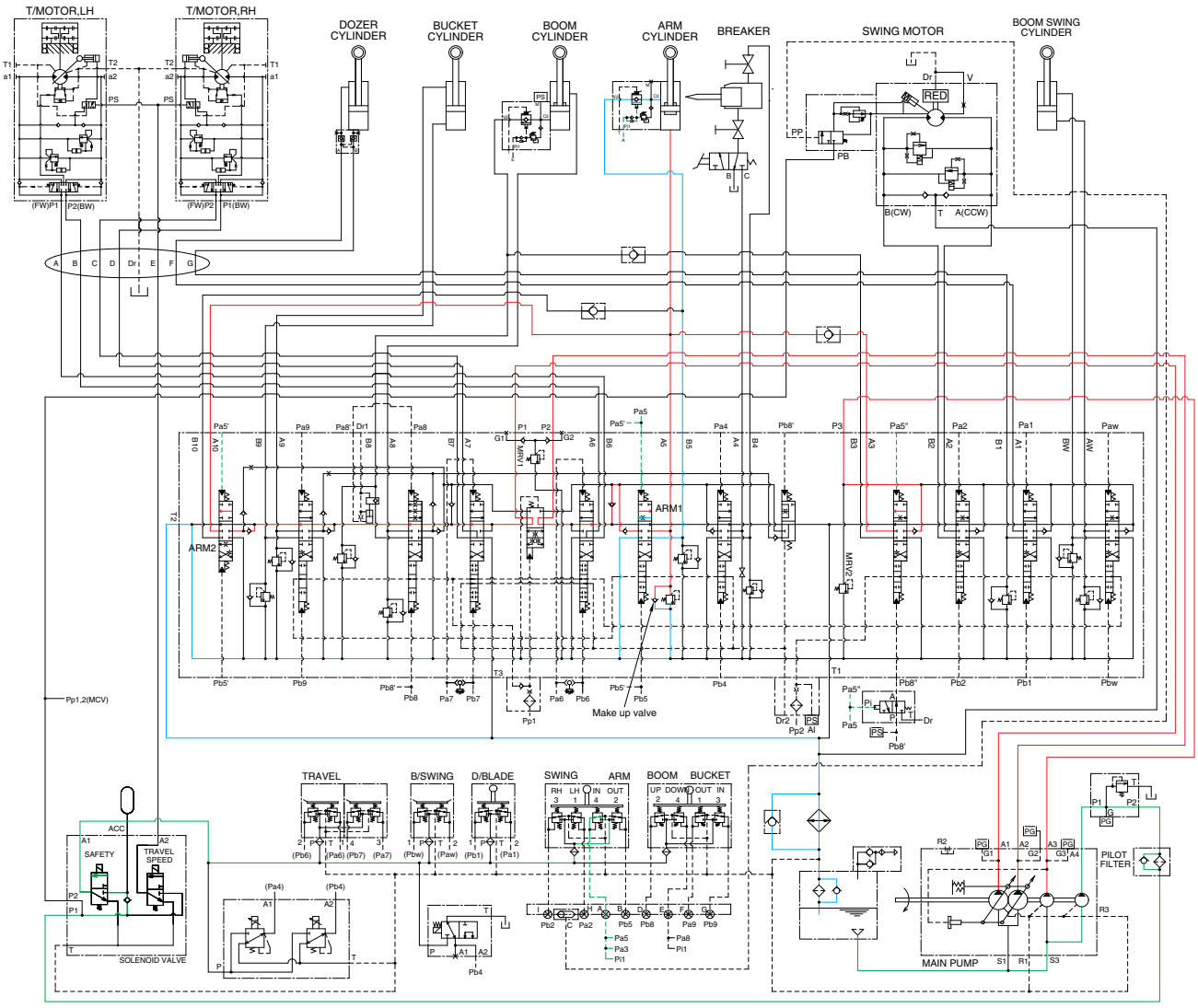
80CR9A3HC07

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

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

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

3. ARM ROLL IN OPERATION



80CR9A3HC08

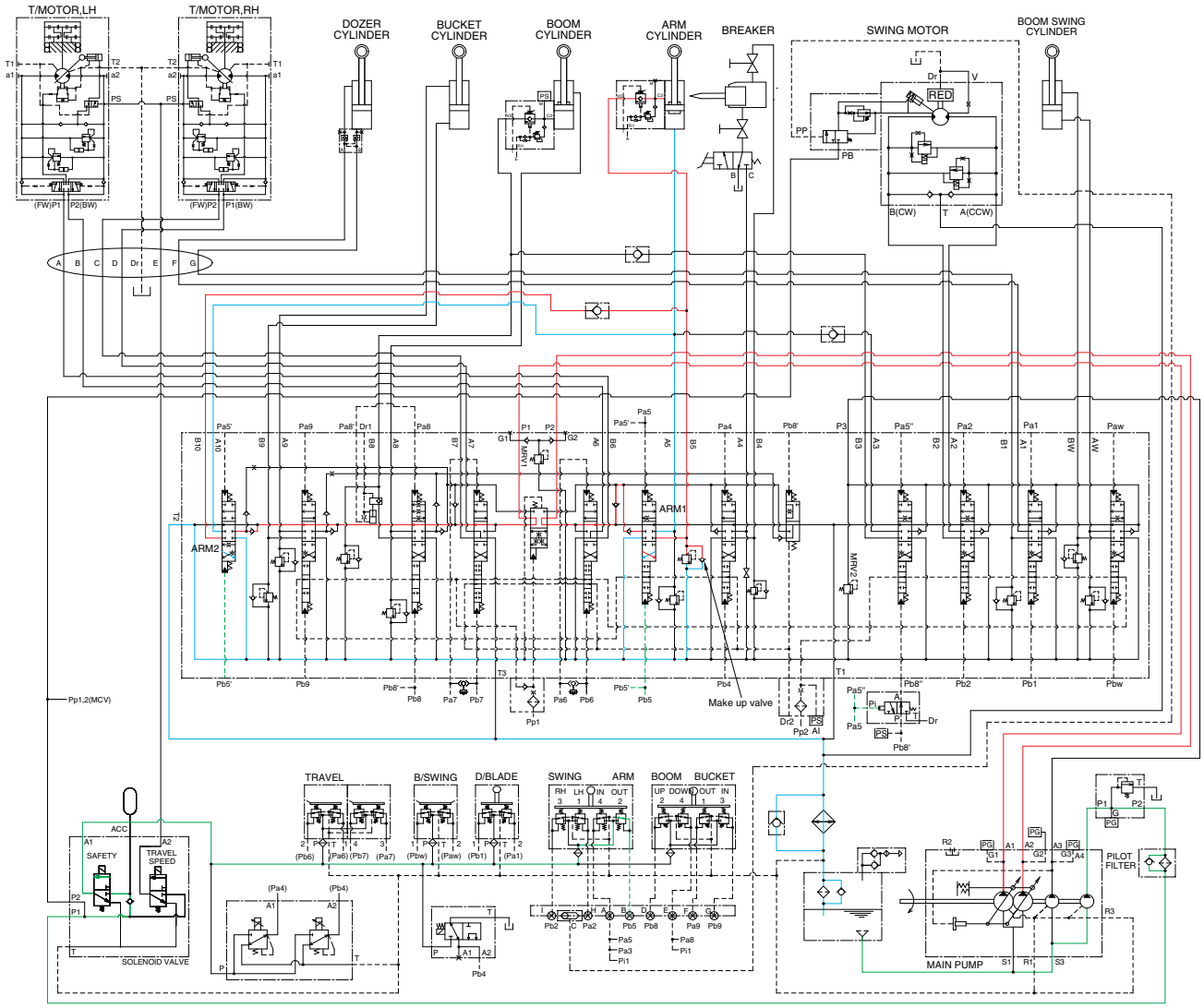
When the left control lever is pulled back, the arm spools in the main control valve are moved the to roll in position by the pilot oil pressure from the remote control valve.

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

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

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

4. ARM ROLL OUT OPERATION



80CR9A3HC09

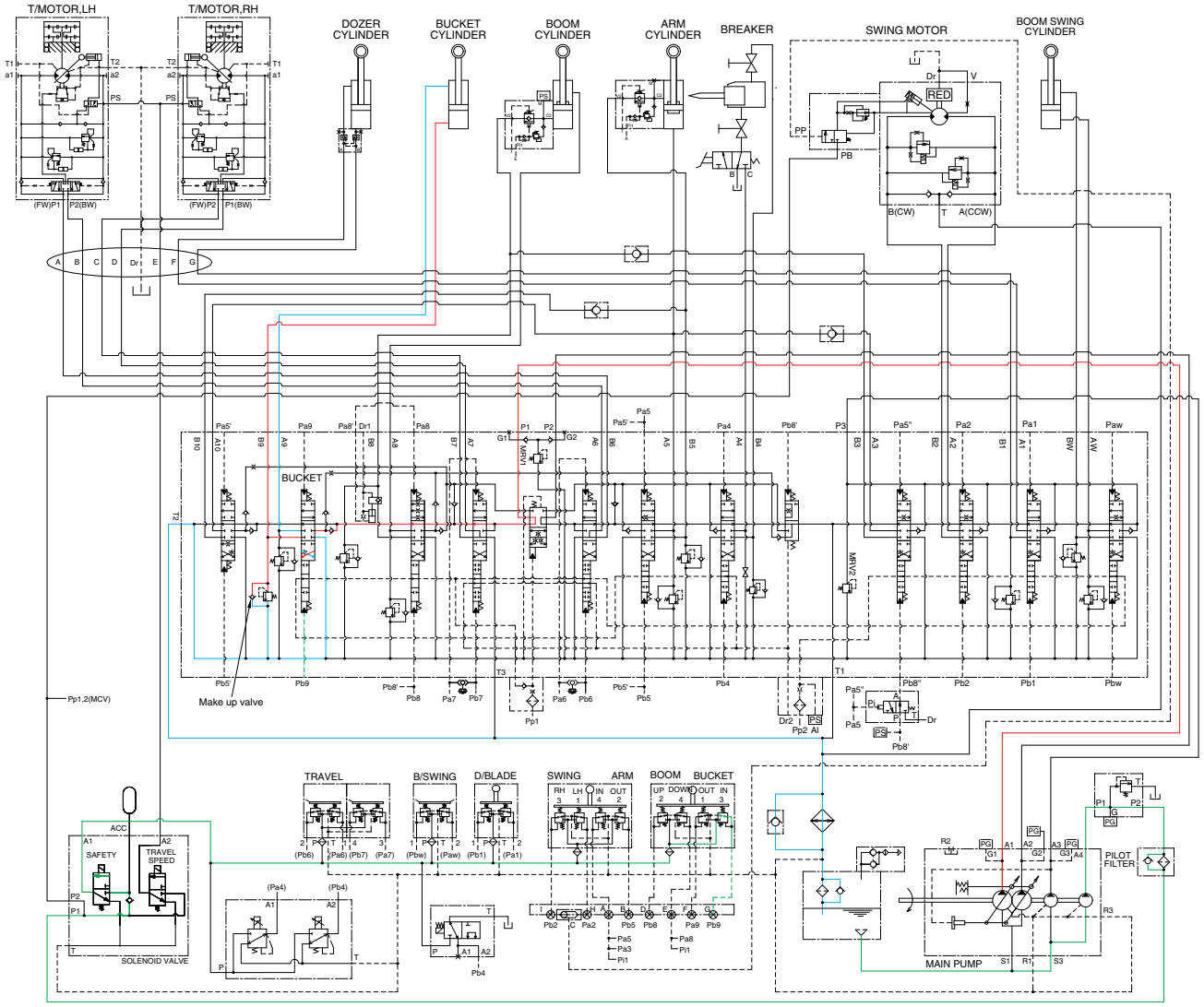
When the left control lever is pushed forward, the arm spool in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.

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

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

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

5. BUCKET ROLL IN OPERATION



80CR9A3HC10

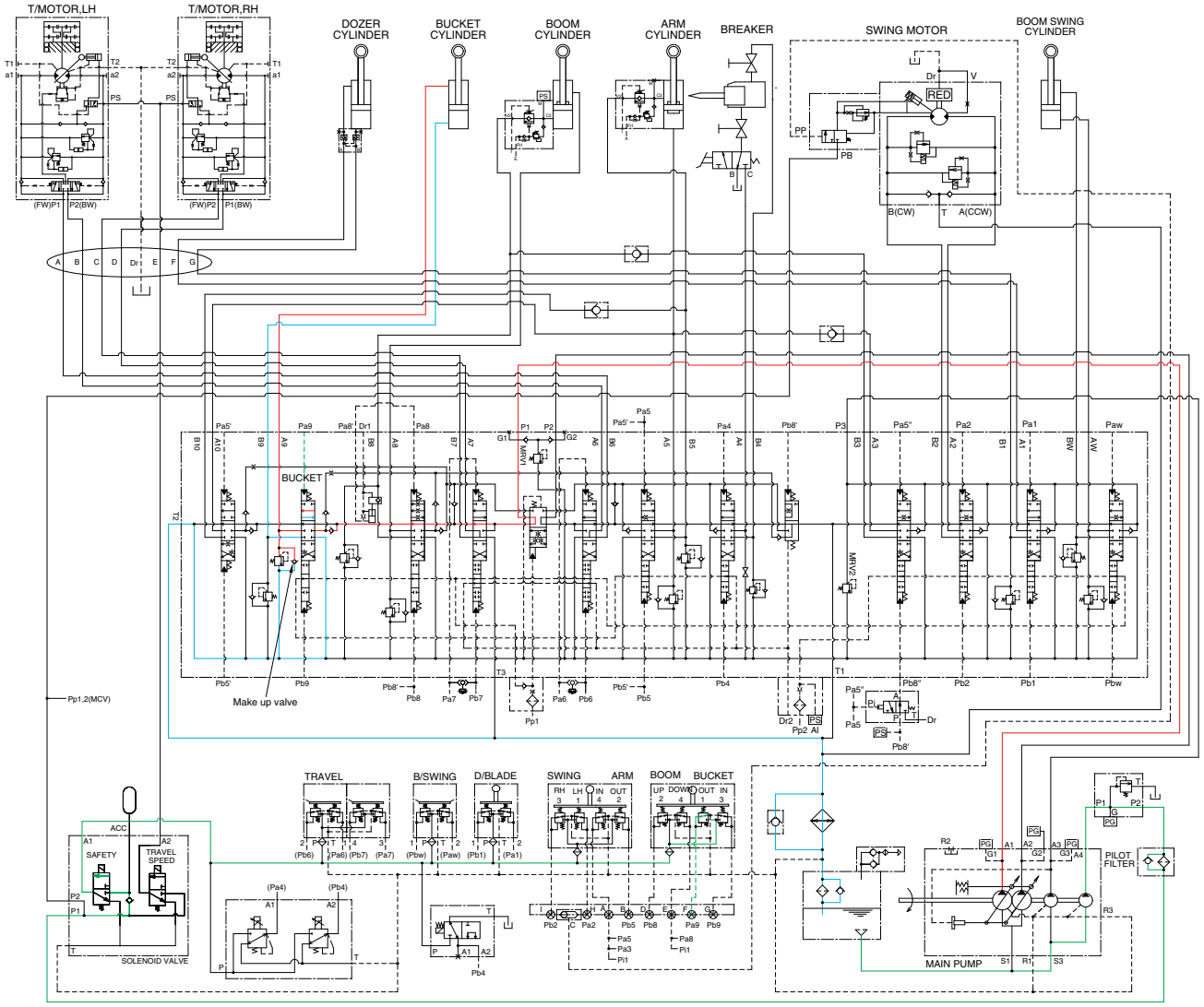
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

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

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

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

6. BUCKET ROLL OUT OPERATION



80CR9A3HC11

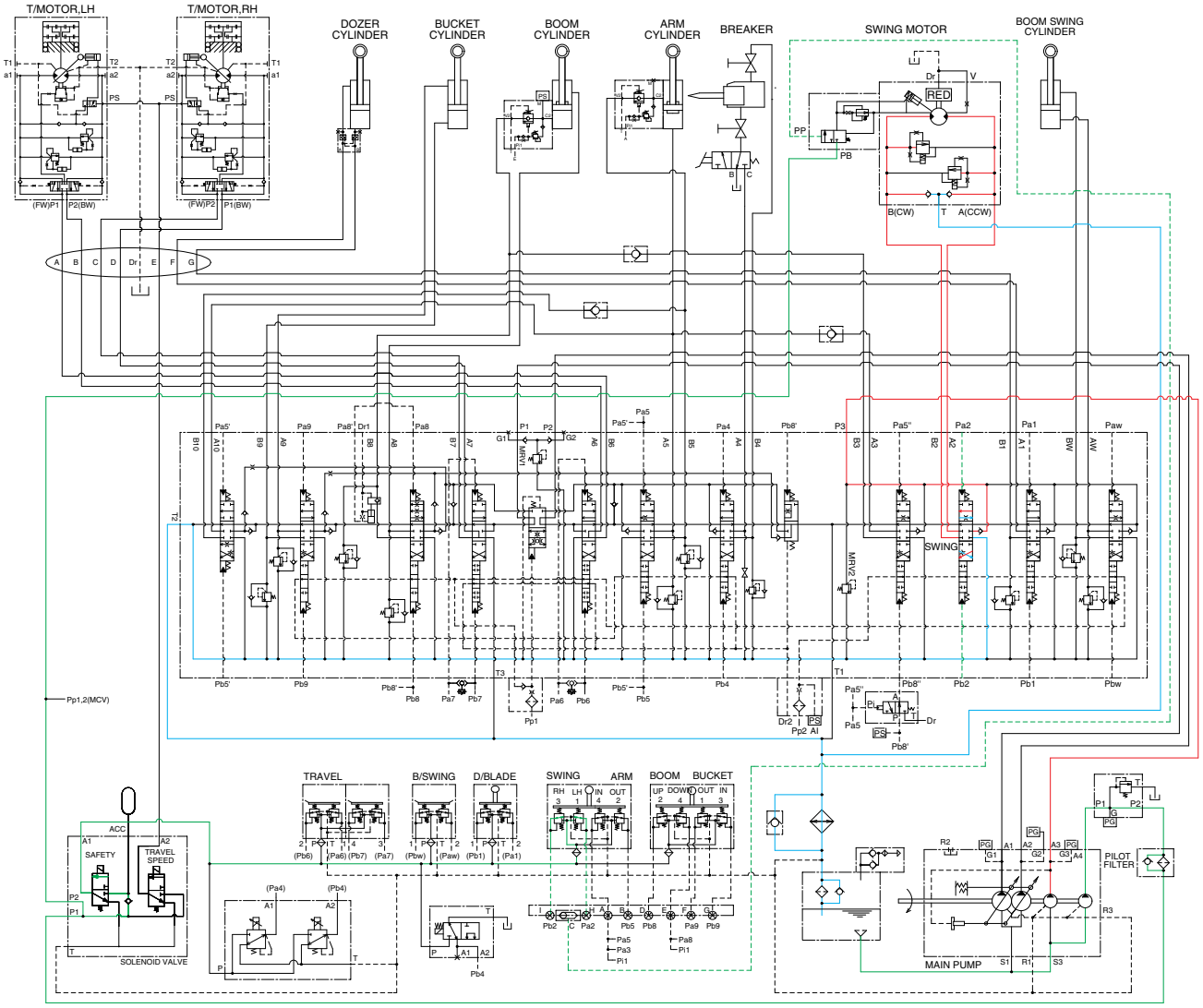
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

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

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

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

7. SWING OPERATION



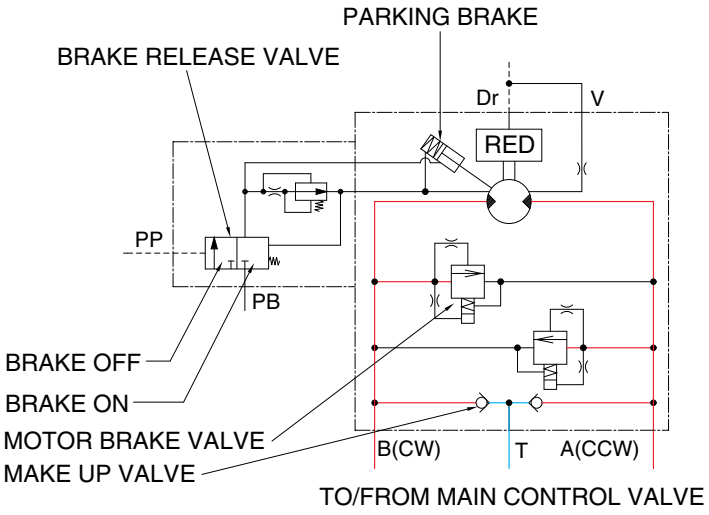
80CR9A3HC12

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

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

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

SWING CIRCUIT OPERATION



80CR9A3HC40

1) MOTOR BRAKE VALVE

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

2) MAKE UP VALVE

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

3) PARKING BRAKE

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

PARKING BRAKE "OFF" OPERATION

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

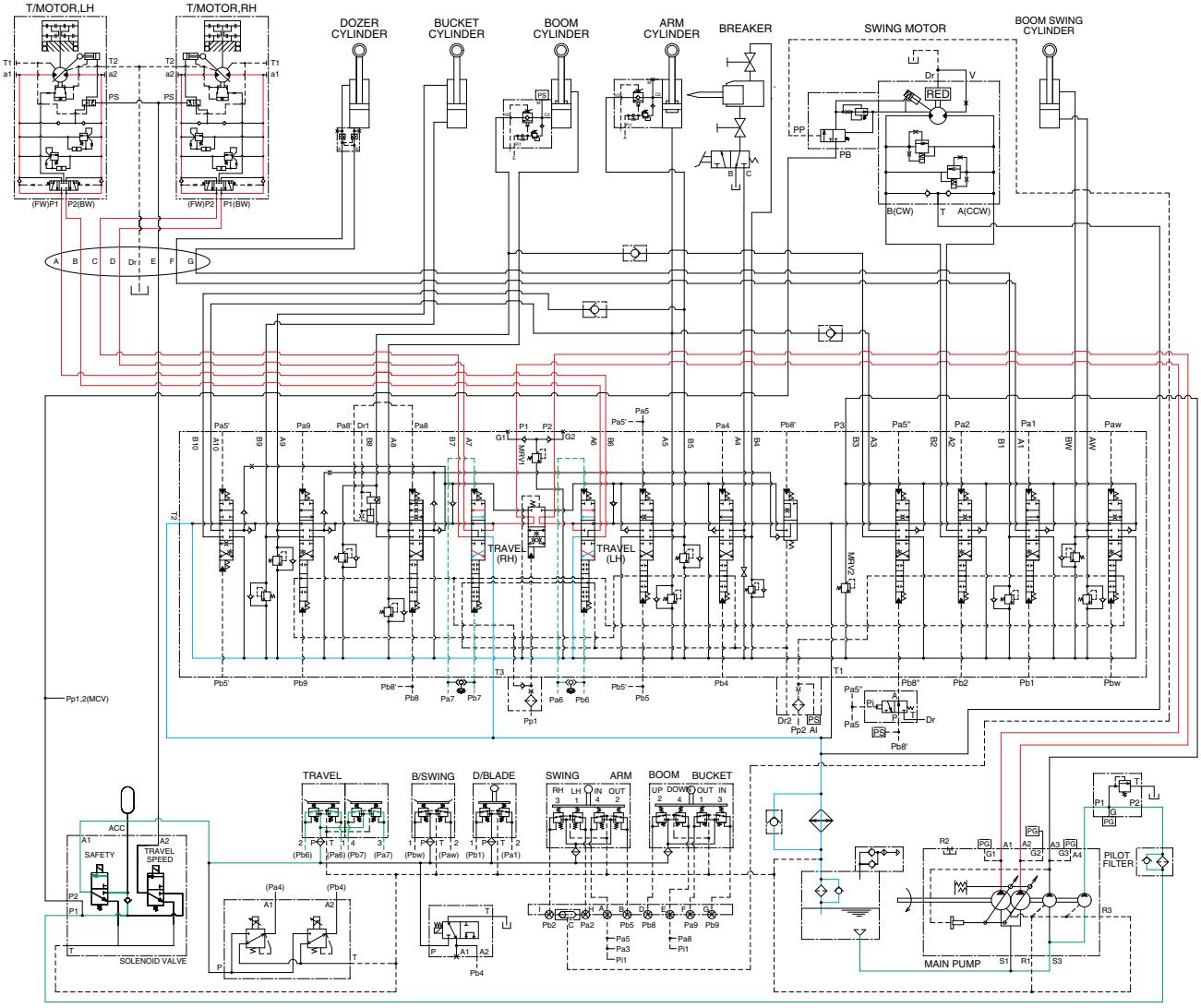
When the left control lever placed in the swing position, the pilot pressure at the shuttle valve is transferred to the brake release valve and the brake release valve is change over. Then the pilot pressure lift the brake piston and release the parking brake.

PARKING BRAKE "ON" OPERATION

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

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

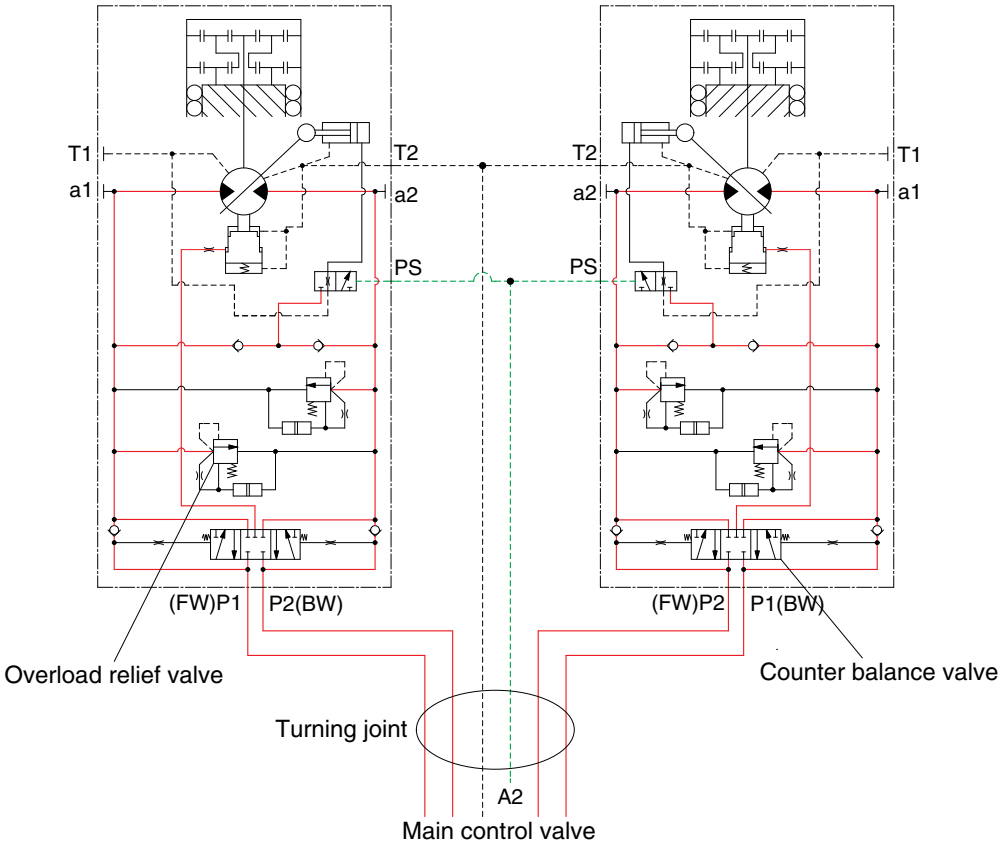
8. TRAVEL FORWARD AND REVERSE OPERATION



80CR9A3HC14

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

TRAVEL CIRCUIT OPERATION



80CR93HC15

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

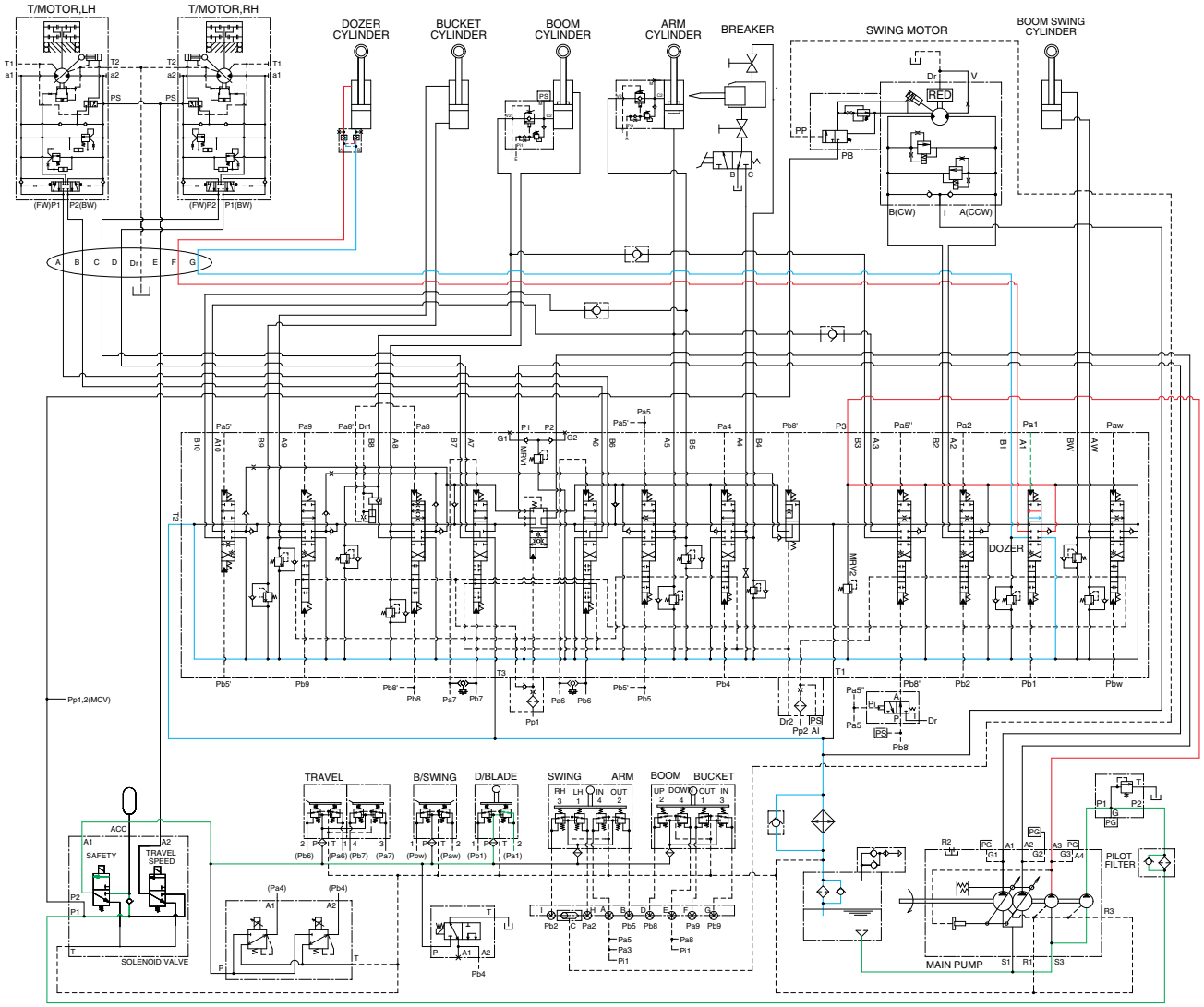
1) COUNTER BALANCE VALVE

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

2) OVERLOAD RELIEF VALVE

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

9. DOZER UP OPERATION



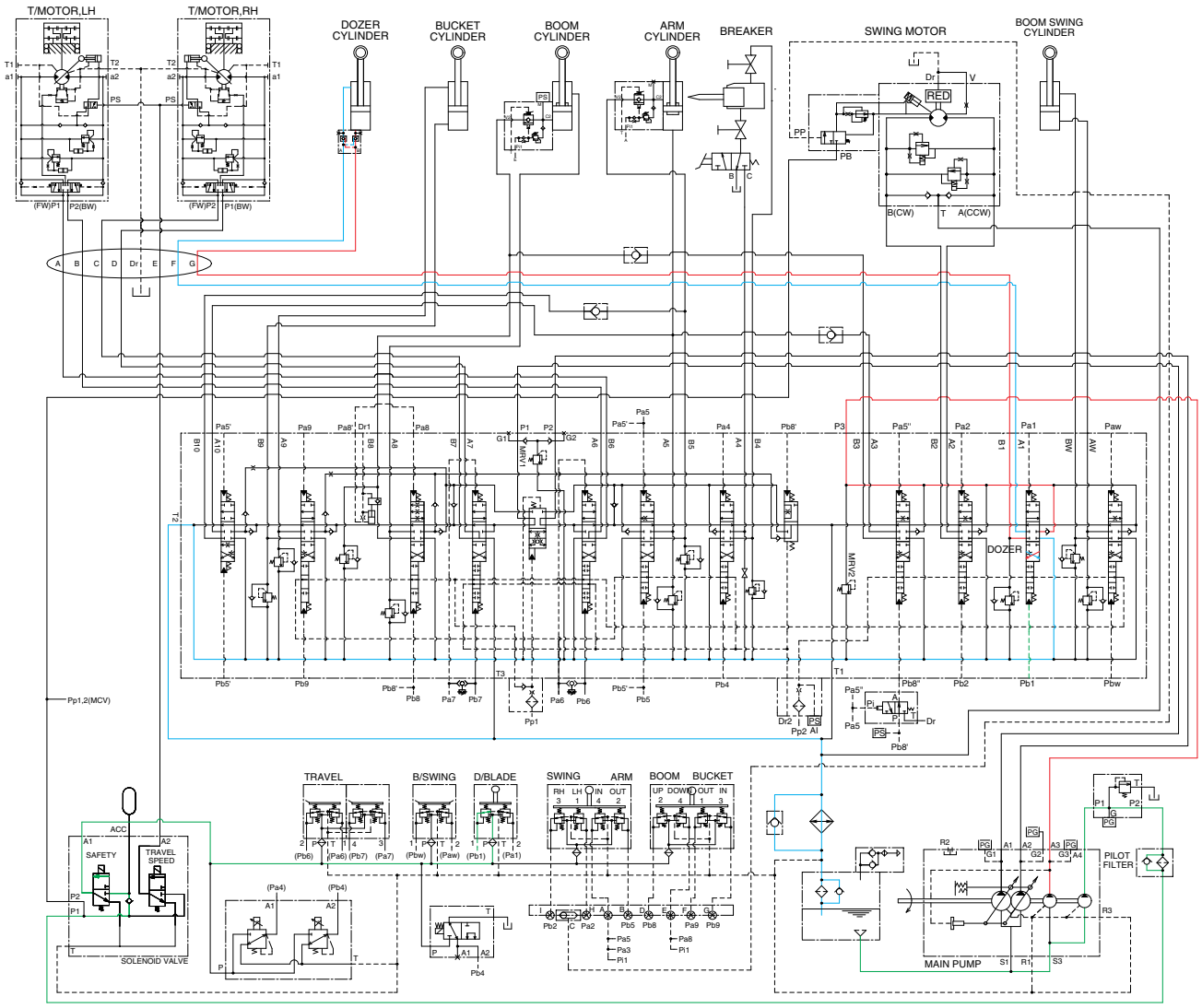
80CR9A3HC16

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

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

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

10. DOZER DOWN OPERATION



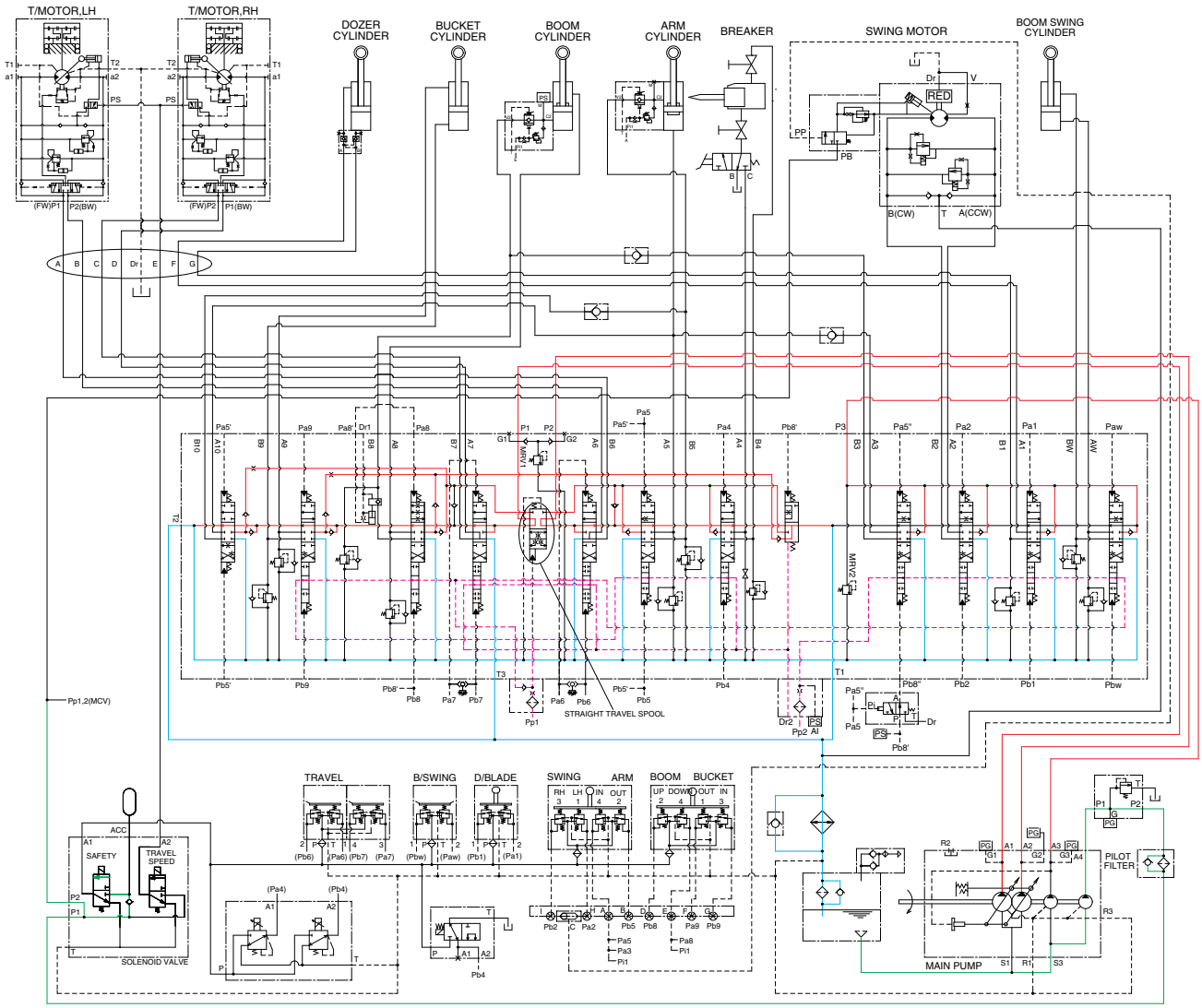
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

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

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

GROUP 5 COMBINED OPERATION

1. OUTLINE



80CR9A3HC21

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

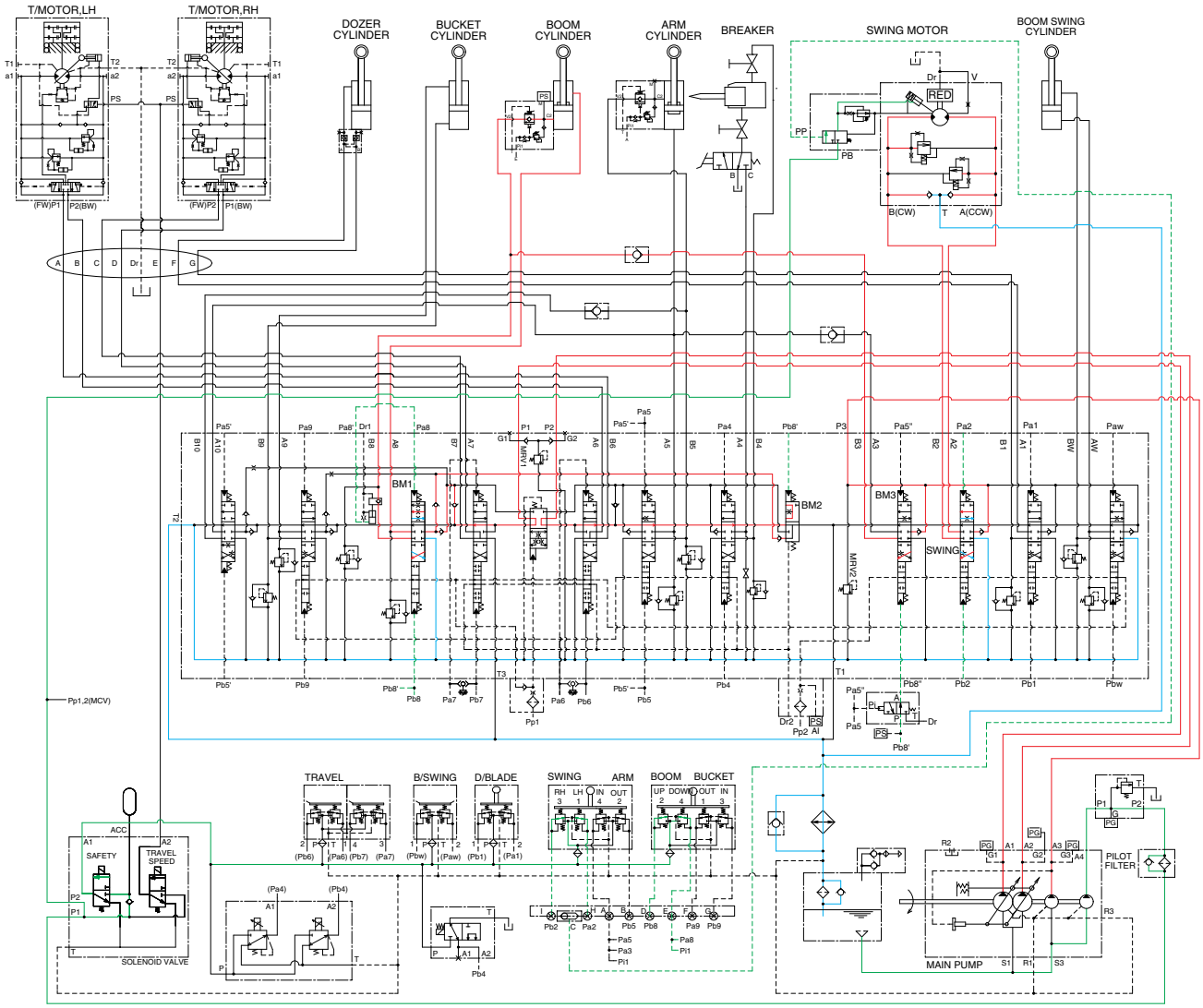
STRAIGHT TRAVEL SPOOL

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

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

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

2. COMBINED SWING AND BOOM OPERATION



80CR9A3HC22

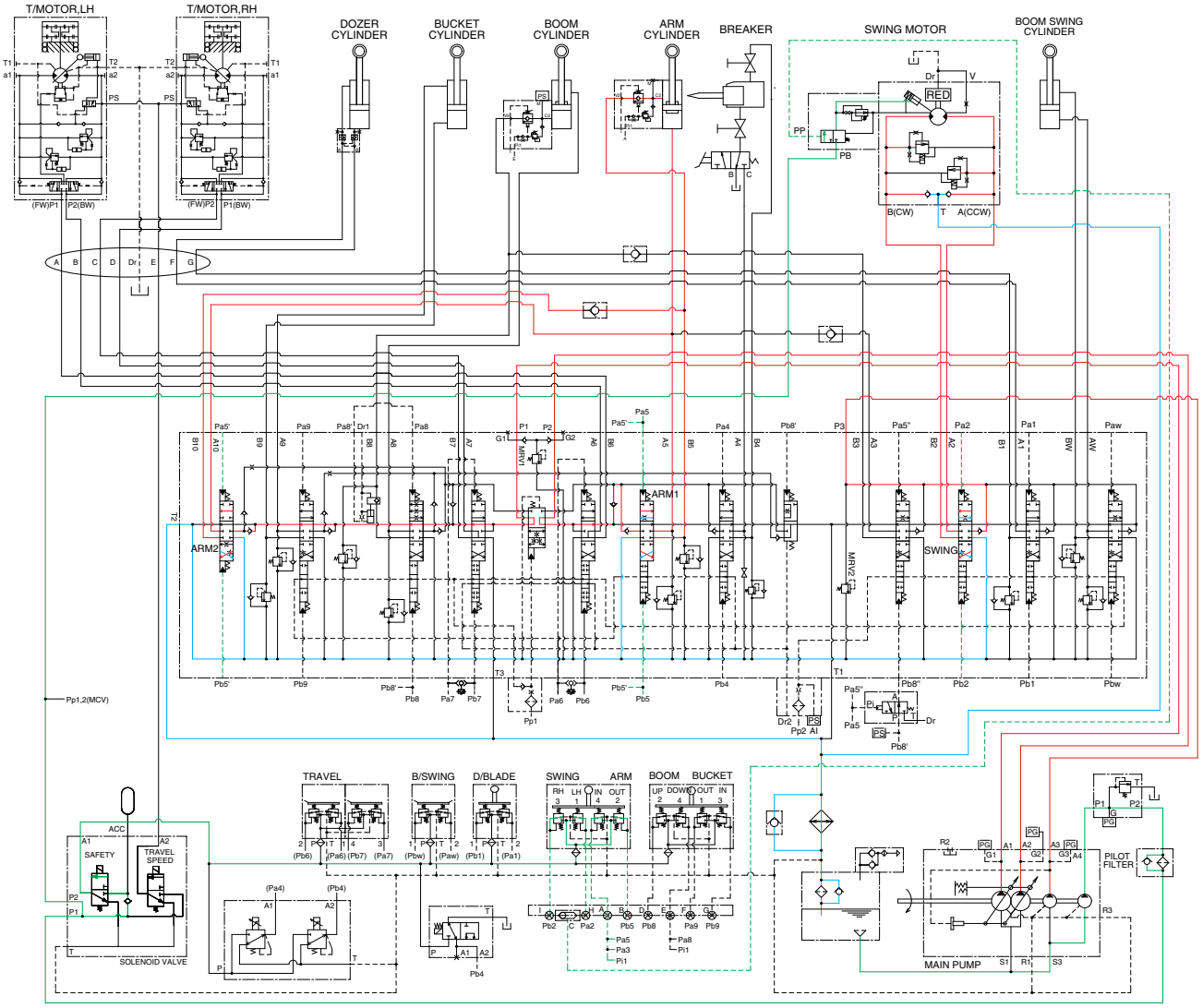
When the swing and boom functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

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

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

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



80CR9A3HC23

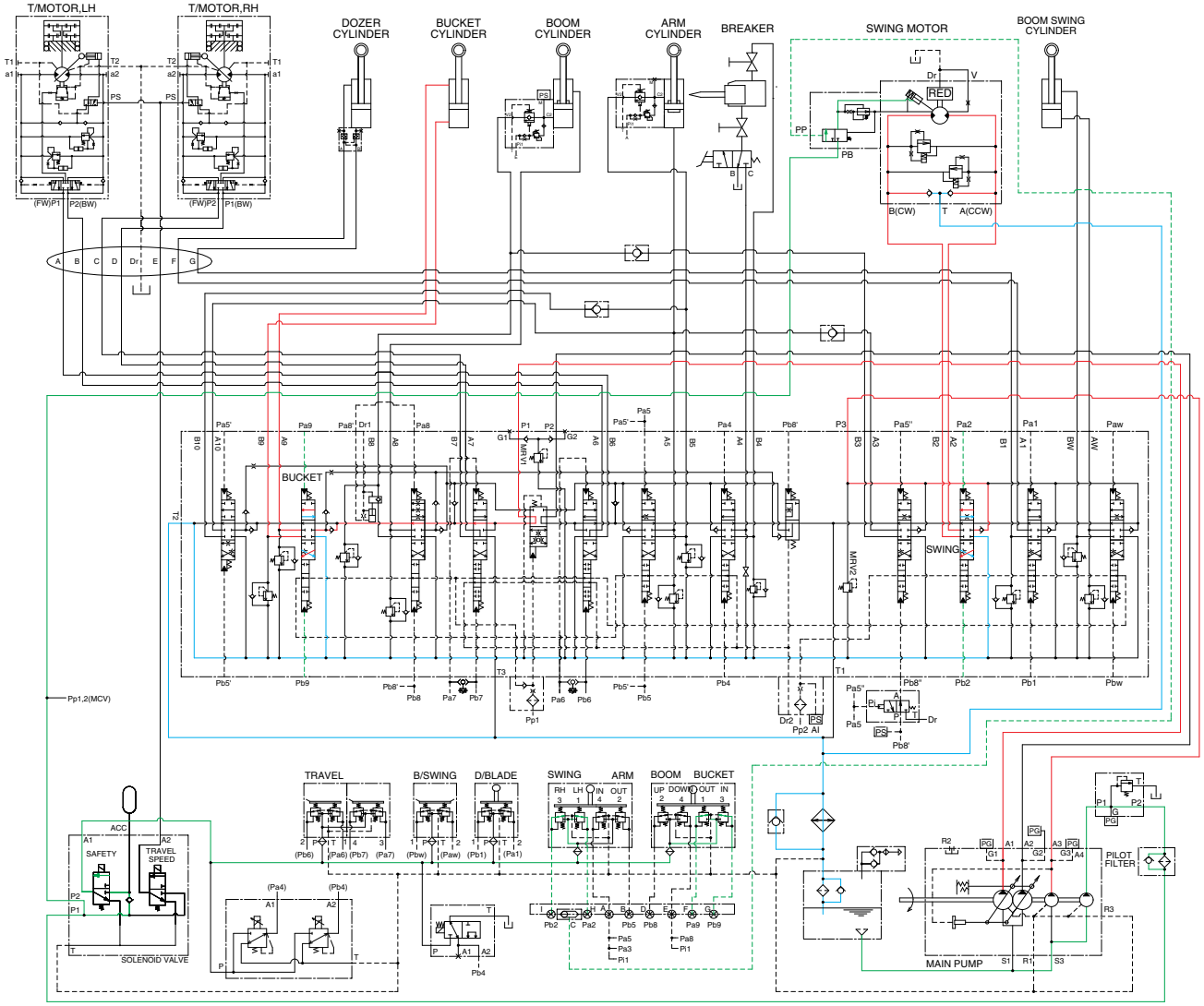
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

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

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

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



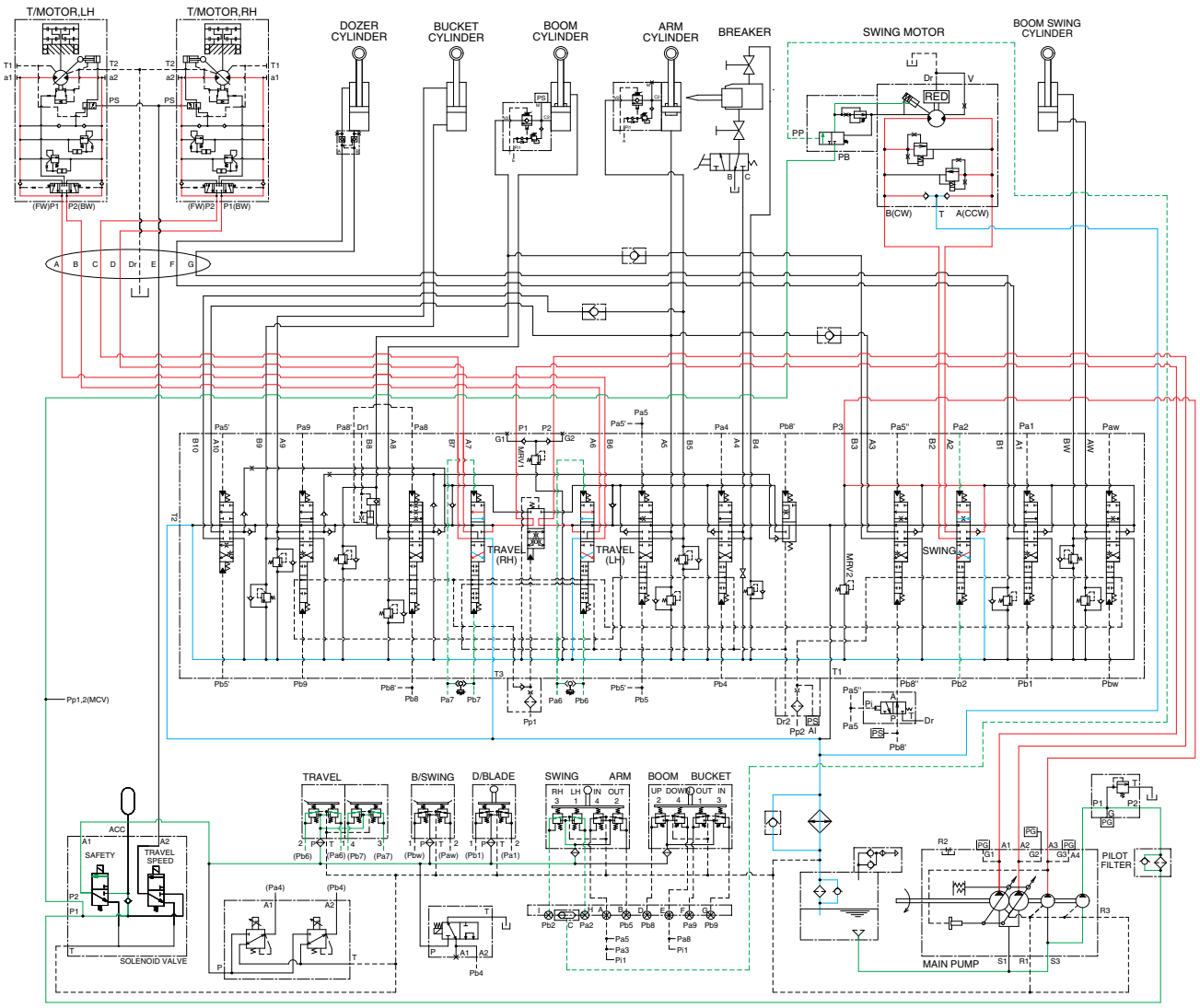
80CR9A3HC24

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

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

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

5. COMBINED SWING AND TRAVEL OPERATION



80CR9A3HC26

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

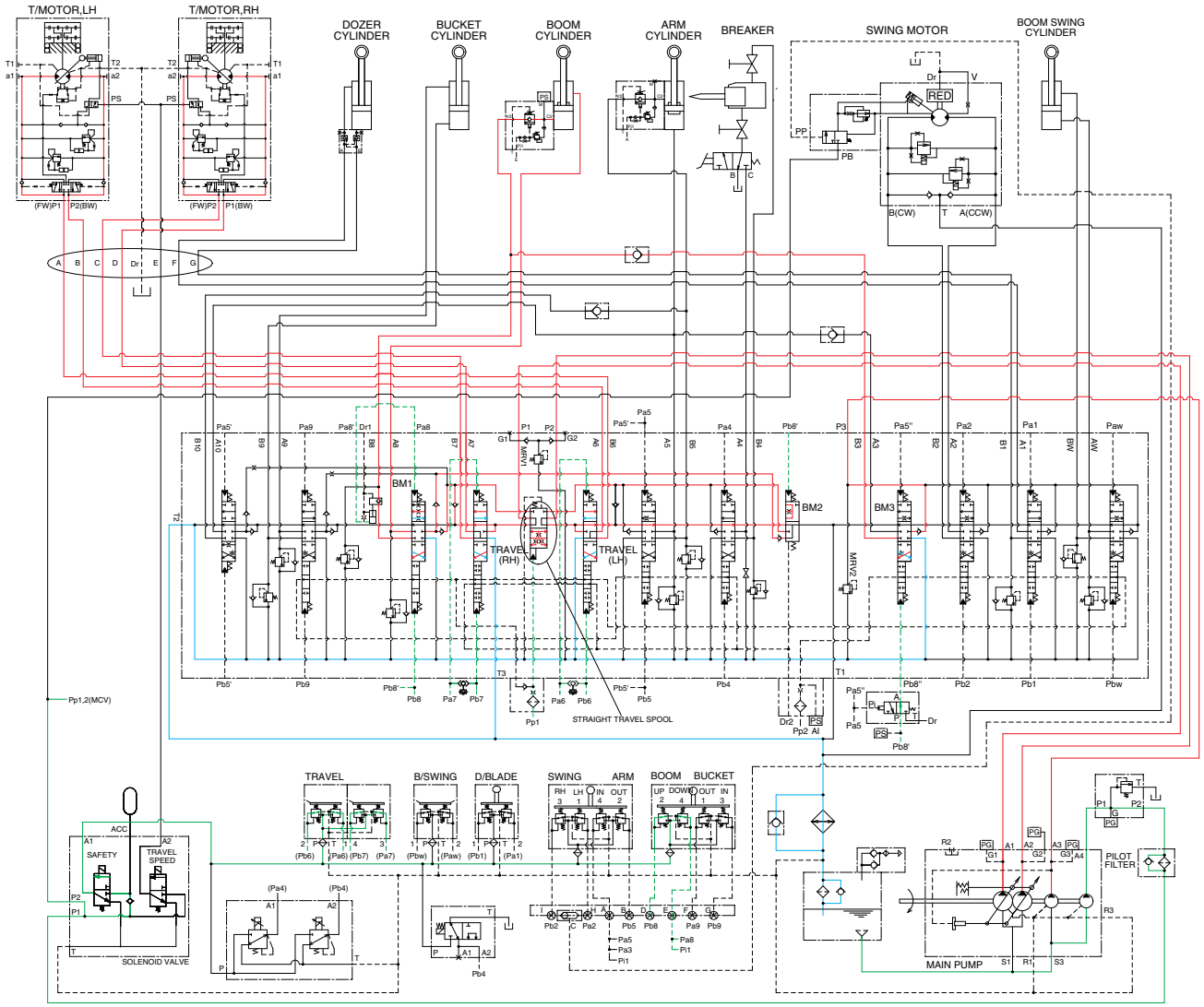
The oil from the A3 pump flows into the swing motor through the swing spool.

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

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

The superstructure swings and the machine travels straight.

6. COMBINED BOOM AND TRAVEL OPERATION



80CR9A3HC27

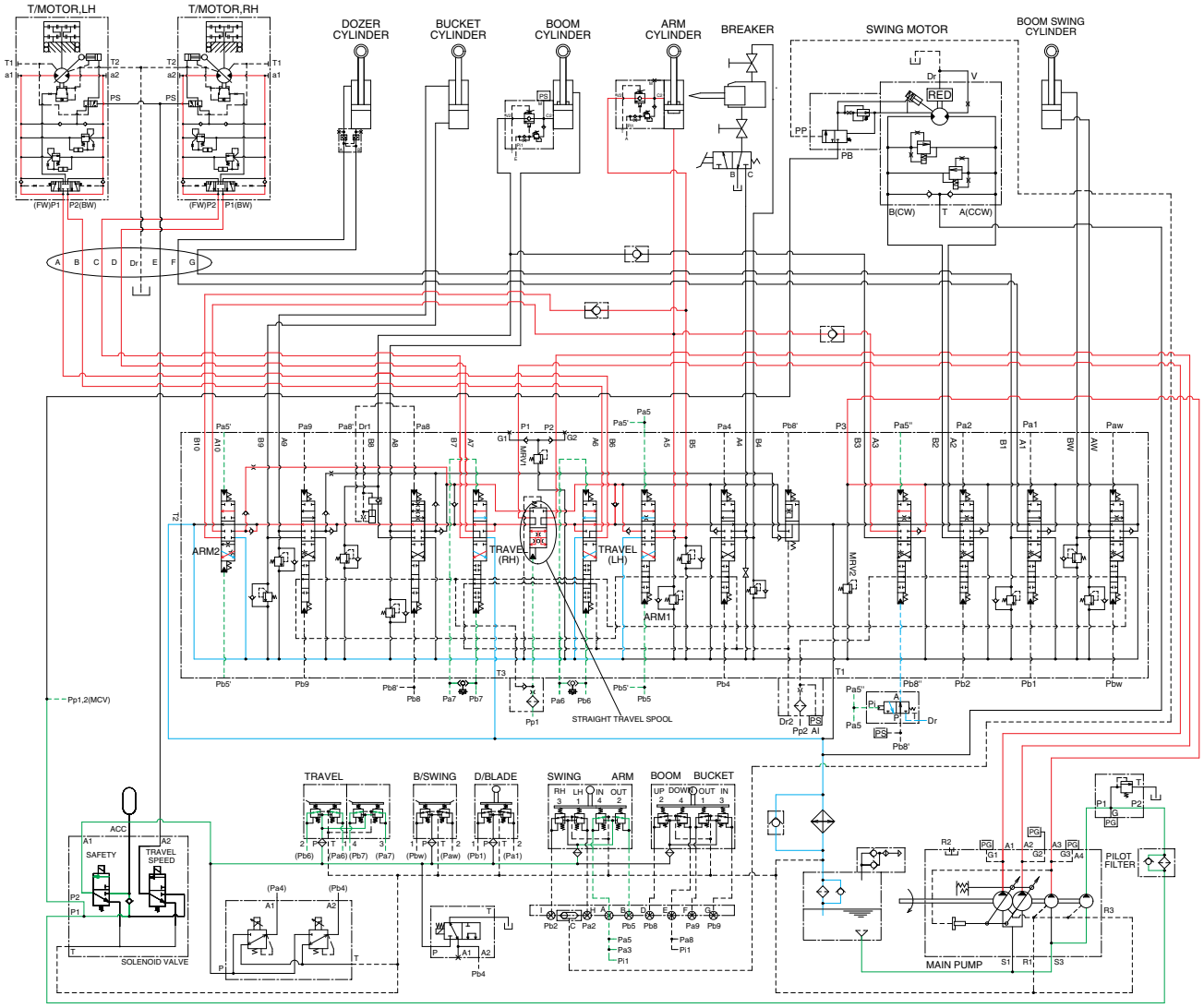
When the boom and travel functions are operated, simultaneously the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the straight travel spool is pushed to the up by the oil pressure from pilot pump.

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

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

The boom is operated and the machine travels straight.

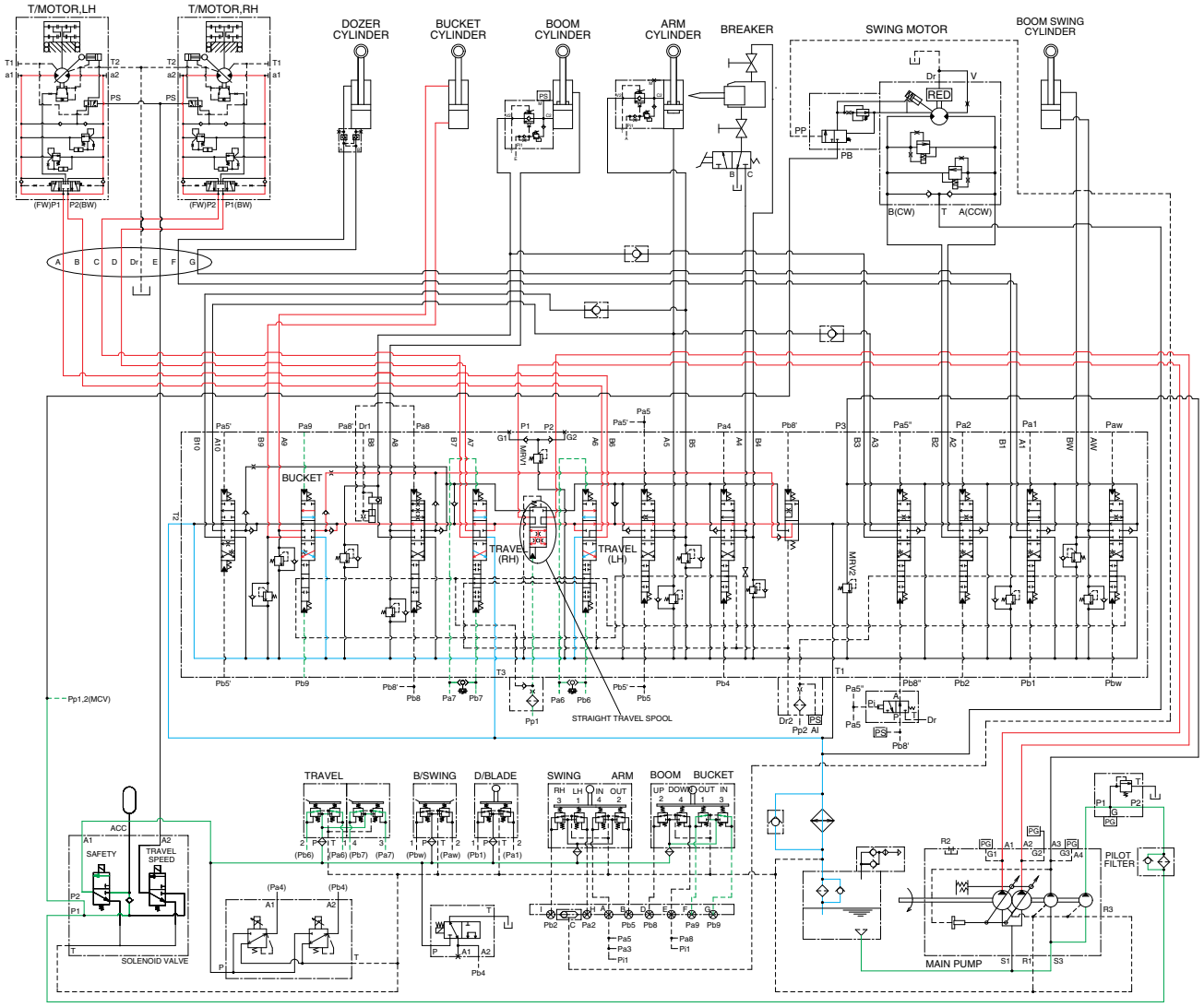
7. COMBINED ARM AND TRAVEL OPERATION



80CR9A3HC28

When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the straight travel spool is pushed to the up by the oil pressure from pilot pump.
The oil from the A1 and A2 pumps flows into the travel motors and the arm cylinder through travel spools and arm spools via the straight travel spool.
At the same time, the oil from the A3 pump flows into the arm cylinder through the arm 3 spool via the selector valve.
The arm is operated and the machine travels straight.

8. COMBINED BUCKET AND TRAVEL OPERATION



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

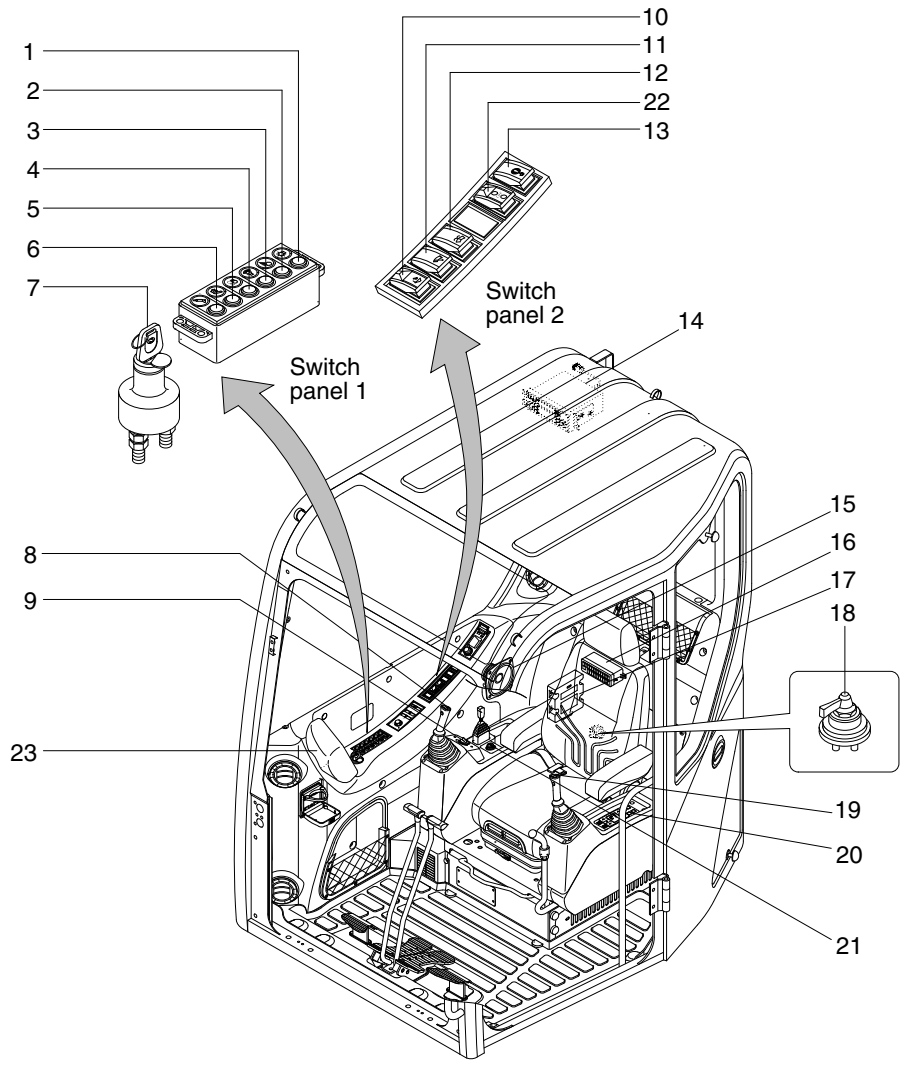
The bucket is operated and the machine travels straight.

SECTION 4 ELECTRICAL SYSTEM

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

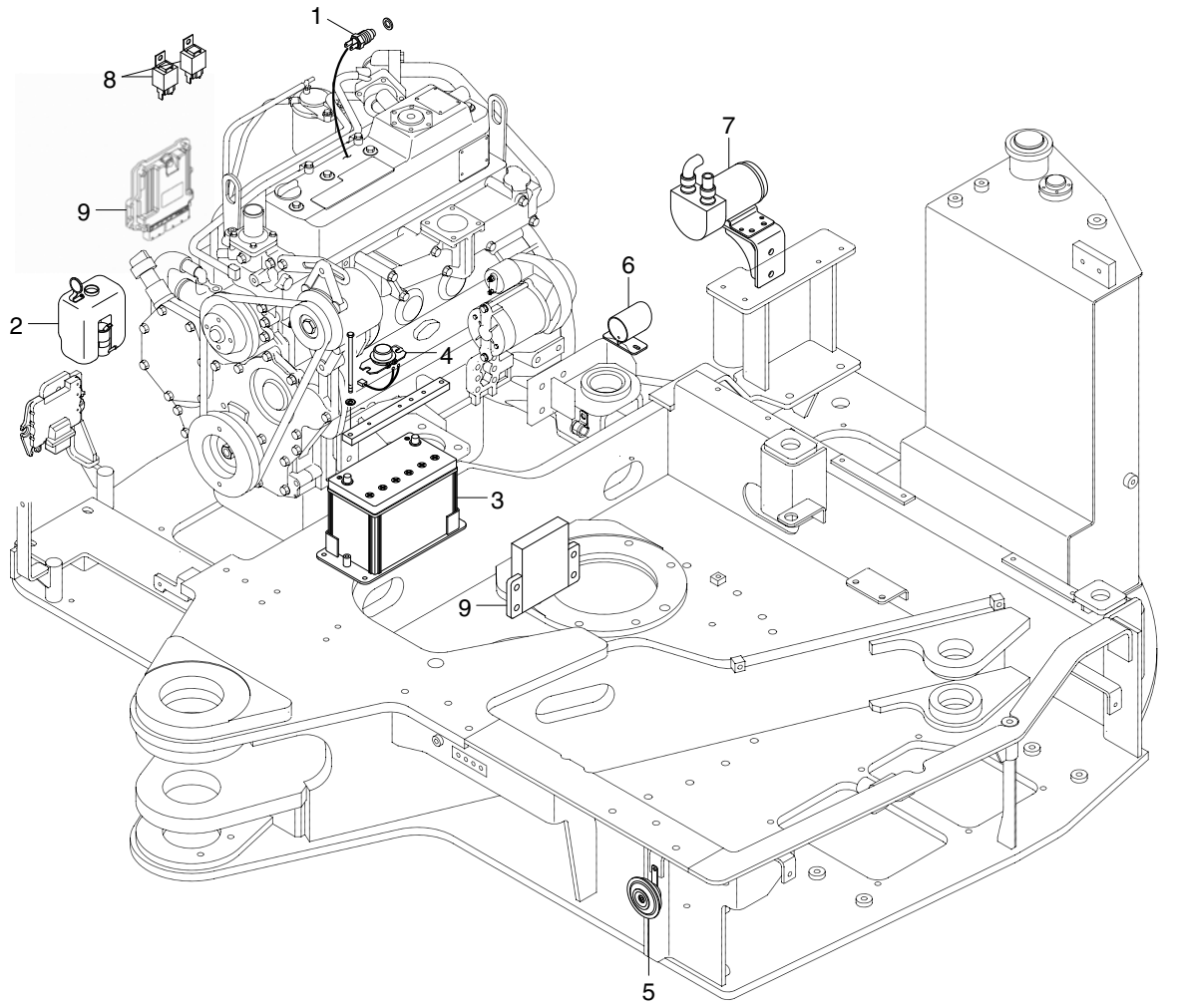
1. LOCATION 1



80CR9A4EL20

1	Head light switch	9	Accel dial switch	17	Machine control unit
2	Work light switch	10	Quick clamp switch	18	Master switch
3	Travel alarm switch	11	Wiper switch	19	Horn switch
4	Cab light switch	12	Washer switch	20	Aircon & heater controller
5	Beacon switch	13	Overload switch (opt)	21	Cigar lighter
6	Breaker selection switch (opt)	14	Radio & USB player	22	DPF switch
7	Start switch	15	Speaker	23	Cluster
8	Breaker operation switch (opt)	16	Fuse box		

2. LOCATION 2



80CR9A4EL03

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

GROUP 2 MONITORING SYSTEM (machine serial No.: ~#1364)

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) STRUCTURE

The cluster consists of LCD and switches as shown below. The LCD is to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection.

Also, The LCD is to set and display for modes, monitoring and utilities with the switches.

The switches or touch screen are to set the machine operation modes.

※ The cluster installed on this machine does not entirely guarantee the condition of the machine. Daily inspection should be performed according to chapter 6, Maintenance.

※ When the cluster provides a warning immediately check the problem, and perform the required action.

80CR9A4EL21

※ The warning lamp pops up, lights ON (on the left-top side) and the buzzer sounds when the machine has a problem.

The warning lamp lights ON until the problem is cleared. Refer to page 4-6 for details.

2) GAUGE

(1) Operation screen

When you first turn starting switch ON, the operation screen will appear.

Default (A type)

559A3CD07A

Option (B type)

559A3CD07B

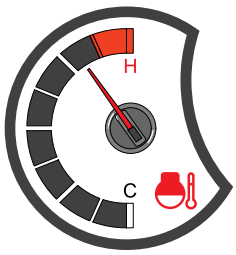
Option (C type)

559A3CD07C

1	Engine coolant temp gauge	3	Fuel level gauge	5	Accel dial
2	Hydraulic oil temp gauge	4	Engine rpm		

※ **Operation screen type can be set by the screen type menu of the display.**
Refer to page 4-25 for details.

(2) Engine coolant temperature gauge



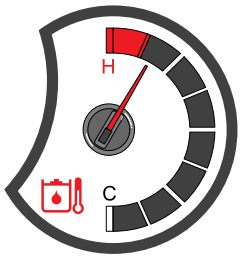
55I3CD07G

① This gauge indicates the temperature of coolant.
- Black range : 40-115˚C (104-239˚F)
- Red range : Above 115˚C (239˚F)

② If the indicator is in the red range or lamp lights ON in red, turn OFF the engine and check the engine cooling system.

※ **If the gauge indicates the red range or lamp lights ON 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.**

(3) Hydraulic oil temperature gauge



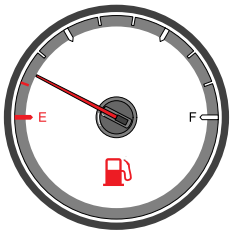
55I3CD07E

① This gauge indicates the temperature of hydraulic oil.
- Black range : 40-105˚C (104-221˚F)
- Red range : Above 105˚C (221˚F)

② If the indicator is in the red range or lamp lights ON in red, reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

※ **If the gauge indicates the red range or lamp lights ON 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.**

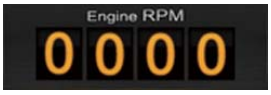
(4) Fuel level gauge



55I3CD07F

① This gauge indicates the amount of fuel in the fuel tank.
② Fill the fuel when the red range, or lamp lights ON in red.
※ **If the gauge indicates the red range or lamp lights ON 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.**

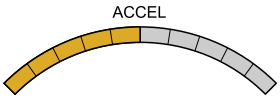
(5) Engine rpm display



559A3CD35

① This displays the engine speed.

(6) Accel dial display



55I3CD07C

① This displays acceleration dial level from 0 to 10 step.

3) COMMUNICATION ERROR AND LOW VOLTAGE WARNING POP-UP

(1) Communication error pop-up

559A3CD71

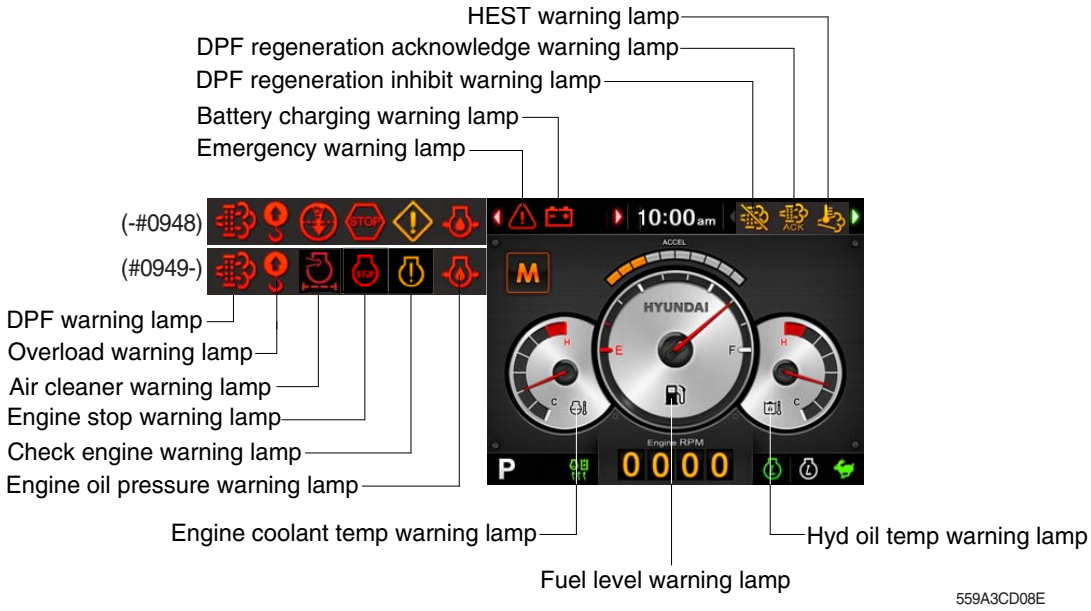
① Cluster displays this communication error pop-up when it has communication error with MCU.
② Communication error pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ If communication with MCU become normal state, it will disappear automatically.

(2) Low voltage warning pop-up

559A3CD72

① Cluster displays this low voltage warning pop-up when the battery voltage is low.
② Low voltage warning pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ This pop-up will disappear with using touch screen or buzzer stop switch. While the battery voltage is low, buzzer sounds every minute.
④ When the battery voltage is higher than 11.5 V, the pop-up off.

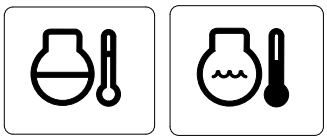
4) WARNING LAMPS



※ **Each warning lamp on the left-top of the LCD pops up on the center of LCD and the buzzer sounds when the each warning is happened. The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or the pop-up is touched. And the buzzer stops. Refer to page 4-14 for the switch.**

※ **When the warning lamps light ON more than 4, you can check all lamps with next page button (◀ , ▶) near the warning lamps.**

(1) Engine coolant temperature warning lamp

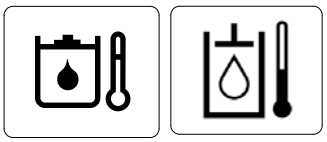


① The ⚠ lamp pops up on the center of LCD and the buzzer sounds when the engine coolant temperature is over 115˚C.

② The pop-up ⚠ lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.

③ Check the cooling system when the lamp keeps ON.

(2) Hydraulic oil temperature warning lamp

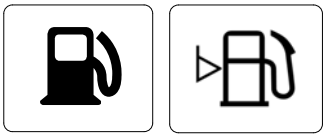


① The ⚠ lamp pops up on the center of LCD and the buzzer sounds when the hydraulic oil temperature is over 105˚C.

② The pop-up ⚠ lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.

③ Check the hydraulic oil level and hydraulic oil cooling system.

(3) Fuel level warning lamp



① This warning lamp lights ON and the buzzer sounds when the level of fuel is below 10%.

② Fill the fuel immediately when the lamp is ON.

(4) Emergency warning lamp

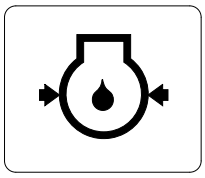
21093CD30

① This lamp pops up and the buzzer sounds when each of the below warnings are happened.
- Engine coolant overheating (over 115˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Accel dial circuit abnormal or open

※ **The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also the buzzer stops.**
This is same as following warning lamps.

② When this warning lamp lights ON, machine must be checked and serviced immediately.

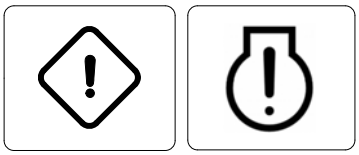
(5) Engine oil pressure warning lamp



21093CD32

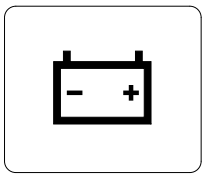
① This lamp lights ON when the engine oil pressure is low.
② If the lamp lights ON, shut OFF the engine immediately. Check oil level.

(6) Check engine warning lamp



① This lamp lights ON when the communication between MCU and engine ECM on the engine is abnormal, or if the cluster received any fault code from engine ECM.
② Check the communication line between them.
If the communication line is OK, then check the fault codes on the cluster.
③ Also, this lamp pops up when the level of DPF soot is high.
※ Refer to the page 4-8 for the DPF warning lamp.

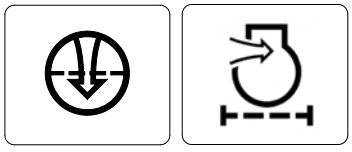
(7) Battery charging warning lamp



21093CD34

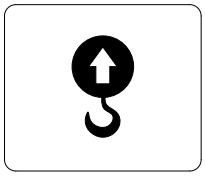
① This lamp lights ON when the battery charging voltage is low.
② Check the battery charging circuit when this lamp is ON.

(8) Air cleaner warning lamp



① This lamp lights ON when the filter of air cleaner is clogged.
② Check the filter and clean or replace it.

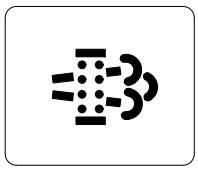
(9) Overload warning lamp (opt)



21093CD36

① When the machine is overload, the overload warning lamp lights ON during the overload switch is ON. (if equipped)
② Reduce the machine load.
Initiate a manual regeneration

(10) DPF (diesel particulate filter) warning lamp

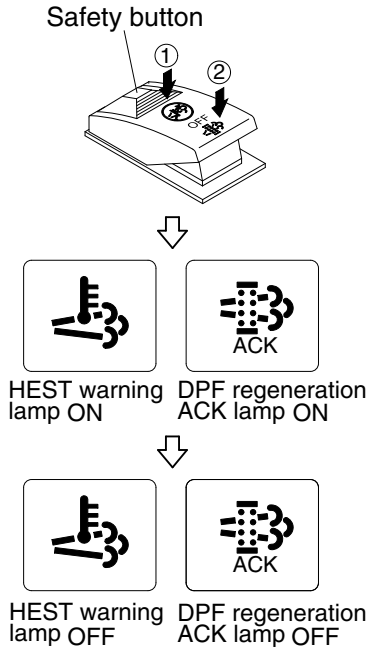


2609A3CD19

① This warning lamp lights ON or OFF when the regeneration is needed.
② This warning lamp lights ON while DPF regeneration inhibit switch is in "Regeneration ingibited" state, when stationary regeneration is permitted.
③ This warning lamp lights ON during reset regeneration standby or in back up mode.
④ This warning lamp lights flash during reset regeneration standby DPF regeneration inhibit switch is in "Regeneration inhibited" state.
※ Consequences of delaying regeneration
- Poor performance caused by increasing exhaust gas pressure.
- Higher fuel consumption
- Shorter filter lifetime

Condition	Warning lamp			Remedy
	DPF	Check engine	Stop engine	
		or (pop up)	or (pop up)	
Normal	Off	Off	Off	· Automatic regeneration
Soot low	On	Off	Off	· Push DPF switch to OFF position if DPF switch is in inhibit position. · Engine power may be reduced automatically (soot medium)
Soot midium	Blink	Off	Off	
Soot high	On	On	Off	· Engine power and speed will be reduced automatically · Initiate a manual regeneration
Stop	On	Off	On	· Stop the engine immediatary. · Please contact your Hyundai service center or local dealer.

※ **Manual regeneration method of DPF**



559A3CD143

※ Manual regeneration applies if the machine is in a fireproof area and there is no plan to turn off the maching during the regeneration.

① Stop and park the machine.

② The accel dial to the lowerest position and operate the engine in idling.

③ Pull the safety button and push the switch to position ② to initiate the manual regeneration of DPF.

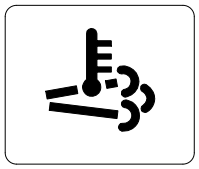
※ Refer to the page 4-58 for the switch operation.

※ The engine speed may increase gradually to high idle rpm and DPF regeneration begins and it will take approximately 25~30 minutes.

④ When the manual regeneration starts, the DPF warning lamp turns OFF and the regeneration acknowledge lamp and HEST warning lamp will light ON during the regeneration function is operating.

⑤ The regeneration acknowledge lamp and HEST warning lamp will light OFF when the regeneration function is completed.

(11) **HEST** (High exhaust system temperature) **warning lamp**



2609A3CD21

① This warning lamp indicates, when illuminated, that exhaust temperatures are high due to regeneration of the DPF.

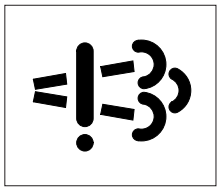
② The lamp will also illuminate during a manual regeneration.

③ When this lamp is illuminated, be sure the exhaust pipe outlet is not directed at any surface or material that can melt, burn, or explode.

⚠ When this lamp is illuminated, the exhaust gas temperature could reach 600˚C [1112˚F], which is hot enough to ignite or melt common materials, and to burn people.

※ The lamp does not signify the need for any kind of equipment or engine service; It merely alerts the equipment operator to high exhaust temperatures. It will be common for the lamp to illuminate on and off during normal equipment operation as the engine completes regeneration.

(12) Emission system fail warning lamp



300A3CD15

① This warning lamp indicates there are faults related to the emission system.

② The lamp lights ON when each of the below warnings is happened.

a. The EGR valve malfunctions.

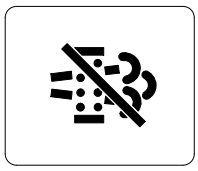
b. Electrical malfunction of the EGR control sensors. (disconnection, short)

c. Tampering with the EGR control sensors.

③ **This warning lamp can be shown together with DPF warning lamp or engine fail lamp or engine stop warning lamp when diagsis DPF systems.**

※ **Please contact your Hyundai service center or local dealer.**

(13) DPF regeneration inhibit warning lamp

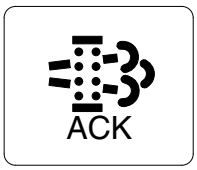


2609A3CD20

① This warning lamp indicates, when illuminated, the DPF switch is pushed inhibit position, therfore automatic and manual regeneration can not occur.

※ **Refer to the page 4-58 for the DPF switch.**

(14) DPF regeneration acknowledge warning lamp



559A3CD10

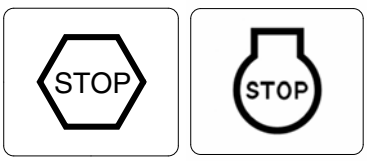
① This warning lamp lights ON stationary regeneration is in process.

② This warning lamp lights ON, when stationary regeneration is in process after DPF regeneration request switch is pressed and hold for more than 3 seconds.

③ This warning lamp lights flash when stationary regeneration standby or regeneration interlock switch is in "regeneration permitted (interlock enabled) status.

④ This warning lamp lights flash while stationary regeneration standby or back mode, when DPF regeneration inhibit switch in "Regeneration permitted" status and regeneration interlock switch is in regeneration permitted status.

(15) Stop engine warning lamp

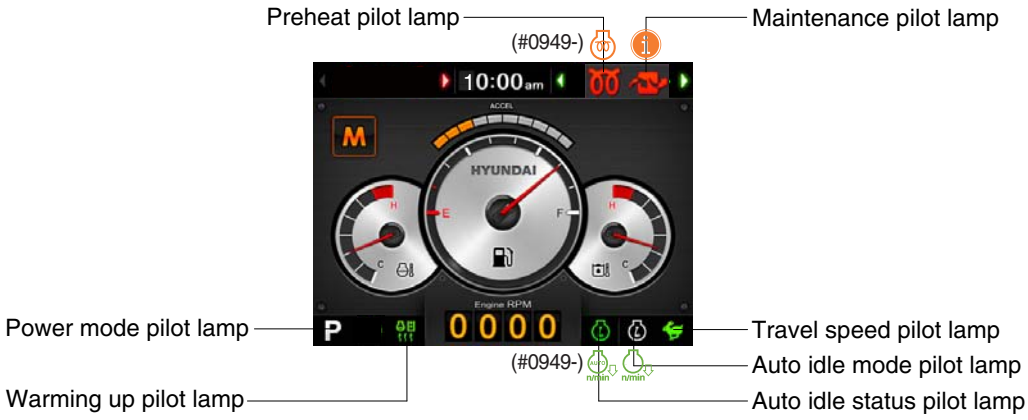


① If the lamp lights ON, stop the engine immediately and check the engine.

② Check the fault codes on the monitor.

※ **Please contact your Hyundai service center or local dealer.**

5) PILOT LAMPS



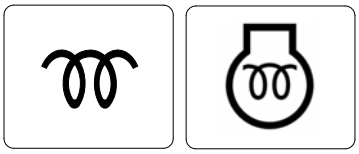
559A3CD02E

※ **When the pilot lamps light ON more than 3, you can check all lamps with next page button (◀, ▶).**

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
2	Travel mode		Low speed traveling
			High speed traveling
3	Auto idle mode		Auto idle status
			Auto idle mode

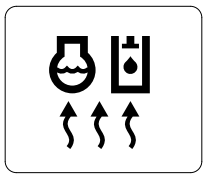
(2) Preheat pilot lamp



55I3CD39

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

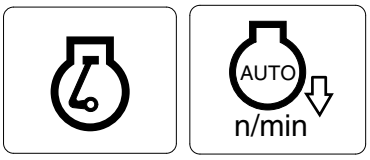
(3) Warming up pilot lamp



21093CD40

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 the engine.

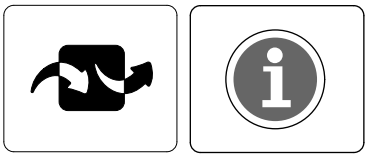
(4) Auto idle status/ mode pilot lamp



① The auto idle pilot lamp will be ON when the idle mode is selected.

② The auto idle status pilot lamp will be ON when all levers and pedals are at neutral position, and the auto idle mode is selected.

(5) Maintenance pilot lamp



① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.

② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.

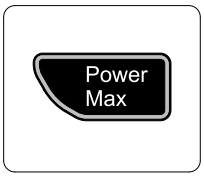
※ Refer to the page 4-19.

6) SWITCHES

559A3CD47

※ **When the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 4-11 for details.**

(1) Power mode switch

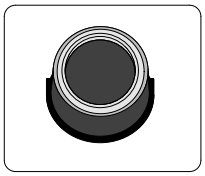


559A3CD25

① This switch is to select the machine power mode and selected power mode pilot lamp is displayed on the pilot lamp position.
- P : Heavy duty power work.
- S : Standard power work.

② The pilot lamp changes S → P → S in order.

(2) Select switch



55I3CD50C

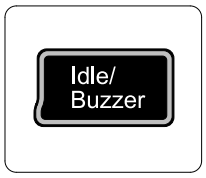
① This switch is used to select or change the menu and input value.

② Knob push
- Long (over 2 sec) : Return to the operation screen
- Medium (0.5~2 sec) : Return to the previous screen
- Short (below 0.5 sec) : Select menu

③ Knob rotation

This knob changes menu and input value.
- Right turning : Down direction / Increase input value
- Left turning : Up direction / Decreased input value

(3) Auto idle/ buzzer stop switch



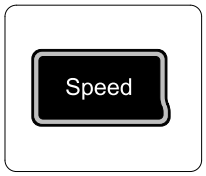
559A3CD50D

① This switch is used to activate or cancel the auto idle function.

※ **Refer to the page 4-12 for details.**

② The buzzer sounds when the machine has a problem.
In this case, push this switch and buzzer stops, but the warning lamp blinks until the problem is cleared.

(4) Travel speed control switch

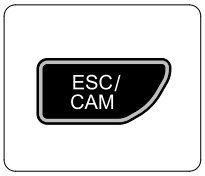


55I33CD50B

① This switch is used to select the travel speed alternatively.

- : Low speed
- : High speed

(5) Escape/ Camera switch



559A3CD50E

① This switch is used to return to the previous menu or parent menu.

② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 4-23 for the camera.

③ If the camera is not installed, this switch is used only ESC function.

7) MAIN MENU

· Operation screen


559A3CD32A


559A3CD32B


559A3CD32C

Tap **M** or Press

Press ESC/CAM

Main menu screen


559A3CD32D

Sub menu screen


559A3CD32E

※ Please refer to select switch, page 4-13 for selection and change of menu and input value.

(1) Structure

No	Main menu	Sub menu	Description
1	 Monitoring 55I3CD51A	Active fault - Machine Active fault - Engine Logged fault - Machine Logged fault - Engine Monitoring (Analog) Monitoring (Digital) - Input Monitoring (Digital) - Output	MCU ECU MCU ECU Machine information Switch status Output status
2	 Management 55I3CD51B	ESL mode setting Change password Maintenance information Machine Information A/S phone number Service menu	ESL mode setting Password change Replacement, Change interval oils and filters Cluster, MCU, Engine, Machine A/S phone number, A/S phone number change Delete logged faults, Software download, Operating hour, power shift
3	 Display 55I3CD51C	Clock Screen type Brightness setting Unit setting Language Calibration	Clock A type, B type, C type Manual, Auto Temperature, Pressure 12 language Calibrating the touch screen
4	 Utilities 55I3CD51D	Camera setting Mode Video	Number of active, Display order, Camera No. Operation mode select Play music and video file

(2) Monitoring

① Active fault - Machine

559A3CD50 559A3CD50A

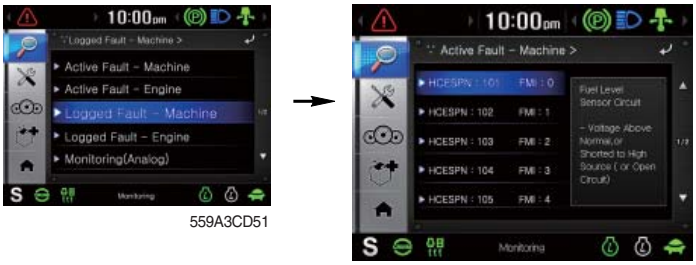
· The active faults of the MCU can be checked by this menu.

② Active fault - Engine

559A3CD50B 559A3CD50C

· The active faults of engine ECU can be checked by this menu.

③ Logged fault - Machine/ Engine



559A3CD51 559A3CD50A

· The logged faults of the MCU or engine ECU can be checked by this menu.
· Only for the service person.

④ Monitoring (Analog)

559A3CD52 559A3CD52A

· The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu.

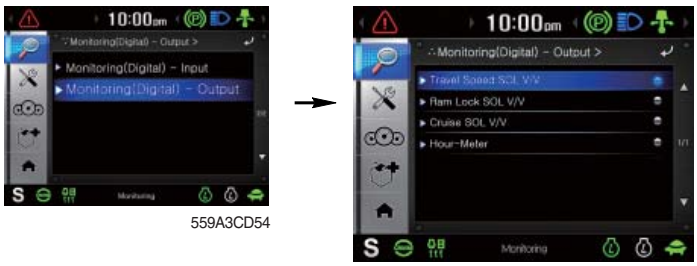
⑤ **Monitoring** (Digital) - **Input**

559A3CD53

559A3CD53A

· The switch status can be confirmed by this menu.
· The activated switchs are blue light ON.

⑥ **Monitoring** (Digital) - **Output**



559A3CD54

559A3CD54A

· The output status can be confirmed by this menu.
· The output pilot lamps are blue light ON.

(3) Management

① ESL mode setting

559A3CD55

559A3CD55A

559A3CD55B

· **ESL mode setting**

- ESL : Engine Starting Limit
- ESL mode is desingned to be a theft deterrent or will prevent the unauthorized operation of the machine.
- If the ESL mode was selected Enable, the password will be required when the start switch is turned ON.
- **Disable** : Not used ESL function

  Enable (always) : The password is required whenever the operator starts engine.

  Enable (Interval): The password is required when the operator starts engine first.
  But the operator can restart the engine within the interval time without inputting the password.
  The interval time can be set maximum 2 days.

  ※**Default password : 00000**

  ※**Password length : 5~10 digit**

② Change password

- The password is 5~10 digits.

559A3CD56

559A3CD56A

Enter the current password

559A3CD56B

Enter the new password

559A3CD56C

Enter the new password again

559A3CD56D

The new password is stored in the MCU.

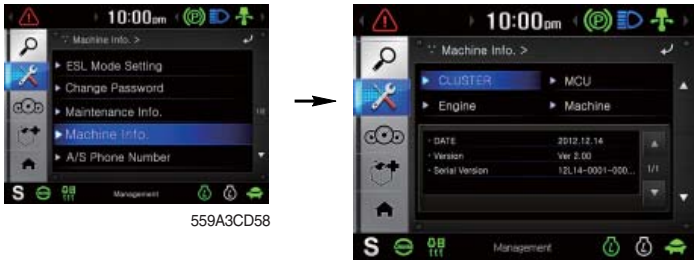
③ Maintenance information

559A3CD57 559A3CD57A 559A3CD57B

- Elapse : Maintenance elapsed time.
- Interval : The change or replace interval can be changed in the unit of 50 hours.
- History-Hour : Maintenance replacement history.
- Replacement : The elapsed time will be reset to zero (0).
- **Change or relpace interval**

No	Item	Interval
1	Engine oil	500
2	Final gear oil	1000
3	Swing gear oil	1000
4	Hydraulic oil	5000
5	Pilot line filter	1000
6	Hydraulic oil return filter	1000
7	Engine oil filter	500
8	Fuel filter	500
9	Pre-filter	500
10	Hydraulic tank breather	250
11	Air cleaner	500
12	Radiator coolant	2000
13	Swing gear pinion grease	1000

④ Machine Information



559A3CD58 559A3CD58A

- This can confirm the identification of the cluster, MCU, engine and machine.

⑤ **A/S phone number**

559A3CD59 559A3CD59A 559A3CD59B

· The A/S phone number can be checked and changed.

⑥ **Service menu**

559A3CD60 Enter the password 559A3CD60A 559A3CD60B

· Delete logged fault : Logged faults of MCU or engine ECU can be deleted.
· S/W download : Update and display software about operating system, application, image and font.
· Operating hours : Operating hours since the machine line out can be checked.
· Power shift : Set power shift mode (standard/option)

(4) Display

① **Clock**

559A3CD61 559A3CD61A

· The first line's three spots "****－**－**" represent Year/Month/Day each.
· The second line shows the current time. (AM, PM/0:00~12:59)

② Screen type

559A3CD62

559A3CD62A

· The screen type (A,B,C) of the LCD can be selected by this menu.

③ Brightness setting calibration

559A3CD63

559A3CD63A

Manual (1st~10th step)

Auto (day/night) 559A3CD63B

Auto (time) 559A3CD63C

· If "Auto" is chosen, brightness for day and night can be differently set up. Also, users can define which day time interval. (Set day starting time and ending time)

④ Unit setting

559A3CD64

559A3CD64A

· Temperature : ˚C ↔ ˚F
· Pressure : bar ↔ MPa ↔ kgf/cm² ↔psi

⑤ Language

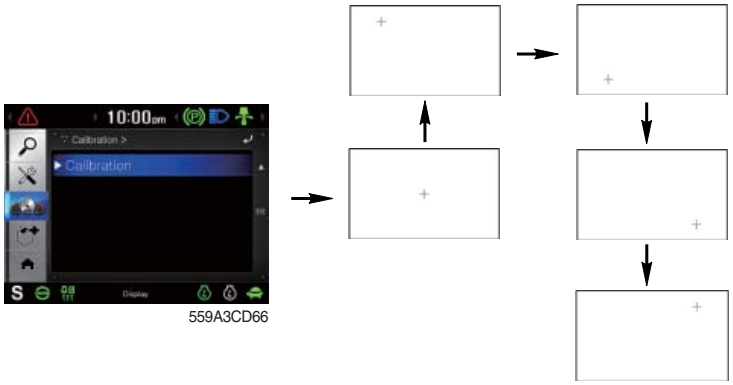
559A3CD65

559A3CD65A

· User can select preferable language and all displays are changed the selected language.

⑥ Calibration

· When touch awareness goes wrong, this function use.
Fall in the next step if touches the middle point of cross with fingernail.
If touches total five points as follows, the setting is completed.



559A3CD66

2609A3CD149-153

(5) Utilities

① Camera setting

- Three cameras can be installed on the machine and the display order can be set by this menu.
- If the camera was not equipped, this menu is not useful.

559A3CD67

559A3CD67A

- In the operation screen, if the ESC/CAM switch is pushed, rear view camera display or stop.
- Turnning the select switch in clockwise direction, the next ordered will be shown and in counter-clockwise direction, the previously ordered will be shown. Also, you can change camera channel using touch the screen.
- Push the select switch or touch the screen, the displayed screen will be enlargement.

559A3CD68

559A3CD68A

559A3CD68B

② Mode

559A3CD69

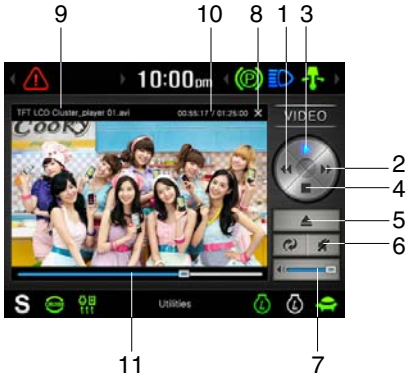
559A3CD69A

- When this cluster's buttons are not work, you can control using touch screen instead of these buttons.
- You can only control in this mode screen.

③ Video

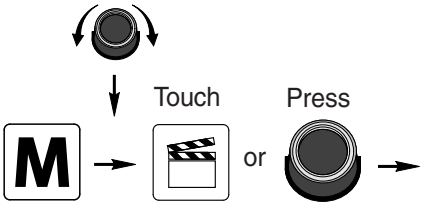
· Play MP4 or codec file of external hard disk through USB port.
· The USB port is located under the cluster.

559A3CD70



559A3CD70A

559A3CD70B



559A3CD70C

· Over 1100 engine rpm, the screen turns into the operation screen with MP4 or codec file playing for the safety.

No.	Function	Control	No.	Function	Control
1	Previous track	Power mode switch or touch	7	Sound volume	Speed switch or touch
2	Next track	Speed switch or touch	8	Stop	ESC/CAM button or touch
3	Play	Touch	9	File name	-
4	Pause	Touch	10	Current time/ Total time	-
5	Contents display	Touch	11	Current playing time	-
6	Mute	Touch	-	-	-

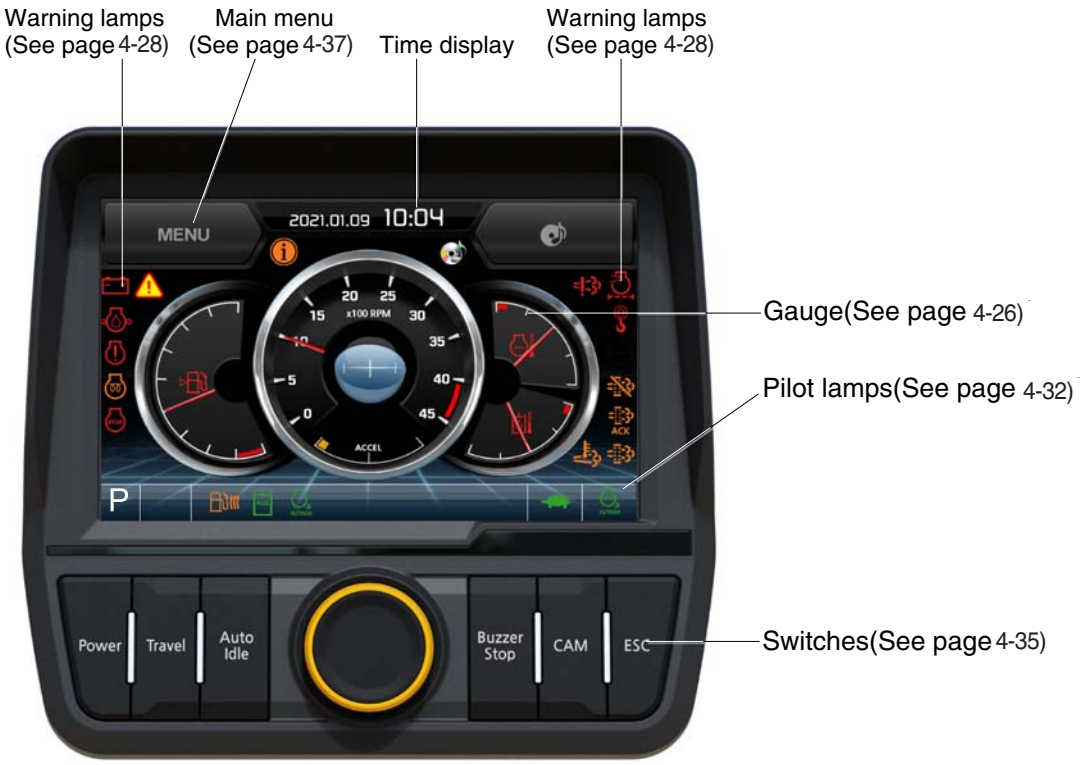
MONITORING SYSTEM ((machine serial No.: #1365~)

1) STRUCTURE

The cluster consists of LCD and switches as shown below. The LCD is to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection.
Also, The LCD is to set and display for modes, monitoring and utilities with the switches.
The switches or touch screen are to set the machine operation modes.

※ **The cluster installed on this machine does not entirely guarantee the condition of the machine. Daily inspection should be performed according to chapter 6, Maintenance.**

※ **When the cluster provides a warning immediately check the problem, and perform the required action.**



HX60A3CD100B

※ **The warning lamp pops up, lights ON (on the left-top side) and the buzzer sounds when the machine has a problem.**
The warning lamp lights ON until the problem is cleared. Refer to page 4-25 for details.

2) GAUGE

(1) Operation screen

When you first turn starting switch ON, the operation screen will appear.

HX60A3CD101A

1	Engine coolant temp gauge	3	Fuel level gauge	5	Accel dial
2	Hydraulic oil temp gauge	4	Engine rpm	6	Clinometer

※ Operation screen type can be set by the screen type menu of the display.
Refer to page 4-49 for details.

(2) Engine coolant temperature gauge

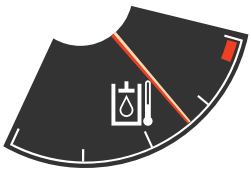
290F3CD53

① This gauge indicates the temperature of coolant.
- Black range : 40-115˚C (104-239˚F)
- Red range : Above 115˚C (239˚F)

② If the indicator is in the red range or lamp lights ON in red, turn OFF the engine and check the engine cooling system.

※ If the gauge indicates the red range or lamp lights ON 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.

(3) Hydraulic oil temperature gauge



290F3CD54

① This gauge indicates the temperature of hydraulic oil.
- Black range : 40-105˚C (104-221˚F)
- Red range : Above 105˚C (221˚F)

② If the indicator is in the red range or lamp lights ON in red, reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

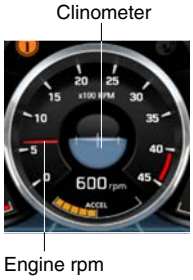
※ If the gauge indicates the red range or lamp lights ON in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

(4) Fuel level gauge

HX60A3CD55A

① This gauge indicates the amount of fuel in the fuel tank.
② Fill the fuel when the red range, or lamp lights ON in red.
※ **If the gauge indicates the red range or lamp lights ON 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 rpm display



HX60A3CD105K

① This displays the engine speed.

(6) Accel dial display

290F3CD59

① This displays acceleration dial level from 0 to 10 step.

3) COMMUNICATION ERROR AND LOW VOLTAGE WARNING POP-UP

(1) Communication error pop-up

HX60A3CD107A

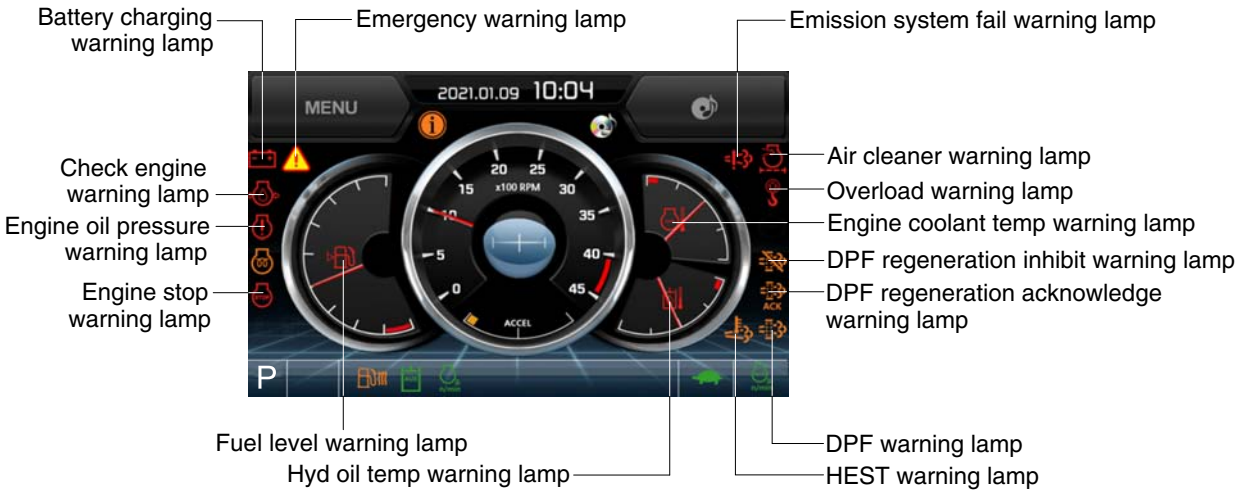
① Cluster displays this communication error pop-up when it has communication error with MCU.
② Communication error pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ If communication with MCU become normal state, it will disappear automatically.

(2) Low voltage warning pop-up

HX60A3CD108

① Cluster displays this low voltage warning pop-up when the battery voltage is low.
② Low voltage warning pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ This pop-up will disappear with using touch screen or buzzer stop switch. While the battery voltage is low, buzzer sounds every minute.
④ When the battery voltage is higher than 11.5 V, the pop-up off.

4) WARNING LAMPS

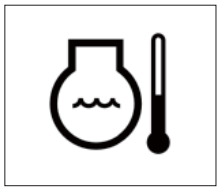


HX60A3CD109C

※ **Each warning lamp on the left-top of the LCD pops up on the center of LCD and the buzzer sounds when the each warning is happened. The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or the pop-up is touched. And the buzzer stops. Refer to page 4-36 for the switch.**

※ **When the warning lamps light ON more than 4, you can check all lamps with next page button (◀ , ▶) near the warning lamps.**

(1) Engine coolant temperature warning lamp



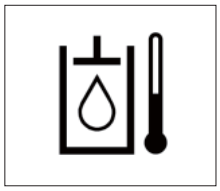
290F3CD61

① The lamp pops up on the center of LCD and the buzzer sounds when the engine coolant temperature is over 115˚C or more.

② The pop-up lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.

③ Check the cooling system when the lamp keeps ON.

(2) Hydraulic oil temperature warning lamp



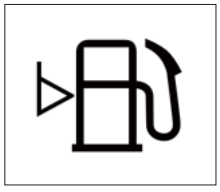
290F3CD62

① The lamp pops up on the center of LCD and the buzzer sounds when the hydraulic oil temperature is over 105˚C or more.

② The pop-up lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.

③ Check the hydraulic oil level and hydraulic oil cooling system.

(3) Fuel level warning lamp



290F3CD63

① This warning lamp lights ON and the buzzer sounds when the level of fuel is below 10%.

② Fill the fuel immediately when the lamp is ON.

(4) Emergency warning lamp

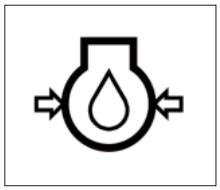
290F3CD64

① This lamp pops up and the buzzer sounds when each of the below warnings are happened.
- Engine coolant overheating (over 115˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Accel dial circuit abnormal or open

※ **The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also the buzzer stops.**
This is same as following warning lamps.

② When this warning lamp lights ON, machine must be checked and serviced immediately.

(5) Engine oil pressure warning lamp



290F3CD65

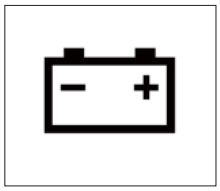
① This lamp lights ON when the engine oil pressure is low.
② If the lamp lights ON, shut off the engine immediately. Check oil level.

(6) Check engine warning lamp

290F3CD66

① This lamp lights ON when the communication between MCU and engine ECM on the engine is abnormal, or if the cluster received any fault code from engine ECM.
② Check the communication line between them.
If the communication line is OK, then check the fault codes on the cluster.
③ Also, this lamp pops up when the level of DPF soot is high.
※ Refer to the page 4-30 for the DPF warning lamp.

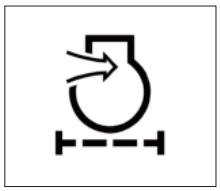
(7) Battery charging warning lamp



290F3CD67

① This lamp lights ON when the battery charging voltage is low.
② Check the battery charging circuit when this lamp is ON.

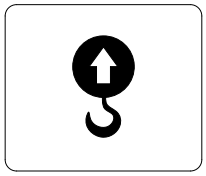
(8) Air cleaner warning lamp



290F3CD68

① This lamp lights ON when the filter of air cleaner is clogged.
② Check the filter and clean or replace it.

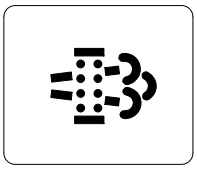
(9) Overload warning lamp (option)



21093CD36

① When the machine is overload, the overload warning lamp lights ON during the overload switch is ON. (if equipped)
② Reduce the machine load.
Initiate a manual regeneration

(10) DPF (diesel particulate filter) warning lamp

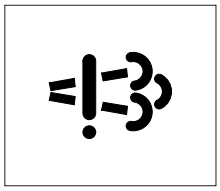


2609A3CD19

① This warning lamp lights ON or OFF when the regeneration is needed.
② This warning lamp lights ON while DPF regeneration inhibit switch is in "Regeneration ingibited" state, when stationary regeneration is permitted.
③ This warning lamp lights ON during reset regeneration standby or in back up mode.
④ This warning lamp lights flash during reset regeneration standby DPF regeneration inhibit switch is in "Regeneration inhibited" state.
※ Consequences of delaying regeneration
- Poor performance caused by increasing exhaust gas pressure.
- Higher fuel consumption
- Shorter filter lifetime

Condition	Warning lamp			Remedy
	DPF	Check engine (pop up)	Stop engine (pop up)	
Normal	Off	Off	Off	· Automatic regeneration
Soot low	On	Off	Off	· Push DPF switch to OFF position if DPF switch is in inhibit position. (see 4-57 page) · Engine power may be reduced automatically (soot medium)
Soot midium	Blink	Off	Off	
Soot high	On	On	Off	· Engine power and speed will be reduced automatically · Initiate a manual regeneration
Stop	On	Off	On	· Stop the engine immediatary. · Please contact your Hyundai service center or local dealer.

(12) Emission system fail warning lamp



300A3CD15

① This warning lamp indicates there are faults related to the emission system.

② The lamp lights ON when each of the below warnings is happened.

a. The EGR valve malfunctions.

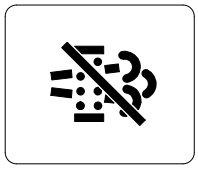
b. Electrical malfunction of the EGR control sensors. (disconnection, short)

c. Tampering with the EGR control sensors.

③ **This warning lamp can be shown together with DPF warning lamp or engine fail lamp or engine stop warning lamp when diagsis DPF systems.**

※ **Please contact your Hyundai service center or local dealer.**

(13) DPF regeneration inhibit warning lamp

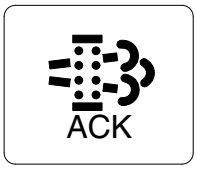


2609A3CD20

① This warning lamp indicates, when illuminated, the DPF switch is pushed inhibit position, therfore automatic and manual regeneration can not occur.

※ **Refer to the page 4-57 for the DPF switch.**

(14) DPF regeneration acknowledge warning lamp



559A3CD10

① This warning lamp lights ON stationary regeneration is in process.

② This warning lamp lights ON, when stationary regeneration is in process after DPF regeneration request switch is pressed and hold for more than 3 seconds.

③ This warning lamp lights flash when stationary regeneration standby or regeneration interlock switch is in "regeneration permitted (interlock enabled) status.

④ This warning lamp lights flash while stationary regeneration standby or back mode, when DPF regeneration inhibit switch in "Regeneration permitted" status and regeneration interlock switch is in regeneration permitted status.

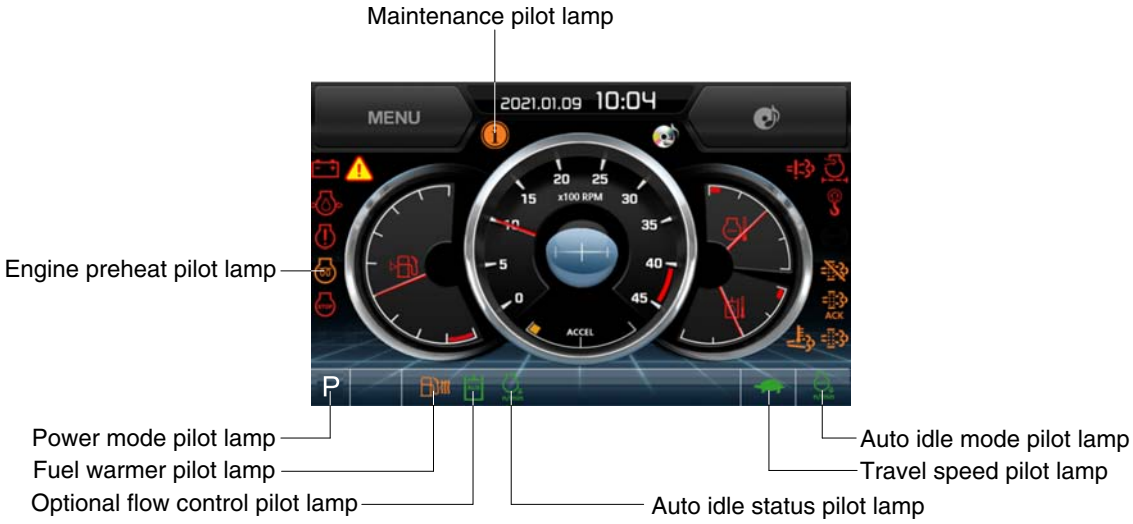
(15) Engine stop warning lamp

① If the lamp lights ON, stop the engine immediately and check the engine.

② Check the fault codes on the monitor.

※ **Please contact your Hyundai service center or local dealer.**

5) PILOT LAMPS



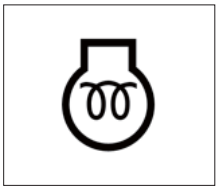
HX60A3CD112C

※ The left and the right movement buttons (◀ and ▶) are activated when nine indicator or more light, and touching the button shifts to the previous/next page. The buttons are not activated when eight indicators or less light.

(1) Mode pilot lamp

Sequence	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
2	Travel mode		Low speed traveling
			High speed traveling
3	Auto idle mode	AUTO n/min	Auto idle mode
		n/min	Auto idle status

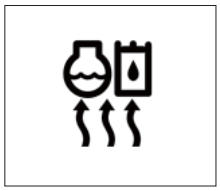
(2) Engine preheat pilot lamp



290F3CD79

① Turning the start switch ON automatically starts preheating.
② Start the engine after this indicator turns off.
See Page 4-4.

(3) Warming up pilot lamp

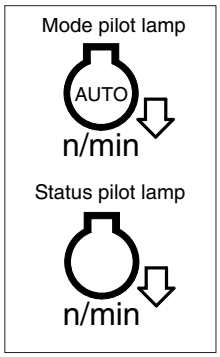


290F3CD80

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 the engine.

(4) Auto idle status/ mode pilot lamp



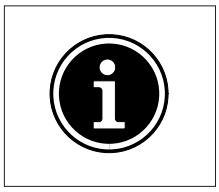
85A3CD106

① The auto idle mode pilot lamp will be ON when the idle mode is selected.

② The auto idle status pilot lamp will be ON when all levers and pedals are at neutral position, and the auto idle mode is selected.

③ One of the lever or pedal is operated, the status lamp will be OFF and the engine speed returns to the previous conditions.

(5) Maintenance pilot lamp



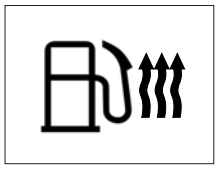
HX60A3CD116

① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.

② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.

※ **Refer to the page 4-41.**

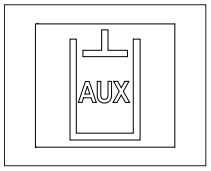
(6) Fuel warmer pilot lamp



HX60A3CD111

① This lamp is turned ON when the coolant temperature is below 10˚C (50˚F) or the hydraulic oil temperature 20˚C (68˚F).
② The automatic fuel warming is cancelled when the engine coolant temperature is above 60˚C, and the hydraulic oil temperature is above 45˚C since the start switch was ON position.

(7) Optional flow control pilot lamp



HW60A3CD48A

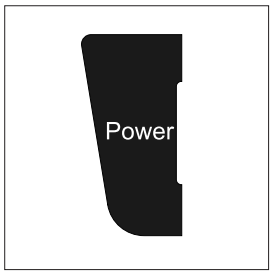
① The indicator lights when activating (performing) the optional flow control function.
※ **Refer to the Page 4-41.**

6) SWITCHES

HX60A3CD117D

※ **Selecting the switch displays the indicator on LCD. See Page 4-32 for further information.**

(1) Power mode switch

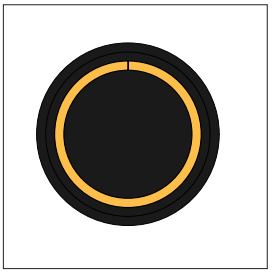


HX60A3CD118

① This switch selects the system power mode, and the selected power mode indicator is displayed on the indicator position.
- P : High-load work
- S : Standard load work

② The indicators shifts in the sequence of S → P → S.

(2) Select switch



HX60A3CD119

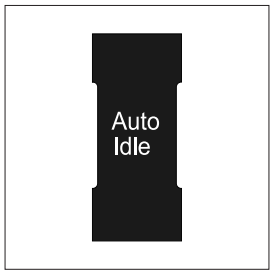
① The switch is used for selecting or changing the menus and input values.

② Knob pressing
- Pressing short (0.5 sec. or less) : Menu selecting

③ Knob turning

This knob is used for changing menus and input values :
- Right turning : Increasing downward direction and input value
- Left turning : Decreasing upward direction and input value

(3) Auto idle switch



HX60A3CD120

① This switch is used for operating or canceling the auto idle function.

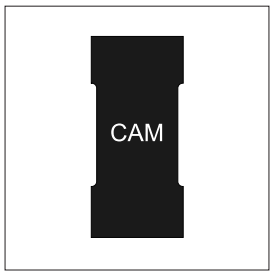
※ **See Page 4-32 for further information.**

(4) Buzzer stop switch

HX60A3CD121

① The buzzer sounds when the system fails.
In such a case, press the switch to stop the buzzer. The alarm indication is kept lit until trouble is resolved.

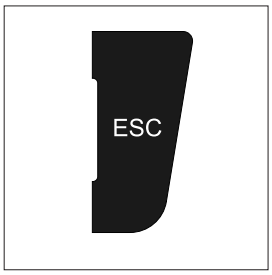
(5) Camera switch



HX60A3CD122

① Pressing this switch on the operation screen of the main menu displays the area illuminated by the camera mounted on the system (if the camera is mounted).
See Page 4-51 for information of the camera.

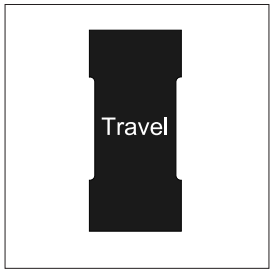
(6) Escape switch



HX60A3CD123

① This switch is used for return to the previous or the next menu.

(7) Travel speed switch



HX60A3CD104

① This switch is used for changing driving speed.
: High speed
: Low speed

※ **Do not operated the driving speed switch during driving. System stability may adversely be affected.**

⚠ **Rapid change of system stability may cause injury or death of driver.**

7) MAIN MENU

Main menu screen

HX60A3CD124A

Tap MENU or Press

Press ESC

Sub menu screen

HX60A3CD125A

※ See “Selection Switch” on page 4-35 for further information on selection and change of the menus and input values.

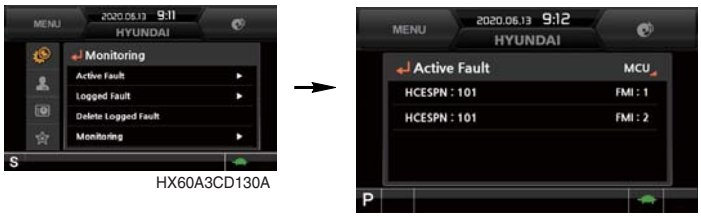
※ Touching the main menu switch, or pressing the selection switch prompts the sub-menu screen.

(1) Structure

No.	Main menu	Sub-menu	Description
1	 Monitoring	Active fault Logged fault Delete logged fault Monitoring	List of active fault of system/engine List of logged fault of system/engine Deleting specifics of logged fault (system/engine) Monitoring (conditions of system, switch, and output)
2	 Management	Maintenance info. Aux flow setting ELS mode setting Machine information Contact Cluster update Service menu	Checking and initialization of service Interval of oil and filters Optional attachment setting ELS mode setting/user password changing Information of cluster, MCU, engine system Display and change of contact information for after-sales services System and application updating Power shift, Operation hours, Main gauge type, Display RPM, DPF filter exchange, AVCU setting, Adding language
3	 Display	Clock adjust Brightness setting Unit setting Language selection	Current time setting Manual, auto Temperature, Distance, Pressure, Flow, Volumn 24 languages
4	 Utilities	Entertainment Camera setting Clinometer setting Emergency mode	Video/music file playing Setup of number of active cameras, display sequences, and camera numbers Initializing slope sensor Back-up switch for failed cluster switch

(2) Monitoring

① Active fault - system

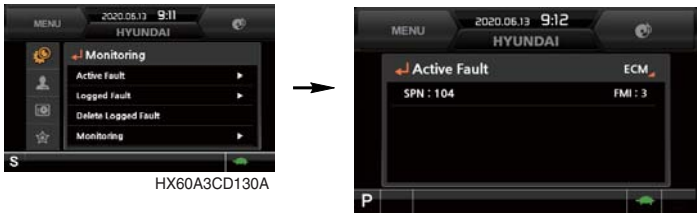


HX60A3CD130A

HX60A3CD131A

· You may use this menu to check active fault of MCU.

② Active fault - engine



HX60A3CD130A

HX60A3CD133A

· You may use this menu to check active fault of engine ECM.

③ Logged fault - system/engine

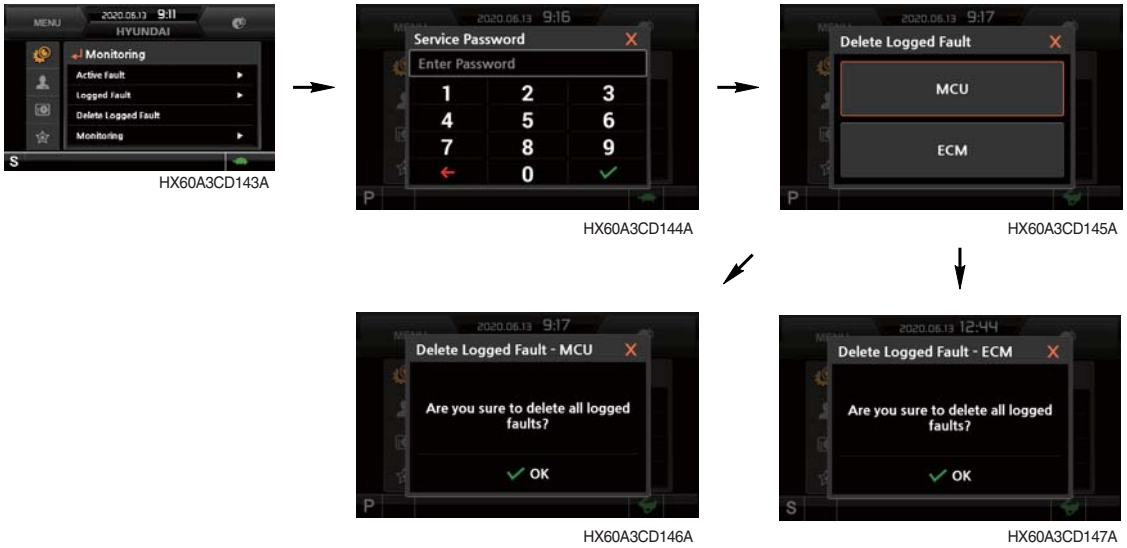
HX60A3CD134A

HX60A3CD135A

HX60A3CD136A

· You may use this menu to check fault logged on system MCU or engine ECM.
· The menu is accessible by maintenance engineer only.

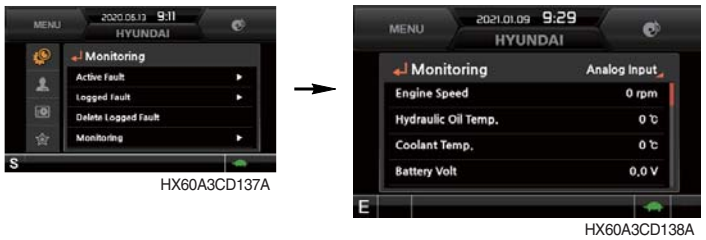
④ Delete logged fault



HX60A3CD143A HX60A3CD144A HX60A3CD145A HX60A3CD146A HX60A3CD147A

· Delete logged fault: You are allowed to delete fault logged on system MCU or engine ECM. (Deletion can be deleted only while the engine is kept stopped.)

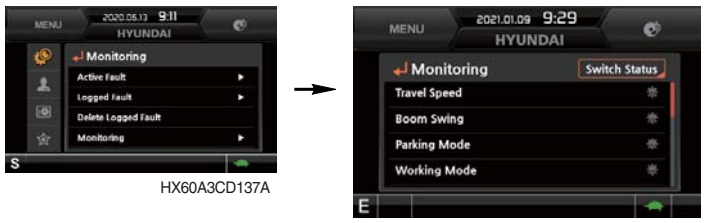
⑤ Monitoring (system conditions)



HX60A3CD137A HX60A3CD138A

· You may use this menu to check the system conditions such as engine rotation rate, oil temperature, voltage and pressure.

⑥ Monitoring (switch conditions)



HX60A3CD137A HX60A3CD140A

· You may use this menu to check digital switch information of the system.
· The operation switch lights blue.

⑦ Monitoring (output conditions)

HX60A3CD137A

HX60A3CD142A

- You may use this menu to check digital output information of the system.
- Output lights blue.

(3) Management

① Maintenance info.

HX60A3CD158A HX60A3CD157A HX60A3CD159A

- Elapsed: Time elapsed since inspection and maintenance is displayed.
- Change interval: You are allowed of changing exchange cycle in 50 hours.
- History-Hourmeter: History of inspection, maintenance and exchange is displayed.
- Replacement: Elapsed time is reset to zero.
- **Change or replace interval**

No	Item	Interval
1	Engine oil	500
2	Final gear oil	1000
3	Hydraulic oil	5000
4	Pilot line filter	1000
5	Hydraulic oil return filter	1000
6	Engine oil filter	500
7	Fuel filter	500
8	Pre-filter	500
9	Hydraulic tank breather	250
10	Air cleaner	500
11	Radiator coolant	2000

② Aux flow setting

a. Optional attachment setup

HW60A3CD33OA HW60A3CD41OA HW60A3CD42O

- Setup up to three optional attachments.

ⓐ Rotary grapple (4-way)
ⓑ Grapple (2-way)
ⓒ Auger (2-way)

※ Each option attachment operating in one of two user modes (Type A and B)

b. Proportional flow control setting

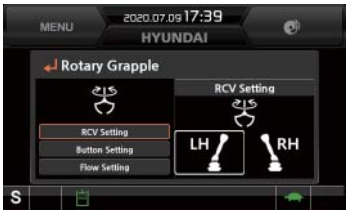
You may use this menu to set the values of individual option attachments.

a) Rotary setup

HW60A3CD42O

HW60A3CD51OA

· Rotary selecting
RCV, button, and flow setup.

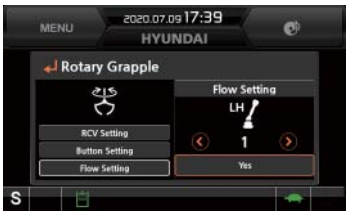


HW60A3CD52OA

· RCV setup
- It is possible to set operating RCV for rotary operation to LH or RH .
- Selecting rotary RCV to LH automatically sets grapple RCV to RH.

HW60A3CD53OA

· Button setup (rotating clockwise)
- Selecting clockwise rotating direction to LH automatically sets counterclockwise rotating direction to RH.

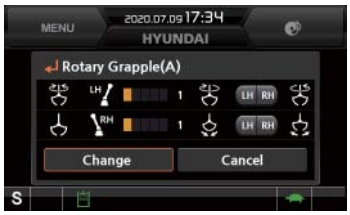


HW60A3CD54OA

· Flow setup
- You may set flow between Level 1 and 5.

b) Grapple setting

HW60A3CD42O



HW60A3CD61OA

· Grapple selection
RCV, button and flow setup

HW60A3CD62OA

· RCV setup
- It is possible to set RCV for grapple operation to LH or RH.
- Selecting grapple RCV to RH automatically sets rotary RCV to LH.

HW60A3CD63OA

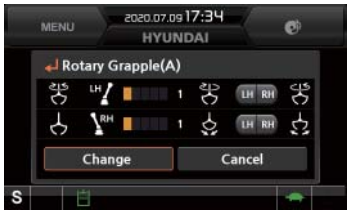
· Button setup (Close)
- Setting Close to RH automatically sets Open to LH.

HW60A3CD72OA

HW60A3CD64OA

· Flow setup
- Setting between Level 1 and 5.

HW60A3CD42O



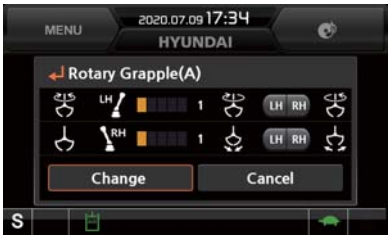
HW60A3CD71OA

· Never forget to select Change button **once** flow setting is complete.

※ Saved setting is stored in each icon, and value finally stored becomes active.
※ You may use any stored values by pressing Icon button.
※ It is possible to perform two user's settings per attachment (A and B), and to store up to six values. (Two for 4-way, four for 2-way)

c) Checking settings

HX60A3CD81OA



HW60A3CD71OA

※ Operating optional attachment function activates the symbol AUX on the bottom of the main screen.

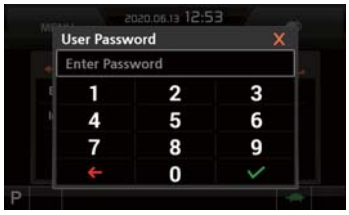
※ You are allowed of checking settings as follows in the course of Menu - Administrator Functions - Optional Attachment.

(a) Rotary setup
- Rotary RCV setup : LH
- Rotary flow level : 3
- CW direction control : LH
- CCW direction control : RH

(b) Grapple setup
- Grapple RCV setup : RH
- Grapple flow level : 3
- Open control : LH
- Close contro l: RH

③ ESL mode setting

HX60A3CD148A



HX60A3CD149A

HX60A3CD150A

- The ESL mode setting is designed to prevent theft and unauthorized operation of the system.
- When selecting the ESL mode setting to continuous operation, password should be entered when turning the Start button ON.
- Disabled : The ESL mode setting function does not operate.
  Continuous operation : Password should be entered whenever operator starts the engine.
  Enable(interval): Password should be entered when operator starts the engine first. It is not required to enter the password until restart within specified time.
  You may set the specified time up to two days.

※ Default password : 00000

※ Length of password : 5-10 digits

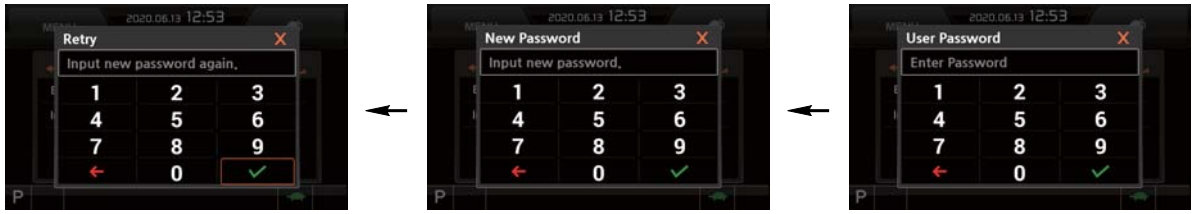
④ Changing password

- The length of the password is between 5 and 10 digits.

HX60A3CD151A HX60A3CD149A HX60A3CD153A

Entering current password

Selecting Change Password



HX60A3CD156A HX60A3CD155A HX60A3CD149A

Storing new password in MCU

Entering new password again

Entering new password

⑤ Machine information

HX60A3CD160A HX60A3CD161A HX60A3CD162A

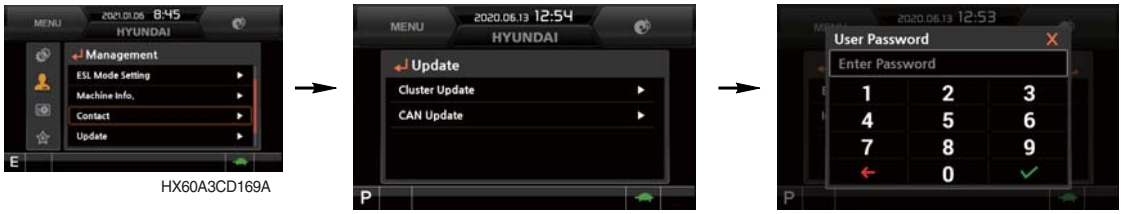
· On this screen, you may check information of the instrument panel, the system controller (MCU), the engine and the system.

⑥ Contact

HX60A3CD163A HX60A3CD164A HX60A3CD165A

· You may check or change the contact information for after-sales services.

⑦ Cluster update



HX60A3CD169A HX60A3CD170A HX60A3CD149A

Selecting Cluster Update Entering user's password

· It is possible to update the cluster and CAN.

※ **Do not turn power off while updating.**

a. Application update

HX60A3CD172A HX60A3CD173A HX60A3CD174A

Selecting application items Selecting files to update Selecting OK

HX60A3CD176 HX60A3CD175A

Completed In progress

b. System update

HX60A3CD177A

Selecting system items

HX60A3CD173A

Selecting files to update

HX60A3CD174A

Selecting OK

HX60A3CD175A

In progress

HX60A3CD176

Completed

⑧ Service menu

HX60A3CD165A HX60A3CD144A HX60A3CD168A

Entering service password

- Power shift : Set the power shift mode (default/option).
- Operating hours : You may check operating hours of the system in individual modes after acceptance of the system.
- Main gauge type : It is possible to display engine rotation rate or fuel level on the main gage of the main screen.
- Display RPM : It is possible to set display of numeric value of engine rotation rate on the main gauge of the main screen.
- DPF filter exchange : You may initialize parameters relevant to DPF of engine ECU after cleaning the DPF filter.
- AVCU setting : You may select Standard, 2-Way or 4-Way dependent upon the system options.
- Adding language : It is possible to update language displayed on the cluster when it is required to correct language.

※ The service menu is accessible by maintenance engineer only. Do not attempt unauthorized adjustment.

(4) Display

① Clock adjust

HX60A3CD191A

HX60A3CD192A

- "****-**-**" on the first line indicates year/month/day.
- The second line indicates current time (00:00 - 12:59 am/pm)

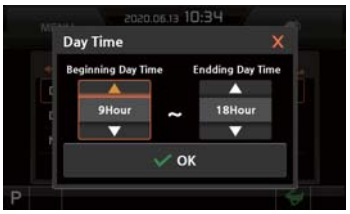
② Brightness setting

HX60A3CD193A

Manual (Level 1 to 10) HX60A3CD194A

HX60A3CD195A

Auto (daytime) HX60A3CD196A



Auto (day/night) HX60A3CD197A

- Selecting “Auto” allows setting brightness different in day and night. It is also allowed to set hours in daytime. (Setting beginning day time and ending day time)

③ Unit setting

HX60A3CD198A

HX60A3CD199A

- Metric: Units are changed to metric units.
- U.S. units: Units are changed to U.S. units.
- User setting : Units are changed to user setting.

Item	Metric system	U.S. unit	User's setup
Temperature	˚C	˚F	˚C, ˚F
Distance	km	mile	km, mile
Pressure	bar	Mpa	bar, Mpa, kgf/cm^2, psi
Flow	lpm	gpm	lpm, gpm
Volume	l	gal	l, gal

④ Language selection

HX60A3CD200A

HX60A3CD201A

· You may select your language (from 24 languages), and all the information is displayed in the selected language.

(5) Utilities

① Entertainment

HX60A3CD70A HX60A3CD208A HX60A3CD209A

- You may play MP4 or CODEC files of detachable hard disk through USB port.
- USB port is on the left of the instrument panel.
- When engine rotation rate exceeds 1100 rpm or higher, the screen is switched to the operation screen even while MP4 or CODEC file is played for safety. When engine rotation rate drops to 1100 rpm or lower, animation clip is played again.

⚠ Do not play animation clip while operating the system to prevent risks of accident.

② Camera setting

HX60A3CD202A HX60A3CD203A

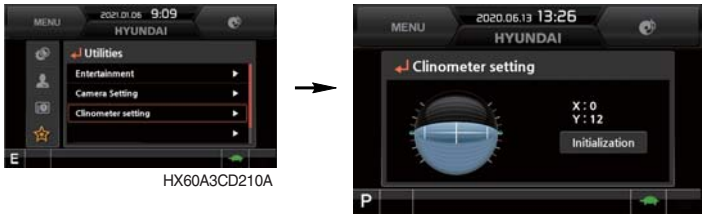
- You may install three cameras on the system, and set display sequence on this menu.
- If no camera is installed, this menu is disabled.

- When rotating Select switch clockwise, the screen of the next camera is displayed. When rotating the switch counterclockwise, the screen of the previous camera is displayed. You may also change the camera channel by touching the screen.
- You may display or hide the mini instrument panel by pressing Select switch or touching the screen.
  (Mini instrument panel displayed → hidden → displayed)

HX60A3CD204

- Pressing ESC switch or touching X icon on the screen terminates the camera mode.

③ Clinometer setting

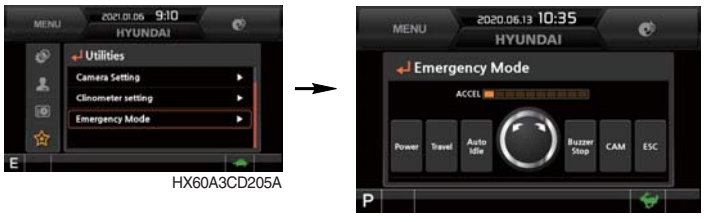


HX60A3CD210A

HX60A3CD211A

- Pressing “Default” when the system is kept on flat surface resets X and Y values to zero.
- You may check gradient of the system on the operating screen of the instrument panel.

④ Emergency mode

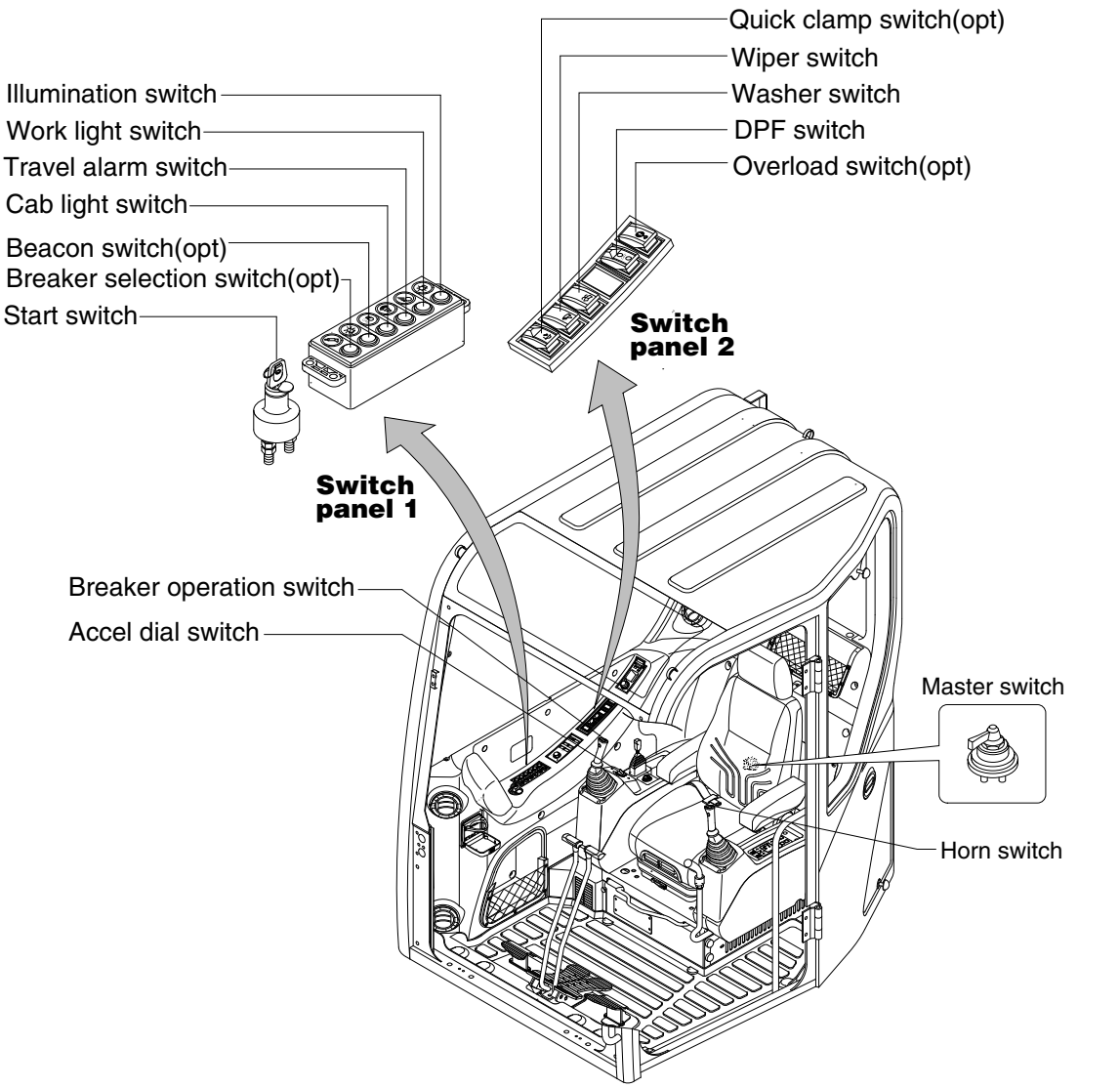


HX60A3CD205A

HX60A3CD206A

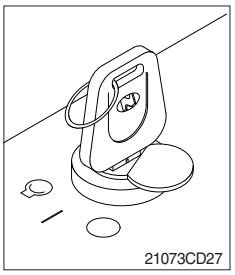
- When the switch or the acceleration dial of the monitor fails, the switch is displayed on LCD, and you are allowed to perform operation by touching the screen.
- Such operation is allowed only on this mode screen.

3. SWITCHES



80CR9A3CD02

1) STARTING SWITCH

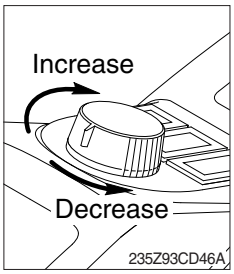


(1) There are three positions, OFF, ON and START.

- ◯ (OFF) : None of electrical circuits activate.
- | (ON) : All the systems of machine operate.
- (START) : Use when starting the engine.
  Release key immediately after starting.

※ Key must be in the ON position with engine running to maintain electrical and hydraulic function and prevent serious machine damage.

2) ACCEL DIAL

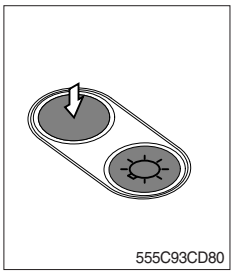


(1) There are 10 dial setting.

(2) Setting 1 is low idle and setting 10 is high idle.

- By rotating the accel dial to right : Engine speed increased.
- By rotating the accel dial to left : Engine speed decreased.

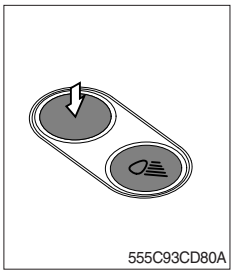
3) HEAD LIGHT SWITCH



(1) This switch is used to operate the head light.

- Press the switch once, the head light comes ON and the pilot lamp ON.
- Press the switch once more, the head light and pilot lamp turn off.

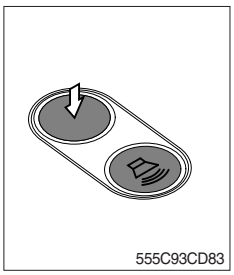
4) WORK LIGHT



(1) This switch is used to operate the work light.

- Press the switch once, the work light comes ON and the pilot lamp ON.
- Press the switch once more, the work light and pilot lamp turn off.

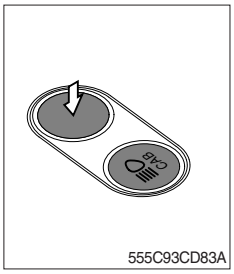
5) TRAVEL ALARM SWITCH



(1) This switch is used to alarm surroundings when the machine travels to forward and backward.

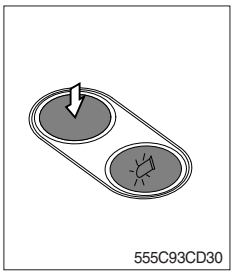
(2) On pressing this switch, the alarm operates only when the machine is traveling.

6) CAB LIGHT SWITCH



(1) This switch turns on the cab light on the cab.

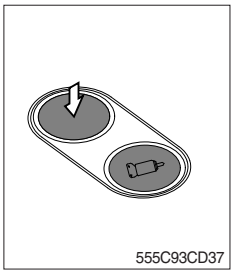
7) BEACON SWITCH (option)



(1) This switch turns ON the rotary light on the cab.

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

8) BREAKER SELECTION SWITCH (option)



(1) This switch is used to operate breaker.

※ **The breaker operates only when this switch is pressed.**

※ **This switch applies to single action hydraulic attachment circuit.**

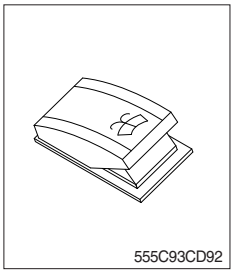
9) WIPER SWITCH

(1) This switch is used to operate the wiper.
The wiper operates.

※ **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, motor failure can result.**

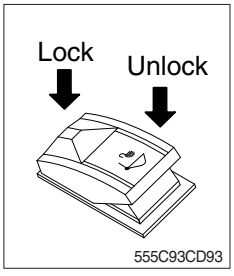
10) WASHER SWITCH



(1) This switch is used to operate the washer.

· The washer liquid is sprayed and the wiper is operated only while pressing this switch. If release the switch, return to the first position.

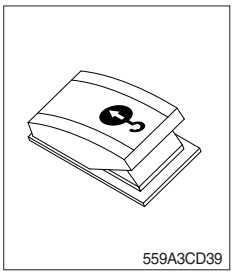
11) QUICK CLAMP SWITCH (option)



(1) This switch is used to engage or disengage the moving hook on quick clamp.

※ **Refer to the operator's manual page 8-6 for details.**

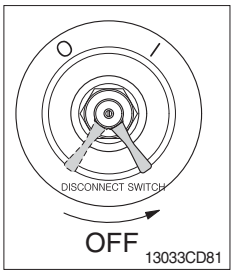
12) OVERLOAD SWITCH (option)



(1) When this switch pressed ON position, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.

(2) When it pressed OFF position, buzzer stops and warning lamp goes out.

13) MASTER SWITCH

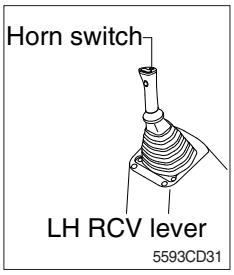


(1) This switch is used to shut off the entire electrical system.

(2) I : The battery remains connected to the electrical system.
O : The battery is disconnected to the electrical system.

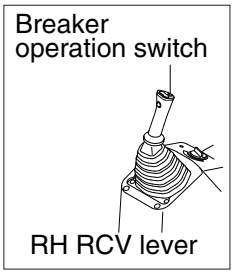
※ **Never turn the master switch to O (OFF) with the engine running. It could result in engine and electrical system damage.**

14) HORN SWITCH



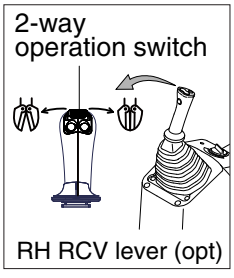
(1) This switch is at the top of left side control lever.
On pressing, the horn sounds.

15) BREAKER AND 2-WAY OPERATION SWITCH



(1) On pressing this switch, the breaker operates only when the breaker selection switch on the switch panel is selected.

※ **This switch applies to single action hydraulic attachment circuit.**



(2) This switch operates the clamshell or shear.

※ **This switch applies to double action hydraulic attachment circuit.**

16) DPF (diesel particulate filter) SWITCH

(1) This switch is used to select the regeneration function of the DPF.

(2) Inhibit position (①)

① The inhibit position disallows any automatic or manual regeneration of the DPF.

② This may be used by operator to prevent regeneration when the machine is operating in a hazardous environment concerned about high temperature.

③ It is strongly recommended that this position is only activated when high temperatures may cause a hazardous condition.

(3) OFF position

This position will initate a automatic regeneration of the DPF.

(4) Manual regeneration position (②)

① This position will only initate a manual regeneration of the DPF when the machine is in non-mission condition, engine must run at low idle speed and DPF soot levels are high enough to allow regeneration.

② HEST lamp will be illuminated during the entire regeneration.

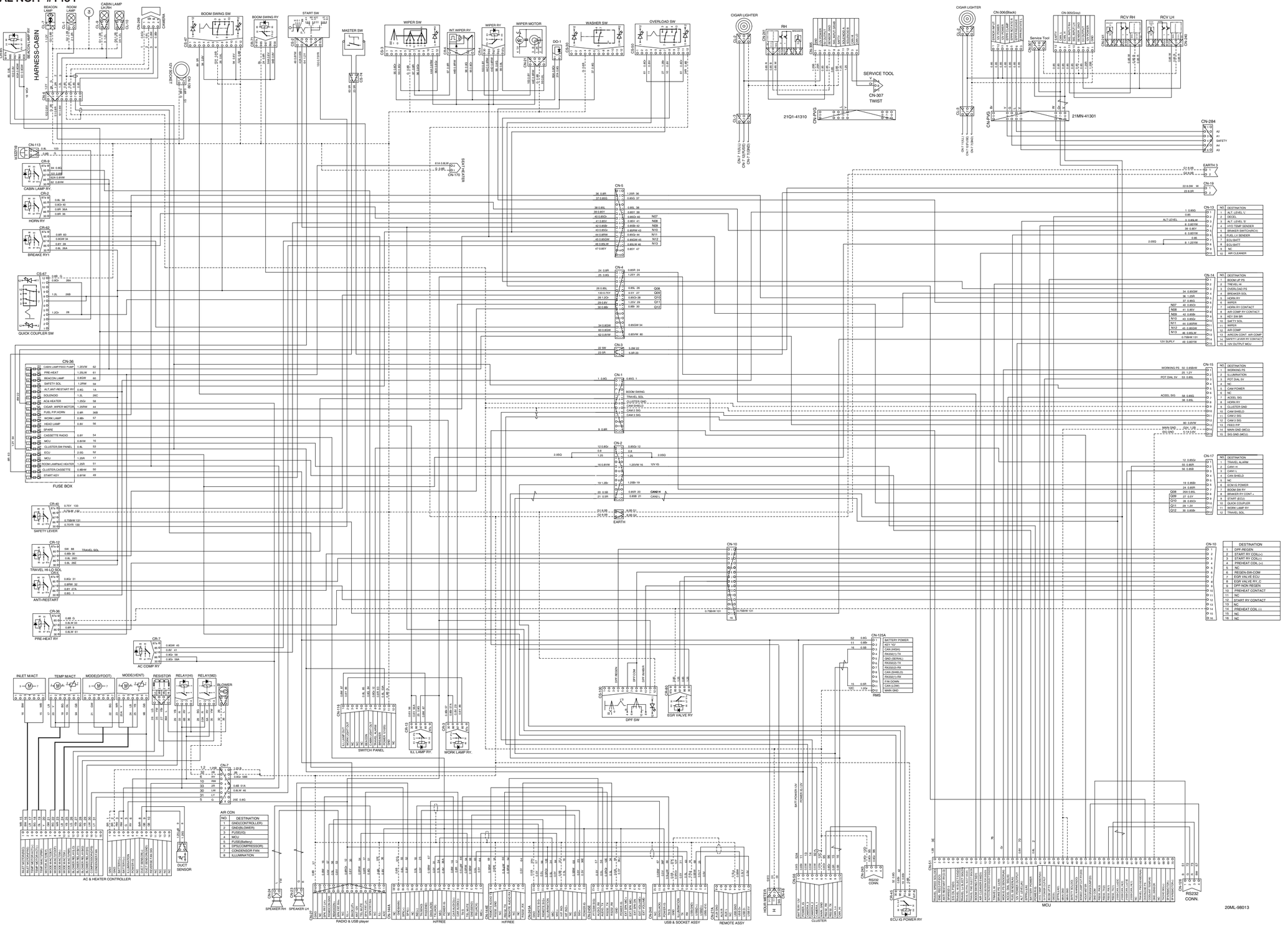
※ **Refer to the page 4-9 for details.**

※ **This switch can be move to the manual regeneration position (②) only when the safety button is pulled to backward.**

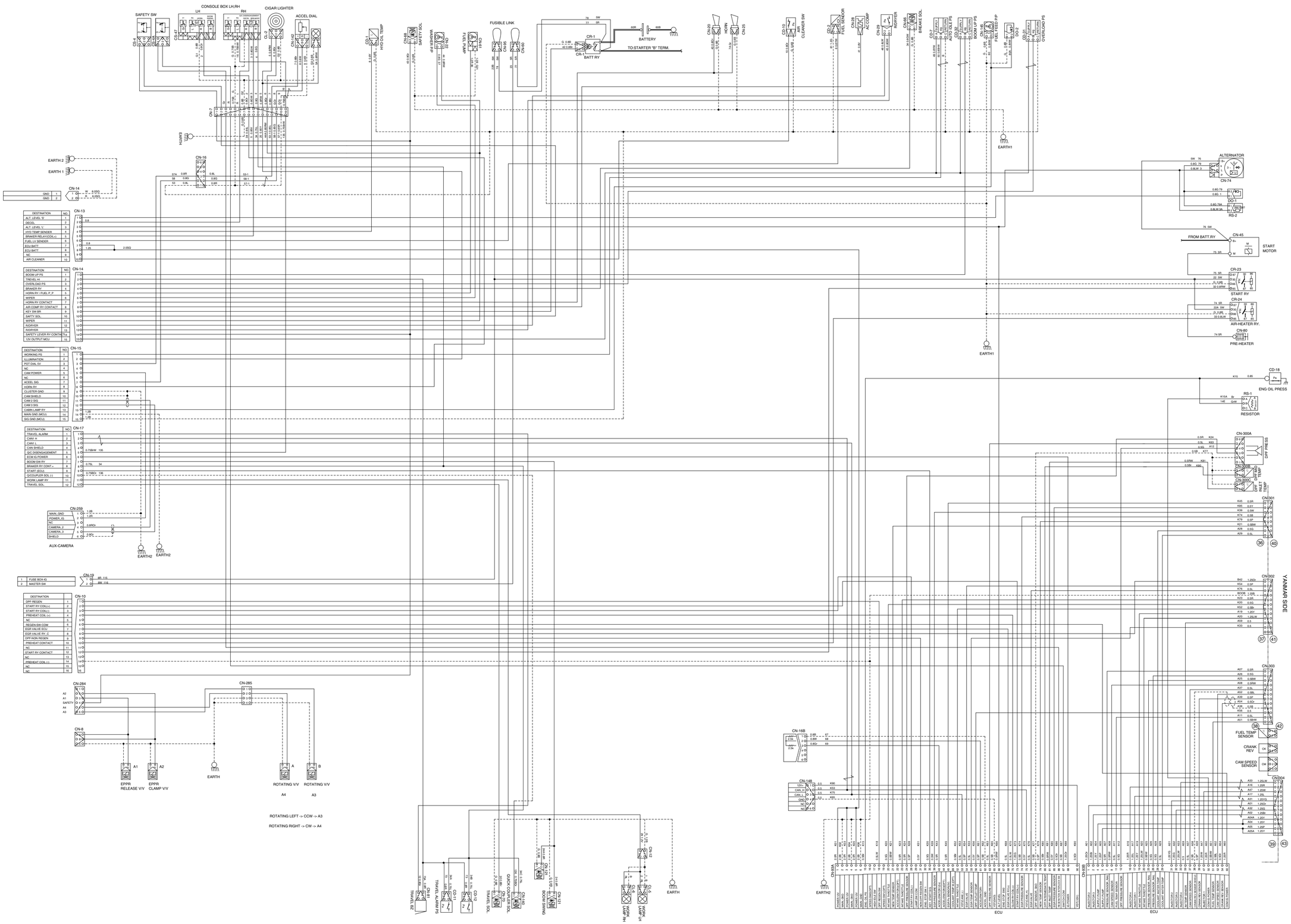
※ **Also, this switch return to the OFF position when released the manual regeneration position (②).**

· ELECTRICAL CIRCUIT (1/2)

- MACHINE SERIAL NO. : -#1454



- MACHINE SERIAL NO. : #1455-



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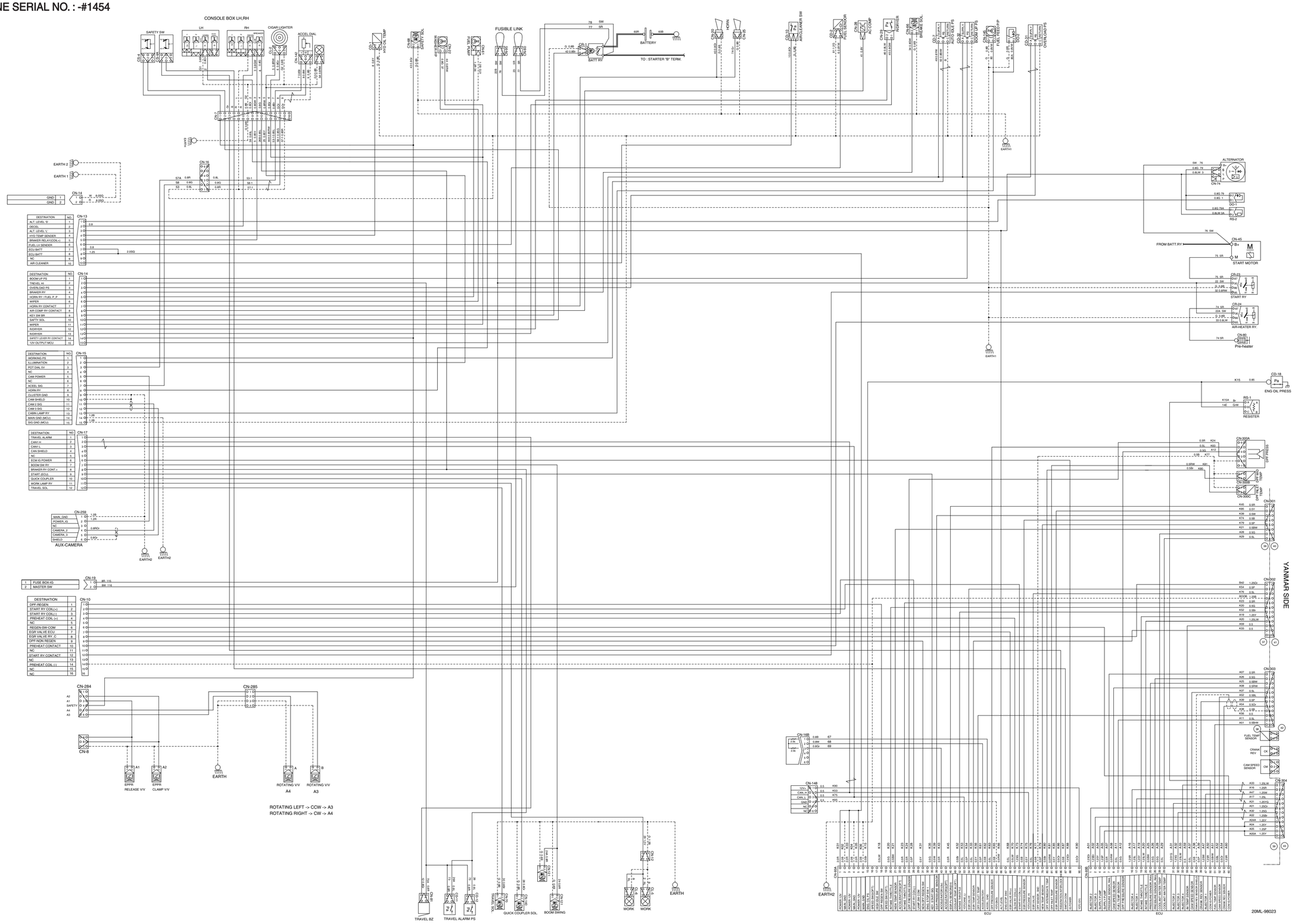
· ELECTRICAL CIRCUIT (2/2)

- MACHINE SERIAL NO. : -#1454



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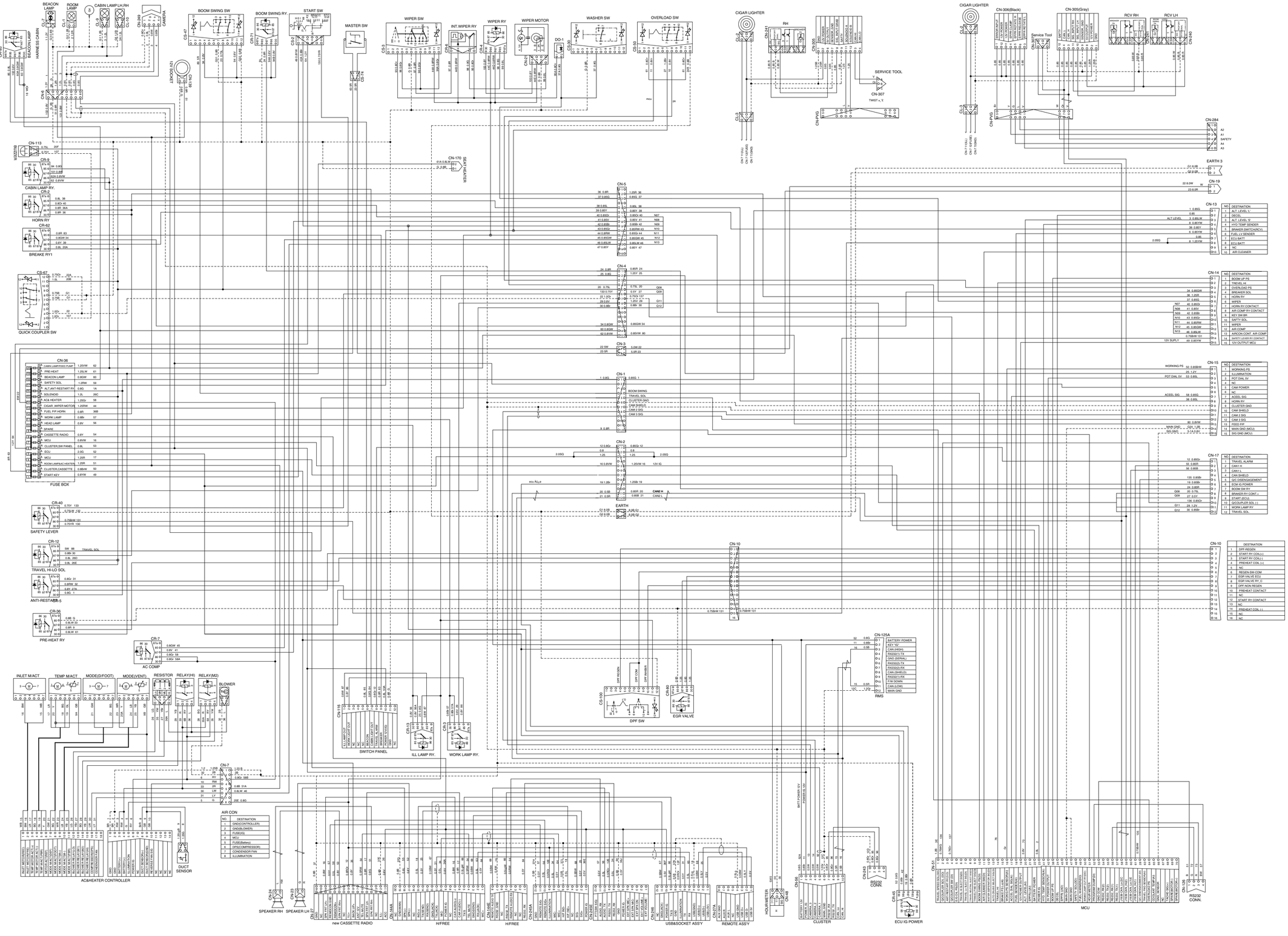
- MACHINE SERIAL NO. : #1455-



20ML-98014-00

MEMORANDUM

1. POWER CIRCUIT

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

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

1) OPERATING FLOW

Battery → Battery relay (CR-1) → Fusible link (CN-60) → I/conn [CN-19 (2)] → Master switch [CS-74]

- → Fuse box [No.1] → Start switch [CS-2 (1)]
- → Fuse box [No.2]
  - → Radio & USB player [CN-27 (8)]
  - → Cluster [CN-56 (1)]
  - → Hour meter [CN-48 (1)]
- → Fuse box [No.3]
  - → I/conn [CN-7 (5)] → AC & Heater controller
  - → I/conn [CN-6 (3)] → Room lamp [CL-1 (2)]
  - → 12V socket [CN-139 (2)]
- → Fuse box [No.4] → I/conn [CN-2 (7)] → MCU [CN-51 (22)]
- → Fuse box [No.5] → I/conn [CN-2 (2, 3)] → ECU [CN-93A (1, 3, 5)]

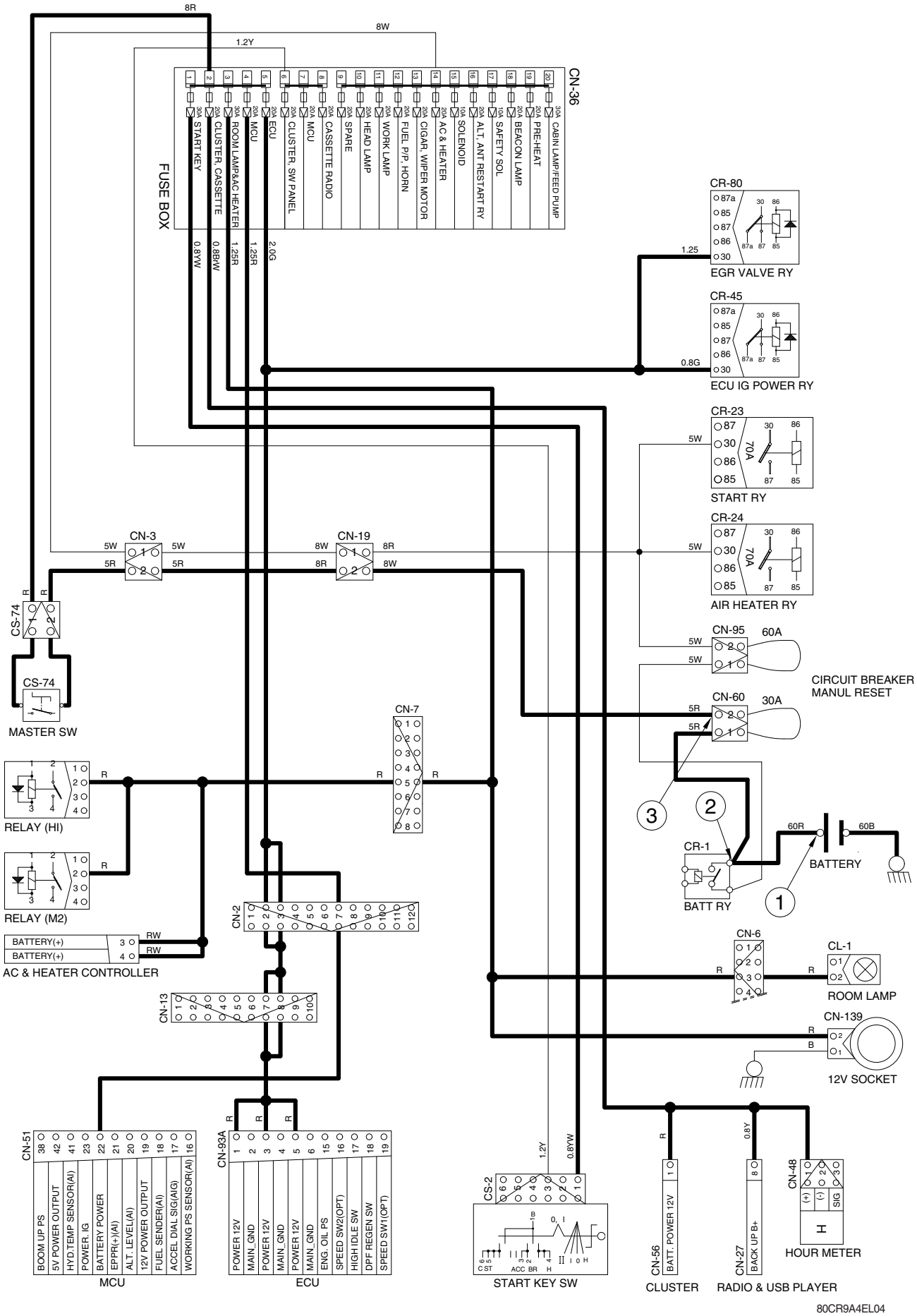
※ I/conn : Intermediate connector

2) CHECK POINT

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

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Fusible link [CN-60] → I/conn [CN-19 (2)] → I/conn [CN-3 (2)] → Master switch [CS-74] → Fuse box [No.1] → Start key [CS-2 (1)]

※ Start switch : ON

→ Start switch ON [CS-2 (2)] → ECU IG power relay [CR-45 (86)]
→ I/conn [CN-5 (9)] → I/conn [CN-14 (9)] →
Battery relay [CR-1] : Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2 (3)] → Fuse box (all power is supplied with electric component)

※ Start switch : START

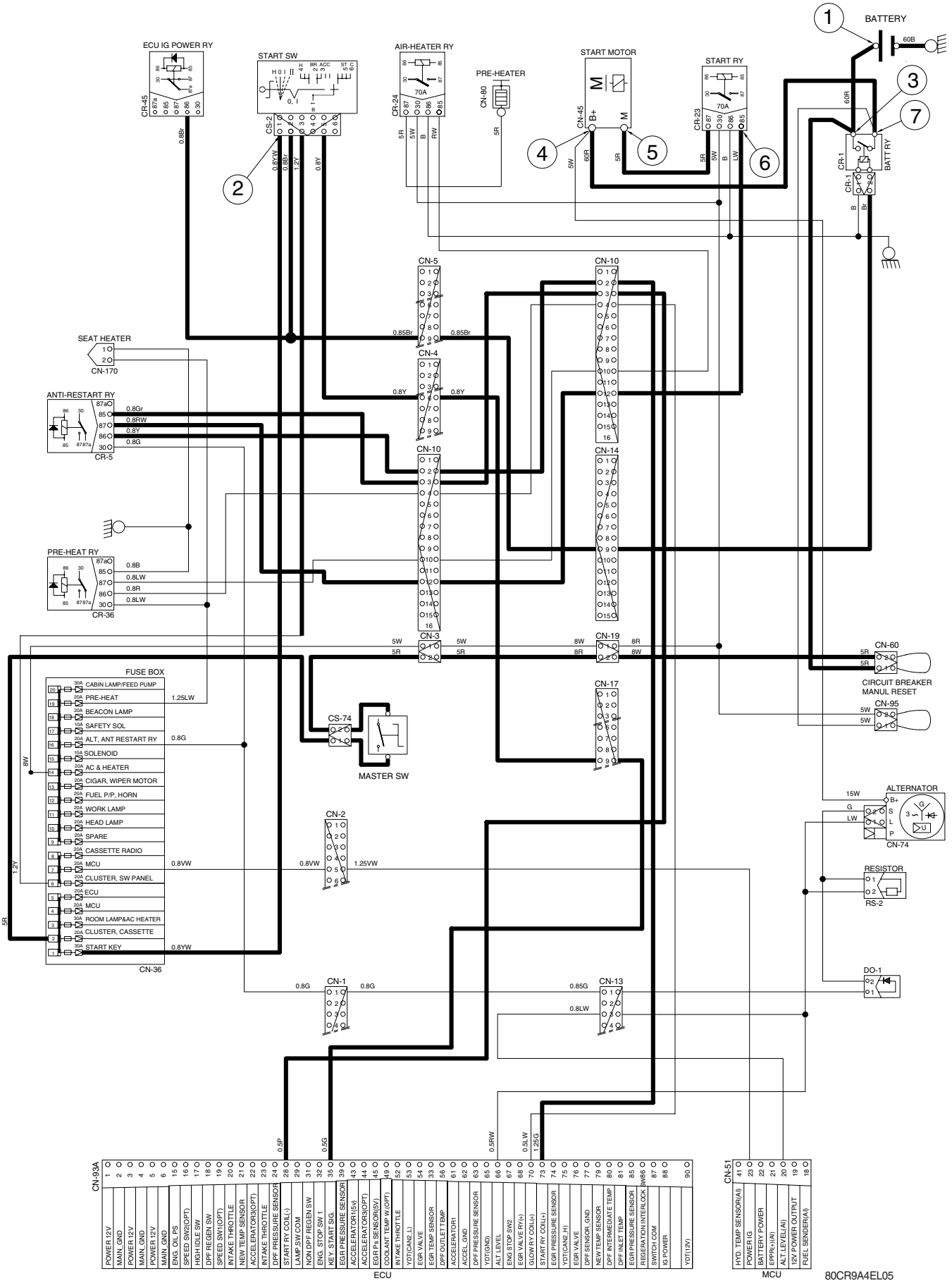
Start switch START [CS-2 (5)] → I/conn [CN-4 (6)] → I/conn [CN-14 (9)] → ECU [CN-93A (35) → (28, 73)] → I/conn [CN-10 (2, 3)] → I/conn [CN-10 (2, 3)] → Anti-restart relay [CR-5 (30) → (87)] → I/conn [CN-10 (12)] → I/conn [CN-10 (12)] → Start relay [CR-23 (30) → (87)] → Start motor operating

2) CHECK POINT

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

※ GND : Ground

STARTING CIRCUIT



3. CHARGING CIRCUIT

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

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

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

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-13 (3)] → MCU [CN-51 (20)] → Cluster warning lamp

(2) Charging flow

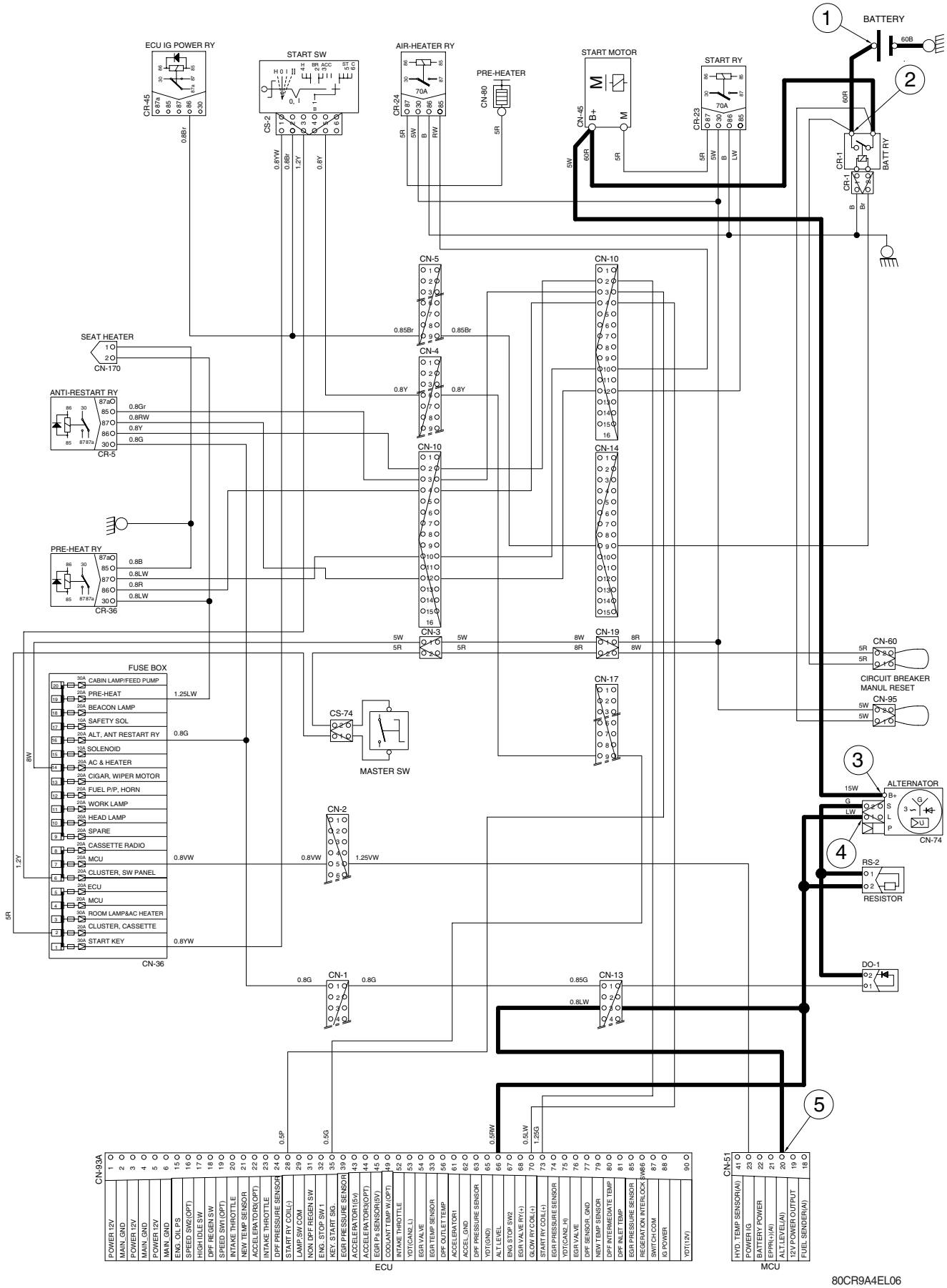
Alternator "B^+" terminal → Battery relay → Battery (+) terminal

2) CHECK POINT

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

※ GND : Ground

CHARGING CIRCUIT



4. ILLUMINATION AND WORK LAMP CIRCUIT

1) OPERATING FLOW

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

(1) Head lamp switch ON

Illumination lamp switch ON [CN-116(1)] → Illumination lamp relay [CR-13 (85) → (87)]
- → I/conn [CN-4 (2)] → I/conn [CN-15 (2)] → I/conn [CN-7 (11)]
  - → Cigar lighter [CL-2 (1)]
  - → Accel dial [CN-142 (2)]
- → Remote controller illumination ON [CN-245A (9)]
- → Radio & USB player illumination ON [CN-27 (9)]
- → USB & Socket illumination ON [CN-246 (7)]
- → DPF switch illumination ON [CS-100 (11)]
- → I/conn [CN-7 (8)] → AC/Heater controller illumination ON

(2) Work lamp switch ON

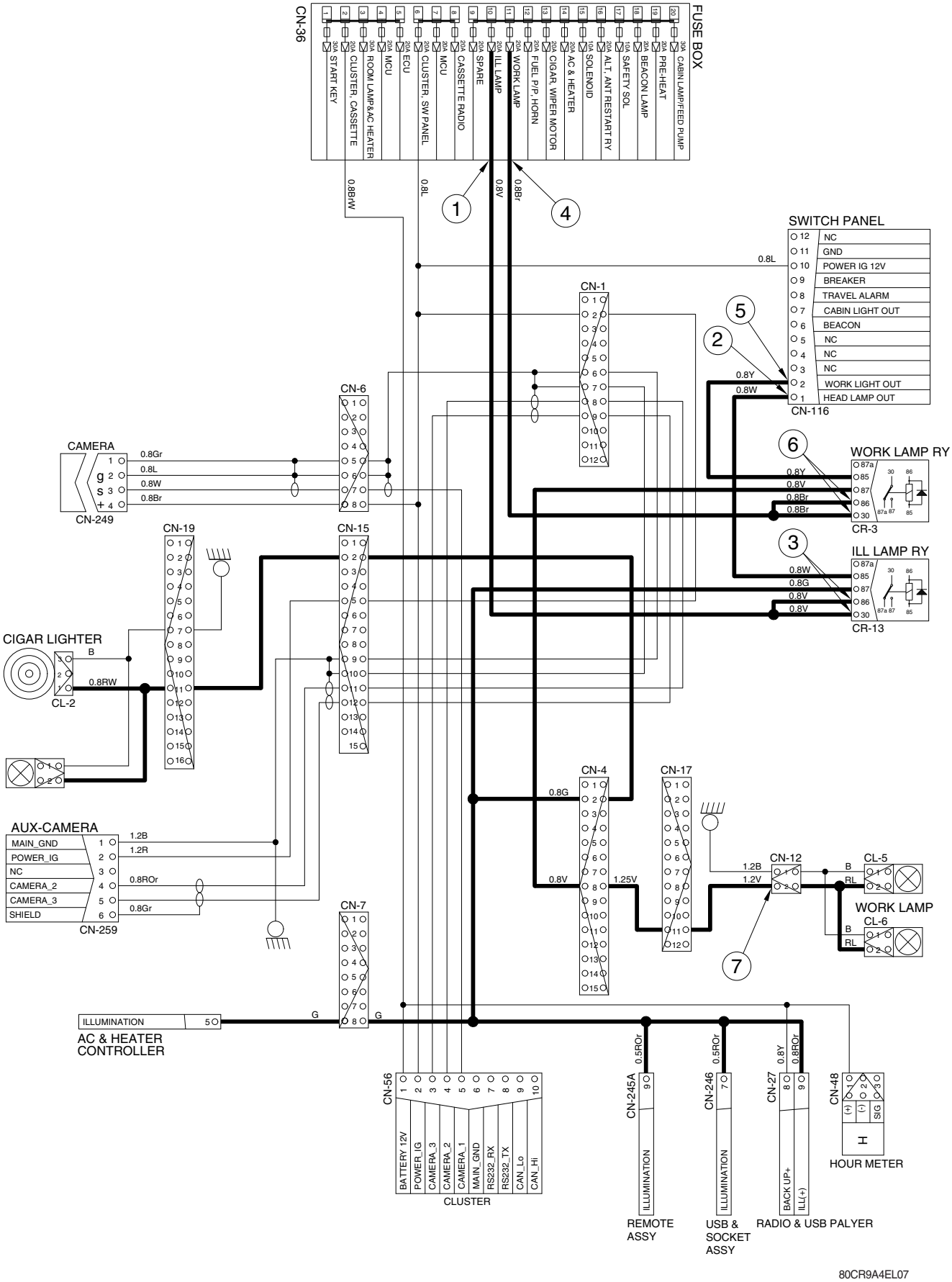
Work light switch ON [CN-116 (2)] → Work lamp relay [CR-3 (85) → (87)] → I/conn [CN-4 (8)]
I/conn [CN-17 (11)] → I/conn [CN-12 (2)] → Work lamp ON [CL-5 (2), CL-6 (2)]

2) CHECK POINT

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

※ GND : Ground

ILLUMINATION AND WORK LAMP CIRCUIT



5. BEACON LAMP AND CAB LAMP CIRCUIT

1) OPERATING FLOW

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

(1) Beacon lamp switch ON

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

(2) Cab lamp switch ON

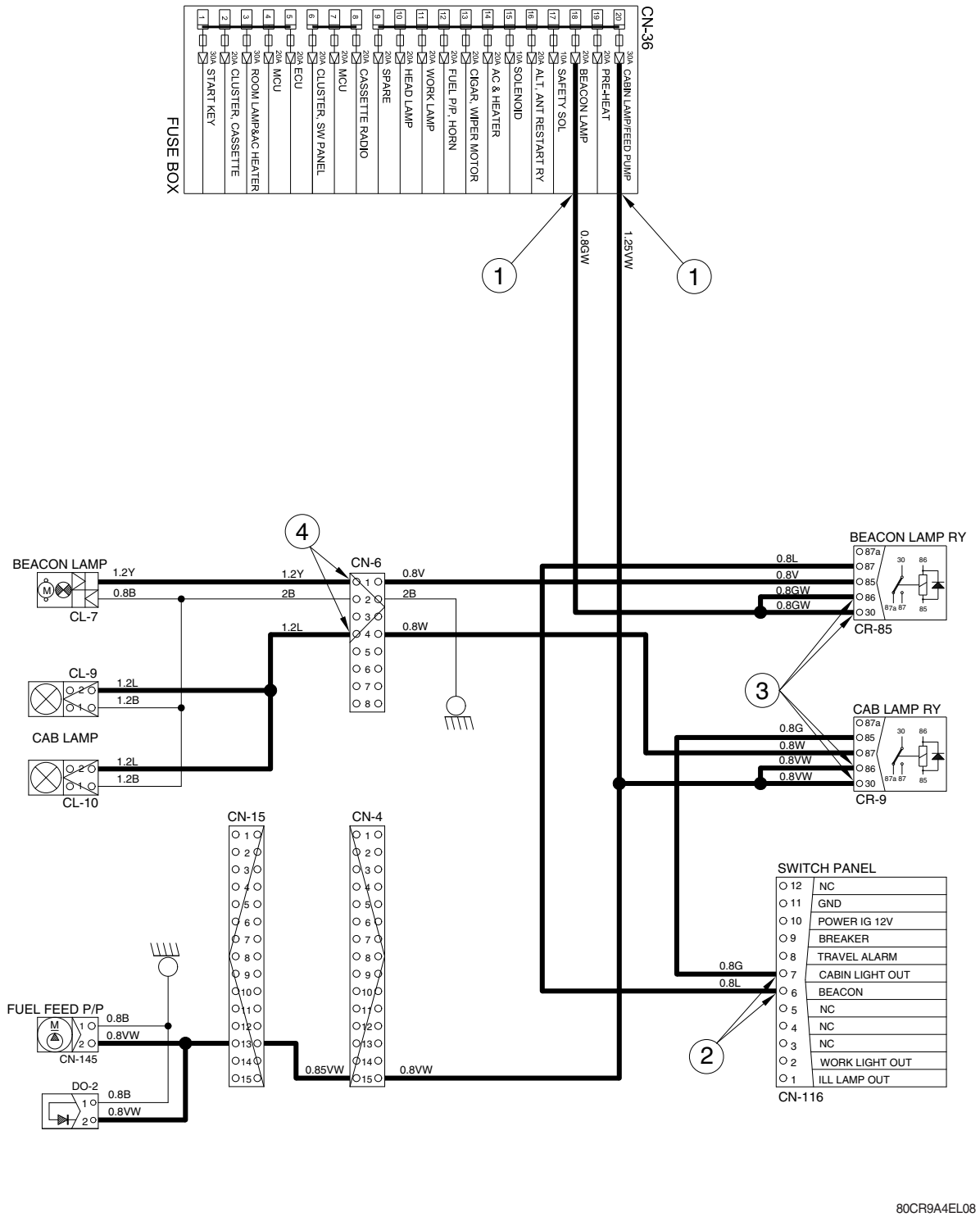
Cab lamp switch ON [CN-116 (7)] → Cab lamp relay [CR-9 (87)] → I/conn [CN-6 (4)] → Cab lamp ON [CL-9 (2), CL-10 (2)]

2) CHECK POINT

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

※ GND : Ground

BEACON LAMP CIRCUIT



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6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

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

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

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

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

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

Washer switch ON [CS-30 (6)] → I/conn [CN-5 (3)] → I/conn [CN-14 (6)]
→ Washer pump operating [CN-22 (1)]

(4) Auto parking (when switch OFF)

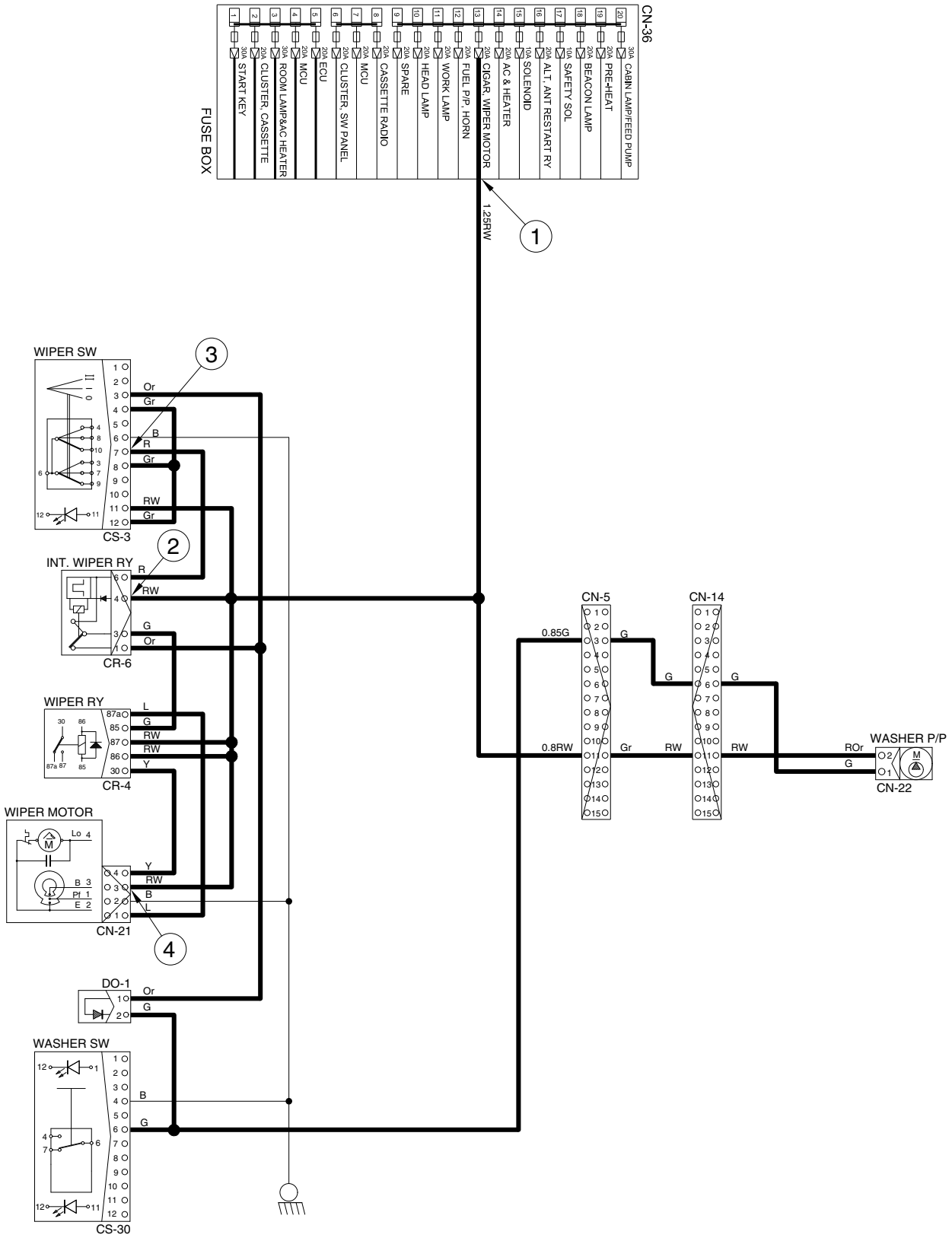
Switch OFF → Wiper motor [CN-21 (1)] → Wiper switch [CS-3 (5)→(8)] → Int wiper relay [CR-6 (6)→(3)]
→ Wiper relay [CR-4 (85) → (30)] → Wiper motor [CN-21 (4)]
→ Wiper motor parking position by wiper motor controller

2) CHECK POINT

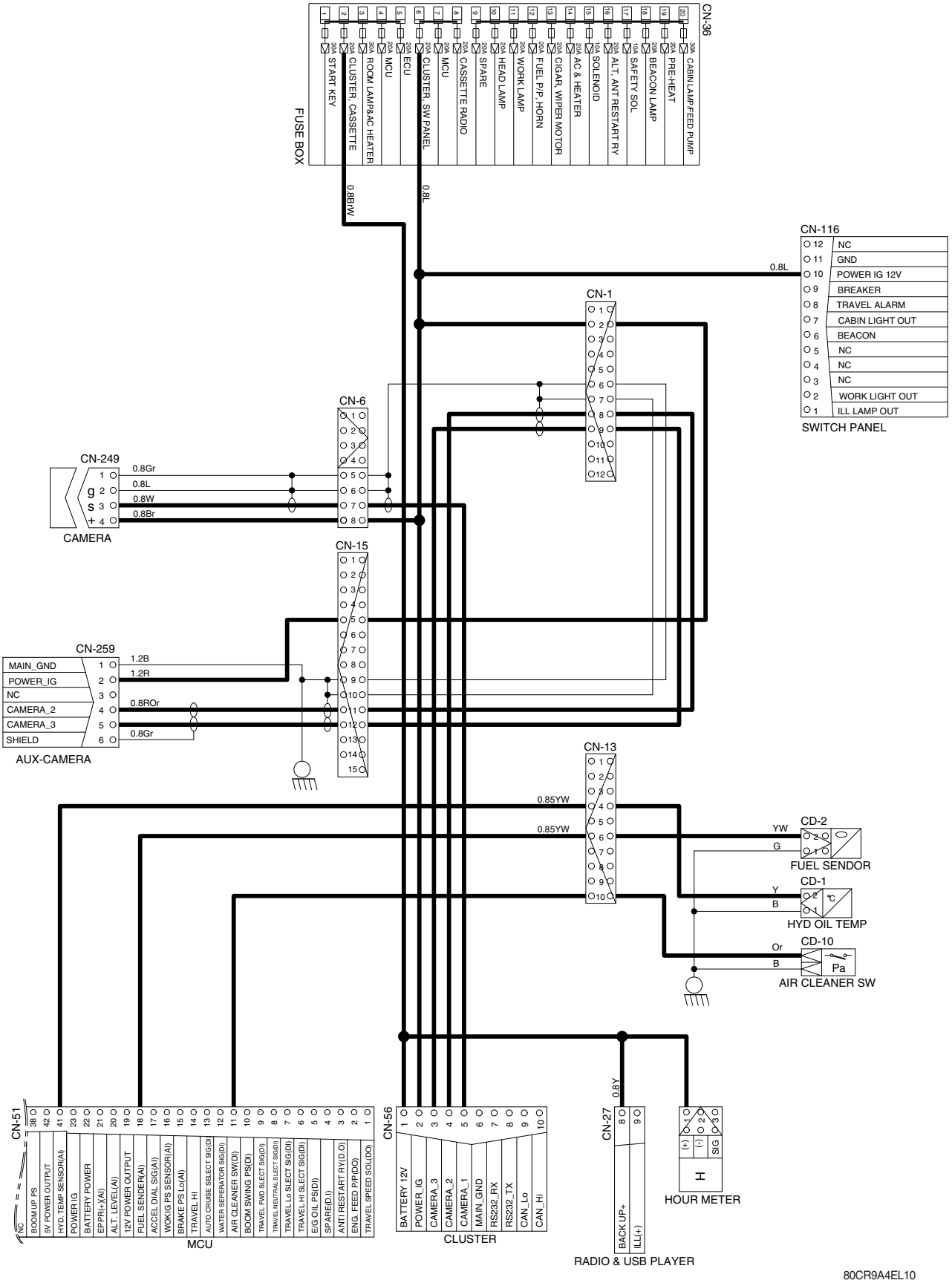
Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (wiper motor)	10~12.5V

※ GND : Ground

WIPER AND WASHER CIRCUIT



MONITORING CIRCUIT



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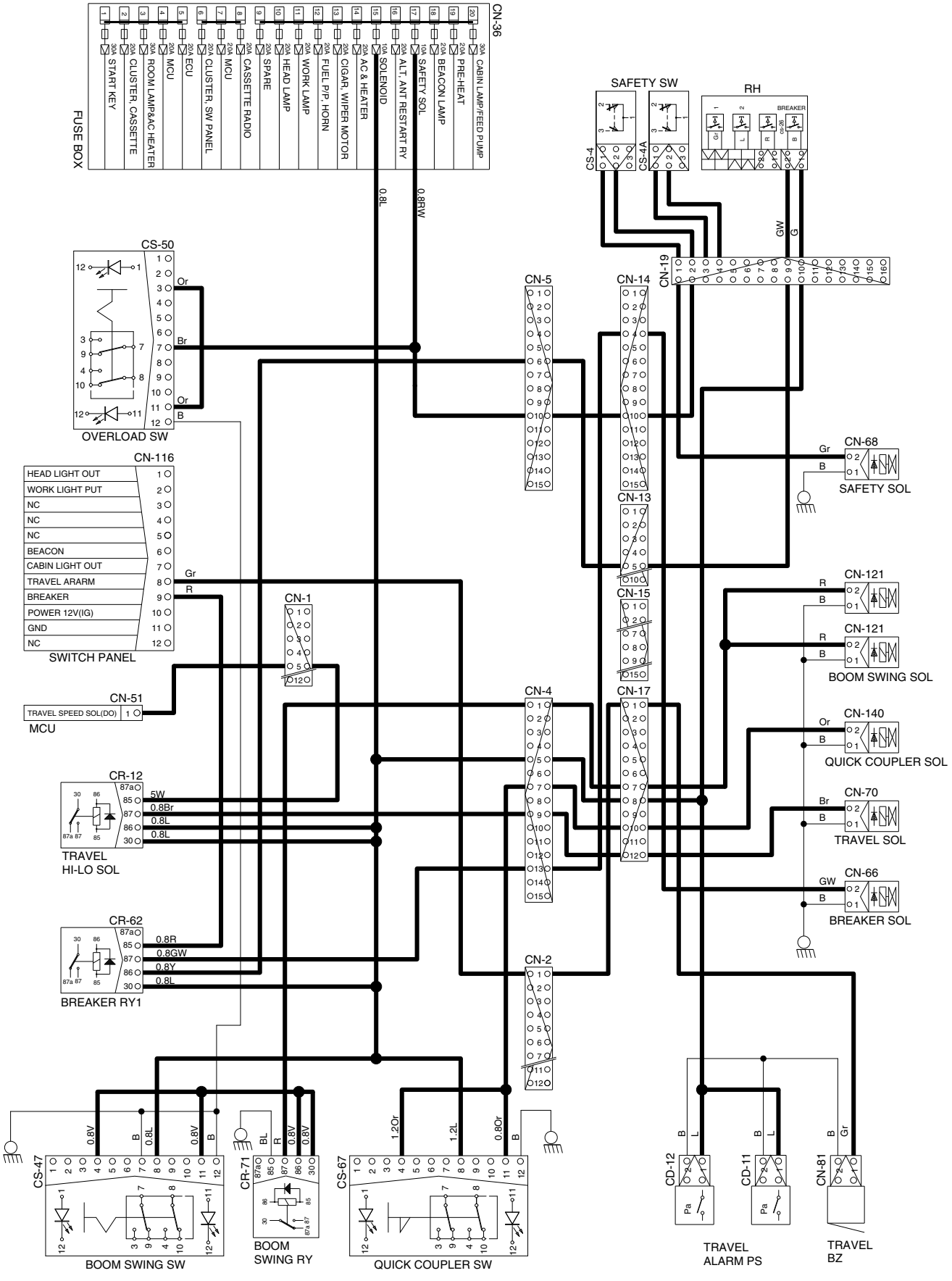
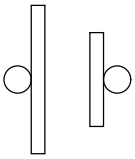
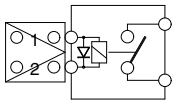
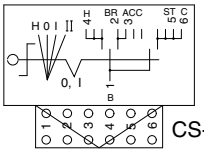
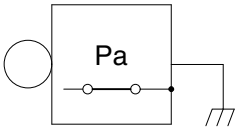
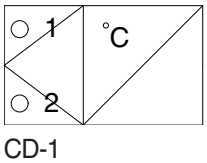
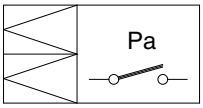
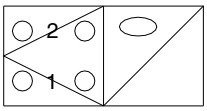
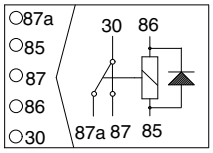
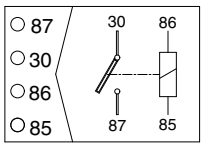
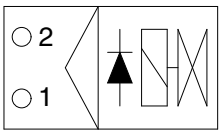
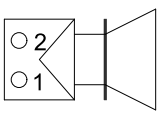
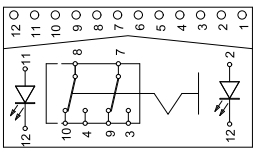
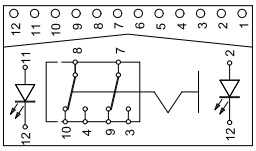
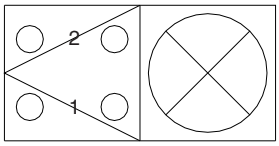
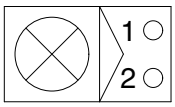
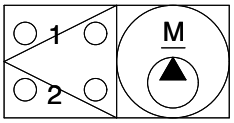
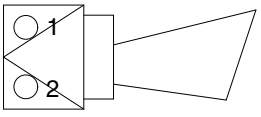
ELECTRIC CIRCUIT FOR HYDRAULIC

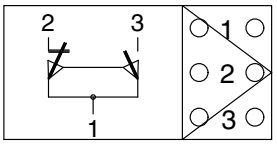
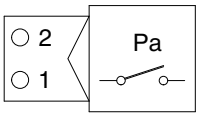
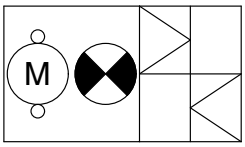
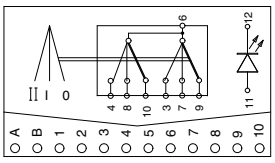
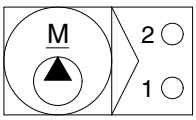
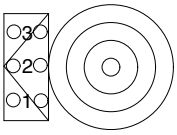


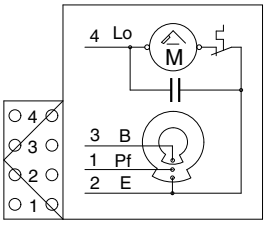
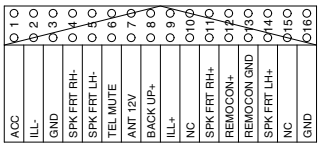
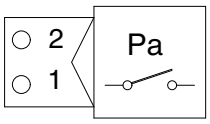
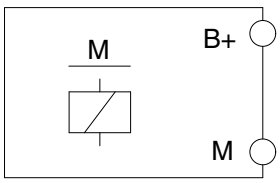
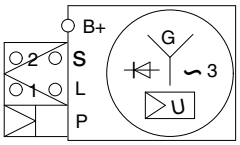
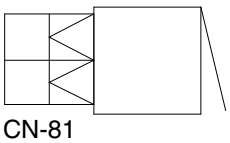
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

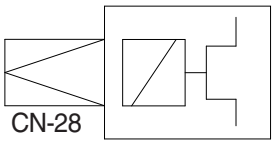
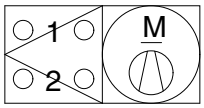
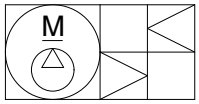
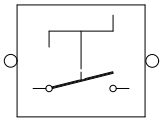
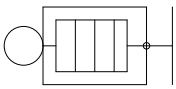
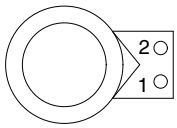
Part name	Symbol	Specification	Check
Battery		12V × 100Ah	※ Check specific gravity 1.280 over : over charged 1.280 ~ 1.250 : normal 1.250 below : recharging
Battery relay	 CR-1	Rated load : 12V 100A (continuity) 1000A (30 second)	※ Check coil resistance Normal : about 12 Ω ※ Check contact Normal : ∞ Ω
Start key	 CS-2	12V	※ Check contact OFF : ∞ Ω (for each terminal) ON : 0 Ω (for terminal 1-3 and 1-2) START : 0 Ω (for terminal 1-5)
Pressure switch (for engine oil)	 CD-18	0.5 kgf/cm² (N.C TYPE)	※ Check resistance Normal : 0 Ω (CLOSE)
Hydraulic oil temperature sensor	 CD-1	0.5 kgf/cm² (N.C TYPE)	※ Check resistance 50˚C : 804 Ω 80˚C : 310 Ω 100˚C : 180 Ω

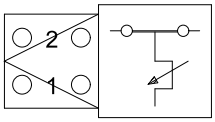
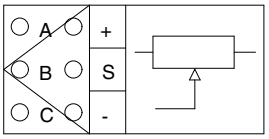
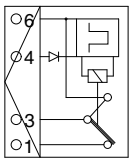
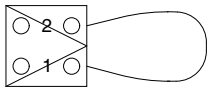
Part name	Symbol	Specification	Check
Air cleaner pressure switch	 CD-10	Pressure: 635mmH_2O (N.O TYPE)	※ Check contact Normal : ∞ Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 100 Ω Low : 500 Ω Empty warning :700 Ω
Relay	 CR-2 CR-3 CR-4 CR-5 CR-7 CR-9 CR-12 CR-13 CR-36 CR-45 CR-62 CR-71 CR-80 CR-85	12V 20A	※ Check resistance Normal : about 200 Ω (for terminal 85-86) : 0 Ω (for terminal 30-87a) : ∞ Ω (for terminal 30-87)
Relay	 CR-23 CR-24	12V 70A	※ Rated coil current 1.2±0.3A
Solenoid valve	 CN-66 CN-68 CN-70 CN-121 CN-140	12V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	4 Ω 20W	※Check resistance Normal : 4 Ω

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

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

Part name	Symbol	Specification	Check
Wiper motor	 CN-21	12V 3A	※ Check contact Normal : 6 Ω (for terminal 2-6)
Radio & USB player	 CN-27	24V 2A	※ Check voltage 20 ~ 25V (for terminal 1-3, 3-8)
Receiver dryer	 CN-29	12V	※ Check contact Normal : 0 Ω
Starter	 CN-45	12V × 3kW	※ Check contact Normal : 0.1 Ω
Alternator	 CN-74	12V 60A	※ Check contact Normal : 0 Ω (for terminal B^+-1) Normal : 24 ~ 27.5V
Travel buzzer	 CN-81	12V 0.5A	※ Check contact Normal : 5.2 Ω

Part name	Symbol	Specification	Check
Compressor	 CN-28	12V 79W	-
Blower fan motor	 CN-83	12V 9.5A	※ Check resistance 2.5 Ω (for terminal 1-2)
Fuel feed pump	 CN-61	12V	-
Master switch		12V 1000A	-
Preheater	 CN-80	12V 42A 500W	-
12V socket	 CN-139	12V 120W	-

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

GROUP 5 CONNECTORS

1. CONNECTOR DESTINATION

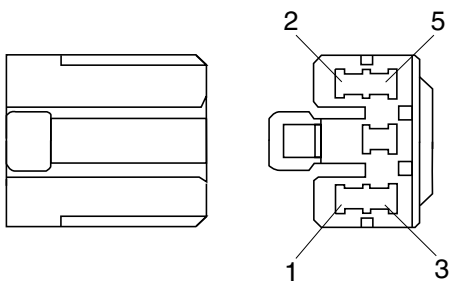
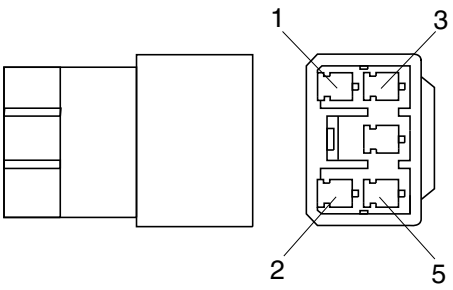
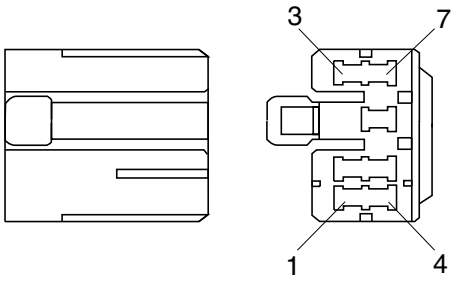
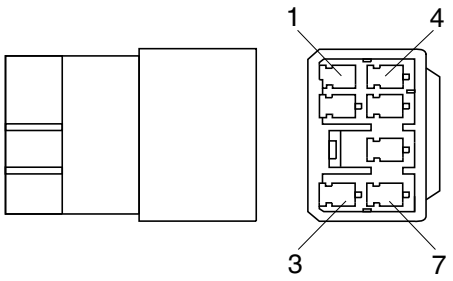
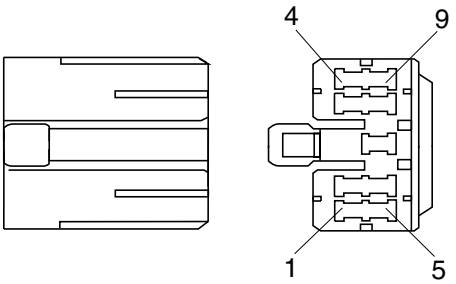
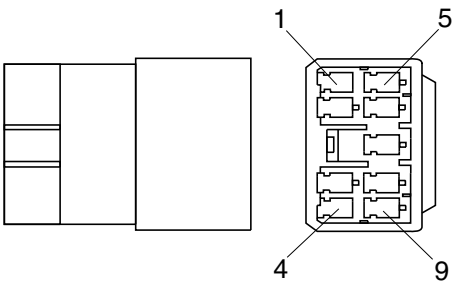
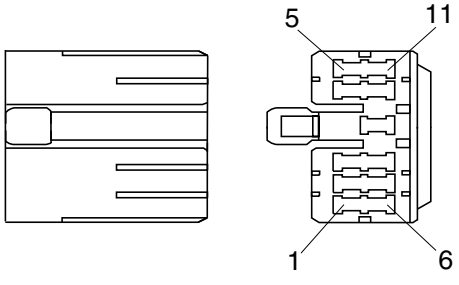
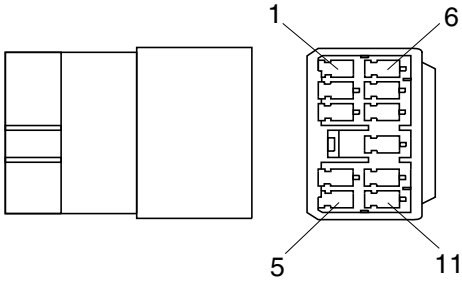
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	12	Cab room harness - Main harness	S816-012002	174663-2
CN-2	AMP	12	Aircon harness - Cab room harness	S816-012002	174663-2
CN-3	YAZAKI	2	Fusible link - Fuse box	S813-030201	S813-130201
CN-4	AMP	15	Cab room harness - Main harness	2-85262-1	368301-1
CN-5	AMP	15	Cab room harness - Main harness	2-85262-1	368301-1
CN-6	DEUTSCH	8	Cab harness - Cab room lamp harness	DT06-8S	DT04-8P
CN-7	AMP	16	Main harness - Console harness	368047-1	368050-1
CN-10	AMP	16	Bottom harness - Main harness	368047-1	368050-1
CN-12	AMP	2	Work lamp harness - Boom harness	S816-002002	S816-102002
CN-13	AMP	10	Bottom harness - Main harness	174655-2	174557-2
CN-14	AMP	15	Bottom harness - Main harness	2-85262-1	368301-1
CN-15	AMP	15	Main harness - Bottom harness	2-85262-1	368301-1
CN-17	AMP	12	Main harness - Bottom harness	S816-012002	S816-112002
CN-19	YAZAKI	2	Main harness - Bottom harness	S813-030201	S813-130201
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	12	Wiper harness	S816-012002	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	2	Speaker LH	MG610070	-
CN-24	KET	2	Speaker RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27	KUM	16	Radio and USB player	PK145-16017	-
CN-28	AMP	1	Air conditioner compressor	S810-001202	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse box	21L7-00250	-
CN-45	KET	1	Starter	ST710246-2	ST710592-2
CN-48	-	3	Hour meter	2-520193-2	-
CN-51	AMP	70	MCU	1-968879-1	-
CN-55	AMP	2	Travel alarm PS	S816-002002	S816-102002
CN-56	AMP	10	Cluster	-	S816-110002
CN-60	YAZAKI	2	Fusible link	-	7122-4125-50
CN-61	TERM	1	Fuel filler pump	S822-014000	S822-114000
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel HI-LO solenoid	DT06-2S-EP06	-

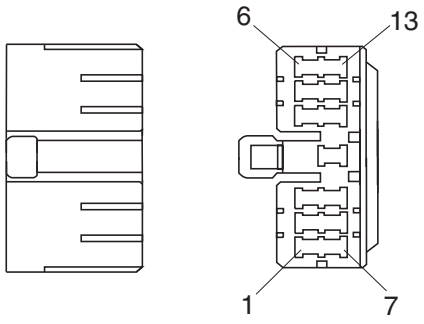
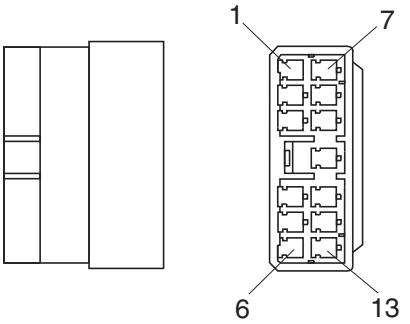
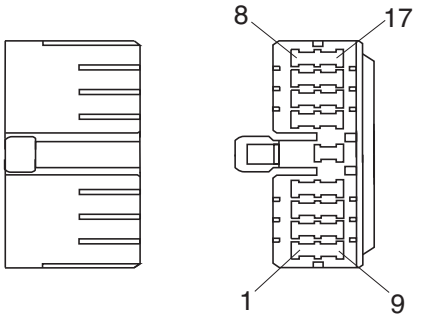
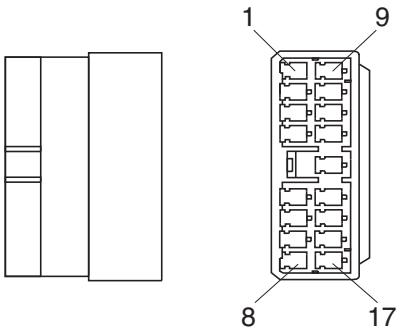
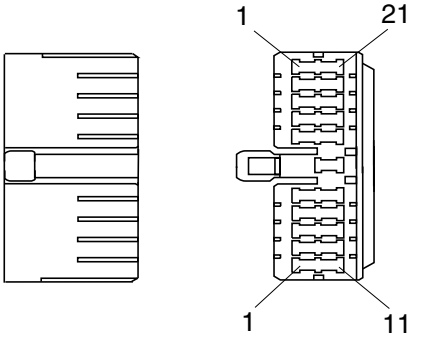
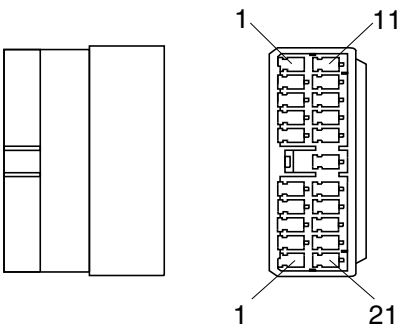
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-74	KET	2	Alternator	ST710285-2	-
CN-80	AMP	1	Pre heater	ST710384-2	-
CN-81	TERM	2	Travel buzzer	S822-014000	S822-114000
CN-83	AMP	2	Air-con fan	MG640188-5	-
CN-93A	AMP	94	ECU	3-1355136-3	-
CN-93B	AMP	60	ECU	1897635-2	-
CN-95	YAZAKI	2	Fusible link	4	S813-130201
CN-116	AMP	12	Switch panel	368542-1	-
CN-121	DEUTSCH	1	Boom swing	DT06-2S-EP06	-
CN-126	-	4	RS232 connector	-	
CN-139	AMP	2	12V socket	S810-002202	-
CN-140	DEUTSCH	2	Quick coupler	DT06-2S-EP06	DT04-2P-E005
CN-142	DEUTSCH	3	Accel dial	DT06-3S-EP06	-
CN-144	AMP	2	Handsfree	S810-002202	-
CN-145	KET	2	Fuel feed pump	7123-6423-30	-
CN-148	DEUTSCH	6	Service tool	DT06-6S-E008	-
CN-170	PACKARD	2	Seat heat switch	12162017	-
CN-243	-	4	RS232 connector	-	-
CN-245	AMP	12	Remote controller assy	368542-1	-
CN-246	AMP	12	USB & Socket assy	174045-2	-
CN-249	DEUTSCH	4	Rear camera	-	DT04-4P
CN-258	KET	1	Aircon comp power	MG640944-5	MG650943-5
CN-263	DEUTSCH	2	Aircon comp relay	DT06-2S-EP06	DT04-2P-E005
CN-300A	AMP	6	DPF pressure	1438153-5	-
CN-300B	FCI	2	DPF mid temperature	542002006	-
CN-300C	FCI	2	DPF inlet temperature	542002008	-
CN-301	AMP	8	EGR sensor	776532-1	-
CN-302	AMP	12	EGR valve	776533-1	-
· LAMP					
CL-1	KET	2	Room lamp	MG610392	-
CL-2	AMP	3	Cigar light	S810-003202	-
CL-3	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-4	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-5	DEUTSCH	2	Work lamp	DT06-2S-EP06	-
CL-6	DEUTSCH	2	Work lamp	DT06-2S-EP06	
CL-7	-	1	Beacon lamp	-	S822-114000
CL-9	DEUTSCH	2	Cab lamp	DT06-2S-EP06	-
CL-10	DEUTSCH	1	Cab lamp	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
· RELAY					
CR-1	AMP	2	Battery relay	S816-002002	S816-102002
CR-2	AMP	4	Horn relay	S810-004002	-
CR-5	AMP	4	Anti-restart relay	S810-004002	-
CR-6	KET	6	Int wiper relay	S810-006002	-
CR-12	AMP	4	Travel relay	S810-004002	-
CR-23	KET	2	Start relay	S814-002001	-
CR-24	KET	2	Air heater relay	S814-002001	-
CR-33	AMP	4	Air-con fan relay	S810-004002	-
CR-36	AMP	4	Pre-heater relay	S810-004002	-
CR-45	AMP	4	ECU power	S810-004002	-
· SENDER					
CD-1	AMP	2	Hydraulic temp sender	85202-1	-
CD-2	AMP	2	Fuel sender	-	S816-102002
CD-7	DEUTSCH	3	Auto idle pressure switch	DT06-3S-EP06	-
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-11	-	2	Travel pressure switch	MG640795	-
CD-12	-	2	Travel pressure switch	MG640795	-
CD-18	YAZAKI	1	Engine oil pressure	7123-5014	-
CD-32	DEUTSCH	3	Boom up pressure	DT06-3S-EP06	-
DO-1	-	2	Diode	21EA-50570	-
DO-2	-	2	Diode	21EA-50570	-
DO-3	-	2	Diode	21EA-50570	-
· SWITCH					
CS-2	KET	6	Start key switch	S814-006000	-
CS-3	SWF	12	Wiper switch	585790	-
CS-4	AMP	3	Safety switch	S816-003002	-
CS-4A	AMP	3	Safety switch	-	174359-2
CS-5	DEUTSCH	2	Horn-LH switch	-	DT04-2P-E005
CS-26	DEUTSCH	2	Breaker switch	-	DT04-2P-E005
CS-30	SWF	12	Wiper washer	585790	-
CS-47	SWF	12	Boom swing switch	585790	-
CS-67	SWF	12	Quick coupler switch	589790	-
CS-74	YAZAKI	2	Master switch	S813-030201	S813-130201
CS-100	SWF	12	DPF switch	589790	-

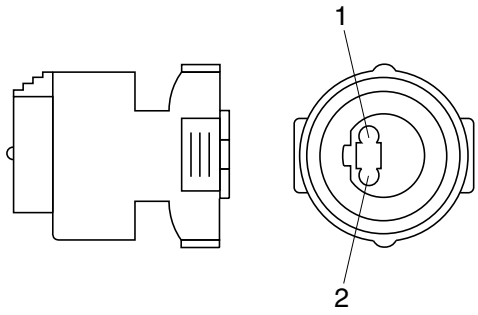
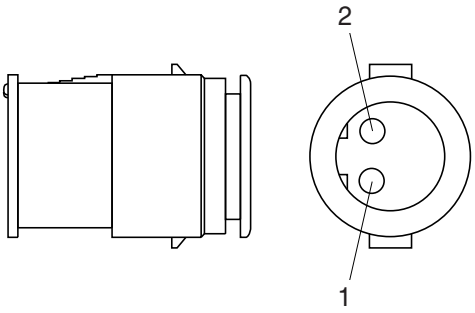
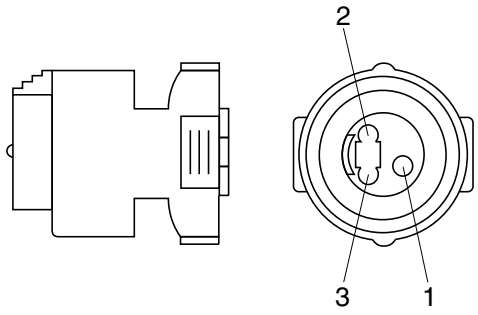
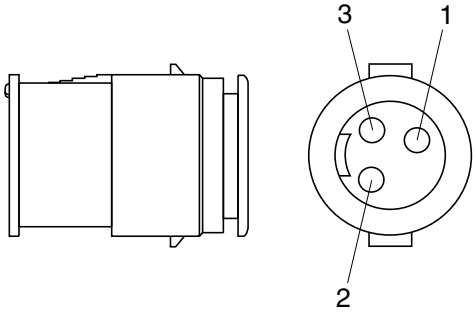
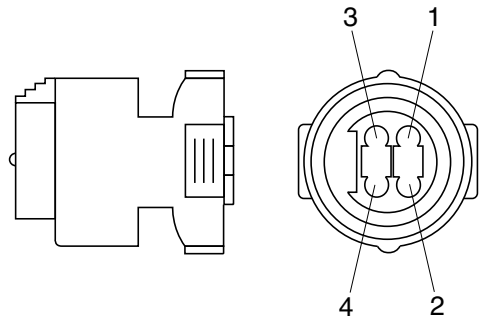
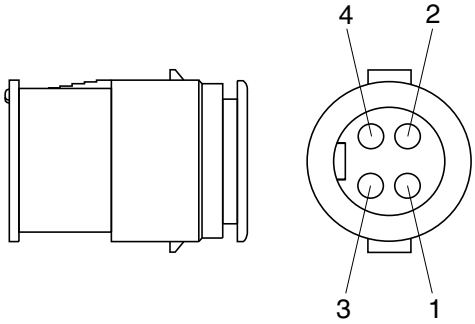
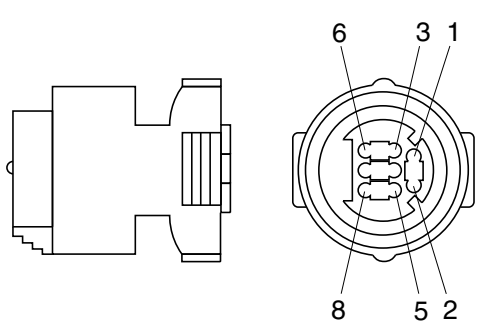
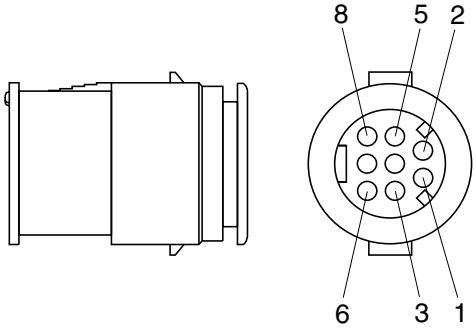
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

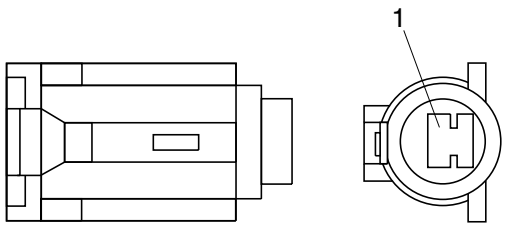
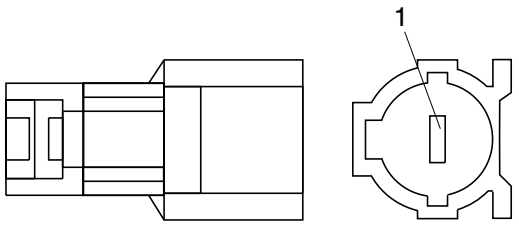
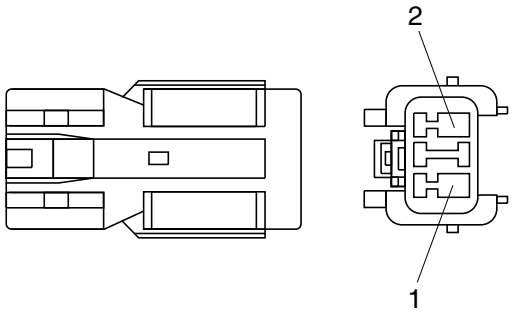
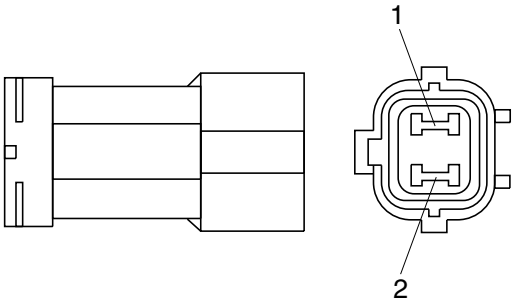
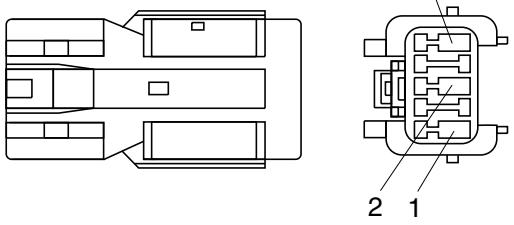
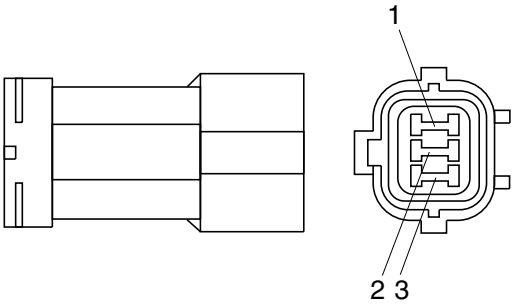
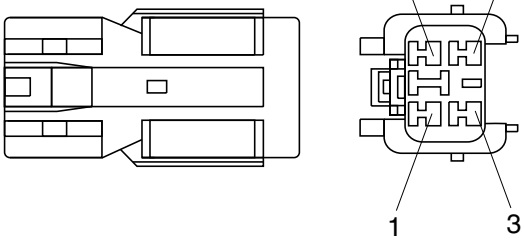
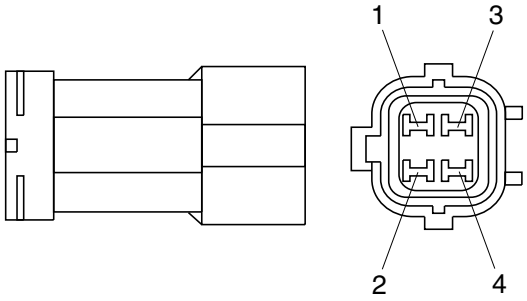
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 S811-109002
11	 S811-011002	 S811-111002

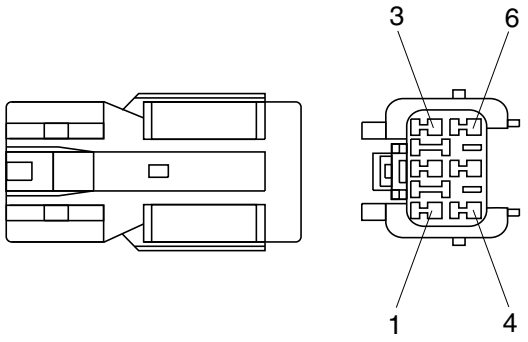
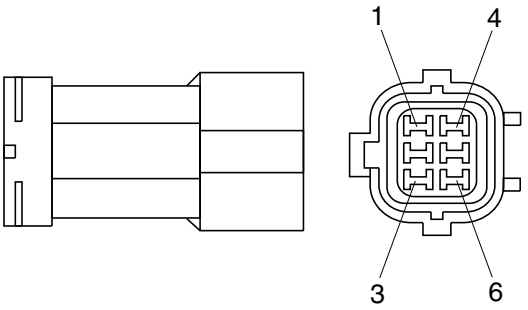
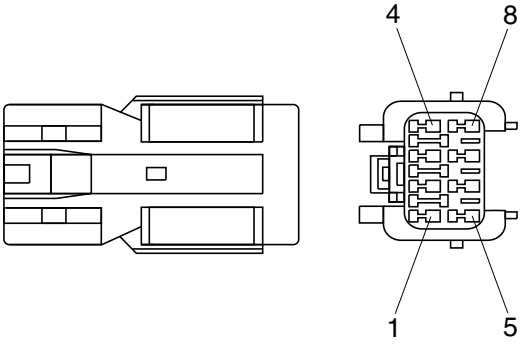
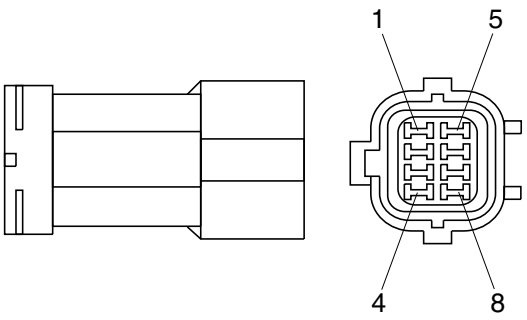
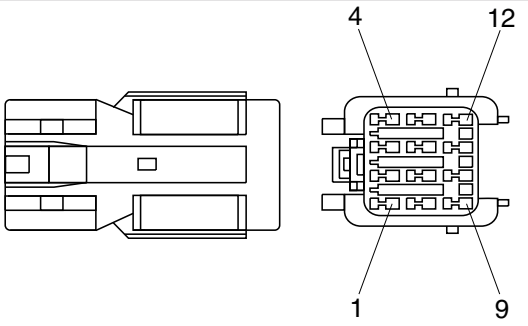
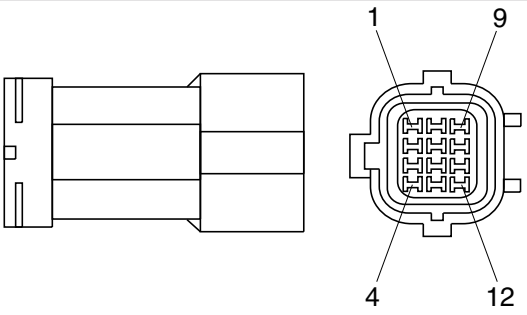
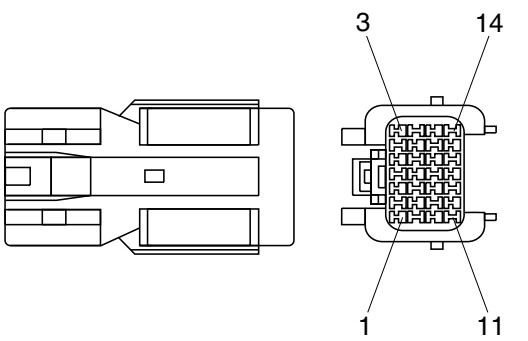
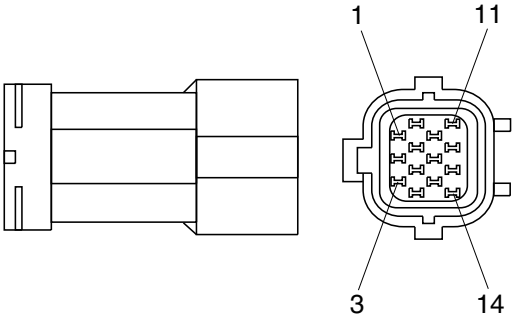
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

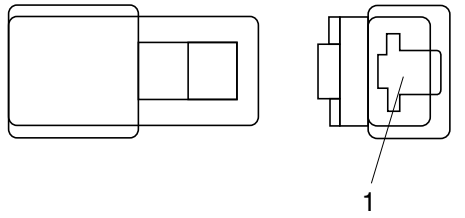
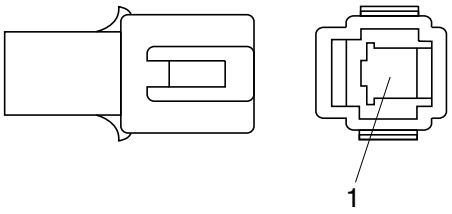
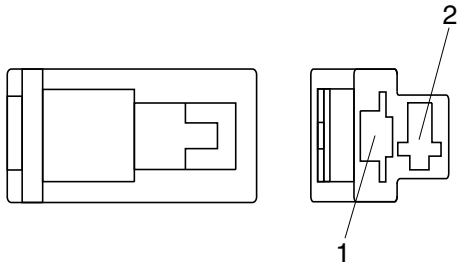
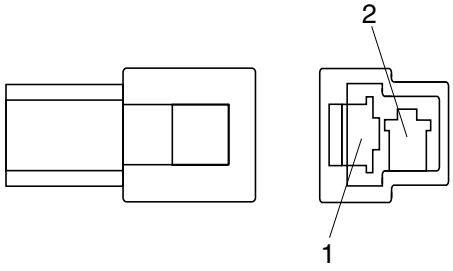
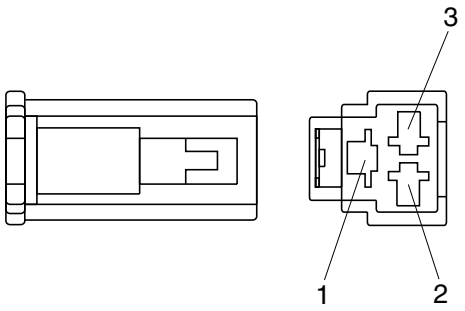
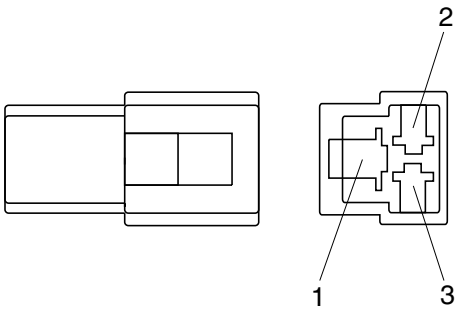
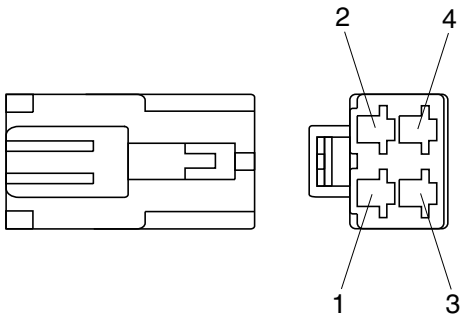
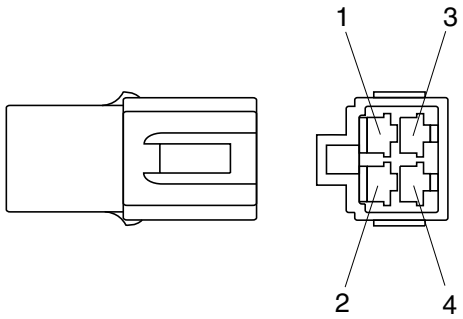
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

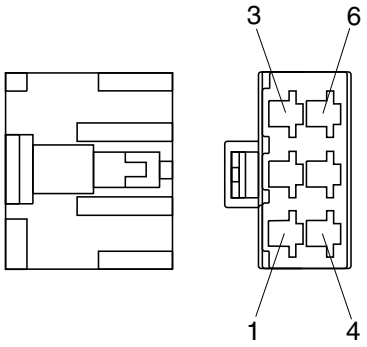
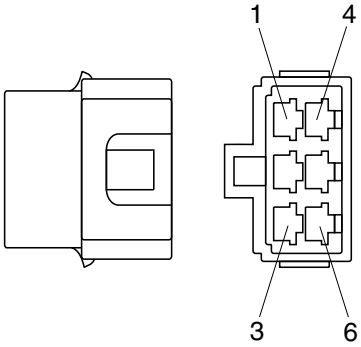
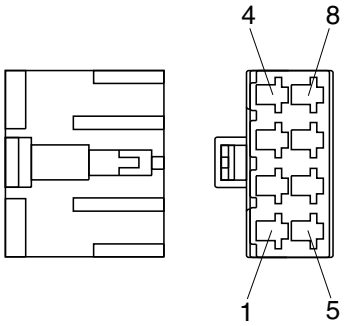
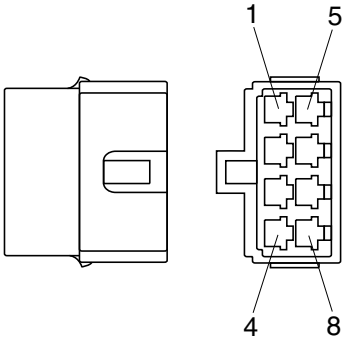
3) SWP TYPE CONNECTOR

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

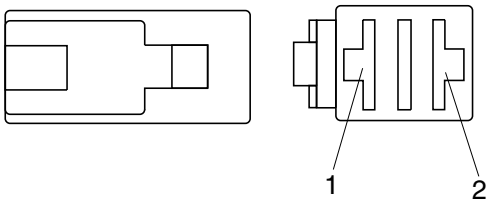
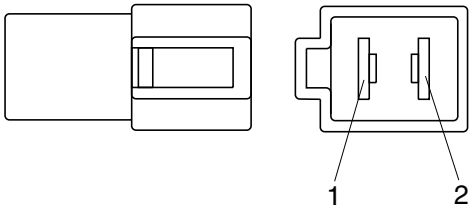
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

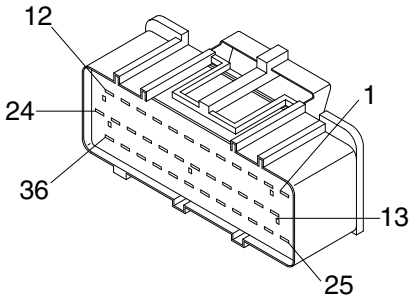
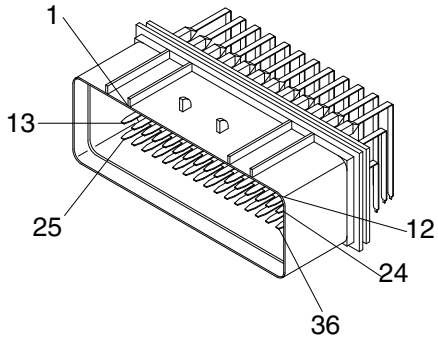
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

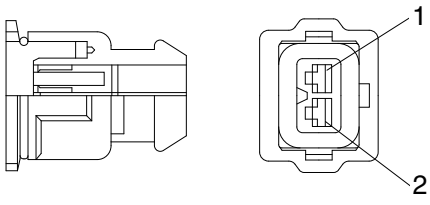
5) 375 FASTEN TYPE CONNECTOR

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

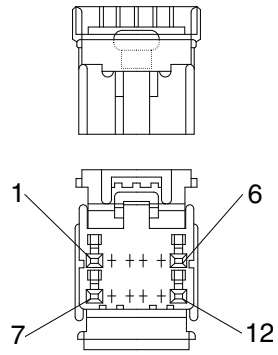
6) AMP ECONOSEAL CONNECTOR

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

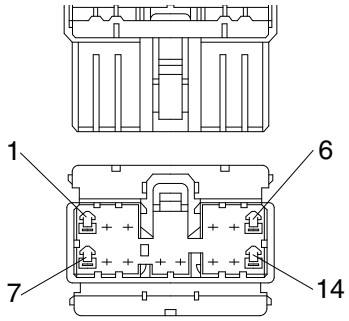
7) AMP TIMER CONNECTOR

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

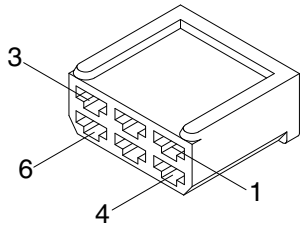
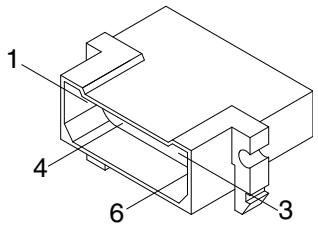
8) AMP 040 MULTILOCK CONNECTOR

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

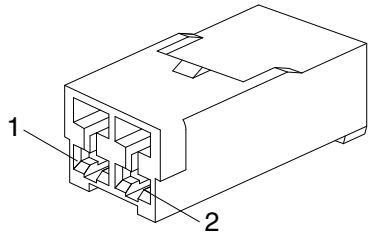
9) AMP 070 MULTILOCK CONNECTOR

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

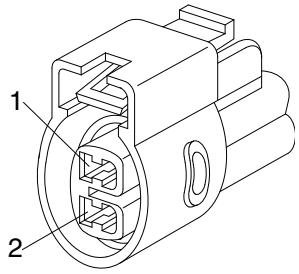
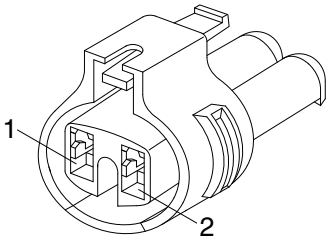
10) AMP FASTIN - FASTON CONNECTOR

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

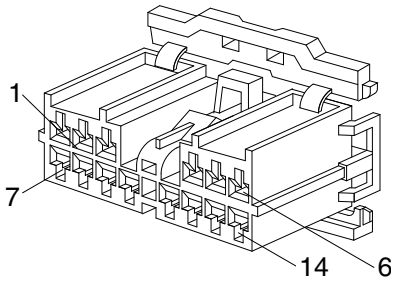
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

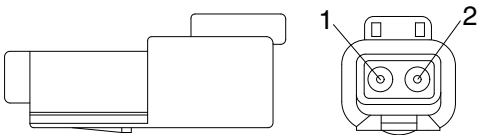
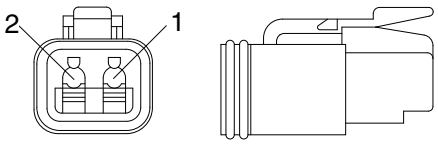
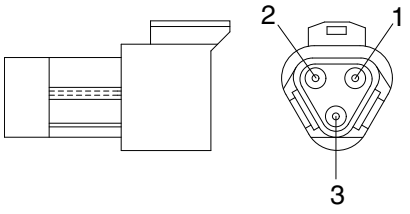
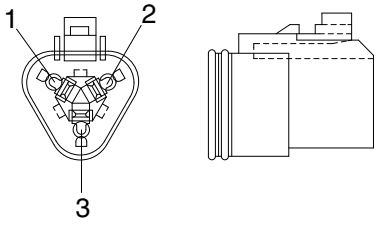
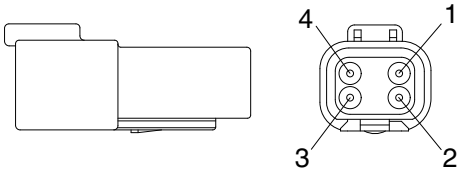
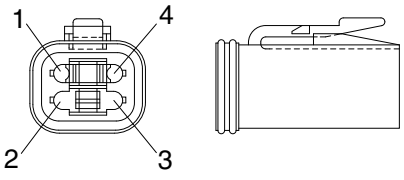
14) DEUTSCH DT CONNECTORS

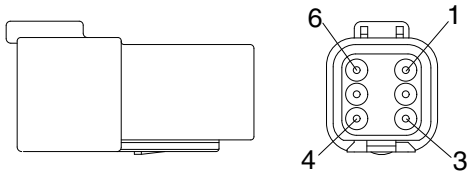
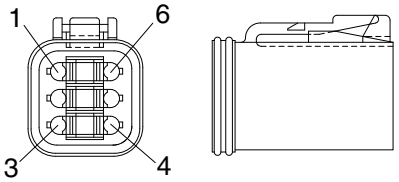
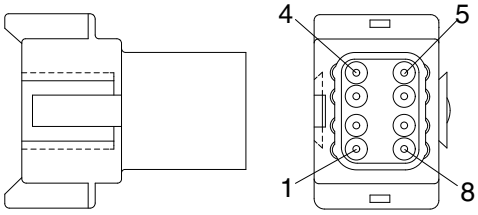
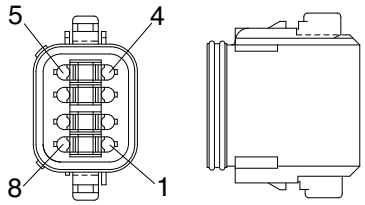
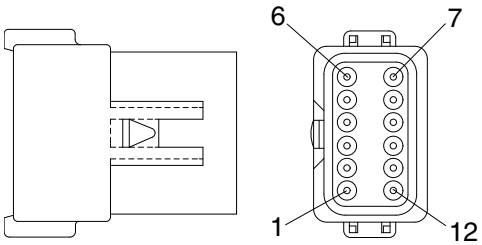
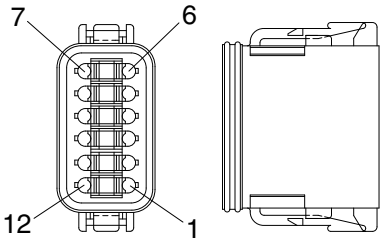
DT 06 - 3S - ★★★★

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

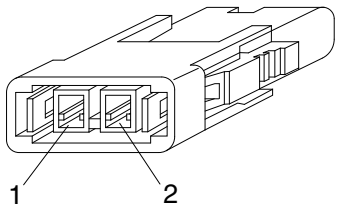
※ Modification

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

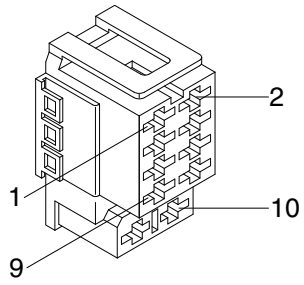
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT06-2P
3	 DT06-3S	 DT06-3P
4	 DT06-4S	 DT06-4P

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

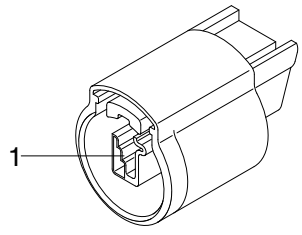
15) MOLEX 2CKTS CONNECTOR

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

16) ITT SWF CONNECTOR

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

17) MWP NMWP CONNECTOR

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

GROUP 6 FAULT CODES

1. MACHINE FAULT CODE

Fault code		Description
HCESPN	FMI	
101	3	Hydraulic oil temperature sensor circuit - voltage above normal or shorted to high source (or open circuit)
	4	Hydraulic oil temperature sensor circuit - voltage below normal or shorted to low source
105	0	Working pressure sensor data above normal range (or open circuit)
	1	Working pressure sensor data below normal range
	2	Working pressure sensor data error
	3	Engine intake maniford #1 temperature - voltage above normel
	4	Working pressure sensor circuit - voltage below normal, or shorted to low source
108	0	Travel oil pressure sensor data above normal range (or open circuit)
	1	Travel oil pressure sensor data below normal range
	2	Travel oil pressure sensor data error
	4	Travel oil pressure sensor circuit - voltage below normal or shorted to low source
122	0	Overload pressure sensor data above normal range (or open circuit)
	1	Overload pressure sensor data below normal range
	2	Overload pressure sensor data error
	3	Overload pressure sensor circuit - voltage below normal or shorted to low source
301	3	Fuel level sensor circuit - voltage above normal or shorted to high source (or open circuit)
	4	Fuel level sensor circuit - voltage below normal or shorted to low source
503	0	Brake pressure sensor data above normal range (or open circuit)
	1	Brake pressure sensor data below normal range
	2	Brake pressure sensor data error
	4	Brake pressure sensor data - voltage below normal or shorted to low source
505	0	Working brake pressure sensor data above normal range (or open circuit)
	1	Working brake pressure sensor data below normal range
	2	Working brake pressure sensor data error
	4	Working brake pressure sensor circuit - voltage below normal, or shorted to low source
530	0	Travel fwd pilot pressure sensor data above normal range (or open circuit)
	1	Travel fwd pilot pressure sensor data below normal range
	2	Travel fwd pilot pressure sensor data error
	4	Travel fwd pilot pressure sensor circuit - voltage below normal, or shorted to low source
	14	Travel fwd pilot pressure sensor circuit - special instructions
	16	Travel fwd pilot pressure sensor circuit - voltage valid but above normal operational range
701	4	Hour meter circuit - voltage below normal, or shorted to low source
705	0	MCU input voltage high
	1	MCU input voltage low
707	1	Alternator node I voltage low (or open circuit)
714	3	Acc. dial circuit - voltage above normal, or shorted to high source (or open circuit)
	4	Acc. dial circuit - voltage below normal, or shorted to low source
840	2	Cluster communication data error
841	2	ECM communication data error
IDSP		Water in fuel warning
Lo bat		Low battery warning

2. ENGINE FAULT CODE

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522400	2	Crankshaft speed sensor	Crankshaft signal error
	5		No signal from crankshaft
522401	2	Camshaft speed sensor	Camshaft signal error
	5		No signal from camshaft
	7		Angle offset error
523249	5	Crankshaft speed sensor, Camshaft speed sensor	Crankshaft/camshaft, speed sensor non-input (simultaneous)
91	3	Accelerator sensor 1	Accelerator sensor 1 error (voltage high)
	4		Accelerator sensor 1 error (voltage low)
28	3	Accelerator sensor 2	Accelerator sensor 2 error (voltage high)
	4		Accelerator sensor 2 error (voltage low)
522624	7	Accelerator sensor 1 + 2	Dual accelerator sensor error (closed position)
522623	7		Dual accelerator sensor error (open position)
29	3	Accelerator sensor 3	Accelerator sensor 3 error (voltage high)
	4		Accelerator sensor 3 error (voltage low)
	8	Pulse sensor	Pulse accelerator sensor error (pulse communication)
28	0	Accelerator sensor 3	Accelerator sensor 3 error (foot pedal in open position)
	1		Accelerator sensor 3 error (foot pedal in closed position)
51	3	Intake throttle position sensor	Intake throttle position sensor error (voltage high)
	4		Intake throttle position sensor error (voltage low)
102	3	EGR low pressure side pressure sensor	ERG low pressure side pressure sensor error (excessive sensor output)
	4		ERG low pressure side pressure sensor error (insufficient sensor output)
	13		ERG low pressure side pressure sensor error (abnormal learning value)
	10		ERG low pressure side pressure sensor error (detected value error)
1209	3	EGR pressure sensor (high-pressure side)	ERG high pressure side pressure sensor error (excessive sensor output)
	4		ERG high pressure side pressure sensor error (insufficient sensor output)
	13		ERG high pressure side pressure sensor error (abnormal learning value)
	10		ERG high pressure side pressure sensor error (detected value error)
110	3	Engine coolant temperature sensor	Engine coolant temperature sensor error (excessive sensor output)
	4		Engine coolant temperature sensor error (insufficient sensor output)
	10		Engine coolant temperature sensor error (detected value error)
	0		Engine coolant temperature high (overheat)
172	3	Ambient air temperature sensor	Ambient air temperature sensor error (voltage high)
	4		Ambient air temperature sensor error (voltage low)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
174	3	Fuel temperature sensor	Fuel temperature sensor error (voltage high)
	4		Fuel temperature sensor error (voltage low)
	0		Fuel temperature high
157	3	Rail pressure sensor	Rail pressure sensor error (voltage high)
	4		Rail pressure sensor error (voltage low)
3251	3	DPF differential pressure sensor	DPF differential pressure sensor error (excessive sensor output)
	4		DPF differential pressure sensor abnormal rise in differential pressure
	0		DPF differential pressure sensor error abnormal rise in differential pressure
	13		DPF differential pressure sensor error (abnormal learning value)
4795	31	DPF substrate/DPF differential pressure sensor	DPF substrate/DPF differential pressure sensor error (DPF substrate removal/DPF differential pressure sensor detected value error)
3609	3	DPF high pressure side pressure sensor	DPF high pressure side pressure sensor error (excessive sensor output)
	4		DPF high pressure side pressure sensor error (insufficient sensor output)
	10		DPF high pressure side pressure sensor error (detected value error)
3242	3	DPF intermediated temperature sensor	DPF inlet temperature sensor error (excessive sensor output)
	4		DPF inlet temperature sensor error (insufficient sensor output)
	10		DPF inlet temperature sensor error (detected value error)
	0		DPF inlet temperature sensor abnormal temperature (abnormally high)
3250	3	DPF intermediate temperature sensor	DPF intermediate temperature sensor error (excessive
	4		DPF intermediate temperature sensor error (insufficient sensor output)
	10		DPF intermediate temperature sensor error (detected value error)
	1		DPF intermediate temperature sensor abnormal temperature (abnormally low)
108	3	Atmospheric pressure sensor	Atmospheric pressure sensor error (excessive sensor output)
	4		Atmospheric pressure sensor error (insufficient sensor output)
	10		Atmospheric pressure sensor error (characteristic error)
173	3	Exhaust manifold temperature sensor	Exhaust manifold temperature sensor error (excessive sensor output)
	4		Exhaust manifold temperature sensor error (insufficient sensor output)
	10		Exhaust manifold temperature sensor error (detected value error)
1485	7	Main relay	Main relay contact sticking
	2		Main relay early opening

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522243	5	Starting aid relay	Starting aid relay disconnection
	6		Starting aid relay relay GND short circuit
654	5	Injector (No.1 cylinder)	Disconnection (injector-specific)
	6		Coil short circuit
	3		Short circuit
653	5	Injector (No.2 cylinder)	Disconnection (injector-specific)
	6		Coil short circuit
	3		Short circuit
652	5	Injector (No.3 cylinder)	Disconnection (injector-specific)
	11		Coil short circuit
	3		Short circuit
651	5	Injector (No.4 cylinder)	Disconnection (injector-specific)
	6		Coil short circuit
	3		Short circuit
4257	12	All injectors	Injector drive IC error
2797	6		Injector drive circuit (Bank1) shotrt circuit (4TN: common circuit for No.1, No4 and all 3TN cylinders)
2798	6		Injector drive circuit (Bank2) short circuit (4TN: circuit for No.2 and 3 cylinders)
523462	13	Injector (correction value)	Inujector (No.1 cylinder) correction value error
523463	13		Inujector (No.2 cylinder) correction value error
523464	13		Inujector (No.3 cylinder) correction value error
522465	13		Inujector (No.4 cylinder) correction value error
522571	3	SCV (MPROP)	SCV (MPROP) L side VB short circuit
	6		SCV (MPROP) L side GND short circuit
633	3		SCV (MPROP) H side VB short circuit
	6		SCV (MPROP) H side GND short circuit
	5		SCV (MPROP) disconnection
522572	6		SCV (MPROP) drive current (high level)
	11		SCV (MPROP) pump overload error
157	0	Rail pressure error	Rail pressure too high
	18		Rail pressure deviation error (low rail pressure)
	15		Rail pressure deviation errer (high rail pressure)
	16	PLV (common rail pressure limit valve)	PLV open valve
523469	0		Rail pressure fault (The times of PLV valve opening error)
523470	0		Rail pressure fault (The time of PLV valve opening error)
523489	0		Rail pressure fault (The actual rail pressure is too high during PRV limp home)
523498	9		Rail pressure fault (contrilled rail pressure error after PLV valve opening)
523491	0	Rail pressure control	Rail pressure fault (injector B/F temperature error during PLV4 limp home)
523460	7		Rail pressure fault (operation time error during RPS limp home)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
190	16	Overspeed	Overspeed
2950	5	Intake throttle drive circuit	No-load of throttle valve drive H bridge circuit
	3		Power short circuit of throttle valve drive H bridge output 1
	4		GND short circuit of throttle valve drive H bridge output 1
	6		Overload on the drive H bridge circuit of throttle valve
2951	3		VB power short circuit of throttle valve drive H bridge output 2
	4		GND short circuit of throttle valve drive H bridge output 1
2950	7		Throttle valve sticking (sticking open)
2951	7		Throttle valves sticking (sticking closed)
522596	9	CAN 2	TSC1 (SA1) reception timeout
522597	9		TSC1 (SA2) reception timeout
522599	9		Y_ECR1 reception timeout
522600	9		Y_EC reception timeout
522601	9		Y_RSS reception timeout
237	31		VI_ reception timeout
	13		VI_ reception data error
522609	9		Y_ETCP1 reception timeout
522618	9		EBC1 reception timeout
522619	9		Y_DPFIF reception timeout
522730	12		Immobilzer error (CAN communication)
1202	2		Immobilizer error (system)
522610	9	CAN 1	CAN 1 (for EGR): reception timeout from the EGR valve
522611	9		CAN 1 (for exhaust throttle): receptiom timeout
2791	0	EGR valve	EGR overvoltage error
	1		EGR low voltage error
	7		EGR feedback error
	9		EGR ECM data error
	12		Disconnection in EGR motor coils
522579	12		Short circuit in EGR motor coils
522580	12		EGR position sensor error
522581	7		EGR valve sticking error
522183	7		EGR initialization error
522184	1		EGR high temperature thermistor error
522617	1		EGR low temperature thermistor error
522746	12		EGR target value out of range
522747	12	Exhaust throttle	Exhaust throttle (voltage fault)
522748	12		Exhaust throttle (motor fault)
522749	12		Exhaust throttle (sensor system fault)
	12		Exhaust throttle (MPU fault)
522750	12		Exhaust throttle (PCB fault)
522751	19		Exhaust throttle (CAN fault)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
630	12	EEPROM	EEPROM memory deletion error
522576	12		EEPROM memory reading error
522578	12		EEPROM memory writing error
522585	12	ECU internal fault	CY 146 SPI communication fault
522588	12		Excessive voltage of supply 1
522589	12		Insufficient voltage of supply 1
522590	12		Sensor supply voltage error 1
522591	12		Sensor supply voltage error 2
522592	12		Sensor supply voltage error 3
522744	4		Actuator drive circuit 1 short to ground
522994	4		Actuator drive circuit 2 short to ground
523471	6		Actuator drive circuit 3 chort to ground
523473	12		AD converter fault 1
523474	12		AD converter fault 2
523475	12		External monitoring IC and CPU fault 1
523476	12		External monitoring IC and CPU fault 2
523477	12		ROM fault
523478	12		Shutoff path fault 1
523479	12		Shutoff path fault 2
523480	12		Shutoff path fault 3
523481	12		Shutoff path fault 4
523482	12		Shutoff path fault 5
523483	12		Shutoff path fault 6
523484	12		Shutoff path fault 7
523485	12		Shutoff path fault 8
523486	12		Shutoff path fault 9
523487	12		Shutoff path fault 10
523488	0		Recognition error of engine speed
3059	5	Breather heater (optional parts for 4TNV86CT and 4TNV98CT)	Breather heater disconnection
	4		Breather heater short circuit (GND)
	3		Breather heater short circuit (VB)
522323	0	Air cleaner switch	Air cleaner clogged alarm
522329	0	Water weparator switch	Water separator alarm
167	5	Charge switch	Charge switch disconnection
	1		Charge alarm
100	4	Oil pressure switch	Oil pressure switch disconnection
	1		Low oil pressure alarm
522573	0	DPF	Excessive PM accumulation (method C)
522574	0		Excessive PM accumulation (method P)
522575	7		Regeneration falure (stationary regeneration failure)
522577	11		Regeneration failure (staonary regeneration not performed)
3250	0	DPF intermediate temperature sensor	DPF intermediate temperature sensor abnormal rise in temperature (post-injection malfunction)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
3720	16	DPF OP interface	Ash cleaning request 1
	0		Ash cleaning request 2
3719	16		Stationary regeneration standby
	0		Backup mode
3695	14		Reset regeneration is inhibited
3719	9		Regeneration faulure (recovery regeneration failure)
	7		Recovery regeneration is inhibited

SECTION 5 TROUBLESHOOTING

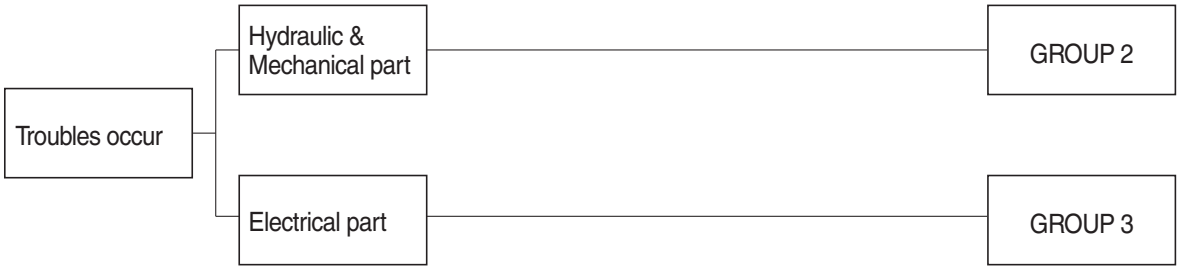
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

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

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

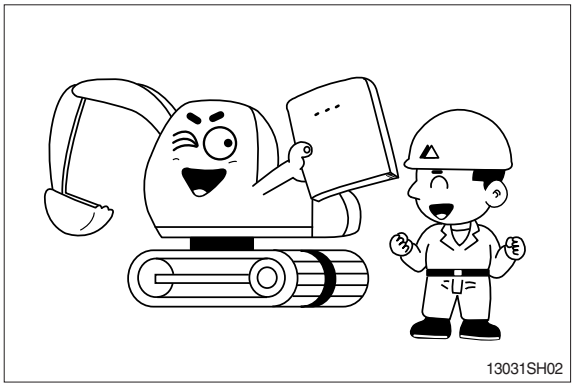


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

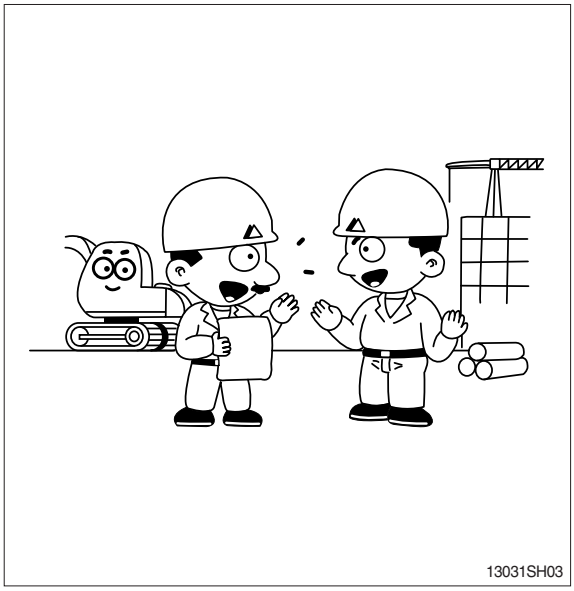
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.


13031SH02

STEP 2. Ask the operator

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

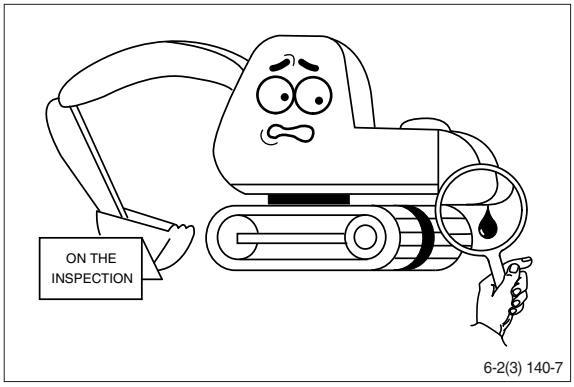
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously?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


13031SH03

STEP 3. Inspect the machine

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

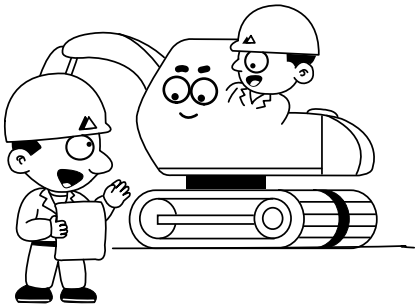
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



6-2(3) 140-7

STEP 4. Inspect the trouble actually on the machine

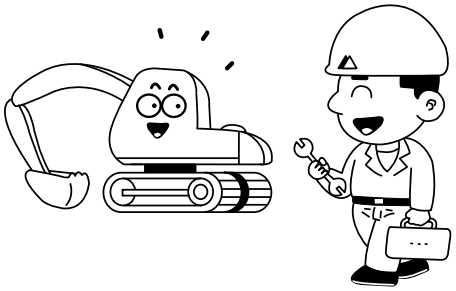
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



6-3(1) 140-7

STEP 5. Perform troubleshooting

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

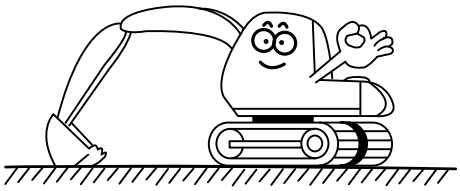


13031SH05

STEP 6. Trace a cause

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

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



6-3(3) 140-7

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

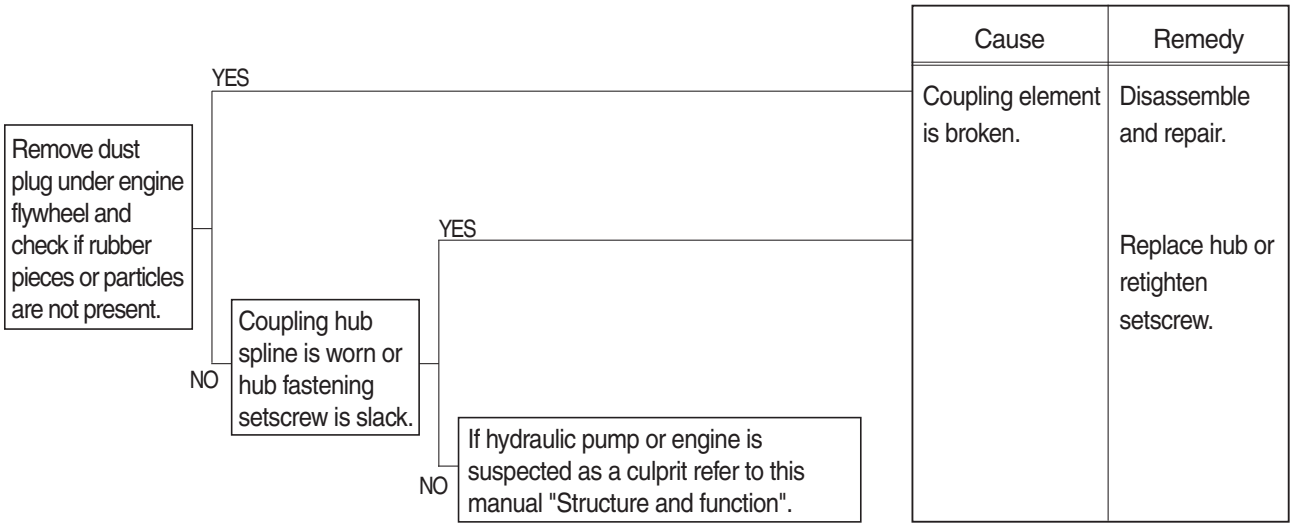
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

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

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

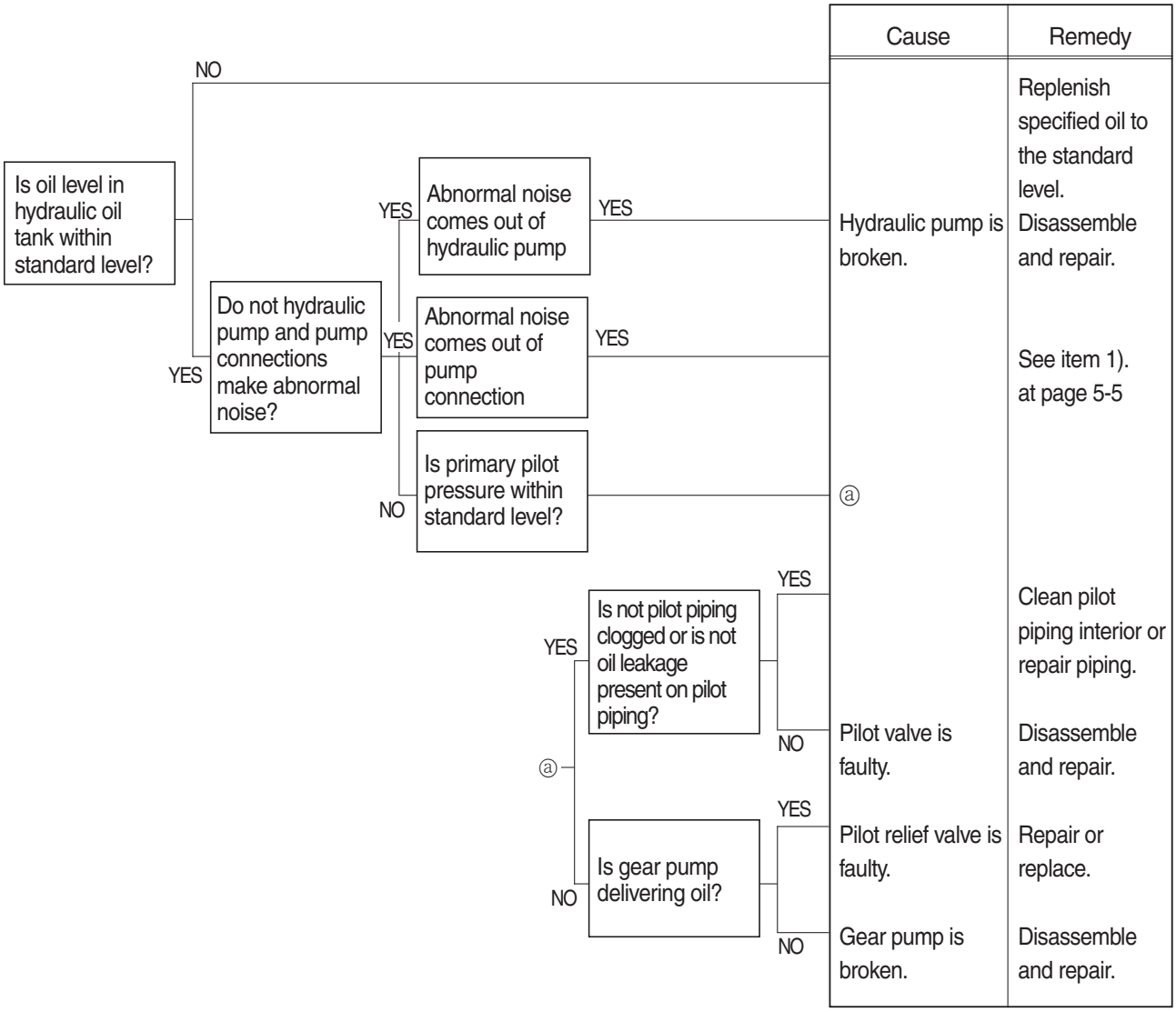
2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



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

2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

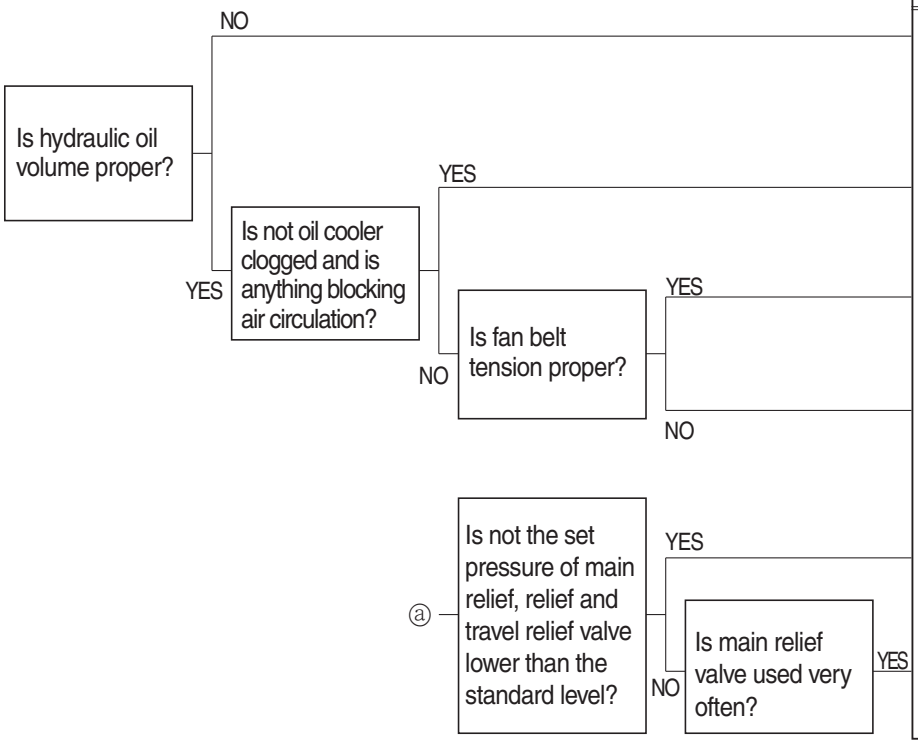


3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

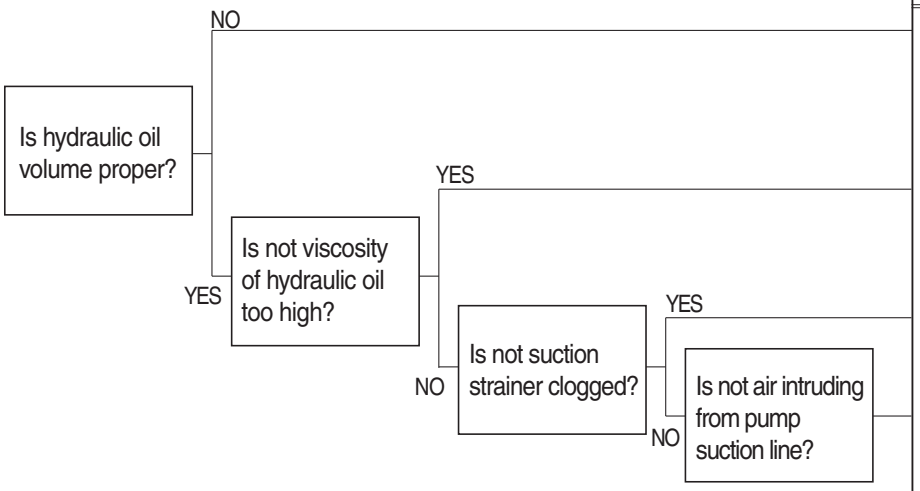
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



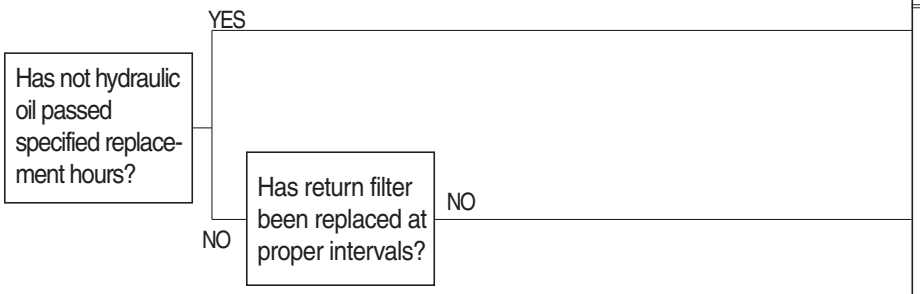
Cause	Remedy
ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Secure air circulation route. Adjust belt tension or replace belt. Readjust set pressure. Reduce load.

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.

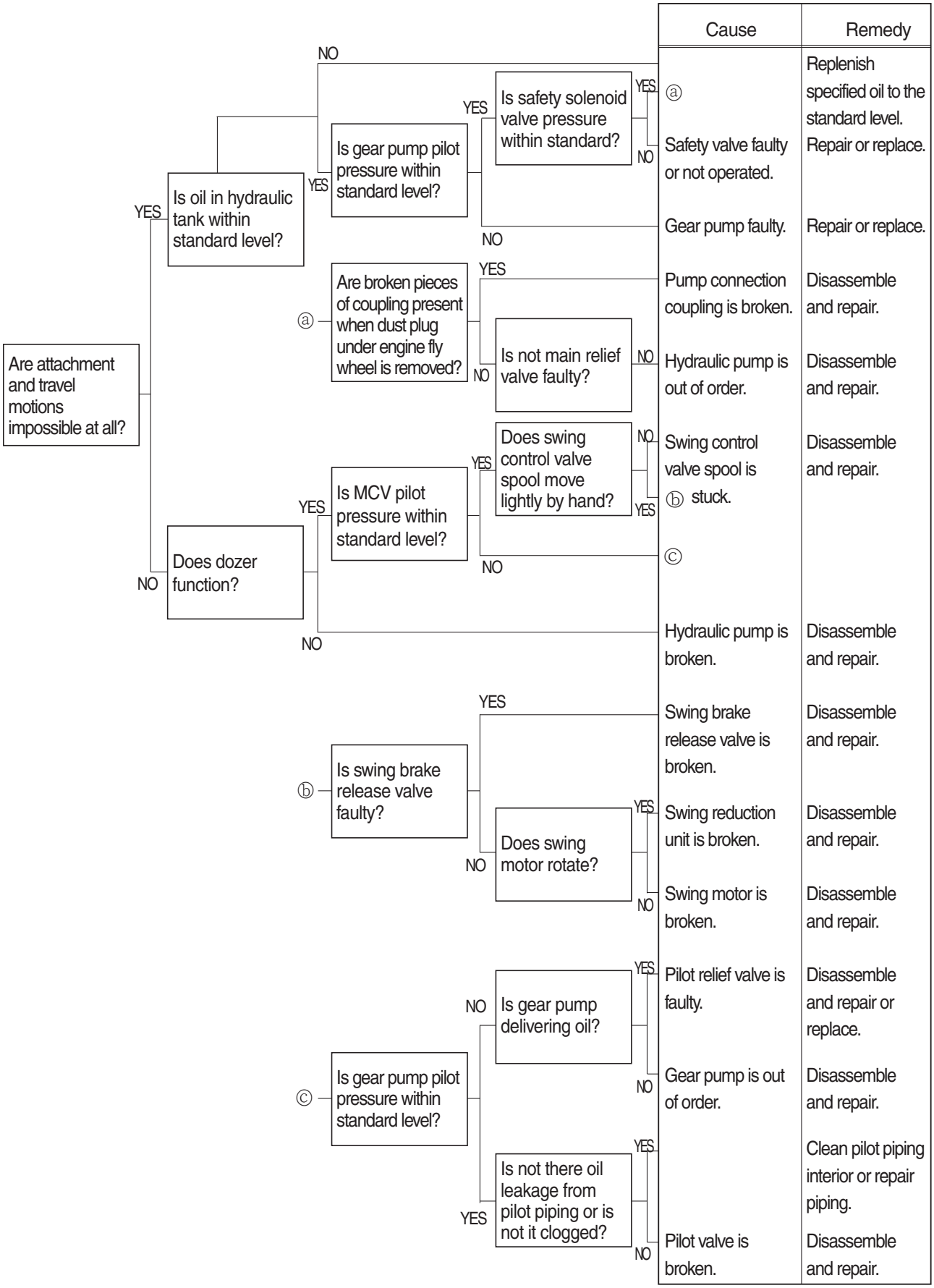
4) HYDRAULIC OIL IS CONTAMINATED



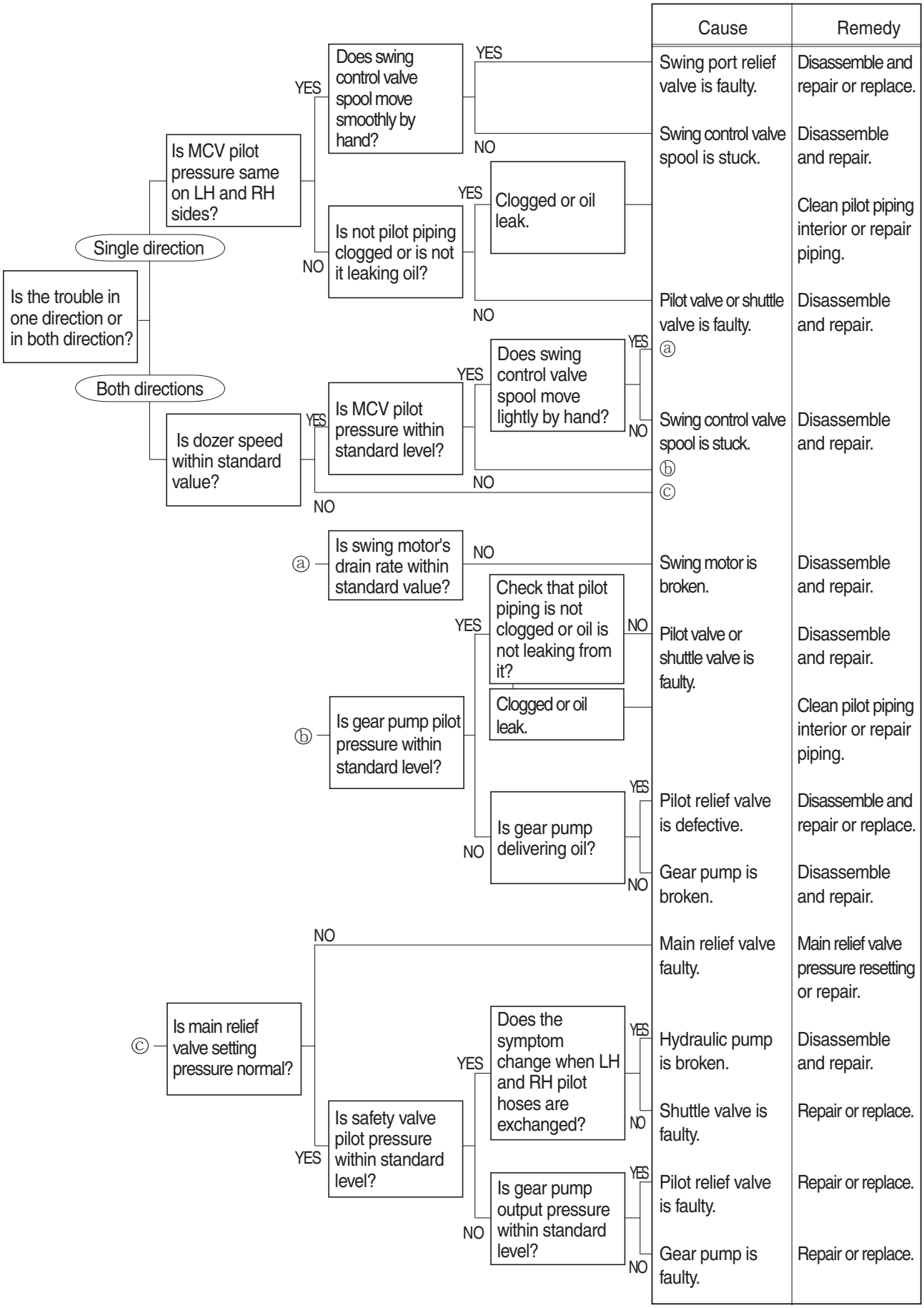
Cause	Remedy
	Replace hydraulic oil to be specified. Flush with hydraulic oil and replace return filter.

4. SWING SYSTEM

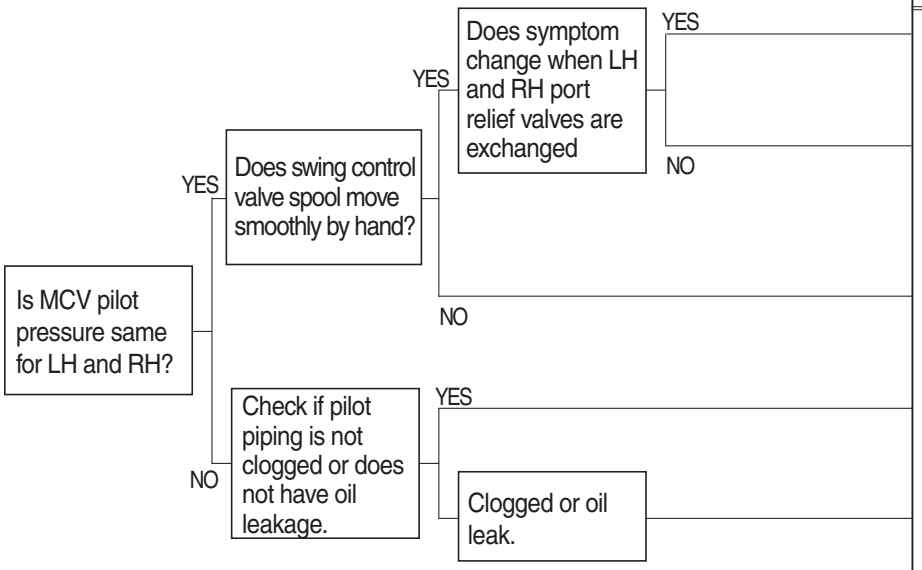
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



2) SWING SPEED IS LOW

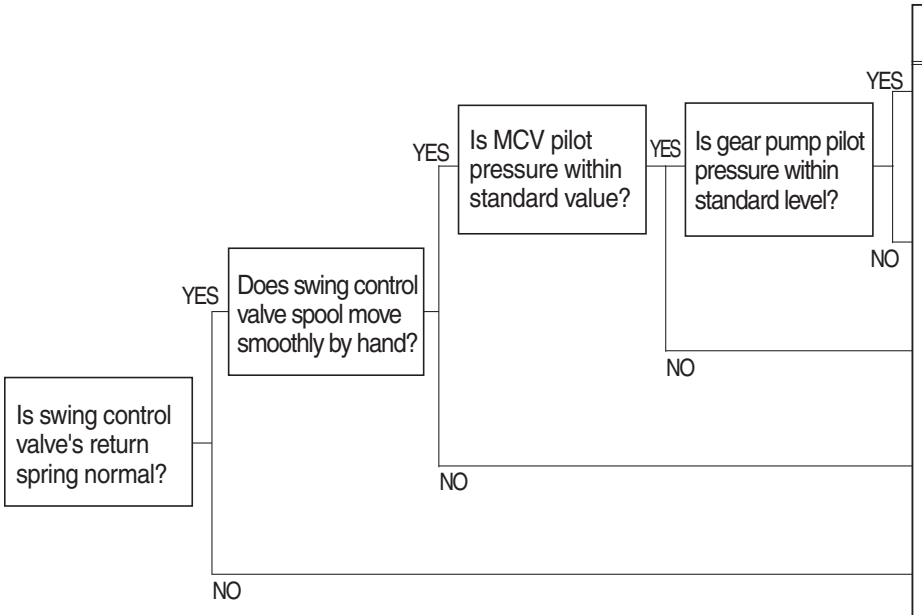


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



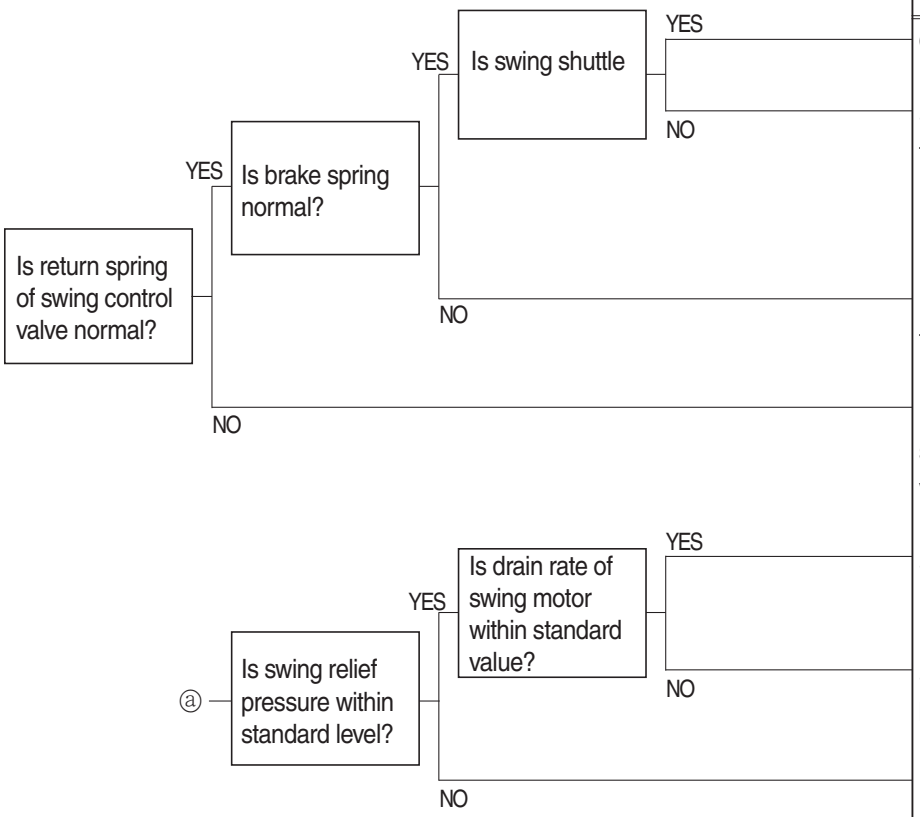
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

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.

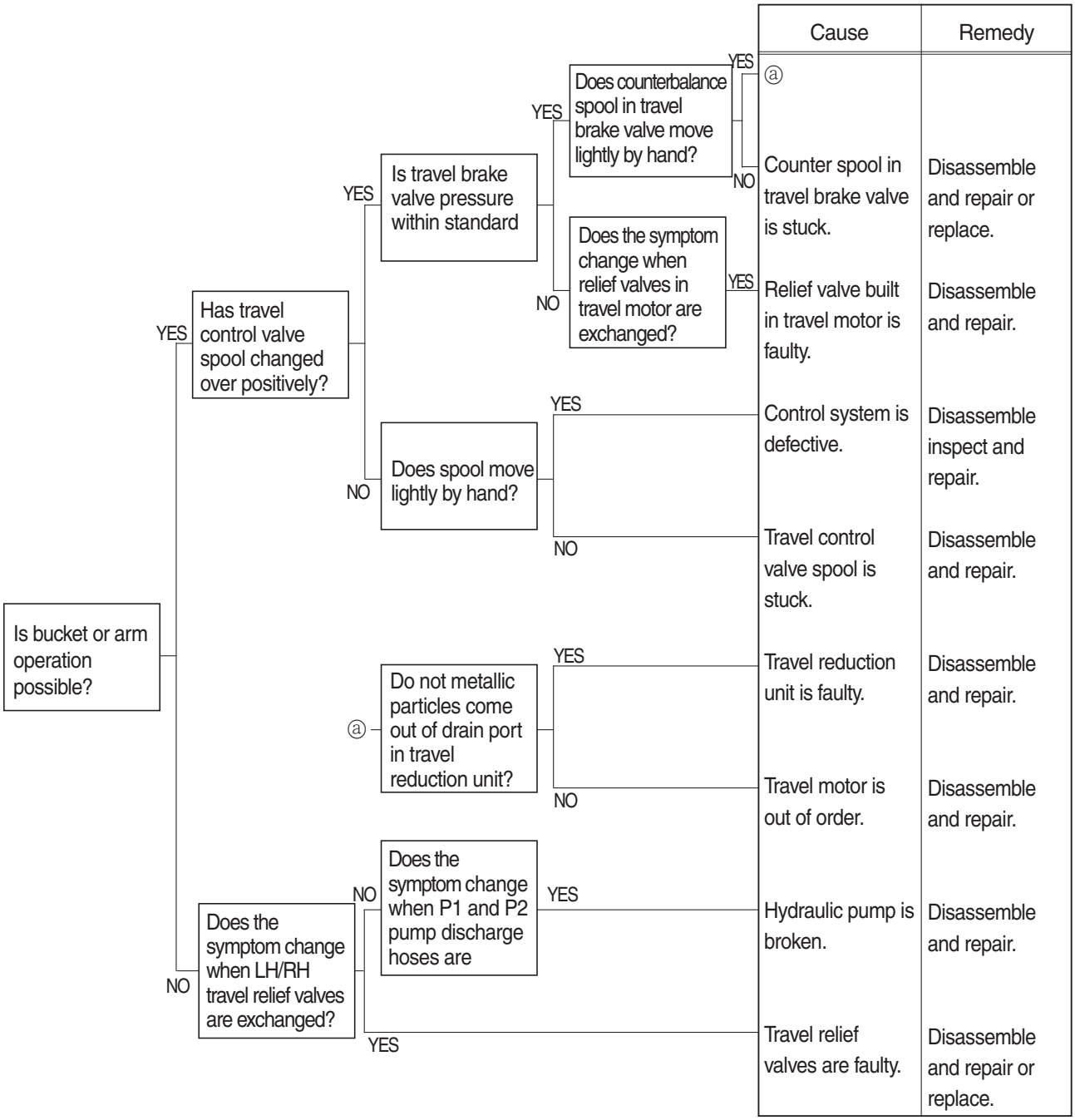
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



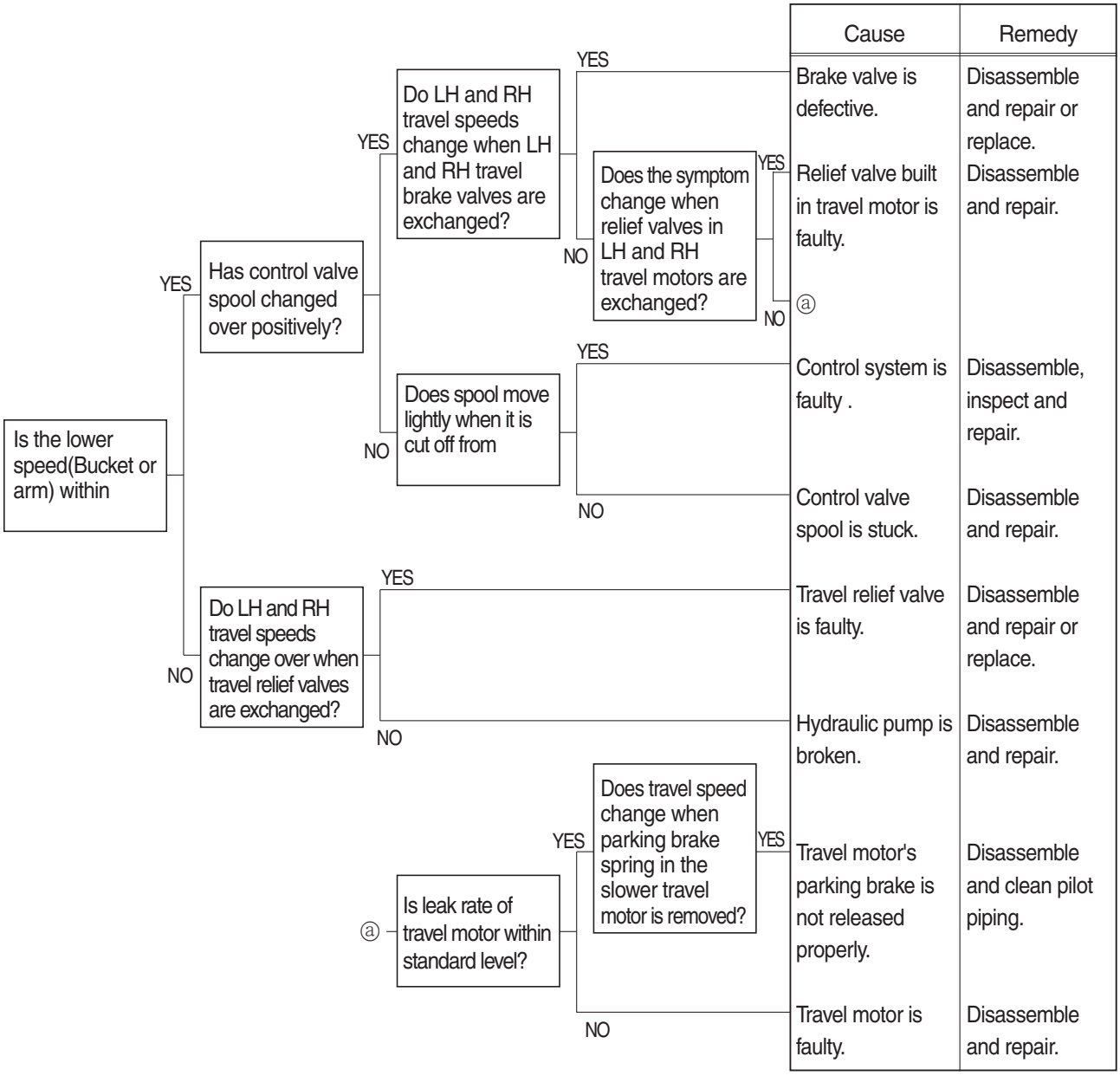
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
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

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

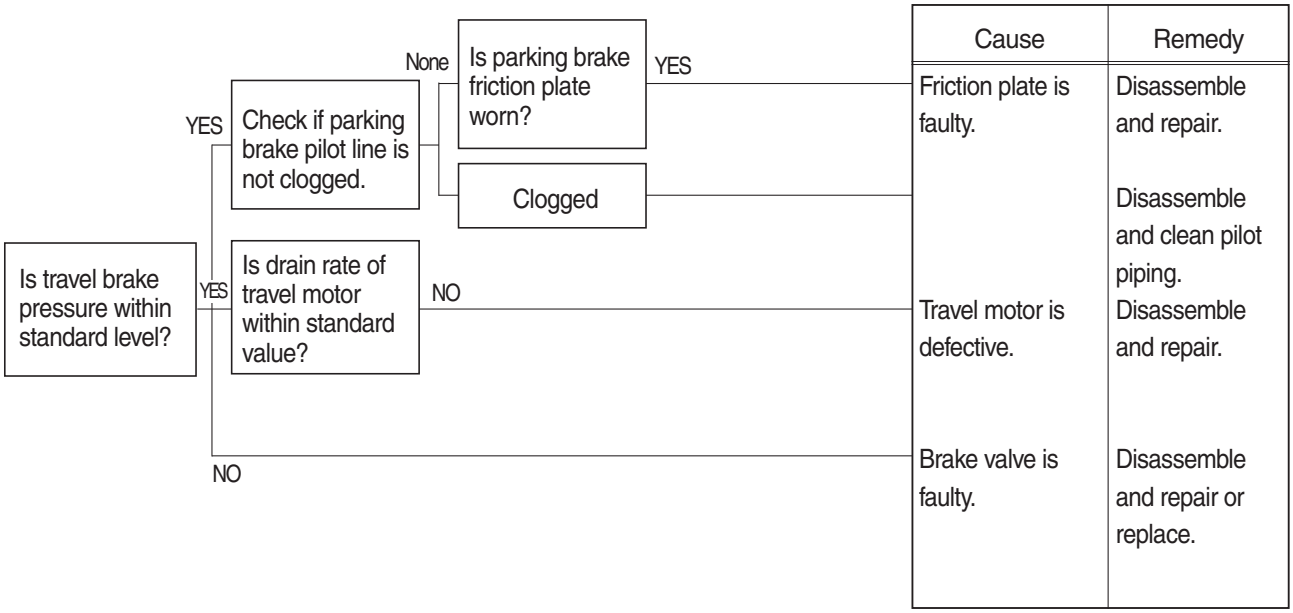


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

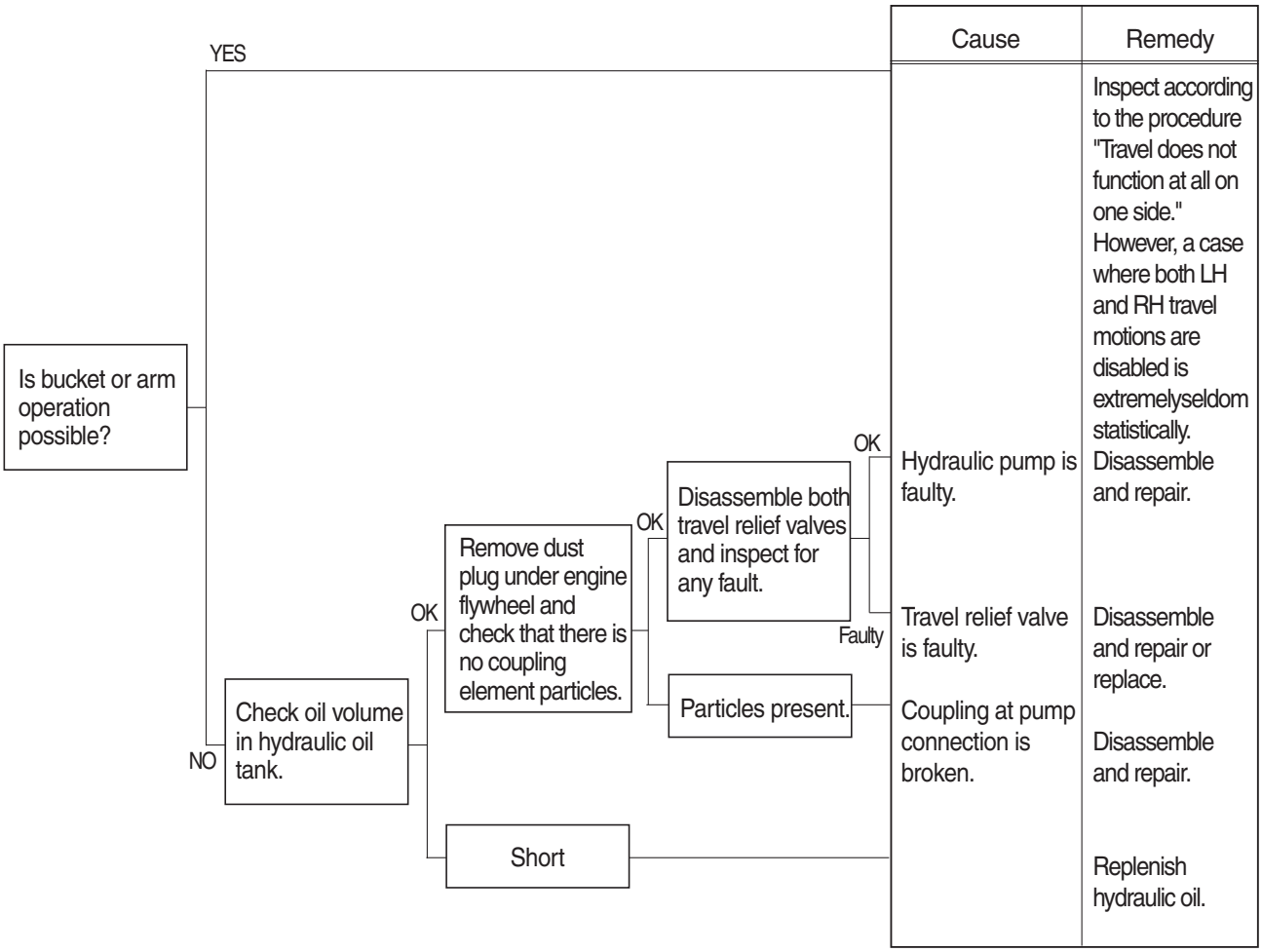


3) MACHINE DOES NOT STOP ON A SLOPE

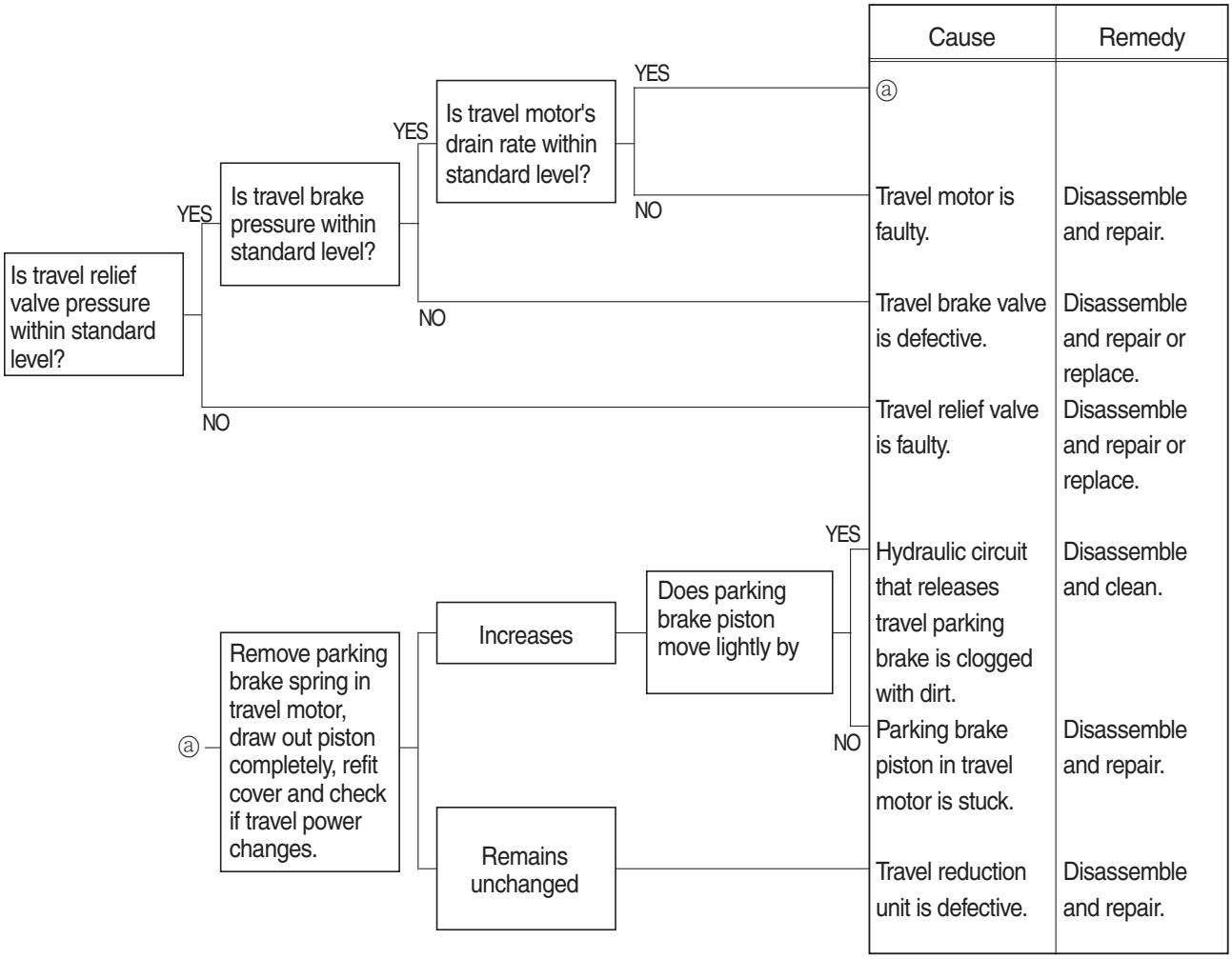
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

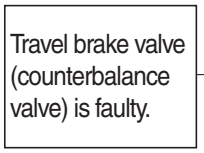


5) TRAVEL ACTION IS POWERLESS (travel only)



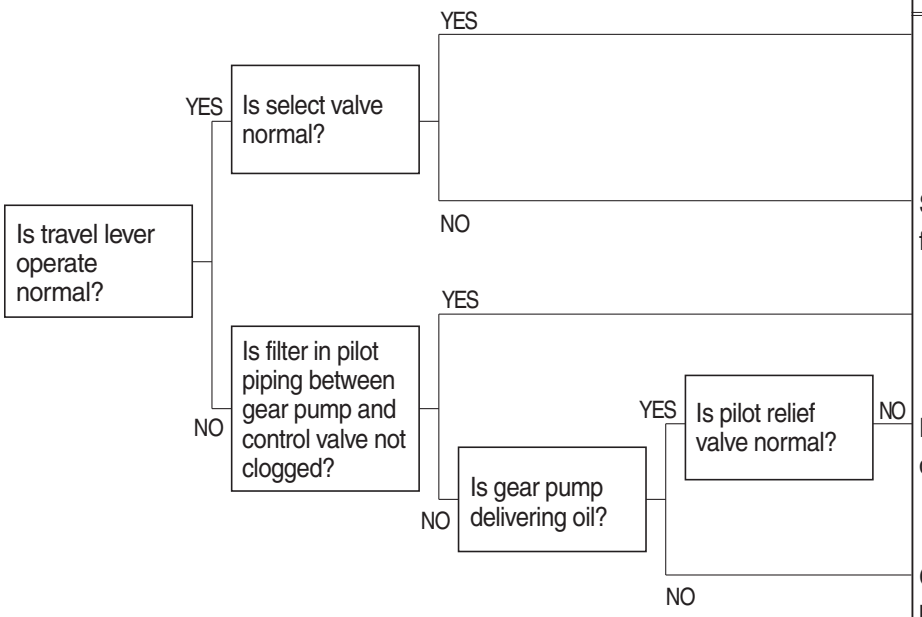
Cause	Remedy
ⓐ	
Travel motor is faulty.	Disassemble and repair.
Travel brake valve is defective.	Disassemble and repair or replace.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic circuit that releases travel parking brake is clogged with dirt.	Disassemble and clean.
Parking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

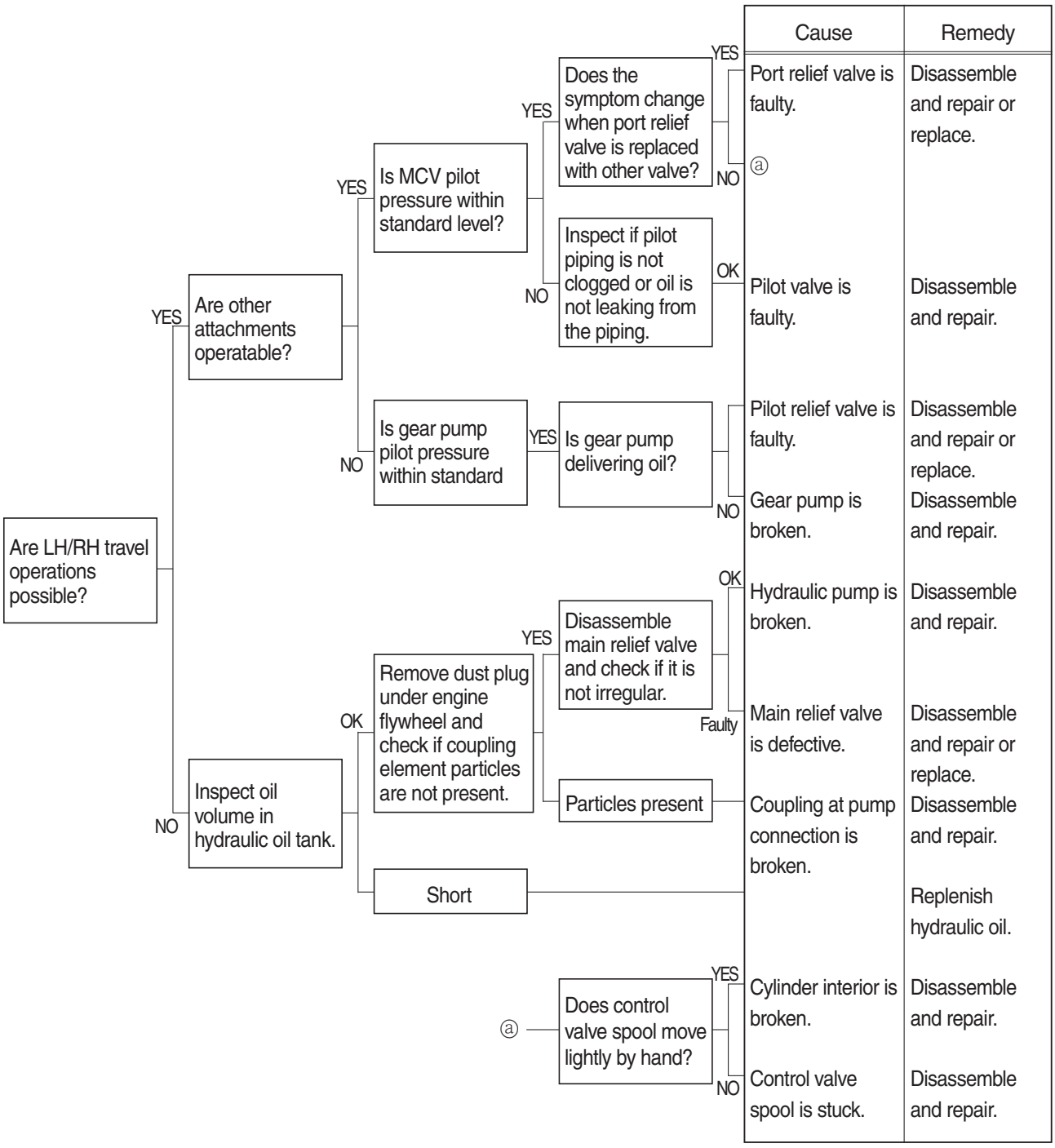
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



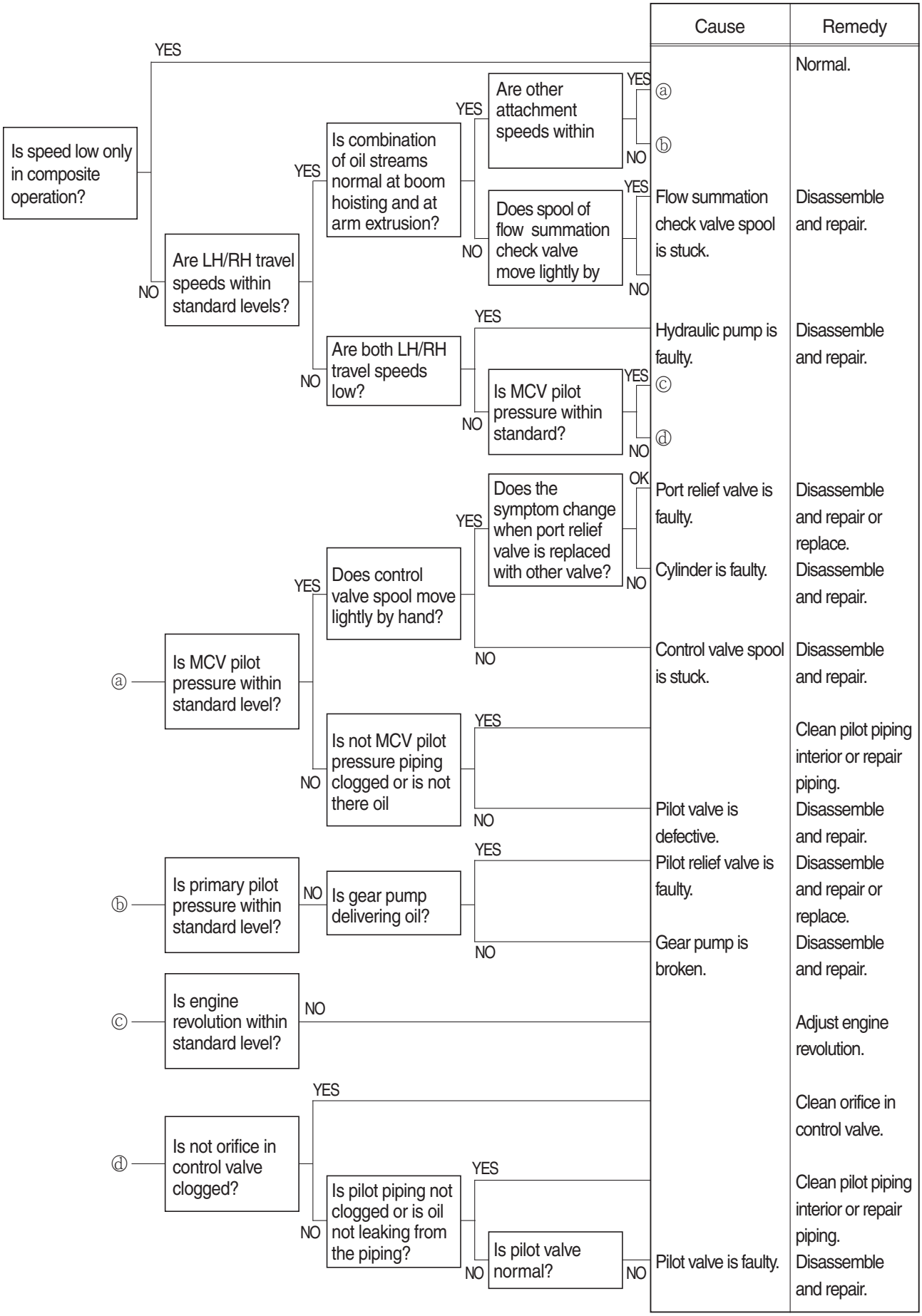
Cause	Remedy
	Normal.
Select valve is faulty.	Repair or replace.
	Remove dirt on pilot line filter.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

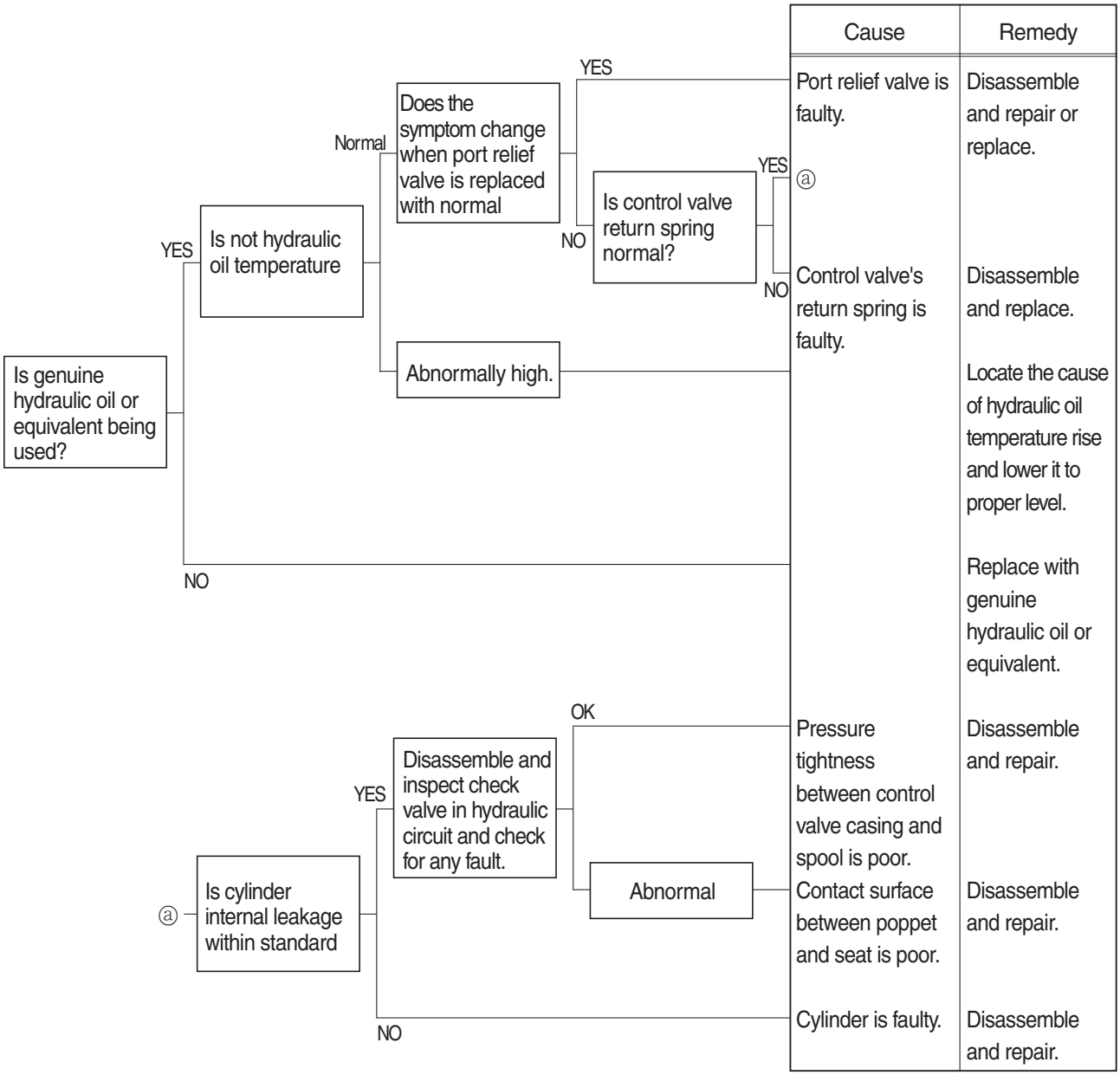
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

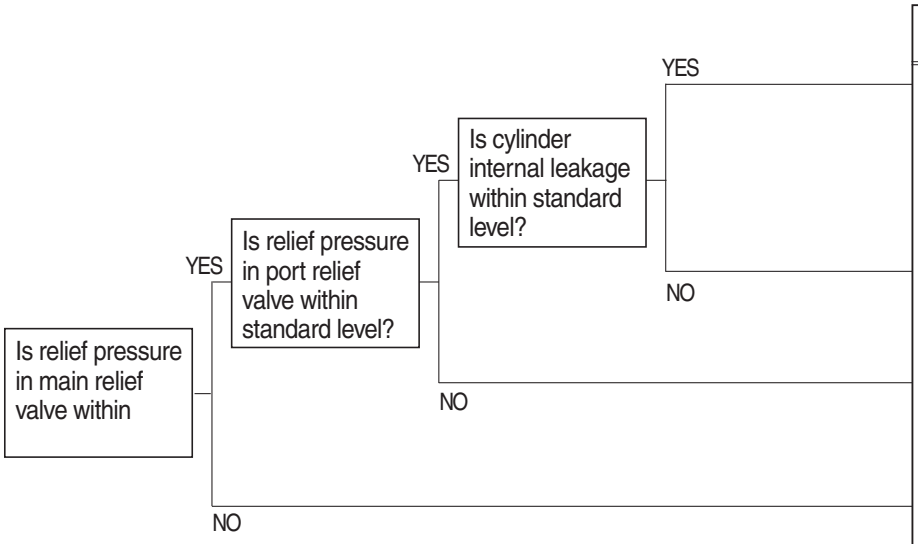


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



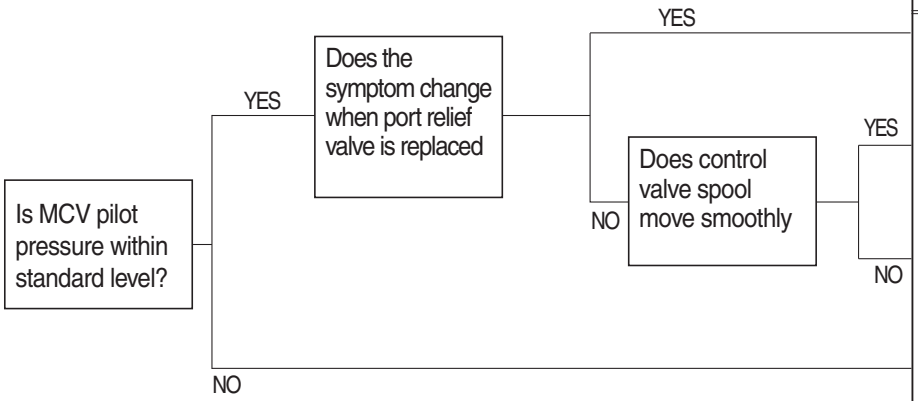
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
ⓐ	
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between 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 and repair.

4) BOOM, ARM OR BUCKET POWER IS WEAK



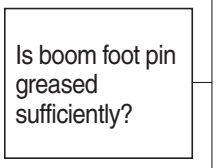
Cause	Remedy
	Check according to the procedure in Item "Speed is low".
Cylinder is faulty.	Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

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



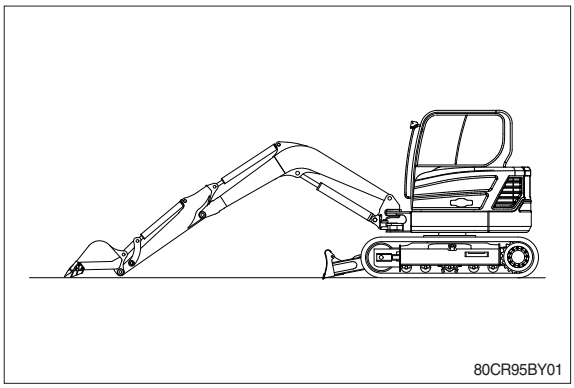
YES

NO

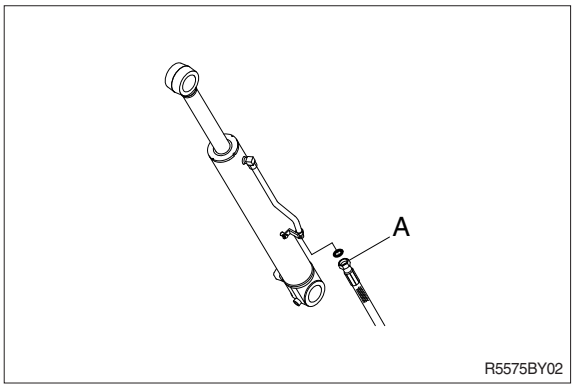
Cause	Remedy
	Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is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

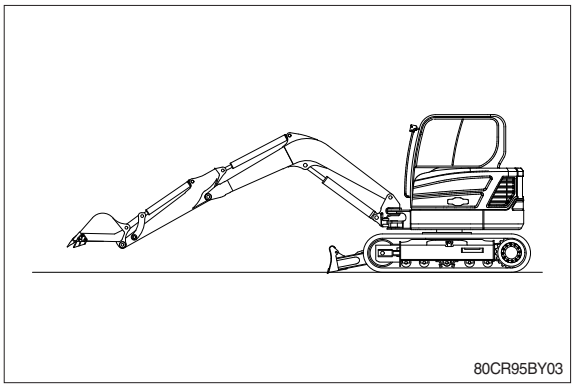


2. Disconnect hose(A) from rod side of boom cylinder and drain oil from cylinders and hose.(Put cups on piping and hose ends)



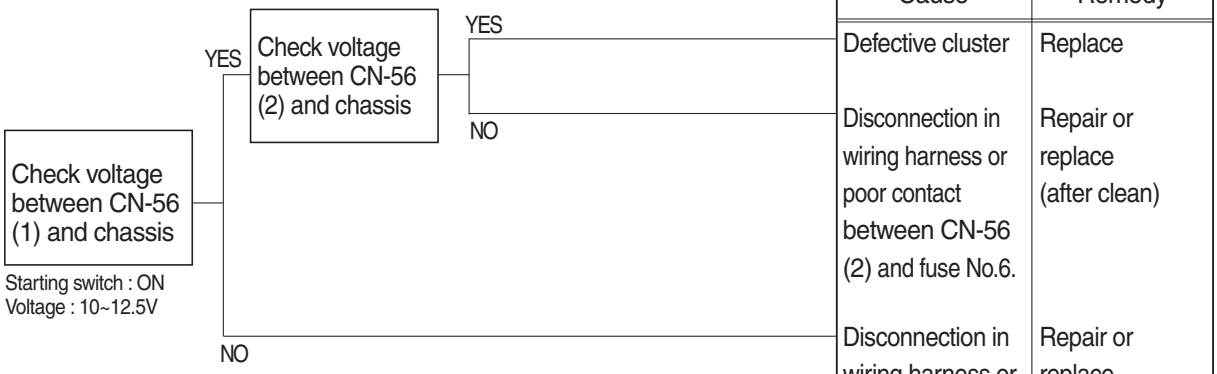
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

   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

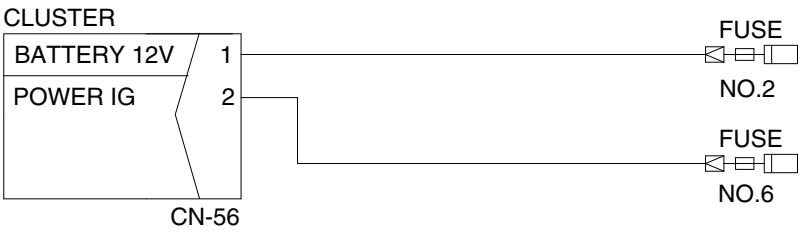
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.2 and No.6.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56 (2) and fuse No.6.	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-56 (1) and fuse No.2	Repair or replace (after clean)

Check voltage

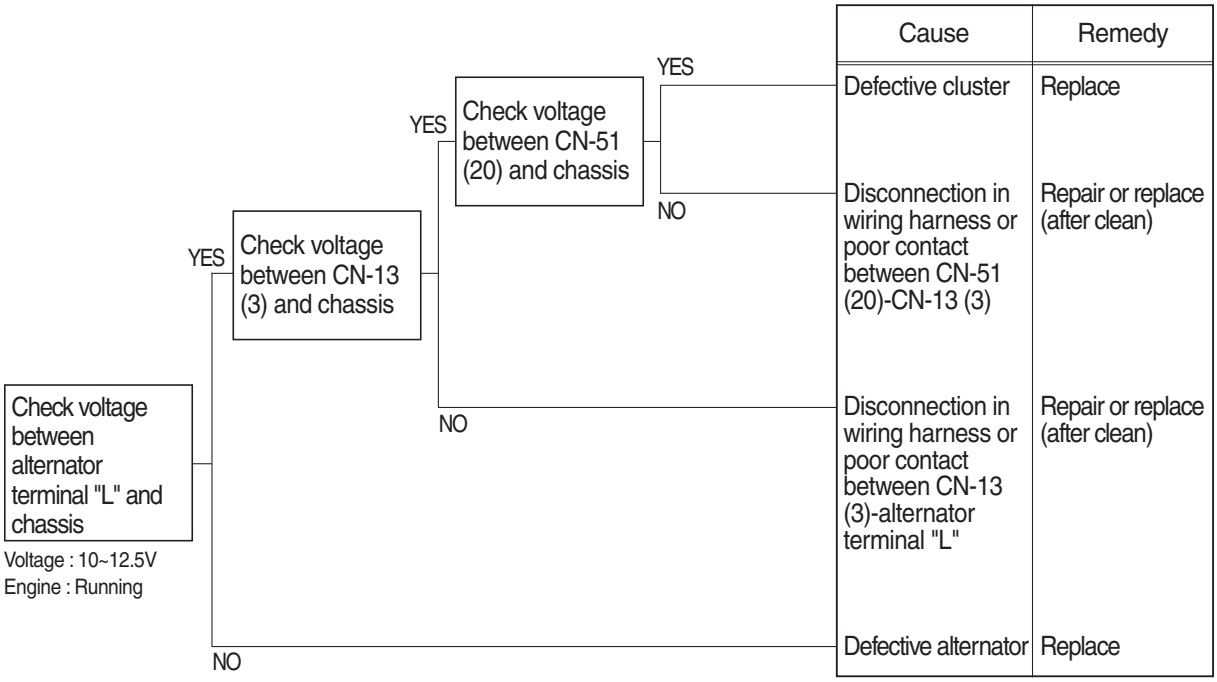
YES	10 ~ 12.5V
NO	0V



80CR9A5TS10

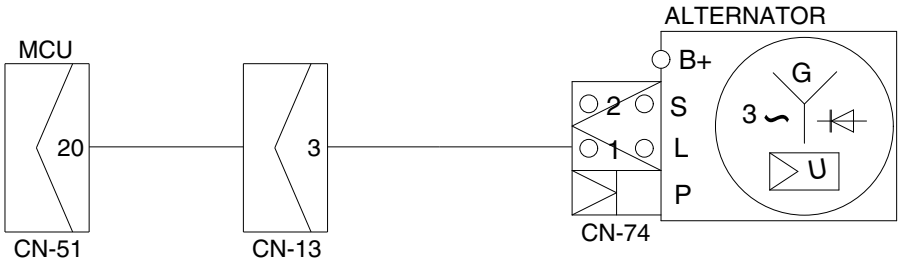
2. BATTERY CHARGING WARNING LAMP LIGHTS UP (starting switch : ON)

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



Check voltage

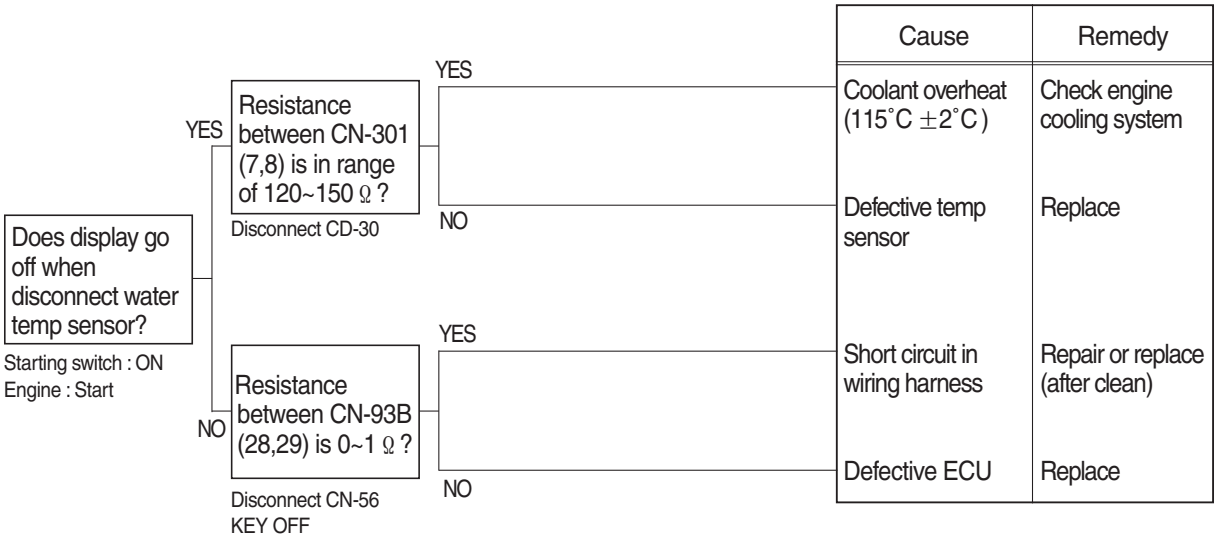
YES	10 ~ 12.5V
NO	0V

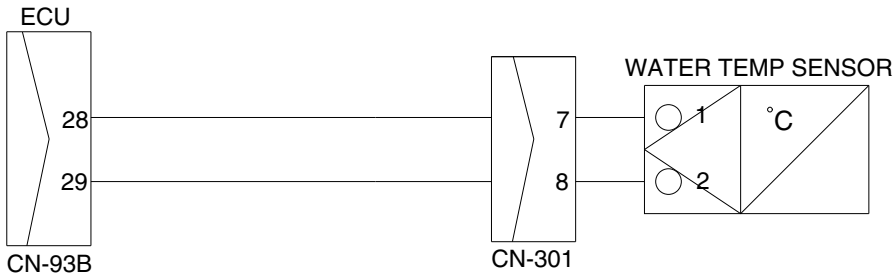


80CR9A5TS02

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

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

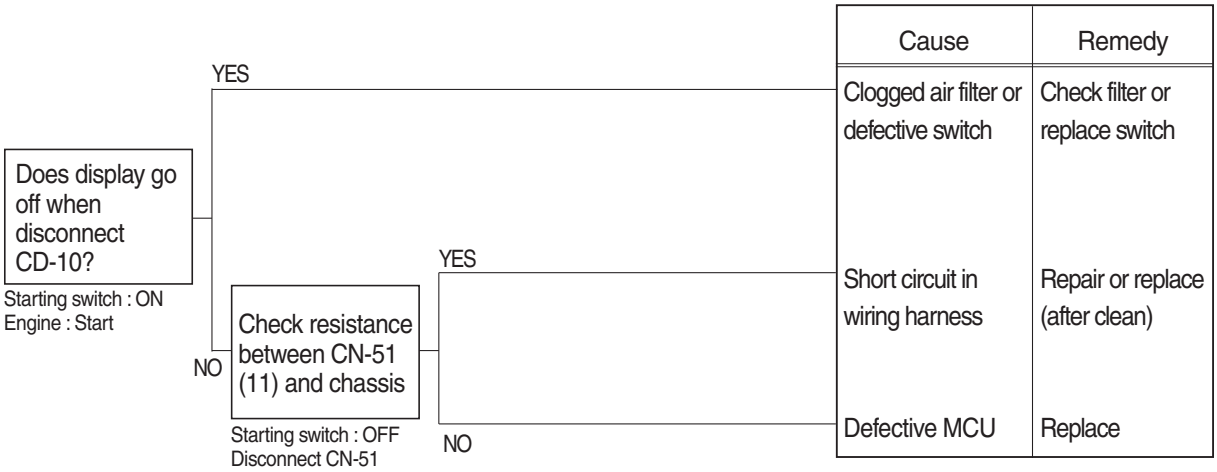




559A5TS03

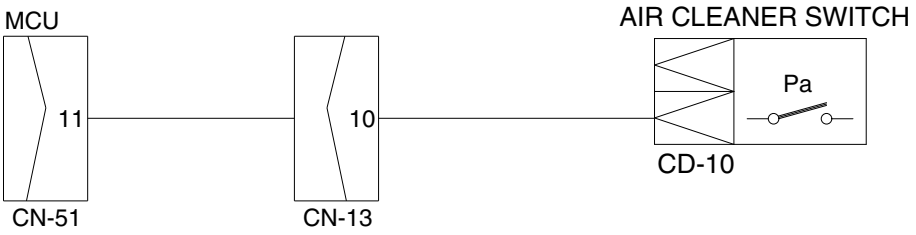
4. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

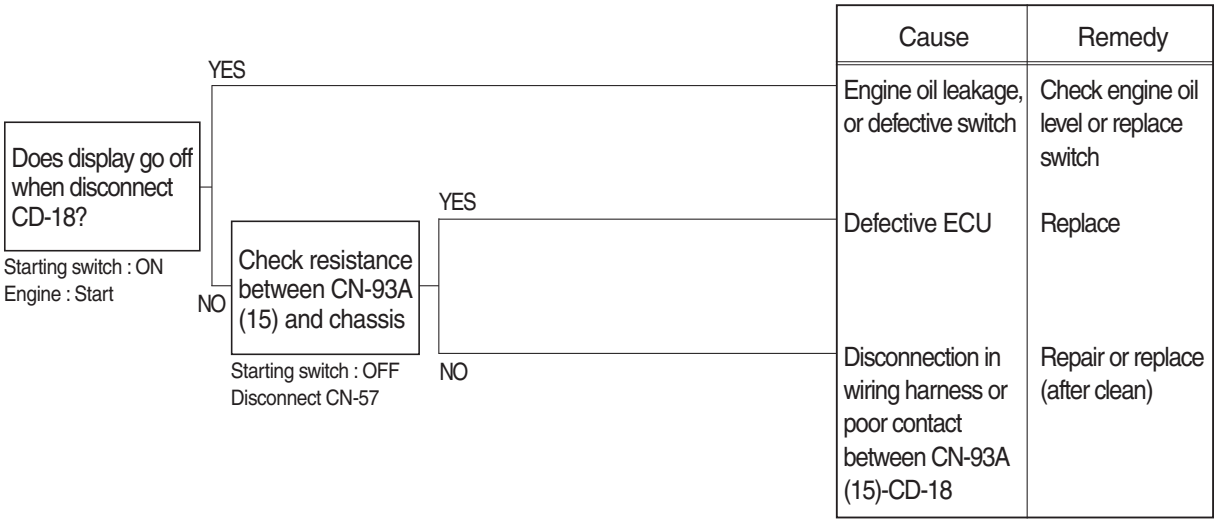
YES	MAX 1Ω
NO	MIN 1M Ω



80CR9A5TS13

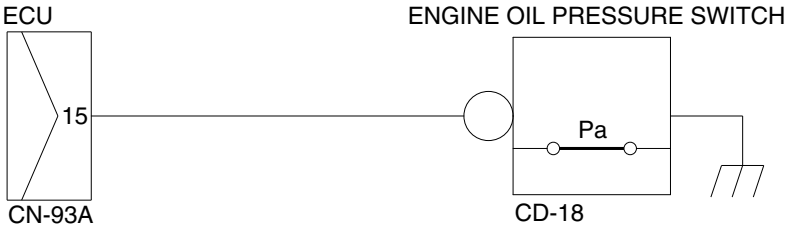
5. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

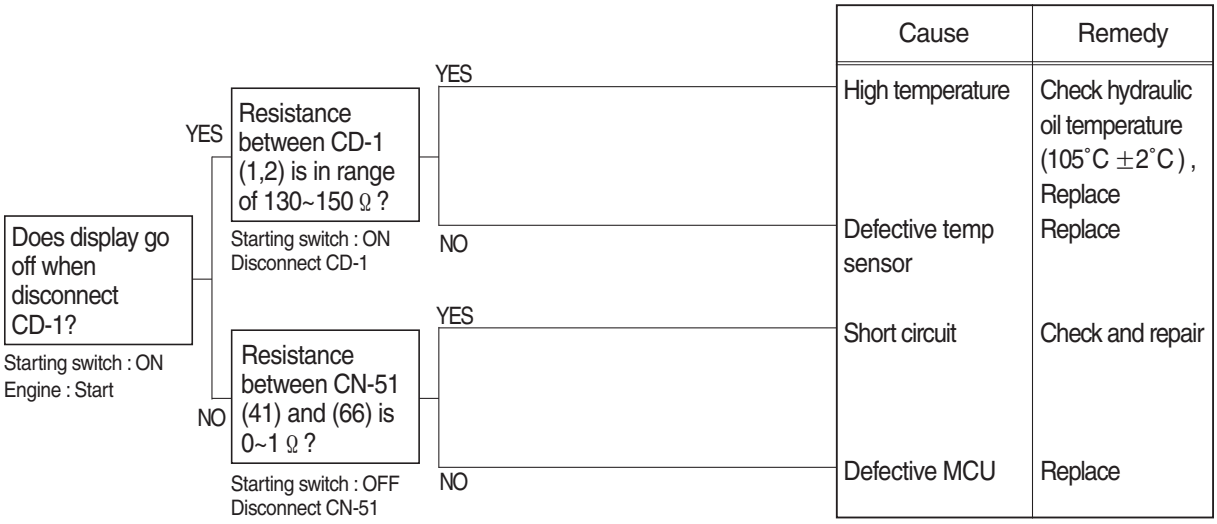
YES	MAX 1Ω
NO	MIN 1MΩ

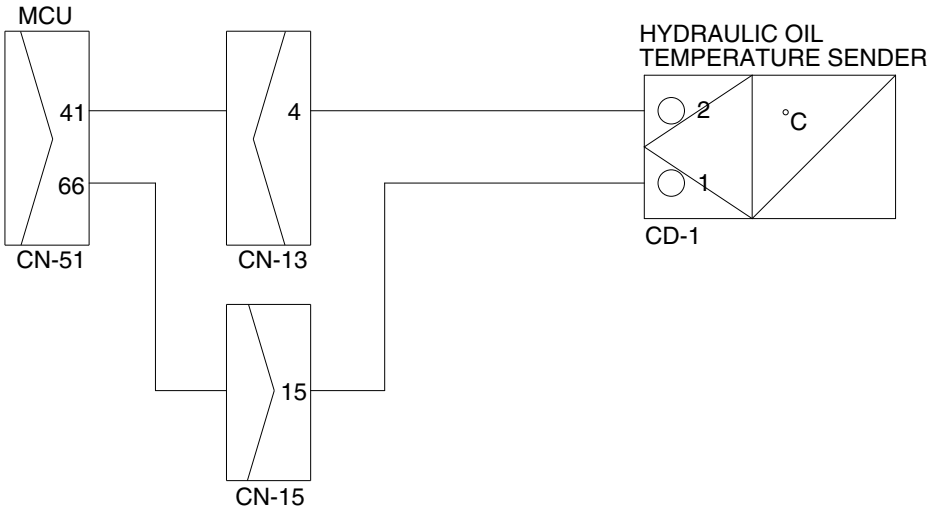


559A5TS14

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

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

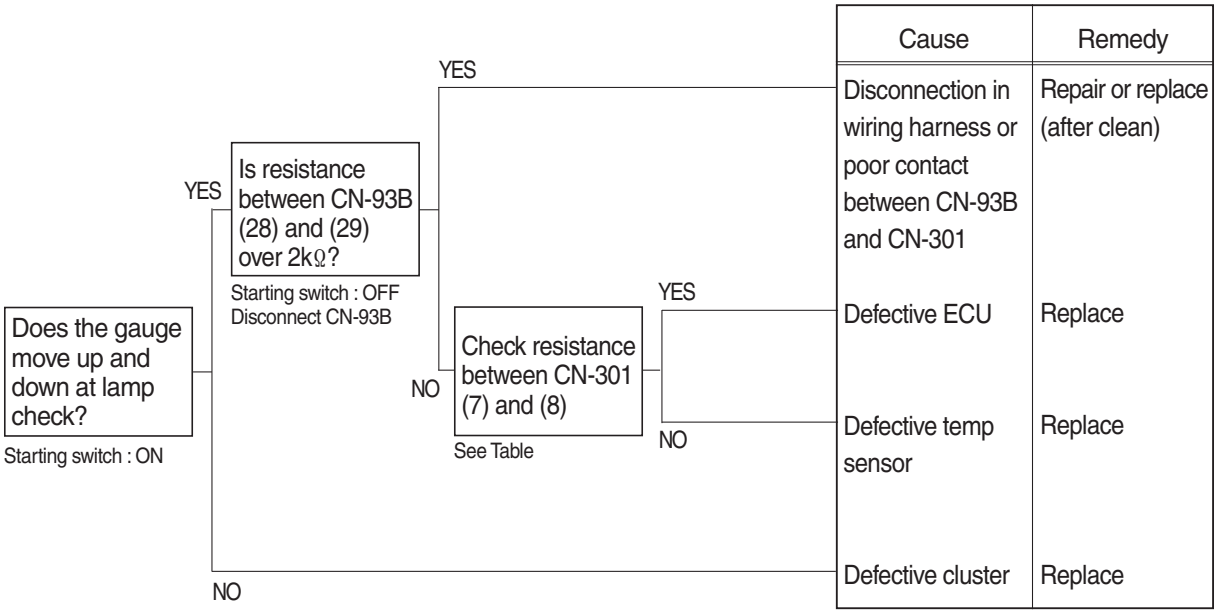


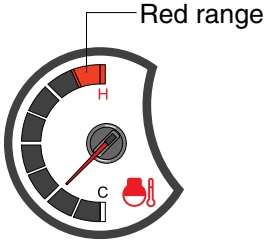


80CR9A5TS15

7. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

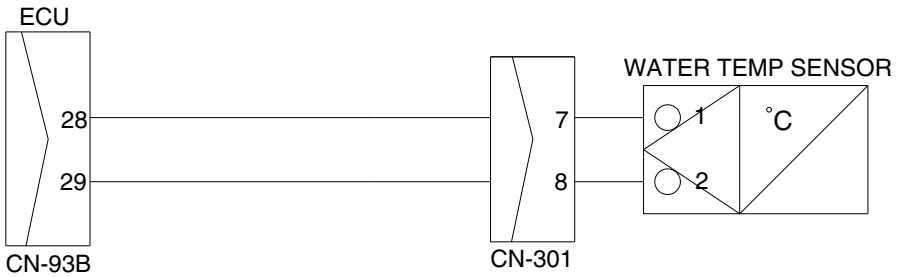
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

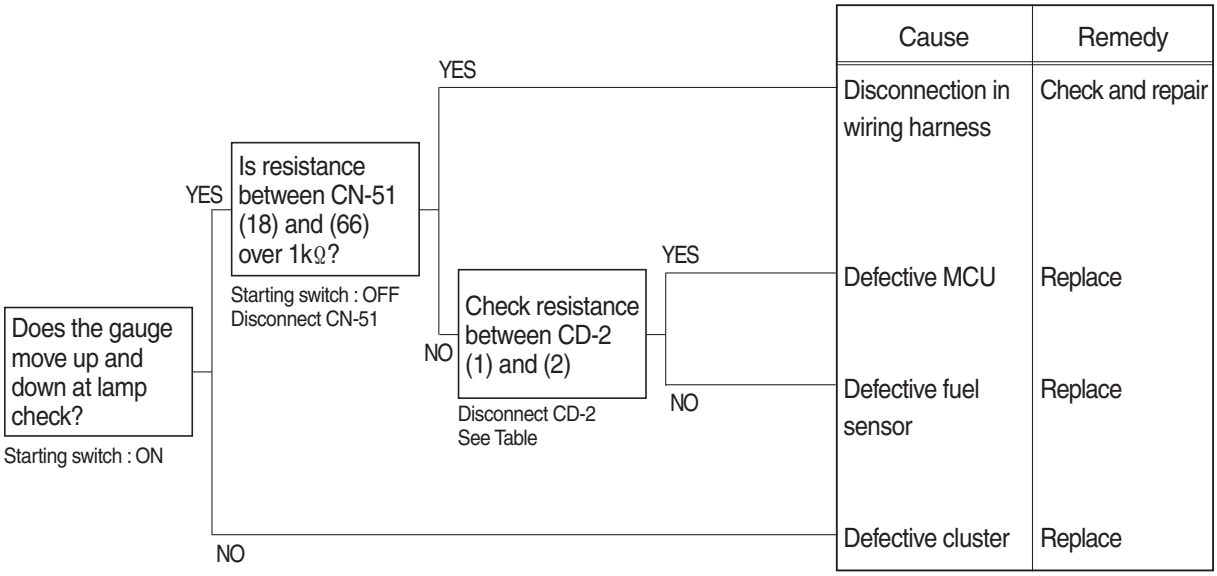
Item \ Temperature	40˚C	85~110˚C	115˚C (red range)
Unit Resistance(Ω)	1170~	270~130	~124
Tolerance(%)	±5	-8~0	±5

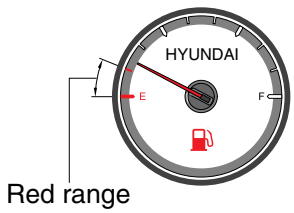


559A5TS03

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

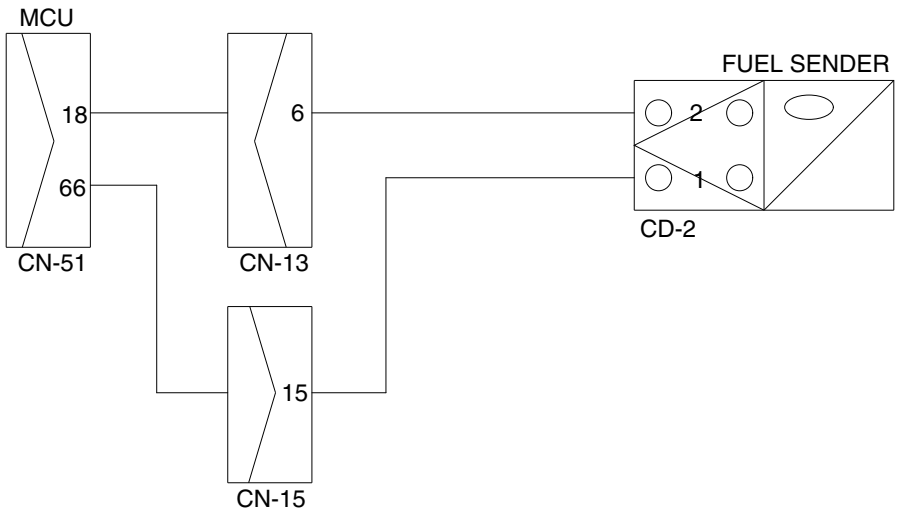
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

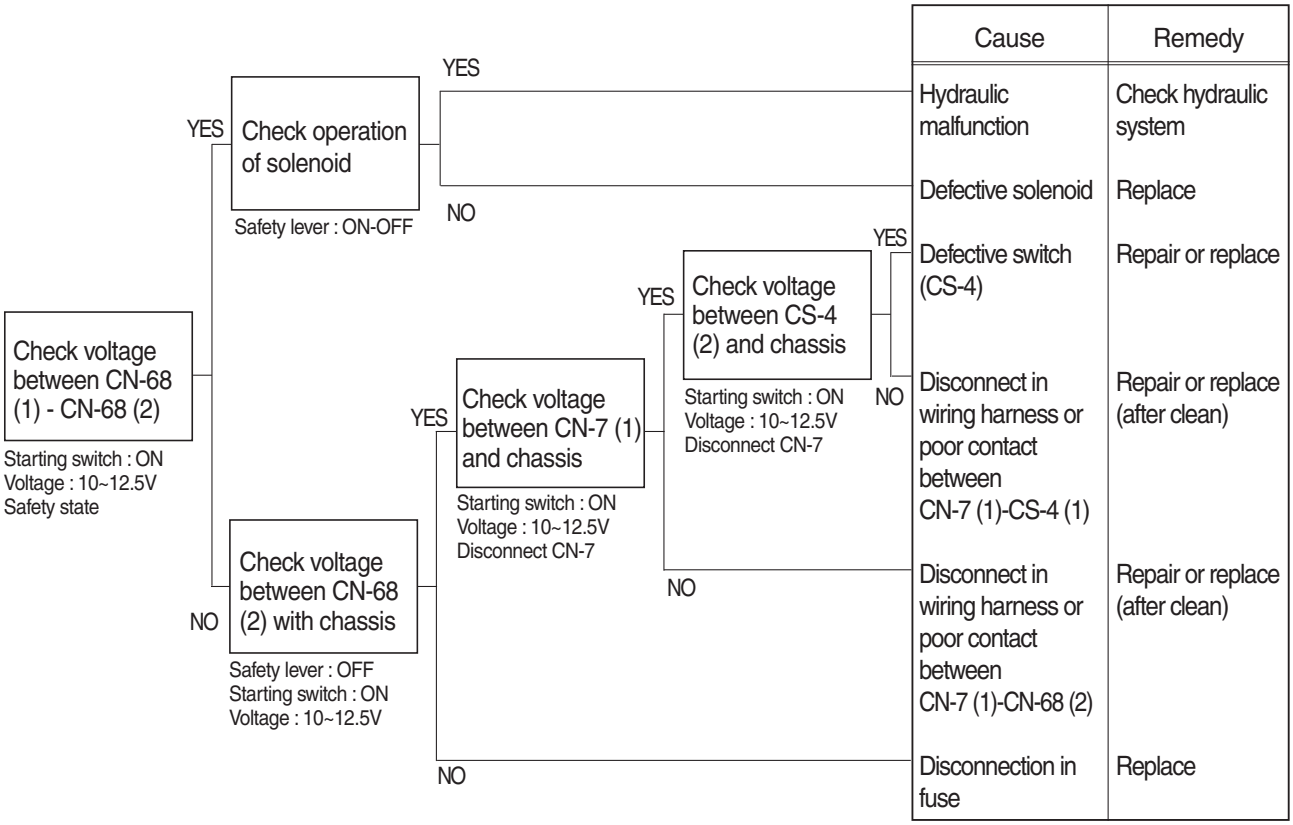
Item \ Level	Empty	1/2	Full
Unit Resistance (Ω)	700	300	~100
Tolerance (%)	±5	±8	±5

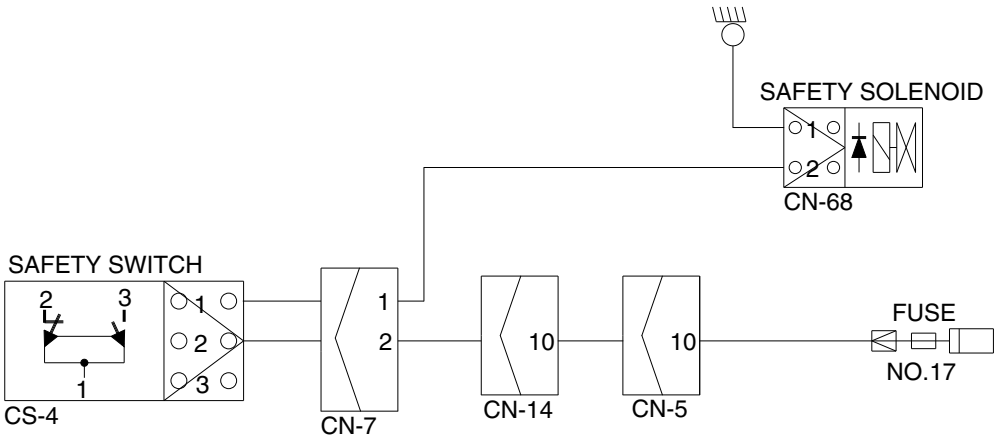


80CR9A5TS16

9. WHEN SAFETY SOLENOID DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.17.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

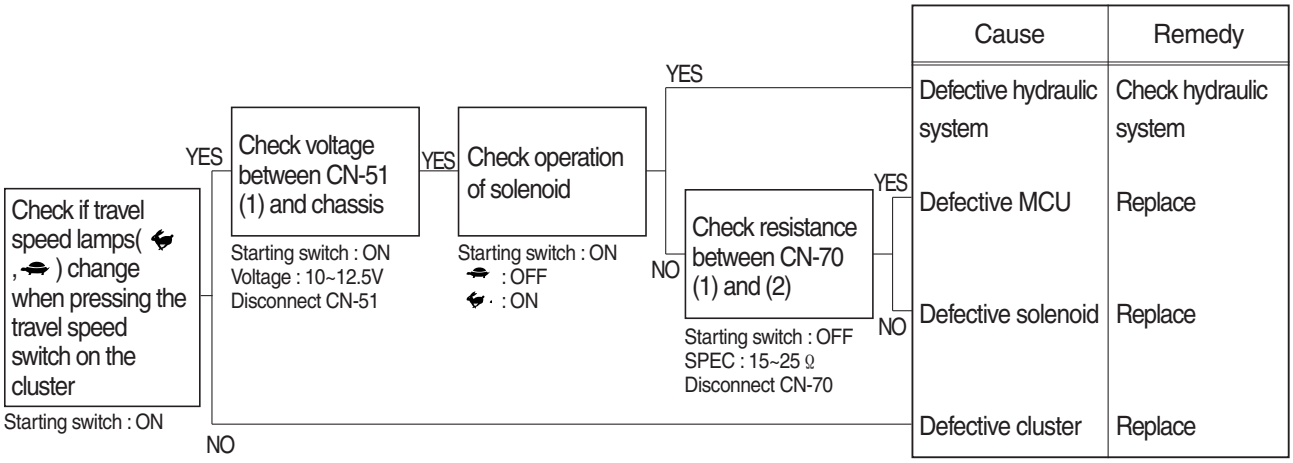


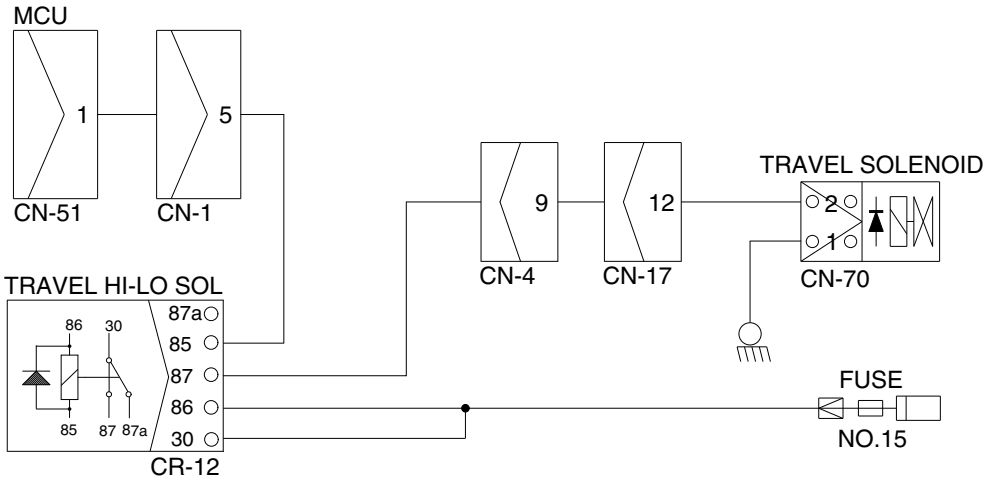


80CR9A5TS17

10. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE

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

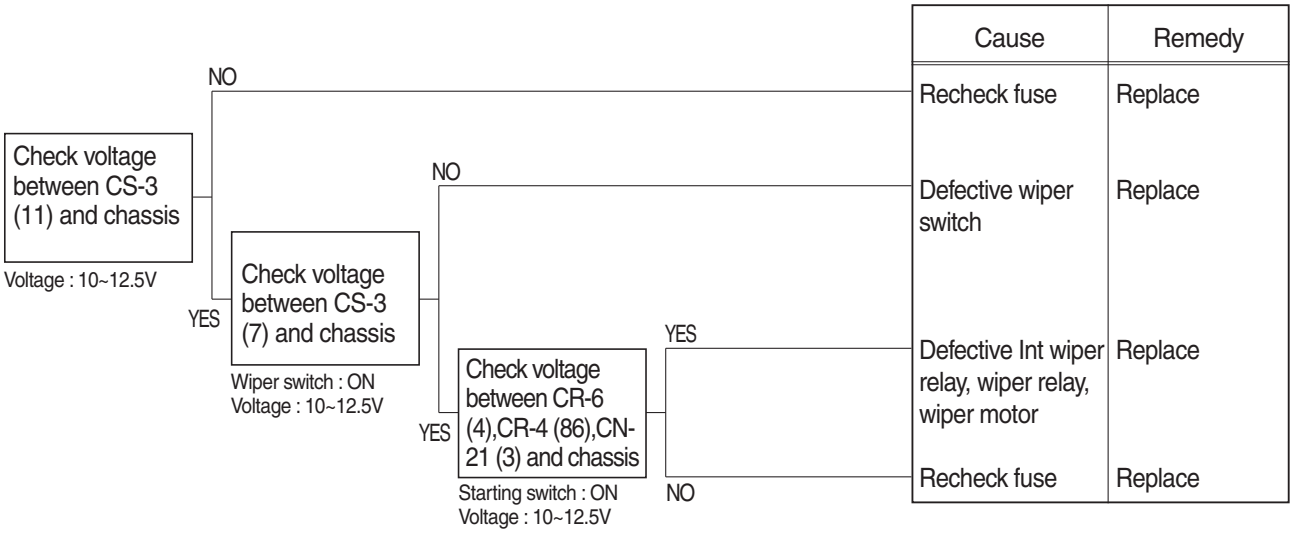


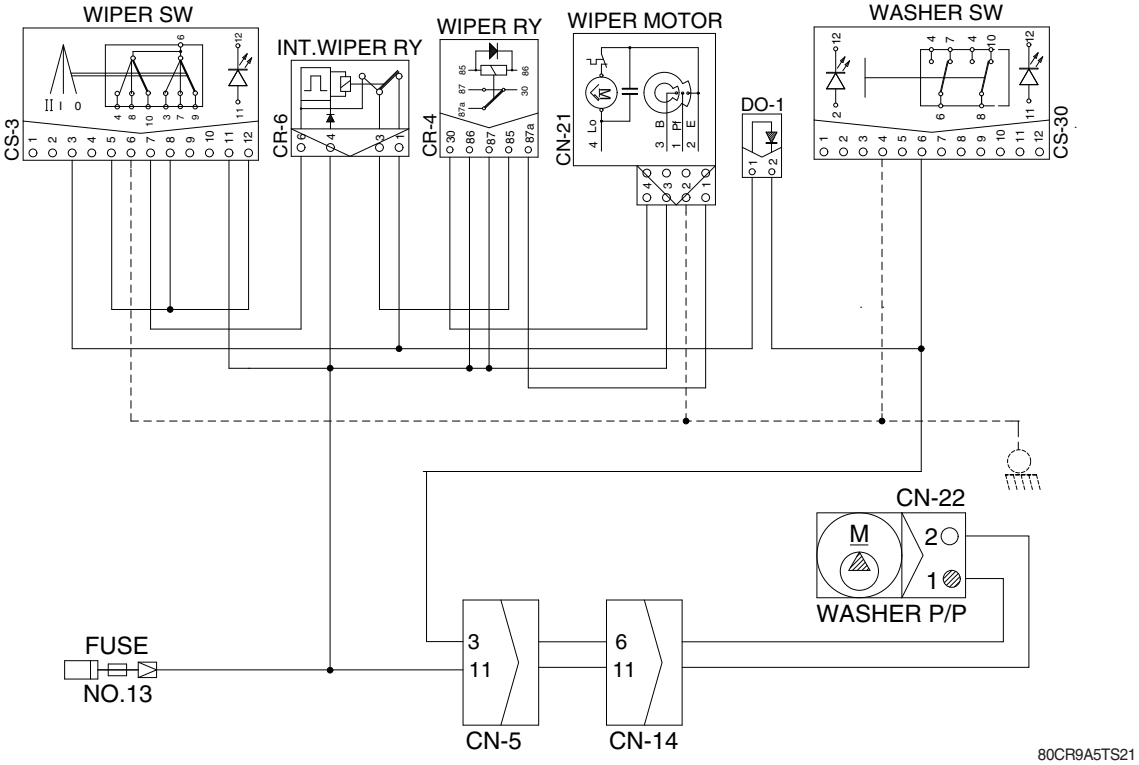


80CR9A5TS18

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

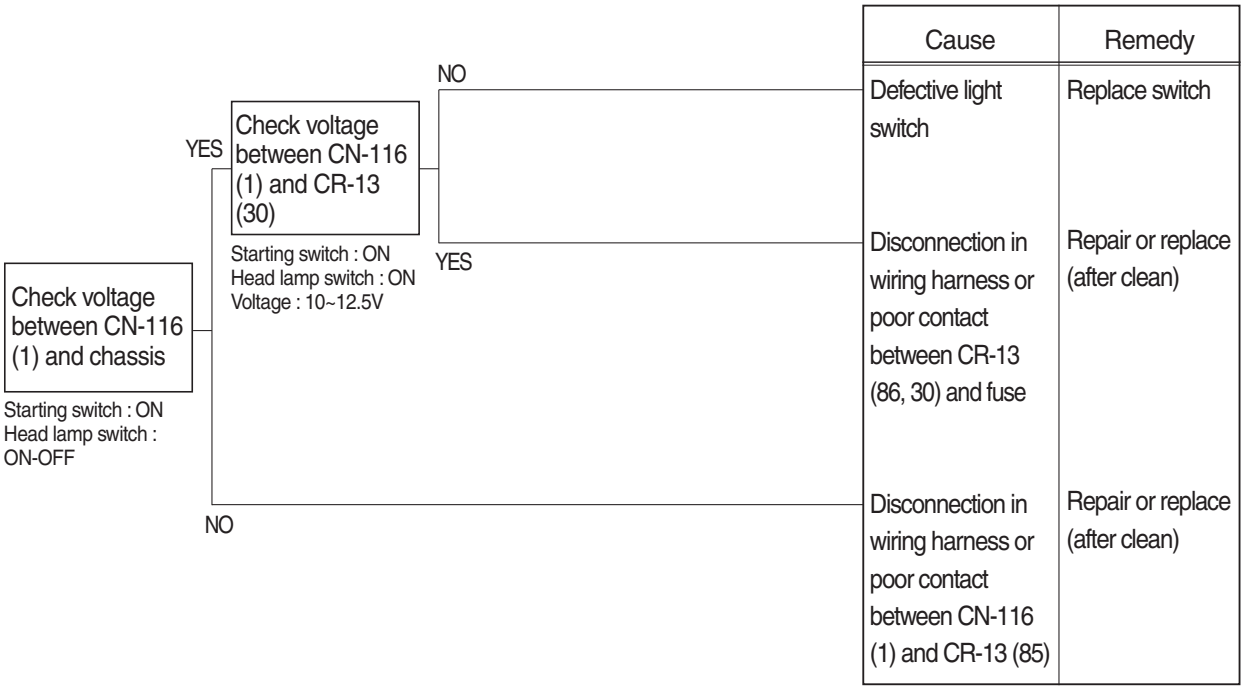
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No.13 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



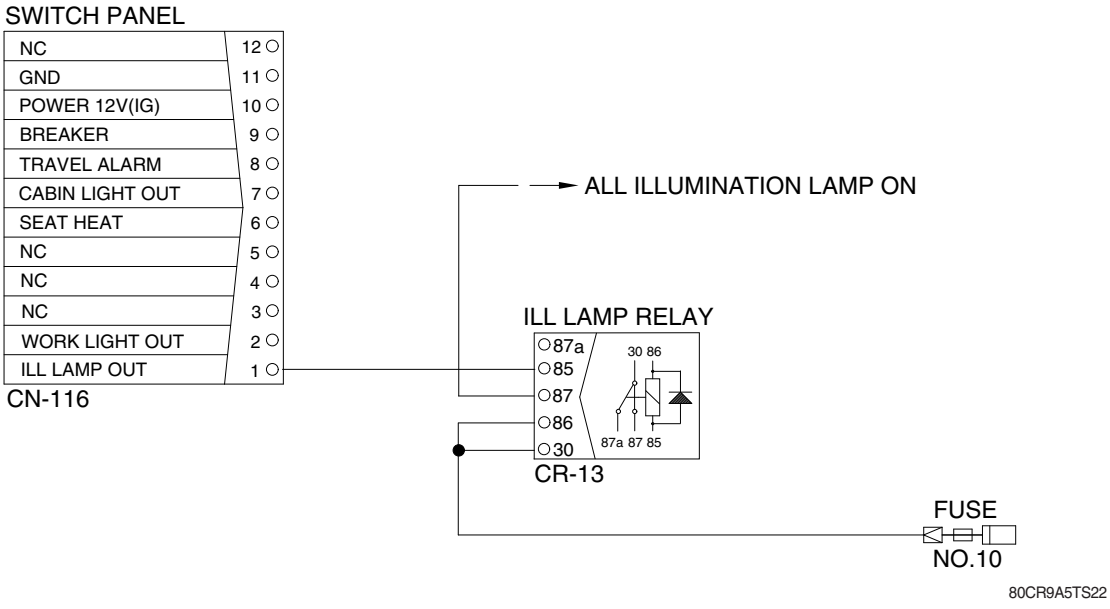


12. WHEN STARTING SWITCH IS TURNED ON, ILLUMINATION LAMP DOES NOT LIGHTS UP

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



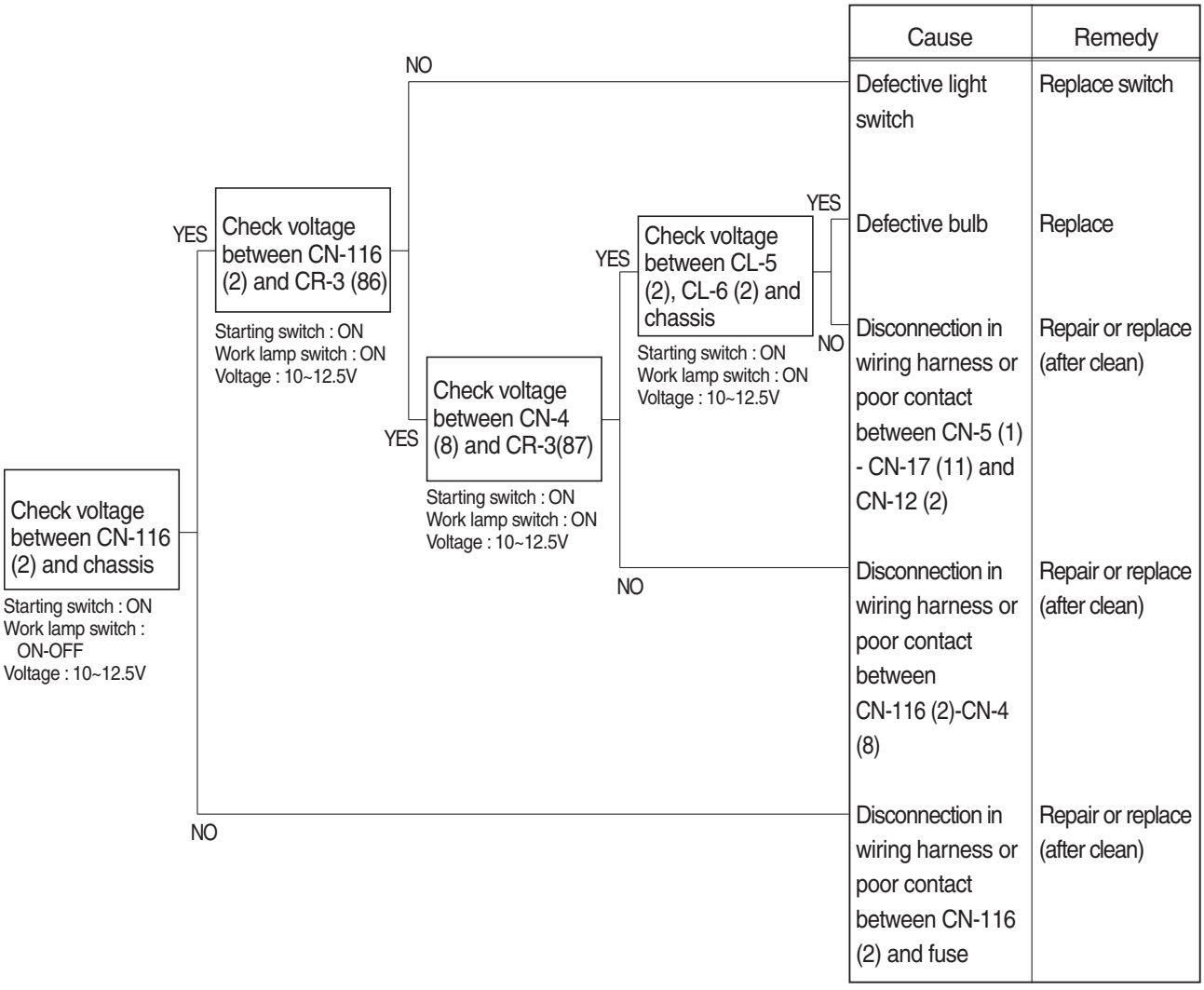
Cause	Remedy
Defective light switch	Replace switch
Disconnection in wiring harness or poor contact between CR-13 (86, 30) and fuse	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (1) and CR-13 (85)	Repair or replace (after clean)



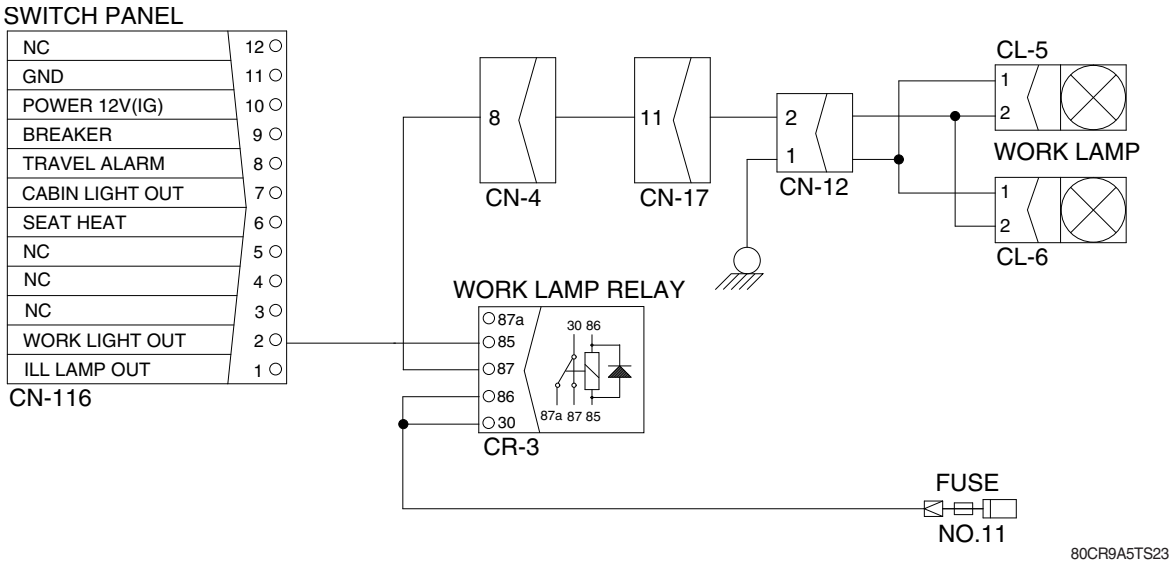
80CR9A5TS22

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

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



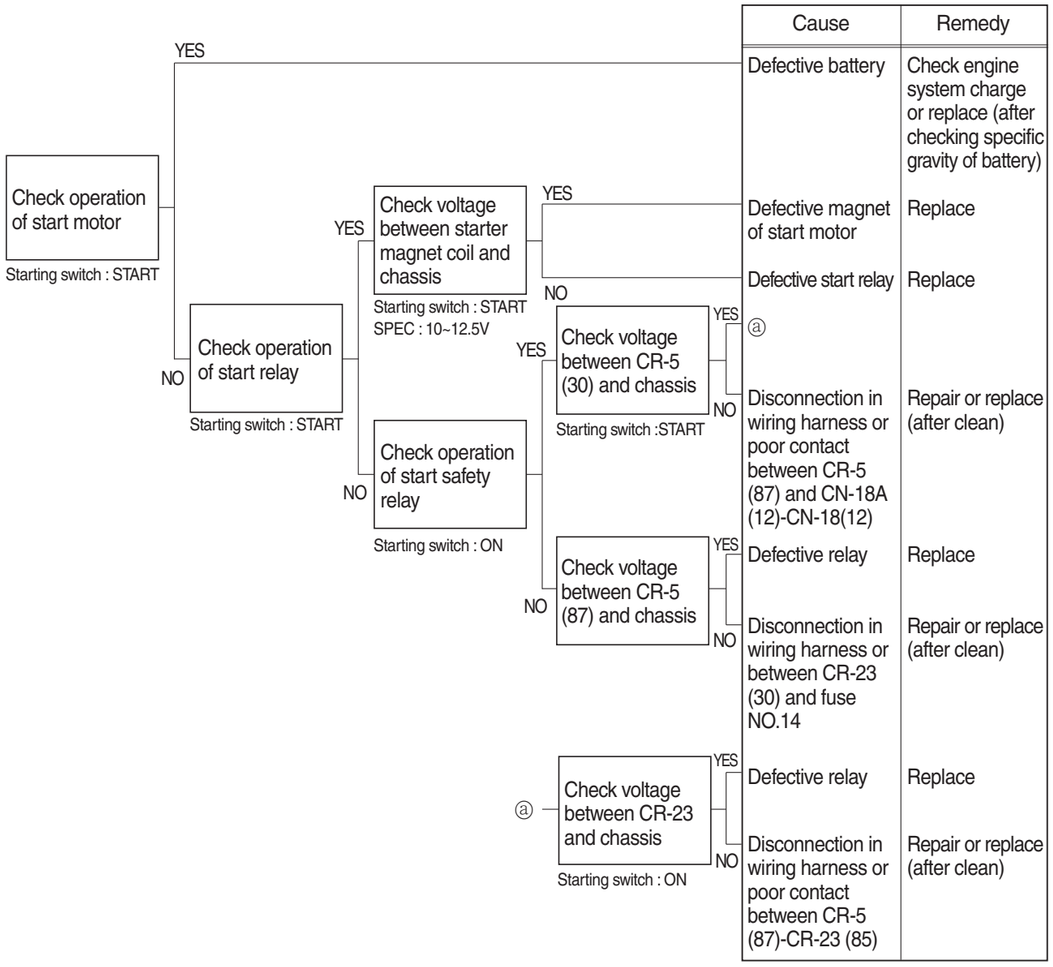
Cause	Remedy
Defective light switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-5 (1) - CN-17 (11) and CN-12 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (2)-CN-4 (8)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (2) and fuse	Repair or replace (after clean)

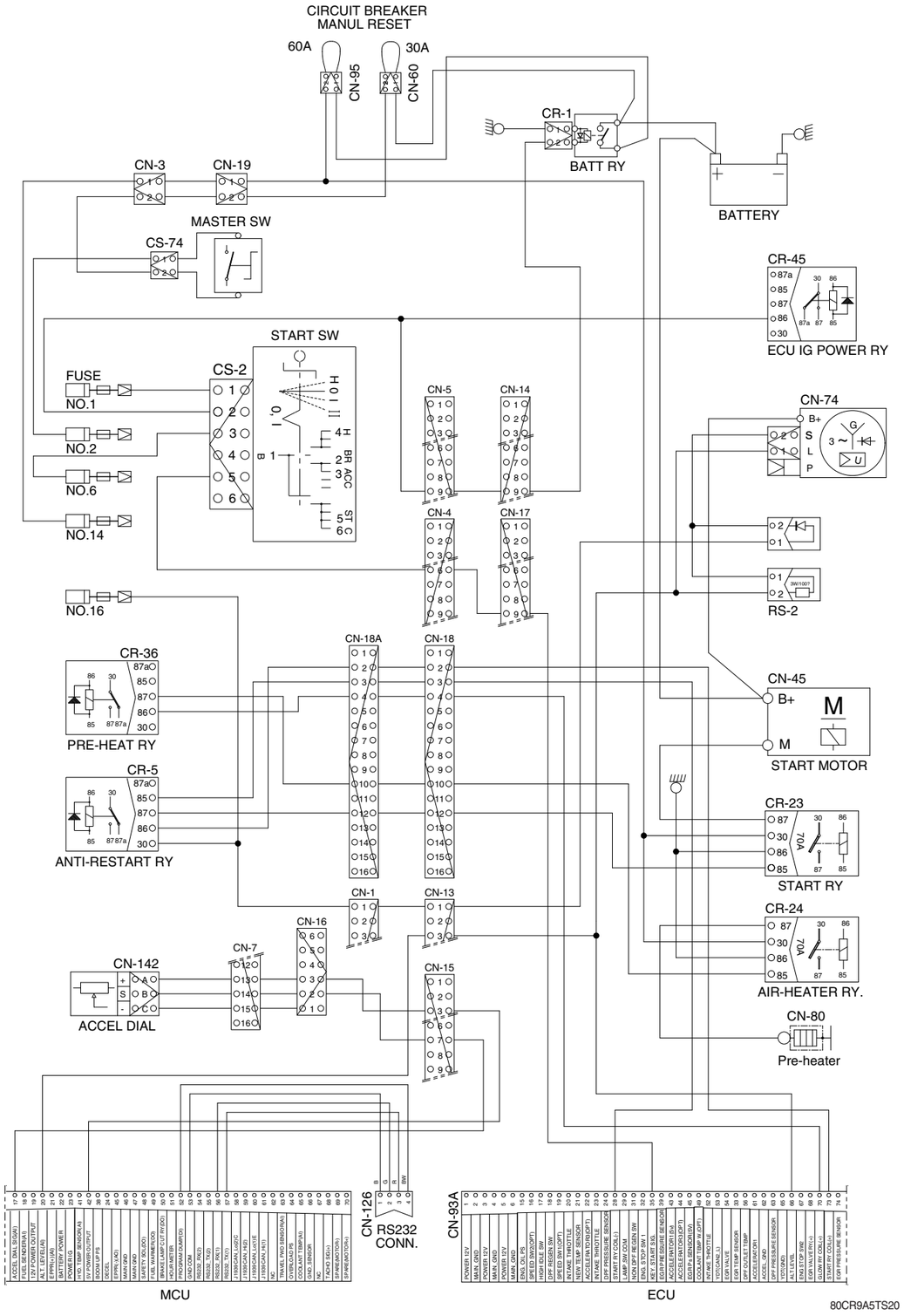


80CR9A5TS23

14. WHEN ENGINE DOES NOT START

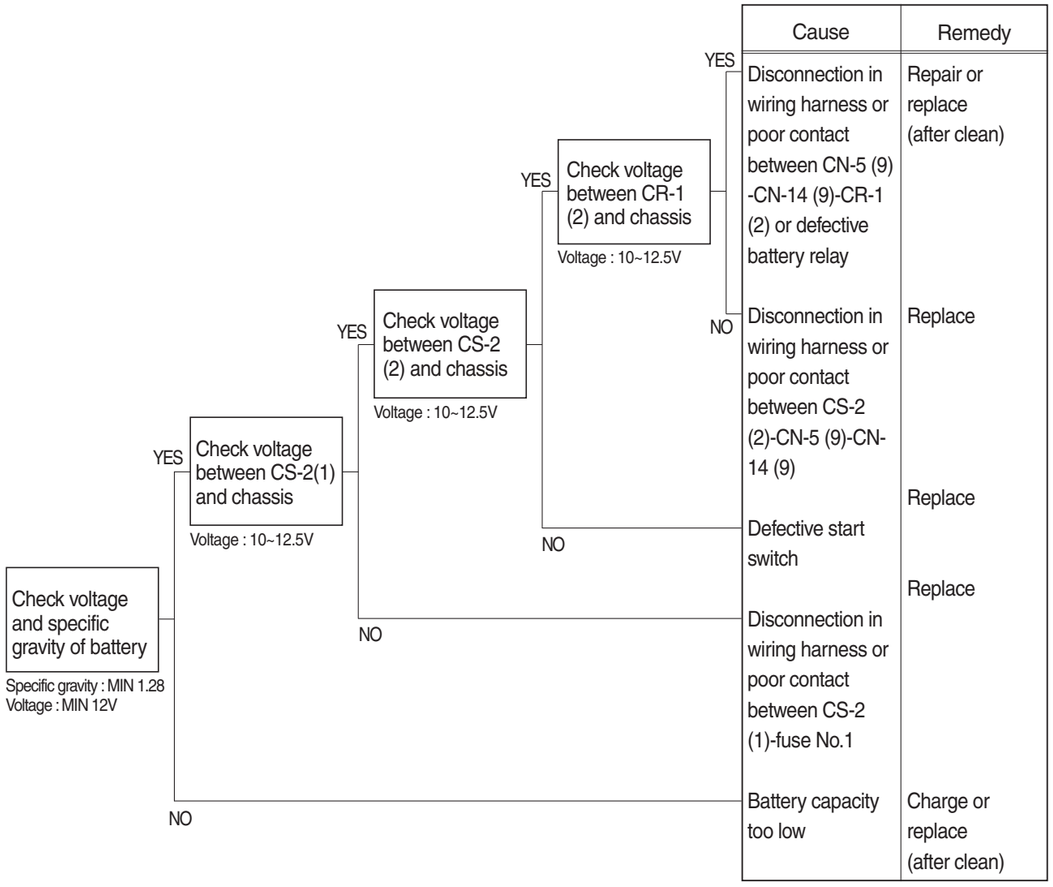
- Check supply of the power at engine stop solenoid while starting switch is ON.
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors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

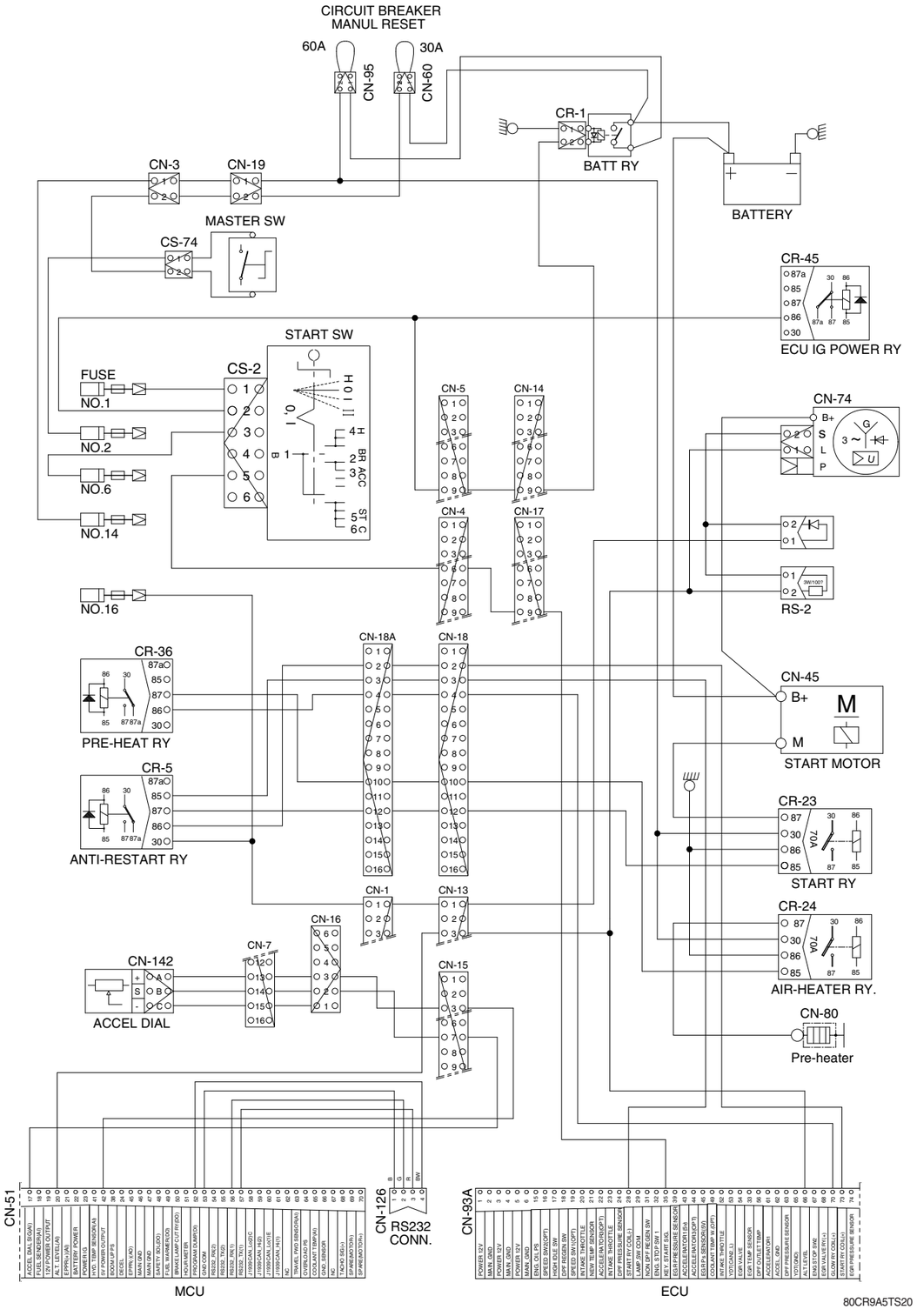




15. WHEN STARTING SWITCH ON DOES NOT OPERATE

- 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.





SECTION 6 MAINTENANCE STANDARD

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check:

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

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

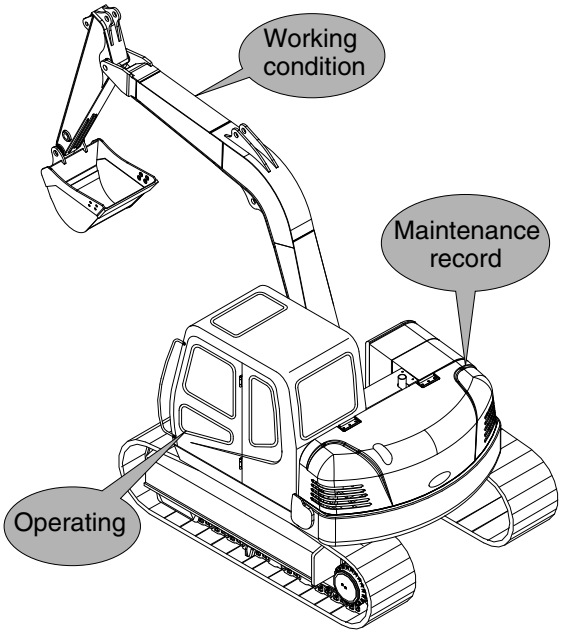
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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

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

3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

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

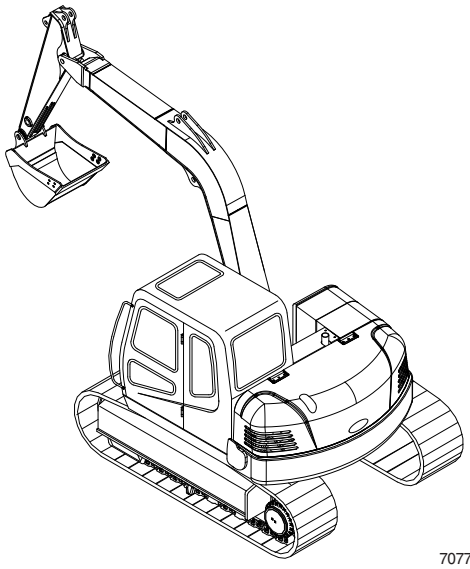


7077MS01

2. TERMINOLOGY

1) STANDARD

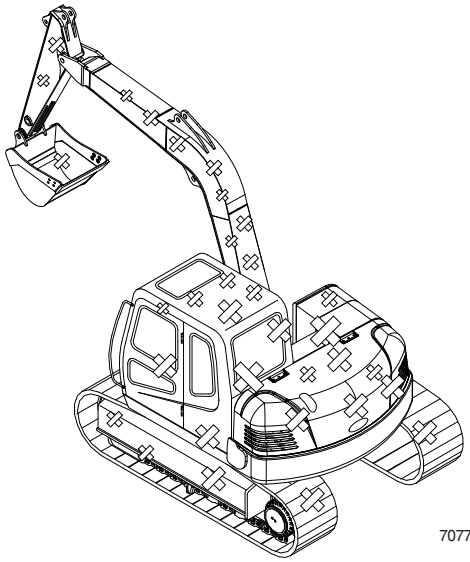
Specifications applied to the brand-new machine, components and parts.



7077MS02

2) SERVICE LIMIT

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



7077MS03

3. OPERATION FOR PERFORMANCE TESTS

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

(1) The machine

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

(2) Test area

① Select a hard, flat surface.

② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.

③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(3) Precautions

① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.

② Operate the machine carefully and always give first priority to safety.

③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.

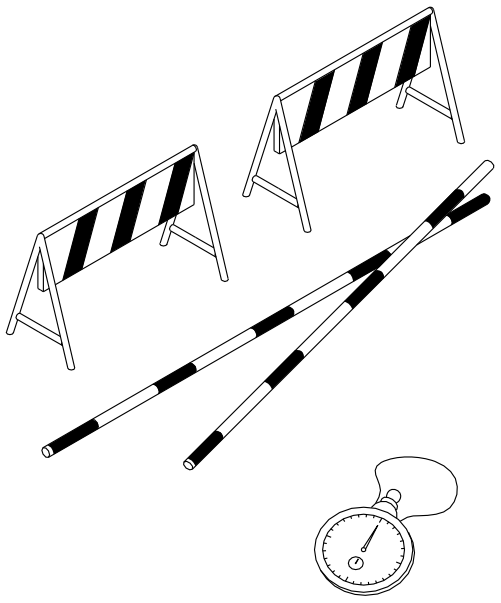
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements

① Accurately calibrate test instruments in advance to obtain correct data.

② Carry out tests under the exact test conditions prescribed for each test item.

③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



7-3 (140-7)

2) ENGINE SPEED

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

(3) Measurement

① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.

② Measure and record the engine speed at each mode (P, S).

③ Select the P-mode.

④ Lightly operate the bucket control lever a few times, then return the control lever to neutral; The engine will automatically enter the auto-idle speed after 4 seconds.

⑤ Measure and record the auto deceleration speed.

60CR9AMS01

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remark
R80CR-9A	Start idle	1000±50	
	P mode	1800±50	
	S mode	1700±50	
	Auto decel	1100±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.

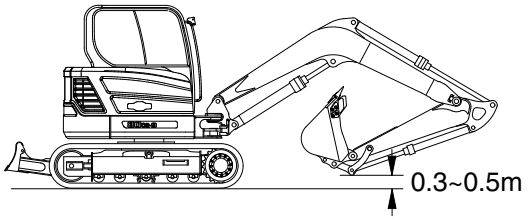
(2) Preparation

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˚C.



80CR96MC04

(3) Measurement

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

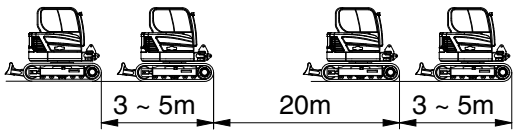
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

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

④ Measure the time required to travel 20m.

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

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



80CR96MC05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
R80CR-9A	1 Speed	25.7±2.0	32	Steel track
	2 Speed	15.7±1.0	20	Steel track

4) TRACK REVOLUTION SPEED

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

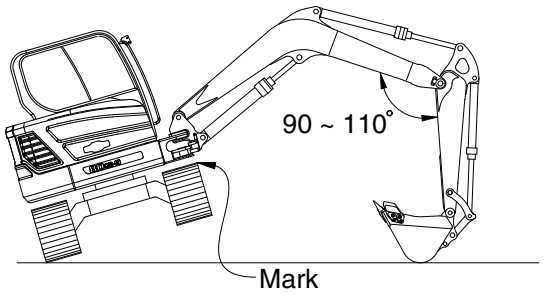
(2) Preparation

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.



80CR96MC06

(3) Measurement

① Select the following switch positions.

· Travel mode switch : 1 or 2 speed

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

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

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

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

(4) Evaluation

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

Unit : Seconds / 3 revolutions

Model	Travel speed	Standard	Maximum allowable
R80CR-9A (steel track)	1 Speed	22.6±1.5	28.3
	2 Speed	13.7±1.5	17.1

5) TRAVEL DEVIATION

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

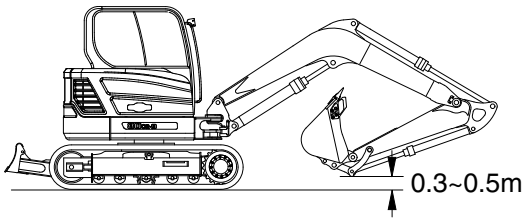
(2) Preparation

① Adjust the tension of both tracks to be equal.

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

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

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



80CR96MC04

(3) Measurement

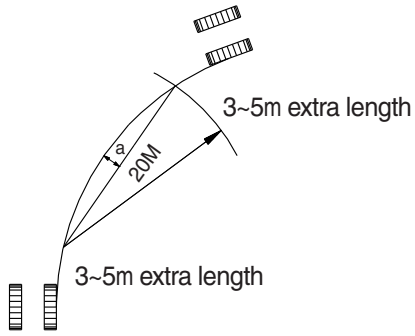
① Measure the amount of mistracking at high and low travel speeds.

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

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

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

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



7-7(2) 140-7

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20m

Model	Standard	Maximum allowable	Remarks
R80CR-9A	200 below	240	

6) SWING SPEED

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

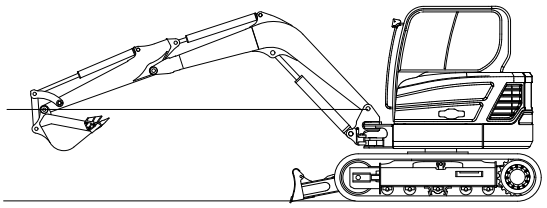
(2) Preparation

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

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

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

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



80CR96MC07

(3) Measurement

① Operate swing control lever fully.

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

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

(4) Evaluation

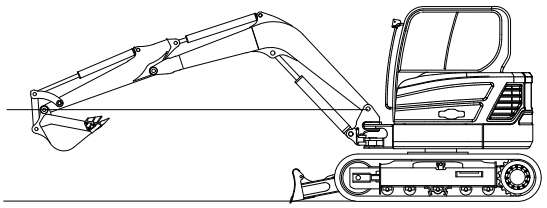
The time required for 2 swings should meet the following specifications.

Unit : Seconds / 2 revolutions

Model	Standard	Maximum allowable	Remarks
R80CR-9A	13.2±1.0	16.5	

7) SWING FUNCTION DRIFT CHECK

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



80CR96MC07

(2) Preparation

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

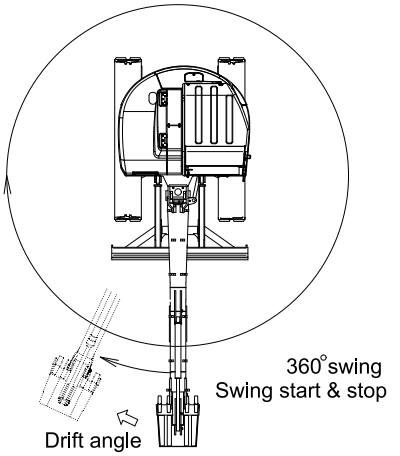
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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

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

⑤ Swing the upperstructure 360˚.

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



80CR96MC08

(3) Measurement

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

② Measure the distance between the two marks.

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

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

(4) Evaluation

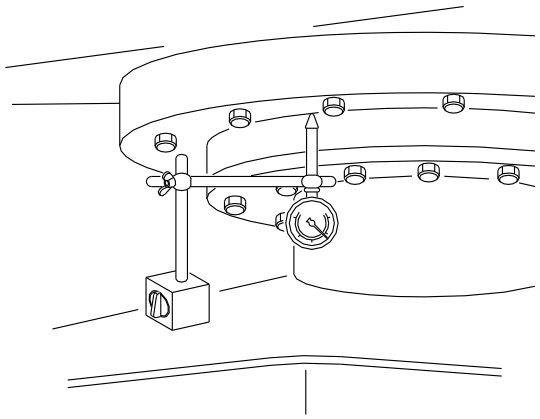
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remarks
R80CR-9A	90 below	127.6	

8) SWING BEARING PLAY

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



7-10(1) 140-7

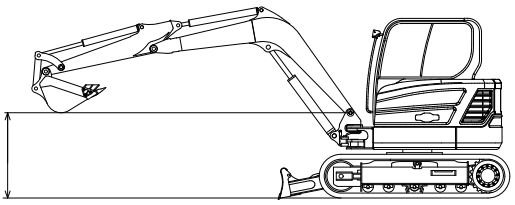
(2) Preparation

① Check swing bearing mounting cap screws for loosening.
② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.
③ Install a dial gauge on the track frame as shown, using a magnetic base.
④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.
⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
⑥ Bucket should be empty.

(3) Measurement

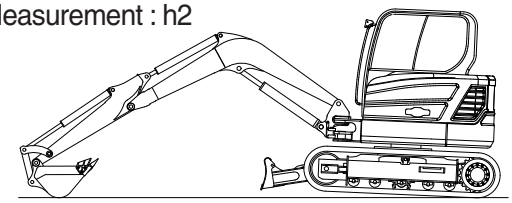
① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).
③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1

Measurement : h1



80CR96MC09

Measurement : h2



80CR96MC10

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

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

9) HYDRAULIC CYLINDER CYCLE TIME

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

(2) Preparation

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

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

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

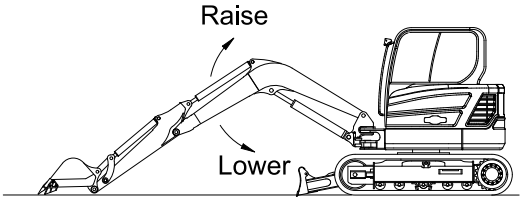
④ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

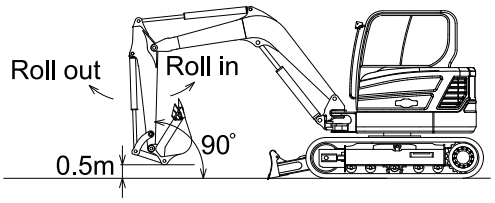
① To measure cylinder cycle times.

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

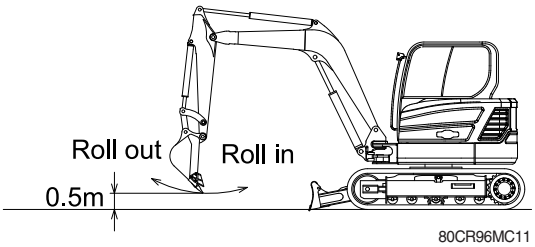
Boom cylinder



Arm cylinder



Bucket cylinder



80CR96MC11

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

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds

Model	Function	Standard	Maximum allowable	Remarks
R80CR-9A	Boom raise	2.9±0.4	3.5	
	Boom lower	2.7±0.4	3.3	
	Arm in	2.8±0.4	3.4	
	Arm out	2.7±0.3	3.1	
	Bucket load	3.6±0.4	4.2	
	Bucket dump	2.3±0.3	2.7	
	Dozer up (raise)	2.7±0.3	3.2	
	Dozer down (lower)	2.6±0.3	3.1	

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.

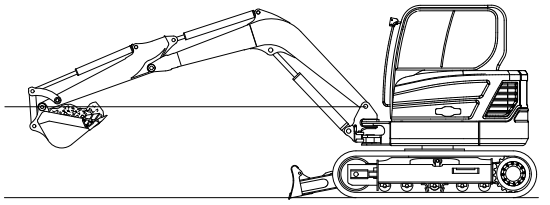
- $W = M^3 \times 1.5$
  Where :
  M^3 = Bucket heaped capacity (m^3)
  1.5 = Soil specific gravity

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˚C.



80CR96MC12

(3) Measurement

① Stop the engine.

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

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

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

Unit : mm / 5min

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

11) CONTROL LEVER OPERATING FORCE

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

(2) Preparation

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

(3) Measurement

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

(4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

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

12) CONTROL LEVER STROKE

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

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

(2) Preparation

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

(3) Measurement

① Stop the engine.

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

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

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

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

13) PILOT PRIMARY PRESSURE

(1) Preparation

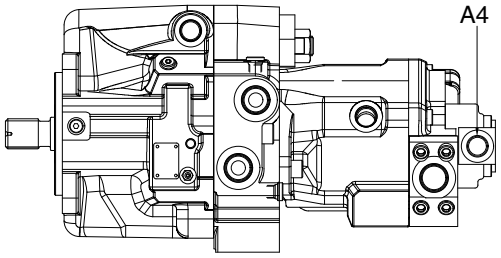
① Stop the engine.

② Push the pressure release button to bleed air.

③ Loosen and remove plug on the pilot pump delivery port (A4) and connect pressure gauge.

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

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



80CR96MC13

(2) Measurement

① Measure the primary pilot pressure in the M mode.

(3) Evaluation

The average measured pressure should meet the following specifications:

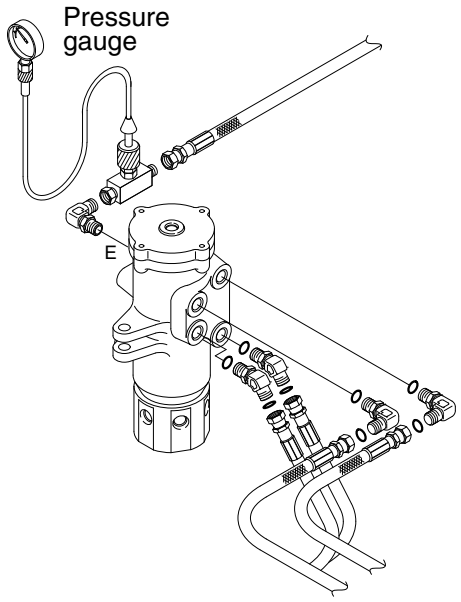
Unit : kgf / cm²

Model	Standard	Remarks
R80CR-9A	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 assembly to turning joint E port as shown.
④ Start the engine and check for on leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC14

(2) Measurement

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

(3) Evaluation

The average measured pressure should be within the following specifications.

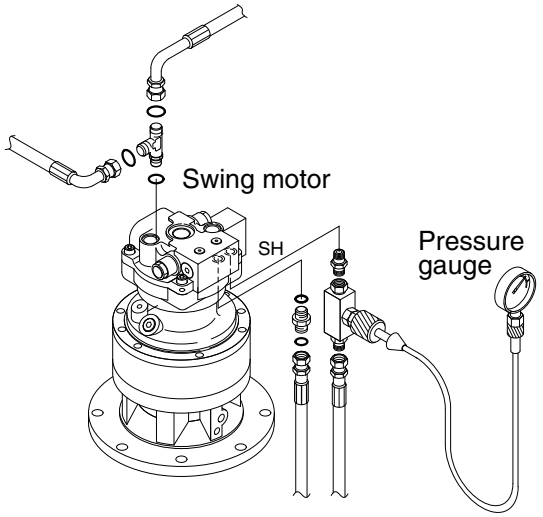
Unit : kgf / cm²

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

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ Install a connector and pressure gauge assembly to swing motor SH port, as shown.
④ Start the engine and check for oil leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC15

(2) Measurement

① Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
② Repeat three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

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

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

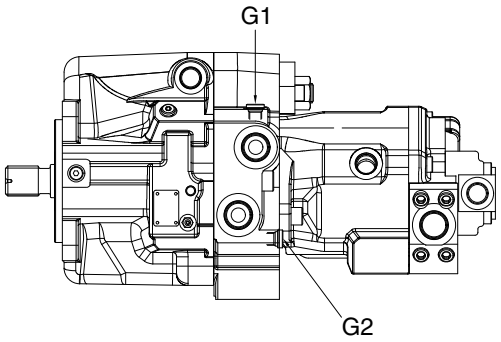
① Stop the engine.

② Push the pressure release button to bleed air.

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

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

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



80CR96MC17

(2) Measurement

① Measure the main pump delivery pressure at high idle.

(3) Evaluation

The average measured pressure should meet the following specifications.

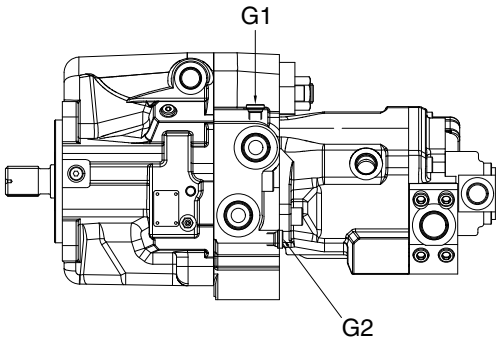
Unit : kgf / cm²

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

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ To measure the system relief pressure. Install a connector and pressure gauge assembly main pump gauge port, as shown.
④ Start the engine and check for oil leakage from the port.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



80CR96MC17

(2) Measurement

① Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.
② In the swing function, place bucket against an immovable object and measure the relief pressure.
③ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

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

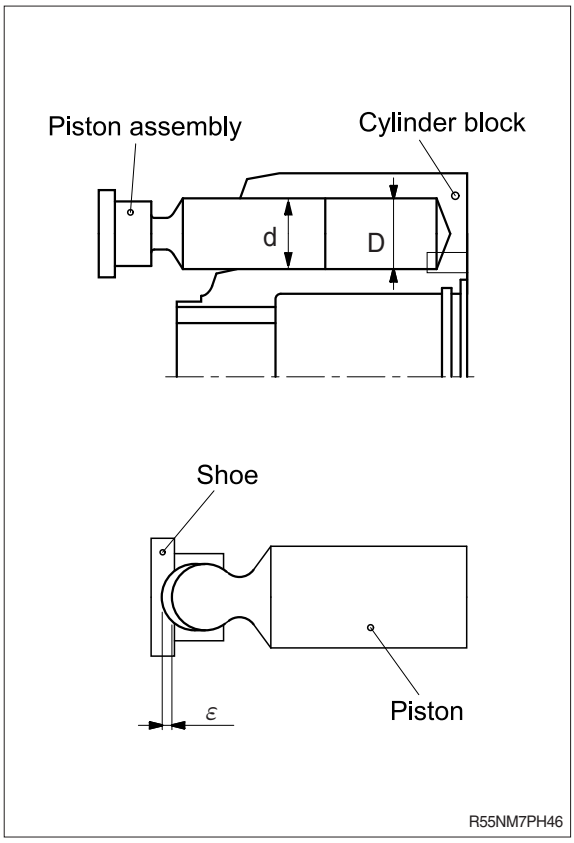
1) PISTON ASSEMBLY AND CYLINDER BLOCK

(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 $\leq$ 0.050 mm

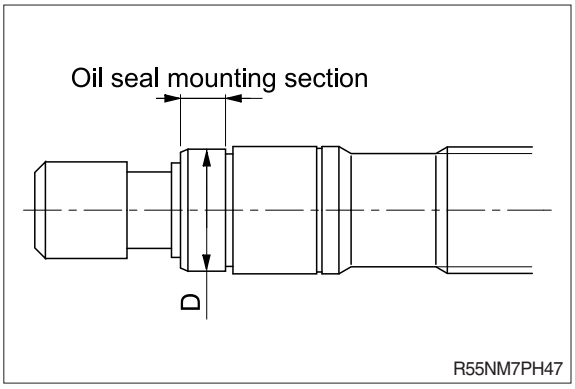
2) PISTON SHOE AND PISTON

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



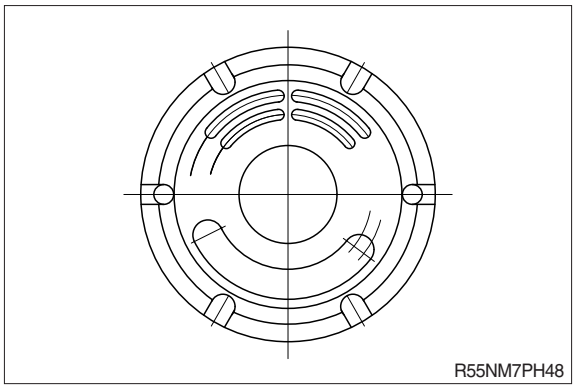
3) SHAFT

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



4) CONTROL PLATE

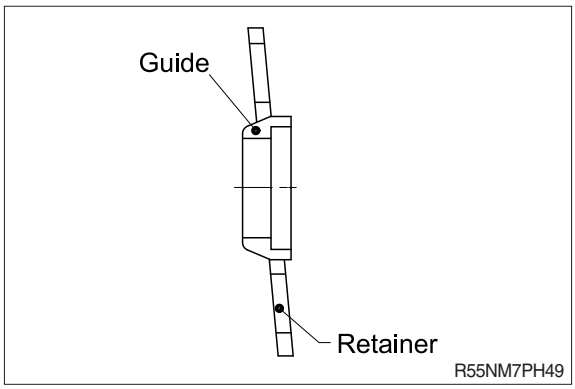
(1) Check the slide surface for any damage. When the damage is large, replace the plate with new one.



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

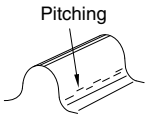
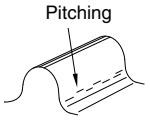
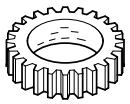
3. SWING MOTOR

1) POSSIBLE REASONS FOR THE TROUBLE AND ITS COUNTERMEASURES

Trouble	Possible reasons		Countermeasure
Motor does not move. The supplied pressure is enough.	Relief valve	Setting pressure is too low.	Replace the relif valve assembly.
		Faulty operation.	
	Hydraulic motor	Burned inner parts.	Replace the hydraulic motor assembly.
		Too much internal leakage.	
	Reduction gear	Damage to the gears.	Replace the reduction gear assembly.
	Overload	-	Remove the overload.
Insufficient torque	Relief valve	Setting pressure is too low.	Replace the relief valve assembly.
		Faulty operation.	
	Hydraulic motor	Burned sliding parts.	Replace the hydraulic motor assembly.
		Too much internal leakage.	
	Reduction gear	Damage to the gears.	Replace the pinion kit, carrier kit.
		Damage to bearings.	
Abnormal noise	Cavitation noise	Insufficient flow.	Adjust the piping.
	Hydraulic motor	Damage to sliding parts.	Replace the hydraulic motor assembly.
	Reduction gear	Damage to the gears.	Replace the pinion kit, carrier kit.
		Damage to bearings	
	Pinion gear	Damage to the gear surface.	Replace the pinion kit.
Oil leakage	Body gasket	Damage to O-rings.	Replace the O-ring
		Loose bolts.	Re-tighten the loose bolts.
	Pinion gear	Damage to oil seal.	Replace the pinion kit.
Delay in start up, or delay in stopping	Relief valve	Faulty operation.	Replace the relief valve assembly.
	Check valve	Internal leakage.	Replace the body H kit.
Excessive heat generation	Hydraulic motor	Burned or damaged sliding parts.	Replace the hydraulic motor assembly.
	Reduction gear	Damage to the gears.	Replace the pinion kit, carrier kit.
		Damage to bearings	

2) STANDARD FOR PARTS INSPECTION

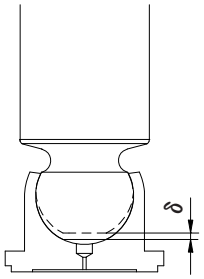
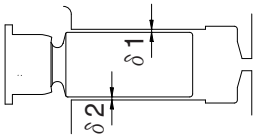
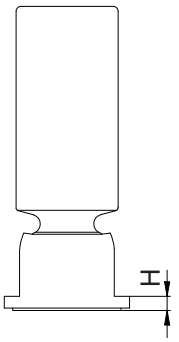
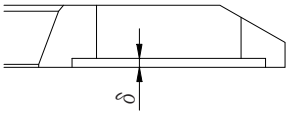
(1) Reduction gear section

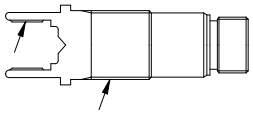
Part	Extent of the damage	Inspection standard	Action
A internal gear	Excessive wear of the surface	Pitching area 5% or more of the gear surface 	Replace the pinion kit.
Carrier 1 Carrier 2	Damage to spline section	By visual	Replace the carrier kit.
S1 gear S2 gear b1 gear b2 gear	Excessive wear of the surface	Pitching area 5% or more of the gear surface 	Replace the carrier kit.
	Excessive wear of the bearing surface	By visual pitching, flaking 	
Ring	Excessive wear of the bearing surface	By visual pitching, flaking 	Replace the carrier kit.
Roller	Excessive wear of the bearing surface	By visual pitching, flaking 	Replace the carrier kit.
Other (O-ring, screw, etc.)	Damage, excessive rust	-	Replace each part.

(2) Hydraulic motor section

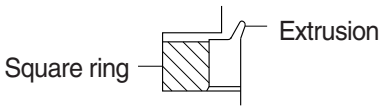
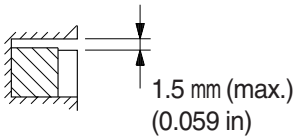
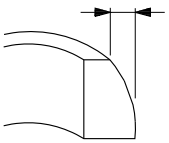
Part	Extent of the damage	Inspection standard	Action
Shaft	Excessive wear of the spline section	Worn depth : 25 μm or more	Replace the hydraulic motor assembly.
Cylinder barrel	Excessive wear to the sliding surface of the valve plate	Worn depth : 20 μm or more	Replace the cylinder barrel kit.
Valve plate	Excessive wear to the sliding surface of the cylinder barrel	Worn depth : 20 μm or more	Replace the cylinder barrel kit.
Piston shoe	Wear of joint section of shoe	Play of piston and shoe : 0.3 mm or more by hand operation	Replace the cylinder barrel kit.
Swash plate	Excessive wear to the sliding surface of the shoe	Worn depth : 0.1 mm or more	Replace the swash plate kit.
Other (O-ring, screw, etc.)	Damage, excessive rust	-	Replace each part.

4. TRAVEL DEVICE

Part name	Check point	Standard dimension	Maximum allowable value (criteria)	Remedy
Piston assy (13) 	Play between piston and slipper	δ = 0.1 mm	δ < 0.5 mm	Replace 9 sets of piston assy
Piston assy (B) and cylinder block (8) 	Clearance/diameter between piston diameter and cylinder bore (δ1 + δ2)	0.03 mm	< 0.07 mm	Replace the set of 1 cylinder barrel and 9 piston assys
Slipper 	Height of the plate	Height H 5 mm	Height H < 4.6 mm	Replace 9 sets of piston assy
Retainer (11) 	Wear		Wear depth δ < 0.2mm	Replace
Swash plate (7)	Condition of sliding surface	Roughness < Ra 0.2μ m	Roughness < Ra 1.6μ m	Replace

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

5. TURNING JOINT

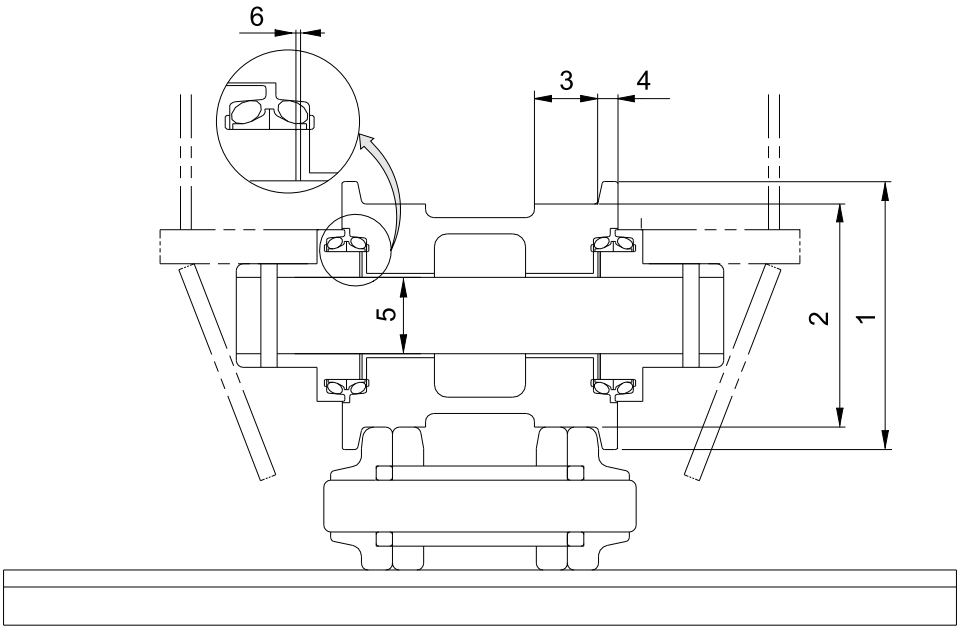
Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure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

6. CYLINDER

Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal.	· 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

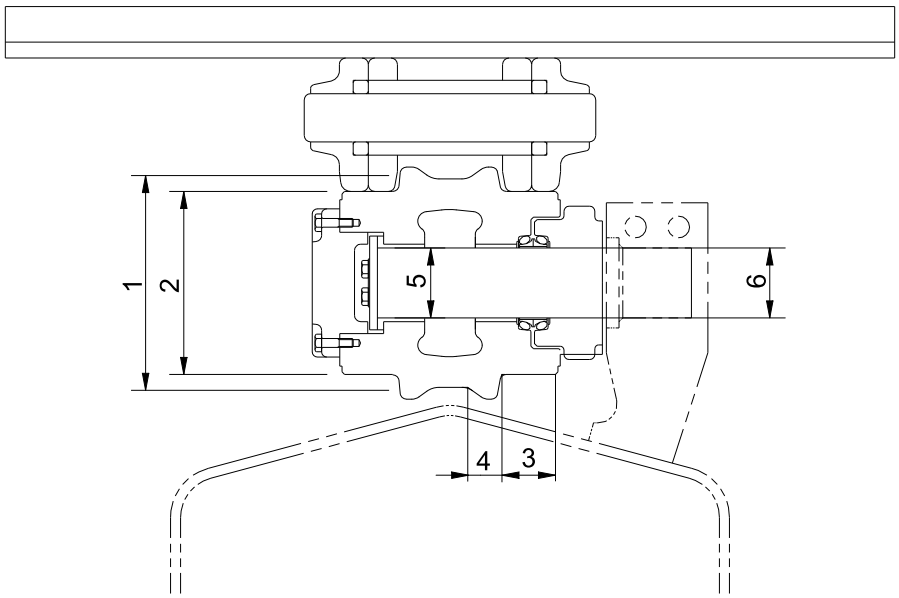


80CR96MC21

Unit : mm

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

2) CARRIER ROLLER

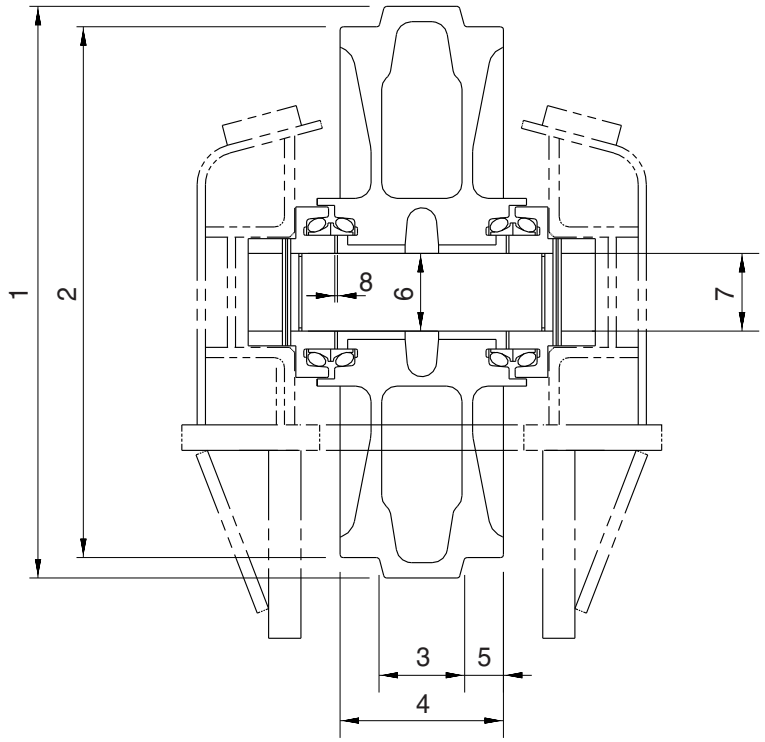


80CR96MC20

Unit : 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	Clearance 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



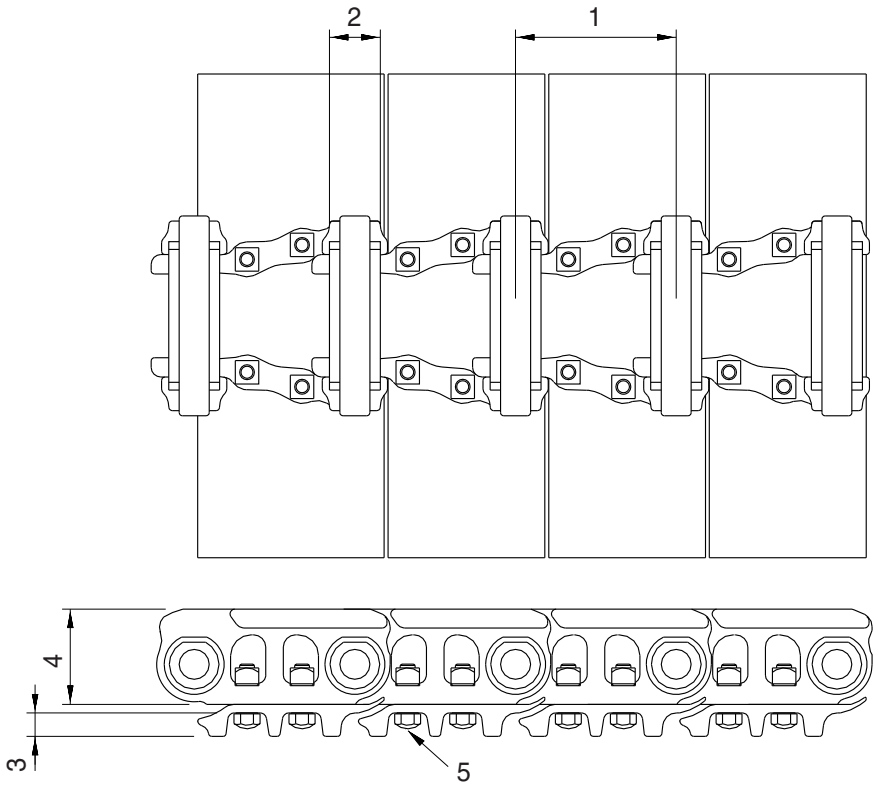
21037MS03

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	ø 60 0 -0.03	ø 60 +0.07 +0.03	0.03~0.1	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance		Clearance limit		Replace bushing
		0.35~1.3		2.0		

4) TRACK

(1) Steel track

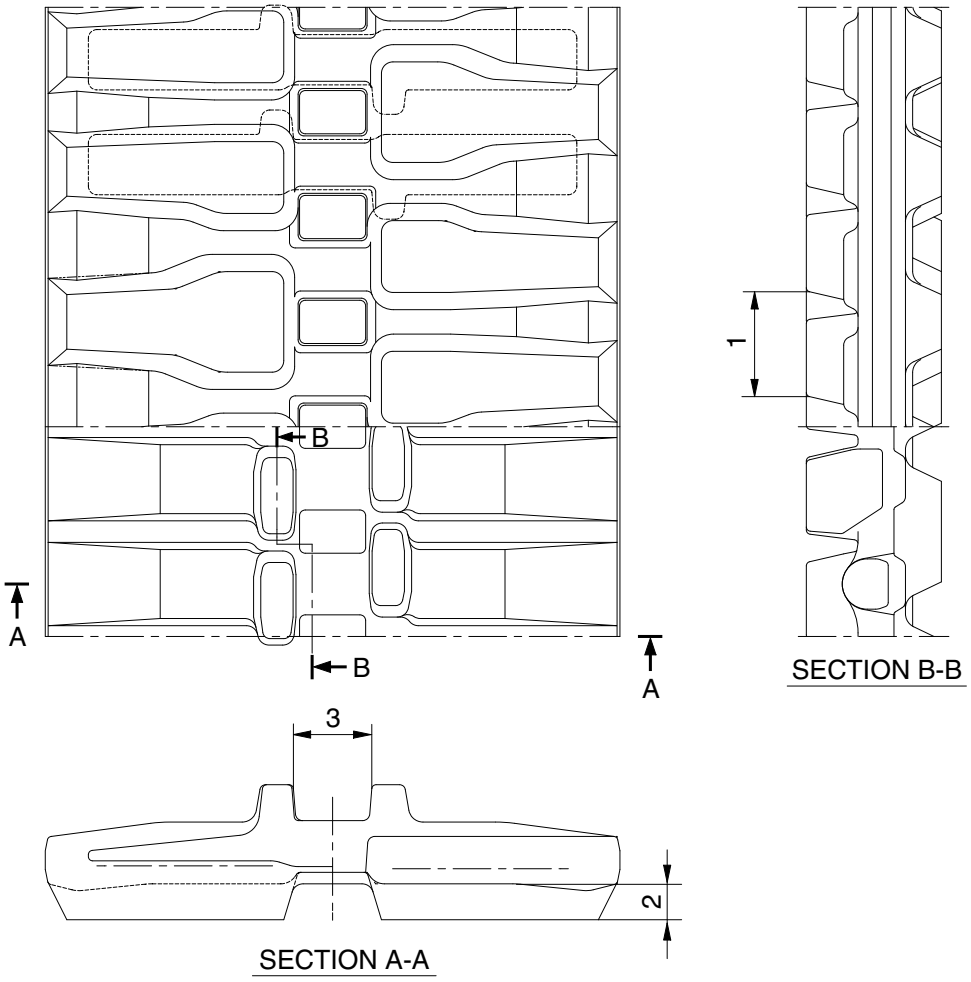


21037MS04

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	ø 41.3	ø 34.3	Rebuild or replace
3	Height of grouser	20	10	
4	Height of link	74	66	
5	Tightening torque	Initial tightening torque : 25.5 ± 2.5 kgf · m		Retighten

(2) Rubber track

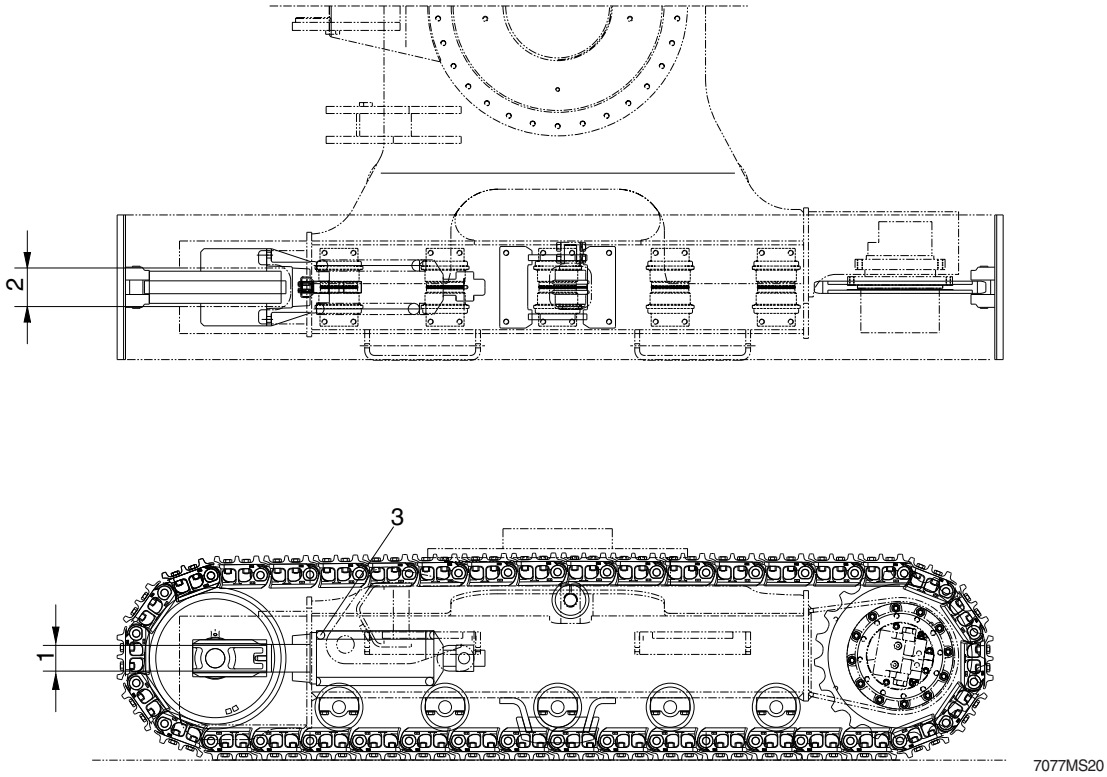


R5576MC17

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	

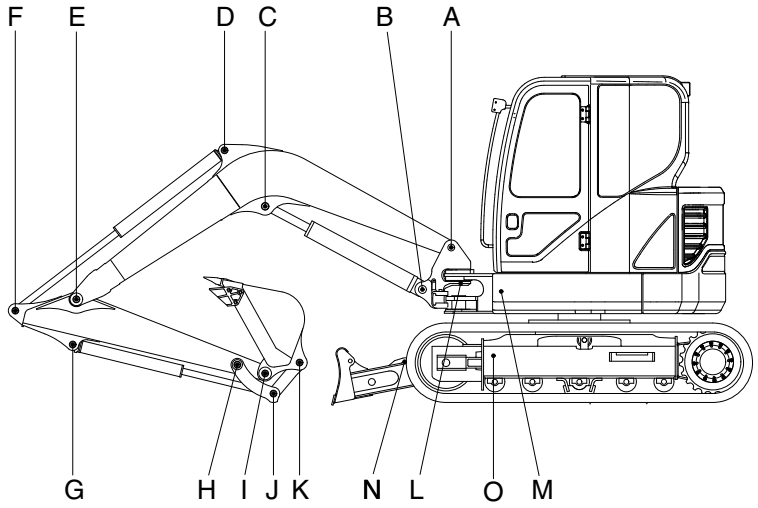
5) TRACK FRAME AND RECOIL SPRING



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	
		ø 170×370	320	5,083 kg	-	4,174 kg	

2. WORK EQUIPMENT



80CR96MC22

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	Boom swing post	110	109	108.5	110.5	111	〃
M	Boom swing cylinder	65	64	63.5	65.5	66	〃
N	Blade cylinder	65	64	63.5	65.5	66	〃
O	Blade and frame link	55	54	53.5	55.5	56	〃

SECTION 7 DISASSEMBLY AND ASSEMBLY

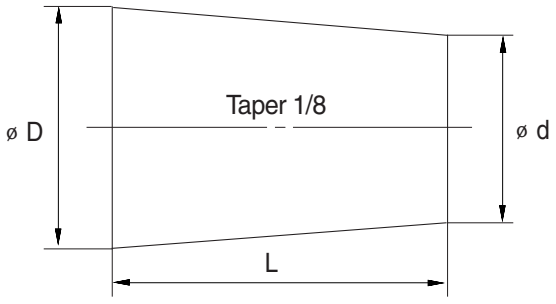
SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

1) Lower the work equipment completely to the ground.
   If the coolant contains antifreeze, dispose of it correctly.
2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
3) When draining oil, prepare a container of adequate size to catch the oil.
4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.
6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
7) Check the number and thickness of the shims, and keep in a safe place.
8) When raising components, be sure to use lifting equipment of ample strength.
9) When using forcing screws to remove any components, tighten the forcing screws alternately.
10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.
11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.
12) If the part is not under hydraulic pressure, the following corks can be used.

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



2. INSTALL WORK

1) Tighten all bolts and nuts(Sleeve nuts) to the specified torque.
2) Install the hoses without twisting or interference.
3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
4) Bend the cotter pin or lock plate securely.
5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.
6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
7) Clean all parts, and correct any damage, dents, burrs, or rust.
8) Coat rotating parts and sliding parts with engine oil.
9) When press fitting parts, coat the surface with antifriction compound(LM-P).
10) After installing snap rings, check that the snap ring is fitted securely in the ring groove(Check that the snap ring moves in the direction of rotation).
11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.
13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:
    (1) Start the engine and run at low idling.
    (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100㎜ before the end of the stroke.
    (3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)
    (4) After completing this operation, raise the engine speed to the normal operating condition.

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

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

3. COMPLETING WORK

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

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

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

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket)	M10 × 1.5	6.9±1.0	50±7.2
2		Engine mounting bolt (bracket-frame)	M16 × 2.0	25±2.5	181±18.1
3		Radiator mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
4		Coupling mounting bolt	M14 × 2.0	14±1.0	101±7.2
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	12±1.0	86.8±7.2
6		Main control valve mounting bolt	M 8 × 1.25	3.4±0.7	24.6±5.0
7		Fuel tank mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
8		Hydraulic oil tank mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
9		Turning joint mounting bolt, nut	M12 × 1.75	12.3±1.3	89±9.4
10	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
11		Swing bearing upper mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
12		Swing bearing lower mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
13		Travel motor mounting bolt	M16 × 2.0	23±2.5	166±18.1
14	Under carriage	Sprocket mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
15		Carrier roller mounting bolt, nut	M16 × 2.0	29.7±3.0	215±21.7
16		Track roller mounting bolt	M14 × 2.0	19.6±2.0	142±14.5
17		Track tension cylinder mounting bolt	M16 × 2.0	29.7±3.0	215±21.7
18		Track shoe mounting bolt, nut	M14 × 1.5	25.5±2.5	184±18.1
19	Others	Counter weight mounting bolt	M27 × 3.0	140±15	1013±108
20		Cab mounting bolt, nut	M12 × 1.75	12.2±1.3	88.2±9.4
21		Operator's seat mounting bolt	M 8 × 1.25	1.17±0.5	8.5±3.6

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

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

(2) Fine thread

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

2) PIPE AND HOSE (FLARE type)

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

3) PIPE AND HOSE (ORFS type)

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

4) FITTING

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

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

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

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

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

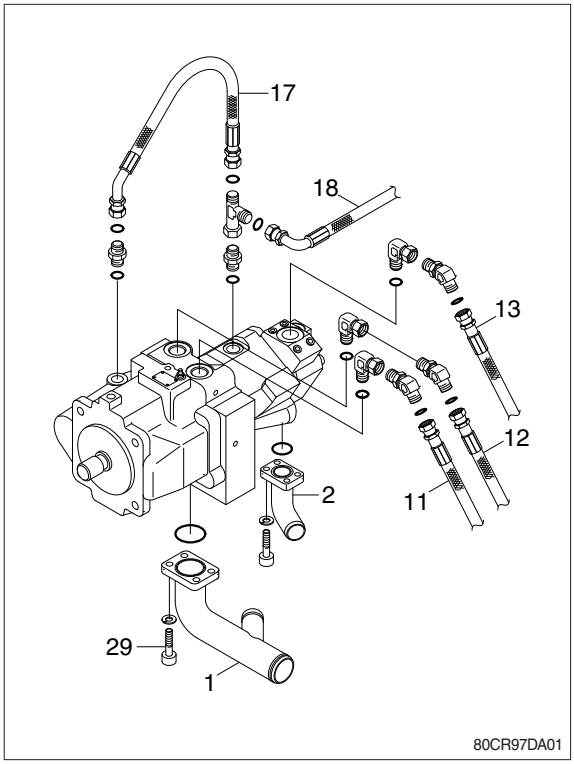
(6) Remove bolts (29) and disconnect pump suction pipe (1, 2).

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

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

- Weight : 60 kg (70 lb)

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



2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

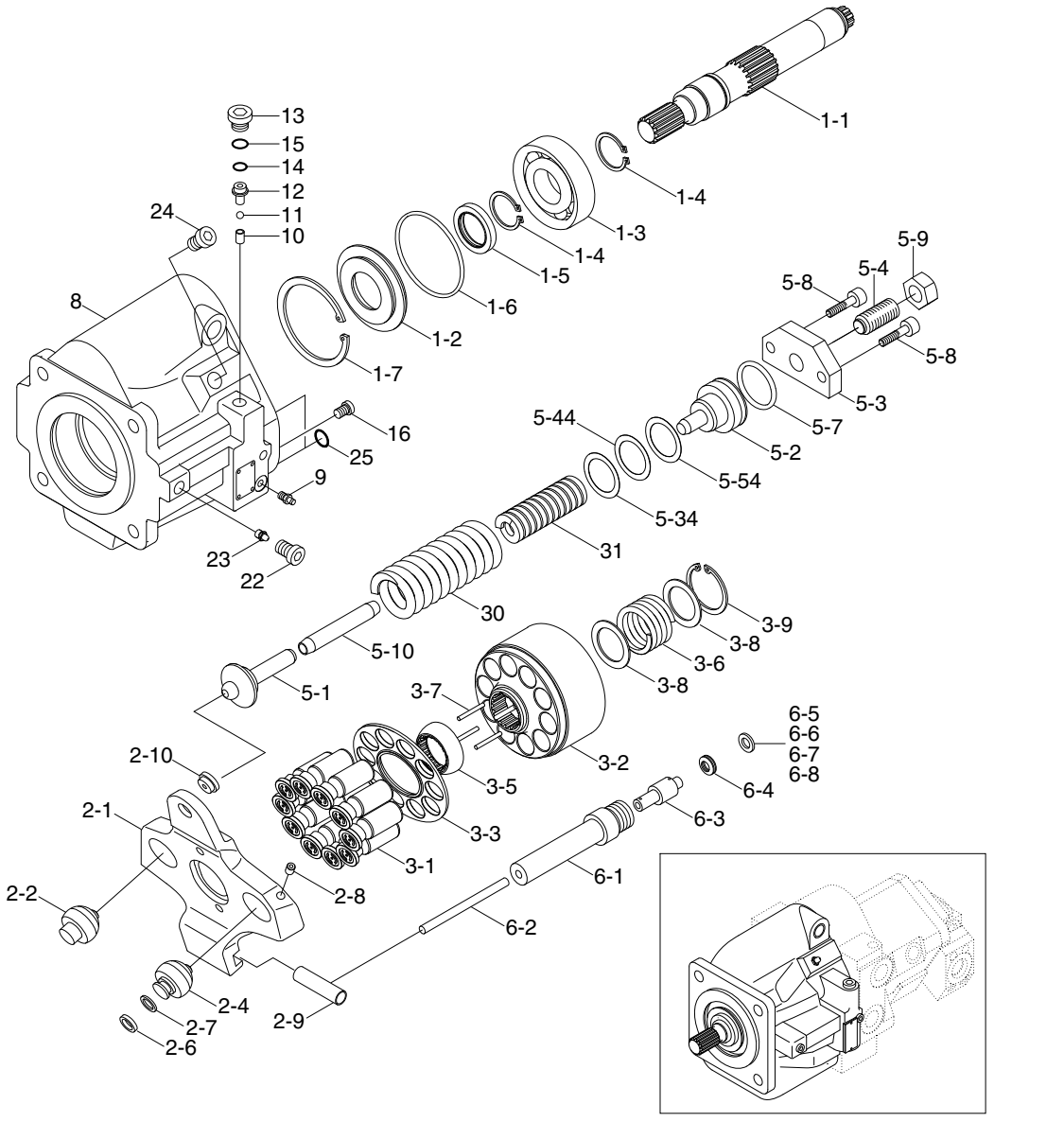
(6) Bleed the air from the hydraulic pump.
① Loosen the air vent plug.
② Start the engine, run at low idling, and check oil come out from plug.
③ Tighten plug.

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

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

2. MAIN PUMP

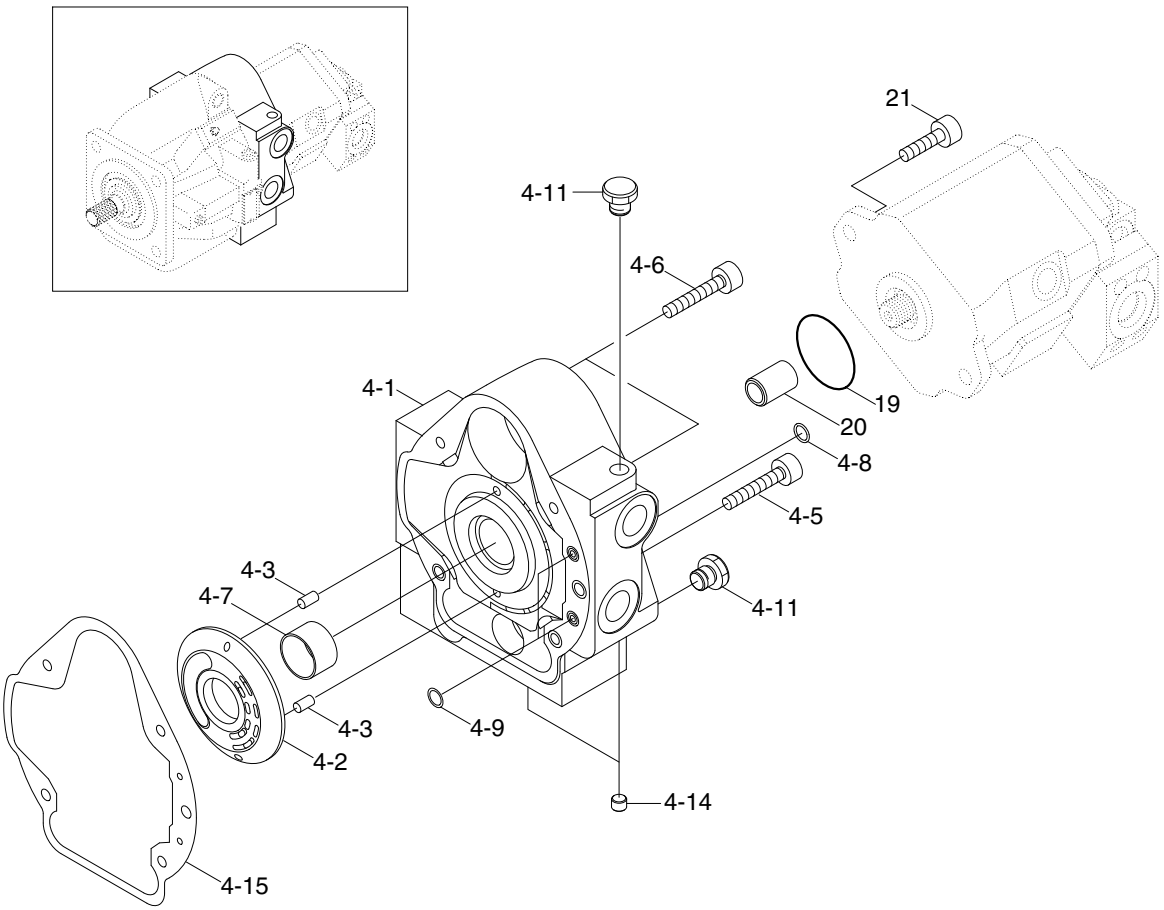
1) STRUCTURE (1/3)



80CR97MP100

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

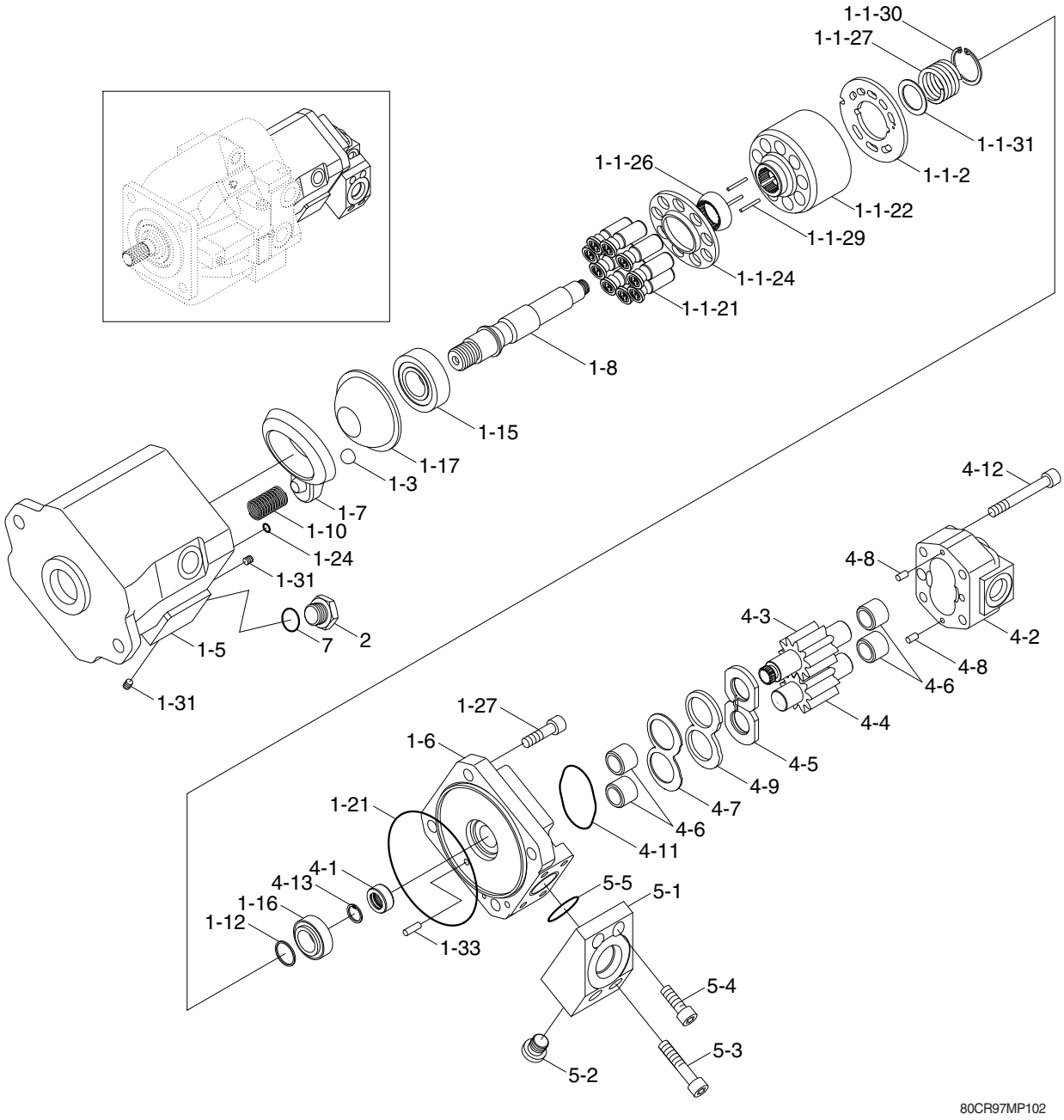
STRUCTURE (2/3)



80CR97MP101

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

STRUCTURE (3/3)



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

3. DISASSEMBLY AND ASSEMBLY

1) NECESSARY TOOLS AND JIGS

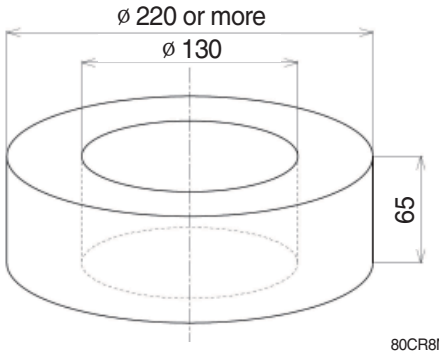
The following tools and jigs are necessary to disassemble and assemble the pump.

(1) Tools

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

(2) Jigs

Disassemble table



80CR8MP01

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

Guide bolt for disassemble and assemble port plate

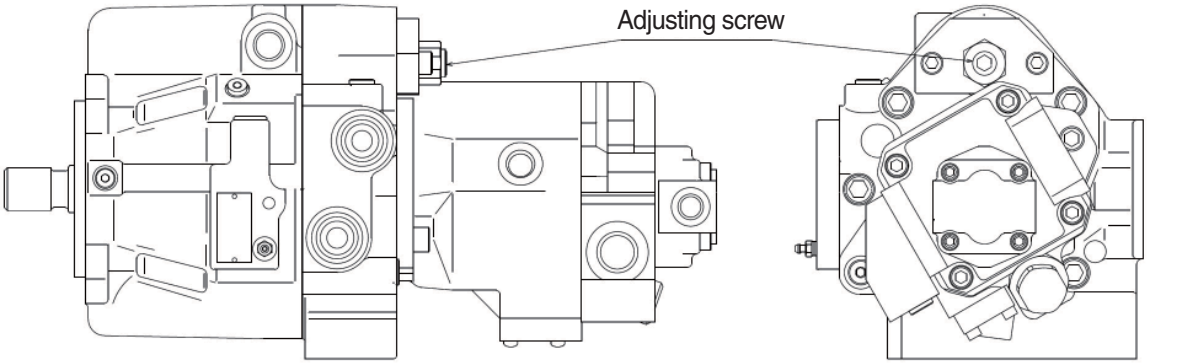
Stud bolt can be possible

80CR8MP02

2) CAUTIONS DURING DISASSEMBLING AND ASSEMBLING

(1) Cautions for disassembling

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



80CR8MP03

(2) Cautions for assembling

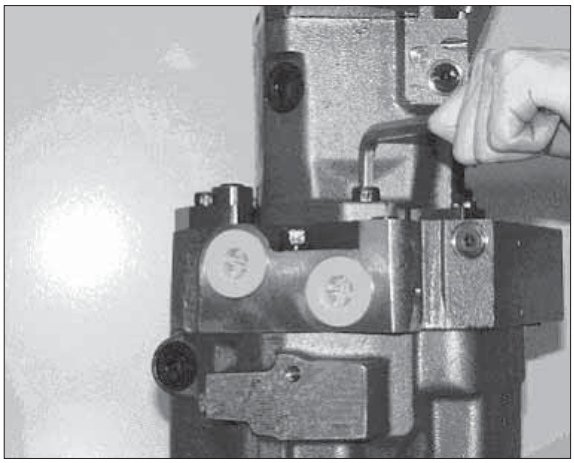
① Wash each part thoroughly.
② During assembling, take utmost care not to damage the part or allow foreign materials to enter.
③ Special attention is necessary for assemble port plate, because spring load is very high.
④ As a rule, the O-ring and oil seal should not be reused.
⑤ Apply the grease for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

3) DISASSEMBLING PROCEDURE (main pump)

(1) Disassembling the rear pump.

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

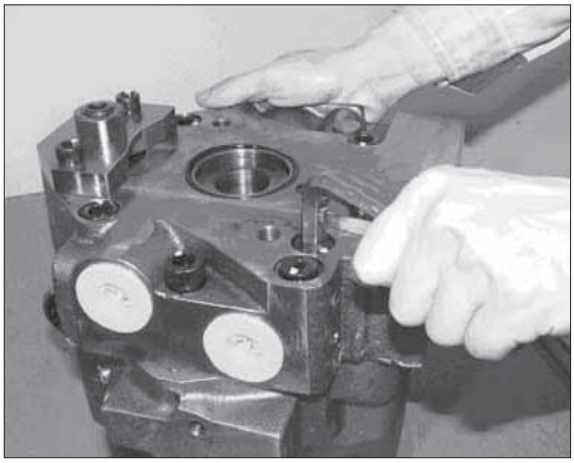
② Coupling on the port plate side are detached at the same time.



80CR8MP04

(2) Remove the port plate.

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

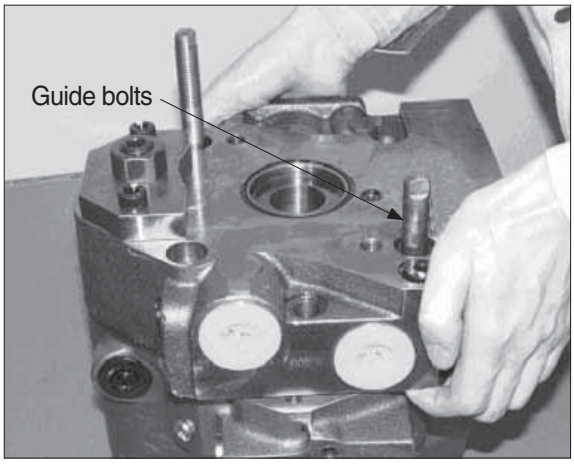


80CR8MP05

② Install the guide bolts to the port plate.

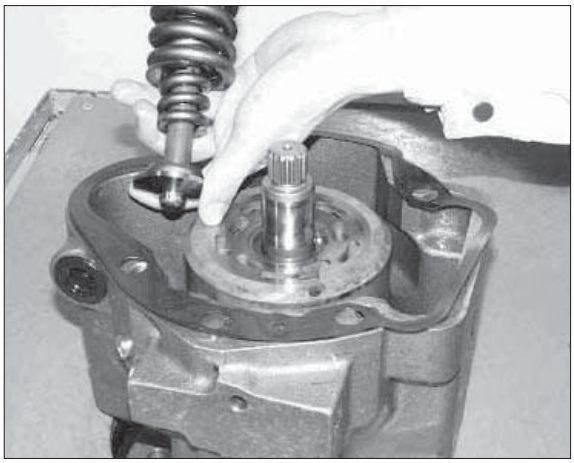
Be careful because control plate and control piston are on the backside of port plate.

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



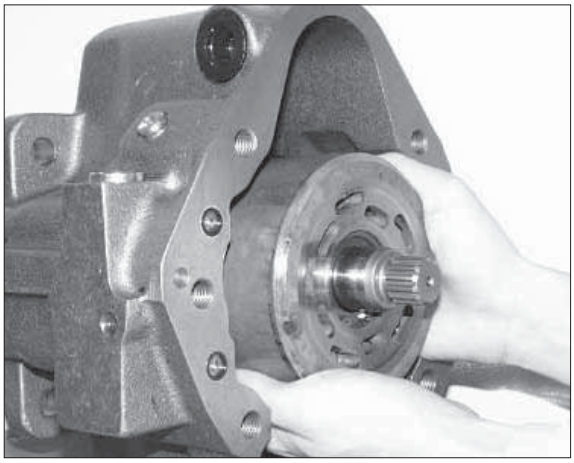
80CR8MP06

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



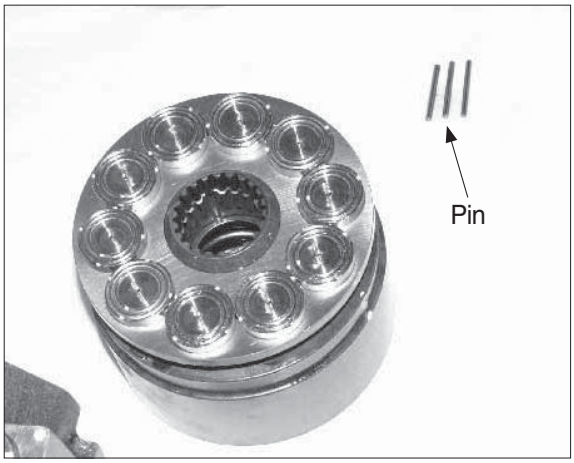
80CR8MP07

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



80CR8MP08

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

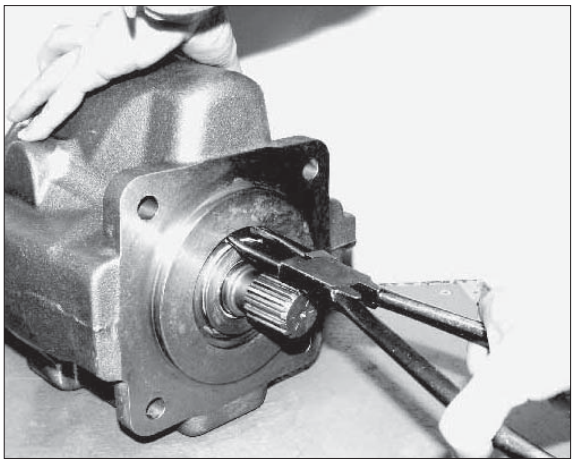


80CR8MP09

(5) Remove the shaft.

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

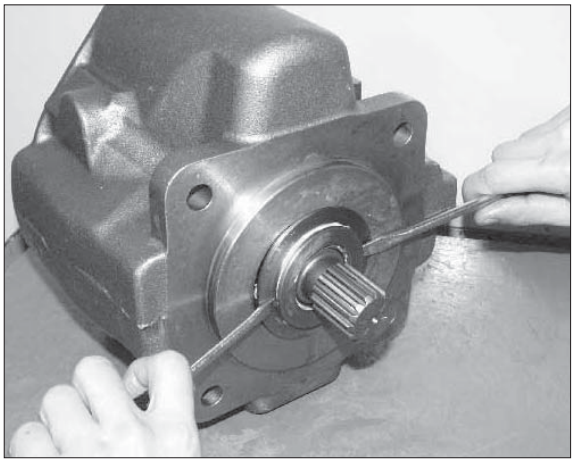
Pliers for retaining rings
(For bore use ; retaining ring for 80)



80CR8MP10

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

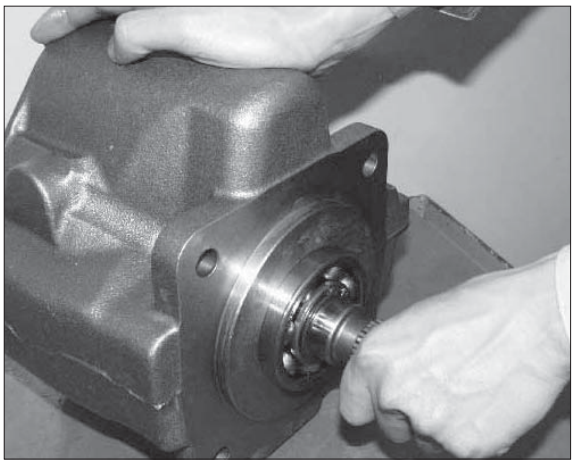
Screwdrivers for slotted-head screws (medium size)



80CR8MP11

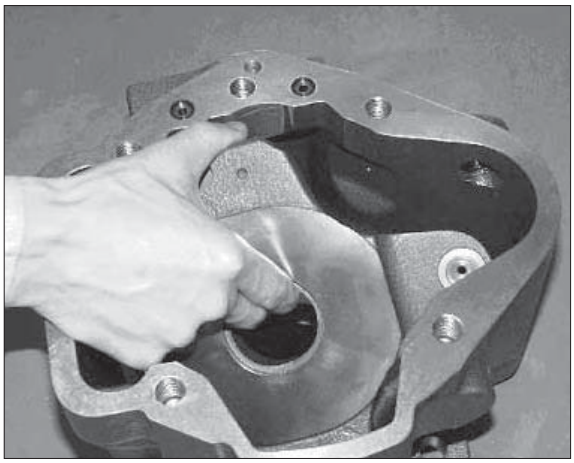
③ Remove the shaft.

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



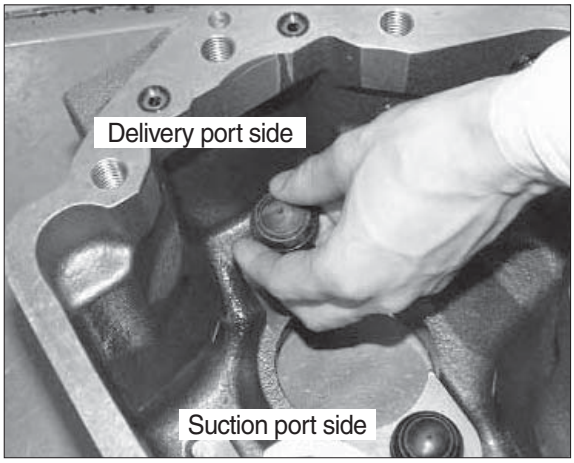
80CR8MP12

(6) Remove the swash plate.



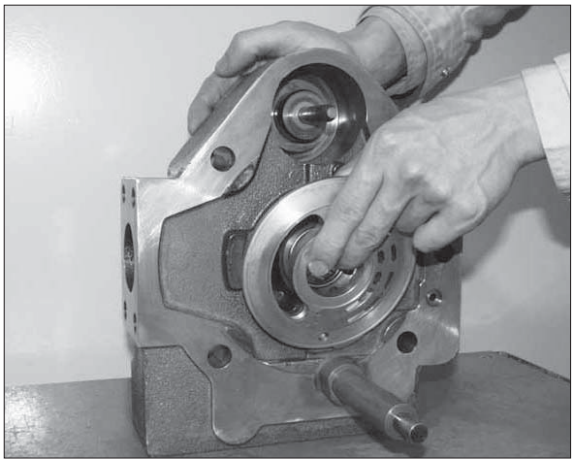
80CR8MP13

(7) Disassemble the ball guide.



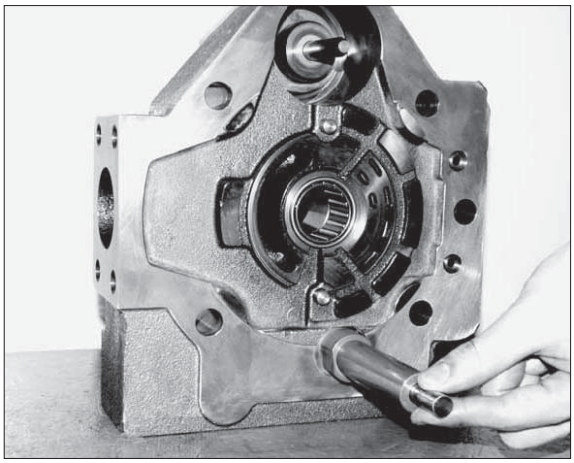
80CR8MP14

(8) Disassemble the port plate.
① Remove the control plate.



80CR8MP15

② Remove the control piston assembly.
Remove the piston.

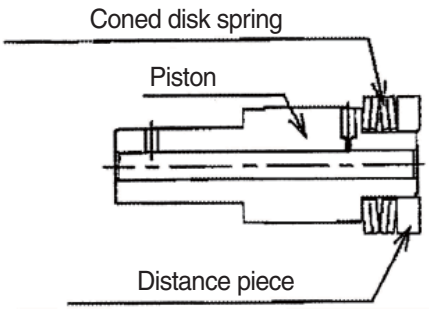


80CR8MP16

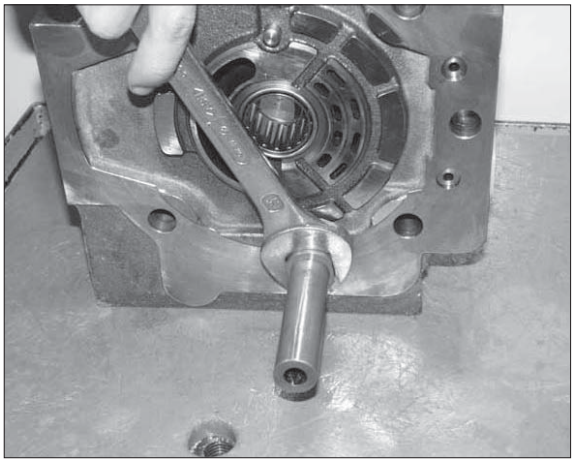
③ Remove the cylinder.

· Spanner (27 ㎜)

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



80CR8MP18



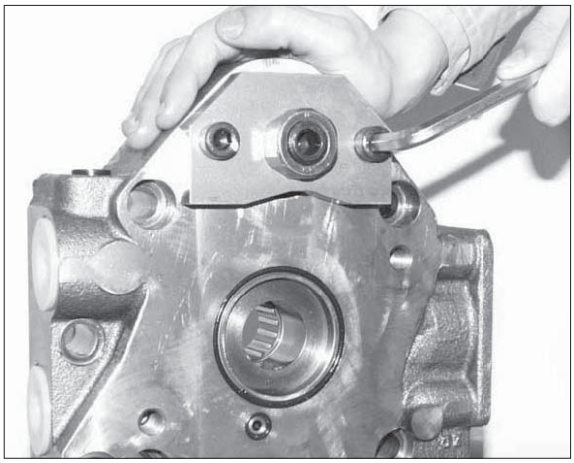
80CR8MP17

④ Remove the spring seat assembly.

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

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

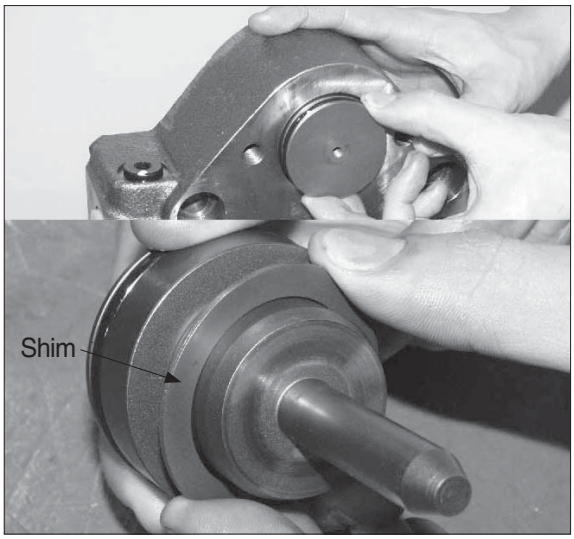
Only when it is necessary



80CR8MP19

⑤ Remove the spring seat.

Be careful because shim might attach to the spring seat.

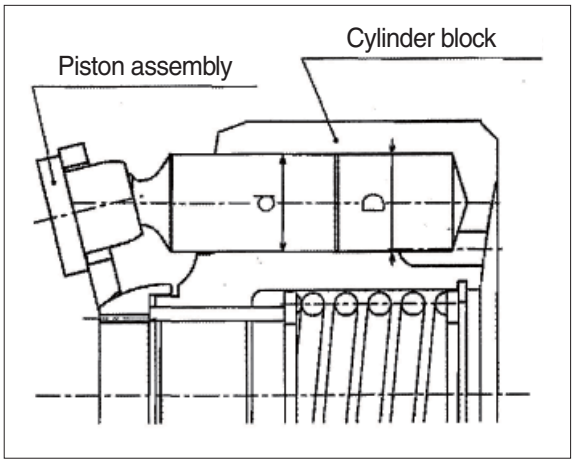


80CR8MP20

4) MAINTENANCE AND SERVICE STANDARD FOR THE MAIN PUMP

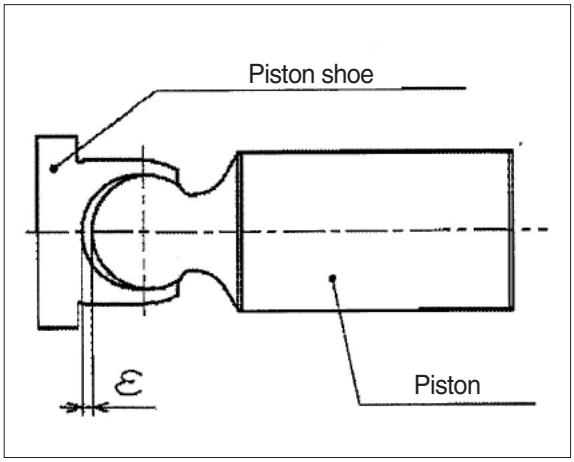
Before inspection wash the parts well and dry them completely.
Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.
Replace the seal also when any remarkable deformation and damage are found.

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



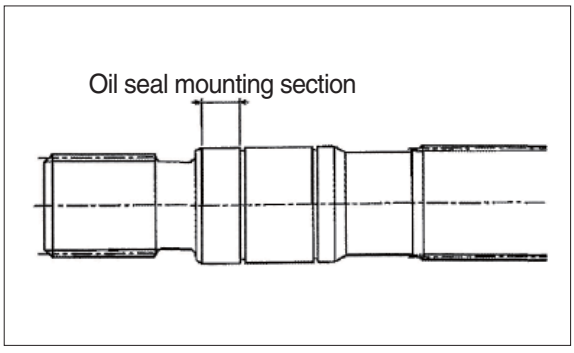
80CR8MP21

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



80CR8MP22

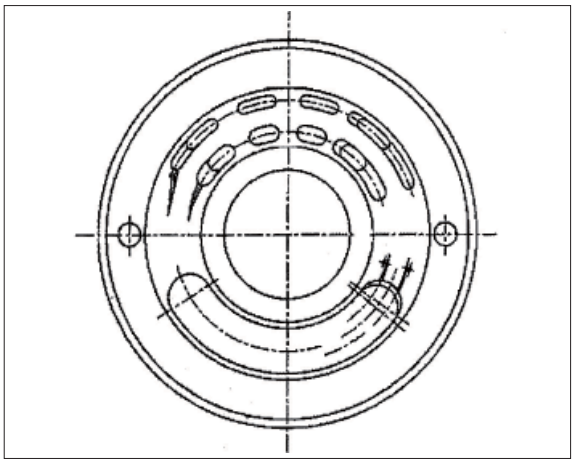
(3) Shaft
- Check the wear amount of the oil seal mounting section.
  Wear amount ≤ 0.025 mm



80CR8MP23

(4) Control plate

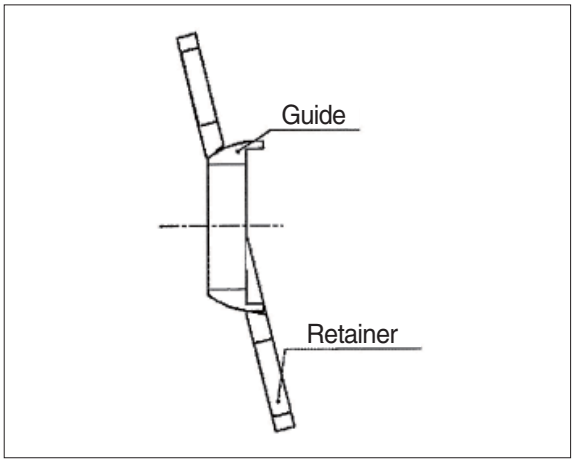
- Check the slide surface for any damage.
  When the damage is large replace the control plate with new one.



80CR8MP24

(5) Guide and retainer

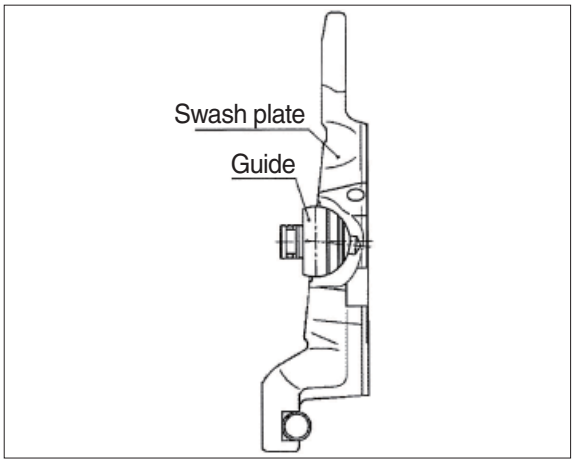
- Check for scouring or stepped wear.
  If this can not be corrected replace the guide and the retainer as a set.
- Fine scouring or damage can be corrected with lapping.
  Carry out through washing after lapping.



80CR8MP25

(6) Guide and swash plate

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

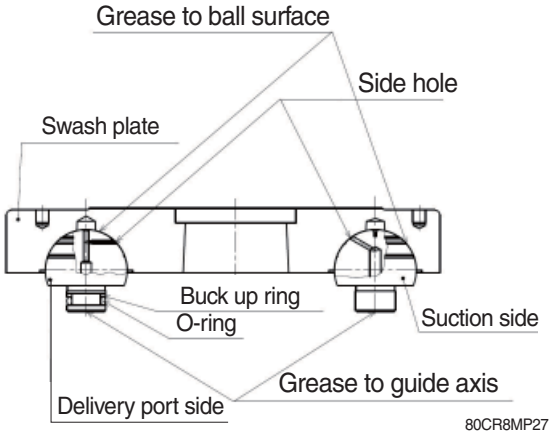


80CR8MP26

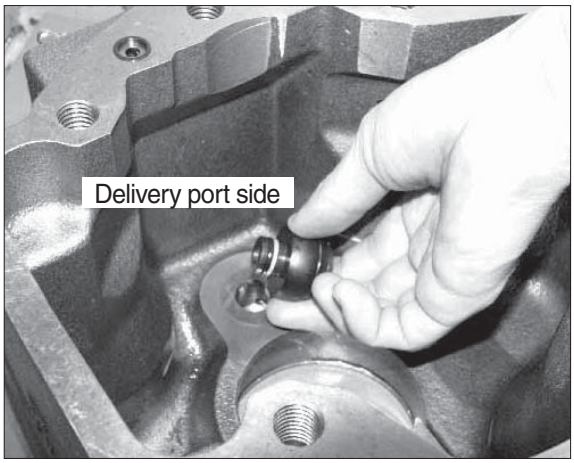
5) ASSEMBLING PROCEDURE (main pump)

(1) Assemble the swash plate

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

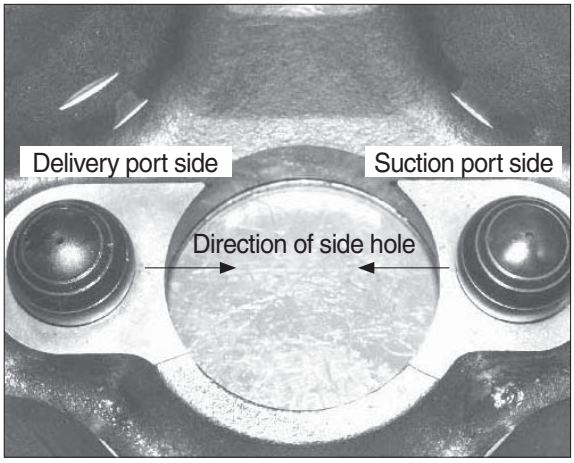


80CR8MP27



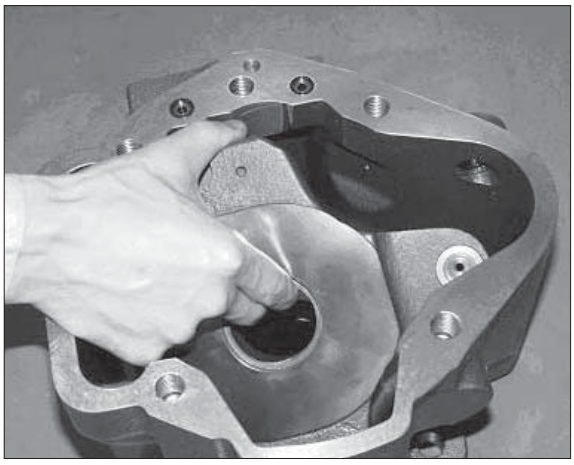
80CR8MP28

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



80CR8MP29

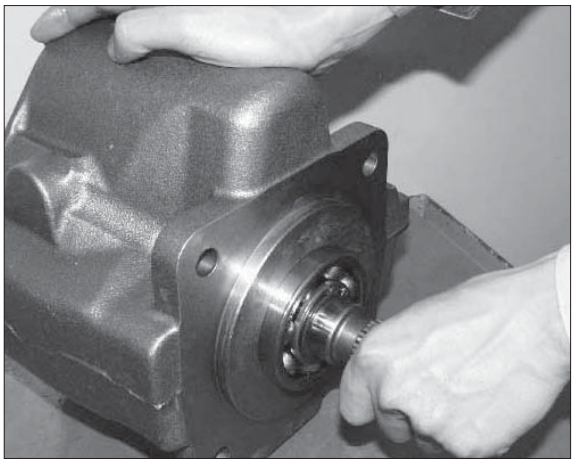
③ Install the swash plate.


80CR8MP30

(2) Assemble the shaft

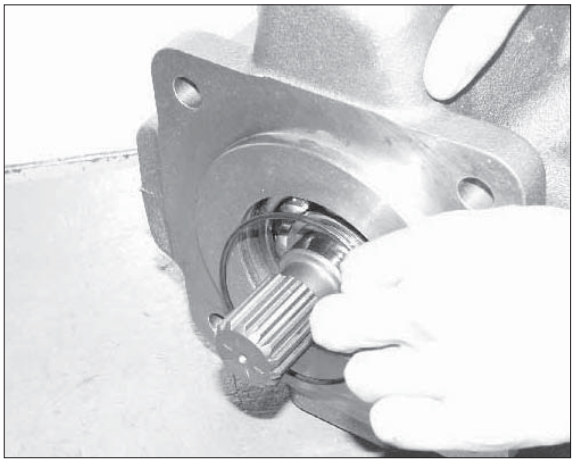
① Install the shaft into the housing with taking care not to drop swash plate out. Fix the bearing outer ring firmly into the housing hole.

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



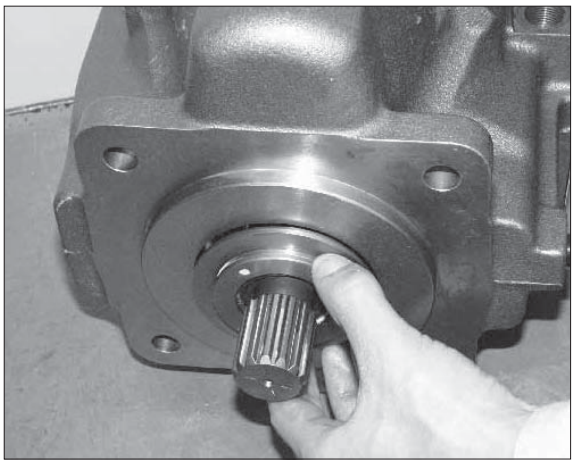
80CR8MP31

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



80CR8MP32

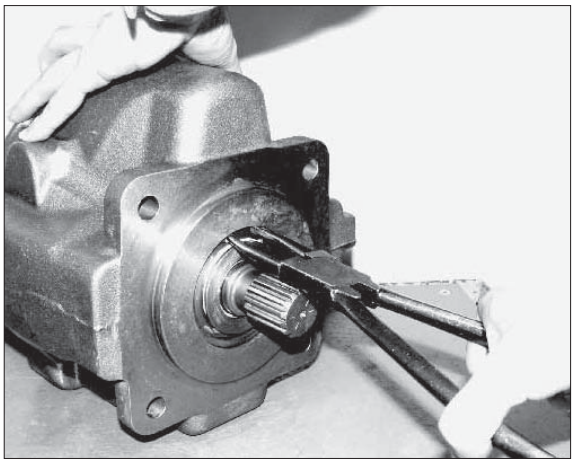
③ Install the oil seal case into the shaft. Apply grease to the oil seal lip beforehand.
Be careful not to damage shaft seal with spline.



80CR8MP33

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

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



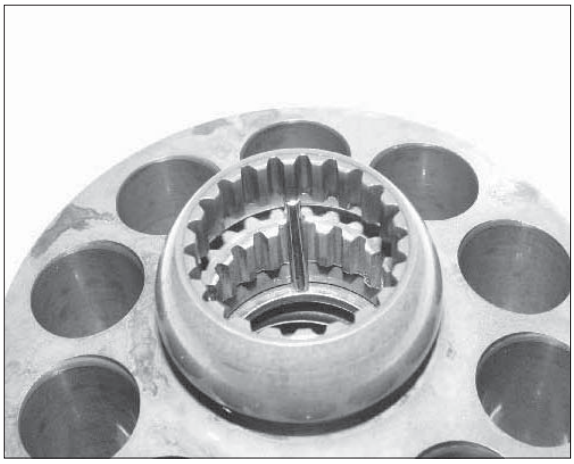
80CR8MP34

(3) Assemble the rotary group.

① Apply the grease to the parallel pins (ø3×30, 3 pieces) and install them to the ditch part of spline.

80CR8MP35

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

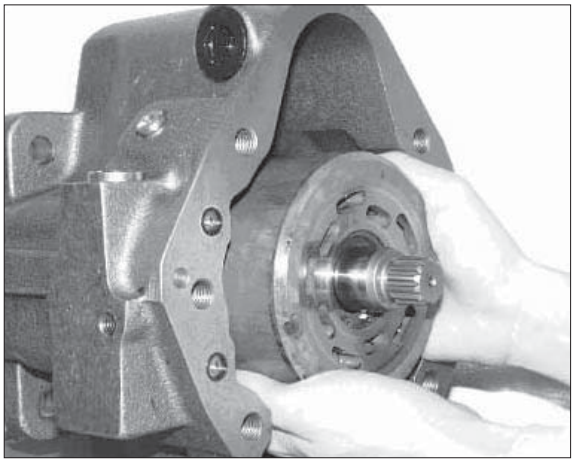


80CR8MP36

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

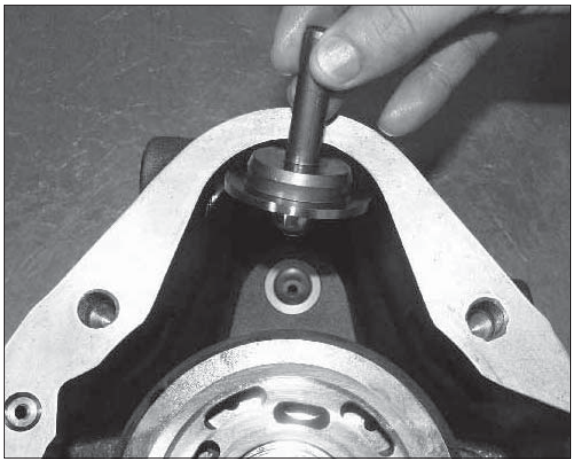
80CR8MP37

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



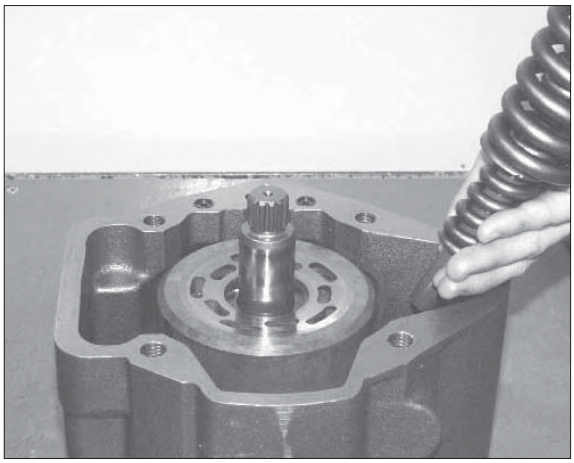
80CR8MP38

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



80CR8MP39

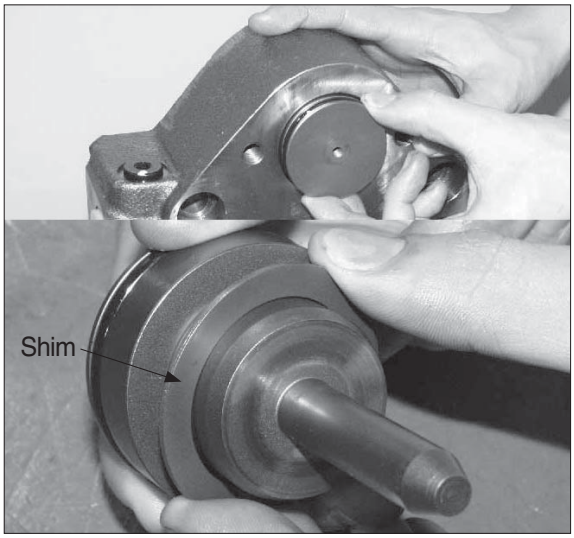
② Assemble the springs (inner and outer) and the guide.



80CR8MP40

③ Install the spring seat into the port plate.

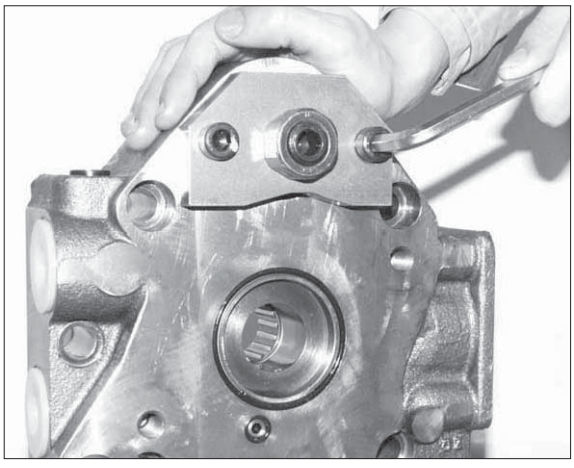
Apply grease to the shim for dropout prevention when shim has attached to the spring seat.



80CR8MP20

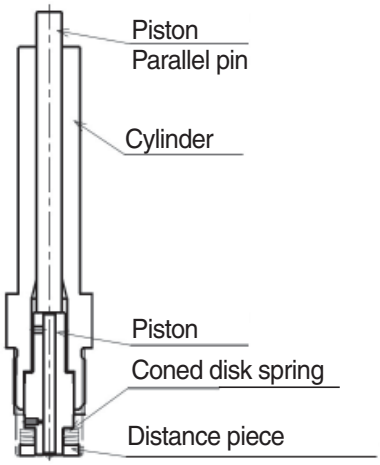
④ Assemble the cover.
Fix the hexagon socket head cap screws.
(M10×30, 2 pieces)

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



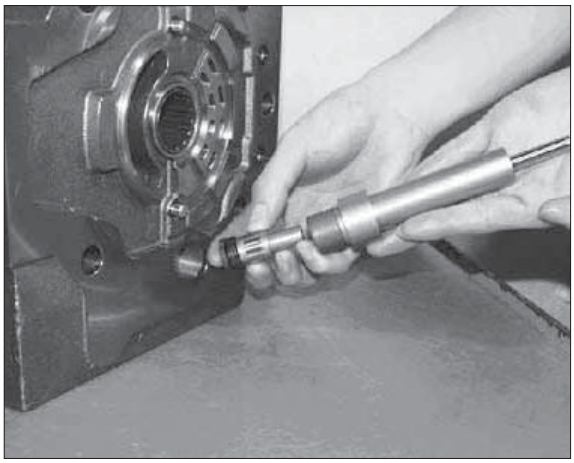
80CR8MP41

(6) Assemble the control piston assembly.



80CR8MP43

Apply three bond #1305 to the thread of the cylinder.
Spanner (27 mm)
Tightening torque : 14.5±1.4 kgf · m
(105±10.3 lbf · ft)

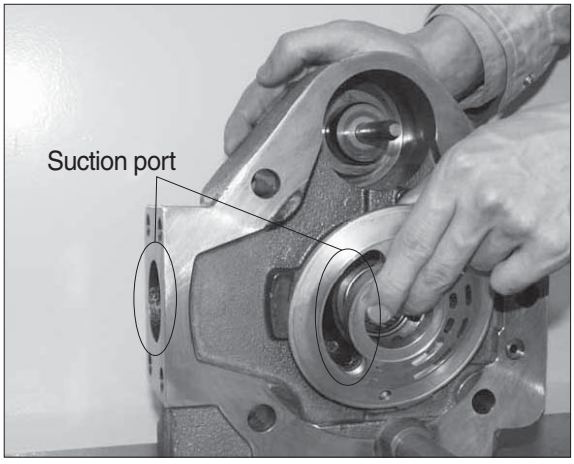


80CR8MP42

(7) Assemble the control plate.

① Apply the grease between port plate and control plate for dropout prevention and assemble the control plate to the port plate.

② Apply the grease to the operating surface of control plate.

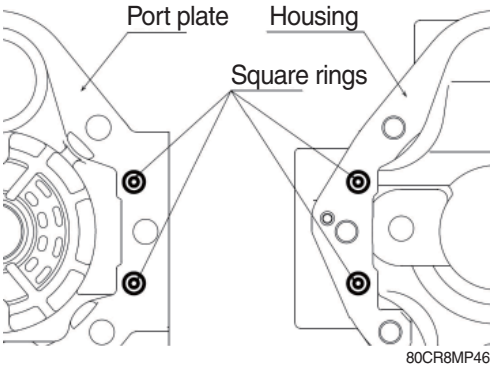


80CR8MP44

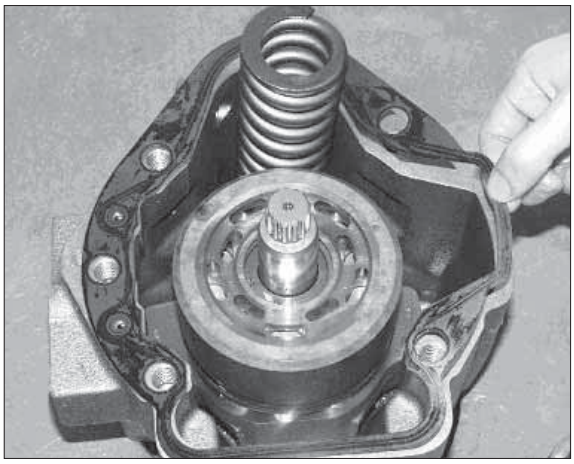
(8) Assemble the port plate assembly.

① Assemble the square rings to the housing side and port plate side (each 2 pieces).

② Assemble the gasket on the housing surface.



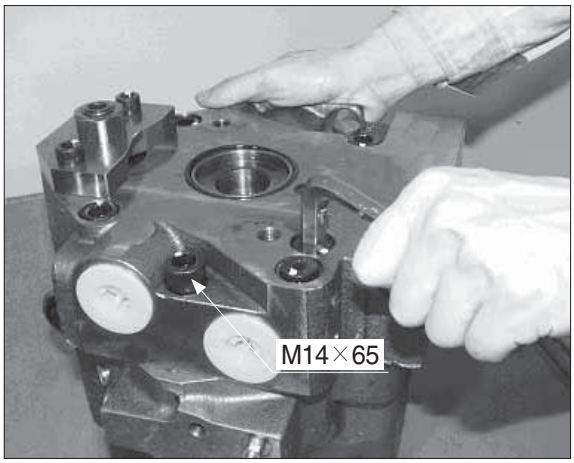
80CR8MP46



80CR8MP45

③ Fix the port plate with the hexagon socket head cap screw.
(M14×70, 4 pieces)
(M14×65, 1 pieces)

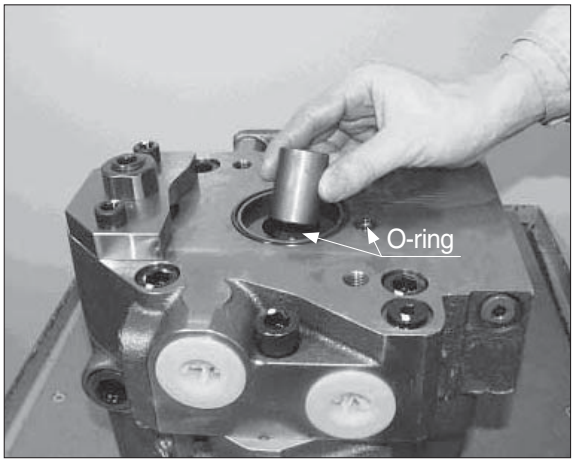
Hexagon socket screw key
(Hexagon side distance : 12 mm)
Tightening torque : 16.8±1.5 kgf · m
(122±11.1 lbf · ft)



80CR8MP47

(9) Assemble the rear pump.
Install the coupling.

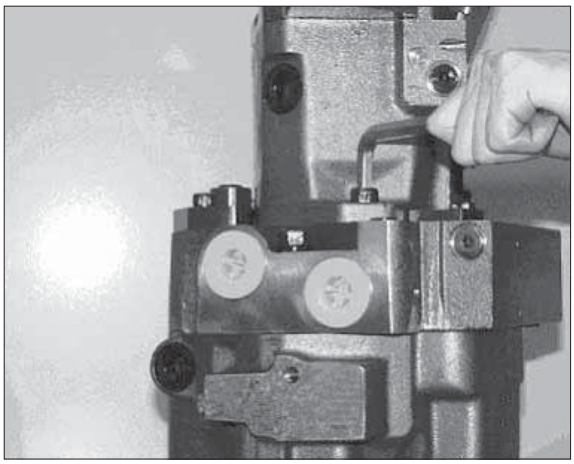
Confirm the O-rings.



80CR8MP48

① Fix the rear pump with the hexagon socket head cap screws.
(M12×30, 2 pieces)

Hexagon socket screw key
(Hexagon side distance : 10 mm)
Tightening torque : 11.2±1.2 kgf · m
(81.1±8.9 lbf · ft)



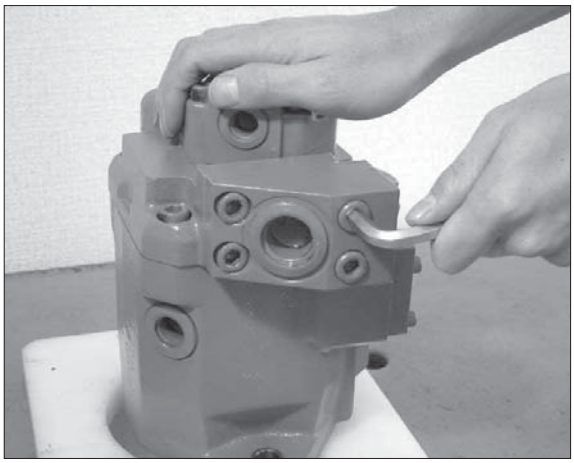
80CR8MP49

6) DISASSEMBLING PROCEDURE (rear pump)

(1) Remove the flange.

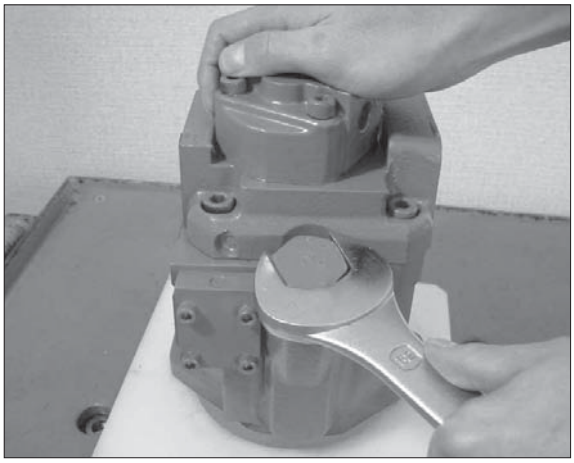
Remove the hexagon socket head cap screws.
(M10×45, 2 pieces, M10×20, 2 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 mm)



80CR8MP50

(2) Remove the plug.
Spanner (32 mm)

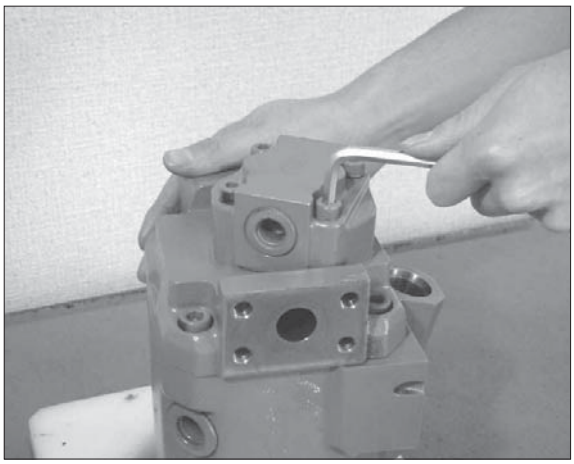


80CR8MP51

(3) Remove the gear pump.

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

Hexagon socket screw key
(Hexagon side distance : 6 mm)

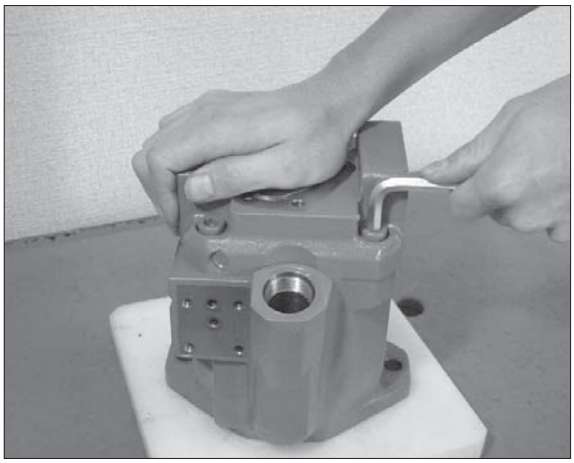


80CR8MP52

(4) Remove the port plate.

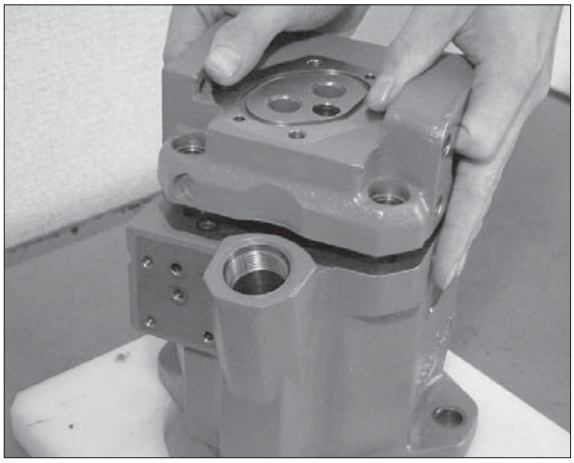
① Remove the hexagon socket head cap screws.
(M10×30, 4 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 ㎜)



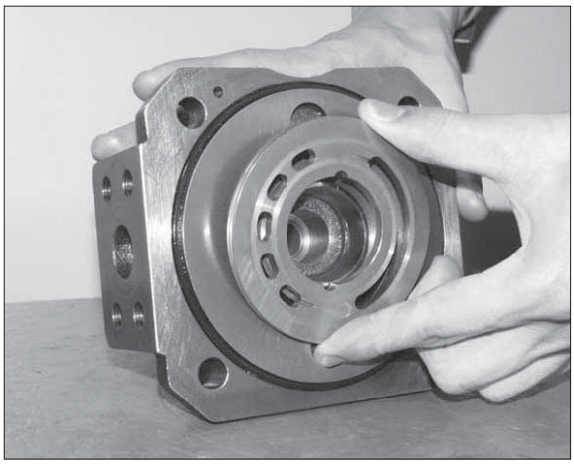
80CR8MP53

② Remove the port plate.



80CR8MP54

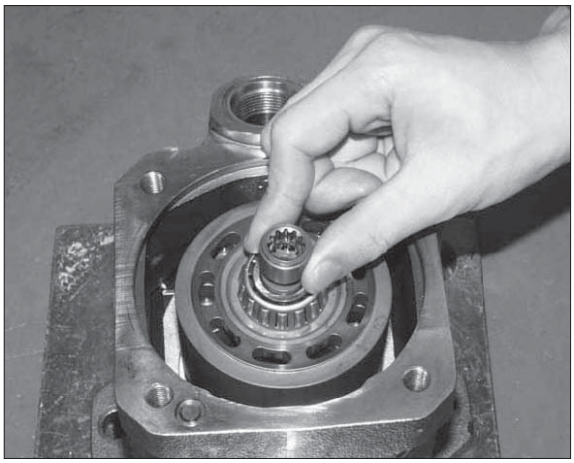
③ Remove the control plate from the port plate.



80CR8MP55

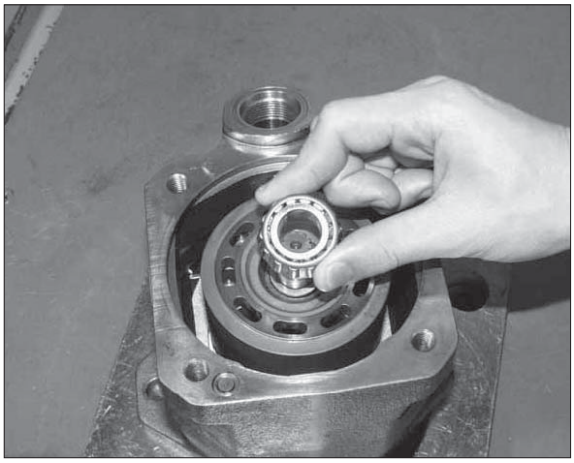
(5) Remove the parts from the pump housing.

① Remove the coupling.



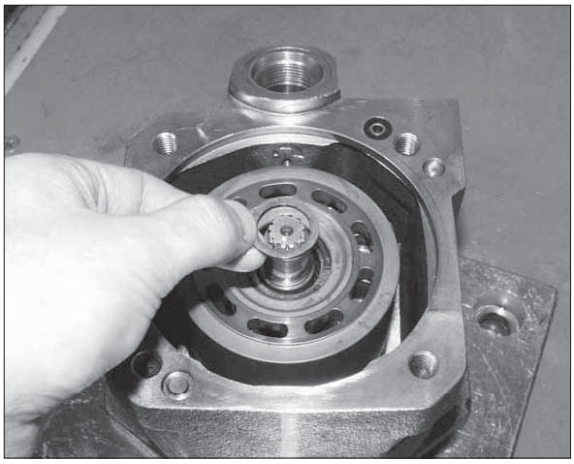
80CR8MP56

② Remove the bearing.



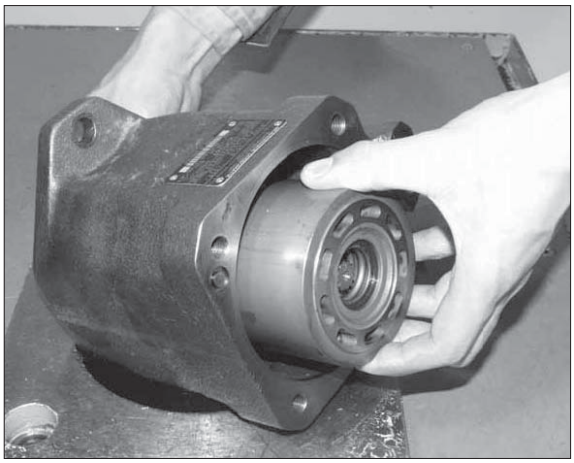
80CR8MP57

③ Remove the shim.



80CR8MP58

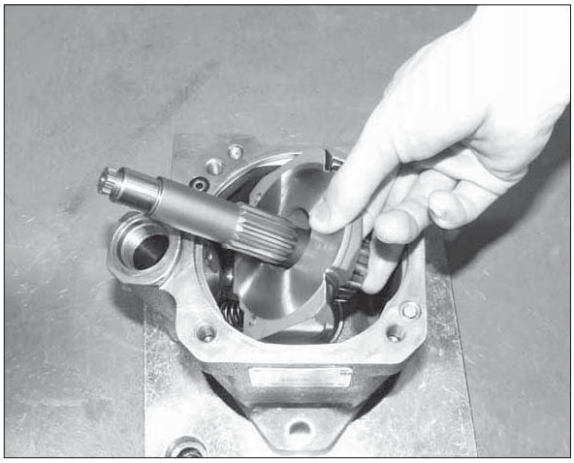
④ Remove the rotary group.



80CR8MP59

⑤ Remove the swash plate and the drive shaft.

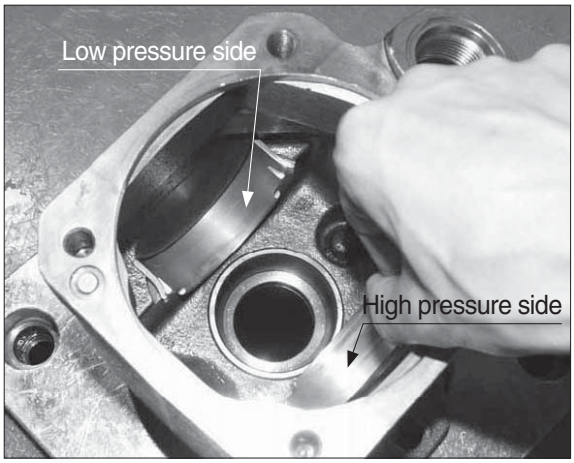
Note the spring that is on the back side of the swash plate.



80CR8MP60

⑥ Remove the cradle shells.

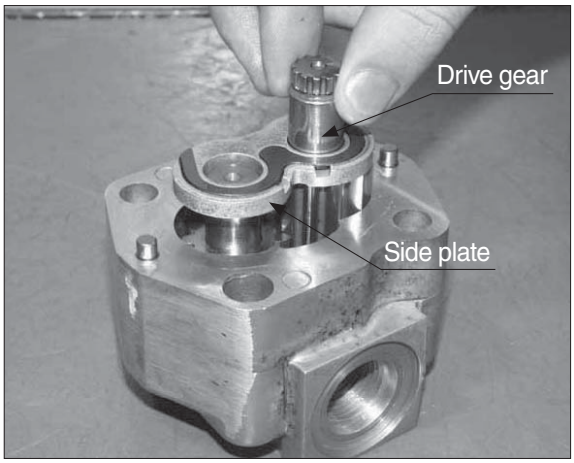
Mark the cradle shells so that it should not make a mistake in the position of a low-pressure side and a high-pressure side.



80CR8MP61

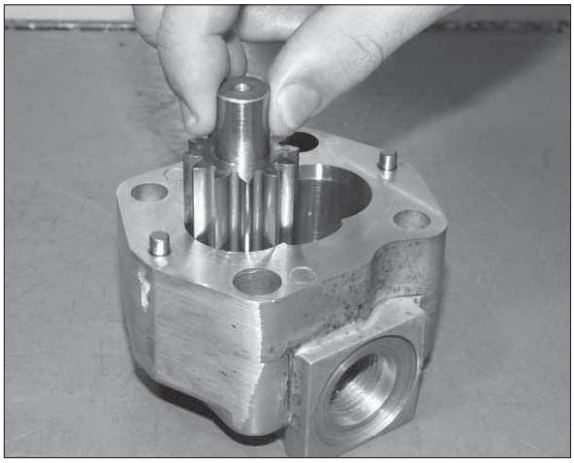
(4) Disassemble the gear pump.

① Remove the drive gear and the side plate.



80CR8MP62

② Remove the idle gear.

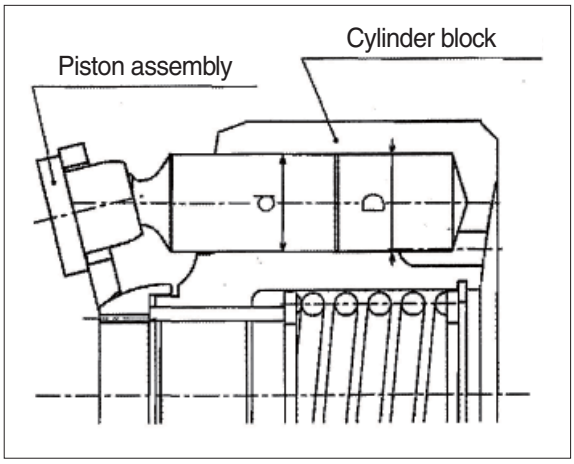


80CR8MP63

7) MAINTENANCE AND SERVICE STANDARD FOR THE REAR PUMP

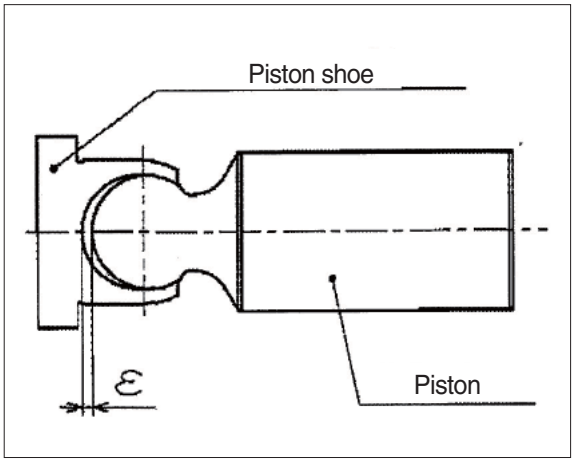
Before inspection wash the parts well and dry them completely.
Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.
Replace the seal also when any remarkable deformation and damage are found.

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



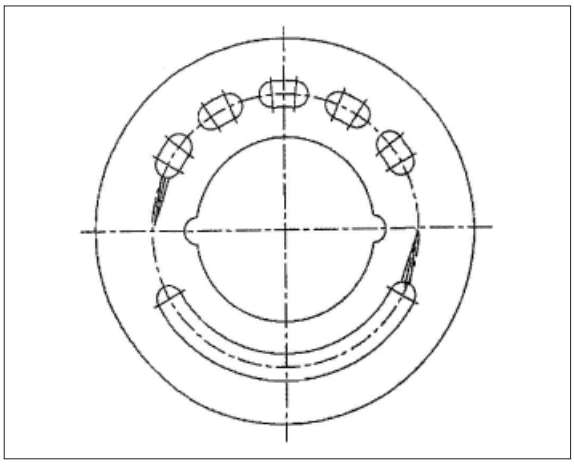
80CR8MP21

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

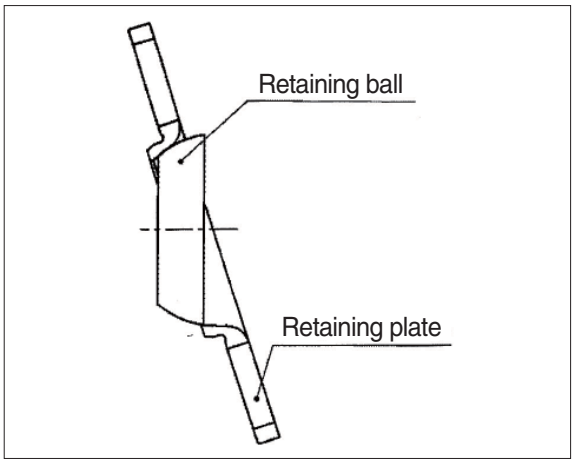


80CR8MP22

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

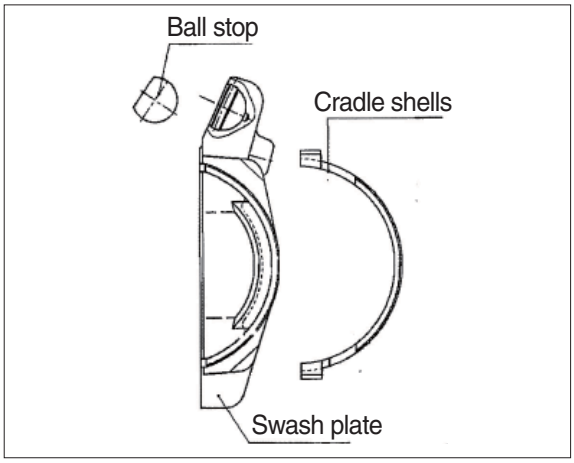

80CR8MP64

(4) Retaining ball and retaining plate
- Check for scouring or stepped wear.
  If this can not be corrected replace the retaining ball and the retaining plate as a set.
- Fine scouring or damage can be corrected with lapping.
  Carry out through washing after lapping.



80CR8MP65

(5) Swash plate and ball stop and cradle shells
- Check for scouring or stepped wear.
  If this can not be corrected replace the swash plate and the ball stop and the cradle shells as a set.



80CR8MP66

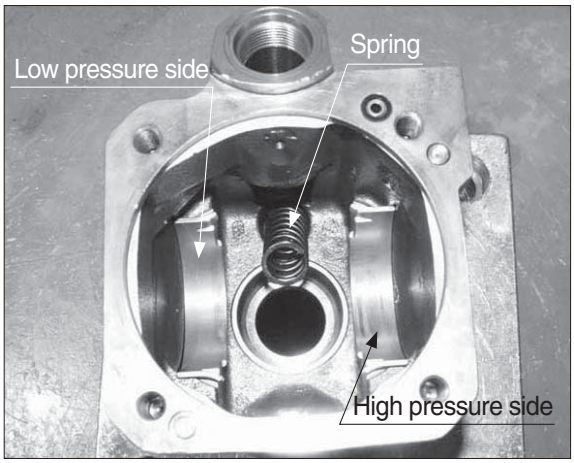
8) ASSEMBLING PROCEDURE (rear pump)

(1) Assemble the swash plate and the drive shaft.

① Assemble the cradle shells.

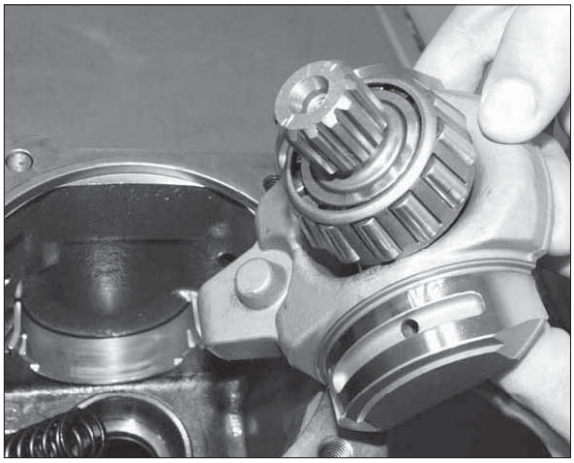
Note the mark of the low-pressure side and the high-pressure side if you use the disassembled parts again.

② Assemble the spring.

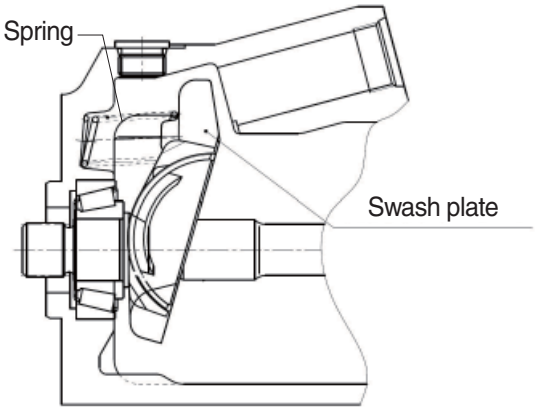


80CR8MP67

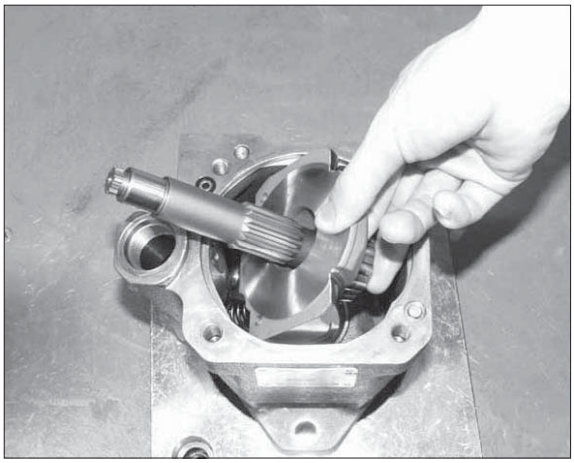
③ Assemble the swash plate with the drive shaft.



80CR8MP68



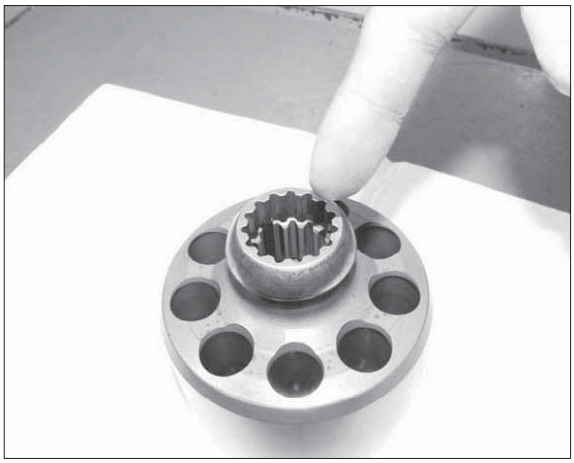
80CR8MP69



80CR8MP70

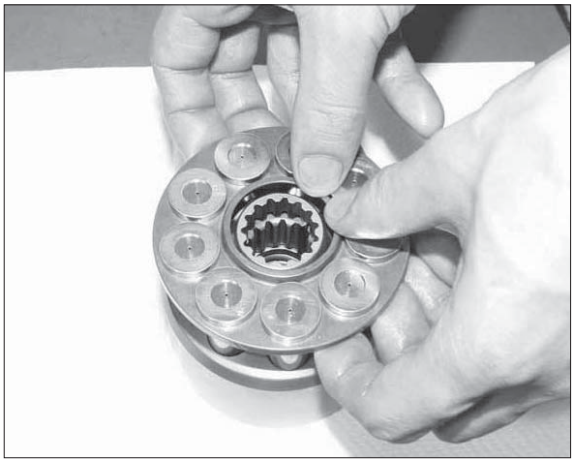
(2) Assemble the rotary group.

① Apply the grease to the surface of retaining ball and assemble it along the cylinder block spline.



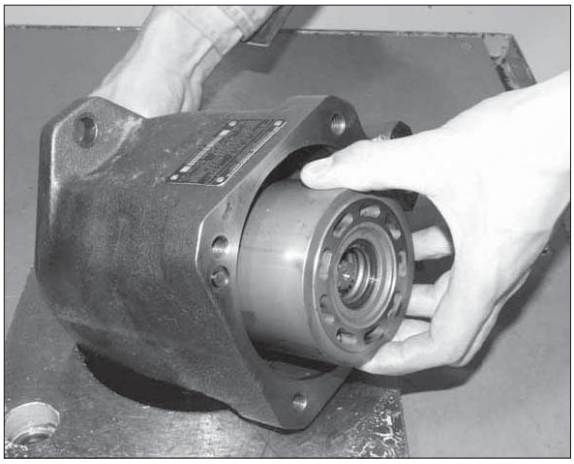
80CR8MP71

② Apply the grease to the end part of the shoes and assemble the piston complete into the hole of retaining plate and cylinder block.



80CR8MP72

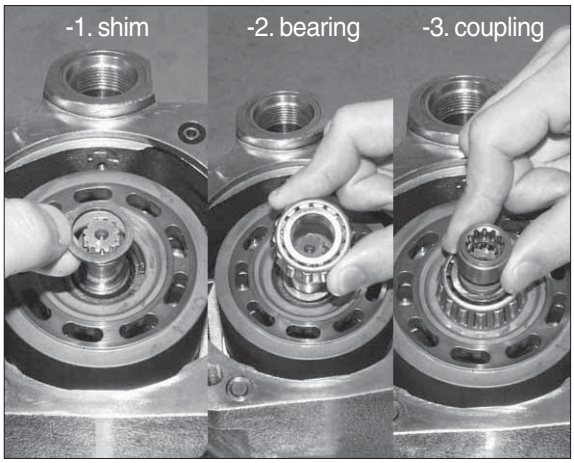
(3) Install the rotary group.
(Along the shaft spline)



80CR8MP73

(4) Assemble the shim and the bearing and the coupling

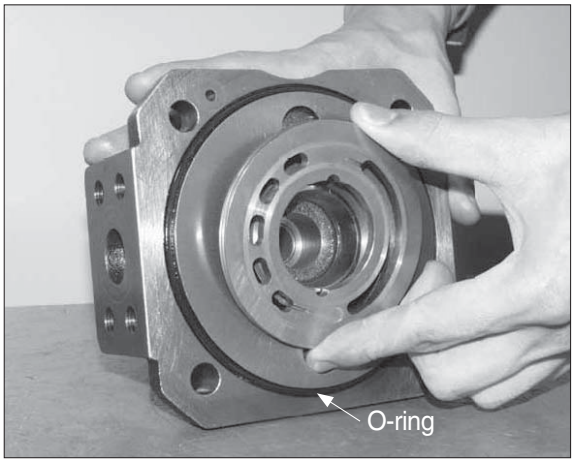
① Assemble the shim to the drive shaft.
② Assemble the bearing on the shim.
③ Assemble the coupling to the drive shaft.



80CR8MP74

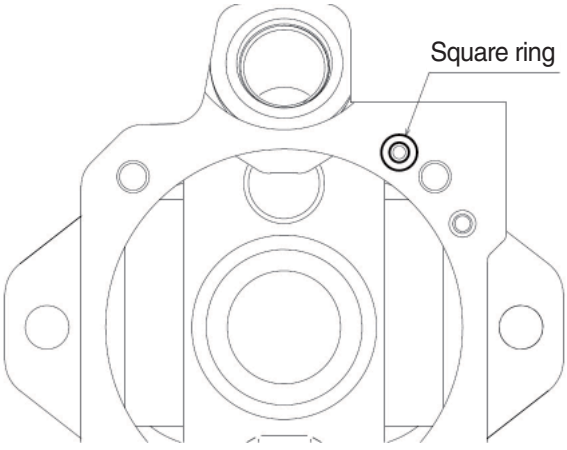
(5) Apply the grease between port plate and control plate for dropout prevention and assemble the control plate to the port plate.

Confirm the O-ring.



80CR8MP75

(6) Assemble the port plate.
Confirm the square ring.

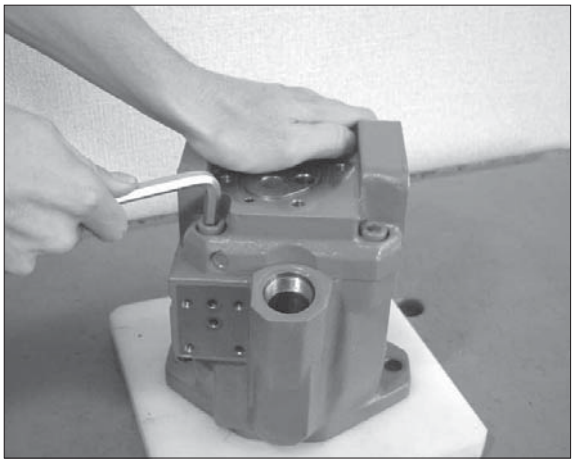


80CR8MP76

(M10×30, 4 pieces)

Hexagon socket screw key
(Hexagon side distance : 8 mm)

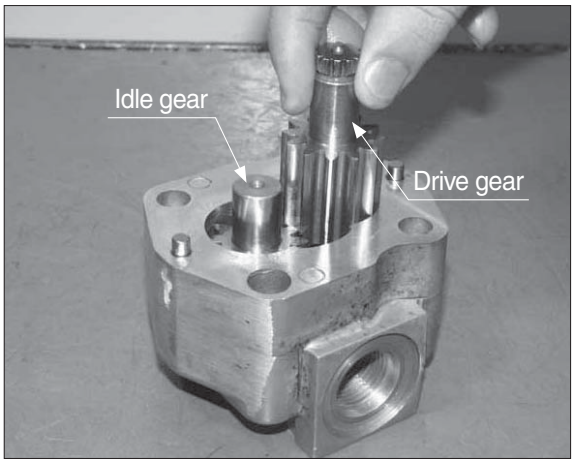
Tightening torque : 6.3±0.71 kgf · m
(45.7±5.2 lbf · ft)



80CR8MP77

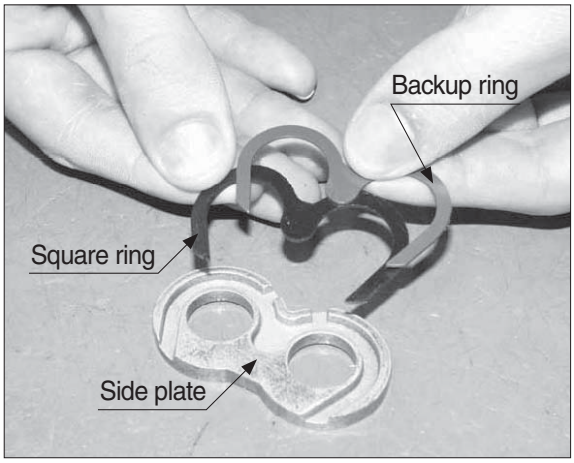
(7) Assemble the gear pump.

① Install the drive gear and the idle gear.



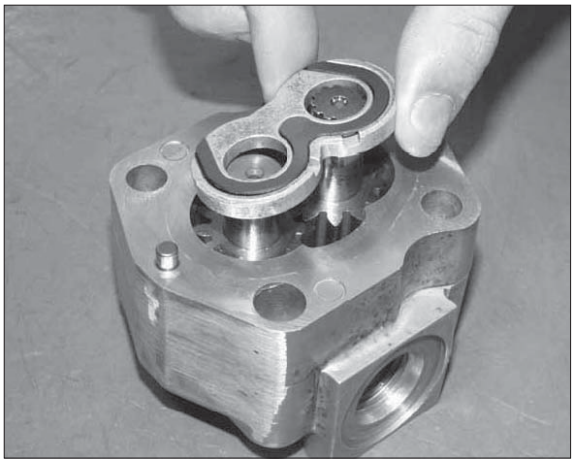
80CR8MP78

② Apply the grease to the square ring and the backup ring for dropout prevention and install the rings into the side plate.



80CR8MP79

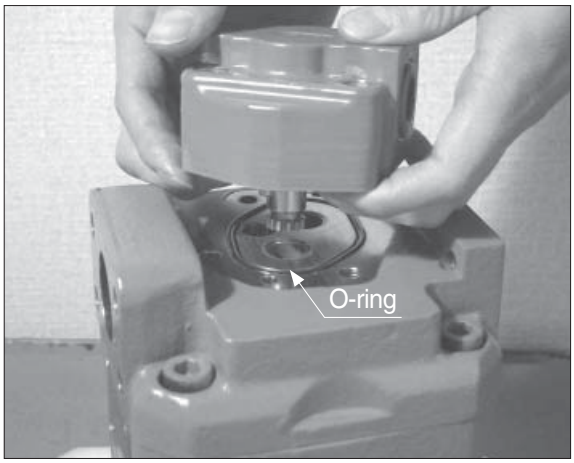
③ Apply the grease to the side plate for dropout prevention and assemble it.



80CR8MP80

(8) Assemble the gear pump on the port plate.

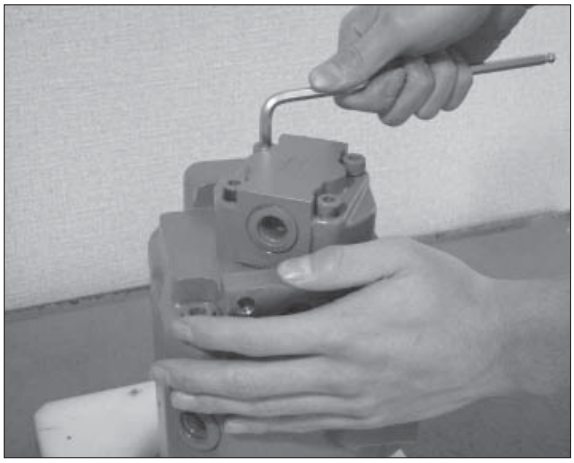
Confirm the O-ring.



80CR8MP81

Hexagon socket head cap screws
(M8×50, 4 pieces)

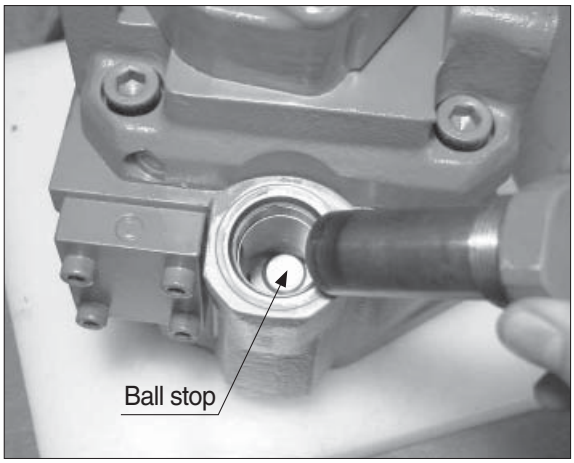
Hexagon socket screw key
(Hexagon side distance : 6 mm)
Tightening torque : 3.26±0.31 kgf · m
(23.6±2.2 lbf · ft)



80CR8MP82

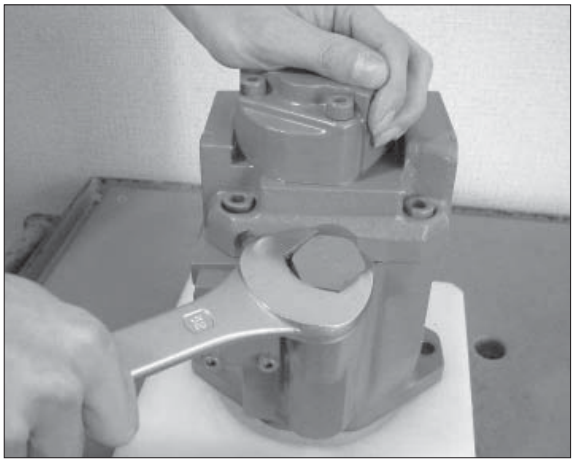
(9) Assemble the plug.

Confirm that the planar section of the ball stop is upward.



80CR8MP83

Spanner (32 mm)
Tightening torque : 15.3 kgf · m (111 lbf · ft)

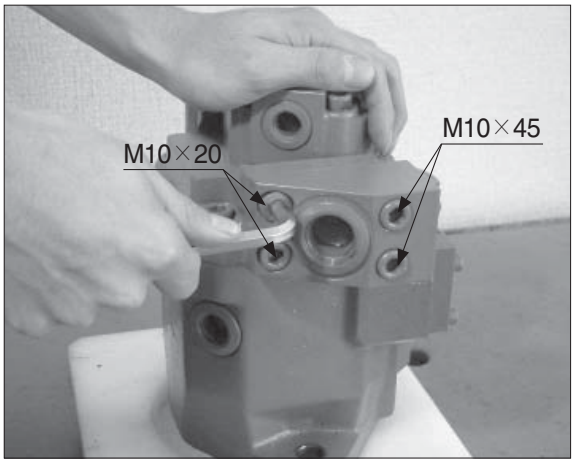


80CR8MP84

(10) Assemble the flange.

Hexagon socket head cap screws
(M10 × 45, 2 pieces, M10 × 20, 2 pieces)

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



80CR8MP85

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 hydraulic hose.

(5) Disconnect pilot line hoses.

(6) Remove links.

(7) Sling the control valve assembly and remove the control valve mounting bolt.
· Weight : 40 kg (90 lb)

(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.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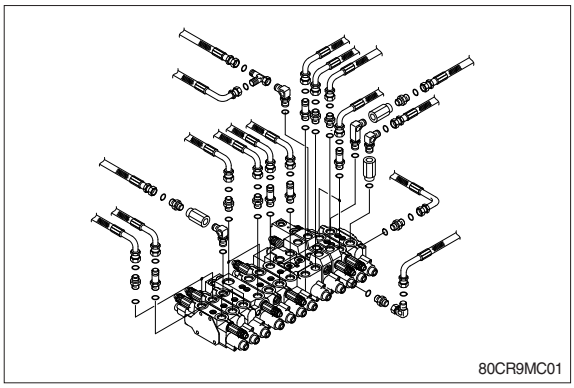
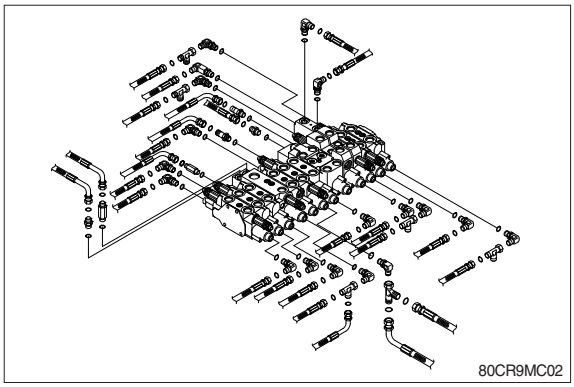
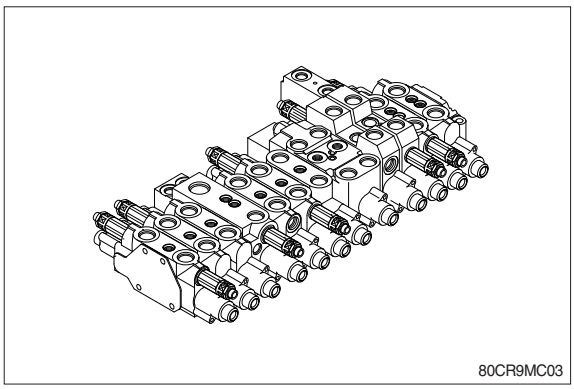
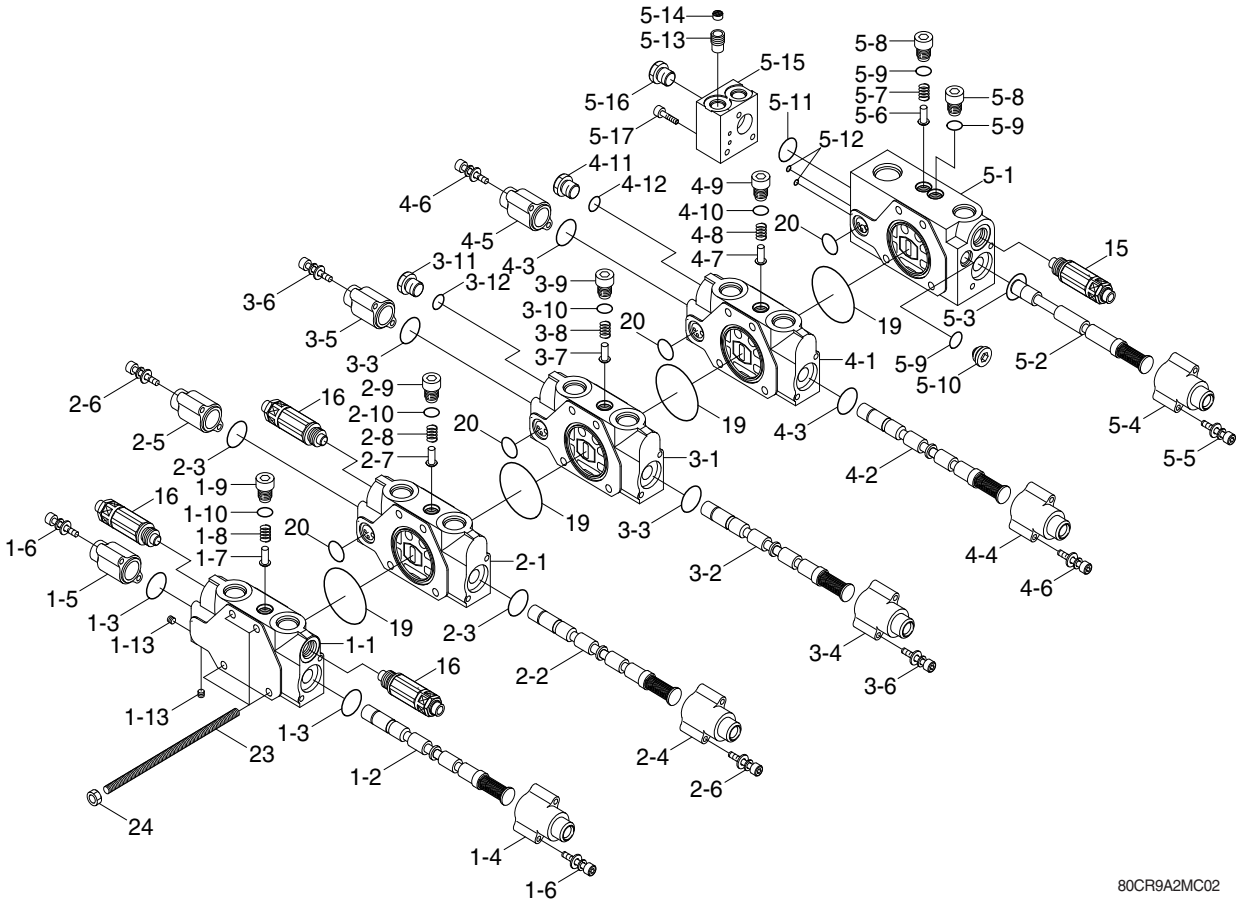

80CR9MC01


80CR9MC02

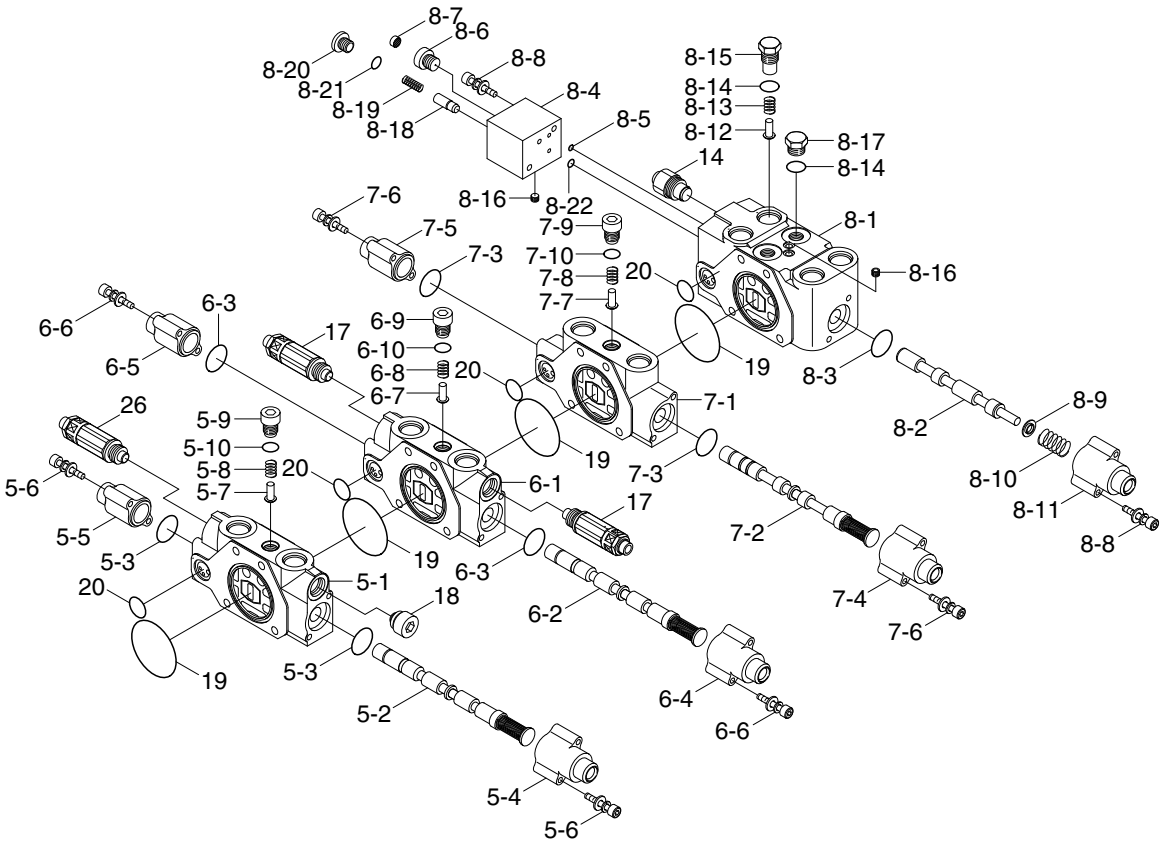

80CR9MC03

3. STRUCTURE (1/4)



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

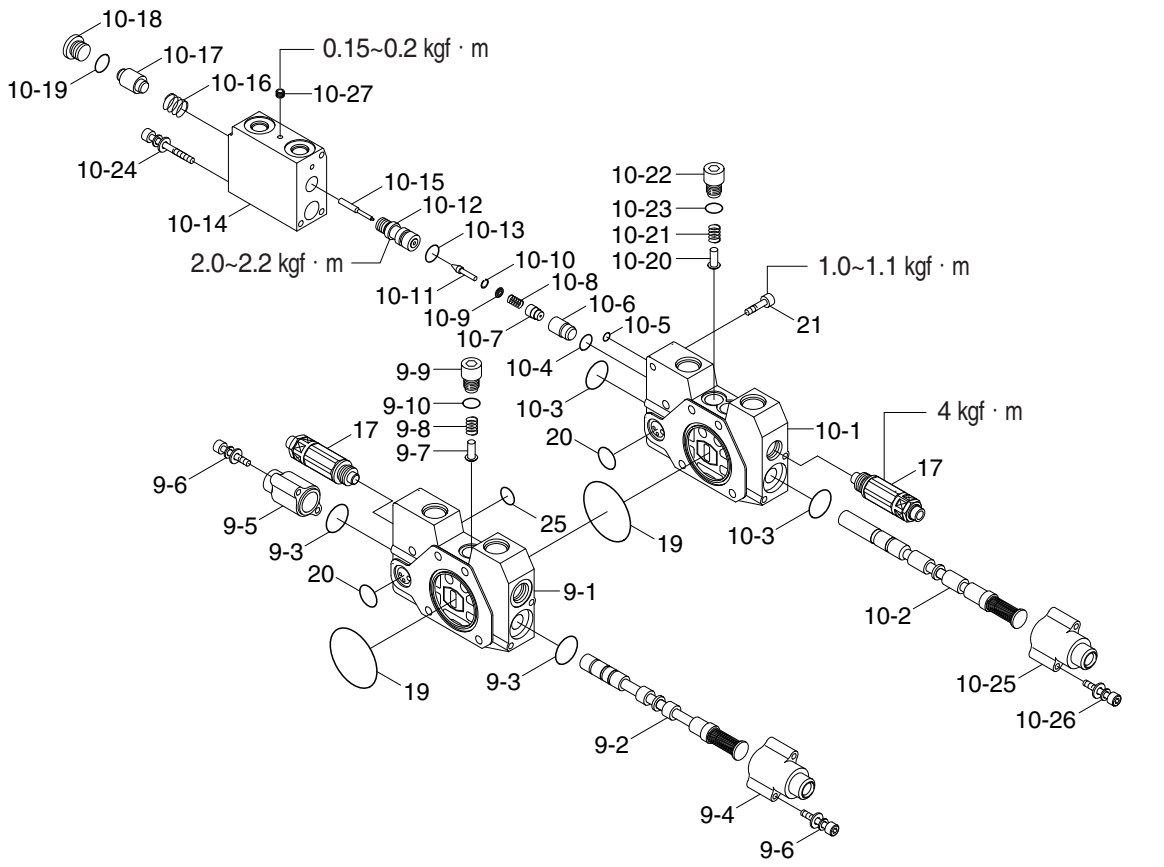
STRUCTURE (2/4)



80CR92MC03

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

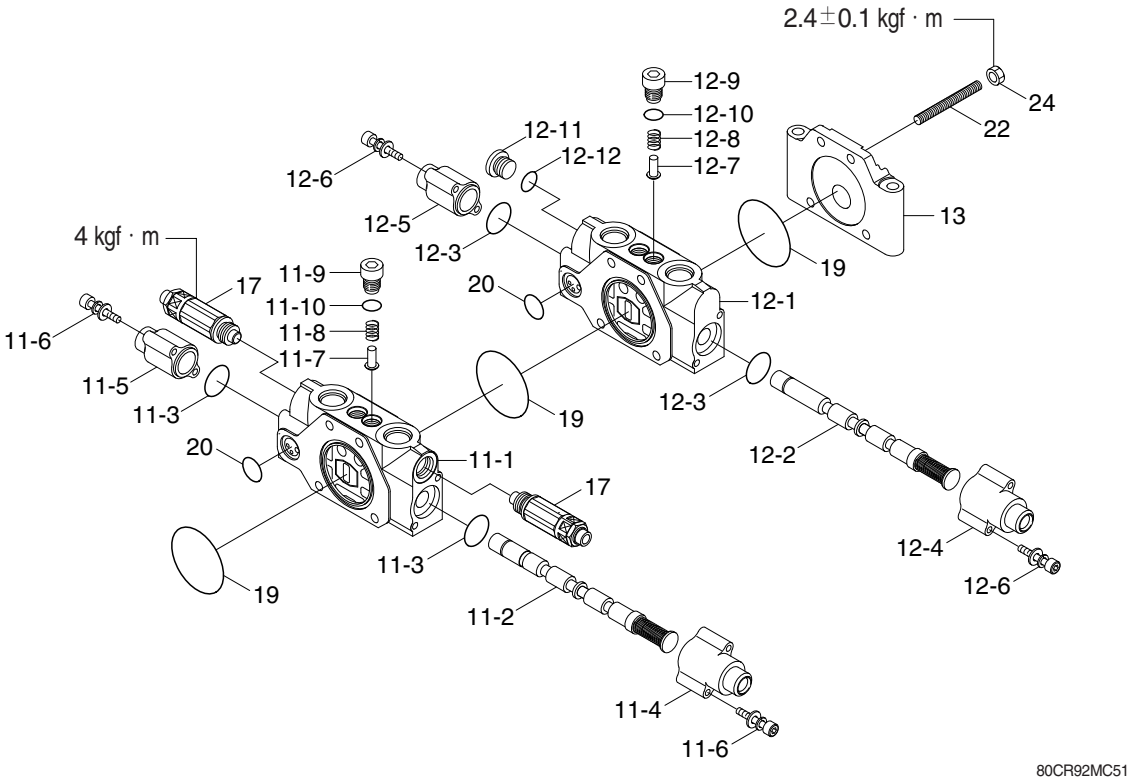
STRUCTURE (3/4)



80CR92MC41

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

STRUCTURE (4/4)



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

3. DISASSEMBLY

1) PRECAUTIONS FOR DISASSEMBLY

(1) Since hydraulic devices are all machined precisely with clearances being very little, carry out the disassembly and assembly work at a clean place and make sure to prevent the device from being entered with dust, sand, and the like.

(2) Before disassembly work, prepare necessary material such as the structural drawing for control valve to fully understand the structure and others.

(3) When removing the control valve from the machine, put a dustproof cap on each port and then clean the outside of assembly after checking the installation of caps.
Furthermore, prepare a suitable workbench with clean paper or rubber mat on it for the work.

(4) Since there is a possibility of rust when the disassembled parts are left, apply anti-corrosive oil to the parts and seal them.

(5) Hold the control valve body when carrying or moving. Especially, do not hold the exposed spool after removing a pilot cover from the control valve.

(6) Do not hit the control valve even if it does not move smoothly.

(7) It is recommend carrying out various tests (relief valve setting, leak test, internal pressure loss check, etc.) after the disassembly and assembly of the control valve, which requires a hydraulic test device.
Accordingly, when the disassembly might be possible technically but the test and/or adjustment might be impossible, do not carry out the work.

⚠ Before removing the pipes, attach suitable indications on them to be able to locate their positions later. If there is a mistake in piping between the ports, unintentional movement could result in an accident.

⚠ Falling or hitting the control valve could bend the spool, which could result in an accident.

⚠ If foreign matter enters each port, there could be a control valve malfunction, resulting in an accident.

⚠ Since the load side port could hold an empty weight or enclosed pressure, release the inside pressure before loosening the piping.
There could be a fall of attachments or a jet of high-temperature hydraulic fluid.

⚠ The control valve becomes high temperature after operating the machine; after checking that the temperature becomes low, start the work.

⚠ The control valve has complicated connections and seals through the internal passages, which means that there could be enclosed pressure, resulting in an oil jet after disassembly.
Ware safety goggles during disassembly work because there could be a blow off of parts if they are caught.

2) NECESSARY TOOLS AND OTHERS

(1) Before disassembling the control valve, prepare the following tools.
The tools below are used to disassemble this control valve only; tools for disassembling the port fittings are not included.

Name of tool	Quantity	Size (㎜)
Hexagonal wrench	Each 1	4, 5, 6, 8 and 10
Socket wrench	Each 1	13, 19, 21, 22 and 30
Socket wrench	Each 1	13, 19, 21, 22 and 30
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~ 14.5 lbf · ft)
Torque wrench	1	2.0 ~ 12.0 kgf · m (14.5 ~ 86.8 lbf · ft)
Magnet	1	-
Pliers	1	-
Slotted screwdriver	1	-
Tweezers	1	-

Prepare clean wash oil, hydraulic fluid, grease, tag paper, marker pen and others before work.

3) DISASSEMBLY OF EACH PART

Before disassembly work, check that there is no dust on the outside of the control valve and then place it on a workbench with actuator ports facing upward.

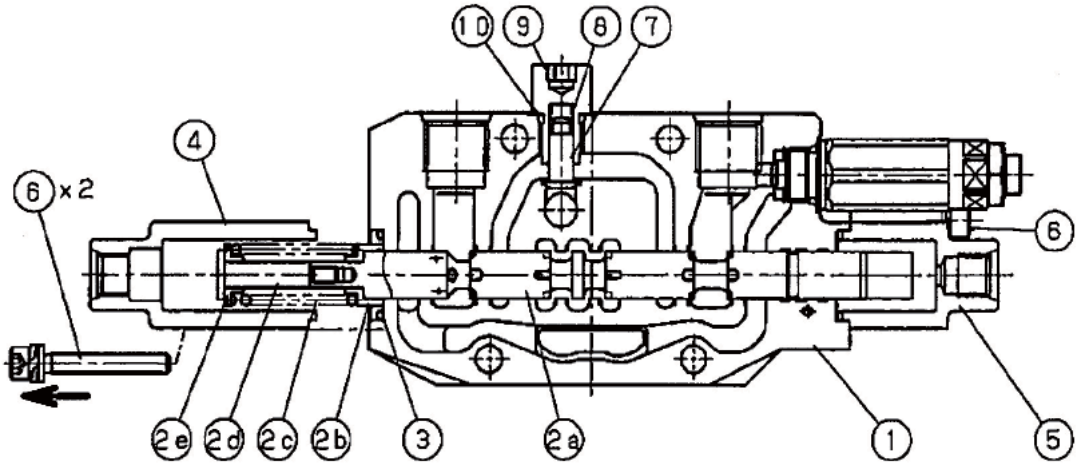
The numbers in ( ) in the explanation and in ◯ in the figures show reference numbers in the parts table in the specifications and drawings.

(1) Spool draw-out procedures

■ **Except P1, P2 inlet & straight travel block**

Taking the dozer spool as an example, the draw-out procedures are as follows.

① Remove 2 hex socket head bolt with washer (⑥) with 5 ㎜ hexagonal wrench.
② Remove pilot cover (④).
③ With a spring in the dozer spool exposed, pull out spool assy from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
④ The other spools can also be pulled out in the same manner.
· At this time, check O-ring (③) is on the bottom of body side flange.



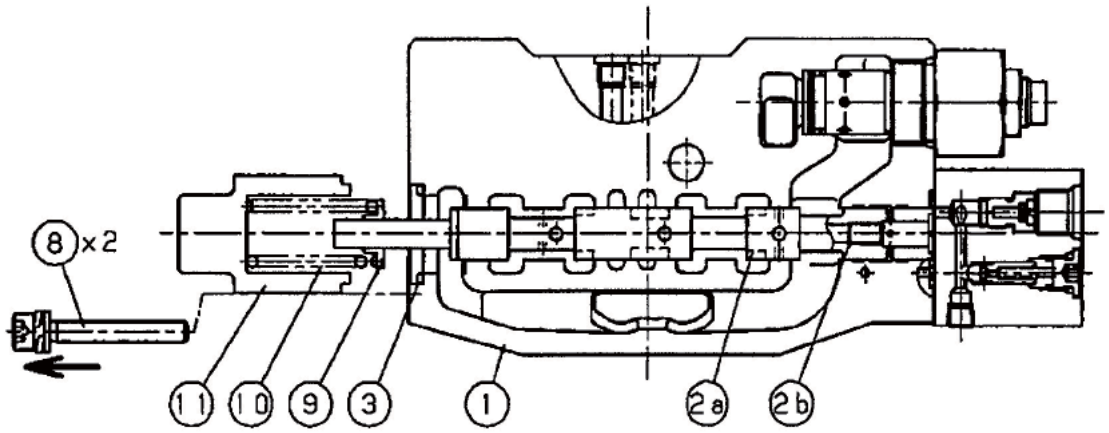
80CR97MCV01

1	Work body	2d	End spool	6	Hex socket head bolt with washer
2	Dozer spool assy	2e	Spring seat	7	Check valve poppet
2a	Dozer spool	3	O-ring	8	Check valve spring
2b	Spring seat	4	Pilot cover	9	Check valve plug
2c	Spring	5	Pilot cover	10	O-ring

■ **P1, P2 inlet & straight travel block**

The draw-out procedures for the straight travel spool are as follows.

① Remove 2 hex socket head bolt with washer (⑧) with 5 ㎜ hexagonal wrench.
② Remove pilot cover (⑪).
③ With spring and the end of straight travel spool exposed from spool sleeve, pull out spring at first, and pull out spool from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
· At this time, check O-ring (③) is on the bottom of body side flange.



80CR97MCV02

1	Work body	8	Hex socket head bolt with washer
2	Straight travel spool assy	9	Spring seat
2a	Straight travel spool	10	Spring
2b	Plug	11	Pilot cover
3	O-ring		

(2) Check valve disassembly procedures

■ **Standard type check valve (see figure 4)**

① Hold the control valve body at workbench or hold it by two or more people.

② Loosen and remove check valve plug (⑨) at the center of the control valve upper surface with 8 ㎜ hexagonal wrench.
When it is hard to loosen the plug because O-ring (⑩) bites the screw, do not loosen forcibly, refasten it once and then try to loosen again.

③ From the hole where check valve plug has been removed, remove check valve spring (⑧) and check valve (⑦) with tweezers or magnet.

· The numbers in figure 4 are the same as those in the P1, P2 inlet & straight travel block in the specifications and drawings.
· Except for the P1, P2 inlet & straight travel block the shape of check valve is different, however, they can be disassembled in the same manner.
· The numbers in figure 5 are the same as those in the P3 inlet & boom 2 block in the specifications and drawings.
· The numbers in figure 6 are the same as those in the dozer block in the specifications and drawings.

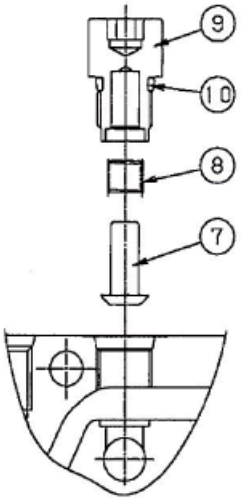


Figure 4. Check valve
(P1, P2 inlet & straight travel)

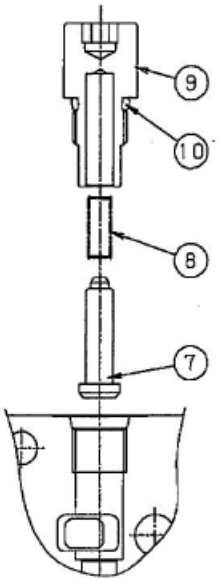


Figure 5. Check valve
(P3 inlet & boom 2, travel)

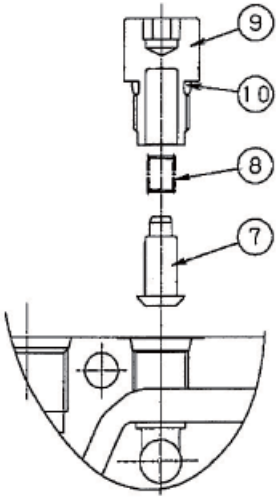


Figure 6. Check valve
(Swing & boom swing, dozer, arm 3 & boom 3, service, arm, boom, bucket, arm 2)

80CR97MCV03

(3) Accessory valve removal procedures

※ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace the accessory valve as assy if any malfunction occurs.

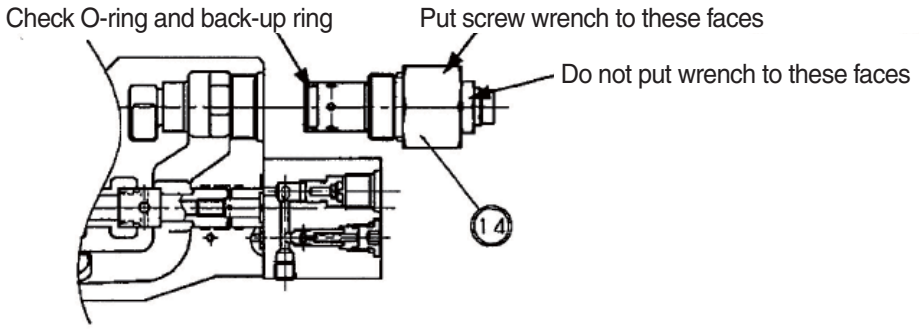
■ Removing main relief valve (MRV1) : see page 2-9 and 7-44

① Loosen and remove main relief valve (⑭) with 30 ㎜ screw wrench or socket wrench.

· Put screw wrench (or socket wrench) to 30 ㎜ hexagonal part of pressure regulating body.

· Check O-ring and back-up ring are on the part of main relief valve seat.

※ Do not put 19 mm screw wrench to the lock nut part when removing.
Only lock nut is loosened to change the main relief valve setting, which could result in the degradation in performance or damage.



80CR97MCV04

■ Removing relief valve (MRV2, ORV) : see page 2-9

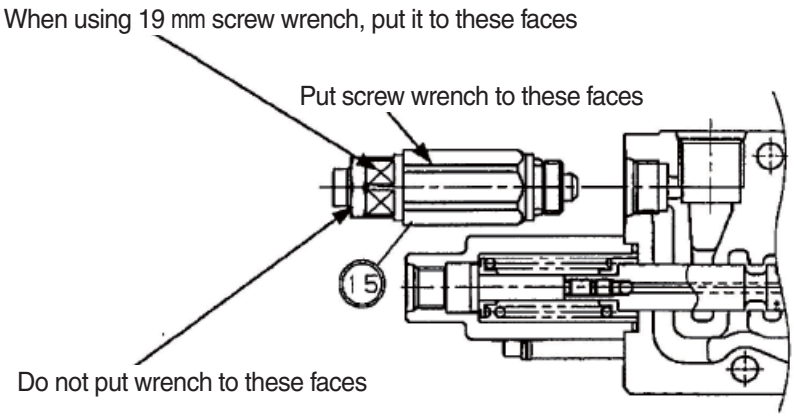
Taking relief valve in the P3 inlet & boom 2 block as an example, the removal procedures are as follows.

① Loosen and remove relief valve (⑮) with 22 mm screw wrench or socket wrench.

· Put screw wrench (or socket wrench) to 22 mm hexagonal part of pressure regulating body.

· If there is no 22 mm screw wrench (or socket wrench), it is also possible to loosen and remove by putting 19 mm screw wrench to the hexagonal part as shown in the below.

※ If using 19 mm screw wrench to remove, do not put it to the lock nut part.
Only lock nut is loosened to change the relief valve setting, which could result in the degradation in performance or damage.



80CR97MCV05

※ Removing accessoory valve causes the seat to be exposed.
Flaws of the seat causes leakage from the inside cylinder port, which makes the holding capacity of attachment worse.
When storing it, be careful not to damage the seat.

(4) Block disassembly procedures

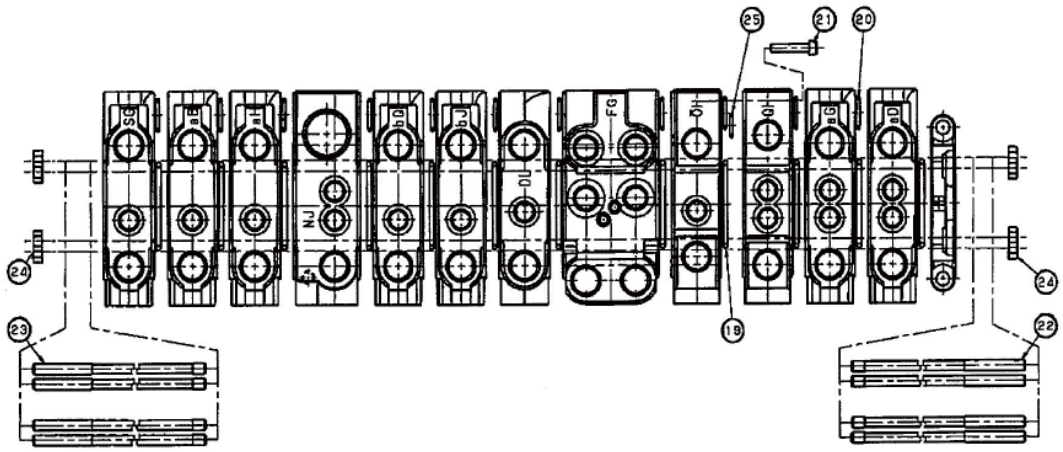
① Loosen and remove hexagonal socket head bolt (㉑) assembled in the body QH with 5 ㎜ hexagonal wrench.

② Loosen and remove 8 M8 hexagonal nut (㉔) for assembling block on the both side of control valve with 13 ㎜ screw wrench or socket wrench.

③ When 8 tie bolt (㉒, ㉓) are loosen and pulled out from the control valve side, each block can be removed.

· Be careful not to drop or lose various O-ring (⑲, ⑳, ㉕) installed on the matching surfaces for each block.

· Do not disassemble 2 plugs installed in the body SG except in cases of absolute necessity since they are used as drill holes for making passages.



80CR97MCV06

(5) Precautions after disassembly

※ For the parts already removed in the work, store and/or transport them with attention on flaws and dirt.

When carrying out another work, storage, or transportation with the parts removed condition, apply caps or plastic tape to the holes from which the parts have been taken out, protecting the holes from being entered with dust or the like.

4. ASSEMBLY

1) PRECAUTIONS FOR ASSEMBLY

(1) Be careful that the unevenness of fastening torque and the contamination of dust during assembly work could result in malfunction.
In addition, observe fastening torque values specified in the specifications and drawings.
(2) During assembly work, compare valves with control valve structural drawing and check the number of parts whether there is any improper assembly and/or the omission of parts.
(3) For the parts to be used in assembly, dip in fluid oil as need arises to reassemble after washing well in washing oil and being dried.
(4) After cleaning and degreasing the surface sufficiently, apply loctite to 2 threads of the screw from the tip. (Too much loctite could result in malfunction after squeezing out)
(5) For the part to be attached or assembled with two or more bolts and nuts, fastening them evenly and alternately for several times, not once with the specified torque.
The unevenness of fastening torque could result in the leakage of hydraulic fluid too the outside and/or malfunctions.

2) PRECAUTIONS FOR ASSEMBLING SEAL PARTS

(1) All seals are to be renewed at assembly.
(2) Check seals for defects in molding and flaws in handling.
Do not use the seal with defect and/or flaw.
(3) The seals used on sliding surfaces and the places to be installed with seals are to be applied with grease or hydraulic fluid for sufficient lubrication where not specially noted.
(4) Do not make seals longer up to permanent deformation.
(5) O-ring is not to be twisted during assembly.
Kinked O-ring could cause oil leakage after installation because kinks are hard to restored.

3) NECESSARY TOOLS AND OTHERS

Before assembling the control valve, prepare the following tools.
The tools below are used to assemble this control valve only; tools for assembling the port fittings are not included.

Name of tool	Quantity	Size (mm)
Hexagonal wrench	Each 1	4, 5, 6, 8 and 10
Socket wrench	Each 1	13, 19, 21, 22 and 30
Socket wrench	Each 1	13, 19, 21, 22 and 30
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~ 14.5 lbf · ft)
Torque wrench	1	2.0 ~ 12.0 kgf · m (14.5 ~ 86.8 lbf · ft)
Magnet	1	-
Pliers	1	-
Slotted screwdriver	1	-
Tweezers	1	-

Prepare clean wash oil, hydraulic fluid, grease, loctite #242 and others before work.

4) ASSEMBLING WORK

※ The numbers in ( ) in the explanation and in ○ in the figures show reference numbers in the parts table in the specifications and drawings.

※ For the fastening torque values for screws, see the 2-9 and 7-43~46.

(1) Assembling block (see figure 10 and 11)

① On a surface plate with clean rubber plates on it, place blocks with actuator port surface facing upward in the order shown in "Orders of assembling bodies" on the next page.

※ Check the matching surfaces in each block for dust or the like, and check whether O-ring shown in the specifications and drawings are surely put in each groove for O-ring.
Kinked O-ring could cause the leakage of hydraulic fluid to the outside due to the malfunction of sealing performance.
If O-ring are not installed surely in O-ring grooves, there would be the nip of O-ring, resulting in the leakage of hydraulic fluid to the outside when assembling the bodies.

② Put and fasten 8 tie bolt (㉒, ㉓) through the bodies from the side of control valve, and fasten 8 M8 hexagon nut (㉔) to the bolts **by hand**.

③ Check that all the body surfaces are in alignment in this condition.
If not, make all the body surfaces in alignment by hitting them with plastic hammers or the like.
Before aligning the bottom surfaces, remove the rubber plates and others that have been laid at ①.
However, check that there is no dust or no unevenness on the surface from which the above rubber plates have been removed.

※ Do not hit hard when using a plastic hammer.
Hard hitting could cause displacements in the portion that has been ailgned.
Check the alignment with a flat plate or the like after aligning.
If there is large displacement in any block, bad connection between internal passages could cause a malfunction.
If any seal position overlaps the passage, there could be the leakage of hydraulic fluid to the outside.

④ After checking that the surfaces are in alignment, fasten 8 M8 hexagon nut (㉔) that have been put on in ② with the torque specified in the specifications and drawings with 13 ㎜ socket wrench.

※ Fasten 8 M8 hexagon nut evenly and little by little in several times.
Uneven fastening makes the body assy curve easily, which could result in leakage or malfunction after installation on the machine.
If you find any curve in the body assy, it is necessary to reassemble or to correct it by pressing machine or the like.

⑤ Finally, fasten hex socket head bolt (㉔) located between the body QH and body OH with a specified torque with 5 ㎜ hexagonal wrench.

Orders of assembling blocks

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
ID	SG	aB	aH	NJ	bQ	bJ	DL	FG	OH	QH	aG	aD	HB

※ Identifications (ID) are engraved on the top (actuator port side) of the block.

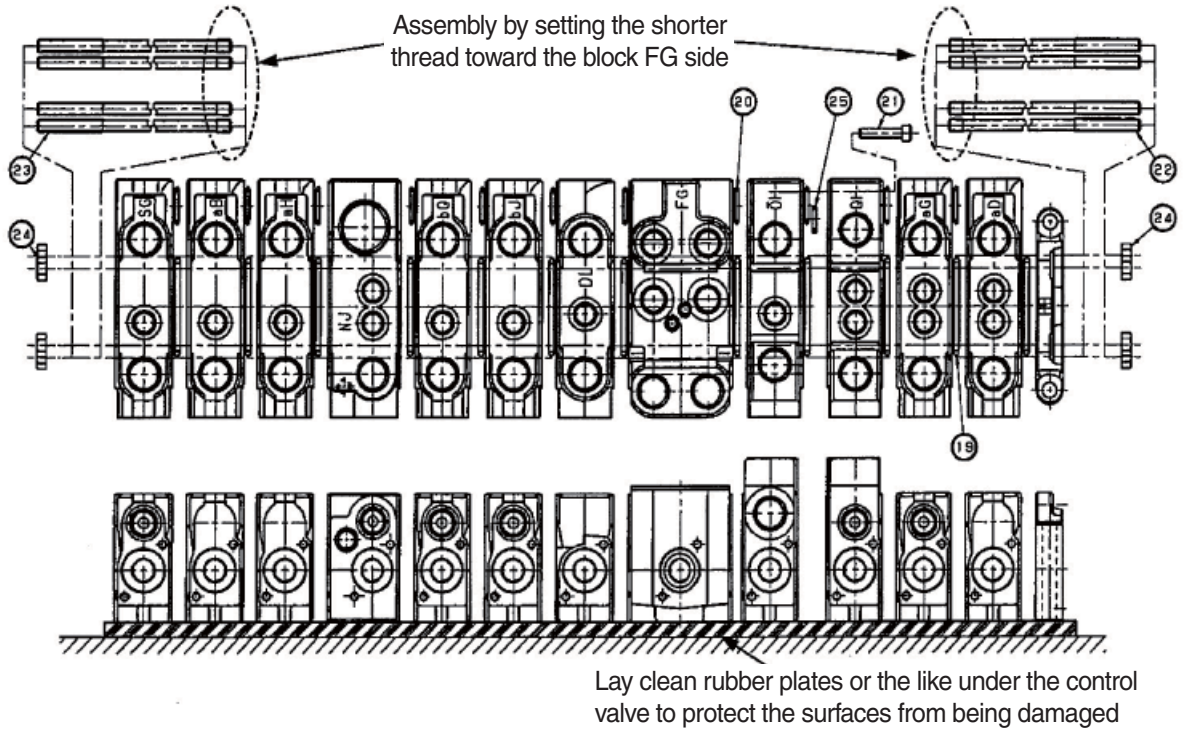


Figure 10. Block assy

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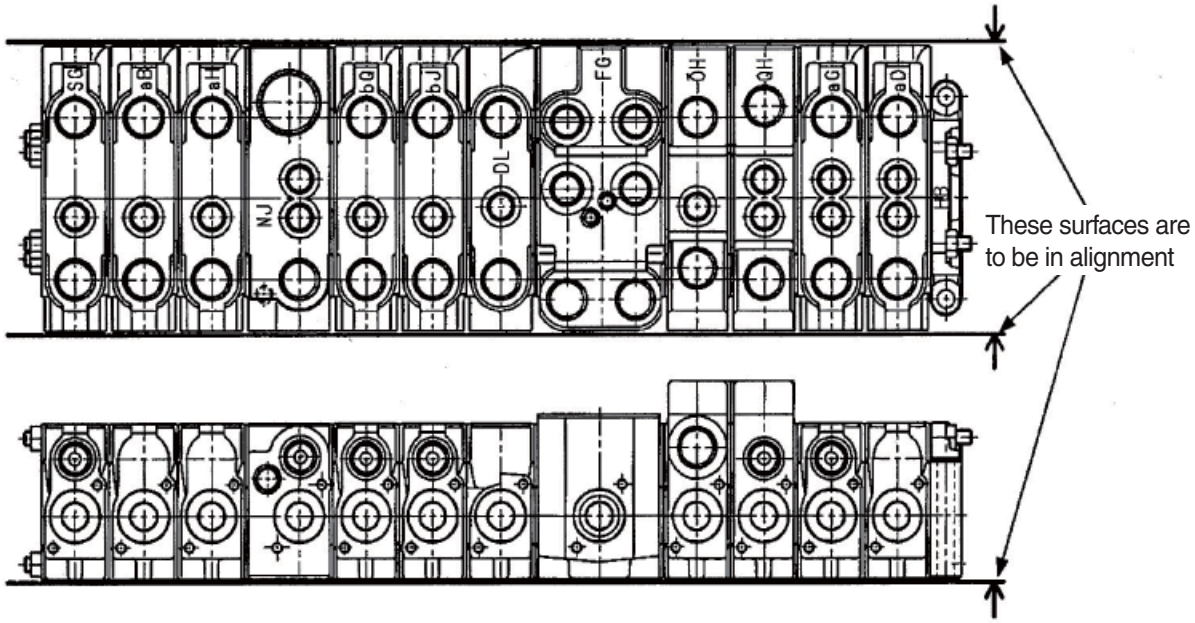


Figure 11. Block assy (after assembly)

80CR97MCV08

(2) Accessory valve installing procedures

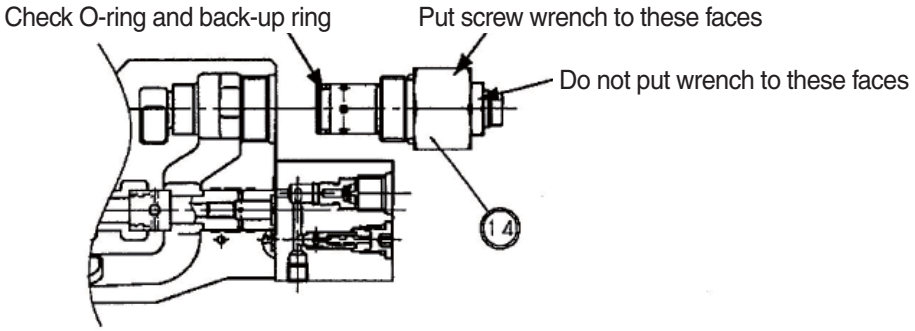
※ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace in assy if any malfunction occurs.

■ Installing main relief valve (MRV1) : see page 2-9 and 7-44

① Fasten main relief valve (⑭) with specified torque with 30 mm screw wrench (or socket wrench).

· Put screw wrench (or socket wrench) to 30 mm hexagonal part of pressure regulating body.

· Check O-ring and back-up ring are on the part of main relief valve seat.



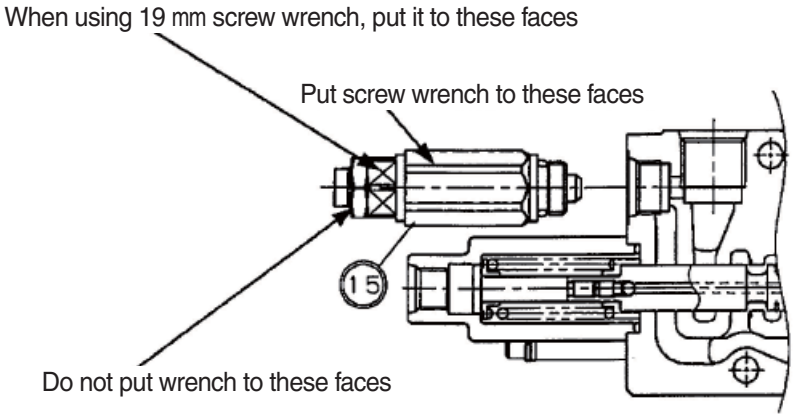
80CR97MCV09

■ Installing relief valve (MRV2, ORV) : see page 2-9

① Fasten relief valve (⑮) with specified torque with 22 mm screw wrench (or socket wrench).

· Put screw wrench (or socket wrench) to 22 mm hexagonal part of pressure regulating body.

· If there is no 22 mm screw wrench (or socket wrench), it is also possible to fasten with 19 mm screw wrench to the hexagonal part as shown in the below.



80CR97MCV10

※ Be careful not to damage the seat of socket that sticks out above the tip when installing relief valve to the body.
If the seat is damaged, there could be internal leakage, resulting in the malfunction of holding attachment.
Do not put 19 mm screw wrench to the lock nut part when installing.
Lock nut truns with adjustable screw free turning, resulting in the degradation in performance or damage.

(3) Check valve assembly procedures

■ **Standard type check valve (see figure 14)**

① Hold the control valve body at workbench or hold it by two or more people.

② Assemble check valve (⑦) and check valve spring (⑧) in sequence at the center of control valve top surface.
Then, set check valve (⑦) vertically. (Check that the check valve is in nearly at the center of hole)

③ Check that O-ring (⑩) is securely installed with check valve plug (⑨) and then screw it into the part where check valve has been assembled.

④ Fasten check valve plug (⑨) with specified torque with 8 mm hexagonal wrench.

· The other check valves can be assembled in the same manner, use suitable parts in the drawing. (see figure 15 and 16)
If assembly is mistaken, check valve could not function or there could be damage.

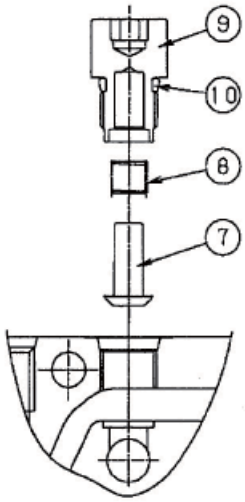


Figure 14. Check valve
(P1, P2 inlet & straight travel)

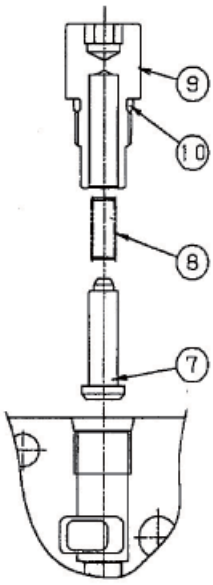


Figure 15. Check valve
(P3 inlet & boom 2, travel)

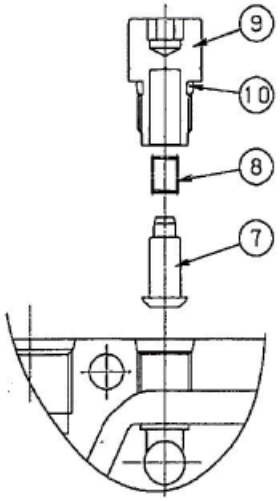


Figure 16. Check valve
(Swing & boom swing, dozer, arm 3 & boom 3, service, arm, boom, bucket, arm 2)

80CR97MCV11

(4) Spool installing procedures

■ **Except P1, P2 inlet & straight travel block**

Taking the dozer spool as an example, the installing procedures are as follows.

① After checking whether there is no dust or the like in the spool sleeves of the body and/or spool assy and O-ring (③) is securely installed with that the flange bottom of the body, insert the dozer spool assy into spool sleeve of the body with attention on the position and direction.

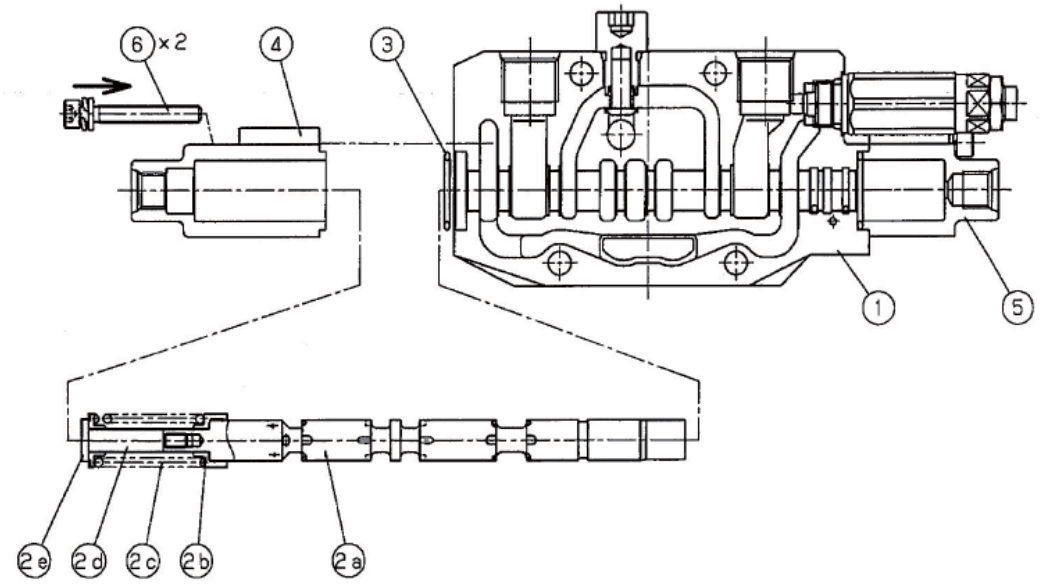
· Then, apply little hydraulic fluid to spool before the insertion.

※ Carefully insert spool assy into the spool sleeve horizontally.
If it is hard to insert, forcible insertion could cause impressions on spool sleeves and/or spools, resulting in malfunction.
If you feel any feeling of wrongness such as catches or strong resistance, pull it out once to check whether there is the adhesion of dust or the development of flaw or burr.
If there are flaws or burns, there could be malfunction so that replace body and spool in set.

· When there is no feeling of wrongness, move it slowly several times to check the movement and no feeling of wrongness again.

② Press pilot cover (④) in a direction from the spring side of spool assy to the flange of the body. Fasten 2 hex socket head bolt with washer (⑥) with specified torque with 5 mm hexagonal wrench.

③ The other spools can be assembled in the same manner.



80CR97MCV12

■ **P1, P2 inlet & straight travel block**

The installing procedures for the staight travel spool is as follows.

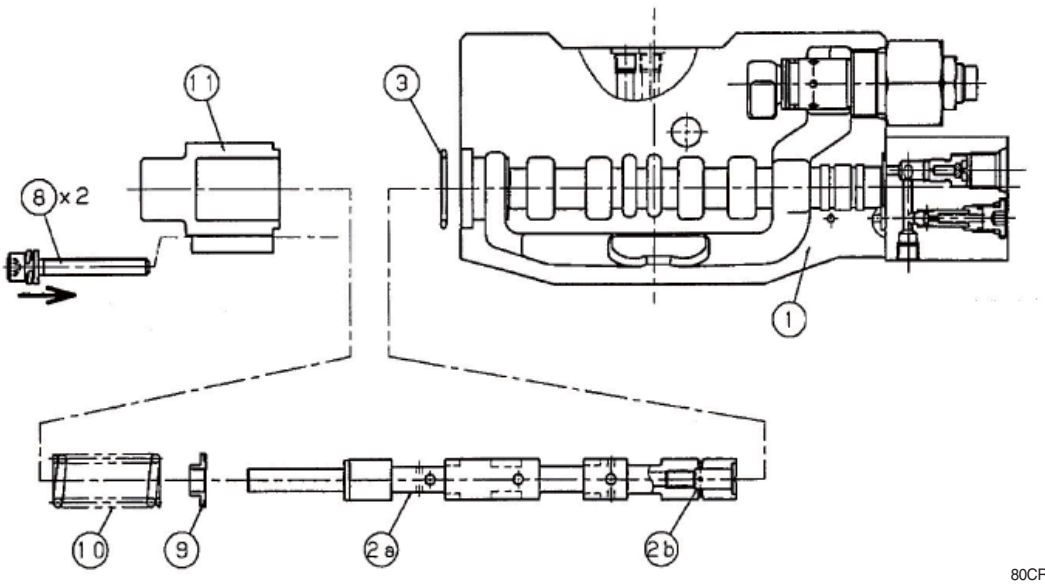
① Assemble spring seat (⑨) and spring (⑩) at the end of spool.

② After checking whether there is no dust or the like in the spool sleeves of the body any/or spool and O-ring (③) is securely installed with that the flange bottm of the body, insert the straight travel spool with spring into spool sleeves of the body with attention on the position and direction.

· Then, apply little hydraulic fluid to spool before the insertion.

⚠ **Carefully insert the straight travel spool into the spool sleeve horizontally.**
If it is hard to insert, forcible insertion could cause impressions on spool sleeves and/or spools, resulting in internal leakage.
If you feel any feeling of wrongness such as catches or strong resistance, pull it out once to check whether there is the adhesion of dust or the development of flaw or burr.
If there are flaws or burns, there could be internal leakage so that replace body and spool in set.

③ Press pilot cover (⑪) in a direction from the spring side of spool assy to the flange of the body. Fasten 2 hexagon socket head bolt with washer (⑧) with specified torque with 5 ㎜ hexagonal wrench.



80CR97MCV13

5. MAINTENANCE STANDARD

1) PARTS CHECK

Name	Inspection item	Criterion and treatment
Work body	Presence of scratch, rust, corrosion	Replace it if any of the followings is damaged · Sliding parts for spool, especially lands with holding pressure · Body flanges receiving spool · Seal parts contacting with O-ring in ports · Seats in relief and overload relief valves · Damage spoiling normal functions
Spool	Presence of scratch, scuff, rust, corrosion Insert spool into body and stroke it with turning	Replace it if scratch is on outer sliding part Replace or correct it if spool does not move smoothly
Check valve (Load check valve)	Damage to check valve or check valve spring Insert check valve into check valve plug to operate	Replace or correct it if flaw or dent is on seat Smooth moving without scratch is normal Replace it if not
Spring and related parts	Rust, corrosion, deformation, breakage in return spring seat, plug, cover	Replace it if there is non-smooth operation or heavy damage
Sealing of spools	Hardened, deformed, or damaged O-ring	Replace it
Relief valve	Rust in appearance Matching surface of valve seat Abnormality in spring O-ring, back-up ring	Replace it Replace it if there is flaw or dent Replace it 100% replacement in principle

6. PROBLEM CAUSES AND MEASURES

※ If any abnormal condition is found, check whether control valve itself fails or there is problem in pump, cylinder, motor, or hydraulic circuit. For this check, it is necessary to measure pilot pressure, pump discharge pressure, and load pressure. Observe the above disassembly and assembly procedures even if any part is disassembled or inspected.

※ Be careful of dust proofing. Dust is very harmful to hydraulic devices.

※ Carefully handle moving movable parts. Correct it with oilstone or replace it even if there is a minor flaw. Clean it sufficiently after correction.

※ Protect the seal surface of O-ring from being damaged. The damage could cause oil leakage.

1) CONTROL VALVE

Phenomenon	Possible causes	Treatment
No movement in each attachment. Slow operation (Power shortage) or slow response	Operation failure in relief valve	Measure relief valve pressure
	· Dust between regulating valve and seat★	· Replacement in assy★
	· Dust between regulating valve seats★	· Replacement in assy★
	· Stick of regulating valve★	· Replacement in assy★
	· Breakage or fatigue of spring★	· Replacement in assy★
	· Loosened adjustable screw	· Readjust and fasten lock nut with specified torque
		· Disassemble and clean it
	Dust between body and spool, or stick	Replace body and spool if damage is big
Cylinder's empty weight falling in neutral is big	Execssive gap between block and spool	Replace spool
	Spool is not returned to neutral completely	Measure pilot secondary pressure
	· Dust storage between body and spool, or stick	· Disassemble and clean, or replace body and spool in set for stick
	· Breakage or fatigue of spring	· Replace spring
	Operation failure in relief valve (ORV) (see 5. Maintenance standard)	Measure relief valve pressure (ORV) (see 5. Maintenance standard)
	Operation failure in lock valve	Replace lock valve assy (including lock valve body)
	· Dust between lock valves or needle valve seats	
	· Stick of lock valve or needle valve	
	· Orifice clogging in lock valve	
When operating to rise cylinder at starting operation, it lowers	Operation failure in load check valve	
	· Dust between load check valve and body	· Disassemble and clean Replace body and load check valve if damage is big
	· Stick in load check valve	· Disassemble and clean Replace body and load check valve if damage is big
	· Breakage or fatigue of spring	· Replace spring

For problem with ★ mark, must replace relief valve in assy.

2) RELIEF VALVE

Relief valve is the most important part for performance and safety, and is very difficult to readjust the setting at a place except maintenance shops with adequate equipment.

Replace in assy if any of the following malfunctions occurs.

Treatments here are only for reference, and the replacement in assy is in principle.

Phenomenon	Possible causes	Treatment
Pressure cannot rise	Any pressure regulating valve, regulating valve, or piston in relief valves has stuck to keep opening, or dust presents on any seat in relief valves	· Check whether foreign matter has been stored in matching parts in relief valves · Each part is to be slid freely · Clean all parts completely
Relief pressure is unstable	Each regulating valve in relief valves is damaged Piston has stuck in pressure regulating valve	· Replace damaged parts · Clean all parts completely · Remove flaws from surface
Relief pressure is out of setting range	Attrition by dust Lock nut and adjustable screw are loosened Breakage or fatigue of spring Operation failure in relief valve (MRV and ORV)	Disassemble and clean Regurate pressure Replace spring Measure pressures of relief valve (MRV and ORV)
Oil leakage	Damage in each seat Attrition in O-ring Stick of each part due to dust	Replace damaged or attrition part Check each part moves smoothly, and reassemble Check that there is no scratch, dent, or foreign matter, and reassemble

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

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

(4) Disconnect hose assembly (12, 13).

(5) Disconnect pilot line hoses (15, 29, 32, 33).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (21).

※ Motor device weight : 80 ㎏ (176 ㏪)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.

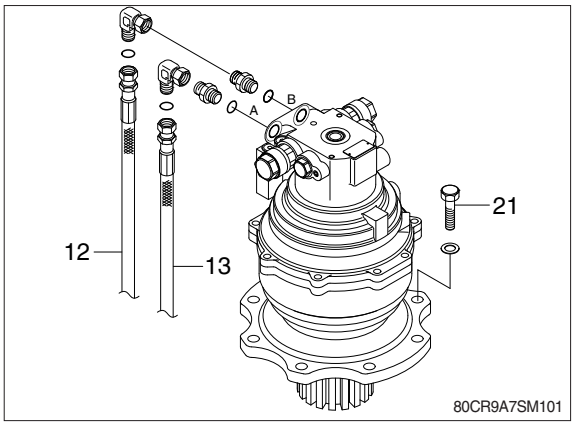
2) INSTALL

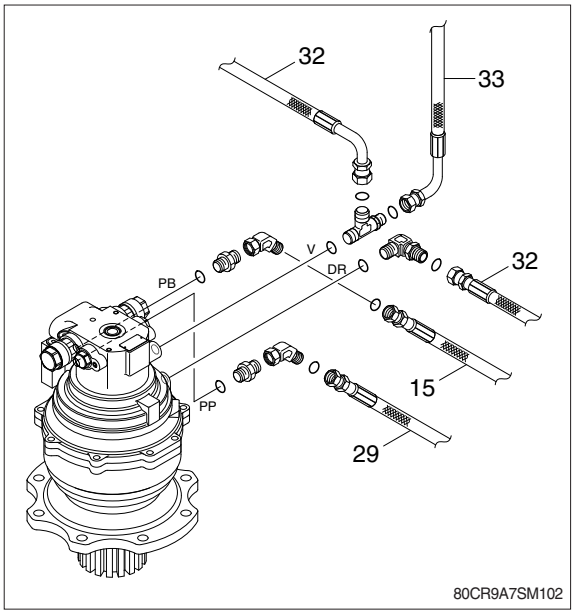
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the swing motor.

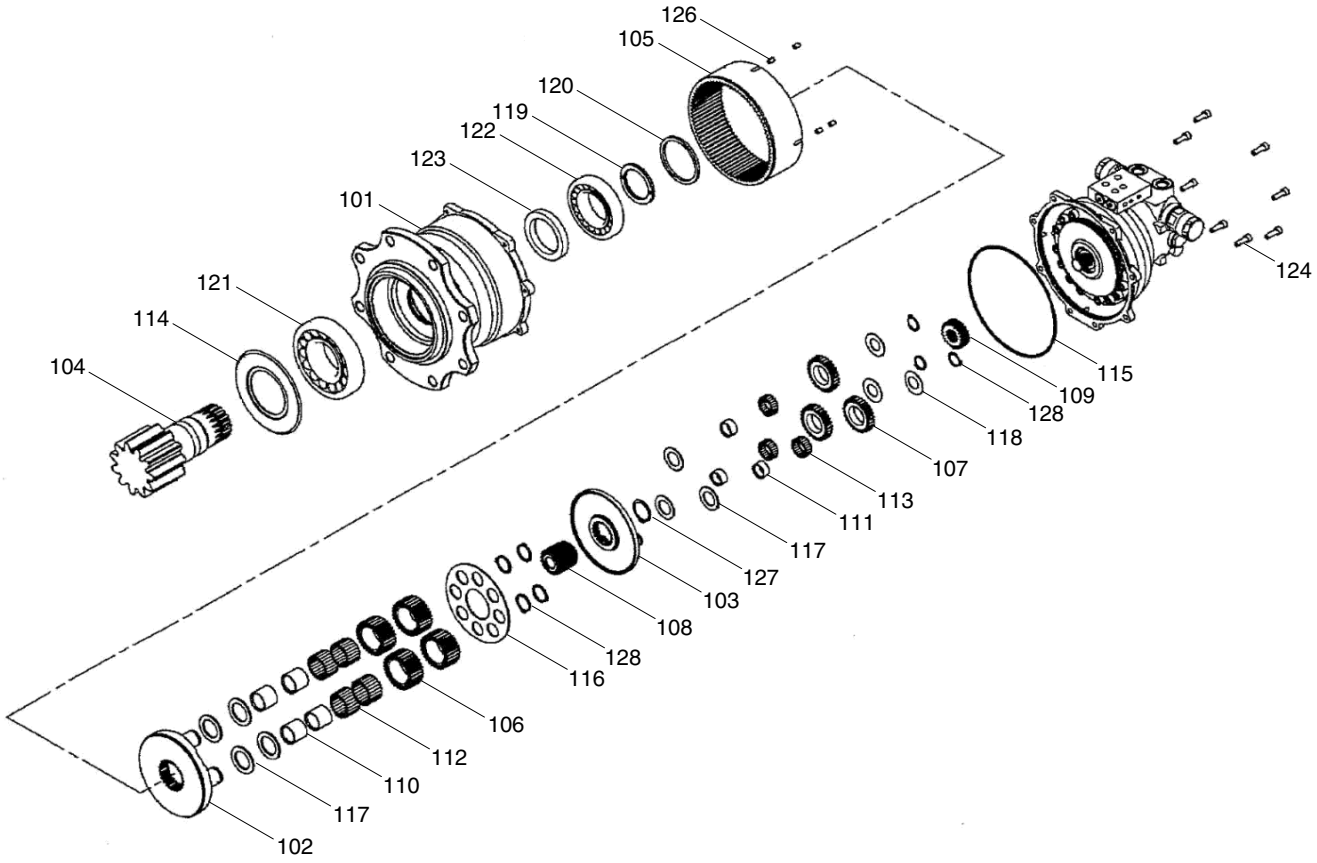
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling and check oil come out from plug.
⑤ Tighten plug fully.

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





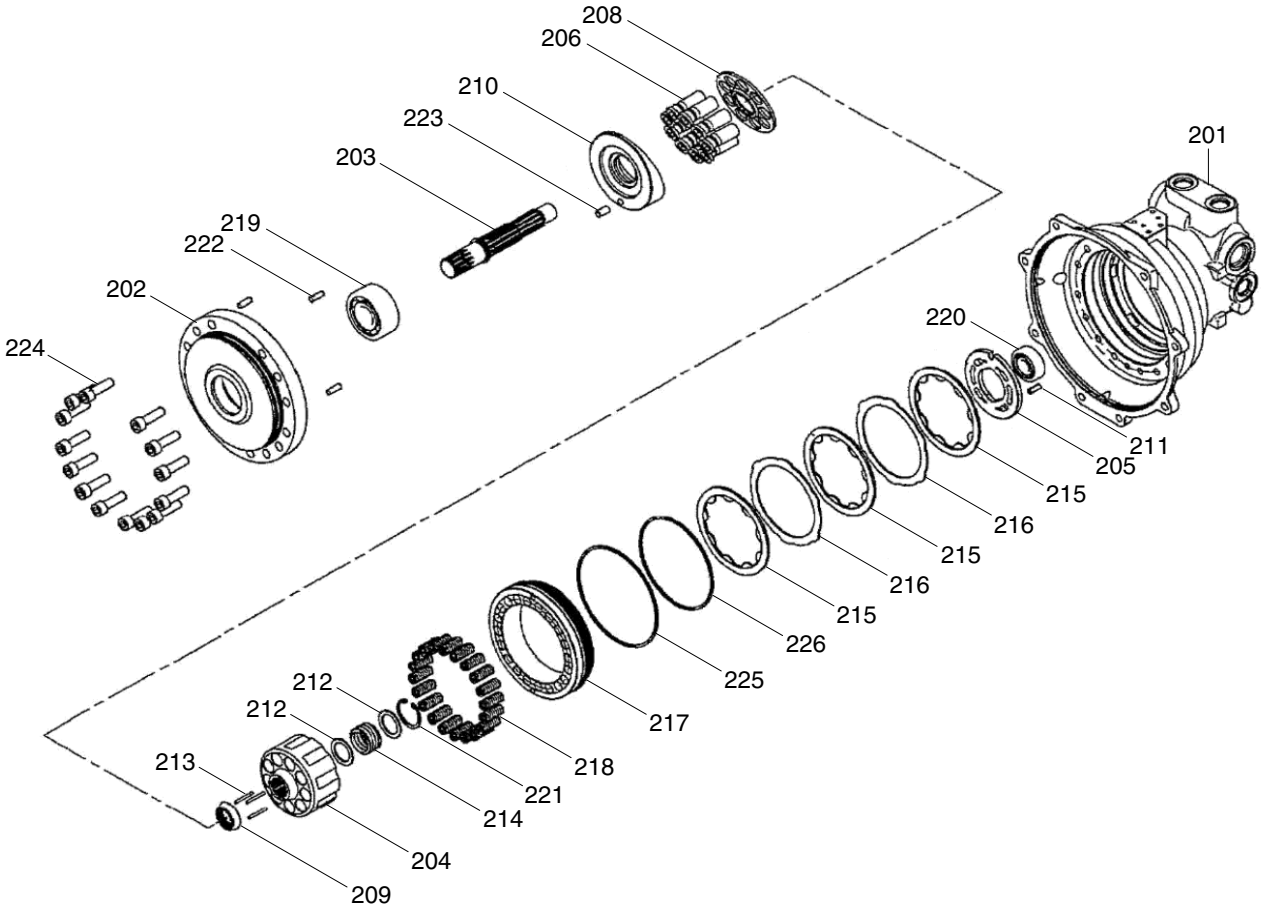
2) COMPONENTS (1/3)



80CR9A2SM15

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

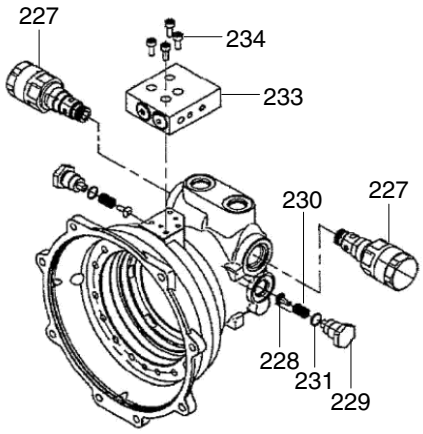
COMPONENTS (2/3)



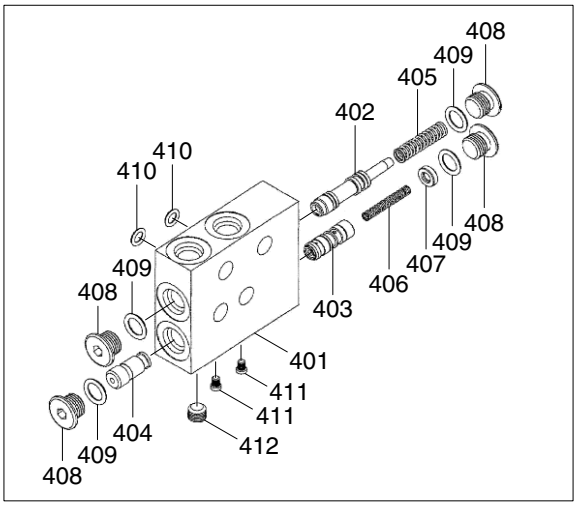
80CR9A2SM16

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

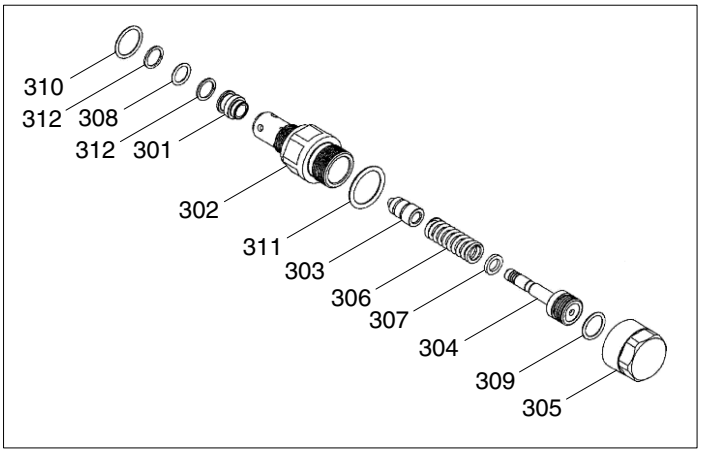
COMPONENTS (3/3)



DETAIL ITEM 233



DETAIL ITEM 227



80CR9A2SM16-1

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

2) GENERAL ATTENTION

Please pay attention following points.

(1) Working should be done at the clean place and pay attention not to attach dust, paint cake and water. And prepare the clean box to put into the disassembled parts.

(2) Before disassembling, clean up the dust which is attached to the outside of the swing motor and take out paint which is attached to the binding parts by the wire brush.

(3) To make the original position when assembling, make a marking before disassembling.

(4) Give special care to protect parts from damage.

(5) Wash parts with washing oil sufficiently.

(6) Check parts whether there is friction loss or seize and take out burr with sand paper.

(7) Change the seals and snap rings to new ones.

3) DISASSEMBLY AND ASSEMBLY PROCEDURE

As the swing motor composes 2 blocks (hydraulic motor and reduction gear), explain each block disassembly and assembly procedure.

And please refer to the page 7-67~69.

4) TOOLS FOR DISASSEMBLY AND ASSEMBLY

No.	Tool	
1 2	Preset type hand torque wrench	45 N (JIS B4650) 90 N (JIS B4650)
3 4 5	Hexagon bar bit for above wrench	Two-plane width 5 Two-plane width 6 Two-plane width 8
6	Single purpose type hand torque	T = 12±0.6 kgf · m (86.8±4.4 lbf · ft) Two-plane 27 T = 22.5±2.5 kgf · m (163±18.1 lbf · ft) Two-plane 41
7 8 9	Hexagon bar wrench	Two-plane width 5 Two-plane width 6 Two-plane width 8
10	Spanner	Two-plane width 27 Two-plane width 41
11	Minus driver	Width 6~10
12 13 14	Snap ring pliers	Ø 35 for hole Ø 30 for shaft Ø 48 for shaft
15	Hammer	-
16	Plastic hammer	-
17 18 19 20 21	Other	Grease (oil designated hydraulic oil) Wire brush Sand paper Anti-loose adhesive (three bond #1305)

3. DISASSEMBLY

1) HYDRAULIC MOTOR

(1) Loose the hexagon socket head cap bolts (124), and take out the hydraulic motor assembly from the reduction gear body.

· Tools required :
Hexagon bar wrench : 6 mm

※ When taking out the hydraulic motor assembly from the reduction gear body, the drain port should be open.
When it is difficult to take out, insert the minus driver into the binding face to the body. If a part of the binding the surface becomes convex by the driver, take out the burr completely.

(2) Loose the hexagon socket head cap bolts (234), and take out the timer valve (233) from the hydraulic motor assembly.

· Tools required :
Hexagon bar wrench : 5 mm

(3) Take out the relief valve assembly (227).

· Tools required :
Spanner : 41 mm

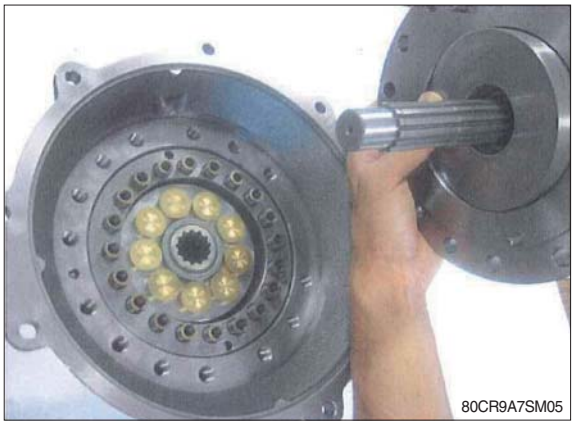
※ Do not disassemble the relief valve assembly, unless it is necessary.

(4) Loose the hexagon socket head cap bolts (224), and take out it.

· Tools required :
Hexagon bar wrench : 8 ㎜

(5) Take out the plate S (202).

※ Pay attention not to drop off swash plate (210).



(6) Take out the swash plate (210) and the shaft kit from the plate S (202).

※ When it is difficult to take out the shaft, hit the opposite side slightly by the plastic hammer.
As the bearing (216) is pressed into the shaft, do not disassemble unless it is necessary to change the bearing.

(7) Take out the spring B (218) from the brake piston (217).

· Spring B (218) : 20 pcs

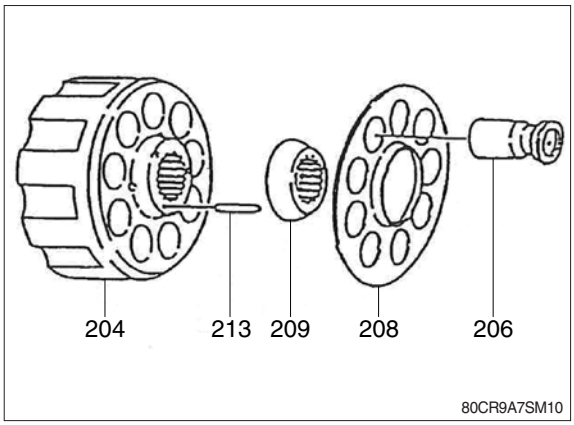
(8) Take out the parallel pin (222) from the plate S (202).

· Parallel pin (222) : 3 pcs

(9) Take out the cylinder barrel kit.

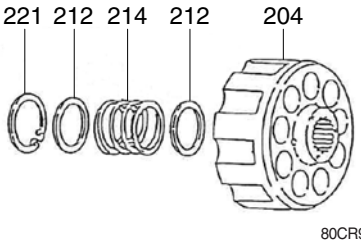
※ Pay attention not to lose parts, which are scattered easily.
There is a possibility to stay valve plate (205) on bottom face of cylinder barrel. Pay attention not to drop off it.

(10) Take out the piston assemblies (206), the shoe (208), the barrel holder (209) and the pin (213).



(11) Take out the snap ring (221), the retainer (212) and the spring C (214).

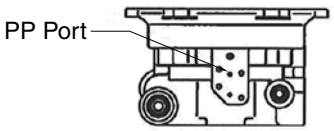
· Tools required :
Snap ring plier : ø 35 for hole



80CR9A7SM11-1

(12) Take out the brake piston (217) and the O-ring (225, 226) from body H (201).

※ Blow in air from PP port little by little to remove brake piston.
Pay attention not to come off it suddenly.



80CR9A7SM12-1

80CR9A7SM12

(13) Take out the disk plate (215), and the steel plate (216).
- Disk plate (215) : 3 pcs
- Steel plate (216) : 2 pcs

80CR9A7SM13

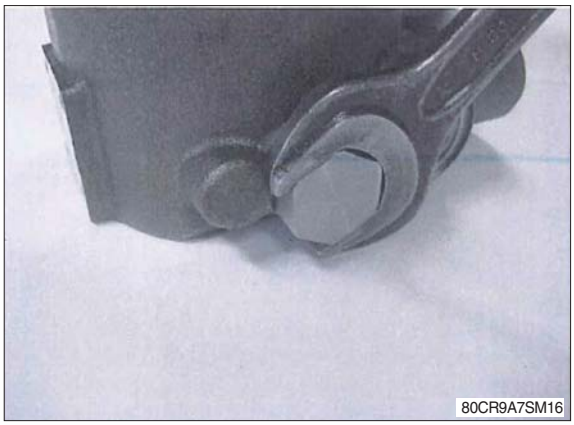
80CR9A7SM14

(14) Take out the valve plate (205).

80CR9A7SM15

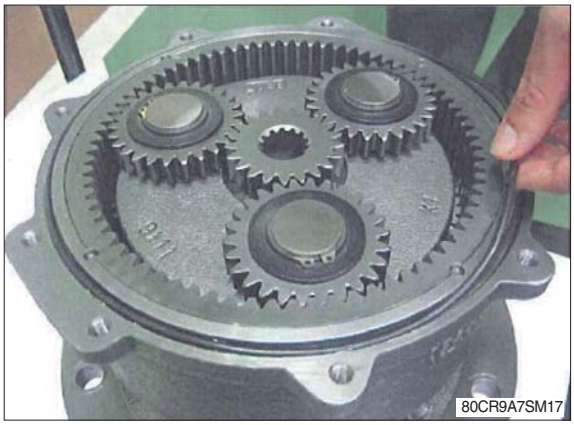
(15) Loose the plug (229), and take out the check valve (228) and the spring (230). (2 locations)

· Tools required :
Spanner : 27 mm

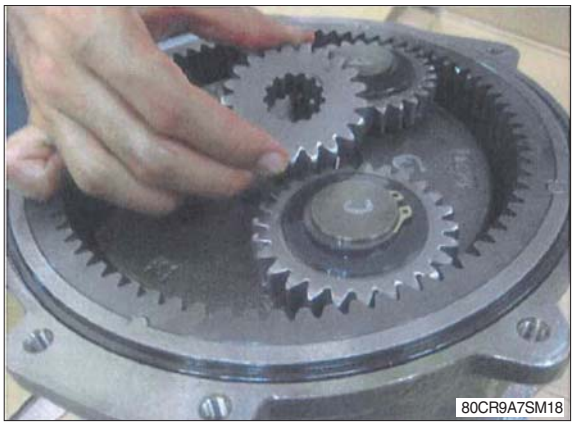


2) REDUCTION GEAR

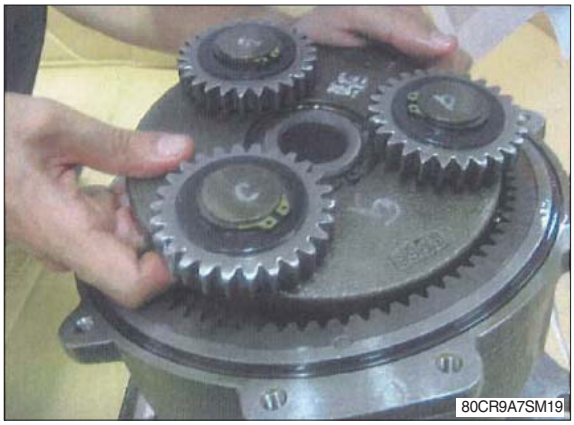
(1) Take out the O-ring (115).



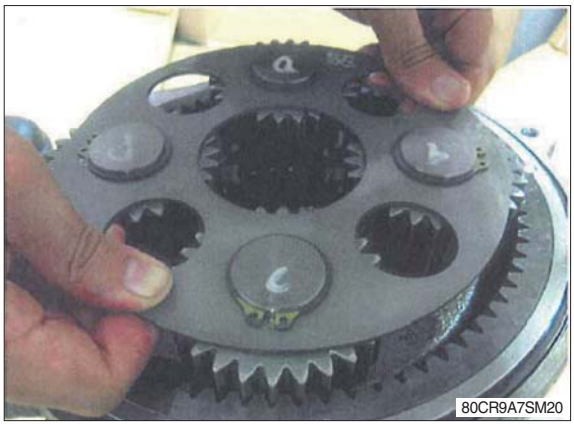
(2) Take out the S2 gear (109).



(3) Take out the carrier 2 kit.



(4) Take out the carrier 1 kit.



(5) Take out the snap ring (128), the thrust washer (118), the b2 gears (107) and the needles 2 (113) from the carrier 2 kit.

(6) Take out the snap ring (128), and the S1 gear (108) from the carrier 2 kit.

(7) Take out the ring 2 (111) and thrust washers (117) from the carrier 2 kit.

(8) Take out the snap ring (128) and the thrust plate 1 (116) from the carrier 1 kit.

(9) Take out the b1 gears (106) and needles (112) from the carrier 1 kit.

(10) Take out the rings 1 (110) and the thrust washers (117) from the carrier 1 kit.

4. ASSEMBLY

1) HYDRAULIC MOTOR SECTION

(1) Press-fit the bearing (220) and spring pin (211) into the body H (201).

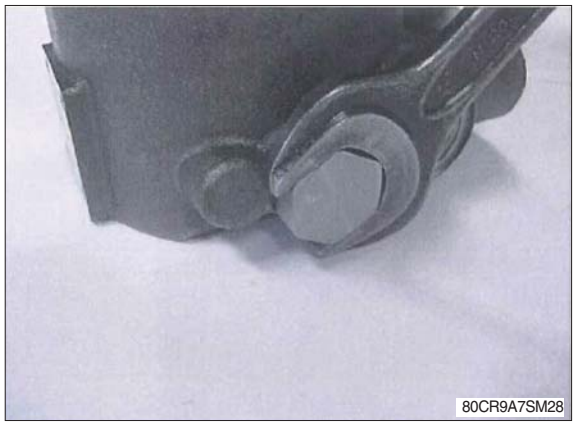

80CR9A7SM27

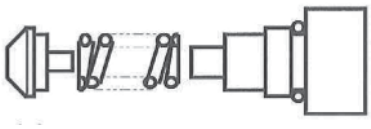
(2) Insert the 2 check valves (228) (1 pc/side), springs (230) (1pc/side) and plug (229) (1pc/side) with O-ring (231) in that order into the body H (201). (2 locations)

· Tools required :
Spanner : 27 mm
Torque wrench

※ Apply grease slightly to the O-ring and assemble to pay attention not biting the seals.

· Plug tightening torque :
12±0.6 kgf · m (86.8±4.34 lbf · ft)

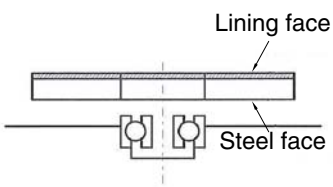

80CR9A7SM28


80CR9A7SM28-1

(3) Place the valve plate (205) onto the body H (201).

※ The steel face of the valve plate should be downside and assemble.


80CR9A7SM29



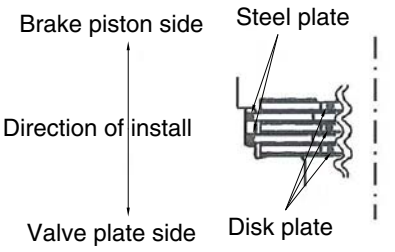
80CR9A7SM29-1

(4) Assemble the disk plate (215) and steel plate (216).

※ Number of parts count on installing
- Disc plate : three
- Steel plate : two

※ Please assemble exact number of parts and exact order. (refer the below drawing)

※ Please install disc plate ditch wih accuracy in order to install cylinder barrel assy into it on (9), see the page 7-81.

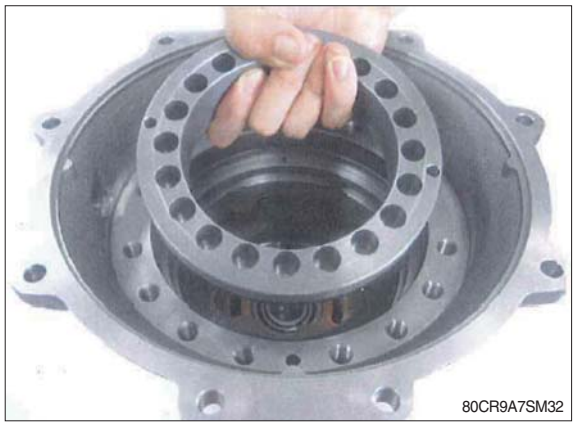


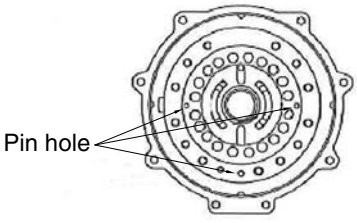
80CR9A7SM31-1

(5) Make the brake piston assembly which placed O-rings (225, 226) on brake piston (217), and place it onto the body H (201).

Place the brake piston assembly onto plate S placed 3 pins, then place it onto the body H as matched pin hole position. After that, press-fit it by tightening hexagon bolts little by little.
Check no pushed out, scratches and dust on O-ring at this time.
To preven the brake piston assembly falling off, apply grease on plate S.
Take out the plate S after placed brake piston assembly.

※ Pay attention to jam seal parts, install them applying grease on O-rings.



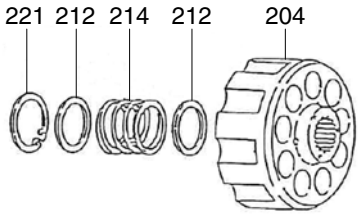


80CR9A7SM32-1

(6) Place the retainer (212), spring C (214) and retainer (212) in that order into the cylinder barrel (204), and then secure them with the snap ring (221).

· Tools required :

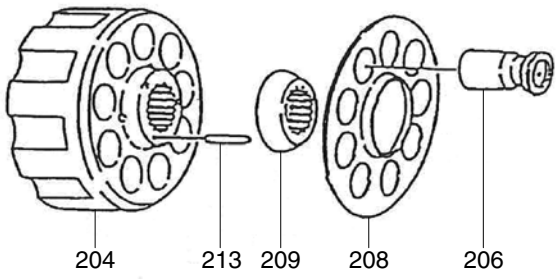
Snap ring plier : ø 28 for hole



80CR9A7SM11-1

(7) Make the shoe holder assembly which has the 9 piston assemblies (206) placed on the shoe holder (208).

(8) Place the 3 pins (213), barrel holder (209) and the shoe holder assembly onto the cylinder barrel (204) to make up a cylinder barrel assembly.

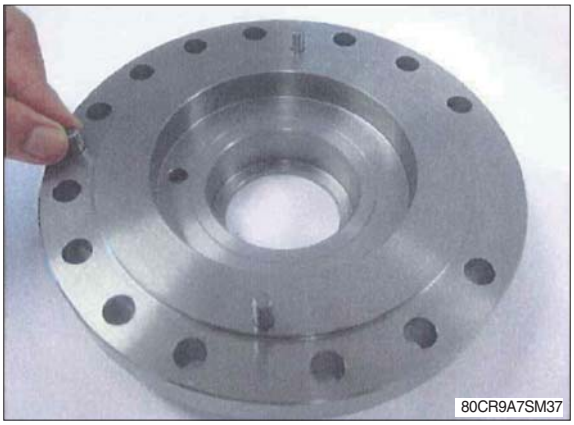


80CR9A7SM10

(9) Insert cylinder barrel assembly along ditch of disk plate into body H (201).

(10) Place the parallel pins (222) into the plate S (202).

· Parallel pin (222) : 3 pcs



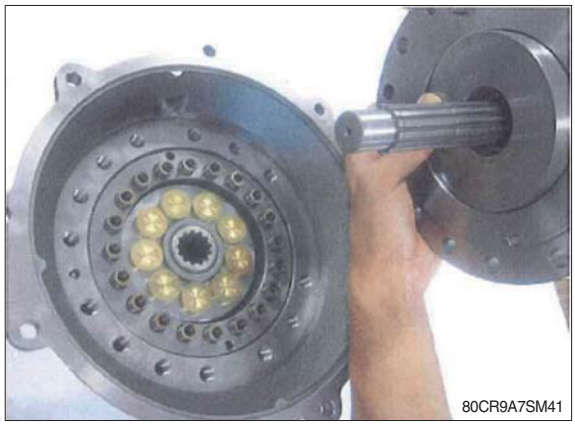
(11) Insert the spring B (218) into the brake piston (217).

· Spring B (218) : 20 pcs

(12) Press-fit bearing (219) with shaft (203).

(13) Place the shaft kit and the swash plate (210) into the plate S (202).

(14) Join the body H (201) and the plate S (202).



(15) Bolt the plate S (202) together with the 14 hexagon socket head cap bolts (224).

· Tools required :
Hexagon bar wrench : 8 mm
Torque wrench

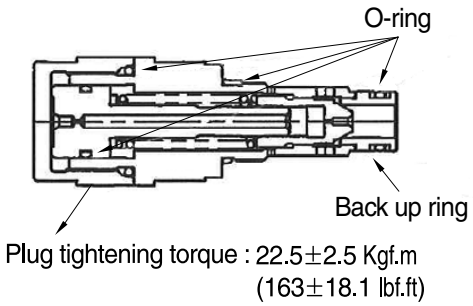
· Bolt tightening torque :
6±0.3 kgf · m (43.4±2.17 lbf · ft)

(16) Screw up the relief valve assembly.
(both side)

· Tools required :
Spanner : 41 mm
Torque wrench

· Plug tightening torque :
22.5±2.5 kgf · m (163±18.1 lbf · ft)

※ Once the relief valve is disassembled, replace the O-ring and the back up ring in the below, and screw the cap with the following torque.



80CR9A7SM43-1

80CR9A7SM43

(17) Screw up the timer valve.

· Tools required :
Hexagon bar wrench : 5 mm
Torque wrench

· Plug tightening torque :
1.2±0.1 kgf · m (8.7±0.72 lbf · ft)

80CR9A7SM44

2) REDUCTION GEAR SECTION

(1) Place the ring (110) (1 pc/pin) and the thrust washer (117) (1 pc/pin) in that order onto the pins of the carrier 1 (102). (4 locations)

(2) Place the b1 gear (106) (1 pc/pin) and the 92 needles 1 (112) (24 pcs/pin) in that order onto the 4 pins of the carrier 1 (102). (4 locations)

(3) Place the thrust plate (116) and the 4 snap rings (128) (1 pc/pin) to make up a carrier 1 kit.

· Tools required :
Snap ring plier : ø 30 for shaft

※ Pay attention to the direction of the snap ring. The edge side should be uppermost. Pay attention not to open the snap ring too much.
The snap ring which was opened too much should lose tension and be replaced.

(4) Place the thrust washer (117) (1 pc/pin) and the ring 2 (111) (1 pc/pin) in that order onto the pin of the carrier 2 (103). (3 locations)

80CR9A7SM48

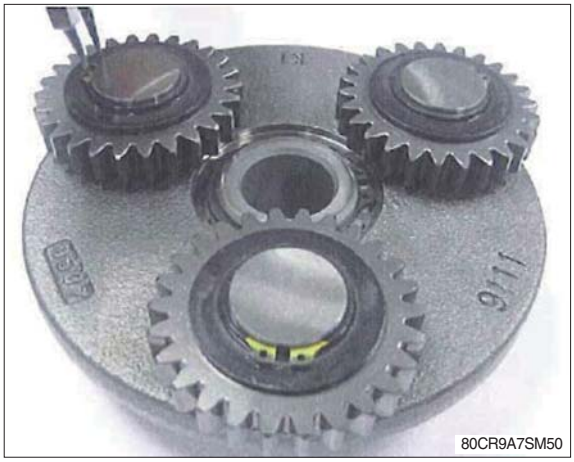
(5) Place the S1 gear (108) onto the carrer 2 (103) to make up a carrier 2 kit.
· Tools required :
Snap ring plier : ø 48 for shaft

※ Pay attention to the direction of the snap ring. The edge side should be uppermost. Pay attention not to open the snap ring too much.
The snap ring which was opened too much should lose tension and be replaced.

80CR9A7SM49

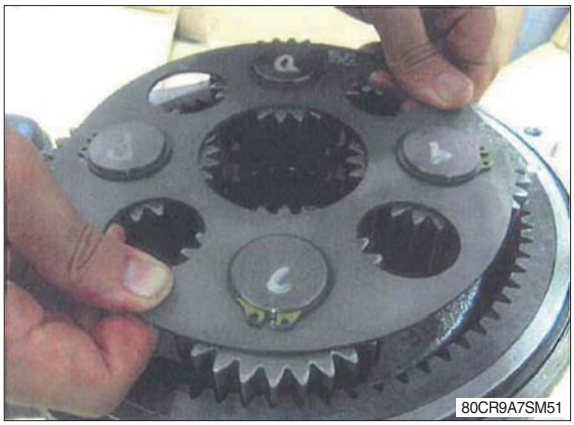
(6) Place the b2 gears (107) (1 pc/pin), the 72 needle (113) (24 pcs/pin), and the snap ring (128) in that order onto the pin of the carrier 2 (103). (3 locations)
· Tools required :
Snap ring plier : ø 30 for shaft

※ Pay attention to the direction of the snap ring. The edge side should be uppermost. Pay attention not to open the snap ring too much.
The snap ring which was opened too much should lose tension and be replaced.



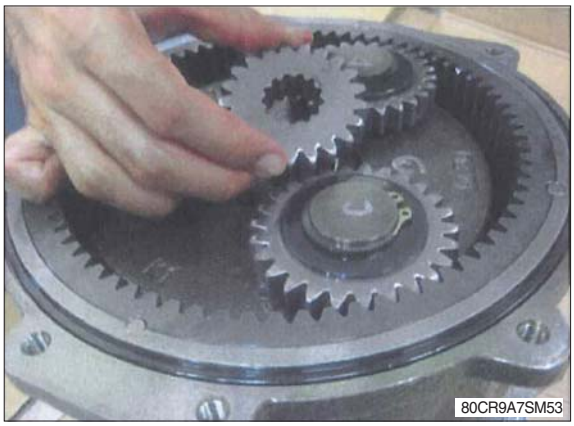
80CR9A7SM50

(7) Place the carrier 1 assembly into the body (101) align spline of carrier to the pinion shaft (104).

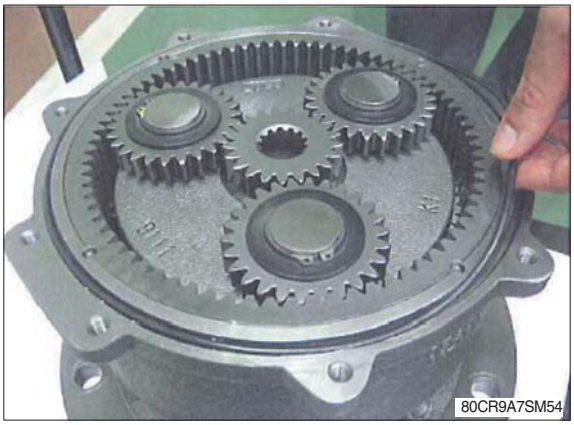


(8) Place the carrier 2 assembly into the body (101) align spline of S1 gear (108) to the b1 gear (106).

(9) Place the S2 gear (109) into the carrier 2 assembly.



(10) Place the O-ring (115) onto the body (101).



(11) Fill body (101) with hydraulic oil.

※ Oil : ISO VG 46 or equivalent
Oil amount : 2 to 3 mm below top of the B2 gear.
Wipe oil off flange surface if it is spilled.

(12) Join the hydraulic motor and the body, and then bolt them together with the hexagon socket head cap bolts (124).

· Tools required :
Hexagon bar wrench : 6 mm
Torque wrench

※ Align the shaft of the motor to the S2 gear.
Apply anti-loose adhesive to the screws.

· Plug tightening torque :
3±0.3 kgf · m (21.7±2.17 lbf · ft)

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.

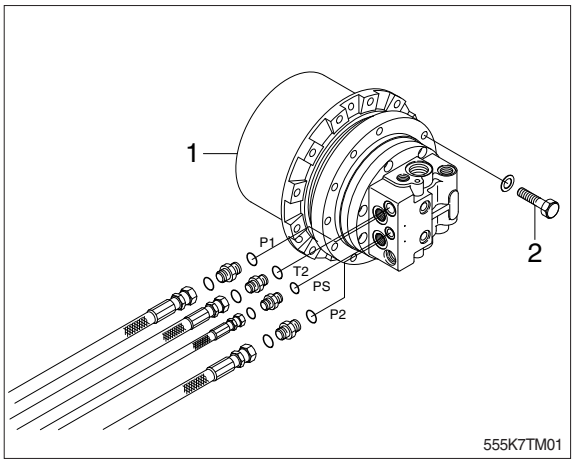
(6) Remove the hose.

※ **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 : 85 kg (190 lb)



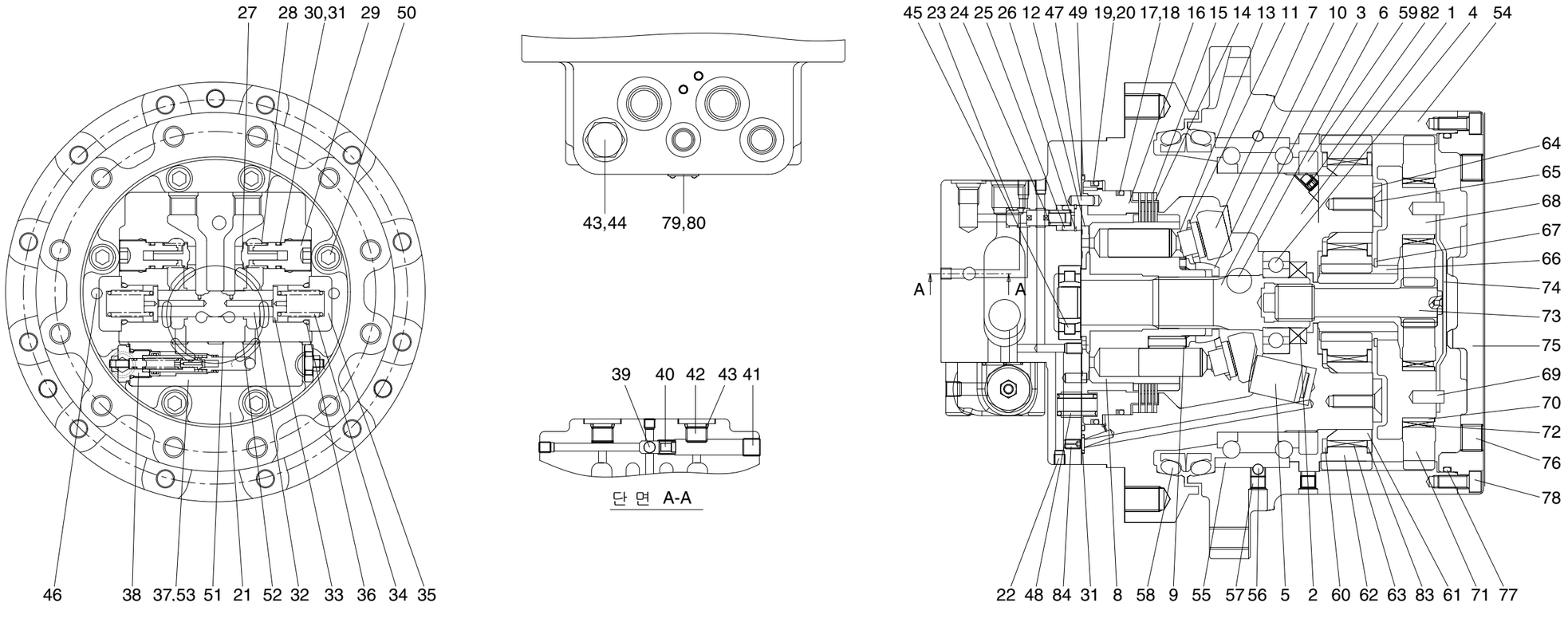
2) INSTALL

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

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

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

2) STRUCTURE



80CR92TM03

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

3) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name of tools	Size	Name of applied parts
Hexagonal L-wrench	2.5	Orifice (84)
	4	Plug (22)
	6	Plug (41), wrench bolt (65, 78)
	8	Plug (76)
	-	Plug (29, 42, 44)
Socket wrench / spanner	27	Plug (35), Relief valve assembly (38)
Snap-ring plier (for holes, axis)		Snap ring (26, 67)
Solder hammer		Bearing (4), Pin (46, 47), Oil seal (2)
Torque wrench		Size : 500, 3000
Jig for assembling oil seal		Oil seal (2)
Induction heating apparatus for bearing		Bearing (4)

(2) Tightening torque

No.	Name	Size	Torque
			kgf · m
22	Plug	NPT 1/16	0.7~1.1
29	Plug	M24	5
41	Plug	PT 1/4	5
50	Wrench bolt	M12×35L	10
76	Plug	PT 3/8	8.5
65, 78	Wrench bolt	M8×20L	10

2. DISASSEMBLY

1) GENERAL PRECAUTIONS

(1) Select a clean place for disassembling.
Spread a rubber plate on a working table in order to prohibit the damage of parts.

(2) Clean a deceleration equipment and a motor part, washing out dirt and unnecessary substances.

(3) Without any damage of O-ring, oil seal, the adhered surface of other seals, a gear, a pin, the adhered surface of other bearings, and the surface of moisturized copper, treat each parts.

(4) Numbers written in the parenthesis, ( ), next to the name of a part represent the part numbers of a previous page.

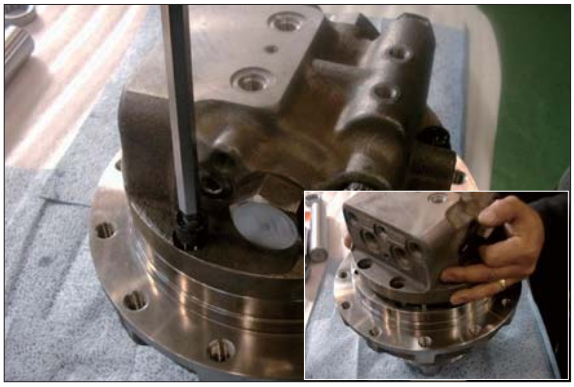
(5) The side of a pipe in a motor can be written as a rear side ; the side of out-put as a front side.

(6) In case of bonding bolts, combine a standard torque by torque wrench after spraying loctite 262 on the tab parts. (It can be dealt as assembling NPTF screws and an acceleration equipment.)

2) DISASSEMBLING

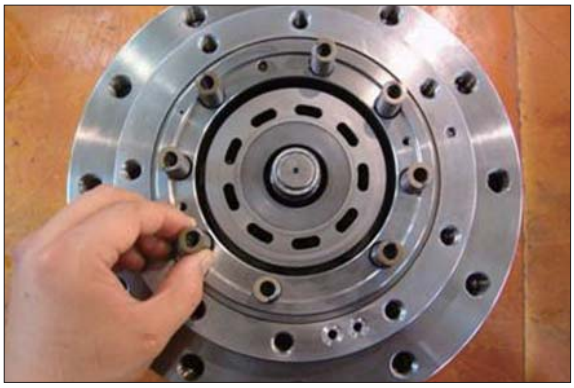
(1) Motor unit

① Put the motor assembly on the assemble table.
Using L-Wrench, disassemble wrench bolt (50)-8EA and so respectively disassemble shaft casing assembly and rear cover assembly.



7078TM01/01A

② Disassemble spring (48)-8EA From shaft casing (1).

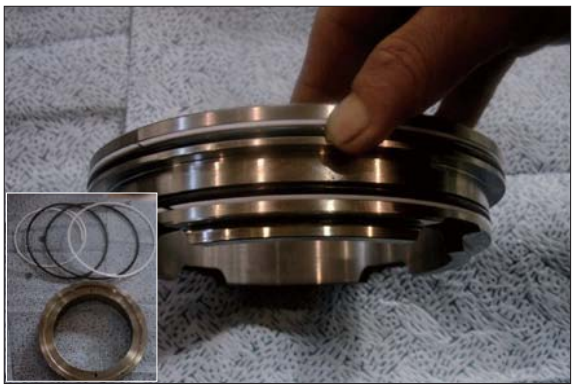


7078TM02

③ Using jig, disassemble parking piston (16) from shaft casing (1).

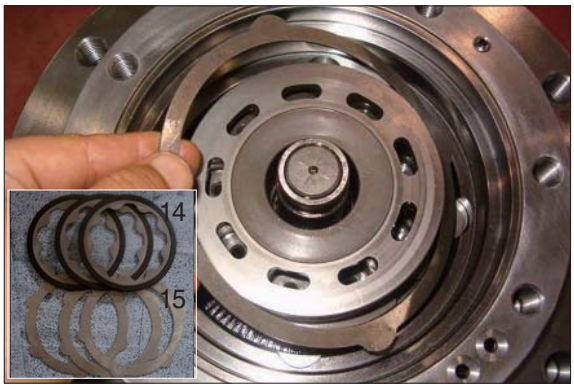
7078TM03

④ Disassemble O-ring (17, 19) and back up ring (18, 20) from parking piston (16)



7078TM04/04A

⑤ Respectively in order friction plate (14), parking plate (15) disassemble from shaft casing (1).



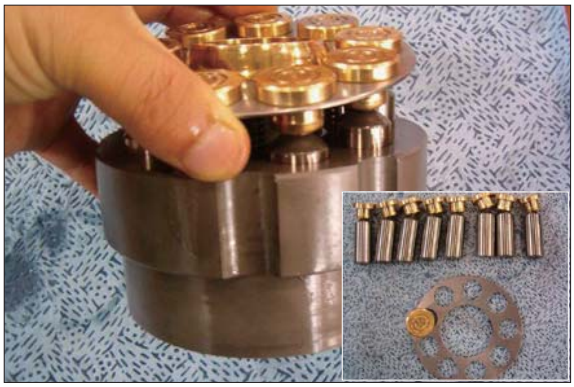
7078TM05/05A

⑥ Disassemble cylinder block assembly (8) from shaft casing (1).

7078TM06

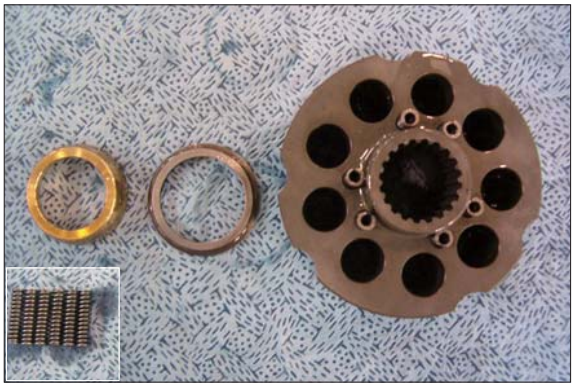
(2) Cylinder block

① Disassemble set plate (11), piston assembly (13) from cylinder block assembly.



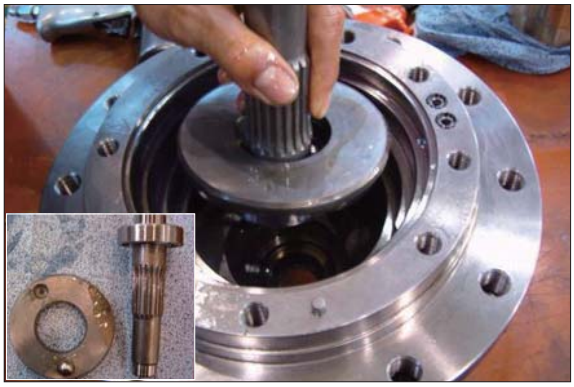
7078TM07/07A

② Disassembling in order cylinder block (8), ball guide (10) and spring (9).



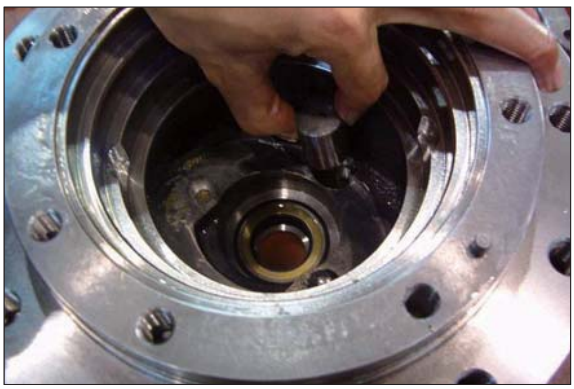
7078TM08/08A

③ Disassembling swash plate (7) and shaft (3) from shaft casing (1).



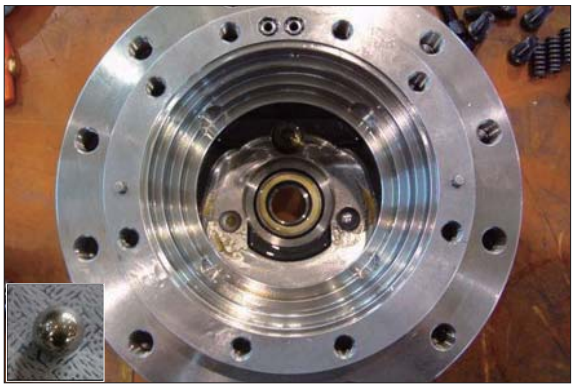
7078TM09/09A

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



7078TM10

⑤ Disassembling steel ball (6) from shaft casing (1).



7078TM11/11A

(3) Rear cover

① Disassembling valve plate (12) from rear cover (21).

7078TM12

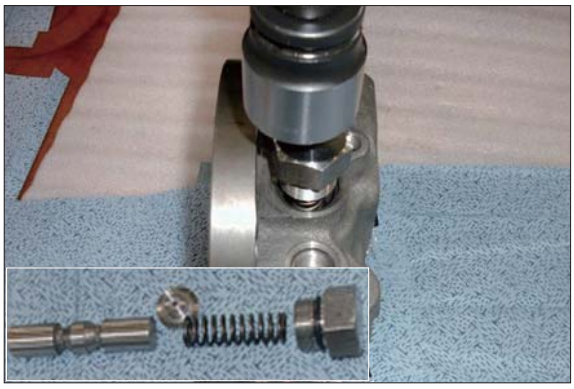
② Using plier jig, disassembling in order snap ring (26), stopper (25), spring (24), spool (23) from rear cover (21).

7078TM13

③ Using L-wrench, disassembling relief valve assembly (38) from rear cover (21).

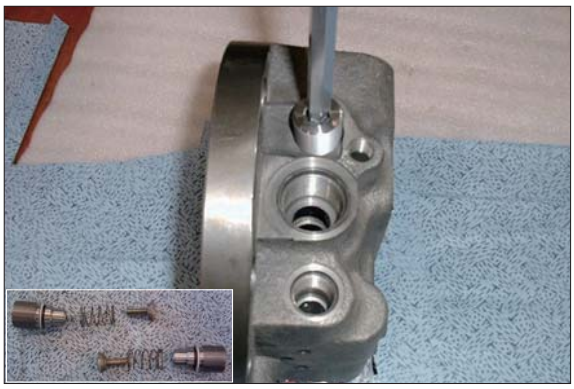
555K7TM14/14A

④ Using torque wrench, disassembling plug (35) in order O-ring (36), spring 34), spring seat (33), main spool (32) from rear cover (21).



7078TM15/15A

⑤ Using L-wrench, disassembling plug (29) in order O-ring (30), back up ring (31), spring (28) and check (27) from rear cover (21).



7078TM16/16A

(4) Reduction gear

① Using L-wrench, disassembling wrench bolt (78) and then ring gear cover (75), O-ring (77) from ring gear (54).

7078TM17/17A

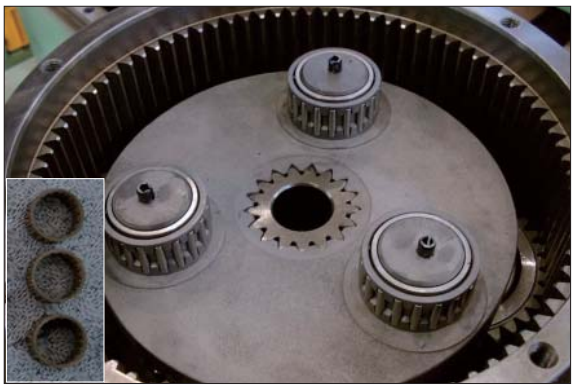
② Disassembling thrust plate (74) from ring gear (54).

7078TM18/18A

③ Disassembling in order planetary gear (71), drive gear (73) from ring gear (54).

7078TM19/19A

④ Disassembling needle bearing (72) from ring gear (54).

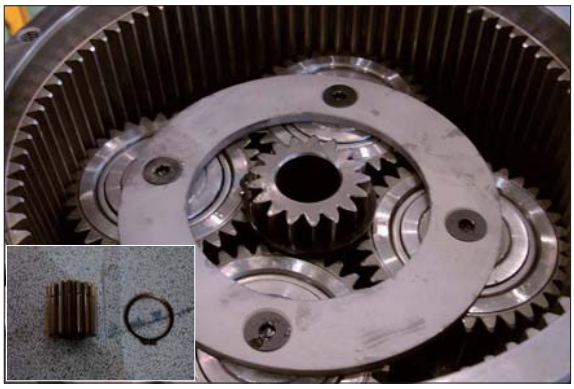


7078TM20/20A

⑤ Disassembling in order collar (70), carrier (68) from ring gear (54).

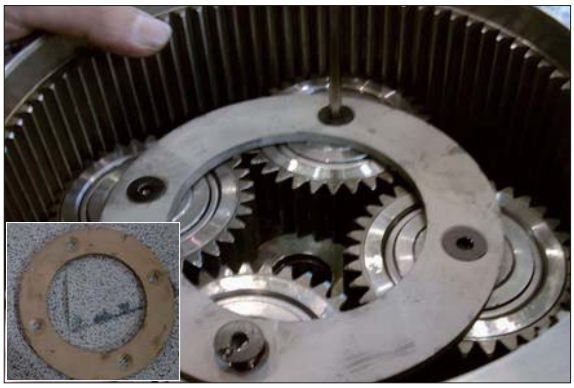
7078TM21/21A

⑥ Disassembling sun gear (66) from ring gear (54) and then disassembling snap ring (67) with plier jig.



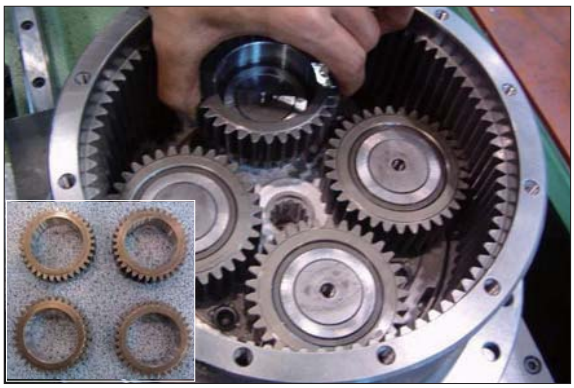
7078TM22/22A

⑦ Using L-wrench, disassembling plate head bolt (65)-4EA from ring gear (54) and then disassembling plate (64).



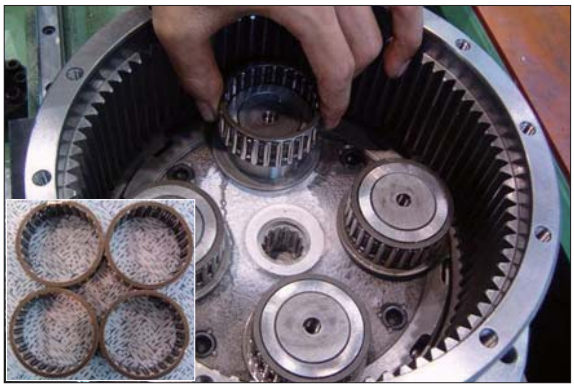
7078TM23/23A

⑧ Disassembling planetary gear (62)-4EA from ring gear (54).



7078TM24/24A

⑨ Disassembling needle bearing (63)-4EA from ring gear (54).

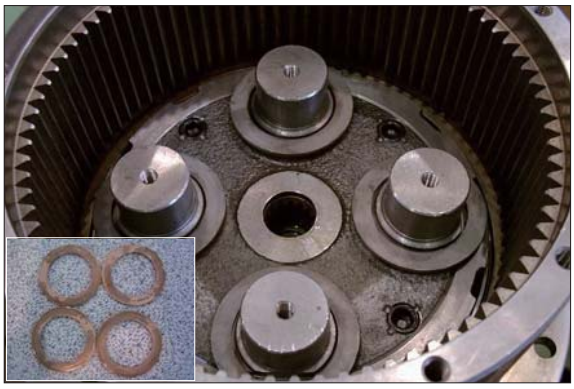


7078TM25/25A

⑩ Disassembling collar (61)-4EA from ring gear (54).

7078TM26/26A

⑪ Disassembling washer (60)-4EA from ring gear (54).

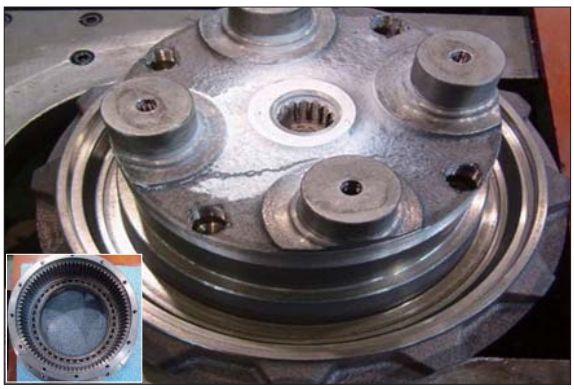


7078TM27/27A

⑫ Using jig, disassembling nut (59) when inner pressed state with L-wrench bolt from ring gear (54).

7078TM28/28A/B

⑬ Put the reduction gear on the assembling jig and then disassembling ring gear (54).



7078TM29/29A

3. ASSEMBLY

1) GENERAL SUGGESTIONS

(1) After washing each parts cleanly, dry it with compressed air.
Provided that you do not wash friction plate with treated oil.

(2) In bonding each part, fasten bond torque.

(3) When using a hammer, do not forget to use a plastic hammer.

2) ASSEMBLING

(1) Sub of turning axis

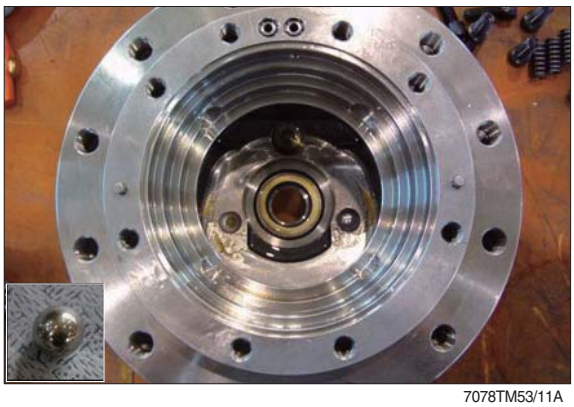
① Using a jig, insert the steel ball (56) to the shaft casing (1) and then assemble plug (57).

7078TM51

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

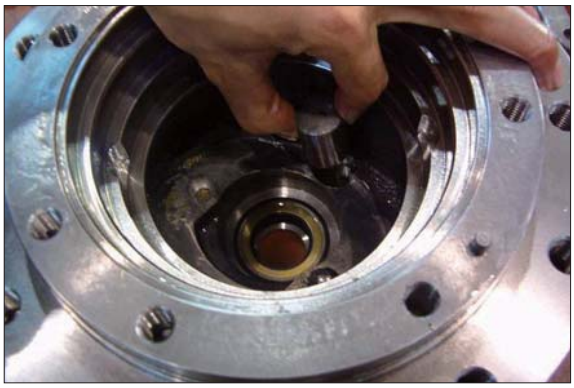
7078TM52

③ Assemble swash steel ball (6) to the shaft casing (1) with grease.



7078TM53/11A

④ Assemble swash piston (5) to the shaft casing (1).



7078TM54

⑤ Heat pressing bearing to the shaft (3).

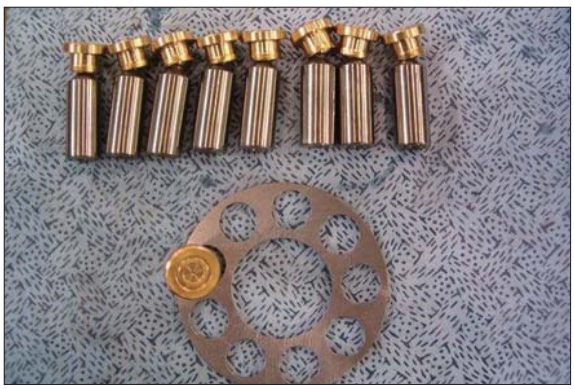
7078TM55

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

7078TM56

(2) Cylinder block sub assembly

① Assemble piston assembly (13) to the set plate (11, 9 set).

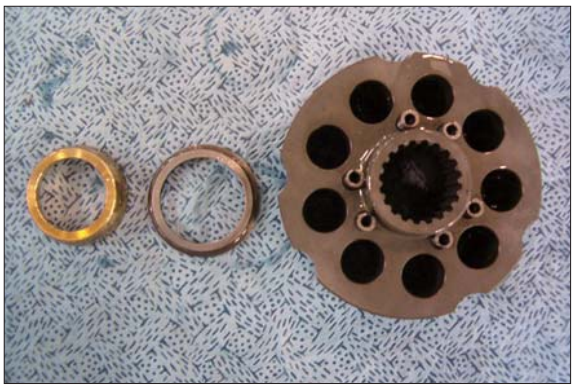


7078TM57

② Assemble spring (9) to the cylinder block (8, 6 set).

7078TM58

③ Assemble ball guide (10) to the cylinder block (8).



7078TM08/08A

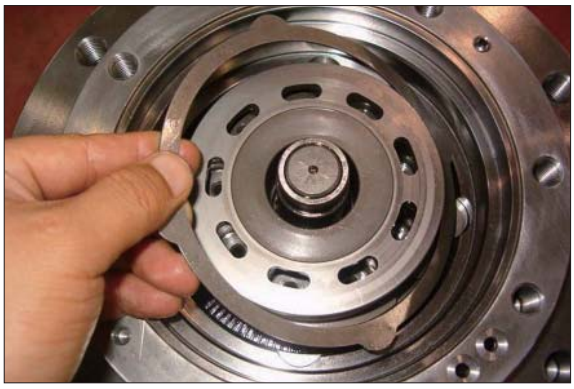
④ Assemble sub-assembled piston (11, 13) to the cylinder block (8).

7078TM60

⑤ Assemble cylinder block (8) to the shaft casing (1).

7078TM06

⑥ Assembling friction plate (14), parking plate (15) (respectively 3EA assembling) to the shaft casing (1).

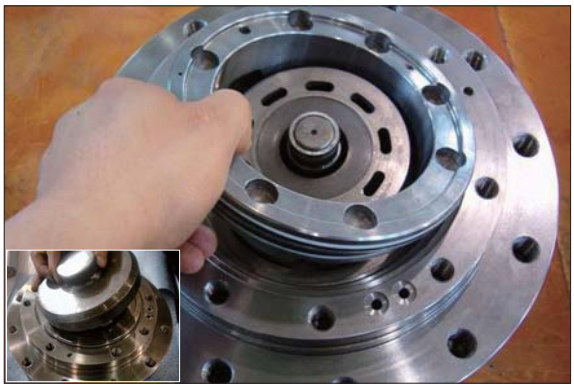


7078TM05

⑦ Assembling back up ring (18), O-ring (17, 19), back up ring (20) to the parking piston (16).

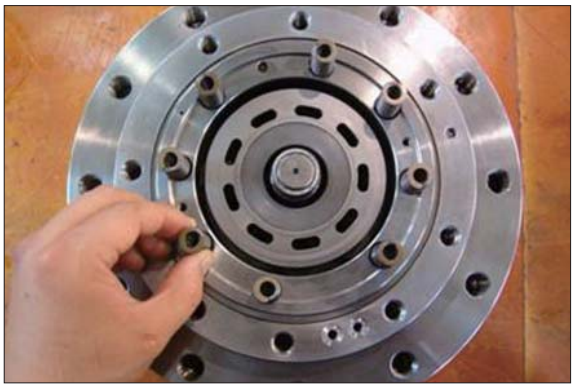
7078TM04/04A

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



7078TM64/64A

⑨ Assemble spring (48) to the shaft casing (1) and then assemble O-ring (49).



7078TM02

(3) Rear cover assembly

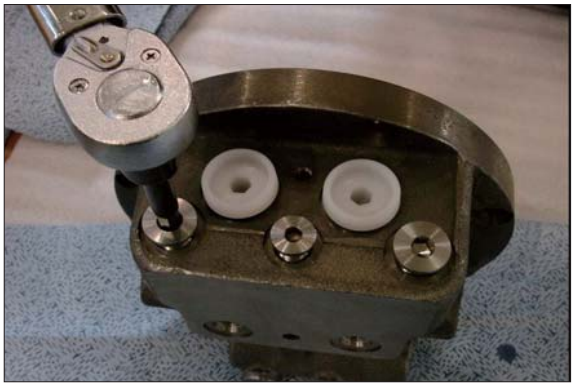
① Using a L-Wrench, assemble plug (22) 10EA to the rear cover (21).

7078TM66

② Assemble in order steel ball (39), check-seat (40) and plug (41) to the rear cover (21).

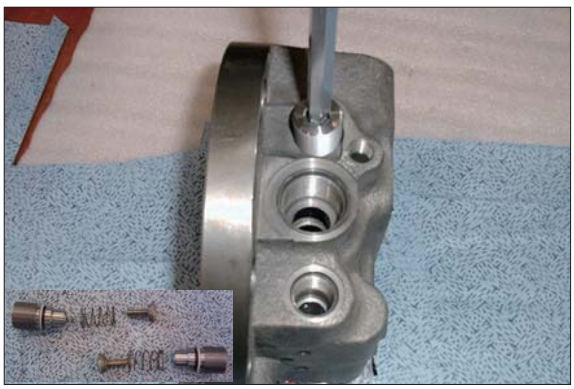
7078TM67

③ Assemble plug (42, 44), O-ring (43) to the rear cover (21).



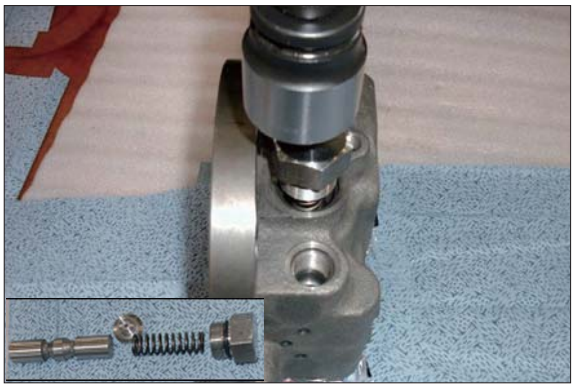
7078TM68

④ Assemble check (27), spring (28) to rear cover (21) and assemble back up ring (31), O-ring (30) to the plug (29) after then using L-Wrench.



7078TM16/16A

⑤ Insert main spool (32), spring-seat (33), spring (34) to the rear cover (21) and assemble plug (35) with L-wrench.

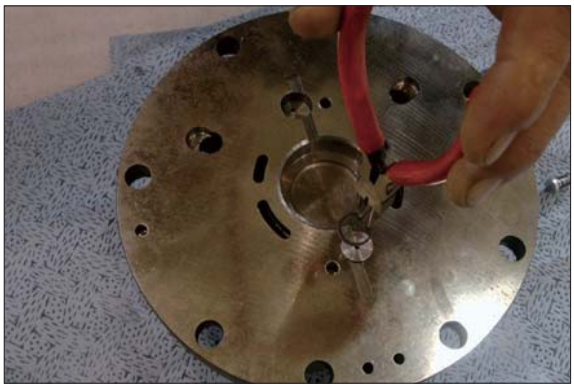


7078TM15/15A

⑥ Assemble relief valve assembly (38) (with left-right symmetry) to the rear cover (21) and then tighten with a torque wrench.

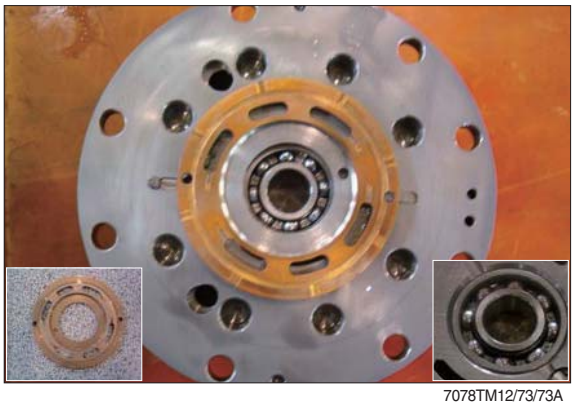
7078TM71

⑦ Using a plier jig, assemble snap ring (26), stopper (25), spring (24), spool (23) to the rear cover.



7078TM13

⑧ Assemble roller bearing (45), pin (46) and valve plate (12) to the rear cover (21).



7078TM12/73/73A

⑨ Combine rear cover assembly and shaft casing assembly with bolt (50).

7078TM74

(4) Travel reduction gear

① Before assembling nut (59) to the motor. Eliminate burr and alien substances ready for assembling.

7078TM77/28A

② Insert ring gear (54) to the spray washing M/C and heat 69˚C ~70˚C one minute.

7078TM78

③ Assembling angular bearing (55) to the ring gear (54).

7078TM79/79A

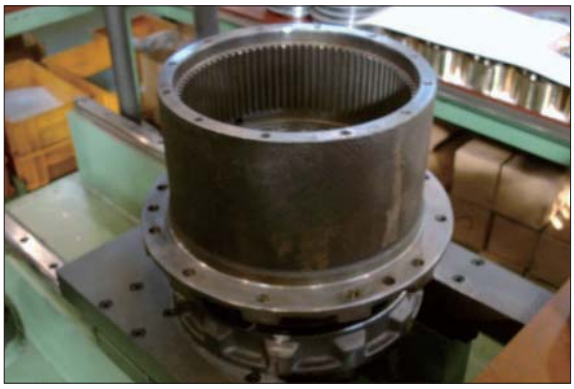
④ Insert steel ball (56) 105EA to the ring gear (54) with a jig after assembling plug (57) 2EA with L-Wrench.

7078TM80/80A

⑤ Assemble floating seal (58) to ring gear (54) and motor part with a jig.

7078TM81/81A/82

⑥ Upset the ring gear (54) and assemble with motor.

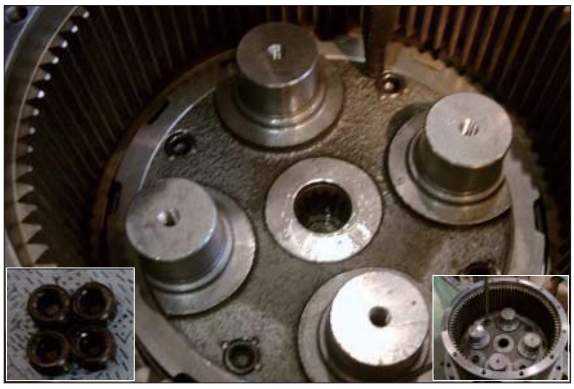


7078TM83

⑦ Combine nut (59) to the ring gear (54) and pressing use a jig and then assembling with torque-wrench.

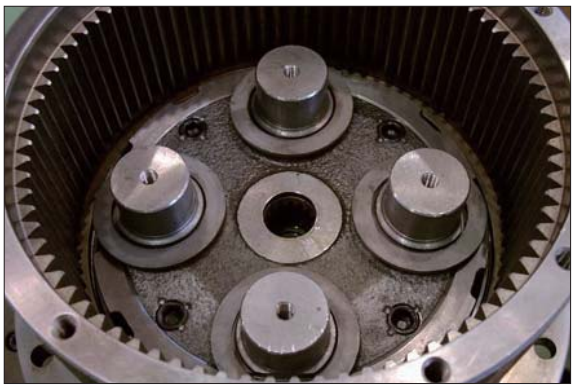
7078TM28/28B/28C

⑧ Using a L-wrench, assembling plug-4EA to the ring gear (54) and then cocking by a jig.



7078TM84/84A/85

⑨ Assemble washer (60)-4EA the ring gear (54).

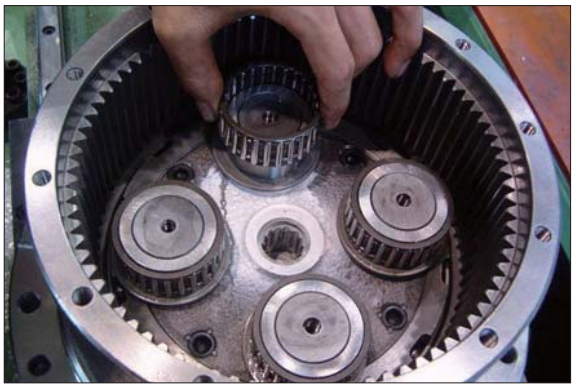


7078TM27

⑩ Assemble collar (61)-4EA to the ring gear (54).

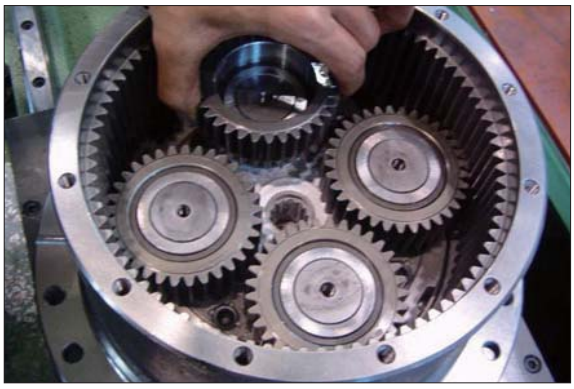
7078TM26

⑪ Assemble needle bearing (63)-4EA to the ring gear (54).



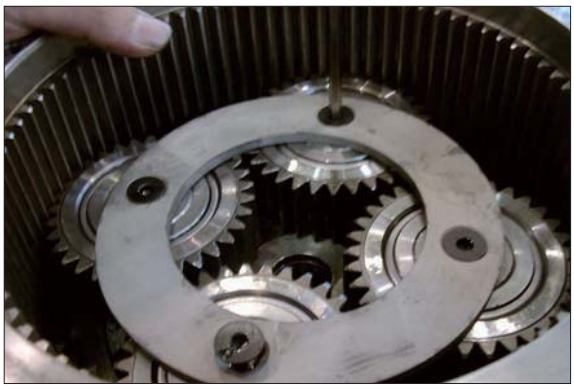
7078TM25

⑫ Assemble planetary gear (62)-4EA to the ring gear (54).



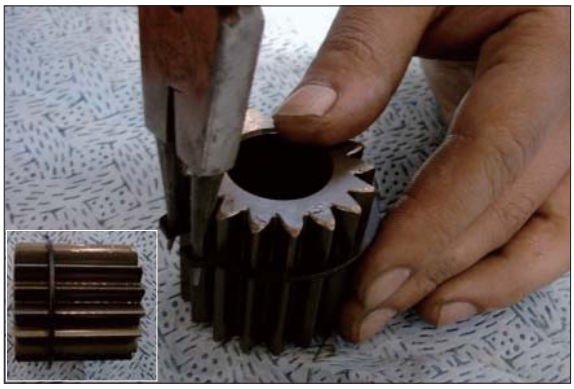
7078TM24

⑬ Assemble plate (64)-1EA to the ring gear (54) and then combine plate head bolt (65)-4EA with L-wrench.
(after paste loctite and then combine the plate head bolt).



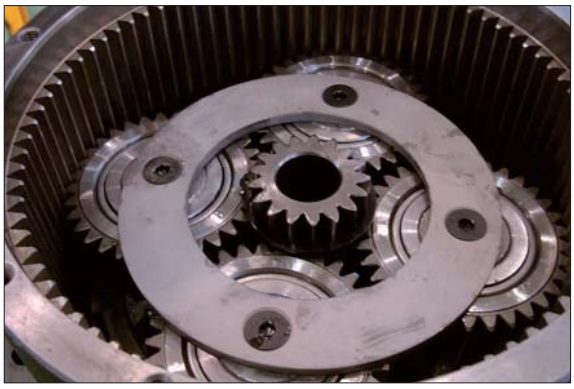
7078TM23

⑭ Assembling snap ring (67) to the sun gear (66) with a plier jig.



7078TM86/86A

⑮ Assemble sun gear with snap ring assembly to the ring gear (54).



7078TM22

⑯ Assemble in order collar (70), spring pin (69) to the carrier (68).

7078TM21

⑰ Assemble carrier sub assembly to the ring gear (54).

7078TM87

⑱ Assemble needle bearing (72)-3EA to the ring gear (54).

7078TM20

⑲ Assemble in order planetary gear (71), drive gear (73) to the ring gear (54).

7078TM19

⑳ Assemble thrust plate (74) to the ring gear (54).

7078TM18

㉑ Assemble in order ring gear cover (75) with O-ring (77) and then assemble wrench bolt (78) with torque-wrench.

7078TM17/17A

㉒ Roll the tarpon tape to the ring gear (54) and then combine with L-wrench(after test of drain part water pressure and capacity and then assemble plug PT3/8 form).

7078TM88

(5) Test

① Motor water pressure test

-Check the oil leak for one minute by appearance test at air pressure 5 kgf/cm^2.

7078TM89

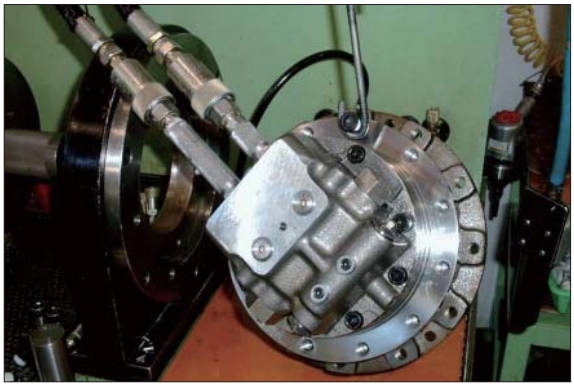
② Performance test

-Pour the gear oil (80W-90) by beaker at the reduction gear.

7078TM90

③ Test bench mounting

-Partially performance test by mounting motor test bench.



7078TM91

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

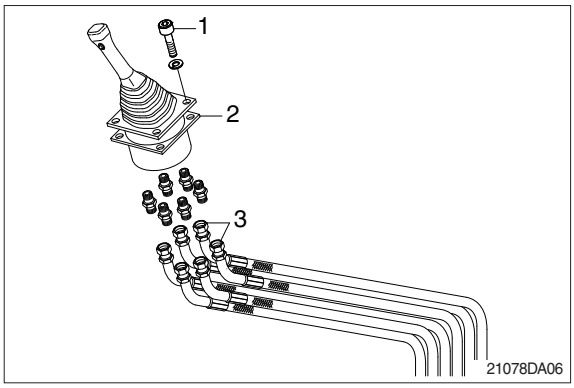
(4) Loosen the socket bolt (1).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.



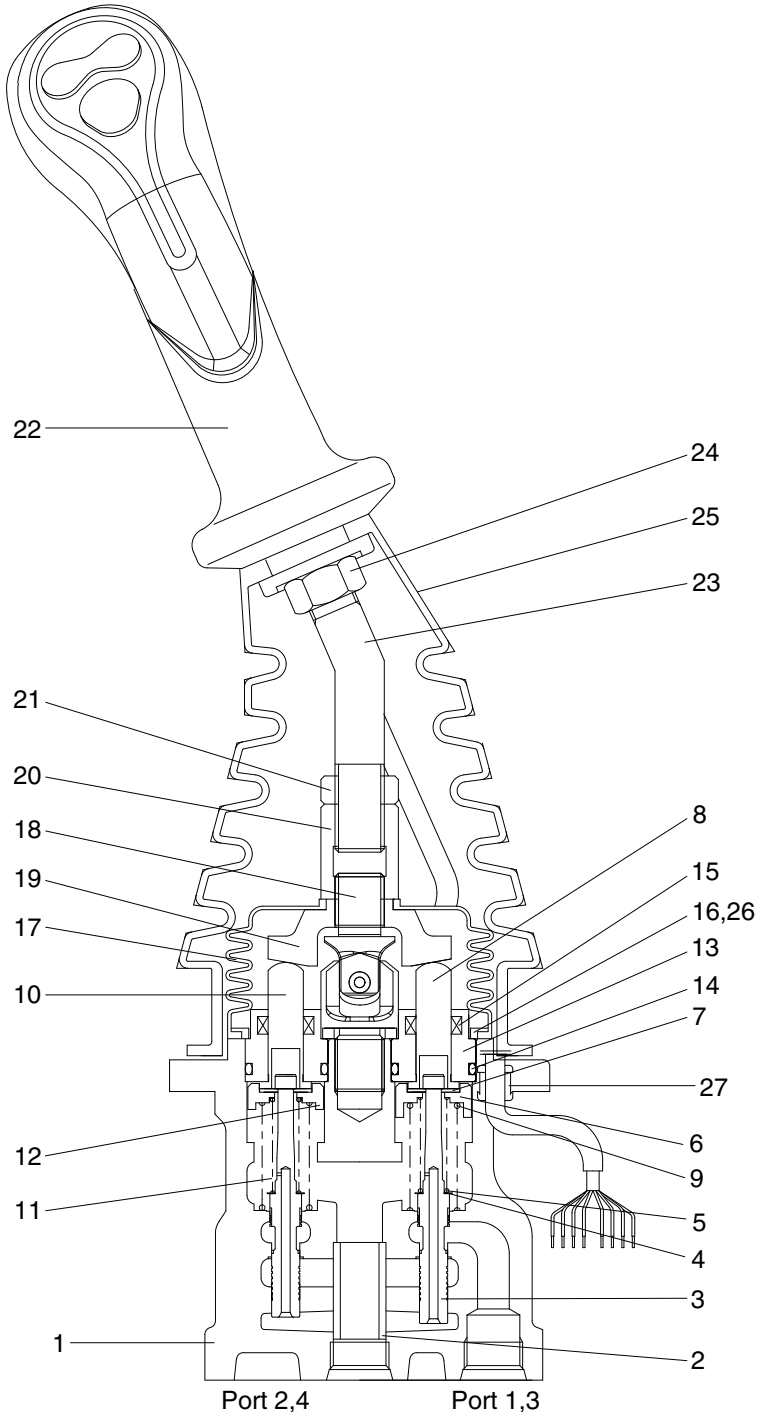
2) INSTALL

(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



60W9S2RL02

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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	B 
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf·m	lbf·ft
Joint	18	M14	3±0.2	14.5±1.4
Adjusting nut	20	M14	6±0.6	43.4±4.3
Lock nut	21	M14	6±0.6	43.4±4.3

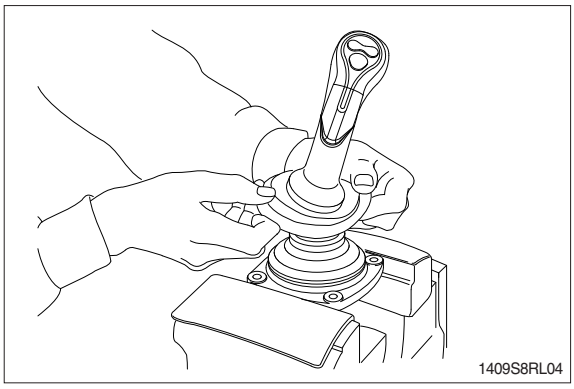
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

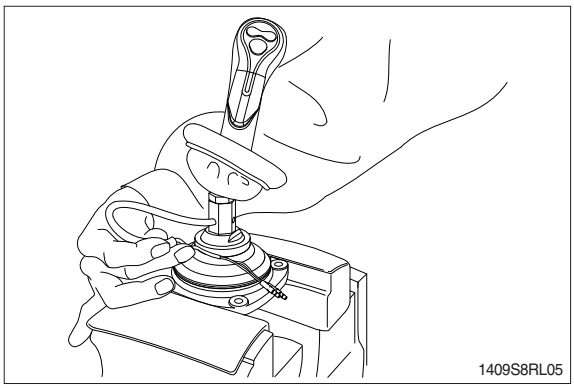
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

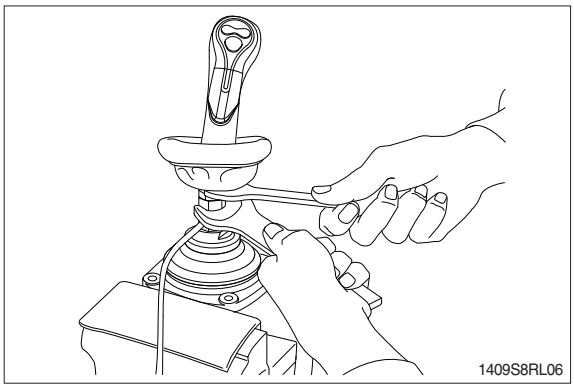
(3) Remove end of boot (25) from case (1) and take it out upwards.



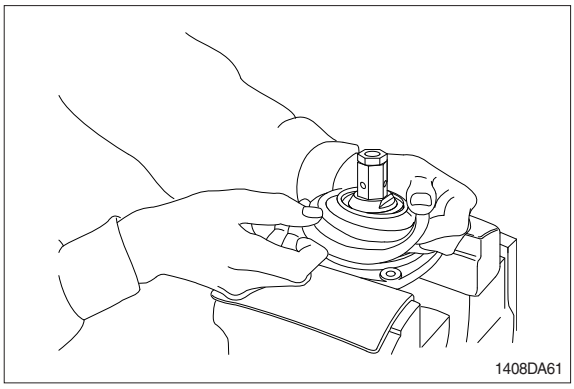
※ For valve with switch, remove cord also through hole of casing.



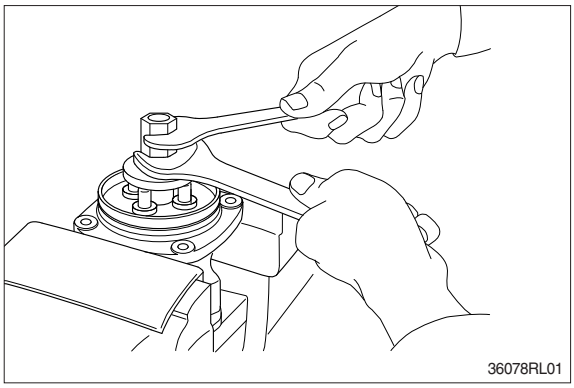
(4) Loosen lock nut (21) and adjusting nut (20) with spanners on them respectively, and take out handle section as one body.

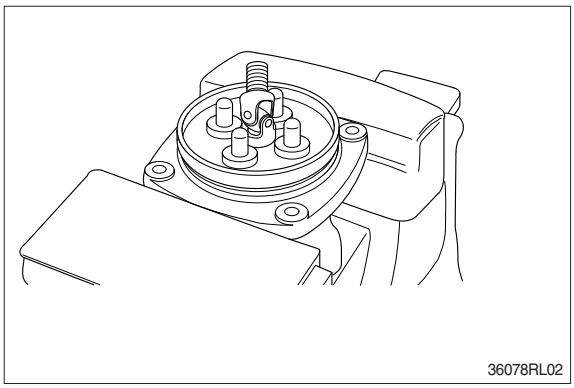


(5) Remove the boot (17).



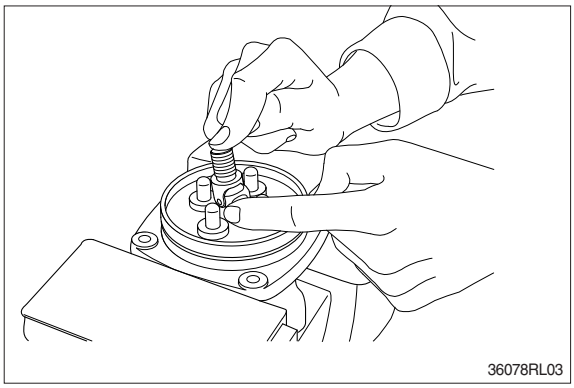
(6) Loosen adjusting nut (20) and swash plate (19) with spanners on them respectively, and remove them.

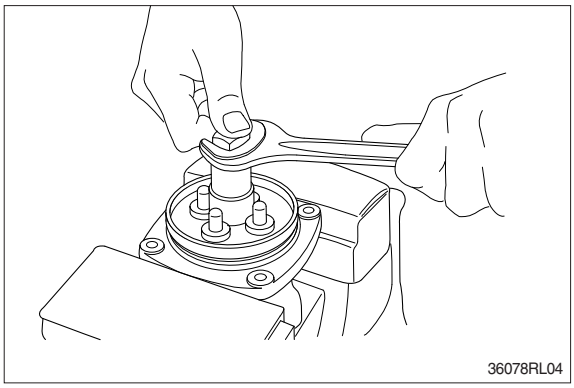




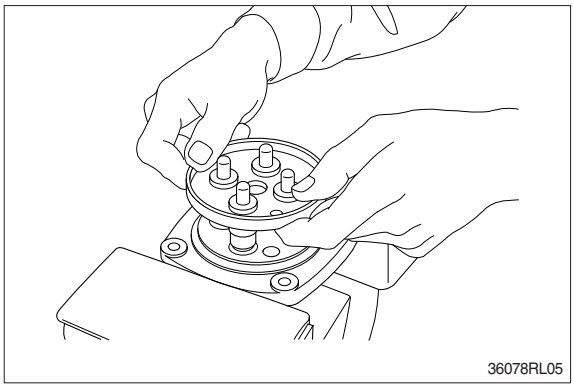
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (9) is strong in force, plate (16), plug (13) and push rod (10) will come up on loosening joint.
Pay attention to this.





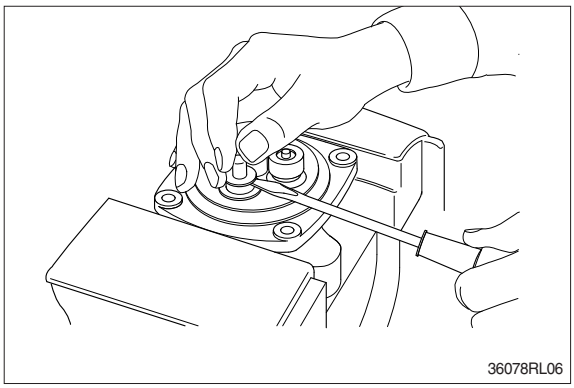
(8) Remove plate (16).



(9) When return spring (9) is weak in force, plug (13) stays in casing because of sliding resistance of O-ring.

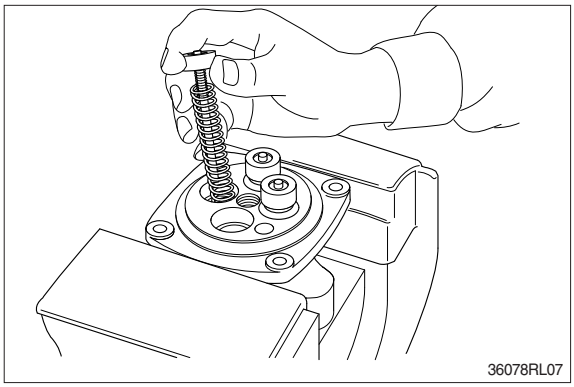
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (9) force.
Pay attention to this.



(10) Remove reducing valve subassembly and return spring (9) out of casing.

※ Record relative position of reducing valve subassembly and return springs.

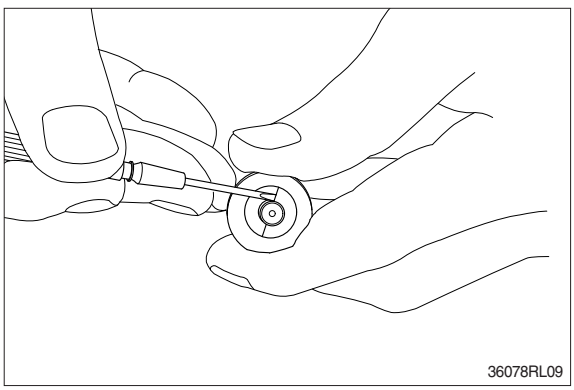


(11) For disassembling reducing valve section, stand it vertically with spool (3) bottom placed on flat workbench. Push down spring seat (6) and remove two pieces of semicircular stopper (7) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

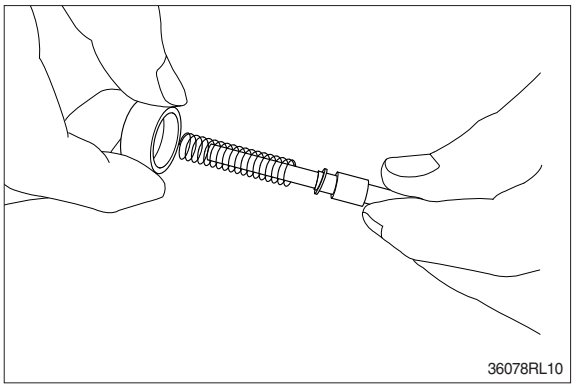
※ Record original position of spring seat (6).

※ Do not push down spring seat more than 6 mm.

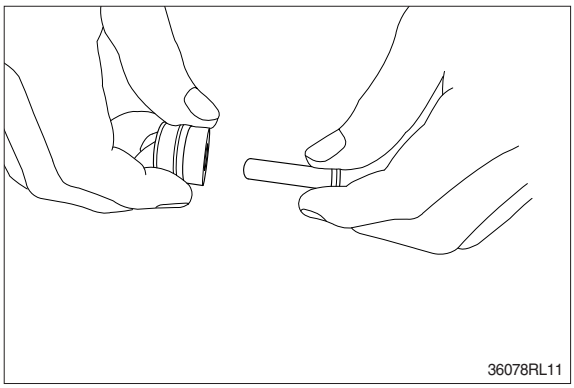


(12) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

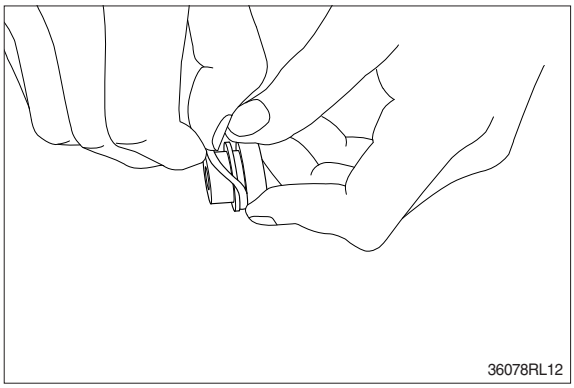
※ Until being assembled, they should be handled as one subassembly group.

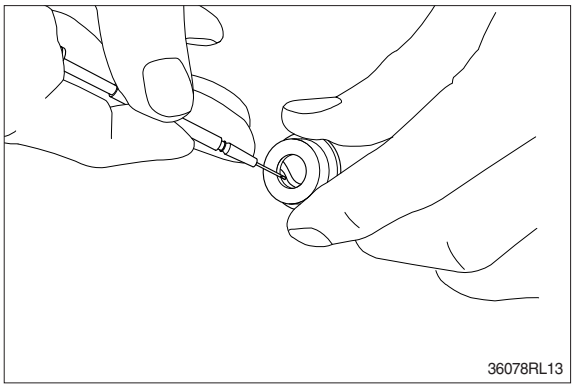


(13) Take push rod (10) out of plug (13).

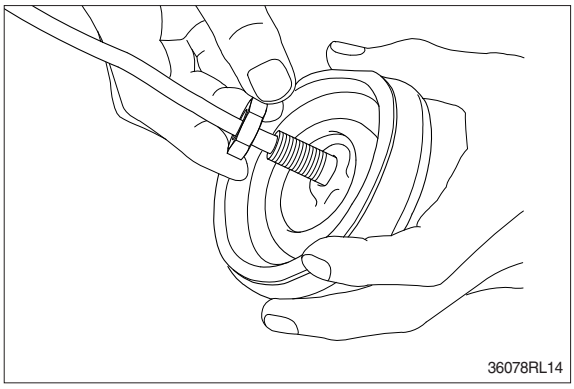


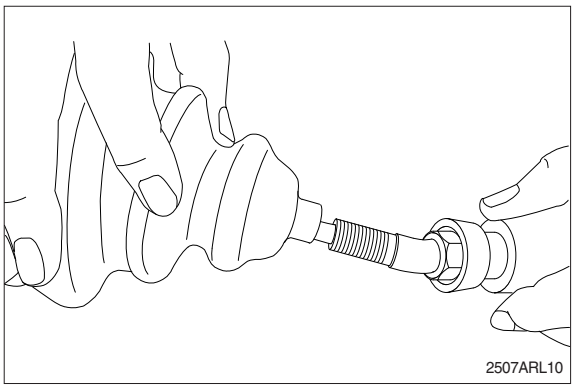
(14) Remove O-ring (14) and seal (15) from plug (13).
Use small minus screwdriver or so on to remove this seal.





(15) Remove lock nut (21) and then boot (25).





(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.

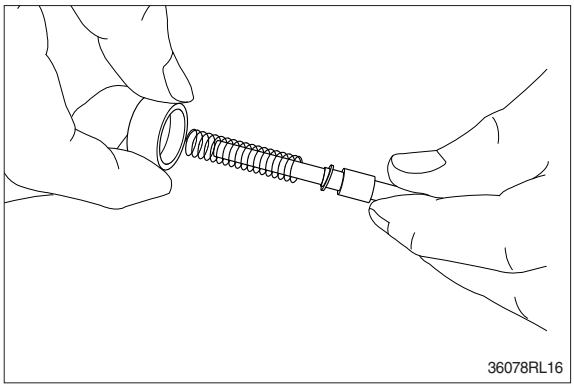
(18) Rust prevention of parts.

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.

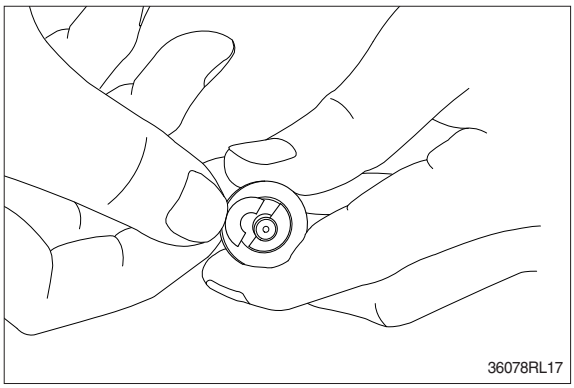
4) ASSEMBLY

(1) Put shim (4), springs (5) and spring seat (6) onto spool (4) in this order.



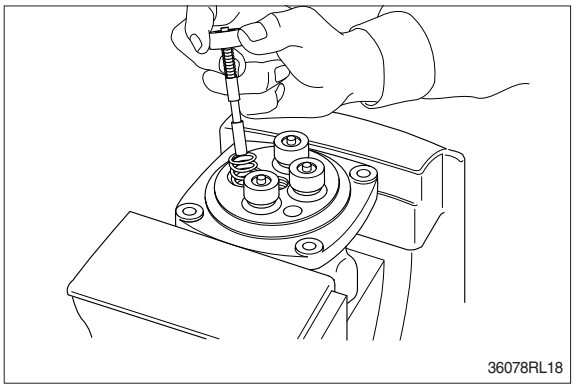
(2) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (7) on spring seat without piling them on.

※ Assemble stopper (7) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6 mm.

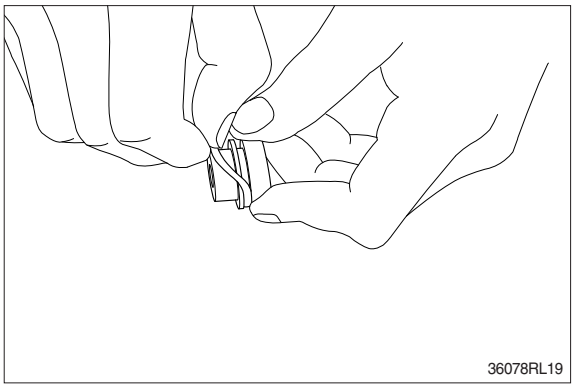


(3) Assemble spring (9) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

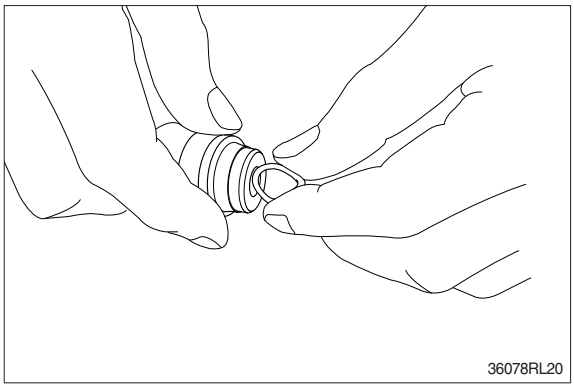


(4) Assemble O-ring (14) onto plug (13).



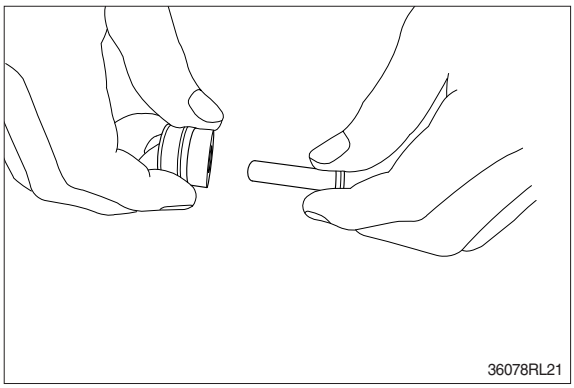
(5) Assemble seal (15) to plug (13).

※ Assemble seal in such lip direction as shown below.



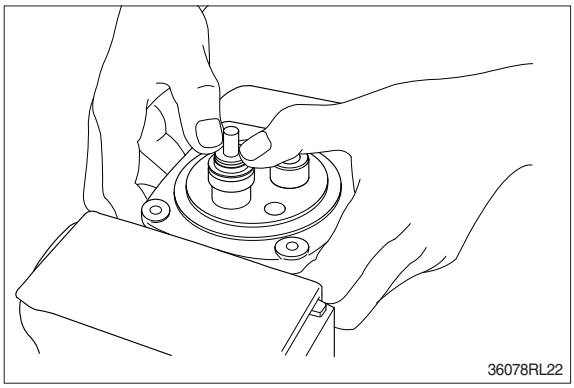
(6) Assemble push rod (10) to plug (13).

※ Apply working oil on push-rod surface.

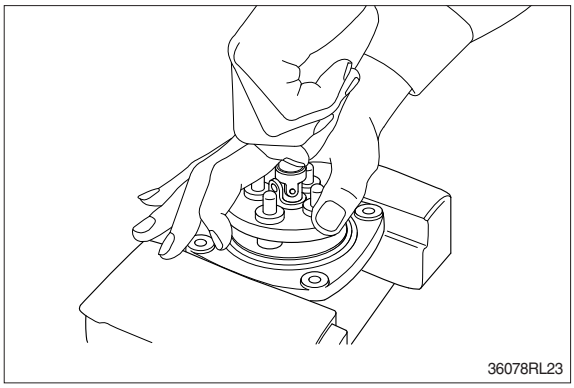


(7) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

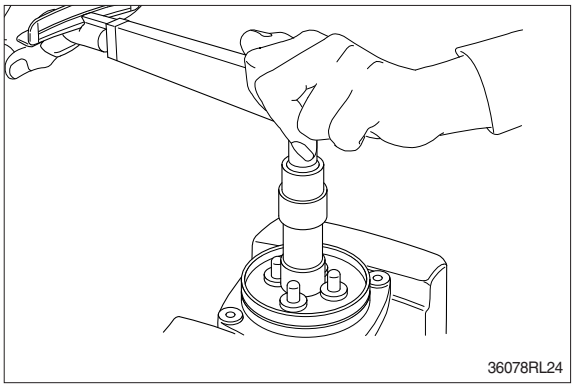


(8) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (16), and tighten joint (18) temporarily.



(9) Fit plate (16).

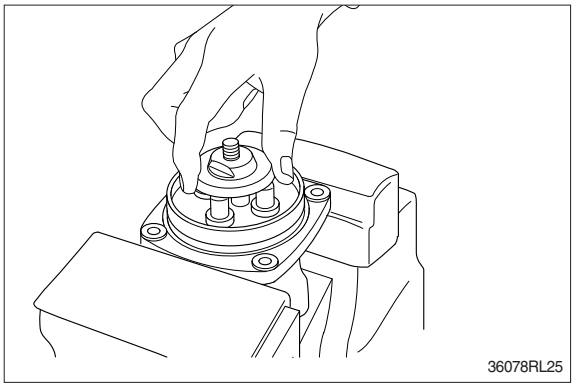
(10) Tighten joint (18) with the specified torque to casing, utilizing jig.



(11) Assemble swash plate (19) to joint (18).

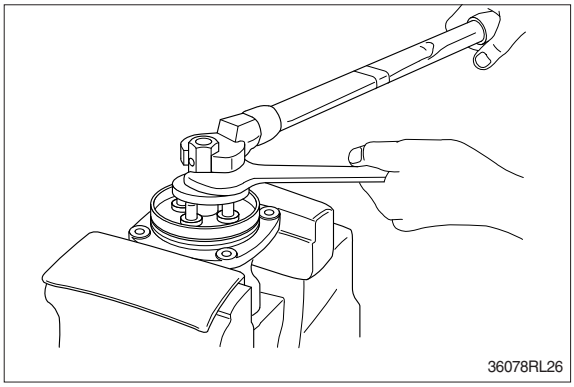
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

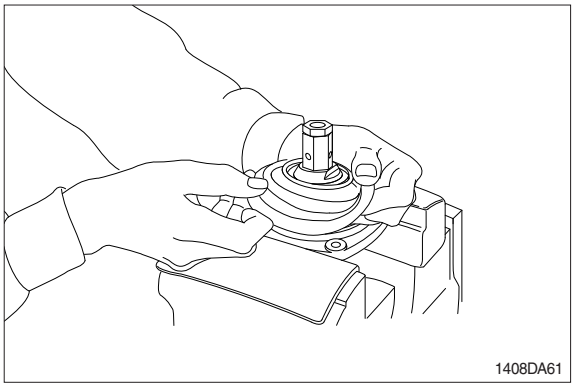


(12) Assemble adjusting nut (20), apply spanner to width across flat of plate (19) to fix it, and tighten adjusting nut to the specified torque.

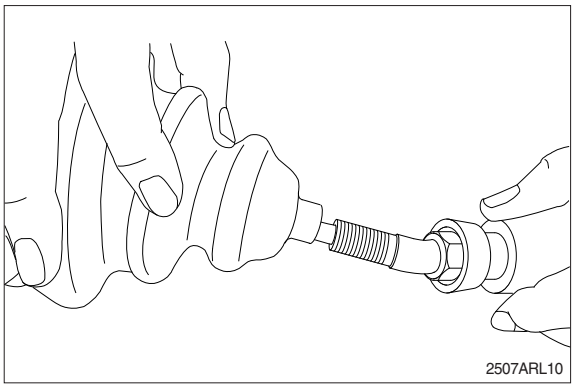
※ During tightening, do not change position of disk.

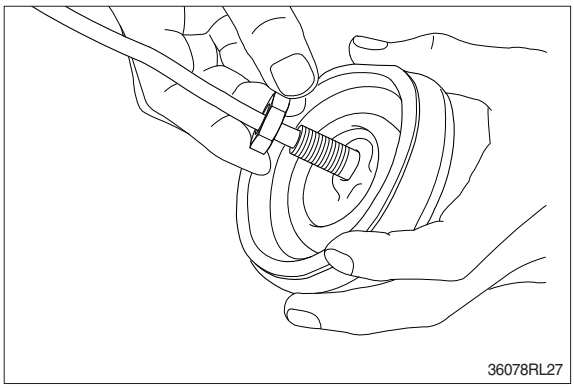


(13) Fit boot (17) to plate.

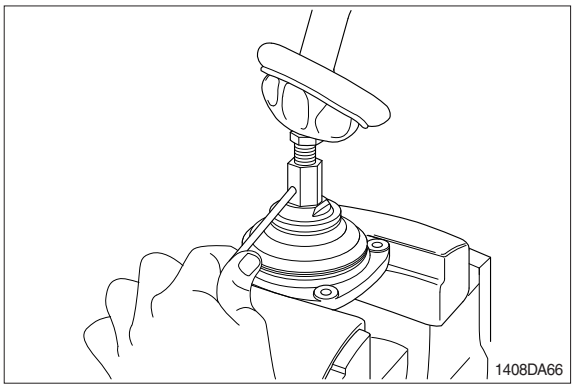


(14) Fit boot (25) and lock nut (21), and handle subassembly is assembled completely.



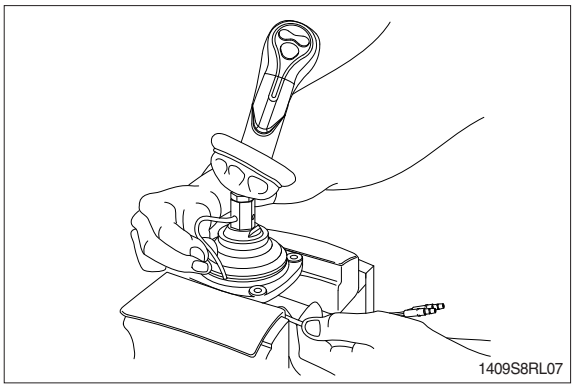


(15) Pull out cord and tube through adjusting nut hole provided in direction 60˚ to 120˚ from casing hole.

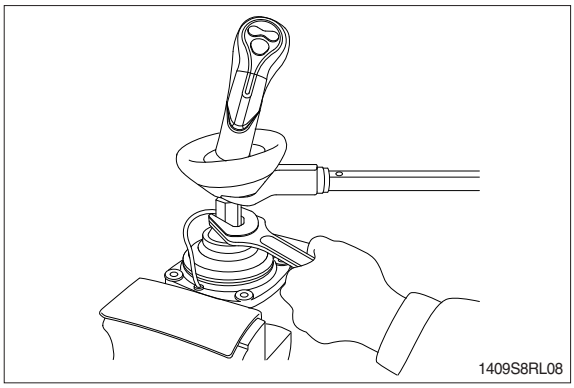


(16) Assemble bushing (27) to plate and pass cord and tube through it.

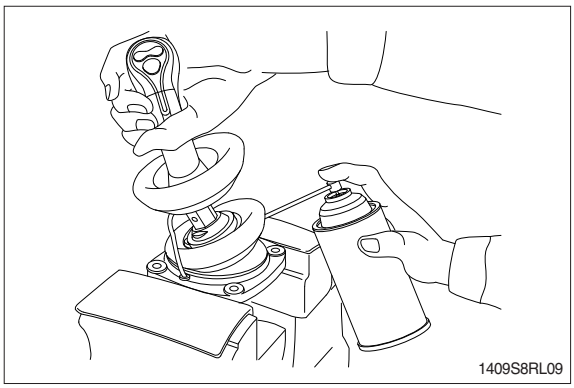
※ Provide margin necessary to operation.



(17) Determine handle direction, tighten lock nut (21) to specified torque to fix handle.

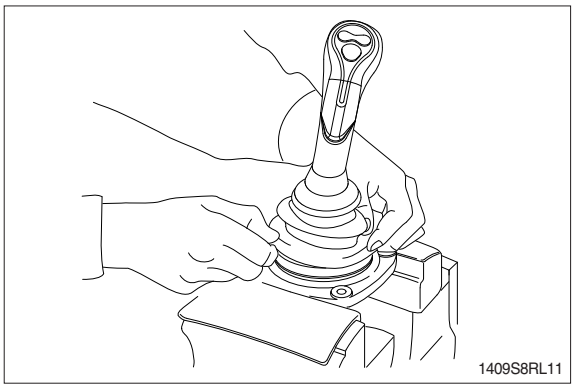


(18) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(19) Assemble lower end of bellows to casing.

(20) 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.**

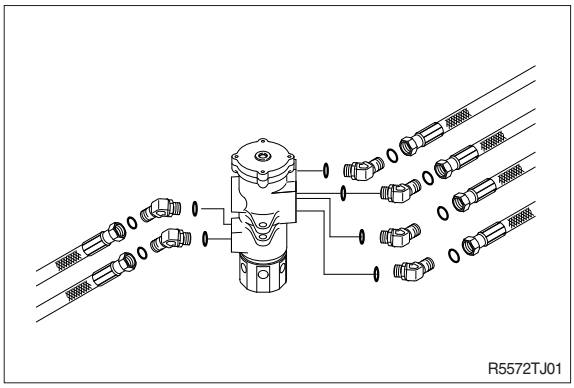
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.


13031GE18

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

- Weight : 30 kg (70 lb)
- Tightening torque : 12.3± 1.3 kgf · m (88.9± 9.4 lbf · ft)


R5572TJ01

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

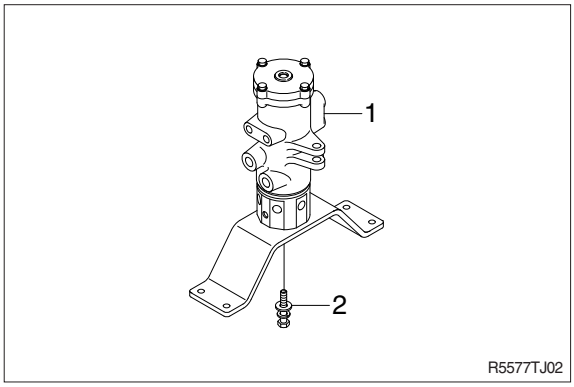
2) INSTALL

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

※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

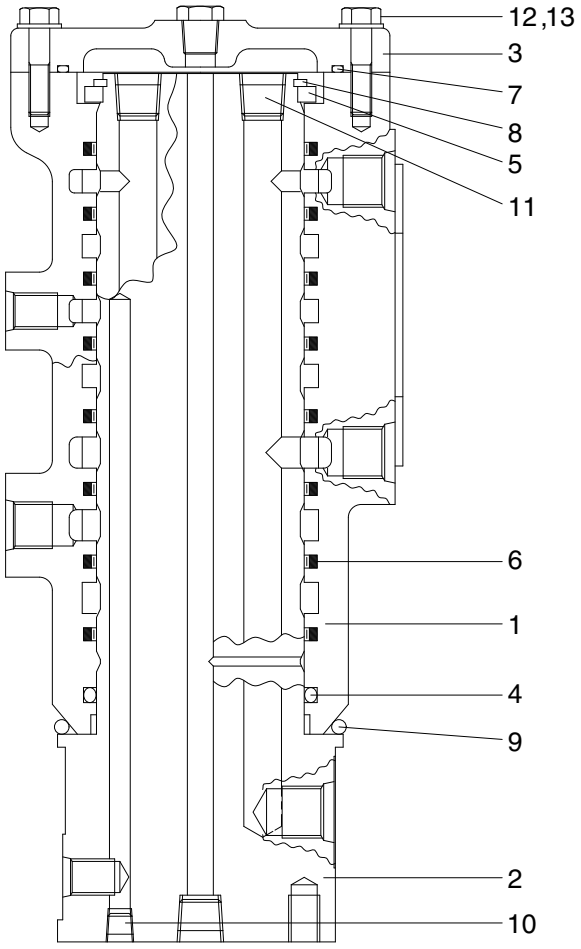
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



R5577TJ02

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



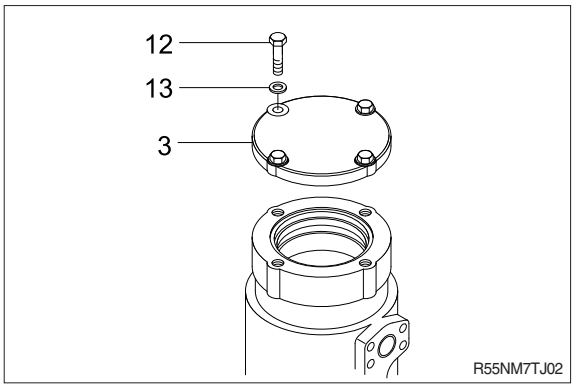
555K7TJ03

1	Hub	6	Slipper seal	10	Plug
2	Shaft	7	O-ring	11	Plug
3	Cover	8	Retainer ring	12	Hexagon bolt
4	O-ring	9	O-ring	13	Spring washer
5	Ring				

2) DISASSEMBLY

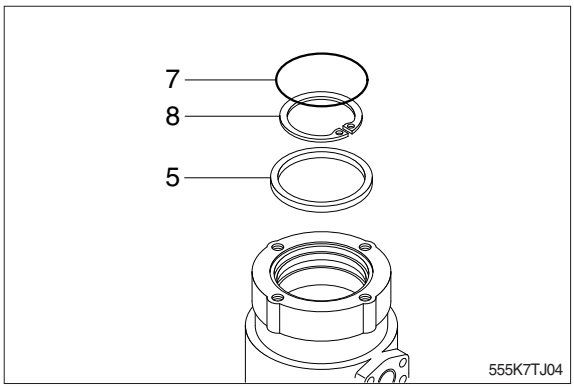
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (12), washer (13) and cover (3).



(2) Remove O-ring (7).

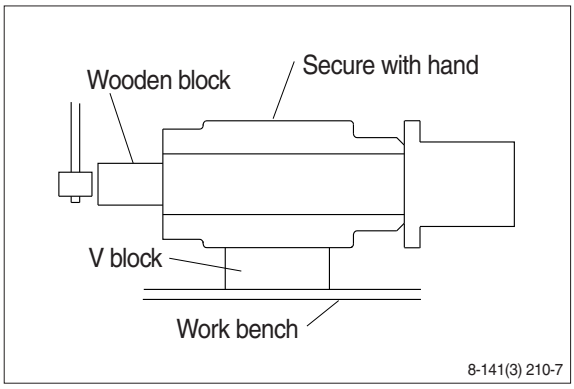
(3) Remove retainer ring (8) and ring (5).



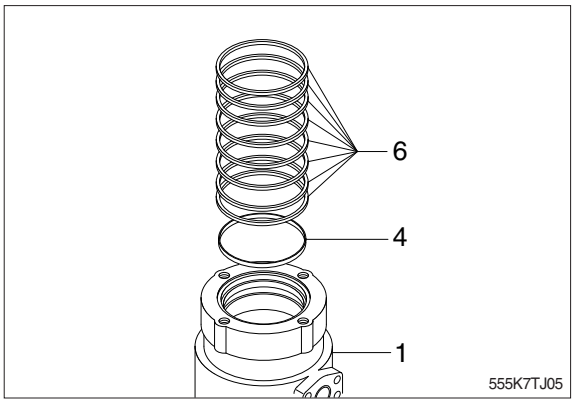
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).



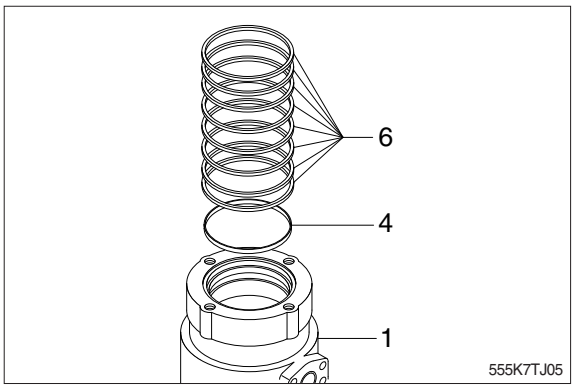
(5) Remove eight slipper seals (6) and O-ring (4) from hub (1).



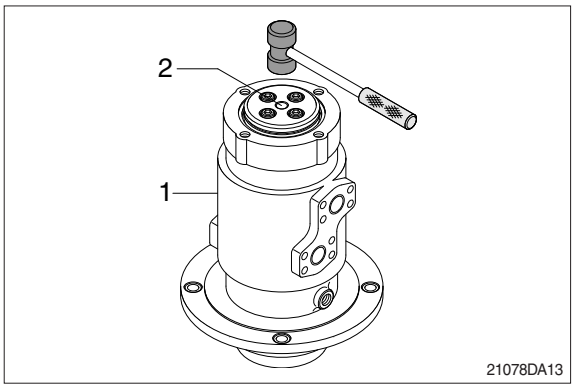
3) ASSEMBLY

※ 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 O-ring (4) to hub (1).

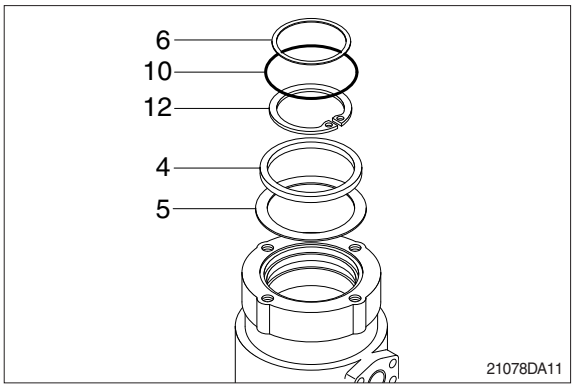


(2) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.

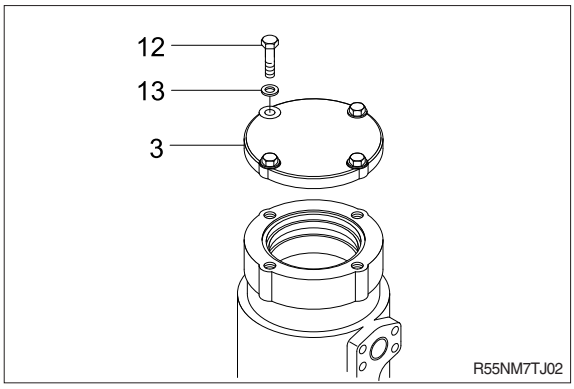


(3) Ring (5) and retainer ring (8) to shaft (2).

(4) Fit O-ring (7) to hub (1).



(5) Install cover (3) to body (1) and tighten bolts (12) with washer (13).



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

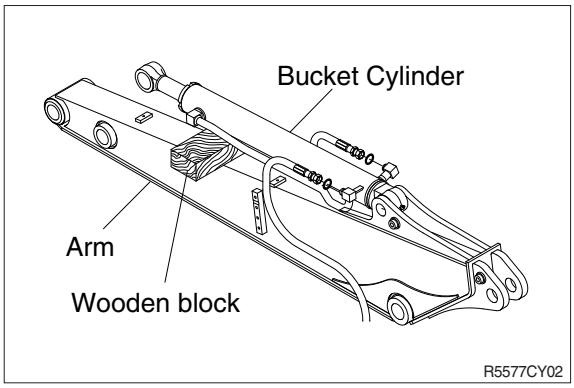
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.**

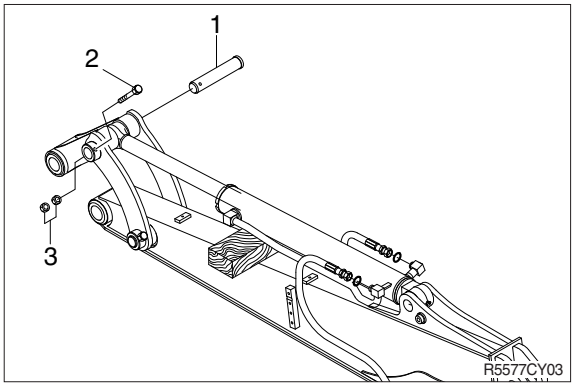
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

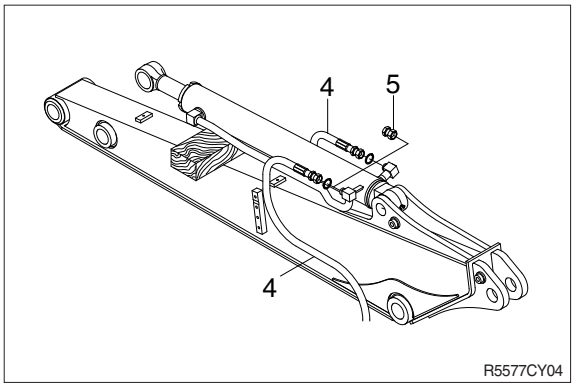


② Remove bolt (2), nut (3) and pull out pin (1).

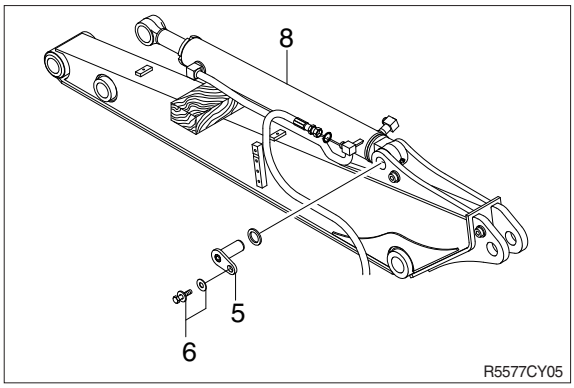
※ Tie the rod with wire to prevent it from coming out.



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 : 60 kg (130 lb)



(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.

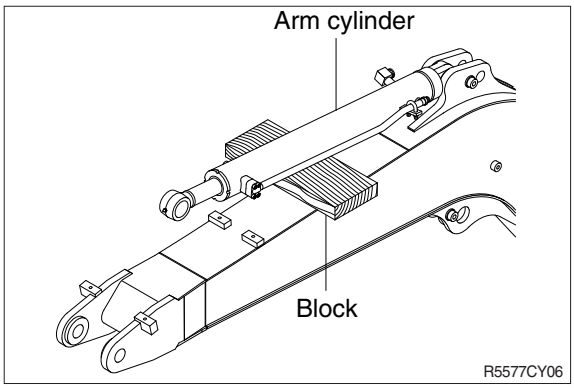
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

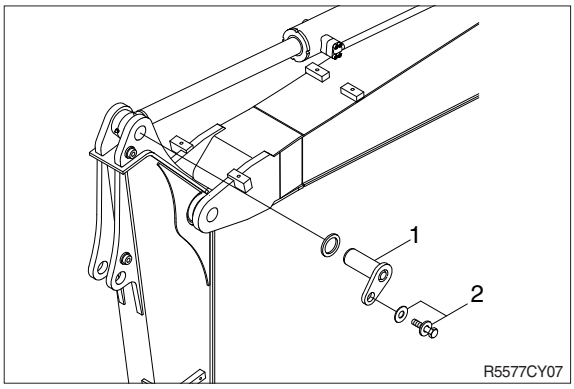
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



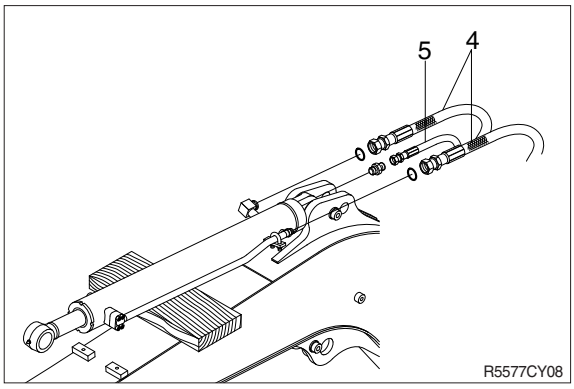
② Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

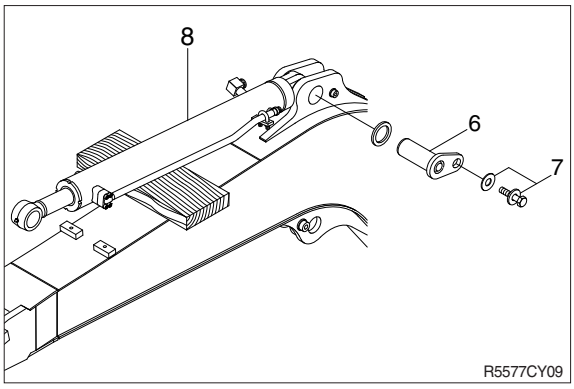


③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).



⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).
⑥ Remove arm cylinder assembly (8).
・Weight : 90 kg (200 lb)



(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.

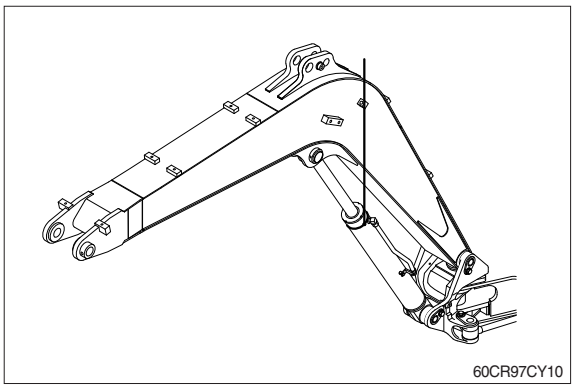
⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ 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.

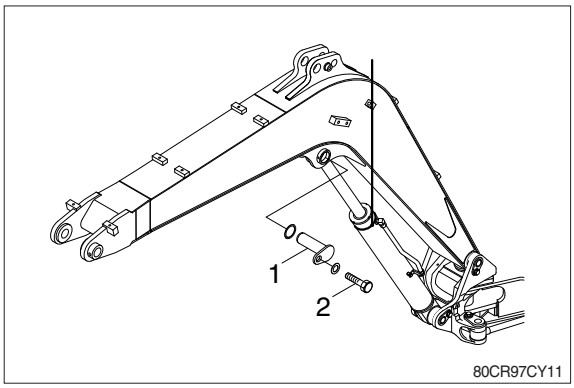
① Disconnect greasing hoses.

② Sling boom cylinder assembly.

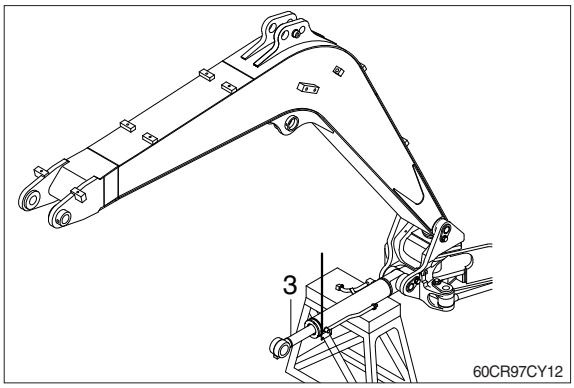


③ Remove bolt (2) and pull out pin (1).

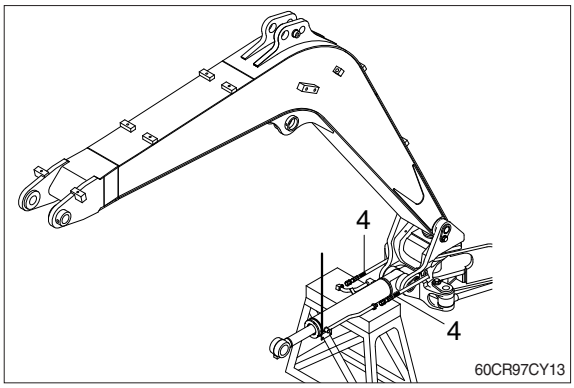
※ Tie the rod with wire to prevent it from coming out.



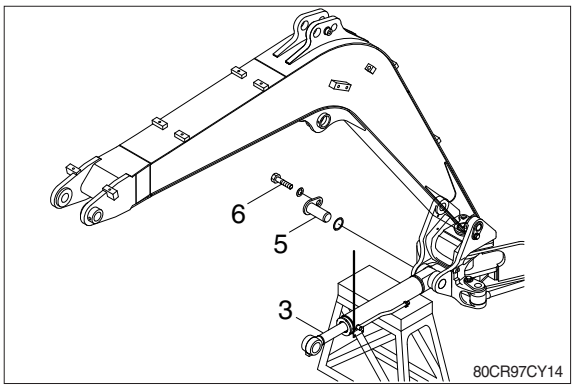
④ Lower the boom cylinder assembly (3) on a stand.



⑤ Disconnect boom cylinder hoses (4) and put plugs on cylinder pipe.



⑥ Remove bolt (6) and pull out pin (5).
⑦ Remove boom cylinder assembly (3).
· Weight : 110 kg (240 lb)



(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.

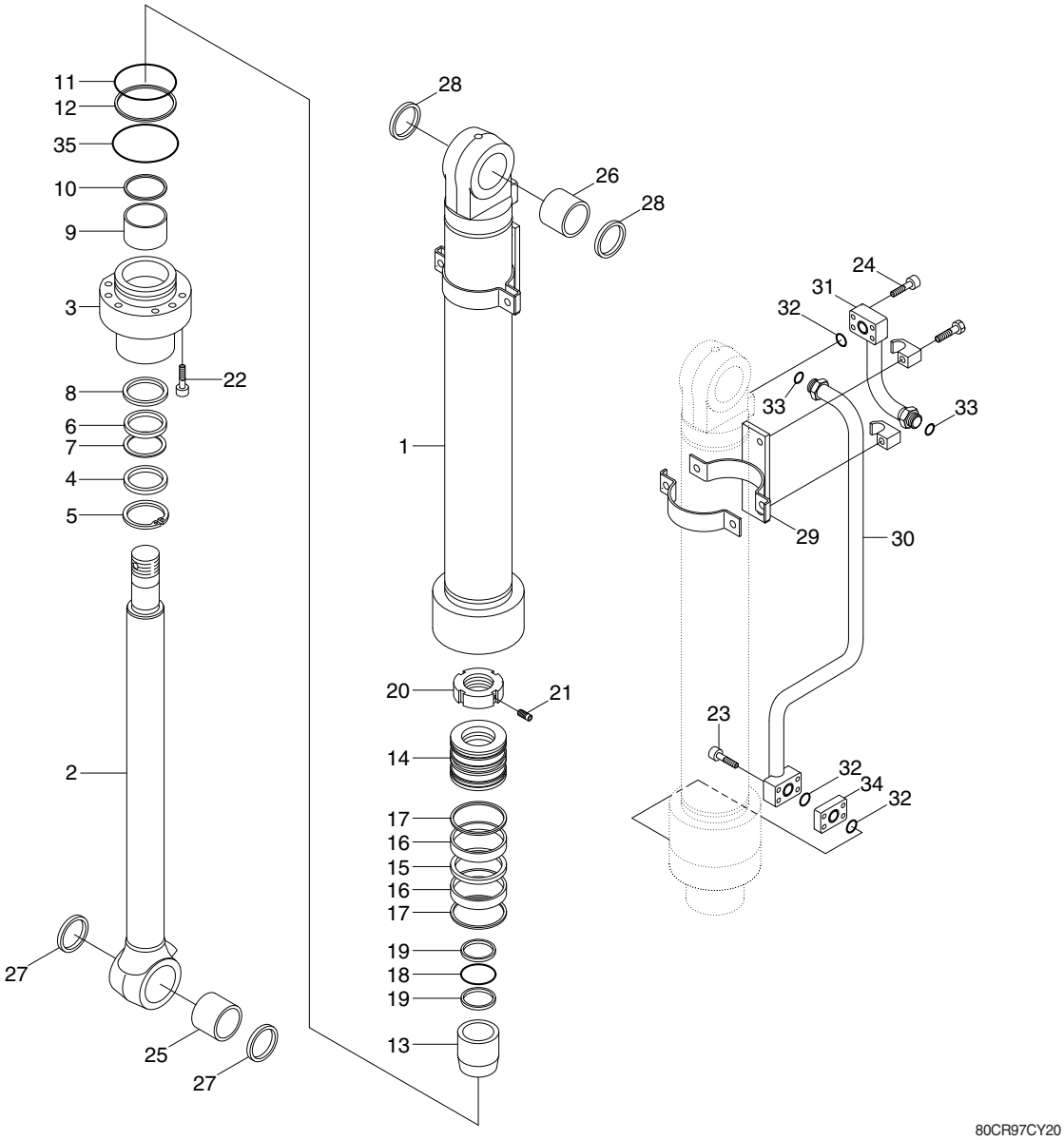
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

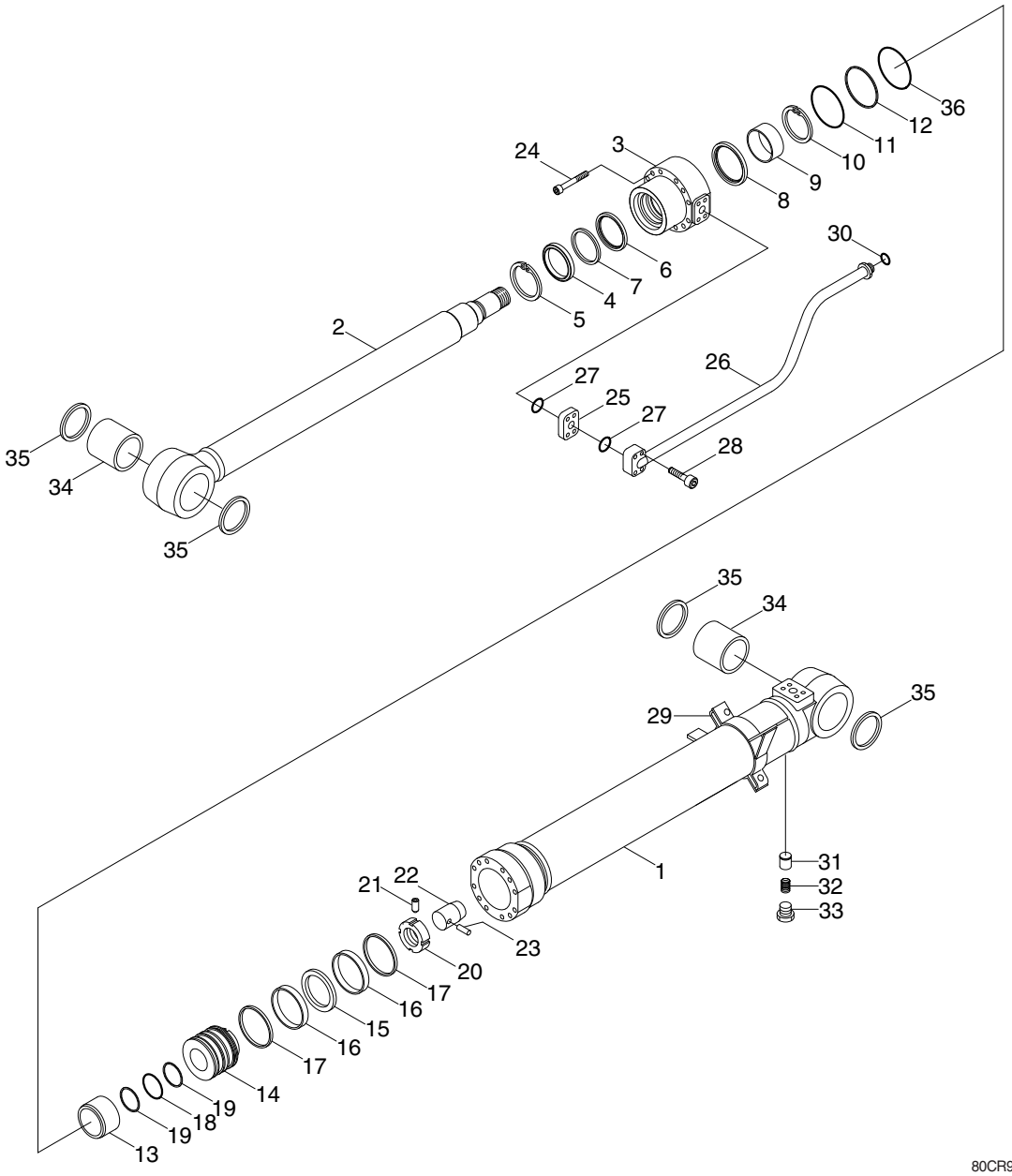
(1) Bucket cylinder



80CR97CY20

1	Tube assy	13	Cushing ring	25	Pin bushing
2	Rod assy	14	Piston	26	Pin bushing
3	Gland	15	Piston seal	27	Dust seal
4	Dust wiper	16	Wear ring	28	Dust seal
5	Retaining ring	17	Dust ring	29	Band assy
6	Rod seal	18	O-ring	30	Pipe assy
7	Back up ring	19	Back up ring	31	Pipe assy-B
8	Buffer ring	20	Lock nut	32	O-ring
9	Bushing	21	Set screw	33	O-ring
10	Retaining ring	22	Socket bolt	34	Flange
11	O-ring	23	Socket bolt	35	O-ring
12	Back up ring	24	Socket bolt		

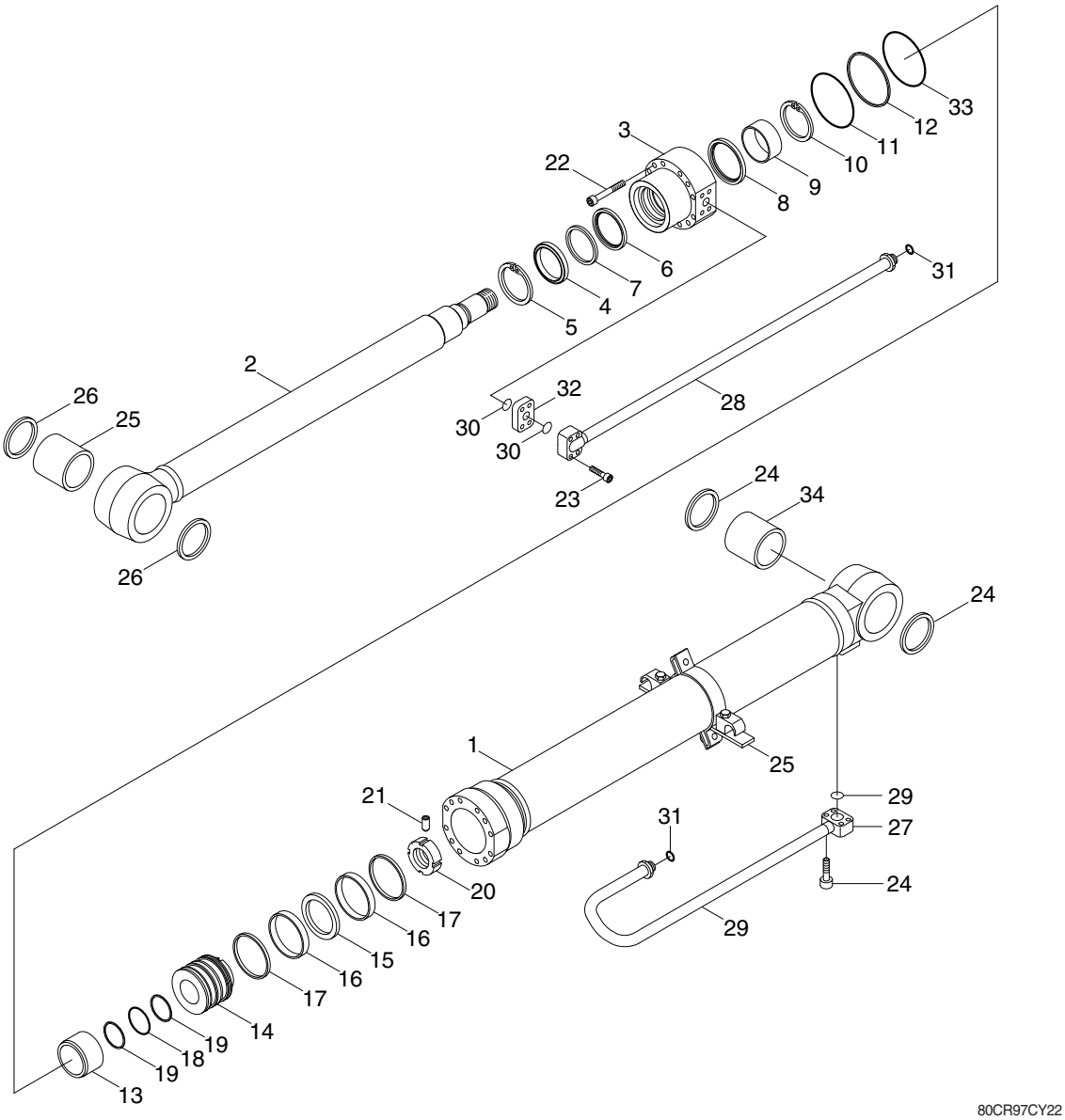
(2) Arm cylinder



80CR9A7CY21

1	Tube assy	13	Cushing ring	25	Flange
2	Rod assy	14	Piston	26	Pipe assy-R
3	Gland	15	Piston seal	27	O-ring
4	Dust wiper	16	Wear ring	28	Socket bolt
5	Retaining ring	17	Dust ring	29	Band assy
6	Rod seal	18	O-ring	30	O-ring
7	Back up ring	19	Back up ring	31	Check valve
8	Buffer ring	20	Lock nut	32	Coil spring
9	Dry bearing	21	Set screw	33	Plug
10	Retaining ring	22	Plunger	34	Pin bushing
11	O-ring	23	Parallel pin	35	Dust seal
12	Back up ring	24	Socket bolt	36	O-ring

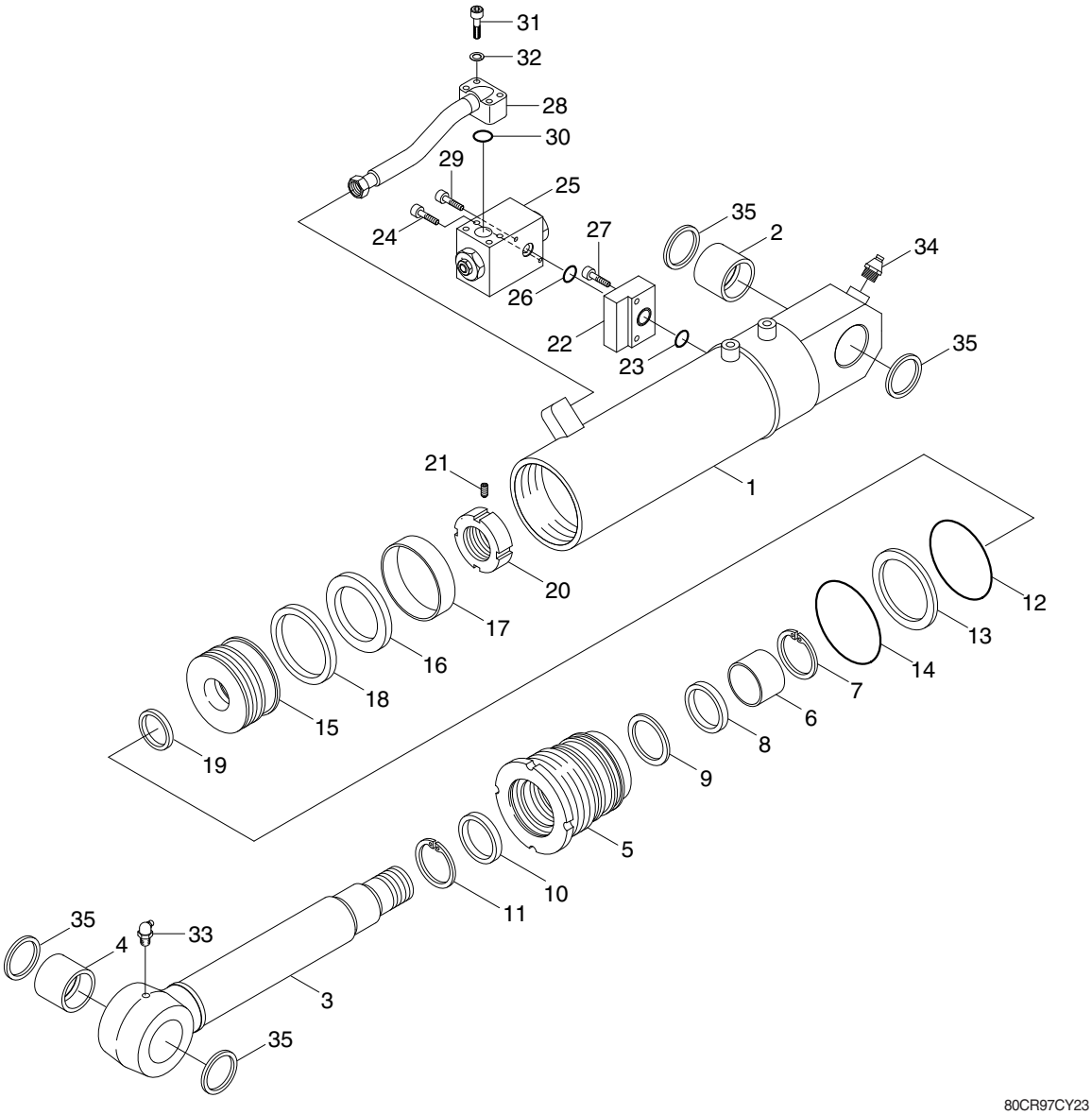
(3) Boom cylinder



80CR97CY22

1	Tube assy	12	Back up ring	23	Socket bolt
2	Rod assy	13	Cushing ring	24	Socket bolt
3	Gland	14	Piston	25	Pin bush
4	Dust wiper	15	Piston seal	26	Dust seal
5	Retaining ring	16	Wear ring	27	Band assy
6	Rod seal	17	Dust ring	28	Pipe assy-R
7	Back up ring	18	O-ring	29	Pipe assy-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Bushing	20	Lock nut	31	O-ring
10	Retaining ring	21	Set screw	32	Flange
11	O-ring	22	Socket bolt	33	O-ring

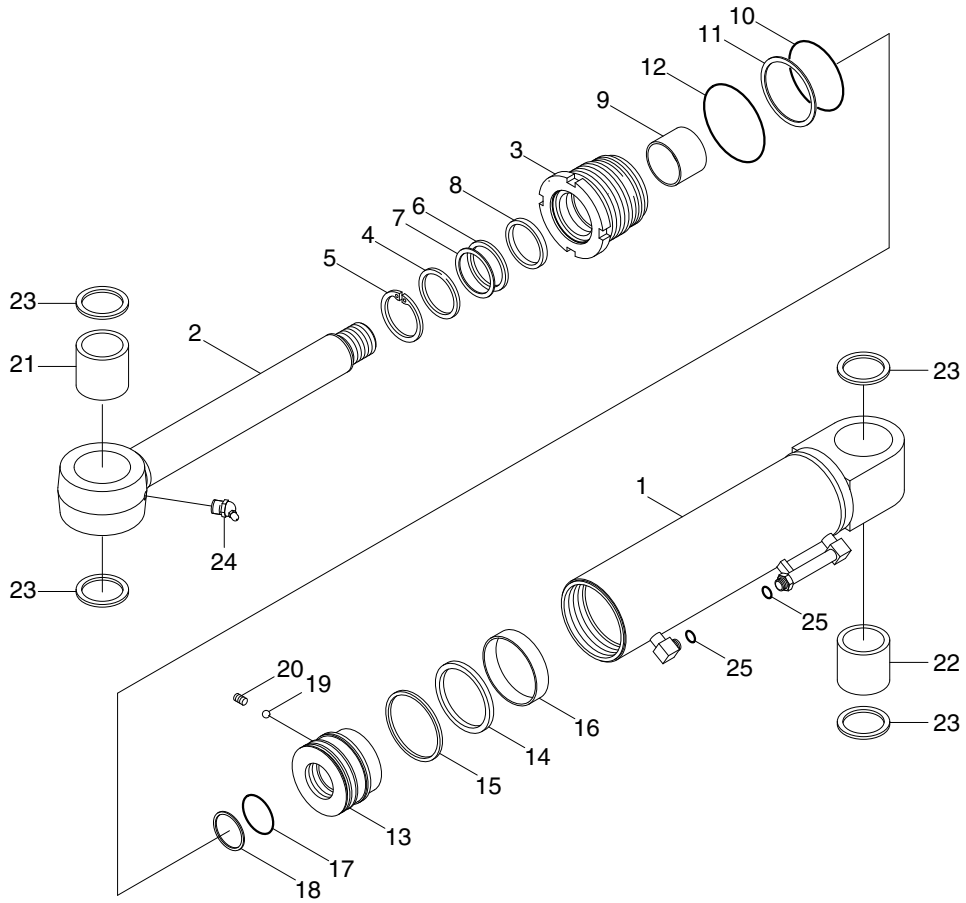
(4) Dozer cylinder



80CR97CY23

1	Tube assy	13	Back up ring	25	Check valve
2	Pin bushing	14	O-ring	26	O-ring
3	Gland	15	Piston	27	Hex socket bolt
4	Pin bushing	16	Piston seal	28	Pipe assy
5	Rod cover	17	Wear ring	29	Hex socket bolt
6	Rod bush	18	Dust ring	30	O-ring
7	Retaining ring	19	O-ring	31	Hex socket bolt
8	Buffer seal	20	Piston nut	32	Spring washer
9	U-packing	21	Set screw	33	Grease nipple
10	Dust wiper	22	Spacer	34	Grease nipple
11	Retaining ring	23	O-ring	35	Pin wiper
12	O-ring	24	Hex socket bolt		

(5) Boom swing cylinder

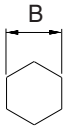


80CR97CY24

1	Tube assy	10	O-ring	19	Steel ball
2	Rod assy	11	Back up ring	20	Set screw
3	Rod assy	12	O-ring	21	Pin bushing
4	Dust wiper	13	Piston	22	Grease nipple
5	Retaining ring	14	Piston seal	23	Dust seal
6	Rod seal	15	Dust ring	24	Grease nipple
7	Back up ring	16	Wear ring	25	O-ring
8	Buffer ring	17	O-ring		
9	Du bushing	18	Back up ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name	Specification	
Allen wrench	8	
	10	
Spanner	M22	
Hook spanner	Suitable size	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Gland mounting bolt (socket head bolt)	Boom cylinder	22	M14×2.0	15±1.5	108±10.8
	Arm cylinder	24	M14×2.0	15±1.5	108±10.8
	Bucket cylinder	22	M12×1.75	9.4±1.0	68±7.2
Gland	Dozer cylinder	5	M135×2.0	75±7.5	540±54
	Boom swing cylinder	3	M115×2.0	92±9.2	665±66.5
Lock nut	Boom cylinder	20	M50×2.0	130±13	940±94
	Arm cylinder	20	M42×2.0	75±7.5	540±54
	Bucket cylinder	20	M39×2.0	75±7.5	540±54
	Dozer cylinder	20	M55×2.0	130±13	940±94
Piston	Boom cylinder	14	M60×3.0	75±7.5	540±54
	Arm cylinder	14	M55×2.0	60±6.0	434±43.4
	Bucket cylinder	14	M48×2.0	50±5.0	362±36.2
	Dozer cylinder	15	M65×3.0	75±7.5	540±54
	Boom swing	13	M50×2.0	125±12.5	904±90.4

3) DISASSEMBLY

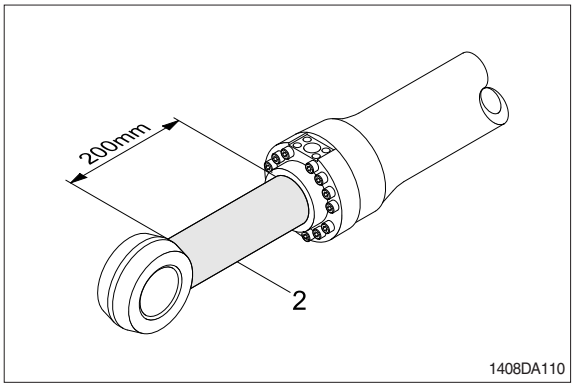
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

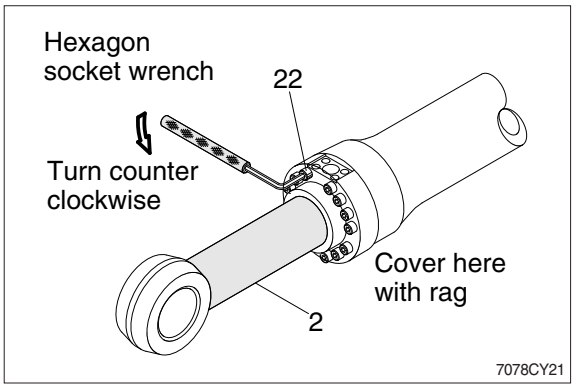
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200 ㎜ (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



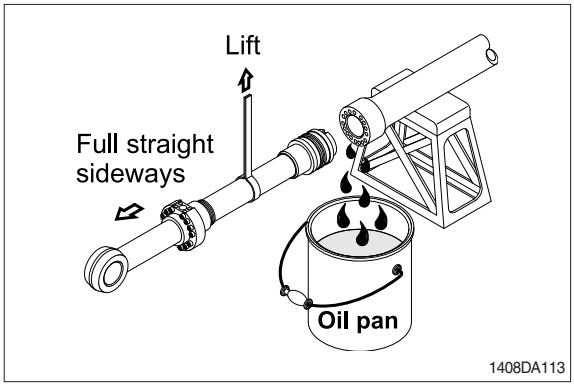
③ Loosen and remove socket bolts (22) of the gland in sequence.

※ 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).

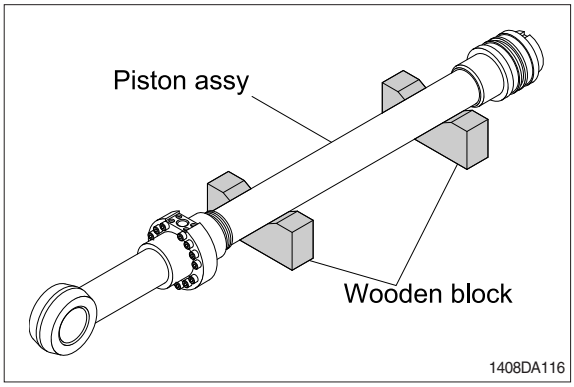
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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.

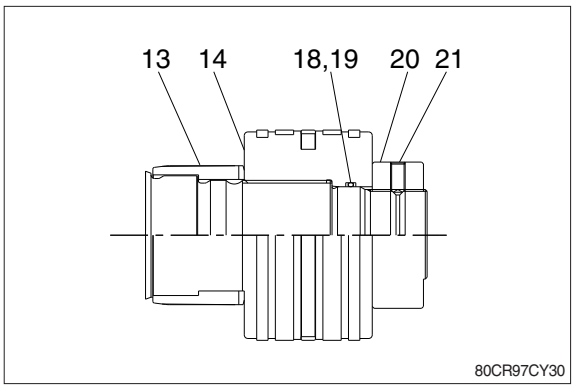


(2) Remove piston and rod cover

① Remove screw (21).
Remove lock nut (20).

※ Since lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock nut (20).

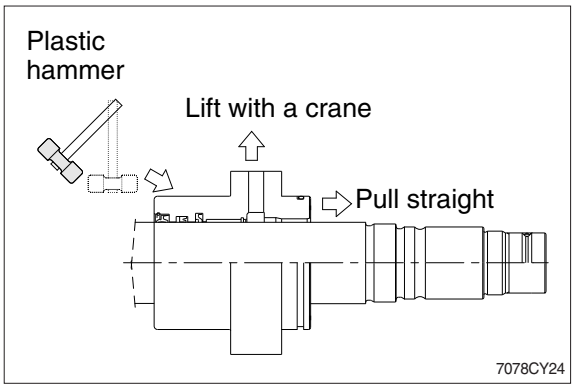
② Remove piston assembly (14), back up ring (19), and O-ring (18).



③ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.
Exercise care so as not to damage the lip of rod bushing (9) and packing (4, 5, 6, 7, 8) by the threads of rod assembly (2).

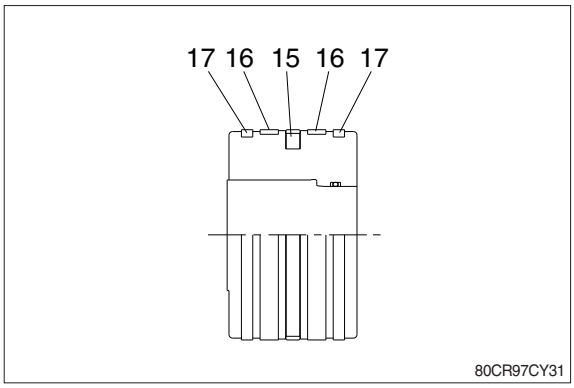


(3) Disassemble the piston assembly

① Remove wear ring (16).

② Remove dust ring (17) and piston seal (15).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

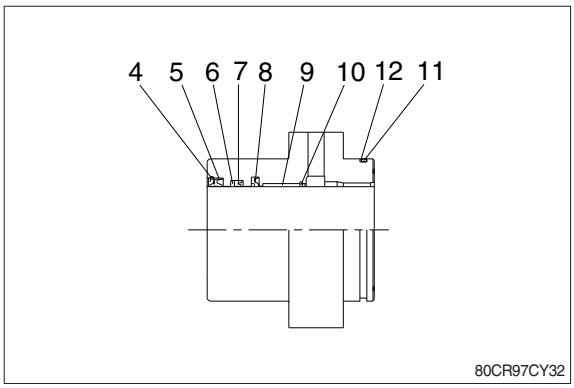
① Remove back up ring (12) and O-ring (11).

② Remove snap ring (5), dust wiper (4).

③ Remove back up ring (7), rod seal (6) and buffer ring (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

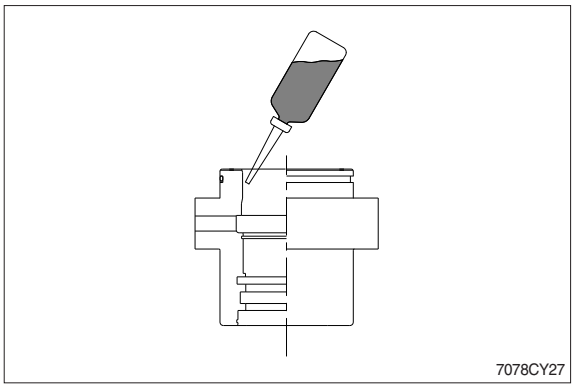


4) ASSEMBLY

(1) Assemble cylinder head assembly

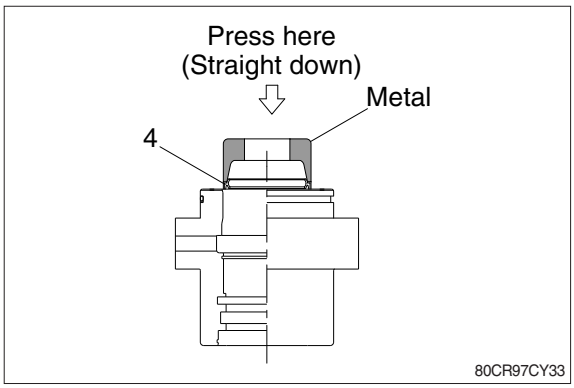
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland (3) with hydraulic oil.



② Coat dust wiper (4) with grease and fit dust wiper (4) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

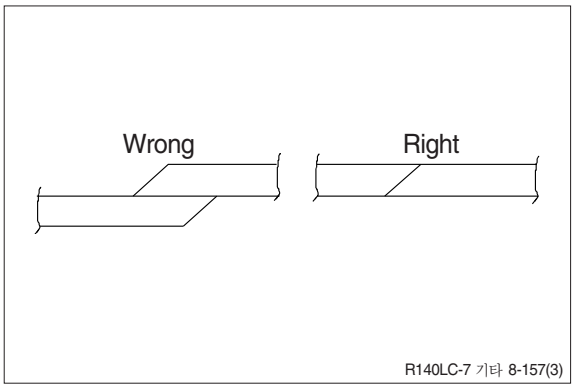
③ Fit snap ring (5) to the stop face.



④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

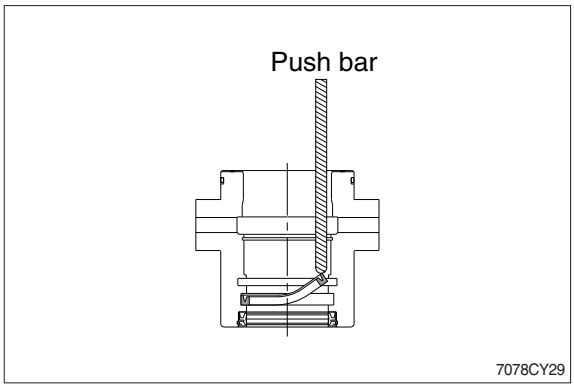
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until one side of it is inserted into groove.



※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

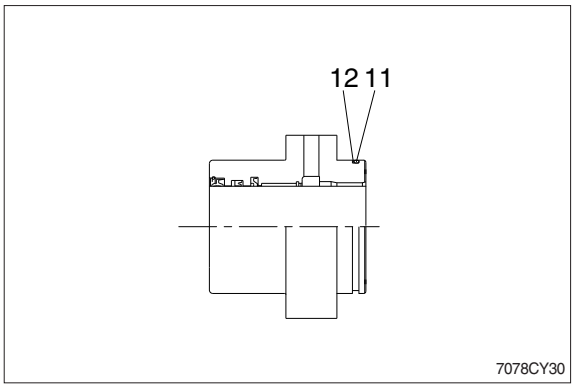
※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

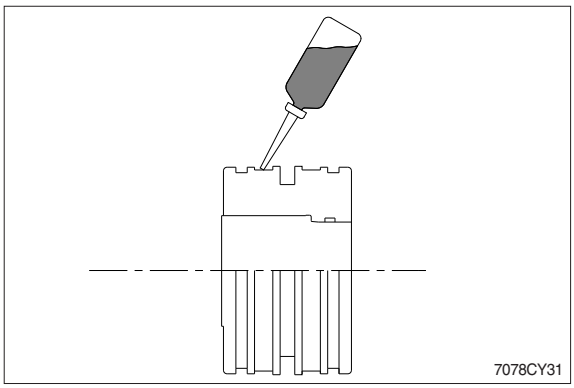
⑥ Fit O-ring (11) to gland (3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

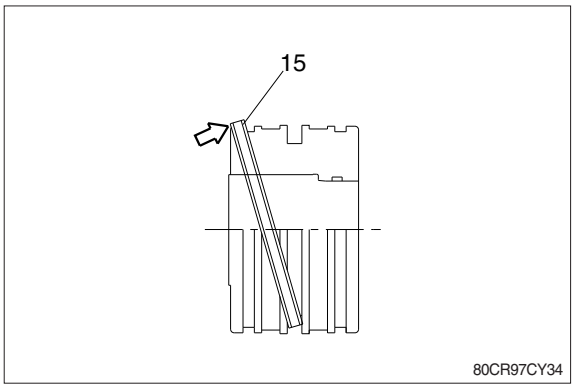
① Coat the outer face of piston (14) with hydraulic oil.



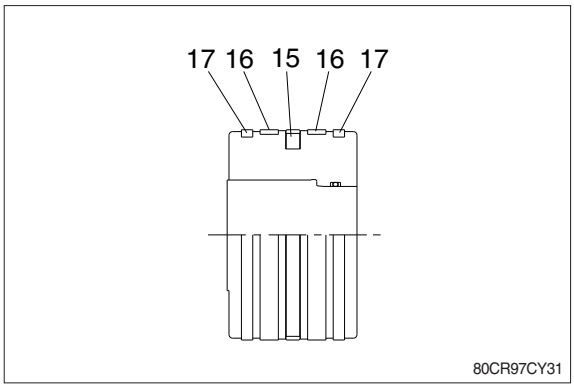
② Fit piston seal (15) to piston.

※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



③ Fit wear ring (16) and dust ring (17) to piston (14).

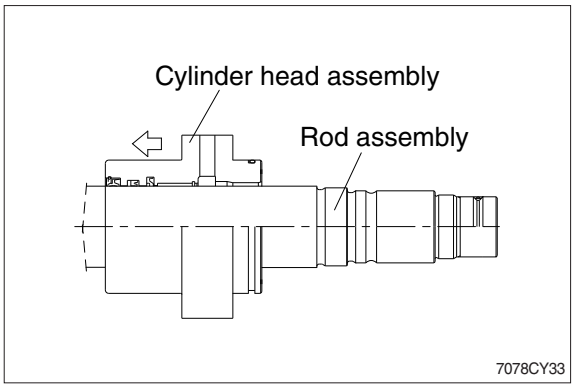


(3) Install piston and cylinder head

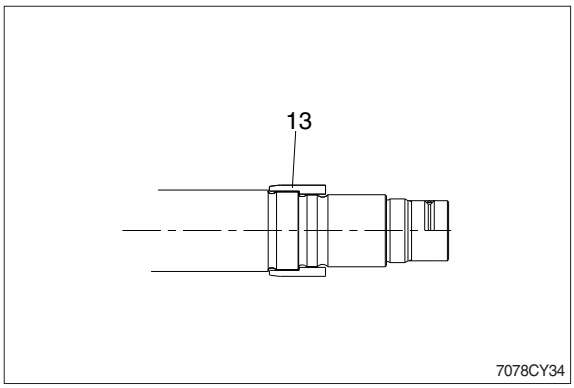
① Fix the rod assembly to the work bench.

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.



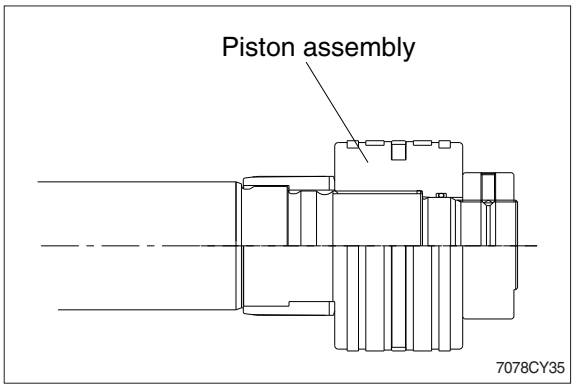
④ Insert cushion ring (13) to rod assembly.
Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque :

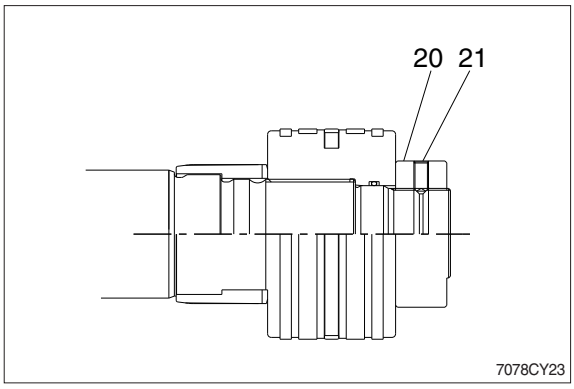
Item		kgf · m	lbf · ft
Boom	14	75±7.5	540±54
Arm	14	60±6.0	434±43
Bucket	14	50±5.0	362±36
Dozer	15	75±7.5	540±54
Boom swing	13	125±12.5	904±90



⑥ Fit lock nut (20) to piston and screw (21).

· Tightening torque :

Item		kgf · m	lbf · ft
Boom	20	130±13	940±94
Arm	20	75±7.5	542±54
Bucket	20	75±7.5	542±54
Dozer	20	130±13	940±94



(3) Overall assemble

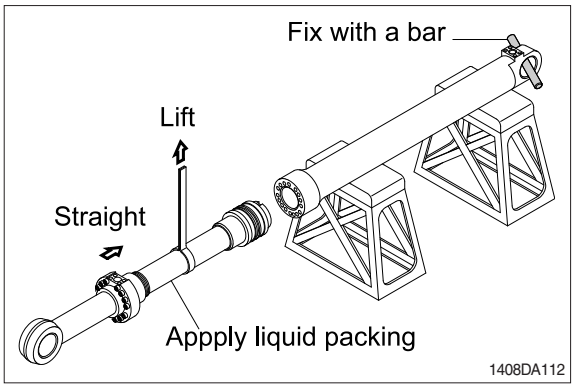
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

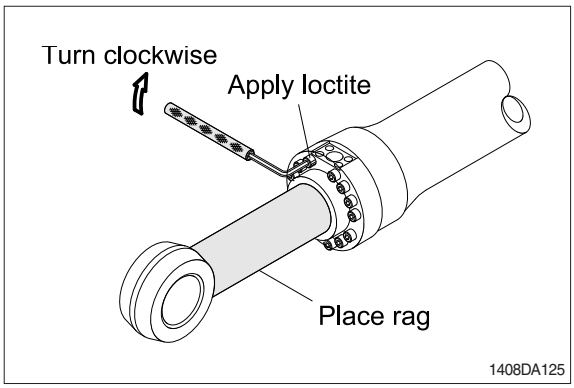
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

※ Refer to the table of tightening torque.





1. TRACK LINK

1) REMOVAL

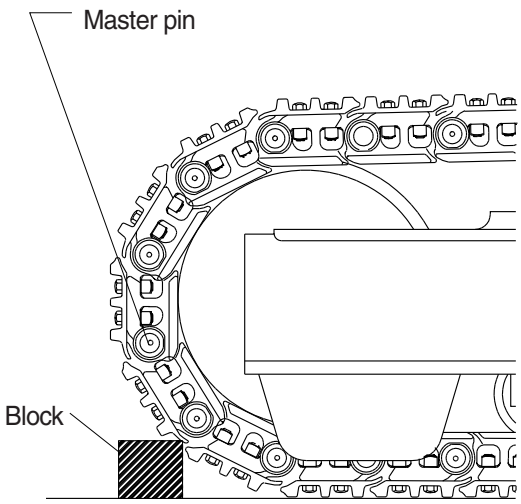
(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

(3) Push out master pin by using a suitable tool.

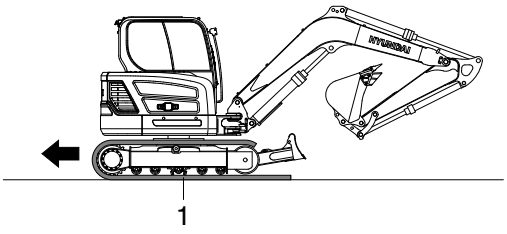


8-161(1) 140-7

(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.

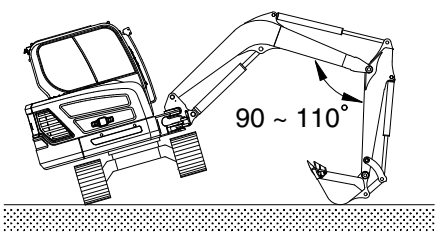


55Z97TR01

2) INSTALL

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

※ Adjust the tension of the track link.

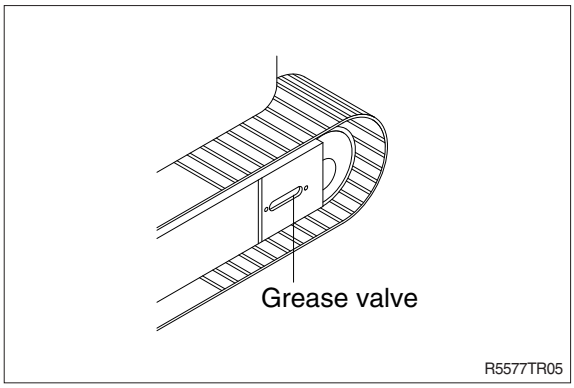


55Z97TR02

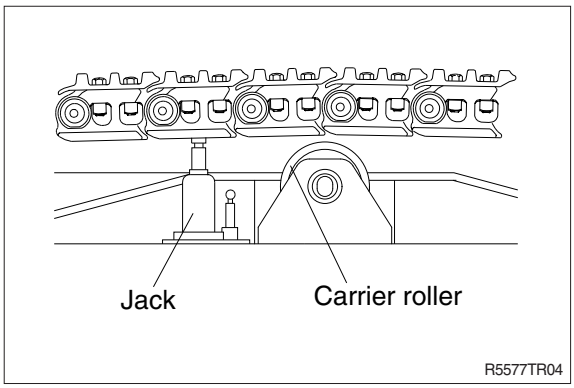
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.

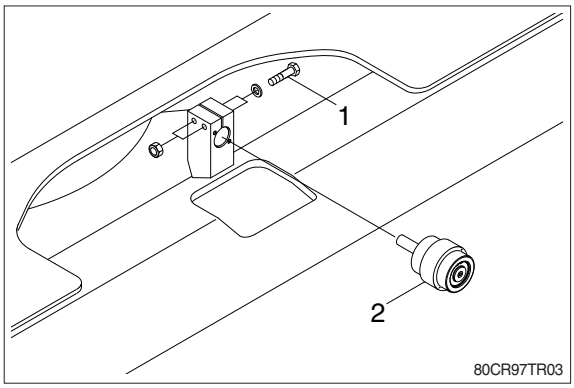


(2) Jack up the track link height enough to permit carrier roller removal.



(3) Remove bolt (1) at both side.

(4) Remove carrier roller (2).
- Weight : 8 kg (17.6 lb)



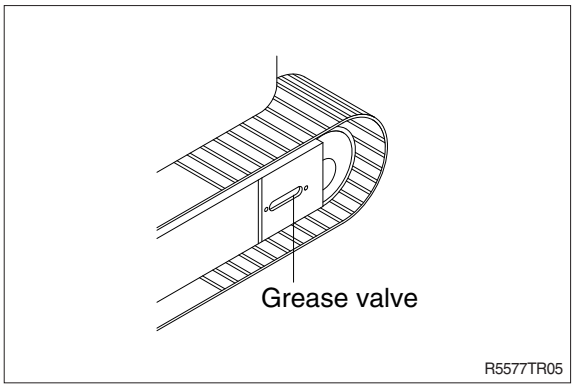
2) INSTALL

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

3. TRACK ROLLER

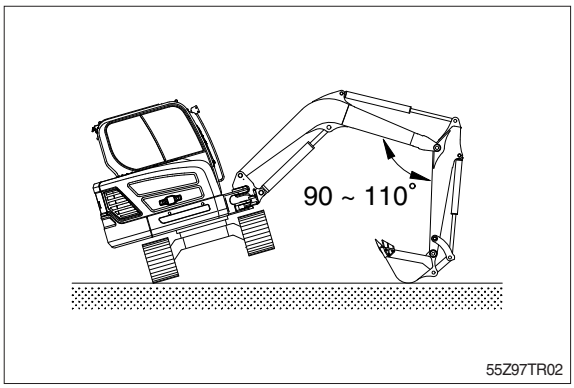
1) REMOVAL

(1) Loosen tension of the track link.



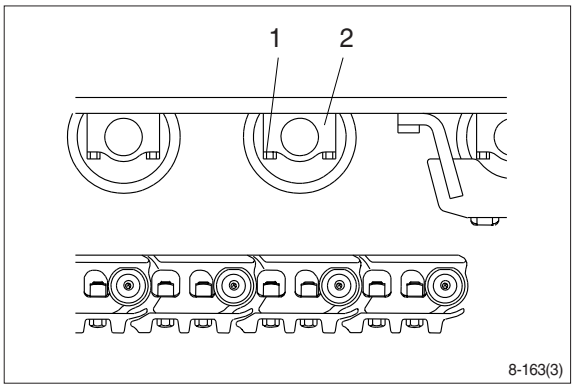
(2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the track roller (3).

· Weight : 16 kg (36 lb)



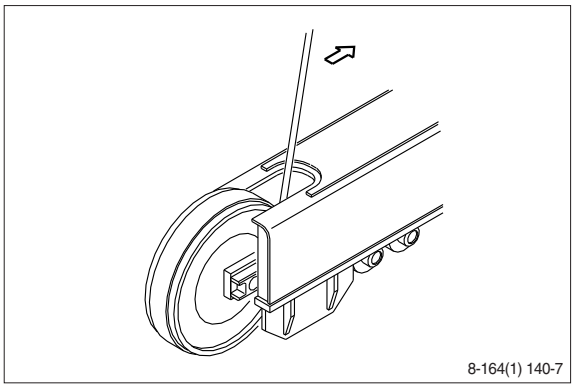
2) INSTALL

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

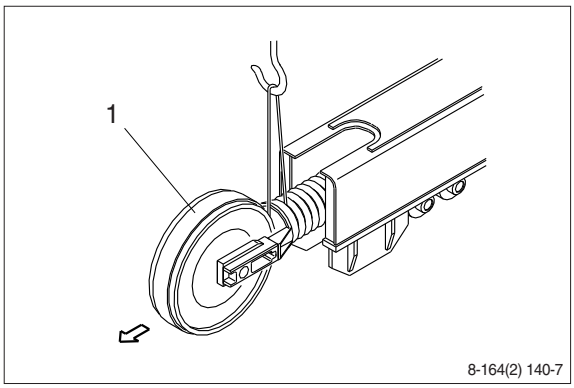
4. IDLER AND RECOIL SPRING

1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.

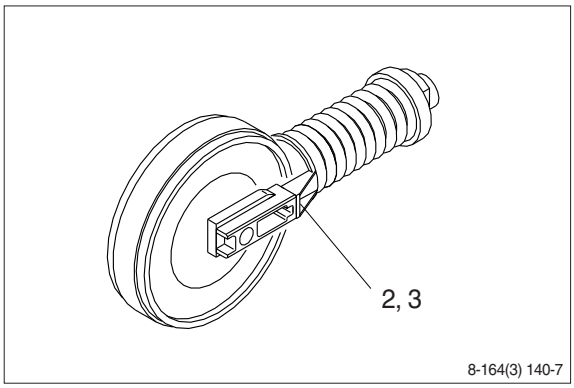

8-164(1) 140-7

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 110 kg (240 lb)



8-164(2) 140-7

(3) Remove the bolts (2), washers (3) and separate idler from recoil spring.

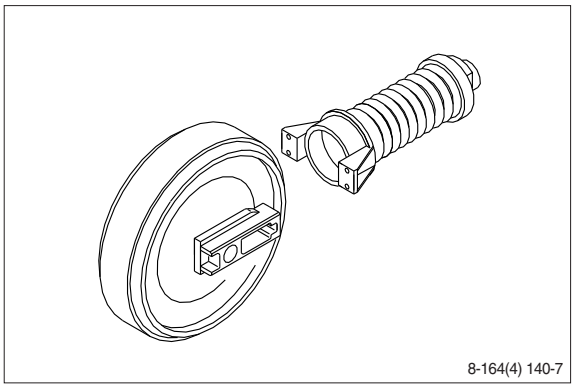


8-164(3) 140-7

2) INSTALL

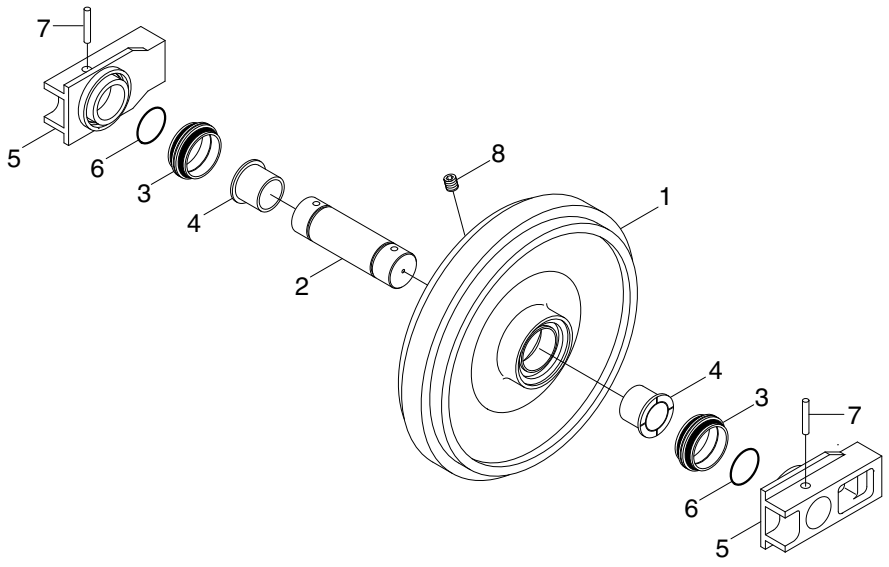
(1) Carry out installation in the reverse order to removal.

※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.


8-164(4) 140-7

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



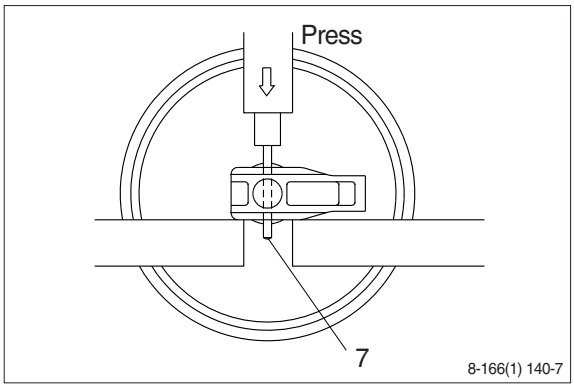
80CR97ID30

1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Bracket	8	Plug
3	Seal assembly	6	O-ring		

(2) Disassembly

① Remove plug and drain oil.

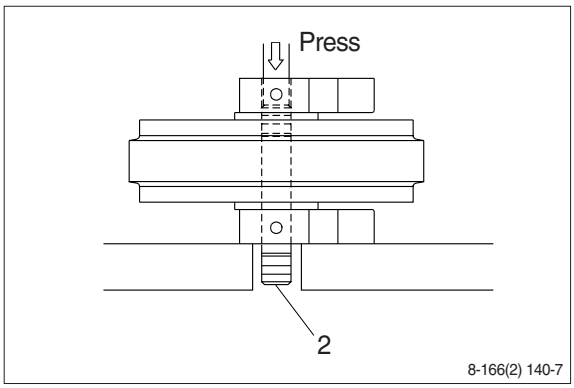
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

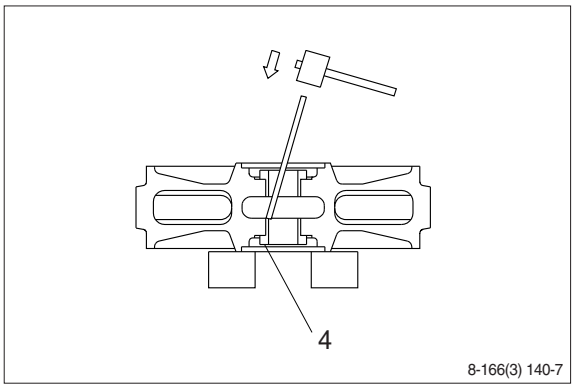
④ Remove seal (3) from idler (1) and bracket (5).

⑤ Remove O-ring (6) from shaft.



⑥ Remove the bushing (4) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

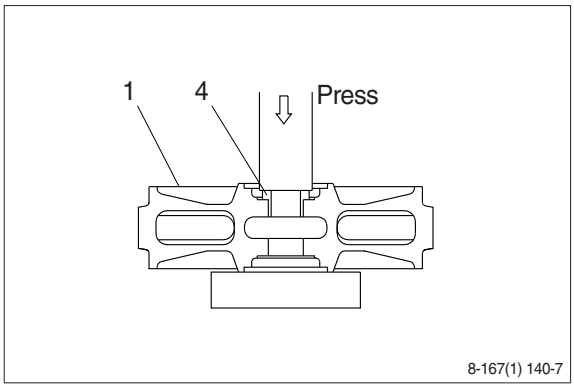


(3) **Assembly**

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

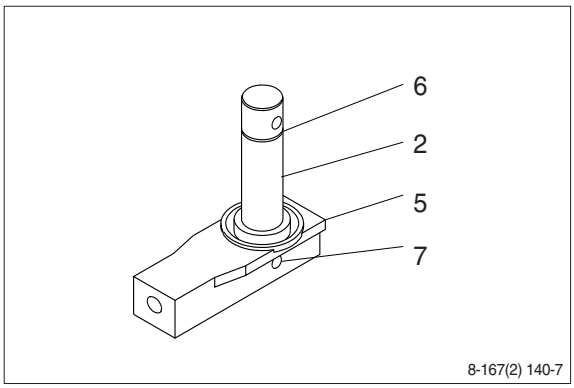
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1) 140-7

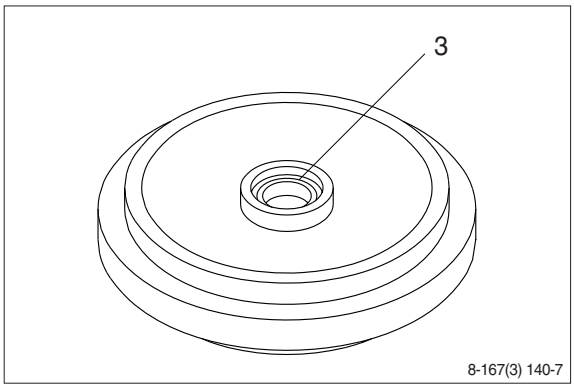
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



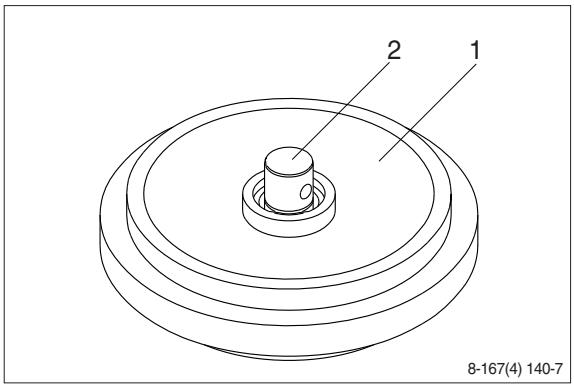
8-167(2) 140-7

④ Install seal (3) to shell (1) and bracket (5).



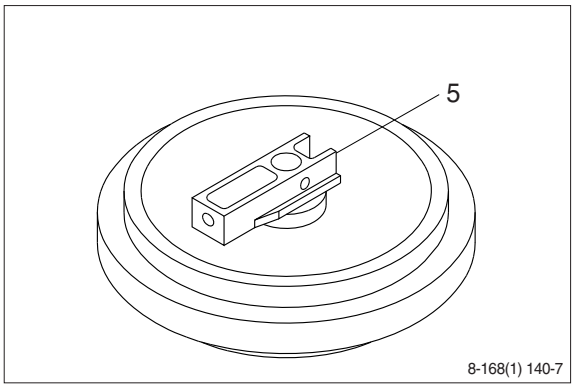
8-167(3) 140-7

⑤ Install shaft (2) to shell (1).

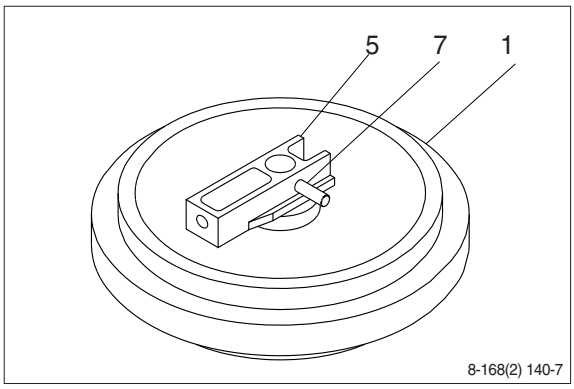


8-167(4) 140-7

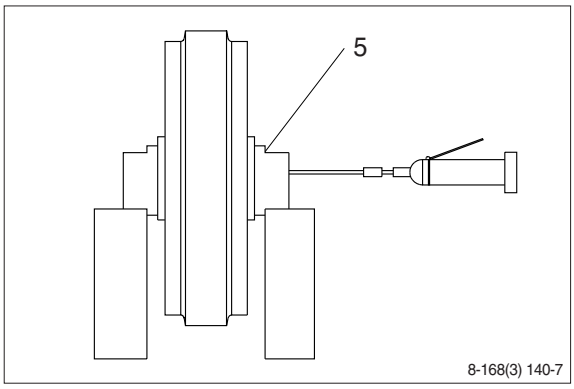
⑥ Install bracket (5) attached with seal (3).



⑦ Knock in the spring pin (7) with a hammer.

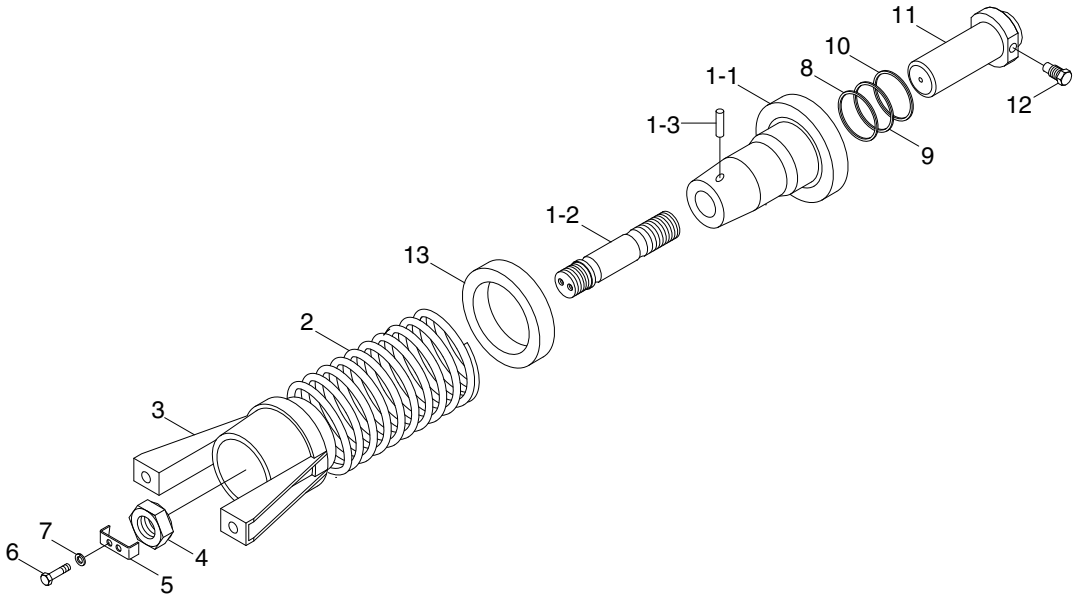


⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



80CR97ID31

1-1	Body	4	Lock nut	9	Back up ring
1-2	Tie bar	5	Lock plate	10	Dust seal
1-3	Spring pin	6	Bolt	11	Rod assembly
2	Spring	7	Spring washer	12	Grease valve
3	Bracket	8	Rod seal	13	Spacer

(2) Disassembly

① Apply pressure on spring (2) with a press.

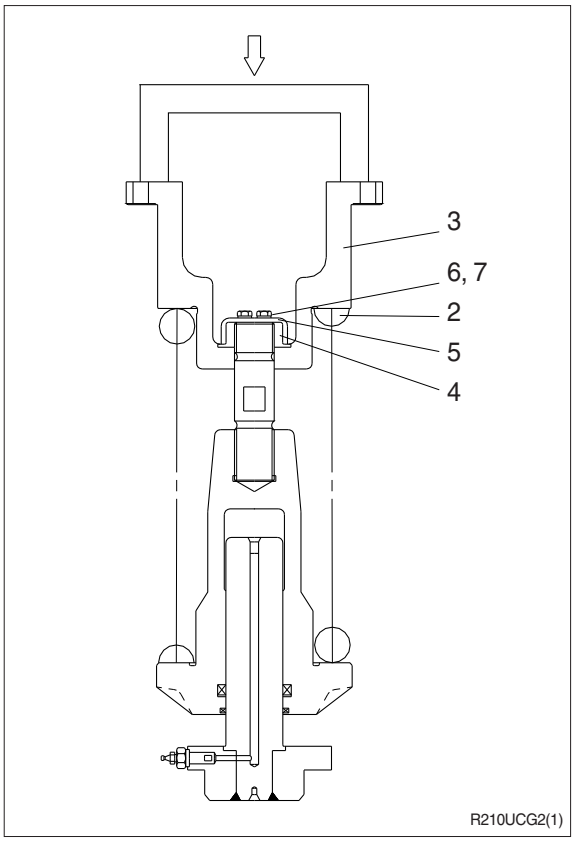
※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

・Spring set load : 5083 kg (11210 lb)

② Remove bolt (6), spring washer (7) and lock plate (5).

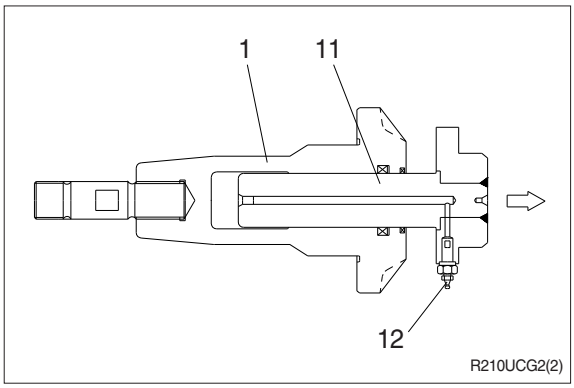
③ Remove lock nut (4).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove bracket (3) and spring (2).

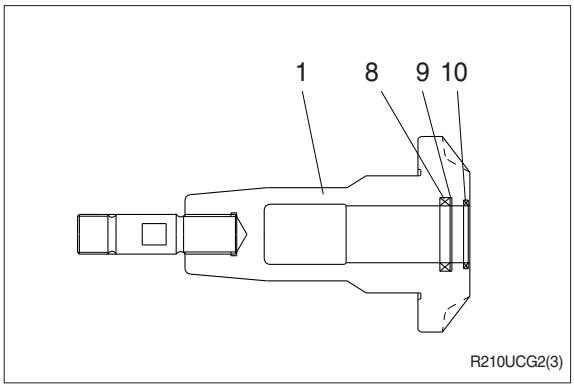


⑤ Remove rod (11) from body (1-1).

⑥ Remove grease valve (12) from rod (11).



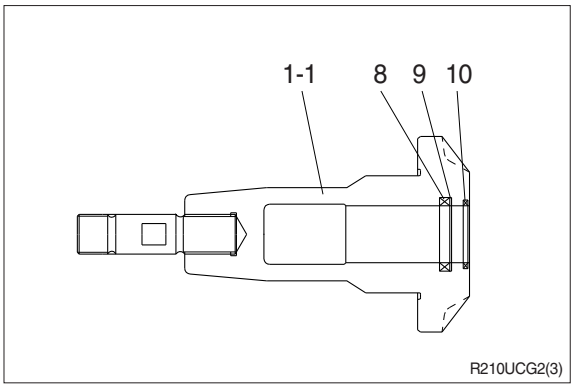
⑦ Remove rod seal (8), back up ring (9) and dust seal (10).



(3) Assembly

Install dust seal (10), back up ring (9) and rod seal (8) to body (1-1).

※ When installing dust seal (10) and rod seal (8), take full care so as not to damage the lip.



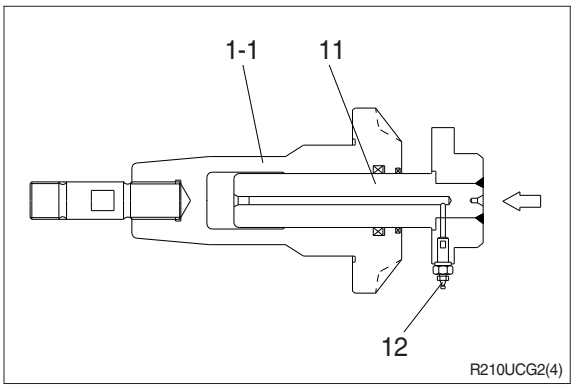
② Pour grease into body (1-1), then push in rod (11) by hand.

After take grease out of grease valve mounting hole, let air out.

※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve (12) to rod (11).

·Tightening torque : 13±1.0 kgf·m (94±7.2 lbf·ft)

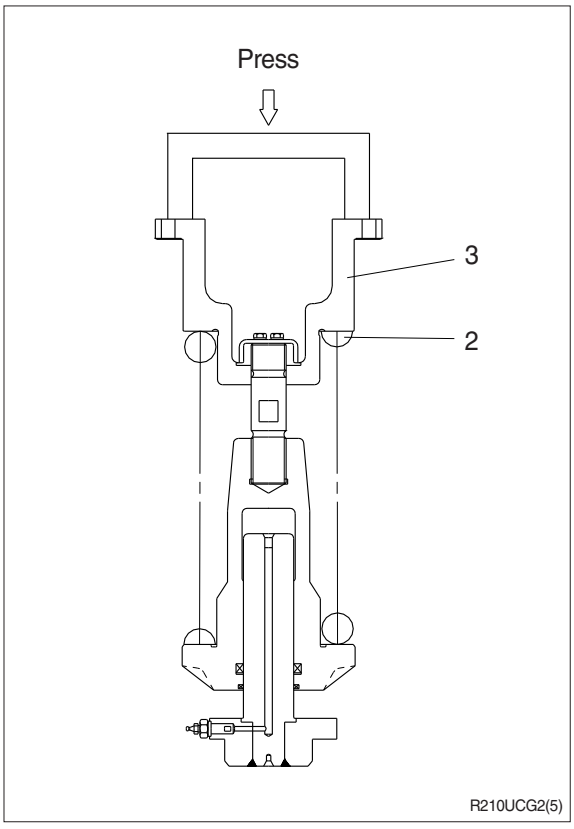


④ Install spring (2) and bracket (3) to body (1-1).

⑤ Apply pressure to spring (2) with a press and tighten lock nut (4).

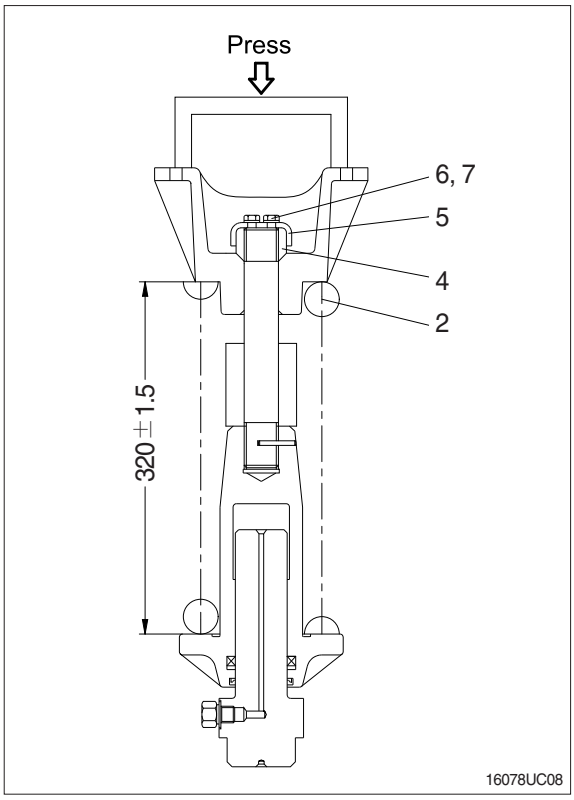
※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.

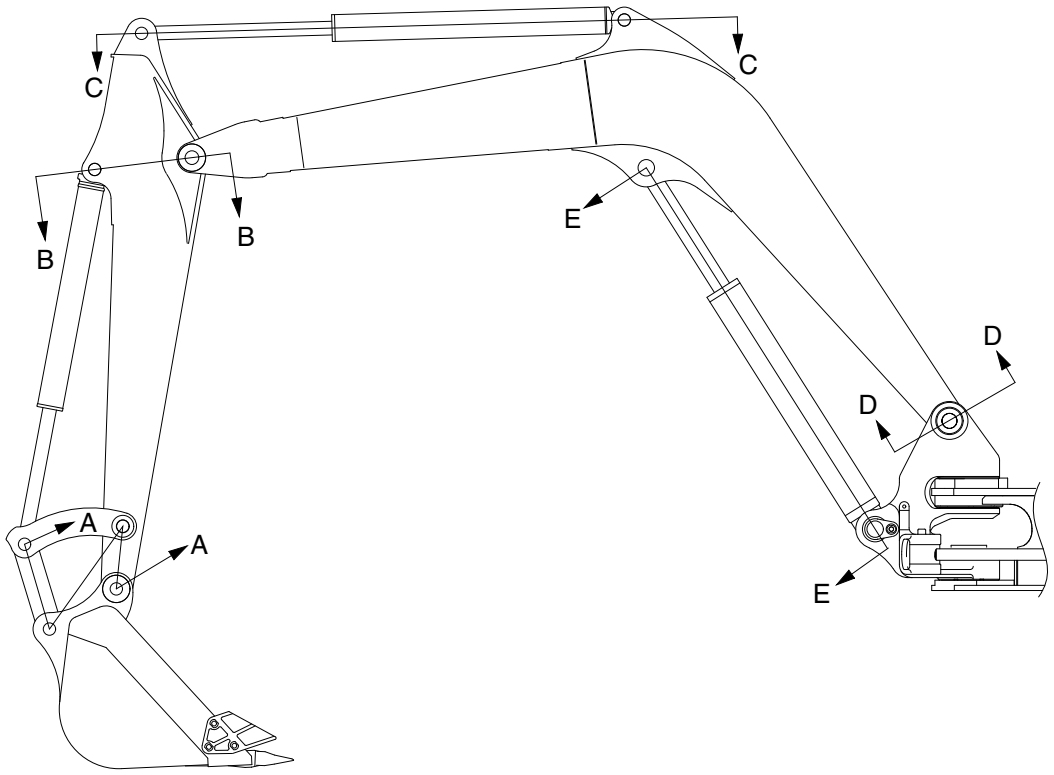


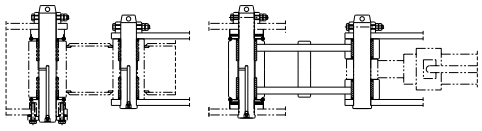
⑥ Lighten the press load and confirm the set length of spring (2).

⑦ After the setting of spring (2), install lock plate (5), spring washer (7) and bolt (6).

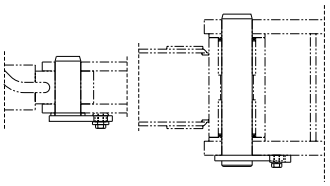


1. STRUCTURE

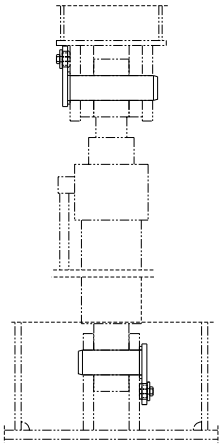




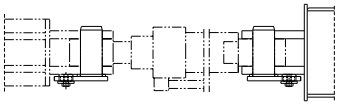
SECTION A-A



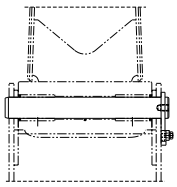
SECTION B-B



SECTION E-E



SECTION C-C



SECTION D-D

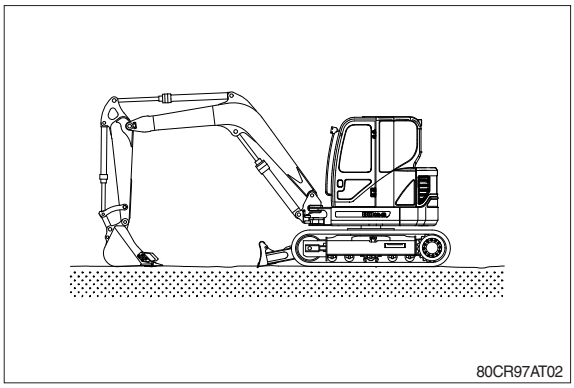
80CR97AT01

2. REMOVAL AND INSTALL

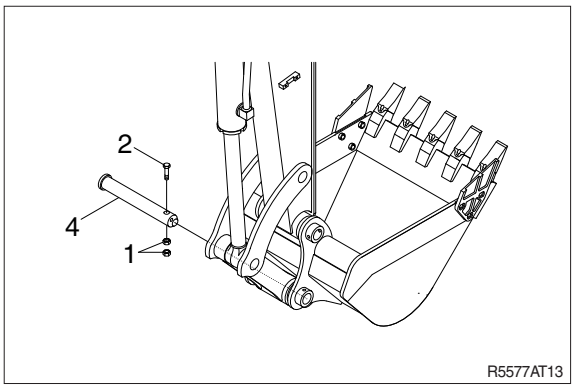
1) BUCKET ASSEMBLY

(1) Removal

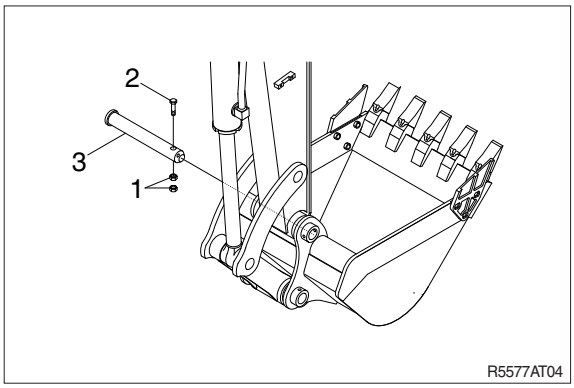
① Lower the work equipment completely to ground with back of bucket facing down.



② Remove nut (1), bolt (2) and draw out the pin (4).



③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly.
- Weight : 230 kg (510 lb)

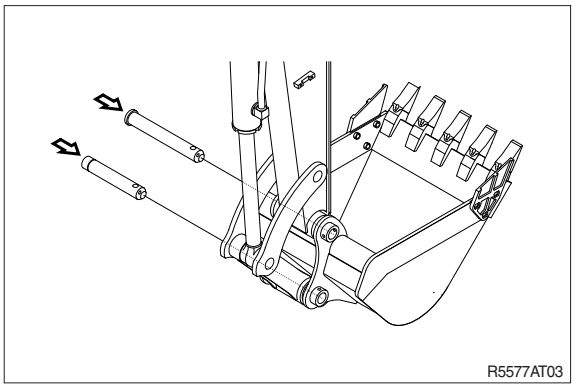


(2) Install

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 (4).

⚠ Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

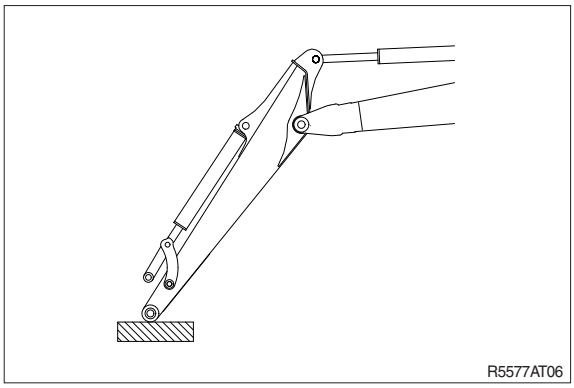
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

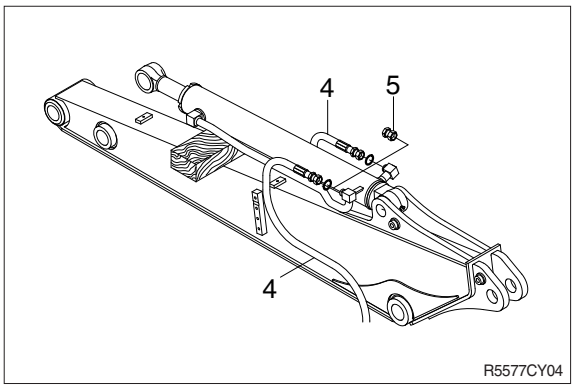
※ Tie the rod with wire to prevent it from coming out.

④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

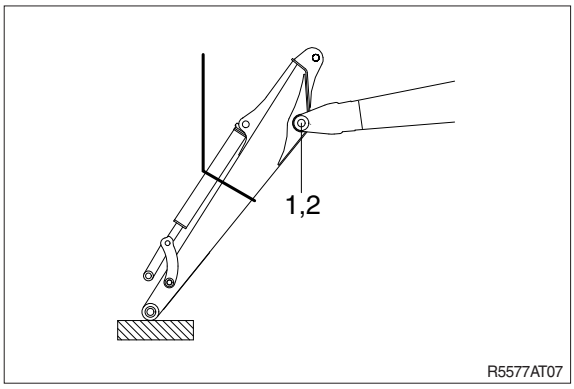
⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly.
· Weight : 180 kg (400 lb)

※ When lifting the arm assembly, always lift the center of gravity.


R5577AT06



R5577CY04



R5577AT07

(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

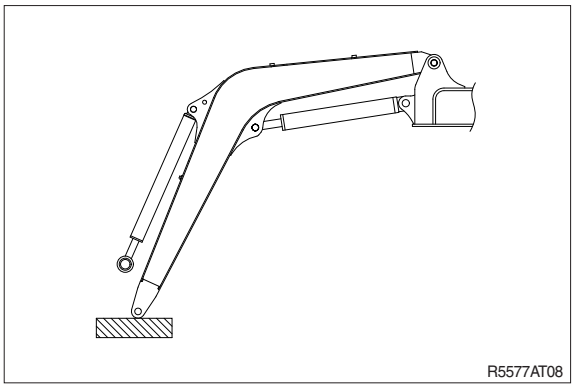
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

① Remove arm and bucket assembly.

② For details, see removal of arm and bucket assembly.
Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.

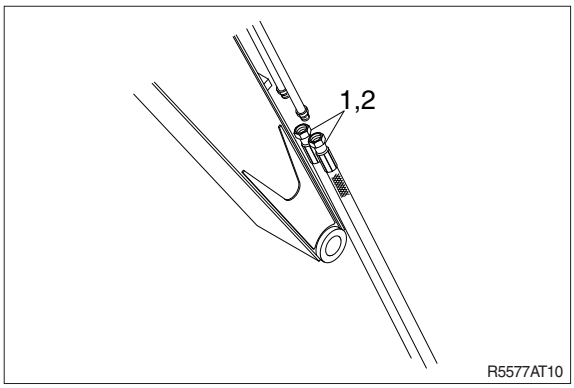

R5577AT08

③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hos e(1).

※ When the hose are disconnected, oil may spurt out.

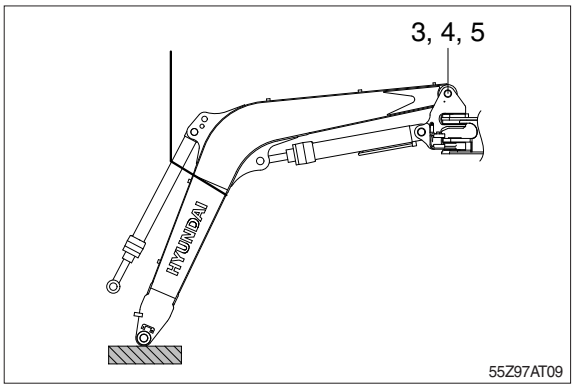
⑤ Sling boom assembly (3).



R5577AT10

⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly.
· Weight : 420 kg (930 lb)

※ When lifting the boom assembly always lift the center of gravity.



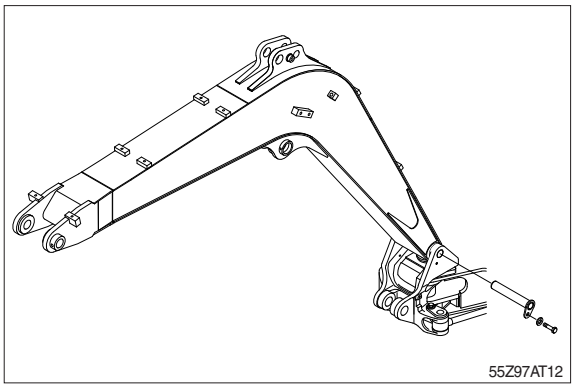
55Z97AT09

(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.


55Z97AT12

SECTION 8 COMPONENT MOUNTING TORQUE

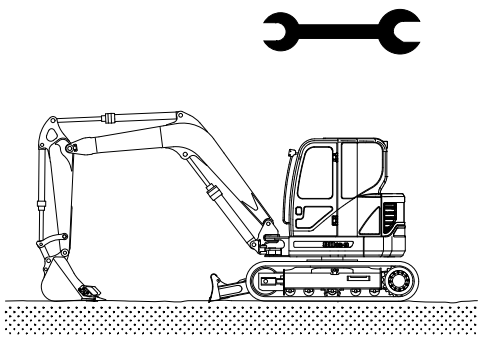
SECTION 8 COMPONENT MOUNTING TORQUE

GROUP 1 INTRODUCTION GUIDE

1. This section shows bolt specifications and standard torque values needed when mounting components to the machine.
2. Use genuine Hyundai spare parts.
   We expressly point out that Hyundai will not accept any responsibility for defects resulted from non-genuine parts.
   In such cases Hyundai cannot assume liability for any damage.

※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.

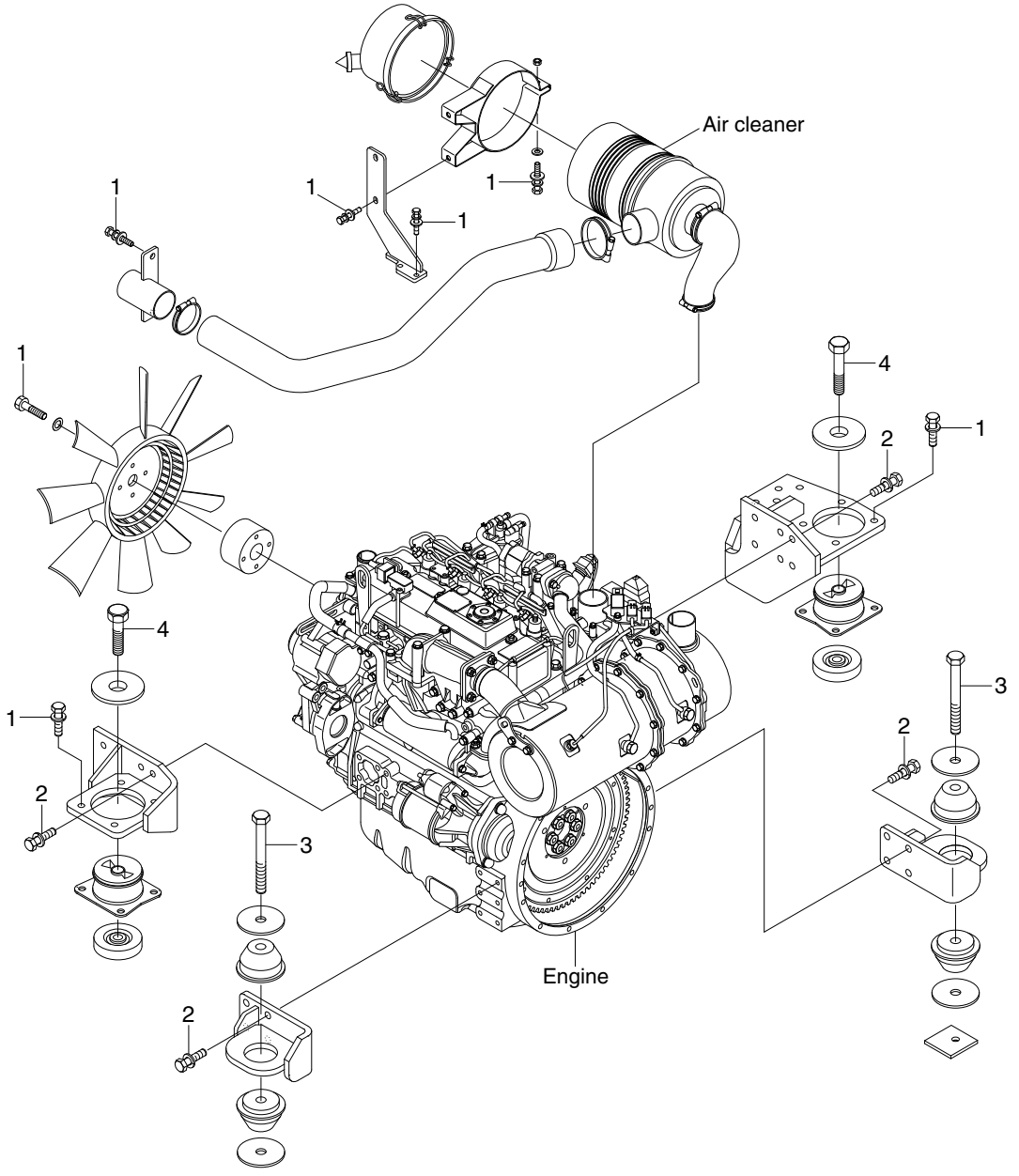
※ Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.



80CR98CM20

GROUP 2 ENGINE SYSTEM

1. ENGINE AND ACCESSORIES MOUNTING



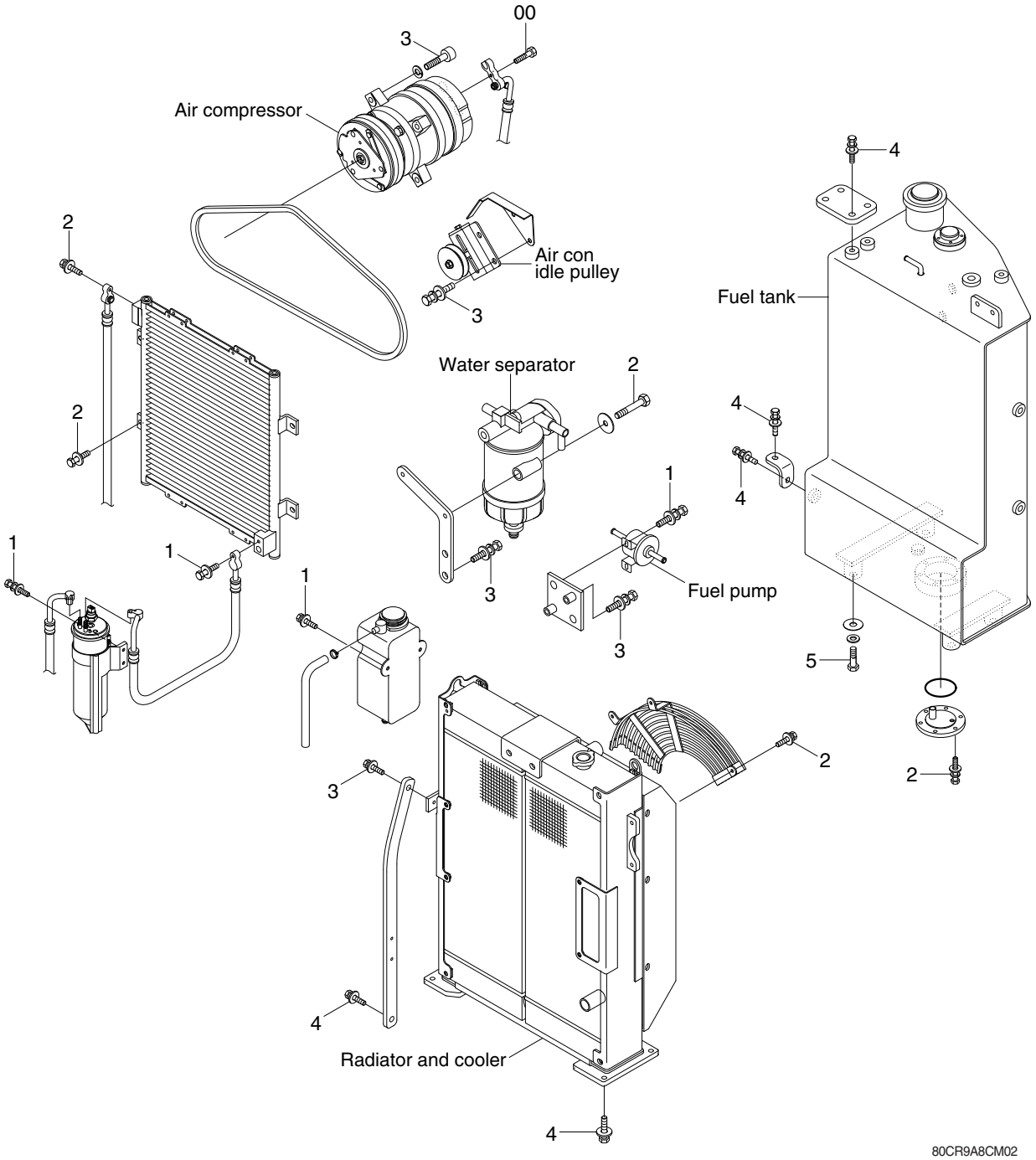
80CR9A8CM01

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	3.0±2.0	21.7±14.5
2	M10×1.5	6.9±1.0	49.9±7.2

Item	Size	kgf · m	lbf · ft
3	M12×1.75	10±1.0	72.3±7.2
4	M16×2.0	25±2.5	181±18

2. COOLING SYSTEM AND FUEL TANK MOUNTING

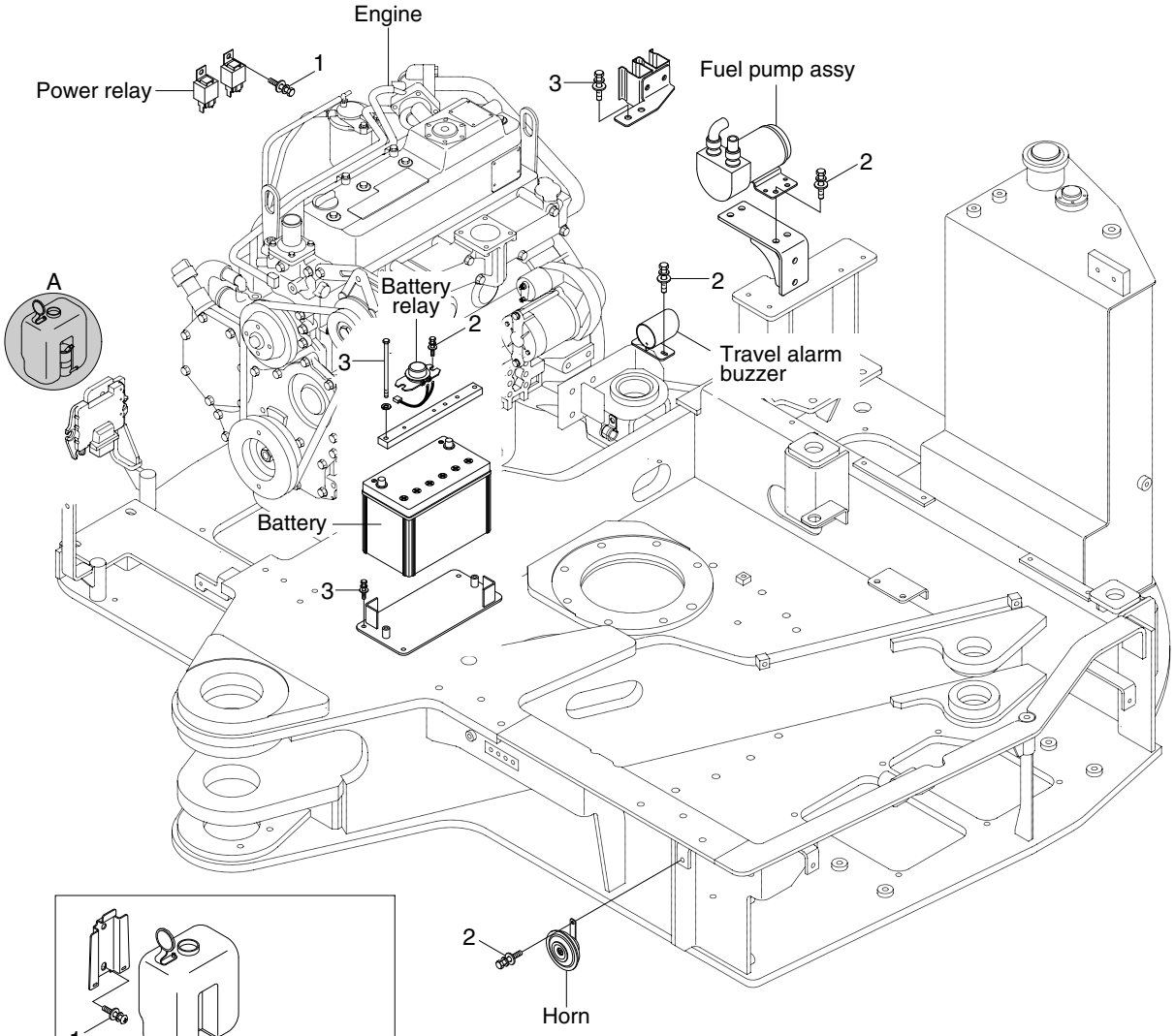


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.25	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
4	M12×1.75	12.8±3.0	92.6±21.7
5	M16×2.0	25±2.5	181±18.1

ELECTRIC COMPONENTS MOUNTING



80CR9A8CM03

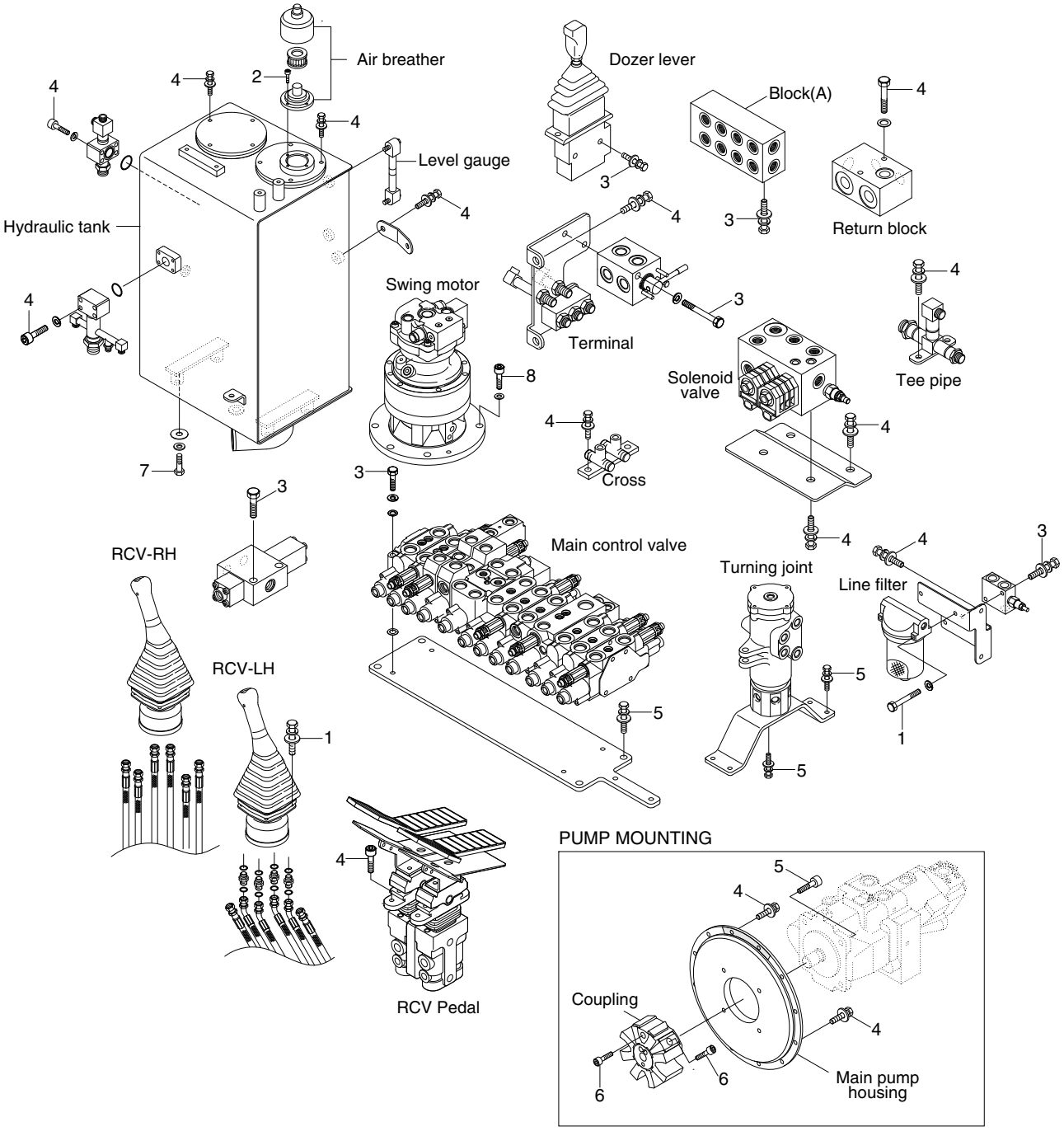
· Tightening torque

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



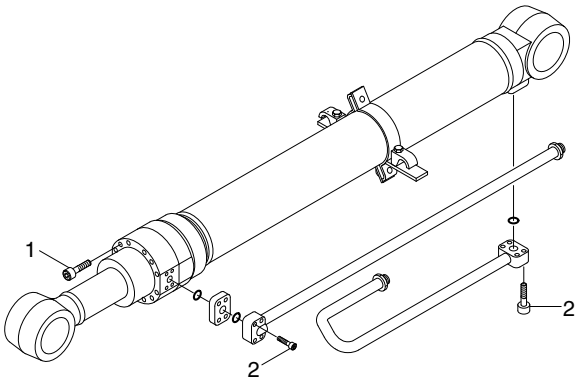
80CR9A8CM05

· Tightening torque

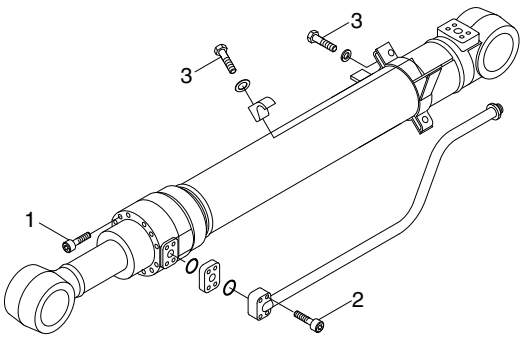
Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 6×1.0	1.44±0.3	10.4±2.2
3	M 8×1.25	2.5±0.5	18.1±3.6
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.2±1.3	88.2±9.4
6	M14×2.0	14.0±1.0	101±7.2
7	M16×2.0	25.0±2.5	118±18.1
8	M16×2.0	29.7±4.5	215±33.0

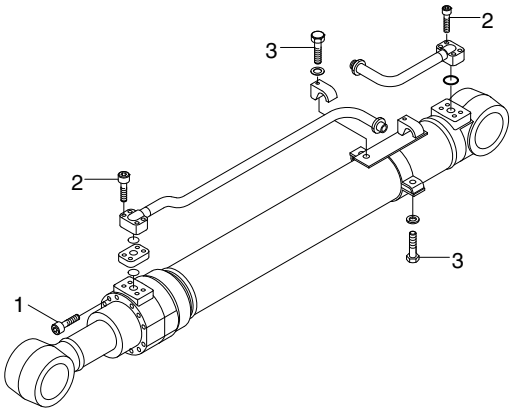
2. HYDRAULIC COMPONENTS MOUNTING 2



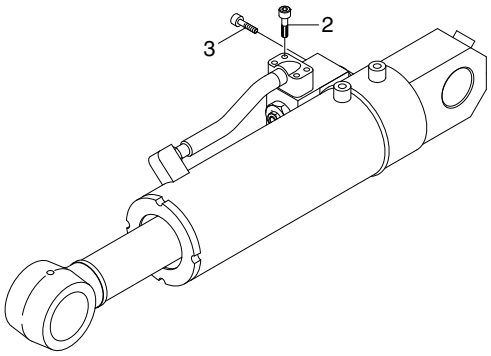
BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER



DOZER CYLINDER

80CR9A8CM06

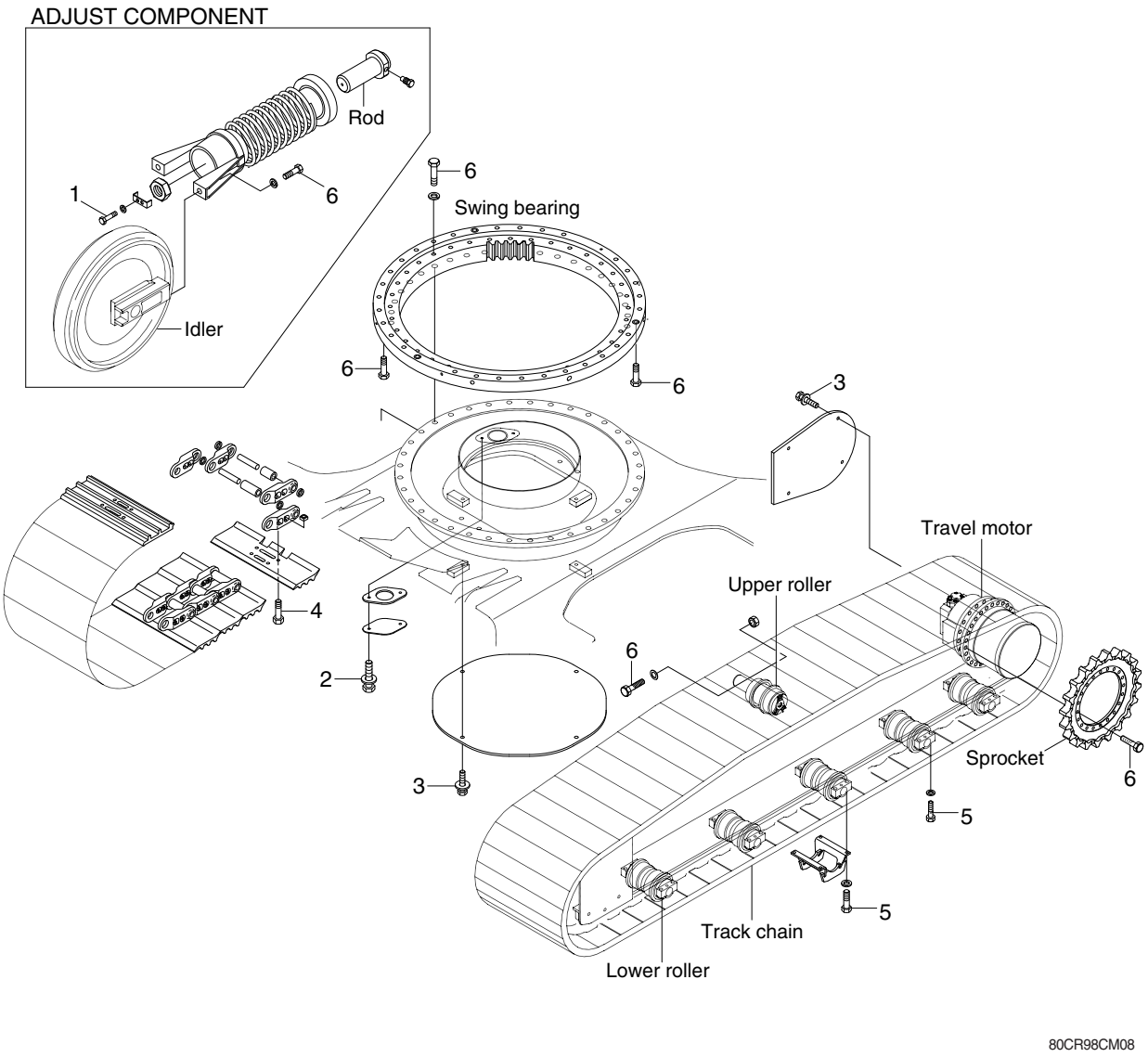
· Tightening torque

Gland mounting bolt (1)

Item	Size	kgf · m	lbf · ft
Boom cylinder	M14	15±1.5	108±10.8
Arm cylinder	M14	15±1.5	108±10.8
Bucket cylinder	M12	9.4±1.0	68±7.2

Item	Size	kgf · m	lbf · ft
2	M8×1.25	2.7±0.3	19.5±2.2
3	M10×1.5	3.2±0.3	23.1±2.2

GROUP 5 UNDERCARRIAGE



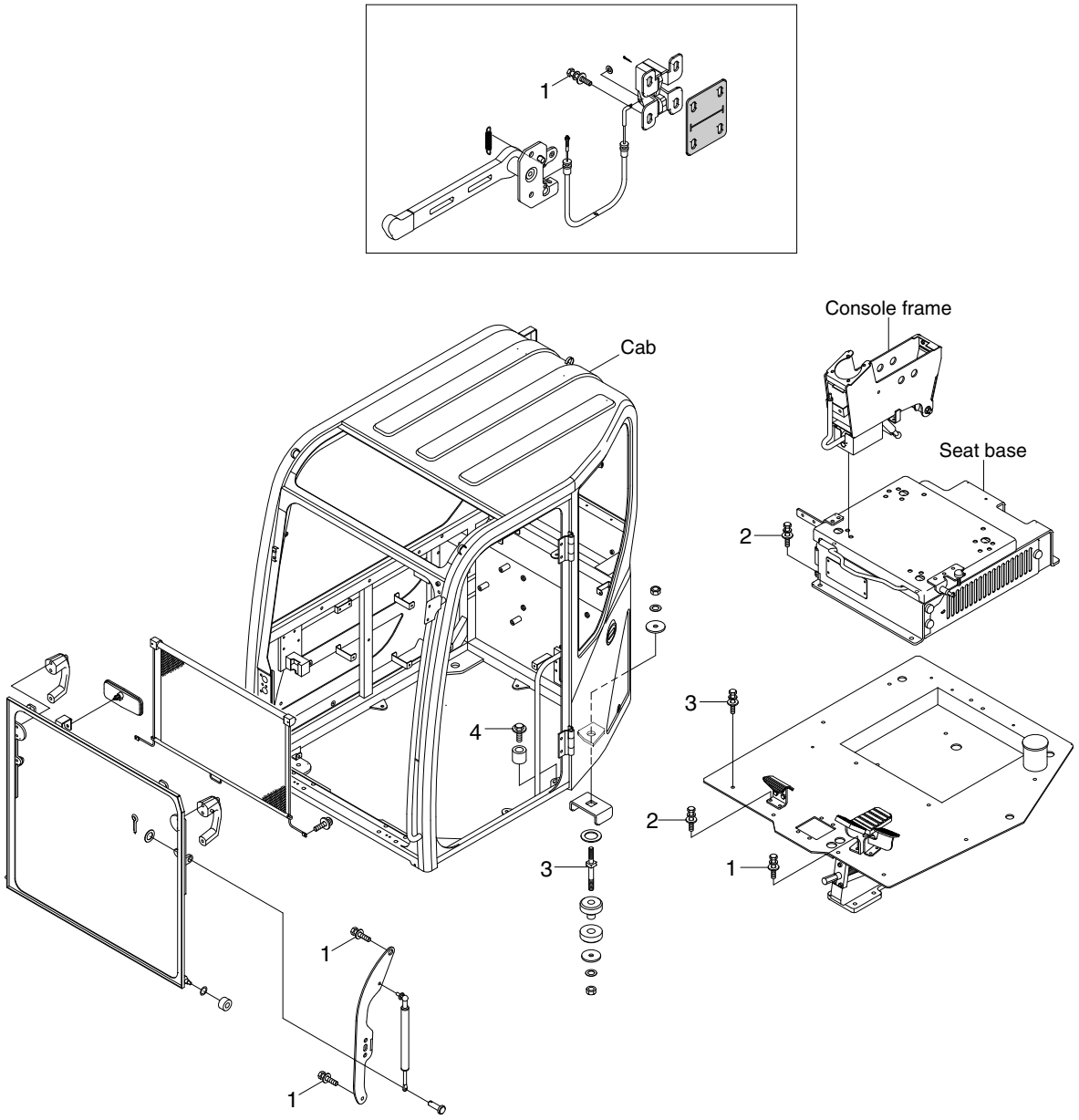
80CR98CM08

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M8×1.25	3.4±0.5	24.6±3.6
2	M10×1.5	6.9±1.4	49.9±10.1
3	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
4	M14×1.5	25.5±2.5	184±18.1
5	M14×2.0	19.6±2.0	142±14.5
6	M16×2.0	29.7±3.0	215±21.7

1. CAB AND ACCESSORIES MOUNTING



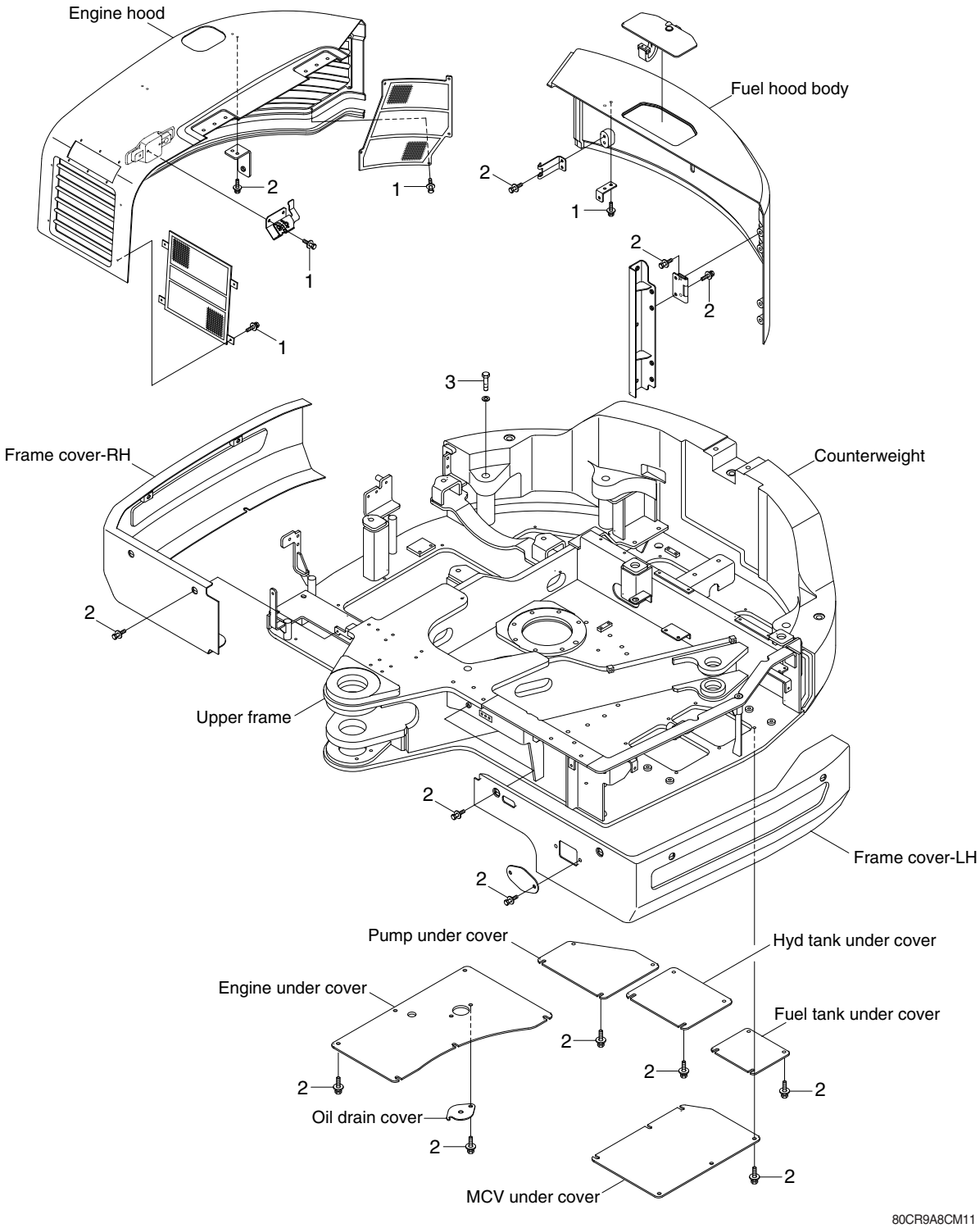
80CR98CM09

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	4.7±0.9	34.0±6.5

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M16×2.0	29.7±4.5	215±32.5

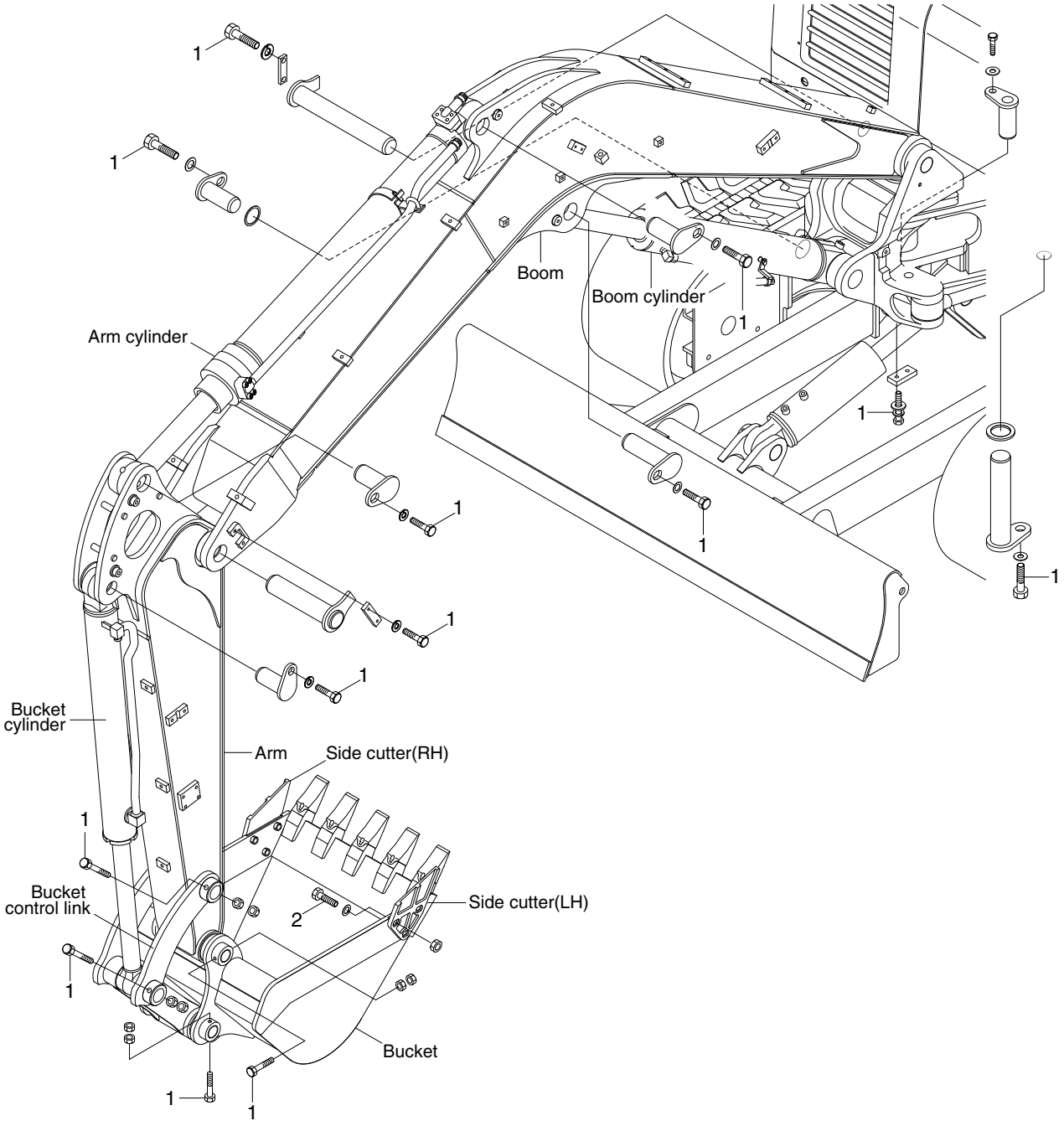
2. COWLING MOUNTING



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M27×3.0	140±15	1013±108



80CR9A8CM12

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
2	M20×2.5	57.9±8.7	419±62.9