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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 HD Hyundai Construction Equipment 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 HD Hyundai Construction Equipment distributors.

Get the most up-to-date information before you start any work.

Filing method

1. See the page number on the bottom of the page.
   File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1

   2 - 3
   - 2 : Item number(2. Structure and Function)
   - 3 : Consecutive page number for each item.

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

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

Revised edition mark(①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

Convert 55mm into inches.

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

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

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

2. Convert 550mm into inches.

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

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

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

Millimeters to inches

1mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

	0	1	2	3	4	5	6	7	8	9
0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
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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

1l = 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

1l = 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

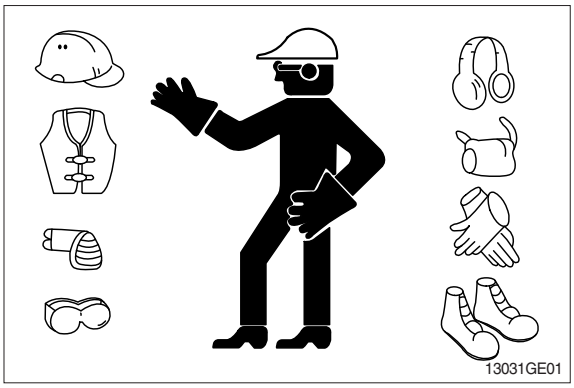
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

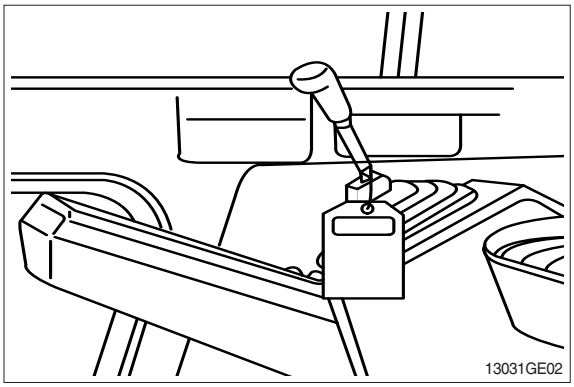
WEAR PROTECTIVE CLOTHING

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



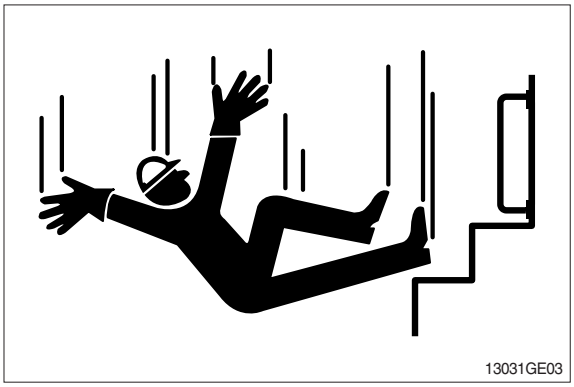
WARN OTHERS OF SERVICE WORK

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.

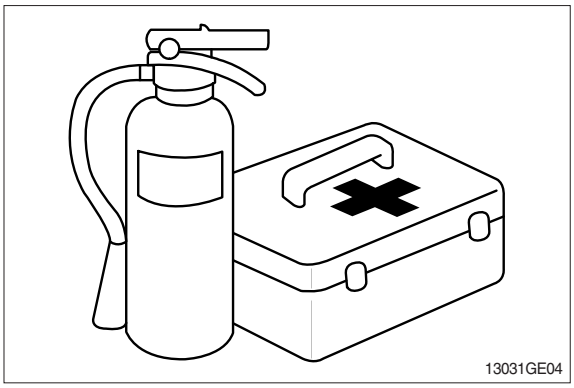


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

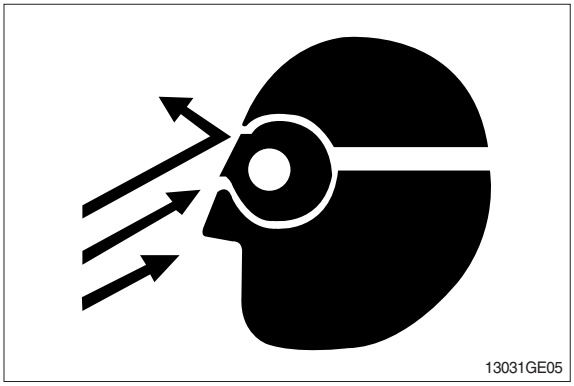
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

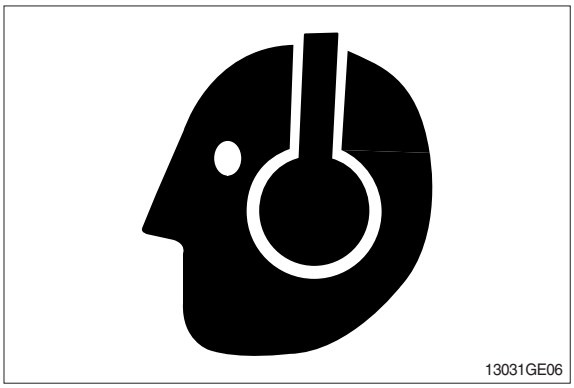
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

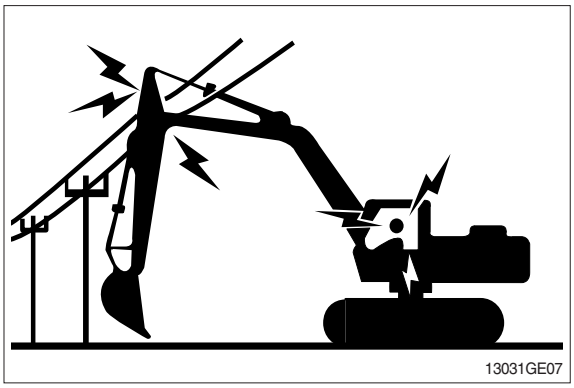
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

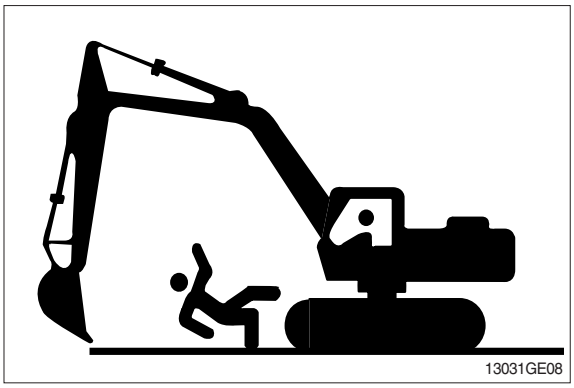
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



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.

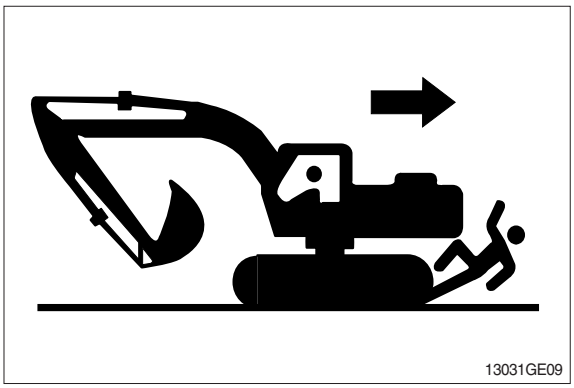

13031GE08

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

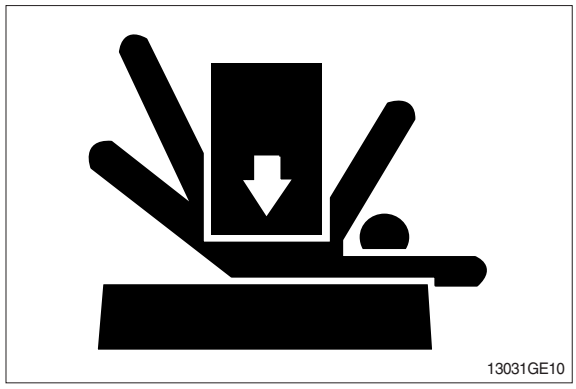
Before working on the machine:

·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.

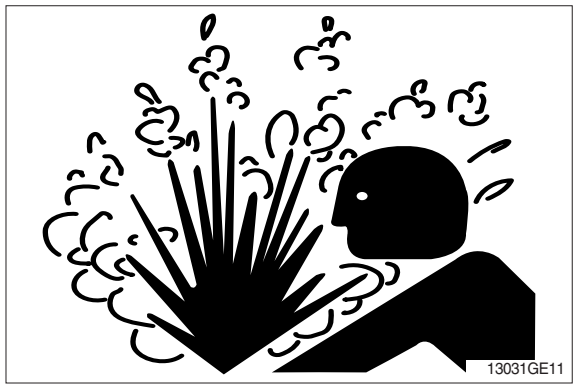
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



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.



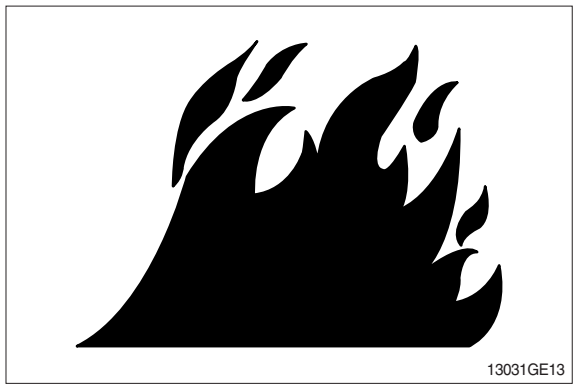
HANDLE FLUIDS SAFELY-AVOID FIRES

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.

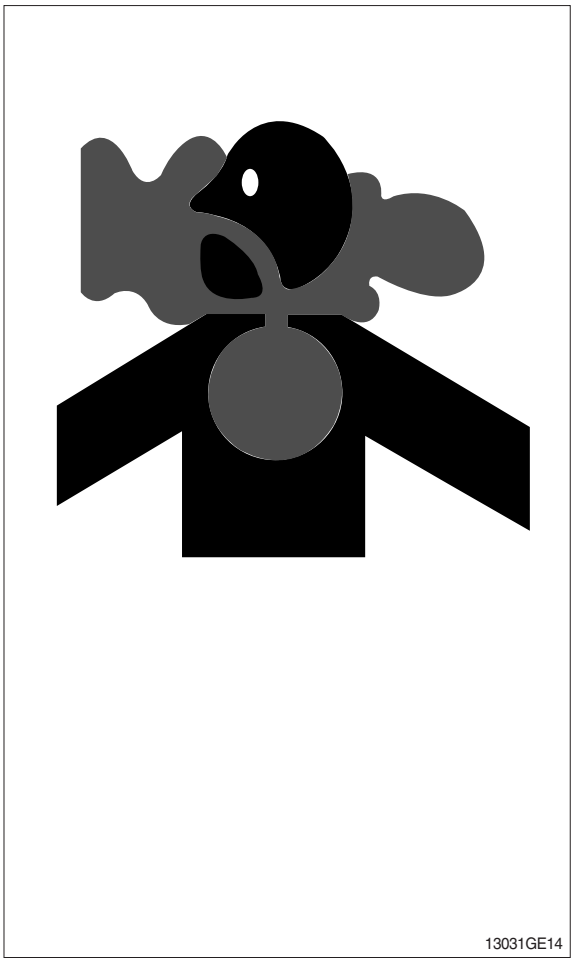
Do not store oily rags; They can ignite and burn spontaneously.



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.

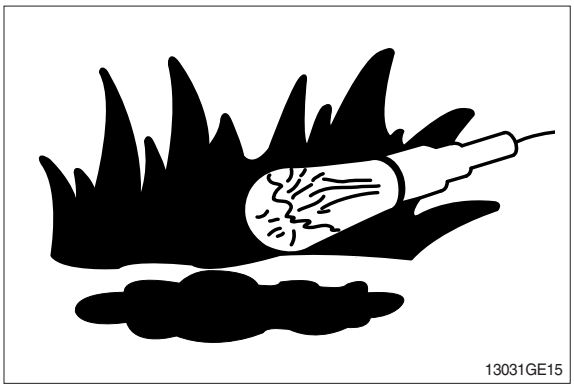
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

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

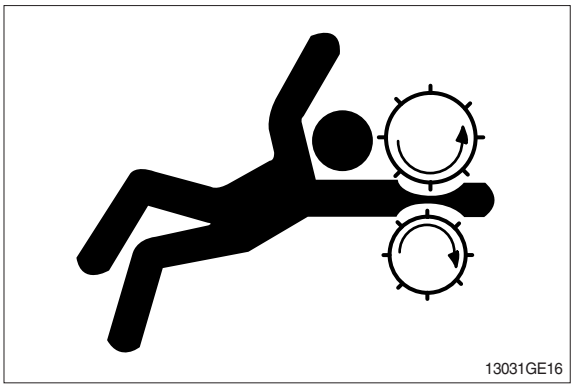
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



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.

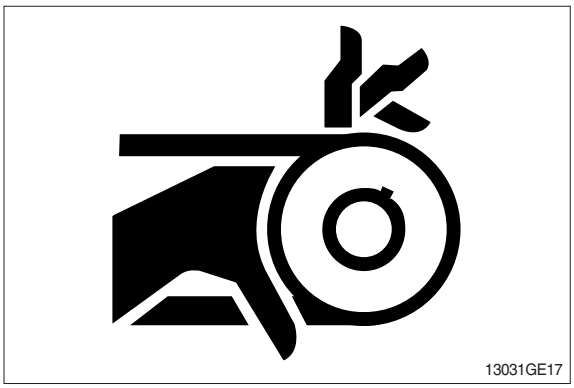
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



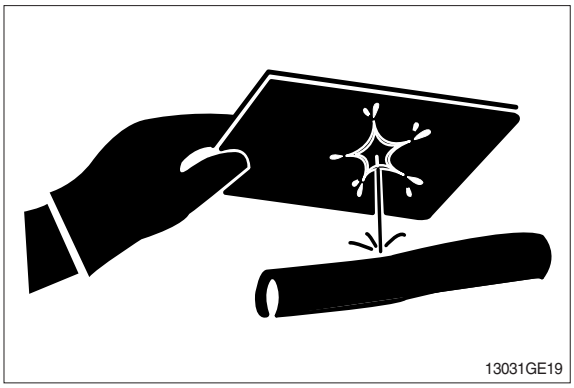
AVOID HIGH PRESSURE FLUIDS

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.

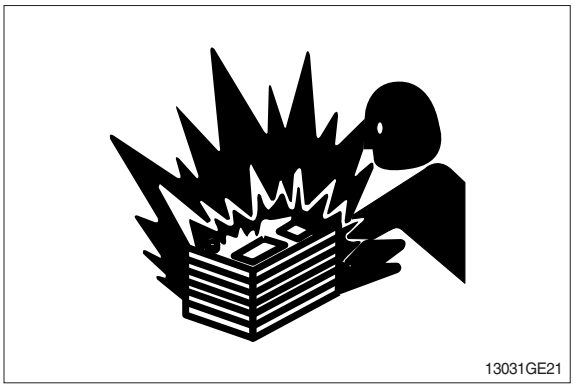
Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.

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:

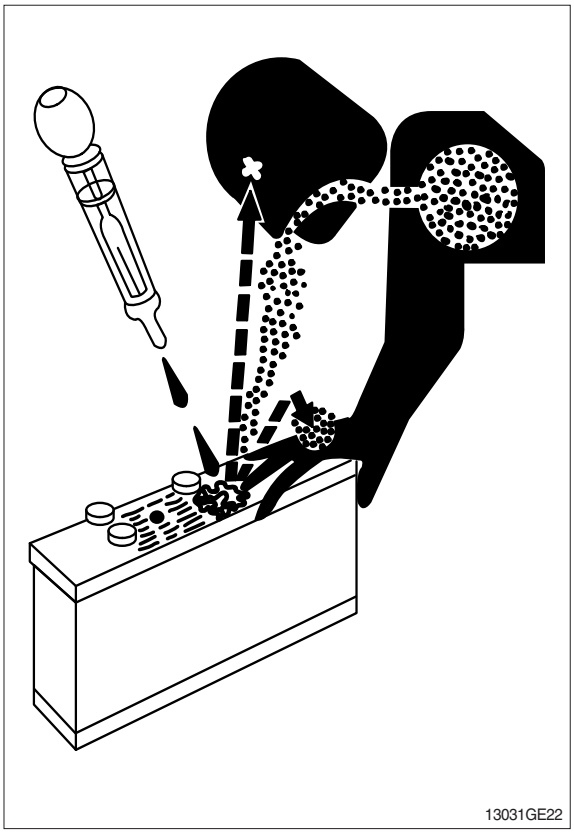
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

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.



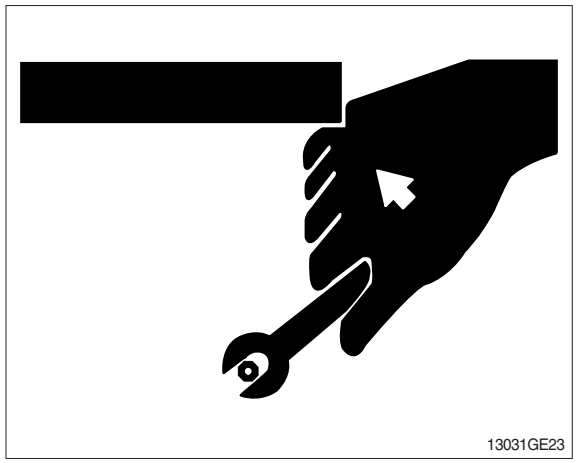
USE TOOLS PROPERLY

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.)

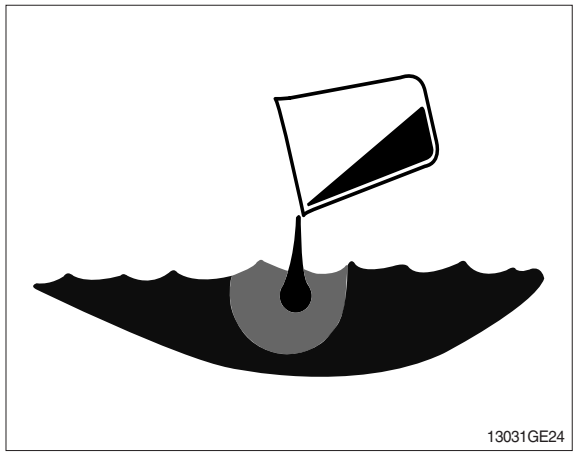


DISPOSE OF FLUIDS PROPERLY

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

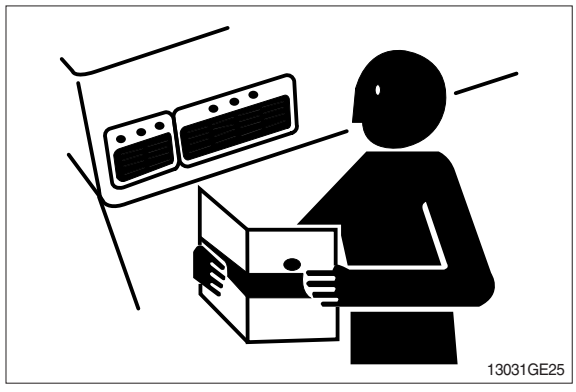
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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



REPLACE SAFETY SIGNS

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

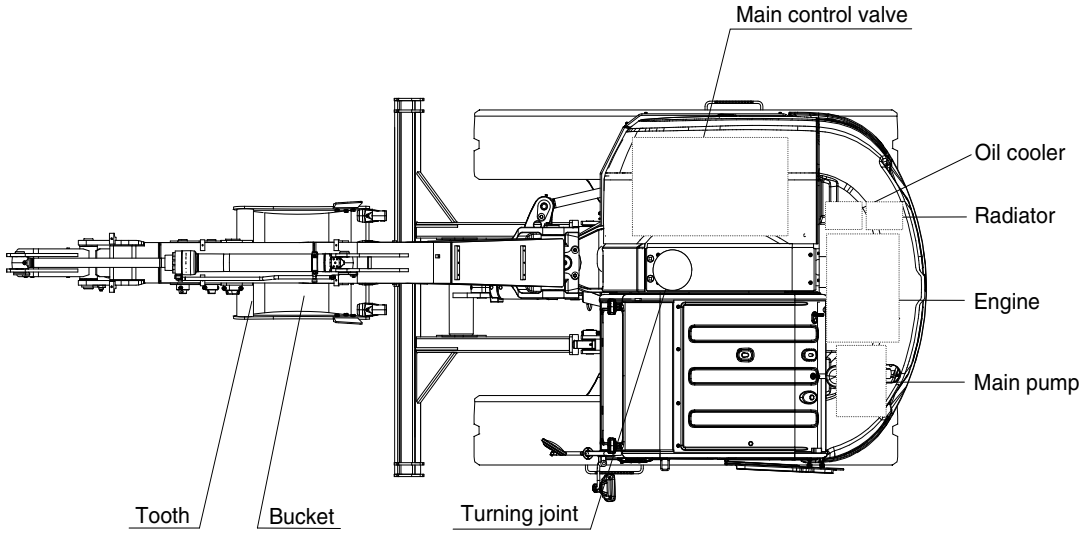


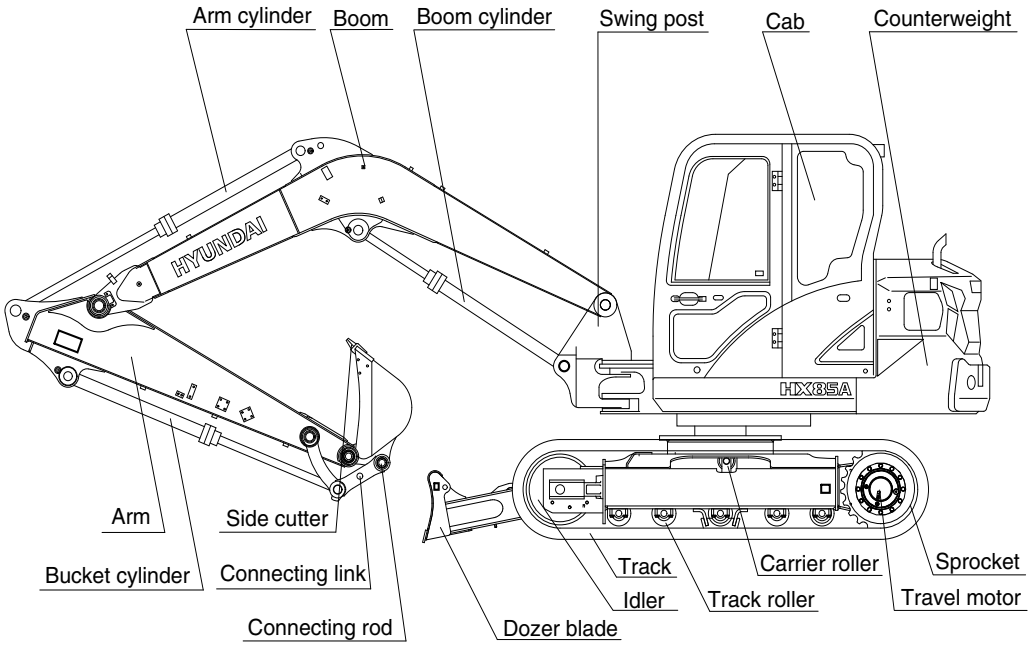
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

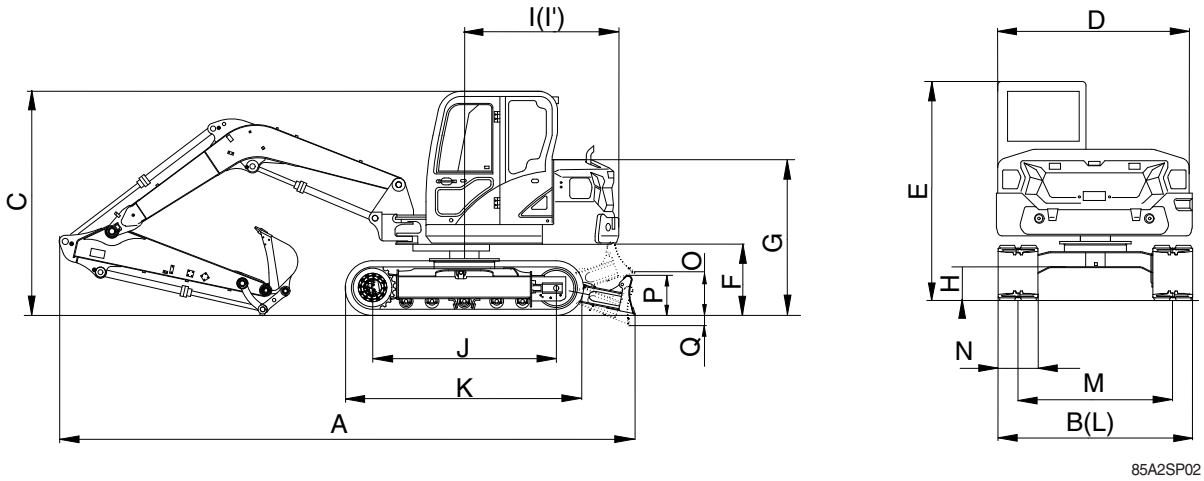




856A2SP01

2. SPECIFICATIONS

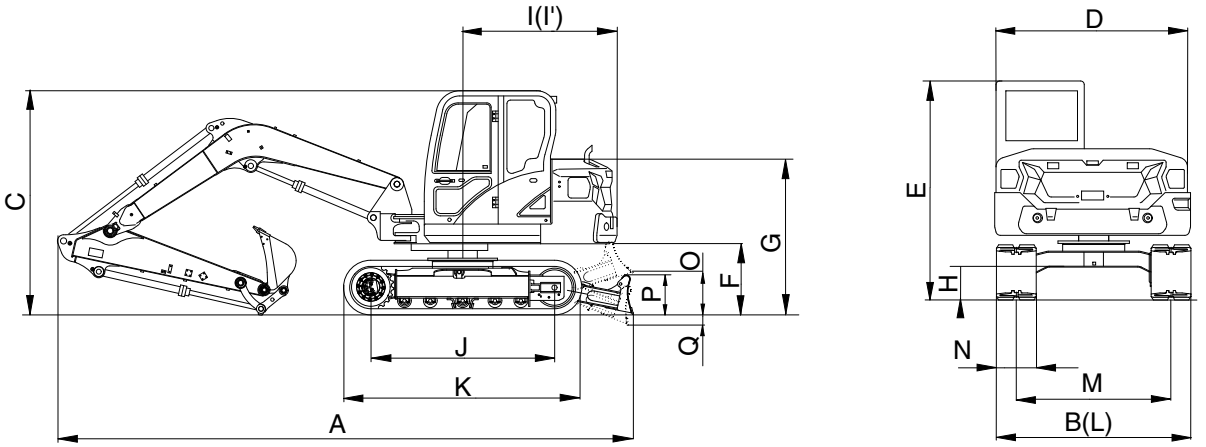
1) 3.55 m (11' 8") MONO BOOM, 1.75 m (5' 9") ARM WITH BOOM SWING SYSTEM



85A2SP02

Description		Unit	Specification
Operating weight		kg (lb)	8530 (18810)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.25 (0.33)
Overall length	A	mm (ft-in)	6585 (21' 7")
Overall width, with 450 mm shoe	B		2300 (7' 7")
Overall height	C		2560 (8' 5")
Superstructure width	D		2300 (7' 7")
Overall height of cab	E		2560 (8' 5")
Ground clearance of counterweight	F		745 (2' 5")
Engine cover height	G		1750 (5' 9")
Minimum ground clearance	H		260 (1' 0")
Rear-end distance	I		1600 (5' 3")
Rear-end swing radius	I'		1645 (5' 5")
Distance between tumblers (Steel)	J		2280 (7' 6")
Distance between tumblers (Rubber)			2270 (7' 5")
Undercarriage length (Steel)	K		2906 (9' 6")
Undercarriage length (Rubber)			2900 (9' 6")
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		430 (1' 4")
Depth of blade down	Q		410 (1' 3")
Travel speed (Low/high)		km/hr (mph)	2.7/5.2 (1.7/3.2)
Swing speed		rpm	9.5
Gradeability		Degree (%)	30 (58)
Ground pressure (450 mm shoe)		kgf/cm^2 (psi)	0.38 (5.42)
Max traction force		kg (lb)	7580 (16700)

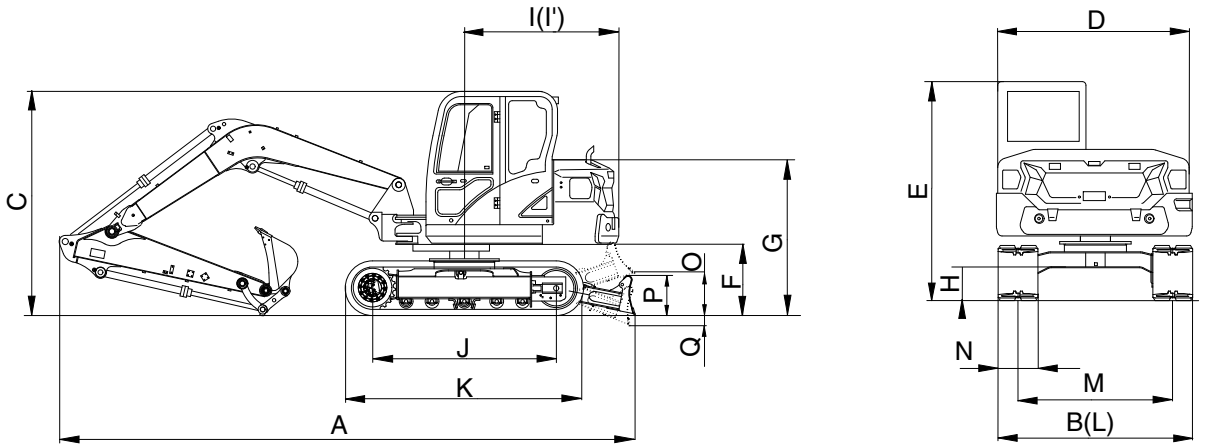
2) 3.55 m (11' 8") MONO BOOM, 2.1 m (6' 11") ARM WITH BOOM SWING SYSTEM



85A2SP02

Description		Unit	Specification
Operating weight		kg (lb)	8610 (18980)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.25 (0.33)
Overall length	A	mm (ft-in)	6655 (21' 10")
Overall width, with 450 mm shoe	B		2300 (7' 7")
Overall height	C		2560 (8' 5")
Superstructure width	D		2300 (7' 7")
Overall height of cab	E		2560 (8' 5")
Ground clearance of counterweight	F		745 (2' 5")
Engine cover height	G		1750 (5' 9")
Minimum ground clearance	H		360 (1' 2")
Rear-end distance	I		1600 (5' 3")
Rear-end swing radius	I'		1645 (5' 5")
Distance between tumblers (Steel)	J		2280 (7' 6")
Distance between tumblers (Rubber)			2270 (7' 5")
Undercarriage length (Steel)	K		2906 (9' 6")
Undercarriage length (Rubber)			2900 (9' 6")
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)	2.7/5.2 (1.7/3.2)
Swing speed		rpm	9.5
Gradeability		Degree (%)	30 (58)
Ground pressure (450 mm shoe)		kgf/cm^2 (psi)	0.38 (5.47)
Max traction force		kg (lb)	7580 (16700)

3) 3.92 m (12' 1") 2PCS BOOM, 1.75 m (5' 9") ARM WITH BOOM SWING SYSTEM

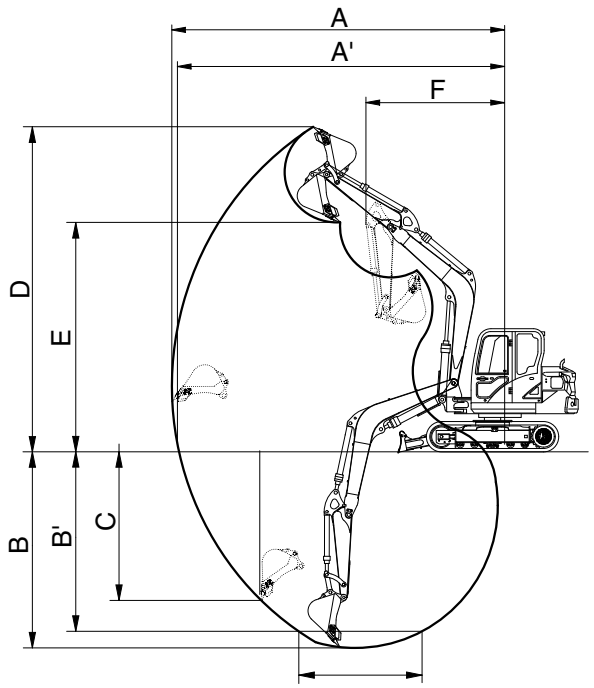


85A2SP02

Description		Unit	Specification
Operating weight		kg (lb)	9000 (19840)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.25 (0.33)
Overall length	A	mm (ft-in)	6790 (22' 3")
Overall width, with 450 mm shoe	B		2300 (7' 7")
Overall height	C		2560 (8' 5")
Superstructure width	D		2300 (7' 7")
Overall height of cab	E		2560 (8' 5")
Ground clearance of counterweight	F		745 (2' 5")
Engine cover height	G		1750 (5' 9")
Minimum ground clearance	H		360 (1' 2")
Rear-end distance	I		1600 (5' 3")
Rear-end swing radius	I'		1645 (5' 5")
Distance between tumblers (Steel)	J		2280 (7' 6")
Distance between tumblers (Rubber)			2270 (7' 5")
Undercarriage length (Steel)	K		2906 (9' 6")
Undercarriage length (Rubber)			2900 (9' 6")
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)	2.7/5.2 (1.7/3.2)
Swing speed		rpm	9.5
Gradeability		Degree (%)	30 (58)
Ground pressure (450 mm shoe)		kgf/cm^2 (psi)	0.40 (5.72)
Max traction force		kg (lb)	7580 (16700)

3. WORKING RANGE

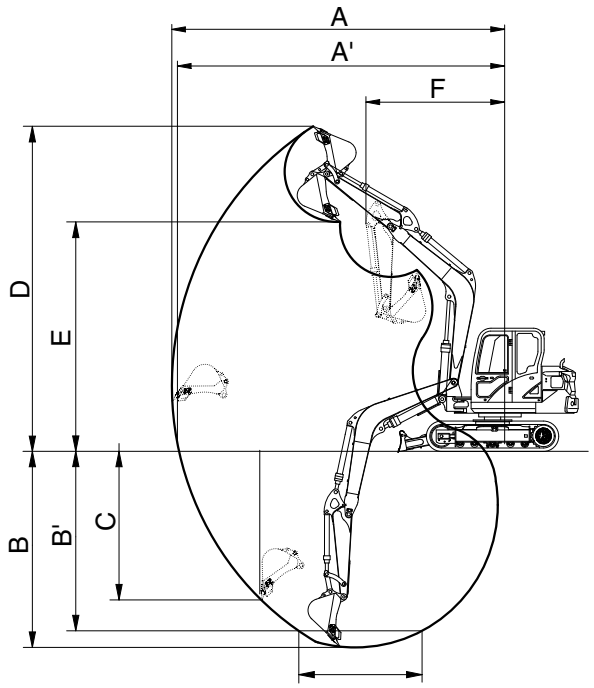
1) HX85A, MONO BOOM



85A0SP03

Description	m (ft-in)	Boom	3.55 (11' 8")	
		Arm	1.75 (5' 9")	2.10 (6' 11")
Max digging reach	mm (ft-in)	A	7090 (23' 3")	7420 (24' 4")
Max digging reach on ground		A'	6940 (22' 8")	7280 (23' 9")
Max digging depth		B	4240 (13' 9")	4590 (15' 0")
Max digging depth (8 ft level)		B'	3880 (12' 7")	4270 (14' 0")
Max vertical wall digging depth		C	3660 (12' 0")	4010 (13' 2")
Max digging height		D	7035 (23' 0")	7290 (23' 9")
Max dumping height		E	5000 (16' 4")	5250 (17' 3")
Min swing radius		F	2560 (8' 4")	2770 (9' 10")
Boom swing radius (left/right)			70˚/60˚	
Bucket digging force	kN	SAE	52.9	52.9
	kgf		5389	5389
	lbf		11882	11882
	kN	ISO	61.5	61.5
	kgf		6268	6268
	lbf		13819	13819
Arm digging force	kN	SAE	39.7	35.8
	kgf		4042	3646
	lbf		8911	8038
	kN	ISO	41.4	37.1
	kgf		4222	3787
	lbf		9307	8348

2) HX85A, 2PCS BOOM



85A0SP03

Description	m (ft-in)	Boom	3.92 (12' 10")	
		Arm	1.75 (5' 9")	2.10 (6' 11")
Max digging reach	mm (ft-in)	A	7550 (24' 8")	7890 (25' 9")
Max digging reach on ground		A'	7400 (24' 3")	7750 (25' 5")
Max digging depth		B	4260 (13' 9")	4610 (15' 2")
Max digging depth (8 ft level)		B'	4100 (13' 5")	4460 (14' 7")
Max vertical wall digging depth		C	3840 (12' 6")	4185 (13' 8")
Max digging height		D	7910 (25' 9")	8230 (27' 0")
Max dumping height		E	5870 (19' 3")	6195 (20' 4")
Min swing radius		F	2470 (8' 10")	2780 (9' 2")
Boom swing radius (left/right)			70˚/60˚	
Bucket digging force	kN	SAE	52.9	52.9
	kgf		5389	5389
	lbf		11882	11882
	kN	ISO	61.5	61.5
	kgf		6268	6268
	lbf		13819	13819
Arm digging force	kN	SAE	39.7	35.8
	kgf		4042	3646
	lbf		8911	8038
	kN	ISO	41.4	37.1
	kgf		4222	3787
	lbf		9307	8348

4. WEIGHT

Item	kg	lb
Upperstructure assembly		
· Main frame weld assembly	790	1740
· Engine assembly	270	600
· Main pump assembly	32	70
· Main control valve assembly	90	200
· Swing motor assembly	80	170
· Hydraulic oil tank assembly	76	168
· Fuel tank assembly	57	126
· Boom swing post	225	500
· Counterweight	1006	2220
· Cab assembly	332	730
Lower chassis assembly		
· Track frame weld assembly	858	1890
· Swing bearing	155	340
· Travel motor assembly	85	190
· Turning joint	26	57
· Track recoil spring	123	271
· Idler	130	290
· Carrier roller	14	31
· Track roller	160	360
· Track-chain assembly (450 ㎜ standard triple grouser shoe)	858	1890
· Dozer blade assembly	337	740
Front attachment assembly (3.55 m boom,1.75 m arm, 0.25 m^3 SAE heaped bucket)		
· 3.55 m boom assembly	405	890
· 1.75 m arm assembly	167	370
· 0.25 m^3 SAE heaped bucket	188	410
· Boom cylinder assembly	113	249
· Arm cylinder assembly	67	150
· Bucket cylinder assembly	60	130
· Dozer cylinder assembly	64	141
· Bucket control link assembly	80	180
· Boom swing cylinder assembly	66	150
· Angle dozer cylinder assembly	63	139
· Dozer cylinder assembly (for angle)	64	141
· Adjust cylinder assembly	65	143
· Angle blade assembly	485	1070

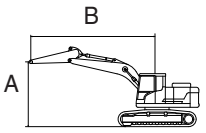
※ This information is different with operating and transportation weight because it is not including harness, pipe, oil, fuel so on.

※ Refer to Transportation for actual weight information and Specifications for operating weight.

5. LIFTING CAPACITIES

Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3550	1750	1000	450	-	Down	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*2280	*2280	3.21
(19.7 ft)	lb									*5030	*5030	(10.5)
4.5 m	kg					*1890	1860			*1910	1540	5.02
(14.8 ft)	lb					*4170	4100			*4210	3400	(16.5)
3.0 m	kg			*2970	*2970	*2140	1800			*1820	1210	5.81
(9.8 ft)	lb			*6550	*6550	*4720	3970			*4210	2670	(19.1)
1.5 m	kg					*2620	1700	*1970	1120	*1930	1100	6.06
(4.9 ft)	lb					*5780	3750	*4340	2470	*4250	2430	(19.9)
Ground	kg			3620	2960	*2870	1630			*2010	1130	5.87
Line	lb			7980	6530	*6330	3590			*4430	2490	(19.2)
-1.5 m	kg	*3910	*3910	4210	2990	*2590	1630			*2040	1360	5.16
(-4.9 ft)	lb	*8620	*8620	9280	6590	*5710	3590			*4500	3000	(16.9)
-3.0 m	kg			*2290	*2290					*1750	*1750	3.57
(-9.8 ft)	lb			*5050	*5050					*3860	*3860	(11.7)

※ Note

1. Lifting capacity are based on ISO 10567.
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3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *indicates load limited by hydraulic capacity.

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
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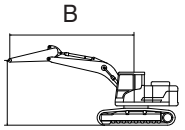
⚠ Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3550	1750	1000	450	-	Up	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*2280	*2280	3.21
	lb									*5030	*5030	(10.5)
4.5 m (14.8 ft)	kg					*1890	1710			1720	1420	5.02
	lb					*4170	3770			3790	3130	(16.5)
3.0 m (9.8 ft)	kg			*2970	*2970	2020	1660			1340	1110	5.81
	lb			*6550	*6550	4450	3660			2950	2450	(19.1)
1.5 m (4.9 ft)	kg					1910	1560	1240	1030	1220	1010	6.06
	lb					4210	3440	2730	2270	2690	2230	(19.9)
Ground Line	kg			3460	2680	1840	1500			1260	1040	5.87
	lb			7630	5910	4060	3310			2780	2290	(19.2)
-1.5 m (-4.9 ft)	kg	*3910	*3910	3490	2710	1840	1490			1520	1240	5.16
	lb	*8620	*8620	7690	5970	4060	3280			3350	2730	(16.9)
-3.0 m (-9.8 ft)	kg			*2290	*2290					*1750	*1750	3.57
	lb			*5050	*5050					*3860	*3860	(11.7)

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Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3550	1750	1150	450	-	Down	-	-	-

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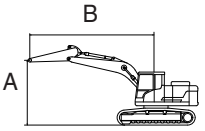

Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*2280	*2280	3.21
(19.7 ft)	lb									*5030	*5030	(10.5)
4.5 m	kg					*1890	*1890			*1910	1620	5.02
(14.8 ft)	lb					*4170	*4170			*4210	3570	(16.5)
3.0 m	kg			*2970	*2970	*2140	1880			*1820	1270	5.81
(9.8 ft)	lb			*6550	*6550	*4720	4140			*4010	2800	(19.1)
1.5 m	kg					*2620	1780	*1970	1180	*1930	1160	6.06
(4.9 ft)	lb					*5780	3920	*4340	2600	*4250	2560	(19.9)
Ground	kg			*3620	3110	*2870	1720			*2010	1190	5.87
Line	lb			*7980	6860	*6330	3790			*4430	2620	(19.2)
-1.5 m	kg	*3910	*3910	*4210	3130	*2590	1710			*2040	1430	5.16
(-4.9 ft)	lb	*8620	*8620	*9280	6900	*5710	3770			*4500	3150	(16.9)
-3.0 m	kg			*2290	*2290					*1750	*1750	3.57
(-9.8 ft)	lb			*5050	*5050					*3860	*3860	(11.7)

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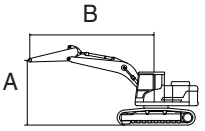
Make adjustments to the rated load as necessary for non-standard configurations.

Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3550	1750	1150	450	-	Up	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*2280	*2280	3.21
	lb									*5030	*5030	(10.5)
4.5 m (14.8 ft)	kg					*1890	1790			1800	1490	5.02
	lb					*4170	3950			3970	3280	(16.5)
3.0 m (9.8 ft)	kg			*2970	*2970	2110	1740			1400	1170	5.81
	lb			*6550	*6550	4650	3840			3090	2580	(19.1)
1.5 m (4.9 ft)	kg					2000	1640	1310	1090	1290	1070	6.06
	lb					4410	3620	2890	2400	2840	2360	(19.9)
Ground Line	kg			*3620	2820	1930	1580			1330	1100	5.87
	lb			*7980	6220	4250	3480			2930	2430	(19.2)
-1.5 m (-4.9 ft)	kg	*3910	*3910	3660	2850	1930	1570			1590	1310	5.16
	lb	*8620	*8620	8070	6280	4250	3460			3510	2890	(16.9)
-3.0 m (-9.8 ft)	kg			*2290	*2290					*1750	*1750	3.57
	lb			*5050	*5050					*3860	*3860	(11.7)

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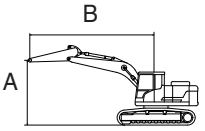
Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3550	2100	1150	450	-	Down	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*1930	*1930	3.88
(19.7 ft)	lb									*4250	*4250	(12.7)
4.5 m	kg					*1660	*1660			*1630	1430	5.43
(14.8 ft)	lb					*3660	*3660			*3590	3150	(17.8)
3.0 m	kg			*2480	*2480	*1950	1900	*1760	1210	*1560	1150	6.15
(9.8 ft)	lb			*5470	*5470	*4300	4190	*3880	2670	*3440	2540	(20.2)
1.5 m	kg			*4440	3250	*2480	1790	*1890	1170	*1650	1060	6.39
(4.9 ft)	lb			*9790	7170	*5470	3950	*4170	2580	*3640	2340	(21.0)
Ground	kg			*3720	3090	*2830	1710	*1960	1140	*1860	1090	6.21
Line	lb			*8200	6810	*6240	3770	*4320	2510	*4100	2400	(20.4)
-1.5 m	kg	*3290	*3290	*4490	3090	*2690	1690			*1910	1270	5.56
(-4.9 ft)	lb	*7250	*7250	*9900	6810	*5930	3730			*4210	2800	(18.2)
-3.0 m	kg			*2950	*2950					*1810	*1810	4.16
(-9.8 ft)	lb			*6500	*6500					*3990	*3990	(13.7)

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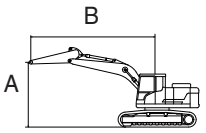
Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3550	2100	1150	450	-	Up	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*1930	*1930	3.88
(19.7 ft)	lb									*4250	*4250	(12.7)
4.5 m	kg					*1660	*1660			1590	1320	5.43
(14.8 ft)	lb					*3660	*3660			3510	2910	(17.8)
3.0 m	kg			*2480	*2480	*1950	1750	1340	1110	1280	1070	6.15
(9.8 ft)	lb			*5470	*5470	*4300	3860	2950	2450	2820	2360	(20.2)
1.5 m	kg			3790	2960	2010	1650	1300	1080	1180	980	6.39
(4.9 ft)	lb			8360	6530	4430	3640	2870	2380	2600	2160	(21.0)
Ground	kg			3620	2800	1920	1570	1270	1050	1210	1000	6.21
Line	lb			7980	6170	4230	3460	2800	2310	2670	2200	(20.4)
-1.5 m	kg	*3290	*3290	3620	2800	1900	1550			1420	1170	5.56
(-4.9 ft)	lb	*7250	*7250	7980	6170	4190	3420			3130	2580	(18.2)
-3.0 m	kg			*2950	2890					*1810	1790	4.16
(-9.8 ft)	lb			*6500	6370					*3990	3950	(13.7)

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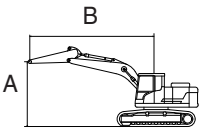
Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
2 PCS BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3917	1750	1150	450	-	Down	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		At max. reach								
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
										m (ft)
6.0 m	kg	*2750	*2750					*2450	2120	4.11
(19.7 ft)	lb	*6060	*6060					*5400	4670	(13.5)
4.5 m	kg	*2580	*2580	*2150	1860			*1960	1270	5.58
(14.8 ft)	lb	*5690	*5690	*4740	4100			*4320	2800	(18.3)
3.0 m	kg			*2410	1760	*1860	1120	*1790	1030	6.29
(9.8 ft)	lb			*5310	3880	*4100	2470	*3950	2270	(20.6)
1.5 m	kg			*2720	1630	*1900	1070	*1680	950	6.52
(4.9 ft)	lb			*6000	3590	*4190	2360	*3700	2090	(21.4)
Ground	kg			*2660	1550	*1770	1050	*1550	970	6.34
Line	lb			*5860	3420	*3900	2310	*3420	2140	(20.8)
-1.5 m	kg	*2910	2890	*2110	1550			*1300	1140	5.71
(-4.9 ft)	lb	*6420	6370	*4650	3420			*2870	2510	(18.7)
-3.0 m	kg									
(-9.8 ft)	lb									

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2 PCS BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3917	1750	1150	450	-	Up	-	-	-

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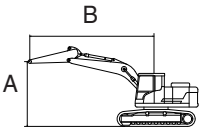

Load point height		At max. reach								
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
										m (ft)
6.0 m	kg	*2750	*2750					2400	1950	4.11
(19.7 ft)	lb	*6060	*6060					5290	4300	(13.5)
4.5 m	kg	*2580	*2580	2090	1710			1430	1170	5.58
(14.8 ft)	lb	*5690	*5690	4610	3770			3150	2580	(18.3)
3.0 m	kg			1990	1620	1250	1020	1150	940	6.29
(9.8 ft)	lb			4390	3570	2760	2250	2540	2070	(20.6)
1.5 m	kg			1850	1490	1210	980	1060	860	6.52
(4.9 ft)	lb			4080	3280	2670	2160	2340	1900	(21.4)
Ground	kg			1770	1410	1180	950	1090	890	6.34
Line	lb			3900	3110	2600	2090	2400	1960	(20.8)
-1.5 m	kg	*2910	2600	1770	1410			1280	1040	5.71
(-4.9 ft)	lb	*6420	5730	3900	3110			2820	2290	(18.7)
-3.0 m	kg									
(-9.8 ft)	lb									

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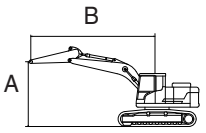
Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
2 PCS BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3917	2100	1150	450	-	Down	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach		
		Capacity						Capacity		Reach
										m (ft)
6.0 m	kg			*2110	1860			*2070	1730	4.68
(19.7 ft)	lb			*4650	4100			*4560	3810	(15.3)
4.5 m	kg			*1990	1880			*1690	1140	5.99
(14.8 ft)	lb			*4390	4140			*3730	2510	(19.6)
3.0 m	kg			*2280	1780	*1790	1120	*1600	940	6.64
(9.8 ft)	lb			*5030	3920	*3950	2470	*3530	2070	(21.8)
1.5 m	kg			*2640	1640	*1870	1070	*1560	870	6.86
(4.9 ft)	lb			*5820	3620	*4120	2360	*3440	1920	(22.5)
Ground	kg			*2690	1540	*1820	1030	*1450	890	6.69
Line	lb			*5930	3400	*4010	2270	*3200	1960	(22.0)
-1.5 m	kg	*3350	2830	*2270	1530	*1360	1040	*1250	1020	6.10
(-4.9 ft)	lb	*7390	6240	*5000	3370	*3000	2290	*2760	2250	(20.0)
-3.0 m	kg	*1670	*1670	*1100	*1100			*750	*750	4.90
(-9.8 ft)	lb	*3680	*3680	*2430	*2430			*1650	*1650	(16.1)

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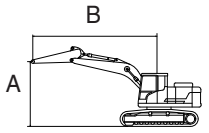
Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
2 PCS BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
	3917	2100	1150	450	-	Up	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach		
								Capacity		Reach
										m (ft)
6.0 m	kg			2090	1710			1940	1590	4.68
(19.7 ft)	lb			4610	3770			4280	3510	(15.3)
4.5 m	kg			*1990	1740			1270	1040	5.99
(14.8 ft)	lb			*4390	3840			2800	2290	(19.6)
3.0 m	kg			2020	1640	1260	1030	1050	860	6.64
(9.8 ft)	lb			4450	3620	2780	2270	2310	1900	(21.8)
1.5 m	kg			1860	1500	1210	980	980	790	6.86
(4.9 ft)	lb			4100	3310	2670	2160	2160	1740	(22.5)
Ground	kg			1760	1400	1160	940	1000	810	6.69
Line	lb			3880	3090	2560	2070	2200	1790	(22.0)
-1.5 m	kg	*3350	2550	1750	1390	1170	940	1150	930	6.10
(-4.9 ft)	lb	*7390	5620	3860	3060	2580	2070	2540	2050	(20.0)
-3.0 m	kg	*1670	*1670	*1100	*1100			*750	*750	4.90
(-9.8 ft)	lb	*3680	*3680	*2430	*2430			*1650	*1650	(16.1)

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Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3550	1750	1000	450	-	Down	-	-	-

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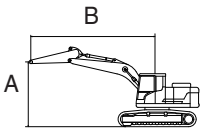

Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*2280	*2280	3.21
	lb									*5030	*5030	(10.5)
4.5 m (14.8 ft)	kg					*1890	1870			*1910	1550	5.02
	lb					*4170	4120			*4210	3420	(16.5)
3.0 m (9.8 ft)	kg			*2970	*2970	*2140	1810			*1820	1220	5.81
	lb			*6550	*6550	*4720	3990			*4010	2690	(19.1)
1.5 m (4.9 ft)	kg					*2620	1710	*1970	1130	*1930	1110	6.06
	lb					*5780	3770	*4340	2490	*4250	2450	(19.9)
Ground Line	kg			*3620	2980	*2870	1650			*2010	1140	5.87
	lb			*7980	6570	*6330	3640			*4430	2510	(19.2)
-1.5 m (-4.9 ft)	kg	*3910	*3910	*4210	3000	*2590	1640			*2040	1370	5.16
	lb	*8620	*8620	*9280	6610	*5710	3620			*4500	3020	(16.9)
-3.0 m (-9.8 ft)	kg			*2290	*2290					*1750	*1750	3.57
	lb			*5050	*5050					*3860	*3860	(11.7)

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Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3550	1750	1000	450	-	Up	-	-	-

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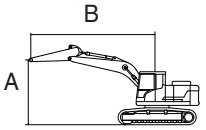

Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*2280	*2280	3.21
	lb									*5030	*5030	(10.5)
4.5 m (14.8 ft)	kg					*1890	1740			1740	1450	5.02
	lb					*4170	3840			3840	3200	(16.5)
3.0 m (9.8 ft)	kg			*2970	*2970	2040	1690			1360	1130	5.81
	lb			*6550	*6550	4500	3730			3000	2490	(19.1)
1.5 m (4.9 ft)	kg					1940	1590	1260	1050	1240	1030	6.06
	lb					4280	3510	2780	2310	2730	2270	(19.9)
Ground Line	kg			3510	2730	1870	1520			1280	1060	5.87
	lb			7740	6020	4120	3350			2820	2340	(19.2)
-1.5 m (-4.9 ft)	kg	*3910	*3910	3540	2750	1860	1520			1540	1270	5.16
	lb	*8620	*8620	7800	6060	4100	3350			3400	2800	(16.9)
-3.0 m (-9.8 ft)	kg			*2290	*2290					*1750	*1750	3.57
	lb			*5050	*5050					*3860	*3860	(11.7)

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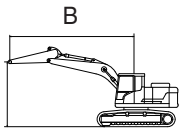
Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3550	1750	1150	450	-	Down	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*2280	*2280	3.21
	lb									*5030	*5030	(10.5)
4.5 m (14.8 ft)	kg					*1890	*1890			*1910	1630	5.02
	lb					*4170	*4170			*4210	3590	(16.5)
3.0 m (9.8 ft)	kg			*2970	*2970	*2140	1900			*1820	1280	5.81
	lb			*6550	*6550	*4720	4190			*4010	2820	(19.1)
1.5 m (4.9 ft)	kg					*2620	1800	*1970	1190	*1930	1170	6.06
	lb					*5780	3970	*4340	2620	*4250	2580	(19.9)
Ground Line	kg			*3620	3130	*2870	1730			*2010	1200	5.87
	lb			*7980	6900	*6330	3810			*4430	2650	(19.2)
-1.5 m (-4.9 ft)	kg	*3910	*3910	*4210	3150	*2590	1720			*2040	1440	5.16
	lb	*8620	*8620	*9280	6940	*5710	3790			*4500	3170	(16.9)
-3.0 m (-9.8 ft)	kg			*2290	*2290					*1750	*1750	3.57
	lb			*5050	*5050					*3860	*3860	(11.7)

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Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3550	1750	1150	450	-	Up	-	-	-

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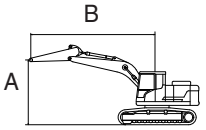

Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*2280	*2280	3.21
	lb									*5030	*5030	(10.5)
4.5 m (14.8 ft)	kg					*1890	1820			1820	1520	5.02
	lb					*4170	4010			4010	3350	(16.5)
3.0 m (9.8 ft)	kg			*2970	*2970	2130	1770			1420	1190	5.81
	lb			*6550	*6550	4700	3900			3130	2620	(19.1)
1.5 m (4.9 ft)	kg					2030	1670	1330	1100	1300	1090	6.06
	lb					4480	3680	2930	2430	2870	2400	(19.9)
Ground Line	kg			*3620	2870	1960	1600			1350	1120	5.87
	lb			*7980	6330	4320	3530			2980	2470	(19.2)
-1.5 m (-4.9 ft)	kg	*3910	*3910	3710	2890	1950	1600			1620	1330	5.16
	lb	*8620	*8620	8180	6370	4300	3530			3570	2930	(16.9)
-3.0 m (-9.8 ft)	kg			*2290	*2290					*1750	*1750	3.57
	lb			*5050	*5050					*3860	*3860	(11.7)

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Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
MONO BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3550	2100	1150	450	-	Down	-	-	-

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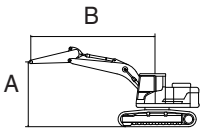

Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*1930	*1930	3.88
(19.7 ft)	lb									*4250	*4250	(12.7)
4.5 m	kg					*1660	*1660			*1630	1440	5.43
(14.8 ft)	lb					*3660	*3660			*3590	3170	(17.8)
3.0 m	kg			*2480	*2480	*1950	1910	*1760	1220	*1560	1160	6.15
(9.8 ft)	lb			*5470	*5470	*4300	4210	*3880	2690	*3440	2560	(20.2)
1.5 m	kg			*4440	3270	*2480	1800	*1890	1180	*1650	1070	6.39
(4.9 ft)	lb			*9790	7210	*5470	3970	*4170	2600	*3640	2360	(21.0)
Ground	kg			*3720	3110	*2830	1720	*1960	1150	*1860	1100	6.21
Line	lb			*8200	6860	*6240	3790	*4320	2540	*4100	2430	(20.4)
-1.5 m	kg	*3290	*3290	*4490	3110	*2690	1700			*1910	1280	5.56
(-4.9 ft)	lb	*7250	*7250	*9900	6860	*5930	3750			*4210	2820	(18.2)
-3.0 m	kg			*2950	*2950					*1810	*1810	4.16
(-9.8 ft)	lb			*6500	*6500					*3990	*3990	(13.7)

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MONO BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3550	2100	1150	450	-	Up	-	-	-

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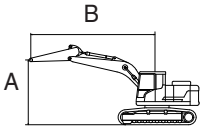

Load point height		Load radius								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*1930	*1930	3.88
	lb									*4250	*4250	(12.7)
4.5 m (14.8 ft)	kg					*1660	*1660			1610	1340	5.43
	lb					*3660	*3660			3550	2950	(17.8)
3.0 m (9.8 ft)	kg			*2480	*2480	*1950	1780	1360	1130	1300	1080	6.15
	lb			*5470	*5470	*4300	3920	3000	2490	2870	2380	(20.2)
1.5 m (4.9 ft)	kg			3840	3000	2040	1670	1320	1100	1200	1000	6.39
	lb			8470	6610	4500	3680	2910	2430	2650	2200	(21.0)
Ground Line	kg			3670	2850	1950	1590	1290	1070	1230	1020	6.21
	lb			8090	6280	4300	3510	2840	2360	2710	2250	(20.4)
-1.5 m (-4.9 ft)	kg	*3290	*3290	3670	2850	1930	1570			1440	1190	5.56
	lb	*7250	*7250	8090	6280	4250	3460			3170	2620	(18.2)
-3.0 m (-9.8 ft)	kg			*2950	2930					*1810	*1810	4.16
	lb			*6500	6460					*3990	*3990	(13.7)

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		3917	1750	1150	450	-	Down	-	-	-

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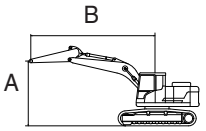


Load point height		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach		
								Capacity		Reach
										m (ft)
6.0 m	kg	*2750	*2750					*2450	2160	4.11
(19.7 ft)	lb	*6060	*6060					*5400	4760	(13.5)
4.5 m	kg	*2580	*2580	*2150	1900			*1960	1310	5.58
(14.8 ft)	lb	*5690	*5690	*4740	4190			*4320	2890	(18.3)
3.0 m	kg			*2410	1800	*1860	1140	*1790	1050	6.29
(9.8 ft)	lb			*5310	3970	*4100	2510	*3950	2310	(20.6)
1.5 m	kg			*2720	1670	*1900	1100	*1680	970	6.52
(4.9 ft)	lb			*6000	3680	*4190	2430	*3700	2140	(21.4)
Ground	kg			*2660	1590	*1770	1070	*1550	1000	6.34
Line	lb			*5860	3510	*3900	2360	*3420	2200	(20.8)
-1.5 m	kg	*2910	*2910	*2110	1600			*1300	1170	5.71
(-4.9 ft)	lb	*6420	*6420	*4650	3530			*2870	2580	(18.7)
-3.0 m	kg									
(-9.8 ft)	lb									

※ Note

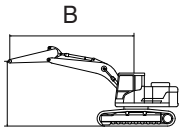
1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *indicates load limited by hydraulic capacity.

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult your HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

⚠ Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
2 PCS BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3917	1750	1150	450	-	Up	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach Capacity		At max. reach Reach
										m (ft)
6.0 m	kg	*2750	*2750					2450	2010	4.11
(19.7 ft)	lb	*6060	*6060					5400	4430	(13.5)
4.5 m	kg	*2580	*2580	2130	1760			1460	1210	5.58
(14.8 ft)	lb	*5690	*5690	4700	3880			3220	2670	(18.3)
3.0 m	kg			2030	1670	1280	1060	1180	970	6.29
(9.8 ft)	lb			4480	3680	2820	2340	2600	2140	(20.6)
1.5 m	kg			1890	1540	1230	1020	1090	900	6.52
(4.9 ft)	lb			4170	3400	2710	2250	2400	1980	(21.4)
Ground	kg			1810	1460	1200	990	1120	920	6.34
Line	lb			3990	3220	2650	2180	2470	2030	(20.8)
-1.5 m	kg	*2910	2690	1810	1470			*1300	1080	5.71
(-4.9 ft)	lb	*6420	5930	3990	3240			*2870	2380	(18.7)
-3.0 m	kg									
(-9.8 ft)	lb									

※ Note

1. Lifting capacity are based on ISO 10567.
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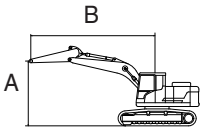
⚠ Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
2 PCS BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3917	2100	1150	450	-	Down	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		At max. reach								
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
										m (ft)
6.0 m	kg			*2110	1900			*2070	1760	4.68
(19.7 ft)	lb			*4650	4190			*4560	3880	(15.3)
4.5 m	kg			*1990	1920			*1690	1170	5.99
(14.8 ft)	lb			*4390	4230			*3730	2580	(19.6)
3.0 m	kg			*2280	1820	*1790	1150	*1600	960	6.64
(9.8 ft)	lb			*5030	4010	*3950	2540	*3530	2120	(21.8)
1.5 m	kg			*2640	1680	*1870	1100	*1560	890	6.86
(4.9 ft)	lb			*5820	3700	*4120	2430	*3440	1960	(22.5)
Ground	kg			*2690	1580	*1820	1060	*1450	910	6.69
Line	lb			*5930	3480	*4010	2340	*3200	2010	(22.0)
-1.5 m	kg	*3350	2900	*2270	1570	*1360	1060	*1250	1050	6.10
(-4.9 ft)	lb	*7390	6390	*5000	3460	*3000	2340	*2760	2310	(20.0)
-3.0 m	kg	*1670	*1670	*1100	*1100			*750	*750	4.90
(-9.8 ft)	lb	*3680	*3680	*2430	*2430			*1650	*1650	(16.1)

※ Note

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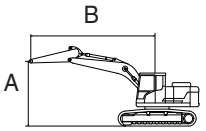
⚠ Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

Type		Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
2 PCS BOOM	ANGLE BLADE	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		3917	2100	1150	450	-	Up	-	-	-

· : Rating over-front · : Rating over-side or 360 degree



Load point height		At max. reach								
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
										m (ft)
6.0 m	kg			*2110	1760			1980	1640	4.68
(19.7 ft)	lb			*4650	3880			4370	3620	(15.3)
4.5 m	kg			*1990	1790			1300	1080	5.99
(14.8 ft)	lb			*4390	3950			2870	2380	(19.6)
3.0 m	kg			2050	1690	1280	1060	1070	890	6.64
(9.8 ft)	lb			4520	3730	2820	2340	2360	1960	(21.8)
1.5 m	kg			1900	1550	1230	1010	1000	820	6.86
(4.9 ft)	lb			4190	3420	2710	2230	2200	1810	(22.5)
Ground	kg			1800	1450	1190	970	1020	840	6.69
Line	lb			3970	3200	2620	2140	2250	1850	(22.0)
-1.5 m	kg	*3350	2640	1780	1440	1200	980	1170	960	6.10
(-4.9 ft)	lb	*7390	5820	3920	3170	2650	2160	2580	2120	(20.0)
-3.0 m	kg	*1670	*1670	*1100	*1100			*750	*750	4.90
(-9.8 ft)	lb	*3680	*3680	*2430	*2430			*1650	*1650	(16.1)

※ Note

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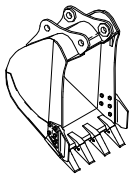
⚠ Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET



0.25, 0.28 m³ SAE heaped bucket

Capacity		Width		Weight	Tooth	Recommendation			
						3.55 m (11' 8") Mono boom		3.92 m (12' 10") Mono boom	
SAE heaped	CECE heaped	Without side cutter	With side cutter			1.75 m arm (5' 9")	2.10 m arm (6' 11")	1.75 m arm (5' 9")	2.10 m arm (6' 11")
0.25 m³ (0.33 yd³)	0.21 m³ (0.27 yd³)	672 mm (26.5")	796 mm (31.3")	188 kg (414 lb)	4 EA	●	●	●	◐
0.28 m³ (0.37 yd³)	0.25 m³ (0.33 yd³)	672 mm (26.5")	830 mm (32.7")	250 kg (551 lb)	4 EA	●	◐	■	■

※ : Standard bucket

● Applicable for materials with density of 2100 kg/m³ (3540 lb/yd³) or less

◐ Applicable for materials with density of 1800 kg/m³ (3030 lb/yd3) or less

■ Applicable for materials with density of 1500 kg/m³ (2530 lb/yd³) or less

▲ Applicable for materials with density of 1200 kg/m³ (2020 lb/yd³) or less

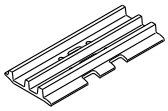
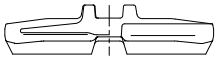
× Not recommended

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

Shapes		Triple grouser		Rubber track
				
Shoe width	mm (in)	450 (18)	600 (24)	450 (18)
Operating weight	kg (lb)	8530 (18810)	8700 (19810)	8480 (18700)
Ground pressure	kgf/cm^2 (psi)	0.38 (5.42)	0.29 (4.15)	0.38 (5.38)
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	40 EA

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	18.3:1
Rated gross horse power (SAE J1995)	66.9 Hp at 2400 rpm (49.9 kW at 2400 rpm)
Maximum torque at 1350 rpm	24.6 kgf · m (178 lbf · ft)
Engine oil quantity	10.5 ℓ (2.8 U.S. gal)
Dry weight	278 kg (610 lb)
High idling speed	2550 ± 50 rpm
Low idling speed	1000 ± 50 rpm
Rated fuel consumption	233 g/Hp · hr at 2400 rpm
Starting motor	12 V-3 kW
Alternator	12 V-100 A
Battery	1 × 12 V × 100 Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement piston pumps
Capacity	72 cc/rev
Maximum pressure	280 kgf/cm^2 (3980 psi)
Rated oil flow	144 ℓ /min (38 U.S.gpm)
Rated speed	2000 rpm

3) GEAR PUMP (P4)

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	8 cc/rev
Maximum pressure	34 kgf/cm^2 (479 psi)
Rated oil flow	16 ℓ /min (4.5 U.S.gpm/3.5 U.K.gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	9 spools sectional inline
Operating method	Hydraulic pilot system
Main relief valve pressure	280 kgf/cm^2 (3980psi)
Overload relief valve pressure	310 kgf/cm^2 (4410psi)

5) SWING MOTOR

Item	Specification
Type	Axial piston motor
Capacity	43.4 cc/rev
Relief pressure	245 kgf/cm^2 (3485 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

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	286 kgf/cm^2 (4068 psi)
Reduction gear type	2 stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	6.4 kgf/cm^2 (91 psi)
Braking torque	18.5 kgf · m (134 lbf · ft)

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	Ø120 × Ø70 × 865 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	Ø100 × Ø60 × 860 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	Ø90 × Ø55 × 685 mm
	Cushion	Extend only
Dozer cylinder	Bore dia × Rod dia × Stroke	Ø130 × Ø70 × 190 mm
	Cushion	-
Boom swing cylinder	Bore dia × Rod dia × Stroke	Ø110 × Ø60 × 707 mm
	Cushion	-
Angle dozer cylinder	Bore dia × Rod dia × Stroke	Ø140 × Ø70 × 180 mm
	Cushion	Ø100 × Ø60 × 461 mm

※ **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.**

※ **2PCS Boom cylinder / Bore dia × Rod dia × Stroke /** Ø95 × Ø55 × 550 mm

8) SHOE

Item	Width	Ground pressure	Link quantity	Overall width
Steel	450 mm (18")	0.38 kgf/cm^2 (5.42 psi)	40	2300 mm (7' 7")
	600 mm (24")	0.29 kgf/cm^2 (4.15 psi)	40	2390 mm (7' 10")
Rubber	450 mm (18")	0.38 kgf/cm^2 (5.38 psi)	-	2300 mm (7' 7")

9) BUCKET

Item	Capacity		Tooth quantity	Width	
	SAE heaped	CECE heaped		Without side cutter	With side cutter
STD	0.25 m^3 (0.33yd^3)	0.21 m^3 (0.27yd^3)	4	730 mm (28.7")	800 mm (31.5")

9. RECOMMENDED OILS

HD Hyundai Construction Equipment 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 HD Hyundai Construction Equipment and, therefore, will meet the highest safety and quality requirements.
We recommend that you use only HD Hyundai Construction Equipment genuine lubricating oils and grease officially approved by HD Hyundai Construction Equipment.

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	10.5 (2.8)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Final drive	Gear oil	1.1×2 (0.3×2)	★SAE 75W-90 SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank; 56 (14.8) System; 109 (28.8)	★ISO VG 15 ISO VG 32 ISO VG 46, HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	115 (30.4)	★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★2	13 (3.4)	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 : HD Hyundai Construction Equipment Bio Hydrauilc Oil

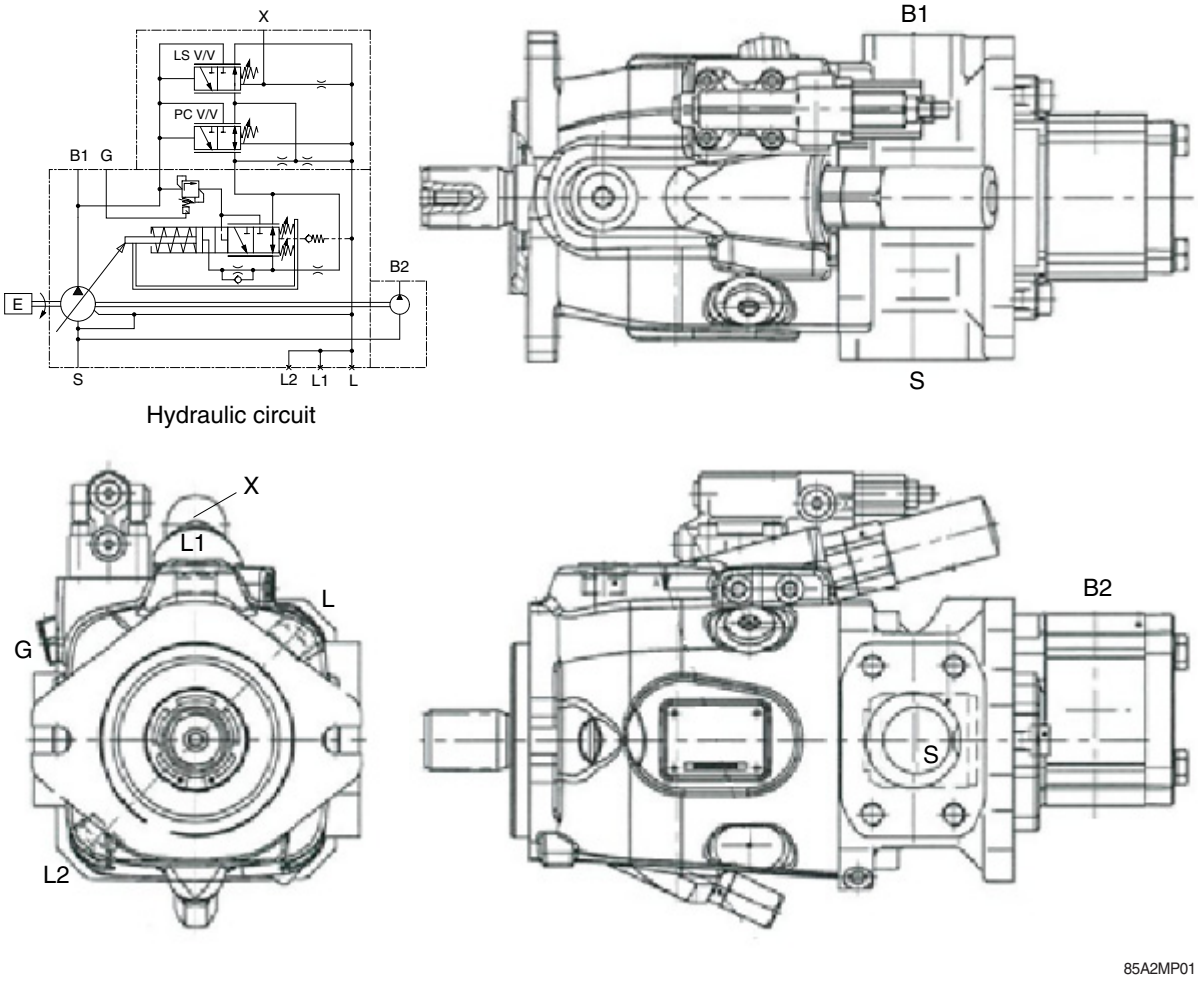
※ Using any lubricating oils other than HD Hyundai Construction Equipment genuine products may lead to a deterioration of performance and cause damage to major components.
※ Do not mix HD Hyundai Construction Equipment genuine oil with any other lubricating oil as it may result in damage to the systems of major components.
※ Do not use any engine oil other than that specified above, as it may clog the diesel particulate filter(DPF).
※ For HD Hyundai Construction Equipment genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact HD Hyundai Construction Equipment dealers.

SECTION 2 STRUCTURE AND FUNCTION

GROUP 1 HYDRAULIC PUMP

1. GENERAL

This variable displacement piston pump consists of main pump and pilot pump.



Hydraulic circuit

Description of the ports

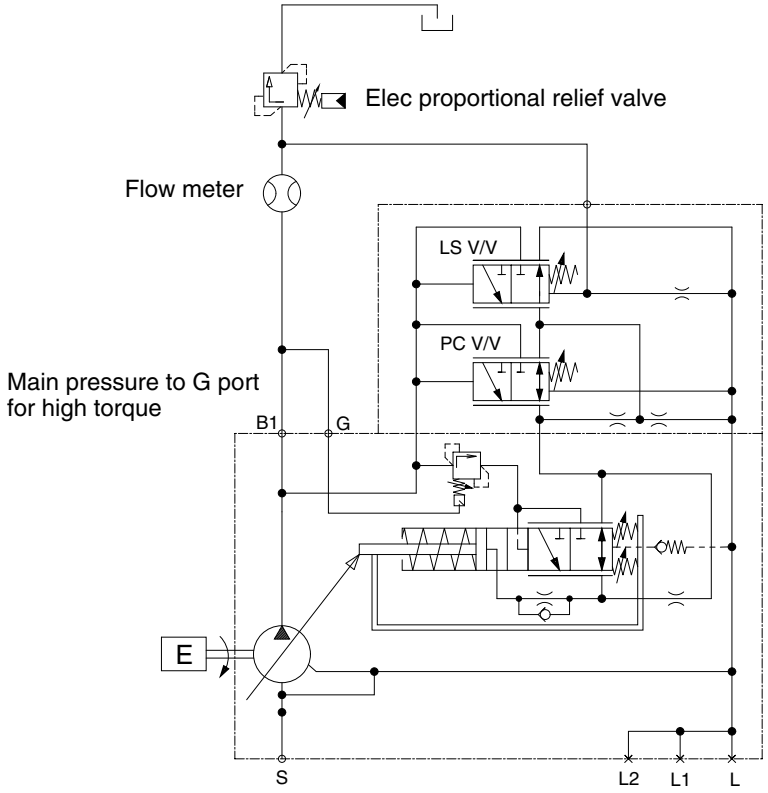
Port	Name	Bore
S1	Suction port	SAE 2"
B1	Discharge port	SAE 1"
B2	Discharge port	PF7/8-14UNF
G	High pressure port	M10x1
X	Pilot pressure port	PF7/16-20UNF
L, L1, L2	Case drain port	PF7/8-14UNF

2. START OF POWER CONTROL

Setting of starting point in P-Q curve shall be carried out as per following conditions and procedures.

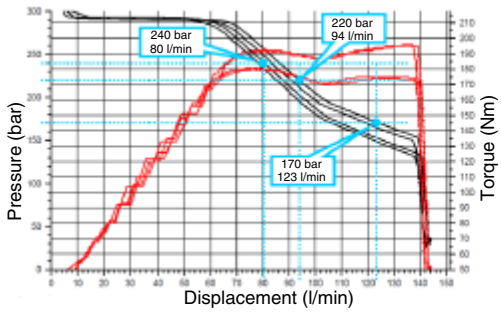
1) CONDITIONS

(1) Engine shall be running at 2000 rpm.
(2) Oil temperature shall be adjusted at 40 ℃.
(3) Pressure gauges and a flow meter shall be installed.

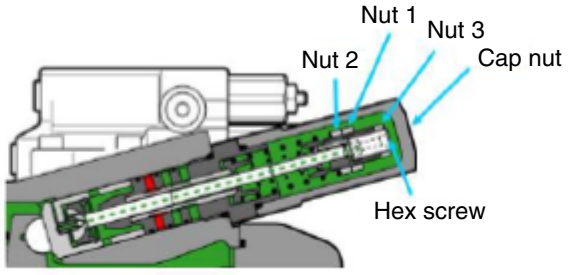


Schematic circuit

85A2MP10



P-Q curve



Pump schematic drawing

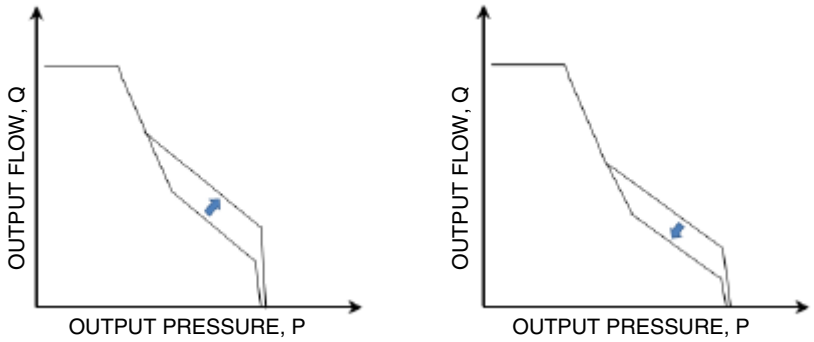
85A2MP11

2) PROCEDURES

(1) Loosen nut 1 fixing nut 2.
(2) Adjust outer spring by tightening or loosening nut 2.
① Increase pressure up to 170 bar.
② Turn Nut 2 clockwise to increase power until pumping flow reaches 123 ℓ/min (±4 ℓ/min).
(3) Secure the setting of nut 2 by tightening nut 1.

3) CHANGE OF P-Q CURVE

(1) If length of outer spring is decreased by tightening nut 2, the P-Q curve is moved to right in general like a graph left under as the spring tension is increased.
(2) If length of outer spring is increased by loosening nut 2, the P-Q curve is moved to left in general like a graph right under as the spring tension is decreased.



85A2MP12

3. END OF POWER CONTROL

Setting of ending point in P-Q curve shall be carried out following procedures and conditions.

1) CONDITIONS

(1) The conditions shall be set same as above.

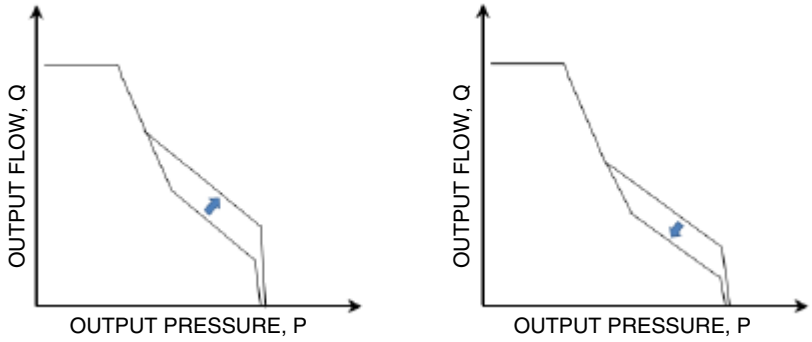
2) PROCEDURES

(1) Loosen the nut 3.
(2) Set end of control by turning Hexagonal screw.
① Increase pressure to 220 bar.
② Turn Screw clockwise to increase power until 92 ℓ /min (±4 ℓ /min) is reached.
(3) Secure the setting of nut 3.
(4) Tighten Cap nut.

3) CHANGE OF P-Q CURVE

(1) If length of Inner spring is deceased by tightening hexagonal screw, lower part of P-Q curve is moved to right like a graph left under as the tension force of spring is increased.

(2) If length of Inner spring is increased by loosening hexagonal screw, lower part of P-Q curve is moved to left like a graph left under as the tension force of spring is decreased.



85A2MP13

4. APPENDIXES

Required torque for bolt tightening

Part	Name	Required torque	
		kgf·m	lbf·ft
Nut 1	14 mm	5.1	36.9
Nut 2	14 mm	5.1	36.9
Nut 3	10 mm	4.1	29.7
Cap nut	32 mm	7.1	51.4
Hexagon screw	10 mm	-	-

5. DUAL TORQUE MODE

Pump power needs to be decreased in case that engine power is not enough to cover air condition operating at maximum pump operating. This function lets the pump power decrease by operating of dual torque valve.

(1) Normal operating condition (without air conditioner mode)

Solenoid valve (7) maintains the pushed position and allows oil to flow from passage (15) to passage (19). The pressure pushes dual torque valve (5) not to allow the pumping oil to flow toward control valve (6) inside. As a result, pressure in front of dual torque valve (5) does not effect on the angle of swash plate (25).

(2) Excessive operating condition (by air conditioner mode)

If air conditioner operates with maximum pump operating, the increased power will overload engine. Therefore, pump power needs to be decreased to share power consumption with air conditioner without overload to engine.

Connection between passage (15) and passage (19) is blocked by deactivation of solenoid valve (7). Dual torque valve which was pushed by the pressure in passage (19) also returns to initial position by spring force. This return allows the pumping oil to flow toward control valve (6) inside. The angel of swash plate (25) is decreased by the pressure in control valve. As a result, pump flow is decreased and power consumption by pump also is decreased.

6. UPSTROKE

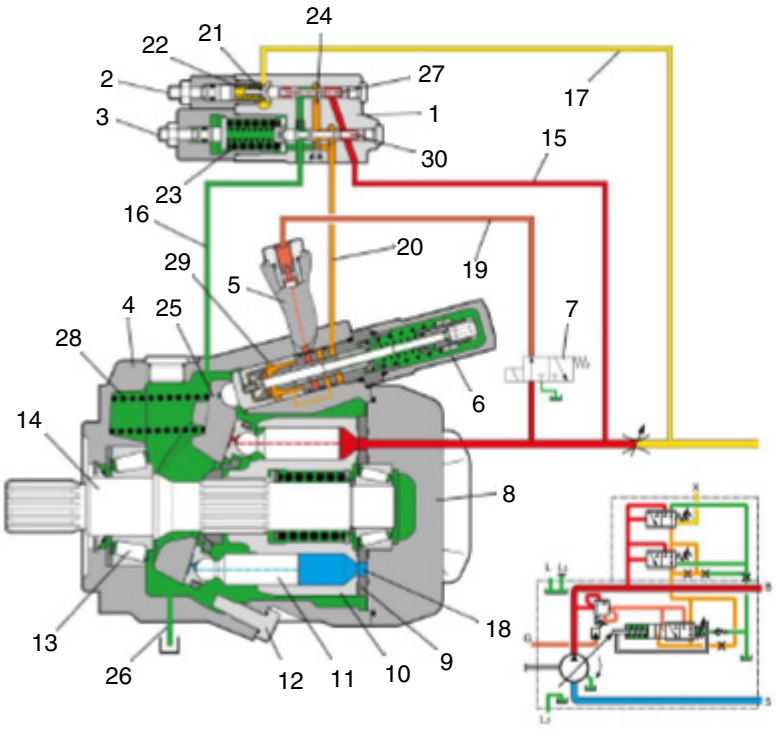
Upstroking of the pump occurs as a demand for flow from attachment.

The increased demand for flow causes a LS pressure in passage (17). The LS pressure in passage (17) combines with the force of spring (22) in cavity (21). The force of spring (22) causes pump pressure to be higher than pressure of passage (17).

If the combination of LS pressure and spring force is greater than the pump discharge pressure in passage (15), this difference pressure causes a spool (27) to move right. As the spool (27) moves right, the spool (27) blocks inflow of pumping oil to control piston (6) through passage (20). Swash plate (25) is controlled by pressure and flow as much as hydraulic system requests.

Pilot oil in passage (20) drains to passage (24). The oil then flows into housing through passage (16) into the housing and finally drains to tank. It also causes pumping flow to increase. As flow requirement is satisfied, pump output pressure increases. The pressure increases until the pressure in passage (24) moves flow compensator spool (27) up to be satisfied with system requirement for pressure and flow.

· Pump discharge pressure = force of spring (22) + LS pressure (17)



85A2MP14

1 Regulator
2 Flow adjustment screw
3 Pressure adjustment screw
4 Pump housing
5 Dual torque valve
6 Control valve
7 Solenoid valve
8 Port plate
9 Distributor plate
10 Cylinder block
11 Piston
12 Minimum flow limitation valve
13 Bearing
14 Drive shaft
15 Passage (high pressure)
16 Passage (leakage pressure)
17 Passage (pilot pressure)
18 Passage (suction pressure)
19 Passage (dual torque valve pilot pressure)
20 Passage (control piston pilot pressure)
21 Cavity
22 Spring
23 Spring
24 Passage
25 Swash plate
26 Casing drain
27 Flow compensator spool
28 Spring
29 Cross drilled hole
30 Pressure compensator spool

7. DESTROKE

The decreased flow demand causes LS pressure in passage (17). LS pressure in passage (17) combines with force of spring (22) in cavity (21).

This combination of LS pressure and spring force is less than the pump pressure in passage (15). It causes flow compensator spool (27) to move left.

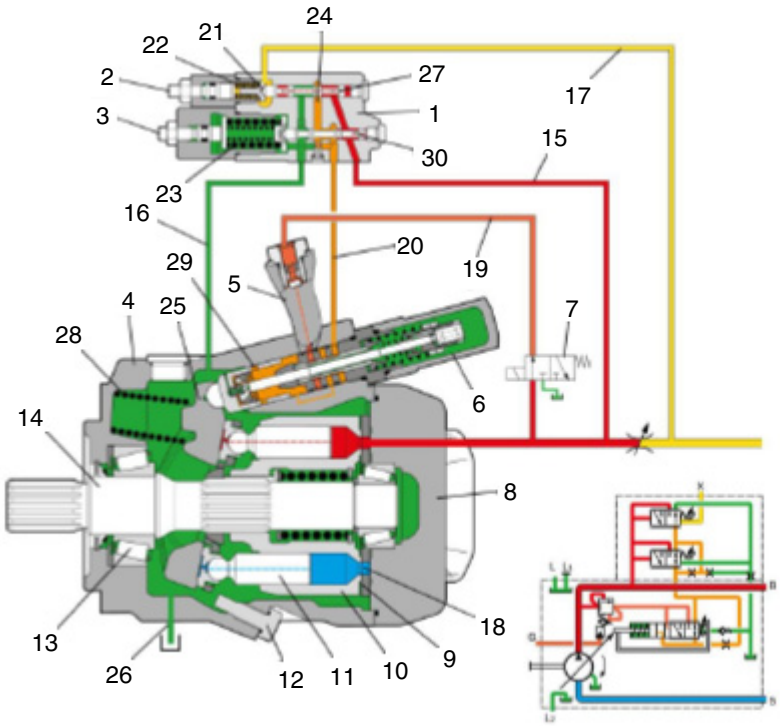
Pumping oil now flows through passage (15). The oil then flows past flow compensator spool (27), and then to control piston (6) through passage (20).

Combined force of pump pressure behind control piston (6) and counter spring (28) is bigger than force of springs inside control piston (6). Angle of swash plate (25) decreases.

This action results in decreasing of pump output and system pressure.

When the flow is decreased enough, flow compensator spool (27) moves right up to the balance position.

Swash plate (25) maintains the angle that is sufficient to provide the lower required pressure. If the operator does not operate RCV lever or pedal, the pump will return to low pressure stand-by.



85A2MP15

8. LOW PRESSURE STAND-BY

Low pressure standby constitutes the following condition: a running engine and inactive attachment. There is no flow demand or pressure demand on the pump. Therefore, there is no LS pressure in passage (17).

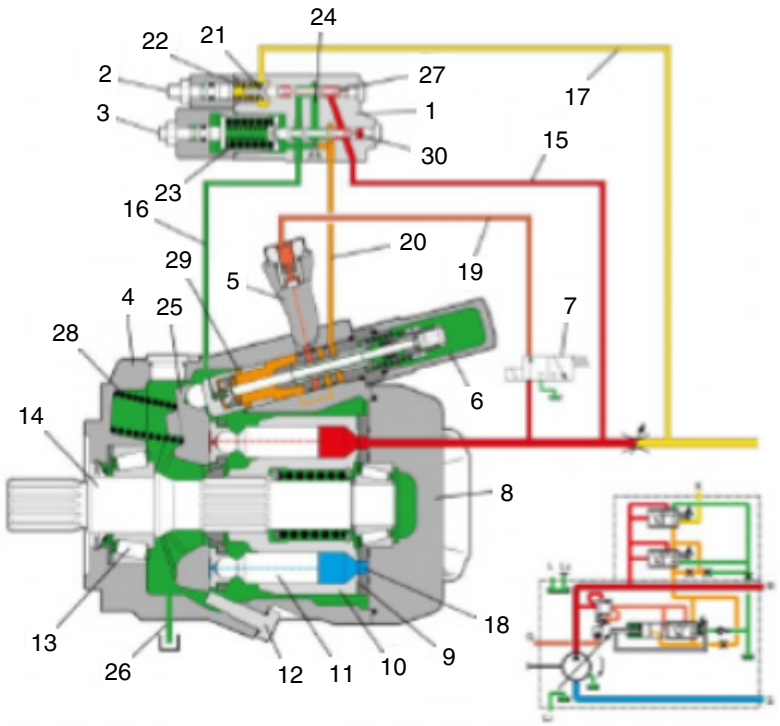
Before you start the engine, counter spring (28) holds swash plate (25) at the maximum angle. As the pump begins to operate, oil begins to flow and pressure increases in the system.

As the pressure increases, the pressure pushes flow compensator spool (27) against spring (22). It causes flow compensator spool (27) to move left. It opens passage (24) in order to allow pumping oil to flow to control piston (6) via passage (20).

The oil acts against control piston (6) in order to overcome the force of counter spring (28). The oil causes control piston (6) to move to the left. When control piston (6) moves to the left, the piston moves swash plate (25) toward the minimum angle. Control piston (6) continues to move to the left until cross-drilled hole (29) allows the oil to drain to pump housing. Cross-drilled hole (29) limits the maximum travel of control piston (6) toward the left.

The pump supplies a sufficient amount of flow that can compensate for the system leakage and the pump leakage. The leakage to the pump housing is flowed from the cross-drilled hole. The pump maintains low pressure stand-by. Low pressure stand-by should not exceed 15 bar.

※ Low pressure standby will vary in the same pump as the system leakage or the pump leakage increases. The pump will slightly upstroke in order to compensate for the leakage increasing. Control piston (6) will cover much flow control than the flow through the cross-drilled hole.



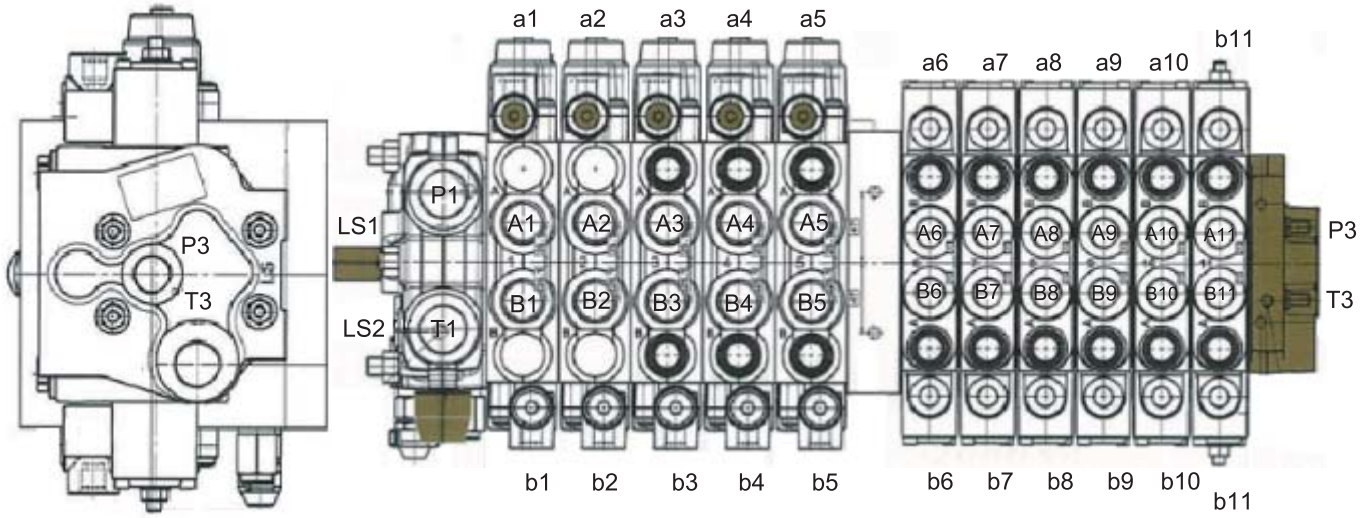
85A2MP16

9. CUT OFF FUNCTION

Once sudden pressure increasing in LS line occurs while attachments work, flow decreasing should be a necessary function to prevent a shock inside the pump. When high pressure in passage (15) flows to regulator (1), spools are likely to move by its force. However, shift of flow compensator spool (27) is restricted by LS pressure pushing spring (22) which is generated from attachments. Therefore, flow compensator spool (27) still blocks a connection from passage (27) to passage (24). The flow blocked by flow compensator spool (27) alternatively shifts pressure compensator spool (30) to right. Passage (15) connects to passage (20) by this shift. High pressure flows to control valve (6), then decreases an angle of swash plate (25). Pumping flow finally will decrease by shift of flow compensator spool (27) although flow compensator spool (27) does not shift.

GROUP 2 MAIN CONTROL VALVE

1. OUTLINE

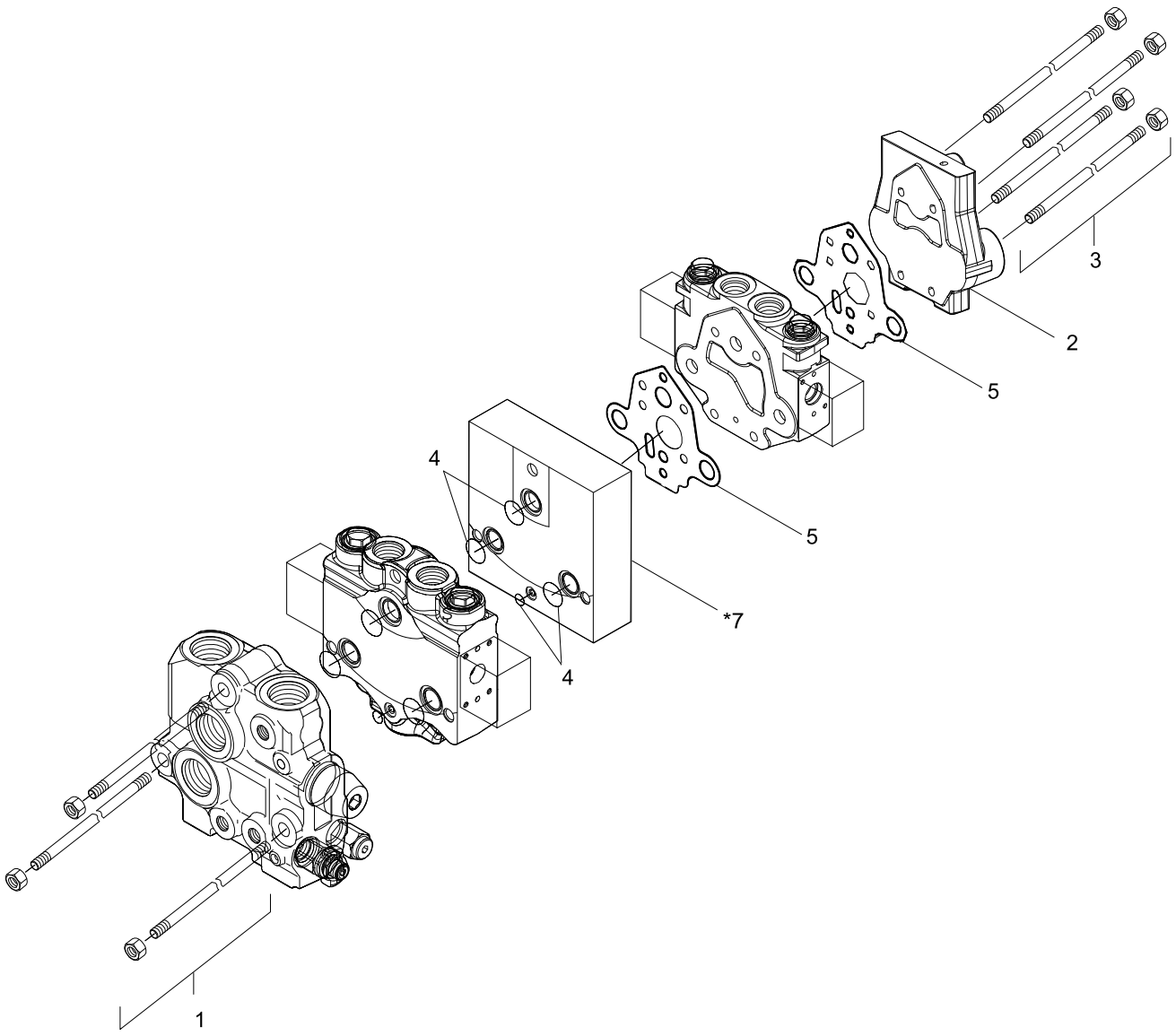


85A2MC01

Mark	Port name
P1	Pump port
P3	Pump port
A11	Swing port (LH)
B11	Swing port (RH)
A6	Dozer down port
B6	Dozer up port
A7	Boom swing port (LH)
B7	Boom swing port (RH)
A9	2 Way (opt)
B9	2 Way (opt)
A8	2 pcs boom up port (opt)
B8	2 pcs boom down port (opt)
A4	Arm out port
B4	Arm in port
A2	Travel port [LH/FW]
B2	Travel port [LH/RR]
A1	Travel port [RH/FW]
B1	Travel port [RH/RR]
A3	Boom up port
B3	Boom down port
A5	Bucket in port
B5	Bucket out port
A10	Auxiliary 1 port (opt)
B10	Auxiliary 1 port (opt)
T1	Tank return port

Mark	Port name
T3	Tank return port
a11	Swing pilot port (LH)
b11	Swing pilot port (RH)
a6	Dozer down pilot port
b6	Dozer up pilot port
a7	Boom swing pilot port (LH)
b7	Boom swing pilot port (RH)
a9	2 Way pilot port (opt)
b9	2 Way pilot port (opt)
a8	2 pcs boom up pilot port (opt)
b8	2 pcs boom down pilot port (opt)
a4	Arm out pilot port
b4	Arm in pilot port
a2	Travel pilot port (LH/FW)
b2	Travel pilot port (LH/RR)
a1	Travel pilot port (RH/FW)
b1	Travel pilot port (RH/RR)
a3	Boom up pilot port
b3	Boom down pilot port
a5	Bucket in pilot port
b5	Bucket out pilot port
a10	Auxiliary 1 pilot port (opt)
b10	Auxiliary 1 pilot port (opt)
LS1	Load sensing port (opt)
LS2	Load sensing port (opt)

2. STRUCTURE (1/5)

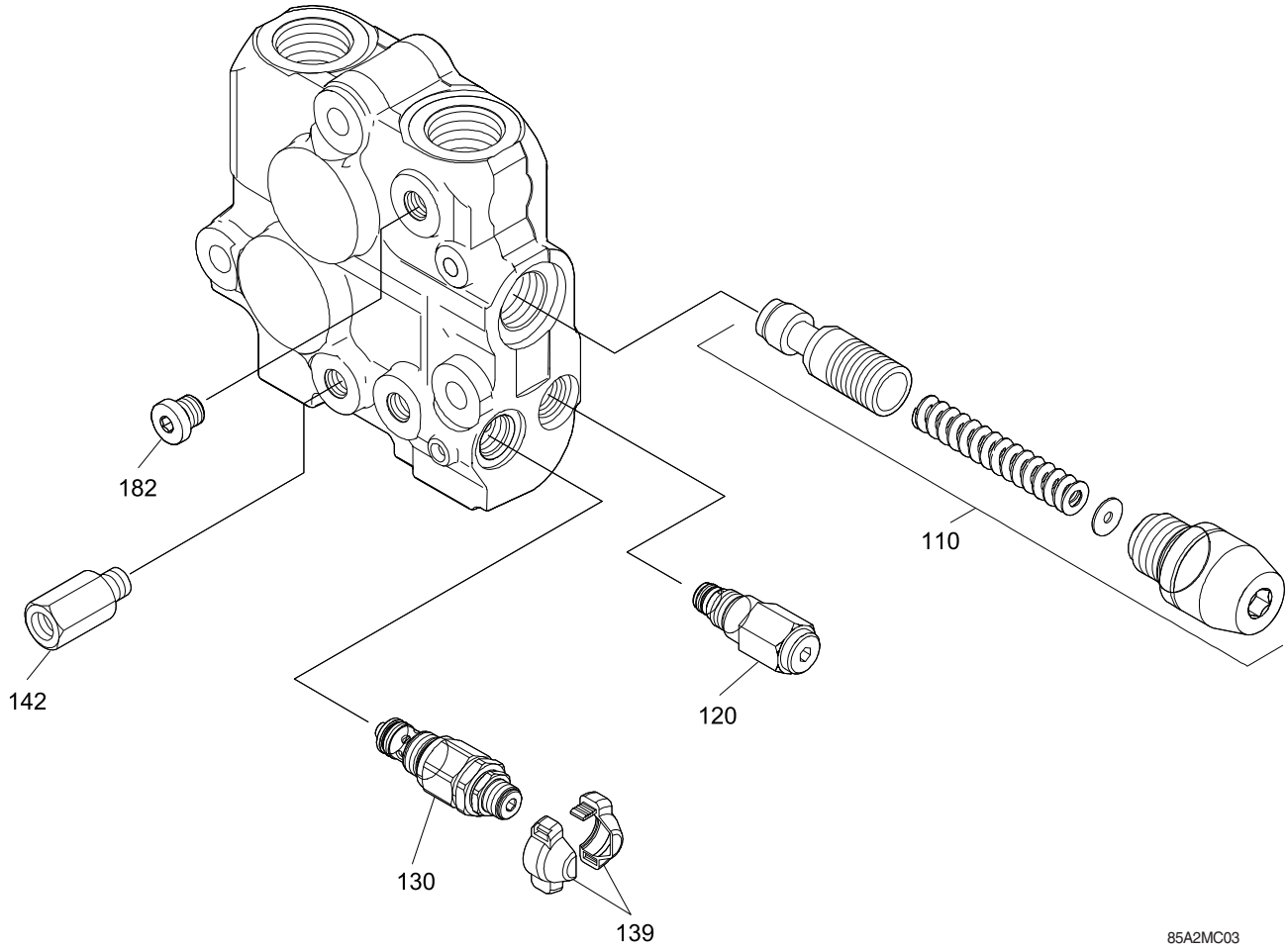


85A2MC02

1	Tie rod	3	Tie rod	5	Plate seal
2	Outlet block assy	4	Seal kit	7	Inner plate block assy

STRUCTURE (2/5)

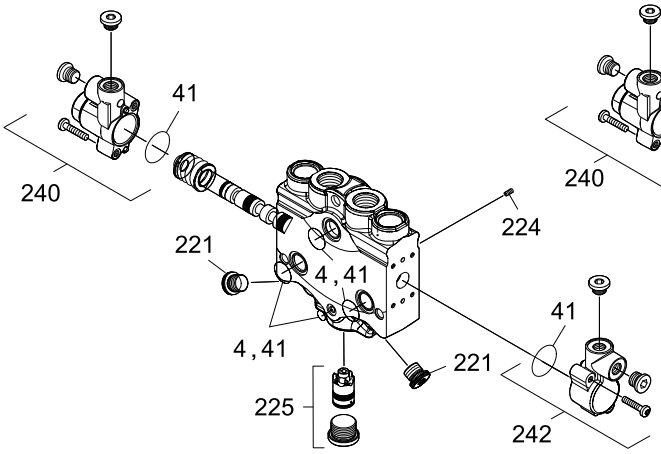
1 (INLET)



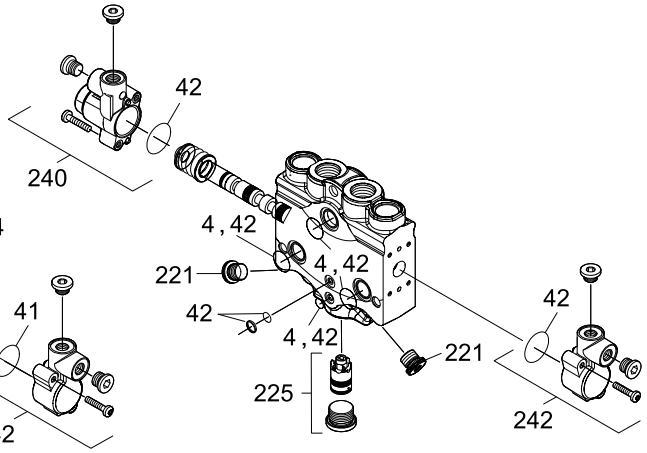
1-110 Regulator kit	1-130 Relief valve	1-142 Shuttle valve
1-120 Flow regulator	1-139 Half blue cover	1-182 Plug

STRUCTURE (3/5)

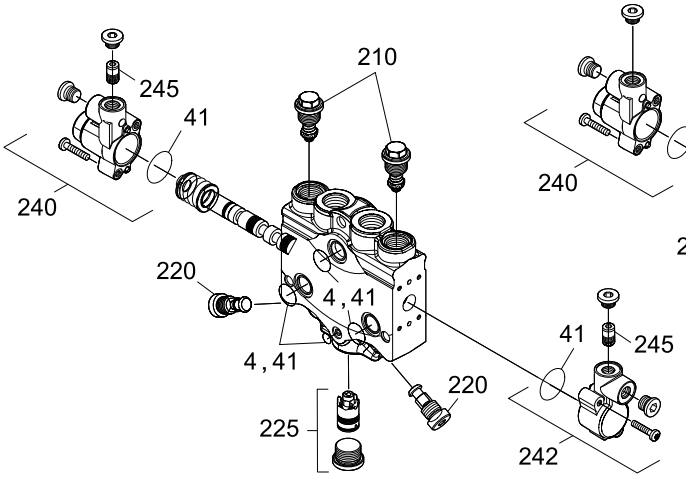
2 (TRAVEL-LH)



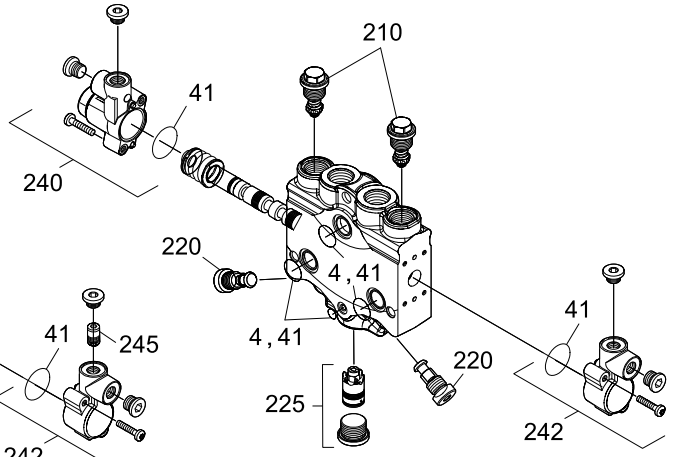
3 (TRAVEL-RH)



4 (BOOM), 5 (ARM)



6 (BUCKET)



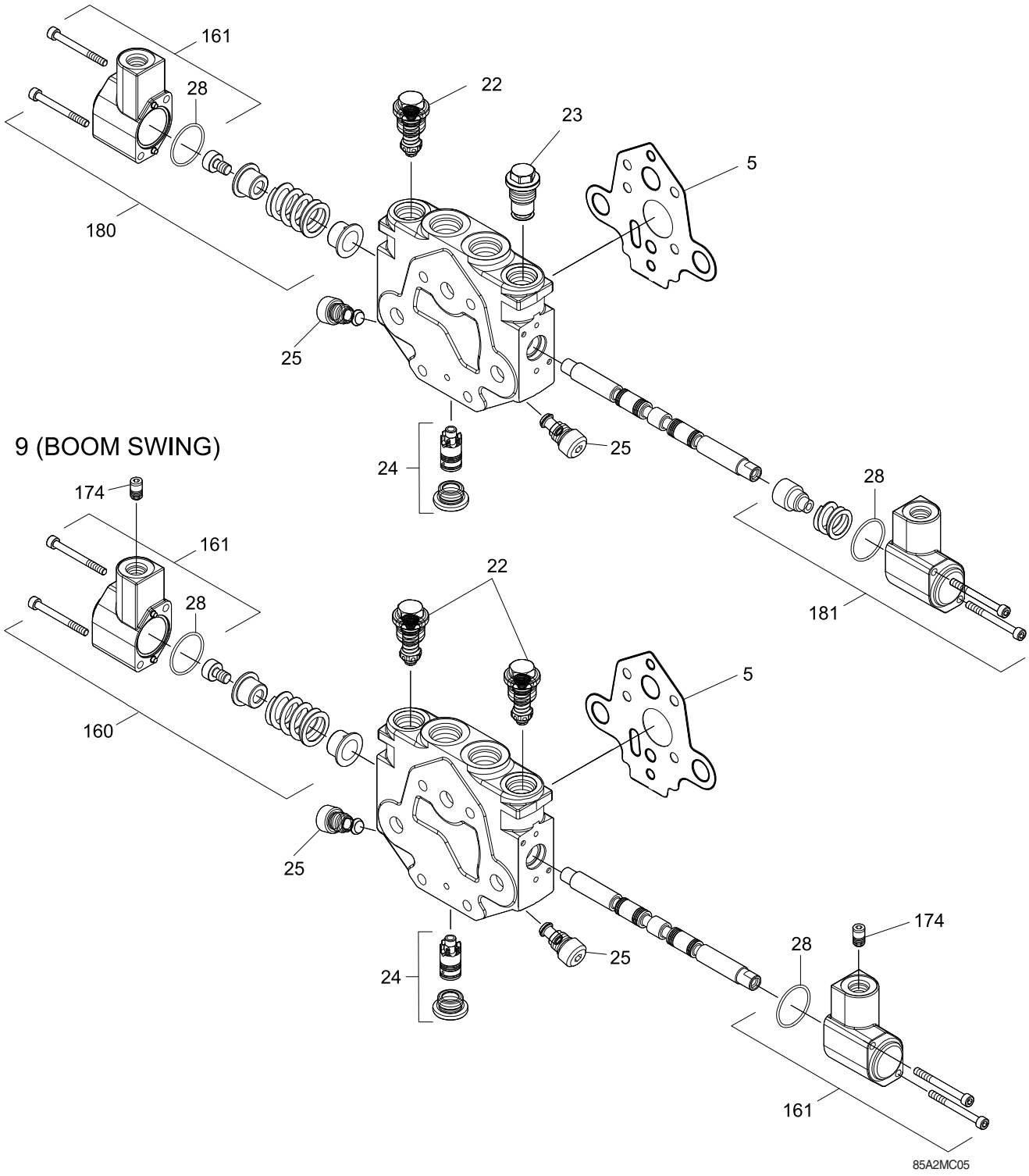
55Z92MC04

2-4	Seal kit	3-221	Plug	4-240	Cover kit	5-242	Cover kit
2-41	Seal kit	3-225	Compensator kit	4-242	Cover kit	5-245	Snubber
2-221	Plug	3-240	Cover kit	4-245	Snubber	6-4	Seal kit
2-224	Throttle element	3-242	Cover kit	5-4	Seal kit	6-41	Seal kit
2-225	Compensator kit	4-4	Seal kit	5-41	Seal kit	6-210	Relief valve
2-240	Cover kit	4-41	Seal kit	5-210	Relief valve	6-220	Check valve
2-242	Cover kit	4-210	Relief valve	5-220	Check valve	6-225	Compensator kit
3-4	Seal kit	4-220	Check valve	5-225	Compensator kit	6-240	Cover kit
3-42	Seal kit	4-225	Compensator kit	5-240	Cover kit	6-242	Cover ki

STRUCTURE (4/5)

8 (DOZER)

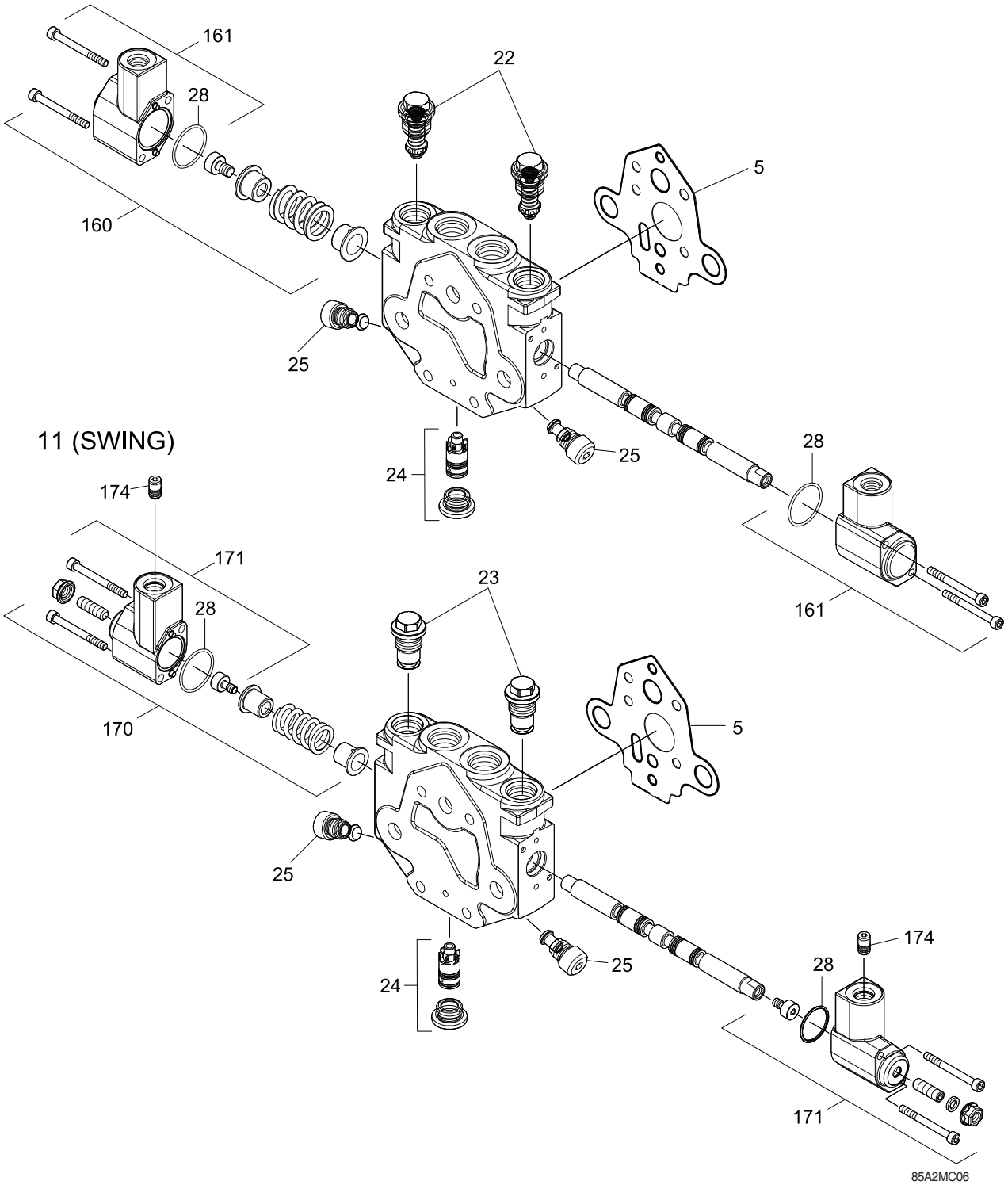
9 (BOOM SWING)



8-5	Plate seal	8-161	Cover kit	9-25	Check valve
8-22	Relief valve	8-180	W/spool cover kit	9-28	Seal kit
8-23	Plug	8-181	W/spool cover kit	9-160	W/spool cover kit
8-24	Compensator kit	9-5	Plate seal	9-161	Cover kit
8-25	Check valve	9-22	Relief valve	9-174	Snubber
8-28	Seal kit	9-24	Compensator kit		

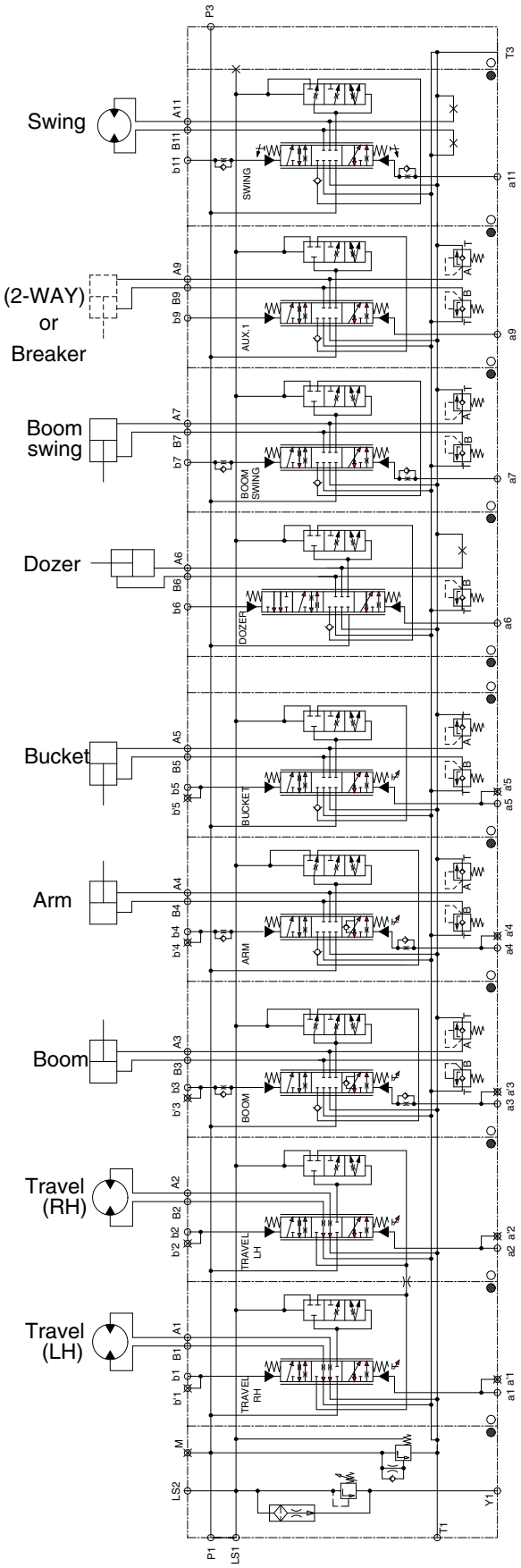
STRUCTURE (5/5)

10 (AUX 1)



10-5	Plate seal	10-160	W/spool cover kit	11-25	Check valve
10-22	Relief valve	10-161	Cover kit	11-28	Seal kit
10-24	Compensator kit	11-5	Plate seal	11-170	W/spool cover kit
10-25	Check valve	11-23	Plug	11-171	Cover kit
10-28	Seal kit	11-24	Compensator kit	11-174	Snubber

3. HYDRAULIC CIRCUIT (boom swing, 2-way)

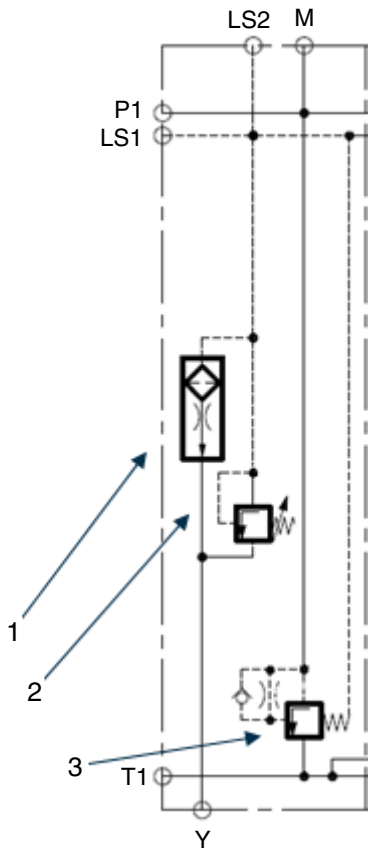


85A2MC07

4. FUNCTION

1) INLET ELEMENT DESCRIPTION

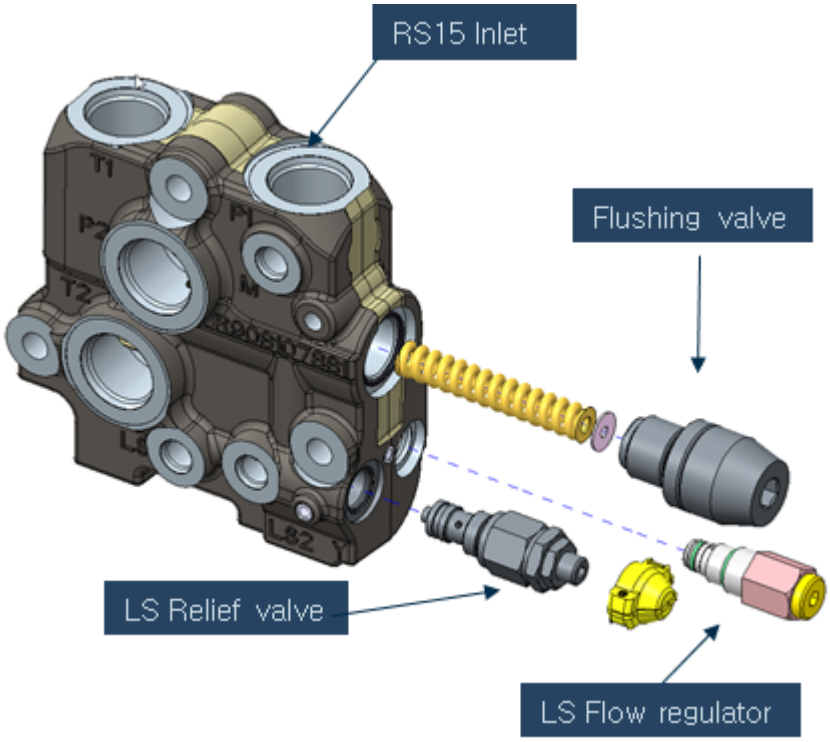
- The inlet plate has the line connections P, T, LS,Y and M.
- The inlet element moreover comprises all components necessary for the system function: One flow control valve (1) for the controlled unloading of the LS line and one LS pressure relief valve (2) to limit the maximum system pressure.
- Protection of the system by means of LS pressure relief valve (2) combined with flushing valve (3).



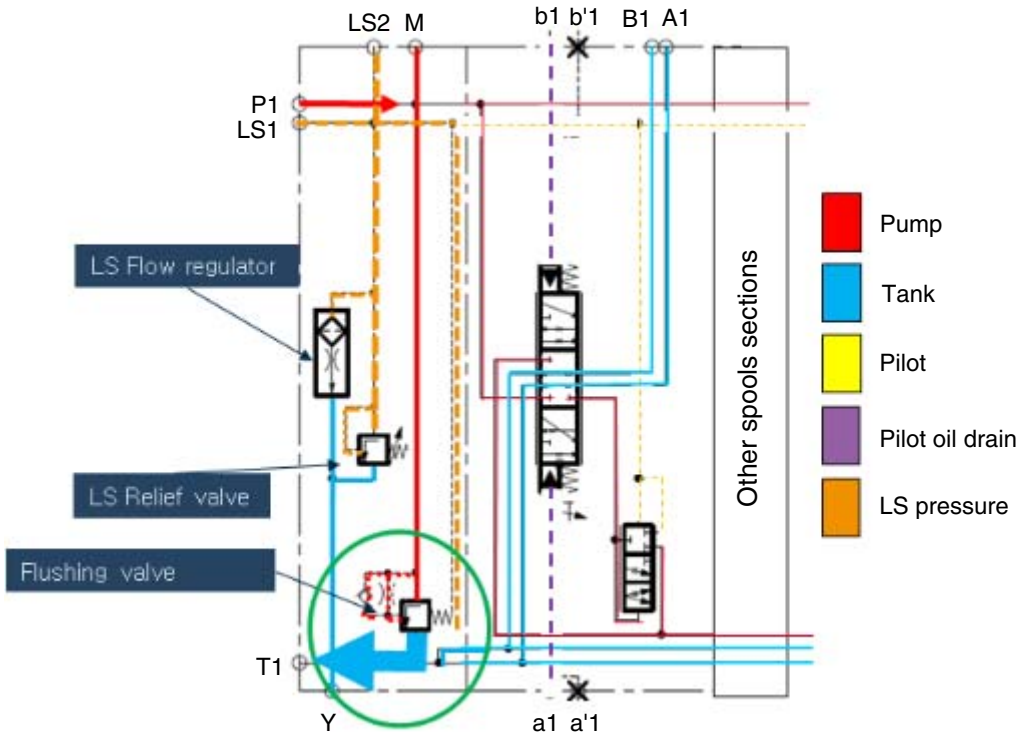
85A2MC10

(1) Inlet description - all spools at neutral position

First section-travel-represented at neutral



85A2MC11



85A2MC12

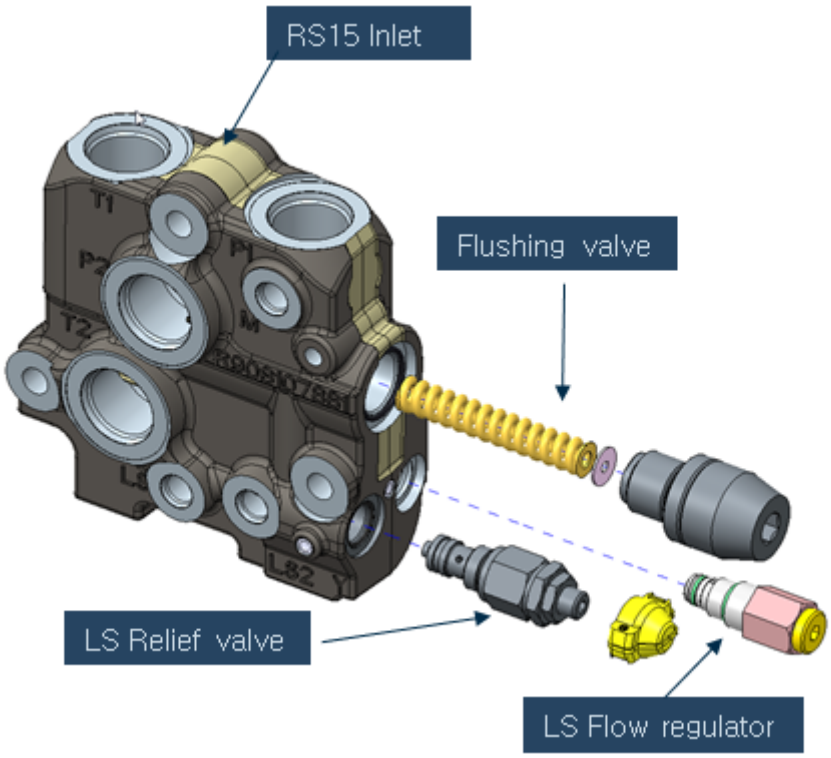
The Inlet element allows the exchange of the in the flow from the pump and the out flow to the tank.

When all sections are in neutral position, the pump is in stand-by and flow is reduced to the minimum pump flow (14 ℓ/min).

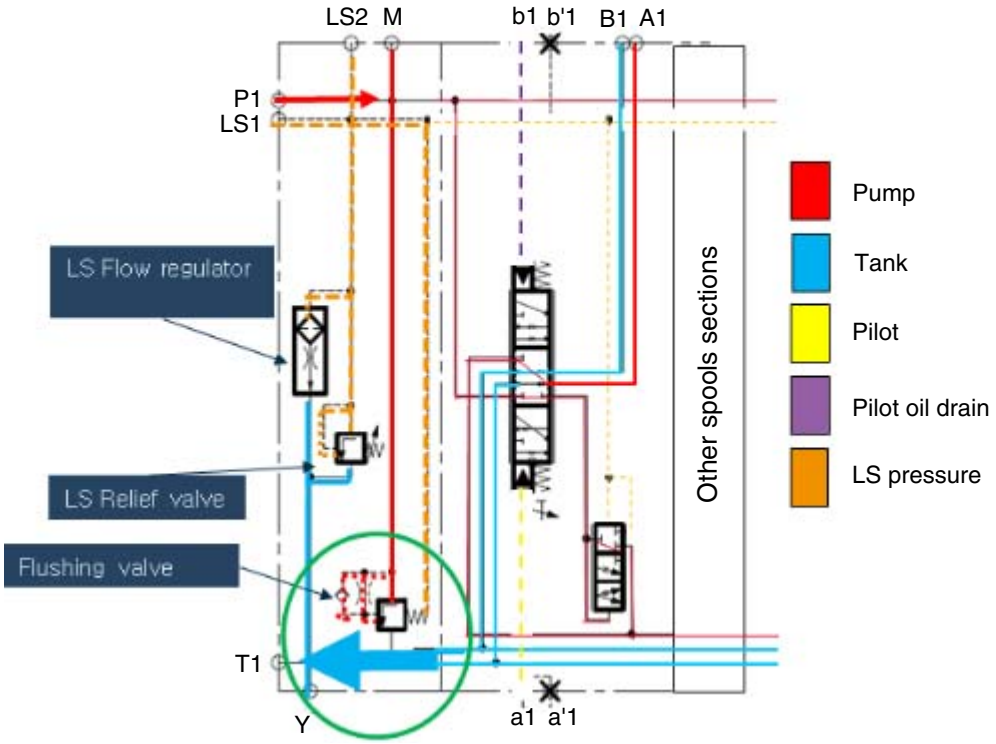
All the minimum pump flow pass through the flushing valve which is open, it means connected to the tank.

(2) Inlet description - spool actuated

First section-travel-PABT spool position represented.



85A2MC13

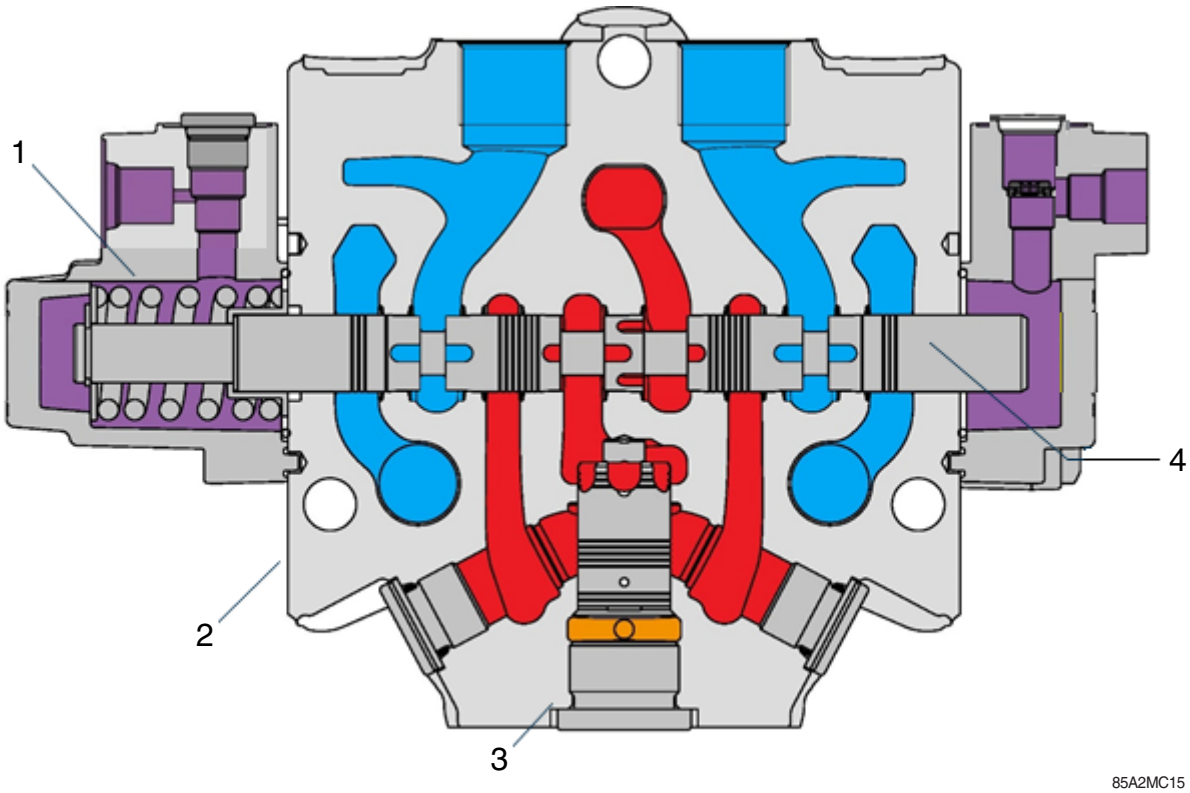


85A2MC14

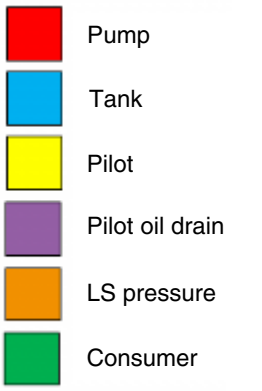
As soon as one or more spool moves, the flow stop to pass trough the flushing valve, which is closed, not anymore connected to the tank. The flow pass trough the spool to reach the movement, and then go to the tank by the T line after the spool.

2) TRAVEL SECTION DESCRIPTION - SECTION 1 AND 2

(1) Component description



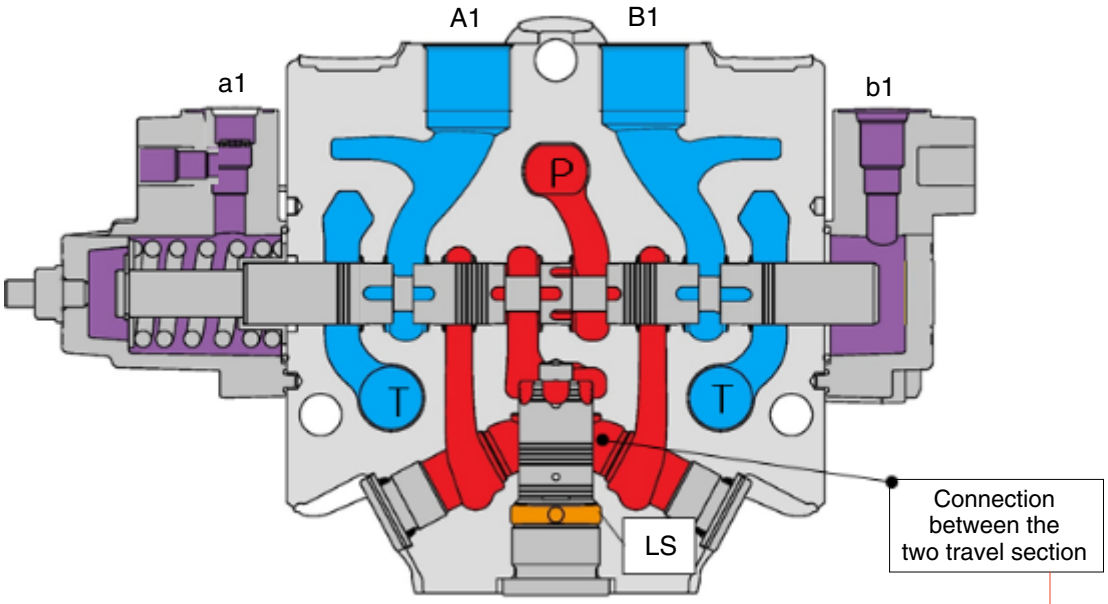
85A2MC15



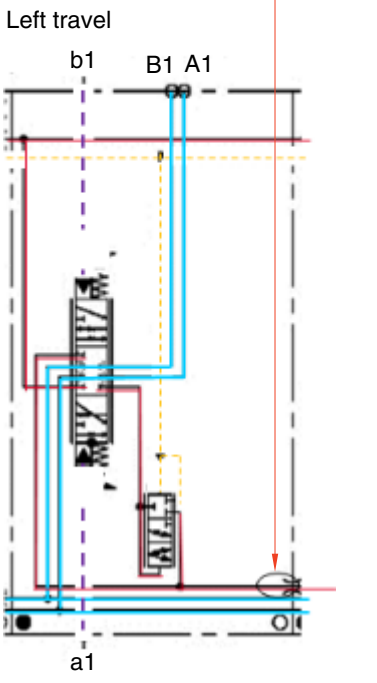
85A2MC16

1 Spring pack
2 Housing
3 Pressure compensator
4 Spool

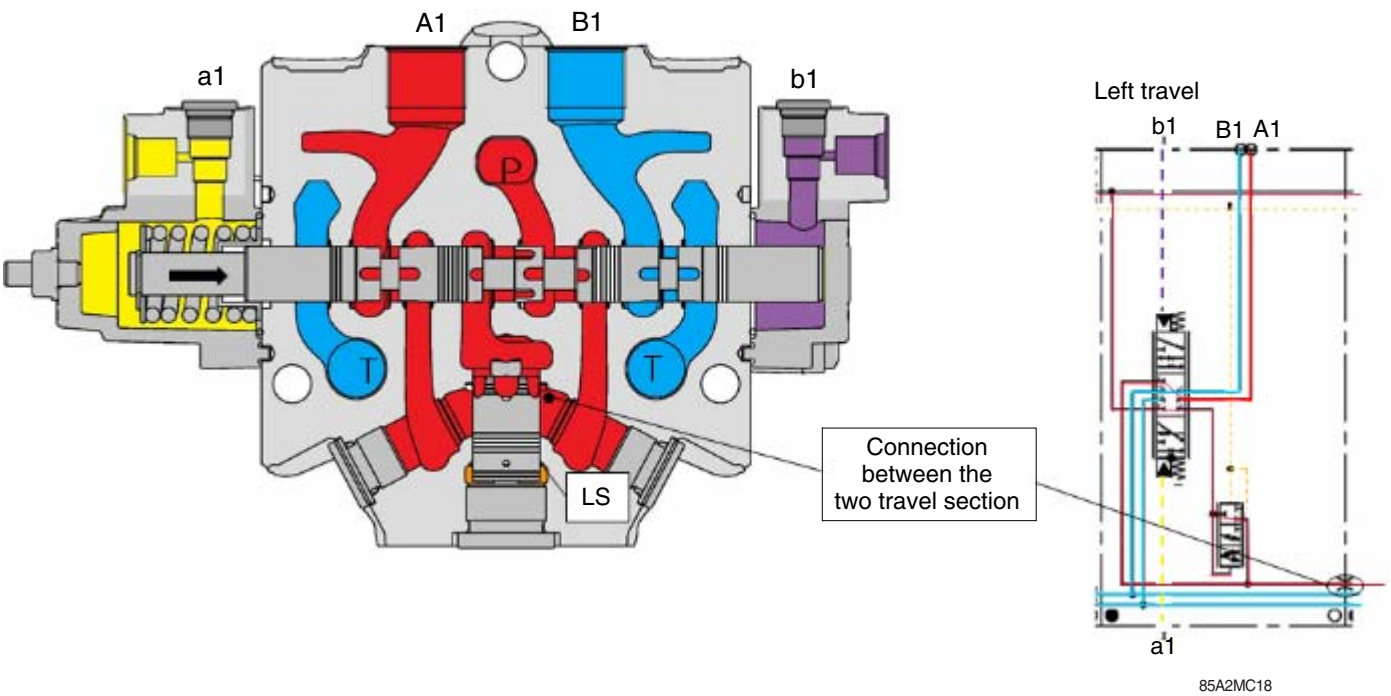
(2) Neutral position



The spool is in neutral position, pump is in low pressure stand-by. The A and B ports are not connected to the pumps but to the tank. This is in order to ensure A and B to be drained to tank. The two translation branches, 1 and 2, are connected in order not to have differences in traction.

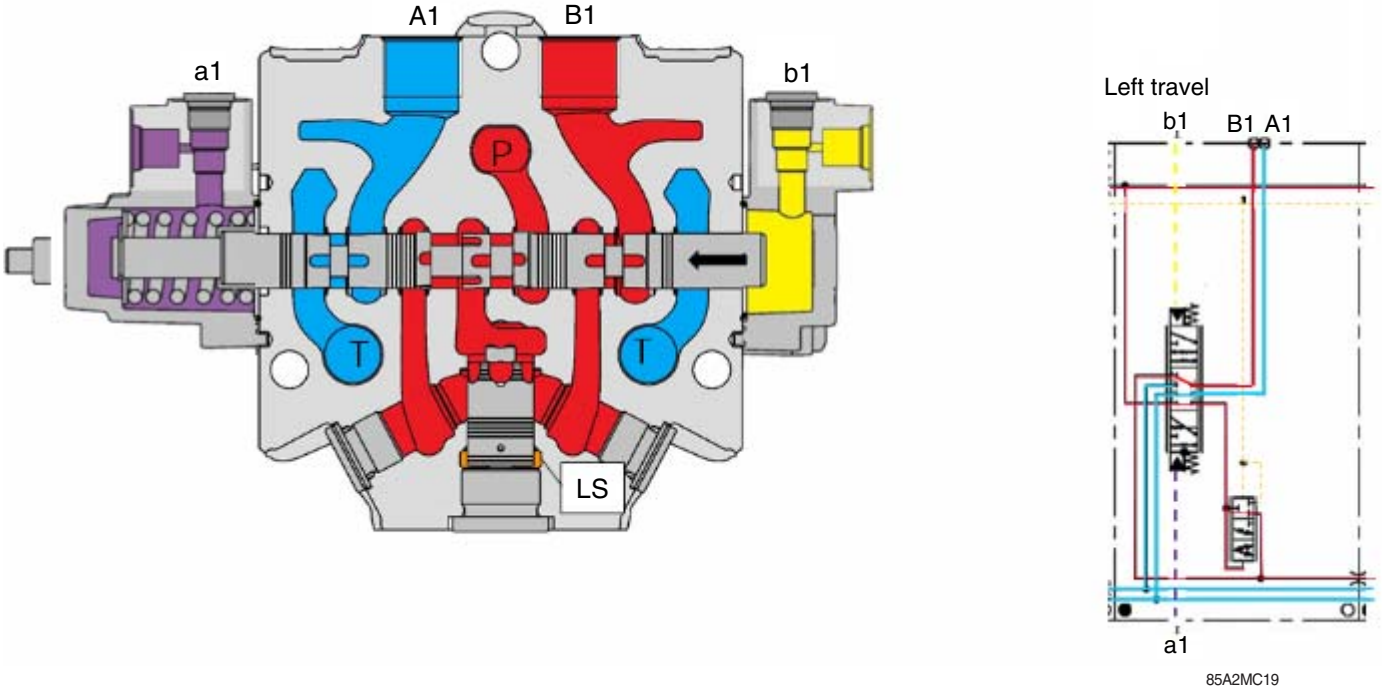


(3) Travel forward position



When the pilot pressure is led to the port a1, the oil from the pump flows to the cylinder port A1 and oil from the cylinder flows into the tank through the cylinder port B1.

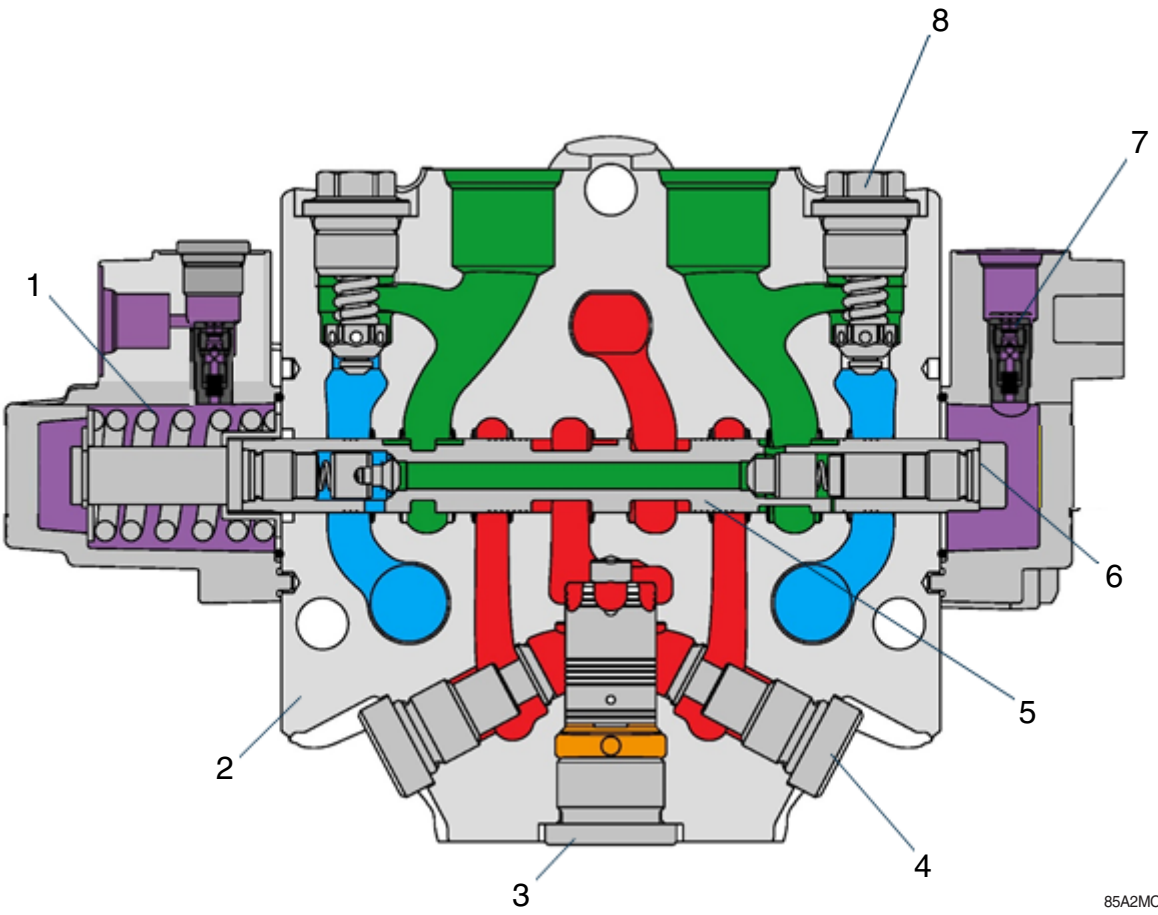
(4) Travel reverse position



When the pilot pressure is led to the port b1, the oil from the pump flows to the cylinder port B1 and oil from the cylinder flows into the tank through the cylinder port A1.

3) BOOM AND ARM SECTION 3 AND 4 DESCRIPTION - WITH REGENERATION SPOOLS

(1) Component description



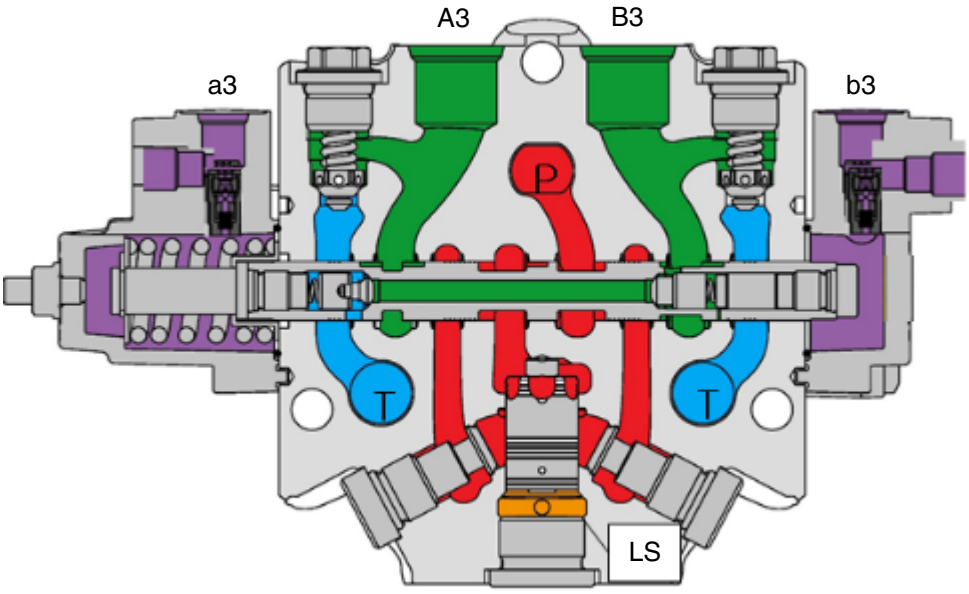
85A2MC20

- Pump
- Tank
- Pilot
- Pilot oil drain
- LS pressure
- Consumer
- Regeneration flow (position PABT on 2-25 pages)

85A2MC21

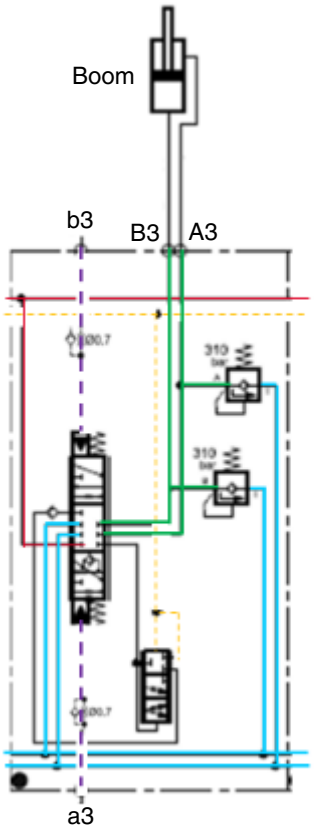
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Regeneration spool
6 Spool
7 Shuttle valve
8 Relief valves

(2) Neutral position



85A2MC22

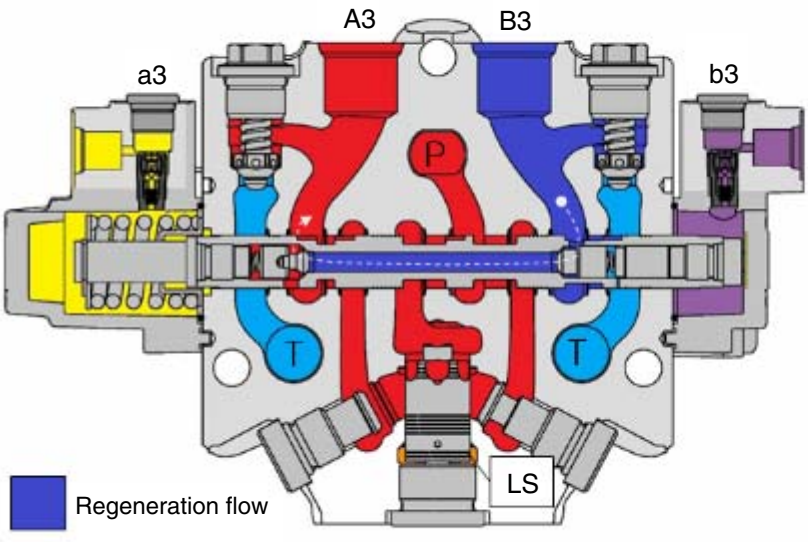
The spool is in neutral position, oil from the pump is blocked, pump is in low pressure stand-by. The A and B ports are not connected to the pump nor the tank.

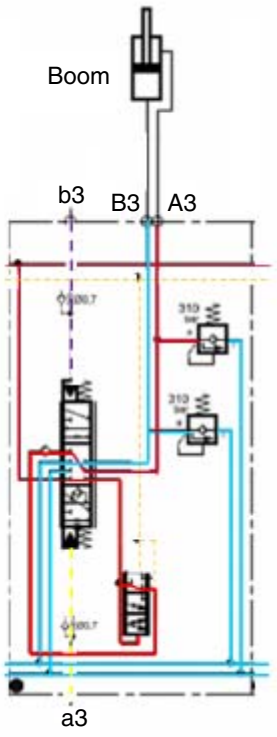


85A2MC23

(3) Boom section description

① Boom down position

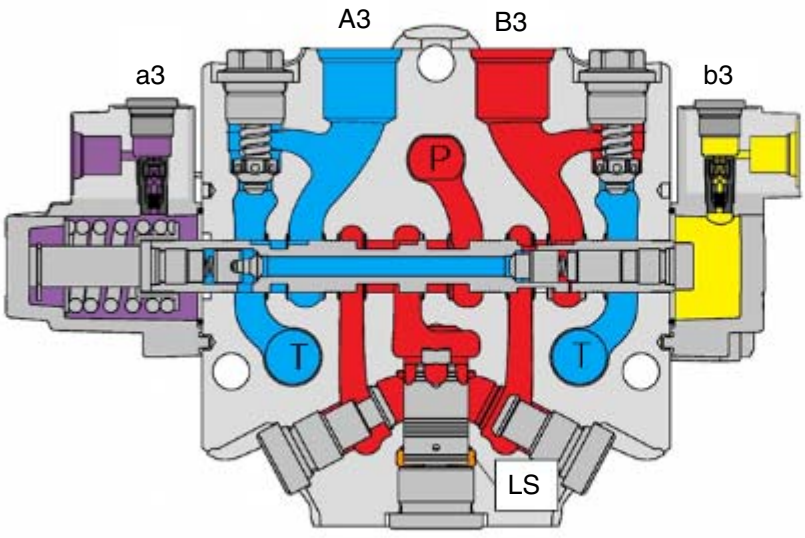


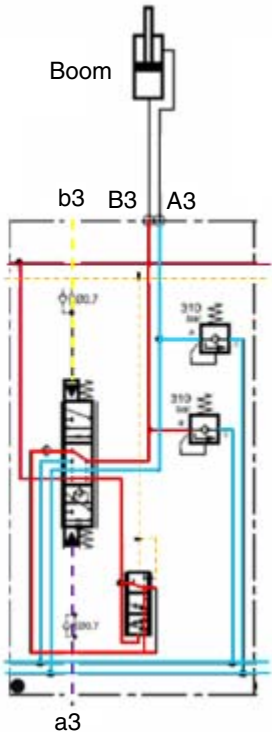


85A2MC24

When the pilot pressure is led to the port a3, the oil from the pump flows to the cylinder port A3 and oil from the cylinder flows partially into the tank and partially trough regeneration path B to A through the cylinder port B3.

② Boom up position



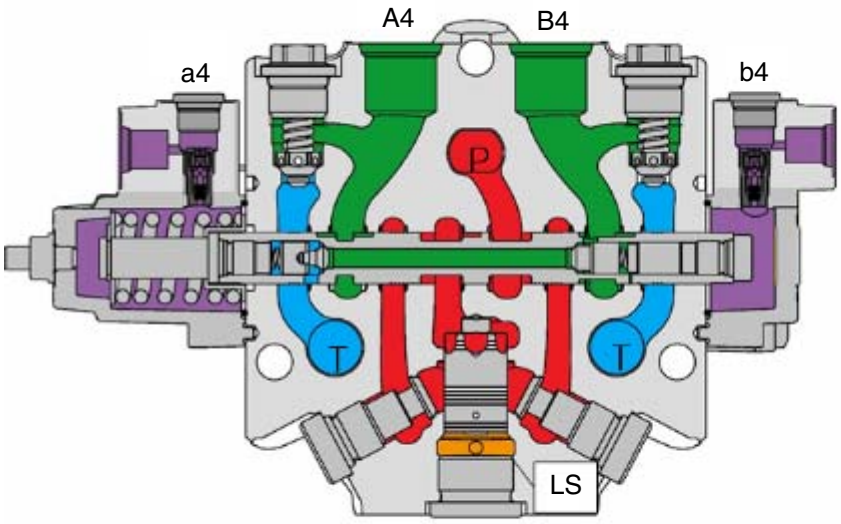


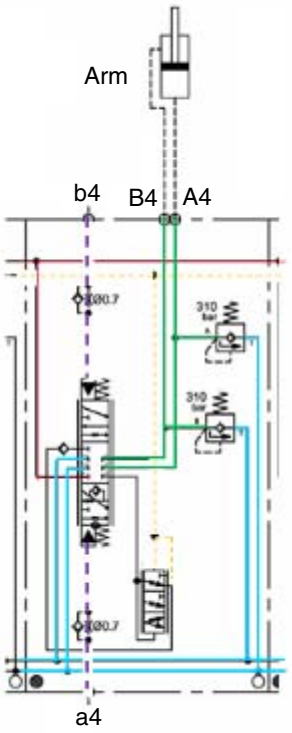
85A2MC25

When the pilot pressure is led to the port b3, the oil from the pump flows to the cylinder port B3 and oil from the cylinder flows into the tank through the cylinder port A3.

(4) Arm section description

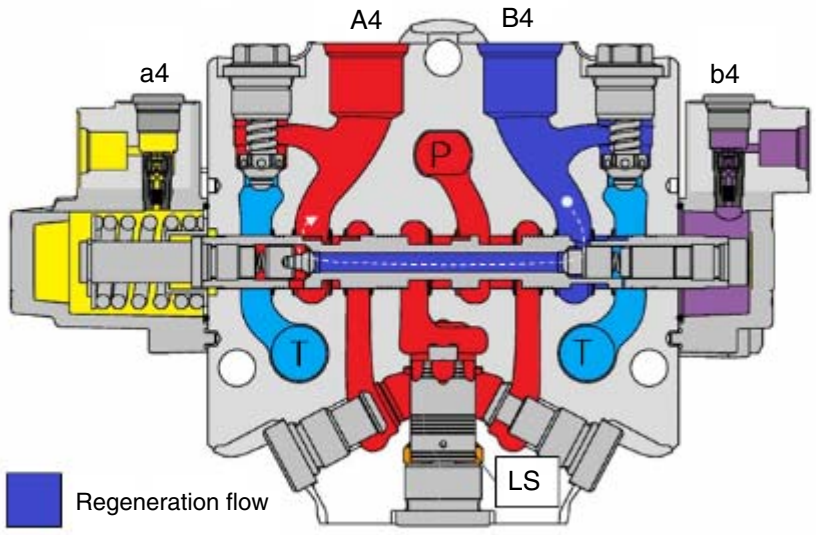
① Neutral position

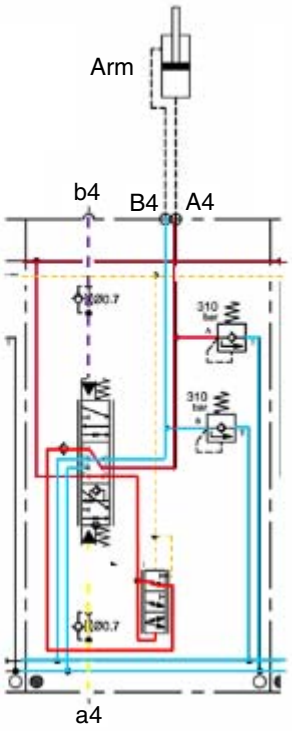




The spool is in neutral position, oil from the pump is blocked, pump is in low pressure stand-by. The A4 and B4 ports are not connected to the pump nor the tank.

② Arm roll in position

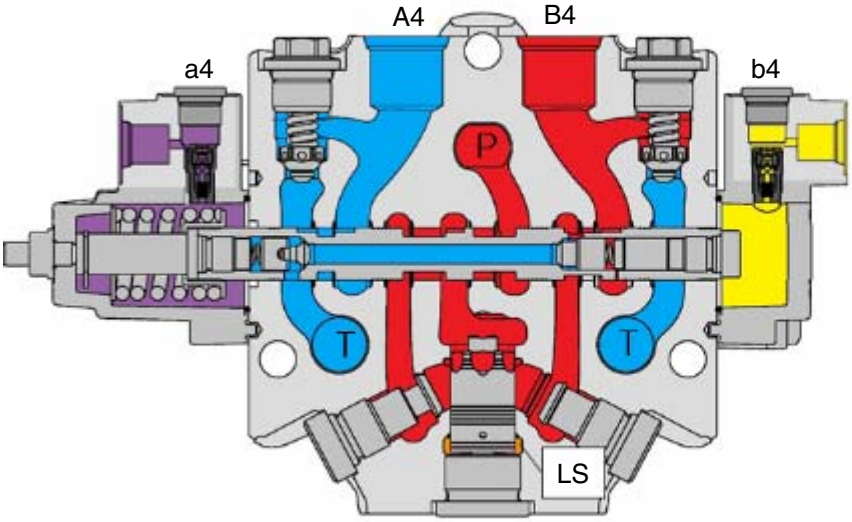


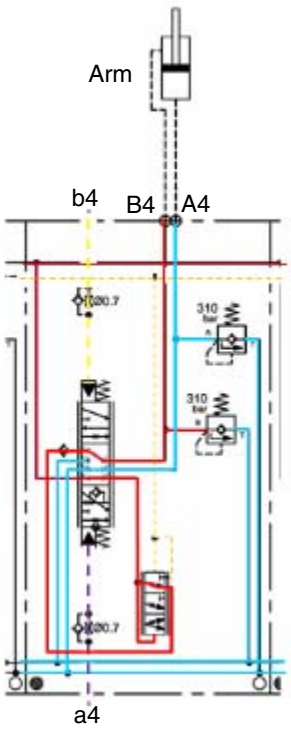


85A2MC27

When the pilot pressure is led to the port a4, the oil from the pump flows to the cylinder port A4 and oil from the cylinder flows partially into the tank and partially trough regeneration path B to A through the cylinder port B4 .

③ Arm roll out position



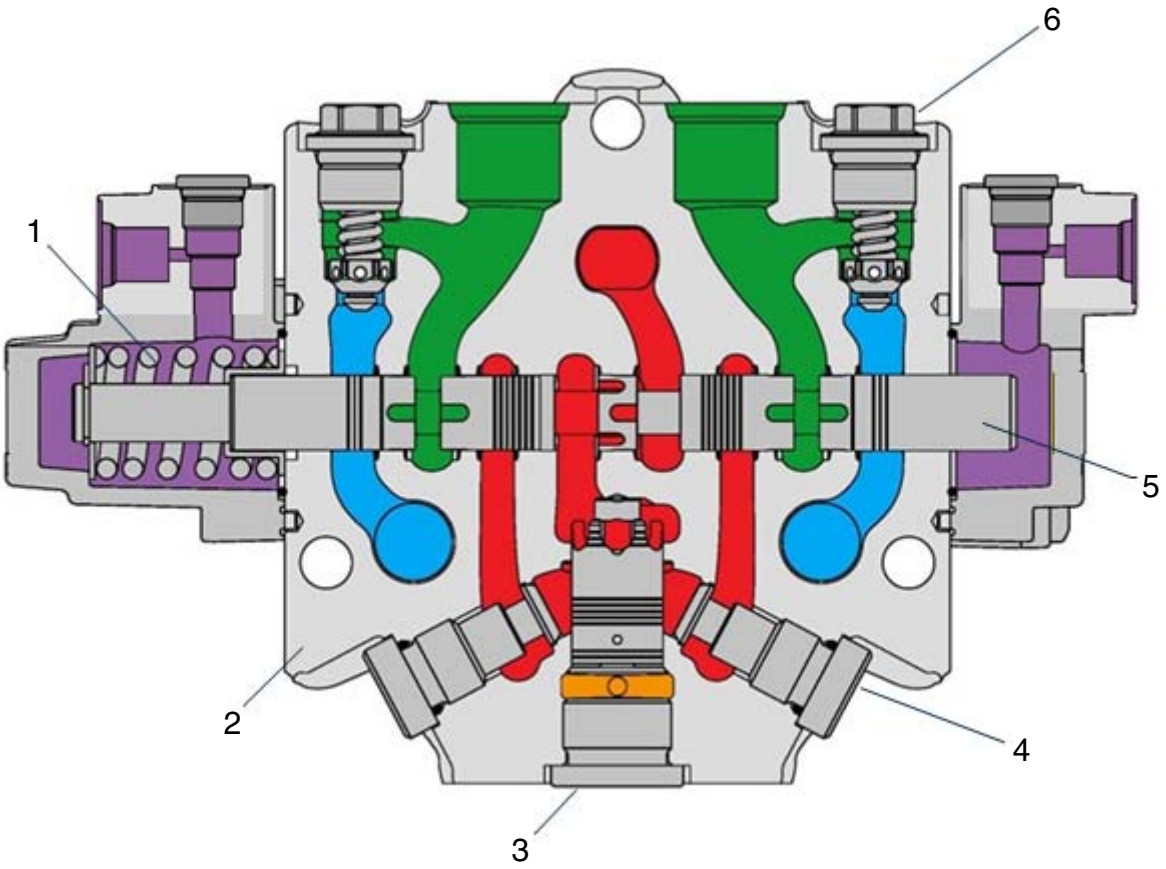


85A2MC28

When the pilot pressure is led to the port b4, the oil from the pump flows to the cylinder port B4 and oil from the cylinder flows into the tank through the cylinder port A4.

4) BUCKET SECTION DESCRIPTION - SECTION 5

(1) Component description



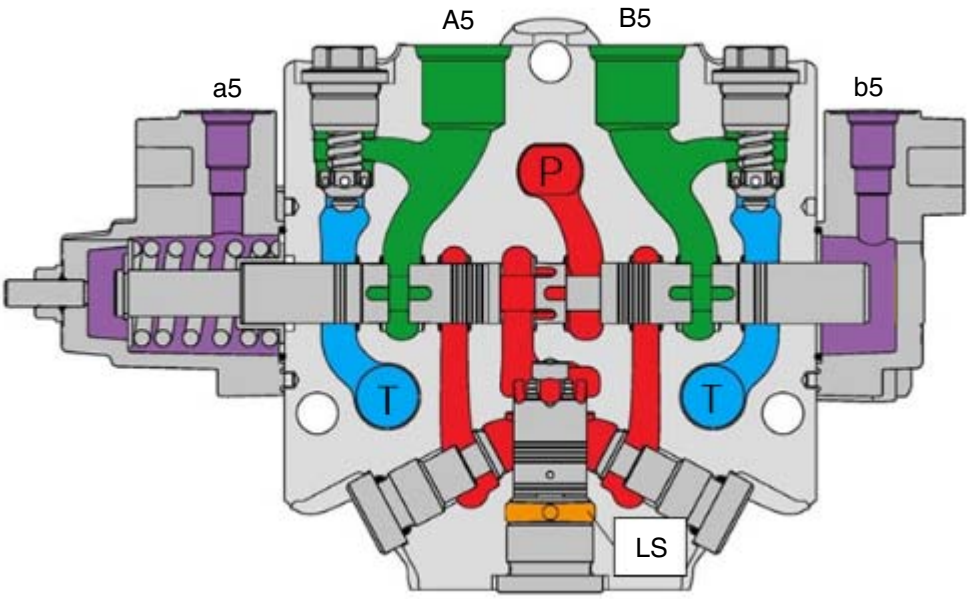
85A2MC29

- Pump
- Tank
- Pilot
- Pilot oil drain
- LS pressure
- Consumer

85A2MC30

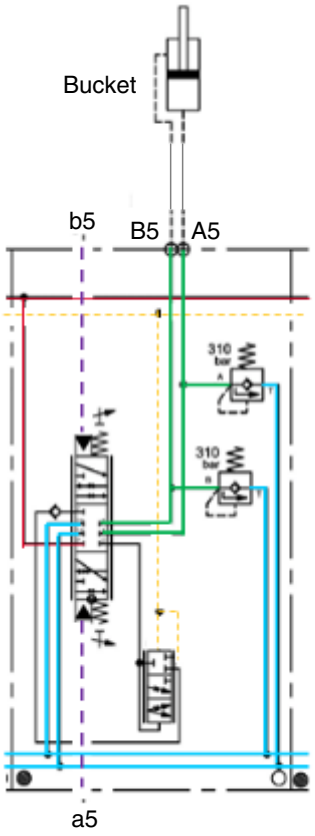
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
6 Overload relief valves

(2) Neutral position



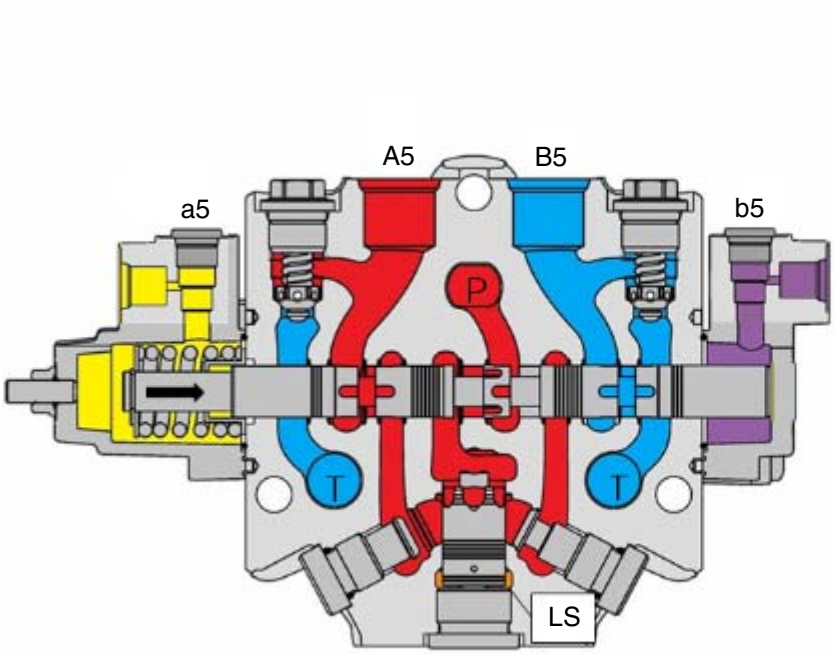
85A2MC31

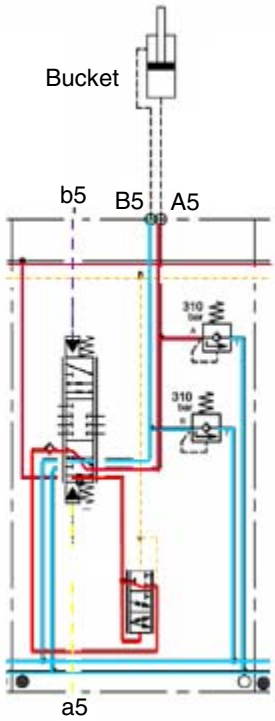
The spool is in neutral position, pump is in low pressure stand-by. The A5 and B5 ports are not connected to the pumps nor the tank.



85A2MC32

(3) Bucket roll in position

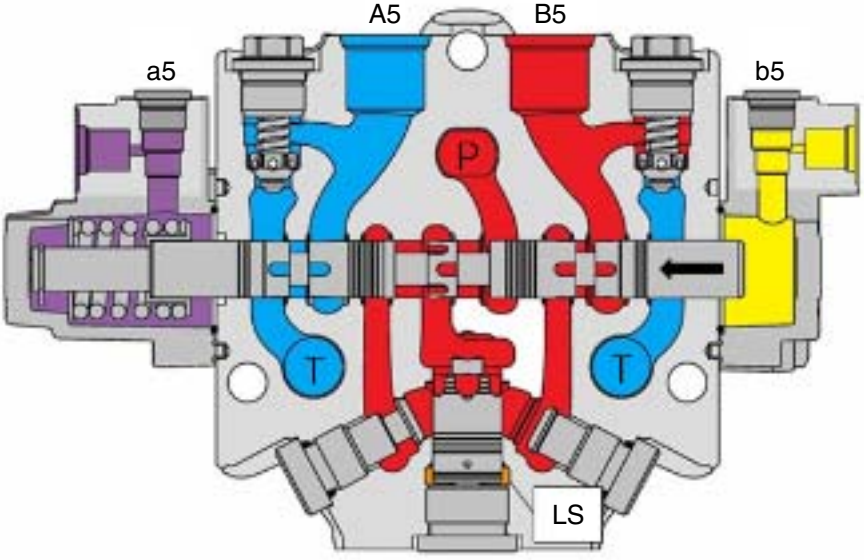


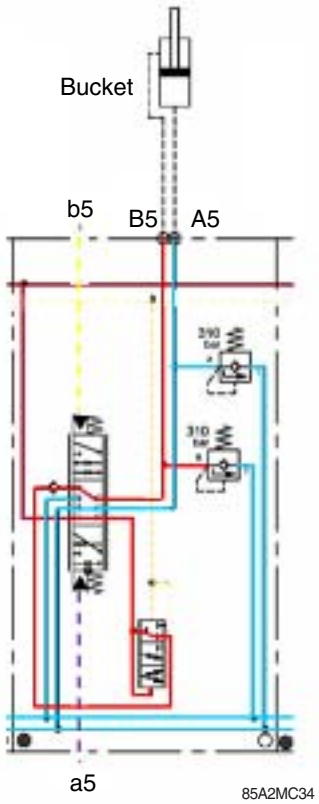


85A2MC33

When the pilot pressure is led to the port a5, the oil from the pump flows to the cylinder port A5 and oil from the cylinder flows into the tank through the cylinder port B5.

(4) Bucket roll out position



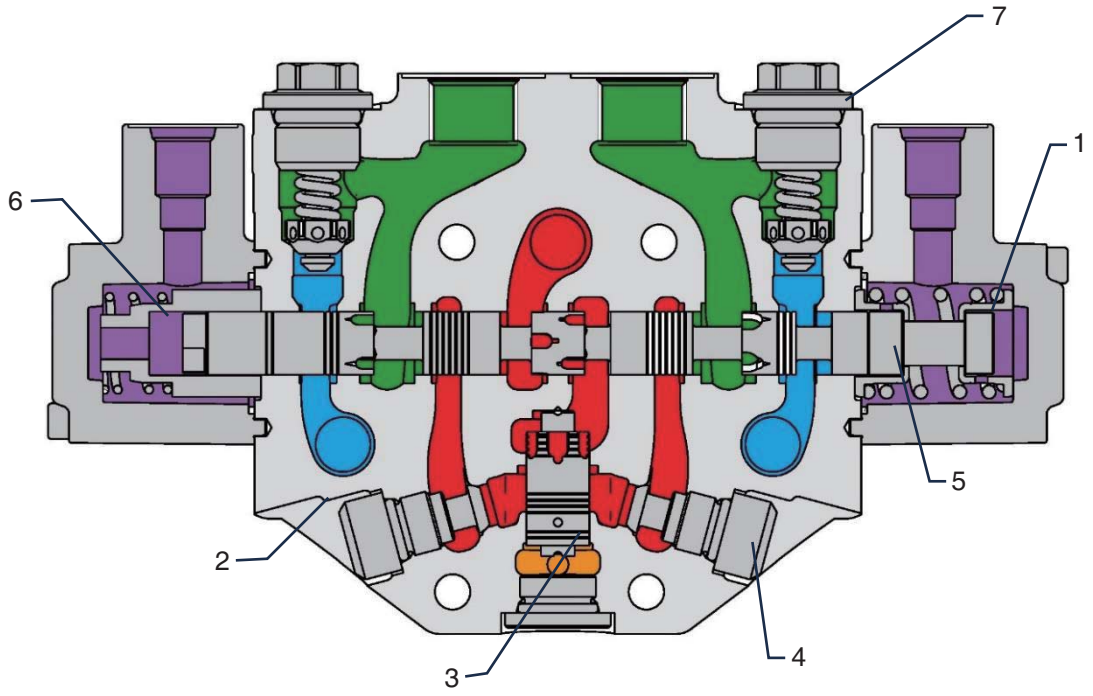


85A2MC34

When the pilot pressure is led to the port b5, the oil from the pump flows to the cylinder port B5 and oil from the cylinder flows into the tank through the cylinder port A5.

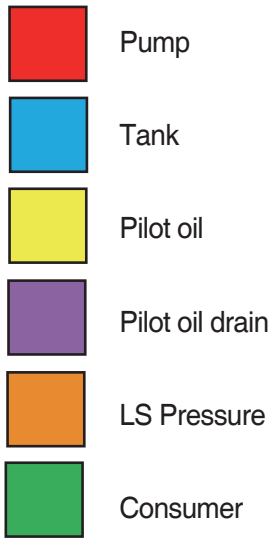
5) BUCKET SECTION DESCRIPTION - SECTION 6

(1) Component description



85A2MC35

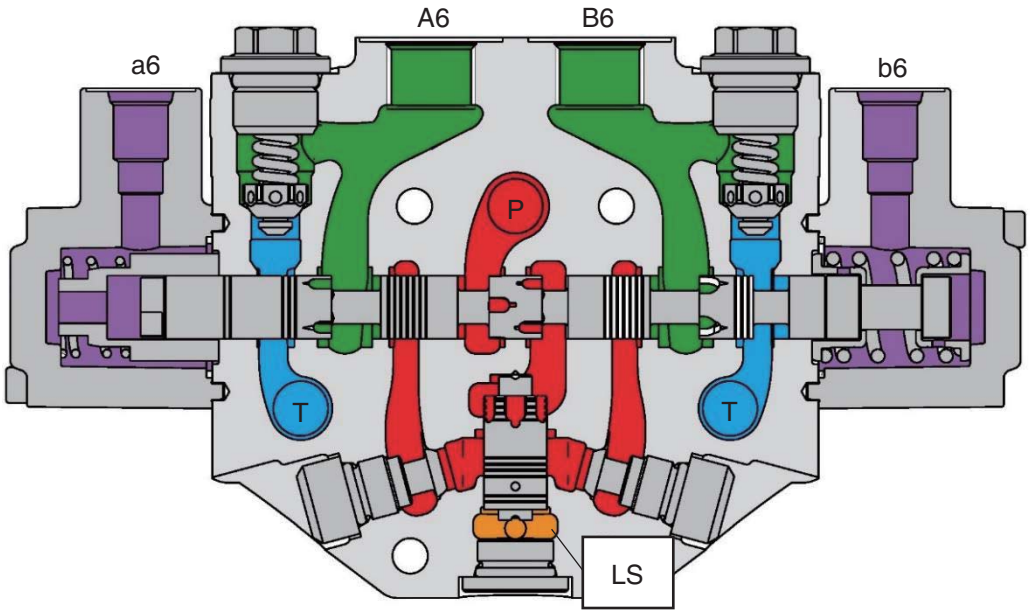
※ This particular slide has a four position spool: neutral, roll in, roll out and floating position.



85A2MC36

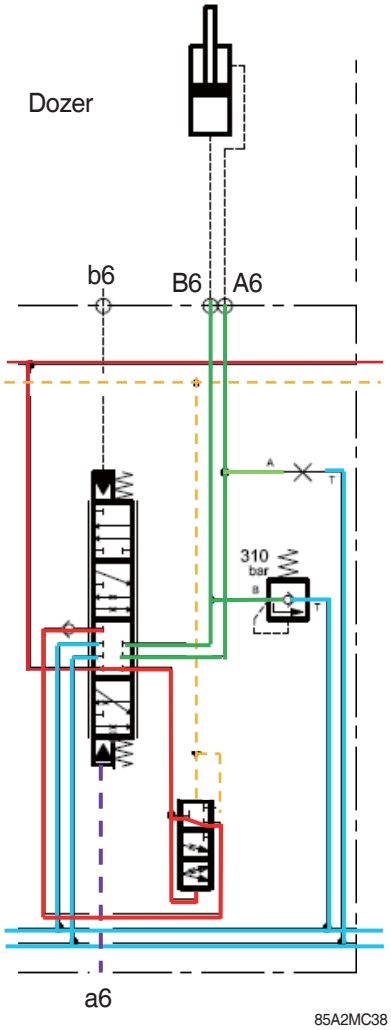
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
6 Fourth position spring pack
7 Relief valves

(2) Neutral position



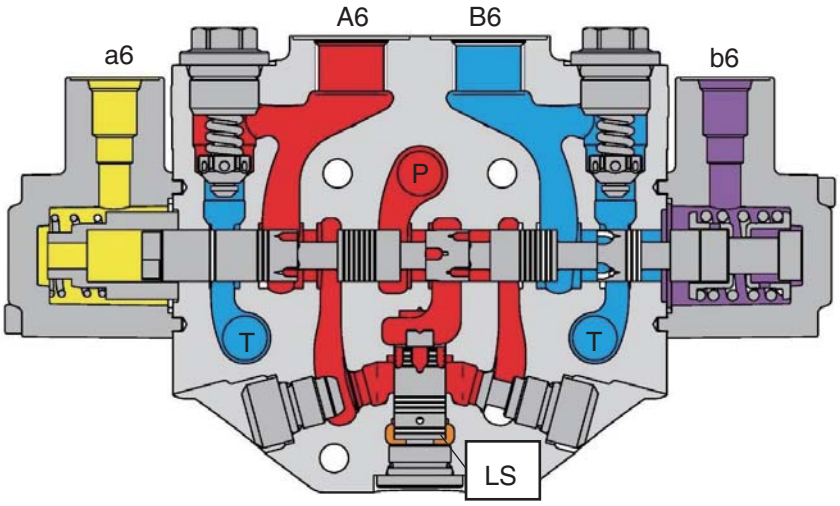
85A2MC37

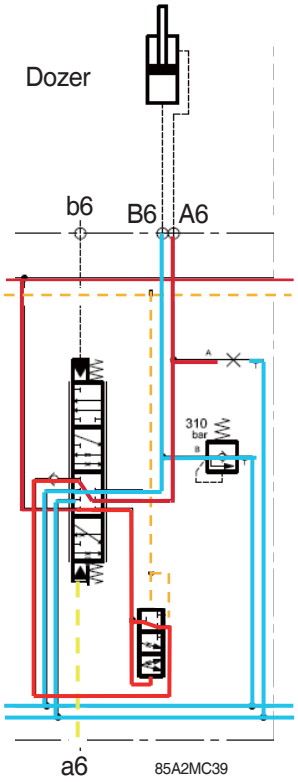
The spool is in neutral position, oil from the pump is not connected to the A6 or to the B6 ports. Pump is in low pressure stand-by.



85A2MC38

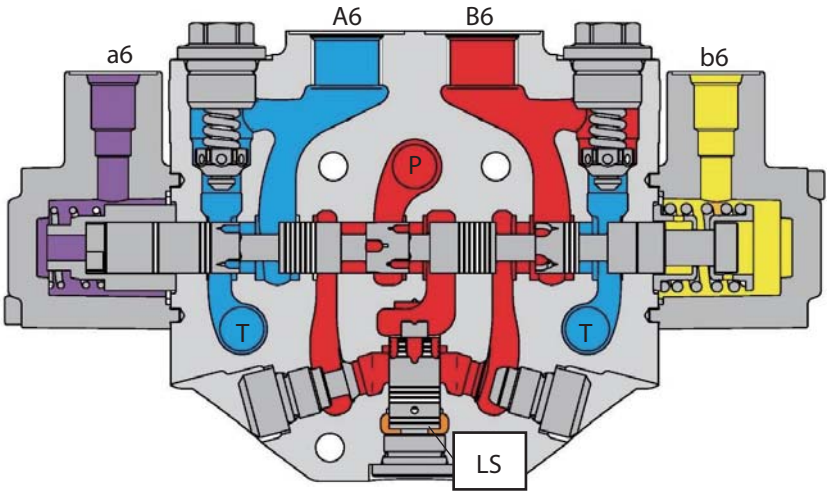
(3) PABT position (dozer up)

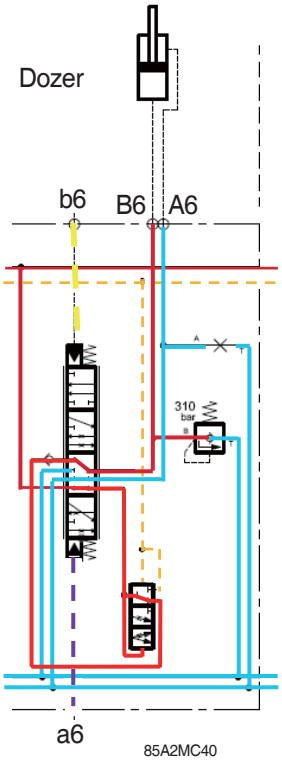




When the pilot pressure is led to the port a6, the oil from the pump flows to the cylinder port A6 and oil from the cylinder flows into the tank through the cylinder port B6.

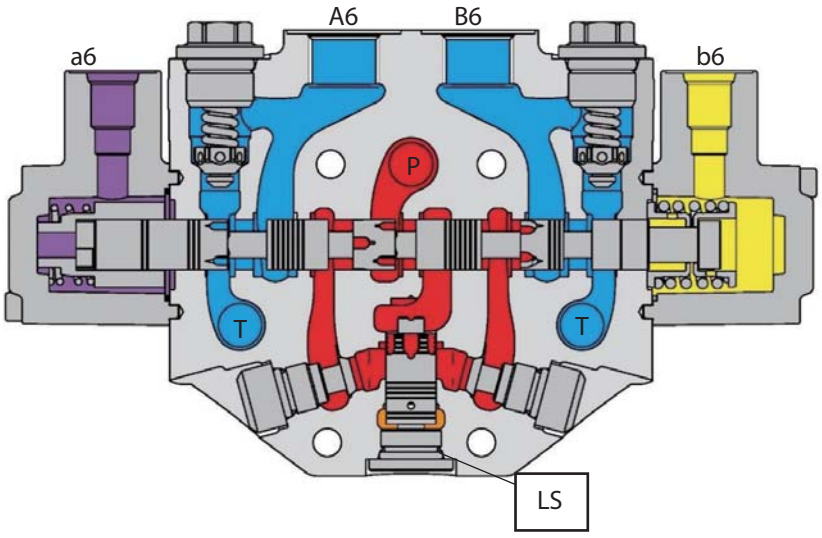
(4) PBAT position (dozer down)

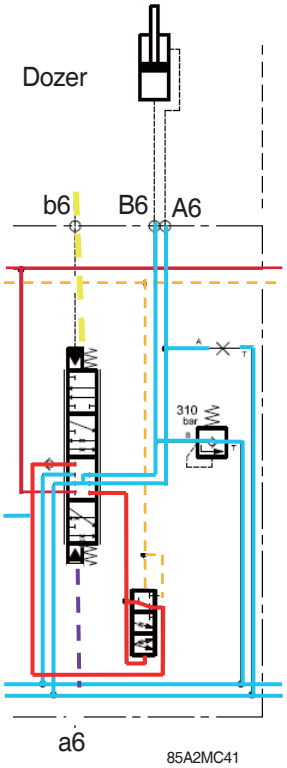




When the pilot pressure is led to the port b6, the oil from the pump flows to the cylinder port B6 and oil from the cylinder flows into the tank through the cylinder port A6.

(5) Floating position

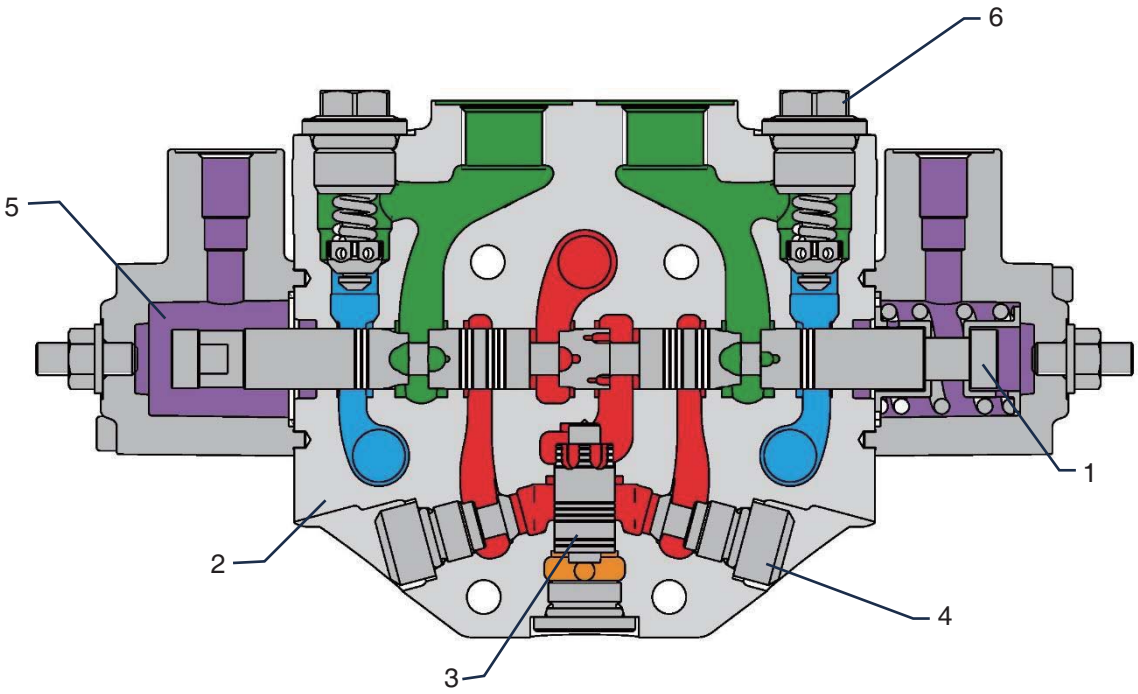




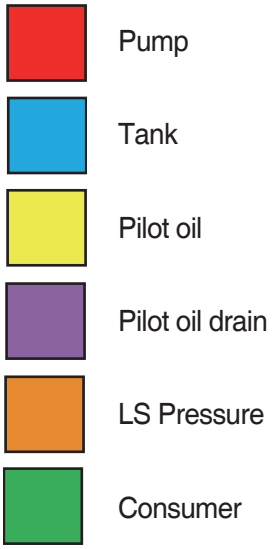
When the pilot pressure is led to the port b6 to maximal pressure, the spool is in the forth position, floating. The pump is in low pressure stand-by while A and B are connected to tank.

6) SLICES DESCRIPTION 7 : BOOM SWING

(1) Component description



85A2MC42

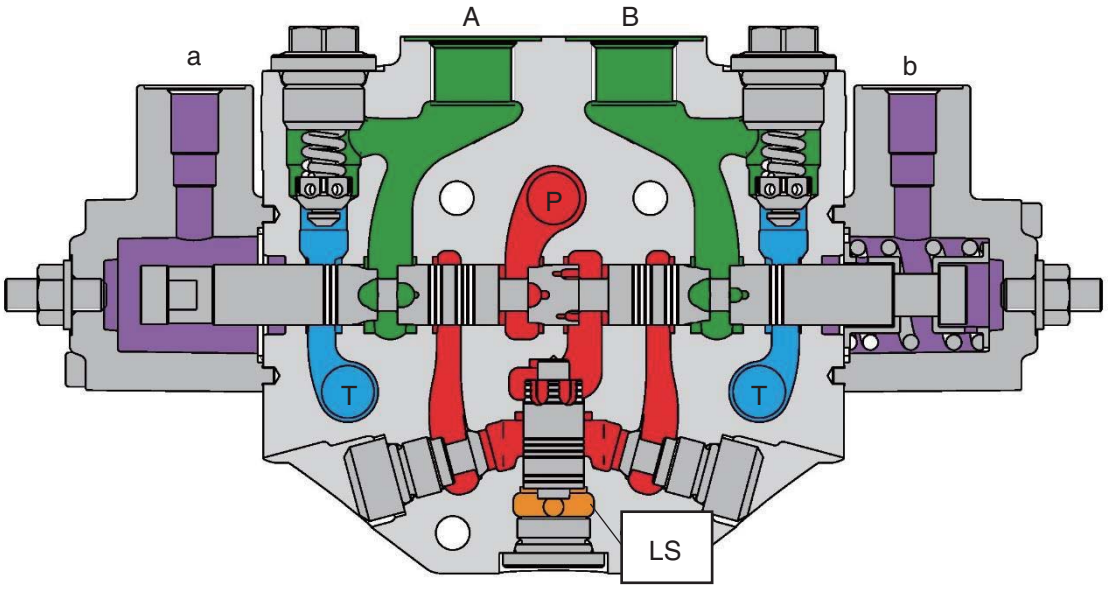


Pump
Tank
Pilot oil
Pilot oil drain
LS Pressure
Consumer

85A2MC43

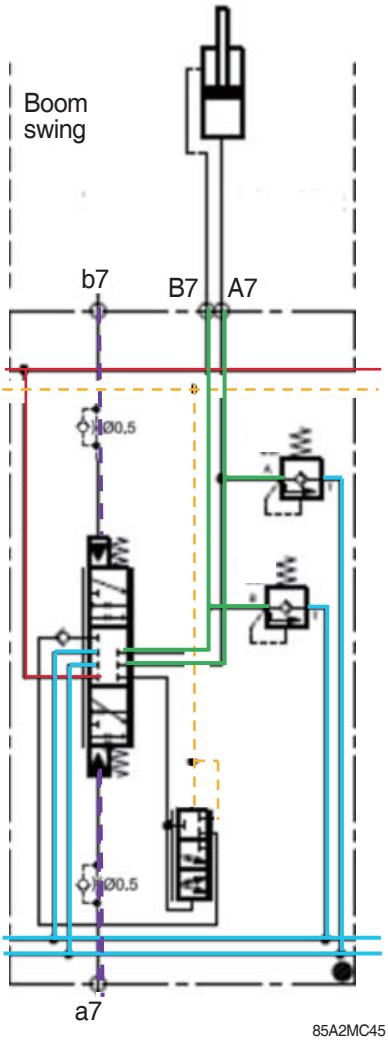
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
6 Relief valves

(2) Neutral position



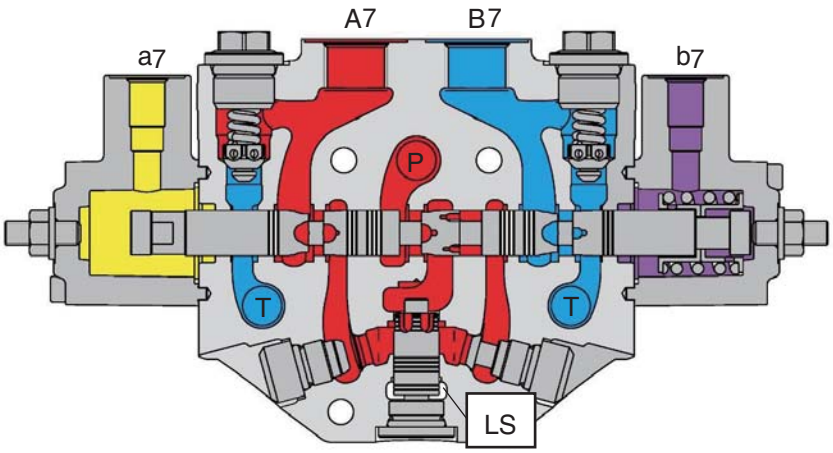
85A2MC44

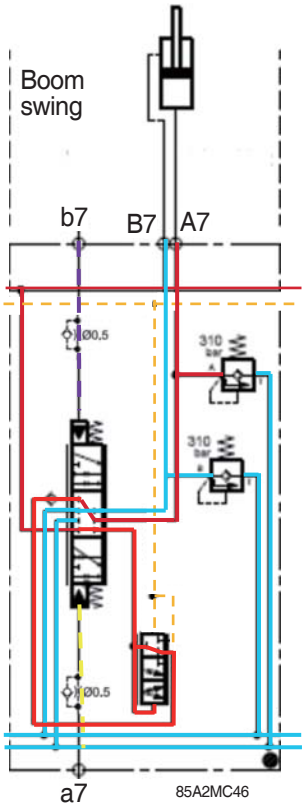
The spool is in neutral position, pump is in low pressure stand-by. The A7 and B7 ports are not connected to the pumps nor the tank.



85A2MC45

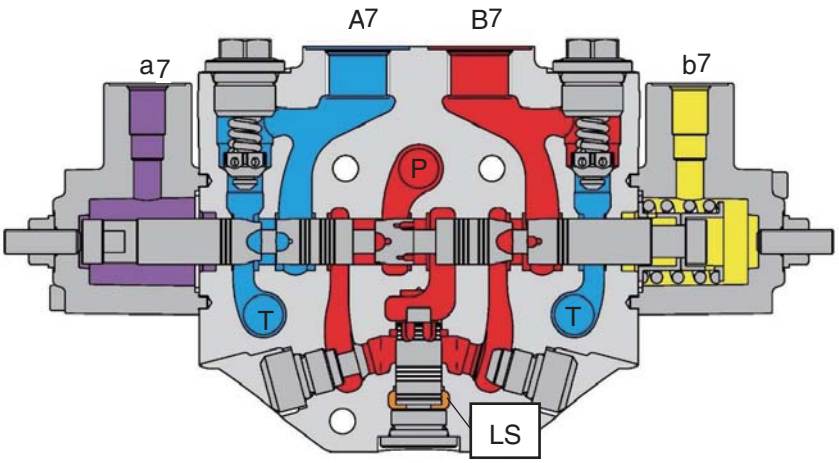
(3) PABT position

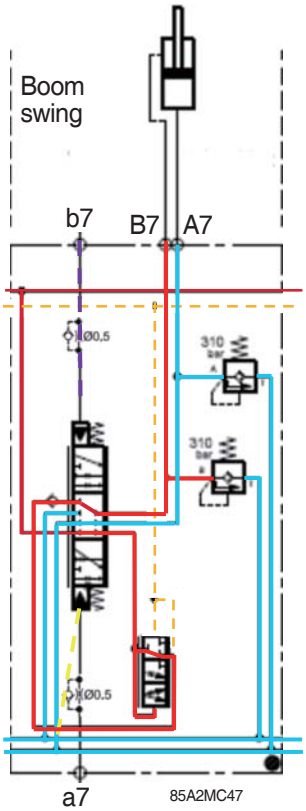




When the pilot pressure is led to the port a7, the oil from the pump flows to the cylinder port A7 and oil from the cylinder flows into the tank through the cylinder port B7.

(4) PBAT position

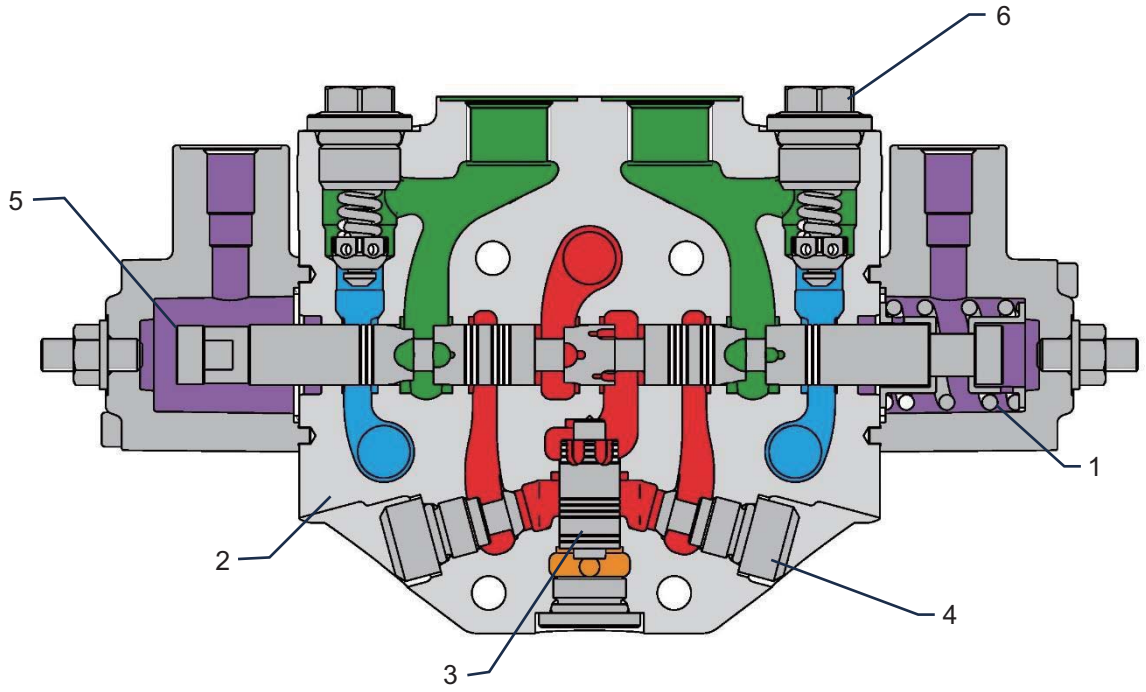




When the pilot pressure is led to the port b7, the oil from the pump flows to the cylinder port B7 and oil from the cylinder flows into the tank through the cylinder port A7.

7) SLICES DESCRIPTION 8 TO 10 : 2 PCS BOOM - AUX 1 - AUX 2

(1) Component description



85A2MC48

Pump

Tank

Pilot oil

Pilot oil drain

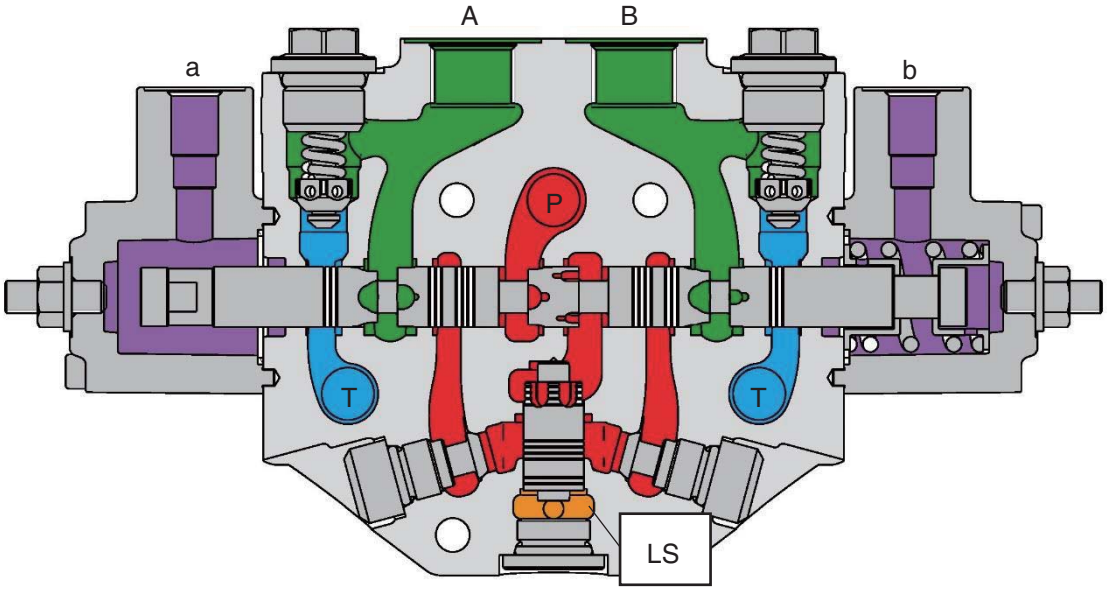
LS Pressure

Consumer

85A2MC43

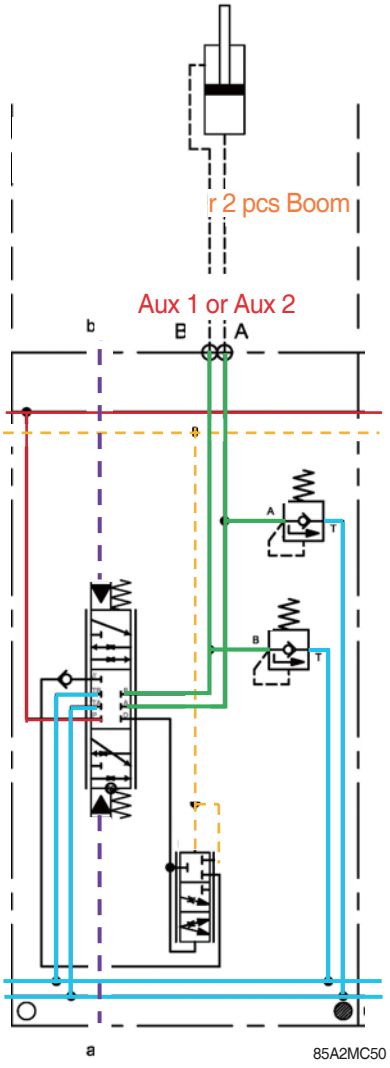
1 Spring pack
2 Housing
3 Pressure compensator
4 Check valves
5 Spool
6 Relief valves

(2) Neutral position



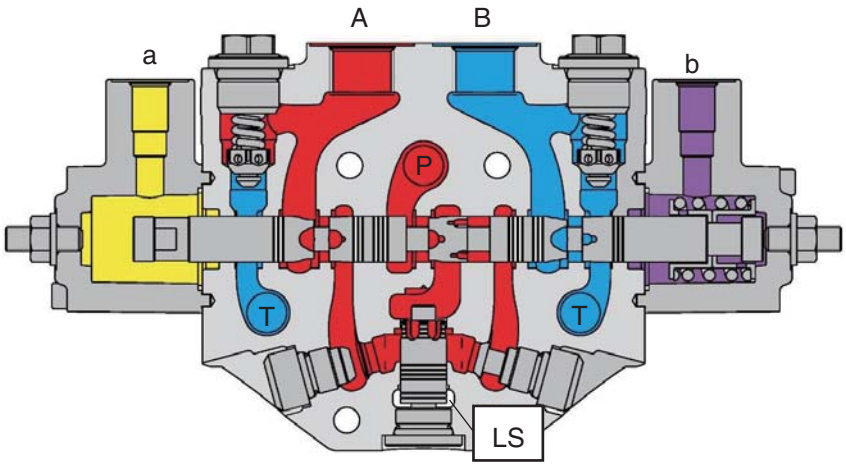
85A2MC49

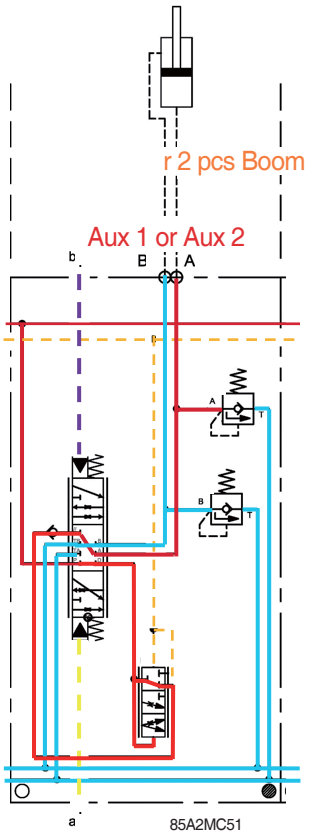
The spool is in neutral position, pump is in low pressure stand-by. The A and B ports are not connected to the pumps nor the tank.



85A2MC50

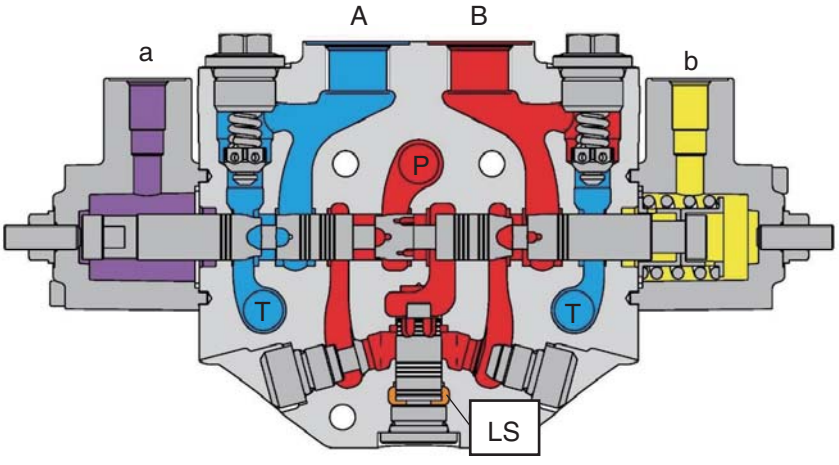
(3) PABT position

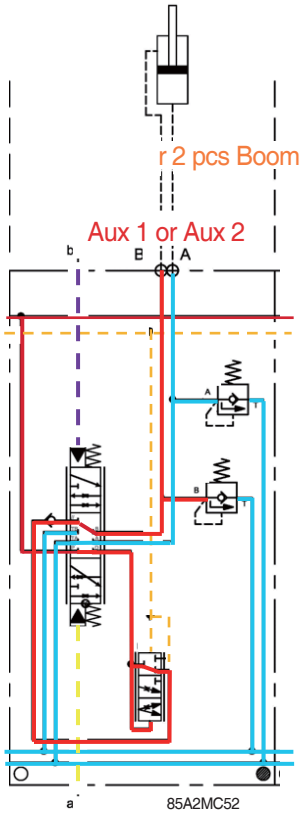




When the pilot pressure is led to the port a, the oil from the pump flows to the cylinder port A and oil from the cylinder flows into the tank through the cylinder port B.

(4) PBAT position

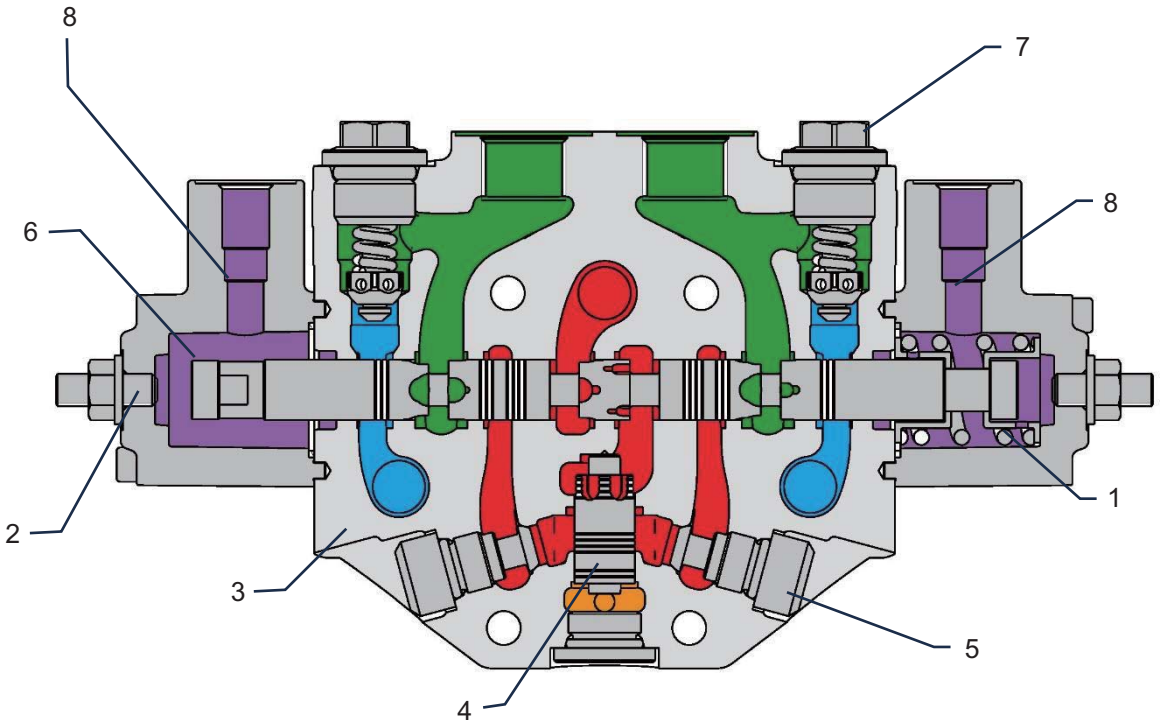




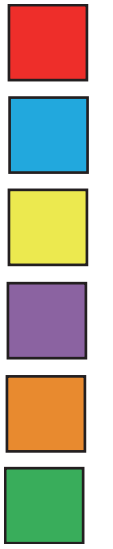
When the pilot pressure is led to the port b, the oil from the pump flows to the cylinder port B and oil from the cylinder flows into the tank through the cylinder port A.

8) SWING SLICE DESCRIPTION

(1) Component description



85A2MC53



Pump

Tank

Pilot oil

Pilot oil drain

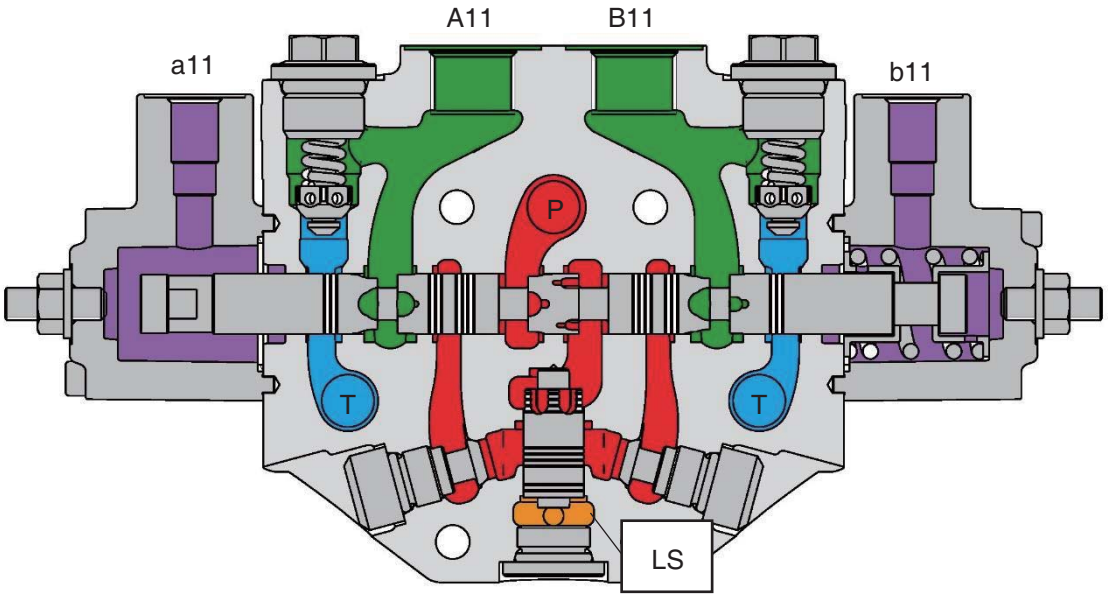
LS Pressure

Consumer

85A2MC43

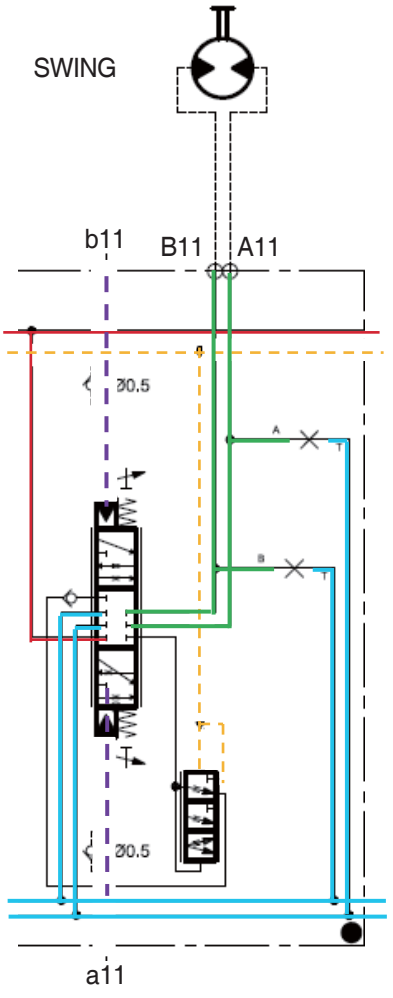
1 Spring pack
2 Stroke limitation device
3 Housing
4 Pressure compensator
5 Check valves
6 Spool
7 Plug
8 Snubbers

(2) Neutral position



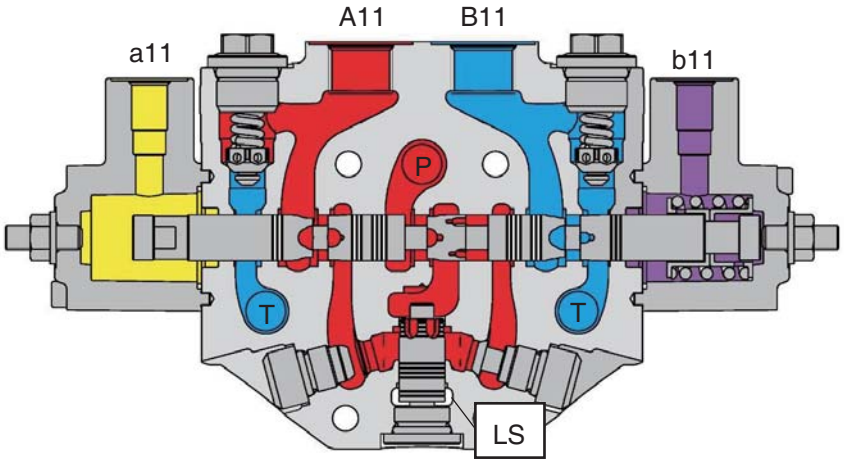
85A2MC54

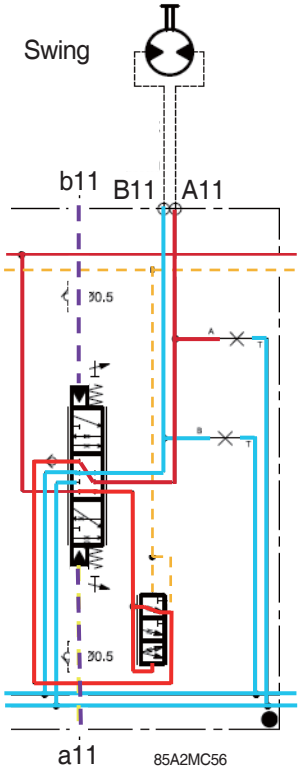
The spool is in neutral position, pump is in low pressure stand-by. The A and B ports are not connected to the pumps nor the tank. This slice is equipped with spool stroke limiters



85A2MC55

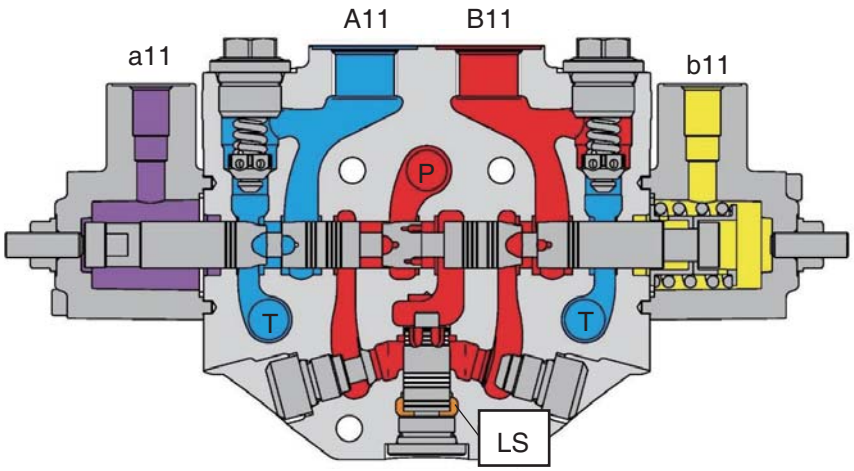
(3) PABT position

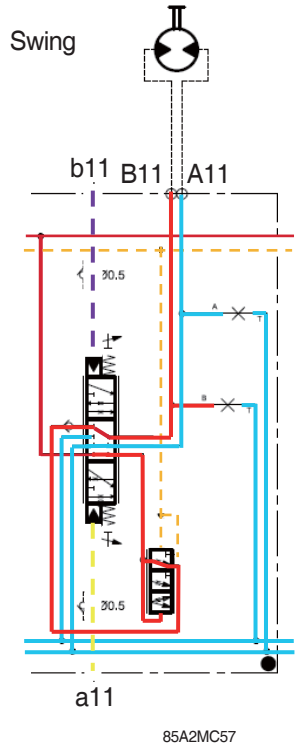




When the pilot pressure is led to the port a11, the oil from the pump flows to the motor port A11 and oil from the cylinder flows into the tank through the motor B11.

(4) PBAT position





When the pilot pressure is led to the port b11, the oil from the pump flows to the motor port B11 and oil from the cylinder flows into the tank through the motor port A11.

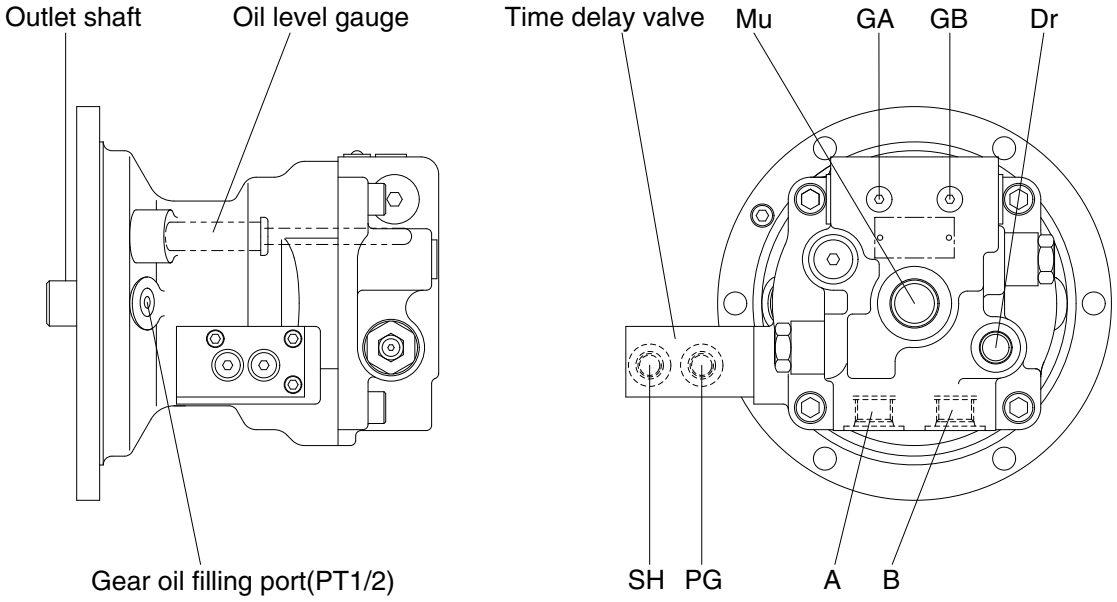
GROUP 3 SWING DEVICE

1. STRUCTURE

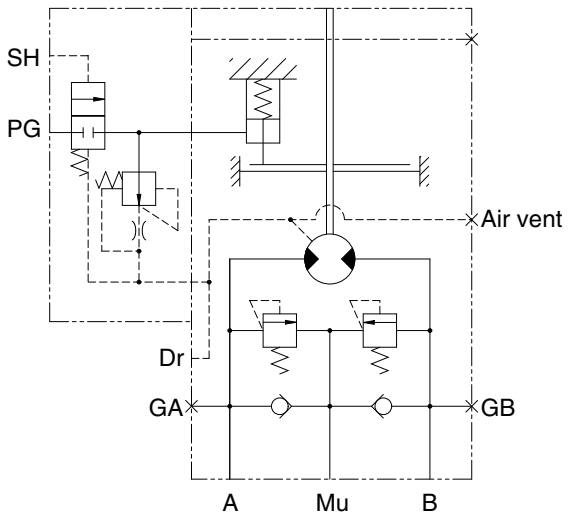
Swing device consists swing motor, swing reduction gear.

1) SWING MOTOR

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

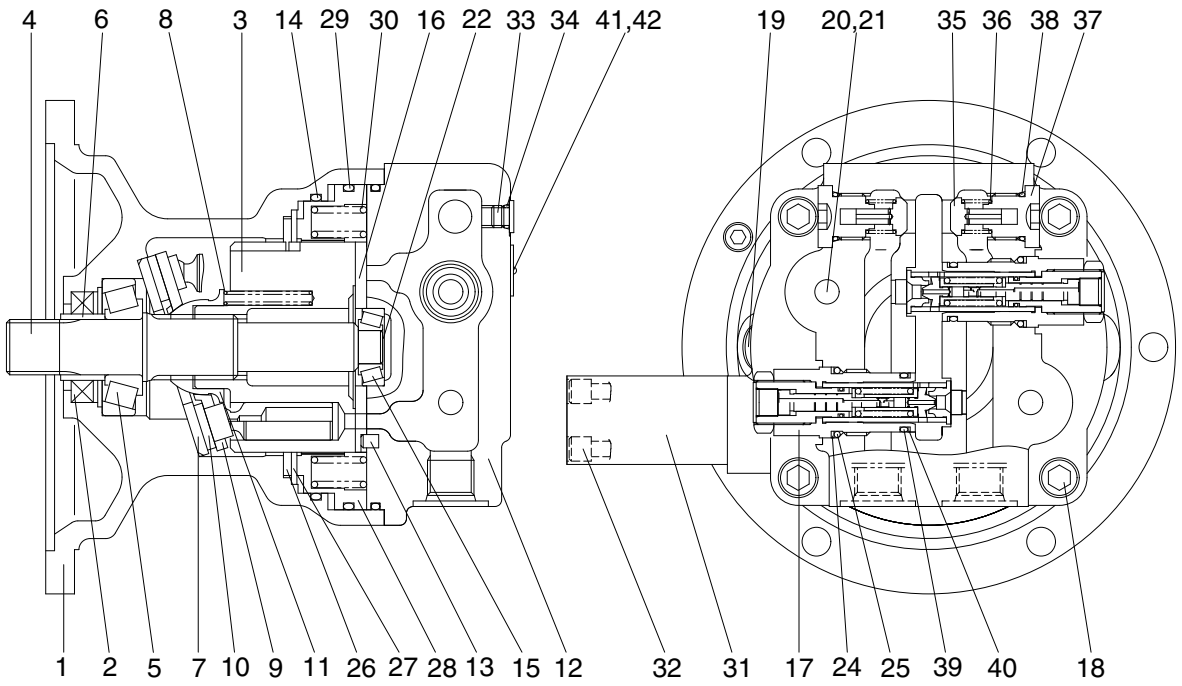


5592SM01



Hydraulic circuit

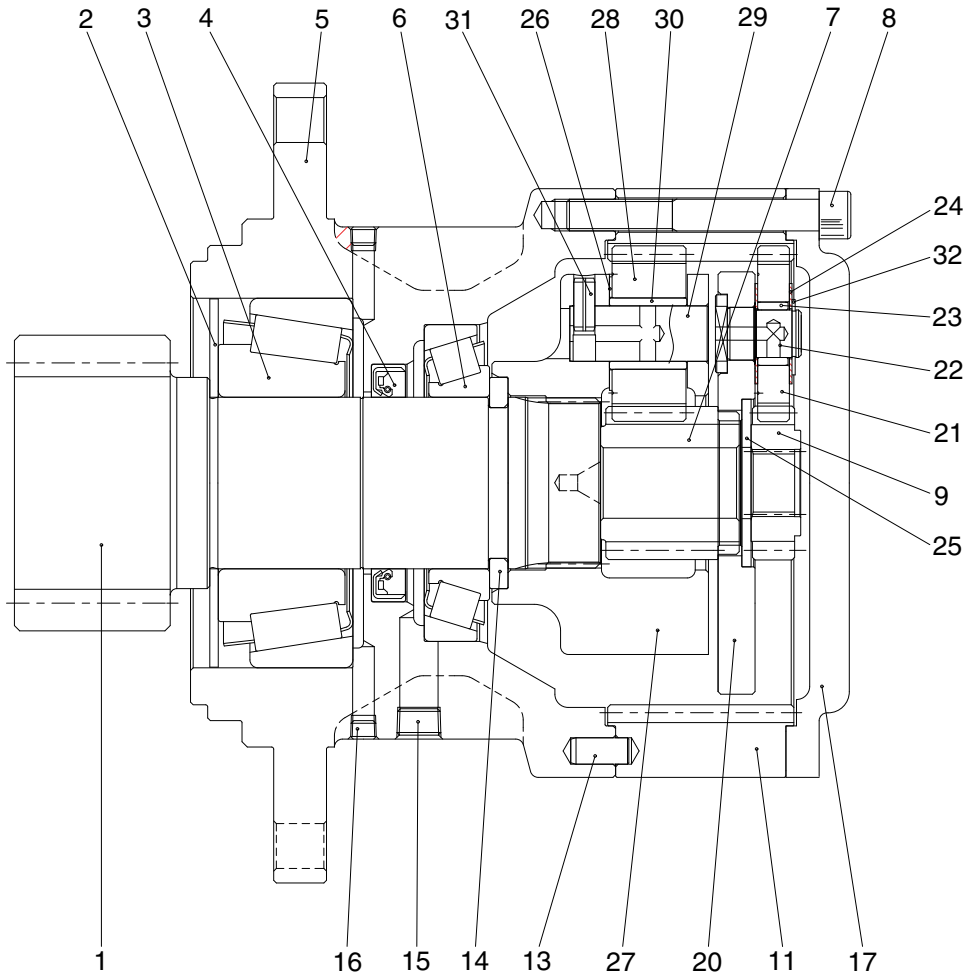
Port	Port name	Port size
A	Main port	SAE PF 1/2
B	Main port	SAE PF 1/2
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
GA,GB	Gauge port	PF 1/4



555K2SM03

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

2) REDUCTION GEAR



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

2. FUNCTION

1) ROTARY PART

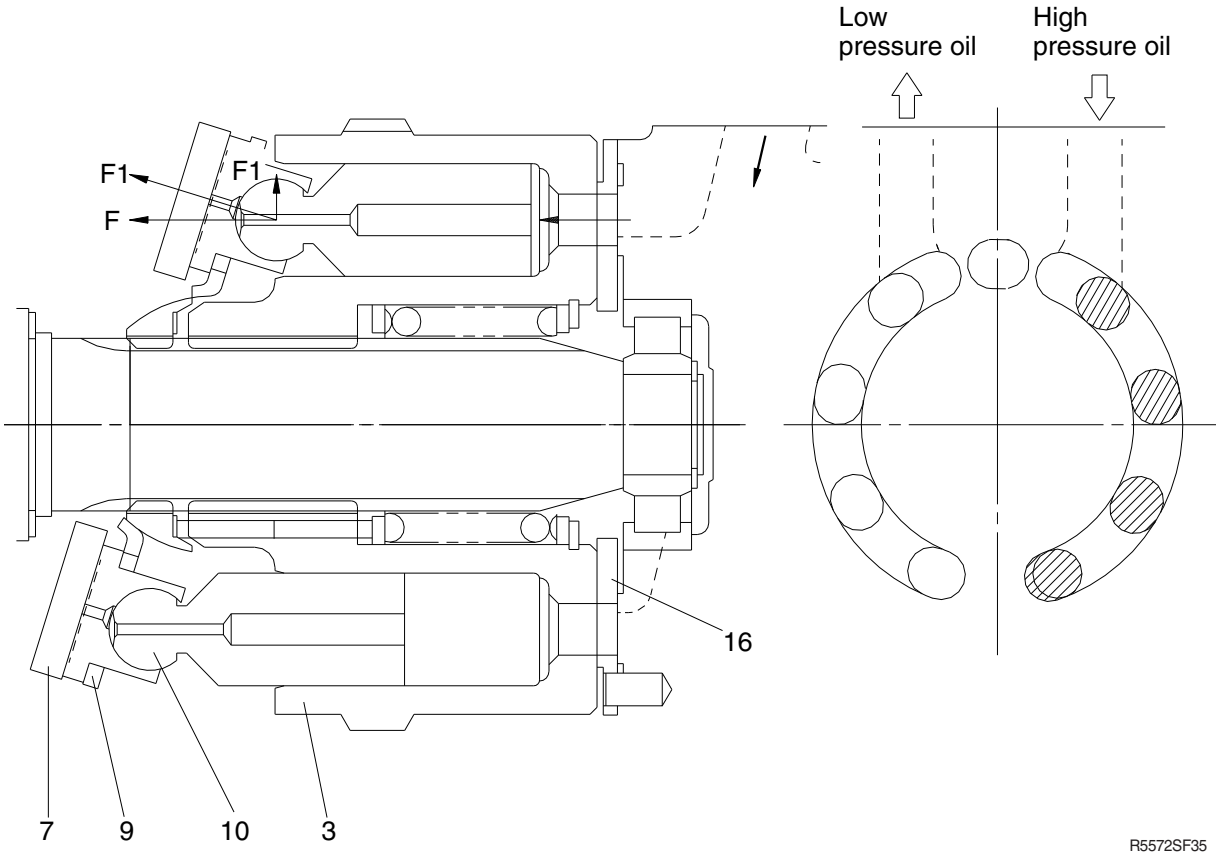
When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force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

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

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

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

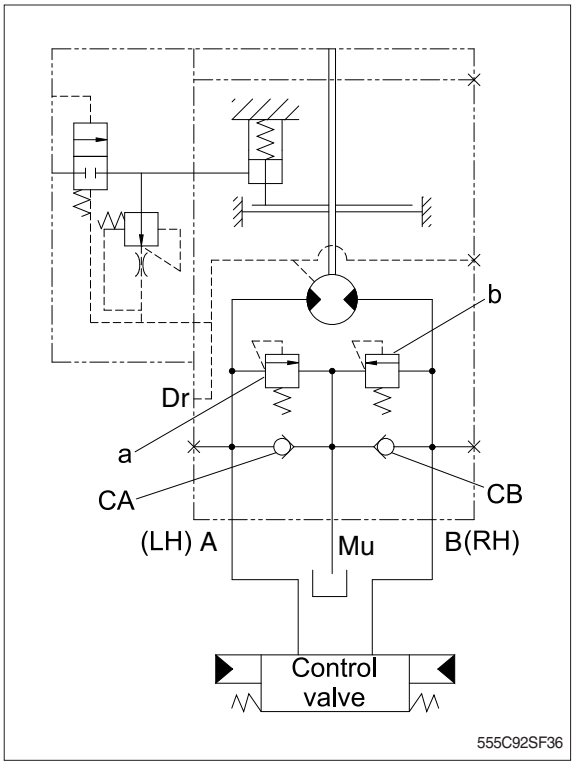
Where p : Effective difference of pressure (kgf/cm^2)
q : Displacement (cc/rev)
T : Output torque ($kgf \cdot cm$)
Z : Piston number (9EA)
A : Piston area (cm^2)
θ : Tilting angle of swash plate (degree)
S : Piston stroke (cm)



2) MAKE UP VALVE

(1) Outline

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



(2) Function

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

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

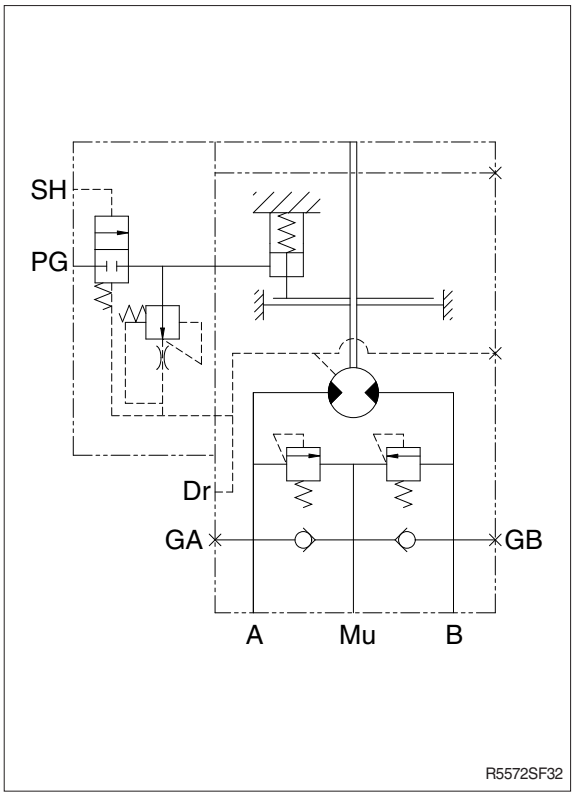
(3) Operation

① When starting swing

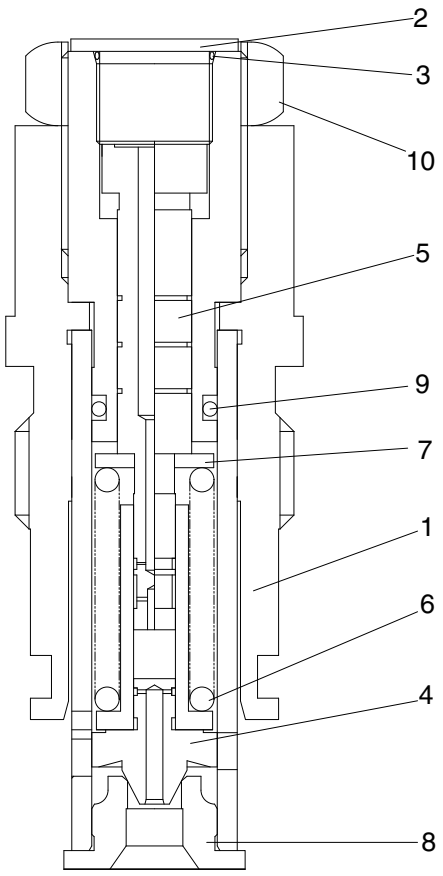
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port B. Because of this, the pressure at port B rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port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

② When stopping swing

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



3) RELIEF VALVE



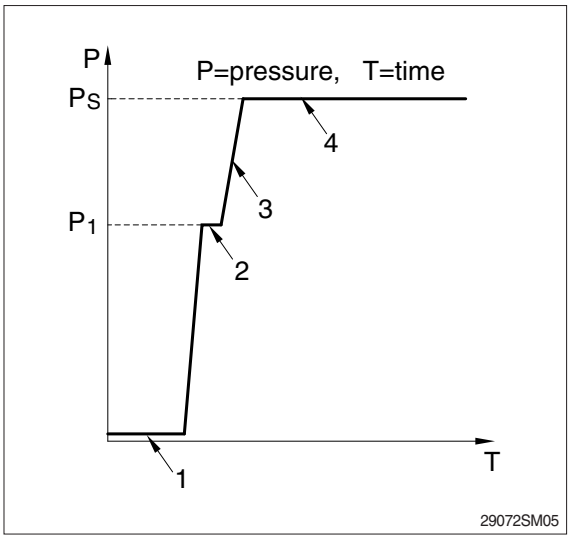
1 Body
2 Plug
3 O-ring
4 Plunger
5 Piston
6 Spring
7 Spring seat
8 Seat
9 O-ring
10 Nut

(1) Construction of relief valve

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

(2) Function of relief valve

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

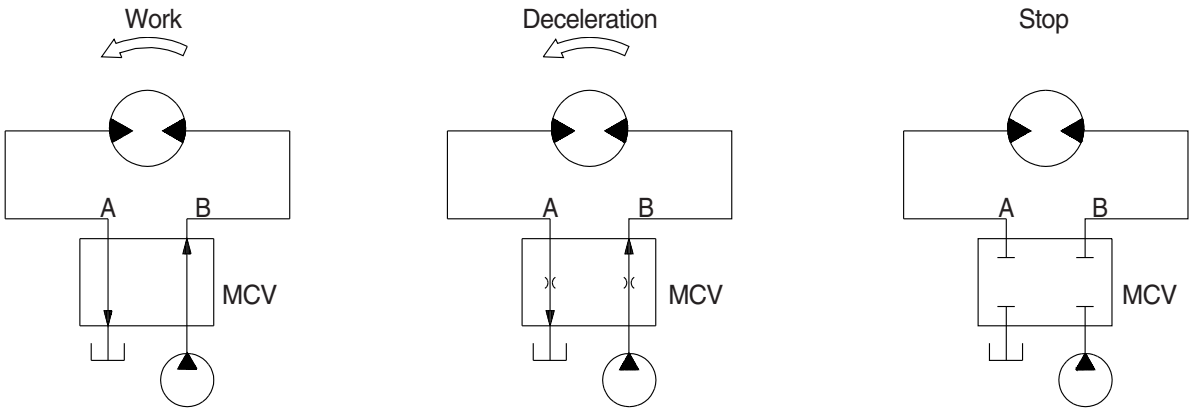


4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



MCV A, B opened | MCV A, B throttled | MCV A, B closed

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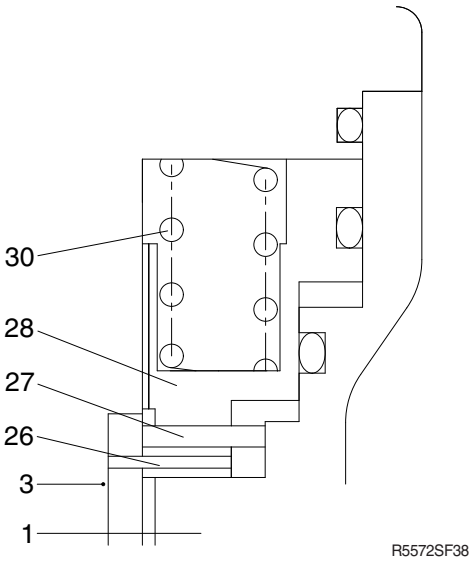
(2) Mechanical swing parking brake system

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

① Brake assembly

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

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



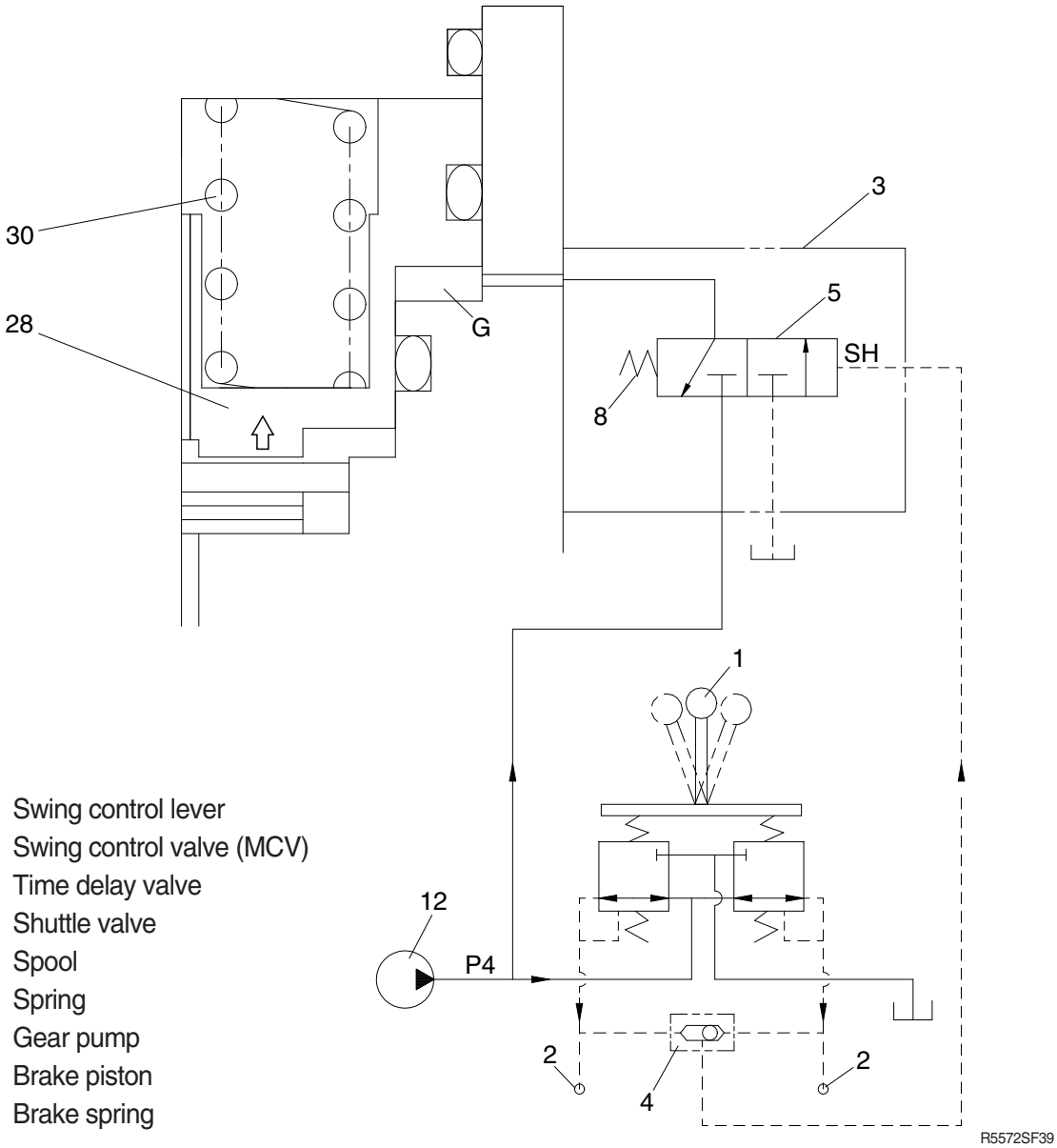
R5572SF38

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

② Operating principle

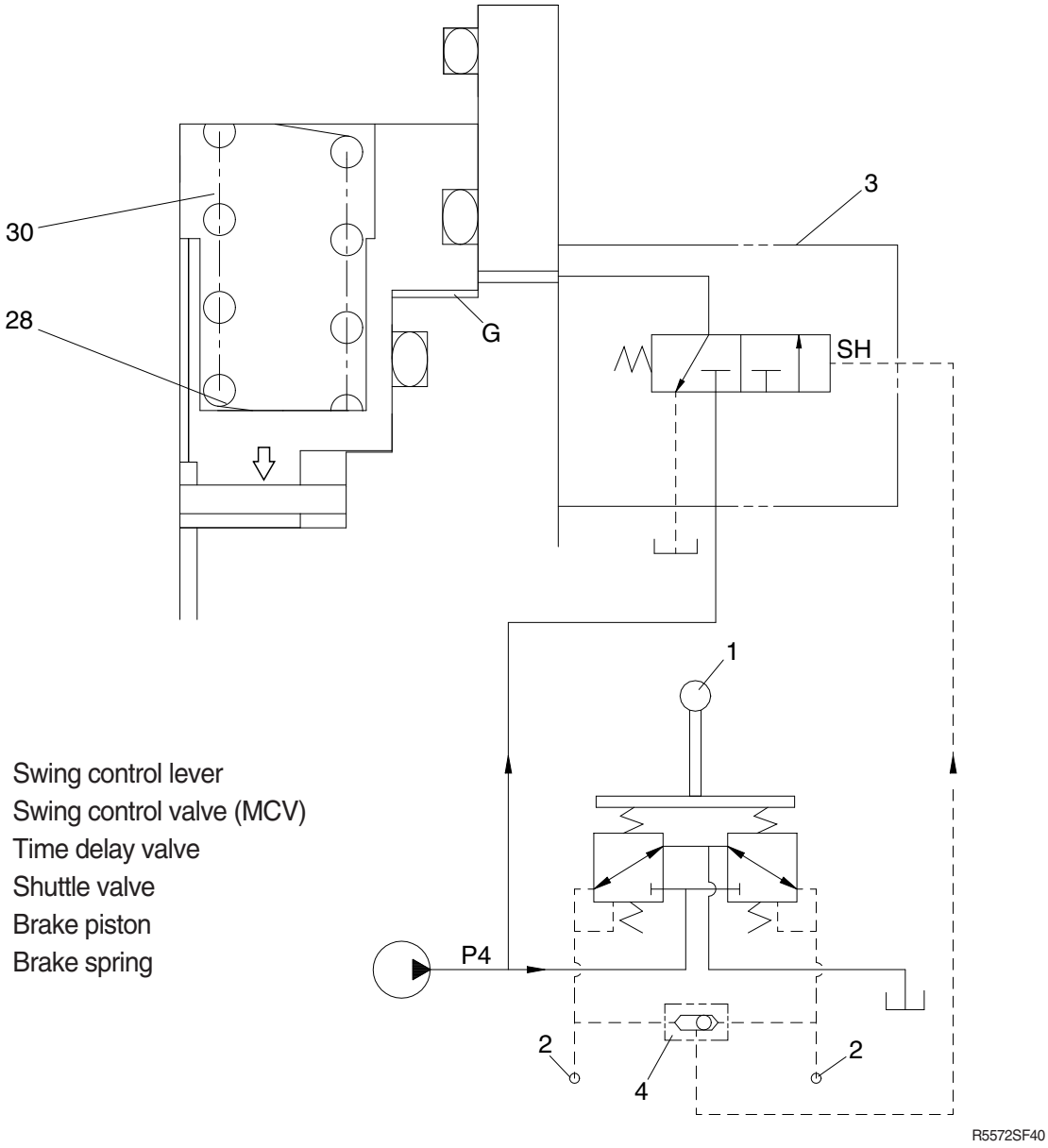
a. When the swing control lever (1) is set to the swing position, the pilot oil go to the swing control valve (2) and to SH of the time delay valve (3) via the shuttle valve (4), this pressure move spool (5) to the leftward against the force of the spring (8), so pilot pump charged oil (P4) goes to the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

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



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

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



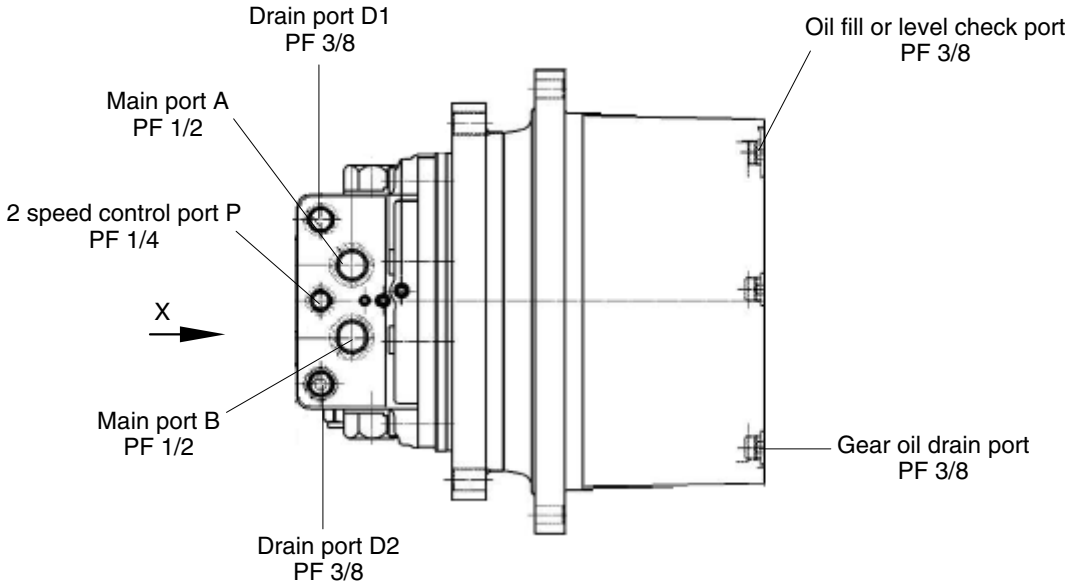
1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
28 Brake piston
30 Brake spring

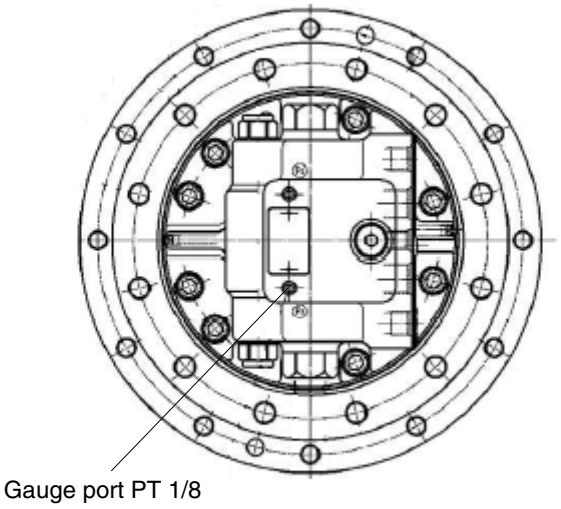
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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

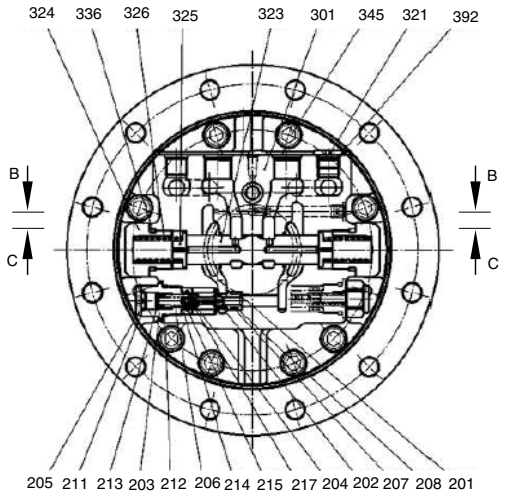




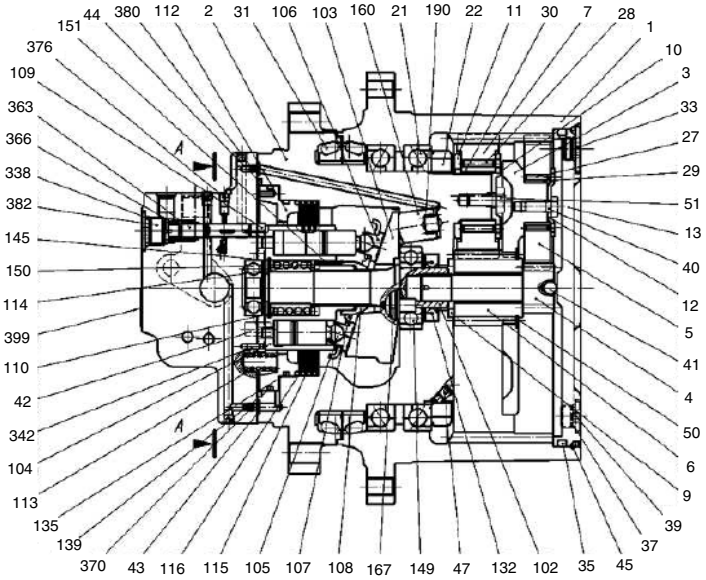
VIEW X

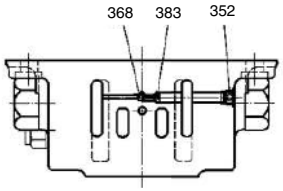
85A2TM01

2) STRUCTURE

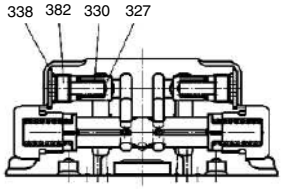


SECTION A-A





SECTION B-B



SECTION C-C

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1	Hub	29	Inner ring	104	Cylinder block	139	O-ring	211	O-ring	324	Plug
2	Spindle	30	Inner ring	102	Shaft	145	Snap ring for hole	212	O-ring	325	Spring retainer
3	Carrier	31	Floating seal	103	Swash plate	149	Ball bearing	213	Shim	327	Valve
4	Sun gear 1	33	Plug	105	Piston	150	Ball bearing	214	Piston	328	Spring
5	Planetary gear 1	35	O-ring	106	Shoe	151	Roller	215	O-ring	330	Spring
6	Sun gear 2	37	O-ring	107	Retainer plate	160	Piston	217	Orifice	336	O-ring
7	Planetary gear 2	39	Plug	108	Thrust ball	167	Pivot	301	Rear flange	338	O-ring
9	Thrust collar 1	40	Hex head bolt	109	Timing plate	170	Spring	323	Spool	342	Parallel pin
10	Thrust washer 1	41	Steel ball	110	Washer	201	Valve seat	352	Hex socket plug	345	Hex socket bolt
11	Thrust washer 2	42	Parallel pin	112	Piston	202	Valve	368	Steel ball	363	Spool
12	Thrust washer 3	43	O-ring	113	Spring	203	Sleeve	375	Hex socket plug	366	Spring
13	Cover	44	O-ring	114	Spring	204	Collar	379	Filter	382	Plug
21	Bell bearing	45	Ring	115	Friction plate	205	Plug	380	Orifice	392	O-ring
22	Ring nut	47	Hex socket set screw	116	Mating plate	206	Spring	383	Plug		
27	Needle roller bearing	50	Retaining ring for shaft	132	Oil seal	207	O-ring	390	Name plate		
28	Needle roller bearing	51	Hex head bolt	135	O-ring	208	Back-up ring	321	Plug		

2. OPERATING DESCRIPTION

1) REDUCTION GEAR

(1) Function

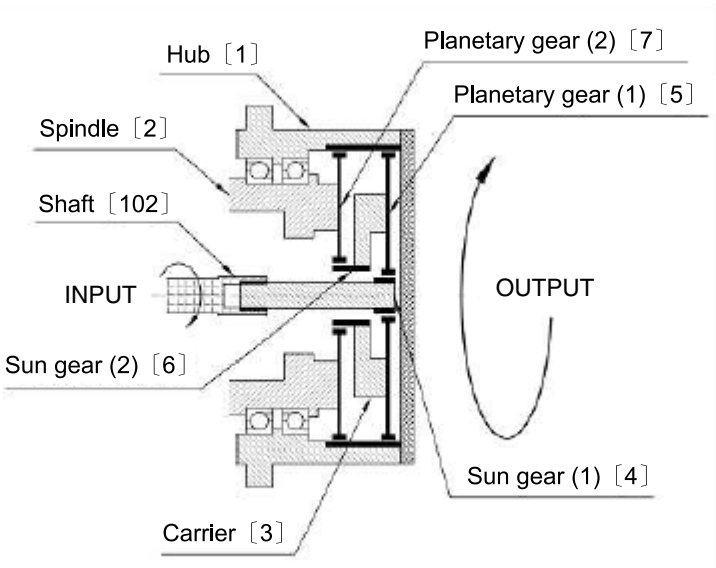
This reduction gear unit is composed of two stage planetary gear mechanism and reduces high speed rotation from hydraulic motor and converts it into low-speed, high-torque rotation.

(2) Operating description

The rotation of the shaft [102] is transmitted to the sun gear (1) [4] of the first stage which is linked with the shaft [102] by the spline. At this time, since the sun gear (1) [4] is meshed with the planetary gears (1) [5], and the planetary gears (1) [5] are also meshed with the hub [1], the planetary gears (1) [5] revolve.

Since the planetary gears (1) [5] are meshed with the carrier [3] and the carrier [3] meshed with the sun gear (2) [6], the revolution of the planetary gears (1) [5] makes the sun gear (2) [6] rotate.

The rotation of the sun gear (2) [6] is transmitted to the hub [1] through the planetary gear (2) [7] fixed by the pillar of the spindle [2]. The rotation of the hub [1] is output rotation.



85A2TM03

2) HYDRAULIC MOTOR (WITH BRAKE VALVE, PARKING BRAKE AND HIGH-LOW 2-SPEED SWITCHING MECHANISM)

(1) Function

① **Hydraulic motor**

This hydraulic motor is a swash-plate-type axial-piston motor.

Converting the force of pressurized oil supplied from a pump into rotary motion.

② **Brake valve**

a. It controls inertia when stopping the hydraulic motor, in order to provide smooth stopping.

b. It prevents cavitation from occurring inside the hydraulic motor.

c. It opens the ports for releasing the parking brake while travelling and closes the ports when stopping.

③ **Parking valve**

With friction-plate-type braking mechanism, the parking brake prevents an excavator from sliding downwards due to gravity when stopping on a slope. It is integrated as a part of the hydraulic motor.

④ **High-low 2-speed switching mechanism**

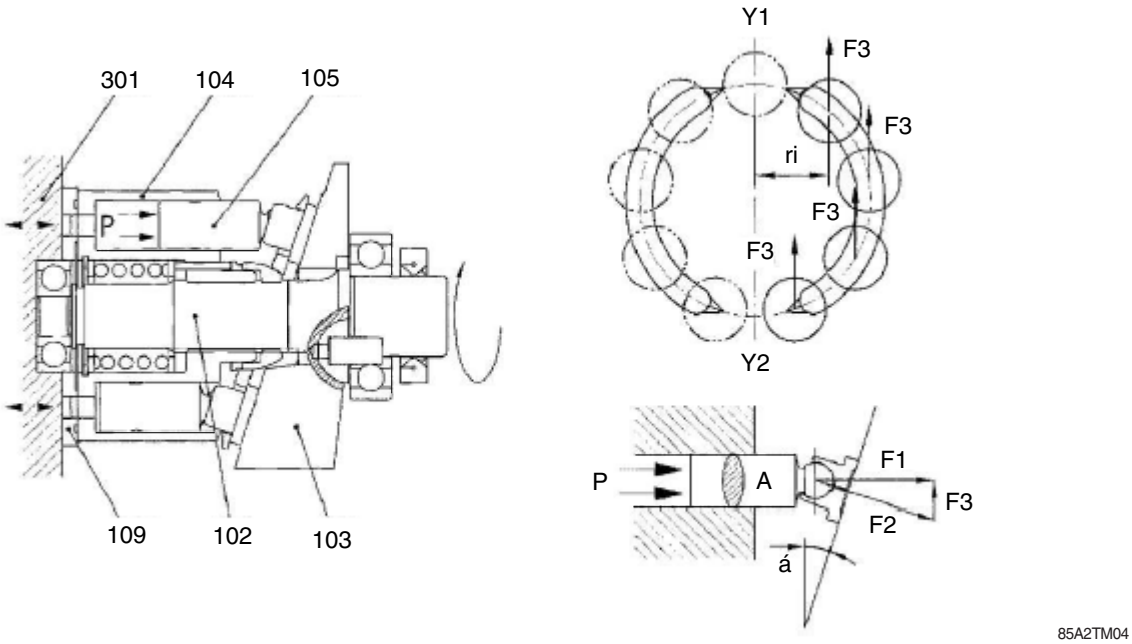
The movements of the switching spool and the control piston adjust an angle of the swash plate, and change the piston displacement in the hydraulic motor.

(2) Operation principle

① **Hydraulic motor**

Pressurized oil from the main port (A) enters the rear flange [301] of the traveling unit, passes through the brake valve and is led into the cylinder block [104] through the timing plate [109]. The oil only enters the cylinder block [104] on either side of axis Y1-Y2 and generates force (F [N] = P [MPa] × A [mm^2]) when it pushes the pistons [105] (4 or 5 pistons).

As the angle of swash plate [103] is fixed at the angle (α °) to the shaft [102] axis, the force generated on the swash plate [103] can be separated into two component forces (F2, F3). Only F3 generates radial force which turns into torque (T=F3×ri). The sum of all torques {T= Σ (F3×ri)} created by pistons [105] turns into rotational force which rotates the cylinder block [104]. As the cylinder block [104] is linked to the shaft [102] with the spline, the shaft [102] rotates and the rotational torque is transmitted.



② Brake valve

The port (A) and Port (B) are the input and output ports for hydraulic oil. The following description assumes that hydraulic oil is fed through port (A). If the oil is fed through port (B), the flow and motion are reversed. The direction of rotation of the motor is also reversed.

a. Normal Operation

Hydraulic oil is fed from the pump to the port (A), causing the hydraulic motor to rotate. The details are as follows.

First, hydraulic oil fed from the pump enters at the port (A) and opens the valve [327]. The oil passes through the valve [327] enters the hydraulic motor through the port (C) and applies rotary force to the hydraulic motor.

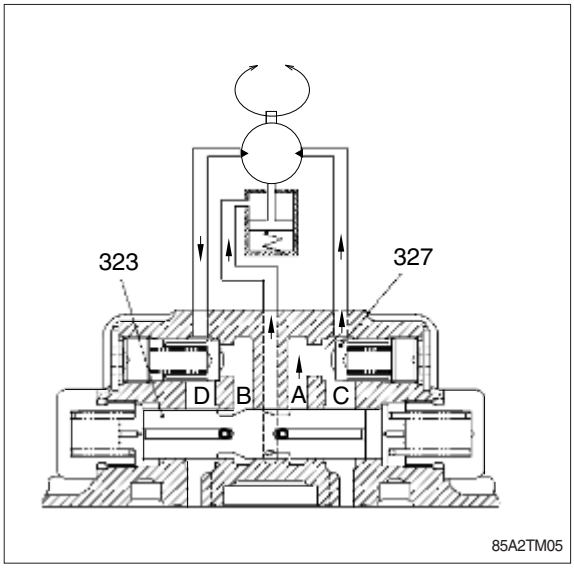
At the same time, the hydraulic oil also passes through the small holes in the spool [323] and through the passage (a) to the chamber (b).

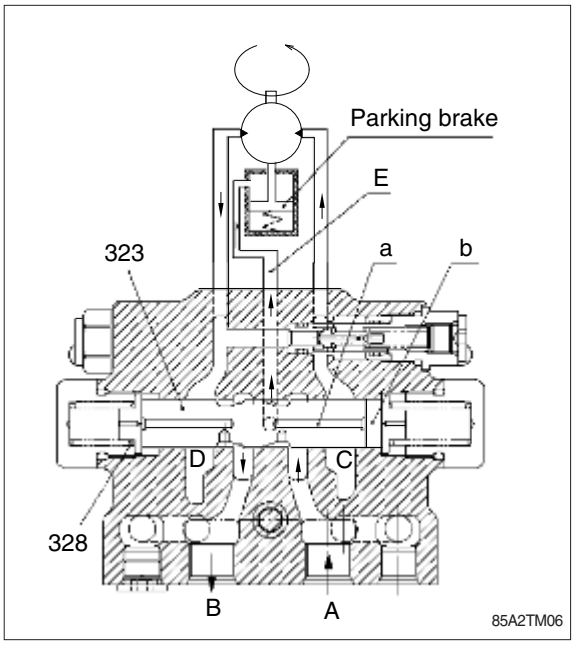
The hydraulic pressure in the chamber (b) causes the spool [323] to move from the central position to the left. At this time a groove in the

spool [323] forms a passage for the hydraulic oil

to pass between the port (D) and port (B). The hydraulic oil ejected from the hydraulic motor flows from the port (D) to the port (B), and the hydraulic motor rotates. The hydraulic oil from the port (B) returns to the oil tank.

Also, as the spool [323] moves to the left, the hydraulic oil enters the port (E). The hydraulic oil at the port (E) flows to the parking brake and the 2-speed switching valve.





b. Stop operation

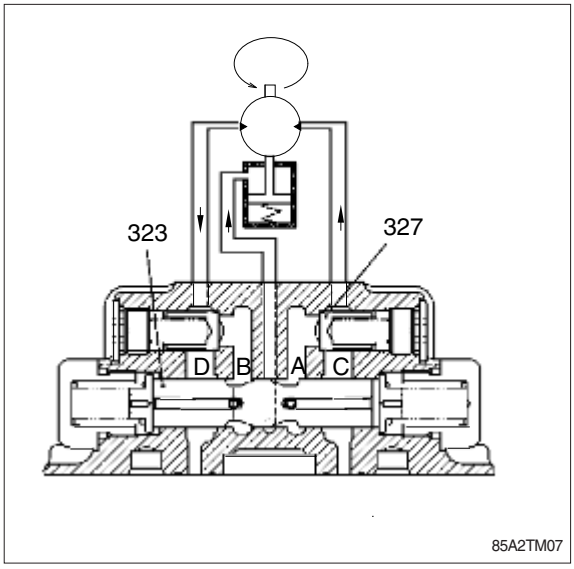
Braking Operation When pressurized oil supplies through the port (A) is suspended while traveling, the hydraulic force to push the spool [323] is lost, and the spool [323] which is slid to the left side, tries to return to the neutral position due to the spring [328] force. At that time, though the oil in the chamber (b) tries to flow out to the port (A) side through the passage (a) in the spool [323], its flow is restricted and the back pressure is generated by throttle effect in the passage (a). As the result, the return speed of the spool [323] is controlled. At the same time, the hydraulic motor tries to rotate with its inertia force even though the pressurized oil is suspended, and the return oil from the hydraulic motor tries to return to the port (B) from the port (D) through the passage formed from the spool groove and rear flange [301].

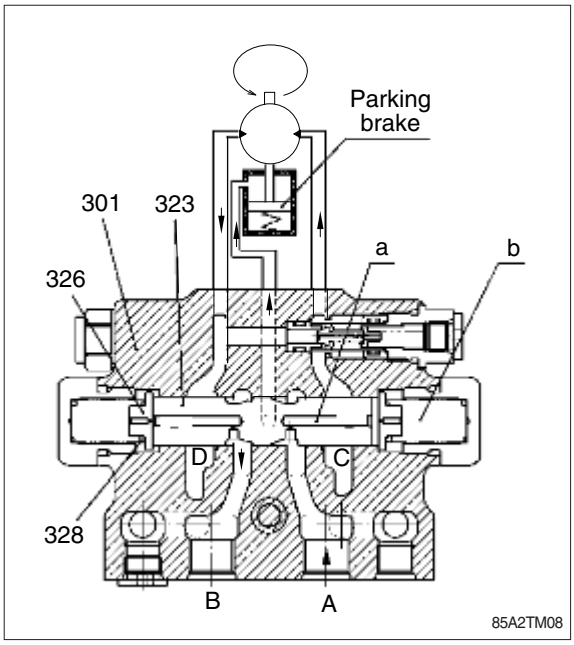
When the spool [323] entirely returns to the neutral position, the passage is completely closed by the spool [323], and the hydraulic motor ceases its rotation. While running, the brake valve smoothly stops rotation of the hydraulic motor which tries to rotate with its inertia force, by means of throttling the return side passage of the hydraulic motor, generating back pressure due to shape of the spool groove and controlling the return speed of the spool [323].

On the other hand, during brake operation, the hydraulic motor tries to rotate with its inertia force and to intake oil by its pumping function.

However, the intake side is closed its passage with the spool [323], oil supply is suspended. This causes cavitation in the hydraulic motor.

To prevent the cavitation, the valve [327] is operated by very slight negative pressure to open the passage of the port (A) side and intake the port (C) of the hydraulic motor.

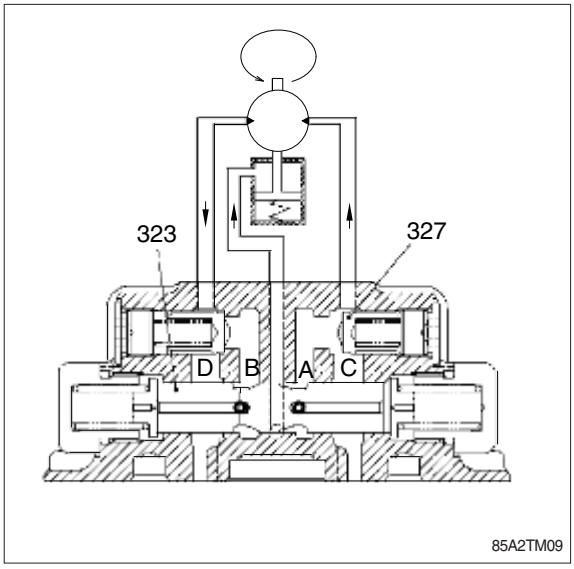


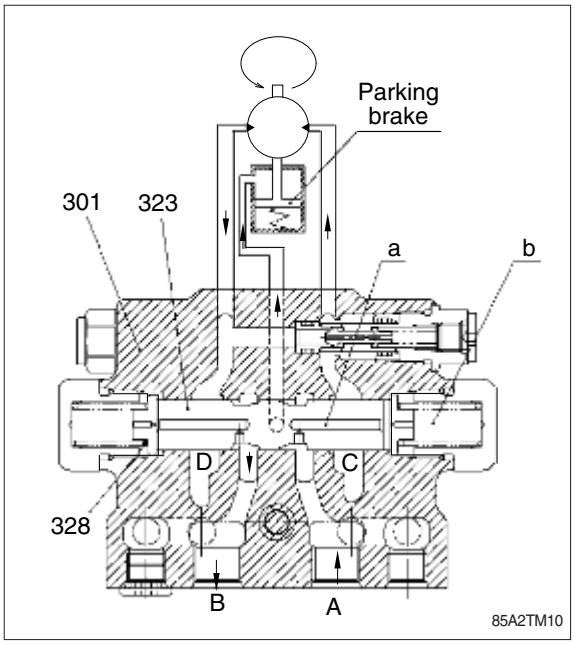


c. Down-hill

When going down-hill, external force acts to accelerate the hydraulic motor. As the result, the pressure at the port (A) and port (C) decrease and the spool [323] tries to return to the neutral position. The movement of the spool [323] reduces the size of flow channel from the port (D) to the port (B) on the output side of the hydraulic motor. This restricts the amount of hydraulic oil ejected from the port (D) to the port (B). At the same time, the pressure at the port (D) (back pressure) increases.

Thus overrunning when going down-hill is prevented by controlling the flow rate and pressure.



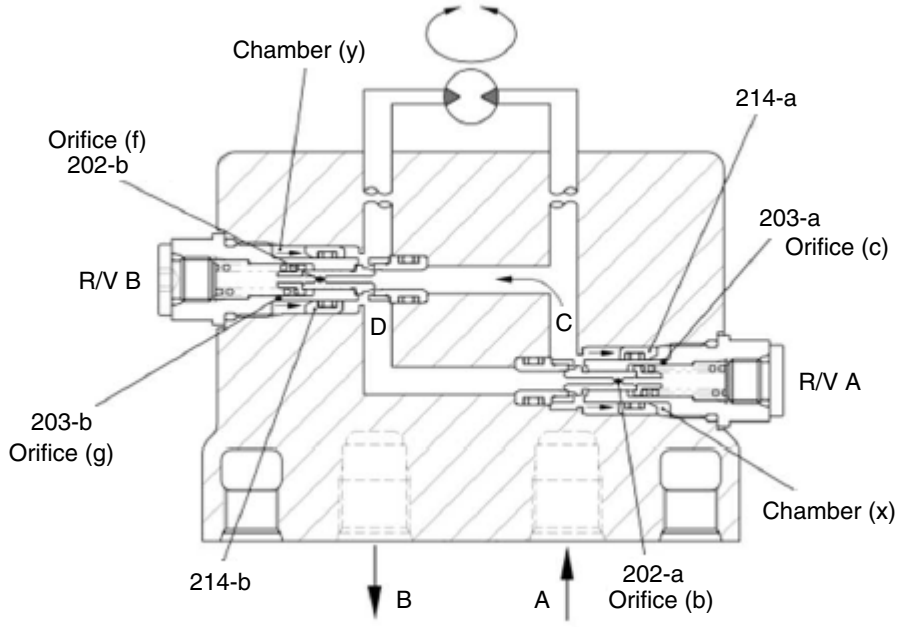


③ Operation description of relief valve

a. Starting

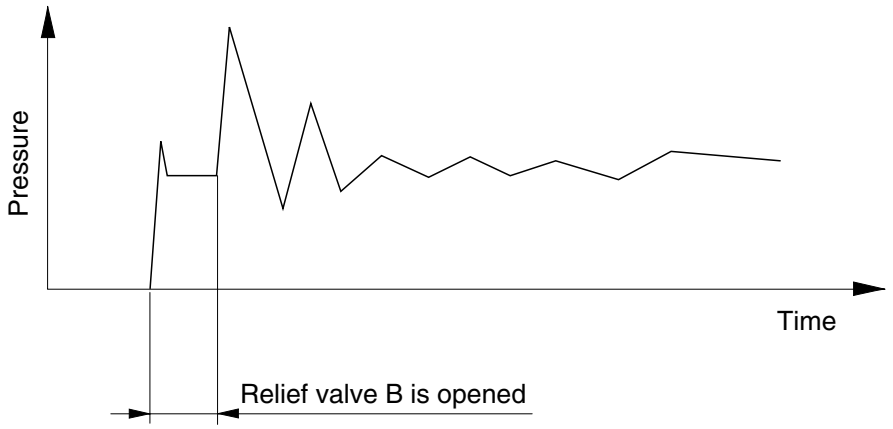
The pressurized oil supplied from the pump is led to the port (C) from the port (A). since the port (C) is connected with the hydraulic motor, the pressurized oil brings rotation to the hydraulic motor. At this time, the valve [202-a] of the relief valve(R/V) “A” is not opened for the pressurized oil of the port (C). The piston [214-a] moves to the stroke end of the direction of the arrow with the pressurized oil. The oil in the chamber (x) is led to the port (D) through the orifice (c) of the sleeve [203-a] and the orifice (b) of the valve [202-a]. The pressurized oil of the port (C) opens the valve [202-b] (b) of the relief valve “B” with set pressure, and the pressurized oil is led to the port (D). The pressurized oil from the port (C) is also led to the chamber (y) through the orifice (f) of the valve [202-b] and the orifice (g) of the sleeve [203-b]. When the piston [214-b] doesn’t reach the stroke end due to previous stopping condition, the piston [214-b] moves to the stroke end by the pressurized oil from the port “C” After the piston [214-b] reaches the stroke end, the pressure between the orifice (f) of the valve [202-b] and the orifice (g) of the sleeve [203-b] rises. Cracking pressure of the valve [202-b] turns into more than the system pressure of the excavator and the valve [202-b] is closed.

The pressure of the port (C) rises by operation of the relief valve(R/V) “A” and “B”, and the hydraulic motor can obtain torque.



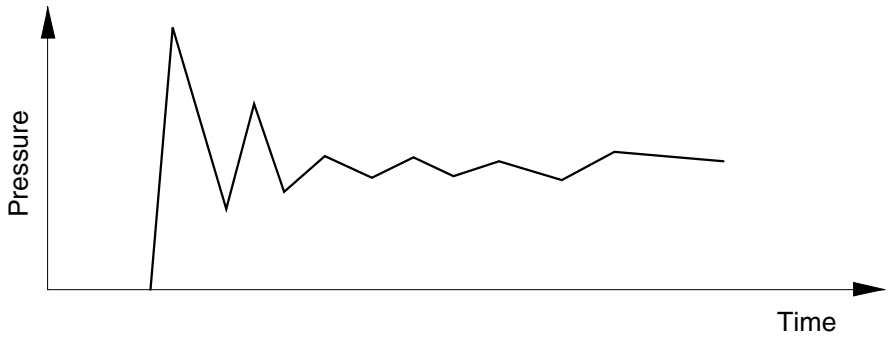
85A2TM11

The pressure of the port (C) at starting is as follows.



85A2TM12

When the piston [214-b] position has reached the stroke end due to the just before the stopping condition, the valve [202-b] of the relief valve (R/V) “B” is not opened.
The pressure of the port (C) in this case is as follows.



85A2TM13

The pressure of the port (C) at starting depends on the piston [214-b] position.

※ When the pressurized oil supplied from the pump is led to the port (D) from the port (B), operation explanation becomes what replaced the relief valve (R/V) “A” and relief valve (R/V) “B”.

b. Stopping

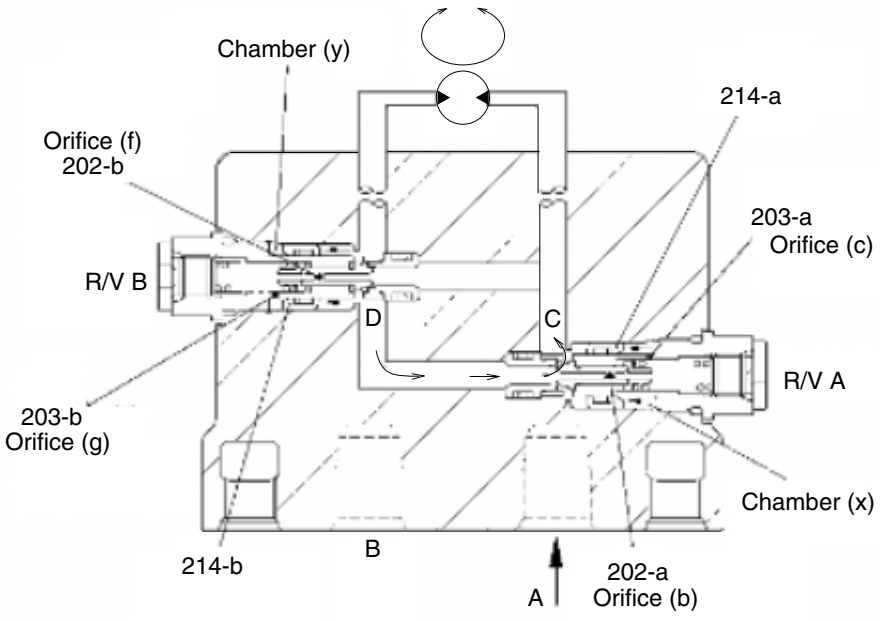
When the pressurized oil from the port “A” is suspended. The spool [323] tries to return to the neutral position and the pressure of the port “D” increases because the hydraulic motor tries to rotate with its inertia.

The pressurized oil of the port (D) is led to the chamber (x) through the orifice (b) of the valve [202-a] and the orifice (c) of the sleeve [203-a]. The piston [214-a] moves to the stroke end of the direction of the arrow with the pressurized oil led to the chamber (x). While the piston [214-a] is moving, the pressure in the chamber (x) does not rise. The pressurized oil of the port (D) opens the valve [202-a] of the relief valve (R/V) “A” with set pressure, and the pressurized oil flows into the port (C). (Pressure while the piston [214-a] is moving to the stroke end. : Primary relief pressure)

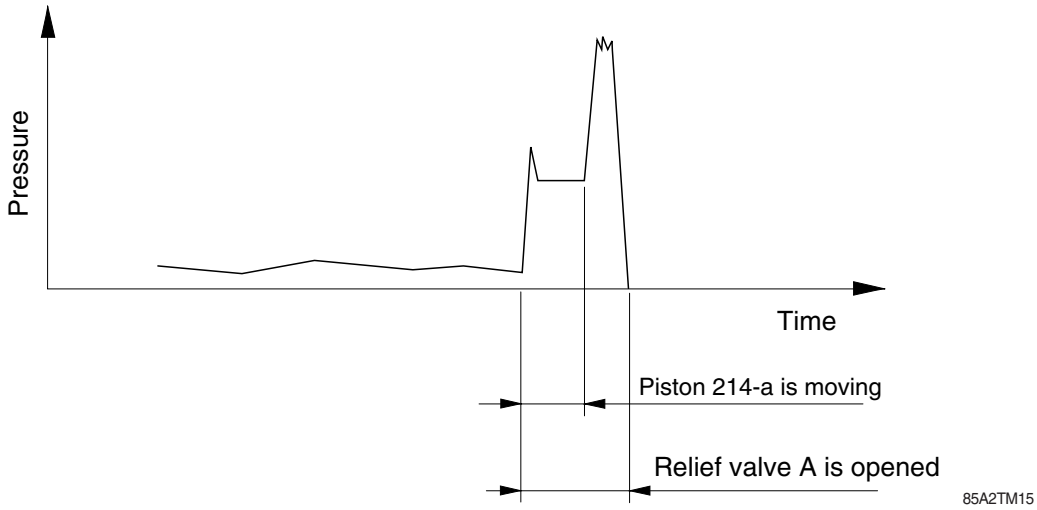
The pressure of the port (D) is controlled by operation of the relief valve (R/V) “A”, and cavitation is prevented by supplying oil to the port (C).

When the piston [214-a] reaches the stroke end, the pressure of the chamber (x) and the pressure between the orifice (b) of the valve [202-a] and the orifice (c) of the sleeve [203-a] rises, and the valve [202-a] is closed. At this time, the pressure when the valve [202-a] opens exceeds the system pressure of the excavator. (Pressure at the time of the completion of the piston move: Secondary relief pressure)

The piston [214-b] of the relief valve (R/V) “B” moves to the direction of the arrow with the pressurized oil of the port (D). The oil of the chamber (y) is led to the port (C) through the orifice (g) of the sleeve [203-b] and the orifice (f) of the valve [202-b].



The pressure of the port (D) at stopping is as follows.



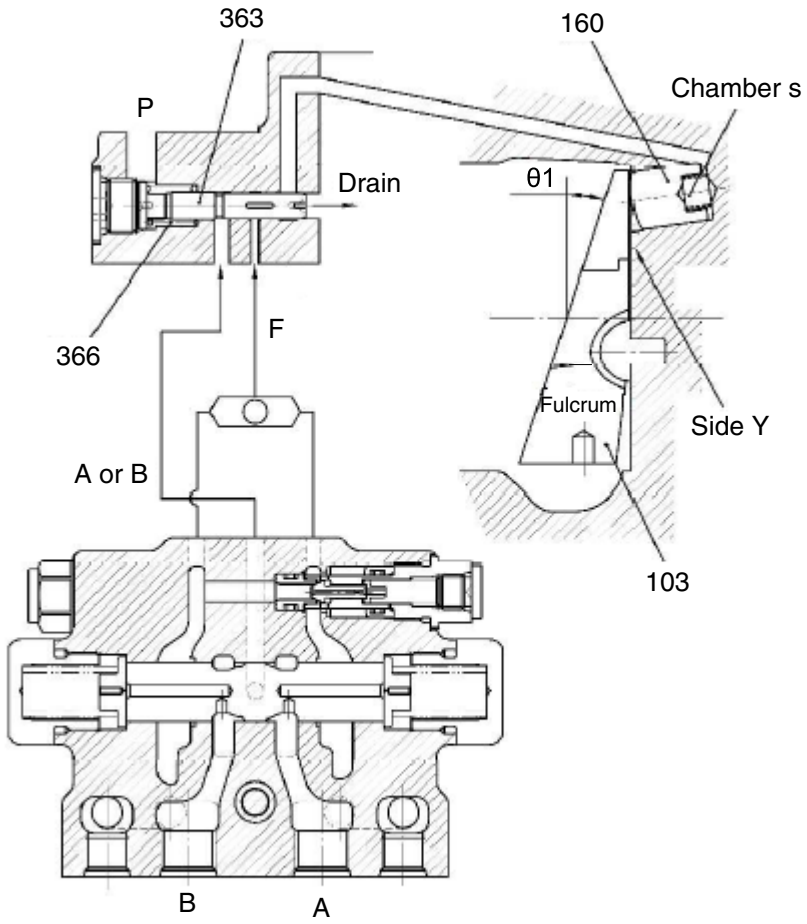
Pressure while the piston is moving to the stroke end : Primary relief pressure
Pressure at the time of completion of the piston move : Secondary relief pressure

④ High-low 2-speed switching mechanism

a. Low Speed

When the pilot pressure is not provided from the port (P), the traveling unit is low speed mode. At this time, the spool [363] is pressed to the left side by the force of the spring [366], the pressurized oil supplied from the port (F) is shut off, and the oil in the chamber (s) is released into the drain (motor case) through the spool [363].

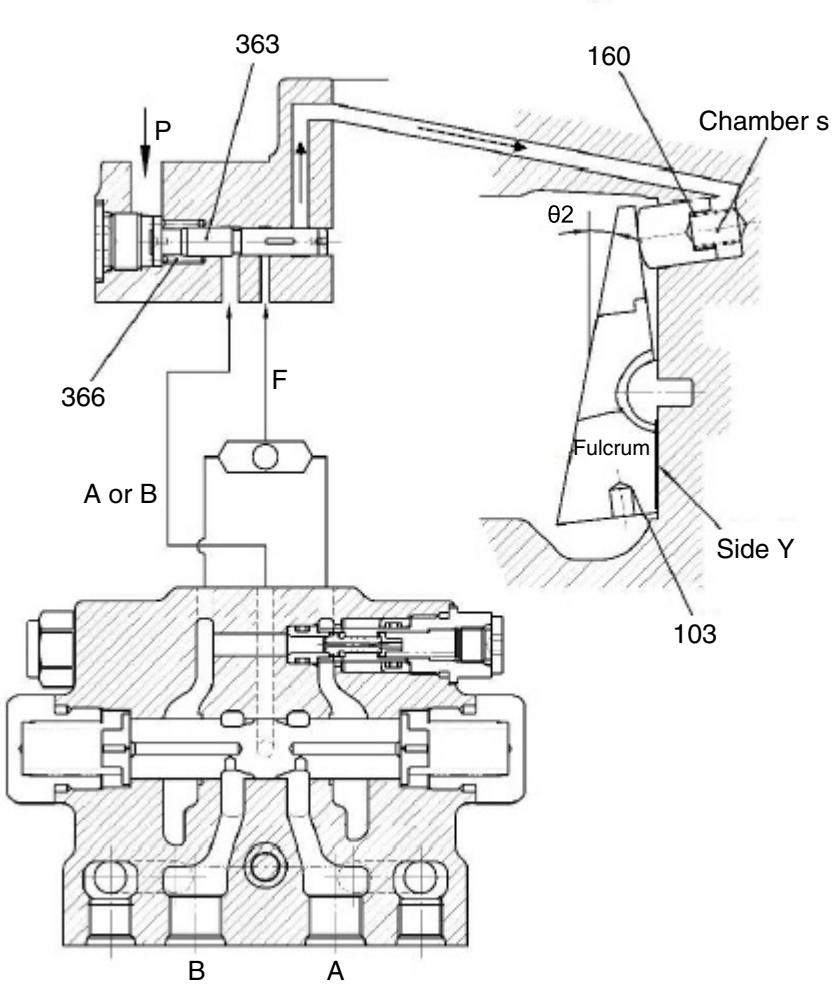
Since the force of the piston [160] is small, the swash plate [103] is parallel to side (Y). At this time, the swash plate [103] is tilted at the maximum angle (θ 1), thus leading to low speed operation.



b. High speed

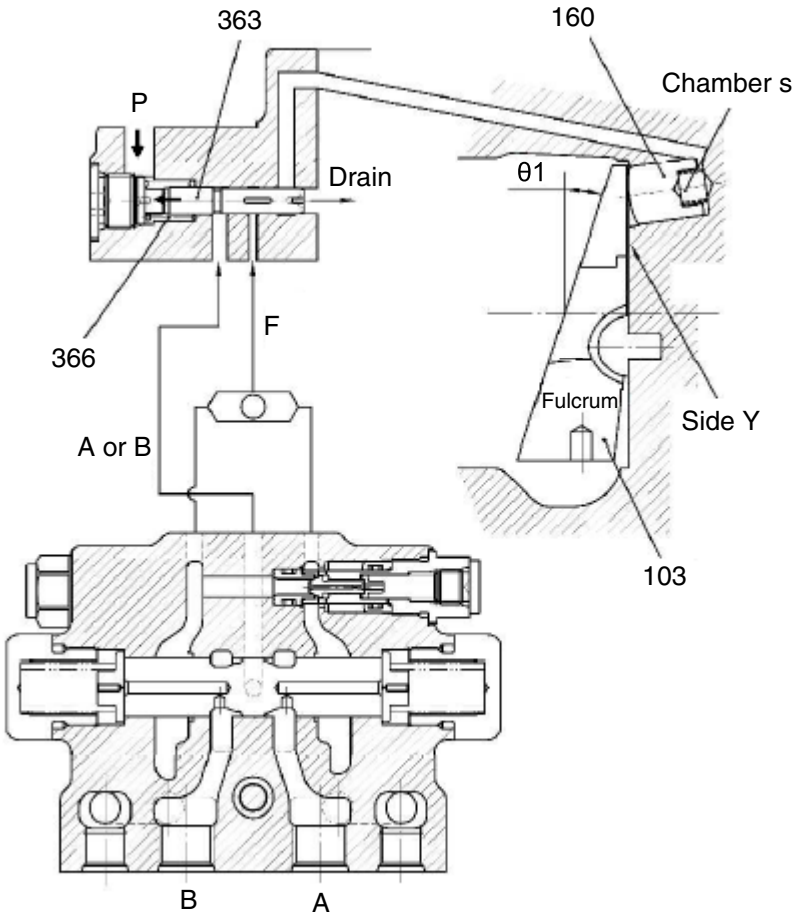
When the pilot pressure is supplied to the port (P), the traveling unit is high speed mode. At this time, the pressure overcomes the force of the spring [366] and spool [363] is slid to the right side. The pressurized oil supplied from the port (F) is then led to the chamber (s) through the spool [363].

Since the force that works to the swash plate [103] is increased by the pressurized oil of the chamber (s), the piston [160] pushes the swash plate [103] until the swash plate [103] touch on the side (x). At this time, the swash plate [103] is tilted at the minimum angle (θ 2), thus leading to high-speed operation.



c. Automatic switching from high speed to low speed

As the load on the hydraulic motor increases, the pressure at the port (A) or (B) also Increases. While operating at the high speed mode, when the pressure at the port (A) or (B) reaches the setting pressure, the spool [363] is pressed leftwards. From this point, the operation is as described for ' Low Speed mode '. The force that works to the swash plate [103] from the piston [160] is decreased, and the hydraulic oil of the chamber (s) is led to drain (motor case) through the spool [363]. The swash plate [103] touches on the side (Y). At this time, the swash plate [103] is tilted at the maximum angle (θ 1). Thus in this state the hydraulic motor has the maximum displacement with low rotary speed.



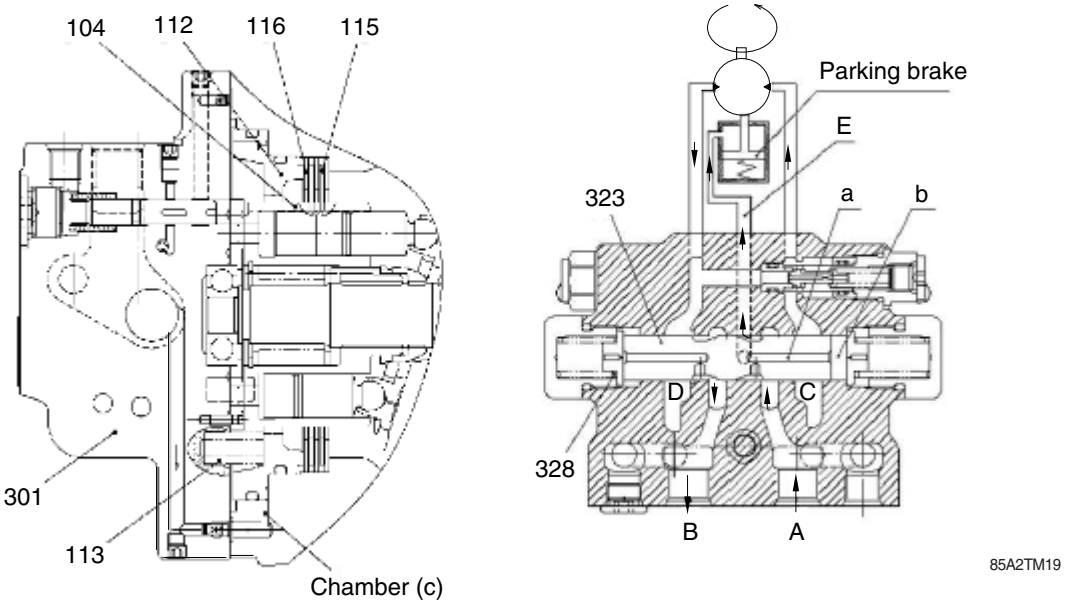
85A2TM18

⑤ Parking brake

a. Traveling

When hydraulic oil is fed from the pump to the port (A) or port (B), causing the spool [323] to move to the left or right. The movement of the spool [323] opens the port (E). The hydraulic oil is fed from the port (E) to the chamber (c). When the pressure increases more than the force of the springs [113], the piston [112] moves in the direction of the rear flange [301]. As the result, the force from the piston [112] onto the mating plates [116] and friction plates [115] lose, and the friction plates [115] are relieved from the fixing.

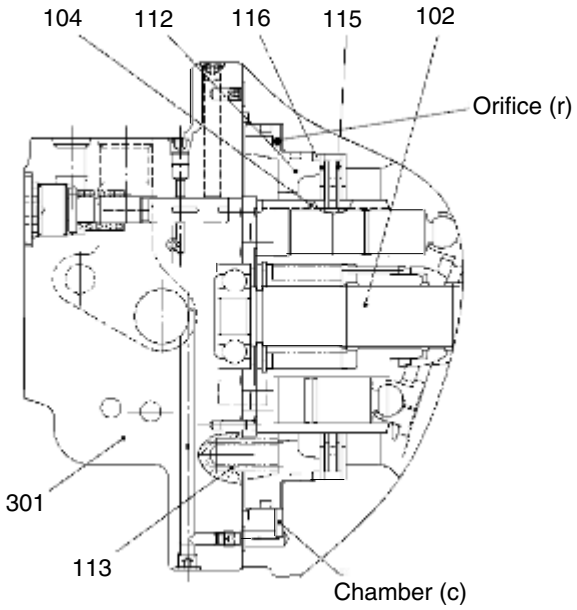
Since the friction plates [115] linked with the cylinder block [104], the braking force of the cylinder block [104] is released, and the hydraulic motor is able to rotate freely.



b. Stopping

When hydraulic oil fed from the pump to the port (A) or port (B) stops, the spool [323] moves to the neutral position and closes the port (E).

While the spool is returning to the neutral position, the pressurized oil in the chamber (c) is being drained to not only the port (A) or (B) but also to the drain (motor case) through the orifice (r). As the result, the pressure in the chamber (c) falls. When this pressure falls below the release pressure of the parking brake, the hydraulic force on the piston [112] becomes less than the force of the springs [113]. The springs [113] cause the piston [112] to press the mating plates [116] and friction plates [115]. The action creates the friction that serves as the braking force. Since the friction plates [115] are linked with both the cylinder block [104] and the shaft [102], the brake torque is applied to the hydraulic motor while stopped.

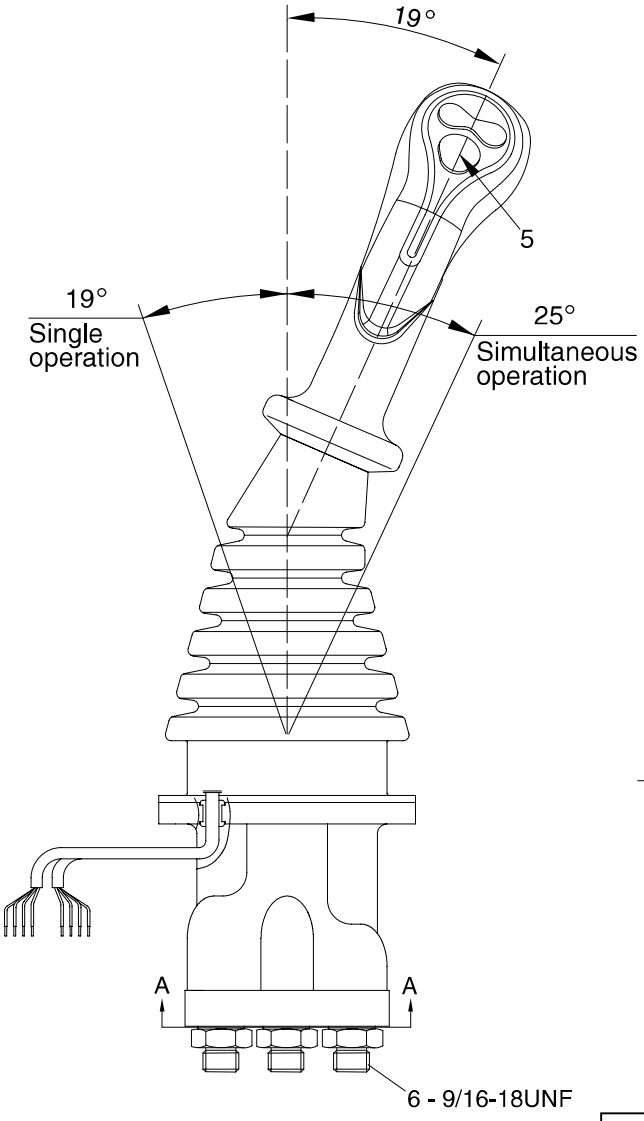


※ If torque exceeding the parking brake torque acts from the outside, the traveling unit will rotate.

GROUP 5 RCV LEVER

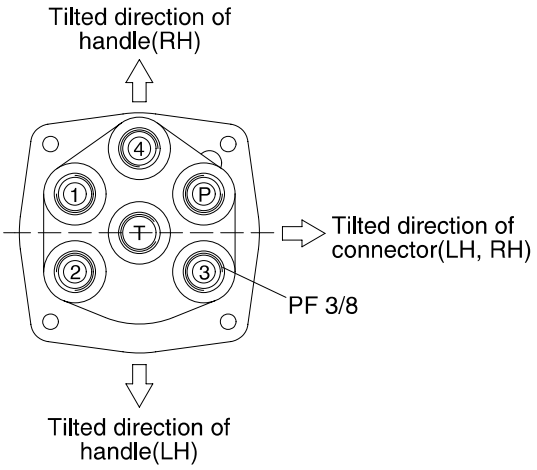
1. STRUCTURE

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.



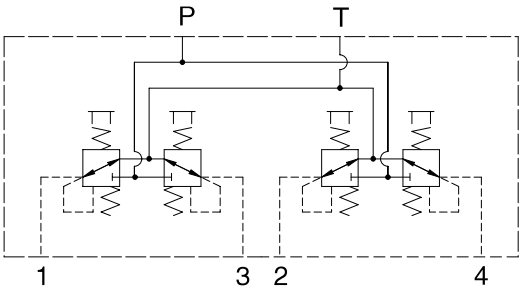
Switches

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	

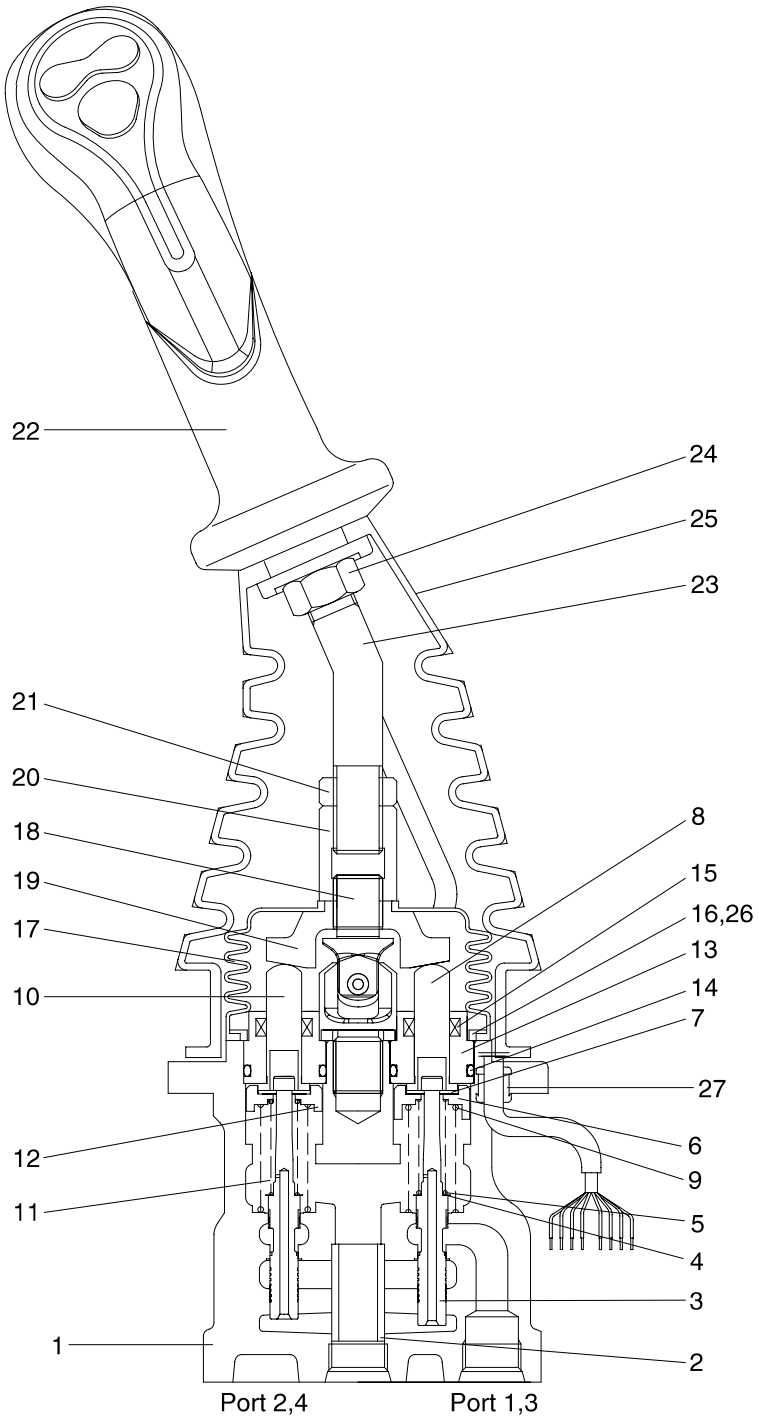
CROSS SECTION

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



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.

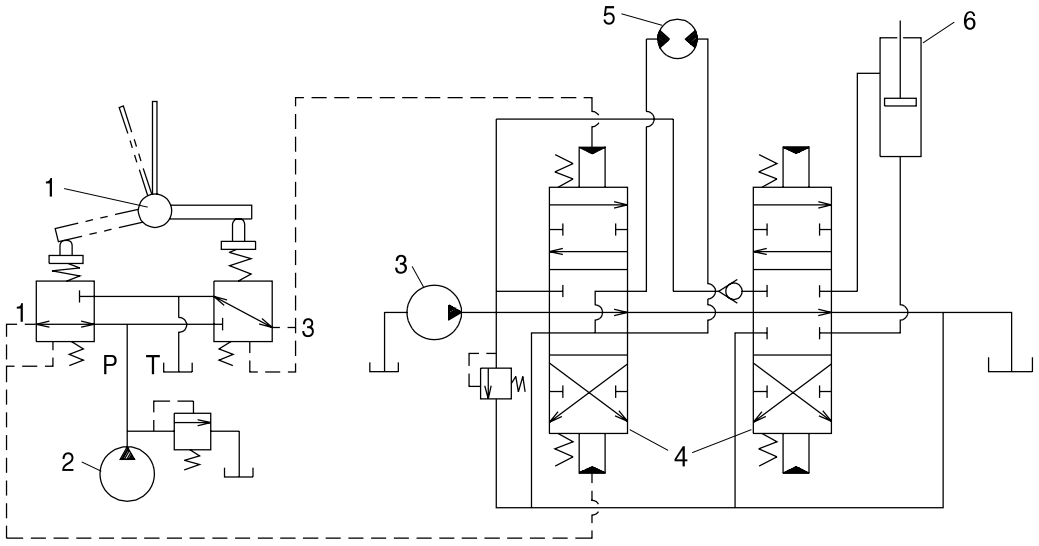
The spring (9) works on the case (1) and spring seat (6, 12) and tries to return the push rod (8,10) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

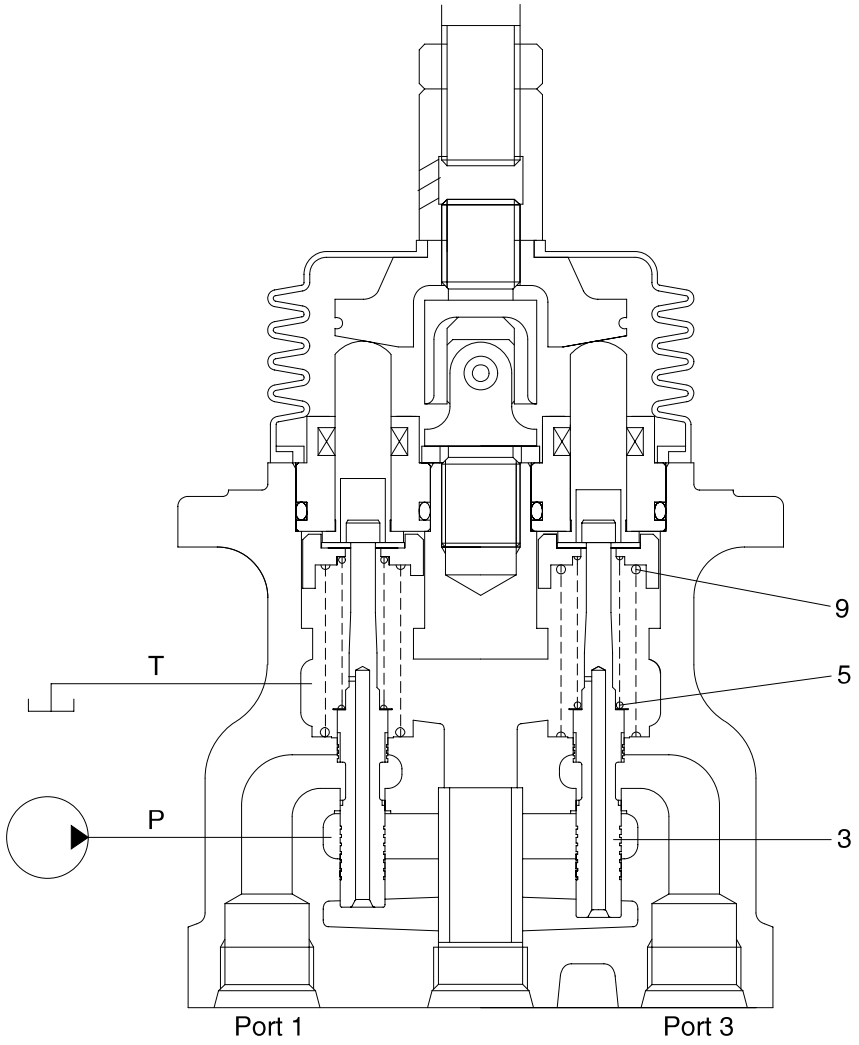
The diagram shown below is the typical application example of the pilot valve.



2-70

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

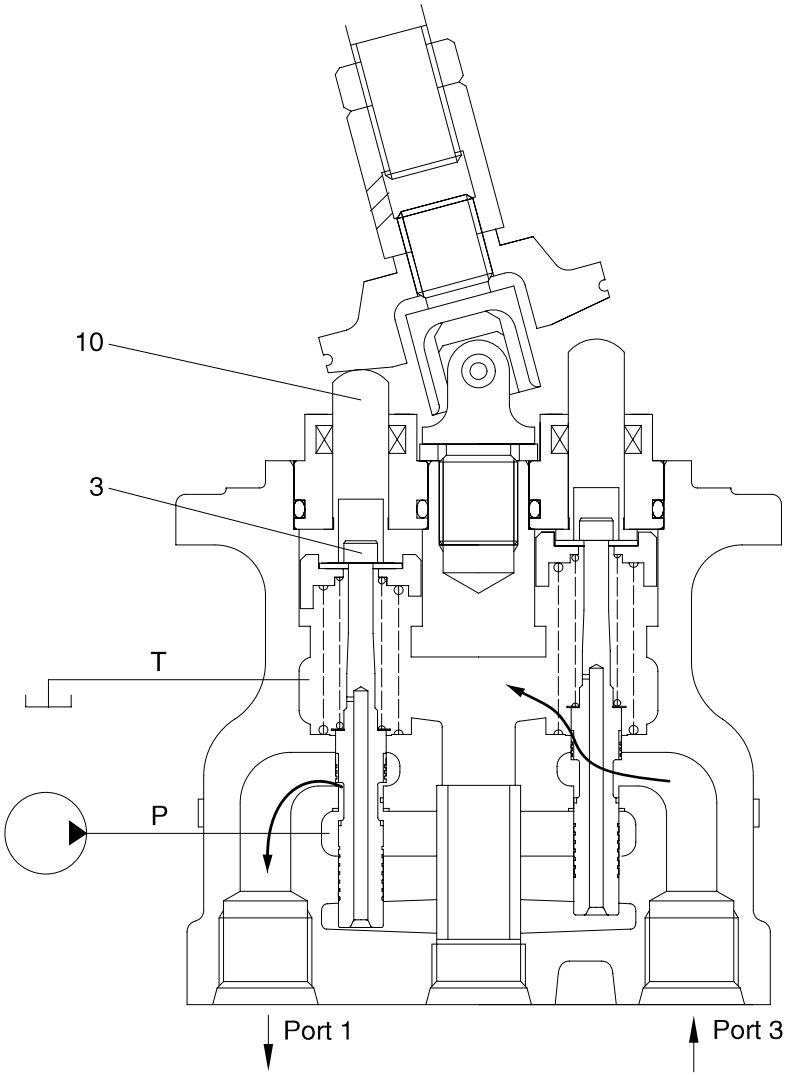
(1) Case where handle is in neutral position



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



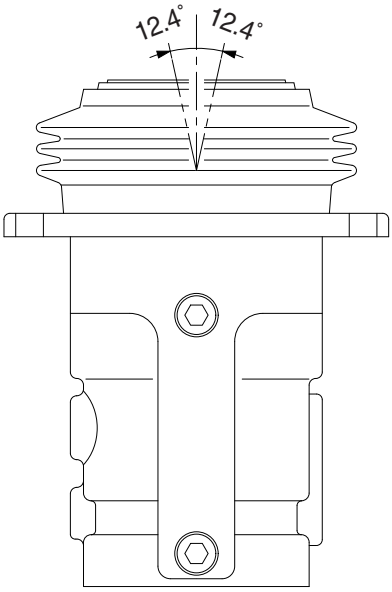
60W9S2RL04

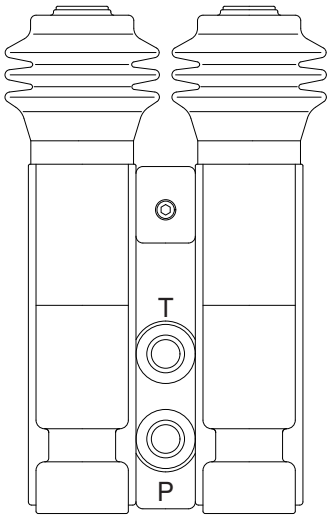
When the push rod (10) is stroked, the spool (3) moves downwards.
Then port P is connected with port 1 and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, 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.

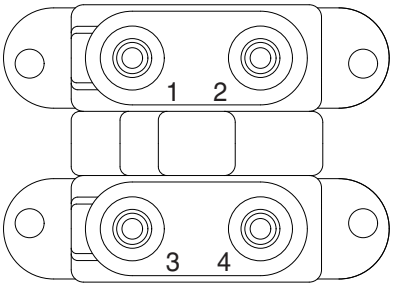
GROUP 6 RCV PEDAL

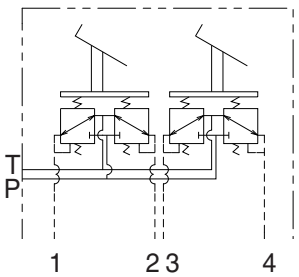
1. STRUCTURE

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)	

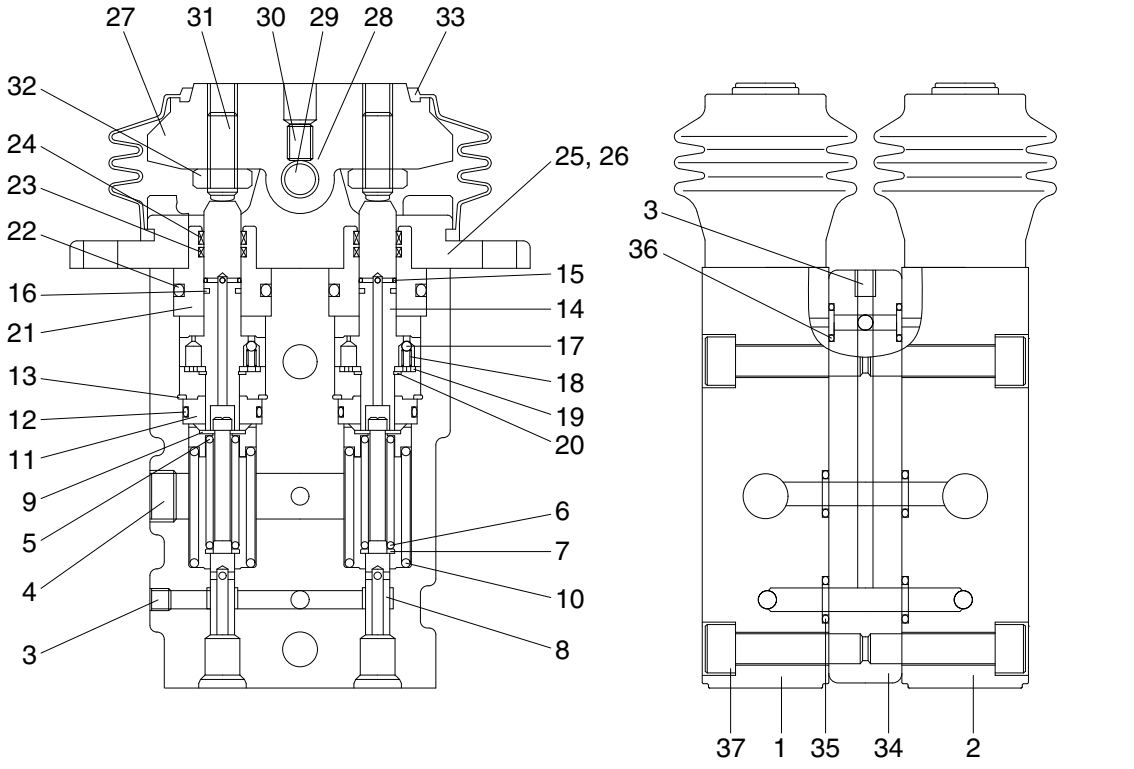
14072SF73

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.

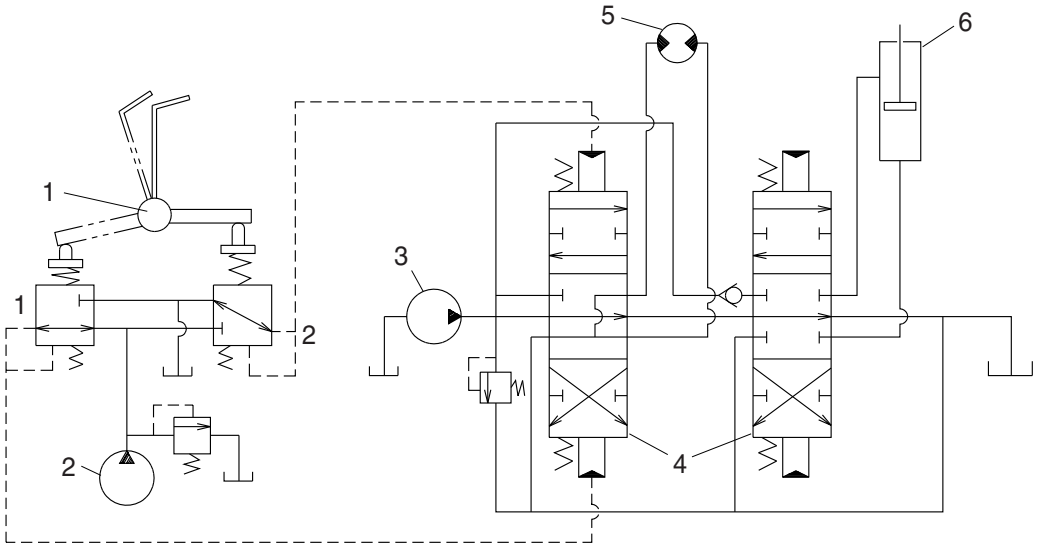
The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

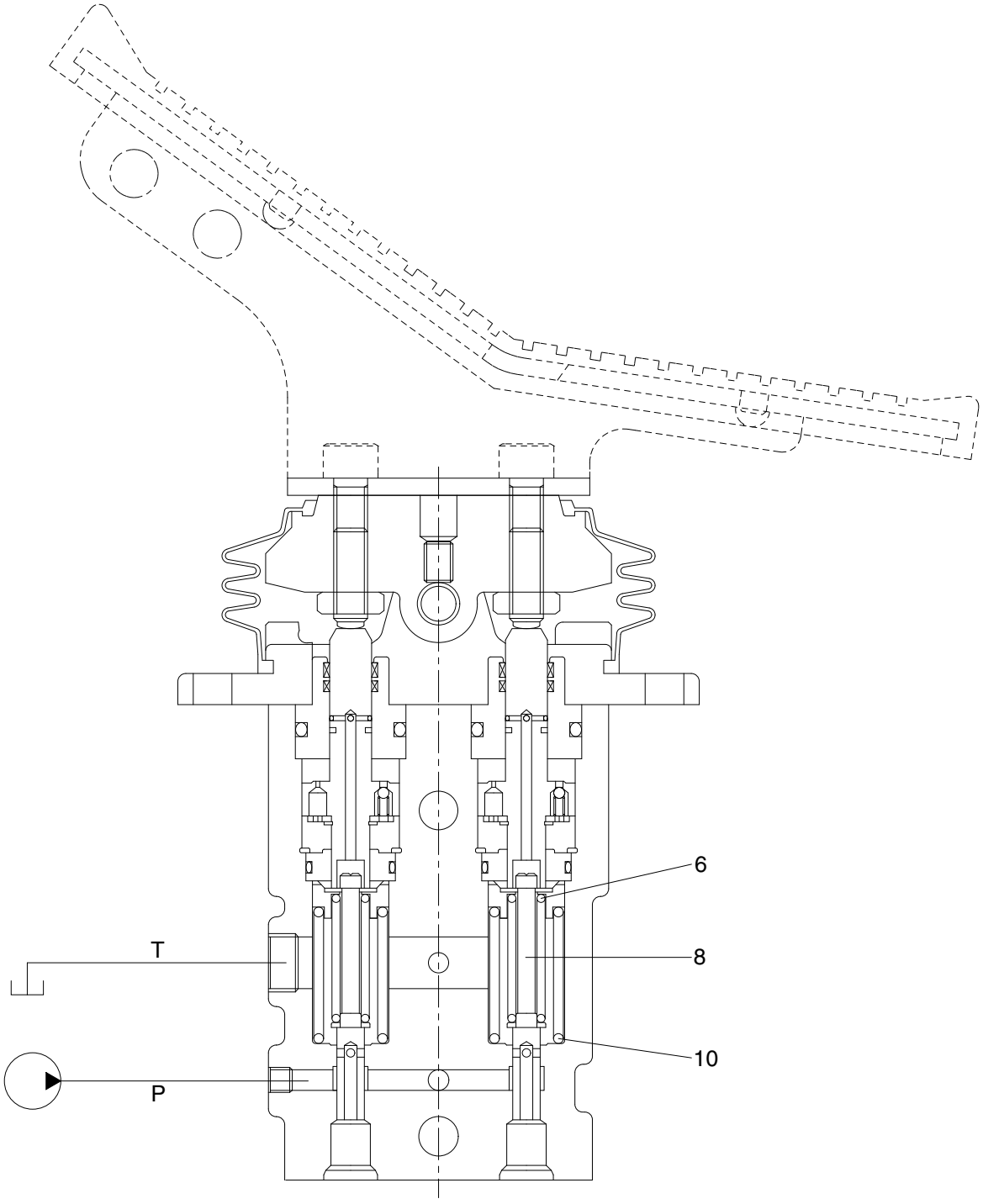
The diagram shown below is the typical application example of the pilot valve.



2-76

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

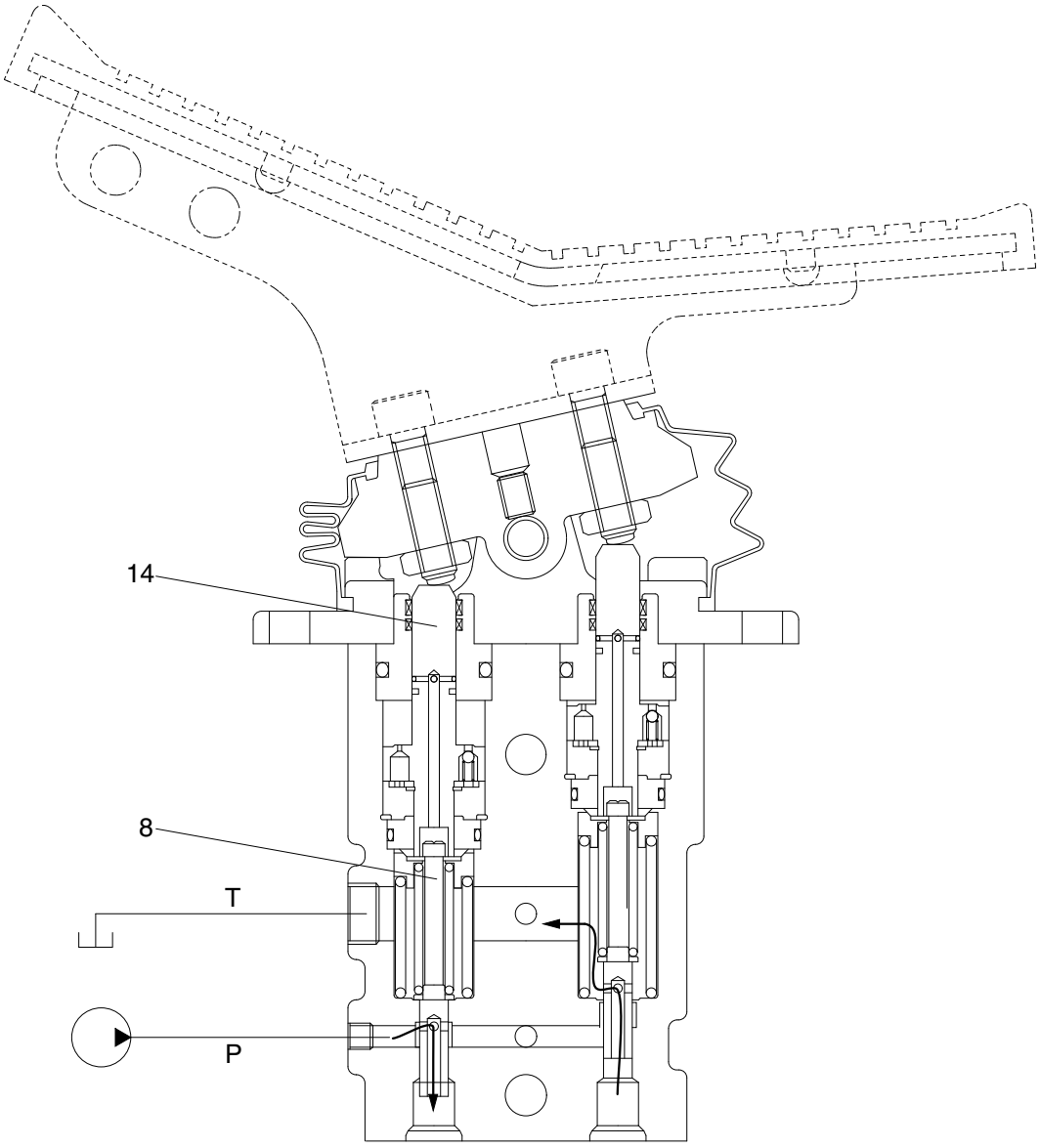
(1) Case where handle is in neutral position



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

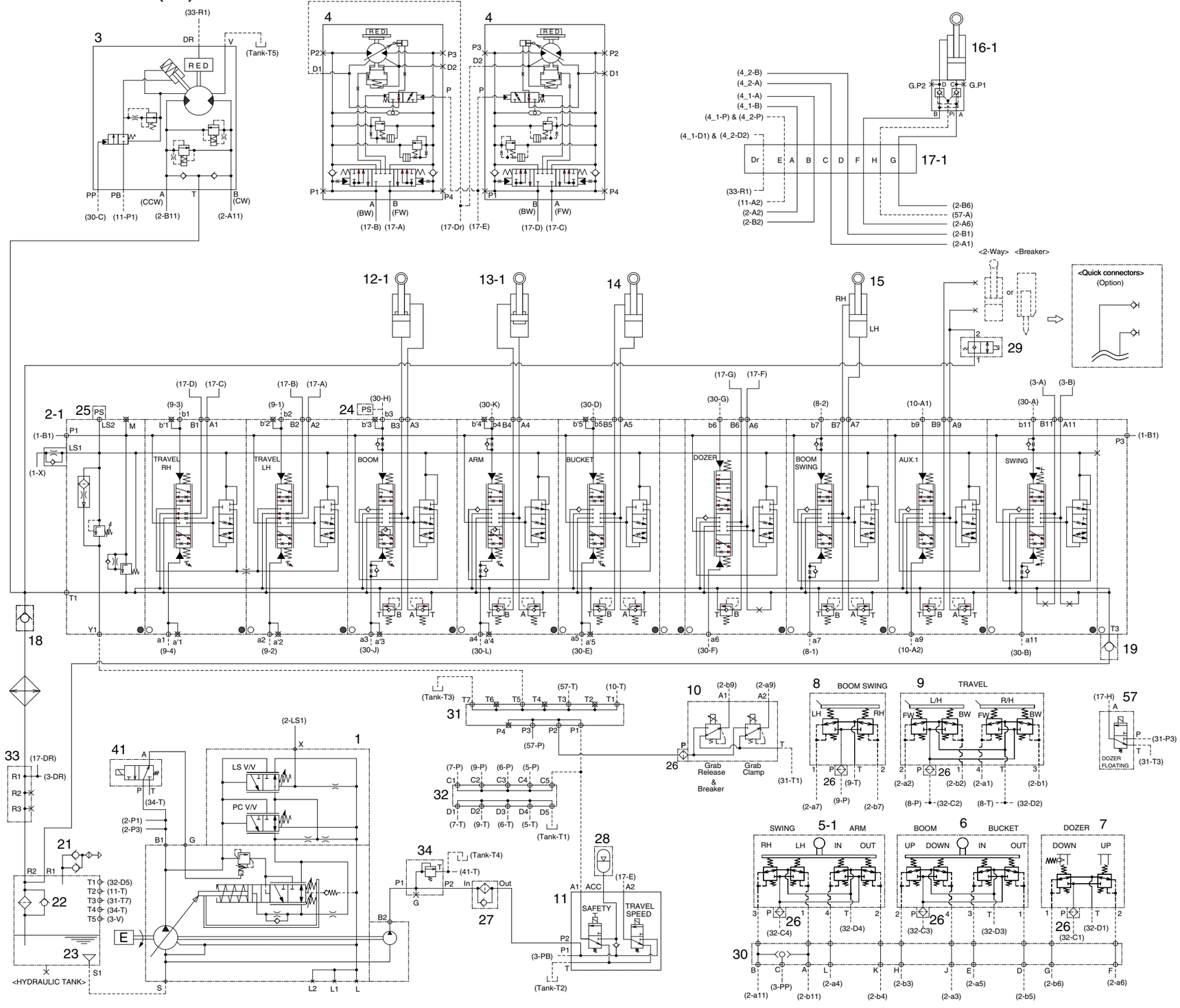


14072SF75

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

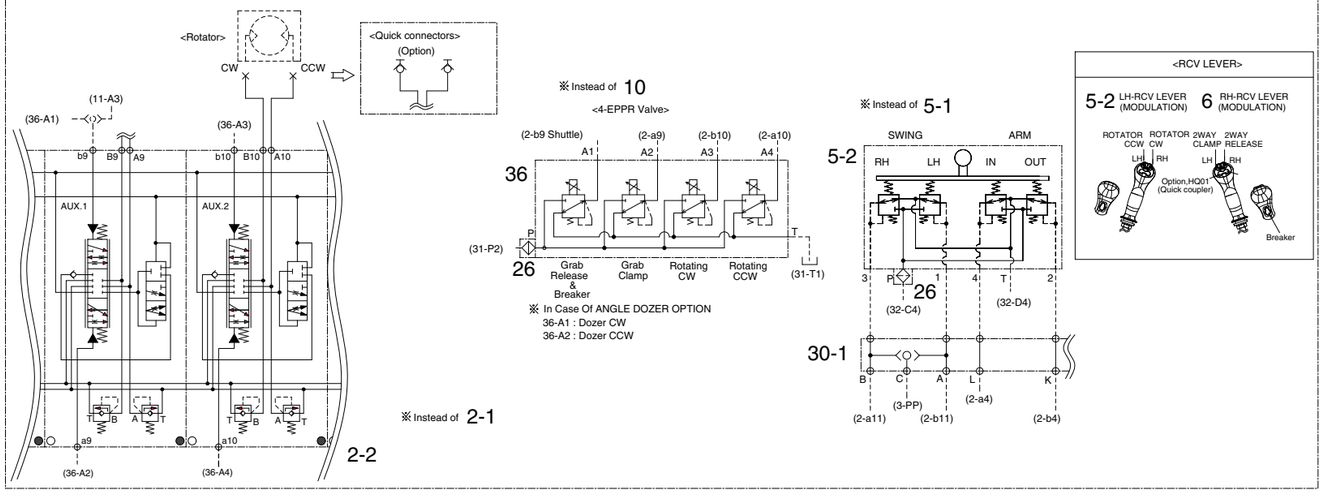
1. HYDRAULIC CIRCUIT (1/3)



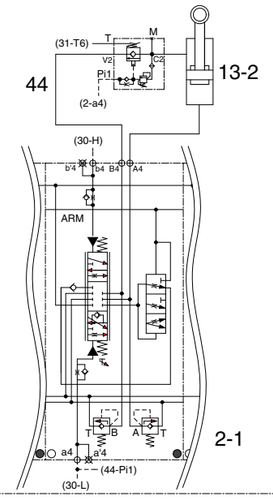
1 Main pump
2-1 Main control valve
3 Swing motor
4 Travel motor
5-1 RCV lever(LH)
6 RCV lever(RH)
7 RCV lever(dozer)
8 O.P.T pedal
9 Travel pedal
10 2 EPPR valve
11 Solenoid valve assy
12-1 Boom cylinder
13-1 Arm cylinder
14 Bucket cylinder
15 Boom swing cylinder
16-1 Dozer cylinder
17-1 Turning joint
18 Return check valve
19 Return check valve
20 Radiator total assy
21 Air breather
22 Return filter w/bypass valve
23 Suction strainer
24 Pressure sensor
25 Pressure sensor
26 Last guard filter
27 Pilot filter
28 Accumulator
29 Solenoid valve
30-1 Terminal assy
31 Block(A)
32 Block(B)
33 Return pipe
34 Relief valve
35-1 Dozer handle
41 Solenoid valve
55 Shuttle tee
57 Solenoid valve

2. HYDRAULIC CIRCUIT (2/3)

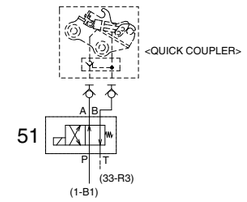
Rotating (Option Code : HR02)



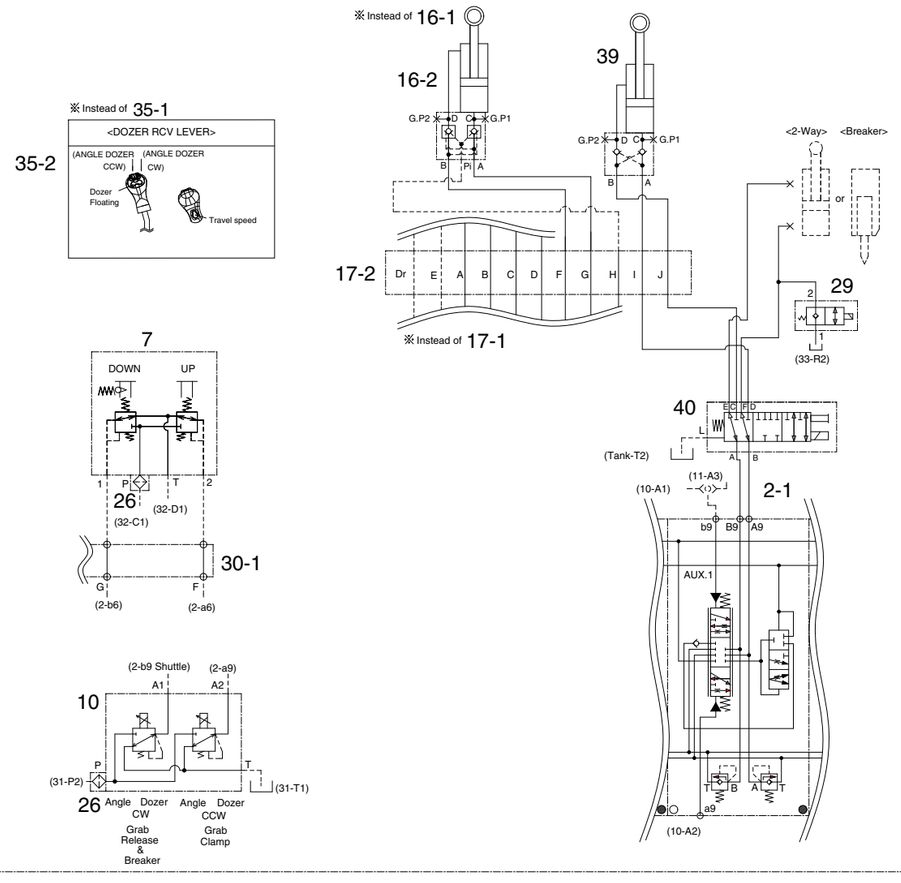
Arm Safety Lock (Option Code : AS01 or AS02)



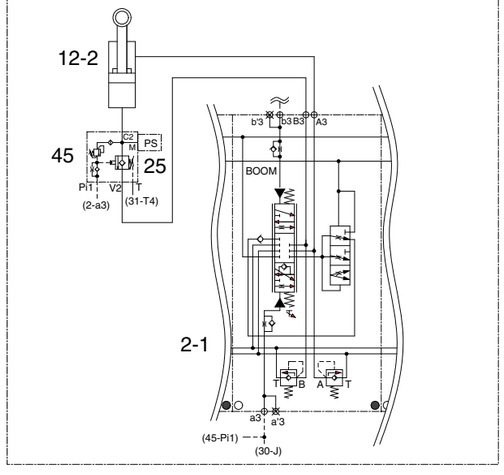
Quick Coupler (Option Code : HQ01)



Angle Dozer (Option Code : BR12)



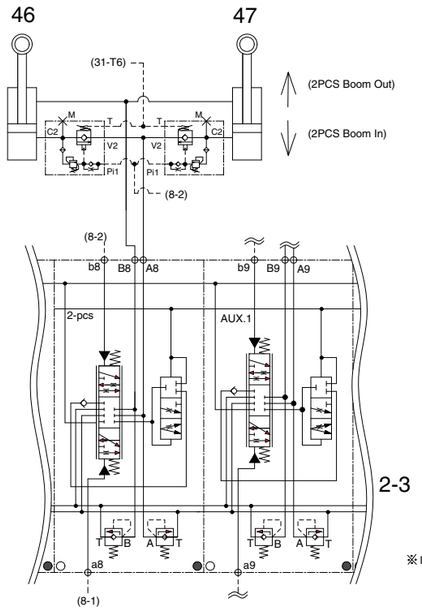
Boom Safety Lock (Option Code : BS01 or BS02)

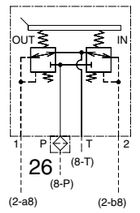


2-2 Main control valve
5-2 RCV lever(LH)
12-2 Boom cylinder
13-2 Arm cylinder
16-2 Dozer cylinder
17-2 Turning joint
25 Pressure sensor
26 Last guard filter
35-2 Dozer handle
36 4 EPPR valve
39 Angle dozer cylinder
40 Selector valve
44 Safety lock valve
45 Safety lock valve
51 Cartridge vavle

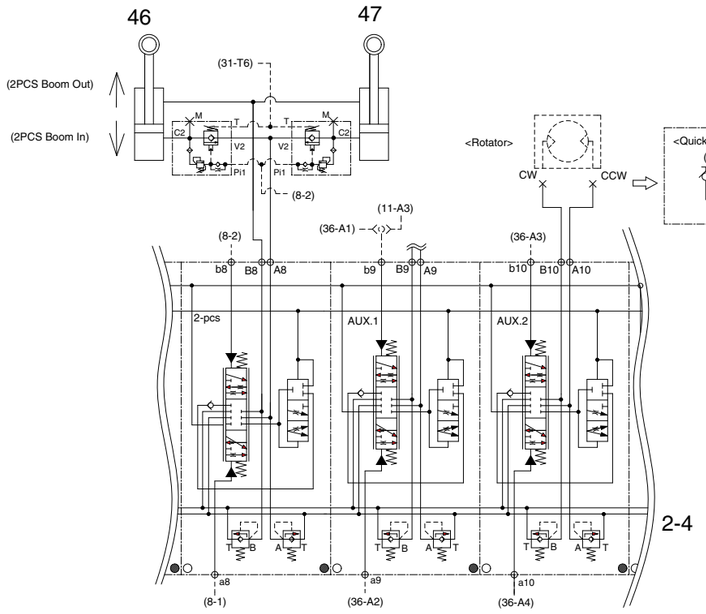
3. HYDRAULIC CIRCUIT (3/3)

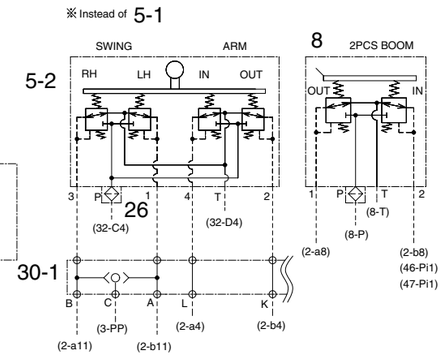
2PCS BOOM (Option Code : BM09)

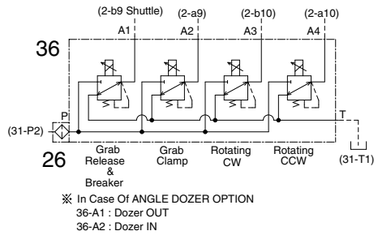




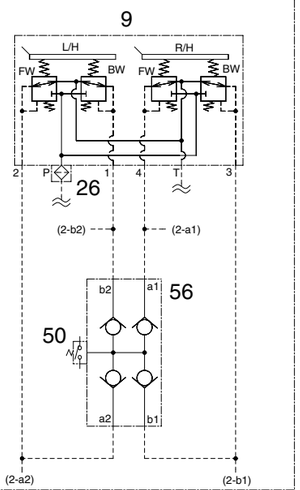
2PCS BOOM + Rotating (Option Code : BM09, HR02)



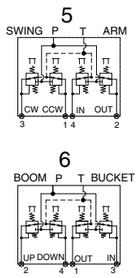




i-20.255;Travel Alarm
i-37.138;(Option Code : EA01)

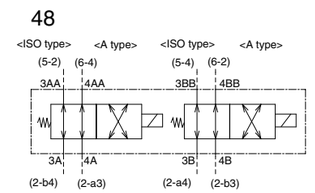


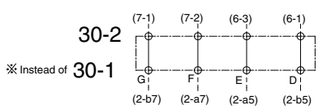
RCV LEVER(LH/RH) OPTION



PART NO (5 :LH / 6 : RH)				OPTION CODE	REMARKS	
					PRODUCER	MODULATION
5-1	31MQ-21130	6	31MQ-21120	HR00	EATON (Handle : Daehyun)	RH
5-2	31MQ-21110			HR02		LH, RH

Pattern Change (Option Code : PV01)





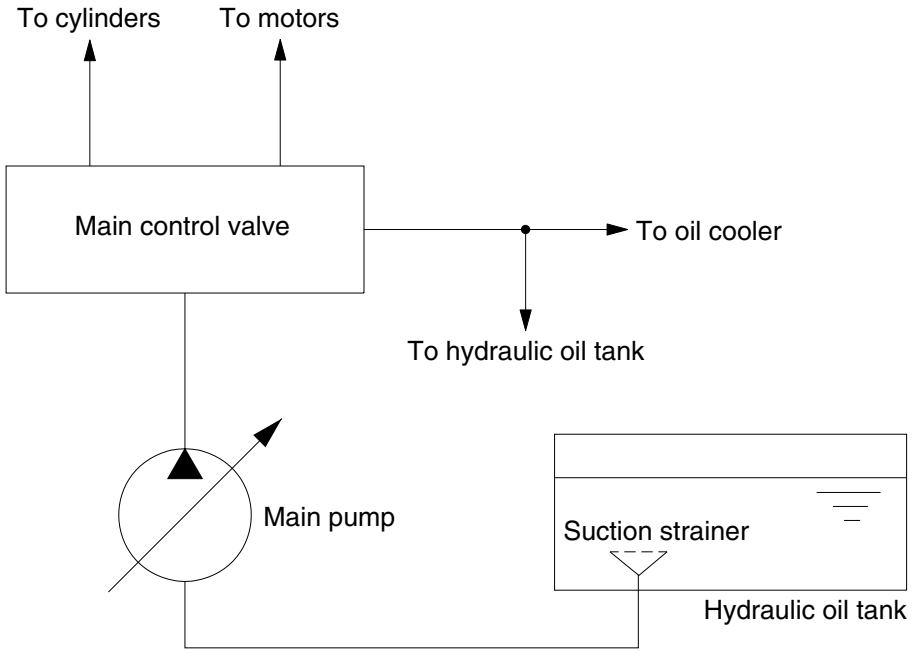
	LH RCV	RH RCV
ISO type	ARM OUT (J1-M1) SWING CCW / SWING CW ARM IN (J3-M3)	BOOM DOWN (J2-M2) BUCKET IN / BUCKET OUT BOOM UP(J4-M4)
A type	BOOM DOWN(J1-M2) SWING CCW / SWING CW BOOM UP(J3-M4)	ARM OUT (J2-M1) BUCKET IN / BUCKET OUT ARM IN (J4-M3)

2-3 Main control valve
2-4 Main control valve
5-2 RCV lever(LH)
8 O.P.T pedal
26 Last guard filter
30-2 Terminal assy
35-2 Dozer handle
36 4 EPPR valve
46 2 pcs boom cylinder(LH)
47 2 pcs boom cylinder(RH)
48 Pattern change valve
50 Pressure switch
56 Shuttle 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

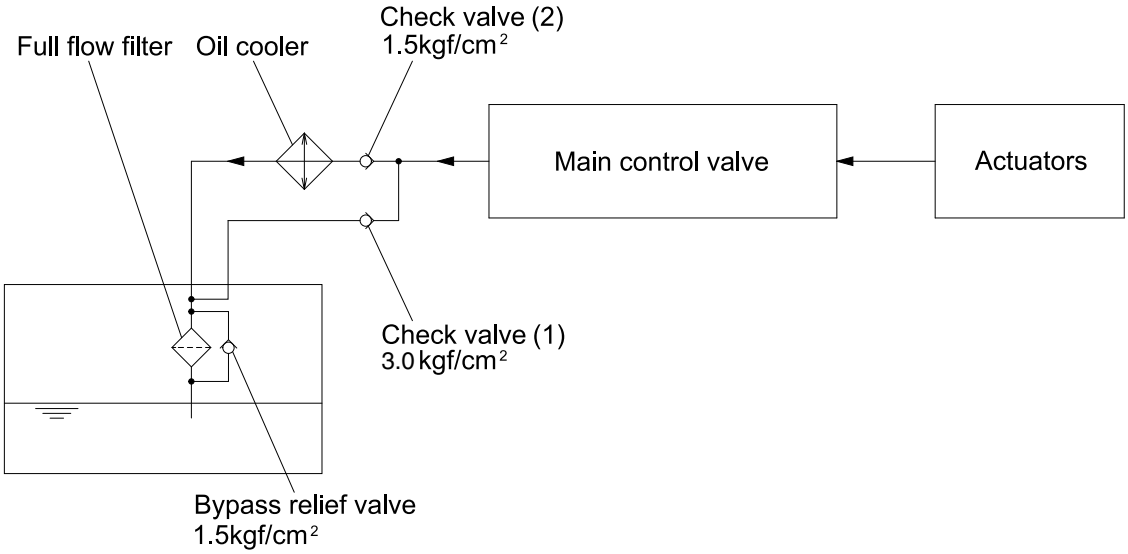


140L3CI01

The pumps receive oil from the hydraulic tank through a suction strainer. 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. RETURN CIRCUIT

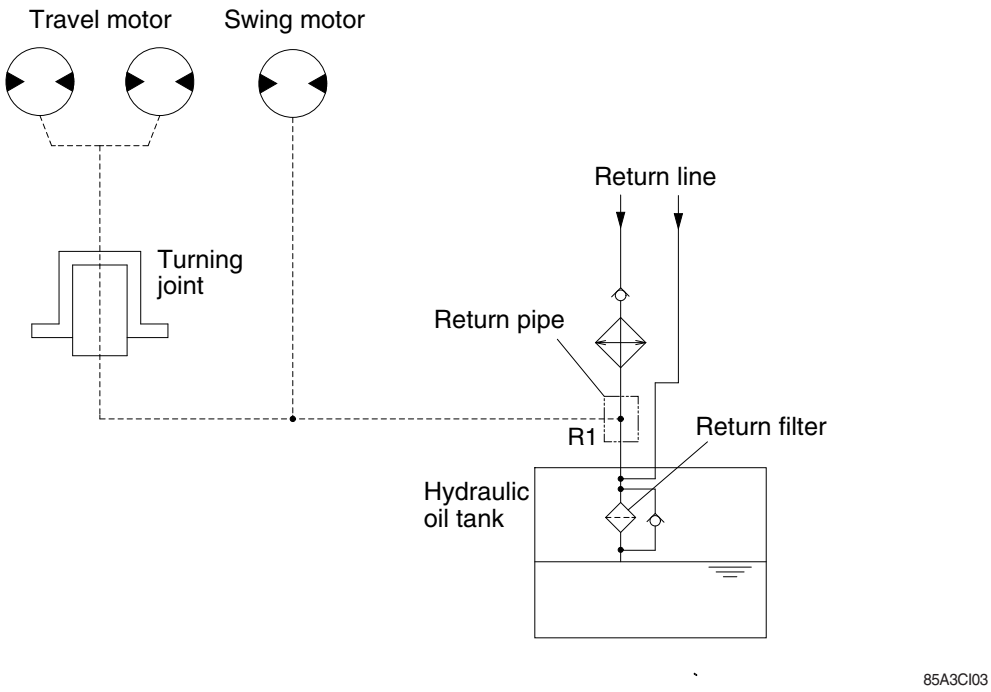


85A3CI02

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3. DRAIN CIRCUIT



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

1) TRAVEL MOTOR DRAIN CIRCUIT

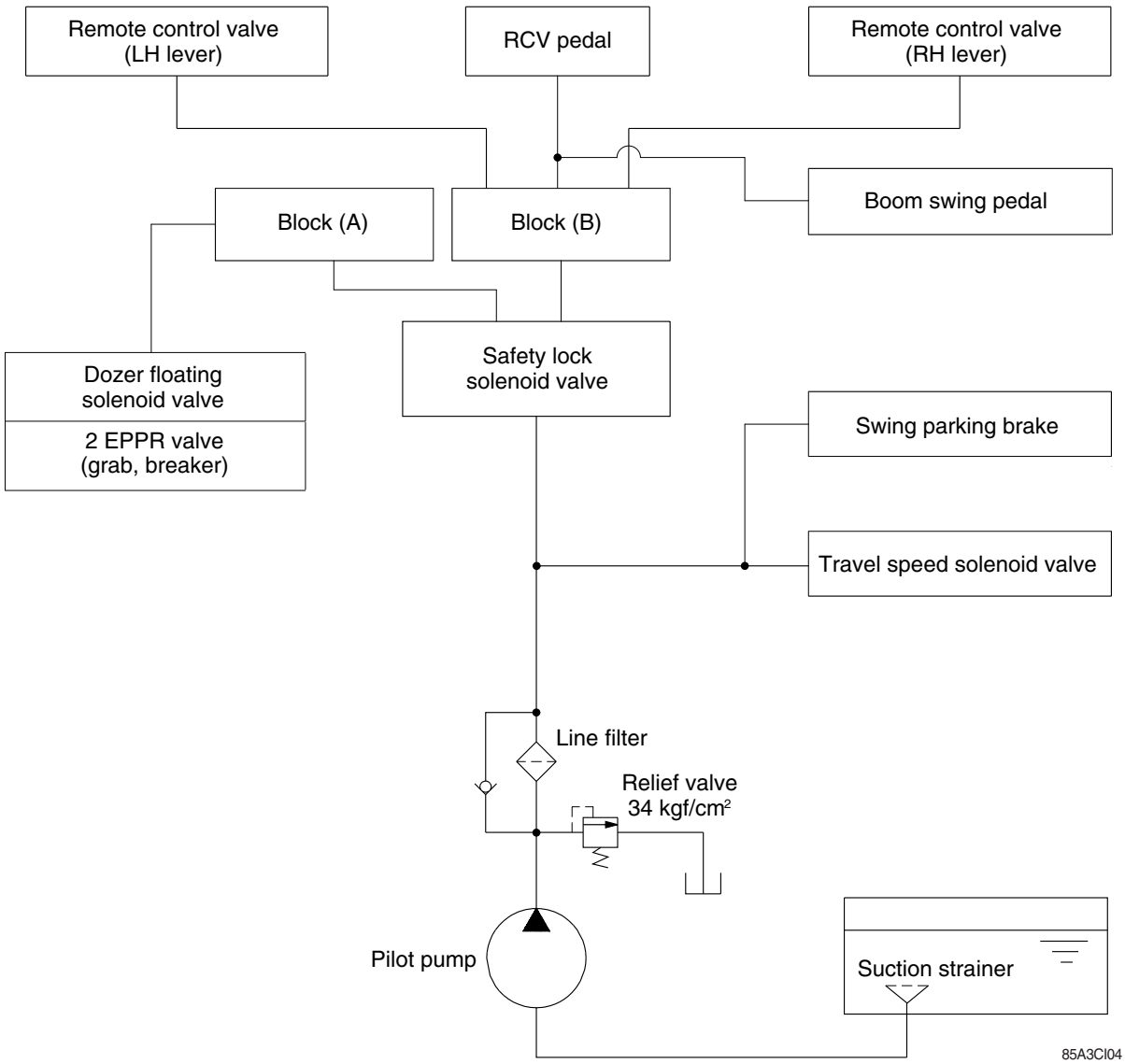
Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and return to the hydraulic tank after being filtered by return filter.

2) SWING MOTOR DRAIN CIRCUIT

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

GROUP 3 PILOT CIRCUIT



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

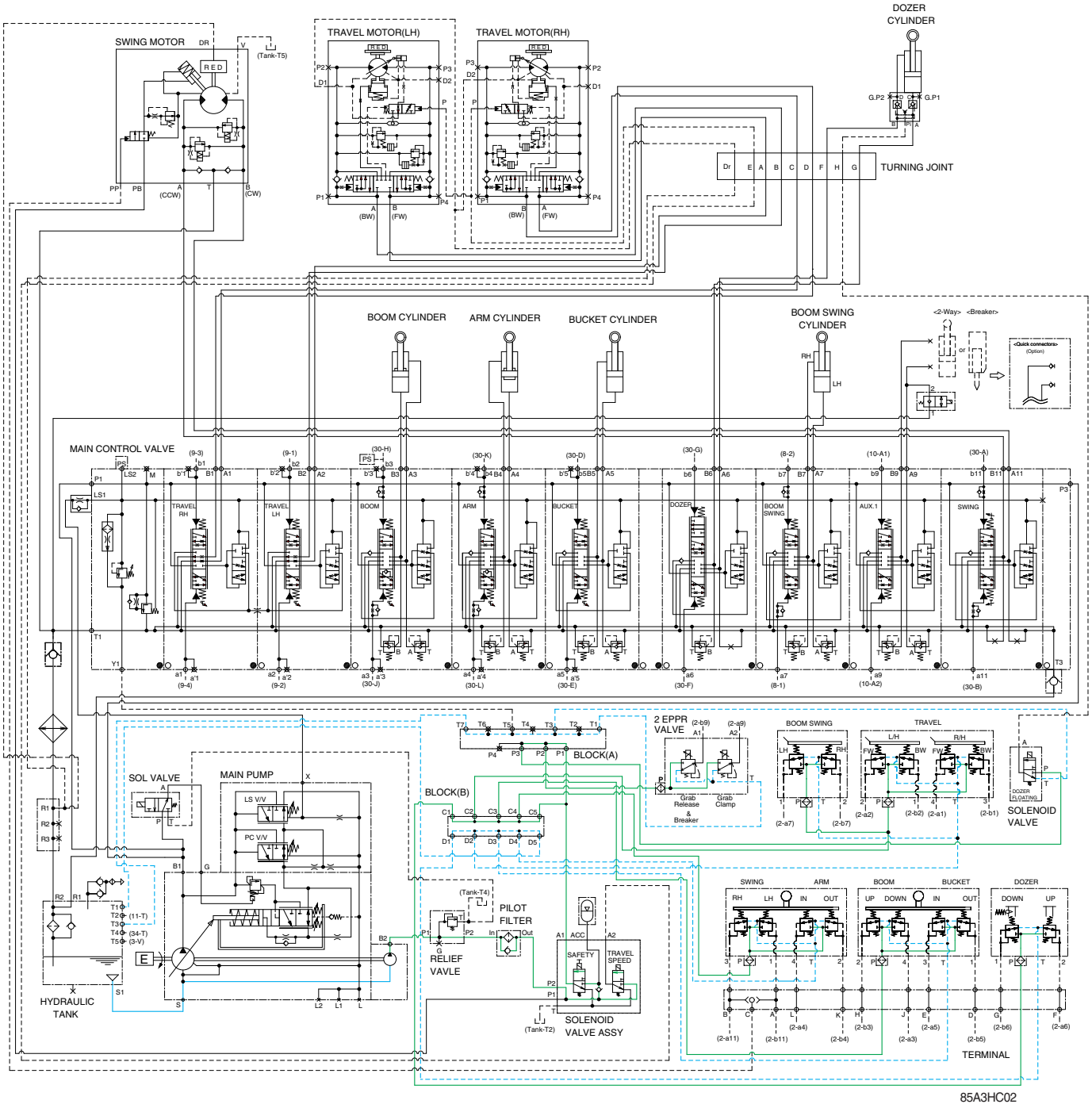
The pilot line is provided with relief valve, receives the oil from the hydraulic tank through the suction strainer.

The discharged oil from the pilot pump flows to the remote control valve through line filter, safety lock solenoid valve and block (B) and flows to the dozer floating solenoid valve and 2 EPPR valve (grab, breaker) through line filter and block (A).

Also, the discharged oil from the pilot pump flows to swing parking brake and travel speed solenoid valve through line filter.

※ The circuit diagram may differ from the equipment, so please check before a repair.

1. SUCTION, DELIVERY AND RETURN CIRCUIT



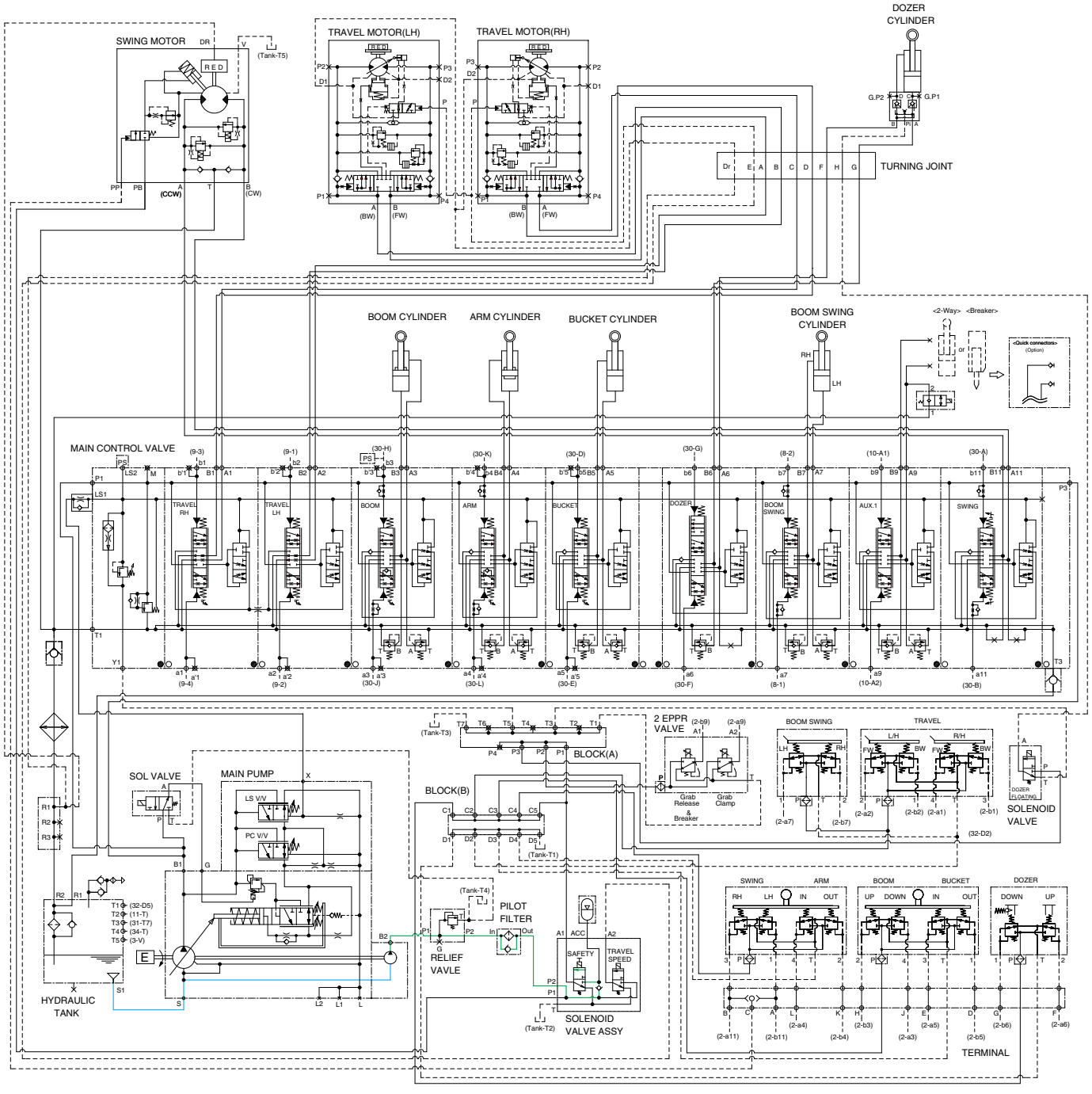
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot line for limiting the pilot circuit pressure.

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

The return oil flow into the hydraulic tank.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. SAFETY VALVE (SAFETY LEVER)

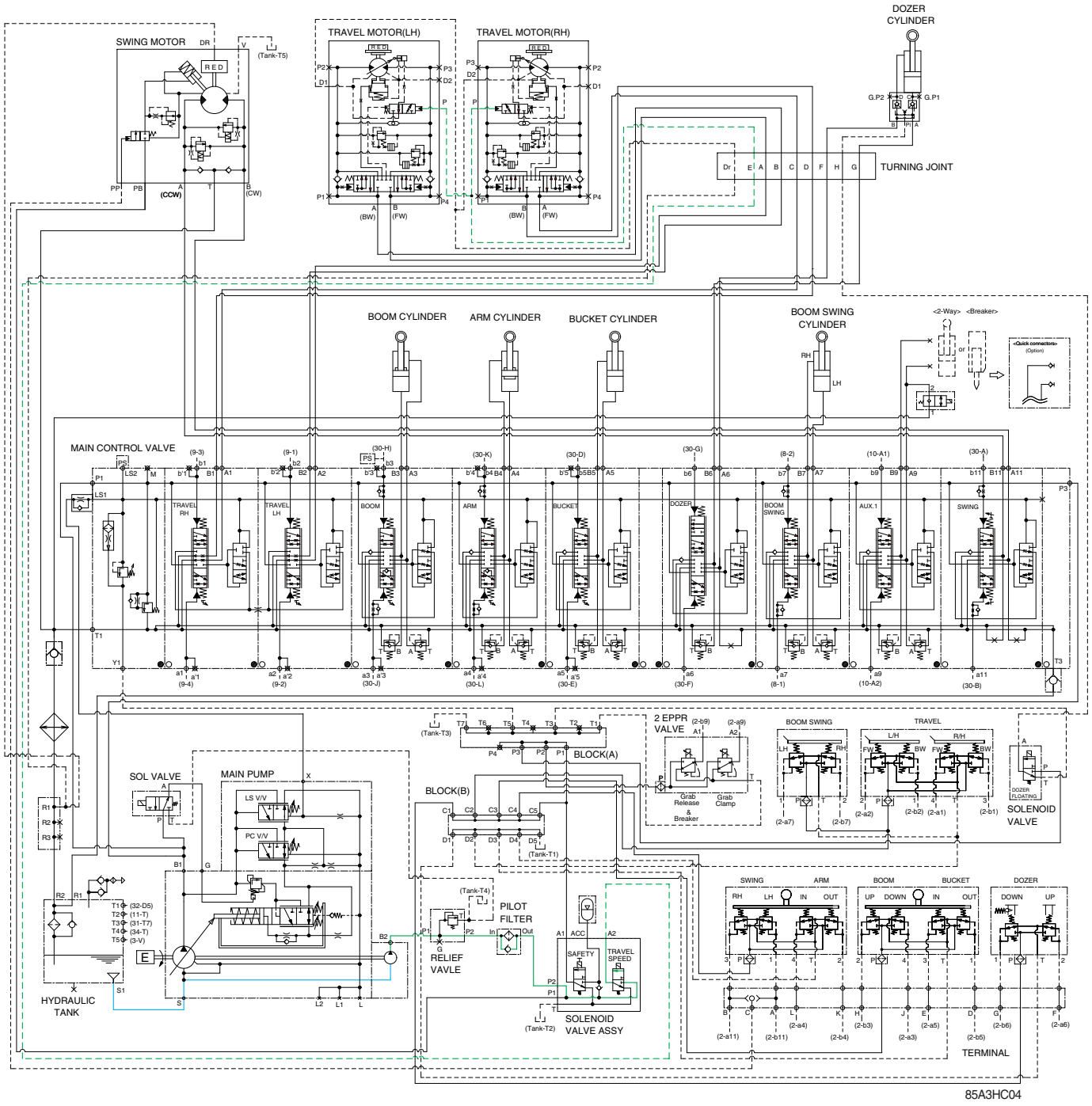


When the lever of the safety solenoid valve is moved downward, oil flows into the remote control valve through solenoid valve and line filter.

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

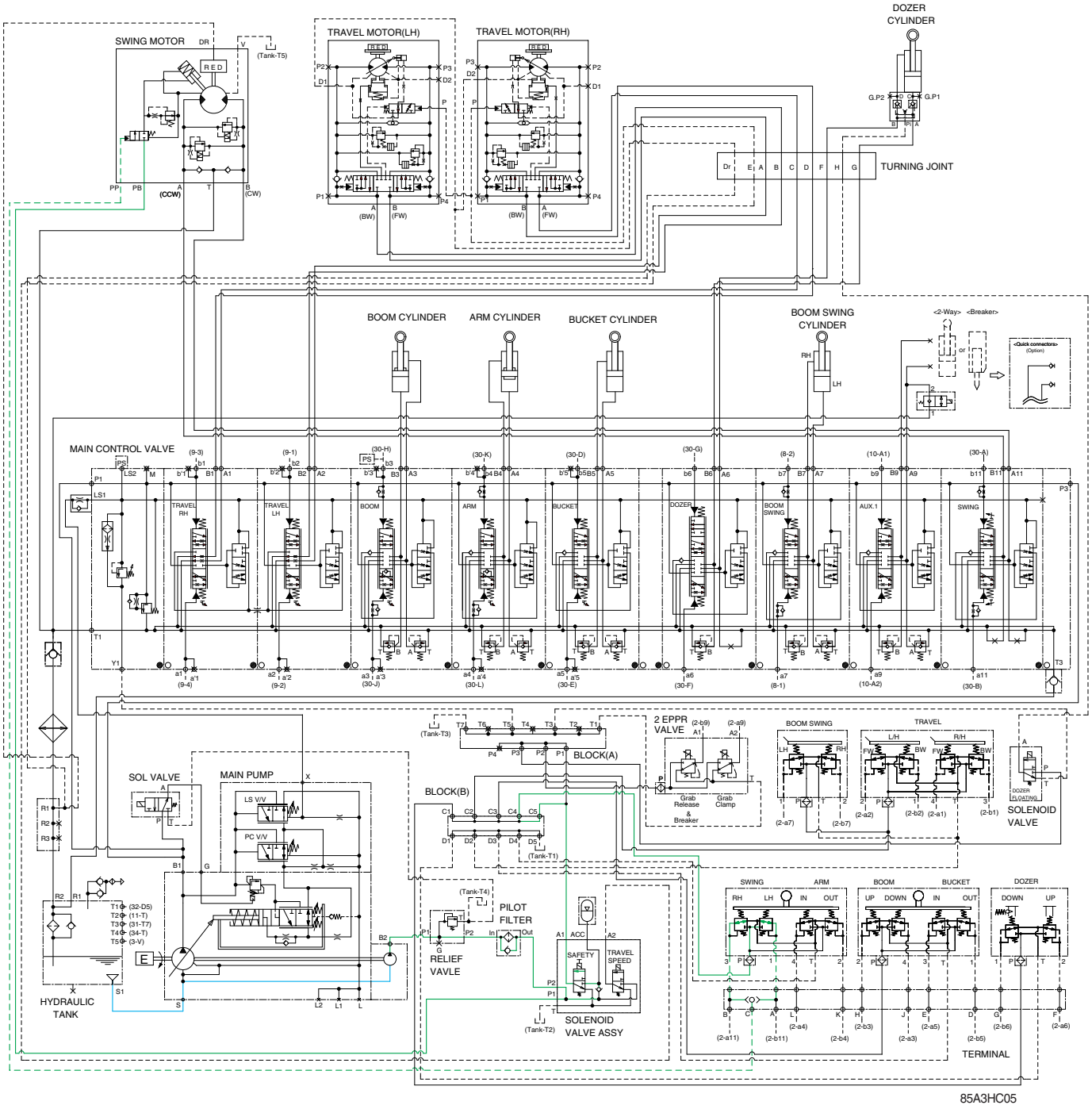
3. TRAVEL SPEED CONTROL SYSTEM



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 P 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 P port returns to the hydraulic tank.
As a result, the control piston is returned by the main oil flow, thus the displacement is maximized.

※ The circuit diagram may differ from the equipment, so please check before a repair.

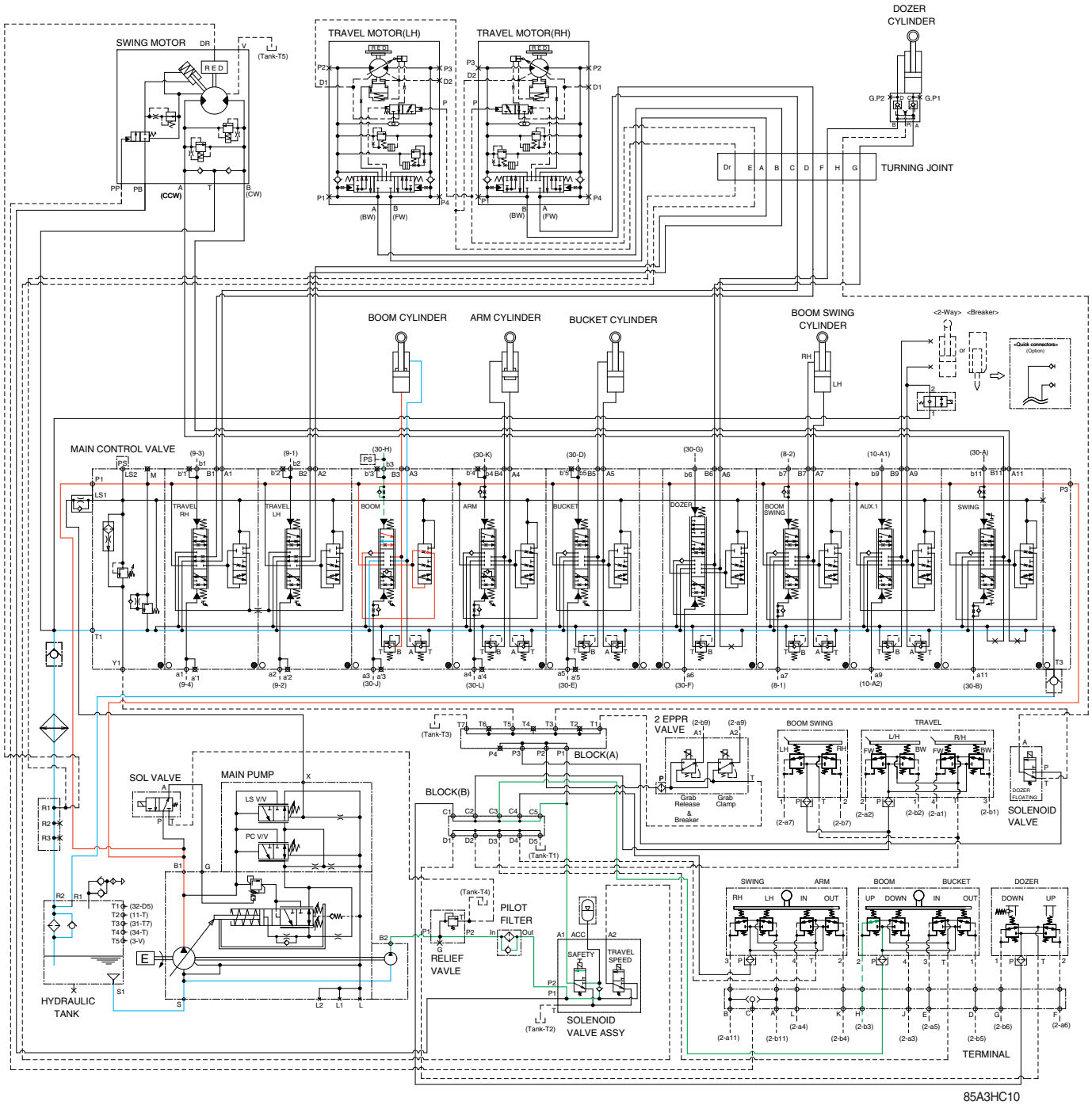
4. SWING PARKING BRAKE RELEASE



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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

1. BOOM UP OPERATION

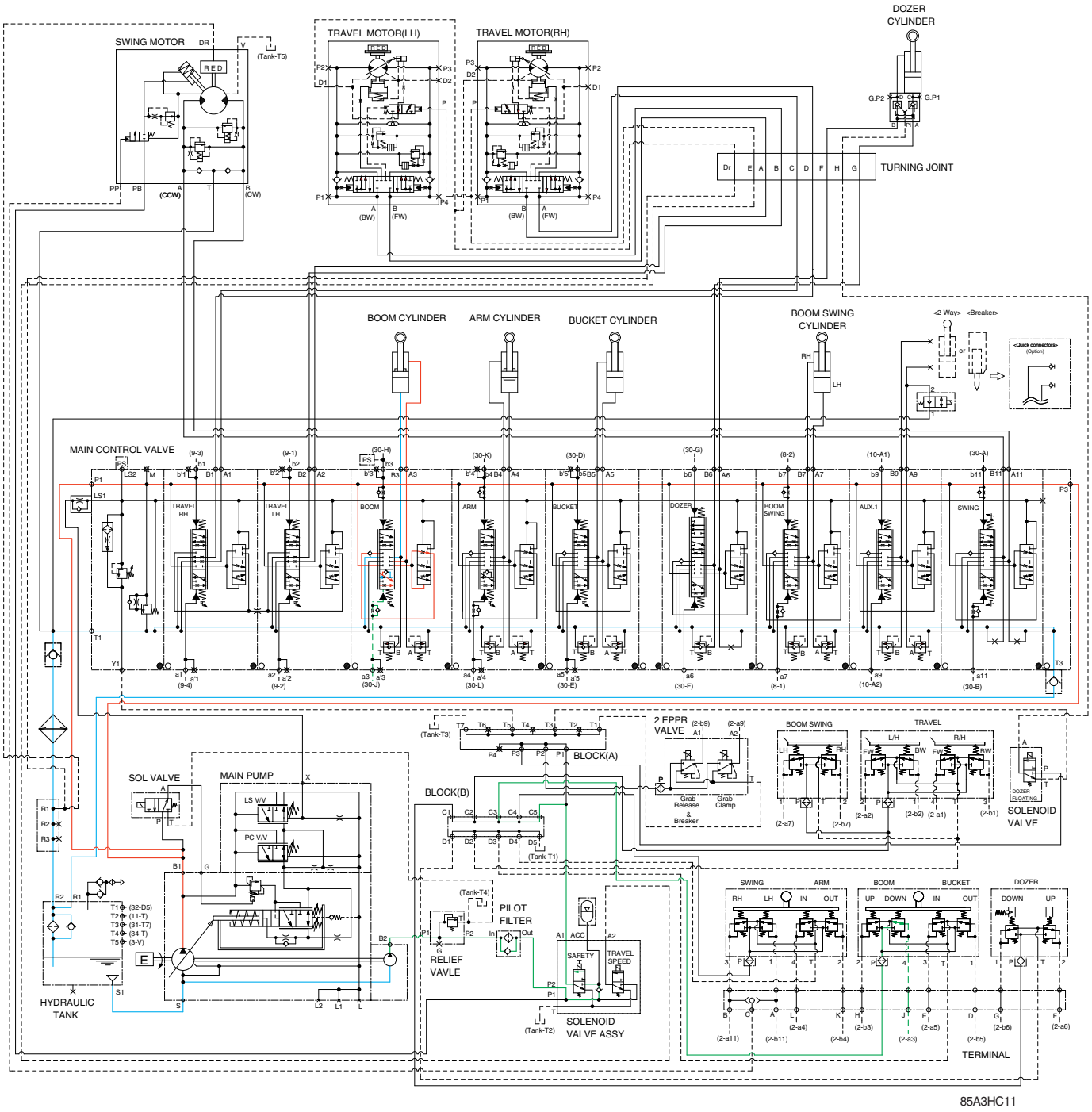


When the right control lever is pulled back, the boom spool in the main control valve is moved to the up position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the main control valve and then goes to the large chamber of boom cylinder. At the same time, the oil from the small chamber of boom cylinder 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. BOOM DOWN OPERATION



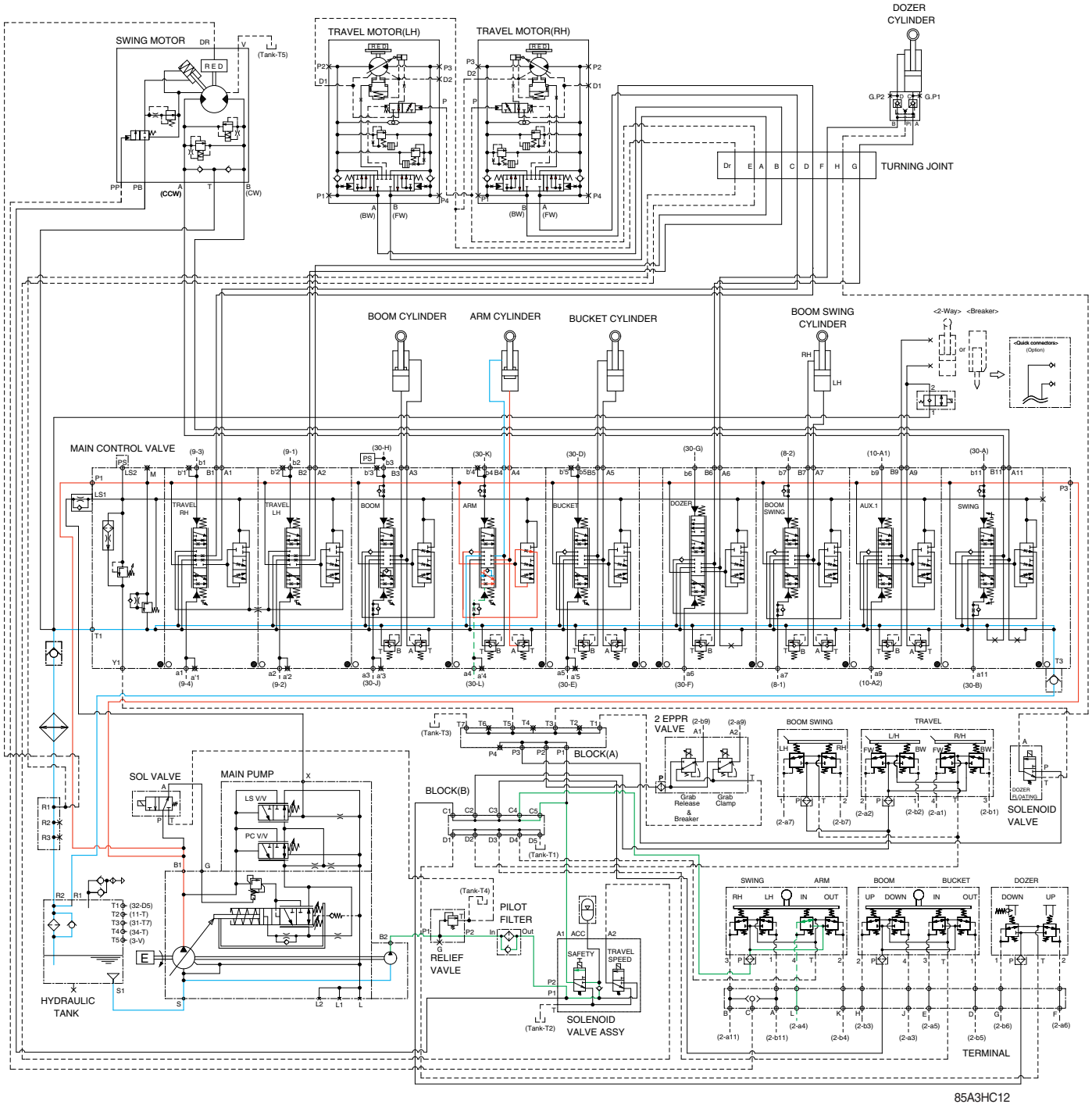
When the right control lever is pushed forward, the boom spool in the main control valve is moved to the down position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the main control valve and then goes to the small chamber of boom cylinder. At the same time, the oil from the large chamber of boom cylinder 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3. ARM ROLL IN OPERATION



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

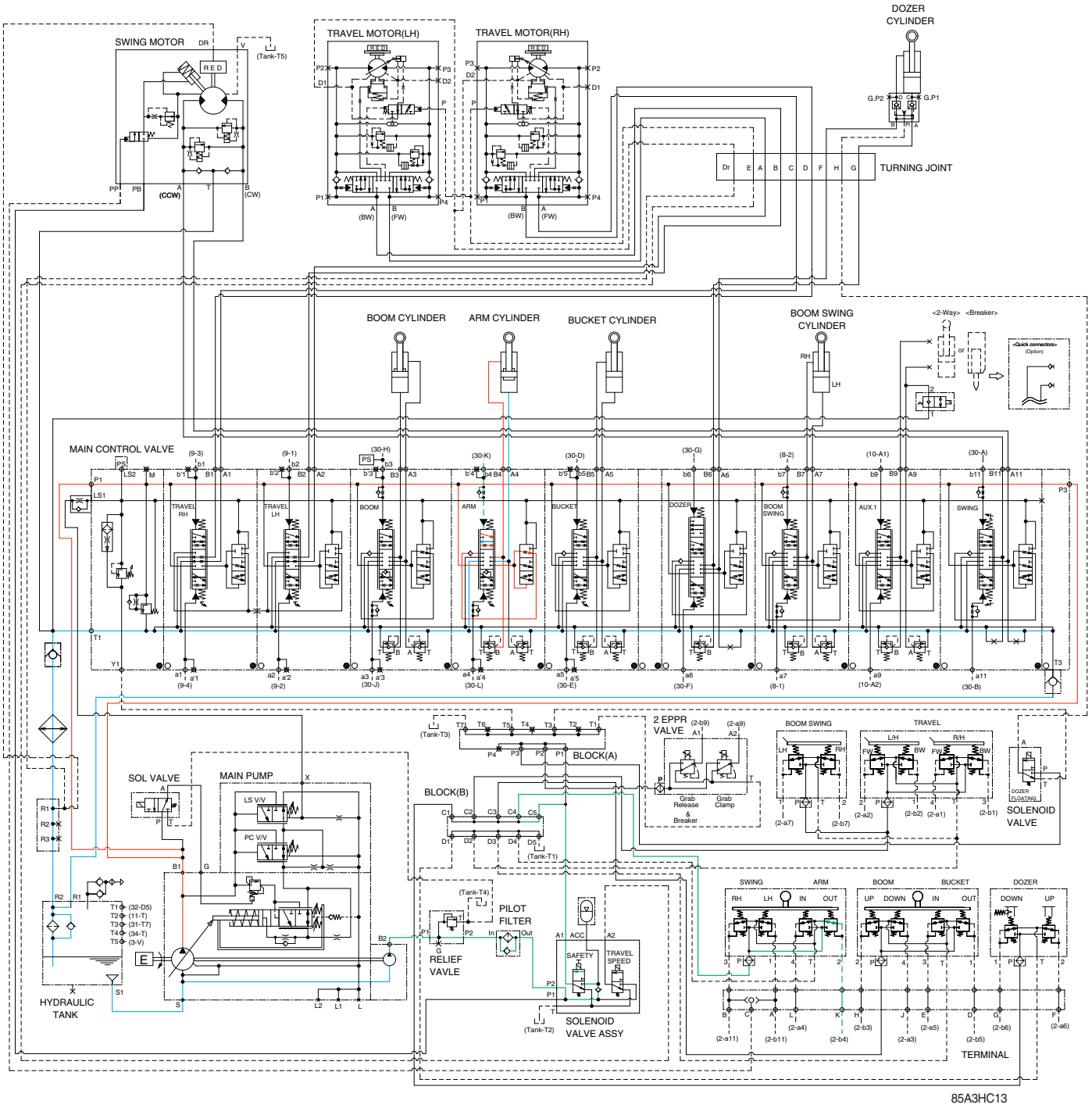
The oil from the main pump flows into the main control valve and then goes to the large chamber of arm cylinder.

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

4. ARM ROLL OUT OPERATION



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

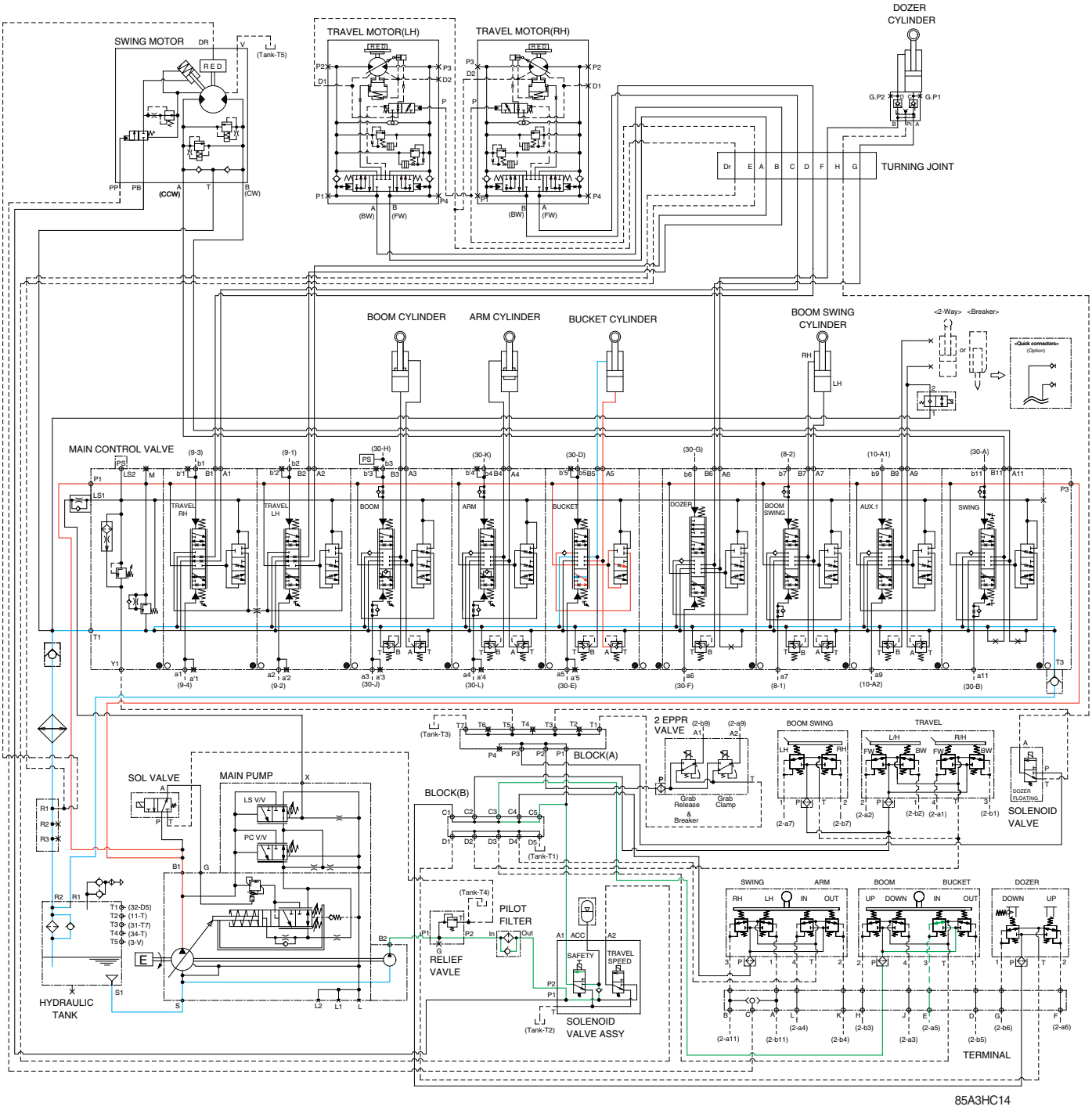
The oil from the main pump flows into the main control valve and then goes to the small chamber of arm cylinder.

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

5. BUCKET ROLL IN OPERATION



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

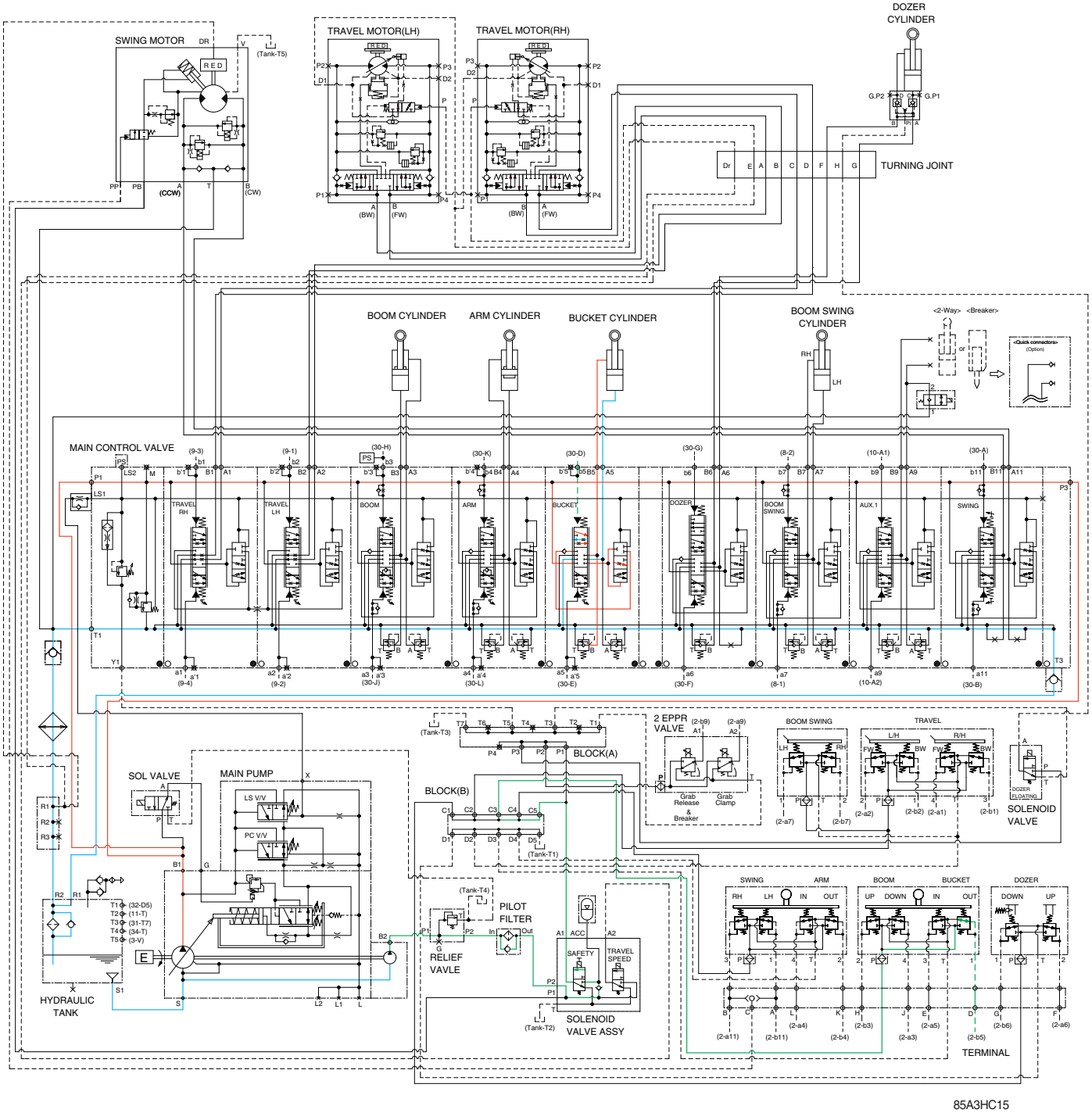
The oil from the main pump flows into the main control valve and then goes to the large chamber of bucket cylinder.

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

6. BUCKET ROLL OUT OPERATION



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

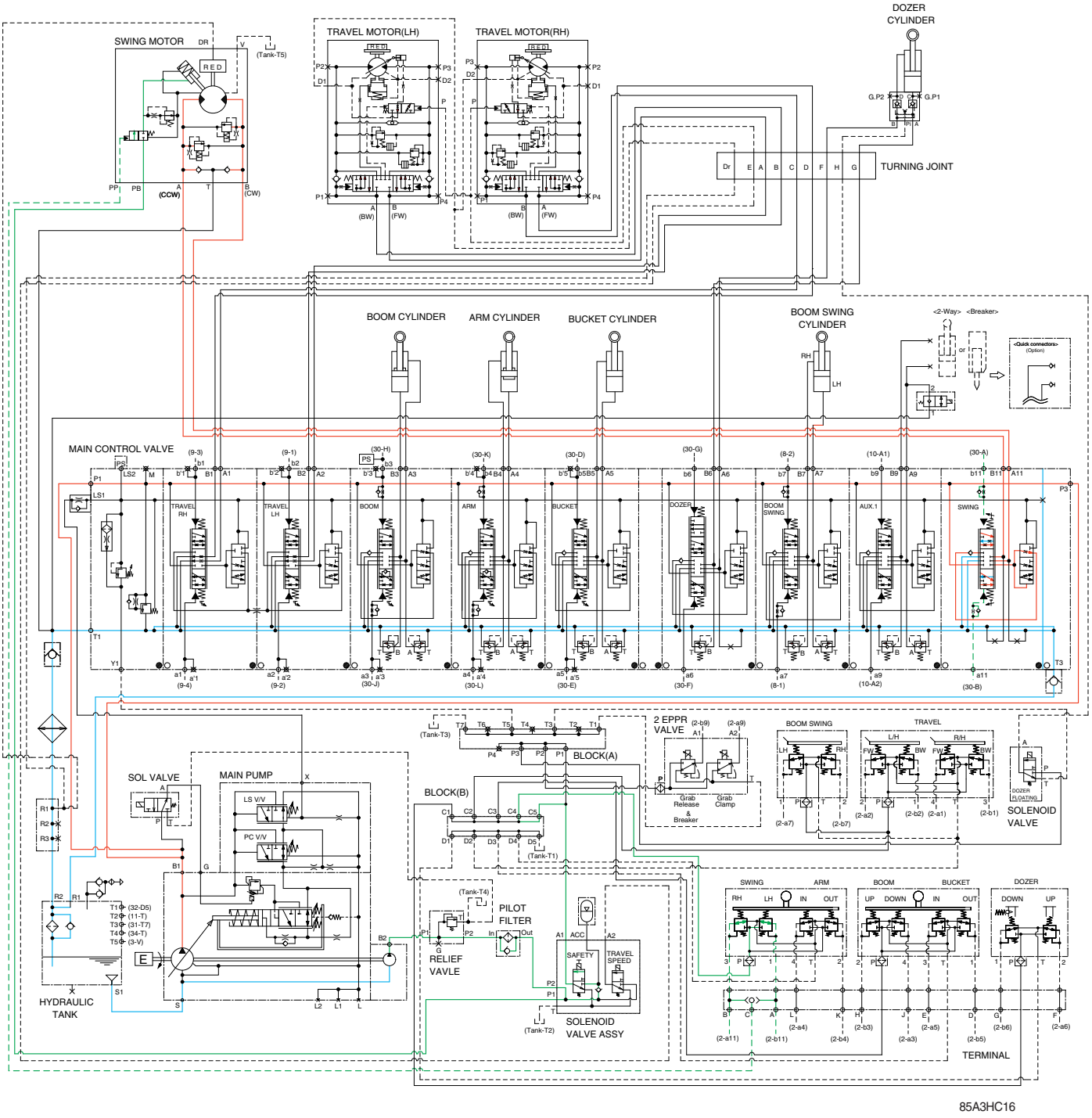
The oil from the main pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

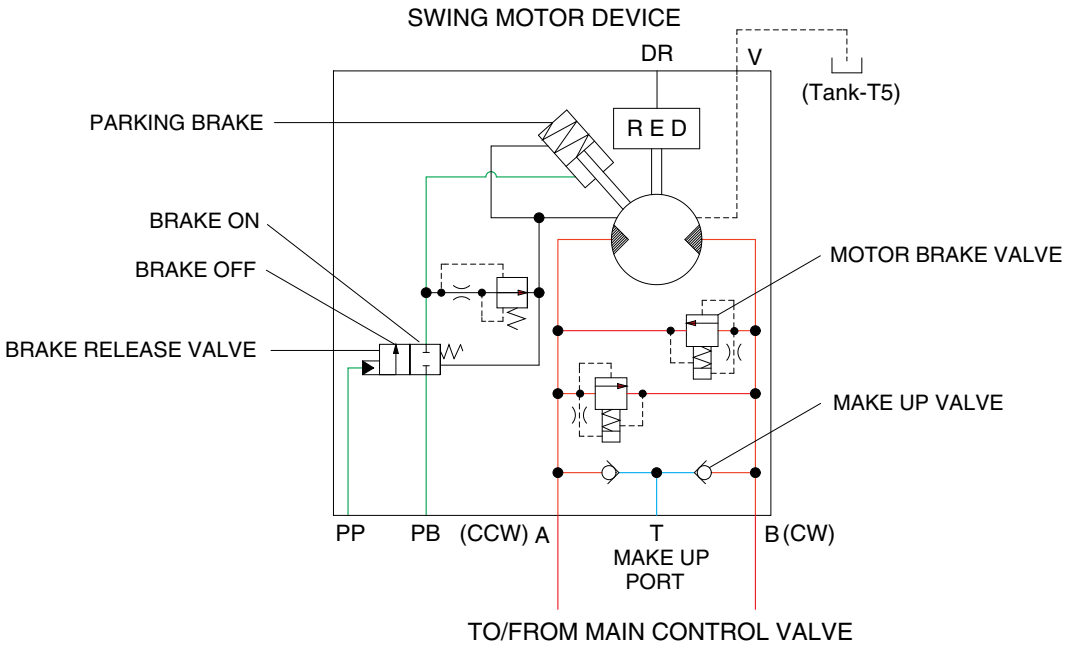
7. SWING OPERATION



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

※ The circuit diagram may differ from the equipment, so please check before a repair.

SWING CIRCUIT OPERATION



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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

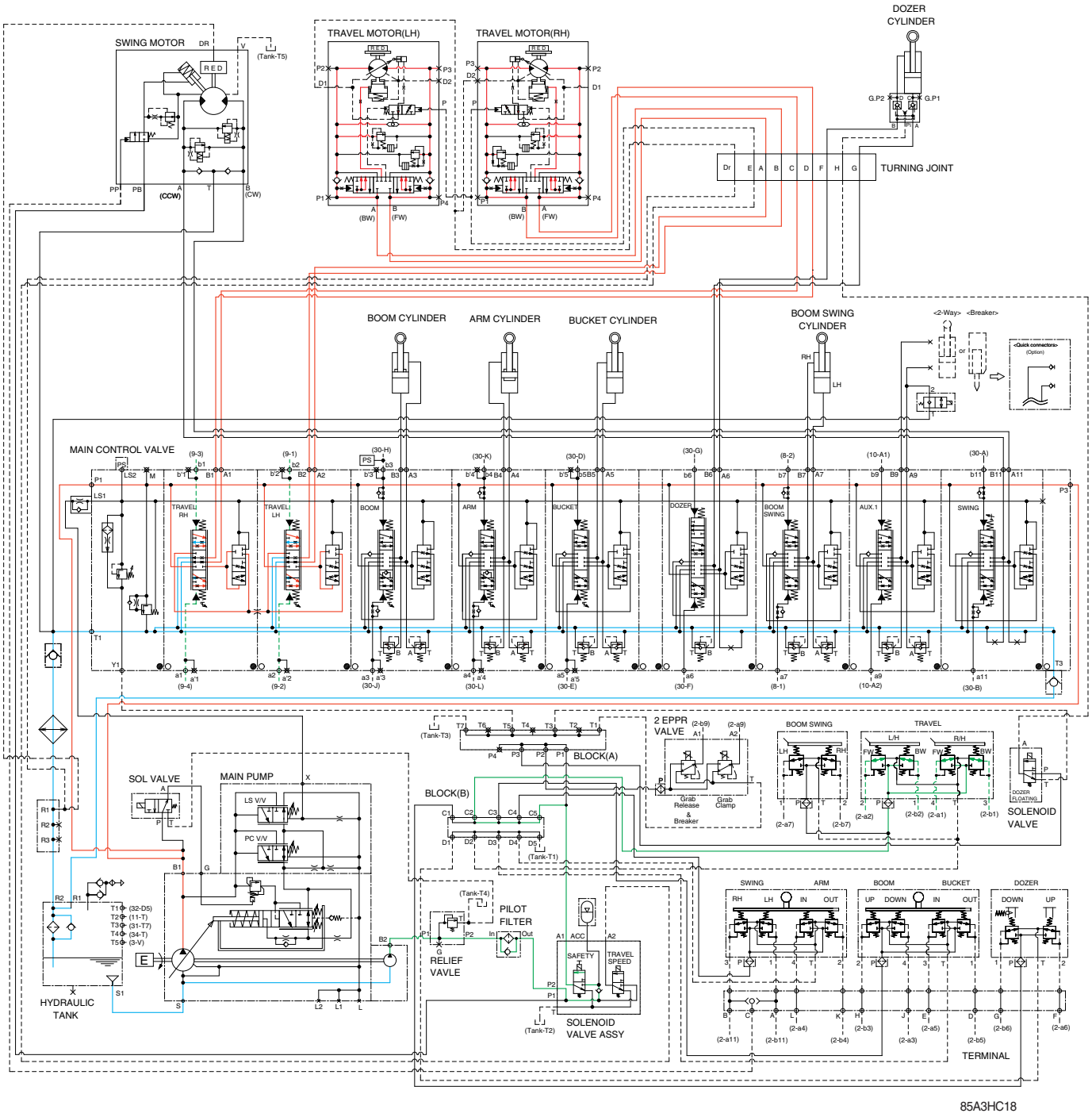
The parking brake is released by the pilot pressure oil from the pilot pump.
When the left control lever placed in the swing position, the pilot pressure (PP) at the shuttle valve is transferred to the brake release valve and the brake release valve is change over. Then the pilot pressure (PB) lift the 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".

※ The circuit diagram may differ from the equipment, so please check before a repair.

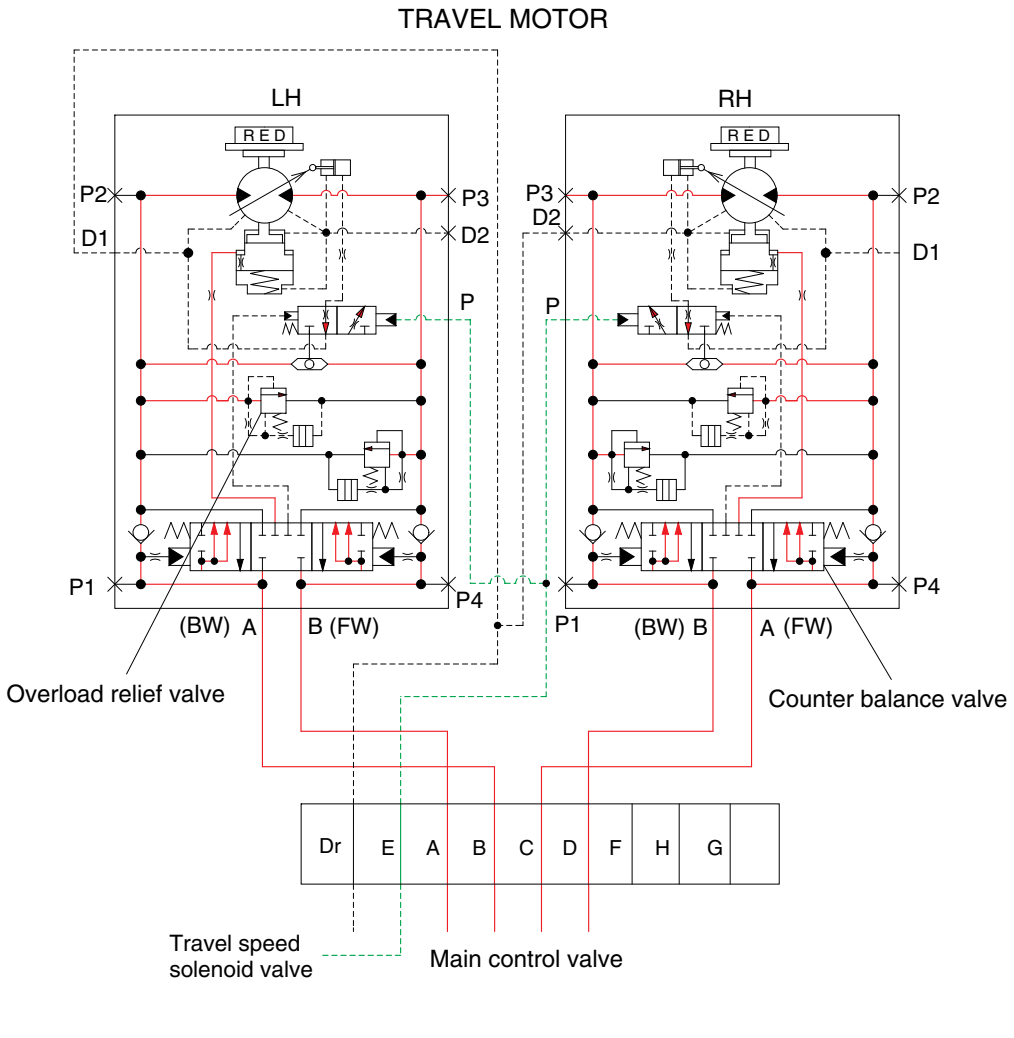
8. TRAVEL FORWARD AND REVERSE OPERATION



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

※ The circuit diagram may differ from the equipment, so please check before a repair.

TRAVEL CIRCUIT OPERATION



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

1) COUNTER BALANCE VALVE

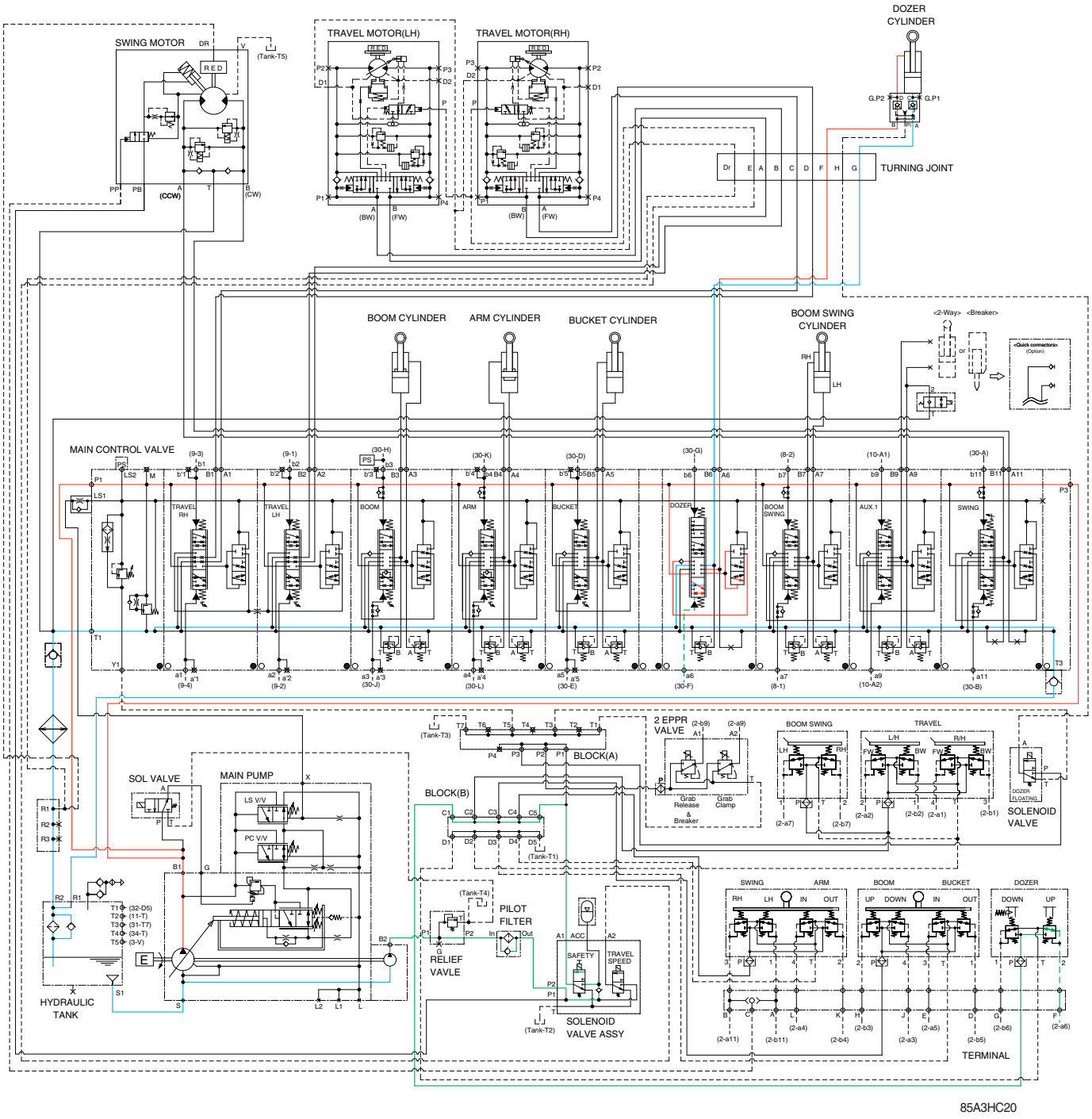
When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 286 kgf/cm^2 (4068 psi) 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

9. DOZER UP OPERATION



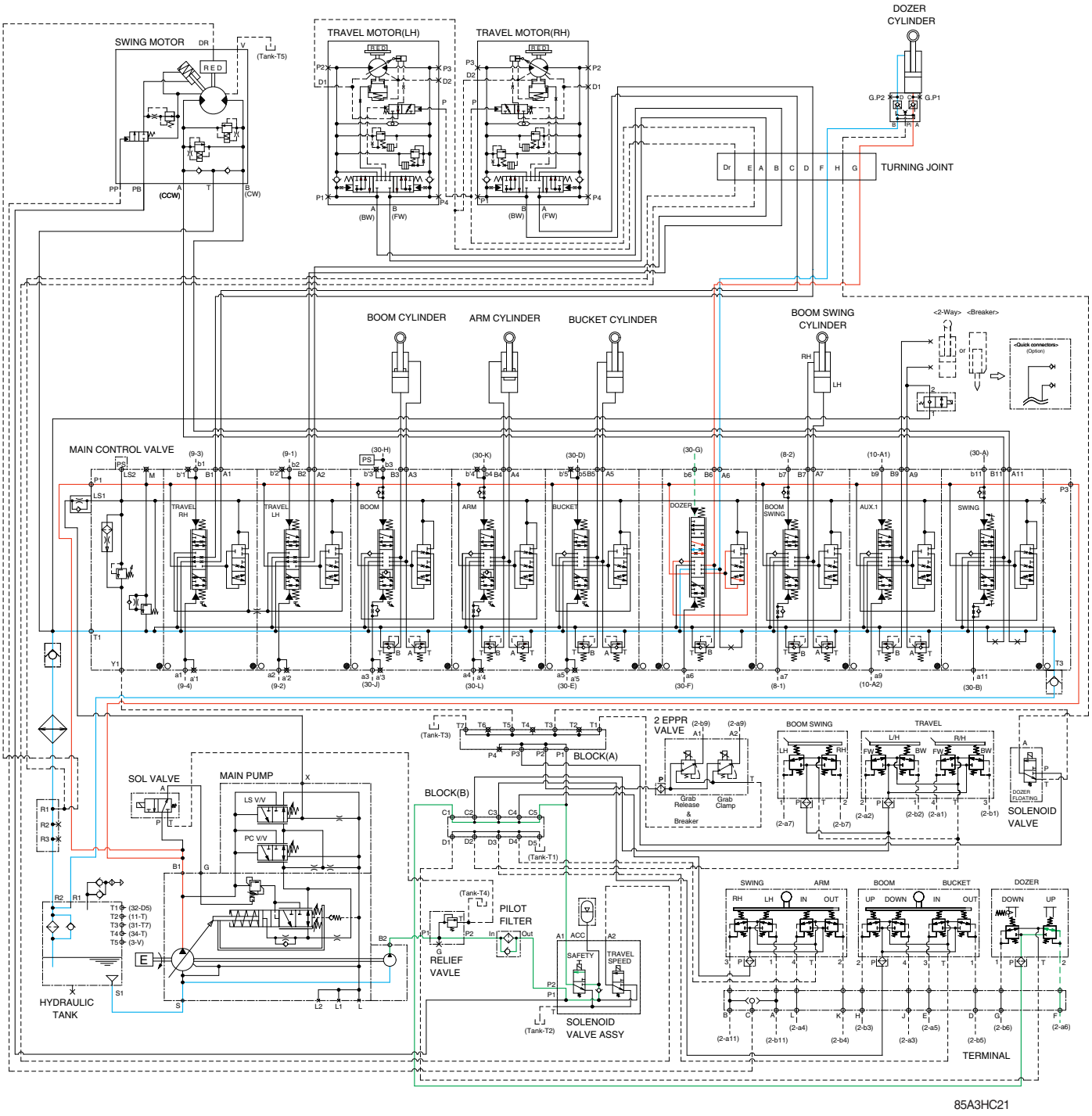
When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.

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

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

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.

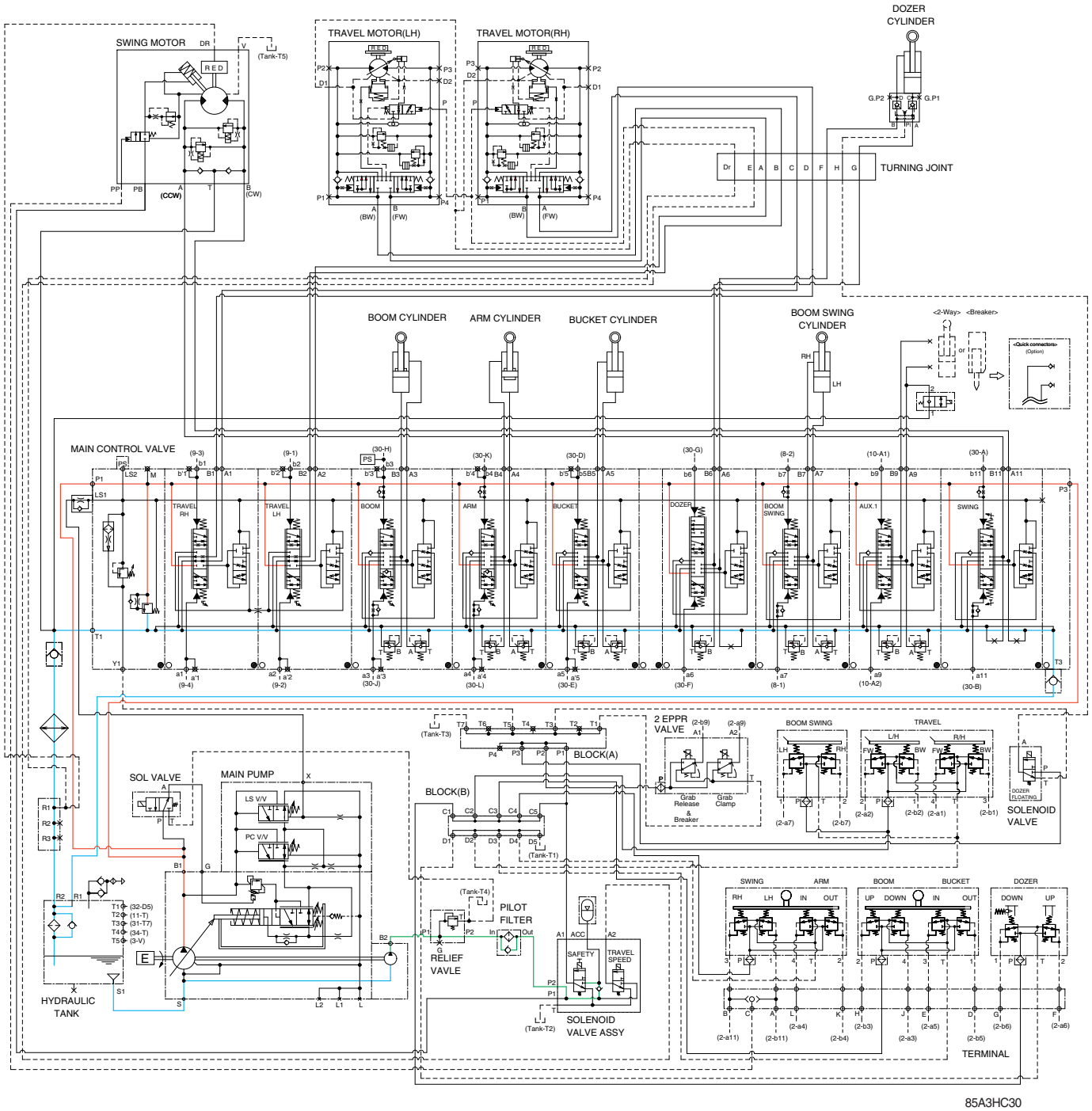
The oil from the main pump flows into the main control valve and then goes to the large chamber of dozer cylinders through the turning joint.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

GROUP 5 COMBINED OPERATION

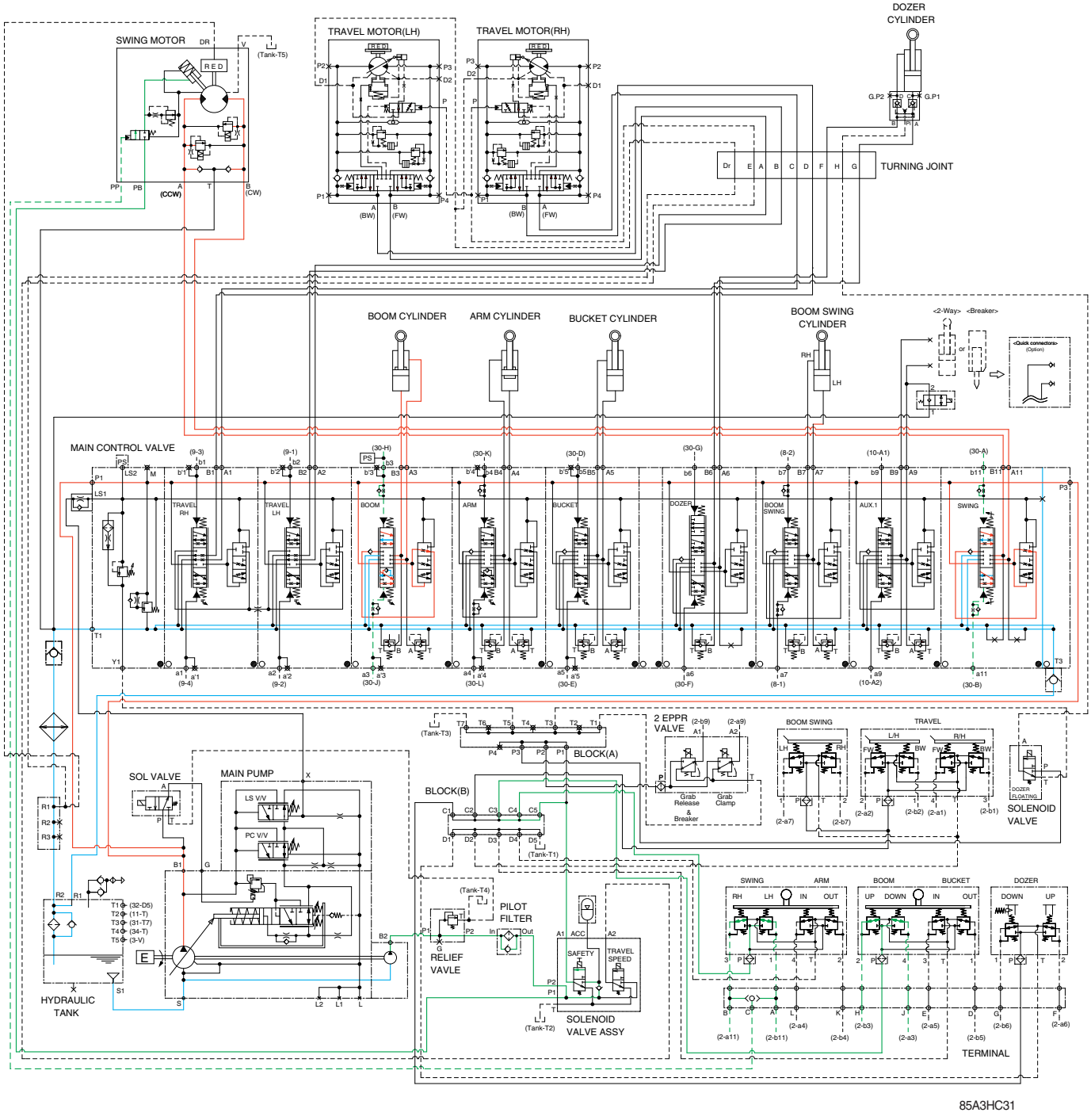
1. OUTLINE



The oil from the main pump flows through the parallel 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. COMBINED SWING AND BOOM OPERATION



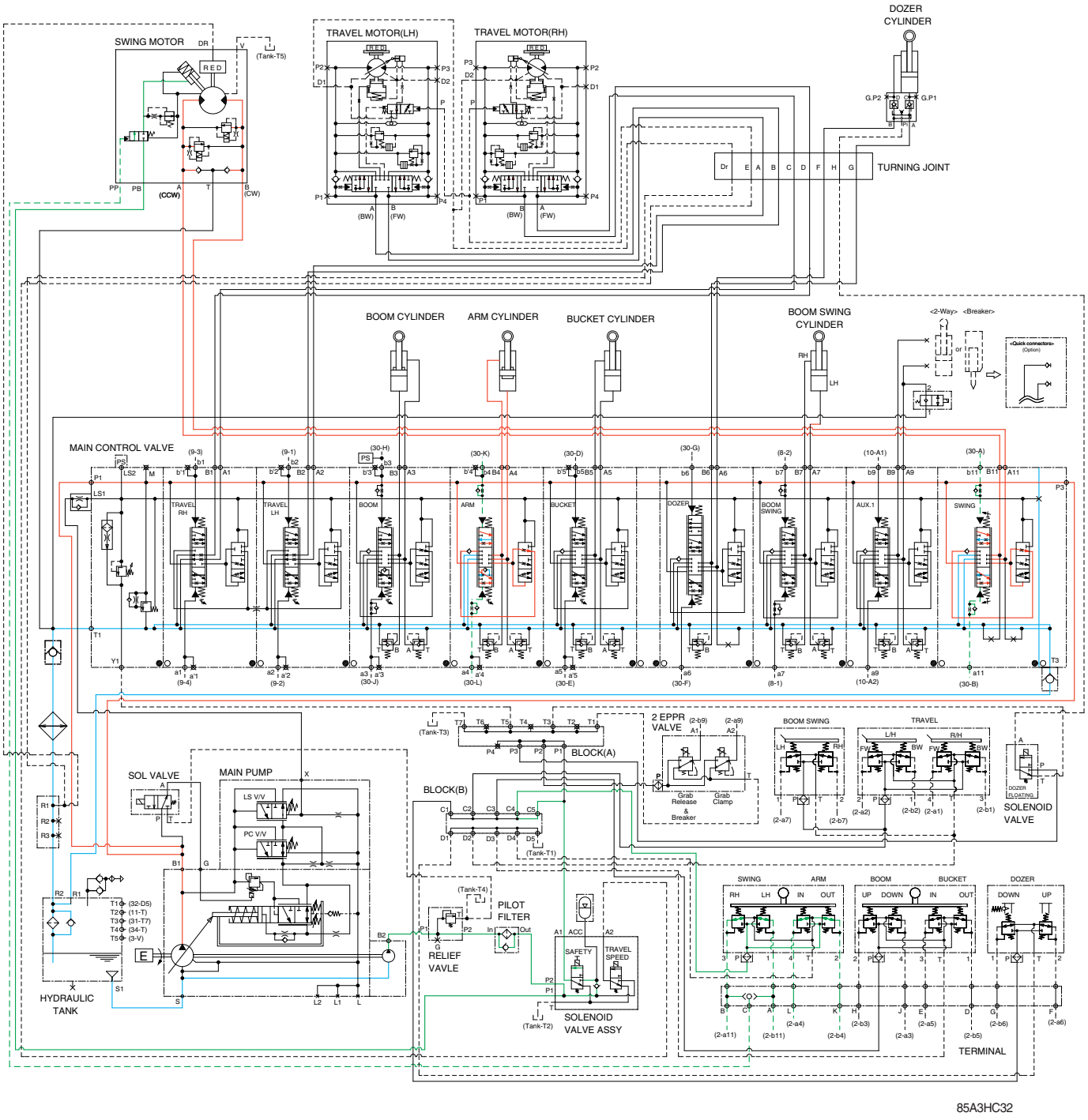
When the swing and boom functions are operated, simultaneously the swing spool and boom spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the boom cylinder through boom spool and flows into the swing motor through the swing spool via the parallel passage.

The superstructure swings and the boom is operated.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3. COMBINED SWING AND ARM OPERATION



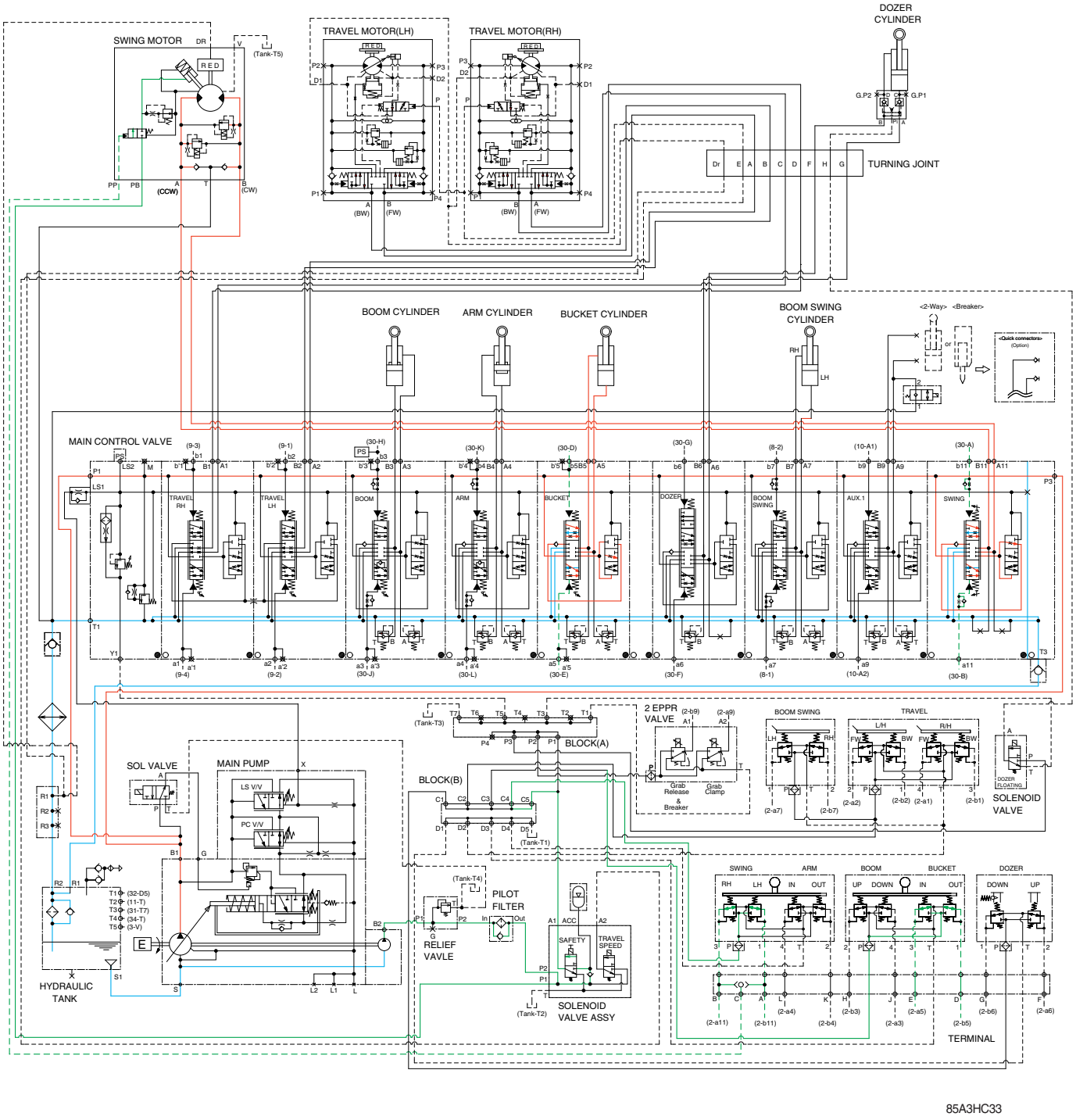
When the swing and arm functions are operated, simultaneously the swing spool and arm spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the swing motor through swing spool via the parallel passage and flows into the arm cylinder through the arm spool.

The superstructure swings and the arm is operated.

※ The circuit diagram may differ from the equipment, so please check before a repair.

4. COMBINED SWING AND BUCKET OPERATION



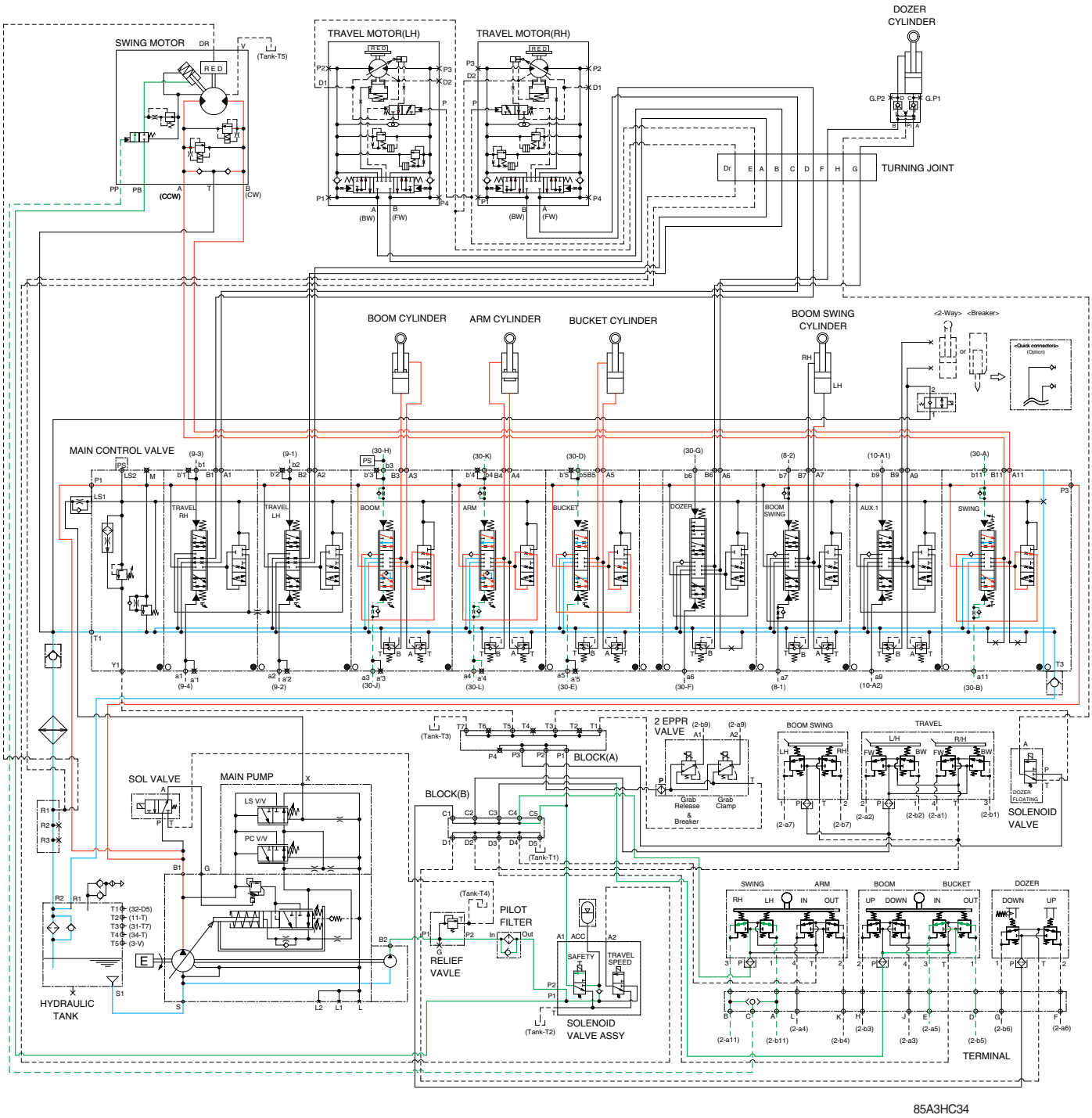
When the swing and bucket functions are operated, simultaneously the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the swing motor through the swing spool via the parallel passage and flows into the bucket cylinder through the bucket spool.

The superstructure swings and the bucket is operated.

※ The circuit diagram may differ from the equipment, so please check before a repair.

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION



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

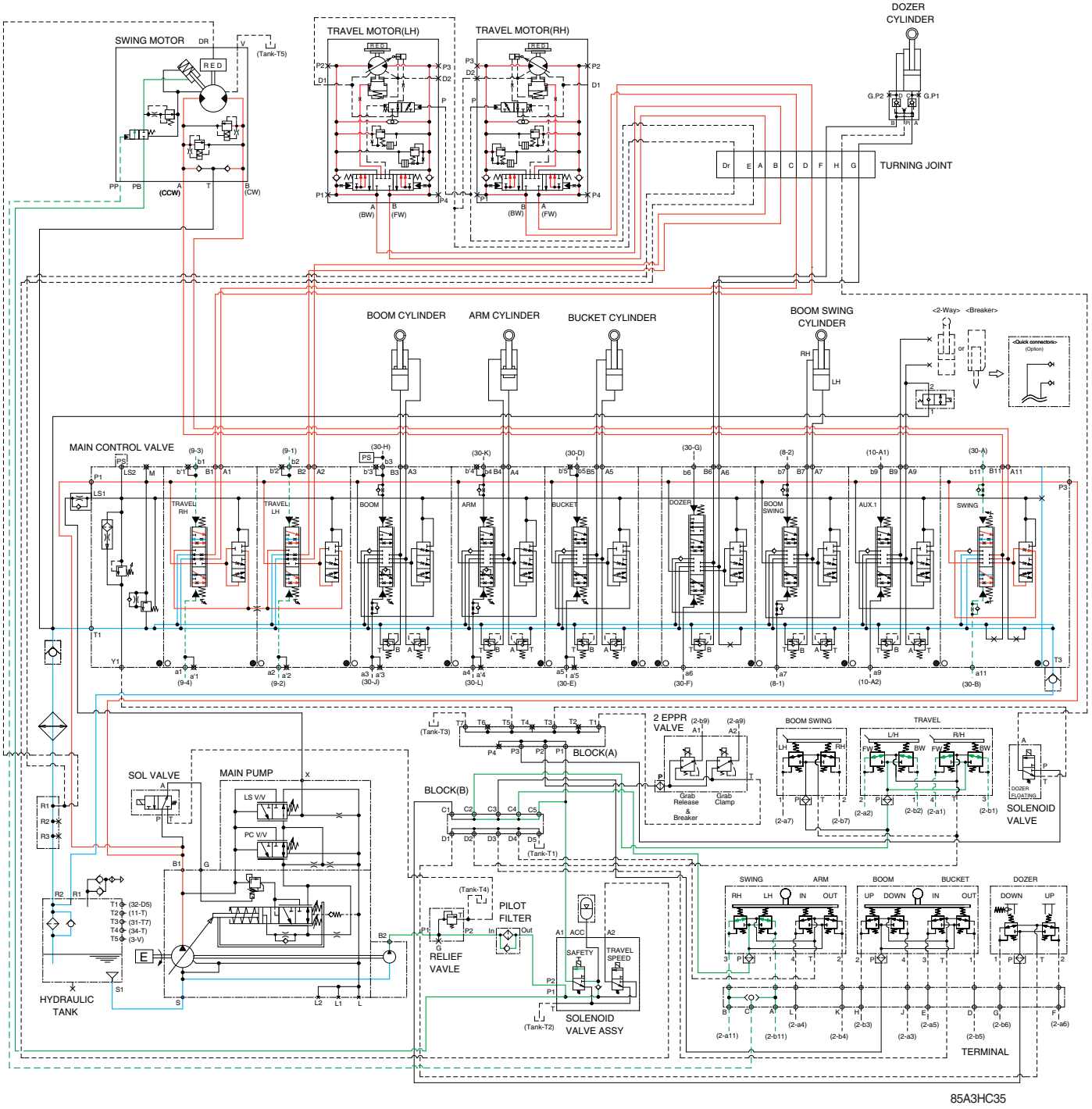
The oil from the main pump flows into the boom cylinder, arm cylinder and bucket cylinder through the boom spool, arm spool, bucket spool by the parallel passage.

Also, the oil flows into the swing motor through the swing spool via the parallel passage.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

6. COMBINED SWING AND TRAVEL OPERATION



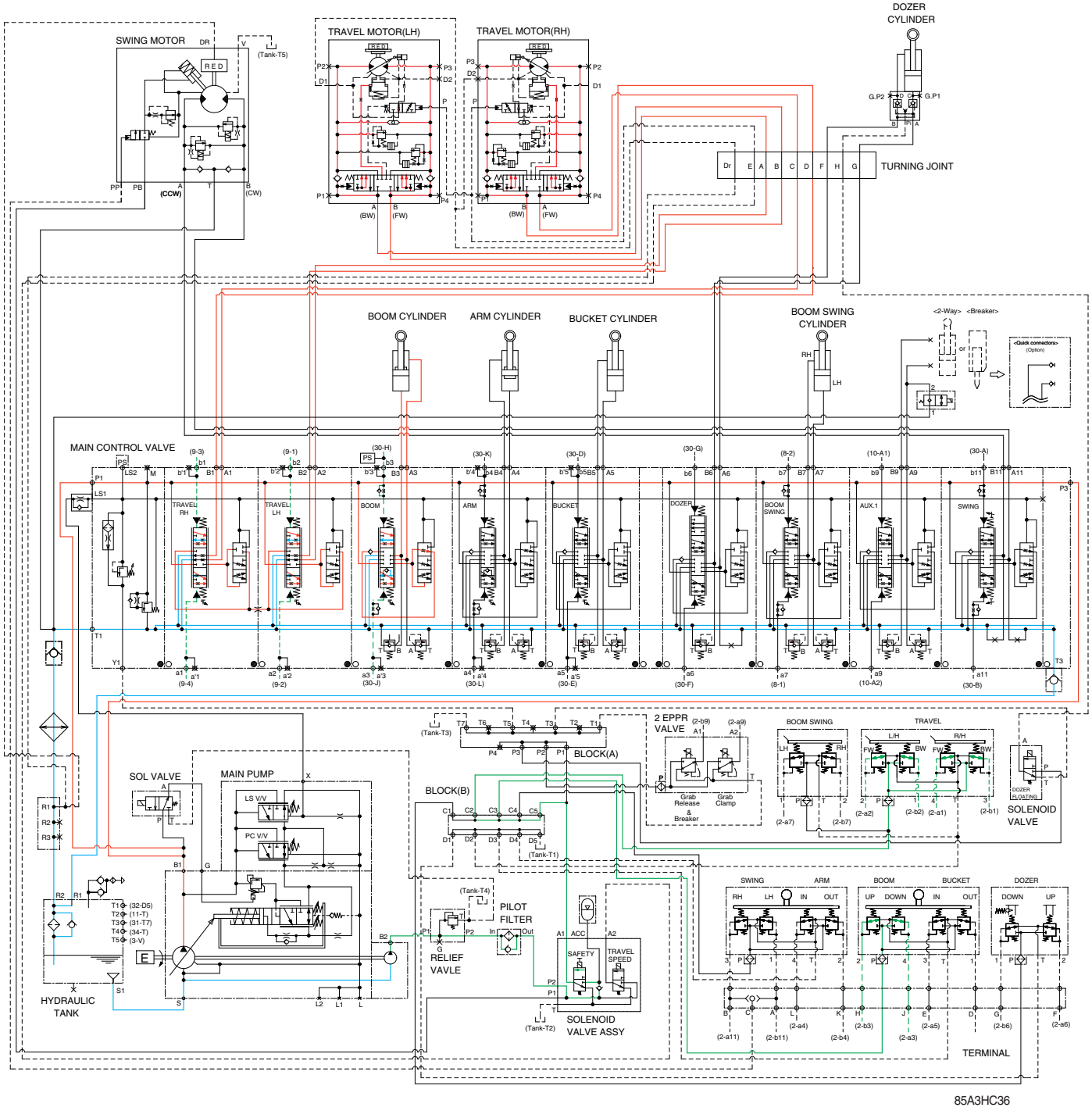
When the swing and travel functions are operated, simultaneously the swing spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the swing motor and LH and RH travel motors through the swing spool and both travel spools via the parallel passage.

The superstructure swings and the machine travels straight.

※ The circuit diagram may differ from the equipment, so please check before a repair.

7. COMBINED BOOM AND TRAVEL OPERATION



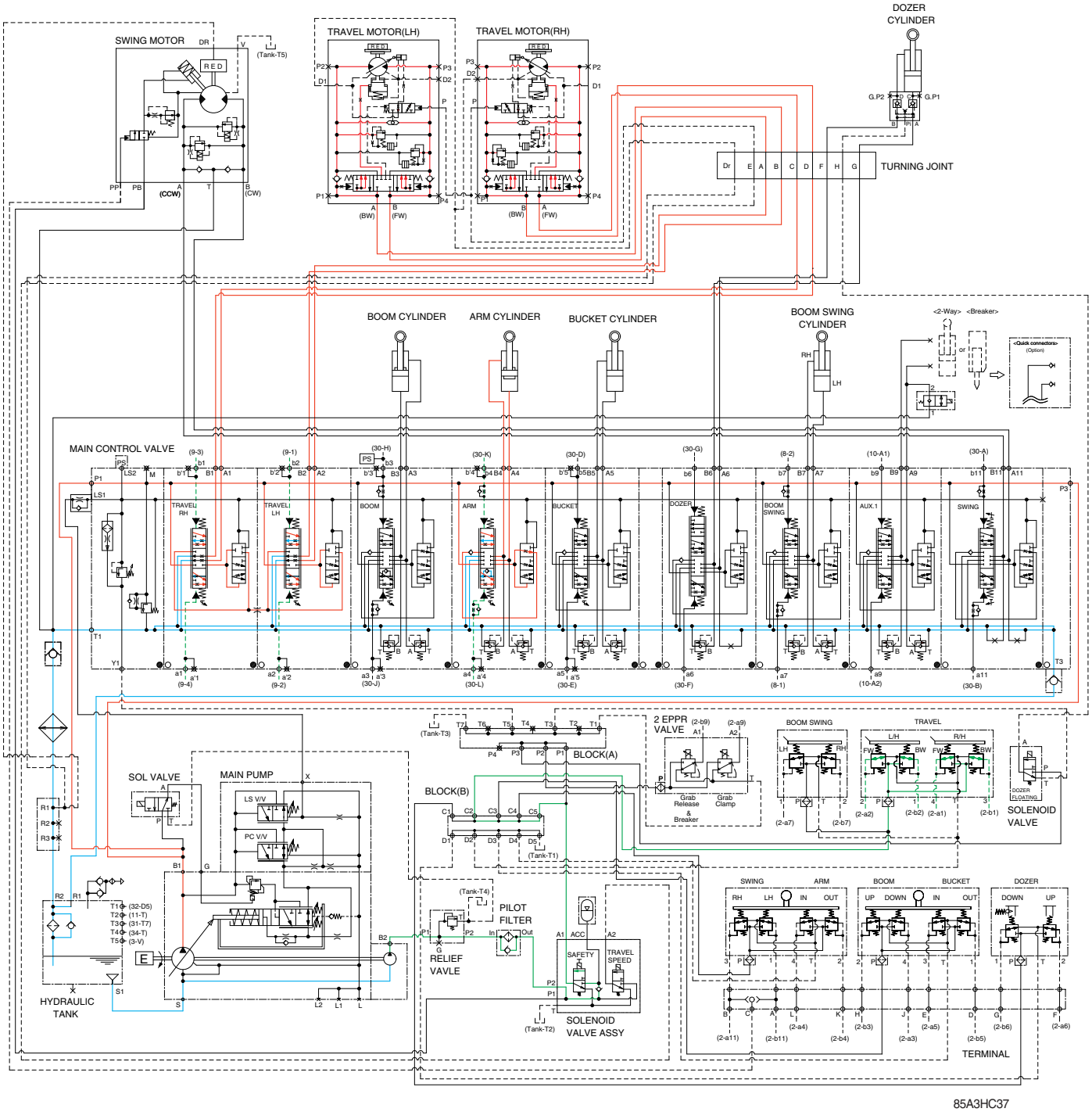
When the boom and travel functions are operated, simultaneously the boom spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the boom cylinder and the travel motors through boom, travel LH and travel RH spools via the parallel passage.

The boom is operated and the machine travels straight.

※ The circuit diagram may differ from the equipment, so please check before a repair.

8. COMBINED ARM AND TRAVEL OPERATION



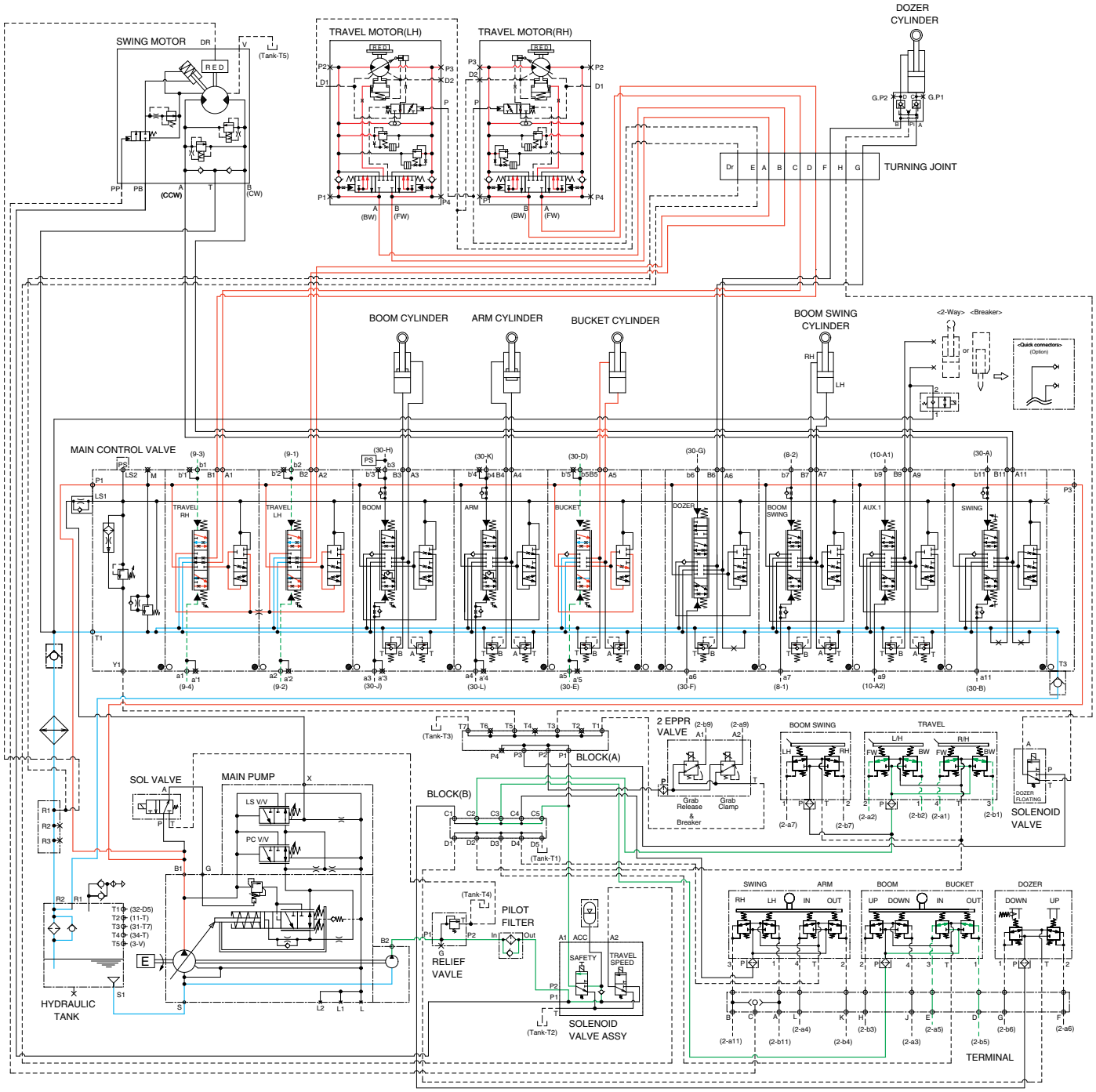
When the arm and travel functions are operated, simultaneously the arm spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the travel motors and the arm cylinder through travel spools and arm spools via the parallel passage.

The arm is operated and the machine travels straight.

※ The circuit diagram may differ from the equipment, so please check before a repair.

9. COMBINED BUCKET AND TRAVEL OPERATION



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

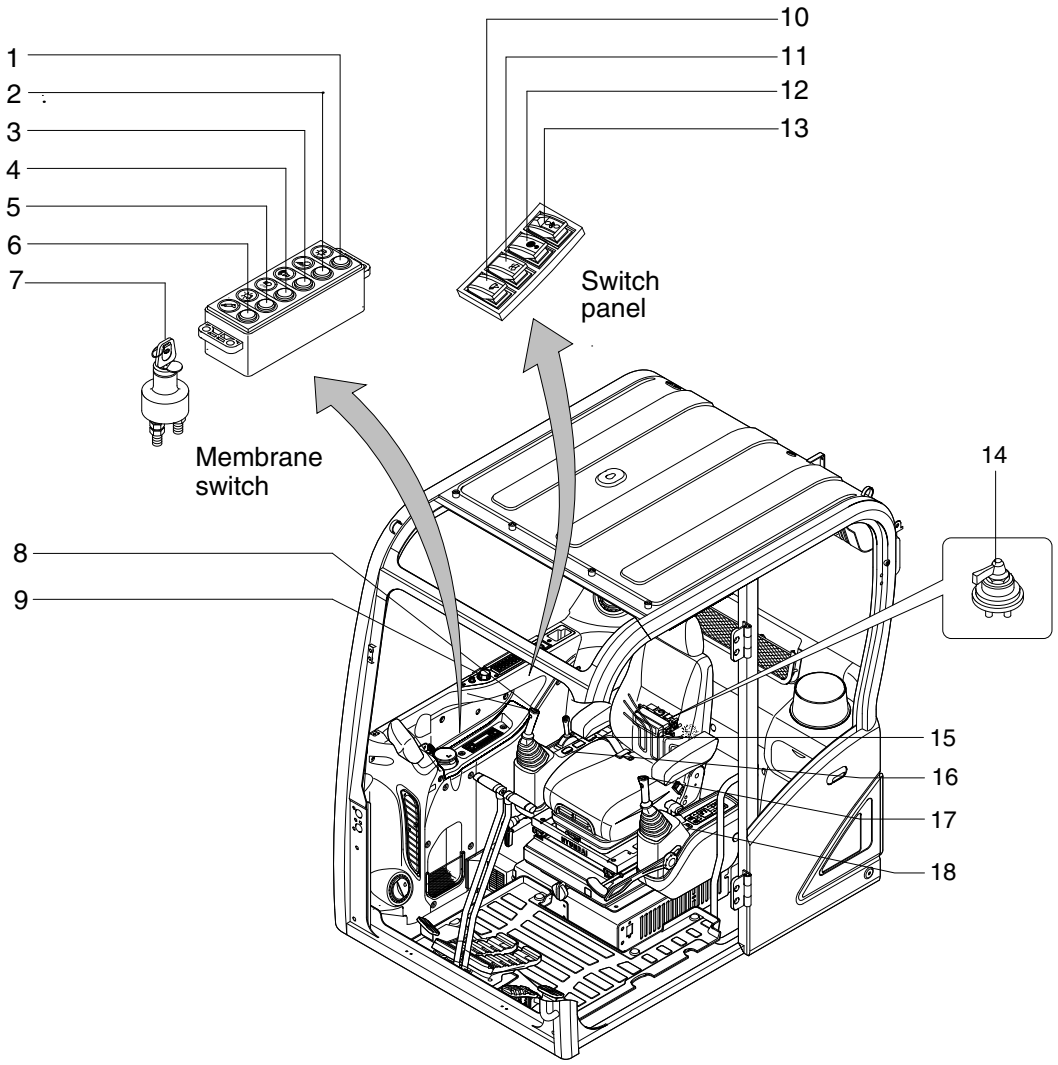
※ The circuit diagram may differ from the equipment, so please check before a repair.

SECTION 4 ELECTRICAL SYSTEM

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

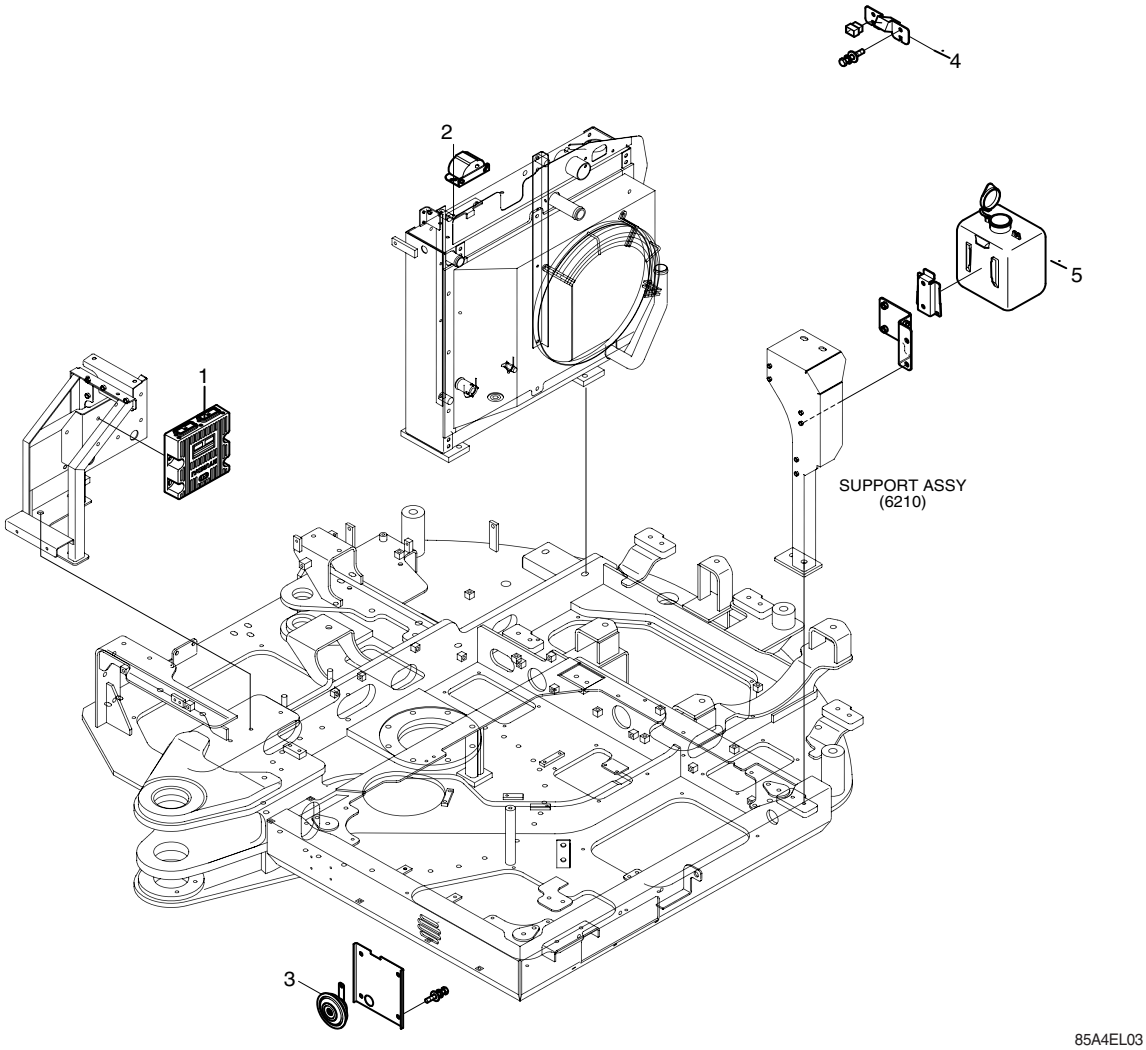
1. LOCATION 1



85A4EL20

1	Head light switch	7	Start switch	13	DPF switch
2	Work light switch	8	Breaker operation switch (opt)	14	Master switch
3	Travel alarm switch	9	Accel dial switch	15	Pattern change switch
4	Cab light switch	10	Wiper switch	16	AUX switch
5	Beacon switch	11	Washer switch	17	Horn switch
6	Breaker selection switch (opt)	12	Overload switch (opt)	18	Quick coupler switch

2. LOCATION 2



1	Engine control unit	4	Cover
2	Driving alarm buzzer	5	Washer tank assy
3	Horn	6	Rear view camera assy

GROUP 2 MONITORING SYSTEM (-#0490)

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.

85A4EL21

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

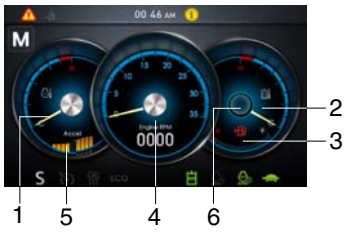
The warning lamp lights ON until the problem is cleared. Refer to page 4-6 for details.

2) GAUGE

(1) Operation screen

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

Default (A type)



85A3CD159A

Option (B type)

HX603CD07B

Option (C type)

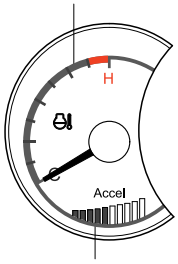
HX603CD07C

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 4-21 for details.

(2) Engine coolant temperature gauge

Engine coolant temp gauge



Accel dial gauge

85A3CD101

① This gauge indicates the temperature of coolant.
- Black range : 43˚C (104˚F) or more and below 110 ˚C (239˚ F)
- Red range : Above 110˚C (239˚F) or more

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.

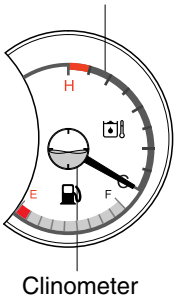
※ If the gauge indicates the red range or lamp lights ON in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

③ Accel dial gauge

Displays the levels (0~9) of the accel dial.

(3) Hydraulic oil temperature gauge

Hydraulic oil temp gauge



Clinometer

85A3CD102

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

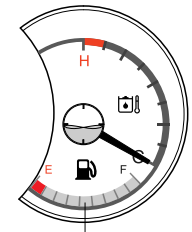
② If the indicator is in the red range or lamp lights ON in red, reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

※ 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.

③ Clinometer

Displays the gradient information of the machine.

(4) Fuel level gauge

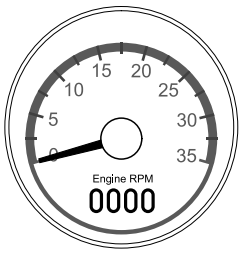


Fuel level gauge

85A3CD103

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



HX603CD35

① This displays the engine revolutions per minute.

3) COMMUNICATION ERROR AND LOW VOLTAGE WARNING POP-UP

(1) Communication error pop-up

HX603CD30

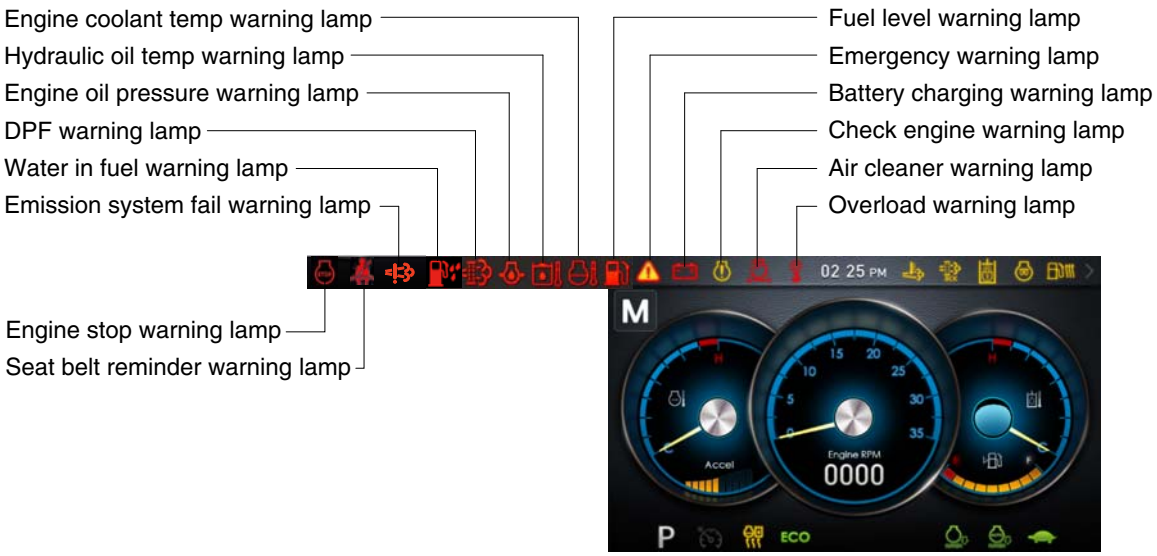
① Cluster displays this communication error pop-up when it has communication error with MCU.
② Communication error pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ If communication with MCU become normal state, it will disappear automatically.

(2) Low voltage warning pop-up

HX603CD31

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

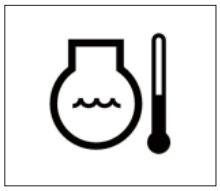


85A3CD104

※ **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 4-13 for the switch.**

※ **When the warning lamps light ON more than 6, you can check all lamps with next page button (◀ , ▶) near the warning lamps.**

(1) Engine coolant temperature warning lamp



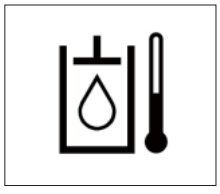
290F3CD61

① The lamp pops up on the center of LCD and the buzzer sounds when the engine coolant temperature is over 110˚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



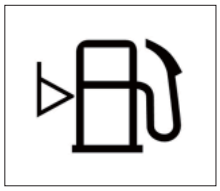
290F3CD62

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 9%.
② Fill the fuel immediately when the lamp is ON.

(4) Emergency warning lamp

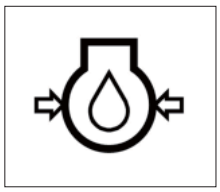
290F3CD64

① This lamp pops up and the buzzer sounds when each of the below warnings are happened.
- 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.

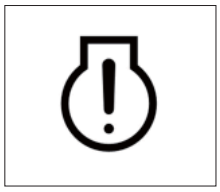
(5) Engine oil pressure warning lamp



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.

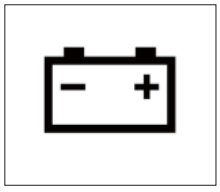
(6) Check engine warning lamp



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 4-8 for the DPF warning lamp.

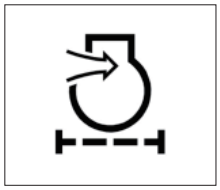
(7) Battery charging warning lamp



290F3CD67

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

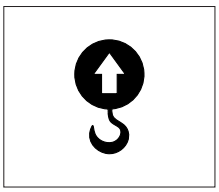
(8) Air cleaner warning lamp



290F3CD68

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

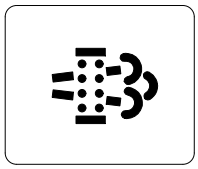
(9) Overload warning lamp (opt)



HX603CD80

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



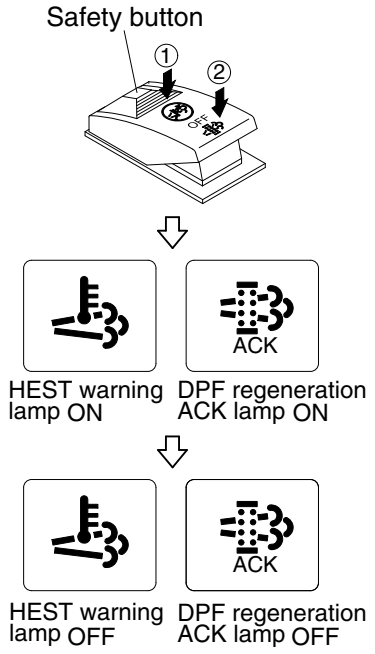
2609A3CD19

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 4-40 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 HD Hyundai Construction Equipment service center or local dealer.

※ Manual regeneration method of DPF



559A3CD143

※ Manual regeneration applies if the machine is in a fireproof area.

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.

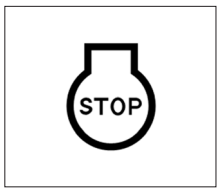
※ Refer to the page 4-29 for the switch operation.

※ 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) Stop engine warning lamp



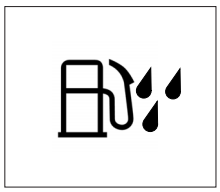
290F3CD252

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 HD Hyundai Construction Equipment service center or local dealer.

(12) Water in fuel warning lamp



HX60A3CD110

① This warning lamp lights ON when water is in fuel.

② Check the water separator.

(13) Seat belt reminder warning lamp

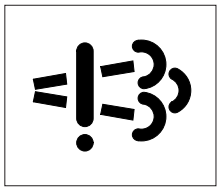
290F3CD252

① When operator don't fasten the seat belt, the seat belt reminder warning lamp pops up and the buzzer sounds.

② Fasten the seat belt.

③ The warning lamp lights ON until fasten the seat belt and the buzzer sounds for 30 seconds.

(14) 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.

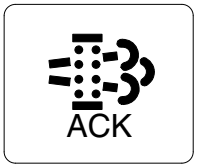
b. Electrical malfunction of the EGR control sensors. (disconnection, short)

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 HD Hyundai Construction Equipment service center or local dealer.**

(15) DPF regeneration acknowledge warning lamp



559A3CD10

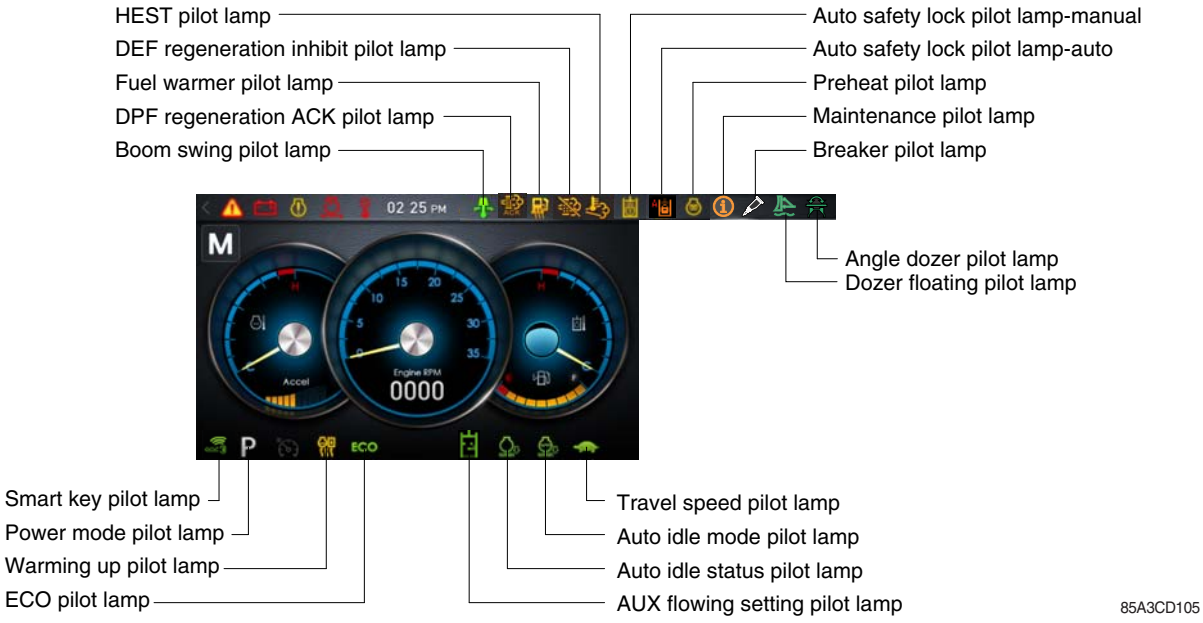
① This warning lamp lights ON stationary regeneration is in process.

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.

5) PILOT LAMPS

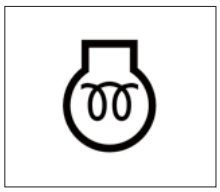


※ When the pilot lamps light ON more than 3, you can check all lamps with next page button (◀ , ▶).

(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 mode
			Auto idle status

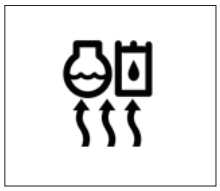
(2) Preheat pilot lamp



290F3CD79

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

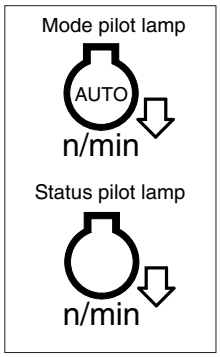


290F3CD80

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

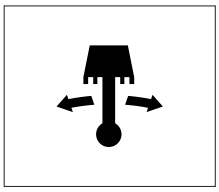
85A3CD110

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 page 4-28.**

(6) Boom swing pilot lamp

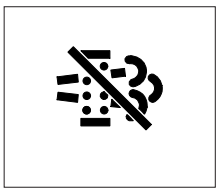


HX603CD82

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

※ **Refer to the operator's manual page 3-42-1.**

(7) DPF regeneration inhibit warning lamp

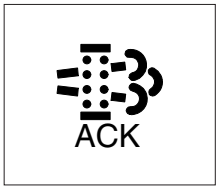


85A3CD107

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

※ **Refer to page 4-40 for the DPF switch.**

(8) DPF regeneration acknowledge warning lamp

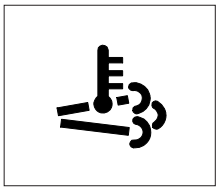


85A3CD108

① This warning lamp will light ON during the regeneration function is operating.

② Also, this lamp will light OFF when the regeneration function is completed.

(9) HEST (High exhaust system temperature) warning lamp



85A3CD109

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.

(10) Smart key pilot lamp (opt)

300A3CD36

① This lamp will be ON when the engine is started by the start button.

② This lamp is red when the a authentication fails, green when succeeds.

※ Refer to the page 4-22.

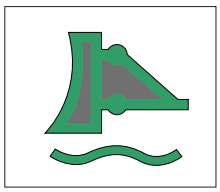
(11) ECO pilot lamp

85A3CD111

① This lamp will be ON when the ECO switch is pressed.

② The machine will be operated in economy conditions.

(12) Dozer floating pilot lamp

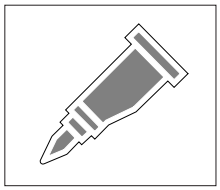


85A3CD112

① This lamp will be ON when the dozer floating lever is pressed.

※ **Refer to the operator's manual 3-42-1.**

(13) Breaker pilot lamp



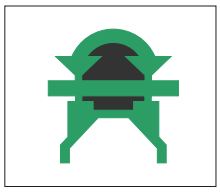
85A3CD116

① This lamp will be ON as conditions below.

- The breaker selection switch is pressed on the membrane switch.
- The AUX switch is pressed to OFF positions.

※ **Refer to page 4-38 and 4-40.**

(14) Angle dozer pilot lamp (opt)

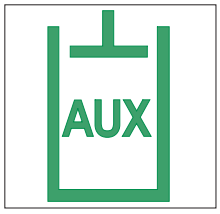


85A3CD113

① This lamp will be ON when the AUX switch is pressed to ANGLE DOZER positions.

※ **Refer to page 4-40.**

(15) AUX flowing setting pilot lamp



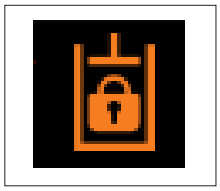
85A3CD114

① This lamp will be ON as conditions below.

- The AUX flow setting is selected Enables in the cluster.
- The AUX switch is pressed to AUX positions.

※ **Refer to page 4-33 and 4-40.**

(16) Auto safety lock pilot lamp-manual



85A3CD114

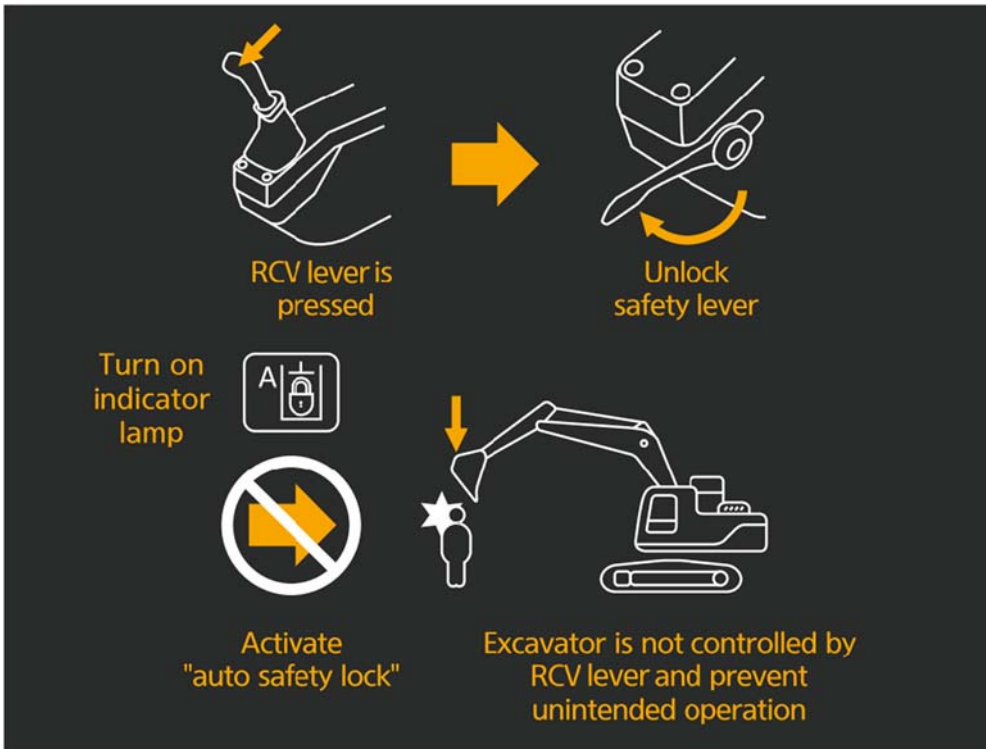
① This lamp will be ON when the safety lever is in the lock positions.

※ **Refer to page 4-43.**

(17) Auto safety lock pilot lamp-auto

300A3CD37

① Auto safety lock system prevents unintended operation of the machine in order to improve safety.
② Only if safety lever is locked, engine is started.
③ If operator unlock safety lever when RCV lever is pressed, machine is not controlled by RCV lever.



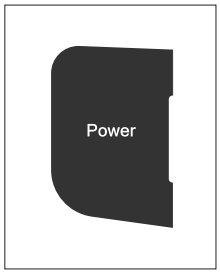
300A3CD38

6) SWITCHES

85A3CD117

※ **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

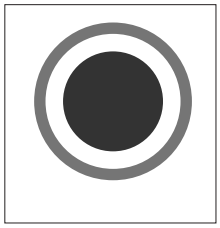


85A3CD117A

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



85A3CD117B

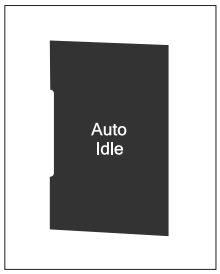
① This switch is used to select or change the menu and input value.

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



85A3CD117C

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

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

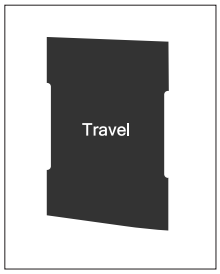
② The buzzer sounds when the machine has a problem.
In this case, push this switch and buzzer stops, but the warning lamp blinks until the problem is cleared.

(4) Buzzer stop switch

85A3CD117D

① 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.

(5) Travel speed control switch

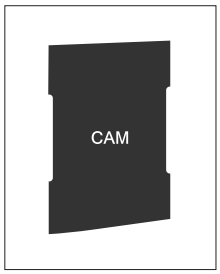


85A3CD117E

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

- : Low speed
- : High speed

(6) Escape/ Camera switch

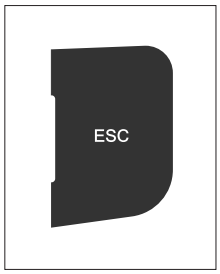


85A3CD117F

① In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).

※ **Please refer to page 4-33 for the camera.**

(7) Escape switch



85A3CD117G

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

7) MAIN MENU

· Operation screen

85A3CD159

HX603CD32B

HX603CD32C

Tap

M or

Press

Press

ESC/ CAM

Main menu screen

85A3CD118

Sub menu screen

85A3CD119

85A3CD120

※ Please refer to select switch, page 4-16 for selection and change of menu and input value.

(1) Structure

No	Main menu	Sub menu	Description
1	 Monitoring 55I3CD51AK	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 55I3CD51BK	ESL mode setting Automatic engine shutdown Change password AUX flow setting Option attach Maintenance information Machine Information A/S phone number Service menu	ESL mode setting, Smart key setting One time, Always, Disabled Password change 2 way, 4 way Setting option attachment 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 DPF filter replacement, AVCU setting
3	 Display 55I3CD51CK	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 55I3CD51DK	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

85A3CD121 85A3CD122

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

② Active fault - Engine

85A3CD123 85A3CD124

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

③ Logged fault - Machine/ Engine

85A3CD125 559A3CD50A

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

④ Monitoring (Analog)

85A3CD127 85A3CD128

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

⑤ Monitoring (Digital) - Input

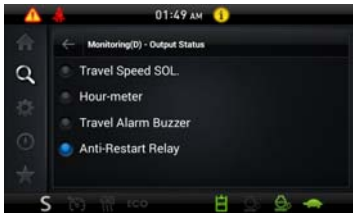
85A3CD129

85A3CD130

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

⑥ Monitoring (Digital) - Output

85A3CD132



85A3CD133

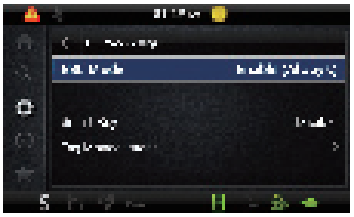
- The output status can be confirmed by this menu.
- The output pilot lamps are blue light ON.

(3) Management

① ESL mode setting

85A3CD134

85A3CD135



85A3CD136

· **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

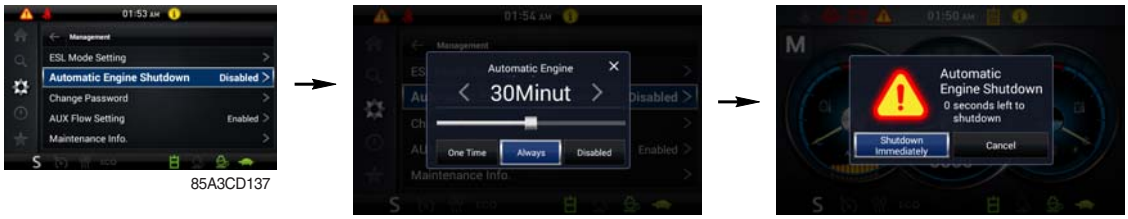
※Password length : 5~10 digit

· **Smart key (option) :** Smart key is registered when equipped with optional smart key. If smart key is not inside of the cabin, authentication process fails and the password entering is needed.

※Engine Starting Condition

Case	ESL Mode	Smart Key	Condition
1	Disable	Disable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started without password input.
2	Disable	Enable	If Smart Key is enabled, ESL Mode is automatically enabled. This Case 2 work the same as the Case 4.
3	Enable	Disable	- With registered tag : Engine can be started with password input. - Without registered tag : Engine can be started with password input.
4	Enable	Enable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started with password input.

② Automatic engine shutdown



85A3CD137 85A3CD138 85A3CD139

85A3CD140

The automatic engine shutdown function can be set by this menu.

a. Once (one time)

· Automatic shutdown function set Once when key-on or engine operation condition.
  - Key-off when the shutdown button clicks after pop-up the automatic stop icon.
  - Shift automatic shutdown function to Disable when when the cancel button clicks after pop-up the automatic stop icon.
· Keep Disable for the automatic shutdown function when key-off after key-on again or start engine.

b. Always (continuous use)

· Automatic shutdown function set Always when key-on or engine operation condition.
  - Key-off when the shutdown button clicks after pop-up the automatic stop icon.
  - Shift automatic shutdown function to Disable when when the cancel button clicks after pop-up the automatic stop icon.
· Keep Always for the automatic shutdown function when key-off after key-on again or start engine.

c. Disable

· Disable the engine automatic shutdown function.

③ Change password

- The password is 5~10 digits.

85A3CD141

85A3CD142

Enter the current password

85A3CD143

Enter the new password

85A3CD144

The new password is stored in the MCU.

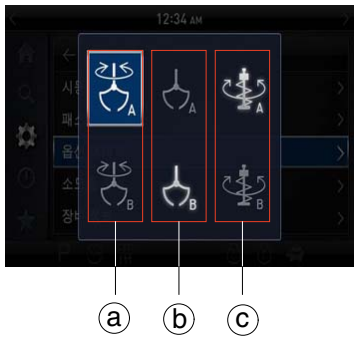
85A3CD145

Enter the new password again

④ AUX flow setting

a. Option attach selection

85A3CD146



R559A3CD42O

- Three kinds of option attachment can be selected by this menu.
  - ⓐ Rotary Grapple (Equipped with 4 way option)
  - ⓑ Grapple (Equipped with 2 or 4 way option)
  - ⓒ Auger (Equipped with 2 or 4 way option)

※ There are two user modes (type A or B) in each option attach.

b. Proportional flow control setting

User can set preferable value of each option attachment by this menu.

a) Rotary setting

HX603CD43O

85A3CD149

· Select Rotary
RCV, button and flow
can be set by this menu

85A3CD150

· RCV setting
- Enable set LH or RH RCV for rotary operation.
- Example :
Select LH for rotary ->
RH set for grapple automatically.

85A3CD151

· Button setting (CW rotation)
- Enable set LH or RH button for CW or CCW rotation.
- Example :
Select LH for CW rotation ->
RH set for CCW rotation
automatically

85A3CD152

· Flow setting
- Enable set from level 1 to level 5.
- Example :
Select level 3.
- Press Yes after flow setting.

b) Grapple setting

HX603CD43O

85A3CD153

· Select grapple
RCV, button and flow
can be set by this menu

85A3CD154

· RCV setting
- Enable set LH or RH RCV for grapple operation.
- Example :
Select RH for grapple ->
LH set for rotary automatically.

85A3CD155

· Button setting (Close)
- Enable set LH or RH button for close or open.
- Example :
Select RH for Close ->
LH set for open automatically

85A3CD158

85A3CD156

· Flow setting
- Enable set from level 1 to level 5.
- Example :
Select level 1.
- Press Yes after flow setting.

HX603CD43O

85A3CD157

· Save setting value
- Enable save setting value by pressing change ( ) button.

· Setting value saved once, it memorized in each icon and the last setting value is activated.
· Saved setting can be used by pressing Icon button only.
· There are two kinds (A and B) in each option attach setting and six kinds of option attach setting can be saved totally (2 of 4 way, 4 of 2 way).

c. Confirmation

85A3CD159

85A3CD160

AUX flowing setting pilot lamp ( ) is activated on the lower side of the main screen as below conditions.

- The AUX switch is pressed to the AUX position and the AUX flow setting is selected Enabled.

Previous setting value can be checked by following procedure.

- Menu > Management > AUX flow setting

a) Rotary setting
   - Rotary RCV : LH
   - Rotary flow level : 3
   - CW rotation : LH
   - CCW rotation : RH

b) Grapple setting
   - Grapple RCV : RH
   - Grapple flow level : 3
   - Open : LH
   - Close : RH

⑤ Maintenance information

85A3CD161 85A3CD162 85A3CD163

- 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	Hydraulic oil	5000
4	Hydraulic oil pilot line filter	1000
5	Hydraulic oil return filter	1000
6	Engine oil filter	500
7	Fuel filter	500
9	Pre-filter	500
10	Hydraulic tank air breather	1000
11	Air cleaner	500
12	Radiator coolant	2000

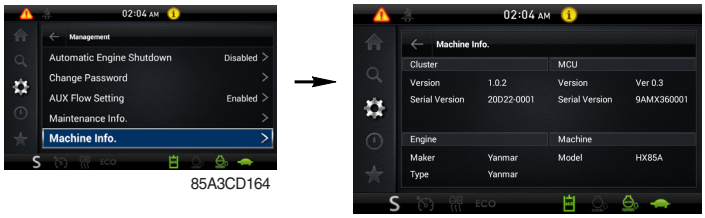
- User cab be set to pop-up the replacement parts that residual time is less than 50 hours based on the replacement interval.
  - Pop-up the replacement parts list once when start switch is key-on.

85A3CD166

85A3CD167

- Please contact to parts dealer for supplies replacement.
  It can be a disadvantage for warranty repair when not to replace with supplies on time and use genuine parts.

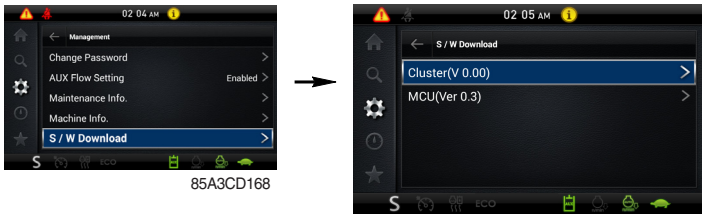
⑥ Machine Information



85A3CD164 85A3CD165

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

⑦ S/W download

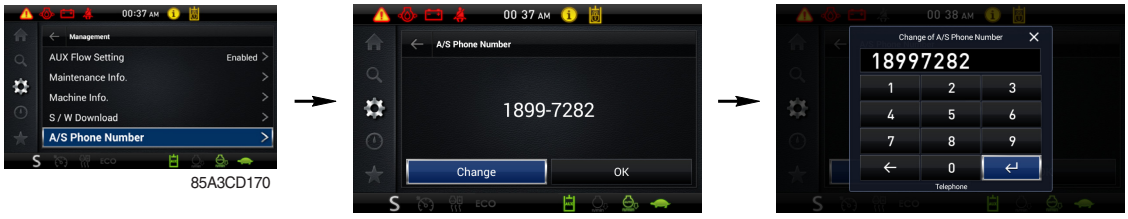


85A3CD168 85A3CD169

· Display and update software version about operating system, application, image and font through this menu.

※ Do not turn off the start switch when update process is proceeding.

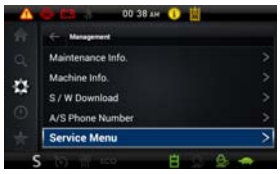
⑧ A/S phone number



85A3CD170 85A3CD171 85A3CD172

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

⑨ Service menu



85A3CD173

Enter the password 85A3CD174

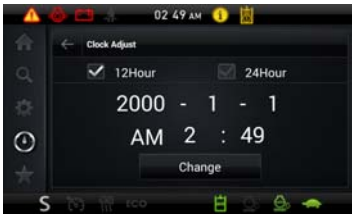
85A3CD175

- Delete logged fault : Logged faults of MCU or engine ECU can be deleted. (only when the engine is stopped)
- Operating hours : Operating hours since the machine line out can be checked.
- Power shift : Set power shift mode (standard/option)
- RPM & Fuel : The engine rpm or fuel gauge can be display on the center of the cluster operation screen.
- PRM number : The engine rpm number can be display or not on the center of the cluster operation screen.
- DPF filter replacement : Engine ECM parameter can be initialized when the DPF cleaning process is finished.
- AVCU setting : Selection of the 2 way, 4 way, angle dozer can be set when the machine line out.

(4) Display

① Clock

85A3CD176

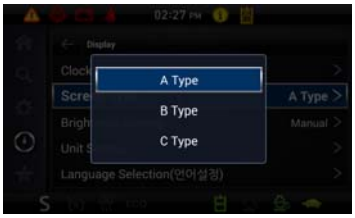


559A3CD61A

- 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

85A3CD178



85A3CD179

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

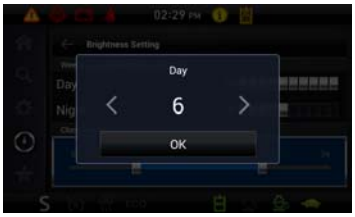
③ Brightness setting calibration

85A3CD180

85A3CD181

Manual (1st~10th step)

Auto (day/night) 85A3CD182



Auto (time) 85A3CD183

- 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

85A3CD184

85A3CD185

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

⑤ Language

85A3CD186

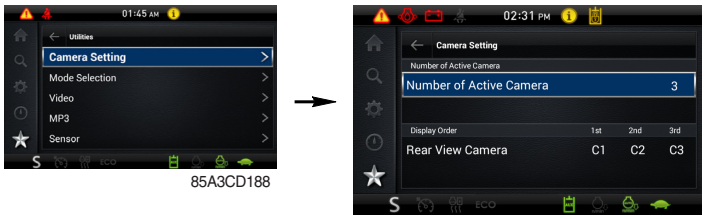
85A3CD187

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

(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.



85A3CD188

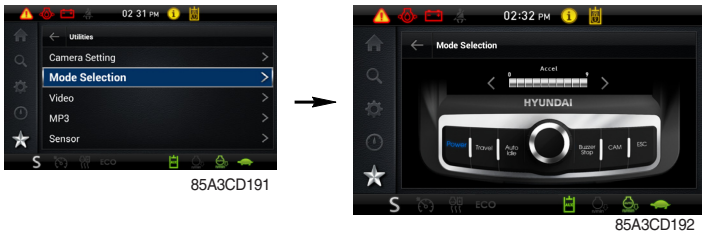
85A3CD189

- 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.

85A3CD190

HX85A3CD68A

② Mode



85A3CD191

85A3CD192

- 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.

85A3CD193

HX85A3CD194A


HX85A3CD194B

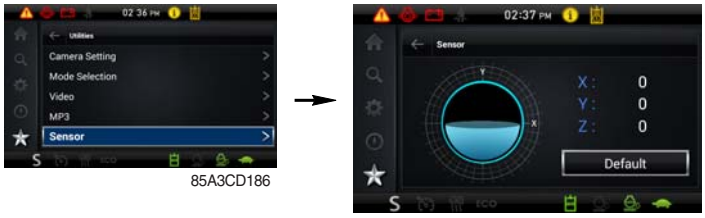
85A3CD159


HX85A3CD194B

· 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	Display list	Touch	6	After 10 sec	Touch
2	Before 10 sec	Touch	7	Stop	ESC switch or touch
3	Previous track	Touch	8	Mute	Touch
4	Play/pause	Touch	9	Sound volume	Select switch or touch
5	Next track	Touch	10	Playing time	-

④ Clinometer



85A3CD186

85A3CD196

· When the machine is on the flatland, if tap the "initialization", the values of X, Y, Z reset "0".
· You can confirm tilt of machine in cluster's operating screen.

⑤ Manual

85A3CD197

85A3CD198

· You can read the manual of the cluster on the monitor.

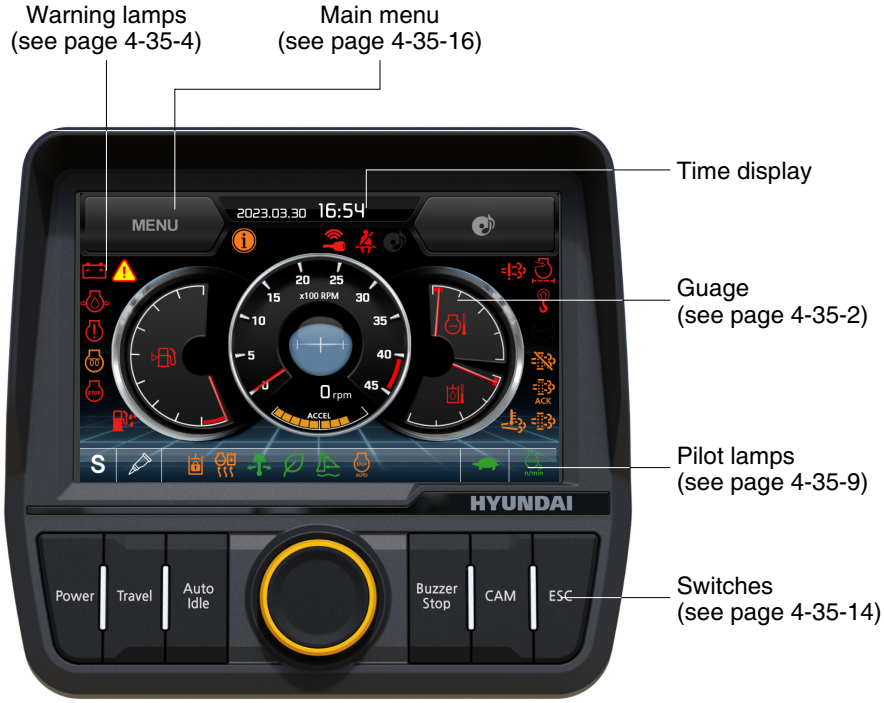
GROUP 2 MONITORING SYSTEM (#0491-)

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.**



85A4EL04

※ **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 4-35-4 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 gauge	6	Clinometer

(2) Engine coolant temperature gauge

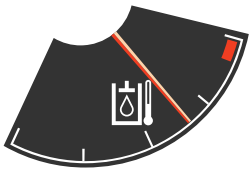
290F3CD53

① This gauge indicates the temperature of coolant.
- Black range : General state
- Red range : Engine overheated state

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 even though the machine is in the normal condition range, check the electric device as this can be caused by poor connection of sensor or connector, and poor grounding of the instrument, etc.

(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 in the normal condition range, check the electric device as this can be caused by poor connection of sensor.

(4) Fuel level gauge

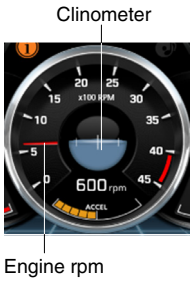
HX60A3CD55A

① This gauge indicates the amount of fuel in the fuel tank.
- Black range : 11% or more
- Red range : below 11%

② Fill the fuel when in 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 in the normal condition range, check the electric device as this can be caused by poor connection of sensor.**

(5) Engine rpm gauge and clinometer



HX60A3CD105K

① This displays the engine speed.

② This displays the tilt of machine.

(6) Accel dial gauge

290F3CD59

① This gauge indicates the level of accel dial 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

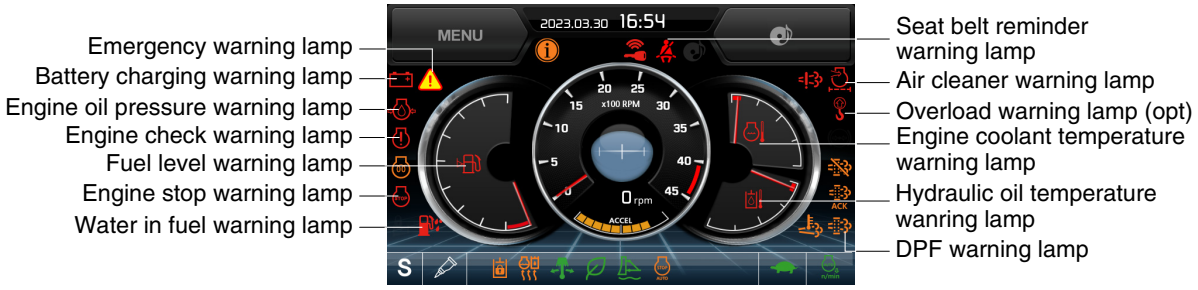
① Cluster displays this low voltage warning pop-up when the battery voltage is low.

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.

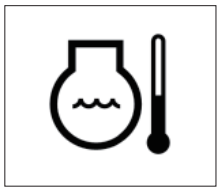
4) WARNING LAMPS



85A3CD218

※ **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 up when the buzzer stop switch is pushed or the pop-up is touched. And the buzzer stops. Refer to page 4-35-15 for the switch.**

(1) Engine coolant temperature warning lamp



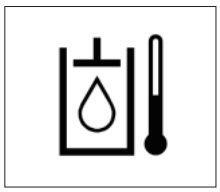
290F3CD61

① The lamp pops up on the center of LCD and the buzzer sounds when the engine coolant temperature is over 110˚C or more.

② The pop-up lamp moves to the original position and lights up 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



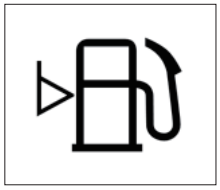
290F3CD62

① This warning 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



290F3CD63

① This warning lamp lights up and the buzzer sounds when the level of fuel is below 11%.

② Fill the fuel immediately when the lamp is ON.

(4) Emergency warning lamp

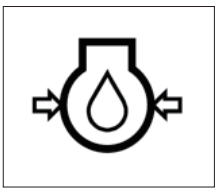
290F3CD64

① This warning lamp pops up and the buzzer sounds when each of the below warnings occurs.
- 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 will stop.**
This is same as following warning lamps.

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

(5) Engine oil pressure warning lamp



290F3CD65

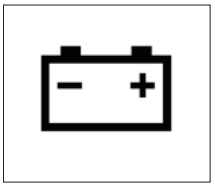
① This lamp lights up when the engine oil pressure is low.
② If the lamp lights up, shut OFF the engine immediately. Check oil level.

(6) Check engine warning lamp

290F3CD66

① Warning lamp is turned ON when the engine must be checked.
※ **When the warning lamp is turned ON, stop the machine and find the cause for repair.**

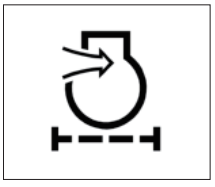
(7) Battery charging warning lamp



290F3CD67

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

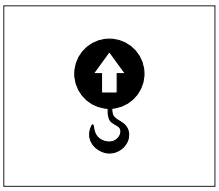
(8) Air cleaner warning lamp



290F3CD68

① This warning lamp lights up when the air cleaner is clogged.
② Check, clean or replace the filter.

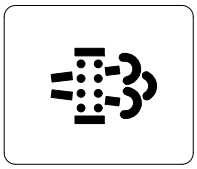
(9) Overload warning lamp (opt)



HX603CD80

① When the machine is overloaded, the overload warning lamp lights up when the overload switch is ON. (if equipped)
② Reduce the machine load.

(10) DPF (diesel particulate filter) warning lamp



2609A3CD19

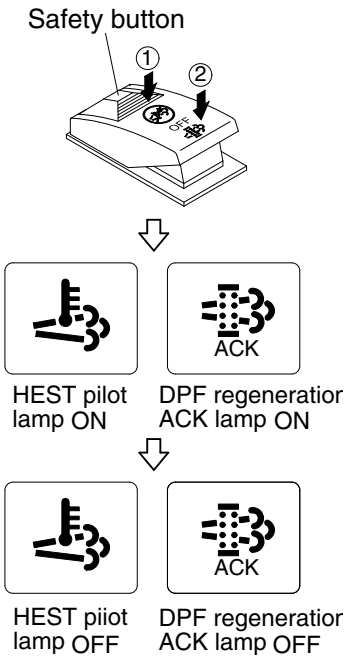
① This warning lamp lights up or go off when the regeneration is needed.
② This warning lamp lights up while DPF regeneration inhibit switch is in "Regeneration ingibited" state, when stationary regeneration is permitted.
③ This warning lamp lights up during reset regeneration standby or in back up mode.
④ This warning lamp blinks 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 3-39 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 HD Hyundai Construction Equipment service center or local dealer.

※ Manual regeneration method of DPF



85A3CD213

※ Manual regeneration must be operated in a fireproof area.

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.

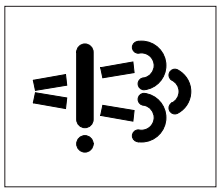
※ Refer to page 4-40 for the switch operation.

※ 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 light go off and the regeneration acknowledge lamp and HEST warning lamp will light up while the regeneration function is operating.

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

(11) Emission system fail warning lamp



300A3CD15

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

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

a. The EGR valve malfunctions.

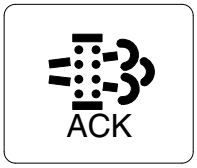
b. Electrical malfunction of the EGR control sensors. (disconnection, short)

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 DPF system is diagnosed.

※ Please contact your HD Hyundai Construction Equipment service center or local dealer.

(12) DPF regeneration acknowledge warning lamp



559A3CD10

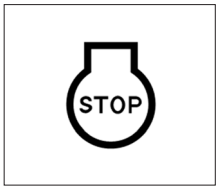
① This warning lamp lights up stationary regeneration is in process.

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

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

④ This warning lamp blinks 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.

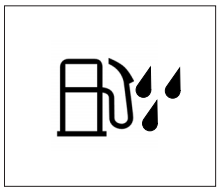
(13) Stop engine warning lamp



290F3CD252

① If this warning lamp lights up, stop the engine immediately and check the engine.
② Check the fault codes on the monitor.
※ **Please contact your HD Hyundai Construction Equipment service center or local dealer.**

(14) Water in fuel warning lamp



HX60A3CD110

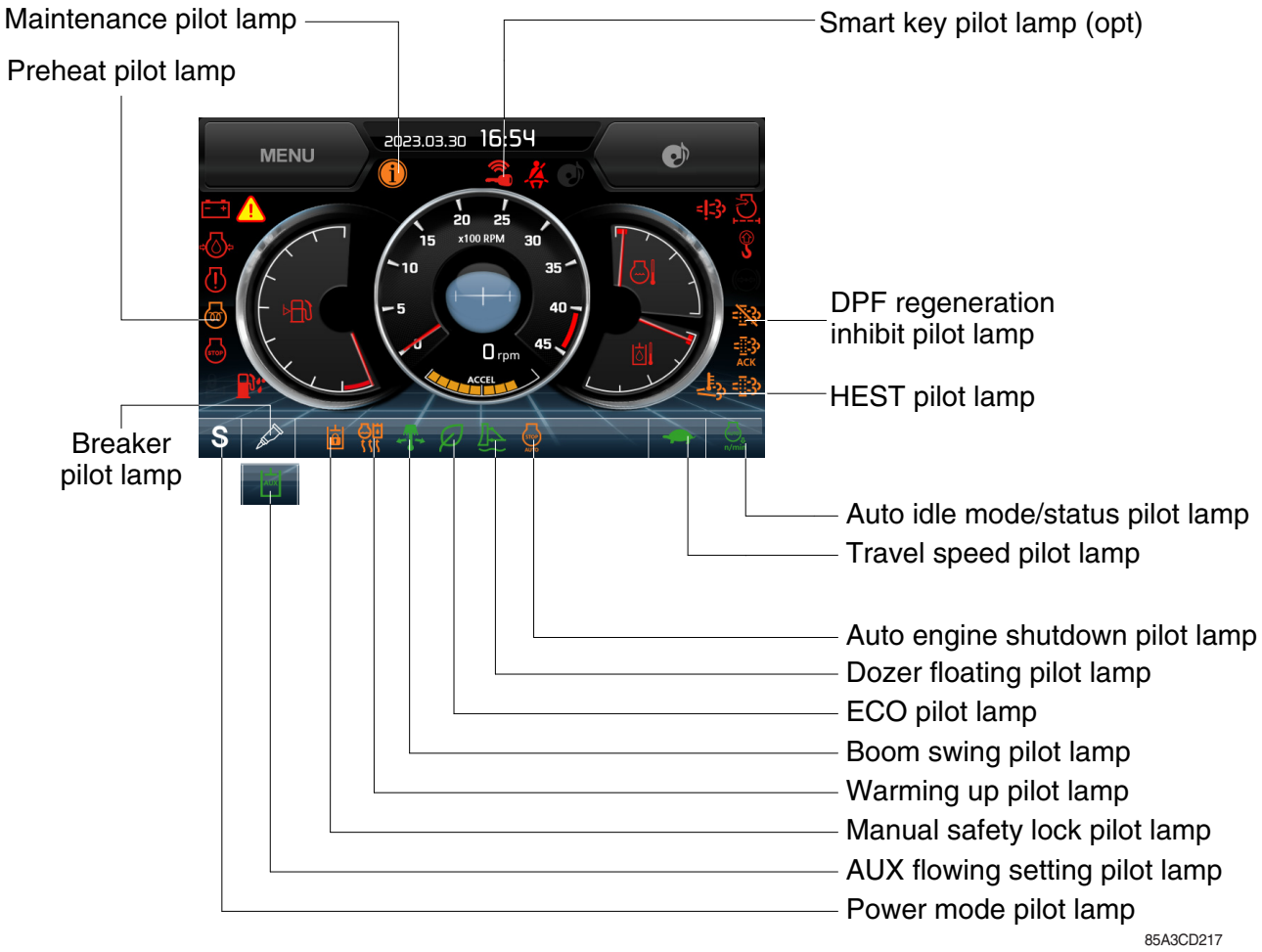
① This warning lamp lights up when the water separator is full of water or malfunctioning.
② When this lamp lights up, stop the machine and drain water from the water separator.

(15) Seat belt reminder warning lamp

300A3CD25

① When operator does not fasten the operator's seat belt, the seat belt reminder warning lamp lights up and the buzzer sounds.
② Fasten the seat belt.

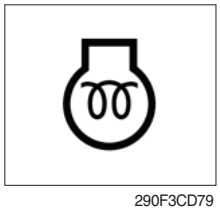
5) PILOT LAMPS



(1) Mode pilot lamps

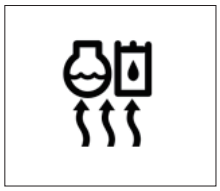
No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
2	Travel mode		Low speed traveling
			High speed traveling
3	Auto idle mode	AUTO n/min	Auto idle mode
		n/min	Auto idle status

(2) Preheat pilot lamp


290F3CD79

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

(3) Warming up pilot lamp

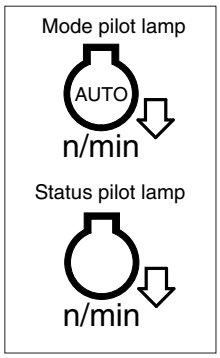


290F3CD80

① This lamp is lights up 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 (86˚F), or when 10 minutes have passed since starting the engine.

(4) Auto idle mode/status pilot lamp



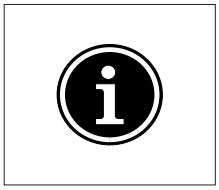
85A3CD106

① The auto idle mode pilot lamp will light up when the idle mode is selected.

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

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

(5) Maintenance pilot lamp



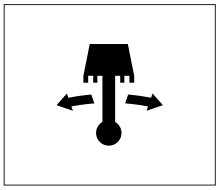
HX60A3CD116

① This lamp lights up when consumable parts are in need of replacement. It means that the change or replacement interval of parts is 30 hours from the required change interval.

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

※ **Refer to page 4-35-20.**

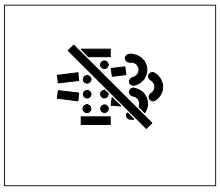
(6) Boom swing pilot lamp



HX603CD82

① This lamp lights up when the boom offset switch is pressed.

(7) DPF regeneration inhibit pilot lamp

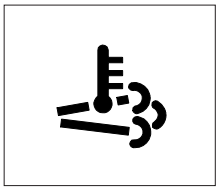


85A3CD107

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

※ **Refer to page 4-40 for the DPF switch.**

(8) HEST (High exhaust system temperature) pilot lamp



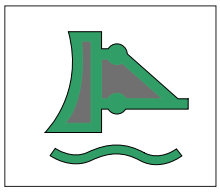
85A3CD109

① This pilot 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 is common for the lamp to illuminate on and off during normal equipment operation as the engine completes regeneration cycles.

(9) Dozer floating pilot lamp

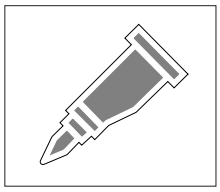


85A3CD112

① This lamp will be light up when the dozer floating lever is pressed.

※ Refer to the operator's page 3-42-1.

(10) Breaker pilot lamp

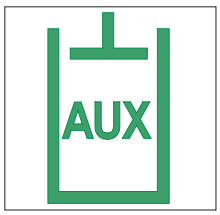


85A3CD116

① This lamp will be light up as conditions below.
- The breaker selection switch is pressed on the membrane switch.
- The AUX switch is pressed to OFF positions.

※ Refer to page 4-39 and 4-40.

(11) AUX flowing setting pilot lamp



85A3CD114

① This lamp will be light up as conditions below.
- The AUX flow setting is selected Enables in the cluster.
- The AUX switch is pressed to AUX positions.

※ Refer to page 4-35-20 and 3-39.

(12) ECO pilot lamp

85A3CD111A

① This lamp will light up when the ECO switch is pressed.
② The machine will be operated in economy conditions.

(13) Manual safety lock pilot lamp

140WA3CD37

① This lamp lights up when the safety knob is set to the LOCK position.

※ **Refer to the operator's page 3-42 for the safety knob.**

(14) Auto safety lock pilot lamp

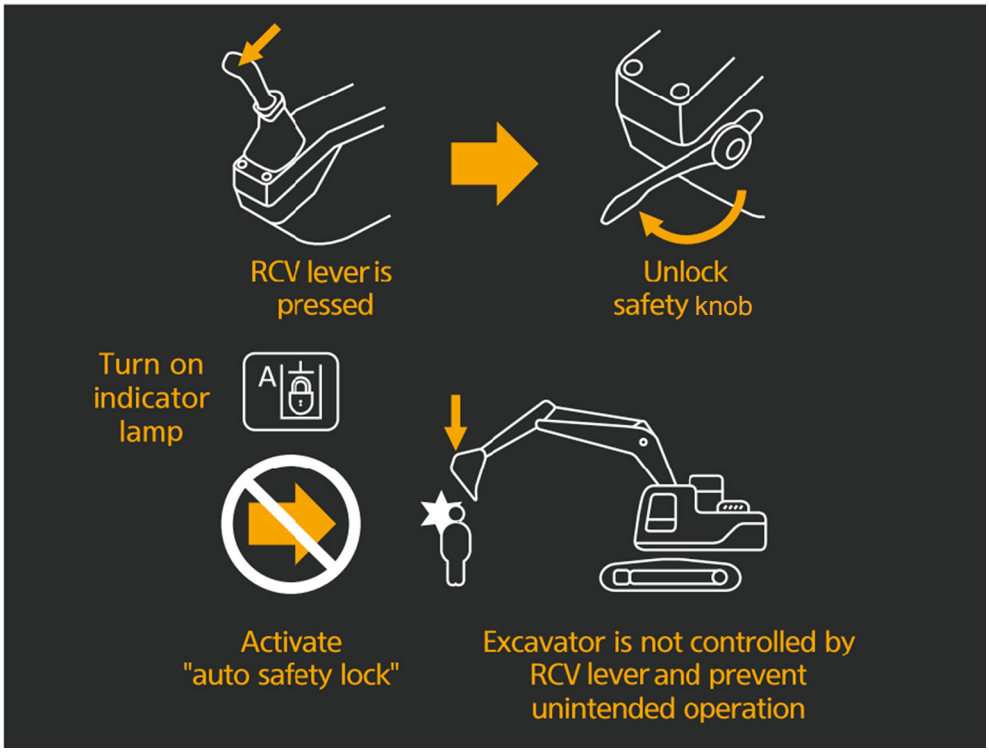
300A3CD37

① Auto safety lock system prevents unintended operation of the machine in order to improve safety.

② Engine will only start if safety knob is locked.

③ If operator unlock safety knob when RCV lever is pressed, machine is not controlled by RCV lever.

⚠ **If operator unlocks safety knob while any control/function is being operated, the machine will move violently. This could cause serious injury, death or damage to property.**



300A3CD38A

(15) Auto engine shutdown pilot lamp

220A3CD202A

① This lamp lights up when the auto engine shutdown is activated.

※ **Refer to page 4-35-25.**

(16) Smart key pilot lamp (opt)

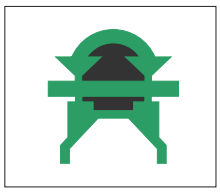
300A3CD36A

① This lamp lights up when the engine is started by the start button.

② This lamp is red when the a authentication fails, it will be green when it authentication is successful.

※ **Refer to page 4-35-24.**

(17) Angle dozer pilot lamp (opt)

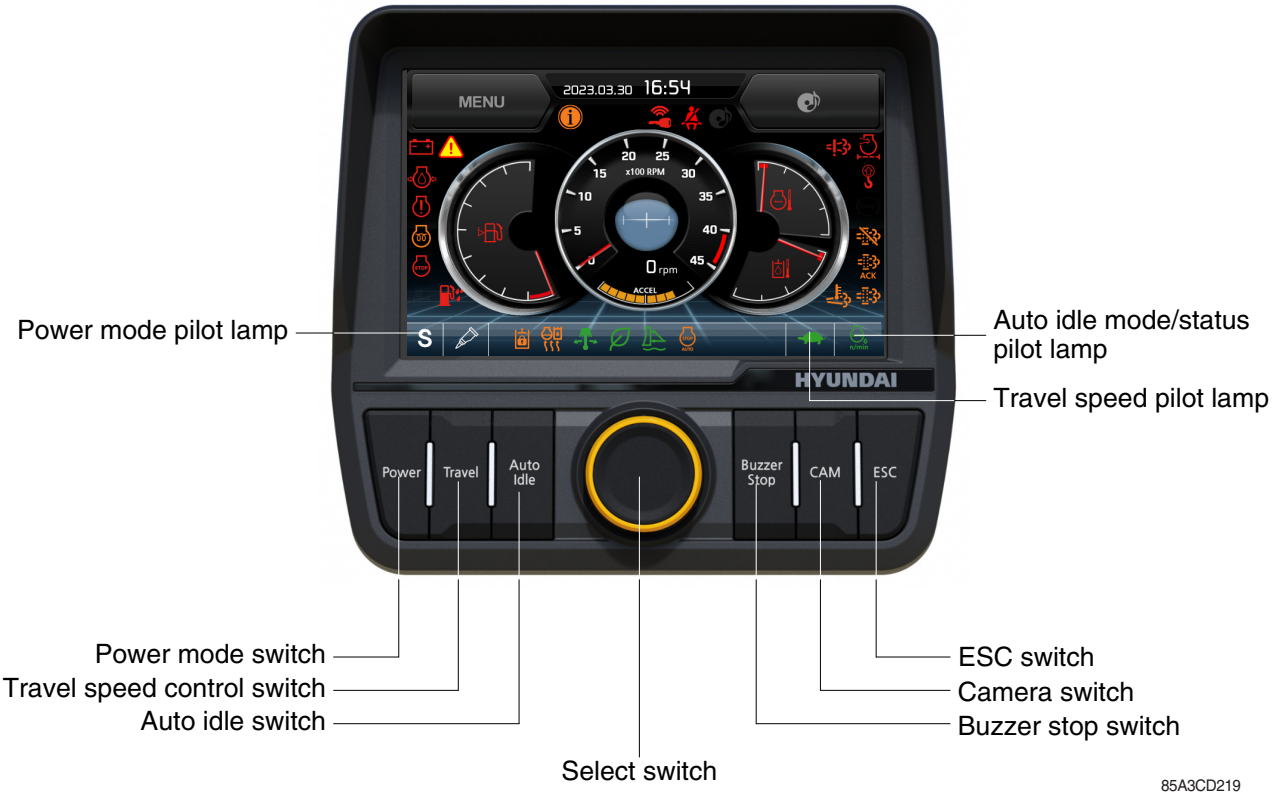


85A3CD113

① This lamp will be light up when the AUX switch is pressed to ANGLE DOZER positions.

※ **Refer to page 4-40.**

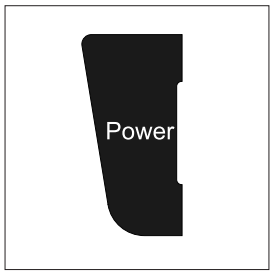
6) SWITCHES



85A3CD219

※ **When the switches are selected, the pilot lamps are displayed on the LCD. Refer to page 4-35-9 for details.**

(1) Power mode switch

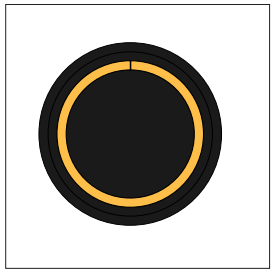


HX60A3CD118

① This switch is to select the machine power mode and when pressed, the power mode pilot lamp will be displayed on the section of the monitor.
- P : Heavy duty power work.
- S : Standard power work.

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

(2) Select switch



HX60A3CD119

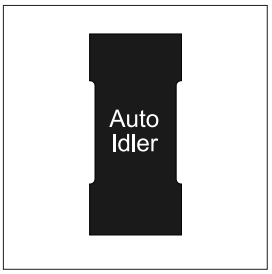
① This switch is used to select or change the menu or input value.

② Knob push
- 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 switch

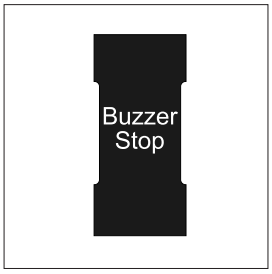


HX60A3CD120

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

※ **Refer to page 4-35-10 for details.**

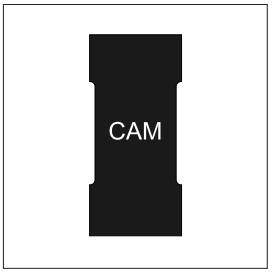
(4) Buzzer stop switch



HX60A3CD121

① The buzzer sounds when the machine has a problem.
In this case, push this switch and buzzer stops, but the warning lamp lights up until the problem is cleared.

(5) Camera switch

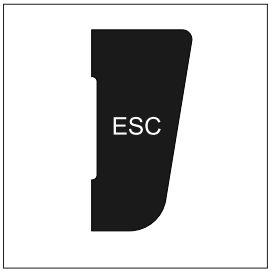


HX60A3CD122

① In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).

※ **Please refer to page 4-35-32 for the camera.**

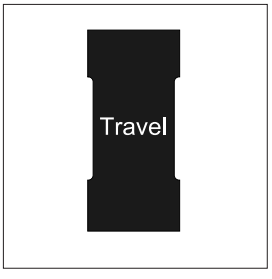
(6) Escape switch



HX60A3CD123

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

(7) Travel speed control switch



HX60A3CD104

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

- : Low speed
- : High speed

※ **Do not change the setting of the travel speed switch while machine is moving. Machine stability may be adversely affected.**

⚠ **Serious injury or death can result from sudden changes in machine stability.**

7) MAIN MENU

Main menu screen

HX60A3CD124A

Tap MENU or Press

Press

Sub menu screen

HW60AH3CD125A

※ Please refer to the select switch, page 4-35-14 for selection and change of menus and input values.

※ In the operation screen, tap MENU or press the select switch to access the sub-menu screen.

(1) Structure

No	Main menu	Sub menu	Description
1	 Monitoring	Active fault - Machine Active fault - Engine Logged fault - Machine/engine Delete logged fault Monitoring - Machine Monitoring - Switch Monitoring - Output	MCU ECU MCU, ECU MCU, ECU Engine rpm, oil temp, voltage and pressure etc. Digital switch status Digital output status
2	 Management	Maintenance information Breaker flow level AUX flow setting ESL mode setting Auto engine shutdown Change password Machine information A/S phone number Cluster update CAN update Service menu	Elapsed time, Change interval, Replacement etc. Breaker flow level setting Option attch selection, Proportional flow control setting, Confirmation ESL mode setting One time, Always, Disable Password change Cluster, MCU, Engine, Machine A/S phone number, A/S phone number change Application, System Program download, Update Power shift, Operating hour, Gauge type, Rpm, AVCU set, Language update etc
3	 Display	Clock Brightness Unit Language	Current time set Manual, Auto Temperature, Pressure, Flow, Distance, Volumn 22 kinds
4	 Utilities	Entertainment Camera setting Clinometer setting Manual Emergency mode	Video/music file playing Setup of number of active cameras, display sequences, and camera numbers Initializing slope sensor Display cluster manual Back-up switch for failed cluster switch and accel dial

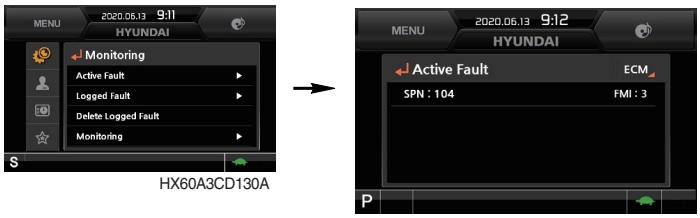
(2) Monitoring

① Active fault - Machine

HX60A3CD130A HX60A3CD131A

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

② Active fault - Engine



HX60A3CD130A HX60A3CD133A

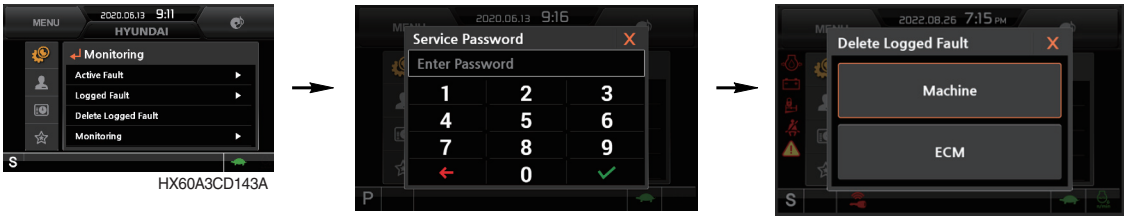
· The active faults of the engine ECU can be checked by this menu.

③ Logged fault - Machine/ Engine

HX60A3CD134A HX60A3CD135A HX60A3CD136A

· The logged faults of the machine MCU or engine ECU can be checked by this menu.
· This menu can be used only HCE service man.

④ Delete logged fault

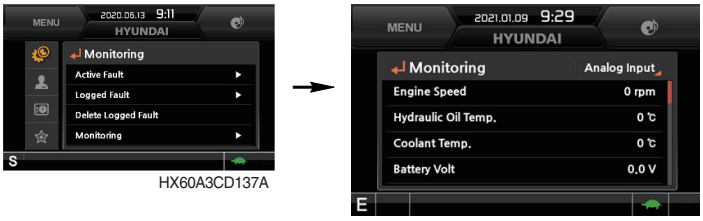


HX60A3CD143A HX60A3CD144A HW60AH3CD145A

HX60A3CD146A HW60AH3CD147A

· The logged faults of the MCU, engine ECU can be deleted by this menu.
(It is possible under the engine stop conditions)

⑤ Monitoring (machine status)



HX60A3CD137A HX60A3CD138A

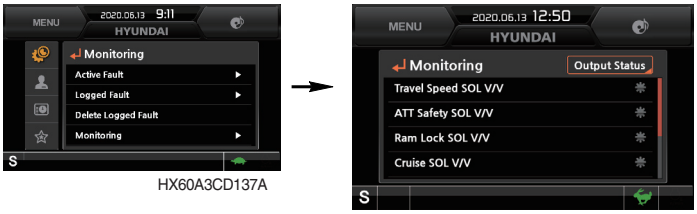
· The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu.

⑥ Monitoring (switch status)

HX60A3CD137A HX60A3CD140A

· The digital switch status of the machine can be checked by this menu.
· The activated switch will display in blue color.

⑦ **Monitoring** (output status)



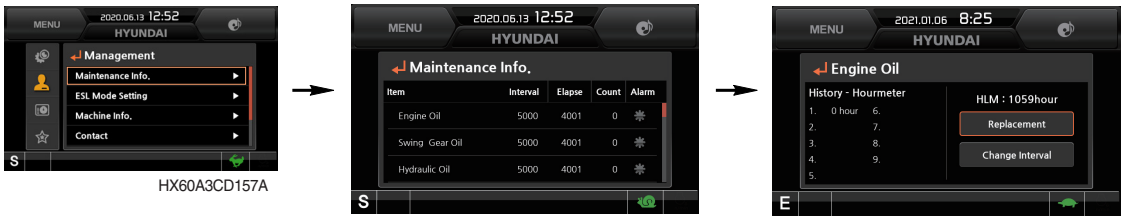
HX60A3CD137A

HX60A3CD142A

- The digital output status of the machine can be checked by this menu.
- The digital output status will display in blue color.

(3) Management

① Maintenance information

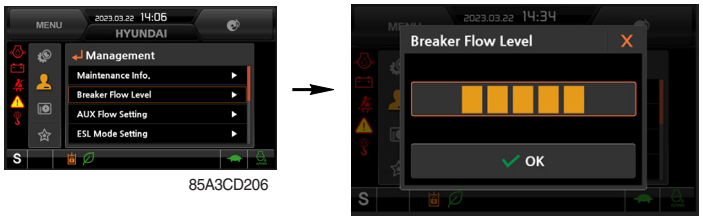


HX60A3CD157A HX60A3CD199K HX60A3CD159A

- Elapsed time : Display the elapsed time after the maintenance.
- Change interval : The change intervals can be changed in hour increments of 50.
- Change history : Display the change history for the maintenance.
- Replacement : The elapsed time will be reset to zero (0).
- Change or replace interval

※ **Refer to the operator's page 6-16.**

② Breaker flow level

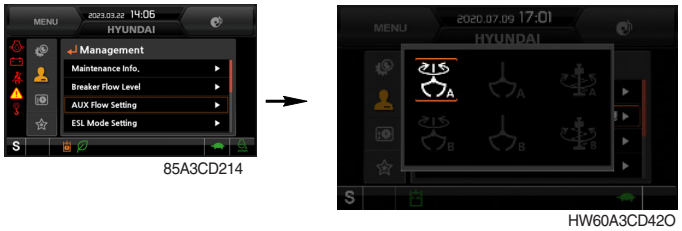


85A3CD206 85A3CD207

- The breaker flow level can be modulated in 1~5 steps.

③ AUX flow setting

a. Option attach selection



85A3CD214 HW60A3CD42O

- Three kinds of option attachment can be selected by this menu.
  - ⓐ Rotary grapple (4-way)
  - ⓑ Grapple (2-way)
  - ⓒ Auger (2-way)

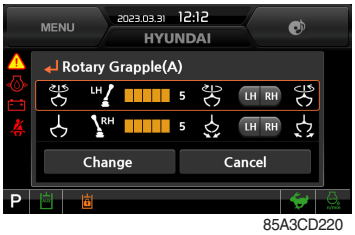
※ **There are two user modes (type A or B) in each option attachment.**

b. Proportional flow control setting

The preferable value of each option attachment can be set by this menu.

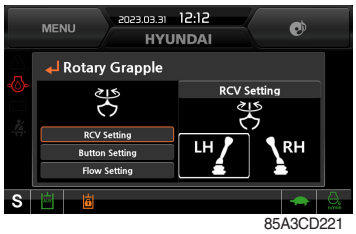
a) Rotary setting

HW60A3CD42O



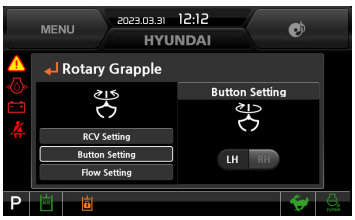
85A3CD220

· Select rotary
RCV, button and flow can be set by this menu



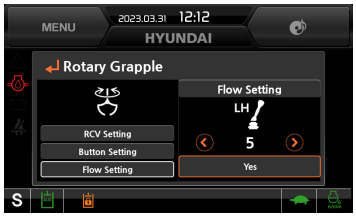
85A3CD221

· RCV setting
– Enable set LH or RH RCV for rotary operation.
– Select LH for rotary → RH set for grapple automatically



85A3CD222

· Button setting (CW rotation)
– Select LH for CW rotation → RH set for CCW rotation automatically

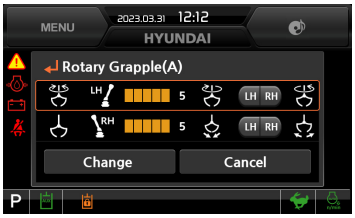


85A3CD223

· Flow setting
– Enable set from level 1 to level 5.

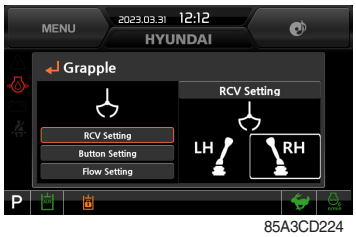
b) Grapple setting

HW60A3CD42O



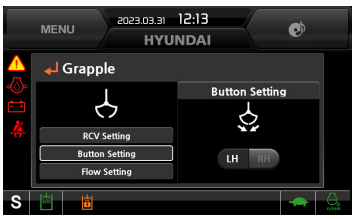
85A3CD220

· Select grapple
RCV, button and flow can be set by this menu



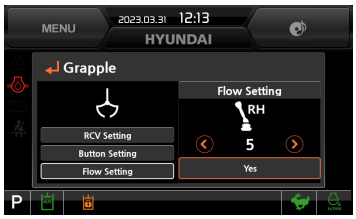
85A3CD224

· RCV setting
– Enable set LH or RH RCV for grapple operation.
– Select LH for grapple → RH set for rotary automatically



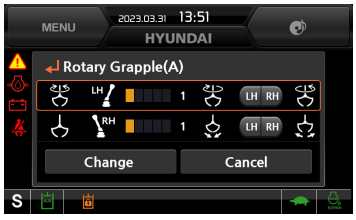
85A3CD225

· Button setting (Close)
– Select RH for Close → LH set for open automatically



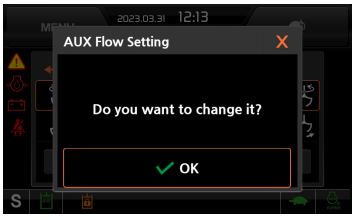
85A3CD226

· Flow setting
– Enable set from level 1 to level 5.



85A3CD227

· Flow setting value can be saved by pressing change button.

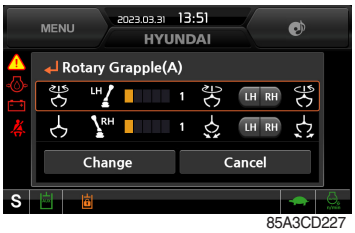


85A3CD228

※ Setting value saved once, it memorized in each icon and the last setting value is activated.
※ Saved setting can be used by pressing Icon button only.
※ There are two kinds (A and B) in each option attach setting and six kinds of option attach setting can be saved totally (2 of 4-way, 4 of 2-way).

c) Confirmation

HX60A3CD81OA



85A3CD227

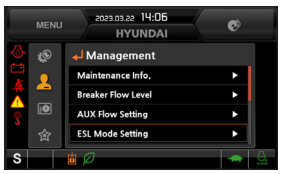
· AUX flowing setting pilot lamp ( ) is activated on the lower side of the main screen as below conditions.

※ **The AUX switch is pressed to the AUX position and the AUX flow setting is selected Enabled.**

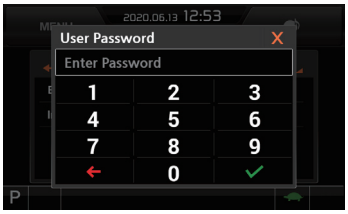
a) Rotary setting
- Rotary RCV : LH
- Rotary flow level : 3
- CW rotation : LH
- CCW rotation : RH

b) Grapple setting
- Grapple RCV : RH
- Grapple flow level : 3
- Open : LH
- Close : RH

④ ESL mode setting



85A3CD215



HX60A3CD149A

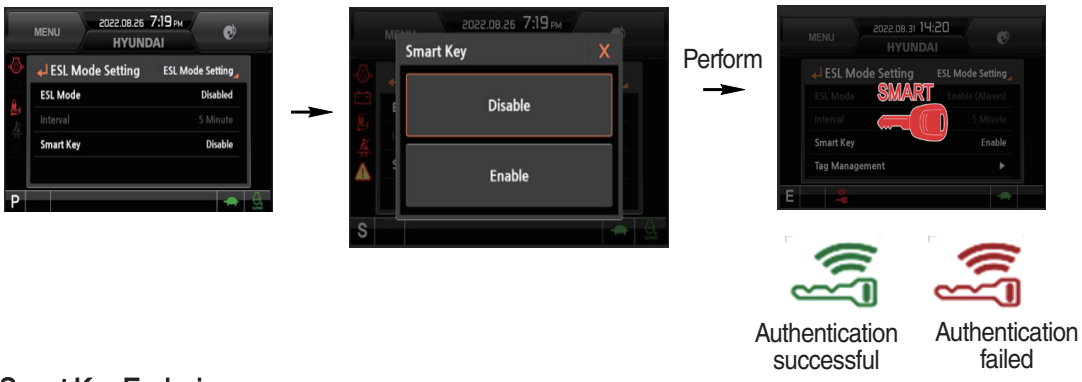
HW60AH3CD150A

- ESL : Engine Starting Limit
- ESL mode is designed to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- Disable : ESL function is disabled and password is not required to start engine.
  Enable (always) : The password is required whenever the operator starts engine.
  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 to a maximum 4 hours.

※ Default password : 00000
Password length : 5~10 digits

Start Limit - Smart Key Setting (When smart key is installed)



- **Smart Key Exclusive**

  When the Smart key option (optional) is installed, Smart key menu is shown, and performance or non-performance of Smart key authentication can be set through the Smart key menu.

  When the Smart key is not in the cabin, the approval procedure is rejected, and password must be entered.

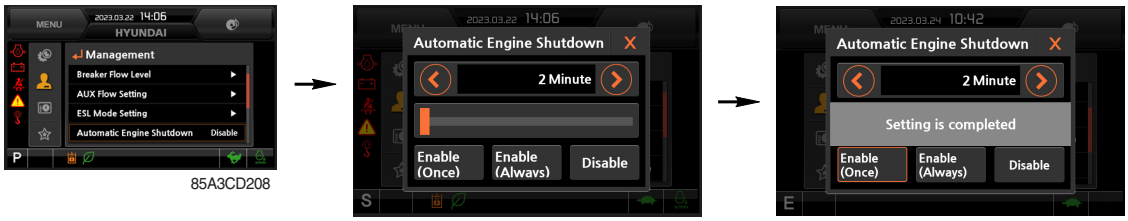
Start Limit - Tag Management

- The tag management menu is activated only when the Smart key menu is set through performance. Tag can be registered or deleted.
  - · When registering the tag : Locate only the tag preferred for registration inside the cabin.
  - · When deleting the tag : All registered tags are deleted.

※ Engine Starting Condition

Case	ESL Mode	Smart Key	Condition
1	Disable	Disable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started without password input.
2	Disable	Enable	If Smart Key is enabled, ESL Mode is automatically enabled. This Case 2 work the same as the Case 4.
3	Enable	Disable	- With registered tag : Engine can be started with password input. - Without registered tag : Engine can be started with password input.
4	Enable	Enable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started with password input.

⑤ Automatic engine shutdown



85A3CD208 85A3CD209 85A3CD210

85A3CD211

The automatic engine shutdown function can be set by this menu.

a. Once (one time)

· Automatic shutdown function set Once when key-on or engine operation condition.
  - Key-off when the shutdown button clicks after pop-up the automatic stop icon.
  - Shift automatic shutdown function to Disable when the cancel button clicks after pop-up the automatic stop icon.

· Keep Disable for the automatic shutdown function when key-off after key-on again or start engine.

b. Always (continuous use)

· Automatic shutdown function set Always when key-on or engine operation condition.
  - Key-off when the shutdown button clicks after pop-up the automatic stop icon.
  - Shift automatic shutdown function to Disable when when the cancel button clicks after pop-up the automatic stop icon.

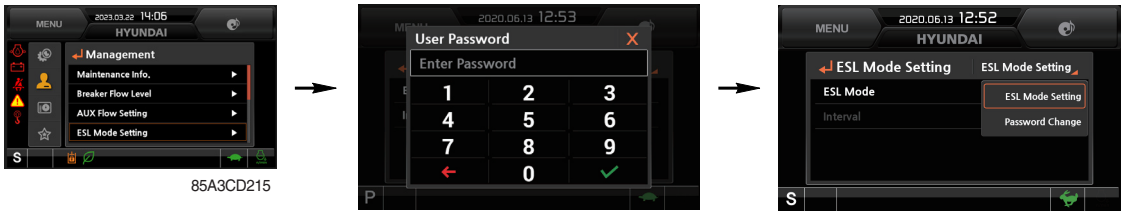
· Keep Always for the automatic shutdown function when key-off after key-on again or start engine.

c. Disable

· Disable the engine automatic shutdown function.

⑥ Password change

– The password is 5~10 digits.



85A3CD215

HX60A3CD149A

HX60A3CD153A

Enter the current password

Select the password change

HX60A3CD156A

HX60A3CD155A

HX60A3CD149A

Saved the new password in the MCU

Enter the new password again

Enter the new password

⑦ Machine information

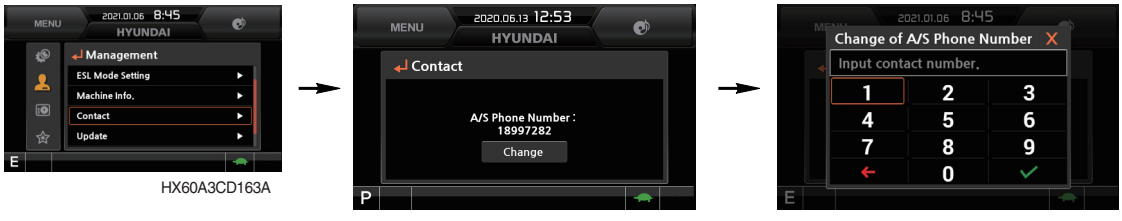
HX60A3CD160A

HX60A3CD161A

HX60A3CD162A

· The information of the cluster, machine MCU and engine and machine checked by this menu.

⑧ A/S phone number



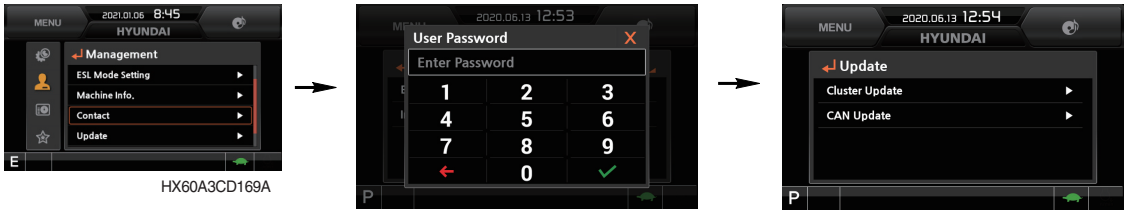
HX60A3CD163A

HX60A3CD164A

HX60A3CD165A

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

⑨ Cluster update



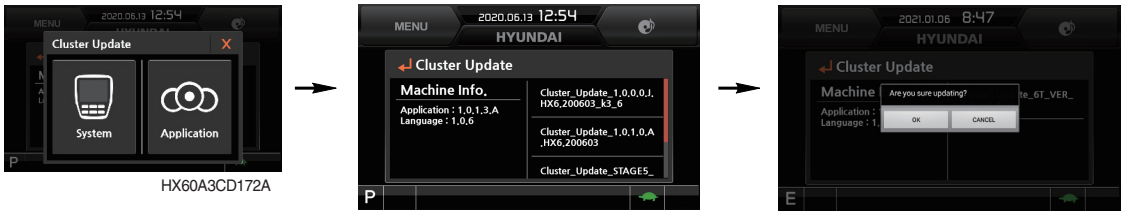
HX60A3CD169A HX60A3CD149A HX60A3CD170A

Enter the user password Select the cluster update

· The cluster and CAN device can be updated by this menu.

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

a. Application update



HX60A3CD172A HX60A3CD173A HX60A3CD174A

Select application item Select file to update Select OK

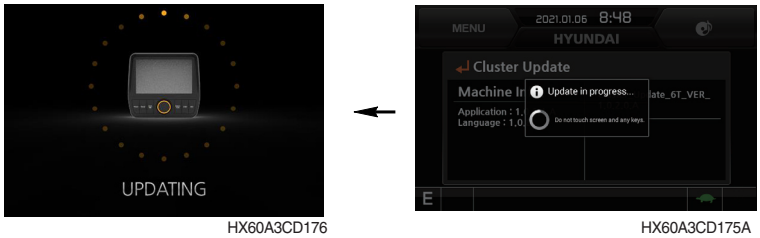
HX60A3CD176 HX60A3CD175A

Completed In process

b. System update

HX60A3CD177A HX60A3CD173A HX60A3CD174A

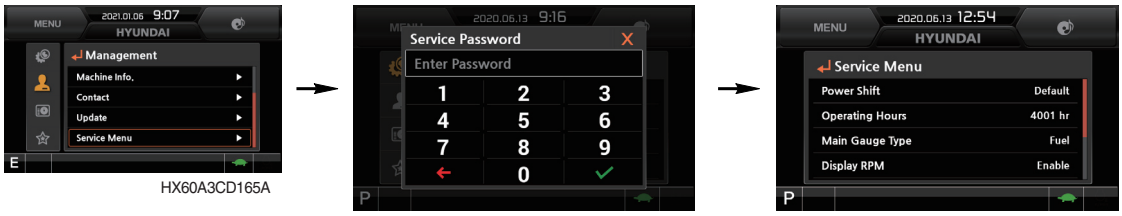
Select system item Select file to update Select OK



HX60A3CD176 HX60A3CD175A

Completed In process

⑩ Service menu



HX60A3CD165A HX60A3CD144A HX60A3CD168A

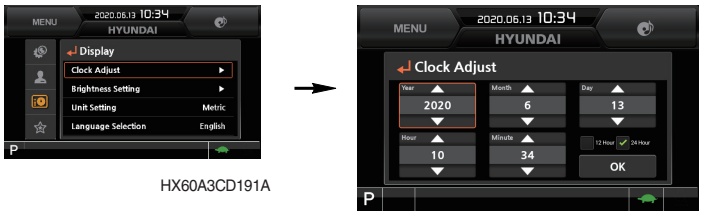
Enter the manager password

- Power shift : Power shift mode (default/option can be set by this menu.
- Operating hours : Operating hours in individual modes since the machine line out can be checked by this menu.
- Main gauge type : The engine rpm or fuel level gauge can be display on the main gauge of the main screen by this menu.
- Display RPM : Display the numeric value of engine rpm on the main gauge of the main screen can be set by this menu.
- AVCU setting : 2-Way or 4-Way dependent upon the machine options can be selected by this menu.
- Adding language : The language displayed on the cluster can be update by this menu when it is required to correct language.

※ This menu can be used only HCE service man. Do not attempt unauthorized adjustment.

(4) Display

① Clock adjust

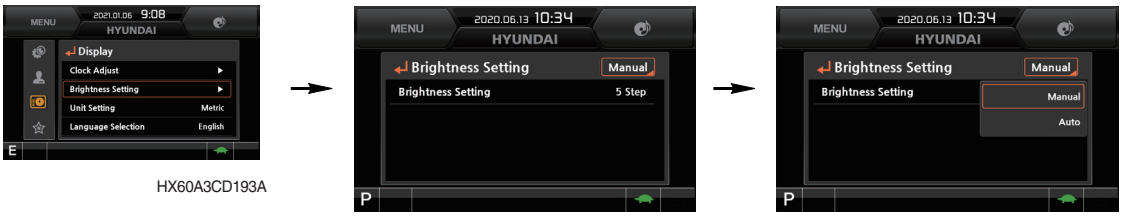


HX60A3CD191A

HX60A3CD192A

- The first row of boxes indicate Year/Month/Day.
- The second row shows the current time. (AM, PM/0:00~12:59)

② Brightness

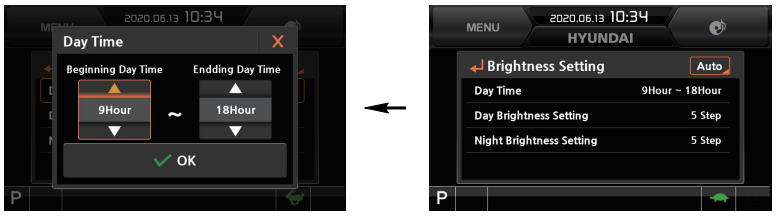


HX60A3CD193A

HX60A3CD194A

HX60A3CD195A

Manual (1st~10th step)



HX60A3CD197A

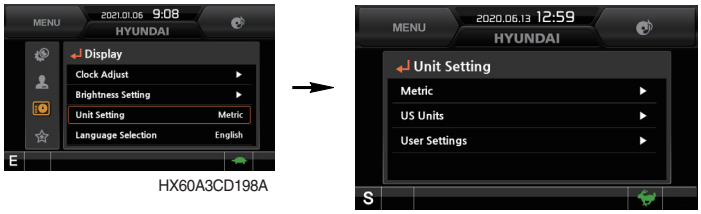
Auto (day/night)

HX60A3CD196A

Auto (day time)

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

③ Unit set



HX60A3CD198A

HX60A3CD199A

– Metric units : Units change to metric units.
– US units : Units change to U.S. units
– User setting : Units change to user setting units

Item	Metric units	U.S. units	User setting
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

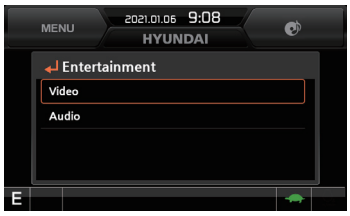
HX60A3CD201A

· User can select preferable language (22 languages) and all displays are changed the selected language.

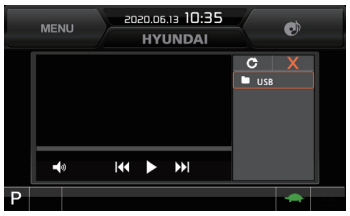
(5) Utilities

① Entertainment

HX60A3CD70A



HX60A3CD208A



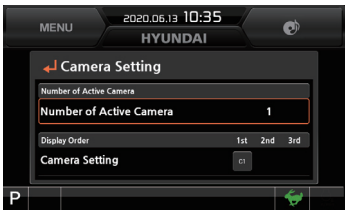
HX60A3CD209A

- Play MP4 or codec file of external hard disk through USB port.
- The USB port is located left side of the cluster.
- Over 1100 engine rpm, the screen turns into the operation screen with MP4 or codec file playing for the safety. The video is played again when the engine revolution is 1100 rpm or less.

⚠ The video play is prohibited for the safety reason when the machine is operated.

② Camera setting

HX60A3CD202A

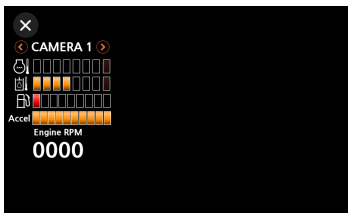


HX60A3CD203A

- Three cameras can be installed on the machine and display order can be set by this menu.

※ If the camera is not equipped, this menu is not useful.

- Turning the select switch in clockwise direction, the next ordered will be shown and in counter-clockwise direction, the previously ordered will be shown. Also, the camera channel can be changed by touching the screen.
- Display change to reduction size or display is not visible by pushing the select switch or touch the screen.
  (display reduction size → hiding → display)

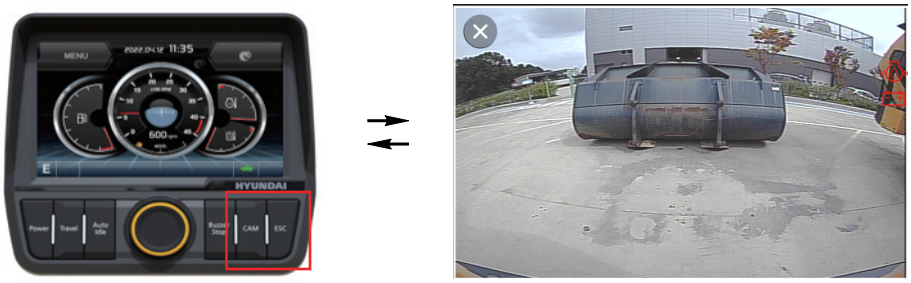


HX60A3CD204

- The camera display is terminated by pressing the ESC switch or touch the X icon on the screen.

· **Camera control switch**

- Select the CAM switch to activate Rear / RH view camera from the beginning screen.
- While in that mode, select the ESC switch to return to the home screen.



③ Clinometer setting

HX60A3CD210A

HX60A3CD211A

· When the machine is on the flatland, if you touch "initialization" on cluster, the values of X, Y will reset to "O".
· You can confirm tilt of machine in cluster's operating screen.

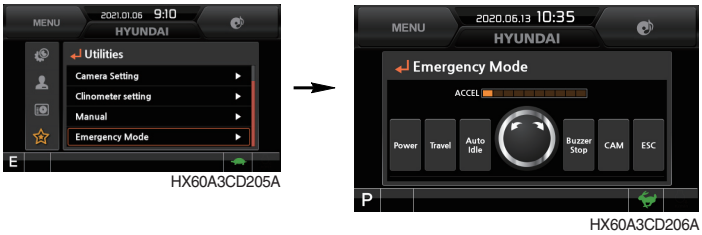
④ Manual

HX60A3CD212A

85A3CD229

· Manual of the cluster can be read on the monitor.

⑤ Emergency mode

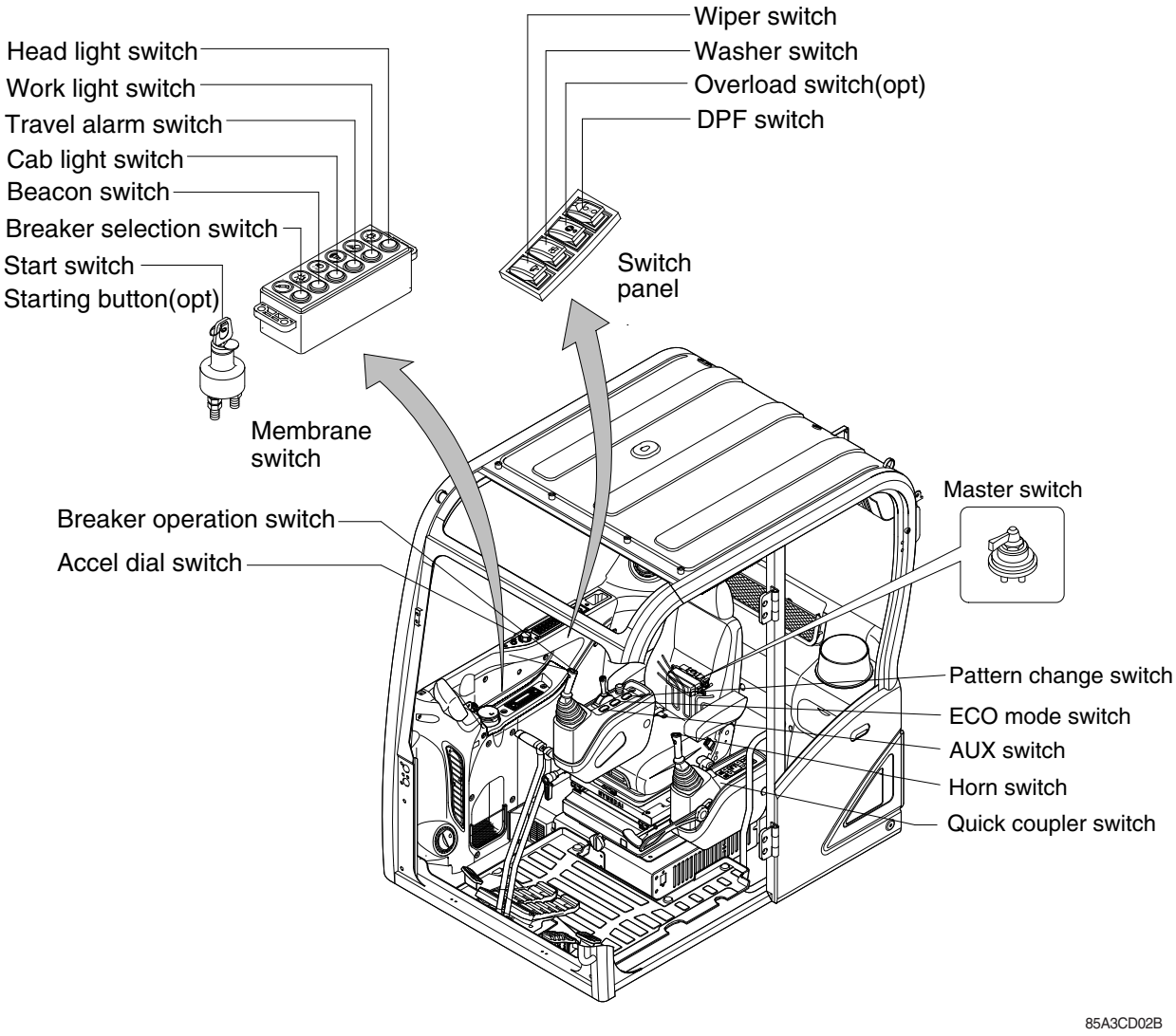


HX60A3CD205A

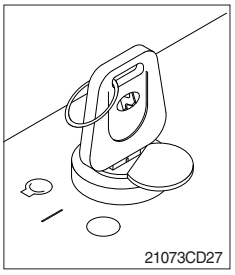
HX60A3CD206A

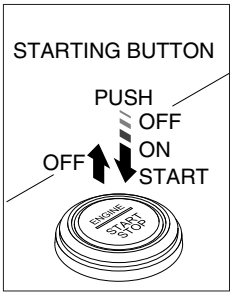
· When switches of the monitor and the accel dial fails, switches are displayed on LCD, and you are allowed to perform operation by touching the screen.
· Such operation is allowed only on this mode screen.

3. SWITCHES



1) STARTING SWITCH





Starting button with smart key tag (opt)

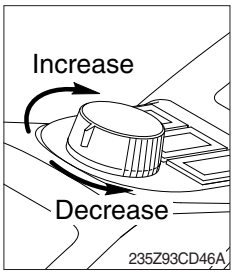
(1) There are three positions, OFF, ON and START.

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

※ **If you turn ON the starting switch in cold weather, the fuel warmer is automatically operated to heat the fuel by sensing the coolant temperature. Start the engine in 1~2 minutes after turning ON the starting switch. More time may take according to ambient temperature.**

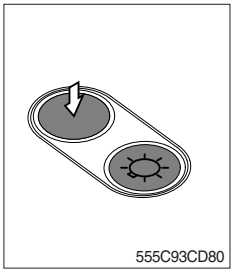
※ **Key must be in the ON position with engine running maintain electrical and hydraulic function and prevent serious machine damage.**

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.

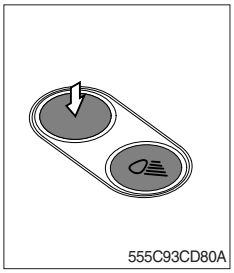
3) HEAD LIGHT SWITCH



(1) This switch is used to operate the illumination.
(2) Press the switch once, the head light and illumination lamps come ON.
- Air conditioner and heater controller
- Radio and USB player
- USB socket, DPF switch, accel dial and cigar lighter

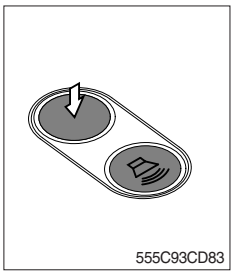
(3) Press the switch once more, the head light and illumination lamps turn off.

4) WORK LIGHT SWITCH



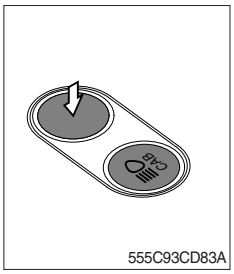
(1) This switch is used to operate the work light.
- Press the switch once, the work light comes ON and the pilot lamp ON.
- Press the switch once more, the work light and pilot lamp turn off.

5) TRAVEL ALARM SWITCH



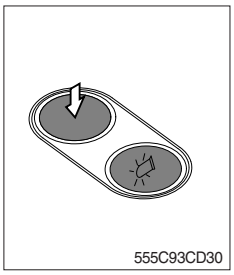
(1) This switch is to activate travel alarm function surrounding when the machine travels.
- ON : The travel alarm function is activated.
- OFF : The travel alarm function is not activated.

6) CAB LIGHT SWITCH



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

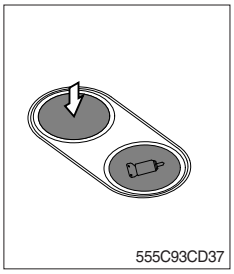
7) BEACON SWITCH (option)



(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)



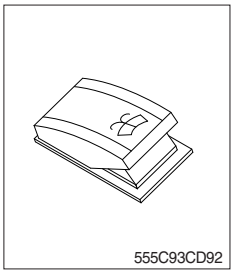
(1) When this switch is pressed, the breaker will be ready to operation.

※ **Refer to page 4-39 for details.**

9) WIPER SWITCH

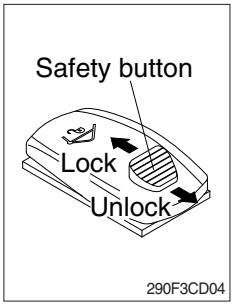
(1) This switch is used to operate the wiper.
The wiper operates.
Wiper motor doesn't operate with front sliding door open.
If wiper does not operate with the switch in the ON position, turn the switch off immediately. Check the cause. If the switch remains ON, motor failure can result.

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 COUPLER SWITCH (option)



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

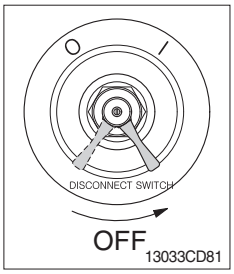
※ **Refer to the operator's manual page 8-6 for details.**

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

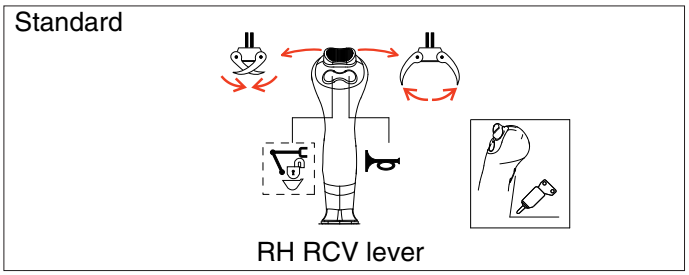


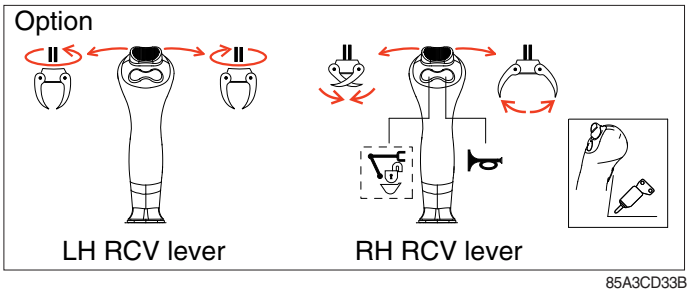
(1) This switch is used to shut off the entire electrical system.

(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) CONTROL LEVER SWITCH (LH, RH)





(1) This switch use to operates the breaker operation by third step.

- **First step : Select breaker selection switch on the membrane switch.**
- **Second step : Select Aux switch to position 3.**
- **Third step : Press breaker operation switch.**

(2) This switch operates the clamshell or shear.

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

15) 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.

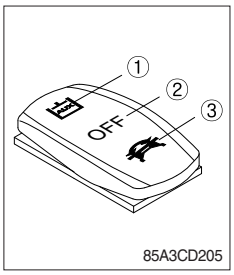
② HEST lamp will be illuminated during the entire regeneration.

※ **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).**

16) AUX SWITCH (option)



(1) This switch is used to select the auxiliary optional functions.

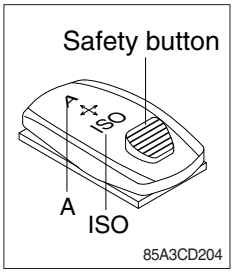
① : Angle dozer

② : Off

③ : Breaker operating or 2way or 4way

※ **Refer to page 4-14 for the details.**

17) PATTERN CHANGE SWITCH



(1) The pattern change can be operated easily using this switch.

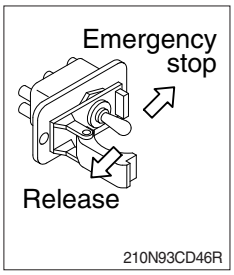
· Position ISO : ISO type pattern

· Position A : A type pattern

⚠ **Before starting the machine, check switch position.**

※ **Refer to page 4-22 for the details.**

18) EMERGENCY ENGINE STOP SWITCH



(1) This switch is used to emergency stop the engine.

※ Be sure to keep the emergency switch on the release position when restart the engine.

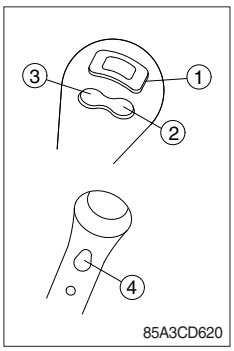
19) ECO MODE SWITCH

(1) This switch is used to improve the fuel economy of the equipment.

(2) The pump horsepower is reduced, when you press this switch.

20) LH RCV LEVER SWITCH

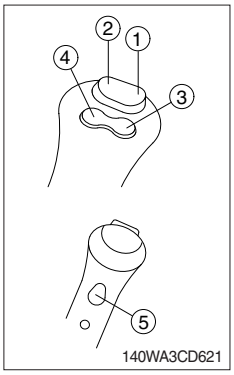
(1) Button type



The switches on the LH RCV lever is function as below.

① None
② None
③ None
④ None

(2) Proportional type (option)



The switches on the LH RCV lever is function as below.

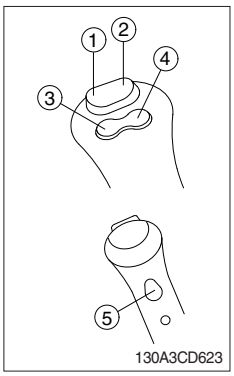
① CW rotating switch
When this switch is pressed, the clockwise rotating will operate.

② CCW rotating switch
When this switch is pressed, the counterclockwise rotating will operate.

③ None.
④ None.
⑤ None.

21) RH RCV LEVER SWITCH

(1) Proportional type



The switches on the RH RCV lever is function as below.

① **2-way clamp switch**

When this switch is pressed, the clamp will only operate when the crusher operation mode is selected.

② **2-way release switch**

When this switch is pressed, the release or breaker will operate when the crusher operation mode or breaker operation mode is selected.

③ **Quick coupler switch**

This switch is used to engage or disengage the moving hook on quick coupler.

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

④ **Horn switch**

When this switch is pressed, the horn will sound.

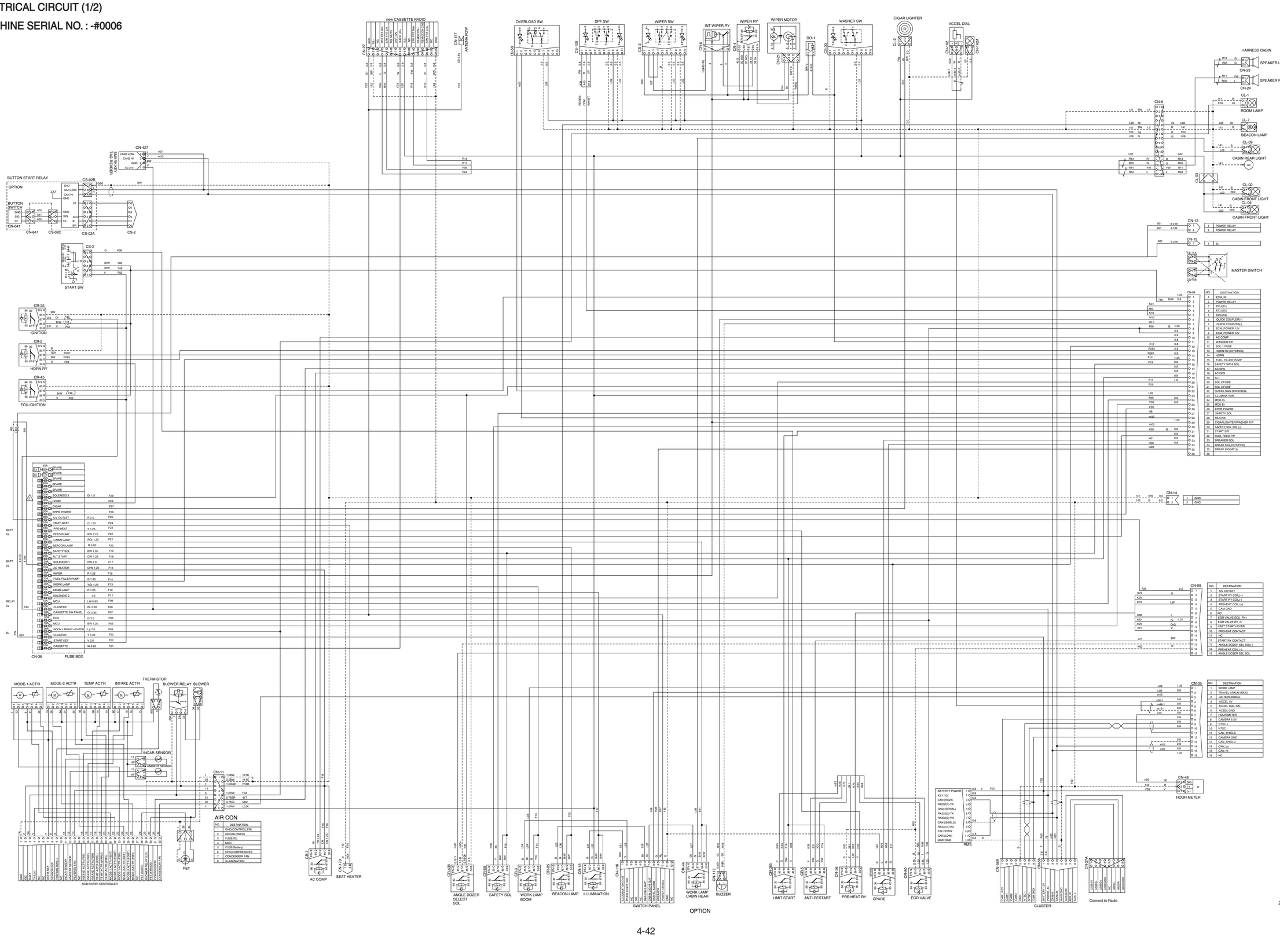
⑤ **Breaker switch**

When this switch is pressed, the breaker will only operate when the breaker operation mode is selected.

GROUP 3 ELECTRICAL CIRCUIT

· ELECTRICAL CIRCUIT (1/2)

- MACHINE SERIAL NO. : -#0006



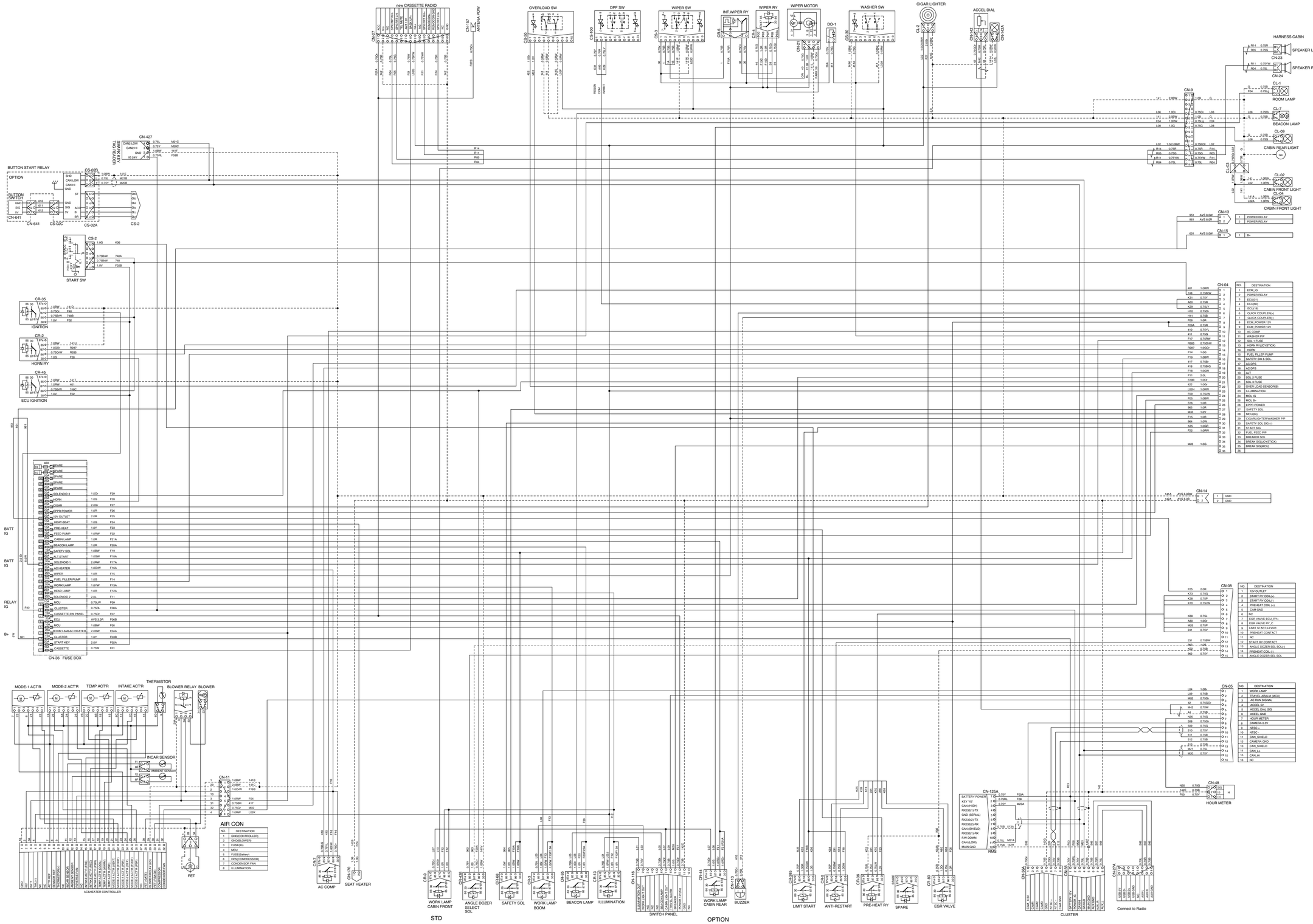
NO.	DESTINATION
1	ECM_IG
2	POWER RELAY
3	ECU(5V)
4	ECU(GND)
5	ECU(1B)
6	QUICK COUPLER(+)
7	QUICK COUPLER(-)
8	ECM_POWER 12V
9	ECM_POWER 12V
10	AC COMP
11	WASHER P/P
12	SOL 1 FUSE
13	HORN RY(JOYSTICK)
14	HORN
15	FUEL FILLER PUMP
16	SAFETY SW & SOL
17	AC DPS
18	AC DPS
19	ALT
20	SOL 2 FUSE
21	SOL 3 FUSE
22	OVER LOAD SENSOR(B)
23	ILLUMINATION
24	MCU IG
25	MCU B+
26	EPPR POWER
27	SAFETY SOL
28	MCU(64)
29	CIGARLIGHTER/WASHER P/P
30	SAFETY SOL SIG (-)
31	START SIG
32	FUEL FEED P/P
33	BREAKER SOL
34	BREAK SIG(JOYSTICK)
35	BREAK SIG(MCU)
36	

NO.	DESTINATION
1	12V OUTLET
2	START RY COIL(+)
3	START RY COIL(-)
4	PREHEAT COIL (+)
5	CAM GND
6	NC
7	EGR VALVE ECU_RY+
8	EGR VALVE RY_C
9	LIMIT START-LEVER
10	PREHEAT CONTACT
11	NC
12	START RY CONTACT
13	ANGLE DOZER SEL SOL(-)
14	PREHEAT COIL (-)
15	ANGLE DOZER SEL SOL

NO.	DESTINATION
1	WORK LAMP
2	TRAVEL ANALM (MCU)
3	AC RUN SIGNAL
4	ACCEL 5V
5	ACCEL DIAL SIG
6	ACCEL GND
7	HOUR METER
8	CAMERA 6.5V
9	NTSC +
10	NTSC -
11	CAN_SHIELD
12	CAMERA GND
13	CAN_SHIELD
14	CAN_L0
15	CAN_HI
16	NC

NO.	DESTINATION
1	GND(CONTROLLER)
2	GND(BLOWER)
3	FUSE(IG)
4	MCU
5	FUSE(Battery)
6	DPS(COMPRESSOR)
7	CONDENSOR FAN
8	ILLUMINATION

- MACHINE SERIAL NO. : #0007-



NO.	DESTINATION
1	GND(CONTROLLER)
2	GND(BLOWER)
3	FUSE(IG)
4	MCU
5	FUSE(Battery)
6	DPS(COMPRESSOR)
7	CONDENSOR FAN
8	ILLUMINTION

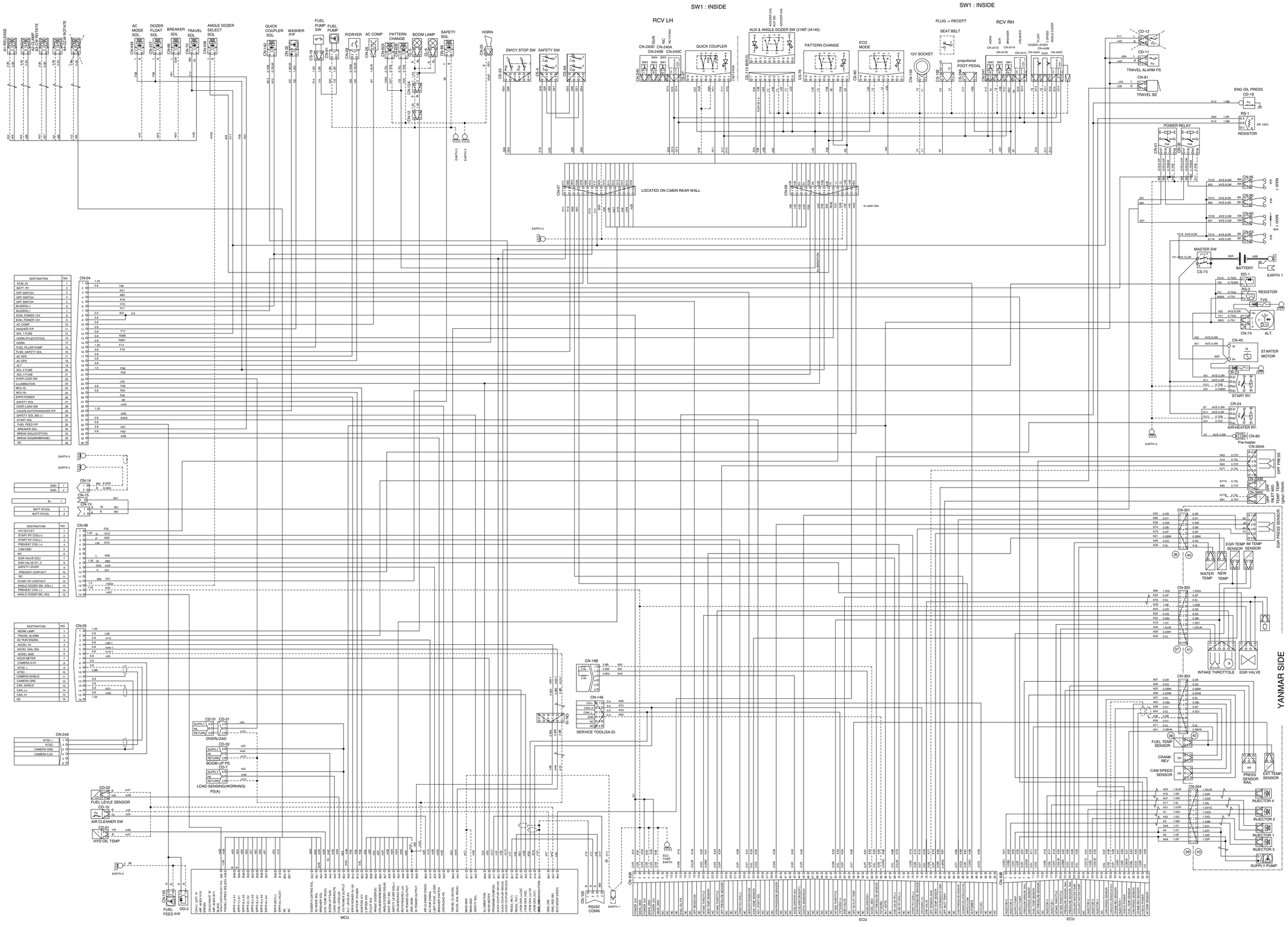
NO.	DESTINATION
1	ECM_IG
2	POWER RELAY
3	ECU(5V)
4	ECU(GS)
5	ECU(18)
6	QUICK COUPLER(-)
7	QUICK COUPLER(+)
8	ECM_POWER 12V
9	ECM_POWER 12V
10	AC COMP
11	WASHER P/P
12	SOL 1 FUSE
13	HORN PH.(JOYSTICK)
14	HORN
15	FUEL FILLER PUMP
16	SAFETY SW & SOL
17	AC DPS
18	AC DPS
19	ALT
20	SOL 3 FUSE
21	SOL 3 FUSE
22	OVER LOAD SENSOR(B)
23	ILLUMINATION
24	MCU IG
25	MCU B+
26	EPPR POWER
27	SAFETY SOL
28	MCU(5V)
29	CIGARLIGHTER/WASHER P/P
30	SAFETY SOL SIG (-)
31	START SIG
32	FUEL FEED P/P
33	BREAKER SOL
34	BREAK SIG(JOYSTICK)
35	BREAK SIG(MCU)
36	

NO.	DESTINATION
1	12V OUTLET
2	START RY COIL(+)
3	START RY COIL(-)
4	PREHEAT COIL (+)
5	CAM GND
6	NC
7	EGR VALVE ECU_RY+
8	EGR VALVE RY_C
9	LIMIT START-LEVER
10	PREHEAT CONTACT
11	NC
12	START RY CONTACT
13	ANGLE DOZER SEL SOL(-)
14	PREHEAT COIL (-)
15	ANGLE DOZER SEL SOL

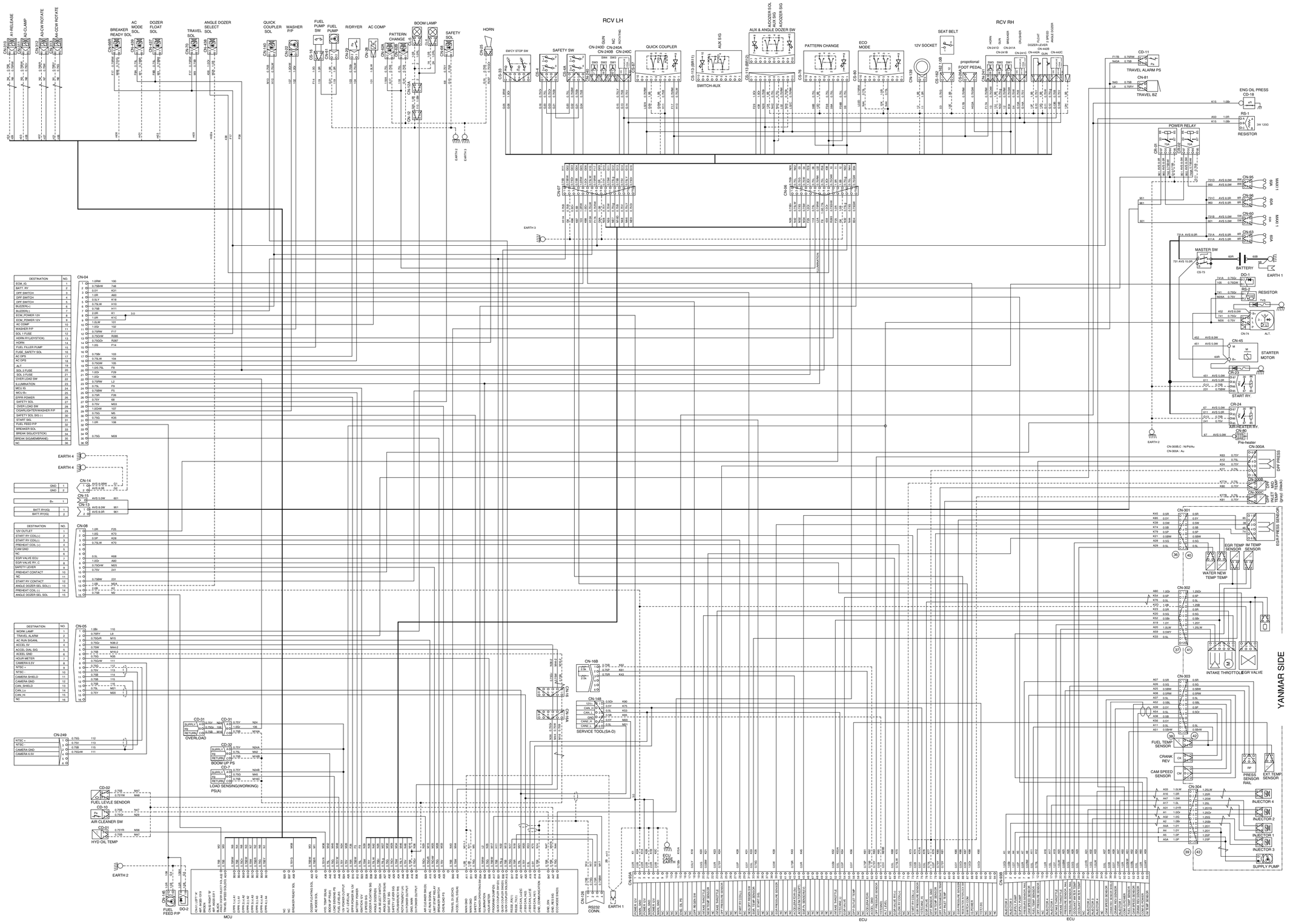
NO.	DESTINATION
1	WORK LAMP
2	TRAVEL ANALM (MCU)
3	AC RUN SIGNAL
4	ACCEL 5V
5	ACCEL DIAL SIG
6	ACEEL GND
7	HOUR METER
8	CAMERA 6.5V
9	NTSC +
10	NTSC -
11	CAN_SHIELD
12	CAMERA GND
13	CAN_SHIELD
14	CAN_Lo
15	CAN_Hi
16	NC

· ELECTRICAL CIRCUIT (2/2)

- MACHINE SERIAL NO. : -#0006

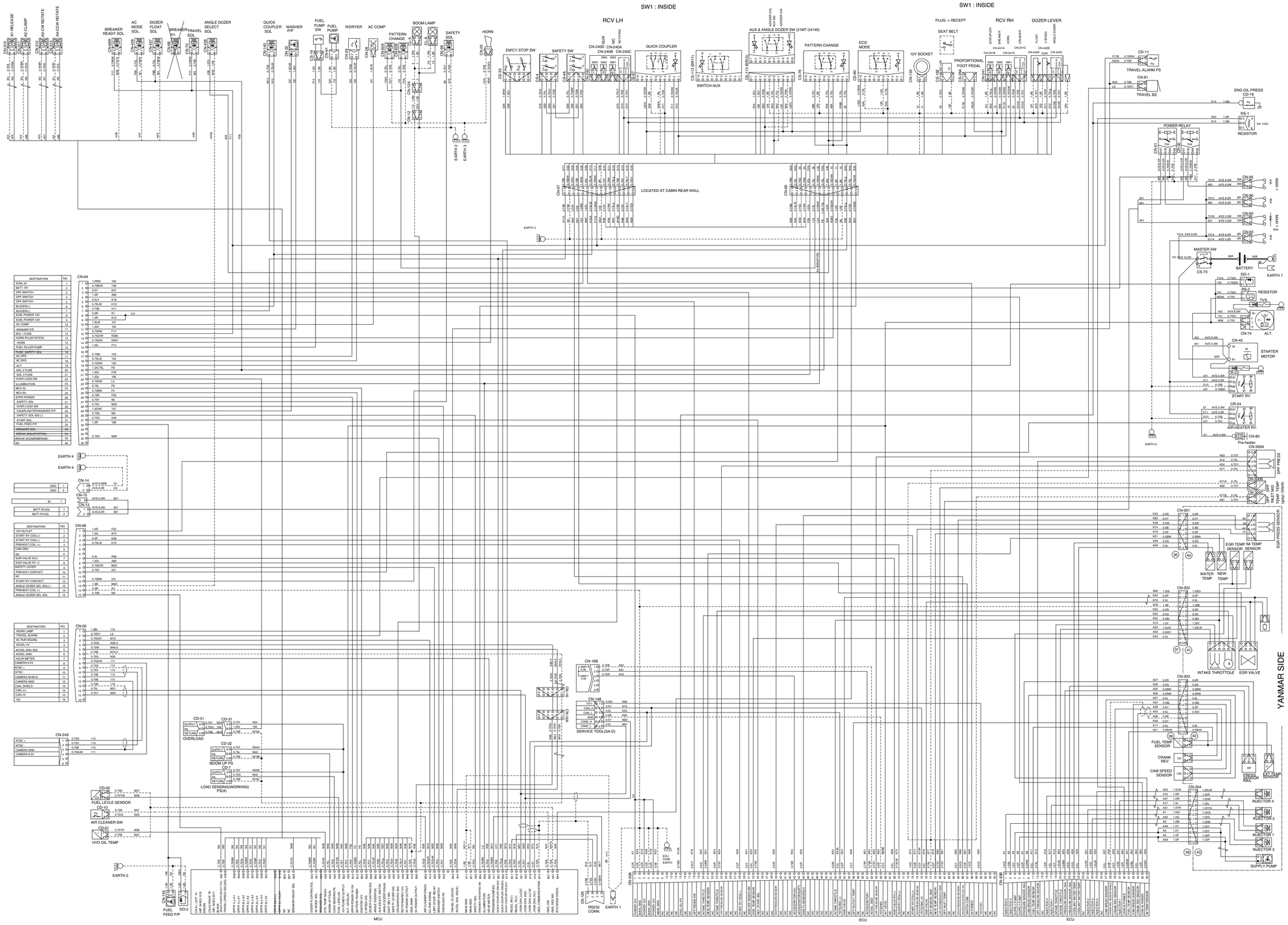


- MACHINE SERIAL NO. : #0007-#0278



20MQ-98204-00

- MACHINE SERIAL NO. : #0279-



20MQ-98205-00

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 → Master switch [CS-73 (L)]
  - → Fusible link (CN-63)
    - → Start relay [CR-23 (30)]
    - → Air heater relay [CR-24 (30)]
  - → Fusible link (CN-96) → Power ralay [CR-01 (30)]
  - → Fusible link (CN-96) → Power ralay [CR-02 (30)]
  - → Fusible link (CN-60) → I/conn [CN-15 (1)]
- → Fuse box [No.2]
  - → Start switch [CS-2 (1)]
  - → Iginition relay [CR-35 (30)]
  - → ECU relay [CR-45 (30)]
- → Fuse box [No.1] → Radio & USB player [CN-27 (8)]
- → Fuse box [No.3]
  - → Cluster [CN-56 (1)]
  - → RMS [CN-125A (1)]
  - → Hour meter [CN-48 (1)]
- → Fuse box [No.4]
  - → I/conn [CN-11 (5)]
    - → AC & Heater controller (3)
    - → Blower relay (2)
  - → I/conn [CN-6 (7)] → Room lamp [CL-1 (2)]
- → Fuse box [No.5] → I/conn [CN-04 (25)] → MCU [CN-51 (B12)]
- → Fuse box [No.6]
  - → I/conn [CN-04 (8, 9)] → ECU [CN-93A (1, 3, 5)]
  - → EGR valve relay [CR-80 (30)]

※ I/conn : Intermediate connector

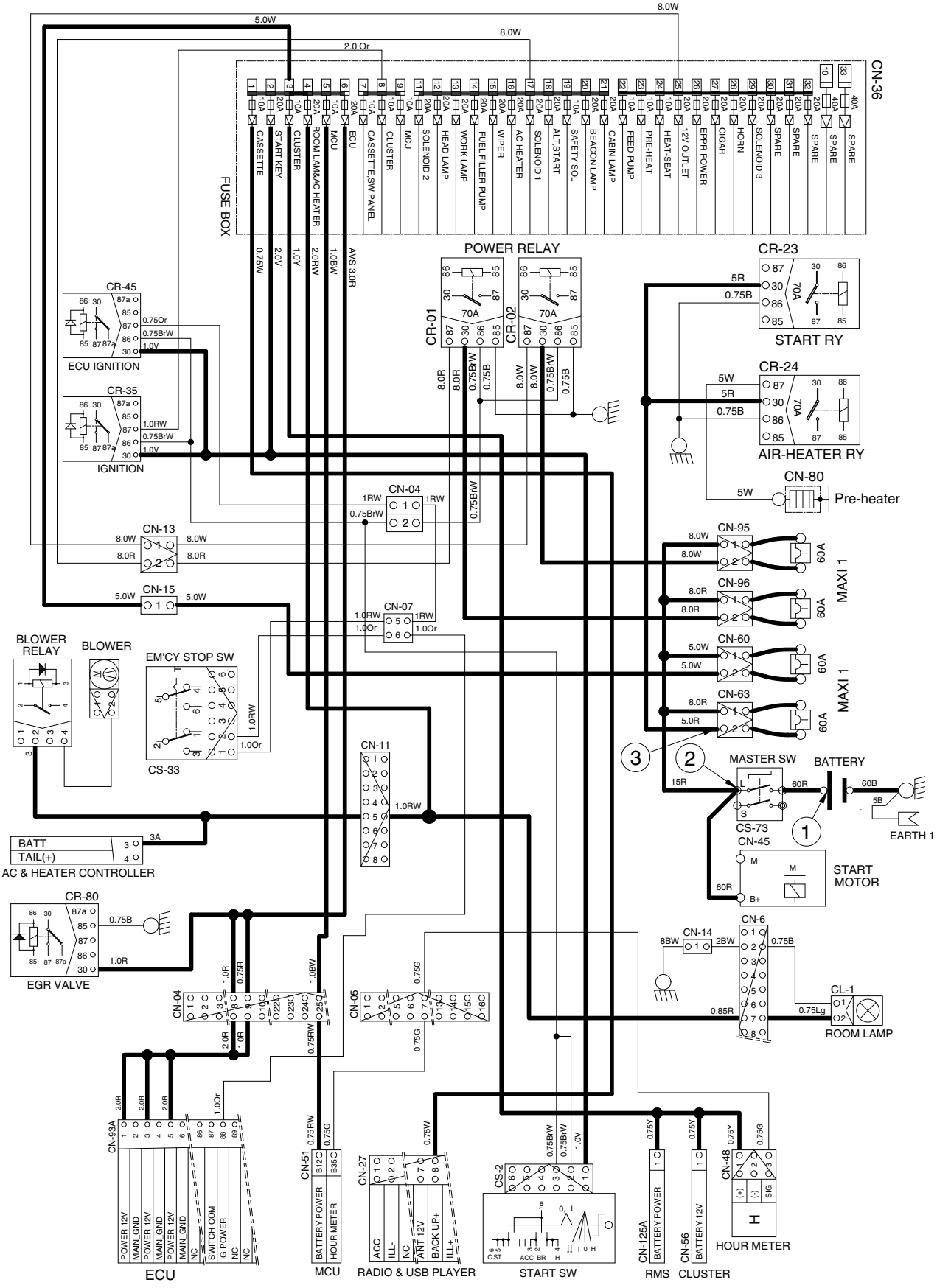
2) CHECK POINT

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

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

POWER CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Master switch [CS-73 (L)] → Fusible link [CN-60]
→ I/conn [CN-15 (1)] → Fuse box No.2 → Start switch [CS-2 (1)]

(1) Start switch : ON

Start switch ON [CS-2 (2,3)] → Ignition [CR-35 (86) → (87)] → Fuse box [No.7,8,9]
→ I/conn [CN-04 (2)]
→ Power relay [CR-01 (86) → (87)] → CN-13 [(2)] → Fuse box [No.11~21]
→ Power relay [CR-02 (86) → (87)] → CN-13 [(1)] → Fuse box [No.22~32]

(2) Start switch : START

Start switch START [CS-2 (6)] → Limit start [CR-385 (30) → (87)] → I/conn [CN-04 (31)]
→ ECU [CN-93A (35) → (28, 73)] → I/conn [CN-08 (2, 3)] → Anti-restart relay [CR-5 (30) → (87)]
→ I/conn [CN-08 (12)] → Start relay [CR-23 (85) → (87)] → Start motor [CN-45 (M)]
→ Starter operating

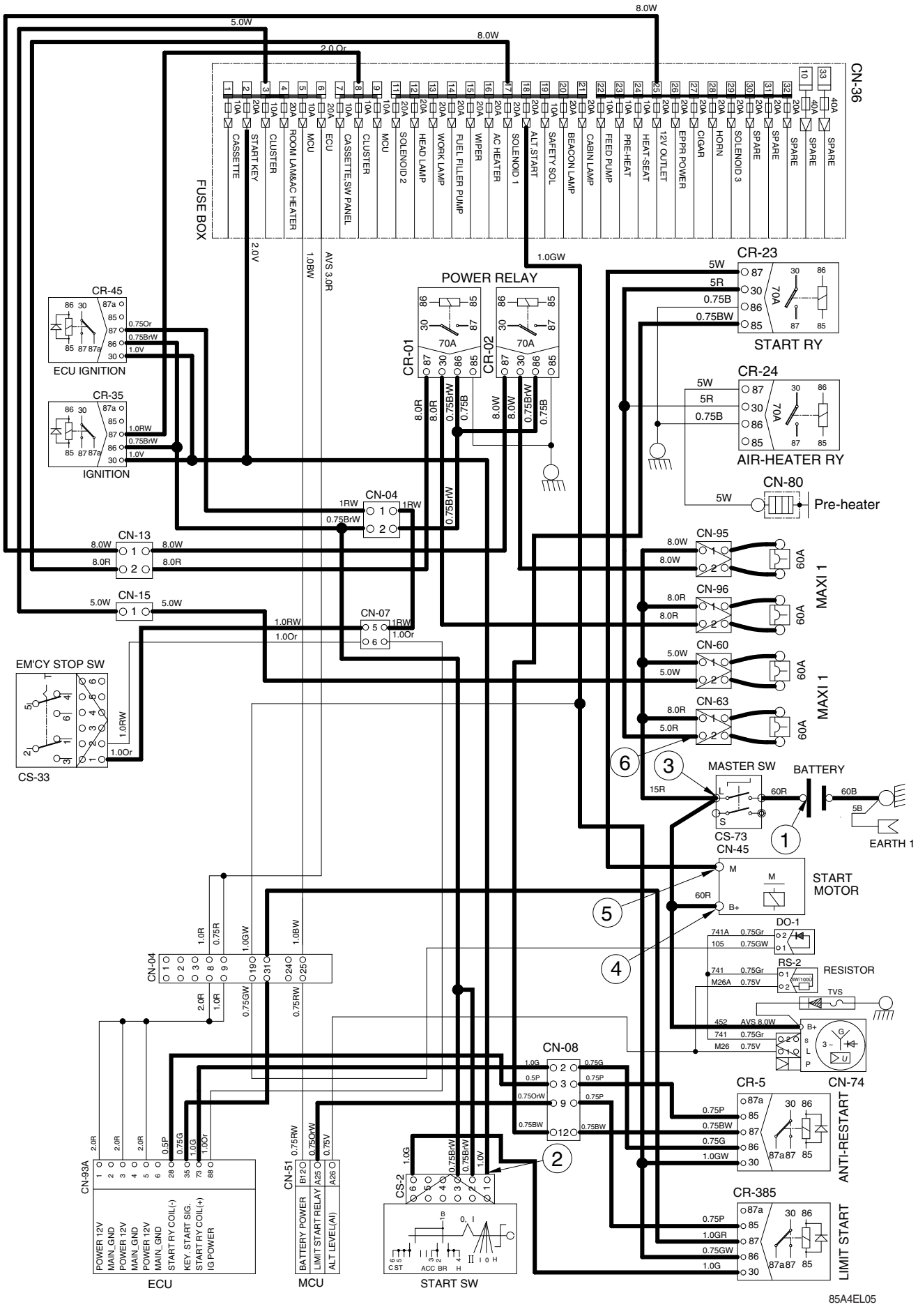
CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① – GND (battery) ② – GND (start key) ③ – GND (master switch) ④ – GND (starter B^+) ⑤ – GND (starter M) ⑥ – GND (Fusible link)	10~12.5V

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

STARTING CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

3. CHARGING CIRCUIT

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

Charging current generated by operating alternator flows into the battery through the master switch (CS-73).

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

1) OPERATING FLOW

(1) Warning flow

Alternator [CN-74 (1)] → MCU [CN-51 (A26)] → Cluster warning lamp (via CAN interface)

(2) Charging flow

Alternator [CN-74 (B+)] → Master switch [CS-73 (L)] → Battery (+) terminal → Bettery charging

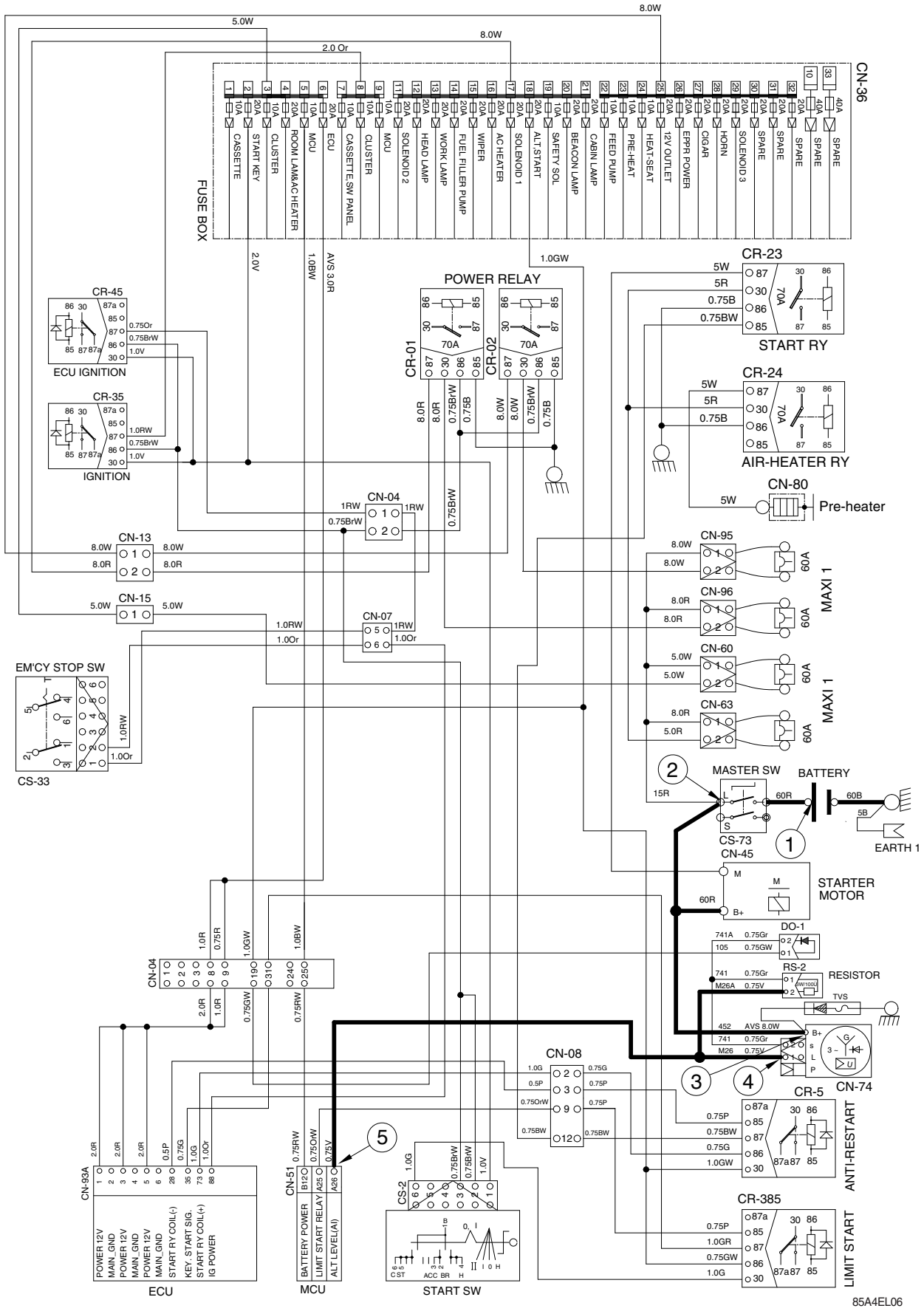
2) CHECK POINT

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

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

CHARGING CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

4. ILLUMINATION AND WORK LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.12) → Illumination [CR-13 (30,86)]
Fuse box (No.12) → Front cab work lamp relay [CR-9 (30,86)]
Fuse box (No.13) → Boom work lamp relay [CR-3 (30,86)]
Fuse box (No.7) → Switch panel [CN-116 (10)]

(1) Illumination lamp switch ON

Illumination lamp switch ON [CN-116 (1)] → Illumination lamp relay [CR-13 (85) → (87)]
- → I/conn [CN-04 (23)] → I/conn [CN-06 (07)]
  - → Quick coupler switch ill lamp ON [CS-67 (8)]
  - → Aux & angle dozer sw ill lamp ON [CS-133 (8)]
  - → ECO mode sw ill lamp ON [CS-80 (10)]
- → Radio & USB player illumination lamp ON [CN-27 (9)]
- → I/conn [CN-11 (8)] → AC/Heater controller illumination lamp ON
- → Overload switch illumination lamp ON [CS-50 (8)]
- → Wiper switch illumination lamp ON [CS-3 (8)]
- → Washer switch illumination lamp ON [CS-30 (8)]
- → Cigar lighter [CL-2 (1)]
- → Accel dial lamp [CN-142A (2)]

(2) Work lamp switch ON

Work light switch ON [CN-116 (2)] → Work lamp relay [CR-3 (85) → (87)] → I/conn [CN-05 (1)]
I/conn [CN-12 (2)] → Boom work lamp ON [CL-5 (2), 6 (2)]

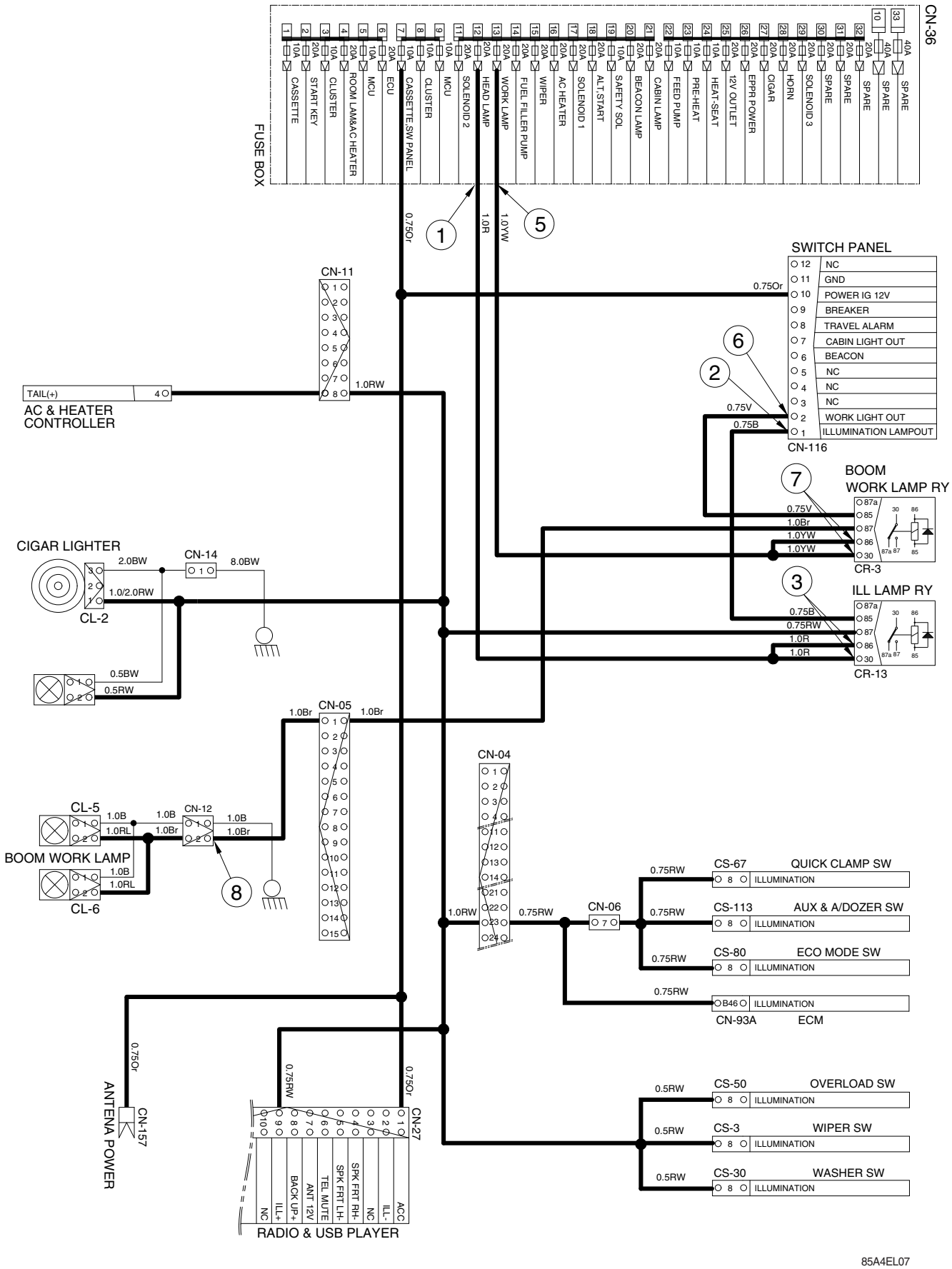
2) CHECK POINT

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

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

ILLUMINATION AND WORK LAMP CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

5. BEACON LAMP AND CAB LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.12) → Cab front work lamp relay [CR-9 (30, 86)]
Fuse box (No.20) → Beacon lamp relay [CR-85 (30, 86)]
Fuse box (No.21) → Cab rear work lamp relay [CR-44 (30, 86)]
Fuse box (No.7) → Switch panel [CN-116 (10)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-116 (6)] → Beacon lamp relay [CR-85 (85) → (87)] → I/conn [CN-5 (5)] → Beacon lamp ON [CL-7]

(2) Cab lamp switch ON

Cab lamp switch ON [CN-116 (7)] → Front lamp relay [CR-9 (85) → (87)] → I/conn [CN-9 (12)] → I/conn [CL-03 (2)] → Cab front lamp ON [CL-02 (2), CL-04 (2)]

Cab lamp switch ON [CN-116 (7)] → Cab rear lamp relay [CR-44 (85) → (87)] → I/conn [CN-9 (8)] → Cab rear lamp ON [CL-09 (02)]

Cab lamp ON [CL-3 (2), 4 (2)]

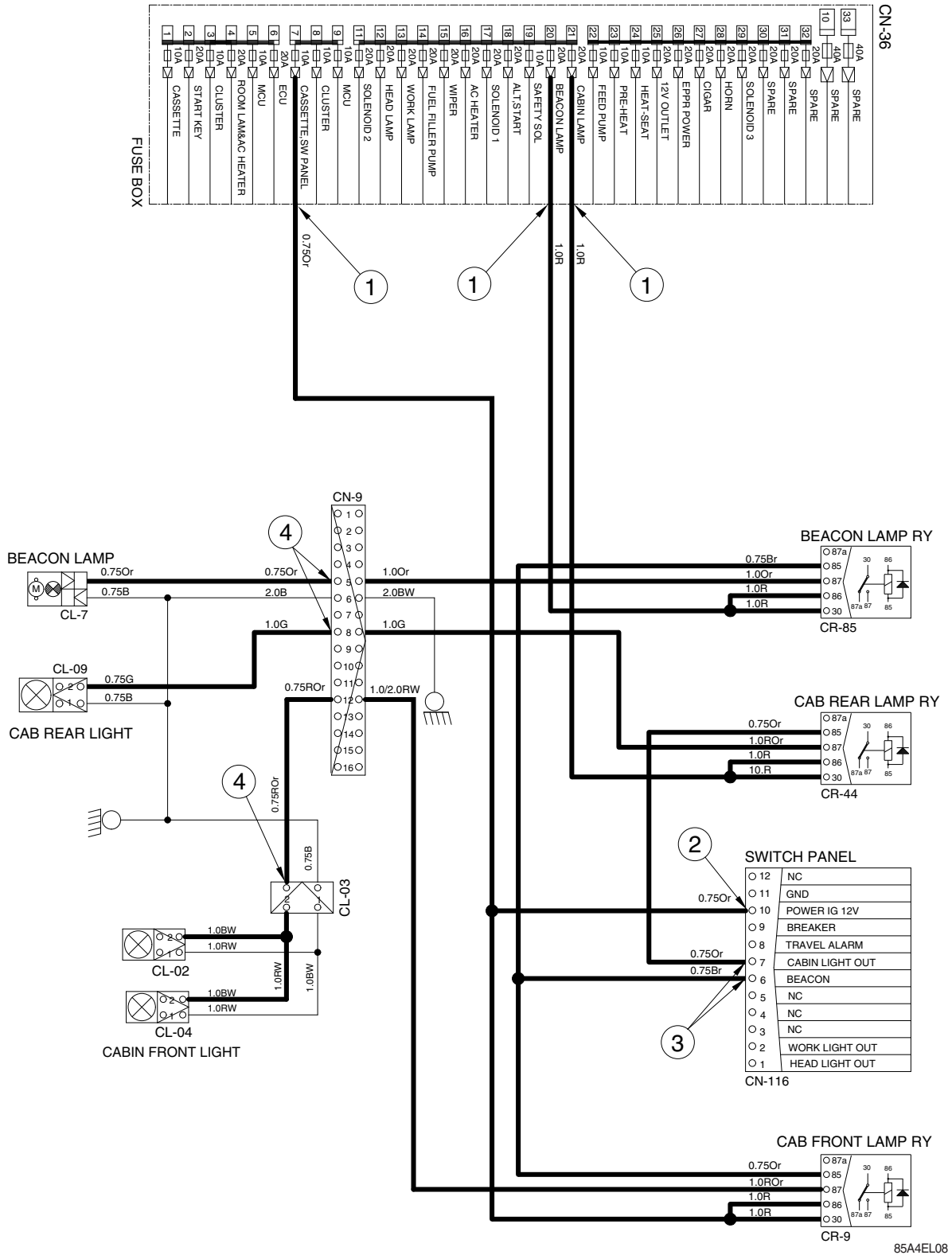
2) CHECK POINT

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

BEACON AND CAB LAMP CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

Fuse box (No.15) → Wiper relay [CR-4 (86, 87)]
→ Int wiper relay [CR-6 (3)]
→ Wiper motor [CN-21 (3)]
→ I/conn [CN-04 (29)] → Washer pump [CN-22 (2)]

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

Wiper switch ON [CS-3 (3)] → Int wiper relay [CR-6 (4)→(2)] → Wiper relay [CR-4 (85)→(30)]
→ Washer motor operating [CN-21 (4)]

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

Wiper switch ON [CS-3 (4)] → Int wiper relay [CR-6 (1)] → Washer switch [CS-30 (2)]
→ Wiper relay [CR-4 (85) → (87a)]
→ Wiper motor operating [CN-21 (1)]

Washer switch ON [CS-30 (2)] → I/conn [CN-04 (11)] → Washer pump operating [CN-22 (1)]

(4) Auto parking (when switch OFF)

Switch OFF → Wiper motor [CN-21 (1)] → Wiper switch [CS-3] → Int wiper relay [CR-6 (4)→(2)]
→ Wiper relay [CR-4 (85) → (30)] → Wiper motor [CN-21 (4)]
→ Wiper motor parking position by wiper motor controller

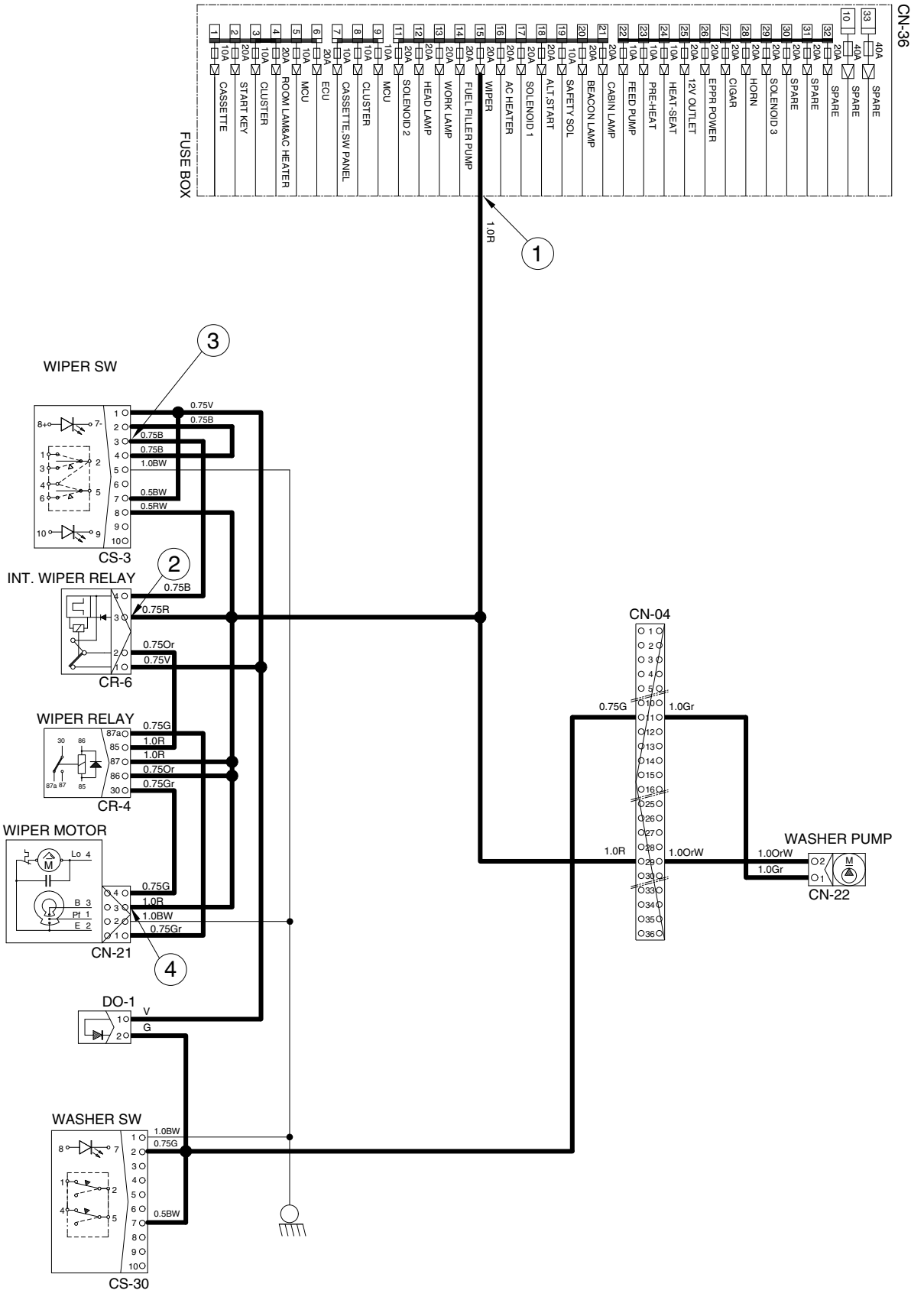
2) CHECK POINT

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

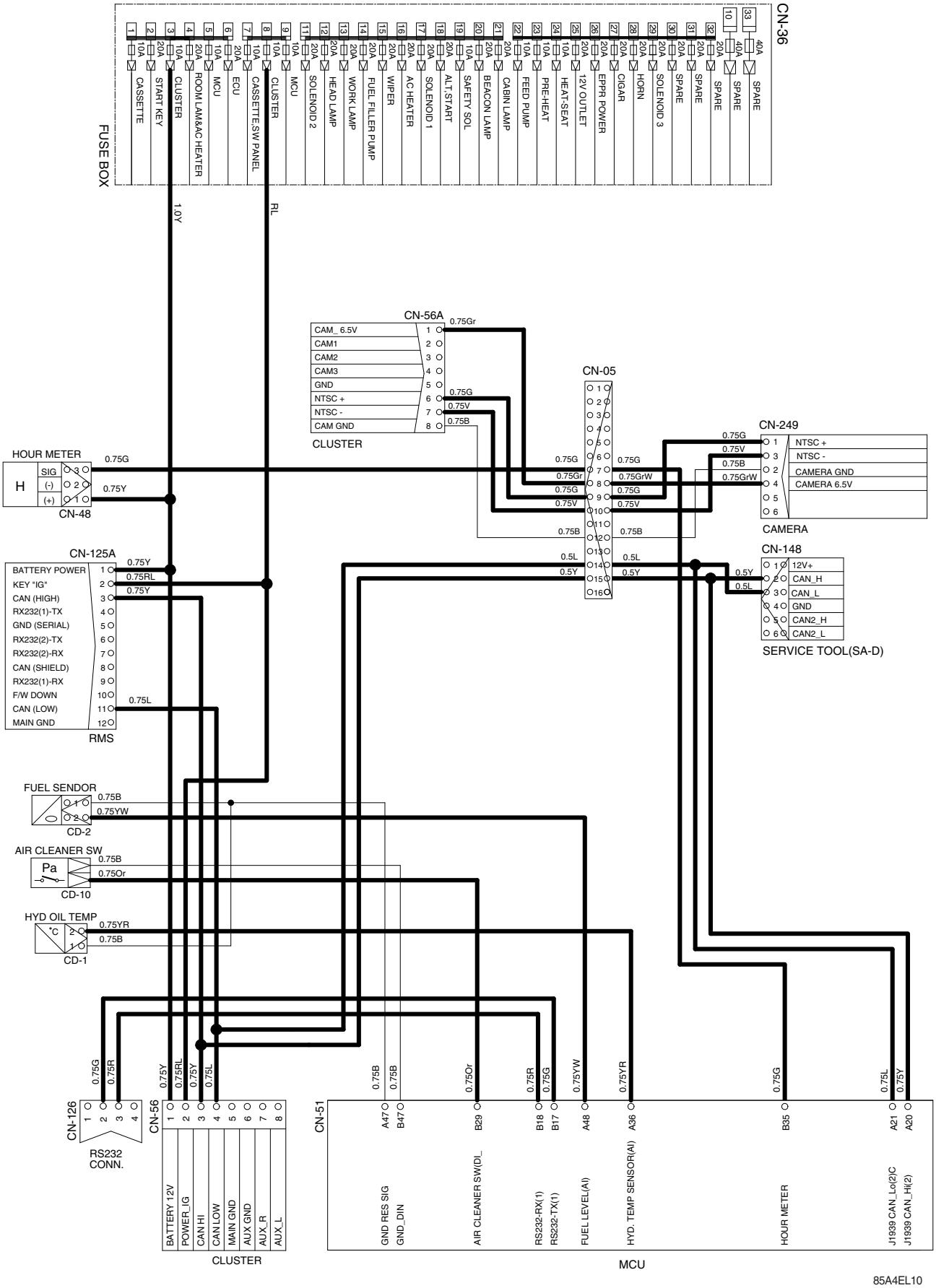
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT



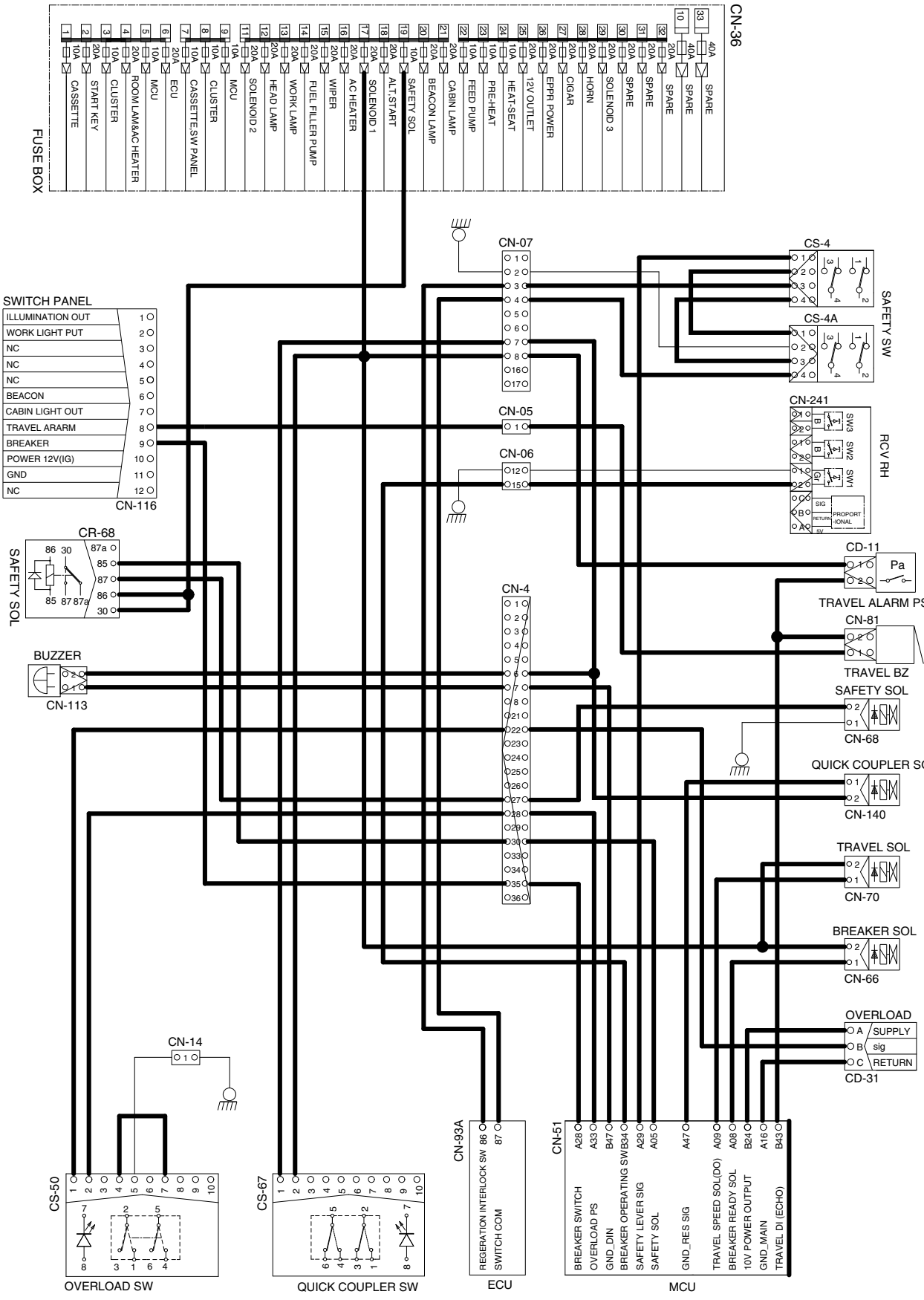
※ The circuit diagram may differ from the equipment, so please check before a repair.

MONITORING CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

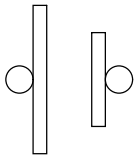
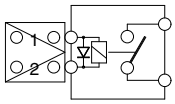
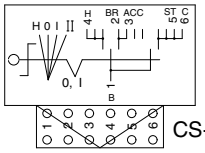
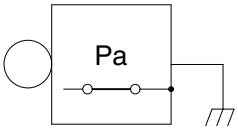
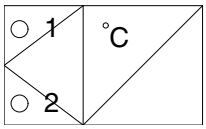
ELECTRIC CIRCUIT FOR HYDRAULIC

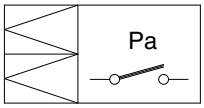
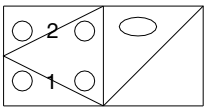
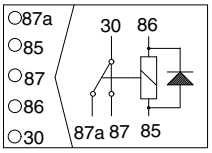
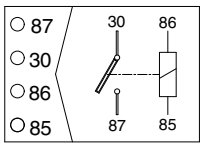
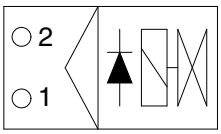
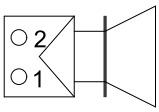


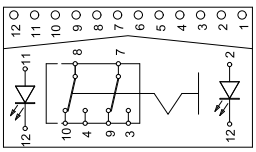
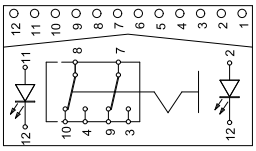
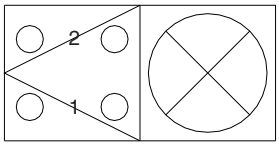
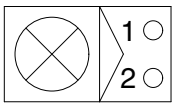
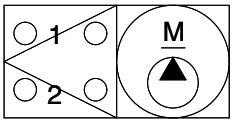
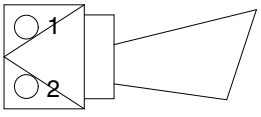
85A4EL11

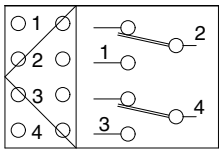
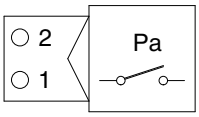
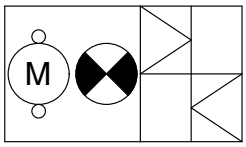
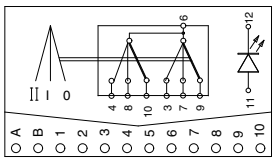
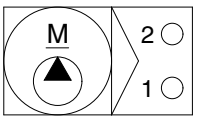
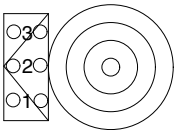
※ The circuit diagram may differ from the equipment, so please check before a repair.

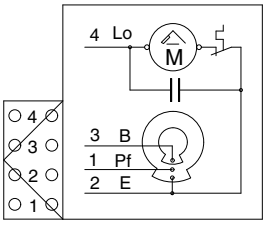
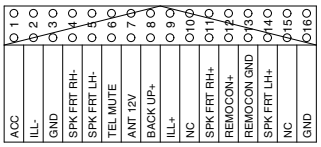
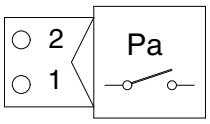
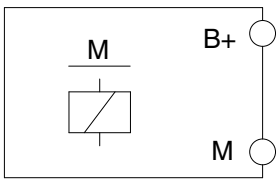
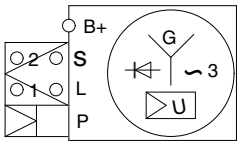
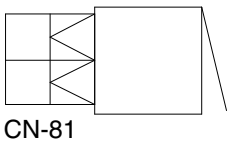
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

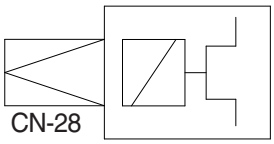
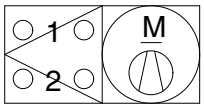
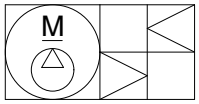
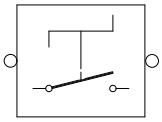
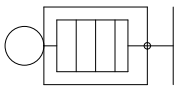
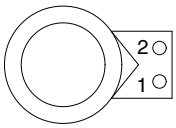
Part name	Symbol	Specification	Check
Battery		12V × 100Ah	※ Check specific gravity 1.280 over : over charged 1.280 ~ 1.250 : normal 1.250 below : recharging
Battery relay	 CR-1	Rated load : 12V 100A (continuity) 1000A (30 second)	※ Check coil resistance Normal : about 12Ω ※ Check contact Normal : ∞Ω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

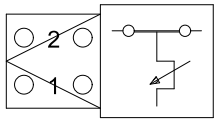
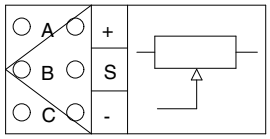
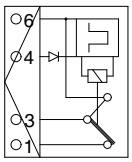
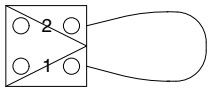
Part name	Symbol	Specification	Check
Air cleaner pressure switch	 CD-10	Pressure: 635mmH_2O (N.O TYPE)	※ Check contact Normal : ∞Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 100Ω Low : 500Ω Empty warning :700Ω
Relay	 CR-2 CR-3 CR-4 CR-5 CR-7 CR-9 CR-12 CR-13 CR-36 CR-45 CR-62 CR-71 CR-80 CR-85	12V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

Part name	Symbol	Specification	Check
Boom swing switch	 CS-47	12V 16A	※ Check contact Normal OFF - ∞Ω (for terminal 1-5,2-6) - 0Ω (for terminal 5-7,6-8)
Quick coupler switch	 CS-67	12V 16A	※ Check contact Normal OFF - ∞Ω (for terminal 1-5,2-6) - 0Ω (for terminal 5-7,6-8)
Work, cab lamp	 CL-5 CL-6 CL-9 CL-10	12V 65W (H3 TYPE)	※ Check disconnection Normal : 1.2Ω
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-25	12V	100±5dB

Part name	Symbol	Specification	Check
Safety switch	 CS-4	Micro	※ Check contact Normal : 0Ω(for terminal A-B) : ∞Ω(for terminal A-C) Operating : ∞Ω(for terminal A-B) : 0Ω(for terminal A-C)
Pressure switch	 CD-11 CD-12	10bar (N.C type)	※ Check contact Normal : 0.1Ω
Beacon lamp	 CL-7	12V (Strobe type)	※ Check disconnection Normal : a fewΩ
Wiper switch	 CS-3	12V 16A	※Check contact Normal : ∞Ω
Washer pump	 CN-22	12V 3.8A	※Check contact Normal : 3Ω(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 : 6Ω(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 : 0Ω
Starter	 CN-45	12V × 3kW	※ Check contact Normal : 0.1Ω
Alternator	 CN-74	12V 100A	※ Check contact Normal : 0Ω(for terminal B^+-1) Normal : 24 ~ 27.5V
Travel buzzer	 CN-81	12V 0.5A	※ Check contact Normal : 5.2Ω

Part name	Symbol	Specification	Check
Compressor		12V 79W	-
Blower fan motor	 CN-83	12V 9.5A	※ Check resistance 2.5Ω(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 : 0Ω (for terminal 1-2) the atmosphere temp : over 4˚C
Accel dial	 CN-142	-	※ Check resistance Normal : about 5kΩ (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

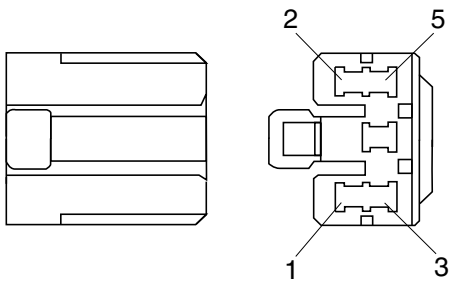
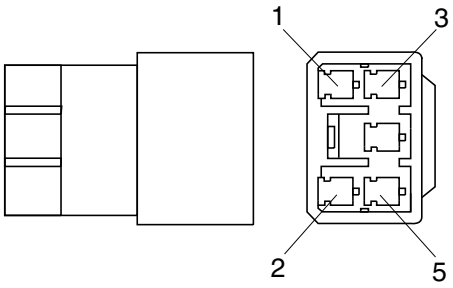
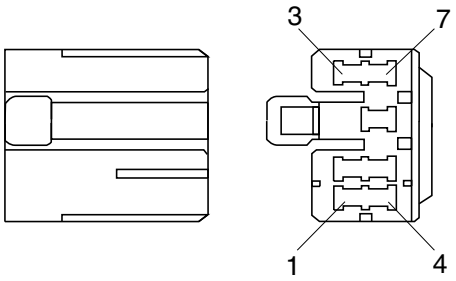
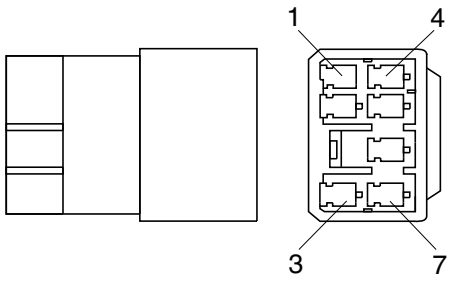
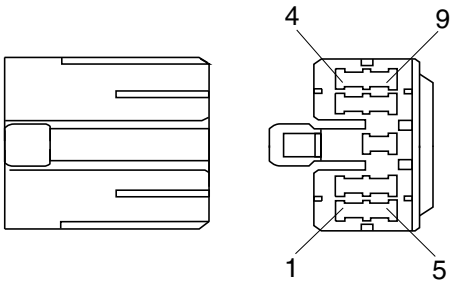
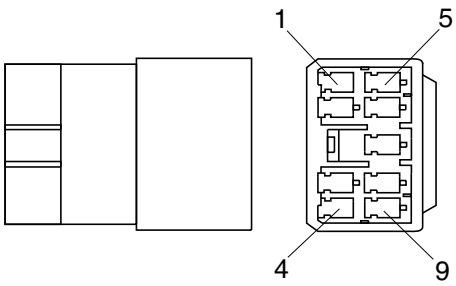
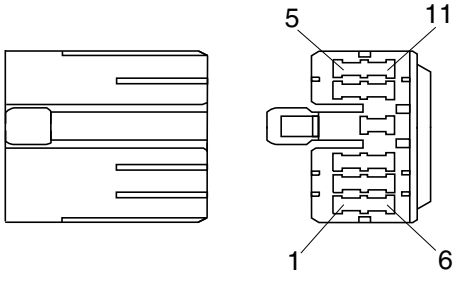
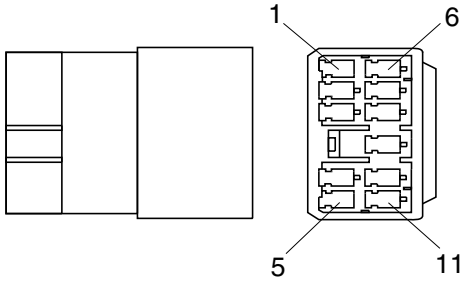
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-4	AMP	15	Cab room harness - Main harness	-	1743062-2
CN-5	AMP	16	Cab room harness - Main harness	-	368050-1
CN-6	-	15	Cab harness - Cab room lamp harness	2-85262-1	368301-1
CN-7	AMP	16	Main harness - Console harness	368047-1	368050-1
CN-8	AMP	15	Main harness - Cab harness	-	308301-1
CN-11	-	8	Air-con	DT06-8S-EP06	-
CN-12	DEUTSCH	2	Boom lamp	DT06-2S-EP06	-
CN-13	KET	2	Power connector	MG610557-5	-
CN-14	KET	2	Earth connector	MG620558-5	-
CN-15	KET	1	Power connector	MG640944-5	-
CN-16	AMP	6	Emergency throttle	-	174264-2
CN-16B	AMP	6	Emergency throttle	S816-006002	-
CN-22	KET	2	Washer tank	MG640605	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27	-	16	Cassette radio	PK145-16017	-
CN-28	AMP	1	Air conditioner compressor	S810-001202	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse box	21MN-55100	-
CN-51	MOLEX	48	MCU	64320-3319	-
CN-52	MOLEX	48	MCU	64320-3311	-
CN-56	AMP	8	Cluster	-	S816-108202
CN-56A	-	8	Cluster	174982	-
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	-
CN-62	MTA	-	Master switch	03-210000	-
CN-62A	DEUTSCH	2	Pattern change solenoid - Cab harness	DT06-2S-EP06	DT04-2P- E005
CN-62B	DEUTSCH	2	Pattern change solenoid - Cab harness	DT06-2S-EP06	DT04-2P- E005
CN-63	MTA	-	Master switch	03-210000	-
CN-66R	DEUTSCH	2	Breaker ready solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	A1 safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	A2 Travel solenoid	DT06-2S-EP06	-
CN-74	KET	2	Alternator	MG640188-5	-
CN-80	YAZAKI	1	Pre heater	7323-3010	-
CN-81	DEUTSCH	2	Buzzer	DT06-2S-EP06	-
CN-93A	AMP	94	ECU case	3-1355136-3	-
CN-93B	AMP	60	ECU case	1897635-2	-
CN-95	MTA	-	Fuse holder	03-210000	-

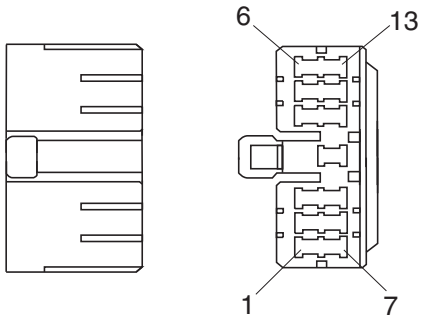
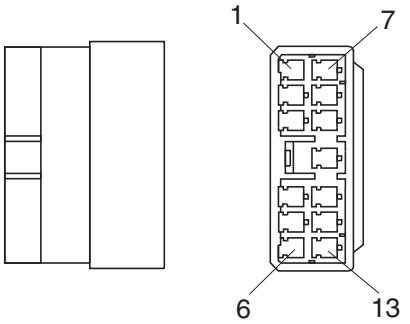
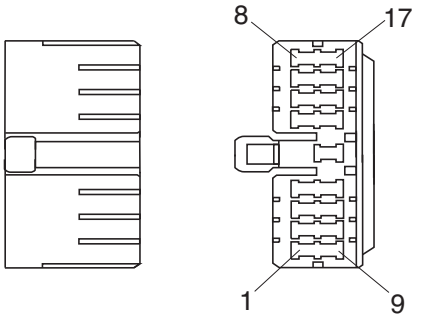
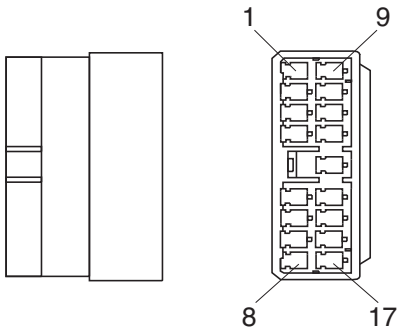
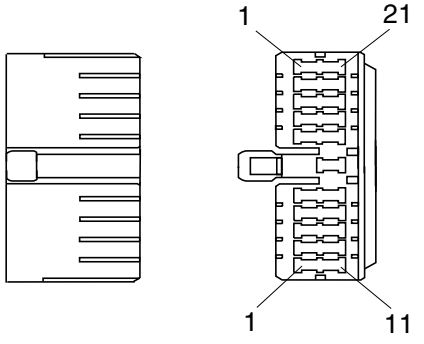
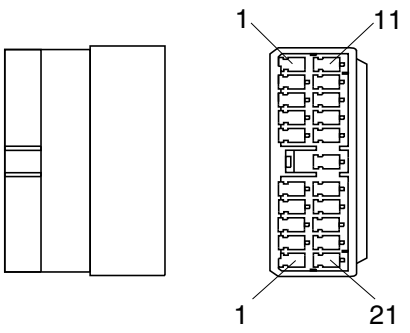
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-96	MTA	-	Fuse holder	03-210000	-
CN-113	-	2	Buzzer	S810-002202	-
CN-116	-	12	Switch panel	368542-1	-
CN-125A	-	12	RMS	DT06-126-P021	-
CN-126	DEUTSCH	4	RS-232 connector	DT06-4S-EP06	-
CN-139	-	2	Dozer socket	S810-002202	-
CN-140	DEUTSCH	2	Quick coupler solenoid	DT06-2S-ER06	DT04 -2P-E005
CN-142	-	6	Accel dial	DT06-8S-EP06	-
CN-145	YAZAKI	2	Fuel feed pump	7123-6423-30	-
CN-148	DEUTSCH	6	Service tool	DT06-6S-E008	-
CN-170	-	2	Seat heat switch	12052641	-
CN-240C	-	3	LH joystick	DT06-3S	-
CN-241A	-	2	Breaker switch	-	DT04-2P
CN-241B	-	3	Clamp release switch	DT06-3S	-
CN-241C	-	2	Quick coupler switch	-	DT06-2S
CN-249	DEUTSCH	6	Rear camera	DT06-6S	DT04-6P
CN-300A	AMP	6	DPF pressure	1438153-5	-
CN-300B	FCI	2	DPF mid temperature	54200206	-
CN-300C	FCI	2	DPF inlet temperature	54200208	-
CN-301	AMP	8	EGR sensor	776532-1	-
CN-302	AMP	12	EGR sensor	776533-1	-
CN-303	AMP	12	EGR valve	776533-2	-
CN-304	AMP	12	Cab rail	776533-3	-
CN-310	DEUTSCH	2	Release or breaker	DT06-2S-EP06	-
CN-311	DEUTSCH	2	Clamp	DT06-2S-EP06	-
CN-312	DEUTSCH	2	Rotating	DT06-2S-EP06	-
CN-313	DEUTSCH	2	Rotating	DT06-2S-EP06	-
CN-427	MOLEX	4	Smart reader	39012040	-
CN-437	DEUTSCH	2	Float solenoid	DT06-2S-EP06	-
CN-438	DEUTSCH	2	Angle dozer sele ct solenoid	DT06-2S-EP06	DT04-2P-E005
CN-439	DEUTSCH	2	AC mode solenoid	DT06-2S-EP06	-
CN-442A	-	3	Angle dozer switch	-	DT04-3P
CN-442B	-	2	Dozer float switch	DT06-2S	-
CN-442C	-	2	2 speed switch	DT04-2P	-
·LAMP					
CL-1	-	2	Room lamp	MG610392	-
CL-2	-	-	Ci		
CL-3	-	2	Cab lamp	DT06-2S-EP06	-
CL-5	-	2	LH work lamp	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CL-6	-	2	RH work lamp	DT06-2S-EP06	-
CL-7	-	2	Beacon lamp	DT06-2S-EP06	-
CL-9	-	2	Rear cab lamp	DT06-2S-EP06	-
·RELAY					
CR-1	KET	4	Power relay	MG612017-5	-
CR-2	KET	4	Power relay	MG612017-5	-
CR-23	KET	4	Power relay	MG612017-5	-
CR-24	KET	4	Power relay	MG612017-5	-
·SENDER					
CD-1	AMP	2	Hydraulic temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-7	DEUTSCH	3	Load sensing pressure	DT06-3S-EP006	-
CD-10	AMP	2	Air cleaner switch	85202-1	-
CD-11	KET	2	Travel alarm pressure	MG640795	-
CD-18	YAZAKI	1	Engine oil pressure	7123-5014	-
CD-31	DEUTSCH	3	Overload pressure	DT06-3S-EP006	-
CD-32	DEUTSCH	3	Boom up pressure	DT06-3S-EP006	-
DO-1	AMP	2	Starter	S816-002002	-
·SWITCH					
CS-2	-	6	Start key	S814-006000	-
CS-3	CARLING	10	Wiper motor	VC2-01	-
CS-4	-	4	Safety switch	174257-2	-
CS-4A	-	4	Safety switch	174259-2	-
CS-16	AMP	2	Fuel filler pump switch	174352-2	174354-2
CS-26A	-	2	Foot pedal seat belt	S816-002002	S816-102002
CS30	CARLING	10	Wiper masher	VC2-01	-
CS-33	-	6	Emergency stop switch	A816-006002	-
CS-50	-	10	Overload switch	VC2-01	-
CS-67	CARLING	10	Quick coupler	VC2-01	-
CS-76	CARLING	10	Pattern change	VC2-01	-
CS-80	CARLING	10	ECO mode	VC2-01	-
CS-100	CARLING	10	DPF switch	VC2-01	-
CS-113	CARLING	2	AUX	174352-2	174354-2
CS-162	-	2	Foot pedal seat belt	DT06-2S	DT04-2P

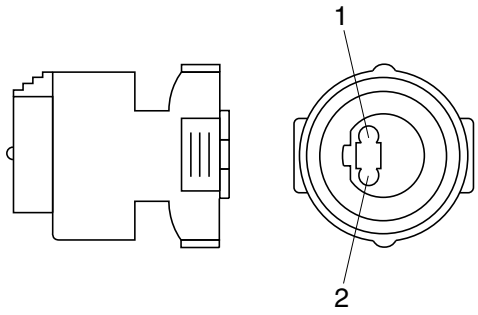
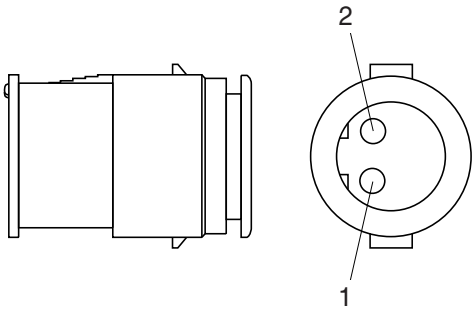
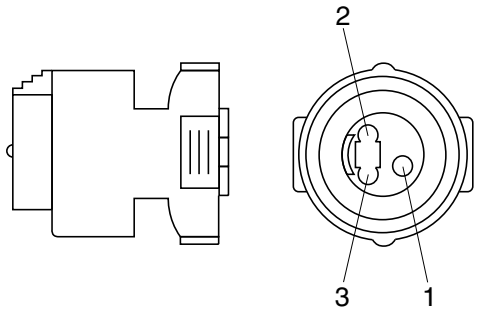
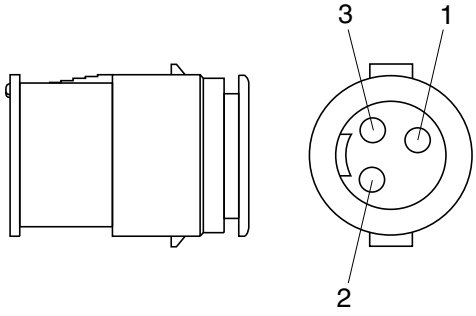
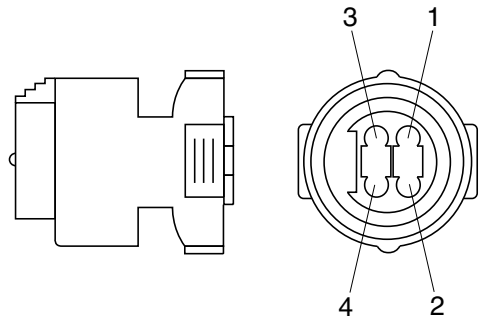
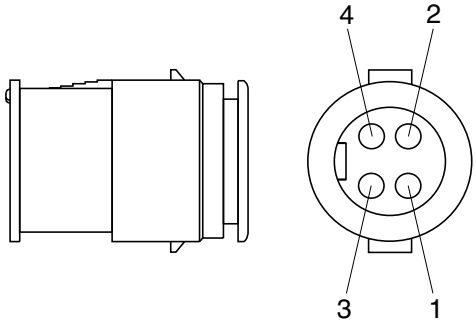
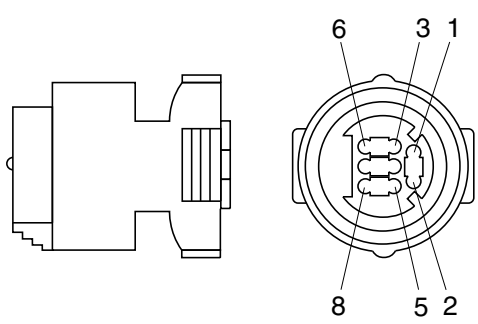
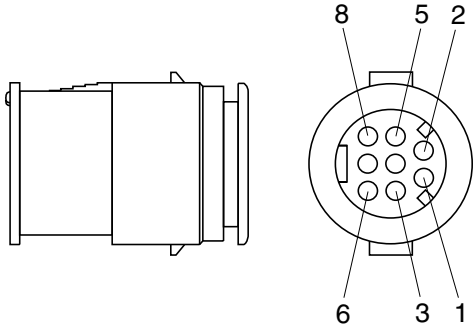
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

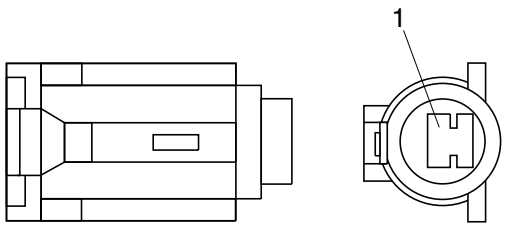
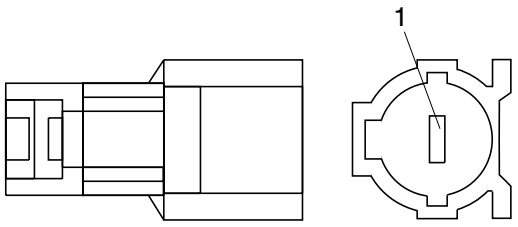
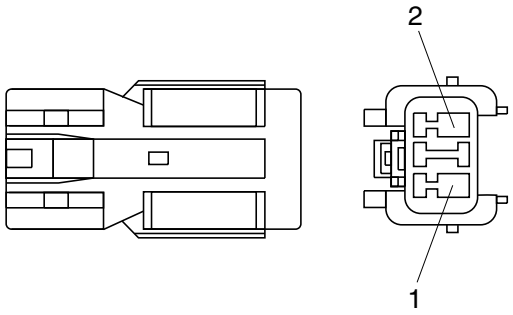
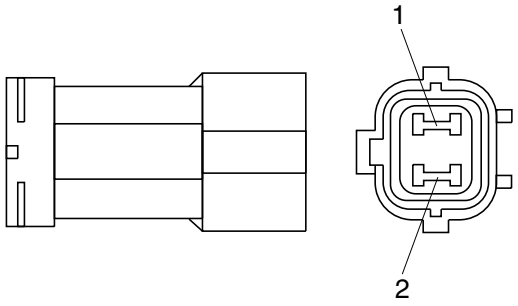
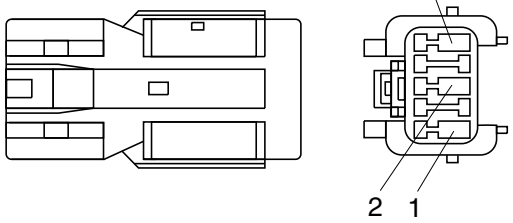
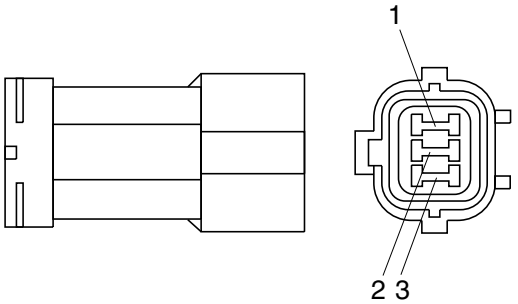
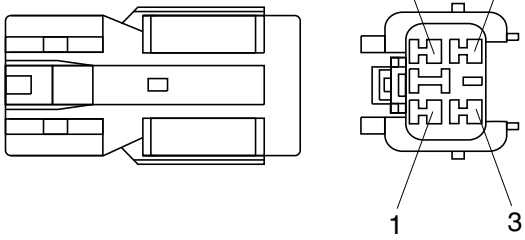
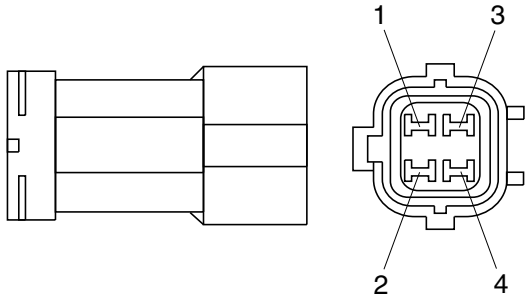
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 S811-109002
11	 S811-011002	 S811-111002

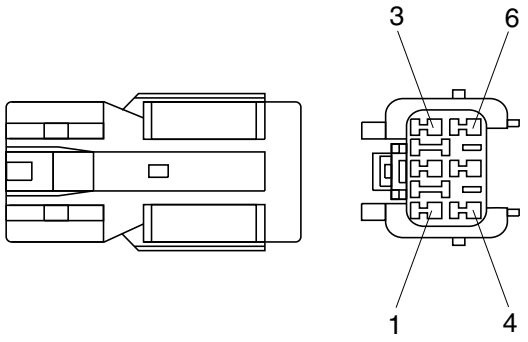
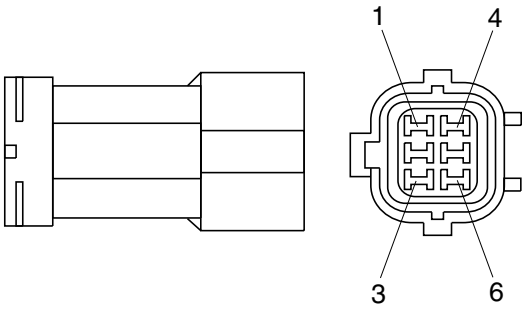
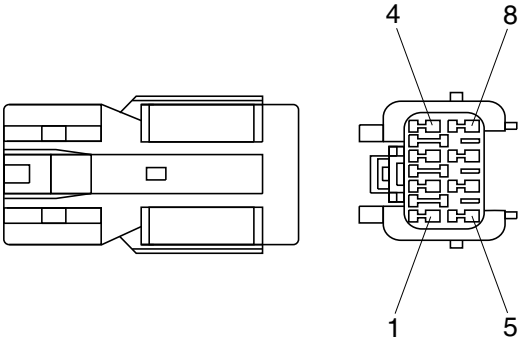
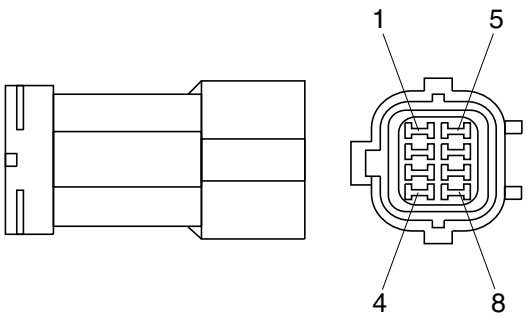
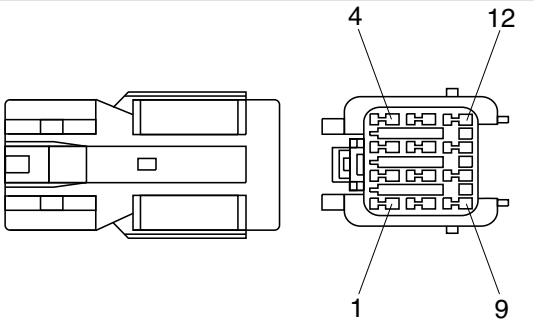
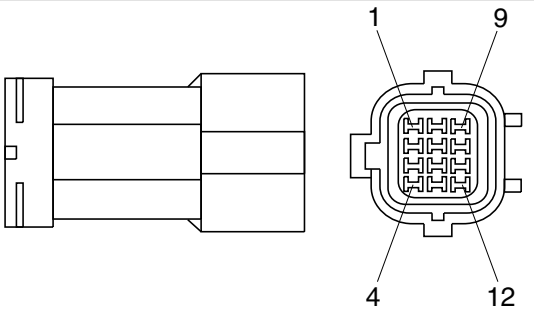
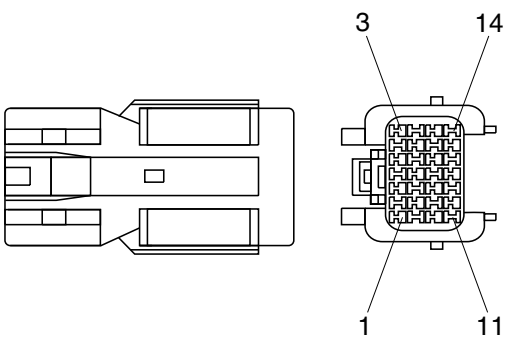
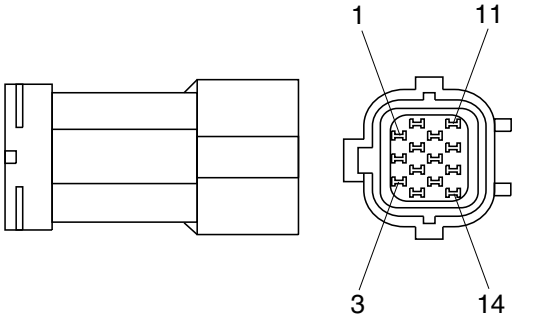
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

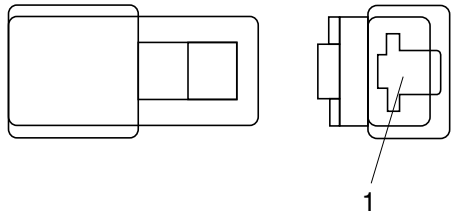
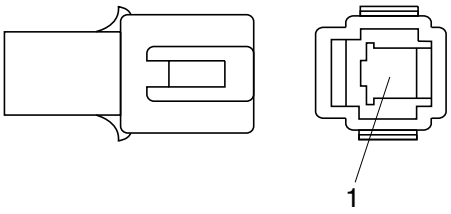
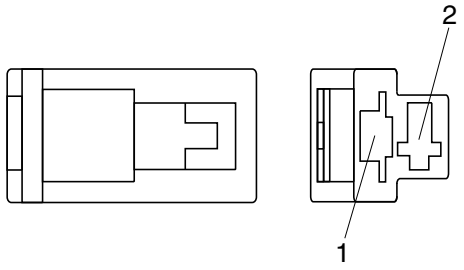
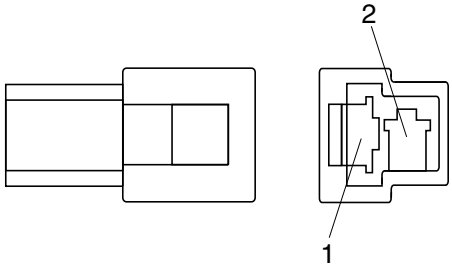
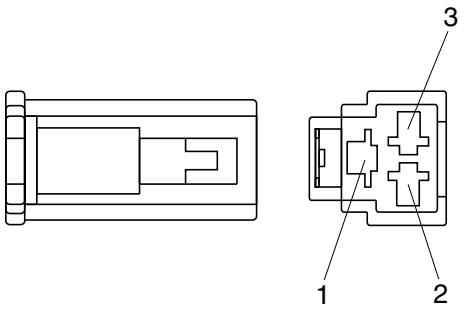
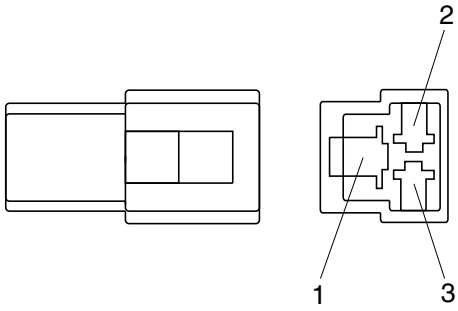
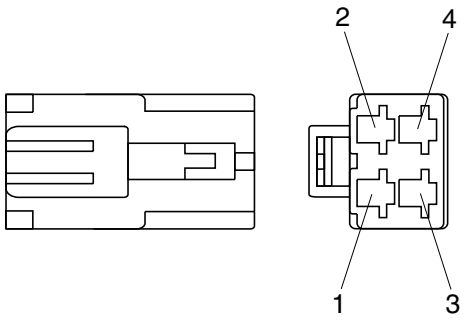
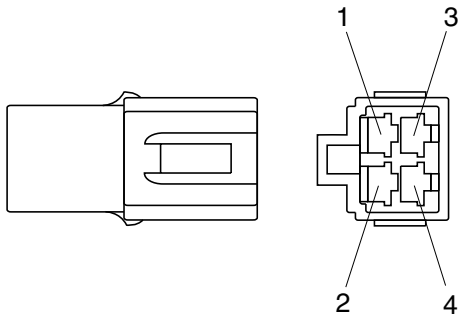
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

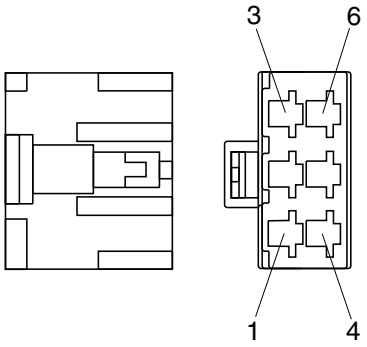
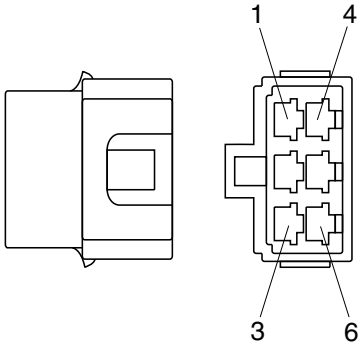
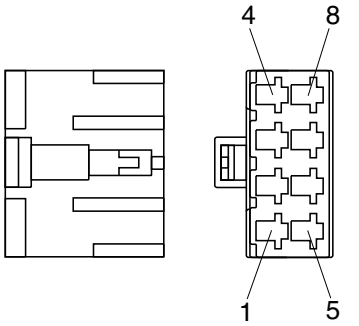
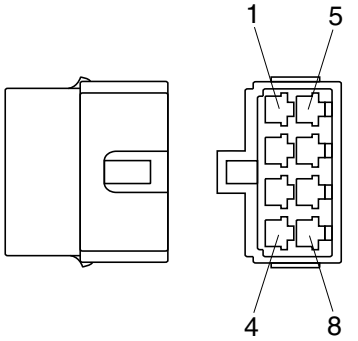
3) SWP TYPE CONNECTOR

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

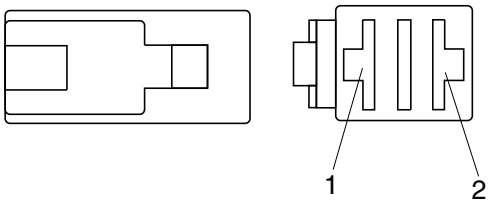
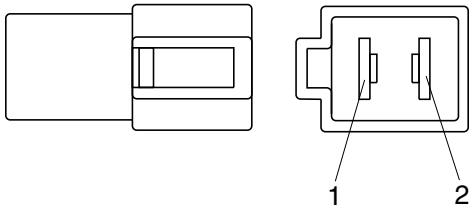
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

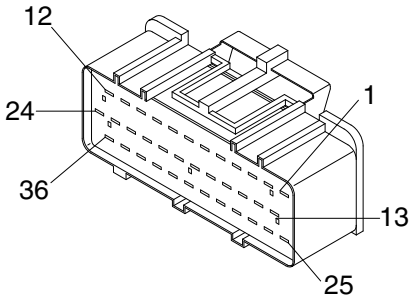
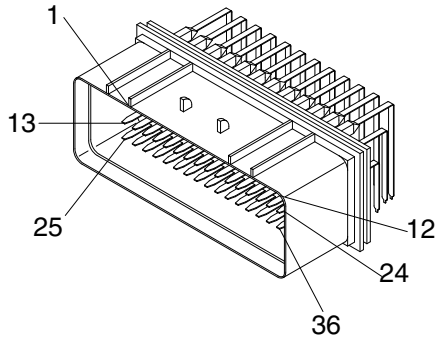
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

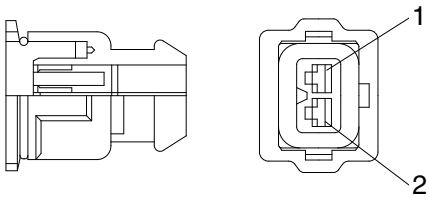
5) 375 FASTEN TYPE CONNECTOR

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

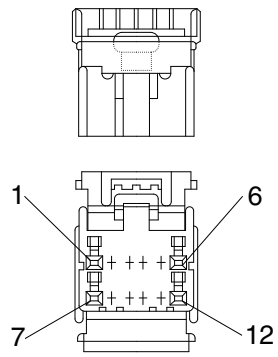
6) AMP ECONOSEAL CONNECTOR

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

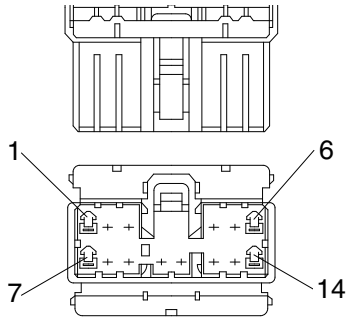
7) AMP TIMER CONNECTOR

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

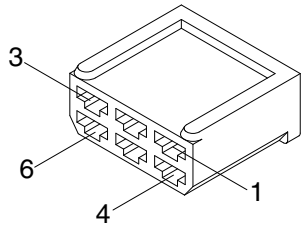
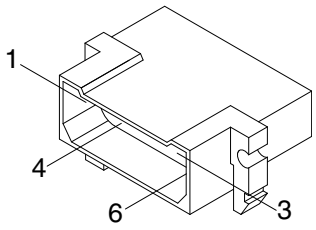
8) AMP 040 MULTILOCK CONNECTOR

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

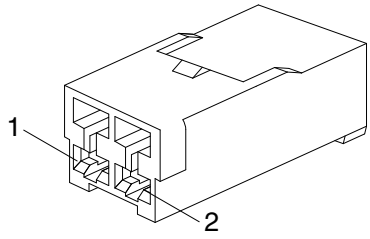
9) AMP 070 MULTILOCK CONNECTOR

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

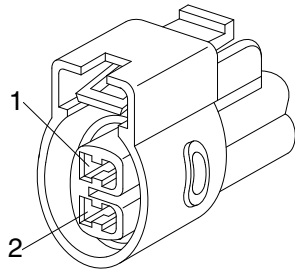
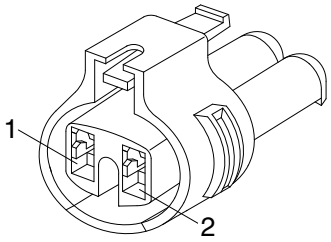
10) AMP FASTIN - FASTON CONNECTOR

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

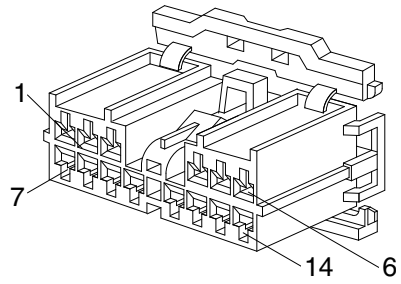
11) KET 090 CONNECTOR

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	

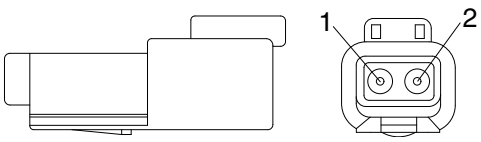
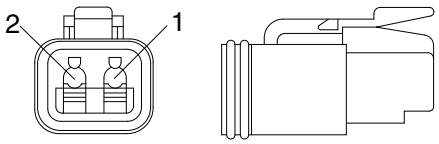
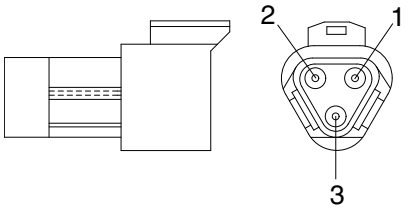
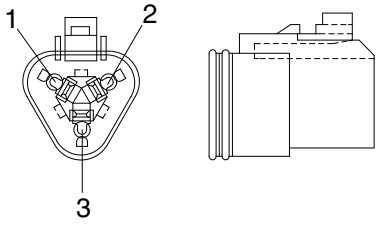
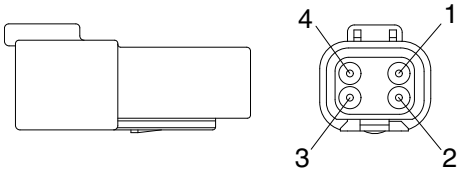
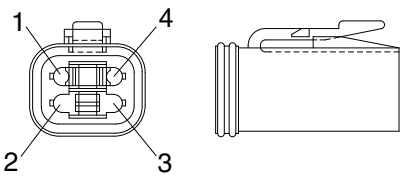
14) DEUTSCH DT CONNECTORS

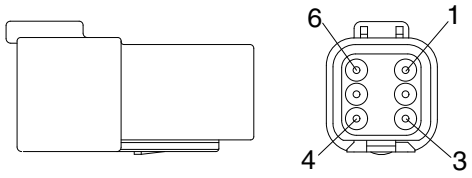
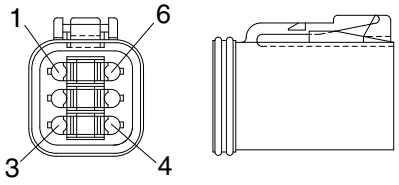
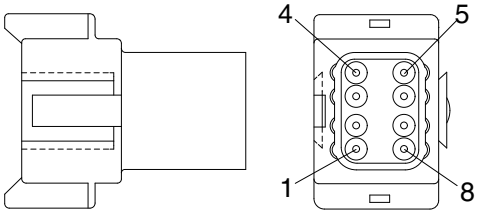
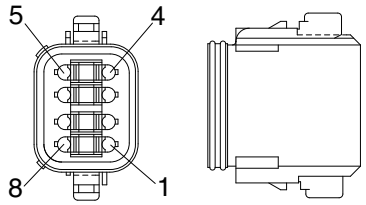
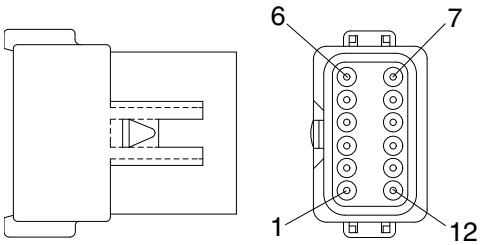
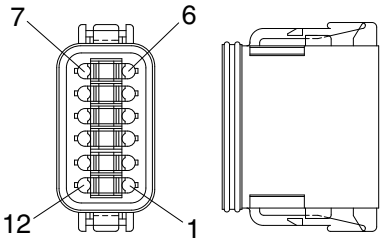
DT 06 - 3S - ★★★★

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

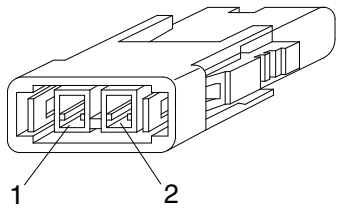
※ Modification

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

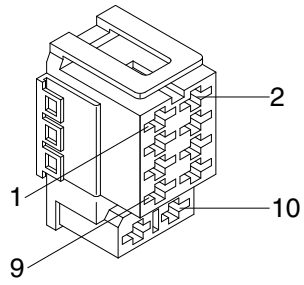
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT06-2P
3	 DT06-3S	 DT06-3P
4	 DT06-4S	 DT06-4P

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

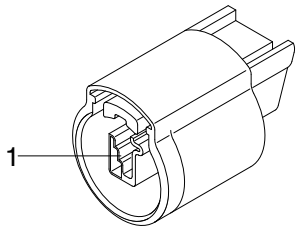
15) MOLEX 2CKTS CONNECTOR

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

16) ITT SWF CONNECTOR

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

17) MWP NMWP CONNECTOR

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

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
	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

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

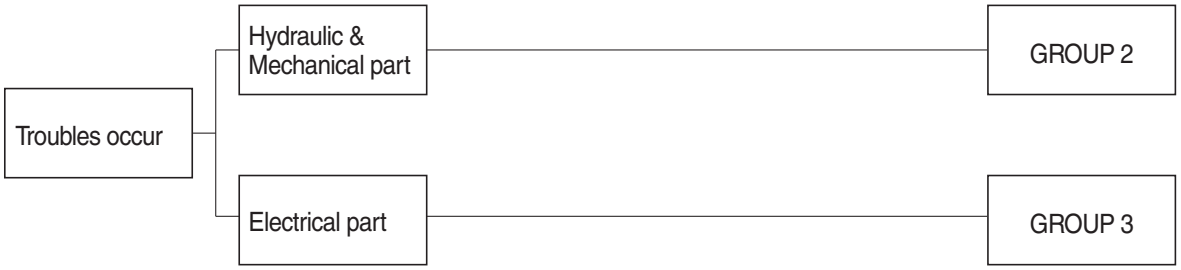
GROUP 1 BEFORE TROUBLESHOOTING

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.

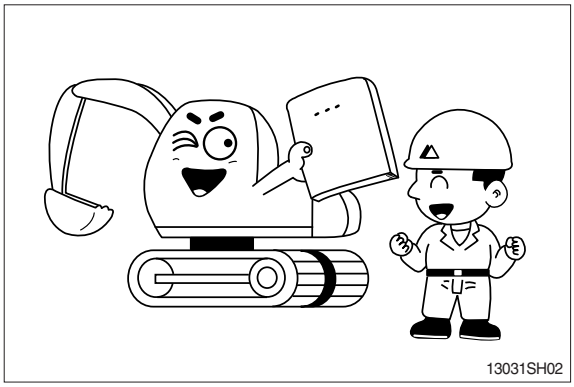


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

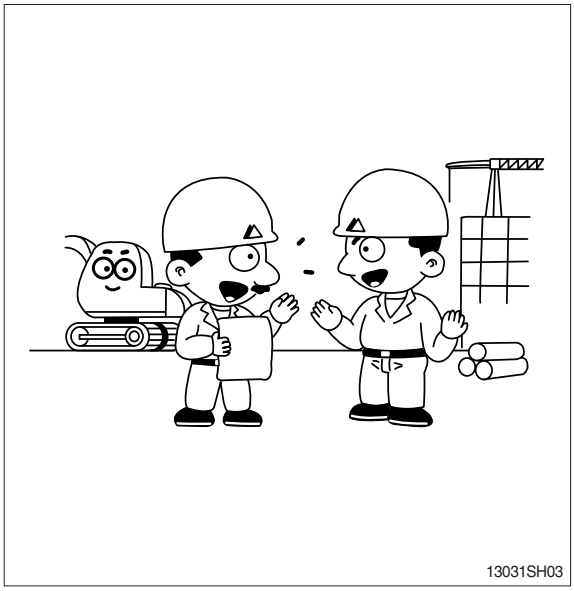
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.


13031SH02

STEP 2. Ask the operator

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

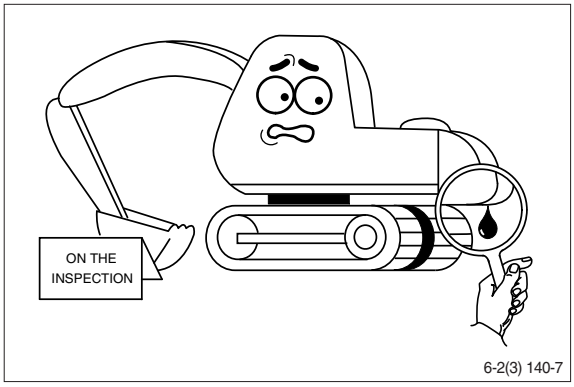
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously?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

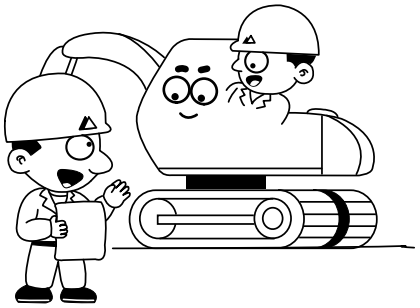
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



6-2(3) 140-7

STEP 4. Inspect the trouble actually on the machine

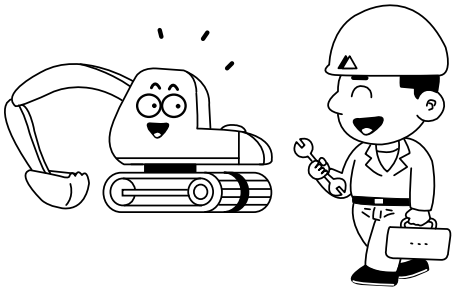
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



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.



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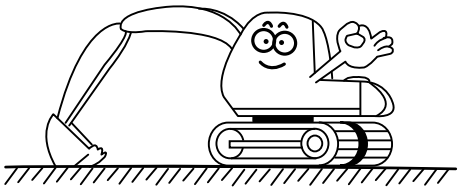
STEP 6. Trace a cause

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.

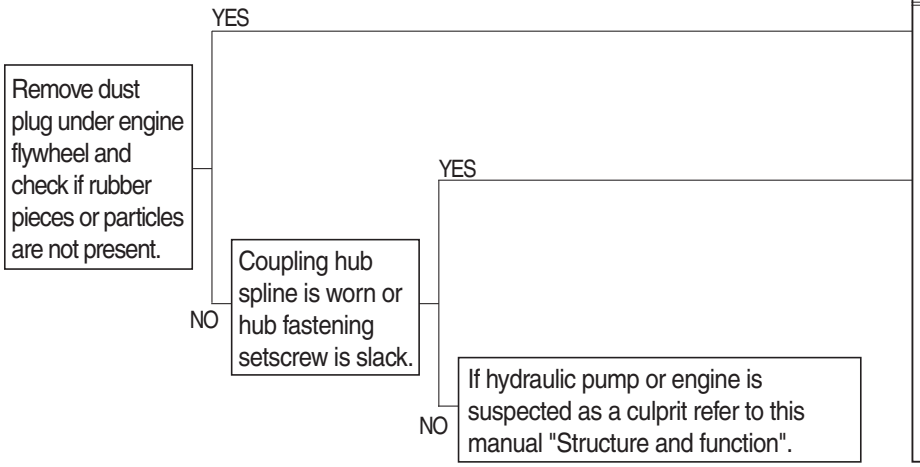
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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.

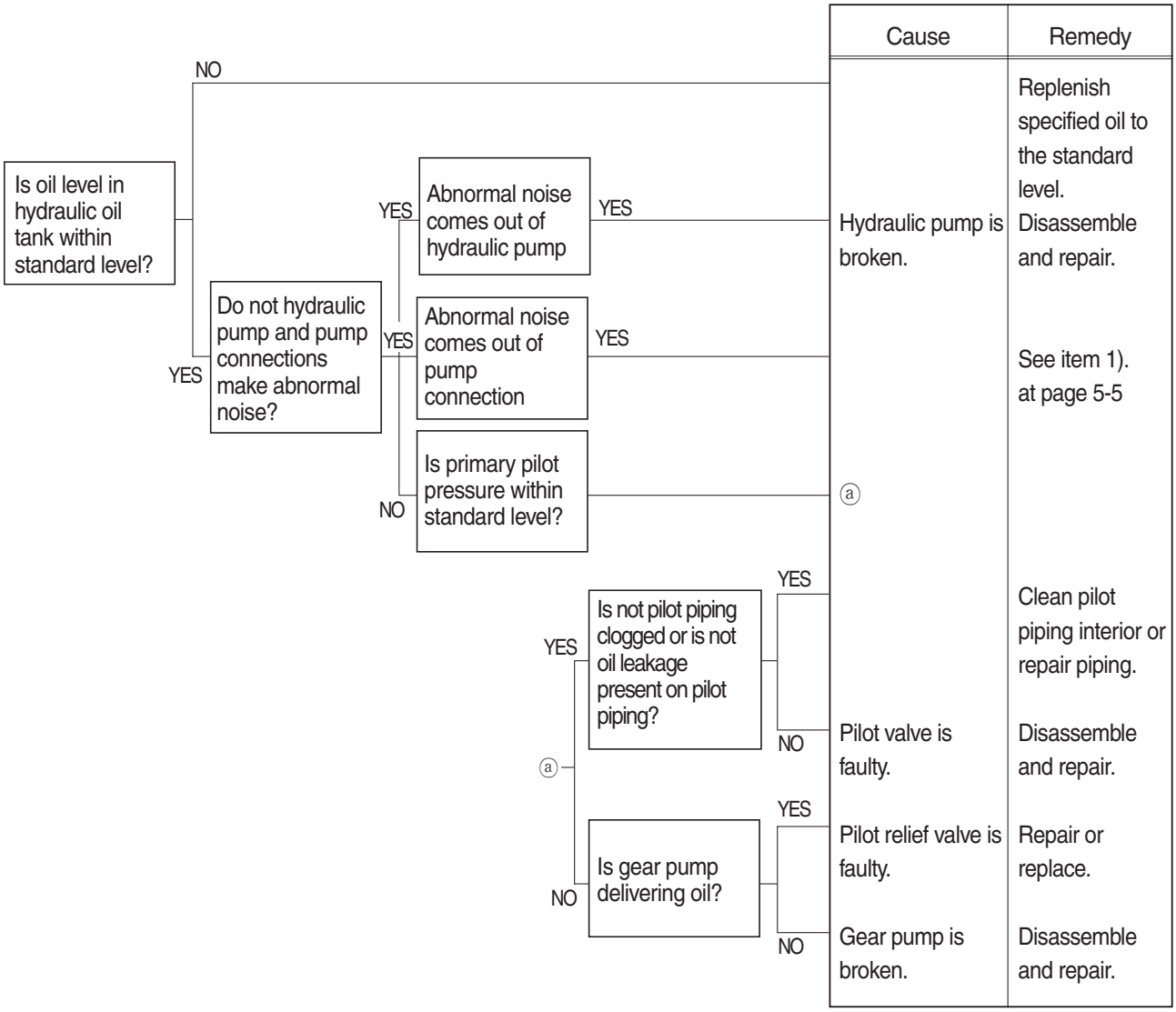
2. DRIVE SYSTEM

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



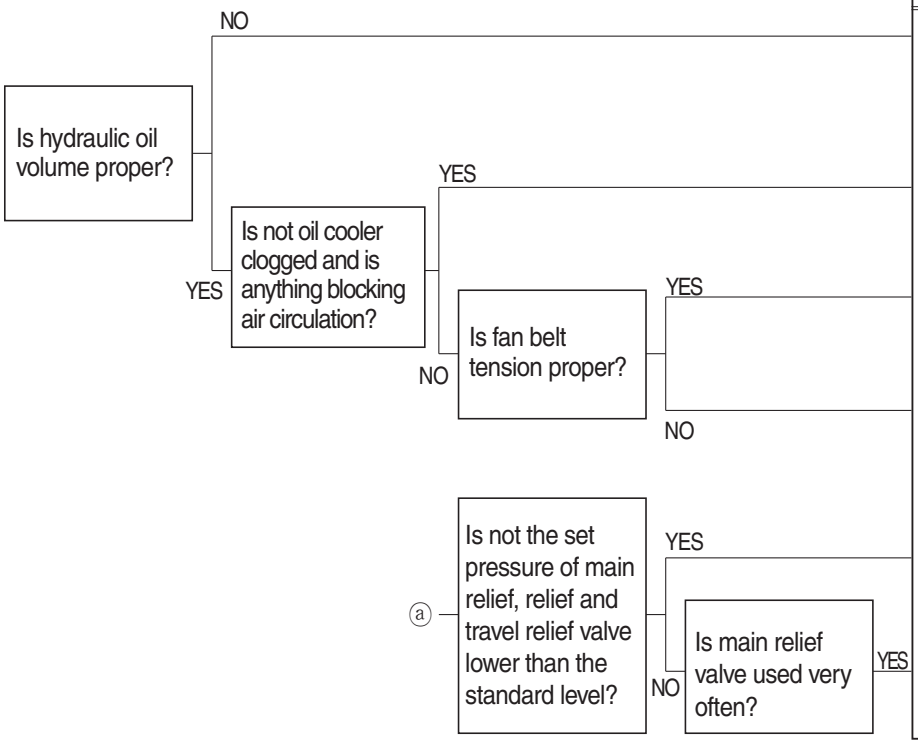
Cause	Remedy
	Replenish specified oil to the standard level.
Hydraulic pump is broken.	Disassemble and repair.
	See item 1). at page 5-5
ⓐ	
	Clean pilot piping interior or repair piping.
Pilot valve is faulty.	Disassemble and repair.
Pilot relief valve is faulty.	Repair or replace.
Gear pump is broken.	Disassemble and repair.

3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

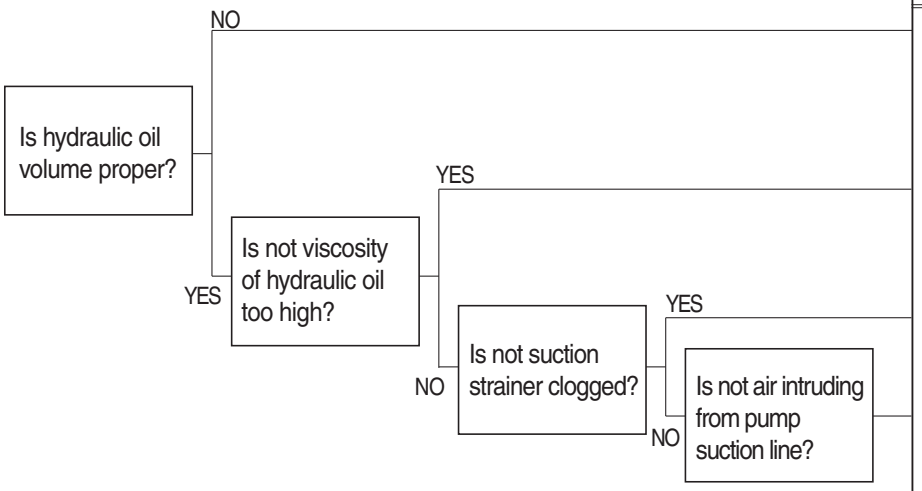
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



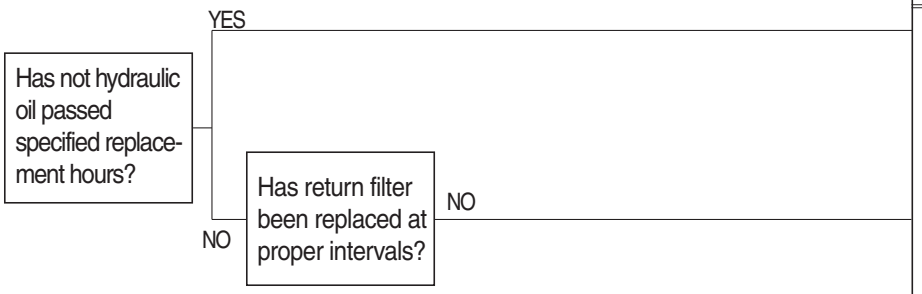
Cause	Remedy
ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Secure air circulation route. Adjust belt tension or replace belt. Readjust set pressure. Reduce load.

3) CAVITATION OCCURS WITH PUMP



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

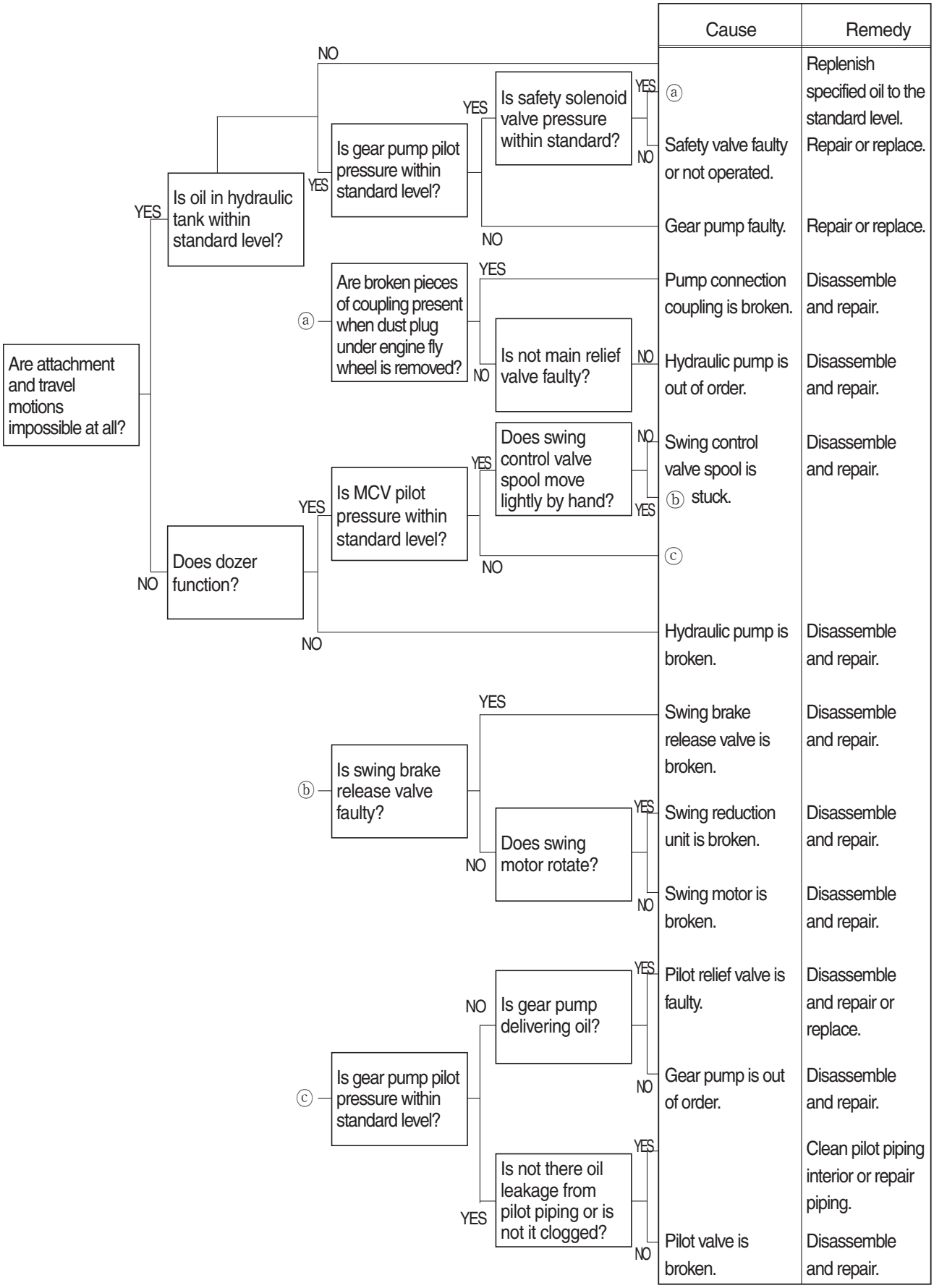
4) HYDRAULIC OIL IS CONTAMINATED



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

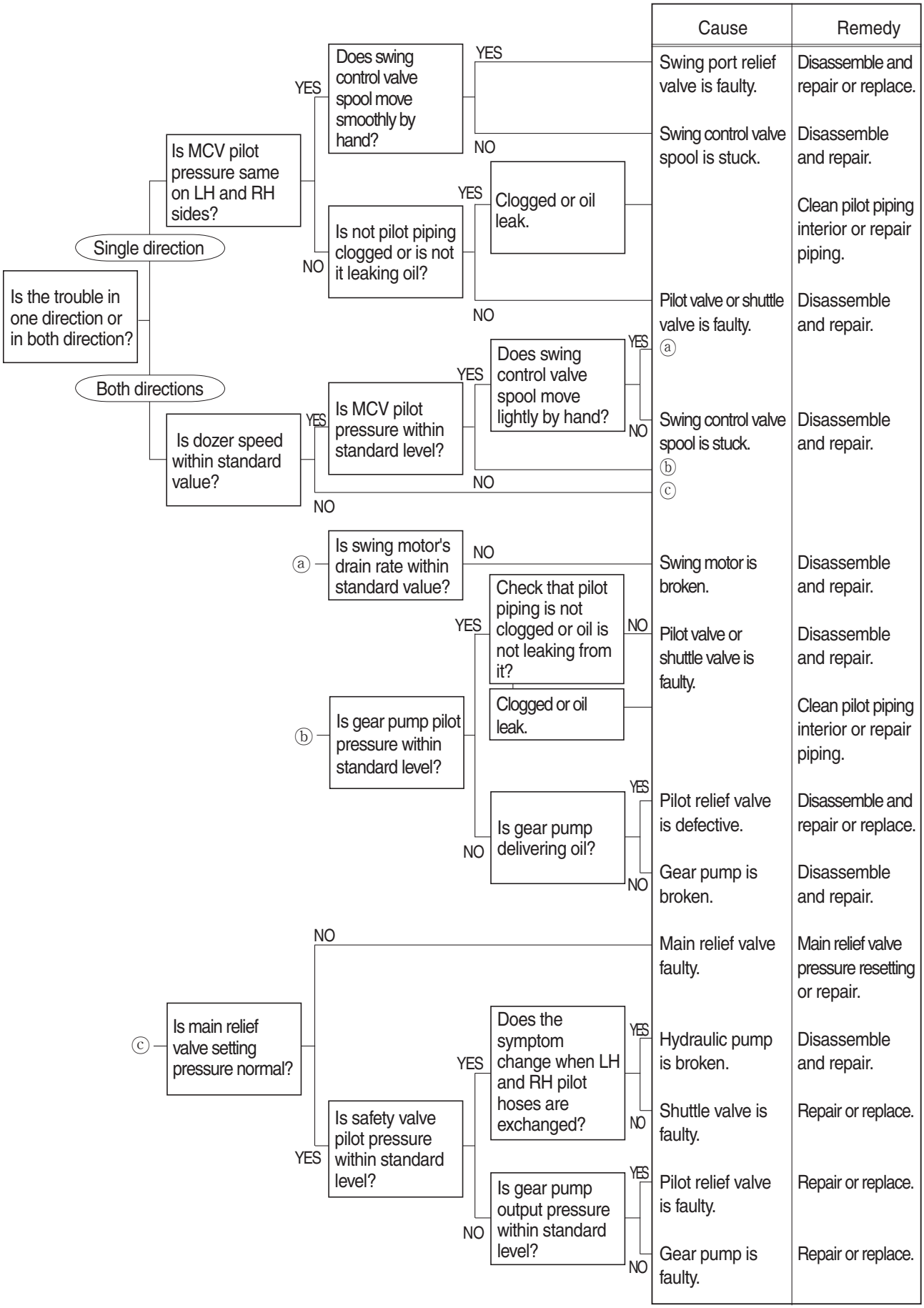
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

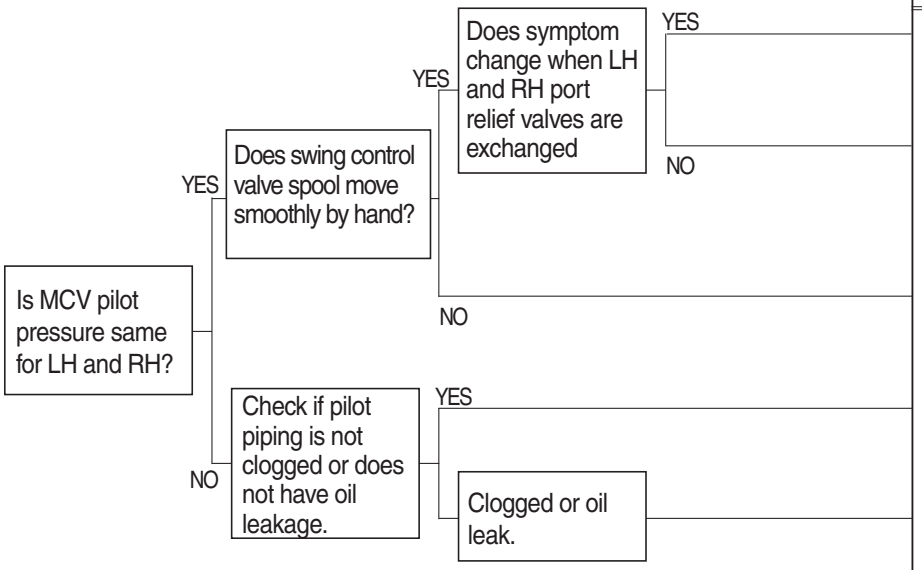


Cause	Remedy
ⓐ Safety valve faulty or not operated.	Replenish specified oil to the standard level. Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is ⓑ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

2) SWING SPEED IS LOW

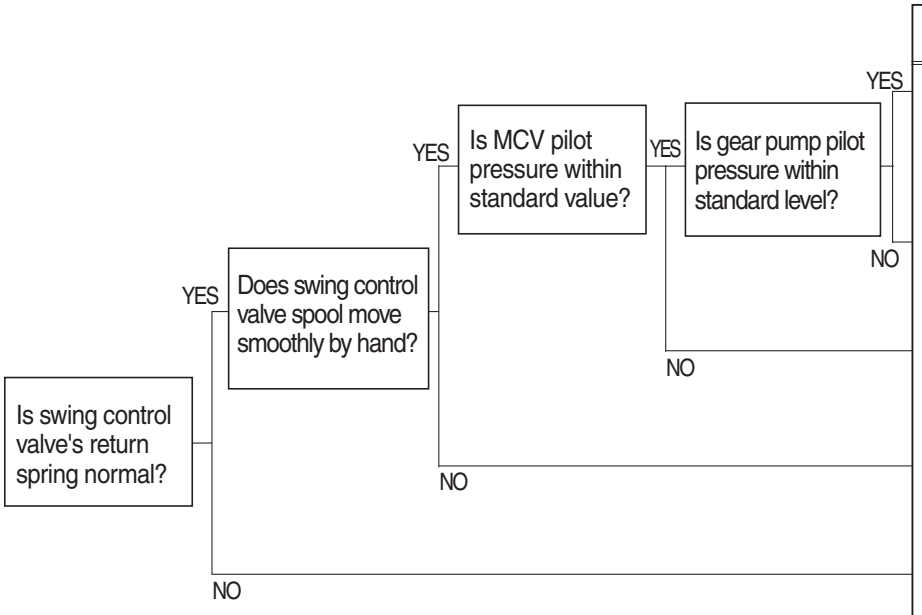


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



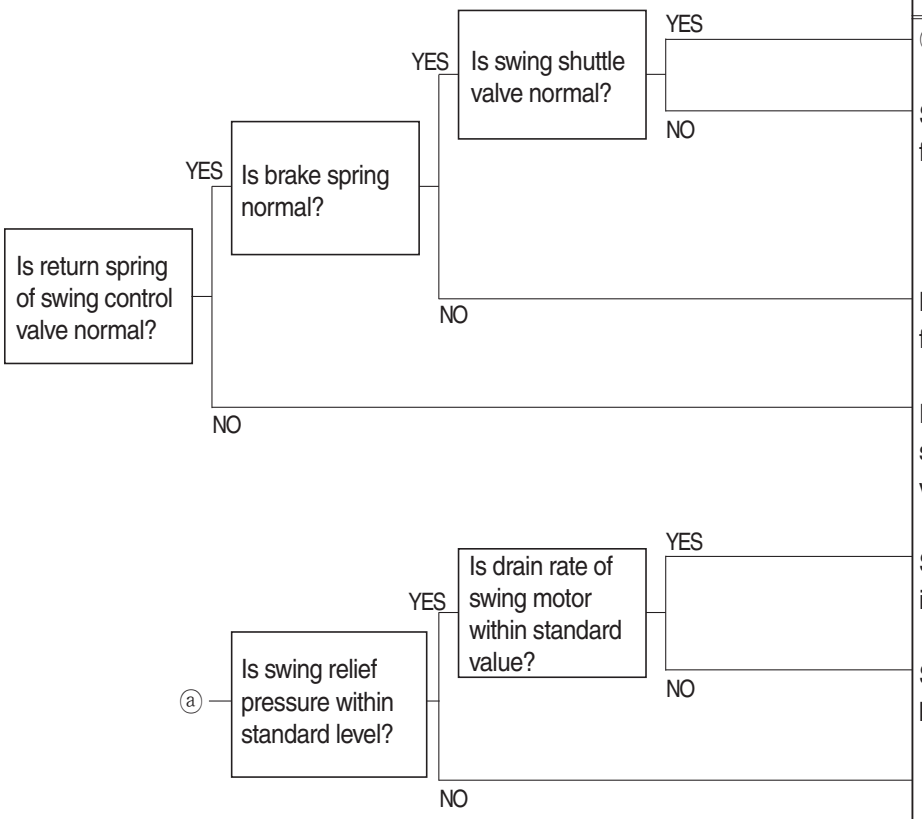
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



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

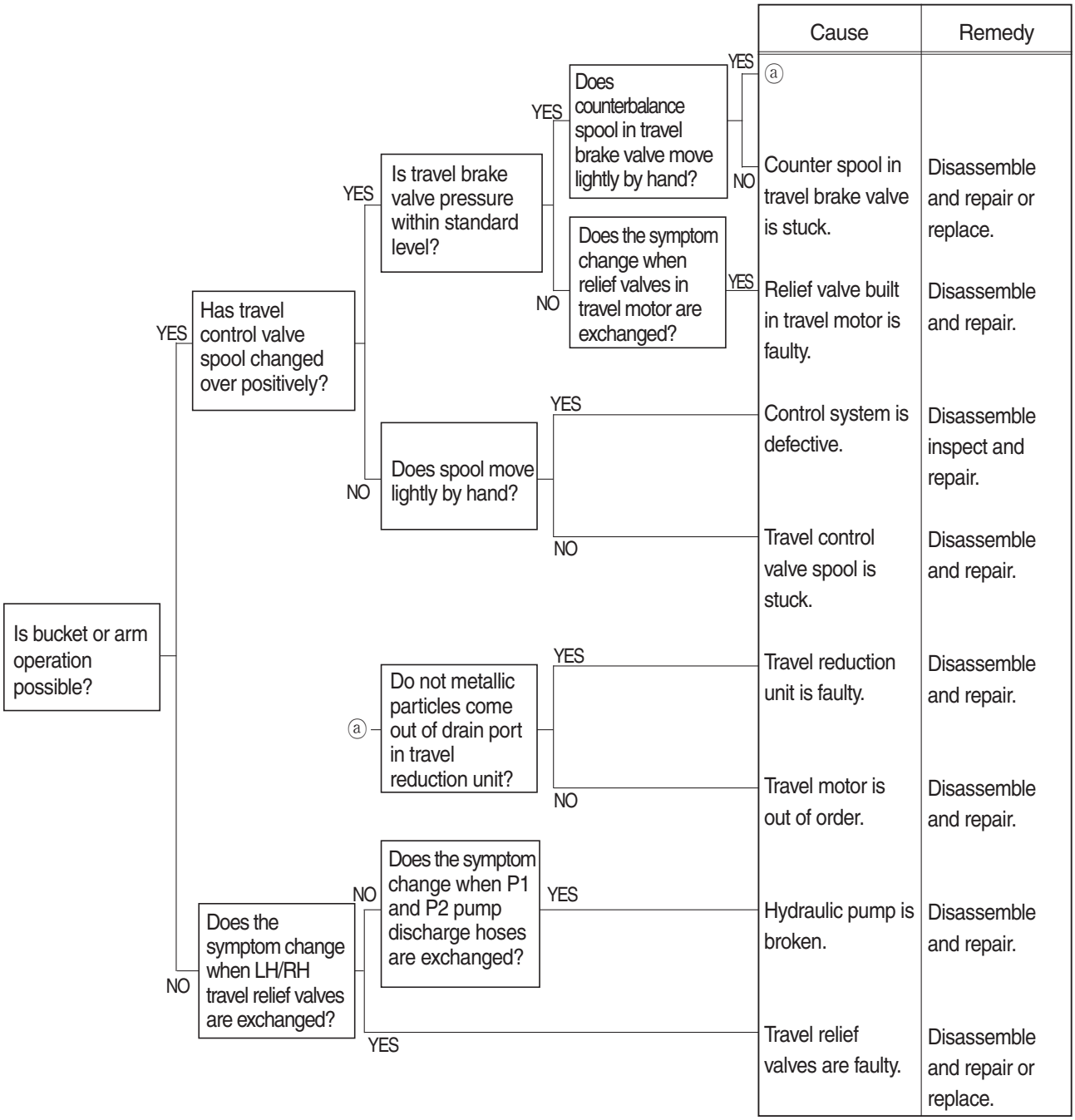
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



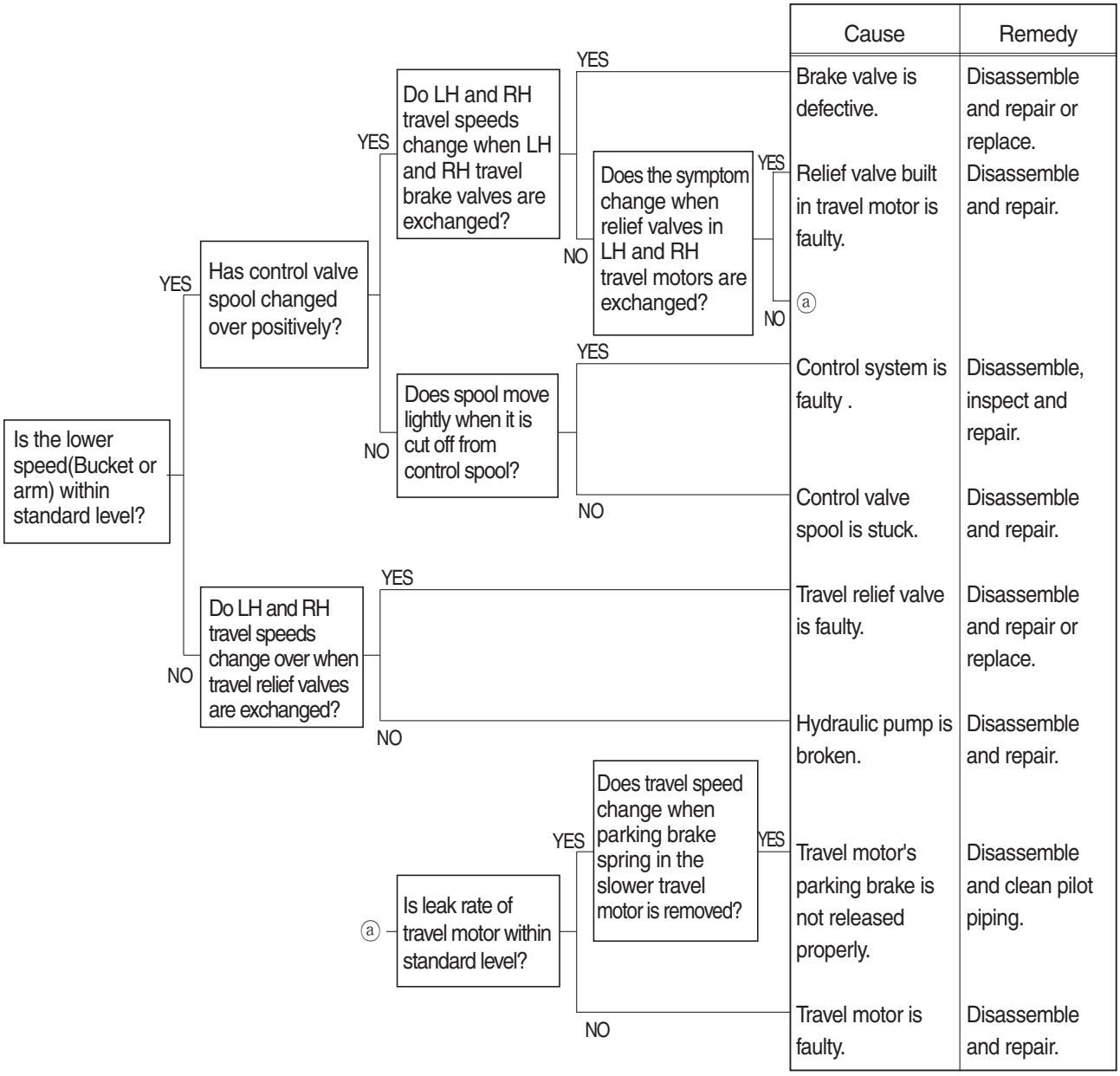
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
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

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

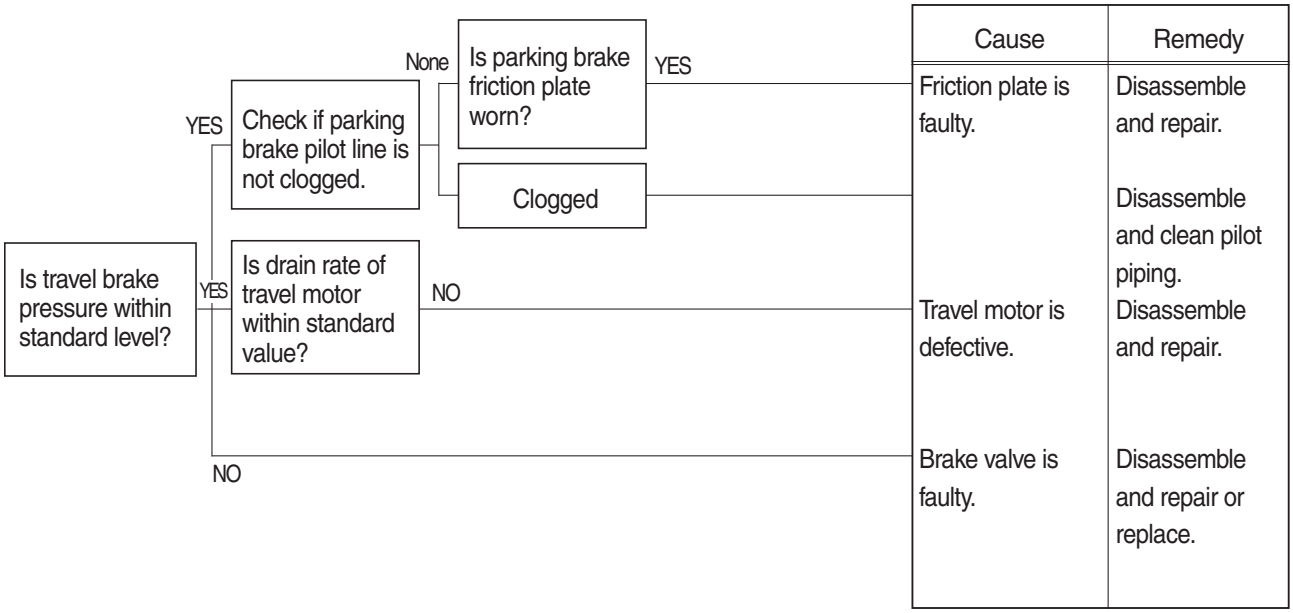


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

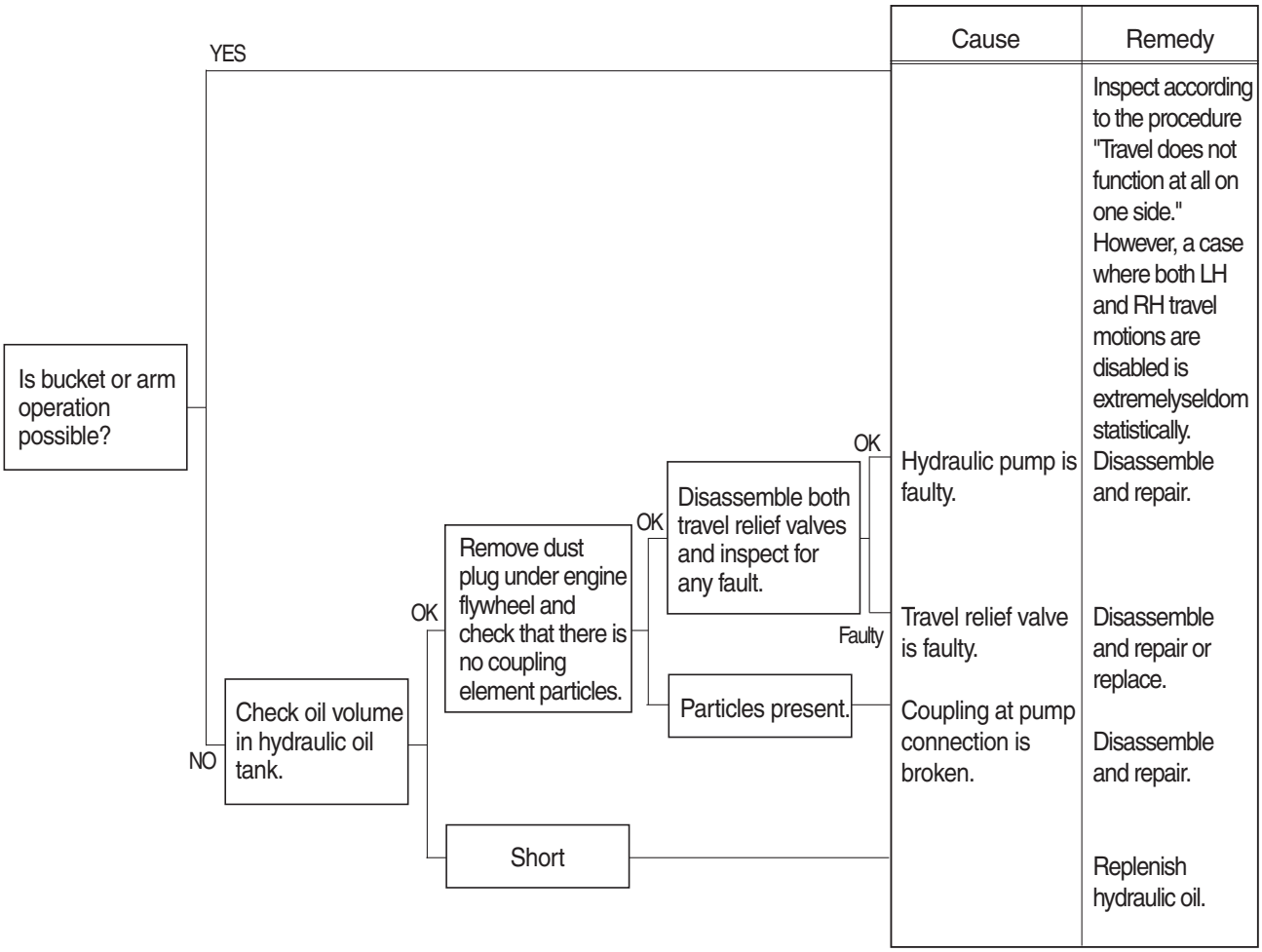


3) MACHINE DOES NOT STOP ON A SLOPE

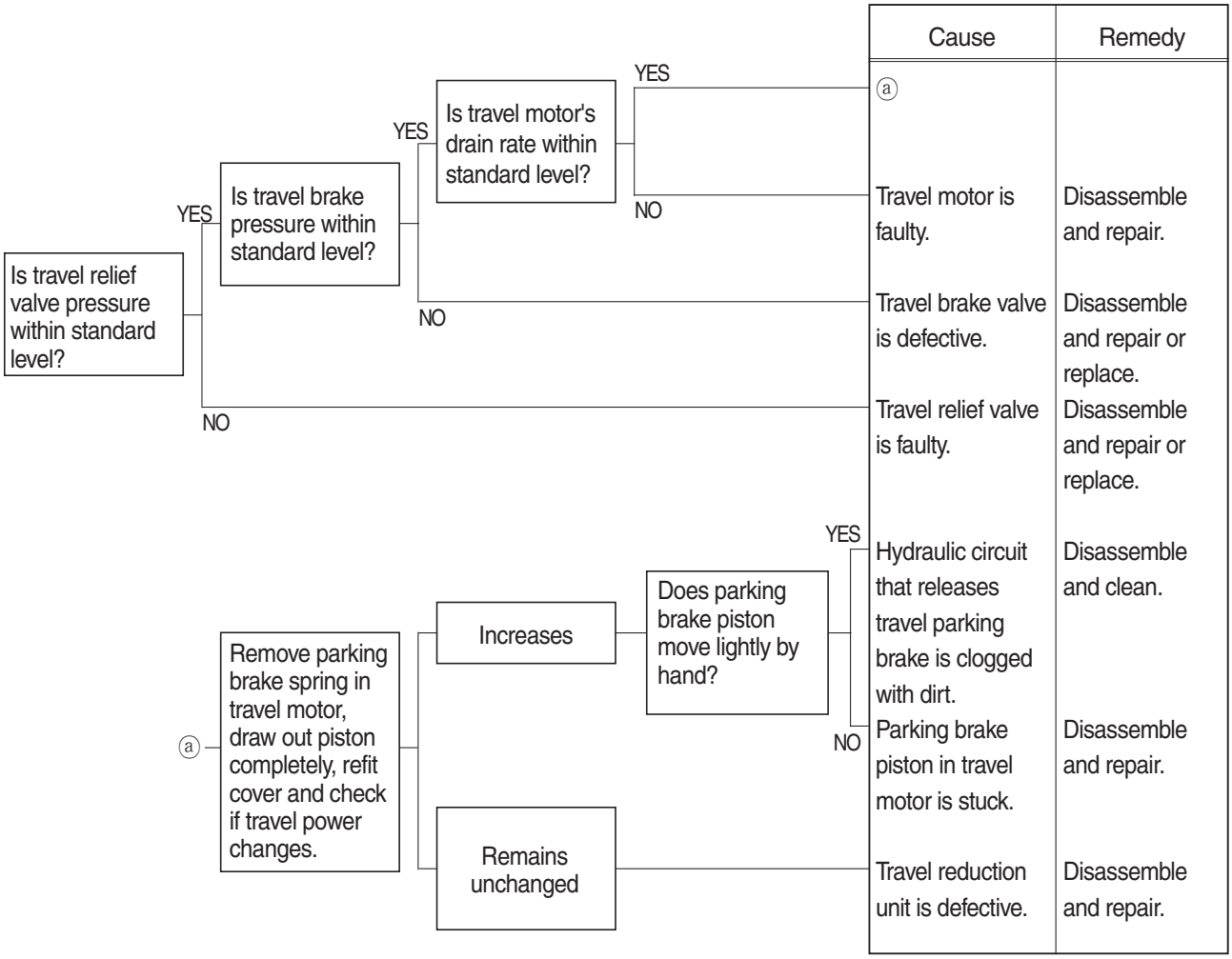
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

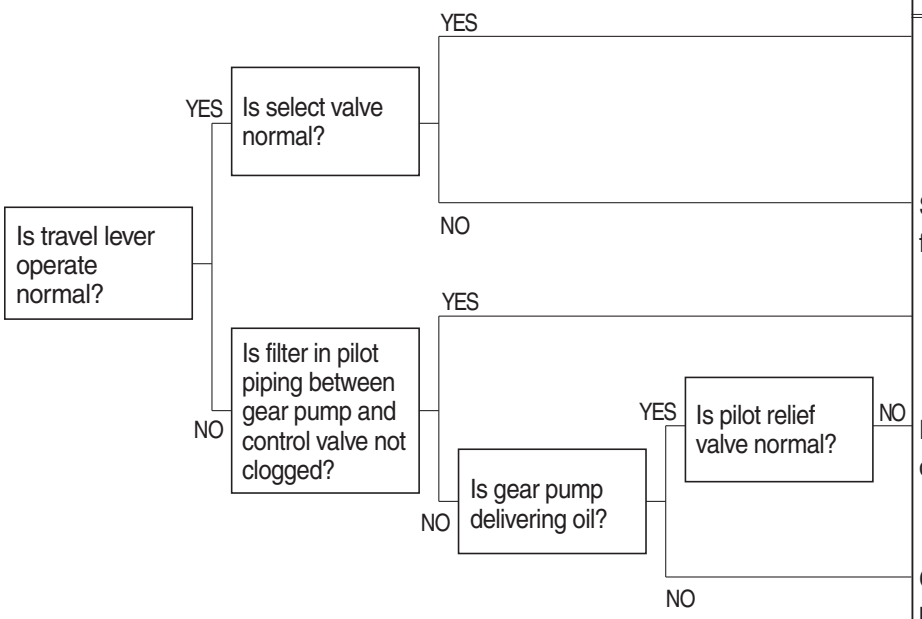


5) TRAVEL ACTION IS POWERLESS (travel only)



6) MACHINE RUNS RECKLESSLY ON A SLOPE

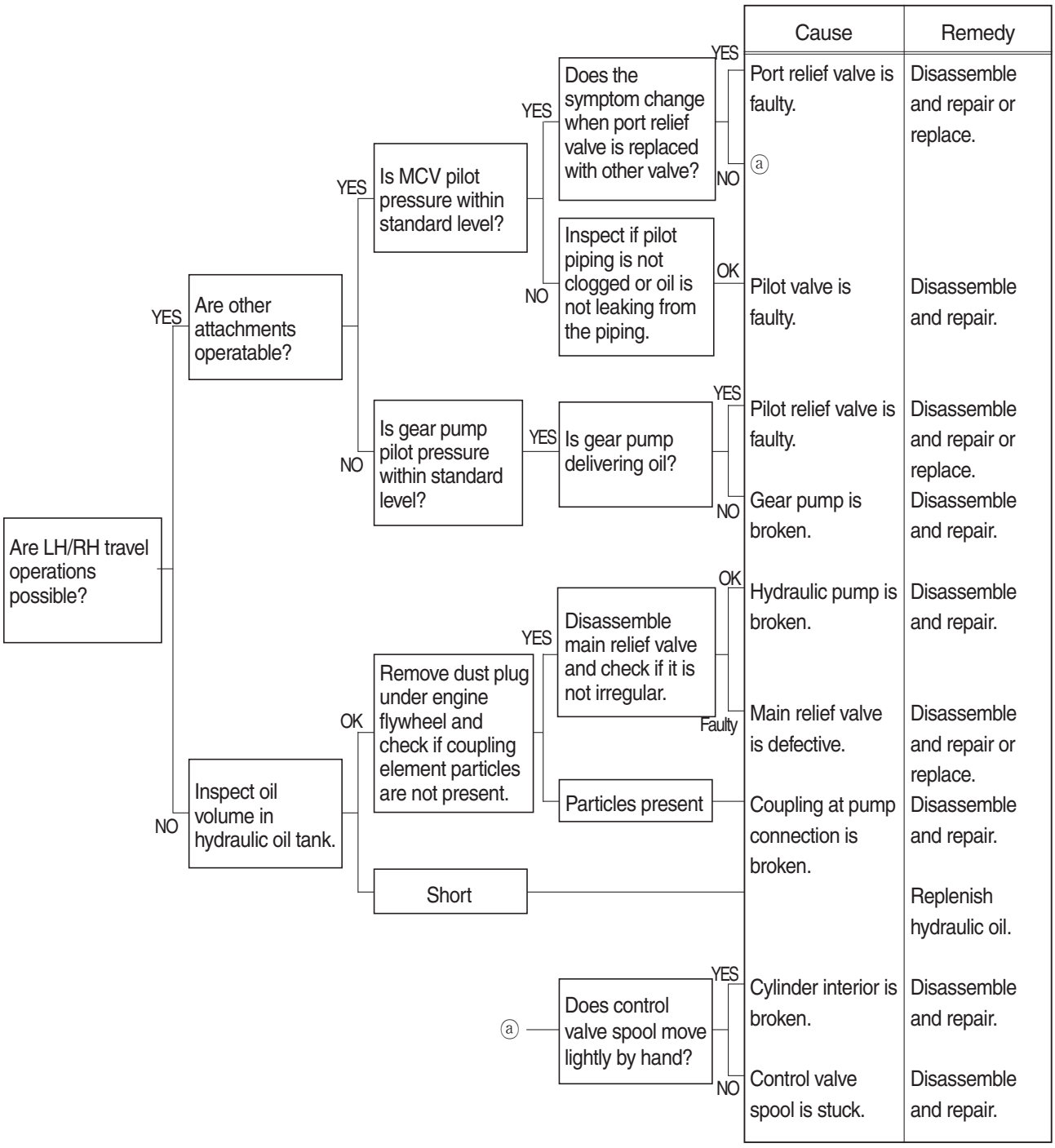
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



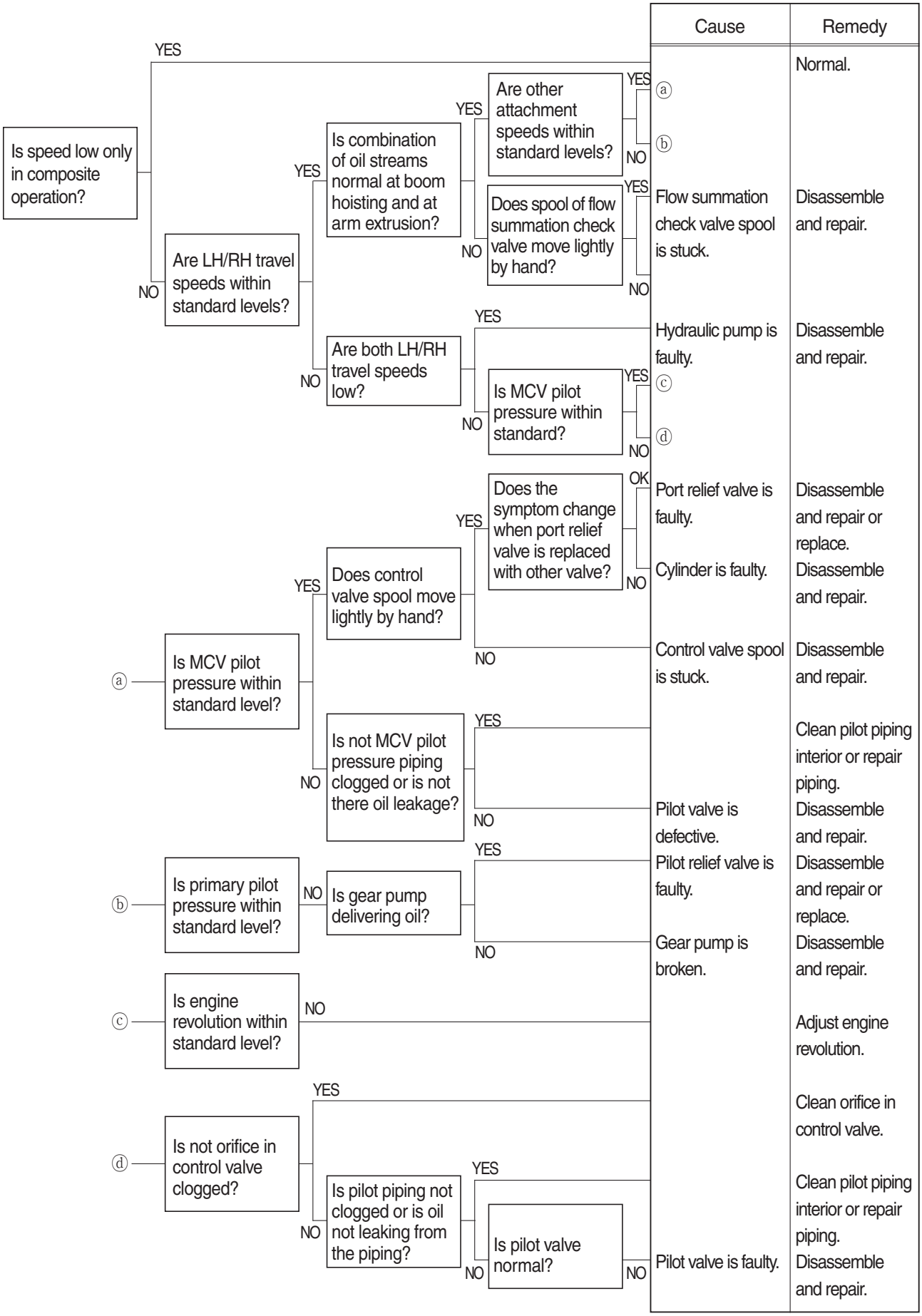
Cause	Remedy
	Normal.
Select valve is faulty.	Repair or replace.
	Remove dirt on pilot line filter.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

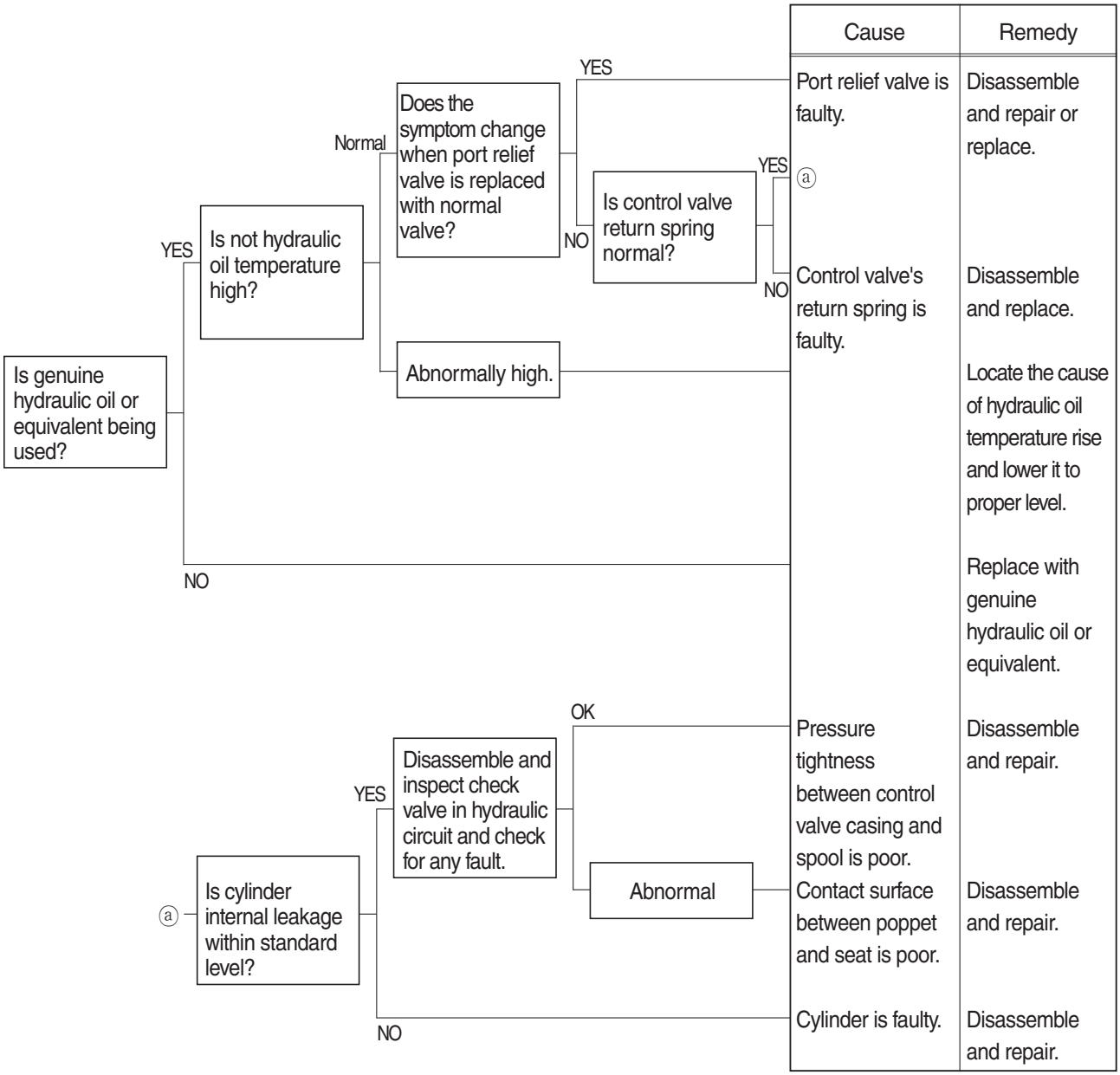
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



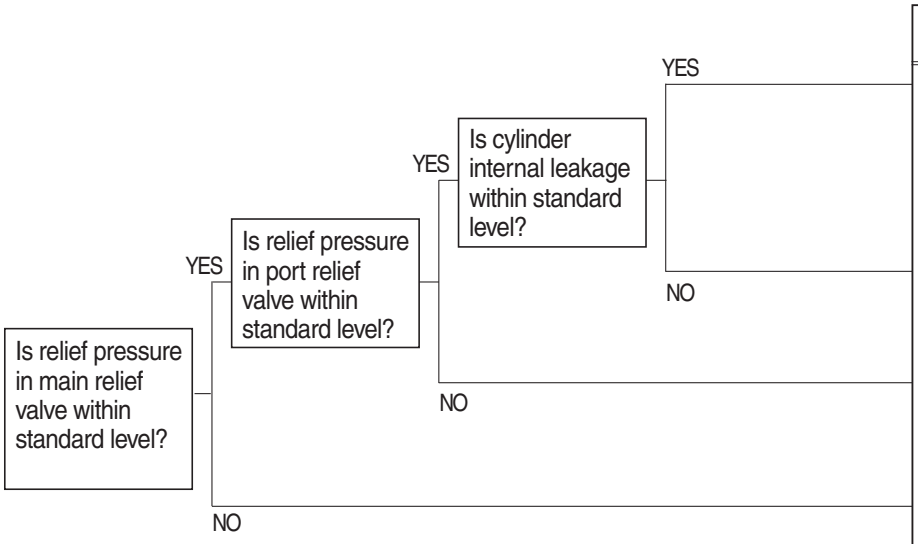
2) BOOM, ARM OR BUCKET SPEED IS LOW



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

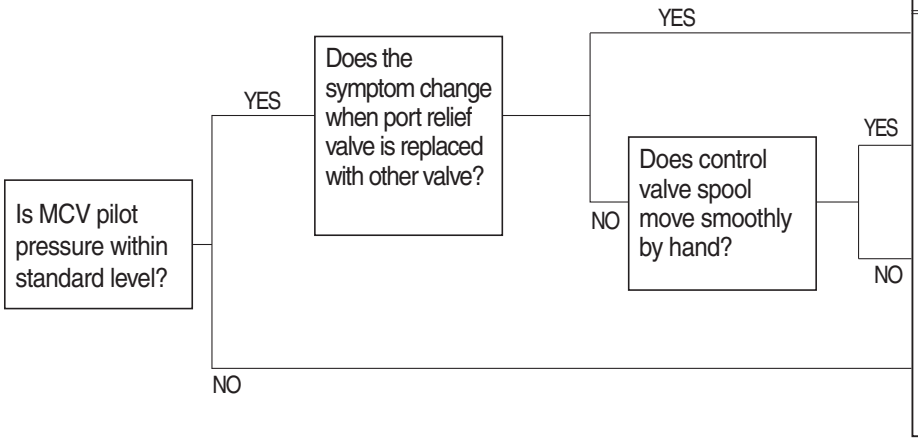


4) BOOM, ARM OR BUCKET POWER IS WEAK



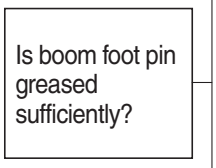
Cause	Remedy
	Check according to the procedure in Item "Speed is low".
Cylinder is faulty.	Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

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



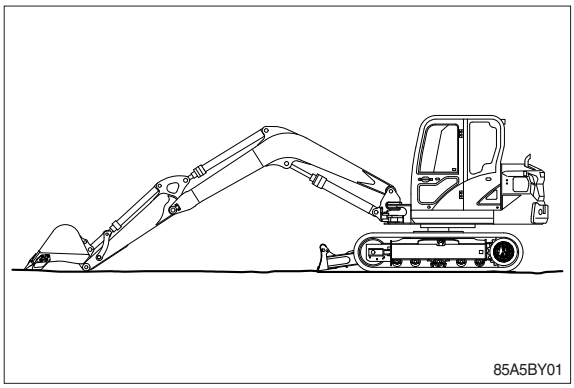
YES

NO

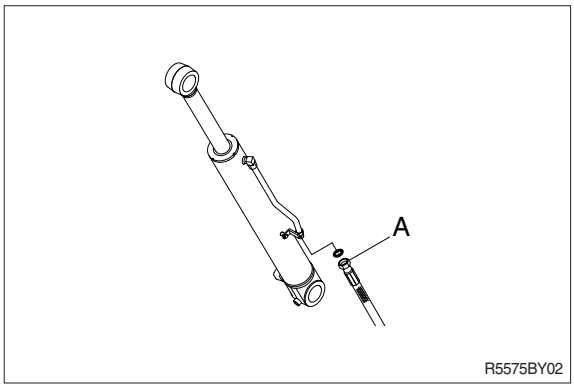
Cause	Remedy
	Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is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

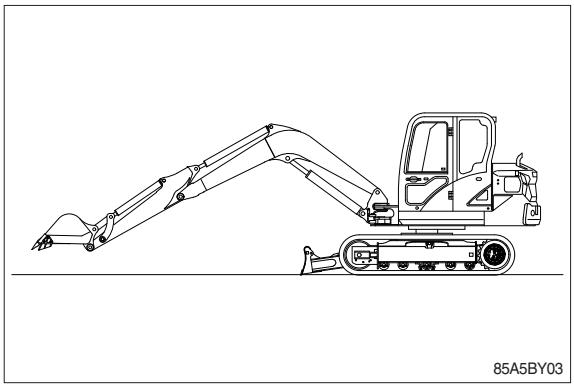


2. Disconnect hose(A) from rod side of boom cylinder and drain oil from cylinders and hose.(Put cups on piping and hose ends)



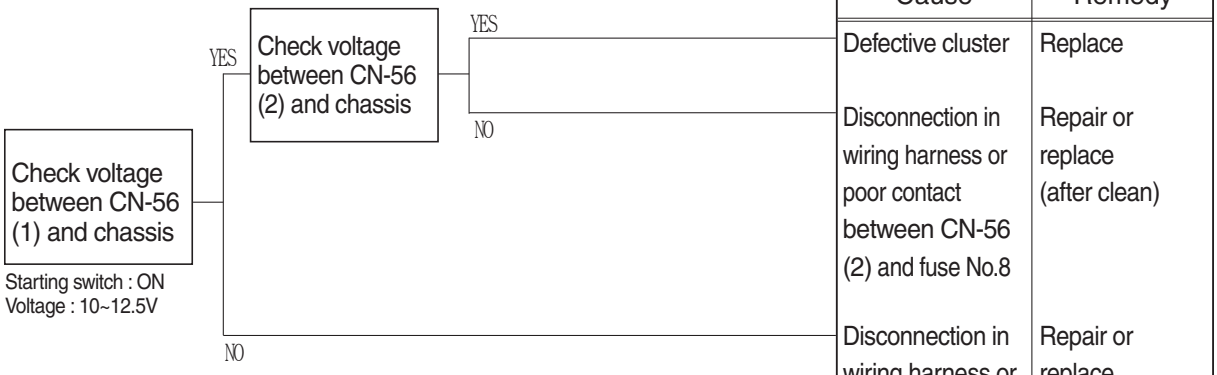
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

   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

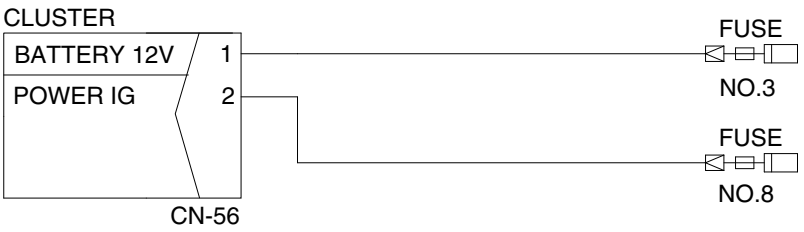
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.3 and No.8
·After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56 (2) and fuse No.8	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-56 (1) and fuse No.3	Repair or replace (after clean)

Check voltage

YES	10 ~ 12.5V
NO	0V



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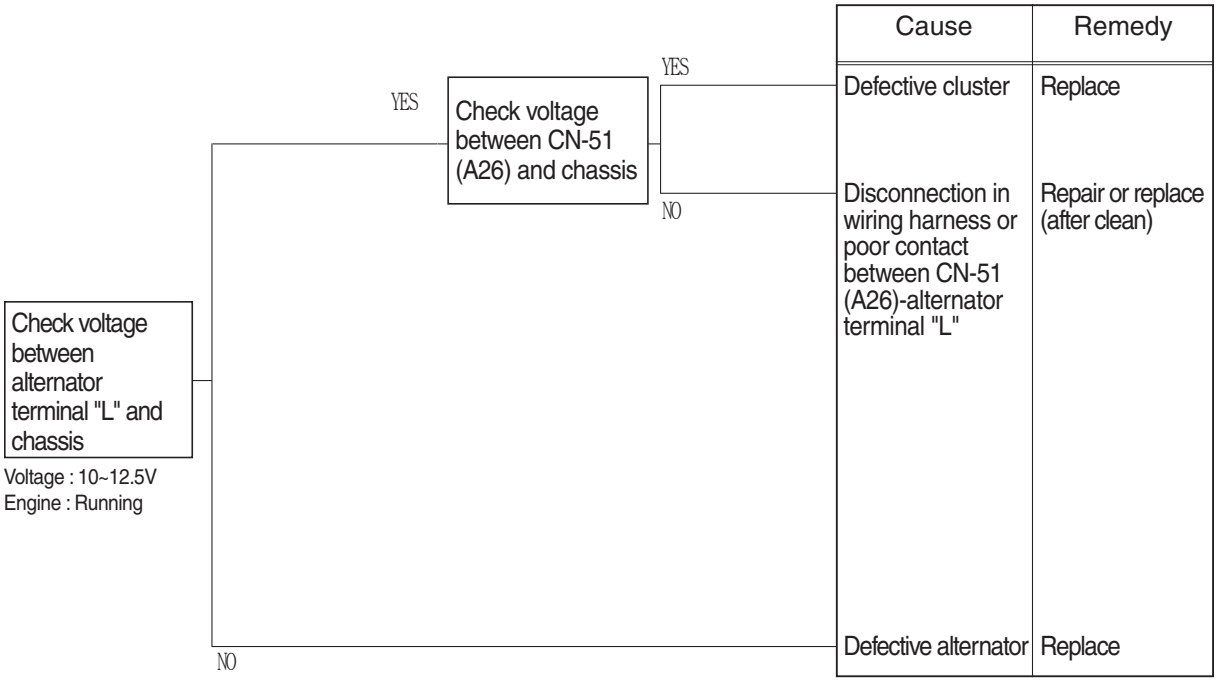
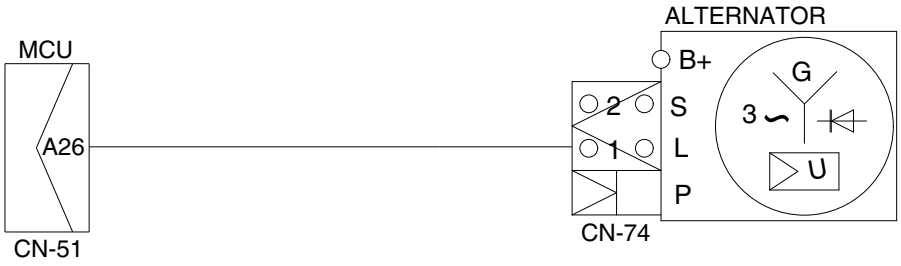
2. BATTERY CHARGING WARNING LAMP LIGHTS UP (starting switch : ON)

·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



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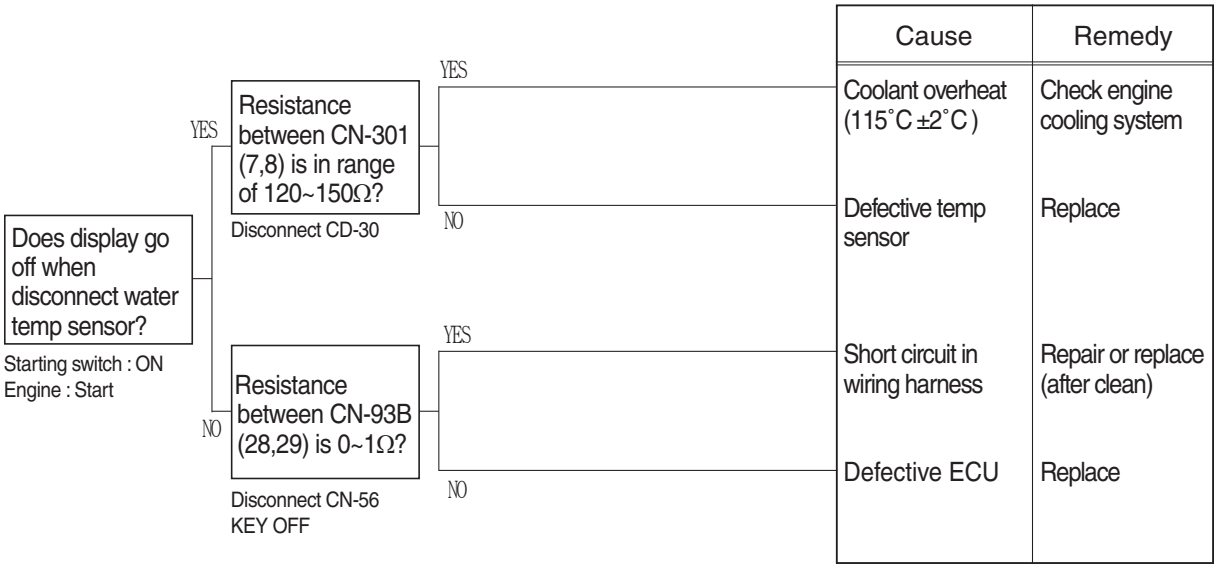
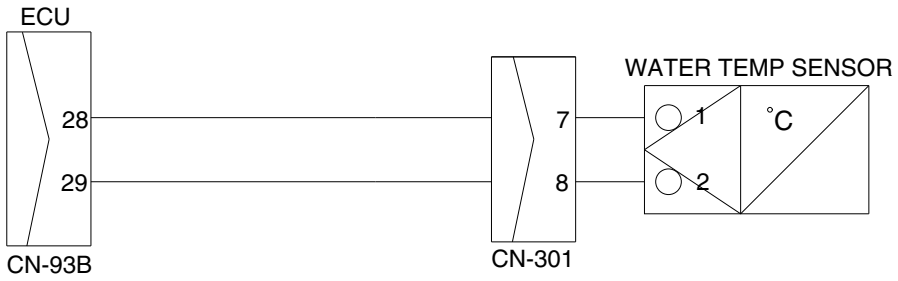
3. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

·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.

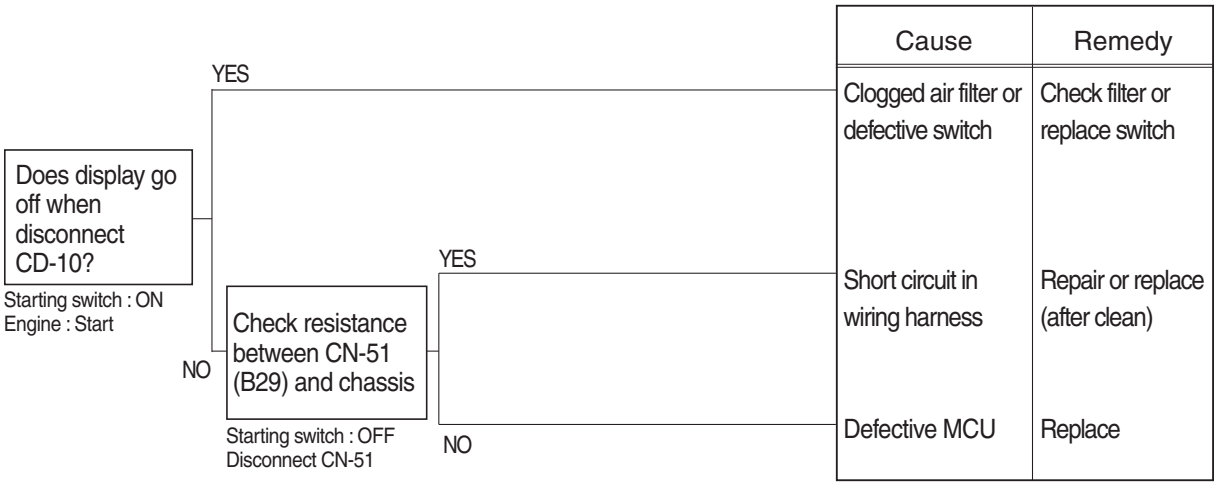




559A5TS03

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.



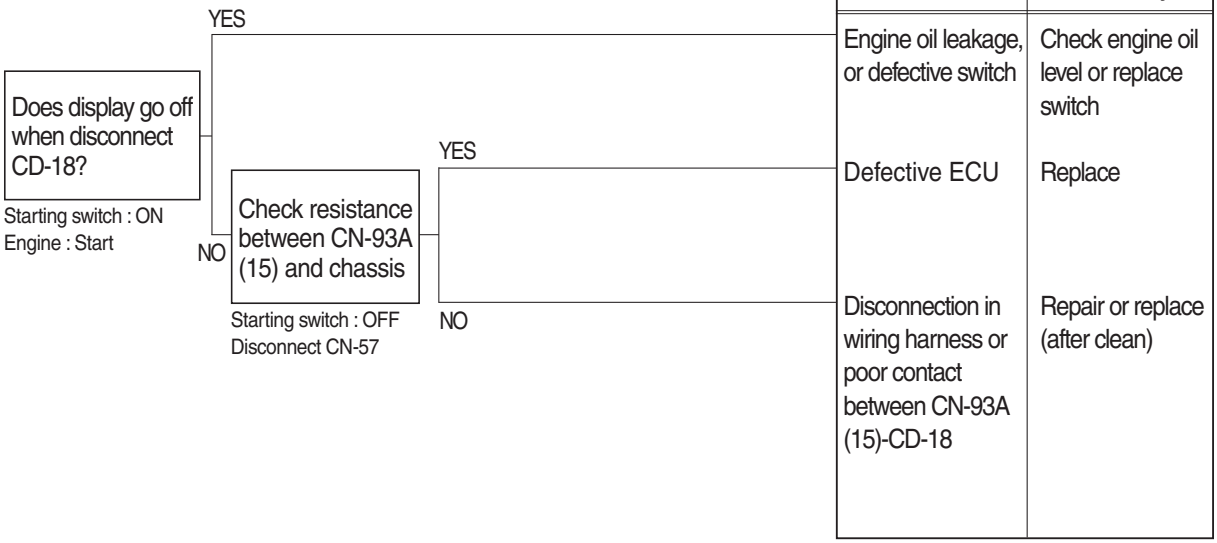
Check resistance

YES	MAX 1Ω
NO	MIN 1MΩ

85A5TS13

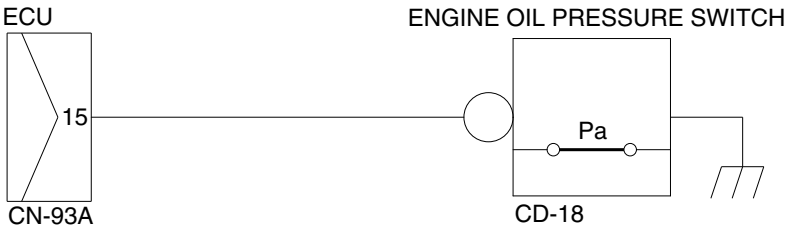
5. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

·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

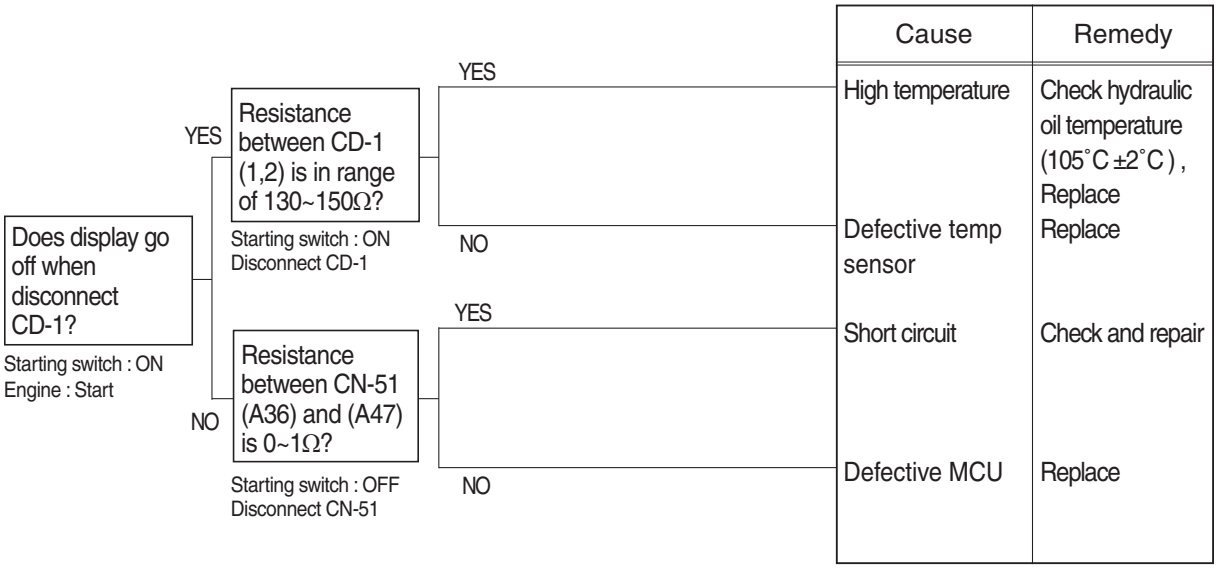
YES	MAX 1Ω
NO	MIN 1MΩ

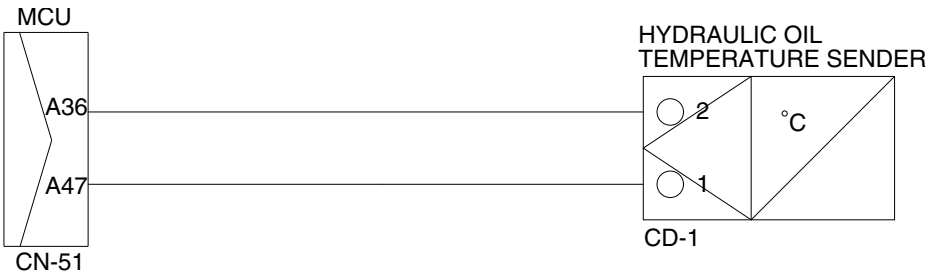


559A5TS14

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.

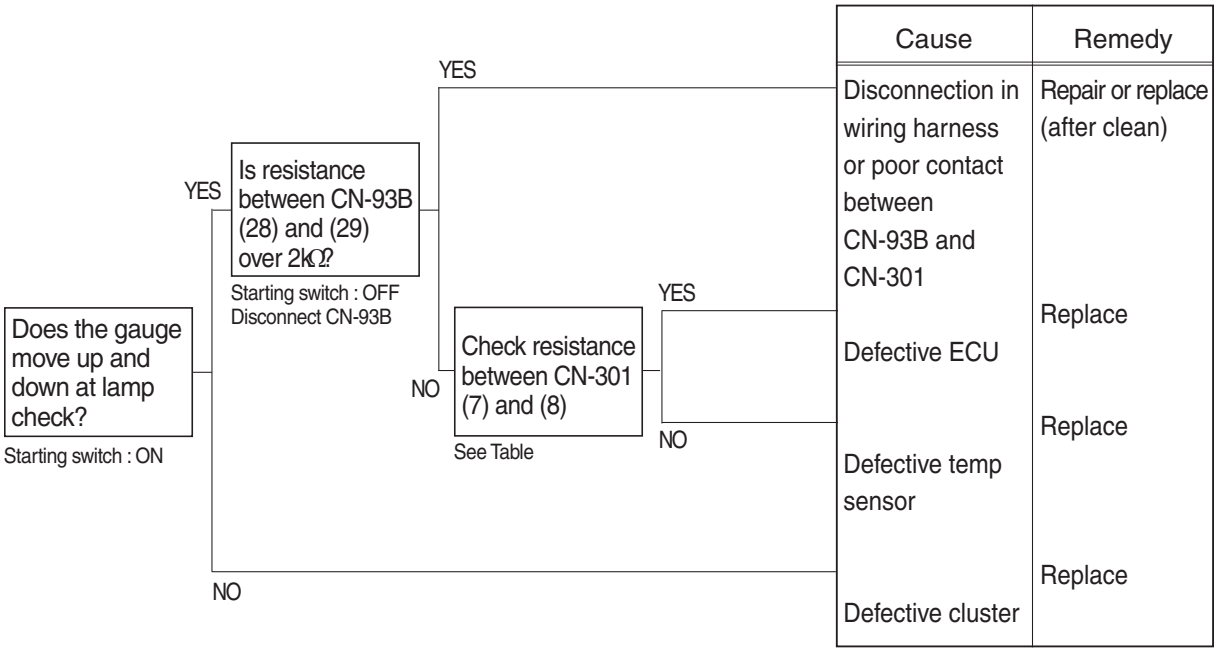


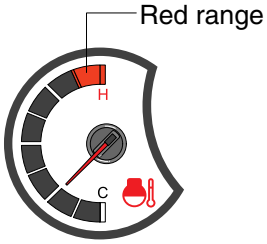


85A5TS15

7. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

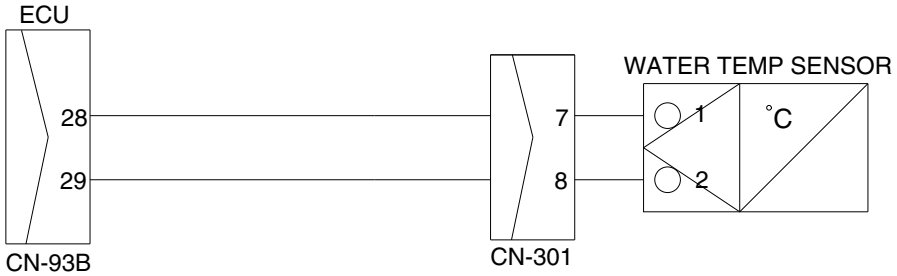
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

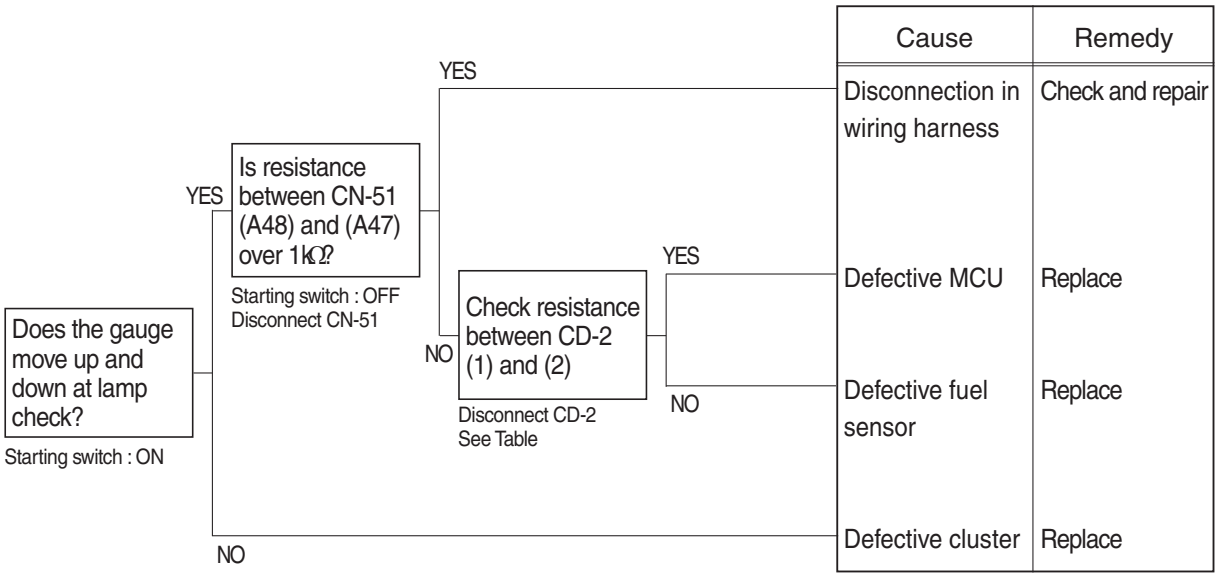
Item \ Temperature	40˚C	85~110˚C	115˚C (red range)
Unit Resistance(Ω)	1170~	270~130	~124
Tolerance(%)	±5	-8~0	±5

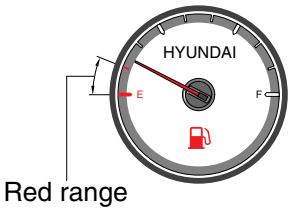


559A5TS03

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

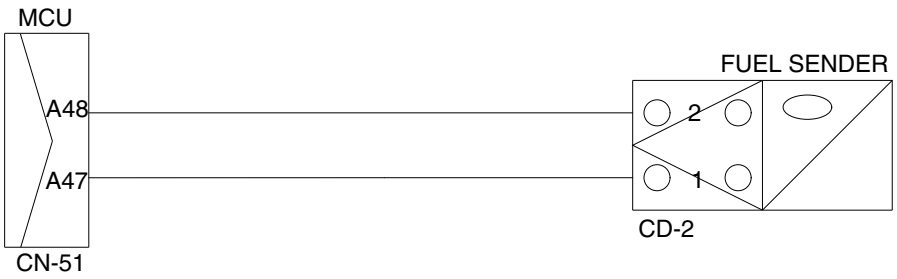
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

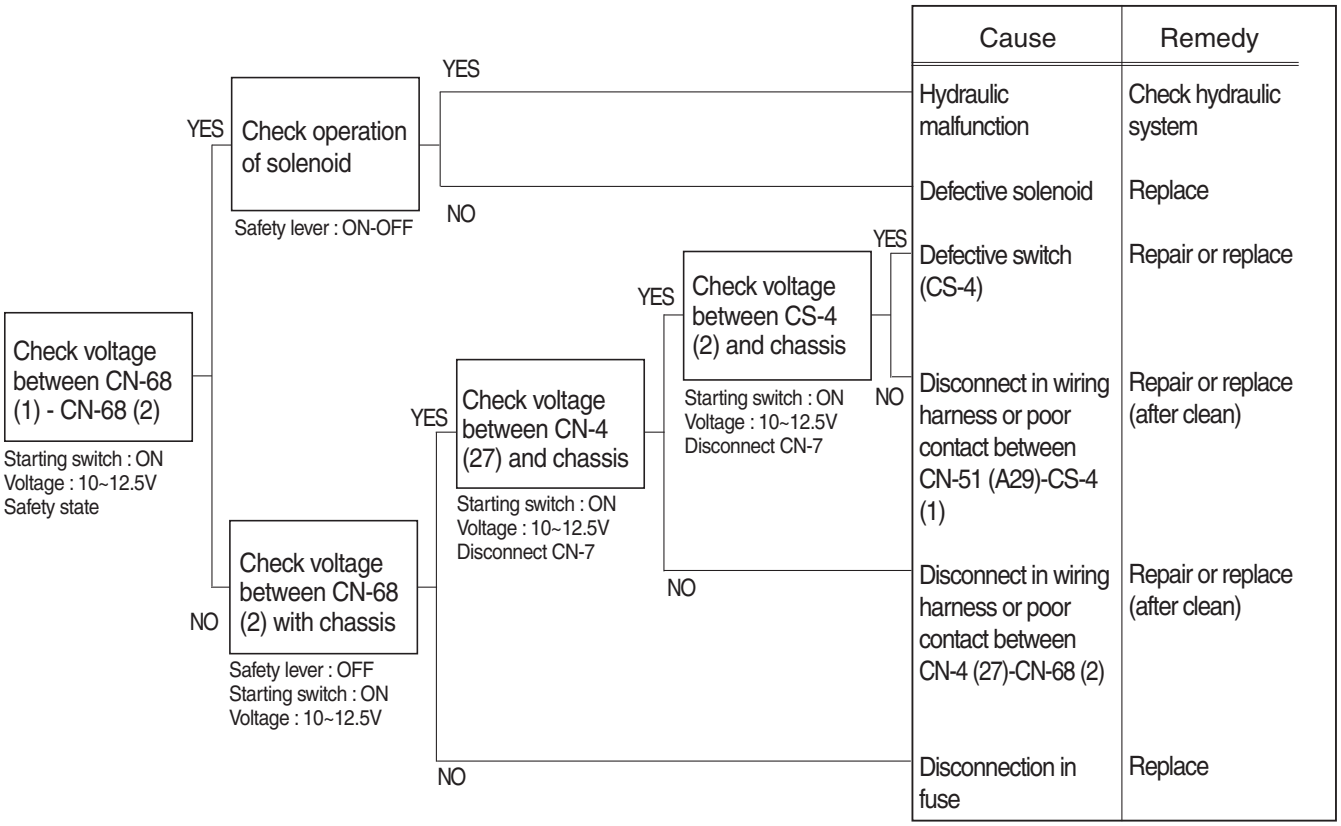
Item \ Level	Empty	1/2	Full
Unit Resistance (Ω)	700	300	~100
Tolerance (%)	±5	±8	±5

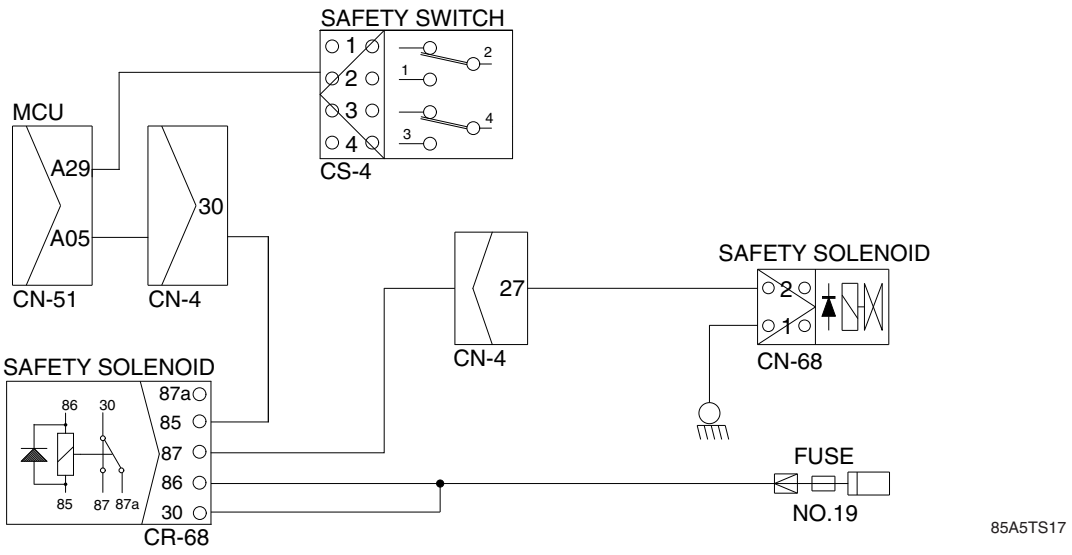


85A5TS16

9. WHEN SAFETY SOLENOID DOES NOT OPERATE

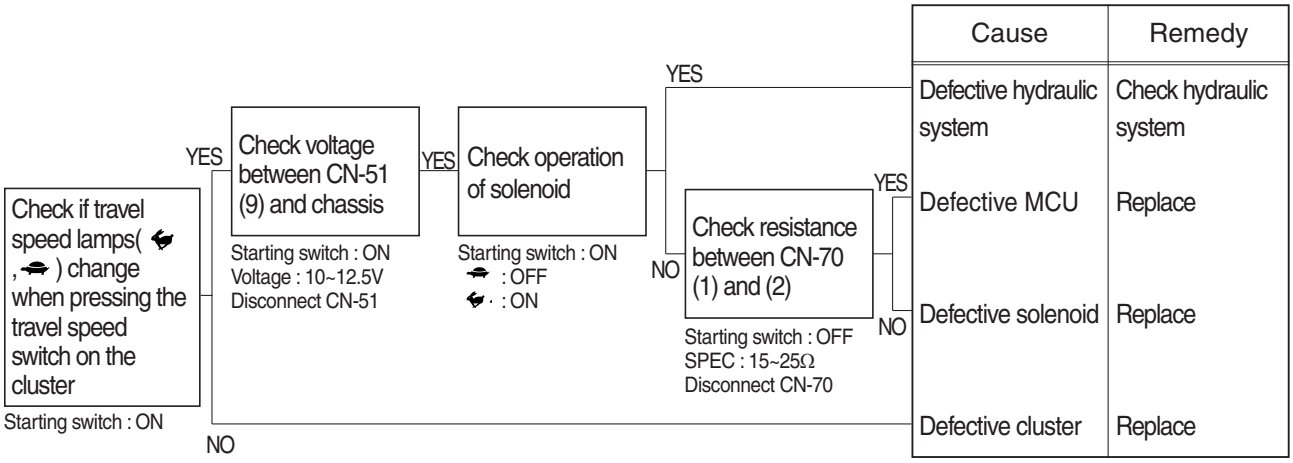
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.19.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.

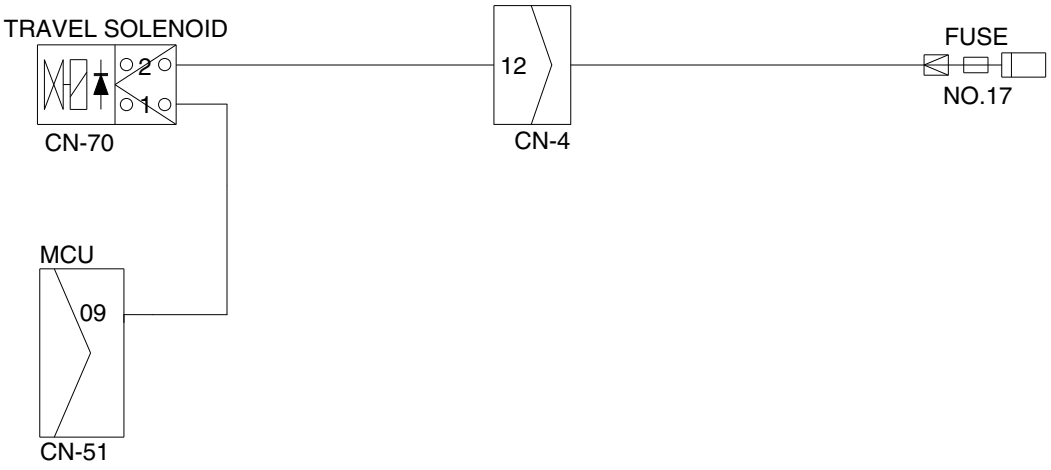




10. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE

·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.17.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.

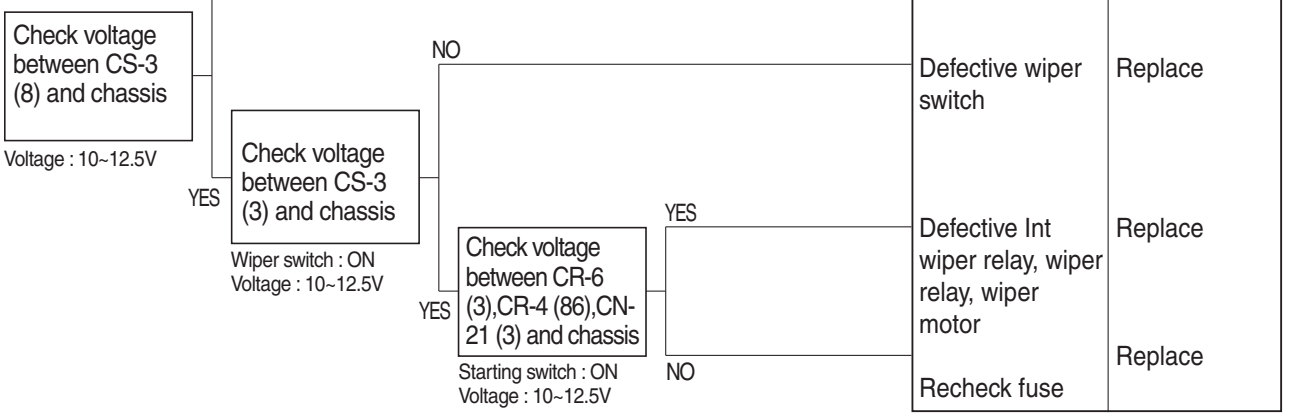




85A5TS18

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.15 is not blown out.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.

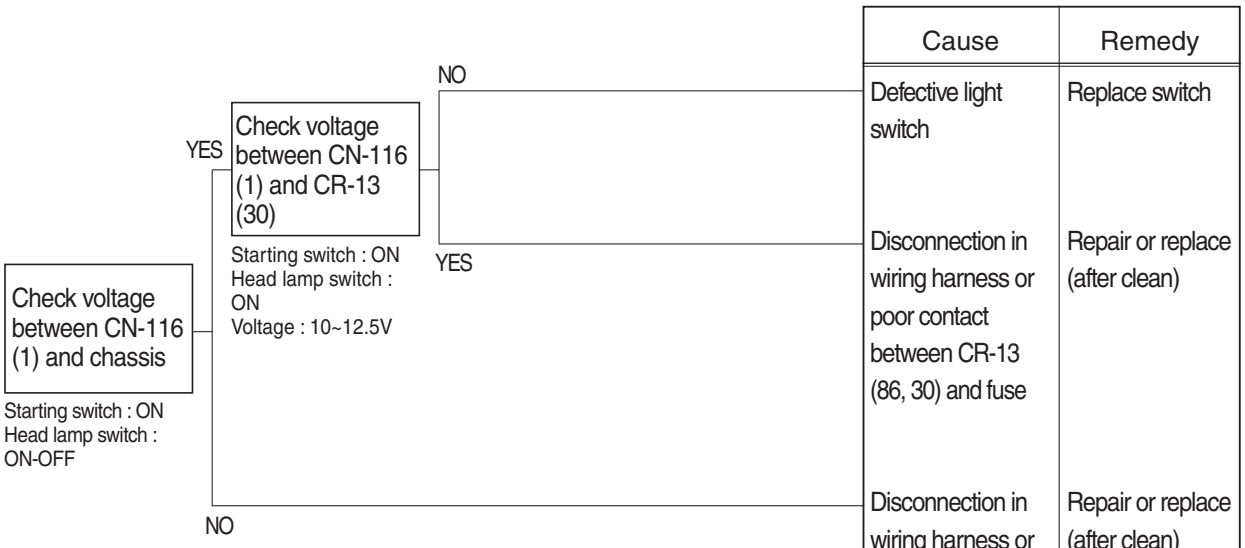


Cause	Remedy
Recheck fuse	Replace
Defective wiper switch	Replace
Defective Int wiper relay, wiper relay, wiper motor	Replace
Recheck fuse	Replace

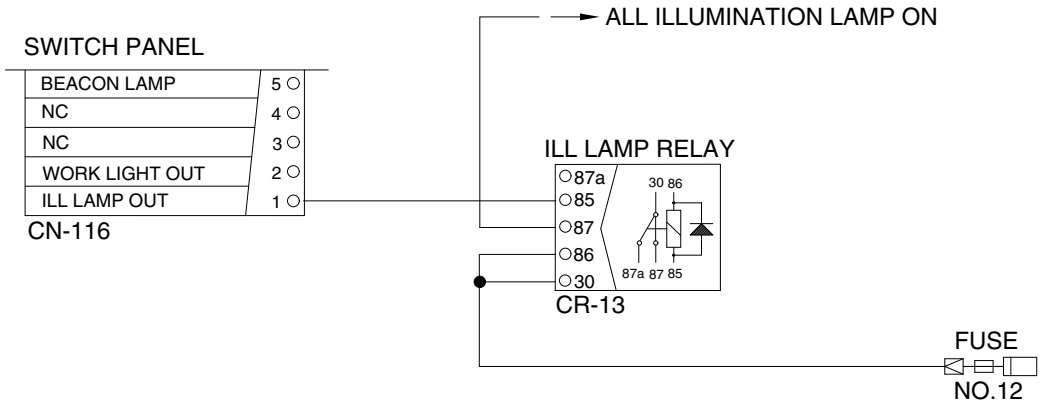
※ Refer to the page 4-56.

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.12.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.



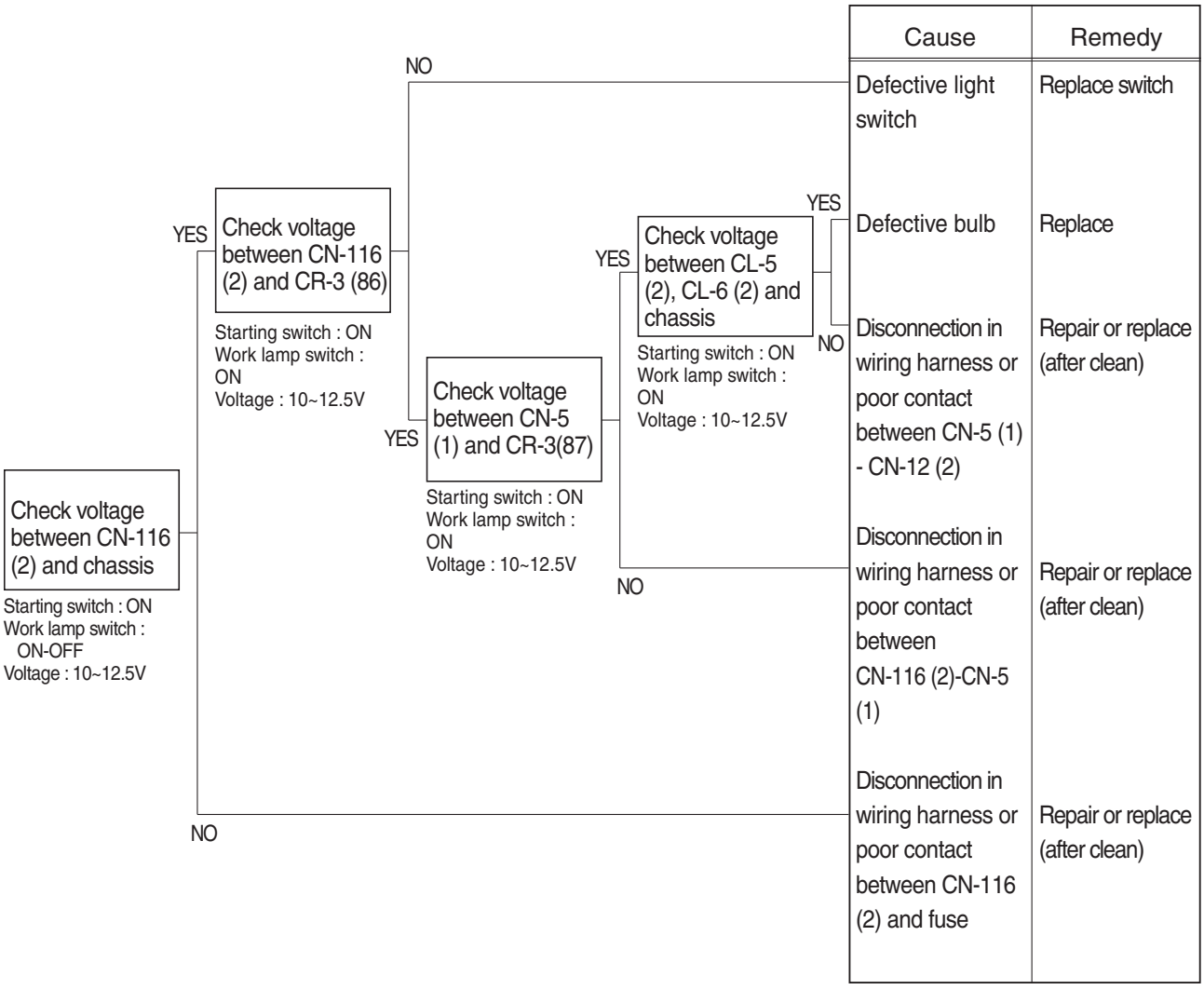
Cause	Remedy
Defective light switch	Replace switch
Disconnection in wiring harness or poor contact between CR-13 (86, 30) and fuse	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (1) and CR-13 (85)	Repair or replace (after clean)

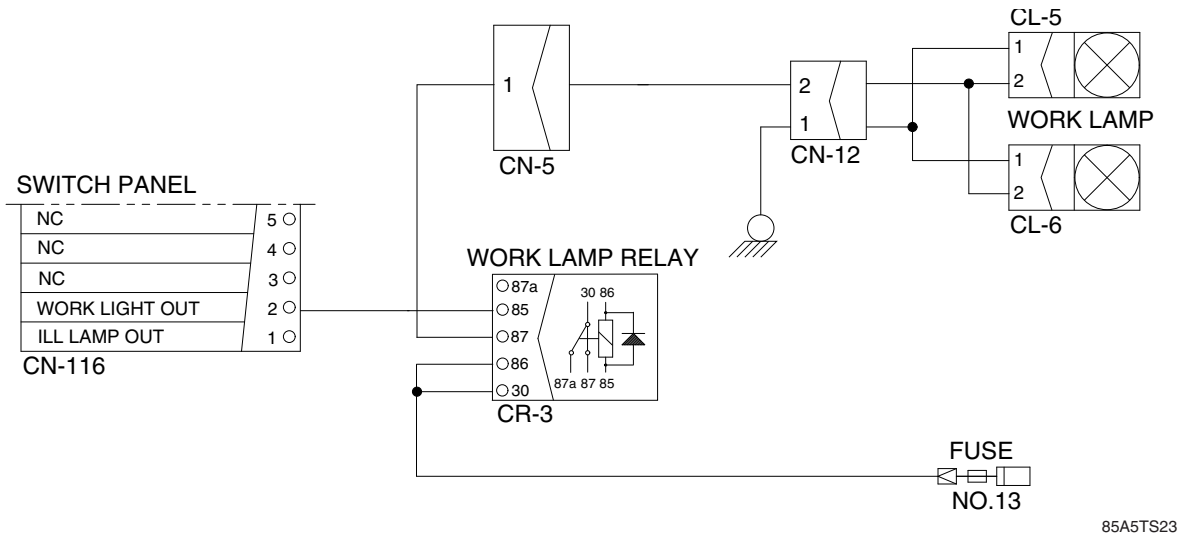


85A5TS22

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

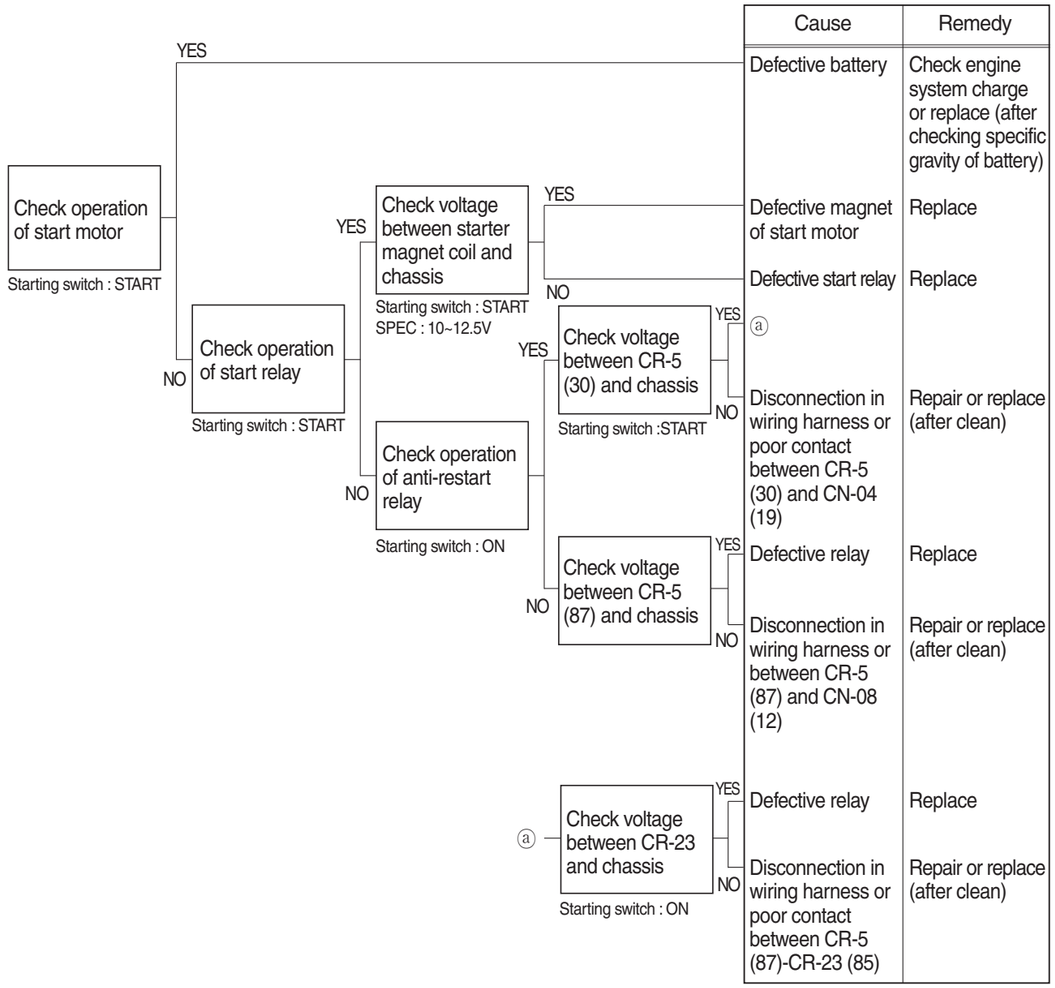
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.13.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.



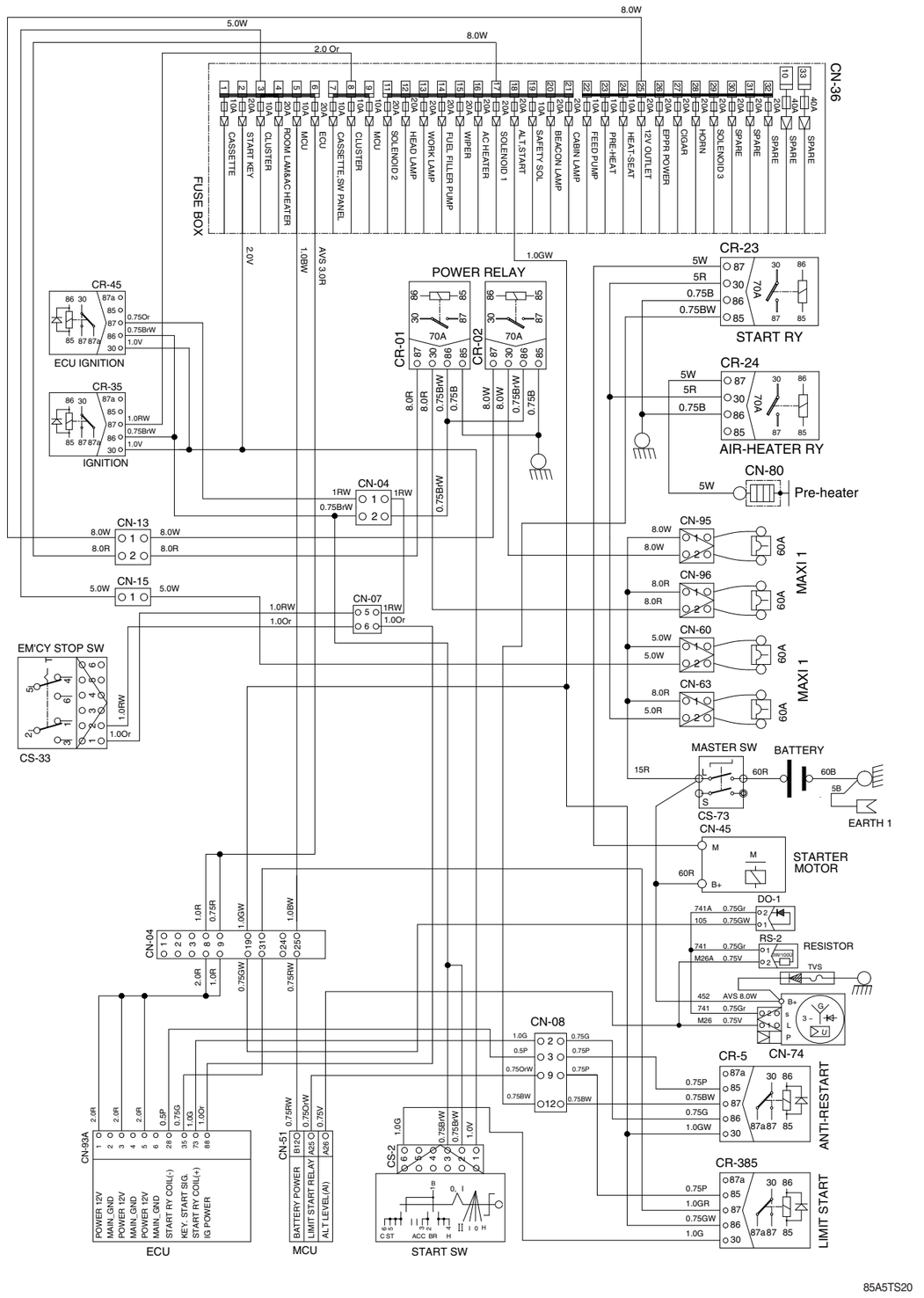


14. WHEN ENGINE DOES NOT START

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



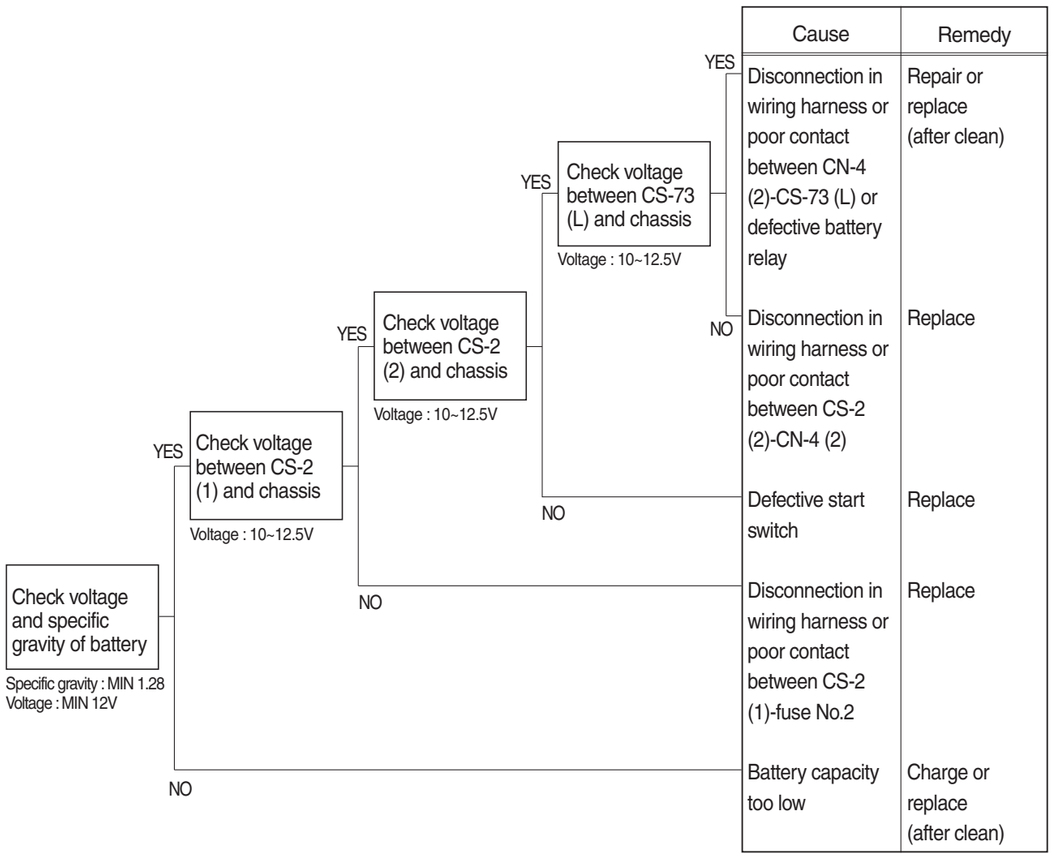
Cause	Remedy
Defective battery	Check engine system charge or replace (after checking specific gravity of battery)
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CR-5 (30) and CN-04 (19)	Repair or replace (after clean)
Defective relay	Replace
Disconnection in wiring harness or between CR-5 (87) and CN-08 (12)	Repair or replace (after clean)
Defective relay	Replace
Disconnection in wiring harness or poor contact between CR-5 (87)-CR-23 (85)	Repair or replace (after clean)



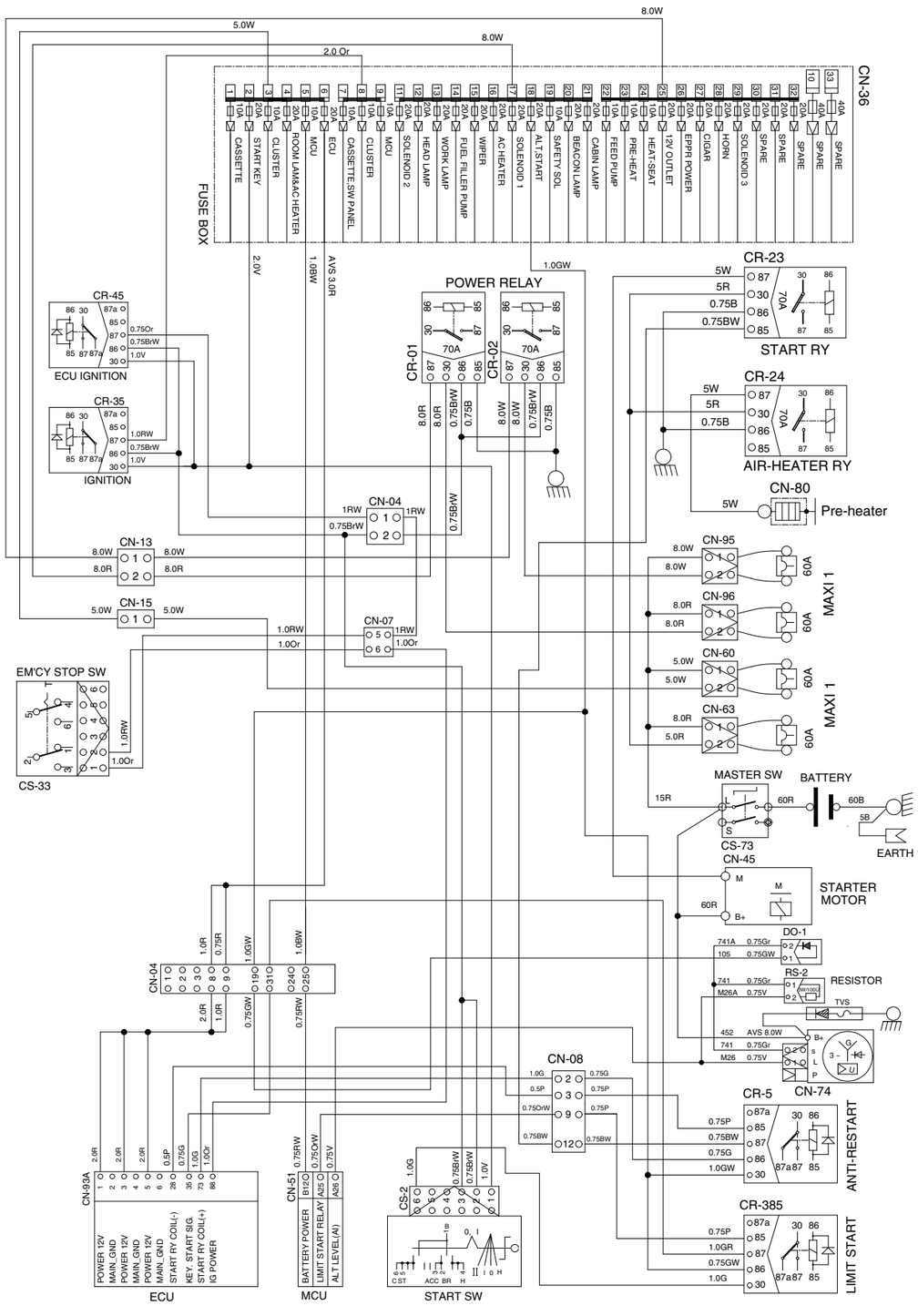
85A5TS20

15. WHEN STARTING SWITCH ON DOES NOT OPERATE

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



Cause	Remedy
Disconnection in wiring harness or poor contact between CN-4 (2)-CS-73 (L) or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2 (2)-CN-4 (2)	Replace
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2 (1)-fuse No.2	Replace
Battery capacity too low	Charge or replace (after clean)



85A5TS20

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 HD Hyundai Construction Equipment spec.

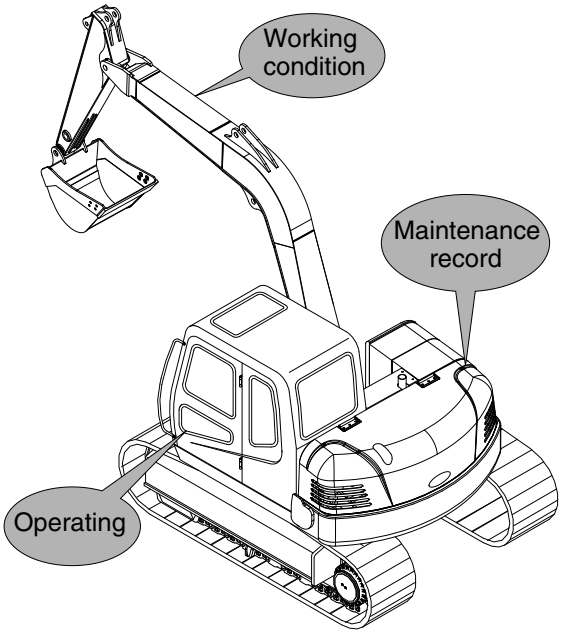
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

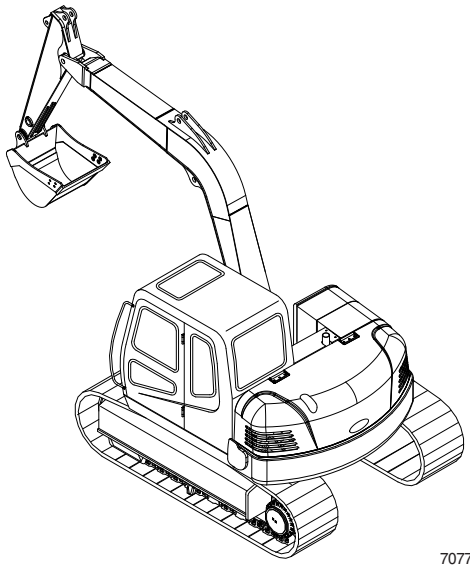


7077MS01

2. TERMINOLOGY

1) STANDARD

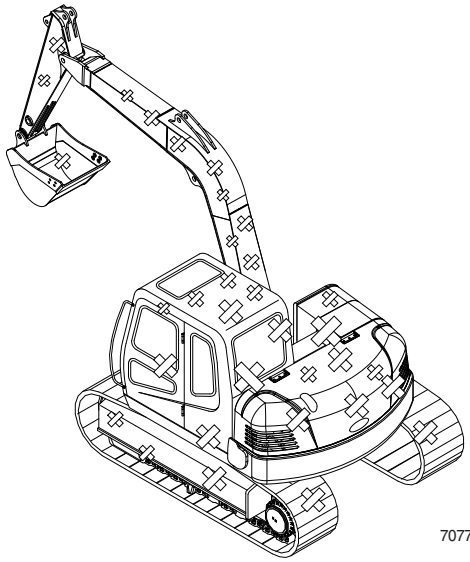
Specifications applied to the brand-new machine, components and parts.



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.

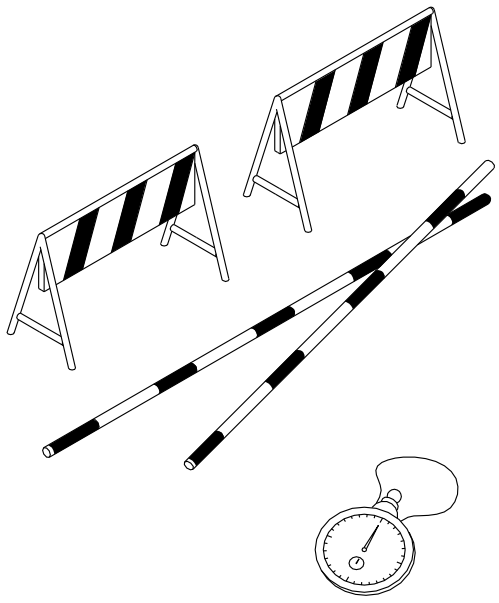
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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.

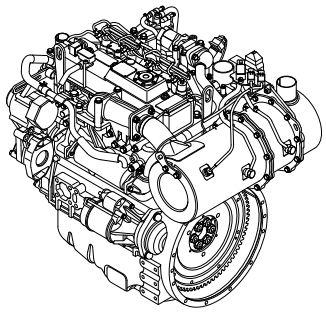
② Measure and record the engine speed at each mode (P, S).

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.

CLUSTER



85A6MS01

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remark
HX85A	Start idle	1000±50	
	P mode	2100±50	
	S mode	1950±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.

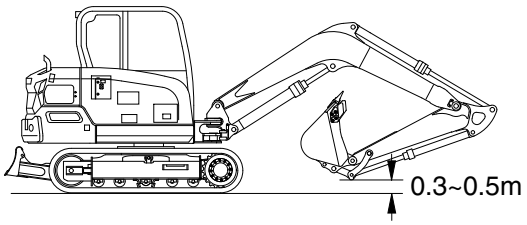
(2) Preparation

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.



85A6MC04

(3) Measurement

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

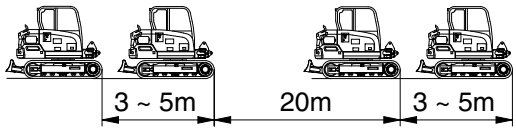
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

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.



85A6MC05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
HX85A	1 Speed	26.0±2.0	32.5	
	2 Speed	13.6±1.0	17	

4) TRACK REVOLUTION SPEED

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

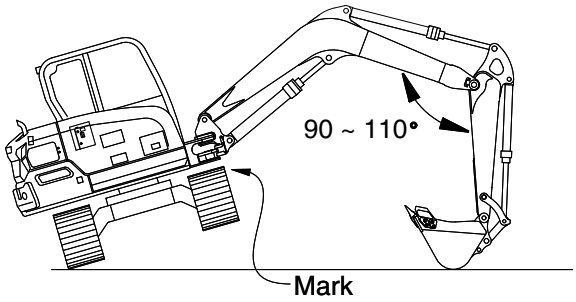
(2) Preparation

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.



85A6MC06

(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
HX85A (Rubber track)	1 Speed	21.2±1.5	26.3
	2 Speed	10.9±1.5	13.6

5) TRAVEL DEVIATION

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

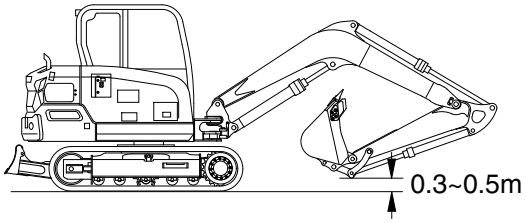
(2) Preparation

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.



85A6MC04

(3) Measurement

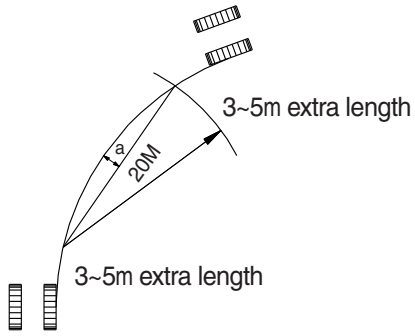
① Measure the amount of mistracking at high and low travel speeds.

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
HX85A	200 below	240	

6) SWING SPEED

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

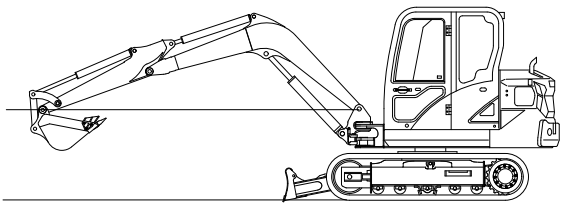
(2) Preparation

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.



85A6MC07

(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
HX85A	12.6±1.0	15.8	

7) SWING FUNCTION DRIFT CHECK

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

(2) Preparation

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

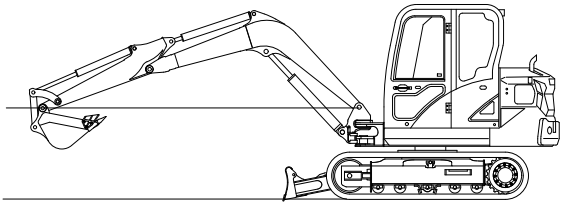
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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

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

⑤ Swing the upperstructure 360˚.

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



85A6MC07

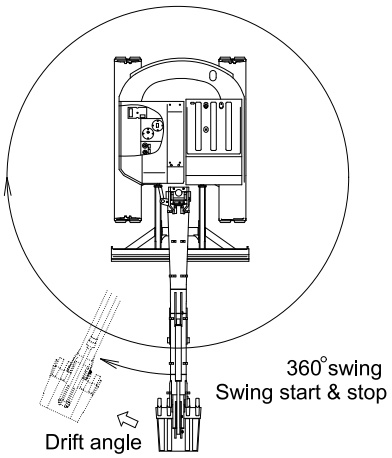
(3) Measurement

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.



85A6MC08

(4) Evaluation

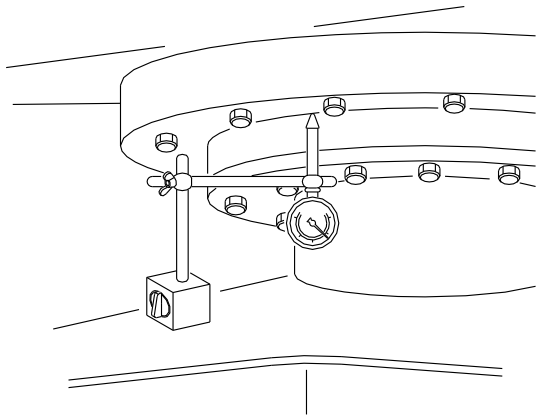
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remarks
HX85A	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

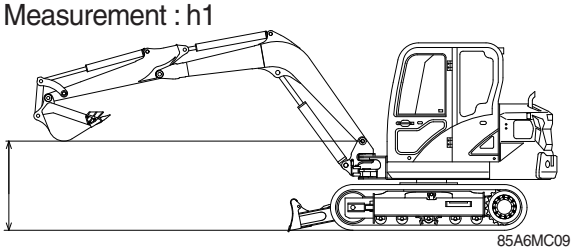
(2) Preparation

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

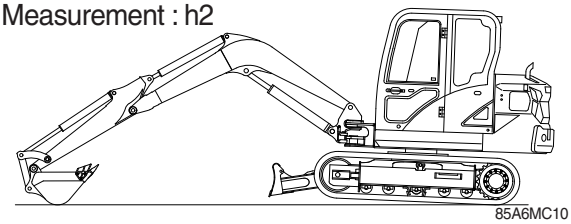
① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).
③ Calculate bearing play (H) from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

Measurement : h1



85A6MC09

Measurement : h2



85A6MC10

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX85A	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.

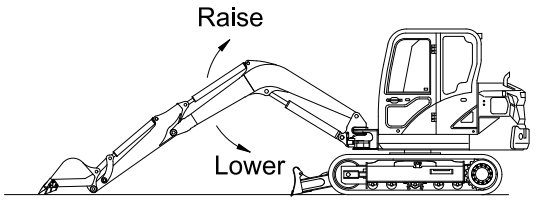
④ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

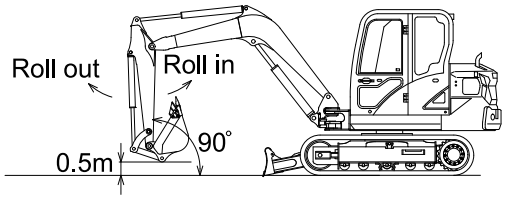
① To measure cylinder cycle times.

- 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.

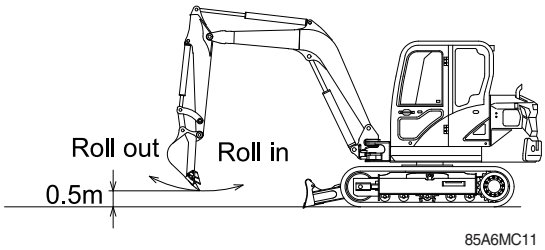
Boom cylinder



Arm cylinder



Bucket cylinder



85A6MC11

- 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
HX85A	Boom raise	3.0±0.4	3.6	
	Boom lower	2.6±0.4	3.1	
	Arm in	2.4±0.4	2.9	
	Arm out	2.8±0.3	3.4	
	Bucket load	2.2±0.4	2.6	
	Bucket dump	2.0±0.3	2.4	
	Dozer up (raise)	3.5±0.3	4.2	
	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.
- $W = M^3 \times 1.5$

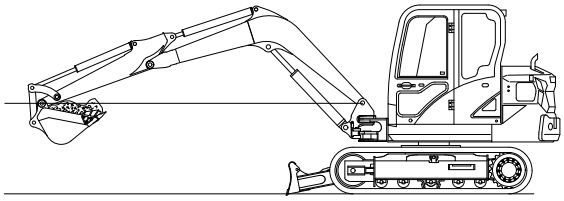
Where :
M^3 = Bucket heaped capacity (m^3)
1.5 = Soil specific gravity

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.



85A6MC12

(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
HX85A	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
HX85A	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
HX85A	Boom lever	82±10	103	
	Arm lever	82±10	103	
	Bucket lever	82±10	103	
	Swing lever	82±10	103	
	Travel lever	148±20	185	

13) PILOT PRIMARY PRESSURE

(1) Preparation

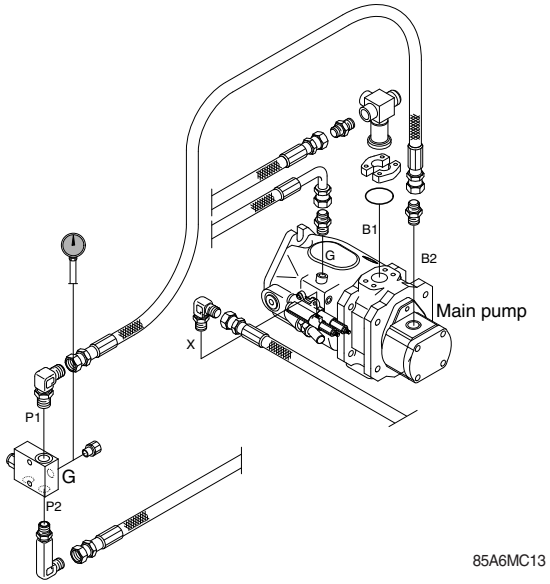
① Stop the engine.

② Push the pressure release button to bleed air.

③ Loosen and remove plug on the pilot pump delivery port (P2) 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.



(2) Measurement

① Measure the primary pilot pressure in the M mode.

(3) Evaluation

The average measured pressure should meet the following specifications:

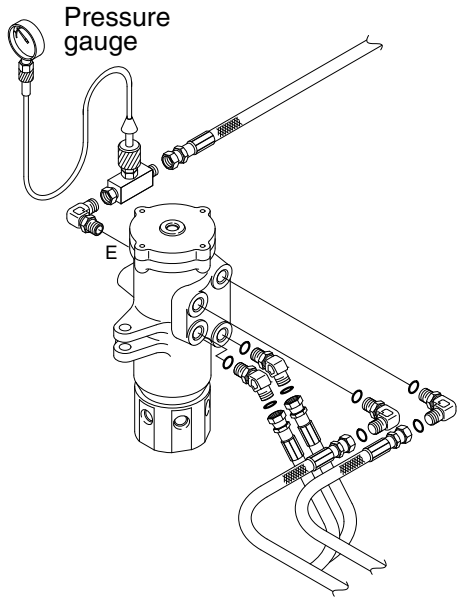
Unit : kgf / cm²

Model	Standard	Remarks
HX85A	31~34	at 1000rpm (Engine speed)

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
HX85A	1 Speed	0	-	
	2 Speed	33±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

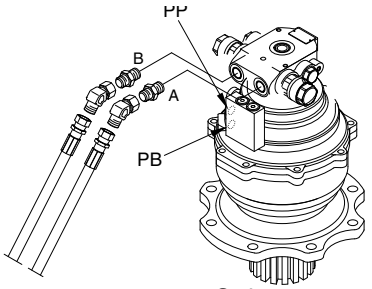
① Stop the engine.

② Push the pressure release button to bleed air.

③ Install a connector and pressure gauge assembly to swing motor PP 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.



Swing motor

85A6MC15

(2) Measurement

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

② Repeat three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Description	Standard	Remarks
HX85A	Brake disengaged	25~40	
	Brake applied	0	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

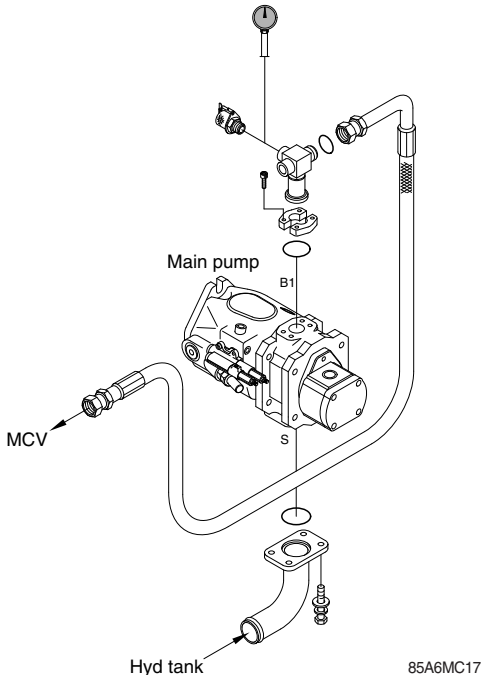
① Stop the engine.

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 (B1) as shown.

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

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



(2) Measurement

① Measure the main pump delivery pressure at high idle.

(3) Evaluation

The average measured pressure should meet the following specifications.

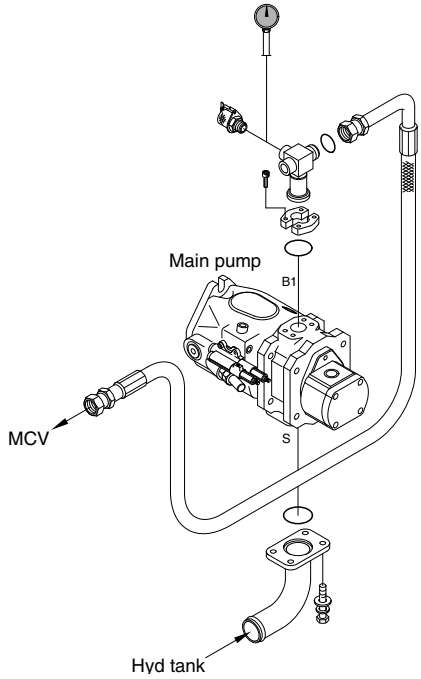
Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX85A	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.



85A6MC17

(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 / cm²

Model	Function to be tested	Standard	Port relief setting
HX85A	Boom, Arm, Bucket	285±10	310±10
	Travel	285±10	-
	Swing	250±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.

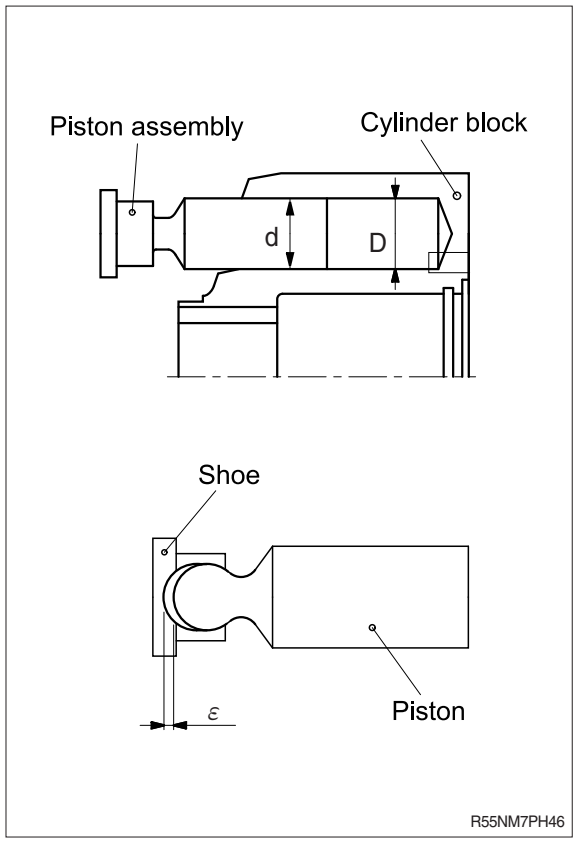
1) PISTON ASSEMBLY AND CYLINDER BLOCK

(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 ≤ 0.050 mm

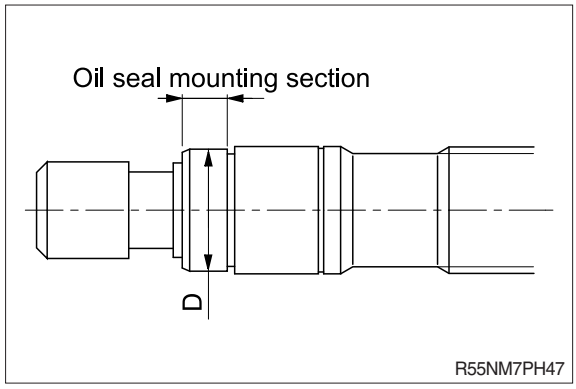
2) PISTON SHOE AND PISTON

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



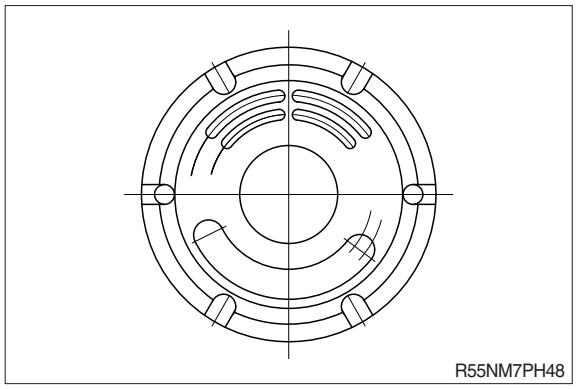
3) SHAFT

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



4) CONTROL PLATE

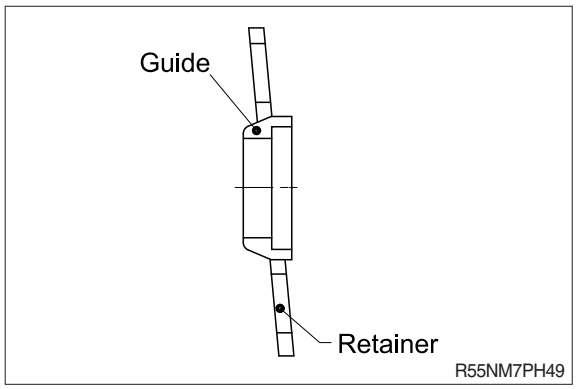
(1) Check the slide surface for any damage. When the damage is large, replace the plate with new one.



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.

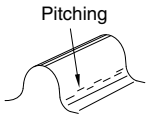
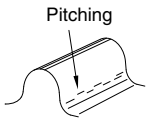
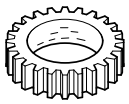
3. SWING MOTOR

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

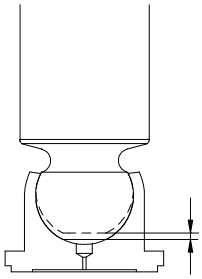
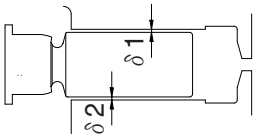
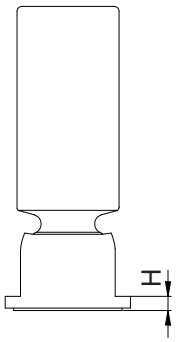
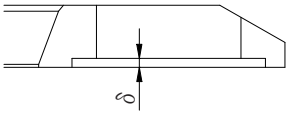
(1) Reduction gear section

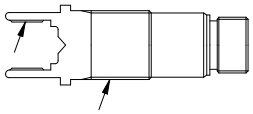
Part	Extent of the damage	Inspection standard	Action
A internal gear	Excessive wear of the surface	Pitching area 5% or more of the gear surface 	Replace the pinion kit.
Carrier 1 Carrier 2	Damage to spline section	By visual	Replace the carrier kit.
S1 gear S2 gear b1 gear b2 gear	Excessive wear of the 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

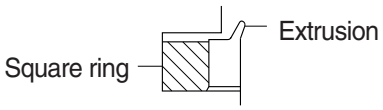
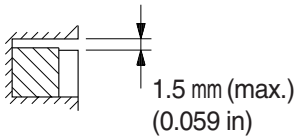
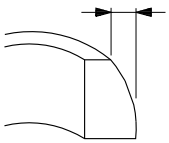
Part	Extent of the damage	Inspection standard	Action
Shaft	Excessive wear of the spline section	Worn depth : 25 μm or more	Replace the hydraulic motor assembly.
Cylinder barrel	Excessive wear to the sliding surface of the valve plate	Worn depth : 20 μm or more	Replace the cylinder barrel kit.
Valve plate	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	= 0.1 mm	< 0.5 mm	Replace 9 sets of piston assy
Piston assy (B) and cylinder block (8) 	Clearance/diameter between piston diameter and cylinder bore ($\delta 1 + \delta 2$)	0.03 mm	< 0.07 mm	Replace the set of 1 cylinder barrel and 9 piston assys
Slipper 	Height of the plate	Height H 5 mm	Height H < 4.6 mm	Replace 9 sets of piston assy
Retainer (11) 	Wear		Wear depth < 0.2mm	Replace
Swash plate (7)	Condition of sliding surface	Roughness < Ra 0.2μm	Roughness < Ra 1.6μm	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 0.2μm	Roughness < Ra 0.8μm	Replace the set of cylinder barrel and valve plate
Valve plate (12)	Condition of sliding surface	Roughness < Ra 0.4μm	Roughness < Ra 1.6μm	Replace the set of cyli-nder barrel and valve plate

5. TURNING JOINT

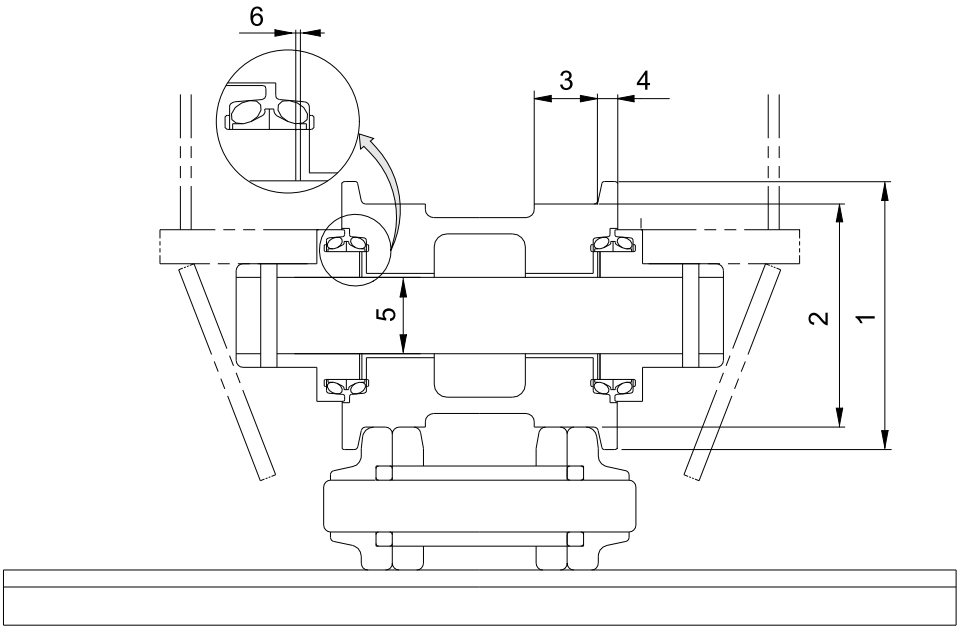
Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	·Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure 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. STEEL TRACK

1) TRACK ROLLER

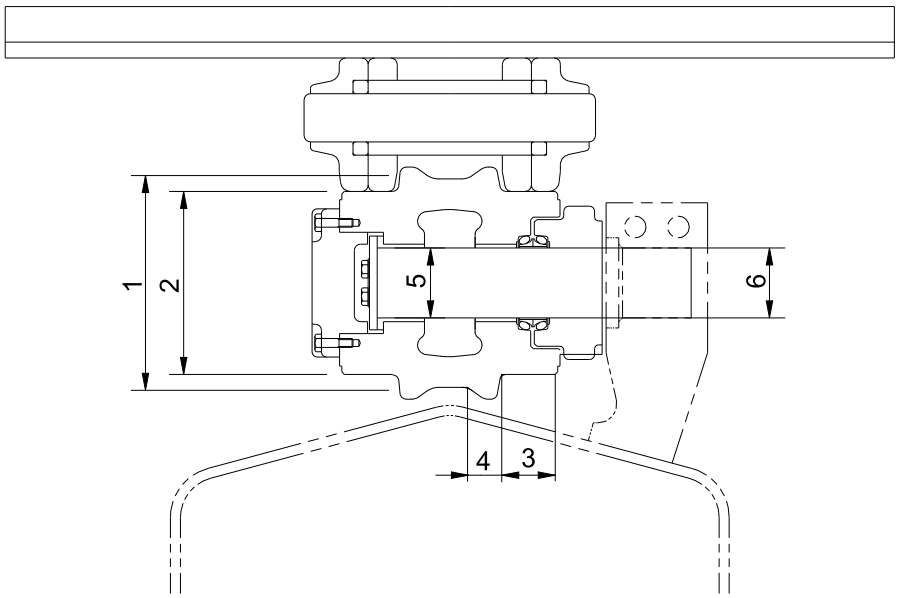


80CR96MC21

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		Ø149		-		
2	Outside diameter of tread	Ø125		Ø115		
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			
		Ø40 0 -0.03	Ø40 +0.3 +0.25	0.25 to 0.33	2.0	
6	Side clearance of roller (both side)	Standard clearance		Clearance limit		Replace
		0.4~1.21		2.0		

2) CARRIER ROLLER

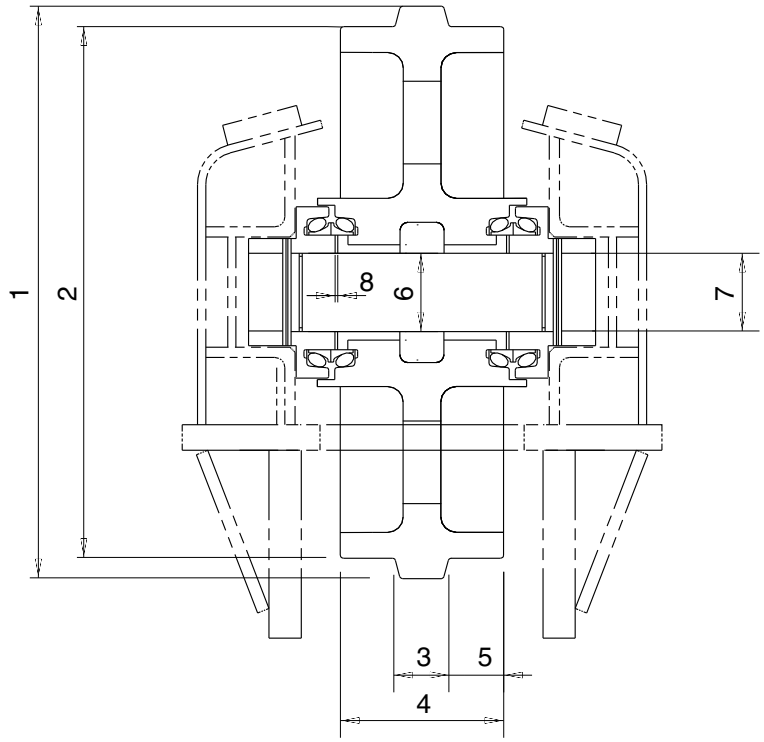


80CR96MC20

Unit : ㎜

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		Ø115		-		
2	Outside diameter of tread	Ø95		Ø85		
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			
		Ø38 $^{0}_{-0.03}$	Ø38 $^{+0.35}_{+0.3}$	0.3 ~ 0.38	2.0	
6	Clearance between shaft and support	Shaft	Support	0.3 ~ 0.6	1.2	
		Ø38 $^{-0.2}_{-0.3}$	Ø38 $^{+0.3}_{+0.1}$			

3) IDLER



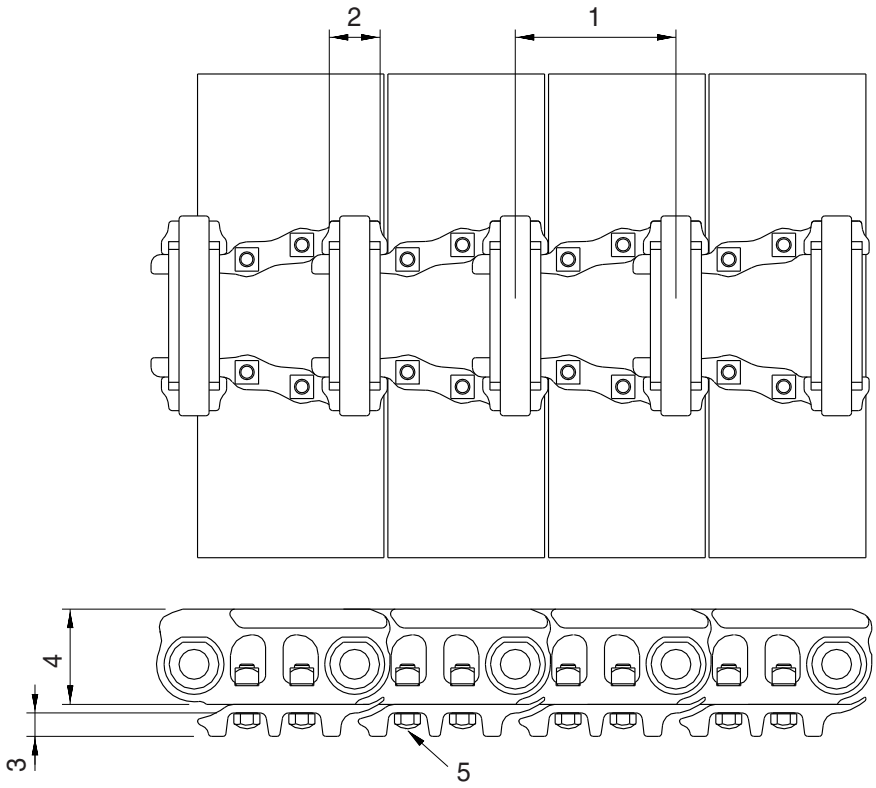
85A7MS03

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of protrusion	Standard size		Repair limit		Rebuild or replace
		Ø440		-		
2	Outside diameter of tread	Ø410		Ø400		
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			
		Ø60 0 -0.03	Ø60.3 +0.08 +0.03	0.33~0.41	2.0	
7	Clearance between shaft and support	Ø60 0 -0.03	Ø60 +0.07 +0.03	0.03~0.1	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance		Clearance limit		Replace bushing
		0.2~0.5		2.0		

4) TRACK

(1) Steel track

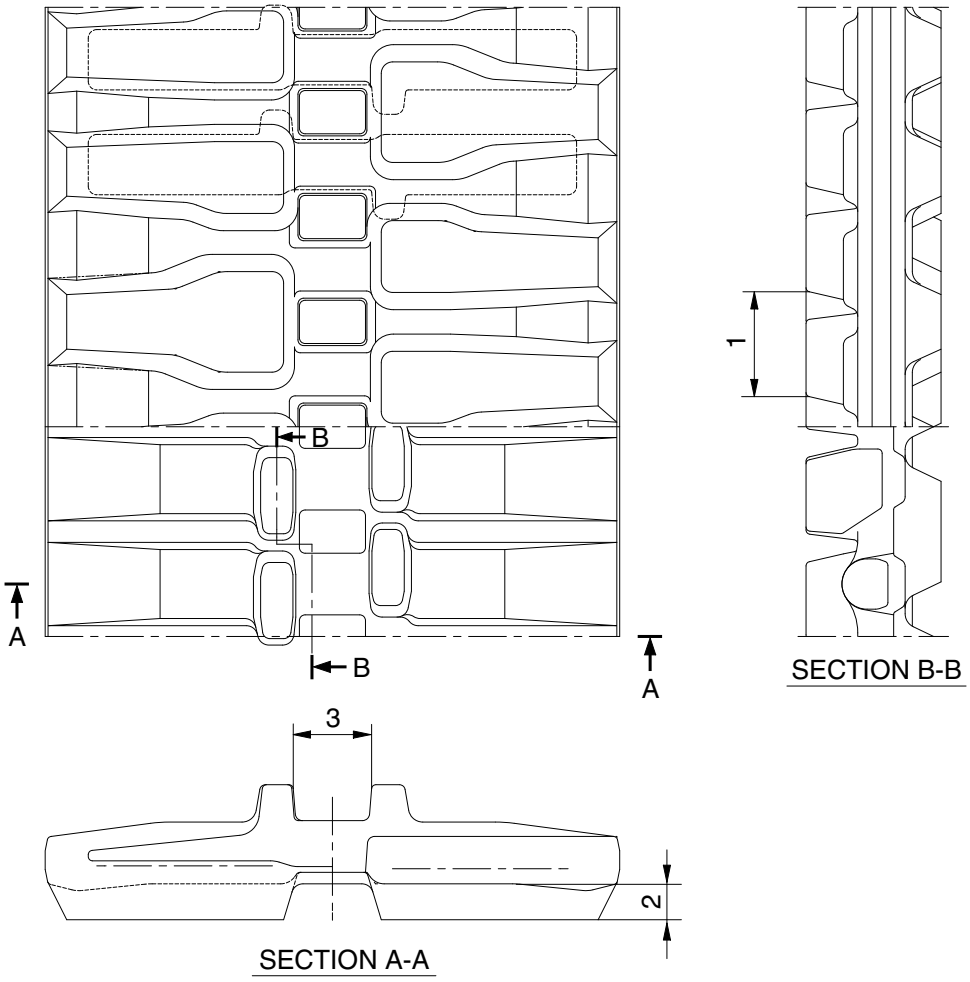


21037MS04

Unit : mm

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		154	158.3	
2	Outside diameter of bushing	Ø41.3	Ø34.3	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

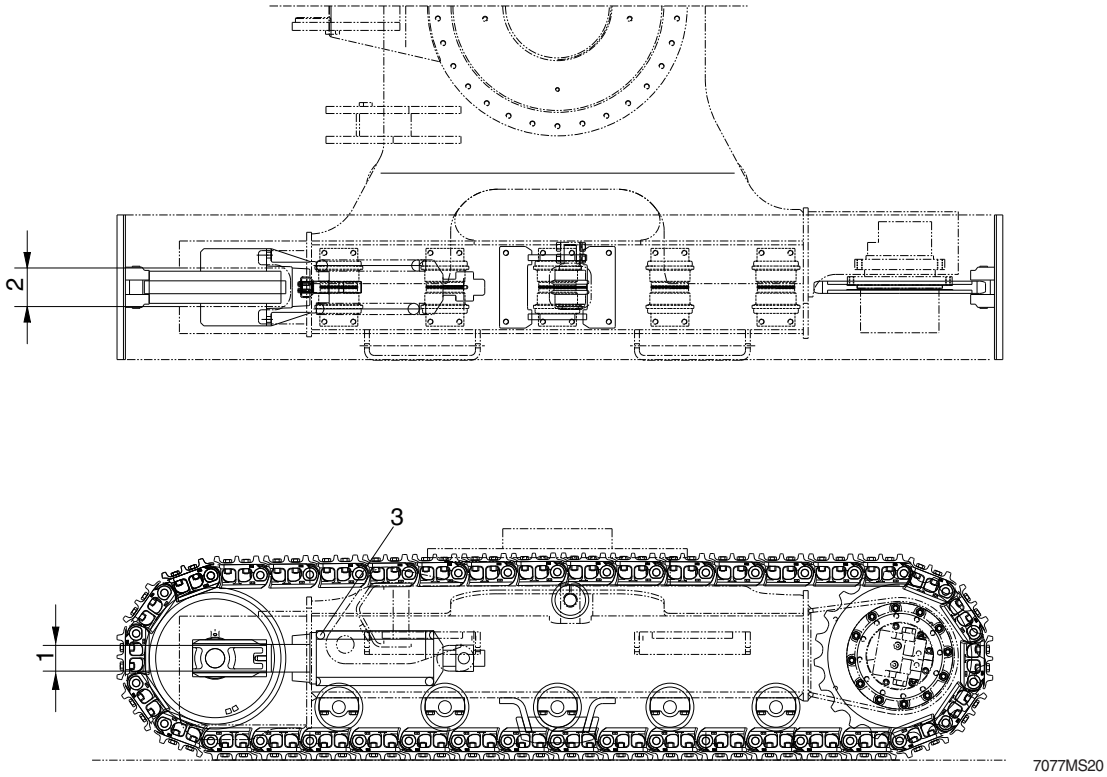


R5576MC17

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	

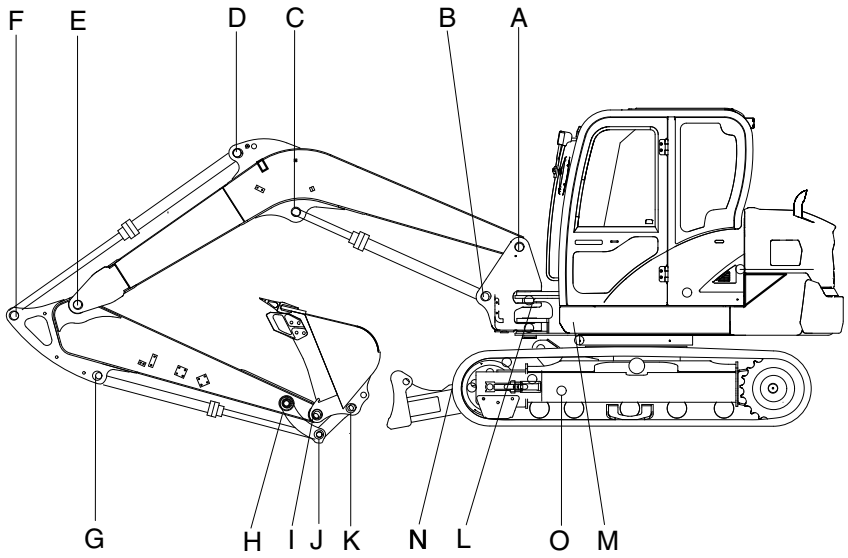
5) TRACK FRAME AND RECOIL SPRING



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	
		Ø170×360	320	4,816 kg	-	3,955 kg	

2. WORK EQUIPMENT



85A6MC22

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

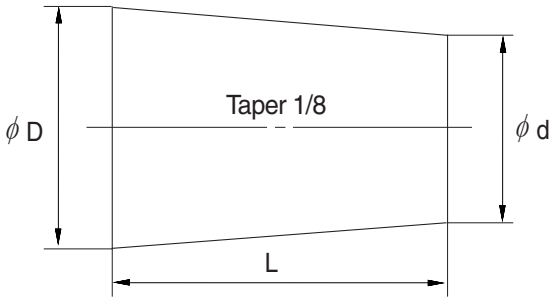
SECTION 7 DISASSEMBLY AND ASSEMBLY

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	7±1.5	50.6±10.9
2		Engine mounting bolt (bracket-frame)	M16 × 2.0	30±4.5	217±32.5
3		Radiator mounting bolt, nut	M14 × 2.0	14±1.0	101±7.2
4		Coupling mounting socket bolt	M14 × 2.0	14±1.0	101±7.2
		Coupling mounting clamp bolt	M16 × 2.0	11±1.0	79.6±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
			M10 × 1.5	7±1.5	50.6±10.9
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	M14 × 2.0	19.6±2.0	142±14.5
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

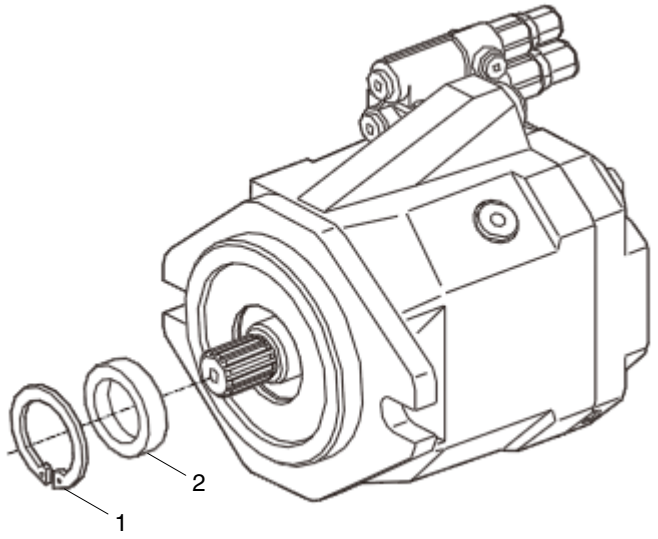
4) FITTING

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

GROUP 3 PUMP DEVICE

1. DISASSEMBLY

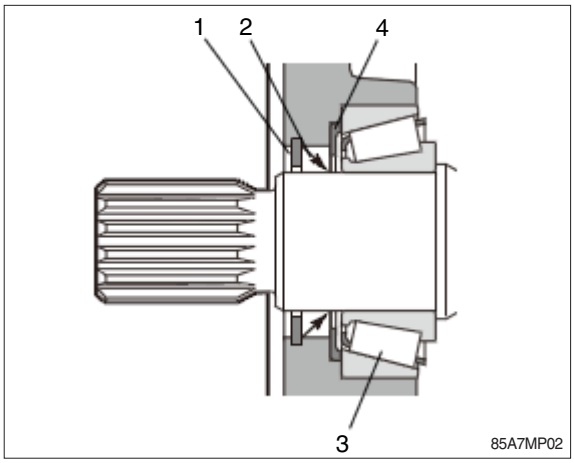
1) SEALING OF THE DRIVE SHAFT



85A7MP01

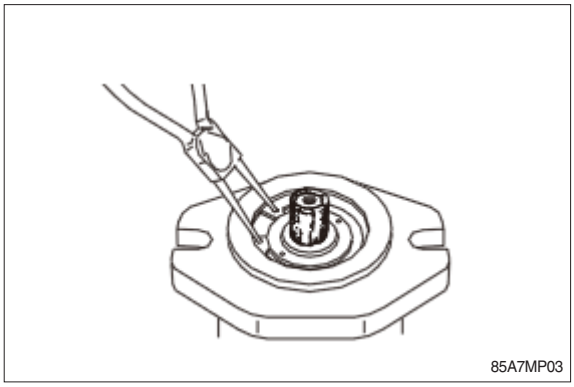
(1) Components

① Circlip
② 2 Shaft seal
③ 3 Bearing
④ 4 Stop ring



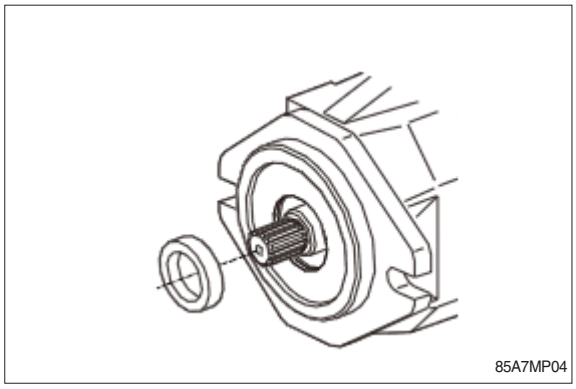
85A7MP02

(2) Protect the drive shaft.
(3) Remove the circlip.
(4) Remove shaft seal to front.

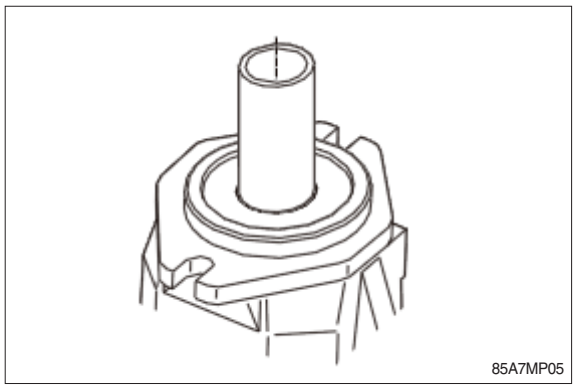

85A7MP03

※ Change the shaft seal and check its sliding surface (drive shaft) and housing and grease the sealing ring.

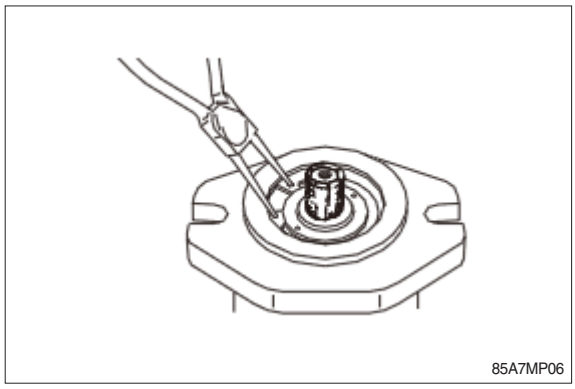
※ Visual check shaft seal and housing.



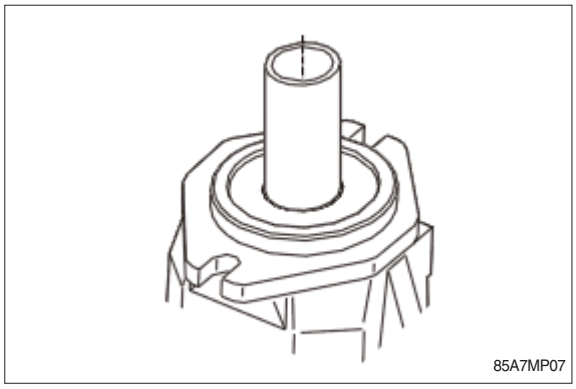
(5) Assembling of the sealing ring carefully down to the distance ring.



(6) Assemble the snap ring.

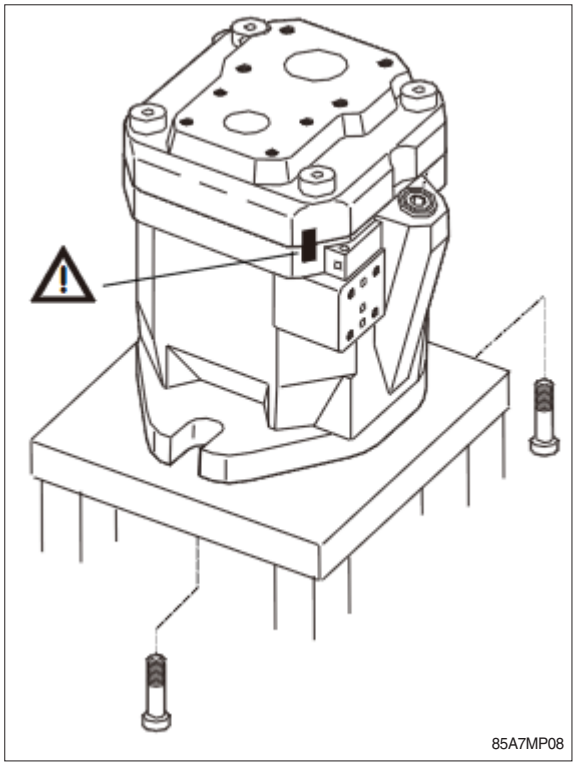


※ Visual check to ensure that the circlip is correctly located in the groove.

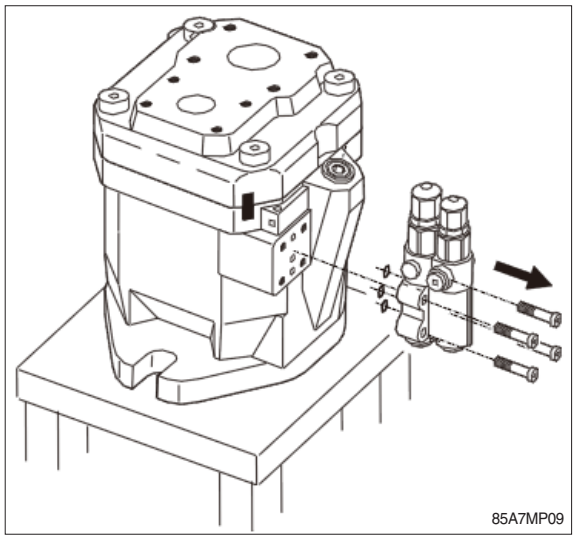


2) DISSAMBLE THE PUMP

※ Disassembly position
Mark the location of the connection plate on the housing of pump.



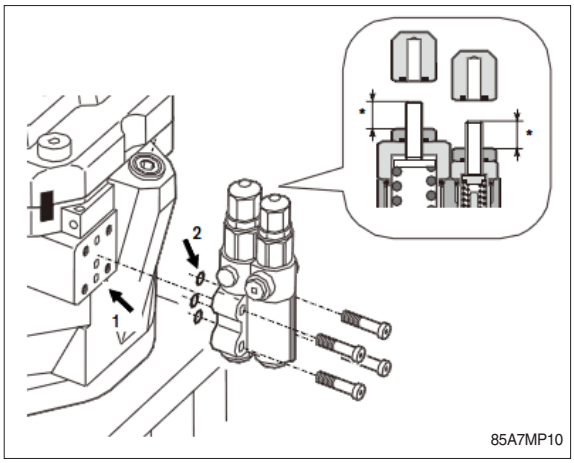
(1) Remove the control valve.



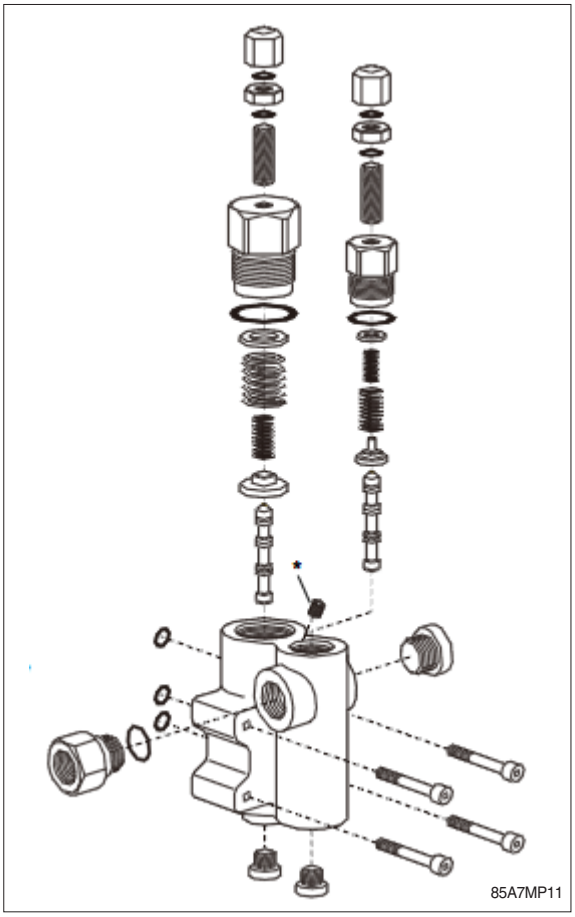
(2) Remove the control valve

※ Measure dimension * and note down.

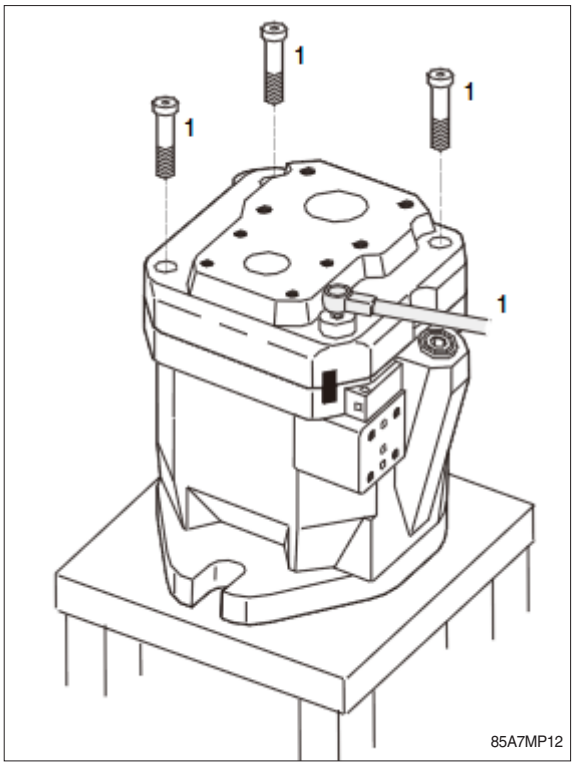
※ Check sealing surface (1) and O-rings (2).



※ Only DFR with orifice

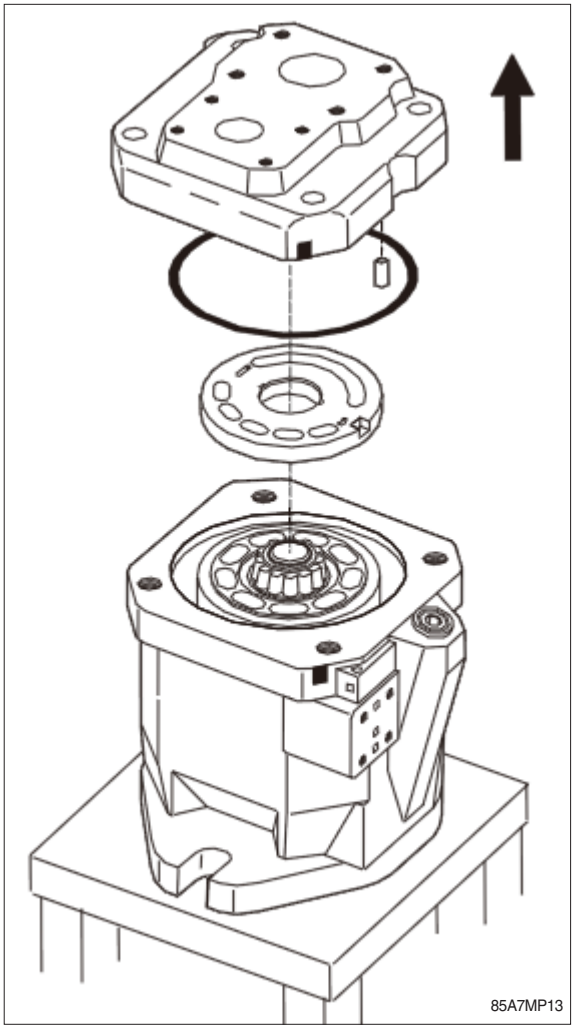


(2) Remove the socket screws (1).



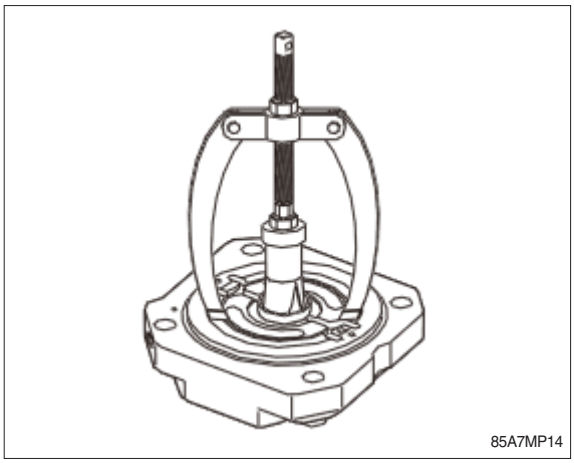
(4) Remove connection plate.

※ Control plate can drop down - keep tight while removing connection plate.



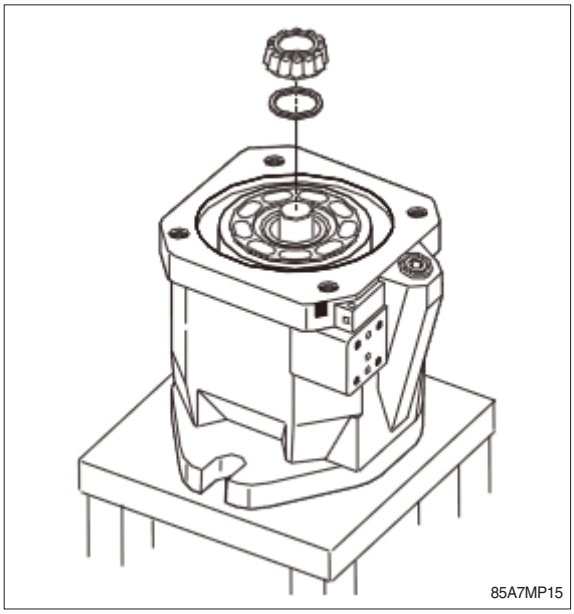
(5) Pull bearing of the connection plate out using a bearing puller.

※ Do not damage the sealing surface.

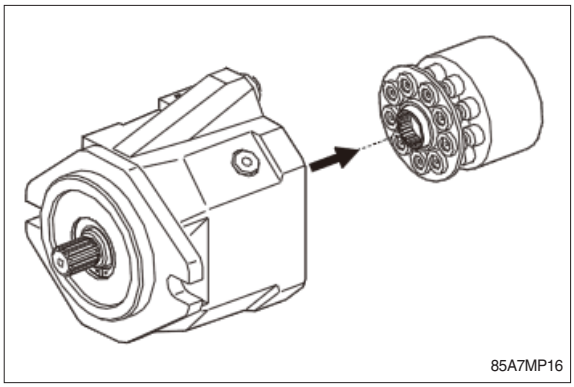


(6) Remove bearing and shim.

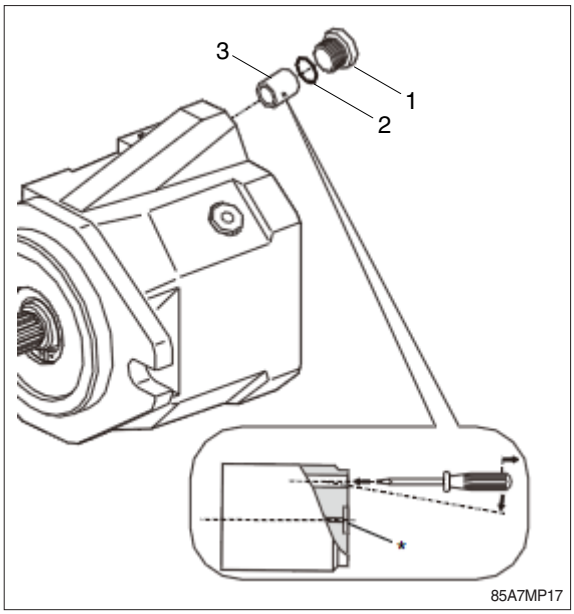
※ Do not damage the sealing surface.



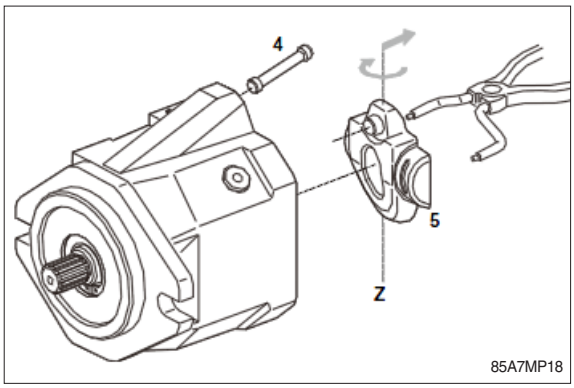
(7) Remove the rotary group in a horizontal position.



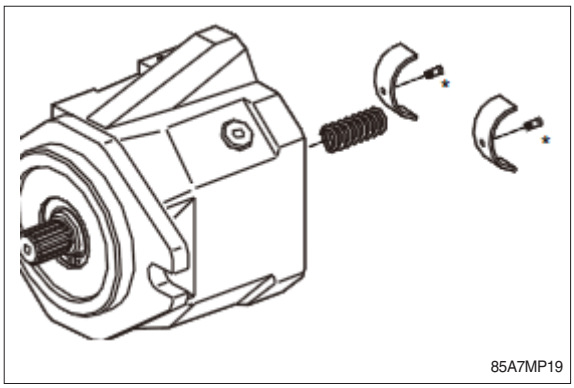
(8) Remove plug (1) with seal (2).
(9) Pull out control piston (3) (- flat surface *-) with tool.



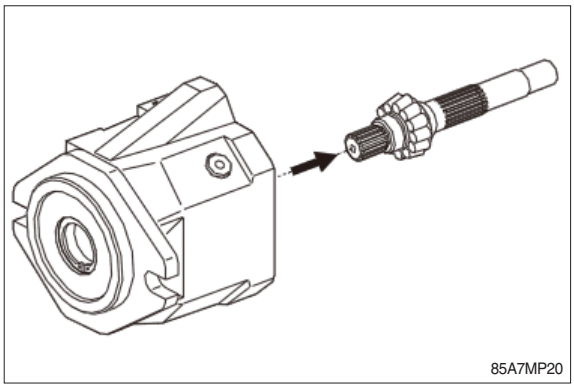
(10) Remove piston rod and swash plate.
Turn swash plate (5) inside of the housing slightly along Z-axis with tool. Remove piston rod (4). Remove swash plate (5).
Do not damage the piston rod and swash plate.



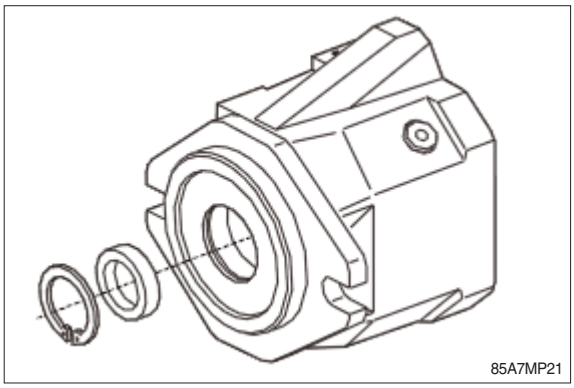
(11) Remove bearing shells and bearing.
※ Attention for position.
Only size 60~85



(12) Remove drive shaft with bearing.



(13) Remove circlip and shaft seal.

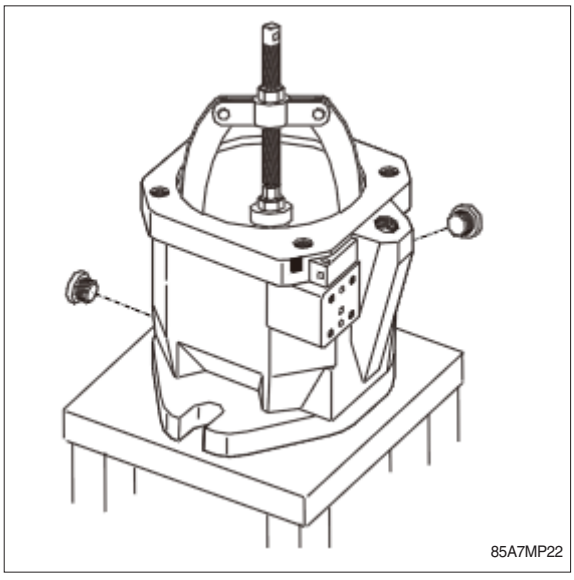


(14) Pull out outer race of tapered bearing out of housing press seat.

※ Use bearing puller.

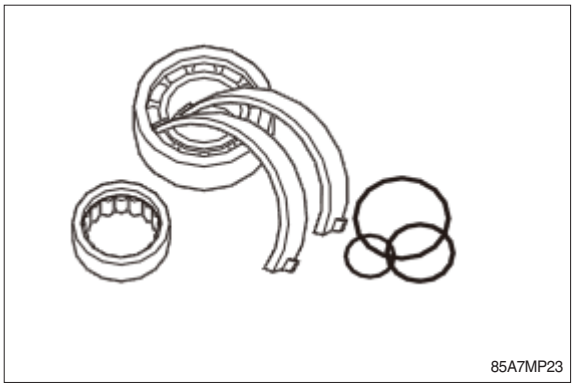
(15) Remove all plugs.

(16) Remove stop ring.

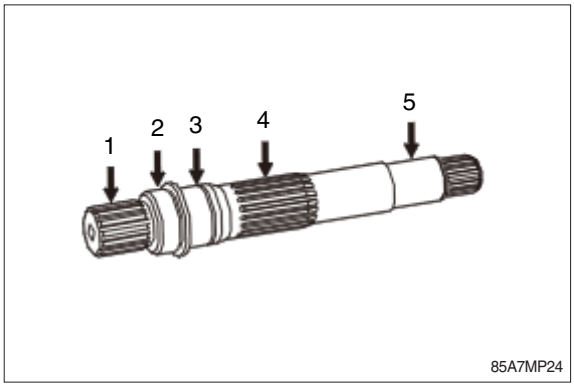


3) INSPECTION

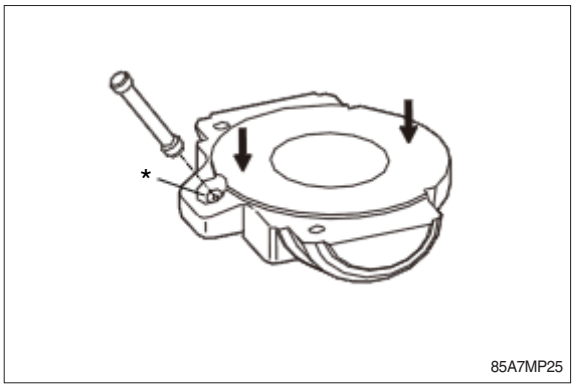
(1) Renew all bearings and seals.



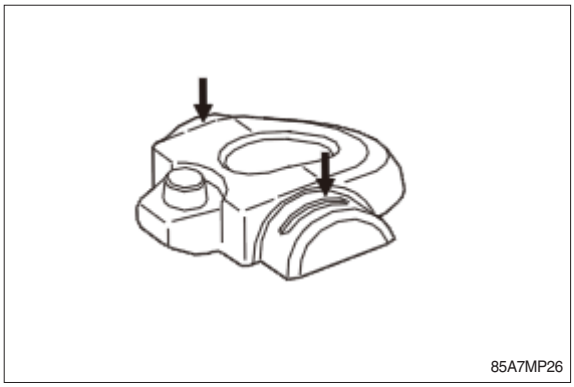
(2) Check below items
① Wear on slines, fretting
② Drive shaft seal wear grooves
③ Bearing seat
④ Splines for cylinder drive
⑤ Bearing seat



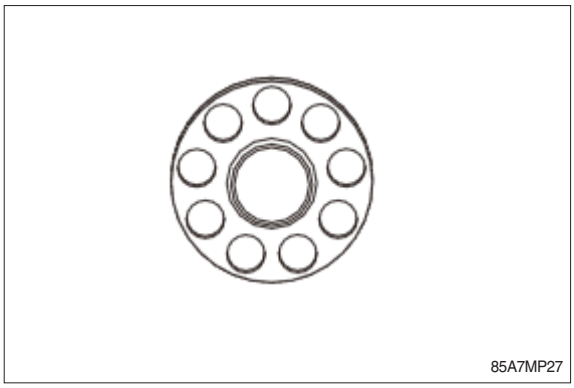
(3) Sliding surface free of grooves.
* Check for freedom of piston rod movement.



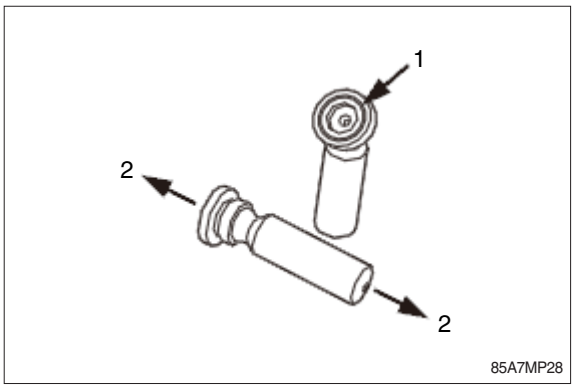
(4) Bearing surfaces



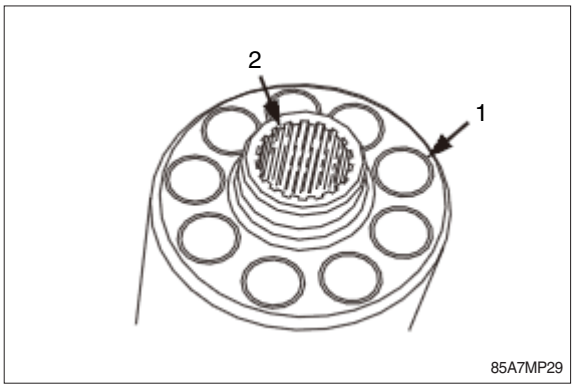
(5) That the retaining plate is free of grooves and that there is no wear in the slipper pad area.



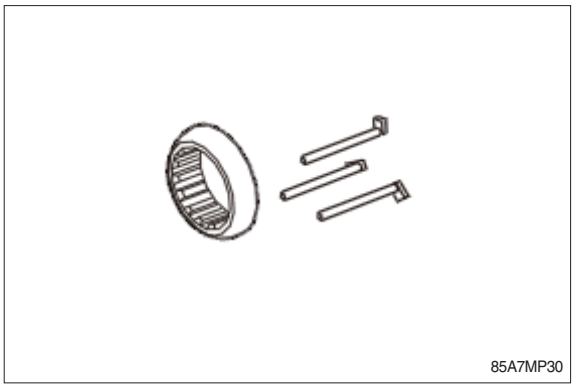
(6) Check to see that there are no scratches or metal deposits on the sliding surface (1), and that there is no axial play (2), (pistons must only be replaced as a set).



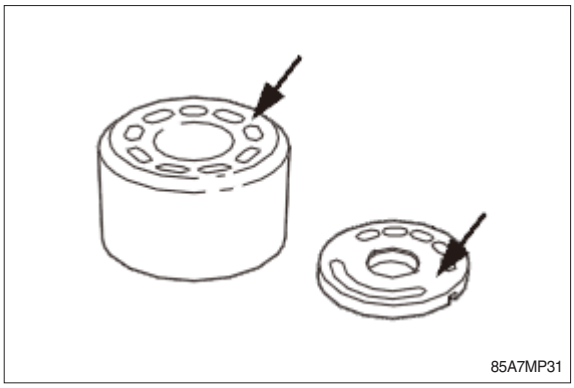
(7) Cylinder bores (1), splines (2).



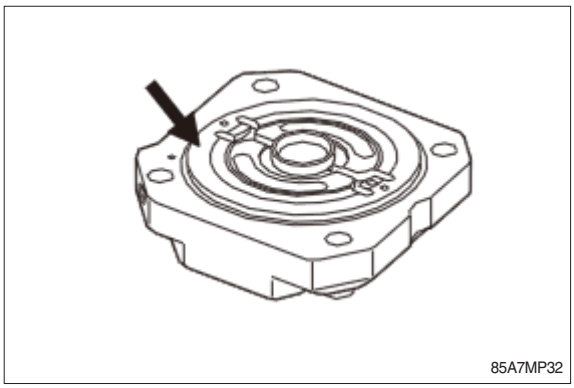
(8) Free of grooves, no signs of wear.



(9) Cylinder sliding surface free of grooves, no wear, no embedded foreign particles. That there are no scratches on the control plate. (Only replace them as a set).

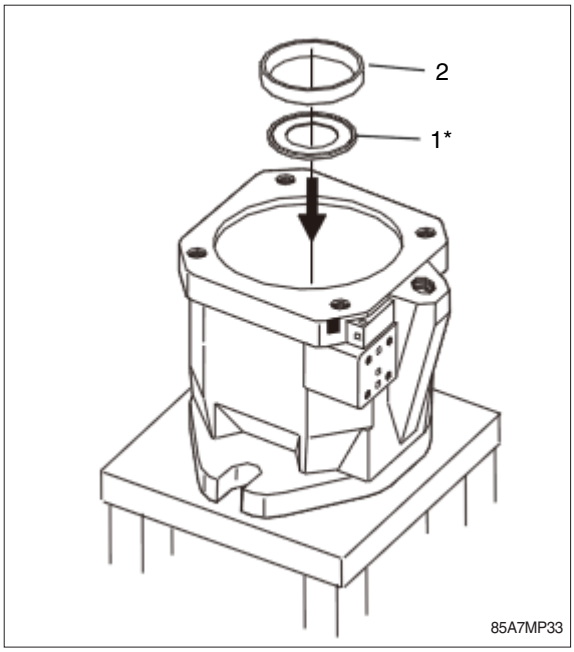


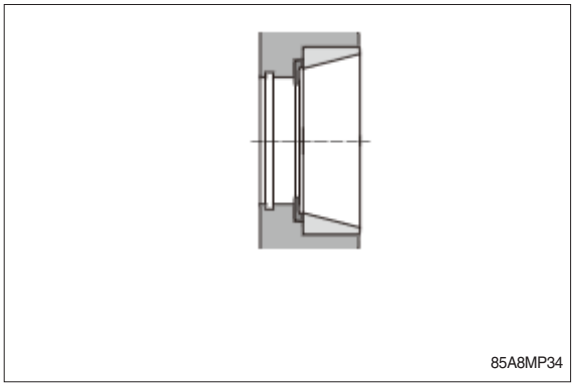
(10) Mounting surface - control plate undamaged



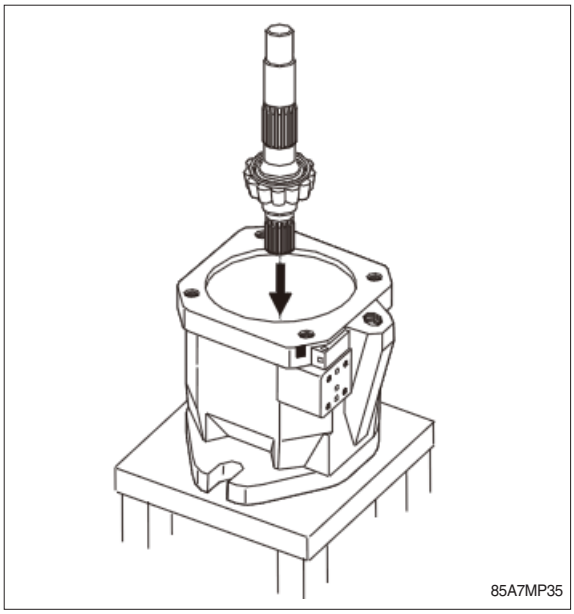
4) ASSEMBLY

(1) Assemble stop ring (1, * see also below spare part list).
(2) Press-in distance ring (2) with tool.

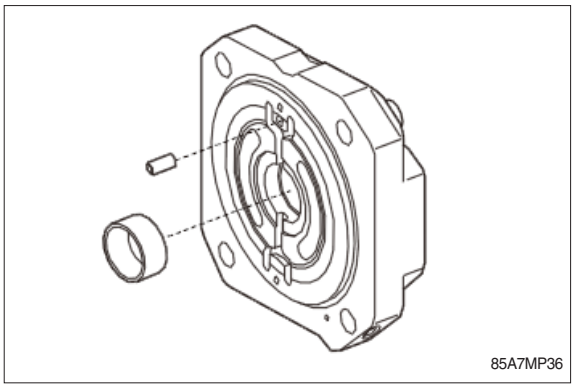




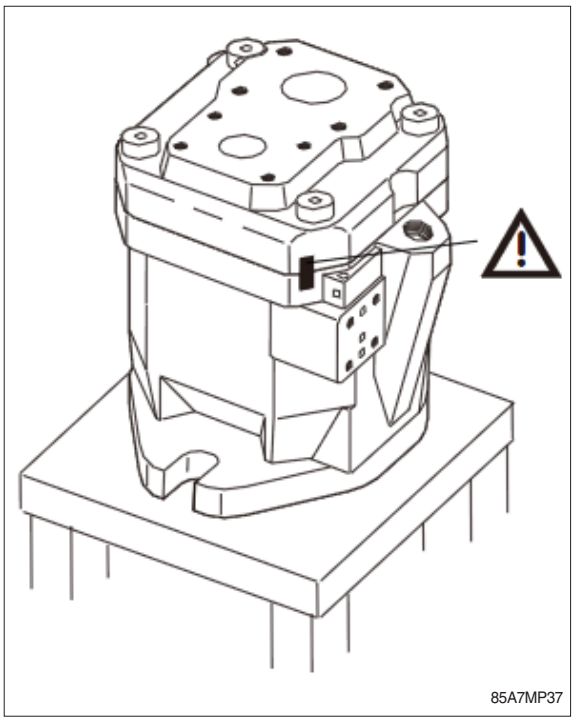
(3) Assemble shaft in correct position.
※ Do not cut shaft seal.



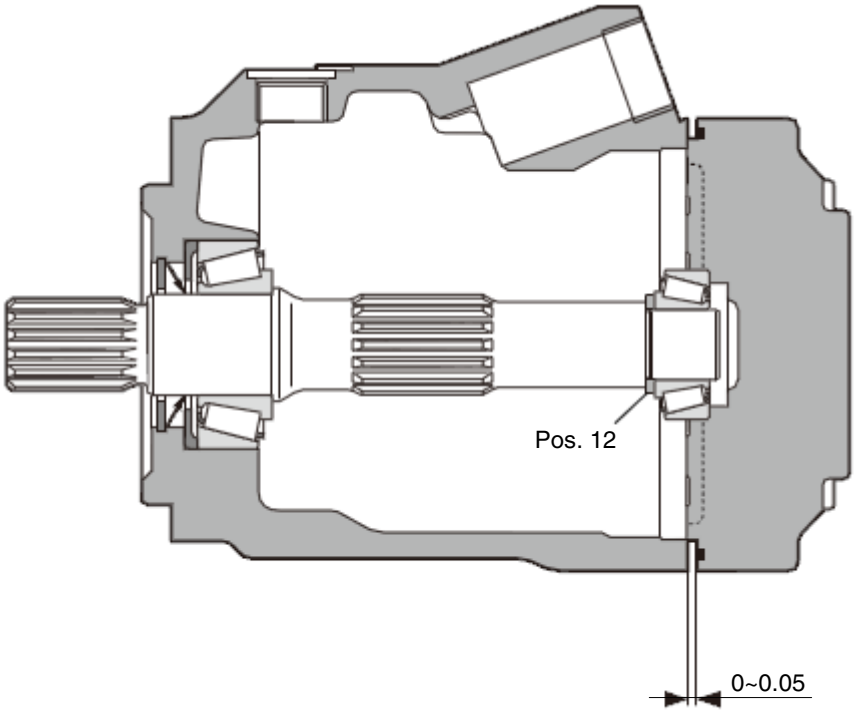
(4) Press-in outer racer of rear bearing into connection plate.



(5) Assemble connection plate to pump acc. sign.
(6) Tighten the 4 socket screws.
(7) Adjustment of taper roller bearing
① Disassemble connection plate.



② Taper roller bearing initial tension



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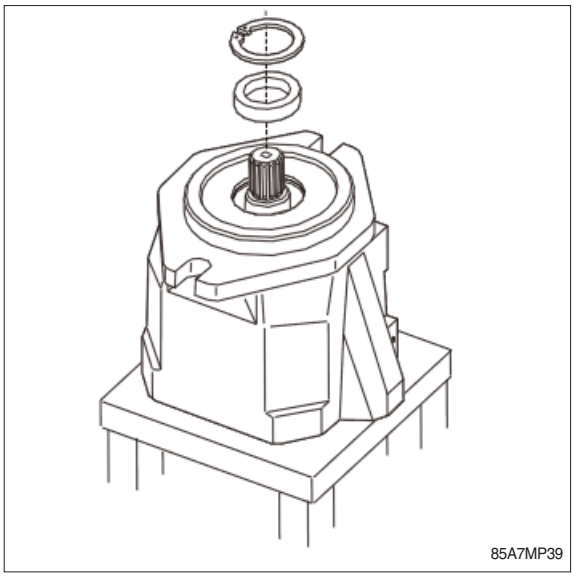
※ Adjustment of taper roller bearing set
Cast iron housing must have initial tension of the bearings :
0~0,05 mm, grind position 12 if necessary.

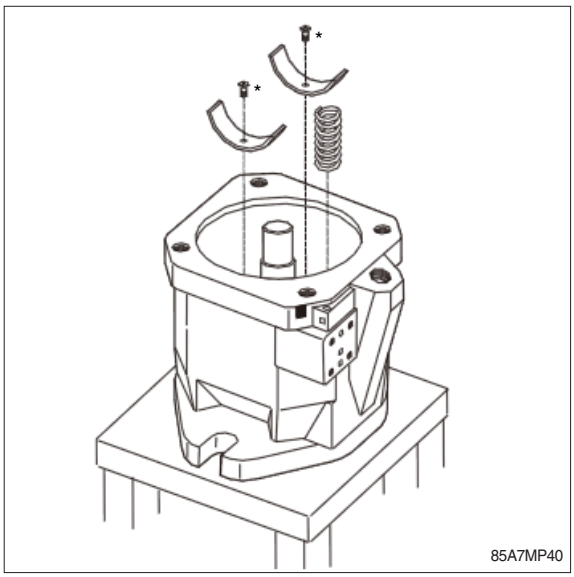
(8) Assembly instruction shaft seal see page 6.



(9) Fit in bearing shells and spring.

※ Fix with grease.

* Only size 60~85

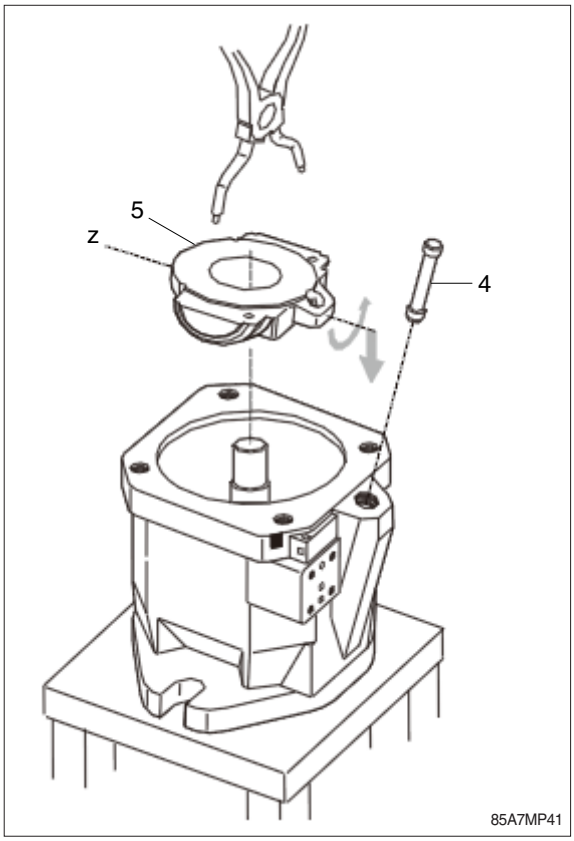


(10) Assemble swash plate (5) and piston rod (4) into pump.

※ Spring guide pin in correct position.

※ Check correct position of the spring.

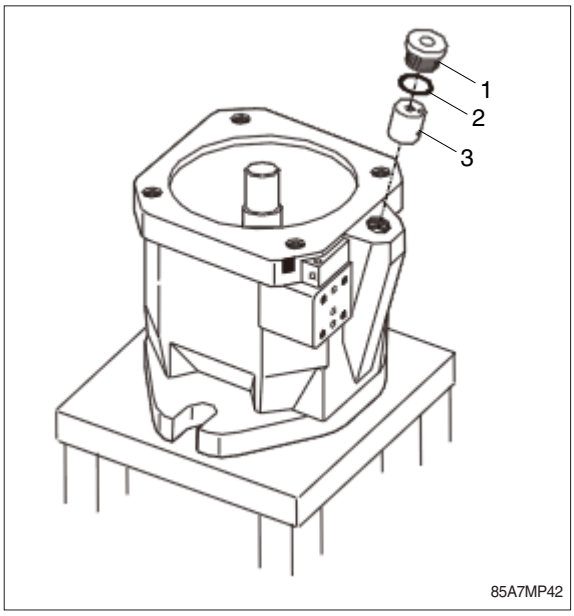
(11) Assemble piston rod (4), control piston (3), seal (2), and plug (1).



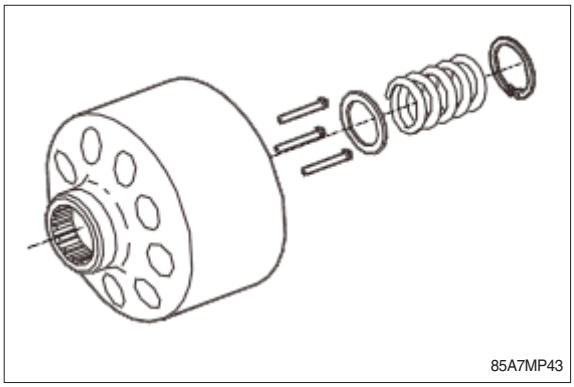
(12) Assemble piston rod (4), control piston (3),seal (2) and plug (1).

※ Plug tighten torque.

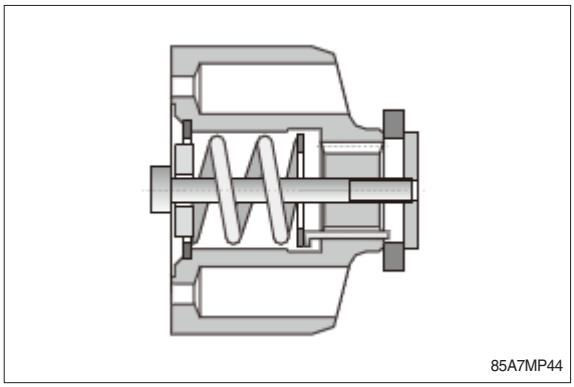
- Size 28, 45, 60
  19.4±2.0 kgf · m (140+14.5 lbf · ft)
- Size 85
  32.6±2.0 kgf · m (236+14.5 lbf · ft)



(13) Fit pressure pins using an assembly aid.

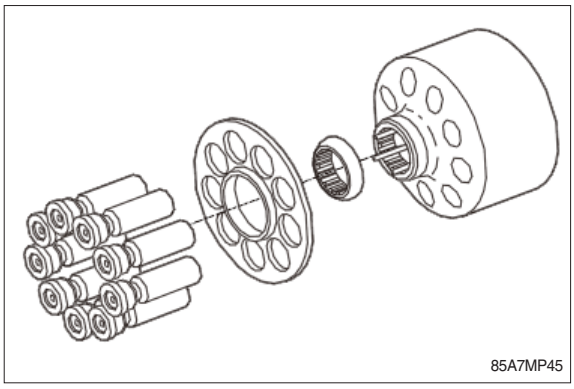


(14) Pre-tension the spring using a suitable device.

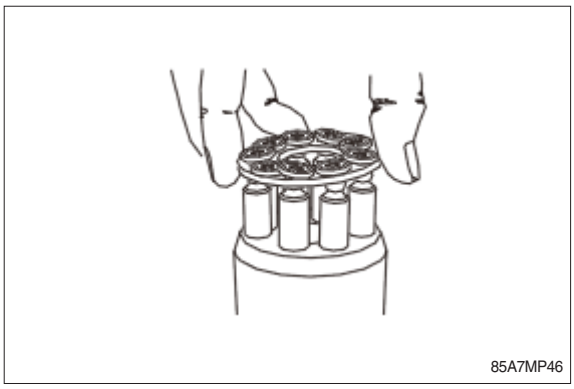


(15) Assemble piston with retaining plate.

※ Oil piston and slipper pad.



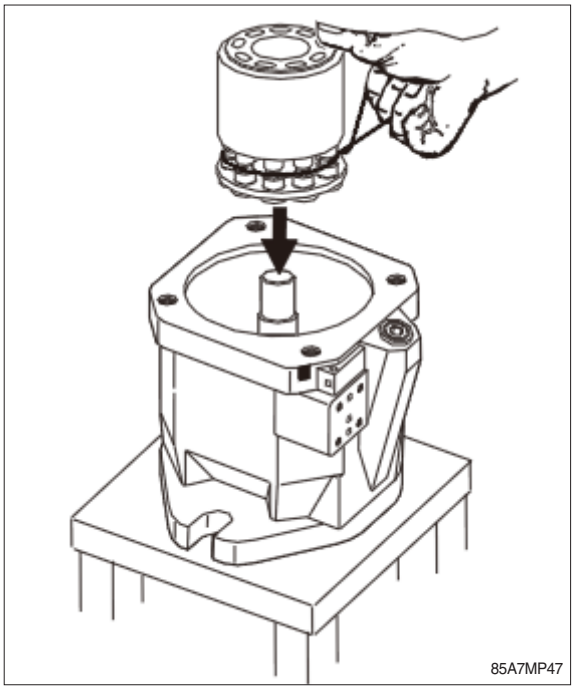
(16) Assemble piston with retaining plate.



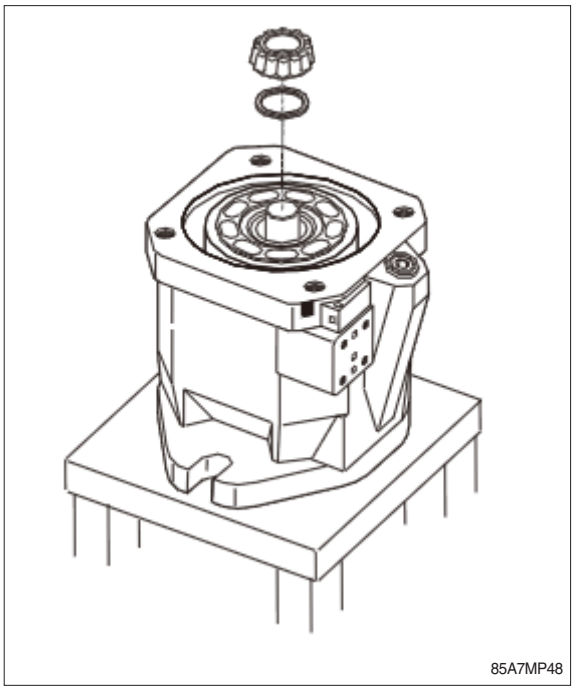
(17) Fit rotary group

※ Assembly aid

Hold the pistons by using an O-ring.



(18) Assemble bearing and adjustment shim to shaft.



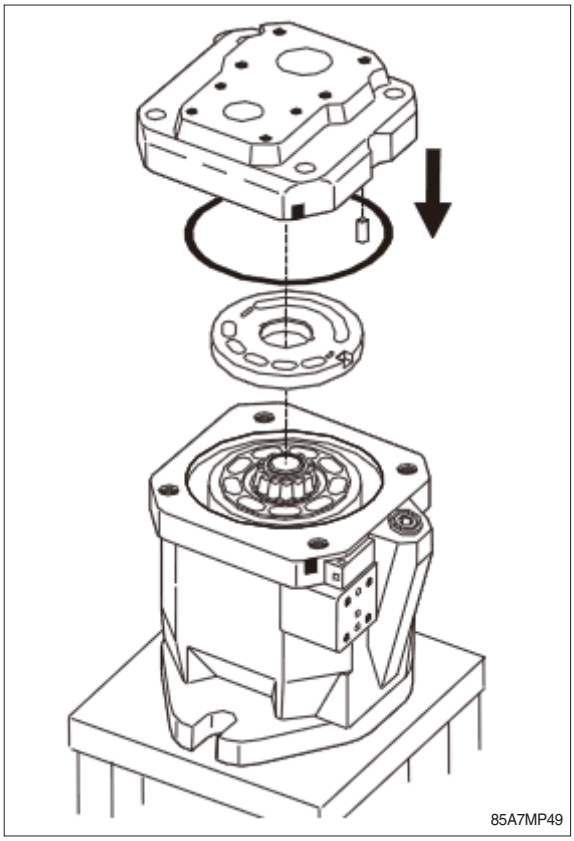
(19) Fit O-ring.

※ Fix with grease.

(20) Fit control plate.

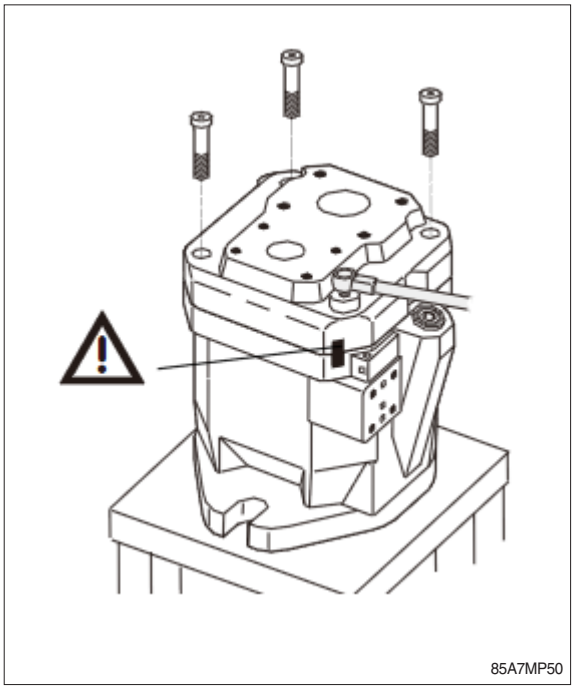
※ Fix with grease.

※ Check correct position to pin.

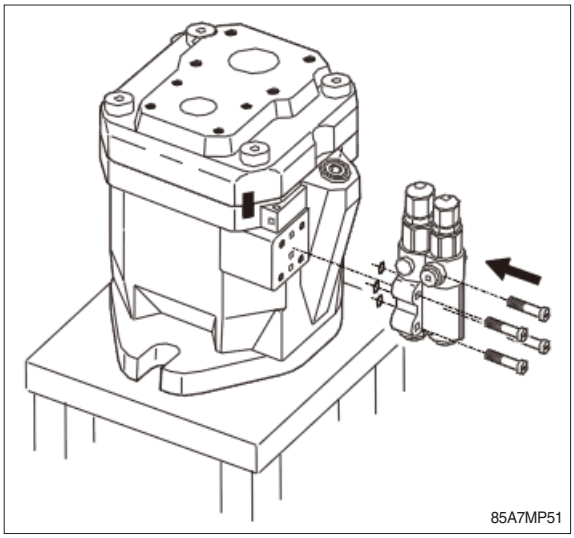


(21) Assemble connection plate.

※ Check the correct position to housing.

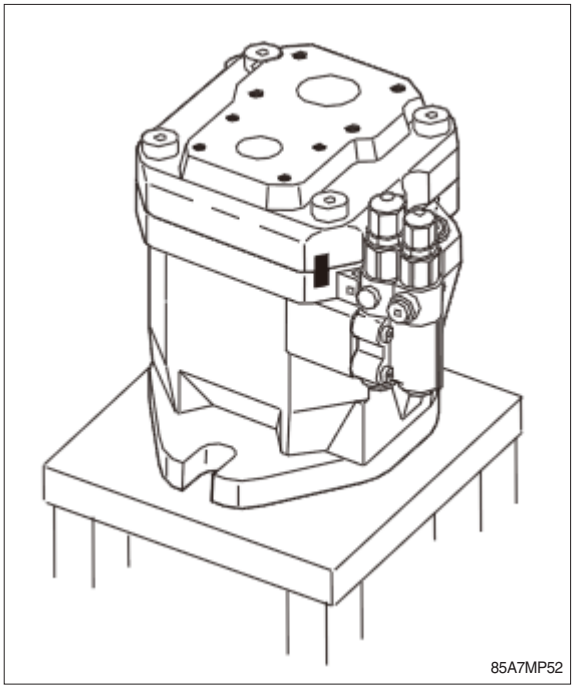


(22) Assemble control valve.



(23) Final pump assembly

※ Double check of the housing signs.



1) STARTING, MAXIMAL PRESSURE SET UP

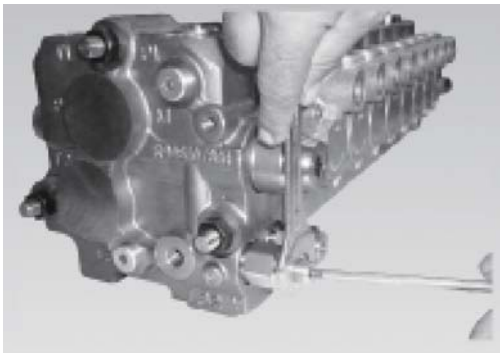
(1) Break the locking cover with a pair of pliers.
Decalibrate the LS pressure relief valve (19 mm open end spanner on counternut ; 5 mm socket wrench) before starting the machine.
Maintain one of the control block spool valve in action before the linked hydraulic receiver is at the end of stroke.

H940AC6SE01

※ On the spool valve, the value of the secondary valve pressure must be greater than that of the LS pressure relief valve to adjust.

(2) Adjust the maximum pressure measured in M using the LS pressure relief valve (19 mm open end spanner on counternut ; 5 mm socket wrench.

Tighten the counternut of the adjusting screw to the torque :
- 2.55±0.25 kgf · m (18.4±1.8 lbf·ft)



H940AC6SE02

Protect the setting by putting a new locking cover.
Fit together two half covers.

2) LS PRESSURE RELIEF VALVE REPLACEMENT

The control block does not need to be removed from the machine to perform this operation.

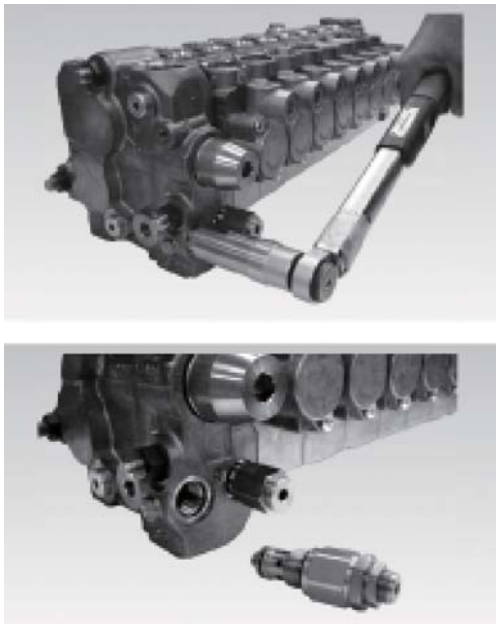
⚠ Place all of the machine's actuators connected to the control block in neutral position. Release stored pressure by operating all the spools.

(1) On the inlet element, unscrew the LS pressure relief valve (24 mm open end spanner).

※ Reassembly
Install the LS pressure relief valve on the inlet element.
- Torque :
  4.59±0.46 kgf · m (33.2±3.3 lbf·ft)

Set the LS pressure relief valve to the specified value

Fit a new appropriate locking cover



H940AC6SE03

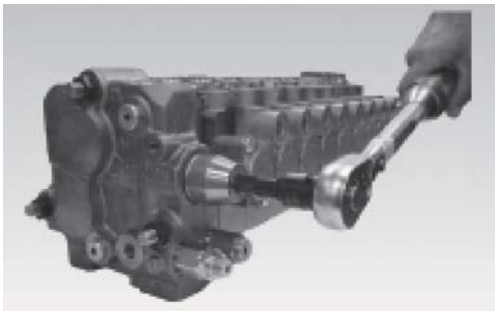
3) REGULATING UNIT REPLACEMENT

(1) Unscrew the plug (12 mm socket wrench).

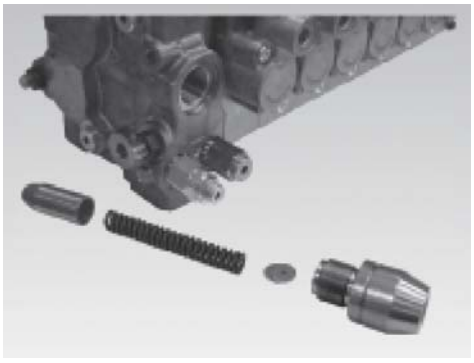
(2) Remove using a magnet to extact it from its bore : shims, spring, piston.

※ Clean parts to remove any attracted metal particle.
Do not use magnet for reassembly.

※ Reassembly
Reassemble parts in reverse order.
- Torque :
  10.2±1.02 kgf · m (73.8±7.38 lbf·ft)



H940AC6SE04



H940AC6SE05

4) FLOW REGULATOR REPLACEMENT

(1) Unscrew the flow regulator (22 mm open end spanner).

※ Reassembly
reassemble parts in reverse order.
- Torque :
2.04±0.20 kgf · m (14.8±1.48 lbf·ft)

H940AC6SE06

H940AC6SE07

5) PRESSURE COMPENSATOR REPLACEMENT

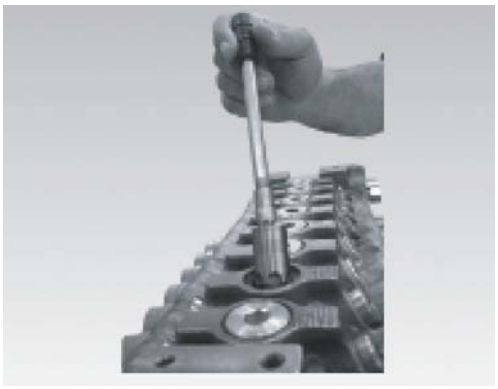
(1) Unscrew the compensator plug (12 mm socket wrench).

(2) Remove the compensator piston using a magnet to extract it from its bore.

※ Clean parts to remove any attracted metal particle.
Do not use magnet for reassembly.

※ Reassembly
reassemble parts in reverse order.
- Torque :
12.2±1.22 kgf · m (88.5±8.85 lbf·ft)

H940AC6SE10



H940AC6SE11

H940AC6SE12

6) CHECK VALVE REPLACEMENT

(1) Unscrew one of the check valves (6 mm socket wrench).

※ Reassembly
Install the check valve on the distribution element.
- Torque :
7.14±0.71 kgf · m (51.6±5.16 lbf·ft)

H940AC6SE13

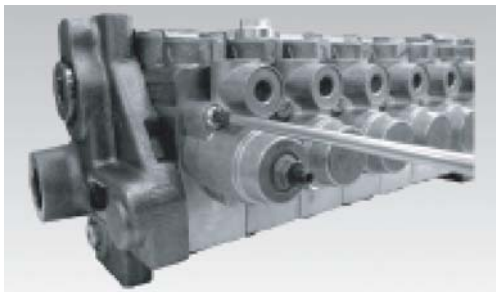
H940AC6SE14

7) REMOVAL OF THE HYDRAULIC COVER

(1) Remove the 2 mounting screws.

(2) Remove the cover and O-ring.

※ Reassembly
Replace the cover O-ring.
Reassemble parts in reverse order.
Torque for the 2 mounting screws.
- Torque :
0.61±0.06 kgf · m (4.43±0.44 lbf·ft)



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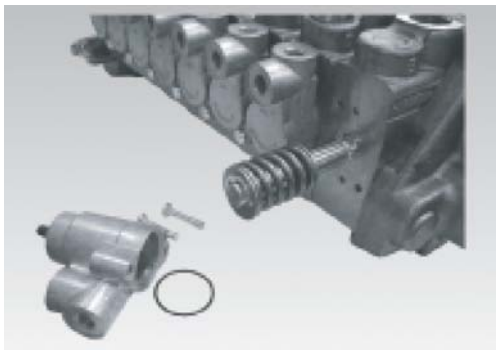


H940AC6SE16

8) COMPLET CONTROL BLOCK DISASSEMBLY/ASSEMBLY

(1) Remove the control block from the machine.
Remove the 3 nuts (19 mm ring wrench).

H940AC6SE18

(2) Remove the final element.
Separate the distribution elements.

H940AC6SE19

(3) Reassembly
- Replace the O-rings between distribution elements, initial element and final element.
- Check the cleanliness of the element faces.
- In case of tie rods reassembly, check their orientation : the shortest thread goes into the final element.
- Torque for the 3 tie rods :
  6.12±0.25 kgf · m (44.3±4.43 lbf·ft)
- Reassemble elements in reverse order
  Place the control block horizontally on an even support area to tight the nuts.
  Torque for the 3 nuts :
  6.12±0.25 kgf · m (44.3±4.43 lbf·ft)

H940AC6SE20

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.

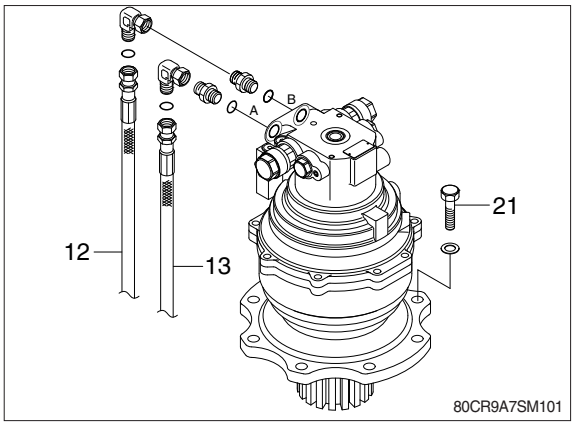
② Pour in hydraulic oil until it overflows from the port.

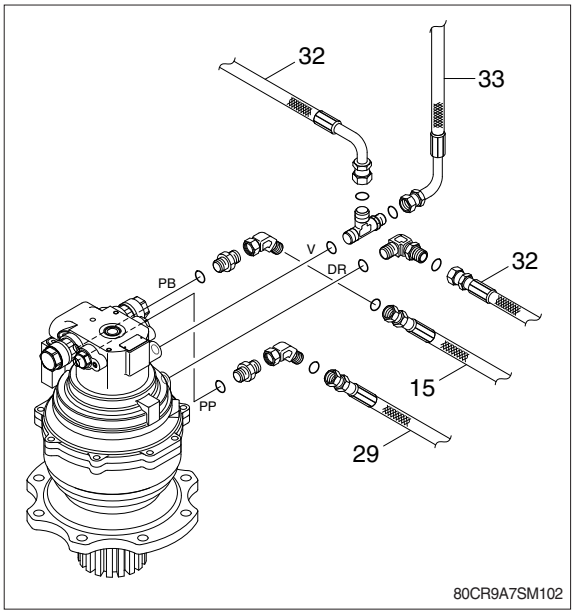
③ Tighten plug lightly.

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

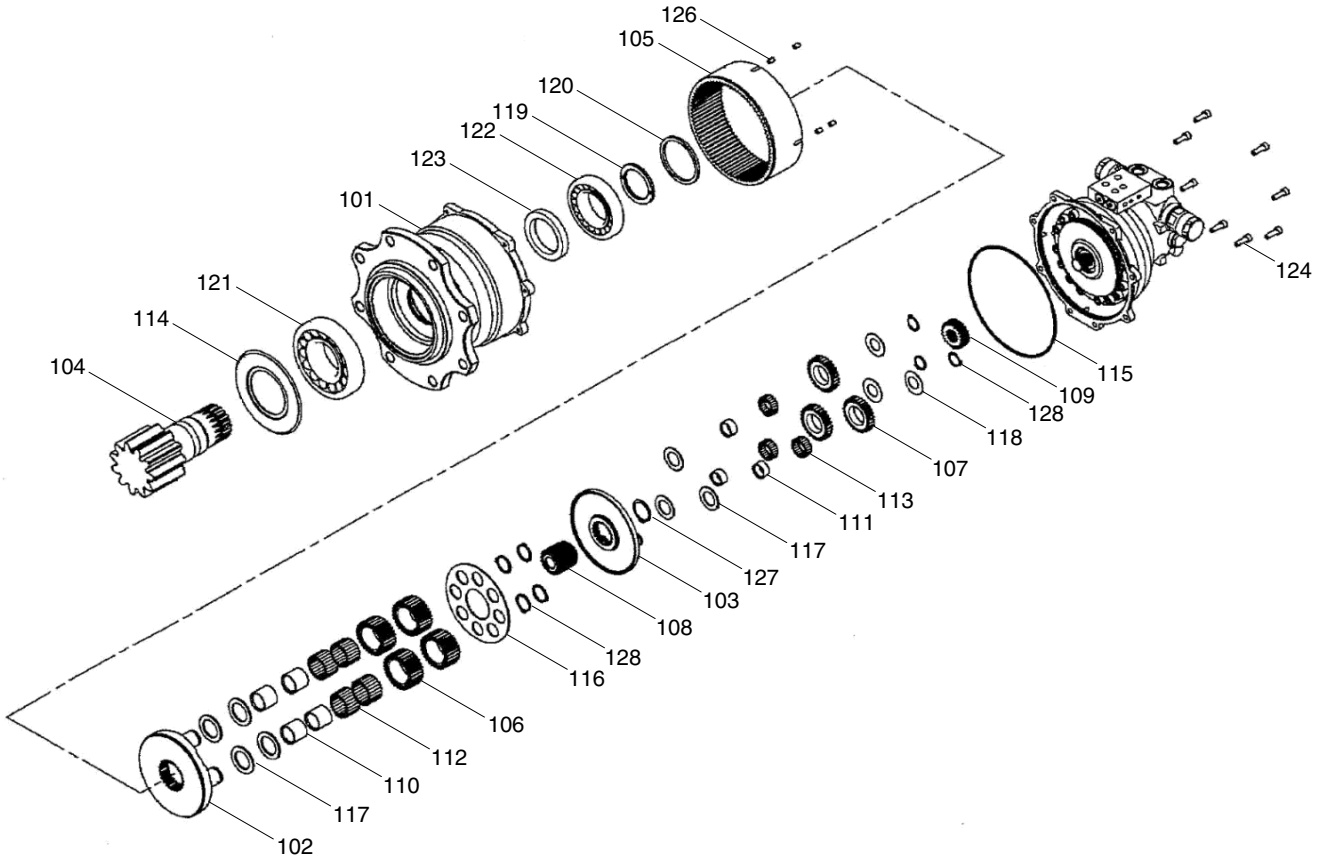
⑤ Tighten plug fully.

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





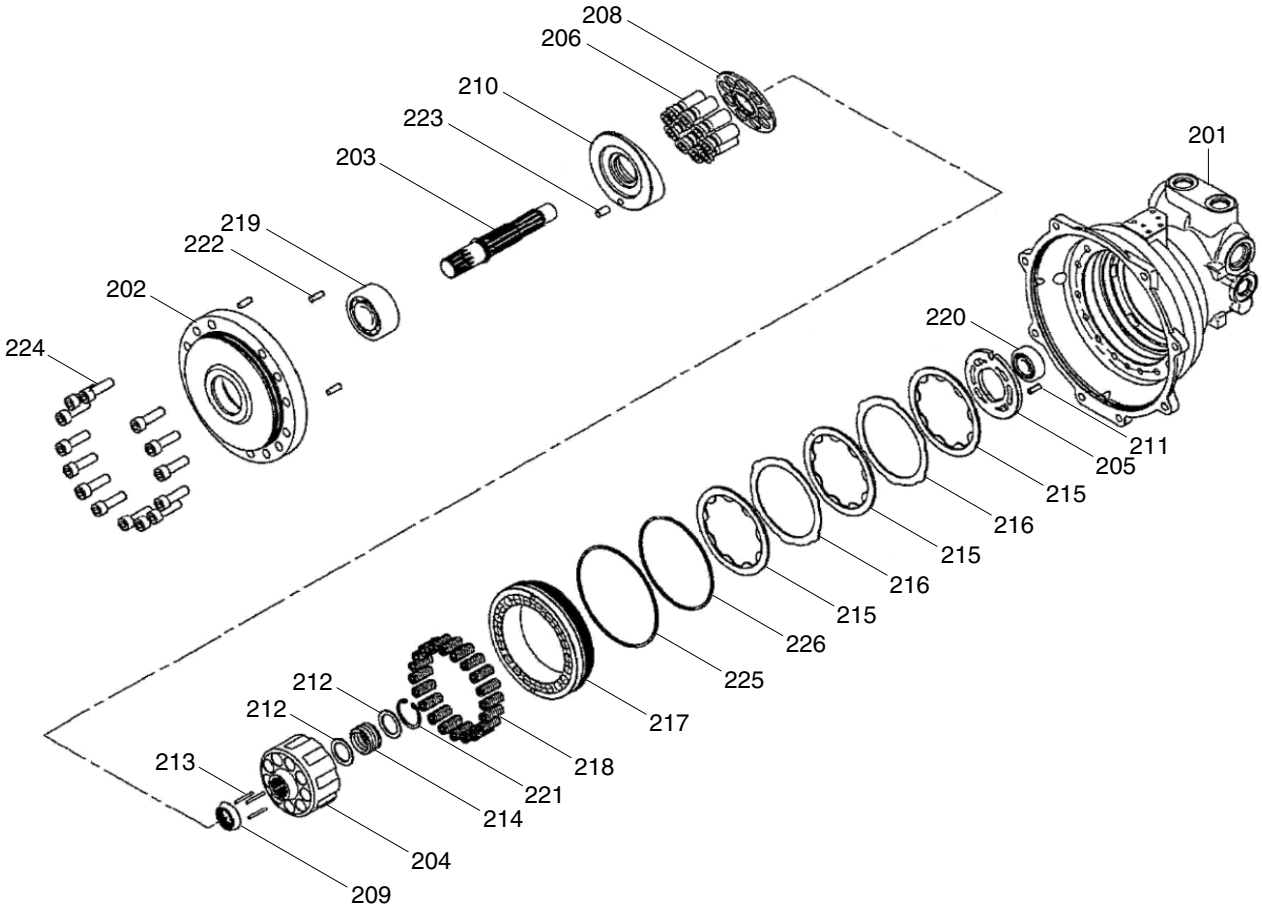
2) COMPONENTS (1/3)



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

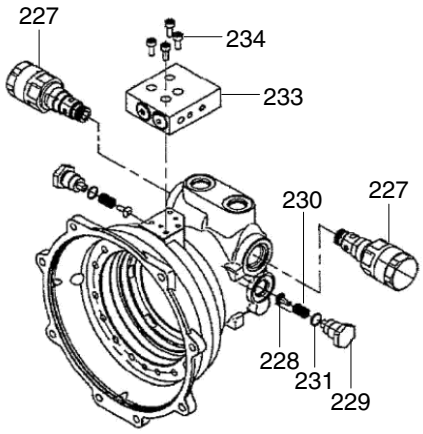
COMPONENTS (2/3)



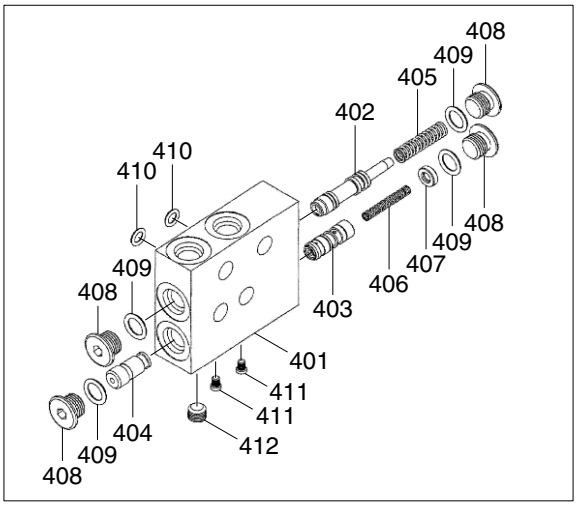
80CR9A2SM16

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		

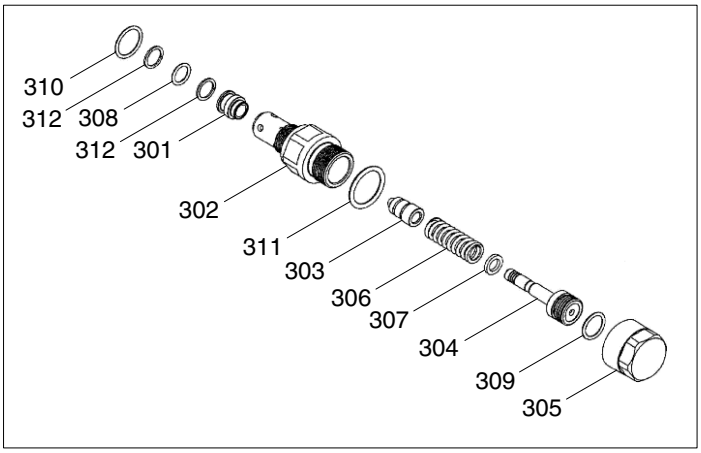
COMPONENTS (3/3)



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	Ø35 for hole Ø30 for shaft Ø48 for shaft
15	Hammer	-
16	Plastic hammer	-
17 18 19 20 21	Other	Grease (oil designated hydraulic oil) Wire brush Sand paper Anti-loose adhesive (three bond #1305)

3. DISASSEMBLY

1) HYDRAULIC MOTOR

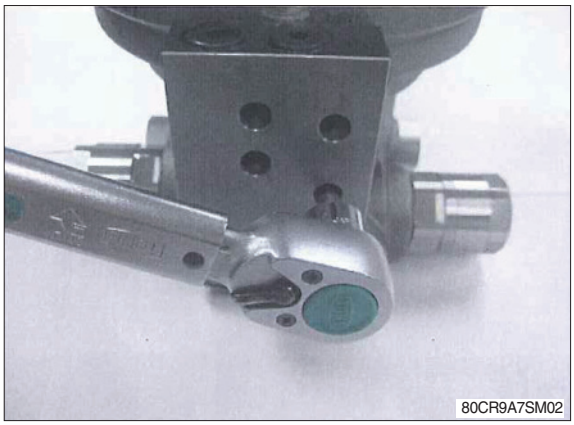
(1) Loose the hexagon socket head cap bolts (124), and take out the hydraulic motor assembly from the reduction gear body.

· Tools required :
Hexagon bar wrench : 6 ㎜

※ When taking out the hydraulic motor assembly from the reduction gear body, the drain port should be open.
When it is difficult to take out, insert the minus driver into the binding face to the body. If a part of the binding the surface becomes convex by the driver, take out the burr completely.

(2) Loose the hexagon socket head cap bolts (234), and take out the timer valve (233) from the hydraulic motor assembly.

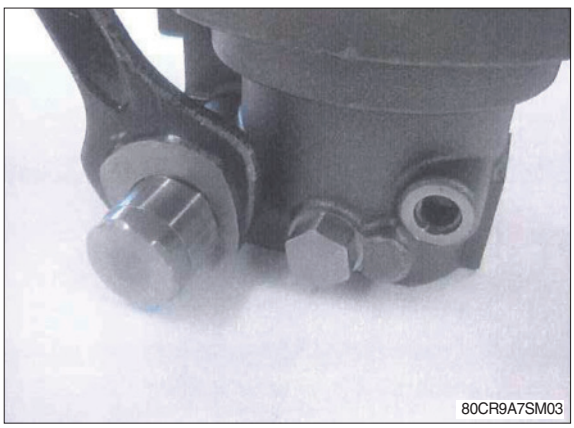
· Tools required :
Hexagon bar wrench : 5 ㎜



(3) Take out the relief valve assembly (227).

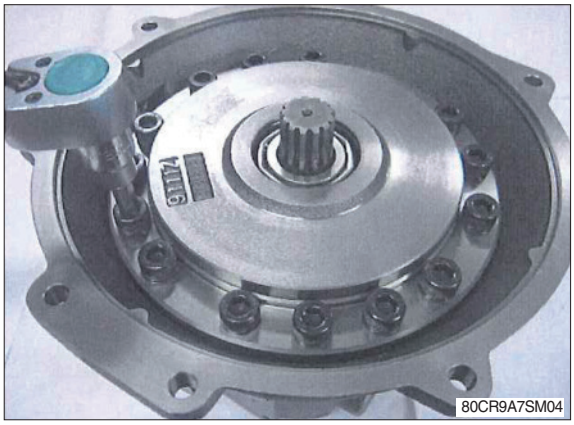
· Tools required :
Spanner : 41 ㎜

※ Do not disassemble the relief valve assembly, unless it is necessary.



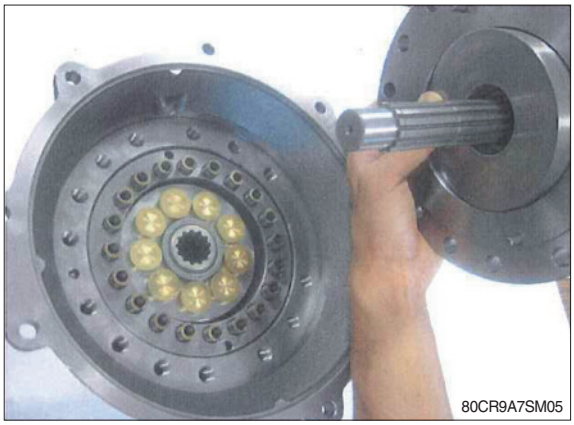
(4) Loose the hexagon socket head cap bolts (224), and take out it.

· Tools required :
Hexagon bar wrench : 8 ㎜



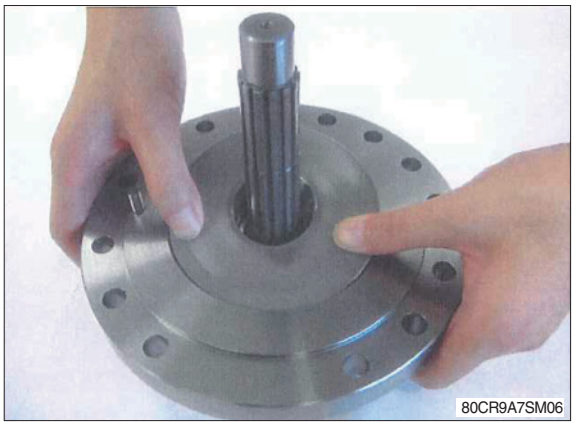
(5) Take out the plate S (202).

※ 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.

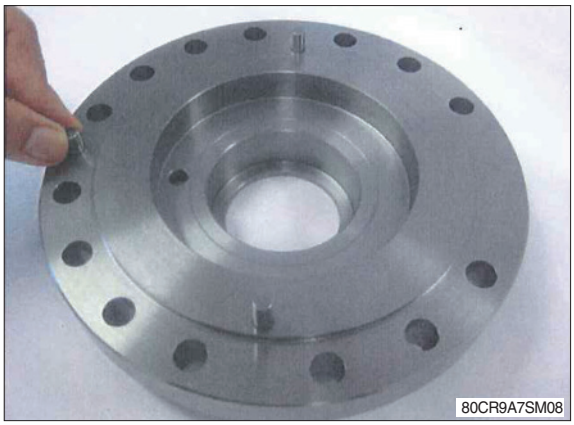


(7) Take out the spring B (218) from the brake piston (217).

· Spring B (218) : 20 pcs

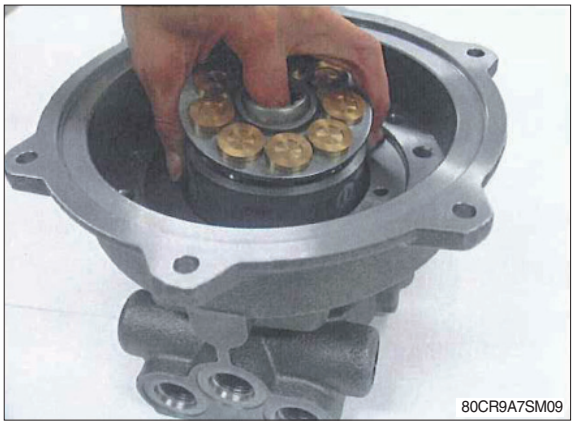
(8) Take out the parallel pin (222) from the plate S (202).

· Parallel pin (222) : 3 pcs

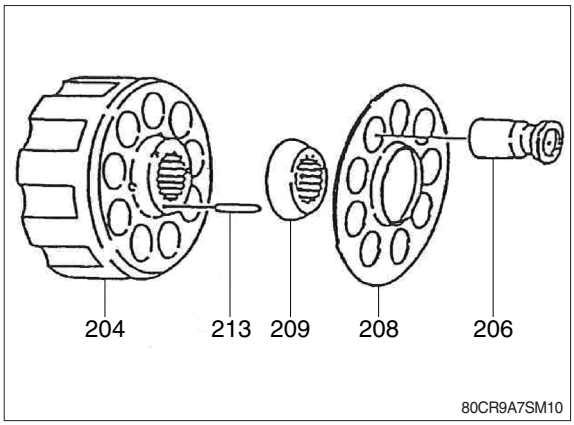


(9) Take out the cylinder barrel kit.

※ 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.

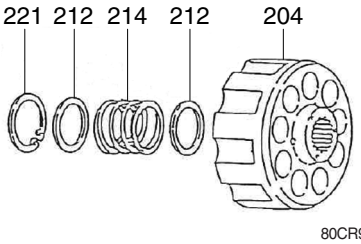


(10) Take out the piston assemblies (206), the shoe (208), the barrel holder (209) and the pin (213).



(11) Take out the snap ring (221), the retainer (212) and the spring C (214).

· Tools required :
Snap ring plier : Ø35 for hole



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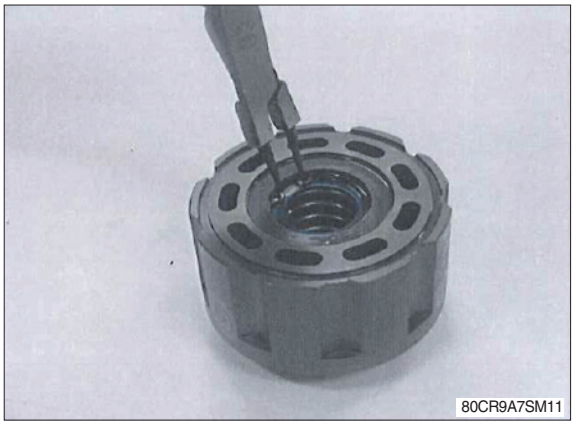
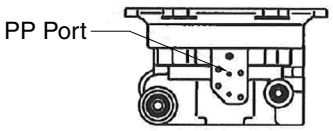
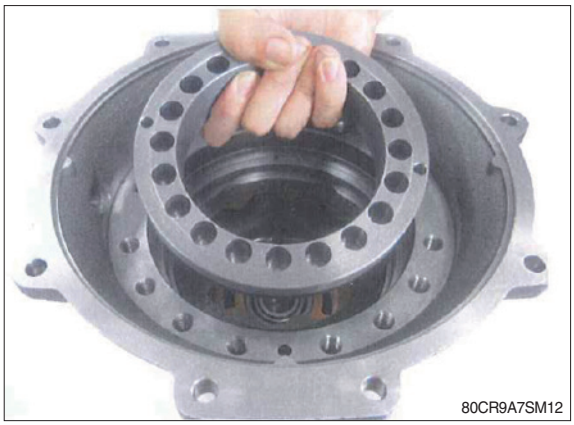


(12) Take out the brake piston (217) and the O-ring (225, 226) from body H (201).

※ Blow in air from PP port little by little to remove brake piston.
Pay attention not to come off it suddenly.

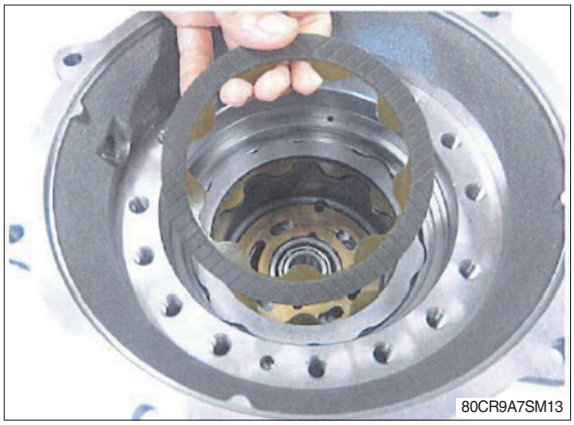


80CR9A7SM12-1



80CR9A7SM12

(13) Take out the disk plate (215), and the steel plate (216).
- Disk plate (215) : 3 pcs
- Steel plate (216) : 2 pcs



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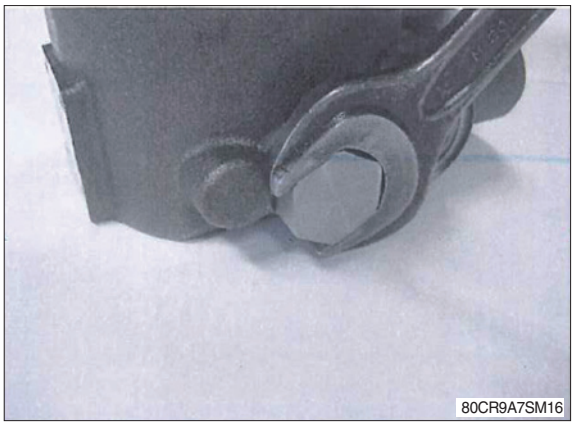
80CR9A7SM14

(14) Take out the valve plate (205).

80CR9A7SM15

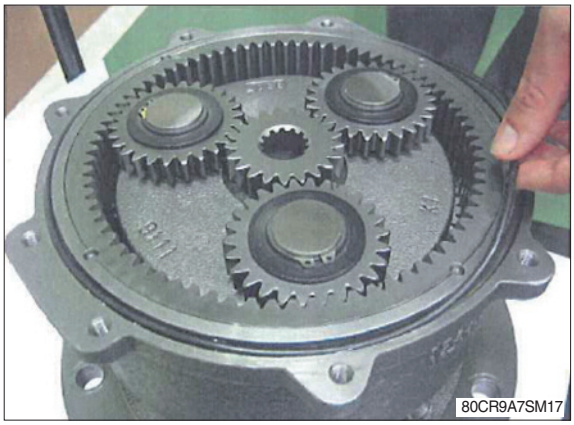
(15) Loose the plug (229), and take out the check valve (228) and the spring (230). (2 locations)

· Tools required :
Spanner : 27 mm

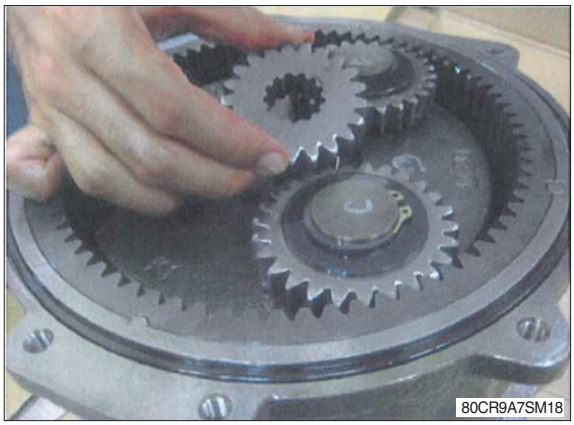


2) REDUCTION GEAR

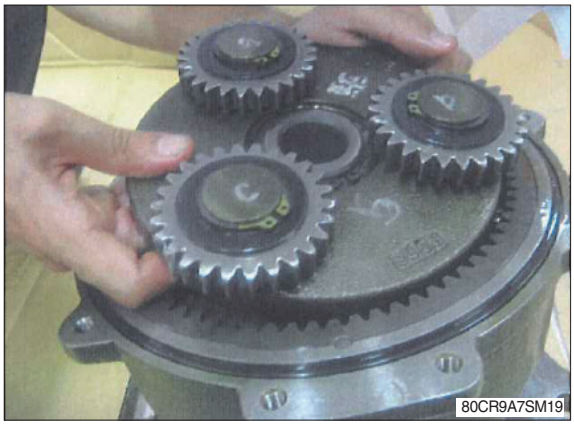
(1) Take out the O-ring (115).



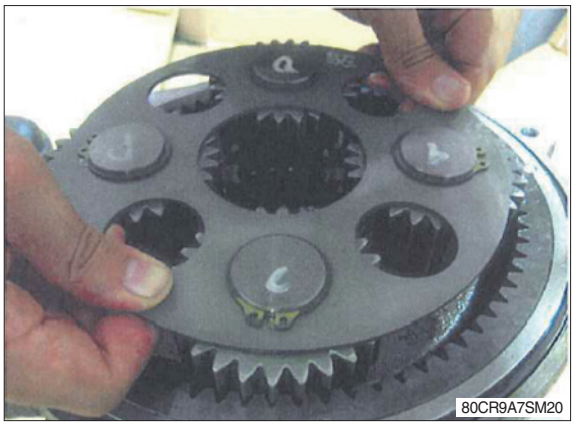
(2) Take out the S2 gear (109).



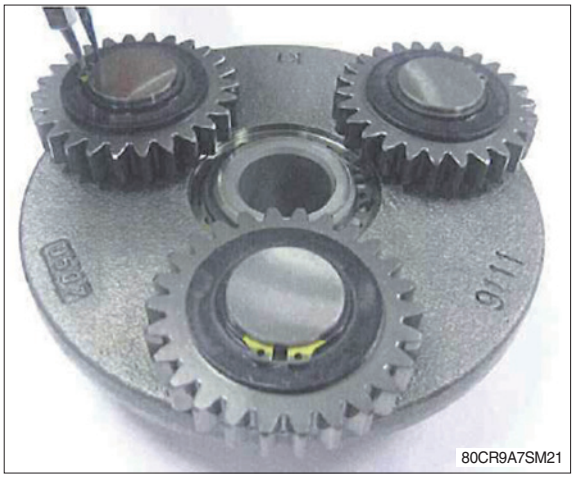
(3) Take out the carrier 2 kit.



(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).

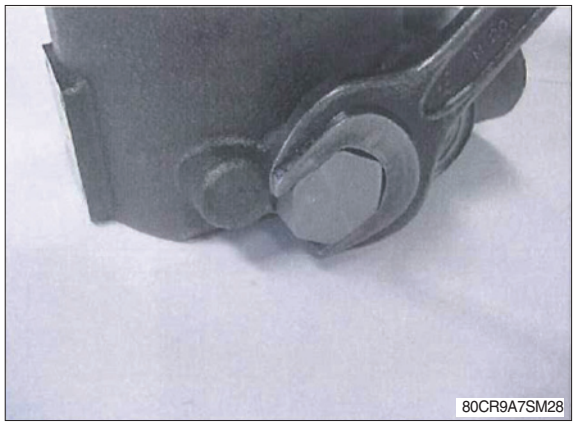

80CR9A7SM27

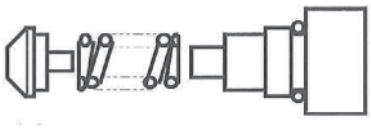
(2) Insert the 2 check valves (228) (1 pc/side), springs (230) (1pc/side) and plug (229) (1pc/side) with O-ring (231) in that order into the body H (201). (2 locations)

· Tools required :
Spanner : 27 mm
Torque wrench

※ Apply grease slightly to the O-ring and assemble to pay attention not biting the seals.

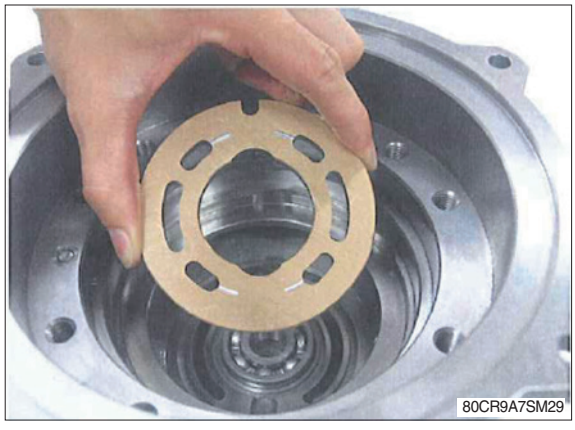
· Plug tightening torque :
12±0.6 kgf · m (86.8±4.34 lbf · ft)

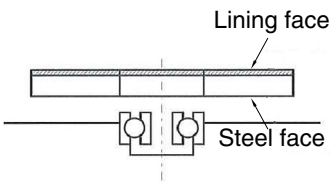

80CR9A7SM28


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



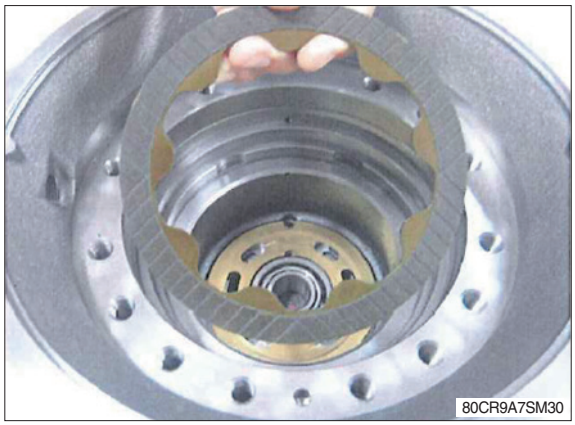
80CR9A7SM29-1

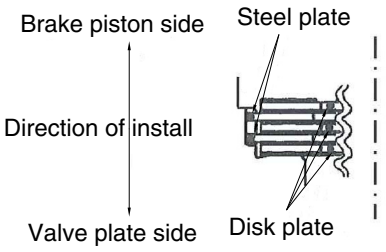
(4) Assemble the disk plate (215) and steel plate (216).

※ Number of parts count on installing
- Disc plate : three
- Steel plate : two

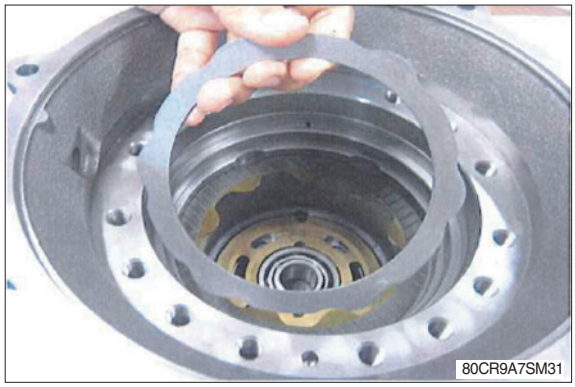
※ Please assemble exact number of parts and exact order. (refer the below drawing)

※ Please install disc plate ditch wih accuracy in order to install cylinder barrel assy into it on (9), see the page 7-81.





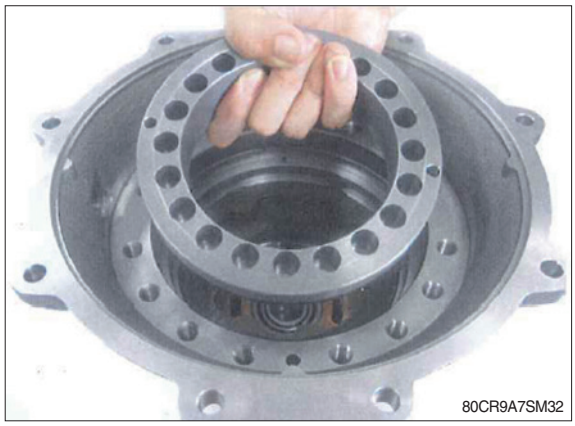
80CR9A7SM31-1

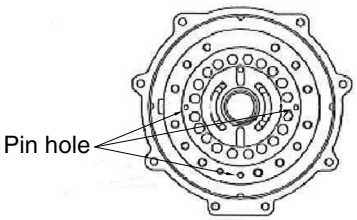


(5) Make the brake piston assembly which placed O-rings (225, 226) on brake piston (217), and place it onto the body H (201).

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.



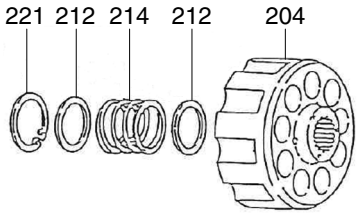


80CR9A7SM32-1

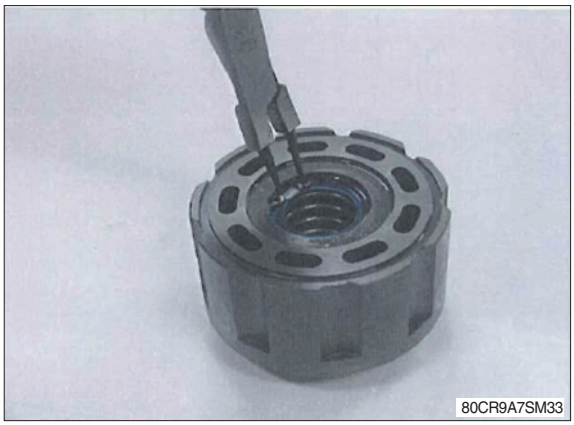
(6) Place the retainer (212), spring C (214) and retainer (212) in that order into the cylinder barrel (204), and then secure them with the snap ring (221).

· Tools required :

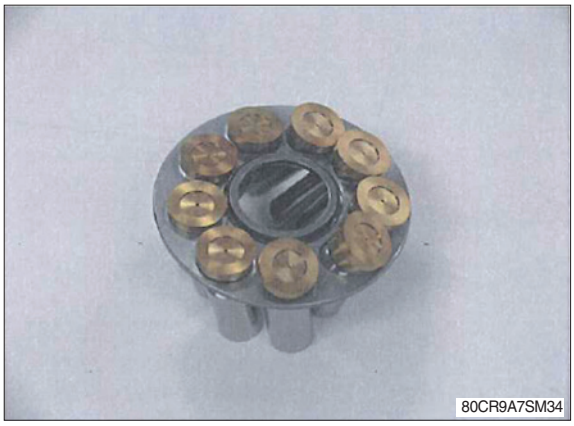
Snap ring plier : Ø28 for hole



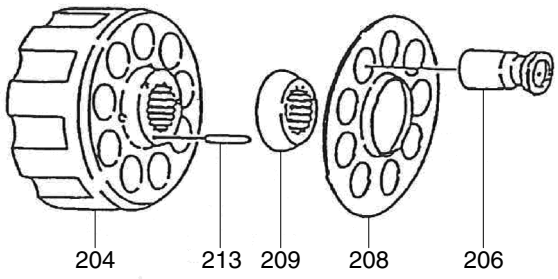
80CR9A7SM11-1



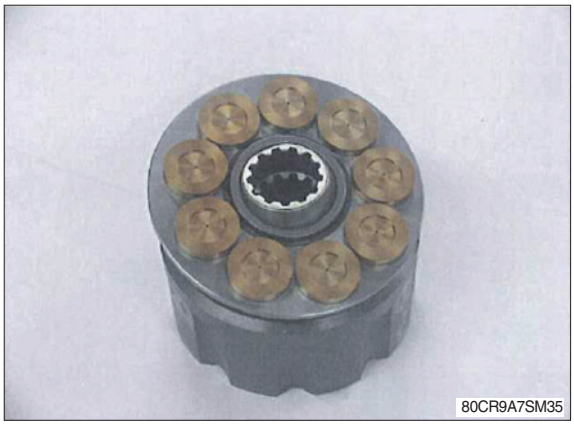
(7) Make the shoe holder assembly which has the 9 piston assemblies (206) placed on the shoe holder (208).



(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.



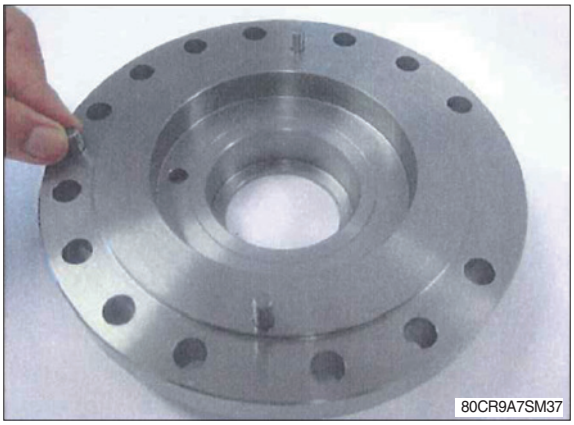
80CR9A7SM10



(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

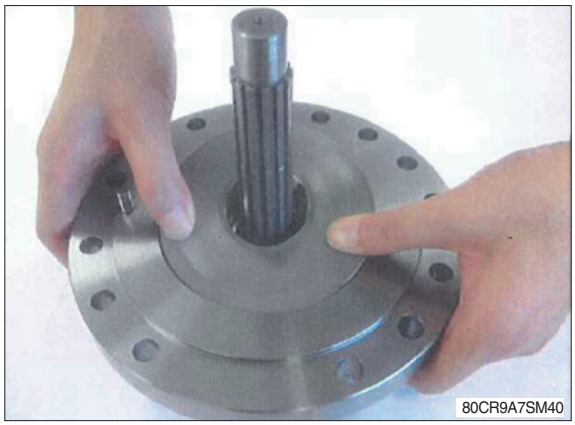


(11) Insert the spring B (218) into the brake piston (217).

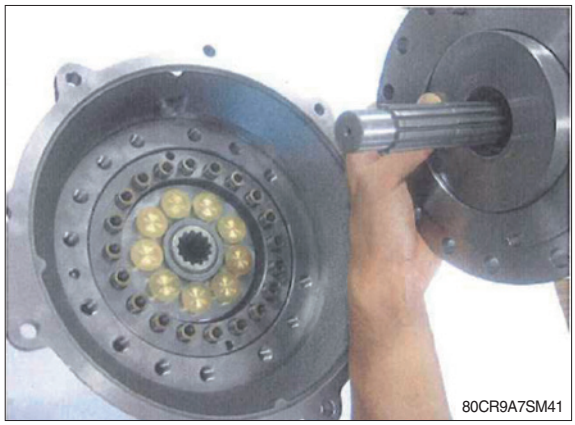
· Spring B (218) : 20 pcs

(12) Press-fit bearing (219) with shaft (203).

(13) Place the shaft kit and the swash plate (210) into the plate S (202).



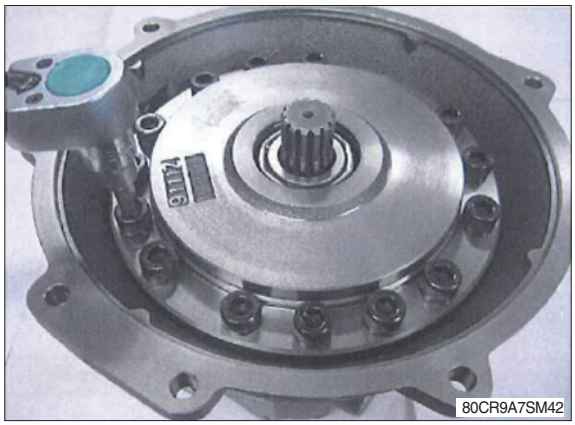
(14) Join the body H (201) and the plate S (202).



(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)

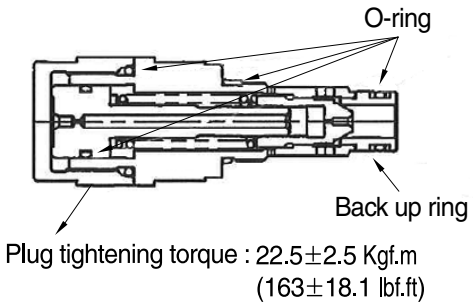


(16) Screw up the relief valve assembly.
(both side)

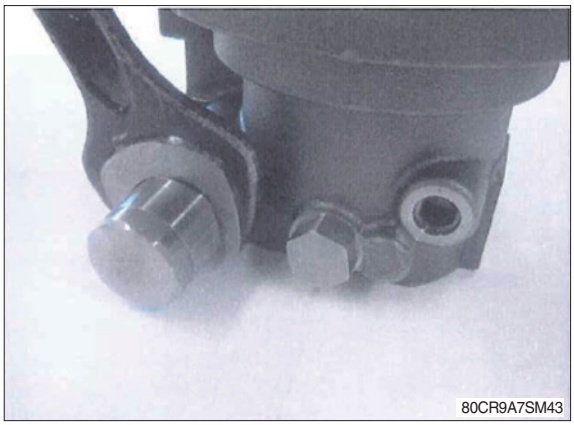
· Tools required :
Spanner : 41 mm
Torque wrench

· 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

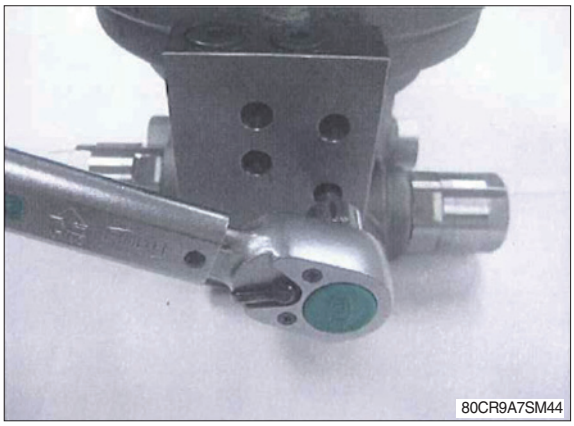


80CR9A7SM43

(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 : Ø30 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

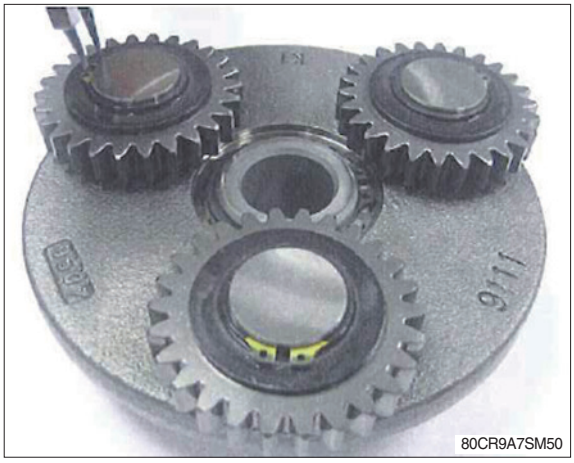
(5) Place the S1 gear (108) onto the carrer 2 (103) to make up a carrier 2 kit.
· Tools required :
Snap ring plier : Ø48 for shaft

※ 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

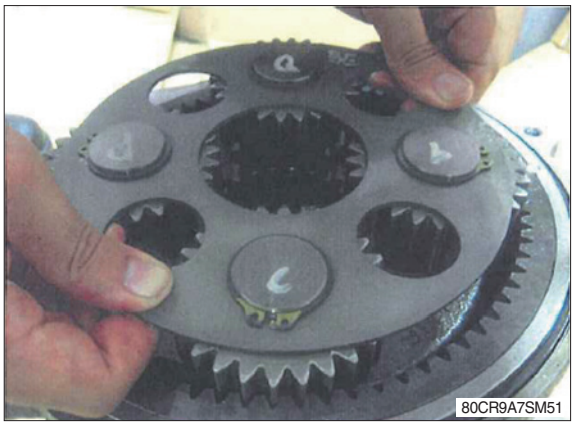
(6) Place the b2 gears (107) (1 pc/pin), the 72 needle (113) (24 pcs/pin), and the snap ring (128) in that order onto the pin of the carrier 2 (103). (3 locations)
· Tools required :
Snap ring plier : Ø30 for shaft

※ 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.

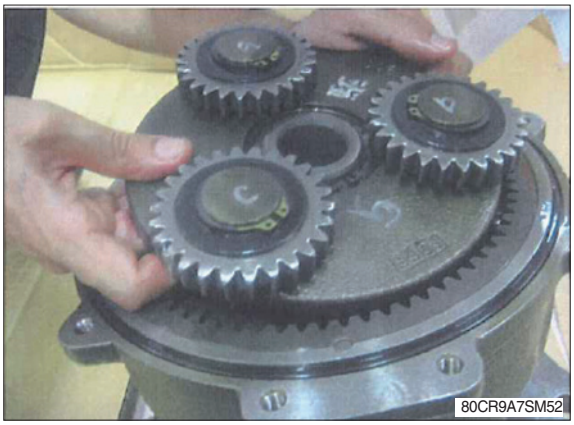


80CR9A7SM50

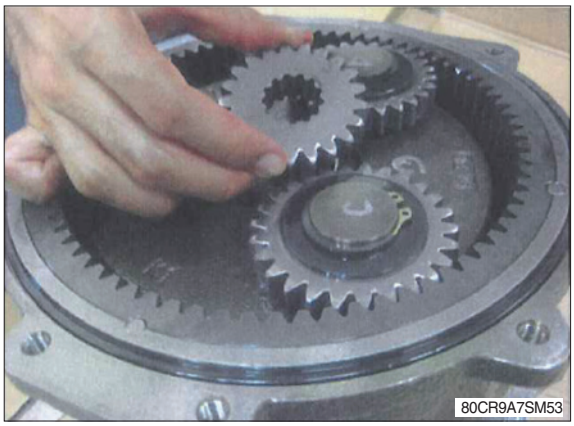
(7) Place the carrier 1 assembly into the body (101) align spline of carrier to the pinion shaft (104).



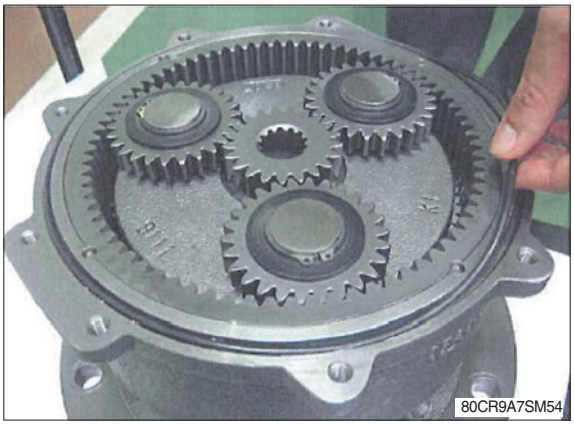
(8) Place the carrier 2 assembly into the body (101) align spline of S1 gear (108) to the b1 gear (106).



(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.

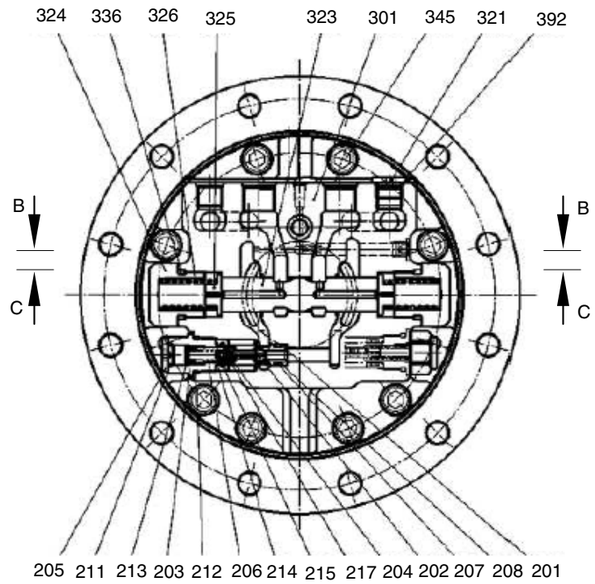
(12) Join the hydraulic motor and the body, and then bolt them together with the hexagon socket head cap bolts (124).

· Tools required :
Hexagon bar wrench : 6 mm
Torque wrench

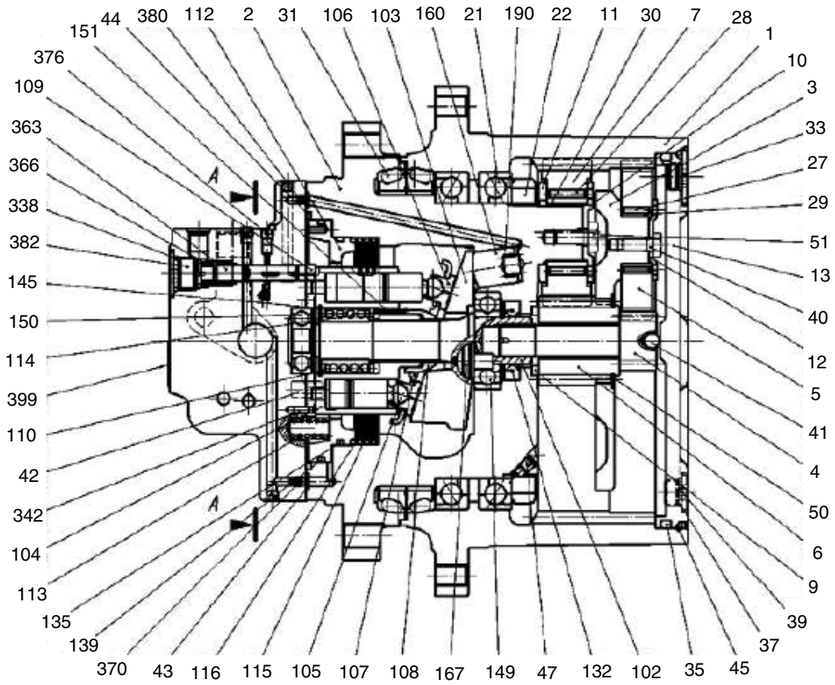
※ Align the shaft of the motor to the S2 gear.
Apply anti-loose adhesive to the screws.

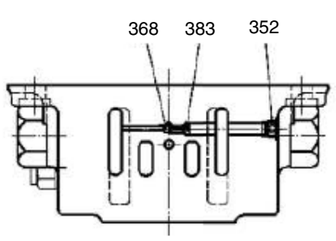
· Plug tightening torque :
3±0.3 kgf · m (21.7±2.17 lbf · ft)

1. STRUCTURE

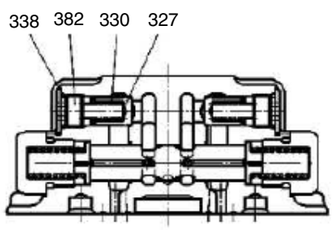


SECTION A-A





SECTION B-B



SECTION C-C

85A2TM02

1	Hub	29	Inner ring	104	Cylinder block	139	O-ring	211	O-ring	324	Plug
2	Spindle	30	Inner ring	102	Shaft	145	Snap ring for hole	212	O-ring	325	Spring retainer
3	Carrier	31	Floating seal	103	Swash plate	149	Ball bearing	213	Shim	327	Valve
4	Sun gear 1	33	Plug	105	Piston	150	Ball bearing	214	Piston	328	Spring
5	Planetary gear 1	35	O-ring	106	Shoe	151	Roller	215	O-ring	330	Spring
6	Sun gear 2	37	O-ring	107	Retainer plate	160	Piston	217	Orifice	336	O-ring
7	Planetary gear 2	39	Plug	108	Thrust ball	167	Pivot	301	Rear flange	338	O-ring
9	Thrust collar 1	40	Hex head bolt	109	Timing plate	170	Spring	323	Spool	342	Parallel pin
10	Thrust washer 1	41	Steel ball	110	Washer	201	Valve seat	352	Hex socket plug	345	Hex socket bolt
11	Thrust washer 2	42	Parallel pin	112	Piston	202	Valve	368	Steel ball	363	Spool
12	Thrust washer 3	43	O-ring	113	Spring	203	Sleeve	375	Hex socket plug	366	Spring
13	Cover	44	O-ring	114	Spring	204	Collar	379	Filter	382	Plug
21	Bell bearing	45	Ring	115	Friction plate	205	Plug	380	Orifice	392	O-ring
22	Ring nut	47	Hex socket set screw	116	Mating plate	206	Spring	383	Plug		
27	Needle roller bearing	50	Retaining ring for shaft	132	Oil seal	207	O-ring	390	Name plate		
28	Needle roller bearing	51	Hex head bolt	135	O-ring	208	Back-up ring	321	Plug		

2. DISASSEMBLY

1) PREPARATION

Prepare for the following items before disassembling.

(1) Workbench preparationHowever, disassembly procedure is not affected even if the disassembled product are different from this manual.

① Prepare a sturdy workbench with which the internal parts of a traveling unit can be disassembled or assembled, is wide enough to place parts so they do not move or fall off from the bench while working.

② Spread a rubber or vinyl sheet on the workbench.

(2) Preparation of tools and facilities

2) GENERAL PRECAUTIONS

⚠ Internal parts are covered with hydraulic fluid and gear oil during disassembly and are slippery.If a part slips out from your hand and falls, it could result in bodily injury or could damage the part. Be very careful for handling.

⚠ If combustibles such as white kerosene are used for washing parts, be careful for handling. These combustibles are easily ignited, and could result in fire or injury.

(1) Before disassembling, perform inspections and confirm clearly the indication of no abnormality, which may be occurring, and work according to the disassembly procedure.

(2) All parts are manufactured precisely. Be careful for handling. Avoid rough contact or drop of parts.

(3) Do not bang or remove parts forcefully. Such act could cause burs or damages on the parts, which leads to failure of assembling or inferior performance.

(4) If you leave disassembled parts or with partially disassembling, rust could develop on the parts due to moisture or dirt. If you have to interrupt the work before completion, take measures to protect against rust or dust.

(5) Put a counter mark on mating faces of parts when disassembling.

(6) Tidy removed parts when disassembling so as not to damage or lose the parts while working.

(7) As a rule, once any type of seal are disassembled, they should be replaced with new ones even if they show no signs of damage. New parts shall be provided prior to disassembling

(8) The photographs and drawings contained in this manual are of representative models. However, disassembly procedure is not affected even if the disassembled product are different from this manual.

3) DISASSEMBLY PROCEDURE

(1) Washing the traveling unit

① Fasten eye bolts into the spindle (2).

※ Tighten the two eyebolts symmetrically into the screw holes for mounting the spindle.

② Hook the wire in the eyebolts, hoist the traveling unit with a crane and carry to the washing tank.

85A7TM01

③ Wash each part of the traveling unit with a brush.

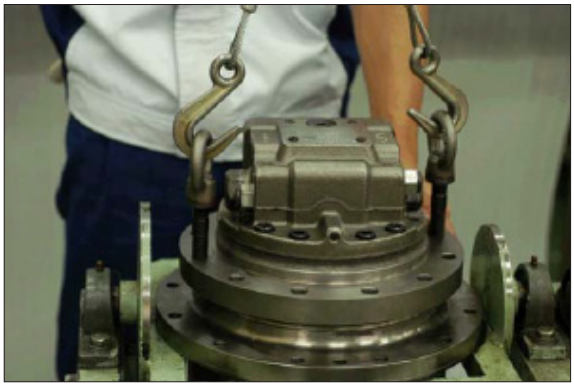
※ The clearance between the hub (1) and the spindle (2) (floating seal mounting section) is clogged up with soil and mud. Be sure to clean these portions with particular care.

85A7TM02

(2) Traveling unit installation

① Hoist the traveling unit and put it to the reversing device workbench like the left picture.

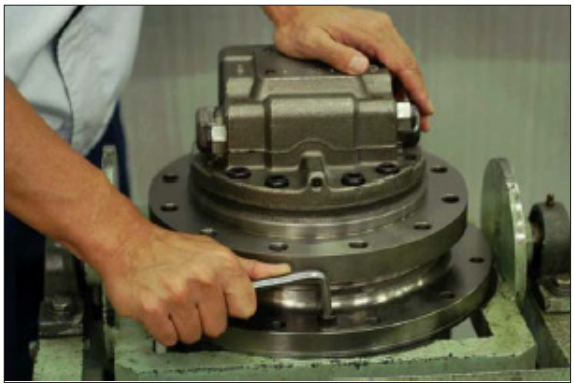
※ Match the screw holes of the spindle (2) to the screw holes of the reversing device and carefully insert the traveling unit to the installation area on the reversing device.



85A7TM03

② Mount the traveling unit into the reversing device so that the two hexagon socket bolts are positioned symmetrically.

⚠ Tighten the hexagon socket bolts completely. If not completely tightened, the traveling unit could fall off the reversing device, causing injury when the reversing device plate is turned.



85A7TM04

(3) Lubricating oil extraction

※ If disassembling the rear flange only, proceed to the item (8) of page 19.

① Turn the reversing device plate so that the reduction gear oil drain port is at upward.

② Loosen and remove the plugs (39), (33).

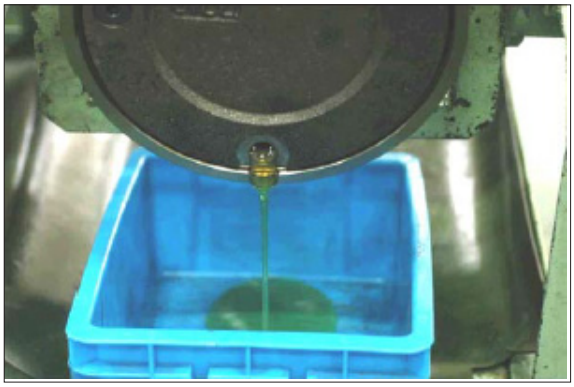
③ Turn the reversing device plate to remove the gear oil. (The drain port shall be at downward.)

85A7TM05

※ Prepare a container that can fully collect the gear oil discharged. (The oil volume inside the reduction gear portion is about 1.1 liters.)

④ Remove the O-rings (37) from the plugs (33), (39).

※ Do not reuse the O-rings (37).



85A7TM06

(4) Cover removal

① Turn the reversing device plate so that the reduction gear oil drain port is upward.

② Remove the ring (45) using the steel rod (Ⅰ).

③ Tighten two inside bolts of the cover removal jig into screw holes for the plug (33) and (39).

④ Put blocks under two outside bolts of the cover removal jig and tighten slowly equally them to remove it.

85A7TM07

※ When it is hard to remove the cover (13) because of resistance of the O-ring (35), lift it up while lightly and equally tapping the outer rim of the cover by a plastic hammer.

⑤ Remove the O-ring (35) from the cover (13).

※ Do not reuse the O-ring (35).

85A7TM08

(5) Sun gear 1 removal

① Remove the sun gear 1 (4).

② Remove the steel ball (41) from the sun gear 1 (4).

85A7TM09

(6) Carrier assy removal

① Remove the carrier assy from the hub (1).

※ The thrust collar 1 (9) may be pulled out together when pulling the carrier assy.

※ Grasp the planetary gears 1 (5) and remove slowly and vertically them against the axis of the pillars of carrier assy, otherwise the planetary gears 1 (5) might damage inner tooth of the hub (1) by the edge of them.

※ Be careful not to drop the carrier assy because it slips easily with lubricating oil.

85A7TM10

② Carrier assy disassembly

- Loosen the three hexagon head bolts (40) and remove them from the carrier (3).
- Remove the thrust washers 3 (12) (3 pcs), planetary gears 1 (5) (3 pcs), needle roller bearings (27) (3 pcs), and inner rings (29) (3 pcs) from the carrier (3).

85A7TM11

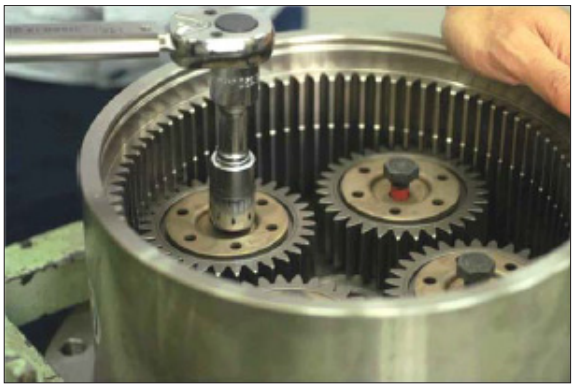
③ Remove the retaining ring (50) from the sun gear 2 (6).

④ Remove the sun gear 2 (6) from the carrier (3).

85A7TM12

(7) Planetary gear 2 removal

① Loosen the hexagon head bolts (51) (4 pcs) and remove them from the spindle (2).
② Remove the planetary gears 2 (7) (4 pcs), the needle roller bearings (28) (4 pcs) and the inner rings (30) (4 pcs).
③ Remove the thrust washers 2 (11) (4 pcs) from the spindle (2).
④ Remove the thrust collar 1 (9) from the spindle (2).



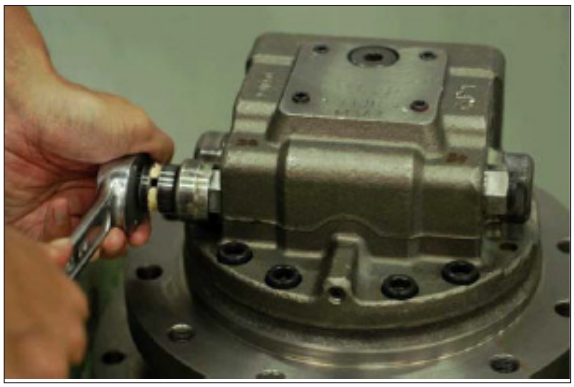
85A7TM13

※ Remove slowly and vertically the planetary gears 2 (7) (4 pcs) against the axis of them, otherwise planetary gears 2 (7) (4 pcs) might damage inner tooth of the hub (1) by the edge of them.
※ Be careful not to drop the planetary gears 2 (7) (4 pcs) because they slip easily with lubricating oil.

85A7TM14

(8) Rear flange removal

※ Turn the reversing device plate so that the rear flange (301) is upward.
These works are to make it easier to remove the plugs at the next work.
※ Do not loosen the bolts if the rear flange inside will not be disassembled.

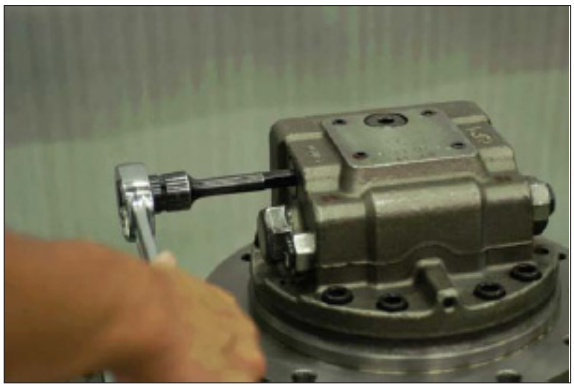


85A7TM15

② Temporarily loosen the sleeves (203) (2 pcs).
③ Temporarily loosen the plugs (324) (2 pcs).

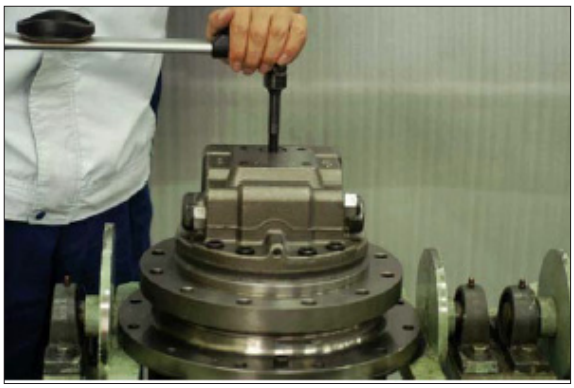
85A7TM16

④ Temporarily loosen the plugs (382) (2 pcs).



85A7TM17

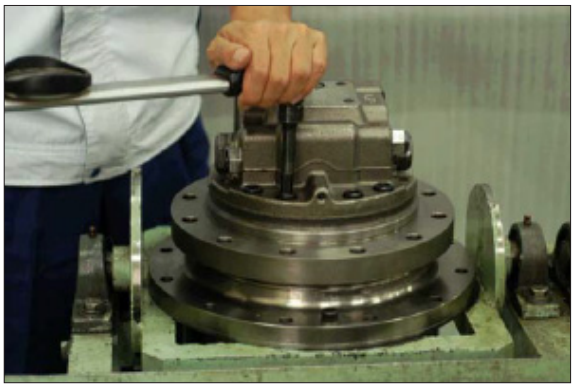
⑤ Temporarily looser the plug (382).



85A7TM18

⑥ Loosen and remove hexagon socket bolts (345) (8 pcs) from the rear flange (301).

※ When loosening the hexagon socket bolts (345) (8 pcs), the rear flange (301) gradually begins to part from the contact face with the spindle (2) due to the springs (113) force assembled inside. Loosen them equally not to make the rear flange (301) to lean.

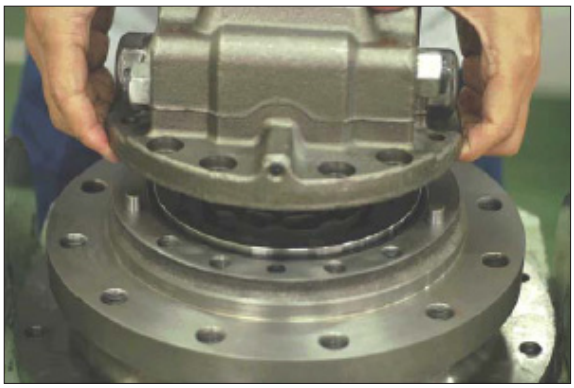


85A7TM19

⑦ Remove the rear flange (301) from the spindle (2).

※ Hold the rear flange (301) by both hands and remove it gently. Perform the work with care not to forcibly pry or strike the rear flange (301).

※ Otherwise the timing plate (109) may drop from the rear flange (301) and be damaged.



85A7TM20

⑧ Remove the parallel pins (42) (2 pcs) from the spindle (2).

85A7TM21

⑨ Remove the O-rings (43) (2 pcs), (44) from the spindle (2).

※ Do not reuse the O-rings (43), (44).

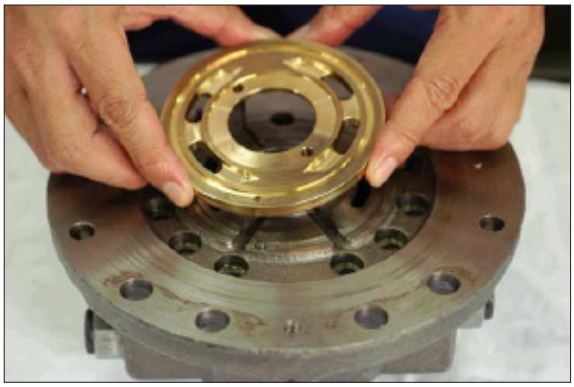
85A7TM22

(9) Disassembly of parts assembled into rear flange

① Put the removed rear flange (301) on the workbench. (Face up the mating face with the spindle (2).)

② Remove the springs (113) (10 pcs) from the rear flange (301).

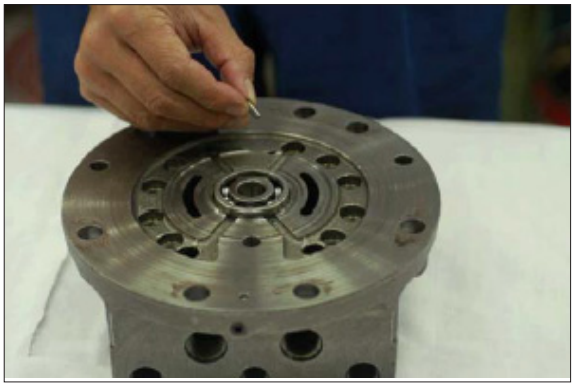
③ Remove the timing plate (109) from the rear flange (301).



85A7TM23

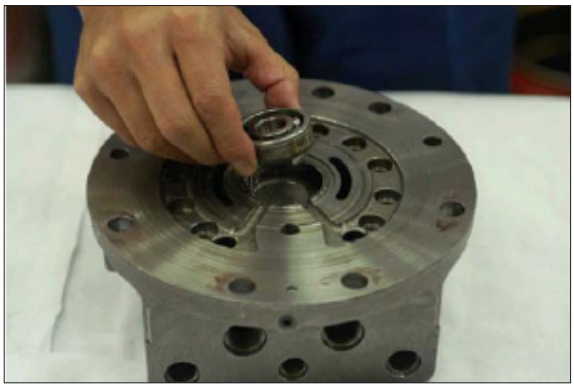
※ The timing plate (109) might stick on the contact face with the rear flange (301). To separate it, insert the spatula into a casting groove of the rear flange (301) and raise it slowly. Never try to insert a sharp or a pointed tool to pry the timing plate (109) off, otherwise the contact faces will suffer damage and may occur oil leakage from it.

④ Remove the parallel pin (342) from the rear flange (301).



7078TM29/29A

⑤ Remove the ball bearing (150) from the rear flange (301).



85A7TM25

(10) SRV disassembly

① Remove the sleeves (203) (2 pcs) from the rear flange (301) .

85A7TM26

② Remove the O-ring (207) and the backup rings (208) (2pcs) from the valve seat (201) one by one.

※ Do not reuse the O-ring (207) and the backup rings (208).

85A7TM27

③ Remove the O-ring (212) from the sleeve (203).

※ Do not reuse the O-ring (212).

85A7TM28

(11) Brake valve parts disassembly

① Remove the plugs (324) (2 pcs) from the rear flange (301).

85A7TM29

② Remove the spring retainers (325) (2 pcs) and the springs (328) (2 pcs) from the rear flange (301).

③ Remove the spool (323) from the rear flange (301).

※ When removing the spool (323), do not tilt the plug port on the rear flange (301) downward so that the spool (323) does not fall off the rear flange (301). Grasp the spool (323) by hand and remove it.

85A7TM30

④ Remove the O-rings (336) (2 pcs) from the plugs (324) (2 pcs).

※ Do not reuse O-ring (336).

85A7TM31

⑤ Remove the plugs (382) (2pcs) from the rear flange (301).

85A7TM32

⑥ Remove the springs (330) (2 pcs) and the valves (327) (2 pcs) from the rear flange (301).

85A7TM33

⑦ Remove the O-rings (338) (2 pcs) from the plugs (382).

※ Do not reuse O-rings (338).

85A7TM34

(12) Pilot valve removal.

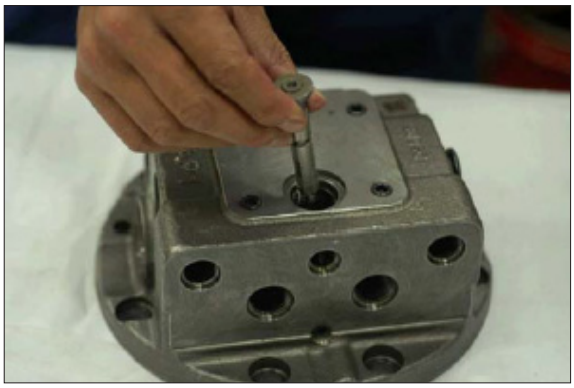
① Remove the plug (382) from the rear flange (301).

② Remove the O-ring (338) from the plug (382).

※ Do not reuse O-ring (338).

85A7TM35

③ Remove the spool (363) and the spring (366) from the rear flange (301).



85A7TM36

(13) Parking brake removal

⚠ The abrupt injection of compressed air could cause the piston (112) to pop out. To ensure your safety, arrange protective cover over the piston (112).

① Remove the piston (112) from the spindle (2) by injecting compressed air into the access hole for parking brake arranged on the spindle (2).

85A7TM37

② Remove the O-rings (135), (139) from the piston (112).

※ Do not reuse O-rings (135), (139).

85A7TM38

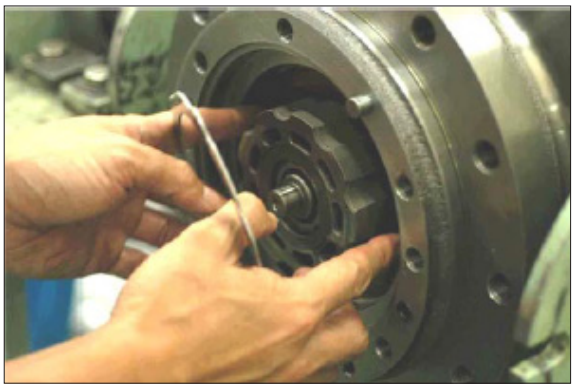
(14) Hydraulic motor disassembly

※ When turning the traveling unit, place an oil container just below the traveling unit to catch the oil.

① Turn the traveling unit 90 degrees.

② Drain hydraulic oil from the traveling unit.

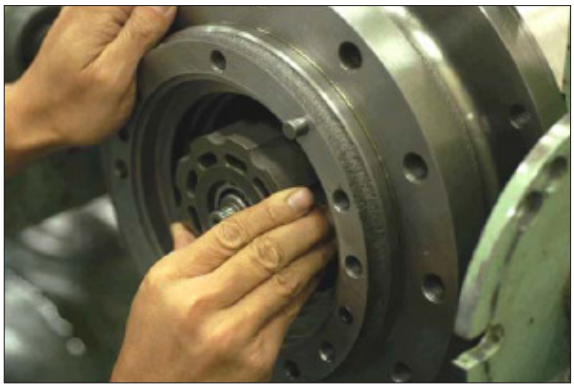
③ Remove the mating plates (116) (4pcs) and the friction plates (115) (3pcs).



85A7TM39

④ Hold the cylinder block (104) by hand, turn alternately 2 or 3 times, and cut off shoes (106) adhered on the swash plate (103).

※ When removing the cylinder block (104) from the spindle (2) without turning 2 or 3 times, the shoes (106) remain adhered on the swash plate (103), and parts (piston, shoe and etc.) mounted into the cylinder block (104) will come off fall into the spindle (2).



85A7TM40

⑤ Draw out the cylinder block (104) from the shaft (102).

⑥ Remove the piston assys (pistons (105), shoes (106)) and the retainer plate (107) from the cylinder block (104).

※ When removing the piston assys, grip the retainer plate (107) with both hands and remove together with it. A piston assy is a minimum unit. If replacement is necessary, replace a piston assy as one unit.

85A7TM41

⑦ Remove the piston assys (9 pcs) (pistons (105), shoes (106)) from the retainer plate (107).

85A7TM42

⑧ Remove the thrust ball (108) from the cylinder block (104).

85A7TM43

⑨ Remove the rollers (151) (3 pcs) from the cylinder block (104).

85A7TM44

(15) Hydraulic motor disassembly

① Place the cylinder block (104) on the press bench.

※ The spring (114) should be removed only when replacing.

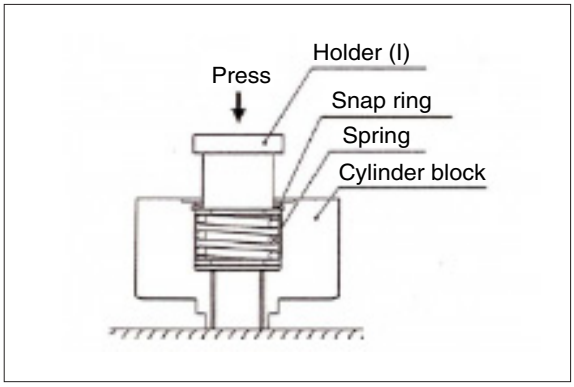
※ The spring (114) is removed by lining up the shaft centers of the holde, and the washer (110) in order to prevent damage to the cylinder block (104) through contact.

※ Cover the cylinder block (104) with a vinyl sheet to prevent the sliding surfaces of the cylinder block (104) from being damaged.

85A7TM45

② Place the holder (I) on the washer (110), and press it while pressing, remove the snap ring (145) with a snap ring pliers.

⚠ Release the press slowly. If release suddenly, the spring (114) will pop out and incurring danger of injury.



85A7TM46

③ Remove the snap ring (145), washer (110), spring (114) and washer (110) from the cylinder block (104).

85A7TM47

(16) Swash plate removal

① Remove the swash plate (103) from the shaft (102).

85A7TM48

② Remove the shaft (102) from the spindle (2) and then, the ball bearing (149) is removed together.

※ When striking the tip of shaft (102) from the reduction gear side to remove it to make easy the work, be careful not to strike hard, because the shaft (102) may pop out.

85A7TM49

③ Remove the pivots (167) (2 pcs) from the spindle (2).

④ Inject compressed air into the access passage for 1st/2nd speed piston (160) arranged into the spindle (2) to remove the 1st/2nd speed piston (160) from the spindle (2).

85A7TM50

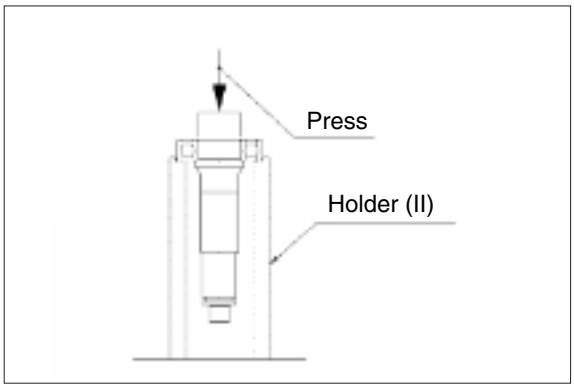
(17) Ball bearing removal

※ The ball bearing (149) should be removed only when replacing.

① Place the holder (Ⅱ) on the press bench and put the shaft (102) into the holder.

② Remove the ball bearing (149) from the shaft (102) by pressing on the shaft end with press.

※ Do not reuse the ball bearing (149).



85A7TM51

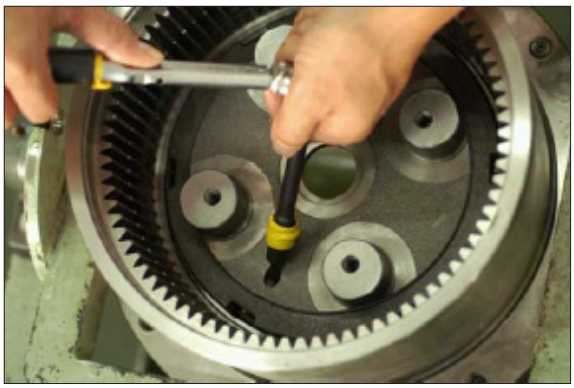
(15) Ring nut removal

① Fix the hub (1) and the spindle (2) with the fixture by tightening the hexagon socket bolts. The bolts should be tightened equally in symmetrical positions with each other.

② Invert the traveling unit. (The side of the reduction gear is turned up.)

85A7TM52

③ Remove the hexagon socket set screws (47) (2 pcs).

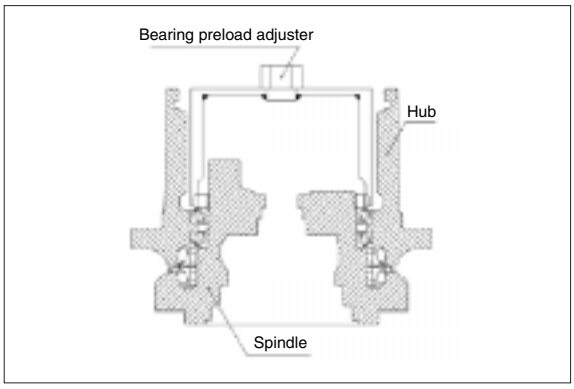


85A7TM53

④ Loosen the ring nut (22) with the bearing preload adjuster.

※ Do not reuse the ring nut (22).

85A7TM54



85A7TM55

⑤ Remove the ring nut (22) from the spindle (2).

⚠ **When removing it, be careful not to injure your hands by touching the screw part.**

85A7TM56

(19) Spindle removal

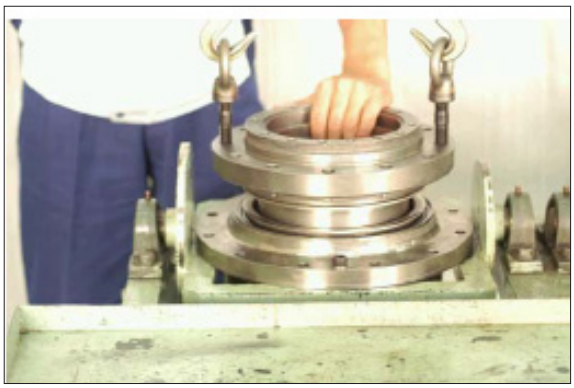
① Invert the traveling unit. (Turn up the side of motor.)

② Remove the fixture from the hub (1) and the spindle (2).

③ Tighten the eye bolts (2 bolts, for M16) in the mounting holes of spindle (2) so they are symmetrically positioned.

④ Hook the eye bolts, gently and slowly hoist with a crane and remove the spindle (2) from the hub (1). At this time, the floating seal (31) and the oil seal (132) come off together.

⚠ A diagonally lifting exerts great force on the hoisting tools and the eyebolts, and the wire may be cut off. Since the wire that is cut off might hit worker and cause injuries, for safety, use a crowbar etc. to remove if the hub (1) cannot be lifted up smoothly.



85A7TM57

(20) Ball bearing removal

① Remove the floating seal (31) from the hub (1).

※ Do not reuse the floating seal (31) .

⚠ When removing it, be careful not to injure your hands by touching the edge.

85A7TM58

② Tapping equally and gradually 3 or 4 points of the end face of the ball bearing (21) with an aluminum rod (pin punch) and a hammer to remove the ball bearing (21) from the hub (1).

※ The ball bearings (21) cannot be reused once their inner races are struck and damaged by a pin punch. Only remove the angular ball bearings (21) when replacement is necessary.

※ The ball bearings (21) get damaged when mating part of its outer race is dislocated from the hub (1) and fall from the reversing device. Put a rubber mat (for buffering the bearing's falling shock) under the hub (1).

③ Turn over the traveling unit.

④ Tapping equally and gradually 3 or 4 points of the end face of the ball bearing (21) with an aluminum rod (pin punch) and a hammer, remove the ball bearing from the hub (1).

85A7TM59

(21) Disassembly of parts assembled into spindle.

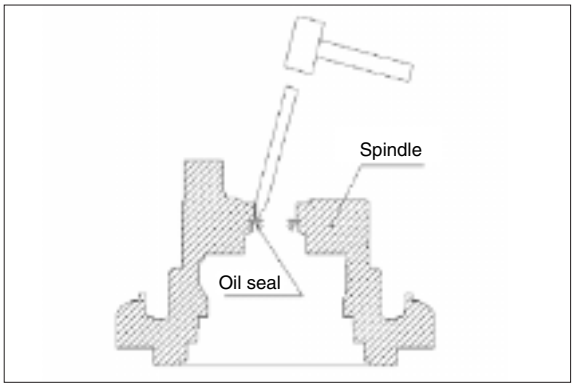
① Remove the floating seal (31) from into spindle (2).

⚠ When removing it, pay attention not to injure your hands by touching the edge.

85A7TM60

② Remove the oil seal (132) from the spindle (2).

※ Do not reuse the floating seal (31) and the oil seal (132).



85A7TM61

(22) Washing

① Separate the hub (1), spindle (2), cover (13) and rear flange (301) from other parts. (hereafter called the built-in parts)

② Wash the built-in parts in a wash tank.

※ Carefully wash to remove any darts from the external surfaces.

85A7TM62

⚠ **As white kerosene is combustible, pay attention to fire, burns and injury.**

※ From the beginning, washing each dirty part by white kerosene will be easy to get damaged. At first, immerse them in white kerosene until dust and fat will be detached sufficiently.

③ Wash the built-in parts in roughly washing container that is filled with white kerosene.

85A7TM63

(23) Finish washing

① Put each part in the washing tank for finishing that equips white kerosene, and wash the whole including the inside sufficiently with white kerosene.

② Wipe white kerosene attached to each part with clean waste cloth.

※ Dry the inside of the hub (1) and spindle (2) by spraying compressed air in place without dust and humidity. After drying, apply hydraulic oil on each part.

85A7TM64

3. MAINTENANCE STANDARDS

Follow these standards when disassembling and inspecting the traveling unit.
Be especially careful not to damage moving and sliding parts.

1) Seals

Once disassembled, all seals (O-rings, oil seals, floating seals) should be replaced with new ones even if no damage is observed.

2) Bolts

Do not reuse bolts coated with adhesive.

3) Maintenance standards for wearing parts

(1) **Replace all parts whose appearance damaged significantly.**

(2) **Replace parts when the following abnormal phenomenon occurs.**

Item No.	Part name	Phenomenon	Service limit
1	Hub	· Serious damage in appearance · Pitting on tooth flank of ring gear · Abnormal wear such as scuffing	-
2	Spindle	· Serious damage in appearance · Abnormal wear such as scuffing	-
3 and others	Carrier assy	· Abnormal wear such as scuffing	-
4 5 6 7	Sun gear 1 Sun gear 2 Planetary gear1 Planetary gear2	· Pitting on tooth flank · Flaking on rolling contact surface with bearing	-
10 11 12	Thrust washer 1 Thrust washer 2 Thrust washer 3	· Tarnish on sliding surface · Abnormally wear on sliding surface	-
21	Ball bearing	· Indentation on contact surface · Flaking on contact surface · Unequal wear on contact surface	-
27 28	Needle roller bearing	· Pitting on roller · Abnormally wear of cage and face	-
29 30	Inner ring	· Flaking on rolling contact surface of bearing.	-
102	Shaft	· Abnormal wear on contact surface with oil seal (132). · Wear on spline.	-
103	Swash plate	· Seizure on sliding surface.	-
104	Cylinder block	· Wear on spline. · Excessive wear on inner surface of bores. · Flaw and wear on sliding surface with timing plate (109).	-

Item No.	Part name	Phenomenon	Service limit
105 106	Piston assy Piston Shoe	· Clearance is found in the axial direction between piston (105) and shoe (106). · Abnormal and unequal wear on shoe.	Clearance 0.15mm below
107	Retainer plate	· Sliding part with shoe (106) is worn unequally. · Flaw and unequal wear on sliding surface with thrust ball (108).	-
108	Thrust ball	· Ball surface sliding part with retainer plate (107) is worn unequally.	-
109	Timing plate	· Seizure and unequal wear on sliding surface	
115 116	Friction plate Mating plate	· Unequal wear on both end faces · Less torque than specified one · Seizure on sliding surface	Braking torque 18.5 kgf·m (134 lbf·ft) or more
112	Piston	· Flaw on outer circumference	-
149 150	Ball bearing	· Indentation on contact surface · Flaking on contact surface · Wear on contact surface	-
160	Piston	· Abnormal wear on contact surface	-
301	Rear flange	· Flaw on sliding surface with spools (323) (363)	-
323 363	Spool	· Unequal wear on outer circumference · Flaw on outer circumference.	-

4. ASSEMBLING

Basically, assembly is carried out by performing the procedure for disassembly in reverse.

1) Preparations

Prepare the same workbench, tools and equipment as those listed in section 2 (disassembly).

2) General precautions

(1) Pay the same attention as for general precautions for disassembly in section 2.

(2) When assembling, remove all foreign objects or metal fragments from parts, and make sure there are no burrs or dents, etc. on parts. If there are burrs or dents, remove with an oilstone.

(3) Replace O-rings, oil seals and floating seals with new ones.

(4) Remove remaining glue of the pillars of the spindle (2) by using the tap (M10x1.5), and wash with solvent. After that, remove solvent of the holes by spraying with compressed air. Replace hexagon head bolts (51) with new ones.

(5) Remove remaining glue of the pillars of the carrier (3) by using the tap (M8x1.25), and wash with solvent. After that, remove solvent of the holes by spraying with compressed air. Replace hexagon head bolts (40) with new ones.

(6) Be careful not to damage O-rings, oil seals and floating seals when mounting. (Apply small amount of grease to make them slippery.)

(7) Be sure to coat the moving and sliding parts of the hydraulic motor section and the valve section with clean hydraulic fluid (NAS standards class 9 or superior) and assemble.

(8) Do not use cloth gloves for assembly. (To prevent fiber pieces from causing faulty operation.)

(9) Bolts and plugs should be tightened by the torque value.

(10) When assembly is complete, plug all ports to prevent dirt from entering.

(11) The photographs and drawings contained in this manual are of representative models. Disassembly procedure is not affected even if the product you are using differs in part.

3) Assembly procedure

※ If reassembling after replacing parts, preload adjustment of the main bearing (21) is necessary. Before assembling, make sure the following parts have been replaced

※ Renewal parts required for preload adjustment of the main bearing: Hub (1), spindle (2), ball bearing (21).

※ If reassembling after replacing the parts listed above, be sure to reassemble using parts that have been adjusted. If you reassembly with parts that have not been adjusted, it will cause malfunction of traveling unit or early failure.

(1) Hub section assembly

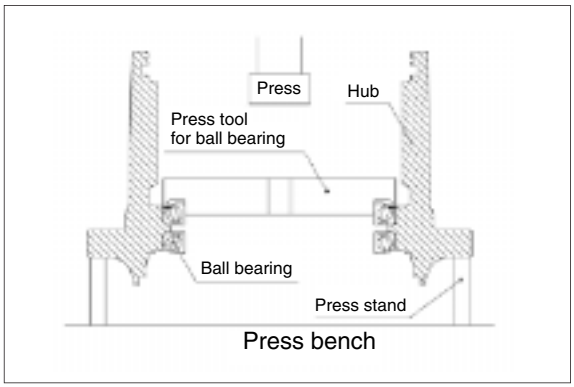
① Place the hub (1) on the press bench.

② Place the ball bearing (21) on the hub (1) with checking the direction, and place the bearing press fitting jig on the outer race, then press fit by the press machine Insert the ball bearing (21) into the hub (1).

③ Turn the hub (1) upside down.

④ Repeat the above procedure to insert the ball bearing (21) into the hub (1).

※ Make sure that the installing direction of the ball bearing (21) is correct.

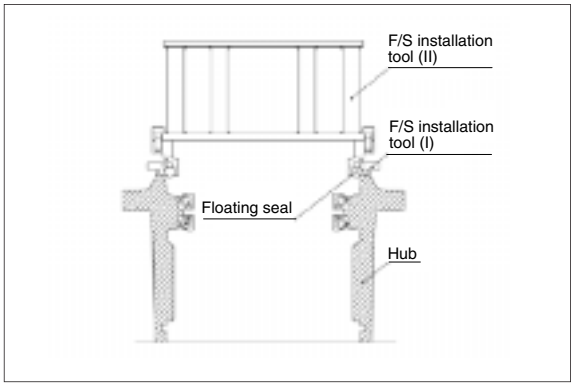


85A7TM70

⑤ Apply thinly lithium grease on the outside circumference of the O-ring of the floating seal (31), and fit the floating seal (31) in the floating seal groove of the hub (1).

※ When applying grease to the O-ring of the floating seal (31), remove the O-ring from the floating seal (31) and apply lightly grease to the entire surface of it.

※ To mount the floating seal (31), place the F/S installation tool (Ⅰ) , floating seal (31) and F/S installation tool (Ⅱ) in that order, and press in until the F/S installation tool (Ⅰ) reaches the F/S installation tool (Ⅱ). After removing the installation tools, make certain that the end face of the hub and the surface of the floating seal (31) are parallel with each other within a tolerance of 1 mm.



85A7TM71

⑥ Fasten two eye bolts in the screw holes of the hub (1) so they are symmetrically positioned.

⑦ Hook the hook on the eye bolts, hoist the hub (1) with a crane, and set the hub (1) on the workbench.

85A7TM69

※ While matching the screw holes of the hub (1) and mounting holes of the workbench, place the hub (1) gently in the mounting holes of the workbench.

⑧ Fix the hub (1) into the workbench by tightening the hexagon socket bolts which are symmetrically positioned.

⚠ Tighten the hexagon socket bolts securely. Failure to do so could result in injury if the traveling unit is inverted and then, falls.

85A7TM72

(2) Spindle assembly

① Apply thinly lithium grease on the outside circumference of the O-ring of the floating seal (31) and mount the floating seal (31) in the floating seal groove of the spindle (2).

※ To mount the floating seal (31), place the F/S installation tool (Ⅲ) , floating seal (31) and F/S installation tool (Ⅱ) in that order, and press in until the F/S installation tool (Ⅱ) reaches the F/S installation tool (Ⅲ). After removing the installation tools, make certain that the end face of the spindle (2) and the surface of the floating seal (31) are parallel with each other within a tolerance of 1 mm.

85A7TM52

② Tighten two eyebolts symmetrically into the spindle (2).

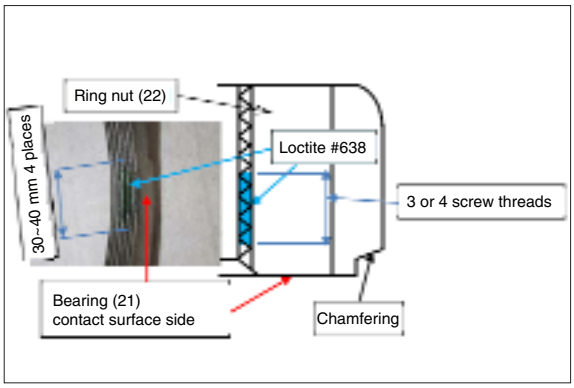
③ Hook the hook on the eyebolts, lift the spindle (2) by the crane, and then insert the spindle (2) into the hub (1) slowly.

④ Fix the hub (1) and spindle (2) with the fixture and then, tighten the bolts equally.

85A7TM73

⑤ Invert the traveling unit. (Turn up the side of reduction gear)

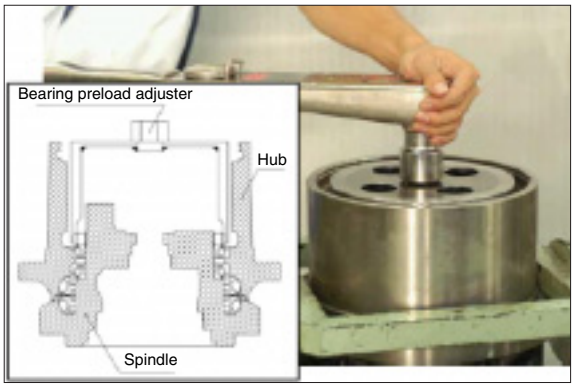
⑥ Apply Loctite #638 like in the left drawing.



85A7TM74

⑦ Tighten the ring nut (22) into the spindle (2) with the bearing preload adjuster. Please note that the contact surface of the ring nut (22) with the ball bearing (21) should be chamfering side.

· Tightening torque: 60±6.0 kgf·m
(434±43.4 lbf·ft)

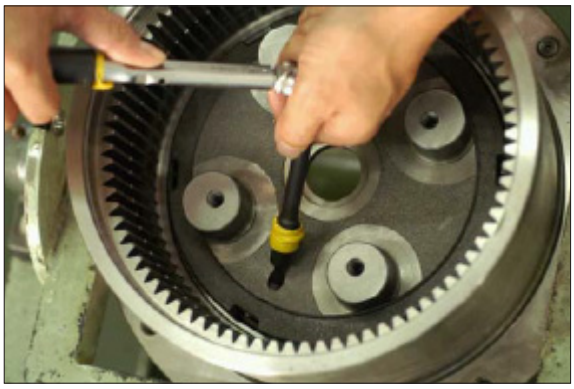


85A7TM75

⑧ Tighten the hexagon socket set screws (47) (2 pcs) with the specified torque.

· Tightening torque: 1.0±0.2 kgf·m
(7.2±1.4 lbf·ft)

⑨ After tightening up the screws, caulk the entrance of the threaded holes to avoid loosening the screws.



85A7TM53

⑩ Invert the traveling unit. (Turn up the side of motor.)

⑪ Remove the fixture.

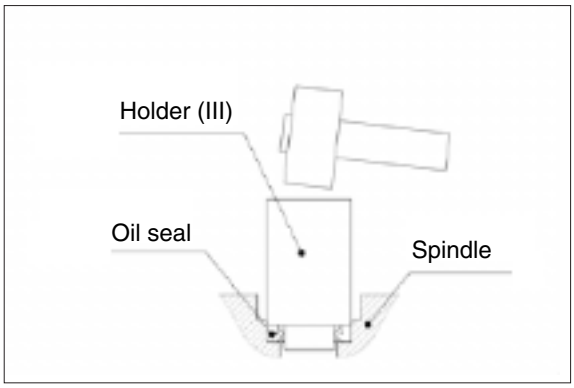
85A7TM52

(3) **Assembly of inner parts of spindle**

① Press fit the oil seal (132) into the spindle (2) with the holder (Ⅲ) and a hammer.

※ Apply lithium grease to the lip section of the oil seal (132) when mounting it.

※ Pay attention for the oil seal (132) direction when assembling.



85A7TM76

② Apply lithium grease to the hemispherical surface of the pivots (167) (2 pcs), and install them into the pin hole of the spindle (2).

③ Apply lithium grease to the spring (190), and install it into the piston (160).

④ Apply hydraulic fluid to the sliding surface of the piston (160), install it into the piston hole of the spindle (2).

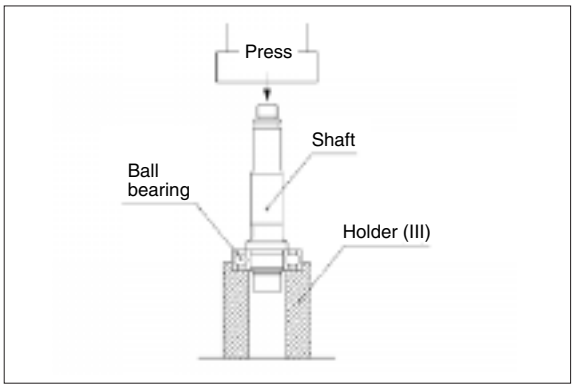
85A7TM50

(4) Shaft assembly

① Put the ball bearing (149) in a heating tank to heat it at 100±10℃ for ten minutes and then insert it into the shaft (102) .

⚠ Wear leather gloves in handling the heated ball bearing (149) due to the possibility of burns.

② Install the shaft (102) slowly into the spindle (2).



85A7TM77

※ When installing the shaft (102), be careful not to damage the lip portion of the oil seal (132). Damage of the lip portion will cause oil leakage and bring premature failure to the traveling unit.

③ Turn the traveling unit 90 degrees. (Axial direction of the traveling unit : level)

85A7TM78

④ Install the swash plate (103) into the spindle (2).

※ Apply lithium grease on the swash plate (103) where mating surface of the spindle (2). Make sure that the pivots (167) mounted on the spindle (2) enter to the pivot holes of the swash plate (103).

85A7TM48

(3) **Assembly of cylinder block interior parts**

※ Insert the THS snap rings (145) so that the snap edge side faces to the entrance of the spring hole.Insert the washer (110) so that the sharp edge side faces to the THS snap ring (145).

① Insert the washer (110), spring (114), washer (110) and snap ring (145) in that order into the cylinder block (104).

② Place the cylinder block (104) on the press bench.

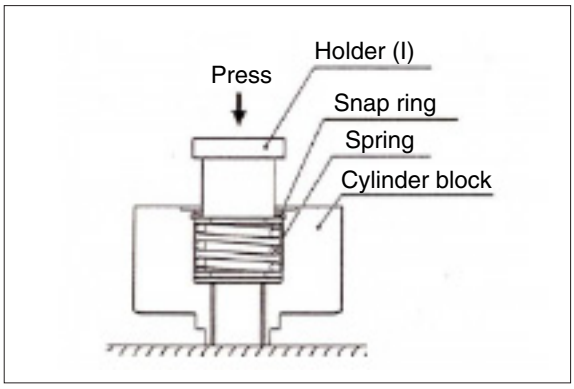
85A7TM47

⚠ Be careful when installing the snap ring (145), since it may pop out and cause injury.

85A7TM45

※ Press force of the spring (114) is 120 kgf (265 lbf) or more. Protect by covering the cylinder block (104) with a vinyl sheet so the contact surface with the timing plate (109) does not get damaged.

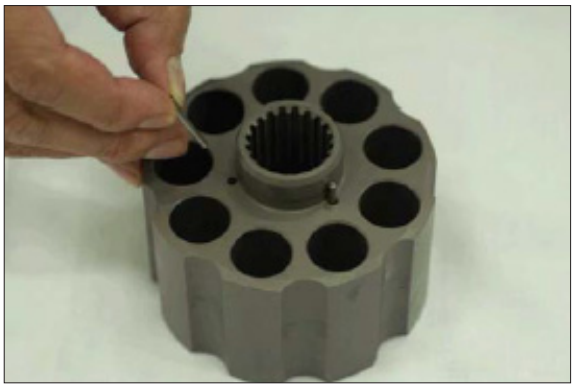
③ Place holder (Ⅰ) on the washer (110), and while clamping with press, install the snap ring (145) into the snap ring groove of the cylinder block (104) with a snap ring pliers.



85A7TM46

(6) **Hydraulic motor parts assembly**

① Place the rollers (151) (3 pcs) into the cylinder block (104) and place the thrust ball (108) on the top.



85A7TM44

② Install the piston assys (9 pcs) into the retainer plate (107).

※ After assembling, dip the whole thing in hydraulic fluid. (NAS standards class 9 or superior)

③ Install the retainer plate (107) and the piston assys (9 pcs) into the cylinder block (104).

85A7TM79

※ Match the round surface sections of the retainer plate (107) and the thrust ball (108).

④ Install the cylinder block assy into the shaft (102).

※ Install the cylinder block assy into the spline of the shaft (102) by aligning the spline hole with the spline of the shaft.

85A7TM80

⑤ After installing the cylinder block assy, rotate it by hand and make sure that it fits properly. If not, inspect it.

※ After installing the cylinder block assy, keep pushing the cylinder block assy to the swash plate side. If not, the thrust ball (108) will be separated from it and then, it will not rotate normally.

85A7TM81

(7) **Parking brake section assembly**

① Invert the traveling unit. (Turn up the motor side) .

② Dip the friction plates (115) into hydraulic oil.

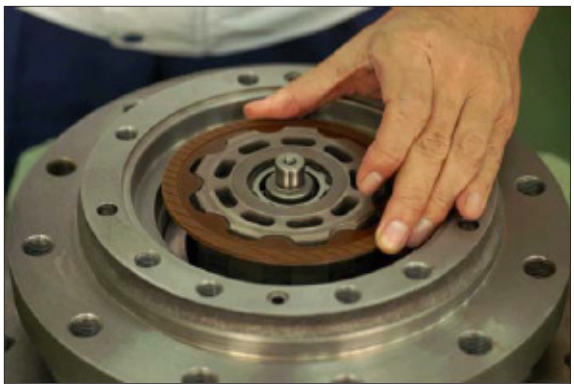
③ Install mating plates (116) (4 pcs) and friction plates (115) (3 pcs) into the spindle (2) in the order of the mating plate (116) and friction plate (115) alternately.

85A7TM82

※ Be careful not to mistake the order of mating plates (116) and friction plates (115).

④ At this time, apply thinly lithium grease to the O-rings (135), (139).

⑤ Install the O-rings (135), (139) into the O-ring grooves of the piston (112). Install the piston (112) into the spindle (2).

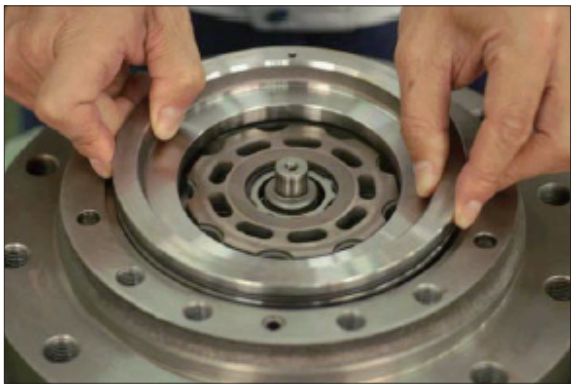


85A7TM83

※ After putting the piston (112) on the spindle (2), push it until the O-ring (139) reaches to the contact surface with the rear flange (301) and then, check whether you can rotate it by your hands. If unable, since it might not be appropriate posture, disassemble and reassemble it.

※ If the piston (112) doesn't enter easily into the spindle (2) because of the resistance of the O-rings, tap the edge of the piston (112) lightly and equally with a plastic hammer to install.

※ Be careful not to damage the O-rings when assembling the piston (112).



85A7TM38

(8) **Assembly of brake valve parts in rear flange**

① Install the O-rings (338) (2 pcs) into the plugs (382) (2 pcs).

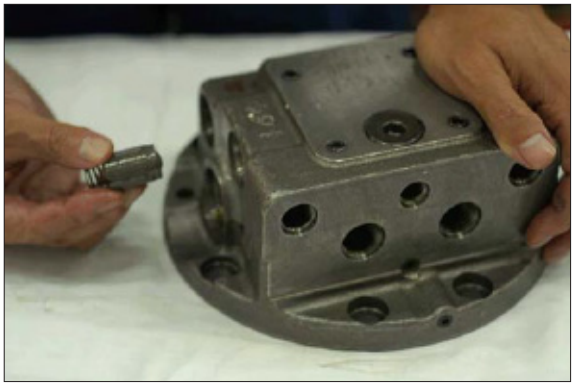
※ Apply lithium grease to the O-rings (338) (2 pcs).

② Install the valves (327) (2 pcs), and springs (330) (2 pcs) into the rear flange (301). At this time, apply lithium grease in order to connect the valve (327) and the spring (330) by cohesion of the grease.

85A7TM34

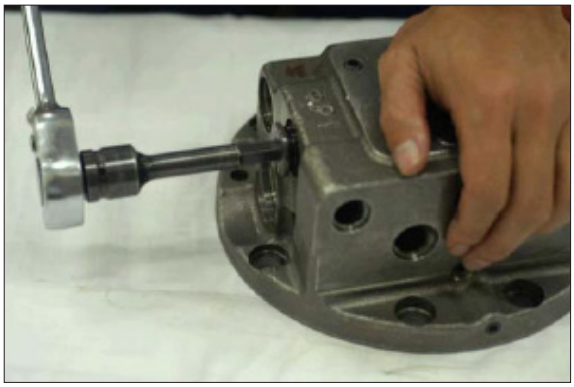
※ For insertion of the plug (382), put the rear flange (301) on the workbench like in the left picture and align the center of tapped hole with the plug center. This is intended to prevent the O-rings (338) from being damaged and the springs (330) from coming out of the valves (327) due to contact between the bore of the rear flange (301) and the valves (327).

※ When the springs (330) are separated from the valve (327), the valves (327) do not touch the seat side of the rear flange (301) correctly, causing oil leakage.



85A7TM33

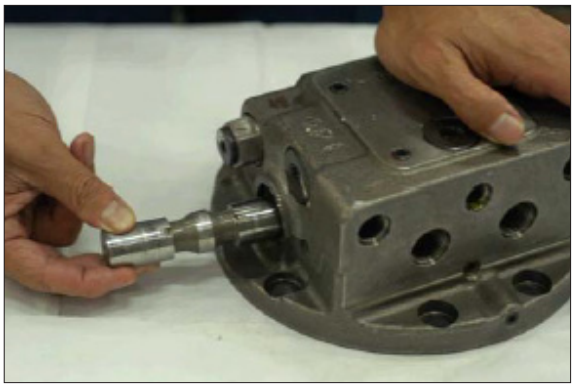
③ After inserting the plugs (382) (2 pcs), temporarily tighten into the rear flange (301) by a hexagon wrench.



85A7TM32

④ Insert the spool (323) into the rear flange (301).

※ Apply hydraulic fluid to the spool (323) and insert it into the rear flange (301). To install the spool (323), align the hole of the rear flange (301) with the axis of the spool (323) so as to prevent the inner surface of the rear flange (301) and the outer surface of the spool (323) from being damaged due to interference. Otherwise internal leaks will occur after reassembly, resulting in performance deterioration of the traveling unit.



85A7TM30

⑤ Insert the O-rings (336) (2 pcs) into the plugs (324) (2 pcs).

※ **Apply lithium grease to the O-rings (336).**

85A7TM31

⑥ Install the spring retainers (325) (2 pcs) and the spring (328) (2 pcs) into the plugs (324) (2 pcs).

⑦ Tighten the plugs (324) (2 pcs) into the rear flange (301).

※ **When tighten the plugs (324) into the rear flange (301), insert carefully so as not to come off the springs (328) (2 pcs) and spring retainer (325) (2 pcs).**

85A7TM84

⑧ Temporarily tighten two plugs (324) into the rear flange (301).

85A7TM85

(9) Assembly of SRV part into rear flange

① Install the O-ring (207) and the backup rings (208) (2pcs) into the valve sheet (201).

② Install the O-ring (212) into the sleeve (203).

※ Apply lithium grease to the O-rings (207), (212).

85A7TM86

③ Insert the sleeve (203) into the rear flange (301).

※ Internal parts of the sleeve kit shall be handled as a set. So do not use separately supplied parts.

85A7TM87

④ Temporarily tighten the sleeves (203) (2 pcs) into the rear flange (301).

85A7TM26

(10) Assembly of rear flange mounted parts

① Assembly of parts mounted into the rear flange (301).

a. Put the rear flange (301) so that the contact surface with the spindle (2) is down.

b. Insert the spring (366) and spool (363) into the rear flange (301).

c. Install the O-ring (338) into the plug ※ (382).

d. Apply lithium grease to the O-ring (338). Temporarily tighten the plug (382) into the rear flange (301).

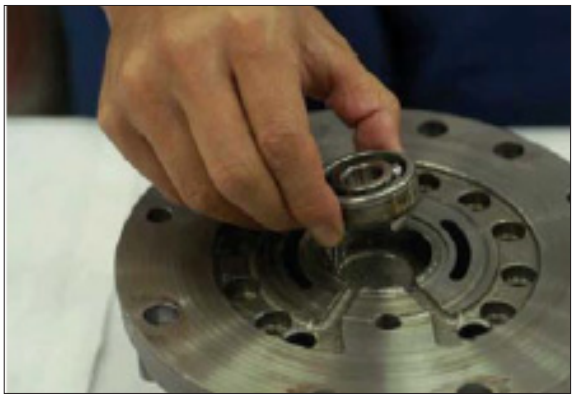
85A7TM88

※ When tightening the plug (382) into the rear flange (301), insert the plug (382) carefully so that the spring (301) may not be deformed.

② Apply hydraulic fluid to the ball bearing (150), and install it into the rear flange (301).

③ Insert the parallel pins (342) (2 pcs) into the pin holes of the rear flange (301).

④ Apply lithium grease to the contact surface of the timing plate (109) in contact with the rear flange (301).



85A7TM25

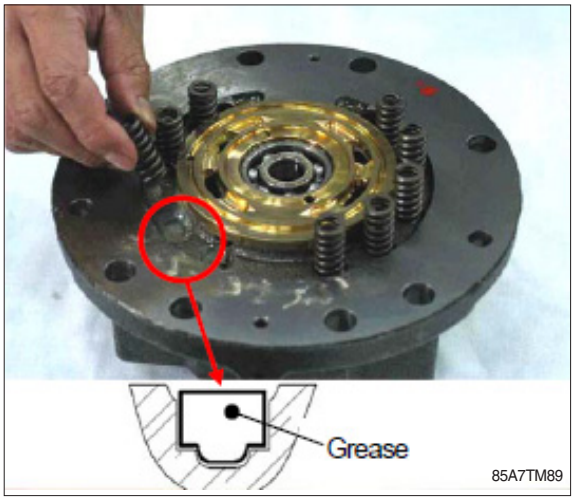
⑤ Install the timing plate (109) on the rear flange (301) using the parallel pin (342) and the ball bearing (150) as a guide.

※ When installing the timing plate (109), make sure it is in close contact with the rear flange (301). The adhesion by the close contact prevents the timing plate (109) from falling from the rear flange (301) when mounting the rear flange (301) onto the spindle (2).

85A7TM23

⑥ Install the springs (113) (10 pcs) into the rear flange (301).

※ Applying plenty of lithium grease to the spring seat surfaces prevents the springs (113) (10 pcs) from falling from the rear flange (301).



85A7TM89

(11) Connection of rear flange with spindle

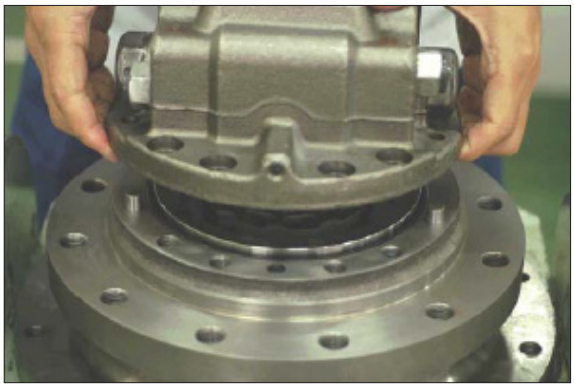
① Install the O-rings (43) (2 pcs), (44) into the O-ring grooves of the spindle (2).
Install the O-rings (43) without applying lithium grease. If assembled with lithium grease applied, the grease may ooze from the mating face of the rear flange (301) and the spindle (2) when the traveling unit is running. This may be mistaken as an oil leak, so do not apply lithium grease.

85A7TM22

② Install the parallel pins (42) (2 pcs) into the spindle (2).
③ Add 1.2 liters of hydraulic fluid into the spindle (2).
④ Apply hydraulic fluid to the contact surface of the cylinder block (104) with the timing plate (109).

85A7TM21

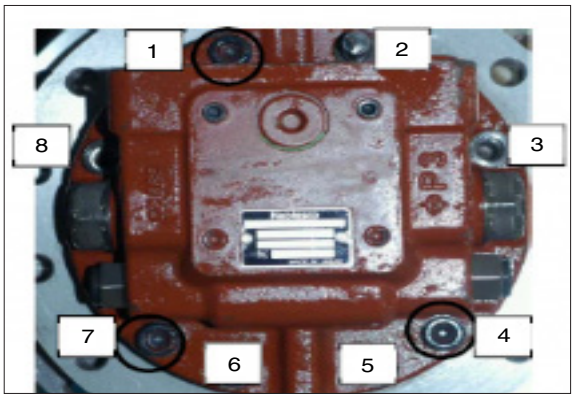
⑤ Install the rear flange (301) onto the spindle (2) so that two parallel pins (42) on the spindle (2) enter the pinholes in the rear flange (301).



85A7TM20

⑥ Temporarily tighten the hexagon socket bolts (345) slowly and evenly (No.1,4,7 3 pcs) so as to keep the gap between the rear flange (301) and the spindle (2) even.

※ If you feel that something is wrong even a little while temporarily tightening, disassemble again and check if parts don't have any abnormal. After that, assemble again.



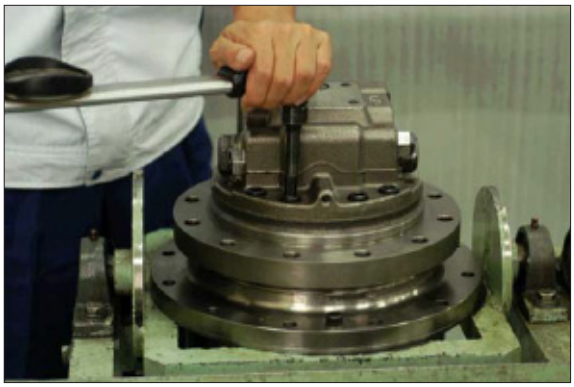
85A7TM90

⑦ Temporally tighten the rest of the hexagon socket bolts (345) (5 pcs).

⑧ Tighten the hexagon socket bolts (345) (8 pcs) equally and evenly with the specified torque.

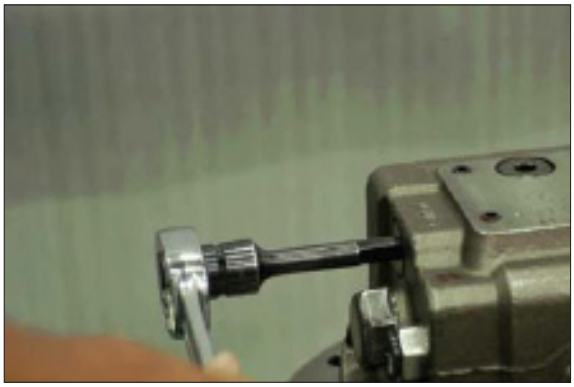
· Tightening torque: 10.4±1.6 kgf·m (75.2±11.6 lbf·ft)

※ Tighten them on diagonally.


85A7TM19

⑨ Tighten the plugs (382) (2 pcs) with the specified torque.

· Tightening torque : 10±2.0 kgf·m (72.3±14.5 lbf·ft)


85A7TM17

⑩ Tighten the sleeves (203) (2 pcs) with the specified torque.

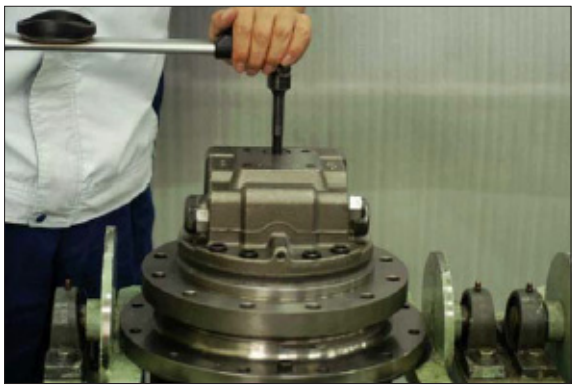
· Tightening torque : 14±1.5 kgf·m (101±10.8 lbf·ft)


85A7TM15

⑪ Tighten the plugs (324) (2 pcs) with the specified torque.
· Tightening torque : 36±4.0 kgf·m
(260±28.9 lbf·ft)

85A7TM16

⑫ Tighten the plug (382) with the specified torque.
· Tightening torque : 10.0±2.0 kgf·m
(72.3±14.5 lbf·ft)



85A7TM18

(12) Carrier assy assembly

※ When assembling, use the new hexagon bolts (40) (3 pcs) and remove the remaining adhesive in the screw holes by tapping (M8x1.25). After that, wash and defat, and then remove washing liquid by air blow. If not removing completely, the hexagon bolts (40) (3 pcs) might loosen because of the lack of the axial force of the bolts.

85A7TM12

① Insert the sun gear 2 (6) into the carrier (3), and install the retaining ring (50) into the groove of the sun gear 2 (6).
② Insert the inner rings (29) (3 pcs), needle roller bearings (27) (3 pcs), planetary gears 1 (5) (3 pcs) and thrust washers 3 (12) (3 pcs) in that order into the pillars of the carrier (3).
③ Install the thrust washers 3 (12) (3 pcs) into the carrier (3) with the trust washer installation tool (carrier (3)).

85A7TM11

④ Tighten the hexagon bolts (40) (3 pcs) with the specified torque.
· Tightening torque : 3.4±0.5 kgf·m
(24.6±3.6 lbf·ft)

※ When not using the jig, be careful not to rotate the thrust washers 3 (12) (3 pcs) during tightening the hexagon bolts (40) (3 pcs). After tightening, make sure to check that the planetary gears 1 (12) (3 pcs) rotate smoothly.

Completion of carrier assy

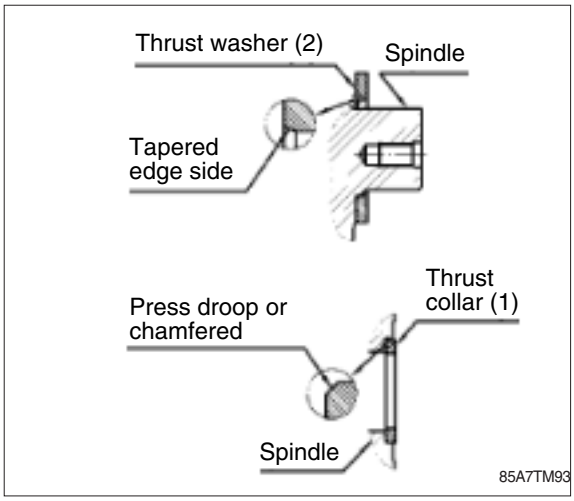

85A7TM91

(13) Planetary gear 2 assembly

※ When assembling, use the new hexagon bolts (51) (4 pcs) and remove the remaining adhesive in the screw holes (4 pcs) by tapping (M10x1.50). After that, wash and defat, and then remove washing liquid by air blow. If not removing completely, the hexagon bolts (51) (4 pcs) might loosen because of the lack of the axial force of the bolts.


85A7TM92

① Invert the traveling unit. (Turn up the side of reduction gear).
② Install the thrust collar 1 (9) into the spindle (2).
③ Install the thrust washer 2 (11) (4 pcs) into the pillars of the spindle (2).



85A7TM93

※ Be careful about the inserting direction of the thrust collar 1 (9) and thrust washer 2 (11) (4 pcs) like in the left drawing.

④ Install the inner rings (30) (4 pcs) into the pillars of the spindle (2).

⑤ Install the needle roller bearings (28) (4 pcs) into the pillars of the spindle (2).

⑥ Install the planetary gears 2 (7) (4 pcs) into the pillars of the spindle (2), meshing with internal teeth of the hub (1).

⑦ Install the thrust washer 1 (10) (4 pcs) into the pillars of the spindle (2) with the thrust washer installation tool (spindle (2)).

85A7TM94

⑧ Tighten the hexagon head bolts (51) (4 pcs) with the specified torque.

· Tightening torque : 5.9±1.0 kgf·m
(42.7±7.2 lbf·ft)

※ When not using the jig, be careful not to rotate the thrust washers 1 (10) (4 pcs) during tightening the hexagon bolts (51) (4 pcs). After tightening, make sure to check that the planetary gears 2 (7) (4 pcs) rotate smoothly.

85A7TM95

(14) Carrier assy assembly

① Install the carrier assy, meshing with internal teeth of hub (1) and planetary gears 1 (5).

85A7TM10

(15) Sun gear 1 (4) assembly

① Install the sun gear 1 (4) into the shaft (102) meshing with the planetary gears 1. At this time, install the steel ball (41) into the sun gear 1 (4).

※ When installing the steel ball (41), apply lithium grease to the steel ball (41) to prevent it from falling down from the sun gear 1 (4).

85A7TM96

(16) Cover assembly

① Install the O-ring (35) into the O-ring groove of the cover (13).

※ Apply lithium grease to the O-ring (35).

② Install the cover (13) into the hub (1).

85A7TM97

※ When installing the cover (13) into the hub (1), tapping evenly the outer circumferen-ce of the cover (13) with a plastic hammer. Be careful not to install the cover (13) forcibly by striking strongly with the hammer. Otherwise the O-ring (35) is damaged resulting in oil leakage.

③ Install the ring (45) in the ring groove of hub (1).

※ Make sure that the ring (45) end gap is not at the notch of the hub (1).

85A7TM98

④ Add 1.1 liters of lubricating oil into the hub (1).

85A7TM99

⑤ Install the O-rings (37) into the plug (33) and plugs (39) (2 pcs).

※ Apply lithium grease to the O-rings (37).

⑥ Tighten the plug (33) and plugs (39) (2 pcs) with the specified torque into the cover (13).

· Tightening torque : 6.0±1 kgf·m (43.4±7.2 lbf·ft)

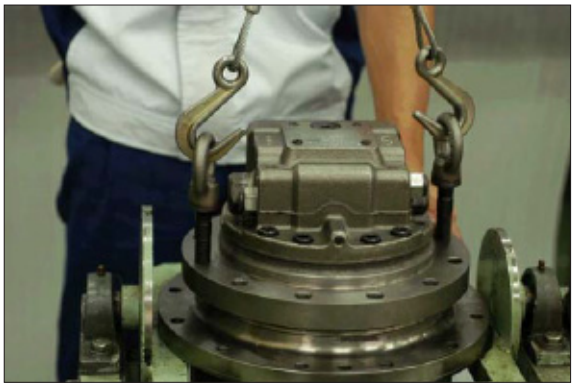
85A7TM100

(17) Removal of assembled traveling unit from the reversing device

① Invert the traveling unit (Turn up the side of motor)

② Remove the bolts tightening the traveling unit to the reversing device.

③ Tighten two eyebolts into the spindle (2).



85A7TM03

※ Be sure that the two eyebolts are positioned symmetrically with each other.

④ Hook the hook on the eyebolts and remove the traveling unit from the reversing device with a crane.

⚠ A diagonally lifting exerts great force on the hoisting tools and the eyebolts, and the wire may be cut off. Since the wire that is cut off might hit worker and cause injuries, for safety, use a crowbar and so on to remove if the hub (1) cannot be lifted up smoothly.

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.

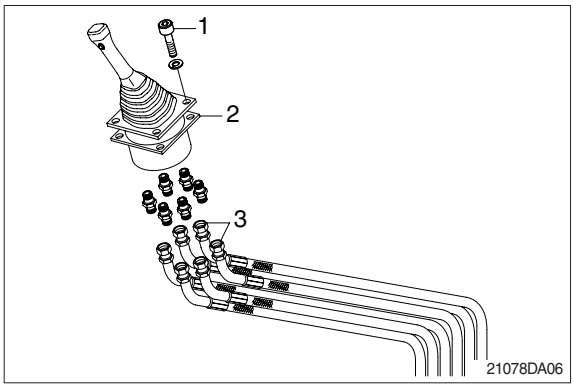
(4) Loosen the socket bolt (1).

(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.



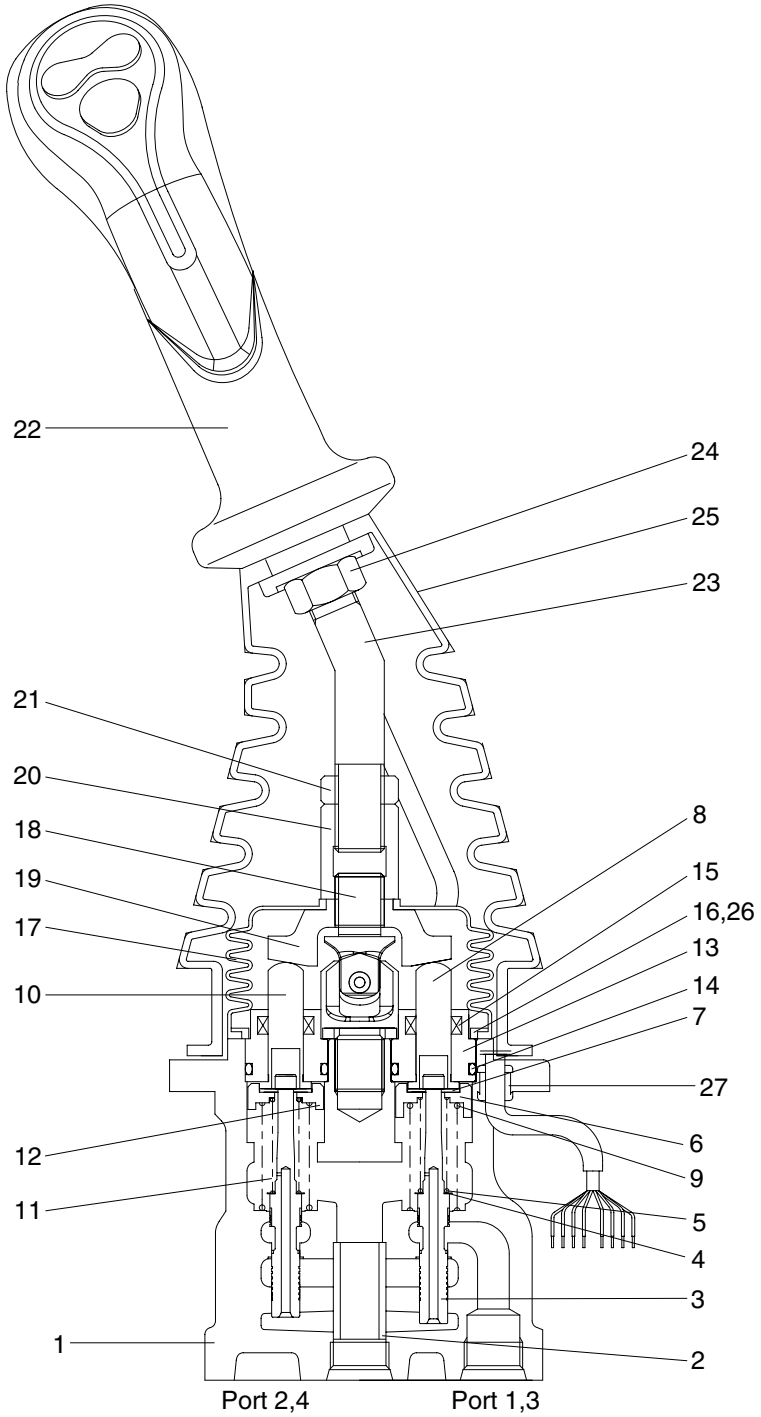
2) INSTALL

(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

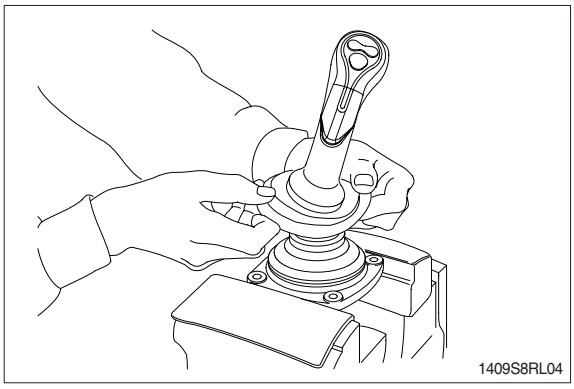
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

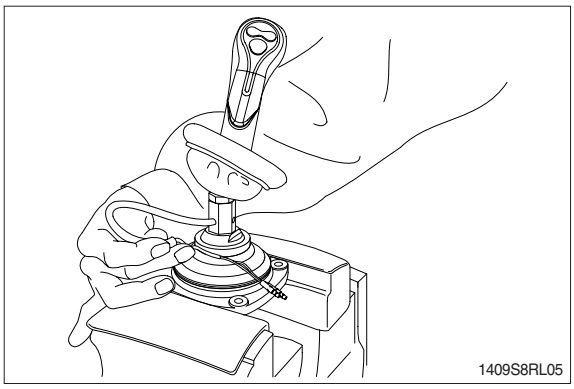
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

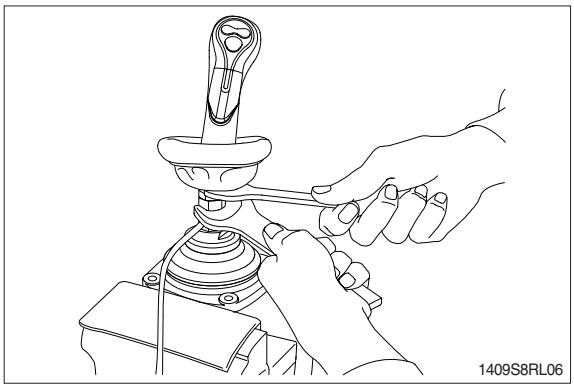
(3) Remove end of boot (25) from case (1) and take it out upwards.



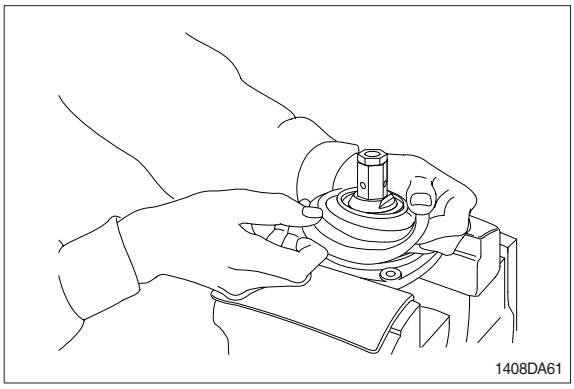
※ For valve with switch, remove cord also through hole of casing.



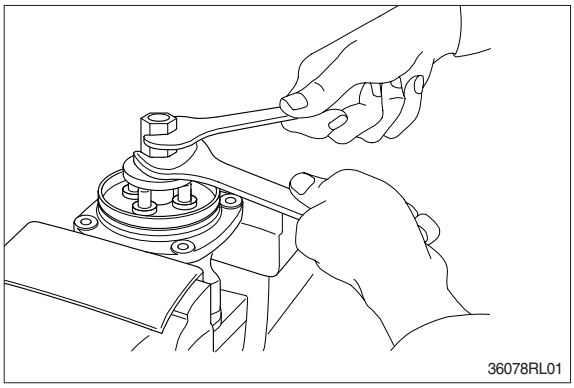
(4) Loosen lock nut (21) and adjusting nut (20) with spanners on them respectively, and take out handle section as one body.

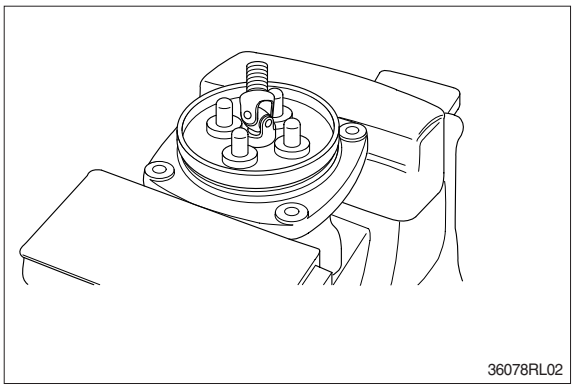


(5) Remove the boot (17).



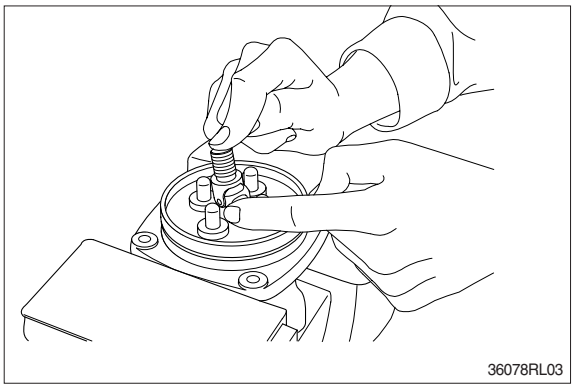
(6) Loosen adjusting nut (20) and swash plate (19) with spanners on them respectively, and remove them.

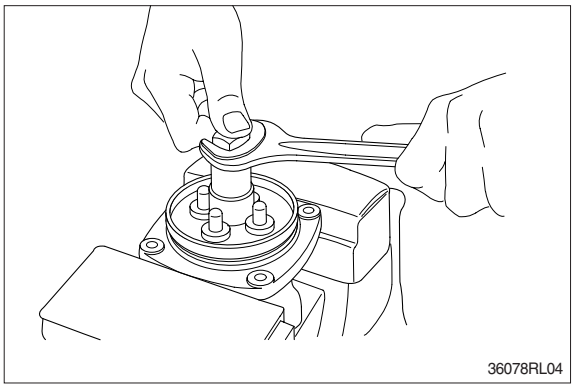




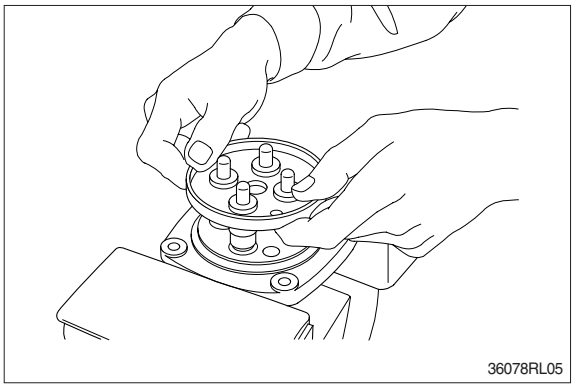
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ 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.





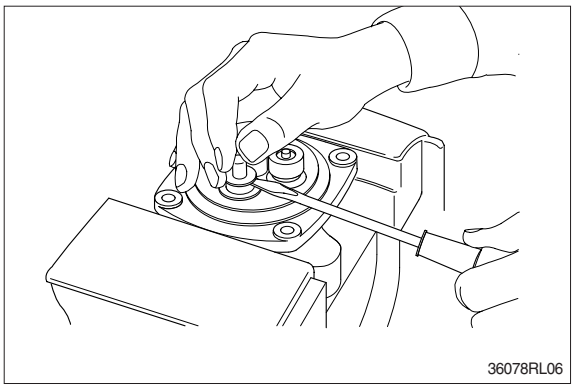
(8) Remove plate (16).



(9) When return spring (9) is weak in force, plug (13) stays in casing because of sliding resistance of O-ring.

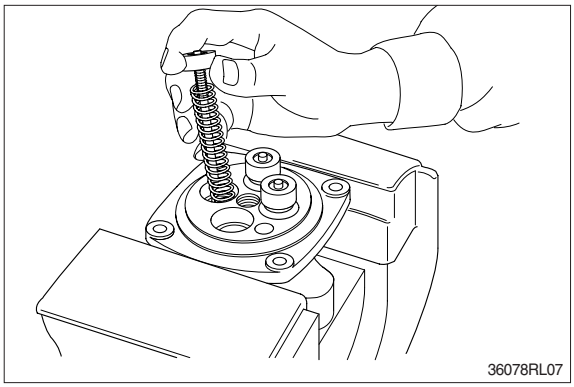
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ 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.

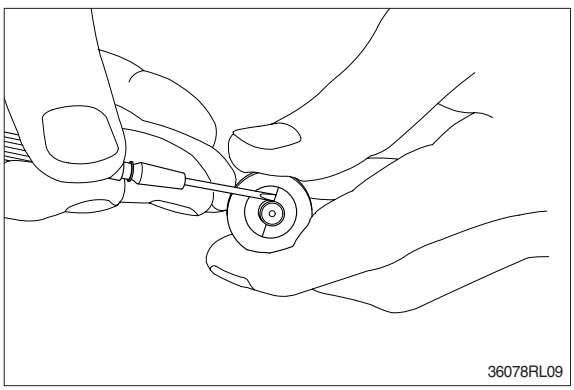


(11) For disassembling reducing valve section, stand it vertically with spool (3) bottom placed on flat workbench. Push down spring seat (6) and remove two pieces of semicircular stopper (7) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

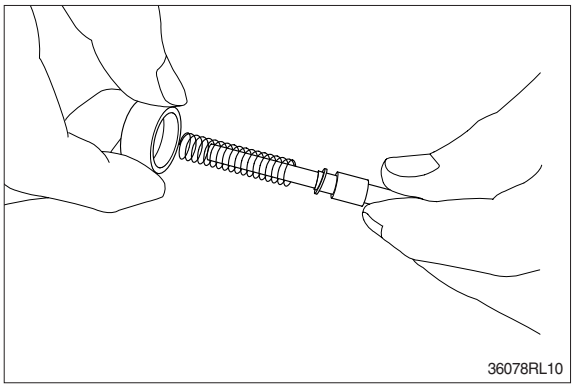
※ Record original position of spring seat (6).

※ Do not push down spring seat more than 6 mm.

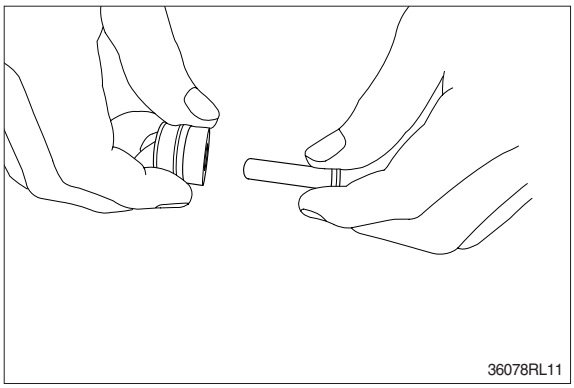


(12) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

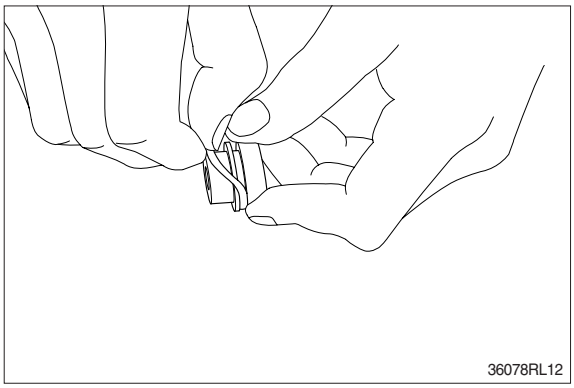
※ Until being assembled, they should be handled as one subassembly group.

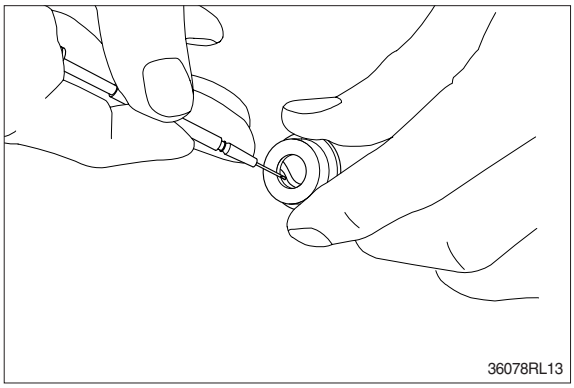


(13) Take push rod (10) out of plug (13).

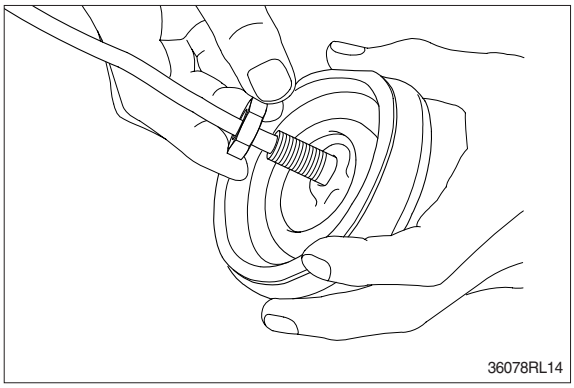


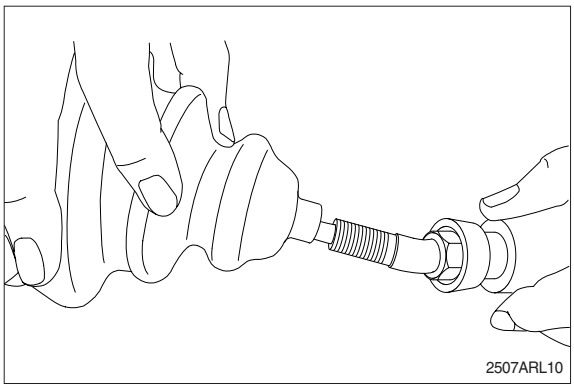
(14) Remove O-ring (14) and seal (15) from plug (13).
Use small minus screwdriver or so on to remove this seal.





(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.

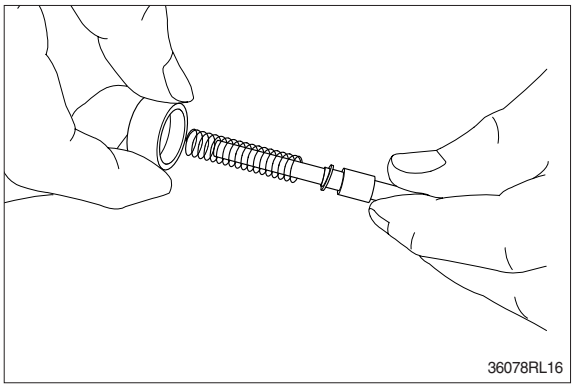
(18) Rust prevention of parts.

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.

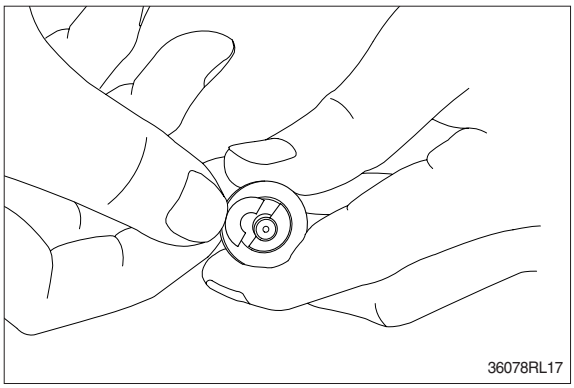
4) ASSEMBLY

(1) Put shim (4), springs (5) and spring seat (6) onto spool (4) in this order.



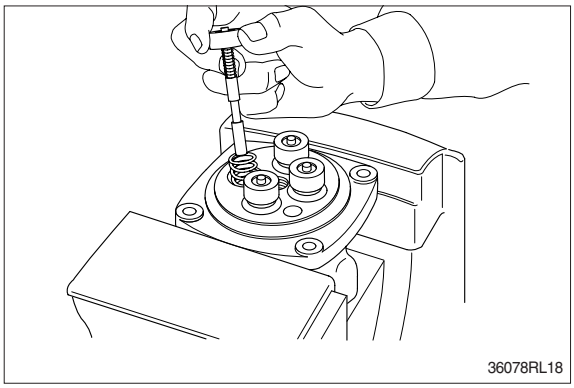
(2) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (7) on spring seat without piling them on.

※ 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.

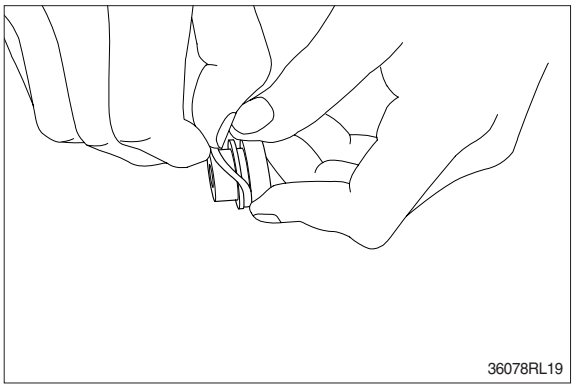


(3) Assemble spring (9) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

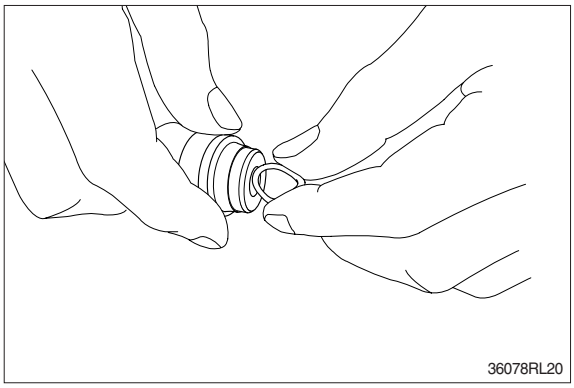


(4) Assemble O-ring (14) onto plug (13).



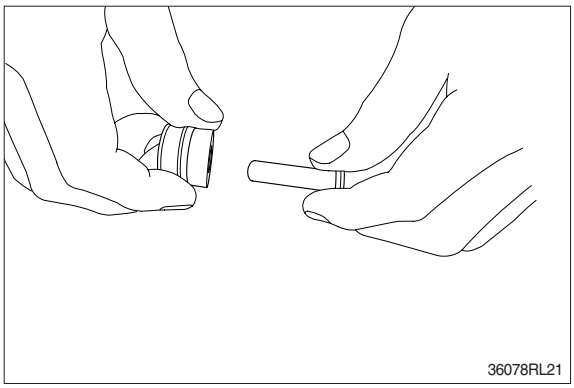
(5) Assemble seal (15) to plug (13).

※ Assemble seal in such lip direction as shown below.



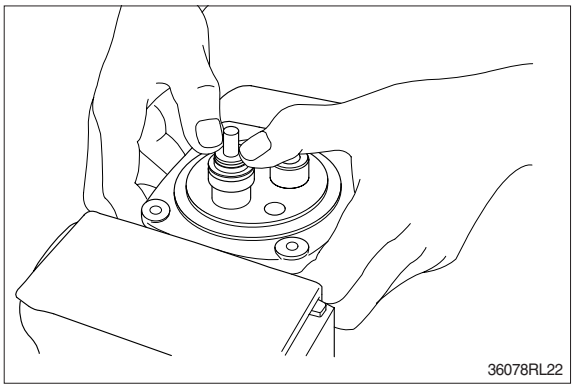
(6) Assemble push rod (10) to plug (13).

※ Apply working oil on push-rod surface.

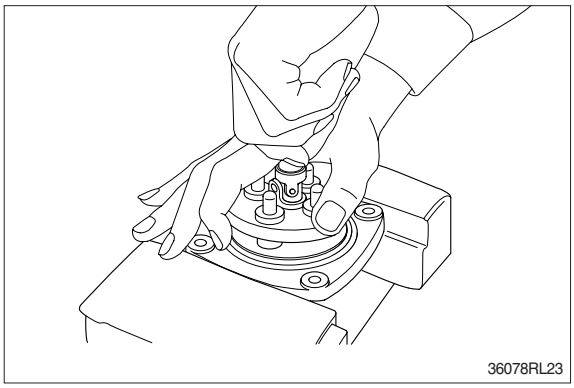


(7) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

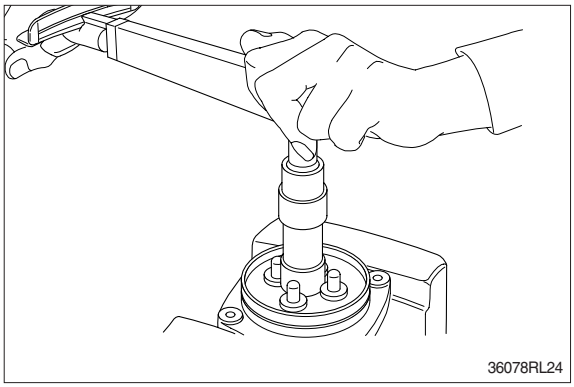


(8) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (16), and tighten joint (18) temporarily.



(9) Fit plate (16).

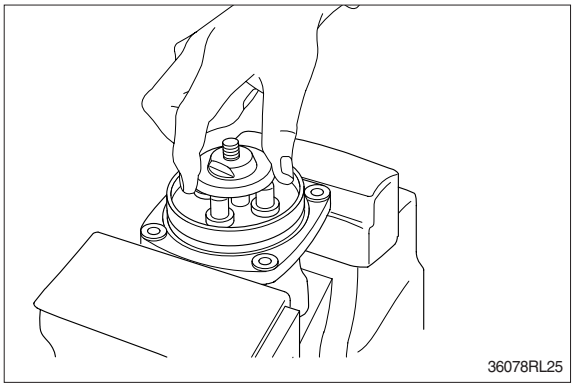
(10) Tighten joint (18) with the specified torque to casing, utilizing jig.



(11) Assemble swash plate (19) to joint (18).

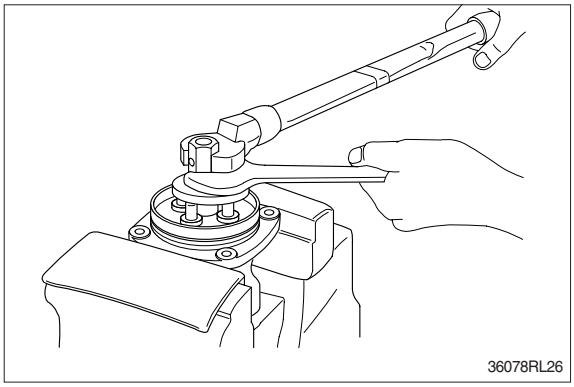
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

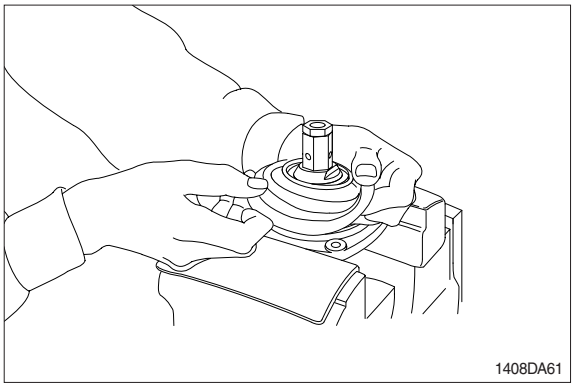


(12) Assemble adjusting nut (20), apply spanner to width across flat of plate (19) to fix it, and tighten adjusting nut to the specified torque.

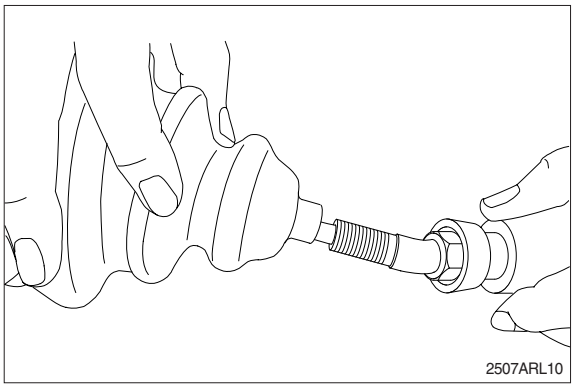
※ During tightening, do not change position of disk.

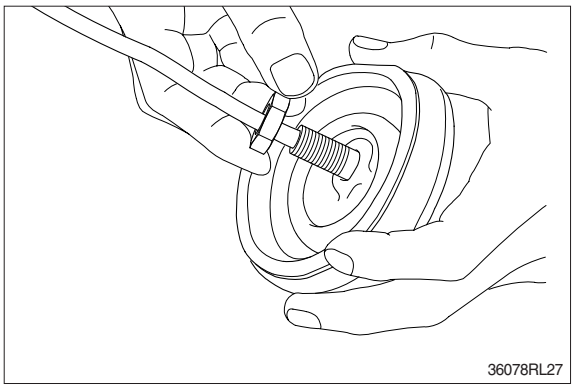


(13) Fit boot (17) to plate.

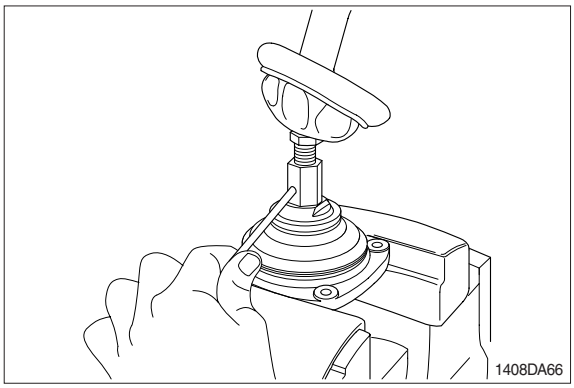


(14) Fit boot (25) and lock nut (21), and handle subassembly is assembled completely.



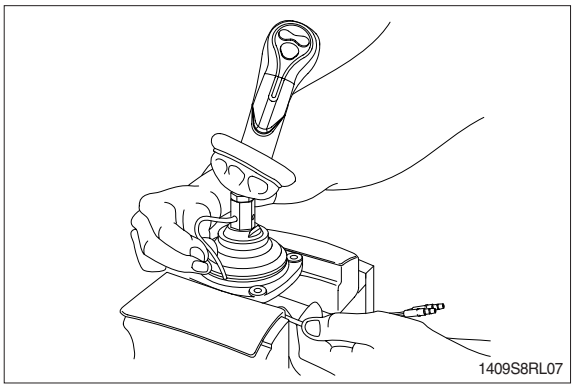


(15) Pull out cord and tube through adjusting nut hole provided in direction 60˚ to 120˚ from casing hole.

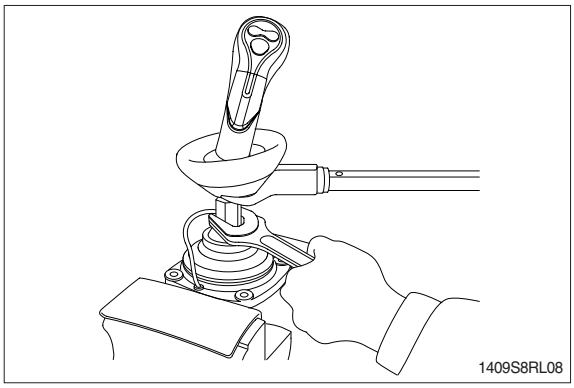


(16) Assemble bushing (27) to plate and pass cord and tube through it.

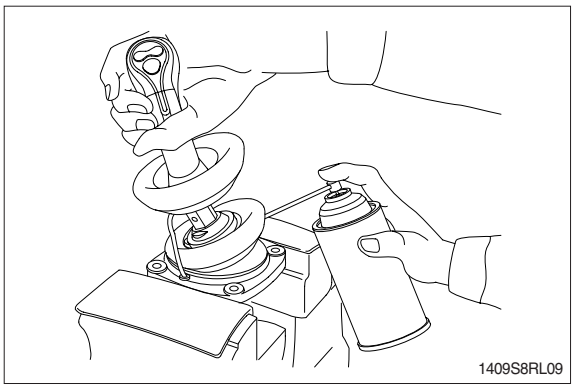
※ Provide margin necessary to operation.



(17) Determine handle direction, tighten lock nut (21) to specified torque to fix handle.

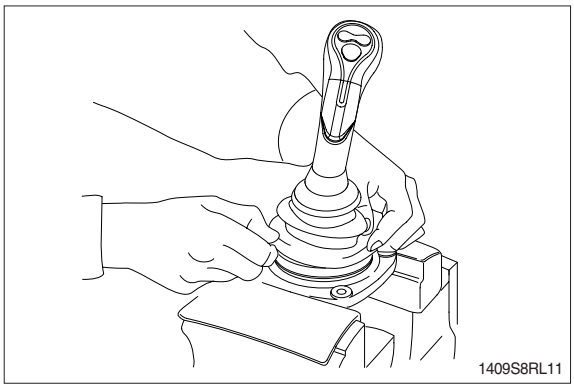


(18) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(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.

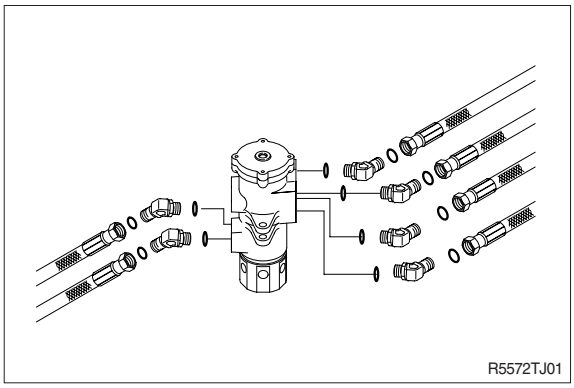
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **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.

(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)



(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

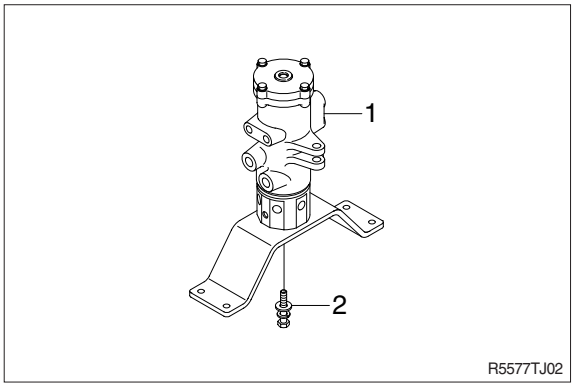
2) INSTALL

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

※ Take care of turning joint direction.

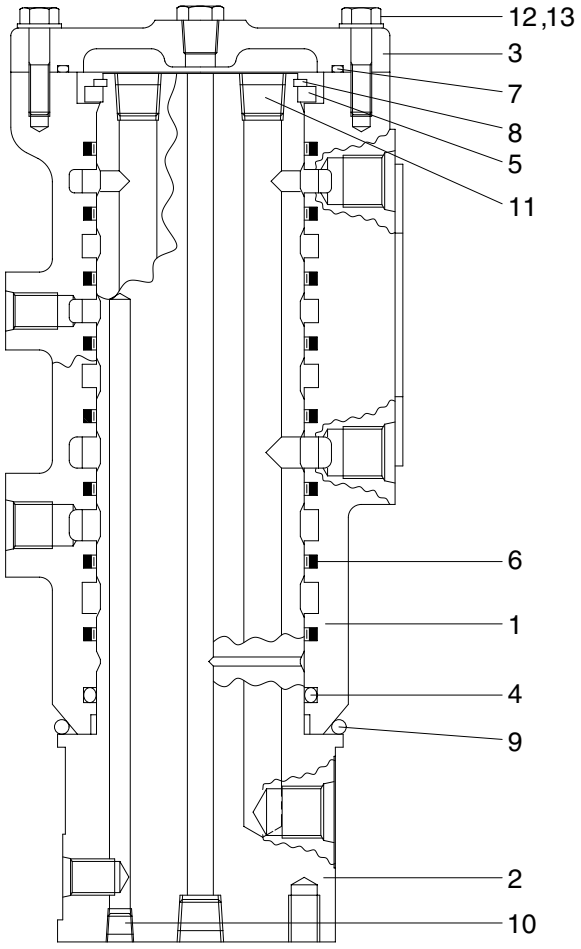
※ Assemble hoses to their original positions.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



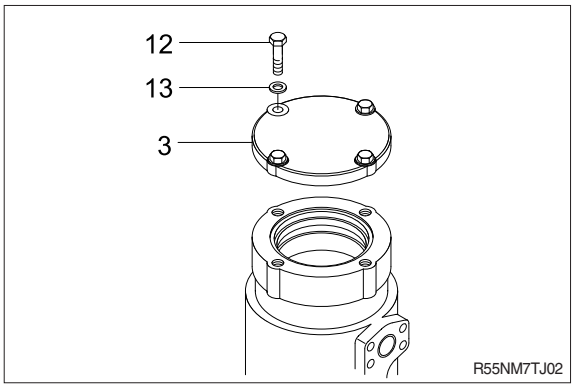
555K7TJ03

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

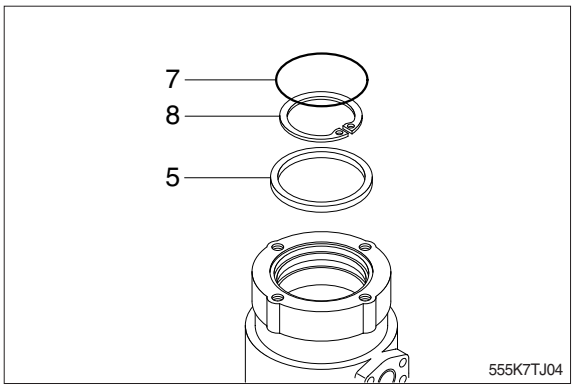
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (12), washer (13) and cover (3).



(2) Remove O-ring (7).

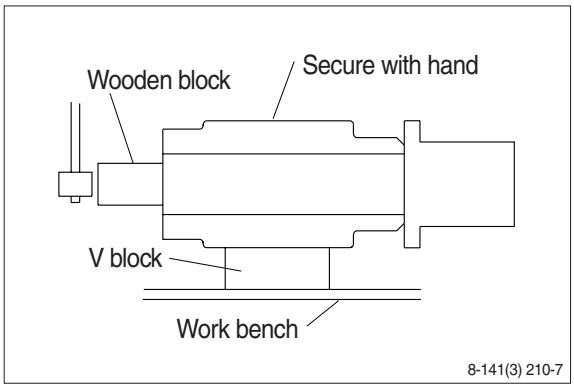
(3) Remove retainer ring (8) and ring (5).



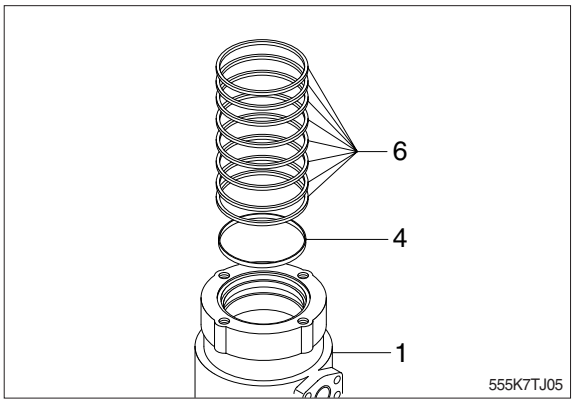
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).



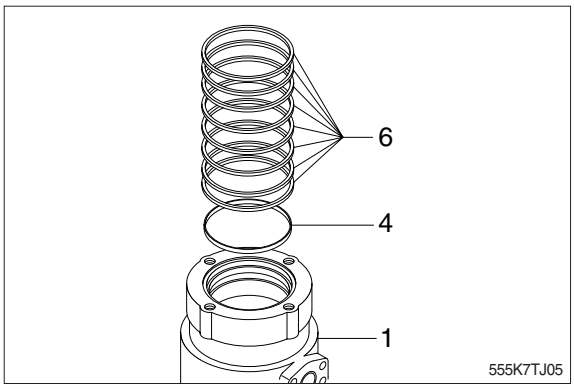
(5) Remove eight slipper seals (6) and O-ring (4) from hub (1).



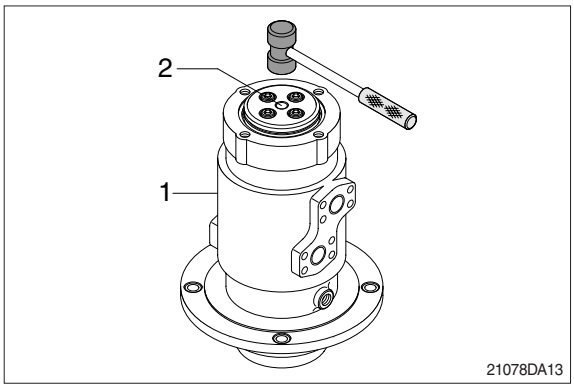
3) ASSEMBLY

※ 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).

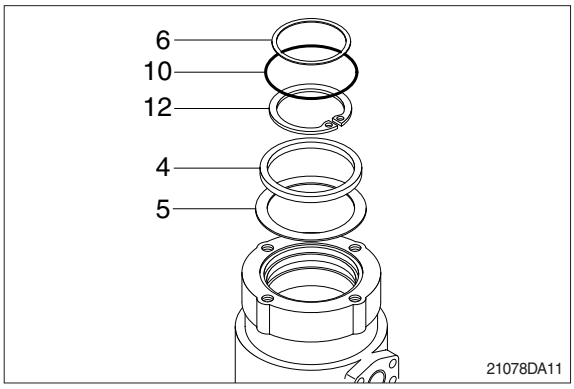


(2) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.

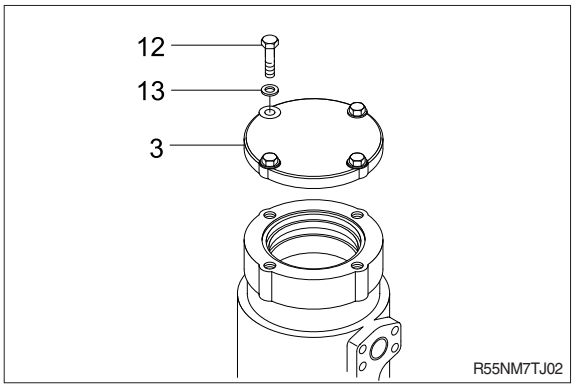


(3) Ring (5) and retainer ring (8) to shaft (2).

(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

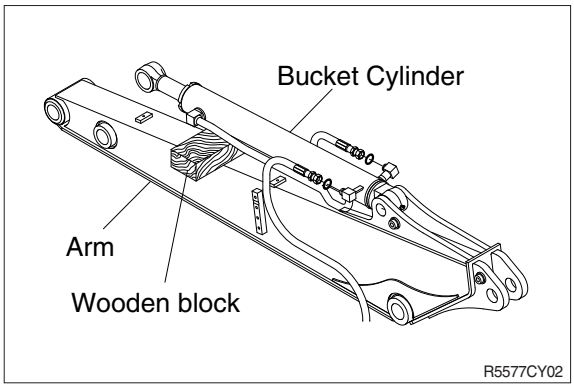
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.**

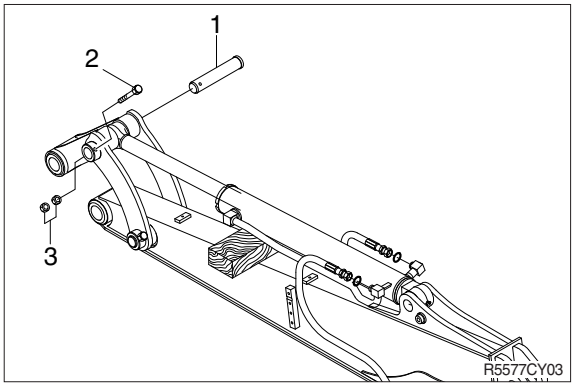
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

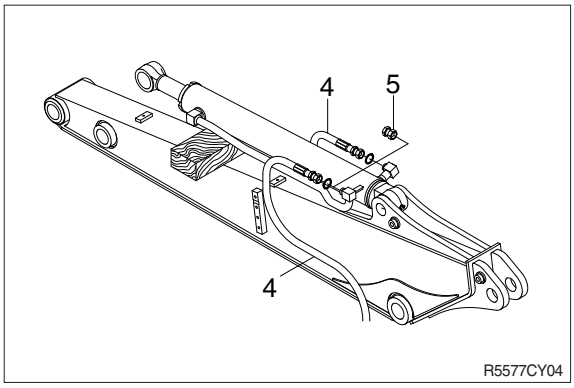


② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



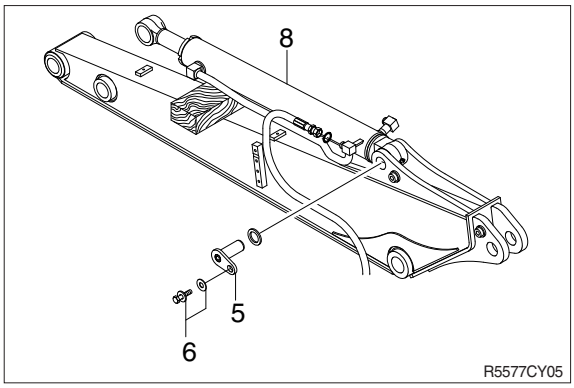
③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



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.

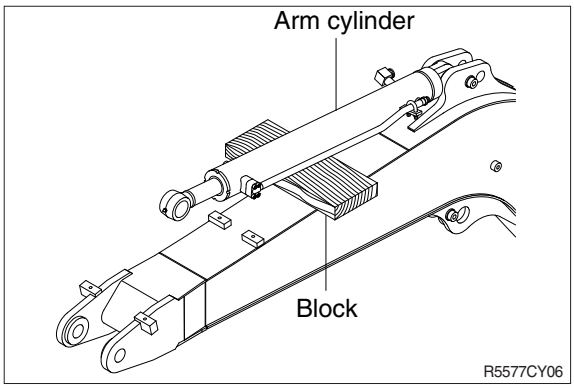
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

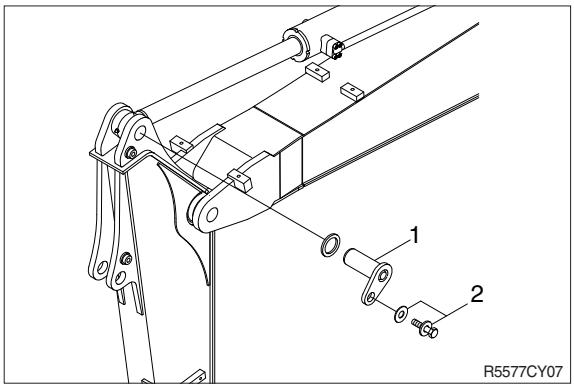
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



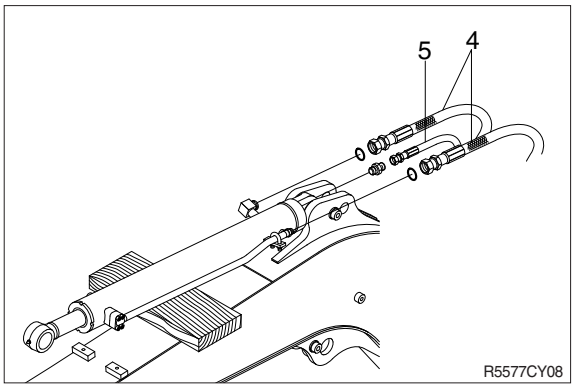
② Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

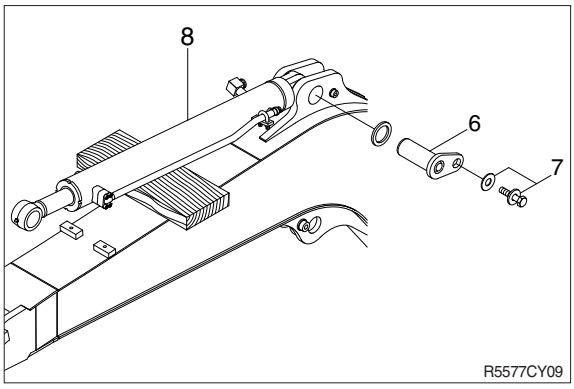


③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

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 : 67 kg (148 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.

② Bleed the air from the arm cylinder.
③ 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.

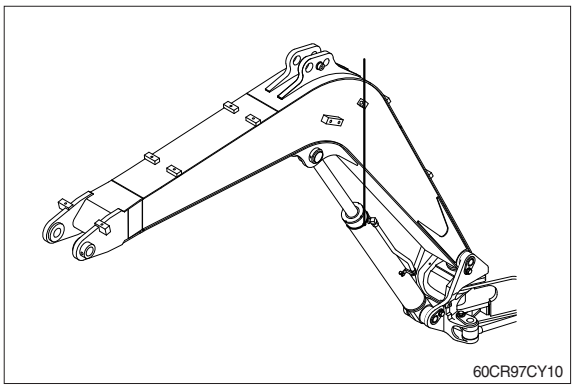
⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ 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.

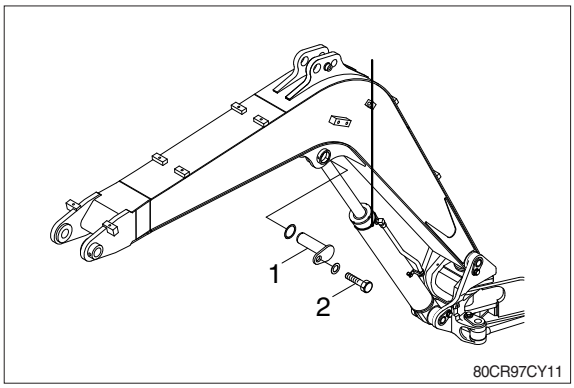
① Disconnect greasing hoses.

② Sling boom cylinder assembly.

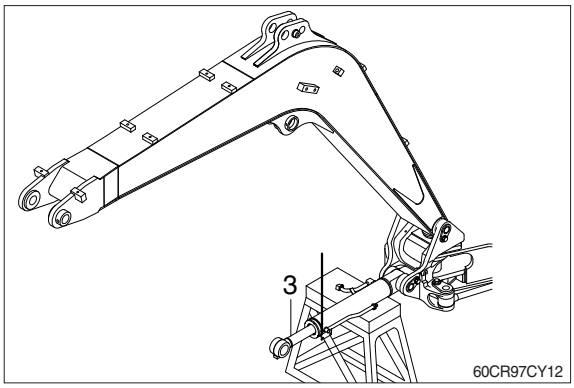


③ Remove bolt (2) and pull out pin (1).

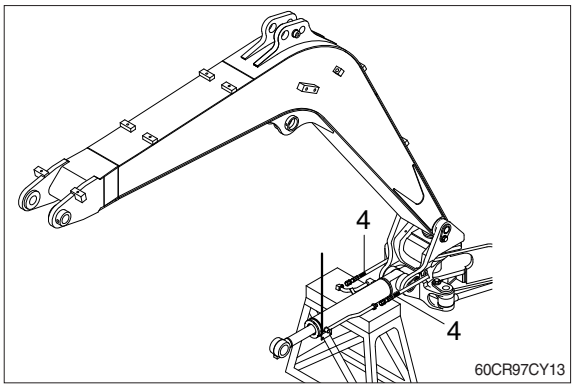
※ Tie the rod with wire to prevent it from coming out.



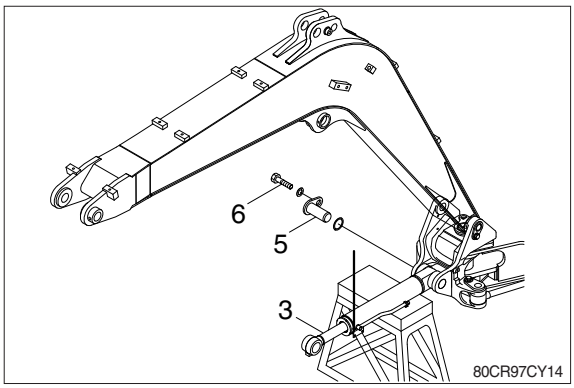
④ Lower the boom cylinder assembly (3) on a stand.



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 : 113 kg (249 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.

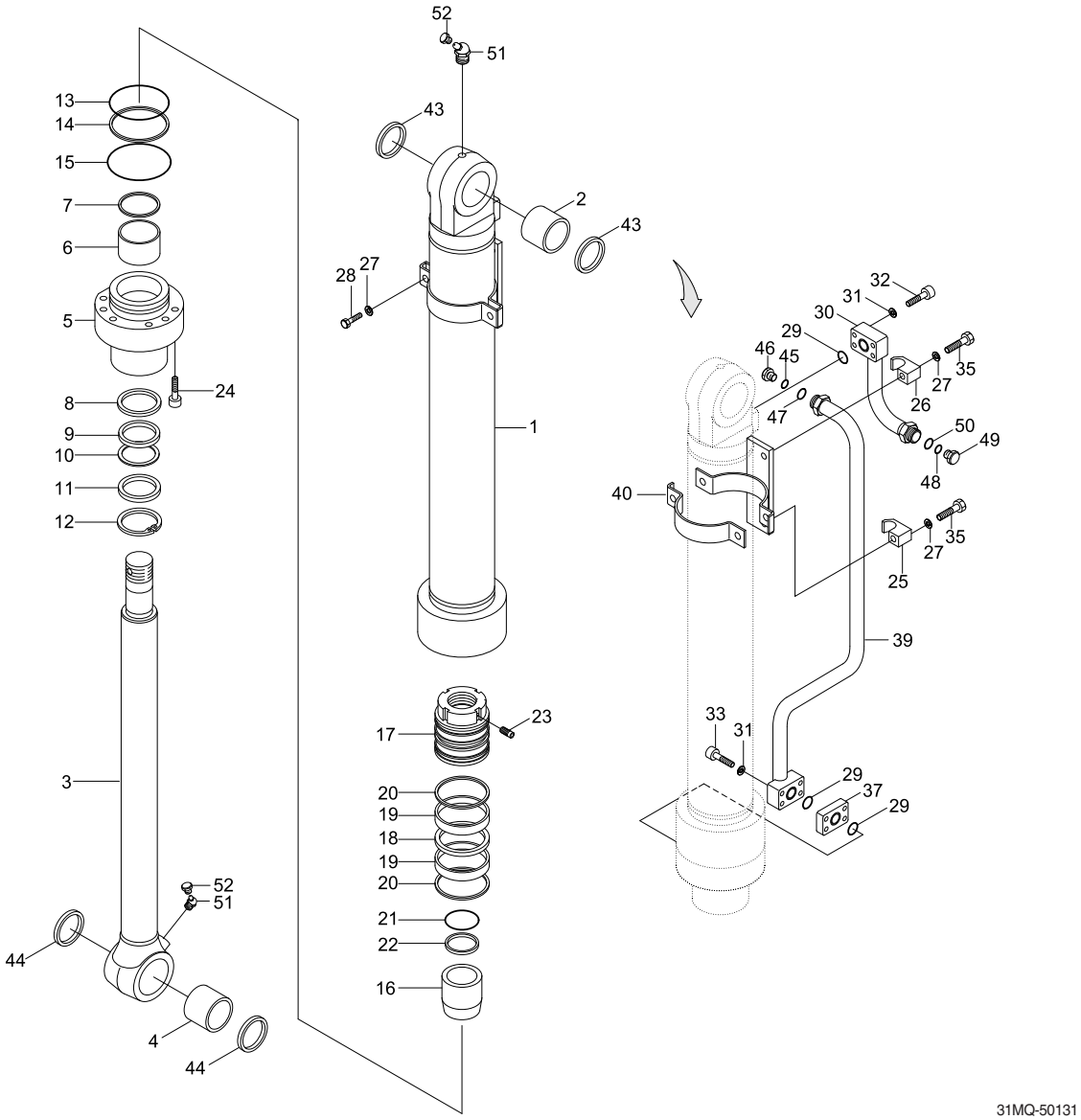
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

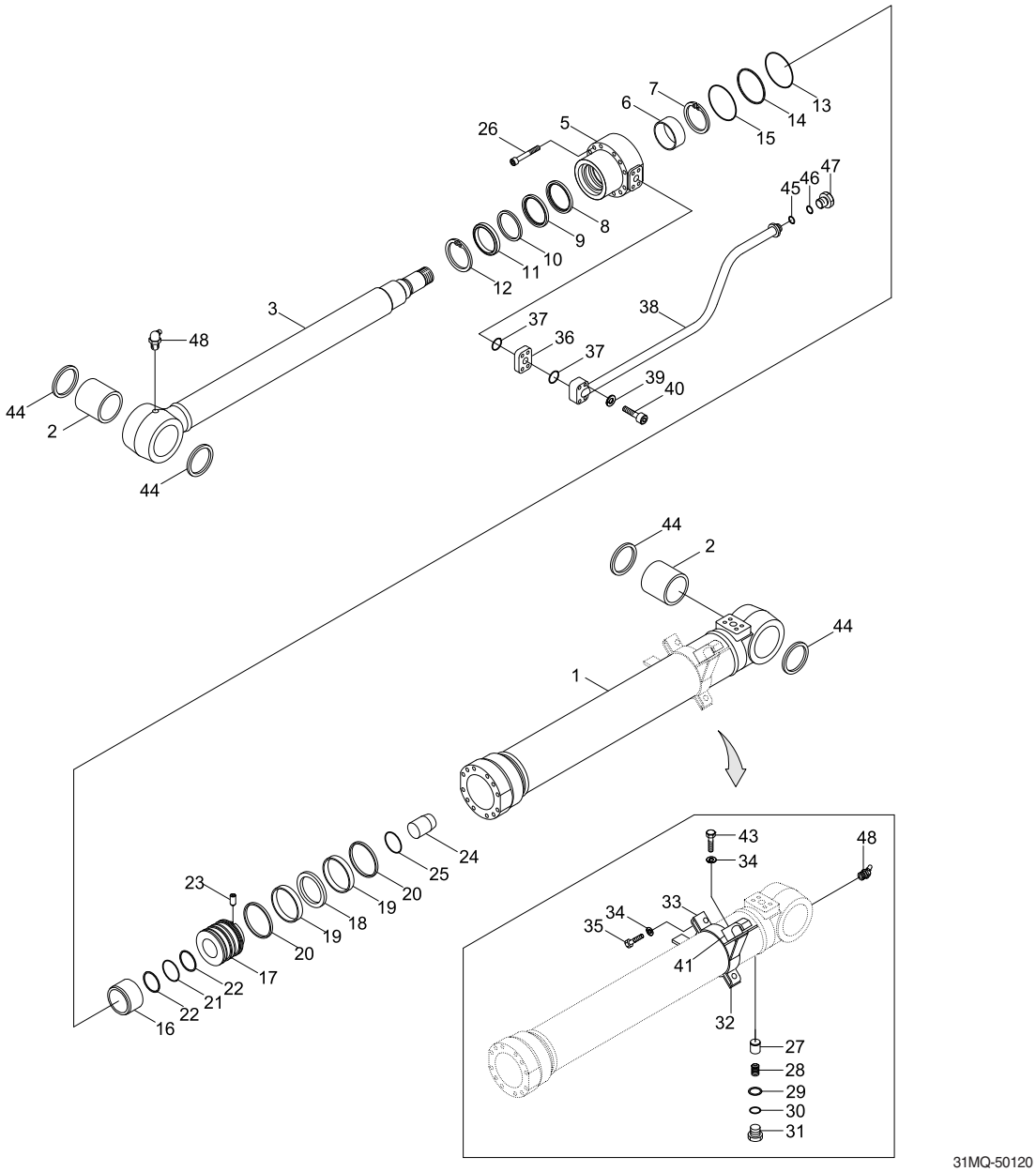
(1) Bucket cylinder



31MQ-50131

1	Tube assembly	17	Piston	33	Hexagon socket bolt
2	Dimple bushing	18	Piston seal	35	Hexagon bolt
3	Rod assembly	19	Wear ring	37	Spacer
4	Dimple bushing	20	Dust ring	39	Pipe assy
5	Rod cover	21	O-ring	40	Clamp
6	Pin bushing	22	Back up ring	43	Dust seal
7	Retainer ring	23	Set screw	44	Pin wiper
8	Buffer seal	24	Hexagon socket bolt	45	O-ring
9	U-packing	25	Band clamp assy	46	Dust cap
10	Back up ring	26	Band clamp assy	47	O-ring
11	Dust seal	27	Spring washer	48	O-ring
12	Retainer ring	28	Hexagon bolt	49	Dust cap
13	O-ring	29	O-ring	50	O-ring
14	Back up ring	30	Pipe assy	51	Grease nipple
15	O-ring	31	Spring washer	52	Cap
16	Cushion ring	32	Hexagon socket bolt		

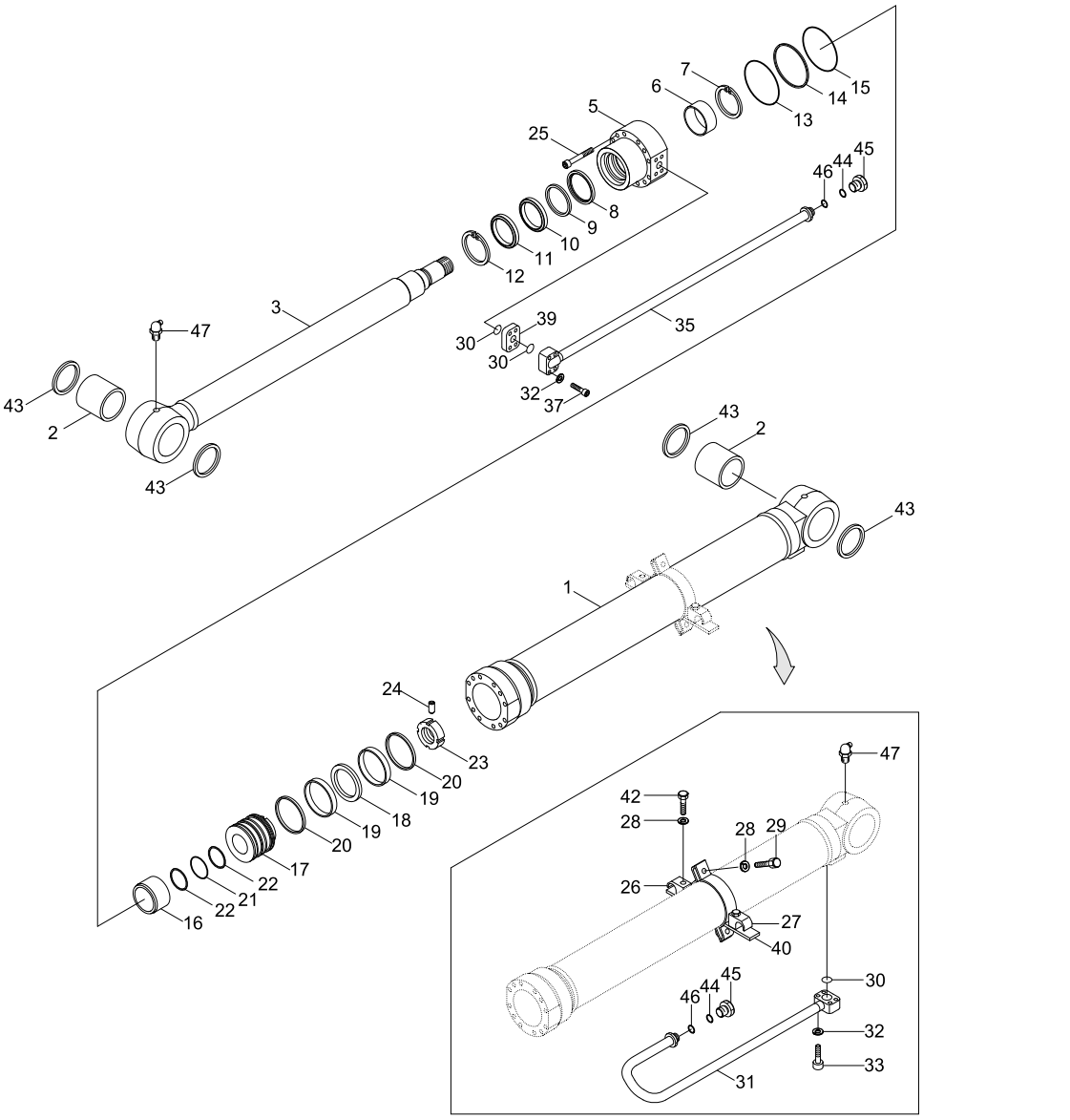
(2) Arm cylinder



31MQ-50120

1	Tube assembly	18	Piston seal	34	Spring washer
2	Dimple bushing	19	Wear ring	35	Hexagon bolt
3	Rod assembly	20	Dust ring	36	Spacer
5	Rod cover	21	O-ring	37	O-ring
6	Pin bushing	22	Back up ring	38	Pipe assy
7	Retainer ring	23	Set screw	39	Hexagon socket bolt
8	Buffer seal	24	Cushion plunger	40	Spring washer
9	U-packing	25	Stop ring	41	Clamp
10	Back up ring	26	Hexagon socket bolt	43	Hexagon bolt
11	Wiper ring	27	Check valve	44	Dust seal
12	Retainer ring	28	Spring	45	O-ring
13	O-ring	29	Spring support	46	O-ring
14	Back up ring	30	O-ring	47	Dust cap
15	O-ring	31	Plug	48	Cap
16	Cushion ring	32	Band clamp assy		
17	Piston	33	Band clamp		

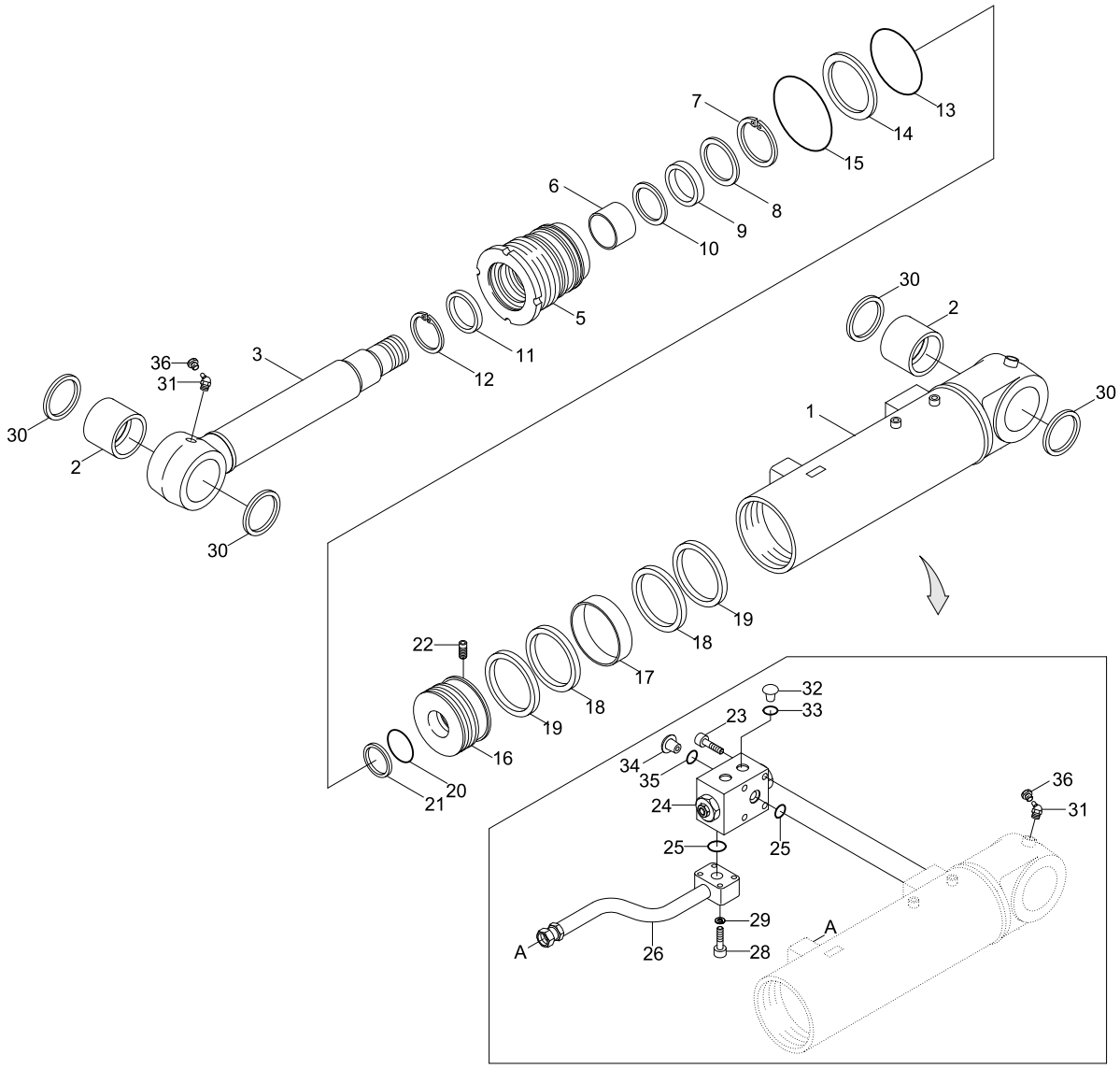
(3) Boom cylinder



31MQ-50110

1	Tube assembly	16	Cushion ring	30	O-ring
2	Dimple bushing	17	Piston	31	Pipe assy
3	Rod assembly	18	Piston seal	32	Spring washer
5	Rod cover	19	Wear ring	33	Hexagon socket bolt
6	Rod bushing	20	Dust ring	35	Pipe assy
7	Retainer ring	21	O-ring	37	Hexagon socket bolt
8	Buffer seal	22	Back up ring	39	Spacer
9	U-packing	23	Nut	40	Clamp
10	Back up ring	24	Set bolt	42	Hexagon bolt
11	Wiper ring	25	Hexagon socket bolt	43	Dust wiper
12	Retainer ring	26	Band clamp assy	44	O-ring
13	O-ring	27	Band clamp assy	45	Dust cap
14	Back up ring	28	Spring washer	46	O-ring
15	O-ring	29	Hexagon bolt	47	Cap

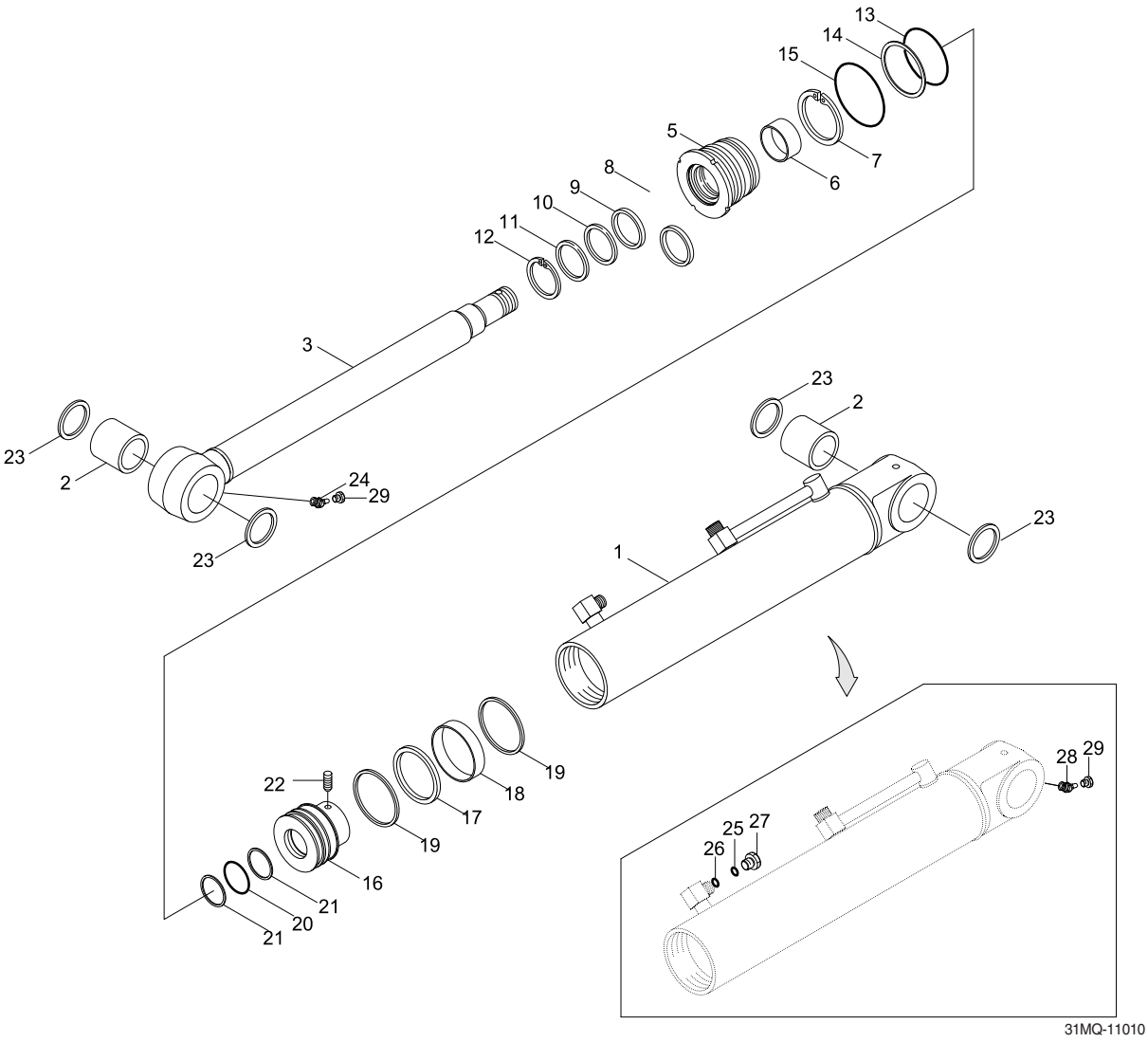
(4) Dozer cylinder



31MQ-40120

1	Tube assembly	13	O-ring	25	O-ring
2	Pin bushing	14	Back up ring	26	Pipe assy
3	Rod assembly	15	O-ring	28	Hexagon socket bolt
5	Rod cover	16	Piston	29	Spring washer
6	Rod bushing	17	Piston seal	30	Dust wiper
7	Retainer ring	18	Wear ring	31	Grease nipple
8	Buffer seal	19	Dust ring	32	Dust cap
9	U-packing	20	O-ring	33	O-ring
10	Back up ring	21	Back up ring	34	Dust cap
11	Wiper ring	23	Set screw	35	O-ring
12	Retainer ring	24	Check valve	36	Cap

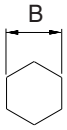
(5) Boom swing cylinder



1	Tube assembly	12	Retainer ring	22	Set bolt
2	Dimple bushing	13	O-ring	23	Dust seal
3	Rod assembly	14	Back up ring	24	Grease nipple
5	Rod cover	15	O-ring	25	O-ring
6	Pin bushing	16	Piston	26	O-ring
7	Retainer ring	17	Piston seal	27	Dust cap
8	Buffer ring	18	Wear ring	28	Grease nipple
9	U-packing	19	Dust seal	29	Cap
10	Back up ring	20	O-ring		
11	Wiper ring	21	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	25	M16×2.0	30±2	217±14.5
	Arm cylinder	26	M14×2.0	19±1.0	137±7.2
	Bucket cylinder	24	M14×2.0	19±1.0	137±7.2
Gland	Dozer cylinder	5	M135×2.0	90±9	651±65.1
	Boom swing cylinder	3	M115×2.0	92±9.2	665±66.5
Lock nut	Boom cylinder	23	M50×2.0	130±13	940±94
	Dozer cylinder	21	M55×2.0	130±13	940±94
Piston	Boom cylinder	17	M60×3.0	75±7.5	542±54
	Arm cylinder	17	M52×2.0	190±19	1374±137
	Bucket cylinder	17	M45×2.0	130±13	940±94.0
	Dozer cylinder	16	M65×3.0	75±7.5	542±54
	Boom swing	13	M50×2.0	125±12.5	904±90.4

3) DISASSEMBLY

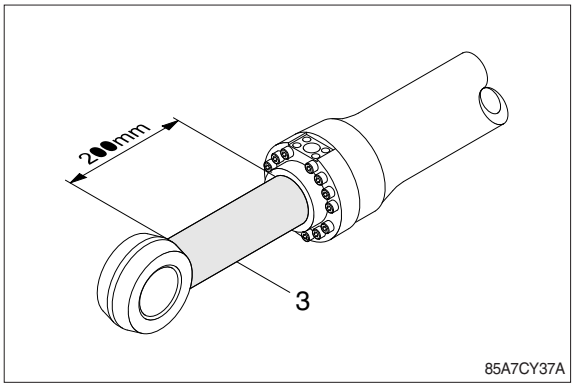
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

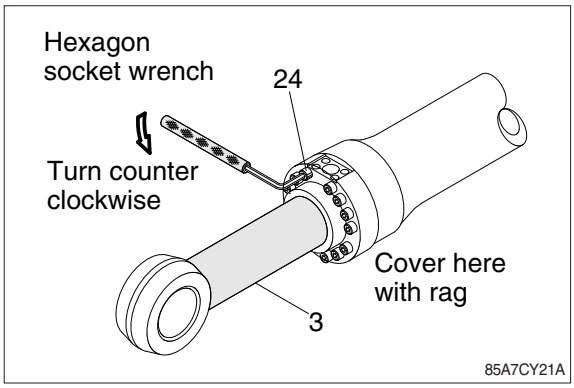
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (3) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



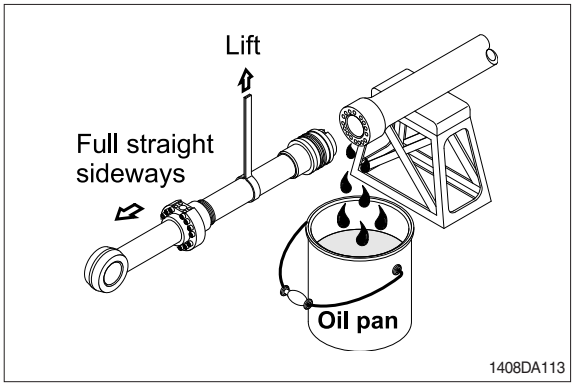
③ Loosen and remove socket bolts (24) of the gland in sequence.

※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly together from tube assembly (1).

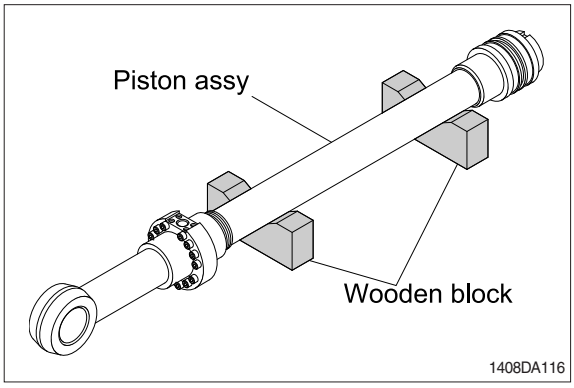
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (3) with a crane or some means and draw it out. However, when rod assembly (3) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



※ Note that the plated surface of rod assembly (3) 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.

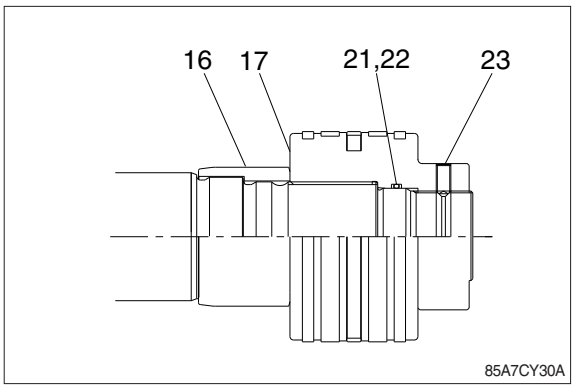
※ Cover a V-block with soft rag.



(2) Remove piston and rod cover

① Remove screw (23).

② Remove piston assembly (17), back up ring (22), and O-ring (21).

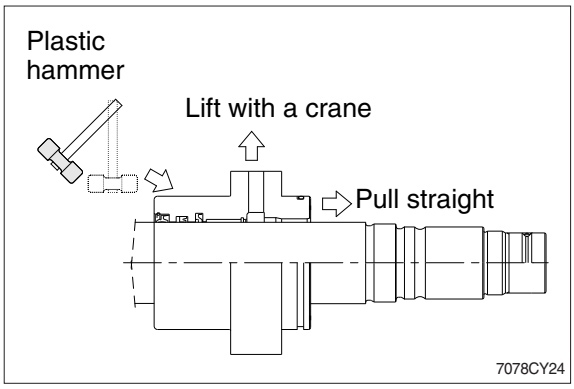


③ Remove the cylinder head assembly from rod assembly (3).

※ 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 (6) and packing (8, 9, 10, 11, 12) by the threads of rod assembly (3).

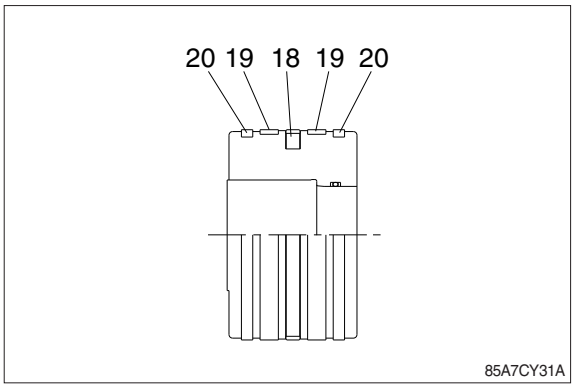


(3) Disassemble the piston assembly

① Remove wear ring (19).

② Remove dust ring (20) and piston seal (18).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble rod cover assembly

① Remove back up ring (14) and O-ring (13, 15).

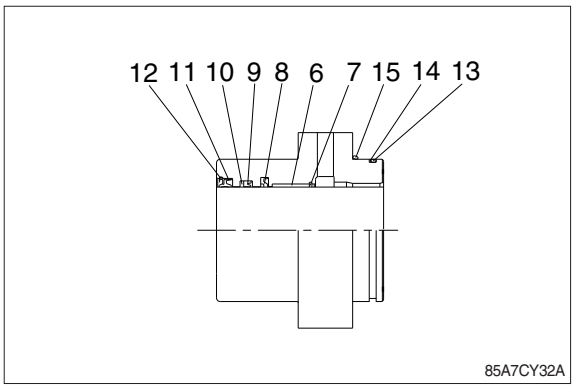
② Remove retainer ring (12), dust wiper (11).

③ Remove back up ring (10), U-packing (9) and buffer seal (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

※ Do not remove bushing (6).

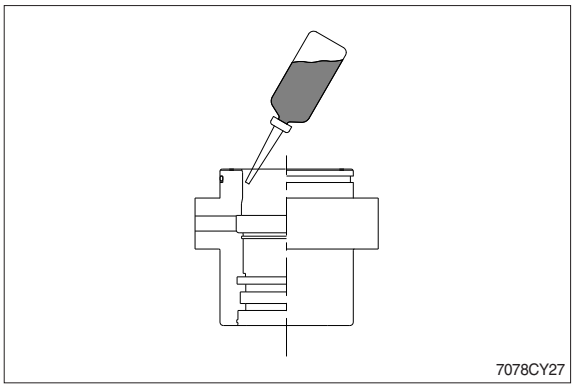


4) ASSEMBLY

(1) Assemble rod cover assembly

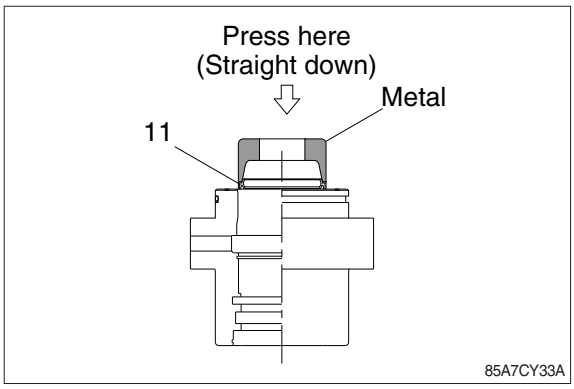
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of rod cover (5) with hydraulic oil.



② Coat dust wiper (11) with grease and fit dust wiper (11) to the bottom of the hole of dust seal.

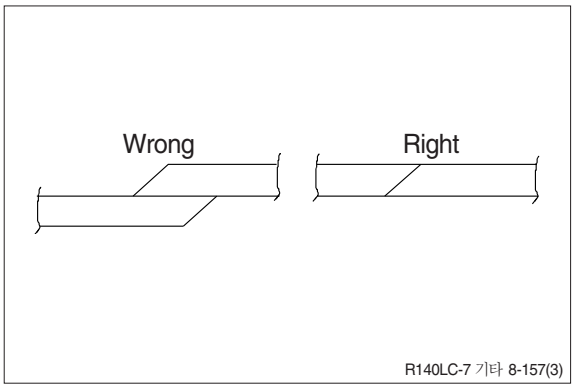
③ At this time, press a pad metal to the metal ring of dust seal.
Fit retainer ring (12) to the stop face.



④ Fit back up ring (10), U-packing (9) and buffer seal (8) to corresponding grooves, in that order.

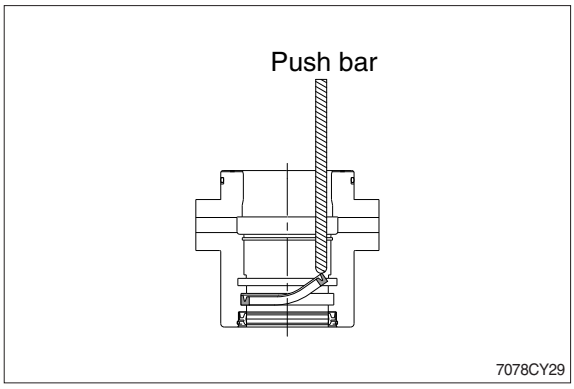
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until one side of it is inserted into groove.



※ U-packing (9) has its own fitting direction. Therefore, confirm it before fitting them.

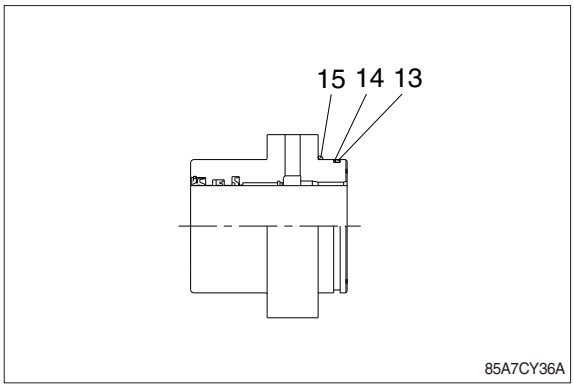
※ Fitting U-packing (9) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (14) to rod cover (5).

※ Put the backup ring in the warm water of 30~50˚C.

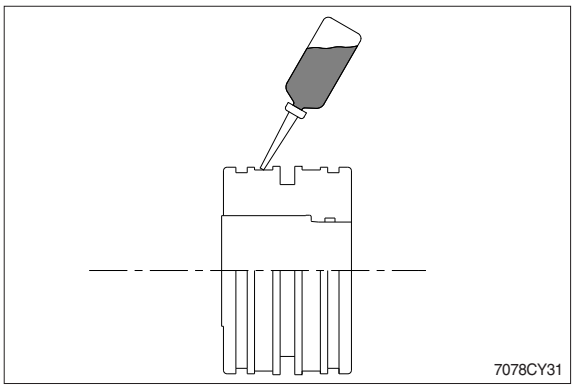
⑥ Fit O-ring (13, 15) to rod cover (5).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

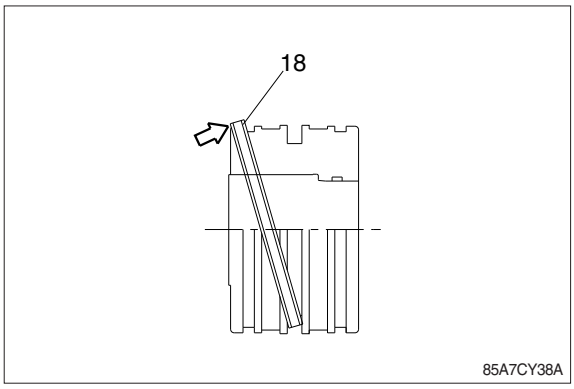
① Coat the outer face of piston (17) with hydraulic oil.



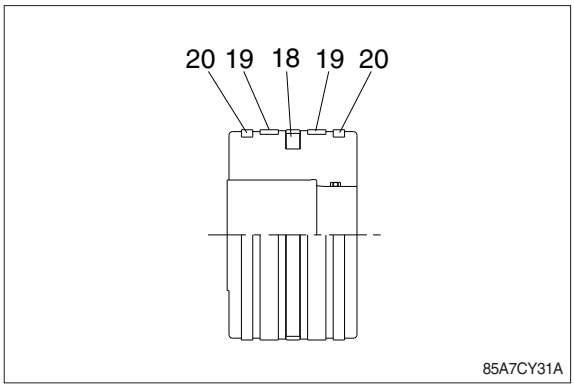
② Fit piston seal (18) to piston.

※ 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 (19) and dust ring (20) to piston (17).

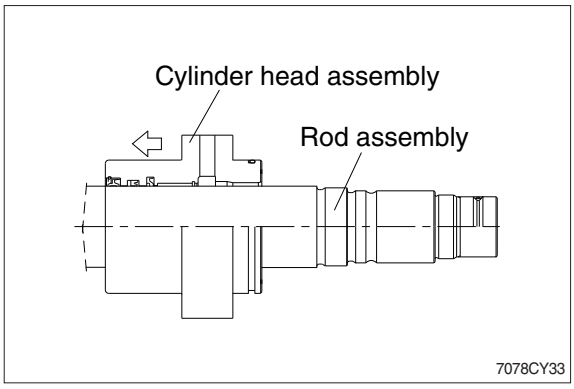


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

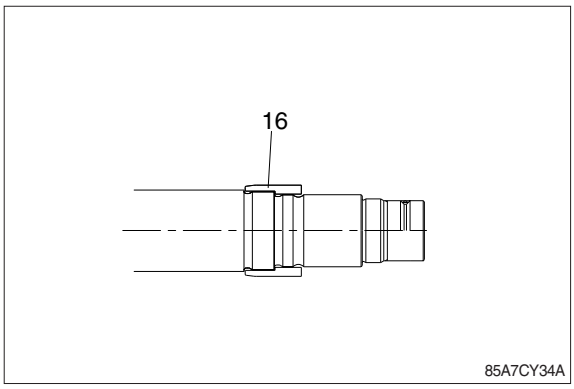
② Apply hydraulic oil to the outer surface of rod assembly (3), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (16) to rod assembly.

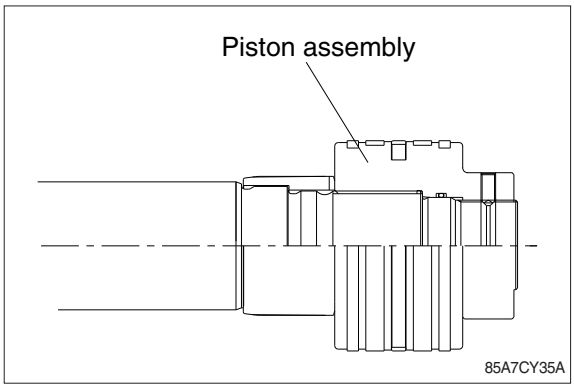
※ Note that cushion ring (16) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque : 130±113 kgf · m
(940±94 lbf · ft)

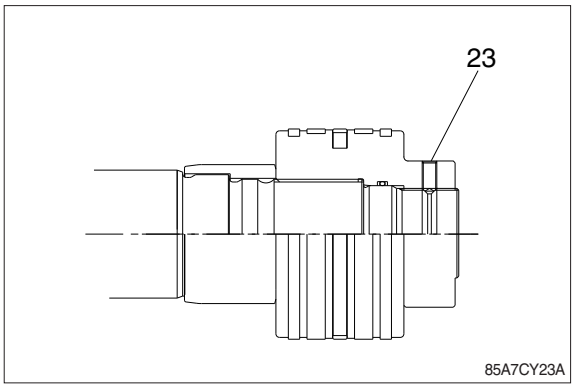
※ Refer to page 7-124.



⑥ Fit screw (23).

· Tightening torque : 1.5 kgf · m
(10.8 lbf · ft)

※ Refer to page 7-124.



(3) Overall assemble

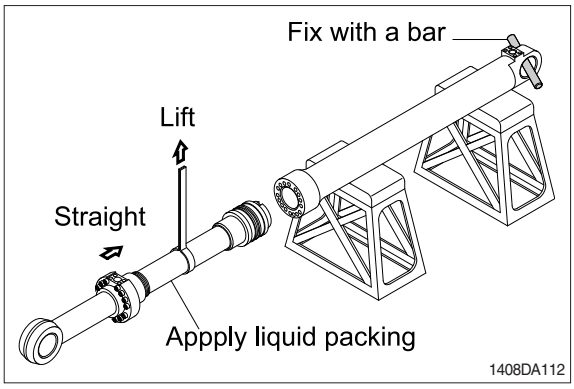
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

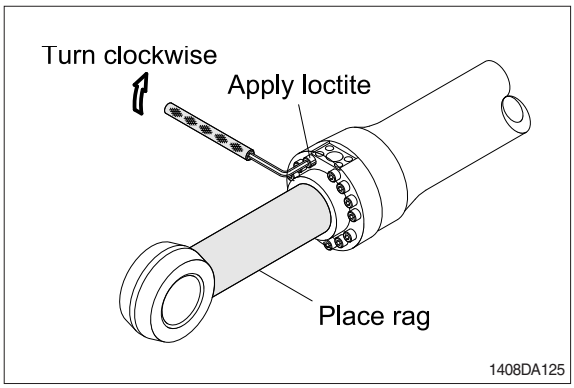
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ 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

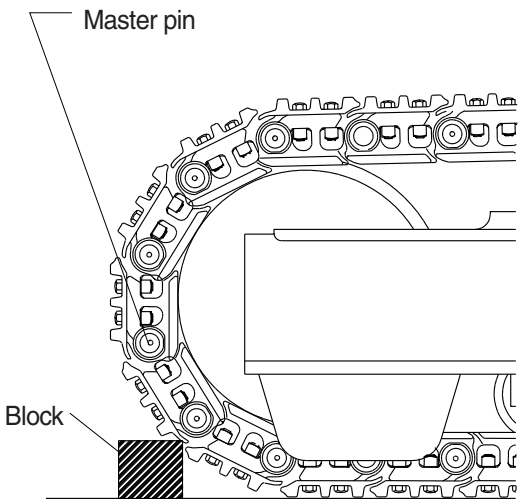
(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(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.

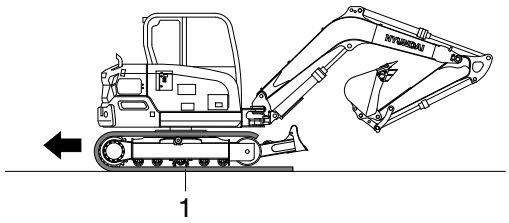


8-161(1) 140-7

(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.

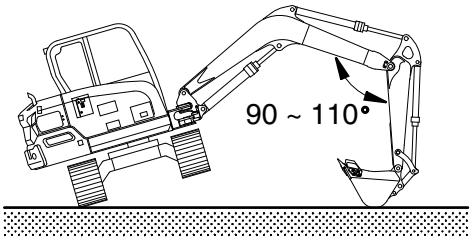


85A7TR01

2) INSTALL

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

※ Adjust the tension of the track link.

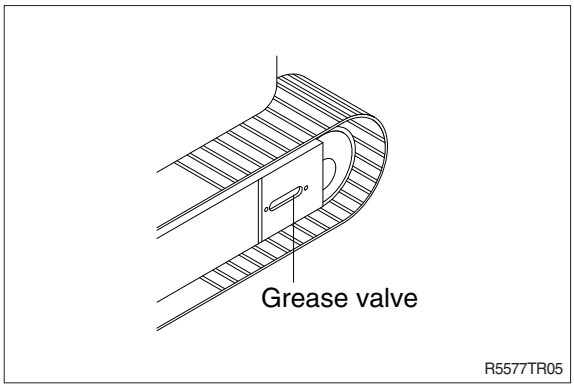


85A7TR02

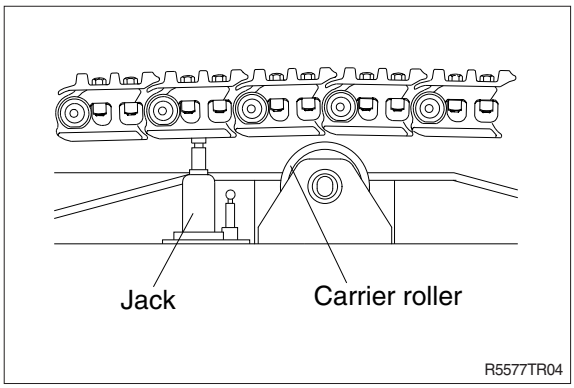
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.

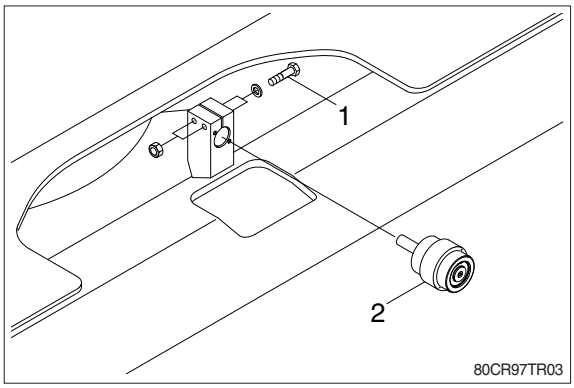


(2) Jack up the track link height enough to permit carrier roller removal.



(3) Remove bolt (1) at both side.

(4) Remove carrier roller (2).
· Weight : 7 kg (15.4 lb)



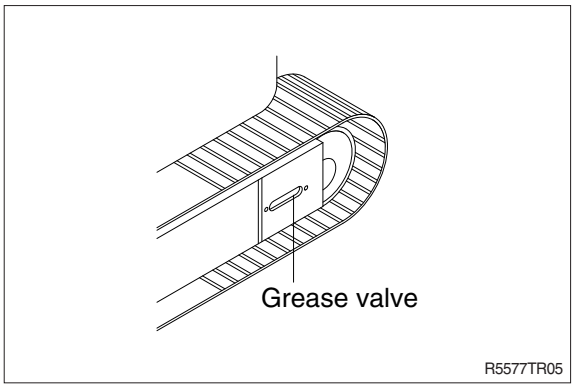
2) INSTALL

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

3. TRACK ROLLER

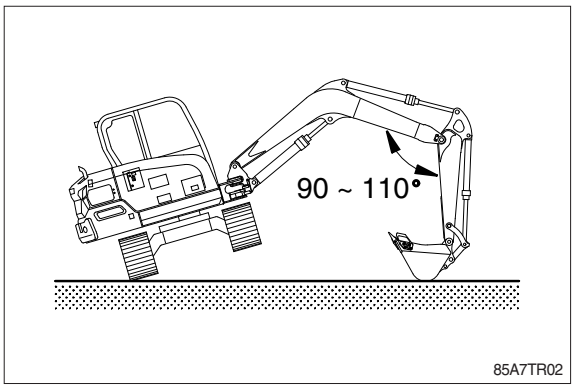
1) REMOVAL

(1) Loosen tension of the track link.



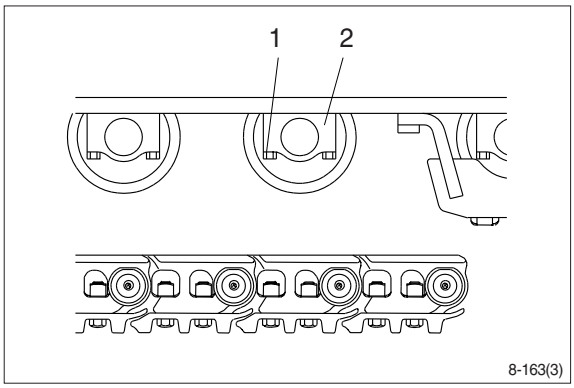
(2) Using the work equipment, push up track frame on side which is to be removed.

※ 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)



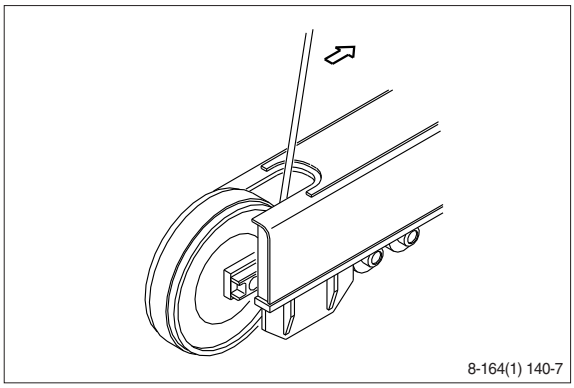
2) INSTALL

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

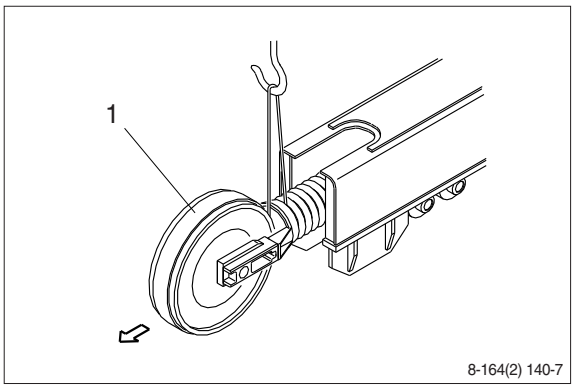
4. IDLER AND RECOIL SPRING

1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.

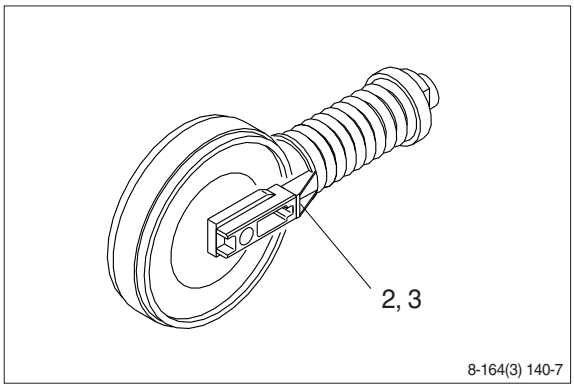

8-164(1) 140-7

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 123 kg (271 lb)



8-164(2) 140-7

(3) Remove the bolts (2), washers (3) and separate idler from recoil spring.

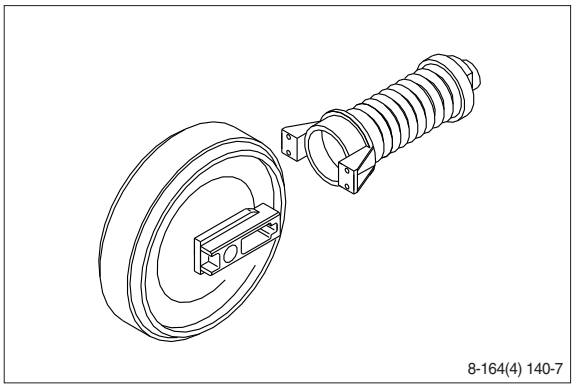


8-164(3) 140-7

2) INSTALL

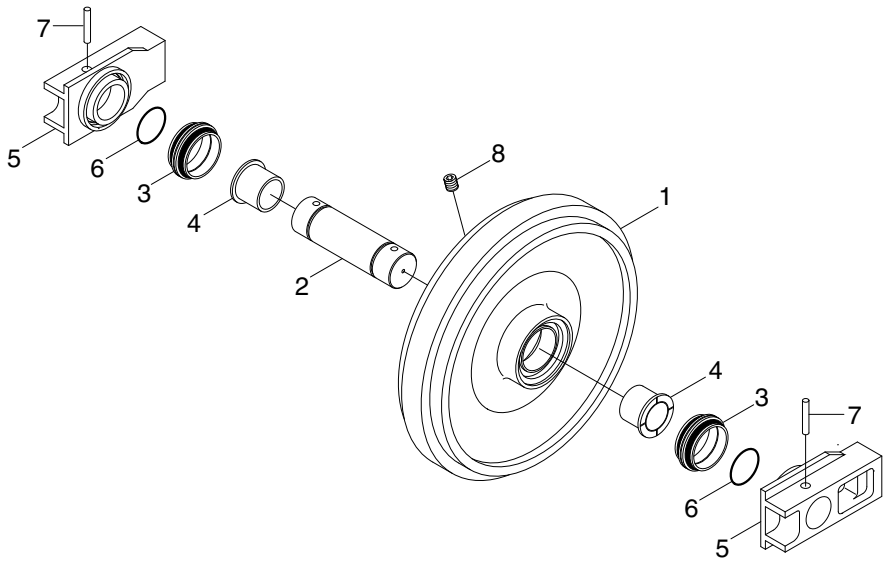
(1) Carry out installation in the reverse order to removal.

※ 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



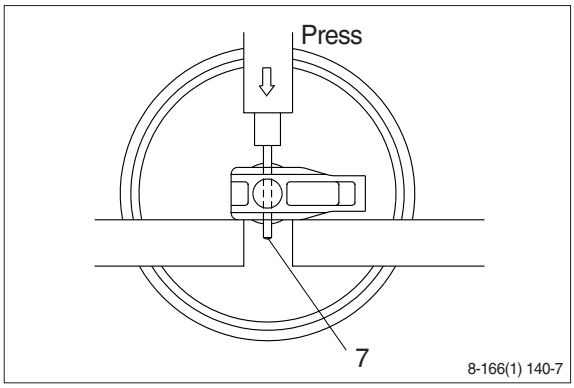
80CR97ID30

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.

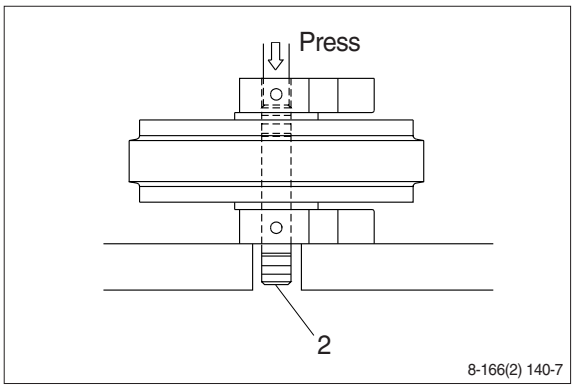
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

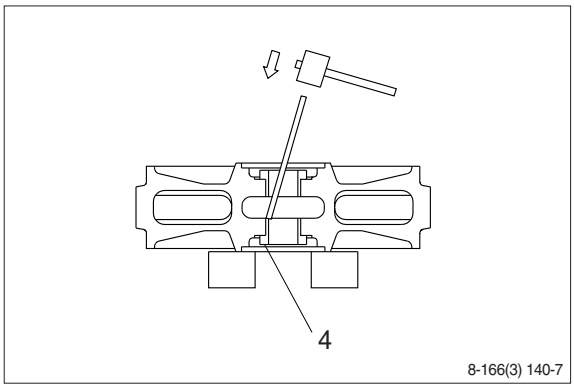
④ Remove seal (3) from idler (1) and bracket (5).

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.

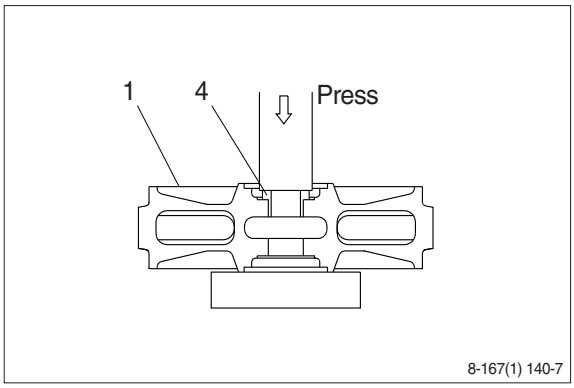


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

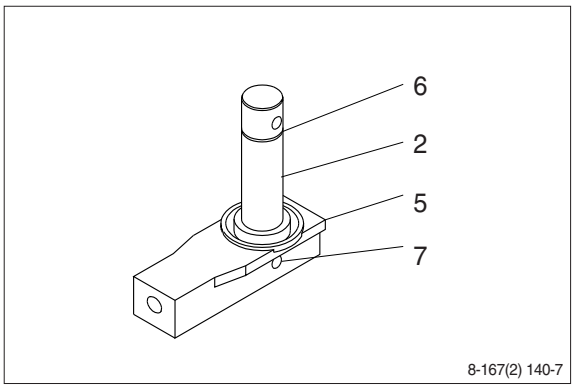
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1) 140-7

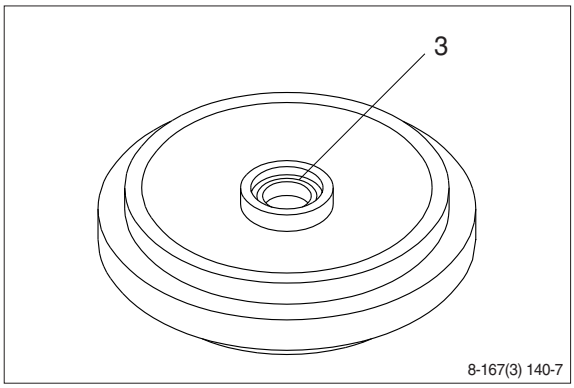
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



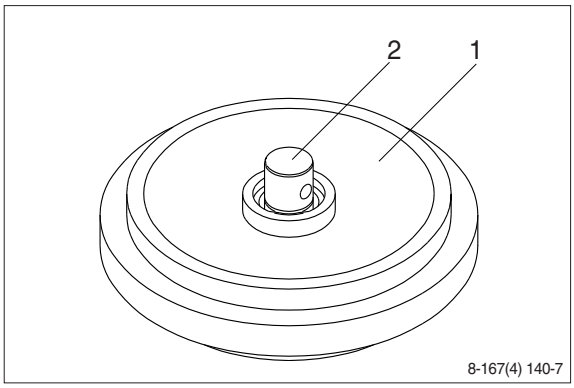
8-167(2) 140-7

④ Install seal (3) to shell (1) and bracket (5).



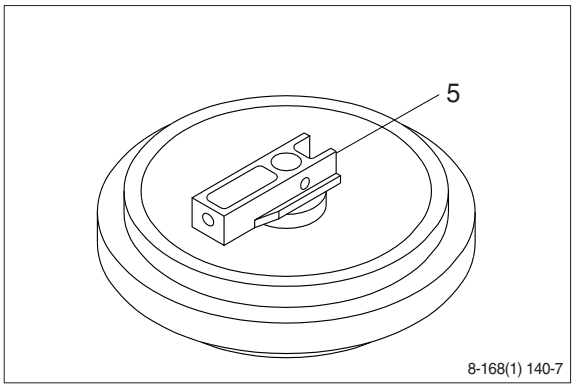
8-167(3) 140-7

⑤ Install shaft (2) to shell (1).

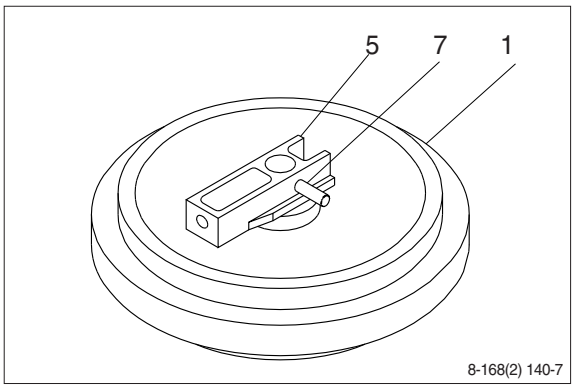


8-167(4) 140-7

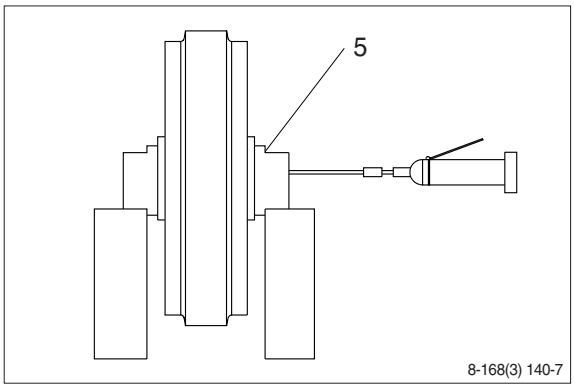
⑥ Install bracket (5) attached with seal (3).



⑦ Knock in the spring pin (7) with a hammer.

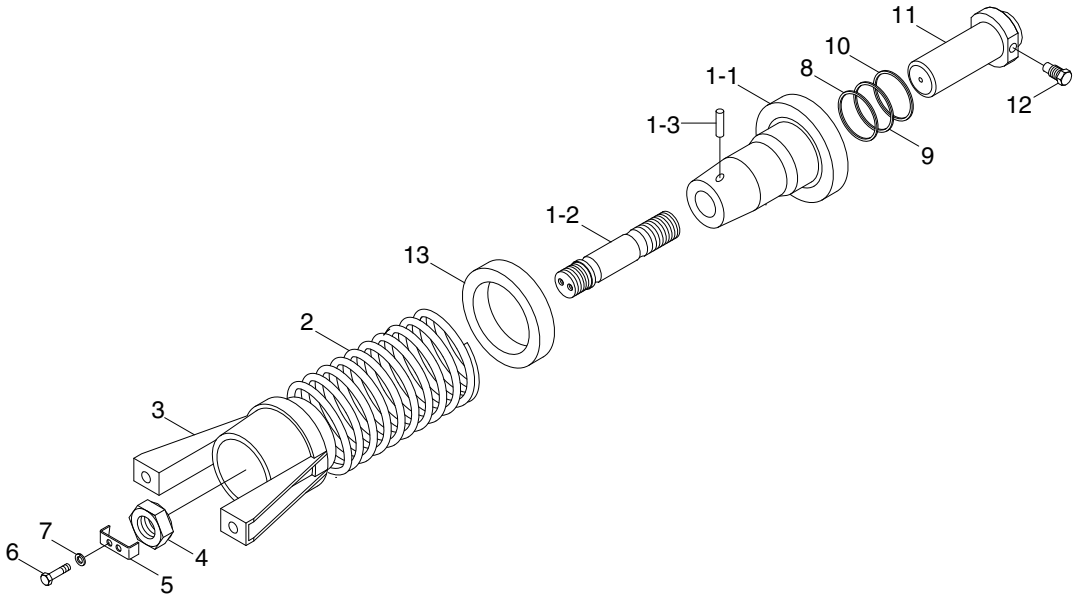


⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



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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.

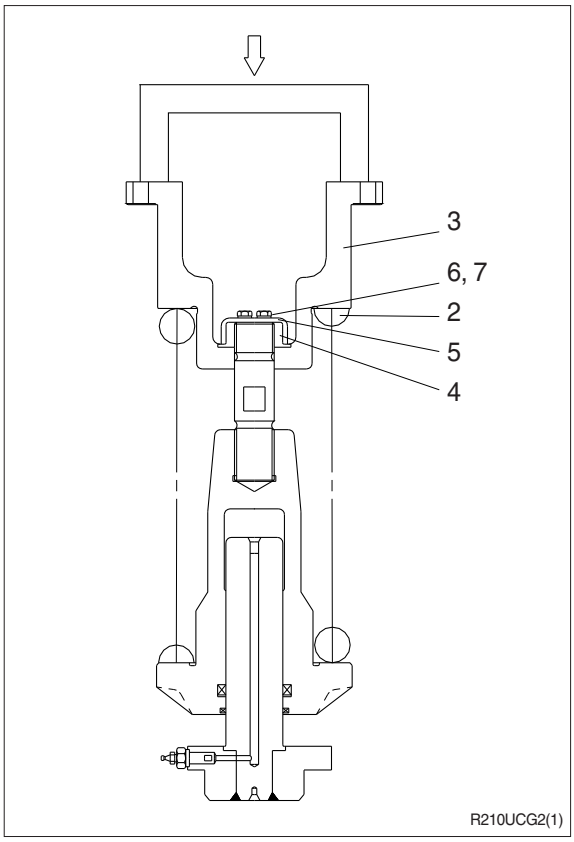
※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

· Spring set load : 4816 kg (10617 lb)

② Remove bolt (6), spring washer (7) and lock plate (5).

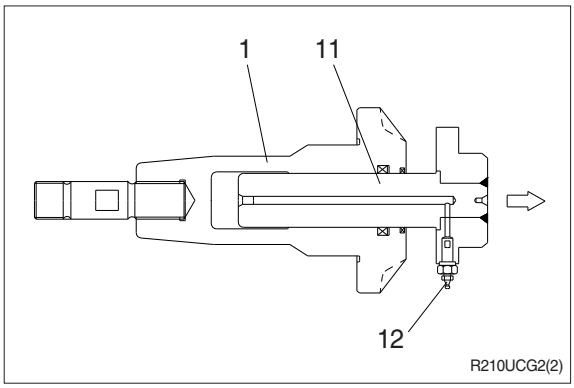
③ Remove lock nut (4).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove bracket (3) and spring (2).

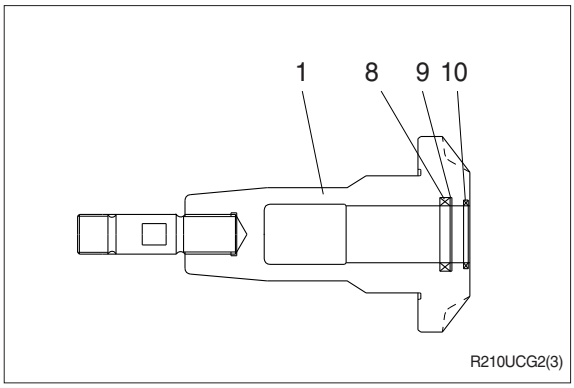


⑤ Remove rod (11) from body (1-1).

⑥ Remove grease valve (12) from rod (11).



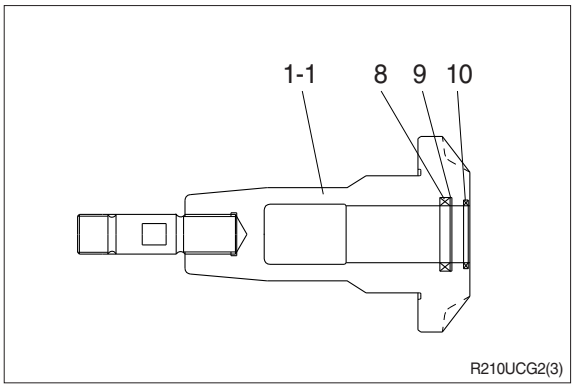
⑦ Remove rod seal (8), back up ring (9) and dust seal (10).



(3) Assembly

① Install dust seal (10), back up ring (9) and rod seal (8) to body (1-1).

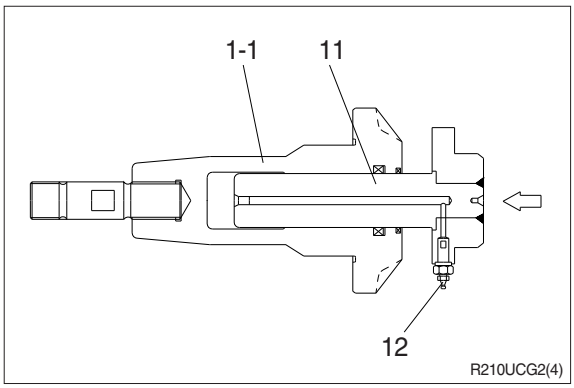
※ When installing dust seal (10) and rod seal (8), take full care so as not to damage the lip.



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)

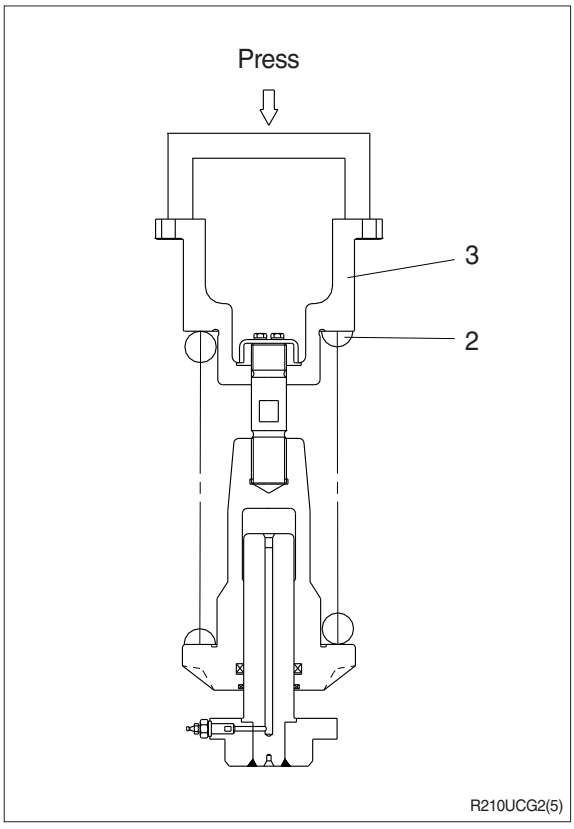


④ Install spring (2) and bracket (3) to body (1-1).

⑤ Apply pressure to spring (2) with a press and tighten lock nut (4).

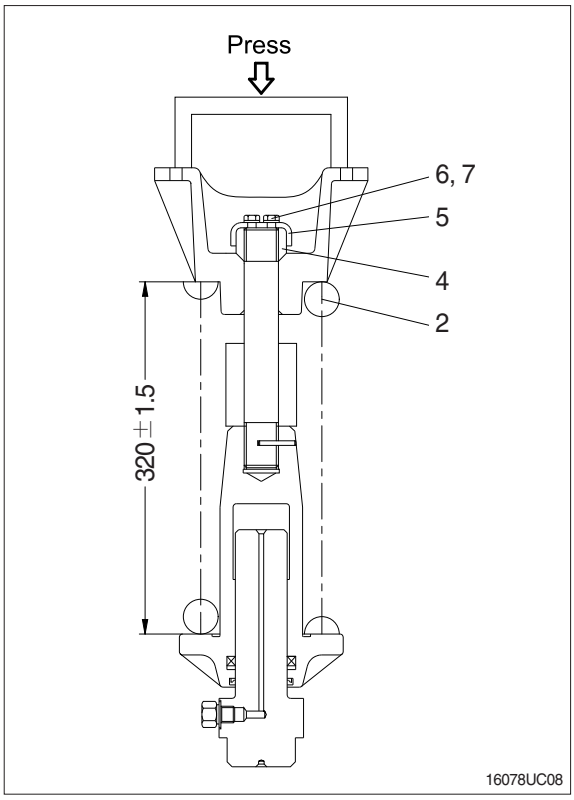
※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.



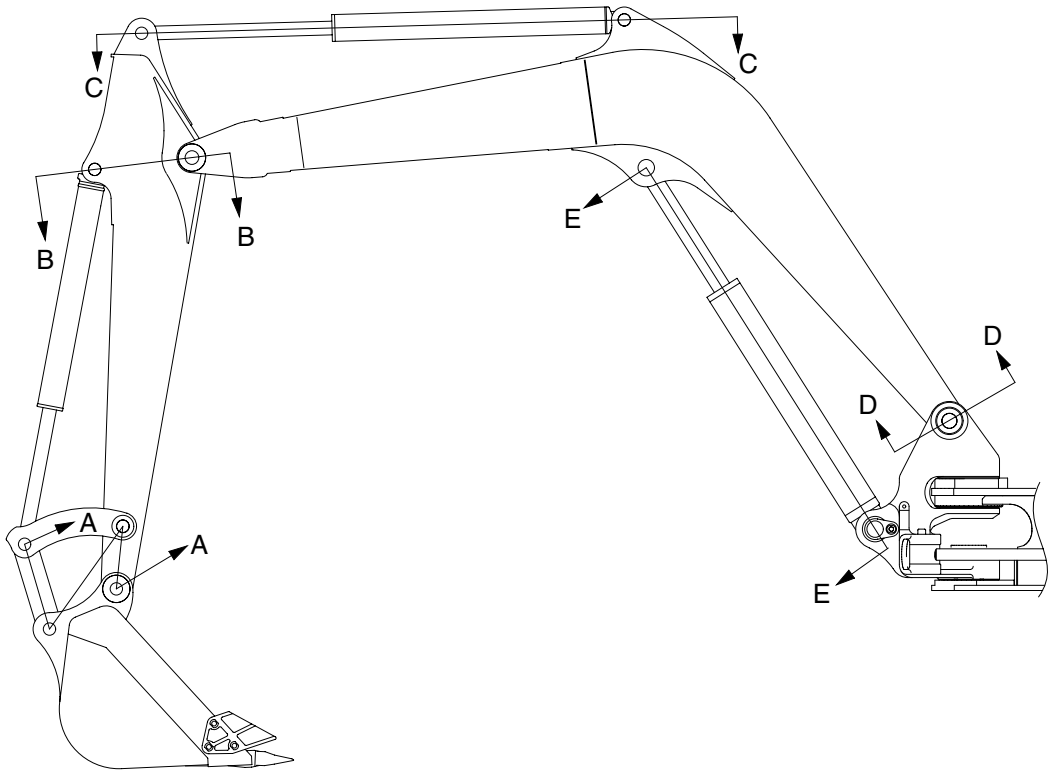
⑥ Lighten the press load and confirm the set length of spring (2).

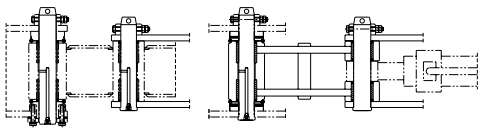
⑦ After the setting of spring (2), install lock plate (5), spring washer (7) and bolt (6).



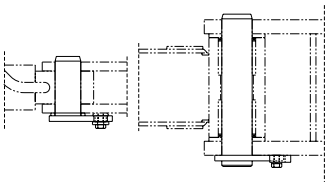
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

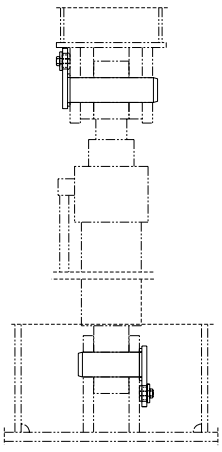




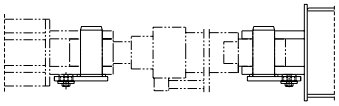
SECTION A-A



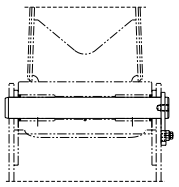
SECTION B-B



SECTION E-E



SECTION C-C



SECTION D-D

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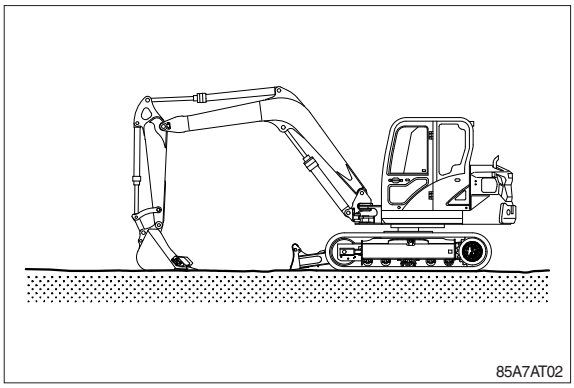
2. REMOVAL AND INSTALL

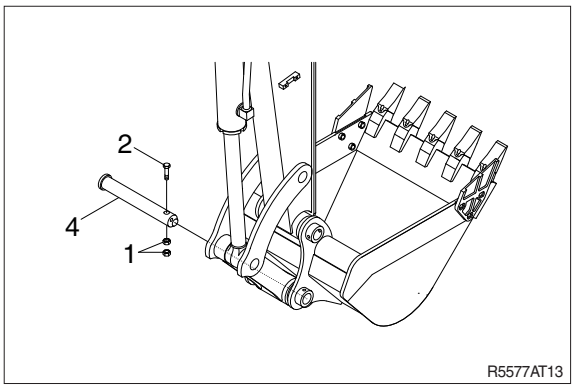
1) BUCKET ASSEMBLY

(1) Removal

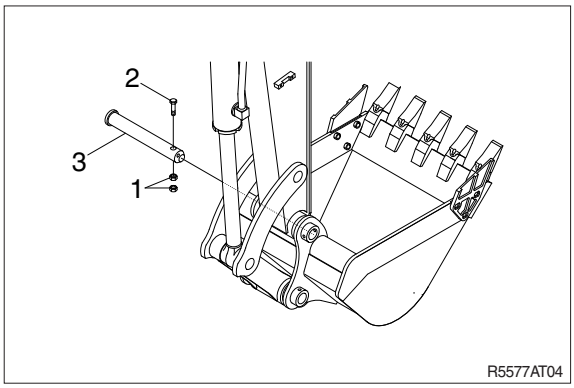
① Lower the work equipment completely to ground with back of bucket facing down.



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)

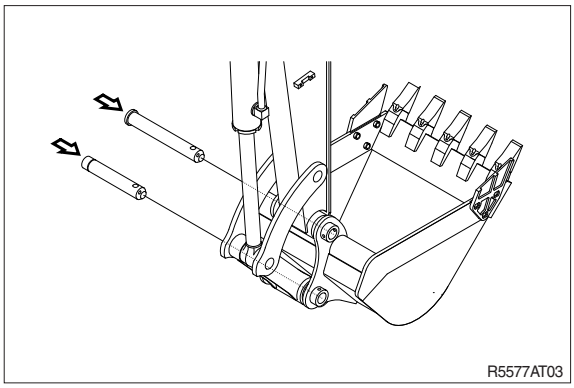


(2) Install

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.

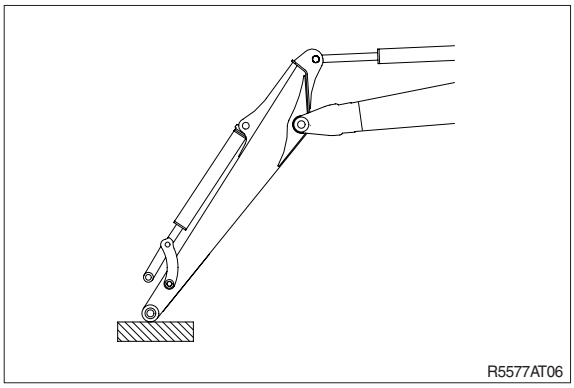
※ Tie the rod with wire to prevent it from coming out.

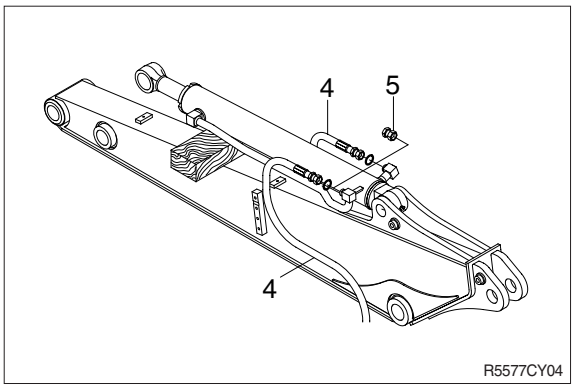
※ For details, see removal of arm cylinder assembly.

④ Place a wooden block under the cylinder and bring the cylinder down to it.

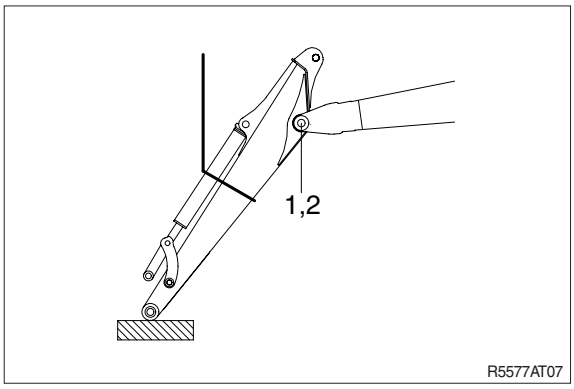
⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly.
· Weight : 167 kg (368 lb)

※ 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.

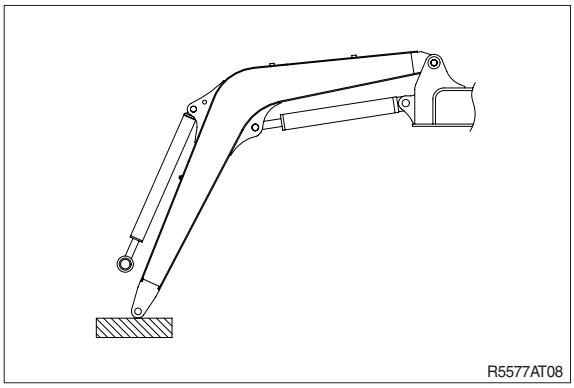
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.

② Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.

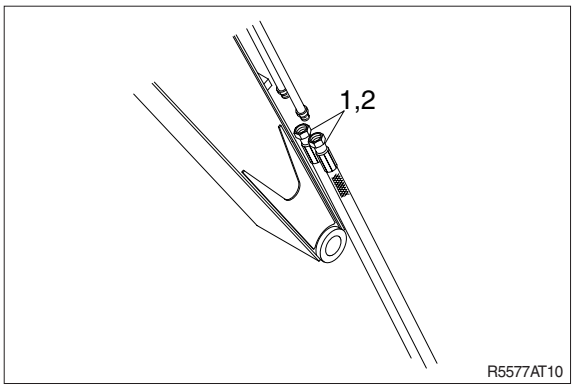

R5577AT08

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.

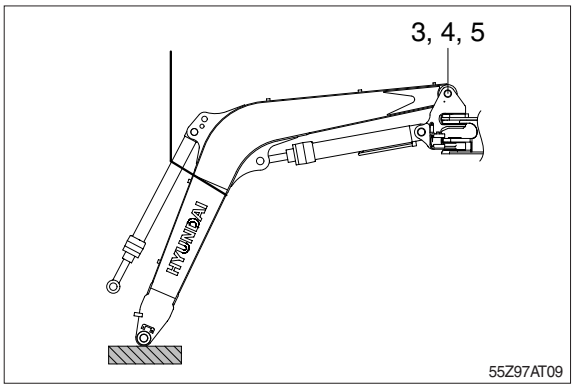
⑤ Sling boom assembly (3).



R5577AT10

⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly.
· Weight : 405 kg (893 lb)

※ When lifting the boom assembly always lift the center of gravity.



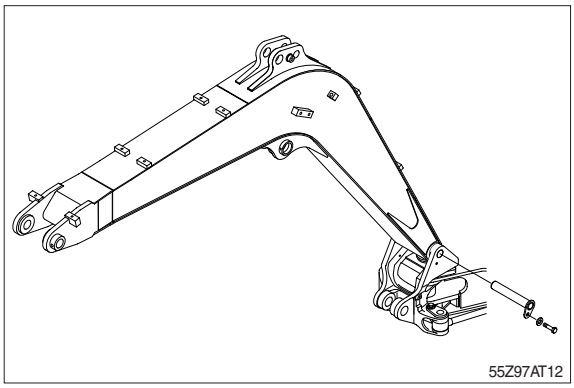
55Z97AT09

(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