CONTENTS

SECTION 1 GENERAL

Group 1 Safety Hints ········· 1-1
Group 2 Specifications ········· 1-10

SECTION 2 STRUCTURE AND FUNCTION

Group 1 Pump Device ········· 2-1
Group 2 Main Control Valve ········· 2-20
Group 3 Swing Device ········· 2-51
Group 4 Travel Device ········· 2-63
Group 5 RCV Lever ········· 2-84
Group 6 RCV Pedal ········· 2-91

SECTION 3 HYDRAULIC SYSTEM

Group 1 Hydraulic Circuit ········· 3-1
Group 2 Main Circuit ········· 3-3
Group 3 Pilot Circuit ········· 3-6
Group 4 Single Operation ········· 3-15
Group 5 Combined Operation ········· 3-27

SECTION 4 ELECTRICAL SYSTEM

Group 1 Component Location ········· 4-1
Group 2 Electrical Circuit ········· 4-3
Group 3 Electrical Component Specification ········· 4-22
Group 4 Connectors ········· 4-33

SECTION 5 MECHATRONICS SYSTEM

Group 1 Outline ········· 5-1
Group 2 Mode Selection System ········· 5-3
Group 3 Automatic Deceleration System ········· 5-6
Group 4 Power Boost System ········· 5-7
Group 5 Travel Speed Control System ········· 5-8
Group 6 Automatic Warming Up System ········· 5-9
Group 7 Engine Overheat Prevention System ········· 5-10
Group 8 Variable Power Control System ········· 5-11

Group 9 Attachment Flow Control System 5-12
Group 10 Intelligent Power Control System 5-13
Group 11 Anti-Restart System 5-15
Group 12 Self-Diagnostic System 5-16
Group 13 Engine Control System 5-50
Group 14 EPPR Valve 5-51
Group 15 Monitoring System 5-56
Group 16 Fuel Warmer System 5-90

SECTION 6 TROUBLESHOOTING

Group 1 Before trobleshooting 6-1
Group 2 Hydraulic and Mechanical System 6-4
Group 3 Electrical System 6-25
Group 4 Mechatronics System 6-43
Group 5 Air conditioner & heater system 6-72

SECTION 7 MAINTENANCE STANDARD

Group 1 Operational Performance Test 7-1
Group 2 Major Components 7-21
Group 3 Track and Work Equipment 7-29

SECTION 8 DISASSEMBLY AND ASSEMBLY

Group 1 Precaution 8-1
Group 2 Tightening Torque 8-4
Group 3 Pump Device 8-7
Group 4 Main Control Valve 8-29
Group 5 Swing Device 8-43
Group 6 Travel Device 8-75
Group 7 RCV Lever 8-139
Group 8 Turning Joint 8-153
Group 9 Boom, Arm, Bucket and Dozer Cylinders 8-158
Group 10 Undercarriage 8-180
Group 11 Work Equipment 8-194

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.

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.
   8 - 4
   8 - 4 - 1 ┐ Added pages
   8 - 4 - 2 ┘
   8 - 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 55 mm into inches.

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

   (2) Locate the number 5 in 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, 55 mm = 2.165 inches.

2. Convert 550 mm 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 55 mm.

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

   (3) The original value (550 mm) 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 550 mm = 21.65 inches.

Millimeters to inches

1 mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

Kilogram to Pound

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 ℓ = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 ℓ = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

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

kgf/cm² to lbf/in²

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

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

Group 1 Safety Hints ········ 1-1
Group 2 Specifications ········ 1-10

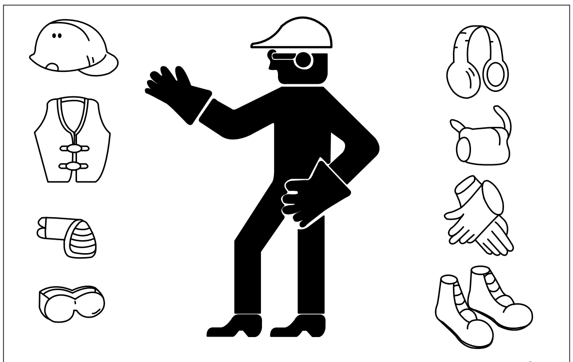
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

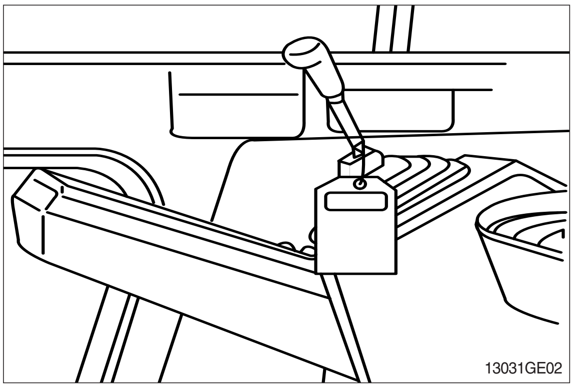
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

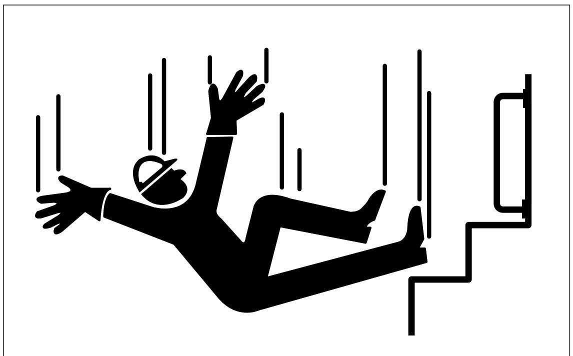
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「Do Not Operate」 tag on the right side control lever.



13031GE02

USE HANDHOLDS AND STEPS

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



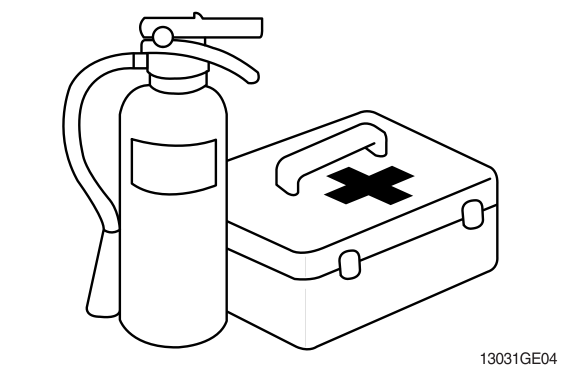
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

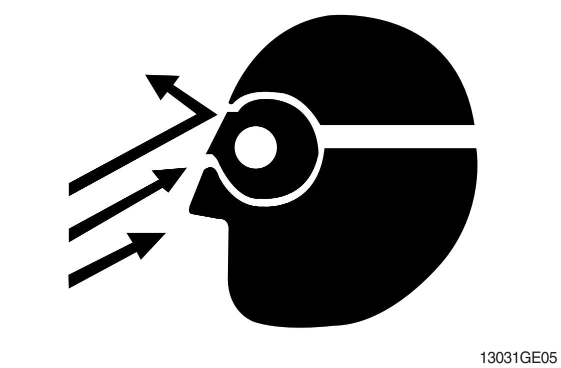
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

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

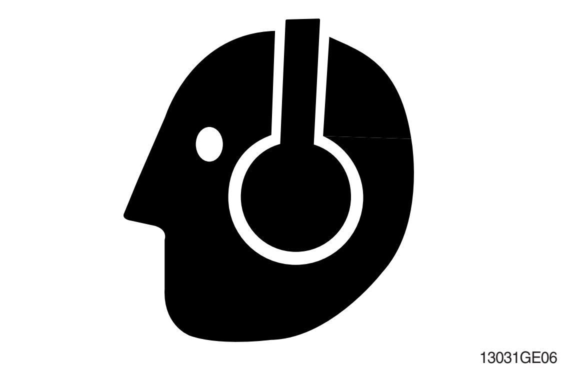


13031GE05

PROTECT AGAINST NOISE

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

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

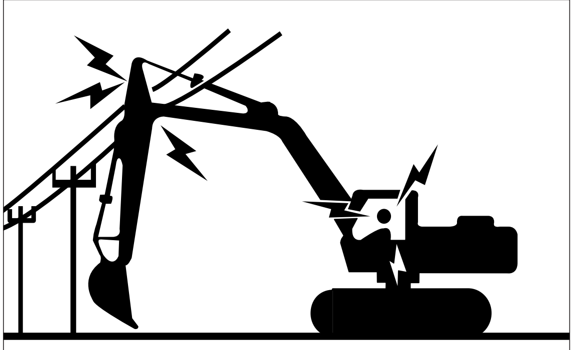


13031GE06

AVOID POWER LINES

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

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

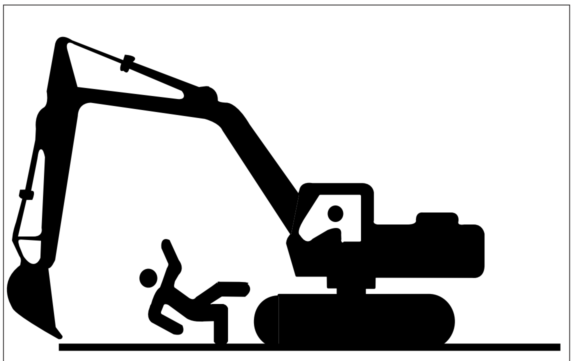


13031GE07

KEEP RIDERS OFF EXCAVATOR

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

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

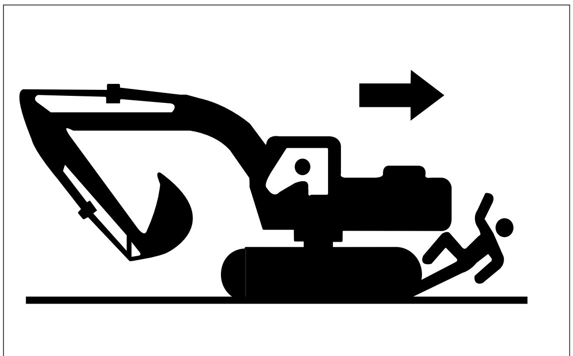

13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

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


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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


13031GE26

PARK MACHINE SAFELY

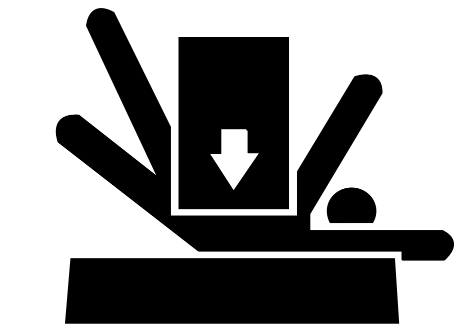
Before working on the machine:

· Park machine on a level surface.
· Lower bucket to the ground.
· Turn auto idle switch off.
· Run engine at low idle speed without load for 5 minutes.
· Turn key switch to OFF to stop engine. Remove key from switch.
· Place safety lever to locked position.
· Allow engine to cool.

SUPPORT MACHINE PROPERLY

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

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

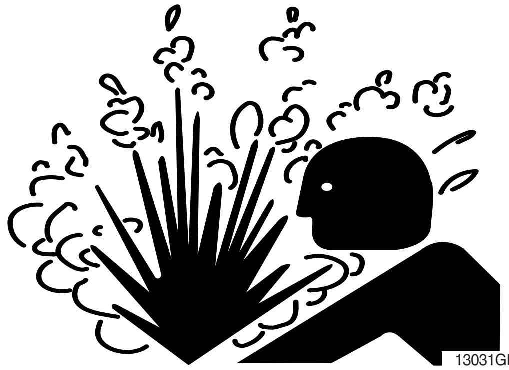


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

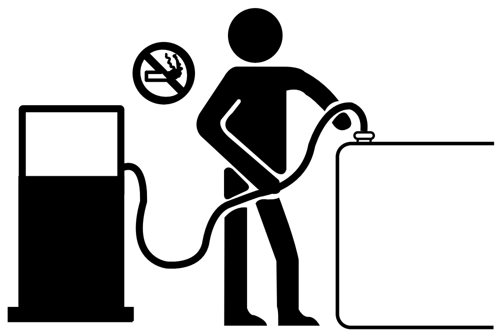
Shut off engine. Only remove filler cap when cool enough to touch with bare hands.



13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

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



13031GE12

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

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

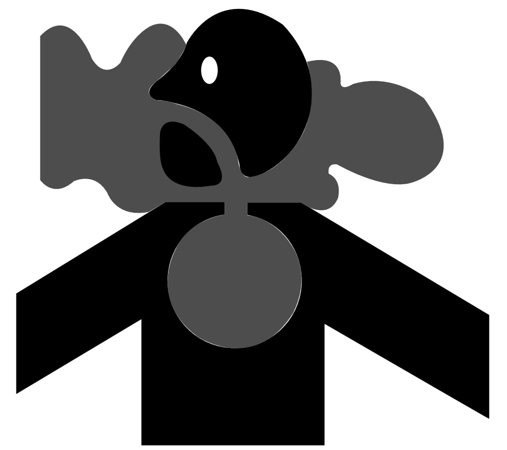
Do not store oily rags; They can ignite and burn spontaneously.

13031GE13

BEWARE OF EXHAUST FUMES

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

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



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

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

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

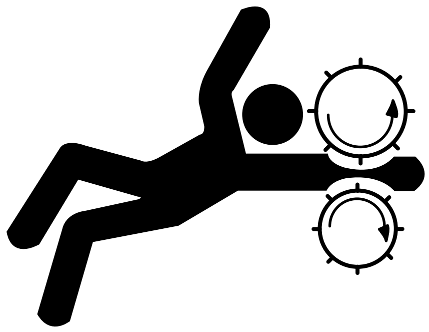
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

13031GE15

SERVICE MACHINE SAFELY

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

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

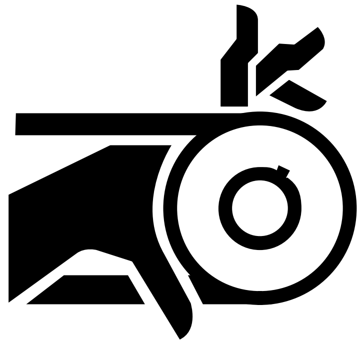


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



13031GE17

AVOID HIGH PRESSURE FLUIDS

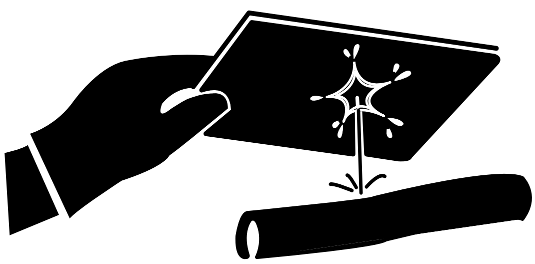
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

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

13031GE20

PREVENT BATTERY EXPLOSIONS

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

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

Do not charge a frozen battery; It may explode. Warm battery to 16 ℃ (60 ℉).

13031GE21

PREVENT ACID BURNS

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

Avoid the hazard by:

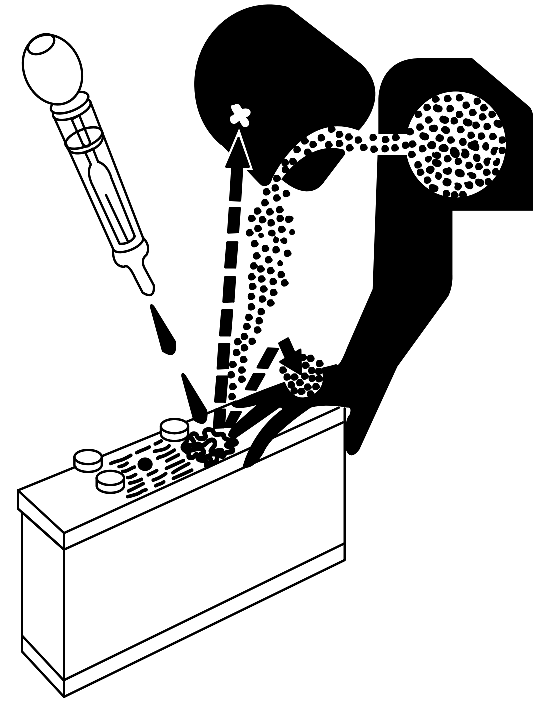
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



13031GE22

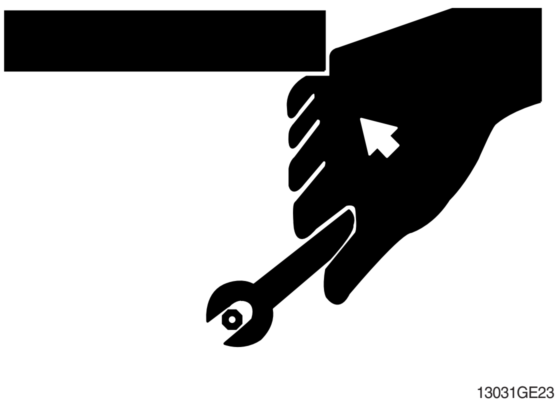
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

Use only recommended replacement parts. (See Parts manual.)



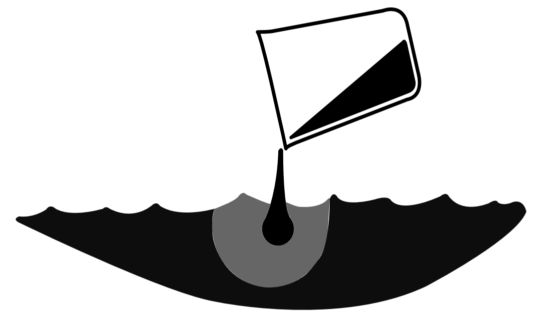
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

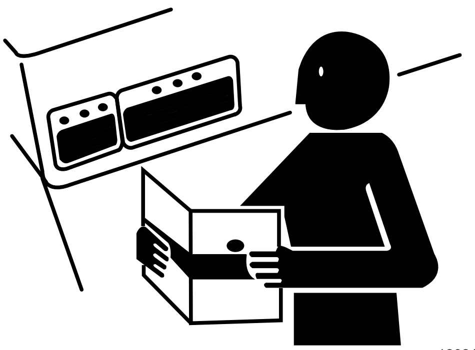
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY LABELS

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



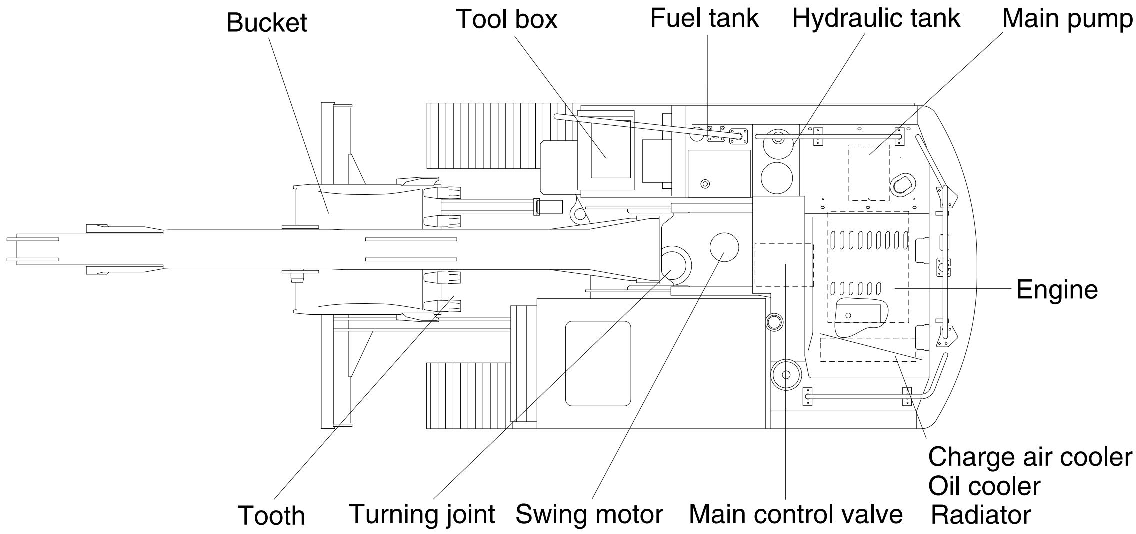
13031GE25

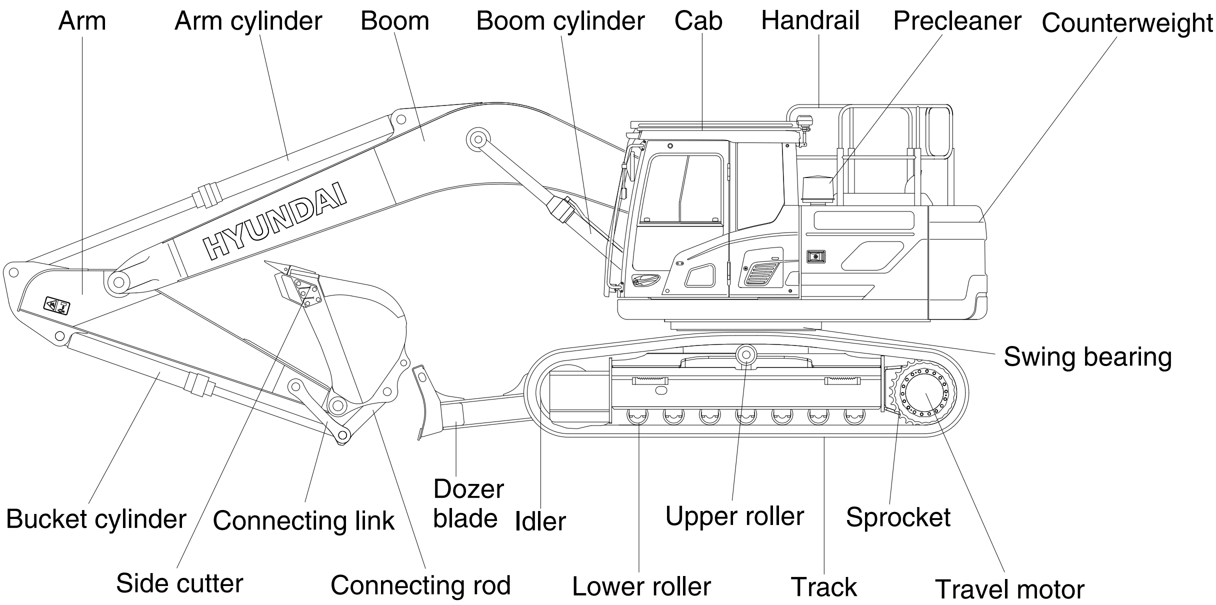
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

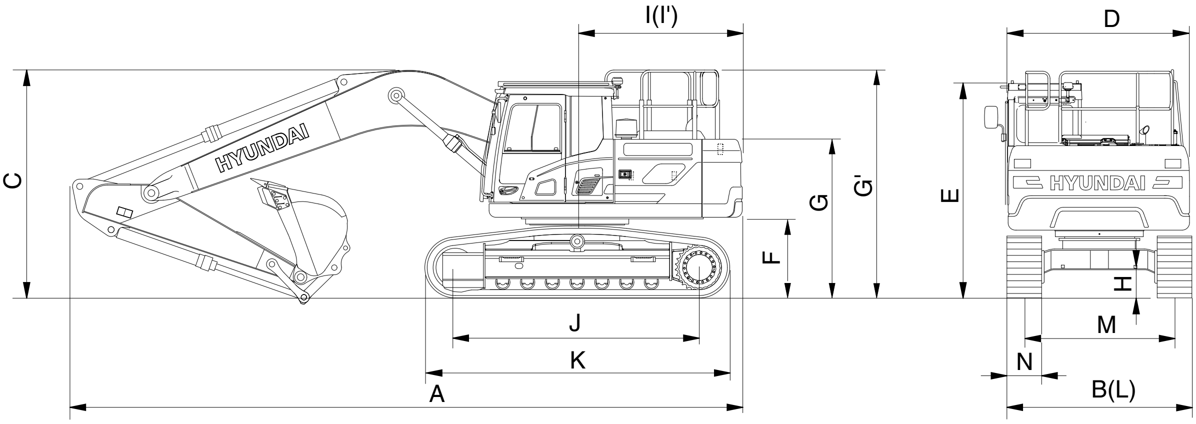




140SA2SP01

2. SPECIFICATIONS

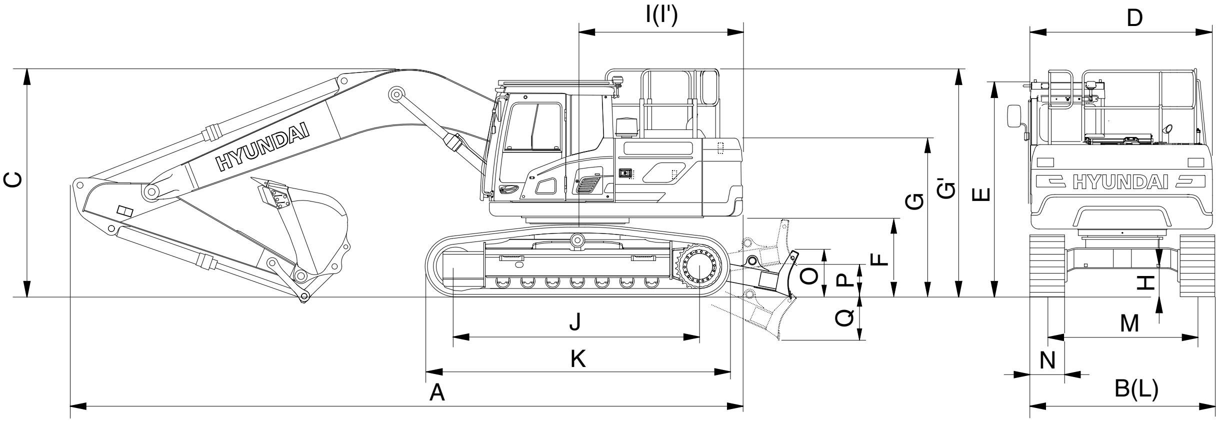
1) HX140 LT3, MONO BOOM



140SA2SP02

Description		Unit		Specification	
		m (ft-in)	Boom	4.6 (15' 1")	
			Arm	2.50 (8' 2")	3.00 (9' 10")
		mm (in)	Shoe	600 (24")	
Operating weight		m3 (yd3)		14325 (31580)	14355 (31650)
Bucket capacity (SAE heaped), standard		kg (lb)		0.52 (0.68)	0.52 (0.68)
Overall length	A	mm (ft-in)		8135 (26' 8")	8100 (26' 7")
Overall width	B			2590 (8' 6")	2590 (8' 6")
Overall width with add footboard	B'			2590 (8' 6")	2590 (8' 6")
Overall height of boom	C			2730 (8' 11")	3160 (10' 4")
Overall width of upper structure	D			2475 (8' 1")	2475 (8' 1")
Overall height of cab	E			2835 (9' 4")	2835 (9' 4")
Ground clearance of counterweight	F			905 (3' 0")	905 (3' 0")
Overall height of engine hood	G			2220 (7' 3")	2220 (7' 3")
Overall height of handrail	G'			2925 (9' 7")	2925 (9' 7")
Minimum ground clearance	H			405 (1' 4")	405 (1' 4")
Rear-end distance	I			2335 (7' 8")	2335 (7' 8")
Rear-end swing radius	I'			2345 (7' 8")	2345 (7' 8")
Distance between tumblers	J			3035 (9' 11")	3035 (9' 11")
Undercarriage length (without grouser)	K			3656 (12' 0")	3656 (12' 0")
Undercarriage length (with grouser)	K'			3706 (12' 2")	3706 (12' 2")
Undercarriage width	L			2475 (8' 1")	2475 (8' 1")
Undercarriage width with add footboard	L'			2475 (8' 1")	2475 (8' 1")
Track gauge	M			1990 (6' 6")	1990 (6' 6")
Track shoe width, standard	N			600 (2' 0")	600 (2' 0")
Track shoe link quantity		EA		46	46
Travel speed (low/high)		km/hr (mph)		3.4/5.8 (2.1/3.6)	3.4/5.8 (2.1/3.6)
Swing speed		rpm		12.4	12.4
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm² (psi)		0.37 (5.23)	0.37 (5.25)
Max traction force		kg (lb)		12670 (27930)	12670 (27930)

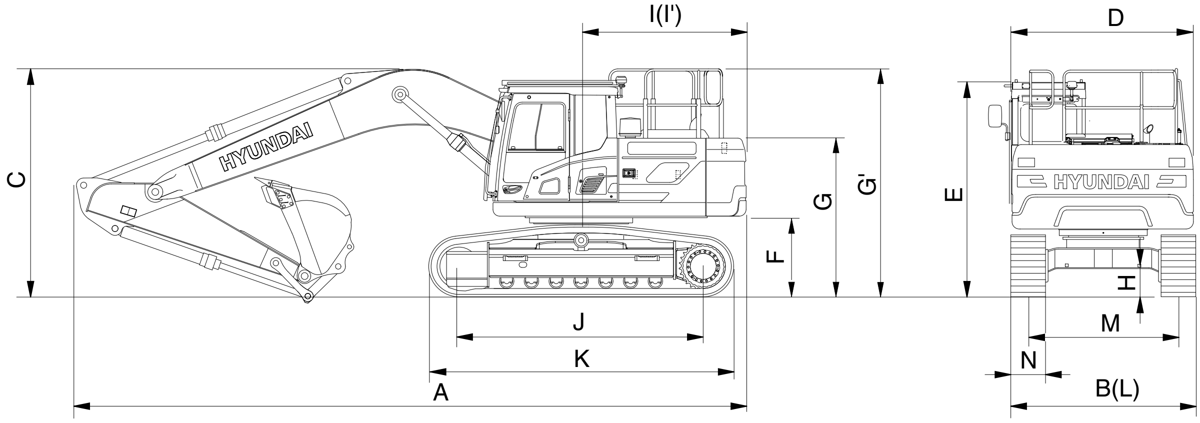
2) HX140 LDT3, MONO BOOM



140SA2SP03

Description		Unit		Specification	
		m (ft-in)	Boom	4.6 (15' 1")	
			Arm	2.50 (8' 2")	3.00 (9' 10")
		mm (in)	Shoe	600 (24")	
Operating weight		m^3 (yd^3)		15230 (33580)	15260 (33640)
Bucket capacity (SAE heaped), standard		kg (lb)		0.52 (0.68)	0.52 (0.68)
Overall length	A	mm (ft-in)		8135 (26' 8")	8100 (26' 7")
Overall width	B			2590 (8' 6")	2590 (8' 6")
Overall width with add footboard	B'			2590 (8' 6")	2590 (8' 6")
Overall height of boom	C			2730 (8' 11")	3160 (10' 4")
Overall width of upper structure	D			2475 (8' 1")	2475 (8' 1")
Overall height of cab	E			2835 (9' 4")	2835 (9' 4")
Ground clearance of counterweight	F			905 (3' 0")	905 (3' 0")
Overall height of engine hood	G			2220 (7' 3")	2220 (7' 3")
Overall height of handrail	G'			2925 (9' 7")	2925 (9' 7")
Minimum ground clearance	H			405 (1' 4")	405 (1' 4")
Rear-end distance	I			2335 (7' 8")	2335 (7' 8")
Rear-end swing radius	I'			2345 (7' 8")	2345 (7' 8")
Distance between tumblers	J			3035 (9' 11")	3035 (9' 11")
Undercarriage length (without grouser)	K			3656 (12' 0")	3656 (12' 0")
Undercarriage length (with grouser)	K'			3706 (12' 2")	3706 (12' 2")
Undercarriage width	L			2475 (8' 1")	2475 (8' 1")
Undercarriage width with add footboard	L'			2475 (8' 1")	2475 (8' 1")
Track gauge	M			1990 (6' 6")	1990 (6' 6")
Track shoe width, standard	N			600 (2' 0")	600 (2' 0")
Height of blade	O			575 (1' 11")	575 (1' 11")
Ground clearance of blade up	P			580 (1' 11")	580 (1' 11")
Depth of blade down	Q			475 (1' 7")	475 (1' 7")
Track shoe link quantity		EA		46	46
Travel speed (low/high)		km/hr (mph)		3.4/5.8 (2.1/3.6)	3.4/5.8 (2.1/3.6)
Swing speed		rpm		12.4	12.4
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm² (psi)		0.42 (5.93)	0.39 (5.58)
Max traction force		kg (lb)		12670 (27930)	12670 (27930)

3) HX140 HWT3, MONO BOOM

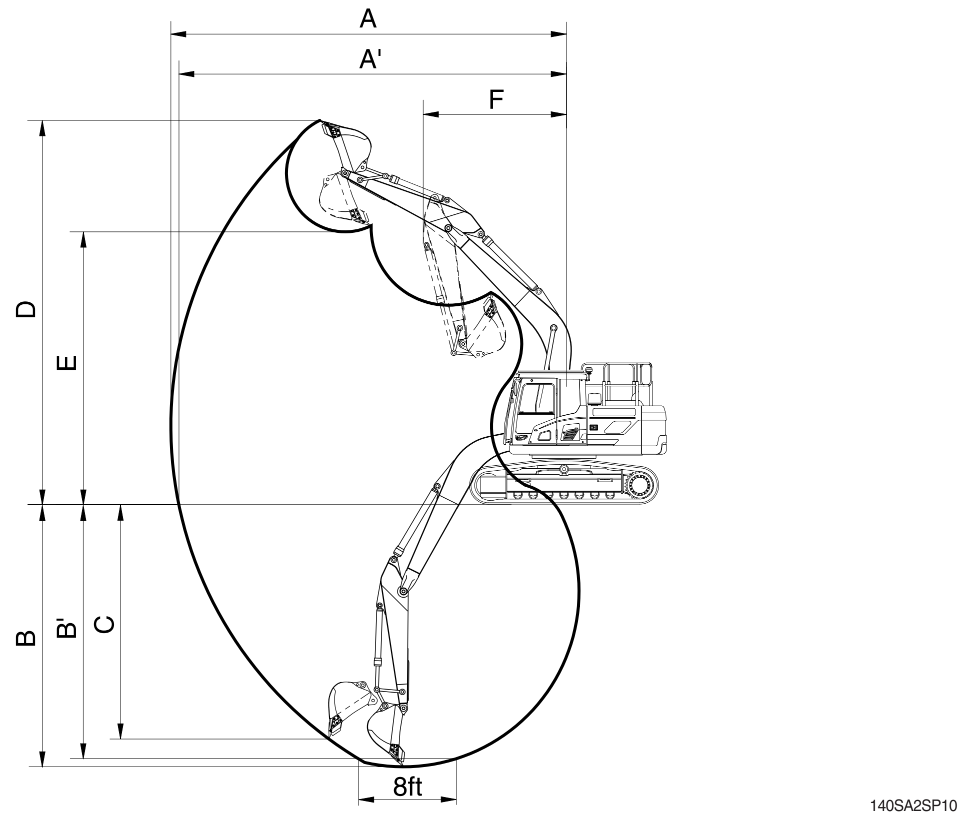


140SA2SP02

Description		Unit		Specification	
		m (ft-in)	Boom	4.6 (15' 1")	
			Arm	2.50 (8' 2")	3.00 (9' 10")
		mm (in)	Shoe	800 (32")	
Operating weight		m^3 (yd^3)		17320 (38180)	17355 (38260)
Bucket capacity (SAE heaped), standard		kg (lb)		0.52 (0.68)	0.52 (0.68)
Overall length	A	mm (ft-in)		7775 (25' 6")	7845 (25' 9")
Overall width	B			2840 (9' 4")	2840 (9' 4")
Overall width with add footboard	B'			2840 (9' 4")	2840 (9' 4")
Overall height of boom	C			2750 (9' 0")	3120 (10' 3")
Overall width of upper structure	D			2475 (8' 1")	2475 (8' 1")
Overall height of cab	E			3135 (10' 3")	3135 (10' 3")
Ground clearance of counterweight	F			1205 (3' 11")	1205 (3' 11")
Overall height of engine hood	G			2470 (8' 1")	2470 (8' 1")
Overall height of handrail	G'			3385 (11' 1")	3385 (11' 1")
Minimum ground clearance	H			600 (2' 0")	600 (2' 0")
Rear-end distance	I			2335 (7' 8")	2335 (7' 8")
Rear-end swing radius	I'			2345 (7' 8")	2345 (7' 8")
Distance between tumblers	J			3030 (9' 11")	3030 (9' 11")
Undercarriage length (without grouser)	K			3770 (12' 4")	3770 (12' 4")
Undercarriage length (with grouser)	K'			3820 (12' 6")	3820 (12' 6")
Undercarriage width	L			2840 (9' 4")	2840 (9' 4")
Undercarriage width with add footboard	L'			2840 (9' 4")	2840 (9' 4")
Track gauge	M			2040 (6' 8")	2040 (6' 8")
Track shoe width, standard	N			800 (2' 7")	800 (2' 7")
Track shoe link quantity		EA		47	47
Travel speed (low/high)		km/hr (mph)		3.4/5.8 (2.1/3.6)	3.4/5.8 (2.1/3.6)
Swing speed		rpm		12.4	12.4
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.33 (4.68)	0.33 (4.69)
Max traction force		kg (lb)		12670 (27930)	12670 (27930)

3. WORKING RANGE AND DIGGING FORCE

1) HX140 LT3/LDT3

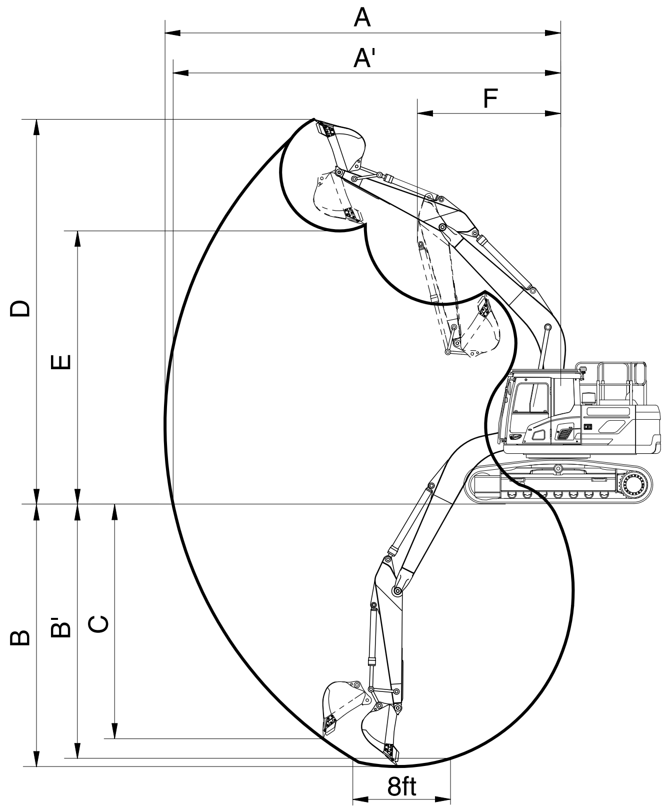


140SA2SP10

Description	m (ft-in)	Boom	4.60 (15' 1")	
		Arm	2.50 (8' 2")	3.00 (9' 10")
Max digging reach	mm (ft-in)	A	8290 (27' 2")	8670 (28' 5")
Max digging reach on ground		A'	8140 (26' 8")	8530 (28' 0")
Max digging depth		B	5380 (17' 8")	5880 (19' 3")
Max digging depth (8 ft level)		B'	5180 (17' 0")	5690 (18' 8")
Max vertical wall digging depth		C	4770 (15' 8")	4980 (16' 4")
Max digging height		D	8580 (28' 2")	8650 (28' 5")
Max dumping height		E	6240 (20' 6")	6350 (20' 10")
Min swing radius		F	2450 (8' 0")	2660 (8' 9")
Bucket digging force	kN	SAE	94.3 [102.4]	94.3 [102.4]
	kgf		9620 [10440]	9620 [10440]
	lbf		21210 [23020]	21210 [23020]
	kN	ISO	111.4 [120.9]	111.4 [120.9]
	kgf		11360 [12330]	11360 [12330]
	lbf		25040 [27180]	25040 [27180]
Arm digging force	kN	SAE	62.0 [67.3]	57.0 [61.9]
	kgf		6320 [6860]	5810 [6310]
	lbf		13930 [15120]	12810 [13910]
	kN	ISO	64.6 [70.1]	59.0 [64.1]
	kgf		6590 [7150]	6020 [6540]
	lbf		14530 [15760]	13270 [14420]

[ ] : Power boost

2) HX140 HWT3



140SA2SP10

Description	m (ft-in)	Boom	4.60 (15' 1")	
		Arm	2.50 (8' 2")	3.00 (9' 10")
Max digging reach	mm (ft-in)	A	8290 (27' 2")	8670 (28' 5")
Max digging reach on ground		A'	8080 (26' 6")	8470 (27' 9")
Max digging depth		B	5110 (16' 9")	5610 (18' 5")
Max digging depth (8 ft level)		B'	4900 (16' 1")	5410 (17' 9")
Max vertical wall digging depth		C	4490 (14' 9")	4700 (15' 5")
Max digging height		D	8860 (29' 1")	8930 (29' 4")
Max dumping height		E	6520 (21' 5")	6620 (21' 9")
Min swing radius		F	2450 (8' 0")	2660 (8' 9")
Bucket digging force	kN	SAE	94.3 [102.4]	94.3 [102.4]
	kgf		9620 [10440]	9620 [10440]
	lbf		21210 [23020]	21210 [23020]
	kN	ISO	111.4 [120.9]	111.4 [120.9]
	kgf		11360 [12330]	11360 [12330]
	lbf		25040 [27180]	25040 [27180]
Arm digging force	kN	SAE	62.0 [67.3]	57.0 [61.9]
	kgf		6320 [6860]	5810 [6310]
	lbf		13930 [15120]	12810 [13910]
	kN	ISO	64.6 [70.1]	59.0 [64.1]
	kgf		6590 [7150]	6020 [6540]
	lbf		14530 [15760]	13270 [14420]

[ ] : Power boost

4. WEIGHT

Item	Qty	HX140 LT3		HX140 LDT3		HX140 HWT3	
	EA	kg	lb	kg	lb	kg	lb
Upperstructure assembly							
· Main frame weld assembly	1	1140	2513	1140	2513	1140	2513
· Engine assembly	1	371	818	371	818	371	818
· Main pump assembly	1	92	203	92	203	92	203
· Main control valve assembly	1	140	309	140	309	140	309
· Swing motor assembly	1	130	287	130	287	130	287
· Hydraulic oil tank WA	1	133	294	133	294	133	294
· Fuel tank WA	1	150	331	150	331	150	331
· Counterweight	1	1900	4189	1900	4189	1900	4189
· Cab assembly	1	495	1091	495	1091	495	1091
Lower chassis assembly							
· Track frame weld assembly	1	1497	3300	1667	3675	2199	4848
· Dozer blade assembly	1	-	-	503	1109	-	-
· Swing bearing	1	214	472	214	472	214	472
· Travel motor assembly	2	278	613	278	613	278	613
· Turning joint	1	56	123	63	139	56	123
· Sprocket	2	40	87	40	87	49	109
· Track recoil spring	2	93	204	93	204	132	291
· Idler	2	104	229	104	229	151	332
· Upper roller	4	19	42	19	42	40	88
· Lower roller	18	35	77	35	77	40	88
· Track Guard	2	36	79	36	79	-	-
· Track Guard	4	-	-	-	-	592	1305
· Track-chain assembly (500 mm, 46 link)	2	922	2033	922	2033	-	-
· Track-chain assembly (600 mm, 46 link)	2	1027	2263	1027	2263	-	-
· Track-chain assembly (700 mm, 46 link)	2	1131	2494	1131	2494	-	-
· Track-chain assembly (700 mm, 47 link)	2	-	-	-	-	1250	2755
· Track-chain assembly (800 mm, 47 link)	2	-	-	-	-	1367	3013
Front attachment assembly							
· 4.6 m mono boom assembly	1	812	1790	812	1790	812	1790
· 2.50 m arm assembly	1	445	981	445	981	445	981
· 3.00 m arm assembly	1	482	1063	482	1063	482	1063
· 0.58 m³ bucket assembly	1	484	1067	484	1067	484	1067
· 0.52 m³ bucket assembly	1	461	1016	461	1016	461	1016
· 0.65 m³ bucket assembly	1	513	1131	513	1131	513	1131
· 0.71 m³ bucket assembly	1	536	1182	536	1182	536	1182
· Boom cylinder assembly	2	119	262	119	262	119	262
· Arm cylinder assembly	1	145	320	145	320	145	320
· Bucket cylinder assembly	1	104	229	104	229	104	229
· Dozer cylinder assembly	2	55	120	55	120	55	120
· Bucket control linkage total	1	114	251	114	251	114	251

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

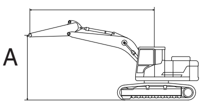
※ Refer to Transportation for actual weight information and Specifications for operating weight.

5. LIFTING CAPACITIES

1) HX140 LT3

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	1900	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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					*3670	*3670			*2180	*2180	5.42
(19.7 ft)	lb					*8090	*8090			*4810	*4810	(17.8)
4.5 m	kg					*3930	3920	*3210	2470	*2020	*2020	6.39
(14.8 ft)	lb					*8660	8640	*7080	5450	*4450	*4450	(21.0)
3.0 m	kg			*6610	*6610	*4820	3720	3650	2410	*2010	1920	6.90
(9.8 ft)	lb			*14570	*14570	*10630	8200	8050	5310	*4430	4230	(22.6)
1.5 m	kg			*7930	6310	5510	3490	3540	2310	*2120	1810	7.06
(4.9 ft)	lb			*17480	13910	12150	7690	7800	5090	*4670	3990	(23.2)
0.0 m	kg			*6750	6040	5320	3330	3460	2240	*2380	1850	6.89
(0.0 ft)	lb			*14880	13320	11730	7340	7630	4940	*5250	4080	(22.6)
-1.5 m	kg	*4910	*4910	*9970	6010	5260	3280	3430	2210	*2910	2060	6.36
(-4.9 ft)	lb	*10820	*10820	*21980	13250	11600	7230	7560	4870	*6420	4540	(20.9)
-3.0 m	kg	*8760	*8760	*8640	6120	5310	3320			4100	2630	5.36
(-9.8 ft)	lb	*19310	*19310	*19050	13490	11710	7320			9040	5800	(17.6)

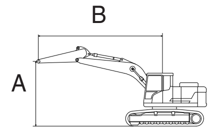
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited 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 with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	1900	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg									*2440	*2440	4.34
(24.6 ft)	lb									*5380	*5380	(14.2)
6.0 m	kg							*2050	*2050	*2070	*2070	5.91
(19.7 ft)	lb							*4520	*4520	*4560	*4560	(19.4)
4.5 m	kg					*3420	*3420	*3220	2520	*1960	*1960	6.81
(14.8 ft)	lb					*7540	*7540	*7100	5560	*4320	*4320	(22.4)
3.0 m	kg			*5510	*5510	*4340	3790	3680	2440	*1980	1770	7.30
(9.8 ft)	lb			*12150	*12150	*9570	8360	8110	5380	*4370	3900	(23.9)
1.5 m	kg			*8570	6470	*5510	3540	3560	2330	*2100	1680	7.44
(4.9 ft)	lb			*18890	14260	*12150	7800	7850	5140	*4630	3700	(24.4)
0.0 m	kg			*7920	6050	5340	3340	3460	2230	*2360	1690	7.28
(0.0 ft)	lb			*17460	13340	11770	7360	7630	4920	*5200	3730	(23.9)
-1.5 m	kg	*4680	*4680	*9710	5950	5230	3250	3400	2180	2870	1850	6.78
(-4.9 ft)	lb	*10320	*10320	*21410	13120	11530	7170	7500	4810	6330	4080	(22.3)
-3.0 m	kg	*7710	*7710	*9300	6010	5240	3260			3550	2280	5.86
(-9.8 ft)	lb	*17000	*17000	*20500	13250	11550	7190			7830	5030	(19.2)
-4.5 m	kg			*6670	6230					*4510	3710	4.24
(-14.8 ft)	lb			*14700	13730					*9940	8180	(13.9)

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).
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※ Lifting capacities are based upon a standard machine conditions.
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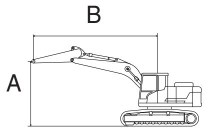
Consult with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	2300	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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					*3670	*3670			*2180	*2180	5.42
(19.7 ft)	lb					*8090	*8090			*4810	*4810	(17.8)
4.5 m	kg					*3930	*3930	*3210	2660	*2020	*2020	6.39
(14.8 ft)	lb					*8660	*8660	*7080	5860	*4450	*4450	(21.0)
3.0 m	kg			*6610	*6610	*4820	4000	3880	2600	*2010	*2010	6.90
(9.8 ft)	lb			*14570	*14570	*10630	8820	8550	5730	*4430	*4430	(22.6)
1.5 m	kg			*7930	6800	5870	3770	3780	2500	*2120	1970	7.06
(4.9 ft)	lb			*17480	14990	12940	8310	8330	5510	*4670	4340	(23.2)
0.0 m	kg			*6750	6520	5680	3610	3700	2430	*2380	2010	6.89
(0.0 ft)	lb			*14880	14370	12520	7960	8160	5360	*5250	4430	(22.6)
-1.5 m	kg	*4910	*4910	*9970	6500	5620	3550	3670	2400	*2910	2230	6.36
(-4.9 ft)	lb	*10820	*10820	*21980	14330	12390	7830	8090	5290	*6420	4920	(20.9)
-3.0 m	kg	*8760	*8760	*8640	6600	5670	3600			*4220	2850	5.36
(-9.8 ft)	lb	*19310	*19310	*19050	14550	12500	7940			*9300	6280	(17.6)

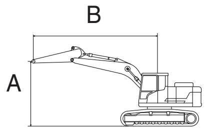
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited 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 with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	2300	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg									*2440	*2440	4.34
(24.6 ft)	lb									*5380	*5380	(14.2)
6.0 m	kg									*2070	*2070	5.91
(19.7 ft)	lb									*4560	*4560	(19.4)
4.5 m	kg					*3420	*3420	*3220	2710	*1960	*1960	6.81
(14.8 ft)	lb					*7540	*7540	*7100	5970	*4320	*4320	(22.4)
3.0 m	kg			*5510	*5510	*4340	4070	*3830	2630	*1980	1930	7.30
(9.8 ft)	lb			*12150	*12150	*9570	8970	*8440	5800	*4370	4250	(23.9)
1.5 m	kg			*8570	6960	*5510	3810	3800	2520	*2100	1820	7.44
(4.9 ft)	lb			*18890	15340	*12150	8400	8380	5560	*4630	4010	(24.4)
0.0 m	kg			*7920	6540	5690	3610	3690	2420	*2360	1850	7.28
(0.0 ft)	lb			*17460	14420	12540	7960	8140	5340	*5200	4080	(23.9)
-1.5 m	kg	*4680	*4680	*9710	6430	5590	3520	3640	2370	*2870	2020	6.78
(-4.9 ft)	lb	*10320	*10320	*21410	14180	12320	7760	8020	5220	*6330	4450	(22.3)
-3.0 m	kg	*7710	*7710	*9300	6500	5600	3530			3800	2480	5.86
(-9.8 ft)	lb	*17000	*17000	*20500	14330	12350	7780			8380	5470	(19.2)
-4.5 m	kg			*6670	*6670					*4510	4010	4.24
(-14.8 ft)	lb			*14700	*14700					*9940	8840	(13.9)

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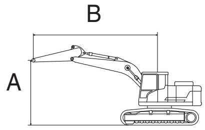
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessary for non-standard configurations.

2) HX140 LDT3

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	1900	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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					*3670	*3670			*2180	*2180	5.42
(19.7 ft)	lb					*8090	*8090			*4810	*4810	(17.8)
4.5 m	kg					*3930	*3930	*3210	2870	*2020	*2020	6.39
(14.8 ft)	lb					*8660	*8660	*7080	6330	*4450	*4450	(21.0)
3.0 m	kg			*6610	*6610	*4820	4320	*4140	2800	*2010	*2010	6.90
(9.8 ft)	lb			*14570	*14570	*10630	9520	*9130	6170	*4430	*4430	(22.6)
1.5 m	kg			*7930	7510	*5900	4090	*4590	2700	*2120	*2120	7.06
(4.9 ft)	lb			*17480	16560	*13010	9020	*10120	5950	*4670	*4670	(23.2)
0.0 m	kg			*6750	*6750	*6630	3920	*4920	2630	*2380	2170	6.89
(0.0 ft)	lb			*14880	*14880	*14620	8640	*10850	5800	*5250	4780	(22.6)
-1.5 m	kg	*4910	*4910	*9970	7200	*6700	3870	*4830	2600	*2910	2420	6.36
(-4.9 ft)	lb	*10820	*10820	*21980	15870	*14770	8530	*10650	5730	*6420	5340	(20.9)
-3.0 m	kg	*8760	*8760	*8640	7310	*5860	3910			*4220	3090	5.36
(-9.8 ft)	lb	*19310	*19310	*19050	16120	*12920	8620			*9300	6810	(17.6)

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).

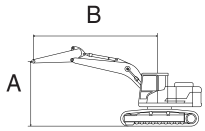
4. *Indicates load limited by hydraulic capacity.

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

⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	1900	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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					*3670	*3670			*2180	*2180	5.42
(19.7 ft)	lb					*8090	*8090			*4810	*4810	(17.8)
4.5 m	kg					*3930	*3930	*3210	2630	*2020	*2020	6.39
(14.8 ft)	lb					*8660	*8660	*7080	5800	*4450	*4450	(21.0)
3.0 m	kg			*6610	*6610	*4820	3950	3660	2570	*2010	*2010	6.90
(9.8 ft)	lb			*14570	*14570	*10630	8710	8070	5670	*4430	*4430	(22.6)
1.5 m	kg			*7930	6710	5530	3720	3550	2470	*2120	1950	7.06
(4.9 ft)	lb			*17480	14790	12190	8200	7830	5450	*4670	4300	(23.2)
0.0 m	kg			*6750	6440	5340	3560	3470	2400	*2380	1980	6.89
(0.0 ft)	lb			*14880	14200	11770	7850	7650	5290	*5250	4370	(22.6)
-1.5 m	kg	*4910	*4910	*9970	6410	5280	3500	3450	2370	*2910	2210	6.36
(-4.9 ft)	lb	*10820	*10820	*21980	14130	11640	7720	7610	5220	*6420	4870	(20.9)
-3.0 m	kg	*8760	*8760	*8640	6520	5330	3550			4120	2820	5.36
(-9.8 ft)	lb	*19310	*19310	*19050	14370	11750	7830			9080	6220	(17.6)

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.

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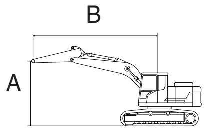
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	1900	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg									*2440	*2440	4.34
(24.6 ft)	lb									*5380	*5380	(14.2)
6.0 m	kg									*2070	*2070	5.91
(19.7 ft)	lb									*4560	*4560	(19.4)
4.5 m	kg					*3420	*3420	*3220	2910	*1960	*1960	6.81
(14.8 ft)	lb					*7540	*7540	*7100	6420	*4320	*4320	(22.4)
3.0 m	kg			*5510	*5510	*4340	*4340	*3830	2830	*1980	*1980	7.30
(9.8 ft)	lb			*12150	*12150	*9570	*9570	*8440	6240	*4370	*4370	(23.9)
1.5 m	kg			*8570	7680	*5510	4130	*4350	2720	*2100	1970	7.44
(4.9 ft)	lb			*18890	16930	*12150	9110	*9590	6000	*4630	4340	(24.4)
0.0 m	kg			*7920	7240	*6410	3930	*4790	2620	*2360	2000	7.28
(0.0 ft)	lb			*17460	15960	*14130	8660	*10560	5780	*5200	4410	(23.9)
-1.5 m	kg	*4680	*4680	*9710	7130	*6710	3840	*4900	2570	*2870	2190	6.78
(-4.9 ft)	lb	*10320	*10320	*21410	15720	*14790	8470	*10800	5670	*6330	4830	(22.3)
-3.0 m	kg	*7710	*7710	*9300	7200	*6230	3850			*4050	2690	5.86
(-9.8 ft)	lb	*17000	*17000	*20500	15870	*13730	8490			*8930	5930	(19.2)
-4.5 m	kg			*6670	*6670					*4510	4360	4.24
(-14.8 ft)	lb			*14700	*14700					*9940	9610	(13.9)

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.

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	1900	600	-	Up	-	-	-

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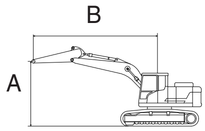

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg lb									*2440 *5380	*2440 *5380	4.34 (14.2)
6.0 m (19.7 ft)	kg lb									*2070 *4560	*2070 *4560	5.91 (19.4)
4.5 m (14.8 ft)	kg lb					*3420 *7540	*3420 *7540	*3220 *7100	2680 5910	*1960 *4320	*1960 *4320	6.81 (22.4)
3.0 m (9.8 ft)	kg lb			*5510 *12150	*5510 *12150	*4340 *9570	4020 8860	3690 8140	2600 5730	*1980 *4370	1900 4190	7.30 (23.9)
1.5 m (4.9 ft)	kg lb			*8570 *18890	6870 15150	*5510 *12150	3770 8310	3570 7870	2490 5490	*2100 *4630	1800 3970	7.44 (24.4)
0.0 m (0.0 ft)	kg lb			*7920 *17460	6450 14220	5350 11790	3570 7870	3470 7650	2390 5270	*2360 *5200	1820 4010	7.28 (23.9)
-1.5 m (-4.9 ft)	kg lb	*4680 *10320	*4680 *10320	*9710 *21410	6350 14000	5250 11570	3480 7670	3420 7540	2340 5160	*2870 *6330	1990 4390	6.78 (22.3)
-3.0 m (-9.8 ft)	kg lb	*7710 *17000	*7710 *17000	*9300 *20500	6410 14130	5260 11600	3490 7690			3570 7870	2450 5400	5.86 (19.2)
-4.5 m (-14.8 ft)	kg lb			*6670 *14700	6640 14640					*4510 *9940	3960 8730	4.24 (13.9)

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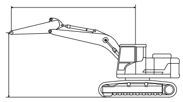
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	2300	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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					*3,670	*3,670			*2,180	*2,180	5.42
(19.7 ft)	lb					*8,090	*8,090			*4,810	*4,810	(17.8)
4.5 m	kg					*3,930	*3,930	*3,210	3,060	*2,020	*2,020	6.39
(14.8 ft)	lb					*8,660	*8,660	*7,080	6,750	*4,450	*4,450	(21.0)
3.0 m	kg			*6,610	*6,610	*4,820	4,610	*4,140	3,000	*2,010	*2,010	6.90
(9.8 ft)	lb			*14,570	*14,570	*10,630	10,160	*9,130	6,610	*4,430	*4,430	(22.6)
1.5 m	kg			*7,930	*7,930	*5,900	4,380	*4,590	2,900	*2,120	*2,120	7.06
(4.9 ft)	lb			*17,480	*17,480	*13,010	9,660	*10,120	6,390	*4,670	*4,670	(23.2)
0.0 m	kg			*6,750	*6,750	*6,630	4,210	*4,920	2,830	*2,380	2,340	6.89
(0.0 ft)	lb			*14,880	*14,880	*14,620	9,280	*10,850	6,240	*5,250	5,160	(22.6)
-1.5 m	kg	*4,910	*4,910	*9,970	7,720	*6,700	4,150	*4,830	2,800	*2,910	2,600	6.36
(-4.9 ft)	lb	*10,820	*10,820	*21,980	17,020	*14,770	9,150	*10,650	6,170	*6,420	5,730	(20.9)
-3.0 m	kg	*8,760	*8,760	*8,640	7,830	*5,860	4,200			*4,220	3,320	5.36
(-9.8 ft)	lb	*19,310	*19,310	*19,050	17,260	*12,920	9,260			*9,300	7,320	(17.6)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	2300	600	-	Up	-	-	-

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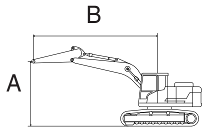

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg					*3,670	*3,670			*2,180	*2,180	5.42
(19.7 ft)	lb					*8,090	*8,090			*4,810	*4,810	(17.8)
4.5 m	kg					*3,930	*3,930	*3,210	2,820	*2,020	*2,020	6.39
(14.8 ft)	lb					*8,660	*8,660	*7,080	6,220	*4,450	*4,450	(21.0)
3.0 m	kg			*6,610	*6,610	*4,820	4,230	3,900	2,760	*2,010	*2,010	6.90
(9.8 ft)	lb			*14,570	*14,570	*10,630	9,330	8,600	6,080	*4,430	*4,430	(22.6)
1.5 m	kg			*7,930	7,200	5,880	4,000	3,790	2,660	*2,120	2,100	7.06
(4.9 ft)	lb			*17,480	15,870	12,960	8,820	8,360	5,860	*4,670	4,630	(23.2)
0.0 m	kg			*6,750	*6,750	5,700	3,840	3,710	2,590	*2,380	2,150	6.89
(0.0 ft)	lb			*14,880	*14,880	12,570	8,470	8,180	5,710	*5,250	4,740	(22.6)
-1.5 m	kg	*4,910	*4,910	*9,970	6,900	5,630	3,780	3,680	2,560	*2,910	2,380	6.36
(-4.9 ft)	lb	*10,820	*10,820	*21,980	15,210	12,410	8,330	8,110	5,640	*6,420	5,250	(20.9)
-3.0 m	kg	*8,760	*8,760	*8,640	7,010	5,690	3,820			*4,220	3,040	5.36
(-9.8 ft)	lb	*19,310	*19,310	*19,050	15,450	12,540	8,420			*9,300	6,700	(17.6)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	2300	600	-	Down	-	-	-

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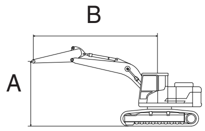

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
7.5 m	kg									*2,440	*2,440	4.34
(24.6 ft)	lb									*5,380	*5,380	(14.2)
6.0 m	kg									*2,070	*2,070	5.91
(19.7 ft)	lb									*4,560	*4,560	(19.4)
4.5 m	kg					*3,420	*3,420	*3,220	3,110	*1,960	*1,960	6.81
(14.8 ft)	lb					*7,540	*7,540	*7,100	6,860	*4,320	*4,320	(22.4)
3.0 m	kg			*5,510	*5,510	*4,340	*4,340	*3,830	3,030	*1,980	*1,980	7.30
(9.8 ft)	lb			*12,150	*12,150	*9,570	*9,570	*8,440	6,680	*4,370	*4,370	(23.9)
1.5 m	kg			*8,570	8,200	*5,510	4,420	*4,350	2,920	*2,100	*2,100	7.44
(4.9 ft)	lb			*18,890	18,080	*12,150	9,740	*9,590	6,440	*4,630	*4,630	(24.4)
0.0 m	kg			*7,920	7,760	*6,410	4,220	*4,790	2,820	*2,360	2,150	7.28
(0.0 ft)	lb			*17,460	17,110	*14,130	9,300	*10,560	6,220	*5,200	4,740	(23.9)
-1.5 m	kg	*4,680	*4,680	*9,710	7,650	*6,710	4,120	*4,900	2,770	*2,870	2,360	6.78
(-4.9 ft)	lb	*10,320	*10,320	*21,410	16,870	*14,790	9,080	*10,800	6,110	*6,330	5,200	(22.3)
-3.0 m	kg	*7,710	*7,710	*9,300	7,720	*6,230	4,140			*4,050	2,890	5.86
(-9.8 ft)	lb	*17,000	*17,000	*20,500	17,020	*13,730	9,130			*8,930	6,370	(19.2)
-4.5 m	kg			*6,670	*6,670					*4,510	*4,510	4.24
(-14.8 ft)	lb			*14,700	*14,700					*9,940	*9,940	(13.9)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 LDT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	2300	600	-	Up	-	-	-

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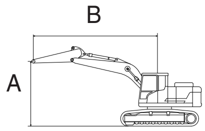

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
7.5 m	kg									*2,440	*2,440	4.34
(24.6 ft)	lb									*5,380	*5,380	(14.2)
6.0 m	kg									*2,070	*2,070	5.91
(19.7 ft)	lb									*4,560	*4,560	(19.4)
4.5 m	kg					*3,420	*3,420	*3,220	2,870	*1,960	*1,960	6.81
(14.8 ft)	lb					*7,540	*7,540	*7,100	6,330	*4,320	*4,320	(22.4)
3.0 m	kg			*5,510	*5,510	*4,340	4,290	*3,830	2,790	*1,980	*1,980	7.30
(9.8 ft)	lb			*12,150	*12,150	*9,570	9,460	*8,440	6,150	*4,370	*4,370	(23.9)
1.5 m	kg			*8,570	7,360	*5,510	4,040	3,810	2,680	*2,100	1,950	7.44
(4.9 ft)	lb			*18,890	16,230	*12,150	8,910	8,400	5,910	*4,630	4,300	(24.4)
0.0 m	kg			*7,920	6,940	5,710	3,840	3,710	2,580	*2,360	1,970	7.28
(0.0 ft)	lb			*17,460	15,300	12,590	8,470	8,180	5,690	*5,200	4,340	(23.9)
-1.5 m	kg	*4,680	*4,680	*9,710	6,830	5,600	3,750	3,650	2,530	*2,870	2,160	6.78
(-4.9 ft)	lb	*10,320	*10,320	*21,410	15,060	12,350	8,270	8,050	5,580	*6,330	4,760	(22.3)
-3.0 m	kg	*7,710	*7,710	*9,300	6,900	5,620	3,760			3,810	2,640	5.86
(-9.8 ft)	lb	*17,000	*17,000	*20,500	15,210	12,390	8,290			8,400	5,820	(19.2)
-4.5 m	kg			*6,670	*6,670					*4,510	4,250	4.24
(-14.8 ft)	lb			*14,700	*14,700					*9,940	9,370	(13.9)

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2) HX140 HWT3

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
		Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
HX140 HWT3	MONO BOOM	4600	2500	1900	800	-	-	-	-	-

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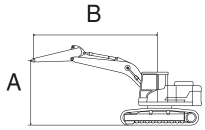


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
7.5 m	kg									*2580	*2580	4.06
(24.6 ft)	lb									*5690	*5690	(13.3)
6.0 m	kg					*3660	*3660			*2130	*2130	5.64
(19.7 ft)	lb					*8070	*8070			*4700	*4700	(18.5)
4.5 m	kg					*4060	*4060	*3460	3090	*2010	*2010	6.51
(14.8 ft)	lb					*8950	*8950	*7630	6810	*4430	*4430	(21.4)
3.0 m	kg			*7180	*7180	*5020	4600	*4220	3020	*2020	*2020	6.96
(9.8 ft)	lb			*15830	*15830	*11070	10140	*9300	6660	*4450	*4450	(22.8)
1.5 m	kg			*6940	*6940	*6080	4370	4370	2920	*2150	*2150	7.05
(4.9 ft)	lb			*15300	*15300	*13400	9630	9630	6440	*4740	*4740	(23.1)
0.0 m	kg			*7140	*7140	6580	4230	4300	2850	*2450	2400	6.82
(0.0 ft)	lb			*15740	*15740	14510	9330	9480	6280	*5400	5290	(22.4)
-1.5 m	kg	*5530	*5530	*9910	7720	6540	4190	4290	2840	*3060	2720	6.22
(-4.9 ft)	lb	*12190	*12190	*21850	17020	14420	9240	9460	6260	*6750	6000	(20.4)
-3.0 m	kg			*8220	7850	*5530	4260			*4540	3600	5.11
(-9.8 ft)	lb			*18120	17310	*12190	9390			*10010	7940	(16.8)

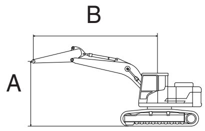
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited 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 with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 HWT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	1900	800	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg					*2690	*2690			*2330	*2330	4.70
(24.6 ft)	lb					*5930	*5930			*5140	*5140	(15.4)
6.0 m	kg							*2310	*2310	*2030	*2030	6.12
(19.7 ft)	lb							*5090	*5090	*4480	*4480	(20.1)
4.5 m	kg					*3550	*3550	*3360	3130	*1950	*1950	6.93
(14.8 ft)	lb					*7830	*7830	*7410	6900	*4300	*4300	(22.7)
3.0 m	kg			*6080	*6080	*4550	*4550	*3920	3040	*1990	*1990	7.35
(9.8 ft)	lb			*13400	*13400	*10030	*10030	*8640	6700	*4390	*4390	(24.1)
1.5 m	kg			*9020	8060	*5710	4410	4390	2930	*2140	*2140	7.44
(4.9 ft)	lb			*19890	17770	*12590	9720	9680	6460	*4720	*4720	(24.4)
0.0 m	kg			*8000	7710	*6520	4230	4290	2840	*2430	2210	7.22
(0.0 ft)	lb			*17640	17000	*14370	9330	9460	6260	*5360	4870	(23.7)
-1.5 m	kg	*5170	*5170	*10210	7640	6500	4150	4250	2810	*3010	2450	6.65
(-4.9 ft)	lb	*11400	*11400	*22510	16840	14330	9150	9370	6190	*6640	5400	(21.8)
-3.0 m	kg	*8400	*8400	*8970	7730	*6030	4180			*4450	3100	5.63
(-9.8 ft)	lb	*18520	*18520	*19780	17040	*13290	9220			*9810	6830	(18.5)

Note 1. Lifting capacity are based on ISO 10567.
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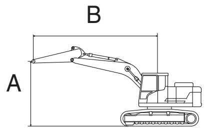
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 HWT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	2300	800	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg									*2580	*2580	4.06
(24.6 ft)	lb									*5690	*5690	(13.3)
6.0 m	kg					*3660	*3660			*2130	*2130	5.64
(19.7 ft)	lb					*8070	*8070			*4700	*4700	(18.5)
4.5 m	kg					*4060	*4060	*3460	3290	*2010	*2010	6.51
(14.8 ft)	lb					*8950	*8950	*7630	7250	*4430	*4430	(21.4)
3.0 m	kg			*7180	*7180	*5020	4880	*4220	3210	*2020	*2020	6.96
(9.8 ft)	lb			*15830	*15830	*11070	10760	*9300	7080	*4450	*4450	(22.8)
1.5 m	kg			*6940	*6940	*6080	4650	4610	3120	*2150	*2150	7.05
(4.9 ft)	lb			*15300	*15300	*13400	10250	10160	6880	*4740	*4740	(23.1)
0.0 m	kg			*7140	*7140	*6690	4510	4540	3050	*2450	*2450	6.82
(0.0 ft)	lb			*15740	*15740	*14750	9940	10010	6720	*5400	*5400	(22.4)
-1.5 m	kg	*5530	*5530	*9910	8220	*6620	4470	4520	3040	*3060	2910	6.22
(-4.9 ft)	lb	*12190	*12190	*21850	18120	*14590	9850	9960	6700	*6750	6420	(20.4)
-3.0 m	kg			*8220	*8220	*5530	4540			*4540	3840	5.11
(-9.8 ft)	lb			*18120	*18120	*12190	10010			*10010	8470	(16.8)

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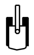
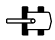
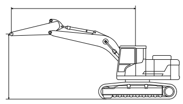
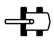
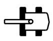
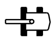
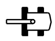
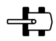
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 HWT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	2300	800	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg					*2690	*2690			*2330	*2330	4.70
(24.6 ft)	lb					*5930	*5930			*5140	*5140	(15.4)
6.0 m	kg							*2310	*2310	*2030	*2030	6.12
(19.7 ft)	lb							*5090	*5090	*4480	*4480	(20.1)
4.5 m	kg					*3550	*3550	*3360	3330	*1950	*1950	6.93
(14.8 ft)	lb					*7830	*7830	*7410	7340	*4300	*4300	(22.7)
3.0 m	kg			*6080	*6080	*4550	*4550	*3920	3240	*1990	*1990	7.35
(9.8 ft)	lb			*13400	*13400	*10030	*10030	*8640	7140	*4390	*4390	(24.1)
1.5 m	kg			*9020	8560	*5710	4690	*4440	3130	*2140	*2140	7.44
(4.9 ft)	lb			*19890	18870	*12590	10340	*9790	6900	*4720	*4720	(24.4)
0.0 m	kg			*8000	*8000	*6520	4510	4530	3040	*2430	2360	7.22
(0.0 ft)	lb			*17640	*17640	*14370	9940	9990	6700	*5360	5200	(23.7)
-1.5 m	kg	*5170	*5170	*10210	8140	*6690	4430	4490	3000	*3010	2630	6.65
(-4.9 ft)	lb	*11400	*11400	*22510	17950	*14750	9770	9900	6610	*6640	5800	(21.8)
-3.0 m	kg	*8400	*8400	*8970	8230	*6030	4460			*4450	3310	5.63
(-9.8 ft)	lb	*18520	*18520	*19780	18140	*13290	9830			*9810	7300	(18.5)

Note 1. Lifting capacity are based on ISO 10567.
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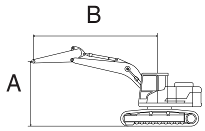
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 HWT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	1900	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg									*2580	*2580	4.06
(24.6 ft)	lb									*5690	*5690	(13.3)
6.0 m	kg					*3660	*3660			*2130	*2130	5.64
(19.7 ft)	lb					*8070	*8070			*4700	*4700	(18.5)
4.5 m	kg					*4060	*4060	*3460	3050	*2010	*2010	6.51
(14.8 ft)	lb					*8950	*8950	*7630	6720	*4430	*4430	(21.4)
3.0 m	kg			*7180	*7180	*5020	4540	*4220	2980	*2020	*2020	6.96
(9.8 ft)	lb			*15830	*15830	*11070	10010	*9300	6570	*4450	*4450	(22.8)
1.5 m	kg			*6940	*6940	*6080	4310	4310	2880	*2150	*2150	7.05
(4.9 ft)	lb			*15300	*15300	*13400	9500	9500	6350	*4740	*4740	(23.1)
0.0 m	kg			*7140	*7140	6490	4170	4240	2810	*2450	2370	6.82
(0.0 ft)	lb			*15740	*15740	14310	9190	9350	6190	*5400	5220	(22.4)
-1.5 m	kg	*5530	*5530	*9910	7610	6450	4130	4230	2800	*3060	2680	6.22
(-4.9 ft)	lb	*12190	*12190	*21850	16780	14220	9110	9330	6170	*6750	5910	(20.4)
-3.0 m	kg			*8220	7750	*5530	4200			*4540	3550	5.11
(-9.8 ft)	lb			*18120	17090	*12190	9260			*10010	7830	(16.8)

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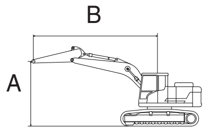
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 HWT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	1900	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg					*2690	*2690			*2330	*2330	4.70
(24.6 ft)	lb					*5930	*5930			*5140	*5140	(15.4)
6.0 m	kg							*2310	*2310	*2030	*2030	6.12
(19.7 ft)	lb							*5090	*5090	*4480	*4480	(20.1)
4.5 m	kg					*3550	*3550	*3360	3090	*1950	*1950	6.93
(14.8 ft)	lb					*7830	*7830	*7410	6810	*4300	*4300	(22.7)
3.0 m	kg			*6080	*6080	*4550	*4550	*3920	3000	*1990	*1990	7.35
(9.8 ft)	lb			*13400	*13400	*10030	*10030	*8640	6610	*4390	*4390	(24.1)
1.5 m	kg			*9020	7960	*5710	4350	4330	2890	*2140	2120	7.44
(4.9 ft)	lb			*19890	17550	*12590	9590	9550	6370	*4720	4670	(24.4)
0.0 m	kg			*8000	7600	6500	4170	4230	2800	*2430	2180	7.22
(0.0 ft)	lb			*17640	16760	14330	9190	9330	6170	*5360	4810	(23.7)
-1.5 m	kg	*5170	*5170	*10210	7540	6410	4090	4190	2770	*3010	2420	6.65
(-4.9 ft)	lb	*11400	*11400	*22510	16620	14130	9020	9240	6110	*6640	5340	(21.8)
-3.0 m	kg	*8400	*8400	*8970	7630	*6030	4130			*4450	3060	5.63
(-9.8 ft)	lb	*18520	*18520	*19780	16820	*13290	9110			*9810	6750	(18.5)

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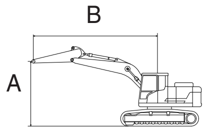
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 HWT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	2500	2300	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg									*2580	*2580	4.06
(24.6 ft)	lb									*5690	*5690	(13.3)
6.0 m	kg					*3660	*3660			*2130	*2130	5.64
(19.7 ft)	lb					*8070	*8070			*4700	*4700	(18.5)
4.5 m	kg					*4060	*4060	*3460	3250	*2010	*2010	6.51
(14.8 ft)	lb					*8950	*8950	*7630	7170	*4430	*4430	(21.4)
3.0 m	kg			*7180	*7180	*5020	4820	*4220	3170	*2020	*2020	6.96
(9.8 ft)	lb			*15830	*15830	*11070	10630	*9300	6990	*4450	*4450	(22.8)
1.5 m	kg			*6940	*6940	*6080	4590	4550	3080	*2150	*2150	7.05
(4.9 ft)	lb			*15300	*15300	*13400	10120	10030	6790	*4740	*4740	(23.1)
0.0 m	kg			*7140	*7140	*6690	4450	4470	3010	*2450	*2450	6.82
(0.0 ft)	lb			*15740	*15740	*14750	9810	9850	6640	*5400	*5400	(22.4)
-1.5 m	kg	*5530	*5530	*9910	8120	*6620	4410	4460	3000	*3060	2870	6.22
(-4.9 ft)	lb	*12190	*12190	*21850	17900	*14590	9720	9830	6610	*6750	6330	(20.4)
-3.0 m	kg			*8220	*8220	*5530	4480			*4540	3790	5.11
(-9.8 ft)	lb			*18120	*18120	*12190	9880			*10010	8360	(16.8)

Note 1. Lifting capacity are based on ISO 10567.
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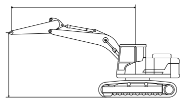
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX140 HWT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		4600	3000	2300	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								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)
7.5 m	kg					*2690	*2690			*2330	*2330	4.70
(24.6 ft)	lb					*5930	*5930			*5140	*5140	(15.4)
6.0 m	kg							*2310	*2310	*2030	*2030	6.12
(19.7 ft)	lb							*5090	*5090	*4480	*4480	(20.1)
4.5 m	kg					*3550	*3550	*3360	3290	*1950	*1950	6.93
(14.8 ft)	lb					*7830	*7830	*7410	7250	*4300	*4300	(22.7)
3.0 m	kg			*6080	*6080	*4550	*4550	*3920	3200	*1990	*1990	7.35
(9.8 ft)	lb			*13400	*13400	*10030	*10030	*8640	7050	*4390	*4390	(24.1)
1.5 m	kg			*9020	8460	*5710	4630	*4440	3090	*2140	*2140	7.44
(4.9 ft)	lb			*19890	18650	*12590	10210	*9790	6810	*4720	*4720	(24.4)
0.0 m	kg			*8000	*8000	*6520	4450	4470	3000	*2430	2330	7.22
(0.0 ft)	lb			*17640	*17640	*14370	9810	9850	6610	*5360	5140	(23.7)
-1.5 m	kg	*5170	*5170	*10210	8040	*6690	4370	4430	2960	*3010	2590	6.65
(-4.9 ft)	lb	*11400	*11400	*22510	17730	*14750	9630	9770	6530	*6640	5710	(21.8)
-3.0 m	kg	*8400	*8400	*8970	8130	*6030	4410			*4450	3270	5.63
(-9.8 ft)	lb	*18520	*18520	*19780	17920	*13290	9720			*9810	7210	(18.5)

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 with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

6. BUCKET SELECTION GUIDE

General bucket

Type	Counterweight						1900 kg		2300 kg	
	Capacity		Width		Weight	Tooth	MONO			
	SAE Heaped	CECE heaped	Without side cutter	With side cutter			4.6 m (15' 1") Boom			
	m³ (yd³)	m³ (yd³)	mm (in)	mm (in)	kg (lb)	EA	2.5 m (8' 2") Arm	3.0 m (9' 10") Arm	2.5 m (8' 2") Arm	3.0 m (9' 10") Arm
General bucket	0.51 (0.67)	0.45 (0.59)	865 (34.1")	995 (39.2")	395 (870)	5	●	●	●	●
	0.59 (0.77)	0.51 (0.67)	955 (37.6")	1085 (42.7")	415 (910)	5	●	◐	●	●
	0.64 (0.84)	0.55 (0.72)	1040 (40.9")	1170 (46.1")	440 (970)	5	●	◐	●	●
	0.76 (0.99)	0.65 (0.85)	1215 (47.8")	1345 (53.0")	490 (1080)	6	■	■	◐	■

●	Applicable for materials with density of 2100 kg/m³ (3500 lb/yd³) or less
◐	Applicable for materials with density of 1800 kg/m³ (3000 lb/yd³) or less
■	Applicable for materials with density of 1500 kg/m³ (2500 lb/yd³) or less
▲	Applicable for materials with density of 1200 kg/m³ (2000 lb/yd³) or less
X	Not recommended

※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult with your local HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

7. UNDERCARRIAGE

1) TYPES OF SHOES

Model	Description	Unit		Triple grouser									
	width	mm	(in)	500	(20")	600	(24")	700	(28")	700	(28")	800	(32")
HX140 LT3	Operating weight	kg	(lb)	14110	31110	14325	31580	14535	32040	-	-	-	-
	Ground pressure	kgf/cm²	(psi)	0.44	(6.3)	0.37	(5.3)	0.32	(4.6)	-	-	-	-
	Overall width	mm		2490	(8' 2")	2590	(8' 6")	2690	(8' 10")	-	-	-	-
	Link quantity	EA		46		46		46		-		-	
HX140 LDT3	Operating weight	kg	(lb)	15015	33100	15230	33580	15440	34040	-	-	-	-
	Ground pressure	kgf/cm²	(psi)	0.46	(6.5)	0.39	(5.6)	0.34	(4.8)	-	-	-	-
	Overall width	mm		2490	(8' 2")	2590	(8' 6")	2690	(8' 10")	-	-	-	-
	Link quantity	EA		46		46		46		-		-	
HX140 HWT3	Operating weight	kg	(lb)	-	-	-	-	-	-	17085	37670	17320	38180
	Ground pressure	kgf/cm²	(psi)	-	-	-	-	-	-	0.37	(5.3)	0.33	(4.7)
	Overall width	mm		-	-	-	-	-	-	2740	(9' 0")	2840	(9' 4")
	Link quantity	EA		-		-		-		47		47	

2) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

Confirm the category from the list of applications in **table 2**, then use **table 1** to select the shoe. Wide shoes (categories B and C) have limitations on applications. Before using wide shoes, check the precautions, then investigate and study the operating conditions to confirm if these shoes are suitable.

Select the narrowest shoe possible to meet the required flotation and ground pressure. Application of wider shoes than recommendations will cause unexpected problem such as bending of shoes, crack of link, breakage of pin, loosening of shoe bolts and the other various problems.

Table 1

Model	Track shoe	Specification	Category
HX140 LT3 HX140 LDT3	500 mm triple grouser	Option	A
	600 mm triple grouser	Standard	B
	700 mm triple grouser	Option	C
HX140 HWT3	700 mm triple grouser	Option	C
	800 mm triple grouser	Option	C

Table 2

Category	Applications	Precautions
A	Rocky ground, river beds, normal soil	· Travel at low speed on rough ground with large obstacles such as boulders or fallen trees or a wide range of general civil engineering work
B	Normal soil, soft ground	· These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees · Travel at high speed only on flat ground · Travel slowly at low speed if it is impossible to avoid going over obstacles
C	Extremely soft ground (swampy ground)	· Use the shoes only in the conditions that the machine sinks and it is impossible to use the shoes of category A or B · These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees · Travel at high speed only on flat ground · Travel slowly at low speed if it is impossible to avoid going over obstacles

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Maker / Model	Cummins / QSB4.5
Type	4-cycle, turbocharged, charge air cooled, electronic controlled diesel engine
Cooling method	Water cooled
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	107 × 124 mm (4.21" × 4.88")
Displacement	4.5 ℓ (275 cu in)
Compression ratio	17.2 : 1
Gross power	130 Hp (97 kW) at 2000 rpm
Net power	127 Hp (95 kW) at 2000 rpm
Max. power	135 Hp (101 kW) at 1800 rpm
Peak Torque	620 N·m (457 lbf·ft) at 1500 rpm
Engine oil quantity	11 ℓ (2.9 U.S. gal)
Wet weight	371 kg (818 lb)
Starter motor	24 V-4.8 kW
Alternator	24 V-70 A

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 72.9 cc/rev
Maximum pressure	350 kgf/cm^2 (4980 psi)
Maximum pressure (power boost)	380 kgf/cm^2 (5400 psi)
Rated oil flow	2 × 131 ℓ/min (34.6 U.S. gpm / 28.8 U.K. gpm)
Rated speed	1800 rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	15 cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	27 ℓ/min (7.1 U.S. gpm/5.9 U.K. gpm)

4) MAIN CONTROL VALVE

Item		Specification
Type		11 spools
Operating method		Hydraulic pilot system
Main relief valve pressure		350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]
Port relief valve pressure	Boom	400 kgf/cm^2 (5690 psi)
	Arm	400 kgf/cm^2 (5690 psi)
	Bucket	400 kgf/cm^2 (5690 psi)

[ ] : Power boost

5) SWING MOTOR

Item		Specification
Type		Fixed displacement axial piston motor
Capacity		72 cc/rev
Relief pressure		280 kgf/cm^2 (3990 psi)
Braking system		Automatic, spring applied hydraulic released
Swing brake		Multi wet disc
Braking torque		640 kgf · m (4630 lbf · ft) over
Brake release pressure	Cracking	18 kgf/cm^2 (256 psi)
	Full stroke	24 kgf/cm^2 (341 psi)
Swing bearing lubrication		Grease-bathed
Reduction gear type		2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Capacity	77/44.5 cc/rev
Relief pressure	350 kgf/cm² (4980 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	1779 kgf·m (12868 lbf·ft)
Brake release pressure	12.5~15.9 kgf/cm² (202~239 psi)
Reduction gear type	2-stage planetary

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Stroke	Ø105 × 1080 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Stroke	Ø115 × 1108 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Stroke	Ø100 × 900 mm
	Cushion	Extend only
Dozer cylinder	Bore dia × Stroke	Ø100 × 250 mm
	Cushion	Extend only

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

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

9. 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	11 (2.9)	★SAE 0W-40 SAE 5W-40 SAE 15W-40
Swing drive	Gear oil	3.5 (0.9)	★SAE 75W-90
Final drive		2.3x2 (0.6x2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank 120 (31.7) System 210 (55.5)	★ISO VG 15 ISO VG 32 ISO VG 68
Fuel tank	Diesel fuel	270 (71.3)	★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 soft water★1	23 (6.1)	Ethylene glycol base permanent type (50 : 50) ★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 : Soft water
City water or distilled water

※ 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.

※ For HD Hyundai Construction Equipment genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact your local HD Hyundai Construction Equipment dealer.

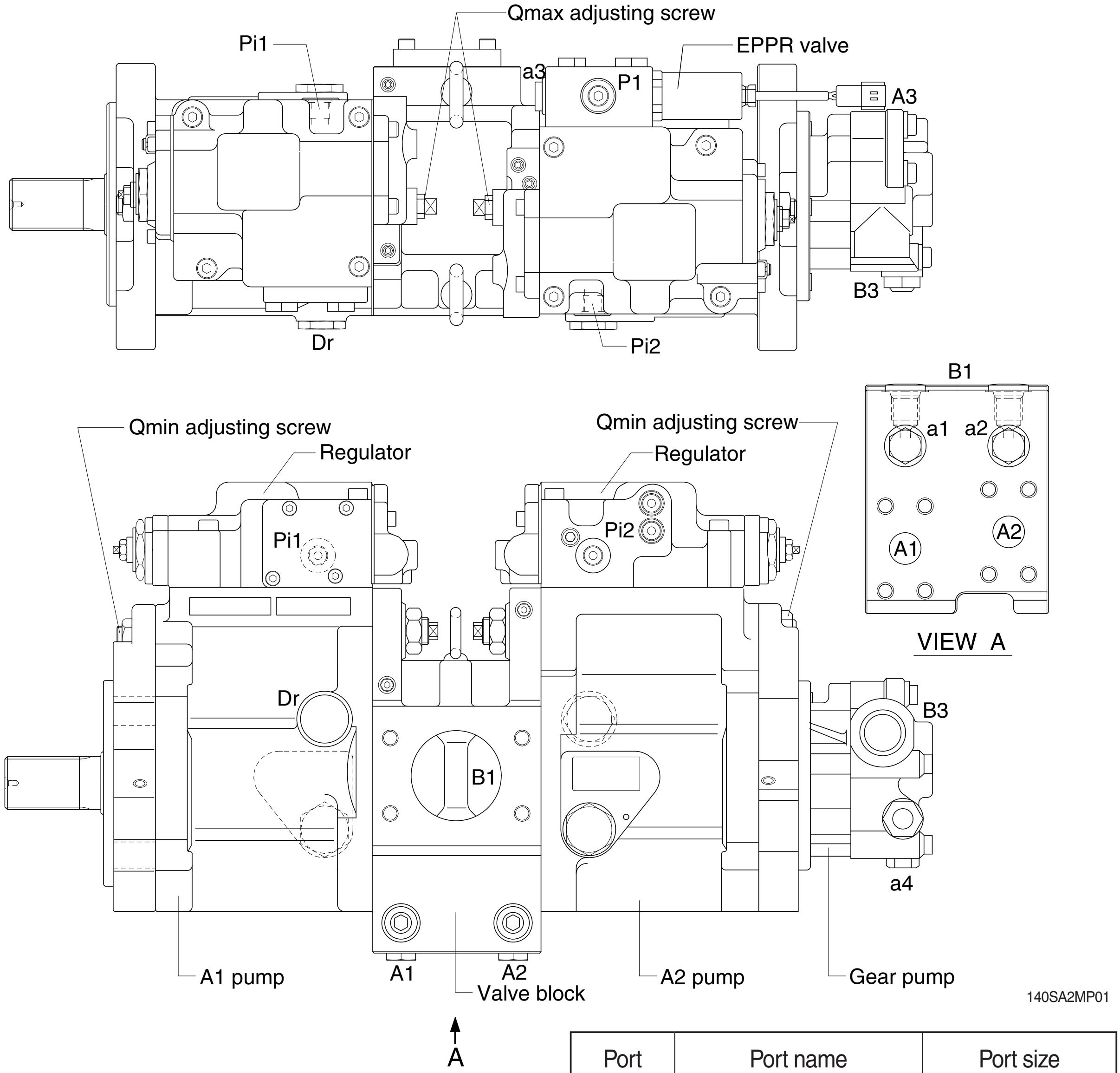
SECTION 2 STRUCTURE AND FUNCTION

Group 1 Pump Device ··· 2-1
Group 2 Main Control Valve ··· 2-20
Group 3 Swing Device ··· 2-51
Group 4 Travel Device ··· 2-63
Group 5 RCV Lever ··· 2-84
Group 6 RCV Pedal ··· 2-91

GROUP 1 PUMP DEVICE

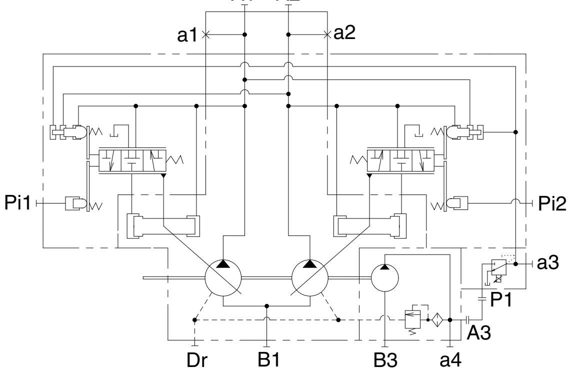
1. STRUCTURE

The pump device consists of main pump, regulator and gear pump.



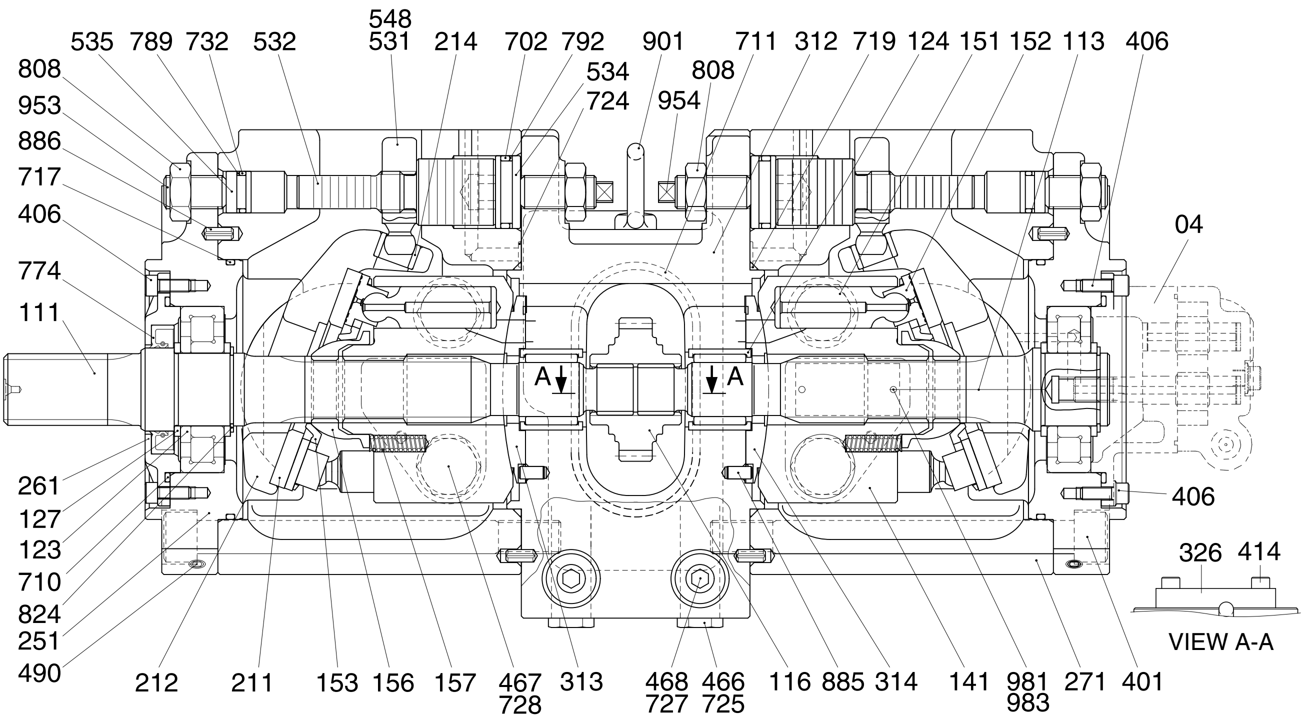
140SA2MP01

Port	Port name	Port size
A1, A2	Delivery port	SAE 6000 psi 3/4"
B1	Suction port	SAE 2500 psi 2 1/2"
Dr	Drain port	PF 1/2 - 19
Pi1, Pi2	Pilot port	PF 1/4 - 15
P1	EPPR port	PF 1/4 - 13
a1, a2	Gauge port	PF 1/4 - 15
a3	Gauge port	PF 1/4 - 13
a4	Gauge port	PF 1/4-14
A3	Gear pump delivery port	PF 1/2 - 19
B3	Gear pump suction port	PF 3/4 - 20.5



1) MAIN PUMP

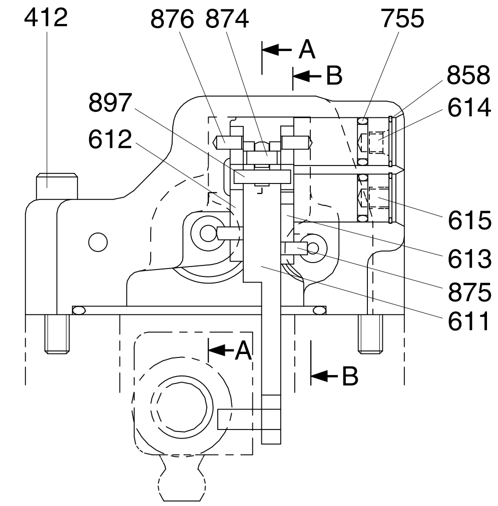
The main pump consists of two piston pumps (A1 & A2) and valve block.

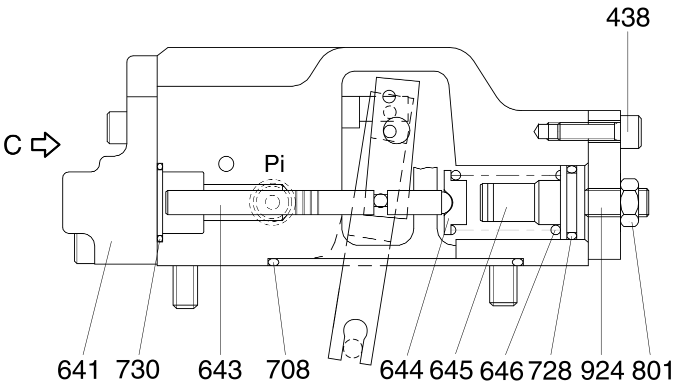


140AS2MP02

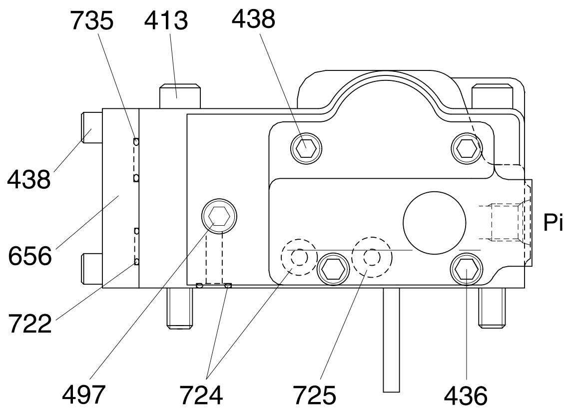
04 Gear pump
111 Drive shaft (F)
113 Drive shaft (R)
116 1st Gear
123 Roller bearing
124 Needle bearing
127 Bearing spacer
141 Cylinder block
151 Piston
152 Shoe
153 Set plate
156 Bushing
157 Cylinder spring
211 Shoe plate
212 Swash plate
214 Tilting bushing
251 Support
261 Seal cover (F)
271 Pump casing
312 Valve block
313 Valve plate (R)
314 Valve plate (L)
326 Cover
401 Hexagon socket bolt
406 Hexagon socket bolt
414 Hexagon socket bolt
466 Plug
467 Plug
468 Plug
490 Plug
531 Tilting pin
532 Servo piston
534 Stopper (L)
535 Stopper (S)
548 Feed back pin
702 O-ring
710 O-ring
711 O-ring
717 O-ring
719 O-ring
724 Square ring
725 O-ring
727 O-ring
728 O-ring
732 O-ring
774 Oil seal
789 Back up ring
792 Back up ring
808 Hexagon head nut
824 Snap ring
885 Pin
886 Spring pin
901 Eye bolt
953 Set screw
954 Set screw
981 Name plate
983 Pin

2) REGULATOR (1/2)

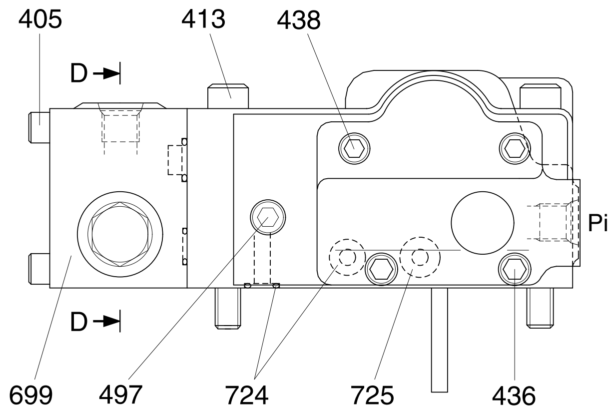




SECTION B-B

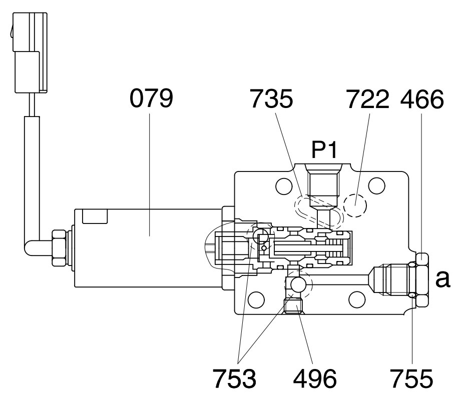


VIEW C (FRONT)

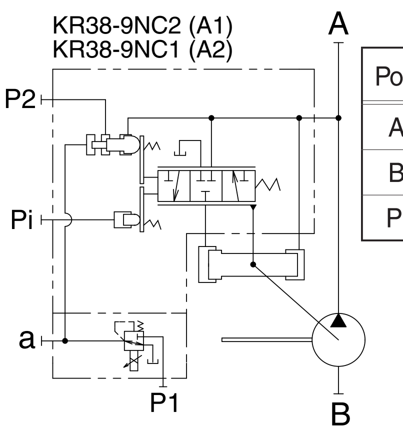


VIEW C (REAR)

140SA2MP04

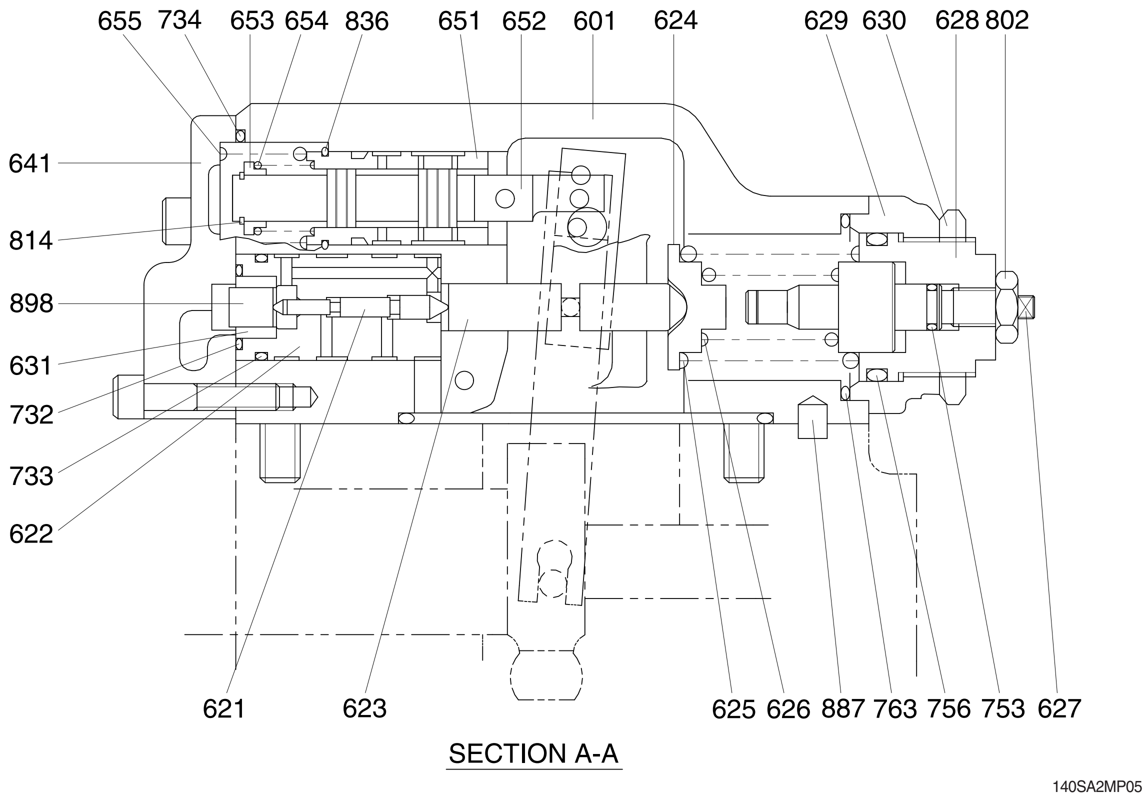


SECTION D-D(REAR)



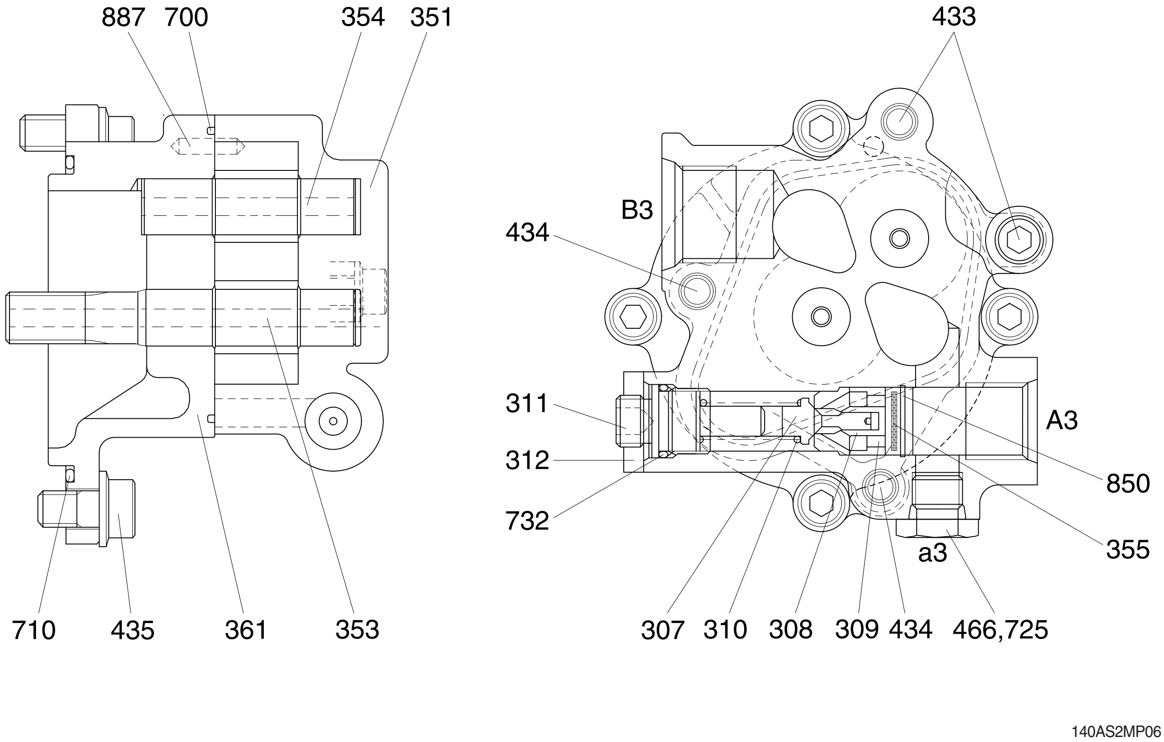
Port	Port name	Port size
A	Delivery port	SAE 6000 psi 3/4"
B	Suction port	SAE 2500 psi 2 1/2"
Pi	Pilot port	PF 1/4-15

REGULATOR (2/2)



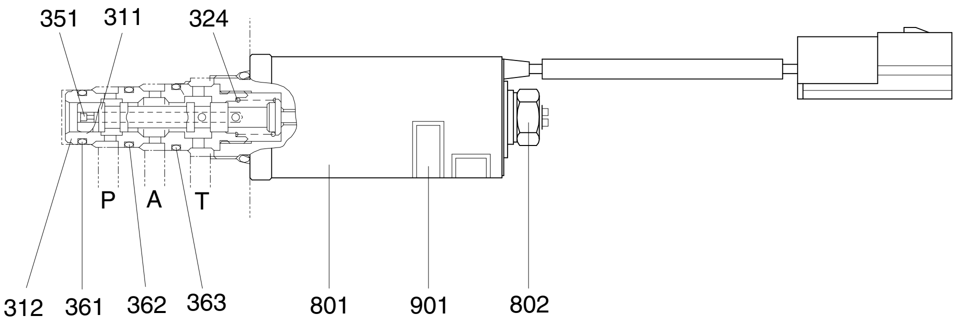
079	EPPR valve assembly	628	Adjust screw (C)	730	O-ring
405	Hexagon socket screw	629	Cover (C)	732	O-ring
412	Hexagon socket screw	630	Lock nut	733	O-ring
413	Hexagon socket screw	631	Sleeve, Pf	734	O-ring
436	Hexagon socket screw	641	Pilot cover	735	O-ring
438	Hexagon socket screw	643	Pilot piston	753	O-ring
466	Plug	644	Spring seat (Q)	755	O-ring
497	Plug	645	Adjust stem (Q)	756	O-ring
601	Casing	646	Pilot spring	763	O-ring
611	Feed back lever	651	Sleeve	801	Lock nut
612	Lever (1)	652	Spool	802	Lock nut
613	Lever (2)	653	Spring seat	814	Snap ring
614	Center plug	654	Return spring	836	Snap ring
615	Adjust plug	655	Set spring	858	Snap ring
621	Compensator piston	656	Block cover	874	Pin
622	Piston case	699	Valve casing	875	Pin
623	Compensator rod	708	O-ring	876	Pin
624	Spring seat (C)	722	O-ring	887	Pin
625	Outer spring	724	O-ring	897	Pin
626	Inner spring	725	O-ring	898	Pin
627	Adjust stem (C)	728	O-ring	924	Set screw

3) GEAR PUMP



307	Poppet	353	Drive gear	466	Plug
308	Seat	354	Driven gear	700	Ring
309	Ring	355	Filter	710	O-ring
310	Spring	361	Front case	725	O-ring
311	Adjusting screw	433	Flange socket	732	O-ring
312	Lock nut	434	Flange socket	850	Snap ring
351	Gear case	435	Flange socket	887	Pin

4) EPPR VALVE ASSY



311	Spool	361	O-ring	802	Hexagon nut
312	Sleeve	362	O-ring	901	Name plate
324	Spring	363	O-ring		
351	Orifice	801	Solenoid		

2. FUNCTION

1) MAIN PUMP

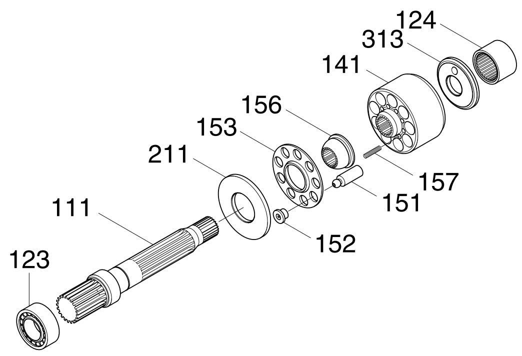
The pumps may be classified roughly into the rotary group performing a rotary motion and working as the major part of the whole pump function: the swash plate group that varies the delivery rates: and the valve cover group that changes over oil suction and discharge : and the PTO group that transfers drive shaft of gear pump.

(1) Rotary group

The rotary group consists of drive shaft (F) (111), cylinder block (141), piston shoes (151,152), set plate (153), spherical bushing (156) and cylinder spring (157). The drive shaft is supported by bearing (123,124) at its both ends.

The shoe is caulked to the piston to from a spherical coupling. It has a pocket to relieve thrust force generated by loading pressure and to take hydraulic balance so that it slides lightly over the shoe plate (211). The sub group composed by a piston and a shoe is pressed against the shoe plate by the action of the cylinder spring via the set plate and a spherical bushing.

Similarly, the cylinder block is pressed against valve plate (313) by the action of the cylinder spring.



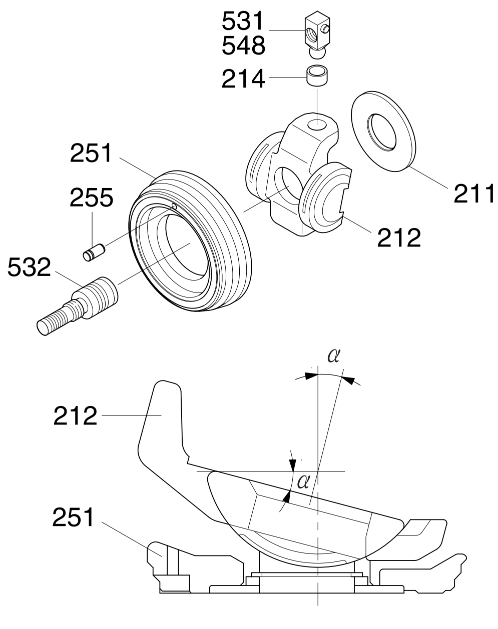
21092MP06

(2) Swash plate group

The swash plate group consists of swash plate (212), shoe plate (211), swash plate support (251), lock pin (255), tilting bushing (214), tilting pin (531) and servo piston (532).

The swash plate is a cylindrical part formed on the opposite side of the sliding surface of the shoe and is supported by the swash support.

If the servo piston moves to the right or left as hydraulic force controlled by the regulator connects to hydraulic chamber located on both sides of the servo piston, the swash plate slides over the swash plate support via the spherical part of the tilting pin to change the tilting angle (α)



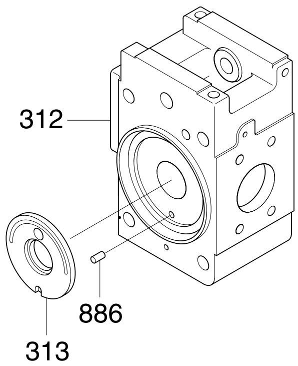
140Z92MP09

(3) Valve block group

The valve block group consists of valve block (312), valve plate (313, 314) and spring pin(886).

The valve plate having two kidmey ports is fixed to the valve block and feeds and collects oil to and from the cylinder block.

The oil changed over by the valve plate is connected to an external pipeline by way of the valve block.



140Z92MP07

2) REGULATOR

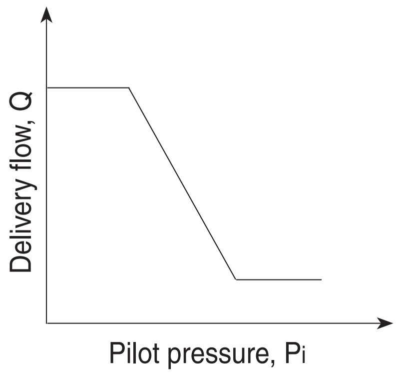
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

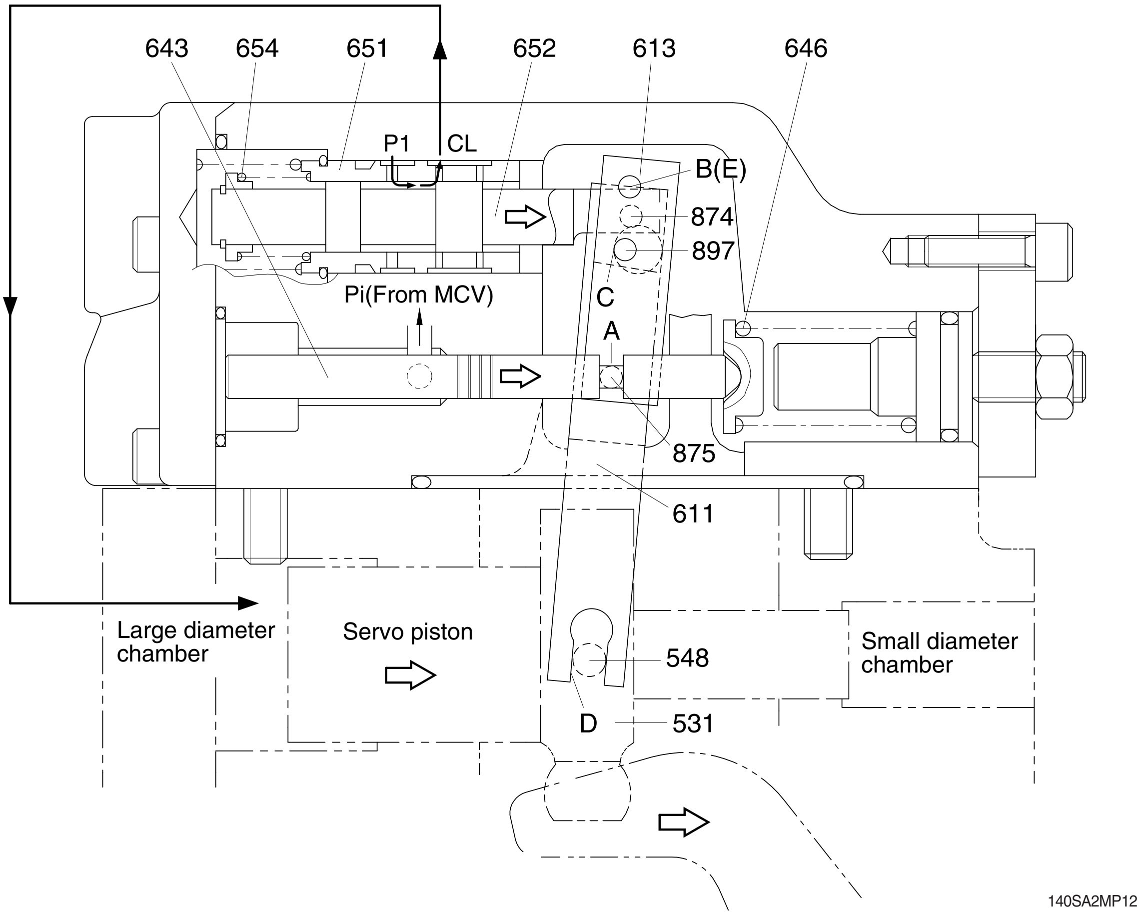
By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

This regulator is of the negative flow control in which the delivery flow Q decreases as the pilot pressure Pi rises.

With this mechanism, when the pilot pressure corresponding to the flow required for the work is commanded, the pump discharges the required flow only, and so it does not consume the power uselessly.

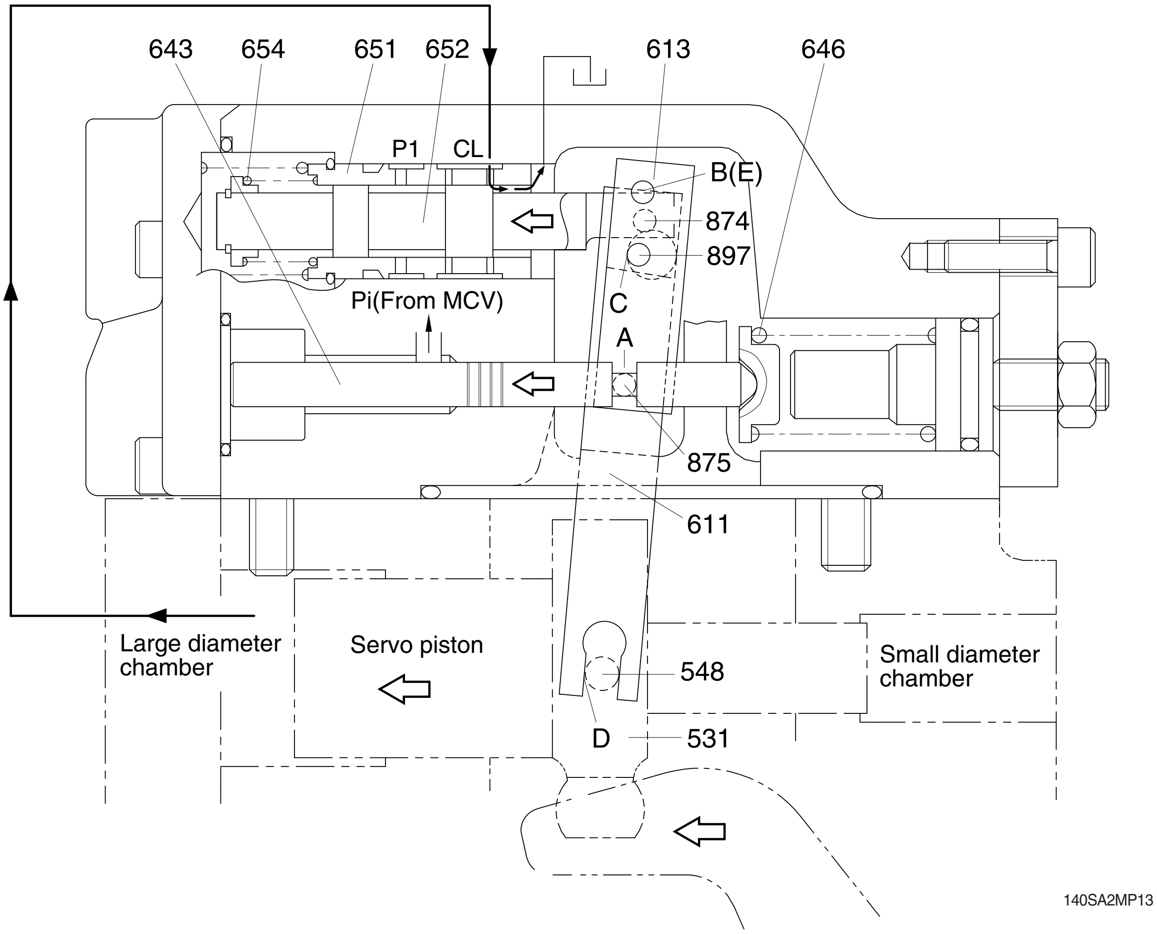


① Flow reducing function



As the pilot pressure Pi rises, the pilot piston (643) moves to the right to a position where the force of the pilot spring (646) balances with the hydraulic force.
The groove (A) in the pilot piston is fitted with the pin (875) that is fixed to lever 2 (613). Therefore, when the pilot piston moves, lever 2 rotates around the fulcrum of point B [fixed by the fulcrum plug (614) and pin (875)]. Since the large hole section (C) of lever 2 contains a protruding pin (897) fixed to the feedback lever (611), the pin (897) moves to the right as lever 2 rotates. Since the opposing-flat section (D) of the feedback lever is fitted with the pin (548) fixed by the tilting pin (531) that swings the swash plate, the feedback lever rotates around the fulcrum of point D, as the pin (897) moves.
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.
The movement of the spool causes the delivery pressure P1 to connect to port CL through the spool and to be admitted to the large diameter section of the servo piston. The delivery pressure P1 that is constantly admitted to the small diameter section of the servo piston moves the servo piston to the right due to the area difference, resulting in decrease of the tilting angle.
When the servo piston moves to the right, point D also moves to the right. The spool is fitted with the return spring (654) and is tensioned to the left at all times, and so the pin (897) is pressed against the large hole section (C) of lever 2.
Therefore, as point D moves, the feedback lever rotates around the fulcrum of point C, and the spool is shifted to the left. This causes the opening between the sleeve (651) and spool (652) to close slowly, and the servo piston comes to a complete stop when it closes completely.

② Flow increasing function

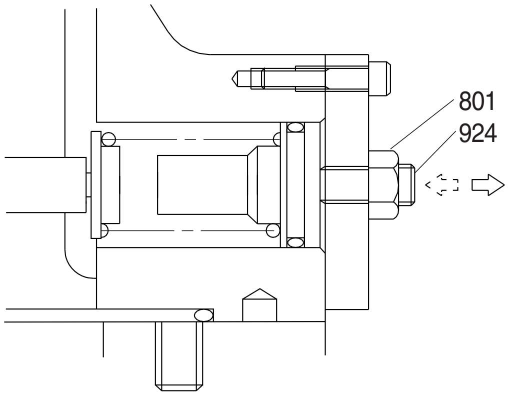


As the pilot pressure Pi decreases, the pilot piston (643) moves to the left by the action of the pilot spring (646) and causes lever 2 (613) to rotate around the fulcrum of point B. Since the pin (897) is pressed against the large hole section (C) of lever 2 by the action of the return spring (654) via the spool (652), pin (874), and feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 2 rotates, and shifts the spool to the left. Port CL opens a way to the tank port as the spool moves. This deprives the large diameter section of the servo piston of pressure, and shifts the servo piston to the left by the discharge pressure P1 in the small diameter section, resulting in an increase in the flow rate.

As the servo piston moves, point D also moves to the left, the feedback lever rotates around the fulcrum of point C, and the spool moves to the right till the opening between the spool and sleeve is closed.

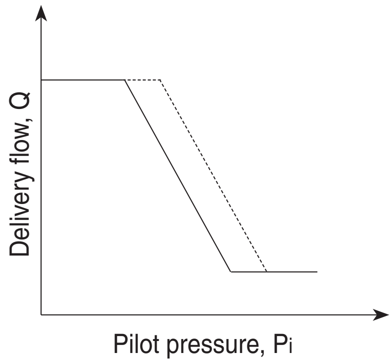
③ Adjustment of flow control characteristic

The flow control characteristic can be adjusted with the adjusting screw.
Adjust it by loosening the hexagon nut (801) and by tightening (or loosening) the hexagonal socket head screw (924).
Tightening the screw shifts the control chart to the right as shown in the figure.

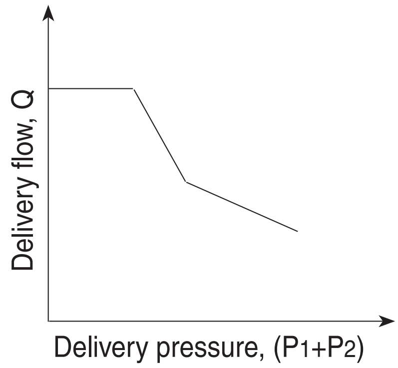


※ Adjusting value

Speed	Adjustment of flow control characteristic		
	Tightening amount of adjusting screw (924)	Flow control starting pressure change amount	Flow change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(ℓ/min)
1900	+1/4	+1.4	+7.1



(2) Total horsepower control

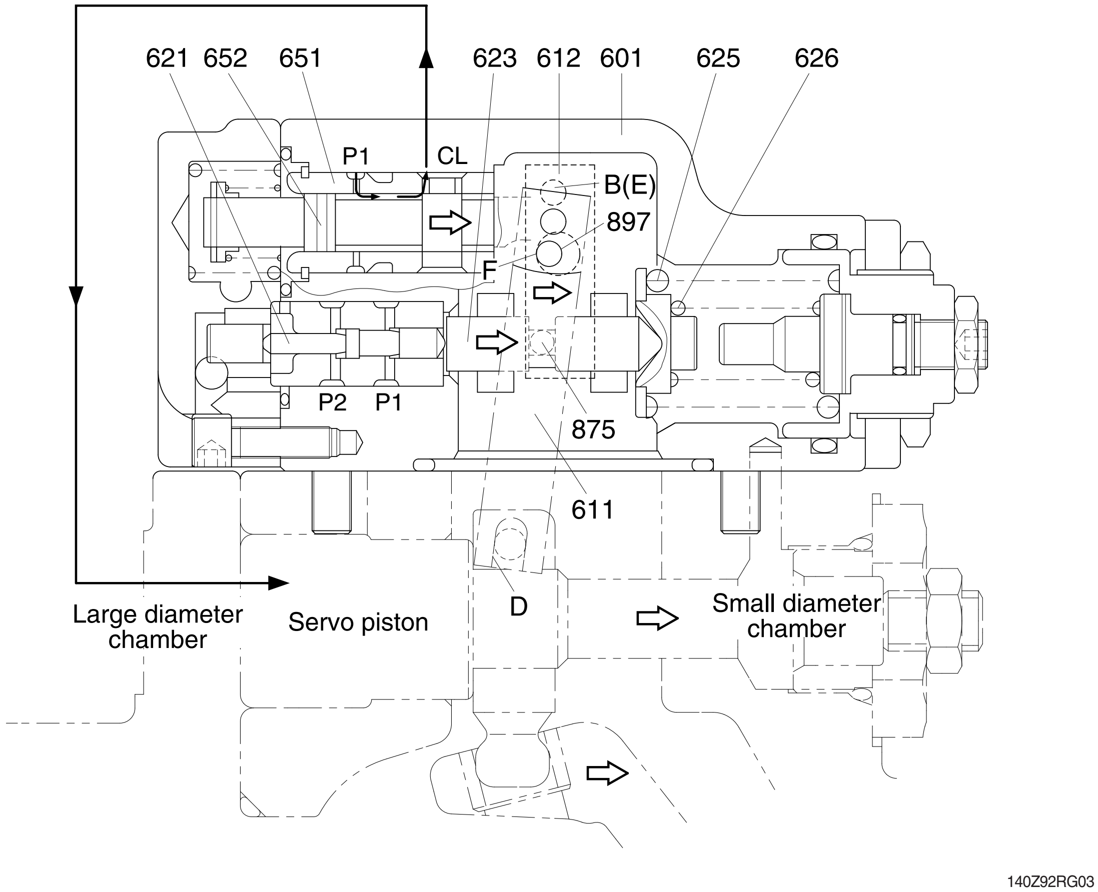


The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.
(The input horsepower is constant when the speed is constant.)
Since the regulator is of the simultaneous total horsepower type that operates by the sum of load pressures of the two pumps in the tandem double-pump system, the prime mover is automatically prevented from being overloaded, irrespective of the load condition of the two pumps, when horsepower control is under way.
Since this regulator is of the simultaneous total horsepower type, it controls the tilting angles (displacement volumes) of the two pumps to the same value as represented by the following equation :

$$Tin = P1 \times q/2\pi + P2 \times q/2\pi$$
$$= (P1+P2) \times q/2\pi$$

The horsepower control function is the same as the flow control function and is summarized in the following. (For detailed behaviors of respective parts, refer to the section of flow control).

① Overload preventive function



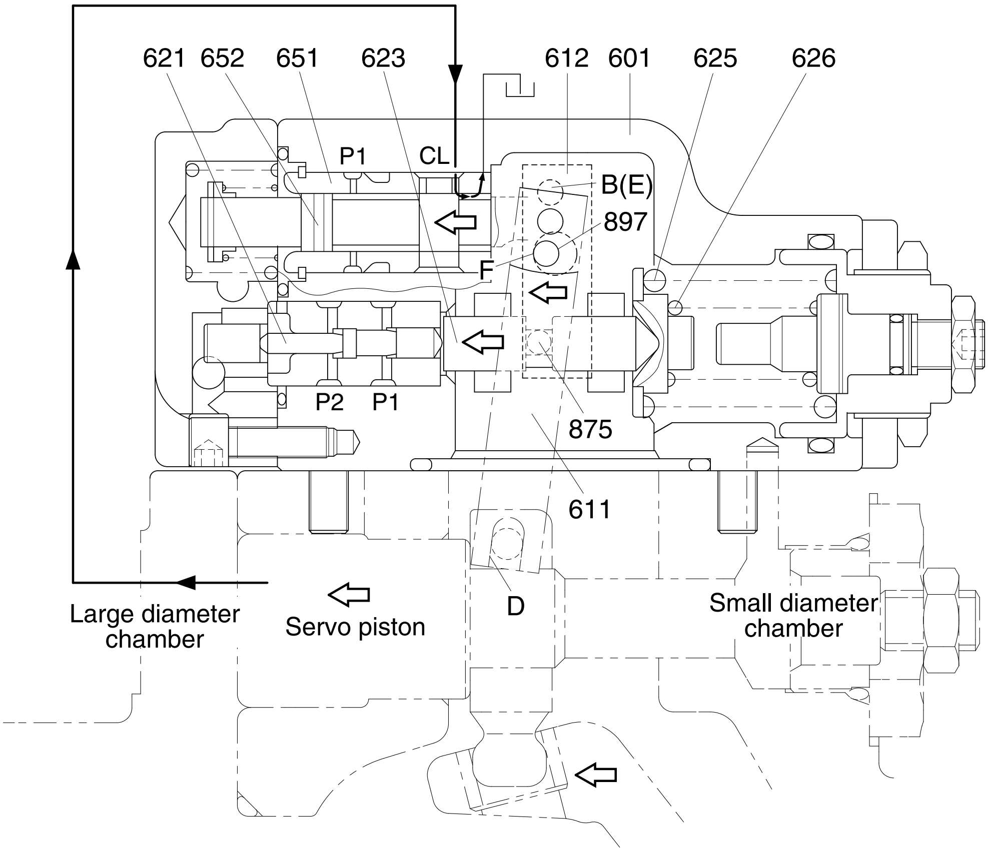
When the self pump delivery pressure P1 or the companion pump delivery pressure P2 rises, it acts on the stepped part of the compensating piston (621). It presses the compensating rod (623) to the right till the force of the outer spring (625) and inner spring (626) balances with the hydraulic force. The movement of the compensating rod is transmitted to lever 1 (612) via pin (875).

Lever 1 rotates around the pin (875) (E) fixed to the casing (601).

Since the large hole section (F) of lever 1 contains a protruding pin (897) fixed to the feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 1 rotates, and then the spool (652) is shifted to the right. As the spool moves, the delivery pressure P1 is admitted to the large diameter section of the servo piston via port CL, causes the servo piston move to the right, reduces the pump delivery, flow rate, and prevents the prime mover from being overloaded.

The movement of the servo piston is transmitted to the feedback lever via point D. Then the feedback lever rotates around the fulcrum of point F and the spool is shifted to the left. The spool moves till the opening between the spool (652) and sleeve (651) is closed.

② Flow reset function



140Z92RG04

As the self pump delivery pressure P1 or the companion pump delivery pressure P2 decreases, the compensating rod (623) is pushed back by the action of the springs (625 & 626) to rotate lever 1 (612) around point E. Rotating of lever 1 causes the feedback lever (611) to rotate around the fulcrum of point D and then the spool (652) to move to the left. As a result, port CL opens a way to the tank port.

This causes the servo piston to move to the left and the pump's delivery rate to increase.

The movement of the servo piston is transmitted to the spool by the action of the feedback mechanism to move it till the opening between the spool and sleeve is closed.

③ **Low tilting angle (low flow) command preferential function**

As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections (C & F) of levers 1 and 2. However, since sections C and F have the pins (Ø4) protruding from the large hole (Ø8), only the lever lessening the tilting angle contacts the pin (897) ; the hole (Ø8) in the lever of a larger tilting angle command is freed without contacting the pin (897). Such a mechanical selection method permits preference of the lower tilting angle command of the flow control and horsepower control.

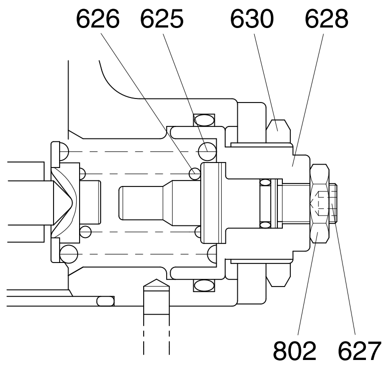
④ **Adjustment of input horsepower**

Since the regulator is of total cumulative horsepower type, adjust the adjusting screws of both the front and rear pumps, when changing the horsepower set values. The pressure change values by adjustment are based on two pumps pressurized at the same time, and the values will be doubled when only one pump is loaded.

a. **Adjustment of outer spring**

Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628).

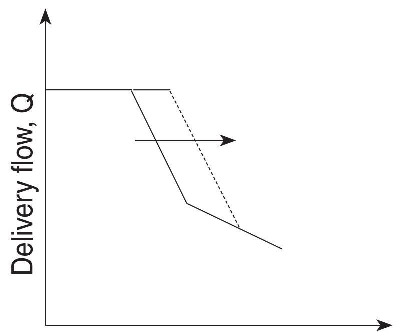
Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C (628) by N turns changes the setting of the inner spring (626), return the adjusting stem C (627) by N×A turns at first. (A=1.48)



140Z92RG07

※ **Adjusting value**

Speed	Adjustment of input horsepower		
	Tightening amount of adjusting screw (C) (628)	Compensa-ting control starting pressure change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(kgf · m)
1900	+1/4	+15.9	+2.5



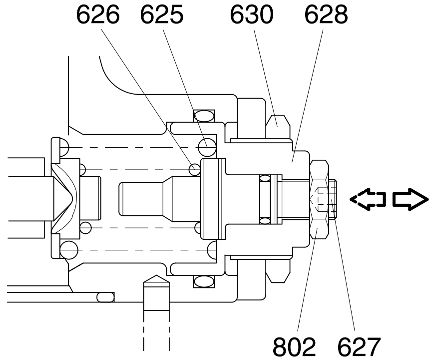
b. Adjustment of inner spring

Adjust it by loosening the hexagon nut (802) and by tightening (or loosening) the adjusting stem C (627).

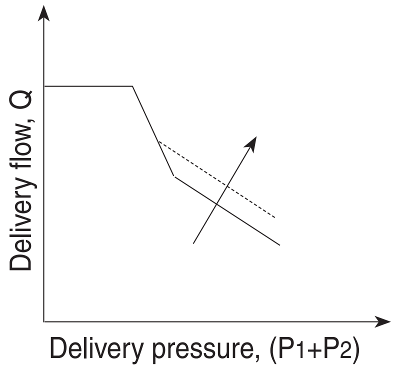
Tightening the screw increases the flow and then the input horsepower as shown in the figure.

※ Adjusting value

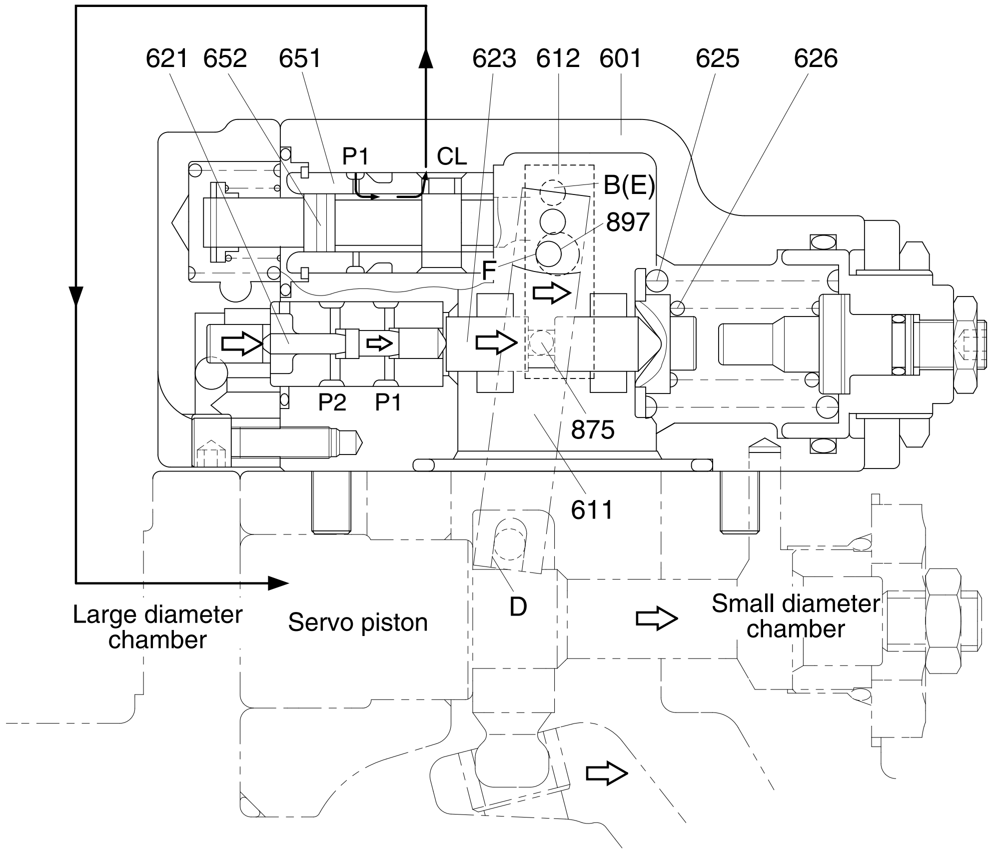
Speed	Adjustment of input horsepower		
	Tightening amount of adjusting stem (C) (627)	Flow change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(ℓ /min)	(kgf · m)
1900	+1/4	+3.22	+3.2



140Z92RG08

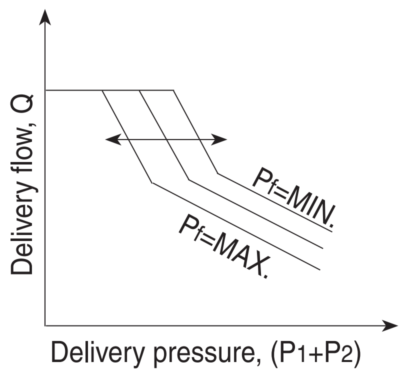


(3) Power shift control



140Z92RG05

The set horsepower valve is shifted by varying the command current level of the proportional pressure reducing valve attached to the pump.
Only one proportional pressure reducing valve is provided.
However, the secondary pressure Pf (power shift pressure) is admitted to the horsepower control section of each pump regulator through the pump's internal path to shift it to the same set horsepower level.



This function permits arbitrary setting of the pump output power, thereby providing the optimum power level according to the operating condition.
The power shift pressure Pf controls the set horsepower of the pump to a desired level, as shown in the figure.
As the power shift pressure Pf rises, the compensating rod (623) moves to the right via the pin (898) and compensating piston (621).
This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure Pf falls.

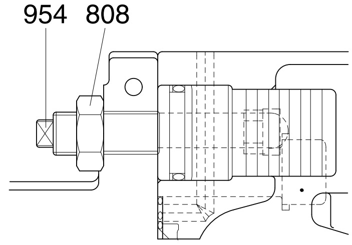
(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

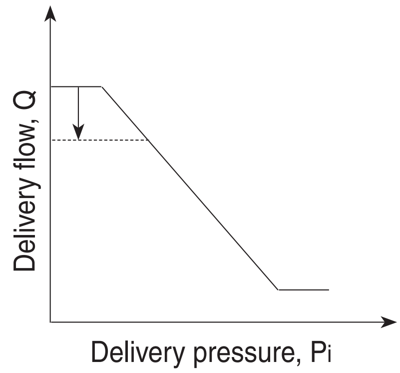
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the set screw (954).

The maximum flow only is adjusted without changing other control characteristics.

Speed	Adjustment of max flow	
	Tightening amount of adjusting screw (954)	Flow change amount
(min^{-1})	(Turn)	(ℓ/min)
1900	+1/4	-3.0



140Z92MP23

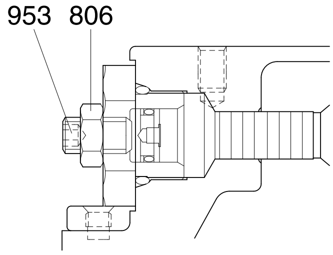


② Adjustment of minimum flow

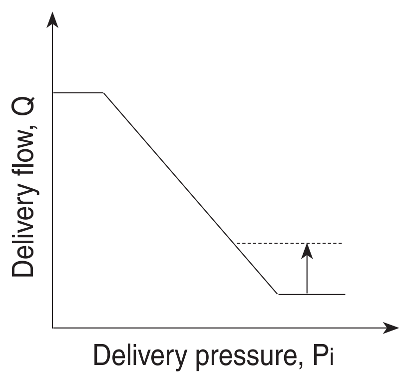
Adjust it by loosening the hexagon nut (806) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

However, remember that, if tightened too much, the required horsepower during the maximum delivery pressure (or during relieving) may increase.

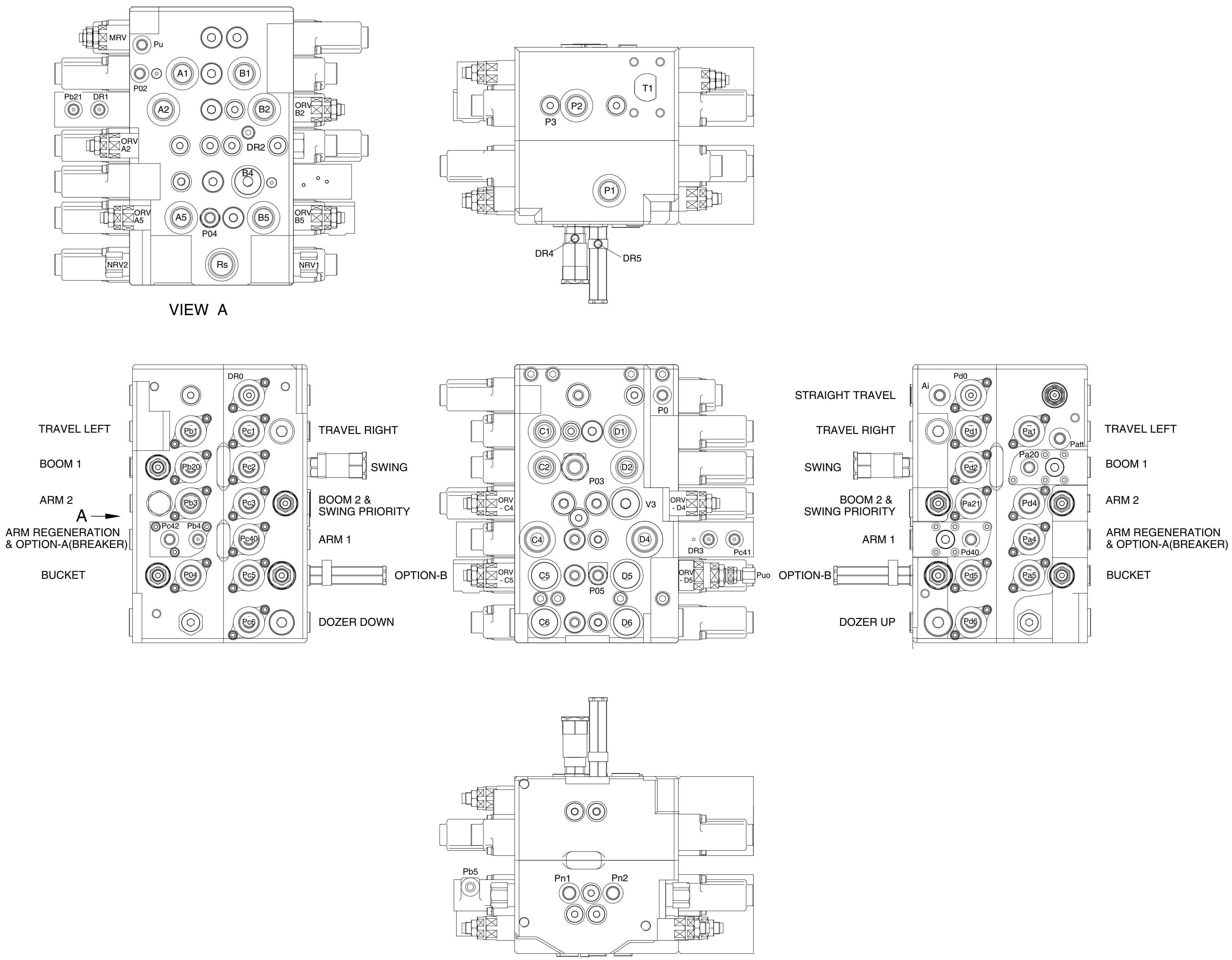
Speed	Adjustment of min flow	
	Tightening amount of adjusting screw (953)	Flow change amount
(min^{-1})	(Turn)	(ℓ/min)
1900	+1/4	+3.0



140Z92MP24



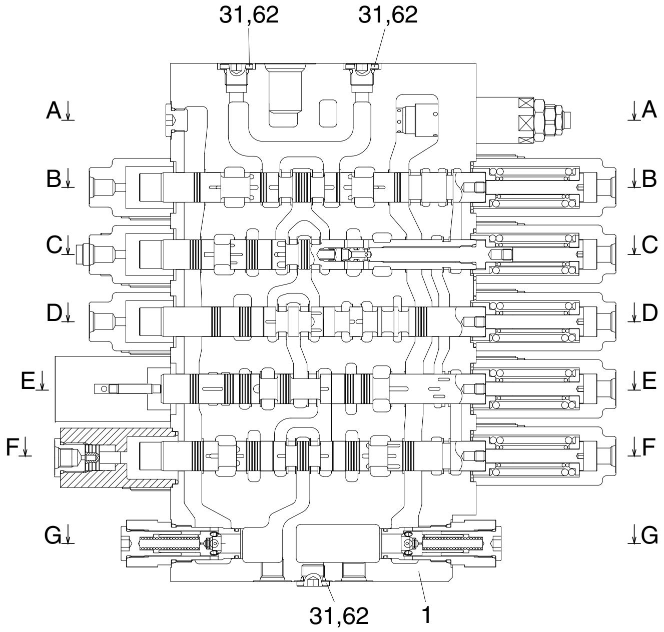
1. STRUCTURE



140SA2MC01

Mark	Port name	Port size	Tightening torque
(Rs)	Make up for swing motor	UNF 1 3/16	18 kgf · m (130 lbf · ft)
(Pd0) Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pb21 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pc41 Pc42 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Pc6 Pd6 P0 Pu Ai Patt P02 P03 P04 P05 DR0 DR1 DR2 DR3	- Travel left pilot port (BW) Travel left pilot port (FW) Travel right pilot port (FW) Travel right pilot port (BW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Lock valve pilot port (boom) Swing pilot port (RH) Swing pilot port (LH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Option C pilot port (dozer blade down) Option C pilot port (dozer blade up) Pilot pressure port Main relief pressure up pilot port Auto idle signal port (Puo) Auto idle signal-attachment Pilot signal port Boom priority pilot port Boom parallel orifice pilot port Breaker summation pilot port Drain port (travel straight) Drain port (boom holding valve) Drain port (boom 2 & swing priority) Drain port (arm holding valve)	PF 1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Pn1 Pn2 (P3)	Negative control signal port (P1 port side) Negative control signal port (P2 port side) -	PF 3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 B2 C2 D2 B4 A5 B5 C5 D5 C6 D6 P1 P2	Travel motor left side port (BW) Travel motor left side port (FW) Travel motor right side port (FW) Travel motor right side port (BW) Boom rod side port Swing motor port (RH) Swing motor port (LH) Option A port (breaker) Bucket head side port Bucket rod side port Option B port Option B port Option C pilot port (dozer down port) Option C pilot port (dozer up port) Pump port (A2 side) Pump port (A1 side)	PF 3/4	15~18 kgf · m (109~130 lbf · ft)
A2 C4 D4	Boom head side port Arm head side port Arm rod side port	PF 1	20~25 kgf · m (115~180 lbf · ft)
DR4 DR5	Drain port (swing logic valve) Drain port (flow summation)	PF 1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000, 1 1/2 (M12×1.75)	8.5~11.5 kgf · m (61.5~83.1 lbf · ft)

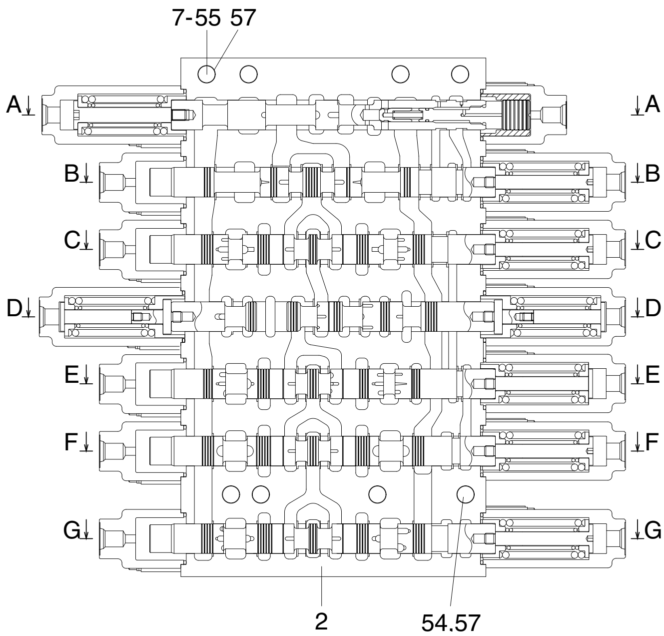
1) P2 SPOOL SECTION



140SA2MC02

1 Housing P1
31 Plug
62 O-ring

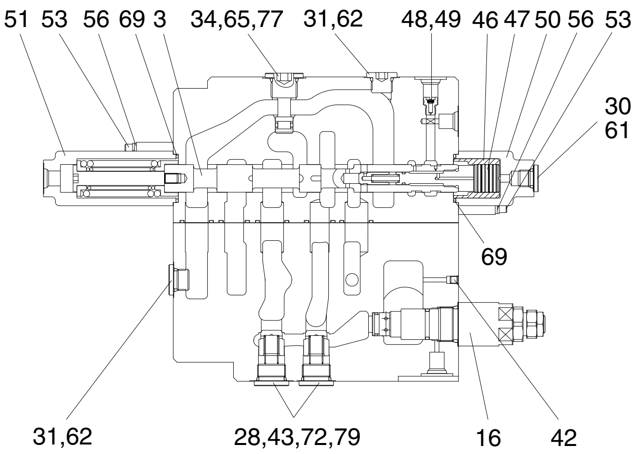
2) P1 SPOOL SECTION



140A2MC03

2 Housing P2
54 Socket bolt
55 Socket bolt
57 Spring washer

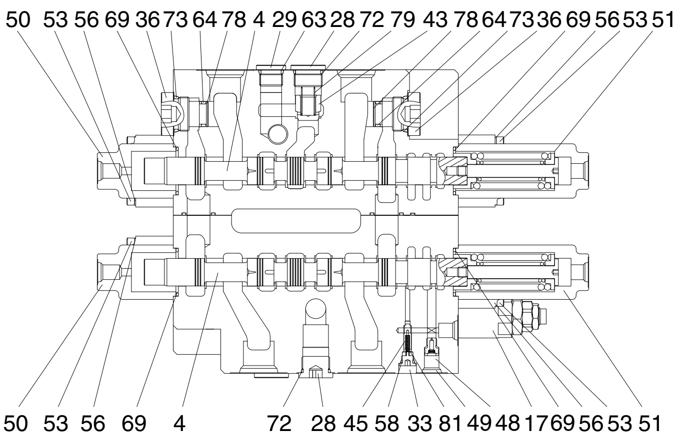
3) STRAIGHT TRAVEL AND SUPPLY SECTION



SECTION A-A

3 Straight travel spool assy
16 Main relief valve
28 Plug
30 Plug
31 Plug
34 Plug
42 Plug
43 Poppet
46 Sleeve
47 Piston
48 Signal orifice
49 Coin type filter
50 Pilot A cap
51 Pilot B1 cap
53 Socket bolt
56 Washer
61 O-ring
62 O-ring
65 O-ring
69 O-ring
72 O-ring
77 Back up ring
79 Spring

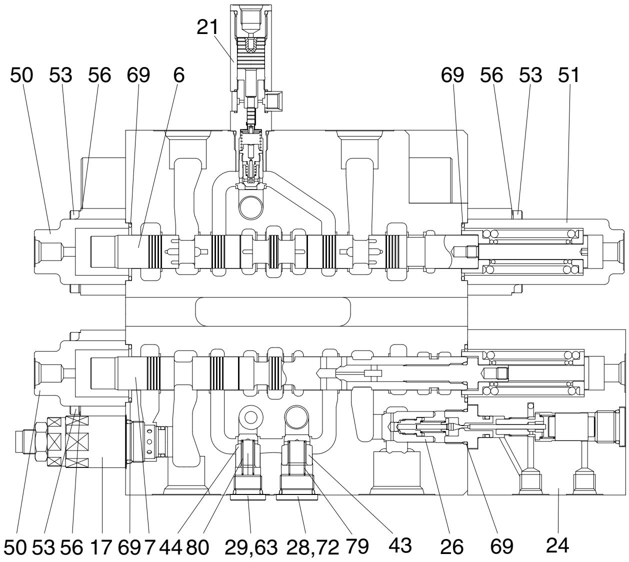
4) TRAVEL RIGHT AND LEFT SECTION



SECTION B-B

4 Travel spool assy
17 Overload relief valve
28 Plug
29 Plug
33 Plug
36 Plug
42 Plug
43 Poppet
45 Poppet
48 Signal orifice
49 Coin type filter
50 Pilot A cap
51 Pilot B1 cap
53 Socket bolt
56 Washer
58 O-ring
63 O-ring
64 O-ring
69 O-ring
72 O-ring
73 O-ring
78 Back up ring
79 Spring
81 Spring

5) SWING AND BOOM 1 SECTION

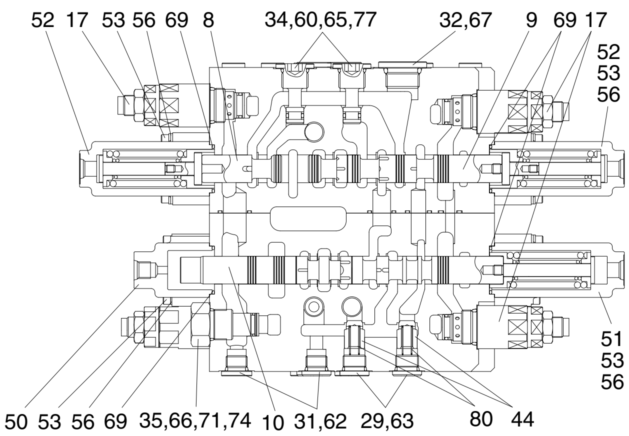


SECTION C-C

6	Swing spool assy
7	Boom 1 spool assy
17	Overload relief valve
21	Swing logic valve
24	Holding valve kit A1
26	Holding valve kit B
28	Plug
29	Plug
43	Poppet
44	Poppet
50	Pilot A cap
53	Socket bolt
56	Washer
63	O-ring
69	O-ring
72	O-ring
79	Spring
80	Spring

140SA2MC06

6) SWING PRIORITY AND BOOM 2 AND ARM 2 SECTION

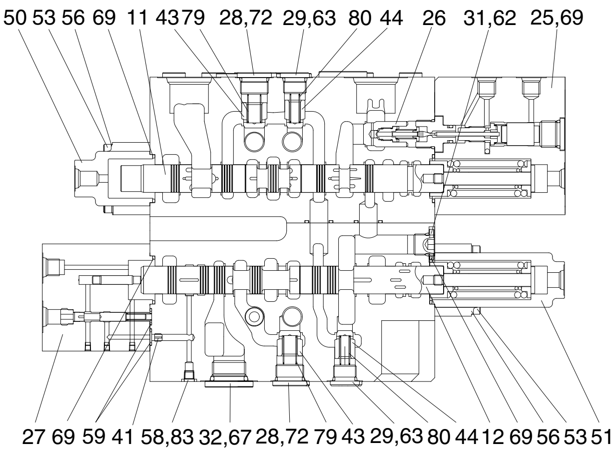


SECTION D-D

8	Swing priority spool assy
9	Boom 2 spool assy
10	Arm 2 spool assy
17	Overload relief valve
29	Plug
31	Plug
32	Plug
34	Plug
35	Plug
44	Poppet
50	Pilot A cap
51	Pilot B1 cap
52	Pilot B2 cap
53	Socket bolt
56	Washer
60	O-ring
61	O-ring
63	O-ring
65	O-ring
66	O-ring
69	O-ring
71	O-ring
74	Back up ring
77	Back up ring
80	Spring

140A2MC07

7) ARM 1 AND ARM REGEN/ BREAKER SECTION

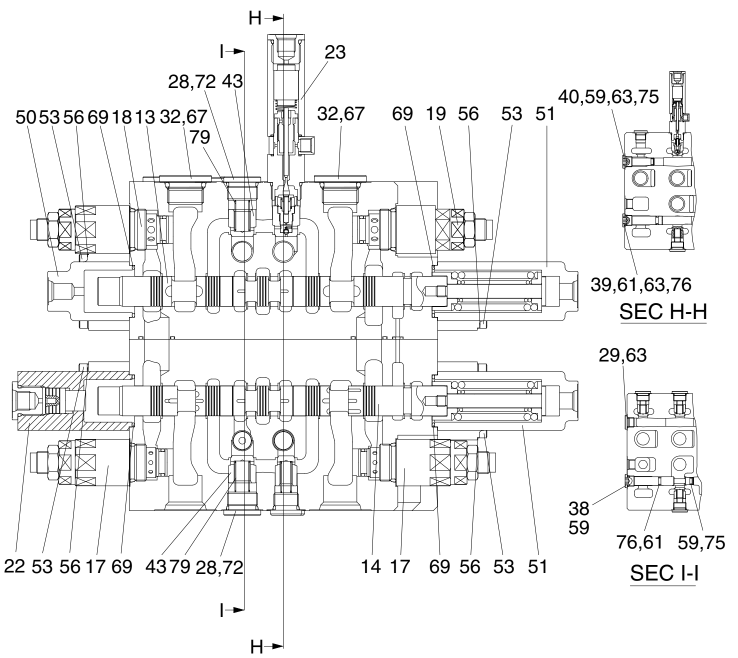


SECTION E-E

140A2MC08

11 Arm 1 spool assy
12 Arm regen spool assy
25 Holding valve kit A2
26 Holding valve kit B
27 Regen block assy
28 Plug
29 Plug
31 Plug
32 Plug
41 Plug
43 Poppet
44 Poppet
50 Pilot A cap
53 Socket bolt
56 Washer
58 O-ring
59 O-ring
62 O-ring
63 O-ring
67 O-ring
69 O-ring
72 O-ring
80 Spring
81 Spring
83 Plug

8) OPTION B AND BUCKET SECTION

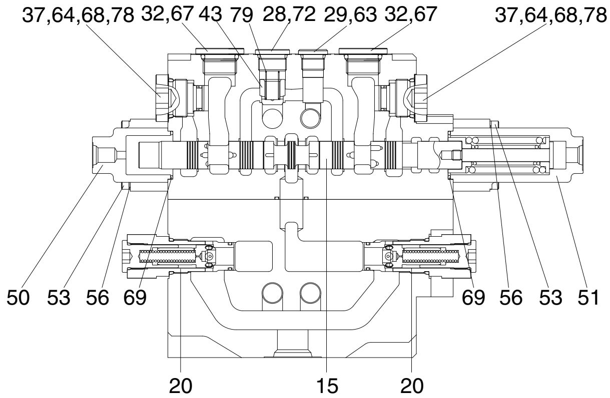


SECTION F-F

140SA2MC09

13 Option B spool assy
14 Bucket spool assy
17 Overload relief valve
19 Overload relief valve
22 Bucket stroke limiter
23 Option ON/OFF valve
28 Plug
29 Plug
32 Plug
38 Plug
39 Plug
40 Plug
43 Poppet
50 Pilot A cap
51 Pilot B1 cap
53 Socket bolt
56 Washer
59 O-ring
61 O-ring
63 O-ring
67 O-ring
69 O-ring
72 O-ring
75 Back up ring
76 Back up ring
79 Spring

9) OPTION C AND NEGATIVE CONTROL SECTION

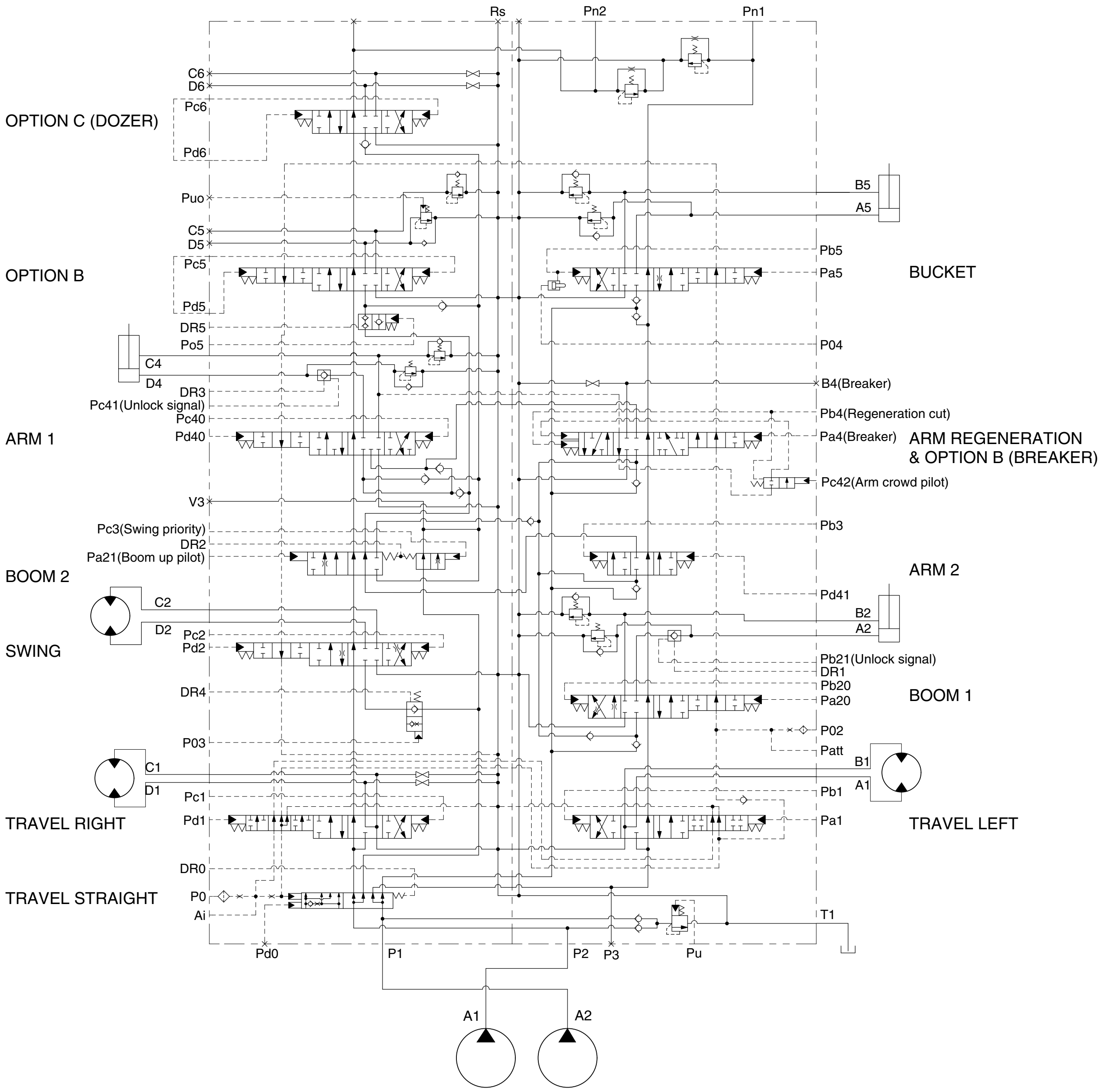


SECTION G-G

140A2MC10

15 Option C1 spool assy
20 Negacon relief valve
28 Plug
29 Plug
32 Plug
37 Plug
43 Poppet
50 Pilot A cap
51 Pilot B1 cap
53 Socket bolt
56 Washer
63 O-ring
64 O-ring
67 O-ring
68 O-ring
69 O-ring
72 O-ring
78 Back up ring
79 Spring

2. HYDRAULIC CIRCUIT



140SA2MC08

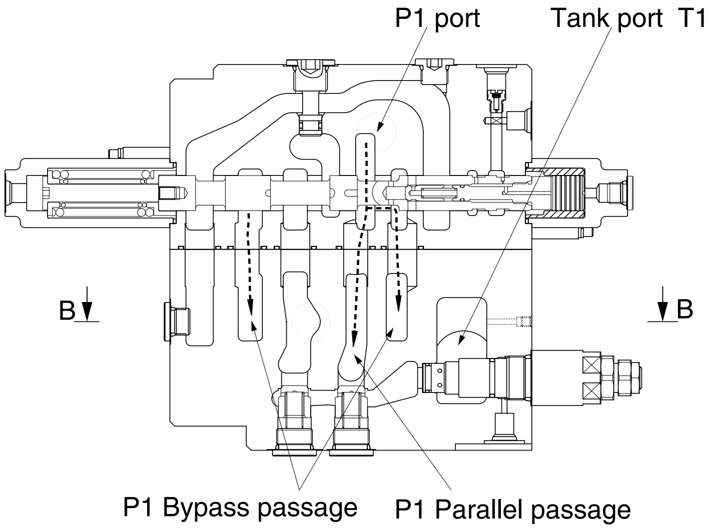
3. FUNCTION

1) CONTROL IN NEUTRAL

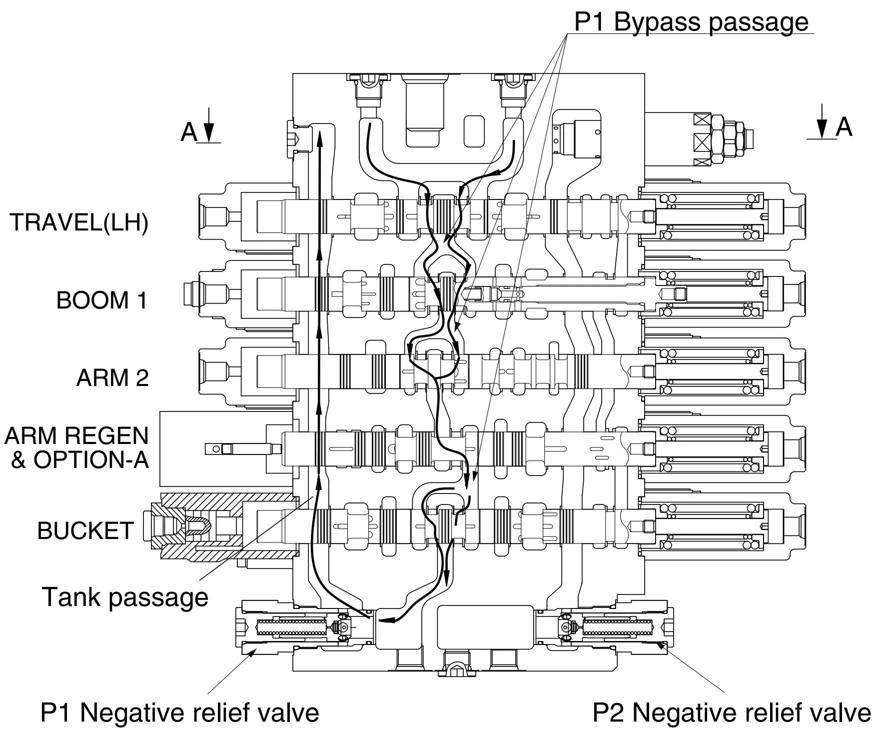
(1) P1 SIDE

The hydraulic fluid from pump A2 flows into the main control valve through the inlet port "P1", pass the straight travel spool into the P1 bypass passage and P1parallel passage.

The hydraulic fluid from the pump A2 is directed to the tank through the bypass passage of spools : travel left, boom 1, arm 2, arm regeneration & option A and bucket, the negative relief valve of P1, tank passage, and the tank port "T1"



SECTION A-A



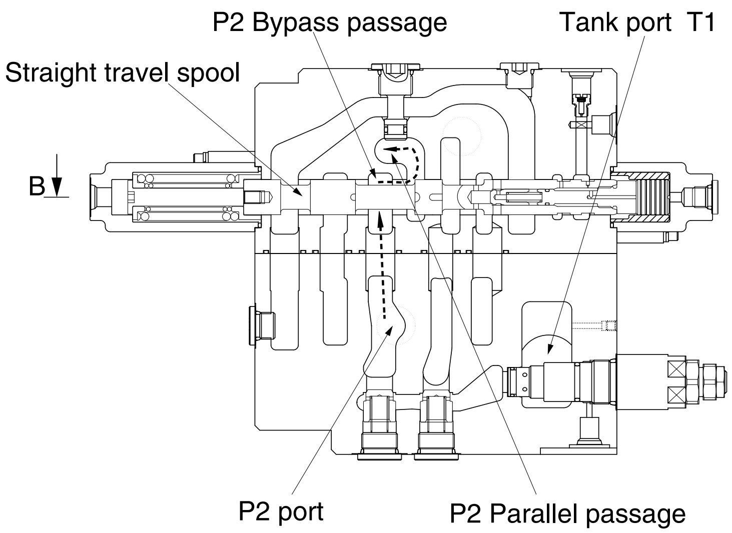
SECTION B-B

145LCR2MC11

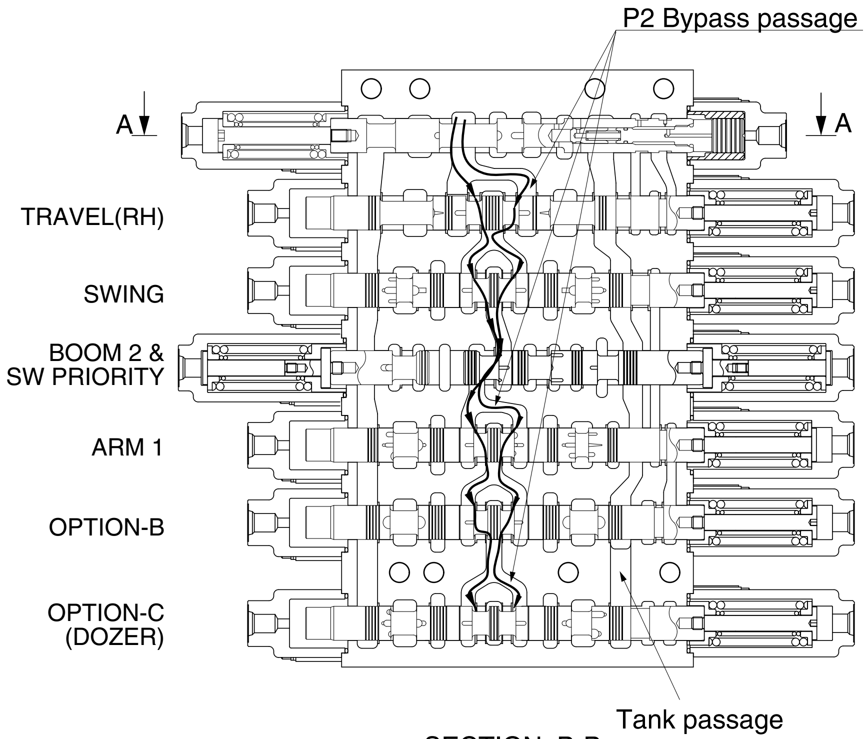
(2) P2 SIDE

The hydraulic fluid from pump A1 flows into the main control valve through the inlet port "P2", into the P2 bypass passage and P2 parallel passage.

The hydraulic fluid from the pump A1 is directed to the tank through the bypass passage of spools : travel right, swing, boom 2 & swing priority, arm 1, option "B" and option "C" (dozer), the negative relief valve of P2, tank passage and the tank port "T1".



SECTION A-A

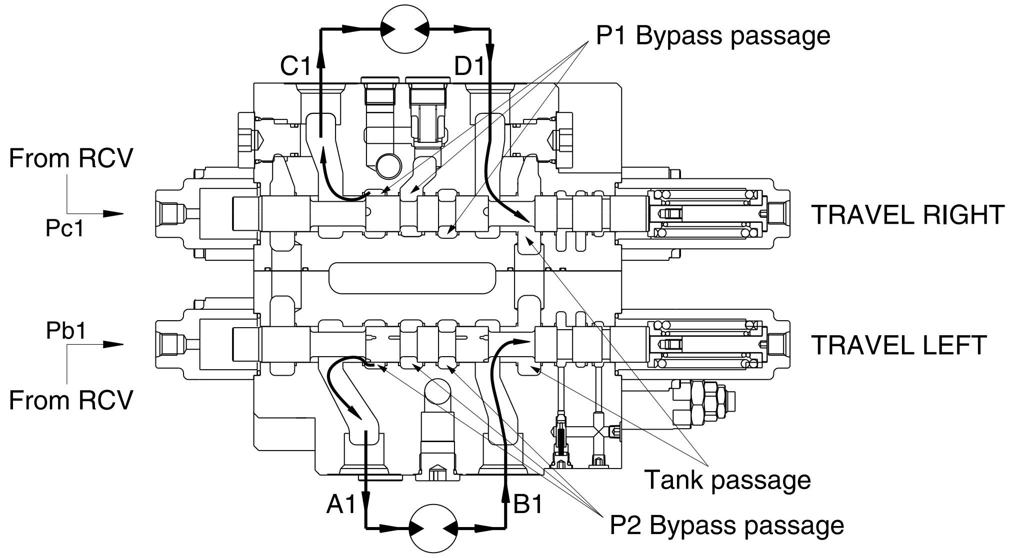


SECTION B-B

145LCR2MC12

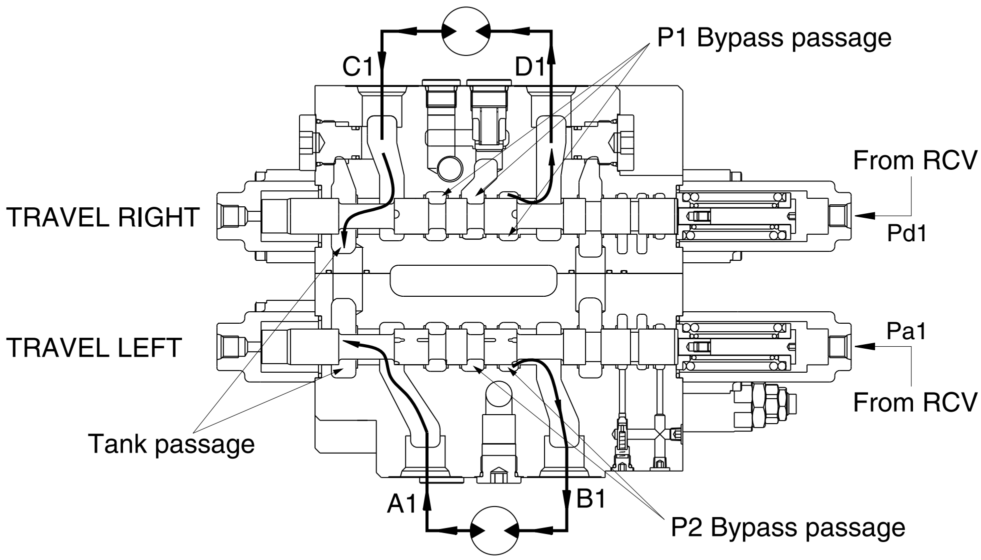
2) TRAVEL OPERATION

(1) TRAVEL FORWARD OPERATION



14092MC18

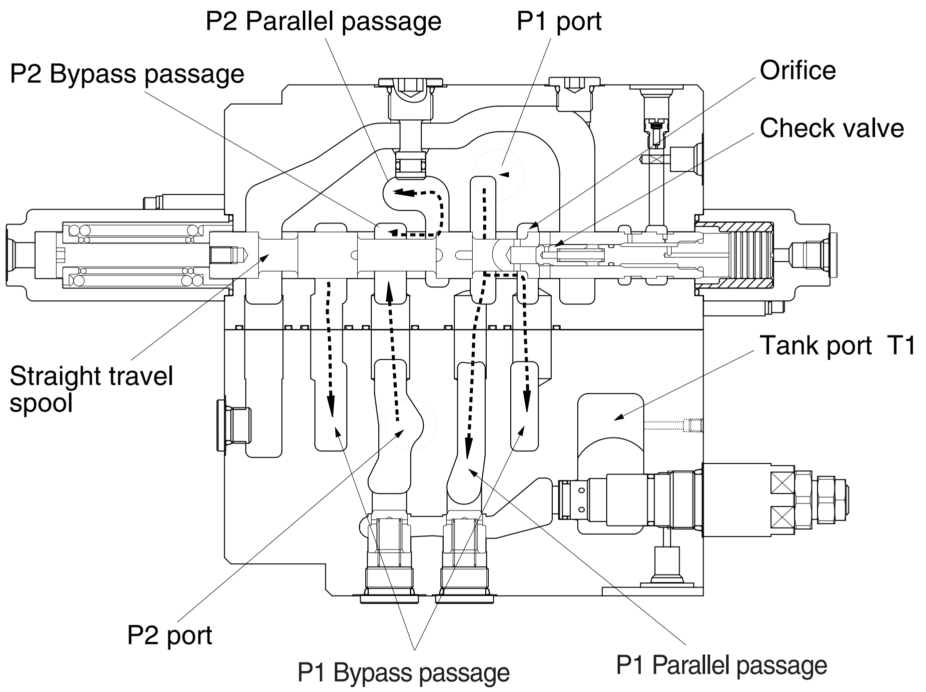
(2) TRAVEL BACKWARD OPERATION



14092MC17

During the travel forward operation, the hydraulic fluid of the pump A2 is supplied to the travel left motor and the hydraulic fluid of the pump A1 is supplied to the other travel right motor.
The pilot pressure from the pilot control valve is supplied to the spring side of pilot port (pb1, pc1).
And it shifts travel right and left spools in the left direction against springs. Hydraulic fluid from the pump A1 flow into the travel right spool through the bypass passage and hydraulic fluid from the pump A2 flow into the travel left spool through the bypass passage.
Then they are directed to the each travel motor through port A1 and C1. As a result, the travel motors turn and hydraulic fluid returns to the tank passage through the travel spools.
In case of the reverse operation, the operation is similar.

(3) TRAVEL STRAIGHT FUNCTION



14092MC19

This function keeps straight travel in case of simultaneous operation of other actuators (boom, arm, bucket, swing) during a straight travel.

① **During travel only :**

The hydraulic fluid of the pump A1 is supplied to the travel right motor and the pump A2 is supplied to the travel left motor.

Thus, the machine keep travel straight.

② **The other actuator operation during straight travel operation :**

When the other actuator spool (s) is selected under straight travel operation, the straight travel spool is moved.

The hydraulic fluid from pump A2 is supplied actuator through P2 and P1 parallel pass and travel motors through orifice at side of straight travel spool.

The hydraulic oil fluid from pump A1 is supplied to travel motors (left/right).

Therefore, the other actuator operation with straight travel operation, hydraulic oil fluid from pump A2 is mainly supplied to actuator, and the hydraulic oil fluid form pump A1 is mainly supplied to travel motors (left/right).

Then the machine keeps straight travel.

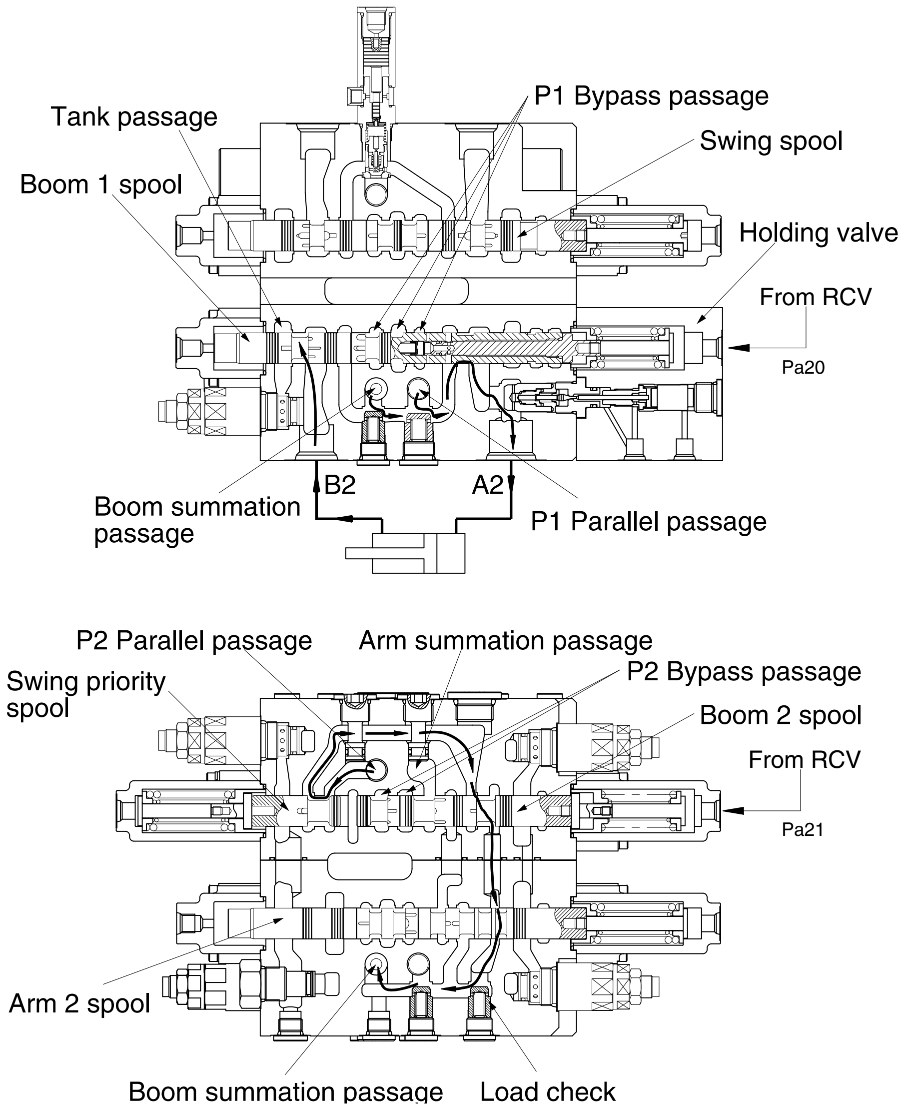
3) BOOM OPERATION

(1) BOOM UP OPERATION

During boom up operation, the pilot secondary pressure from RCV is supplied to the port Pa20 of the spring side and shifts the boom 1 spool in the left direction. The bypass passage is shut off by the movement of the boom 1 spool and the hydraulic oil fluid from pump A2 is entered P1 parallel passage and then passes through the load check, bridge passage and boom holding valve then flows into the port A2. Following this it flows into the head side of the boom cylinder. (In this case, the boom holding valve is free flow condition)

At the same time, the pilot pressure from RCV is supplied to the port Pa21 of the spring side of boom 2 and shifts the boom 2 spool. The bypass passage is shut off by the movement of the boom 2 spool and the hydraulic oil fluid from pump A1 entered boom summation passage via the P2 parallel passage, the land of the swing priority spool, notch of the boom 2 spool, arm 2 spool and the check. The flows combine in passage and are directed to port A2 and head side of boom cylinder.

At the same time, the flow from rod side of the boom cylinder return to the boom 1 spool through the port B2. Thereafter it is directed to the hydraulic oil tank through the tank passage.



140SA2MC24

(2) BOOM DOWN OPERATION

During the boom lowing operation, the pilot pressure from RCV is supplied to the port Pb20 of the spring opposite side and shifts the boom 1 spool in the right direction.

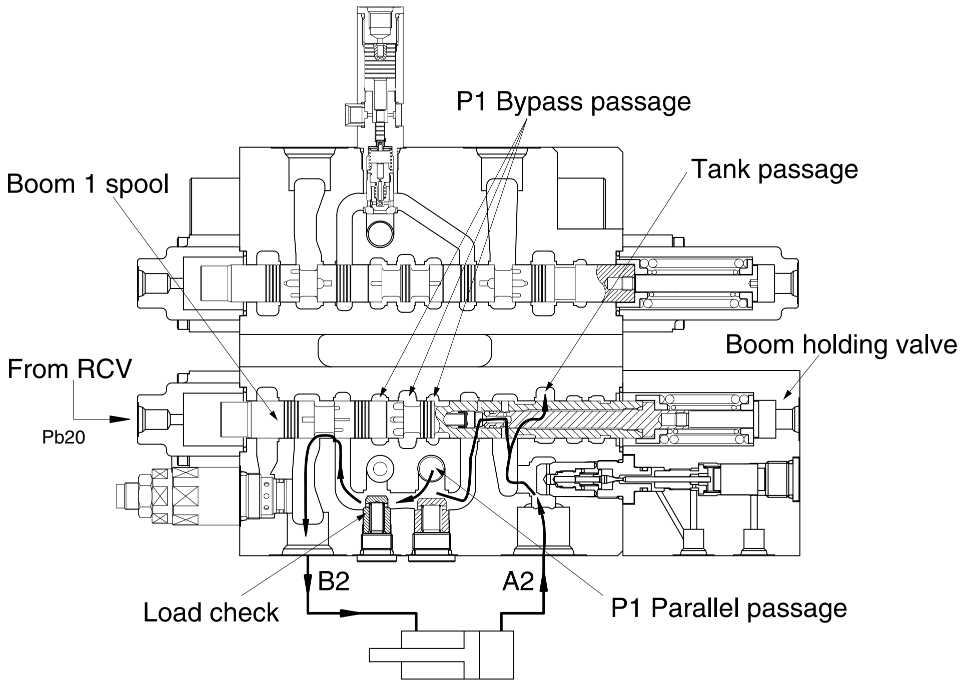
The bypass passage is shut off by the movement of the boom 1 spool and the hydraulic fluid from the pump A2 enters the parallel passage and is directed to the port B2 through the load check. Following this, it flows into the rod side of the boom cylinder.

At the same time, the return flow from the head side of the boom cylinder returns to the port A2 and boom holding valve. And it is directed to the hydraulic oil tank through opened tank passage by movement of the boom 1 spool.

Meanwhile some of return flow is directed to P1 parallel passage through the internal passage of the boom 1 spool. (boom regeneration)

In this case, the holding valve is open condition, for details of the boom holding valve, see page following page.

During the boom lowering operation, the fluid from A1 pump is not summation.

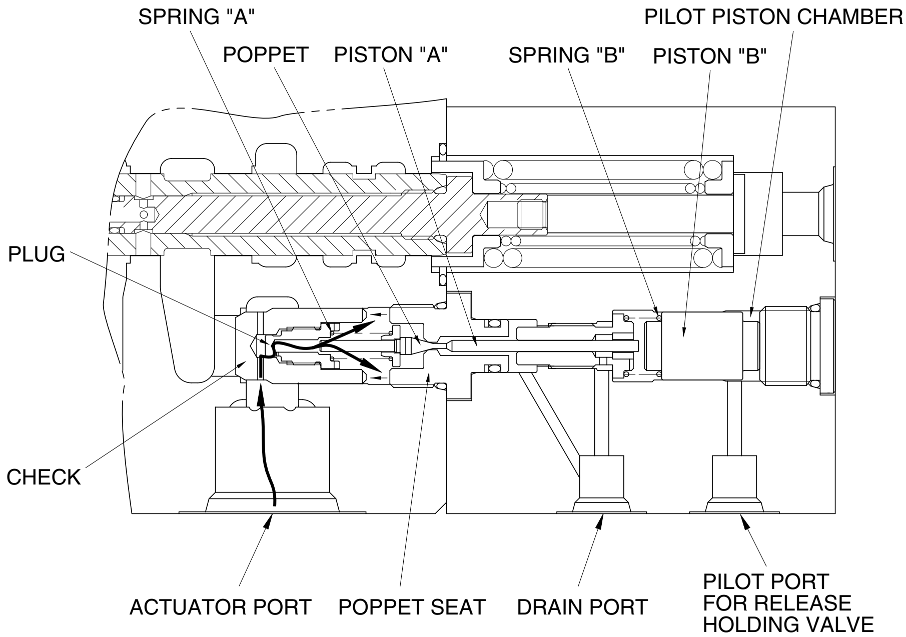


140SA2MC26

4) HOLDING VALVE OPERATION

(1) HOLDING OPERATION

At neutral condition, the pilot piston chamber is connected to drain port through the pilot port.
And the piston "B" is supported with spring "B".
Also, the pressured fluid from actuator entered to inside of the holding valve through the periphery hole of check, crevice of the check and the plug and the periphery hole of plug.
Then, this pressured oil pushed the poppet to the poppet seat and the check to the seat of body.
So the hydraulic fluid from actuator is not escaped and the actuator is not moved.



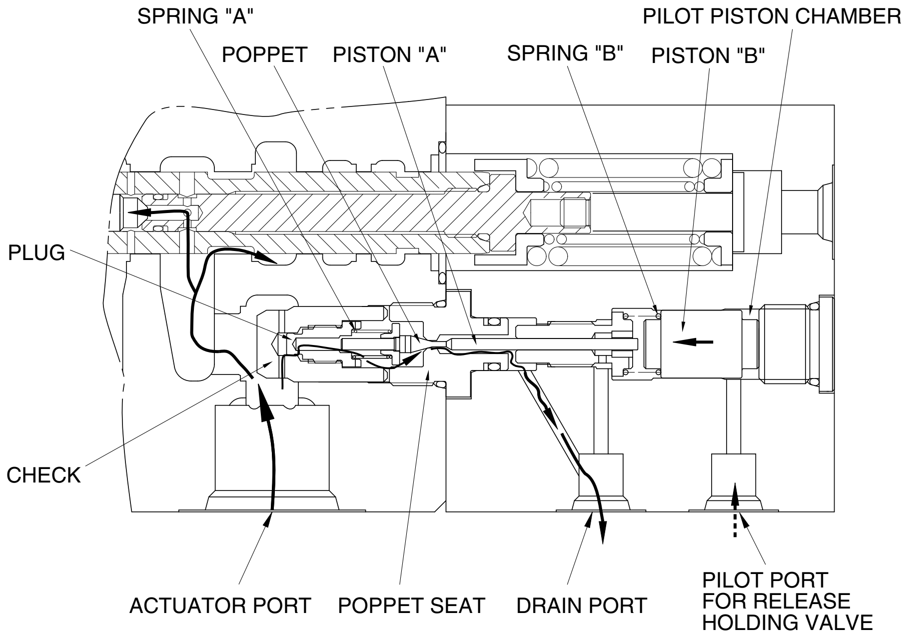
140SA2MC15

(2) RELEASE HOLDING OPERATION

The pilot pressure is supplied to the pilot port for release holding valve and shifts the piston "B" in the left direction against the spring "B", and shifts the poppet in the left direction through piston "B" and piston "A" against spring "B" and shifts the spool in the left side.

At same time, the return fluid from actuator returns to the drain port through the periphery hole of check, crevice of the check and the plug, the periphery hole of the plug, in side of holding valve, crevice of the poppet and the poppet seat, the periphery hole of the poppet seat, crevice of socket and spool and internal passage of spool.

When the poppet is opened, pressure of inside of holding valve is decreased and the return fluid from actuator returns to the tank passage through the notch of spool.



140SA2MC16

5) BUCKET OPERATION

(1) BUCKET IN OPERATION

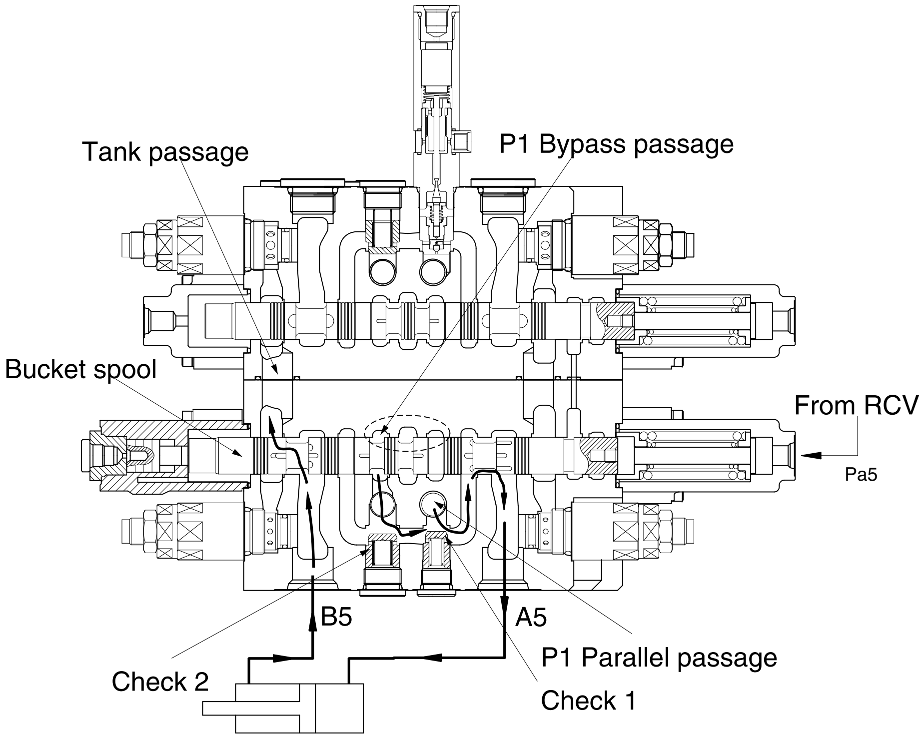
During the bucket in operation, the pilot secondary pressure from RCV is supplied to port Pa5 of the spring side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the bucket spool and the hydraulic fluid from pump A2 entered P1 parallel passage and is directed to the port A5 through the check 1.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check 2.

Following this it flows into the head side of the bucket cylinder.

The return flow from the rod side of the bucket cylinder returns to the bucket spool through the port B5. Thereafter it is directed to the hydraulic oil tank through the tank passage.



145LCR2MC34

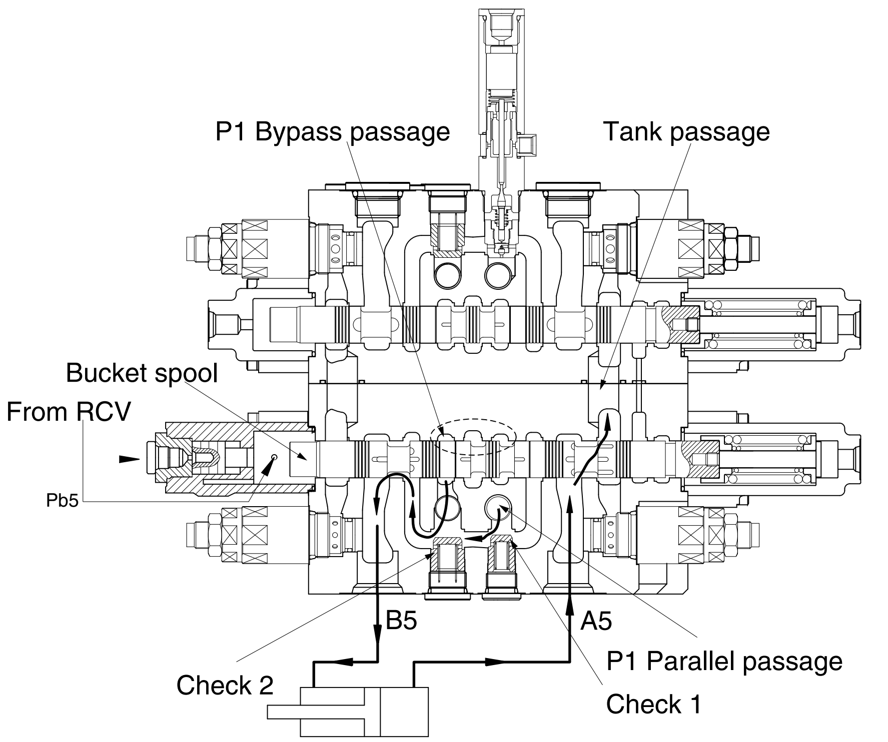
(2) BUCKET OUT OPERATION

During the bucket out operation, the pilot secondary pressure from RCV is supplied to port Pb5 of the spring opposite side and shifts the bucket spool in the right direction.

The bypass passage is shut off by the movement of the bucket spool and the hydraulic fluid from pump A2 entered P1 parallel passage and is directed to the port B5 through the check 1.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port B5 through the check 2.

The return flow from the head side of the bucket cylinder returns to the hydraulic oil tank through the port A5 and the tank passage.

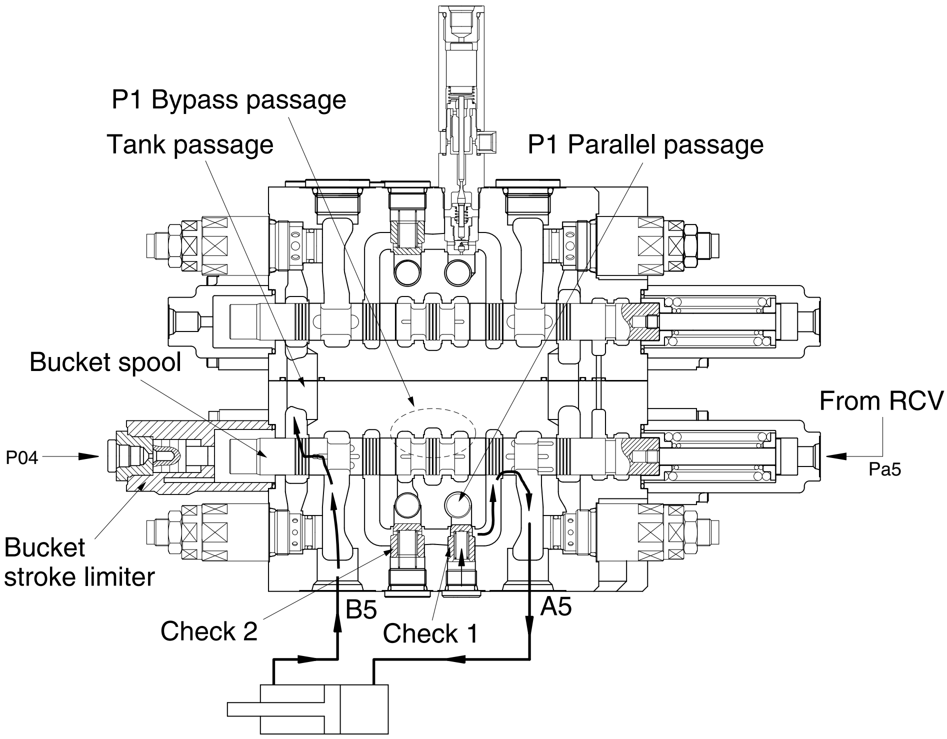


145LCR2MC35

(3) BUCKET IN OPERATION WITH BOOM UP OPERATION

When combined operation, mostly same as previous page but the fluid from P1 bypass passage is empty.

So only the fluid from P1 parallel passage is supplied to the bucket cylinder. Also, parallel passage is installed the bucket stroke limiter for supplying the fluid from pump A2 to the boom operation prior to the bucket operation. In case of the bucket out operation with boom operation, operation is similar.



145LCR2MC29

6) SWING OPERATION

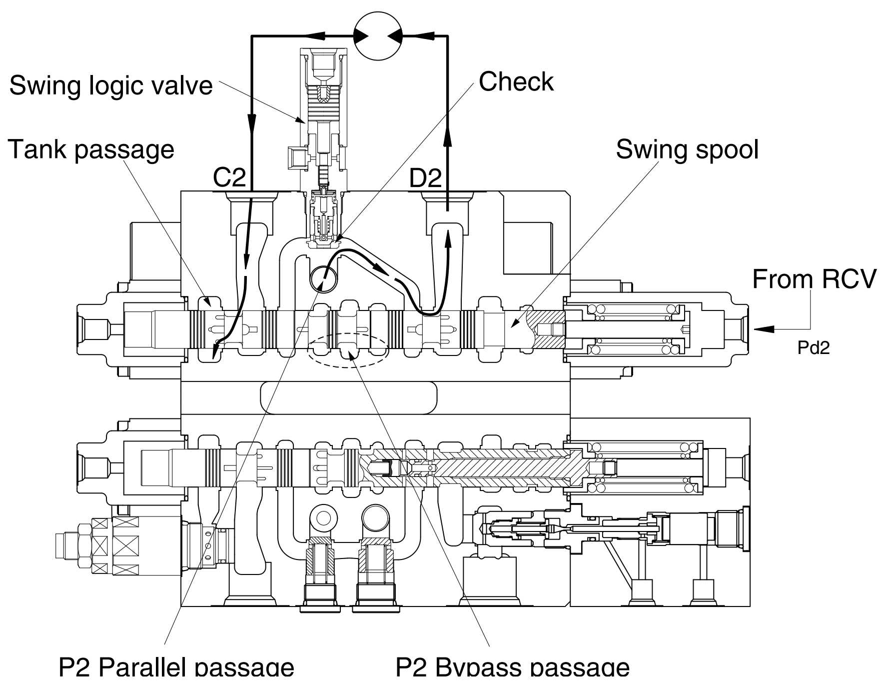
(1) SWING LEFT & RIGHT OPERATION

During the swing left operation, the pilot secondary pressure from the RCV is supplied to the port Pd2 of the spring side and shift the swing spool in left direction. The bypass passage is shut off by the movement of the swing spool and the hydraulic fluid from pump A1 flows into swing spool through the P2 parallel passage. Then it is directed to swing motor through the port D2.

As the result, swing motor turns and flow from the swing motor returns to the hydraulic oil tank through the port C2, swing spool and the tank passage.

In case of swing right operation, the operation is similar to swing left operation but the pilot secondary pressure from the RCV is supplied to the port Pc2 of the spring opposite side.

Accordingly, the hydraulic fluid from pump A1 flows into swing motor through the port C2 and returns to the hydraulic oil tank through the port D2 and the tank passage.

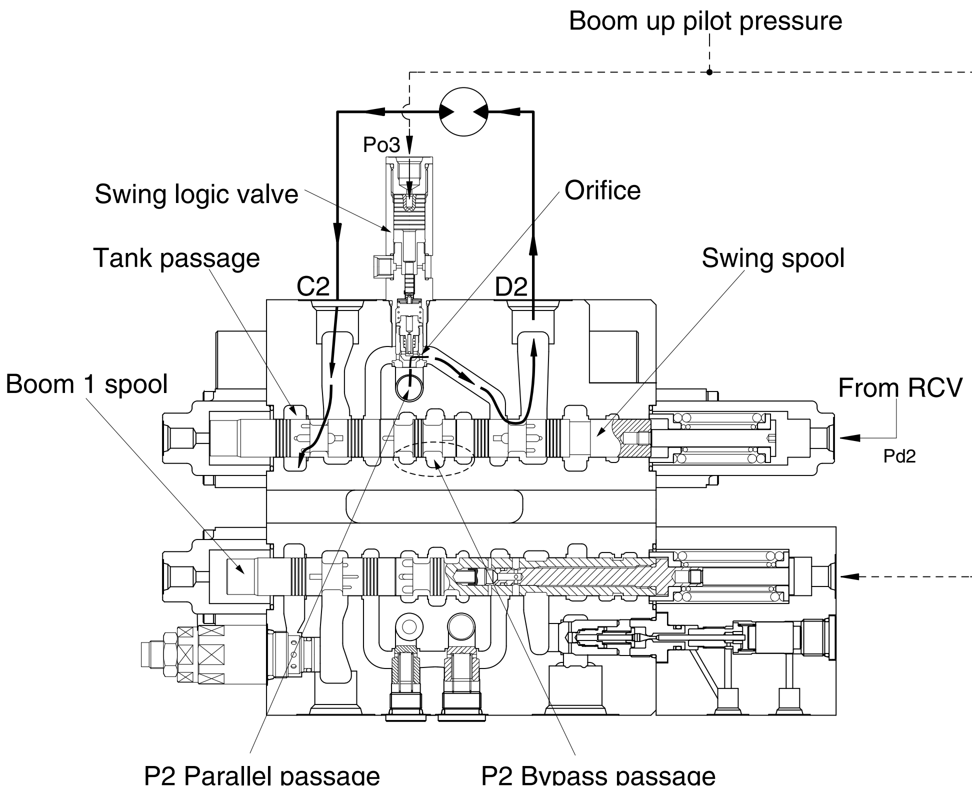


140SA2MC32

(2) SWING LEFT OPERATION WITH ARM OR BOOM OPERATION

When combined operation, mostly same as previous page but the fluid from P2 bypass passage is empty.

So only the fluid from parallel passage is supplied to the swing motor. Also, parallel passage is installed the orifice of swing logic valve for supplying the fluid from pump A1 to the boom or the arm operation prior to the swing operation. In case of the swing right operation with arm or boom operation, operation is similar.



140SA2MC20

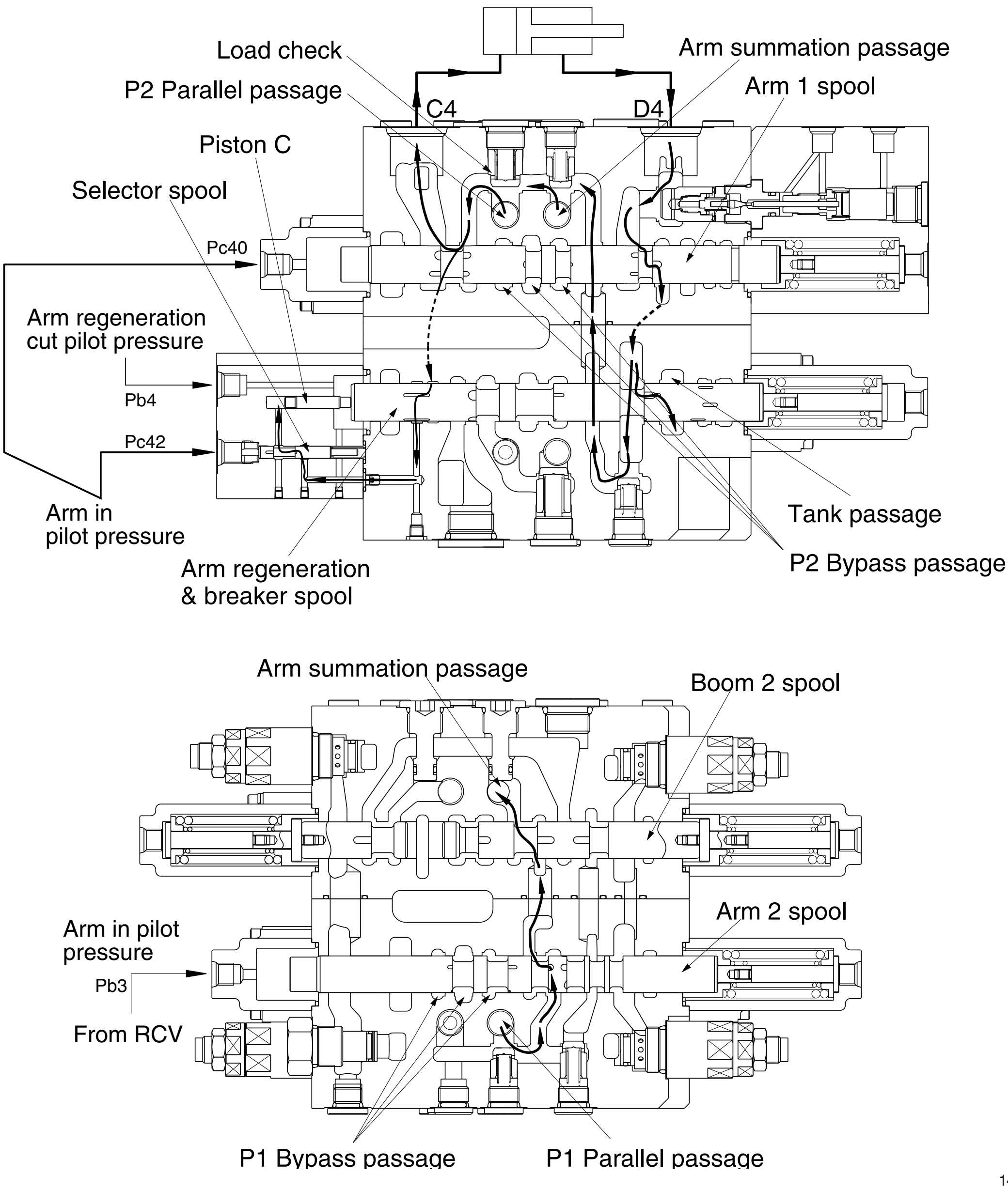
7) ARM OPERATION

(1) ARM IN OPERATION

During arm in operation, the pilot secondary pressure from the RCV is supplied to the port Pc40 of spring opposite side and shifts arm 1 spool in the right direction.

The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic oil from the pump A1 flows into the arm cylinder head side through P2 parallel passage, the load check valve, bridge passage and the port C4.

At same time, the pilot secondary pressure from the RCV is supplied to the port Pb3 of spring opposite side and shifts arm 2 spool in the right direction. The bypass passage is shut off by the movement of the arm 2 spool and the hydraulic fluid from the pump A2 flows into the arm summation passage through P1 parallel passage, the check valve, the arm 2 spool and the boom 2 spool. Then it entered the arm cylinder head side with hydraulic fluid from arm 1 spool.

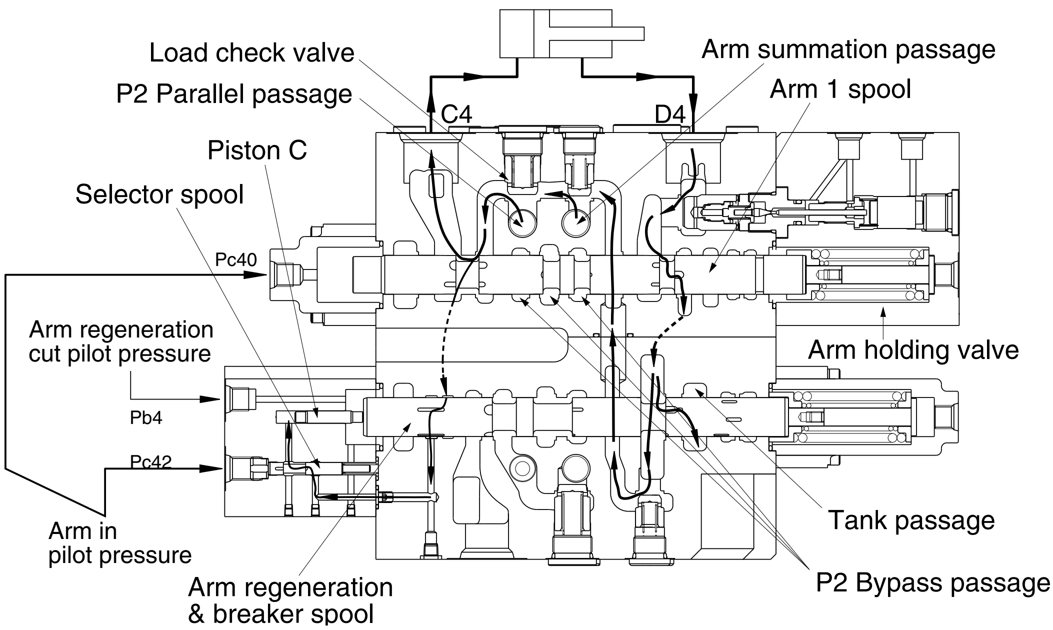


ARM REGENERATION

The return flow from the arm cylinder rod side is pressurized by self weight of arm and so, returns to port D4. The pressurized oil returning to port D4 enters the arm regeneration & breaker spool through the arm holding valve and the arm 1 spool. It is supplied the arm cylinder head through internal passage. This is called the arm regeneration function.

The amount of regeneration fluid is changed by movement of the arm regeneration spool. A few fluids after P2 parallel passage is push piston "C" through the notch of arm regeneration spool and selector spool. At this time, the selector spool is opened by pilot pressure from RCV.
Then, the arm regeneration spool shifts to right side and flow to tank pass increases and regeneration flow decreases. Therefore, pressure of arm cylinder head increases, then, arm regeneration flow decreases.

Furthermore, the arm regeneration cut pressure is supplied to the port Pb4 of spring opposite side and arm regeneration spool is move into the right direction fully. The flow from the arm cylinder rod is returned to the hydraulic oil tank and regeneration function is not activated. (The return fluid is maximum condition)



140SA2MC22

(2) ARM OUT OPERATION

During arm out operation, the pilot secondary pressure from RCV is supplied to the port Pd40 of spring side and shifts arm 1 spool in the left direction.

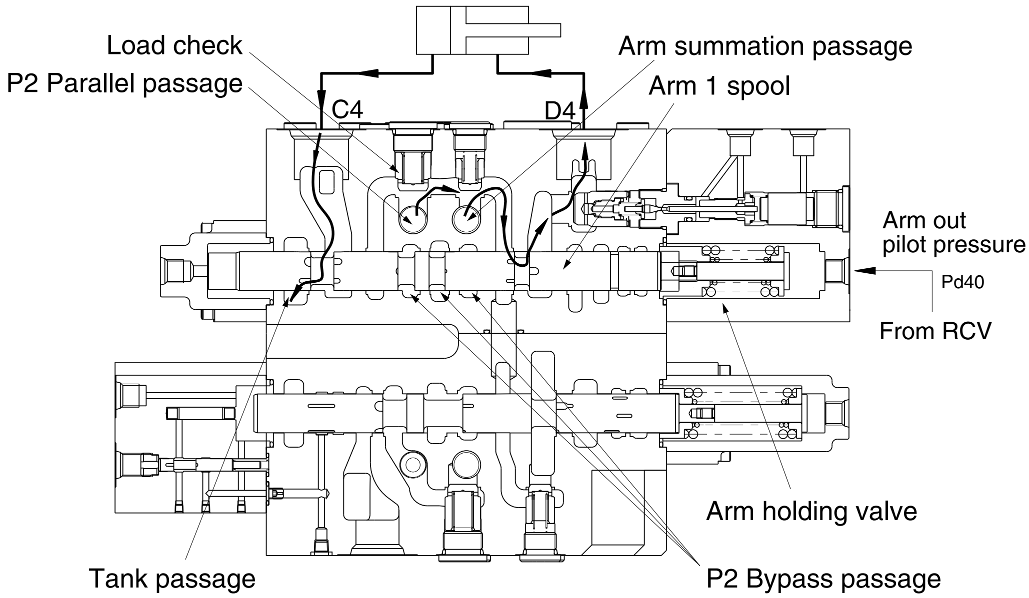
The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic fluid from pump A1 flows into arm 1 spool through the P2 parallel passage. Then it enters into the arm cylinder rod side through the load check, bridge passage, arm holding valve and the port D4.

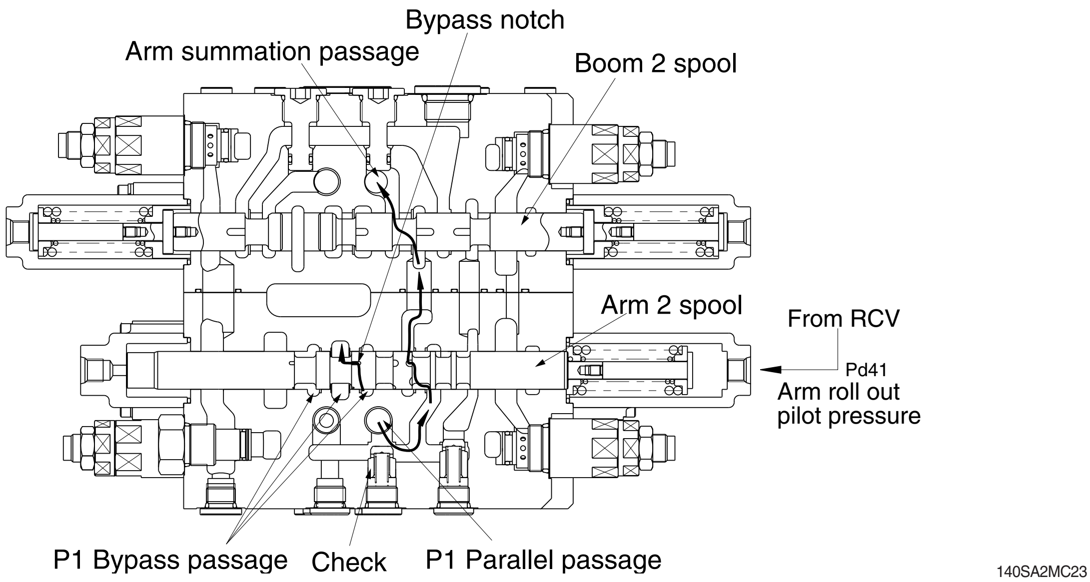
Also, the pilot secondary pressure from RCV is supplied to the port Pd41 of spring side and shifts arm 2 spool in the left direction.

The bypass passage is shut off by the movement of the arm 2 spool and some of the hydraulic fluid from pump A2 bypassed through bypass notch. The rest of hydraulic fluid from pump A2 flows into the arm summation passage through P1 parallel passage, the check valve, arm 2 spool and boom 2 spool.

Then it enters into the arm cylinder rod side with the fluid from the arm 1 spool.

The return flow from the arm cylinder head side returns to the hydraulic tank through the port C4, the arm 1 spool and tank passage.



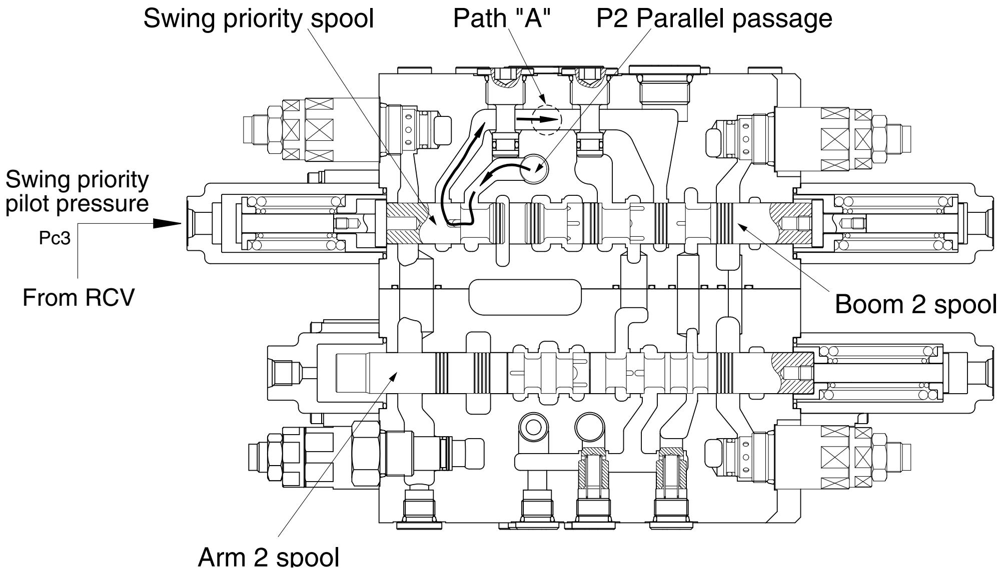


8) SWING PRIORITY FUNCTION

During swing priority operation, the pilot secondary pressure is supplied to the port Pc3 of the spring side of the swing priority spool and shift swing priority spool in the right direction.

The hydraulic fluid from P2 parallel passage flows into the parallel passage of arm 1 side through swing priority spool and the path "A" and also flows into the boom 2 spool.

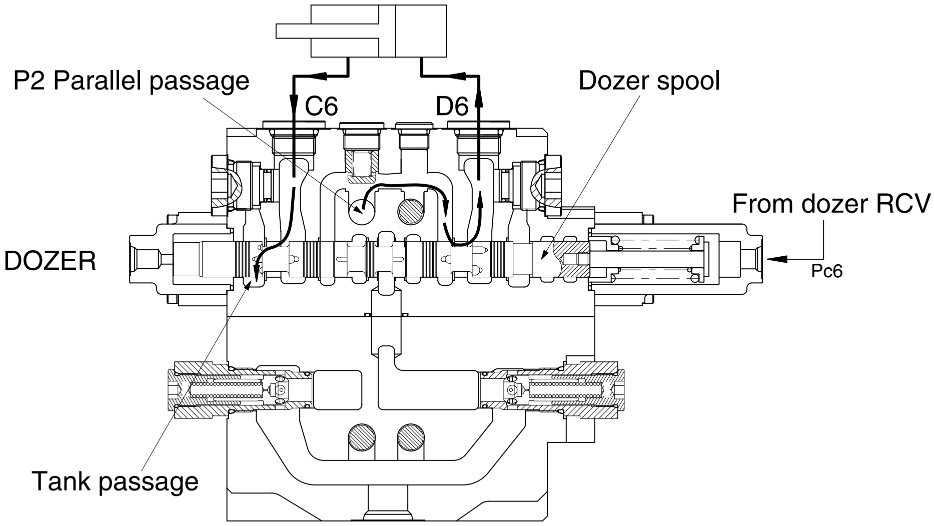
When the swing priority spool is neutral condition, the passage is same as normal condition. But due to shifting of the swing priority spool, the fluid from pump A1 flows to swing side more then the boom 2, arm 1, option B and dozer spools to make the swing operation most preferential.



145LCR2MC27

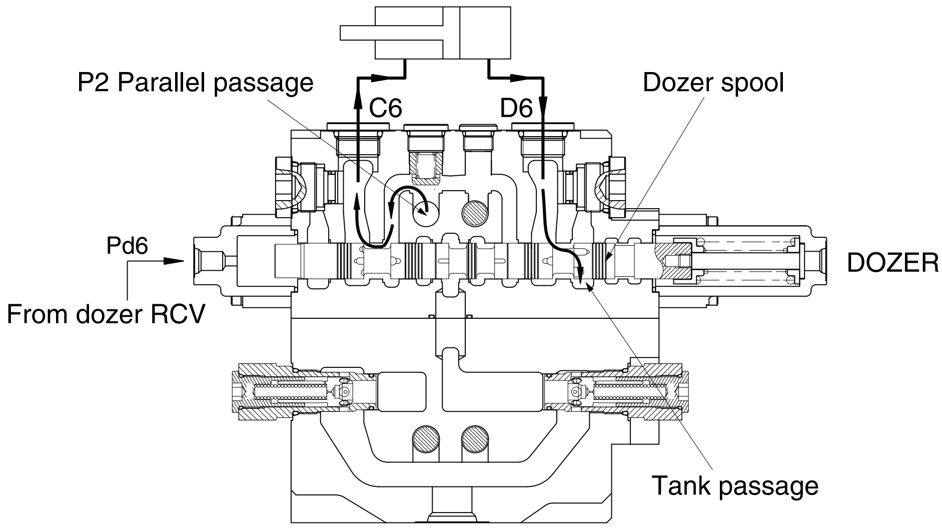
9) DOZER OPERATION

(1) Dozer down operation



14W92MC30

(2) Dozer up operation



14W92MC31

During the dozer down operation, the pilot pressure from the dozer control valve is supplied into the port Pc6 of the spring side and it shifts the dozer spool in the left direction.

The hydraulic fluid from the pump A1 enters the parallel passage and is direction to the head side of the dozer cylinder through port D6.

The return flow from the rod side of the dozer cylinder returns to the dozer spool through C6 port. Thereafter it is directed to the hydraulic tank through tank passage.

In case of the dozer up operation, operation is similar.

10) NEGATIVE RELIEF VALVE OPERATION

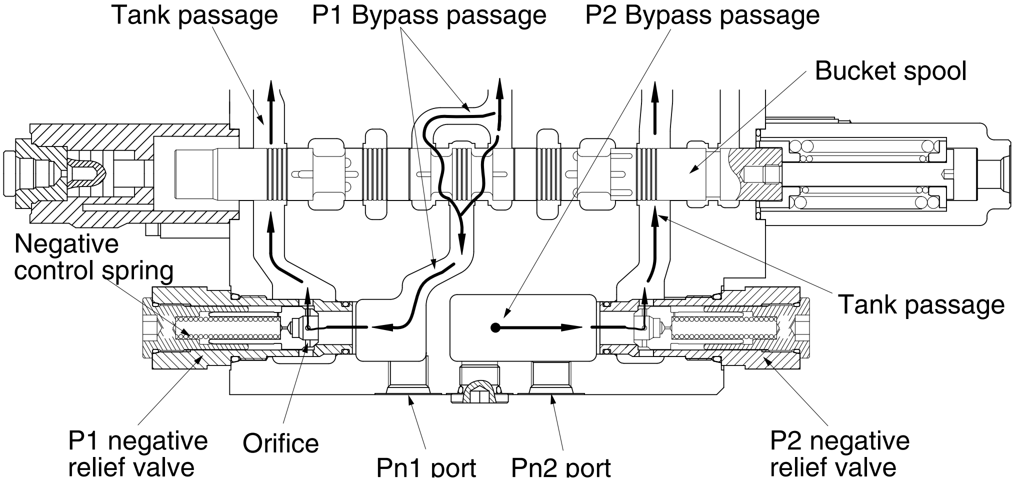
When no function is being actuated on P1 side, the hydraulic fluid from the pump A2, flows into the tank passage through the P1 bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump A2 regulator.

It controls the pump regulator so as to minimize the discharge of the pump A2.

The bypass passage is shut off when the shifting of one or more spools and the flow through bypass passage became zero. The pressure of negative control signal becomes zero and the discharge of the pump A2 becomes maximum.

The negative control pressure reaches to the set level, the hydraulic fluid in the passage pushes open negative control valve and escapes into the return passage.

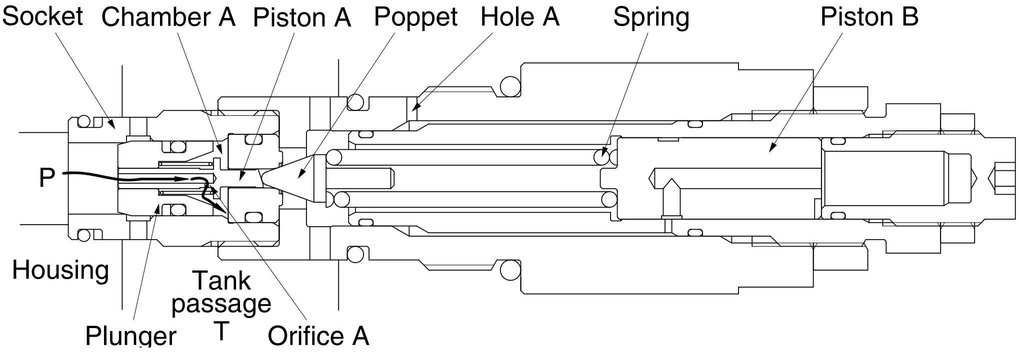
For the pump A1 the same negative control principle.



145LCR2MC28

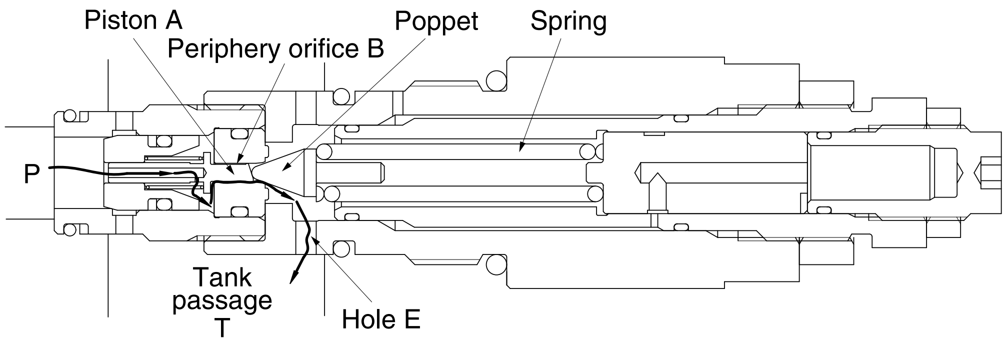
11) OPERATION OF MAIN RELIEF VALVE

(1) The pressurized oil passes through the orifice (A) of the plunger is filled up in chamber A of the inside space, and seats the plunger against the housing securely.



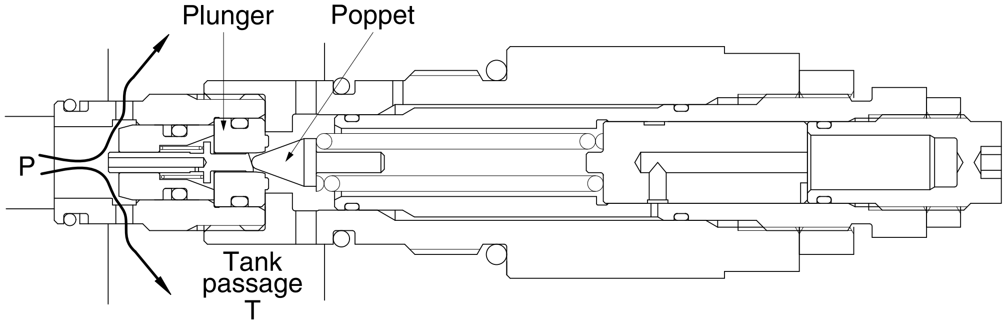
14W92MC36

(2) When the pressure at (P) becomes equal to the set pressure of the spring the hydraulic oil passes through the piston (A) pushes open the poppet and flows to tank passage (T) through the plunger internal passage, periphery orifice A, chamber A, periphery orifice B and the hole (E).



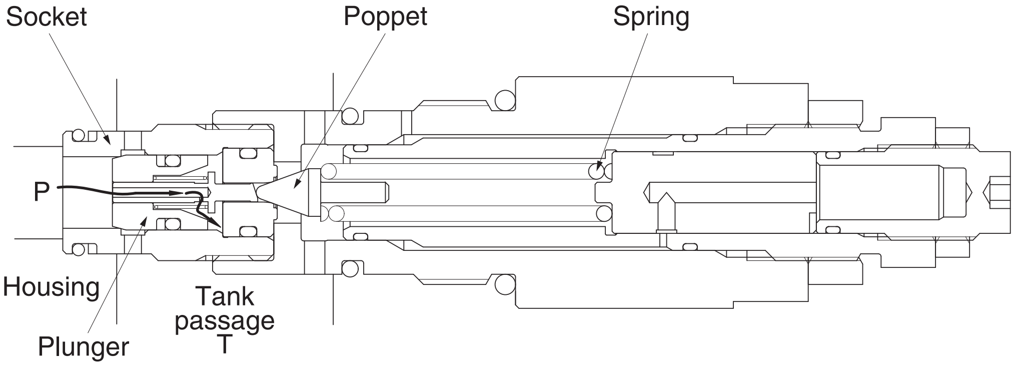
14W92MC37

(3) Opening the poppet causes the pressure in chamber A to fall and the plunger to open. As the result the pressurized oil at port P runs into tank passage (T).



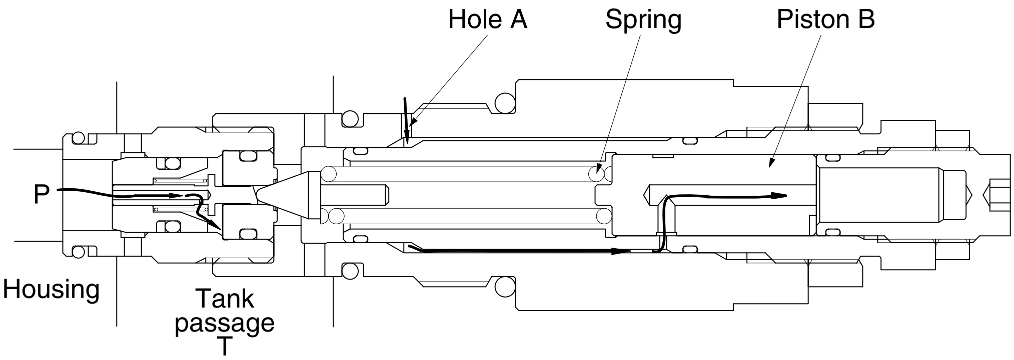
14W92MC38

(4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



14W92MC39

(5) When the power boost switch is ON, the pilot pressure enters through hole A.
It pushes the piston (B) in the left direction to increase the force of the spring and change the relief set pressure to the high pressure.

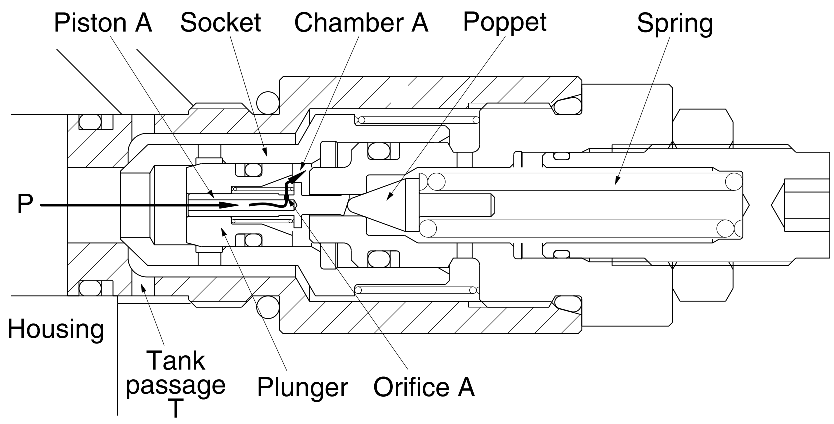


14W92MC40

12) OPERATION OF OVERLOAD RELIEF VALVE

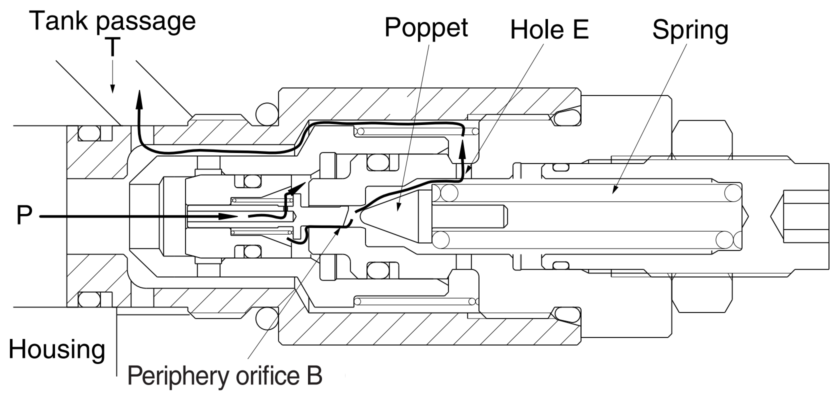
FUNCTION AS RELIEF VALVE

(1) The pressurized oil passes through the piston A and orifice A is filled up in chamber A of the inside space and seat the plunger against the socket and the socket against the housing securely.



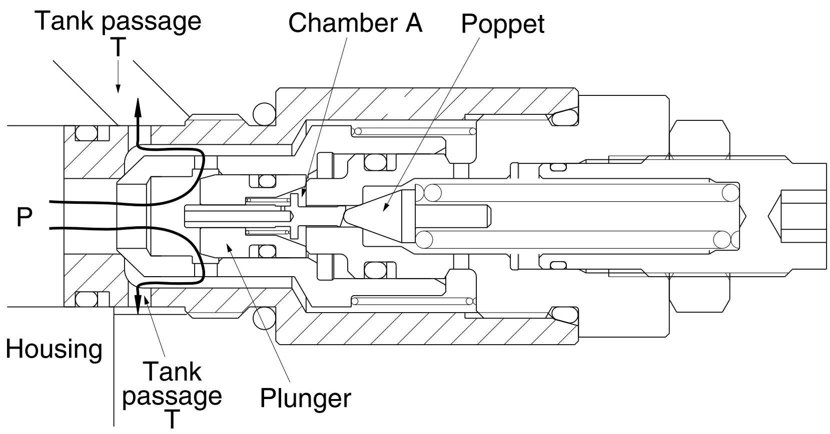
14W92MC41

(2) When the pressure at port P becomes equal to the set pressure of the spring, the pressurized oil pushes open the poppet and flows to tank passage (T) through the plunger internal passage, orifice A, chamber A, periphery orifice B and hole E.



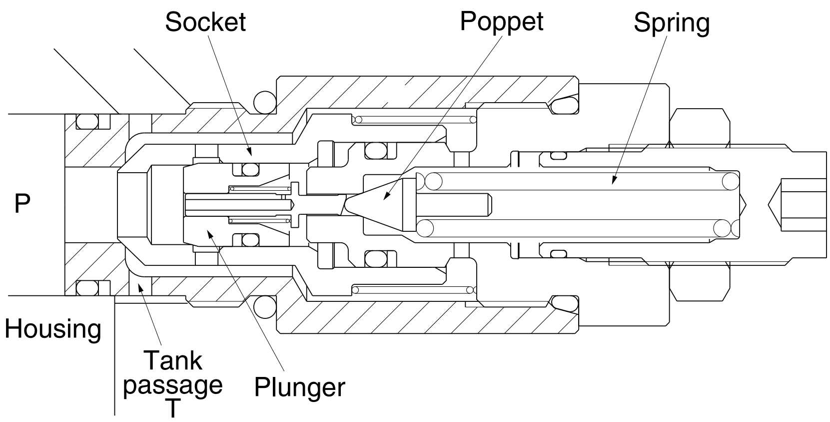
14W92MC42

(3) Opening of the poppet causes the pressure in chamber A to fall and the plunger to open. As the result the pressurized oil at port P runs into tank passage (T).



14W92MC43

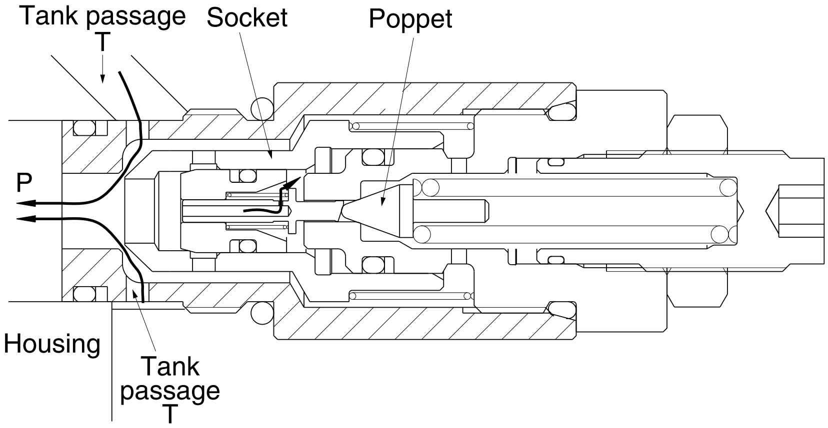
(4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



14W92MC44

MAKE-UP FUNCTION

(5) When negative pressure exists at port P, the oil is supplied through tank passage (T). When the pressure at tank passage (T) becomes higher than that of at port P, the socket moves in the right direction. Then, sufficient oil passes around the socket from tank passage (T) to port P and fills up the space.



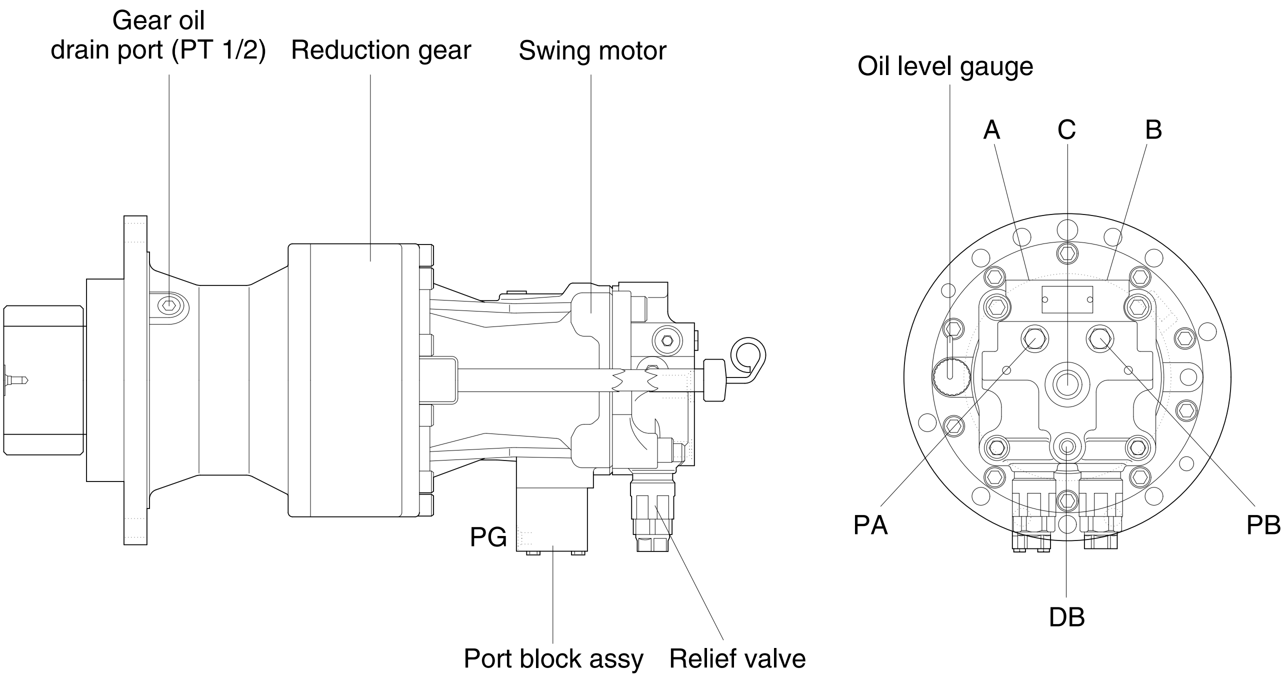
14W92MC45

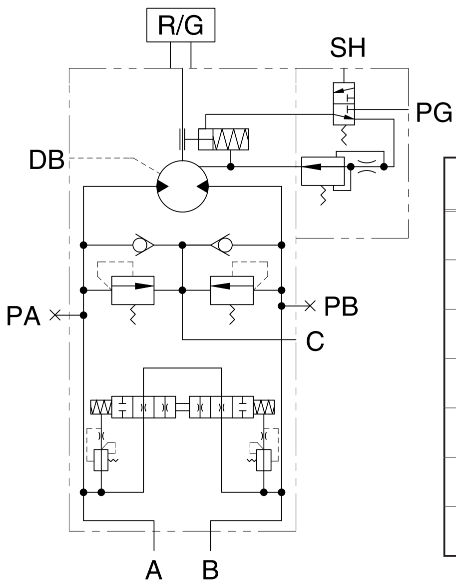
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, and swing reduction gear.

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



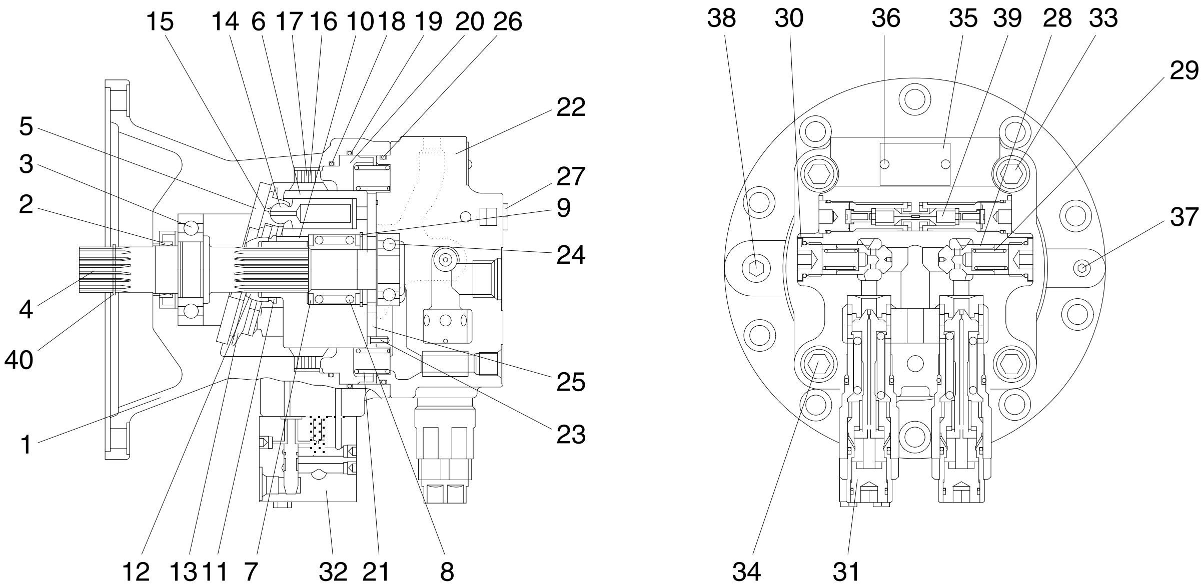


Hydraulic circuit

Port	Port name	Port size
A	Main port	Ø13
B	Main port	Ø13
DB	Drain port	PF 3/8
C	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
PA, PB	Gauge port	PF 1/4

140SA2SM01

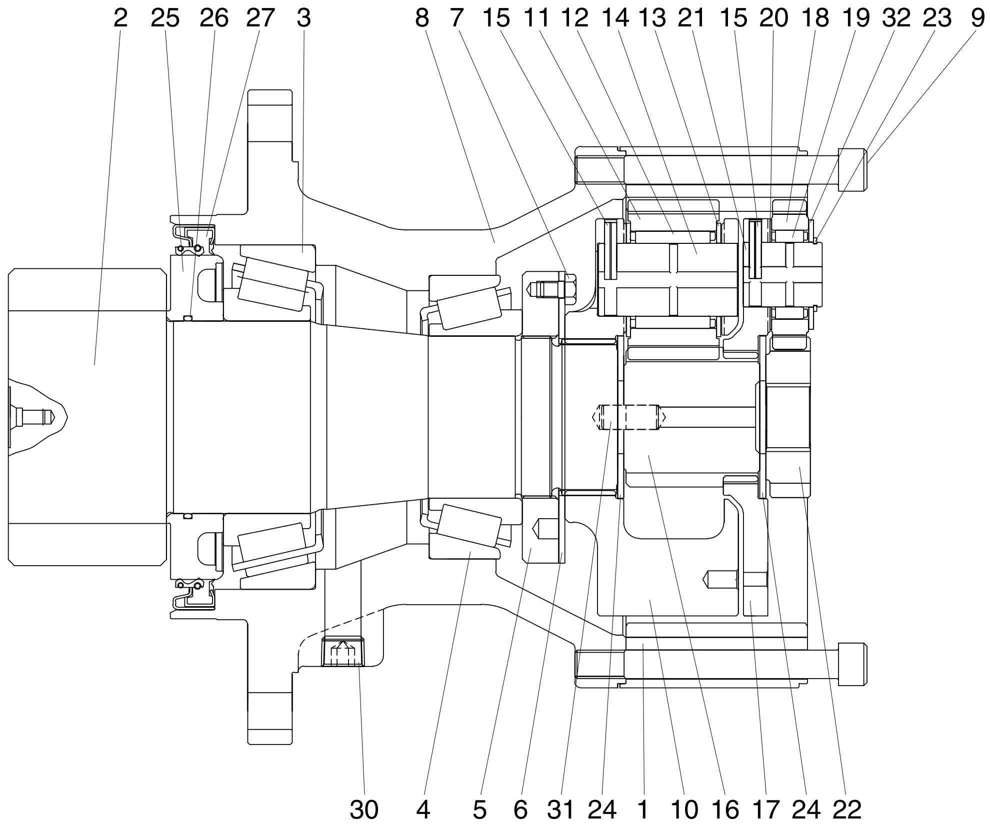
1) SWING MOTOR



140SA2SM02

1	Casing	15	Shoe	29	Spring
2	Oil seal	16	Separate plate	30	Plug assy
3	Ball bearing	17	Friction plate	31	Relief valve assy
4	Drive shaft	18	O-ring	32	Brake valve assy
5	Shoe plate	19	O-ring	33	Socket bolt
6	Rotary block	20	Brake piston	34	Socket bolt
7	Washer	21	Spring	35	Name plate
8	Spring	22	Valve casing	36	Screw
9	Snap ring	23	Spring pin	37	Plug
10	Roller	24	Ball bearing	38	Plug
11	Collar washer	25	Valve plate	39	Reactionless valve assy
12	Thrust ball	26	O-ring	40	Snap ring
13	Retainer plate	27	Plug assy		
14	Piston	28	Plunger		

2) REDUCTION GEAR



125LCR2SM23

1	Ring gear	11	Planetary gear No. 2	21	Carrier pin No. 1
2	Drive shaft	12	Needle bearing	22	Sun gear No. 1
3	Taper roller bearing	13	Thrust washer	23	Snap ring
4	Taper roller bearing	14	Carrier pin No. 2	24	Thrust plate
5	Ring nut	15	Spring pin	25	Sleeve
6	Lock plate	16	Sun gear No. 2	26	O-ring
7	Hexagon bolt	17	Carrier No. 1	27	Oil seal
8	Casing	18	Planetary gear No. 1	30	Plug
9	Socket bolt	19	Needle bearing	31	Parallel pin
10	Carrier No. 2	20	Thrust washer	32	Thrust washer

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a rotary block (6) through valve casing (22) of motor, and valve plate (25).

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

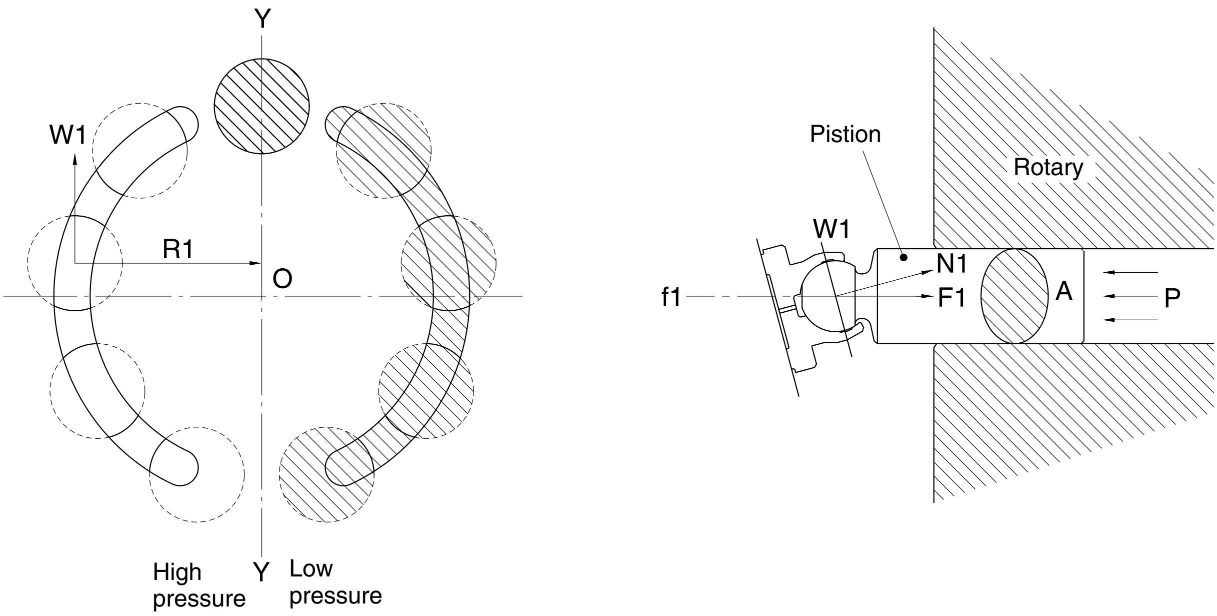
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

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

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

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

This torque transfers the turning force to a rotary (6) through a piston; because a rotary is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



210WA8SM05

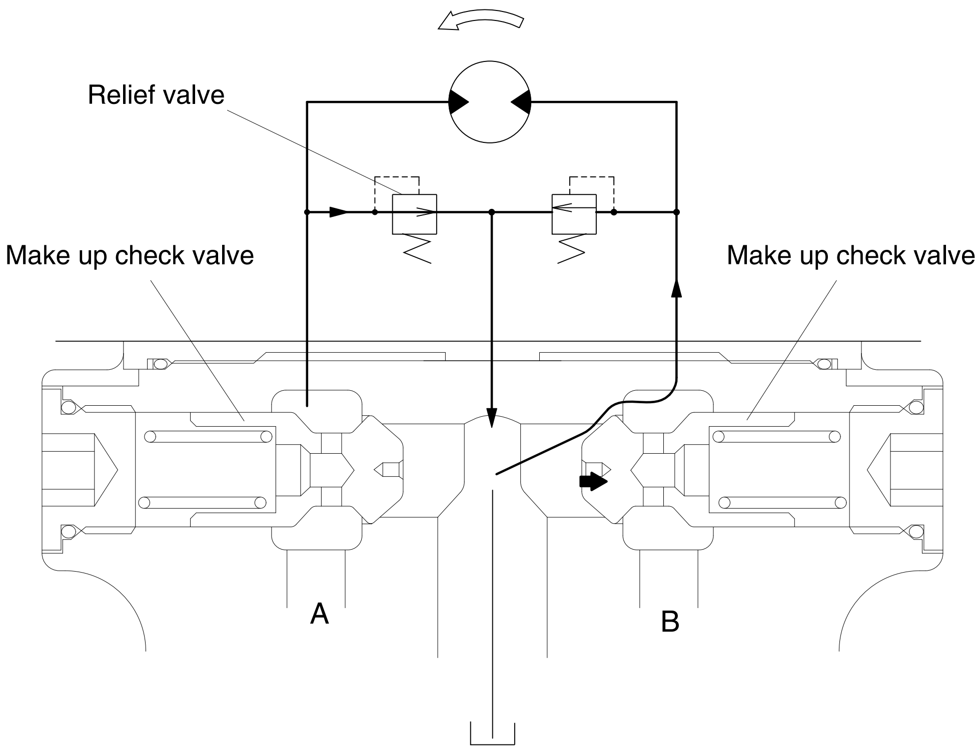
2) MAKE UP VALVE

In the system using this type of motor, there is no counterbalance functioning valve and there happens the case of revolution exceeding hydraulic supply of motor. To prevent the cavitation caused by insufficient oil flow there is a make up valve to fill up the oil insufficiency.

A make up valve is provided immediately before the port leading to the hydraulic oil tank to secure feed pressure required when the hydraulic motor makes a pumping action. The boost pressure acts on the hydraulic motor's feed port via the make up valve.

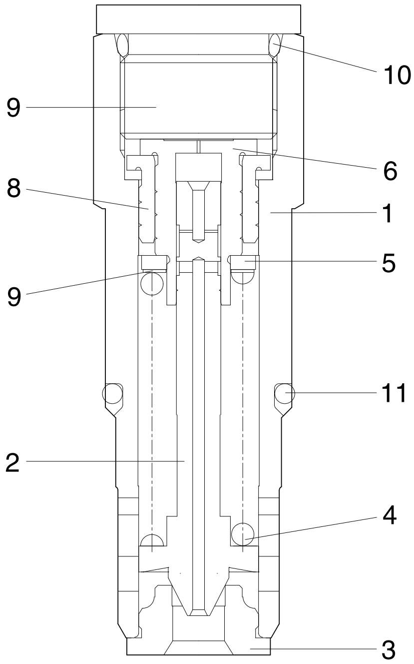
Pressurized oil into the port B, the motor rotate counterclockwise.

If the swing motion is stopped, the oil in the motor is drain via left relief valve, the drain oil run into motor via right make up valve, which prevent the cavitation of motor.



140A2SM04

3) RELIEF VALVE



145WF2SM25

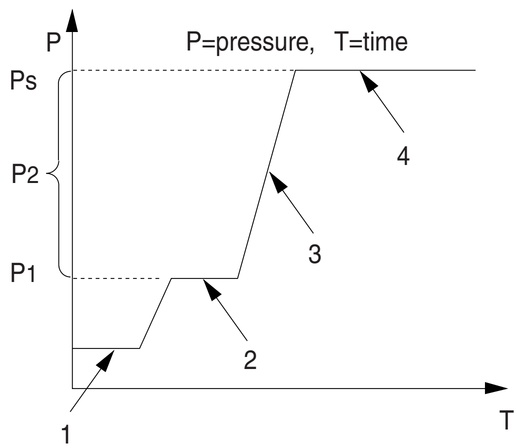
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(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.

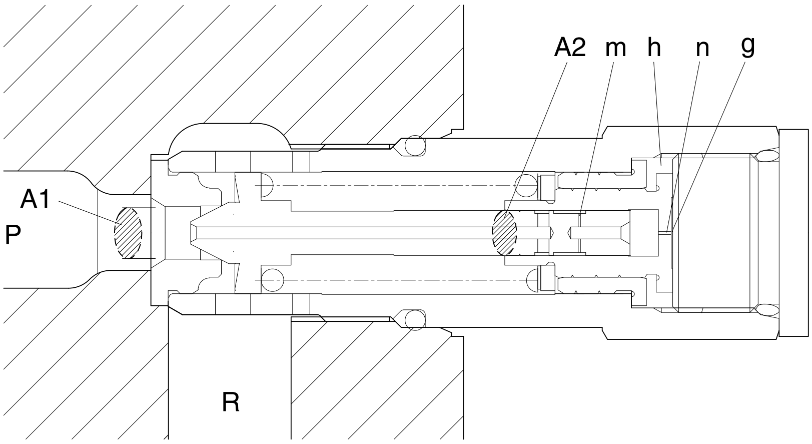
(2) Function of relief valve

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.



2-48(2)

① Ports (P,R) at tank pressure.

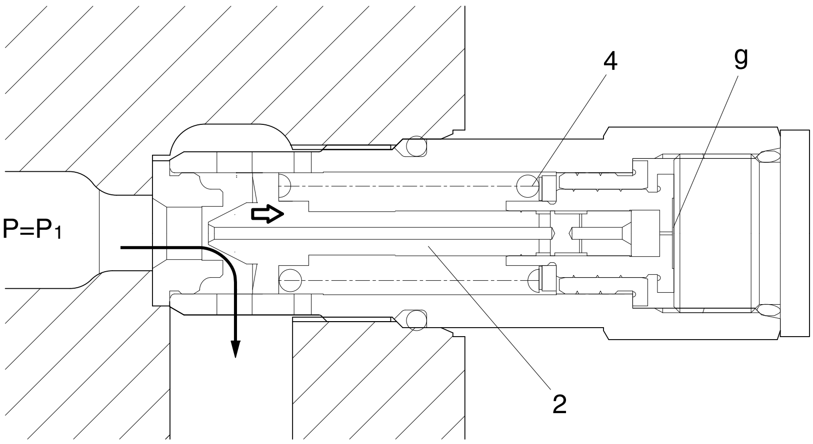


145WF2SM26

② When hydraulic oil pressure ($P \times A_1$) reaches the preset force (F_{SP}) of spring (4), the poppet (2) moves to the right as shown.

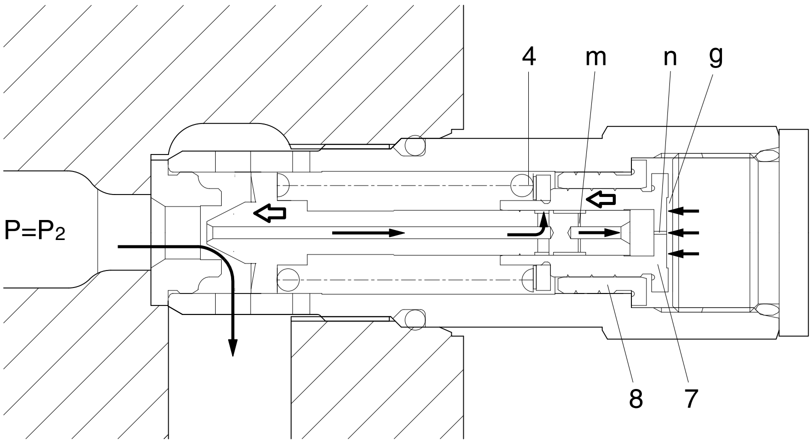
$P_1 \times A_1 = Fsp + Pg \times A_2$

$$P_1 = \frac{Fsp + Pg \times A_2}{A_1}$$



145WF2SM27

③ The oil flows into chamber (g) via orifice (m) and (n). When the pressure of chamber (g) reaches the preset force (F_{SP}) of spring (4), the piston (7) moves left and stop the piston (7) hits the bottom of stopper (8).

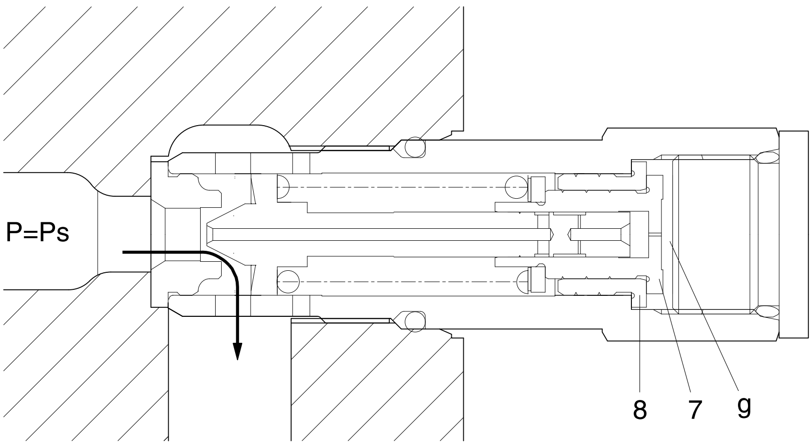


145WF2SM28

④ When piston (7) hits the bottom of stopper (8), it stops moving to the left any further. As the result, the pressure in chamber (g) equals (Ps).

$Ps \times A_1 = Fsp + Ps \times A_2$

$$Ps = \frac{Fsp}{A_1 - A_2}$$



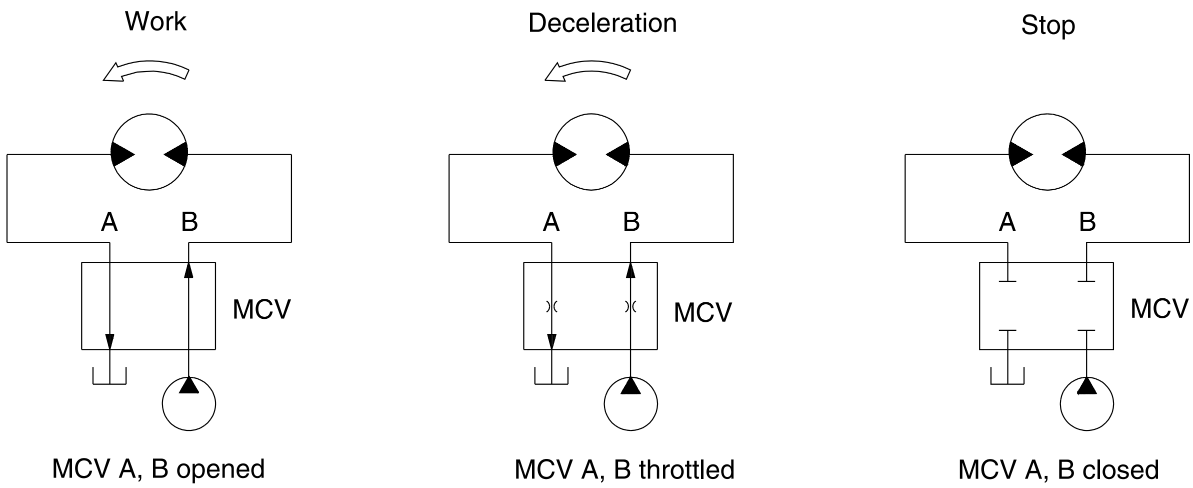
145WF2SM29

5) 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.



140LC2SM08

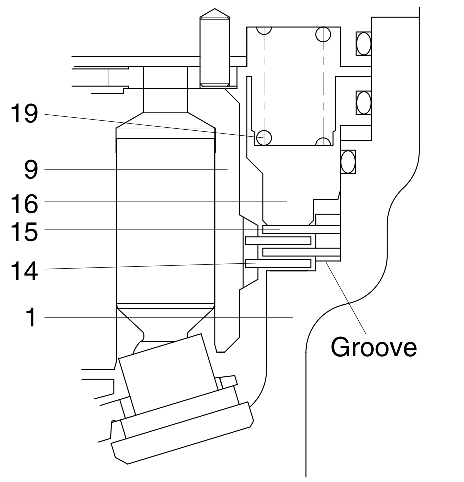
(2) Mechanical swing parking brake system

This is function as a parking brake only when the swing control lever and arm in control lever are not operated.

① Brake operation

Circumferential rotation of separate plate (15) is constrained by the groove located at body (1). When housing is pressed down by brake spring (19) through friction plate (14), separate plate (15) and parking piston (16), friction force occurs between friction plate and separate plate.

Friction force constrains motion of cylinder block (9). When hydraulic force exceeds spring force, brake is released.

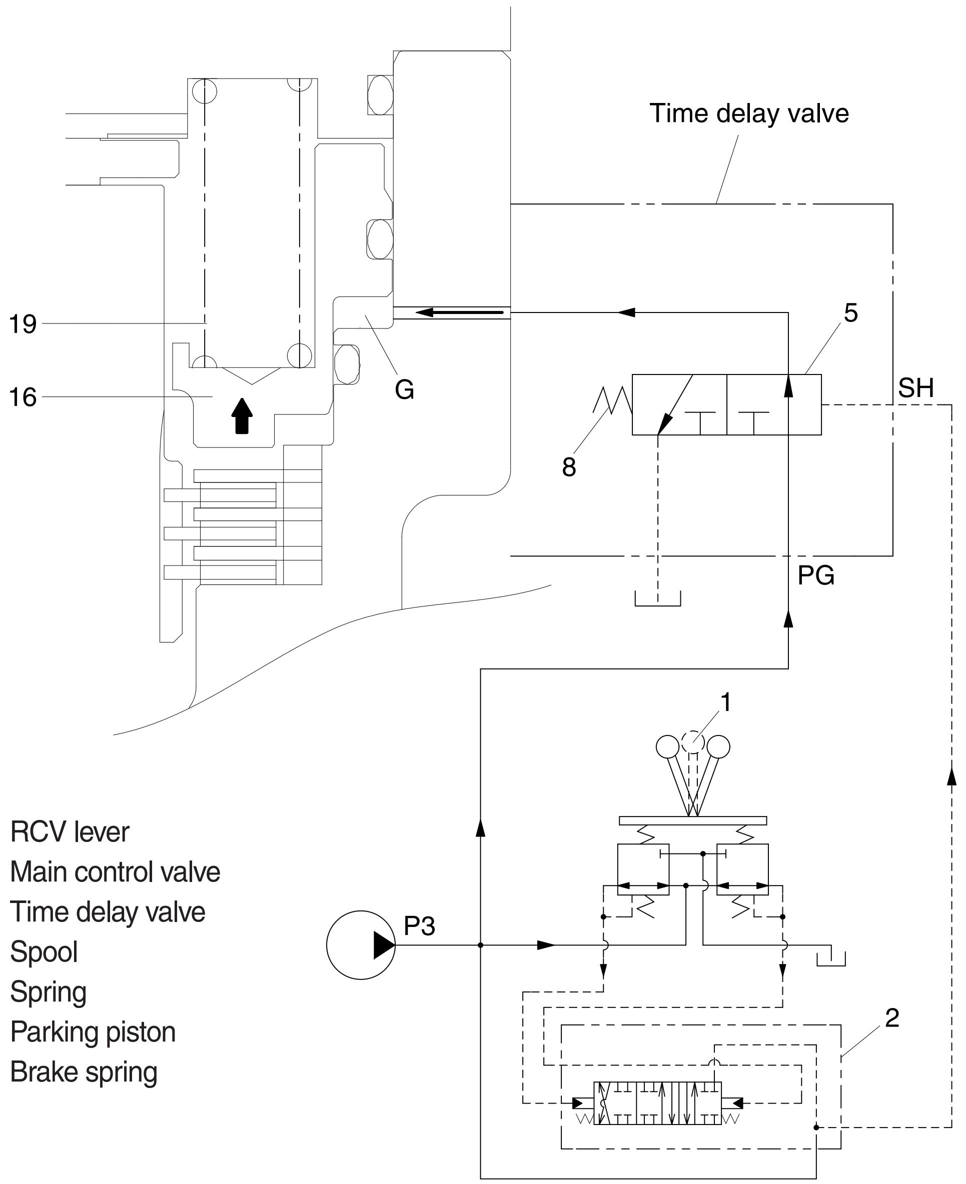


140LC2SM15

1	Body	15	Separate plate
9	Cylinder block	16	Parking piston
14	Friction plate	19	Brake spring

② Operating principle

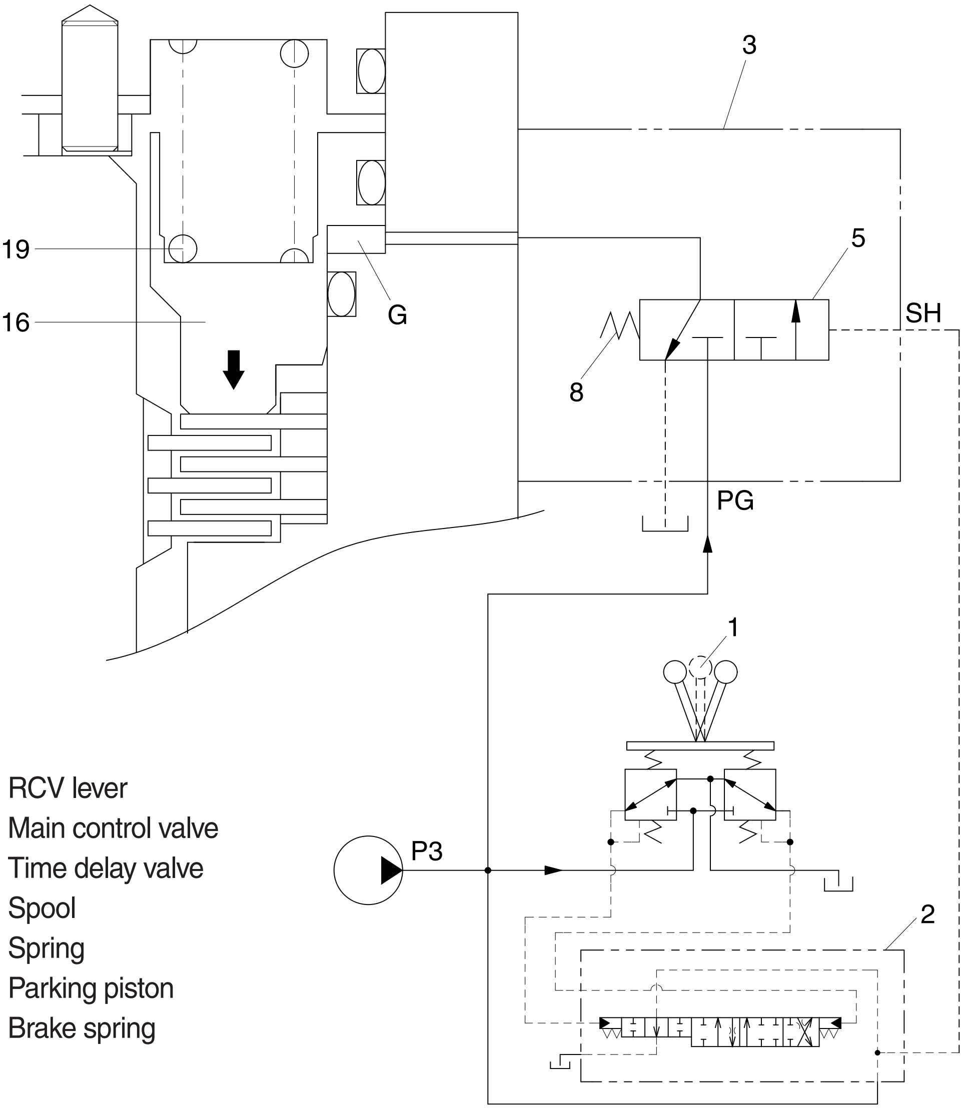
a. When swing or arm in operation of the RCV lever (1) is tilted, the each spool is shifted to left or right and the pilot oil flow is blocked. Then the pilot oil go to SH of the time delay valve (3).
   This pressure moves spool (5) to the leftward against the force of the spring(8), so pilot pump charged oil (P3) goes to the chamber G through port PG.
   This pressure is applied to move the parking piston (16) to the upward against the force of the brake spring (19). Thus, it releases the brake force.



1 RCV lever
2 Main control valve
3 Time delay valve
5 Spool
8 Spring
16 Parking piston
19 Brake spring

140SA2SM36

b. When all of the RCV lever (1) are set the neutral position, the spool (5) returns to right.
Then, the parking piston (16) is moved lower by spring (19) force and the return oil from the chamber G flows back to tank port.
At this time, the brake works.



1	RCV lever
2	Main control valve
3	Time delay valve
5	Spool
8	Spring
16	Parking piston
19	Brake spring

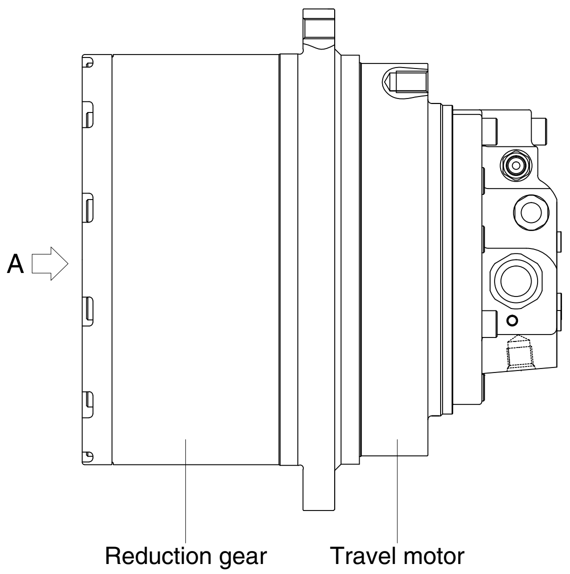
14W92SM17

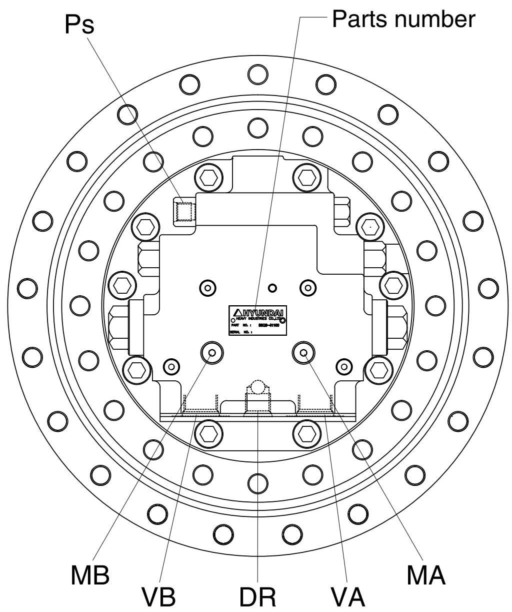
GROUP 4 TRAVEL DEVICE (STD, TYPE 1)

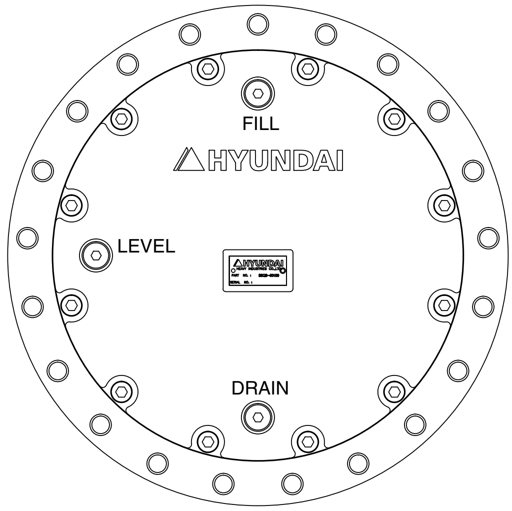
1. CONSTRUCTION

Travel device consists travel motor and gear box.

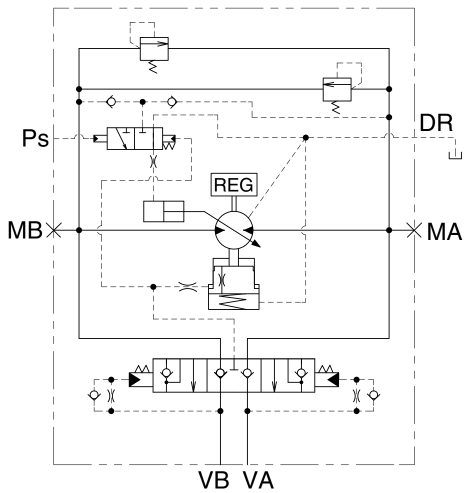
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.







VIEW A

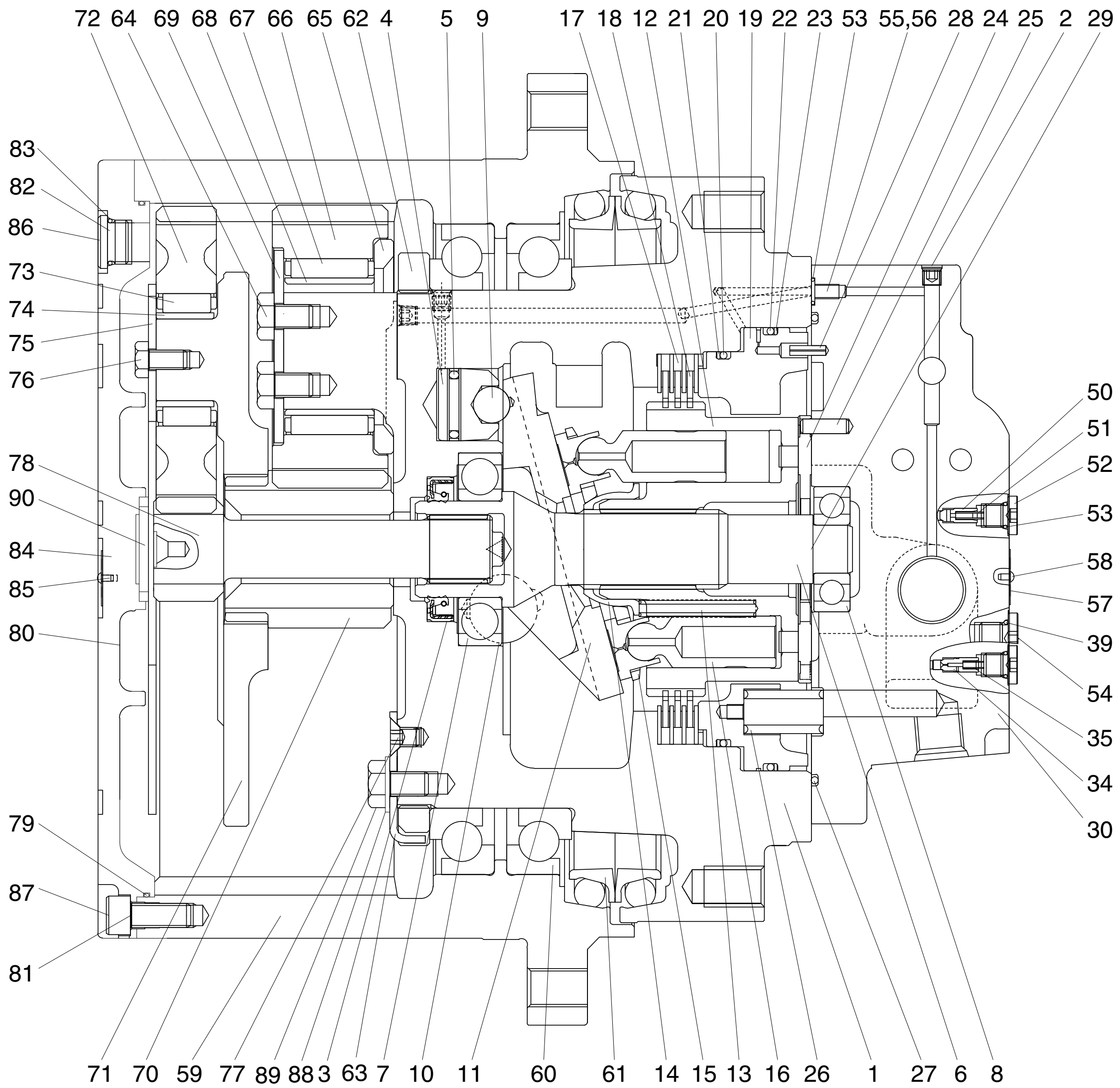


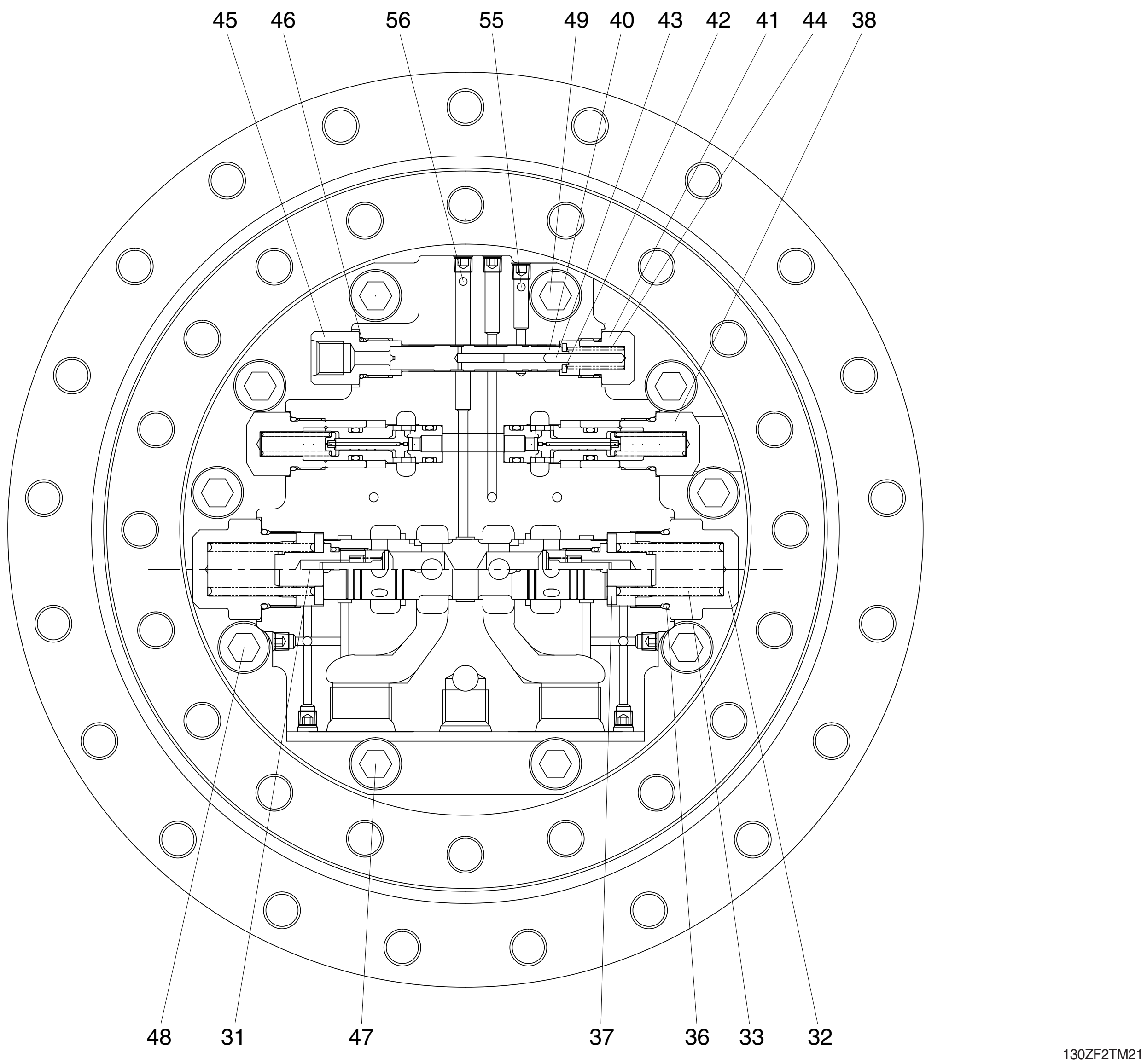
Hydraulic circuit

140LC2TM20

Port	Port name	Port size
VA, VB	Valve port	PF 3/4
Ps	Pilot port	PF 1/4
DR	Drain port	PF 1/2
MA, MB	Gauge port	PF 1/4

2. STRUCTURE





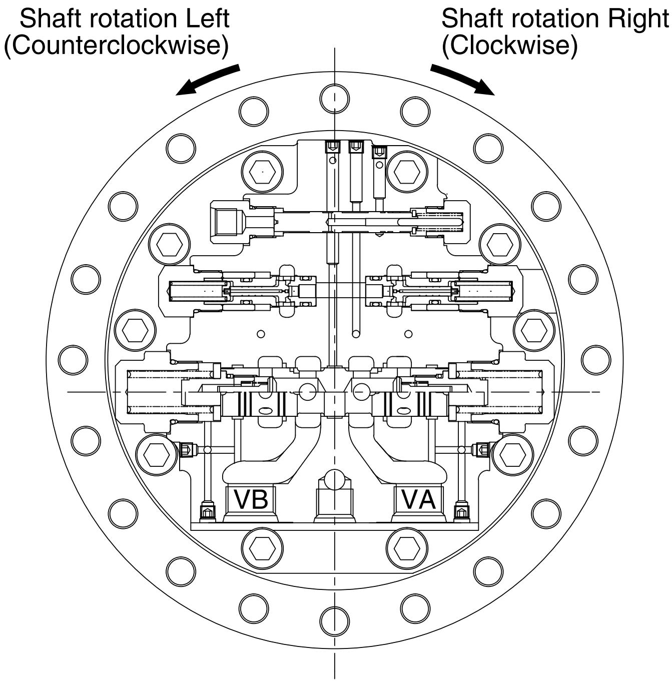
1	Casing
2	Plug
3	Oil seal
4	Piston
5	Piston seal
6	Shaft
7	Front ball bearing
8	Rear ball bearing
9	Steel ball
10	Pivot
11	Swash plate
12	Cylinder block
13	Spring
14	Ball guide
15	Retainer plate
16	Piston assy
17	Friction plate
18	Separated plate
19	Parking piston
20	O-ring
21	Back up ring
22	O-ring
23	Back up ring
24	Valve plate
25	Spring pin
26	Spring
27	O-ring
28	Spring pin
29	Parallel pin
30	Rear cover
31	Main spool assy
32	Cover
33	Spring
34	Restrictor
35	Spring
36	O-ring
37	Spring seat
38	Relief valve assy
39	O-ring
40	Spool
41	Plug
42	Spring seat
43	Parallel pin
44	Spring
45	Connector
46	O-ring
47	Hexagon socket head bolt
48	Hexagon socket head bolt
49	Hexagon socket head bolt
50	Check valve
51	Spring
52	Plug
53	O-ring
54	Plug
55	Restrictor
56	Restrictor
57	Name plate
58	Rivet
59	Ring gear
60	Bearing
61	Floating seal assy
62	Nut ring
63	Lock plate
64	Hexagon head bolt
65	Thrust plate
66	Planetary gear No.2
67	Needle bearing
68	Inner race No. 2
69	Thrust washer
70	Sun gear No.2
71	Carrier No.1
72	Planetary gear No.1
73	Needle bearing
74	Inner race No. 1
75	Thrust plate
76	Hexagon head bolt
77	Countersunk head screw
78	Sun gear No.1
79	O-ring
80	Cover
81	Hex socket head bolt
82	Plug
83	O-ring
84	Name plate
85	Rivet
86	Rubber cap
87	Rubber cap
88	Plain washer
89	Hexagon bolt
90	Thrust plate

3. OPERATION

1) MOTOR

High pressure oil delivered form hydraulic pump is led to inlet port that is provided in the brake valve portion and, through the rear cover (30) and valve plate (24), led to cylinder block (12).

The oil flow and direction of shaft rotation are indicated in table.



Inlet port	Outlet port	Direction of shaft rotation (viewing from rear cover)
VB	VA	Right (clockwise)
VA	VB	Left (counterclock wise)

125LCR2TM23

As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

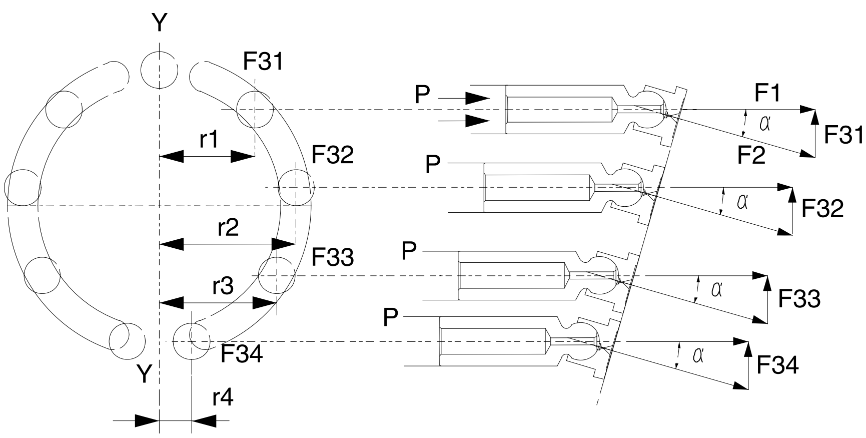
$F1 = P \times A$ (P : pressure, A : area of piston section)

The swash plate (11) with inclined angle of α divides this force F1 into thrust force F2 and radial force F31-34.

This radial force is applied to axis Y-Y as turning force and generate drive torque of T.

$T = r_1 \cdot F31 + r_2 \cdot F32 + r_3 \cdot F33 + r_4 \cdot F34$

This drive torque is transmitted via cylinder block (12) to driving shaft (6).

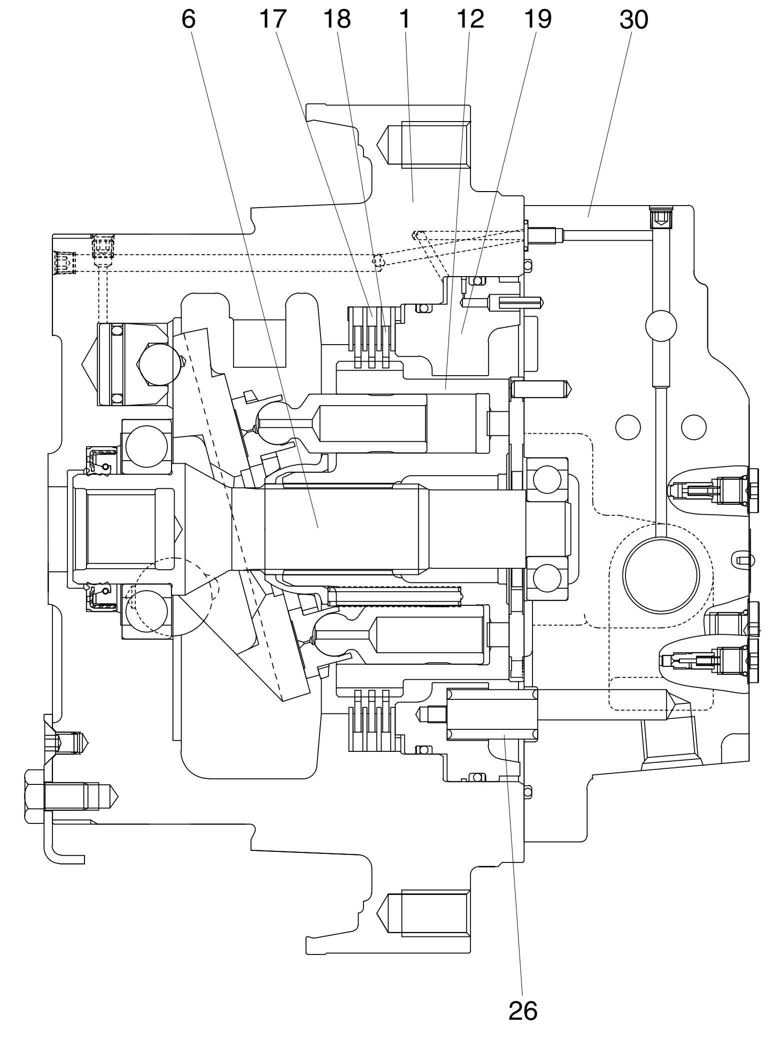


29092TM07

2) PARKING BRAKE

Parking brake is released when high pressure oil selected by the brake valve portion that is connected directly to the rear cover (30), is applied to the parking piston (19).
Otherwise the braking torque is always applied.

This braking torque is generated by the friction between the separated plates (18), inserted into the casing (1), and friction plates (17), coupled to cylinder block (12) by the outer splines.
When no pressure is activated on the parking piston (19), it is pushed by the brake springs (26) and it pushes friction plates (17) and separated plates (18) towards casing (1) and generates the friction force which brakes the rotation of cylinder block (12) and hence the shaft (6).



125LCR2TM24

3) CAPACITY CONTROL MECHANISM

Figure typically shows the capacity control mechanism.

When high speed pilot line is charged with the pressure P_A that overcome the spring (44), the spring (44) is compressed and spool (40) shifts to the right to connect the port P and port C.

Then, the highest pressure is selected by the check valve (50) from inlet and outlet pressure of the motor and high speed pilot line pressure and pushes shifter piston (4). As a result, swash plate (11) turns around the line L which connect the two pivot (10) as shown by dotted lines. The turn stops at the stopper (1-1) of casing and swash plate (11) keeps the position.

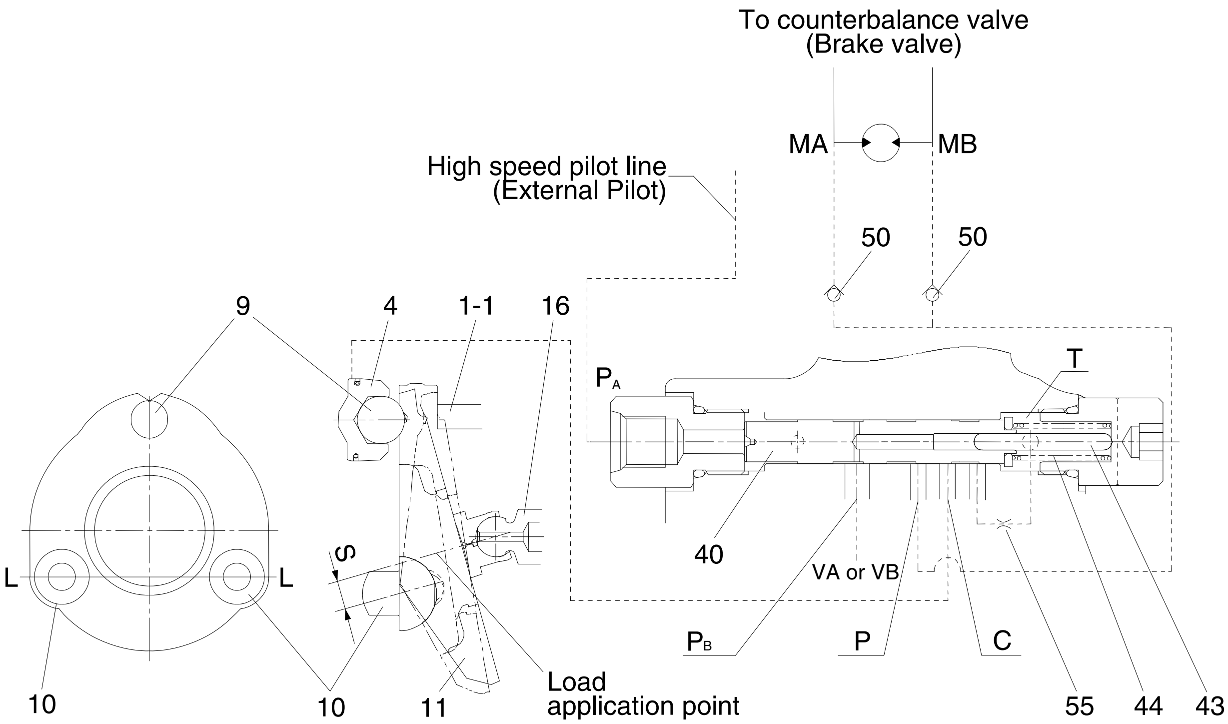
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

When no pressure is in the high speed pilot line P_A, spool (40) is pushed back by the spring (44) and pressure that pressed the shifter piston (4) is released to the hydraulic tank through restrictor (55).

Here, nine pistons are there and they equally spaced on the swash plate (11). The force that summed up those of pistons comes to almost the center of the swash plate (11) as shown. Since the steel balls (10) are off-set by S from the center, the rotating force of product S and the force moves swash plate (11) to the former position and the speed returns to low.

When the power demand exceeds the engine power, such as in steep slope climbing or turning at high speed mode, the system step down to the low speed automatically. The mechanism is that: pump pressure is led to the port P_B and this pressure activate on pin (43). When the pressure at P_B exceeds predetermined value, spool (40) returns to the left by the counter-pressure against pin (43) and the pressure on the shifter piston (4) through port C is released to the tank and the motor comes to low speed.

When P_B goes down, the spool (40) moves to the right and the speed become high.

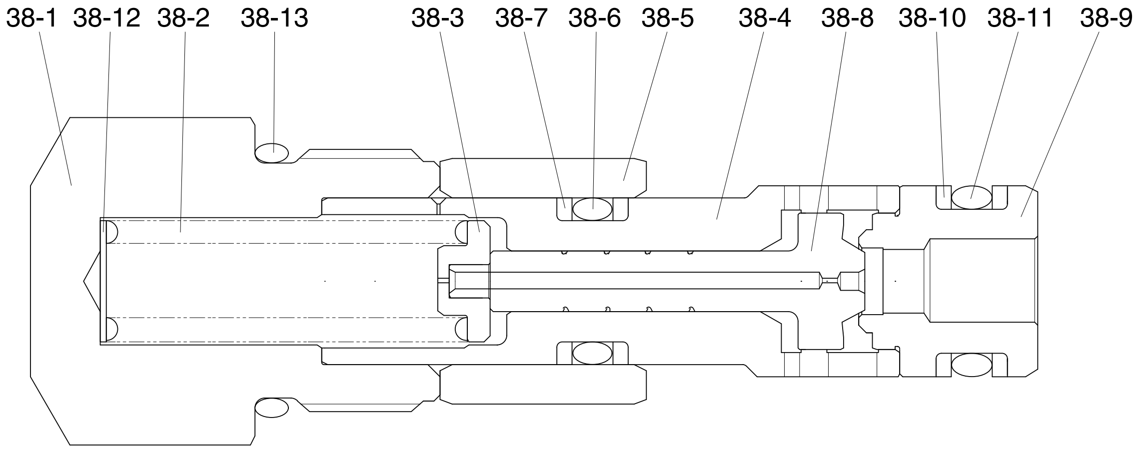


125LCR2TM19

4) OVERLOAD RELIEF VALVE

(1) Structure

This valve is screwed in the motor rear cover (30) and consists of : plug (38-1) that is screwed and fixed in the rear cover (30), poppet (38-8) and supports the poppet seat (38-9), spring (38-2) that is operating relief valve setting pressure and supports the spring seat (38-3), that is inserted in the sleeve (38-4), piston (38-5) that reduce the shock.



125LCR2TM25

38-1	Plug	38-6	O-ring	38-11	O-ring
38-2	Spring	38-7	Back-up ring	38-12	Ring
38-3	Spring seat	38-8	Poppet	38-13	O-ring
38-4	Sleeve	38-9	Poppet seat		
38-5	Piston	38-10	Back-up ring		

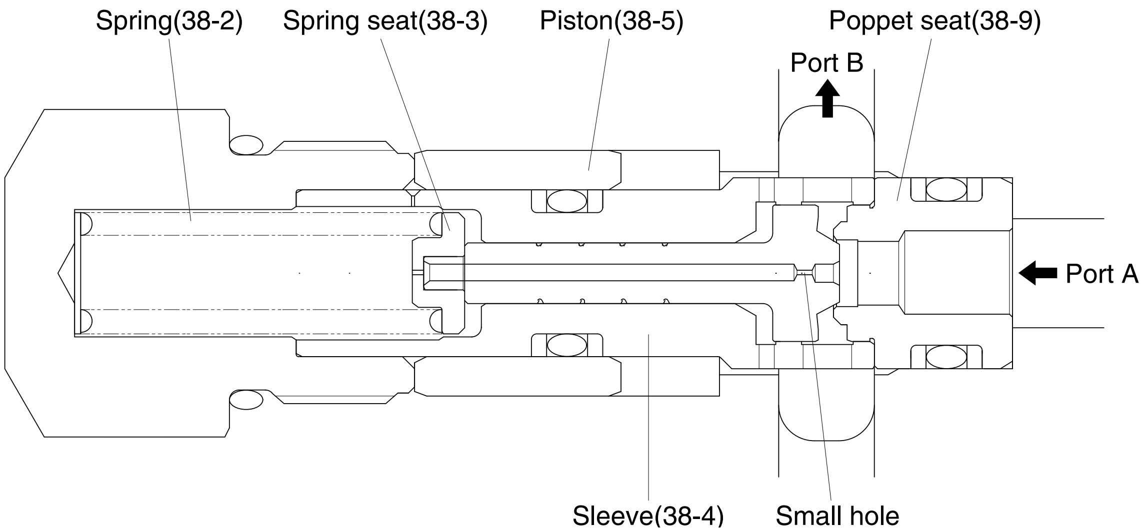
(2) Operation

Two pieces of overload valves are located at cross-over position in the counterbalance circuit of brake valve and have the following functions :

① When hydraulic motor starts, keep the driving pressure below predetermined value and while accelerating, bypasses surplus oil to return line.
② When stopping the motor, keep the brake pressure, that develops on the outlet side of motor, under the predetermined value to stop the inertial force.
③ To accelerate sharply while starting, and to mitigate the braking shock while stopping. For these purposes, the developed pressure is kept comparatively low for a short period, then keep the line pressure as normal value. While the pressure is low, meshing of reduction gears, crawler and sprocket etc. can be smoothly done and the shock are absorbed.

When starting, "A" port pressure of overload valve increases, this pressure is applied to the effective diameter of poppet (38-8) which seats on the poppet seat (38-9) and, at the same time, is delivered, via small hole, to the spring seat (38-3) located inside the sleeve (38-4) and the seat bore pressure increases up to "A" port pressure. The poppet (38-8) opposes to spring (38-2) by the force of the pressure exerted on the area difference between poppet seat's effective diameter and spring seat bore and keep the predetermined pressure.

When hydraulically braking, the piston (38-5) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (38-5) through the small hole in the poppet (38-8), sleeve (38-4) and piston (38-5) moves rightward until it touches the stopper in rear cover. In this while, the poppet (38-8) maintains "A" port pressure at comparatively low against the spring (38-2) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.



125LCR2TM27

5) BRAKE VALVE

(1) Structure

The brake valve portion mainly consists of the following parts:

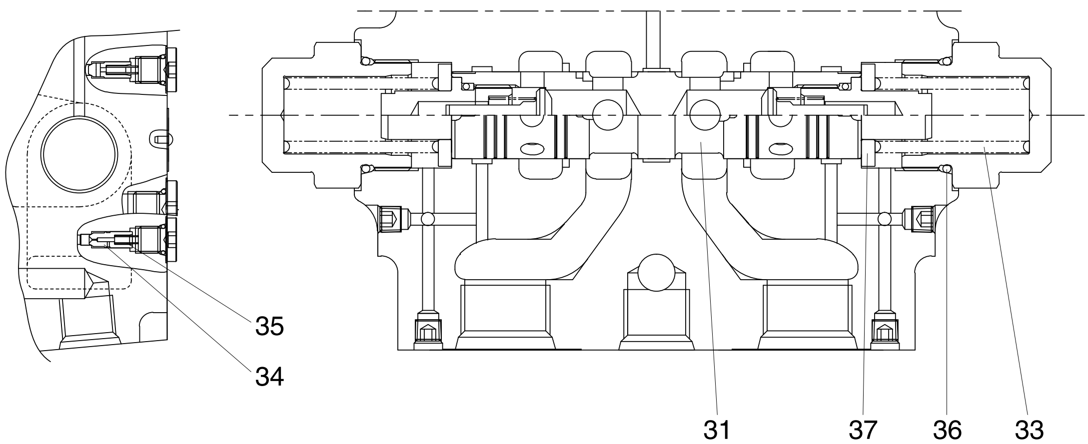
① **Spool**

By shifting the spool (31), the discharged oil from hydraulic motor is automatically shut off or restricted according to the condition and give the effect of holding, accelerating, stopping and counterbalance operations.

(See page 2-67, (2) Operation)

② **Check valve** (built in the spool)

This valve is located in the oil supplying passage to hydraulic motor, and at the same time functions to lock oil displacement. Therefore, this valve serves as not only a suction valve but also a holding valve for hydraulic motor.



125LCR2TM28

31	Main spool	34	Restrictor	36	O-ring
33	Spring	35	Restrictor spring	37	Spring seat

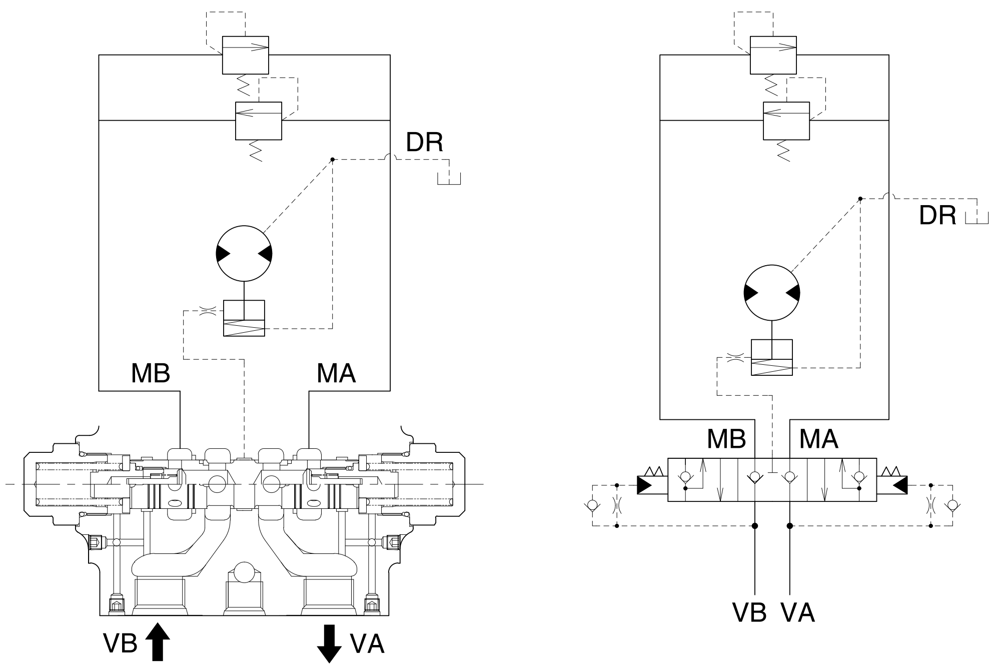
(2) Operation

① Holding operation

When the control valve is at neutral position, VA and VB ports are connected to the tank, and the spring (33) located on both spool ends holds the spool (31) at central position.
Therefore, the passages from VA to MA and VB to MB are closed, which result in closing MA and MB ports connected to hydraulic motor.

Since the passage to parking brake is connected to the tank line, the brake cylinder pressure is equal to the tank pressure and the brake is applied by the springs. Thus, the rotation of the motor is mechanically prevented.
If external torque is exerted on the motor shaft, the motor would not rotate as usual by this negative parking brake.

In case the brake should be released for some reason, pressure is built on MA or MB port. But, due to oil leakage inside hydraulic motor or so, high-pressure oil escapes from the closed circuit and motor rotates a bit. So, the cavitation tends to occur in the lower pressure side of the closed circuit. Then, the check valve, built in the spool (31), operates to avoid the cavitation and opens the passage from VA to MA or from VB to MB. Then the oil equivalent to the leakage is sucked from the tank line to the closed circuit.



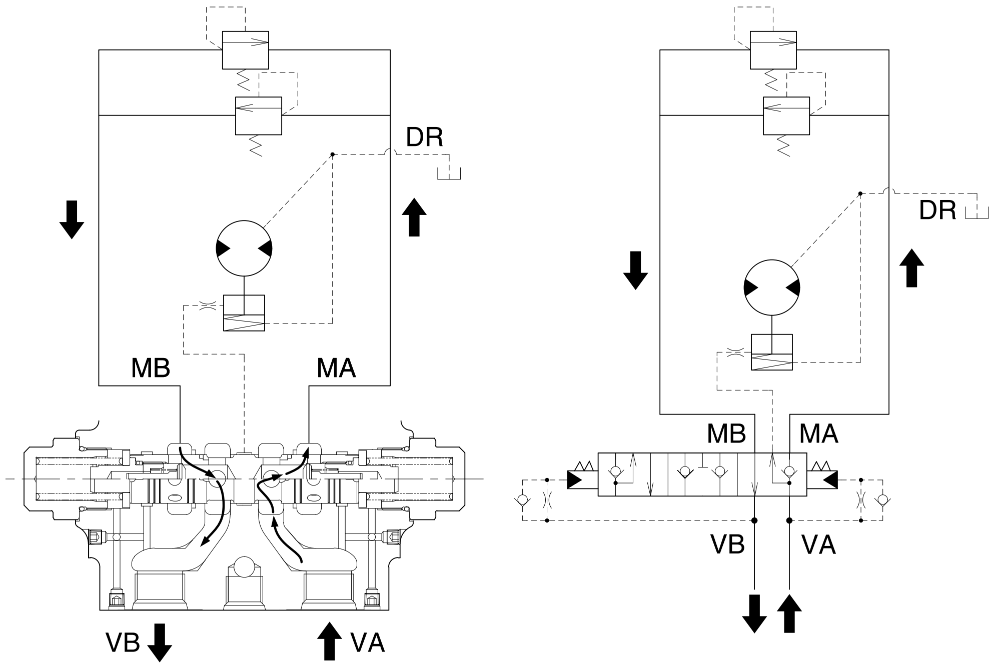
125LCR2TM29

② **Accelerating operation**

When VA and VB ports are connected respectively to pump and tank by operating the control valve, hydraulic oil from pump is forwarded through VA port to push open the check valve provided inside spool (31), and oil flows to motor via MA port to rotate the motor.

Therefore, the pressure increases and negative brake is released by the pressure supplied from pump. At the same time, the pressure of pilot chamber increases to push and move the spool (31) leftwards, overcoming the spring (33) force. Thus, the return line from MB to VB opens to rotate the motor.

In case inertia load is too big to start rotation, accelerating pressure reaches the set pressure of relief valve and high pressure oil is being relieved while the motor gains the rotational speed.
As the rotational speed goes up, the relieved volume decreases, and finally the motor rotates at a fixed speed.



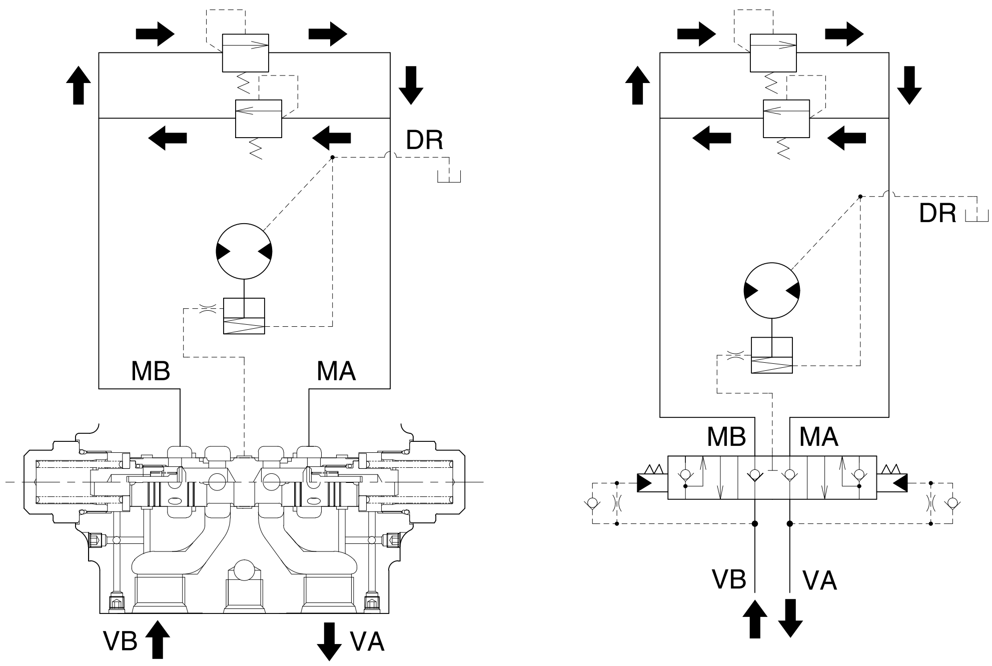
125LCR2TM30

③ Stopping operation

Returning the control valve to neutral position while running the motor, the oil supply is cut off and VA and VB ports are connected to the tank line. Then the pressure of the pilot chamber located on both spool ends become equal, and the spool (31) returns to the neutral position by spring (33) force. Thus, the passage from MA to VA is closed.

Owing to the inertia force of the load, the hydraulic motor tends to continue the rotation. Here, the motor functions as a pump and forwards the oil to MB port but the passage is blocked and MB port pressure increases. Then the relief valve opens to relieve the pressure and rotational speed decelerates and at last the motor stops.

Negative brake release pressure is gradually lowered due to the restrictor and finally the brake works and the motor is mechanically stopped.



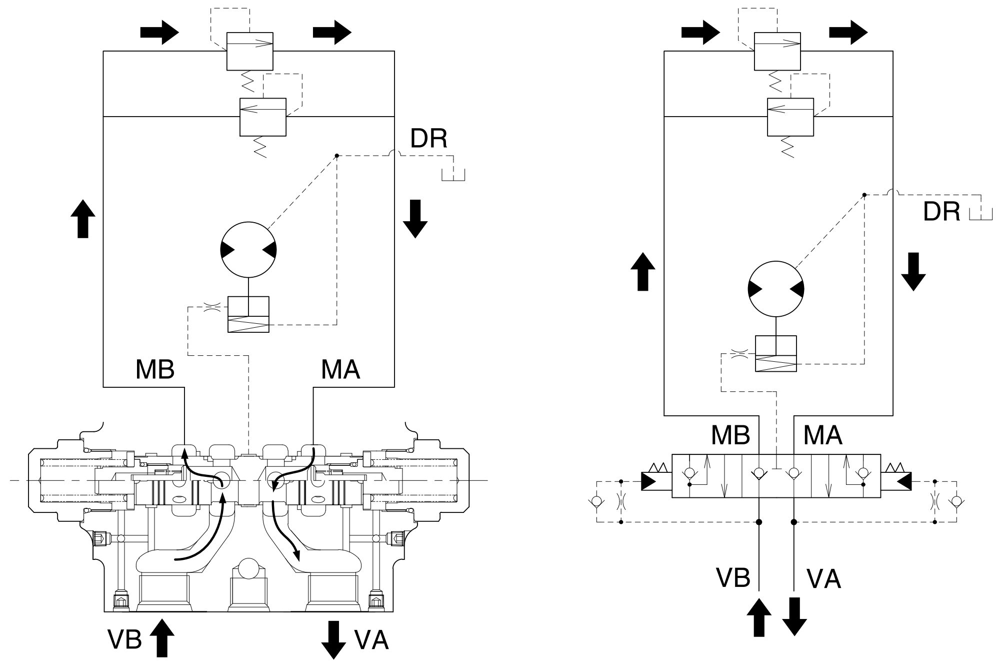
125LCR2TM31

④ Counterbalance operation

Counterbalance operation is required to decelerate slowly the hydraulic motor while absorbing inertia force.

In case the hydraulic oil is gradually decreased from pump to VB port, the drive shaft of hydraulic motor tends to rotate faster than that matched to the volume of oil supply.
Consequently, the pilot chamber pressure on MB to VB side decreases and the spring (33) force moves the spool (31) leftwards towards neutral position.
Therefore, the area of passage from MA to VA becomes smaller and the pressure on MA side rises due to increased resistance in the passage and the motor receives hydraulic braking effect.

If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and spool (31) moves rightwards to enlarge the area of passage from MA to VA. Therefore the braking effect becomes smaller and the rotational speed of motor is controlled to correspond to the volume of supplied oil.
In order to give stable counterbalance operation, the restrictors (34) are set in the pilot chamber to damp the spool (31) movement.
The parking brake is released during pressure adjusting action of the spool (31).



125LCR2TM32

6) REDUCTION GEAR

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force.

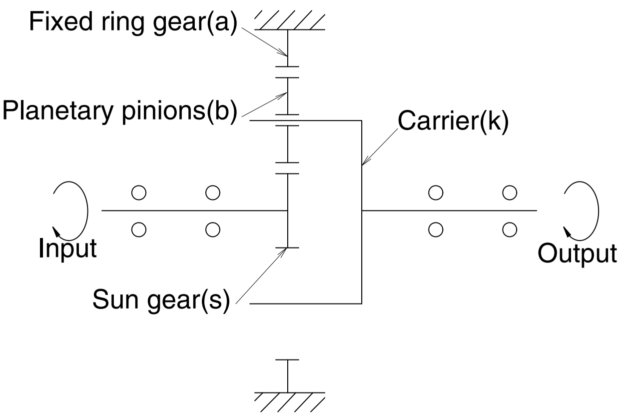
This reduction unit utilizes two stages, planetary reduction system.

Planetary reduction system consists of sun gear, planetary gears, (planetary) carriers, and ring gear.

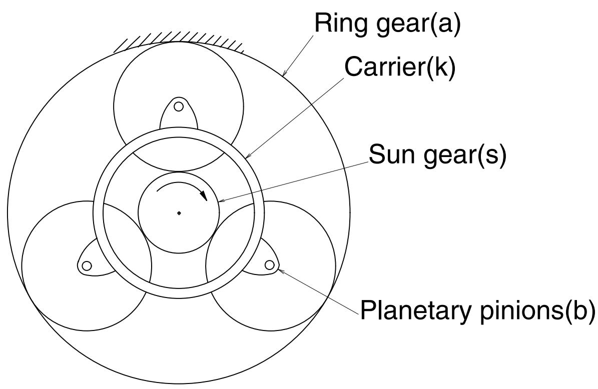
When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).

This movement is transferred to carrier (k) and deliver the torque.

This mechanism is called planetary gear mechanism.



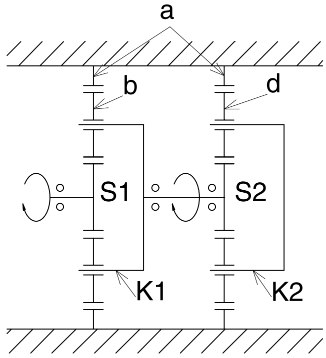
29072TM10



29072TM11

When the sun gear S1 is driven by input shaft, planetary action occurs among gears S1, a and b and revolution of gear b transfers the rotation of carrier K1 to second sun gear S2, and also evokes planetary action between gear S2, a and d.

This time, because carrier K2 is fixed to frame, gear d drives ring gear a and then ring gear a rotates to drive sprocket.



29072TM12

TRAVEL DEVICE (HIGH WALKER, TYPE 2)

1. CONSTRUCTION

A Hydraulic motor includes followings.

· Part of rotary generating turning force

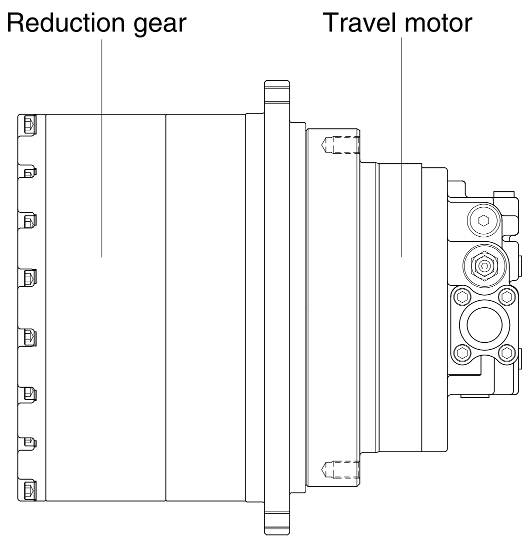
· Part of a valve of relief

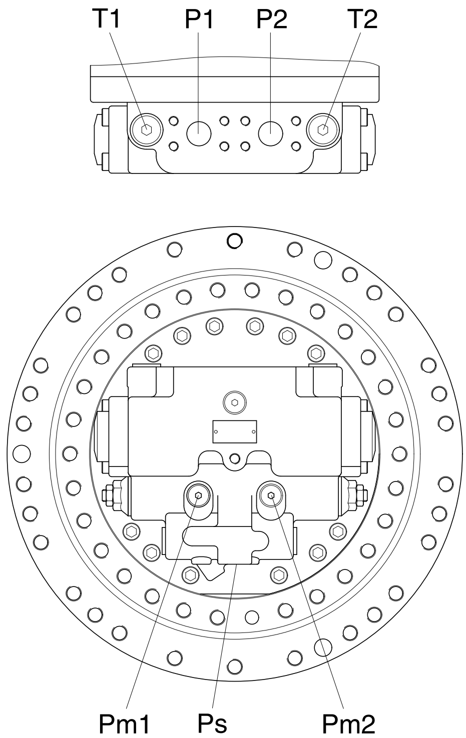
· Part of Brake

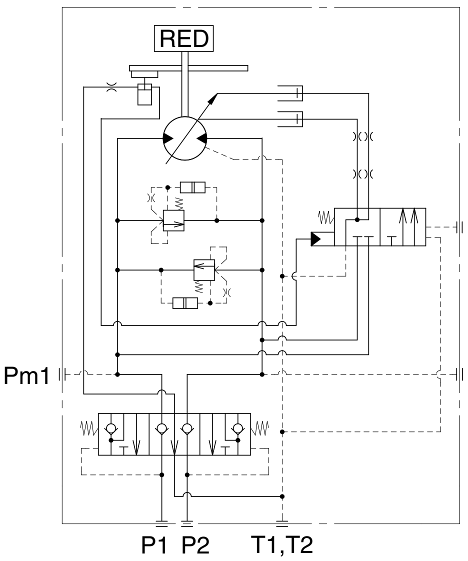
· Part of a valve of counterbalance

· Part of flowing changeover

· Part of auto changeover





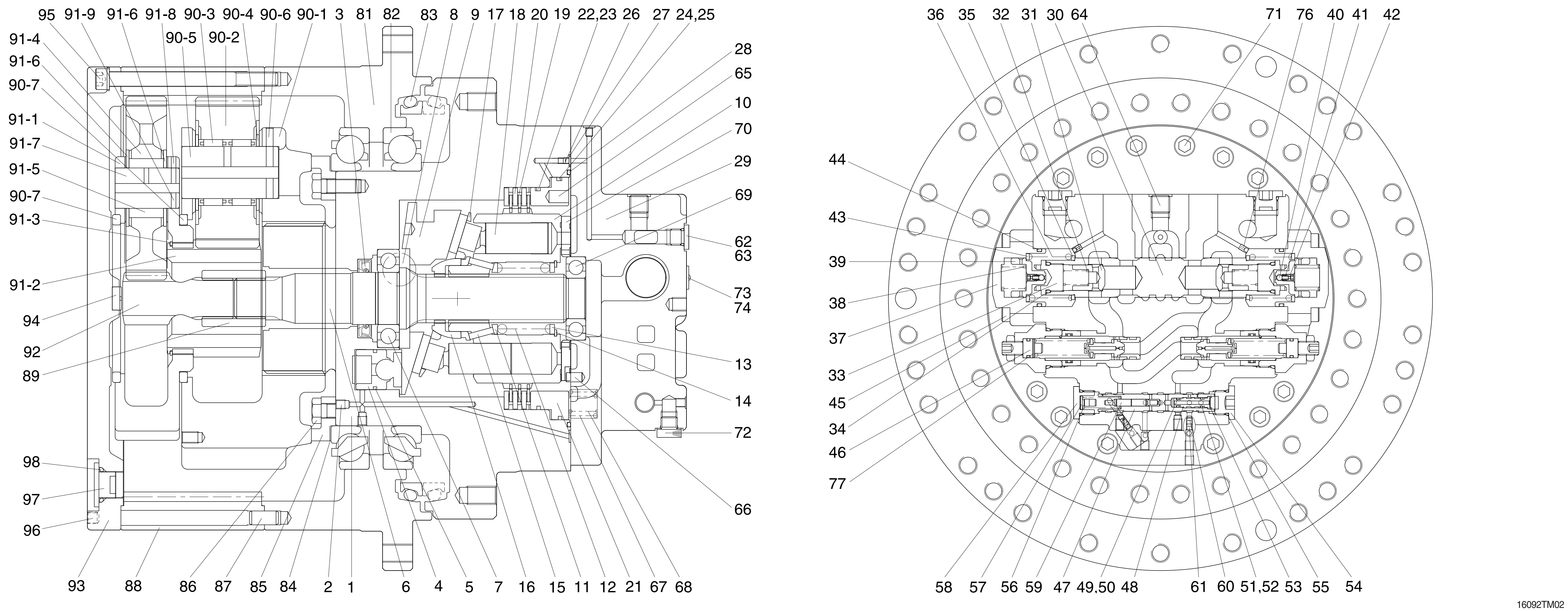


Port	Port name	Port size
P_1, P_2	Main port	SAE 4694psi 1"
Pm_1, Pm_2	Gauge port	PF 1/4
T_1, T_2	Drain port	PF 1/2
Ps	2 speed control port	PF 1/4

16092TM01

Hydraulic circuit

2. STRUCTURE



1 Shaft casing
2 Plug
3 Oil seal
4 Swash piston
5 Piston ring
6 Shaft
7 Bearing
8 Steel ball
9 Swash plate
10 Cylinder block
11 Spring seat
12 Spring
13 End plate
14 Snap ring
15 Pin
16 Ball guide
17 Set plate
18 Piston assy
19 Friction plate
20 Separate plate
21 Parking piston
22 O-ring
23 Back up ring
24 O-ring
25 Back up ring
26 Orifice
27 O-ring
28 O-ring
29 Rear cover
30 Spool
31 Check
32 Spring
33 Plug
34 O-ring
35 Spring seat
36 Spring
37 Cover
38 Spring
39 Spool
40 Steel ball
41 Spring
42 Plug
43 Spring seat
44 O-ring
45 Wrench bolt
46 Relief valve assy
47 Spool
48 Guide
49 O-ring
50 Back up ring
51 O-ring
52 Back up ring
53 Snap ring
54 plug
55 O-ring
56 Spring
57 Spring seat
58 Plug
59 Spool
60 Orifice
61 Orifice
62 Plug
63 O-ring
64 Plug
65 Pin
66 Pin
67 Spring
68 Spring
69 Bearing
70 Valve plate
71 Wrench bolt
72 Plug
73 Name plate
74 Rivet
75 Seal kit
76 Orifice
77 Shim
81 Housing
82 Main bearing
83 Floating seal
84 Shim
85 Retainer
86 Hex head bolt
87 Parallel pin
88 Ring gear
89 Coupling
90 Carrier assy No.2
90-1 Carrier No.2
90-2 Planetary gear No.2
90-3 Needle bearing No.2
90-4 Thrust washer
90-5 Pin No.2
90-6 Spring pin
90-7 Thrust ring
91 Carrier assy No.1
91-1 Carrier No.1
91-2 Sun-gear No.2
91-3 Retaining ring
91-4 Planetary gear No.1
91-5 Needle bearing No.1
91-6 Thrust washer
91-7 Pin No.1
91-8 Spring pin
91-9 Spring pin
92 Sun gear No.1
93 Cover
94 Pad
95 Hex socket head bolt
96 Hex socket Screw
97 Hydraulic plug
98 O-ring
99 Name plate

3. OPERATION

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (10) through rear cover (29) of motor, and valve plate (70).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston assy (18).

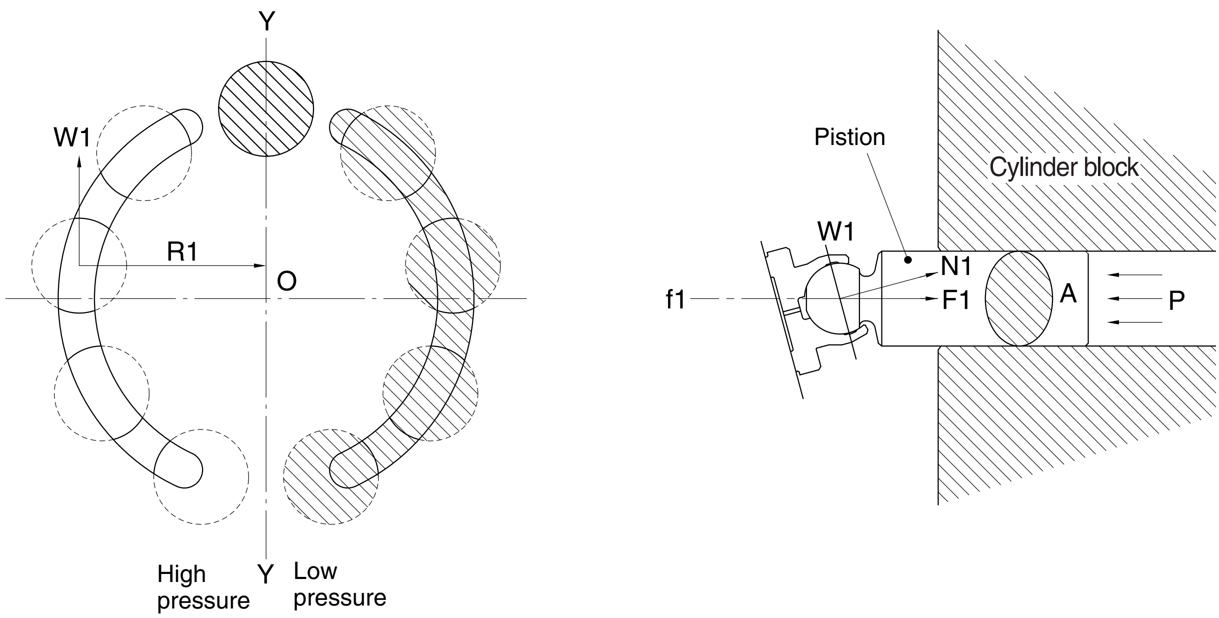
The high hydraulic can generate the force, F1 = P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate (09) of a tilt angle, α.

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

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

This torque transfers the turning force to a cylinder block (10) through a piston; because a cylinder block is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



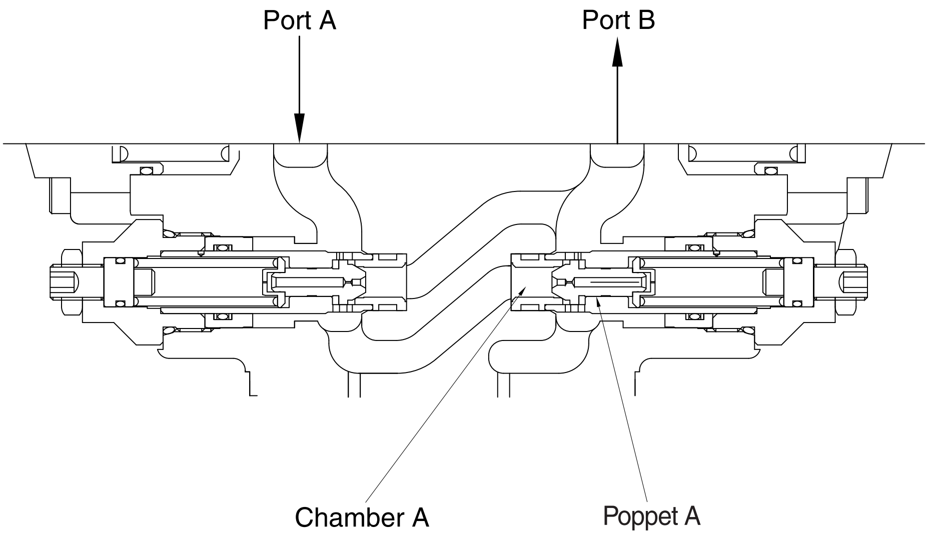
21078TM05

2) WORKING OF RELIEF VALVE

Relief valve carries on two functions of followings.

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

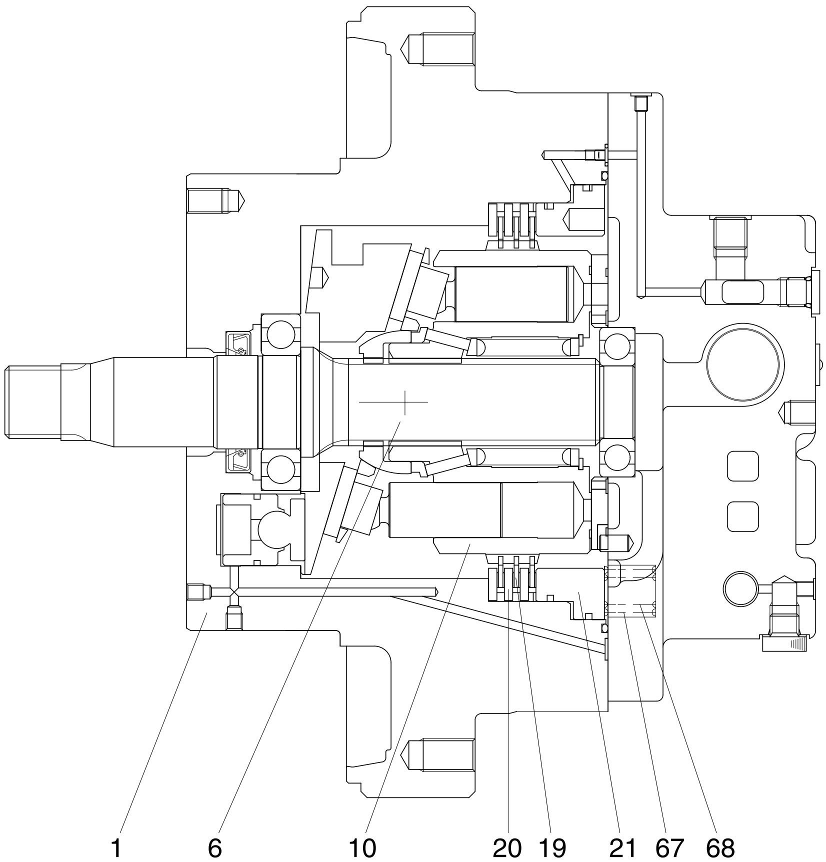
(2) In case of an inertia stopped, it forces an equipment stopped, according to generating the pressure of a brake on the projected side.
Room A is always connected with port A of a motor. If the pressure of port is increased, press poppet A. And if it is higher than the setting pressure of a spring,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



21078TM06A

3) WORKING OF NEGATIVE BRAKE

When the operating pressure is supplied to the brake piston (21) through the spool (simultaneous peripheral operation online) built in the shaft casing (1), the negative brake is released.
When the pressure does not work, the brake always runs.
The force of a brake is generated by the frictional force among a separate plate (20) fixed by shaft casing, parking piston (21) and a frictional plate (19) connected through spline outside a cylinder block (10).
When a pressure does not work on the part of piston, brake spring presses brake piston; oil in a brake room flows into the drain of a motor through an orifice; in that time, brake piston compresses a frictional plate and a detached plate in the middle of shaft casing (1) and brake piston (21) according to the force that presses 10 pieces of brake springs (67, 68); finally, it makes a frictional force.
This frictional force helps the brake fixing a turning shaft (6) connected by a cylinder and spline operated.

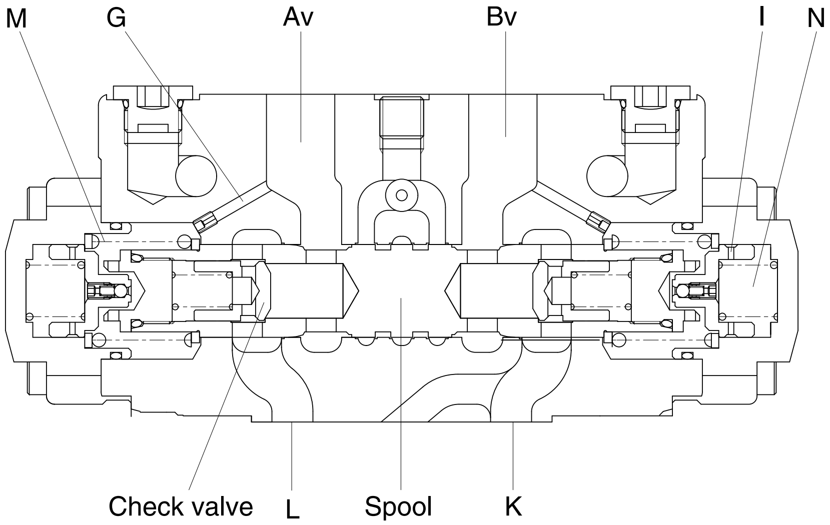


21092TM07

4) COUNTERBALANCE VALVE

Av port is connected to a hydraulic pump; Bv port is connected to a tank.

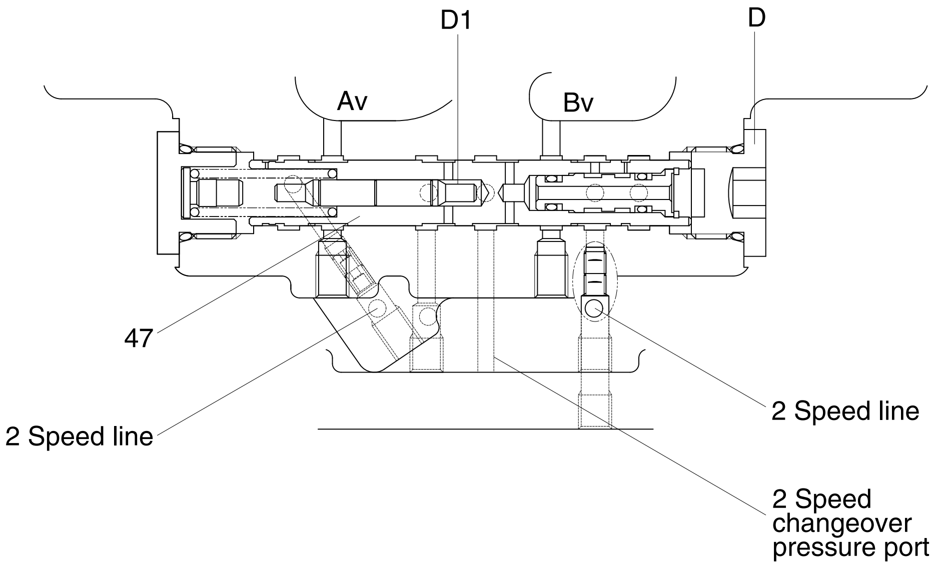
An oil supplied from a hydraulic pump presses check valve and flows into L port. It makes a hydraulic motor circulated. The oil pressure out of a pump is increased and transferred to spring room M through the path G because negative brake is working on. When the pressure of room M exceeds the force of spring that keeps spool at its neutral position, the spool begins to move the right side.
An oil in room N is sent to room M by orifice I and discharged from G line to a tank.
Then the spool moves to the right and the oil flows from K to Bv.



21078TM08

5) WORKING DESCRIPTION OF AUTOMATIC SWITCH (AT NORMAL SPEED)

Due to no pressure on pilot now, spool (47) is not working.



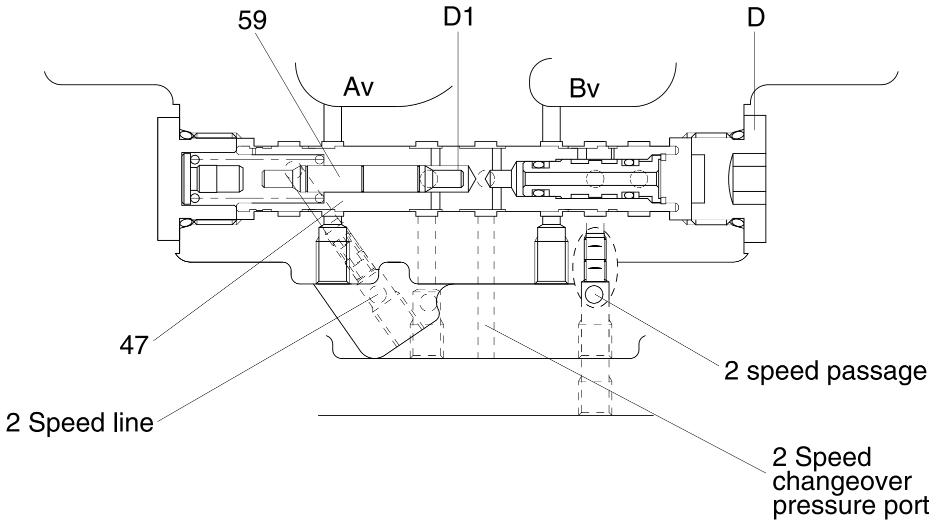
(Normal speed)

21078TM09

6) WORKING DESCRIPTION OF AUTOMATIC SWITCH (AT HIGH SPEED)

At normal speed, once the hydraulic oil which is through the inner path of spool (47) flows into high speed switching pressure port (the pressure of external pilot : Pi = 35 kgf/cm^2) spool (47) moves from right to left.

At high speed, turning pressure of motor (D1) is over 250 kgf/cm^2, when the power forcing to spool (59) (pressure, P1) is stronger than spool (47) and spool (59) is pushed out, after then spool (47) moves from left to right. So it is switched.



(High speed)

21078TM10

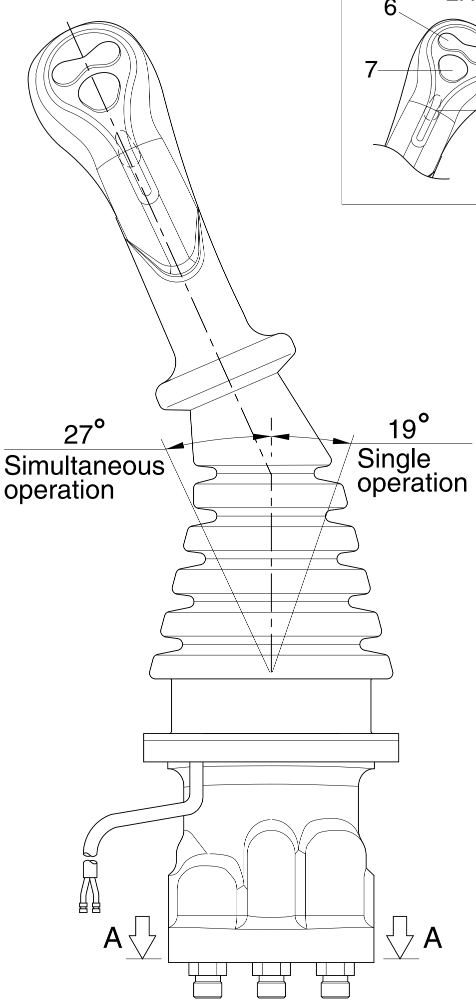
GROUP 5 RCV LEVER

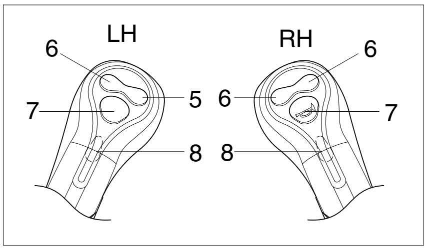
1. STRUCTURE

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.

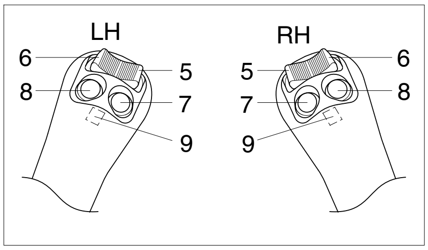
※ **Refer to the parts manual for the types of the RCV lever.**

1) TYPE M1, M10





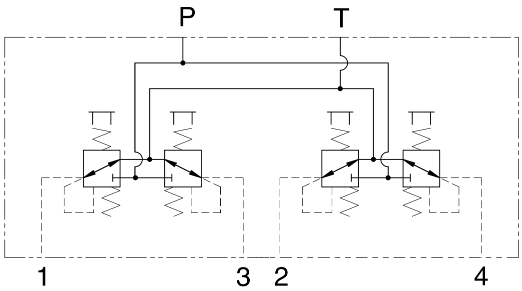
TYPE M1



TYPE M10

Switches

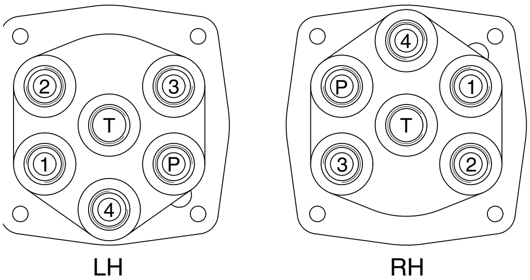
Type	No.	LH	RH
M1	5	Null	Null
	6	Null	Null
	7	One touch decel	Horn
	8	Power boost	Breaker
M10	5	CW rotation	2-way open
	6	CCW rotation	2-way close
	7	One touch decel	Null
	8	Null	Horn
	9	Power boost	Breaker



Hydraulic circuit

Pilot ports

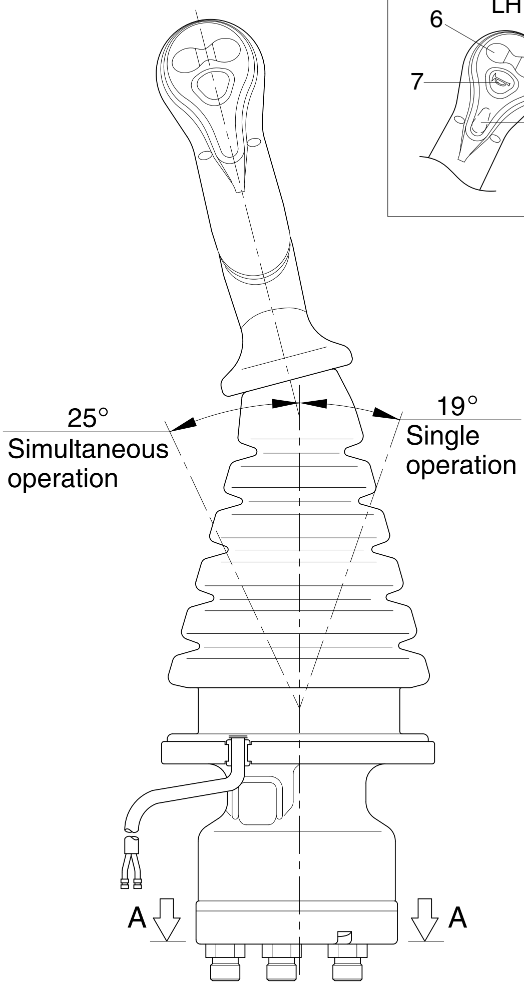
Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 3/8
T	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	
2	Arm out port	Boom up port	
3	Right swing port	Bucket in port	
4	Arm in port	Boom down port	

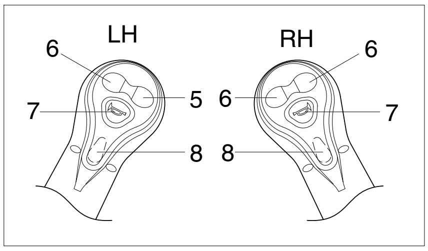


VIEW A-A

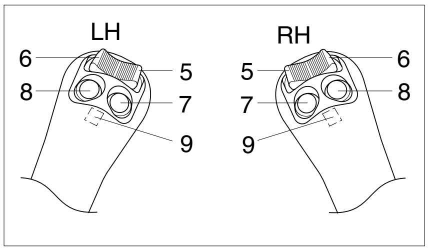
160A2RL01

2) TYPE M11, M12





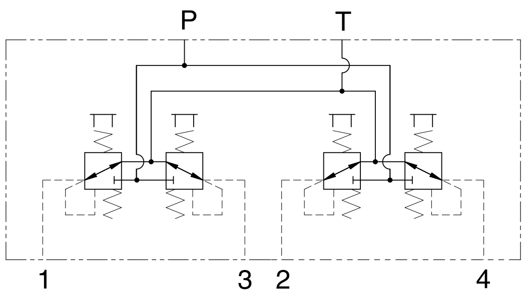
TYPE M12



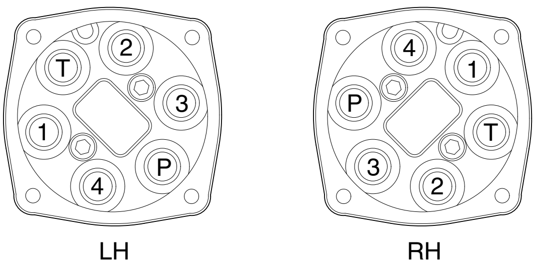
TYPE M11

Switches

Type	No.	LH	RH
M12	5	Null	Null
	6	Null	Null
	7	One touch decel	Horn
	8	Power boost	Breaker
M11	5	CW rotation	2-way open
	6	CCW rotation	2-way close
	7	One touch decel	Null
	8	Null	Horn
	9	Power boost	Breaker



Hydraulic circuit



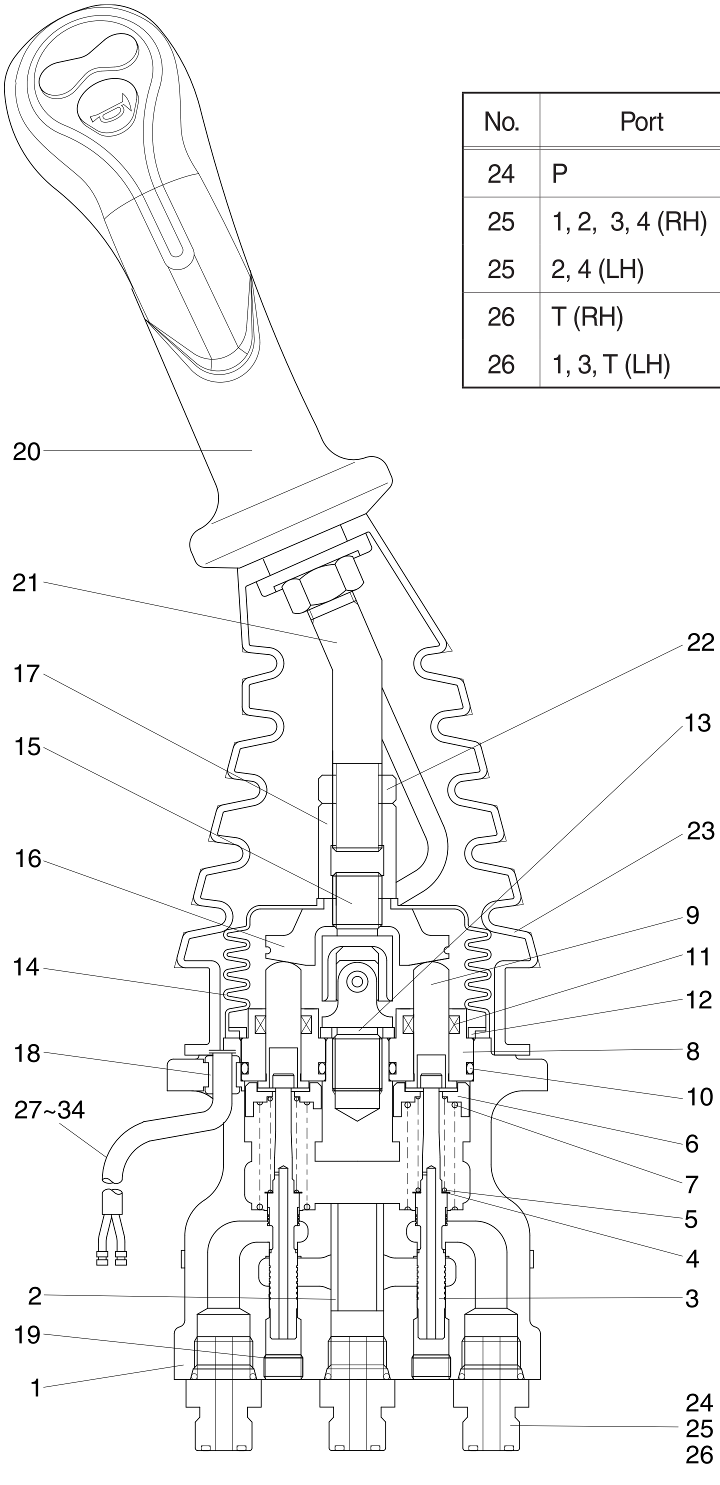
VIEW A-A

Pilot ports

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 out port	Boom up port	
3	Right swing port	Bucket in port	
4	Arm in port	Boom down port	

160A2RL05

3) CROSS SECTION



No.	Port
24	P
25	1, 2, 3, 4 (RH)
25	2, 4 (LH)
26	T (RH)
26	1, 3, T (LH)

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

210S2RL06

Item numbers are based on the type M1.

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, return spring (7), spring seat (6) 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 (9) 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.

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

Item numbers are based on the type M1.

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 (9) is inserted and can slide in the plug (8).

For the purpose of changing the displacement of the push rod through the swash plate (16) and adjusting nut (17) are provided the handle assy (20) that can be tilted in any direction around the fulcrum of the universal joint (15) center.

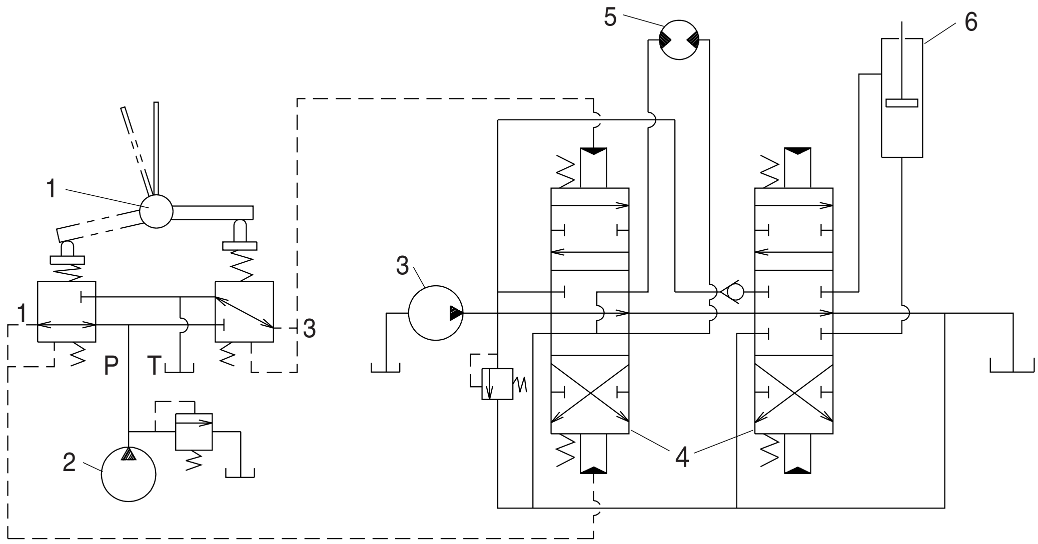
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

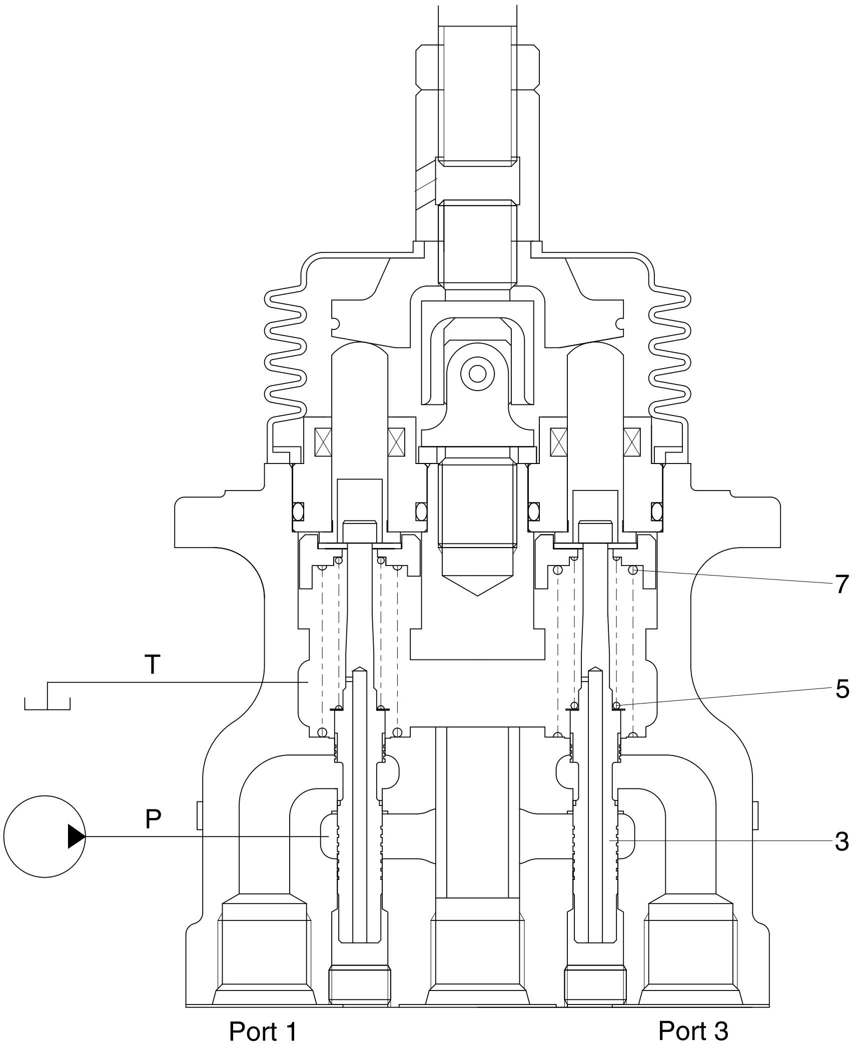
The diagram shown below is the typical application example of the pilot valve.



2-70

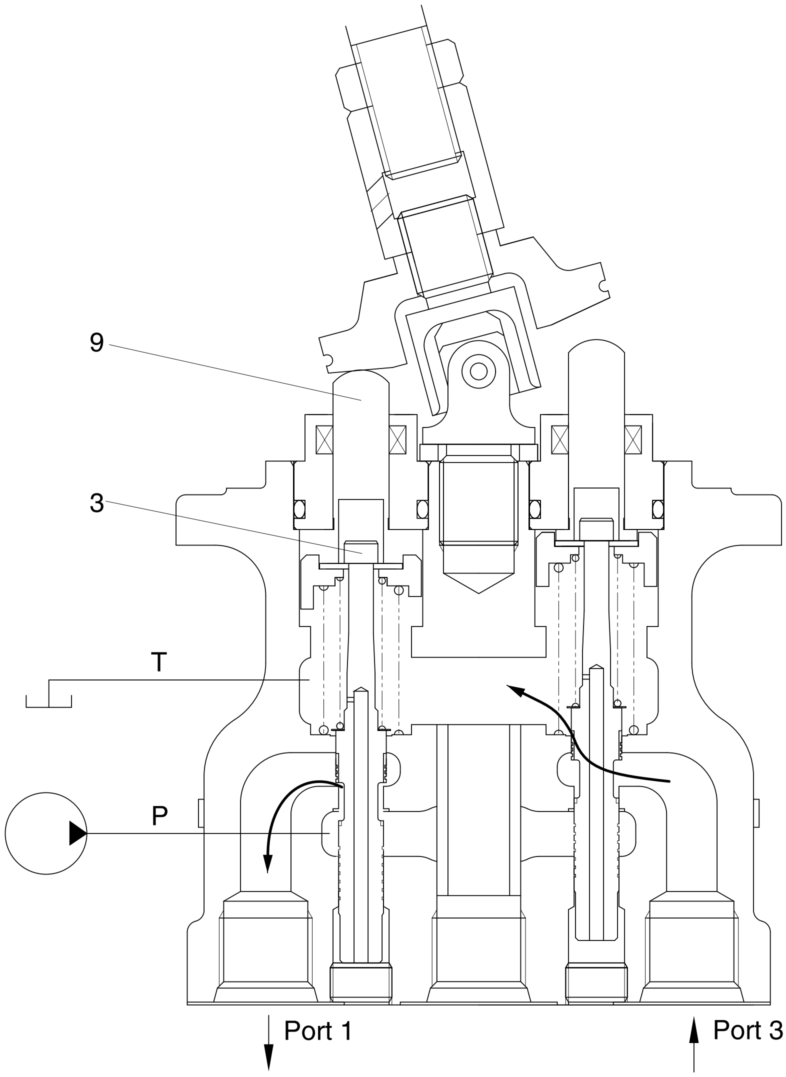
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where handle is in neutral position



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 (7) 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



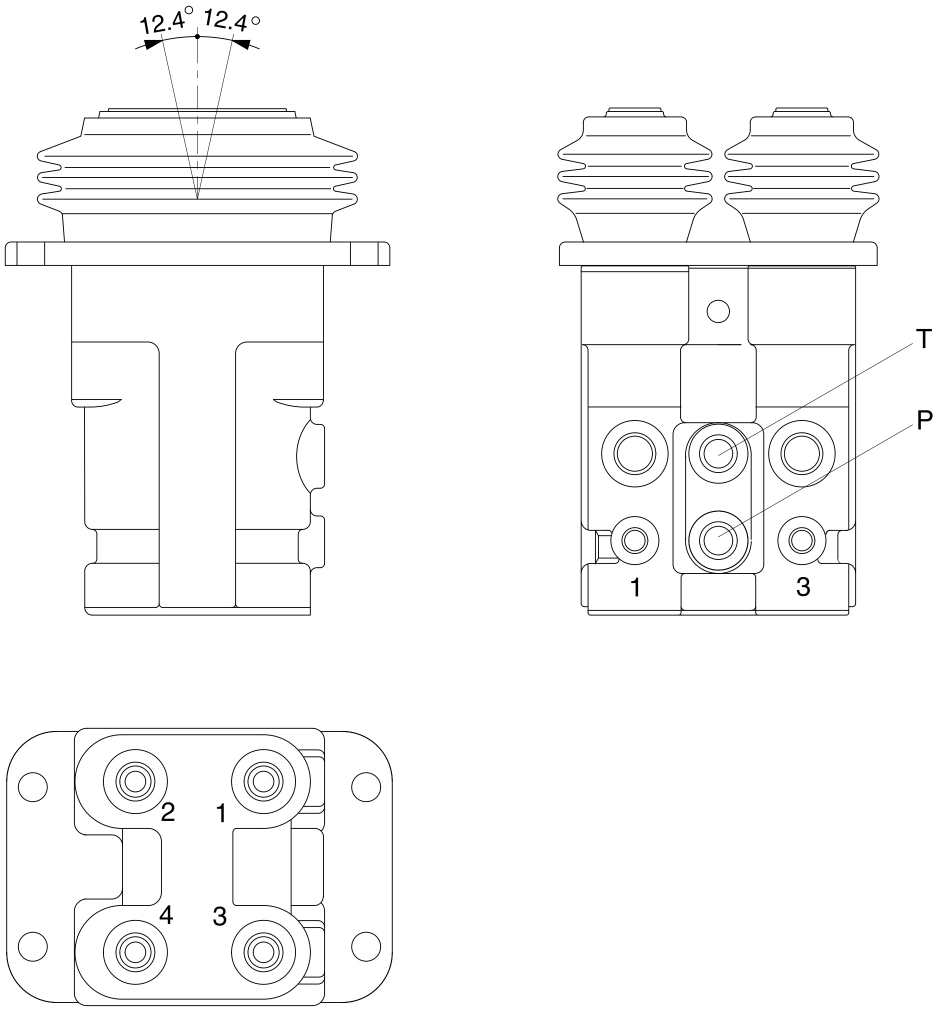
300L2RL04

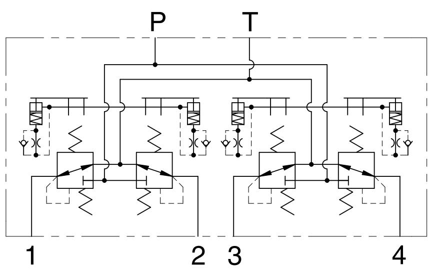
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, 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)	

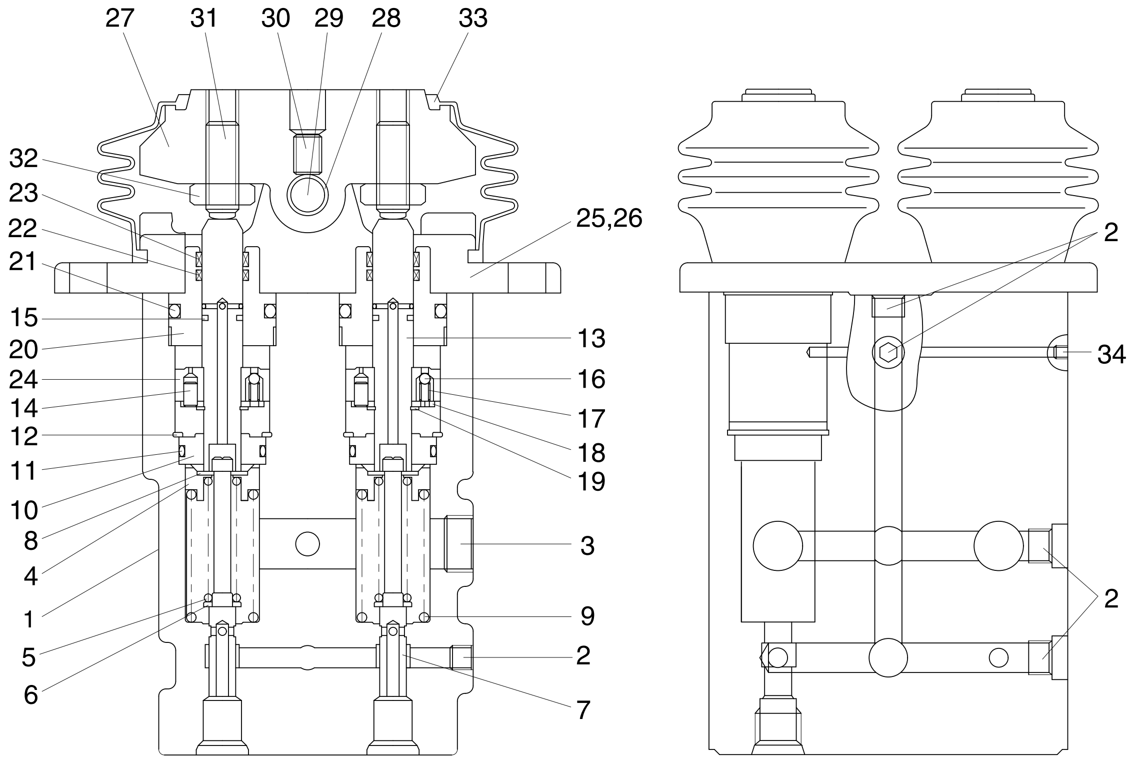
480A2RP01

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 kit (7), spring (5) for setting secondary pressure, return spring (9), stopper (8), and spring seat (6). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 6.3±1 to 24.9±1.5 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (13) 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.



480A2RP02

1	Body	13	Push rod	25	Cover
2	Plug	14	Spring pin	26	Socket bolt
3	Plug	15	Seal	27	Cam
4	Spring seat	16	Steel ball	28	Bushing
5	Spring	17	Spring	29	Cam shaft
6	Spring seat	18	Plate	30	Set screw
7	Spool kit	19	Snap ring	31	Set screw
8	Stopper	20	Plug	32	Hex nut
9	Spring	21	O-ring	33	Bellows
10	Rod guide	22	Oil seal	34	Expand
11	O-ring	23	Dust seal	36	Cap
12	Snap ring	24	Piston		

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (7) 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 (5) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (13) is inserted and can slide in the plug (20).

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.

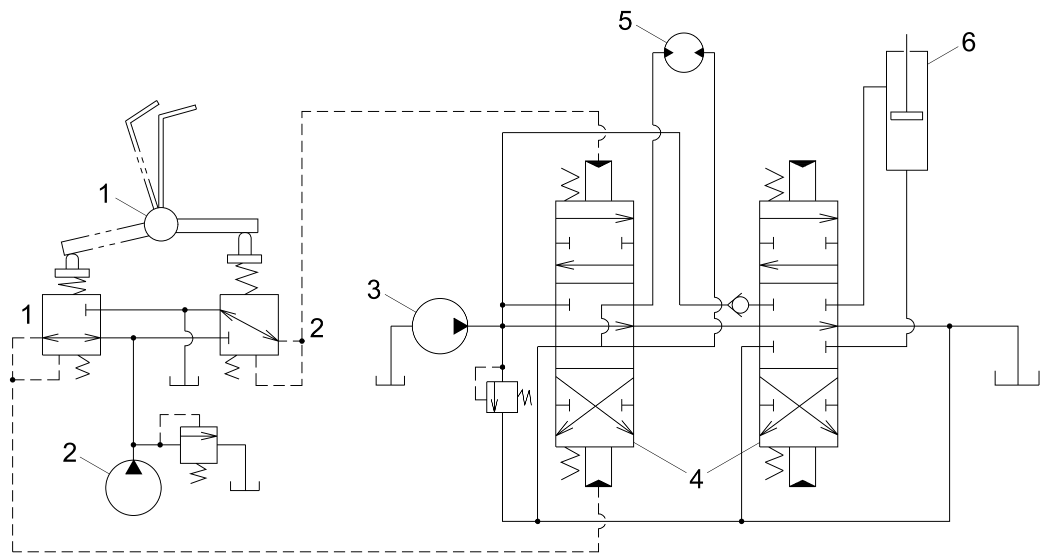
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

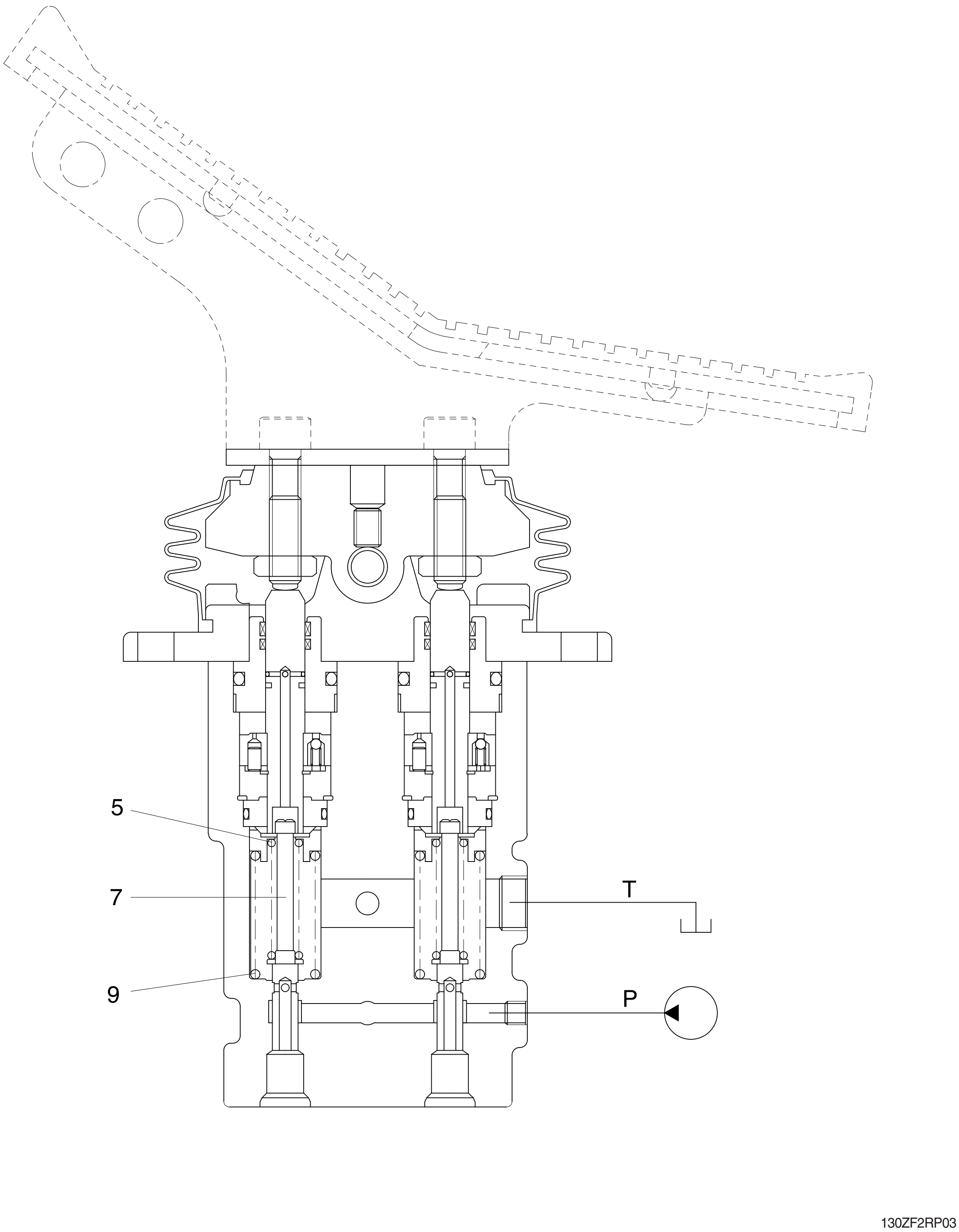
The diagram shown below is the typical application example of the pilot valve.



36072SF01

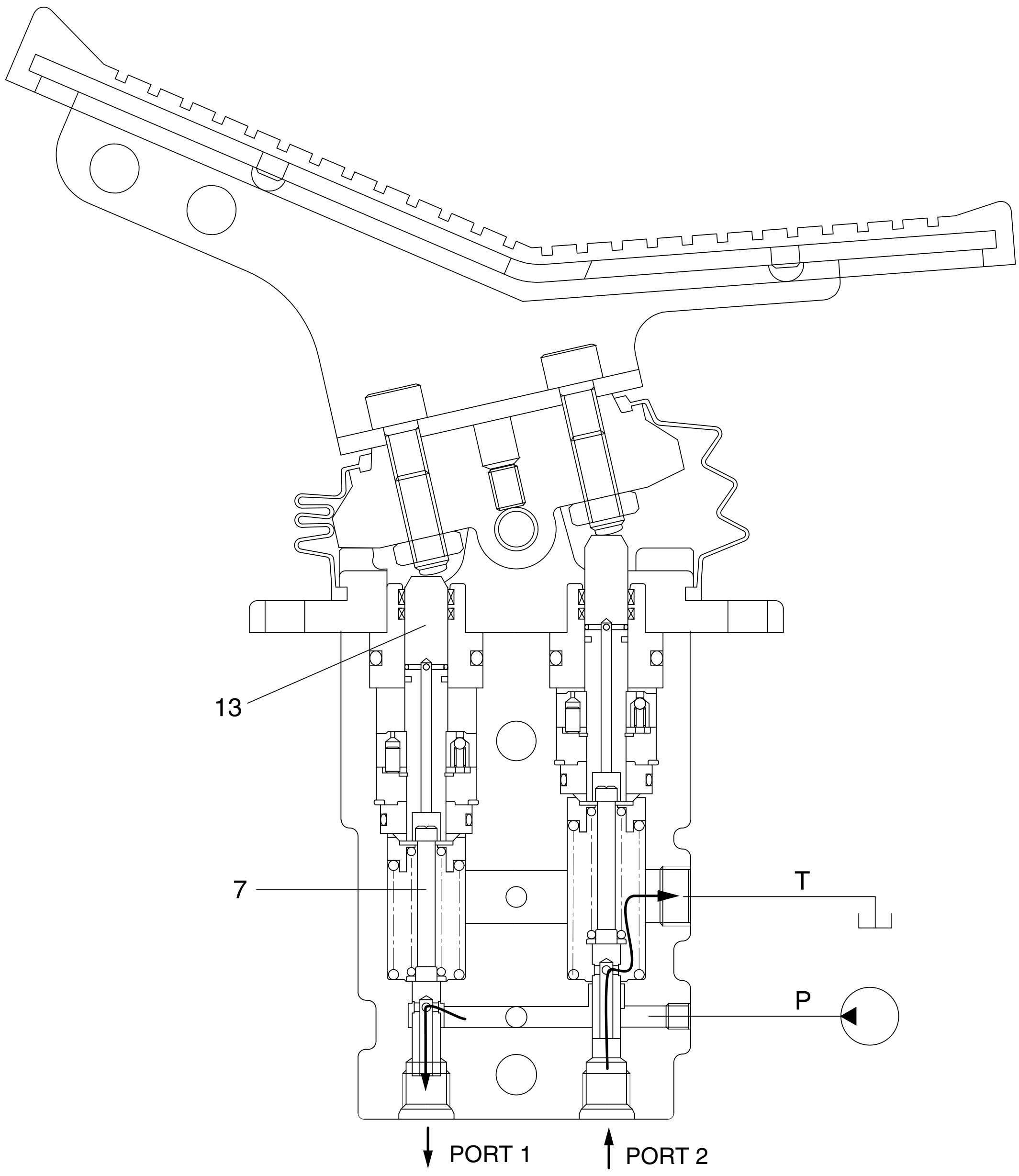
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where pedal is in neutral position



The force of the spring (5) that determines the output pressure of the pilot valve is not applied to the spool kit (7). Therefore, the spool is pushed up by the spring (9) to the position of 1 and port 2. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where pedal is tilted



220F2RP04

When the push rod (13) is stroked, the spool kit (7) moves downwards.

Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.

When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.

In this manner the secondary pressure is kept at the constant value.

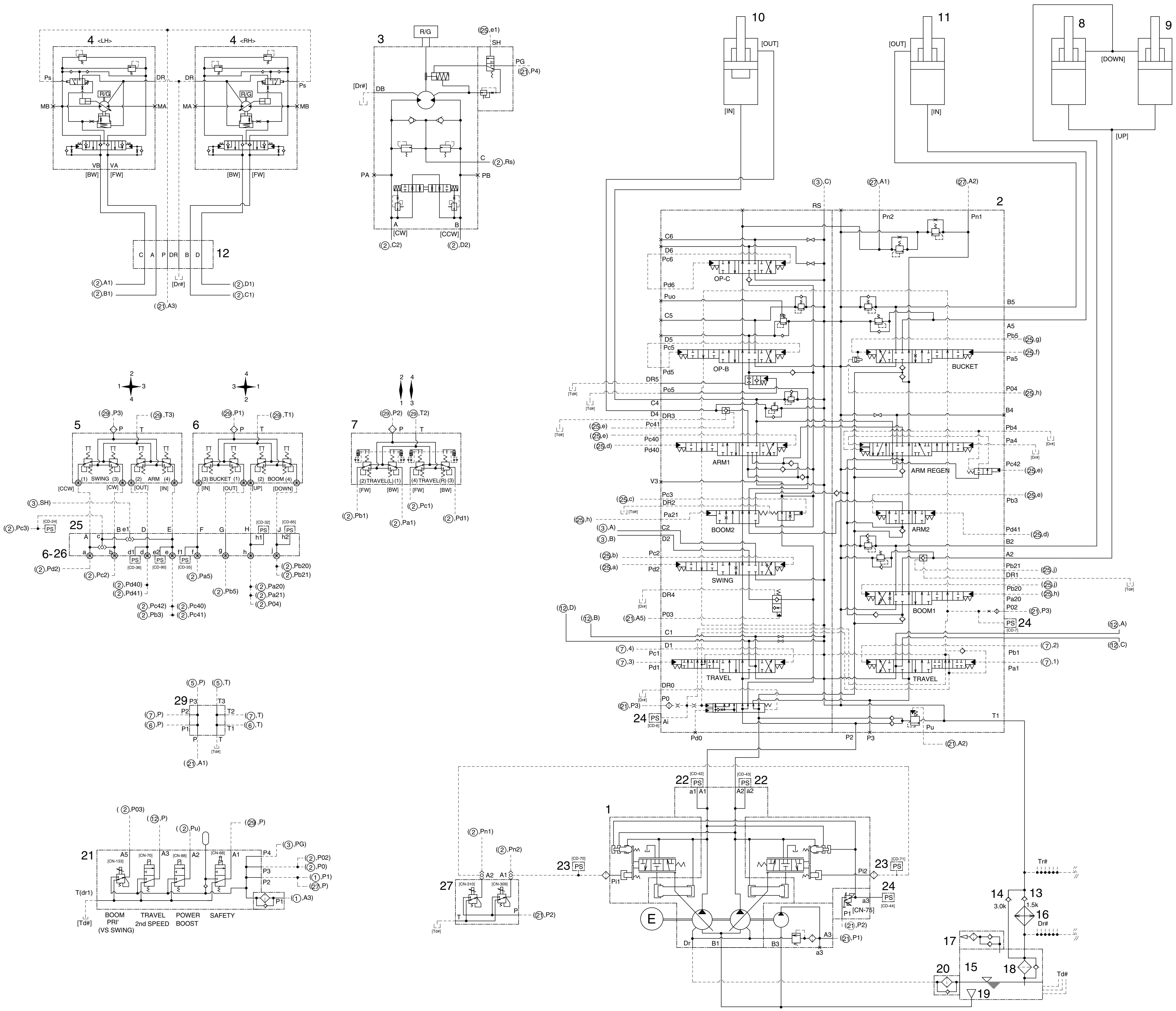
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.

SECTION 3 HYDRAULIC SYSTEM

Group 1 Hydraulic Circuit 3-1
Group 2 Main Circuit 3-3
Group 3 Pilot Circuit 3-6
Group 4 Single Operation 3-15
Group 5 Combined Operation 3-27

GROUP 1 HYDRAULIC CIRCUIT

1. HYDRAULIC CIRCUIT (1/2)

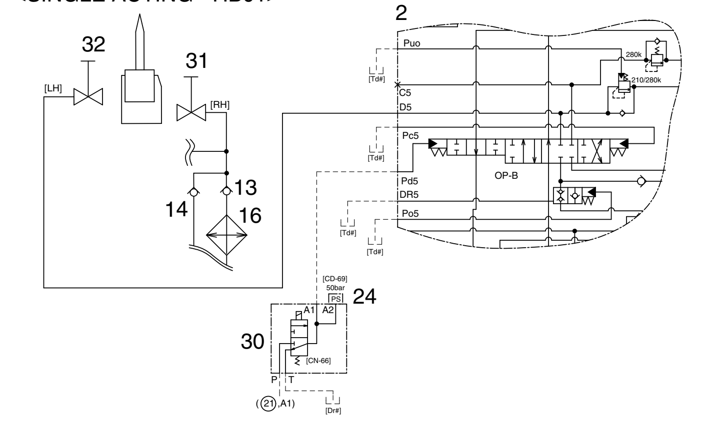


1	Main pump
2	Main control valve
3	Swing motor
4	Travel motor
5	RCV lever (LH)
6	RCV lever (RH)
7	RCV pedal
8	Boom cylinder (LH)
9	Boom cylinder (RH)
10	Arm cylinder
11	Bucket cylinder
12	Turning joint
13	Return check valve
14	Return check valve
15	Hydraulic tank
16	Oil cooler
17	Air breather
18	Return filter w/bypass valve
19	Strainer
20	Drain filter
21	4-cartridge valve
22	Pressure sensor
23	Pressure sensor
24	Pressure sensor
25	Terminal block
26	Last guard filter
27	2-EPPR valve
29	Cross assy

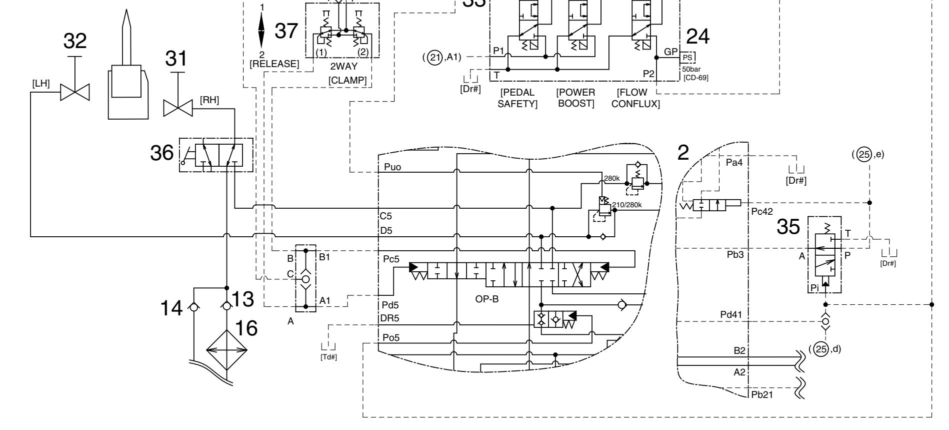
30K4-37200-03 1OF2

2. HYDRAULIC CIRCUIT (2/2)

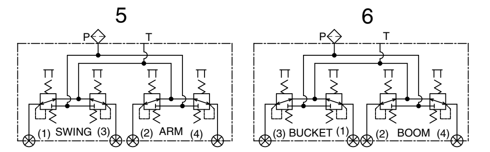
<SINGLE ACTING - HB01>



<DOUBLE ACTING With PEDAL - HB07>

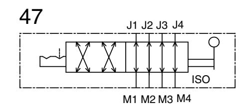


<RCV LEVER(LH/RH) OPTION >



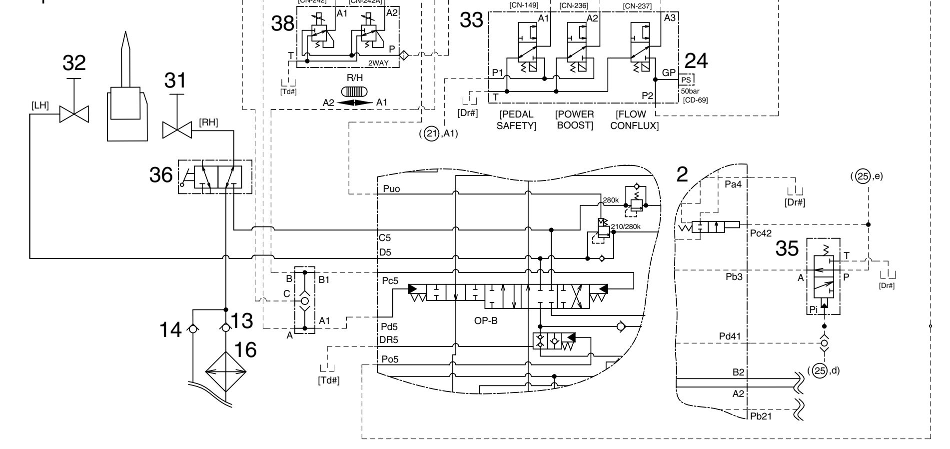
PART NO.				OPTION CODE	REMARKS	
LH		RH			PRODUCER	MODULATION
5	31K4-21012	6	31K4-21022	ERR00, EJA01	EATON	X
	31K4-21133		31K4-21143	ERR01, EJA01	EATON (DAEHYUN)	RH/LH
	31K6-21410		31K6-21420	ERR00, EJA21	KPM (DAEHYUN)	X
	31K6-21430		31K6-21440	ERR01, EJA21	KPM (DAEHYUN)	RH/LH

<PATTERN CHANGE-PV01>

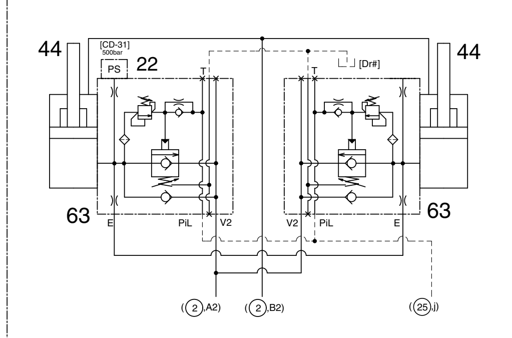


FROM		TO	
ITEM	PORT	ITEM	PORT
5	2	47	J1
	4		J3
6	2		J4
	4		J2
47	M1	25	D
	M2		J
	M3		E
	M4		H

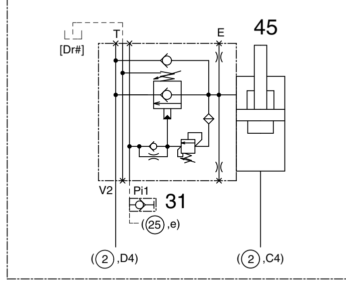
<DOUBLE ACTING With Proportional RCV - HB17>



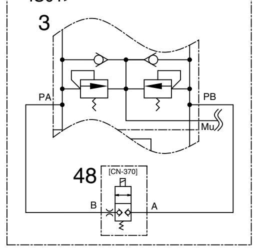
<BOOM SAFETY LOCK>



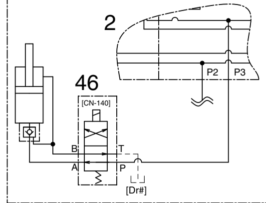
<ARM SAFETY LOCK>



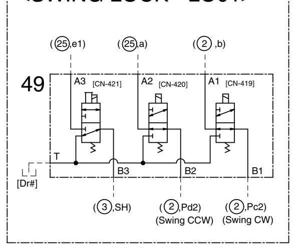
<FINE SWING CONTROL - IS01>



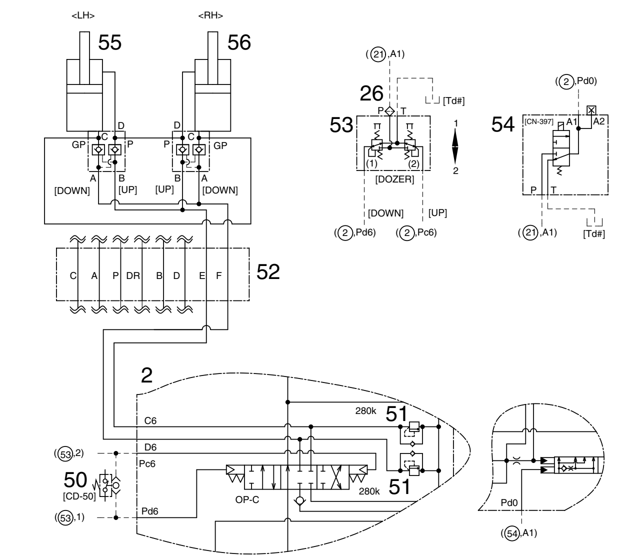
<QUICK COUPLER - HQ01>



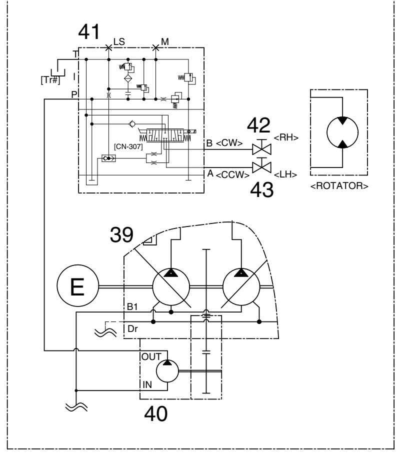
<SWING LOCK - LO01>



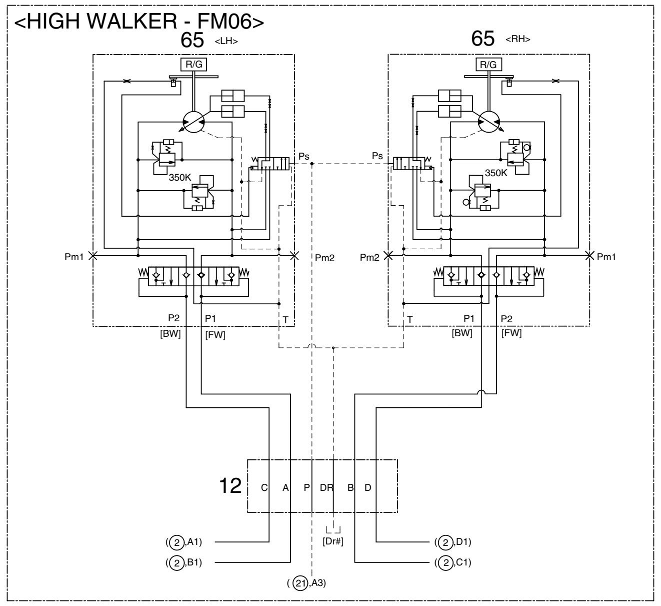
<DOZER - FM04>



<ROTATING - HR02>



<HIGH WALKER - FM06>



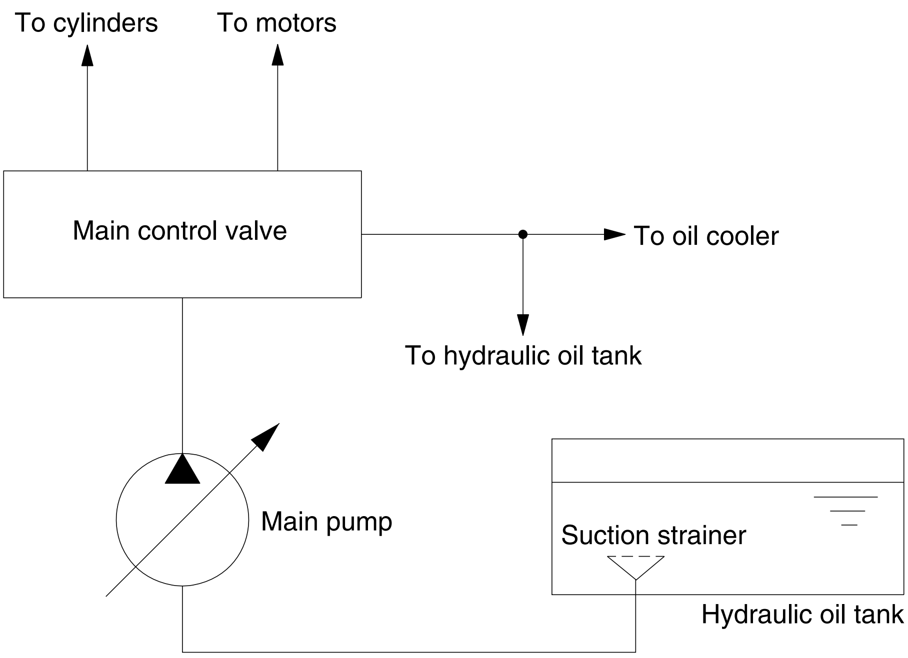
2 Main control valve
5 RCV lever (LH)
6 RCV lever (RH)
13 Check valve
14 Check valve
16 Oil cooler
22 Pressure sensor
24 Pressure sensor
26 Last guard filter
30 Solenoid valve (option)
31 Stop valve (option)
32 Stop valve (option)
33 Solenoid valve (option)
34 Shuttle valve (option)
35 Pilot selector valve (option)
36 3-way valve (option)
37 2-way pedal (option)
38 EPPR valve (option)
39 Main pump (option)
40 Gear pump (option)
41 Proportional valve (option)
42 Stop valve (option)
43 Stop valve (option)
44 Boom safety valve (option)
45 Arm safety vavle (option)
46 Solenoid valve (option)
47 Pattern change valve (option)
48 Solenoid valve (option)
49 3-solenoid valve (option)
51 Pressure switch (option)
52 Turning joint (option)
53 Dozer lever (option)
54 Solenoid valve (option)
55 Dozer cylinder-LH (option)
56 Dozer cylinder-RH (option)

30K4-37200-03 2OF2

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

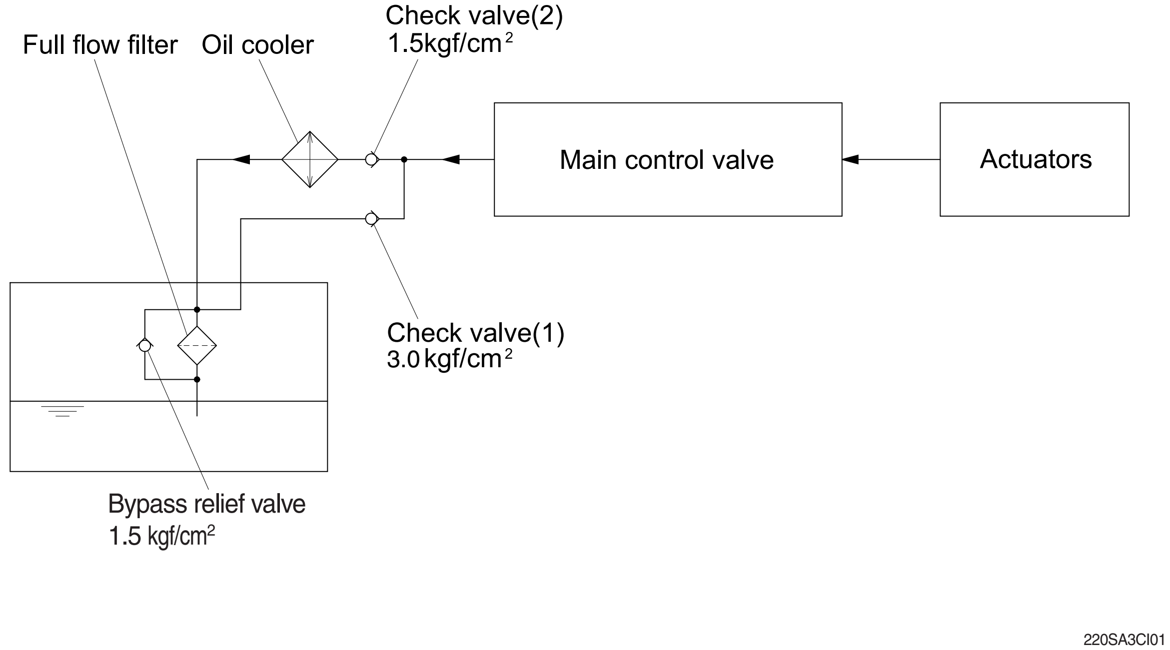


140L3CI01

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 main control valve.
The main control valve controls the hydraulic functions.
The return oil from the actuators flows to the hydraulic tank through the main control valve and the oil cooler.

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

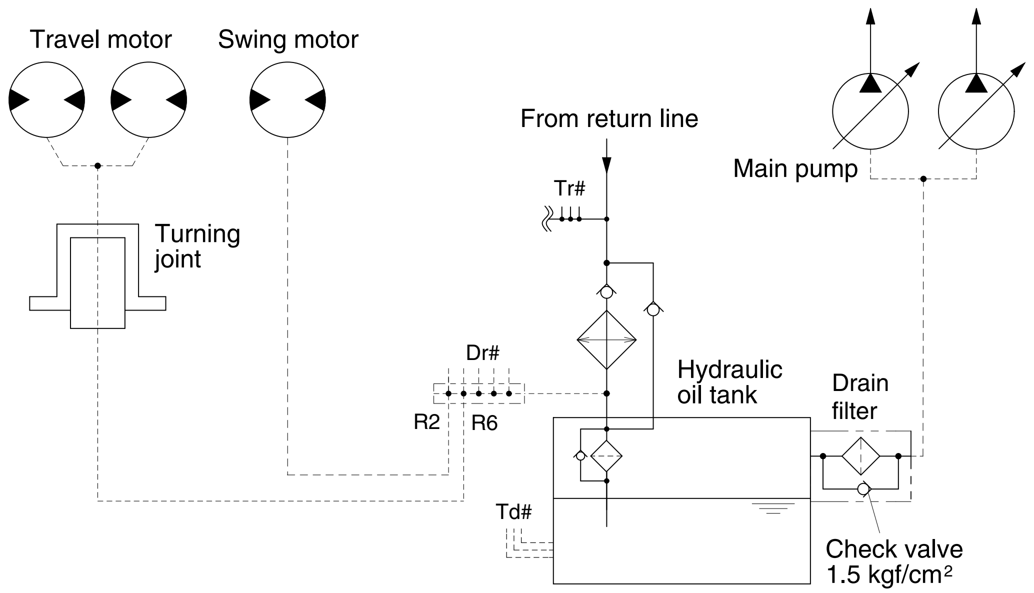
2. RETURN CIRCUIT



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

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

3. DRAIN CIRCUIT



140SA3CI02

Besides internal leaks from the motors and main pump, the oil for lubrication circulates. These oil have to be fed to the hydraulic tank passing through drain filter or return filter.
When the drain oil pressure exceed 1.5 kgf/cm^2 (21 psi), the oil returns to the hydraulic tank directly.

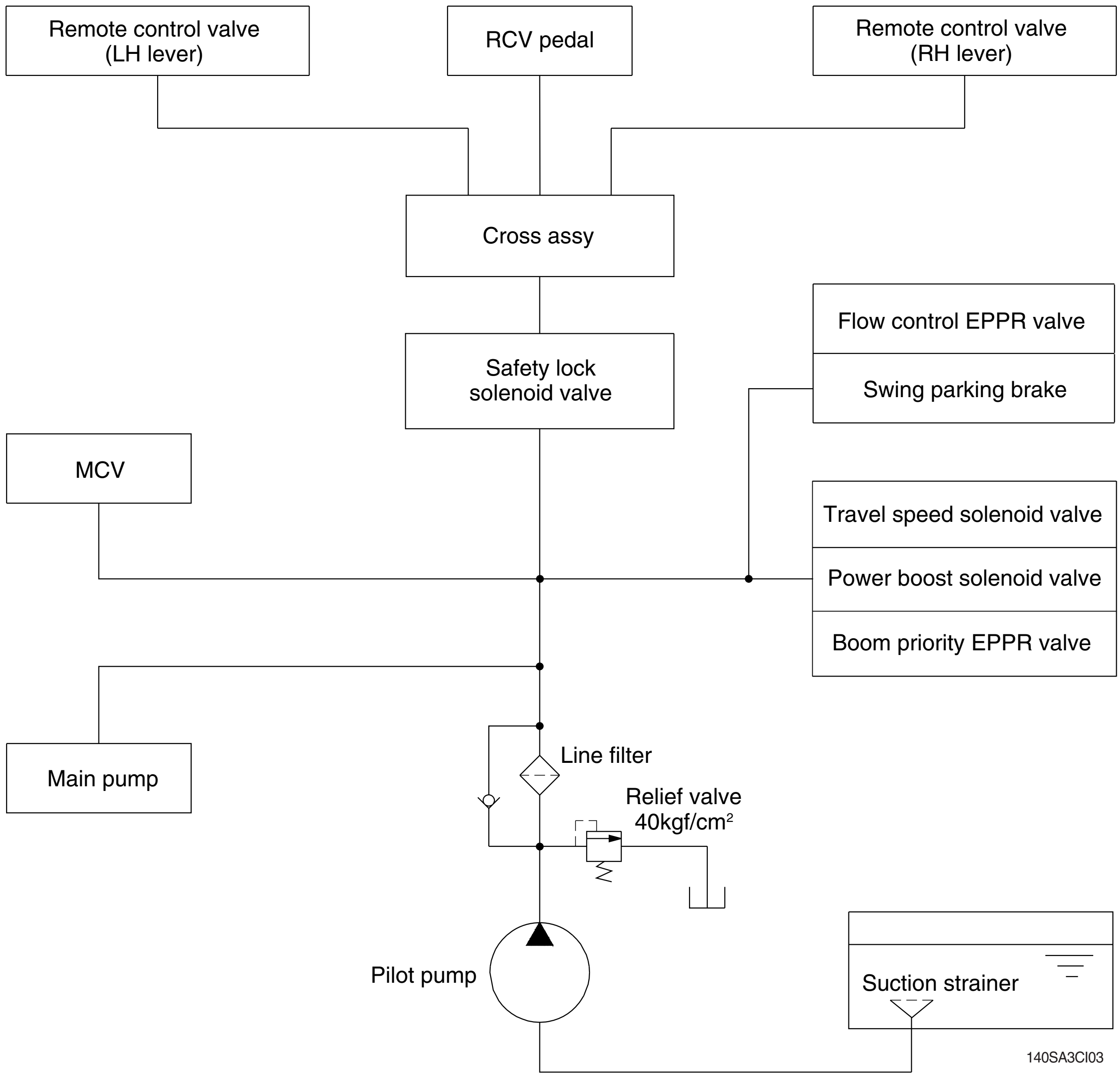
1) TRAVEL MOTOR DRAIN CIRCUIT
Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and return to the hydraulic tank after being filtered by drain filter.

2) SWING MOTOR DRAIN CIRCUIT
Oil leaked from the swing motor returns to the hydraulic tank passing through the return filter.

3) MAIN PUMP DRAIN CIRCUIT
Oil leaked from main pump returns to the hydraulic tank passing through the drain filter.

※ 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.

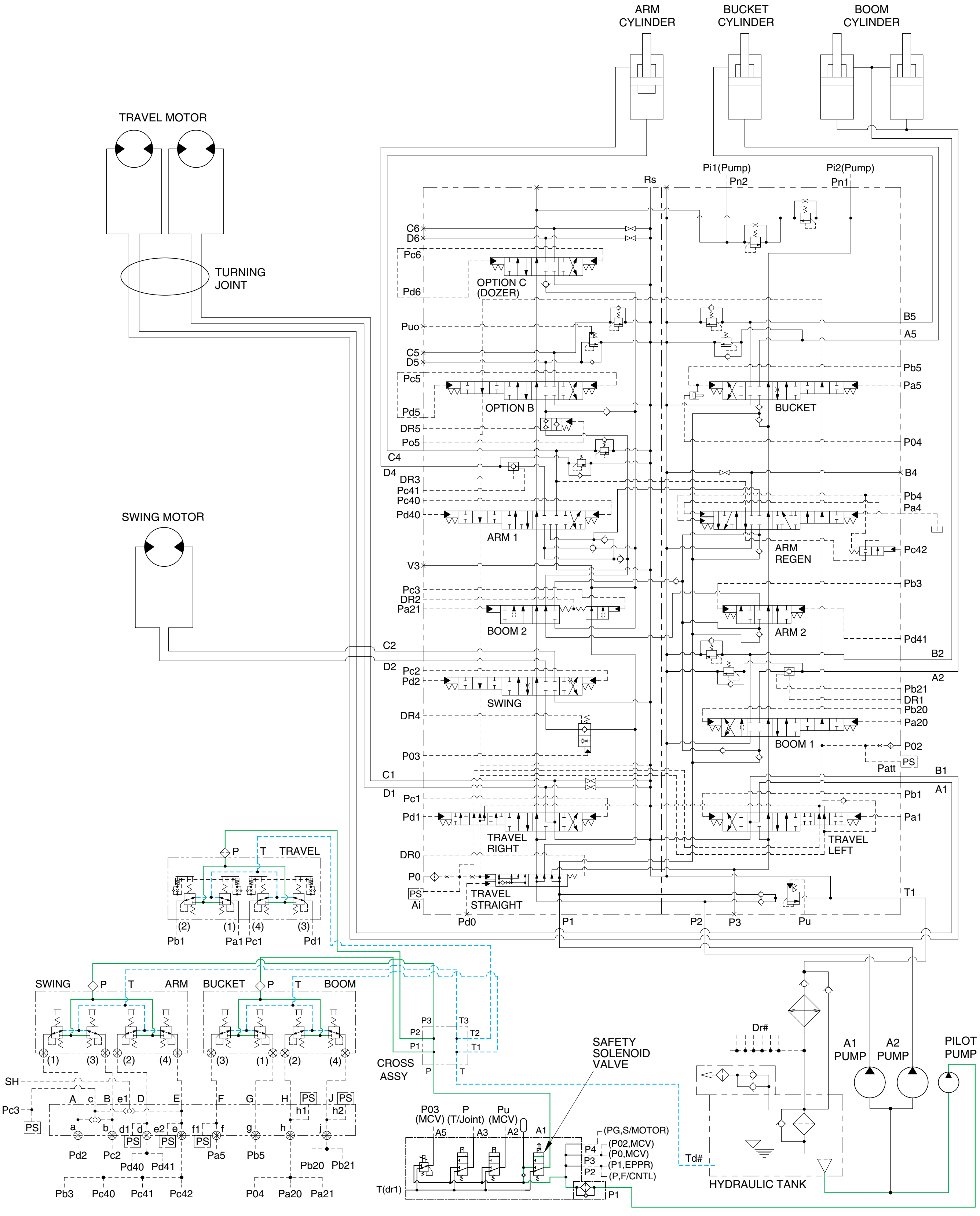
The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction strainer.

The discharged oil from the pilot pump flows to the remote control valve through the cross assy, safety lock solenoid valve and line filter.

Also, it flows to the EPPR valves, solenoid valves, swing parking brake, main control valve and main pump through the line filter.

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



140SA3HC02

The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve. The oil is filtered by the line filter.

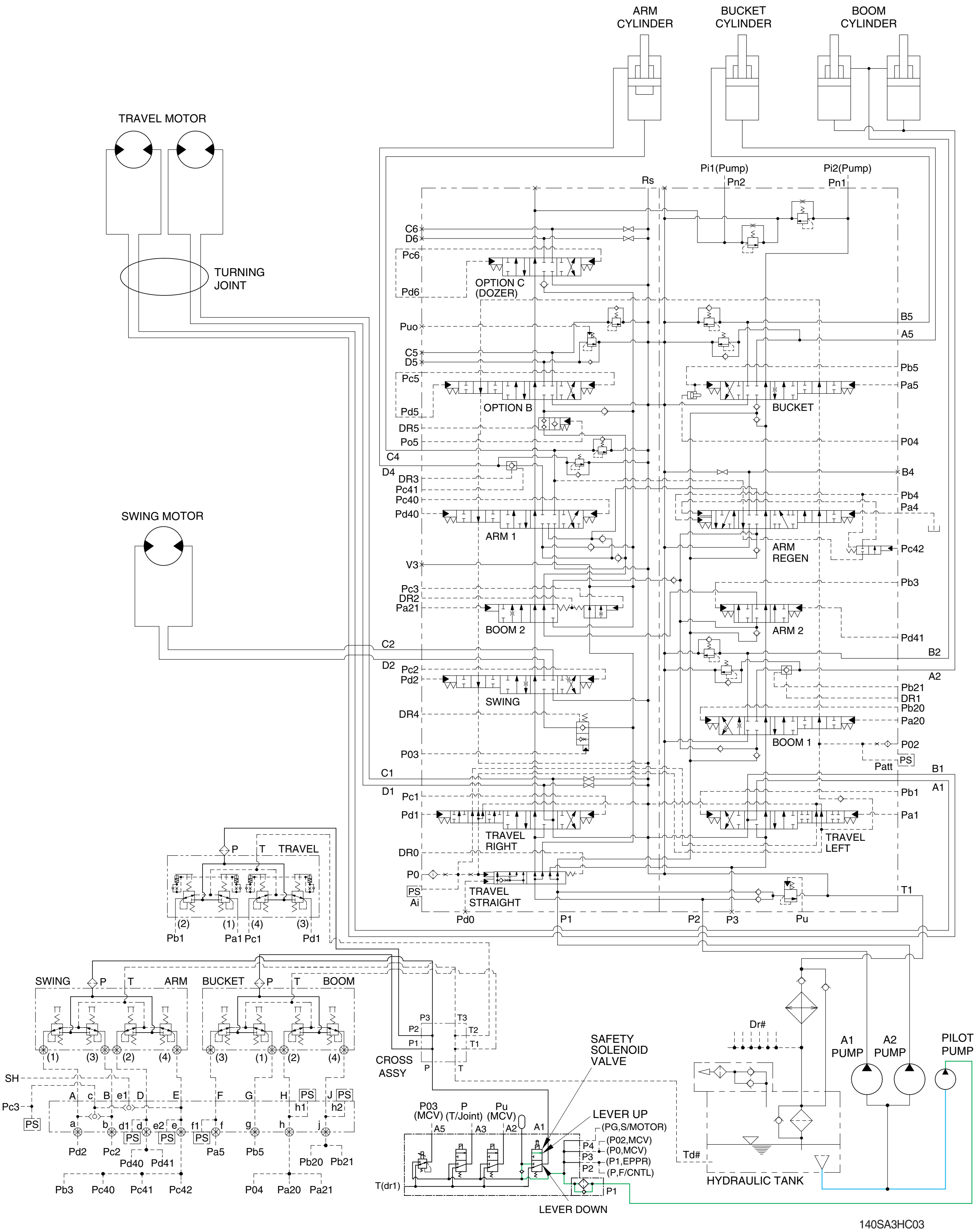
The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

The return oil flow into the hydraulic tank through the cross assy.

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

2. SAFETY VALVE (SAFETY LEVER)

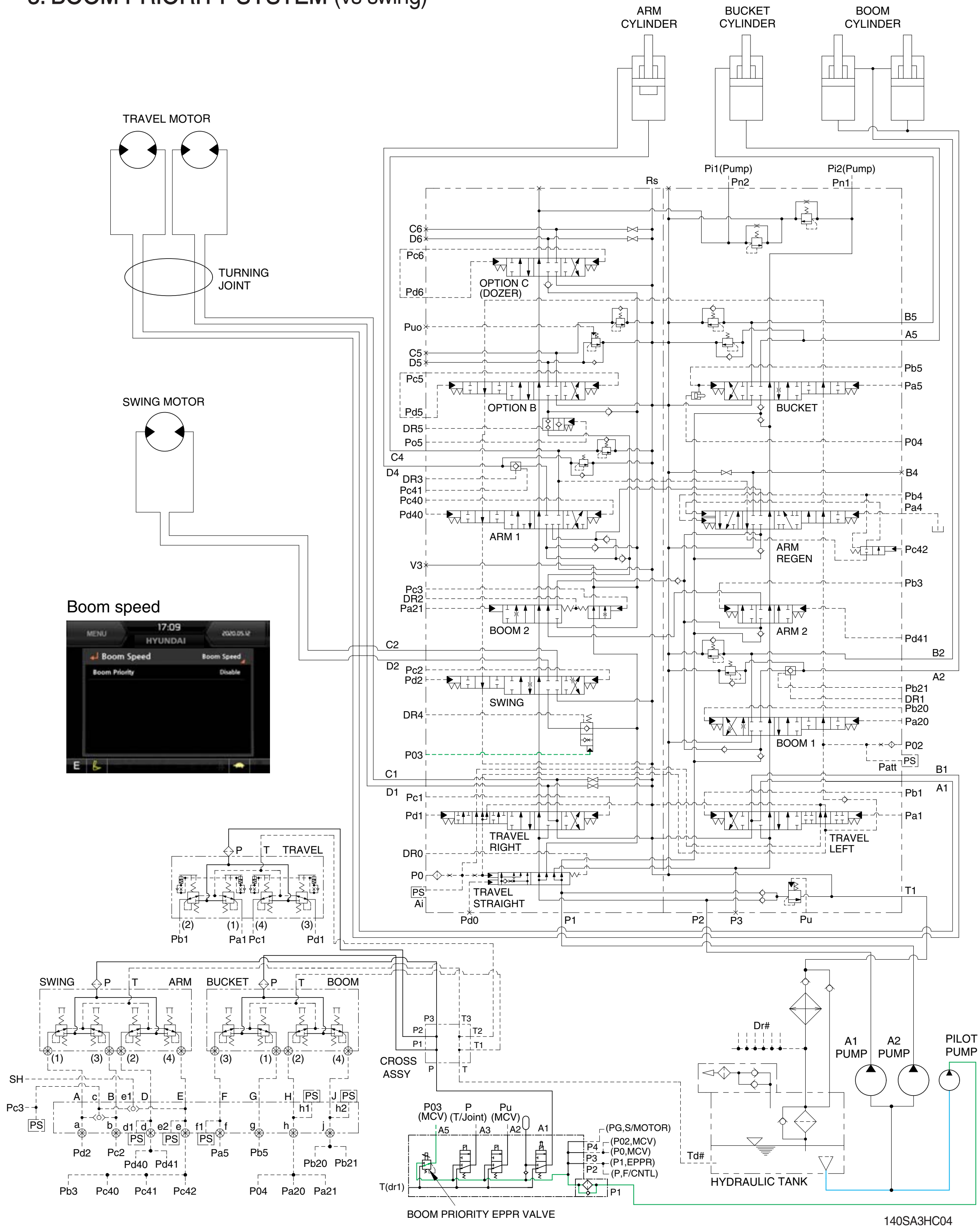


When the lever of the safety solenoid valve is moved upward, oil flows into the remote control valve through the line filter, safety solenoid valve and cross assy.

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

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

3. BOOM PRIORITY SYSTEM (vs swing)



140SA3HC04

When carrying out the combined operation of swing and boom up, the boom up operating speed is lowered then normal operation.

To increase working efficiency, swing speed reducing system is used.

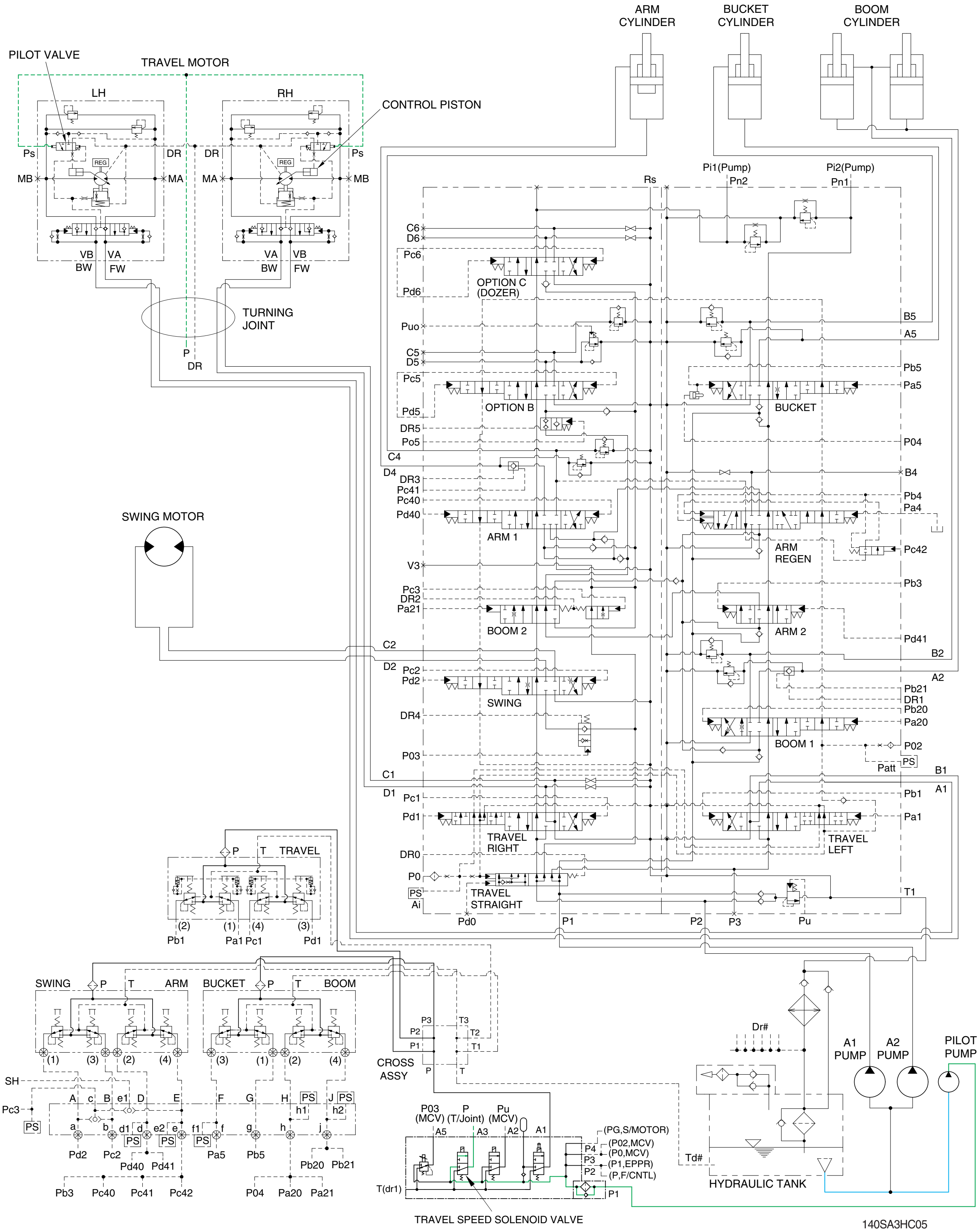
The pilot oil from pilot pump flow into P03 port in main control valve through boom priority EPPR valve. P03 oil pressure moves swing reducing spool to lower position and oil flow rate to the swing motor decreased.

Then, the boom up speed is increased. This is called the boom priority system.

The boom up speed can be adjusted by the cluster. Refer to page 5-77.

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

4. TRAVEL SPEED CONTROL SYSTEM

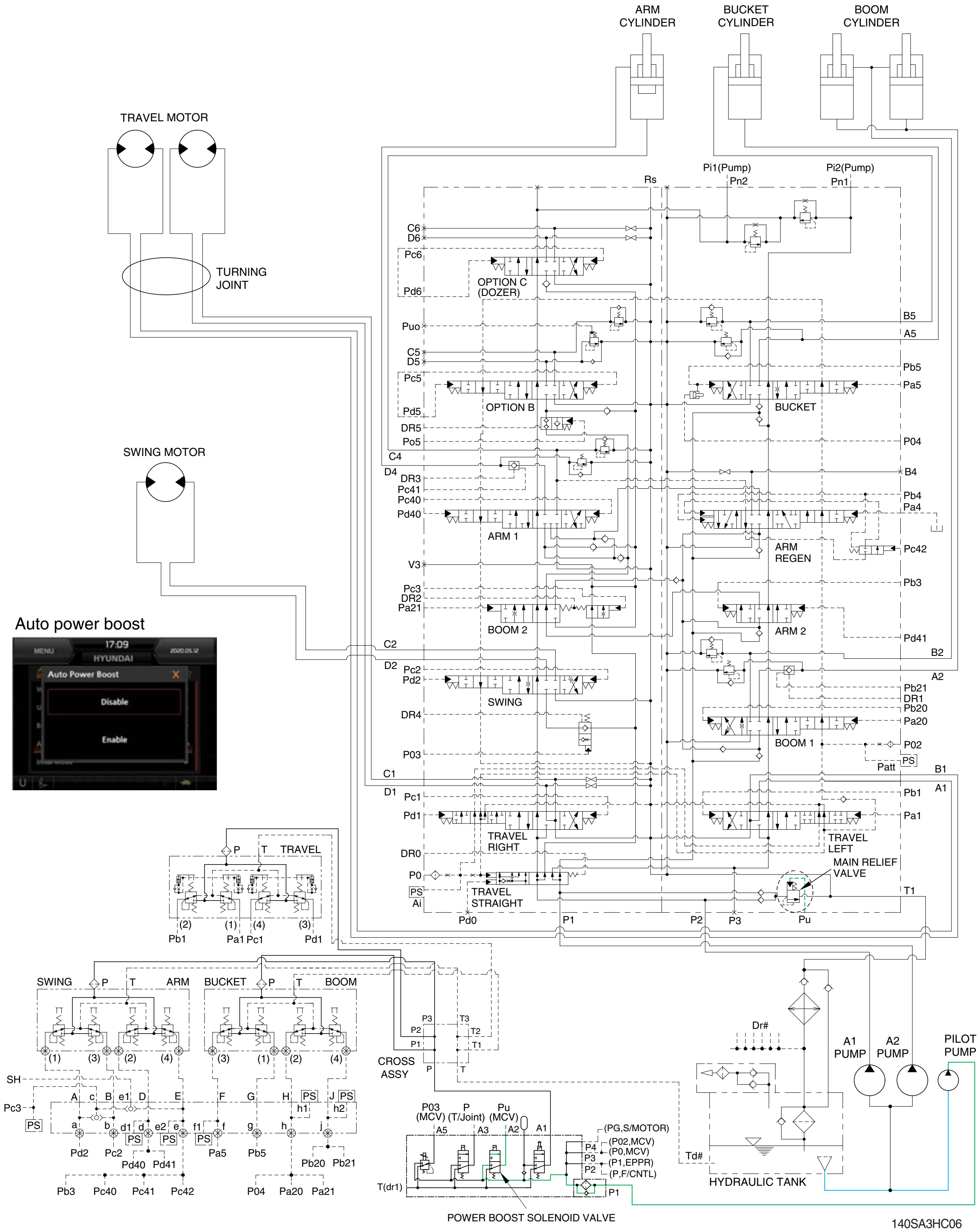


When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston is pushed up, thus minimizing the displacement.

When the travel speed solenoid valve was placed in the Lo position, the oil of **Ps** port return to the tank and the control piston is returned, thus maximizing the displacement.

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

5. MAIN RELIEF PRESSURE CHANGE SYSTEM



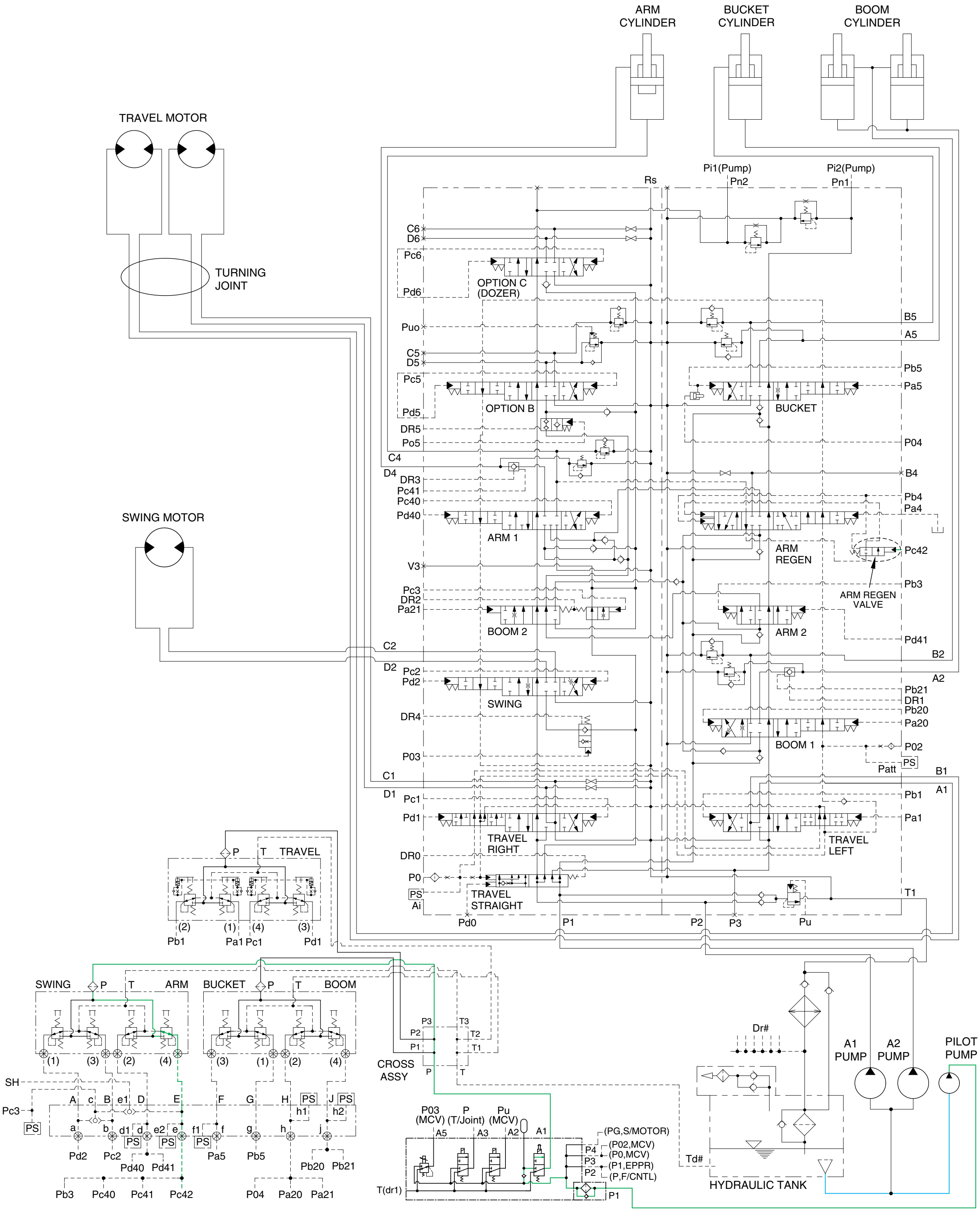
When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pu** port of the main relief valve of main control valve; then the setting pressure of the main relief valve is raised from 350 kgf/cm2 (4980 psi) to 380 kgf/cm2 (5400 psi) for increasing the digging power.

And even when pressed continuously, it is canceled after 8 seconds.

When the auto power boost function is selected to enable on the cluster, the pressure of the main relief pressure is automatically increased to 380 kgf/cm2 (5400 psi) as working condition by the MCU. It is operated max 8 seconds.

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

6. ARM REGENERATION SYSTEM



140SA3HC07

When the arm in control lever is tilted, the pilot oil from pilot pump flow into **Pc42** port in main control valve and the arm regeneration valve is shifted to left.

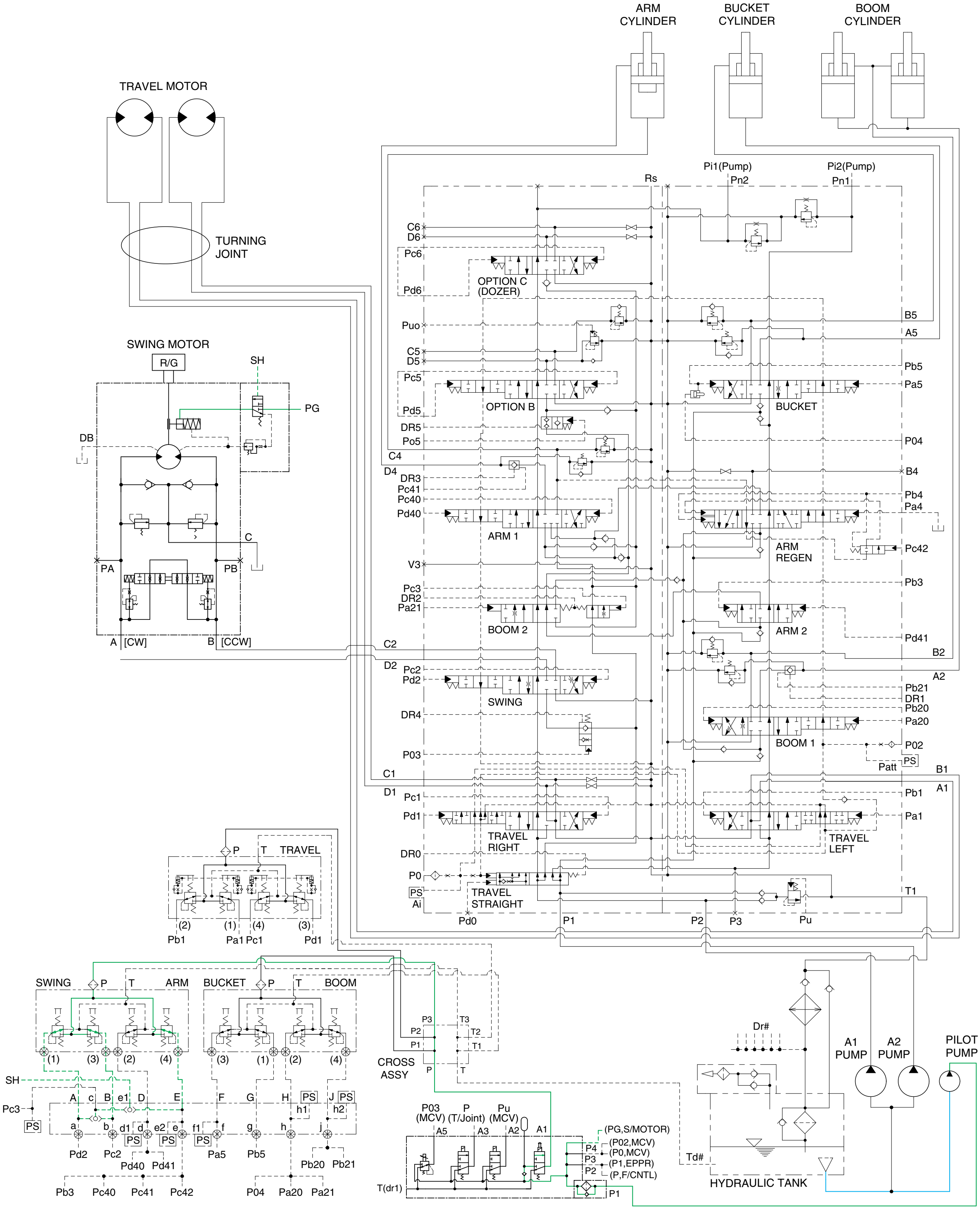
Then, the arm regeneration spool is shift to right and the return oil from arm cylinder rod supplied to arm cylinder head through internal passage. The amount of regeneration oil is changed by movement of the arm regeneration spool.

This is called arm regeneration function.

Refer to page 2-37 for the arm regeneration function.

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

7. SWING PARKING BRAKE RELEASE



140SA3HC08

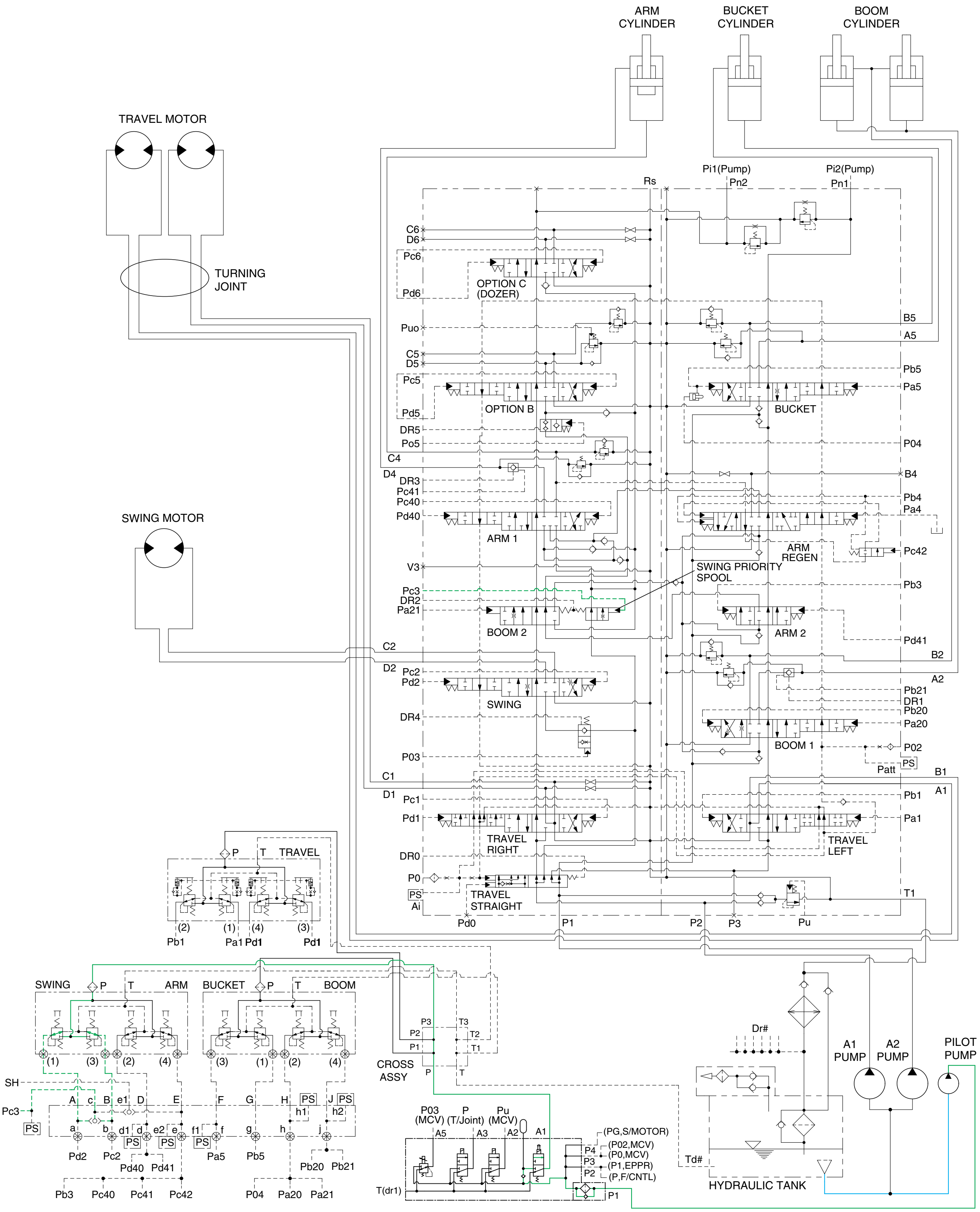
When the swing control lever or arm in control lever is tilted, the pilot oil flows into SH port through shuttle valve.

This pressure moves spool of the swing brake valve so, discharged oil from pilot valve flows to swing motor PG port. This pressure is applied to swing motor disc, thus the brake is released.

When the swing control lever and arm in control lever are 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.

8. SWING PRIORITY SYSTEM



140SA3HC09

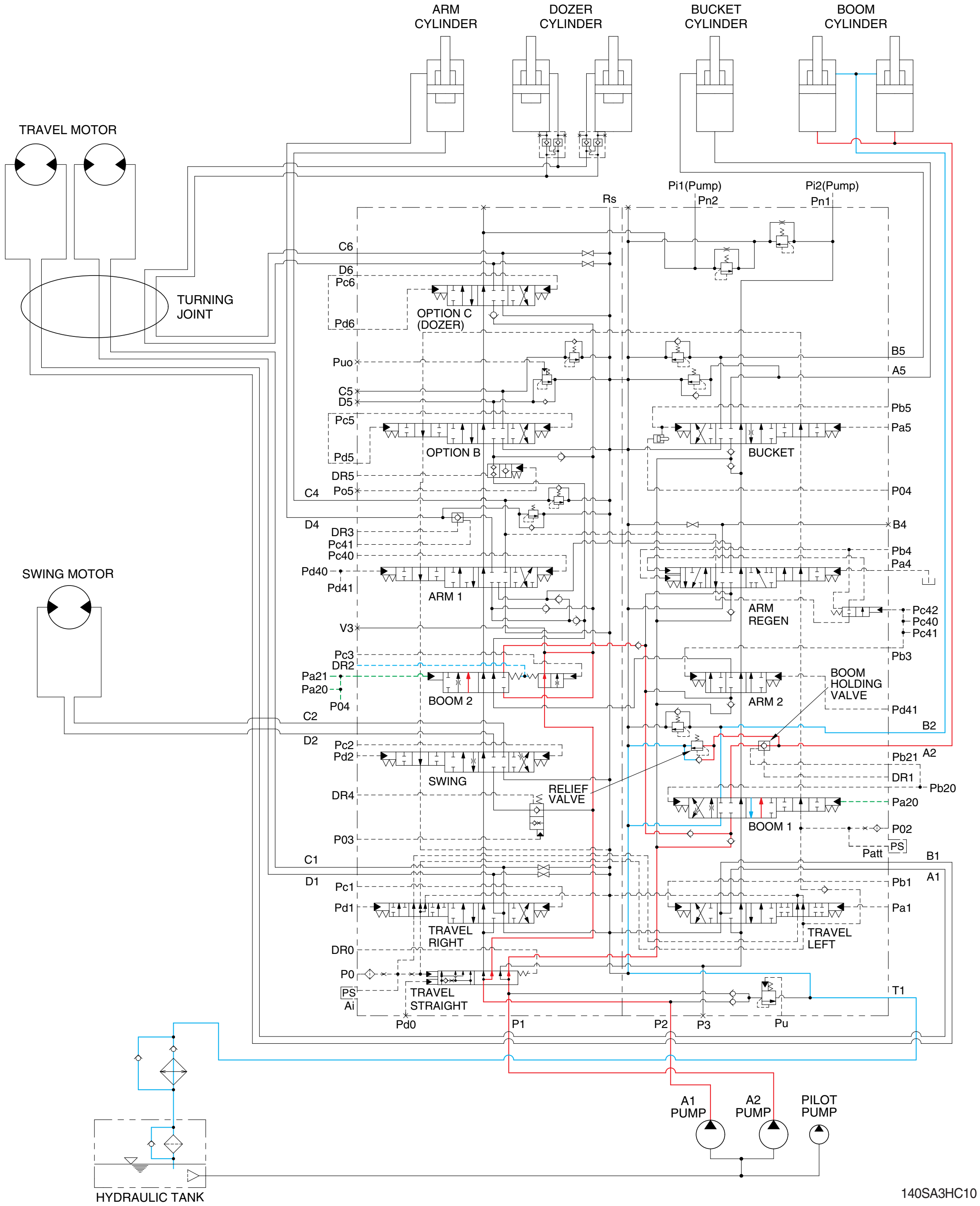
When carrying out the combined operation of swing and arm in of the left control valve, the swing speed can be lowered than operating speed of arm.

Pc3 pressure from the swing shuttle block change the swing priority spool and decreases the oil flow rate to the next section to make the swing operation most preferential.

This is called the swing priority system. For details, refer to page 2-39.

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

1. BOOM UP OPERATION

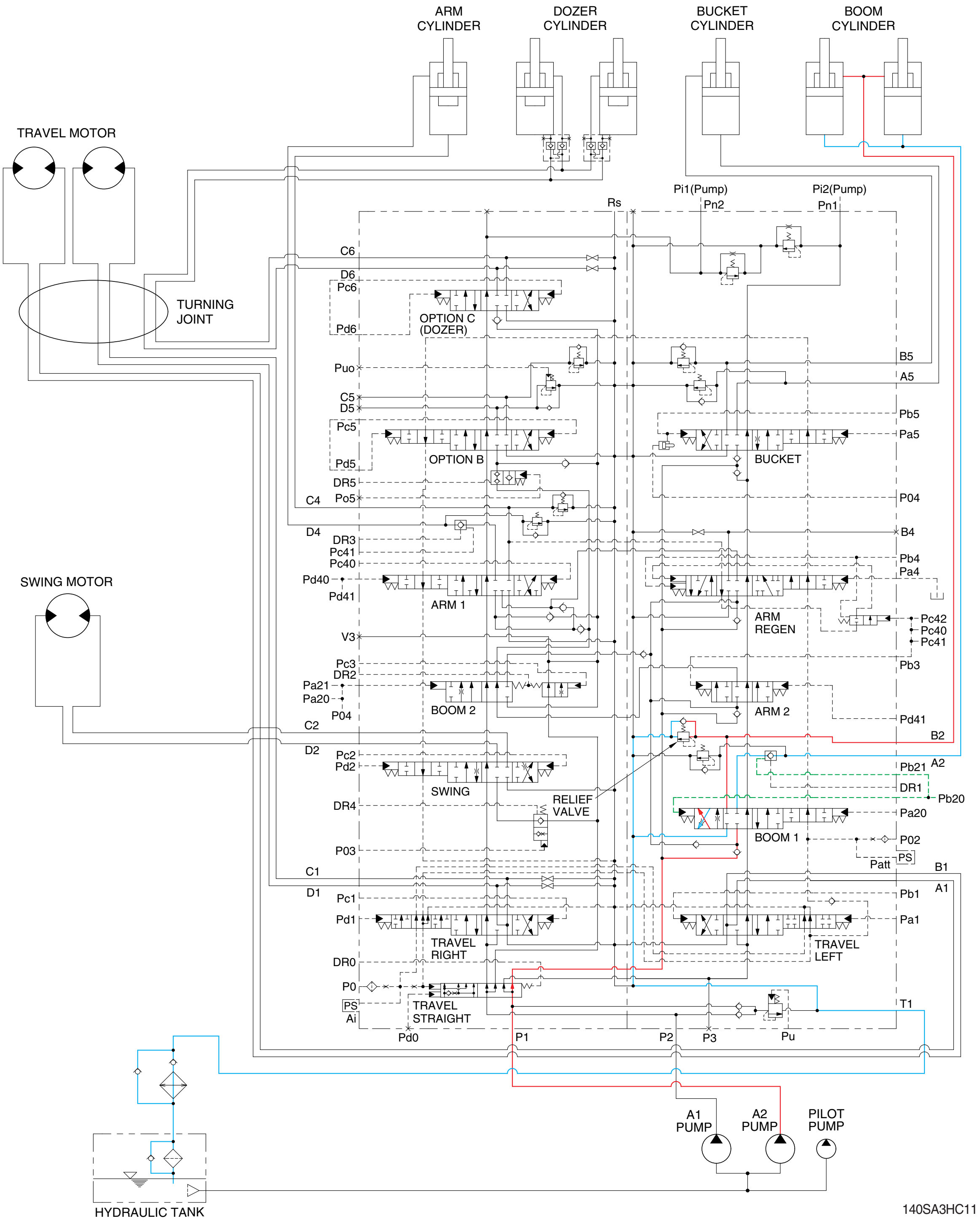


When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure (Pa20, Pa21) from the remote control valve.

The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of boom cylinders. At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom 1 spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder head side 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 head side of the boom cylinder is closed by the boom holding valve. This prevents the hydraulic drift of boom cylinders.

※ 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 1 spool in the main control valve is moved to the down position by the pilot oil pressure (Pb20) from the remote control valve.

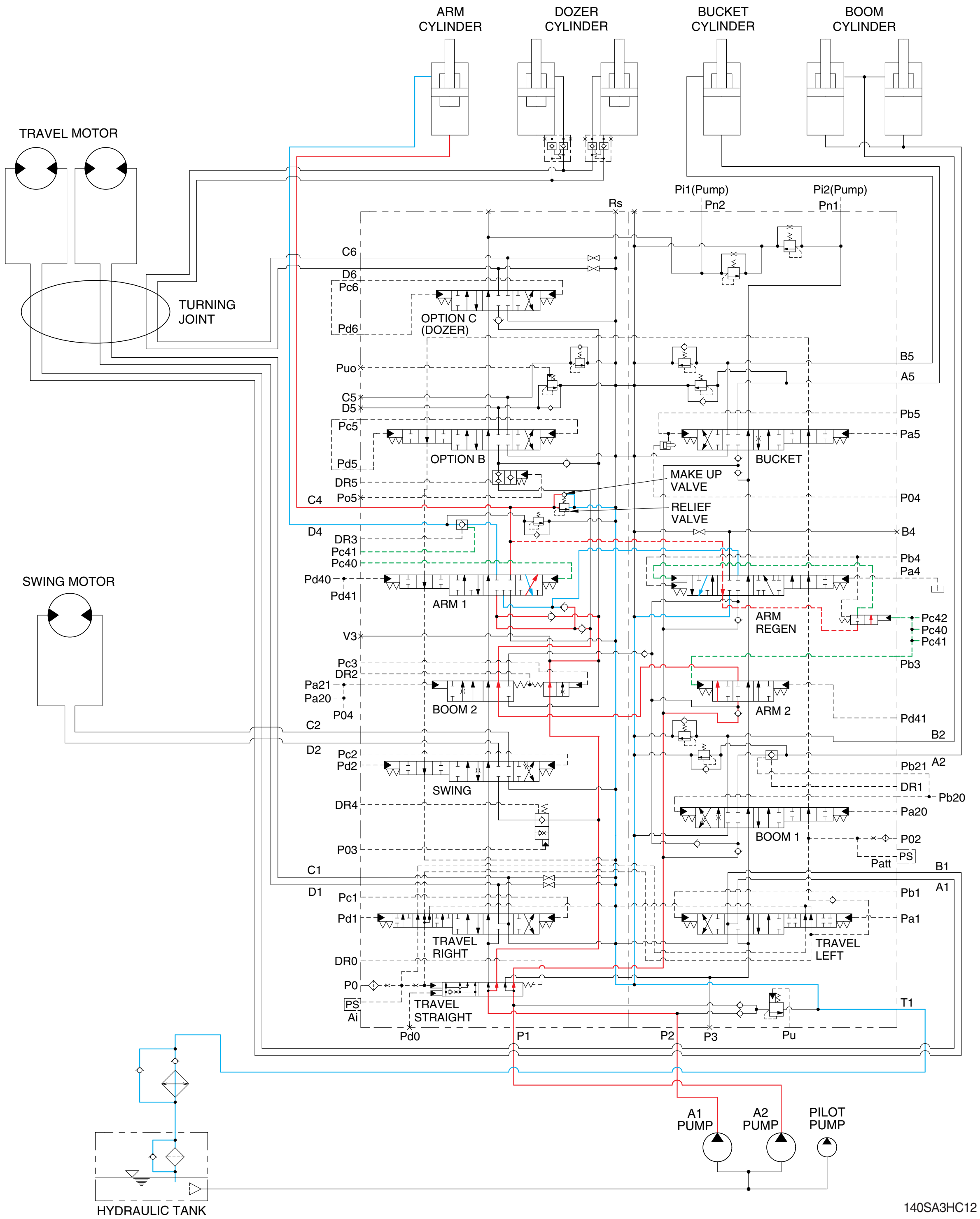
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 spool in the main control valve.

When the down speed of boom is faster, the oil returned from the large chamber of boom cylinder combines with the oil from the A2 pump, and flows into the small chamber of the cylinder.

This prevents cylinder cavitation by the negative pressure when the A2 pump flow can not match the boom down speed. And the excessive pressure in the boom cylinder rod side is prevented by the relief valve.

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

3. ARM IN OPERATION



When the left control lever is pulled back, the arm spools in the main control valve are moved to the arm in position by the pilot oil pressure (Pc40, Pb3) from the remote control valve.

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

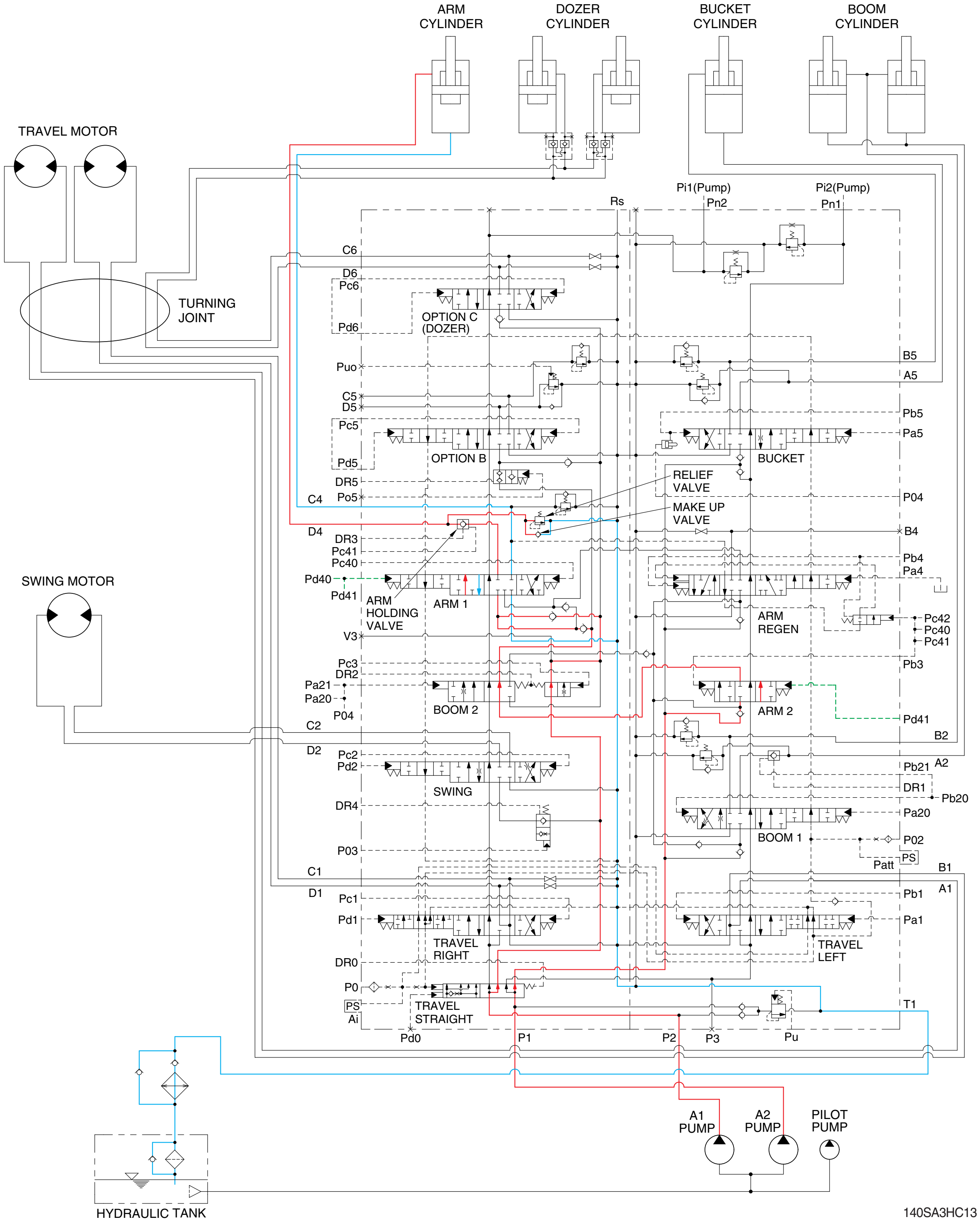
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

The excessive pressure in the arm cylinder head side is prevented by relief valve.

The cavitation which will happen to the head side 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 OUT OPERATION

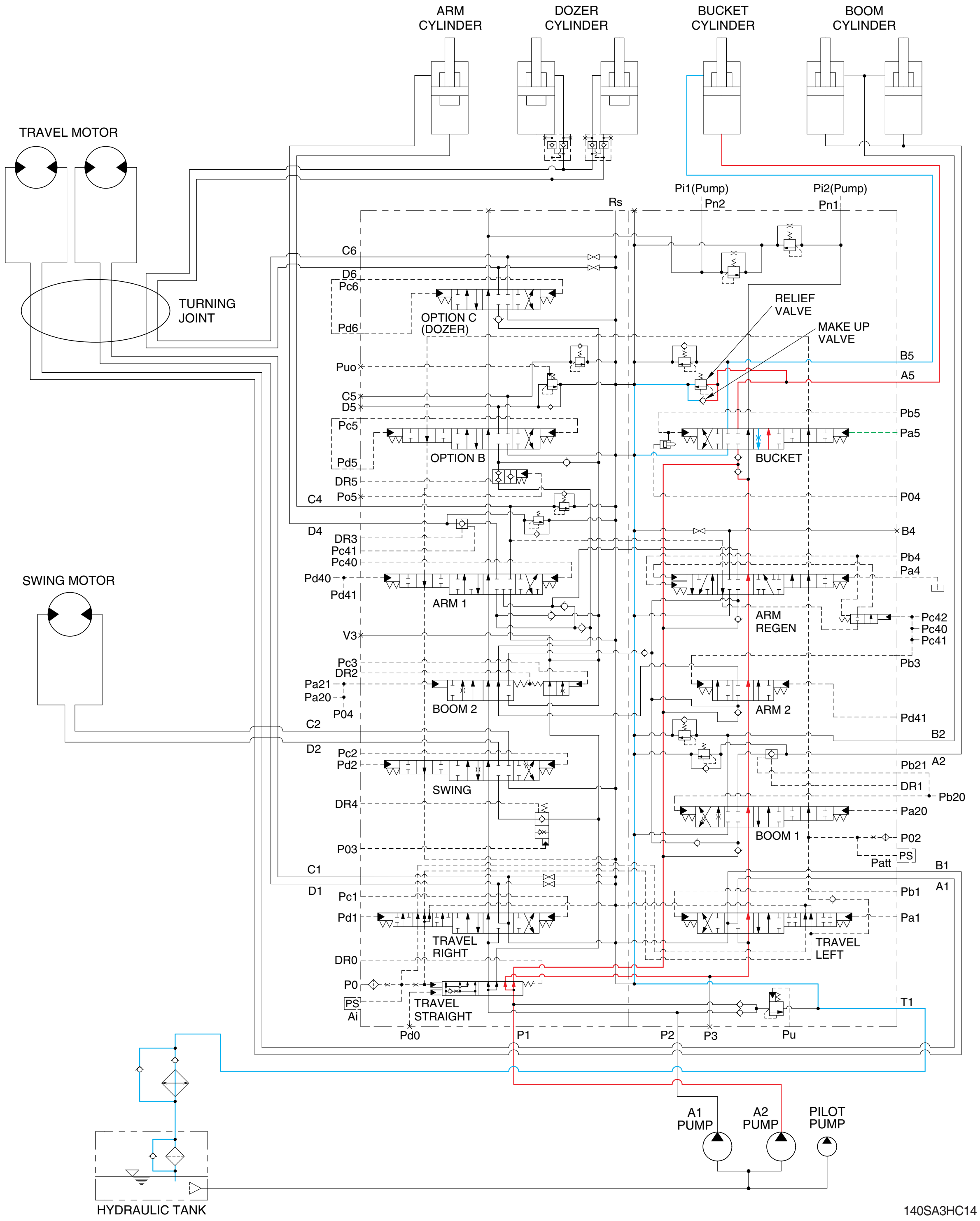


When the left control lever is pushed forward, the arm spools in the main control valve are moved to the arm out position by the pilot oil pressure (Pd40, Pd41) from the remote control valve.

The oil from the A1 and A2 pump flows into the main control valve and then goes to the small chamber of arm cylinder. At the same time, the oil from the large chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls out. The cavitation which will happen to the rod side of the arm cylinder is also prevented by the make-up valve in the main control valve. When the arm is roll out and the control lever is returned to neutral position, the circuit for the holding pressure at the rod side of the arm cylinder is closed by the arm holding valve. This prevent the hydraulic drift of arm cylinder.

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

5. BUCKET 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 (Pa5) from the remote control valve.

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

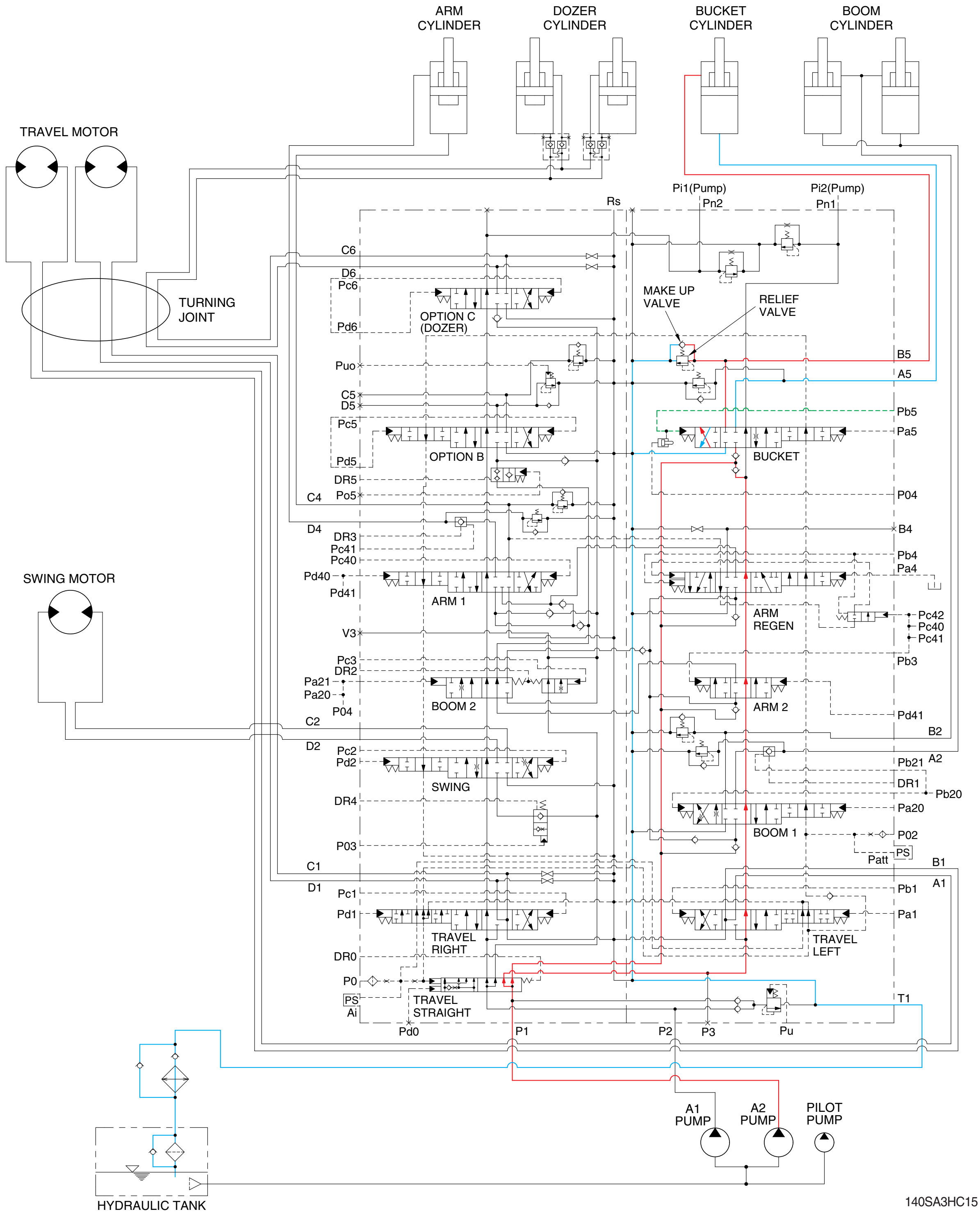
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

The excessive pressure in the bucket cylinder head side is prevented by relief valve.

The cavitation which will happen to the head side 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 OUT OPERATION



When the right control lever is pushed right, the bucket spool in the main control valve is moved to the bucket out position by the pilot oil pressure (Pb5) from the remote control valve.

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

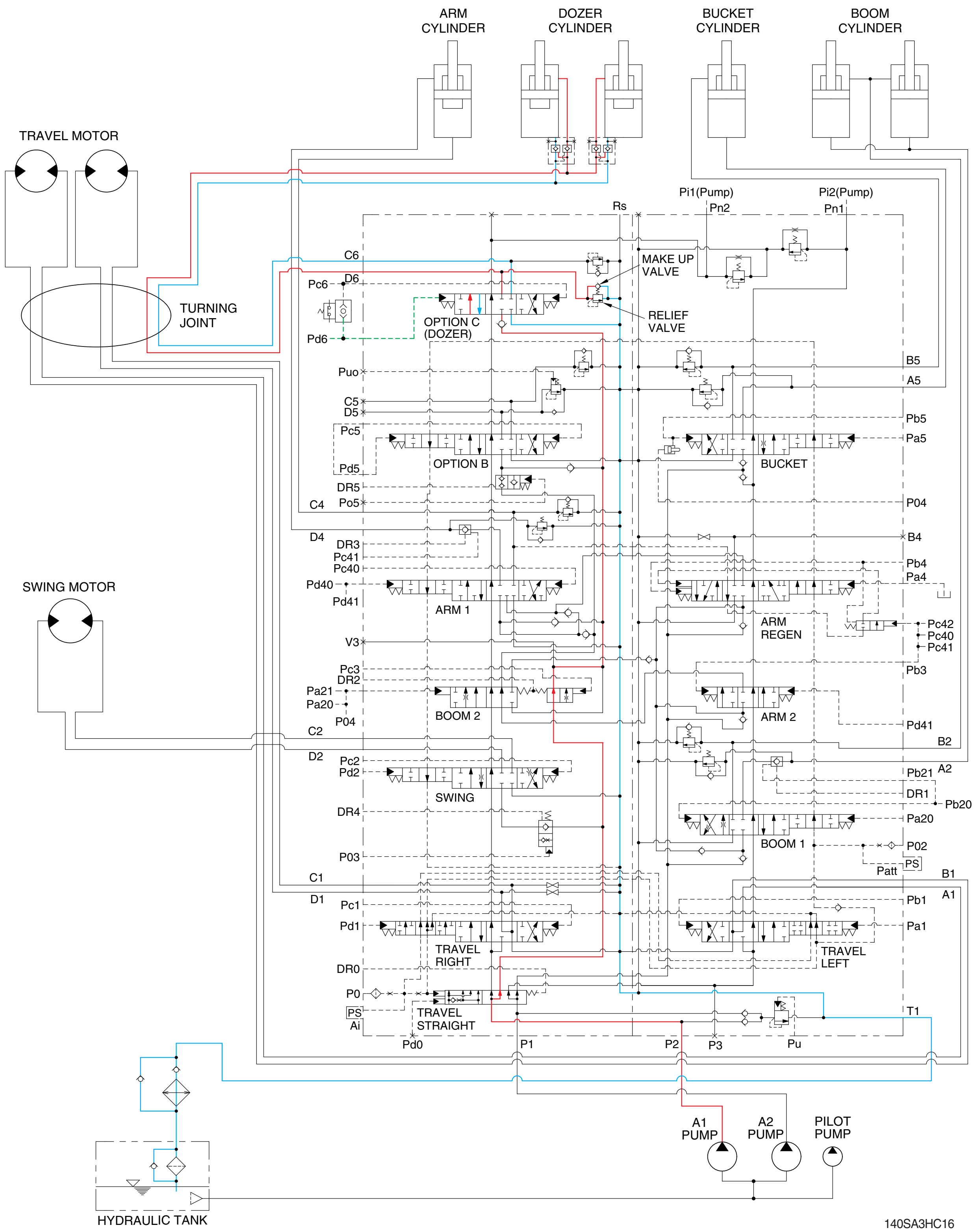
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

The excessive pressure in the bucket cylinder rod side is prevented by relief valve.

The cavitation which will happen to the rod side 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. DOZER UP OPERATION



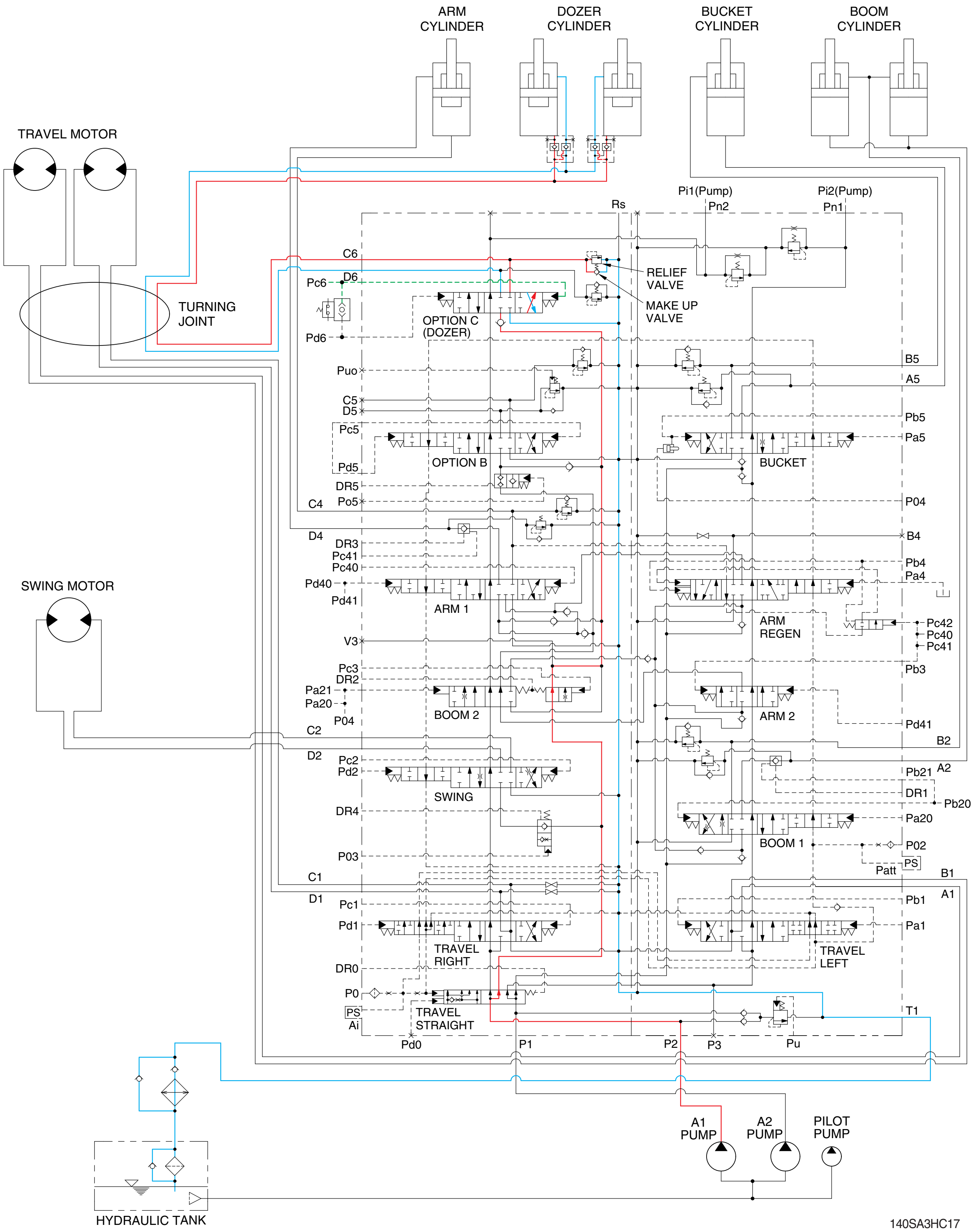
When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure (Pd6) from the remote control valve.

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

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

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

8. DOZER DOWN OPERATION



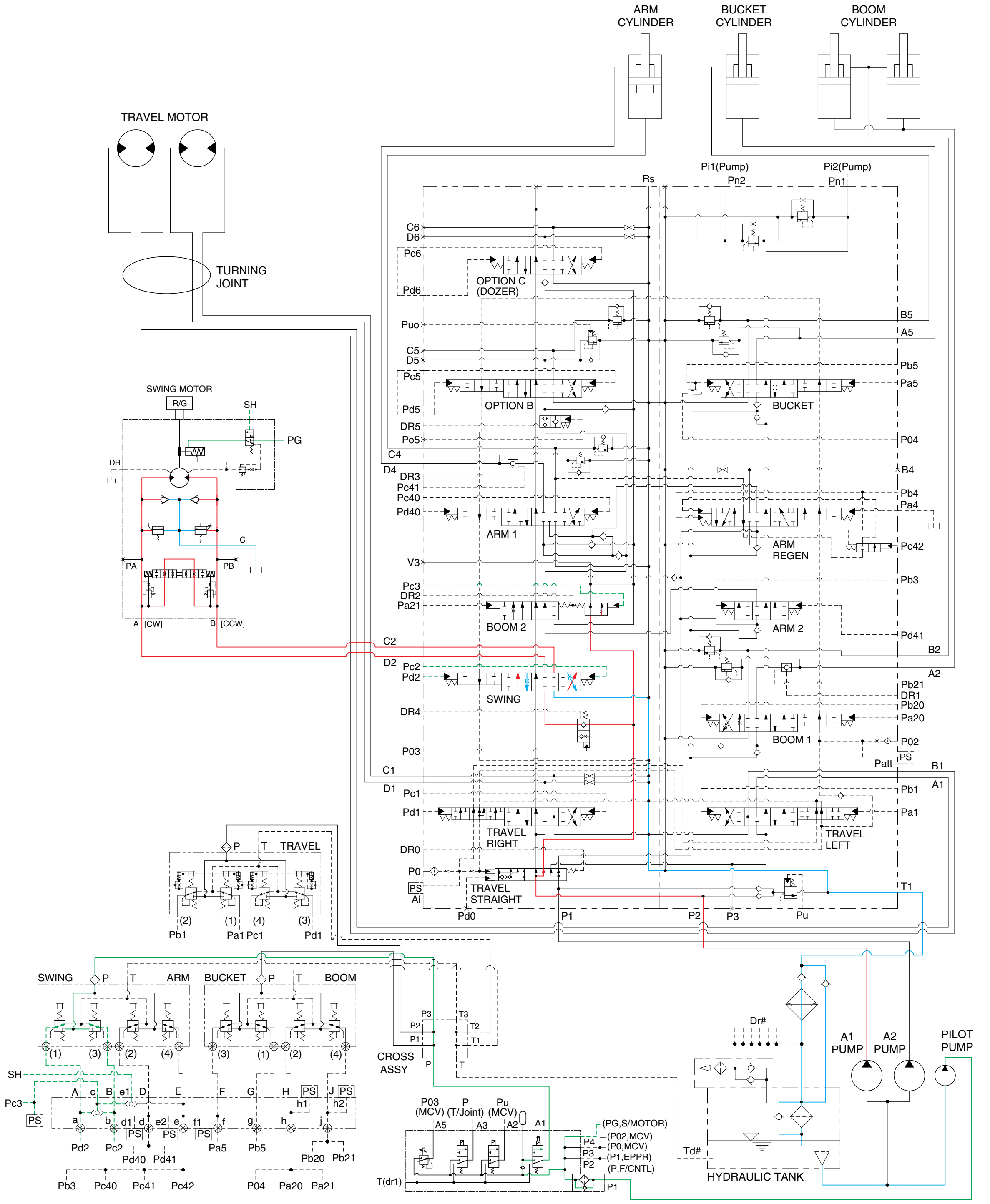
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure (Pc6) from the remote control valve.

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

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

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

9. SWING OPERATION



140SA3HC18

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 (Pc2, Pd2) from the remote control valve.

Also the swing operation preference function is operated by the pilot pressure Pc3 (refer to page 3-14).

The oil from the A1 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.

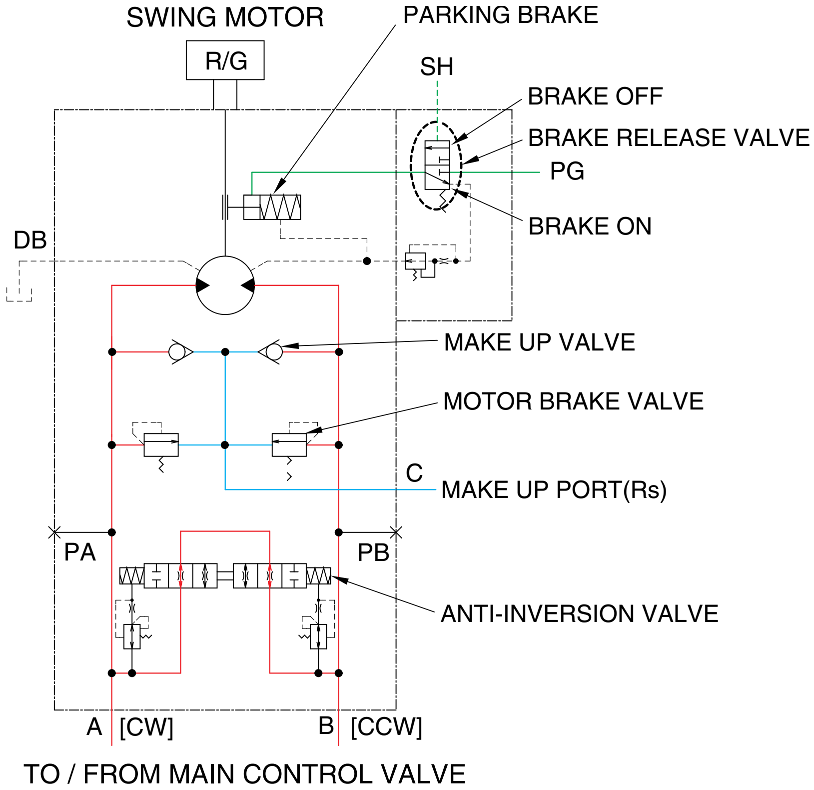
When this happens, the upper structure swings to the left or right.

The swing parking brake, make up valve and the motor brake valve are provided in the swing motor.

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



140SA3HC18A

1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation and controls the swing motor operating pressure 280 kgf/cm² (3990 psi).

2) MAKE UP VALVE

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

3) PARKING BRAKE

This is function as a parking brake only when the swing control lever and arm in control lever are not operated.

PARKING BRAKE "OFF" OPERATION

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

When the swing control lever or arm in control lever placed in the operating position, the pilot oil flows into SH port through the MCV. This pressure transferred to the brake release valve and the brake release valve is change over. Then the pilot oil pressure PG lift the brake piston and release the parking brake.

PARKING BRAKE "ON" OPERATION

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

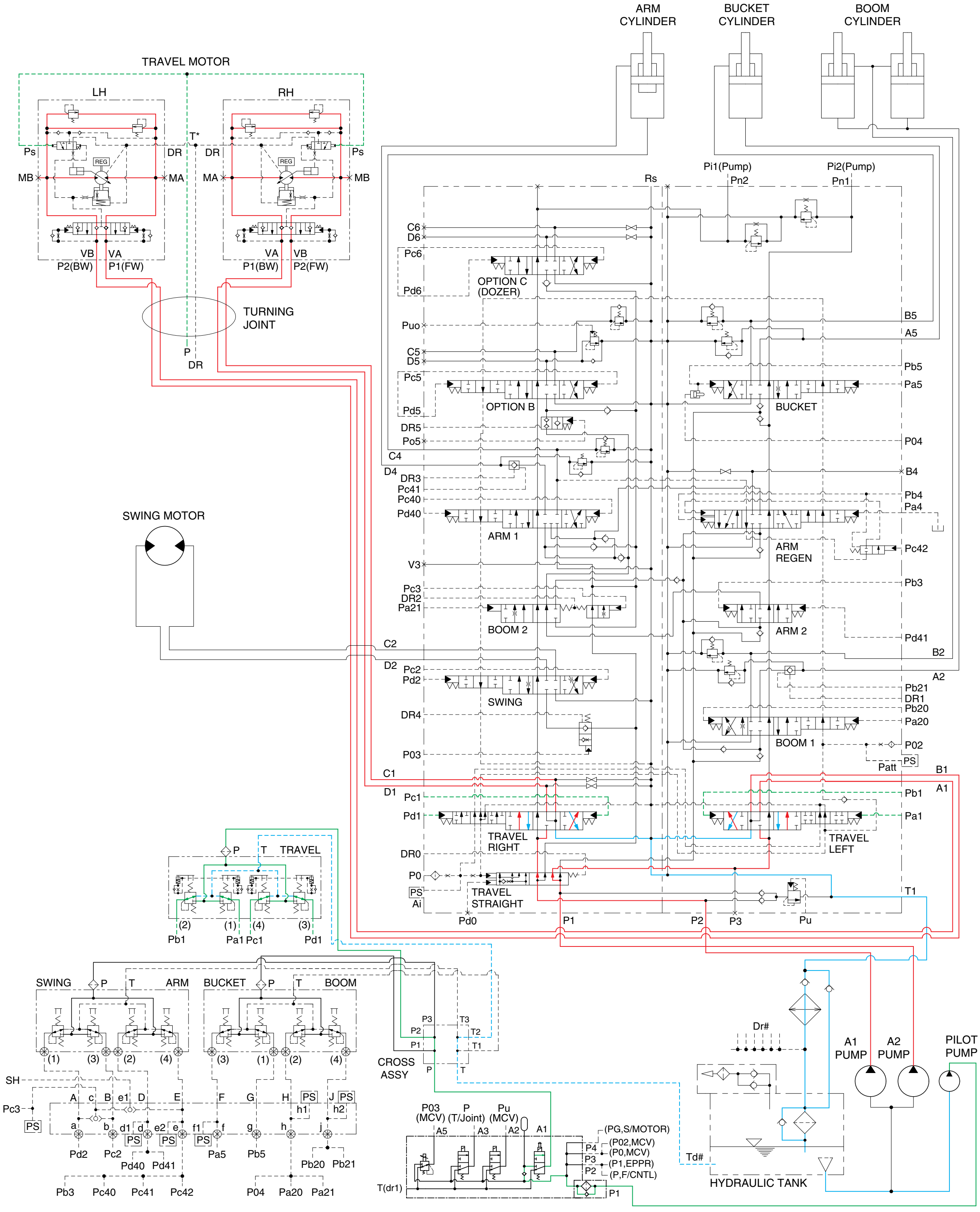
Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the hydraulic oil tank. And the brake is set to 'ON'.

4) ANTI-INVERSION VALVE

This anti-inversion valve absorbs shocks produced as swing motion stops and reduced oscillation cause by swing motion.

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

10. 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 (Pa1, Pb1, Pc1, Pd1) from the remote control valve.

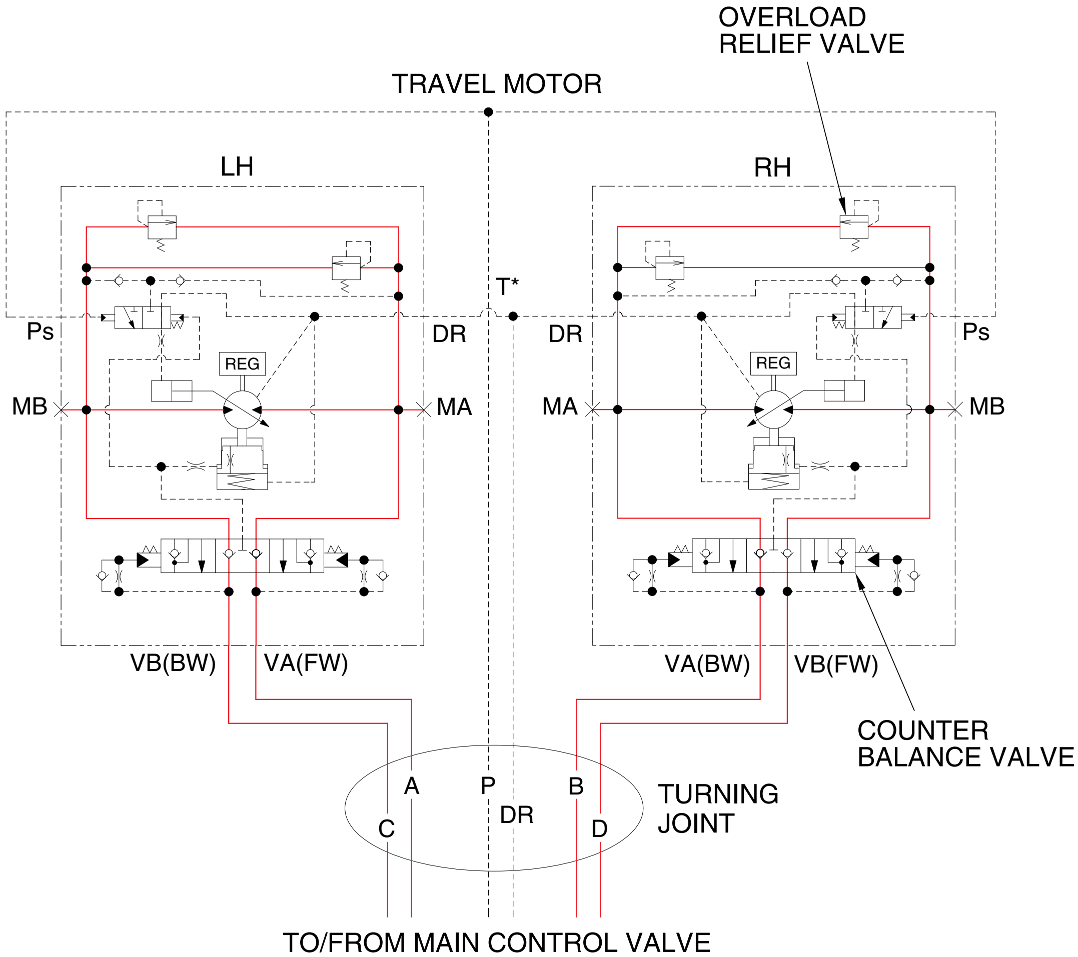
The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

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



140SA3HC19A

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.

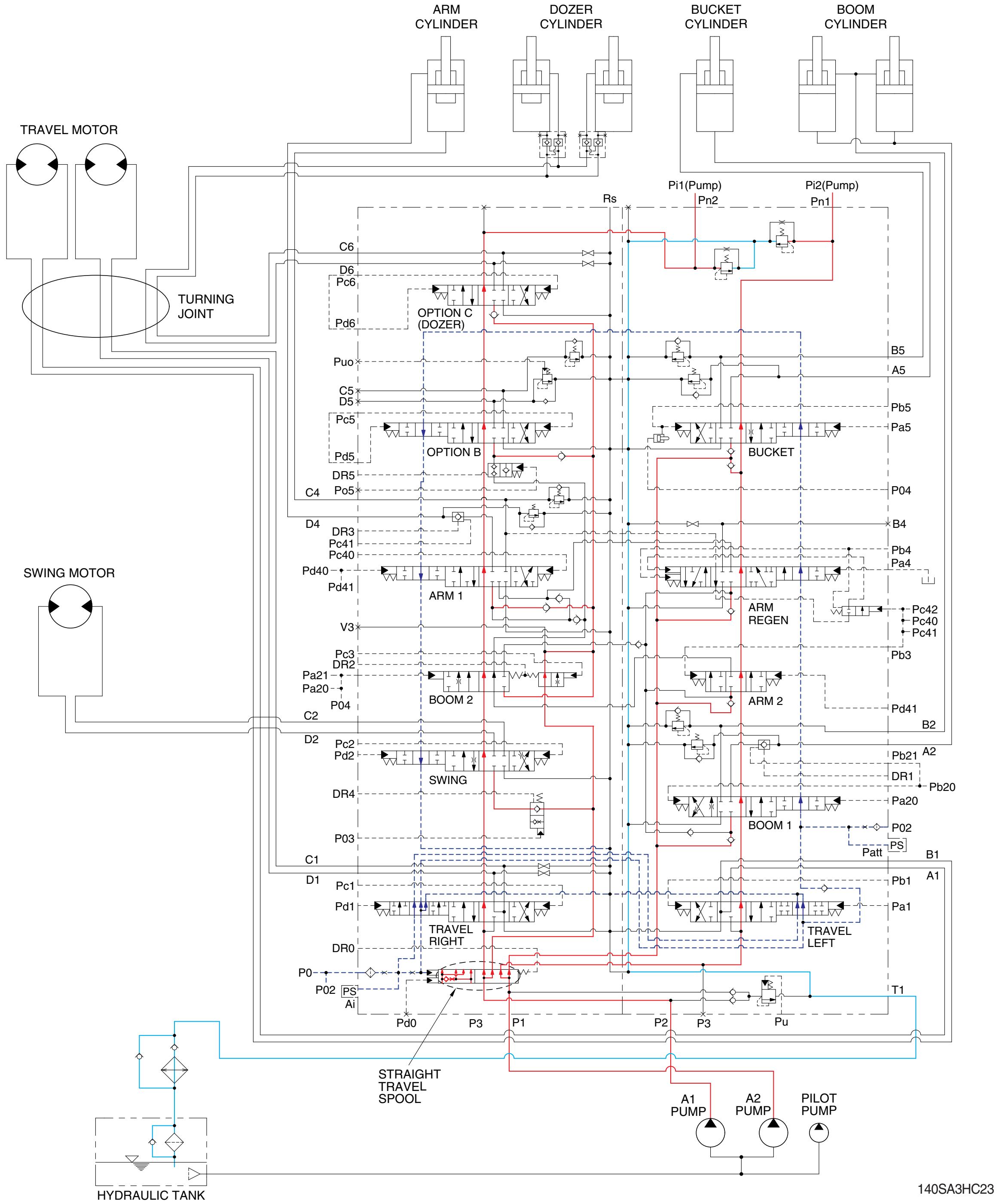
2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 350 kgf/cm^2 (4980 psi) to prevent high pressure generated at a 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.

GROUP 5 COMBINED OPERATION

1. OUTLINE



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

STRAIGHT TRAVEL SPOOL

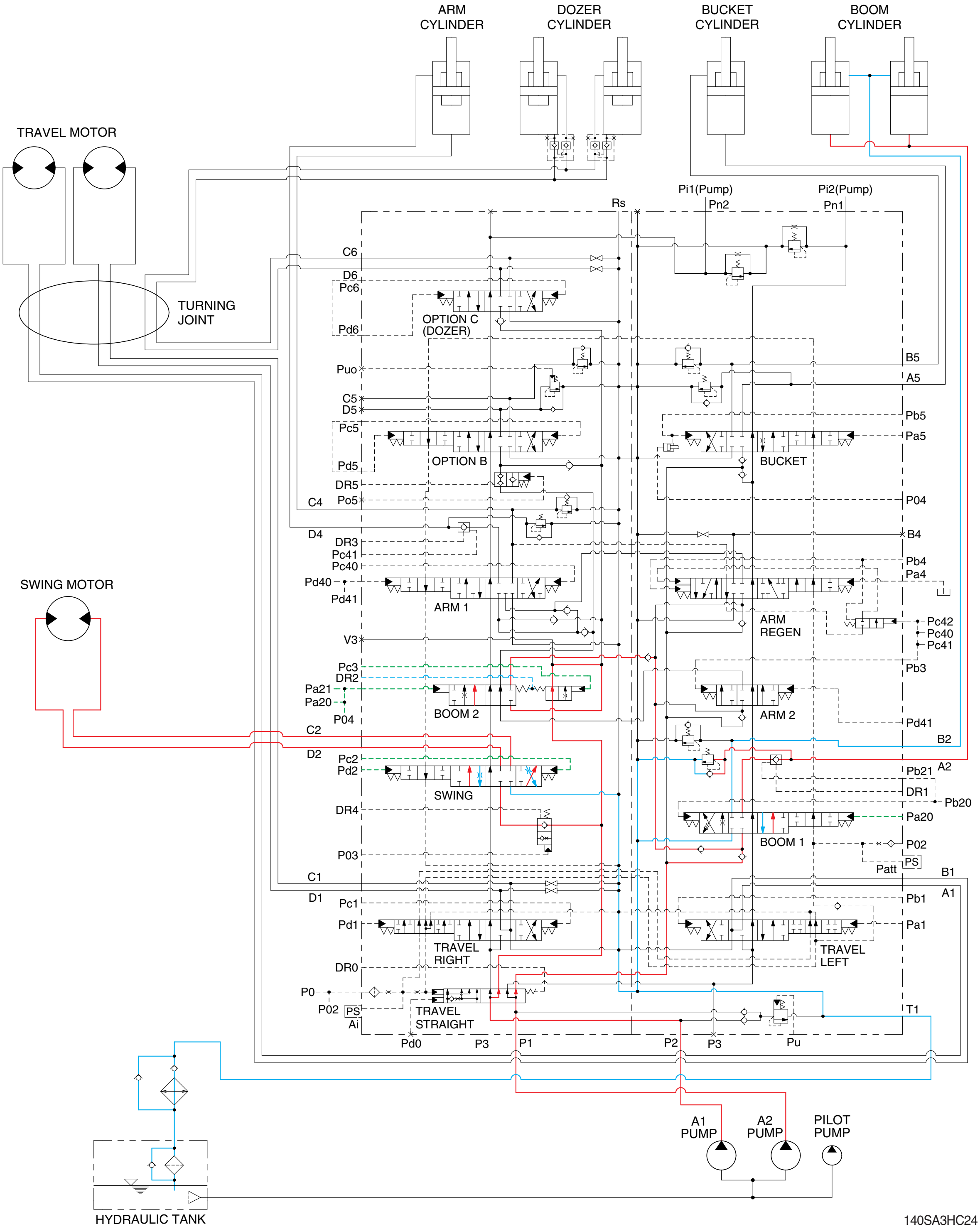
This straight travel spool for straight travel is provided in the main control valve.

If any actuator is operated when traveling, the straight travel spool is pushed to the right by the pilot oil pressure (P0, P02).

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

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

2. COMBINED SWING AND BOOM UP OPERATION



When the swing and boom up functions are operated simultaneously, the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure (Pc2, Pd2, Pa20, Pa21) from the remote control valve.

The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

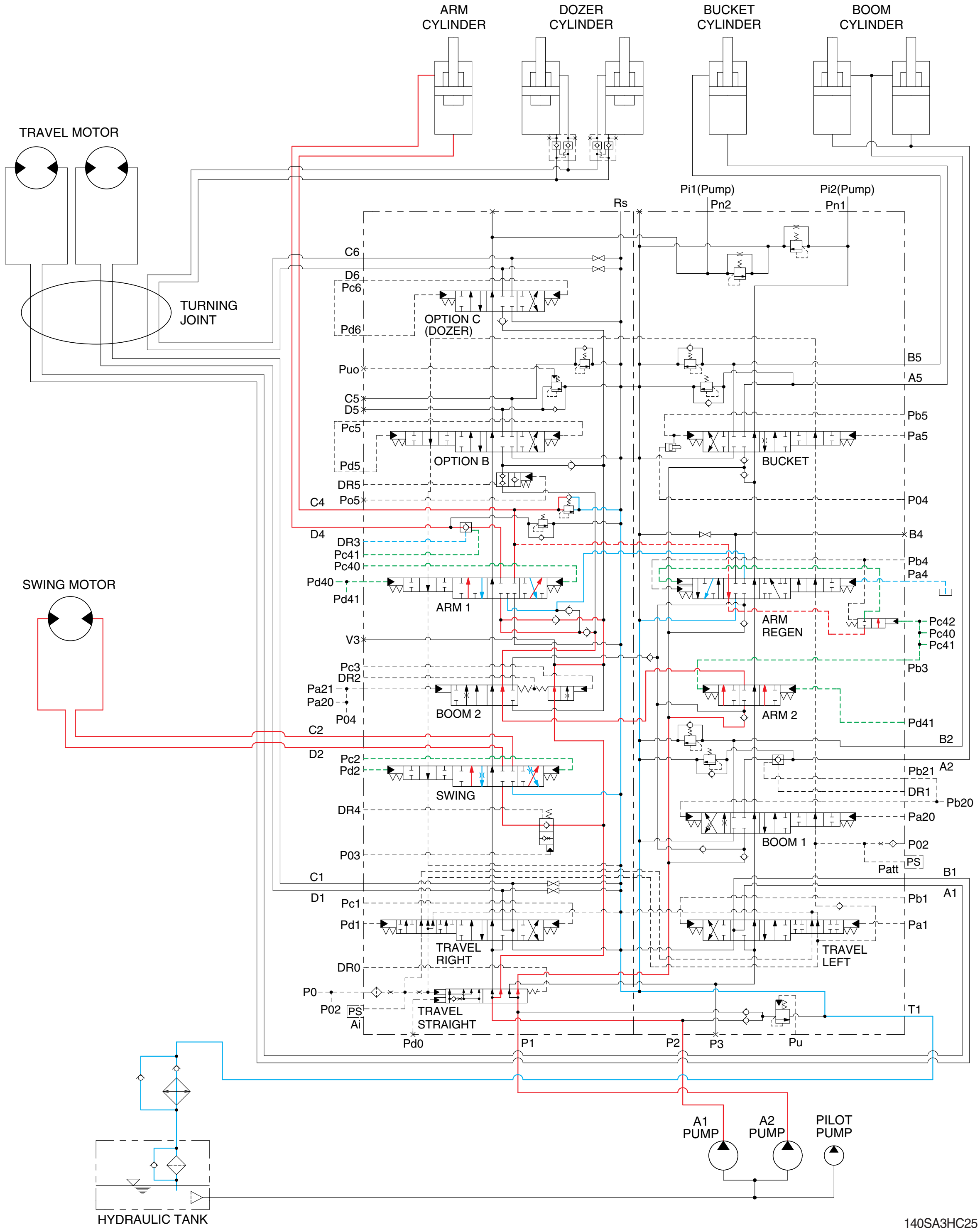
The oil from the A2 pump flows into the boom cylinders through the boom 1 spool in the right control valve.

The super structure swings and the boom is operated.

Refer to page 3-9 for the boom priority system.

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

3. COMBINED SWING AND ARM OPERATION



140SA3HC25

When the swing and arm functions are operated simultaneously, the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure (Pc2, Pd2, Pc40, Pd40, Pd41, Pb3) from the remote control valve.

The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

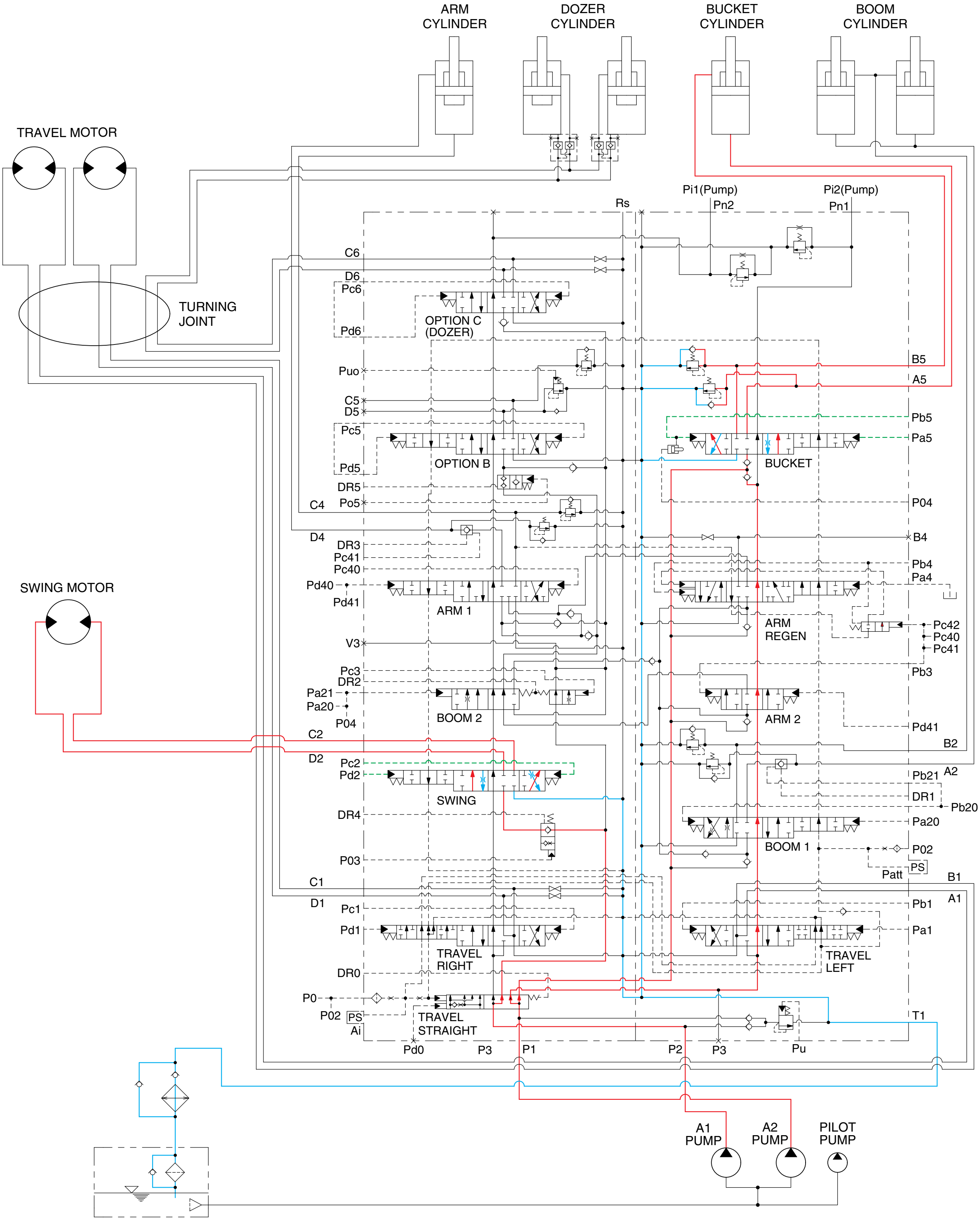
The oil from the A2 pump flows into the arm cylinder through the arm 2 spool of the right control valve.

The super structure swings and the arm is operated.

Refer to page 3-14 for the swing operation preference function.

※ 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 (Pc2, Pd2, Pa5, Pb5) from the remote control valve.

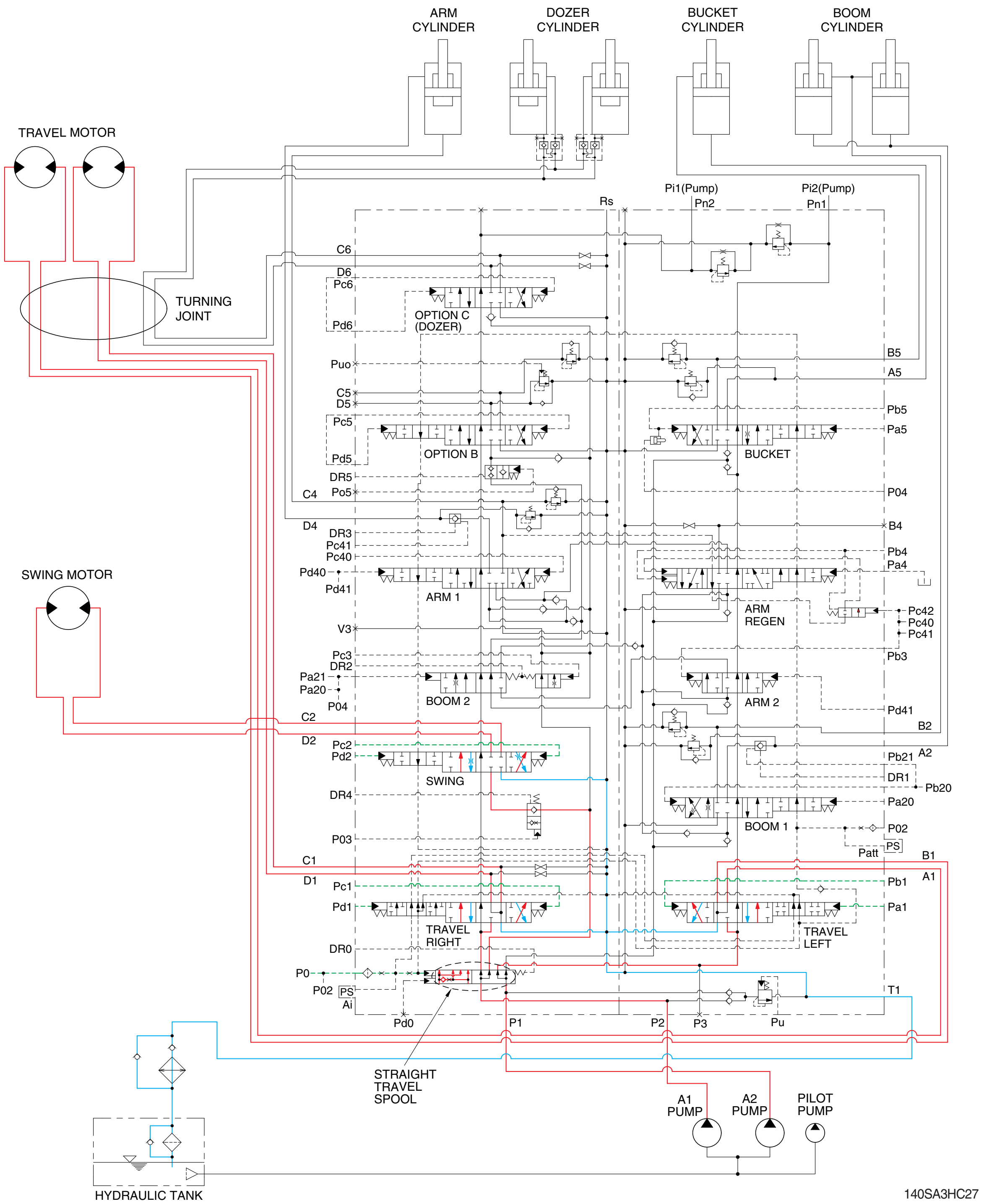
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

The oil from the A2 pump flows into the bucket cylinder through the bucket spool in the right control valve.

The super structure swings and the bucket is operated.

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

5. 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 (Pc2, Pd2, Pa1, Pb1, Pc1, Pd1) from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure (P0, P01) from the pilot pump.

The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

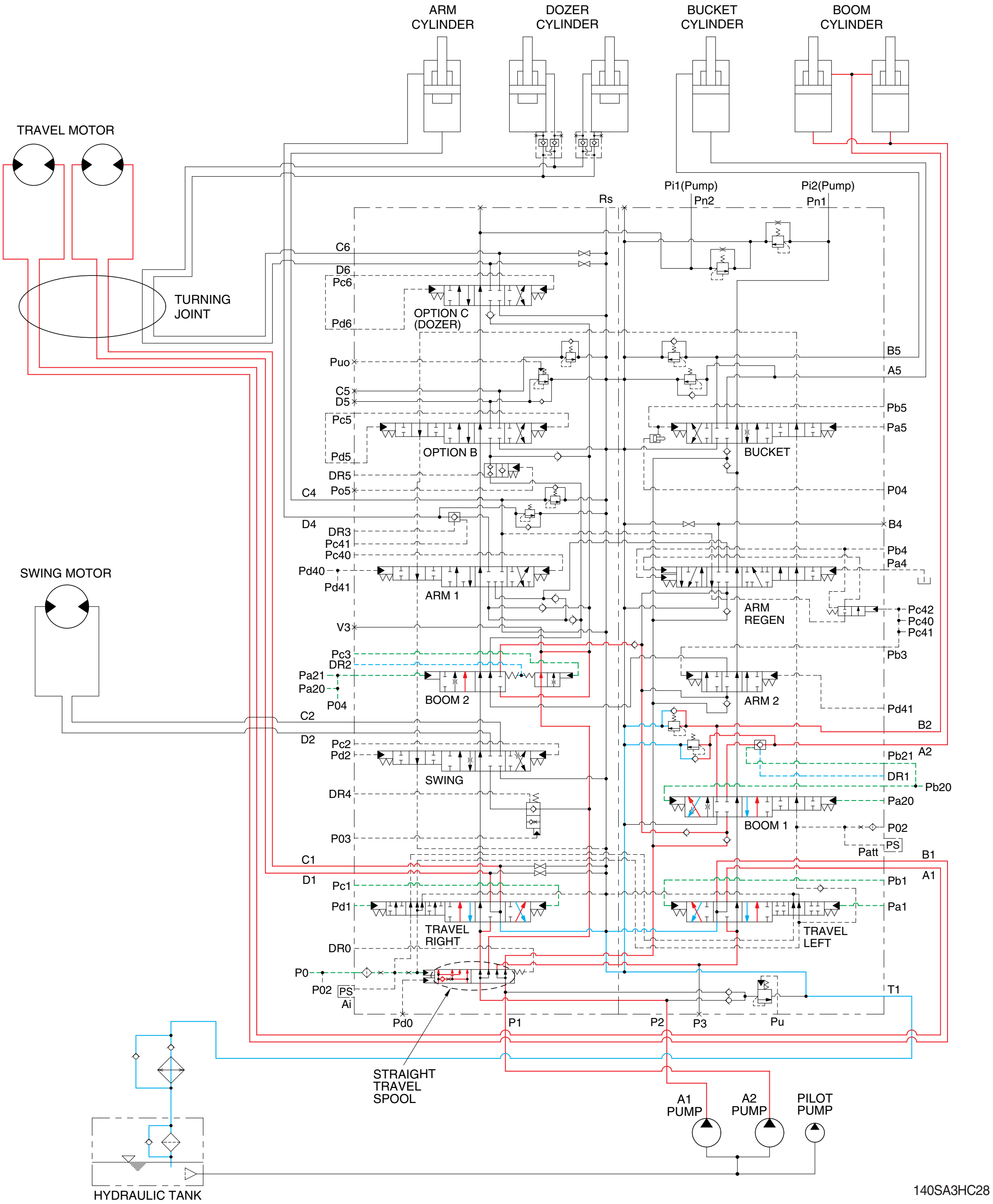
The oil from the A2 pump flows into the swing motor through in the straight travel spool.

When the pressure of the travel motors is lower than the pressure of the swing motor, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The upper structure swings and the machine travels straight.

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

6. COMBINED BOOM AND TRAVEL OPERATION



When the boom and travel functions are operated simultaneously, the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (Pa20, Pa21, Pc2, Pd2, Pa1, Pb1, Pc1, Pd1) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure (P0, P01) from pilot pump.

The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

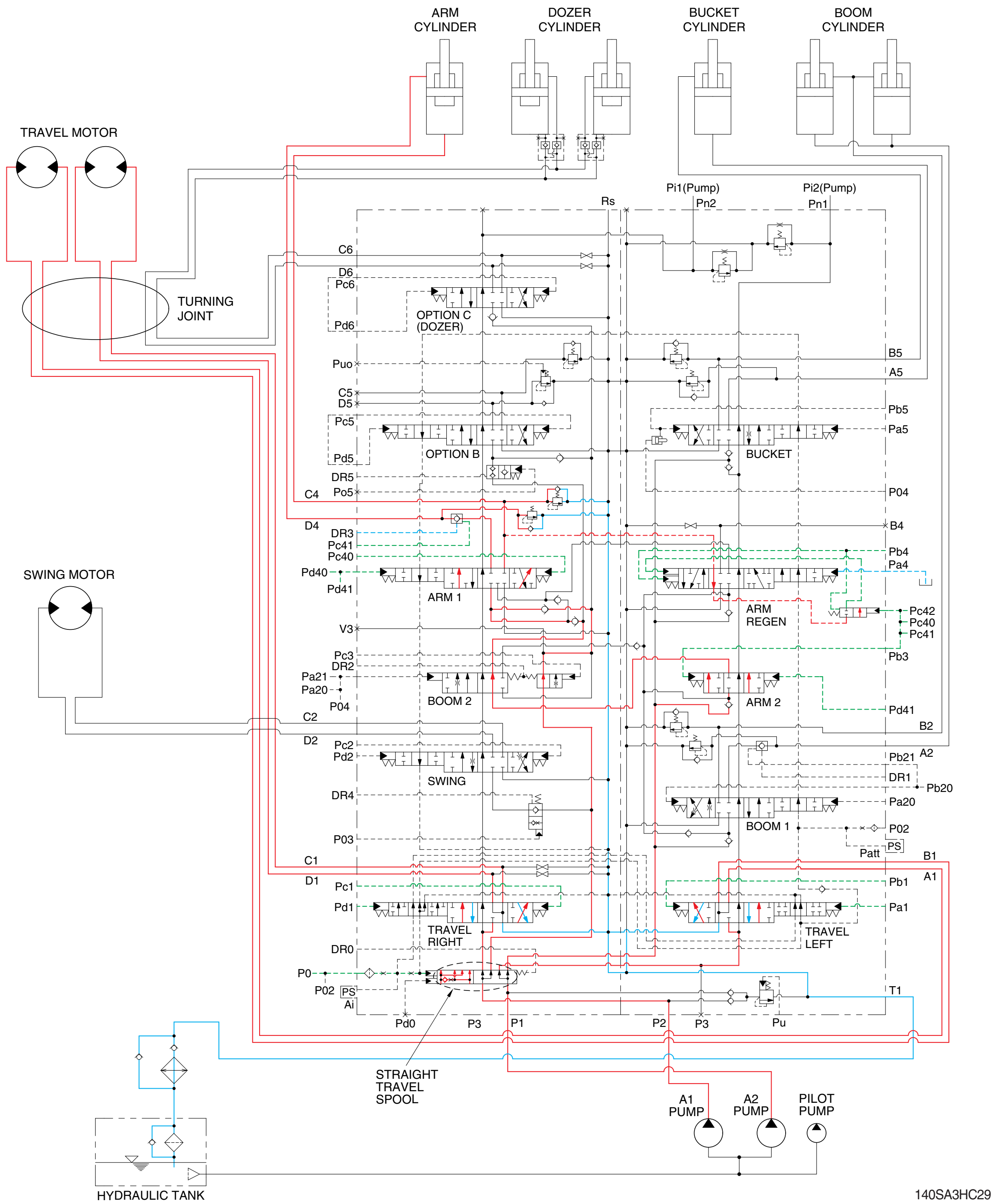
The oil from the A2 pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence oil passage in case boom up operation.

When the pressure of the travel motors is lower than the pressure of the boom cylinders, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The boom is operated and the machine travels straight.

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

7. COMBINED ARM AND TRAVEL OPERATION



When the arm and travel functions are operated simultaneously, the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (Pc40, Pd40, Pd41, Pb3, Pc2, Pd2, Pa1, Pb1, Pc1, Pd1) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure (P0, P01) from pilot pump.

The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

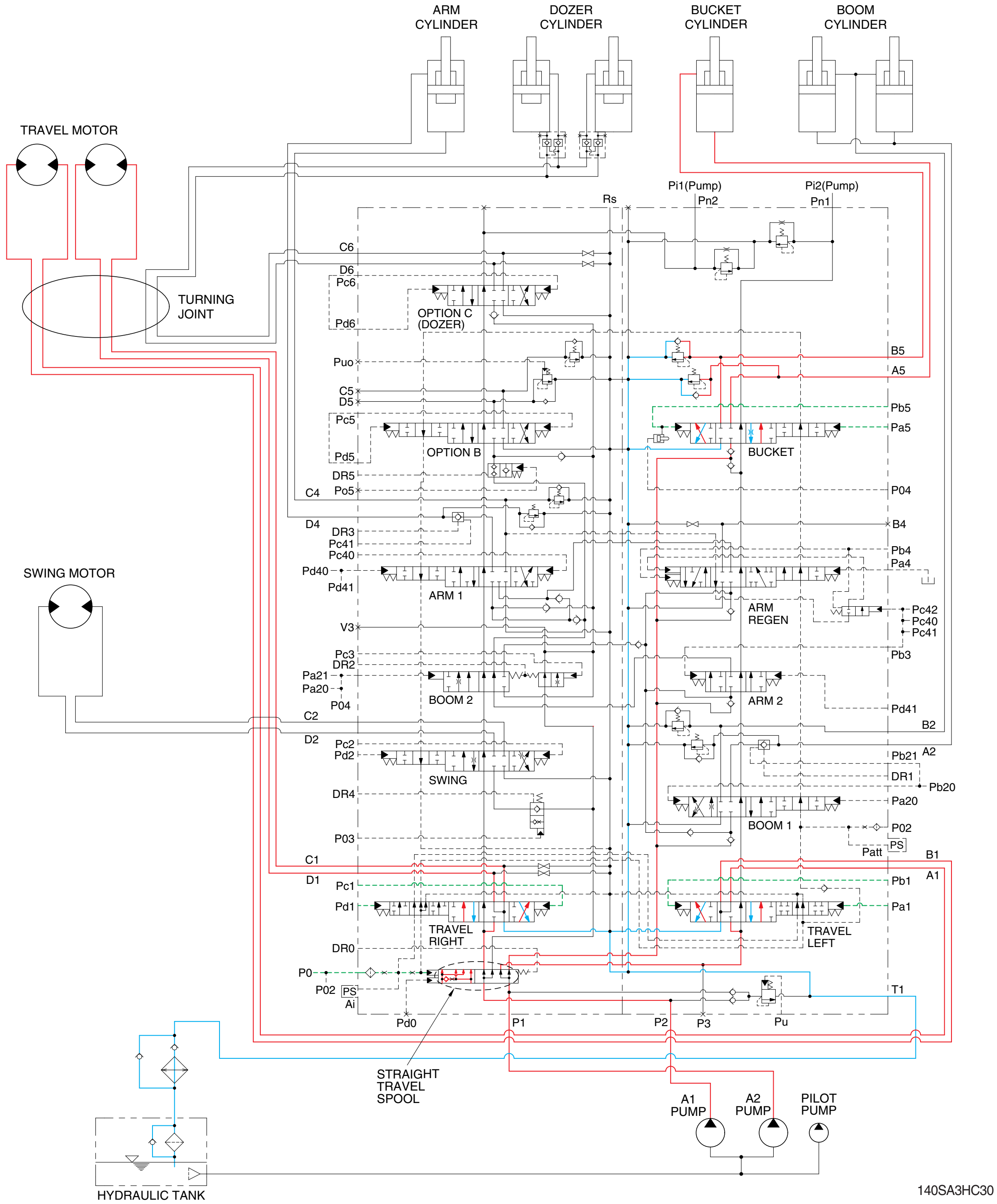
The oil from the A2 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage.

When the pressure of the travel motors is lower than the pressure of the arm cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The arm is operated and the machine travels straight.

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

8. COMBINED BUCKET AND TRAVEL OPERATION



When the bucket and travel functions are operated simultaneously, the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (Pa5, Pb5, Pa1, Pb1, Pc1, Pd1) from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure (P0, P01) from pilot pump. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool of the control valve.

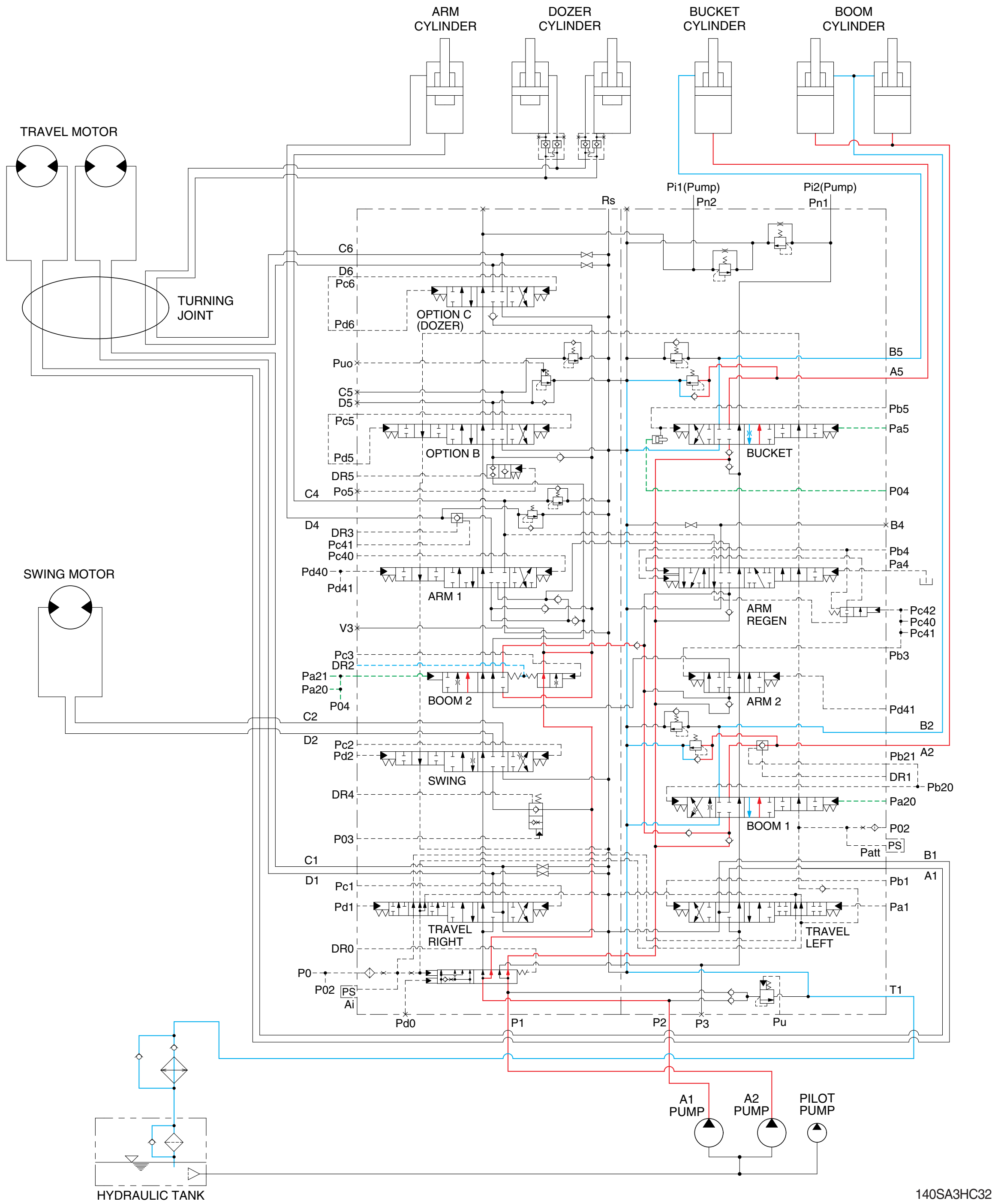
The oil from the A2 pump flows into the bucket cylinder through the bucket spool via the confluence oil passage.

When the pressure of the travel motors is lower than the pressure of the bucket cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The bucket is operated and the machine travels straight.

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

9. COMBINED BOOM UP AND BUCKET IN OPERATION



When the boom up and bucket in functions are operated simultaneously, each spool in the main control valve is moved to the functional position by the pilot oil pressure (Pa20, Pa21, Pa5) from the remote control valve.

The oil from the A1 pump flows into the boom cylinders through the boom 2 spool in the left control valve. The oil from the A2 pump flows into the boom cylinders and bucket cylinder through the boom 1 spool, bucket spool and the parallel and confluence oil passage in the right control valve.

Also, when the boom up and bucket in functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure P04 and then the bucket spool transfers in the half stroke not full stroke (refer to page 2-33). Therefore, the most of pressurized oil flows into boom 1 spool than the bucket spool to make the boom up operation more preferential.

The boom and bucket are operated.

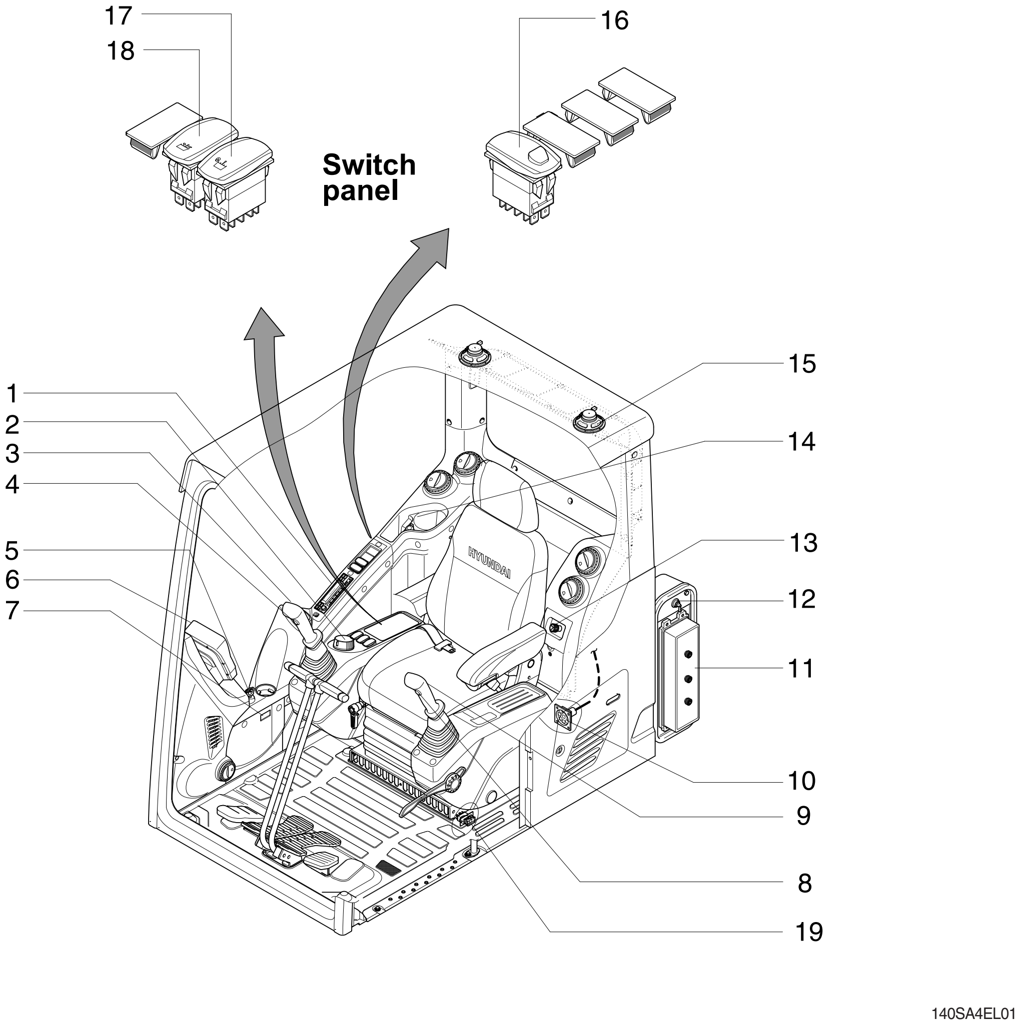
※ The circuit diagram may differ from the equipment, so please check before a repair.

SECTION 4 ELECTRICAL SYSTEM

Group 1 Component Location ········· 4-1
Group 2 Electrical Circuit ········· 4-3
Group 3 Electrical Component Specification ········· 4-22
Group 4 Connectors ········· 4-33

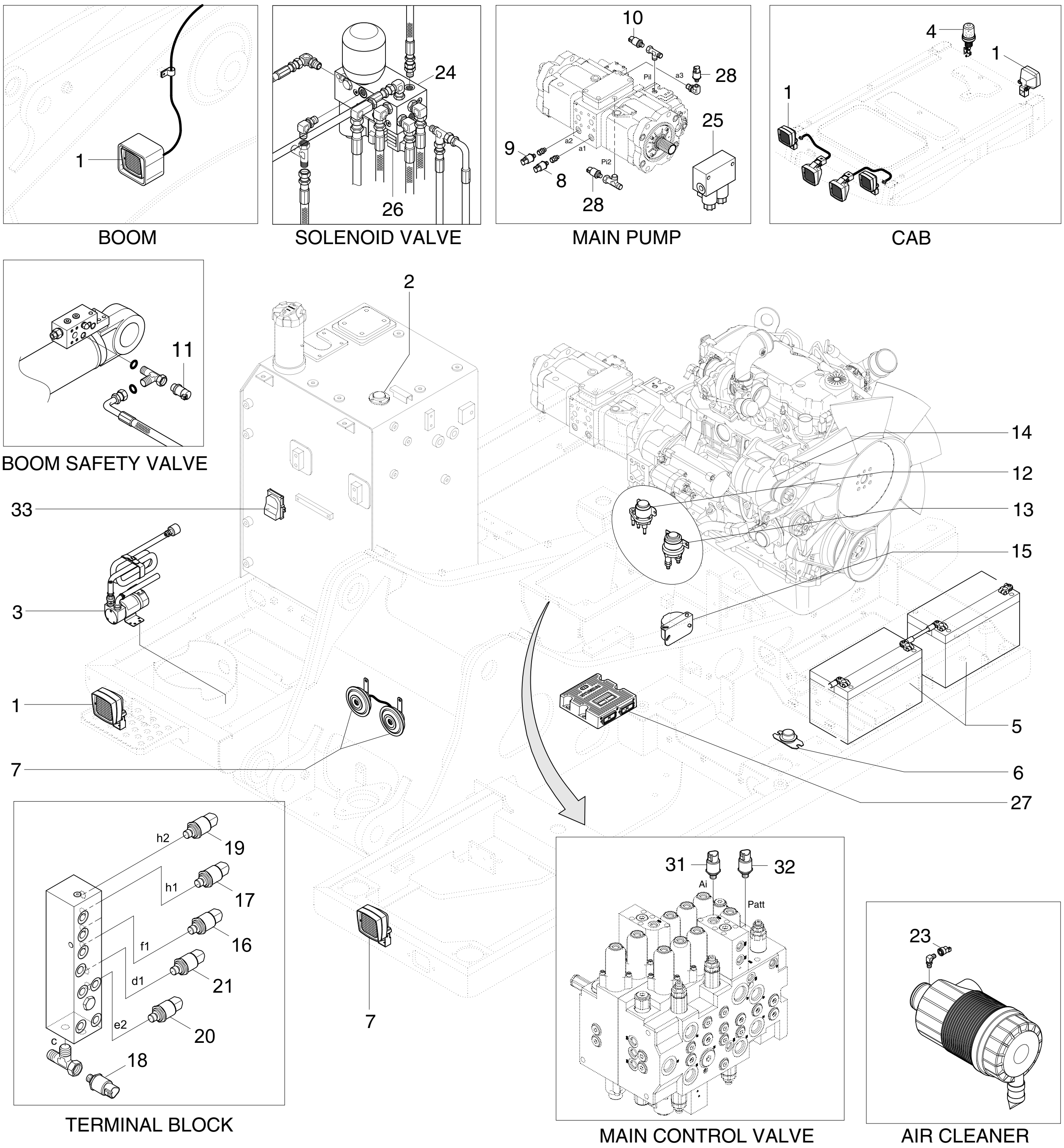
GROUP 1 COMPONENT LOCATION

1. LOCATION 1



1	Radio & USB player	8	Power max switch (null)	15	Speaker
2	Accel dial	9	One touch decel switch	16	Quick clamp switch
3	Horn switch	10	RS232 service socket	17	Swing lock switch
4	Breaker operation switch	11	Fuse & relay box	18	Fine swing switch
5	Starting switch	12	Master switch	19	Emergency engine stop switch
6	Cluster	13	Cigar lighter		
7	Service meter	14	12V socket		

2. LOCATION 2



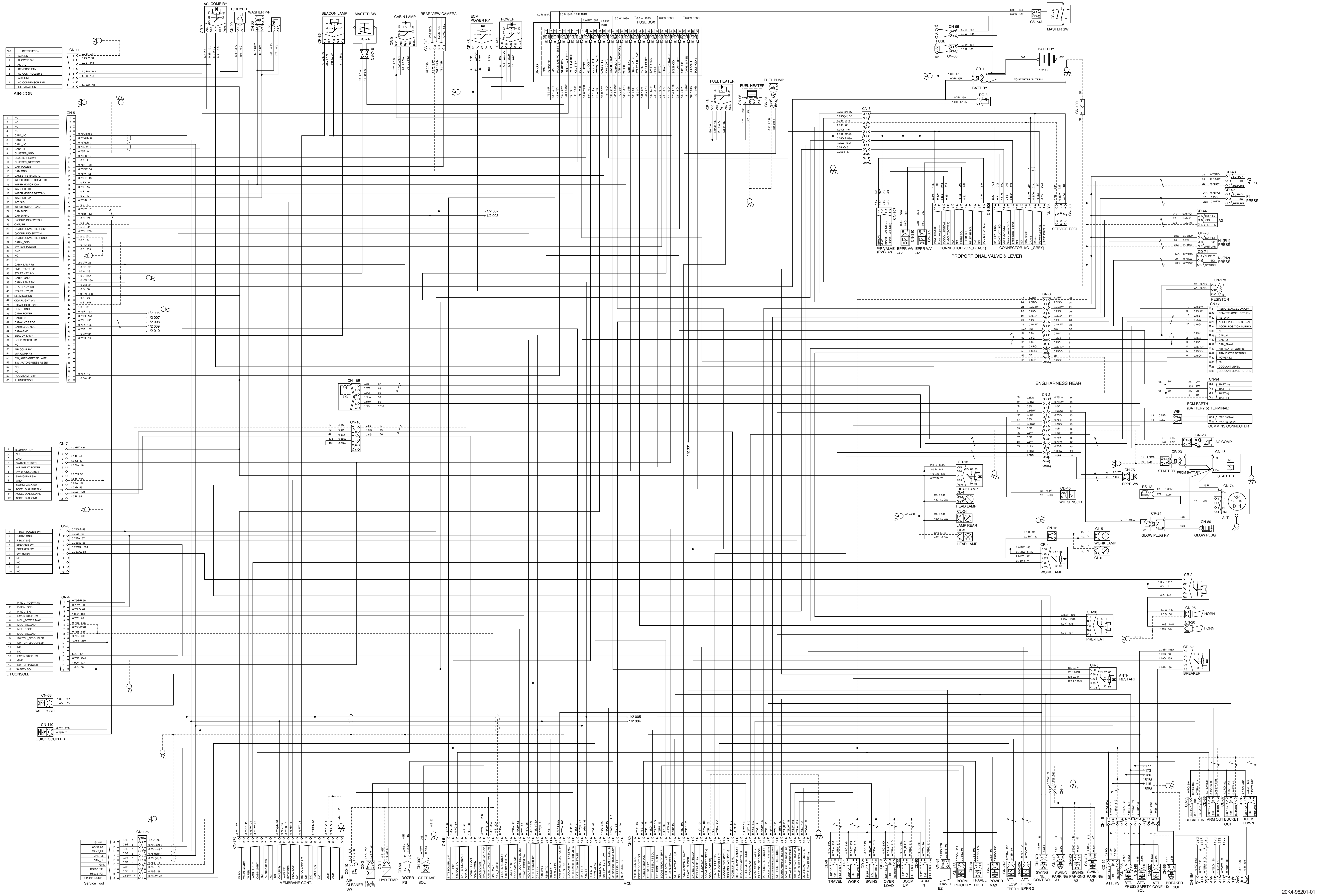
140SA4EL02

1	Lamp	11	Overload pressure sensor	21	Arm out pressure sensor
2	Fuel sender	12	Start relay	23	Air cleaner sensor
3	Fuel filler pump	13	Heater relay	24	Solenoid valve
4	Beacon lamp	14	Alternator	25	Pump flow control EPPR valve
5	Battery	15	Travel alarm buzzer	26	Boom priority EPPR valve
6	Battery relay	16	Bucket in pressure sensor	27	MCU
7	Horn	17	Boom up pressure sensor	28	Nega-control pressure sensor
8	A1 pump pressure sensor	18	Swing pressure sensor	31	Travel pressure sensor
9	A2 pump pressure sensor	19	Boom down pressure sensor	32	Attach pressure sensor
10	EPPR pressure sensor	20	Arm in pressure sensor	33	RDU assy

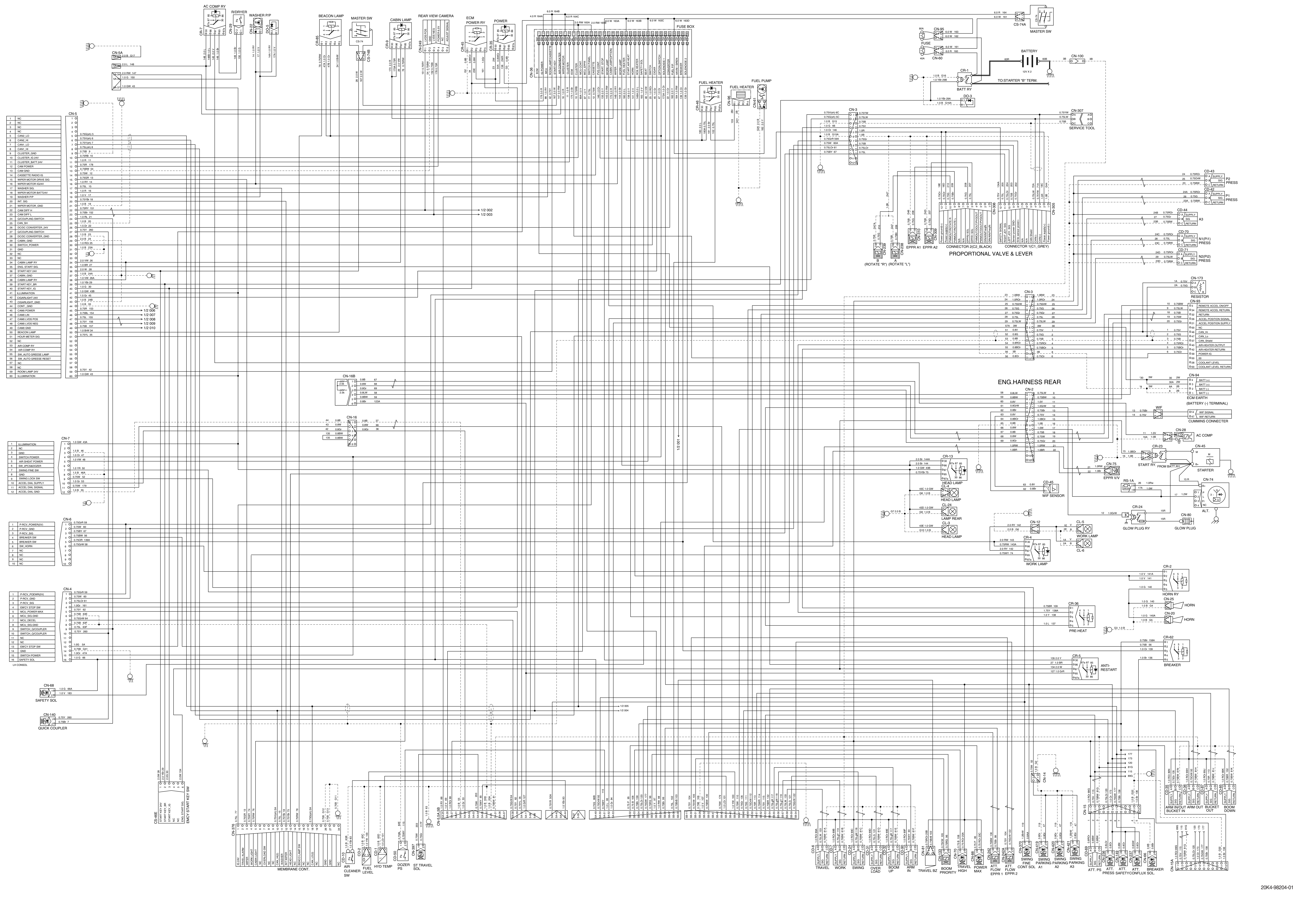
GROUP 2 ELECTRICAL CIRCUIT (1/2)

· ELECTRICAL CIRCUIT (1/2)

- MACHINE SERIAL NO. : -#00122

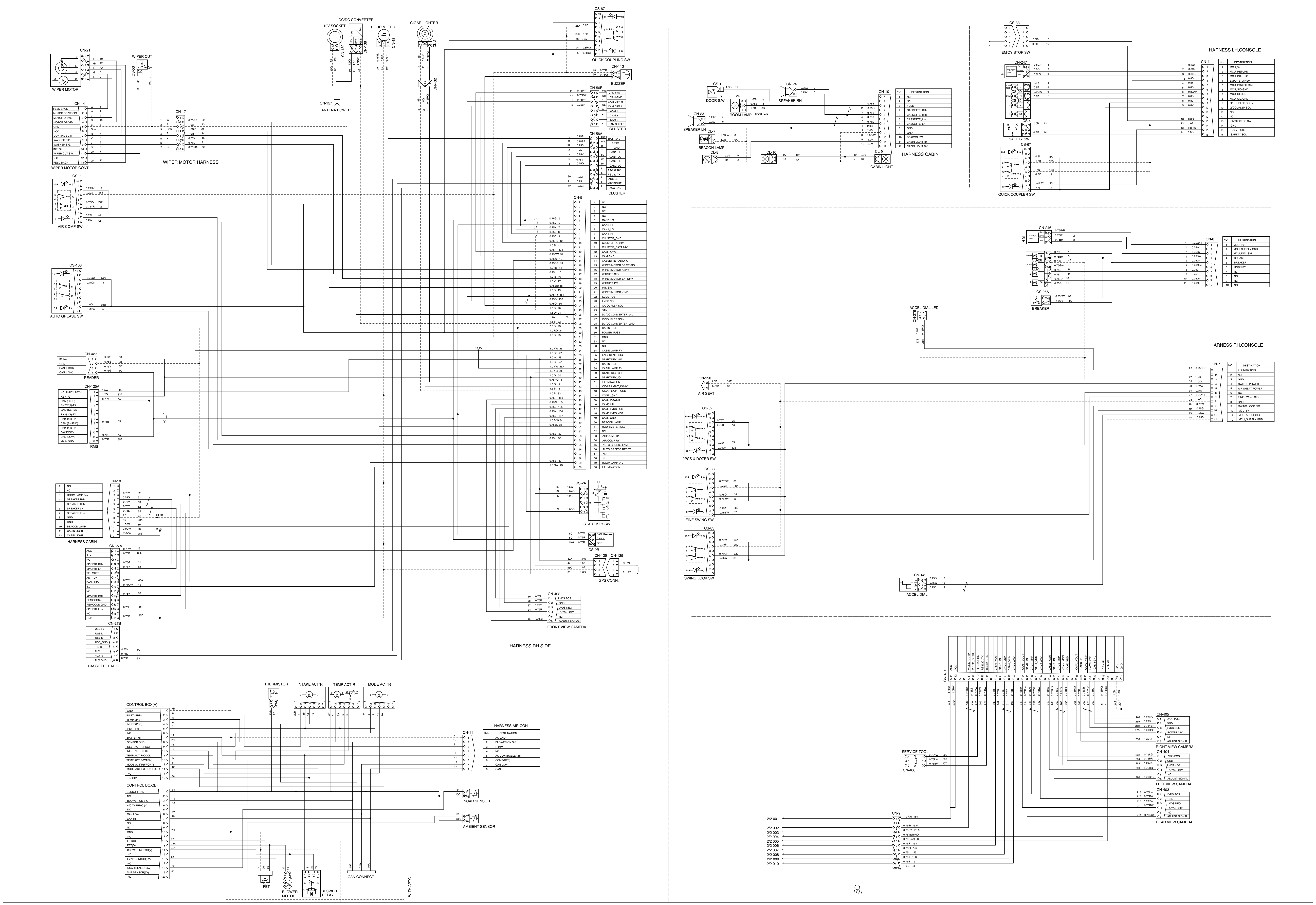


- MACHINE SERIAL NO. : #00123-



20K4-98204-01

· ELECTRICAL CIRCUIT (2/2)



20K6-98100-02

MEMORANDUM

1. POWER CIRCUIT

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

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

1) OPERATING FLOW

Battery → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74A]

- → Fuse box [No.1] → I/conn [CN-3 (8)] → ECM [CN-94 (3, 4)]
- → Fuse box [No.2]
  - → Power relay [CR-35 (30)]
  - → ECM power relay [CR-45 (3)]
- → Fuse box [No.3] → MCU [CN-51 (1)]
- → Fuse box [No.4] → I/conn [CN-5 (59)]
  - → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
    - → Door switch [CS-1]
  - → Radio & USB player [CN-27A (8)]
- → Fuse box [No.5] → Master switch [CS-74B] → I/conn [CN-5 (36)]
  - → Start switch [CS-2A (1)]
  - → RMS [CN-125A (1)]
  - → GPS connection [CN-125 (1)]
- → Fuse box [No.6] → I/conn [CN-11 (5)]
  - → AC & Heater controller box (A)
  - → Blower relay (4)
- → Fuse box [No.7] → I/conn [CN - 5 (18)] → I/conn [CN -17 (5)]
  - → Wiper motor controller [CN-141 (7)]
  - → Wiper motor [CN-21 (4)]
- → Fuse box [No.8] → I/conn [CN - 5 (11)]
  - → Cluster [CN -56A (1)]
  - → Hour meter [CN-48 (1)]

※ I/conn : Intermediate connector

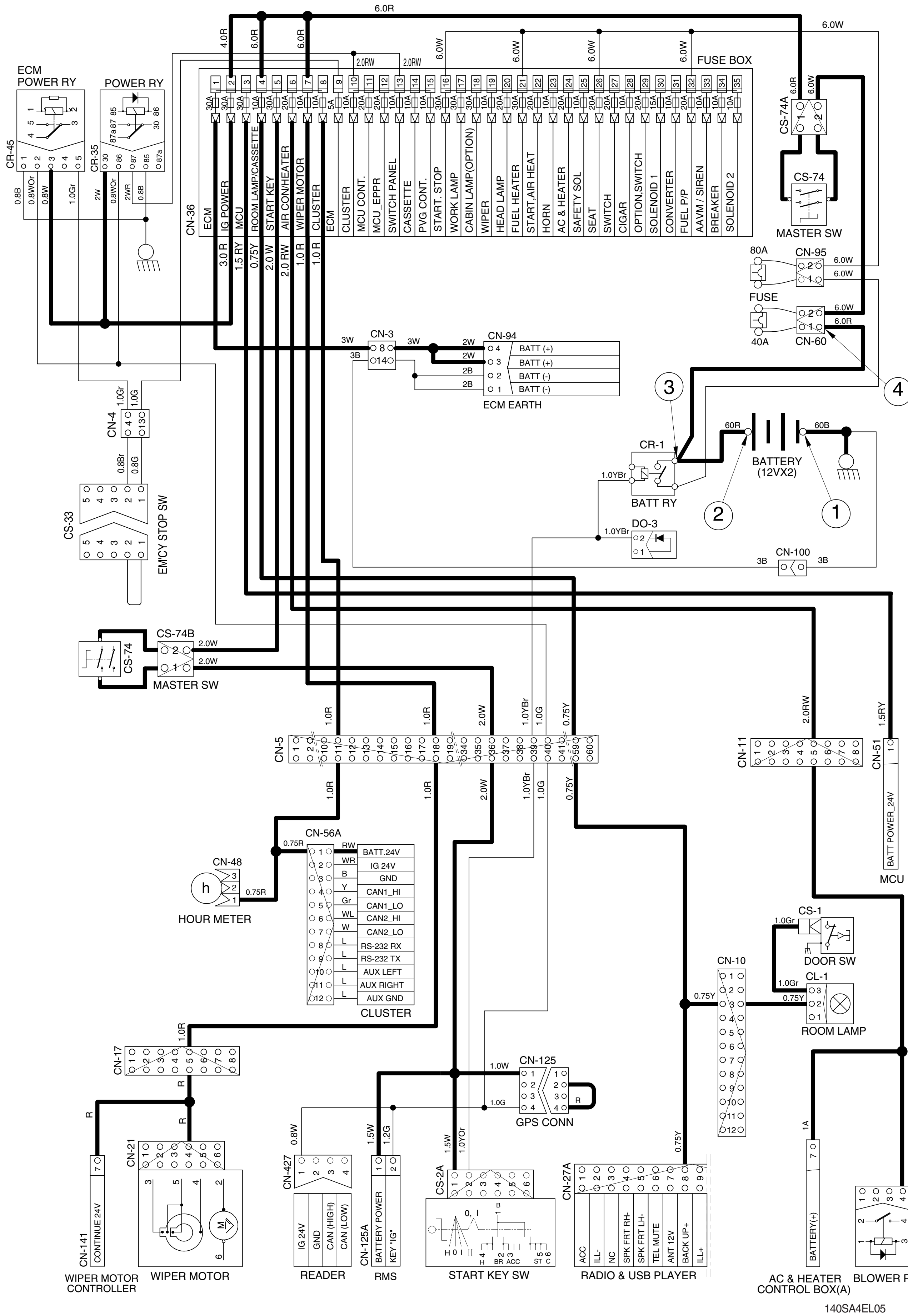
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	OFF	① - GND (battery 1EA)	10~12.5V
		② - GND (battery 2EA)	20~25V
		③ - GND (battery relay)	20~25V
		④ - GND (fuse)	20~25V

※ 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 → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74A]
→ Fuse box [No.5] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)
→ Fuse box [No.2] → Power relay [CR-35 (30)]
→ ECM power relay [CR-45 (3)]

(1) When start switch is in ON position

→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
→ Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)]
→ I/conn [CN-5 (40)] → Power relay [CR-35 (86) → (87)]
→ Fuse box [No.11] → MCU [CN-51 (2)]
→ ECM Power relay [CR-45 (2) → (5)] → I/conn [CN-4 (4)]
→ Emergency engine stop sw [CS-33 (2)→(1)] → I/conn [CN-4 (13)]
→ Fuse box [No. 9] → I/conn [CN-3 (15)]
→ Engine ECM [CN-93 (39)]
→ Reader [CN-427 (1)]
→ RMS [CN-125A (2)]

(2) When start switch is in START position

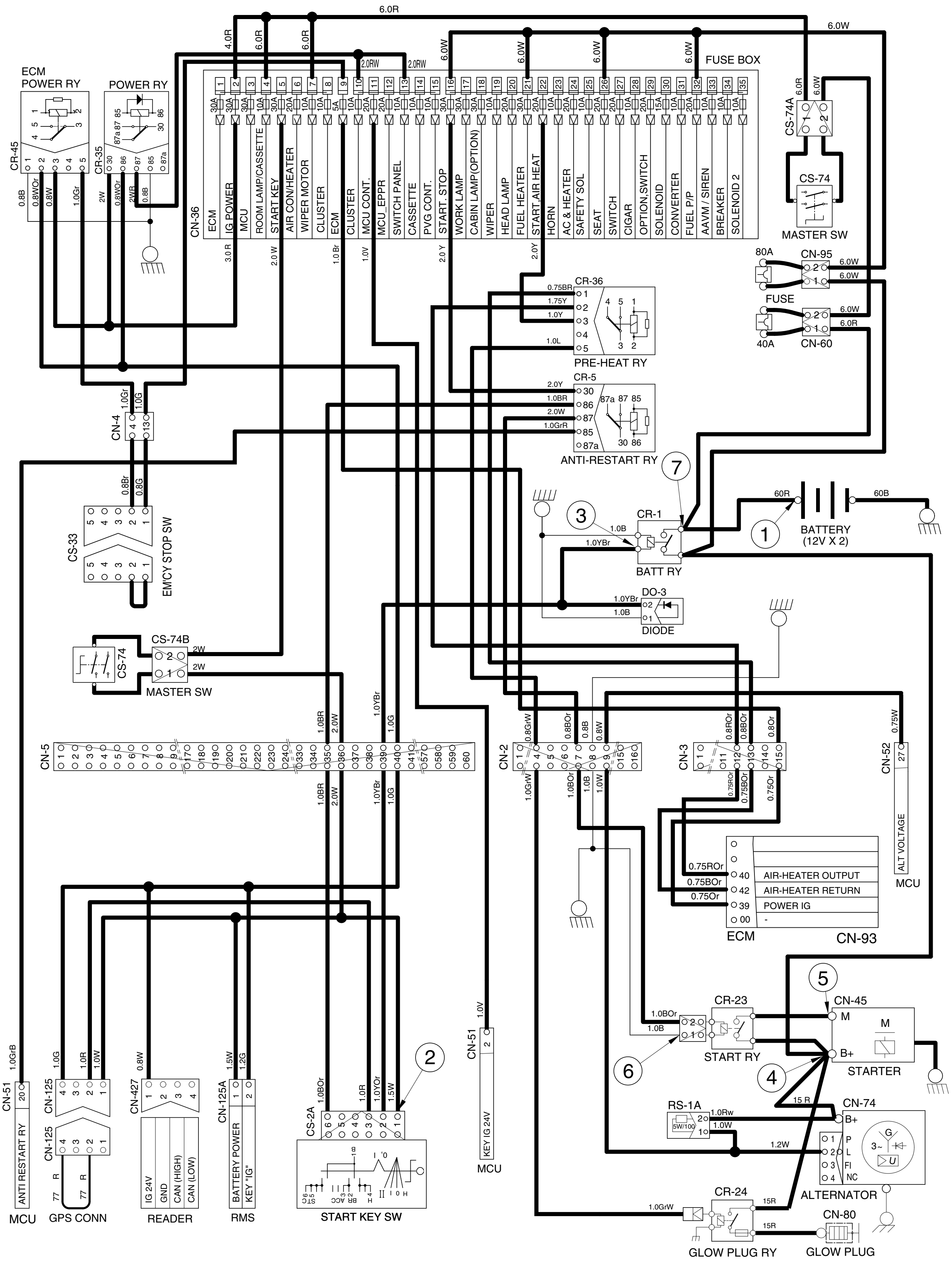
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (86) → (87)]
→ I/conn CN-2 (7) → Start relay [CR-23] → Starter motor operating

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OPERATING	START	① - GND (battery) ② - GND (start switch) ③ - GND (battery relay M4) ④ - GND (starter B^+) ⑤ - GND (starter M) ⑥ - GND (start relay) ⑦ - GND (battery relay M8)	20~25V

※ 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 battery relay [CR-1].

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

1) OPERATING FLOW

(1) Warning flow

Alternator [CN-74 (2)] → I/conn [CN-2 (9)] → MCU alternator voltage [CN-52 (27)]
→ Cluster charging warning lamp (Via CANbus interface)

(2) Charging flow

Alternator [CN-74 (B^+)] → Start motor [CN-45 (B^+)] → Battery relay (M8)
→ Battery (+) terminal
→ Fuse [CN-60] → Master switch [CS-74A] → Fuse box [No.1~8]
→ Fuse [CN-95] → Fuse box [No.16~35]

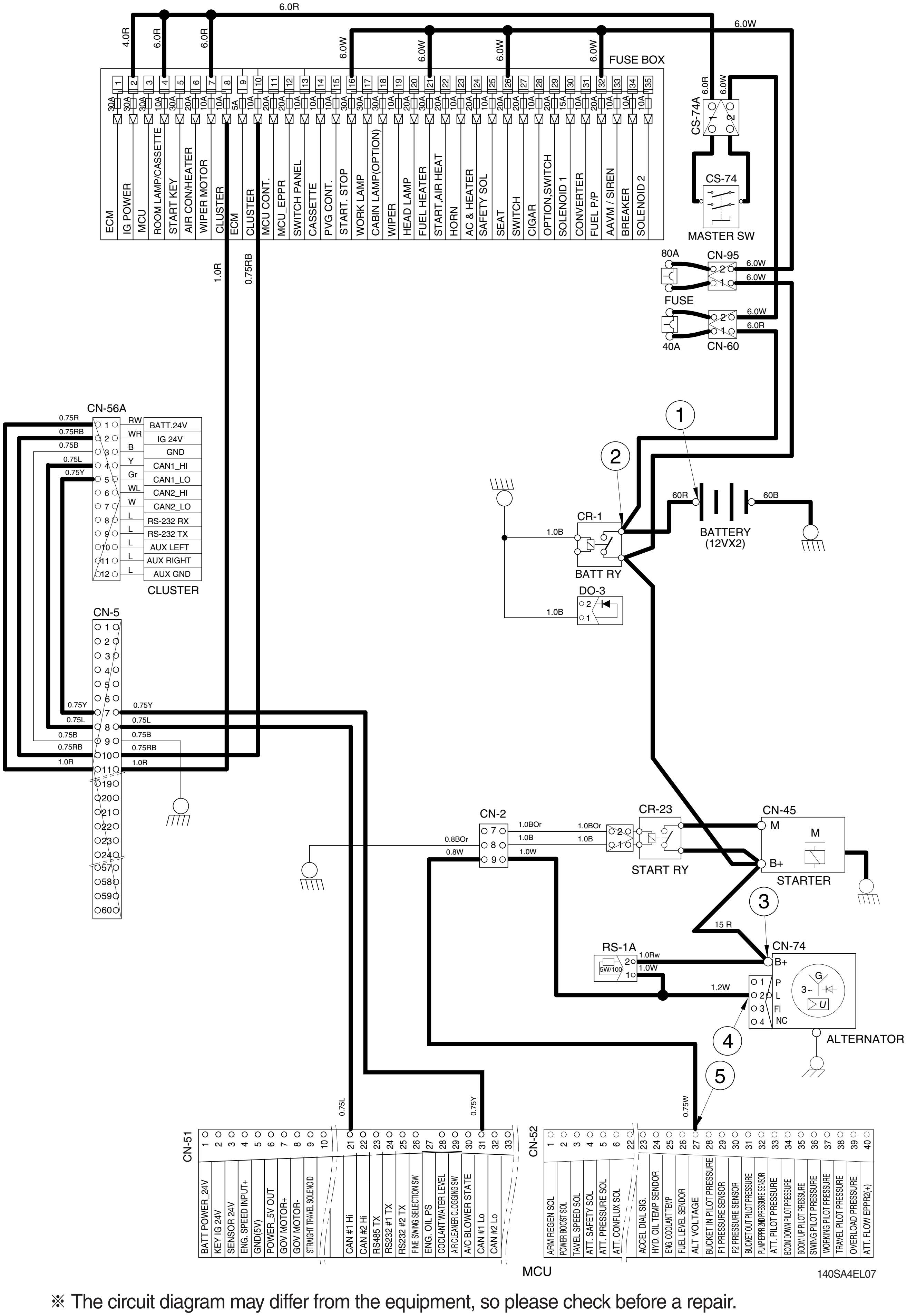
2) CHECK POINT

Engine	Start switch	Check point	Voltage
RUN	ON	① - GND (battery voltage) ② - GND (battery relay) ③ - GND (alternator B^+ terminal) ④ - GND (alternator 2 terminal) ⑤ - GND (MCU)	20~25V

※ 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. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.20) → Head light relay [CR-13 (30, 86)]
Fuse box (No.17) → Work light relay [CR-4 (30, 86)]
Fuse box (No.13) → Membrane controller [CN-376 (1)]

(1) Head light switch ON

Head light switch ON [CN-376 (13)] → Head light relay [CR-13 (85) → (87)]
- → Head light ON [CL-3 (2), CL-4 (1), CL-24 (2)]
- → I/conn [CN-5 (41)] → I/conn [CN-432 (1)] → Cigar lighter [CL-2]
- → I/conn [CN-5 (60)] → Radio & USB player illumination ON [CN-27A (9)]
- → I/conn [CN-7 (1)] → Accel dial LED [CN-279 (2)]

(2) Work light switch ON

Work light switch ON [CN-376 (4)] → Work light relay [CR-4 (85) → (87)]
→ I/conn [CN-12 (2)] → Work light ON [CL-5 (2), CL-6 (2)]

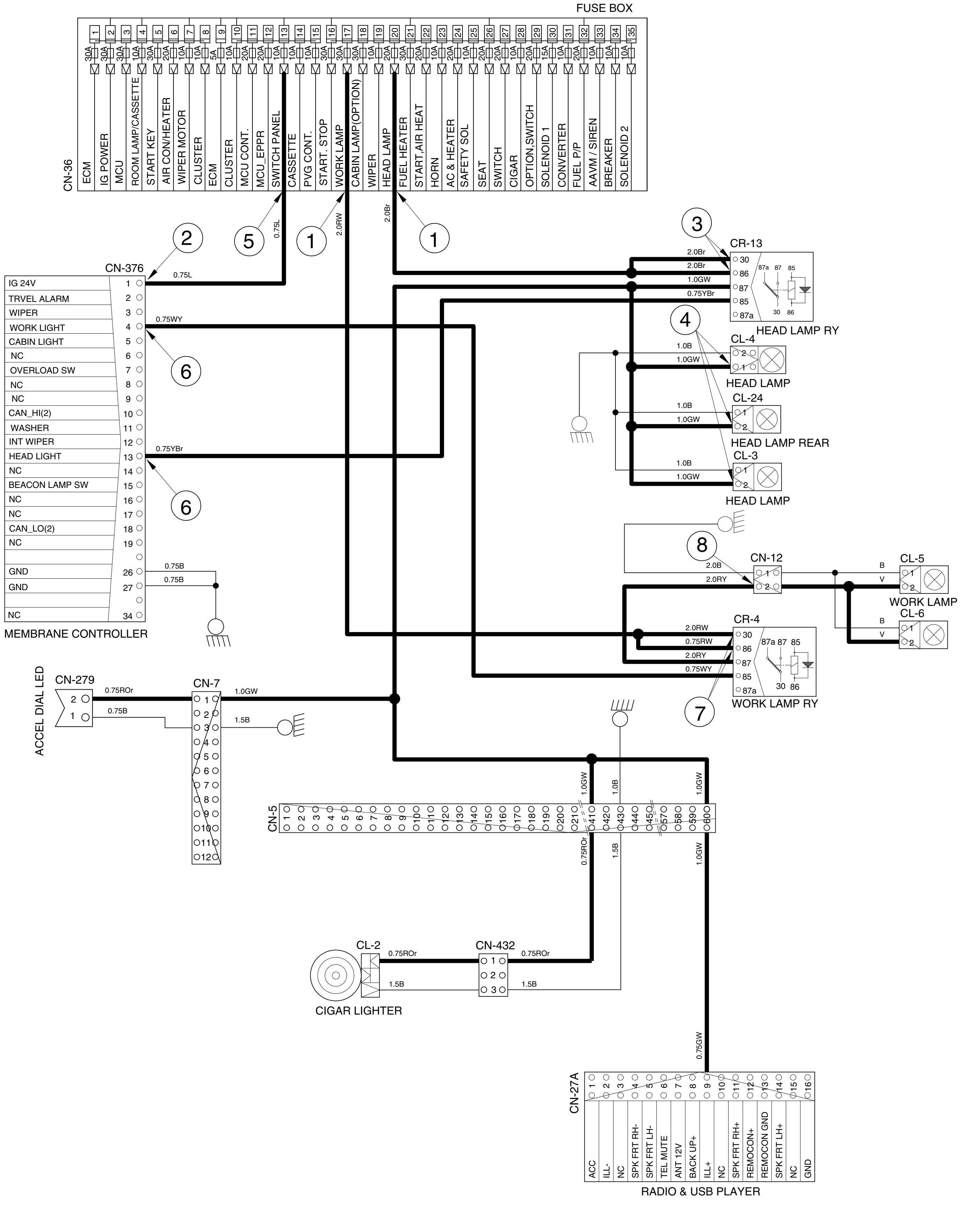
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (head light relay) ④ - GND (head light) ⑤ - GND (fuse box) ⑥ - GND (switch power output) ⑦ - GND (work light relay) ⑧ - GND (work light)	20~25V

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT



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

5. BEACON LAMP AND CAB LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.29) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.18) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.13) → Membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-376 (15)] → Beacon lamp relay [CR-85 (1)→(5)]
→ I/conn [CN-5 (50)] → I/conn [CN-10 (10)] → Beacon lamp ON [CL-7]

(2) Cab light switch ON

Cab light switch ON [CN-376 (5)] → Cab lamp relay [CR-9 (85)→(87)]
→ I/conn [CN-5 (34, 38)] → I/conn [CN-10 (11)] → Cab light ON [CL-8 (2)]
→ I/conn [CN-10 (12)] → Cab light ON [CL-9 (2), CL-10 (2)]

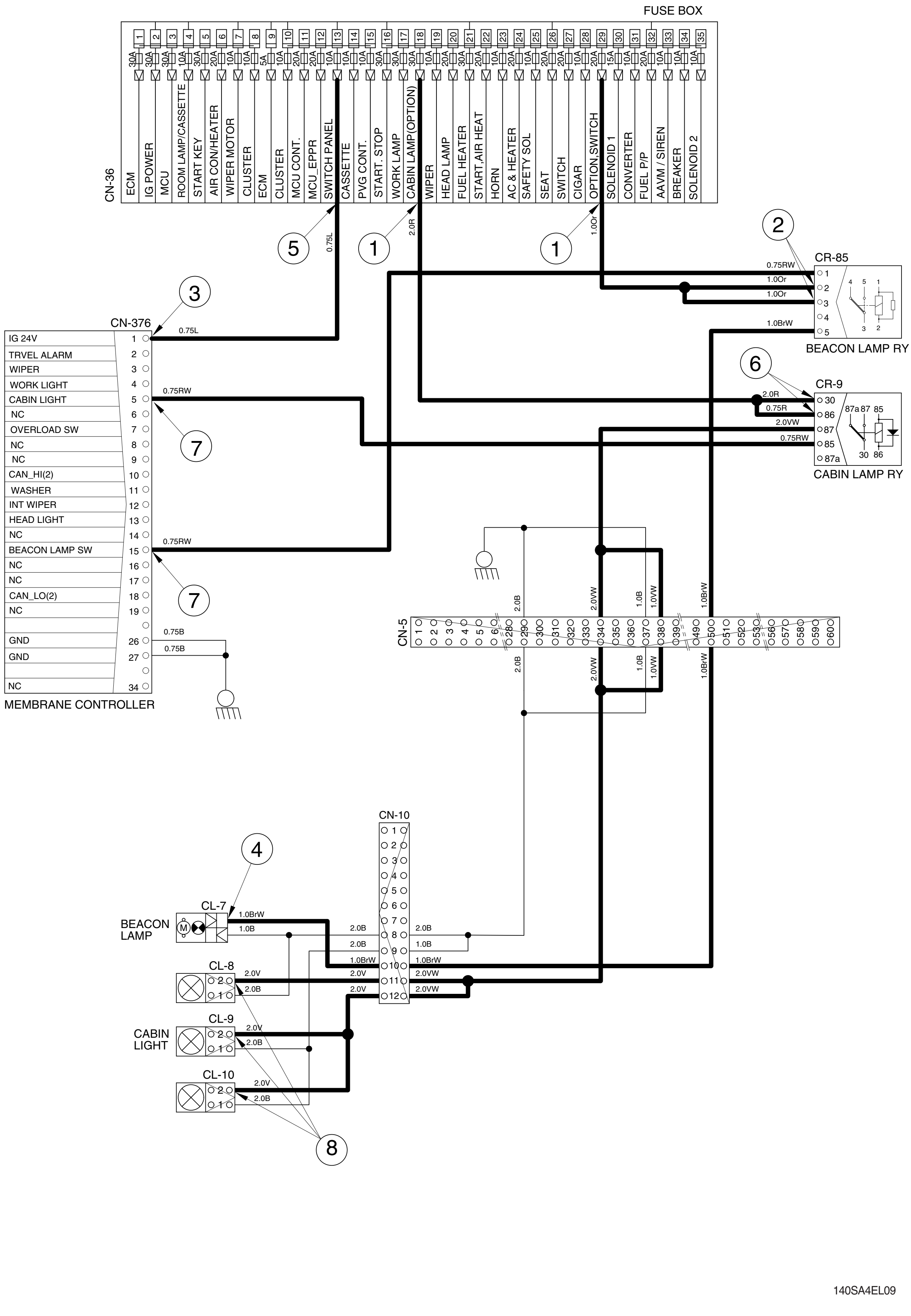
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (beacon lamp relay) ③ - GND (switch power input) ④ - GND (beacon lamp) ⑤ - GND (fuse box) ⑥ - GND (cabin light relay) ⑦ - GND (switch power output) ⑧ - GND (cab light)	20~25V

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT 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.13) → Membrance controller [CN-376 (1)]

Fuse box (No.7) → I/conn [CN-5 (18)] → I/conn [CN-17 (5)] → Wiper motor controller [CN-141 (7)]
→ Wiper motor [CN-21 (4)]

Fuse box (No.19) → I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
→ Wiper pump [CN-22 (2)]

(2) Wiper switch ON (Intermittent)

Wiper switch ON [CN-376 (12)] → I/conn [CN-5 (20)] → I/conn [CN-17 (8)]
→ Wiper motor controller [CN-141 (10)→(3)] → Wiper motor [CN-21 (6)] → Intermittently operating

(3) Wiper switch ON (continual)

Wiper switch ON [CN-376 (3)] → I/conn[CN-5 (15)] → I/conn[CN-17 (2)]
→ Wiper motor controller [CN-141 (2) → (4)] → Wiper motor [CN-21 (2)] → Continual operating

(4) Washer switch ON

Washer switch ON [CN-376 (11)] → I/conn [CN-5 (17)] → I/conn [CN-17 (7)]
→ Wiper motor controller [CN-141 (9) → (8)] → I/conn [CN-17 (6)] → I/conn [CN-5 (19)]
→ Washer pump [CN-22 (1)] → Washer operating
Wiper switch ON [CN-376 (3)] → I/conn[CN-5 (15)] → I/conn[CN-17 (2)]
→ Wiper motor controller [CN-141 (2) → (4)] → Wiper motor [CN-21 (2)] → Continual operating

(5) Auto parking (when switch OFF)

Switch OFF [CN-376 (3)] → Wiper motor parking position by wiper motor controller

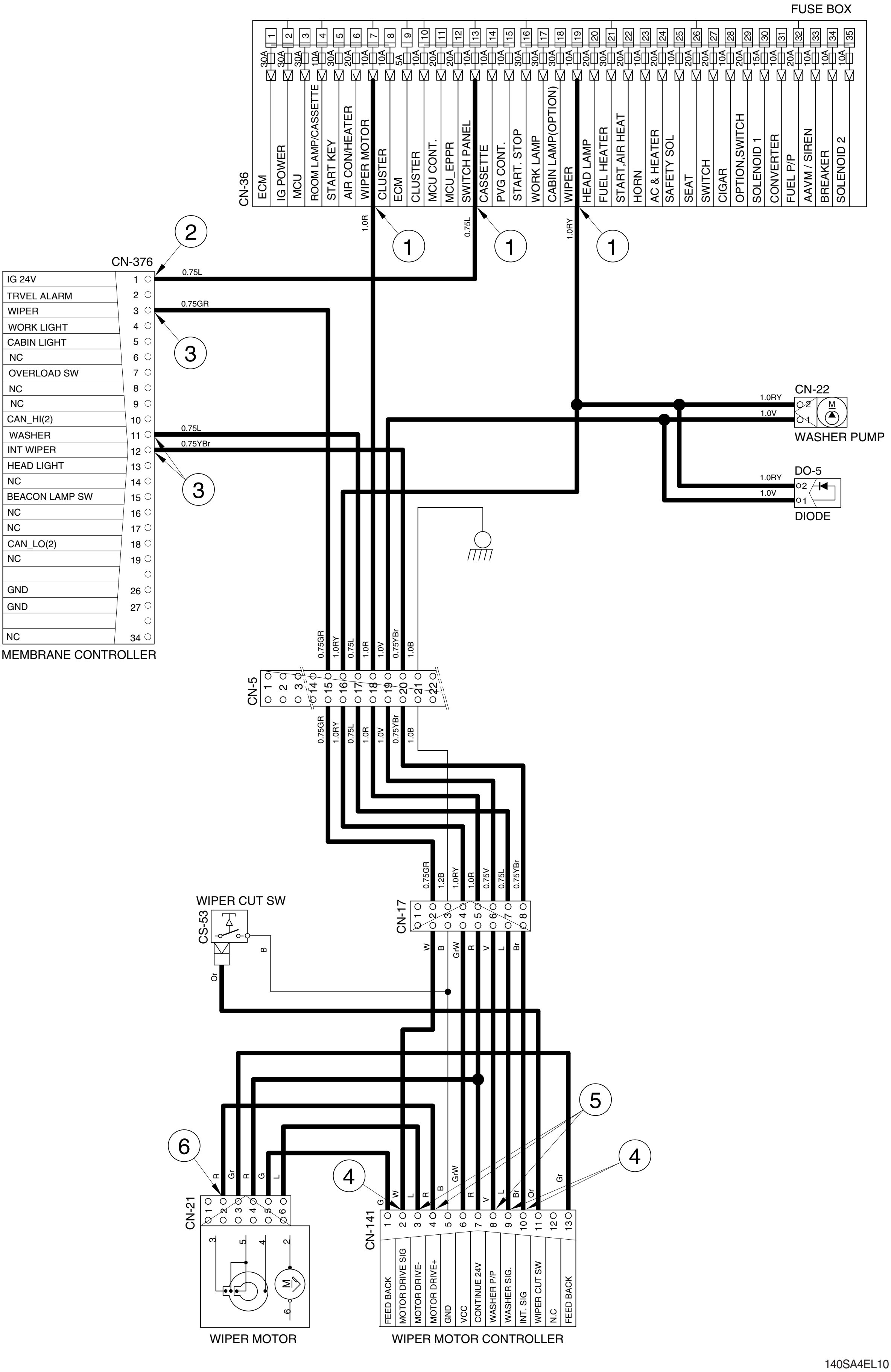
3) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input)	20~25V
		③ - GND (switch power output) ④ - GND (wiper switch power input)	0 ~ 5V
		⑤ - GND (wiper power output)	24V
		⑥ - GND (wiper motor)	0 or 24V

※ GND : Ground

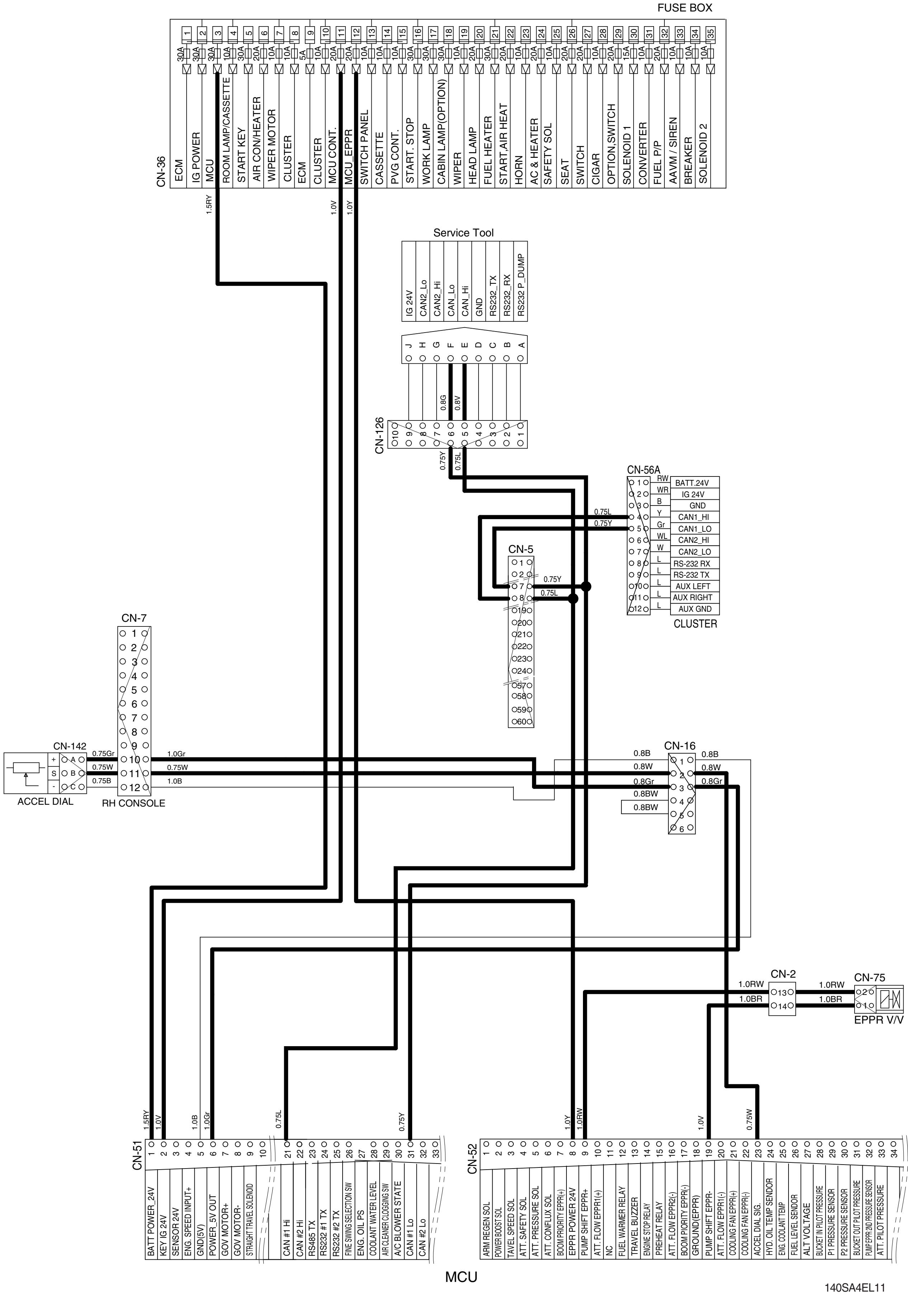
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT



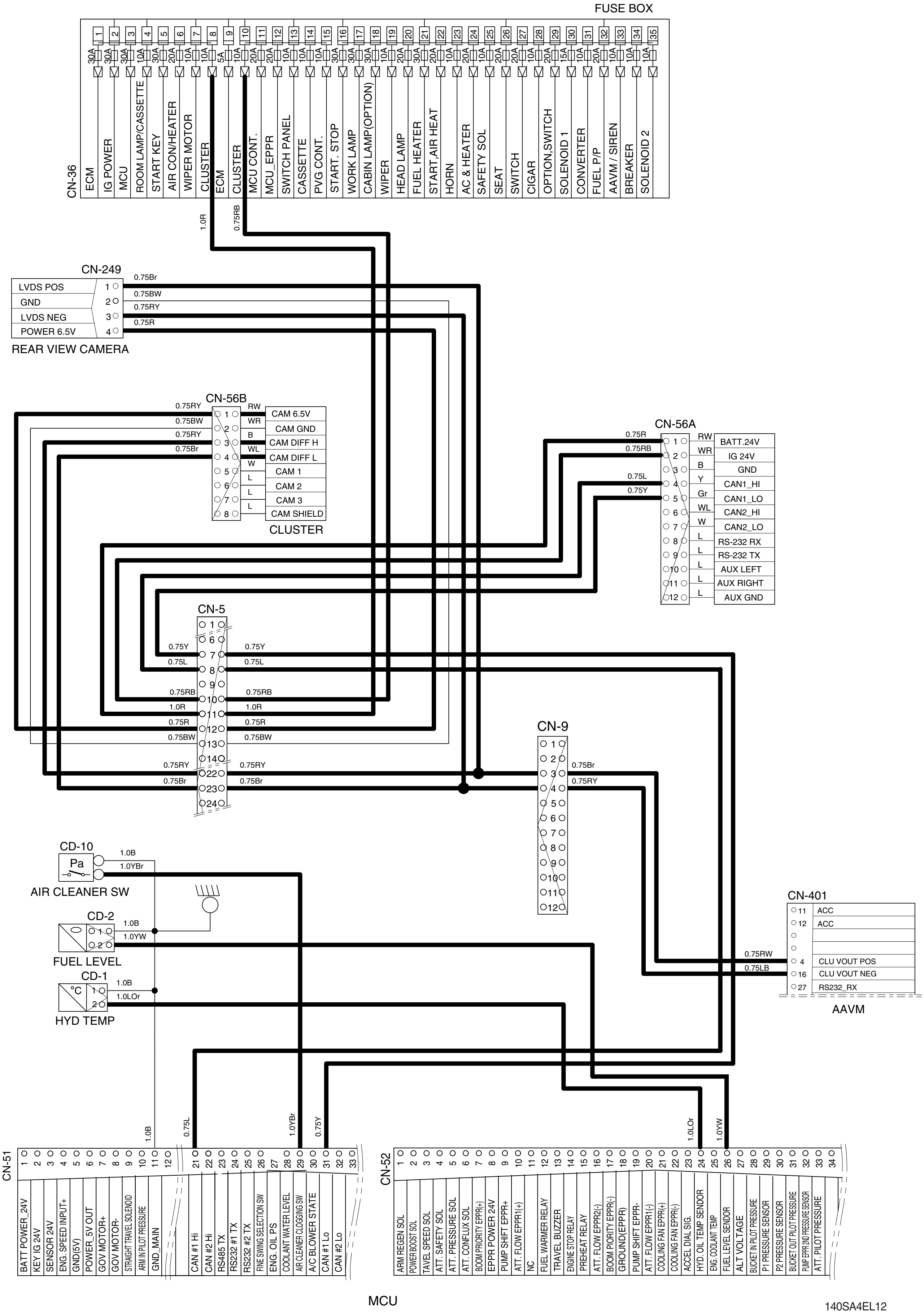
※ The circuit diagram may differ from the equipment, so please check before a repair.

CONTROLLER CIRCUIT



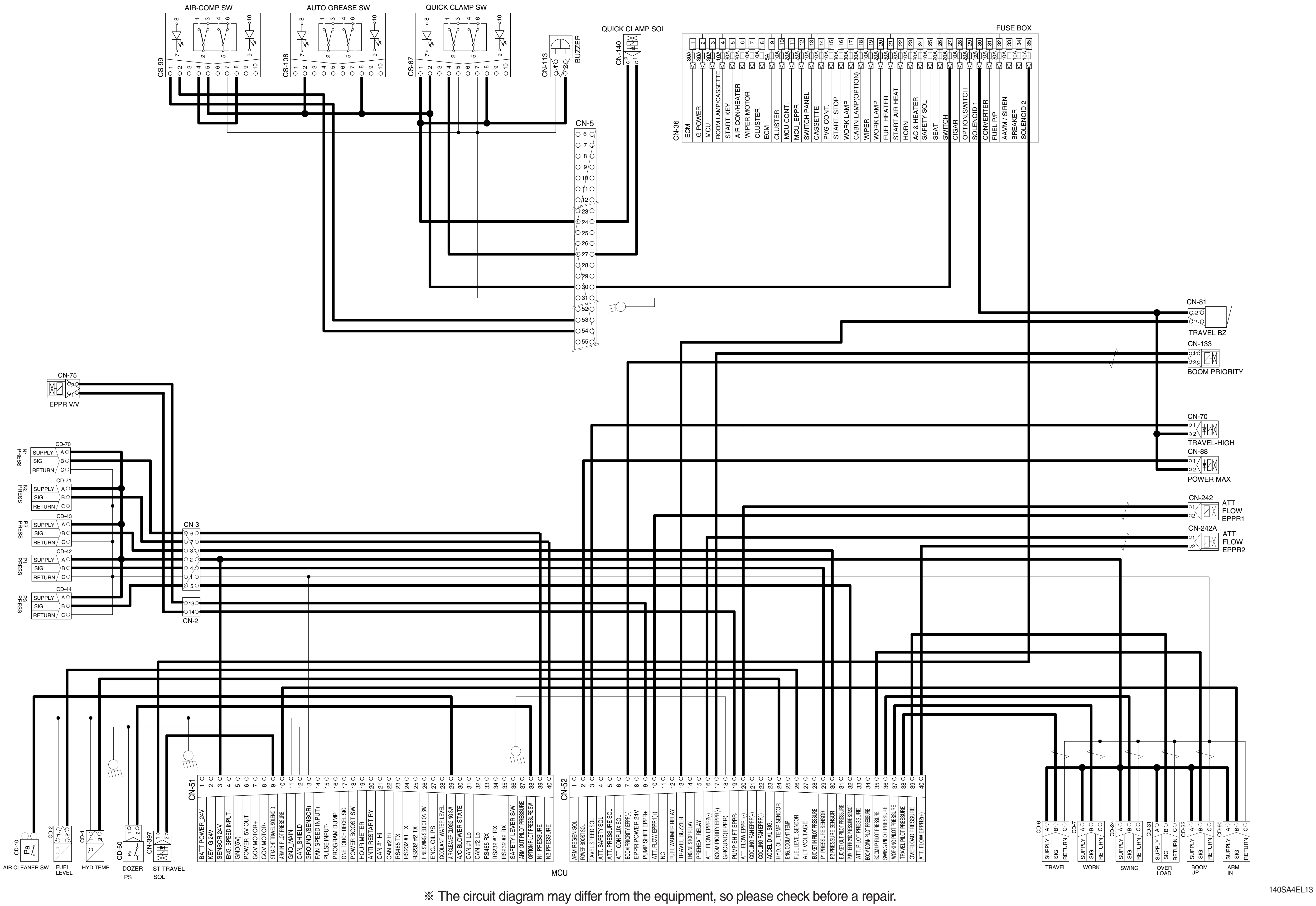
※ The circuit diagram may differ from the equipment, so please check before a repair.

MONITORING CIRCUIT



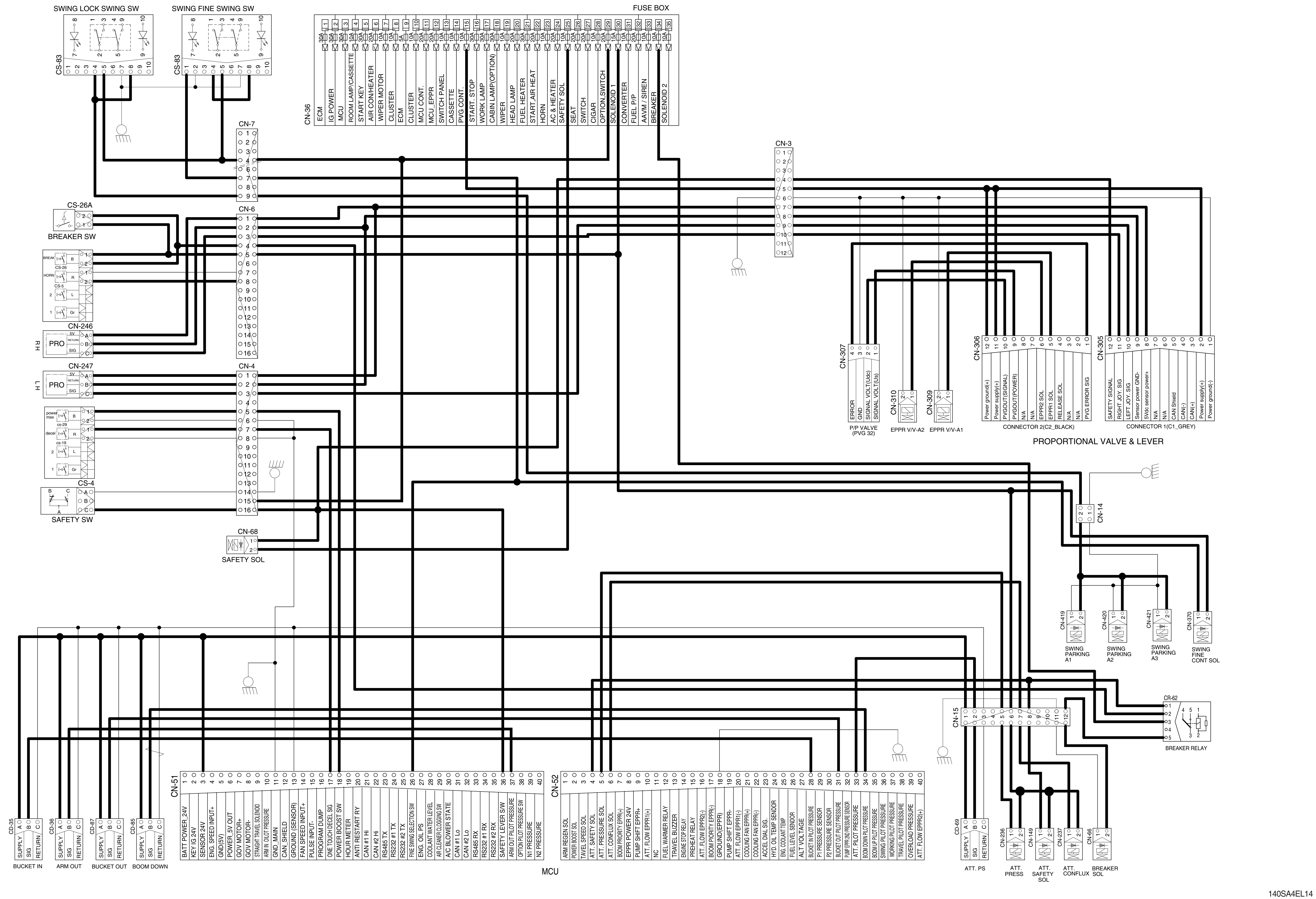
※ The circuit diagram may differ from the equipment, so please check before a repair.

ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)



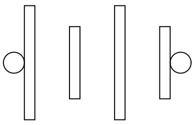
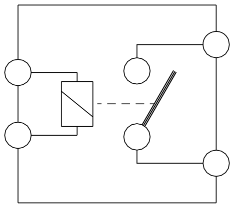
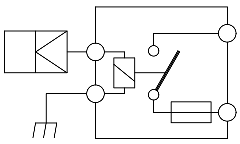
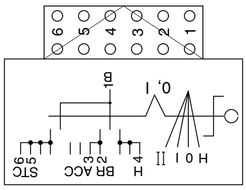
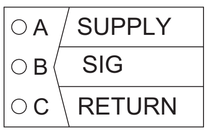
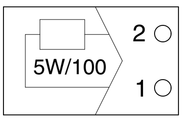
※ The circuit diagram may differ from the equipment, so please check before a repair.

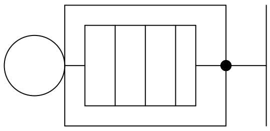
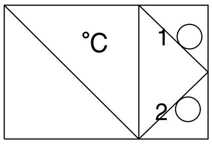
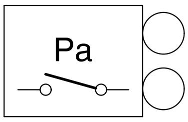
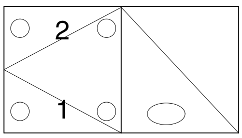
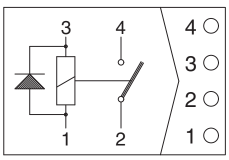
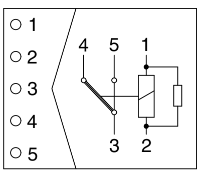
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

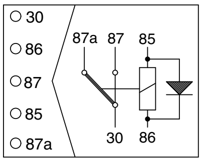
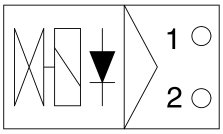
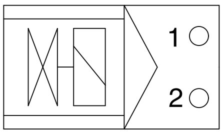
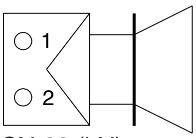
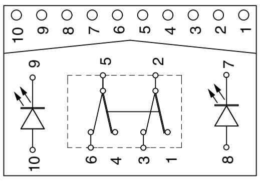
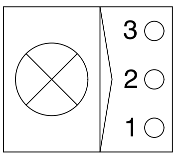


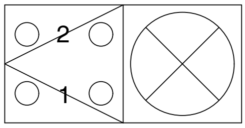
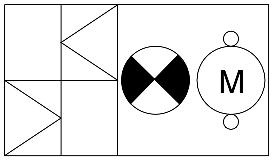
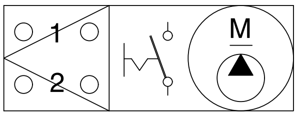
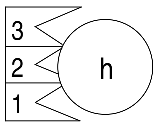
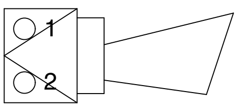
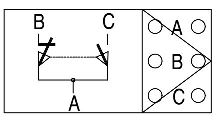
※ The circuit diagram may differ from the equipment, so please check before a repair.

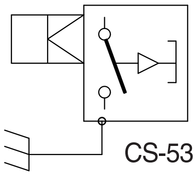
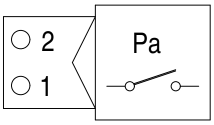
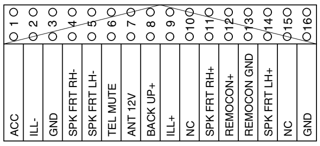
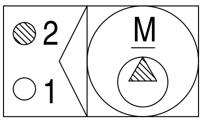
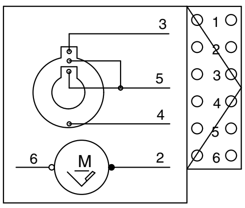
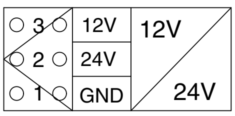
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

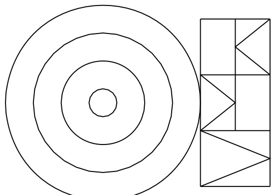
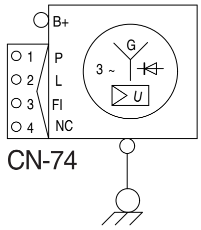
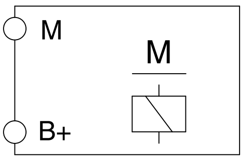
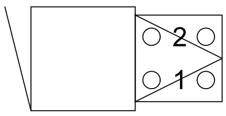
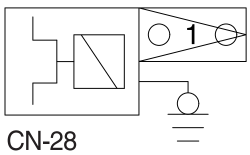
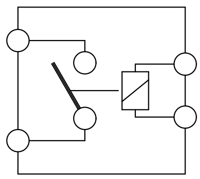
Part name	Symbol	Specifications	Check
Battery		12V×100Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Glow plug relay	 CR-24	24V 200A	※ Check contact Normal : 0.942Ω (For terminal 1-GND)
Start switch	 CS-2A	B-BR : 24V 1A B-ACC : 24V 10A B-ST : 24V 40A	※ Check contact OFF : ∞Ω (for each terminal) ON : 0Ω (for terminal 1-3 and 1-2) START : 0Ω (for terminal 1-6)
Pressure sensor	 CD-6 CD-7 CD-24 CD-31 CD-32 CD-35 CD-36 CD-42 CD-43 CD-44 CD-69 CD-70 CD-71 CD-85 CD-87 CD-90	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 RS-1A	5W 100Ω	※ Check resistance Normal : 100Ω (For terminal 1-2)

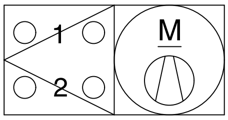
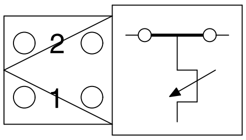
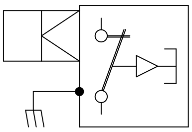
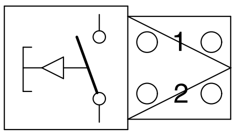
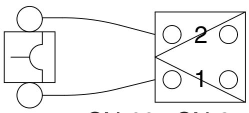
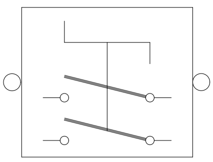
Part name	Symbol	Specifications	Check
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner pressure switch	 CD-10	N.O TYPE	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel level sender	 CD-2	-	※ Check resistance Full : 50Ω 6/12 : 350Ω 11/12 : 100Ω 5/12 : 400Ω 10/12 : 150Ω 4/12 : 450Ω 9/12 : 200Ω 3/12 : 500Ω 8/12 : 250Ω 2/12 : 550Ω 7/12 : 300Ω 1/12 : 600Ω Empty warning : 700Ω
Relay (air con blower)		24V 20A	※ Check resistance Normal : About 200Ω (for terminal 1-3) ∞Ω (for terminal 2-4)
Relay	 CR-2 CR-36 CR-45 CR-62 CR-85	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0Ω (for terminal 3-4) ∞Ω (for terminal 3-5)

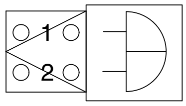
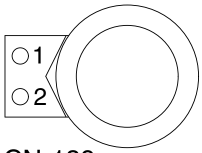
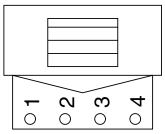
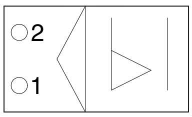
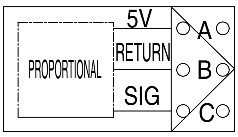
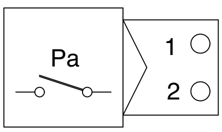
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-5 CR-7 CR-9 CR-13 CR-35 CR-46	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω (for terminal 30-87a) ∞Ω (for terminal 30-87)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-140 CN-149 CN-236 CN-237 CN-370 CN-397 CN-419 CN-420 CN-421	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-133 CN-242 CN-242A CN-309 CN-310	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23 (LH) CN-24 (RH)	20W	※ Check resistance Normal : A fewΩ
Switch (locking type)	 CS-52 CS-67 CS-83 CS-99 CS-108	24V 8A	※ Check contact Normal OFF : ∞Ω (for terminal 2-3, 5-6) 0 Ω (for terminal 1-2, 4-5)
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0Ω OFF : ∞Ω (For terminal 1-2) 0Ω (For terminal 1-3)

Part name	Symbol	Specifications	Check
Head lamp, Work lamp, Cab lamp	 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10 CL-24	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	 CL-7	21V 70W (H1 Type)	※ Check disconnection Normal : A fewΩ
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Hour meter	 CN-48	16~32V	※ Check operation Supply power (24V) to terminal No.2 and connect terminal No.1 and ground
Horn	 CN-20 CN-25	DC22~28V 2A	※ Check operation Supply power (24V) to each terminal and connect ground.
Safety switch	 CS-4	24V 15A (N.C TYPE)	※ Check contact Normal : 0Ω (for terminal A-B) ∞Ω (for terminal A-C) Operating : ∞Ω (for terminal A-B) 0Ω (for terminal A-C)

Part name	Symbol	Specifications	Check
Wiper cut switch	 CS-53	24V (N.O TYPE)	※ Check contact Normal : 0Ω (one pin to ground)
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27A	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22	24V 3.8A	※ Check contact Normal : 10.7Ω (for terminal 1-2)
Wiper motor	 CN-21	24V 2A	※ Check disconnection Normal : 7Ω (for terminal 2-6)
DC/DC Converter	 CN-138	12V 3A	※ Check voltage 24V (for terminal 1-2) 12V (for terminal 1-3)

Part name	Symbol	Specifications	Check
Cigar lighter	 CL-2	24V 5A 1.4W	※ Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Alternator	 CN-74	Denso 24V 70A	※ Check contact Normal : 0Ω (for terminal B^+-2) Normal : 24~27.5V
Starter	 CN-45	24V 4.8kW	※ Check contact Normal : 0.1Ω
Travel alarm	 CN-81	24V 0.5A	※ Check contact Normal : 5.2Ω
Aircon compressor	 CN-28	24V 79W	※ Check contact Normal : 13.4Ω
Start relay	 CR-23	24V 300A	※ Check contact Normal : 0.94Ω (for terminal 1-2)

Part name	Symbol	Specifications	Check
Blower motor		24V 9.5A	※ Check resistance Normal : 2.5Ω (for terminal 1-2)
Thermistor		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω (for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch	 CS-1	24V 2W	※ Check resistance Normal : About 5MΩ
Switch (power max, one touch decel, horn, breaker)	 CS-5 CS-19 CS-26 CS-29	24V 6A	※ Check resistance Normal : ∞Ω
Fuse	 CN-60 CN-95	CN-60 : 40A CN-95 : 80A	※ Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Master switch	 CS-74	6-36V	※ Check disconnection Normal : 0.1Ω

Part name	Symbol	Specifications	Check
Quick clamp buzzer	 CN-113	24V 200mA 107±4dB	-
Socket	 CN-139	12V 10A	-
Fuel heater	 CN-96	-	-
WIF sensor	 CD-45	-	-
Proportional valve sensor	 CN-246 CN-247	-	-
Dozer pressure switch		-	-

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-2	AMP	16	I/conn (Frame harness-Engine harness)	368047-1	368050-1
CN-3	TE/AMP	15	I/conn (Frame harness-Pro vlv harness)	2-85262-1	368537-1
CN-4	AMP/TE	16	I/conn (Console harness LH-Frame harness)	368047-1	368050-1
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	DRB14-60PAE-L018
CN-6	AMP/TE	10	I/conn (Console harness RH-Frame harness)	S816-010002	174657-2
CN-7	AMP/TE	12	I/conn (Console harness RH-Frame harness)	S816-012002	174663-2
CN-9	DEUTSCH	12	I/conn (Frame harness-AAVM harness)	DT06-12SA-EP06	DT04-12PA-P021
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E005
CN-14	DEUTSCH	2	I/conn (Frame harness-Swing parking & fine control)	DT06-2S-EP06	DT04-2P-E005
CN-15	TE/AMP	12	I/conn (Frame harness-Breaker harness)	174661-2	368537-1
CN-16	TYCO	6	Emergency engine start & speed control	S816-006002	S816-106001
CN-16B	TYCO	6	Emergency engine start & speed control	S816-006002	21NB-10710
CN-17	AMP	8	I/conn (Wiper harness-Side harness RH)	S816-008002	S816-108002
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer tank 1	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	Radio & USB player	-	174984-2
CN-28	KET	2	Aircon compressor	MG610320	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse & relay box	21Q7-10910	-
CN-45	RING-TERM	-	Starter motor B^+	S820-108000	-
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	DEUTSCH	40	MCU	DRC26-40SA	-
CN-52	DEUTSCH	40	MCU	DRC26-40SB	-
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	-	-	Fuse	-	-
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	DT04-2P-E005
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-70	DEUTSCH	2	Travel high solenoid	DT06-2S-EP06	-
CN-74	-	4	Alternator terminal	1218 6568	-
CN-75	AMP	2	Pump EPPR	S816-002002	-
CN-80	RING-TERM	-	Glow plug	S820-306000	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	DT04-2P-E005
CN-88	DEUTSCH	2	Power max solenoid	DT06-2S-EP06	-
CN-93	DEUTSCH	50	ECM	DRC26-50S-04	-
CN-94	DEUTSCH	4	ECM earth	DTP06-4S-EP06	-
CN-95	-	-	Fuse	-	-
CN-96	AMP	4	Fuel warmer	2-967325-1	2-967402-2
CN-96A	AMP	3	Fuel warmer	368523-1	-
CN-96B	AMP	4	Fuel warmer	2-967325-2	-
CN-100	KET	1	ECM ground	MG640944-5	-
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	RMS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	RMS	DT06-12S-P021	DT04-12PA-P021
CN-126	TE	10	Service tool	S816-010002	S816-110002
CN-133	DEUTSCH	2	Boom priority solenoid	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-149	DEUTSCH	2	Attach safety solenoid	DT06-2S-EP06	-
CN-156	DEUTSCH	2	Air seat	DT06-2S-EP06	DT04-2P
CN-157	AMP	1	Antena power	S822-014002	-
CN-173	DEUTSCH	3	Resistor	DT06-3S-EP06	DT04-3P-EP10
CN-236	DEUTSCH	2	Attach pressure solenoid	DT06-2S-EP06	-
CN-237	DEUTSCH	2	Attach conflux solenoid	DT06-2S-EP06	-
CN-242	DEUTSCH	2	Attach EPPR 1 (A1)	DT06-2S-EP06	DT04-2P-E0005
CN-242A	DEUTSCH	2	Attach EPPR 2 (A2)	DT06-2S-EP06	DT04-2P-E0005
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	4	Rear view camera	DT06-4S-EP06	DT04-4P-E005
CN-279	AMP	2	Accel dial LED	S816-002002	-
CN-305	DEUTSCH	12	Proportional-Connector 1	DTM06-12SA	-
CN-306	DEUTSCH	12	Proportional-Connector 2	DTM06-12SB	-
CN-307	DEUTSCH	3	Proportional-Service tool	DT06-3S-EP06	DT04-3P-E005
CN-307	AMP	4	Proportional-PVG32	2-967059-1	-
CN-309	DEUTSCH	2	Proportional-EPPR valve A2	DT06-2S-EP06	-

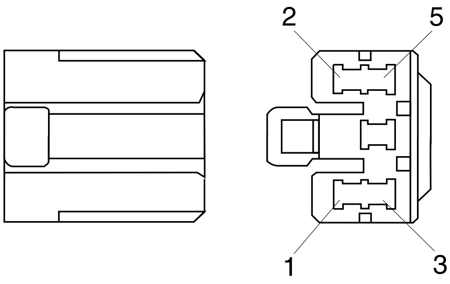
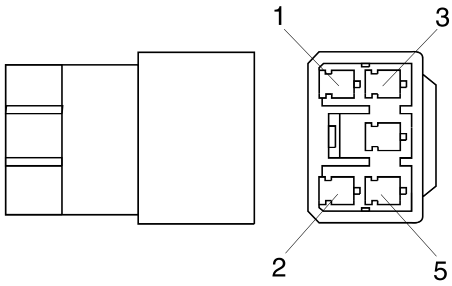
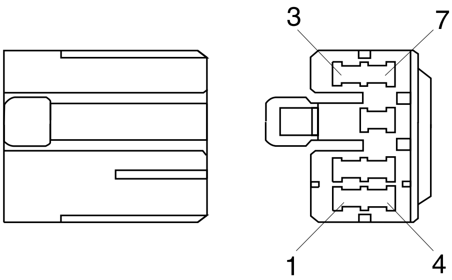
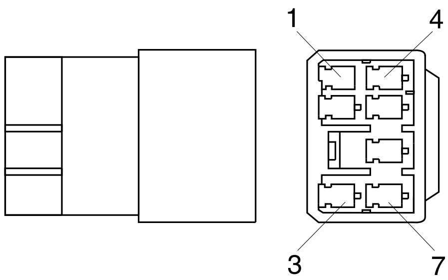
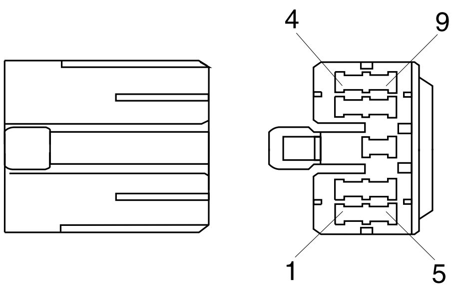
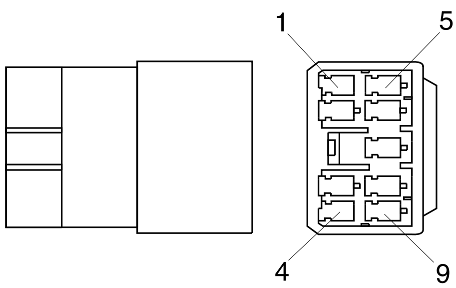
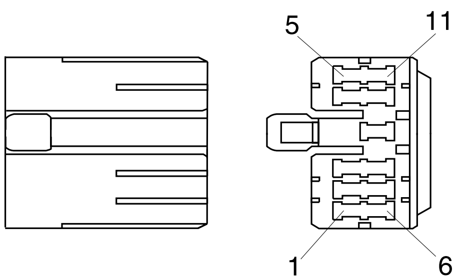
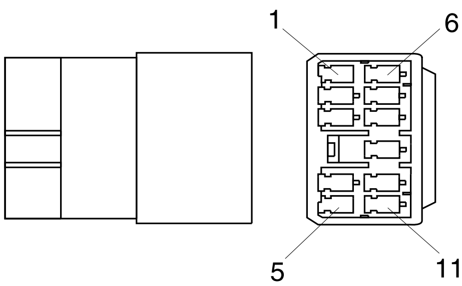
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-310	DEUTSCH	2	Proportional-EPPR valve A1	DT06-2S-EP06	-
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	DT04-2P-E005
CN-376	TE	34	Membrane controller	4-1437290-1	-
CN-397	DEUTSCH	2	Straight travel solenoid	DT06-2S-EP06	DT04-2P-E005
CN-401	TE	35	AAVM controller	776164-1	-
CN-402	DEUTSCH	6	Front view camera	DT06-6S-P021	DT04-6P-P021
CN-403	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP14
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-406	DEUTSCH	3	RS 232	DT06-3S-EP06	DT04-3P-E005
CN-419	DEUTSCH	2	Swing parking-A3	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking-A1	DT06-2S-EP06	-
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
CN-432	AMP	3	Cigar & power	174357-2	-
· Relay					
CR-1	RING-TERM	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	-	-
CR-13	-	5	Head lamp relay	-	-
CR-23	KET	2	Start relay	MG610320	S814-102001
CR-24	RING TERM	1	Preheat relay	S822-014000	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-45	-	5	ECM power relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-62	-	5	Breaker relay	-	-
CR-85	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2A	WP	6	Start key switch	S814-006100	-
CS-2B	DEUTSCH	3	BKCU	DT06-3S-EP06	DT04-3P-E005
CS-4	DEUTSCH	3	Safety switch	DT06-3S	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P
CS-19	DEUTSCH	2	One touch decel switch	-	DT04-2P
CS-26	DEUTSCH	2	Breaker switch	DT06-2S	-

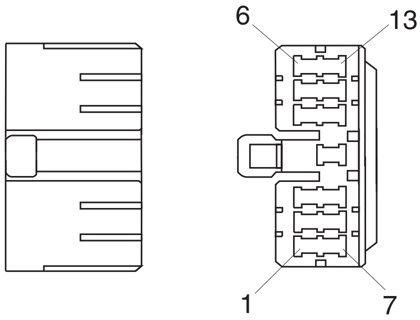
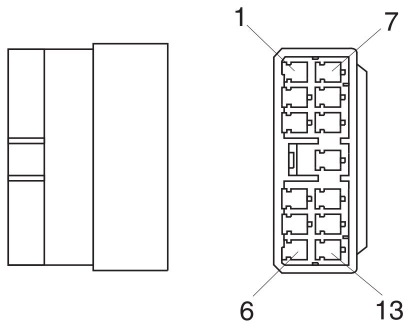
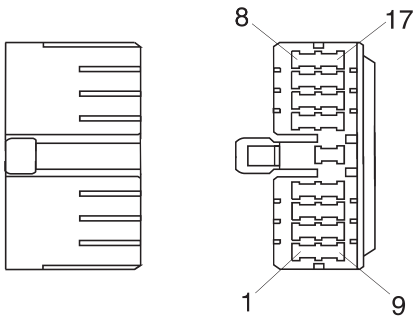
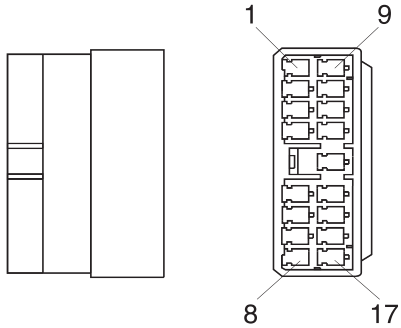
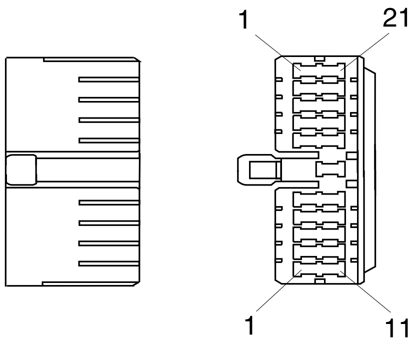
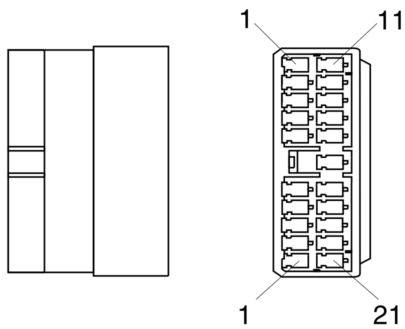
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-26A	AMP	2	Breaker pedal switch	S816-002002	S816-102002
CS-29	DEUTSCH	2	Power max switch	DT06-2S	-
CS-33	AMP	6	Emergency engine stop switch	S816-006002	S816-106002
CS-52	CARLING	10	Adjust & dozer switch	VC2-01	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-67	CARLING	10	Quick clamp switch	VC2-01	-
CS-73	CARLING	10	Swing fine switch	VC2-01	-
CS-74A	AMP	2	Master switch	S813-030201	S813-130201
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	DT04-2P-E005
CS-83	CARLING	10	Swing lock switch	VC2-01	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-
CS-108	CARLING	10	Auto grease switch	VC2-01	-
CS-142	DEUTSCH	3	Accel dial switch	DT06-3S	-
· Light					
CL-1	KET	3	Room lamp	MG651032	-
CL-2	AMP	1	Cigar lighter	S822-014002	S822-114002
CL-3	DEUTSCH	2	Head lamp-LH	DT06-2S-EP06	-
CL-4	DEUTSCH	2	Head lamp-RH	DT06-2S-EP06	-
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	-
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	-
CL-7	DEUTSCH	2	Beacon lamp	DT06-2S-EP06	DT04-2P
CL-8	DEUTSCH	2	Cab light-LH	DT06-2S-EP06	DT04-2P
CL-9	DEUTSCH	2	Cab light-RH	DT06-2S-EP06	DT04-2P
CL-10	DEUTSCH	2	Cab light	DT06-2S-EP06	DT04-2P
CL-24	DEUTSCH	2	Head lamp - Rear	DT06-2S-EP06	DT04-2P-E005
· Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-6	DEUTSCH	3	Travel pressure switch	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Working pressure switch	DT06-3S-EP06	-
CD-10	AMP	2	Air cleaner switch	85202-1	-
CD-24	DEUTSCH	3	Swing pressure sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload pressure sensor	DT06-3S-EP06	DT04-3P-EP06
CD-32	DEUTSCH	3	Boom up pressure sensor	DT06-3S-EP06	-
CD-35	DEUTSCH	3	Bucket in pressure sensor	DT06-3S-EP06	-
CD-36	DEUTSCH	3	Arm out pressure sensor	DT06-3S-EP06	-
CD-42	DEUTSCH	3	A1 pump pressure sensor	DT06-3S-EP06	-
CD-43	DEUTSCH	3	A2 pump pressure sensor	DT06-3S-EP06	-
CD-44	DEUTSCH	3	A3 pump pressure sensor	DT06-3S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CD-45	DEUTSCH	2	WIF sensor	DT06-2S-EP06	DT04-2P-E005
CD-50	KET	2	Dozer pressure sensor	MG640795	-
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	-
CD-70	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 pressure sensor	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down pressure sensor	DT06-3S-EP06	-
CD-87	DEUTSCH	3	Bucket out pressure sensor	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pressure sensor	DT06-3S-EP06	-

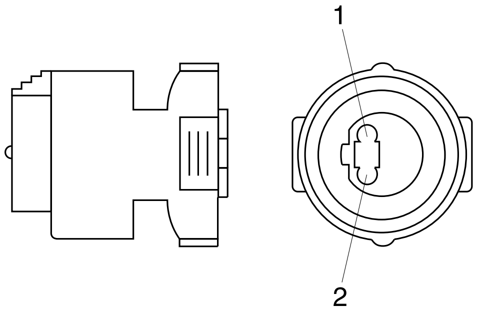
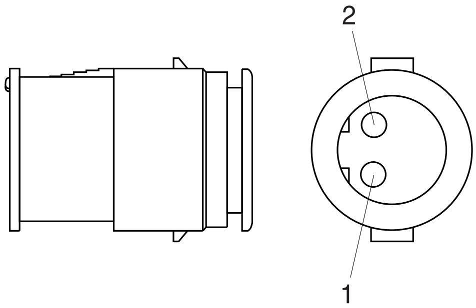
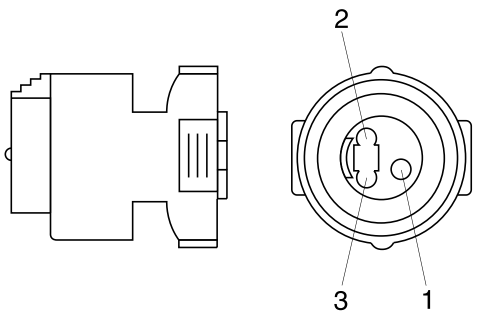
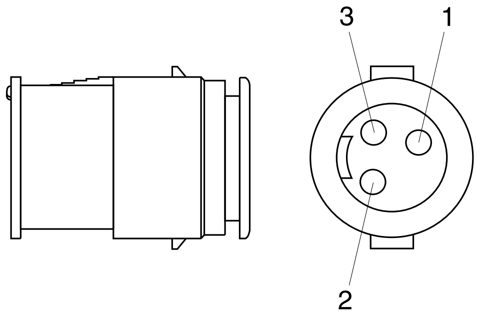
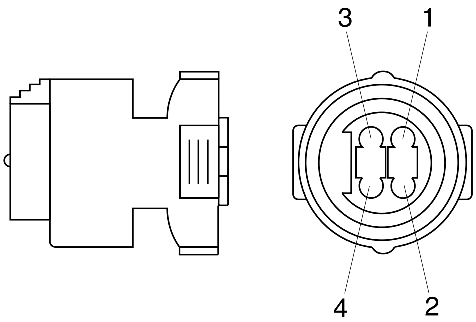
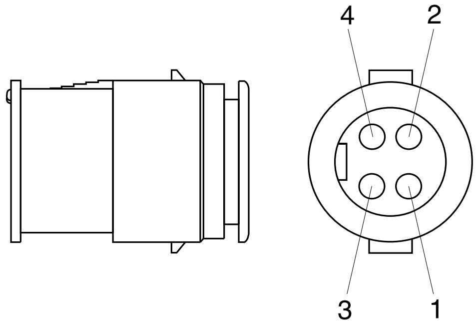
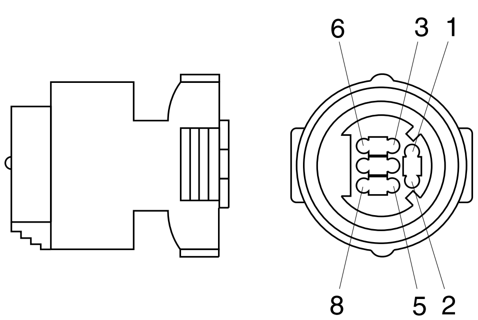
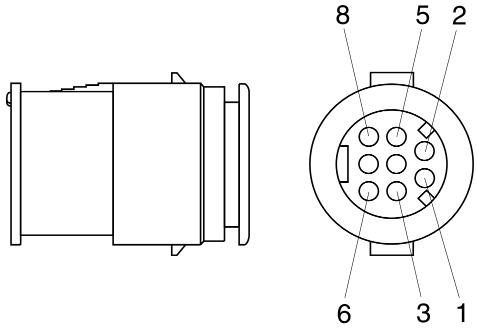
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

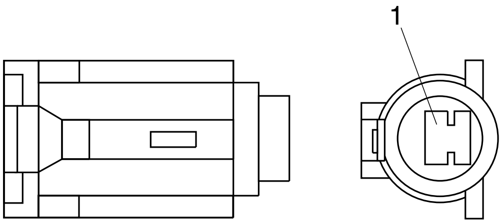
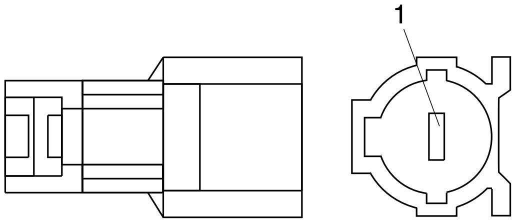
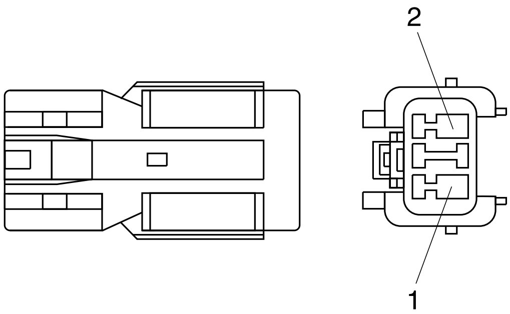
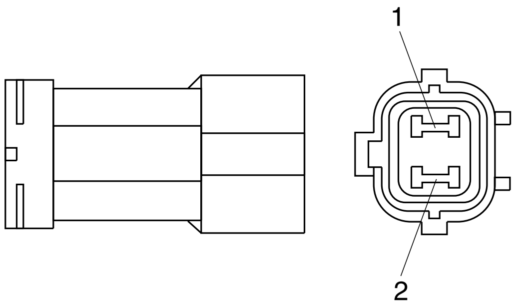
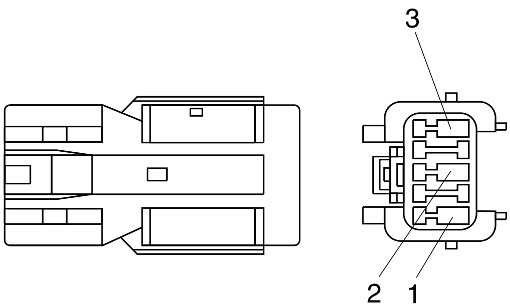
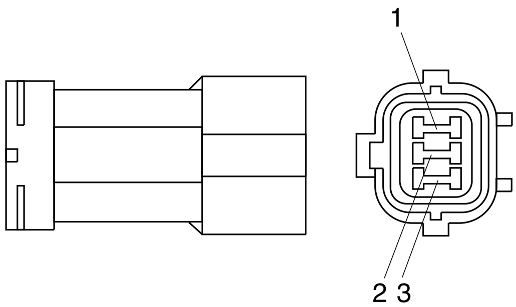
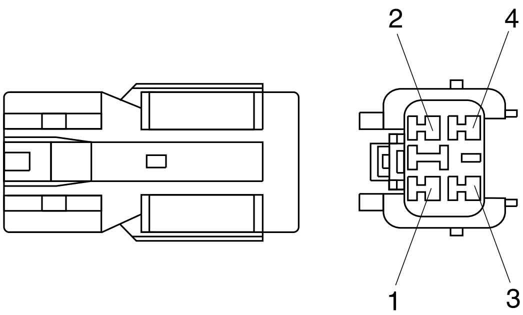
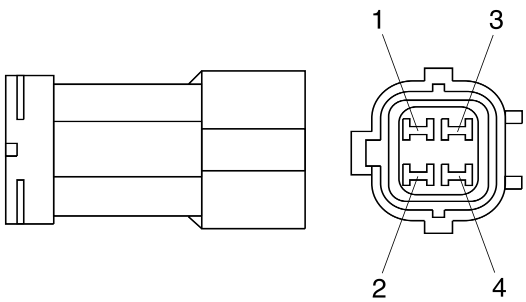
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

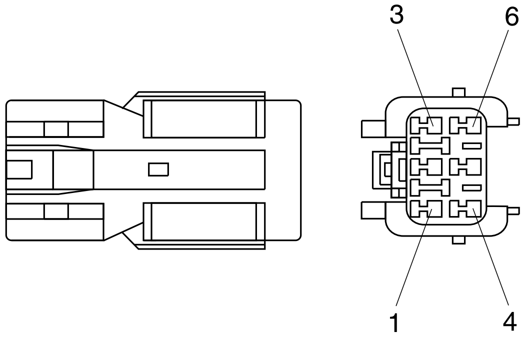
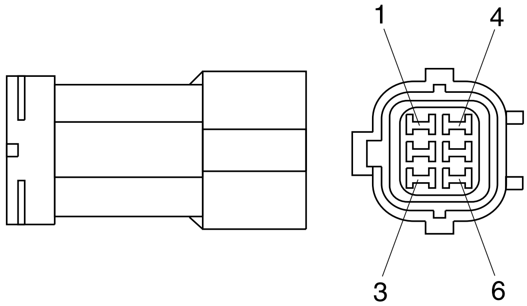
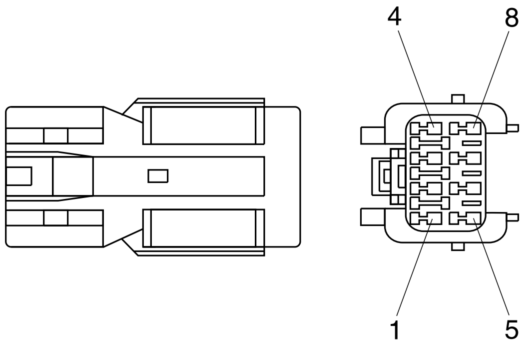
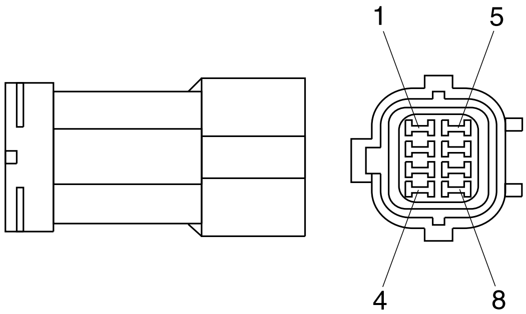
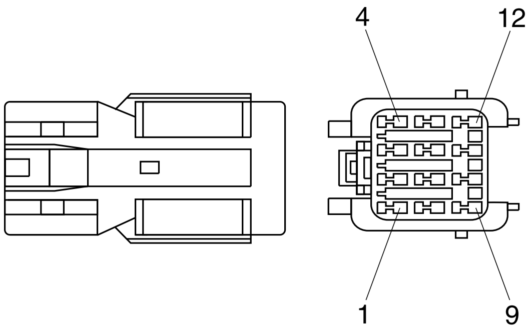
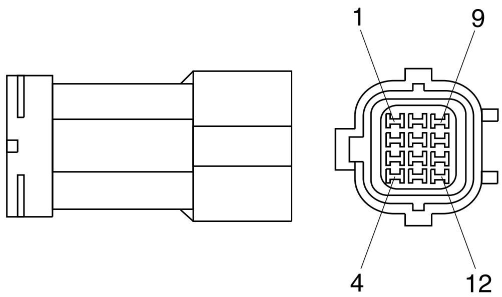
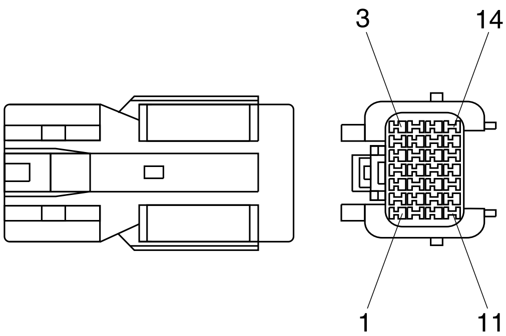
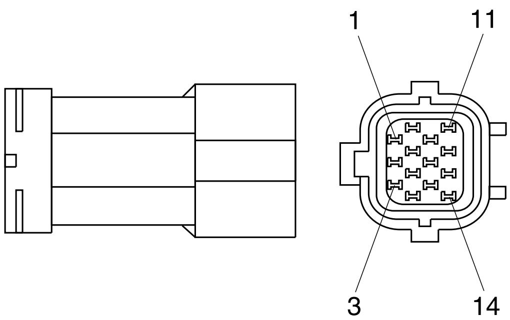
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

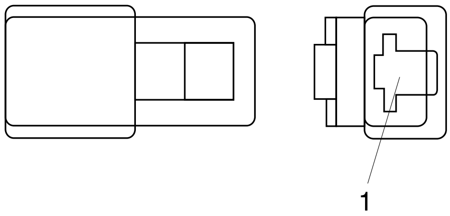
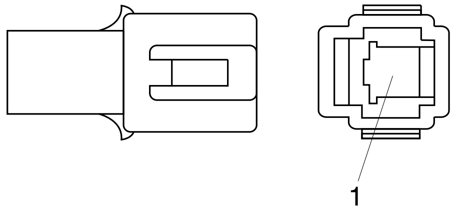
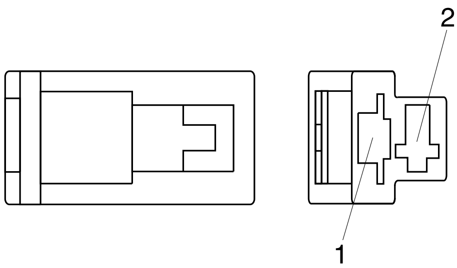
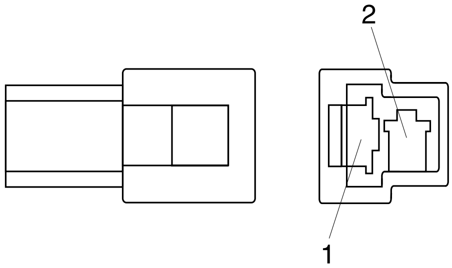
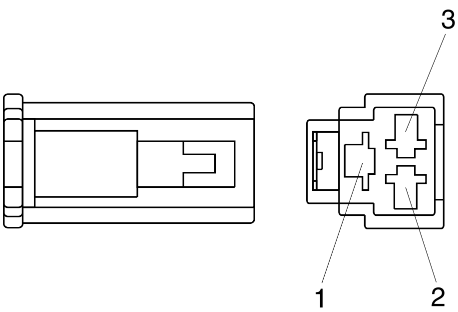
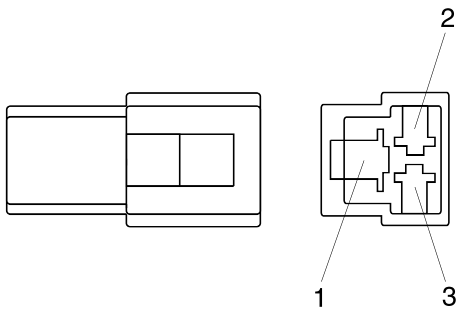
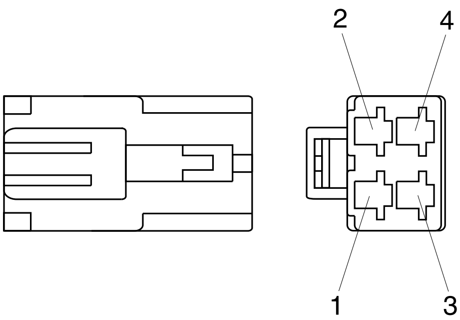
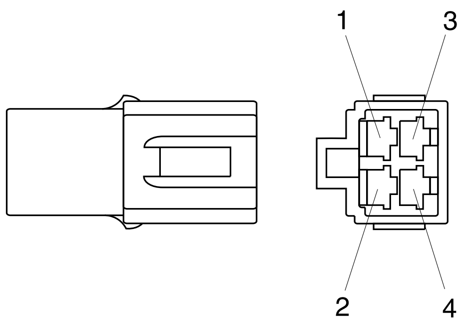
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

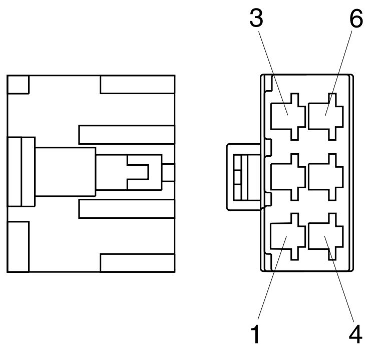
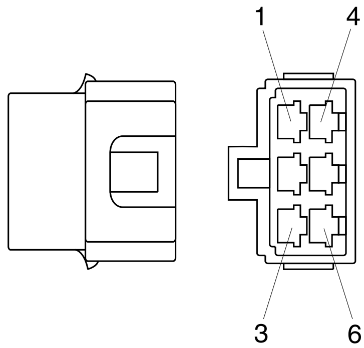
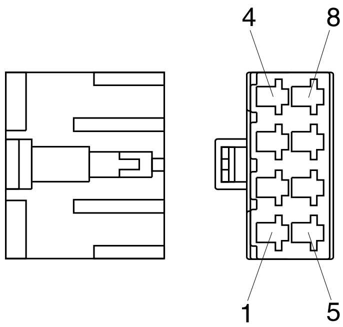
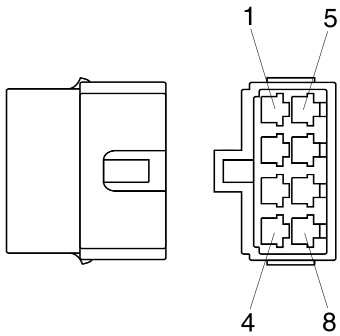
3) SWP TYPE CONNECTOR

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

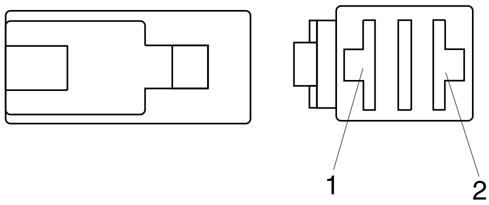
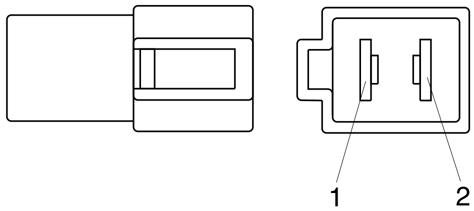
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

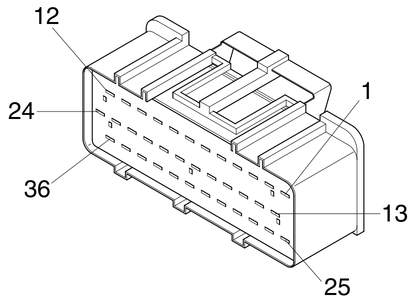
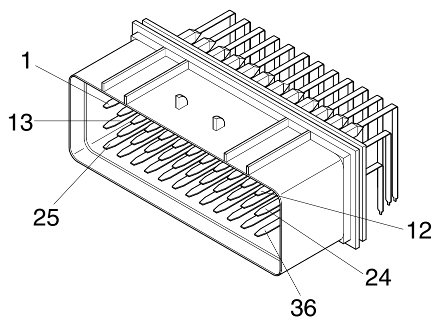
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

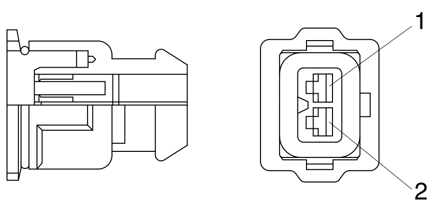
5) 375 FASTEN TYPE CONNECTOR

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

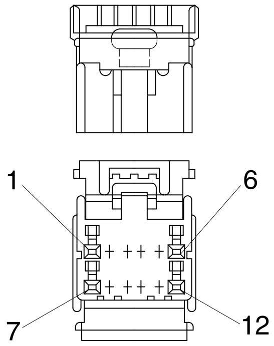
6) AMP ECONOSEAL CONNECTOR

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

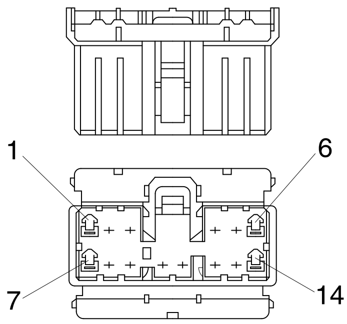
7) AMP TIMER CONNECTOR

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

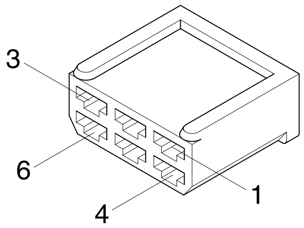
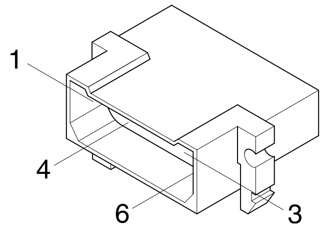
8) AMP 040 MULTILOCK CONNECTOR

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

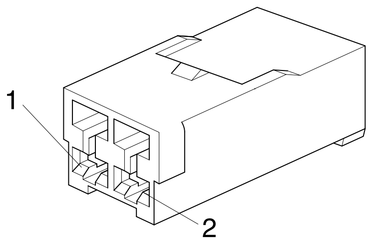
9) AMP 070 MULTILOCK CONNECTOR

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

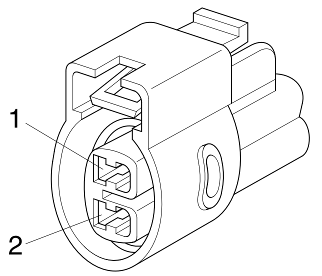
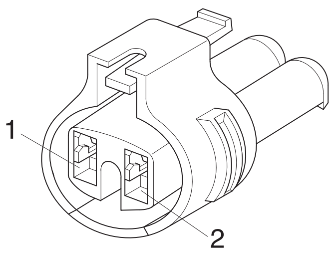
10) AMP FASTIN - FASTON CONNECTOR

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

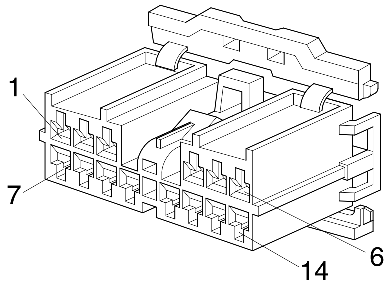
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

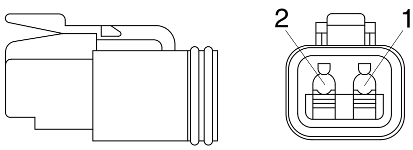
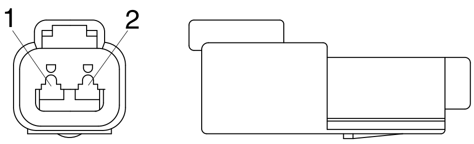
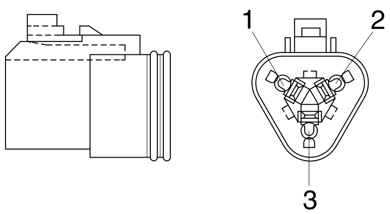
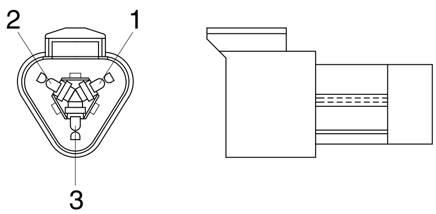
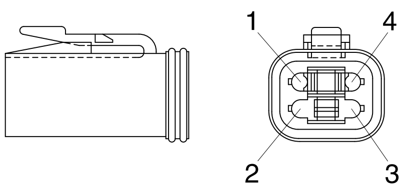
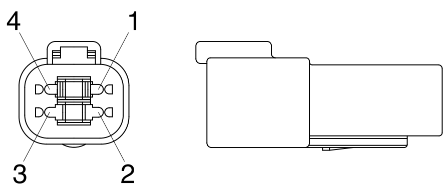
14) DEUTSCH DT CONNECTORS

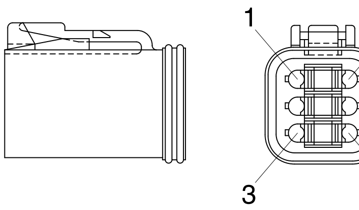
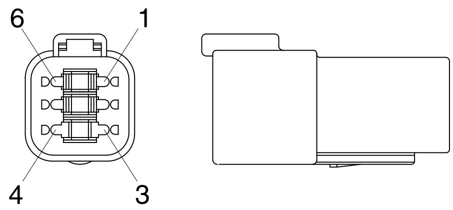
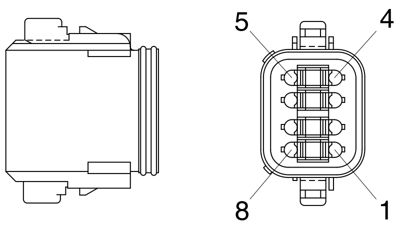
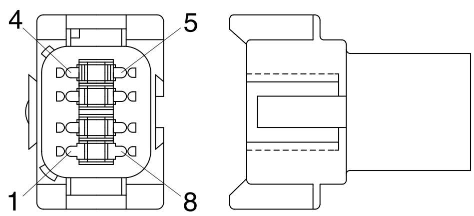
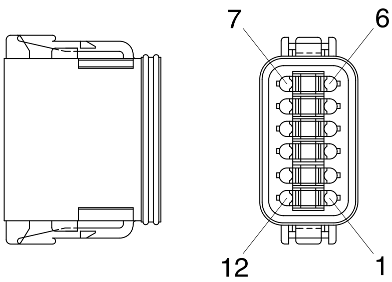
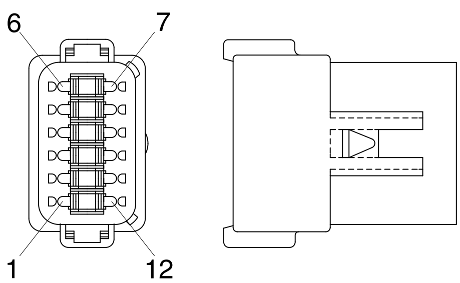
DT 06 - 3S - ★★★★

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

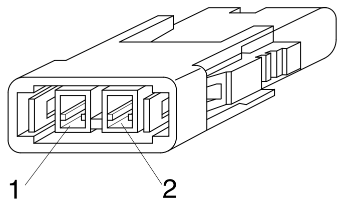
※ Modification

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

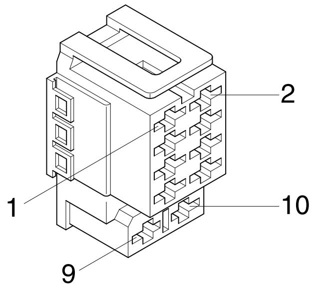
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

No. of pin	Receptacle connector (female)	Plug connector (male)
6	 DT06-6S	 DT04-6P
8	 DT06-8S	 DT04-8P
12	 DT06-12S	 DT04-12P

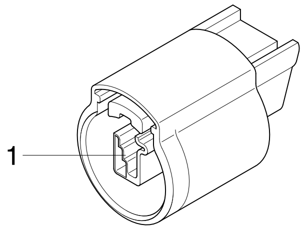
15) MOLEX 2CKTS CONNECTOR

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

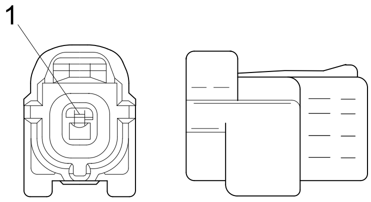
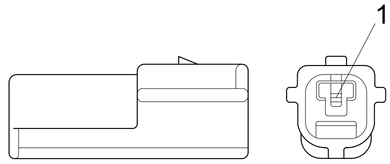
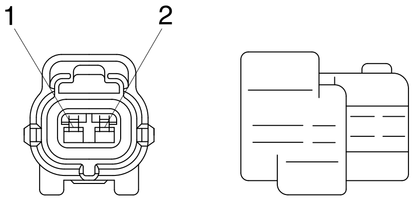
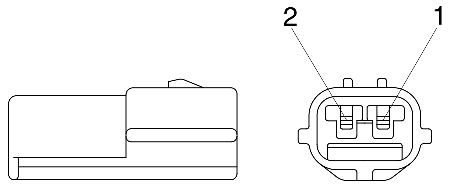
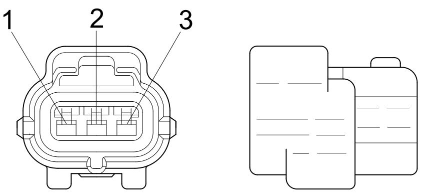
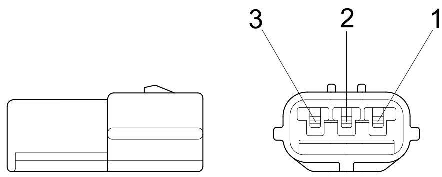
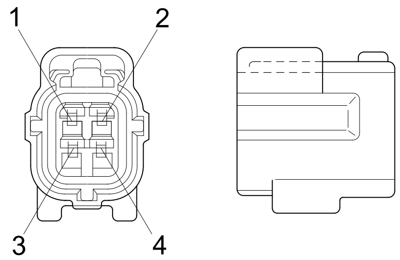
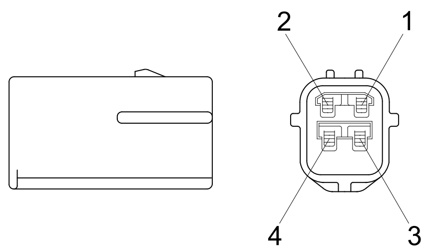
16) ITT SWF CONNECTOR

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	

18) ECONOSEAL J TYPE CONNECTORS

No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S816-001002	 S816-101002
2	 S816-002002	 S816-102002
3	 S816-003002	 S816-103002
4	 S816-004002	 S816-104002

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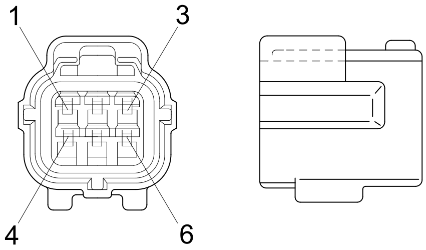
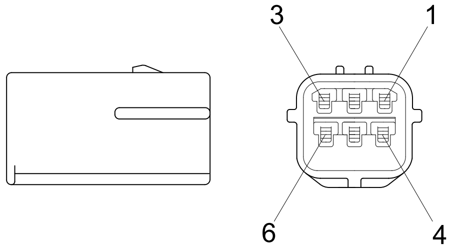
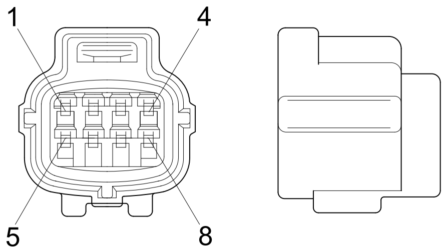
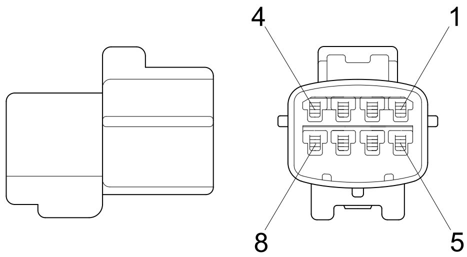
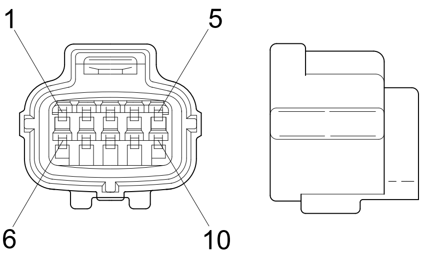
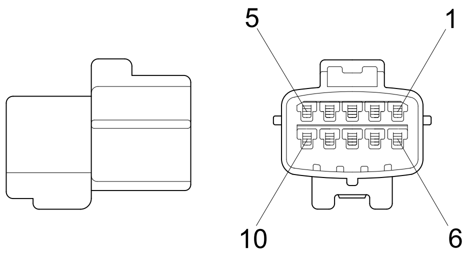
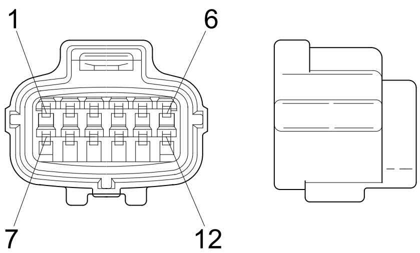
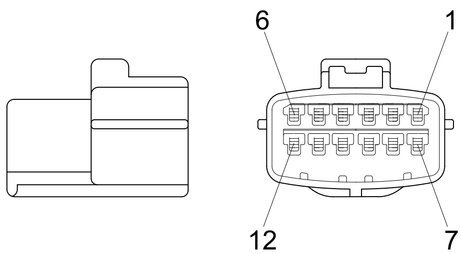
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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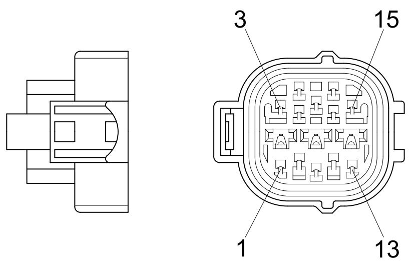
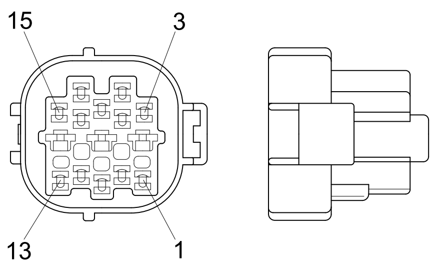
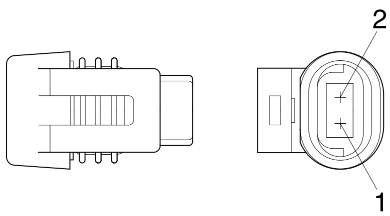
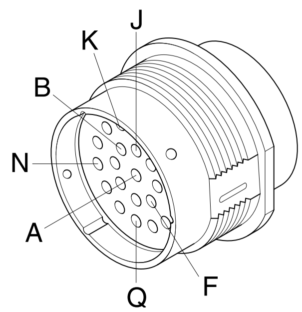
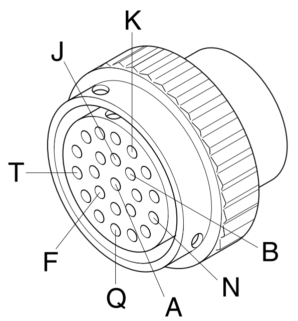
15	 368301-1	 2-85262-1

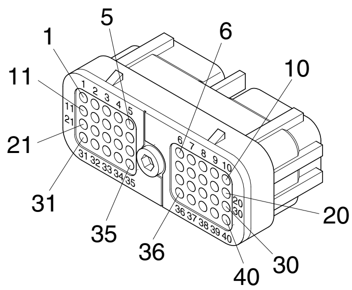
19) METRI-PACK TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	 12040753	

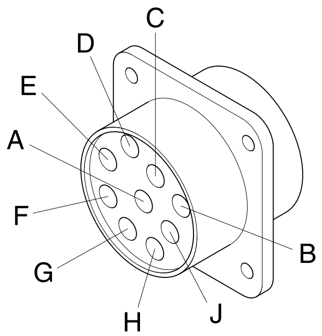
20) DEUTSCH HD30 CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
23	 HD36-24-23SN	 HD34-24-23PN

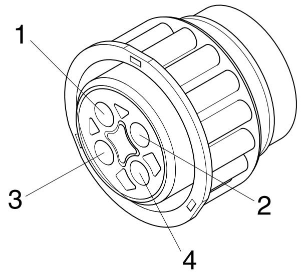
21) DEUTSCH MCU CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
40	 DRC26-40SA/B	

22) DEUTSCH SERVICE TOOL CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
9	 HD10-9-96P	

23) AMP FUEL WARMER CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
4	 2-967325-3	

24) DEUTSCH ENGINE ECM CONNECTOR

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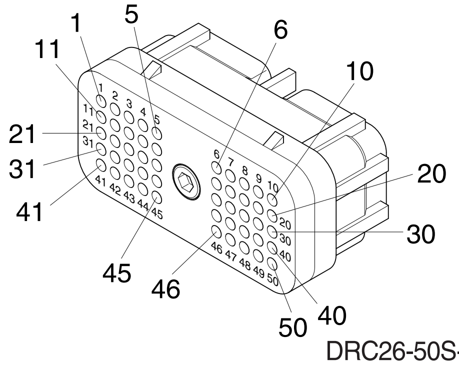
<tr><td>50</td><td>

DRC26-50S-04</td><td></td></tr>
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25) DEUTSCH INTERMEDIATE CONNECTOR

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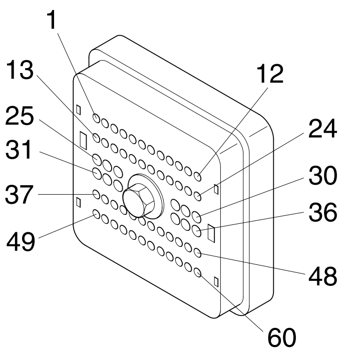
<tr><td>60</td><td>

DRB16-60SAE-L018</td><td></td></tr>
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SECTION 5 MECHATRONICS SYSTEM

Group 1 Outline 5-1
Group 2 Mode Selection System 5-3
Group 3 Automatic Deceleration System 5-6
Group 4 Power Boost System 5-7
Group 5 Travel Speed Control System 5-8
Group 6 Automatic Warming Up System 5-9
Group 7 Engine Overheat Prevention System 5-10
Group 8 Variable Power Control System 5-11
Group 9 Attachment Flow Control System 5-12
Group 10 Intelligent Power Control System 5-13
Group 11 Anti-Restart System 5-15
Group 12 Self-Diagnostic System 5-16
Group 13 Engine Control System 5-50
Group 14 EPPR Valve 5-51
Group 15 Monitoring System 5-56
Group 16 Fuel Warmer System 5-90

SECTION 5 MECHATRONICS SYSTEM

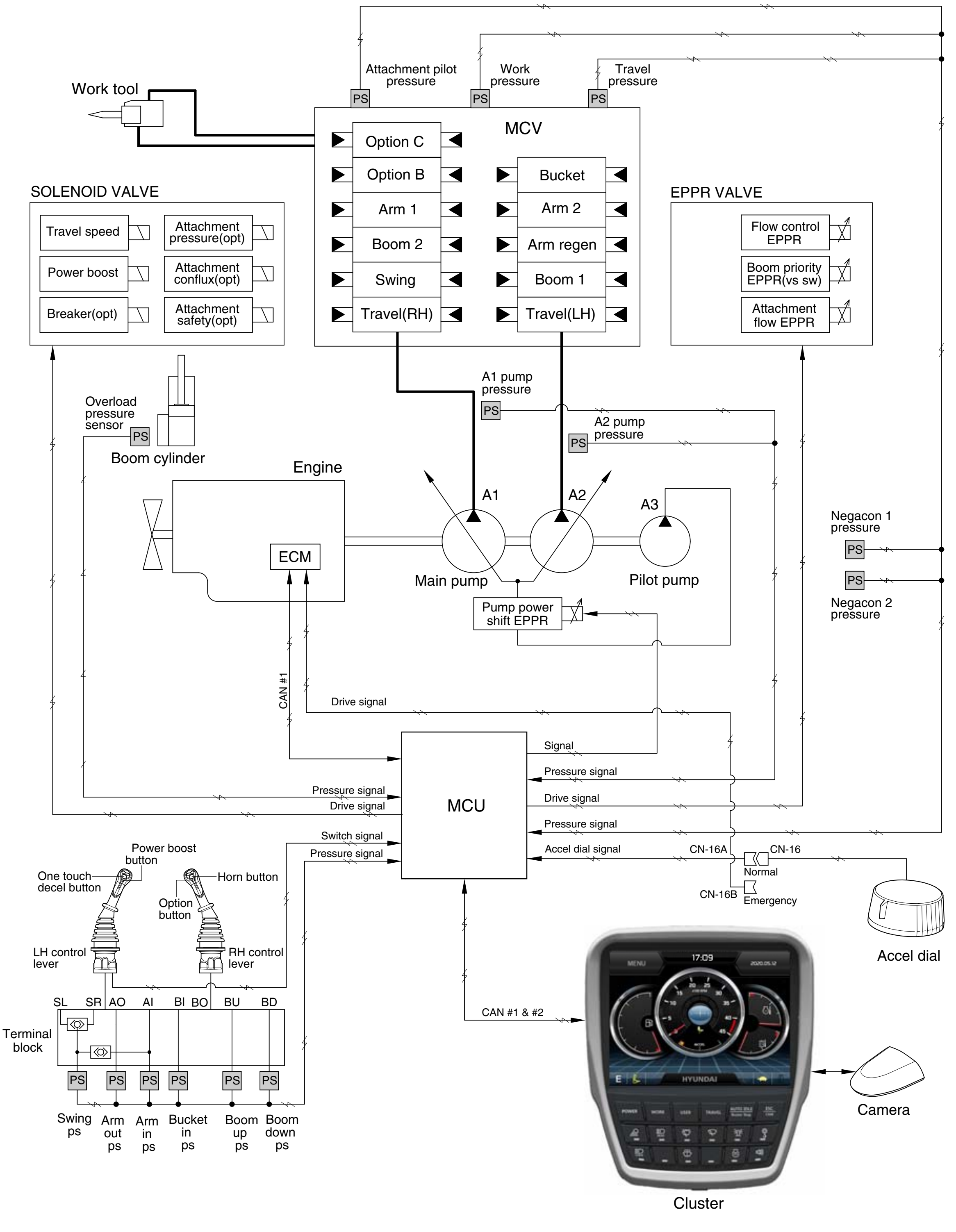
GROUP 1 OUTLINE

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

ADVANCED CAPO SYSTEM

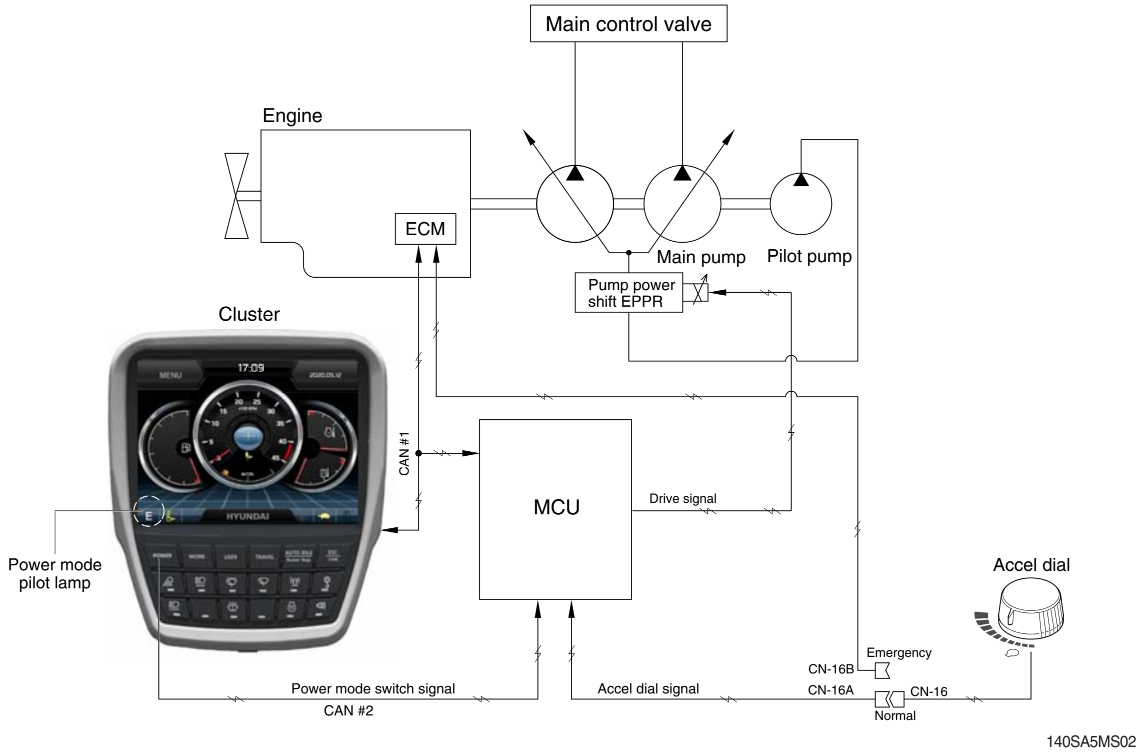
- Mode selection system
  - Power mode selection (P, S, E)
  - Work mode selection
  - User mode system (U)
- Auto deceleration system
- Power boost system
- Travel speed control system
- Automatic warming up system
- Engine overheat prevention system
- New variable power control system
- Attachment flow control system
- Intelligent power control system
- Anti-restart system
- Self-diagnostic system
  - MCU & cluster protection
  - Open-short diagnosis & error code display
  - Machine error & ECM fault code display
- Machine monitoring system
  - Machine condition monitoring
  - Electric signal monitoring
- One touch deceleration system

SYSTEM DIAGRAM



140SA5MS01

1. POWER MODE SELECTION SYSTEM



Mode selection system (micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

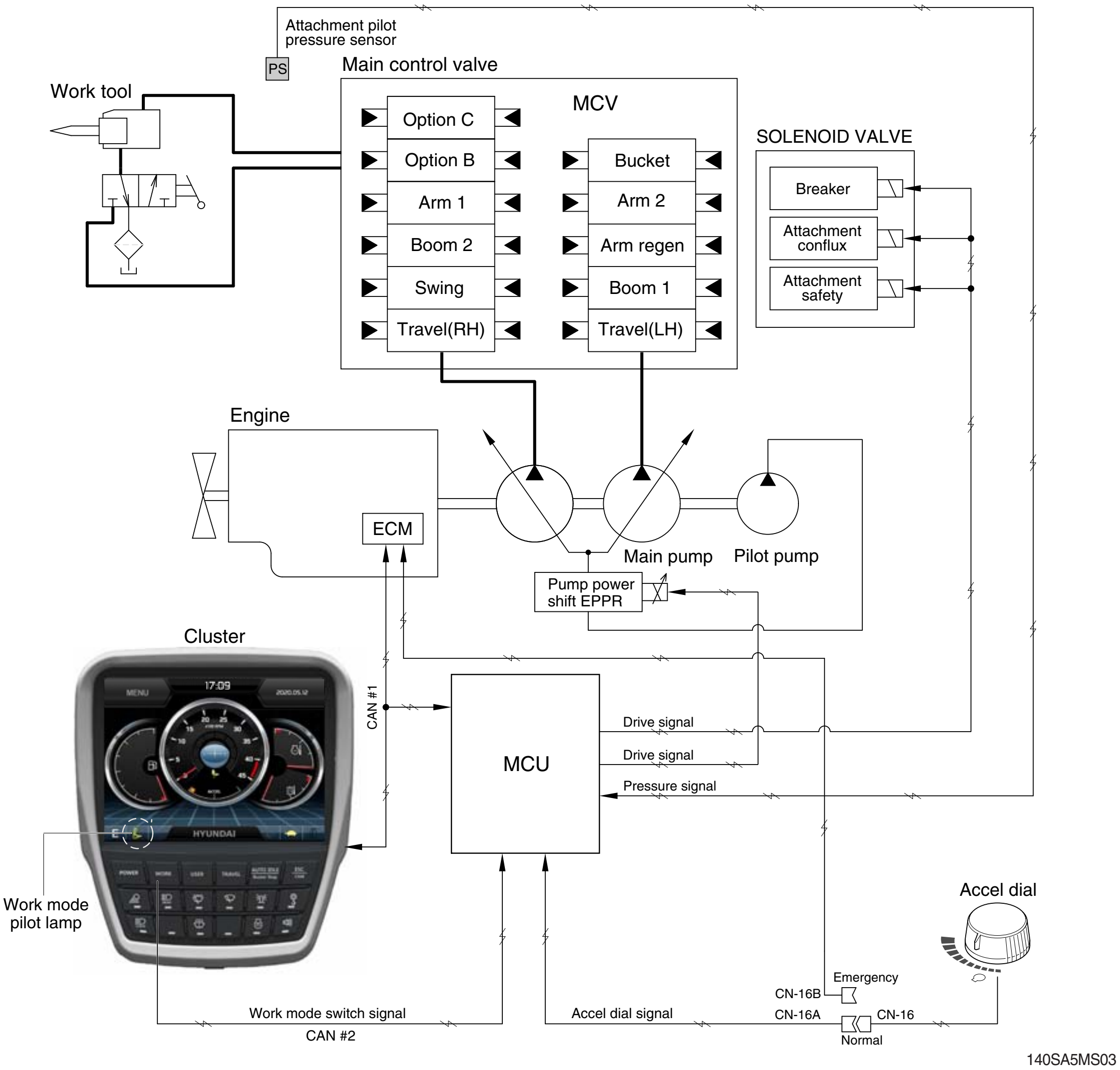
The combination of 3 power modes (P, S, E) and accel dial position (10 set) makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

Power mode	Application	Engine rpm				Pump EPPR (kgf/cm^2)			
		Standard		Option		Standard		Option	
		No load	Load	No load	Load	No load	Load	No load	Load
P	Heavy duty power	1800	1800	1800	1800	8	5	5	5
S	Standard power	1600	1600	1600	1600	11	8	8	8
E	Economy operation	1500	1500	1500	1500	11	8	8	8
Auto decel	Engine deceleration	1150±100	-	1150±100	-	38	38	38	38
One touch decel	Engine quick deceleration	1000±100	-	1000±100	-	38	38	38	38
Key start	Key switch start position	1000±100	-	1000±100	-	38	38	38	38

※ Based on the balance mode.

2. WORK MODE SELECTION SYSTEM

Work mode consists of the general operation (bucket) and the optional attachment (breaker, crusher).



1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

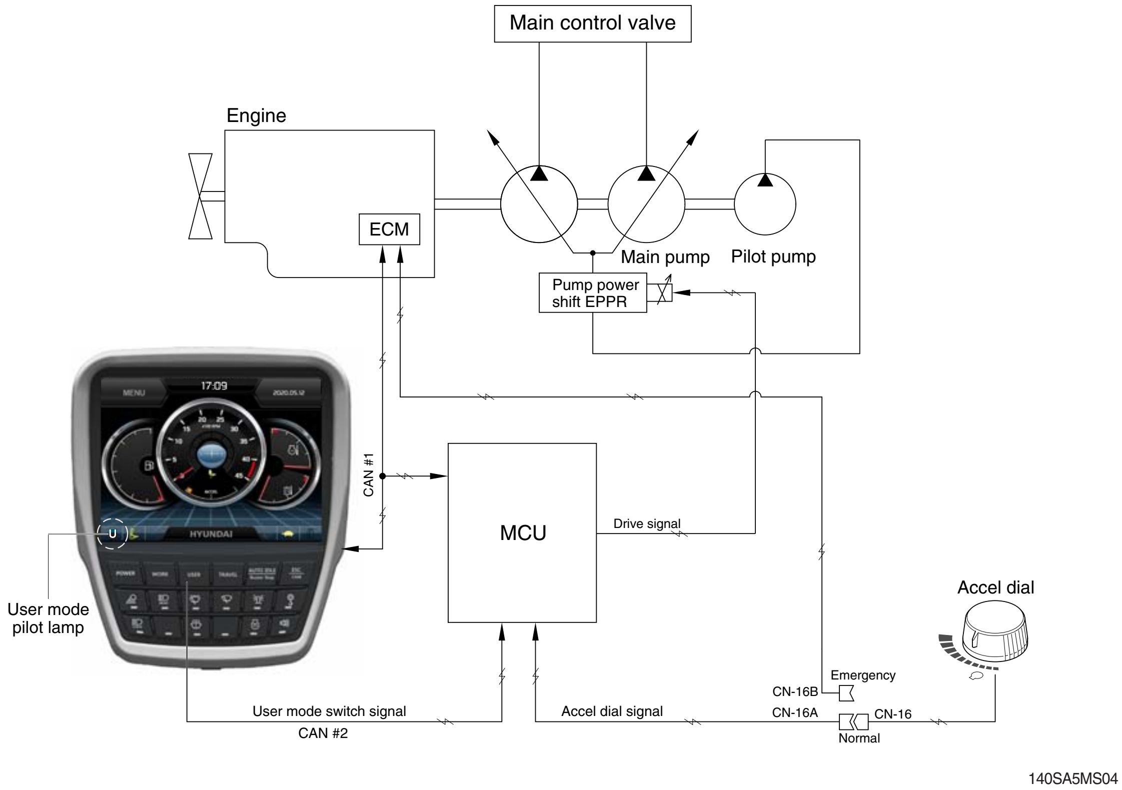
2) ATT WORK MODE (breaker, crusher)

It controls the pump flow and system pressure according to the operation of breaker or crusher.

Description	General mode	Work tool	
	Bucket	Breaker	Crusher
Attachment safety solenoid	OFF	-	ON
Attachment conflux solenoid	OFF	ON/OFF	ON/OFF
Attachment flow EPPR current	100 mA	100~700 mA	100~700 mA
Breaker solenoid★	OFF	ON	-

★ When breaker operating button is pushed.

3. USER MODE SELECTION SYSTEM



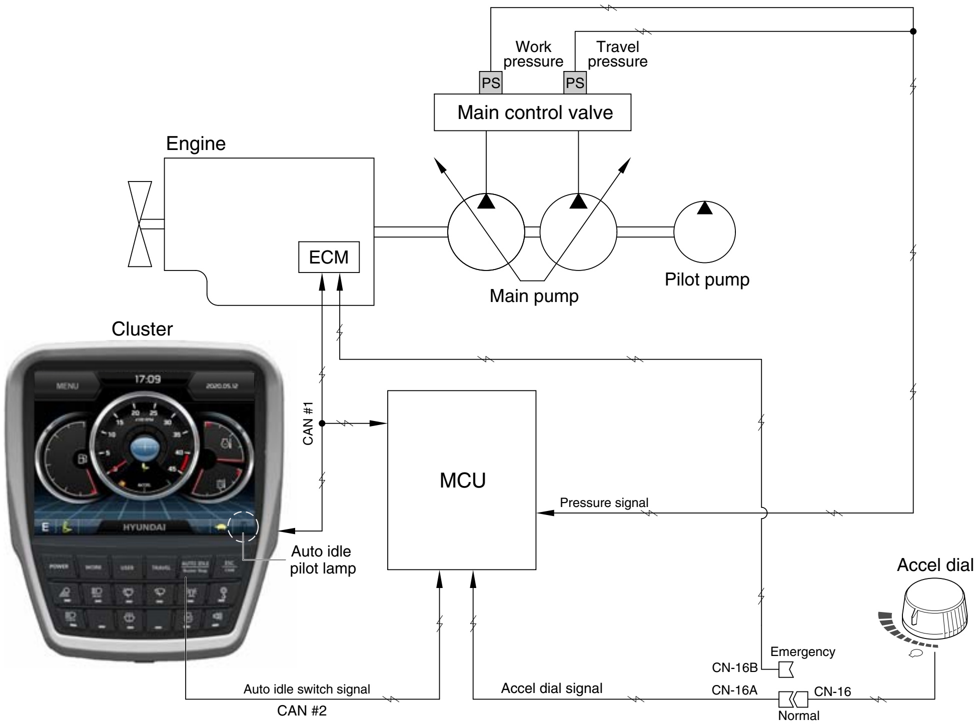
1) Engine speed, idle speed and pump power shift pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift pressure (bar)
1	1550	1000	0
2	1600	1050	3
3	1650	1100	6
4	1700	1150 (auto decel)	9
5	1750	1200	12
6	1800	1250	16
7	1850	1300	20
8	1900	1350	26
9	1950	1400	32
10	2000	1450	38

※ Refer to the page 5-77.

GROUP 3 AUTOMATIC DECELERATION SYSTEM

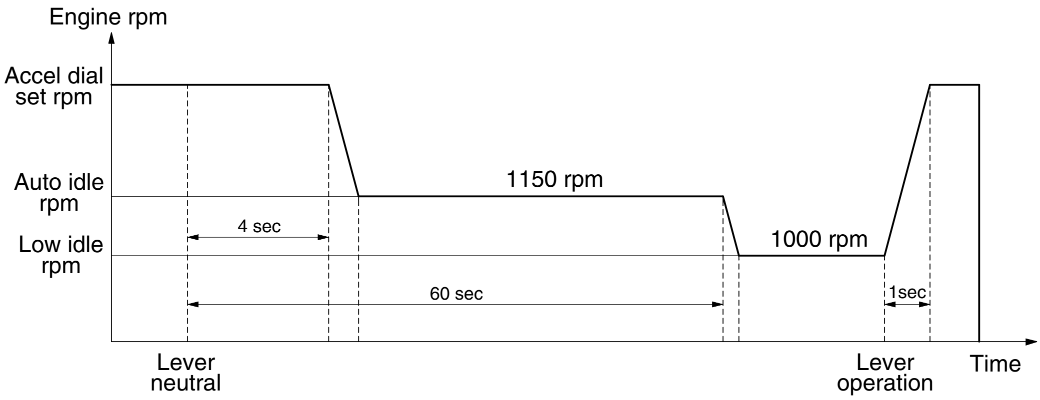


140SA5MS05

1. WHEN AUTO IDLE PILOT LAMP ON

When all of the work equipment control levers including swing and travel levers are at neutral for 4 seconds, MCU sends throttle command to ECM to reduce the engine speed to 1150 rpm. If the control levers are at neutral for 1 minute, MCU reduces the engine speed to 1000 rpm. As the result of reducing the engine speed, fuel consumption and noise are effectively cut down during non-operation of the control levers.

When the auto idle pilot lamp is turned off by pressing the switch or any control lever is operated, the reduced engine speed rises upto the speed before deceleration in a second.



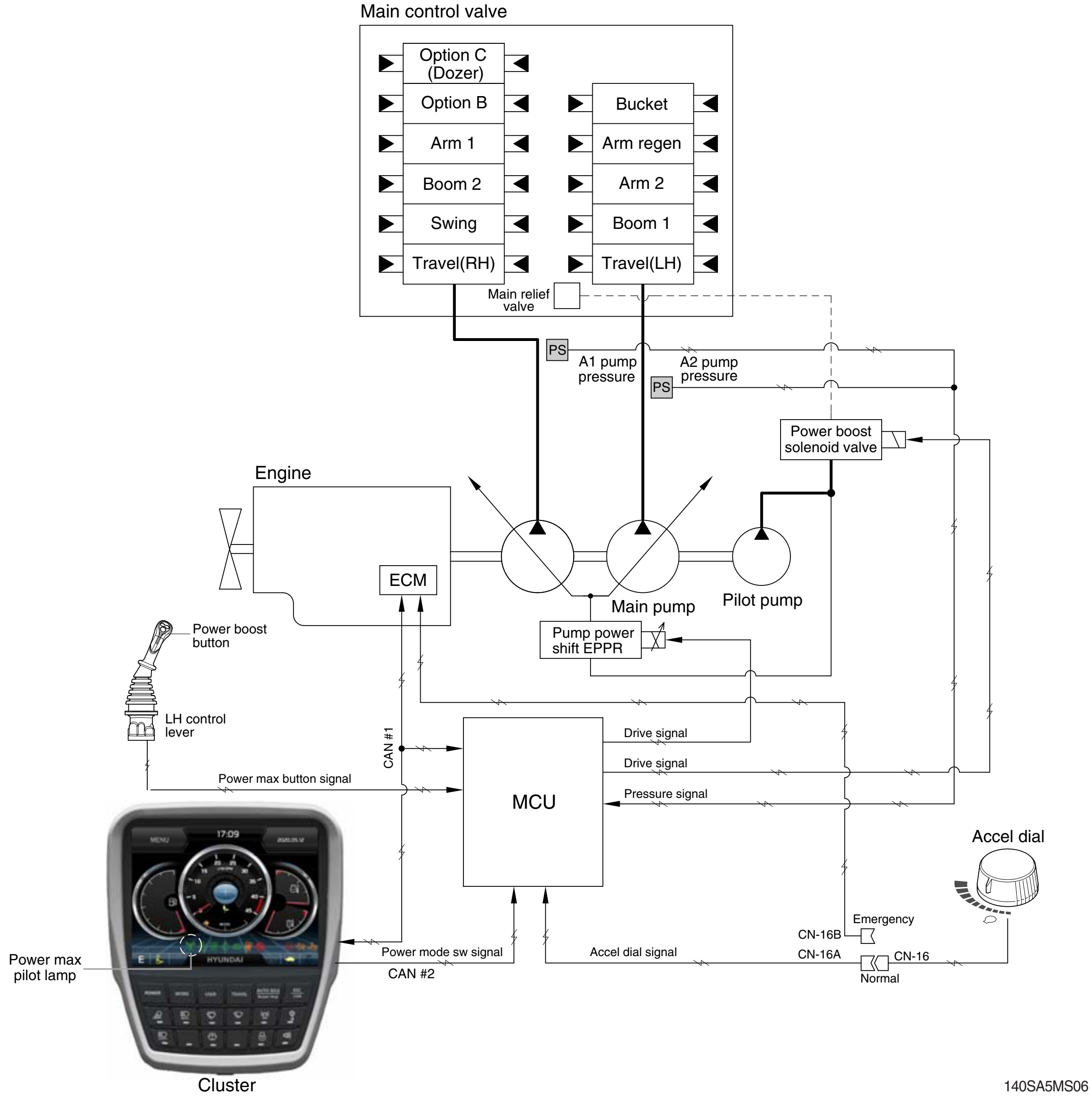
145SA5MS56

2. WHEN AUTO IDLE PILOT LAMP OFF

The engine speed can be set as desired using the accel dial, and even if the control levers are neutral, the engine speed is not reduced.

※ Auto idle function can be activated when accel dial position is over 4.

GROUP 4 POWER BOOST SYSTEM



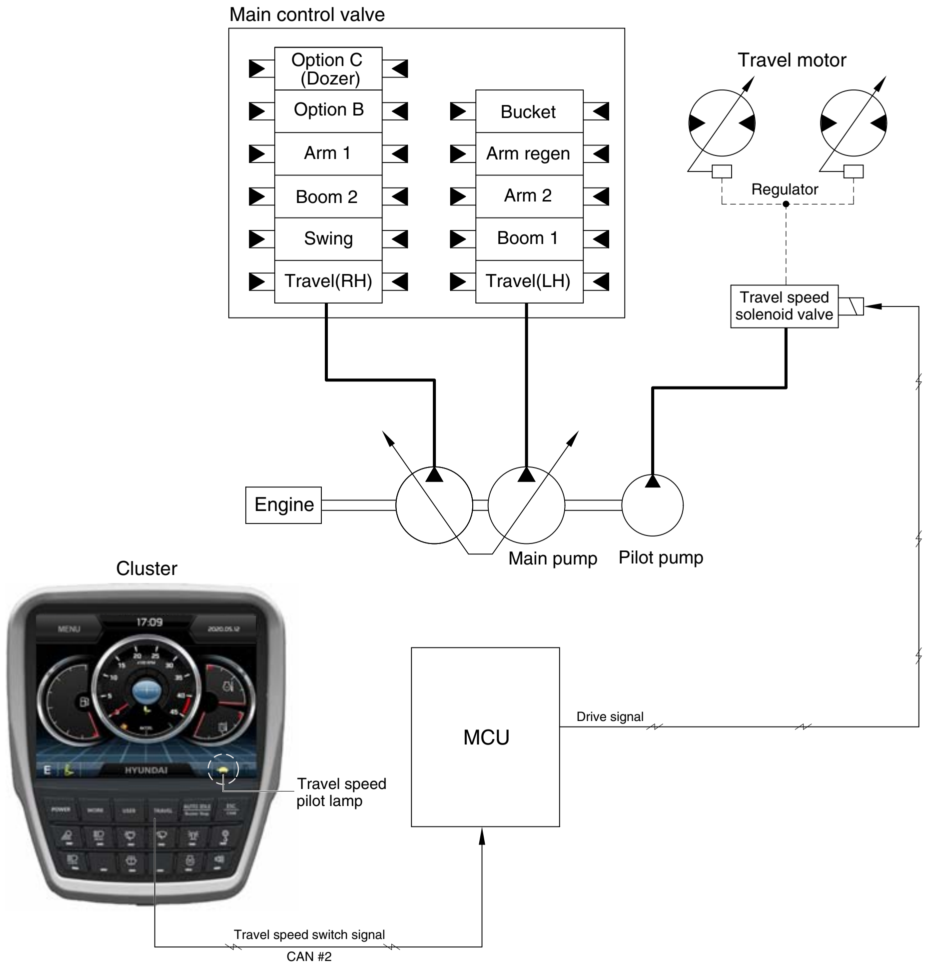
· When the power boost switch on the left control lever is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· When the power boost function is activated, the power boost solenoid valve pilot pressure raises the set pressure of the main relief valve to increase the digging power.

Description	Condition	Function
Activated	Power boost switch : ON Accel dial : over 8	- Power mode : P - Accel dial power : 9 - Power boost solenoid : ON - Power boost pilot lmap : ON - Operating time : max 8 seconds
Canceled	Power boost switch : OFF	- Pre-set power mode - Power boost solenoid : OFF - Power boost pilot lamp : OFF

※ When the auto power boost is set to Enable and power mode is set to P mode on the cluster, the digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.

GROUP 5 TRAVEL SPEED CONTROL SYSTEM



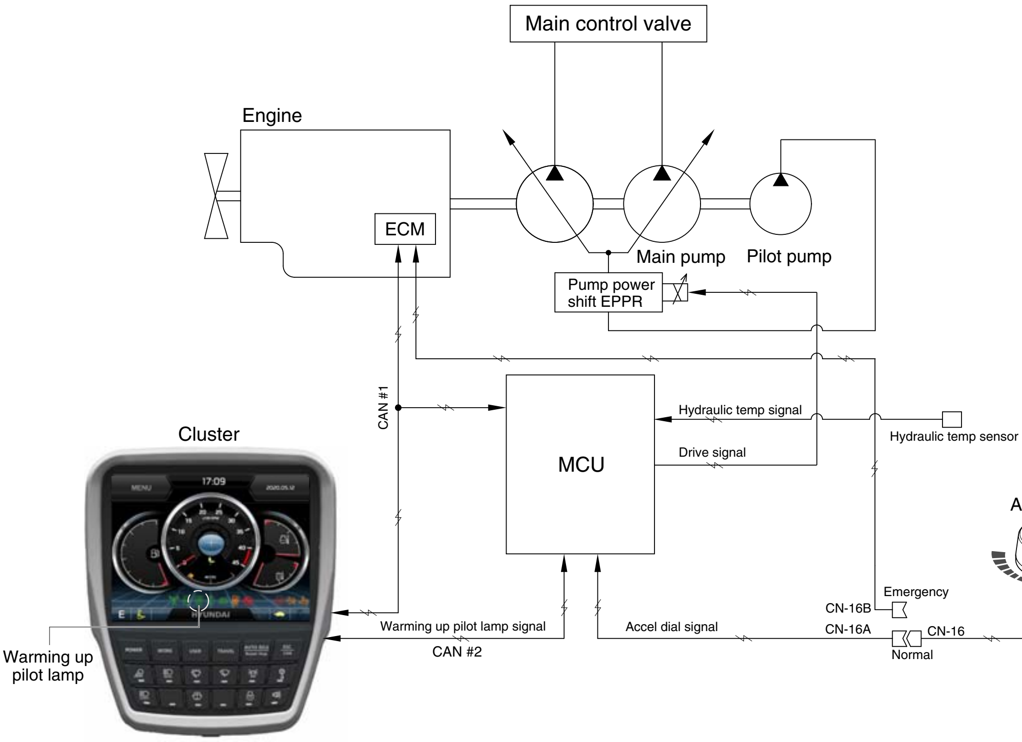
140SA5MS07

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

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

※ Default : Turtle (Low speed)

GROUP 6 AUTOMATIC WARMING UP SYSTEM



140SA5MS08

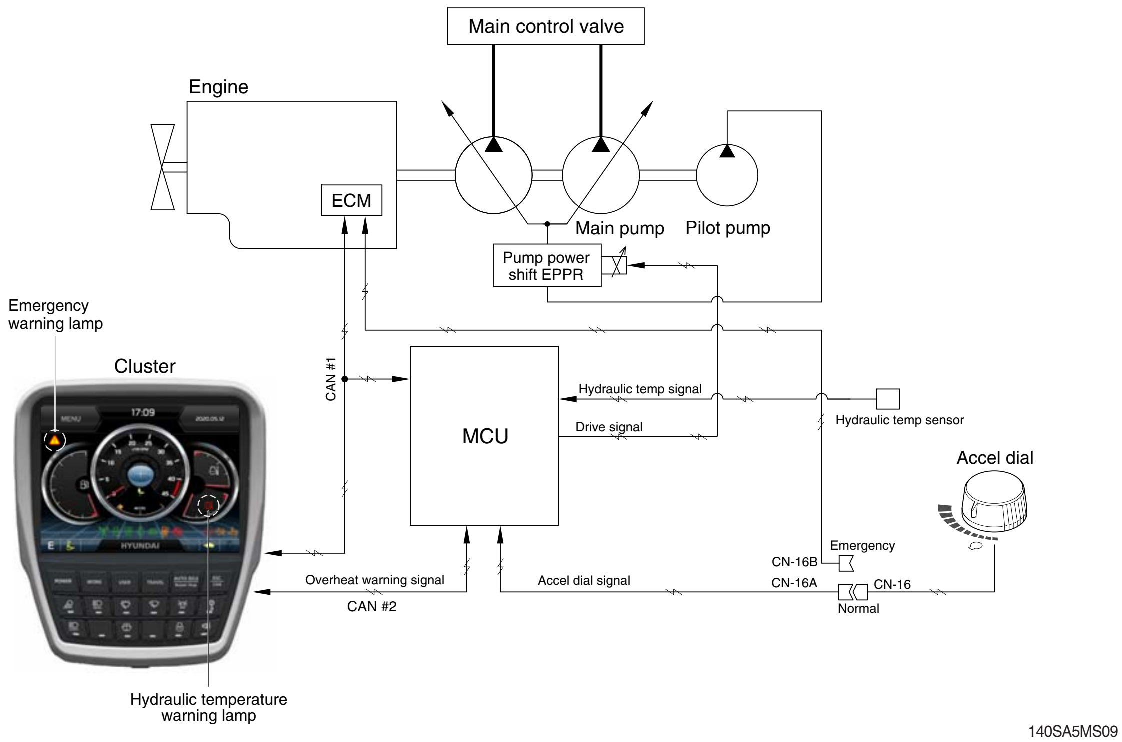
1. The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1400 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

2. In case of the coolant temperature increases up to 30˚C, the engine speed is decreased to key start speed. And if an operator changes power mode set during the warming up function, the MCU cancels the automatic warming up function.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : Below 30˚C (after engine run)	- Power mode : Default (E mode) - Warming up time : 10 minutes (max) - Warming up pilot lamp : ON
Canceled	- Coolant temperature : Above 30˚C - Warming up time : Above 10 minutes - Changed power mode set by operator - RCV lever or pedal operating - Auto idle cancel ※ If any of the above conditions is applicable, the automatic warming up function is canceled	- Power mode : set mode - Warming up pilot lamp : OFF

GROUP 7 ENGINE OVERHEAT PREVENTION SYSTEM

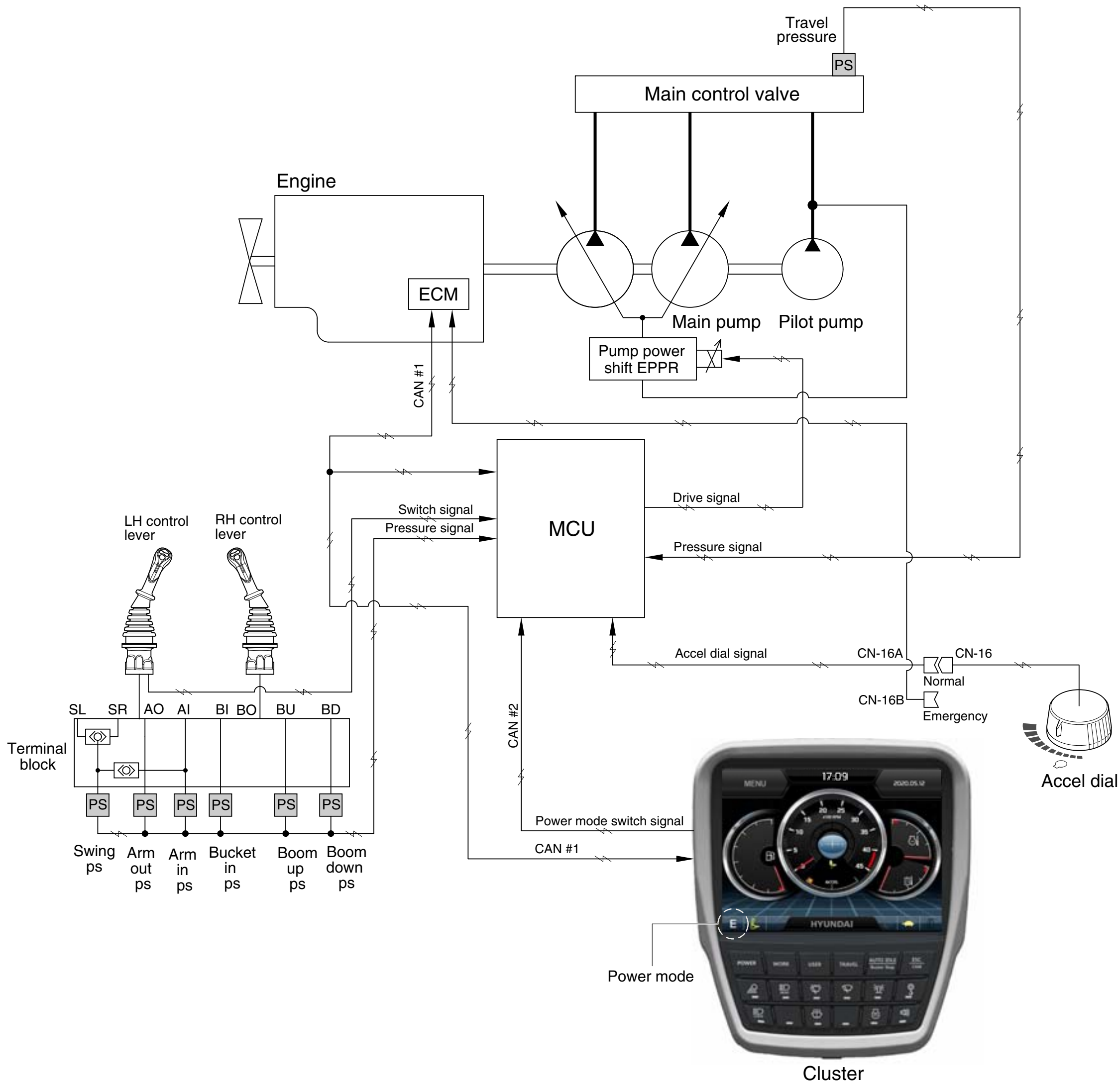


1. If the engine coolant temperature or the hydraulic oil temperature is overheated over set temperature, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

2. LOGIC TABLE

Description		Condition	Function
First step warning	Activated	- Coolant temperature : Above 103˚C - Hydraulic oil temperature : Above 100˚C	- Warning lamp : Pops up and buzzer sounds. - Pump input torque is reduced.
	Canceled	- Coolant temperature : Less than 100˚C - Hydraulic oil temperature : Less than 95˚C	- Return to pre-set the pump absorption torque.
Second step warning	Activated	- Coolant temperature : Above 107˚C - Hydraulic oil temperature : Above 105˚C	- Emergency warning lamp pops up on the center of LCD and the buzzer sounds. - Engine speed is reduced after 10 seconds.
	Canceled	- Coolant temperature : Less than 103˚C - Hydraulic oil temperature : Less than 100˚C	- Return to pre-set the engine speed. - Hold pump absorption torque on the first step warning.

GROUP 8 NEW VARIABLE POWER CONTROL SYSTEM



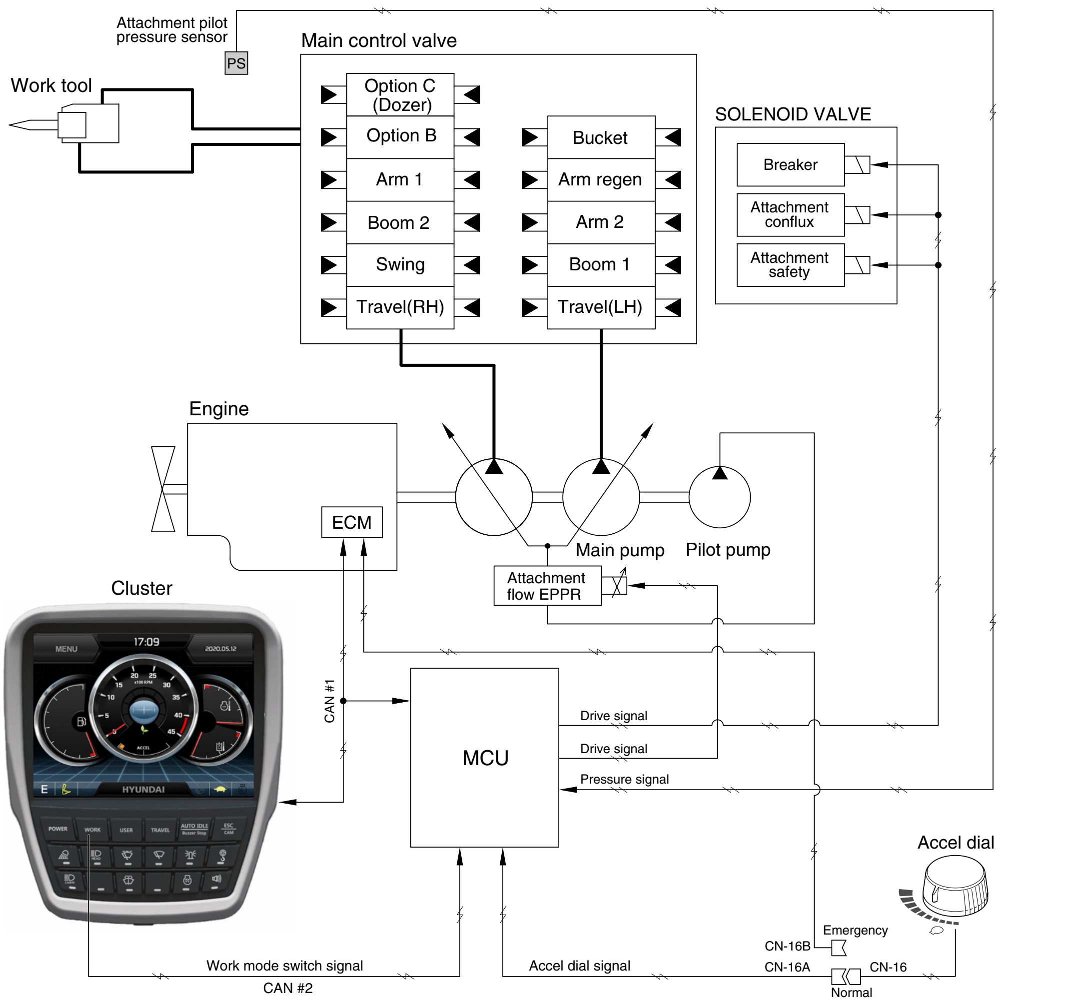
140SA5MS10

· The new variable power control system makes constantly exact pump control through improvement variable engine speed control and response and optimization of control input sensor signal.
It makes fuel saving and smooth control at precise work.

Description	Function	
	Stand by	Working
Engine speed	- 100~150 rpm lower than working	- Set rpm
Pump EPPR	- 13 bar	- 8 bar
Pump flow	- Lower than working	- Normal pump flow

※ The variable power control function can be activated at all of the power mode.

GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM



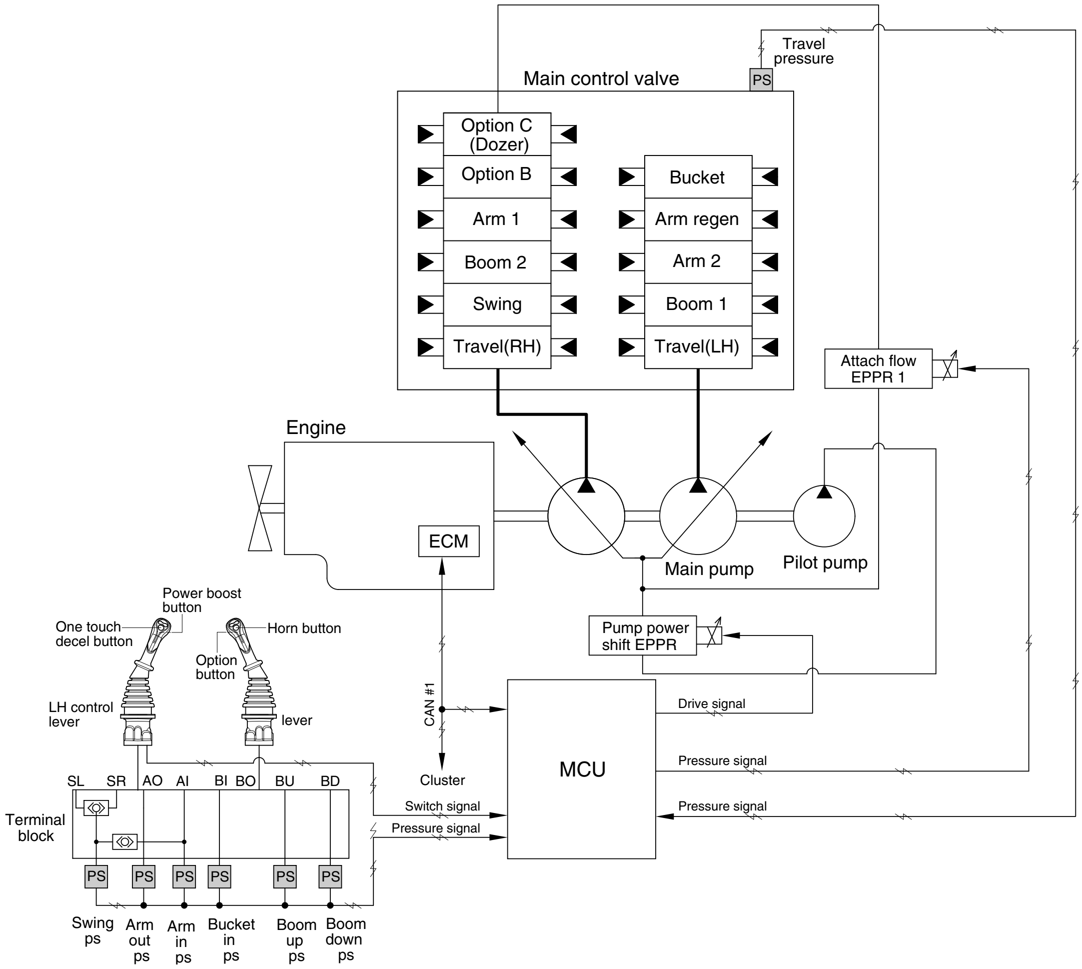
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool	
	Breaker	Crusher
Flow level	100~180 lpm	100~440 lpm
Attach safety solenoid	-	ON
Attach conflux solenoid	-	ON/OFF
Breaker solenoid★	ON	-

※ Refer to the page 5-77 for the attachment kinds and max flow.

★ When breaker operating switch is pushed.

GROUP 10 INTELLIGENT POWER CONTROL SYSTEM



140SA5MS13A

1. When the requirement of pump flow rate is low, IPC mode controls pump flow rate to improve fuel efficiency.

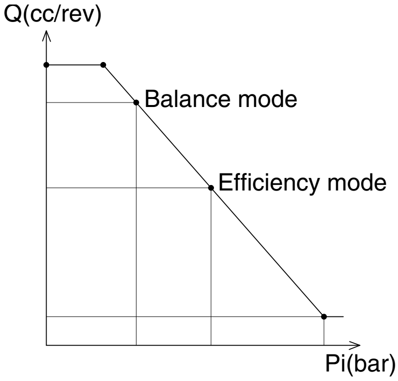
Condition★1	Function
IPC mode : ON★2 Boom up Arm in Not travel motion Not swing motion	Limitation of pump flow rate : Activated
None of upper condition	Limitation of pump flow rate : Canceled

★1 AND condition

★2 IPC mode ON/OFF is selected at "Mode setup > IPC mode". See next page.

2. IPC MODE SELECTION

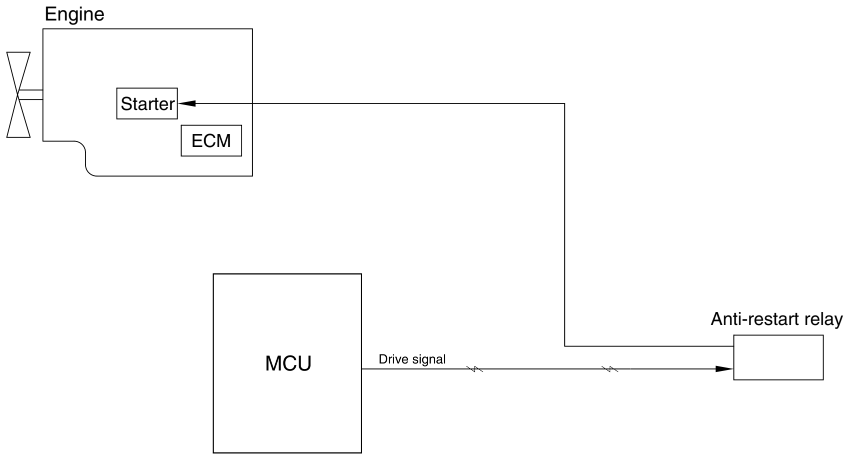
IPC mode ON/OFF and the levels of flow rate limit can be selected at "Mode setup > IPC mode"



145SA5MS19

IPC mode	Description
Balance mode (default)	IPC mode ON, limit level 1
Efficiency mode	IPC mode ON, limit level 2
Speed mode	IPC mode OFF

GROUP 11 ANTI-RESTART SYSTEM



140SA5MS12

1. ANTI-RESTART FUNCTION

After a few seconds from the engine starts to run, MCU turns off the anti-restart relay to protect the starter from inadvertent restarting.

GROUP 12 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

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

2. MONITORING

1) Active fault

220S3CD120A

220S3CD125A

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

2) Logged fault

220S3CD128A

220S3CD124A

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

3) Delete logged fault

220S3CD134A

220S3CD126A

220S3CD127A

· The logged faults of the MCU, can be deleted by this menu.

3. MACHINE ERROR CODES TABLE

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
101	3	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Hydraulic oil temperature display failure 2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2), CN-52 (#24) Checking Open/Short 2. CD-1 (#1), CN-51 (#11) Checking Open/Short				
105	0	10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#37) Checking Open/Short 2. CD-7 (#A) – CN-51 (#3) Checking Open/Short 3. CD-7 (#C) – CN-51 (#13) Checking Open/Short				
108	0	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V		●	
	1	10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#38) Checking Open/Short 2. CD-6 (#A) – CN-51 (#3) Checking Open/Short 3. CD-6 (#C) – CN-51 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">120</td><td>0</td><td>10 seconds continuous, Main Pump 1 (A1) Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V ≤ Main Pump 1 (A1) Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Main Pump 1 (A1) Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Main Pump 1 (A1) Press. display failure
2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure
(Checking list)
1. CD-42 (#B) – CN-52 (#29) Checking Open/Short
2. CD-42 (#A) – CN-51 (#3) Checking Open/Short
3. CD-42 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">121</td><td>0</td><td>10 seconds continuous, Main Pump 2 (A2) Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Main Pump 2 (A2) Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Main Pump 2 (A2) Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Main Pump 2 (A2) Press. display failure
2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure
(Checking list)
1. CD-43 (#B) – CN-52 (#30) Checking Open/Short
2. CD-43 (#A) – CN-51 (#3) Checking Open/Short
3. CD-43 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="3">122</td><td>1</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Overload Press. display failure
2. Control Function – Overload warning alarm failure
(Checking list)
1. CD-31 (#B) – CN-52 (#39) Checking Open/Short
2. CD-31 (#A) – CN-51 (#3) Checking Open/Short
3. CD-31 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
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<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">123</td><td>0</td><td>10 seconds continuous, Negative 1 Press. Sensor
Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Negative 1 Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Negative 1 Press. Sensor
Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Negative 1 Press. display failure
2. Control Function – IPC operation failure, Option attachment flow control operation failure
(Checking list)
1. CD-70 (#B) – CN-51 (#39) Checking Open/Short
2. CD-70 (#A) – CN-51 (#3) Checking Open/Short
3. CD-70 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">124</td><td>0</td><td>10 seconds continuous, Negative 2 Press. Sensor
Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Negative 2 Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Negative 2 Press. Sensor
Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Negative 2 Press. display failure
2. Control Function – Option attachment flow control operation failure
(Checking list)
1. CD-71 (#B) – CN-51 (#40) Checking Open/Short
2. CD-71 (#A) – CN-51 (#3) Checking Open/Short
3. CD-71 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">127</td><td>0</td><td>10 seconds continuous, Boom Up Pilot Press. Sensor
Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Boom Up Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Boom Up Pilot Press. display failure
2. Control Function – Engine/Pump variable horse power control operation failure, IPC operation failure, Boom first operation failure
(Checking list)
1. CD-32 (#B) – CN-52 (#35) Checking Open/Short
2. CD-32 (#A) – CN-51 (#3) Checking Open/Short
3. CD-32 (#C) – CN-5 1(#13) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
128	0	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Down Pilot Press. display failure 2. Control Function – Boom floating operation failure (Checking list) 1. CD-85 (#B) – CN-52 (#34) Checking Open/Short 2. CD-85 (#A) – CN-51 (#3) Checking Open/Short 3. CD-85 (#C) – CN-51 (#13) Checking Open/Short				
129	0	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V	●		
	1	10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In Pilot Press. display failure 2. Control Function – IPC operation failure (Checking list) 1. CD-90 (#B) – CN-51 (#10) Checking Open/Short 2. CD-90 (#A) – CN-51 (#3) Checking Open/Short 3. CD-90 (#C) – CN-51 (#13) Checking Open/Short				
130	0	10 seconds continuous, Bucket In Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Bucket In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Bucket In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Bucket In Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-52 (#31) Checking Open/Short 2. CD-35 (#A) – CN-51 (#3) Checking Open/Short 3. CD-35 (#C) – CN-51 (#13) Checking Open/Short				

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G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">135</td><td>0</td><td>10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Swing Pilot Press. display failure
2. Control Function – IPC operation, Boom first operation failure
(Checking list)
1. CD-24 (#B) – CN-52 (#36) Checking Open/Short
2. CD-24 (#A) – CN-51 (#3) Checking Open/Short
3. CD-24 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">138</td><td>0</td><td>Monitor – Select Attachment (breaker / crusher)
10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>Monitor – Select Attachment(breaker / crusher)
10 seconds continuous, 0.3V≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>Monitor – Select Attachment(breaker / crusher)
10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Attachment Pilot Press. display failure
2. Control Function – Option attachment flow control operation failure
(Checking list)
1. CD-69 (#B) – CN-52 (#33) Checking Open/Short
2. CD-69 (#A) – CN-51 (#3) Checking Open/Short
3. CD-69 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="3">139
(N.A)</td><td>1</td><td>10 seconds continuous, 0.3V≤ Option Pilot Press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td>●</td></tr>
<tr><td>4</td><td>10 seconds continuous, Option Pilot Press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Option Pilot Press. display failure
2. Control Function – Auto Idle operation failure
(Checking list)
1. CD-100 (#B) – CN-52 (#21) Checking Open/Short
2. CD-100 (#A) – CN-51 (#3) Checking Open/Short
3. CD-100 (#C) – CN-1 (#6) Checking Open/Short</td></tr>
</table>

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G : General C : Crawler Type W : Wheel Type

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<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">140</td><td>5</td><td>(Detection)
(When Pump EPPR Current is more than 10 mA)
10 seconds continuous, Pump EPPR drive current < 0 mA
(Cancellation)
(When Pump EPPR Current is more than 10 mA)
3 seconds continuous, Pump EPPR drive current ≥10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Pump EPPR drive current > 1.0A
(Cancellation)
3 seconds continuous, Pump EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Pump horse power setting specification difference
(Fuel efficiency/speed specification failure)
(Checking list)
1. CN-75 (#2) – CN-52 (#9) Checking Open/Short
2. CN-75 (#1) – CN-52 (#19) Checking Open/Short</td></tr>
<tr><td rowspan="3">141</td><td>5</td><td>(Model Parameter) mounting Boom Priority EPPR
(Detection)
(When Boom Priority EPPR Current is more than 10 mA)
10 seconds continuous, Boom Priority EPPR drive current < 0 mA
(Cancellation)
(When Boom Priority EPPR Current is more than 10 mA)
3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Boom Priority EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom first control operation failure
(Checking list)
1. CN-133 (#2) – CN-52 (#7) Checking Open/Short
2. CN-133 (#1) – CN-52 (#17) Checking Open/Short</td></tr>
</table>

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<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">143
(N.A)</td><td>5</td><td>(Detection)
(When Travel EPPR Current is more than 10 mA)
10 seconds continuous, Travel EPPR drive current = 0 mA
(Cancellation)
(When Travel EPPR Current is more than 100 mA)
3 seconds continuous, Travel EPPR drive current ≥ 10 mA</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Travel EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Travel EPPR drive current ≤ 1.0 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – cruise control operation failure
(Checking list)
1. CN-246 (#2) – CN-54 (#39) Checking Open/Short
2. CN-246 (#1) – CN-51 (#40) Checking Open/Short</td></tr>
<tr><td rowspan="3">145
(N.A)</td><td>5</td><td>(Model Parameter) mounting Remote Cooling Fan EPPR
(Detection)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA
(Cancellation)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Remote fan control operation failure
(Checking list)
1. CD-52 (#1) – CN-51 (#9) Checking Open/Short
2. CD-52 (#2) – CN-51 (#14) Checking Open/Short</td></tr>
</table>

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G : General　　C : Crawler Type　　W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">164
(N.A)</td><td>4</td><td>(Detection)
(When Working Cutoff Relay is Off)
10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Working Cutoff Relay is Off)
3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Working Cutoff Relay is On)
10 seconds continuous, Working Cutoff Relay drive current > 6.5 A
(Cancellation)
(When Working Cutoff Relay is On)
3 seconds continuous, Working Cutoff Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure
(Checking list)
1. CR-47 (#85) – CN-54 (#9) Checking Open/Short
2. CR-47 (#30, #86) – Fuse No (#28) Checking Open/Short</td></tr>
<tr><td rowspan="3">166</td><td>4</td><td>(Detection)
(When Power Max Solenoid is Off)
10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Power Max Solenoid is Off)
3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Power Max Solenoid is On)
5 seconds continuous, Power Max Solenoid drive current > 4.5 A
(Cancellation)
(When Power Max Solenoid is On)
3 seconds continuous, Power Max Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Voltage increase operation failure
(Checking list)
1. CN-88 (#1) – CN-52 (#2) Checking Open/Short
2. CN-88 (#2) – Fuse (#30) Checking Open/Short</td></tr>
</table>

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G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
167	4	(Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage $\leq$ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V		●	
		(When Parking mode is not) (Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage $\leq$ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Travel Speed Solenoid is On) 10 seconds continuous, Travel Speed Solenoid drive current > 4.5 A (Cancellation) (When Travel Speed Solenoid is On) 3 seconds continuous, Travel Speed Solenoid drive current $\leq$ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – driving in 1/2 transmission operation failure (Checking list) 1. CN-70 (#1) – CN-52 (#3) Checking Open/Short 2. CN-70 (#2) – Fuse (#30) Checking Open/Short				

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G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
169	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Attachment Conflux Solenoid is Off) 10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Conflux Solenoid is Off) 3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Attachment Conflux Solenoid is On) 10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A (Cancellation) (When Attachment Conflux Solenoid is On) 3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A	●		
	(Results / symptoms) 1. Control Function – Option attachment flow control – Joining operation failure (Eco breaker mode, crusher mode) (Checking list) 1. CN-66 (#1) – CN-15 (#11) Checking Open/Short 2. CN-66 (#2) – CR-62 (#5) Checking Open/Short				
170 (N.A)	4	(Model Parameter) mounting Arm Regenerating Solenoid (Detection) (When Arm Regeneration Solenoid is Off) 10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Arm Regeneration Solenoid is Off) 3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Arm Regeneration Solenoid is On) 10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A (Cancellation) (When Arm Regeneration Solenoid is On) 3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A	●		
	(Detection) (When Arm Regeneration Solenoid is On) 10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A (Cancellation) (When Arm Regeneration Solenoid is On) 3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A				

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G : General C : Crawler Type W : Wheel Type

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<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">171</td><td>4</td><td>Monitor – Selecting attachment(crusher)
(Detection)
(When Attachment Safety Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Attachment Safety Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Attachment Safety Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Attachment Safety Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Option spool pilot pressure cut off failure (crusher mode)
(Checking list)
1. CN-149 (#1) – CN-52 (#4) Checking Open/Short
2. CN-149 (#2) – Fuse (#30) Checking Open/Short</td></tr>
<tr><td rowspan="3">179
(N.A)</td><td>4</td><td>Monitor – Selecting attachment (breaker / crusher)
(Detection)
(When Breaker Operating Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Breaker Operating Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Breaker Operating Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Breaker Operating Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode)
(Checking list)
1. CD-66 (#1) – CN-53 (#9) Checking Open/Short
2. CD-66 (#2) – CN-45 (#B+ term) Checking Open/Short
3. CD-66 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
</table>

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G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">181
(N.A)</td><td>4</td><td>(Model Parameter) mounting Reverse Cooling Fan Solenoid
(Detection)
(When Reverse Cooling Fan Solenoid is Off)
10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Reverse Cooling Fan Solenoid is Off)
3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Reverse Cooling Fan Solenoid is On)
10 seconds continuous, Reverse Cooling Fan Solenoid drive current > 4.5 A
(Cancellation)
(When Reverse Cooling Fan Solenoid is On)
3 seconds continuous, Reverse Cooling Fan Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Cooling Fan reverse control operation failure (not applicable)</td></tr>
<tr><td rowspan="3">188</td><td>5</td><td>(Detection)
(When Attachment Flow EPPR 1 current is equal or more than 300 mA)
10 seconds continuous, Attachment Flow EPPR drive current < 100 mA
(Cancellation)
(When Attachment Flow EPPR 1 current is equal or more than 300 mA)
3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Attachment Flow EPPR 1 drive current > 1.0 A
(Cancellation)
3 seconds continuous, Attachment Flow EPPR 1 drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – IPC operation failure, Option attachment flow control operation failure
(Checking list)
1. CN-242 (#2) – CN-52 (#10) Checking Open/Short
2. CN-242 (#1) – CN-52 (#20) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">189</td><td>5</td><td>(Detection)
(When Attachment Flow EPPR 2 current is equal or more than 300 mA)
10 seconds continuous, Attachment Flow EPPR drive current < 100 mA
(Cancellation)
(When Attachment Flow EPPR 2 current is equal or more than 300 mA)
3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A
(Cancellation)
3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control operation failure
(Checking list)
1. CN-242A (#2) – CN-52 (#40) Checking Open/Short
2. CN-242A (#1) – CN-52 (#16) Checking Open/Short</td></tr>
<tr><td rowspan="4">196
(N.A)</td><td>0</td><td>HW145
10 seconds continuous,
Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V</td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>HW145
10 seconds continuous,
0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>HW145
10 seconds continuous,
Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Driving second pump joining function operation failure
(Checking list)
1. CD-33 (#B) – CN-52 (#11) Checking Open/Short
2. CD-33 (#A) – CN-51 (#3) Checking Open/Short
3. CD-33 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">200</td><td>0</td><td>10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Pump EPPR Press. display failure
2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure
(Fuel efficiency/speed performance failure)
(Checking list)
1. CD-44 (#B) – CN-52 (#32) Checking Open/Short
2. CD-44 (#A) – CN-51 (#3) Checking Open/Short
3. CD-44 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205 (N.A)	0	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V	●		
	1	(Mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V	●		
	4	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Boom Cylinder Rod Press. display failure 2. Control Function – Boom floating control operation failure (Checking list) 1. CD-124 (#B) – CN-53 (#5) Checking Open/Short 2. CD-124 (#A) – CN-53 (#3) Checking Open/Short 3. CD-124 (#C) – CN-53 (#13) Checking Open/Short			
218 (N.A)	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Up Floating Solenoid is On) 10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A (Cancellation) (When Boom Up Floating Solenoid is On) 3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	●		
		(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CD-368 (#1) – CN-53 (#20) Checking Open/Short 2. CD-368 (#2) – CR-35 (#87) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
220 (N.A)	4	Mounting pressure sensor (HCESPN 128 or 205) (Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current > 6.5 A (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CD-369 (#1) – CN-53 (#35) Checking Open/Short 2. CD-369 (#2) – CR-35 (#87) Checking Open/Short				
221 (N.A)	5	Monitor – Selecting attachment (breaker / crusher) (Detection) (When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA (Cancellation) ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P1 relief pressure setting failure (Checking list) 1. CD-365 (#2) – CN-53 (#39) Checking Open/Short 2. CD-365 (#1) – CN-53 (#40) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
222 (N.A)	5	Monitor – Selecting attachment (crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P2 relief pressure setting failure (Checking list) 1. CD-366 (#2) – CN-53 (#32) Checking Open/Short 2. CD-366 (#1) – CN-53 (#33) Checking Open/Short				
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-52 (#26) Checking Open/Short 2. CD-2 (#1) – CN-51 (#11) Checking Open/Short				
325	4	(Model Parameter) mounting Fuel Warmer Relay (Detection) (When Fuel Warmer Relay is Off) 10 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Fuel Warmer Relay is Off) 3 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Fuel Warmer Relay is On) 10 seconds continuous, Fuel Warmer Relay drive current > 4.5 A (Cancellation) (When Fuel Warmer Relay is On) 3 seconds continuous, Fuel Warmer Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Fuel warmer operation failure (Checking list) 1. CR-46 (#85) – CN-52 (#12) Checking Open/Short 2. CR-46 (#86) – Fuse (#21) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
501 (N.A)	0	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Transmission Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Transmission Oil Press. display failure, Transmission Oil low pressure warning failure (Checking list) 1. CD-5 (#B) – CN-54 (#27) Checking Open/Short 2. CD-5 (#A) – CN-54 (#3) Checking Open/Short 3. CD-5 (#C) – CN-54 (#13) Checking Open/Short				
503 (N.A)	0	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Brake Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Brake Oil Press. display failure, Brake Oil low pressure warning failure (Checking list) 1. CD-3 (#B) – CN-54 (#4) Checking Open/Short 2. CD-3 (#A) – CN-54 (#3) Checking Open/Short 3. CD-3 (#C) – CN-54 (#13) Checking Open/Short				
505 (N.A)	0	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Working Brake Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Working Brake Oil Press. display failure, Working Brake Oil low pressure warning failure (Checking list) 1. CD-38 (#B) – CN-54 (#5) Checking Open/Short 2. CD-38 (#A) – CN-54 (#3) Checking Open/Short 3. CD-38 (#C) – CN-54 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General   C : Crawler Type   W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">514
(N.A)</td><td>4</td><td>(Detection)
(When Parking Relay is Off)
10 seconds continuous, Parking Relay drive unit
Measurement Voltage ≤ 3.0V
(Cancellation)
(When Parking Relay is Off)
3 seconds continuous, Parking Relay drive unit
Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Parking Relay is On)
10 seconds continuous, Parking Relay drive current > 6.5 A
(Cancellation)
(When Parking Relay is On)
3 seconds continuous, Parking Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Parking Relay operation failure
(Checking list)
1. CR-66 (#1) – CN-54 (#20) Checking Open/Short
2. CR-66 (#2) – CN-45 (#B+ term) Checking Open/Short</td></tr>
<tr><td rowspan="3">517
(N.A)</td><td>4</td><td>(Detection)
(When Traveling Cutoff Relay is Off)
10 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Traveling Cutoff Relay is Off)
3 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Traveling Cutoff Relay is On)
10 seconds continuous, Traveling Cutoff Relay drive current > 6.5 A
(Cancellation)
(When Traveling Cutoff Relay is On)
3 seconds continuous, Traveling Cutoff Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Traveling Cutoff Relay operation failure
(Checking list)
1. CR-47 (#85) – CN-54 (#9) Checking Open/Short
2. CR-47 (#86) – CN-45 (#B+ term) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
525 (N.A)	4	(Detection) (When Ram Lock Solenoid is Off) 10 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Ram Lock Solenoid is Off) 3 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Ram Lock Solenoid is On) 10 seconds continuous, Ram Lock Solenoid drive current > 6.5 A (Cancellation) (When Ram Lock Solenoid is On) 3 seconds continuous, Ram Lock Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Ram lock control operation failure (Checking list) 1. CN-69 (#1) – CN-54 (#8) Checking Open/Short 2. CN-69 (#2) – CN-45 (#B+ term) Checking Open/Short				
527 (N.A)	4	(Detection) (When Creep Solenoid is Off) 10 seconds continuous, Creep Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Creep Solenoid is Off) 3 seconds continuous, Creep Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Creep Solenoid is On) 10 seconds continuous, Creep Solenoid drive current > 6.5 A (Cancellation) (When Creep Solenoid is On) 3 seconds continuous, Creep Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Creep mode operation failure (Checking list) 1. CN-206 (#1) – CN-54 (#7) Checking Open/Short 2. CN-206 (#2) – CN-45 (#B+ term) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
530 (N.A)	0	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Forward Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-73 (#B) – CN-54 (#6) Checking Open/Short 2. CD-73 (#A) – CN-54 (#3) Checking Open/Short 3. CD-73 (#C) – CN-54 (#13) Checking Open/Short				
531 (N.A)	1	10 seconds continuous, 0.3V≤ Travel Reverse Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Reverse Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Reverse Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-74 (#B) – CN-54 (#23) Checking Open/Short 2. CD-74 (#A) – CN-54 (#3) Checking Open/Short 3. CD-74 (#C) – CN-54 (#13) Checking Open/Short				
705	0	10 seconds continuous, Battery input Voltage > 35V	●		
	1	10 seconds continuous, Battery input Voltage < 18V	●		
	(Results / Symptoms) 1. Control Function – Startup impossibility (Checking list) 1. CS-74A (#1) – CN-51 (#1) Checking Open/Short				
707	1	(When Engine is equal or more than 400 rpm) 10 seconds continuous, Alternator Node L Measurement Voltage < 18V (In case 12v goods, Alternator Node L Measurement Voltage < 9V)	●		
	(Results / Symptoms) 1. Control Function – Battery charging circuit failure (Checking list) 1. CS-74A (#1) – CN-51 (#2) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">714</td><td>3</td><td>(Model Parameter) Mounting Acc. Dial
10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(Model Parameter) Mounting Acc. Dial
10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Acc. Dial Voltage display failure
2. Control Function – Engine rpm control failure
(Checking list)
1. CN-7 (#1) – CN-52 (#23) Checking Open/Short</td></tr>
<tr><td rowspan="3">722</td><td>4</td><td>(Detection)
(When Travel Alarm (Buzzer) Sound is Off)
10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Travel Alarm (Buzzer) Sound Relay is Off)
3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V</td><td></td><td>●</td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Travel Alarm (Buzzer) Sound is On)
10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A
(Cancellation)
(When Travel Alarm (Buzzer) Sound is On)
3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A</td><td></td><td>●</td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Driving alarm operation failure
(Checking list)
1. CN-81 (#1) – CN-52 (#13) Checking Open/Short
2. CN-81 (#2) – Fuse (#30) Checking Open/Short</td></tr>
<tr><td rowspan="2">831</td><td>2</td><td>(When mounting the A/C Controller)
60 seconds continuous, A/C Controller Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – A/C Controller operation failure
(Checking list)
1. CN-11 (#6) – CR-7 (#85) Checking Open/Short
2. CN-11 (#5) – Fuse (#6) Checking Open/Short</td></tr>
<tr><td rowspan="2">840</td><td>2</td><td>60 seconds continuous, Cluster Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Cluster operation failure
(Checking list)
1. CN-56A (#7) – CN-51 (#32) Checking Open/Short
2. CN-56A (#6) – CN-51 (#22) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="2">841</td><td>2</td><td>10 seconds continuous, ECM Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – ECM operation failure
(Checking list)
1. CN-93 (#46) – CN-51 (#21) Checking Open/Short
2. CN-93 (#47) – CN-51 (#31) Checking Open/Short</td></tr>
<tr><td rowspan="2">845
(N.A)</td><td>2</td><td>(When mounting the I/O Controller 1)
60 seconds continuous, I/O Controller 1 Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – I/O Controller 1 operation failure
(Checking list)
1. CN-53 (#21) – CN-51 (#23) Checking Open/Short
2. CN-53 (#31) – CN-51 (#33) Checking Open/Short</td></tr>
<tr><td rowspan="2">848
(N.A)</td><td>2</td><td>(When mounting the Haptic Controller)
60 seconds continuous, Haptic Controller Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Haptic Controller operation failure
(Checking list)
1. CN-8 (#2) – CN-51 (#22) Checking Open/Short
2. CN-8 (#3) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">850</td><td>2</td><td>(When mounting the RMCU)
60 seconds continuous, RMCU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Resuluts / Symptoms)
1. Control Function – RMCU operation failure
(Checking list)
1. CN-125A (#3) – CN-51 (#22) Checking Open/Short
2. CN-125A (#11) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">861
(N.A)</td><td>2</td><td>(When mounting the I/O Controller 2)
60 seconds continuous, I/O Controller 2 communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – I/O Controller 2 operation failure
(Checking list)
1. CN-54 (#21) – CN-51 (#23) Checking Open/Short
2. CN-54 (#31) – CN-51 (#33) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
	(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-401 (#15) – CN-51 (#22) Checking Open/Short 2. CN-401 (#3) – CN-51 (#32) Checking Open/Short				
867	2	60 seconds continuous, RDU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#22) Checking Open/Short 2. CN-376 (#18) – CN-51 (#32) Checking Open/Short				
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#32) Checking Open/Short 2. CN-56A (#6) – CN-51 (#22) Checking Open/Short				
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#22) Checking Open/Short 2. CS-2B (#B) – CN-51 (#32) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

Fault code	J1939 SPN	J1939 FMI	Item	Description
111	629	12	Controller #1	Engine control module critical internal failure - bad intelligent device or component
115	612	2	System diagnostic code # 2	Engine speed/position sensor circuit lost both of two signals from the magnetic pickup sensor - data erratic, intermittent, or incorrect
122	102	3	Boost pressure	Intake manifold pressure sensor circuit – voltage above normal, or shorted to high source
123	102	4	Boost pressure	Intake manifold pressure sensor circuit – voltage below normal, or shorted to low source
124	102	16	Boost pressure	Intake manifold 1 pressure - data valid but above normal operational range - moderately severe level
131	91	3	Accelerator pedal position	Accelerator pedal or lever position sensor circuit - voltage above normal, or shorted to high source
132	91	4	Accelerator pedal position	Accelerator pedal or lever position sensor circuit - voltage below normal, or shorted to low source
133	974	3	Remote accelerator	Remote accelerator pedal or lever position sensor circuit – voltage above normal, or shorted to high source
134	974	4	Remote accelerator	Remote accelerator pedal or lever position sensor circuit – voltage below normal, or shorted to low source
135	100	3	Engine oil pressure	Oil pressure sensor circuit - voltage above normal, or shorted to high source
141	100	4	Engine oil pressure	Oil pressure sensor circuit - voltage below normal, or shorted to low source
143	100	18	Engine oil pressure	Oil pressure low – data valid but below normal operational range - moderately severe level
144	110	3	Engine coolant temperature	Coolant temperature sensor circuit – voltage above normal, or shorted to high source
145	110	4	Engine coolant temperature	Coolant temperature sensor circuit – voltage below normal, or shorted to low source
146	110	16	Engine coolant temperature	Coolant temperature high - data valid but above normal operational range - moderately severe level
147	91	1	Accelerator pedal position	Accelerator pedal or lever position sensor circuit – abnormal frequency, pulse width, or period
148	91	0	Accelerator pedal position	Accelerator pedal or lever position sensor circuit – abnormal frequency, pulse width, or period
151	110	0	Engine coolant temperature	Coolant temperature high - data valid but above normal operational range - most severe level
153	105	3	Intake manifold #1 temp	Intake manifold air temperature sensor circuit - voltage above normal, or shorted to high source
154	105	4	Intake manifold #1 temp	Intake manifold air temperature sensor circuit - voltage below normal, or shorted to low source
155	105	0	Intake manifold #1 temp	Intake manifold air temperature high – data valid but above normal operational range - most severe level

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
187	3510	4	5 Volts dc supply	Sensor supply voltage #2 circuit – voltage below normal, or shorted to low source
193	520199	3	Cruise control	Cruise control (resistive) signal circuit - voltage above normal, or shorted to high source
194	520199	4	Cruise control	Cruise control (resistive) signal circuit - voltage below normal, or shorted to low source
195	111	3	Coolant level	Coolant level sensor circuit - voltage above normal, or shorted to high source
196	111	4	Coolant level	Coolant level sensor circuit - voltage below normal, or shorted to low source
197	111	18	Coolant level	Coolant level - data valid but below normal operational range - moderately severe level
199	1661	4	Engine automatic start lamp	Engine automatic start lamp driver circuit - voltage above normal, or shorted to high source
211	1484	31	J1939 error	Additional auxiliary diagnostic codes logged - condition exists
212	175	3	Oil temperature	Engine oil temperature sensor 1 circuit - voltage above normal, or shorted to high source
213	175	4	Oil temperature	Engine oil temperature sensor 1 circuit - voltage below normal, or shorted to low source
214	175	0	Oil temperature	Engine oil temperature - data valid but above normal operational range - most severe level
221	108	3	Barometric pressure	Barometric pressure sensor circuit – voltage above normal, or shorted to high source
222	108	4	Barometric pressure	Barometric pressure sensor circuit – voltage below normal, or shorted to low source
227	3510	3	5 Volts dc supply	Sensor supply voltage #2 circuit – voltage above normal, or shorted to high source
231	109	3	Coolant pressure	Coolant pressure sensor circuit - voltage above normal, or shorted to high source
232	109	4	Coolant pressure	Coolant pressure sensor circuit - voltage below normal, or shorted to low source
233	109	18	Coolant pressure	Coolant pressure - data valid but below normal operational range - moderately severe level
234	190	0	Engine speed	Engine speed high - data valid but above normal operational range - most severe level
235	111	1	Coolant level	Coolant level low - data valid but below normal operational range - most severe level
237	644	2	External speed input	External speed input (multiple unit synchronization) - data erratic, intermittent, or incorrect
238	3511	4	System diagnostic code # 1	Sensor supply voltage #3 circuit – voltage below normal, or shorted to low source
239	3511	3	System diagnostic code #2	Sensor supply voltage #3 circuit - voltage above normal, or shorted to high source
241	84	2	Wheel-based vehicle speed	Vehicle speed sensor circuit - data erratic, intermittent, or incorrect
242	84	10	Wheel-based vehicle speed	Vehicle speed sensor circuit tampering has been detected – abnormal rate of change

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
244	623	4	Red stop lamp	Red stop lamp driver circuit - voltage below normal, or shorted to low source
245	647	4	Fan clutch output device driver	Fan control circuit - voltage below normal, or shorted to low source
249	171	3	Ambient air temperature	Ambient air temperature sensor circuit - voltage above normal, or shorted to high source
256	171	4	Ambient air temperature	Ambient air temperature sensor circuit - voltage below normal, or shorted to low source
261	174	16	Fuel temperature	Engine fuel temperature - data valid but above normal operational range - moderately severe level
263	174	3	Fuel temperature	Engine fuel temperature sensor 1 circuit - voltage above normal, or shorted to high source
265	174	4	Fuel temperature	Engine fuel temperature sensor 1 circuit - voltage below normal, or shorted to low source
268	94	2	Fuel delivery pressure	Fuel pressure sensor circuit - data erratic, intermittent, or incorrect
271	1347	4	Fuel pump pressurizing assembly #1	High fuel pressure solenoid valve circuit – voltage below normal, or shorted to low source
272	1347	3	Fuel pump pressurizing assembly #1	High fuel pressure solenoid valve circuit – voltage above normal, or shorted to high source
281	1347	7	Fuel pump pressurizing assembly #1	High fuel pressure solenoid valve #1 – mechanical system not responding properly or out of adjustment
285	639	9	Sae J1939 datalink	SAE J1939 multiplexing pgn timeout error - abnormal update rate
286	639	13	Sae J1939 datalink	SAE J1939 multiplexing configuration error – out of calibration
287	91	19	Accelerator pedal position	SAE J1939 multiplexing accelerator pedal or lever sensor system error - received network data in error
288	974	19	Remote accelerator	SAE J1939 multiplexing remote accelerator pedal or lever data error - received network data in error
292	441	14	Auxiliary temperature 1	Auxiliary temperature sensor input 1 - special instructions
293	441	3	OEM Temperature	Auxiliary temperature sensor input # 1 circuit - voltage above normal, or shorted to high source
294	441	4	OEM Temperature	Auxiliary temperature sensor input # 1 circuit - voltage below normal, or shorted to low source
295	108	2	Barometric pressure	Barometric pressure sensor circuit - data erratic, intermittent, or incorrect
296	1388	14	Auxiliary pressure	Auxiliary pressure sensor input 1 - special instructions
297	1388	3	Auxiliary pressure	Auxiliary pressure sensor input # 2 circuit - voltage above normal, or shorted to high source
298	1388	4	Auxiliary pressure	Auxiliary pressure sensor input # 2 circuit - voltage below normal, or shorted to low source
319	251	2	Real time clock power	Real time clock power interrupt - data erratic, intermittent, or incorrect

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
322	651	5	Injector cylinder #01	Injector solenoid cylinder #1 circuit – current below normal, or open circuit
323	655	5	Injector cylinder #05	Injector solenoid cylinder #5 circuit – current below normal, or open circuit
324	653	5	Injector cylinder #03	Injector solenoid cylinder #3 circuit – current below normal, or open circuit
325	656	5	Injector cylinder #06	Injector solenoid cylinder #6 circuit – current below normal, or open circuit
331	652	5	Injector cylinder #02	Injector solenoid cylinder #2 circuit – current below normal, or open circuit
332	654	5	Injector cylinder #04	Injector solenoid cylinder #4 circuit – current below normal, or open circuit
334	110	2	Engine coolant temperature	Coolant temperature sensor circuit – data erratic, intermittent, or incorrect
338	1267	3	Vehicle accessories relay driver	Idle shutdown vehicle accessories relay driver circuit - voltage above normal, or shorted to high source
339	1267	4	Vehicle accessories relay driver	Idle shutdown vehicle accessories relay driver circuit - voltage below normal, or shorted to low source
342	630	13	Calibration memory	Electronic calibration code incompatibility - out of calibration
343	629	12	Controller #1	Engine control module warning internal hardware failure - bad intelligent device or component
349	191	16	Transmission output shaft speed	Transmission output shaft speed - data valid but above normal operational range - moderately severe level
351	3597	12	Controller #1	Injector power supply - bad intelligent device or component
352	3509	4	5 volts DC supply	Sensor supply voltage #1 circuit – voltage below normal, or shorted to low source
386	3509	3	5 volts DC supply	Sensor supply voltage #1 circuit – voltage above normal, or shorted to high source
415	100	1	Engine oil pressure	Oil pressure low – data valid but below normal operational range - most severe level
418	97	15	Water in fuel indicator	Water in fuel indicator high - data valid but above normal operational range – least severe level
422	111	2	Coolant level	Coolant level - data erratic, intermittent, or incorrect
425	175	2	Oil temperature	Engine oil temperature - data erratic, intermittent, or incorrect
428	97	3	Water in fuel indicator	Water in fuel sensor circuit - voltage above normal, or shorted to high source
429	97	4	Water in fuel indicator	Water in fuel sensor circuit - voltage below normal, or shorted to low source
431	558	2	Accelerator pedal low idle switch	Accelerator pedal or lever idle validation circuit - data erratic, intermittent, or incorrect
432	558	13	Accelerator pedal low idle switch	Accelerator pedal or lever idle validation circuit - out of calibration

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
435	100	2	Engine oil pressure	Oil pressure sensor circuit - data erratic, intermittent, or incorrect
441	168	18	Electrical potential (voltage)	Battery #1 voltage low - data valid but below normal operational range – moderately severe level
442	168	16	Electrical potential (voltage)	Battery #1 voltage high - data valid but above normal operational range – moderately severe level
449	157	0	Injector metering rail 1 pressure	Fuel pressure high - data valid but above normal operational range – moderately severe level
451	157	3	Injector metering rail 1 pressure	Injector metering rail #1 pressure sensor circuit - voltage above normal, or shorted to high source
452	157	4	Injector metering rail 1 pressure	Injector metering rail #1 pressure sensor circuit - voltage below normal, or shorted to low source
488	105	16	Intake manifold	Intake manifold 1 temperature - data valid but above normal operational range - moderately severe level
489	191	18	Transmission output shaft speed	Transmission output shaft speed - data valid but below normal operational range - moderately severe level
497	1377	2	Switch circuit	Multiple unit synchronization switch circuit - data erratic, intermittent, or incorrect
523	611	2	System diagnostic code # 1	OEM Intermediate (PTO) speed switch validation - data erratic, intermittent, or incorrect
527	702	3	Circuit - voltage	Auxiliary input/output 2 circuit - voltage above normal, or shorted to high source
528	93	2	Switch - data	Auxiliary alternate torque validation switch - data erratic, intermittent, or incorrect
529	703	3	Circuit - voltage	Auxiliary input/output 3 circuit - voltage above normal, or shorted to high source
546	94	3	Fuel delivery pressure	Fuel delivery pressure sensor circuit - voltage above normal, or shorted to high source
547	94	4	Fuel delivery pressure	Fuel delivery pressure sensor circuit - voltage below normal, or shorted to low source
551	558	4	Accelerator pedal low idle switch	Accelerator pedal or lever idle validation circuit - voltage below normal, or shorted to low source
553	157	16	Injector metering rail 1 pressure	Injector metering rail #1 pressure high – data valid but above normal operational range - moderately severe level
554	157	2	Injector metering rail 1 pressure	Fuel pressure sensor error - data erratic, intermittent, or incorrect
559	157	18	Injector metering rail 1 pressure	Injector metering rail #1 pressure low – data valid but below normal operational range - moderately severe level
584	677	3	Starter solenoid lockout relay driver circuit	Starter relay circuit - voltage above normal, or shorted to high source
585	677	4	Starter solenoid lockout relay driver circuit	Starter relay circuit - voltage below normal, or shorted to low source
595	103	16	Turbocharger 1 speed	Turbocharger #1 speed high - data valid but above normal operational range – moderately severe level

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
596	167	16	Alternate potential (voltage)	Electrical charging system voltage high – data valid but above normal operational range - moderately severe level
597	167	18	Alternate potential (voltage)	Electrical charging system voltage low – data valid but below normal operational range - moderately severe level
598	167	1	Alternate potential (voltage)	Electrical charging system voltage low – data valid but below normal operational range - most severe level
599	640	14	Engine external protection input	Auxiliary commanded dual output shutdown - special instructions
649	1378	31	Engine oil change interval	Change lubricating oil and filter – condition exists
687	103	18	Turbocharger 1 speed	Turbocharger #1 speed low - data valid but below normal operational range – moderately severe level
689	190	2	Engine speed	Primary engine speed sensor error – data erratic, intermittent, or incorrect
691	1172	3	Turbocharger #1compressor inlet temperature	Turbocharger #1 compressor inlet temperature sensor circuit – voltage above normal, or shorted to high source
692	1172	4	Turbocharger #1compressor inlet temperature	Turbocharger #1 compressor inlet temperature sensor circuit – voltage below normal, or shorted to low source
697	1136	3	Sensor circuit - voltage	ECM internal temperature sensor circuit - voltage above normal, or shorted to high source
698	1136	4	Sensor circuit - voltage	Ecm internal temperature sensor circuit - voltage below normal, or shorted to low source
719	22	3	Crankcase pressure	Extended crankcase blow-by pressure circuit - voltage above normal, or shorted to high source
729	22	4	Crankcase pressure	Extended crankcase blow-by pressure circuit - voltage below normal, or shorted to low source
731	723	7	Engine speed sensor #2	Engine speed/position #2 mechanical misalignment between camshaft and crankshaft sensors - mechanical system not responding properly or out of adjustment
757	2802	31	Electronic control module	Electronic control module data lost - condition exists
778	723	2	Engine speed sensor #2	Engine speed sensor (camshaft) error – data erratic, intermittent, or incorrect
779	703	11	Auxiliary equipment sensor input	Warning auxiliary equipment sensor input # 3 (OEM switch) - root cause not known
951	166	2	Cylinder power	Cylinder power imbalance between cylinders - data erratic, intermittent, or incorrect
1117	3597	2	Power supply	Power lost with ignition on - data erratic, intermittent, or incorrect
1139	651	7	Injector cylinder # 01	Injector cylinder #1 - mechanical system not responding properly or out of adjustment
1141	652	7	Injector cylinder # 02	Injector cylinder #2 - mechanical system not responding properly or out of adjustment
1142	653	7	Injector cylinder # 03	Injector cylinder #3 - mechanical system not responding properly or out of adjustment

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
1143	654	7	Injector cylinder # 04	Injector cylinder #4 - mechanical system not responding properly or out of adjustment
1144	655	7	Injector cylinder # 05	Injector cylinder #5 - mechanical system not responding properly or out of adjustment
1145	656	7	Injector cylinder # 06	Injector cylinder #6 - mechanical system not responding properly or out of adjustment
1239	2623	3	Accelerator pedal position	Accelerator pedal or lever position sensor 2 circuit - voltage above normal, or shorted to high source
1241	2623	4	Accelerator pedal position	Accelerator pedal or lever position sensor 2 circuit - voltage below normal, or shorted to low source
1242	91	2	Accelerator pedal position	Accelerator pedal or lever position sensor 1 and 2 - data erratic, intermittent, or incorrect
1256	1563	2	Control module identification input state	Control module identification input state error - data erratic, intermittent, or incorrect
1257	1563	2	Control module identification input state	Control module identification input state error - data erratic, intermittent, or incorrect
1852	97	16	Water in fuel indicator	Water in fuel indicator - data valid but above normal operational range - moderately severe level
1911	157	0	Injector metering rail	Injector metering rail 1 pressure - data valid but above normal operational range - most severe level
2111	52	3	Coolant temperature	Coolant temperature 2 sensor circuit - voltage above normal, or shorted to high source
2112	52	4	Coolant temperature	Coolant temperature 2 sensor circuit - voltage below normal, or shorted to low source
2113	52	16	Coolant temperature	Coolant temperature 2 - data valid but above normal operational range - moderately severe level
2114	52	0	Coolant temperature	Coolant temperature 2 - data valid but above normal operational range - most severe level
2115	2981	3	Coolant pressure	Coolant pressure 2 circuit - voltage above normal, or shorted to high source
2116	2981	4	Coolant pressure	Coolant pressure 2 circuit - voltage below normal, or shorted to low source
2117	2981	18	Coolant pressure	Coolant pressure 2 - data valid but below normal operational range - moderately severe level
2182	1072	3	Engine brake output # 1	Engine brake actuator driver 1 circuit - voltage above normal, or shorted to high source
2183	1072	4	Engine brake output # 1	Engine brake actuator driver 1 circuit - voltage below normal, or shorted to low source
2185	3512	3	System diagnostic code # 1	Sensor supply voltage #4 circuit – voltage above normal, or shorted to high source
2186	3512	4	System diagnostic code # 1	Sensor supply voltage #4 circuit – voltage below normal, or shorted to low source
2195	703	14	Auxiliary equipment sensor	Auxiliary equipment sensor input 3 engine protection critical - special instructions
2215	94	18	Fuel delivery pressure	Fuel pump delivery pressure - data valid but below normal operational range - moderately severe level
2216	94	16	Fuel delivery pressure	Fuel pump delivery pressure - data valid but above normal operational range – moderately severe level

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
2217	630	31	Calibration memory	ECM program memory (RAM) corruption - condition exists
2249	157	1	Injector metering rail 1 pressure	Injector metering rail 1 pressure - data valid but below normal operational range - most severe level
2261	94	15	Fuel delivery pressure	Fuel pump delivery pressure - data valid but above normal operational range - least severe level
2262	94	17	Fuel delivery pressure	Fuel pump delivery pressure - data valid but below normal operational range - least severe level
2263	1800	16	Battery temperature	Battery temperature - data valid but above normal operational range - moderately severe level
2264	1800	18	Battery temperature	Battery temperature - data valid but below normal operational range - moderately severe level
2265	1075	3	Electric lift pump for engine fuel	Fuel priming pump control signal circuit – voltage above normal, or shorted to high source
2266	1075	4	Electric lift pump for engine fuel	Fuel priming pump control signal circuit – voltage below normal, or shorted to low source
2292	611	16	Fuel inlet meter device	Fuel inlet meter device - data valid but above normal operational range - moderately severe level
2293	611	18	Fuel inlet meter device	Fuel inlet meter device flow demand lower than expected - data valid but below normal operational range - moderately severe level
2311	633	31	Fuel control valve #1	Fueling actuator #1 circuit error – condition exists
2321	190	2	Engine speed	Engine speed / position sensor #1 - data erratic, intermittent, or incorrect
2322	723	2	Engine speed sensor #2	Engine speed / position sensor #2 - data erratic, intermittent, or incorrect
2345	103	10	Turbocharger 1 speed	Turbocharger speed invalid rate of change detected - abnormal rate of change
2346	2789	15	System diagnostic code #1	Turbocharger turbine inlet temperature (calculated) - data valid but above normal operational range – least severe level
2347	2629	15	System diagnostic code #1	Turbocharger compressor outlet temperature (calculated) - data valid but above normal operational range – least severe level
2363	1073	4	Engine compression brake output # 2	Engine brake actuator circuit #2 – voltage below normal, or shorted to low source
2365	1112	4	Engine brake output # 3	Engine brake actuator driver output 3 circuit - voltage below normal, or shorted to low source
2367	1073	3	Engine compression brake output # 2	Engine brake actuator circuit #2 – voltage above normal, or shorted to high source
2368	1112	3	Engine brake output # 3	Engine brake actuator driver 3 circuit - voltage above normal, or shorted to high source
2372	95	16	Engine fuel filter differential pressure	Fuel filter differential pressure - data valid but above normal operational range - moderately severe level
2373	1209	3	Exhaust gas pressure	Exhaust gas pressure sensor circuit - voltage above normal, or shorted to high source
2374	1209	4	Exhaust gas pressure	Exhaust gas pressure sensor circuit - voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
2375	412	3	Exhaust gas recirculation temperature	Exhaust gas recirculation temperature sensor circuit - voltage above normal, or shorted to high source
2376	412	4	Exhaust gas recirculation temperature	Exhaust gas recirculation temperature sensor circuit - voltage below normal, or shorted to low source
2377	647	3	Fan clutch output device driver	Fan control circuit - voltage above normal, or shorted to high source
2425	730	4	Intake air heater # 2	Intake air heater 2 circuit - voltage below normal, or shorted to low source
2426	730	3	Intake air heater # 2	Intake air heater 2 circuit - voltage above normal, or shorted to high source
2448	111	17	Coolant level	Coolant level - data valid but below normal operating range - least severe level
2555	729	3	Inlet air heater driver #1	Intake air heater #1 circuit - voltage above normal, or shorted to high source
2556	729	4	Inlet air heater driver #1	Intake air heater #1 circuit - voltage below normal, or shorted to low source
2557	697	3	Auxiliary PWM driver #1	Auxiliary PWM driver #1 - voltage above normal, or shorted to high source
2558	697	4	Auxiliary PWM driver #1	Auxiliary PWM driver #1 - voltage below normal, or shorted to low source
2963	110	15	Engine coolant temperature	Engine coolant temperature high - data valid but above normal operational range - least severe level
2973	102	2	Boost pressure	Intake manifold pressure sensor circuit - data erratic, intermittent, or incorrect

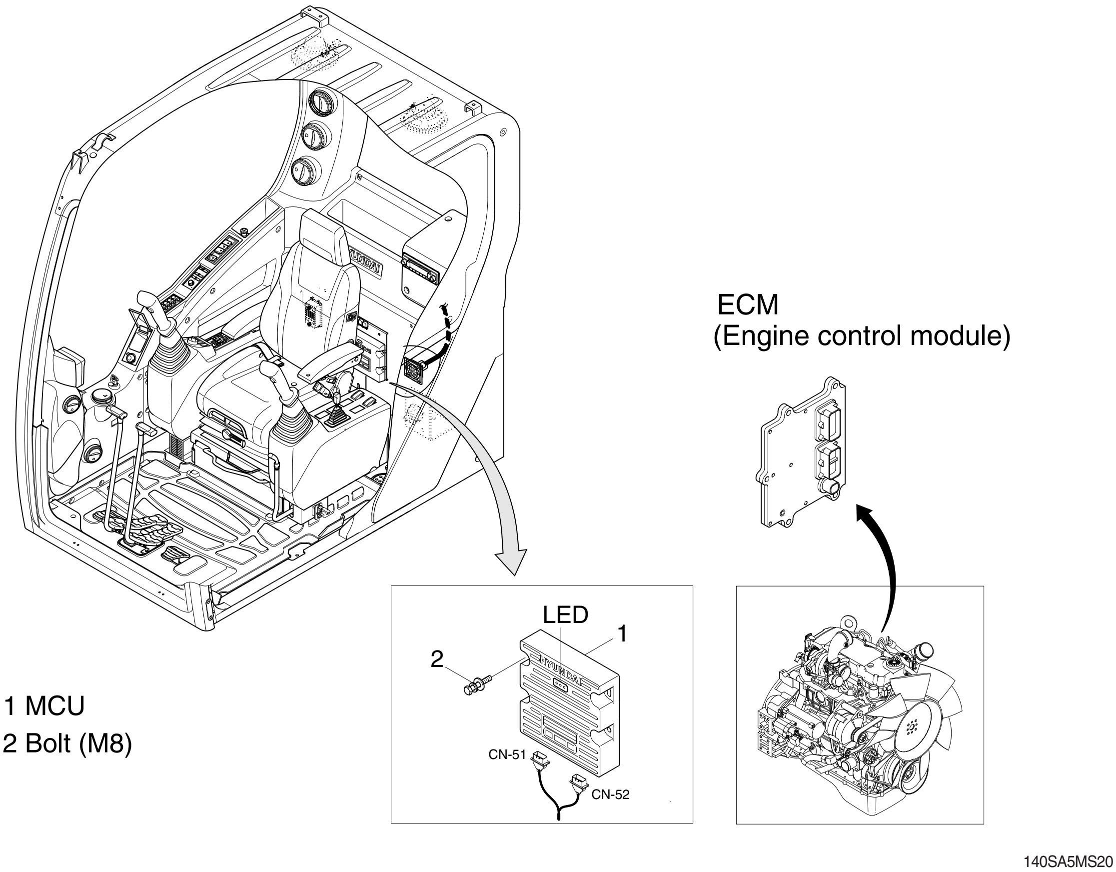
※ Some fault codes are not applied to this machine.

5. AAVM FAULT CODE

Fault Code	Description
A01	AAVM Communication Error -AAVM
A02	AAVM Communication Error -Front Camera
A03	AAVM Communication Error -Rear Camera
A04	AAVM Communication Error -Left Camera
A05	AAVM Communication Error -Right Camera
A06	Manual Setting Fail
A07	No MCU CID
A08	MCU CID Format Error
A09	AAVM Hardware Error -AAVM
A10	AAVM Hardware Error -Front Camera
A11	AAVM Hardware Error -Rear Camera
A12	AAVM Hardware Error -Left Camera
A13	AAVM Hardware Error -Right Camera
A14	MCU CID Model is not registered
A15	MCU CID Model can't be applied

GROUP 14 ENGINE CONTROL SYSTEM

1. MCU and Engine ECM (Electronic Control Module)



2. MCU ASSEMBLY

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

2) Three LED lamps on the MCU display as below.

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

G : green,   R : red,   Y : yellow

GROUP 15 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

EPPR (Electro Proportional Pressure Reducing) valve consists of electro magnet and spool valve installed at main pump.

(1) Electro magnet valve

Receive electric current from MCU and move the spool proportionally according to the specific amount of electric current value.

(2) Spool valve

Is the two way direction control valve for pilot pressure to reduce main pump flow.
When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

2) HOW TO SWITCH THE POWER SHIFT (STANDARD ↔ OPTION) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the power shift (standard ↔ option).

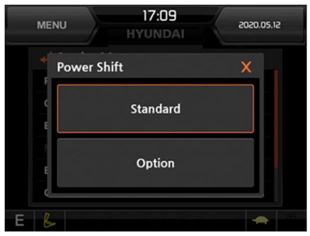
- Management
  · Service menu

220S3CD149A

→

Enter the password 220S3CD150B

→

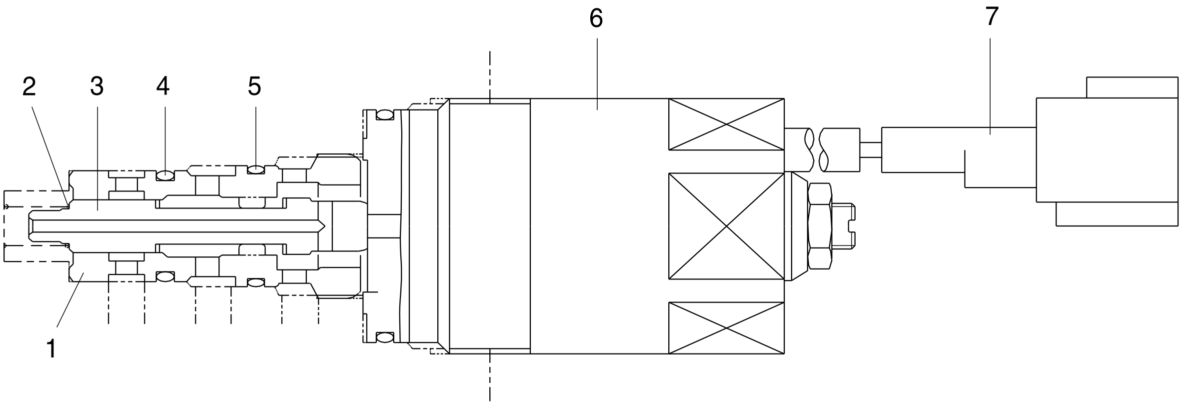


220S3CD251A

· Power shift (standard/option) : Power shift pressure can be set by option menu.

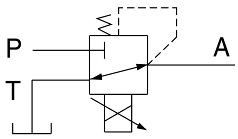
3) OPERATING PRINCIPLE

(1) Structure



5-22(1)

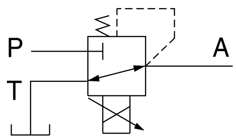
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

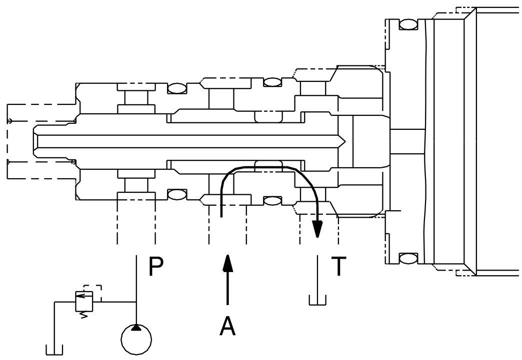


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

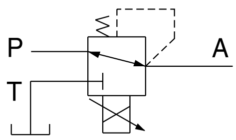
Pressure line is blocked and A oil returns to tank.

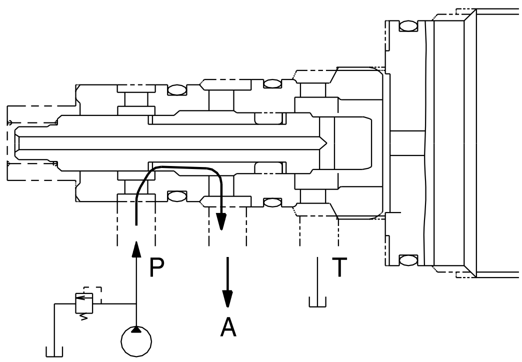




(3) Operating

Secondary pressure enters into A.





5-22(2)

4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-75 from EPPR valve.

② Insert the adapter to CN-75 and install multimeter as figure.

③ Start engine.

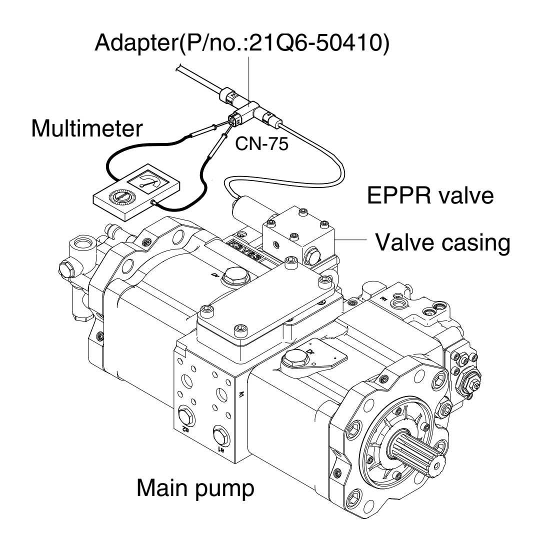
④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

⑥ If rpm display show approx 1600±50 rpm check electric current at bucket circuit relief position.

⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA



140SA5MS21

(2) Check pressure at EPPR valve

① Remove plug and connect pressure gauge as figure.

· Gauge capacity : 0 to 50 kgf/cm2 (0 to 725 psi)

② Start engine.

③ Set S-mode and cancel auto decel mode.

④ Position the accel dial at 10.

⑤ Slowly operate control lever of bucket functions at full stroke over relief and measure the EPPR valve pressure by the the monitoring menu of the cluster.

⑥ If pressure is not correct, adjust it.

⑦ After adjust, test the machine.

Spec : 2~25 kgf/cm2 (30~350 psi)

140SA5MS22

2. BOOM PRIORITY EPPR VALVE

1) COMPOSITION

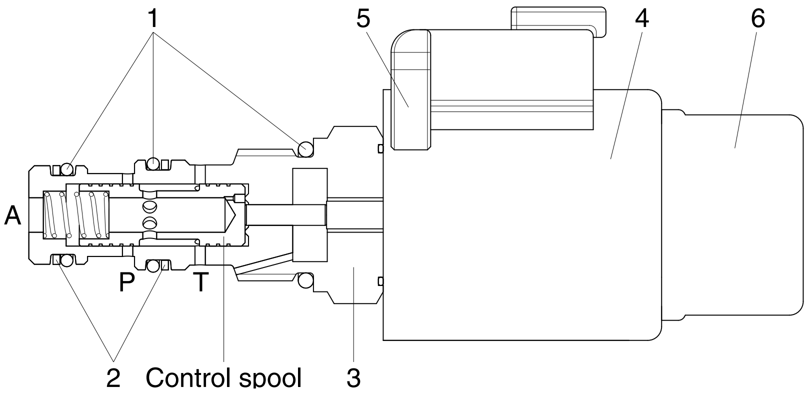
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

2) CONTROL

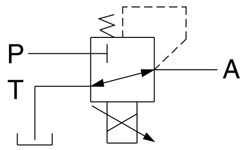
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at 30Ω and 24 V.

3) OPERATING PRINCIPLE

(1) Structure



21095MS14



P : Pilot supply line
T : Return to tank
A : Secondary pressure to flow MCV

1	O-ring	3	Valve body	5	Connector
2	Support ring	4	Coil	6	Cover cap

(2) Operation

In de-energized mode the inlet port (P) is closed and the outlet port (A) is connected to tank port (T).

In energized mode the solenoid armature presses onto the control spool with a force corresponding to the amount of current. This will set a reduced pressure at port A. The setting is proportional to the amount of current applied.

(3) Maximum pressure relief

If a pressure from outside is applied on port A the valve may directly switch to tank port (T) and protect the system before overload.

2) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-133 from EPPR valve.

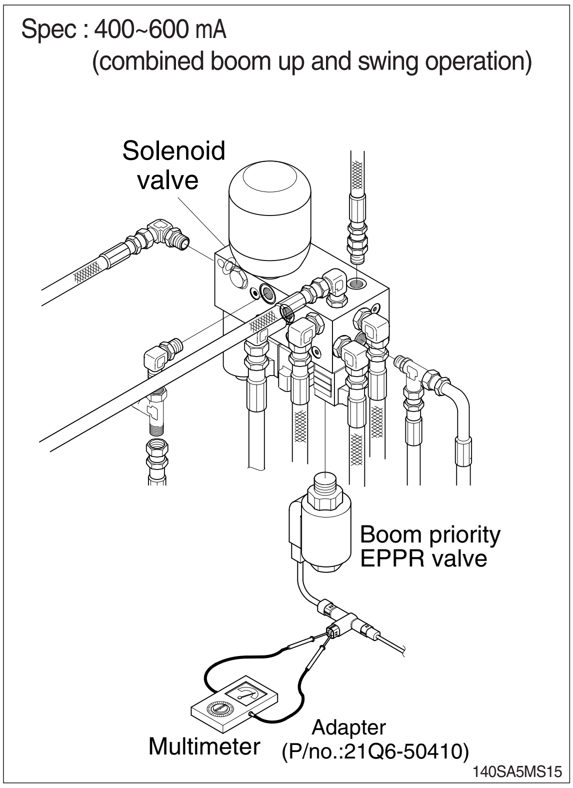
② Insert the adapter to CN-133 and install multimeter as figure.

③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ If rpm display approx 1600±50 rpm disconnect one wire harness from EPPR valve.

⑥ Check electric current in case of combined boom up and swing operation.



(2) Check pressure at EPPR valve

① Remove hose from A5 port and connect pressure gauge as figure.

· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)

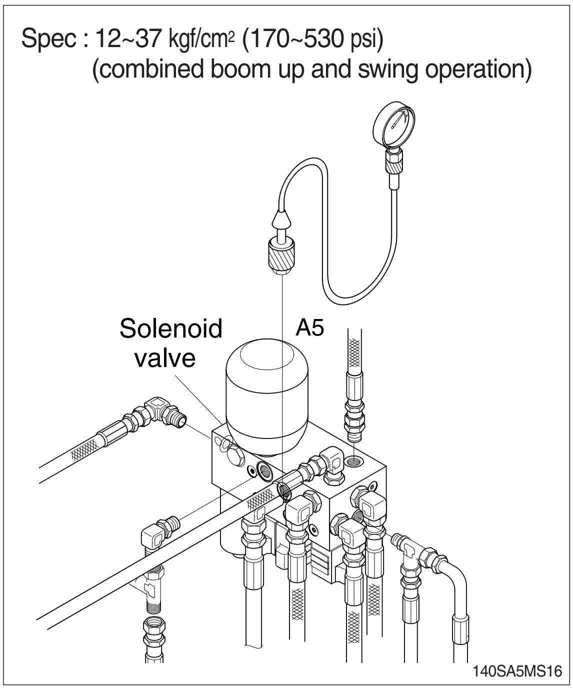
② Start engine.

③ Set S-mode and cancel auto decel mode.

④ If rpm display approx 1600±50 rpm check pressure (In case of combined boom up and swing operation).

⑤ If pressure is not correct, adjust it.

⑥ After adjust, test the machine.



GROUP 16 MONITORING SYSTEM

1. OUTLINE

Monitoring system consists of the monitor part and switch part.

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

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

2. CLUSTER

1) MONITOR PANEL

Normal type

140SA5CD50

Premium type

140SA5CD51

※ The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem. The warning lamp blinks until the problem is cleared. Refer to page 5-63 for details.

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor

a. Buzzer sounding for 4 seconds with HYUNDAI logo on cluster.

※ If the ESL mode is set to the enable, enter the password to start engine.

② After initialization of cluster, the operating screen is displayed on the LCD.
Also, self diagnostic function is carried out.

a. Engine rpm display : 0 rpm

b. Engine coolant temperature gauge : White range

c. Hydraulic oil temperature gauge : White range

d. Fuel level gauge : White range

(2) Start of engine

① Check machine condition

a. RPM display indicates at present rpm

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

※ When normal condition : All warning lamp OFF

c. Work mode selection : General work

d. Power mode selection : E mode or U mode

e. Travel speed pilot lamp : Low (turtle)

② When warming up operation

a. Warming up pilot lamp : ON

b. After engine started, engine speed increases to1400 rpm.

※ Others same as above.

③ When abnormal condition

a. The warning lamp lights up and the buzzer sounds.

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

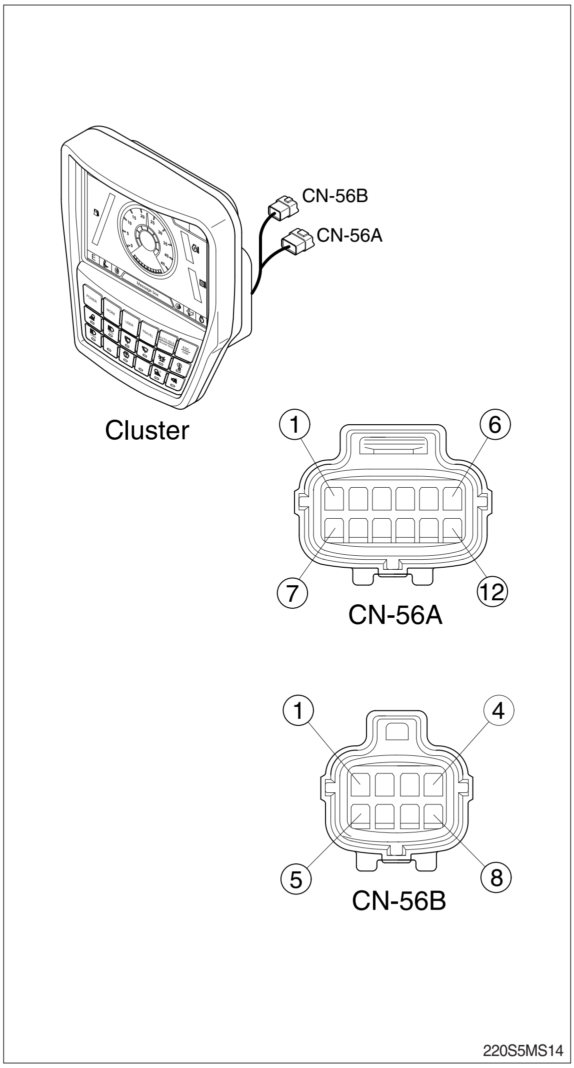
※ The pop-up warning lamp moves to the original position and blink when the buzzer stop switch is pushed. Also the buzzer stops.

3. CLUSTER CONNECTOR

1) NORMAL TYPE

(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32Vdc
2	Power IG {24V}	20~32Vdc
3	GND	-
4	N.C	-
5	N.C	-
6	CAN 2 (H)	0~5Vdc
7	CAN 2 (L)	20~32Vdc
8	N.C	-
9	N.C	-
10	N.C	-
11	N.C	-
12	N.C	-



(2) CN-56B

No.	Name	Signal
1	CAM + 6.5V	6.3~6.7Vdc
2	CAM GND	-
3	CAM DIFF (H)	0~5Vdc
4	CAM DIFF (L)	0~5Vdc
5	CAM 1	NTSC signal
6	CAM 2	NTSC signal
7	CAM 3	NTSC signal
8	CAM shield	0~5Vdc

NTSC : National Television System Committee

2) PREMIUM TYPE

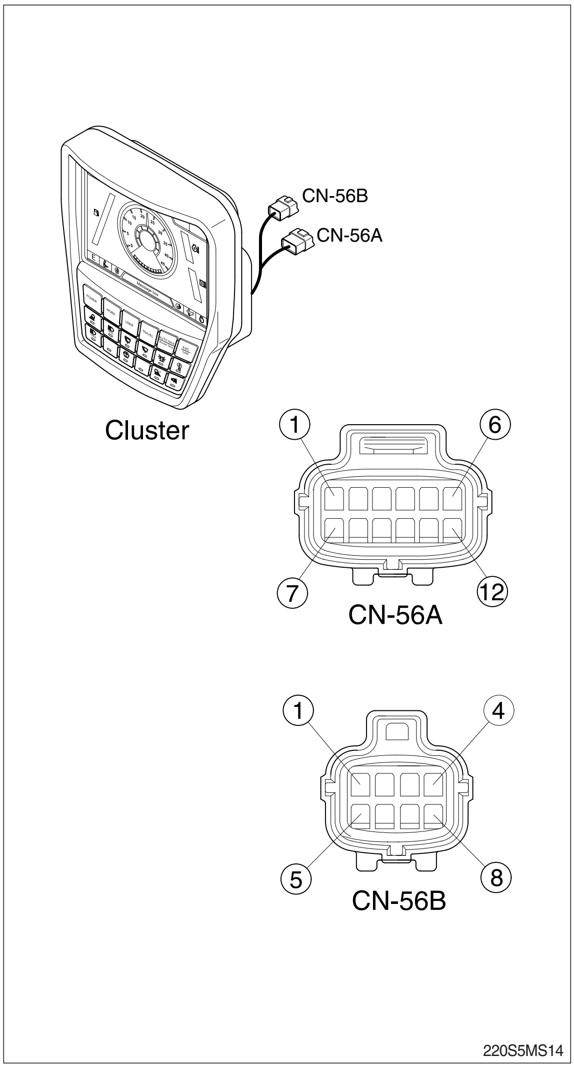
(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32Vdc
2	Power IG {24V}	20~32Vdc
3	GND	-
4	CAN 1 (H)	0~5Vdc
5	CAN 1 (L)	0~5Vdc
6	CAN 2 (H)	0~5Vdc
7	CAN 2 (L)	20~32Vdc
8	N.C	-
9	N.C	-
10	Aux left	0~5V
11	Aux right	0~5V
12	Aux GND	-

(2) CN-56B

No.	Name	Signal
1	CAM + 6.5V	6.3~6.7Vdc
2	CAM GND	-
3	CAM DIFF (H)	0~5V
4	CAM DIFF (L)	0~5V
5	CAM 1	NTSC signal
6	CAM 2	NTSC signal
7	CAM 3	NTSC signal
8	CAM shield	0~5Vdc

NTSC : National Television System Committee



4) GAUGE

(1) Operation screen

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

Normal type

220S3CD551A

Premium type

Default Option

220S3CD151A

1 RPM / Speed gauge
2 Engine coolant temperature gauge
3 Hydraulic oil temperature gauge
4 Fuel level gauge
5 Tripmeter display
6 Eco guage
7 Accel dial gauge

※ Operation screen type can be set by the screen type menu of the display (premium type). Refer to page 5-87 for details.

(2) RPM / Speed gauge

Normal type

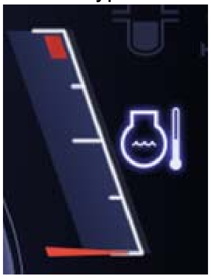
Premium type

220S3CD549

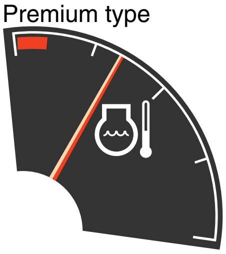
① This displays the engine speed.

(3) Engine coolant temperature gauge

Normal type



Premium type



220S3CD553

① This gauge indicates the temperature of coolant.
- White range : 40-113˚C (104-235˚F)
- Red range : Above 113˚C (235˚F)

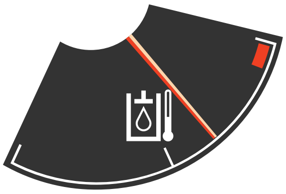
② If the indicator is in the red range or lamp pops up and the buzzer sounds, turn OFF the engine and check the engine cooling system.

※ If the gauge indicates the red range or lamp blinks 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) Hydraulic oil temperature gauge

Normal type

Premium type



220S3CD554

① This gauge indicates the temperature of hydraulic oil.
- White range : 40-100˚C (104-212˚F)
- Red range : Above 100˚C (212˚F)

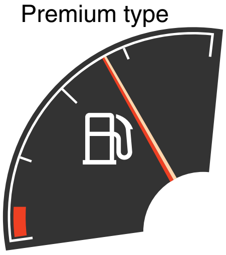
② If the indicator is in the red range or lamp pops up and the buzzer sounds reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

※ If the gauge indicates the red range or lamp blinks 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 electricity or sensor.

(5) Fuel level gauge

Normal type

Premium type



220S3CD555

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

② Fill the fuel when in the red range, or lamp pops up and the buzzer sounds.

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

(6) Tripmeter display

290F3CD56

① This displays the engine the tripmeter.

※ Refer to page 5-88 for details.

(7) Eco gauge

290F3CD58

① This gauge indicates the fuel consumption rate and machine load status so that the operators can operate the machine efficient in regards to fuel consumption.

② Fuel consumption rate or machine load is higher if the number of segments are increased.

③ The color of Eco gauge indicates operation status.

- · White : Idle operation
- · Green : Economy operation
- · Yellow : Non-economy operation at a medium level.
- · Red : Non-economy operation at a high level.

(8) Accel dial gauge

290F3CD59

① This gauge indicates the level of accel dial.

5) WARNING LAMPS

Normal type

400SA3CD503

Premium type

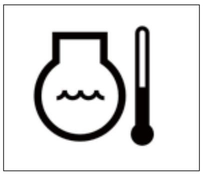
400SA3CD03

※ Warning lamps and buzzer

Warnings	When error happened	Lamps and buzzer
All warning lamps except below	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, blinks and the buzzer stops when; - the buzzer stop switch [AUTO IDLE Buzzer Stop] is pushed - the lamp of the LCD is touched
[COMM ERROR]	Warning lamp pops up on the center of the LCD and the buzzer sounds	· Cluster displays this pop-up when it has communication error with MCU. · If communication with MCU become normal state, it will disappear automatically.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	※ **Refer to page 5-64 for details.**

※ Refer to page 5-70 for the buzzer stop switch [AUTO IDLE Buzzer Stop].

(1) Engine coolant temperature warning lamp



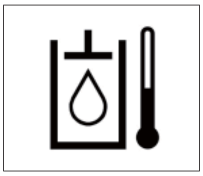
290F3CD61

① Engine coolant temperature warning is indicated in 2 steps.
- 100˚C over : The lamp pops up and the buzzer sounds.
- 107˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch is pushed. The buzzer will stop and , lamps will blink.

③ Check the cooling system when the lamps keep blink.

(2) Hydraulic oil temperature warning lamp



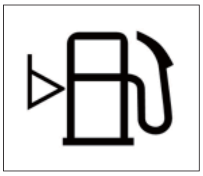
290F3CD62

① Hydraulic oil temperature warning is indicated in 2 steps.
- 100˚C over : The lamp pops up and the buzzer sounds.
- 105˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch is pushed. The buzzer will stop and , lamps will blink.

③ Check the hydraulic oil level and hydraulic cooling system.

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the fuel level is below 23 ℓ (6.1 U.S. gal).

② Fill the fuel immediately after the lamp blinks.

(4) Emergency warning lamp

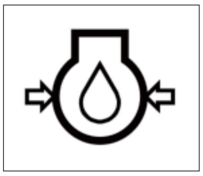
290F3CD64

① This warning lamp pops up and the buzzer sounds when each of the below warnings occurs.
- Engine coolant overheating (over 107˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Cluster communication data error
- Engine ECM communication data error

※ **The pop-up warning lamp moves to the original position and blinks when the buzzer stop switch is pushed. The buzzer will stop.**

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

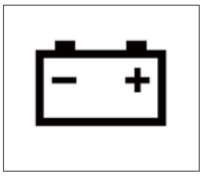
(5) Engine oil pressure warning lamp



290F3CD65

① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.
② If the lamp blinks, shut OFF the engine immediately. Check oil level.

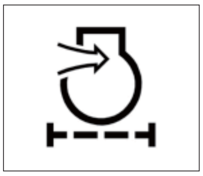
(6) Battery charging warning lamp



290F3CD67

① This warning lamp pops up and the buzzer sounds when the battery charging voltage is low.
② Check the battery charging circuit when this lamp blinks.

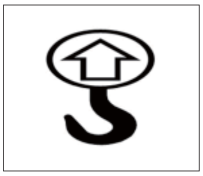
(7) Air cleaner warning lamp



290F3CD68

① This warning lamp pops up and the buzzer sounds when the air cleaner is clogged.
② Check, clean or replace filter.

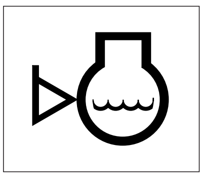
(8) Overload warning lamp (opt)



290F3CD69

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

(9) Coolant level warning lamp



760F3CD58

① This warning lamp indicates lack of coolant.
② Check and refill coolant.

6) PILOT LAMPS

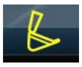
Normal type

400SA3CD574

Premium type

400SA3CD74

(1) Mode pilot lamps

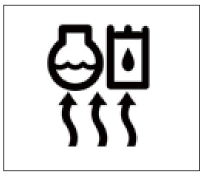
No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
		E	Economy power mode
2	User mode	U	User preferable power mode
3	Work tool mode		General operation - IPC speed mode
			General operation - IPC balance mode
			General operation - IPC efficiency mode
			Breaker operation mode
			Crusher operation mode
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp (null)

290F3CD78

① The lamp will be ON when pushing power max switch on the LH RCV lever.
② The power max function operates for a max period of 8 seconds.
※ **Refer to the operator's manual page 3-36 for power max function.**

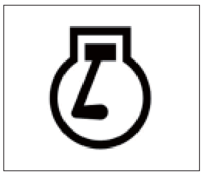
(3) Warming up pilot lamp



290F3CD80

① This lamp 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.

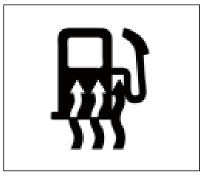
(4) Decel pilot lamp



290F3CD81

① Operating one touch decel switch on the RCV lever makes the lamp light up.
② Also, the lamp will light up. And engine speed will be reduced automatically to save fuel when all levers and pedals are in the neutral position, and the auto idle function is selected.
※ One touch decel is not available when the auto idle pilot lamp is turned ON.
※ Refer to the operator's manual page 3-36.

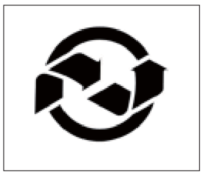
(5) Fuel warmer pilot lamp



290F3CD82

① This lamp lights up when the coolant temperature is below 10°C (50°F) or the hydraulic oil temperature 20°C (68°F).
② The automatic fuel warming is cancelled when the engine coolant temperature is above 60°C (140°F), and the hydraulic oil temperature is above 45°C (113°F) since the start switch was ON position.

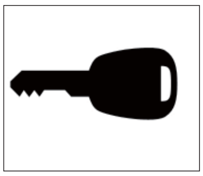
(6) Maintenance pilot lamp



290F3CD83

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 the page 5-81.

(7) Smart key pilot lamp (premium type, opt)



290F3CD214

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 the page 5-82.

(8) Auto engine shutdown pilot lamp (premium type, opt)

220A3CD202A

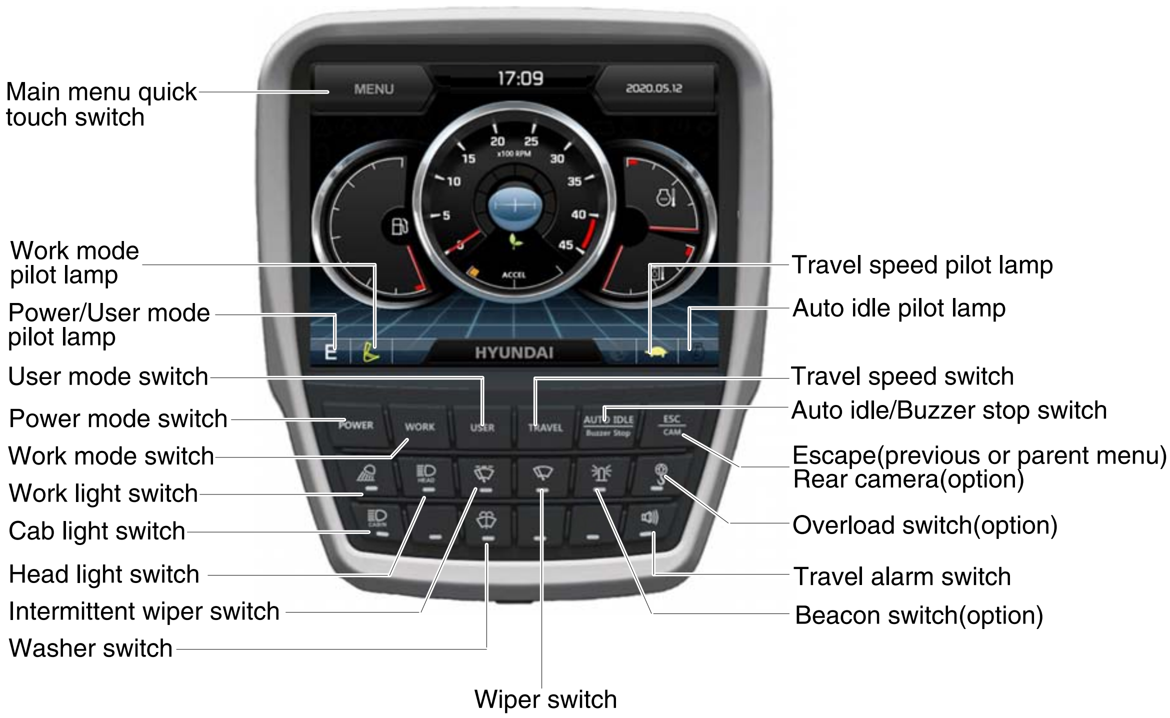
① This lamp lights up when the auto engine shutdown is activated
※ Refer to the page 5-78.

7) SWITCHES

Normal type

220S3CD586A

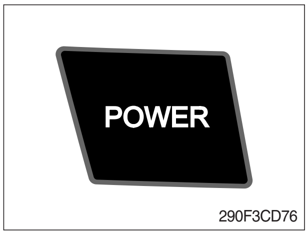
Premium type



220S3CD86B

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-66 for details.

(1) Power mode switch



290F3CD76

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 · E : Economy power work.
The pilot lamp changes E → S → P → E in this order.

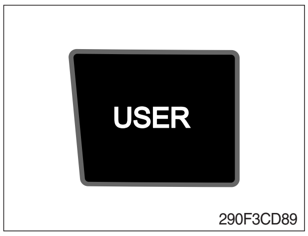
(2) Work mode switch

290F3CD88

① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
 · : General operation mode
 · : Breaker operation mode (if equipped)
 · : Crusher operation mode (if equipped)
 · Not installed : Breaker or crusher is not installed.

※ Refer to the operator's manual page 2-7 for details.

(3) User mode switch



290F3CD89

① This switch is used to select between user mode and general power mode.
- U : User mode
- P/S/E : General power mode

② Refer to the page 5-70 for another set of user mode.

(4) Travel speed switch

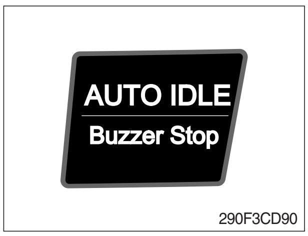
290F3CD91

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.

(5) Auto idle/ buzzer stop switch



290F3CD90

① This switch is used to activate or cancel the auto idle function.
 · Pilot lamp ON : Auto idle function is activated.
 · Pilot lamp OFF : Auto idle function is cancelled.

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.

(6) Escape/Camera switch

290F3CD92

① This switch is used to return to the previous menu or parent menu.
② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 5-88 for the camera.
③ If the camera is not installed, this switch is used only ESC function.

(7) Work light switch


290F3CD93

① This switch is used to operate the work light.
② The pilot lamp lights up when this switch is pressed.

(8) Head light switch

290F3CD94

① This switch is used to operate the head light.
② The pilot lamp lights up when this switch is pressed.

(9) Intermittent wiper switch


290F3CD95

① This switch is used to wipe operates intermittently.
② The pilot lamp lights up when this switch is pressed.

(10) Wiper switch


290F3CD96

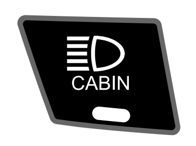
① This switch is used to operate the wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp lights up when this switch is pressed.
※ If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause.
If the switch remains ON, motor failure can result.

(11) Washer switch


290F3CD100

① Washer liquid is sprayed and the wiper is operated only when this switch is pressed.
② The pilot lamp lights up when this switch is pressed.

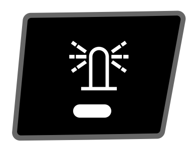
(12) Cab light switch



290F3CD99

① This switch turns on the cab light.
② The pilot lamp lights up when this switch is pressed.

(13) Beacon switch


290F3CD97

① This switch activates the rotary light on the cab.
② The pilot lamp lights up when this switch is pressed.

(14) Overload switch


290F3CD98

① When this switch is activated, buzzer makes sound and overload warning lamp lights up in the event that the machine is or becomes in an overloaded situation.
② When the switch is inactivated, buzzer stops and warning lamp goes off.
⚠ **Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.**

(15) Travel alarm switch


290F3CD101

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.

(16) Main menu quick touch switch

290F3CD217A

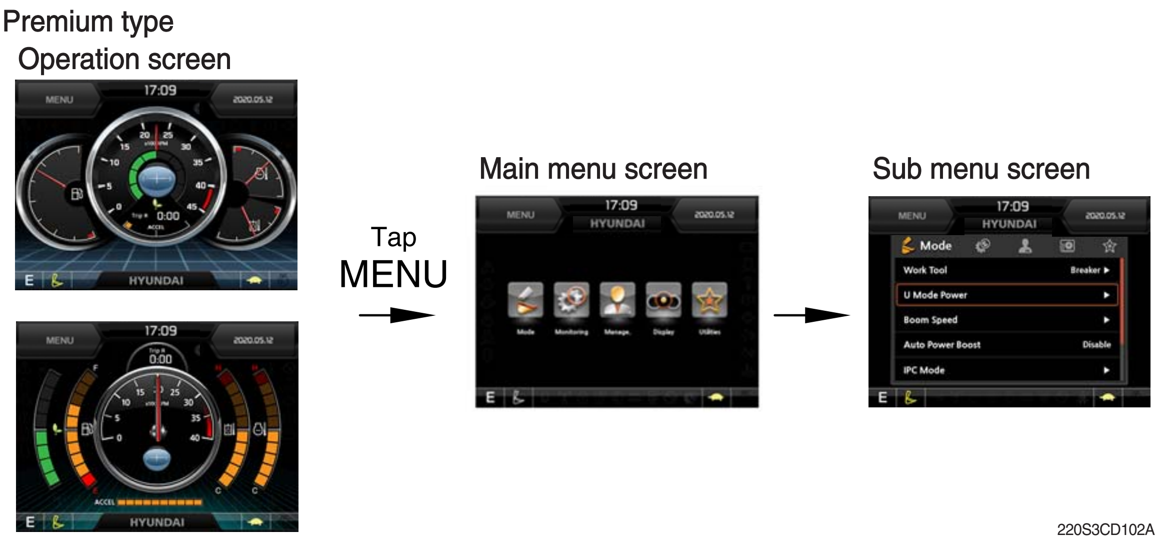
① This switch is to activate the main menu in the cluster.

※ Refer to the page 5-74.

8) MAIN MENU

※ On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

220S3CD502A



220S3CD102A

(1) Structure

No	Main menu	Sub menu	Description
1	 Mode 220S3CD103	Work mode U mode power Boom/Arm speed Auto power boost IPC mode Auto engine shutdown (opt) Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode / initial work mode Switch function
2	 Monitoring 220S3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, AAVM (opt) MCU, AAVM (opt) All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 220S3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor RMCU, Relay drive unit, AAVM (opt) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure Clinometer setting Cluster, ETC device
4	 Display 220S3CD106	Display item Clock Brightness Unit setup Language selection Screen type★	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, ETC A type, B type
5	 Utilities 220S3CD107	Tripmeter Camera setting AUX Manual	3 kinds (A, B, C) Number of active, Display order, AAVM (opt)★

★ : premium type

(2) Mode setup

※ Illustrations are based on the premium type cluster.

① Work mode

220S3CD108A

220S3CD253A

A

220S3CD254A

B

· Select installed optional attachment
  - A : It can set the user's attachment.
    It is available in setting #1~#10.
  - B : Max flow - Set the maximum flow for the attachment.

② U mode power

220S3CD111A

220S3CD112A

· Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.

· U-mode can be activated by user mode switch.

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1550	1000	0
2	1600	1050	3
3	1650	1100	6
4	1700	1150 (auto decel)	9
5	1750	1200	12
6	1800	1250	16
7	1850	1300	20
8	1900	1350	26
9	1950	1400	32
10	2000	1450	38

※One touch decel & low idle : 1000 rpm

③ Boom speed

220S3CD113A

220S3CD115A

· Boom speed
  - Boom priority function can be activated or cancelled
    Enable - Boom up speed is automatically adjusted as working conditions by the MCU.
    Disable - Normal operation

④ Auto power boost

220S3CD118A

220S3CD117A

· The power boost function can be activated or cancelled.
Enable - The digging power is automatically increased as working conditions by the MCU.
It is operated max 8 seconds, then goes off for a period or 1 second and then activates again for 8 seconds and continues this cycle.
Disable - Not operated.

⑤ IPC mode

220S3CD310A

220S3CD311A

220S3CD304A

220S3CD312A

220S3CD305A

220S3CD313A

220S3CD306A

· The IPC mode can be selected by this menu.
- Speed mode
- Balance mode (default)
- Efficiency mode

⑥ Automatic engine shutdown (option)

220S3CD91A

→

220S3CD92A

→

220S3CD93A

· The automatic engine shutdown function can be set by this menu.
- One time
- Always
- Disable
- Wait time setting : Max 40 minutes, min 2 minutes

⑦ Initial mode

220S3CD122A

→

220S3CD119A

· Key on initial mode
- Selected the power mode is activated when the engine is started.

Key on initial work mode
- Not installed
- Last setting
- Work mode

⑧ Emergency mode

220S3CD248A

220S3CD249A

· This mode can be used when the switches are abnormal on the cluster.
· The cluster switches can be selected by touching each icon.

(3) Monitoring

① Active fault

220S3CD120A

220S3CD125A

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

② Logged fault

220S3CD128A

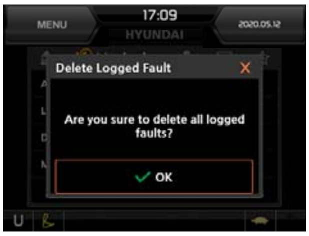
220S3CD124A

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

③ Delete logged fault

220S3CD134A

220S3CD126A



220S3CD127A

· The logged faults of the MCU can be deleted by this menu.

④ Monitoring

220S3CD172A

220S3CD188A

220S3CD189A

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

· The switch status or output status can be confirmed by this menu (Digital input & Digital output).

· The activated switch or output pilot lamps ● will light up.

(4) Management

① Fuel rate information

220S3CD14A

220S3CD15A

A

220S3CD16A

· General record (A)
- Average fuel rate (left) (from "Reset" to now)
  Fuel consumption divided by engine run time (service meter time).
- A days fuel used (right)
  Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).

B

220S3CD17A

· Hourly record (B)
- Hourly fuel rates for past 12 hours (service meter time).
- No record during key-off time.
- One step shift to the right for every one hour.
- Automatic deletion of data from 12 hours and earlier.
- "Reset" deletes all hourly records.

C

220S3CD18A

· Daily record (C)
- Daily fuel consumption for past seven days (MCU real time).
- No record during key-off time.
- One step shift to the right at 24:00 for every day.
- Automatically deletes data from 7 days and earlier.
- All daily records deletion by "Reset".

D

220S3CD19A

· Mode record (D)
- Average fuel rate for each power mode/accel dial (at least 7) from "Reset" till present.
- No record during idle.
- All records can be deleted by "Reset".

② Maintenance information

220S3CD131A

220S3CD132A

220S3CD133A

· Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
· Replacement : The elapsed time will be reset to zero (0).
· Change interval : The change intervals can be changed in hour increments of 50.

※ **Refer to section, Maintenance chart for further information of maintenance interval.**

③ Machine security

220S3CD190A

220S3CD135A

220S3CD136A

220S3CD137A

220S3CD138A

· 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.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- Machine security

  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) + ☑
- Smart key (option) : Refer to next page.

· Password change

- The password is 5~10 digits.

220S3CD190A

220S3CD140A

220S3CD135A

Enter the current password

220S3CD142A

Enter the new password

220S3CD143A

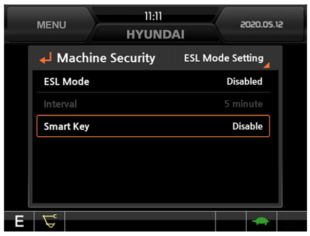
Enter the new password again

※ Before first use, please set user password and owner password in advance for machine security.

- Smart key

220S3CD190A

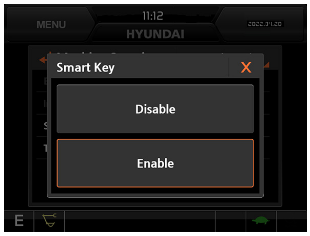
220S3CD135A



235F3CD001

· 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 is needed.

· Tag management menu is activated when the Smart key menu is Enabled.
You can register and delete the tags.

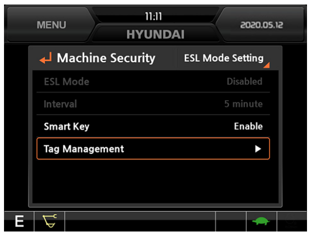


235F3CD002

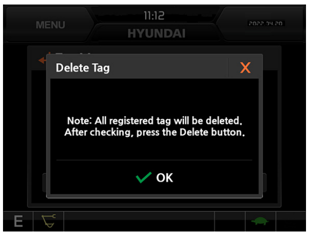
- Tag management

· When registering a tag : Only the tag you want to register must be in the cabin.

· When deleting a tag : All registered tags are deleted.

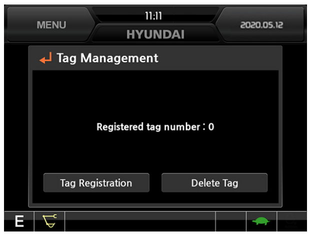


235F3CD003



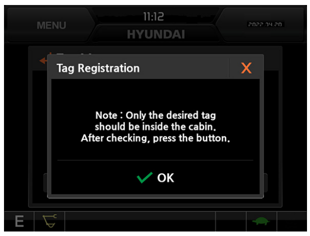
235F3CD006

Deleting



235F3CD004

Registering



235F3CD005

※ 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.

④Machine Information

220S3CD144A

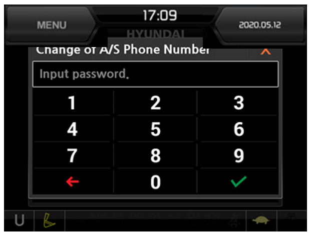
220S3CD145A

· This can confirm the identification of the model information (ECU), MCU, monitor, switch controller, RMCU, relay driver unit, AAVM (opt).

⑤ Contact (A/S phone number)

220S3CD146A

220S3CD147A



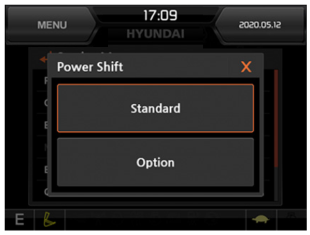
220S3CD148A

Enter the new A/S phone number

⑥ Service menu

220S3CD149A

220S3CD150B



220S3CD251A

※ This menu can be used only HCE service man and can not be accessible by the owner and the operator.

· Power shift (standard/option) : Power shift pressure can be set by option menu.
· Operating hours : Operating hours since the machine line out can be checked by this menu.
· Breaker mode pump acting (null)
· EPPR current level (attach flow EPPR 1 & 2)
· Overload pressure : 100 ~ 350 bar

⑦ Clinometer

220S3CD152A

220S3CD153A

· 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.

⑧ Update (cluster & ETC devices)

220S3CD67A

220S3CD135A

220S3CD280A

· ETC devices and cluster can be updated through CAN 2 network.

· Insert USB memory stick or SD card which includes program files, start download.

220S3CD290A

220S3CD281A

220S3CD291A

220S3CD282A

220S3CD299A

220S3CD292A

220S3CD283A

220S3CD298A

220S3CD293A

220S3CD284A

220S3CD297A

220S3CD294A

220S3CD285A

220S3CD296A

220S3CD295A

(5) Display

① Display item

220S3CD154A

220S3CD155A

220S3CD156A

- The center display type of the LCD can be selected by this menu.
- The engine speed or the tripmeter menu (A,B,C) is displayed on the center display.

② Clock

220S3CD157A

220S3CD158A

- The first row of boxes indicate Year/Month/Day.
- The second row shows the current time. (0:00~23:59)

③ Brightness

220S3CD159A

220S3CD160A

220S3CD139A

220S3CD141A

220S3CD191A

220S3CD192A

- If "Auto" is chosen, brightness for day and night can be set accordingly. Also by using the bar in lower side, users can define which an operation interval belongs to day and night. (in bar figure, white area represents night time while orange shows day time)

④ Unit

220S3CD161A

220S3CD182A

220S3CD183A

220S3CD186A

220S3CD162A

220F3CD193A

- Temperature : ˚C ↔ ˚F
- Pressure : bar ↔ MPa ↔ kgf/cm^2
- Volume : ℓ ↔ gal
- Flow : lpm ↔ gpm
- Distance : km ↔ mile
- Date format : yy/mm/dd ↔ mm/dd/yy ↔ dd-mm-yy

⑤ Language

220S3CD163A

220S3CD164A

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

⑥ Screen type (premium type)

220S3CD165A

A Type (Default)　220S3CD166A

220S3CD156A

B Type (Option)　220S3CD174A

220S3CD167A

(6) Utilites

① Tripmeter

220S3CD168A

220S3CD169A

- A maximum of 3 kinds of tripmeters can be used at the same time.
- Each tripmeter can be turned on by choosing "Start". it also can be turned off by choosing "Stop".
- If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

② Camera setting

- If the rear camera is not installed on the machine, set disable.
- If the rear camera is installed on the machine, set enable.

220S3CD225A

220S3CD255A

220S3CD256A

- In the operation screen, rear camera screen shows up when ESC/CAM switch is pushed.

220S3CD222A


290F3CD221

③ AAVM (Advanced Around View Monitoring, premium type, opt)

· The AAVM switches of the cluster consist of ESC/CAM and AUTO IDLE/Buzzer stop.

Buzzer stop switch

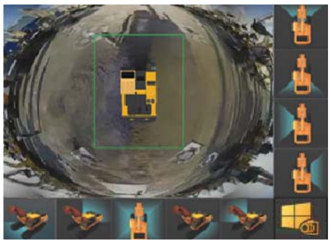
Escape switch

220S3CD244A

- Escape switch
· Activates AAVM mode from the beginning if AAVM is installed.
· While in the AAVM mode, select the ESC switch to return to the home screen.

220S3CD156A

Home screen



AAVM mode 235SA3CD222A

- Buzzer stop switch
· AAVM mode detects surrounding pedestrians or objects and the warning buzzer sounds.
· User can turn OFF the warning sound by pressing buzzer stop switch.

290F3CD246A

· When a worker/pedestrian reaches the green line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a green rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confi rm that the area is safe and clear of workers/objects.

290F3CD247A

· When a worker/pedestrian reaches the red line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a red rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

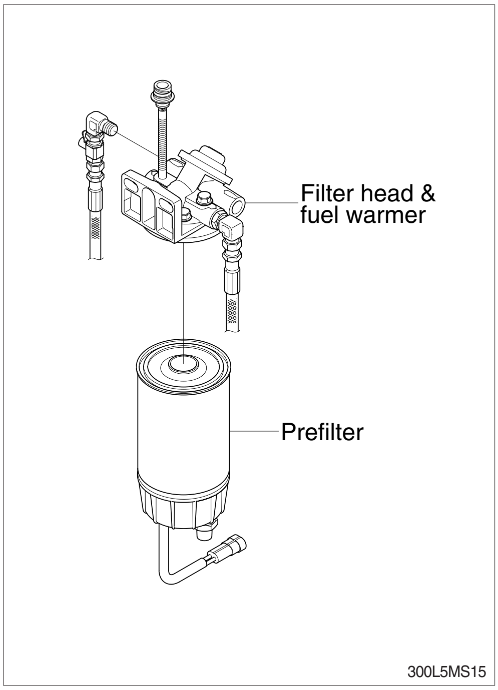
⚠ Failure to comply may result in serious injury or death.

※ In AAVM mode, a touch screen of the LCD is available only.

GROUP 17 FUEL WARMER SYSTEM

1. SPECIFICATION

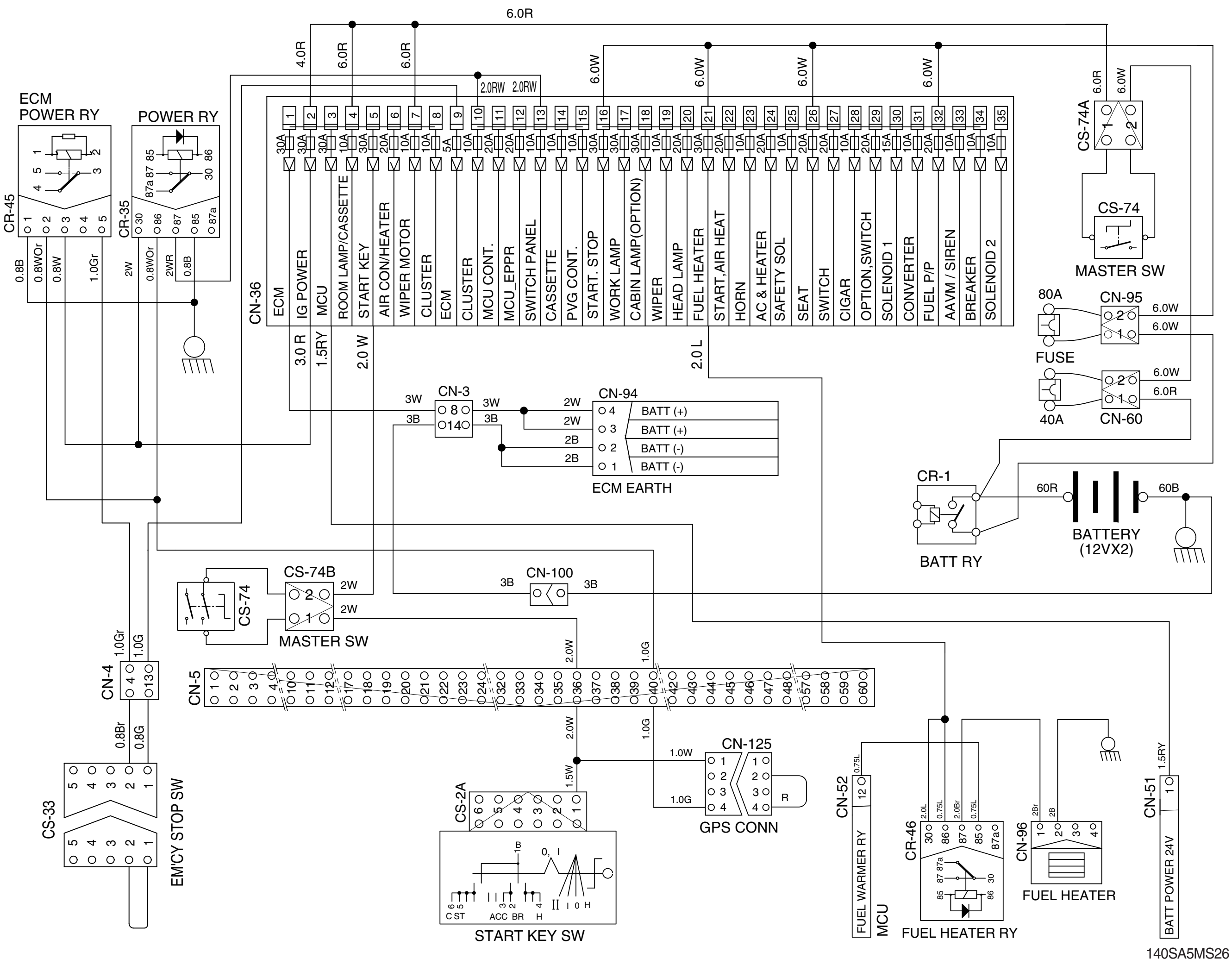
1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A



2. OPERATION

1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
So, fuel is protected from overheating by this mechanism.

3. ELECTRIC CIRCUIT



SECTION 6 TROUBLESHOOTING

Group 1 Before Troubleshooting ··· 6-1
Group 2 Hydraulic and Mechanical System ··· 6-4
Group 3 Electrical System ··· 6-25
Group 4 Mechatronics System ··· 6-43
Group 5 Air conditioner and Heater System ··· 6-72

SECTION 6 TROUBLESHOOTING

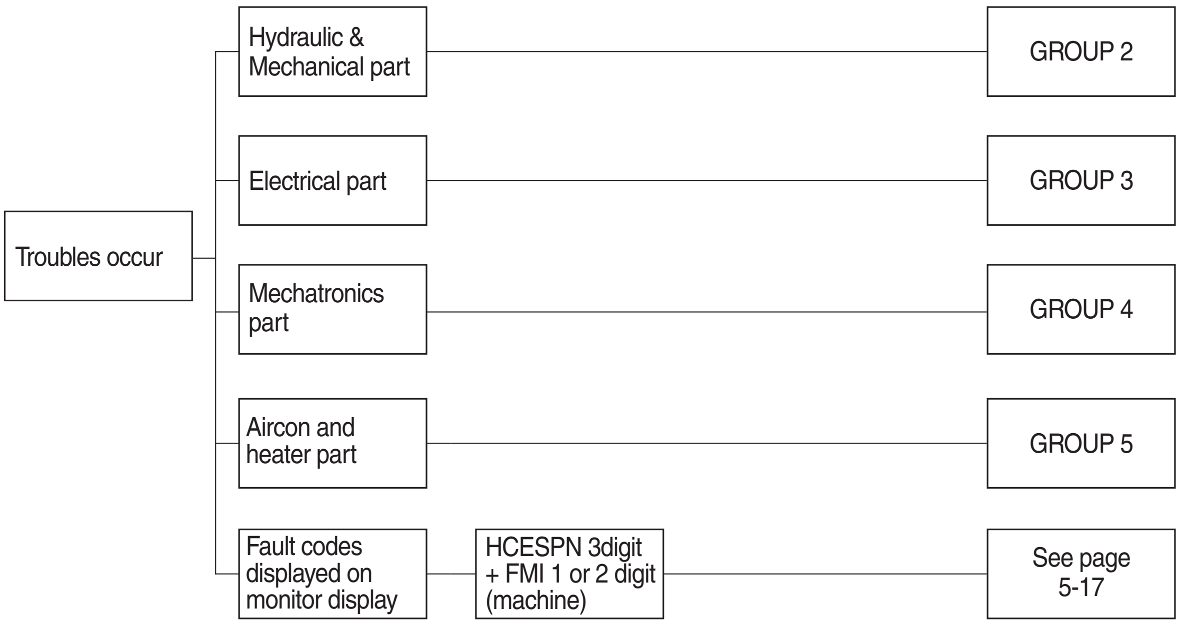
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

The trouble of machine is parted Hydraulic & Mechanical system, Electrical system, Mechatronics system and Air conditioner and heater system. At each system part, an operator can check the machine according to the troubleshooting process diagram.

※ **Before carring out troubleshooting procedure, check monitoring menu in the cluster.**

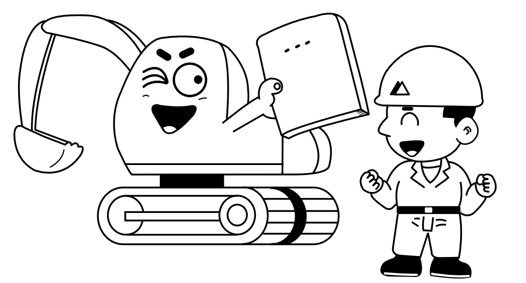


2. DIAGNOSING PROCEDURE

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.

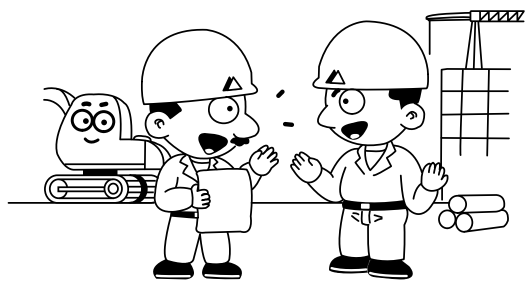


13031SH02

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.

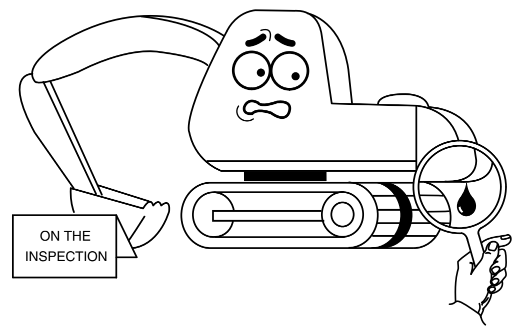


13031SH03

STEP 3. Inspect the machine

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

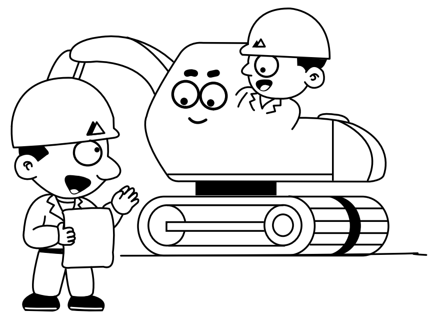
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

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.



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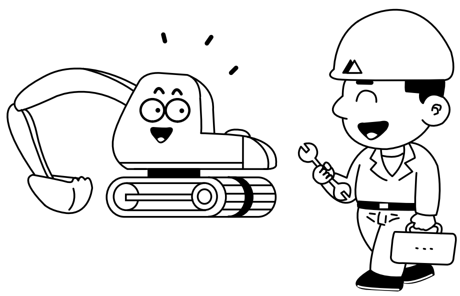
STEP 5. Perform troubleshooting

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

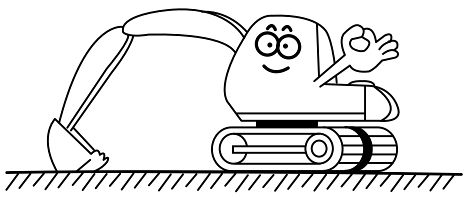


13031SH05

STEP 6. Trace a cause

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

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



(210-7) 6-3(3)

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

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

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

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

2) MACHINE STATUS MONITORING ON THE CLUSTER

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

Analog 1 Analog 2

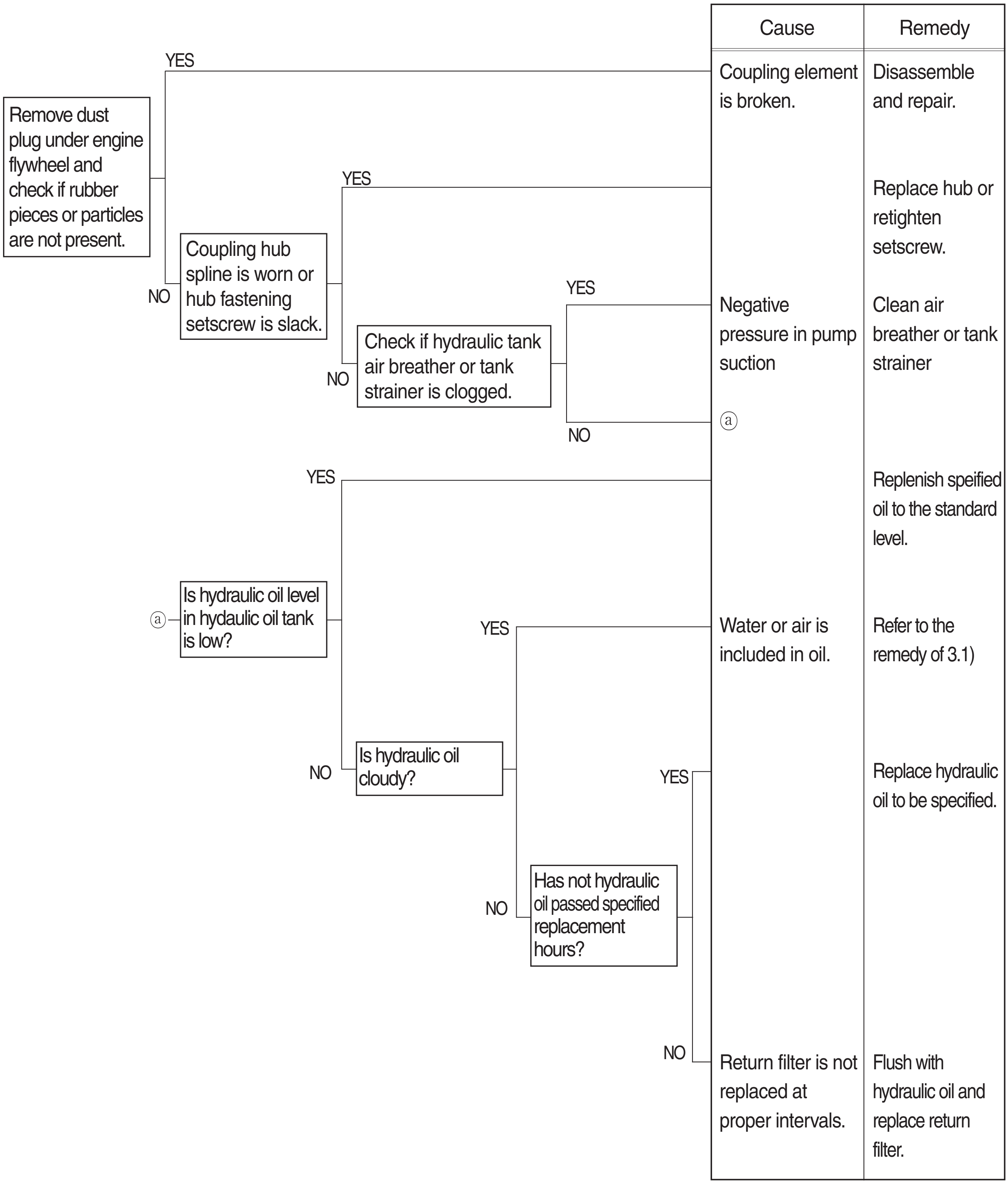
145SA6HS01

(2) Specification

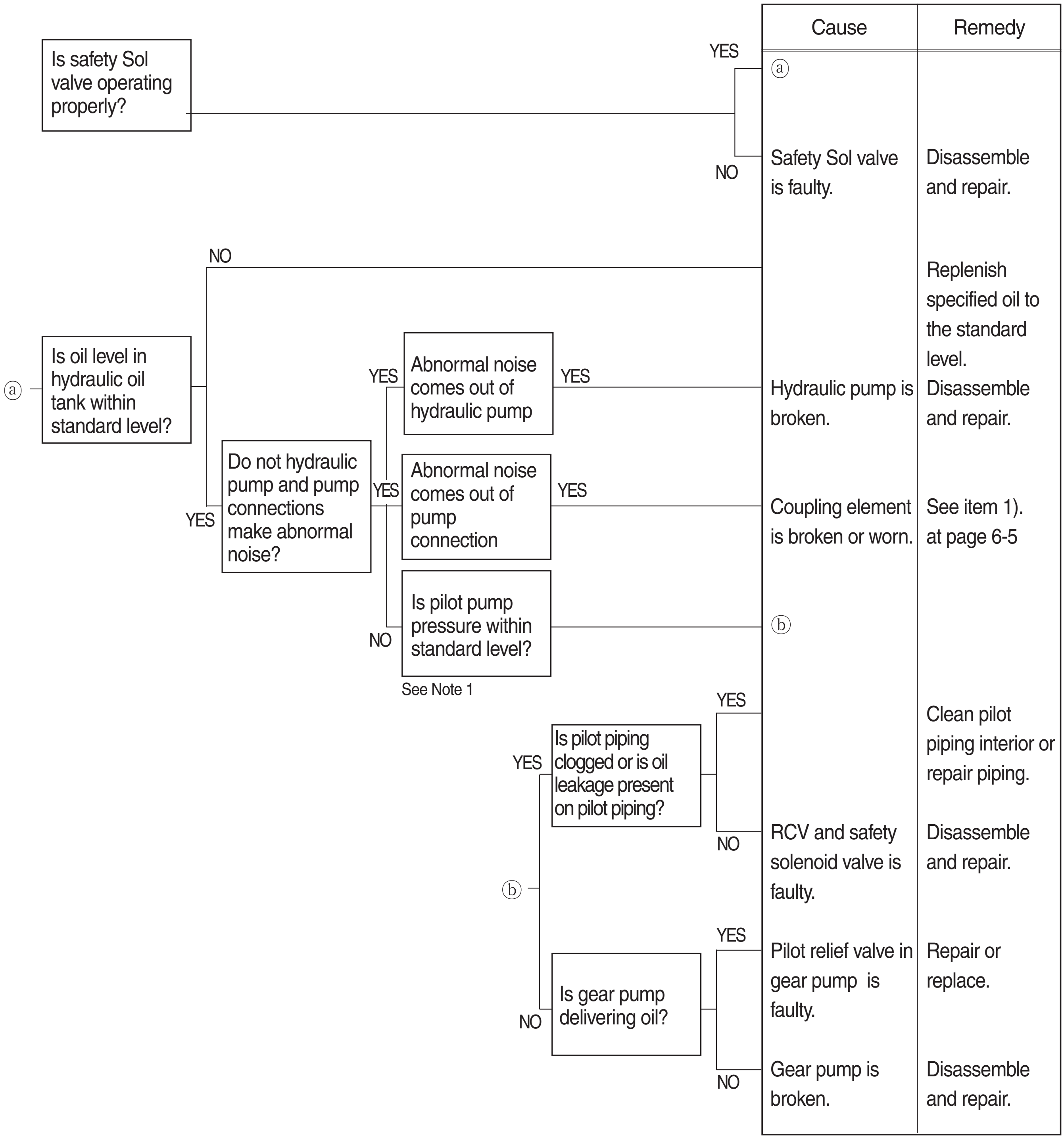
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION

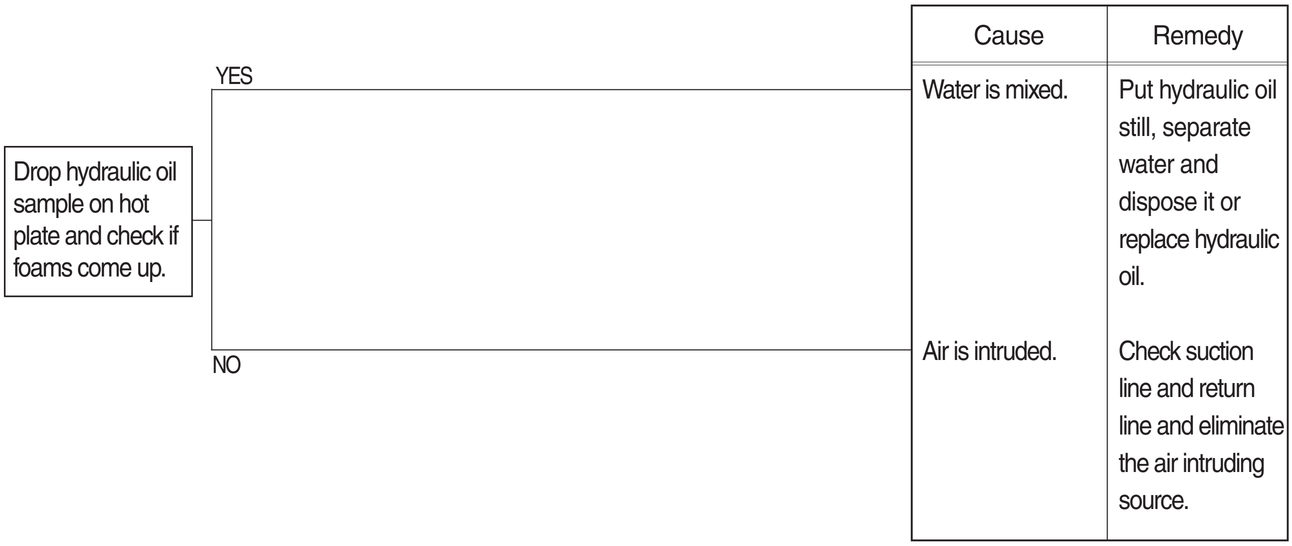


2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

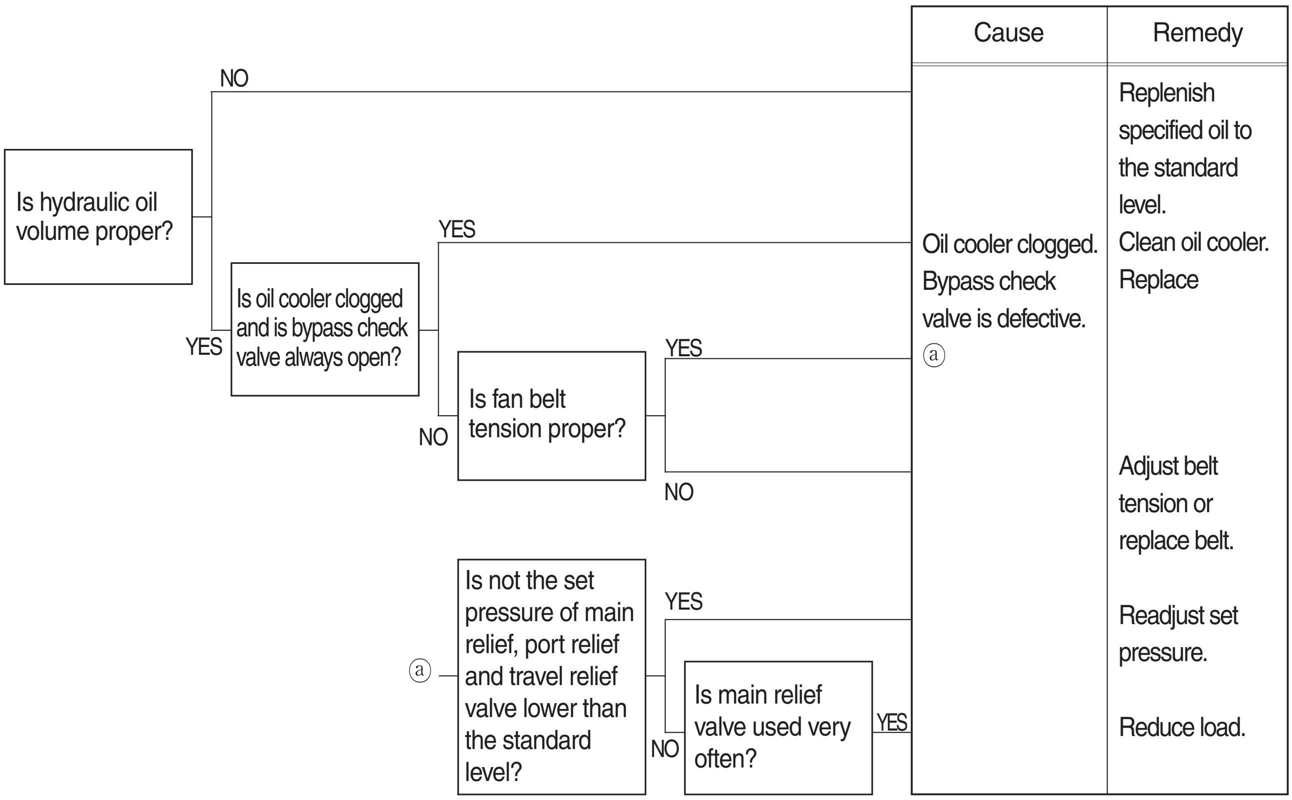


3. HYDRAULIC SYSTEM

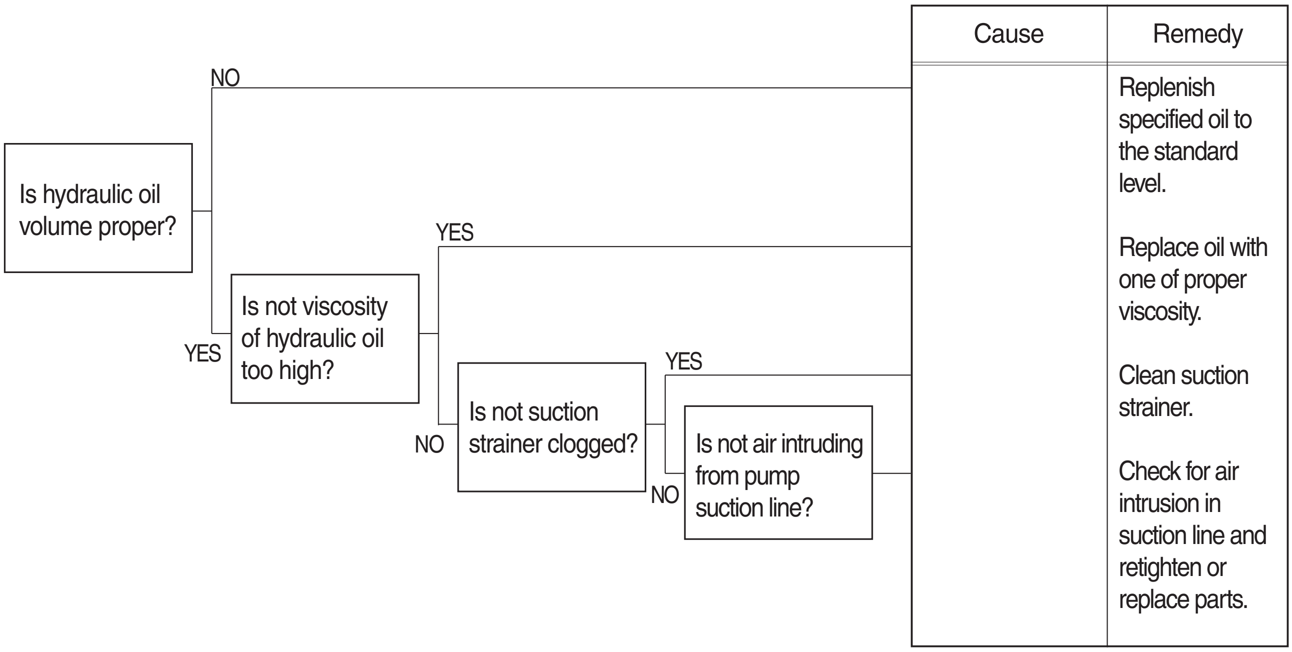
1) HYDRAULIC OIL IS CLOUDY



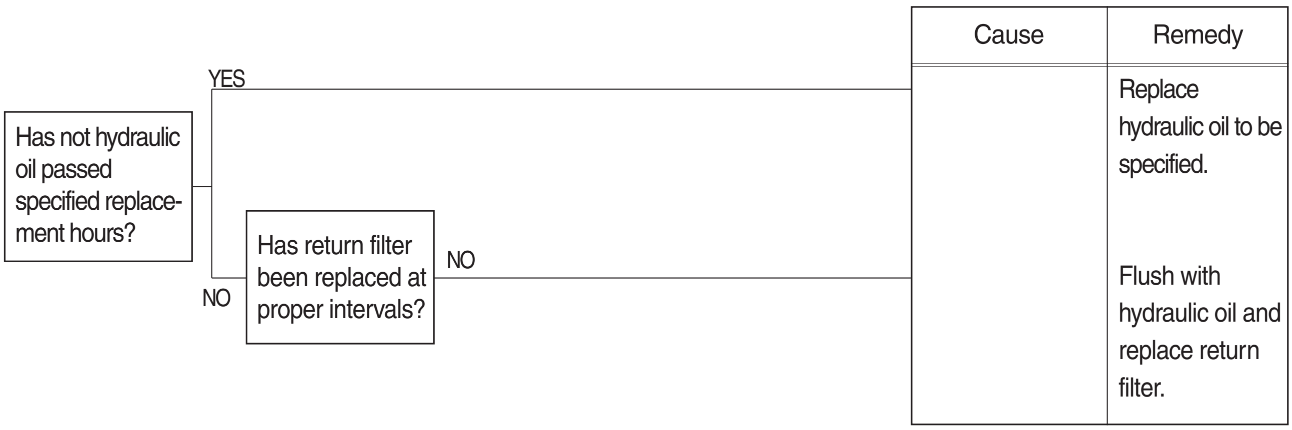
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

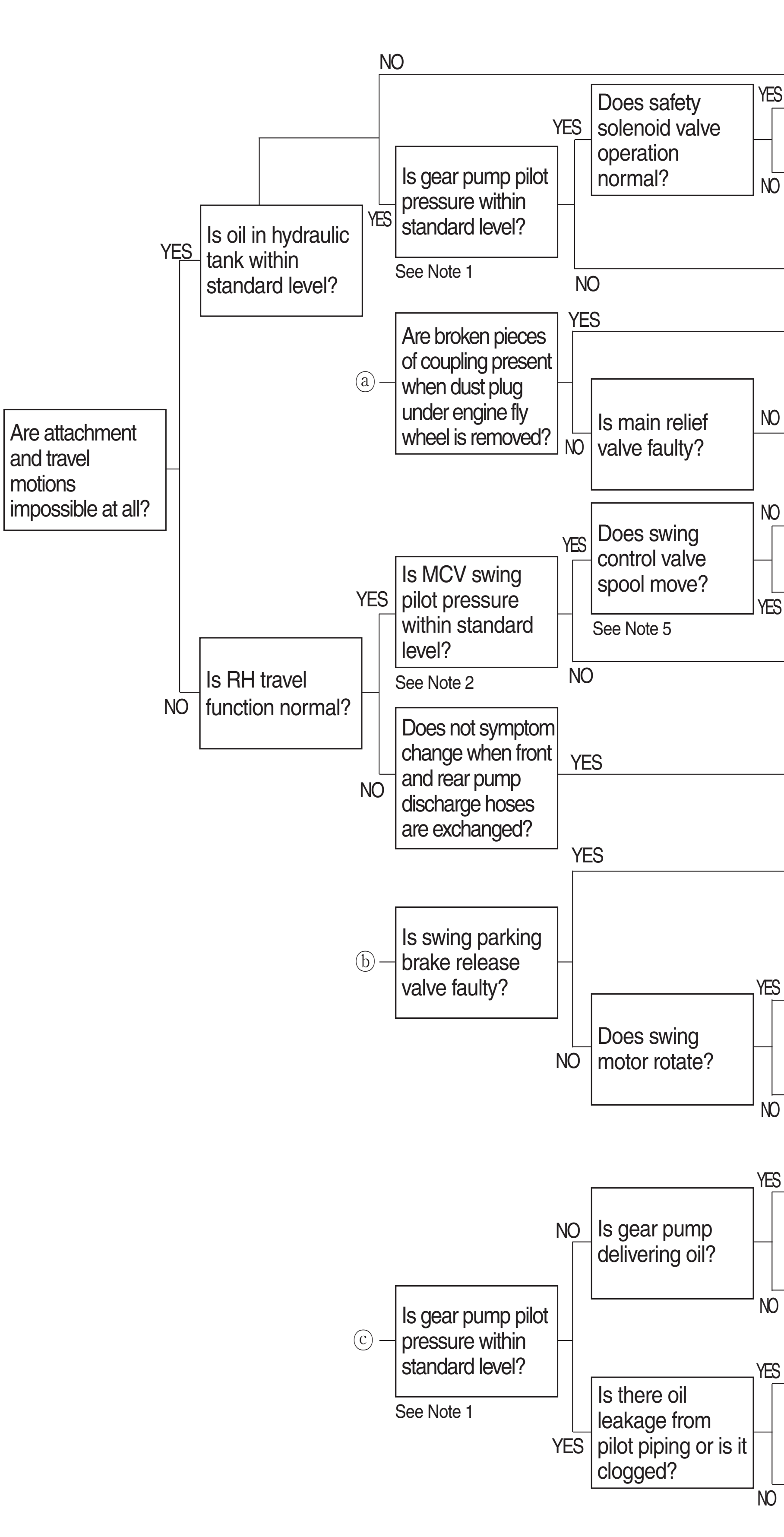


4) HYDRAULIC OIL IS CONTAMINATED



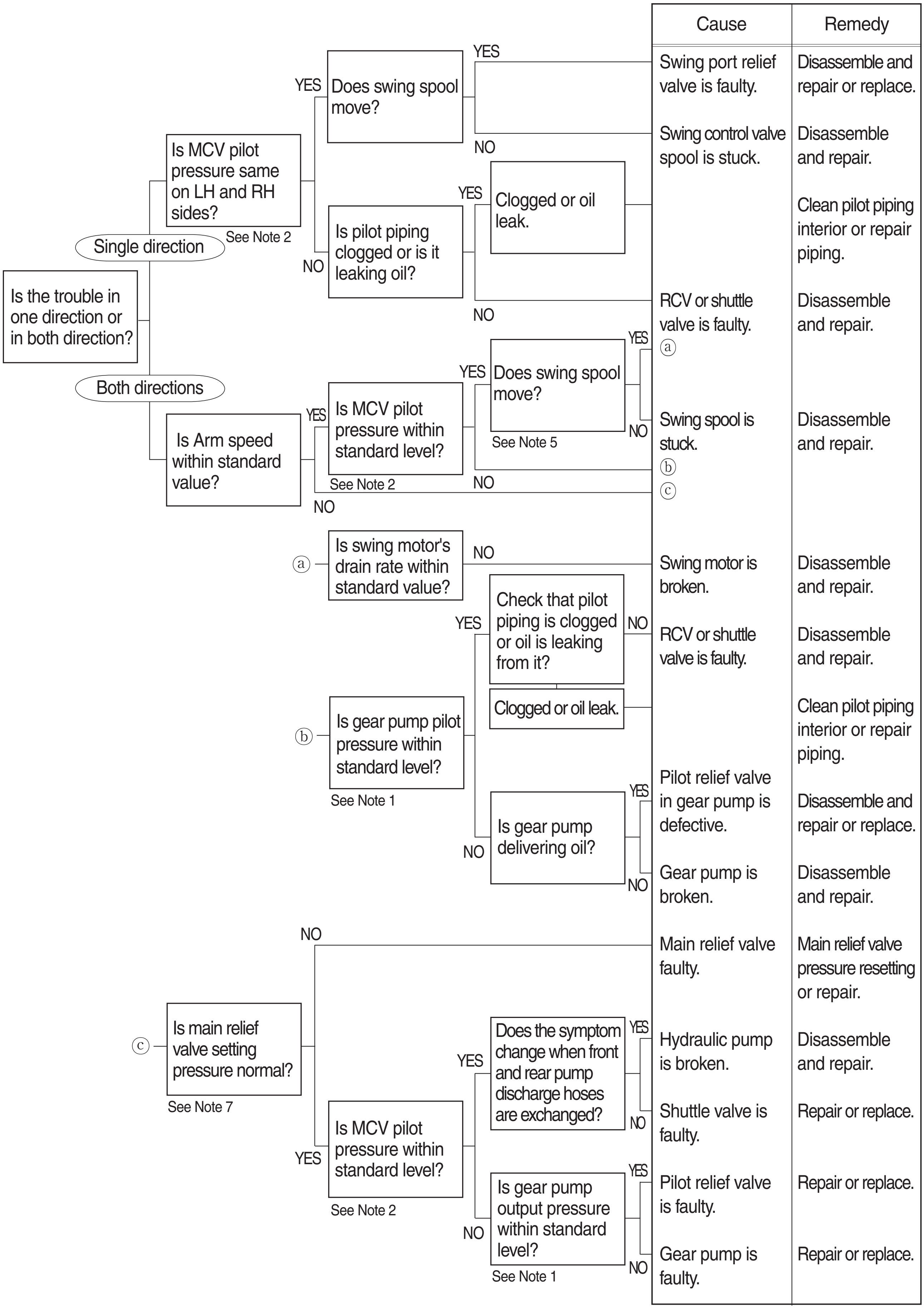
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

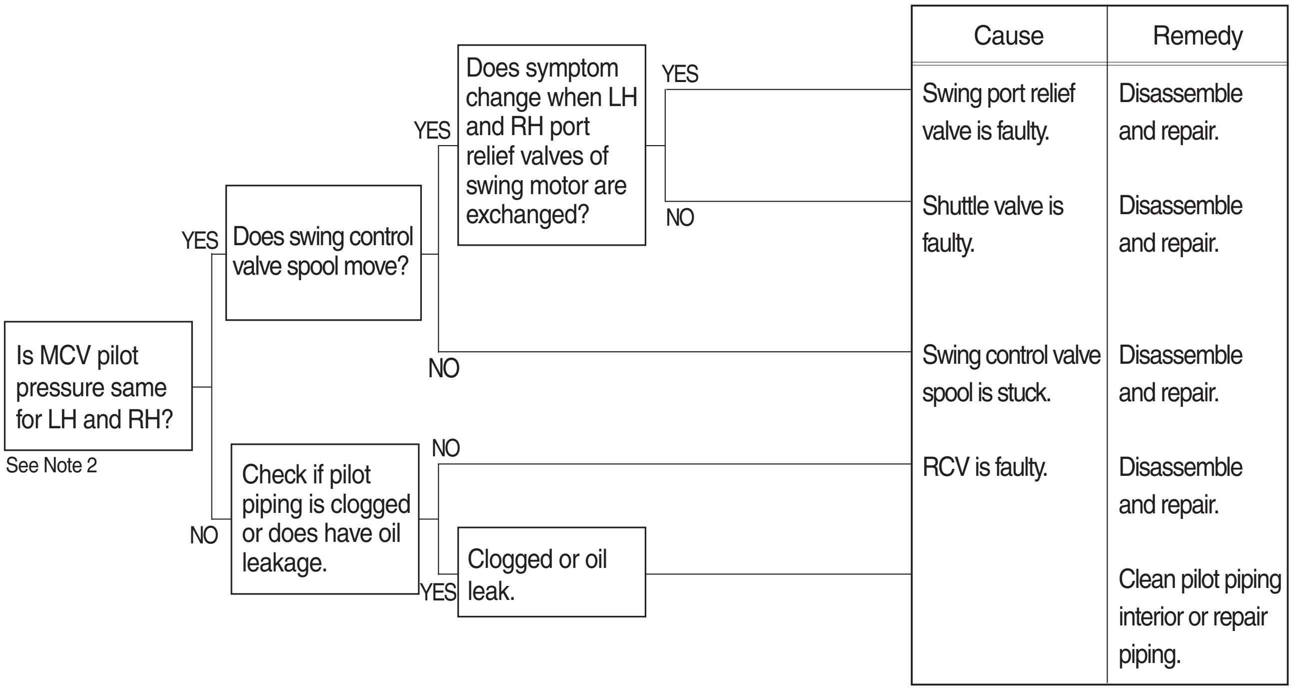


Cause	Remedy
ⓐ	Replenish specified oil to the standard level.
Safety solenoid valve faulty or not operated.	Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
ⓑ	
ⓒ	
Hydraulic pump is broken.	Disassemble and repair.
Swing parking 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 in gear pump is faulty.	Disassemble and repair or replace.
Gear pump is out of order.	Disassemble and repair.
	Clean pilot piping interior or repair piping.
RCV is broken.	Disassemble and repair.

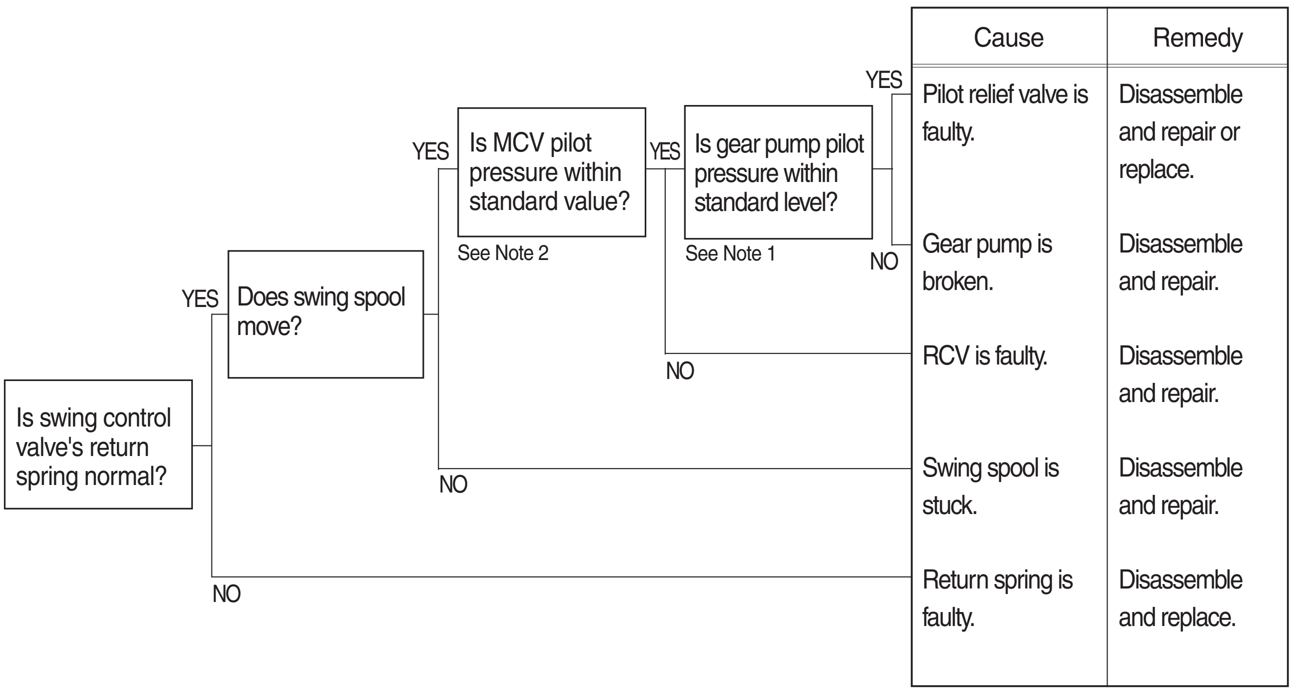
2) SWING SPEED IS LOW



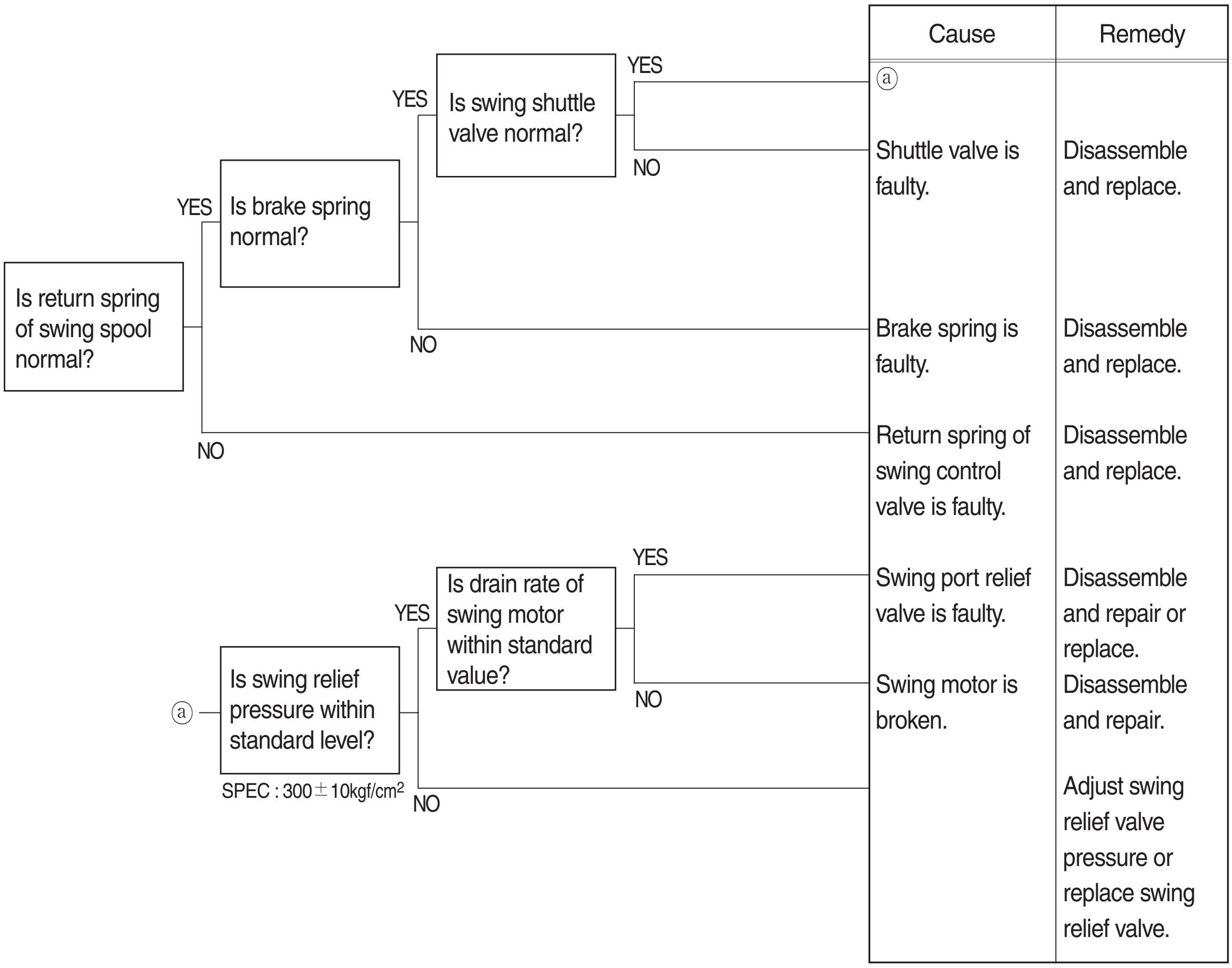
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



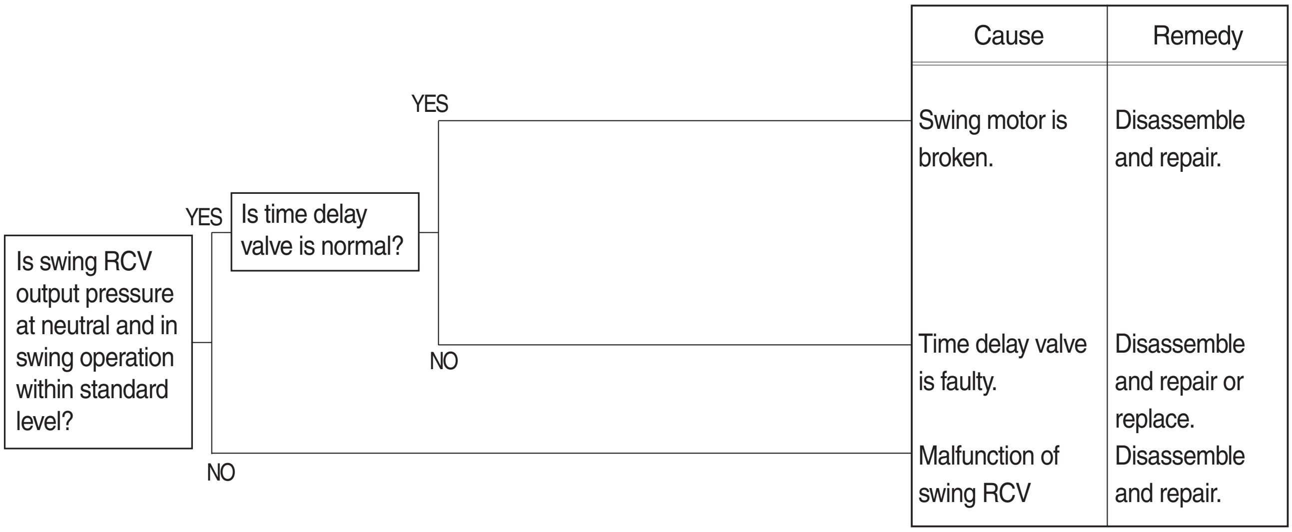
4) MACHINE SWINGS BUT DOES NOT STOP



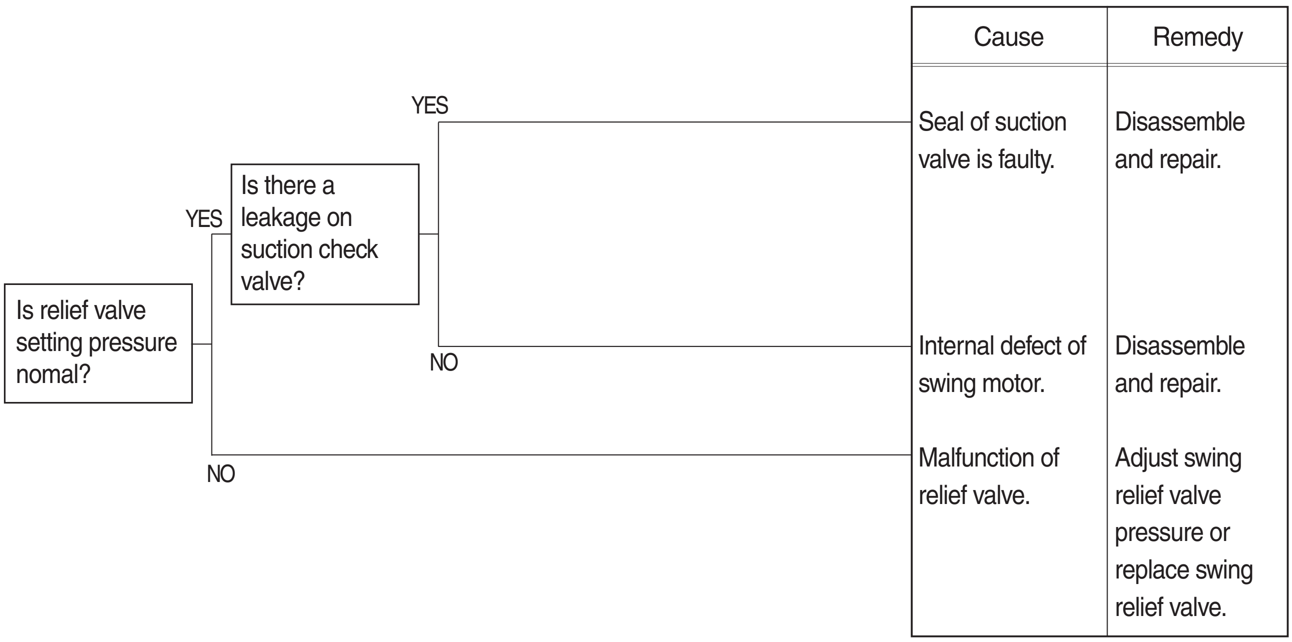
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



6) LARGE SHOCK OCCURS WHEN STOP SWINGING

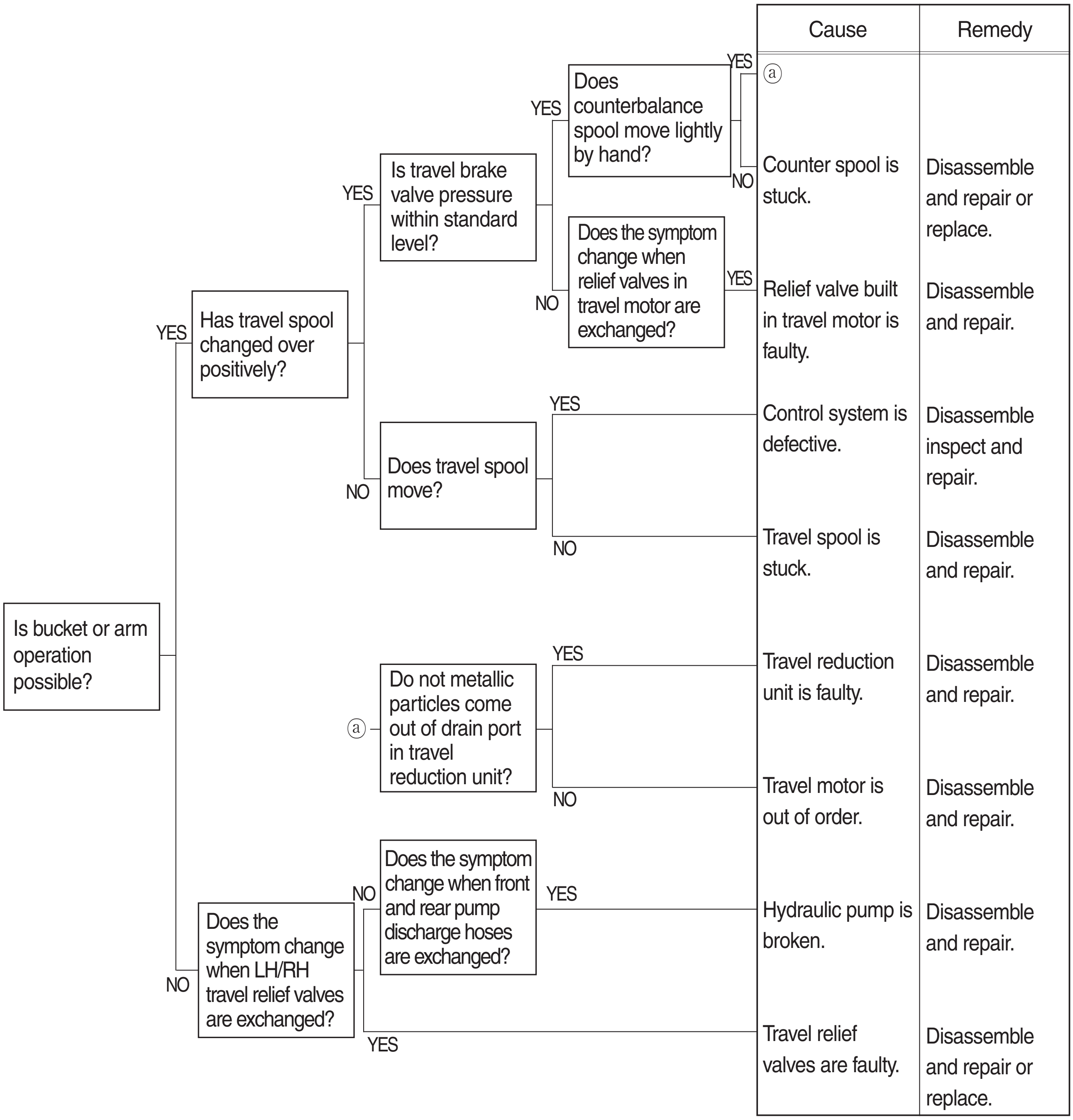


7) LARGE SOUND OCCURS WHEN STOP SWINGING

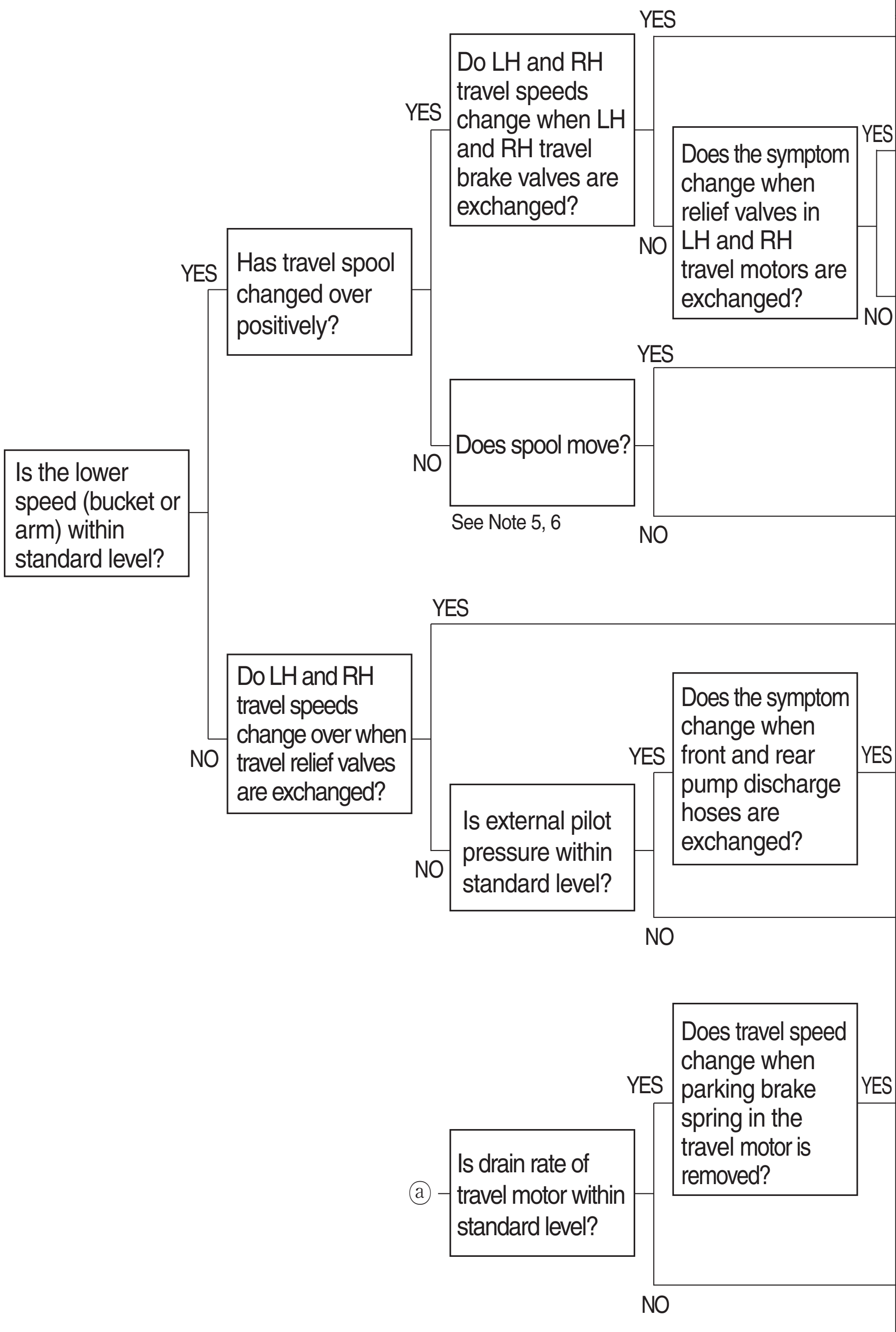


5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



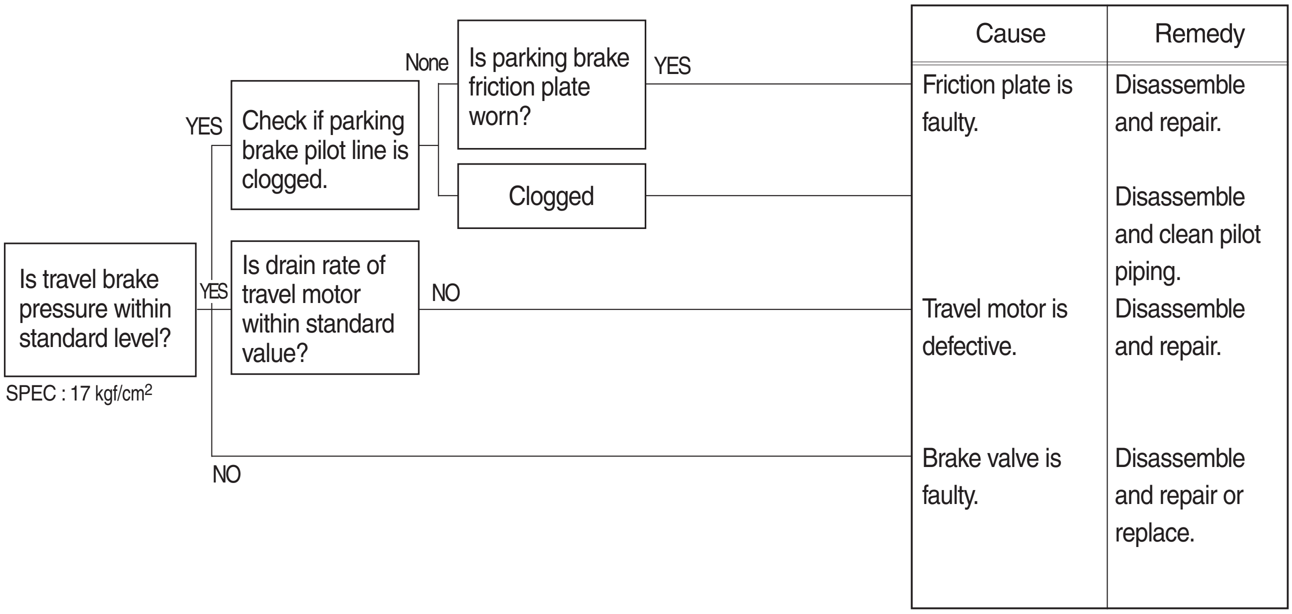
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



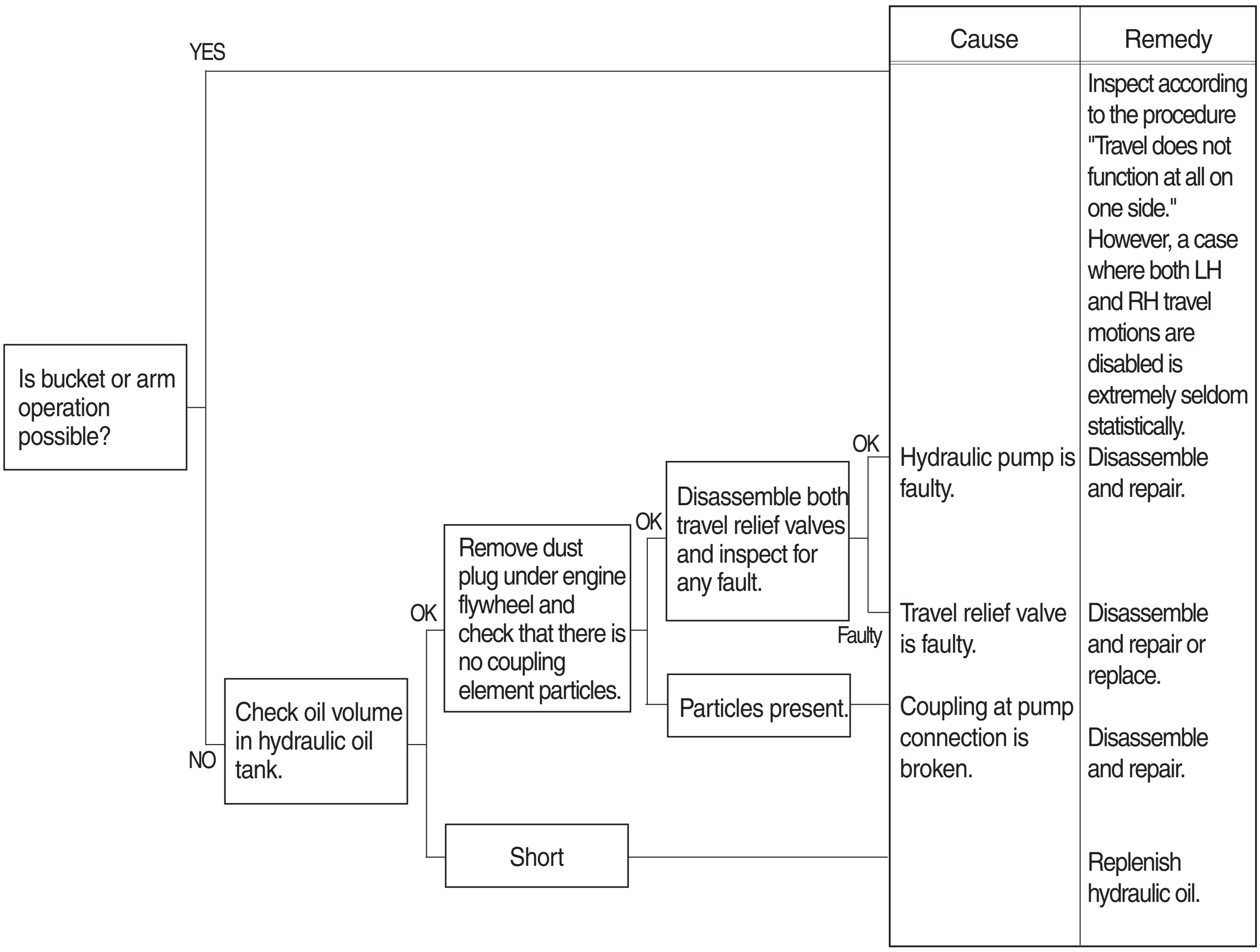
Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic pump is broken.	Disassemble and repair.
External pilot piping is clogged or oil is leaking from it.	Disassemble and clean.
Travel motor's parking brake is not released properly.	Disassemble and clean pilot piping.
Travel motor is faulty.	Disassemble and repair.

3) MACHINE DOES NOT STOP ON A SLOPE

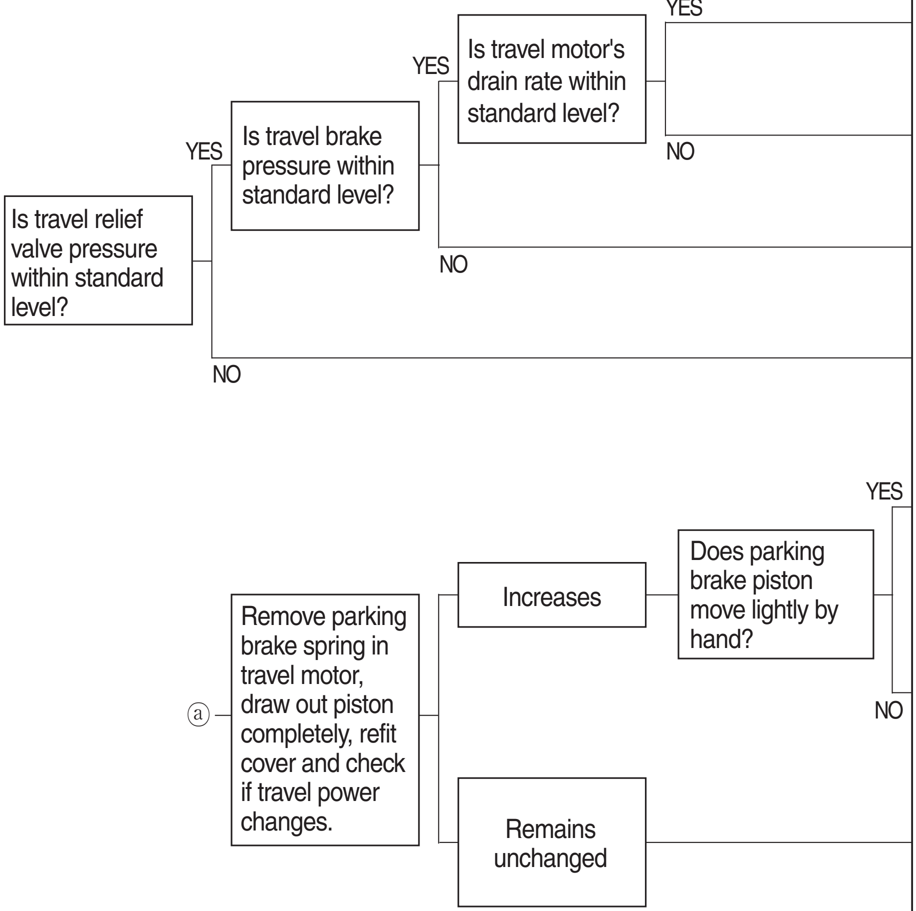
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



5) TRAVEL ACTION IS POWERLESS (travel only)

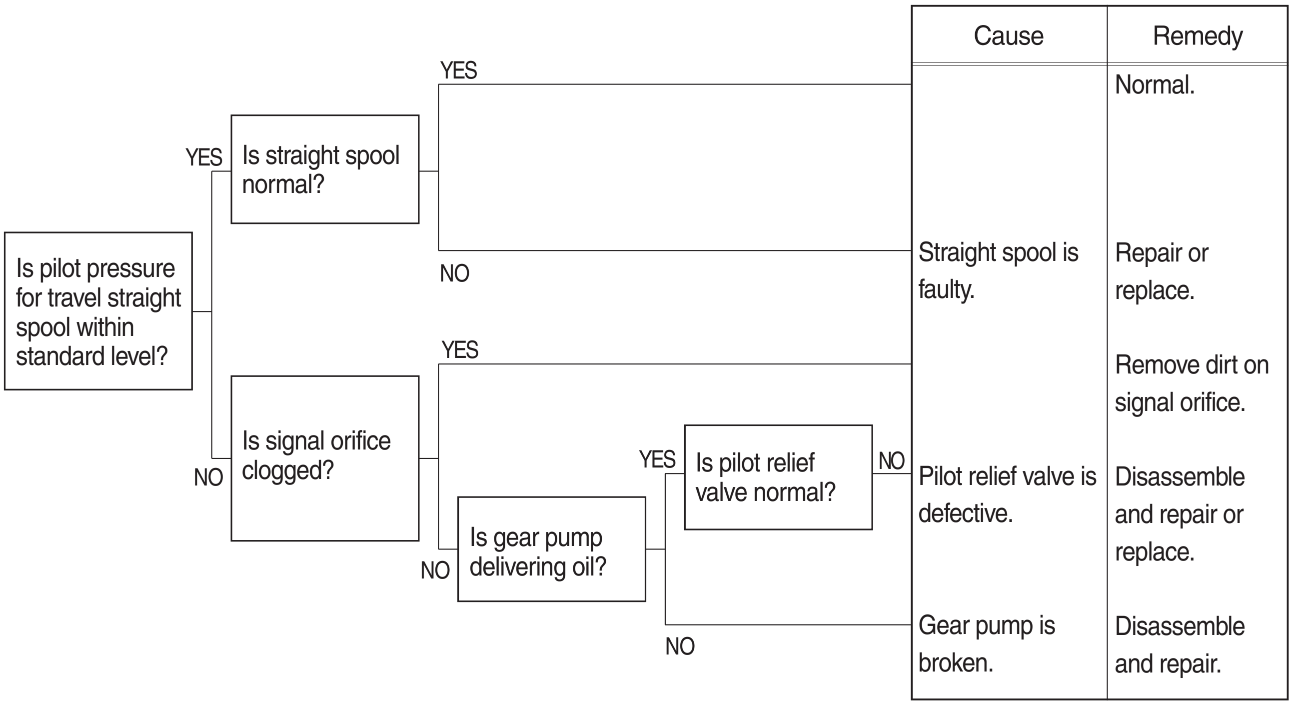


Cause	Remedy
ⓐ	
Travel motor is faulty.	Disassemble and repair.
Travel brake valve is defective.	Disassemble and repair or replace.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic circuit that releases travel parking brake is clogged with dirt.	Disassemble and clean.
Parking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

6) MACHINE RUNS RECKLESSLY ON A SLOPE

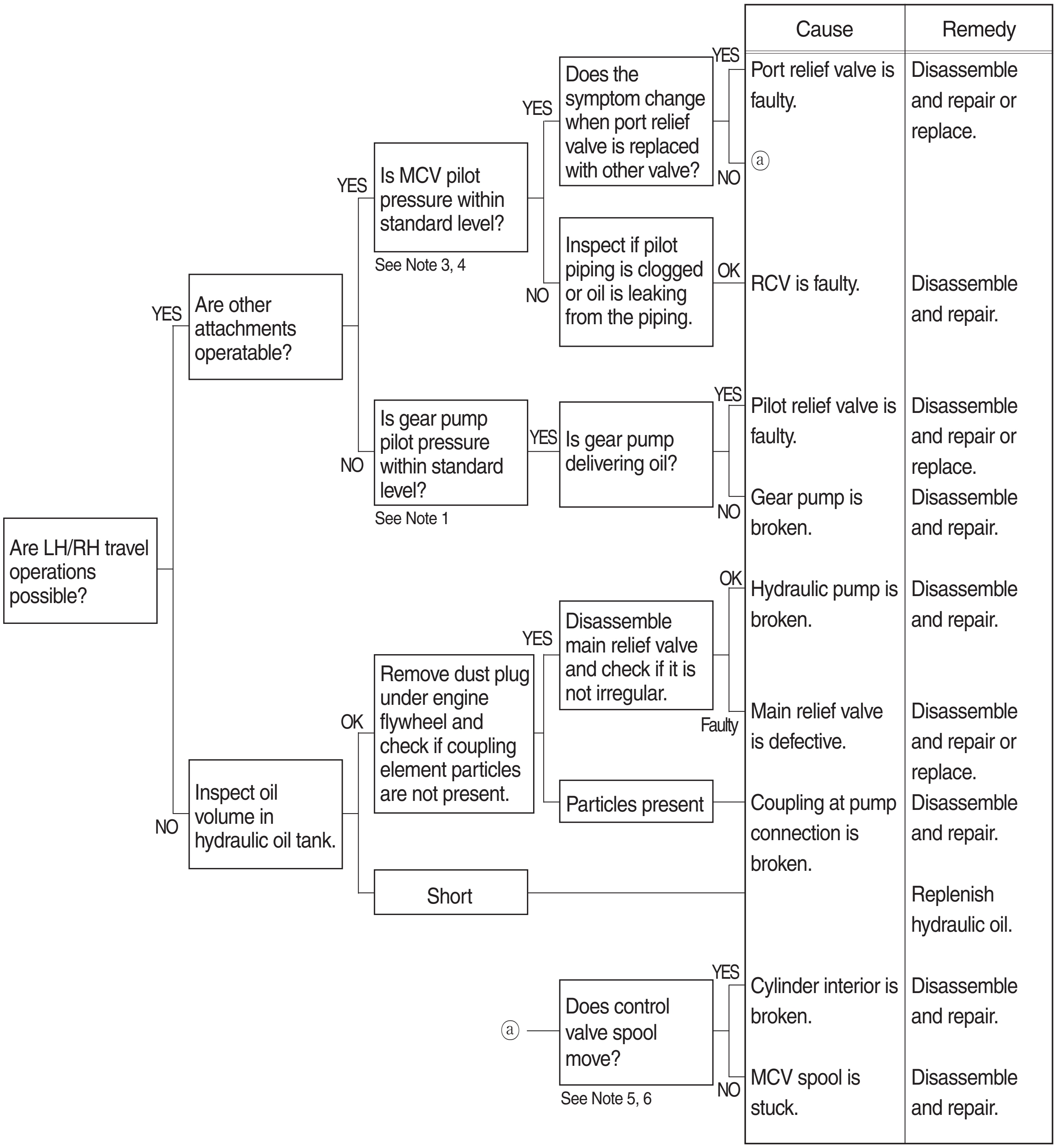
Cause	Remedy
	Disassemble and repair or replace.

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

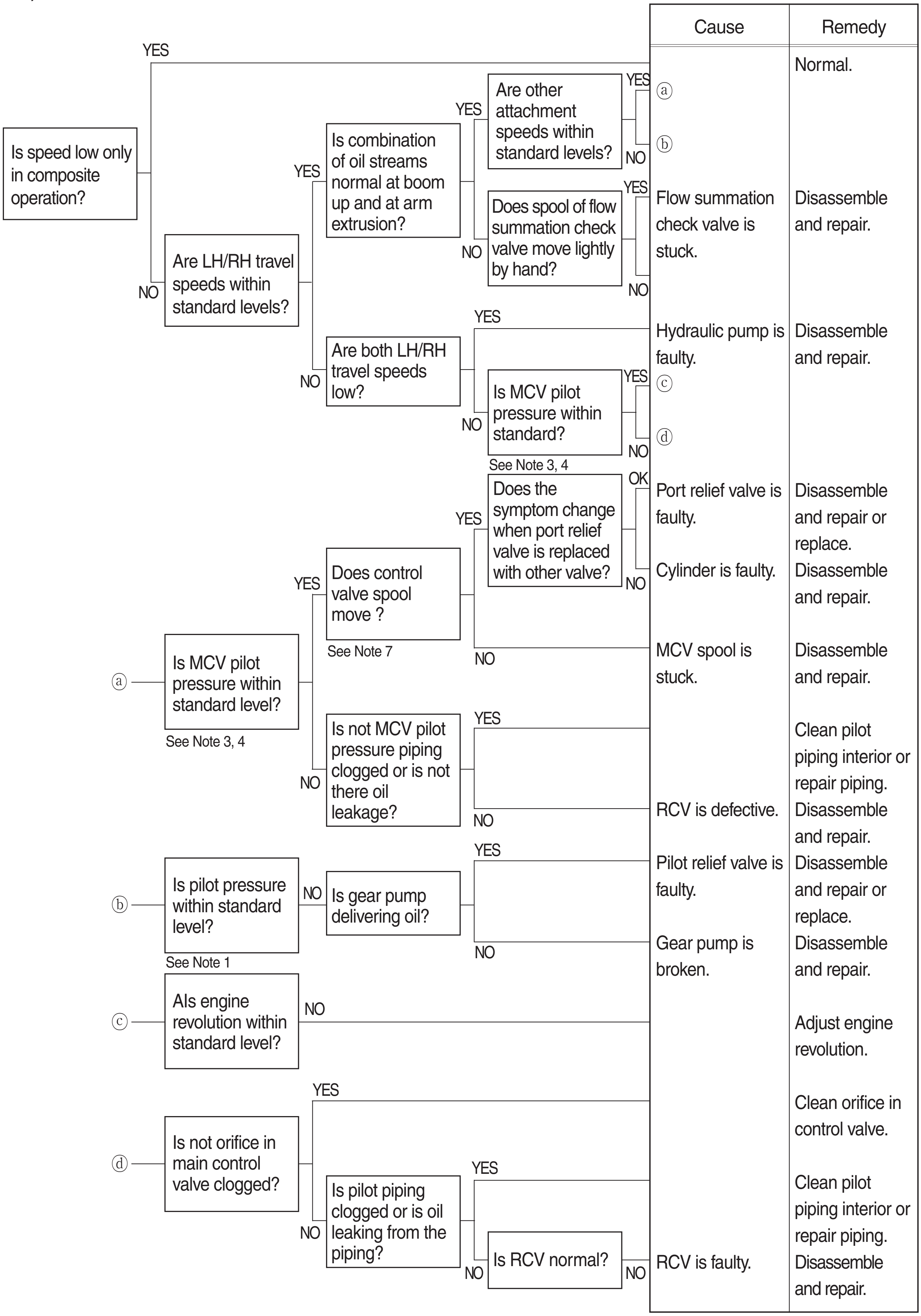


6. ATTACHMENT SYSTEM

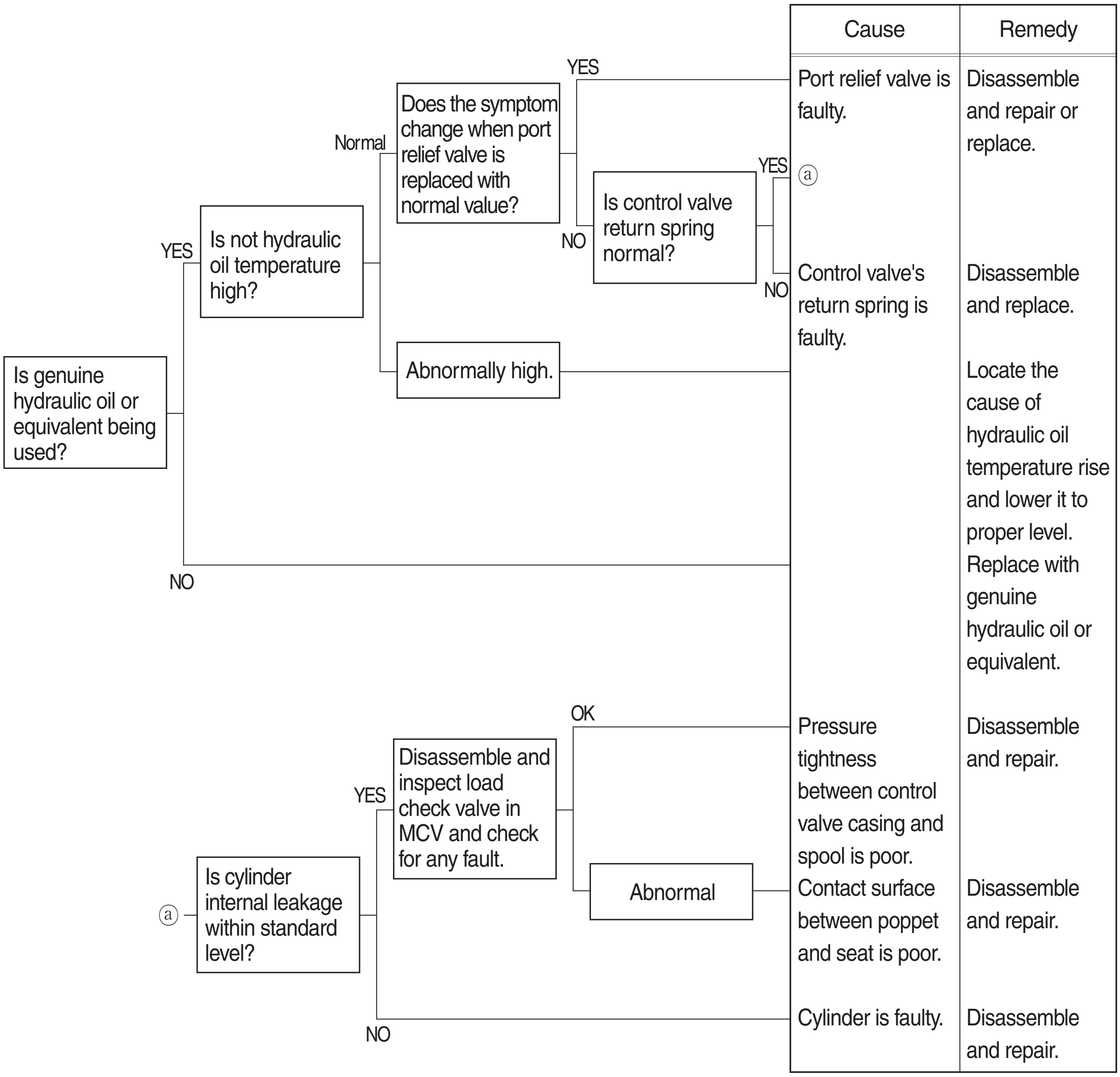
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



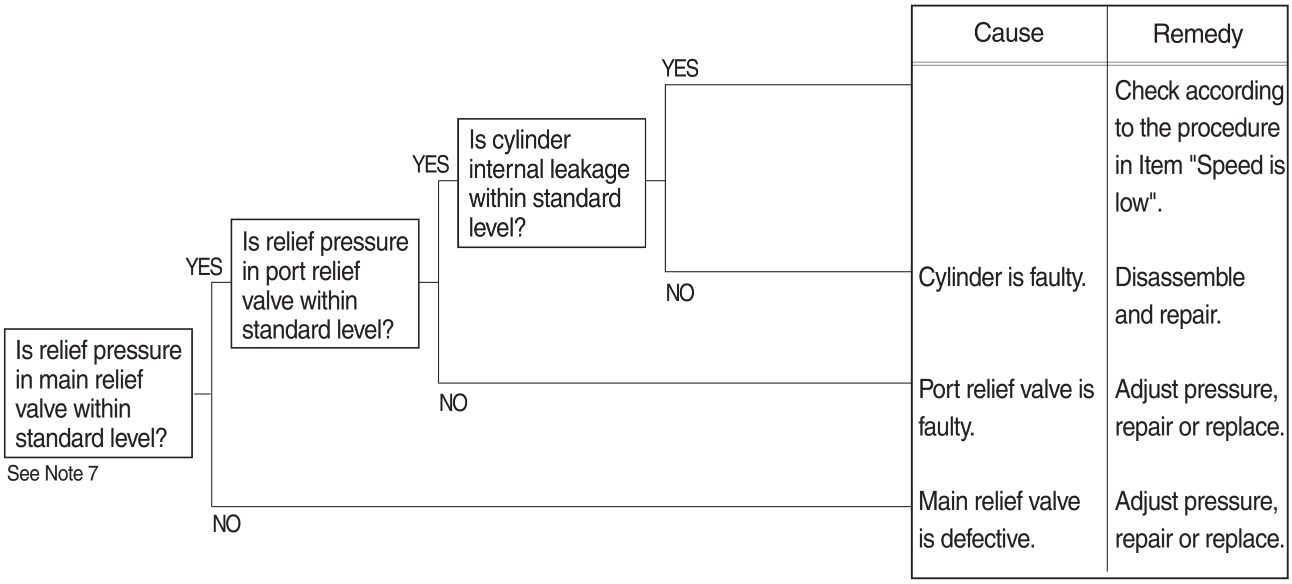
2) BOOM, ARM OR BUCKET SPEED IS LOW



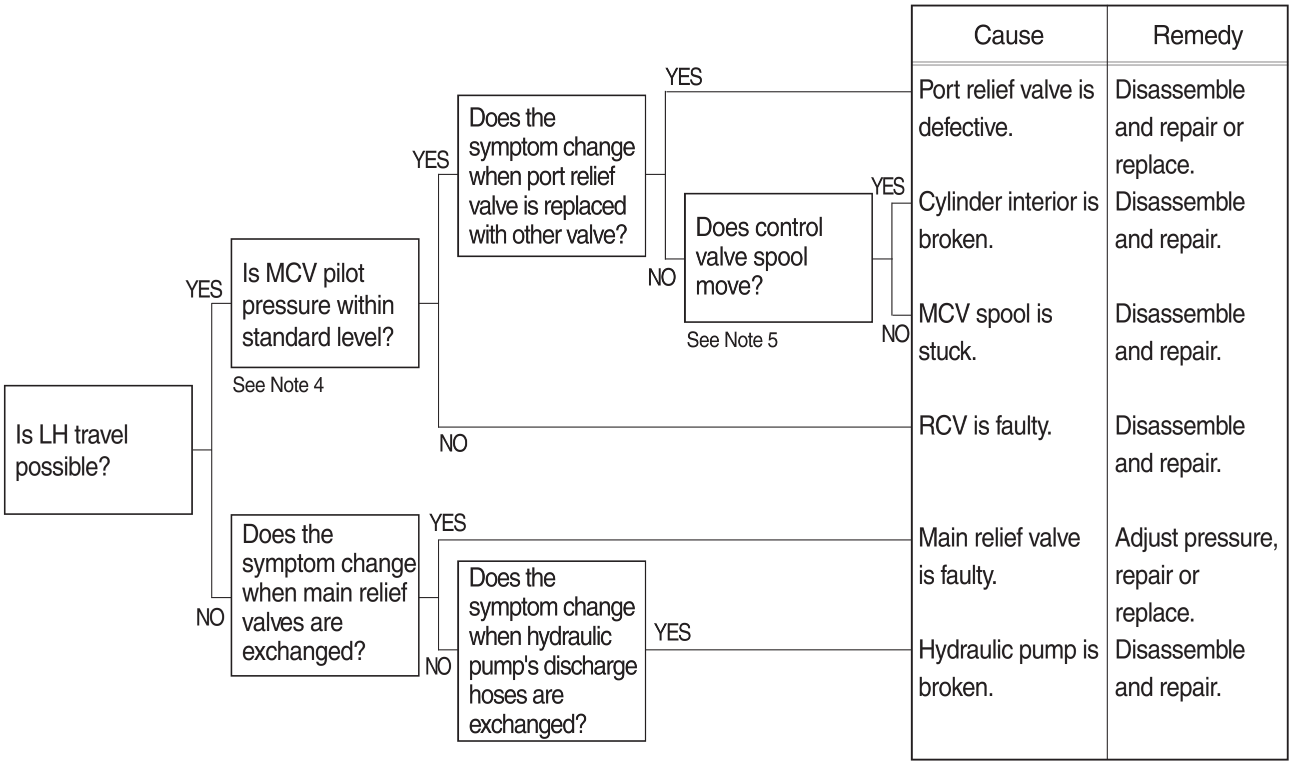
3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

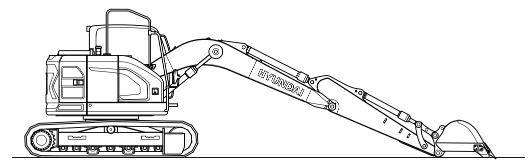
Check	Answer	Cause	Remedy
Is boom foot pin greased sufficiently?	YES		Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
	NO	Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in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

7) TIME LAG OF MACHINE WORKING IS LARGE.

Check	Answer	Cause	Remedy
Is overload relief valve for each spool working properly?	YES		Refer to 2)
	NO	Overload relief valve is faulty.	Disassemble and repair.

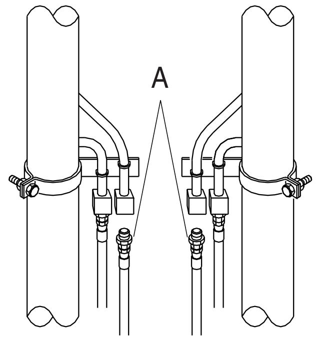
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



145ZF6TS01

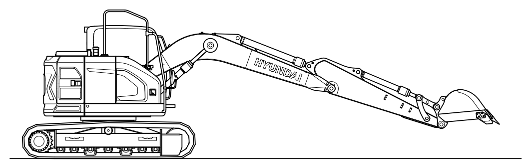
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



(210-7) 6-20(2)

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.

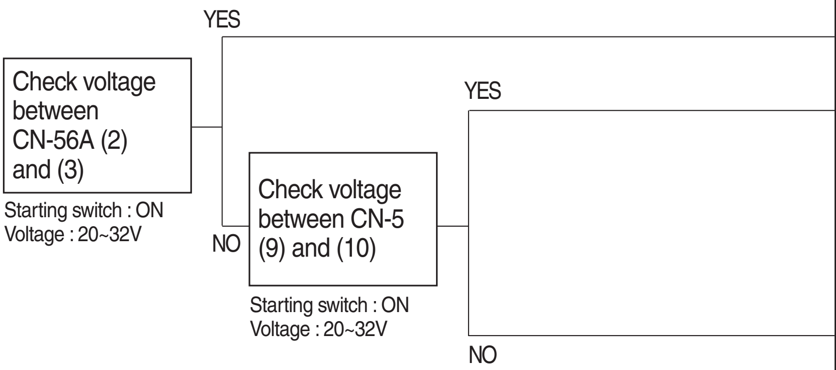


145ZF6TS02

GROUP 3 ELECTRICAL SYSTEM

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

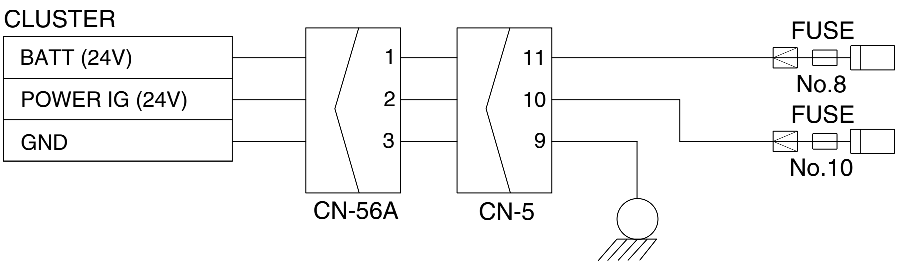
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 8, 10.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-5-CN-56A	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-5 (9) -GND or fuse No. 8, 10	Repair or replace (after clean)

Check voltage

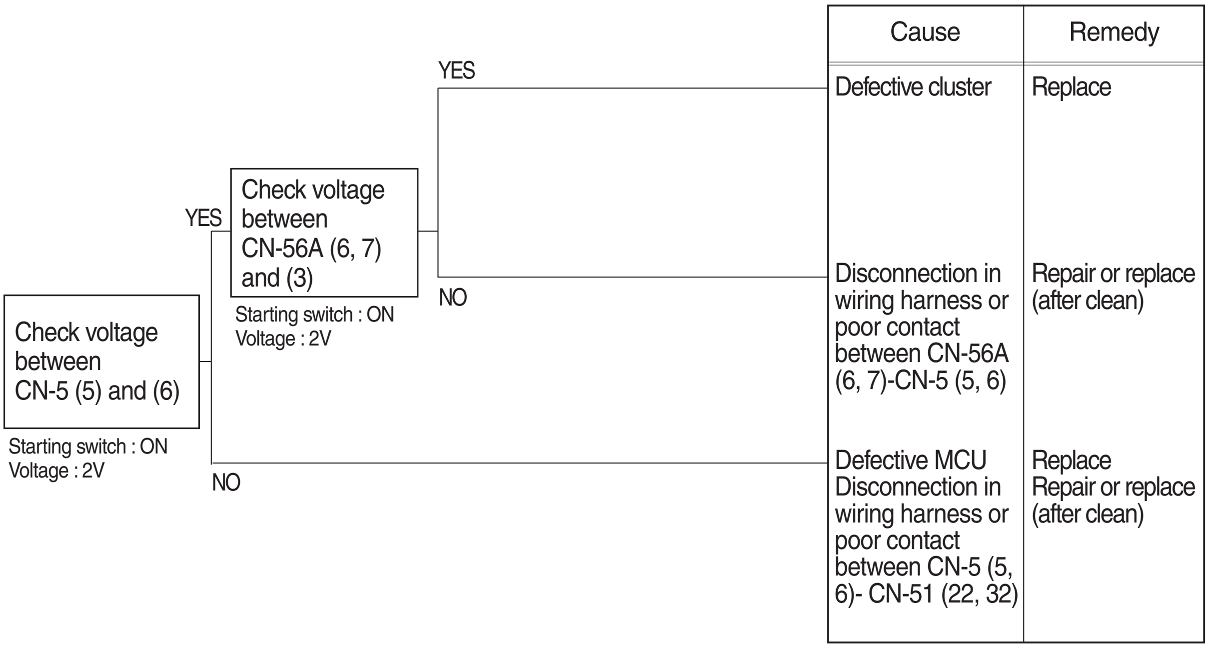
YES	20~32V
NO	0V



140SA6ES01

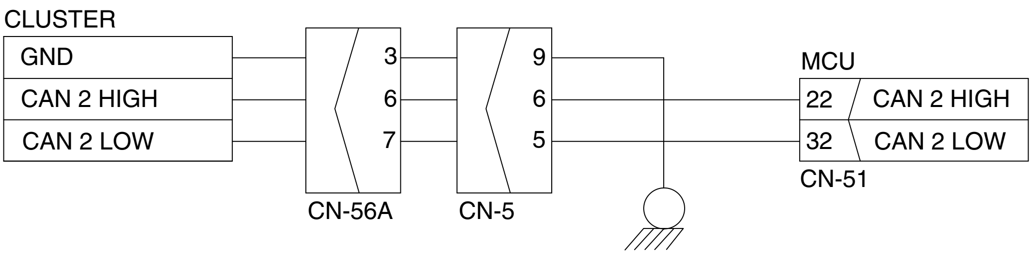
2. COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

- 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

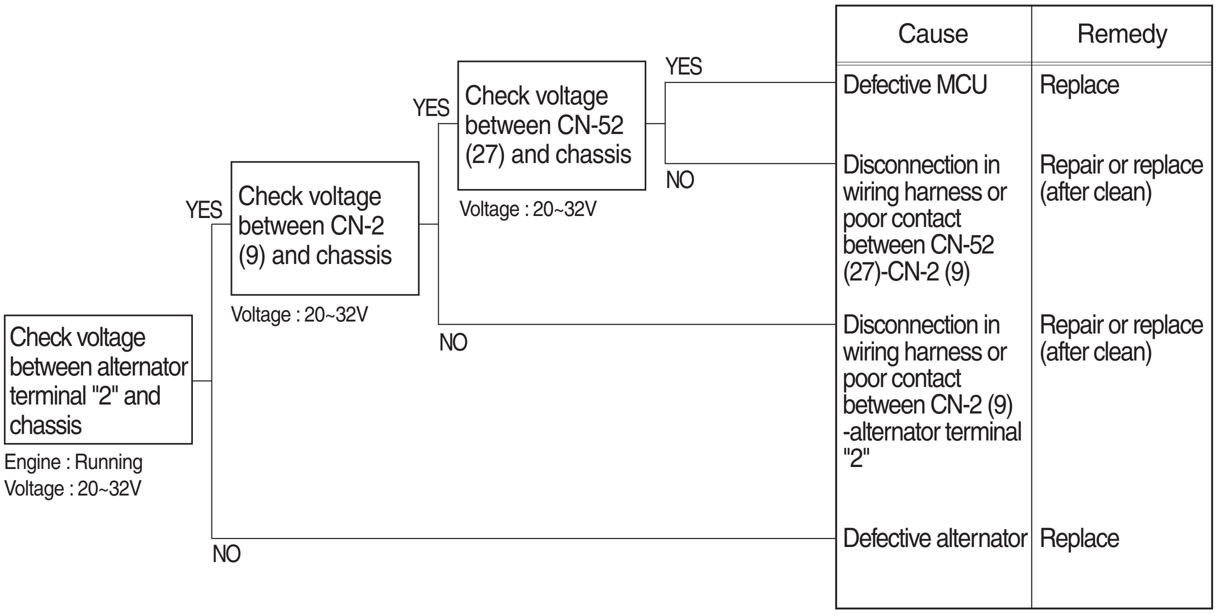
YES	2V
NO	0V



300L6ES02

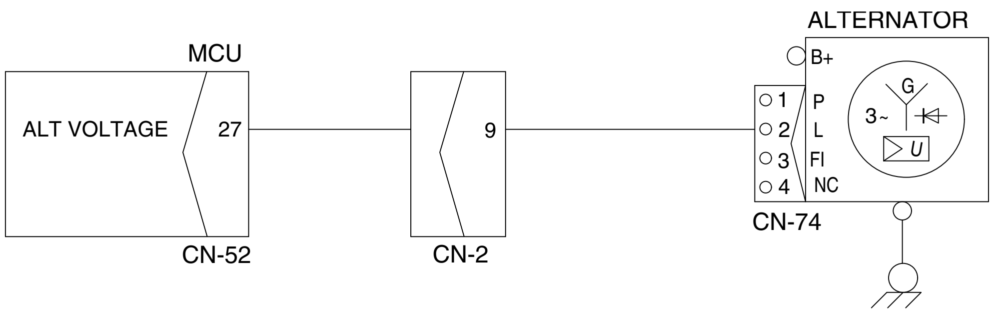
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

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



Check voltage

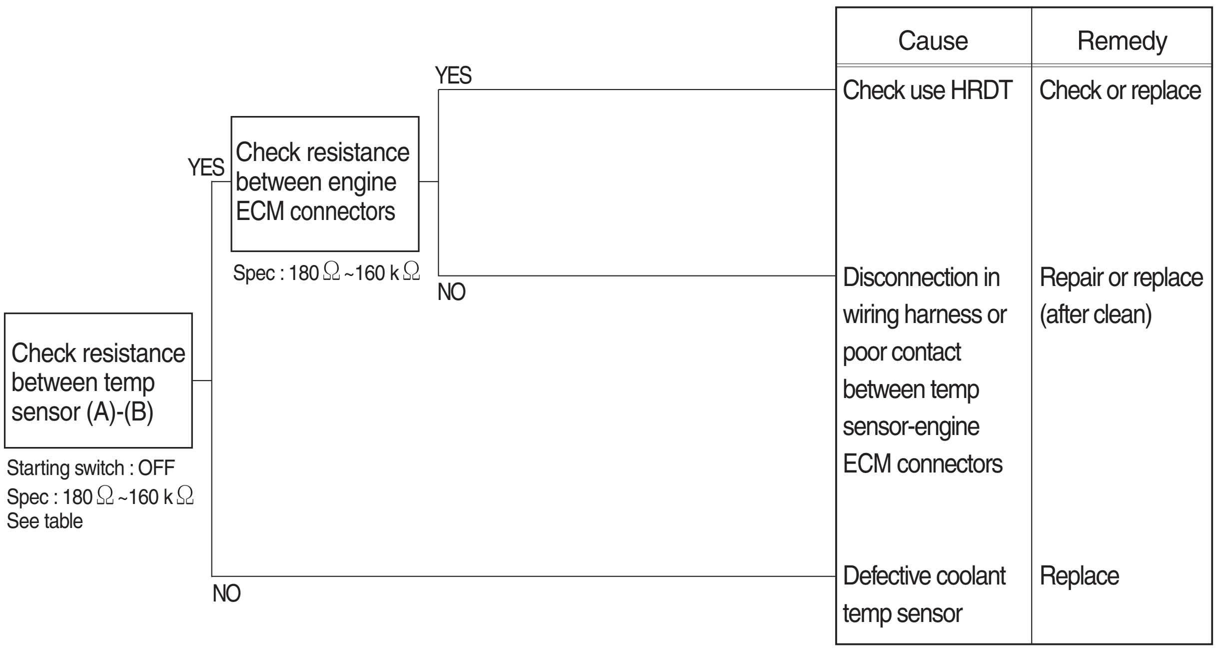
YES	20~32V
NO	0V



140SA6ES03

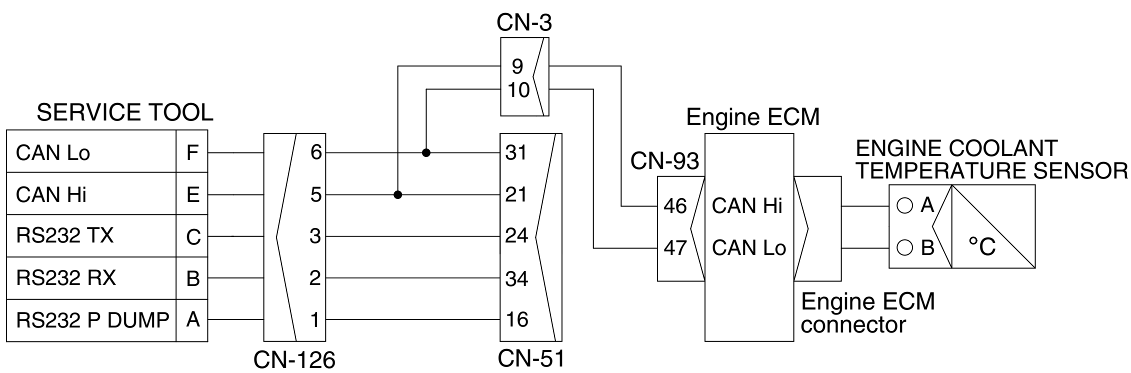
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

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



Check Table

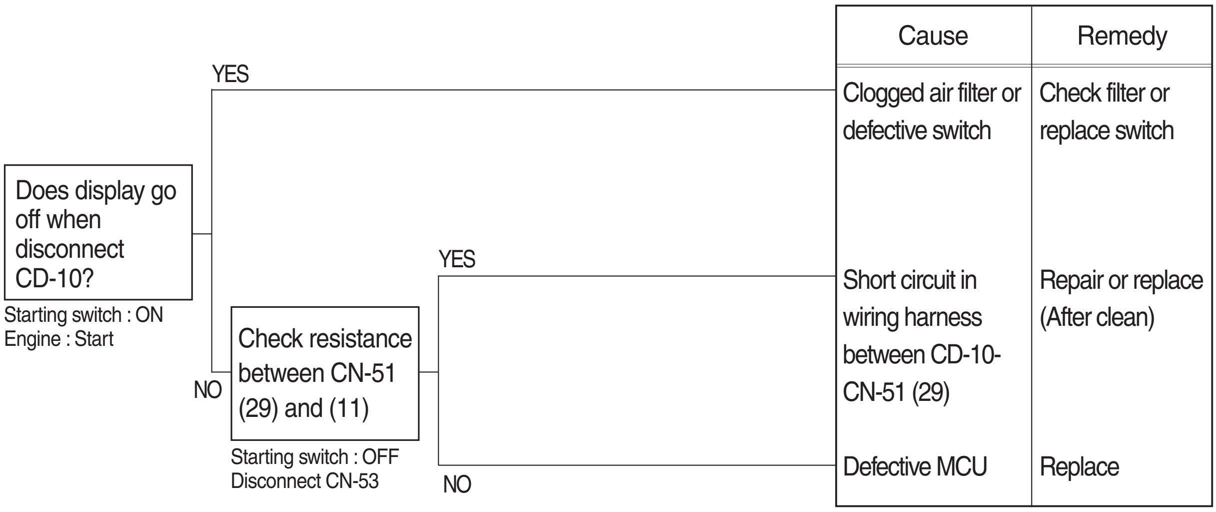
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



140SA6ES04

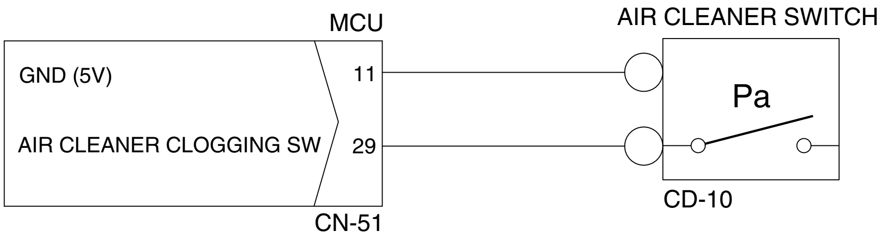
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

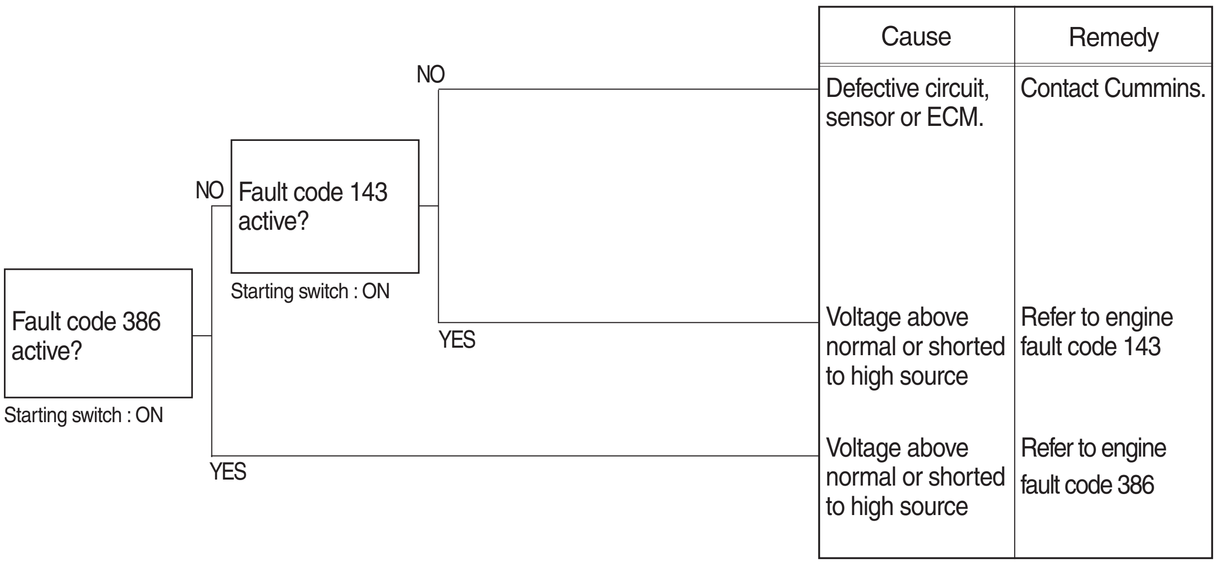
YES	MAX 1Ω
NO	MIN 1MΩ

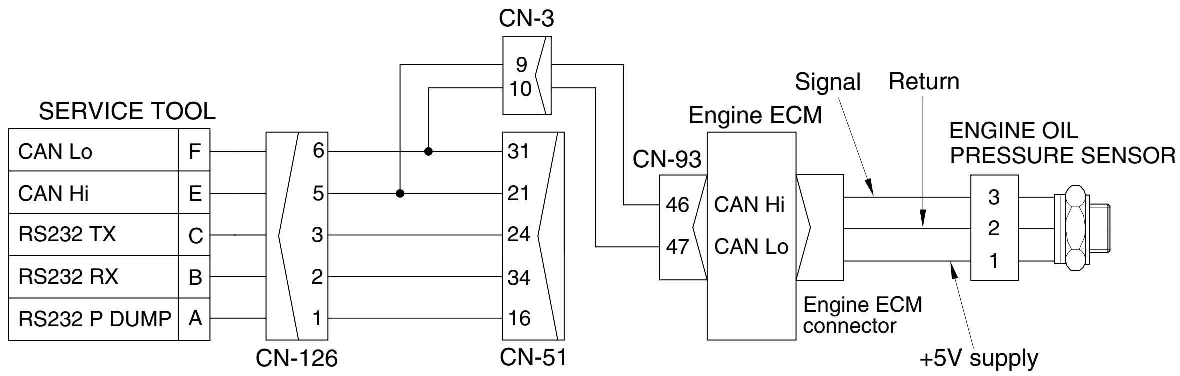


140SA6ES05

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

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

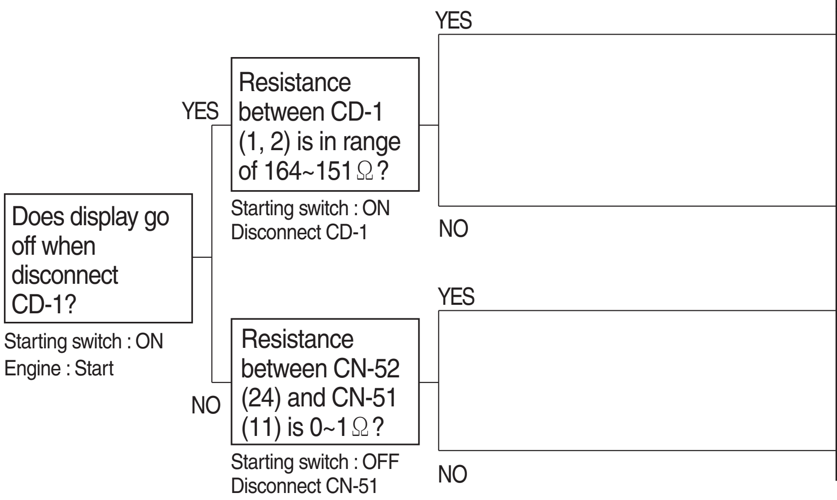




140SA6ES07

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

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



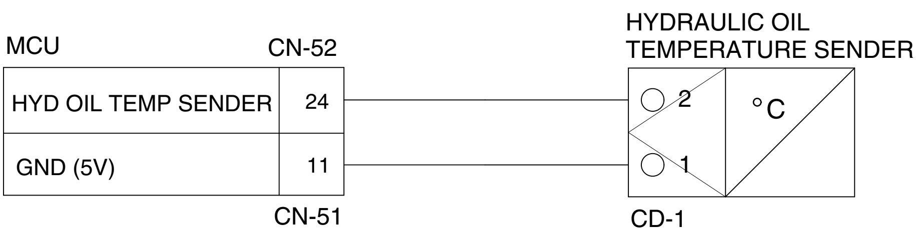
Cause	Remedy
High temperature	Check hydraulic system
Defective temp senser	Replace
Short circuit between temp senser and MCU	Repair or replace
Defective MCU	Replace

Normal type

Premium type

Check Table

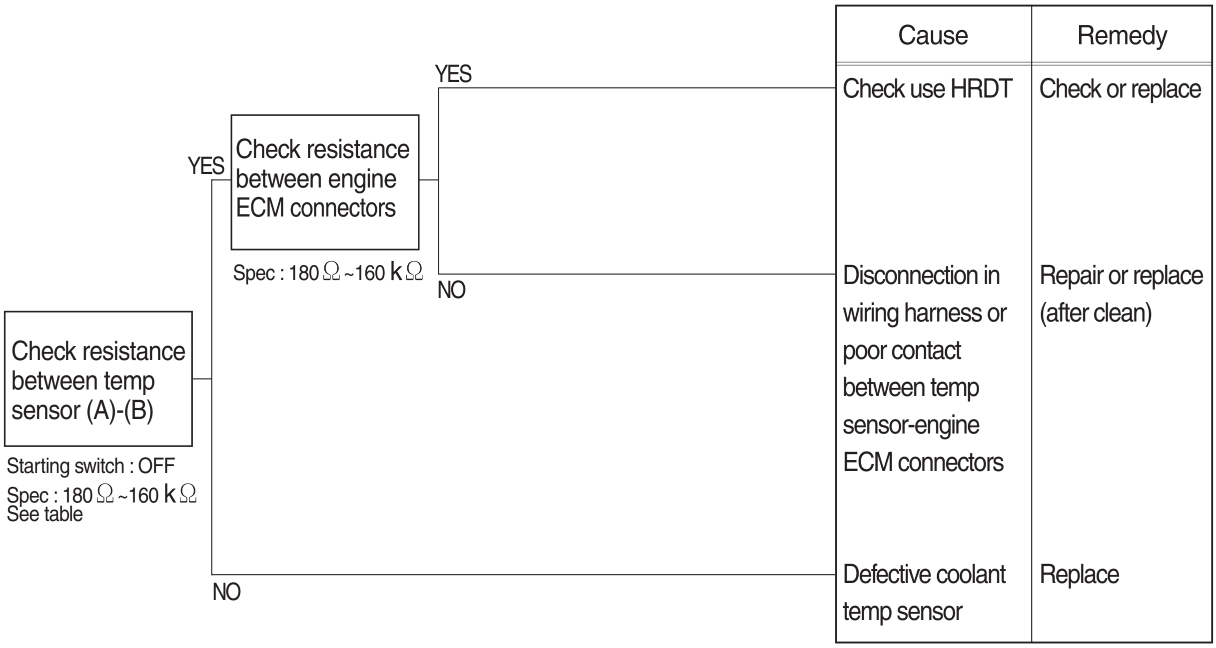
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 0.151



140SA6ES08

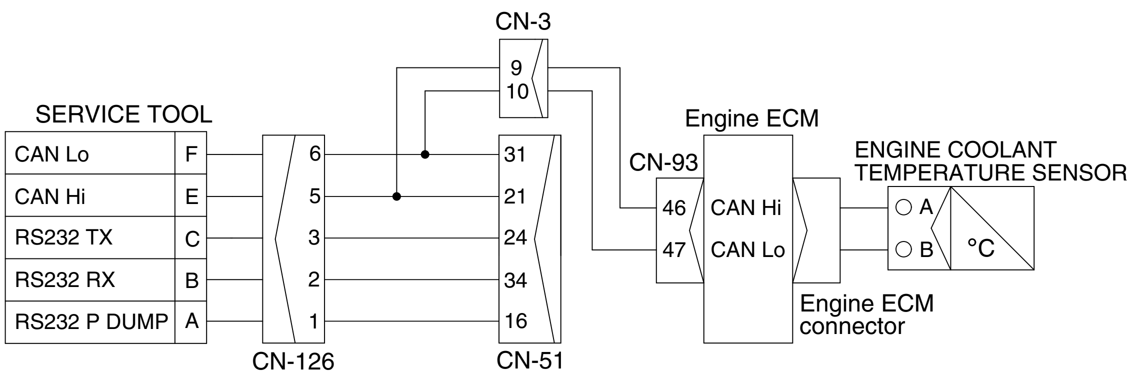
8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE (HCESPN 304, FMI 3 or 4) GAUGE DOES NOT OPERATE

· 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

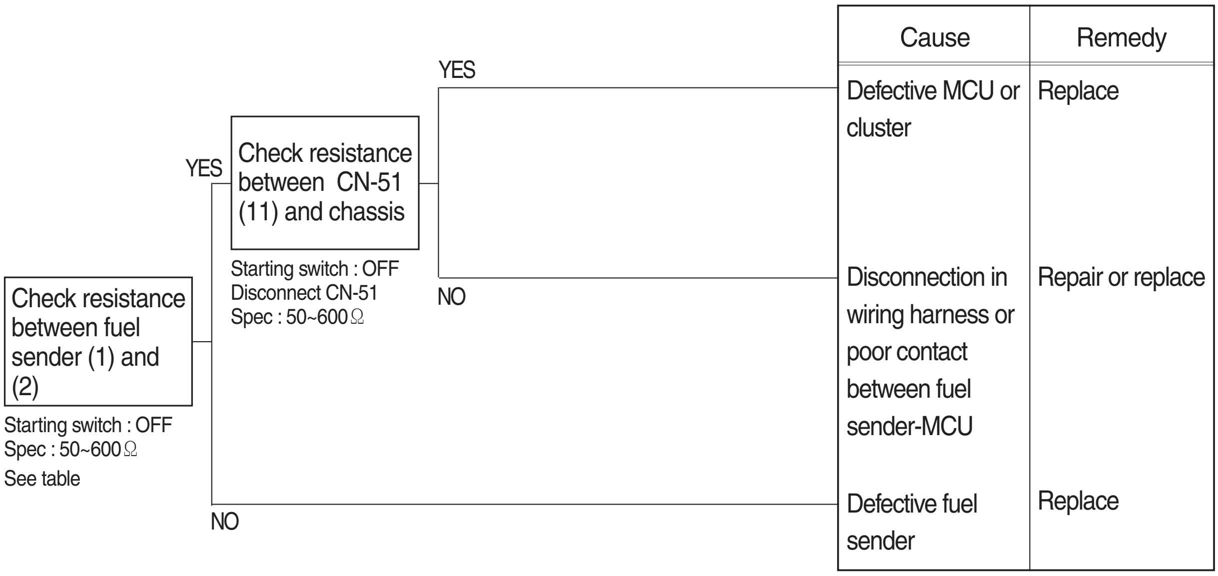
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



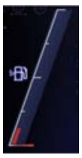
140SA6ES04

9. WHEN FUEL GAUGE DOES NOT OPERATE (HCESPN 301, FMI 3 or 4)

- 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.



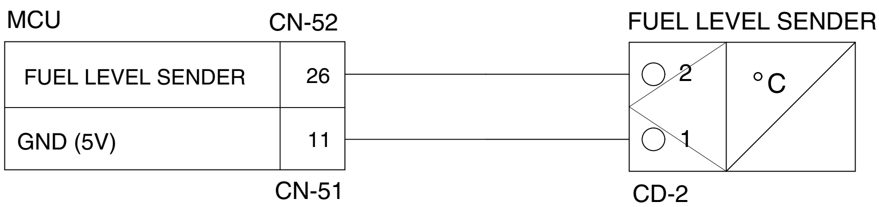
Normal type



Premium type

Check Table

Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-



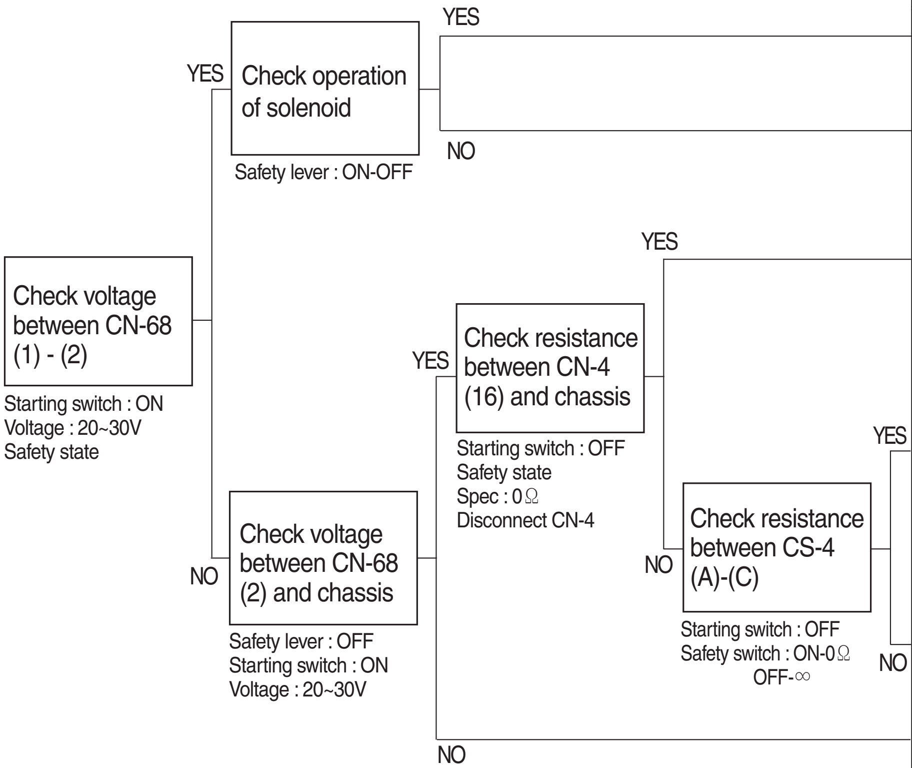
140SA6ES10

10. WHEN SAFETY SOLENOID DOES NOT OPERATE

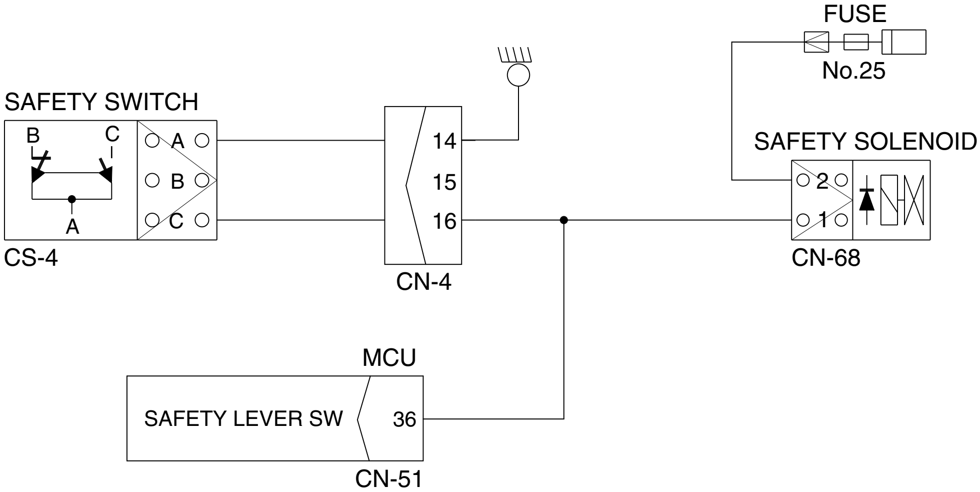
· Before disconnecting the connector, always turn the starting switch OFF.

· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 25.

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



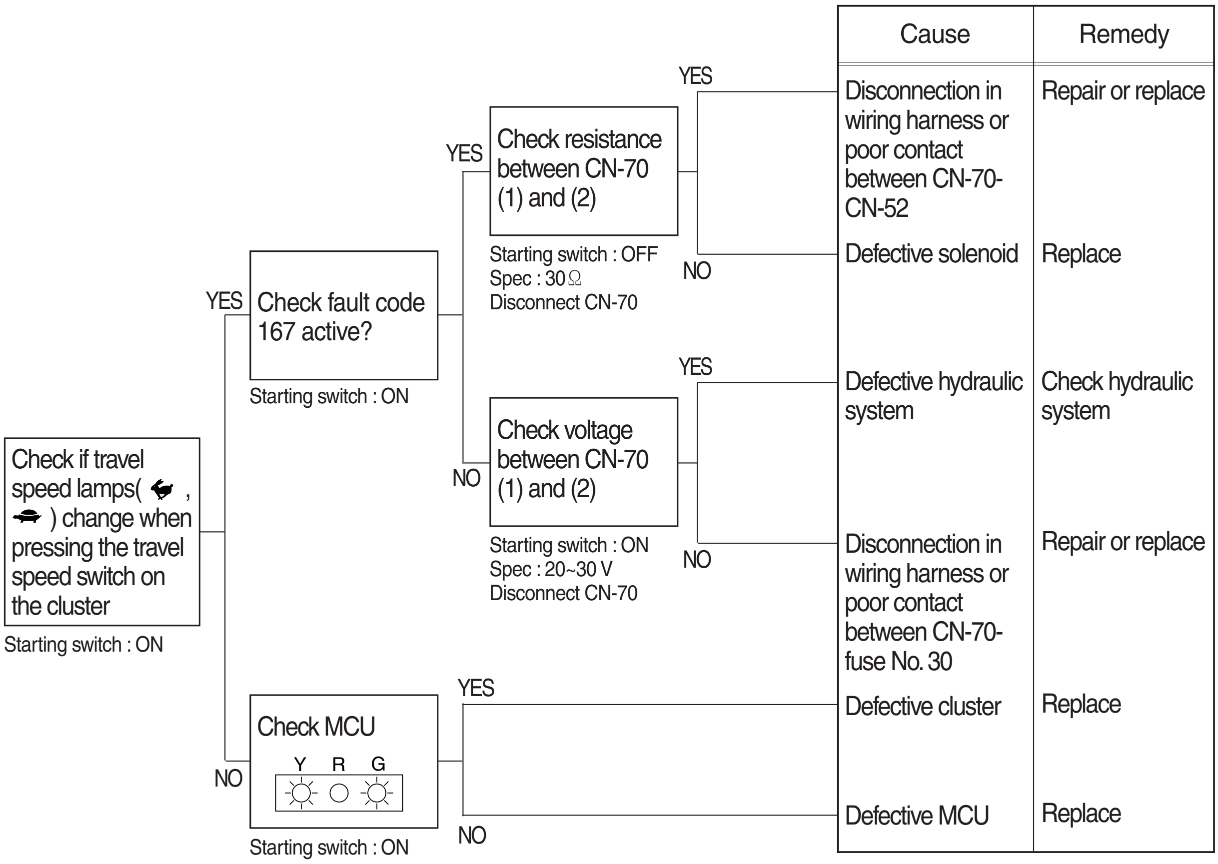
Cause	Remedy
Hydraulic system malfunction	Check hydraulic system
Defective solenoid	Replace
Disconnect in wiring harness or poor contact between CN-4-CN-68	Repair or replace (after clean)
Disconnect in wiring harness or poor contact between CN-4-CS-4	Repair or replace (after clean)
Defective safety switch	Replace
Disconnection in wiring harness between CN-68 (2)-fuse No. 25	Repair or replace

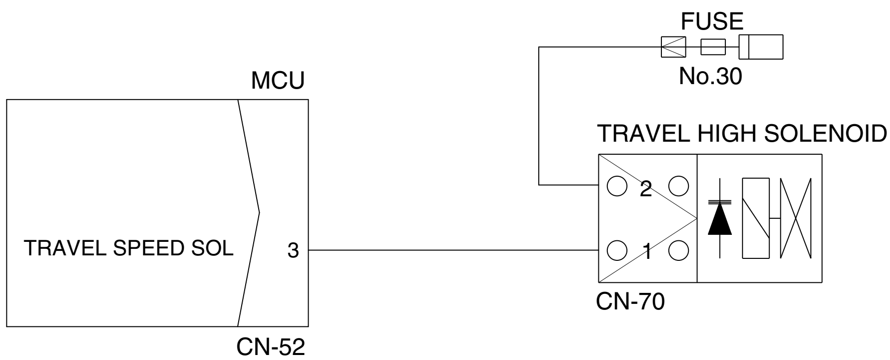


140SA6ES12

11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE (HCESPN 167, FMI 4 or 6)

· 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. 30.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





140SA6ES13

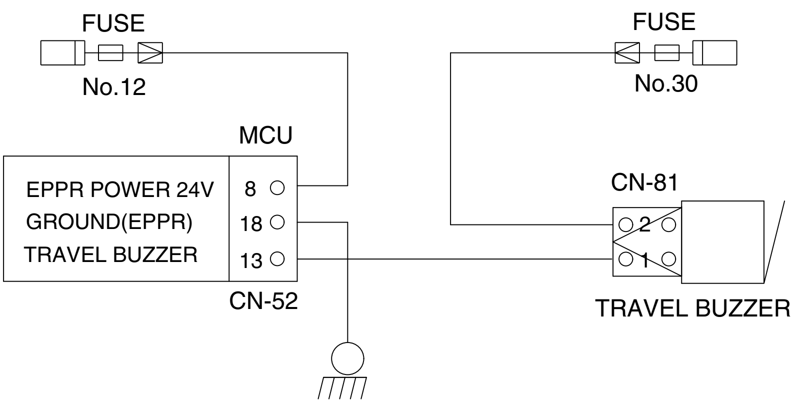
12. TRAVEL ALARM DOES NOT SOUND OR DOES NOT STOP SOUNDING

Check the fuse for travel alarm inside fuse box whether fuse No.30 is blown or not

- YES → Cause: The fuse is blown / Remedy: Replace the fuse
- NO → Check the signal of MCU's pin for back buzzer whether ground signal (DO) generate or not when machine travel mode.
  - YES → Cause: The travel alarm signal of united MCU is defective / Remedy: Check the united MCU program
  - NO → * Prepare with starting switch OFF, then turn start engine and carry out troubleshooting : Between CN-81 (2) - chassis ground : 20-30 voltage . Between CN-81 (1) - chassis ground : Max 1 Ω (resistance) Is the above value normal?

    ** Note : Since voltage value , connector number and pin number varies with each model, should refer to the electric circuit of each model.
    - YES → Cause: The travel buzzer is defective / Remedy: Replace the travel buzzer
    - NO → * Prepare with starting switch OFF, then carry out trouble-shooting without turning starting switch ON : 1. Disconnection in wiring or defective contact in connector between CN-81 (2) inline connector-end connector : Max 1 Ω (resistance) 2. Short circuit with ground circuit between CN-81 (2) inline connector-end connector - chassis ground : Min 1MΩ (resistance)
      - NO → Cause: In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit / Remedy: Replace connector Connect the wire

Cause	Remedy
The fuse is blown	Replace the fuse
The travel alarm signal of united MCU is defective	Check the united MCU program
The travel buzzer is defective	Replace the travel buzzer
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector Connect the wire



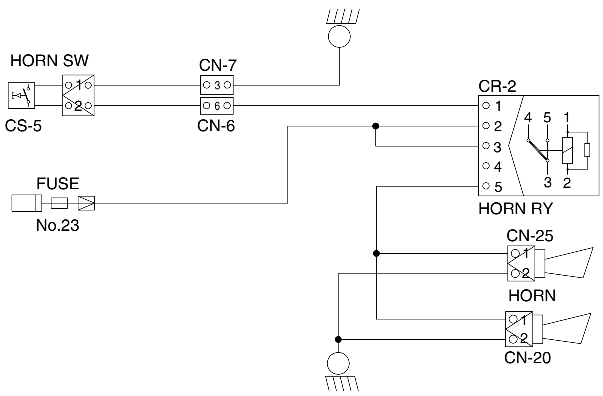
140SA6ES25

13. HORN DOES NOT SOUND

Check the fuse for horn inside fuse box whether fuse No.23 is blown or not

- YES → The fuse is blown → Replace the fuse
- NO → After replacing the relay for horn, check the horn operate
  - YES → The relay is broken → Replace the relay
  - NO → * Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting : Between CN-20 (1) or CN-25 (1) - chassis ground (with horn switch turned ON) : 20-30 voltage
    * Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON : Between CN-20 (2) or CN-25 (2)- chassis ground : Max 1 Ω (resistance)
    Is the above value normal?
    ** Note : Since voltage value , connector number and pin number varies with each model, should refer to the wiring diagram of each model.
    <CN-20 (1)/ CN-25 (1) : Horn connector (+) terminal CN-20 (2) /CN-25 (2) : Horn connector (-) terminal>
    - YES → The horn is defective → Replace the horn
    - NO → * Prepare with starting switch OFF, then carry out trouble-shooting without turning starting switch ON :
      1. Disconnection in wiring or defective contact in connector between CN-20 (1) or CN-25 (1) - inline connector-end connector : Max 1 Ω (resistance)
      2. Short circuit with ground circuit between CN-20 (1) or CN-25 (1) - inline connector-end connector - chassis ground : Min 1M Ω (resistance)
      - NO → In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit → Replace connector. Connect the wire

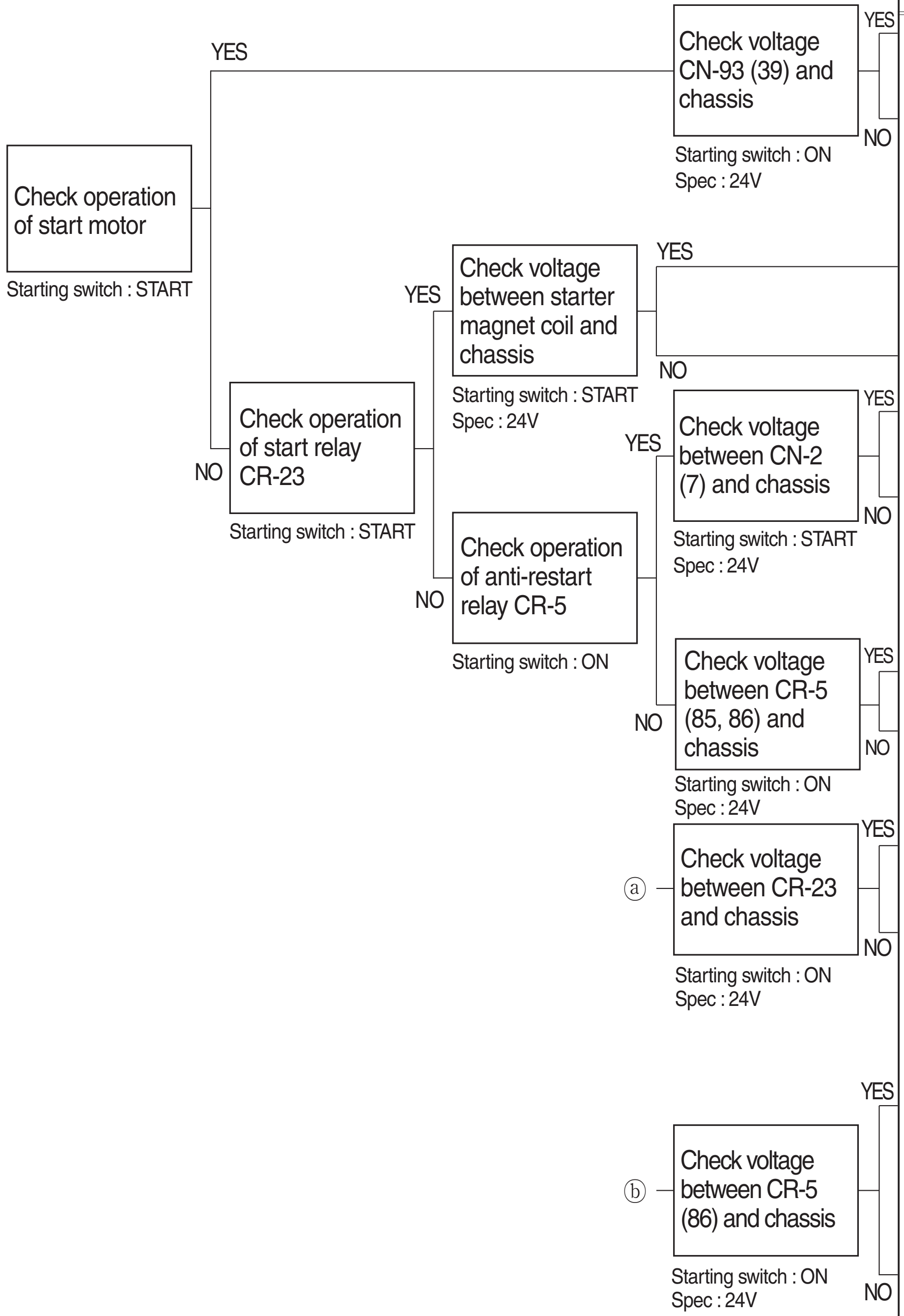
Cause	Remedy
The fuse is blown	Replace the fuse
The relay is broken	Replace the relay
The horn is defective	Replace the horn
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector. Connect the wire



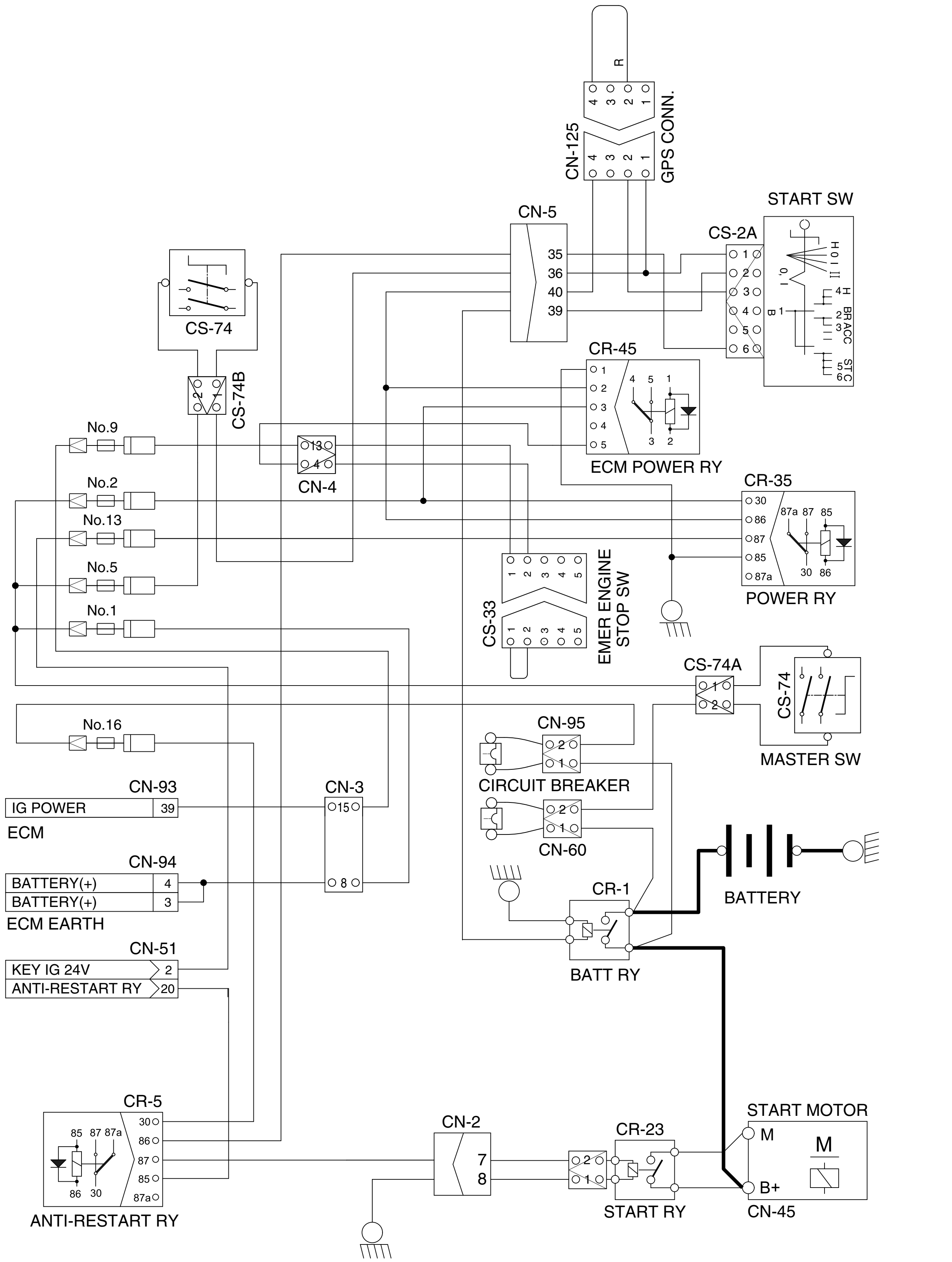
140SA6ES26

14. WHEN ENGINE DOES NOT START (lights up condition)

- 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 and fuse No. 1, 2, 5, 9, 13 and 16 burnt out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



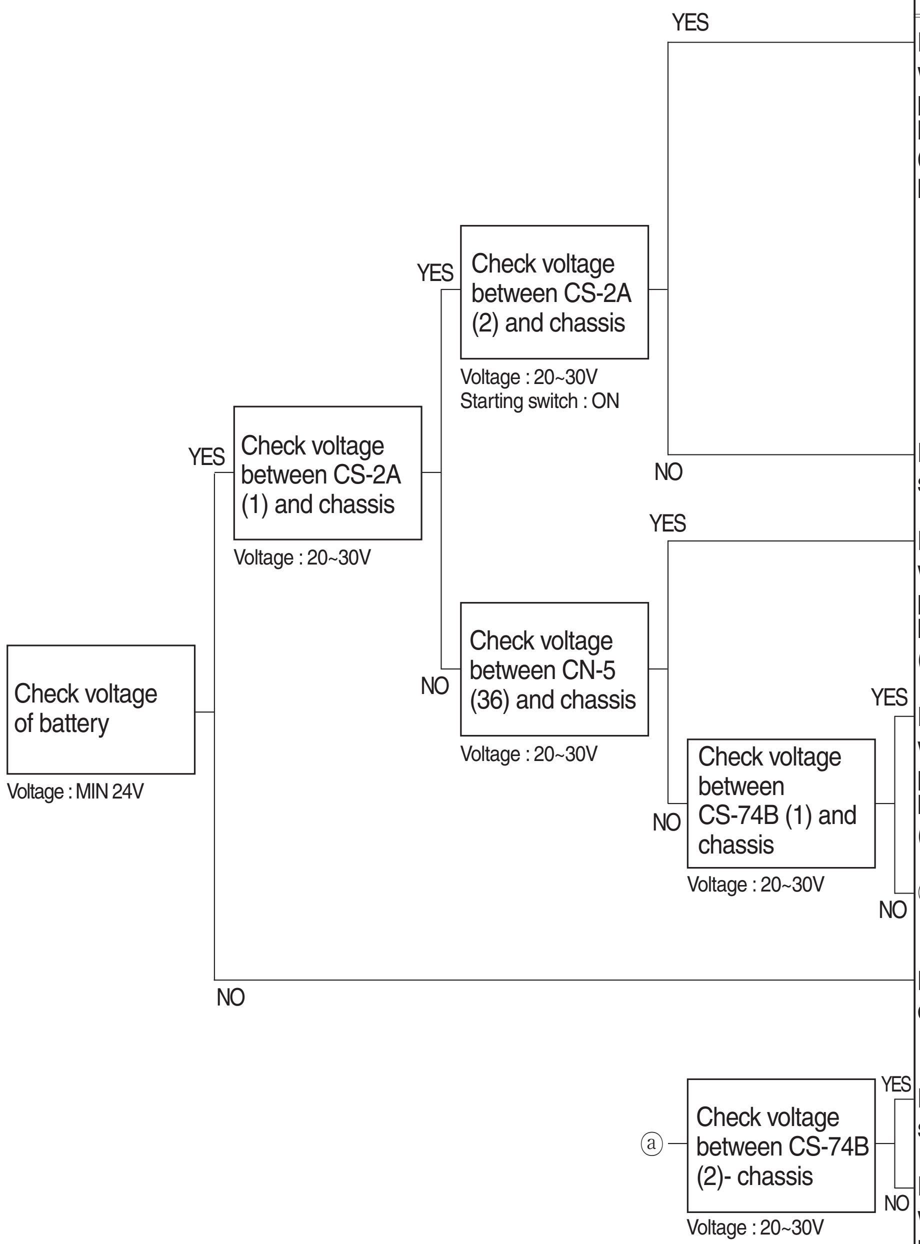
Cause	Remedy
Defective ECM or battery	Replace
Disconnection in wiring harness or between CR-35 (30)-CN-93 (39)	
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CN-2 (7) and CR-5 (87)	Repair or replace (after clean)
Defective relay	Replace
ⓑ	
Defective start relay	Replace
Disconnection in wiring harness or poor contact between CN-2 (7)-CR-23 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-51 (20) - CR-5 (85)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2A (6) -CR-5 (86)	Repair or replace (after clean)



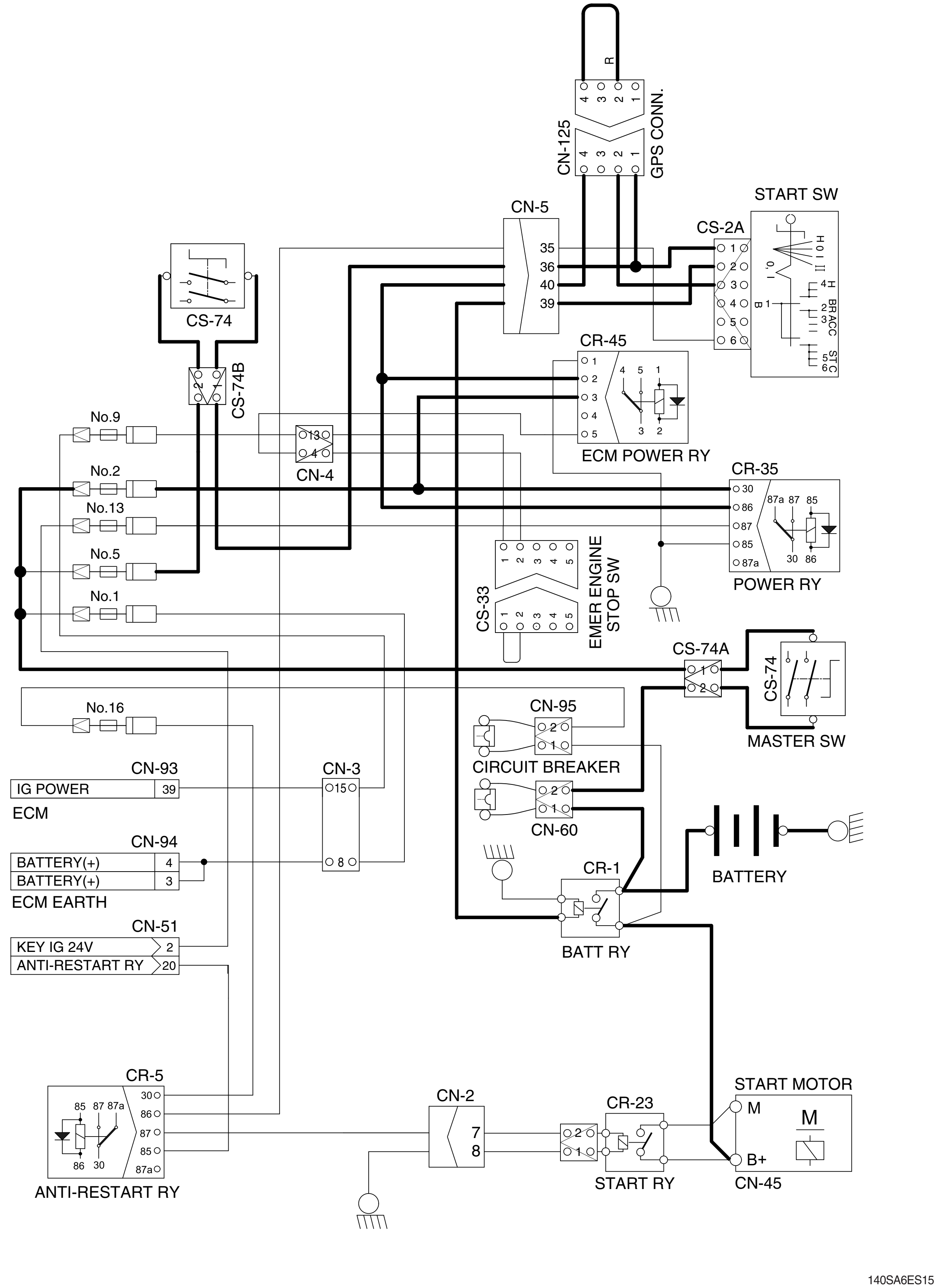
140SA6ES14

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, master switch ON and check blown out of the circuit breaker (CN-60).
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

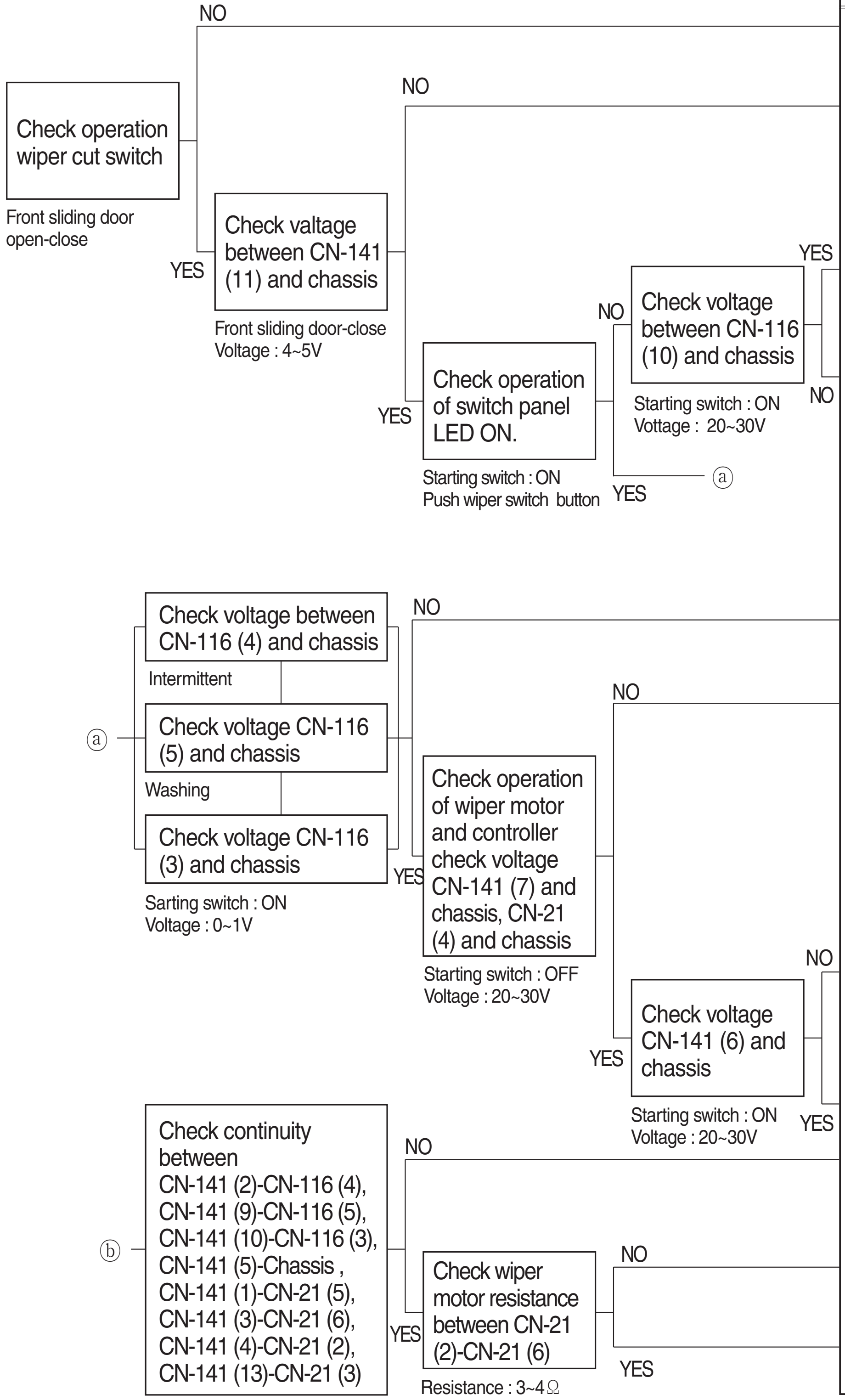


Cause	Remedy
Disconnection in wiring harness or poor contact between CN-5 (39)-CR-1 or defective battery relay	Repair or replace (after clean)
Defective start key switch	Replace
Disconnection in wiring harness or poor contact between CS-2A (1)-CN-5 (36)	Replace
Disconnection in wiring harness or poor contact between CS-74B (1) -CN-5 (36)	Charge or replace (after clean)
Battery discharged	Replace
Defective master switch	Replace
Disconnection in wiring harness or poor contact between CS-74B (2) -CR-1	Charge or replace (after clean)

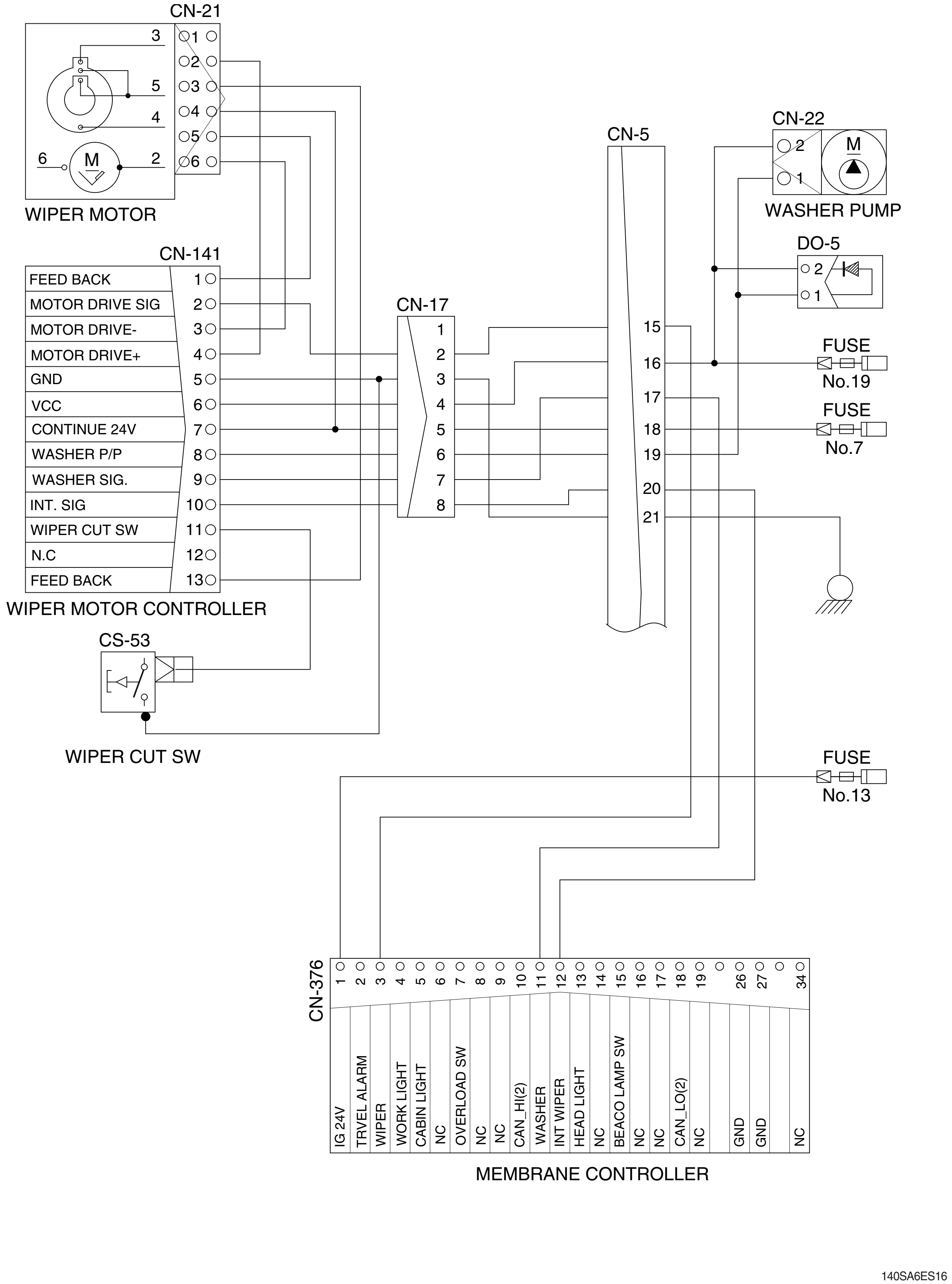


16. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and fuse No. 7, 13 and 19 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

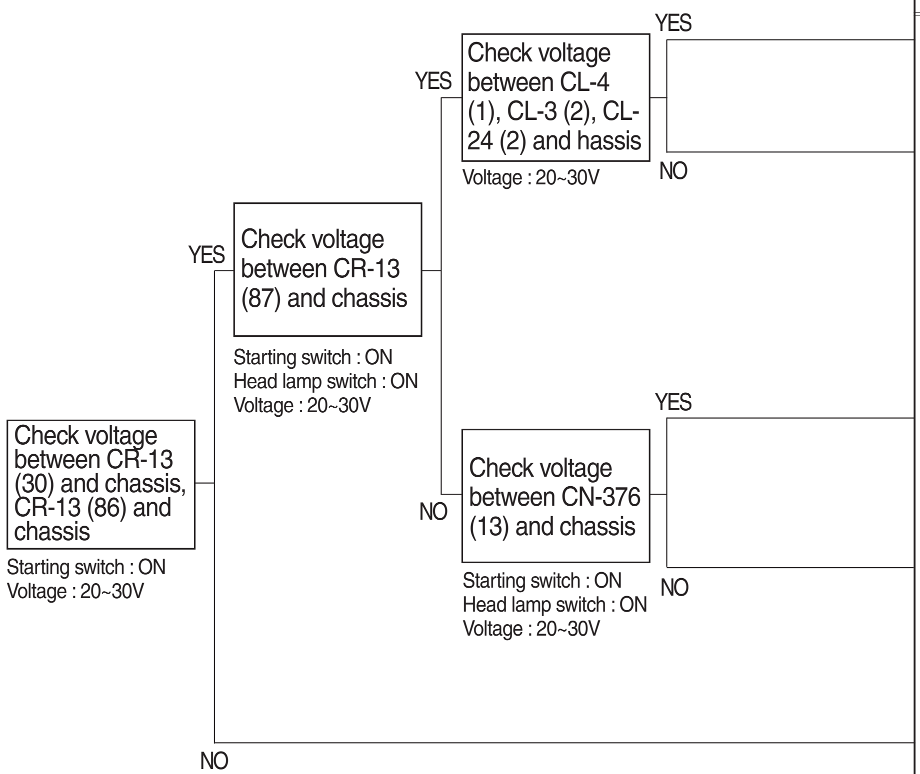


Cause	Remedy
Defective wiper cut switch	Replace
Short circuit in wiring harness or poor contact between CN-141 (11)- CS-53	Repair or replace (after clean)
Defective switch panel	Replace
1)Recheck fuse No.13 2)Disconnection in wiring harness or poor contact between CN-376 (1)-Fuse No.13	Replace Repair or replace (after clean)
Defective switch panel	Replace
1) Recheck fuse No.7 2) Disconnection in wiring harness or poor contact between CN-141 (7)-Fuse No.7, CN-21 (4)-Fuse No.7	Replace Repair or replace (after clean)
1) Recheck fuse No.19 2) Disconnection CN-141(6)-Fuse No.19 ⓑ	Replace Repair or replace (after clean)
Disconnection in wiring harness or poor contact	Repair or replace (after clean)
Defective wiper motor	Replace
Defective wiper motor controller	Replace

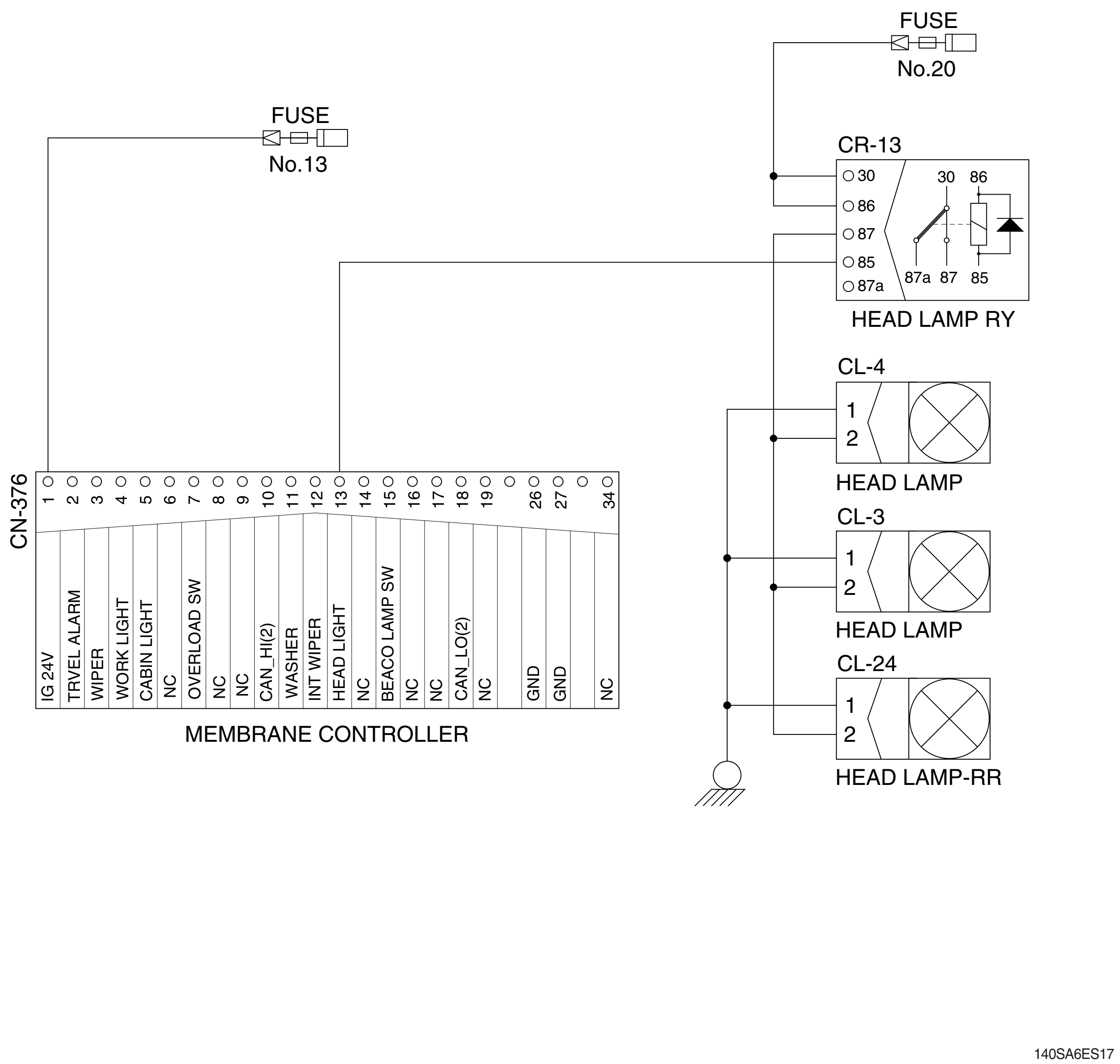


17. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.13 and 20.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

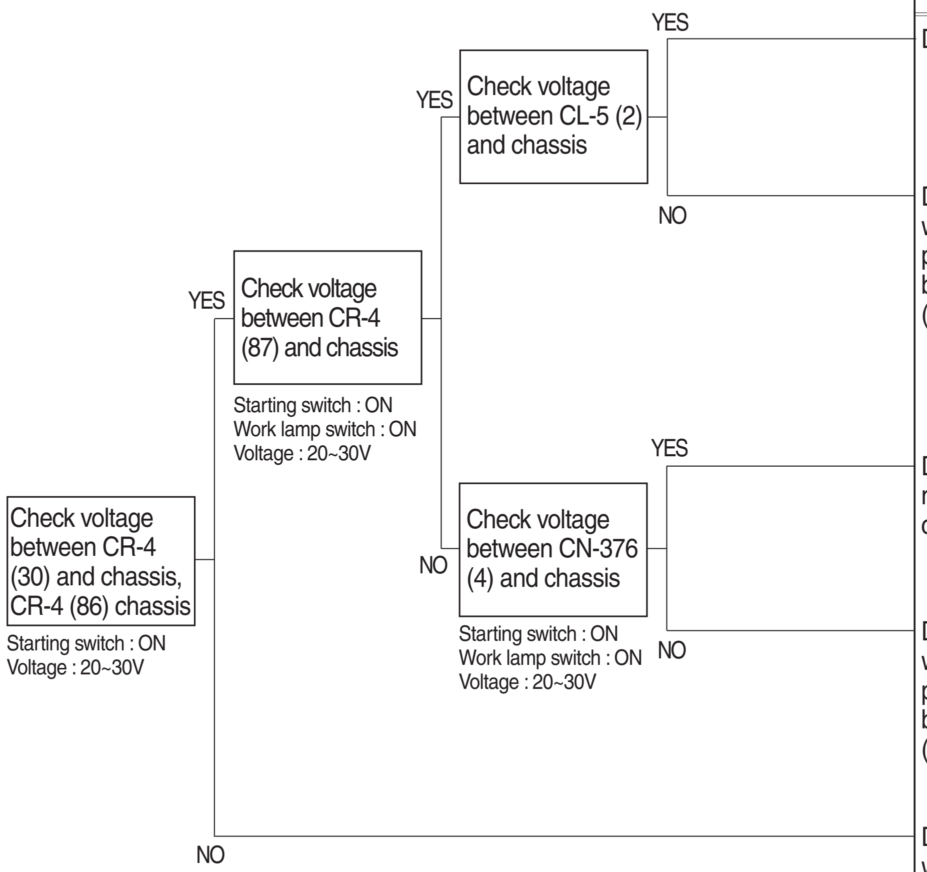


Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-13 (87)-CL-4 (1) or CR-13 (87)-CL-3 (2) or CR-13 (87)-CL-24 (2)	Repair or replace (after clean)
Defective membrance controller	Replace
Disconnection in wiring harness or poor contact between CN-376 (13)-CR-13 (85)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-13 (30) and fuse No.20 or CR-13 (86) - fuse No.20	Repair or replace (after clean)
Recheck fuse No. 20	Replace

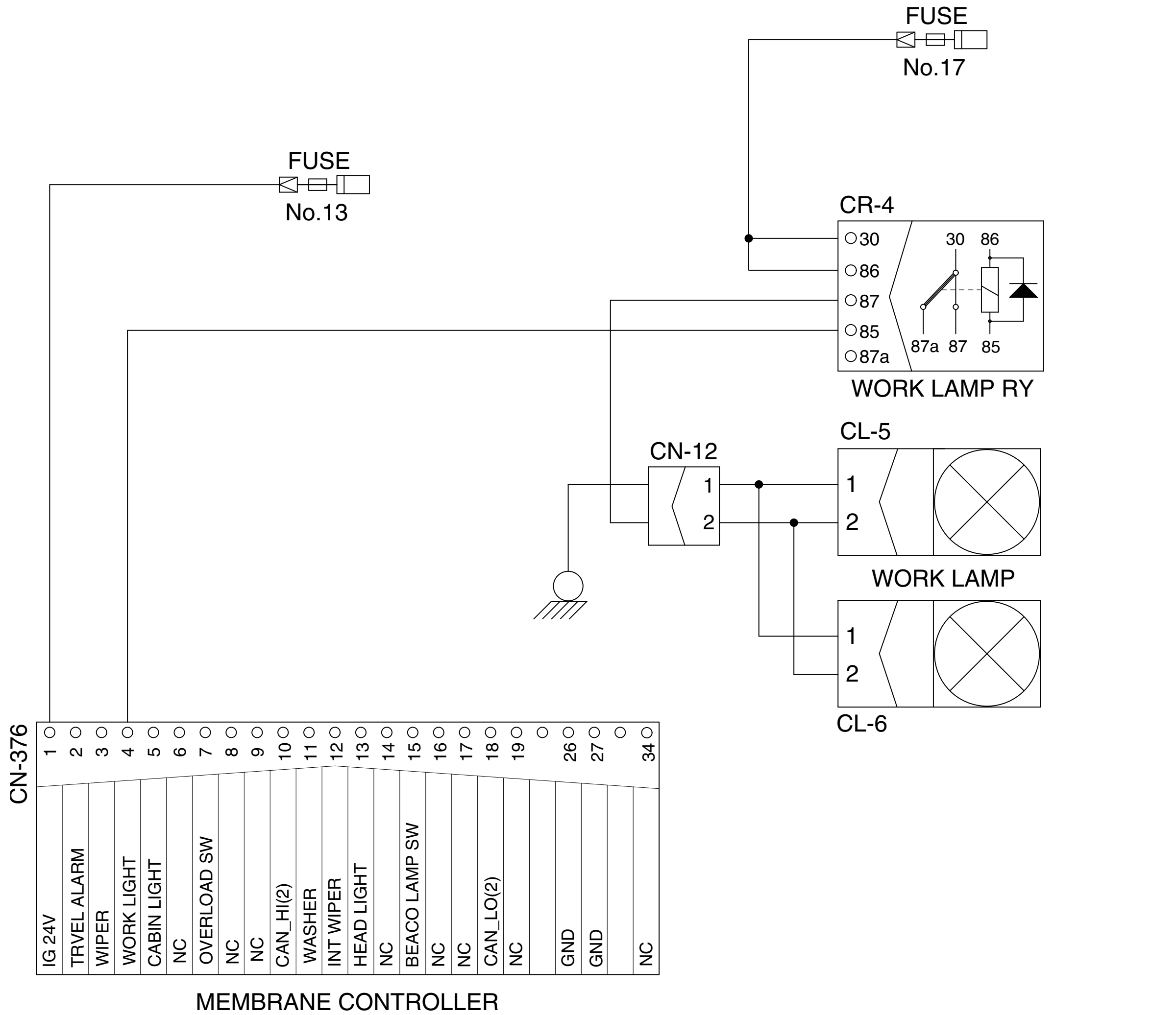


18. WHEN STARTING SWITCH IS TURNED ON, WORK LAMP DOES NOT LIGHTS UP

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



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CL-5 (2)	Repair or replace (after clean)
Defective membrance controller	Replace
Disconnection in wiring harness or poor contact between CR-4 (85)-CN-376 (4)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-4 (30) and fuse No.17 or CR-4 (86) and fuse No.17	Repair or replace (after clean)
Recheck fuse No.17	Replace



140SA6ES18

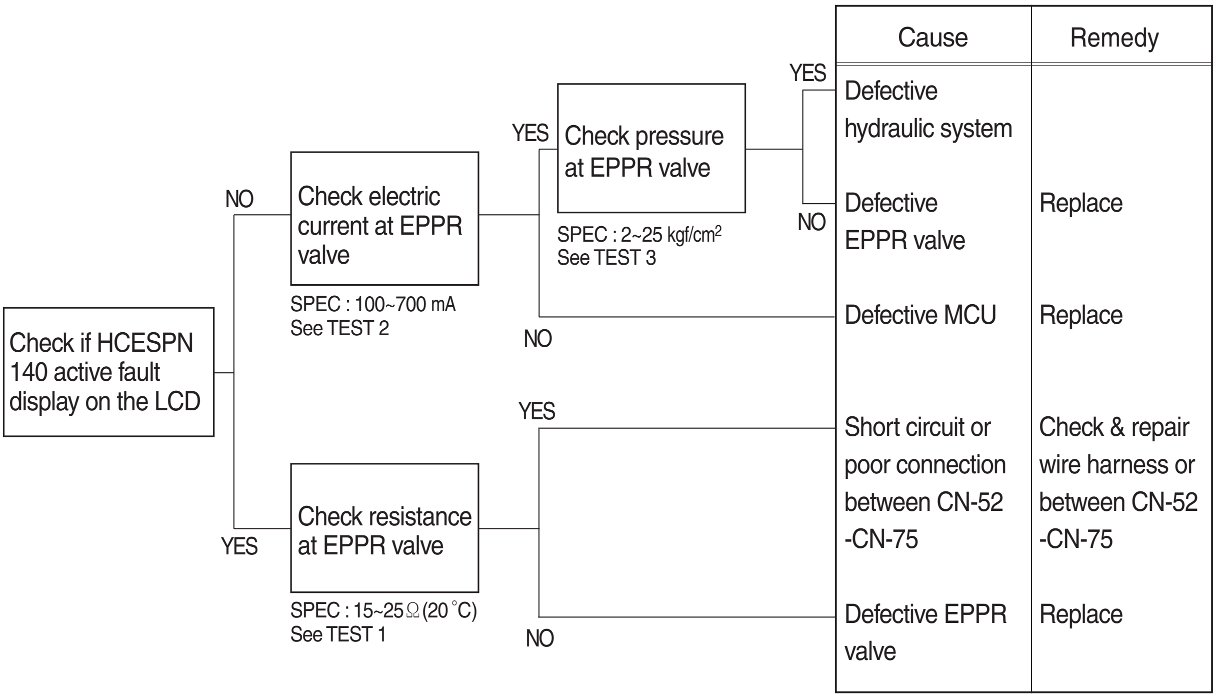
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.

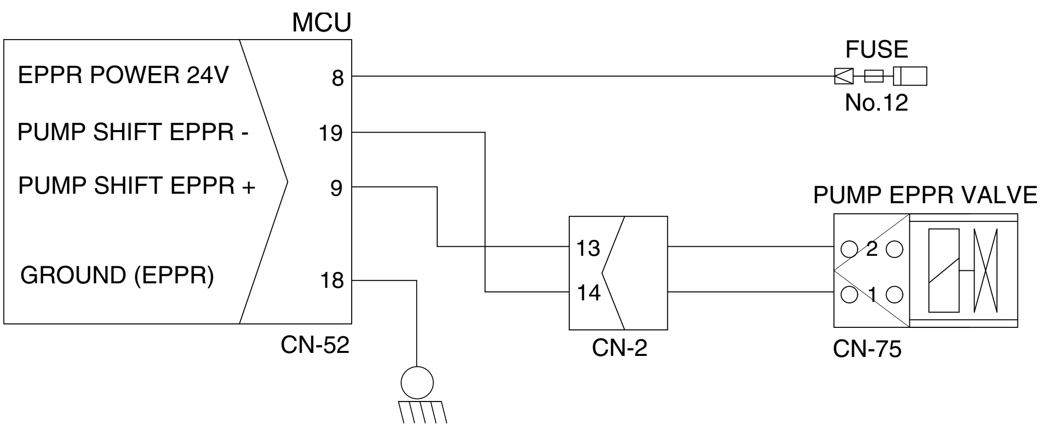
※ Spec : P-mode 1800 ± 50 rpm S -mode 1600 ± 50 rpm E-mode 1500 ± 50 rpm

※ Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

1) INSPECTION PROCEDURE



Wiring diagram



140SA6MS01

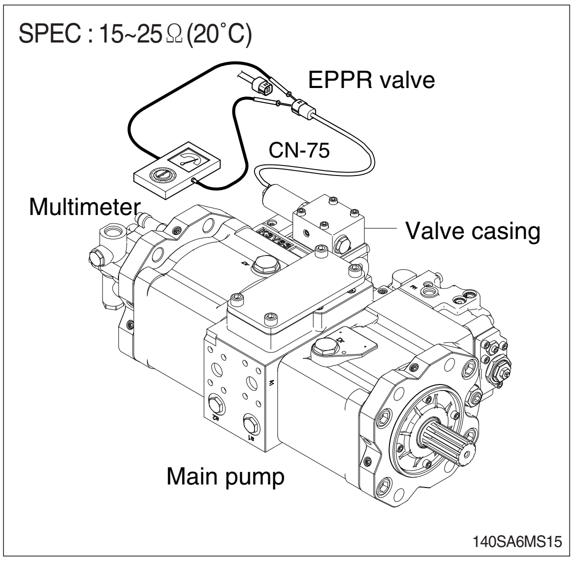
2) TEST PROCEDURE

(1) Test 1 : Check resistance at connector CN-75.

① Starting key OFF.

② Disconnect connector CN-75 from EPPR valve at main hydraulic pump.

③ Check resistance between 2 lines as figure.



(2) Test 2 : Check electric current at EPPR valve.

① Disconnect connector CN-75 from EPPR valve.

② Insert the adapter to CN-75 and install multimeter as figure.

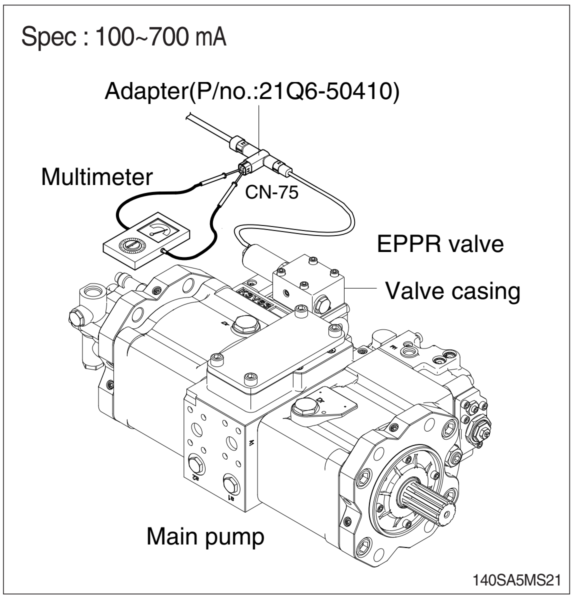
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

⑥ If tachometer show approx 1600±50 rpm disconnect one wire harness from EPPR valve.

⑦ Check electric current at bucket circuit relief position.



(3) **Test 3** : Check pressure at EPPR valve.

① Remove plug and connect pressure gauge as figure.

· Gauge capacity : 0 to 50 kgf/cm^2 (0 to 725 psi)

② Start engine.

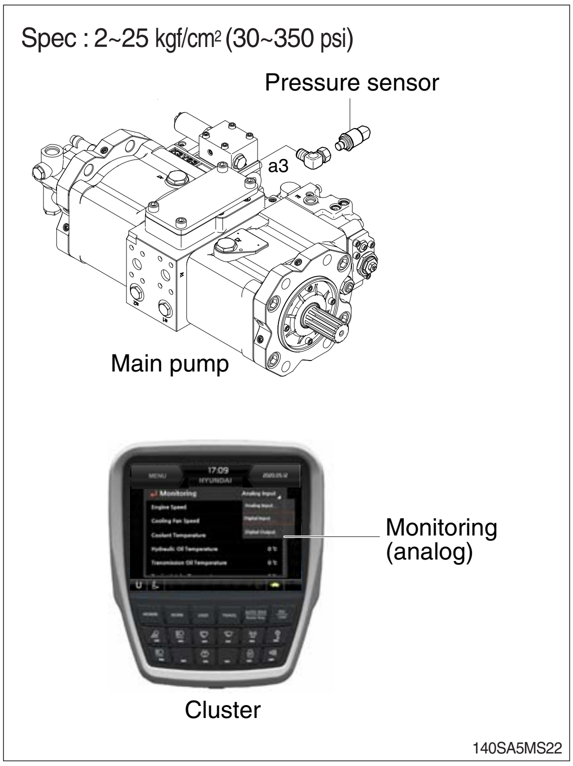
③ Set S-mode and cancel auto decel mode.

④ Position the accel dial at 10.

⑤ Slowly operate control lever of bucket functions at full stroke over relief and measure the EPPR valve pressure by the the monitoring menu of the cluster.

⑥ If pressure is not correct, adjust it.

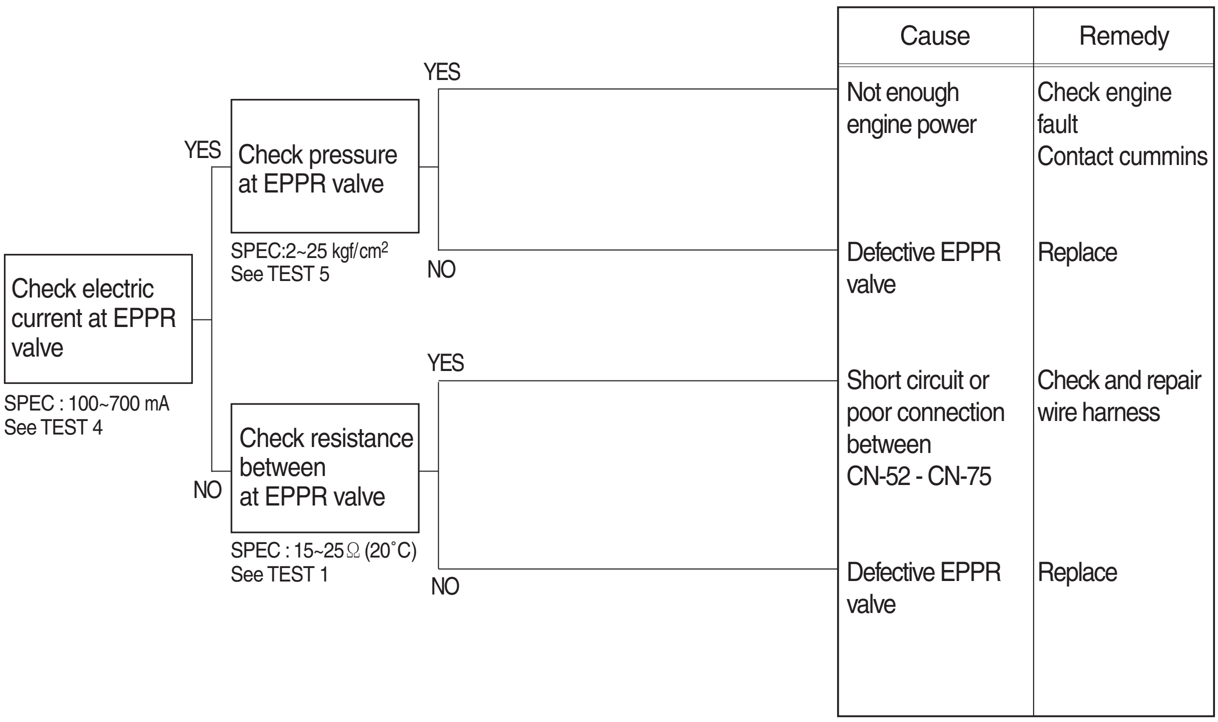
⑦ After adjust, test the machine.



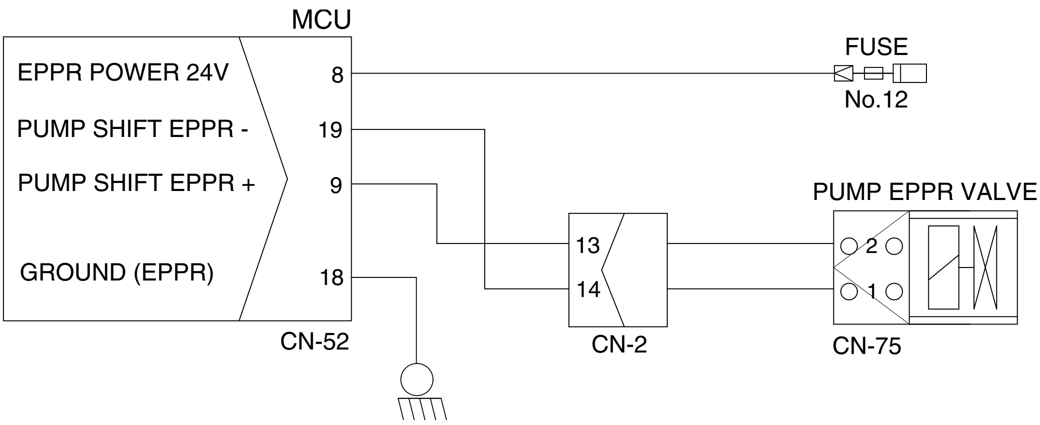
2. ENGINE STALL

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

1) INSPECTION PROCEDURE



Wiring diagram



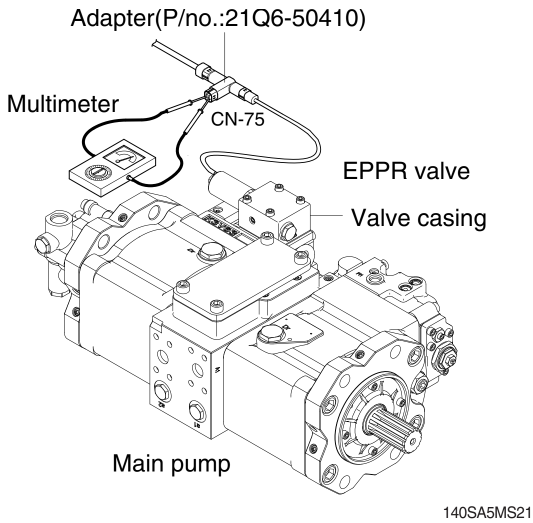
140SA6MS01

2) TEST PROCEDURE

(1) Test 4 : Check electric current at EPPR valve.

① Disconnect connector CN-75 from EPPR valve.
② Insert the adapter to CN-75 and install multimeter as figure.
③ Start engine.
④ Set S-mode and cancel auto decel mode.
⑤ Position the accel dial at 10.
⑥ If rpm show approx 1600±50 rpm disconnect one wire harness from EPPR valve.
⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA

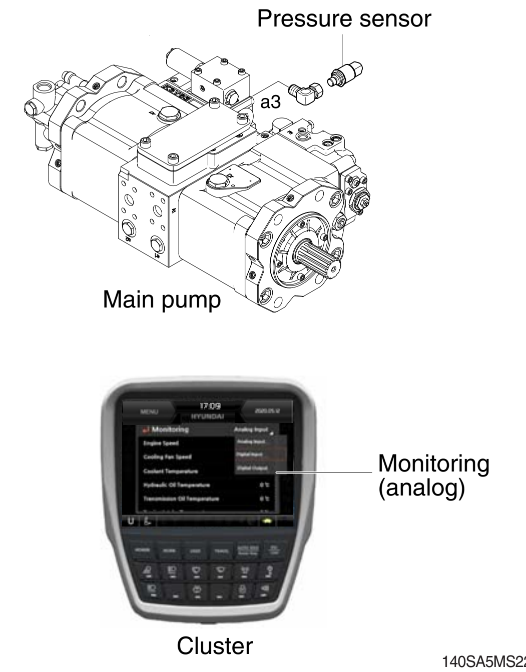


140SA5MS21

(2) Test 5 : Check pressure at EPPR valve.

① Remove plug and connect pressure gauge as figure.
  · Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)
② Start engine.
③ Set S-mode and cancel auto decel mode.
④ Position the accel dial at 10.
⑤ Slowly operate control lever of bucket functions at full stroke over relief and measure the EPPR valve pressure by the the monitoring menu of the cluster.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.

SPEC : 2~25 kgf/cm² (30~350 psi)

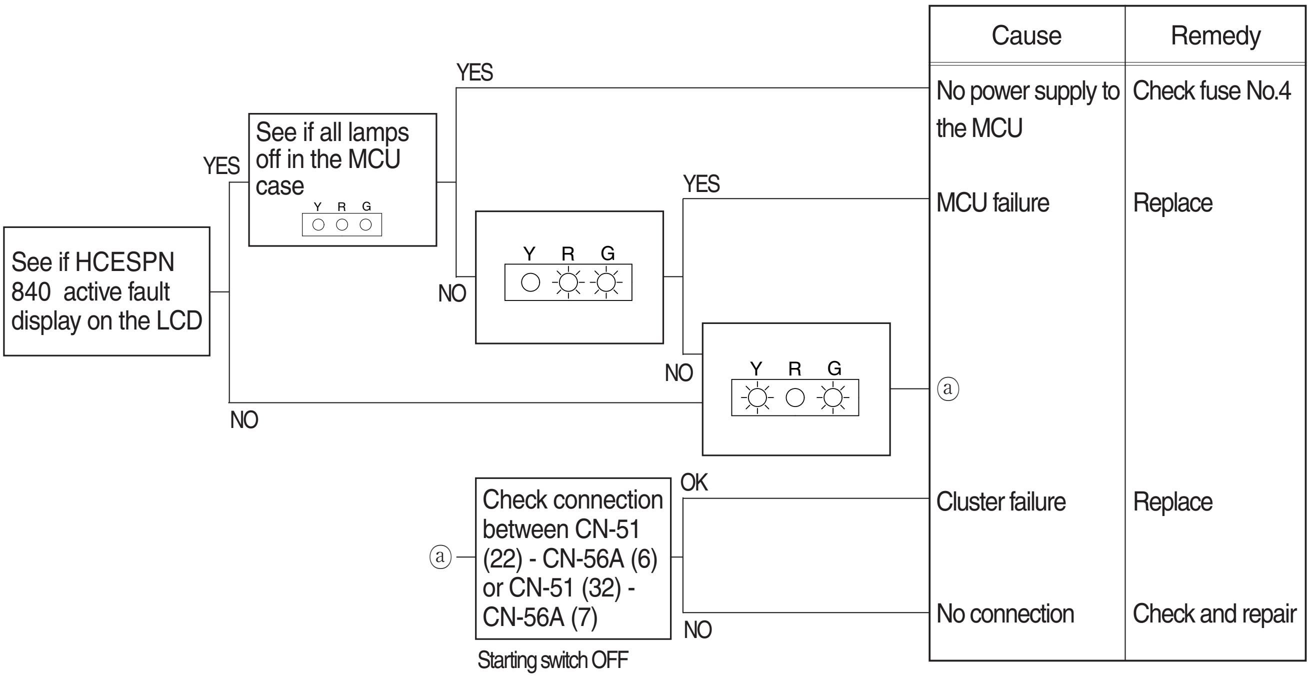


140SA5MS22

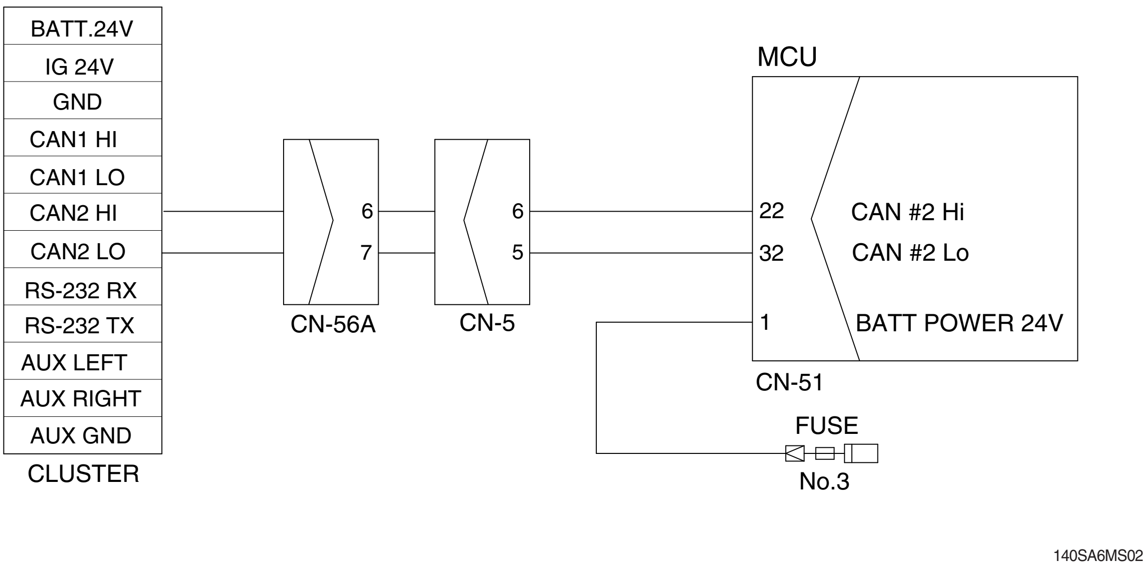
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

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

1) INSPECTION PROCEDURE



Wiring diagram

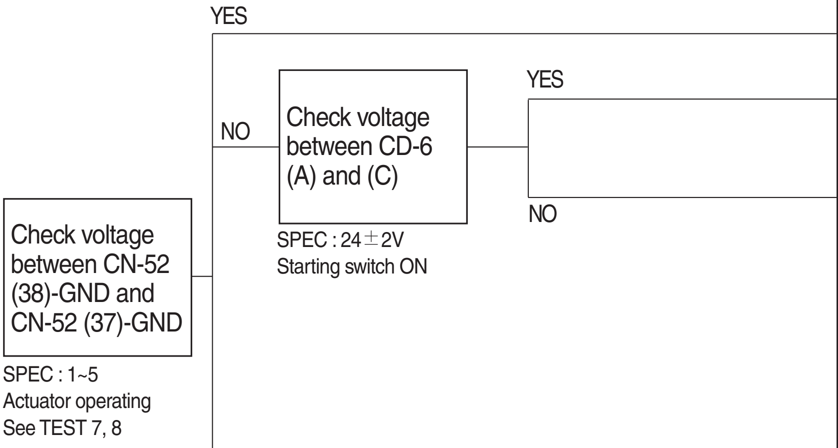


4. AUTO DECEL SYSTEM DOES NOT WORK

· Fault code : HCESPN 105, FMI 0~4 (work pressure sensor)
HCESPN 108, FMI 0~4 (travel oil pressure sensor)

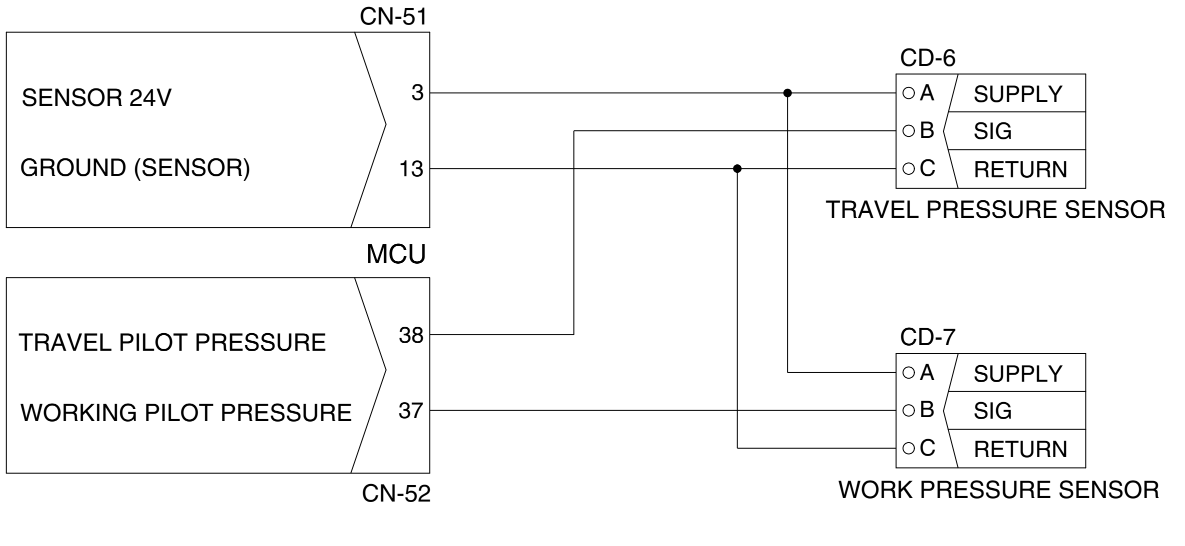
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Defective travel pressure sensor	Replace
Short circuit or poor connection between CN-51 (3)-CD-6 (A) and / or CN-51 (13)-CD-6 (C) (fault code 108 displayed)	Replace or repair
Defective work pressure sensor	Replace
Short circuit or poor connection between CN-51 (3)-CD-7 (A) and / or CN-51 (13)-CD-7 (C) (fault code 105 displayed)	Replace or repair

Wiring diagram



220S6MS03

2) TEST PROCEDURE

(1) Test 7 : Check voltage at CN-52 (38) and ground.

① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (38) of CN-52.

③ Starting switch key ON.

④ Check voltage as figure.

(2) Test 8 : Check voltage at CN-52 (37) and ground.

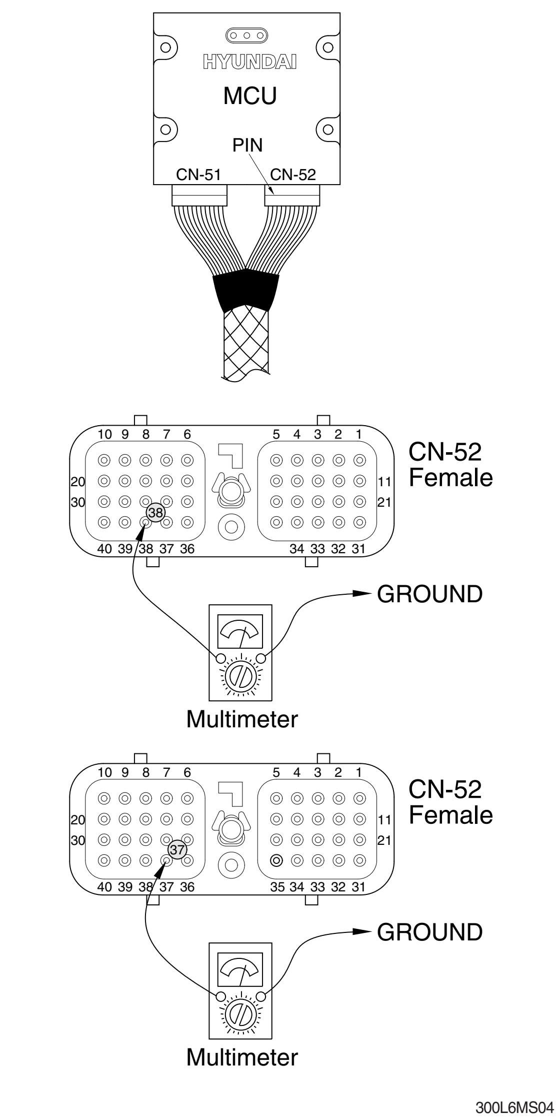
① Prepare 1 piece of thin sharp pin, steel or copper

② Insert prepared pin to rear side of connectors : One pin to (37) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

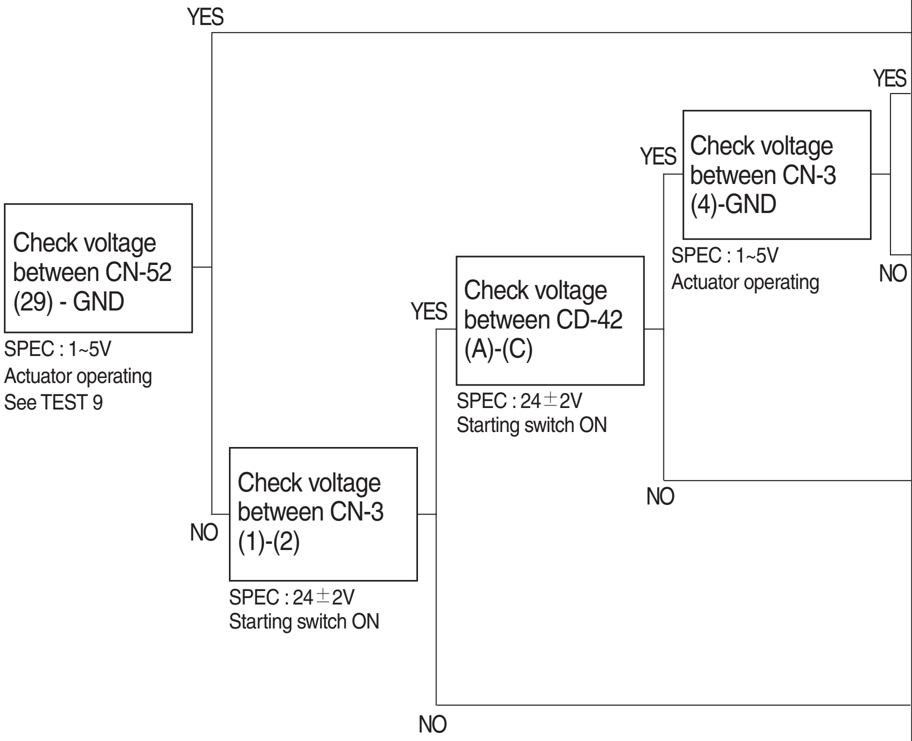


5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

· Fault code : HCESPN 120, FMI 0~4

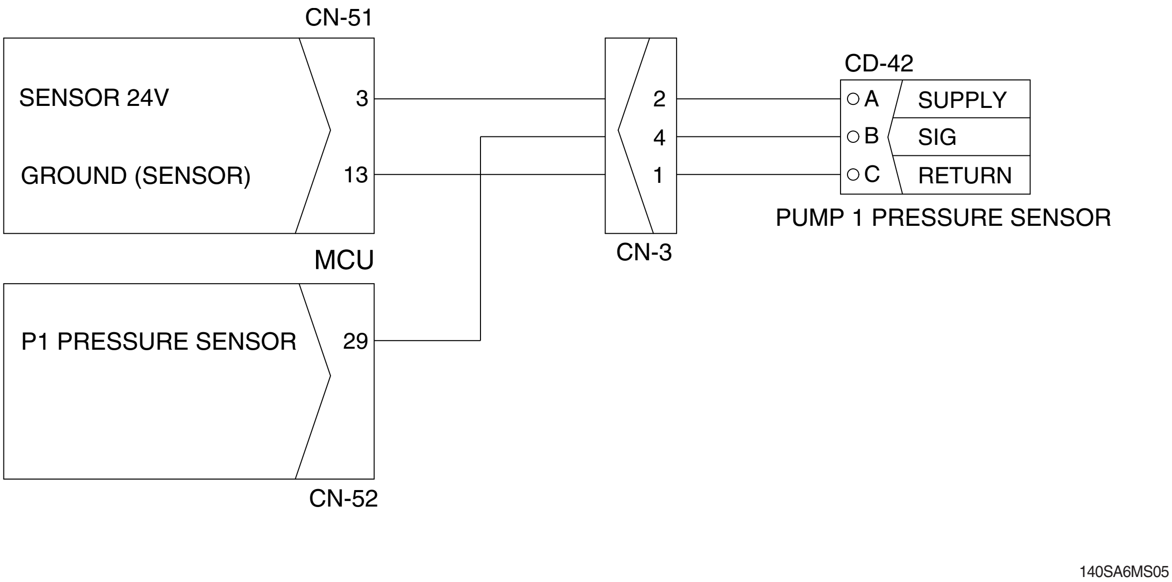
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(29)-CN-3 (4)	Replace or repair
Detective P1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-3 (4)-CD-42 (B)	Replace or repair
Short circuit or poor connection between CD-42 (A)-CN-3 (2) or CD-42 (C)-CN-3 (1)	Replace or repair
Short circuit or poor connection between CN-3 (2)-CN-51 (3) or CN-3 (1) - CN-51 (13)	Replace or repair

Wiring diagram



2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (29) and ground.

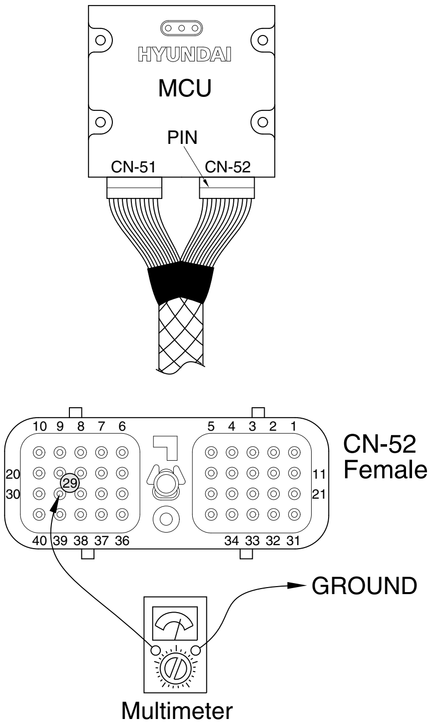
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (29) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



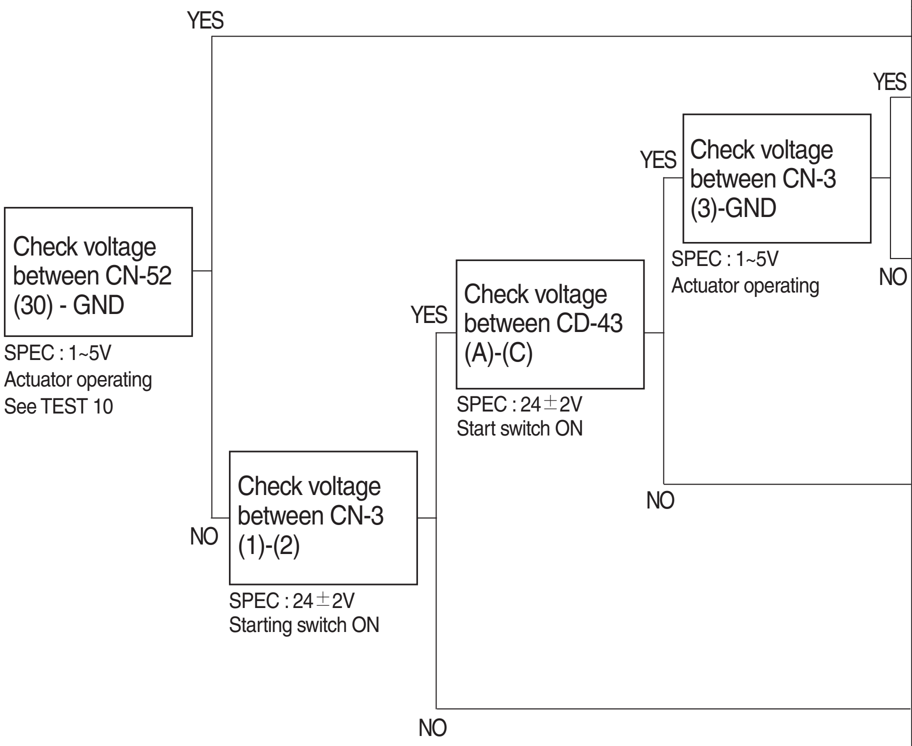
300L6MS06

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

· Fault code : HCESPN 121, FMI 0~4

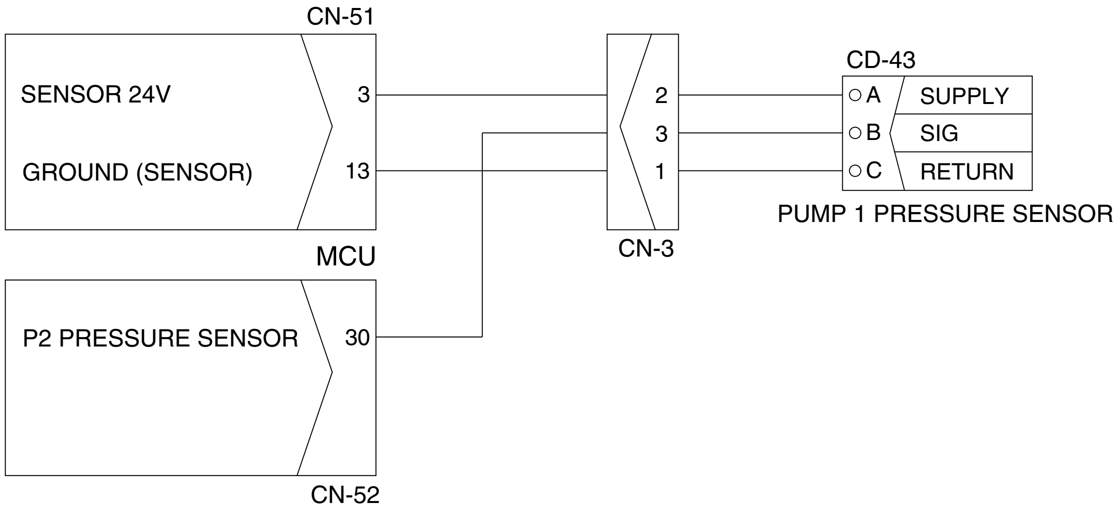
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(30)-CN-3 (3)	Replace or repair
Detective P2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-3 (3)-CD-43 (B)	Replace or repair
Short circuit or poor connection between CD-43 (A)-CN-3 (2) or CD-43 (C)-CN-3 (1)	Replace or repair
Short circuit or poor connection between CN-3 (2)-CN-51 (3) or CN-3 (1)-CN-51 (13)	Replace or repair

Wiring diagram



140SA6MS07

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-52 (30) and ground.

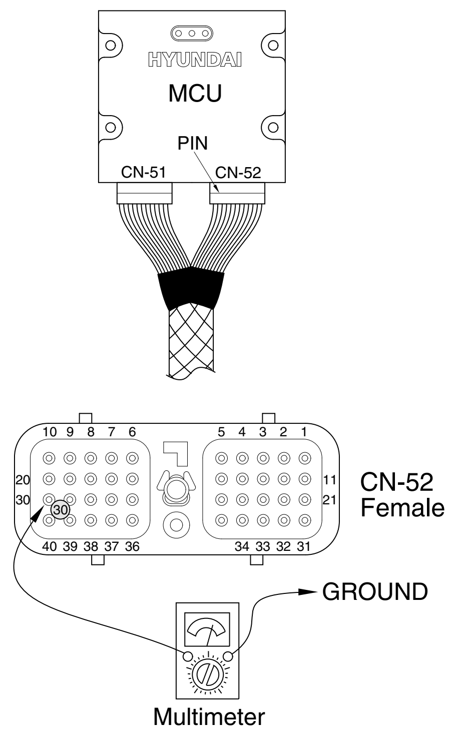
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (30) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



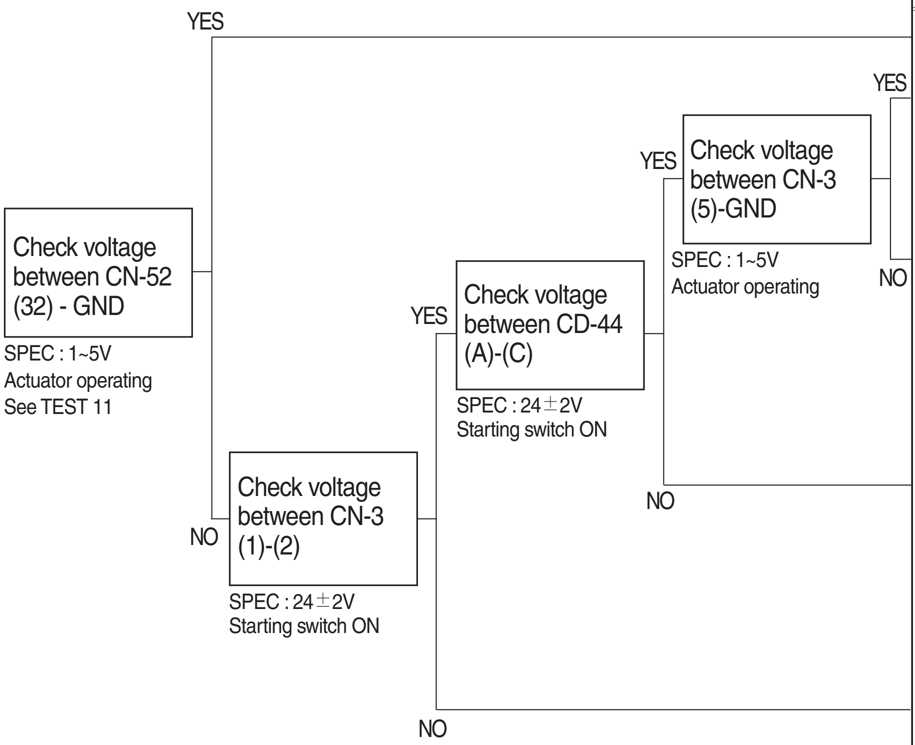
220S6MS08

7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR

· Fault code : HCESPN 125, FMI 0~4

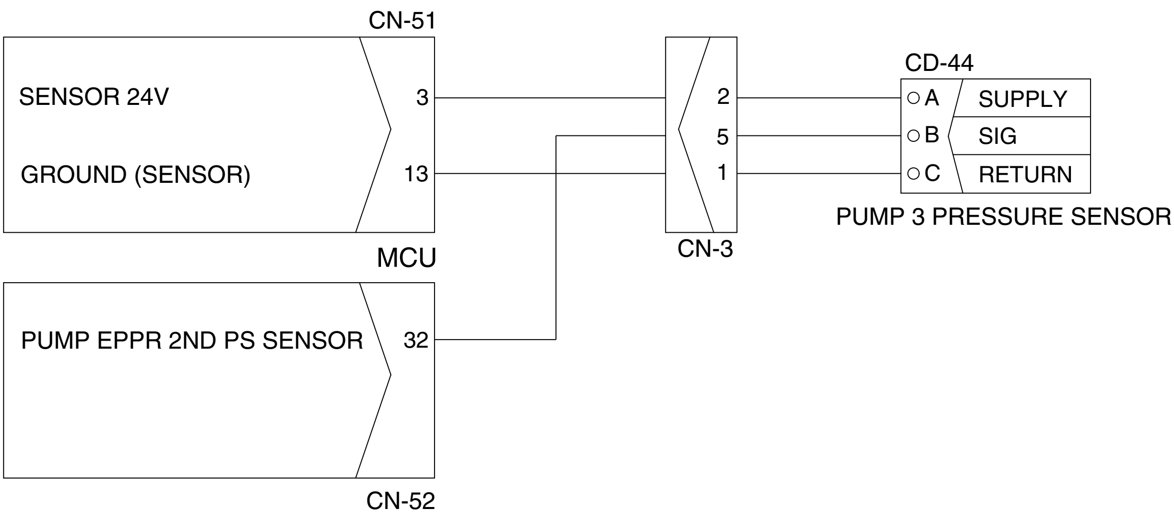
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(32)-CN-3 (5)	Replace or repair
Detective P3 pressure sensor	Replace or repair
Short circuit or poor connection between CN-3 (5)-CD-44 (B)	Replace or repair
Short circuit or poor connection between CD-44 (A)-CN-3 (2) or CD-44 (C)-CN-3 (1)	Replace or repair
Short circuit or poor connection between CN-3 (2)-CN-51 (3) or CN-3 (1)-CN-51 (13)	Replace or repair

Wiring diagram



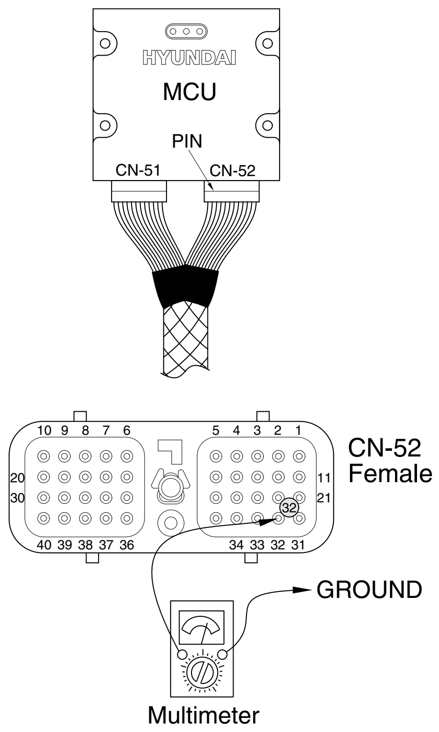
140SA6MS09

2) TEST PROCEDURE

(1) Test 11 : Check voltage at CN-52 (32) and ground.

① Prepare 1 piece of thin sharp pin, steel or copper.
② Insert prepared pin to rear side of connectors : One pin to (32) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



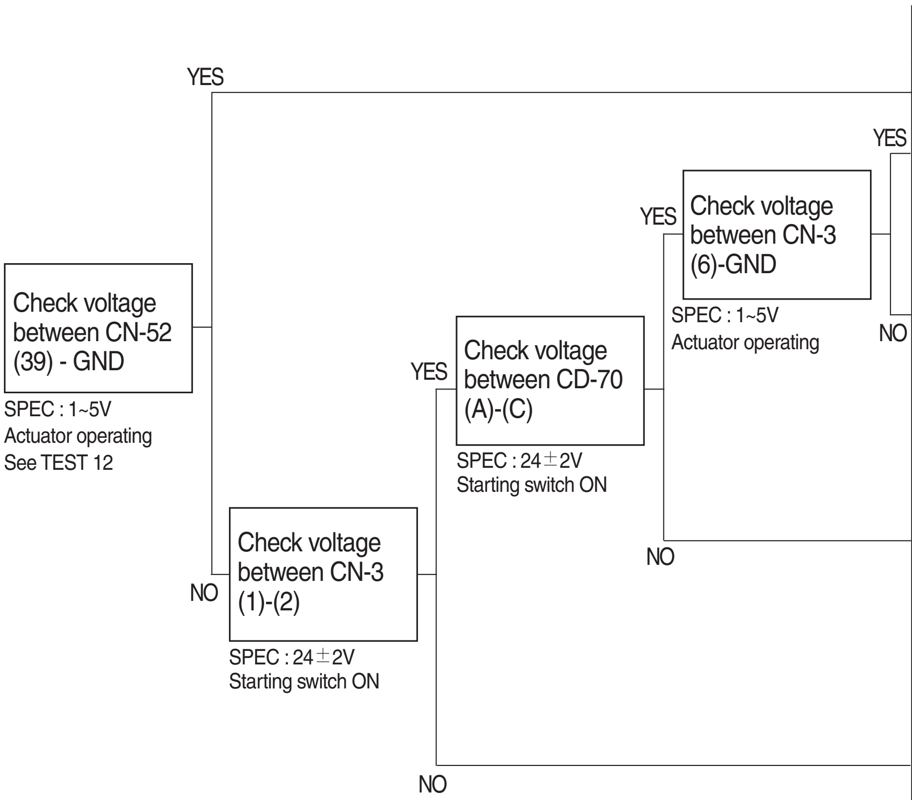
300L6MS10

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

· Fault code : HCESPN 123, FMI 0~4

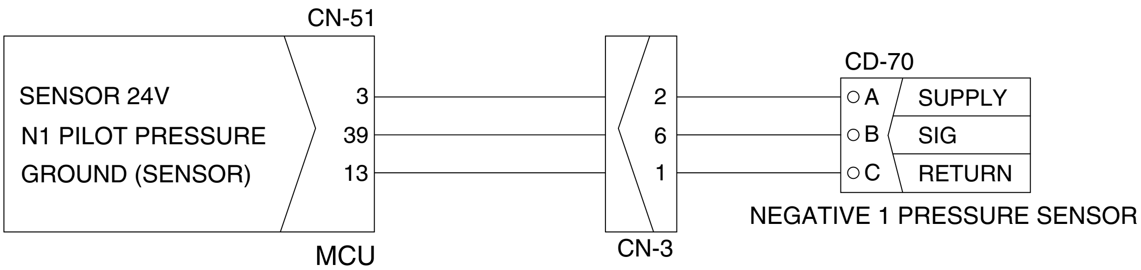
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(39)-CN-3 (6)	Replace or repair
Detective N1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-3 (6)-CD-70 (B)	Replace or repair
Short circuit or poor connection between CD-70 (A)-CN-3 (2) or CD-70 (C)-CN-3 (1)	Replace or repair
Short circuit or poor connection between CN-3 (2)-CN-51 (3) or CN-3 (1)-CN-51 (13)	Replace or repair

Wiring diagram



140SA6MS11

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-51 (39) and ground.

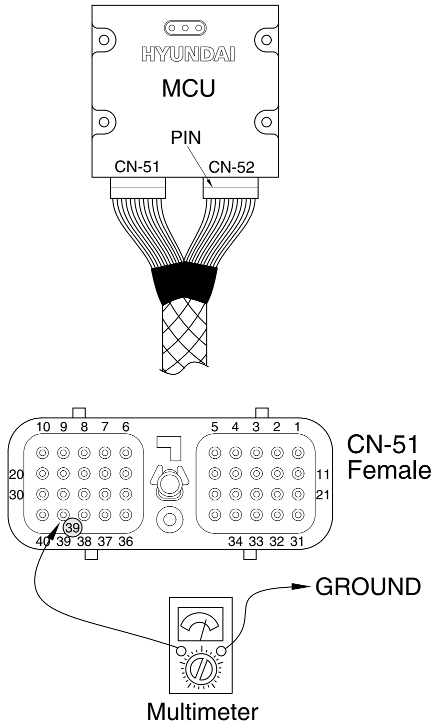
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (39) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



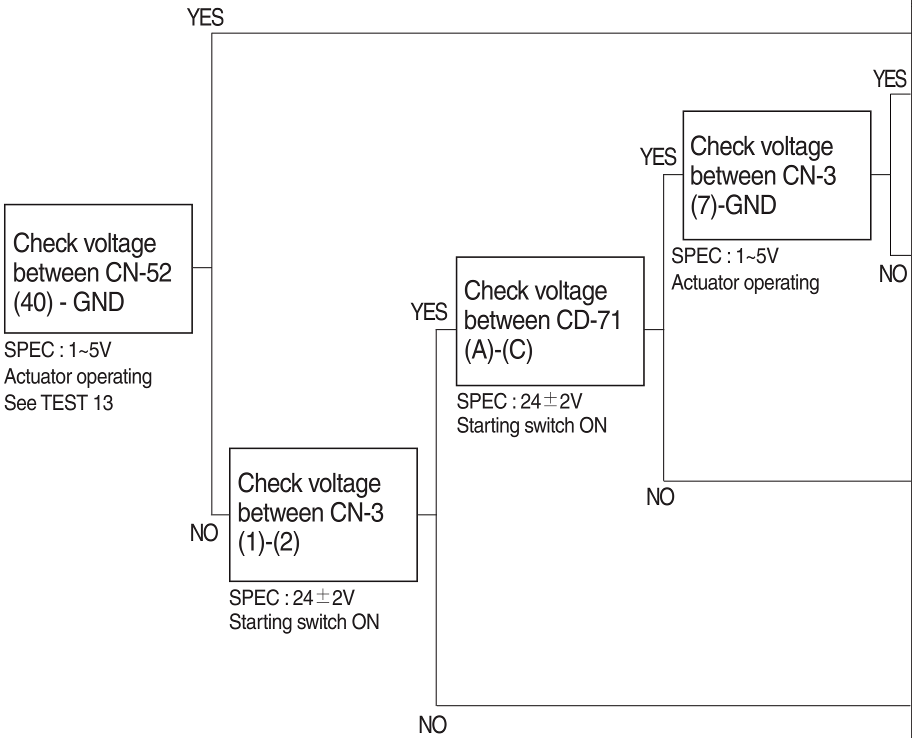
140SA6MS12

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

· Fault code : HCESPN 124, FMI 0~4

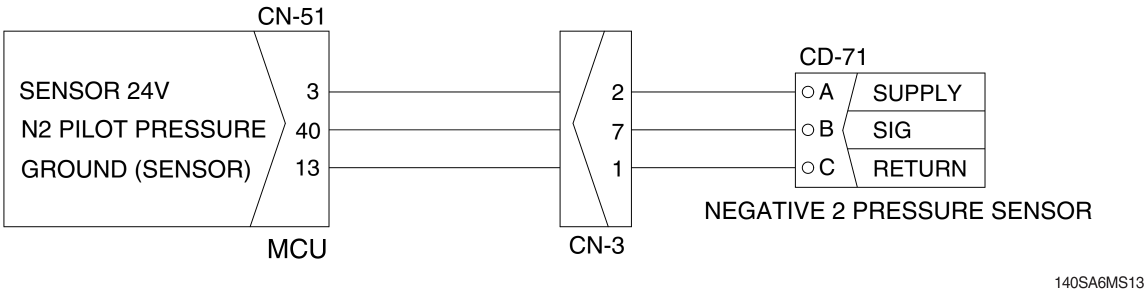
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(40)-CN-3 (7)	Replace or repair
Detective N2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-3 (5)-CD-71 (B)	Replace or repair
Short circuit or poor connection between CD-71 (A)-CN-3 (2) or CD-71 (C)-CN-3 (1)	Replace or repair
Short circuit or poor connection between CN-3 (2)-CN-51 (3) or CN-3 (1)-CN-51 (13)	Replace or repair

Wiring diagram



2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-51 (40) and ground.

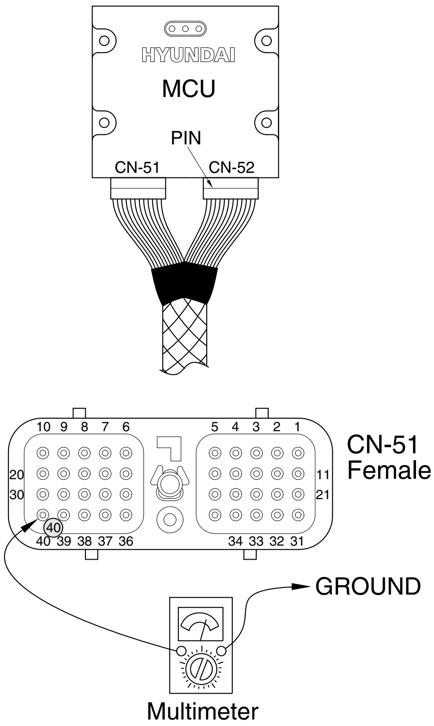
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (40) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



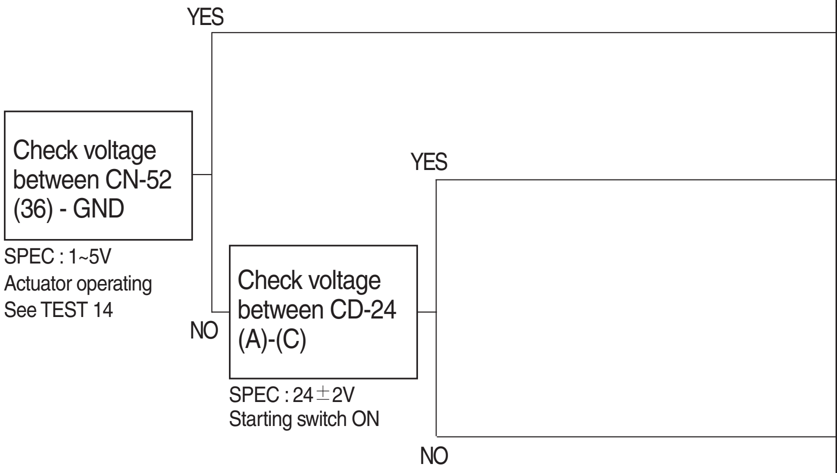
140SA6MS14

10. MALFUNCTION OF SWING PRESSURE SENSOR

· Fault code : HCESPN 135, FMI 0~4

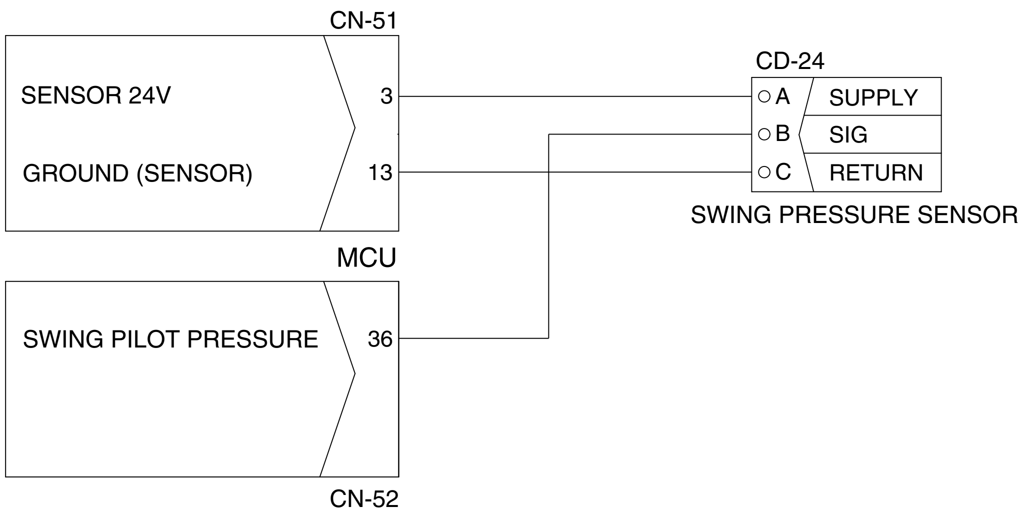
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Detective swing pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (36)-CD-24 (B)	Replace or repair
Short circuit or poor connection between CD-24 (A)-CN-51 (3) or CD-24 (C)- CN-51 (13)	Replace or repair

Wiring diagram



220S6MS15

2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (36) and ground.

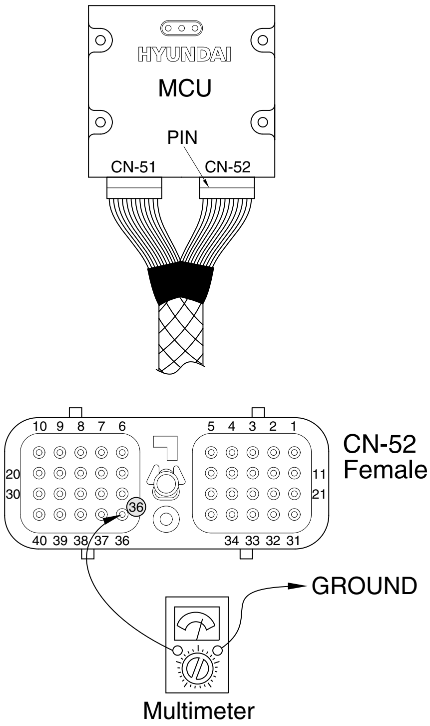
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (36) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



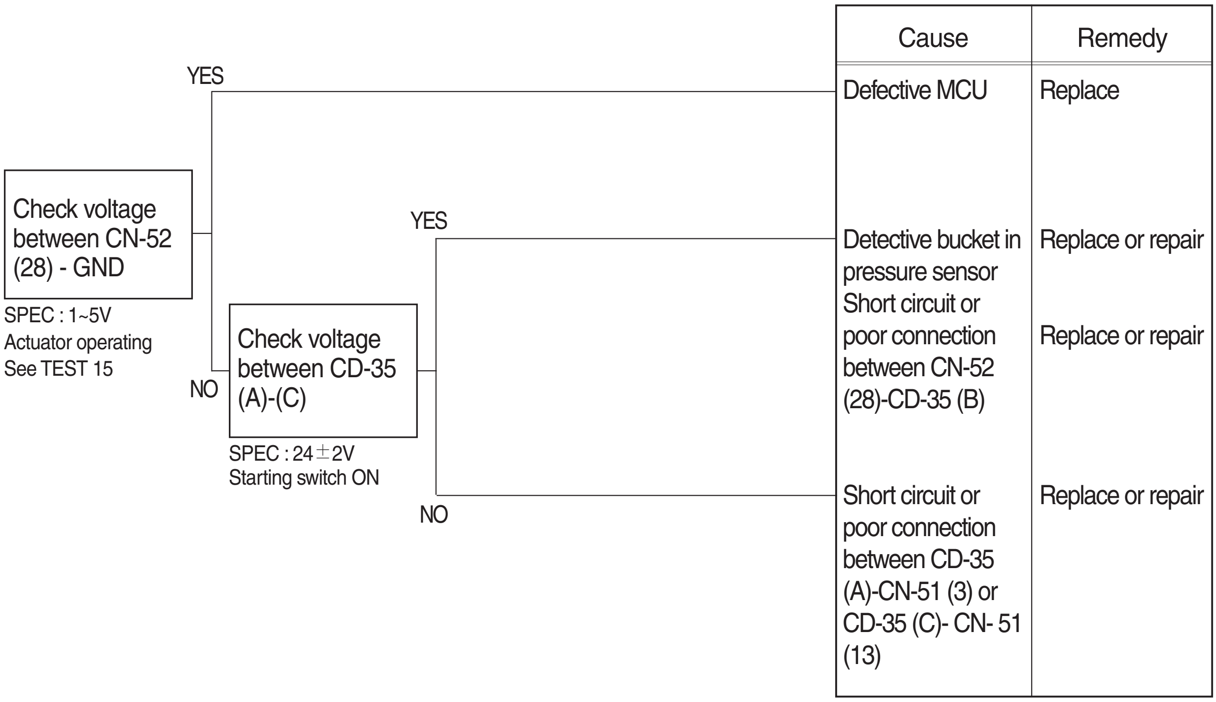
300L6MS16

11. MALFUNCTION OF BUCKET IN PRESSURE SENSOR

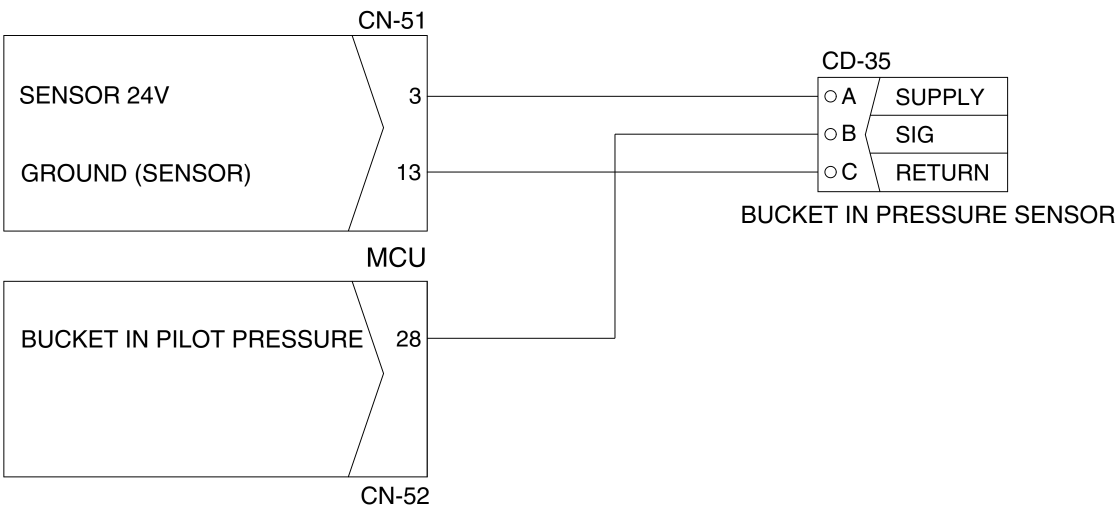
· Fault code : HCESPN 131, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



140SA6MS17

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-52 (28) and ground.

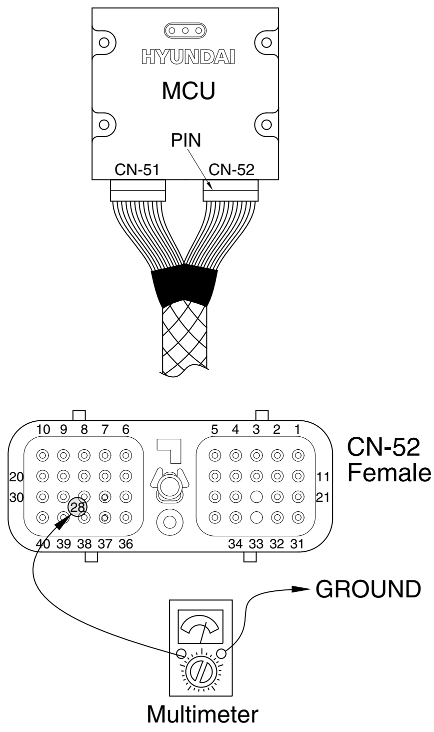
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (28) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



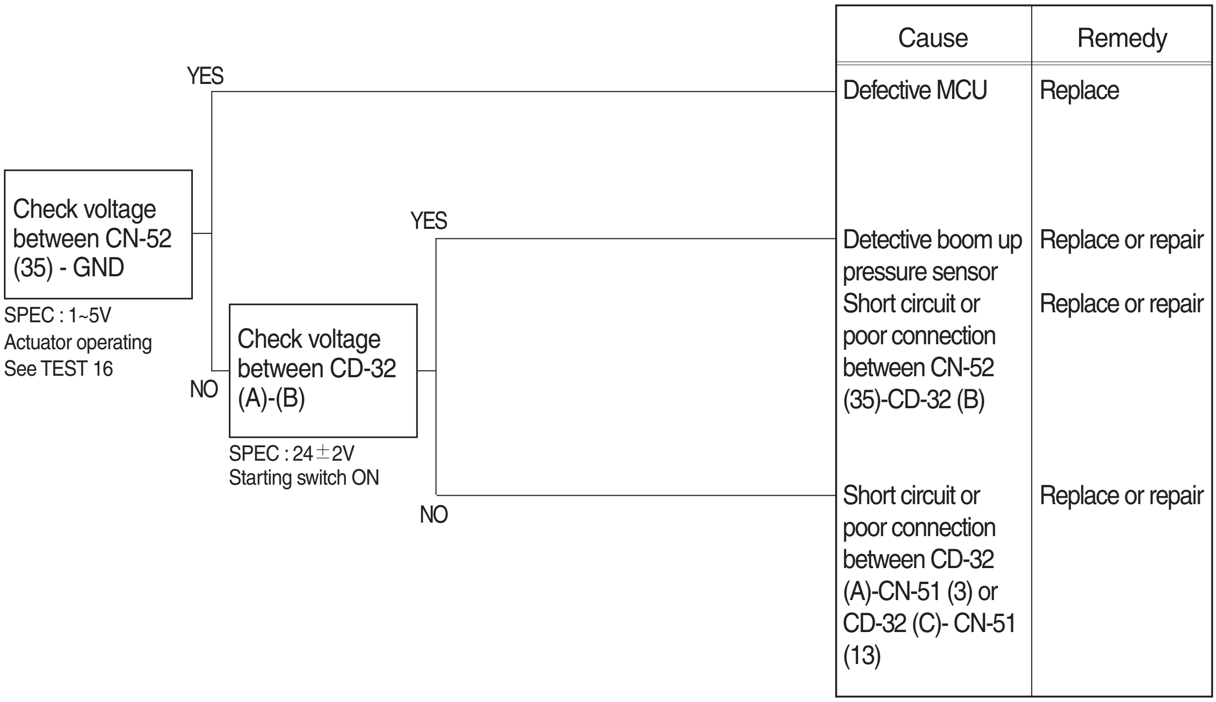
140SA6MS18

12. MALFUNCTION OF BOOM UP PRESSURE SENSOR

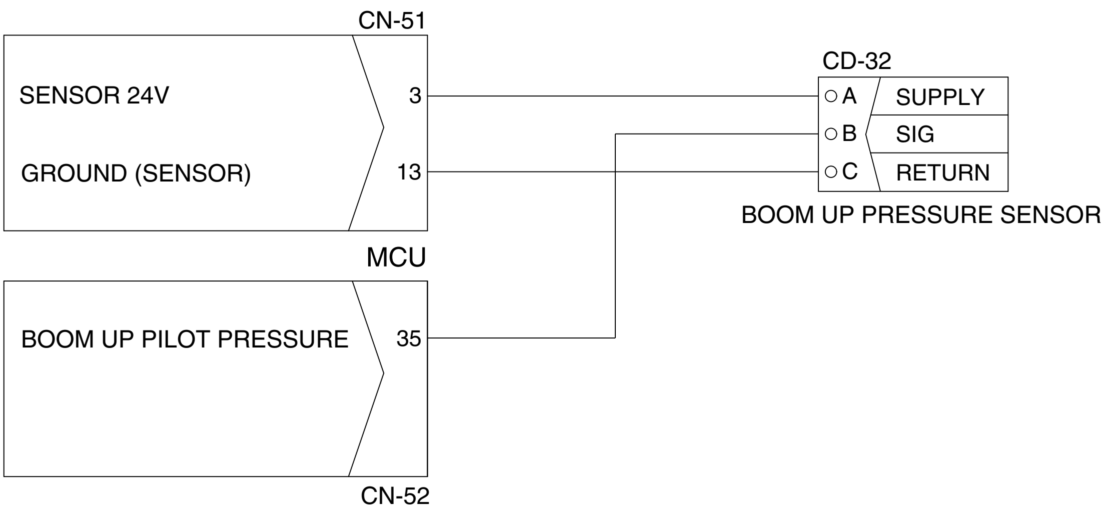
· Fault code : HCESPN 127, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



220S6MS19

2) TEST PROCEDURE

(1) Test 16 : Check voltage at CN-52 (35) and ground.

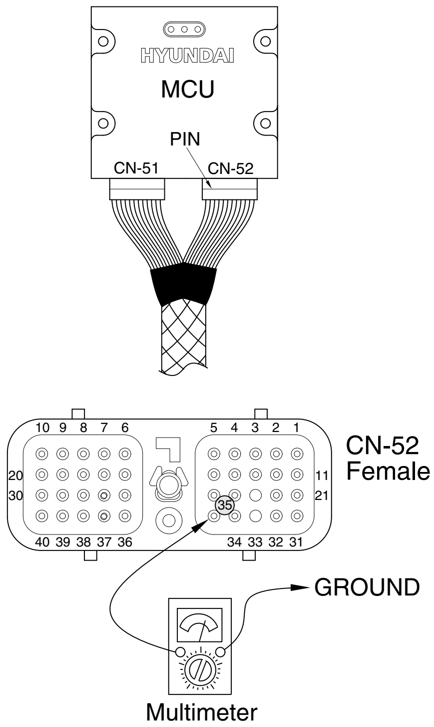
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (35) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



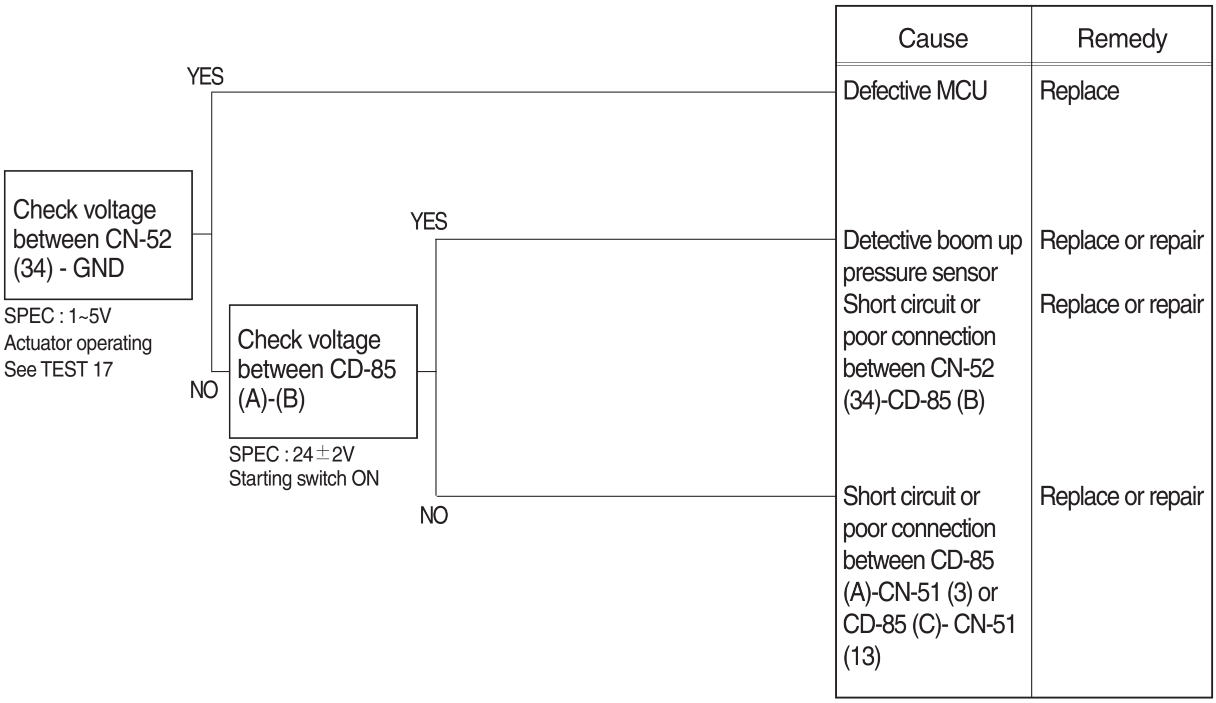
220S6MS20

13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

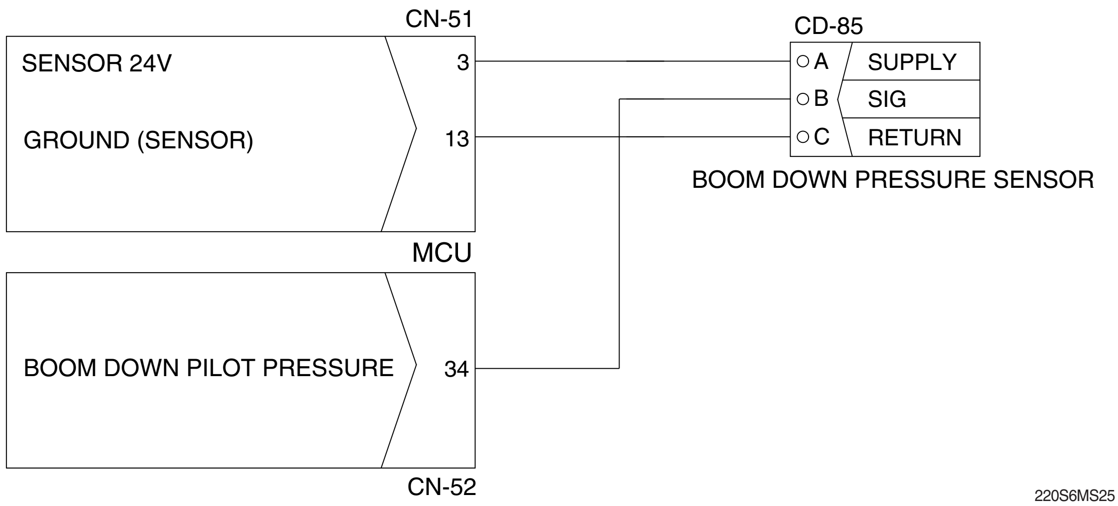
· Fault code : HCESPN 128, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-52 (34) and ground.

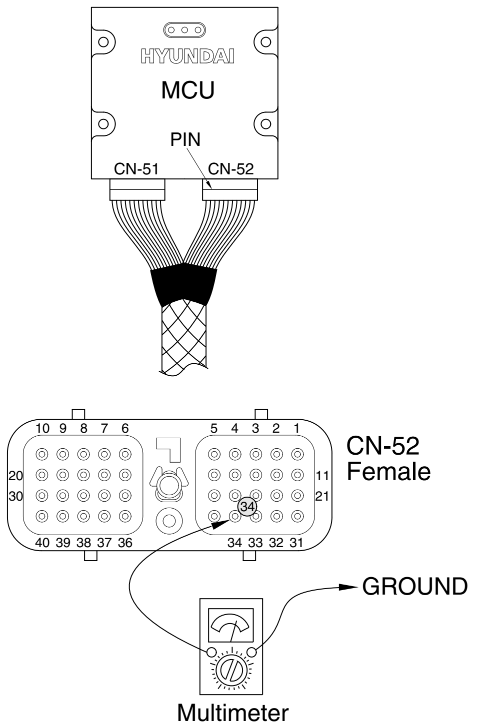
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (34) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



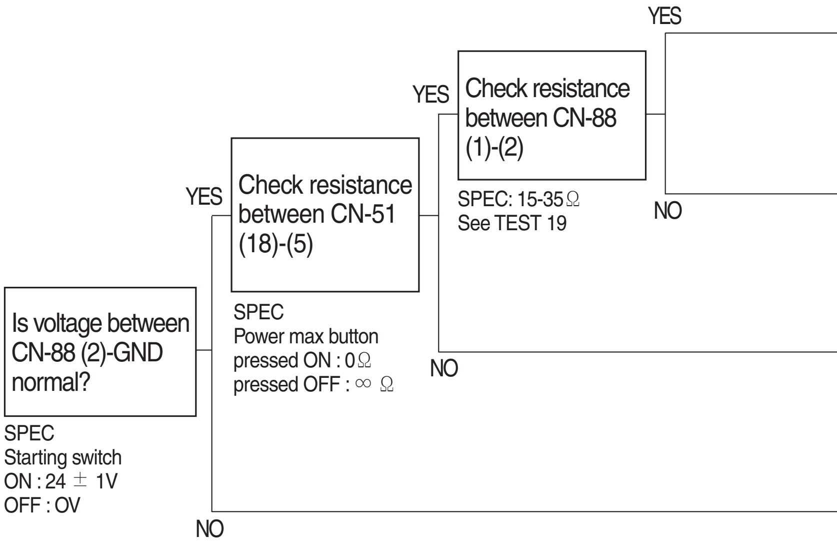
220S6MS26

14. MALFUNCTION OF POWER MAX

· Fault code : HCESPN 166, FMI 4 or 6

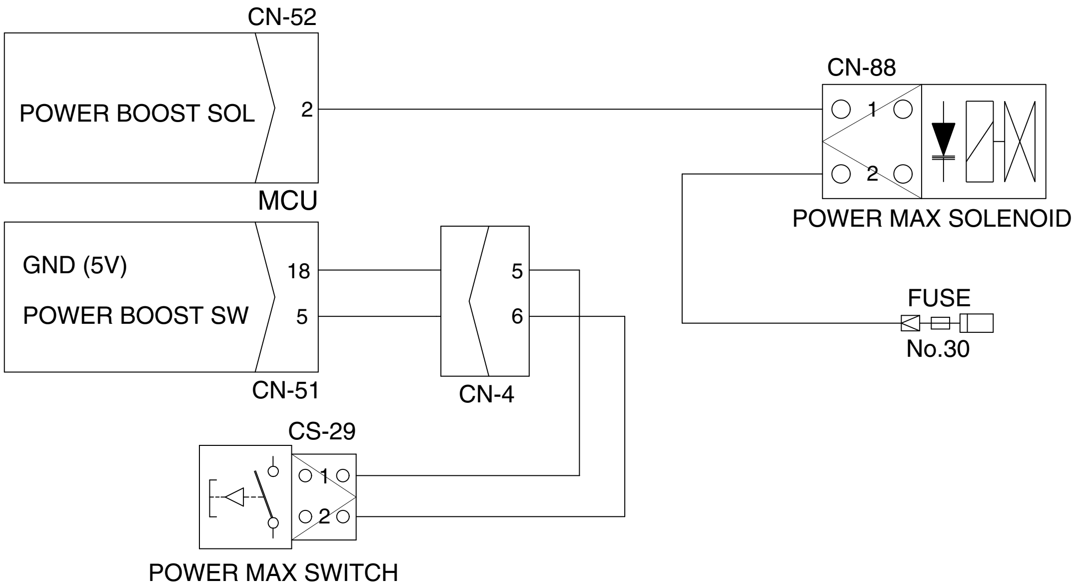
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Short circuit or poor connection between CN-88 (1)-CN-52 (2)	Repair or replace
Defective power max. solenoid valve Check hydraulic system	Repair or replace
Short circuit or poor connection between CN-51 (18)-CS-29 (1)	Repair or replace
Short circuit or poor connection between CN-88 (2)-Fuse No. 30	Repair or replace

Wiring diagram



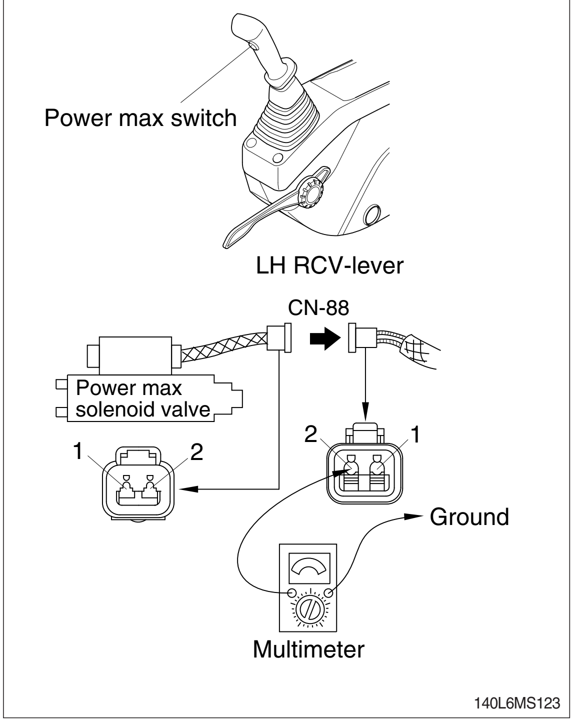
140SA6MS21

2) TEST PROCEDURE

(1) Test 18: Check voltage between connector CN-88 (2) - GND.

① Disconnect connector CN-88 from power max solenoid valve.
② Start switch ON.
③ Check voltage as figure.

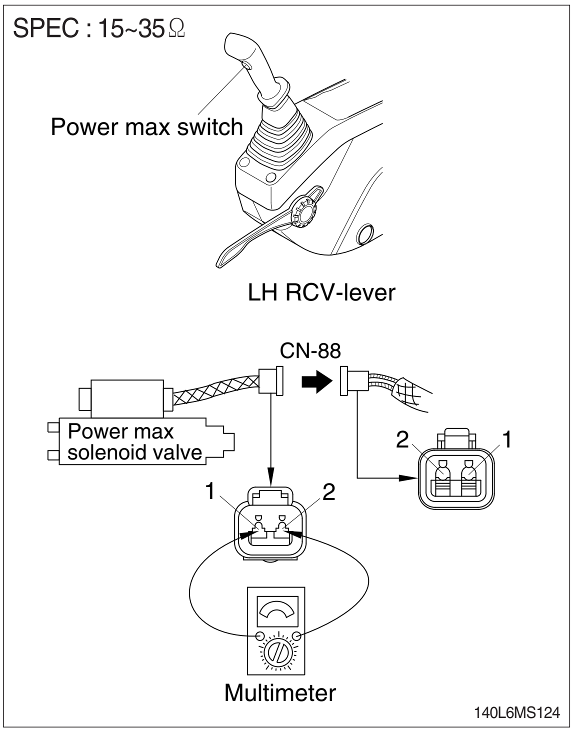
SPEC : Starting switch ON : 24±1V
Starting switch OFF : 0V



(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting switch OFF.
② Disconnect connector CN-88 from power max solenoid valve.
③ Check resistance as figure.

SPEC : 15~35Ω



15. MALFUNCTION OF BOOM PRIORITY EPPR VALVE

· Fault code : HCESPN 141, FMI 5 or 6

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

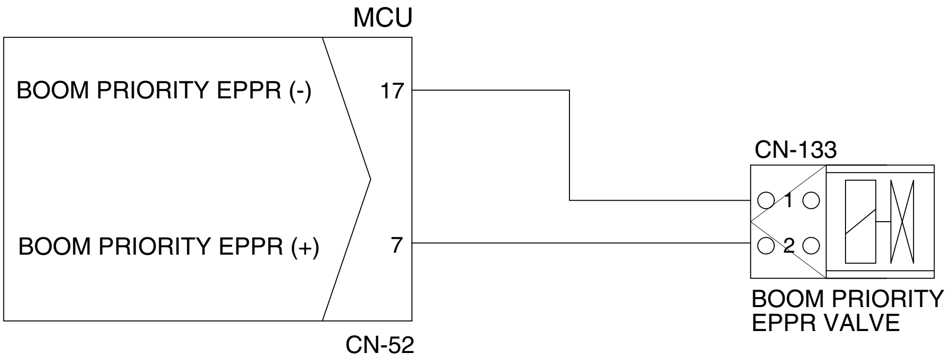
1) INSPECTION PROCEDURE

Check resistance between CN-133 (1)-(2)

SPEC : 20~30V
Starting switch : ON

	Cause	Remedy
YES	Short circuit or poor connection between CN-52 (17)-CN-133 (1) or CN-52 (7)-CN-133 (2)	Repair or replace
NO	Defective EPPR valve	Repair or replace

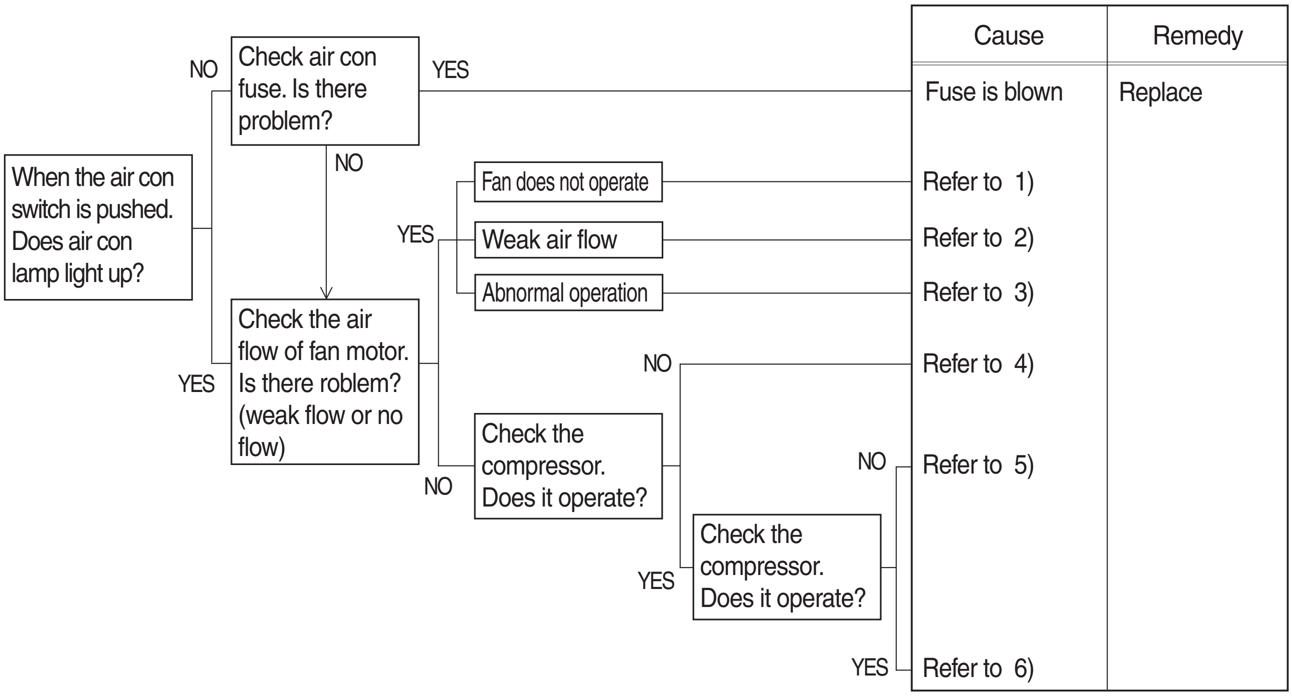
Wiring diagram



220S6MS23

GROUP 5 AIR CONDITIONER & HEATER SYSTEM

1. AIR CONDITIONER DOES NOT OPERATE



1) FAN DOES NOT OPERATE

Cause	Check	Remedy
Fuse is blown or abnormal relay operation	* Fuse * Does relay normally operate?	Replace
Harness short or poor contact	Check any harness short or abnormal contact of connnector	Repair shortage
Fan motor failure	Supply 24V to 2 lead wire from motor and check the operation	Replace
Resistor is broken	Check current flow of resistor with tester	Replace
Fan switch failure	Push fan switch by turn and check the operation	Replace

2) WEAK AIR FLOW FROM FAN MOTOR

Cause	Check	Remedy
Clogged evaporator or obstacles around air inlet	Check if evaporator is contaminated	Clean
Leakage of air flow	Check HVAC case assembly	Adjust
Duct sensor failure	Check if evaporator is frozen	Replace

3) ABNORMAL OPERATION OF FAN MOTOR

Cause	Check	Remedy
Abnormal operation of each step of control	4 step only operate	Replace resistor
	1 or 2 step does not operate	Replace control
	3 or 4 step does not operate	Replace relay

4) COMPRESSOR DOES NOT ROTATE OR HARDLY ROTATE

Cause	Check	Remedy
Loose belt	Belt shaking is severe	Adjust tension
Failure of compressor itself	Belt slip	Repair or Replace
Low voltage of battery	Slip when rotate	Charge battery
Fieldcoil short	Slip when rotate	Replace magnetic clutch
Oily clutch face	Contamination around clutch	Replace magnetic clutch, clean
Fieldcoil is broken	Magnetic clutch does not operate or "∞" resistance	Replace compressor
Leakage of refrigerant or oil inside	Check if wet with oil	Replace compressor Charge refrigerant

5) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Shortage of refrigerant	When air con operate during 5~10 min small temperature difference between high and low pressure pipes.	Repair leakage joint Charge refrigerant
Overcharge of refrigerant	*Magnetic clutch on/off rapidly *High pressure over specification *Lukewarm air from nozzle	Recharge refrigerant following specification
Lower pressure than normal condition at low side	Shortage of refrigerant	Make up refrigerant
	Clogged receive dryer	Replace receive dryer
	Clogged expansion valve	Replace expansion valve
	Clogged or crushed pipe	Replace pipe or clean
	Failure of duct sensor	Replace duct sensor

6) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Lower pressure than normal condition at low side	Failure of duct sensor Magnetic clutch off before air temperature sufficiently down	Replace duct sensor or adjust location
	Defective compressor gasket When compressor off, high and low pressure balance immediatly	Repair compressor or Replace
Higher pressure than normal condition at high side	Failure of condensing Contamination on condenser or insufficient air flow from fan	Clean the condenser Repair fan
	Overcharge of refrigerant	Adjust refrigerant
	Entrained air	Vacuum and recharge
Lower pressure than normal condition at high side	Shortage of refrigerant	Make up refrigerant

SECTION 7 MAINTENANCE STANDARD

Group 1 Operational Performance Test ········· 7-1
Group 2 Major Components ········· 7-21
Group 3 Track and Work Equipment ········· 7-29

SECTION 7 MAINTENANCE STANDARD

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check:

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

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

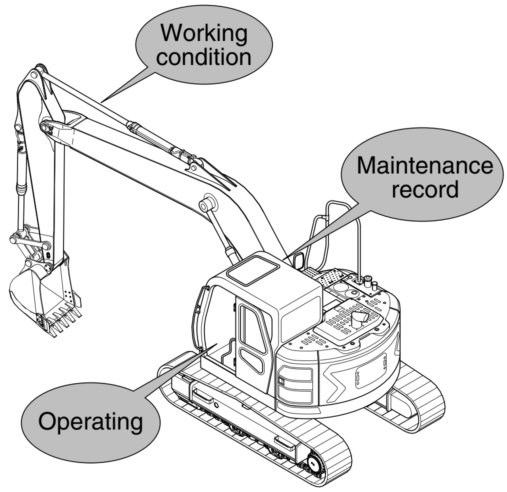
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

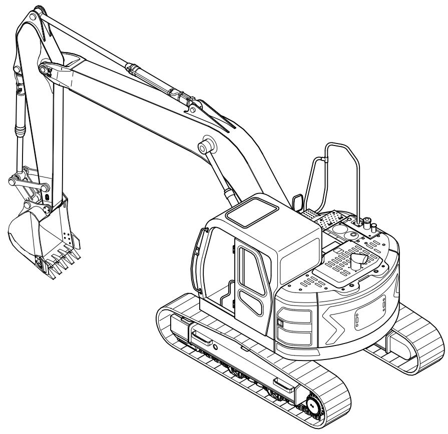


145ZF7MS01

2. TERMINOLOGY

1) STANDARD

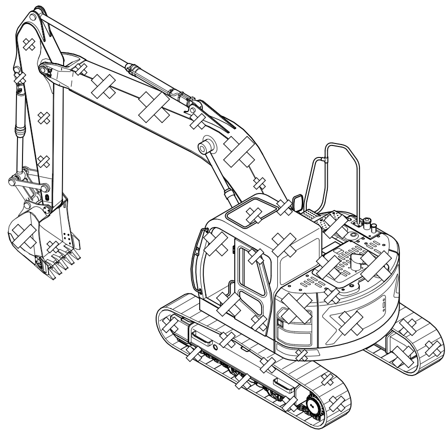
Specifications applied to the brand-new machine, components and parts.



145ZF7MS02

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.



145ZF7MS02A

3. OPERATION FOR PERFORMANCE TESTS

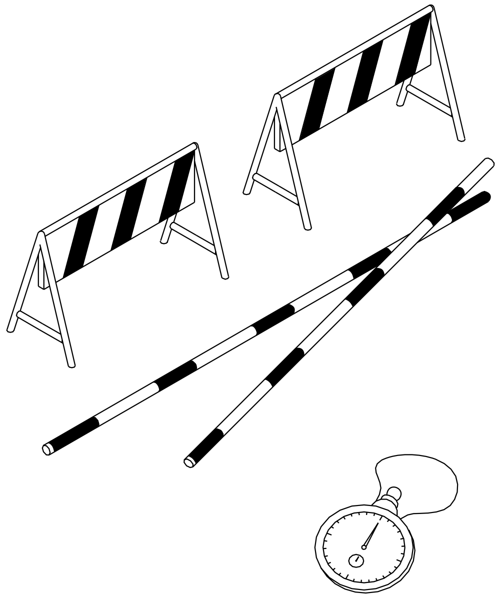
1) Observe the following rules in order to carry out performance tests accurately and safely.

(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.



(290-7TIER) 7-3

2) ENGINE SPEED

(1) Measure the engine speed at each power mode

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

(2) Preparation

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

② Set the accel dial at 10 (Max) position. Measure the engine RPM.

③

Measurement

(3) Start the engine. The engine will run at

① start idle speed. Measure engine speed with a engine rpm display.

Measure and record the engine speed at

② each mode (P, S, E).

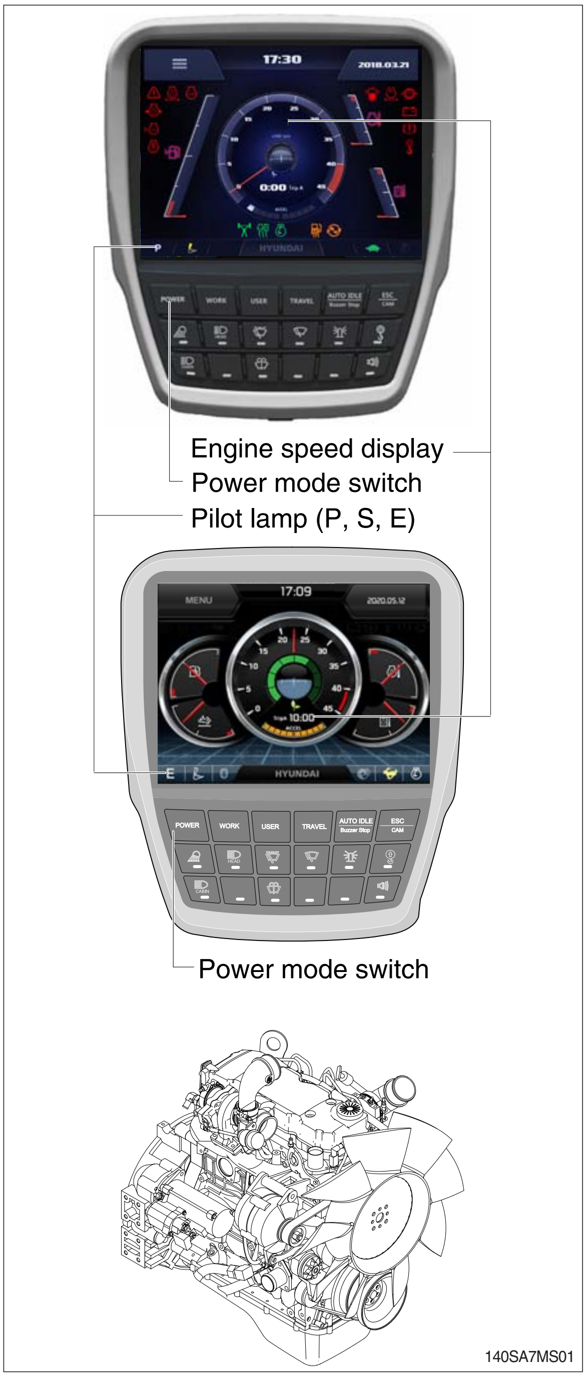
Select the P-mode.

③ Lightly operate the bucket control lever a

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

Measure and record the auto deceleration

⑤ speed.



(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX140L T3	Start idle	1000±50	
	P mode	1800±50	
	S mode	1600±50	
	E mode	1500±50	
	Auto decel	1150±100	
	One touch decel	1000±50	

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

3) TRAVEL SPEED

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

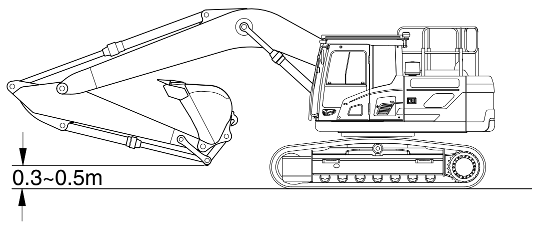
(2) Preparation

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 5 m on both ends for machine acceleration and deceleration.

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

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



140SA7MS02

(3) Measurement

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

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

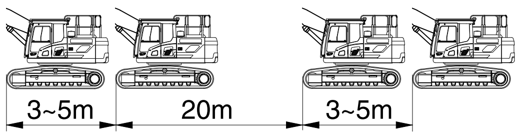
· Power mode switch : P mode

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

④ Measure the time required to travel 20 m.

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.



140SA7MS03

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 m

Model	Travel speed	Standard	Maximum allowable	Remarks
HX140L T3	1 Speed	21.2±2.0	26.6	
	2 Speed	12.4±1.0	15.4	

4) TRACK REVOLUTION SPEED

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

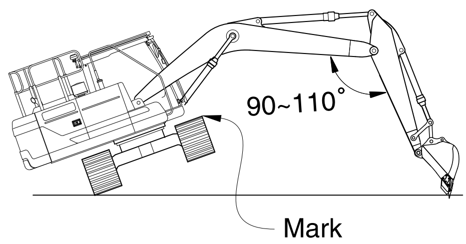
(2) Preparation

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.



140SA7MS04

(3) Measurement

① Select the following switch positions.

· Travel mode switch : 1 or 2 speed

· Power mode switch : P mode

· Auto idle switch : OFF

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
HX140L T3	1 Speed	25.1±2.0	32.4
	2 Speed	14.7±2.0	18.3

5) TRAVEL DEVIATION

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

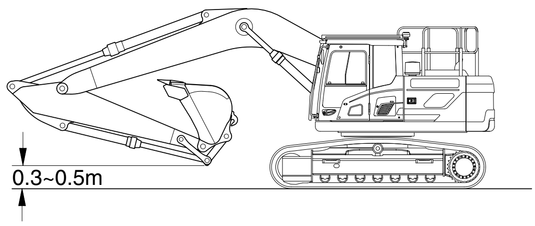
(2) Preparation

① Adjust the tension of both tracks to be equal.

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

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

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



140SA7MS02

(3) Measurement

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

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

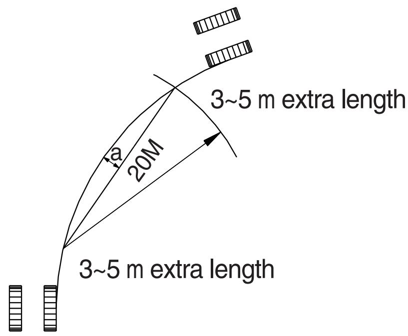
· Power mode switch : P mode

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

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

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

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



(210-7) 7-7(2)

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20 m

Model	Standard	Maximum allowable	Remarks
HX140L T3	200 below	240	

6) SWING SPEED

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

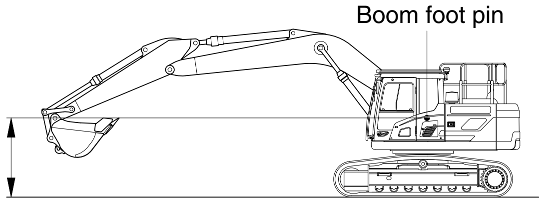
(2) Preparation

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.



140SA7MS05

(3) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Operate swing control lever fully.

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

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

(4) Evaluation

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

Unit : Seconds / 3 revolutions

Model	Power mode switch	Standard	Maximum allowable
HX140L T3	P mode	14.5±1.5	19.6

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.

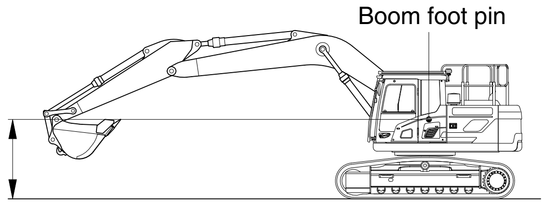
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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.



140SA7MS05

(3) Measurement

① Conduct this test in the M mode.

② Select the following switch positions.

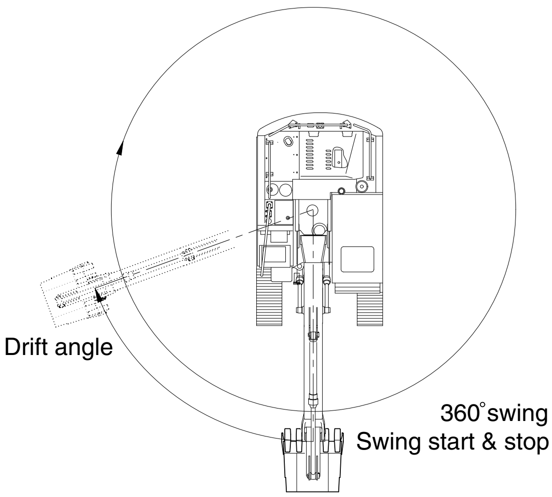
· Power mode switch : P mode

③ Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360˚.

④ Measure the distance between the two marks.

⑤ Align the marks again, swing 360˚, then test the opposite direction.

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



140SA7MS09

(4) Evaluation

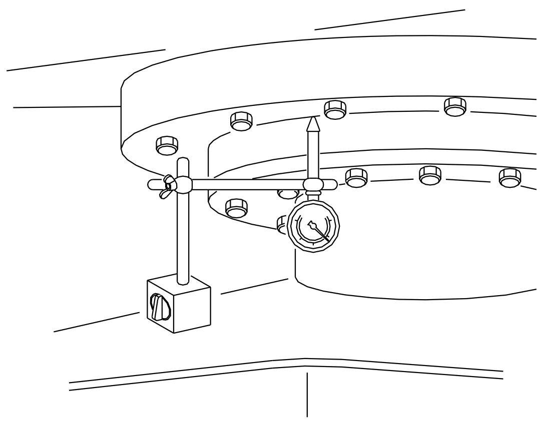
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX140L T3	P mode	90 below	157.5	

8) SWING BEARING PLAY

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



(210-7) 7-10(1)

(2) Preparation

① Check swing bearing mounting cap screws for loosening.

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

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

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

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

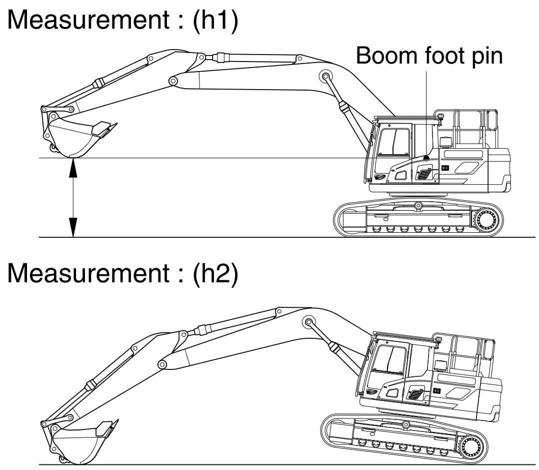
⑥ Bucket should be empty.

(3) Measurement

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

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

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



140SA7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX140L T3	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.

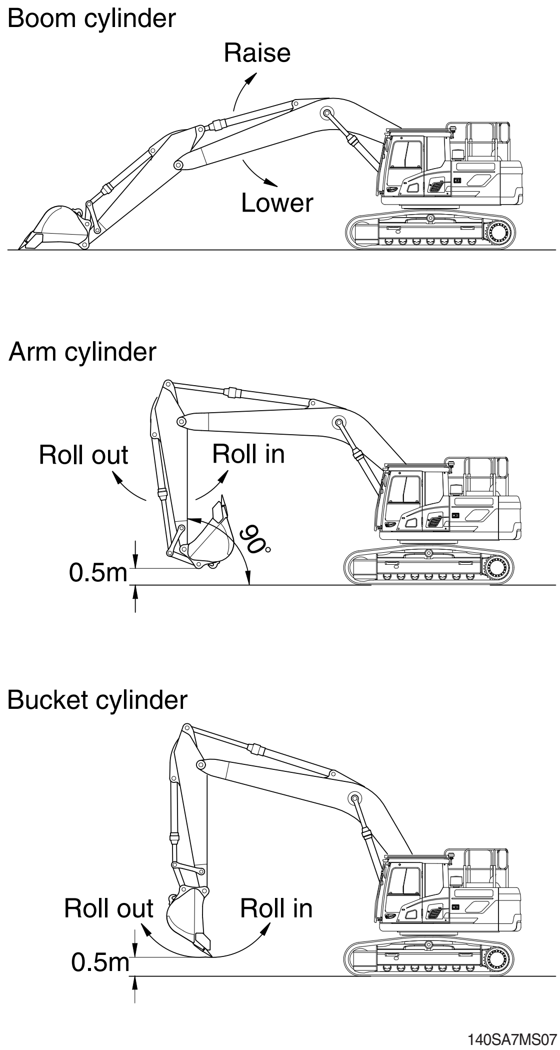
(2) Preparation

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 0.5 m 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 Select the following switch positions.
· Power mode switch : P mode

② To measure cylinder cycle times.

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

- 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
HX140L T3	Boom raise		3.3±0.4	4.3	
	Boom lower		2.5±0.4	3.3	
	Arm in	Regen ON	2.2±0.4	2.9	
		Regen OFF	2.6±0.4	3.4	
	Arm out		2.2±0.4	3.1	
	Bucket in		3.3±0.4	4.6	
	Bucket out		2.1±0.4	3.0	

10) DIG FUNCTION DRIFT CHECK

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

(2) Preparation

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

· $W = M^3 \times 1.5$

Where :

M^3 = Bucket heaped capacity (m^3)

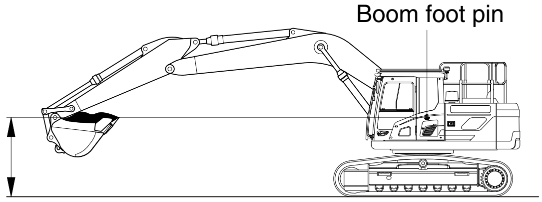
1.5 = Soil specific gravity

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

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



140SA7MS08

(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
HX140L T3	Boom cylinder	10 below	20	
	Arm cylinder	10 below	20	
	Bucket cylinder	40 below	50	

11) CONTROL LEVER OPERATING FORCE

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

(2) Preparation

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

(3) Measurement

① Start the engine.

② Select the following switch positions.

· Power mode switch : P mode

③ Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.

④ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.

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

(4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
HX140L T3	Boom lever	1.8 or below	2.2	
	Arm lever	1.8 or below	2.2	
	Bucket lever	1.8 or below	2.2	
	Swing lever	1.8 or below	2.2	
	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
HX140L T3	Boom lever	110±10	140	
	Arm lever	110±10	140	
	Bucket lever	85±10	110	
	Swing lever	85±10	110	
	Travel lever	142±10	178	

13) PILOT PRIMARY PRESSURE

■ RCV LEVER : M1, M10

※ Refer to the part manual for the RCV lever type.

(1) Preparation

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

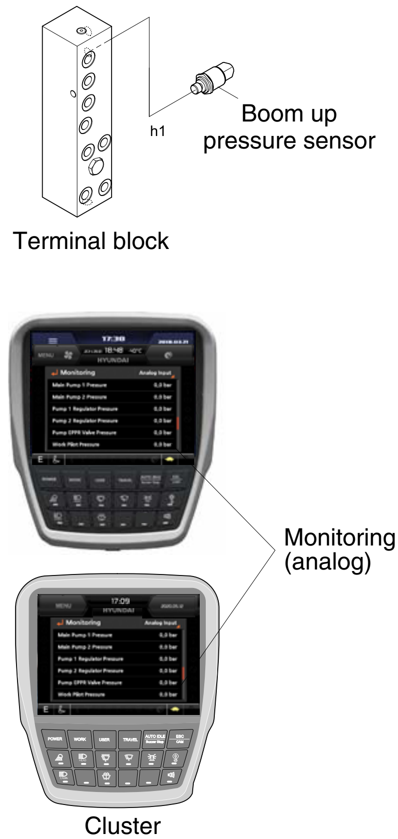
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Auto decel switch : OFF

② Slowly operate the boom control lever of boom up functions at full stroke over relief and measure the primary pilot pressure by the monitoring menu of the cluster.



140SA7MS13

■ RCV LEVER : M11, M12

(1) Preparation

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

② Remove plug on the pilot pump delivery port and connect pressure gauge.

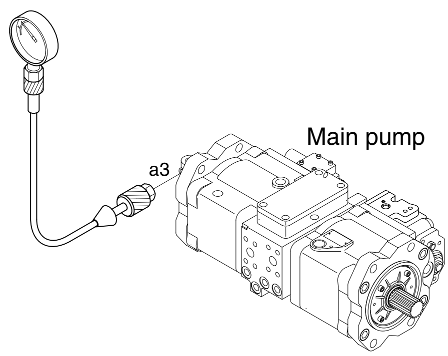
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Auto decel switch : OFF

② Measure the primary pilot pressure by the pressure gauge.



140SA7MS33

(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX140L T3	P mode	40^{+2}_{-2}	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation

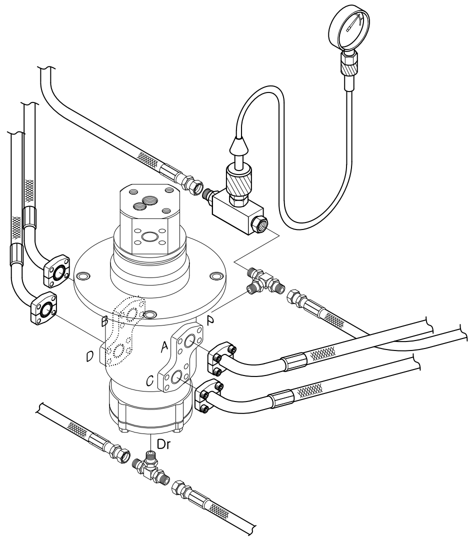
① Stop the engine.

② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

③ To measure the speed selecting pressure: Install a connector and pressure gauge assembly to turning joint P 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.



21077MS13

(2) Measurement

① Select the following switch positions.

Travel mode switch : 1 speed

2 speed

· Mode selector : P mode

② Measure the travel speed selecting pressure in the Hi or Lo mode.

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

(3) Evaluation

The average measured pressure should be within the following specifications.

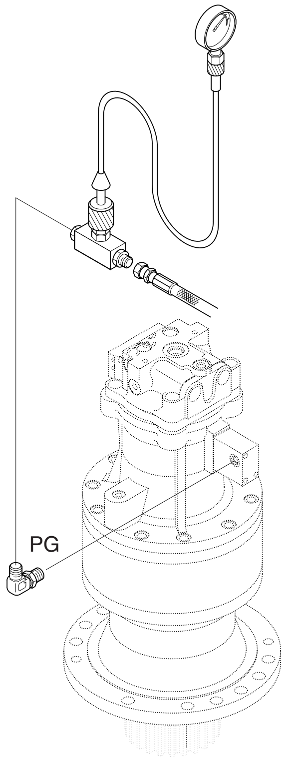
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX140L T3	1 Speed	0	-	
	2 Speed	40±5	-	

15) SWING PARKING BRAKE RELEASING PILOT PRESSURE

(1) Preparation

① Stop the engine.
② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
③ The pressure release L wrench to bleed air.
④ Install a connector and pressure gauge assembly to swing motor SH port, as shown.
⑤ Start the engine and check for oil leakage from the adapter.
⑥ Keep the hydraulic oil temperature at 50±5˚C.



140SA7MS14

(2) Measurement

① Select the following switch positions.
· Power mode switch : P mode
② Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
③ Repeat step ② three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Description	Standard	Allowable limits	Remarks
HX140L T3	Brake disengaged	40	Over 4	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

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

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Measure the main pump delivery pressure in the P mode (high idle).

※ Do not operate any of the RCV lever and pedal.

140SA7MS15

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX140L T3	High idle	30±3	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

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

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

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

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

④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.

140SA7MS15

(3) Evaluation

The average measured pressure should be within the following specifications.

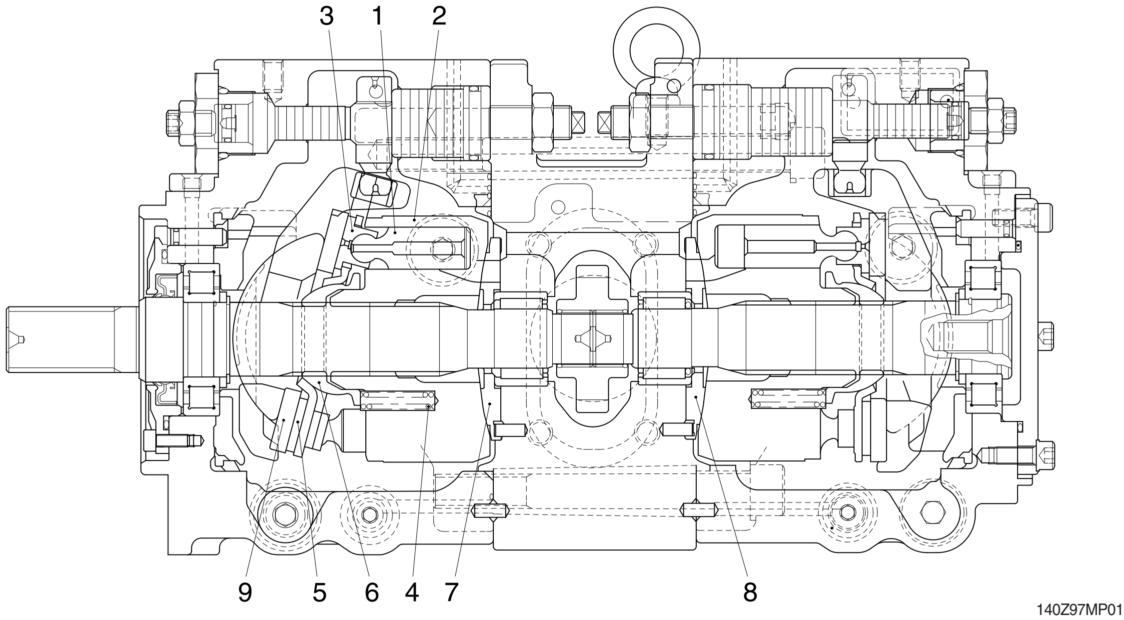
Unit : kgf / cm2

Model	Function to be tested	Standard	Port relief setting at 20 lpm
HX140L T3	Boom, Arm, Bucket	350 (380)±10	400±10
	Travel	350±10	-
	Swing	300±20	-

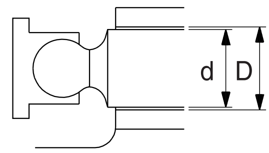
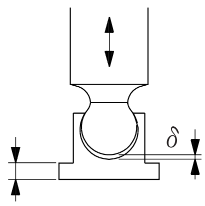
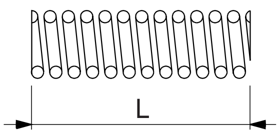
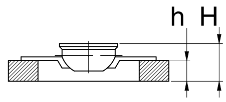
( ) : Power boost

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP



140Z97MP01

Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston (1) & cylinder bore (2) (D-d)		0.032	0.056	Replace piston or cylinder.
Play between piston (1) & shoe caulking section (3) (δ)		0-0.1	0.3	Replace assembly of piston & shoe.
Thickness of shoe (t)		3.9	3.7	
Free height of cylinder spring (4) (L)		41.1	40.3	Replace cylinder spring.
Combined height of set plate (5) (H) & spherical bushing (6) (h) (H-h)		17.0	15.8	Replace set plate or spherical bushing.
Surface roughness for valve plate (Sliding face) (7,8), swash plate (shoe plate area) (9), & cylinder (2) (Sliding face)	Surface roughness necessary to be corrected	3z		Lapping
	Standard surface roughness (Corrected value)	0.4z or lower		

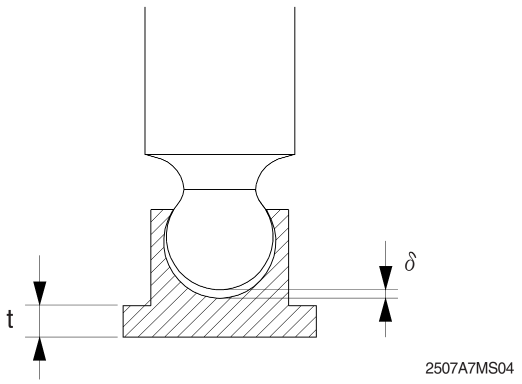
2. MAIN CONTROL VALVE

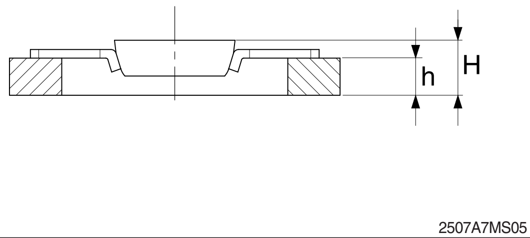
Part name	Inspection item	Criteria & measure
Casing	· Existence of scratch, rusting or corrosion.	· In case of damage in following section, replace part. - Sliding sections of casing fore and spool, especially land sections applied with holded pressure. - Seal pocket section where spool is inserted.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

3. SWING DEVICE

1) WEARING PARTS

Inspection item	Standard dimension	Standard dimension	Counter measures
Clearance between piston and cylinder block bore	0.028	0.058	Replace piston or cylinder block
Play between piston and shoe caulking section (δ)	0	0.3	Replace assembly of piston and shoe
Thickness of shoe (t)	5.5	5.3	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H-h)	6.5	6.0	Replace set of retainer plate and spherical bushing
Thickness of friction plate	4.0	3.6	Replace





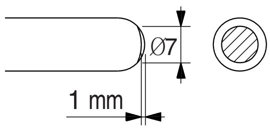
2) SLIDING PARTS

Part name	Standard roughness	Allowable roughness	Remark
Shoe	0.8-Z (Ra=0.2) (LAPPING)	3-Z (Ra=0.8)	
Shoe plate	0.4-Z (Ra=0.1) (LAPPING)	3-Z (Ra=0.8)	
Cylinder	1.6-Z (Ra=0.4) (LAPPING)	12.5-Z (Ra=3.2)	
Valve plate	0.8-Z (Ra=0.2) (LAPPING)	6.3-Z (Ra=1.6)	

4. TRAVEL MOTOR

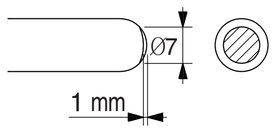
Problem		Cause	Remedy
Does not start	Pressure is not developed	· Pump failure · Control valve malfunction	· Check if action other than traveling is available. If faulty, repair. · Check if spool moves correctly. Repair if necessary.
	Pressure is developed	· Brake valve failure -Sleeve stick -Check valve stick · Motor failure -Valve seat seizure · Gear broken and fragment locked · Overloaded	· Replace brake valve · Replace -Check hydraulic oil for contamination · Replace reduction gear · Reduce load
Oil leakage	Leakage from engaging surfaces	· Scratch on engaging surfaces · Loosening by poor bolt tightening	· Correct surfaces by oilstone or sandpaper or replace · Check after retightening
	Leakage from casing	· Plug loosened · Crack formed by stone	· Retighten · Replace reduction gear
	Leakage from floating seal	· Sliding surfaces worn · Creep on O-ring	· Replace reduction gear · Replace floating seal
	Leakage from hydraulic motor	· Bolt loosened · O-ring damaged · Sealing surface scratched	· Tighten properly · Replace O-ring · Correct by oilstone or sandpaper
Coasts on slope excessively		· Poor volumetric efficiency of hydraulic motor · Increase of internal leakage of brake valve · Parking brake not actuated -Spring breakage -Wear of friction plate	· Replace hydraulic motor · Replace brake valve · Replace spring · Replace parking brake
Excessive temperature on reduction gear case		· Pitting on bearing · Lack of gear oil · Hydraulic oil introduced to gear case	· Replace reduction gear · Supply gear oil properly · Check motor and replace oil seal
Meanders	Meanders at low pressure	· Delivery rate is different between right and left · Motor drain rate is different between right and left	· Repair pump · Replace motor
	Meanders at high pressure	· Delivery rate is different between right and left · Motor drain rate is different between right and left	· Repair regulator or pump · Replace motor
	Meanders at high pressure	· Relief pressure dropped at right and left brake valve · Main relief pressure dropped at right or left of control valve	· Replace brake valve · Replace main relief valve
Pump delivery is poor		· Regulator operation poor · External leakage of pump is excessive	· Repair regulator · Repair pump
External leakage of motor is excessive		-	· Replace motor

5. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000 cc/m at neutral handle position, or more than 2000 cc/m during operation.	Conditions : Primary pressure : 40 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6 troubleshooting, replace the related parts.	

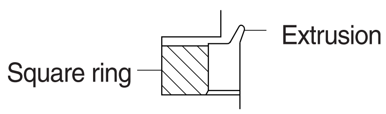
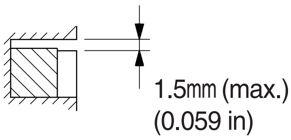
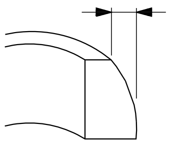
Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

6. RCV PEDAL

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage effect to the system. For example, the primary pressure drop.	Conditions : Primary pressure : 40 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6. Troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

7. 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

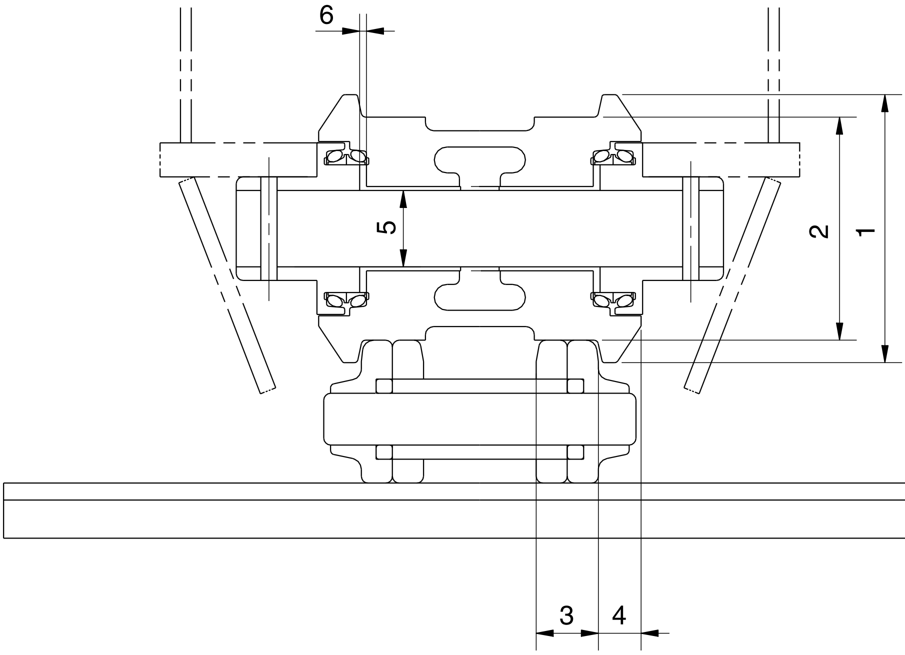
8. CYLINDER

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

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK

1) UPPER ROLLER

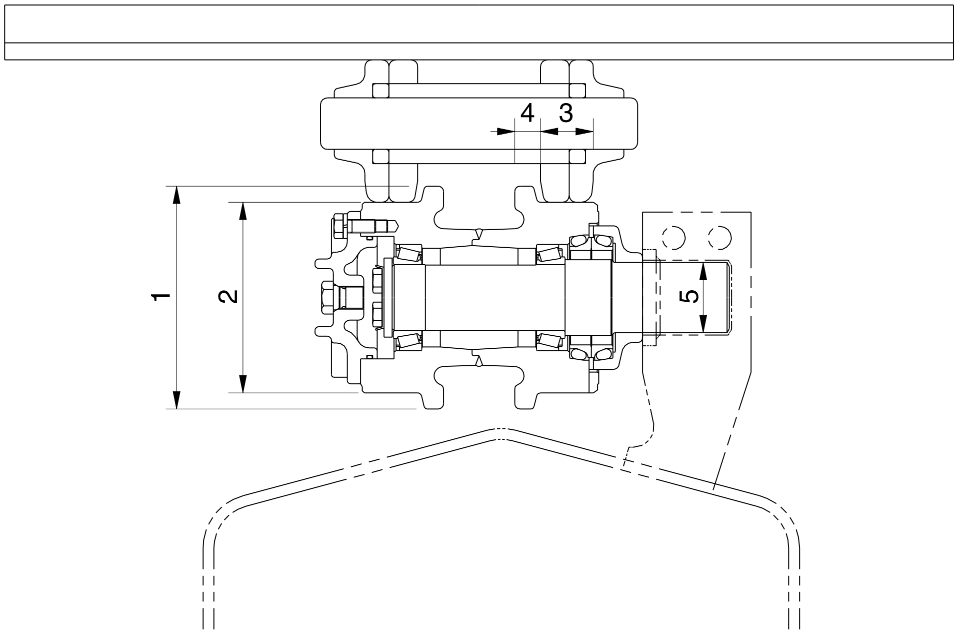


21037MS01

Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th colspan="2"></th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="4">Standard size</td><td colspan="2">Repair limit</td><td rowspan="4">Rebuild or replace</td></tr>
<tr><td colspan="4">Ø173</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="4">Ø143</td><td colspan="2">Ø131</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="4">39.5</td><td colspan="2">45.5</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="4">24.0</td><td colspan="2">-</td><td></td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Clearance between shaft and bushing</td><td colspan="4">Standard size and tolerance</td><td rowspan="3">Standard clearance</td><td rowspan="3">Clearance limit</td><td rowspan="4">Replace bushing</td></tr>
<tr><td colspan="2">Shaft</td><td colspan="2">Hole</td></tr>
<tr><td>Dimension</td><td>Tolerance</td><td>Dimension</td><td>Tolerance</td></tr>
<tr><td>Ø55</td><td>0
-0.33</td><td>Ø55</td><td>+0.35
+0.3</td><td>0.17~0.34</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Side clearance of roller (both side)</td><td colspan="4">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="4">0.21~1.34</td><td colspan="2">2.0</td></tr>
</table>

2) LOWER ROLLER

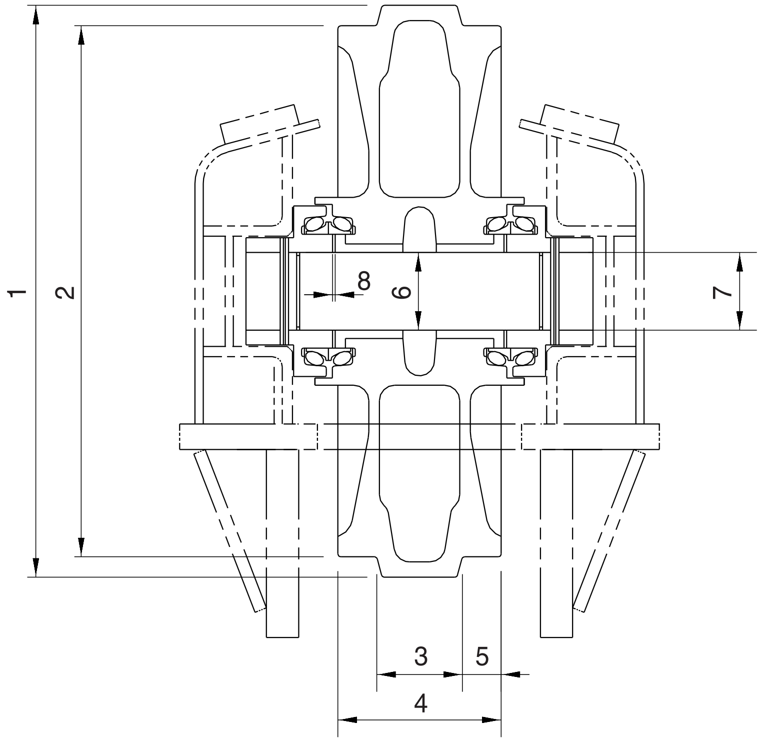


21037MS02

Unit : mm

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø175				–		
2	Outside diameter of tread	Ø151				Ø141		
3	Width of tread	37.25				42.25		
4	Width of flange	18.25				-		
5	Clearance between shaft and bracket	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Dimension	Tolerance	Dimension	Tolerance			
		Ø41.27	0 -0.05	Ø41.5	+0.2 - 0.1	0.13~0.48	1.2	

3) IDLER

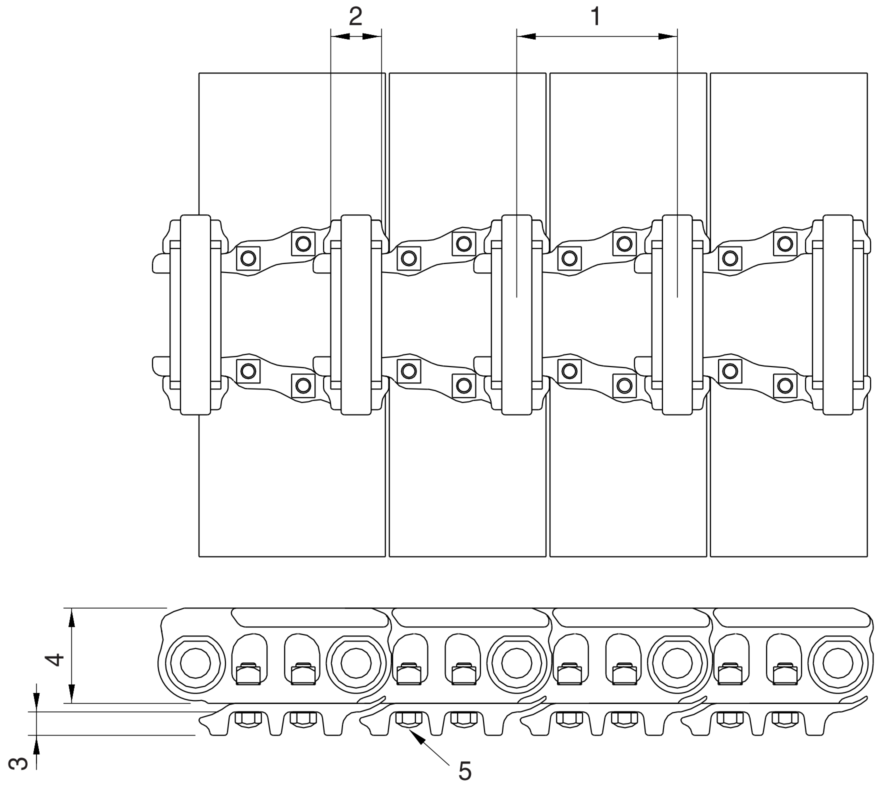


21037MS03

Unit : ㎜

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø552				-		
2	Outside diameter of tread	Ø507				Ø497		
3	Width of protrusion	67				-		
4	Total width	135				-		
5	Width of tread	34				39		
6	Clearance between shaft and bushing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Dimension	Tolerance	Dimension	Tolerance			
		Ø70	0 -0.03	Ø70.3	+0.35 +0.3	0.3 to 0.38	2.0	
7	Clearance between shaft and support	Ø70	0 -0.03	Ø70	+0.106 +0.06	0.03 to 0.1	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance				Clearance limit		Replace bushing
		0.31~1.29				2.0		

4) TRACK

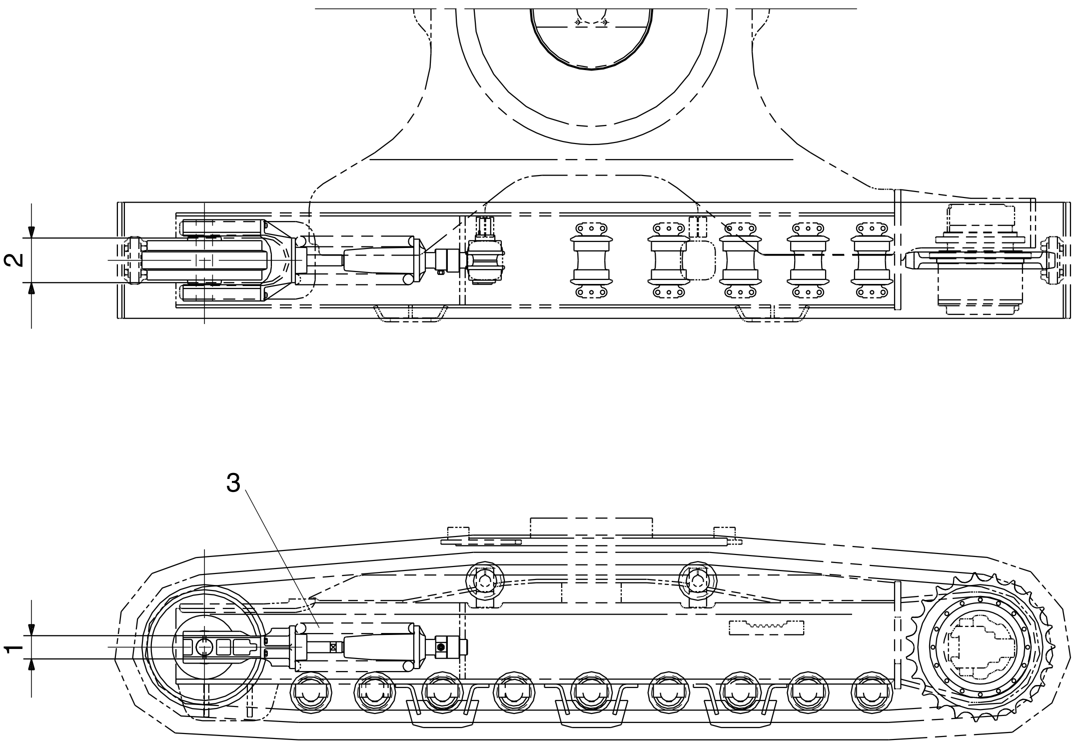


21037MS04

Unit : ㎜

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		171.45	175.65	
2	Outside diameter of bushing	Ø53.75	Ø43.95	Rebuild or replace
3	Height of grouser	25	16	
4	Height of link	94.5	86.5	
5	Tightening torque (Tightening angle method)	Initial tightening torque : 42±4 kgf · m Additional tightening angle : 32˚		Retighten

5) TRACK FRAME AND RECOIL SPRING

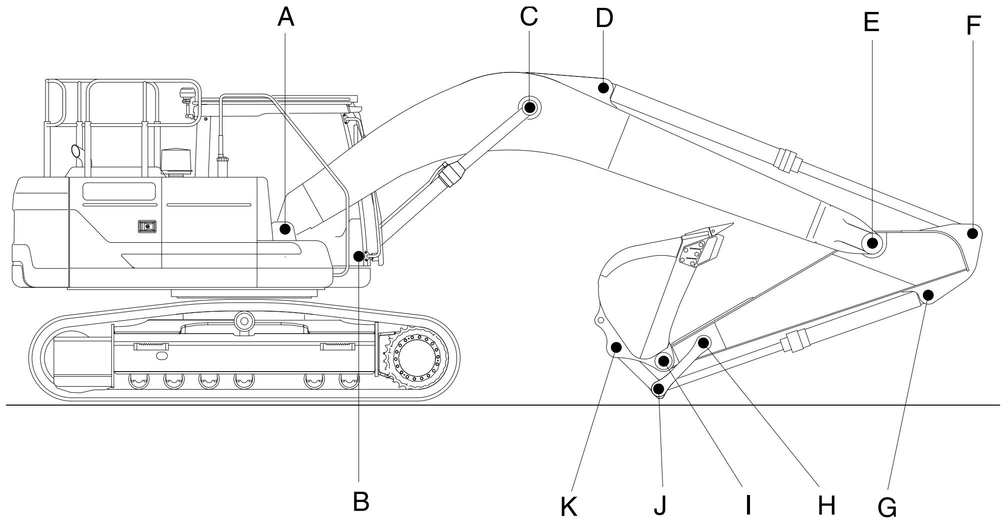


21037MS05

Unit : mm

No.	Check item	Criteria					Remedy
1	Vertical width of idler guide		Standard size		Tolerance	Repair limit	Rebuild or replace
		Track frame	103		+2 / 0	107	
		Idler support	100		+0.3 / - 0.3	98	
2	Horizontal width of idler guide	Track frame	192		+2 / 0	196	
		Idler support	190		-	188	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		470	405	8,497kg	–	6,978kg	

2. WORK EQUIPMENT



140SA7MS21

Unit : ㎜

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	70	69	68.5	70.5	71	Replace
B	Boom Cylinder Head	70	69	68.5	70.5	71	〃
C	Boom Cylinder Rod	70	69	68.5	70.5	71	〃
D	Arm Cylinder Head	70	69	68.5	70.5	71	〃
E	Boom Front	70	69	68.5	70.5	71	〃
F	Arm Cylinder Rod	70	69	68.5	70.5	71	〃
G	Bucket Cylinder Head	70	69	68.5	70.5	71	〃
H	Arm Link	65	64	63.5	65.5	66	〃
I	Bucket and Arm Link	65	64	63.5	65.5	66	〃
J	Bucket Cylinder Rod	70	69	68.5	70.5	71	〃
K	Bucket Link	65	64	63.5	65.5	66	〃

SECTION 8 DISASSEMBLY AND ASSEMBLY

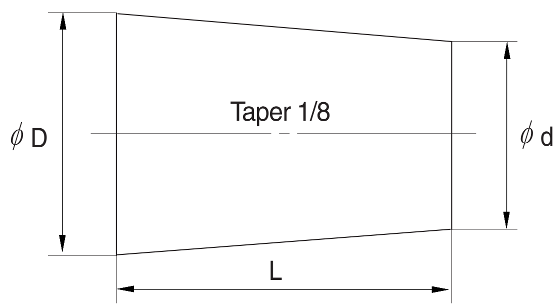
Group 1 Precaution ········ 8-1
Group 2 Tightening Torque ········ 8-4
Group 3 Pump Device ········ 8-7
Group 4 Main Control Valve ········ 8-29
Group 5 Swing Device ········ 8-43
Group 6 Travel Device ········ 8-75
Group 7 RCV Lever ········ 8-139
Group 8 Turning Joint ········ 8-153
Group 9 Boom, Arm, Bucket and Dozer Cylinders ········ 8-158
Group 10 Undercarriage ········ 8-180
Group 11 Work Equipment ········ 8-194

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 100mm 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, FR)	M12 × 1.75	11.5 ± 1.0	83.2 ± 7.2
2		Engine mounting bolt (engine-bracket, RR)	M12 × 1.75	11.5 ± 1.0	83.2 ± 7.2
3		Engine mounting bolt (bracket-frame, FR)	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
4		Engine mounting bolt (bracket-frame, RR)	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
5		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
6		Coupling mounting socket bolt	M16 × 2.0	22 ± 1.0	159 ± 7.2
7		Main pump housing mounting bolt	M10 × 1.5	6.5 ± 0.7	47.0 ± 5.1
8	Hydraulic system	Main pump mounting socket bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
9		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
10		Fuel tank mounting bolt	M20 × 2.5	57.8 ± 5.8	418 ± 42.0
11		Hydraulic oil tank mounting bolt	M20 × 2.5	57.8 ± 5.8	418 ± 42.0
12		Turning joint mounting bolt, nut	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
13	Power train system	Swing motor mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
14		Swing bearing upper part mounting bolt	M18 × 2.5	41.3 ± 4.0	299 ± 28.9
15		Swing bearing lower part mounting bolt	M16 × 1.5	29.7 ± 3.0	215 ± 21.7
16		Travel motor mounting bolt	M16 × 2.0	25.7 ± 4.0	186 ± 28.9
17		Sprocket mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18	Under carriage	Upper roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
19		Upper roller mounting bolt, nut (HW)	M20 × 2.5	59.7 ± 6.0	419 ± 43.4
20		Lower roller mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
21		Lower roller mounting bolt (HW)	M 20× 2.5	57.9 ± 6.0	419 ± 43.4
22		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
23		Track shoe mounting bolt, nut	5/8 - 18UNF	42 ± 4.0	304± 28.9
24		Track guard mounting bolt	M16 × 2.0	29.6 ± 3.2	214± 23.1
25	Others	Counterweight mounting bolt	M27 × 3.0	140 ± 15	1013 ± 108
26		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
27		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8
28		Under cover mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.0

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf·m	lbf·ft	kgf·m	lbf·ft	kgf·m	lbf·ft
M 6 × 1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10 × 1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12 × 1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14 × 2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16 × 2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18 × 2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20 × 2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22 × 2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24 × 3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30 × 3.5	120 ~ 161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8 × 1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10 × 1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12 × 1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14 × 1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16 × 1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18 × 1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20 × 1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22 × 1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24 × 2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30 × 2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

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. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

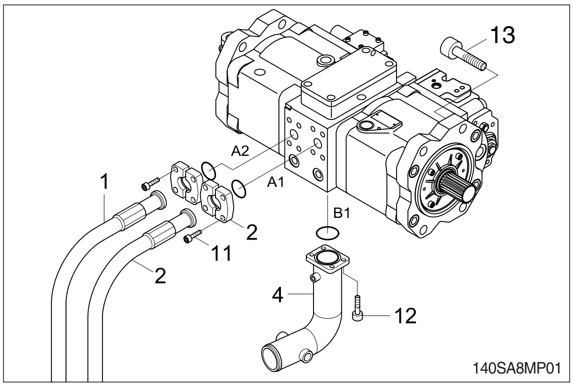
13031GE18

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

· Hydraulic tank quantity : 120 ℓ (31.7 U.S. gal)

(5) Remove socket bolts (11) and disconnect hoses (1, 2).

(6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10).



140SA8MP01

(7) Remove socket bolts (12) and disconnect pump suction pipe (4).

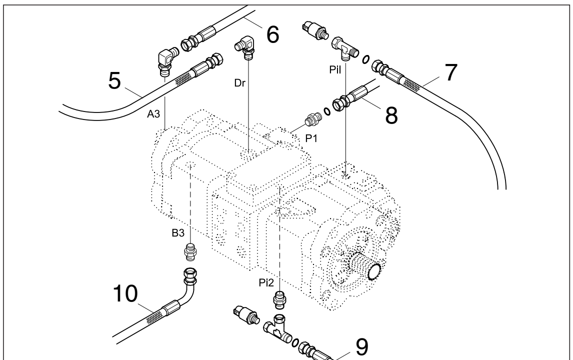
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(8) Sling the pump assembly and remove the pump mounting bolts (13).

· Weight : 92 kg (203 lb)

· Tightening torque : 29.7±4.5 kgf · m (215±32.5 lbf · ft)

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



140SA8MP02

2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

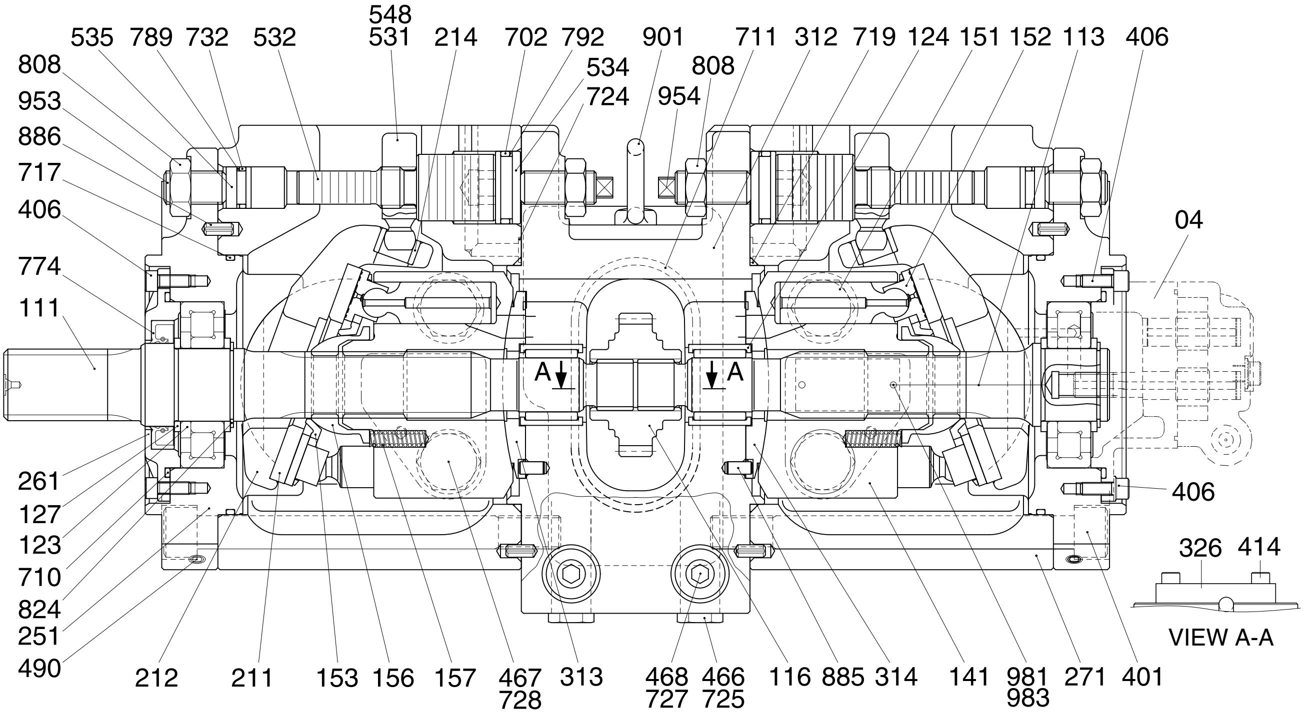
(6) Bleed the air from the hydraulic pump.
 ① Remove the air vent plug (2EA).
 ② Tighten plug lightly.
 ③ Start the engine, run at low idling, and check oil come out from plug.
 ④ Tighten plug.

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

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

2. MAIN PUMP (1/2)

1) STRUCTURE



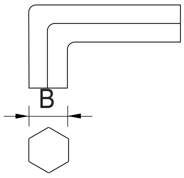
140AS2MP02

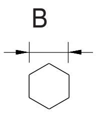
04	Gear pump
111	Drive shaft (F)
113	Drive shaft (R)
116	1st Gear
123	Roller bearing
124	Needle bearing
127	Bearing spacer
141	Cylinder block
151	Piston
152	Shoe
153	Set plate
156	Bushing
157	Cylinder spring
211	Shoe plate
212	Swash plate
214	Tilting bushing
251	Support
261	Seal cover (F)
271	Pump casing
312	Valve block
313	Valve plate (R)
314	Valve plate (L)
326	Cover
401	Hexagon socket bolt
406	Hexagon socket bolt
414	Hexagon socket bolt
466	Plug
467	Plug
468	Plug
490	Plug
531	Tilting pin
532	Servo piston
534	Stopper (L)
535	Stopper (S)
548	Feed back pin
702	O-ring
710	O-ring
711	O-ring
717	O-ring
719	O-ring
724	Square ring
725	O-ring
727	O-ring
728	O-ring
732	O-ring
774	Oil seal
789	Back up ring
792	Back up ring
808	Hexagon head nut
824	Snap ring
885	Pin
886	Spring pin
901	Eye bolt
953	Set screw
954	Set screw
981	Name plate
983	Pin

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/8	-	M10
	6	M 8	BP-1/4	PO-1/4	M12, M14
	8	M10	BP-3/8	PO-3/8	M16, M18
	17	M20, M22	BP-1	PO-1, 1 1/4, 1 1/2	-

Name	B	Hexagon bolt	Hexagon nut	VP plug (PF thread)
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon bolt	Hexagon nut	VP plug (PF thread)
	19	M12	M12	VP-1/4
	24	M16	M16	-
	27	M18	M18	VP-1/2
	30	M20	M20	-
	36	-	-	VP-3/4

Tool name	Part name
Adjustable angle wrench	Medium size, 1 set
Screw driver	Minus type screw driver, Medium size, 2 sets
Hammer	Plastic hammer, 1 set
Pliers	For snap ring, TSR-160
Steel bar	Steel bar of key material approx. 10×8×200
Torque wrench	Capable of tightening with the specified torques

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C) ※Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S45C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

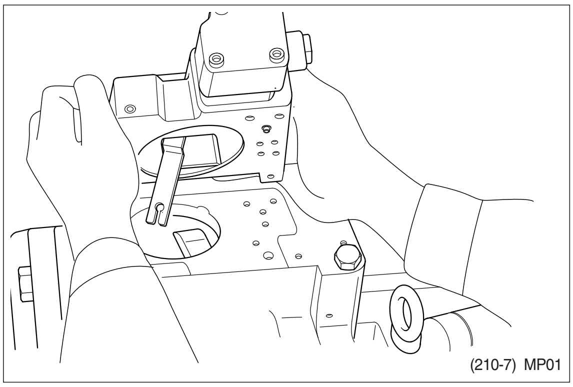
3) DISASSEMBLY

(1) Select place suitable to disassembling.
※ Select clean place.
※ Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.

(2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.

(3) Remove drain port plug (468) and let oil out of pump casing (front and rear pump).

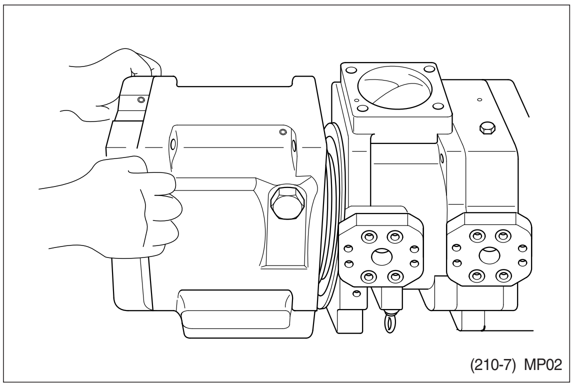
(4) Remove hexagon socket head bolts (412, 413) and remove regulator.



(210-7) MP01

(5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve block (312).
※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.

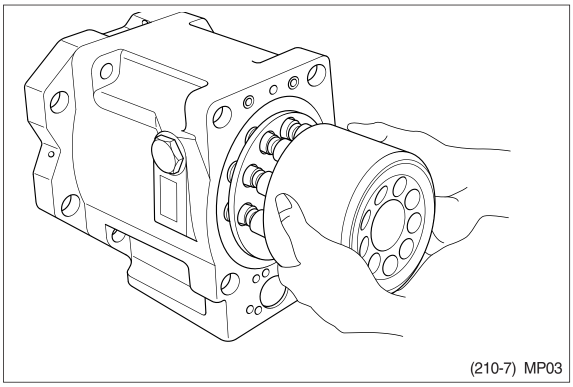
(6) Place pump horizontally on workbench with its regulator-fitting surface down and separate pump casing (271) from valve block (312).
※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



(210-7) MP02

(7) Pull cylinder block (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.

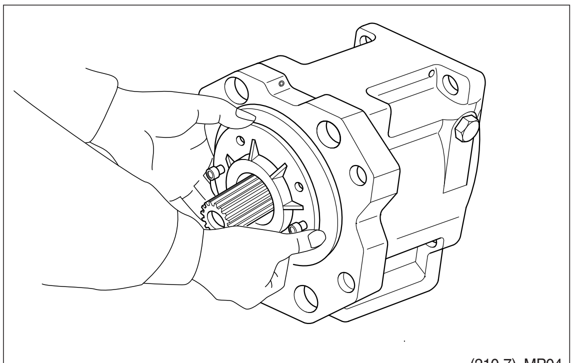


(210-7) MP03

(8) Remove hexagon socket head bolts (406) and then seal cover (F, 261).

※ Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

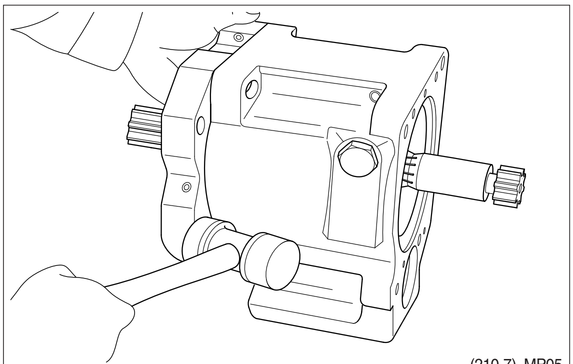
※ Since oil seal is fitted on seal cover (F), take care not to damage it in removing cover.



(210-7) MP04

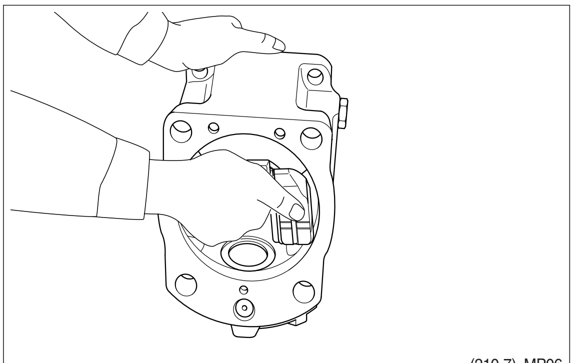
(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).
In case fitting a gear pump, first, remove gear pump.

(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



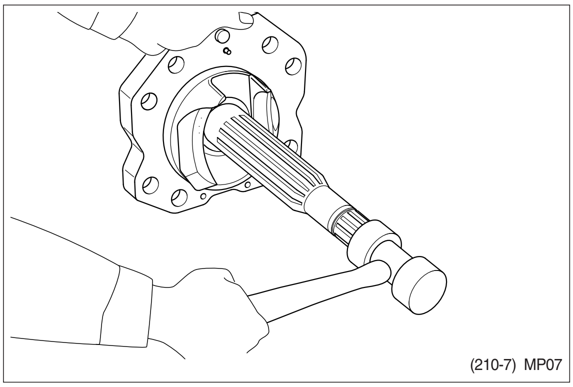
(210-7) MP05

(11) Remove shoe plate (211)and swash plate (212) from pump casing (271).



(210-7) MP06

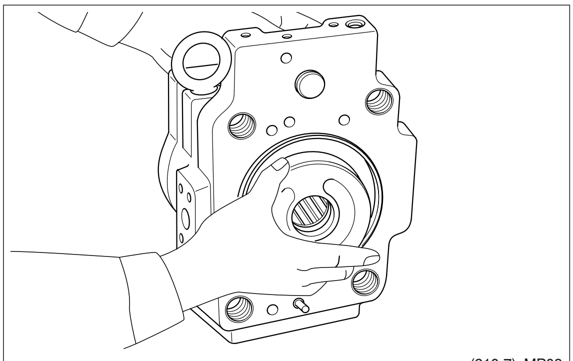
(12) Tapping lightly shaft ends of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



(210-7) MP07

(13) Remove valve plates (313, 314) from valve block (312).

※ These may be removed in work (6).



(210-7) MP08

(14) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin (531) from pump casing (271), and needle bearing (124) and splined coupling (114) from valve block (312).

※ In removing tilting pin, use a protector to prevent pin head from being damaged.

※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.

※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.

※ Do not loosen hexagon nuts of valve block and swash plate support.
If loosened, flow setting will be changed.

4) ASSEMBLY

(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.

② Clean each part fully with cleaning oil and dry it with compressed air.

③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.

④ In principle, replace seal parts, such as O-rings, oil seals, etc.

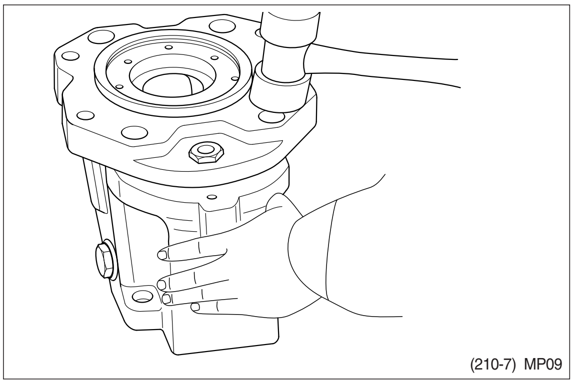
⑤ For fitting bolts, plug, etc, prepare a torque wrench or so on, and tighten them with torques shown in page 8-10, 11.

⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.

※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite (Medium strength) to their threaded sections.

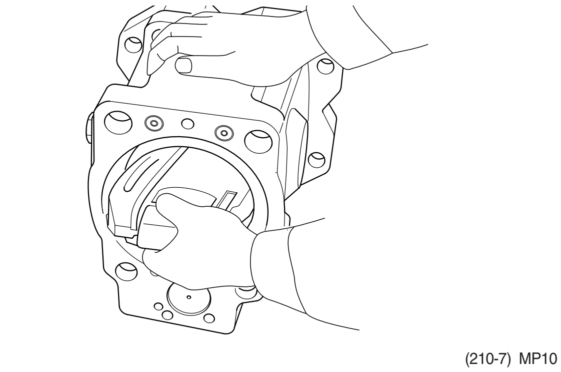


(210-7) MP09

(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531) and fit swash plate (212) to swash plate support (251) correctly.

※ Confirm with fingers of both hands that swash plate can be removed smoothly.

※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



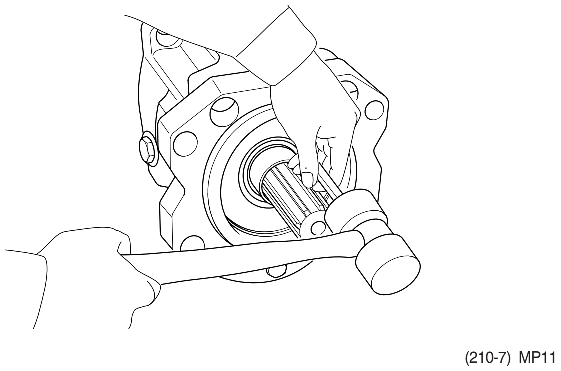
(210-7) MP10

(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

※ Do not tap drive shaft with hammer or so on.

※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.

Fit them fully, using steel bar or so on.



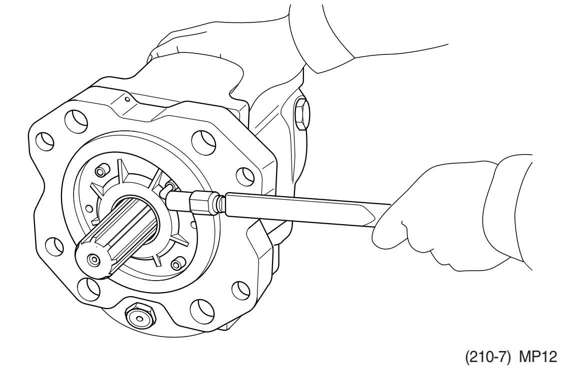
(210-7) MP11

(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

※ Apply grease lightly to oil seal in seal cover (F).

※ Assemble oil seal, taking full care not to damage it.

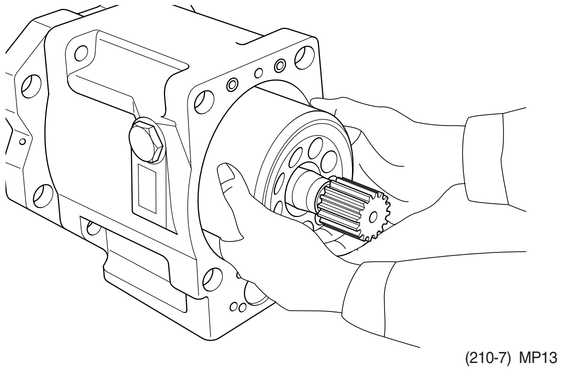
※ For tandem type pump, fit rear cover (263) and seal cover (262) similarly.



(210-7) MP12

(6) Assemble piston cylinder subassembly 〔cylinder block (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157)〕.

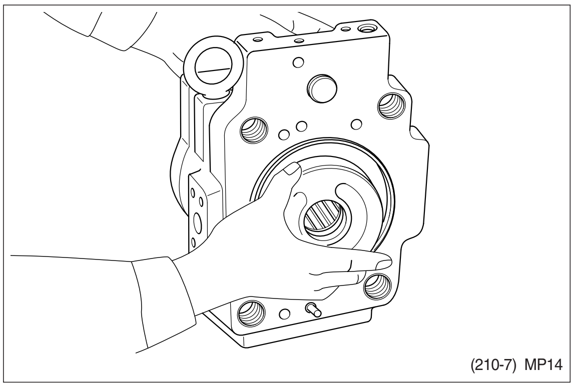
Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.



(210-7) MP13

(7) Fit valve plate (313) to valve block (312), entering pin into pin hole.

※ Take care not to mistake suction / delivery directions of valve plate.



(210-7) MP14

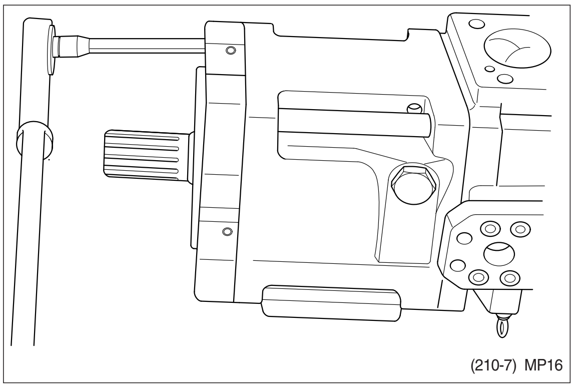
(8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).

※ At first assemble this at rear pump side, and this work will be easy.

※ Take care not to mistake direction of valve block.

※ Clockwise rotation (Viewed from input shaft side) - Fit block with regulator up and with delivery flange left, viewed from front side.

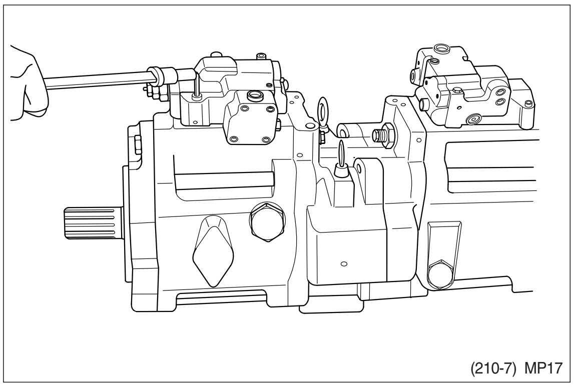
※ Counter clockwise rotation (Viewed from input shaft side) - Fit block with delivery flange right, viewed from front side.



(210-7) MP16

(9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).

※ Take care not to mistake regulator of front pump for that of rear pump.



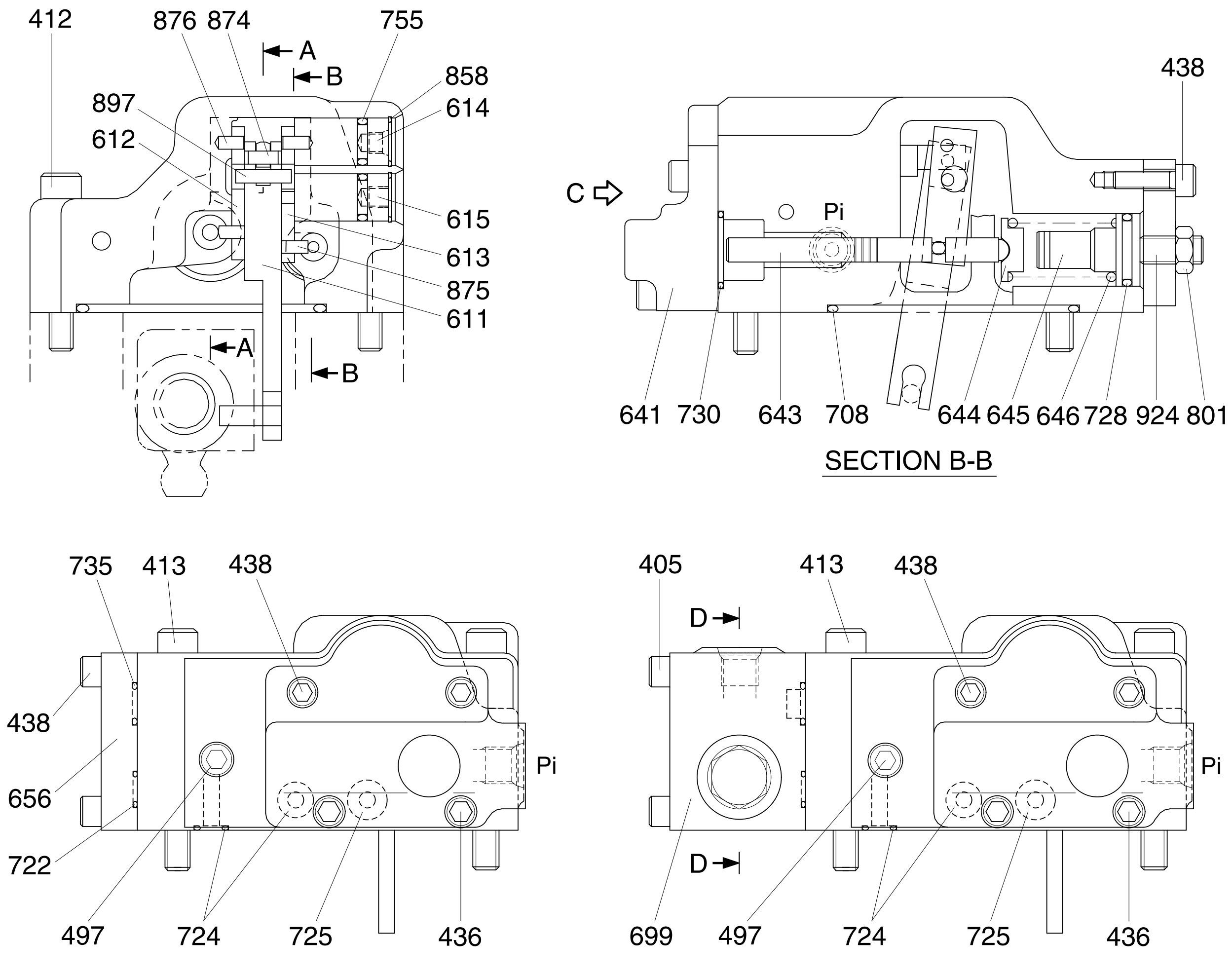
(210-7) MP17

(10) Fit drain port plug (468).

This is the end of reassembling procedures.

3. REGULATOR

1) STRUCTURE (1/2)

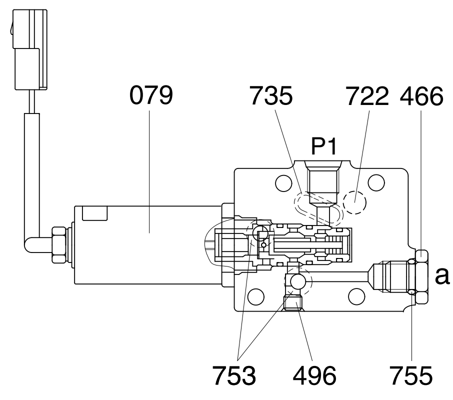


SECTION B-B

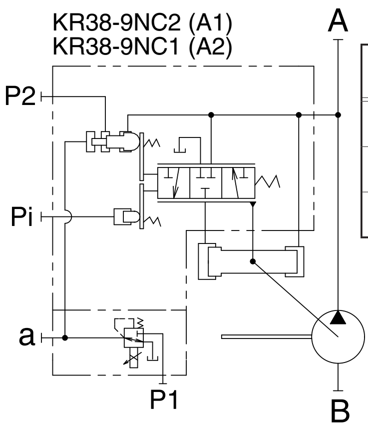
VIEW C (FRONT)

VIEW C (REAR)

140SA2MP04

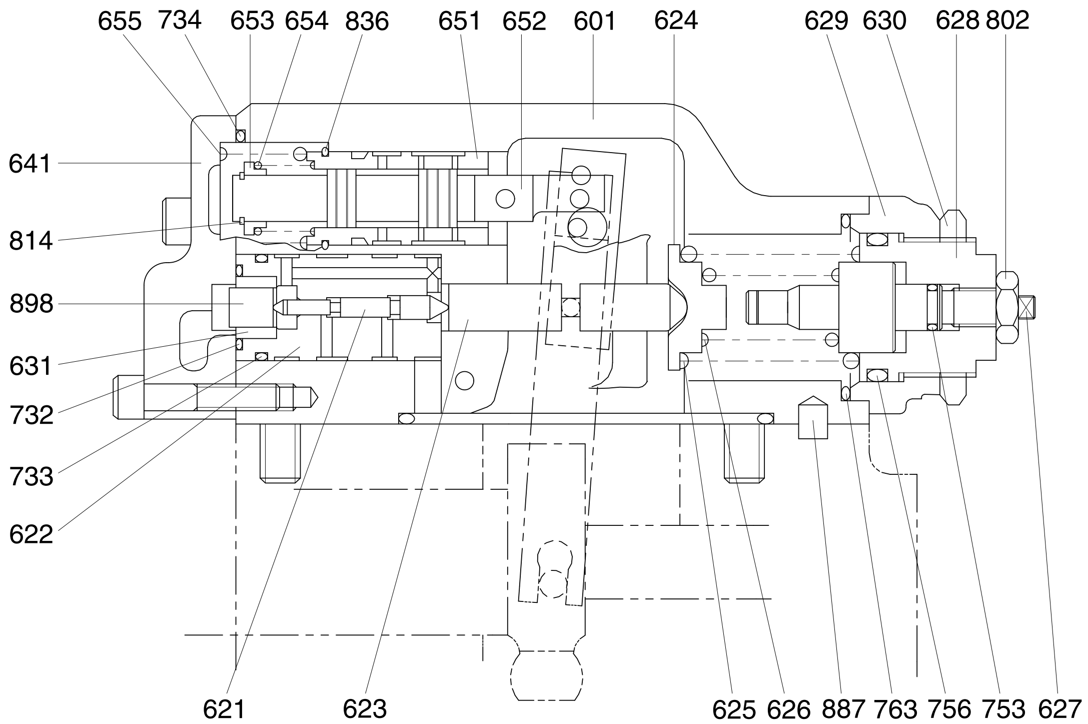


SECTION D-D(REAR)



Port	Port name	Port size
A	Delivery port	SAE 6000 psi 3/4"
B	Suction port	SAE 2500 psi 2 1/2"
Pi	Pilot port	PF 1/4-15

REGULATOR (2/2)



SECTION A-A

140SA2MP05

079	EPPR valve assembly	628	Adjust screw (C)	730	O-ring
405	Hexagon socket screw	629	Cover (C)	732	O-ring
412	Hexagon socket screw	630	Lock nut	733	O-ring
413	Hexagon socket screw	631	Sleeve, Pf	734	O-ring
436	Hexagon socket screw	641	Pilot cover	735	O-ring
438	Hexagon socket screw	643	Pilot piston	753	O-ring
466	Plug	644	Spring seat (Q)	755	O-ring
497	Plug	645	Adjust stem (Q)	756	O-ring
601	Casing	646	Pilot spring	763	O-ring
611	Feed back lever	651	Sleeve	801	Lock nut
612	Lever (1)	652	Spool	802	Lock nut
613	Lever (2)	653	Spring seat	814	Snap ring
614	Center plug	654	Return spring	836	Snap ring
615	Adjust plug	655	Set spring	858	Snap ring
621	Compensator piston	656	Block cover	874	Pin
622	Piston case	699	Valve casing	875	Pin
623	Compensator rod	708	O-ring	876	Pin
624	Spring seat (C)	722	O-ring	887	Pin
625	Outer spring	724	O-ring	897	Pin
626	Inner spring	725	O-ring	898	Pin
627	Adjust stem (C)	728	O-ring	924	Set screw

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="4">Part name</th></tr>
<tr><td>Name</td><td>B</td><td>Hexagon socket head bolt</td><td>PT plug (PT thread)</td><td>PO plug (PF thread)</td><td>Hexagon socket head setscrew</td></tr>
<tr><td rowspan="3">Allen wrench</td><td>4</td><td>M5</td><td>BP-1/16</td><td>-</td><td>M 8</td></tr>
<tr><td>5</td><td>M6</td><td>BP-1/8</td><td>-</td><td>M10</td></tr>
<tr><td>6</td><td>M8</td><td>BP-1/4</td><td>PO-1/4</td><td>M12, M14</td></tr>
<tr><td rowspan="2">Double ring spanner, socket wrench, double (single) open end spanner</td><td>-</td><td>Hexagon head bolt</td><td>Hexagon nut</td><td colspan="2">VP plug (PF thread)</td></tr>
<tr><td>6</td><td>M 8</td><td>M 8</td><td colspan="2">-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="4">Small size, Max 36 mm</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="4">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="4">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="4">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="4">4×100 mm</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="4">Capable of tightening with the specified torques</td></tr>
<tr><td colspan="2">Pincers</td><td colspan="4">-</td></tr>
<tr><td colspan="2">Bolt</td><td colspan="4">M4, Length : 50 mm</td></tr>
</table>

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C) ※Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S35C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

3) DISASSEMBLY

Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

For this reason, replacement of a regulator assembly is recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

(1) Choose a place for disassembly.

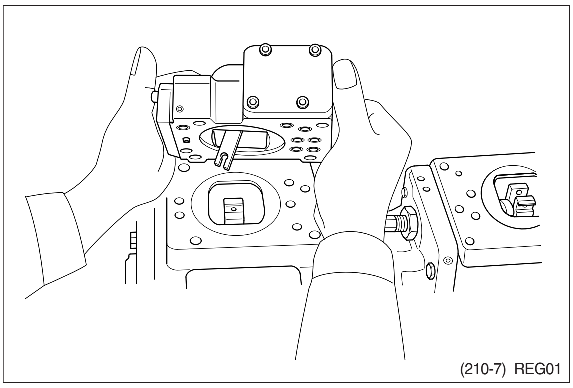
※ Choose a clean place.

※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.

(2) Remove dust, rust, etc. from surfaces of regulator with clean oil.

(3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.

※ Take care not to lose O-ring.

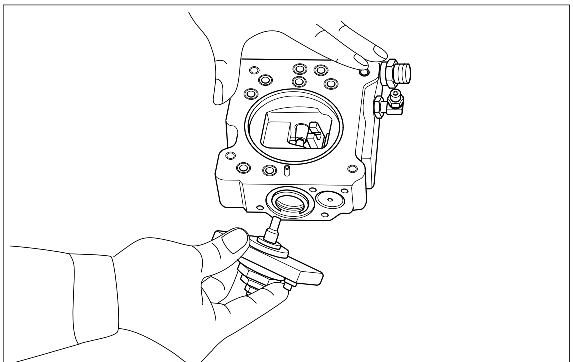


(210-7) REG01

(4) Remove hexagon socket head screw (438) and remove cover (C,629)

※ Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

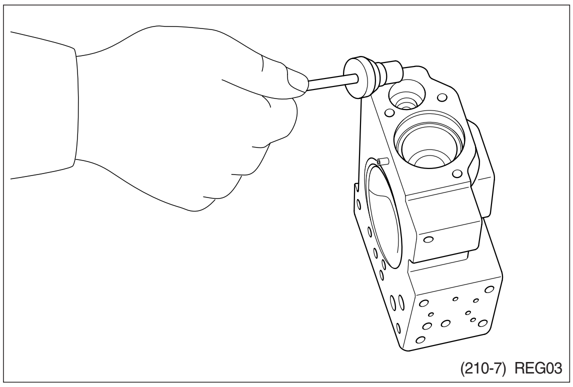
※ Do not loosen these screws and nuts. If they are loosened, adjusted pressure-flow setting will vary.



(210-7) REG02

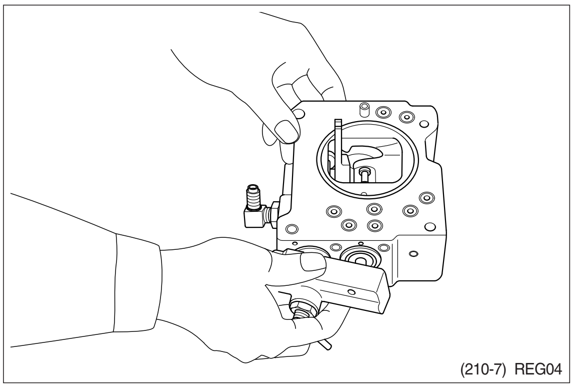
(5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.
Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

※ Adjusting ring (Q,645) can easily be drawn out with M4 bolt.



(210-7) REG03

(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.

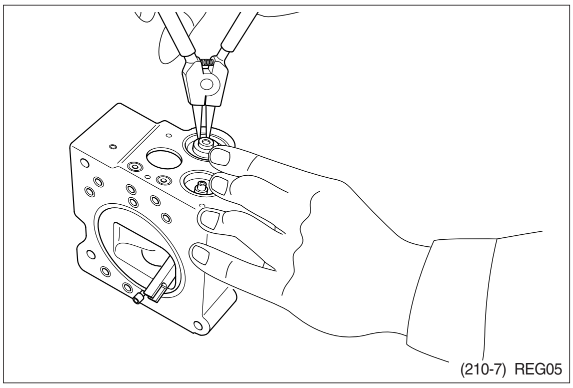


(210-7) REG04

(7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).

※ Sleeve (651) is fitted with snap ring (836).

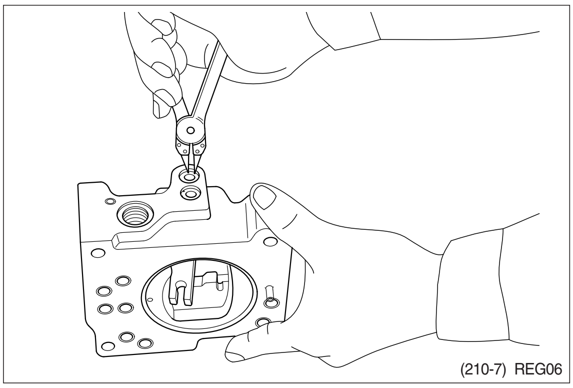
※ When removing snap ring (814), return spring (654) may pop out.
Take care not to lose it.



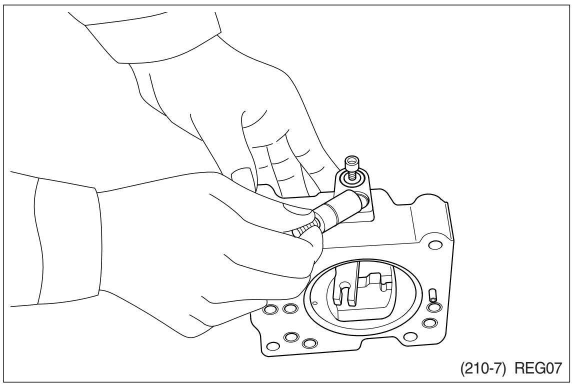
(210-7) REG05

(8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.



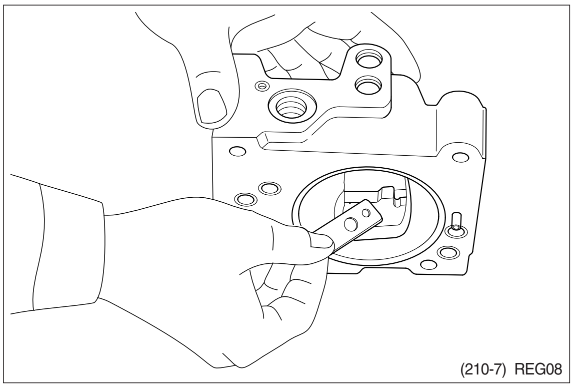
(210-7) REG06



(210-7) REG07

(9) Remove lever (2, 613). Do not draw out pin (875).

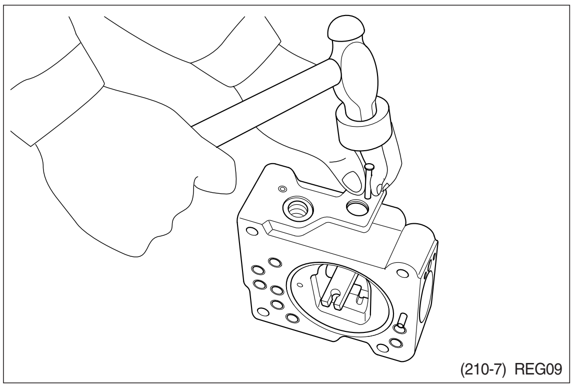
※ Work will be promoted by using pincers or so on.



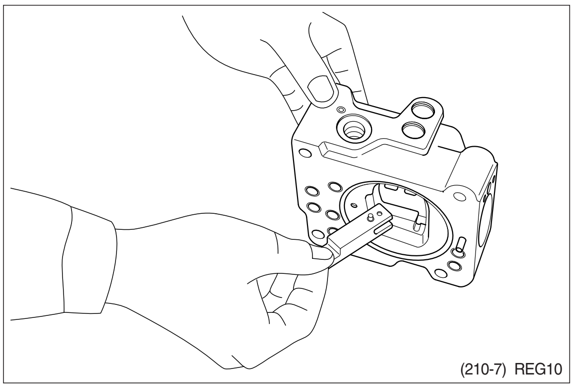
(210-7) REG08

(10) Draw out pin (874) and remove feedback lever (611).

Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever (1, 612).



(210-7) REG09



(210-7) REG10

(11) Remove lever 1 (612). Do not draw out pin (875).

(12) Draw out pilot piston (643) and spool (652).

(13) Draw out piston case (622), compensating piston (621) and compensating rod (623).

※ Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

This completes disassembly.

4) ASSEMBLY

(1) For assembly, reverse disassembly procedures, but pay attention to the following items.

① Always repair parts that were scored at disassembly.

② Get replacement parts ready beforehand. Mixing of foreign matter will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Always tighten bolts, plugs, etc. to their specified torques.

④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.

⑤ Replace seals such as O-ring with new ones as a rule.

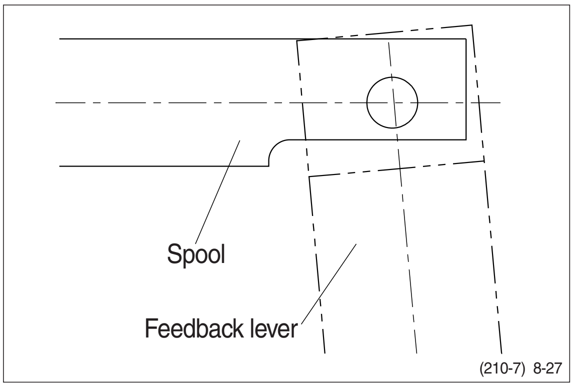
(2) Put compensating rod (623) into compensating hole of casing (601).

(3) Put pin force-fitted in lever 1 (612) into groove of compensating rod and fit lever 1 to pin force-fitted in casing.

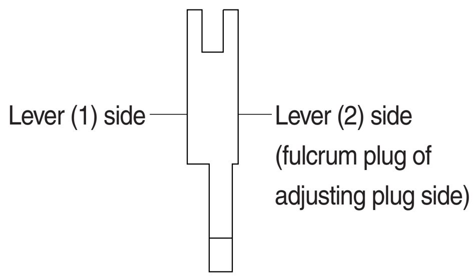
(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

※ Confirm that spool and sleeve slide smoothly in casing without binding.

※ Pay attention to orientation of spool.



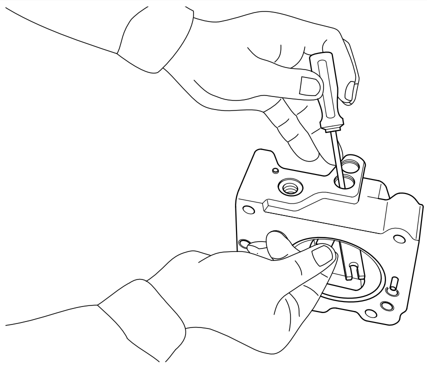
(5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).
※ Insert pin in feedback lever a little to ease operation.
※ Take care not to mistake direction of feedback lever.



(210-7) 8-28

(6) Put pilot piston (643) into pilot hole of casing.
※ Confirm that pilot piston slides smoothly without binding.

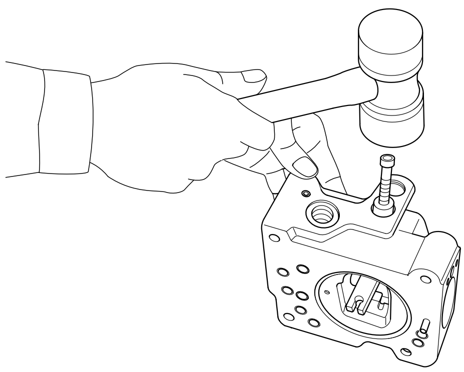
(7) Put pin force-fitted in lever 2 (613) into groove of pilot piston.
Then fix lever 2.



(210-7) REG11

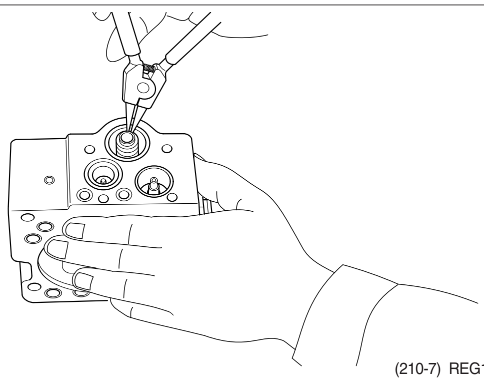
(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever 2.
Then fix locking ring (858).

(9) Insert adjusting plug (615) and fit locking ring.
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.



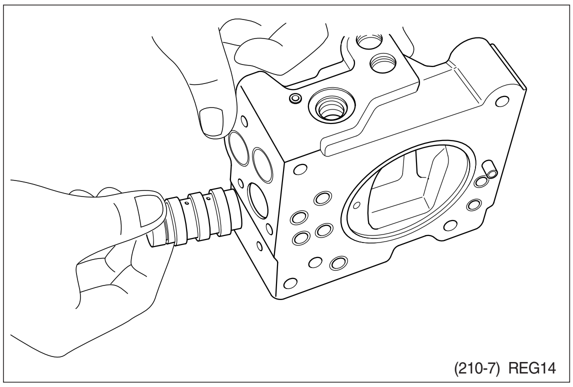
(210-7) REG12

(10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



(210-7) REG13

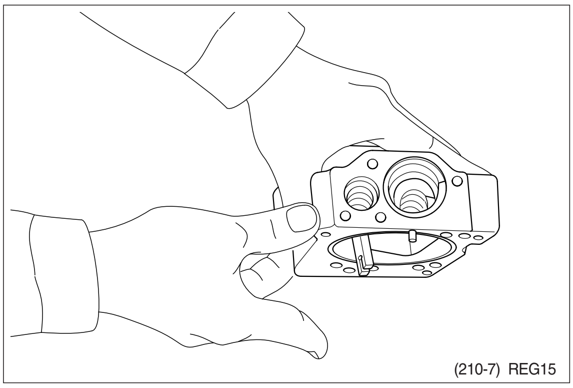
(11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



(210-7) REG14

(12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole.
Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

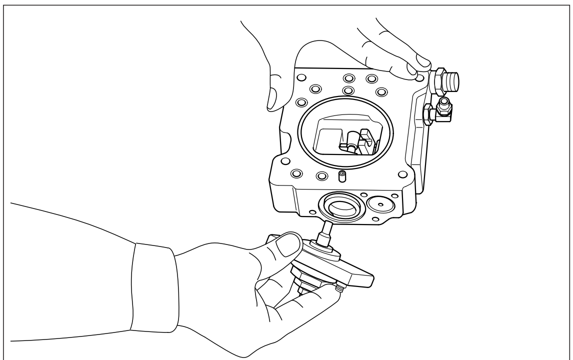
※ When fitting spring seat, take care not to mistake direction of spring seat.



(210-7) REG15

(13) Install cover (C, 629) fitted with adjusting screws (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
Then tighten them with hexagonal socket head screws (438).

This completes assembly.



(210-7) REG16

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

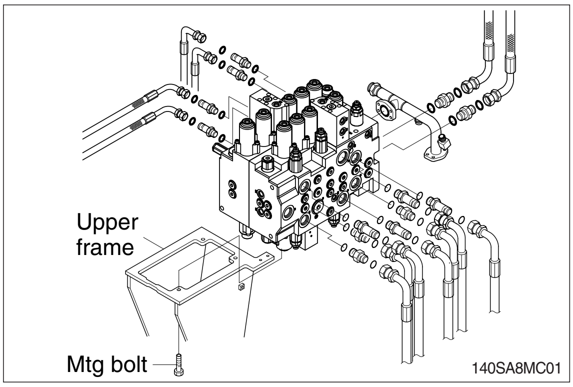
13031GE18

(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.



140SA8MC01

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

(5) Remove bolts and disconnect pipe.

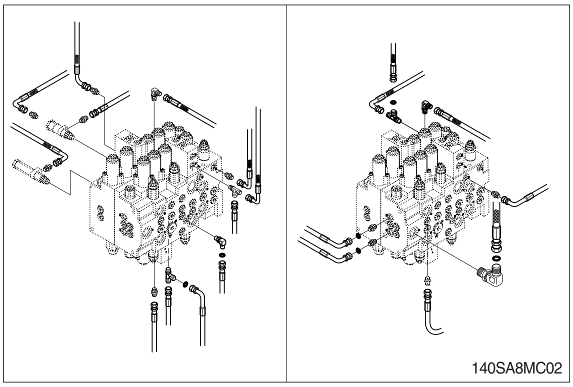
(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.

· Weight : 140 kg (310 lb)

· Tightening torque : 12.2 ± 1.3 kgf · m (88.2 ± 9.4 lbf · ft)



140SA8MC02

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

2) INSTALL

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

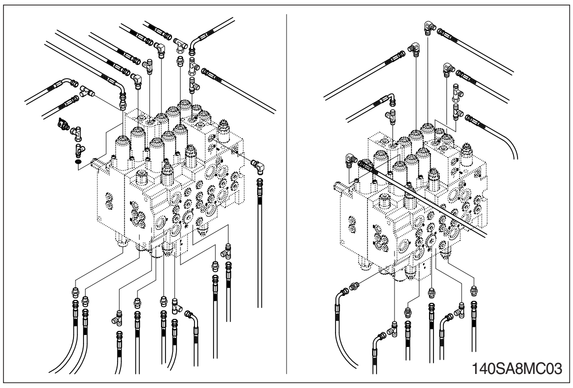
(2) Bleed the air from below items.

① Cylinder (Boom, arm, bucket)

② Swing motor

③ Travel motor

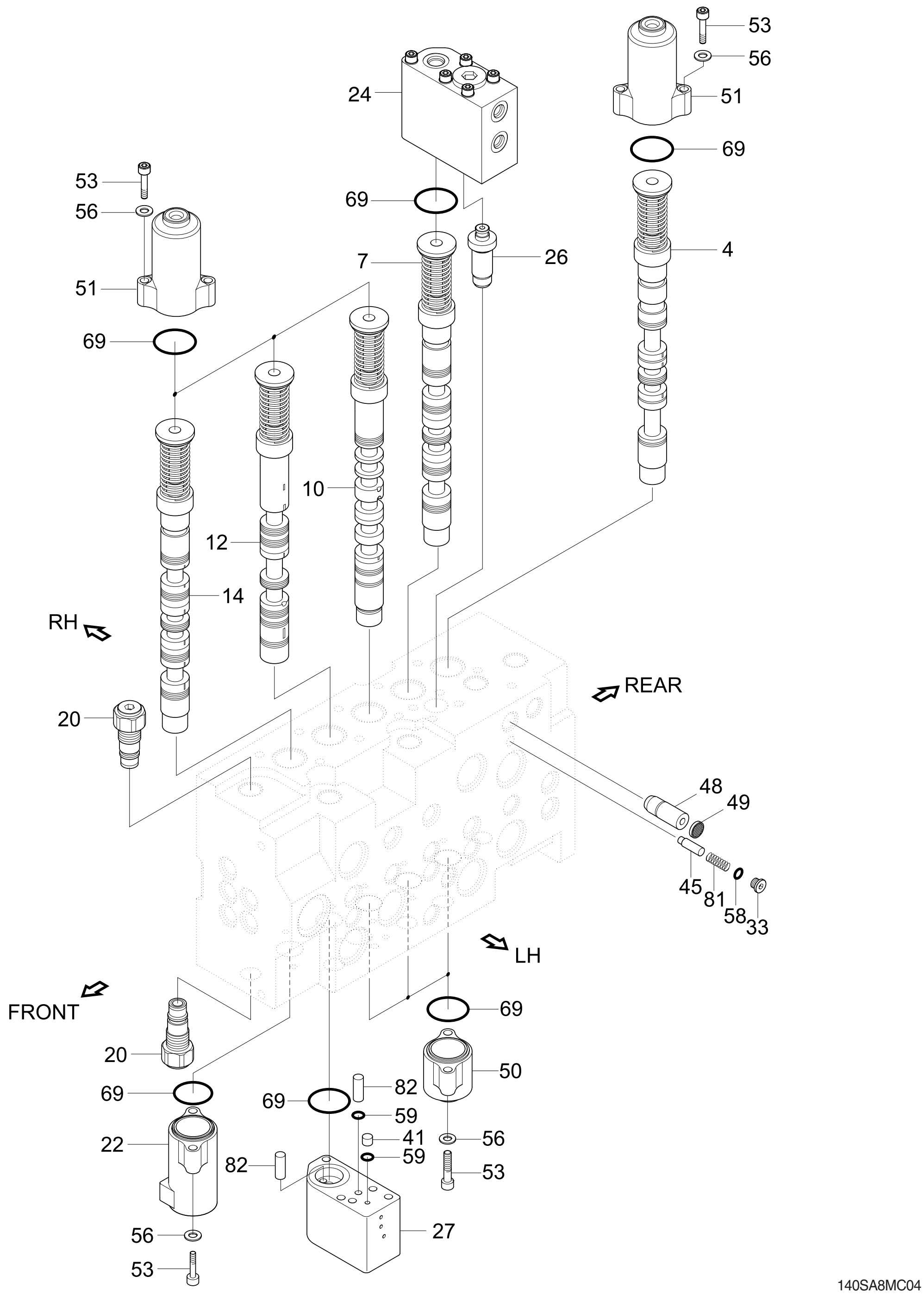
※ See each item removal and install.



140SA8MC03

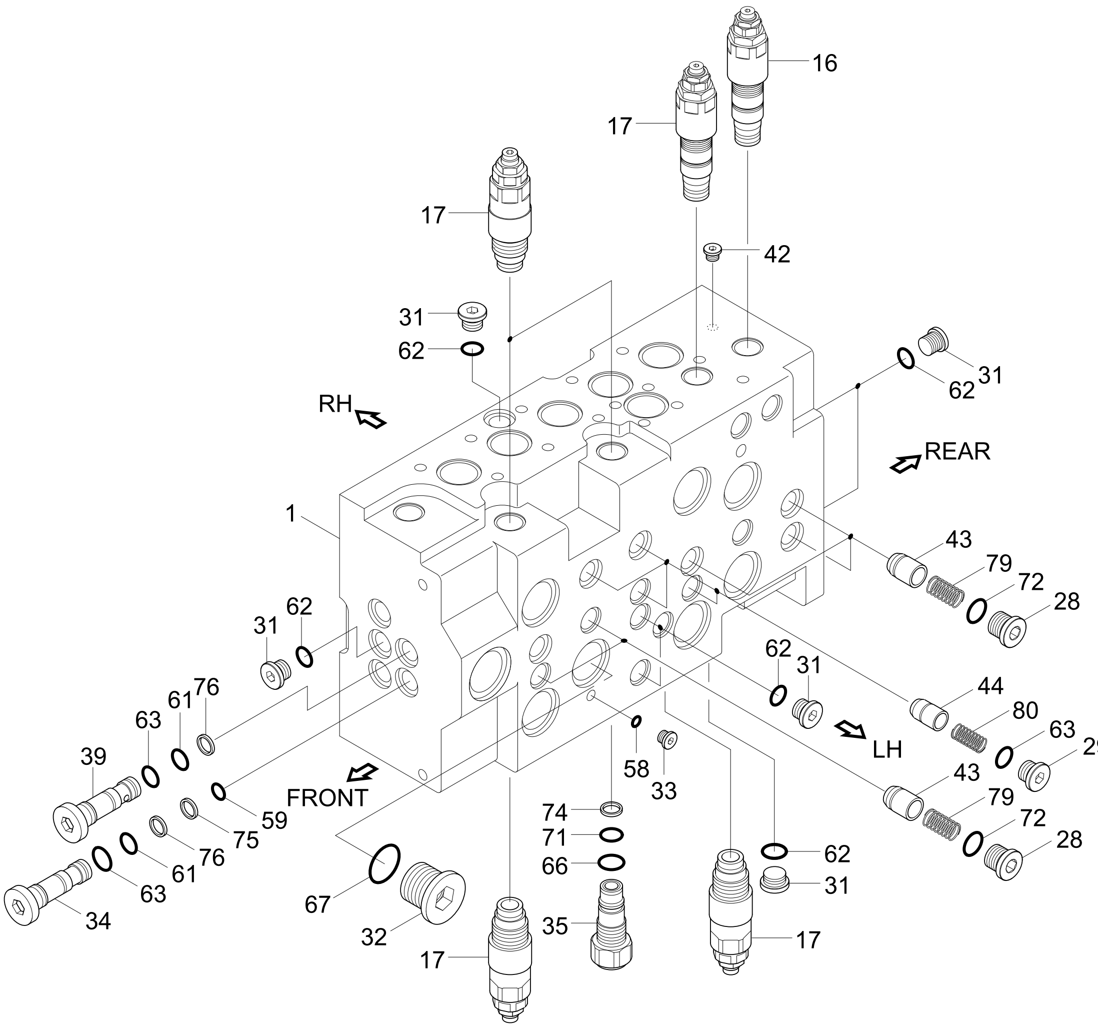
(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.

2. STRUCTURE (1/4)



1	Housing-P1	26	Lock valve kit B	51	Pilot B1 cap
4	Spool assy-travel LH	27	Regeneration block	53	Socket head bolt
7	Spool assy-boom 1	28	Plug	56	Plain washer
10	Spool assy-arm 2	33	Plug	58	O-ring
12	Spool assy-arm regen	41	Plug	59	O-ring
14	Spool assy-bucket	45	Poppet	69	O-ring
20	Nega con relief valve	48	Orifice	81	Spring
22	Bucket stroke limiter	49	Coin type filter	82	Regeneration pin
24	Holding valve kit A1	50	Pilot A cap		

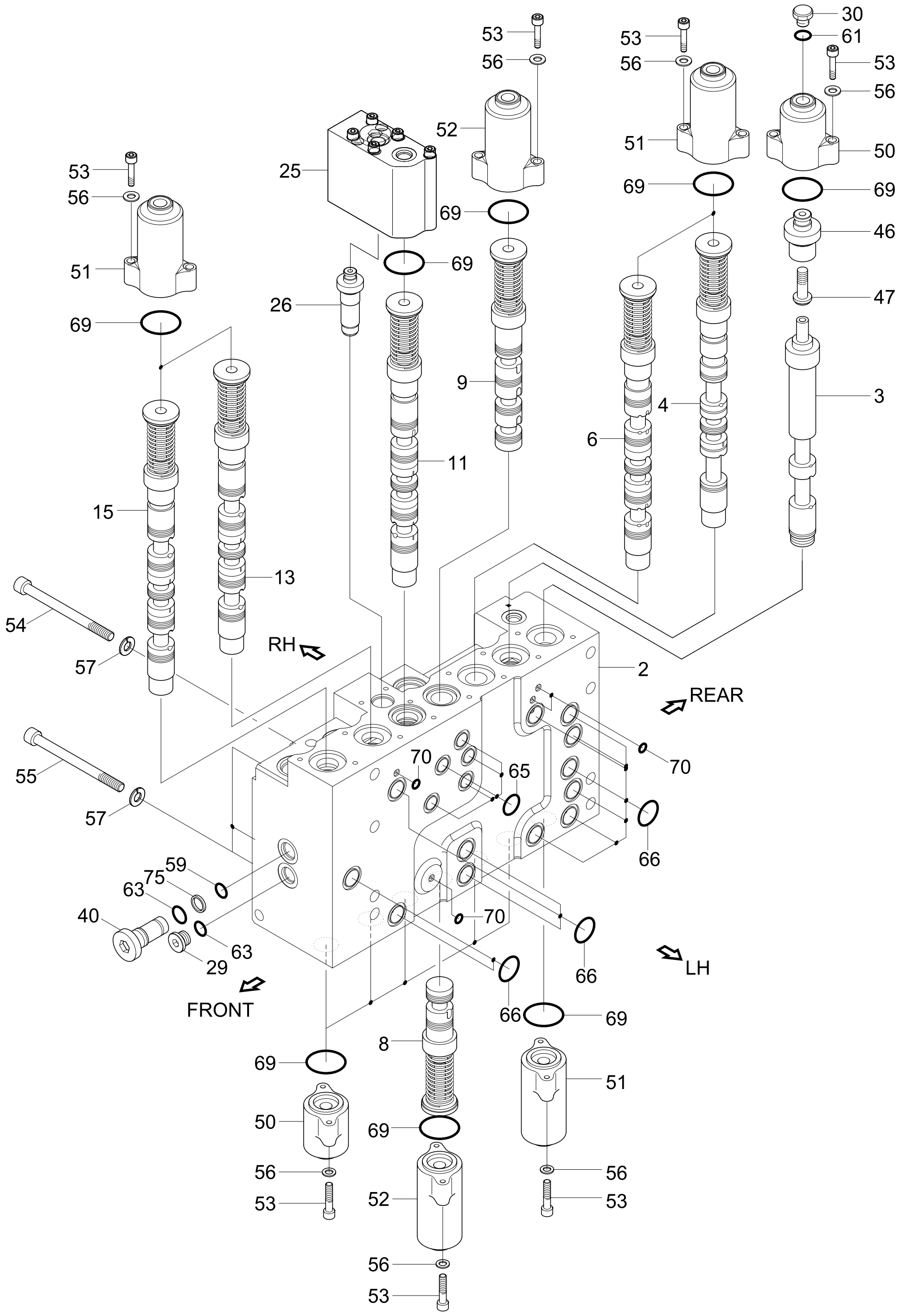
STRUCTURE (2/4)



140SA8MC05

16	Main relief valve	43	Poppet	71	O-ring
17	Overload relief valve	44	Poppet	72	O-ring
28	Plug	58	O-ring	74	Back up ring
29	Plug	59	O-ring	75	Back up ring
31	Plug	61	O-ring	76	Back up ring
32	Plug	62	O-ring	79	Spring
34	Plug	63	O-ring	80	Spring
35	Plug	66	O-ring	83	Plug
39	Plug	67	O-ring		

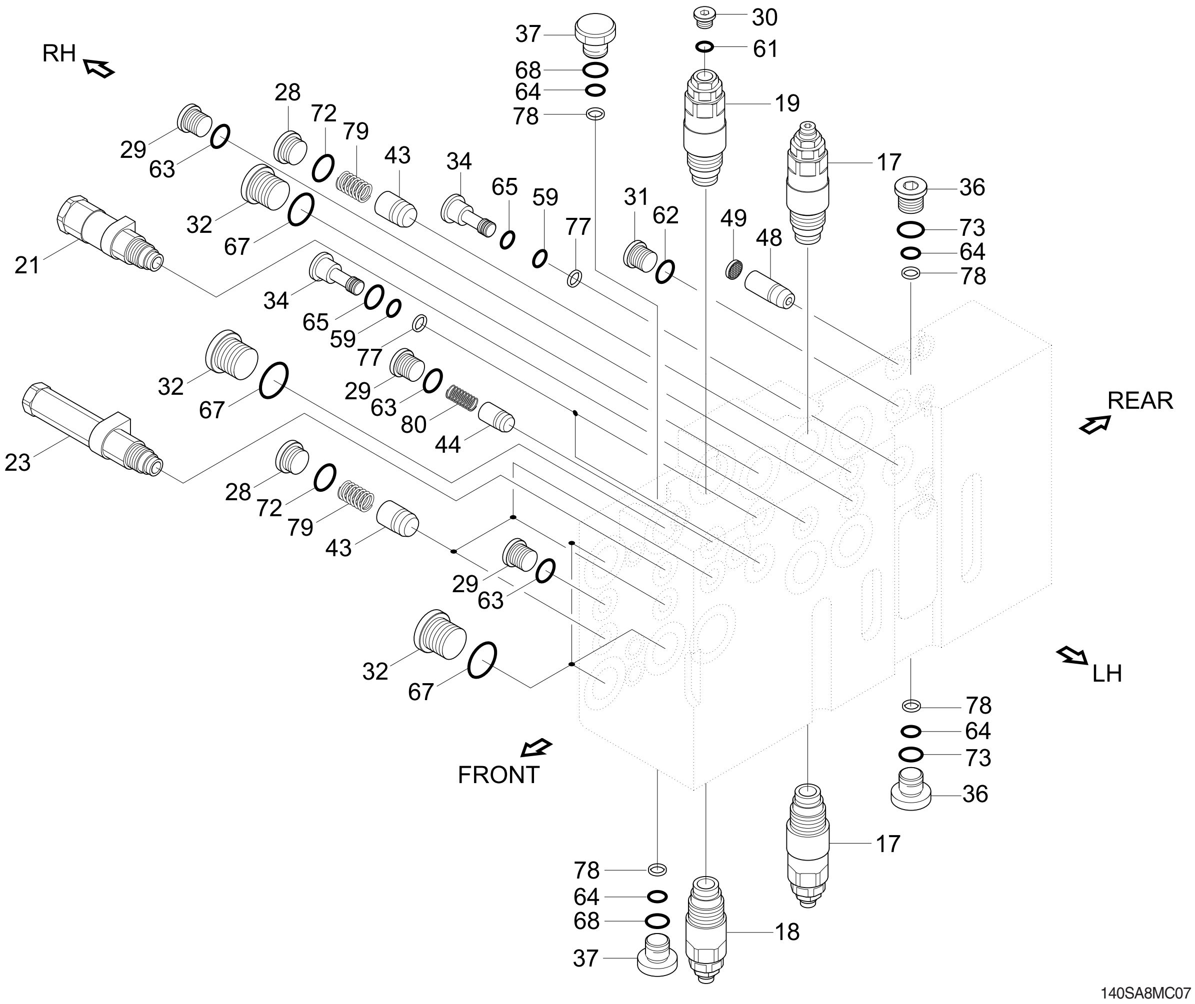
STRUCTURE (3/4)



140SA8MC06

2	Housing-P2	29	Plug	56	Plain washer
3	Spool assy-straight travel	30	Plug	57	Spring washer
4	Spool assy-travel RH	40	Plug	59	O-ring
6	Spool assy-swing	46	Travel straight sleeve	61	O-ring
8	Spool assy-swing priority	47	Travel straight piston	63	O-ring
9	Spool assy-boom 2	50	Pilot A cap	65	O-ring
11	Spool assy-arm 1	51	Pilot B1 cap	66	O-ring
13	Spool assy-option B	52	Pilot B2 cap	69	O-ring
15	Spool assy-dozer	53	Socket head bolt	70	O-ring
25	Holding valve kit A2	54	Socket head bolt	75	Back up ring
26	Lock valve kit-B	55	Socket head bolt		

STRUCTURE (4/4)



17	Overload relief valve	36	Plug	65	O-ring
18	Overload relief valve	37	Plug	67	O-ring
19	Overload relief valve	43	Poppet	68	O-ring
21	Swing logic valve	44	Poppet	72	O-ring
23	ON/OFF valve-option	48	Orifice-signal	73	O-ring
28	Plug	49	Coin type filter	77	Back up ring
29	Plug	59	O-ring	78	Back up ring
30	Plug	61	O-ring	79	Spring
31	Plug	62	O-ring	80	Spring
32	Plug	63	O-ring		
34	Plug	64	O-ring		

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.

(2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(3) When a control valve is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.

(5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) TOOLS

Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	27 and 32
Spanner	Each 1 piece	32 (main relief valve, overload relief valve, negative relief valve) 26 (holding valve)

3) DISASSEMBLY

(1) Disassembly of spools without holding valve

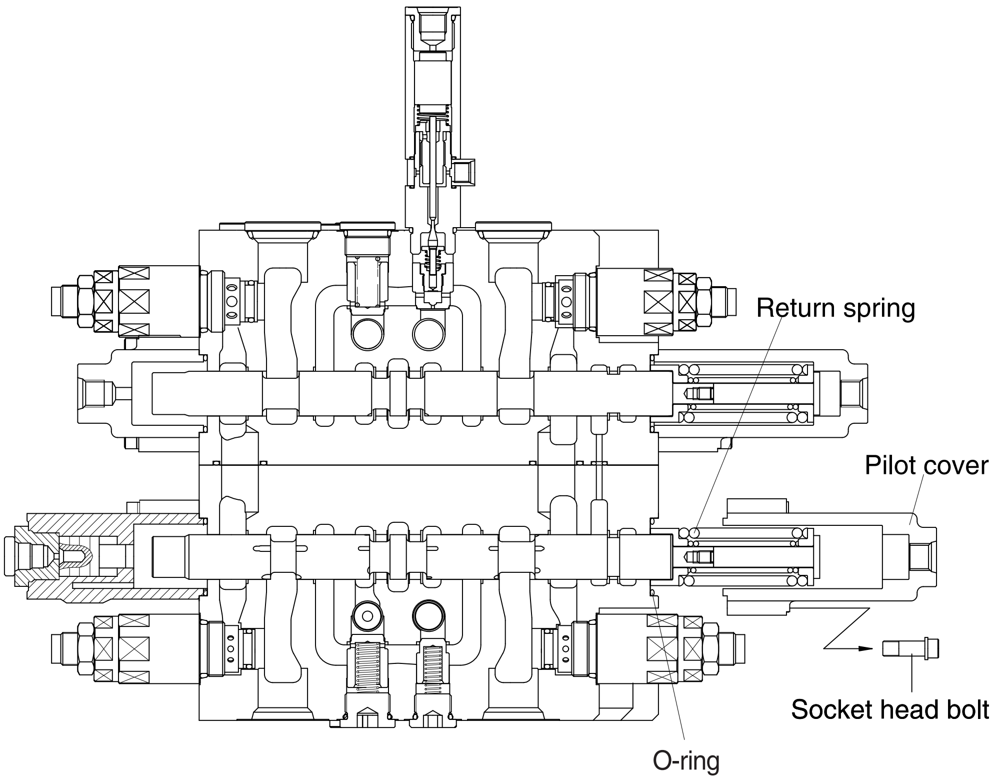
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 ㎜)

② Remove the pilot cover.

※ Pay attention not to lose the O-ring under the pilot cover.

③ Remove the spool assembly from the body by hand slightly.

※ When extracting each spool from its body, pay attention not to damage the body.
※ When extracting each spool assembly, it must be extracted from spring side only.
※ When any abnormal parts are found, replace it with completely new spool assembly.
※ When disassembled, tag the components for identification so that they can be reassembled correctly.



145LCR8MC10

(2) **Disassembly of spools with holding valve** (boom 1, Arm 1 spool)

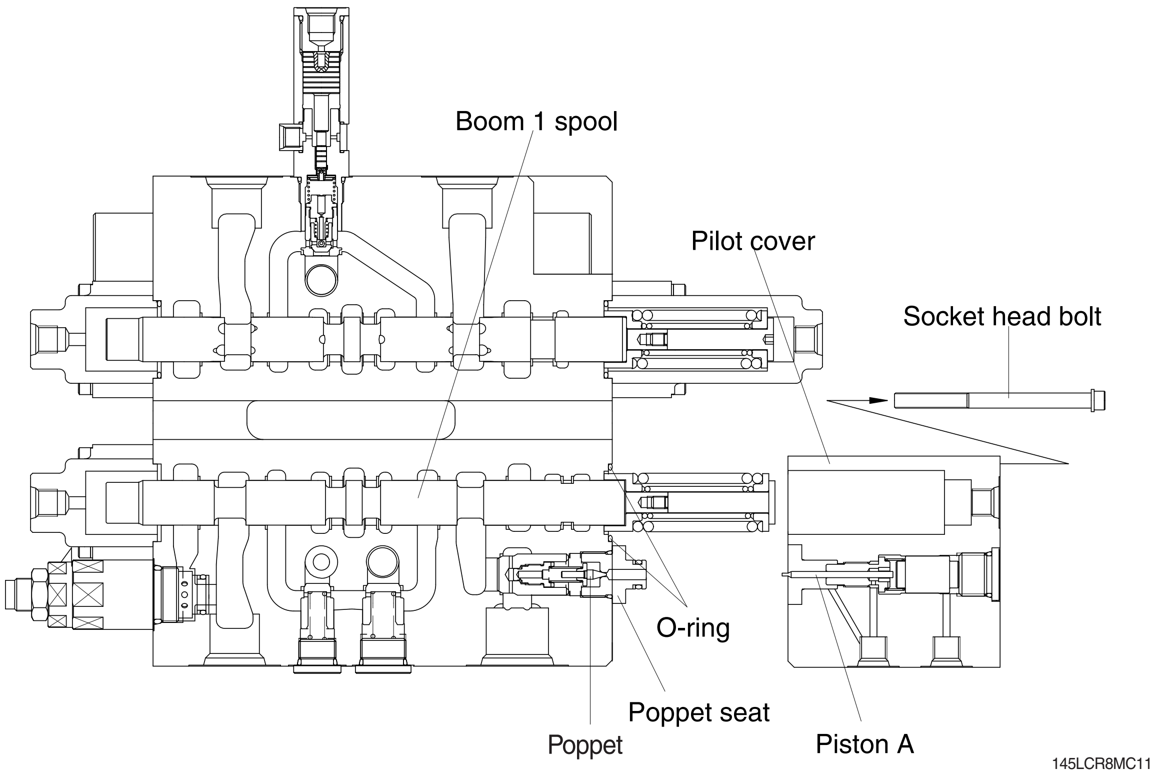
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)

② Remove the pilot cover with internal parts.

※ Pay attention not to lose the O-ring and the poppet under the pilot cover.
※ Pay attention not to damage the "piston A" under pilot cover.

③ Remove the spool assembly from the body by hand slightly.

※ When extracting each spool from its body, pay attention not to damage the body.
※ When extracting each spool assembly, it must be extracted from spring side only.
※ When any abnormal parts are found, replace it with completely new spool assembly.
※ When disassembled, tag the components for identification so that they can be reassembled correctly.



(3) Disassembly of the holding valve

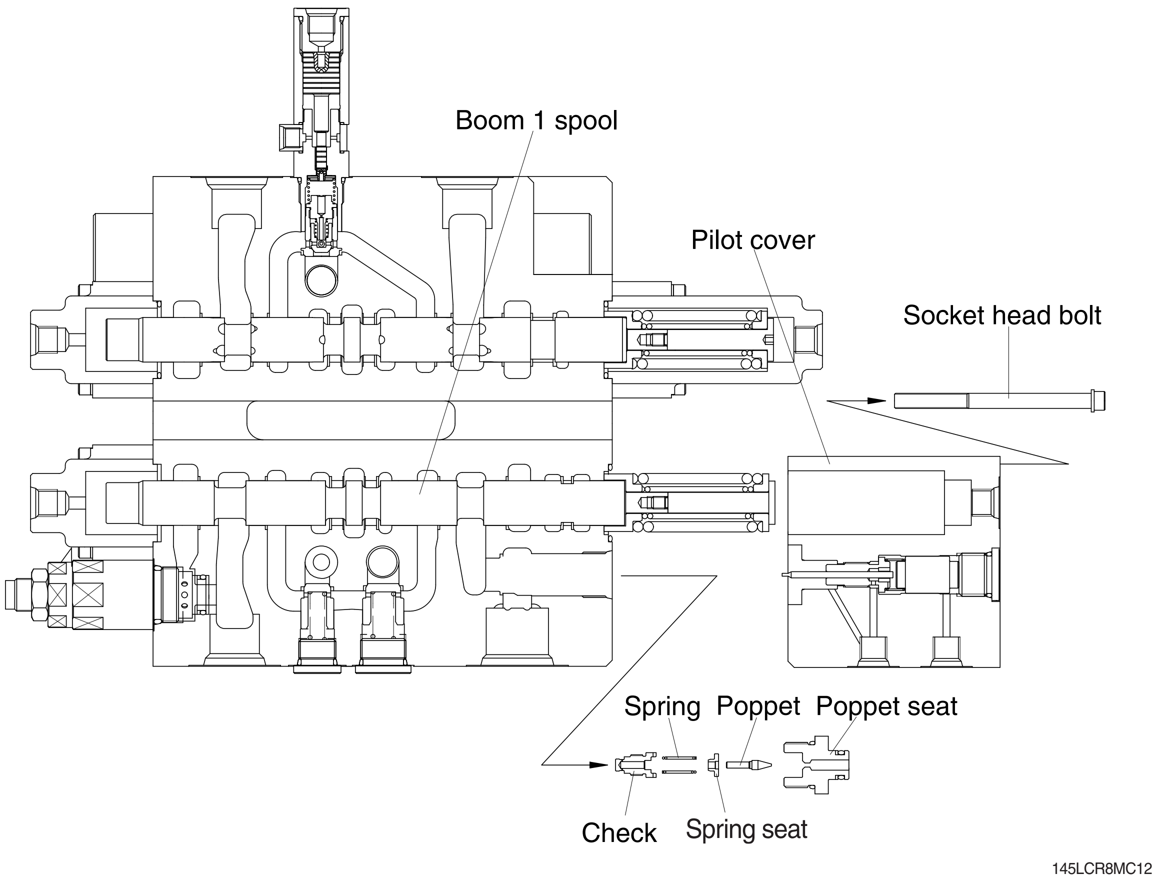
① Remove the pilot cover with the holding valve as described on previous page.

※ Do not disassembled internal parts of the pilot cover.

② Loosen the poppet seat and remove the poppet, spring seat, spring and check. (spanner : 26 ㎜)

※ Pay attention not to lose the poppet.

※ Do not disassembled internal parts of the check.



(4) Disassembly of the load check valve and the negative relief valve

① The load check valve

a. Fix the body to suitable work bench.

※ Pay attention not to damage the body.

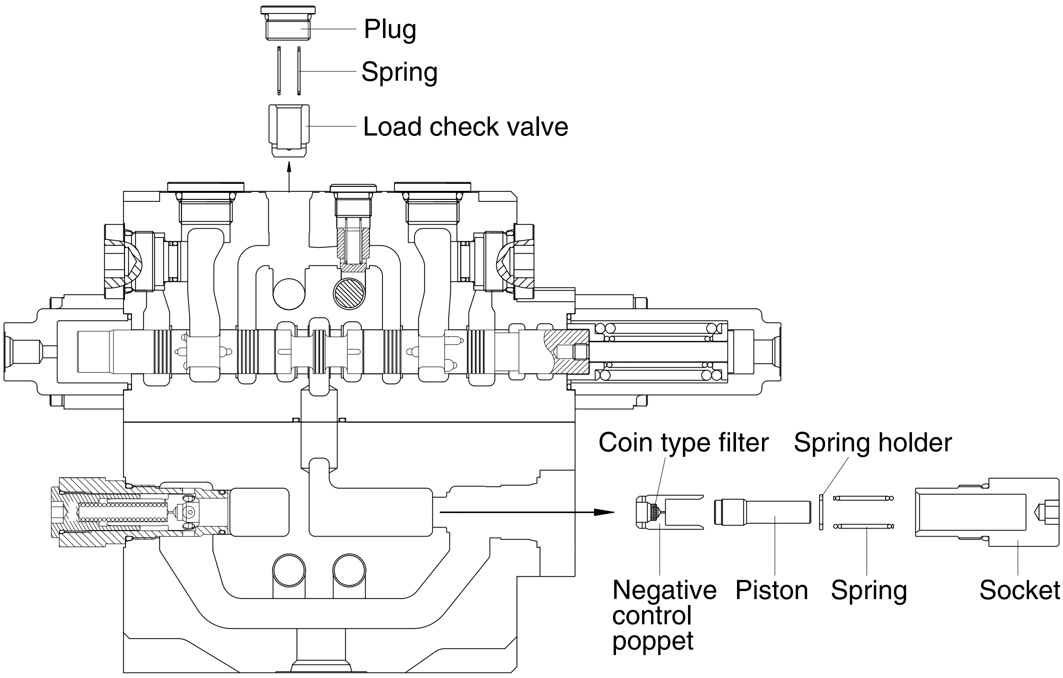
b. Loosen the plug (hexagon wrench : 10 mm).

c. Remove the spring and the load check valve with pincers or magnet.

② The negative relief valve

a. Loosen the socket (spanner : 32 mm).

b. Remove the spring, spring holder, piston and negative control poppet.



14W98MC13

(5) Disassembly of the main and overload relief valve

① Fix the body to suitable work bench.

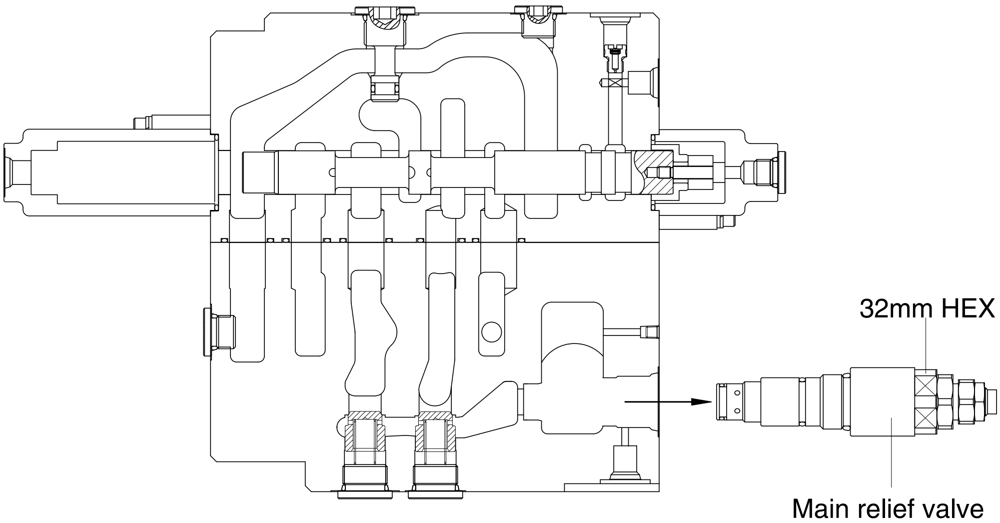
② Remove the main relief valve.
(spanner : 32 ㎜)

③ Remove the overload relief valve.
(spanner : 32 ㎜)

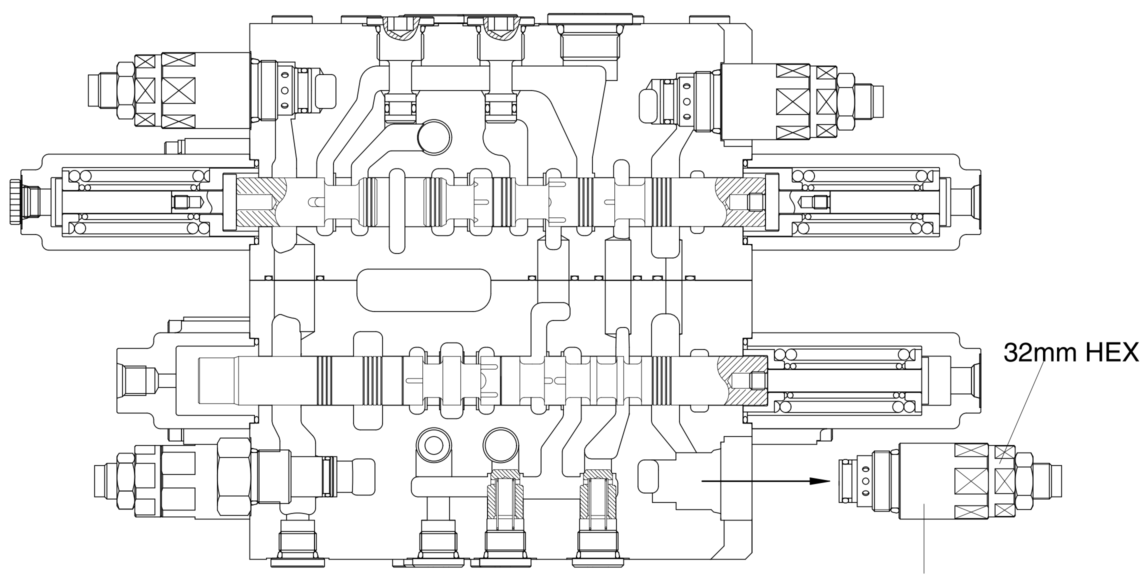
※ When disassembled, tag the relief valve for identification so that they can be reassembled correctly.

※ Pay attention not to damage seat face.

※ When any abnormal parts are found, replace it with completely new relief valve assembly.



Main relief valve



Overload relief valve

145LCR8MC14

(6) Inspection after disassembly

Clean all disassembled parts with clean mineral oil fully, and dry them with compressed air.
Then, place them on clean papers or cloths for inspection.

① Control valve

a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.
b. Confirm that seal groove faces of body and block are smooth and free of dust, dent, rust etc.
c. Correct dents and damages and check seat faces within the body, if any, by lapping.
※ Pay careful attention not to leave any lapping agent within the body.
d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and path's are free foreign matter.
e. If any spring is broken or deformed, replace it with new one.
f. When a relief valve does not function properly, repair it, following it's the prescribed disassembly and assembly procedures.
g. Replace all seals and O-rings with new ones.

② Relief valve

a. Confirm that all seat faces at ends of all poppets and seats are free of defects and show uniform and consistent contact faces.
b. Confirm manually that main poppet and seat can slide lightly and smoothly.
c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.
d. Confirm that springs are free from breakage, deformation, and wear.
e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.
f. Replace all O-rings with new ones.
g. When any light damage is found in above inspections, correct it by lapping.
h. When any abnormal part is found, replace it with a completely new relief valve assembly.

4) ASSEMBLY

(1) General precaution

① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures shown in the previous structure & disassembly section.
② Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
③ Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly. Do not stretch seals so much as to deform them permanently.
④ In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted
⑤ O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.
⑥ Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.
⑦ Do not reuse removed O-rings and seals.

(2) Load check valve

① Assemble the load check valve and spring.
② Put O-rings on to plug.
③ Tighten plug to the specified torque.
· Hexagon wrench : 10 mm
· Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

(3) Negative control relief valve

① Assemble the nega-con poppet, piston, spring holder and spring together into body.
② Put O-ring on to plug and tighten the latter to its specified torque.
· Hexagon wrench : 12 mm
· Tightening torque : 8~9 kgf · m (57.8~65.1 lbf · ft)

(4) Main relief, overload relief valves

Install main relief valve, overload relief valve into the body and tighten to the specified torque.

Component	Tools	Tightening torque	
		kgf · m	lbf · ft
Main relief valve	Spanner 32 mm	8~9	57.8~65.1
Overload relief valve	Spanner 32 mm	8~9	57.8~65.1

(5) Main spools

① Carefully insert the previously assembled spool assemblies into their respective bores within of body.
※ Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.

(6) Pilot covers

① Fit spool covers to the non-spring assembly end of the spool, and tighten the hexagonal socket head bolts to the specified torque.
 · Hexagon wrench : 5 mm
 · Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)

※ Confirm that O-rings have been fitted.

② Fit spring covers to the spring end for the spools, and tighten hexagon socket head bolts to the specified torque.
 · Hexagon wrench : 5mm
 · Tightening torque : 1.0~1.1 kgf·m (7.2~7.9 lbf·ft)

※ Confirm that O-rings have been fitted.

(7) Holding valves

① Assemble the check, spring seat and poppet together into body.

② Tighten the poppet seat to the specified torque.
 · Spanner : 26 mm
 · Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

③ Fit the "piston A" under pilot cover with internal parts into hole on the poppet seat.

④ Tighten hexagon socket head bolt to specified torque.
 · Hexagon wrench : 5mm
 · Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

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

13031GE18

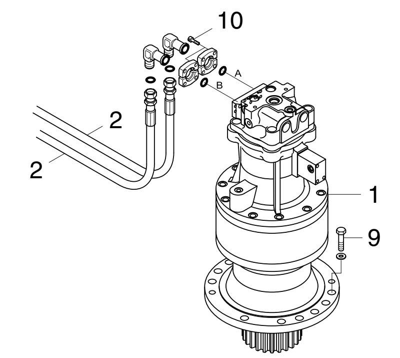
(4) Loosen the bolt (10) and disconnect hose assembly (2).

(5) Disconnect pilot line hoses (3, 4, 5, 6, 7).

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

· Weight : 130 kg (287 lb)

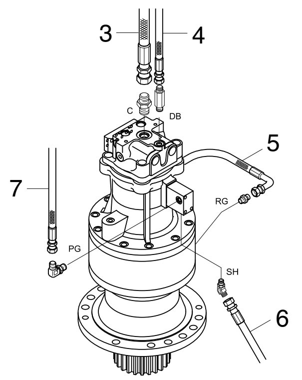
· Tightening torque : 29.6±3.2 kgf · m (214±23.1 lbf · ft)



140SA8SM01

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.



140SA8SM02

2) INSTALL

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

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

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

③ Tighten plug lightly.

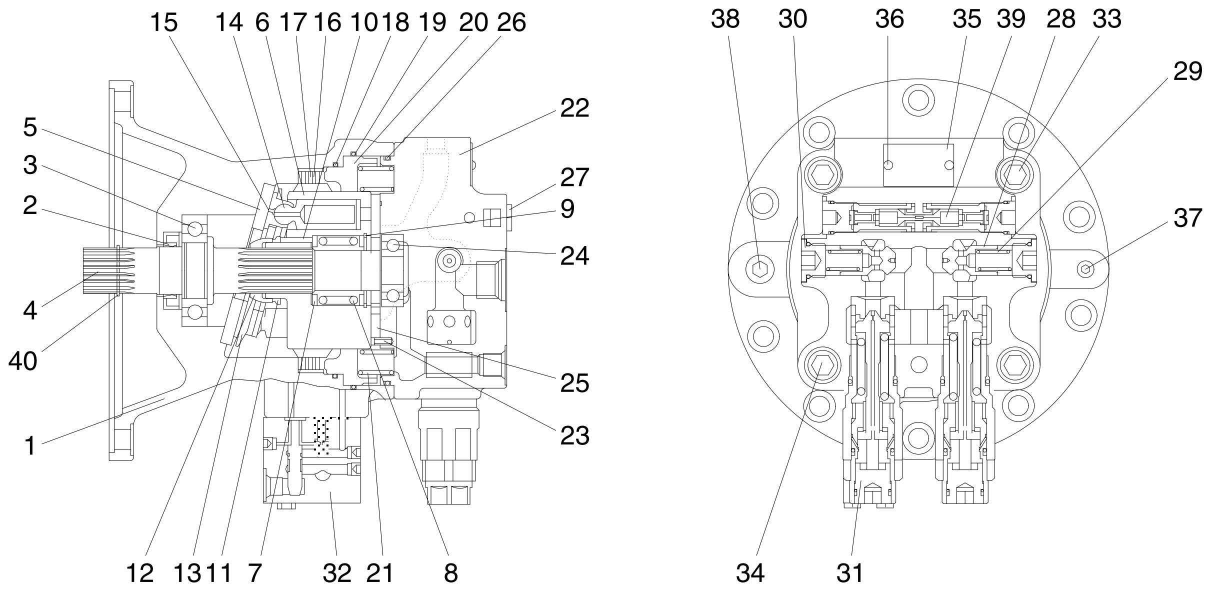
④ Start the engine, run at low idling and check oil come out from plug.

⑤ Tighten plug fully.

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

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



140SA2SM02

1	Casing	15	Shoe	29	Spring
2	Oil seal	16	Separate plate	30	Plug assy
3	Ball bearing	17	Friction plate	31	Relief valve assy
4	Drive shaft	18	O-ring	32	Brake valve assy
5	Shoe plate	19	O-ring	33	Socket bolt
6	Rotary block	20	Brake piston	34	Socket bolt
7	Washer	21	Spring	35	Name plate
8	Spring	22	Valve casing	36	Screw
9	Snap ring	23	Spring pin	37	Plug
10	Roller	24	Ball bearing	38	Plug
11	Collar washer	25	Valve plate	39	Reactionless valve assy
12	Thrust ball	26	O-ring	40	Snap ring
13	Retainer plate	27	Plug assy		
14	Piston	28	Plunger		

2) DISASSEMBLY

※ Some illustrations can be different from the machine.

(1) For easy assembly, put motor on worktable with the spline side of shaft (4) facing downwards.

※ Lay rubber plate on worktable and take care not to damage the components.

125LCR8SM03

(2) Remove snap ring (40) using snap ring plier.

125LCR8SM04

(3) Disassemble level gauge assembly (if equipped) using pipe wrench.

125LCR8SM05

(4) Disassemble two sets of relief valve assembly (51) using socket wrench.

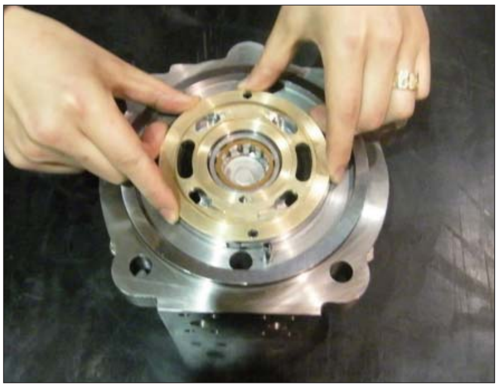
125LCR8SM06

(5) Unscrew M16 socket bolt 33 (2EA), 34 (2EA) using 14 mm hexagon wrench.

125LCR8SM07

(6) Remove valve plate (25) from valve casing.

※ Take care not to drop the valve plate (25).

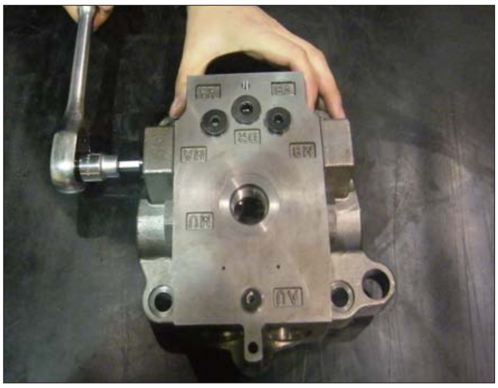


125LCR8SM08

(7) Remove O-ring (19) from valve casing.

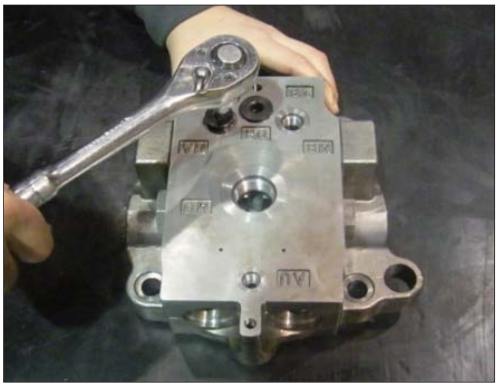
125LCR8SM09

(8) Remove plug (39-1) using hexagon wrench and take out reactionless valve assembly (39). (same for the set on opposite side)



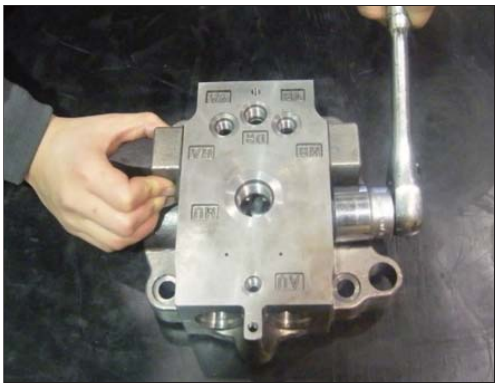
125LCR8SM10

(9) Remove plug assy (27) (2ea) using 6 mm hexagon wrench.



125LCR8SM11

(10) Remove plug assy (30) using 17 mm socket wrench and separate spring ; spring (29) and plunger (28). (same for the set on opposite side)

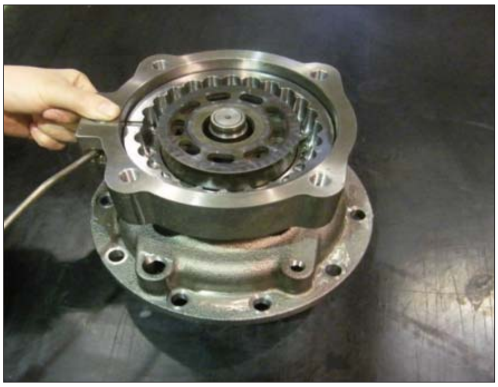


125LCR8SM12

(11) Remove spring (21) (22ea) from brake piston.

125LCR8SM15

(12) Disassemble brake piston (20) from casing using air gun.



125LCR8SM16

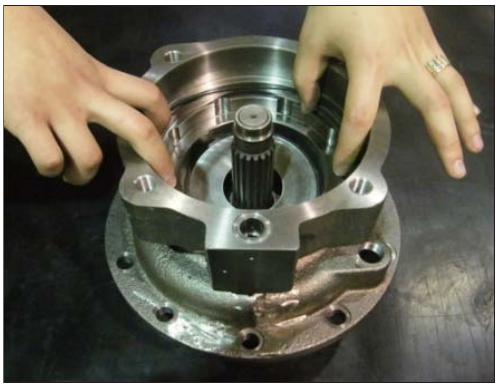
(13) Lay casing down horizontally and remove rotary block assembly from shaft.
And remove all friction plate (17) and separate plate (16).

125LCR8SM17

(14) Separate piston assembly (14, 15), trust ball (12), retainer plate (13).

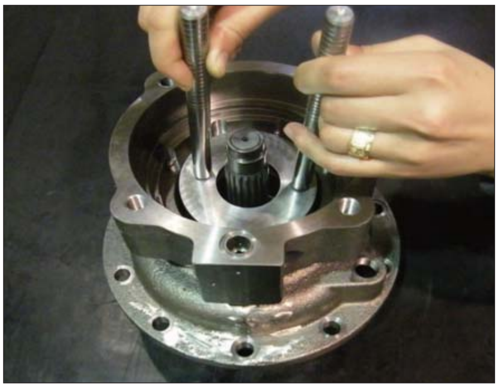
125LCR8SM18

(15) Remove O-ring (18) from casing.



125LCR8SM19

(16) Use a magnet to separate shoe plate (5) from casing.
※ Sliding surface should be carefully treated to avoid scratches and damage.



125LCR8SM20

(17) Disassemble drive shaft (4) and ball bearing (3).

※ Do not remove ball bearing (5) unless malfunction is detected, since it is mounted by shrink fit.

125LCR8SM21

(18) Turn casing (1) upside down and remove oil seal (2) using jig.

125LCR8SM22

3) ASSEMBLY

※ Even though assembly is accomplished by reversing disassembly steps, be careful of the following.

① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
② All parts should be cleaned with cleaner, dried with compressed air.
③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
④ Replacement of O-ring and oil seal with new parts is generally recommended.
⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values.
⑥ When assembling bolt, spread loctite.

(1) Put casing (1) on worktable.
Press oil seal (2) using oil seal jig, until it reach the bottom.
※ Spread grease on external diameter of oil seal.

125LCR8SM23

(2) Mount ball bearing (3, 24) on drive shaft (4) using shrink fitting method.

125LCR8SM24

(3) Assemble shaft assembly in casing using urethane hammer.
※ Take care not to damage oil seal.

125LCR8SM25

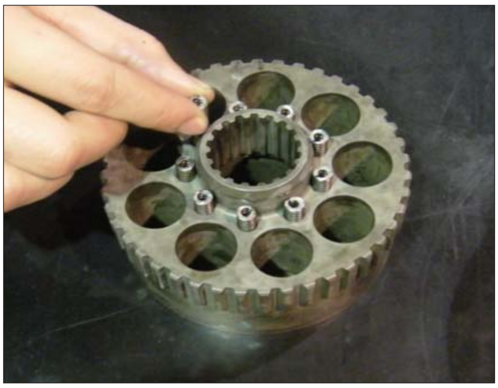
(4) Insert shoe plate (5).
※ Take care not to damage sliding surface.

125LCR8SM26

(5) After applying grease on O-ring (18), insert O-ring in casing (1).

125LCR8SM27

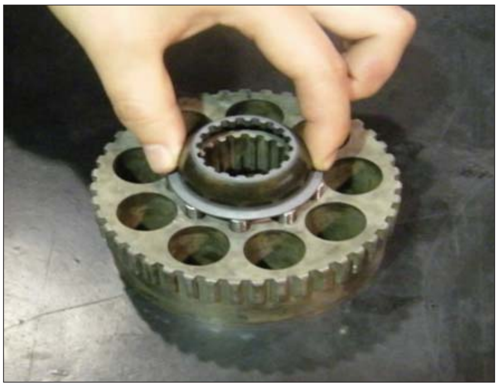
(6) Assemble cylinder spring (8) (9ea) in rotary block (6).



125LCR8SM28

(7) Assemble thrust ball (12) in cylinder block.

※ Take care not to damage sliding surface of cylinder block.



125LCR8SM29

(8) Insert piston assembly (14, 15) in retainer plate (13).

※ Do not mix piston with other piston (9ea/1set).

※ Spread sufficient amount of hydraulic oil on piston assembly.

125LCR8SM30

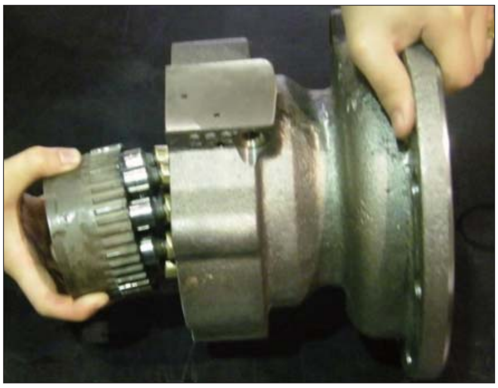
(9) Place all 9 pistons simultaneously into the holes of rotary block.

※ Take care not to damage sliding surface.

125LCR8SM31

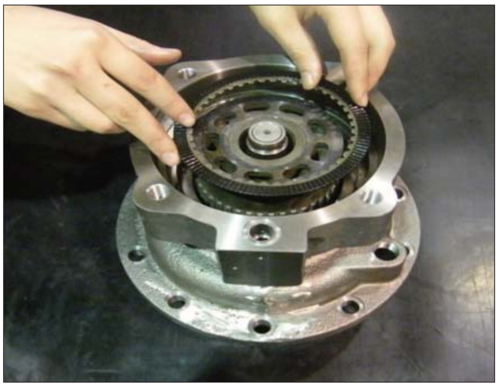
(10) Lay casing down horizontally and put rotary block assembly in casing.

※ Check whether rotary block assembly rotates smoothly.



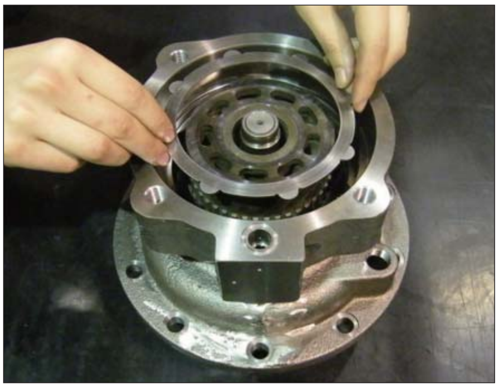
125LCR8SM32

(11) Put friction plate (17) in casing.



125LCR8SM33

(12) Put separate plate (16) in casing.
※ Put friction plate and separate plate alternately.



125LCR8SM34

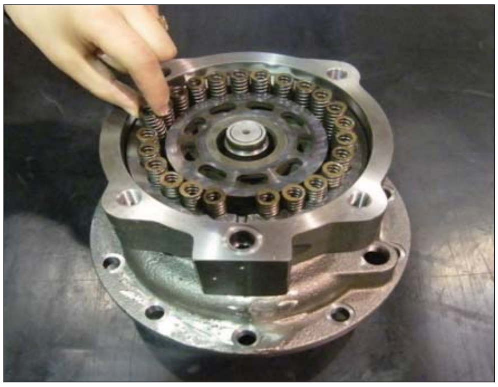
(13) Assemble O-ring (19) in brake piston (20).
※ Apply grease on O-ring.

125LCR8SM35

(14) Assemble parking piston (20) in casing using jig.
※ Pay attention to the hole location of parking piston.

125LCR8SM36

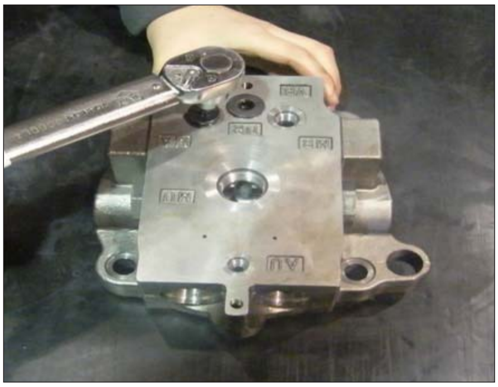
(15) Put spring (21) (22ea) in each hole of brake piston.



125LCR8SM37

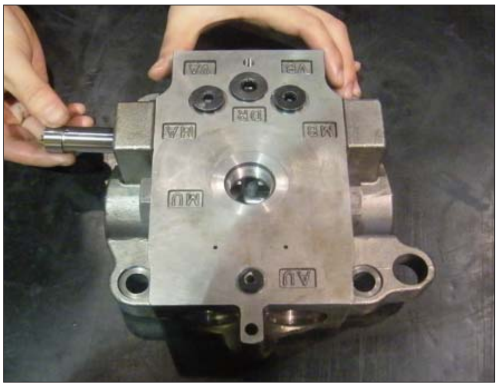
(16) Assemble plug (27) using 6 mm hexagon wrench.

※ Tightening torque : 4.5±0.45 kgf · m (32.5±3.3 lbf · ft)



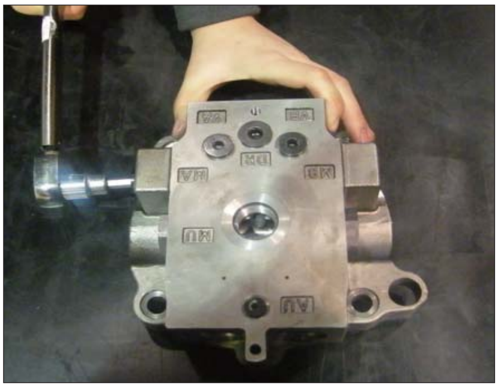
125LCR8SM41

(17) Assemble reactonless valve assembly (39) in valve casing.



125LCR8SM43

(18) Assemble plug (39-1) using hexagon wrench.



125LCR8SM44

(19) Caulk plunger (28) using jig. (same for the set on opposite side)

125LCR8SM45

(20) Assemble spring (29), plug (30). (in that order) (same for the set on opposite side)

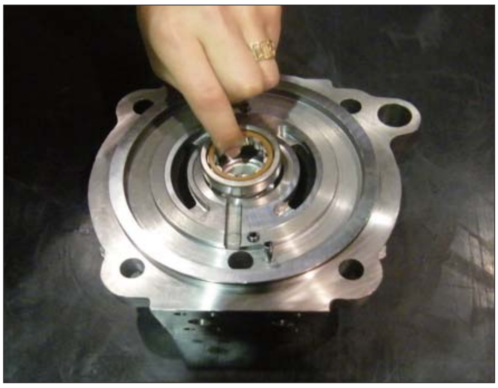
125LCR8SM46

(21) Assemble spring pin (23) in valve casing using jig.

125LCR8SM47

(22) Assemble O-ring (19) & ball bearing (24) in valve casing.

※ Use jig (press fit or cold shrink fit).

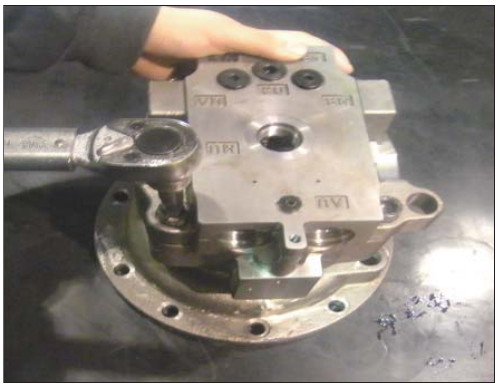


125LCR8SM48

(23) Apply grease on steel side of valve plate (25) to prevent plate from sliding.
Assemble valve plate with the copper side facing upwards.
※ Pay attention to the assembly direction.
※ Take care not to damage sliding surface.


125LCR8SM49

(24) Assemble valve casing by matching its holes and pins of casing and parking piston. And tighten M16 socket bolt 33 (2EA), 34 (2EA) using 14 mm hexagon wrench.
※ Make sure valve plate stays in place.
※ When tightening bolts, make sure mating surfaces between casing and valve casing maintain parallel to each other.


125LCR8SM50

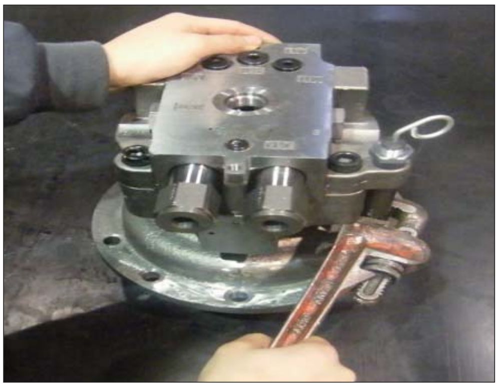
(25) Assemble relief valve assembly (31) using socket wrench in valve casing.
※ Spread grease on O-ring part of relief valve assembly.


125LCR8SM51

(26) Assemble snap ring (40) in shaft by using snap ring plier.


125LCR8SM52

(27) Wrap teflon tape 2 or 3 times around the tap part of level gauge assembly (if equipped).
And assemble it using pipe wrench.



125LCR8SM53

3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

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

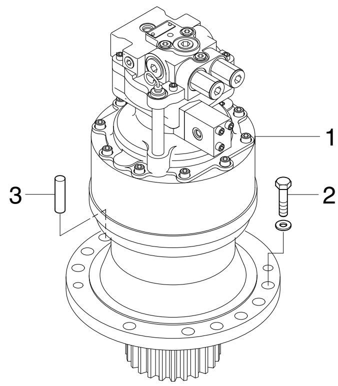
(2) Sling reduction gear assembly (1) and remove dowel pin (3) and mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 75 kg (165 lb)

13031GE18

2) INSTALL

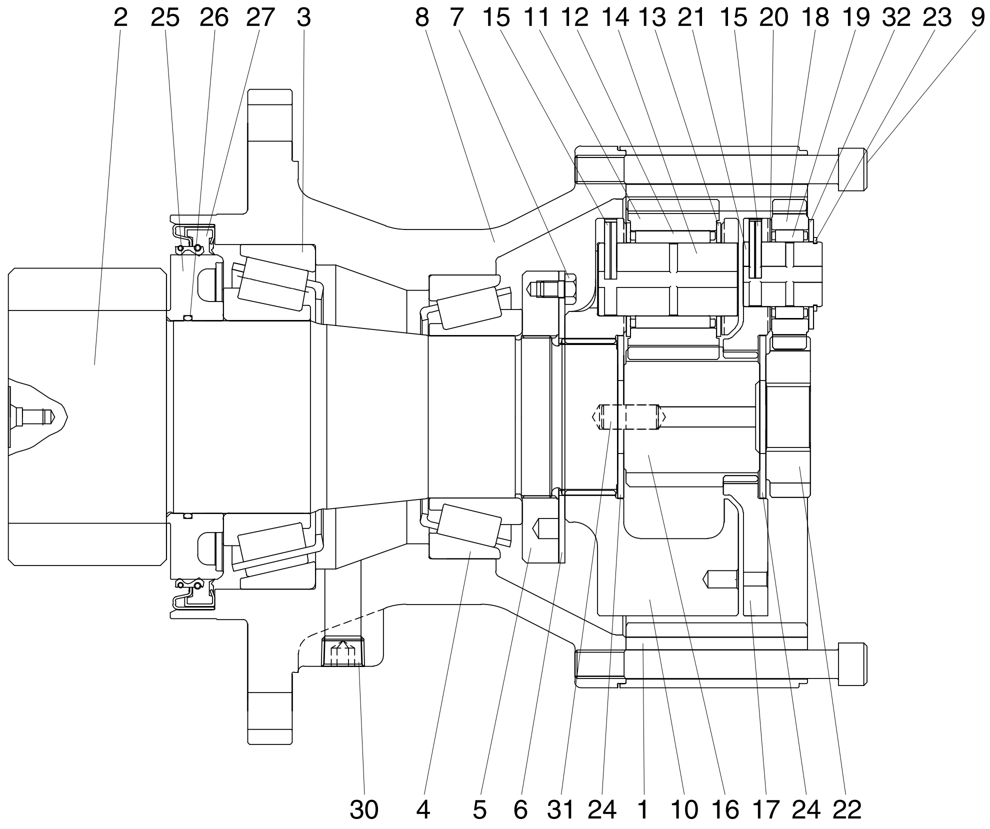
(1) Carry out installation in the reverse order to removal.
· Tightening torque : 29.6 ± 3.2 kgf · m (214 ± 23.1 lbf · ft)



140LC8SM23

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



125LCR2SM23

1	Ring gear	11	Planetary gear No. 2	21	Carrier pin No. 1
2	Drive shaft	12	Needle bearing	22	Sun gear No. 1
3	Taper roller bearing	13	Thrust washer	23	Snap ring
4	Taper roller bearing	14	Carrier pin No. 2	24	Thrust plate
5	Ring nut	15	Spring pin	25	Sleeve
6	Lock plate	16	Sun gear No. 2	26	O-ring
7	Hexagon bolt	17	Carrier No. 1	27	Oil seal
8	Casing	18	Planetary gear No. 1	30	Socket plug
9	Socket bolt	19	Needle bearing	31	Parallel pin
10	Carrier No. 2	20	Thrust washer	32	Thrust washer

2) DISASSEMBLY

(1) Remove the swing motor, and then place swing reduction gear on the bench.

125LCR8SM60

(2) Disassemble sun gear No.1 (22).

125LCR8SM61

(3) Disassemble carrier No.1 sub assembly.

125LCR8SM62

Carrier No.1 sub assy disassembly

(4) Put carrier No.1 sub assembly on the bench, then remove the snap ring (23).

125LCR8SM63

(5) Disassemble thrust washer No.1 (upper) (32).(3 pcs)

125LCR8SM64

(6) Disassemble planetary gear No.1 (18). (3 pcs)

125LCR8SM65

(7) Disassemble thrust plate (24).

125LCR8SM66

(8) Disassemble needle bearing No.1 (19). (3 pcs)

125LCR8SM67

(9) Disassemble thrust washer No.1 (lower) (20). (3 pcs)

125LCR8SM68

(10) After placing spring pin (15) to center of carrier pin No.1 (21) with a jig, disassemble it. (3 pcs)

※ Do not reuse spring pin, carrier and carrier pin.

125LCR8SM69

(11) Disassemble sun gear No.2 (16).

125LCR8SM70

(12) Disassemble carrier No.2 sub assembly.

125LCR8SM71

Carrier No.2 sub assy disassembly

(13) After placing spring pin (15) to center of carrier pin No.2 (14) with a press machine, disassemble it.(3 pcs)

※ Do not reuse spring pin.

125LCR8SM72

(14) Disassemble planetary gear No.2.(3 pcs)

125LCR8SM73

(15) Disassemble thrust plate (24).

125LCR8SM74

(16) Disassemble thrust washer No.2 (13).(6 pcs)

125LCR8SM75

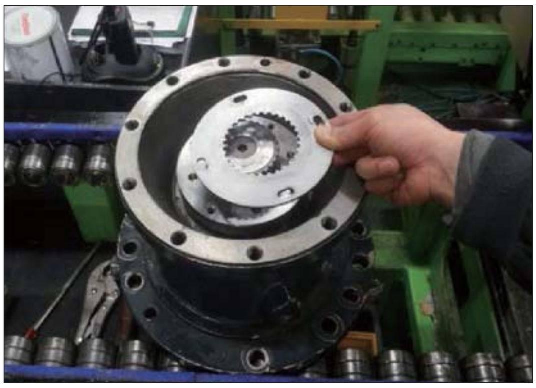
(17) Disassemble needle bearing No.2 (12). (3 pcs)

125LCR8SM76

(18) Separate ring gear (1) from casing (8).

125LCR8SM77

(19) Loosen bolt (7) (4 pcs), and disassemble lock plate (6).



125LCR8SM78

(20) Disassemble ring nut (5) by using the jig.

125LCR8SM79

Drive shaft sub assy disassembly

(21) Separate drive shaft sub assembly from casing (8).

125LCR8SM80

(22) Disassemble taper roller bearing (3) and oil seal (27) by using a press machine.

125LCR8SM81

(23) Disassemble sleeve (25) and O-ring (26).

125LCR8SM82

(24) Disassemble the outer ring of taper roller bearing (3) in casing (8) by using the jig.

125LCR8SM83

3) ASSEMBLY

※ Even though assembly is accomplished by reversing disassembly steps, be careful of the following.

① Repair the damaged part when disassemblying and prepare parts for exchange in advance.

② All parts should be cleaned with cleaner, dried with compressed air.

③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.

④ Replacement of O-ring and oil seal with new parts is generally recommended.

⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values.

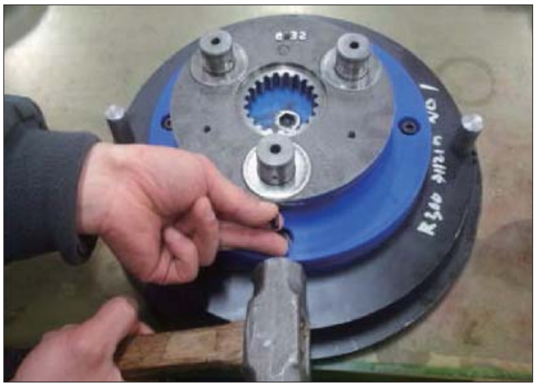
⑥ When assembling bolt, spread loctite.

Carrier No.1 sub assembly

(1) After heating the carrier No.1 (17), assemble carrier pin No.1 (21) to the side without thehole.

125LCR8SM84

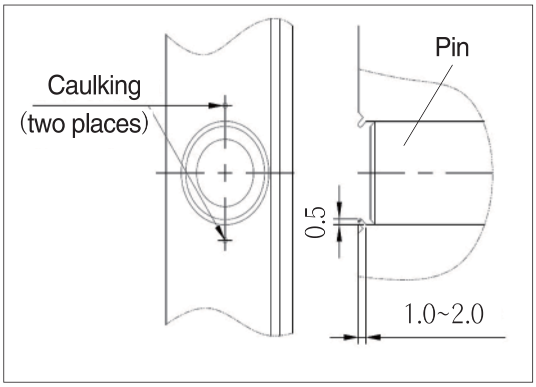
(2) After drilling Ø6 hole, assemble spring pin (15).(3 pcs)



125LCR8SM85

(3) Caulking is performed on the assembled spring pin unit.

※ To cover pins, implement the caulking in two places that are located direction of 180 degrees around assembled spring pin.



125LCR8SM86

(4) Assemble thrust washer No.1 (lower) (20). (3 pcs)

125LCR8SM87

(5) Assemble needle bearing No.1 (19).(3 pcs)

125LCR8SM88

(6) Assemble thrust plate (24).

125LCR8SM89

(7) Assemble planetary gear No.1 (18) of which groove is faced downward.(3 pcs)

125LCR8SM90

(8) Assemble thrust washer No.1 (upper) (32). (3 pcs)

125LCR8SM91

(9) Assemble snap ring (23) (3 pcs), complete carrier No.1 sub assembly.

※ Gear rotation state should be smooth.

125LCR8SM92

Carrier No.2 sub assy assembly

(10) Assemble needle bearing No.2 (12) in the planetary gear No.2 (11).

125LCR8SM93

(11) After spreading grease on thrust washer No.2 (13), assemble it on both upper side and lower side of planetary gear No.2.

125LCR8SM94

(12) Assemble thrust plate (24).

125LCR8SM95

(13) Assemble planetary gear No.2 in the carrier No.2 (10).(3 pcs)

※ Thrust washer No.2 should notseparated.

125LCR8SM96

(14) Assemble carrier pin No.2 (14) to match the pin hole of the carrier No.2.(3 pcs)

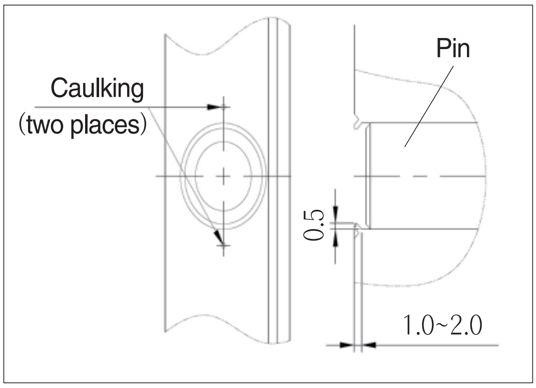
125LCR8SM97

(15) Assemble spring pin (15).(3 pcs)

125LCR8SM98

(16) Caulking is performed on the assembled spring pin unit.

※ To cover pins, implement the caulking in two places that are located direction of 180 degrees around assembled spring pin.



125LCR8SM99

Drive shaft sub assy assembly

(17) After heating sleeve (25), assemble O-ring (26) to groove of inside diameter in it.

125LCR8SM100

(18) Shrink fit the sleeve on drive shaft (2).

※ Be careful of fully seat at the bottom.

125LCR8SM101

(19) Shrink fit taper roller bearing (3) on drive shaft, complete drive shaft sub assembly.

125LCR8SM102

Casing assembly

(20) Press outer ring of the taper roller bearing in the casing (8) by using the jig.

125LCR8SM103

(21) Press in oil seal (27) by using the jig.
※ Be careful of the direction of the assembly.

125LCR8SM104

(22) Assemble drive shaft sub assembly.
※ Be careful of damage of oil seal.

125LCR8SM105

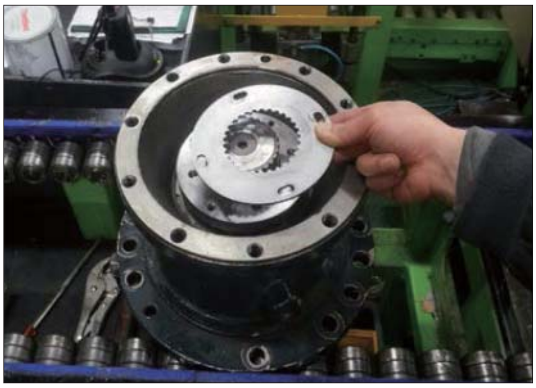
(23) After fixing drive shaft so that it does not fall, and then turn it over, press taper bearing (4).

125LCR8SM106

(24) Assemble nut ring (5) by using the jig.
※ Tightening torque : 3.5±0.4 kgf · m
(25.3±2.9 lbf · ft)

125LCR8SM107

(25) Place lock plate (6) on the nut ring.



125LCR8SM108

(26) After spreading loctite #242, assemble the bolt (7) (4 pcs).
※ Tightening torque : 2.5±0.25 kgf · m
(18.1±1.8 lbf · ft)

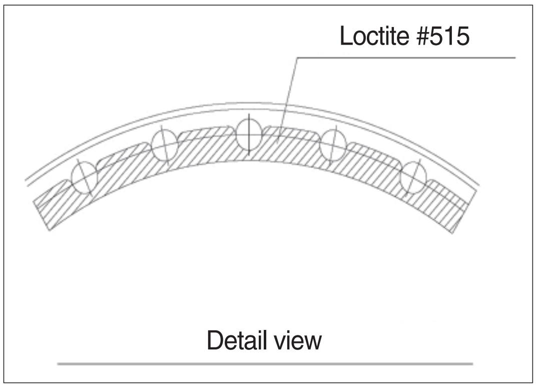
125LCR8SM109

(27) Press parallel pin (31) by using press machine.

125LCR8SM110

(28) Spread the loctite #515 on the casing with reference to the right detail view.

※ Loctite should not flow into casing.



125LCR8SM111

(29) Assemble ring gear (1) in accordance with a pin hole on casing.

※ Be careful of damage of the ring gear.

125LCR8SM112

(30) Assemble carrier No.2 sub assembly.

125LCR8SM113

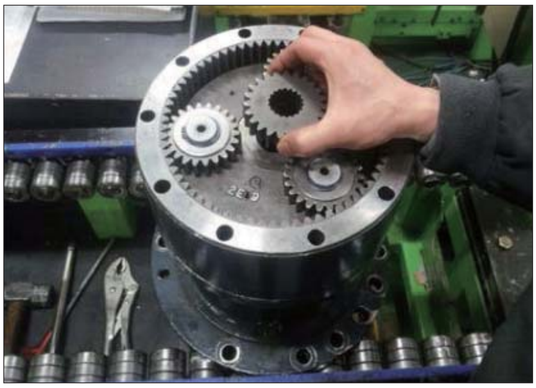
(31) Assemble sun gear No.2 (16).

125LCR8SM114

(32) Assemble carrier No.1 sub assembly.

125LCR8SM115

(33) Assemble sun gear No.1 (22) of which grinding surface is faced downward.



125LCR8SM116

(34) Fill with gear oil 3.5 liter.

125LCR8SM117

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

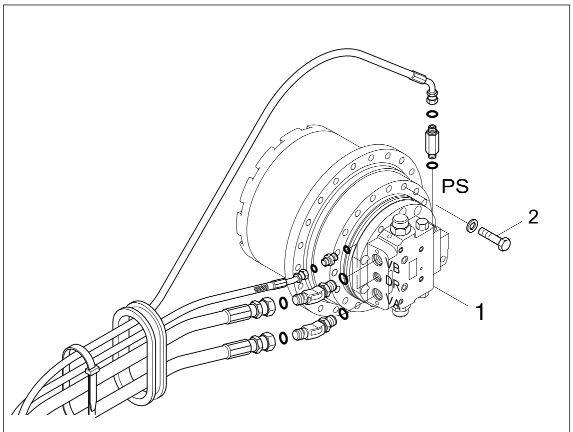
(1) Swing the work equipment 90˚and lower it completely to the ground.

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

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

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

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



140SA8TM01

(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly.**

(5) Remove the cover.

(6) Remove the hose.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.
· Tightening torque : 29.7±3.0 kgf·m (215±21.7 lbf·ft)

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
· Weight : 139 ㎏ (306 ㏈)
· Tightening torque : 25.7±4.0 kgf·m (186±28.9 lbf·ft)

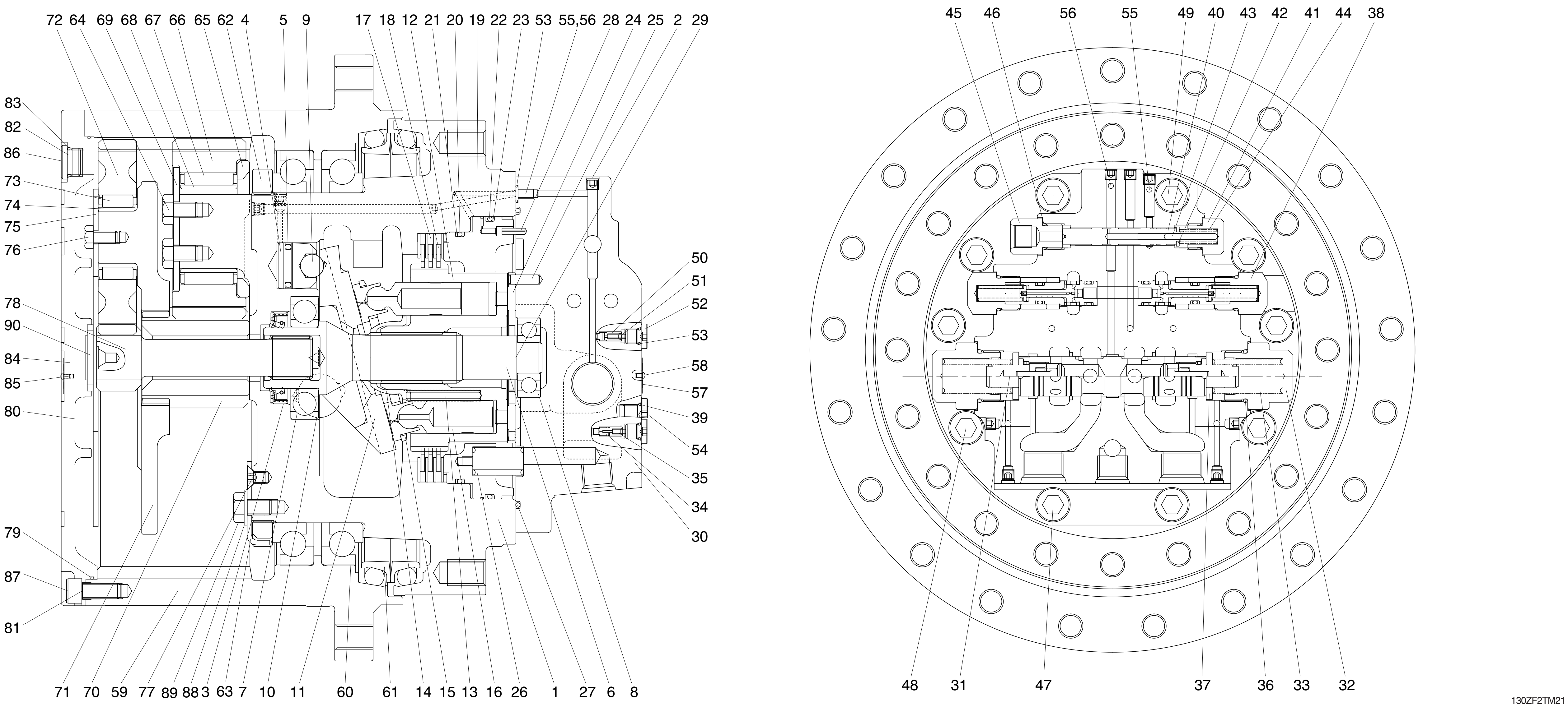
2) INSTALL

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

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

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

2. TRAVEL MOTOR



1	Casing	19	Parking piston	37	Spring seat	55	Restrictor	73	Needle bearing
2	Plug	20	O-ring	38	Relief valve assy	56	Restrictor	74	Inner race No. 1
3	Oil seal	21	Back up ring	39	O-ring	57	Name plate	75	Thrust plate
4	Piston	22	O-ring	40	Spool	58	Rivet	76	Hexagon head bolt
5	Piston seal	23	Back up ring	41	Plug	59	Ring gear	77	Countersunk head screw
6	Shaft	24	Valve plate	42	Spring seat	60	Bearing	78	Sun gear No.1
7	Front ball bearing	25	Spring pin	43	Parallel pin	61	Floating seal assy	79	O-ring
8	Rear ball bearing	26	Spring	44	Spring	62	Nut ring	80	Cover
9	Steel ball	27	O-ring	45	Connector	63	Lock plate	81	Hex socket head bolt
10	Pivot	28	Spring pin	46	O-ring	64	Hexagon head bolt	82	Plug
11	Swash plate	29	Parallel pin	47	Hexagon socket head bolt	65	Thrust plate	83	O-ring
12	Cylinder block	30	Rear cover	48	Hexagon socket head bolt	66	Planetary gear No.2	84	Name plate
13	Spring	31	Main spool assy	49	Hexagon socket head bolt	67	Needle bearing	85	Rivet
14	Ball guide	32	Cover	50	Check valve	68	Inner race No. 2	86	Rubber cap
15	Retainer plate	33	Spring	51	Spring	69	Thrust washer	87	Rubber cap
16	Piston assy	34	Restrictor	52	Plug	70	Sun gear No.2	88	Plain washer
17	Friction plate	35	Spring	53	O-ring	71	Carrier No.1	89	Hexagon bolt
18	Separated plate	36	O-ring	54	Plug	72	Planetary gear No.1	90	Thrust plate

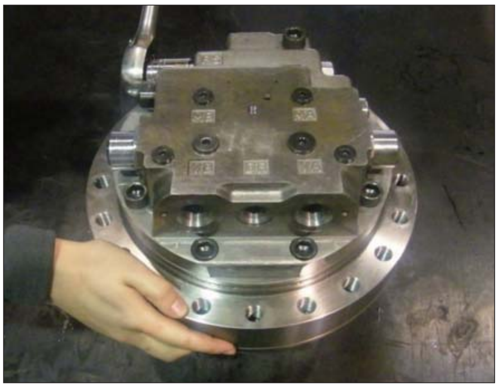
2) DISASSEMBLY

(1) Choose a clean place, remove contaminants (dust, etc) and cleans motor before placing it on worktable.

※ Lay the rubber plate on worktable and take care not to damage the component.

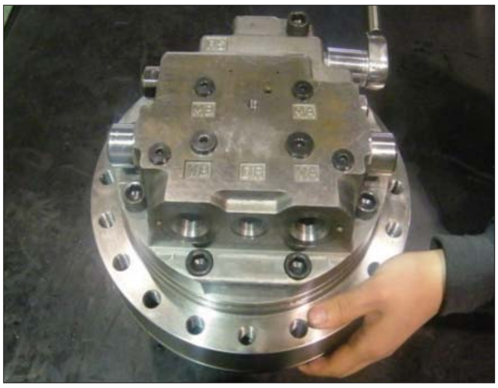
125LCR8TM02

(2) Remove the connector (45) using 21 mm socket wrench.



125LCR8TM03

(3) Remove plug (41) using 21 mm socket wrench.

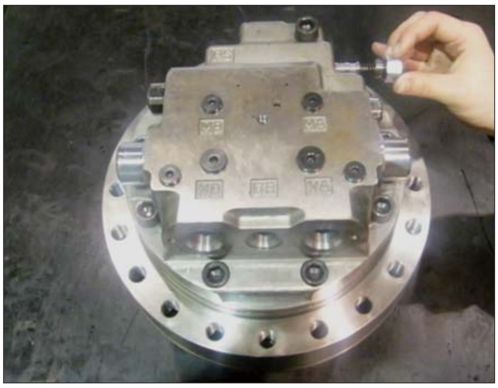


125LCR8TM04

(4) Disassemble parallel pin (43) and spring (44).

※ Do not lose spring.

※ Do not mix spring with other springs.

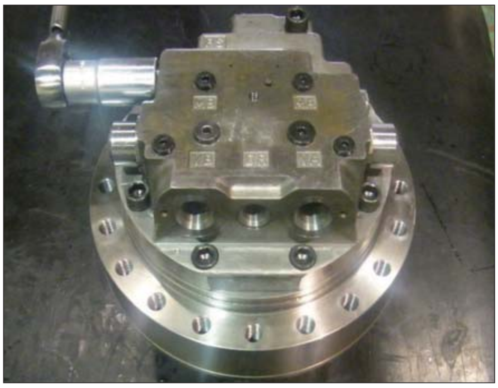


125LCR8TM05

(5) Remove spring seat (42) and spool (40).

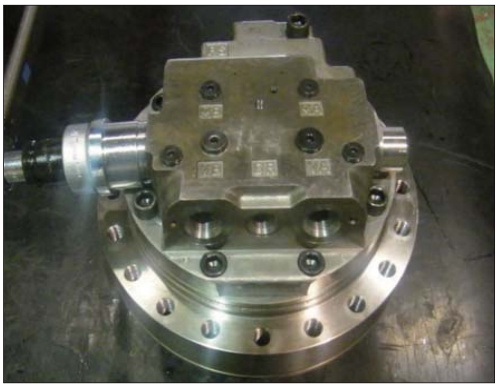
125LCR8TM06

(6) Disassemble relief valve assembly (38) using 26 mm socket wrench. (2 sets)



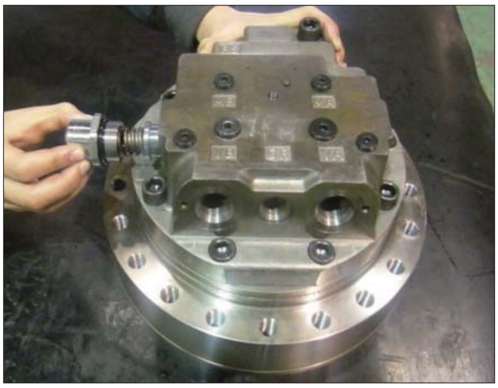
125LCR8TM07

(7) Disassemble cover (32) using 41 mm socket wrench.



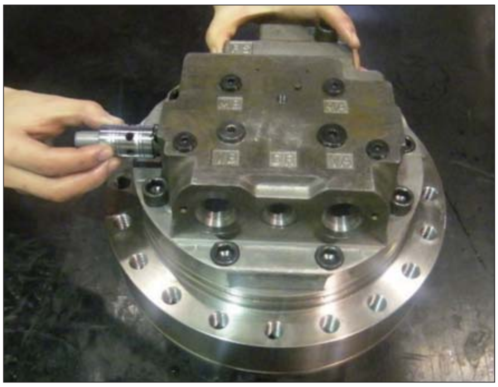
125LCR8TM08

(8) Disassemble spring seat (37) and spring (33). (2 sets)



125LCR8TM09

(9) Separate main spool assembly (31) from rear cover.



125LCR8TM10

(10) Unscrew socket bolt (47) (1EA), (48) (3EA), (49) (6EA) from rear cover.

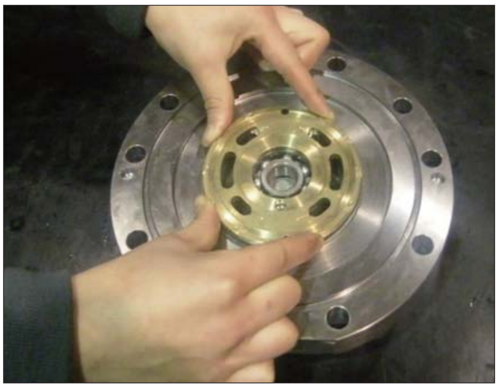
125LCR8TM11

(11) Remove parallel pin (29).

125LCR8TM12

(12) From rear cover, disassemble valve plate (24) and O-ring (27).

※ Take care not to damage assembly surface of rear cover.



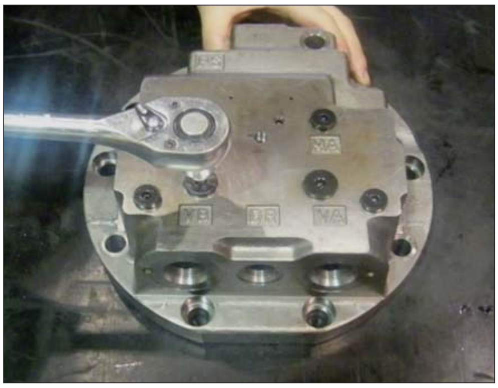
125LCR8TM13

(13) Disassemble restrictor (55, 56) (2EA).

※ Mark the number on restrictor and its hole to avoid confusing (55) and (56).

125LCR8TM14

(14) Remove plug (52).



125LCR8TM15

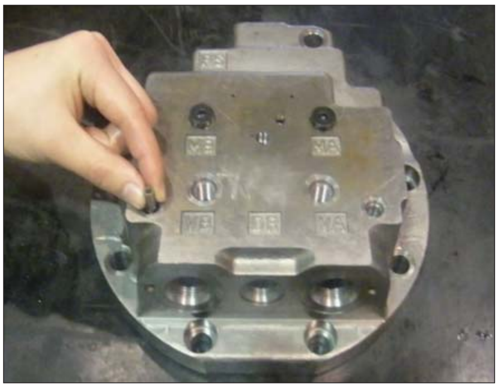
(15) Remove restrictor (34) and spring (35). (2 sets)

※ Do not confuse restrictor (34) and check valve (50).

※ Do not confuse spring (35) and spring (51).

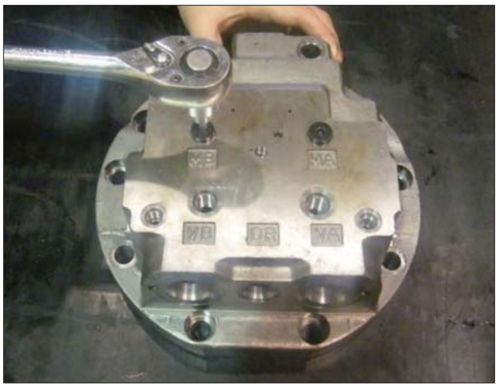
※ Do not lose spring.

※ Do not mix spring with other springs.



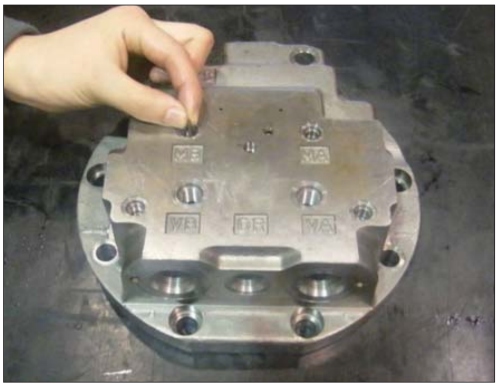
125LCR8TM16

(16) Remove plug (52) using 5 mm hexagon wrench.



125LCR8TM17

(17) Remove check valve (50) and spring (51). (2 sets)
※ Do not confuse restrictor (34) and check valve (50).
※ Do not confuse spring (35) and spring (51).
※ Do not lose spring.
※ Do not mix spring with other springs.



125LCR8TM18

(18) From parking piston, remove spring (26) (12ea).
※ Do not lose spring.
※ Do not mix spring with other springs.

125LCR8TM19

(19) Disassemble parking piston (19) using air gun or jig.

125LCR8TM20

(20) From parking piston, separate O-ring (22) and back-up ring (23).

125LCR8TM21

(21) From parking piston separate O-ring (20) and back-up ring (21).

125LCR8TM22

(22) Lay casing down horizontally and remove cylinder block assembly, friction plate (17) (3EA) and separator plate (18) (4EA).

125LCR8TM23

(23) Separate retainer plate (15) and piston assembly (16).

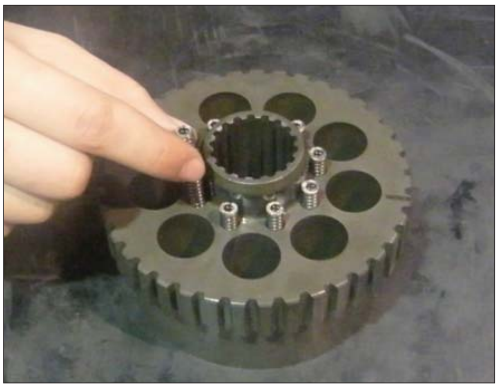
※ Take care not to damage sliding surface of each component.

125LCR8TM24

(24) Disassemble ball guide (14) and spring (13) (9EA).

※ Do not lose spring.

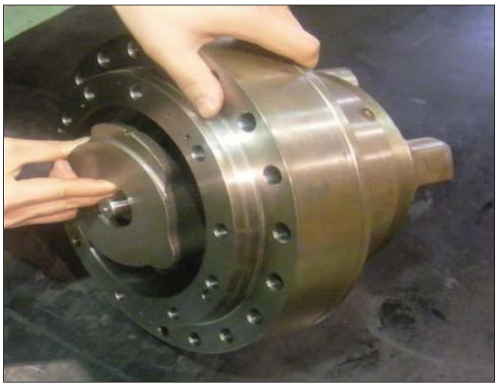
※ Do not mix spring with other springs.



125LCR8TM25

(25) Disassemble swash plate (11) and pivot (10).

※ Take care not to damage sliding surface.



125LCR8TM26

(26) Disassemble shaft (6) and ball bearing (7).

※ Do not remove ball bearing unless malfunction is detected, since it is mounted by shrink fit.

125LCR8TM27

(27) Disassemble 1, 2 speed piston (4) and steel ball (9) using air gun.

125LCR8TM28

(28) Disassemble piston seal (5).

125LCR8TM29

(29) Turn casing (1) upside down and remove oil seal (3) using jig.

125LCR8TM30

3) ASSEMBLY

※ Even though assembly is accomplished by reversing disassembly steps, be careful of the following.

① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
② All parts should be cleaned with cleaner, dried with compressed air.
③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
④ Replacement of O-ring and oil sealwith new parts is generally recommended.
⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values shown table1.
⑥ When assembling bolt, spread Loctite.

(1) Put casing (1) on the worktable.

125LCR8TM31

(2) After applying grease on the external diameter of oil seal (3), insert oil seal in casing.

125LCR8TM32

(3) After applying grease on pivot (10), insert steel ball in casing.

125LCR8TM33

(4) After assembling piston seal (5) and steel ball (9) in 1, 2 speed piston (4), insert piston in hole of casing.

※ Check whether piston sticks in hole.

※ Use piston seal jig.

125LCR8TM34

(5) Mount ball bearing (7) on shaft (6) by shrink fit. Insert shaft in casing.

※ Take care not to damage oil seal.

125LCR8TM35

(6) Assemble swash plate (11) by matching its hole and steel ball.

※ Take care not to damage sliding surface.

125LCR8TM36

(7) Assemble spring (13) (9ea) and ball guide (14) in cylinder block (12) in that order.

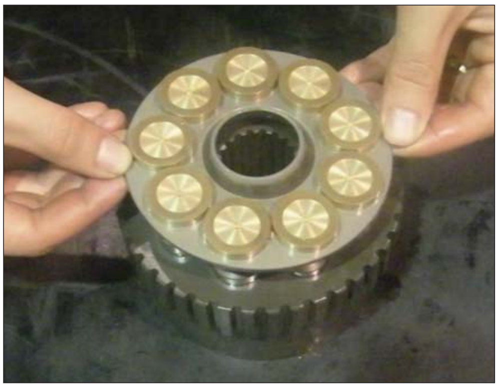
125LCR8TM37

(8) Insert piston assembly (16) in retainer plate (15) and assemble them in cylinder block.

※ Spread hydraulic oil on piston assembly.

※ Take care not to damage each component.

※ Check cylinder block and piston assembly runs properly.

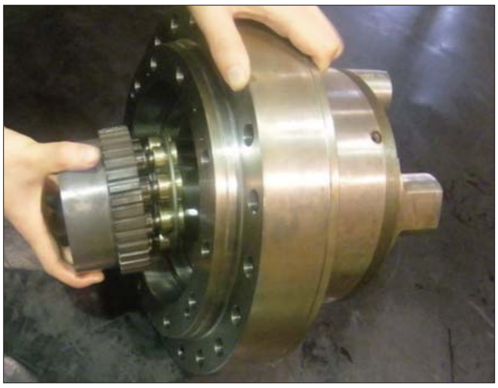


125LCR8TM38

(9) Lay casing down horizontally and assemble cylinder block assembly by matching its spline with shaft.

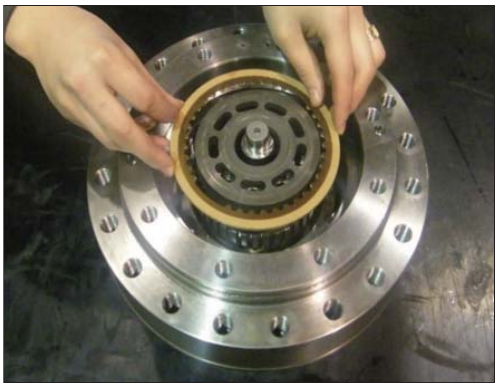
※ Make sure swash plate stays in place.

※ Check the assembling status of cylinder block by pressing it.



125LCR8TM39

(10) Assemble separator plate (18) (4EA) and friction plate (17) (3EA) alternately.



125LCR8TM40

(11) Insert back-up ring & O-ring in parking piston.

125LCR8TM41

(12) Align the pin hole of parking piston (19) with oil hole of casing, assemble them using jig.
※ Spread grease on O-ring and back-up ring.
※ Take care not to damage components.

125LCR8TM42

(13) Insert spring (26) (12EA) in parking piston.

125LCR8TM43

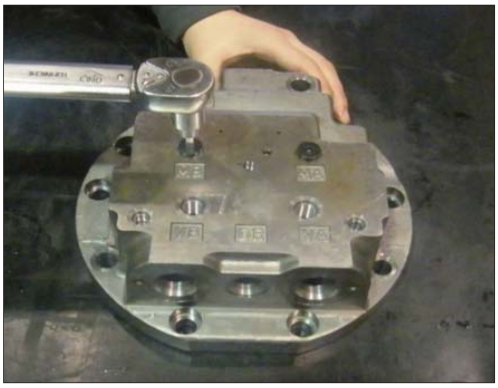
(14) Insert parallel pin (29) (2EA) in casing.

125LCR8TM44

(15) Assemble check valve (50) and spring (51) in order.
※ Do not confuse check valve (50) and restrictor (34).
※ Do not confuse spring (51) and spring (35)

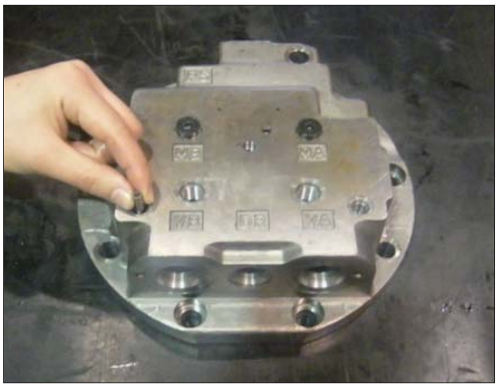
125LCR8TM45

(16) Clamp plug (52) using 5 mm hexagon wrench.
※ Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)



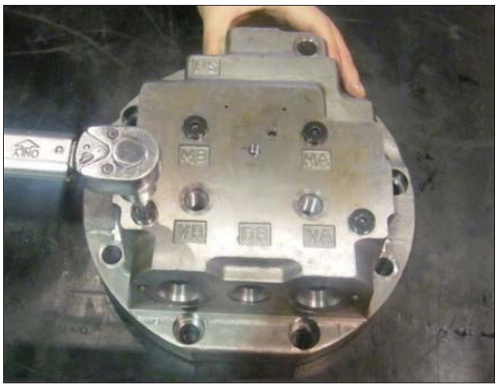
125LCR8TM46

(17) Assemble restrictor (34) and spring (35) in order.
※ Do not confuse check valve (50) and restrictor (34).
※ Do not confuse spring (51) and spring (35).



125LCR8TM47

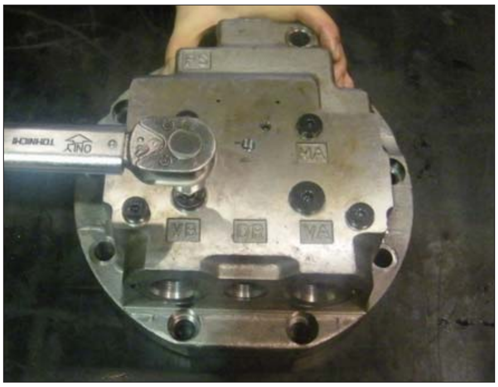
(18) Clamp plug (52).
※ Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)



125LCR8TM48

(19) Clamp plug (54).

※ Tightening torque : 4.5±0.5 kgf · m
(32.5±3.6 lbf · ft)

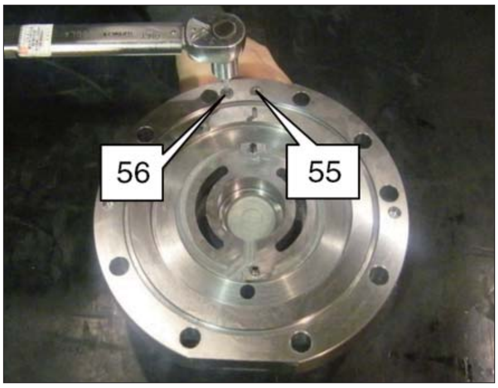


125LCR8TM49

(20) Assemble restrictor (55) and (56) in rear cover.

※ Check whether the restrictor is placed in exact hole.

※ Do not confuse (55) and (56).



125LCR8TM50

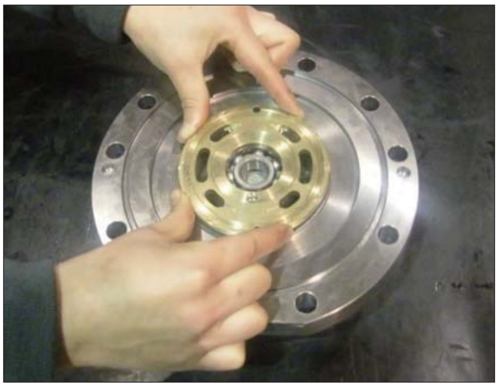
(21) Assemble ball bearing (8) in rear cover using jig.

125LCR8TM51

(22) Insert spring pin (25) (2ea) and (28) in rear cover using jig.

125LCR8TM52

(23) After spreading grease sufficiently to the bottom side of valve plate (24), assemble valve plate in rear cover by matching its holes with pins.
※ Take care not to damage sliding surface.
※ Pay attention to the assembly direction.



125LCR8TM53

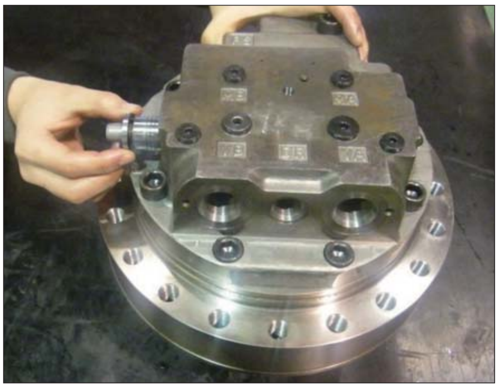
(24) Assemble O-ring (27) in rear cover.
※ Spread grease on O-ring.

125LCR8TM54

(25) Put rear cover upon casing, paying attention to the location of pin and hole. And tighten bolt (47), (48) and (49).
※ Tightening torque : 17.5±1.8 kgf · m
(127±13.0 lbf · ft)
※ Make sure valve plate stays in place.
※ Check bolt position.

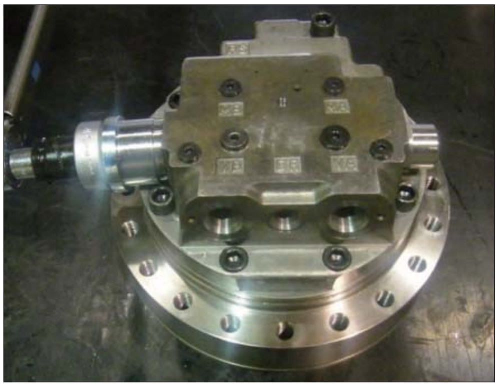
125LCR8TM55

(26) Assemble main spool assembly (31), spring seat (37) and spring (33) in rear cover.

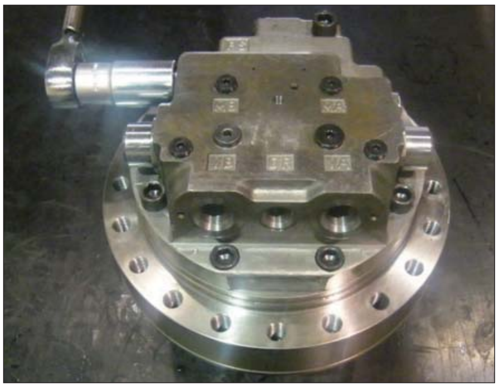


125LCR8TM56

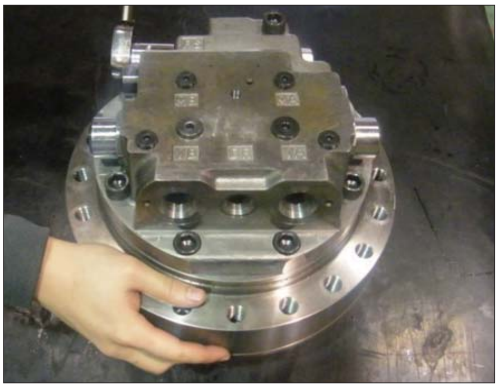
(27) Settle cover (32).
※ Tightening torque : 15±1.5 kgf · m
(108±10.8 lbf · ft)


125LCR8TM57

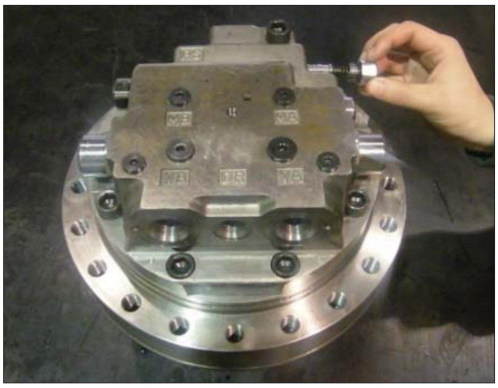
(28) Insert relief valve (38) in rear cover.
※ Tightening torque : 15±1.8 kgf · m
(108±13.0 lbf · ft)


125LCR8TM58

(29) After clamping connector (45) to rear cover, assemble spool (40).
※ Tightening torque : 5.5±0.5 kgf · m
(39.8±3.6 lbf · ft)

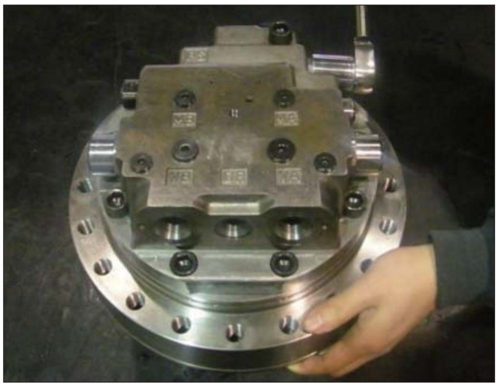

125LCR8TM59

(30) After inserting parallel pin (43), assemble seat-spring (42).


125LCR8TM60

(31) After assembling spring (44) in order, clamp plug (41).

※ Tightening torque : 5.5±0.5 kgf · m
(39.8±3.6 lbf · ft)



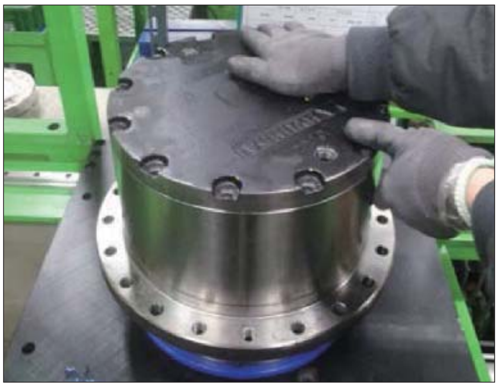
125LCR8TM61

3. TRAVEL REDUCTION GEAR DISASSEMBLY

1) While travel reduction gear is tilted to one side disassemble PF3/8 plug (82), remove gear oil and place motor sideto the bench.

125LCR8TM70

2) Disassemble cover (80) by unscrewing the M10 bolts (81) (12 pcs).



125LCR8TM71

3) Disassemble sun gear No.1 (78).

125LCR8TM72

4) Disassemble carrier No.1 assembly.

125LCR8TM73

Carrier No. 1 sub assy disassembly

5) Disassemble M8 bolt (76) from the carrier assembly. (3 pcs)

125LCR8TM74

6) Disassemble thrust plate (75) from the carrier assembly.

125LCR8TM75

7) Disassemble planetary gear No.1 (72).(3 pcs)

125LCR8TM76

8) Disassemble needle bearing (73).(3 pcs)

※ Do not disassemble inner race in the absence of abnormalities.

125LCR8TM77

9) Disassemble Sun gear No.2 (70).

125LCR8TM78

10) Disassemble M10 bolt (64).(4 pcs)

125LCR8TM79

11) Disassemble thrust washer (65).(4 pcs)

125LCR8TM80

12) Disassemble planetary gear No.2 (66).(4 pcs)

125LCR8TM81

13) Disassemble needle bearing (67).(4 pcs)

125LCR8TM82

14) Disassemble thrust plate (69).(4 pcs)

※ Do not disassemble inner race in the absence of abnormalities.

125LCR8TM83

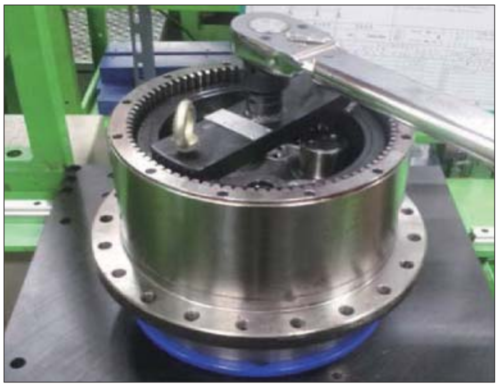
15) Disassemble M10 bolt (89), plain washer (88) and M8 screw (77).

125LCR8TM84

16) Disassemble lock plate (63).

125LCR8TM85

17) Disassemble nut ring (62) by using the jig.



125LCR8TM86

18) Disassemble ring gear assembly (59) from motor assembly.

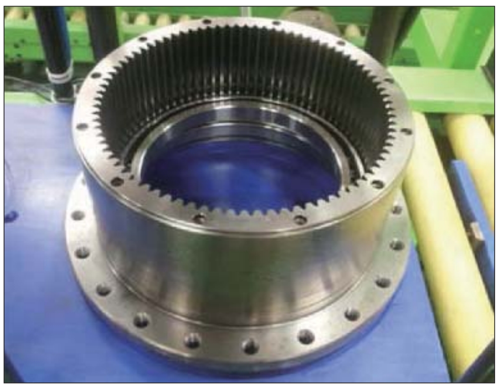
125LCR8TM87

19) Disassemble folating seal assembly (61) from ring gear assembly and motor assembly.

125LCR8TM88

20) Disassemble bearing (60) (2ea) from ring gear assembly.

※ Do not disassemble bearing in the absence of abnormalities.



125LCR8TM89

4. TRAVEL REDUCTION GEAR ASSEMBLY

※ Even though assembly is accomplished by reversing disassembly steps, be careful of the following.

① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
② All parts should be cleaned with cleaner, dried with compressed air.
③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
④ Replacement of O-ring and oil seal with new parts is generally recommended.
⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values.
⑥ When assembling bolt, spread loctite.

1) Put carrier No.1 (71) on the jig, and shrink-fit inner race No.1 (74) to carrier pin.(3 places)
※ Do not tilt inner race to one side.
※ Match inner race and end of carrier pin.

125LCR8TM90

2) Assemble needle bearing (73).(3 pcs)

125LCR8TM91

3) Assemble planetary gear No.1 (72) of which groove is faced downward. (3 places)

125LCR8TM92

4) Assemble thrust plate (75).

125LCR8TM93

5) After spreading loctite #242, assemble the M8 bolt (76).(3 pcs)

※ Tightening torque : 2.7 ± 0.3 kgf · m

※ After the assembly, instantly check the noise and interference by rotatong the gear.

125LCR8TM94

6) First, place bearing (60) on the ring gear (59), then put jig on it, then press it with press machine.

125LCR8TM95

7) After turning ring gear over, assemble bearing the same way.
※ Be care of nick and safety when turn ring gear over.


125LCR8TM96

8) Assemble folating seal assembly (61) by usingthe jig.
※ After assembling, wipe steel-lined section with alcohol.
※ Flatness deviation has to be less than 1 mm.


125LCR8TM97

9) Place folating seal assembly on the motor assembly then assemble it.
※ After assembling, wipe steel-lined section with alcohol.
※ Flatness deviation has to be less than 1 mm.


125LCR8TM98

10) After arriving safely ring gear assembly in the motor assembly, press it with press machine.
※ After press-fitting, clamp ring gear to fixit.
※ When using the press pay attention to bearing damage.


125LCR8TM99

11) After assembling nut ring (62) by using the jig, disassemble the clamping.

※ Tightening torque : 60 kgf · m (434 lbf · ft)

125LCR8TM100

12) Place lock plate (63) on the nut ring groove.

※ Select best position from one of 4 casing hole to assemble lock plate.

125LCR8TM101

13) Place lock plate th the direction which nut ring is loosed and then assemble M10 bolt (89) with M8 screw (77) after spreading loctite #242. (Refer to assembly detail drawing)

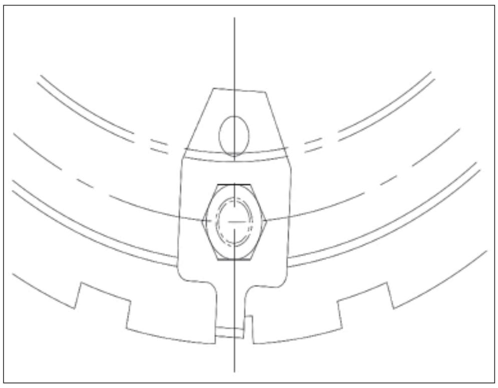
※ Tightening torque (M10) : 5.5 ± 0.6 kgf · m
(39.8 ± 4.3 lbf · ft)

※ Tightening torque (M8) : 2.7 ± 0.3 kgf · m
(19.5 ± 2.2 lbf · ft)

※ Make sure that M8 screw doesn't stick out of lock plate.

125LCR8TM102

※ Assembly detail drawing lock plate.



125LCR8TM103

14) Shrink fit the inner race No.2 (68).(4 pcs)

125LCR8TM104

15) Assemble thrust plate (69).(4 pcs)

125LCR8TM105

16) Assemble needle bearing (67).(4 pcs)

125LCR8TM106

17) Assemble planetary gear No.2 (66).(4 pcs)
※ Grooves of planetary gear will be facingup.

125LCR8TM107

18) Assemble thrust washer (65).(4 pcs)

125LCR8TM108

19) After spreading loctite #242, assemble the M10 bolt (64).(4 pcs)

※ Tightening torque : 5.5 ± 0.6 kgf · m
(39.8 ± 4.3 lbf · ft)

125LCR8TM109

20) Assemble sun gear No.2 (70).

125LCR8TM110

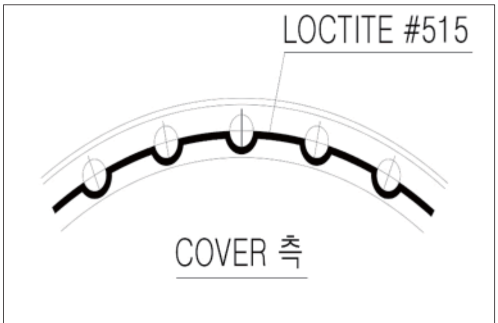
21) Assemble carrier No.1 assembly.

125LCR8TM111

22) Assemble sun gear No.1 (72).

125LCR8TM112

23) Spread the loctite #515 on the cover (80) with reference to the right detail view.



Detail view

125LCR8TM114

24) Place cover (80) to fit the bolt holes.

125LCR8TM115

25) After spreading loctite #242, assemble the M10 bolt (81).(12 pcs)

※ Tightening torque : 6.3 ± 0.7 kgf · m
(45.6 ± 5.1 lbf · ft)

125LCR8TM116

26) Inject the 2.3 ± 0.3 liter gear oil to PF3/8 tap section.

125LCR8TM117

27) After assembling the O-ring (83) to the plug (82), assemble it to the cover. (3 pcs)

※ Tightening torque : 5.5 ± 0.5 kgf · m
(39.8 ± 3.6 lbf · ft)

125LCR8TM118

TRAVEL DEVICE (HIGH WALKER, TYPE2)

1. REMOVAL AND INSTALL

1) REMOVAL

13031GE18

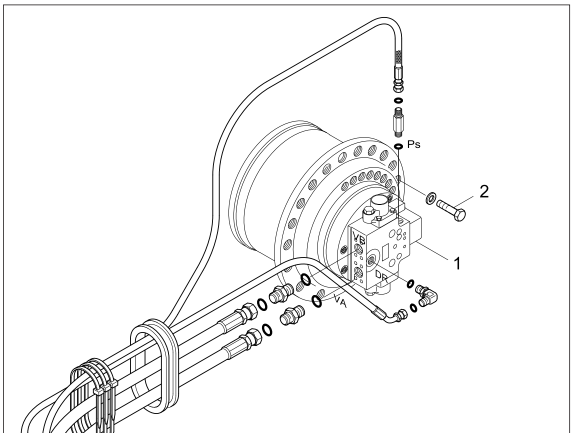
(1) Swing the work equipment 90° and lower it completely to the ground.

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

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

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

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



140SA8TM10

(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly.**

(5) Remove the cover.

(6) Remove the hose.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.
· Tightening torque : 29.7±3.0 kgf·m
(215±21.7 lbf·ft)

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
· Weight : 300 kg (660 lb)
· Tightening torque : 25.7±4.0 kgf·m
(166±28.9 lbf·ft)

2) INSTALL

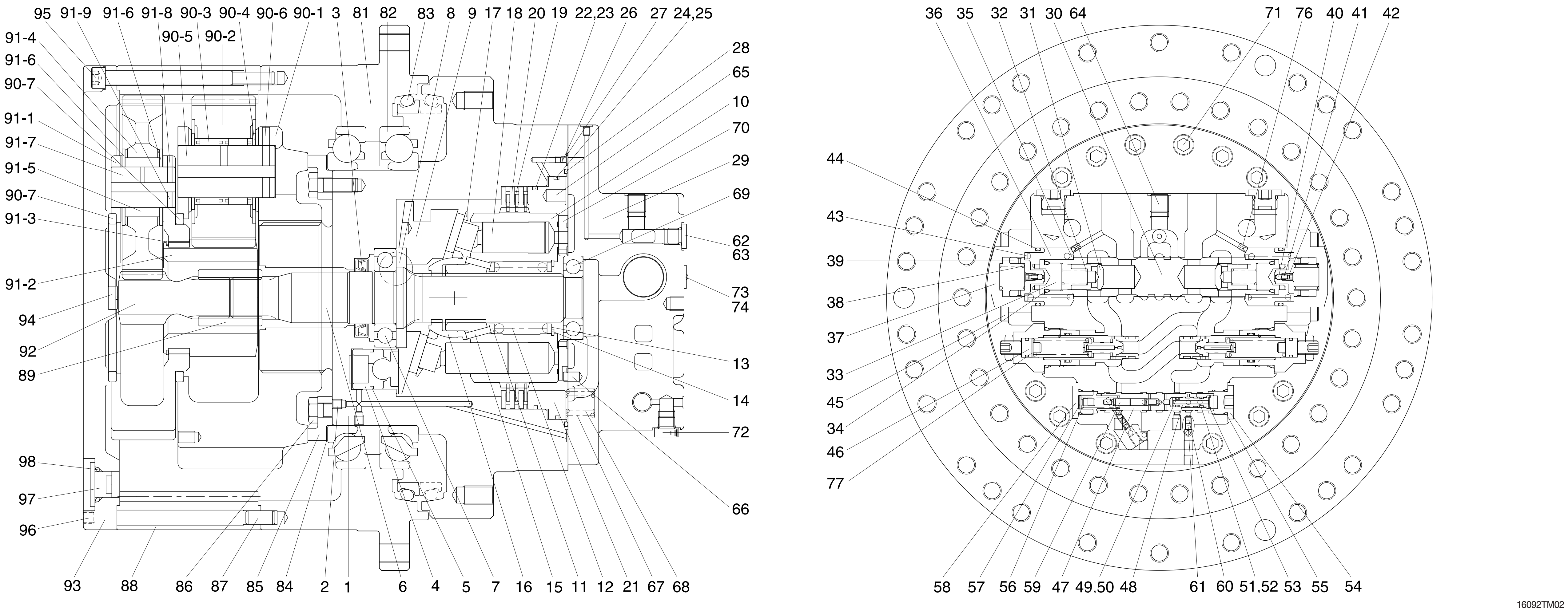
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

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

2. TRAVEL MOTOR

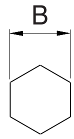
1) STRUCTURE



1	Shaft casing
2	Plug
3	Oil seal
4	Swash piston
5	Piston ring
6	Shaft
7	Bearing
8	Steel ball
9	Swash plate
10	Cylinder block
11	Spring seat
12	Spring
13	End plate
14	Snap ring
15	Pin
16	Ball guide
17	Set plate
18	Piston assy
19	Friction plate
20	Separate plate
21	Parking piston
22	O-ring
23	Back up ring
24	O-ring
25	Back up ring
26	Orifice
27	O-ring
28	O-ring
29	Rear cover
30	Spool
31	Check
32	Spring
33	Plug
34	O-ring
35	Spring seat
36	Spring
37	Cover
38	Spring
39	Spool
40	Steel ball
41	Spring
42	Plug
43	Spring seat
44	O-ring
45	Wrench bolt
46	Relief valve assy
47	Spool
48	Guide
49	O-ring
50	Back up ring
51	O-ring
52	Back up ring
53	Snap ring
54	plug
55	O-ring
56	Spring
57	Spring seat
58	Plug
59	Spool
60	Orifice
61	Orifice
62	Plug
63	O-ring
64	Plug
65	Pin
66	Pin
67	Spring
68	Spring
69	Bearing
70	Valve plate
71	Wrench bolt
72	Plug
73	Name plate
74	Rivet
75	Seal kit
76	Orifice
77	Shim
81	Housing
82	Main bearing
83	Floating seal
84	Shim
85	Retainer
86	Hex head bolt
87	Parallel pin
88	Ring gear
89	Coupling
90	Carrier assy No.2
90-1	Carrier No.2
90-2	Planetary gear No.2
90-3	Needle bearing
90-4	Thrust washer
90-5	Pin No.2
90-6	Spring pin
90-7	Thrust ring
91	Carrier assy No.1
91-1	Carrier No.1
91-2	Sun-gear No.2
91-3	Retaining ring
91-4	Planetary gear No.1
91-5	Needle bearing
91-6	Thrust washer
91-7	Pin No.1
91-8	Spring pin
91-9	Spring pin
92	Sun gear No.1
93	Cover
94	Pad
95	Hex socket head bolt
96	Hex socket Screw
97	Hydraulic plug
98	O-ring
99	Name plate

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name		Remark	
Allen wrench		2, 5, 4, 6, 10	
Socket for socket wrench, spanner	Socket	8, 14, 24, 27	
Torque wrench		Capable of tightening with the specified torques	
Pliers		-	
Plastic and iron hammer		Wooden hammer allowed. Normal 1 or so	
Monkey wrench		-	
Oil seal inserting jig		-	
Bearing pliers		-	
Seal tape		-	
Eye bolt		M10, M12, M14	
Press (0.5 ton)		-	
Oil stone		-	
Bearing assembling jig		-	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Plug	2	NPT 1/16	1±0.1	7.2±0.7
Orifice	26	M5	0.7±0.1	5±0.7
Wrench bolt	45	M12×40	10±1.0	72±7.0
Relief valve	46	HEX 27	18±1.0	130±7.0
Plug	54	PF 1/2	8.5±1.0	61±7.0
Plug	58	HEX 24	5±1.0	36±7.0
Plug	62	PF 1/4	5±1.0	36±7.0
Wrench bolt	71	M12×35	10±1.0	72±7.0
Hex head bolt	-	M12×25	11±1.5	79±10
Hex socket head bolt	-	M12×155	11±1.5	79±10
Hex socket head plug	-	PF 3/4	19±1	137±7.0

3. OUTLINE OF DISASSEMBLING

1) GENERAL SUGGESTIONS

(1) Select a clean place for dismantling.
Spread a rubber plate on a working table in order to prohibit the damage of parts.

(2) Clean a deceleration equipment and a motor part, washing out dirt and unnecessary substances.

(3) Without any damage of O-ring, oil seal, the adhered surface of other seals, a gear, a pin, the adhered surface of other bearings, and the surface of moisturized copper, treat each parts.

(4) Numbers written in the parenthesis, ( ), next to the name of a part represent the part numbers of a cross-sectional view annexed with a drawing.

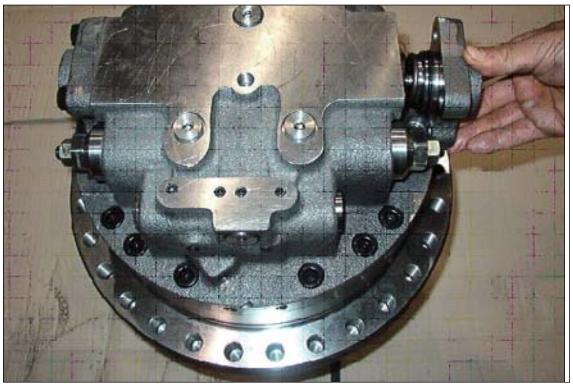
(5) The side of a pipe in a motor can be written as a rear side; the side of out-put as a front side.

(6) Using and combining a liquid gasket, both sides must be dried completely before spraying a liquid gasket.

(7) In case of bonding volts, combine a standard torque by torque wrench after spraying loctite 262 on the tab parts. (It can be dealt as assembling NPTF screws and an acceleration equipment.)

2) DISASSEMBLING

(1) Unloosing wrench bolt and disassemble cover (37).
※ Wrench bolt = M12×40L-8 EA (purchasing goods)

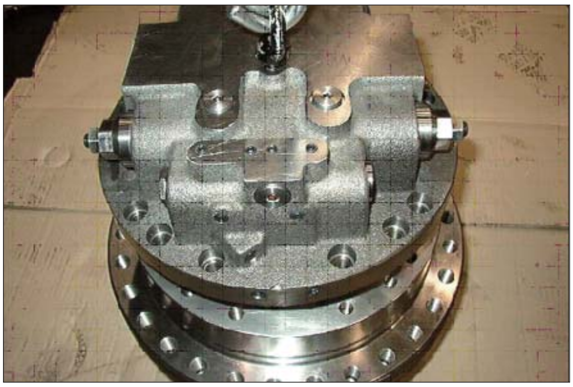


21078TM21

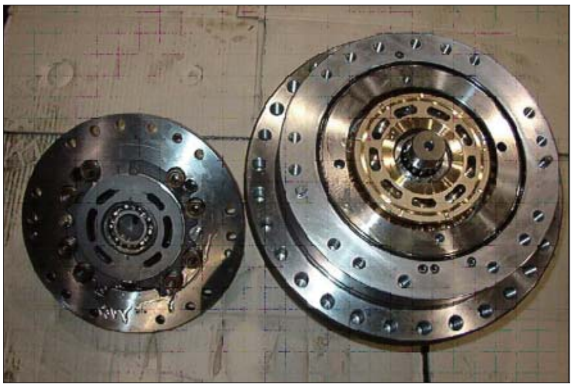
(2) Disassemble parts related to counterbalance valve.

21078TM22

(3) Unloosing wrench bolt (M12×35L, 16 EA) and disassemble rear cover assembly from motor assembly.



21078TM23

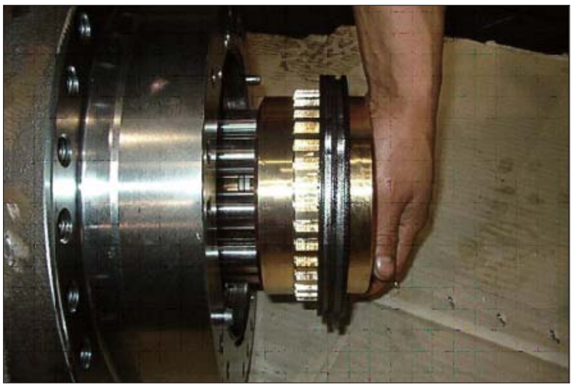


21078TM24

(4) Dismantle packing piston (21) using compressed air.

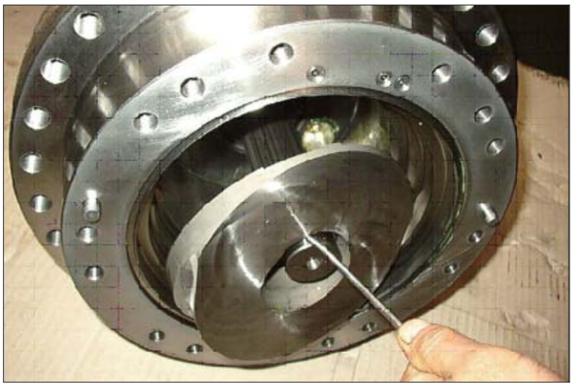
21078TM25

(5) Disassembly rotary kit from motor assembly (cylinder block assembly, piston assembly, ball guide, set plate, friction plate, steel plate...)



21078TM26

(6) Using a jig, disassemble swash plate (9) from shaft casing.



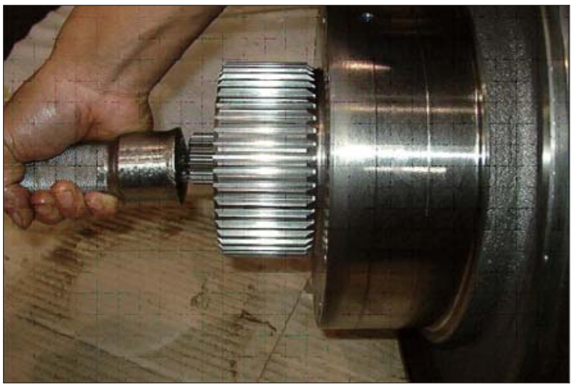
21078TM27

(7) Using compressed air, disassemble piston swash (4) piston ring (5), respectively.

21078TM28

21078TM29

(8) Using a hammer, disassemble shaft (6) from shaft casing (1).



21078TM30

■ Disassemble cylinder sub.

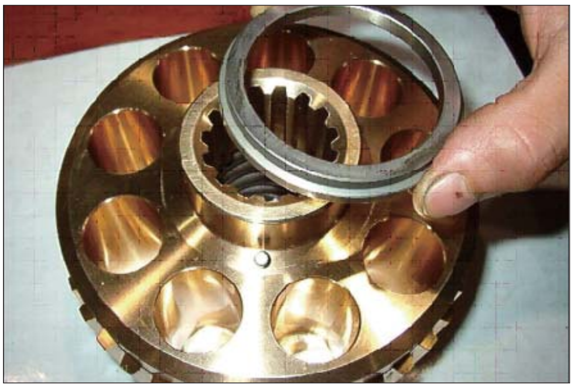
(9) Disassemble cylinder block assembly, piston assembly (9) and seat plate (M).

21078TM31

21078TM32

(10) Disassemble ball guide (16), ring and pin (15) from cylinder block, respectively.

21078TM33



21078TM34

21078TM35

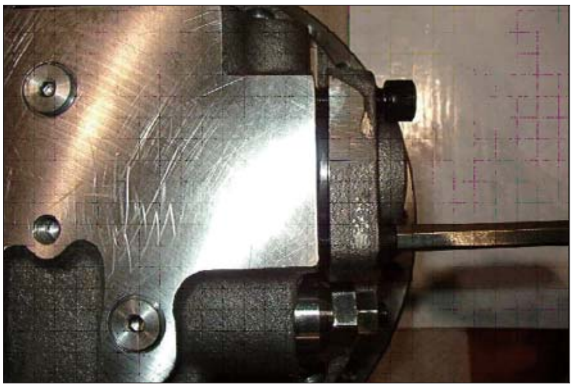
(11) Pushing spring (12) by an assembling jig, disassemble snap ring (14), spring seat (13), spring (12) and spring seat (11), respectively.

21078TM36

21078TM37

■ Disassemble valve casing sub.

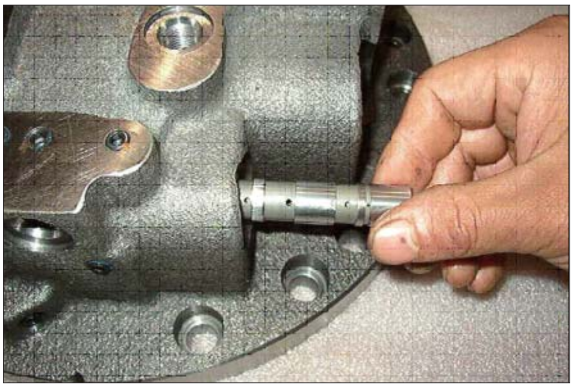
(12) Using an hexagon wrench, unloosing wrench bolt (45) and disassemble cover (37), spring (38), spool (39), spring seat (43), spring (36) and spring seat (35), respectively.
(same balance on both sides)



21078TM38

21078TM39

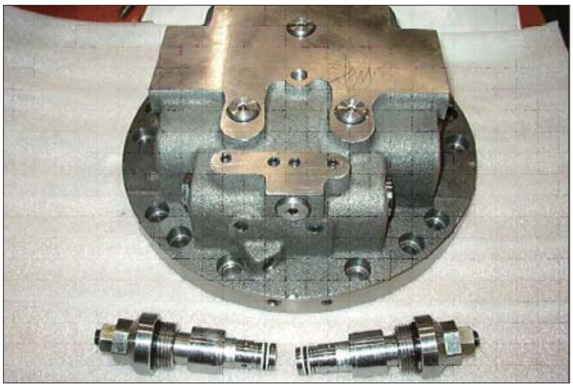
(13) Disassemble spool (59), spool (47), O-ring (51), guide (48) and snap ring (53) on rear cover, respectively.



21078TM40

21078TM41

(14) Using a torque wrench, disassemble relief valve assembly (46) on rear cover.



21078TM42

4. OUTLINE FOR ASSEMBLING

1) GENERAL SUGGESTIONS

(1) After washing each parts cleanly, dry it with compressed air.
Provided that you do not wash friction plate with treated oil.

(2) In bonding each part, fasten bond torque.

(3) When using a hammer, do not forget to use a plastic hammer.

2) ASSEMBLING

■ **Assemble the sub of turning axis**

(1) Using a jig, assemble oil seal (3) into shaft casing (1)

21078TM43

(2) Have a bearing (8) thermal reacted into shaft (6).

21078TM44

21078TM45

21078TM46

(3) Using a jig, assemble shaft assembly into shaft casing (1).

21078TM47

(4) After spreading grease on steel ball (8) assemble into shaft casing (1).

21078TM48

(5) Assemble swash piston assembly (4, 5) into shaft casing (1).

21078TM49

(6) Assemble swash plate (9) into shaft casing (1).

21078TM50

■ Assemble cylinder block sub.

(7) Assemble spring seat (13), spring (12), spring seat (11) into cylinder block (10) respectively, pushing spring (12) using by a jig, assemble snap ring (14) with a snap ring (14).

21078TM51

21078TM52

(8) Assemble ring, pin (15) on cylinder block (10) ball guide (16) respectively.

21078TM53

21078TM54

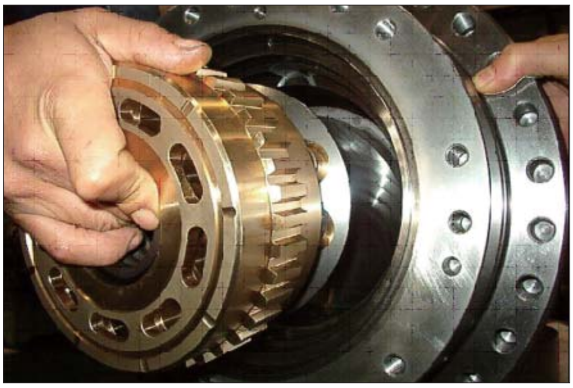
21078TM55

(9) Assemble cylinder block assembly, piston assembly (9), seat plate (17).

21078TM56

21078TM57

(10) Assemble cylinder block assembly (9) into shaft casing (1).



21078TM58

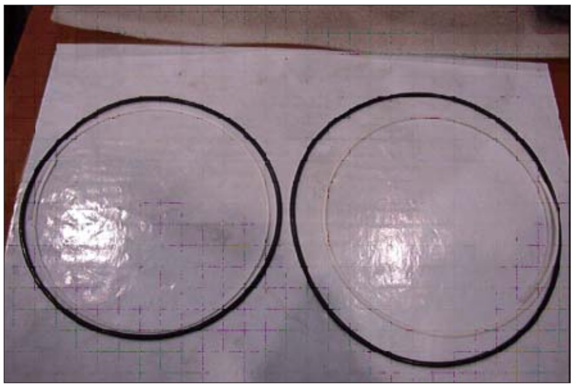
(11) Assemble friction plate (19) and plate (20) into shaft casing (1) respectively, prepare 6 set.

21078TM59

21078TM59-1

(12) Assemble O-ring (22, 23) into packing piston (21).


21078TM60


21078TM60-1

(13) After spreading grease on packing piston (21) bond wrench bolt and assemble shaft casing (1).


21078TM61

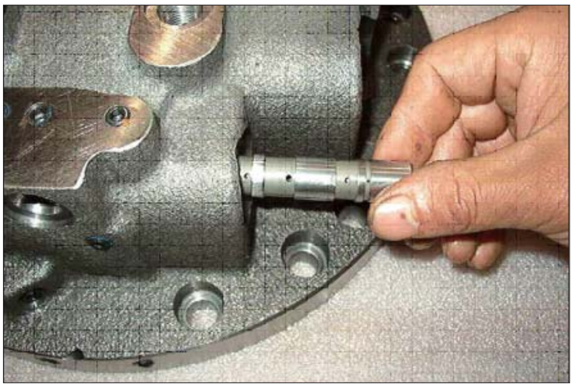
■ Assemble rear cover sub.

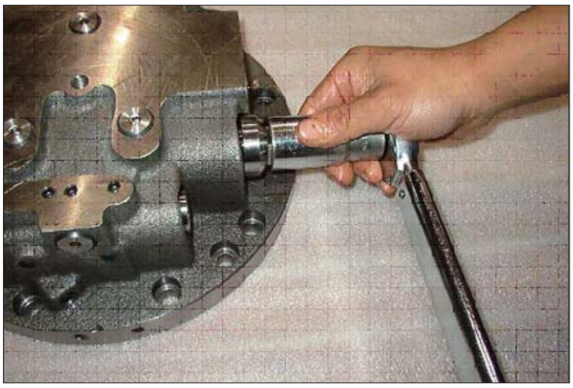
(14) Using a jig, assemble bearing (69) into rear cover (29).


21078TM62

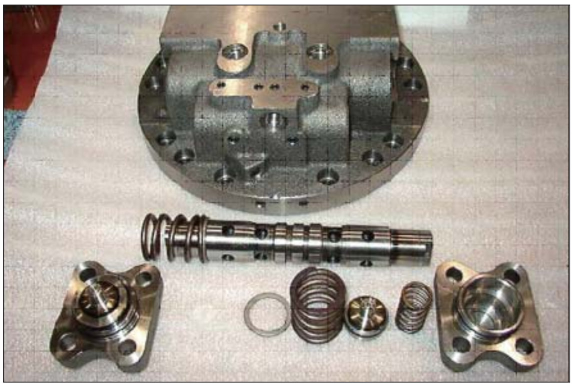
(15) After assembling spool (59), spool (47), O-ring (51), guide (48) and snap ring (53) respectively into rear cover (29).
Using torque wrench, assemble it.


21078TM63

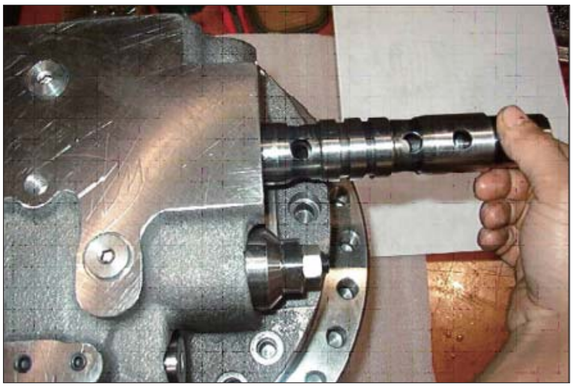

21078TM64


21078TM65

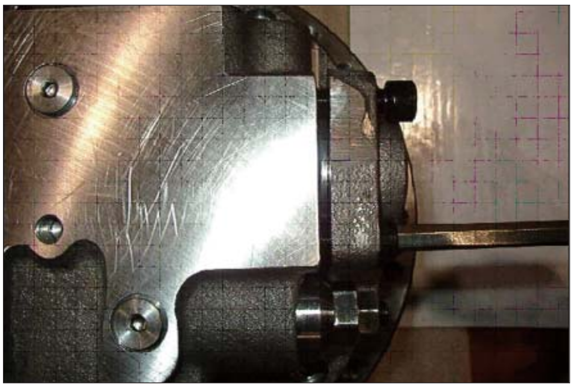
(16) Assemble spring seat (35), spring (36), spring seat (43), spool (39), spring (38), cover (37) respectively and assemble wrench bolt (45).
(same balance on both sides)



21078TM66



21078TM67



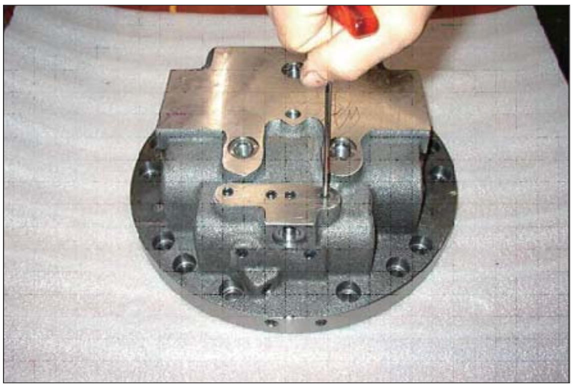
21078TM67-1

(17) Assemble plug (2).

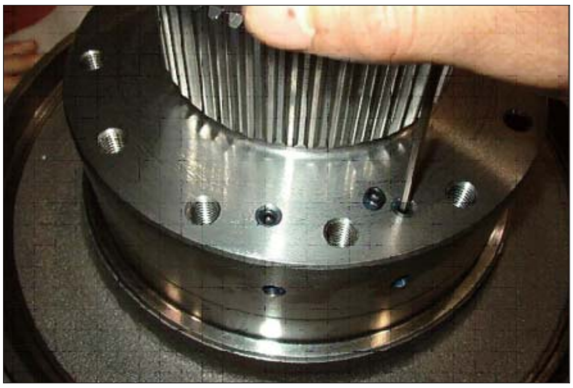
※ Plug (NPT1/16) - 11 EA

21078TM68

21078TM69



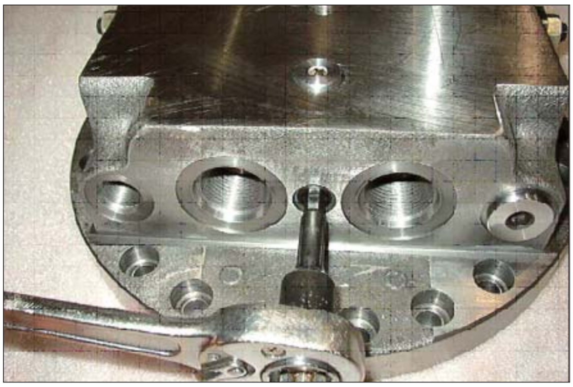
21078TM70



21078TM71

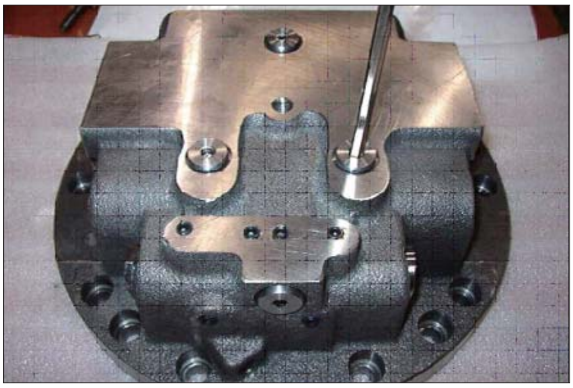
(18) Assemble plug (64).

※ Plug (PT3/8) - 11 EA

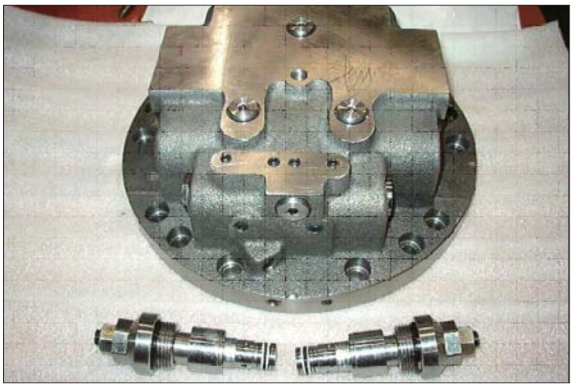


21078TM72

(19) Assemble plug (62, 63) into rear cover (29) and assemble relief valve assembly.



21078TM73



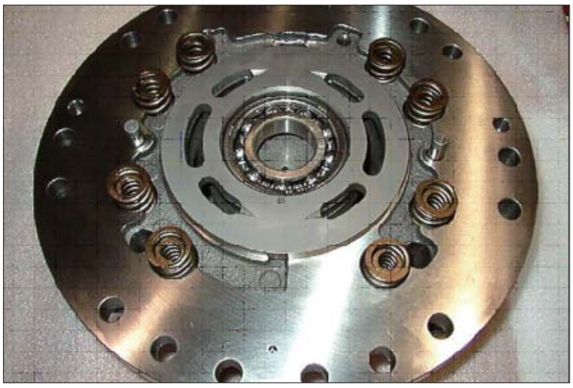
21078TM74

(20) Put spring (67, 68) together into rear cover (29), prepare 6 set.

21078TM75

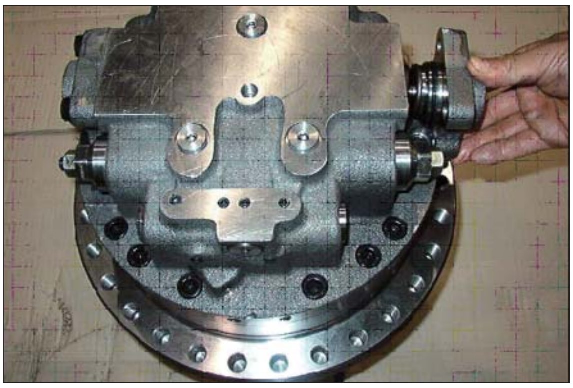
21078TM76

(21) Assemble valve plate (70) into rear cover (29).



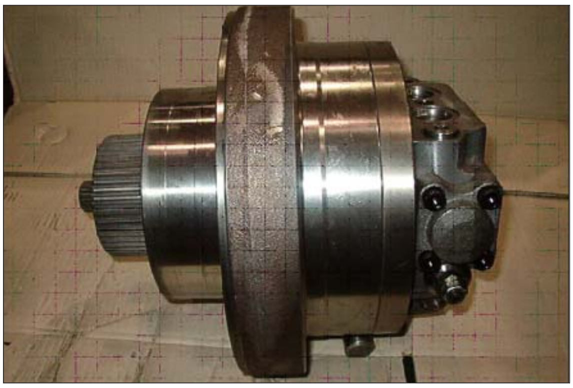
21078TM77

(22) After assembling shaft casing (1) and rear cover (29).
Assemble spool assembly (30), spring (38), spool (39), cover (37) after then complete assembly with wrench bolt (45).



21078TM78

(23) Finish assembly.



21078TM79

5. DISASSEMBLING REDUCTION UNIT

1) PREPARATION FOR DISASSEMBLING

(1) The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.

(2) Locate reducer in order for drain port to be at the lowest level loosen taper screw plug of drain port, and drain oil from reduction gear.

※ While oil is still hot, inside of the unit may be pressurized.

⚠ **Take care of the hot oil gushing out of the unit when loosening the plug.**

(3) Mark for mating

Put marks on each mating parts when disassembling so as to reassemble correctly as before.

21078TM80

2) SETTING REDUCTION UNIT (OR WHOLE PROPELLING UNIT) ON WORK STAND FOR DISASSEMBLING

(1) Remove M12 hexagon socket head bolts (95) at 3 places from cover (93) almost equally apart each other, and then install M12×155L eye bolts.

Lift up the unit using them and place it on work stand with cover upward.

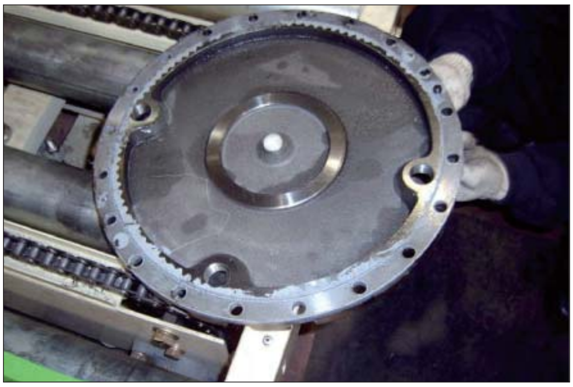
⚠ **Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

21078TM81

3) REMOVING COVER

(1) Remove the rest of M12 hexagon socket head bolts (95) that securing gear and housing. Loosen all the socket bolts and then, disassemble cover.

(2) As the cover (93) is adhered to ring gear (88), disassemble ring gear (88) and cover (93) vy lightly hammering slantwise upward using sharpen punch inserted between the cover and ring gear.



21078TM82

4) REMOVING NO.1 CARRIER SUB ASSEMBLY

(1) Screw three M10 eye-bolt in No.1 carrier and lift up and remove No.1 carrier assy.

21078TM83

(2) Remove No.1 sun gear

※ Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.

21078TM84

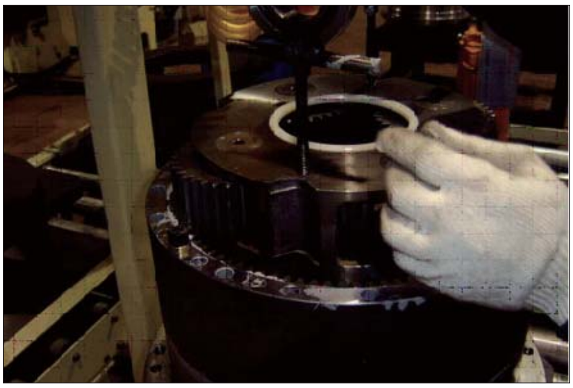
5) REMOVING NO.2 CARRIER SUB ASSEMBLY

(1) Screw three M10 eye-bolt in No.2 carrier and lift up and remove No.2 carrier assy.

21078TM85

(2) Remove No.2 sun gear

※ Be sure to maintain it vertical with the ground when disassembling No.2 sun gear.



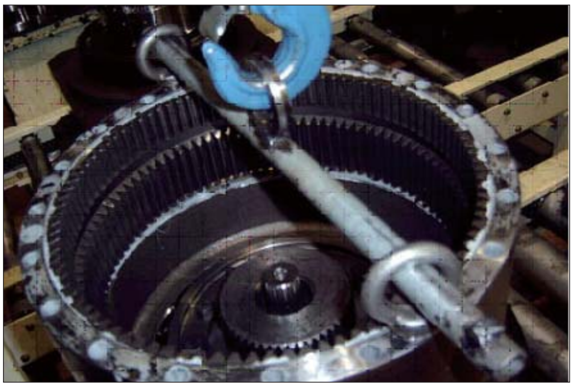
21078TM86

6) REMOVING RING GEAR

(1) As the ring gear (88) is adhered to housing (81), disassemble ring gear (88) and housing (81) by lightly hammering slantwise upward using sharpen punch inserted between the ring gear and housing.

※ Carefully disassembling ring gear not to make scratch on it.

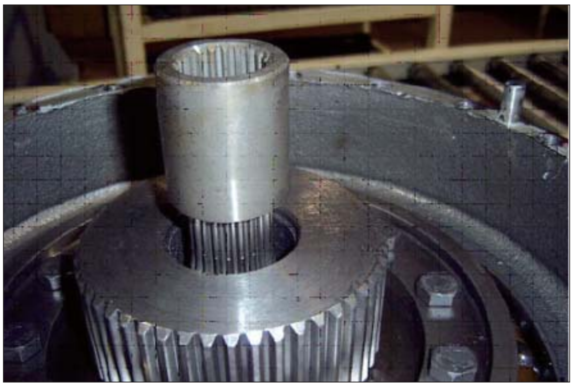
(2) Screw M14 eye-bolt in ring gear and lift up and remove it.



21078TM87

7) REMOVING COUPLING

(1) Remove coupling.

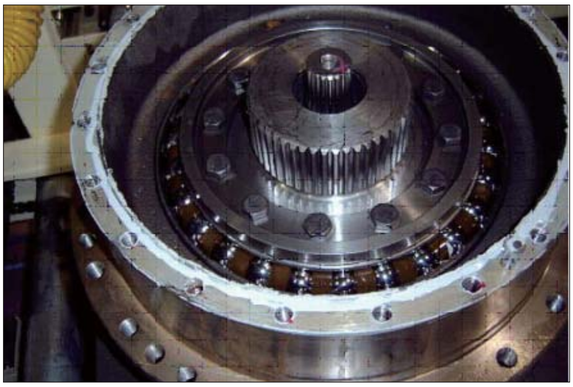


21078TM88

8) REMOVING RETAINER & SHIM

(1) Remove M12 hexagon socket head bolts that secure retainer and motor.

(2) Remove retainer & shim.



21078TM89

9) REMOVING HOUSING SUB ASSEMBLY

(1) Screw M12 eye bolt in housing and lift up housing assembly including angular bearing and floating seal.

21078TM90

10) REMOVING FLOATING SEAL

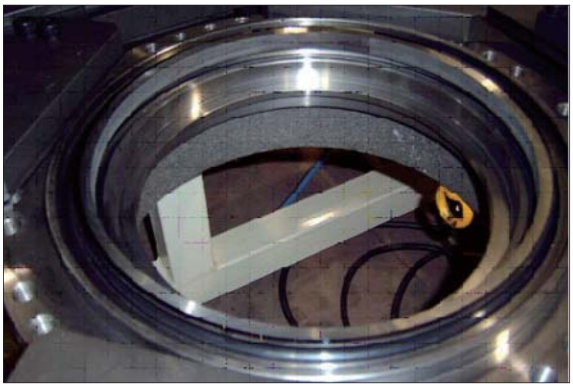
(1) Lift up a piece of floating seal of motor side.

21078TM91

11) DISASSEMBLING HOUSING ASSEMBLY

(1) After turning housing, lift up a piece of floating seal from housing and then remove it.

※ Don't disassemble angular bearing.



21078TM92

12) DISASSEMBLING NO.1 CARRIER

(1) Remove thrust ring (90-7) from carrier.

(2) Knock spring pin (91-8) fully into No.1 pin (91-7).

(3) Remove planetary, thrust washer, No.1 pin, bearing from carrier.

21078TM93

21078TM94

21078TM95

13) DISASSEMBLING NO.2 CARRIER

(1) Disassemble No.2 carriers, using the same method for No.1 carrier assembly.

21078TM96

21078TM97

6. ASSEMBLY REDUCTION GEAR

1) GENERAL NOTES

Clean every part by kerosene and dry them by air blow.
Surfaces to be applied by locktite must be decreased by solvent.
Check every part for any abnormals.
Each hexagon socket head bolt should be used with locktite No. 262 applied on its threads.
Apply gear oil slightly on each part before assembling.
Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

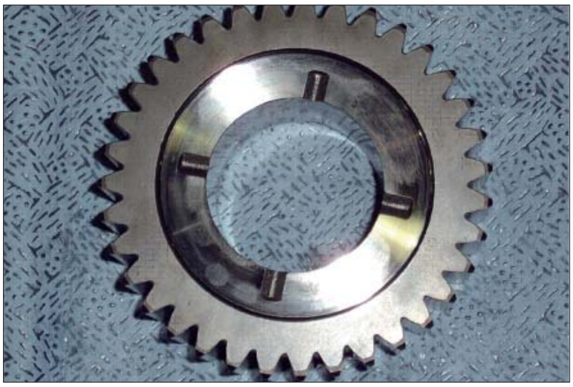
Inspection before reassembling

Thrust washer
· Check if there are seizure, abnormal wear or uneven wear.
· Check if wear is over the allowable limit.

Gears
· Check if there are pitting or seizure on the tooth surface.
· Check if there are cracks on the root of tooth by die check.

Bearings
· Rotate by hand to see if there are something unusual such as noise or uneven rotation.

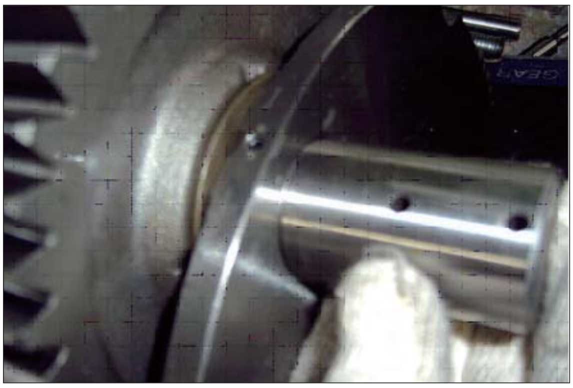
Floating seal
· Check flaw or score on sliding surfaces or O-ring.


21078TM98

2) ASSEMBLING NO.1 CARRIER

(1) Put No.1 carrier (91-1) on a flat place.

(2) Install No.1 needle bearing (91-5) into No.1 planetary gear (91-4), put 2 EA of No.1 thrust washer (91-6) on both sides of bearing, and then, install it into carrier.


21078TM99

(3) Install No.1 pin (91-5) into No.1 carrier where the holes for No.1 pin (91-5) are to be in line with those of No.1 carrier, and then, install spring pins into the holes.


21078TM100

(4) Caulk carrier holes as shown on the picture.

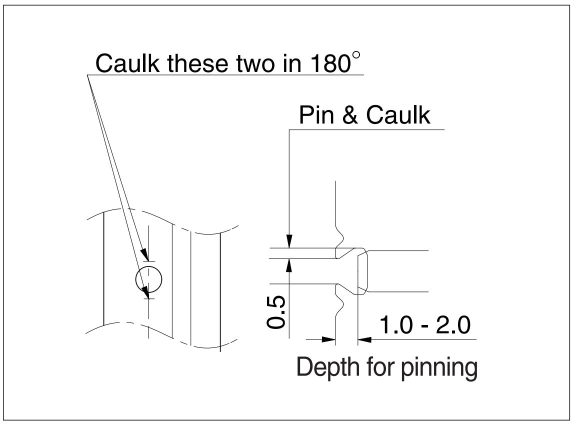
(5) Assembly thrust ring (90-7) into carrier.


21078TM101

3) ASSEMBLING NO.2 CARRIER

(1) Put No.2 carrier (90-1) on a flat place.

(2) Install No.2 needle bearing (90-3) into No.2 planetary gear (90-2), put 2 EA of No.2 thrust washer (90-4) on both sides of bearing, and then, install it into carrier.



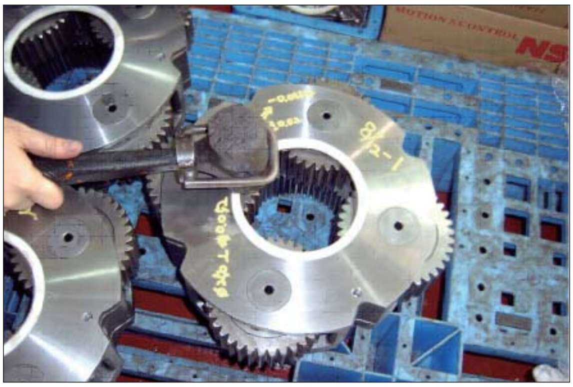
21078TM102

(3) Install No.2 pin (90-5) into No.2 carrier where the holes for No.2 pin (90-5) are to be in line with those of No.2 carrier, and then, install spring pins into the holes.


21078TM103

(4) Caulk carrier holes as shown on the picture.

(5) Assembly thrust ring (90-7) into carrier.



21078TM104

4) ASSEMBLING FLOATING SEAL (83) AND MAIN BEARING (82)

(1) Assemble floating seal into motor by use of pressing jig. Grease the contact parts for floating seal which is assembled into motor.

(2) Heat bearing at 60~70˚C and then, put into the motor side.

21078TM105

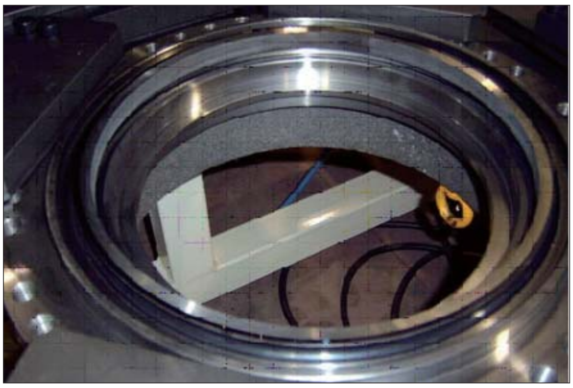
※ Be sure to maintain it vertical with the ground when assembling bearing and floating seal.

21078TM106

5) ASSEMBLING HOUSING

(1) Heat housing at 60~70˚C while clearing it out and then, assemble floating seal into housing by use of pressing jig.

※ Be sure to maintain it vertical with the ground when assembling floating seal.



21078TM705

6) INSTALLING HOUSING ASSEMBLY

(1) Install 2 EA of M12 eye-bolt into housing assembly.

(2) Assemble housing into motor by use of hoist and eye-bolt.

※ Be sure to tighten eye-bolt deep enough.

21078TM108

7) INSTALLING MAIN BEARING (82)

(1) Heat main bearing at 60~70 ℃ and then, install.

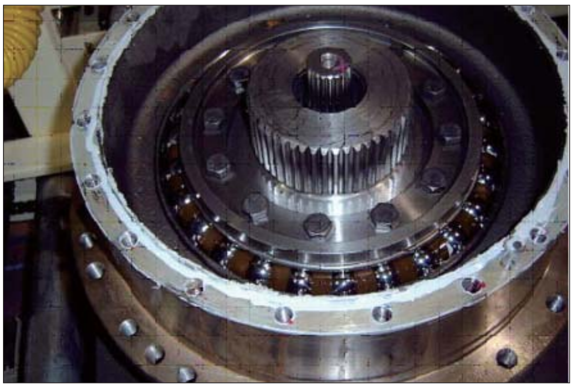
※ Be sure to maintain it vertical with the ground when assembling bearing.

21078TM109

8) INSTALLING RETAINER (85) AND SHIM (84)

(1) Measure clearance between main bearing and retainer by use of jig to decide the thickness of shim and select an appropriate shim, and then, assemble retainer.

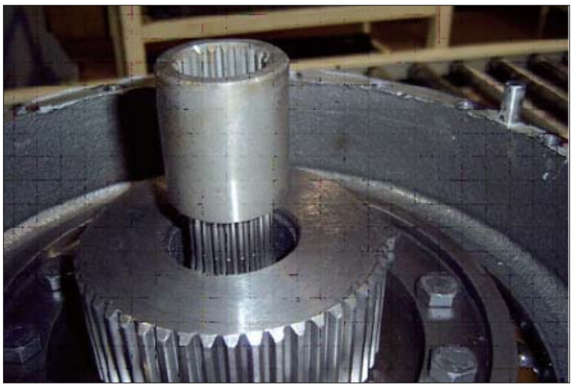
(2) Apply locktite (#262) on M12 hexagon head bolt, and then, bolt.



21078TM110

9) INSTALLING COUPLING

(1) Install coupling on spline of the motor.



21078TM111

10) INSTALLING RING GEAR

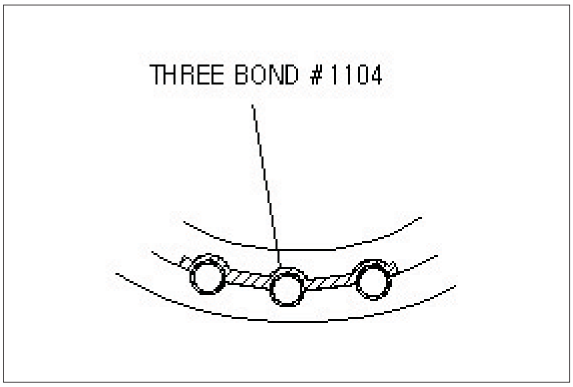
(1) Apply three bone #1104 (loctite #515) on housing for ring gear without gap.

(2) Insert lock pin into housing hole.

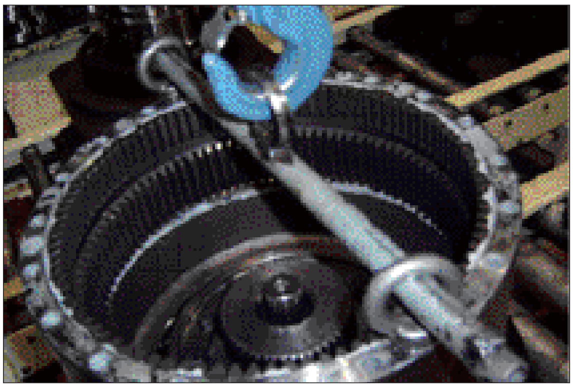
(3) Install M14 eye-bolt on the tap of ring gear.

(4) Lift ring gear and then, assemble into housing in order for hole of ring gear and parallel pin of housing to be in line.

(5) Temporarily secure 4EA of M12 hexagon socket bolt and shim with cover thickness having appropriate torque.



21078TM112A



21078TM113

11) INSTALLING NO.2 CARRIER SUB ASSEMBLY

(1) Install M10 eye-bolt on No.2 carrier assembly.

(2) Lift No.2 carrier assembly and then, slowly put it down on ring gear.

(3) Rotate planetary gear by hands and install on ring gear.

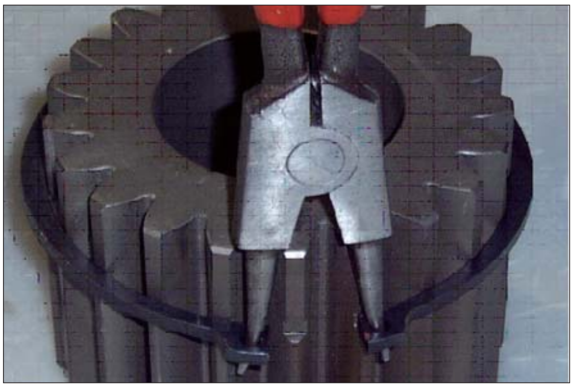
21078TM114

12) INSTALLING NO.2 SUN GEAR (91-2)

(1) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.

21078TM115

(2) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.



21078TM116

13) INSTALLING NO.1 CARRIER SUB ASSEMBLY

(1) Install M10 eye-bolt on No.2 carrier assembly.

(2) Lift No.1 carrier assembly and then, slowly put it down on ring gear.

(3) Rotate planetary gear by hands and install on ring gear.

21078TM117

14) INSTALLING NO.1 SUN GEAR (92)

(1) Put down No.1 sun gear on No.1 carrier, maintaining it vertical with spline of coupling.

(2) Install No.1 sun gear on No.1 planetary gear, matching their teeth.

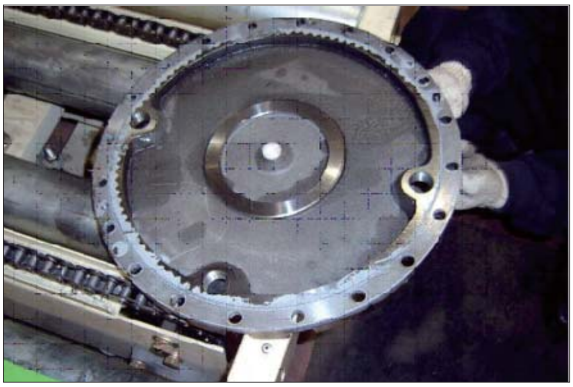
21078TM118

15) INSTALLING COVER (93)

(1) Beat pad (94) with plastic hammer, and press it into the center of cover.

(2) Apply three bond #1104, loctite (#515) on the ring gear for cover without gap.

(3) Put cover on ring gear, apply loctite (#262) on M12 hexagon socket head bolt, and then, bolt.



21078TM119

(4) Fill gear oil (5.8 liter) into drain port.

(5) Apply gear oil on PF3/4 hydraulic plug (97) and then, bolt.

21078TM120

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 washer with bolt (1).

· Tightening torque : 1.05±0.2 kgf · m (7.6±1.45 lbf · ft)

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

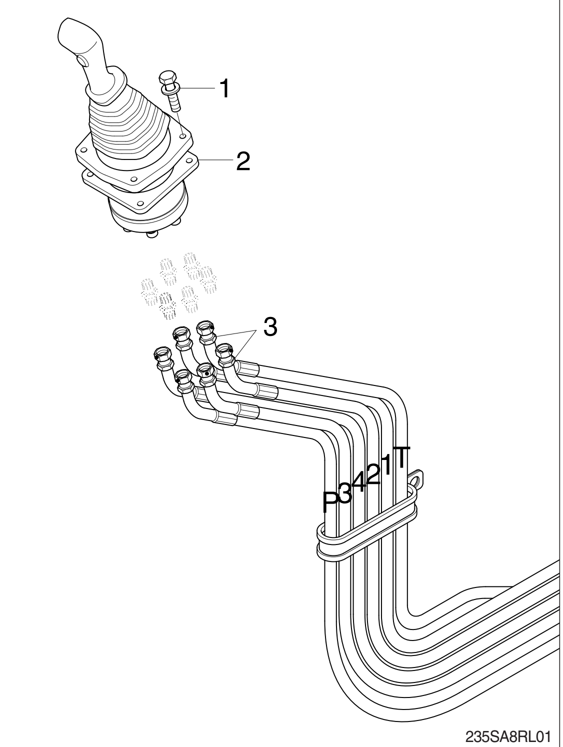
※ When removing the pilot valve assembly, check that all the hoses have been disconnected.

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.

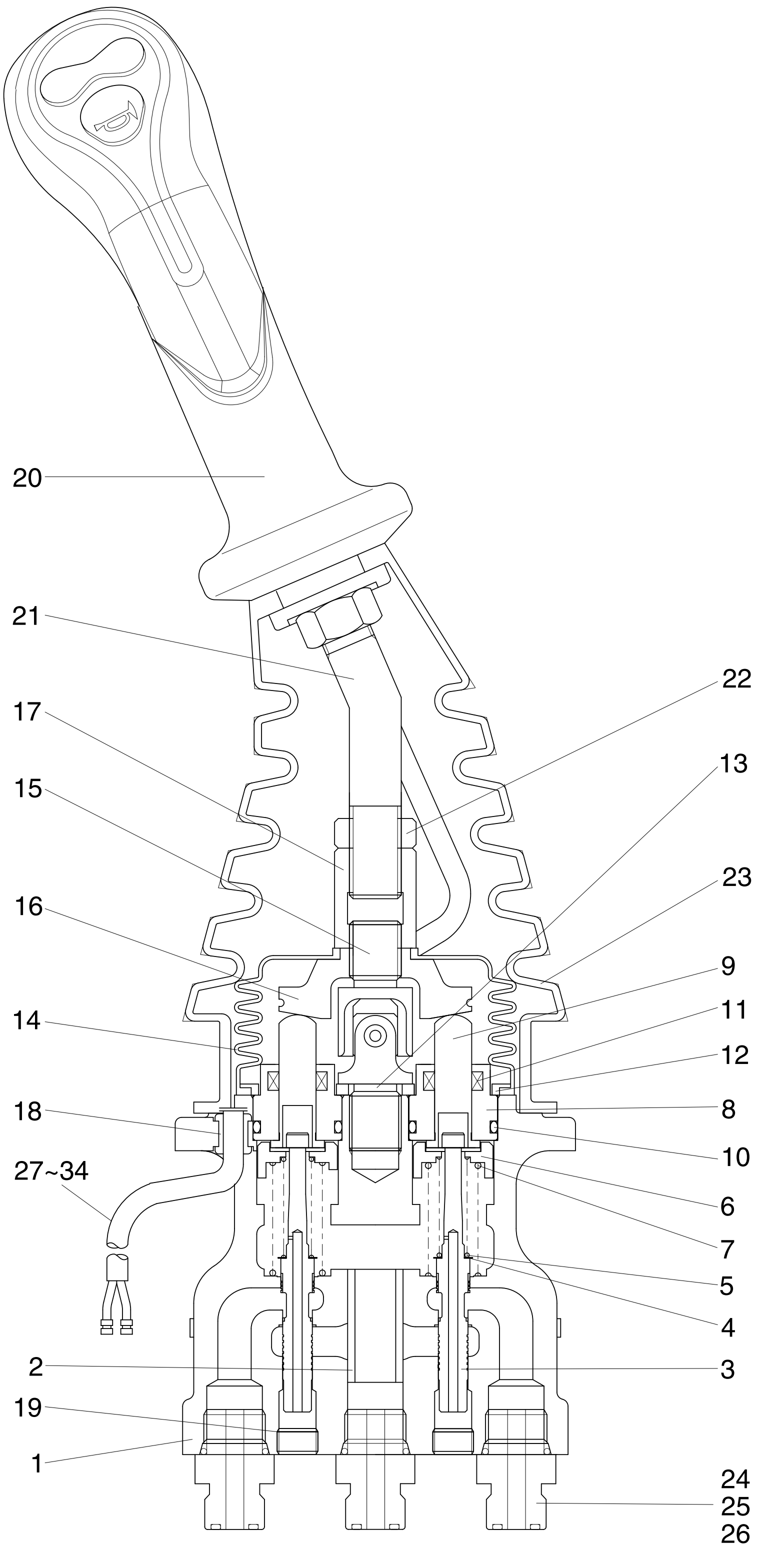
13031GE18



235SA8RL01

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

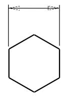


210S2RL06

1	Case
2	Bushing
3	Spool
4	Shim
5	Spring
6	Spring seat
7	Spring
8	Plug
9	Push rod
10	O-ring
11	Rod seal
12	Plate
13	Spacer
14	Boot
15	Joint assembly
16	Swash plate
17	Adjusting nut
18	Bushing
19	Plug
20	Handle assembly
21	Handle bar
22	Nut
23	Boot
24	Last guard filter
25	Connector
26	Connector
27	Connector
28	Connector
27	Connector
29	Connector
30	Connector
31	Small guide
32	Connector
33	Big guide
34	Connector

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	15	M14	3.8	27.5
Swash plate	16	M14	7.0 $\pm$ 0.40	50.6 $\pm$ 2.9
Adjusting nut	17	M14	7.0 $\pm$ 0.40	50.6 $\pm$ 2.9
Lock nut	22	M14	5.0 $\pm$ 0.35	36.2 $\pm$ 2.5

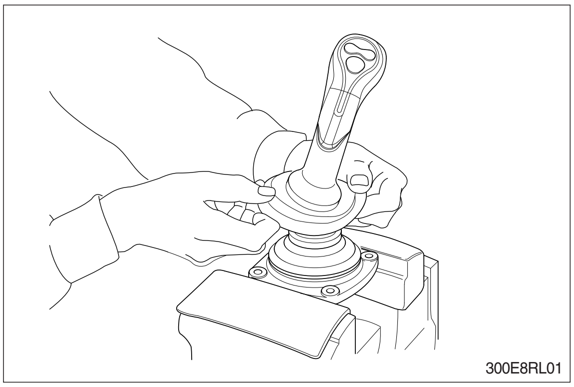
3) DISASSEMBLY

※ Procedures are based on the type M1.

(1) Clean pilot valve with kerosene.
※ Put blind plugs into all ports

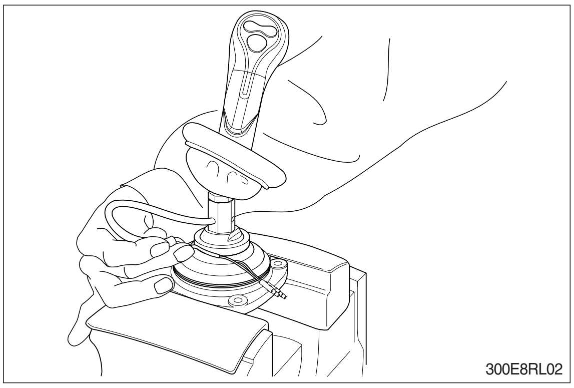
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (23) from case (1) and take it out upwards.



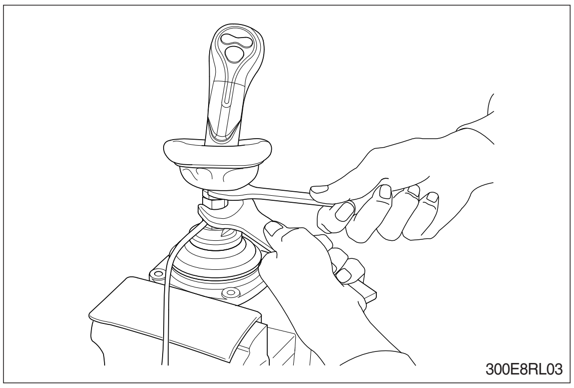
300E8RL01

※ For valve with switch, remove cord also through hole of casing.



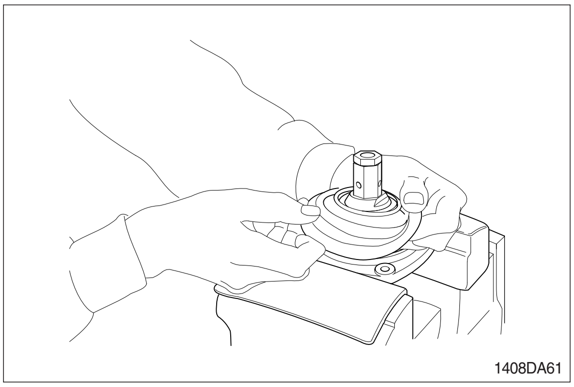
300E8RL02

(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



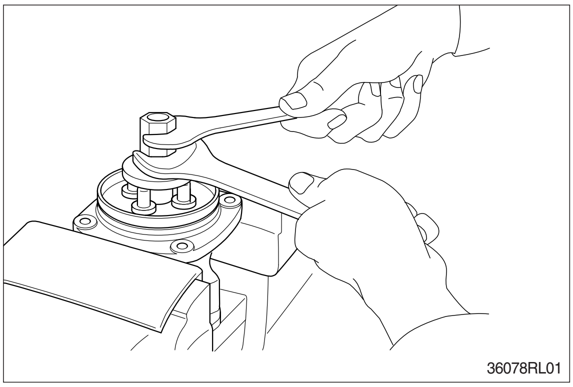
300E8RL03

(5) Remove the boot (14).

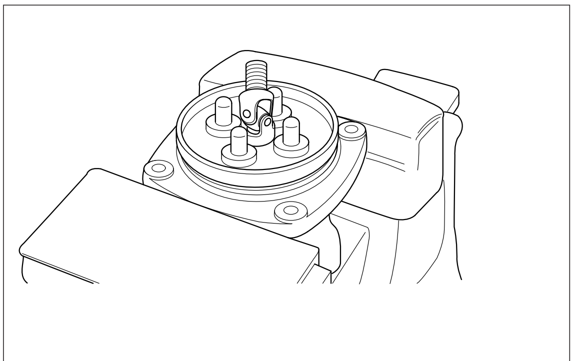


1408DA61

(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.



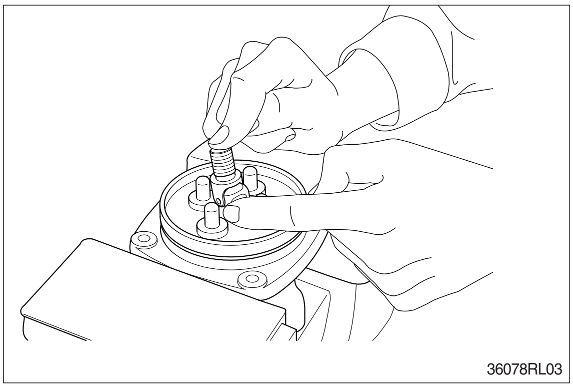
36078RL01



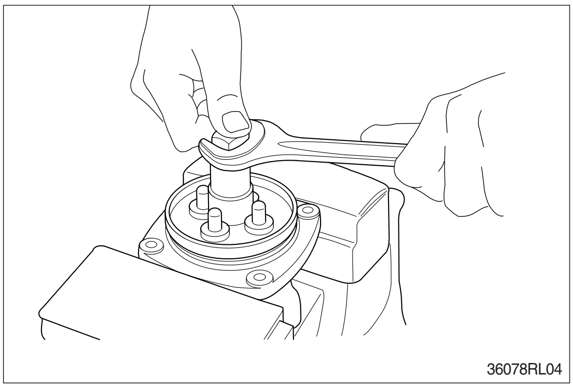
36078RL02

(7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint.
Pay attention to this.

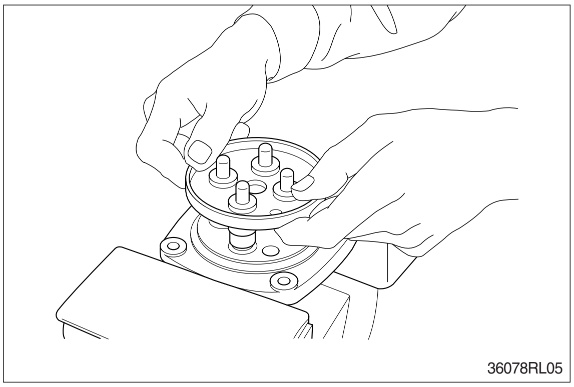


36078RL03



36078RL04

(8) Remove plate (12).

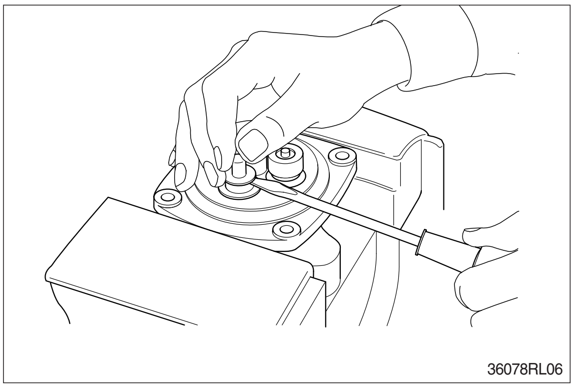


36078RL05

(9) When return spring (7) is weak in force, plug (8) 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.

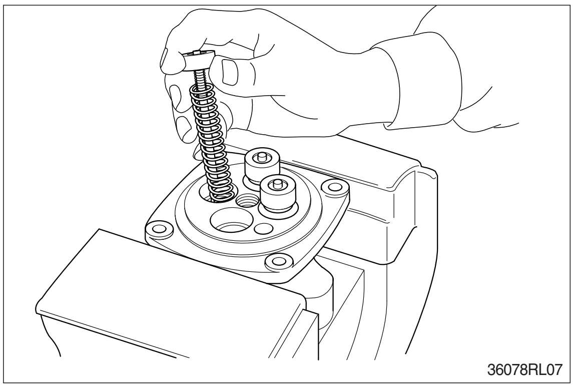
※ During taking out, plug may jump up due to return spring (7) force.
Pay attention to this.



36078RL06

(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



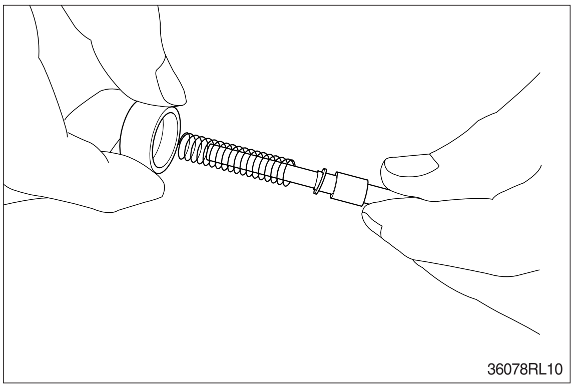
36078RL07

(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

※ Pay attention not to damage spool surface.

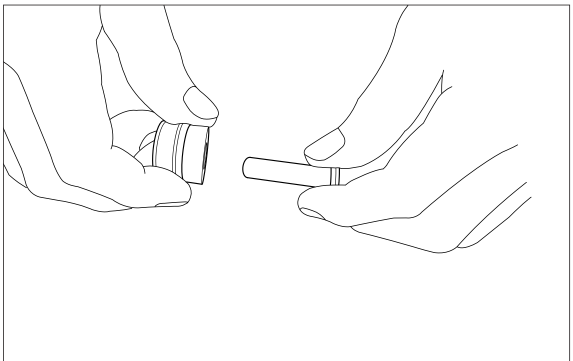
※ Record original position of spring seat (6).

※ Until being assembled, they should be handled as one subassembly group.



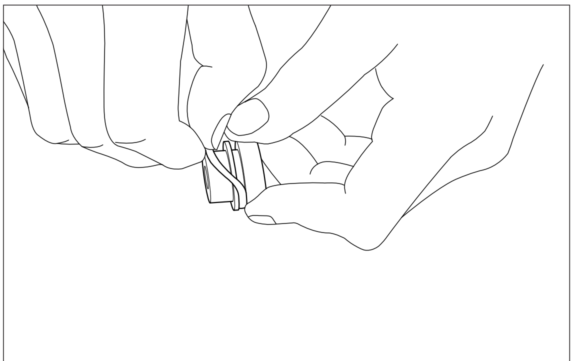
36078RL10

(12) Take push rod (9) out of plug (8).

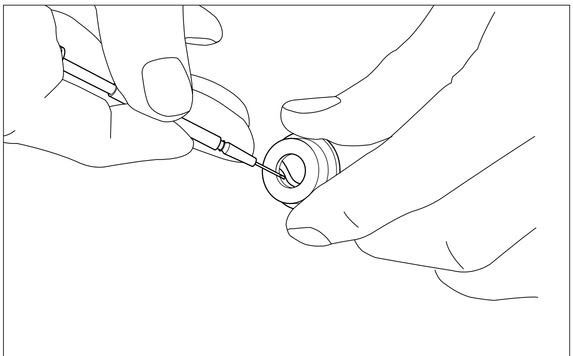


36078RL11

(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.

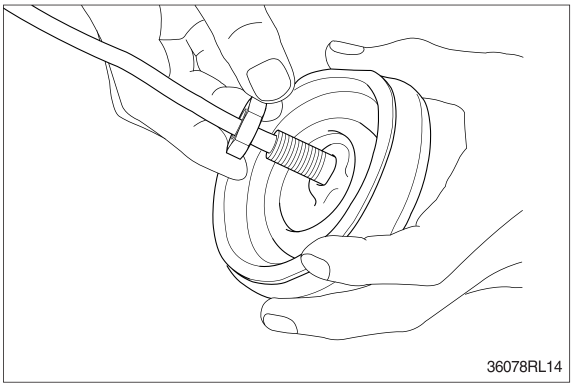


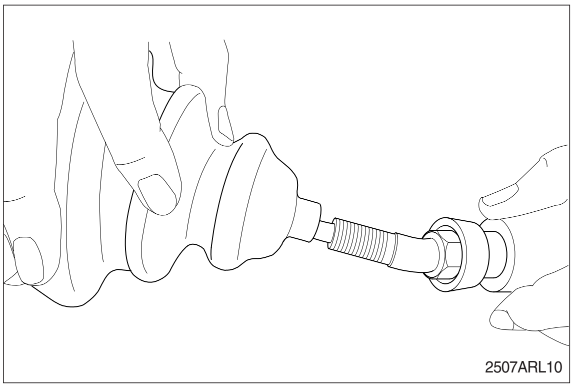
36078RL12



36078RL13

(14) Remove lock nut (22) and then boot (23).





(15) **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.

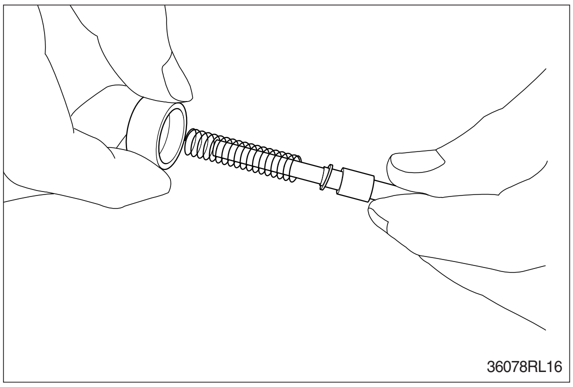
(16) **Rust prevention of parts**

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

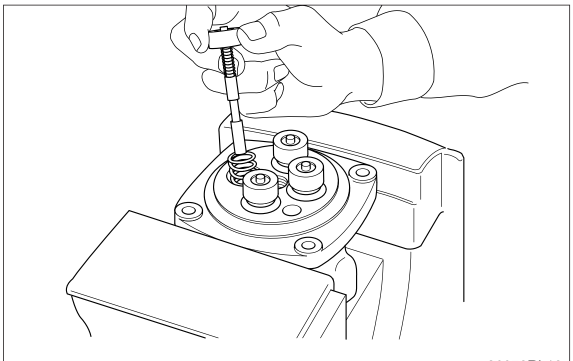
(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



36078RL16

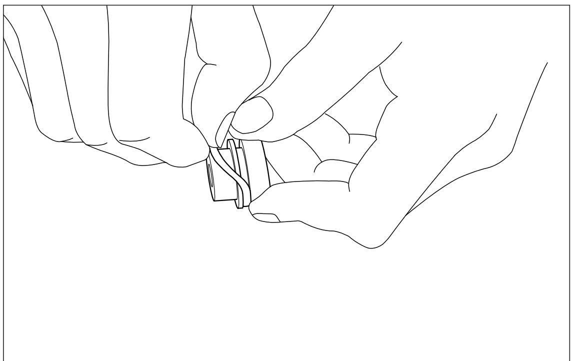
(2) Assemble spring (7) into casing (1).
Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



36078RL18

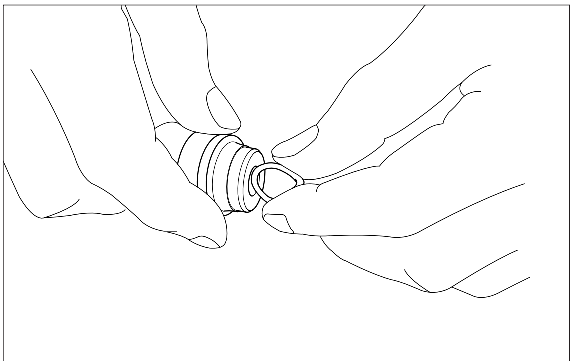
(3) Assemble O-ring (10) onto plug (8).



36078RL19

(4) Assemble seal (11) to plug (8).

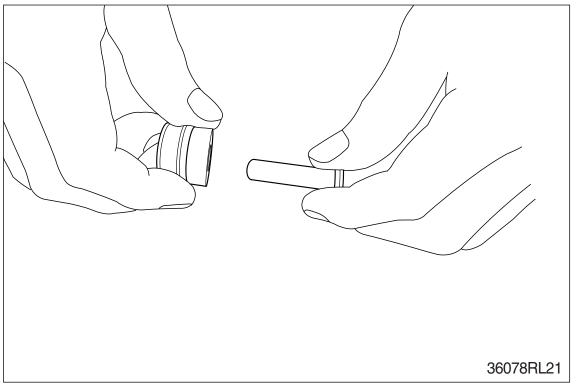
※ Assemble seal in such lip direction as shown below.



36078RL20

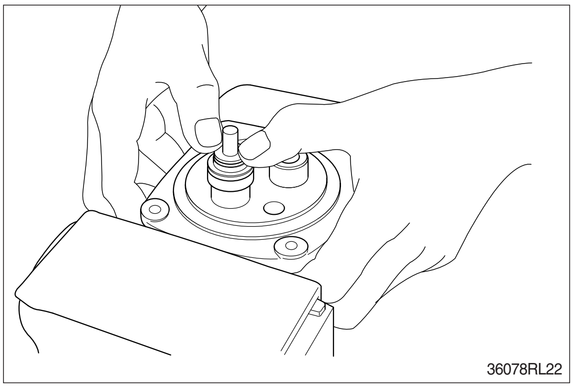
(5) Assemble push rod (9) to plug (8).

※ Apply working oil on push-rod surface.

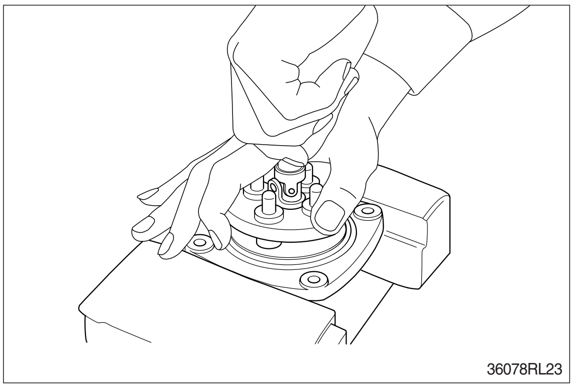


(6) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

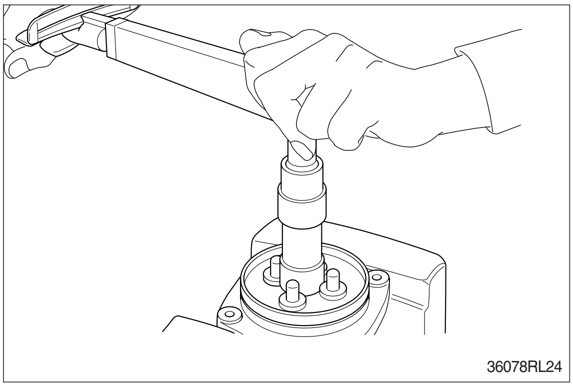


(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



(8) Fit plate (12).

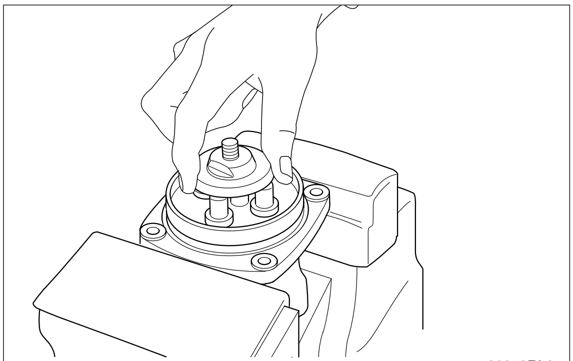
(9) Tighten joint (15) with the specified torque to casing, utilizing jig.



(10) Assemble swash plate (16) to joint (15).

※ Screw it to position that it contacts with 4 push rods evenly.

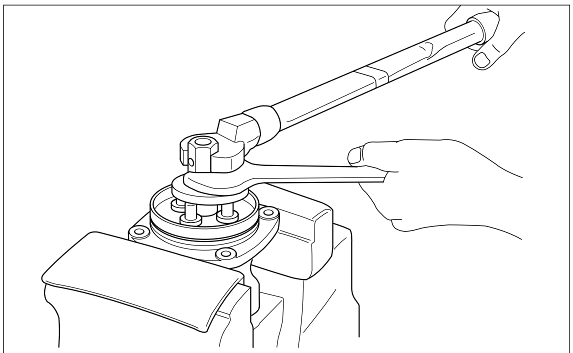
※ Do not screw it over.



36078RL25

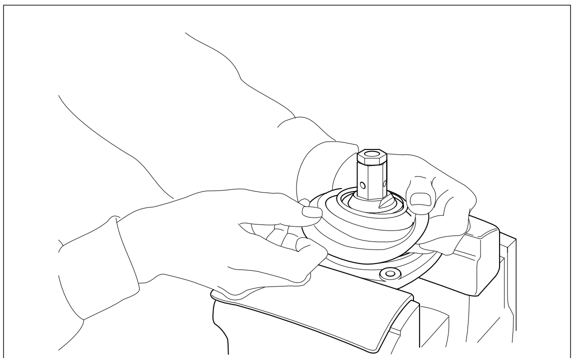
(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

※ During tightening, do not change position of disk.



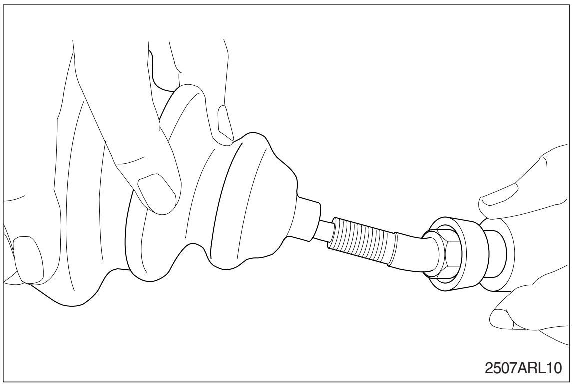
36078RL26

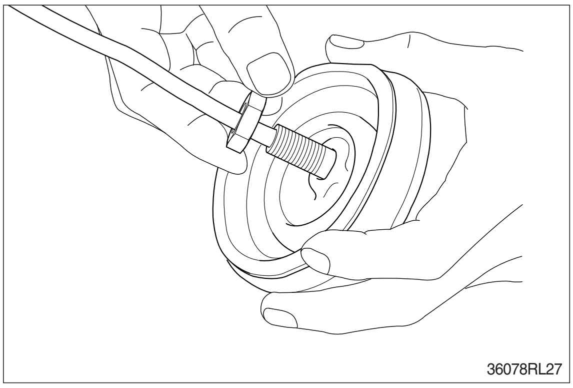
(12) Fit boot (14) to plate.



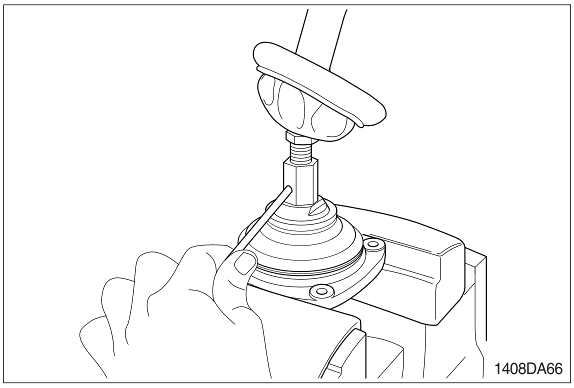
1408DA61

(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



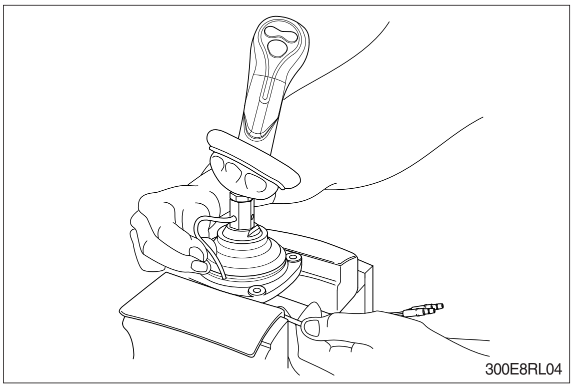


(14) Pull out cord and tube through adjusting nut hole provided in direction 60 °to 120 °from casing hole.

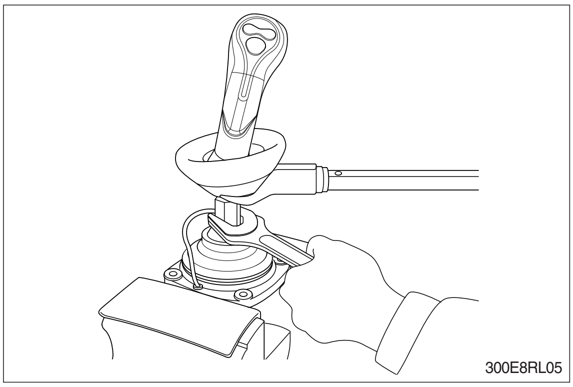


(15) Assemble bushing (18) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.

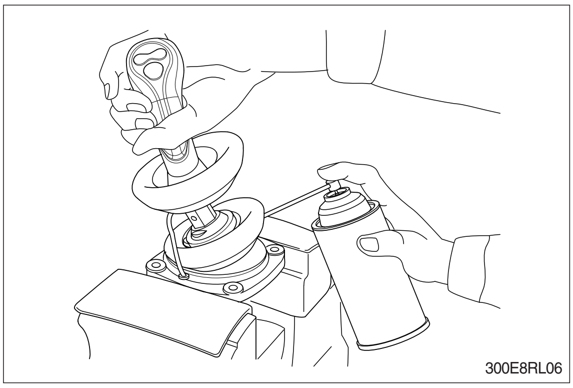


(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



300E8RL05

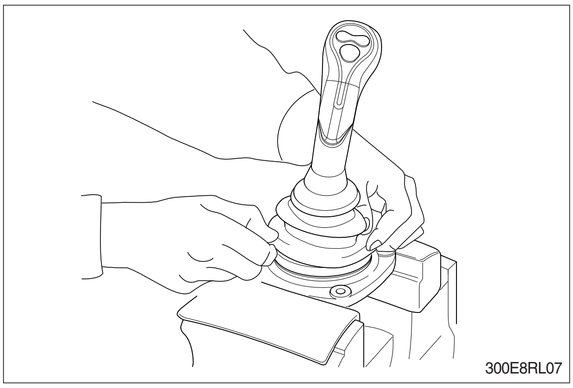
(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



300E8RL06

(18) Assemble lower end of bellows to casing.

(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



300E8RL07

GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

13031GE18

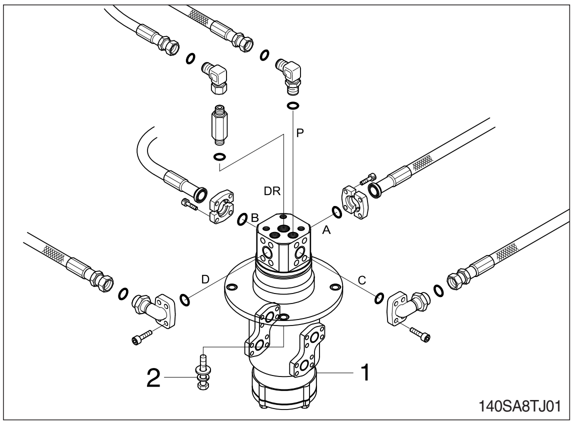
(1) Lower the work equipment to the ground and stop the engine.

(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.



140SA8TJ01

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

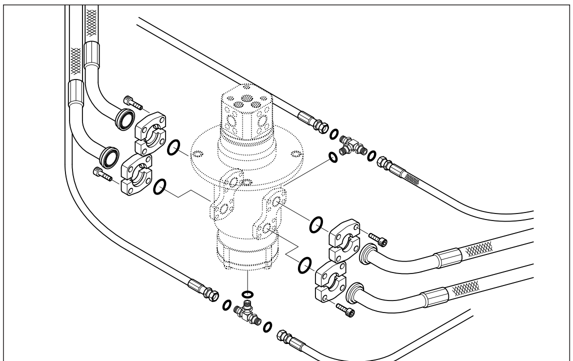
· Weight : 56 kg (123 lb)

· Tightening torque : 12.8±3.0 kgf · m (92.6±21.7 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

2) INSTALL



140SA8TJ02

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

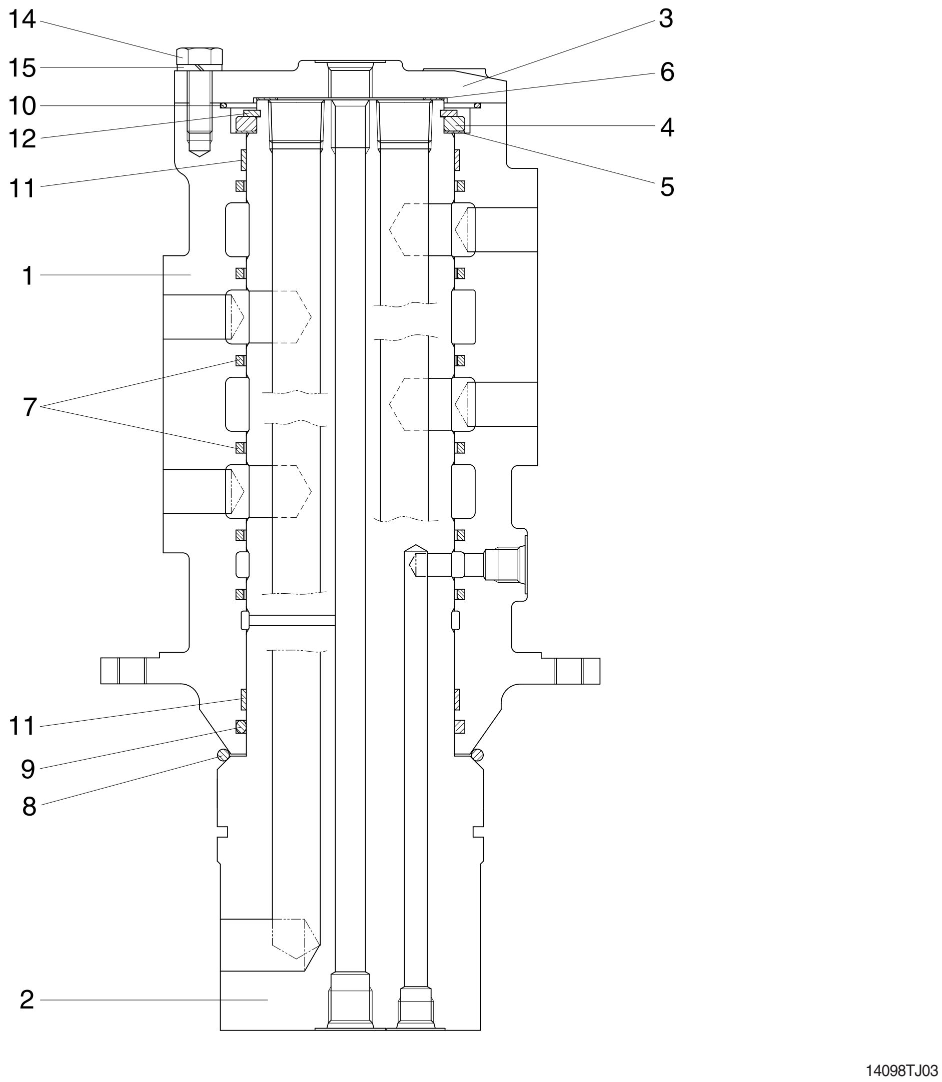
※ Take care of turning joint direction.

※ 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

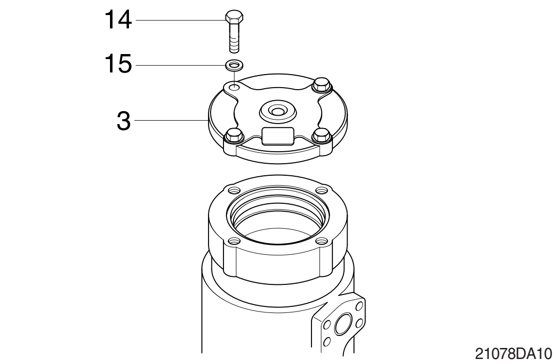


1	Hub	7	Slipper seal	13	Plug
2	Shaft	8	O-ring	14	Hexagon bolt
3	Cover	9	O-ring	15	Spring washer
4	Spacer	10	O-ring	16	Plug
5	Shim	11	Wear ring		
6	Shim	12	Retainer ring		

2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

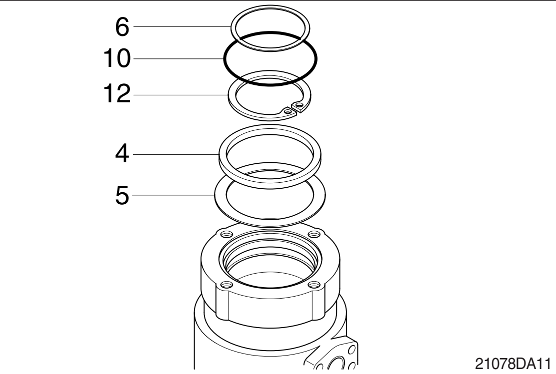
(1) Remove bolts (14), washer (15) and cover (3).



21078DA10

(2) Remove shim (6) and O-ring (10).

(3) Remove retainer ring (12), spacer (4) and shim (5).

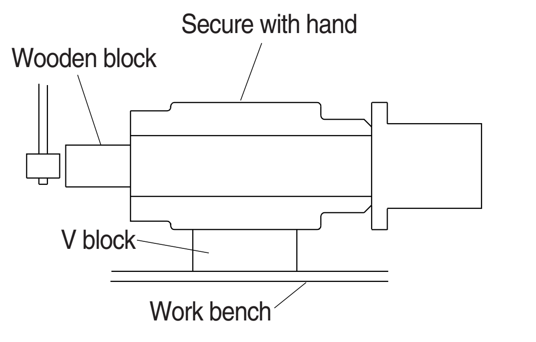


21078DA11

(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

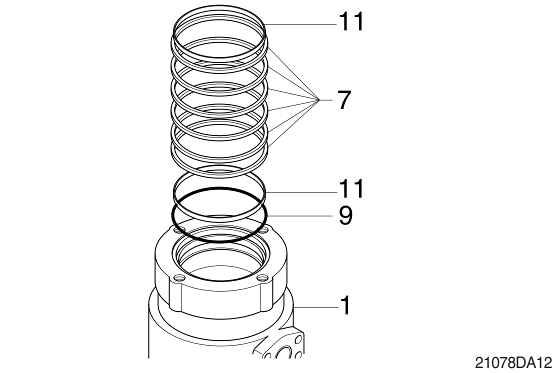
※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



8-14(3) (360-7)

(5) Remove six slipper seals (7) and O-ring (9), two wear ring (11) from hub (1).



21078DA12

3) ASSEMBLY

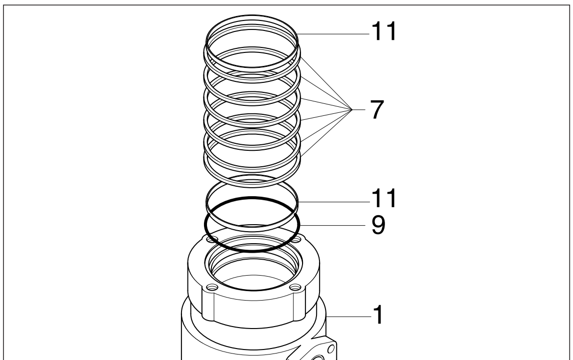
※ Clean all parts.

※ As a general rule, replace oil seals and O-ring.

※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

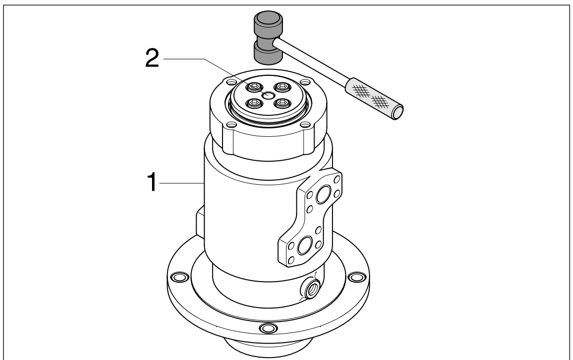
(1) Fix seven slipper seal (7) and O-ring (9), two wear ring (11) to hub (1).

(2) Fit O-ring (8) to shaft (2).



21078DA12

(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.

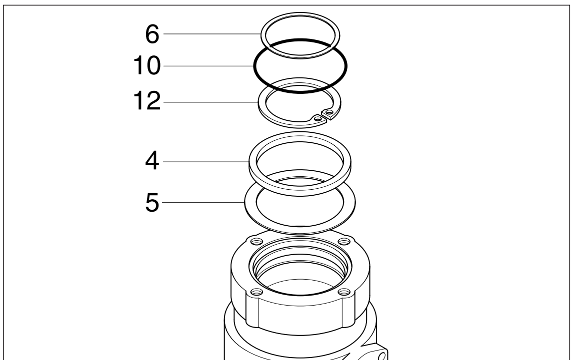


21078DA13

(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

(5) Fit O-ring (10) to hub (1).

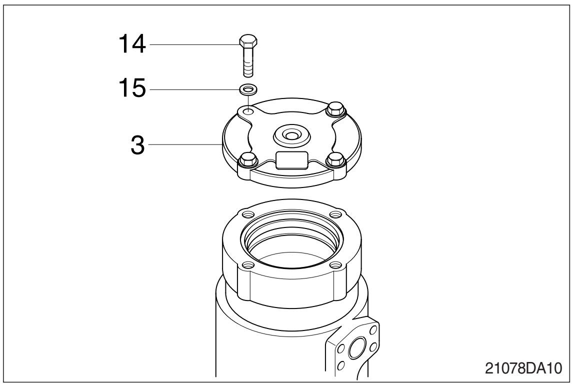
(6) Fit shim (6) to shaft (2).



21078DA11

(7) Install cover (3) to body (1) and tighten bolts (14).

· Torque : 10~12.5 kgf · m (72.3~90.4 lbf · ft)



GROUP 9 BOOM, ARM AND BUCKET CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

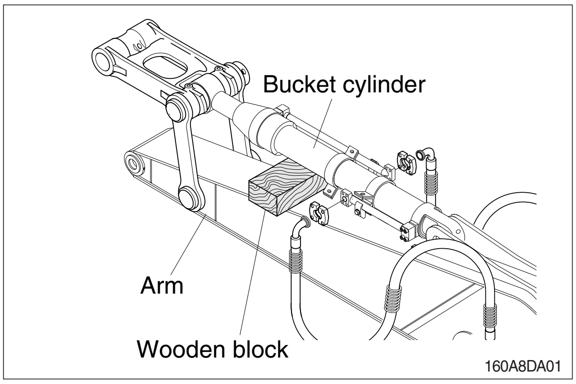
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

13031GE18

① Set block between bucket cylinder and arm.

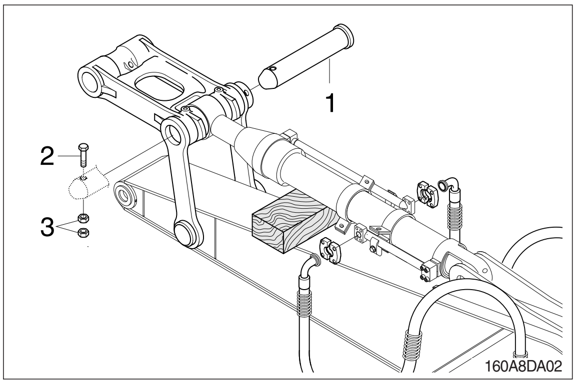


160A8DA01

② Remove bolt (2), nut (3) and pull out pin (1).

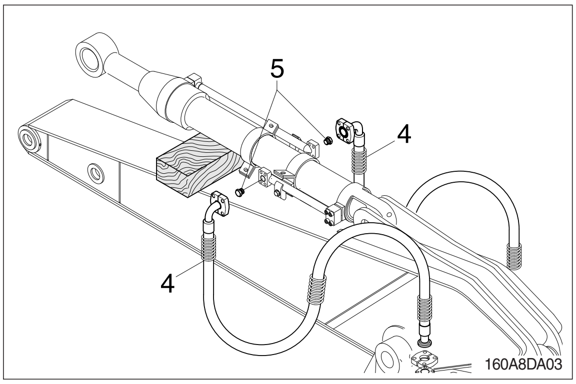
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (2) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)



160A8DA02

③ Disconnect bucket cylinder hoses (4), grease line hose (7) and put plugs (5) on cylinder pipe.



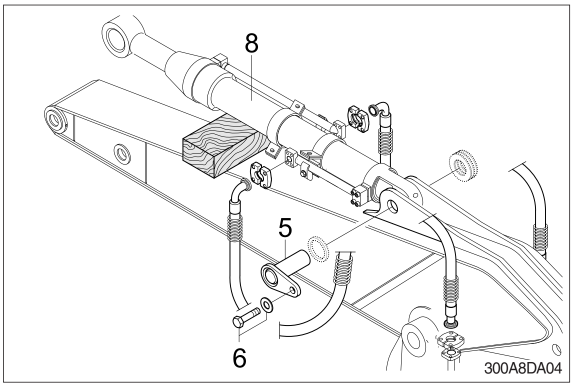
160A8DA03

④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

· Weight : 104 ㎏ (229 ℓb)

· Tightening torque (6) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)



(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.

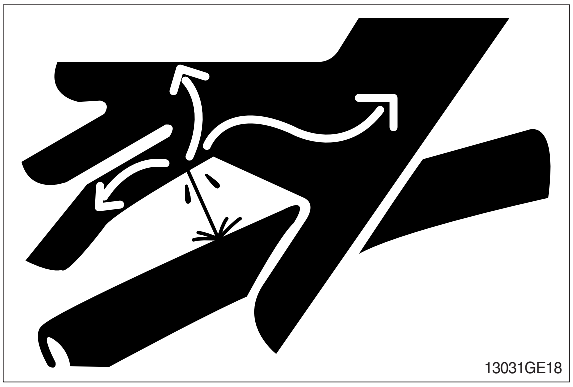
2) ARM CYLINDER

(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.

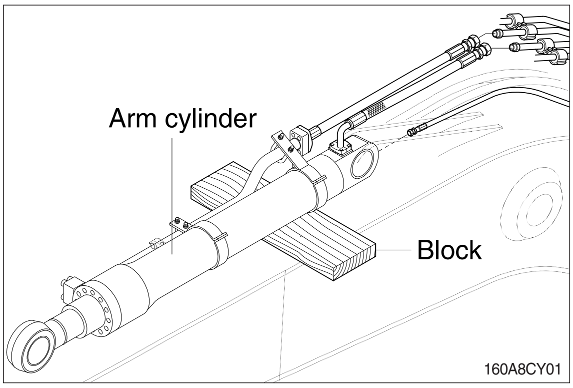


13031GE18

⚠ 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.



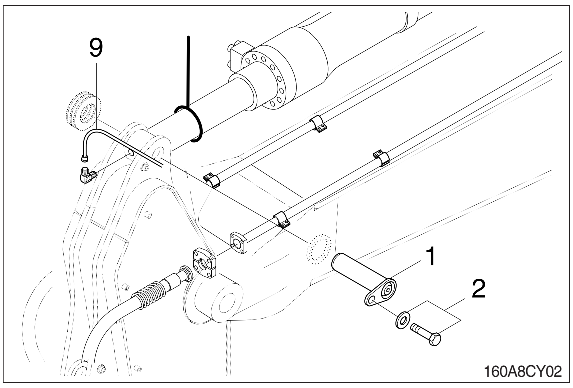
160A8CY01

② Disconnect grease line hose (9).

③ Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

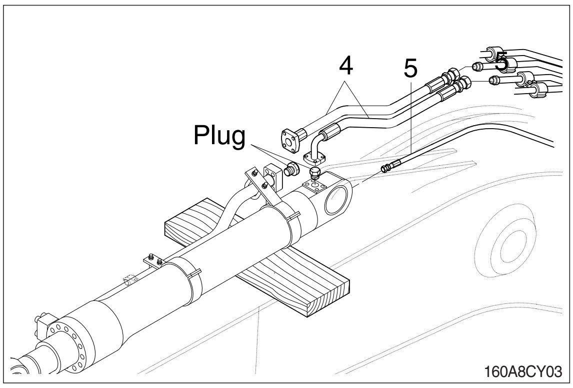
· Tightening torque (2) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)



160A8CY02

④ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

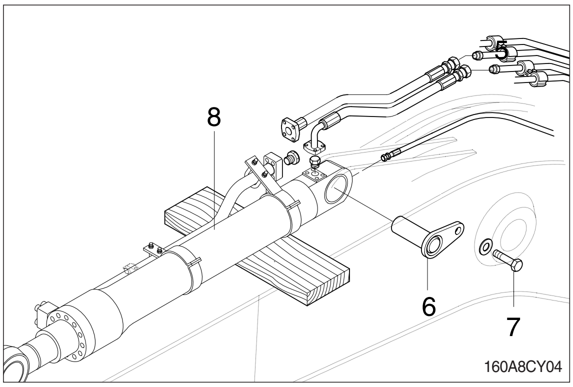
⑤ Disconnect greasing pipings (5).



160A8CY03

⑥ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).
- Tightening torque (7) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)

⑦ Remove arm cylinder assembly (8).
- Weight : 145 kg (320 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

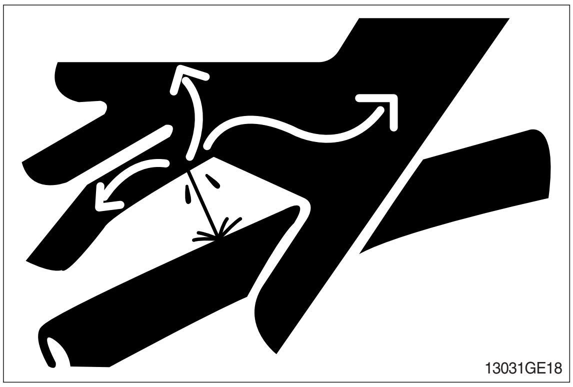
3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.



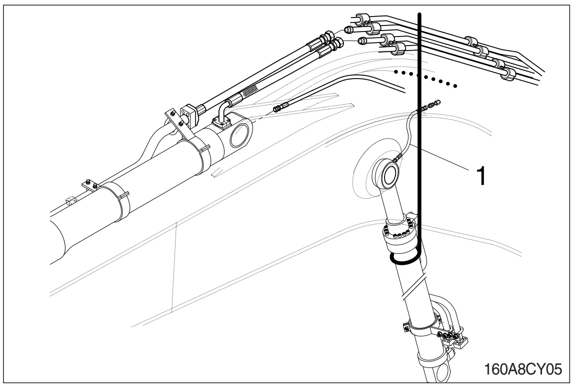
13031GE18

▲ 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 (1).

② Sling boom cylinder assembly.

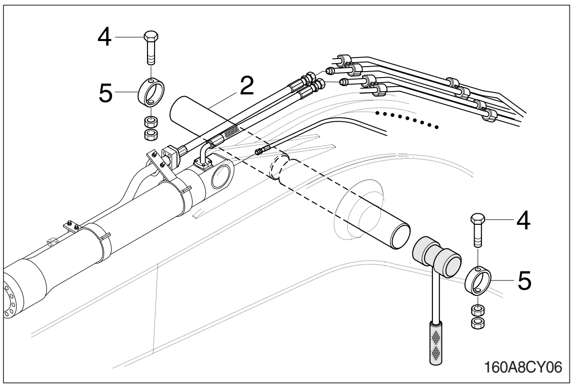


160A8CY05

③ Remove bolt (4), stopper (5) and pull out pin (2).

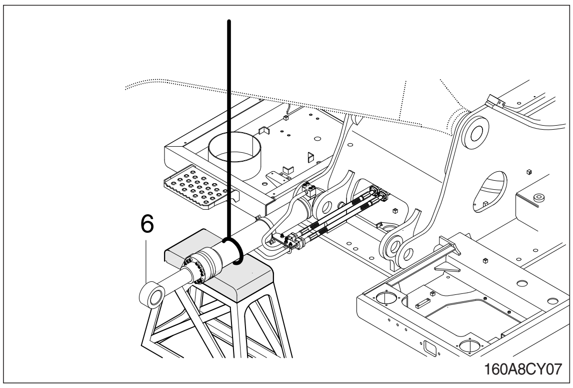
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (4) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)



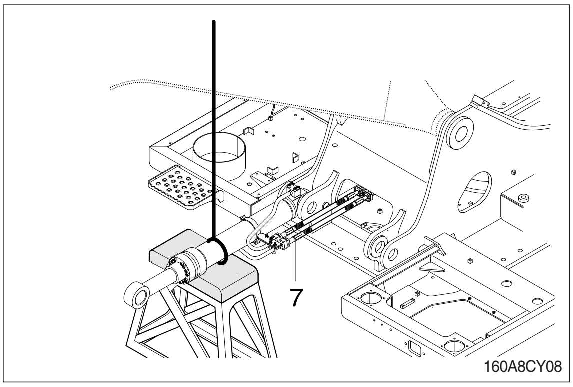
160A8CY06

④ Lower the boom cylinder assembly (6) on a stand.



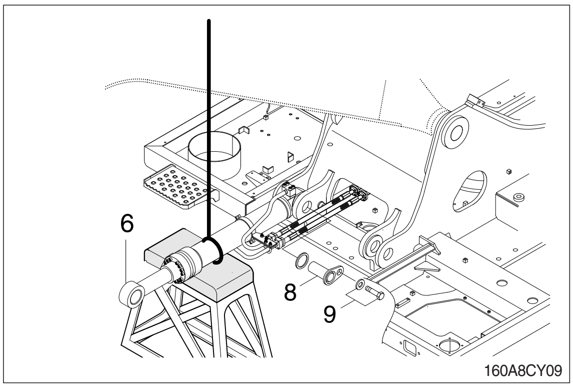
160A8CY07

⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



⑥ Remove bolt (9) and pull out pin (8).
 · Tightening torque (9) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)

⑦ Remove boom cylinder assembly (6).
 · Weight : 119 kg (262 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.**

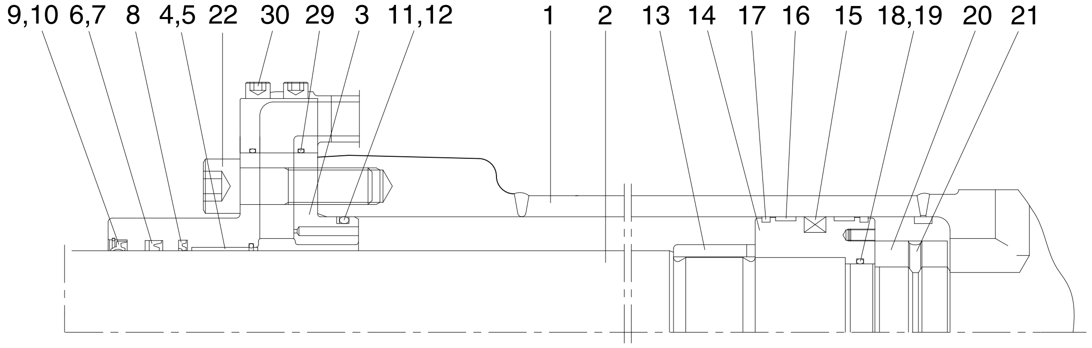
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

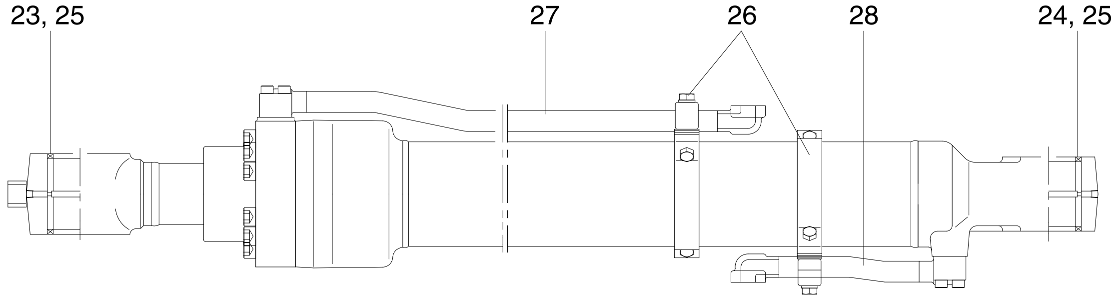
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder (CHANGZHOU)

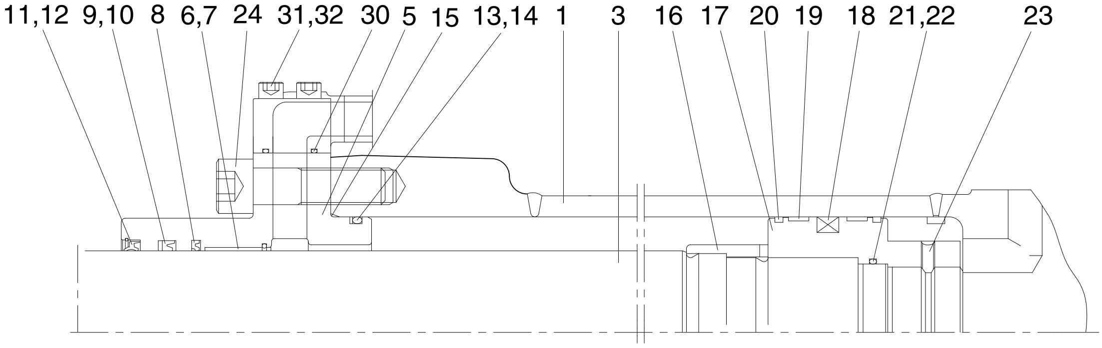


Internal detail

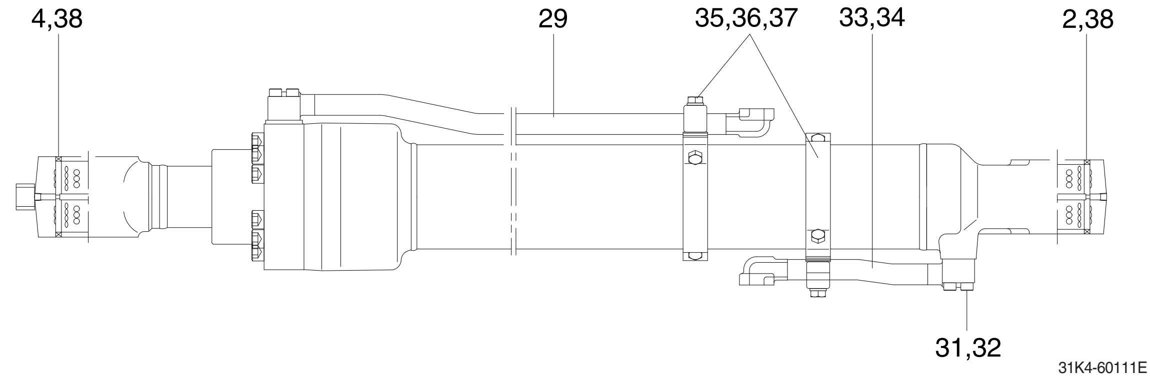


1	Tube assembly	11	O-ring	21	Hex socket headless set screw
2	Rod assembly	12	Back up ring	22	Hexagon socket bolt
3	Gland	13	Cushion ring	23	Dimple bushing
4	DD2 bushing	14	Piston	24	Dimple bushing
5	Snap ring	15	Piston seal	25	Dust seal
6	Rod seal	16	Wear ring	26	Band assembly
7	Back up ring	17	Dust ring	27	Pipe assembly-R
8	Buffer ring	18	O-ring	28	Pipe assembly-B
9	Dust wiper	19	Back up ring	29	O-ring
10	Snap ring	20	Lock nut	30	Hexagon socket head bolt

Bucket cylinder (DY POWER)

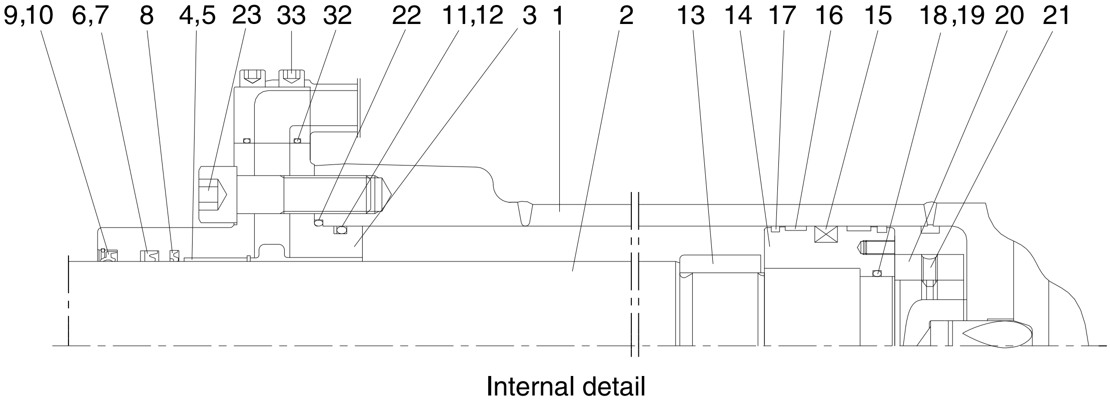


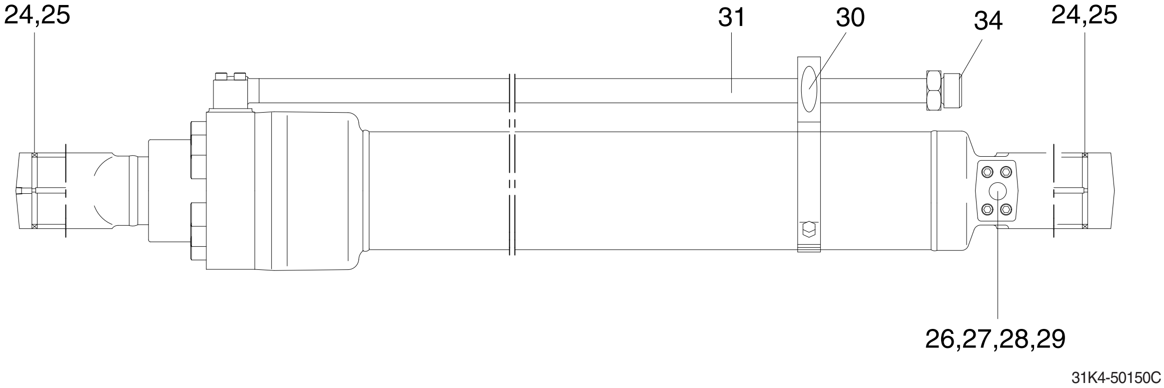
Internal detail



1	Tube assembly	14	Back up ring	27	Hexagon bolt
2	Pin bushing	15	O-ring	28	Spring washer
3	Rod assembly	16	Cushion ring	29	Pipe assy
4	Pin bushing	17	Piston	30	O-ring
5	Rod cover	18	Piston seal	31	Hexagon socket head bolt
6	Rod bushing	19	Wear ring	32	Spring washer
7	Retaining ring	20	Dust ring	33	Pipe assy
8	Buffer seal	21	O-ring	34	O-ring
9	U-packing	22	Back up ring	35	Clamp
10	Back up ring	23	Set screw	36	Spring washer
11	Dust wiper	24	Hexagon socket head bolt	37	Hexagon nut
12	Retaining ring	25	Pipe band assy	38	Pin wiper
13	O-ring	26	Pipe band		

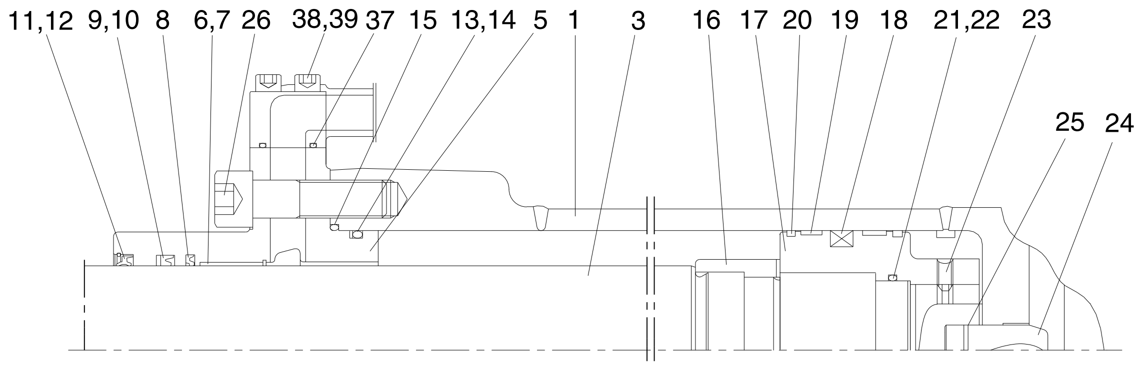
(2) Arm cylinder (CHANGZHOU)



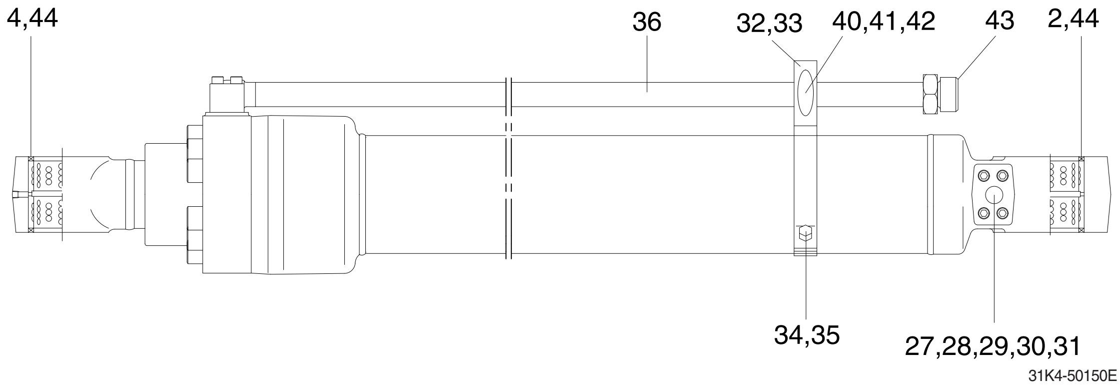


1	Tube assembly	13	Cushion ring	25	Dust seal
2	Rod assembly	14	Piston	26	Check valve
3	Gland	15	Piston seal	27	Coil spring
4	DD2 bushing	16	Wear ring	28	O-ring
5	Snap ring	17	Dust ring	29	Plug
6	Rod seal	18	O-ring	30	Band assembly
7	Back up ring	19	Back up ring	31	Pipe assembly-R
8	Buffer ring	20	Lock nut	32	O-ring
9	Dust wiper	21	Hex socket headless set screw	33	Hexagon socket head bolt
10	Snap ring	22	O-ring	34	O-ring
11	O-ring	23	Hexagon socket head bolt		
12	Back up ring	24	Dimple bushing		

Arm cylinder (DY POWER)

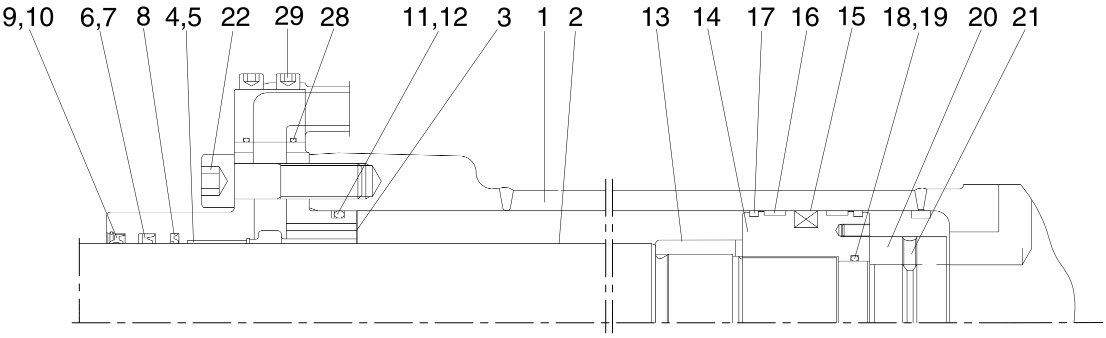


Internal detail

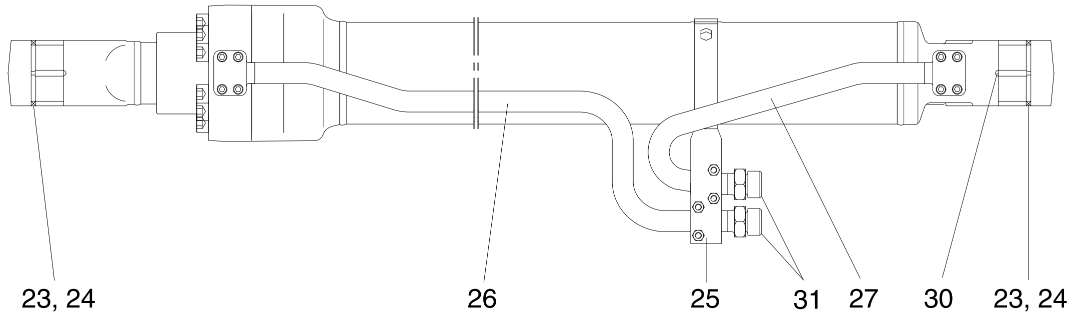


1	Tube assembly	16	Cushion ring	31	Plug
2	Pin bushing	17	Piston	32	Pipe band assy
3	Rod assembly	18	Piston seal	33	Pipe band
4	Pin bushing	19	Wear ring	34	Hexagon bolt
5	Rod cover	20	Dust ring	35	Washer
6	Rod bushing	21	O-ring	36	Pipe assy
7	Retaining ring	22	Back up ring	37	O-ring
8	Buffer seal	23	Set screw	38	Hexagon socket head bolt
9	U-packing	24	Cushion plunger	39	Spring washer
10	Back up ring	25	Stop ring	40	U-bolt
11	Dust wiper	26	Hexagon socket head bolt	41	Spring washer
12	Retaining ring	27	Check	42	Hexagon nut
13	O-ring	28	Spring	43	O-ring
14	Back up ring	29	Bracket	44	Pin wiper
15	O-ring	30	O-ring		

(3) Boom cylinder (CHANGZHOU)

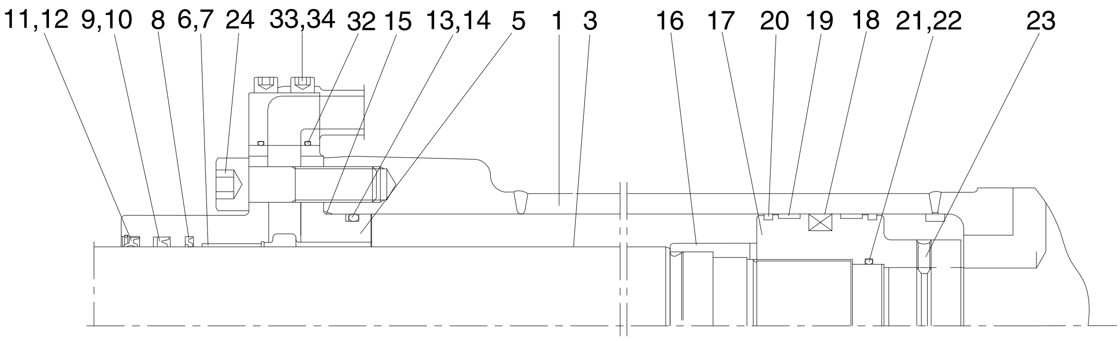


Internal detail

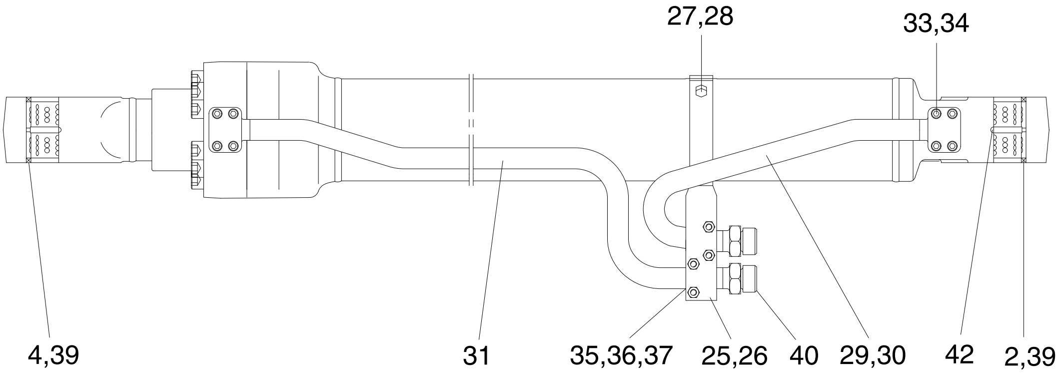


1	Tube assembly	12	Back up ring	23	Dimple bushing
2	Rod assembly	13	Cushion ring	24	Dust seal
3	Gland	14	Piston	25	Band assembly
4	DD2 bushing	15	Piston seal	26	Pipe assembly-R
5	Snap ring	16	Wear ring	27	Pipe assembly-B
6	Rod seal	17	Dust ring	28	O-ring
7	Back up ring	18	O-ring	29	Hexagon socket head bolt
8	Buffer ring	19	Back up ring	30	Socket plug
9	Dust wiper	20	Lock nut	31	O-ring
10	Snap ring	21	Hex socket headless set screw		
11	O-ring	22	Hexagon socket head bolt		

Boom cylinder (DY POWER)

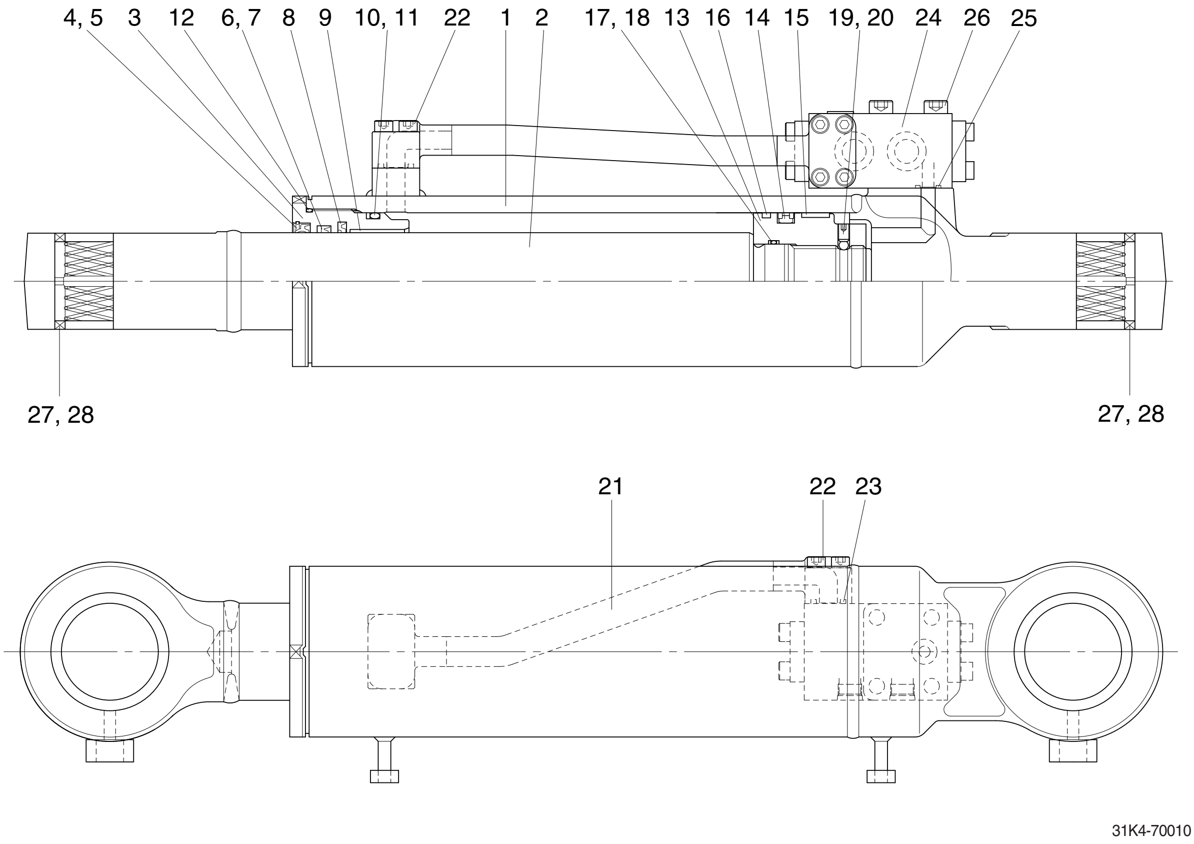


Internal detail



1	Tube assembly	15	O-ring	29	Pipe assy
2	Pin bushing	16	Cushion ring	30	O-ring
3	Rod assembly	17	Piston	31	Pipe assy
4	Pin bushing	18	Piston seal	32	O-ring
5	Rod cover	19	Wear ring	33	Spring washer
6	Rod bushing	20	Dust ring	34	Hexagon socket head bolt
7	Retaining ring	21	O-ring	35	U-bolt
8	Buffer seal	22	Back up ring	36	Spring washer
9	U-packing	23	Set screw	37	Hexagon nut
10	Back up ring	24	Hexagon socket head bolt	38	O-ring
11	Dust wiper	25	Pipe band assy	39	Pin wiper
12	Retaining ring	26	Pipe band	40	O-ring
13	O-ring	27	Hexagon bolt	42	Plug
14	Back up ring	28	Spring washer		

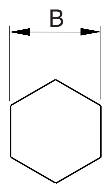
(4) Dozer cylinder (SH PAC)



1	Tube assembly	11	Back up ring	21	Pipe assembly
2	Rod assembly	12	O-ring	22	Hexagon socket head bolt
3	Gland	13	Piston	23	O-ring
4	Dust wiper	14	Piston seal	24	Check valve assembly
5	Retainer ring	15	Wear ring	25	O-ring
6	Rod seal	16	Dust ring	26	Hexagon socket head bolt
7	Back up ring	17	O-ring	27	Pin bushing
8	Buffer ring	18	Back up ring	28	Dust seal
9	Dry bearing	19	Steel ball		
10	O-ring	20	Set screw		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools	Remark	
Allen wrench	6	
	8	
	10	
	12	
	14	
Spanner	7	
	8	
(-) 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
Socket head bolt	Bucket cylinder	22★1★3 24★1★4	M14 M14	15±2.0 19±1.0	108±14.5 137±7.2
		30★3 31★4	M10 M10	5.4±0.5 5.75±0.25	39.1±3.6 41.6±1.8
	Boom cylinder	22★1★3 24★1★4	M14 M14	15±2.0 19±1.0	108±14.5 137±7.2
		29★3 33★4	M8 M8	2.7±0.3 3.25±0.25	19.5±2.2 23.5±1.8
	Arm cylinder	23★1★3 26★1★4	M16 M16	23±2.0 30±2.0	166±14.5 217±14.5
		33★3 38★4	M10 M10	5.4±0.5 5.75±0.25	39.1±3.6 41.6±11.8
	Dozer cylinder	22★5 26★5	M8 M10	3.3±0.3 6.5±0.7	23.9±2.2 47.0±5.1
Gland	Dozer cylinder	3★5	M105	85±8.5	615±61.5
Lock nut	Bucket cylinder	20★3	-	100±10.0	723±72.3
	Boom cylinder	20★3	-	100±10.0	723±72.3
	Arm cylinder	20★3	-	100±10.0	723±72.3

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU
★4 : DY POWER
★5 : SH PAC

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Piston	Bucket cylinder	14★3 17★4	- M60	150±15.0 130±13	1085±108 940±94.0
	Boom cylinder	14★3 17★4	- M65	150±15.0 130±13	1085±108 940±94.0
	Arm cylinder	14★3 17★4	- M70	150±15 190±19	1085±108 1374±137
	Dozer cylinder	13★5	M52	150±15	1085±108
Set screw	Bucket cylinder	21★3 23★4	M8 M12	2.7±0.3 5.25±0.25	19.5±2.2 38.0±1.8
	Boom cylinder	21★3 23★4	M8 M12	2.7±0.3 5	19.5±2.2 36.2
	Arm cylinder	21★3 23★4	M8 M12	2.7±0.3 5	19.5±2.2 36.2
	Dozer cylinder	20★5	M8	1.7±0.2	12.3±1.4

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU
★4 : DY POWER
★5 : SH PAC

3) DISASSEMBLY

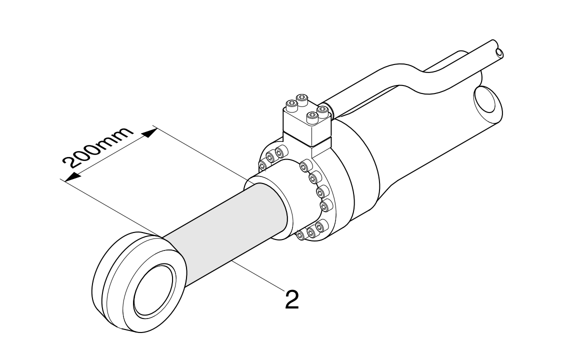
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200mm (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



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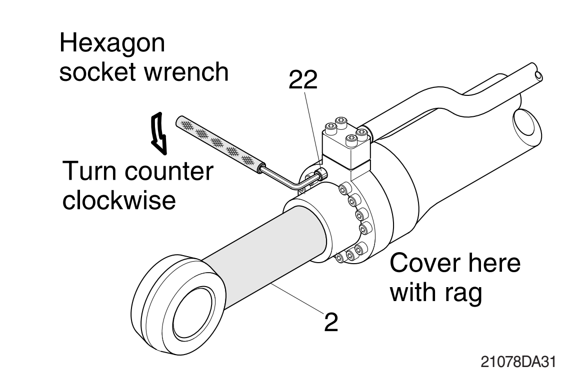
③ Loosen and remove socket bolts (22) of the gland in sequence.

※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



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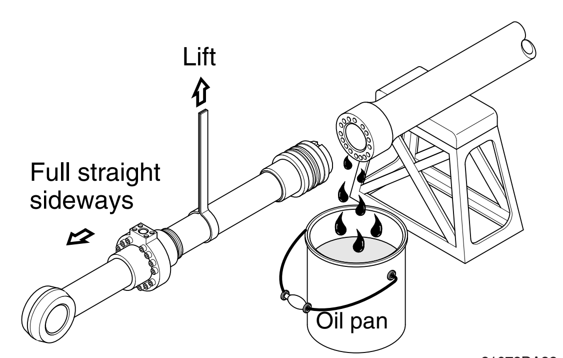
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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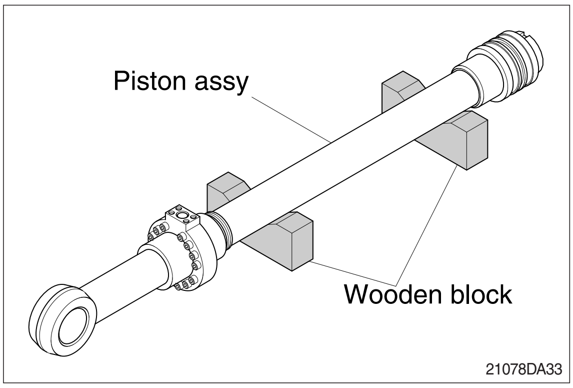
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.

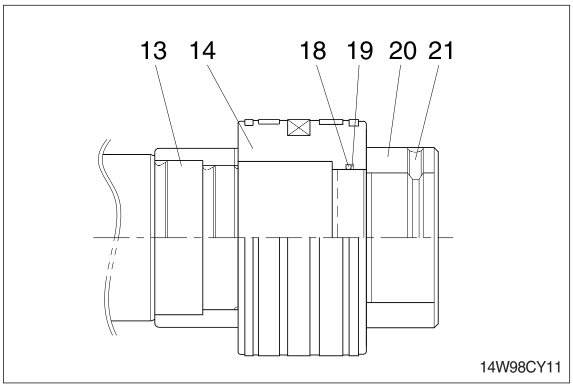


(2) Remove piston and cylinder head

① Remove set screw (21).

※ Since set screw (21) and lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock set screw (21) and lock nut (20).

② Remove piston assembly (14), back up ring (19), and O-ring (18).

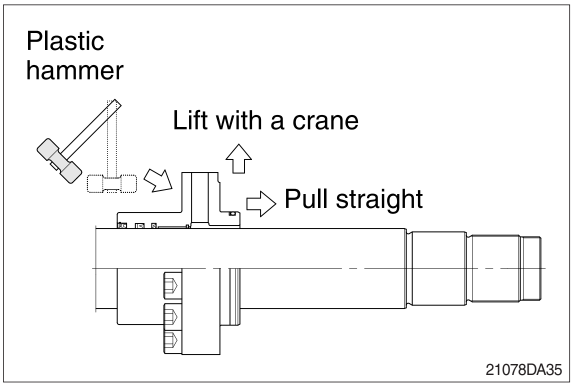


③ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.

Exercise care so as not to damage the lip of rod bushing (4) and packing (5,6,7,8,9,10) by the threads of rod assembly (2).

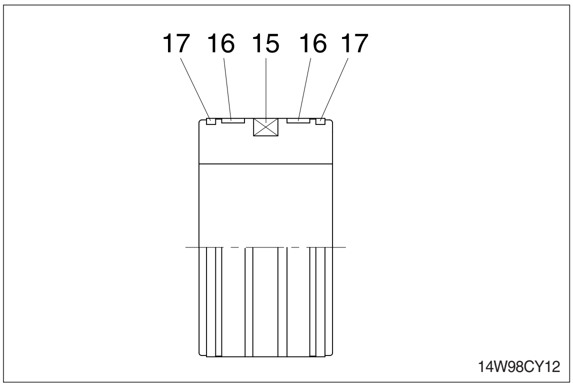


(3) Disassemble the piston assembly

① Remove wear ring (16).

② Remove dust ring (17) and piston seal (15).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

① Remove back up ring (12) and O-ring (11).

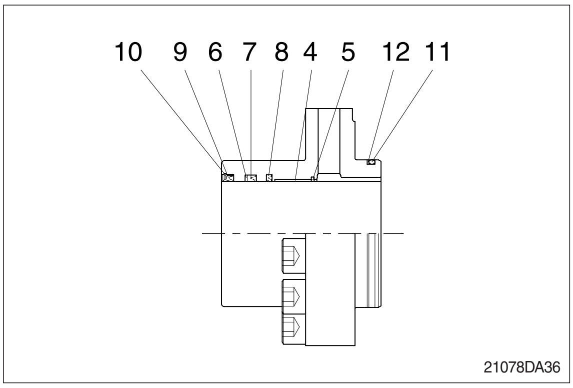
② Remove snap ring (10), dust wiper (9).

③ Remove back up ring (7), rod seal (6) and buffer ring (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

※ Do not remove bushing (4).

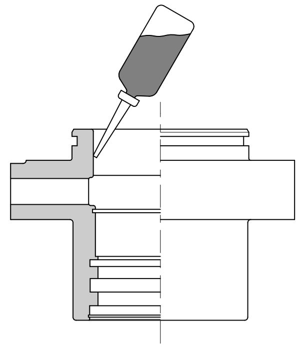


3) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland (3) with hydraulic oil.



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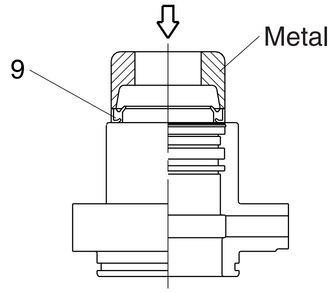
② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

③ Fit snap ring (10) to the stop face.

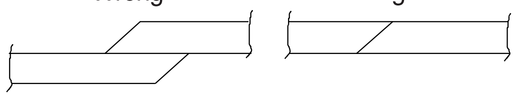


8-157(2)

④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

※ Coat each packing with hydraulic oil before fitting it.

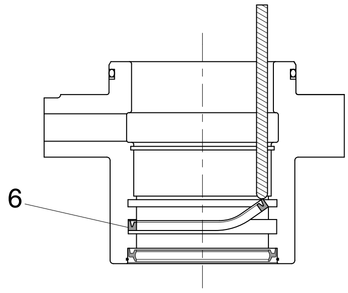
※ Insert the backup ring until one side of it is inserted into groove.



8-157(3)

※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



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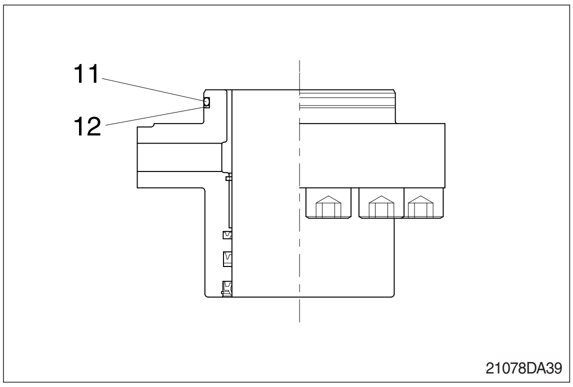
⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

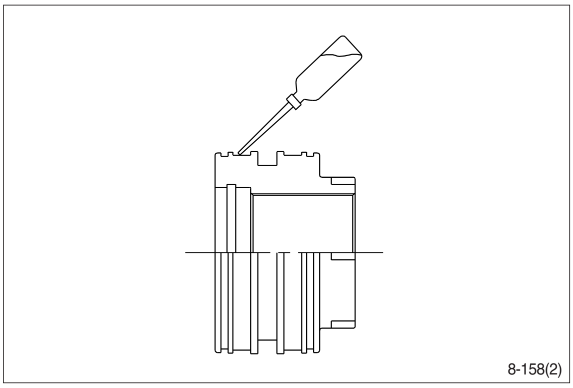
⑥ Fit O-ring (11) to gland (3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

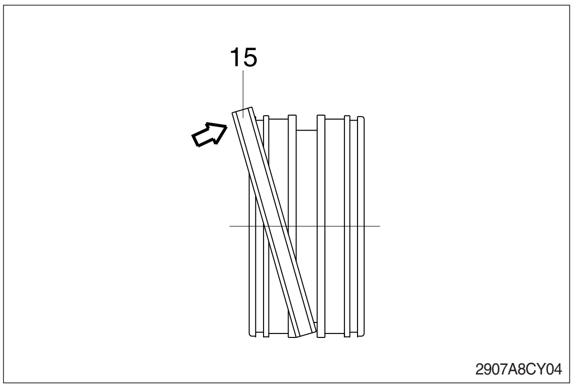
① Coat the outer face of piston (14) with hydraulic oil.



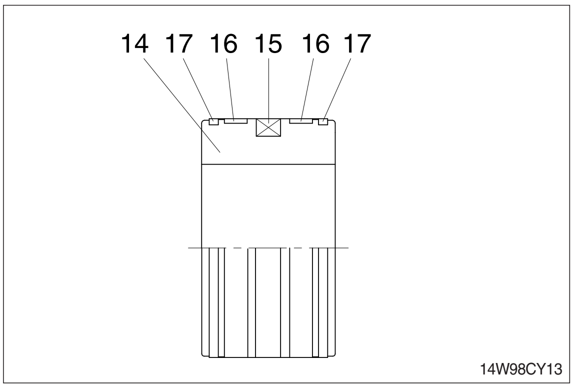
② Fit piston seal (15) to piston.

※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.

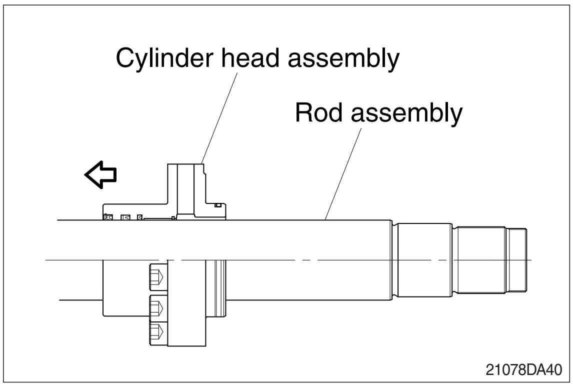


③ Fit wear ring (16) and dust ring (17) to piston (14).

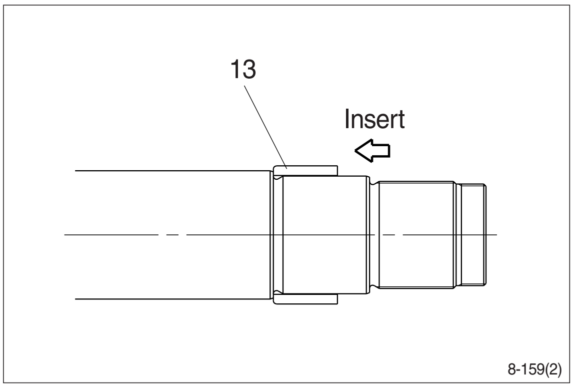


(3) Install piston and cylinder head

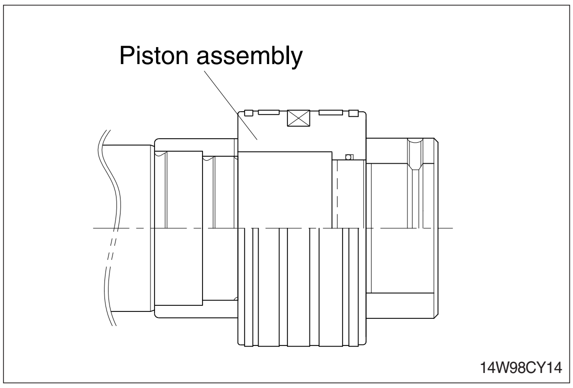
① Fix the rod assembly to the work bench.
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
③ Insert cylinder head assembly to rod assembly.



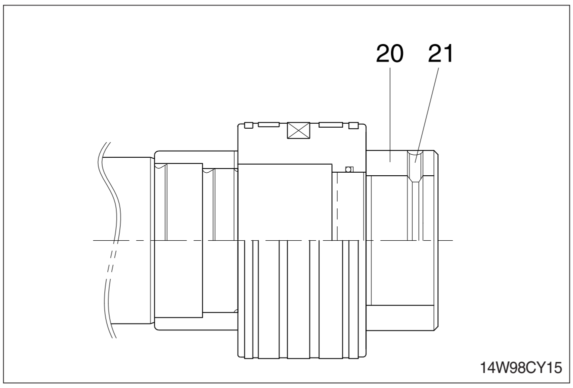
④ Insert cushion ring (13) to rod assembly.
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.
· Tightening torque : 150±15 kgf · m (1085±108 lbf · ft)
※ Refer to page 8-171.



⑥ Fit lock nut (20) and tighten the set screw (21).
· Tightening torque :
Item 20 : 100±10.0 kgf·m (723±72.3 lbf·ft)
Item 21 : 2.7±0.3 kgf·m (19.5±2.2 lbf·ft)
※ Refer to page 8-171.



(3) Overall assemble

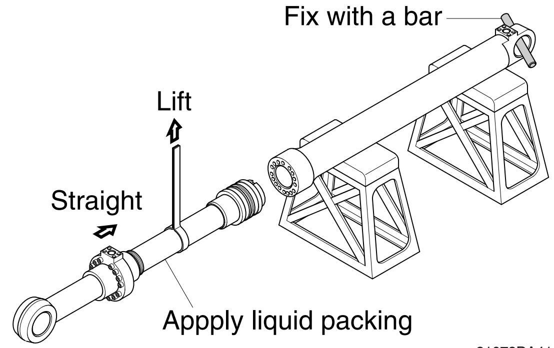
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

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.



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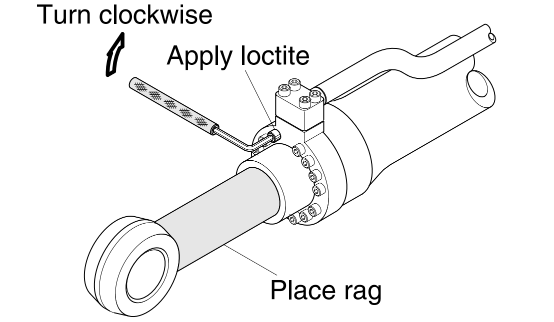


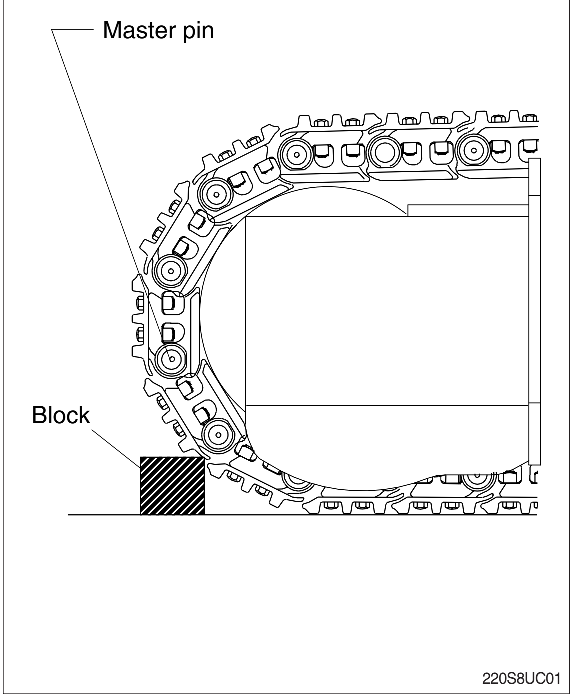
21078DA42

GROUP 10 UNDERCARRIAGE

1. TRACK LINK

1) REMOVAL

(1) Move track link until master pin is over front idler in the position put wooden block as shown.



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(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.

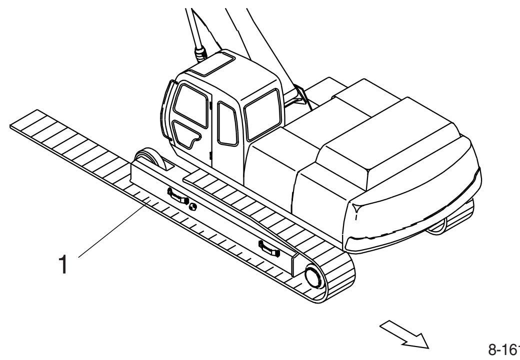
※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

(3) Push out master pin by using a suitable tool.

(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.

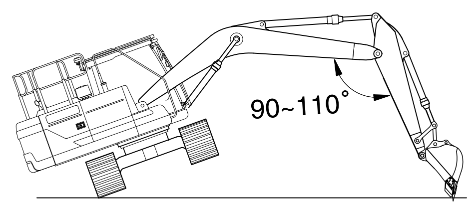


8-161(2)

2) INSTALL

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

※ Adjust the tension of the track link.

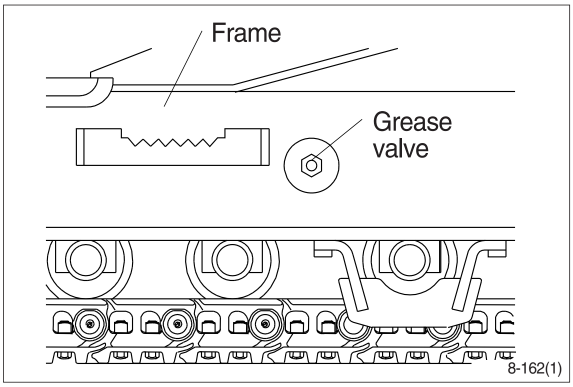


140SA7UC30

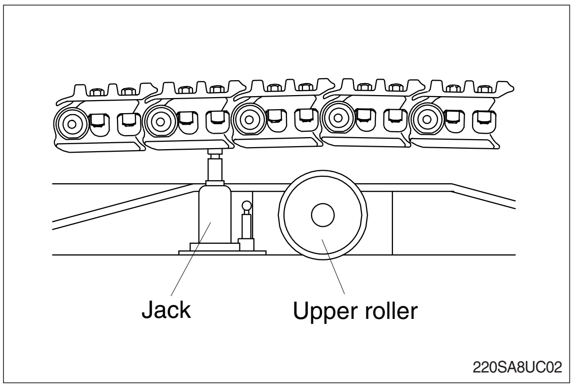
2. UPPER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



(2) Jack up the track link height enough to permit upper roller removal.

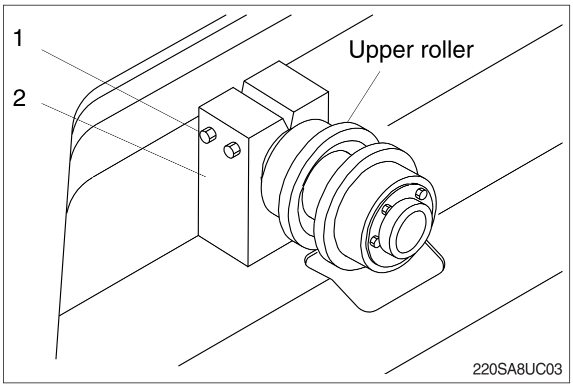


(3) Loosen the lock nut (1).

(4) Open bracket(2) with a screwdriver, push out from inside, and remove upper roller assembly.

· Weight : 19 kg (42 lb)

· Tightening torque : 29.7±3.0 kgf·m
(215±21.7 lbf · ft)



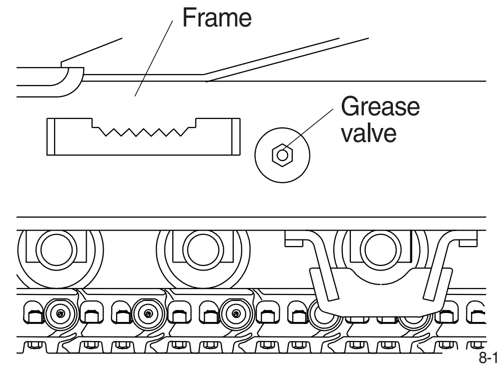
2) INSTALL

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

3. LOWER ROLLER

1) REMOVAL

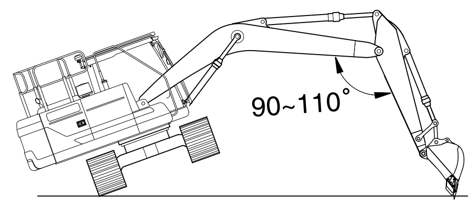
(1) Loosen tension of the track link.



8-163(1)

(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.

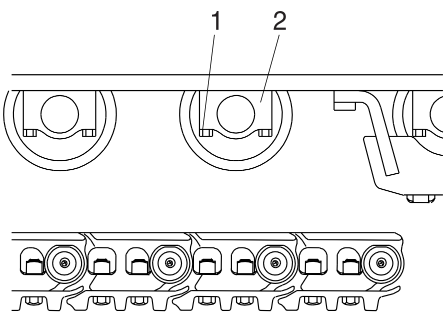


140SA7UC30

(3) Remove the mounting bolt (1) and draw out the lower roller (2).

· Weight : 29 kg (64 lb)

· Tightening torque : 29.7±3.0 kgf·m (215±21.7 lbf · ft)



8-163(3)

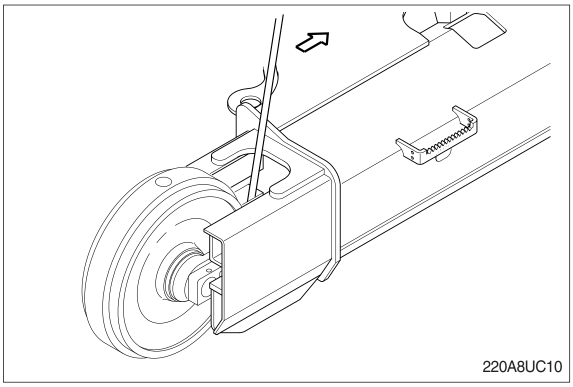
2) INSTALL

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

4. IDLER AND RECOIL SPRING

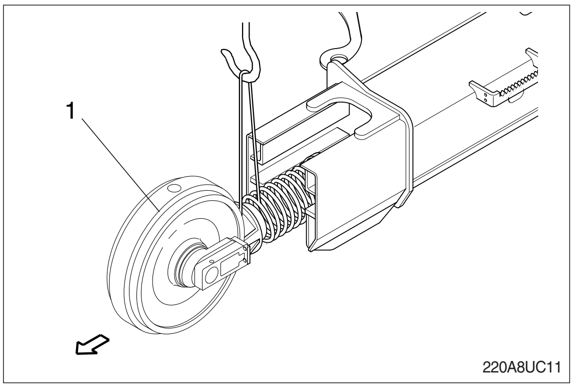
1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.



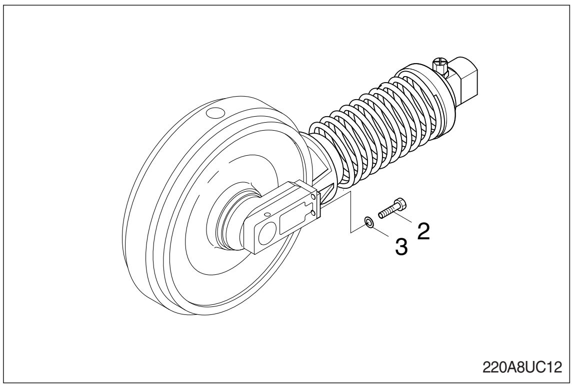
220A8UC10

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 197 kg (434 lb)



220A8UC11

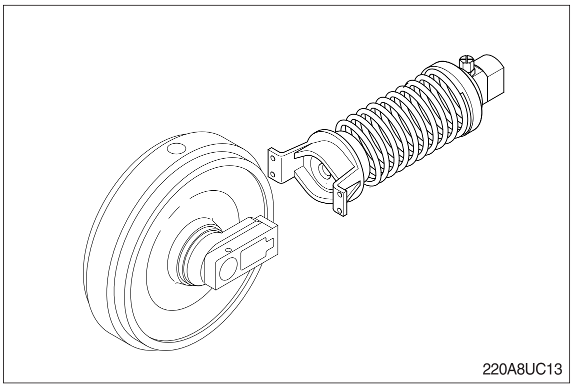
(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.
· Tightening torque : 29.7±3.0 kgf·m
(215±21.7 lbf · ft)



220A8UC12

2) INSTALL

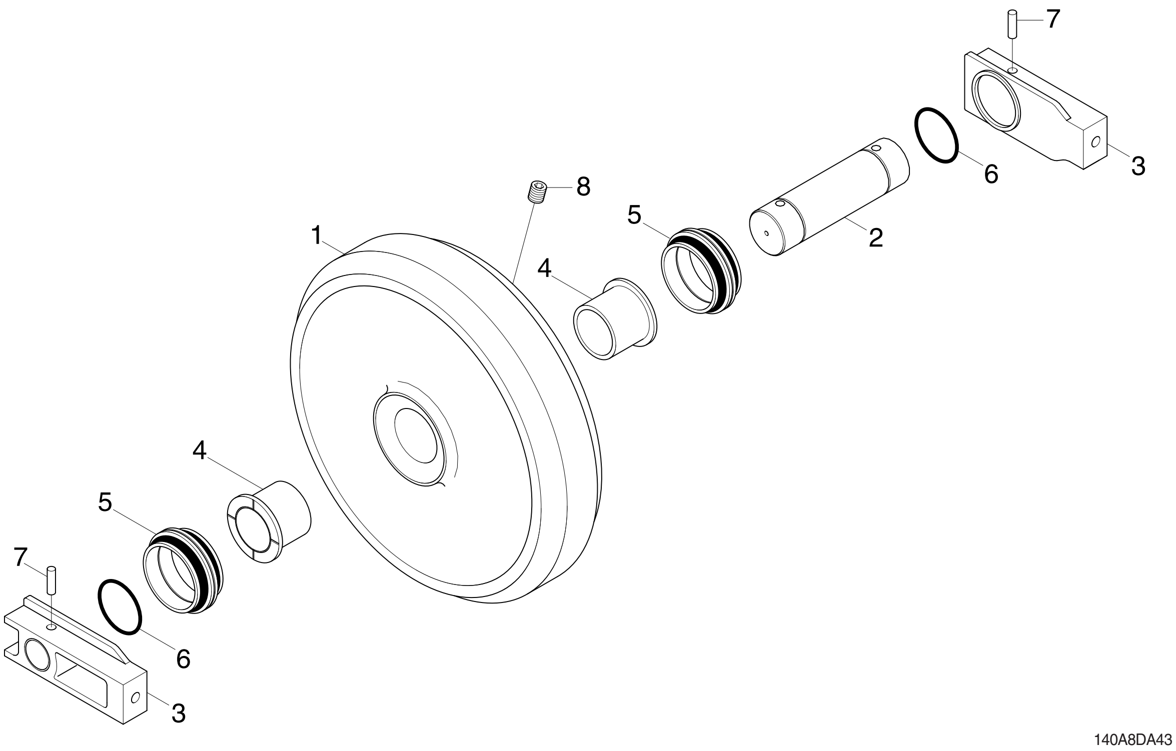
(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



220A8UC13

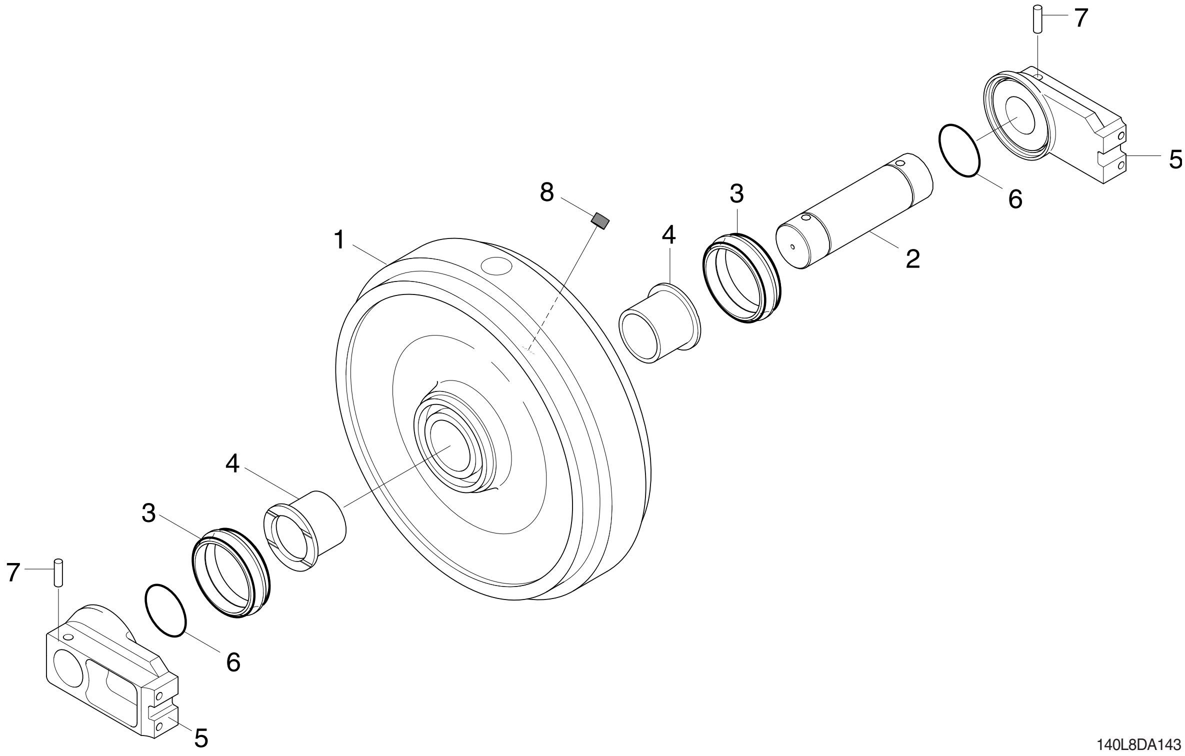
3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure (standard)



1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Seal set	8	Plug
3	Bracket	6	O-ring		

Structure (Option, high walker)



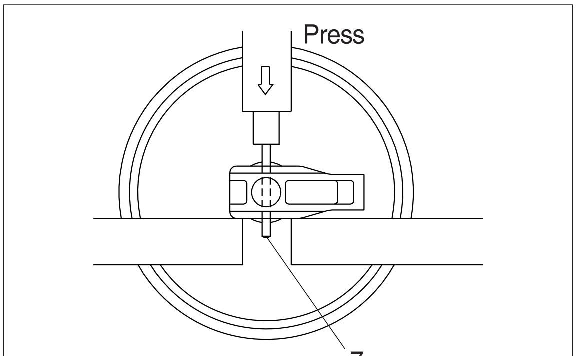
1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Bracket	8	Hex Plug
3	Seal assy	6	O-ring		

(2) Disassembly

※ The illustrations are base on the standa-rd type.

① Remove plug and drain oil.

② Draw out the spring pin (7), using a press.

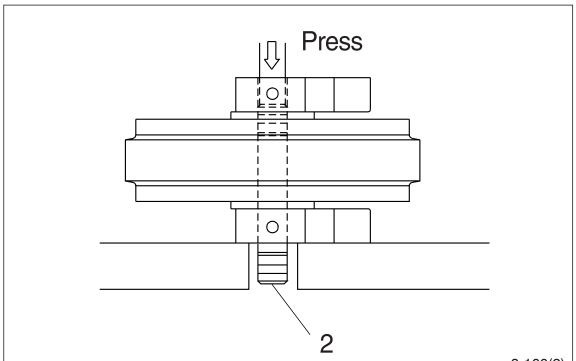


8-166(1)

③ Pull out the shaft (2) with a press.

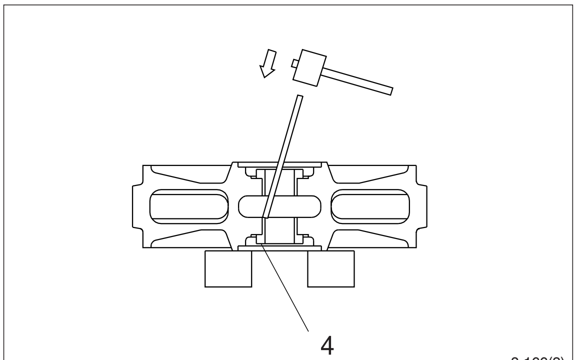
④ Remove seal (5) from idler (1) and bracket (3).

⑤ Remove O-ring (6) from shaft.



8-166(2)

⑥ Remove the bushing (4) from idler, using a special tool.
Only remove bushing if replacement is necessity.



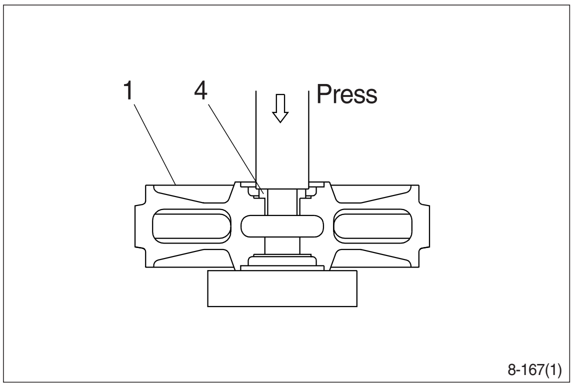
8-166(3)

(3) Assembly

※ Before assembly, clean the parts.

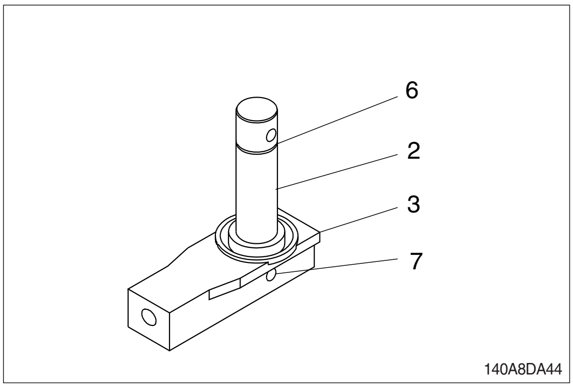
※ Coat the sliding surfaces of all parts with oil.

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.

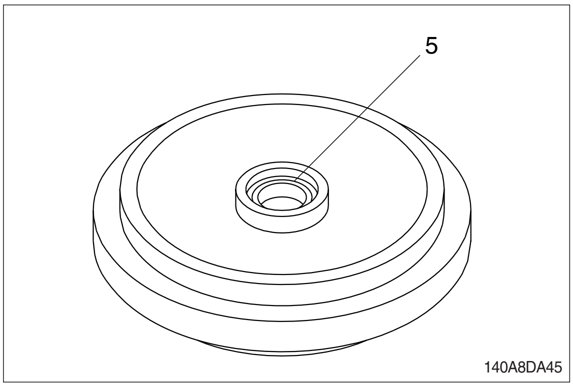


② Coat O-ring (6) with grease thinly, and install it to shaft (2).

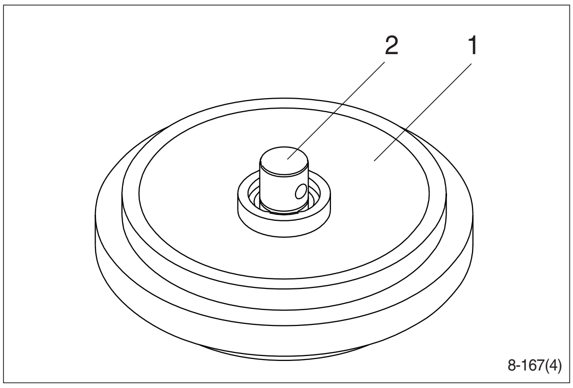
③ Insert shaft (2) into bracket (3) and drive in the spring pin (7).



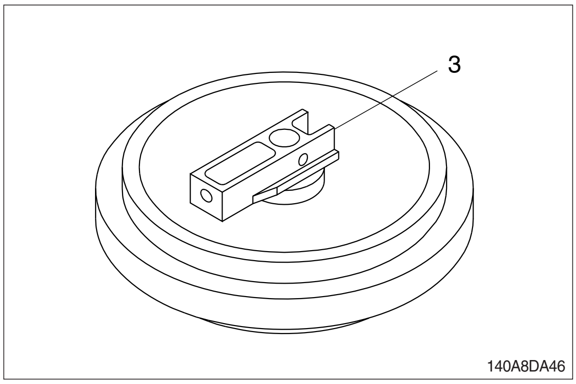
④ Install seal (5) to shell (1) and bracket (3).



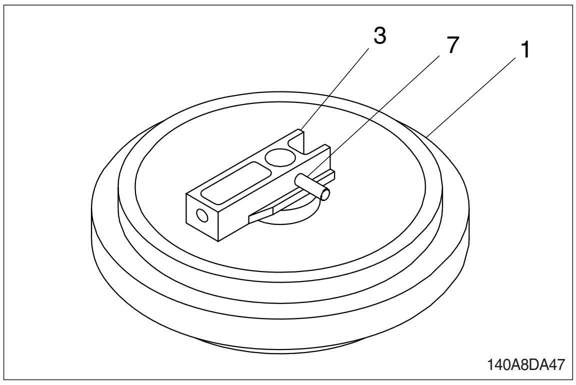
⑤ Install shaft (2) to shell (1).



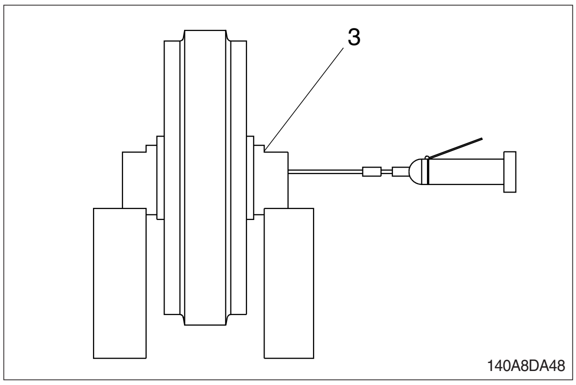
⑥ Install bracket (3) attached with seal (5).



⑦ Knock in the spring pin (7) with a hammer.

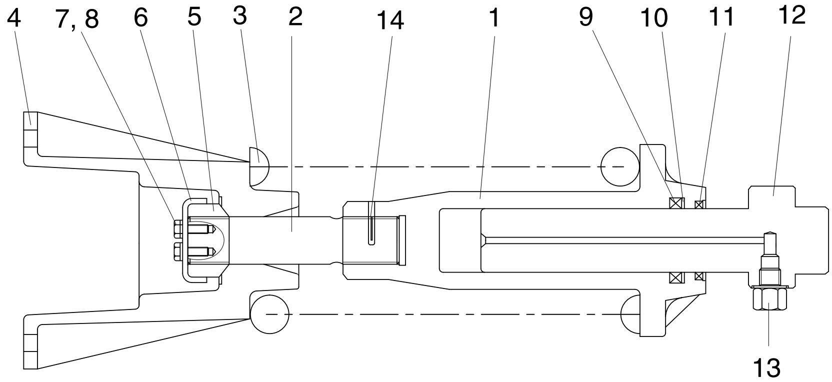


⑧ Lay bracket (3) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

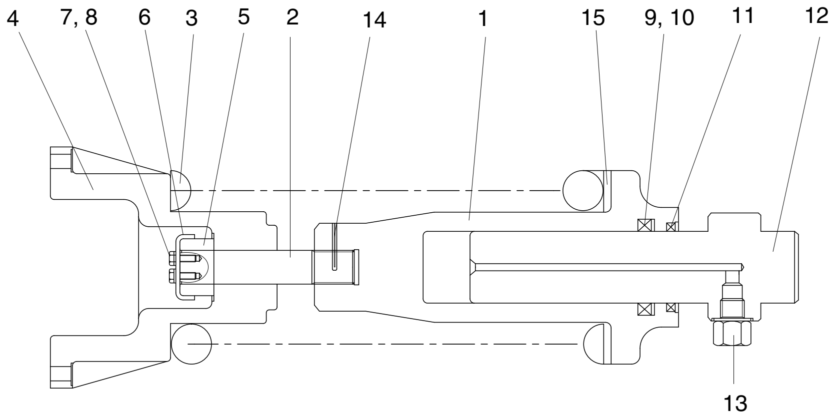
(1) Structure (standard)



140LC8UC30

1	Body	6	Lock plate	11	Dust seal
2	Tie bar	7	Bolt	12	Rod
3	Spring	8	Spring washer	13	Grease valve
4	Bracket	9	Rod packing	14	Spring pin
5	Lock nut	10	Back up ring		

Structure (Option, high walker)



140L8UC130

1	Body	6	Lock plate	11	Dust seal
2	Tie bar	7	Bolt	12	Rod assembly
3	Spring	8	Spring washer	13	Grease valve
4	Bracket	9	Rod seal	14	Spring pin
5	Lock nut	10	Back up ring	15	Spacer

(2) Disassembly

※ The illustrations are base on the standard type.

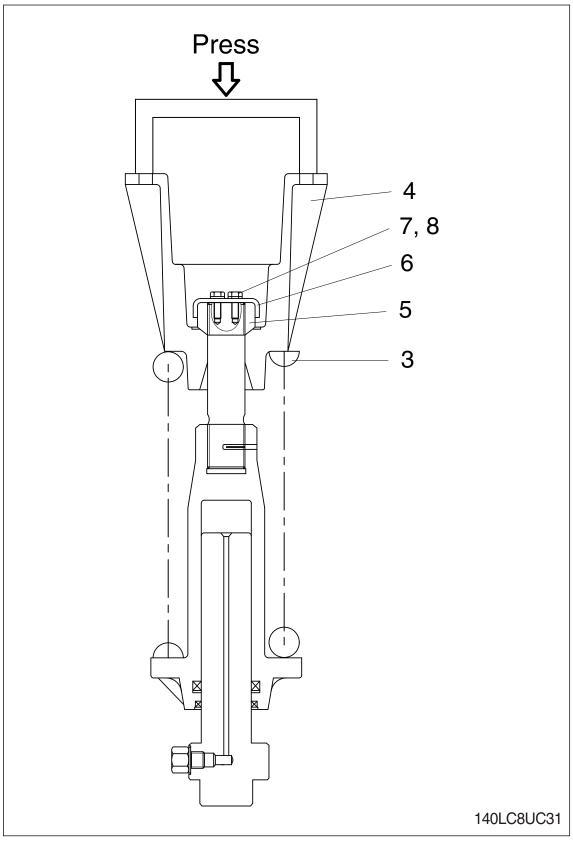
① Apply pressure on spring (3) with a press. The spring is under a large installed load.

※ This is dangerous, so be sure to set properly.

② Remove bolt (7), spring washer (8) and lock plate (6).

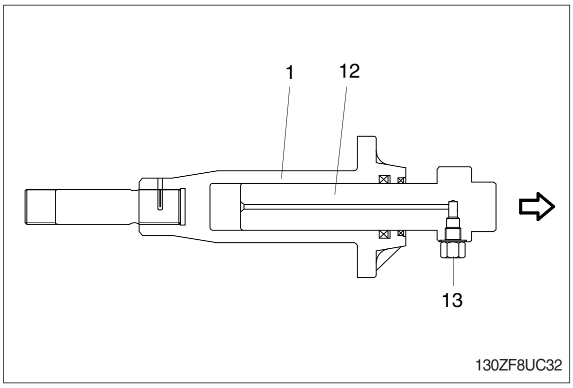
③ Remove lock nut (5).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove bracket (4) and spring (3).

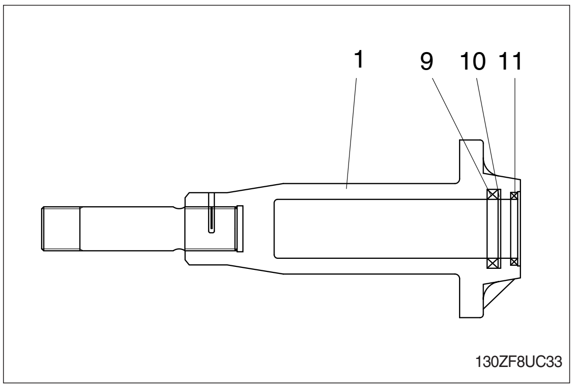


⑤ Remove rod (12) from body (1).

⑥ Remove grease valve (13) from rod (12).



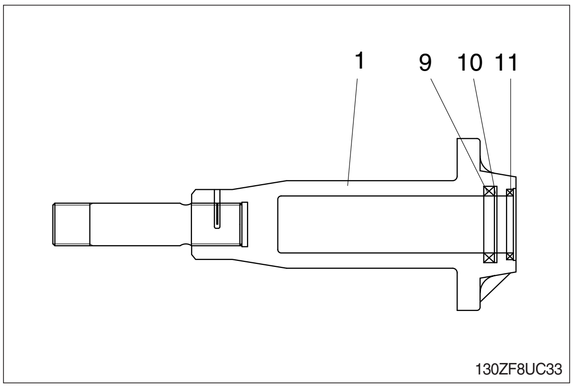
⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



(3) Assembly

① Install dust seal (11), back up ring (10) and rod seal (9) to body (1).

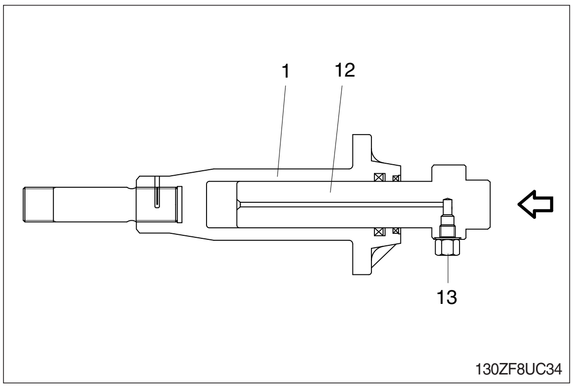
※ When installing dust seal (11) and rod seal (9), take full care so as not to damage the lip.



② Pour grease into body (1), then push in rod (12) by hand.
After take grease out of grease valve mounting hole, let air out.

※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve (13) to rod (12).
· Tightening torque : 13.0±0.5 kgf · m (94.0±3.6 lbf · ft)

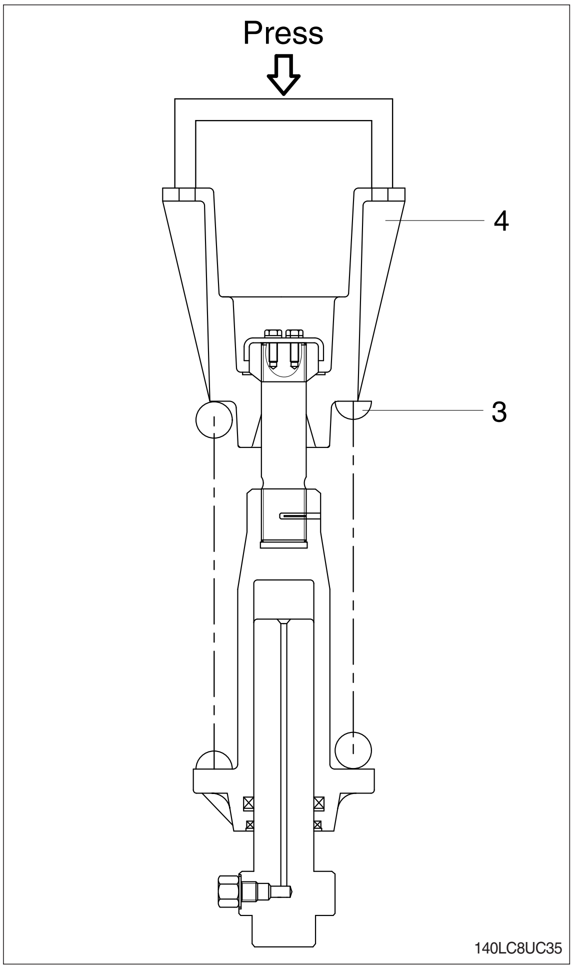


④ Install spring (3) and bracket (4) to body (1).

⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).
· Spring set load
- Standard : 8497 kg (18733 lb)
- High walker : 11908 kg (26253 lb)

※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.



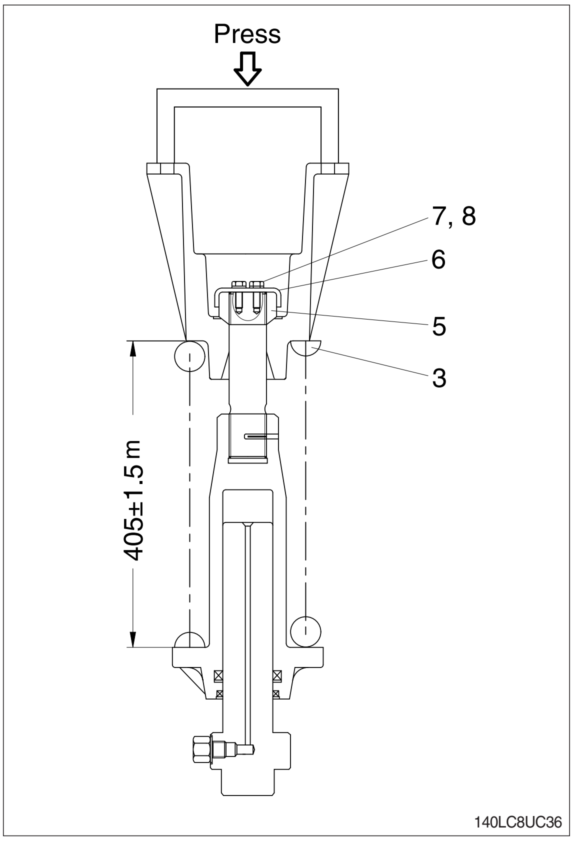
⑥ Lighten the press load and confirm the set length of spring (3).

- Standard : 405±1.5 mm
  (15.9±0.06 in)
- High walker : 420±1.5 mm
  (16.5±0.06 in)

⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).

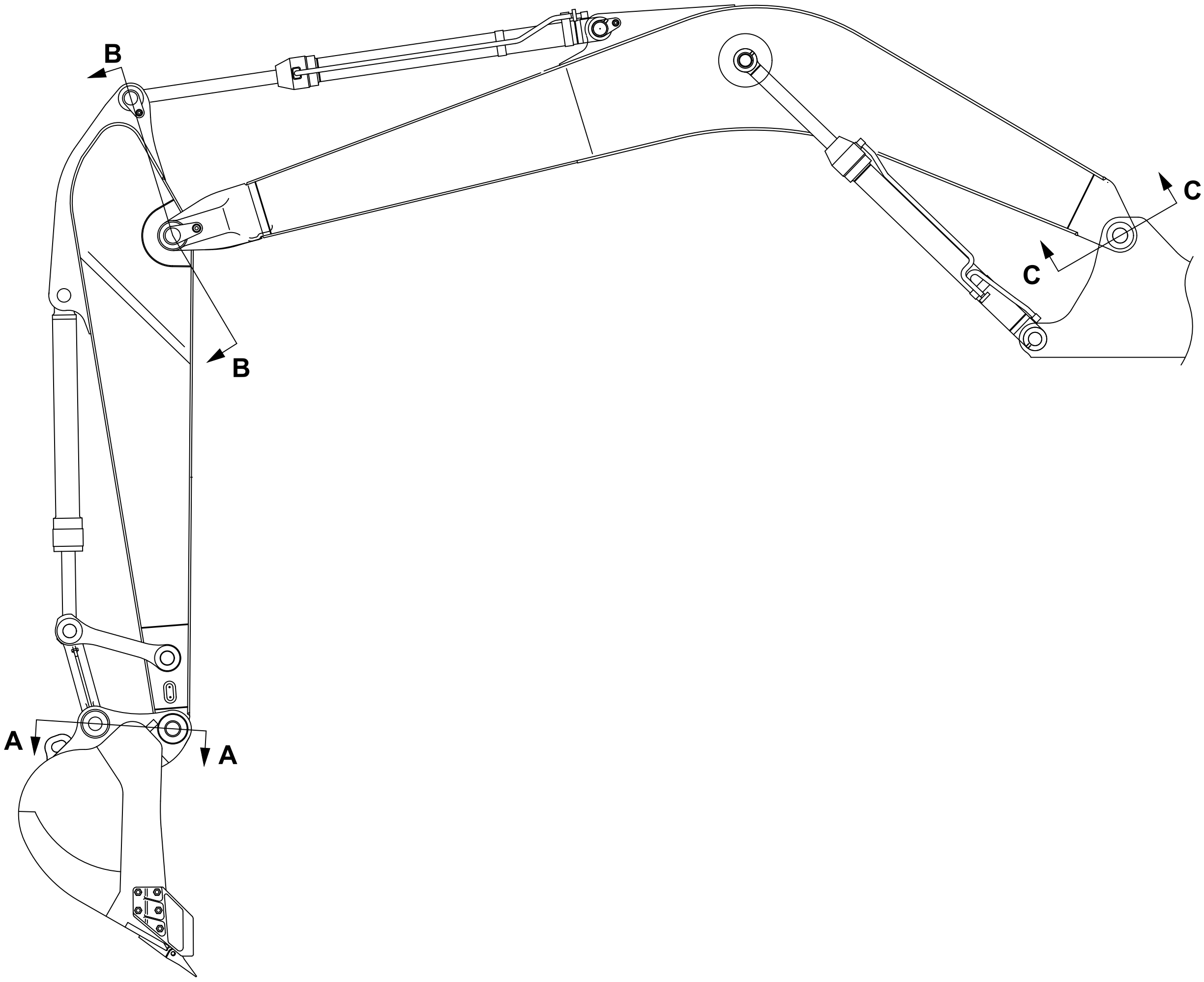
· Tightening torque

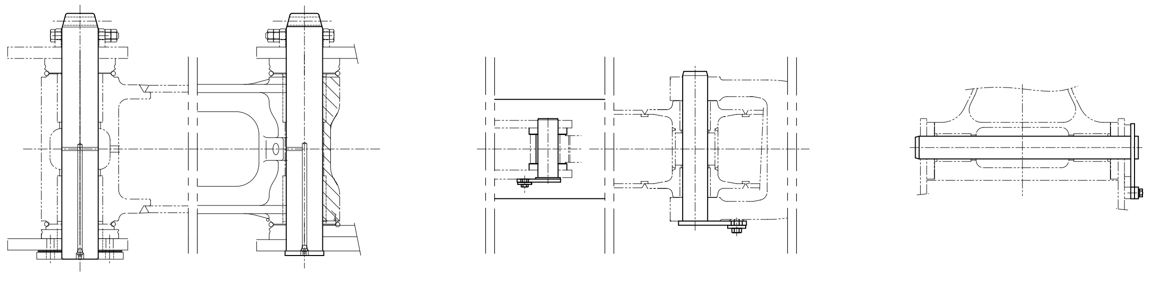
- Standard : 3.4±0.7 kgf·m
  (24.6±5.1 lbf·ft)
- High walker : 15±0.5 kgf·m
  (108±3.6 lbf·ft)



GROUP 11 WORK EQUIPMENT

1. STRUCTURE





SECTION A SECTION B SECTION C

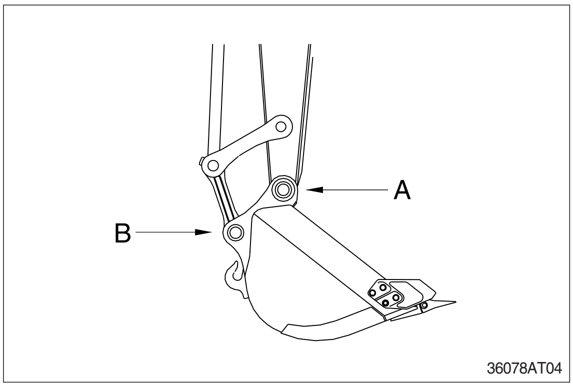
220A8WE10

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

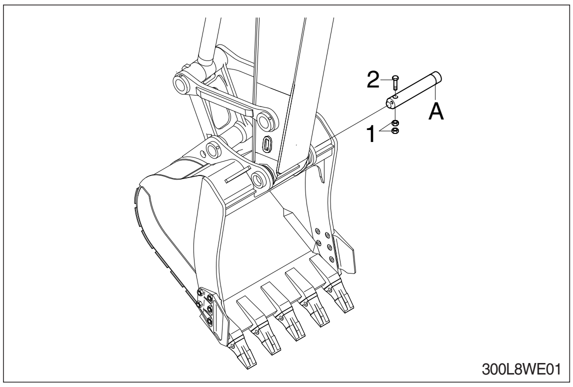
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



② Remove nut (1), bolt (2) and draw out the pin (A).

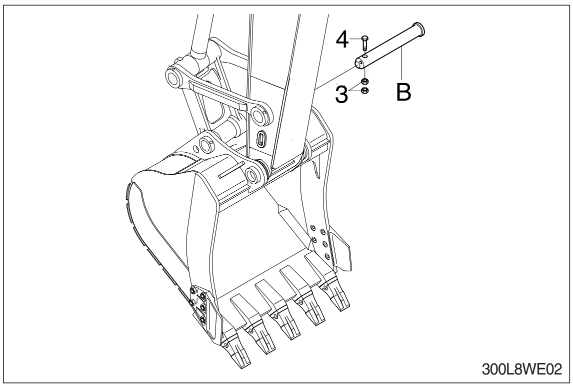
· Tightening torque (1) : 29.7±4.5 kgf·m (215± 32.5 lbf·ft)



③ Remove nut (3), bolt (4) and draw out the pin (B).

· Tightening torque (3) : 29.7±4.5 kgf·m (215± 32.5 lbf·ft)

· Weight : 438 kg (966 lb)

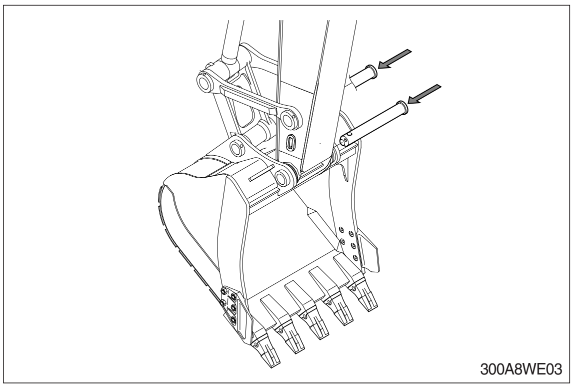


(2) Install

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.



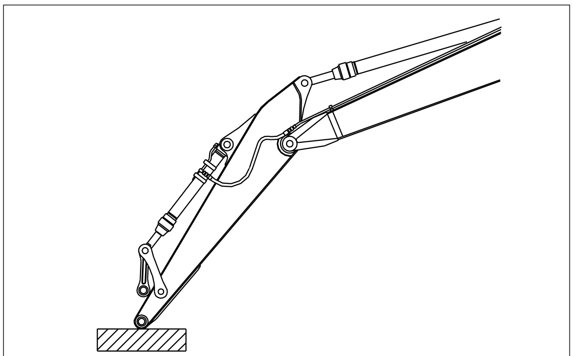
2) ARM ASSEMBLY

(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.**

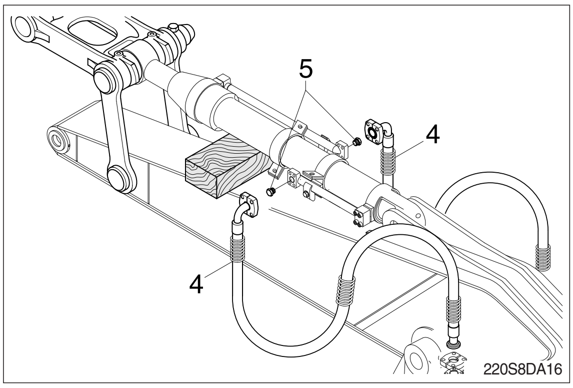
① Remove bucket assembly.
For details, see removal of bucket assembly.



8-175(1)

② Disconnect bucket cylinder hose (1).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**



220S8DA16

③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

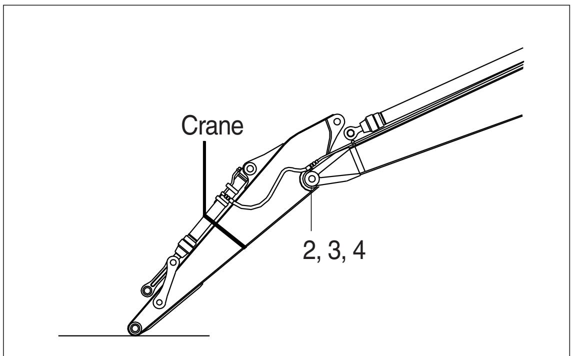
※ Tie the rod with wire to prevent it from coming out.

④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.

- Weight : 681 kg (1500 lb)
- Tightening torque (2) : 12.8±3.0 kgf·m (92.6± 21.7 lbf·ft)

※ When lifting the arm assembly, always lift the center of gravity.



8-175(3)

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

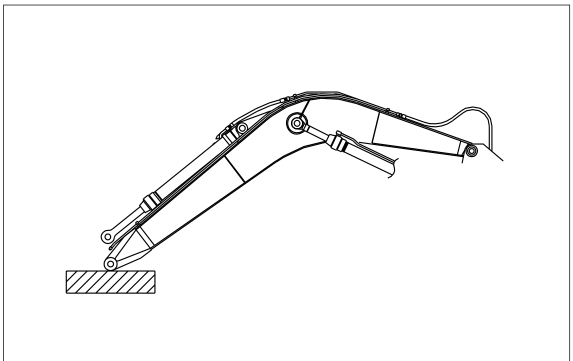
※ Bleed the air from the cylinder.

3) BOOM ASSEMBLY

(1) Removal

① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.

② Remove boom cylinder assembly from boom.
For details, see removal of boom cylinder assembly.



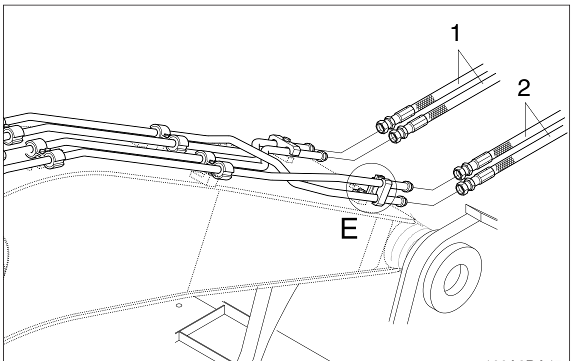
8-176(1)

③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



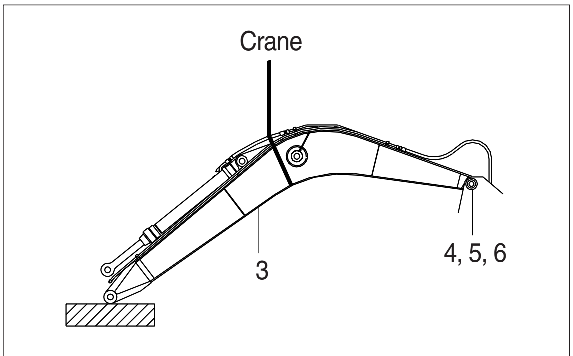
160A8DA45

⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.

· Weight : 992 ㎏ (2190 ℓb)

· Tightening torque (4) : 12.8±3.0 kgf·m (92.6± 21.7 lbf·ft)

※ When lifting the boom assembly always lift the center of gravity.



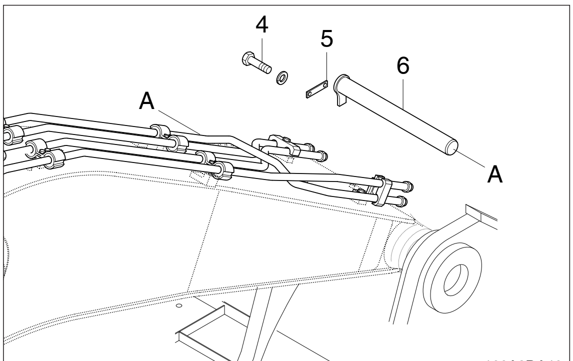
8-176(3)

(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.



160A8DA46