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1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.
This service manual mainly contains the necessary technical information for operations performed in a service workshop.
For ease of understanding, the manual is divided into the following sections.

SECTION 1 GENERAL
This section explains the safety hints and gives the specification of the machine and major components.

SECTION 2 STRUCTURE AND FUNCTION
This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

SECTION 3 HYDRAULIC SYSTEM
This section explains the hydraulic circuit, single and combined operation.

SECTION 4 ELECTRICAL SYSTEM
This section explains the electrical circuit, monitoring system and each component. It serves not only to give an understanding electrical system, but also serves as reference material for trouble shooting.

SECTION 5 MECHATRONICS SYSTEM
This section explains the computer aided power optimization system and each component.

SECTION 6 TROUBLESHOOTING
This section explains the troubleshooting charts correlating problems to causes.

SECTION 7 MAINTENANCE STANDARD
This section gives the judgement standards when inspecting disassembled parts.

SECTION 8 DISASSEMBLY AND ASSEMBLY
This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

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
   Item number(2. Structure and Function)
   Consecutive page number for each item.
3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.
   2 - 4
   2 - 4 - 1
   2 - 4 - 2 Added pages
   2 - 5

Revised edition mark(①②③···)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

   Convert 55mm into inches.

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

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

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

2. Convert 550mm into inches.

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

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

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

Millimeters to inches

ⓑ

1mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

Kilogram to Pound

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 ℓ = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 ℓ = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

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

kgf/cm² to lbf/in²

1kgf / cm² = 14.2233lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

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

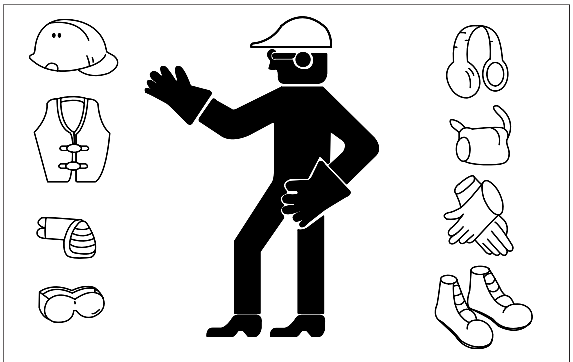
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

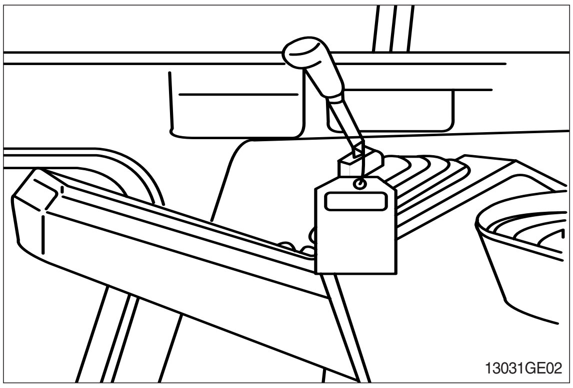
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

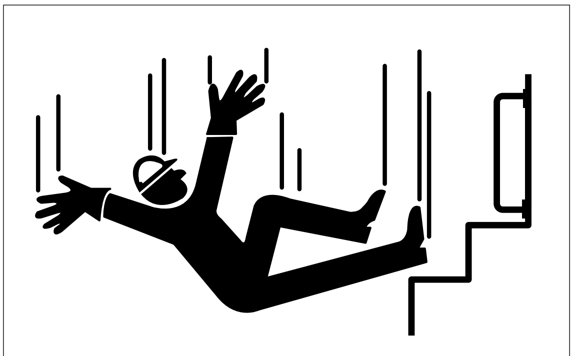
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「**Do Not Operate**」 tag on the right side control lever.



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.



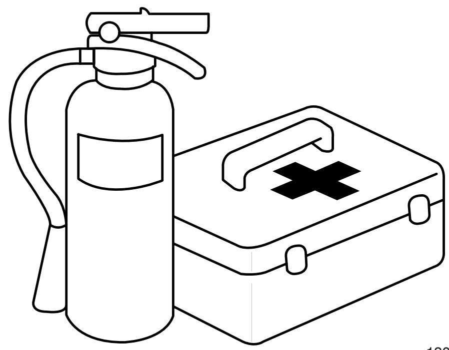
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

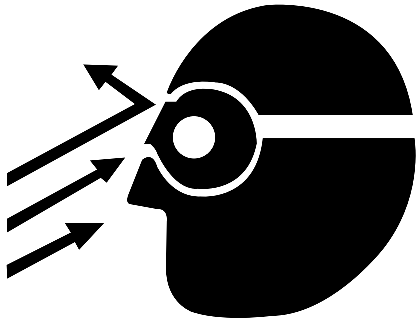
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



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.

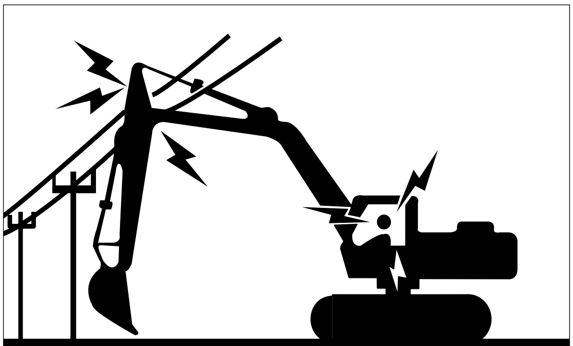
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

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.

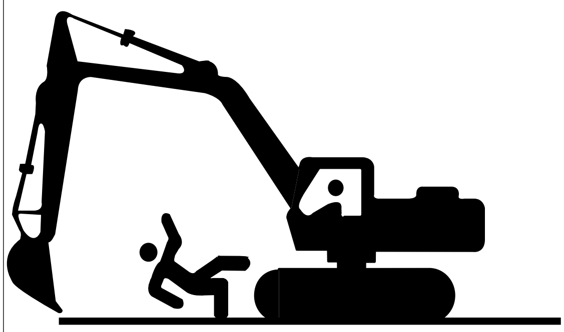


13031GE07

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.



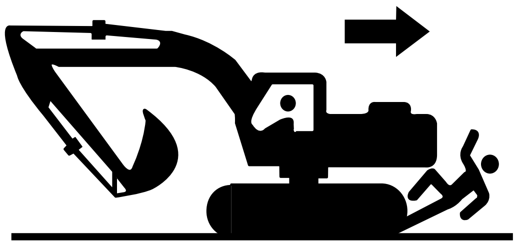
13031GE08

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.

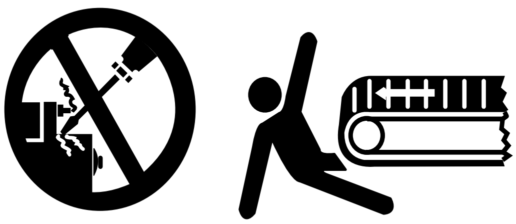


13031GE09

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

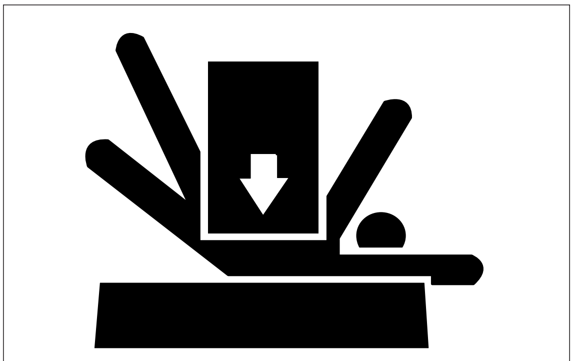
Before working on the machine:

- 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

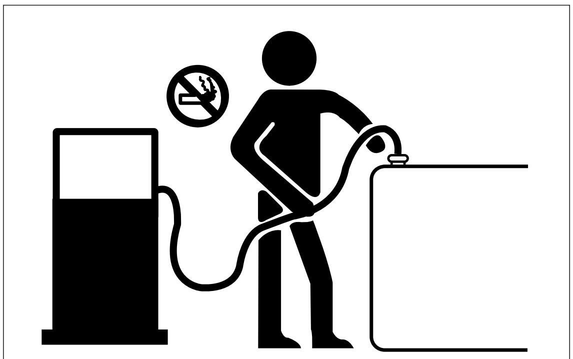
Explosive release of fluids from pressurized cooling system can cause serious burns.

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.

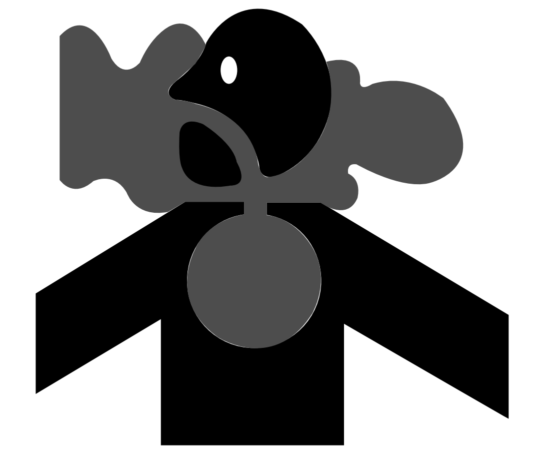
Do not store oily rags; They can ignite and burn spontaneously.

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

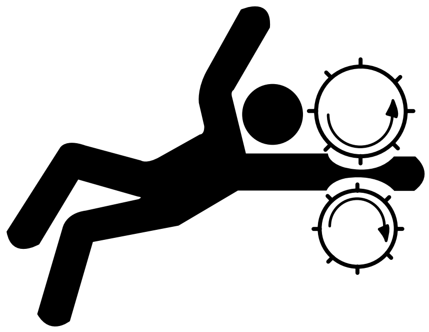
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

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.

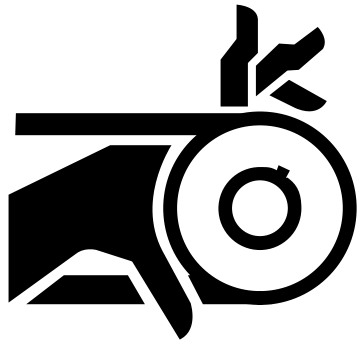


13031GE16

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

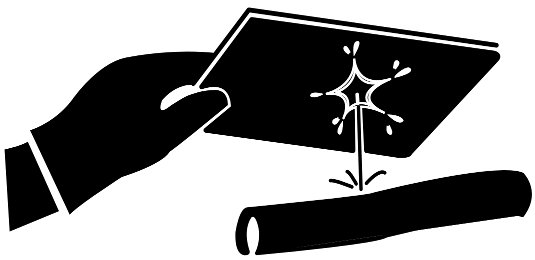
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

13031GE20

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

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

PREVENT BATTERY EXPLOSIONS

13031GE21

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 ℉).

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:

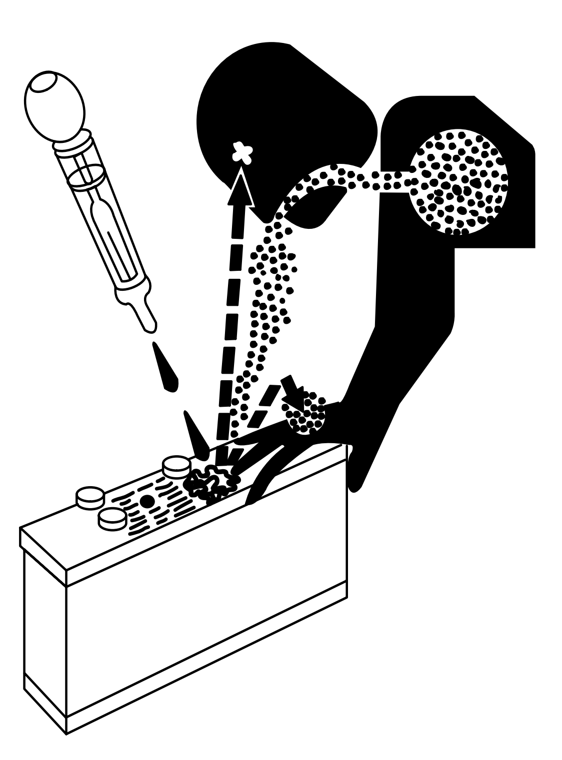
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

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

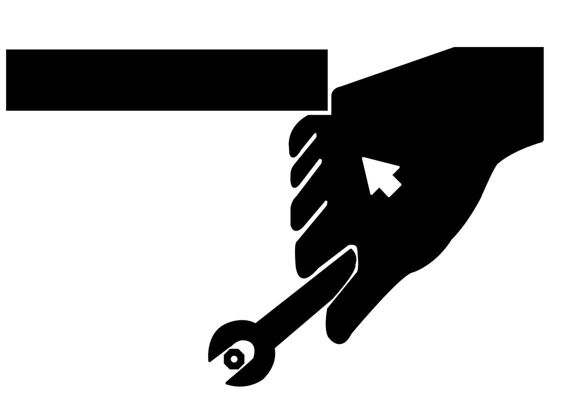
USE TOOLS PROPERLY

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.)



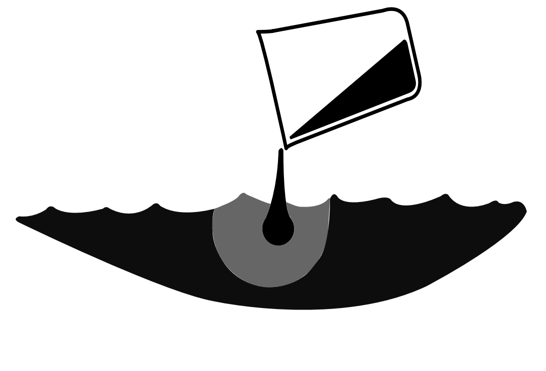
13031GE23

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.

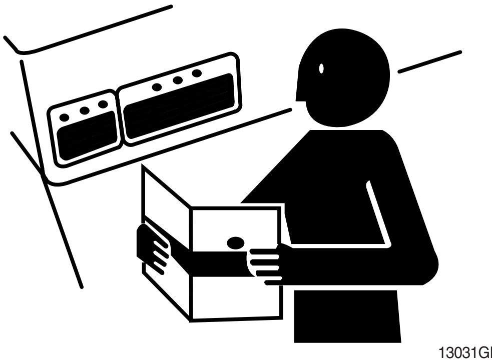
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY LABELS

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



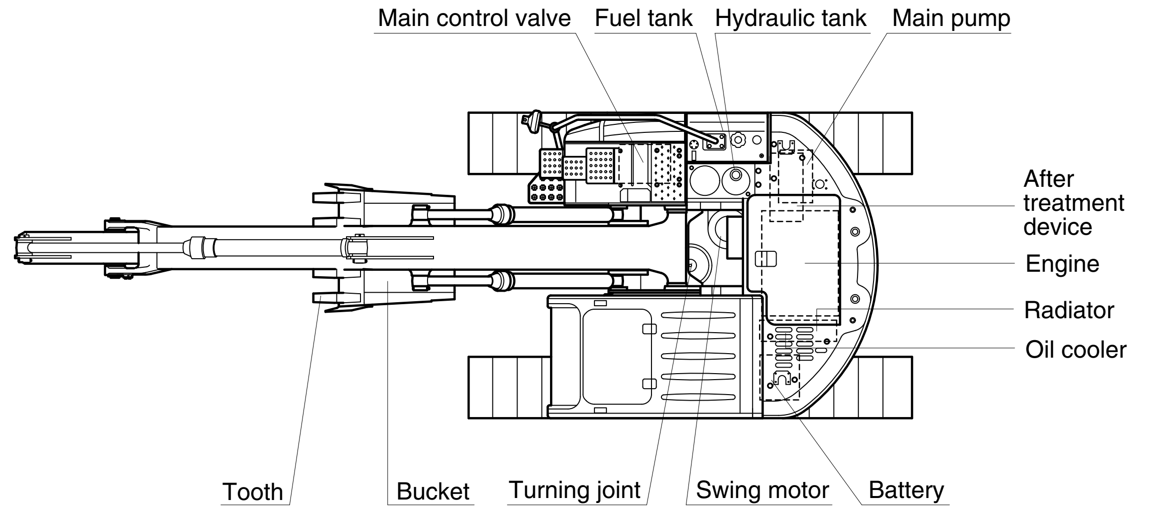
13031GE25

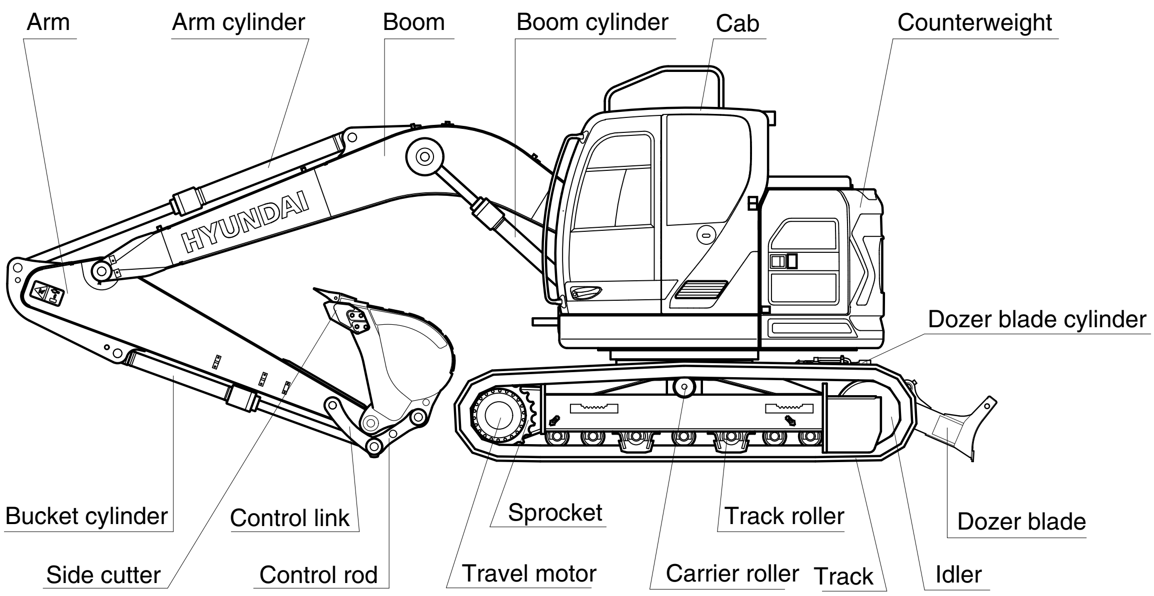
LIVE WITH SAFETY

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



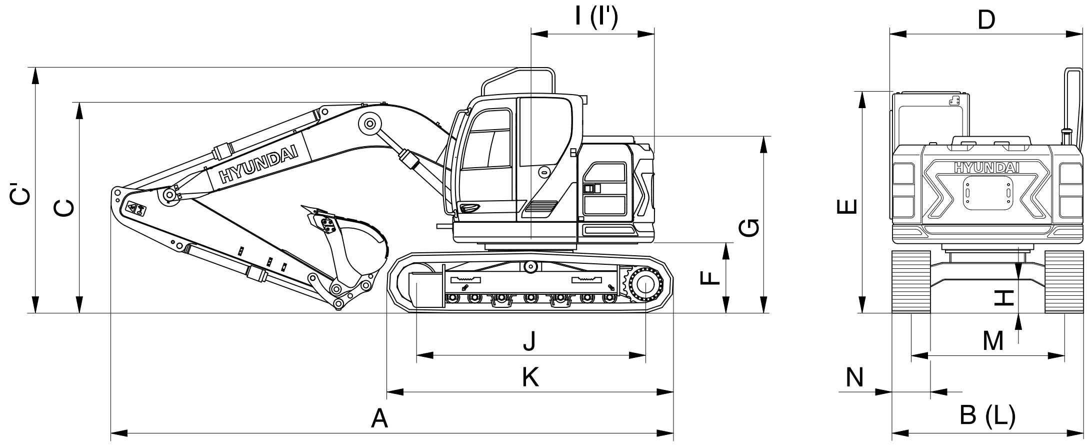


130ZF2SP01

2. SPECIFICATIONS

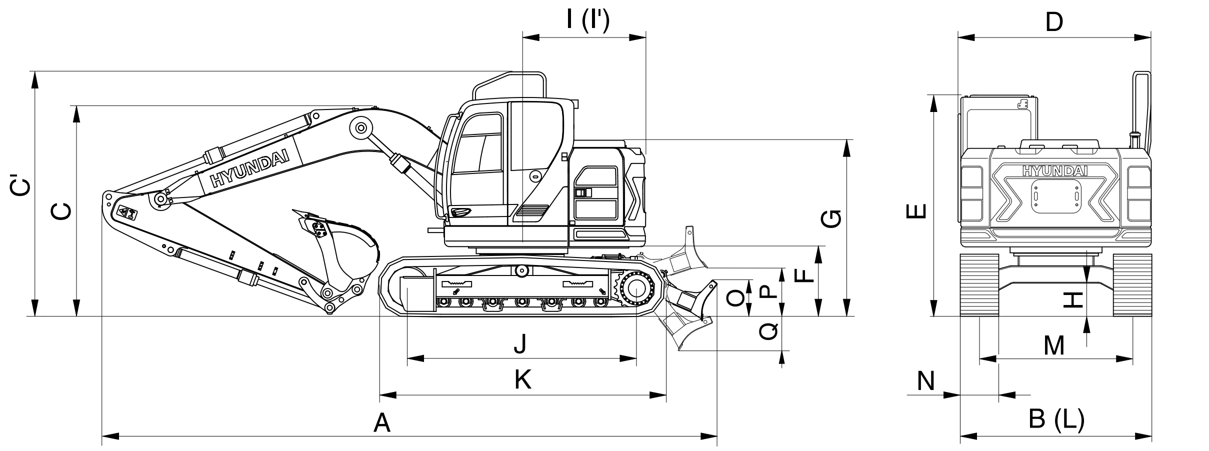
1) HX130LCR

· 4.30 m (14' 1") BOOM and 2.26 m (7' 5") ARM



Description		Unit	Specification
Operating weight		kg (lb)	12700 (28000)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.40 (0.52)
Overall length	A	mm (ft-in)	6860 (22' 6")
Overall width, with 500 mm shoe	B		2490 (8' 2")
Overall height of boom	C		2750 (9' 0")
Overall height of guardrail	C'		3165 (10' 5")
Superstructure width	D		2500 (8' 2")
Overall height of cab	E		2900 (9' 6")
Ground clearance of counterweight	F		900 (2' 11")
Engine cover height	G		2215 (7' 3")
Minimum ground clearance	H		440 (1' 5")
Rear-end distance	I		1500 (4' 11")
Rear-end swing radius	I'		1500 (4' 11")
Distance between tumblers	J		2780 (9' 1")
Undercarriage length	K		3490 (11' 5")
Undercarriage width	L		2500 (8' 2")
Track gauge	M		1990 (6' 6")
Track shoe width, standard	N		500 (20")
Travel speed (low/high)		km/hr (mph)	3.3/5.5 (2.1/3.4)
Swing speed		rpm	12.6
Gradeability		Degree (%)	35 (70)
Ground pressure (500 mm shoe)		kgf/cm^2(psi)	0.42 (5.95)
Max traction force		kg (lb)	11400 (25100)

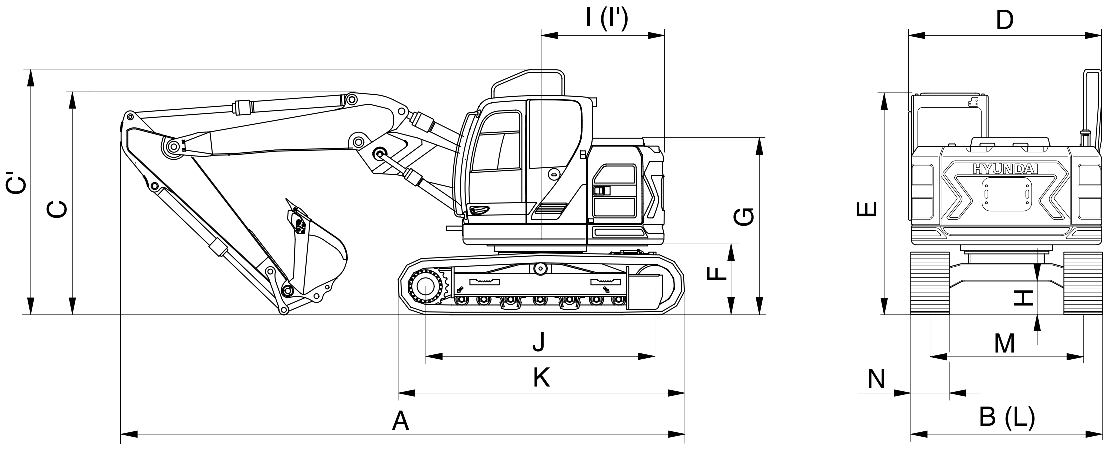
2) HX130LCRD



Description		Unit	Specification
Operating weight		kg (lb)	13400 (29500)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.40 (0.52)
Overall length	A	mm (ft-in)	7600 (24' 11")
Overall width, with 500 mm shoe	B		2490 (8' 2")
Overall height	C		2750 (9' 0")
Overall height of guardrail	C'		3165 (10' 5")
Superstructure width	D		2500 (8' 2")
Overall height of cab	E		2900 (9' 6")
Ground clearance of counterweight	F		900 (2' 11")
Engine cover height	G		2215 (7' 3")
Minimum ground clearance	H		440 (1' 5")
Rear-end distance	I		1500 (4' 11")
Rear-end swing radius	I'		1500 (4' 11")
Distance between tumblers	J		2780 (9' 1")
Undercarriage length	K		3490 (11' 5")
Undercarriage width	L		2500 (8' 2")
Track gauge	M		1990 (6' 6")
Track shoe width, standard	N		500 (20")
Height of blade	O		580 (1' 11")
Ground clearance of blade up	P		545 (1' 9")
Depth of blade down	Q		515 (1' 8")
Travel speed (low/high)		km/hr (mph)	3.3/5.5 (2.1/3.4)
Swing speed		rpm	12.6
Gradeability		Degree (%)	35 (70)
Ground pressure (500 mm shoe)		kgf/cm^2(psi)	0.44 (6.26)
Max traction force		kg (lb)	11400 (25100)

3) HX130LCR 2-PIECE BOOM

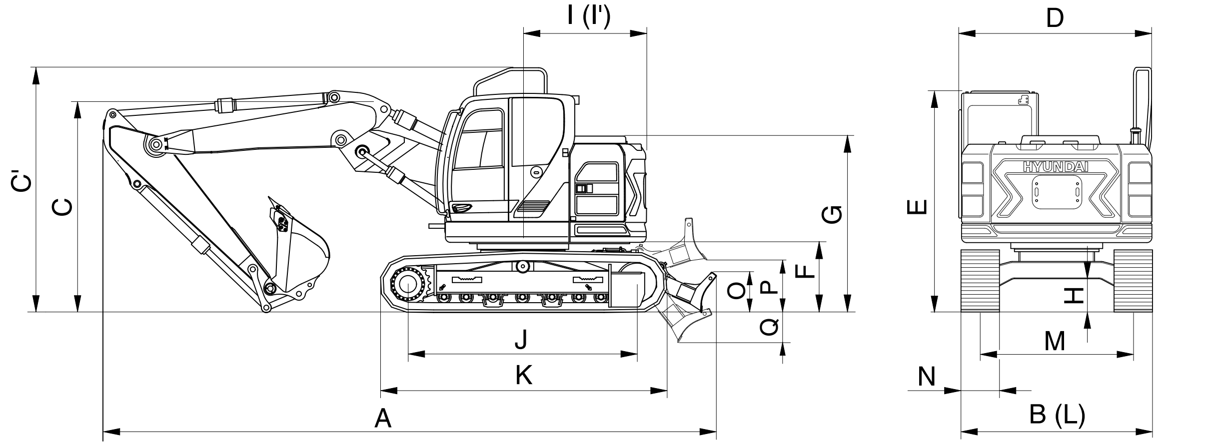
(1) Without dozer



130ZF2SP06

Description		Unit	Specification	
			1.96 m (6' 5") Arm	2.26 m (7' 5") Arm
Operating weight		kg (lb)	13060 (28790)	13090 (28860)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.40 (0.52)	←
Overall length	A	mm (ft-in)	7100 (23' 3")	7090 (23' 2")
Overall width, with 500 mm shoe	B		2490 (8' 2")	←
Overall height	C		2455 (5' 0")	2615 (8' 7")
Overall height of guardrail	C'		3165 (10' 5")	←
Superstructure width	D		2500 (8' 2")	←
Overall height of cab	E		2900 (9' 6")	←
Ground clearance of counterweight	F		900 (2' 11")	←
Engine cover height	G		2215 (7' 3")	←
Minimum ground clearance	H		440 (1' 5")	←
Rear-end distance	I		1500 (4' 11")	←
Rear-end swing radius	I'		1500 (4' 11")	←
Distance between tumblers	J		2610 (8' 6")	←
Undercarriage length	K		3300 (10' 8")	←
Undercarriage width	L		2500 (8' 2")	←
Track gauge	M		1990 (6' 6")	←
Track shoe width, standard	N		500 (20")	←
Travel speed (low/high)		km/hr (mph)	3.3/5.5 (2.1/3.4)	←
Swing speed		rpm	12.6	←
Gradeability		Degree (%)	35 (70)	←
Ground pressure (500 mm shoe)		kgf/cm^2(psi)	0.46 (6.52)	0.46 (6.54)
Max traction force		kg (lb)	11400 (25100)	←

(2) With dozer

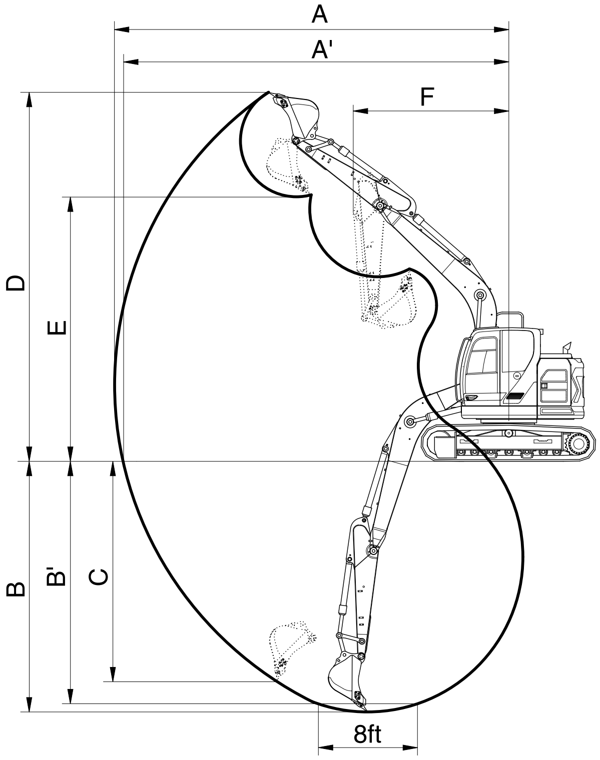


130ZF2SP07

Description		Unit	Specification	
			1.96 m (6' 5") Arm	2.26 m (7' 5") Arm
Operating weight		kg (lb)	13220 (29150)	13250 (29110)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.40 (0.52)	←
Overall length	A	mm (ft-in)	7840 (25' 9")	7830 (25' 8")
Overall width, with 500 mm shoe	B		2490 (8' 2")	←
Overall height	C		2455 (8' 1")	2615 (8' 7")
Overall height of guardrail	C'		3165 (10' 5")	←
Superstructure width	D		2500 (8' 2")	←
Overall height of cab	E		2900 (9' 6")	←
Ground clearance of counterweight	F		900 (2' 11")	←
Engine cover height	G		2215 (7' 3")	←
Minimum ground clearance	H		440 (1' 5")	←
Rear-end distance	I		1500 (4' 11")	←
Rear-end swing radius	I'		1500 (4' 11")	←
Distance between tumblers	J		2780 (9' 1")	←
Undercarriage length	K		3490 (11' 5")	←
Undercarriage width	L		2500 (8' 2")	←
Track gauge	M		1990 (6' 6")	←
Track shoe width, standard	N		500 (20")	←
Height of blade	O		580 (1' 11")	←
Ground clearance of blade up	P		545 (1' 9")	←
Depth of blade down	Q		515 (1' 8")	←
Travel speed (low/high)		km/hr (mph)	3.3/5.5 (2.1/3.4)	←
Swing speed		rpm	12.6	←
Gradeability		Degree (%)	35 (70)	←
Ground pressure (500 mm shoe)		kgf/cm^2(psi)	0.44 (6.27)	0.44 (6.28)
Max traction force		kg (lb)	11400 (25100)	←

3. WORKING RANGE

1) 4.30 m (14' 1") MONO BOOM

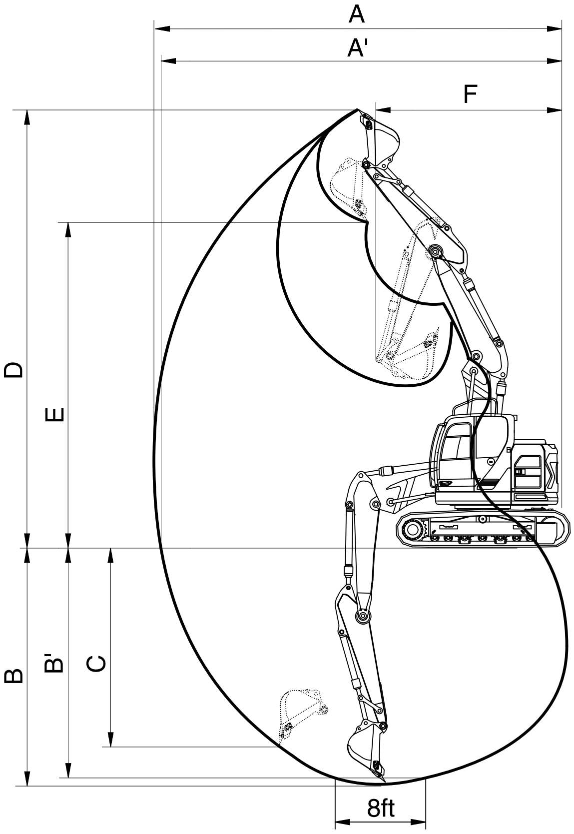


130ZF2SP04

Description		1.96 m (6' 5") Arm	※2.26 m (7' 5") Arm	2.81 (9' 3") Arm
Max digging reach	A	7410 mm (24' 4")	7690 mm (25' 3")	8220 mm (27' 0")
Max digging reach on ground	A'	7250 mm (23' 9")	7540 mm (24' 9")	8080 mm (26' 6")
Max digging depth	B	4720 mm (15' 6")	5020 mm (16' 6")	5570 mm (18' 3")
Max digging depth (8ft level)	B'	4460 mm (14' 8")	4790 mm (15' 9")	5380 mm (17' 8")
Max vertical wall digging depth	C	3960 mm (13' 0")	4290 mm (14' 1")	4830 mm (15' 10")
Max digging height	D	7920 mm (26' 0")	8110 mm (26' 7")	8480 mm (27' 10")
Max dumping height	E	5620 mm (18' 5")	5800 mm (19' 0")	6170 mm (20' 3")
Min swing radius	F	2310 mm (7' 6")	2340 mm (7' 8")	2470 mm (8' 1")
Bucket digging force	SAE	87.8 [95.8] kN	87.8 [95.8] kN	87.8 [95.8] kN
		8954 [9768] kgf	8954 [9768] kgf	8954 [9768] kgf
		19740 [21534] lbf	19740 [21534] lbf	19740 [21534] lbf
	ISO	101.7 [111.0] kN	101.7 [111.0] kN	101.7 [111.0] kN
		10369 [11312] kgf	10369 [11312] kgf	10369 [11312] kgf
		22860 [24938] lbf	22860 [24938] lbf	22860 [24938] lbf
Arm crowd force	SAE	60.6 [66.1] kN	56.1 [61.2] kN	48.3 [52.7] kN
		6178 [6739] kgf	5716 [6236] kgf	4928 [5376] kgf
		13619 [14857] lbf	12602 [13747] lbf	10865 [11852] lbf
	ISO	63.2 [68.9] kN	58.3 [63.6] kN	50.0 [54.5] kN
		6443 [7029] kgf	5943 [6484] kgf	5093 [5556] kgf
		14204 [15495] lbf	13103 [14294] lbf	12228 [12249] lbf

※ : STD　　　[ ] : Power boost

2) 4.556 m (14' 11") 2-PIECE BOOM



130ZF2SP08

Description		1.96 m (6' 5") Arm	2.26 m (7' 5") Arm
Max digging reach	A	7715 mm (25' 4")	8000 mm (26' 3")
Max digging reach on ground	A'	7570 mm (24' 10")	7860 mm (25' 9")
Max digging depth	B	4920 mm (16' 2")	5215 mm (17' 1")
Max digging depth (8ft level)	B'	4790 mm (15' 9")	5095 mm (16' 9")
Max vertical wall digging depth	C	4070 mm (13' 4")	4380 mm (14' 4")
Max digging height	D	8600 mm (28' 3")	8825 mm (28' 11")
Max dumping height	E	6230 mm (20' 5")	6455 mm (21' 2")
Min swing radius	F	2220 mm (7' 3")	2430 mm (8' 0")
Bucket digging force	SAE	87.8 [95.8] kN	87.8 [95.8] kN
		8954 [9768] kgf	8954 [9768] kgf
		19740 [21534] lbf	19740 [21534] lbf
	ISO	101.7 [111.0] kN	101.7 [111.0] kN
		10369 [11312] kgf	10369 [11312] kgf
		22860 [24938] lbf	22860 [24938] lbf
Arm crowd force	SAE	60.6 [66.1] kN	56.1 [61.2] kN
		6178 [6739] kgf	5716 [6236] kgf
		13619 [14857] lbf	12602 [13747] lbf
	ISO	63.2 [68.9] kN	58.3 [63.6] kN
		6443 [7029] kgf	5943 [6484] kgf
		14204 [15495] lbf	13103 [14294] lbf

[ ] : Power boost

4. WEIGHT

Item	HX130LCR		HX130LCRD	
	kg	lb	kg	lb
Upper structure assembly				
· Main frame weld assembly	1231	2710	←	
· Engine assembly	341	750	←	
· Main pump assembly	90	200	←	
· Main control valve assembly	140	310	←	
· Swing motor assembly	120	260	←	
· Hydraulic oil tank assembly	150	330	←	
· Fuel tank assembly	145	320	←	
· Counterweight	2000	4410	←	
· Cab assembly	450	990	←	
Lower chassis assembly				
· Track frame weld assembly (LC type)	1285	2830	1424	3140
· Swing bearing	262	580	←	
· Travel motor assembly	140	310	←	
· Turning joint	56	120	←	
· Track recoil spring	95	210	←	
· Idler	108	240	←	
· Carrier roller	12	26	←	
· Track roller	24	53	←	
· Sprocket	40	88	←	
· Track-chain assembly (500 mm standard triple grouser shoe)	716	1580	←	
· Dozer blade assembly (500 mm shoe)	-		485	1070
Front attachment assembly				
· 4.30 m boom assembly	710	1570	←	
· 2.26 m arm assembly	360	790	←	
· 0.40 m^3 SAE heaped bucket	390	860	←	
· Boom cylinder assembly	200	440	←	
· Arm cylinder assembly	120	270	←	
· Bucket cylinder assembly	80	180	←	
· Bucket control rod assembly	90	200	←	
· Dozer blade cylinder assembly	-		55	120

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

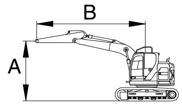
※ Refer to Transportation for actual weight information and Specifications for operating weight.

5. LIFTING CAPACITIES

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX130LCR	Mono	4300	1960	2000	500	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach Capacity		Reach m (ft)
6.0m	kg									*2600	*2600	4.24
19.7ft	lb									*5730	*5730	(13.9)
4.5m	kg					*3340	*3340			*2300	*2300	5.43
14.8ft	lb					*7360	*7360			*5070	*5070	(17.8)
3.0m	kg			*5320	*5320	*3930	3220	*2480	2050	*2260	2040	6.03
9.8ft	lb			*11730	*11730	*8660	7100	*5470	4520	*4980	4500	(19.8)
1.5m	kg			*7280	5610	*4730	3050	*3780	2000	*2390	1900	6.22
4.9ft	lb			*16050	12370	*10430	6720	*8330	4410	*5270	4190	(20.4)
0.0m	kg			*7250	5430	*5280	2940	*3050	1960	*2720	1950	6.03
0.0ft	lb			*15980	11970	*11640	6480	*6720	4320	*6000	4300	(19.8)
-1.5m	kg	*5370	*5370	*7900	5440	*5250	2920			*3490	2260	5.43
-4.9ft	lb	*11840	*11840	*17420	11990	*11570	6440			*7690	4980	(17.8)
-3.0m	kg			*6460	5580					*4340	3290	4.24
-9.8ft	lb			*14240	12300					*9570	7250	(13.9)

※ Note

1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *indicates load limited by hydraulic capacity.

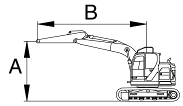
※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult your HD Hyundai Construction Equipment dealer regarding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

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

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	Mono	4300	1960	2000	500	Up	-	-	-

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

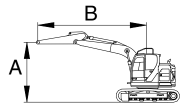


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg									*2600	*2600	4.24
19.7ft	lb									*5730	*5730	(13.9)
4.5m	kg					*3340	3110			*2300	2270	5.43
14.8ft	lb					*7360	6860			*5070	5000	(17.8)
3.0m	kg			*5320	*5320	*3930	2980	*2480	1900	*2260	1880	6.03
9.8ft	lb			*11730	*11730	*8660	6570	*5470	4190	*4980	4140	(19.8)
1.5m	kg			*7280	5100	3910	2810	2520	1850	2380	1750	6.22
4.9ft	lb			*16050	11240	8620	6190	5560	4080	5250	3860	(20.4)
0.0m	kg			*7250	4920	3780	2700	2480	1810	2460	1800	6.03
0.0ft	lb			*15980	10850	8330	5950	5470	3990	5420	3970	(19.8)
-1.5m	kg	*5370	*5370	7480	4930	3760	2680			2860	2080	5.43
-4.9ft	lb	*11840	*11840	16490	10870	8290	5910			6310	4590	(17.8)
-3.0m	kg			*6460	5060					4240	3020	4.24
-9.8ft	lb			*14240	11160					9350	6660	(13.9)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	Mono	4300	1960	2000	500	-	-	-	-

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

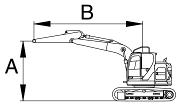


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg									*2600	*2600	4.24
19.7ft	lb									*5730	*5730	(13.9)
4.5m	kg					*3340	2940			*2300	2140	5.43
14.8ft	lb					*7360	6480			*5070	4720	(17.8)
3.0m	kg			*5320	5300	*3930	2810	*2480	1780	*2260	1760	6.03
9.8ft	lb			*11730	11680	*8660	6190	*5470	3920	*4980	3880	(19.8)
1.5m	kg			*7280	4790	3920	2640	2520	1730	*2390	1640	6.22
4.9ft	lb			*16050	10560	8640	5820	5560	3810	*5270	3620	(20.4)
0.0m	kg			*7250	4620	3790	2530	2480	1690	2470	1680	6.03
0.0ft	lb			*15980	10190	8360	5580	5470	3730	5450	3700	(19.8)
-1.5m	kg	*5370	*5370	7500	4620	3770	2510			2870	1940	5.43
-4.9ft	lb	*11840	*11840	16530	10190	8310	5530			6330	4280	(17.8)
-3.0m	kg			*6460	4760					4260	2840	4.24
-9.8ft	lb			*14240	10490					9390	6260	(13.9)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	Mono	4300	2260	2000	500	Down	-	-	-

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

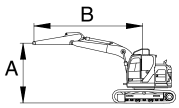


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg					*2780	*2780			*2340	*2340	4.64
19.7ft	lb					*6130	*6130			*5160	*5160	(15.2)
4.5m	kg					*3070	*3070			*2100	*2100	5.75
14.8ft	lb					*6770	*6770			*4630	*4630	(18.9)
3.0m	kg			*4800	*4800	*3690	3250	*3300	2070	*2060	1900	6.32
9.8ft	lb			*10580	*10580	*8140	7170	*7280	4560	*4540	4190	(20.7)
1.5m	kg			*7130	5680	*4550	3070	*3650	2000	*2170	1770	6.50
4.9ft	lb			*15720	12520	*10030	6770	*8050	4410	*4780	3900	(21.3)
0.0m	kg			*7520	5430	*5180	2940	*3900	1950	*2460	1820	6.32
0.0ft	lb			*16580	11970	*11420	6480	*8600	4300	*5420	4010	(20.7)
-1.5m	kg	*4880	*4880	*8050	5400	*5290	2890			*3080	2070	5.75
-4.9ft	lb	*10760	*10760	*17750	11900	*11660	6370			*6790	4560	(18.9)
-3.0m	kg	*9320	*9320	*6880	5510	*4410	2970			*4170	2850	4.64
-9.8ft	lb	*20550	*20550	*15170	12150	*9720	6550			*9190	6280	(15.2)

Unit : mm

Mode	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	Mono	4300	2260	2000	500	Up	-	-	-

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

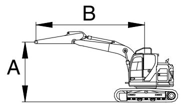


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg					*2780	*2780			*2340	*2340	4.64
19.7ft	lb					*6130	*6130			*5160	*5160	(15.2)
4.5m	kg					*3070	*3070			*2100	2090	5.75
14.8ft	lb					*6770	*6770			*4630	4610	(18.9)
3.0m	kg			*4800	*4800	*3690	3000	2590	1910	*2060	1750	6.32
9.8ft	lb			*10580	*10580	*8140	6610	5710	4210	*4540	3860	(20.7)
1.5m	kg			*7130	5160	3920	2830	2520	1850	*2170	1640	6.50
4.9ft	lb			*15720	11380	8640	6240	5560	4080	*4780	3620	(21.3)
0.0m	kg			7470	4920	3780	2700	2460	1800	2290	1670	6.32
0.0ft	lb			16470	10850	8330	5950	5420	3970	5050	3680	(20.7)
-1.5m	kg	*4880	*4880	7440	4890	3740	2660			2620	1900	5.75
-4.9ft	lb	*10760	*10760	16400	10780	8250	5860			5780	4190	(18.9)
-3.0m	kg	*9320	*9320	*6880	5000	3810	2730			3650	2620	4.64
-9.8ft	lb	*20550	*20550	*15170	11020	8400	6020			8050	5780	(15.2)

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX130LCR	Mono	4300	2260	2000	500	-	-	-	-

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

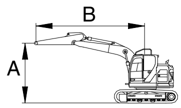


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg					*2780	*2780			*2340	*2340	4.64
19.7ft	lb					*6130	*6130			*5160	*5160	(15.2)
4.5m	kg					*3070	2970			*2100	1960	5.75
14.8ft	lb					*6770	6550			*4630	4320	(18.9)
3.0m	kg			*4800	*4800	*3690	2830	2590	1790	*2060	1640	6.32
9.8ft	lb			*10580	*10580	*8140	6240	5710	3950	*4540	3620	(20.7)
1.5m	kg			*7130	4860	3930	2650	2530	1730	*2170	1530	6.50
4.9ft	lb			*15720	10710	8660	5840	5580	3810	*4780	3370	(21.3)
0.0m	kg			7490	4610	3790	2520	2470	1680	2290	1560	6.32
0.0ft	lb			16510	10160	8360	5560	5450	3700	5050	3440	(20.7)
-1.5m	kg	*4880	*4880	7460	4590	3750	2480			2620	1780	5.75
-4.9ft	lb	*10760	*10760	16450	10120	8270	5470			5780	3920	(18.9)
-3.0m	kg	*9320	*9320	*6880	4690	3820	2550			3660	2450	4.64
-9.8ft	lb	*20550	*20550	*15170	10340	8420	5620			8070	5400	(15.2)

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX130LCR	Mono	4300	2810	2000	500	Down	-	-	-

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

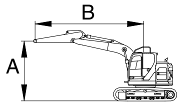


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg					*2460	*2460			*1760	*1760	5.36
19.7ft	lb					*5420	*5420			*3880	*3880	(17.6)
4.5m	kg					*2550	*2550	*2380	2120	*1600	*1600	6.34
14.8ft	lb					*5620	*5620	*5250	4670	*3530	*3530	(20.8)
3.0m	kg			*3820	*3820	*3210	*3210	*2980	2080	*1570	*1570	6.86
9.8ft	lb			*8420	*8420	*7080	*7080	*6570	4590	*3460	*3460	(22.5)
1.5m	kg			*6270	5810	*4150	3090	*3380	2000	*1650	1550	7.03
4.9ft	lb			*13820	12810	*9150	6810	*7450	4410	*3640	3420	(23.1)
0.0m	kg			*7830	5420	*4940	2920	*3740	1920	*1830	1580	6.86
0.0ft	lb			*17260	11950	*10890	6440	*8250	4230	*4030	3480	(22.5)
-1.5m	kg	*4170	*4170	*8140	5320	*5260	2840	*3830	1890	*2210	1760	6.34
-4.9ft	lb	*9190	*9190	*17950	11730	*11600	6260	*8440	4170	*4870	3880	(20.8)
-3.0m	kg	*7330	*7330	*7430	5380	*4880	2870			*3140	2260	5.36
-9.8ft	lb	*16160	*16160	*16380	11860	*10760	6330			*6920	4980	(17.6)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	Mono	4300	2810	2000	500	Up	-	-	-

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

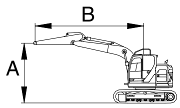


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg					*2460	*2460			*1760	*1760	5.36
19.7ft	lb					*5420	*5420			*3880	*3880	(17.6)
4.5m	kg					*2550	*2550	*2380	1970	*1600	*1600	6.34
14.8ft	lb					*5620	*5620	*5250	4340	*3530	*3530	(20.8)
3.0m	kg			*3820	*3820	*3210	3040	2600	1920	*1570	1520	6.86
9.8ft	lb			*8420	*8420	*7080	6700	5730	4230	*3460	3350	(22.5)
1.5m	kg			*6270	5280	3950	2840	2510	1840	*1650	1430	7.03
4.9ft	lb			*13820	11640	8710	6260	5530	4060	*3640	3150	(23.1)
0.0m	kg			7480	4910	3770	2680	2440	1770	*1830	1450	6.86
0.0ft	lb			16490	10820	8310	5910	5380	3900	*4030	3200	(22.5)
-1.5m	kg	*4170	*4170	7360	4810	3690	2610	2400	1740	*2210	1610	6.34
-4.9ft	lb	*9190	*9190	16230	10600	8140	5750	5290	3840	*4870	3550	(20.8)
-3.0m	kg	*7330	*7330	7430	4870	3710	2630			2880	2070	5.36
-9.8ft	lb	*16160	*16160	16380	10740	8180	5800			6350	4560	(17.6)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	Mono	4300	2810	2000	500	-	-	-	-

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

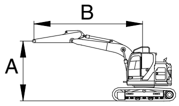


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg					*2460	*2460			*1760	*1760	5.36
19.7ft	lb					*5420	*5420			*3880	*3880	(17.6)
4.5m	kg					*2550	*2550	*2380	1850	*1600	*1600	6.34
14.8ft	lb					*5620	*5620	*5250	4080	*3530	*3530	(20.8)
3.0m	kg			*3820	*3820	*3210	2870	2610	1800	*1570	1420	6.86
9.8ft	lb			*8420	*8420	*7080	6330	5750	3970	*3460	3130	(22.5)
1.5m	kg			*6270	4980	3960	2670	2520	1720	*1650	1330	7.03
4.9ft	lb			*13820	10980	8730	5890	5560	3790	*3640	2930	(23.1)
0.0m	kg			7500	4610	3780	2510	2440	1650	*1830	1350	6.86
0.0ft	lb			16530	10160	8330	5530	5380	3640	*4030	2980	(22.5)
-1.5m	kg	*4170	*4170	7380	4510	3700	2430	2410	1620	*2210	1500	6.34
-4.9ft	lb	*9190	*9190	16270	9940	8160	5360	5310	3570	*4870	3310	(20.8)
-3.0m	kg	*7330	*7330	*7430	4560	3720	2450			2880	1940	5.36
-9.8ft	lb	*16160	*16160	*16380	10050	8200	5400			6350	4280	(17.6)

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX130LCR	2PCS	4556	1960	2350	500	Down	-	-	-

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

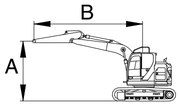


Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach Capacity		Reach
												m (ft)
6.0m	kg					*3290	*3290			*2660	*2660	4.68
19.7ft	lb					*7250	*7250			*5860	*5860	(15.4)
4.5m	kg			*3660	*3660	*3290	*3290			*2350	2340	5.78
14.8ft	lb			*8070	*8070	*7250	*7250			*5180	5160	(19.0)
3.0m	kg			*5610	*5610	*3910	3390	*3360	2170	*2290	1970	6.35
9.8ft	lb			*12370	*12370	*8620	7470	*7410	4780	*5050	4340	(20.8)
1.5m	kg					*4670	3180	*3630	2090	*2380	1840	6.53
4.9ft	lb					*10300	7010	*8000	4610	*5250	4060	(21.4)
0.0m	kg			*4620	*4620	*5130	3040	*3800	2040	*2640	1880	6.35
0.0ft	lb			*10190	*10190	*11310	6700	*8380	4500	*5820	4140	(20.8)
-1.5m	kg			*7520	5630	*5070	3010			*3230	2150	5.78
-4.9ft	lb			*16580	12410	*11180	6640			*7120	4740	(19.0)
-3.0m	kg			*6200	5780	*4050	3120					
-9.8ft	lb			*13670	12740	*8930	6880					

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX130LCR	2PCS	4556	1960	2350	500	Up	-	-	-

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

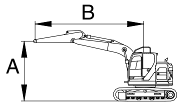


Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach Capacity		Reach
												m (ft)
6.0m	kg					*3290	*3290			*2660	*2660	4.68
19.7ft	lb					*7250	*7250			*5860	*5860	(15.4)
4.5m	kg			*3660	*3660	*3290	*3290			*2350	2170	5.78
14.8ft	lb			*8070	*8070	*7250	*7250			*5180	4780	(19.0)
3.0m	kg			*5610	*5610	*3910	3130	2730	2000	*2290	1820	6.35
9.8ft	lb			*12370	*12370	*8620	6900	6020	4410	*5050	4010	(20.8)
1.5m	kg					4090	2920	2650	1930	2320	1700	6.53
4.9ft	lb					9020	6440	5840	4250	5110	3750	(21.4)
0.0m	kg			*4620	*4620	3950	2790	2590	1870	2390	1730	6.35
0.0ft	lb			*10190	*10190	8710	6150	5710	4120	5270	3810	(20.8)
-1.5m	kg			*7520	5100	3920	2760			2740	1980	5.78
-4.9ft	lb			*16580	11240	8640	6080			6040	4370	(19.0)
-3.0m	kg			*6200	5240	4030	2860					
-9.8ft	lb			*13670	11550	8880	6310					

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	2PCS	4556	1960	2350	500	-	-	-	-

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

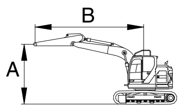


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0m	kg					*3290	3160			*2660	*2660	4.68
19.7ft	lb					*7250	6970			*5860	*5860	(15.4)
4.5m	kg			*3660	*3660	*3290	3140			*2350	2040	5.78
14.8ft	lb			*8070	*8070	*7250	6920			*5180	4500	(19.0)
3.0m	kg			*5610	5540	*3910	2960	2730	1880	*2290	1710	6.35
9.8ft	lb			*12370	12210	*8620	6530	6020	4140	*5050	3770	(20.8)
1.5m	kg					4100	2750	2650	1810	2330	1590	6.53
4.9ft	lb					9040	6060	5840	3990	5140	3510	(21.4)
0.0m	kg			*4620	*4620	3960	2620	2590	1750	2390	1620	6.35
0.0ft	lb			*10190	*10190	8730	5780	5710	3860	5270	3570	(20.8)
-1.5m	kg			*7520	4790	3930	2590			2740	1850	5.78
-4.9ft	lb			*16580	10560	8660	5710			6040	4080	(19.0)
-3.0m	kg			*6200	4930	4040	2690					
-9.8ft	lb			*13670	10870	8910	5930					

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX130LCR	2PCS	4556	2260	2350	500	Down	-	-	-

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

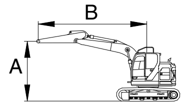


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
7.5m	kg			*3530	*3530					*3290	*3290	3.08
24.6ft	lb			*7780	*7780					*7250	*7250	(10.1)
6.0m	kg					*2940	*2940			*2380	*2380	5.07
19.7ft	lb					*6480	*6480			*5250	*5250	(16.6)
4.5m	kg					*3050	*3050	*2620	2230	*2140	*2140	6.10
14.8ft	lb					*6720	*6720	*5780	4920	*4720	*4720	(20.0)
3.0m	kg			*5110	*5110	*3700	3420	*3200	2180	*2090	1840	6.64
9.8ft	lb			*11270	*11270	*8160	7540	*7050	4810	*4610	4060	(21.8)
1.5m	kg					*4510	3200	*3520	2100	*2160	1720	6.81
4.9ft	lb					*9940	7050	*7760	4630	*4760	3790	(22.4)
0.0m	kg			*4950	*4950	*5060	3040	*3760	2030	*2390	1760	6.64
0.0ft	lb			*10910	*10910	*11160	6700	*8290	4480	*5270	3880	(21.8)
-1.5m	kg			*7690	5590	*5110	2990	*3630	2020	*2870	1980	6.10
-4.9ft	lb			*16950	12320	*11270	6590	*8000	4450	*6330	4370	(20.0)
-3.0m	kg			*6580	5710	*4400	3060			*3610	2610	5.07
-9.8ft	lb			*14510	12590	*9700	6750			*7960	5750	(16.6)

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX130LCR	2PCS	4556	2260	2350	500	Up	-	-	-

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

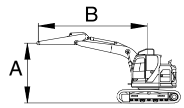


Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach Capacity		Reach m (ft)
7.5m	kg			*3530	*3530					*3290	*3290	3.08
24.6ft	lb			*7780	*7780					*7250	*7250	(10.1)
6.0m	kg					*2940	*2940			*2380	*2380	5.07
19.7ft	lb					*6480	*6480			*5250	*5250	(16.6)
4.5m	kg					*3050	*3050	*2620	2060	*2140	1990	6.10
14.8ft	lb					*6720	*6720	*5780	4540	*4720	4390	(20.0)
3.0m	kg			*5110	*5110	*3700	3160	2740	2020	*2090	1700	6.64
9.8ft	lb			*11270	*11270	*8160	6970	6040	4450	*4610	3750	(21.8)
1.5m	kg					4120	2940	2650	1930	*2160	1590	6.81
4.9ft	lb					9080	6480	5840	4250	*4760	3510	(22.4)
0.0m	kg			*4950	*4950	3950	2790	2580	1860	2230	1610	6.64
0.0ft	lb			*10910	*10910	8710	6150	5690	4100	4920	3550	(21.8)
-1.5m	kg			*7690	5050	3890	2740	2570	1850	2510	1820	6.10
-4.9ft	lb			*16950	11130	8580	6040	5670	4080	5530	4010	(20.0)
-3.0m	kg			*6580	5170	3960	2800			3340	2400	5.07
-9.8ft	lb			*14510	11400	8730	6170			7360	5290	(16.6)

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX130LCR	2PCS	4556	2260	2350	500	-	-	-	-

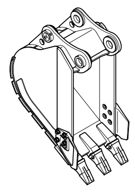
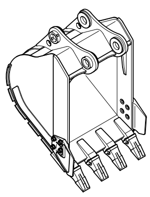
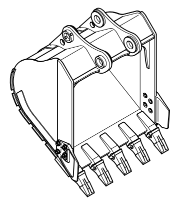
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach Capacity		Reach m (ft)
7.5m	kg			*3530	*3530					*3290	*3290	3.08
24.6ft	lb			*7780	*7780					*7250	*7250	(10.1)
6.0m	kg					*2940	*2940			*2380	*2380	5.07
19.7ft	lb					*6480	*6480			*5250	*5250	(16.6)
4.5m	kg					*3050	*3050	*2620	1940	*2140	1880	6.10
14.8ft	lb					*6720	*6720	*5780	4280	*4720	4140	(20.0)
3.0m	kg			*5110	*5110	*3700	2990	2750	1900	*2090	1590	6.64
9.8ft	lb			*11270	*11270	*8160	6590	6060	4190	*4610	3510	(21.8)
1.5m	kg					4130	2770	2660	1810	*2160	1480	6.81
4.9ft	lb					9110	6110	5860	3990	*4760	3260	(22.4)
0.0m	kg			*4950	4750	3960	2620	2580	1740	2230	1510	6.64
0.0ft	lb			*10910	10470	8730	5780	5690	3840	4920	3330	(21.8)
-1.5m	kg			*7690	4740	3900	2570	2570	1730	2520	1700	6.10
-4.9ft	lb			*16950	10450	8600	5670	5670	3810	5560	3750	(20.0)
-3.0m	kg			*6580	4860	3970	2630			3350	2250	5.07
-9.8ft	lb			*14510	10710	8750	5800			7390	4960	(16.6)

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET

		
0.30 m³ SAE heaped bucket	※ 0.40, 0.45, 0.50 m³ SAE heaped bucket	0.59 m³ SAE heaped bucket

Capacity		Width		Weight	Recommendation				
					4.3 m (14' 1") Mono boom			4.556 m (14' 11") 2-piece boom	
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.96 m arm (6' 5")	2.26 m arm (7' 5")	2.81 m arm (9' 3")	1.96 m arm (6' 5")	2.26 m arm (7' 5")
0.30 m³ (0.39 yd³)	0.27 m³ (0.35 yd³)	610 mm (24.0")	700 mm (27.6")	332 kg (730 lb)	●	●	●	●	●
※ 0.40 m³ (0.52 yd³)	0.35 m³ (0.46 yd³)	760 mm (29.9")	850 mm (33.5")	383 kg (840 lb)	●	●	●	●	●
0.45 m³ (0.59 yd³)	0.40 m³ (0.52 yd³)	830 mm (32.7")	920 mm (36.2")	401 kg (880 lb)	●	●	◐	●	●
0.50 m³ (0.65 yd³)	0.45 m³ (0.59 yd³)	900 mm (35.4")	990 mm (39.0")	419 kg (920 lb)	●	●	◐	●	◐
0.59 m³ (0.77 yd³)	0.52 m³ (0.68 yd³)	1030 mm (40.6")	1120 mm (44.1")	463 kg (1020 lb)	◐	■	▲	◐	■

※ : Standard bucket

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

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

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

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

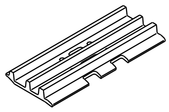
※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for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

7. UNDERCARRIAGE

1) TRACKS

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

2) TYPES OF SHOES

Model	Shapes		Triple grouser		
					
HX130LCR	Shoe width	mm (in)	※ 500 (20)	600 (24)	700 (28)
	Operating weight	kg (lb)	12700 (28000)	12850 (28330)	13000 (28660)
	Ground pressure	kgf/cm^2 (psi)	0.42 (5.95)	0.35 (5.02)	0.31 (4.35)
	Overall width	mm (ft-in)	2500 (8' 2")	2600 (8' 6")	2700 (8' 10")
HX130LCRD	Shoe width	mm (in)	※ 500 (20)	600 (24)	-
	Operating weight	kg (lb)	13400 (29540)	13560 (29890)	-
	Ground pressure	kgf/cm^2 (psi)	0.44 (6.28)	0.37 (5.30)	-
	Overall width	mm (ft-in)	2500 (8' 2")	2600 (8' 6")	-
	Dozer width	mm (ft-in)	2500 (8' 2")	2600 (8' 6")	-

※Standard

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
	HX130LCR/HX130LCRD
Carrier rollers	1 EA
Track rollers	7 EA
Track shoes	45 EA

4) 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

Track shoe	Specification	Category
500 mm triple grouser	Standard	A
600 mm triple grouser	Option	A
700 mm triple grouser	Option	B

※ Table 2

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

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Perkins 854F
Type	4-cycle turbocharged charge air cooled diesel engine
Cooling method	Water cooling
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	99 × 110 mm (3.89" × 4.33")
Piston displacement	3400 cc (207 cu in)
Compression ratio	17 : 1
Rated gross horse power (SAE J1995)	73.6 Hp (55 kW) at 2200 rpm
Maximum torque	43.2 kgf · m (313 lbf · ft) at 1200 rpm
Engine oil quantity	8.0 ℓ (2.1 U.S. gal)
Dry weight	341 kg (752 lb)
High idling speed	2310 ± 50 rpm
Low idling speed	800 ± 100 rpm
Rated fuel consumption	160 g/Hp · hr at 1900 rpm
Starting motor	24 V-4.5 kW
Alternator	24 V-65 A
Battery	2 × 12 V × 100 Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 63 cc/rev
Maximum pressure	330 kgf/cm² (4690 psi) [360 kgf/cm² (5120 psi)]
Rated oil flow	2 × 126 ℓ/min (33.3 U.S. gpm / 27.7 U.K. gpm)
Rated speed	2000 rpm

[ ] : Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	15cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	30 ℓ/min (7.9 U.S. gpm / 6.6 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	11 spools
Operating method	Hydraulic pilot system
Main relief valve pressure	330 kgf/cm^2 (4690 psi) [360 kgf/cm^2 (5120 psi)]
Overload relief valve pressure	380 kgf/cm^2 (5400 psi)

[ ]: Power boost

5) SWING MOTOR

Item	Specification	
	Type 1	Type 2
Type	Fixed displacement axial piston motor	
Capacity	72 cc/rev	71 cc/rev
Relief pressure	285 kgf/cm^2 (4050 psi)	
Braking system	Automatic, spring applied hydraulic released	
Braking torque	Min 30 kgf · m (217 lbf · ft)	31.4 kgf · m (227 lbf · ft)
Brake release pressure	15~50 kgf/cm^2 (273~711 psi)	19.2~50 kgf/cm^2 (273~711 psi)
Reduction gear type	2 - stage planetary	

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	330 kgf/cm^2 (4690 psi)
Capacity (max / min)	77.0/44.5 cc/rev
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	12.5 kgf/cm^2 (178 psi)
Braking torque	33 kgf · m (239 lbf · ft)

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Stroke	Ø100 × 975 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Stroke	Ø110 × 1070 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Stroke	Ø100 × 855 mm
	Cushion	Extend only
Dozer cylinder (option)	Bore dia × Stroke	Ø100 × 240 mm
	Cushion	-
Adjust cylinder (opt)	Bore dia × Stroke	Ø145 × 613 mm
	Cushion	-
Adjust boom cylinder (opt)	Bore dia × Stroke	Ø100 × 975 mm
	Cushion	-

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

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

8) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
HX130LCR	Standard	500 mm (20")	0.42 kgf/cm^2 (5.95 psi)	43	2500 mm (8' 2")
	Option	600 mm (24")	0.35 kgf/cm^2 (5.02 psi)	43	2600 mm (8' 6")
		700 mm (28")	0.31 kgf/cm^2 (4.35 psi)	43	2700 mm (8' 10")
HX130LCRD	Standard	500 mm (20")	0.44 kgf/cm^2 (6.28 psi)	43	2500 mm (8' 2")
	Option	600 mm (24")	0.37 kgf/cm^2 (5.30 psi)	43	2600 mm (8' 6")

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 ℃ (˚F) -50 (-58), -30 (-22), -20 (-4), -10 (14), 0 (32), 10 (50), 20 (68), 30 (86), 40 (104)
Engine oil pan	Engine oil	8.0 (2.1)	★SAE 0W-40
			★SAE 5W-40
			SAE 10W-30
			SAE 10W-40
			SAE 15W-40
Swing drive	Gear oil	Type1 : 3.5 (0.9) Type2 : 2.5 (0.7)	★SAE 75W-90
Final drive		2.3×2 (0.6×2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank: 96 (25.4) System: 160 (42.3)	★ISO VG 15
			ISO VG 32
			ISO VG 46, HBHO VG 46★3
			ISO VG 68
Fuel tank	Diesel fuel★1	240 (63.4)	★ASTM D975 NO.1
			ASTM D975 NO.2
Fitting (Grease nipple)	Grease	As required	★NLGI NO.1
			NLGI NO.2
Radiator (Reservoir tank)	Mixture of antifreeze and soft water★2	20 (5.3)	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 Materia

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

★2 : Soft water
City water or distilled water

★3 : HD Hyundai Construction Equipment Bio Hydraulic Oil

★ : Cold region (Russia, CIS, Mongolia)

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

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

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

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

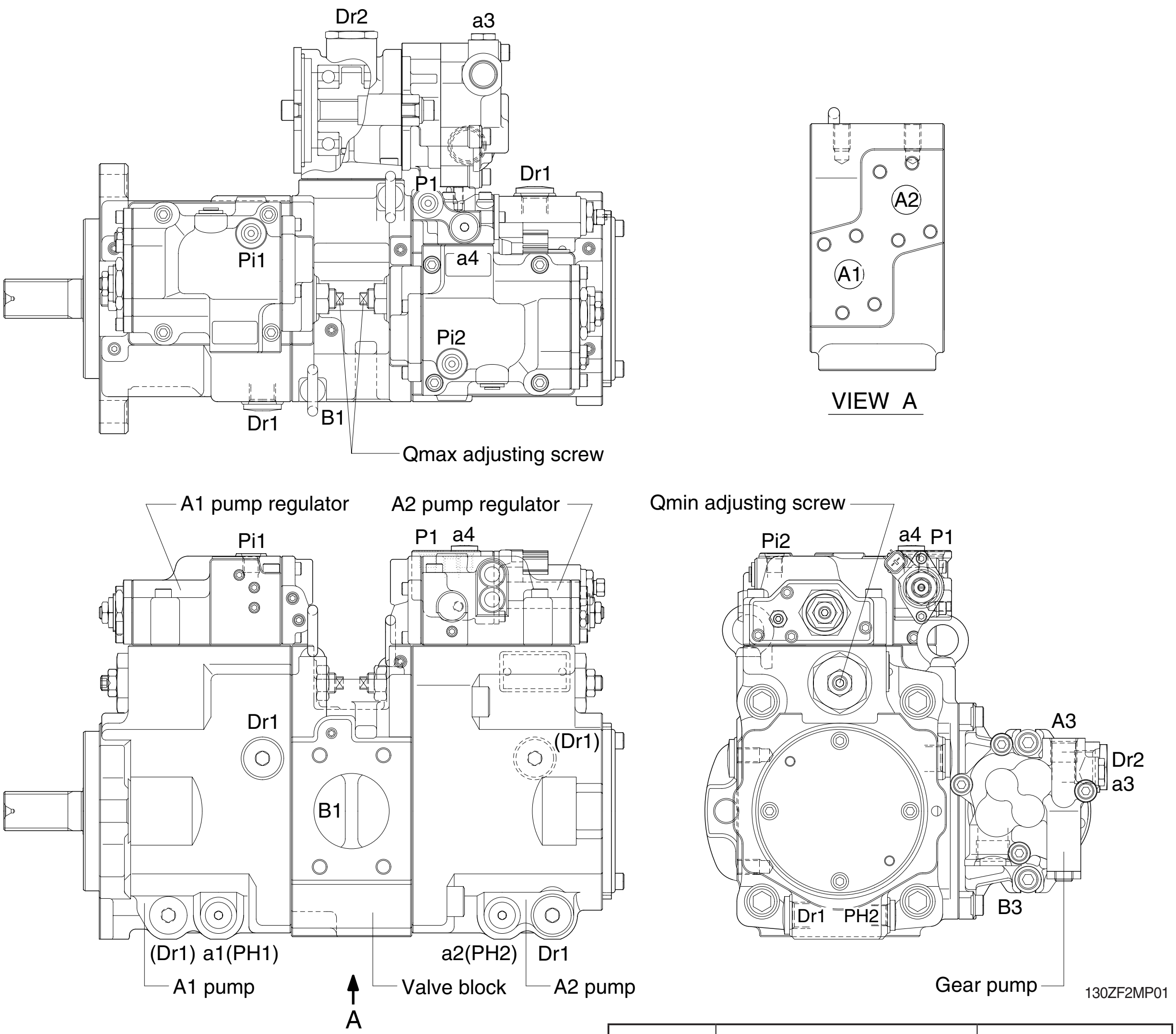
SECTION 2 STRUCTURE AND FUNCTION

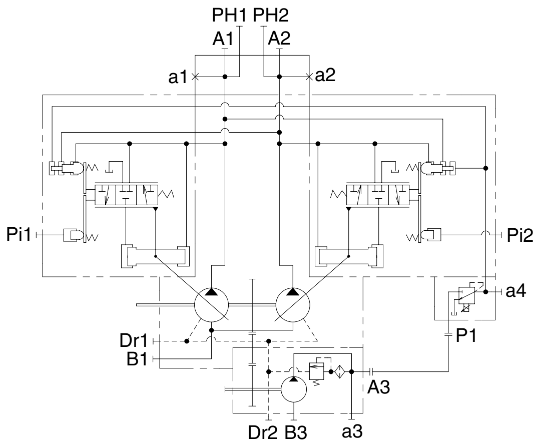
Group 1 Pump Device 2-1
Group 2 Main Control Valve 2-20
Group 3 Swing Device 2-47
Group 4 Travel Device 2-61
Group 5 RCV Lever 2-74
Group 6 RCV Pedal 2-81

GROUP 1 PUMP DEVICE

1. STRUCTURE

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



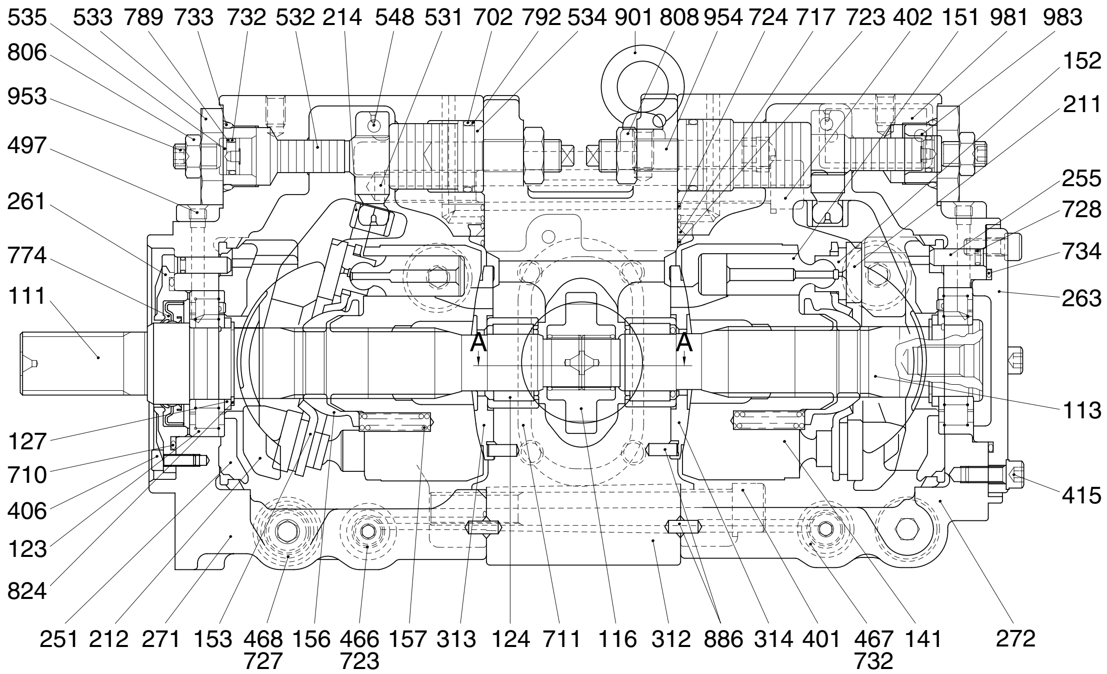


Hydraulic circuit

Port	Port name	Port size
A1, A2	Delivery port	SAE6000 psi 3/4"
B1	Suction port	SAE2500 psi 2 1/2"
Dr1	Drain port	PF 1/2 - 19
Dr2	Drain port	PF 3/4 - 20
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 - 14
PH1, PH2	Servo port	PF 3/8 - 17
a4	Gauge port	PF 1/4-13
A3	Gear pump delivery port	PF 1/2 - 19
B3	Gear pump suction port	PF 3/4 - 20.5

1) MAIN PUMP (1/2)

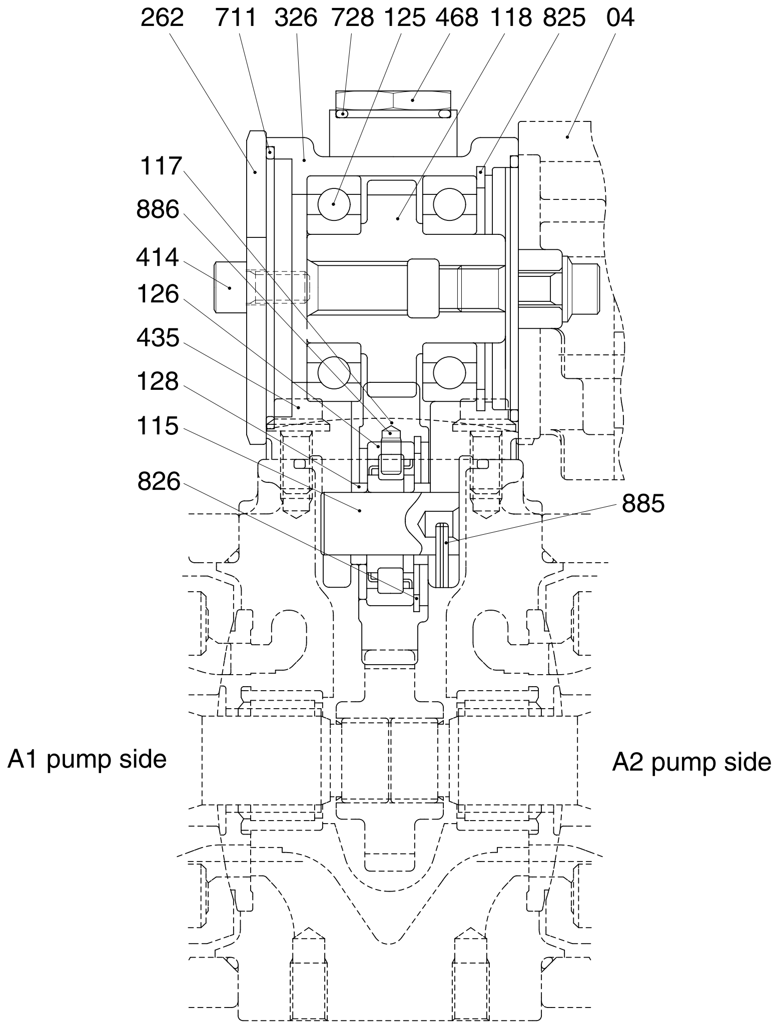
The main pump consists of two piston pumps (A1 and A2) and valve block.



130ZF2MP02

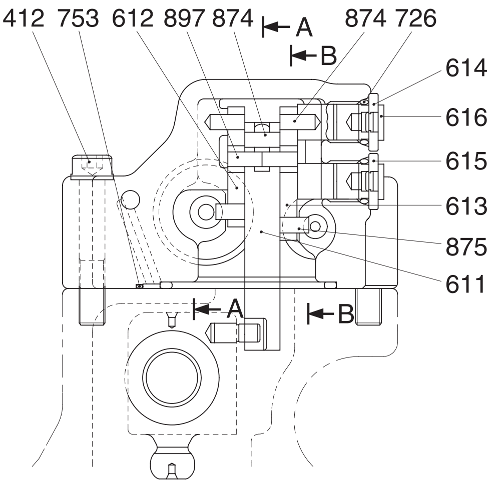
111	Drive shaft (F)
113	Drive shaft (R)
116	1st Gear
123	Roller bearing
124	Needle bearing
127	Bearing spacer
141	Cylinder block
151	Piston
152	Shoe
153	Set plate
156	Bushing
157	Cylinder spring
211	Shoe plate
212	Swash plate
214	Bushing
251	Support
255	Lock pin
261	Seal cover (F)
263	Seal cover (R)
271	Pump casing (F)
272	Pump casing (R)
312	Valve block
313	Valve plate (R)
314	Valve plate (L)
401	Hexagon socket bolt
402	Hexagon socket bolt
406	Hexagon socket bolt
415	Hexagon socket bolt
466	Plug
467	plug
468	Plug
497	Plug
531	Tilting pin
532	Servo piston
533	Plug
534	Stopper (L)
535	Stopper (S)
548	Pin
702	O-ring
710	O-ring
711	O-ring
717	O-ring
723	O-ring
724	Square ring
728	O-ring
732	O-ring
733	O-ring
734	O-ring
774	Oil seal
789	Back up ring
792	Back up ring
806	Nut
808	Hexagon head nut
824	Snap ring
886	Spring pin
901	Eye bolt
953	Set screw
954	Set screw
981	Plate
983	Pin

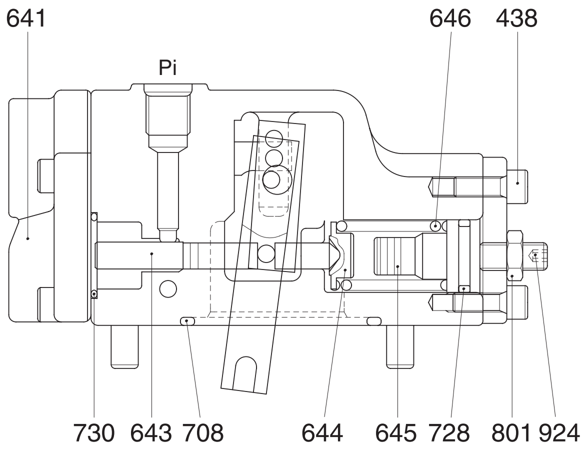
MAIN PUMP (2/2)



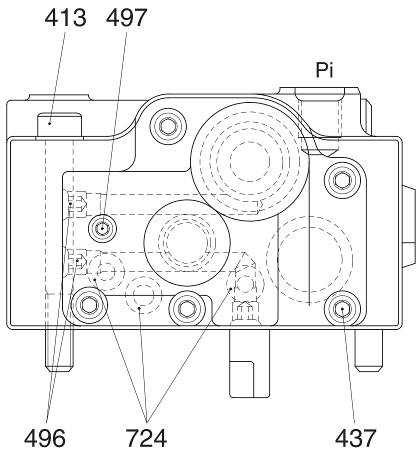
04	Gear pump	128	Bearing spacer	711	O-ring
115	Idler shaft	262	Cover	728	O-ring
117	Gear No. 2	326	Gear case	825	Retainer ring
118	Gear No. 3	414	Hexagon socket bolt	826	Retainer ring
125	Ball bearing	435	Flange socket bolt	885	Spring pin
126	Roller bearing	468	Plug	886	Pin

2) REGULATOR (1/2)

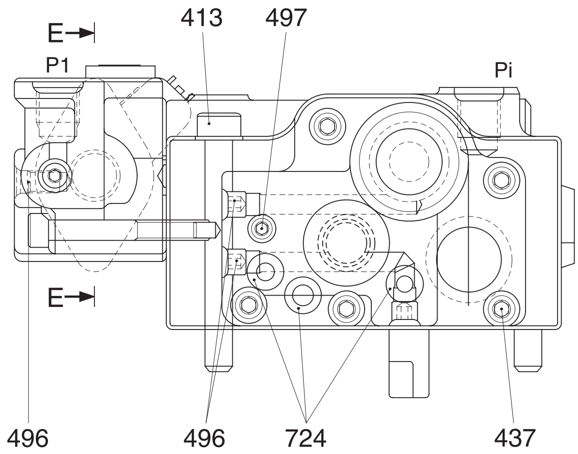




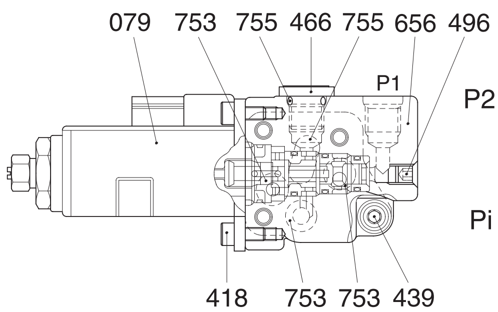
SECTION B-B



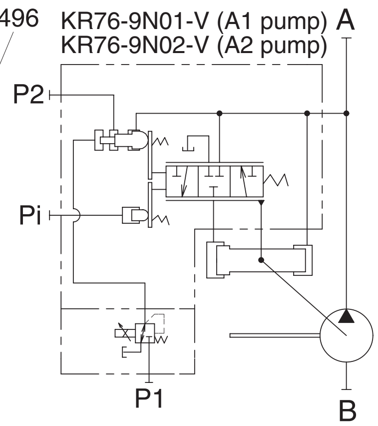
VIEW C (A1 pump)



VIEW C (A2 pump)



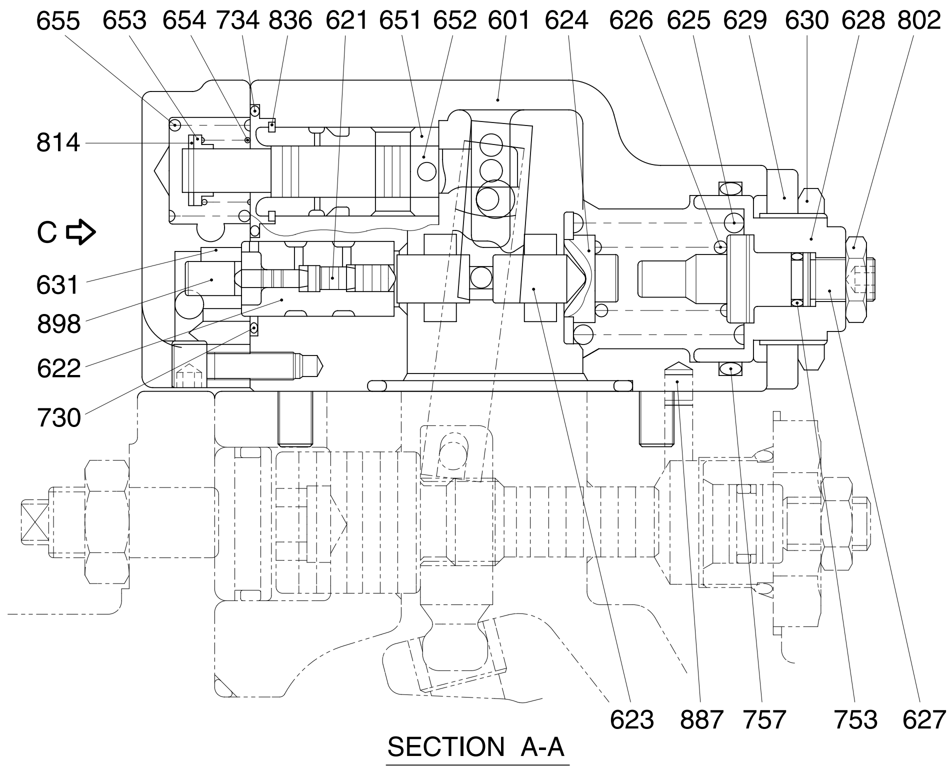
SECTION E-E



130ZF2MP04

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
P1	EPPR valve primary port	PF 1/4-13
P2	Companion delivery port	internal

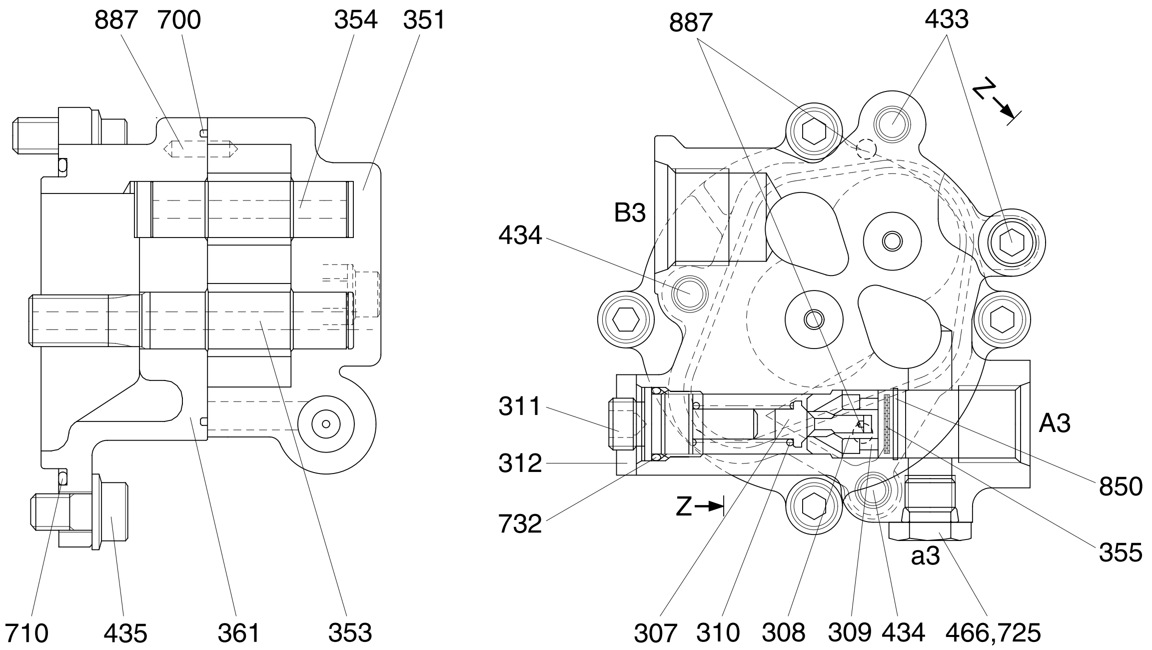
REGULATOR (2/2)



140Z92MP05

079	EPPR valve assembly	624	Spring seat (C)	724	Square ring
412	Hexagon socket screw	625	Outer spring	725	O-ring
413	Hexagon socket screw	626	Inner spring	728	O-ring
418	Hexagon socket screw	627	Adjust stem (C)	730	O-ring
437	Hexagon socket screw	628	Adjust screw (C)	734	O-ring
438	Hexagon socket screw	629	Cover (C)	753	O-ring
439	Hexagon socket screw	630	Lock nut	755	O-ring
466	Plug	631	Sleeve, Pf	757	O-ring
496	Plug	641	Pilot cover	801	Nut
497	Plug	643	Pilot piston	802	Nut
601	Casing	644	Spring seat (Q)	814	Snap ring
611	Feed back lever	645	Adjust stem (Q)	836	Snap ring
612	Lever 1	646	Pilot spring	874	Pin
613	Lever 2	651	Sleeve	875	Pin
614	Center plug	652	Spool	887	Pin
615	Adjust plug	653	Spring seat	897	Pin
616	Plug	654	Return spring	898	Pin
621	Compensator piston	655	Set spring	924	Set screw
622	Piston case	656	Block cover		
623	Compensator rod	708	O-ring		

3) GEAR PUMP



SECTION Z-Z

130ZF2MP06

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

2. FUNCTION

1) MAIN PUMP

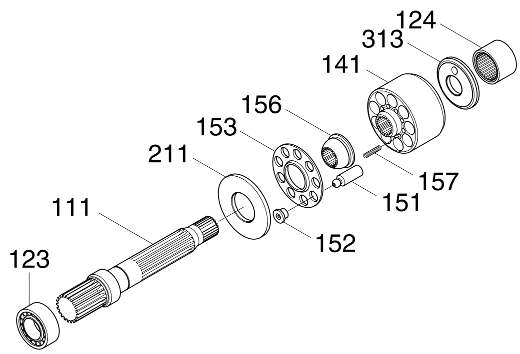
The pumps may be classified roughly into the rotary group performing a rotary motion and working as the major part of the whole pump function: the swash plate group that varies the delivery rates: and the valve cover group that changes over oil suction and discharge : and the PTO group that transfers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



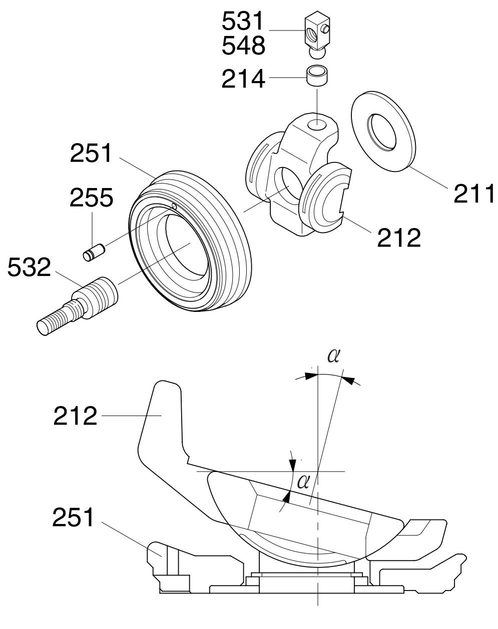
21092MP06

(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)



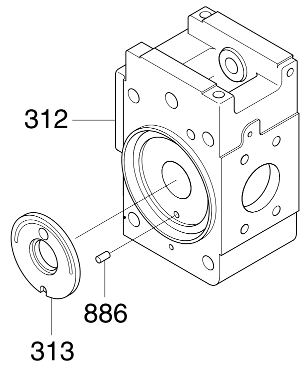
140Z92MP09

(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

(4) PTO group

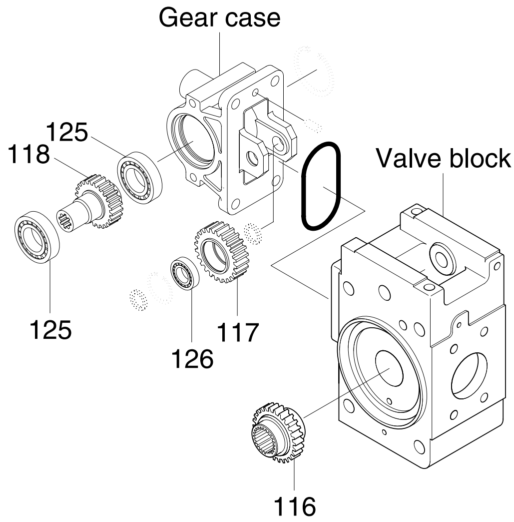
PTO group consist of 1st gear (116) and 2nd gear (117), 3rd gear (118).

2nd gear and 3rd gear are supported by bearings (125, 126), and it can be mounted to the valve block.

Now, if the drive shaft is driven by a prime mover (electric motor, engine, etc), it rotates the cylinder block via a spline linkage at the same time. If the swash plate is tilted as in Fig (previous page) the pistons arranged in the cylinder block make a reciprocating motion with respect to the cylinder block, while they revolve with the cylinder block.

If you pay attention to a single piston, it performs a motion away from the valve plate (oil sucking process) within 180 degrees, and makes a motion towards the valve plate (oil discharging process) in the rest of 180 degrees. When the swash plate has a tilting angle of zero, the piston makes no stroke and discharges no oil.

Concurrently, the auxiliary pump is driven by gears of PTO.



140Z92MP08

2) REGULATOR

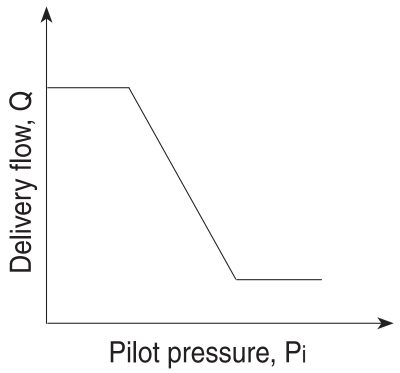
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

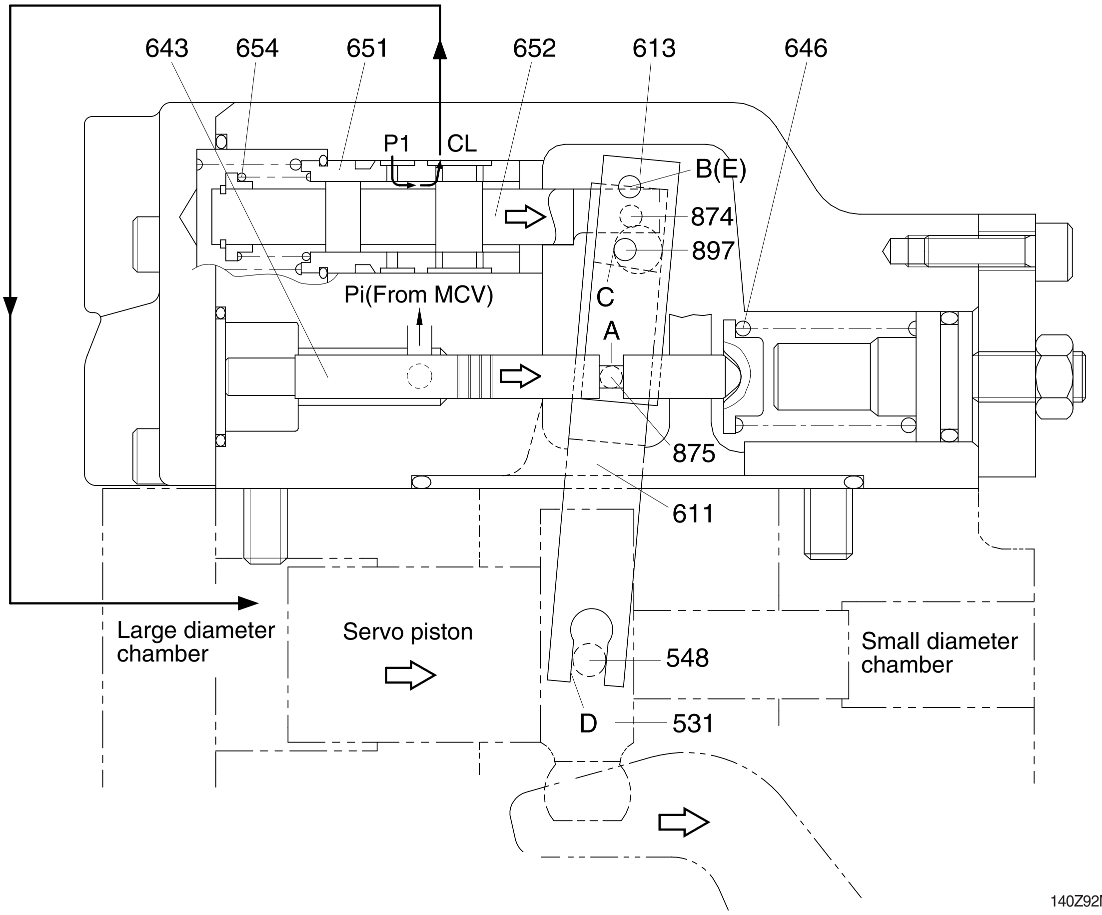
By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

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.



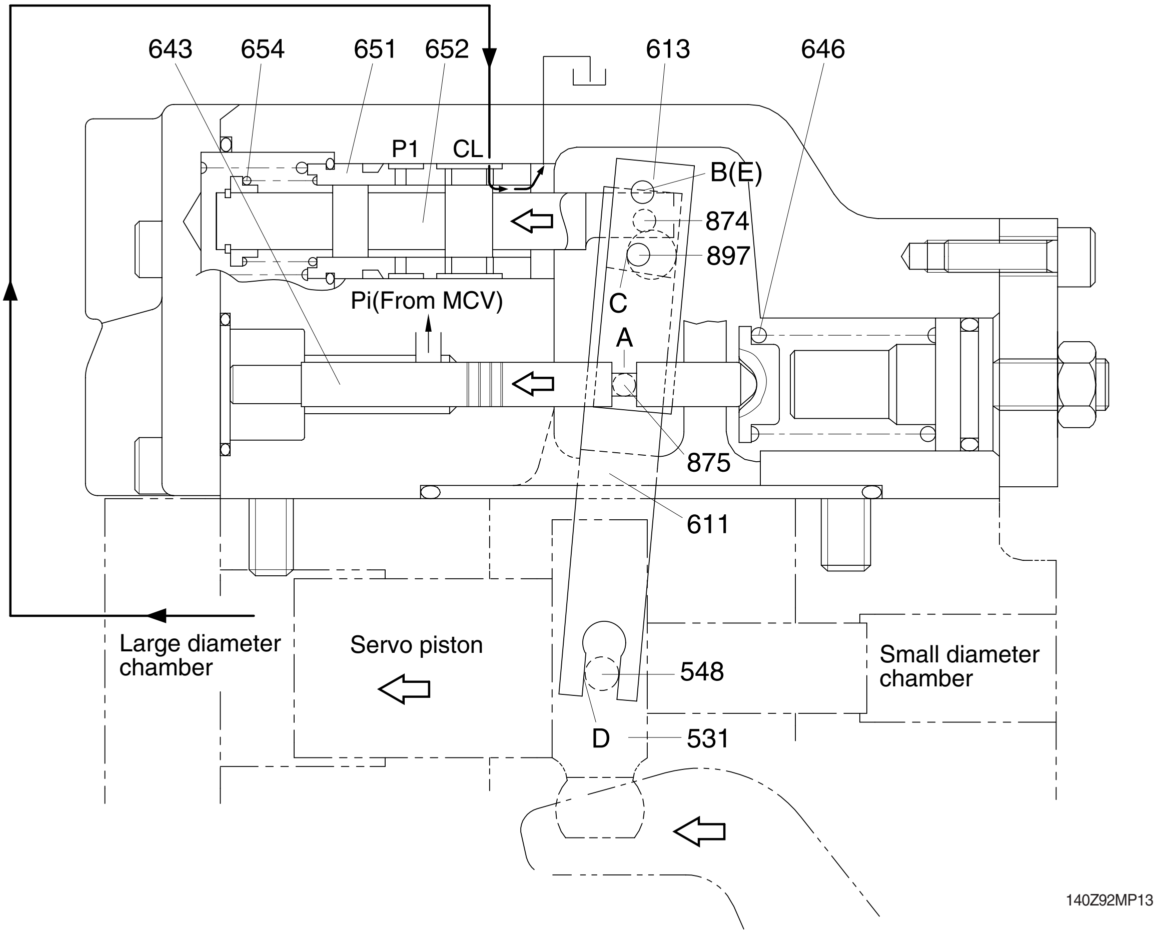
① Flow reducing function



140Z92MP12

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

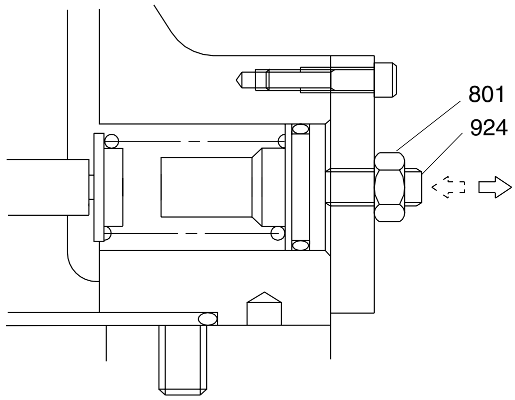
The flow control characteristic can be adjusted with the adjusting screw.

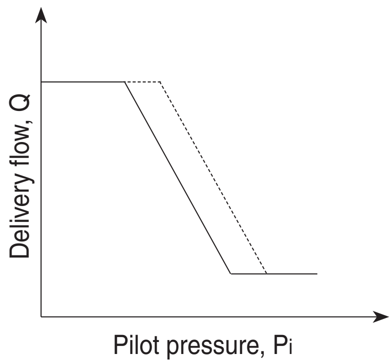
Adjust it by loosening the hexagon nut (801) and by tightening (or loosening) the hexagonal socket head screw (924).

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



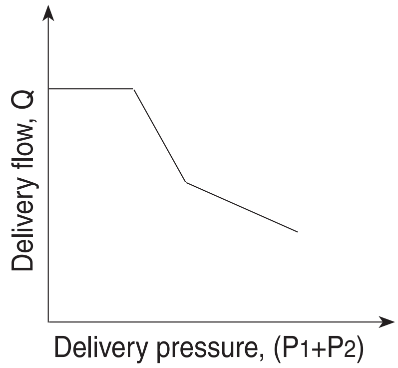


(2) Total horsepower control

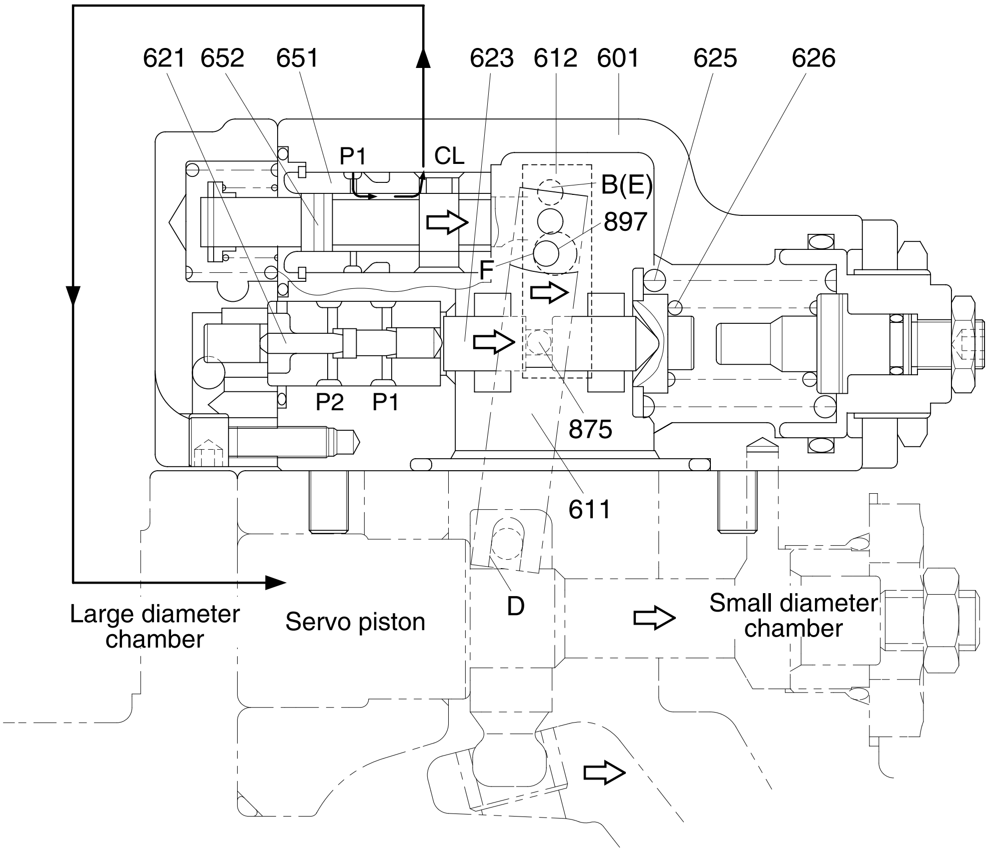
The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.
(The input horsepower is constant when the speed is constant.)
Since 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



140Z92RG03

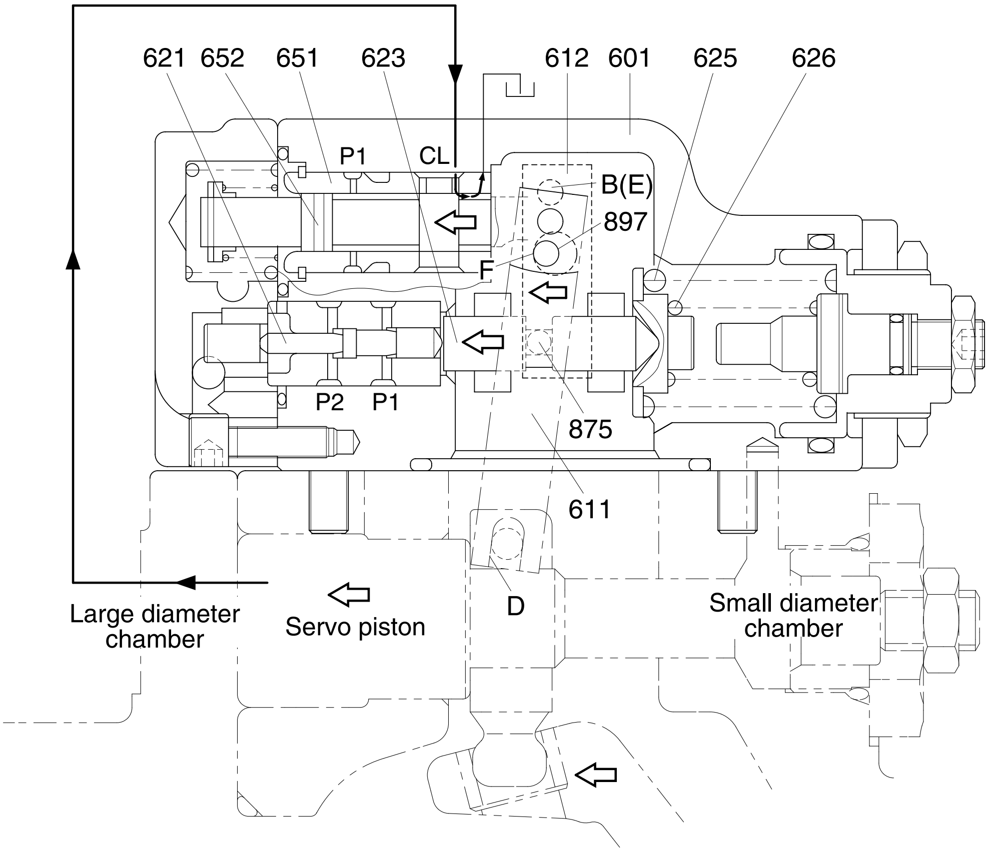
When the self pump delivery pressure P1 or the companion pump delivery pressure P2 rises, it acts on the stepped part of the compensating piston (621). It presses the compensating rod (623) to the right till the force of the outer spring (625) and inner spring (626) balances with the hydraulic force.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

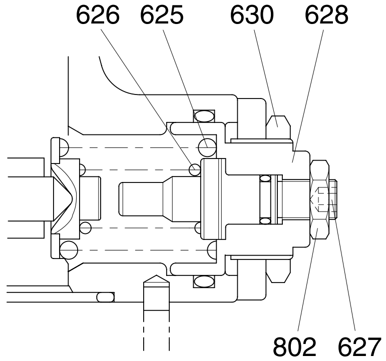
④ **Adjustment of input horsepower**

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).

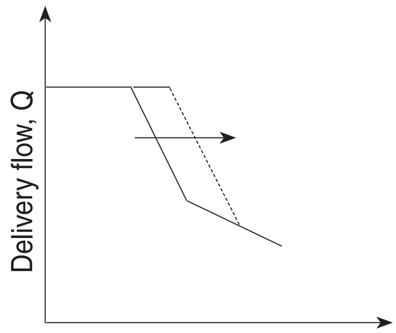
Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C (628) by N turns changes the setting of the inner spring (626), return the adjusting stem C (627) by N×A turns at first. (A=1.73)



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



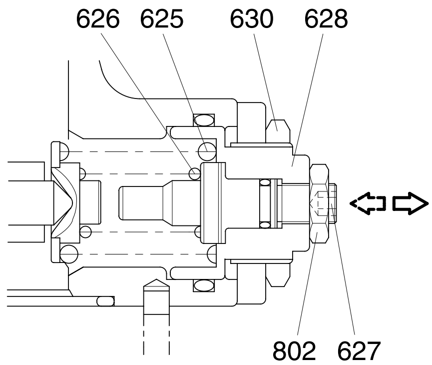
b. **Adjustment of inner spring**

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

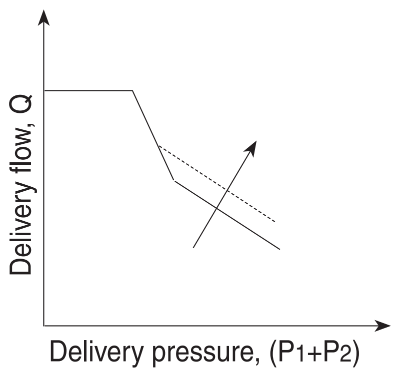
Tightening the screw increases the flow and then the input horsepower as shown in the figure.

※ **Adjusting value**

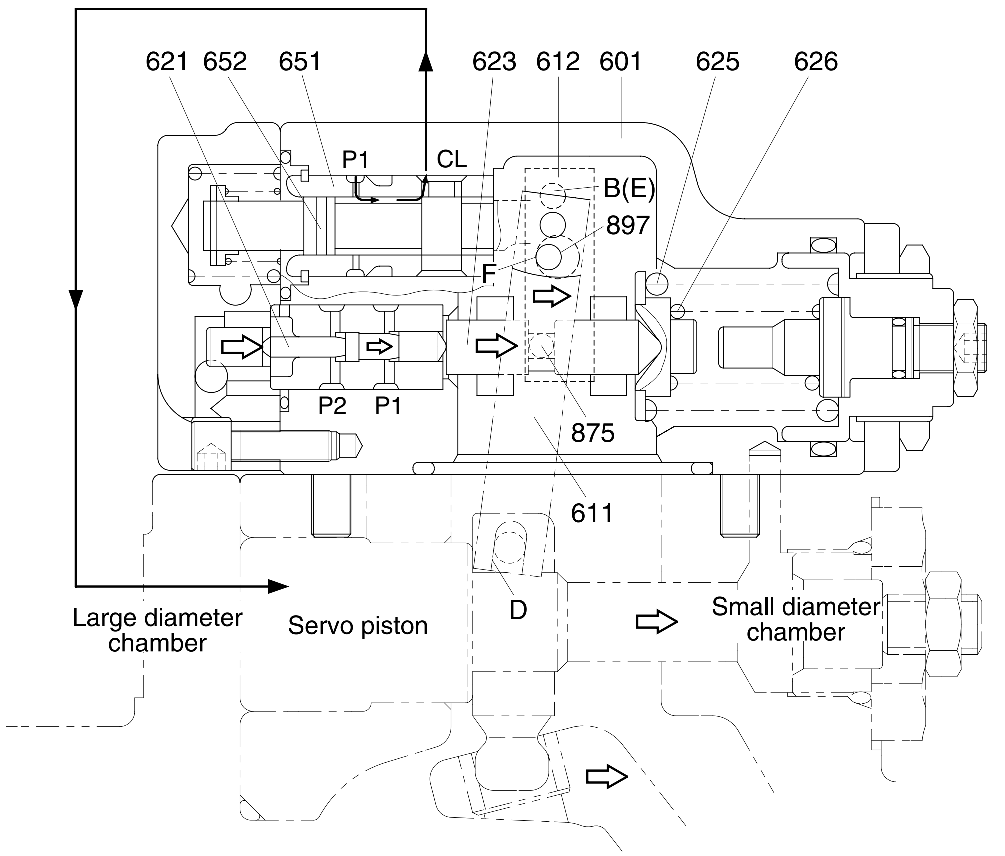
Speed	Adjustment of input horsepower		
	Tightening amount of adjusting stem (C) (627)	Flow change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(ℓ/min)	(kgf · m)
1900	+1/4	+3.2	+3.2



140Z92RG08



(3) Power shift control

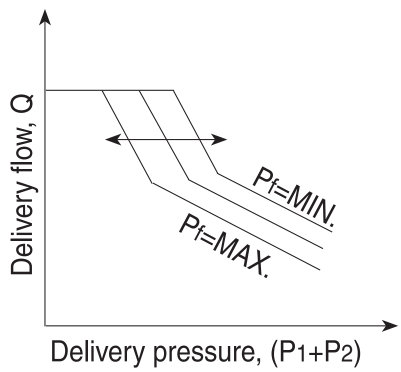


140Z92RG05

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).

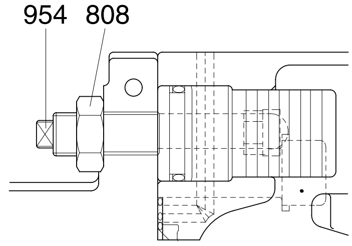
This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure Pf falls.

(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

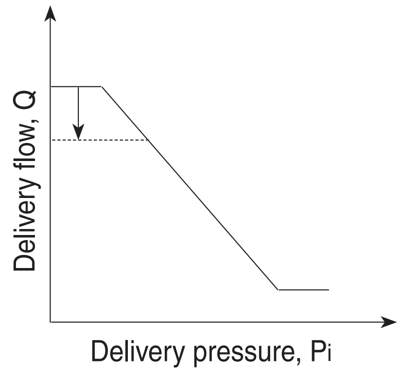
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the set screw (954).

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



140Z92MP23

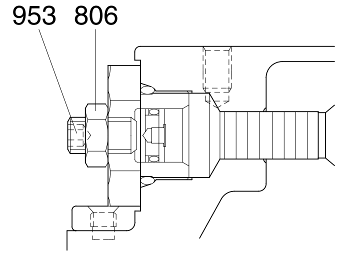
Speed	Adjustment of max flow	
	Tightening amount of adjusting screw (954)	Flow change amount
(min^{-1})	(Turn)	(ℓ/min)
1900	+1/4	-3.0



② Adjustment of minimum flow

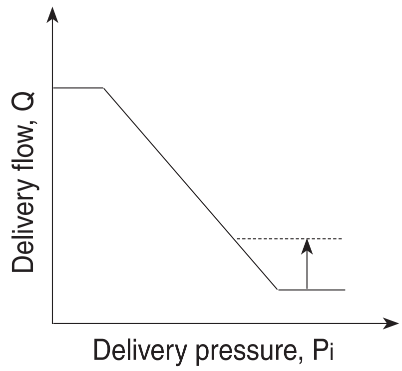
Adjust it by loosening the hexagon nut (806) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

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

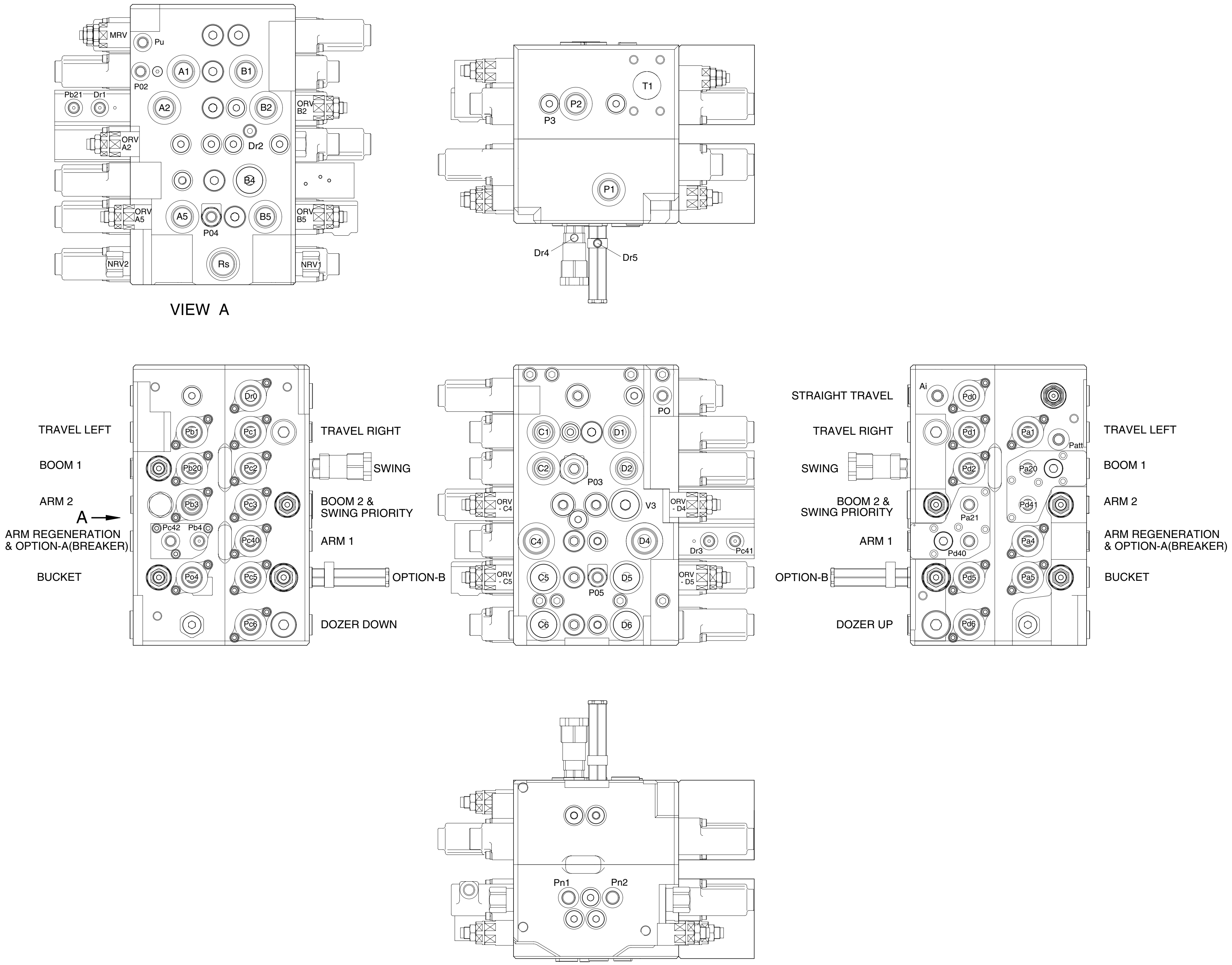


140Z92MP24

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

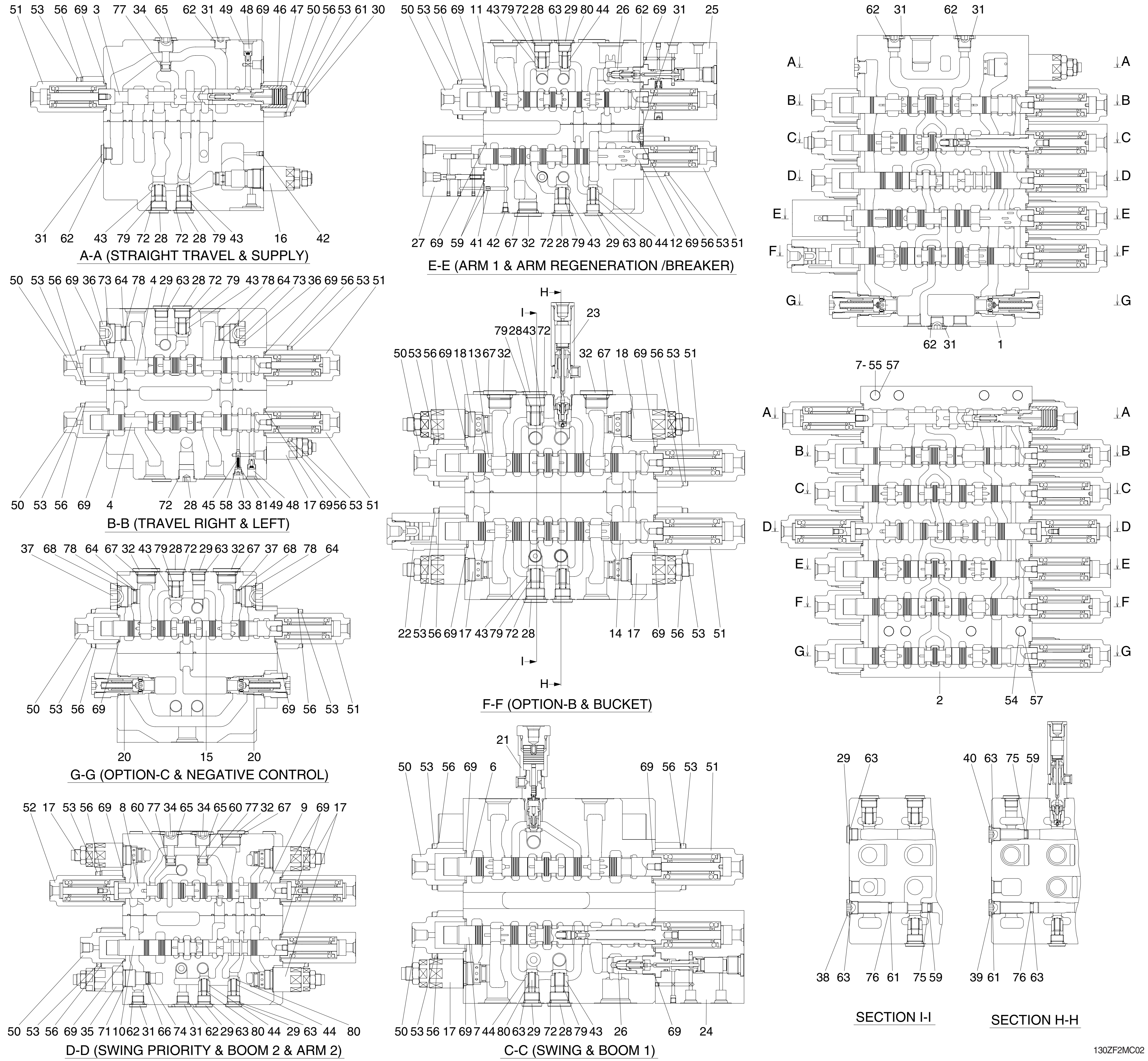


1. STRUCTURE



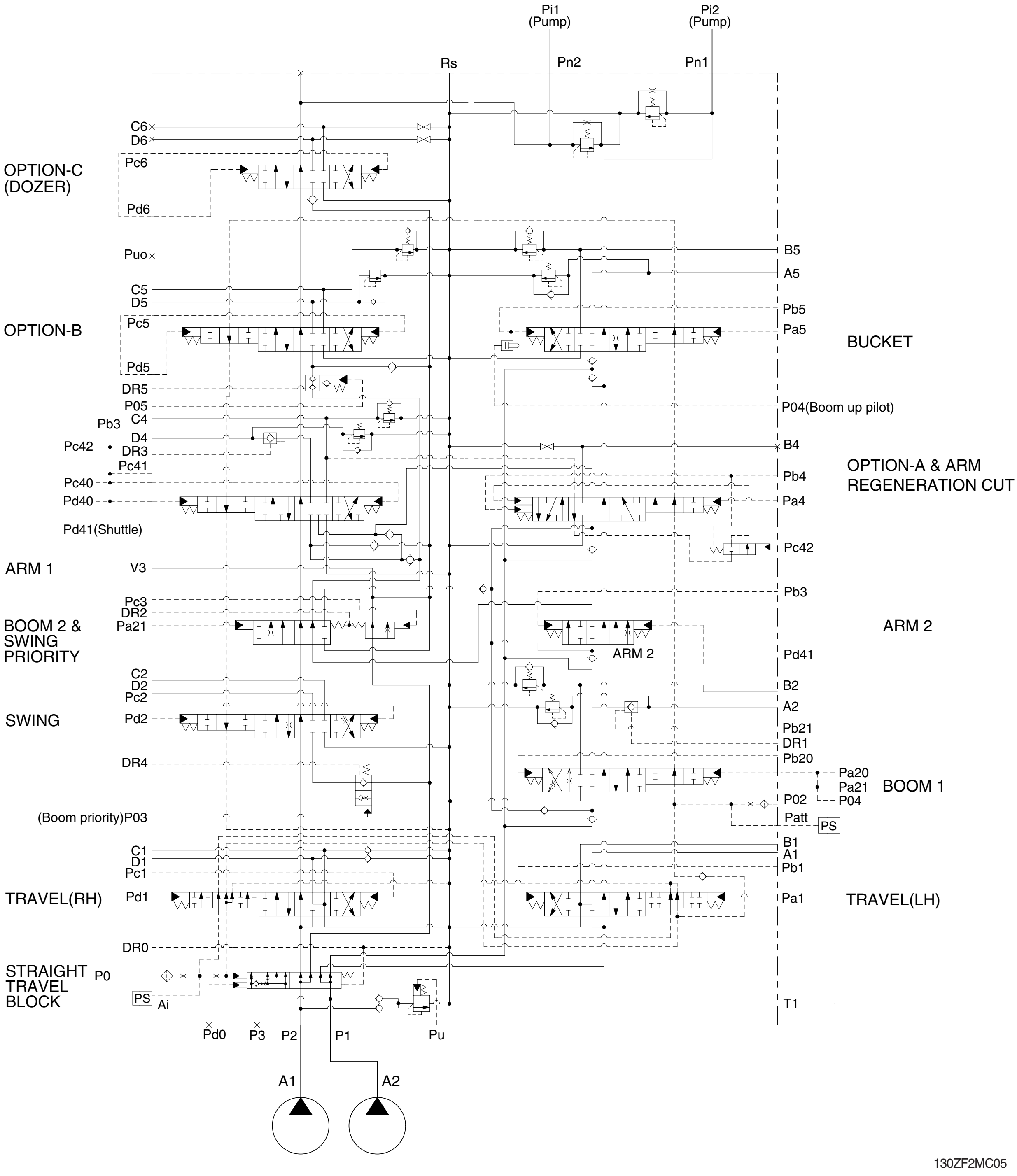
130ZF2MC01

Mark	Port name	Port size	Tightening torque
Rs	Make up for swing motor	UNF 1 3/16	18 kgf · m (130 lbf · ft)
Pa1	Travel left pilot port (BW)	PF 1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Pb1	Travel left pilot port (FW)		
Pc1	Travel right pilot port (FW)		
Pd1	Travel right pilot port (BW)		
Pa20	Boom up pilot port		
Pa21	Boom up confluence pilot port		
Pb20	Boom down pilot port		
Pb21	Lock valve pilot port (boom)		
Pc2	Swing pilot port (RH)		
Pd2	Swing pilot port (LH)		
Pb3	Arm in confluence pilot port		
Pc3	Swing priority pilot port		
Pa4	Option A pilot port (breaker)		
Pb4	Arm in regeneration cut port		
Pc40	Arm in pilot port		
Pc41	Lock valve pilot port (arm)		
Pc42	Arm in regen-cut signal selector port		
Pd40	Arm out pilot port		
Pd41	Arm out confluence pilot port		
Pa5	Bucket in pilot port		
Pb5	Bucket out pilot port		
Pc5	Option B pilot port		
Pd5	Option B pilot port		
Pc6	Option C pilot port (dozer blade down)		
Pd0	Travel straight pilot port		
Pd6	Option C pilot port (dozer blade up)		
P0	Pilot pressure port		
Pu	Main relief pressure up pilot port		
Ai	Auto idle signal port		
Patt	Auto idle signal-attachment		
P02	Pilot signal port		
P03	Boom priority pilot port		
P04	Boom stroke limit port		
P05	Breaker summation pilot port		
Puo	Pilot pressure port (not used)		
Dr0	Drain port (travel straight)		
Dr1	Drain port (boom holding valve)		
Dr2	Drain port (boom 2 & swing priority)		
Dr3	Drain port (arm holding valve)		
P3	Quick clamp port	PF 3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
Pn1	Negative control signal port (P1 port side)		
Pn2	Negative control signal port (P2 port side)		
A1	Travel motor left side port (BW)	PF 3/4	15~18 kgf · m (109~130 lbf · ft)
B1	Travel motor left side port (FW)		
C1	Travel motor right side port (FW)		
D1	Travel motor right side port (BW)		
B2	Boom rod side port		
C2	Swing motor port (RH)		
D2	Swing motor port (LH)		
B4	Option A port (breaker)		
A5	Bucket head side port		
B5	Bucket rod side port		
C5	Option B port		
D5	Option B port		
C6	Option C pilot port (dozer down port)		
D6	Option C pilot port (dozer up port)		
P1	Pump port (P1 side)		
P2	Pump port (P2 side)		
A2	Boom head side port	PF 1	20~25 kgf · m (115~180 lbf · ft)
C4	Arm head side port		
D4	Arm rod side port		
Dr4	Drain port (swing logic valve)	PF 1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
Dr5	Drain port (flow summation)		
T1	Return port	SAE3000, 1 1/2 (M12×1.75)	8.5~11.5 kgf · m (61.5~83.1 lbf · ft)



1	Housing-P1	43	Load check-poppet
2	Housing-P2	44	Load check-poppet
3	Spool-straight travel	45	Signal-poppet
4	Spool-travel (LH, RH)	46	Travel straight-sleeve
6	Spool-swing	47	Travel straight-piston
7	Spool-boom 1	48	Orifice signal
8	Spool-swing priority	49	Coin type filter
9	Spool-boom 2	50	Pilot cap
10	Spool-arm 2	51	Pilot cap
11	Spool-arm 1	52	Pilot cap
12	Spool-arm regeneration	53	Socket bolt
13	Spool-option B	54	Socket bolt
14	Spool-bucket	55	Socket bolt
15	Spool-option C (dozer)	56	Washer
16	Main relief valve	57	Spring washer
17	Overload relief valve	58	O-ring
18	Overload relief valve	59	O-ring
20	Negacon relief valve	60	O-ring
21	Swing logic valve	61	O-ring
22	Bucket logic valve	62	O-ring
23	Option on-off valve	63	O-ring
24	Holding valve kit A1	64	O-ring
25	Holding valve kit A2	65	O-ring
26	Holding valve kit B	66	O-ring
27	Regeneration block	67	O-ring
28	Plug	68	O-ring
29	Plug	69	O-ring
30	Plug	70	O-ring
31	Plug	71	O-ring
32	Plug	72	O-ring
33	Plug	73	O-ring
34	Plug-parallel	74	Backup-ring
35	Plug-relief cat	75	Backup-ring
36	Plug-relief cat	76	Backup-ring
37	Plug-relief cat	77	Backup-ring
38	Plug-bucket	78	Backup-ring
39	Plug-bucket parallel	79	Load check spring
40	Plug-option	80	Load check spring
41	Plug-orifice	81	Poppet signal spring
42	Plug	82	Pin

2. HYDRAULIC CIRCUIT



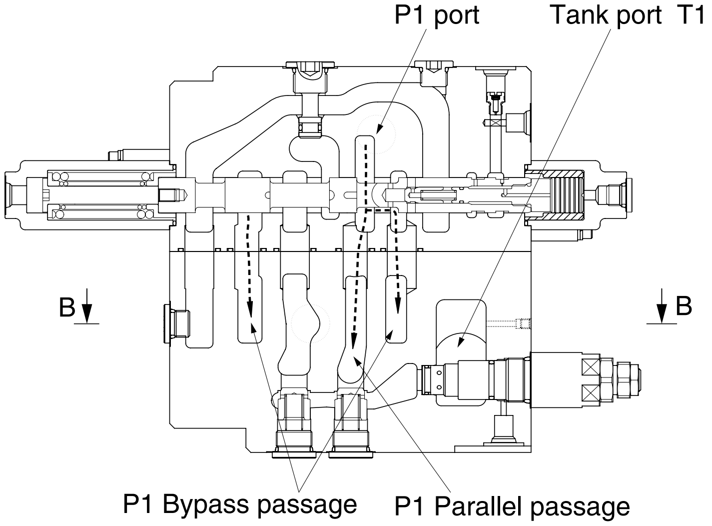
3. FUNCTION

1) CONTROL IN NEUTRAL

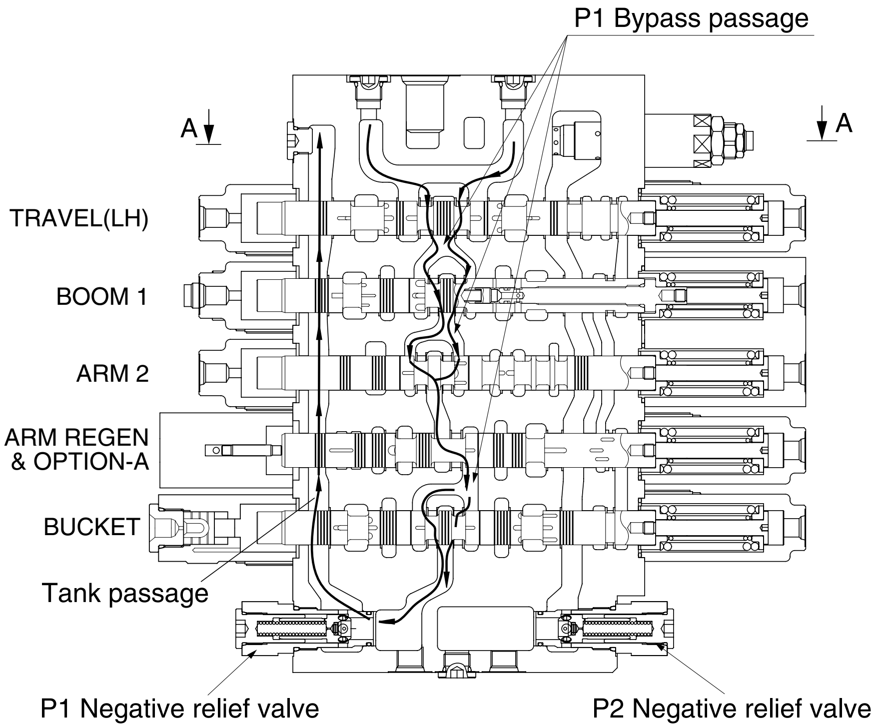
(1) P1 SIDE

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



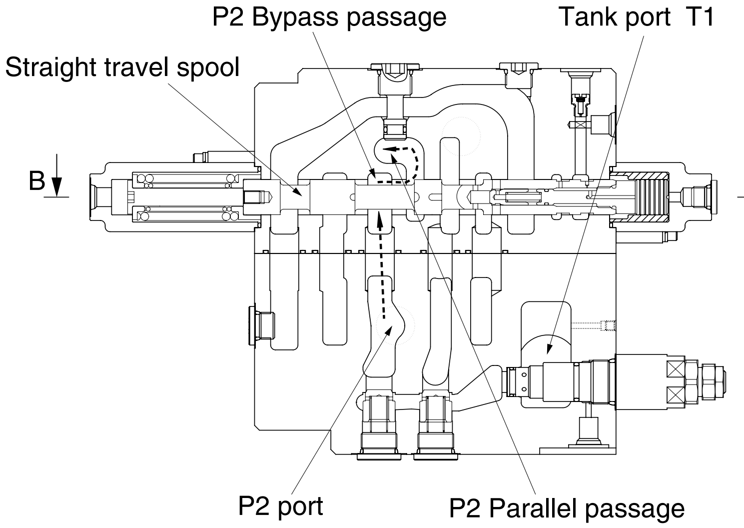
SECTION B-B

125LCR2MC11

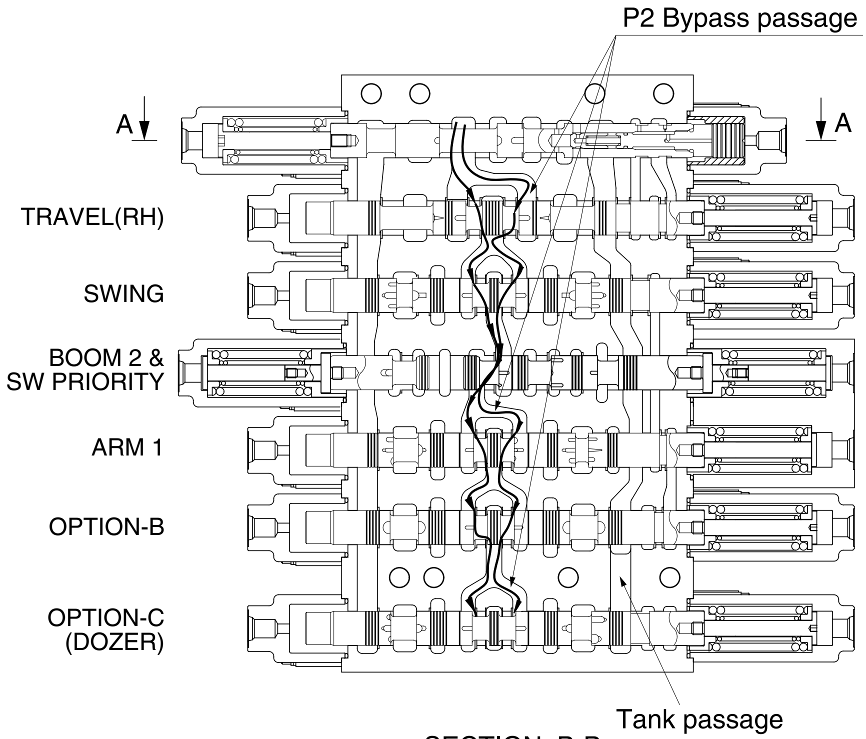
(2) P2 SIDE

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

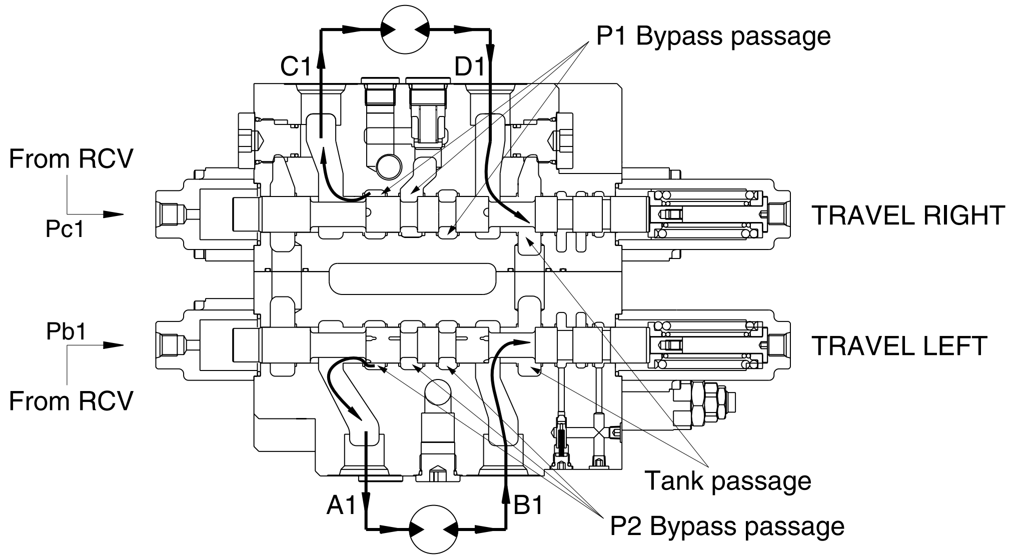


SECTION B-B

14092MC12

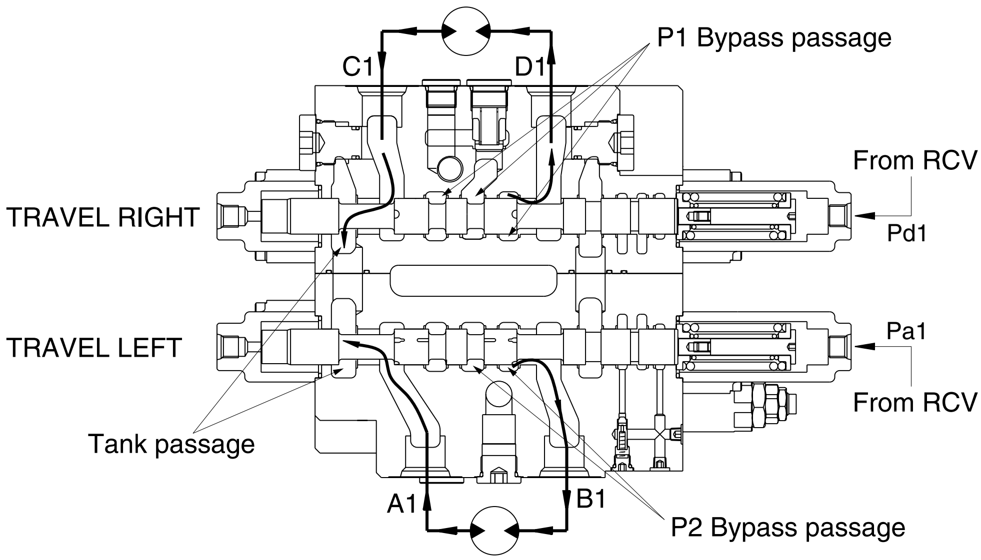
2) TRAVEL OPERATION

(1) TRAVEL FORWARD OPERATION



14092MC18

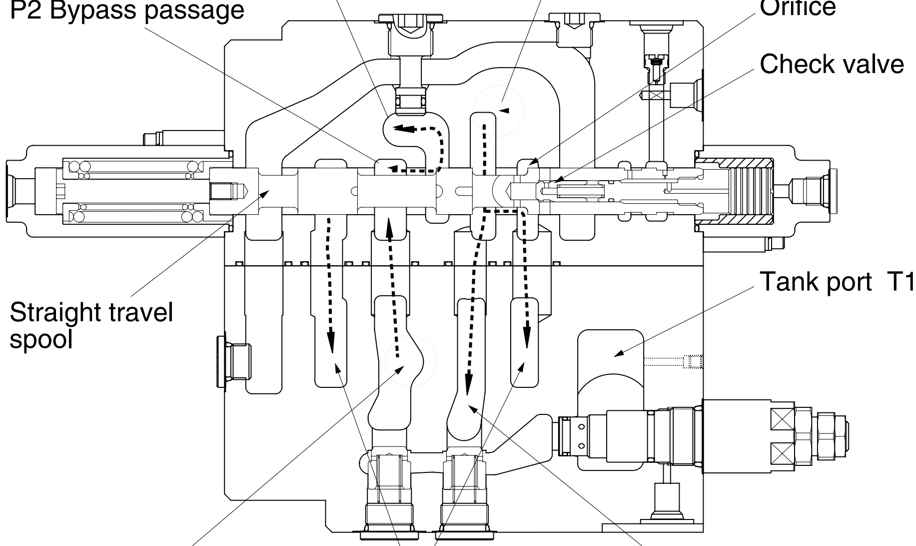
(2) TRAVEL BACKWARD OPERATION



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.

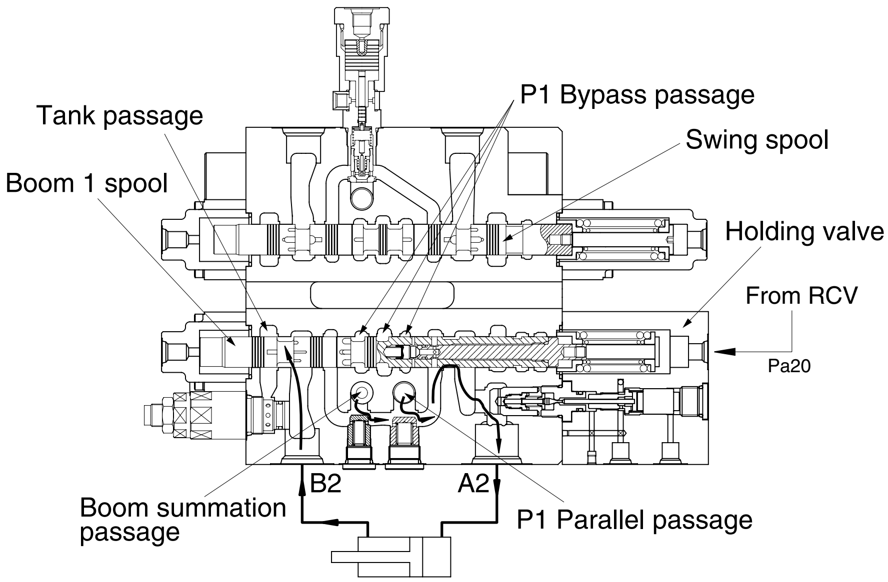
3) BOOM OPERATION

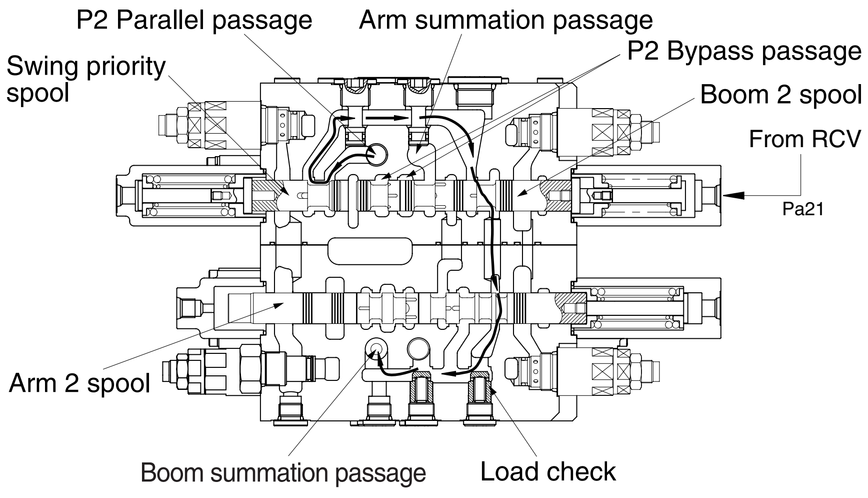
(1) BOOM UP OPERATION

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.





125LCR2MC24

(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.

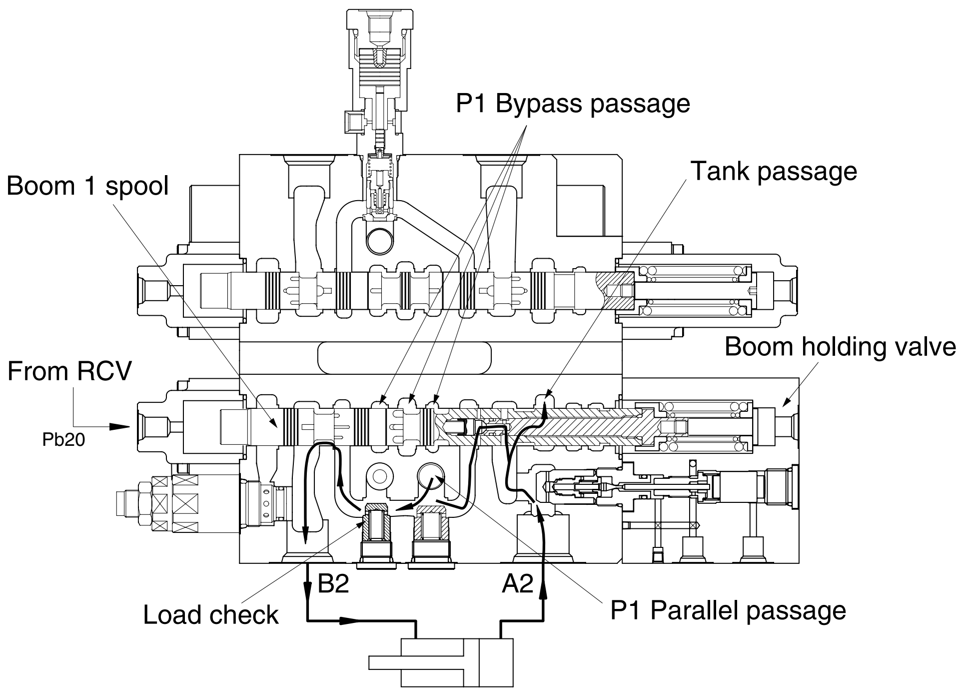
The bypass passage is shut off by the movement of the boom 1 spool and the hydraulic fluid from the pump A2 enters the parallel passage and is directed to the port B2 through the load check. Following this, it flows into the rod side of the boom cylinder.

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.

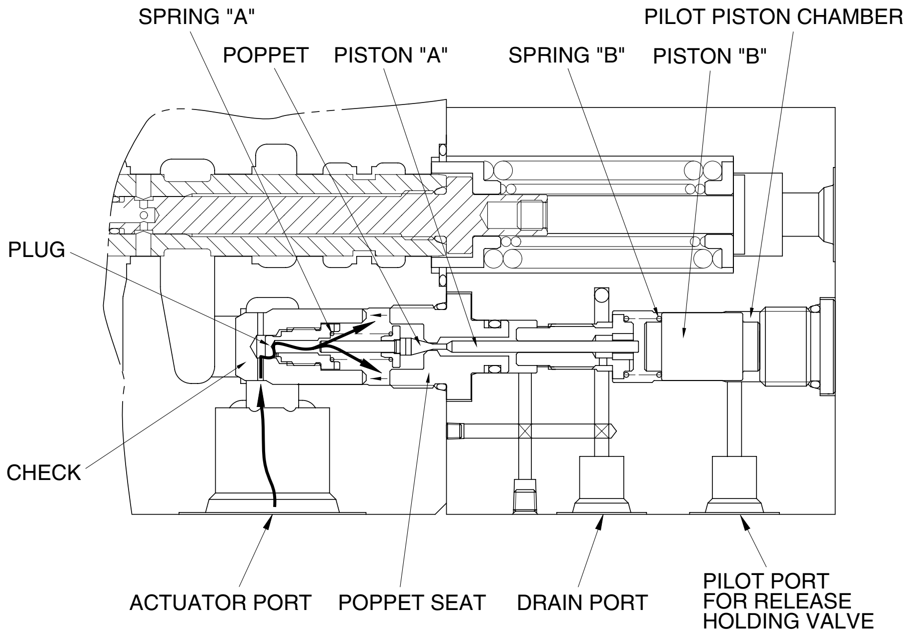


125LCR2MC26

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.



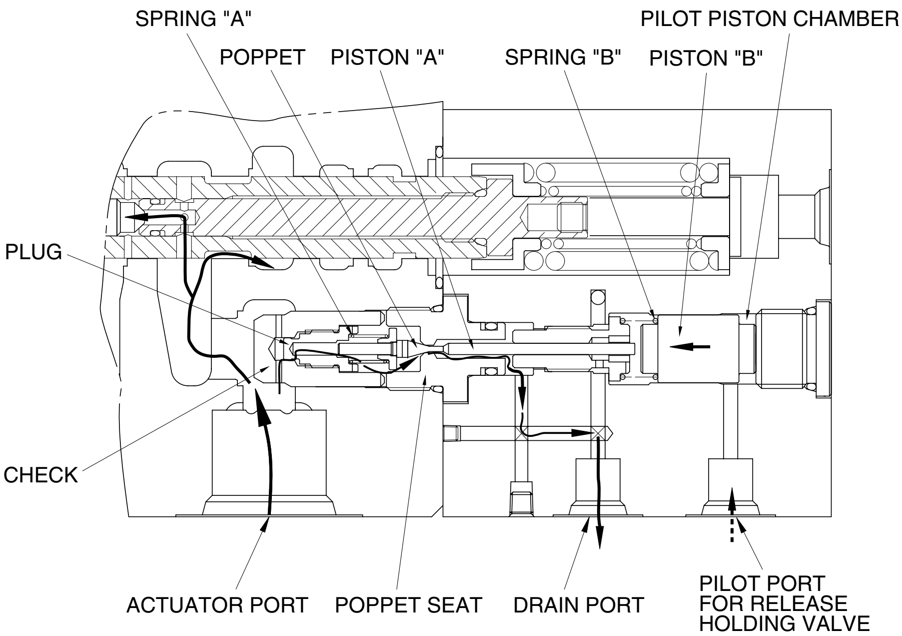
125LCR2MC15

(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.



125LCR2MC16

5) BUCKET OPERATION

(1) BUCKET IN OPERATION

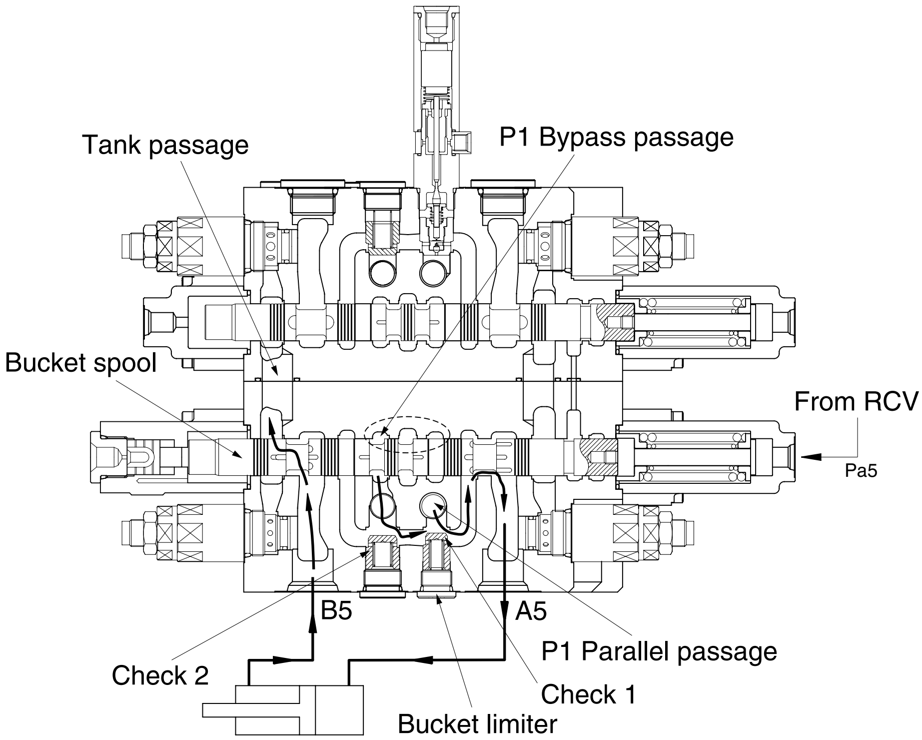
During the bucket in operation, the pilot secondary pressure from RCV is supplied to port Pa5 of the spring side and shifts the bucket spool in the left direction.

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.



130ZF2MC34

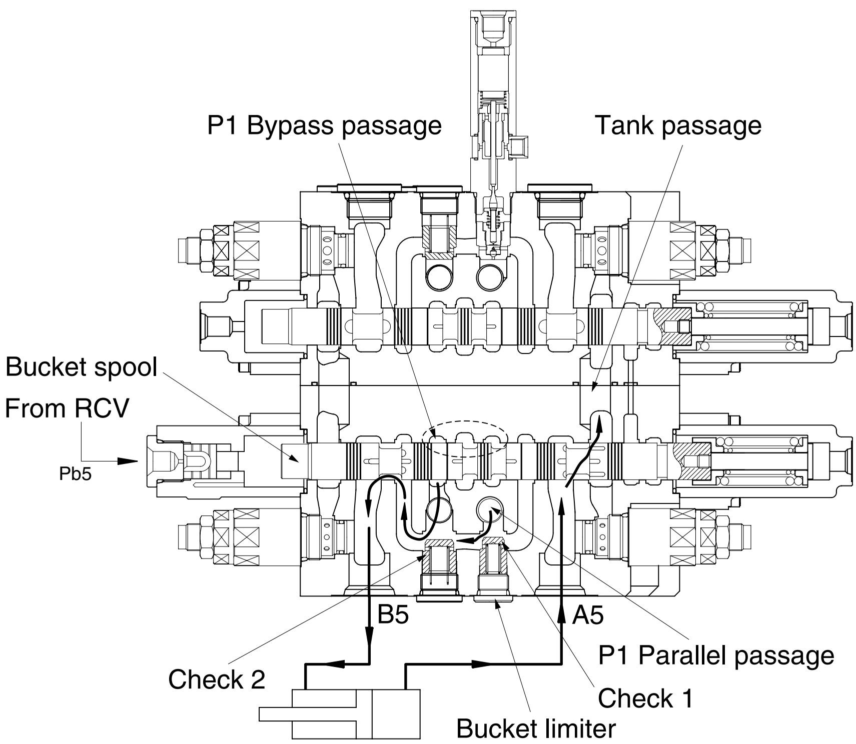
(2) BUCKET OUT OPERATION

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.

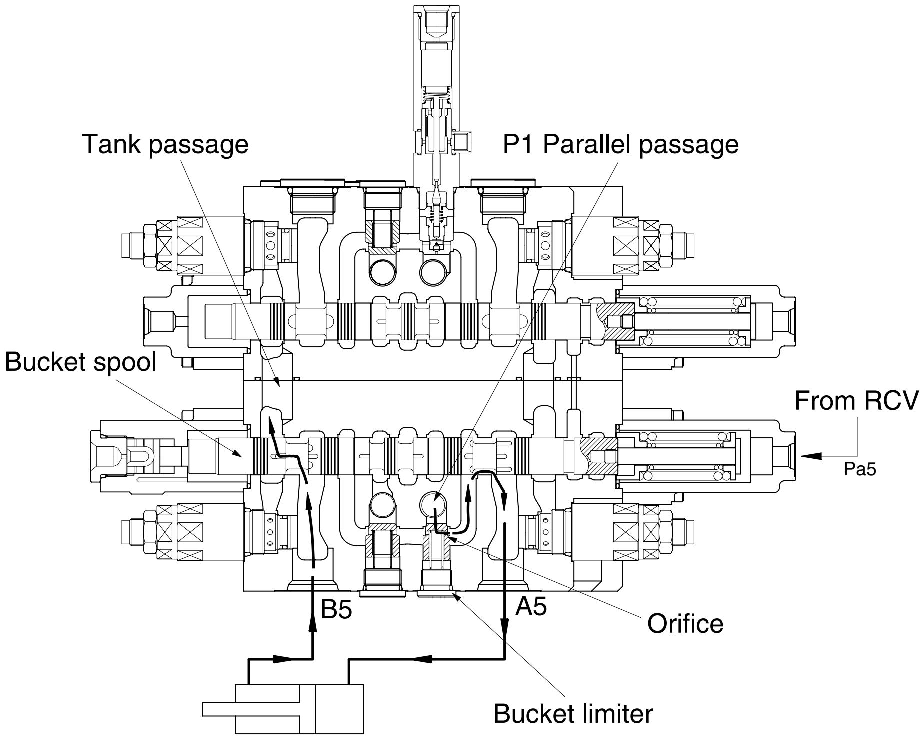


130ZF2MC35

(3) BUCKET IN OPERATION WITH BOOM 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 orifice of bucket 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.



130ZF2MC29

6) SWING OPERATION

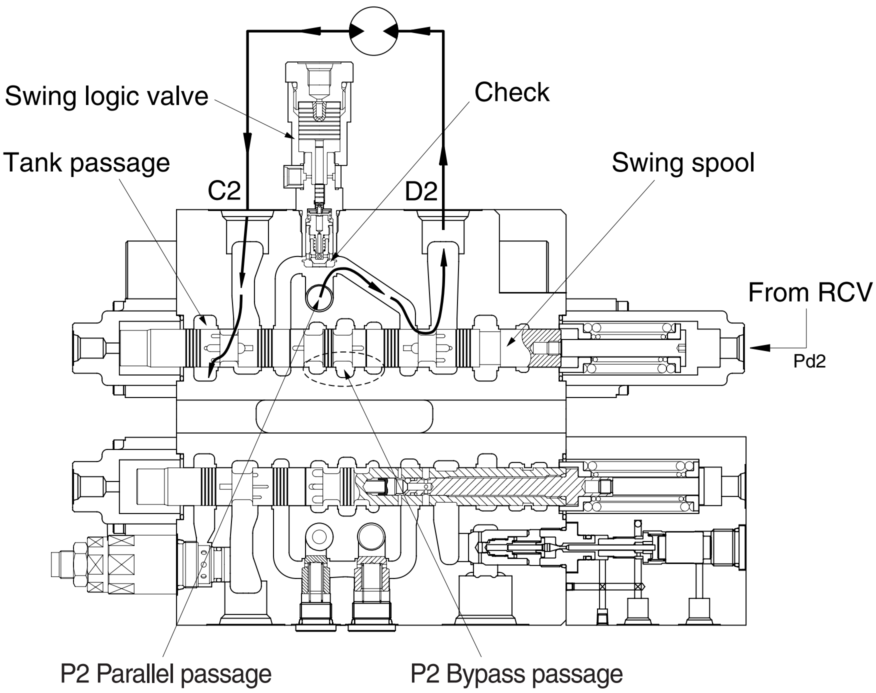
(1) SWING LEFT & RIGHT OPERATION

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.

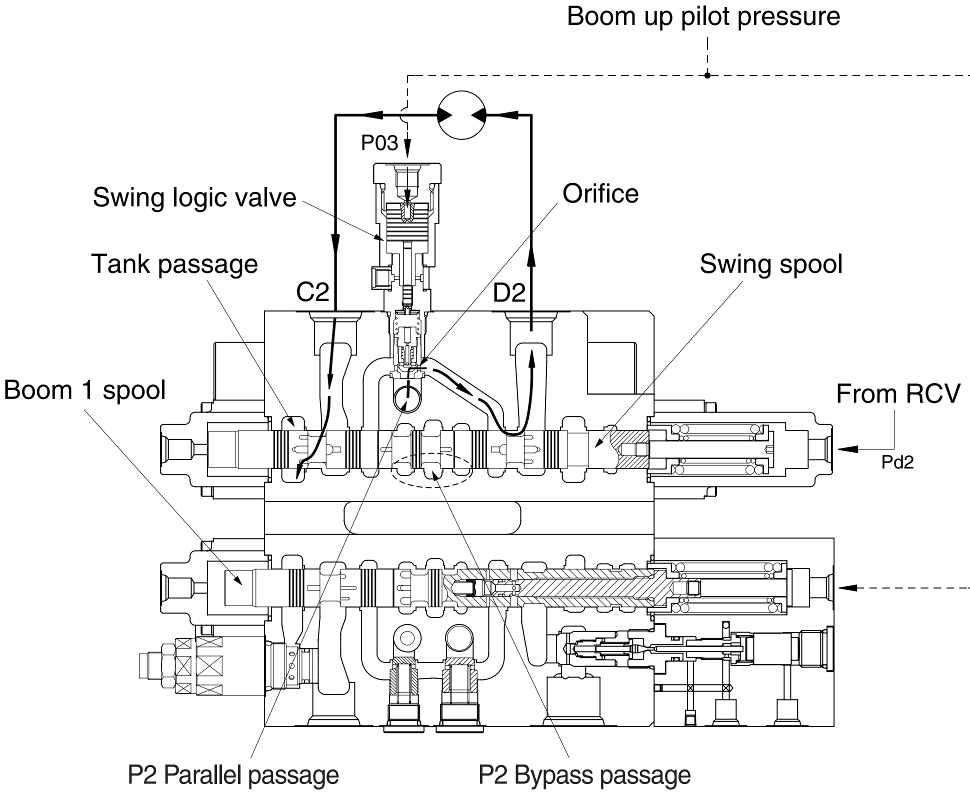


125LCR2MC32

(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.



125LCR2MC20

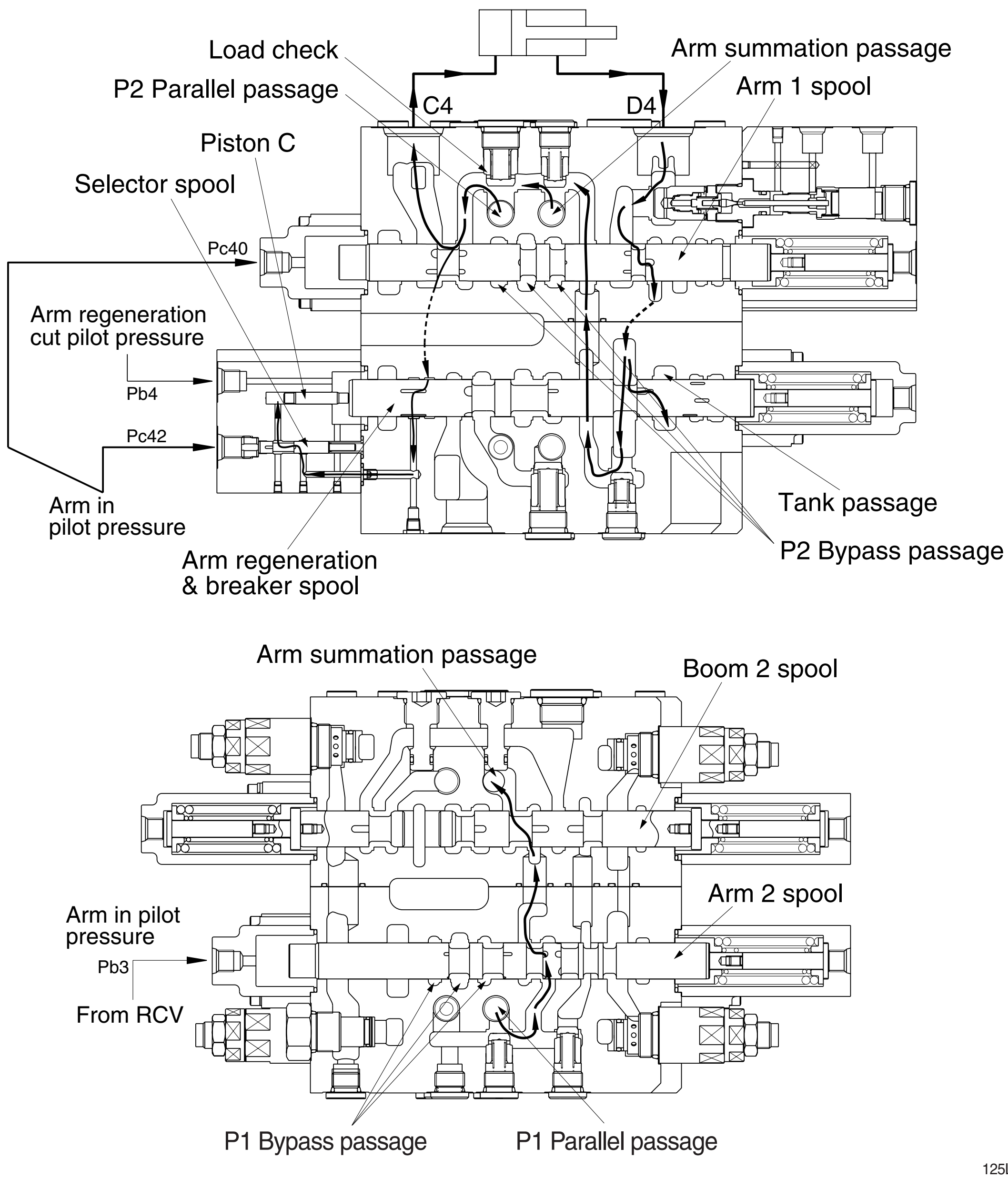
7) ARM OPERATION

(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.



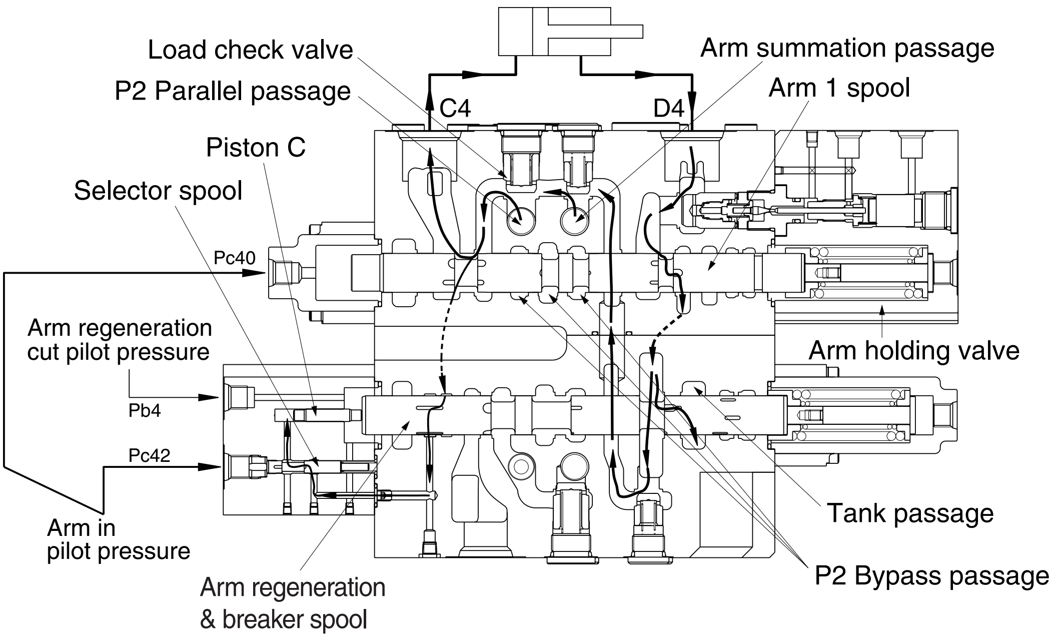
125LCR2MC21

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)



125LCR2MC22

(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.

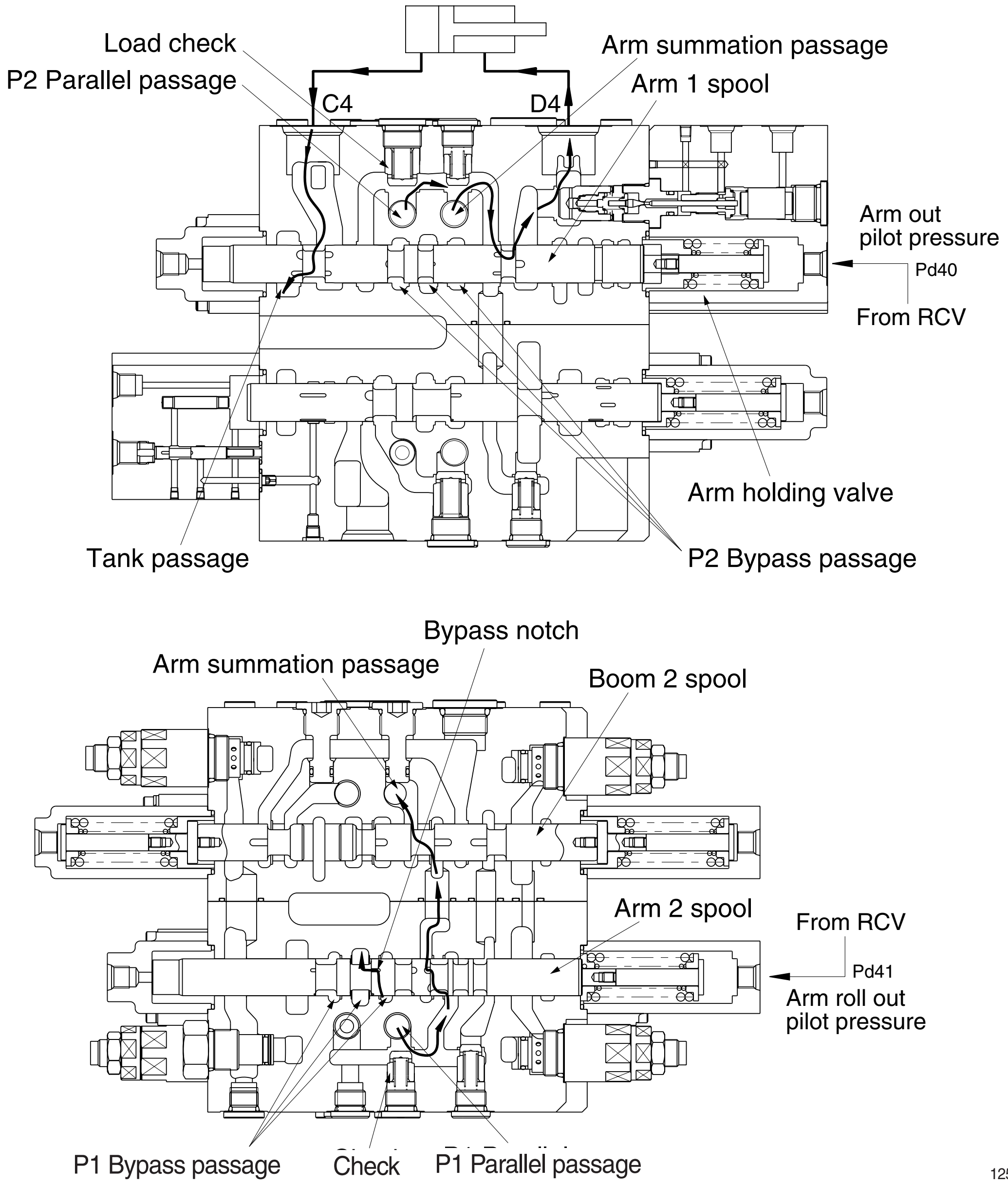
The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic fluid from pump A1 flows into arm 1 spool through the P2 parallel passage. Then it enters into the arm cylinder rod side through the load check, bridge passage, arm holding valve and the port D4.

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.



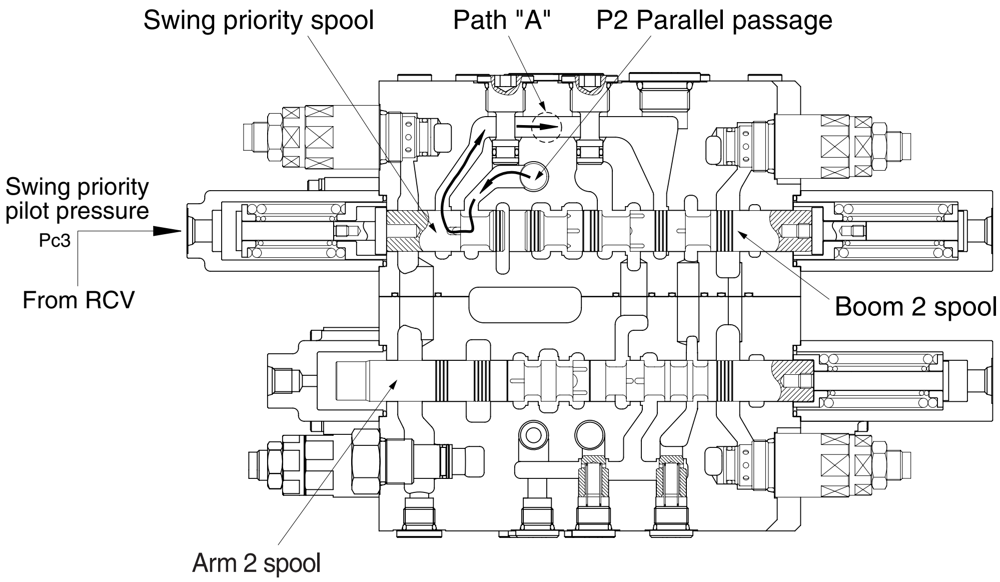
125LCR2MC23

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.

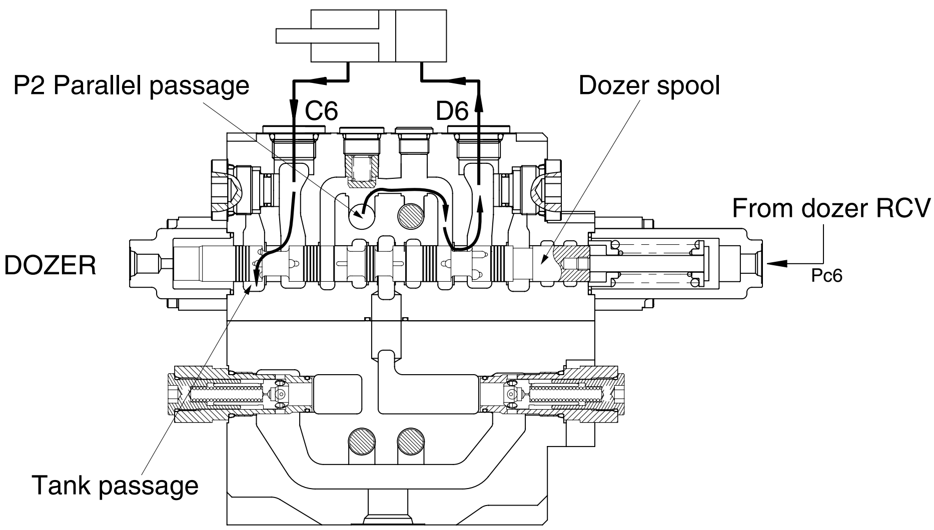
When the swing priority spool is neutral condition, the passage is same as normal condition. But due to shifting of the swing priority spool, the fluid from pump A1 flows to swing side more then the boom 2, arm 1, option B and dozer spools to make the swing operation most preferential.



14W92MC27

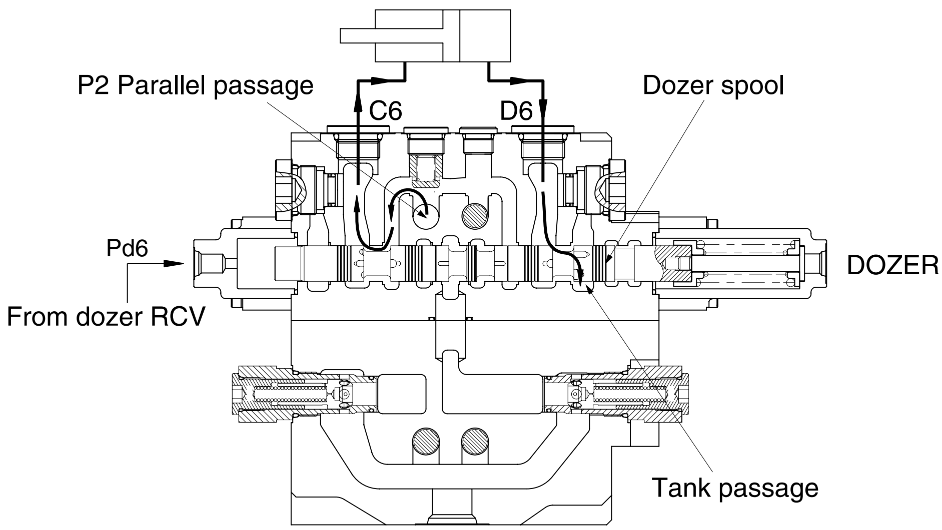
9) DOZER OPERATION

(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

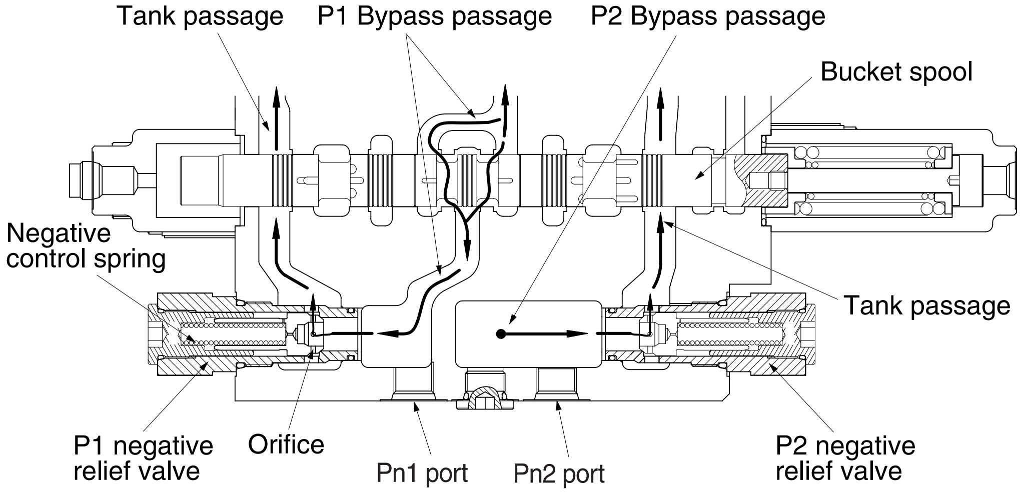
When no function is being actuated on P1 side, the hydraulic fluid from the pump A2, flows into the tank passage through the P1 bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump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

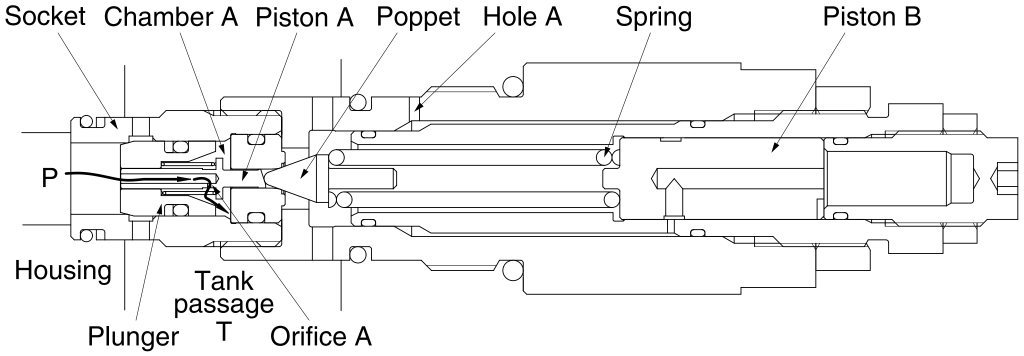
For the pump A1 the same negative control principle.



14W92MC28

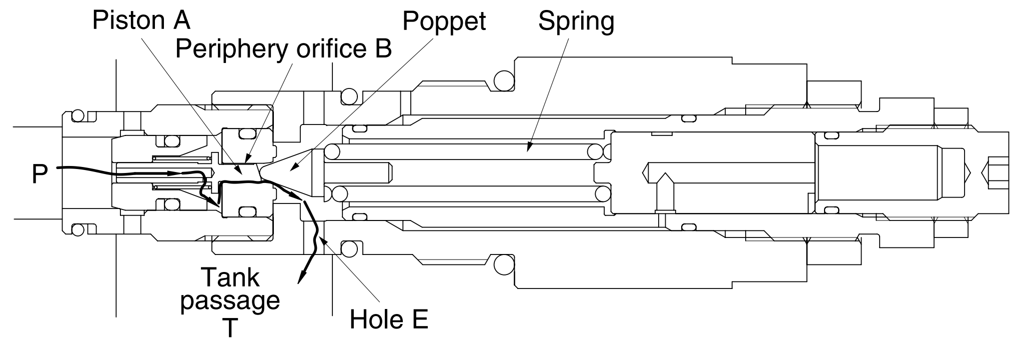
11) OPERATION OF MAIN RELIEF VALVE

(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.



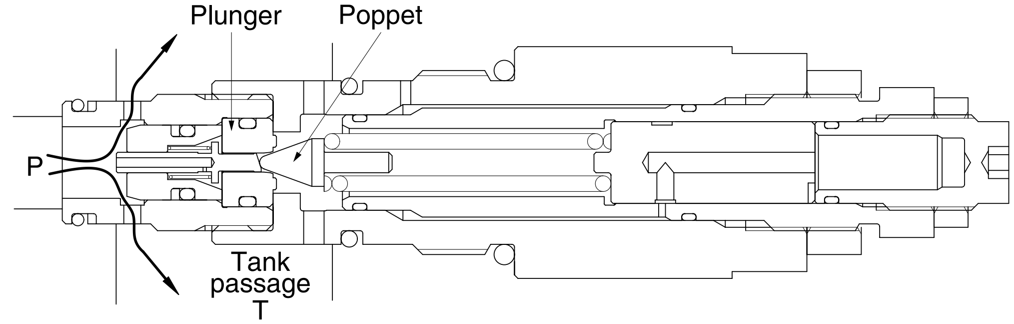
14W92MC36

(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).



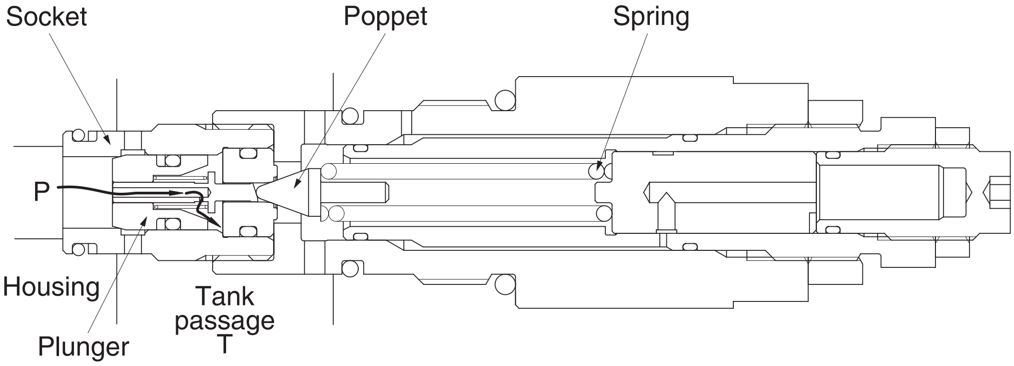
14W92MC37

(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).



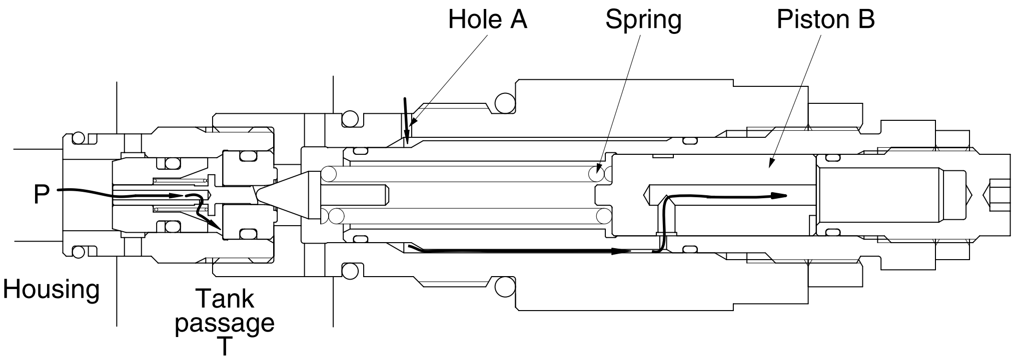
14W92MC38

(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.

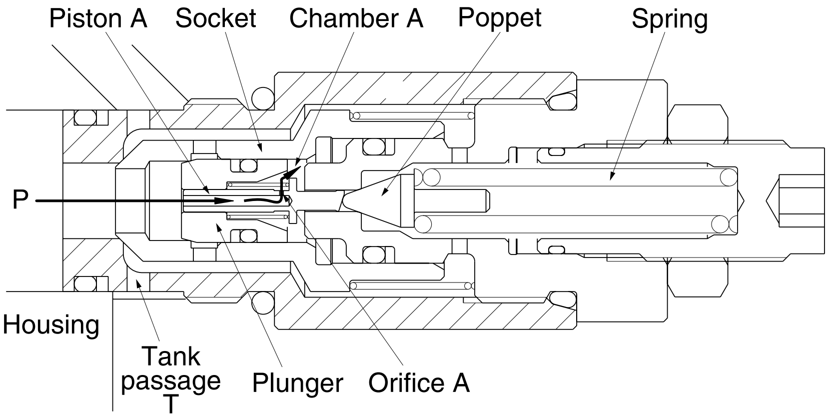


14W92MC40

12) OPERATION OF OVERLOAD RELIEF VALVE

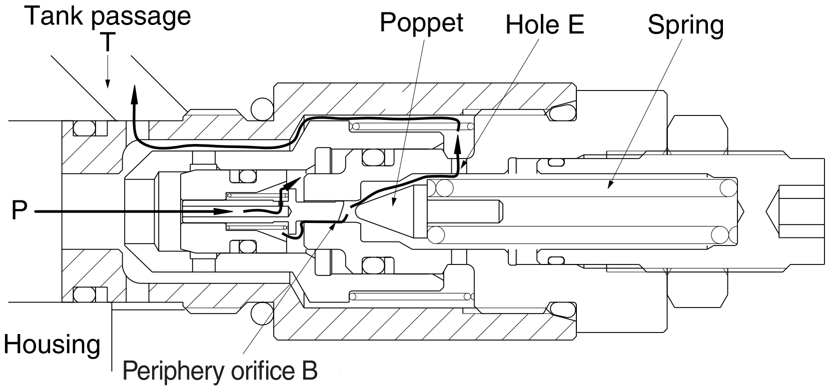
FUNCTION AS RELIEF VALVE

(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.



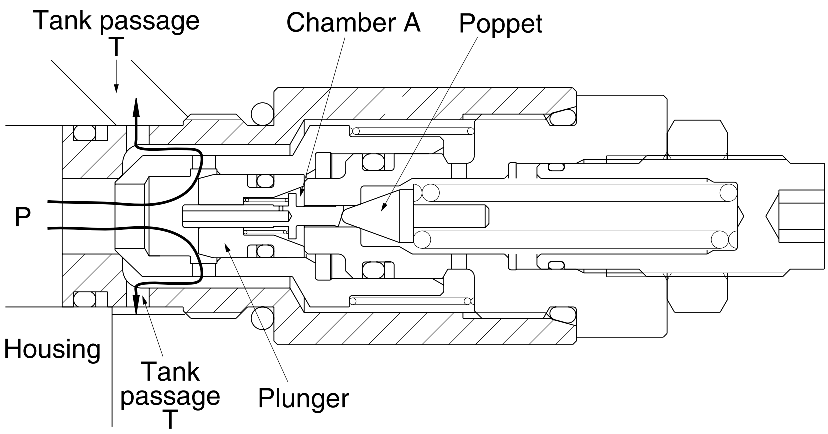
14W92MC41

(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.



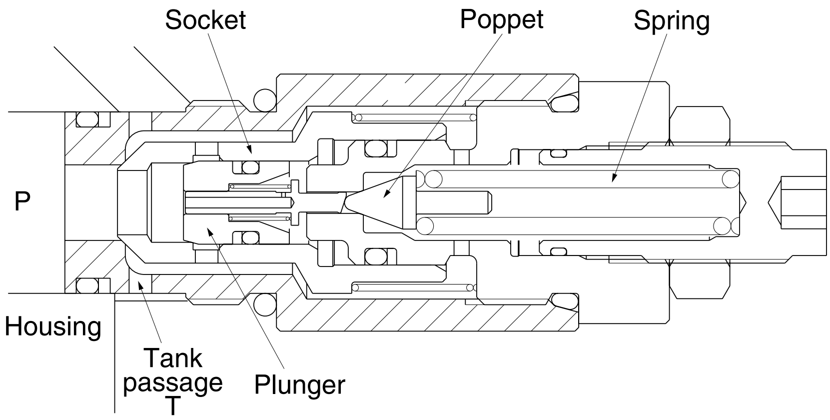
14W92MC42

(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

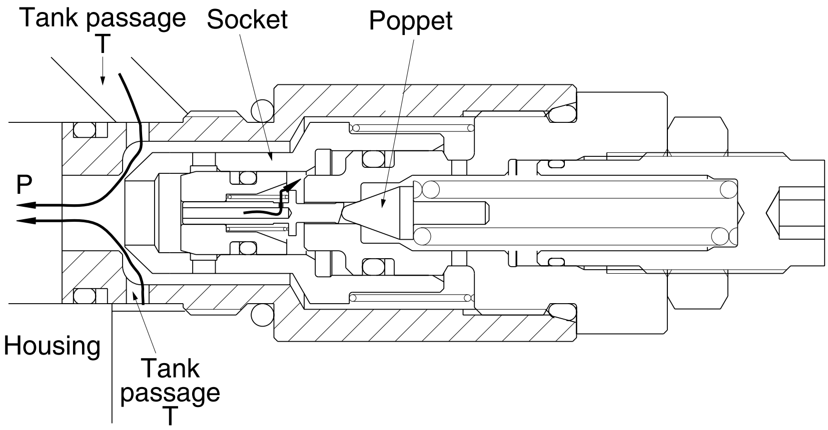
(4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



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.



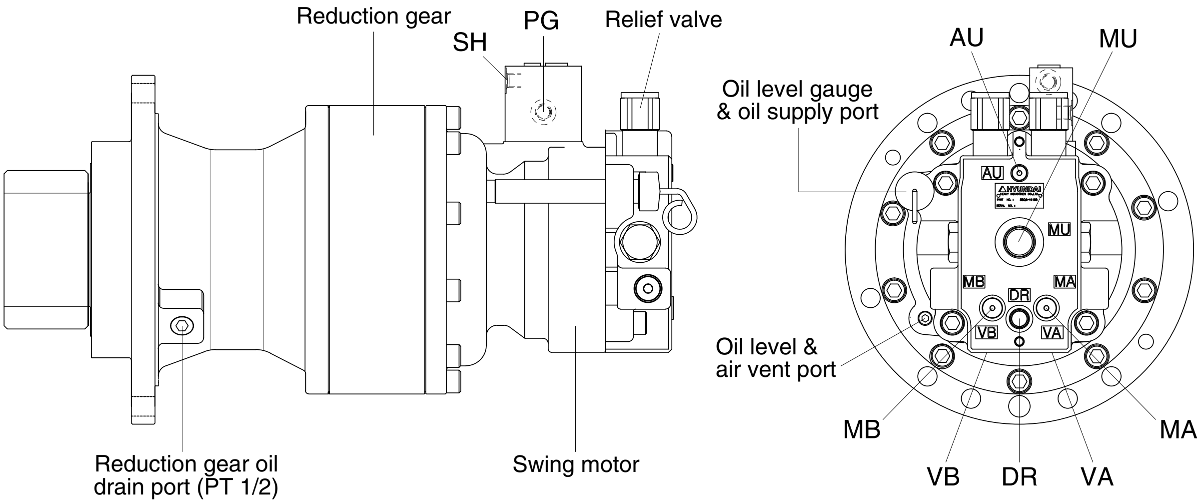
14W92MC45

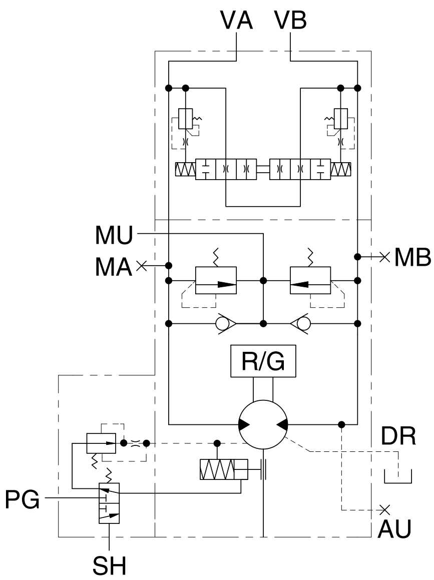
GROUP 3 SWING DEVICE

1. STRUCTURE (TYPE 1)

Swing device consists swing motor, swing reduction gear.

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



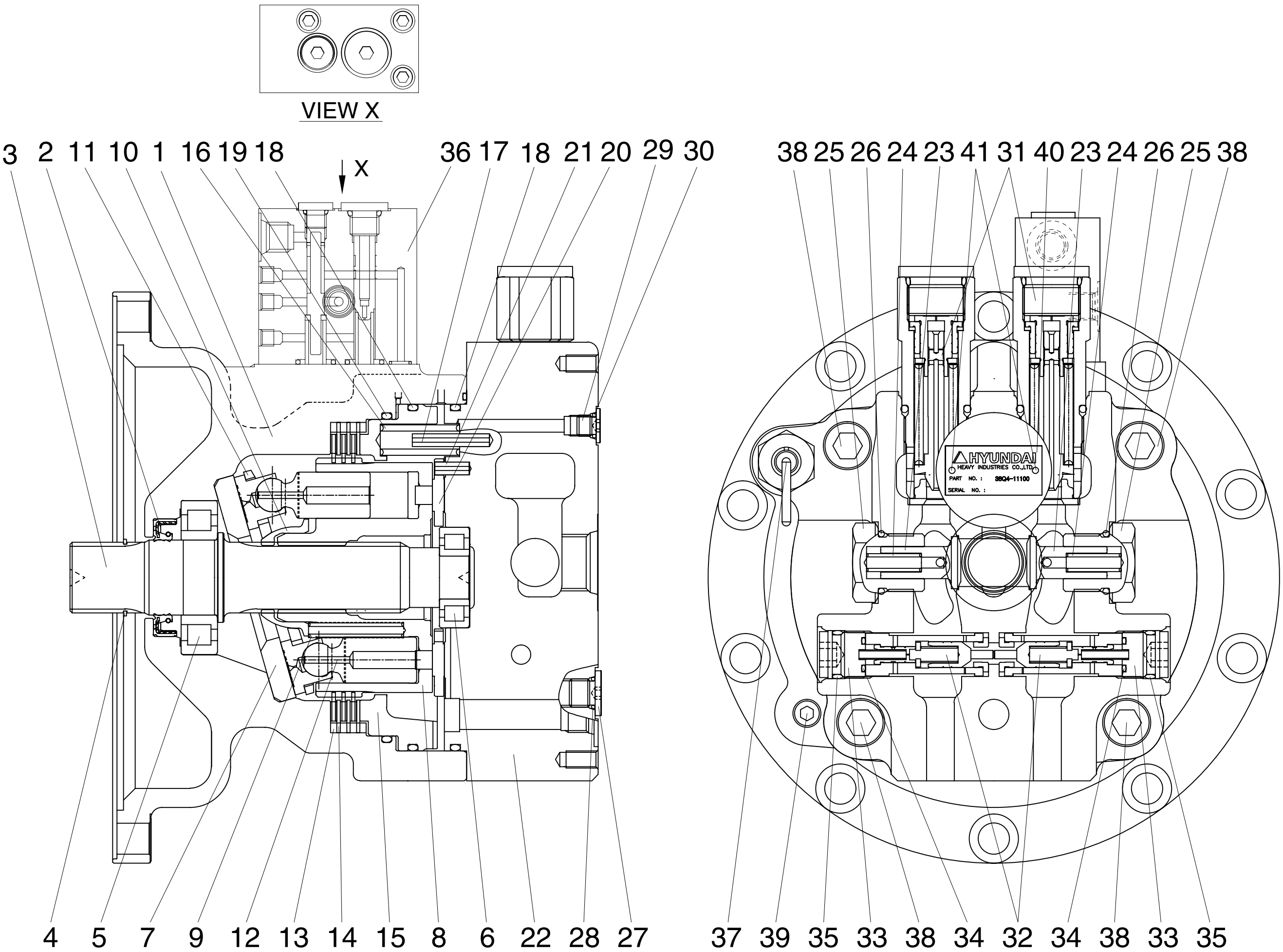


Hydraulic circuit

Port	Port name	Port size
VA	Main port	Ø13
VB	Main port	Ø13
DR	Drain port	PF 3/8
MU	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
MA, MB	Gauge port	PF 1/4
AU	Air vent port	PF 1/8

130ZF2SM21

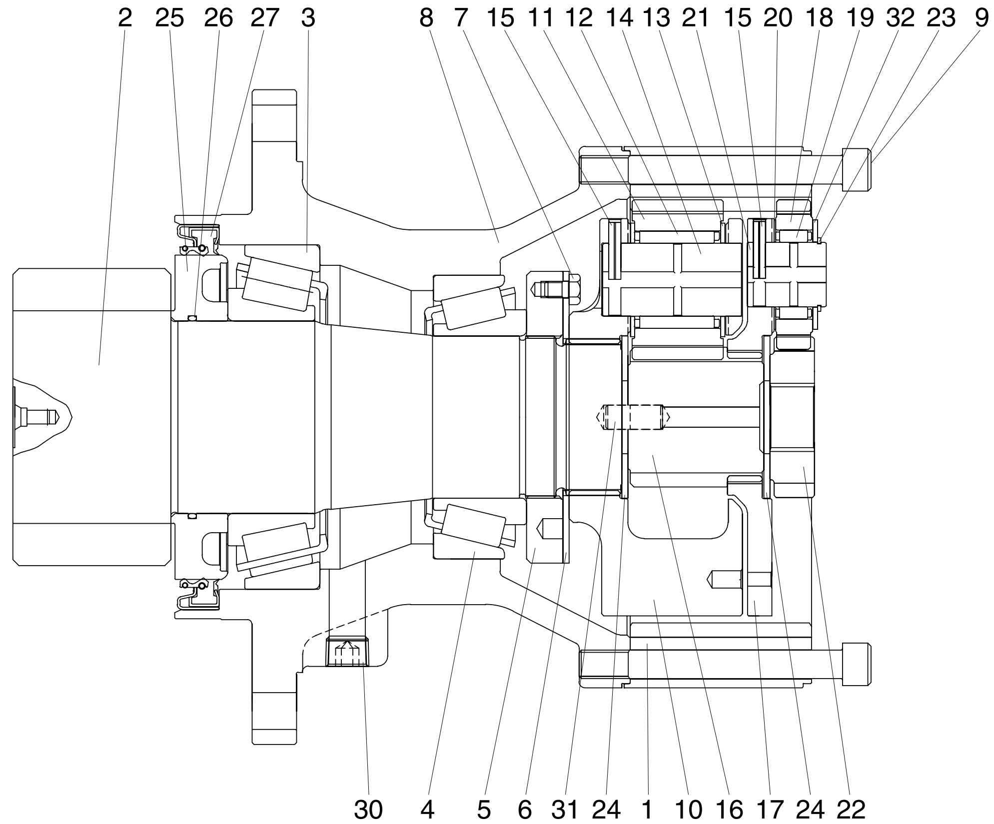
1) SWING MOTOR



130ZF2SM22

1	Casing	15	Parking piston	29	Plug
2	Oil seal	16	Spring	30	O-ring
3	Shaft	17	Spring pin	31	Relief valve assy
4	Snap ring	18	O-ring	32	Anti-rotating valve assy
5	Roller bearing	19	O-ring	33	Plug
6	Roller bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	O-ring
8	Cylinder block	22	Valve casing	36	Time delay valve assy
9	Spring	23	Check valve	37	Level gauge assy
10	Ball guide	24	Spring	38	Socket bolt
11	Retainer plate	25	Plug	39	Plug
12	Piston assy	26	O-ring	40	Name plate
13	Friction plate	27	Plug	41	Rivet
14	Separate plate	28	O-ring		

2) REDUCTION GEAR

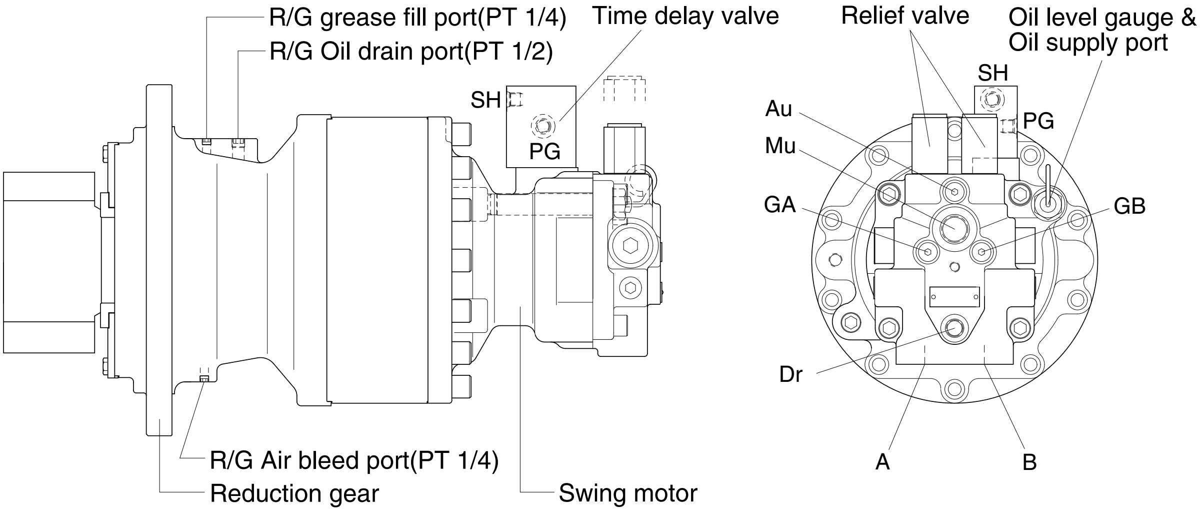


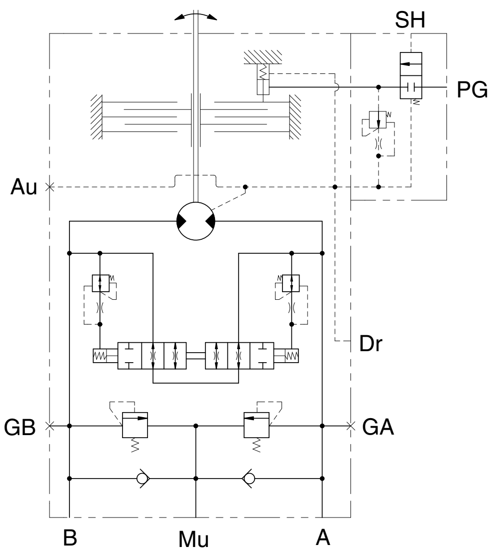
1	Ring gear	11	Planetary gear No. 2	21	Carrier pin No. 1
2	Drive shaft	12	Needle bearing No. 2	22	Sun gear No. 1
3	Taper roller bearing	13	Thrust washer No. 2	23	Snap ring
4	Taper roller bearing	14	Carrier pin No. 2	24	Thrust plate
5	Ring nut	15	Spring pin	25	Sleeve
6	Lock plate	16	Sun gear No. 2	26	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 No. 1	31	Parallel pin
10	Carrier No. 2	20	Thrust washer No. 1	32	Thrust washer No. 1

STRUCTURE (TYPE 2)

Swing device consists swing motor, swing reduction gear.

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



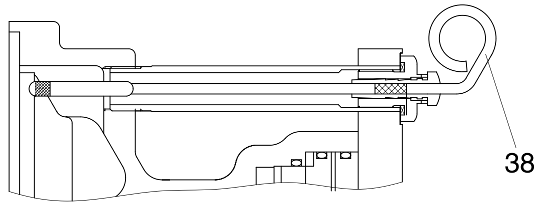


Hydraulic circuit

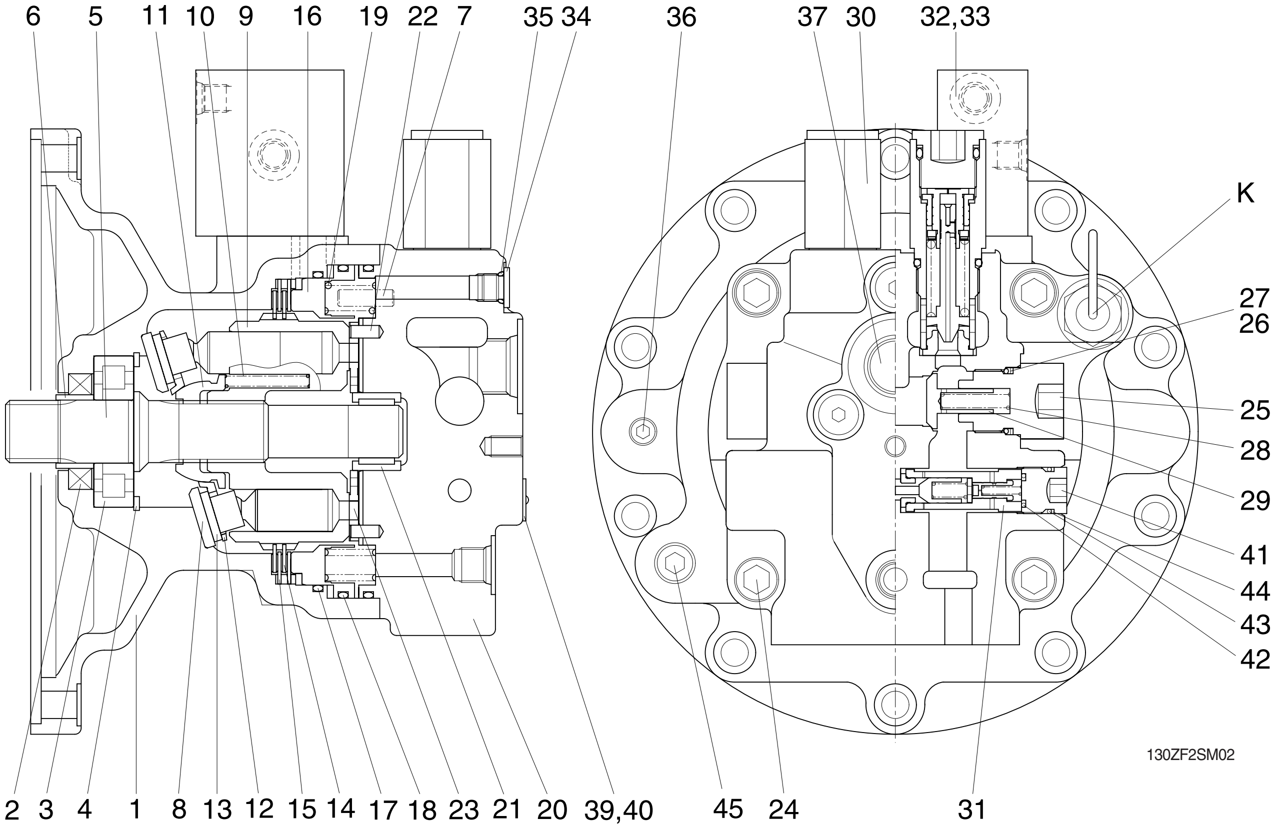
Port	Port name	Port size
A	Main port	Ø13
B	Main port	Ø13
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
GA, GB	Gauge port	PF 1/4
Au	Air vent port	PF 1/4

130ZF2SM01

1) SWING MOTOR

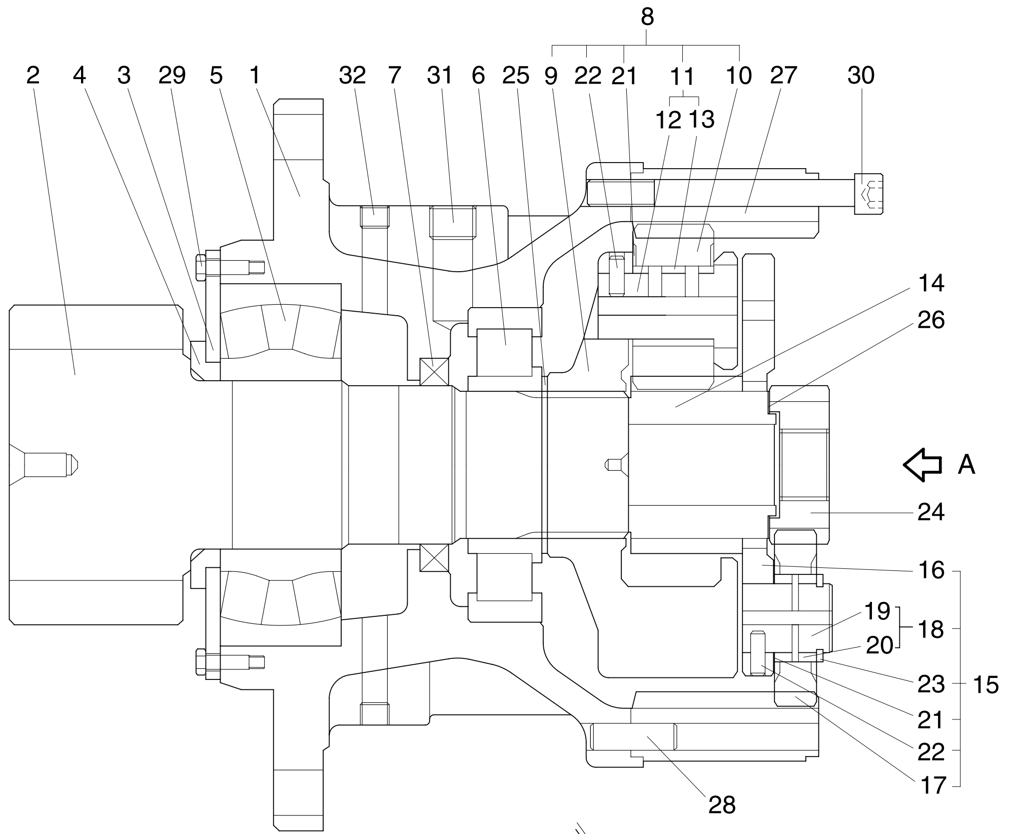


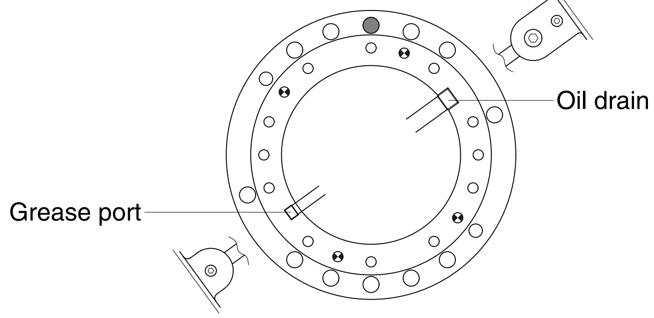
DETAIL K



1	Body
2	Oil seal
3	Roller bearing
4	Snap ring
5	Drive shaft
6	Bushing
7	Pin
8	Shoe plate
9	Cylinder block
10	Spring
11	Ball guide
12	Set plate
13	Piston assembly
14	Friction plate
15	Separate plate
16	Brake piston
17	O-ring
18	O-ring
19	Brake spring
20	Rear cover
21	Needle bearing
22	Pin
23	Valve plate
24	Wrench bolt
25	Plug
26	Back up ring
27	O-ring
28	Spring
29	Check
30	Relief valve
31	Anti-rotating valve
32	Time delay valve
33	Wrench bolt
34	Plug
35	O-ring
36	Plug
37	Plug
38	Level gauge
39	Name plate
40	Rivet
41	Plug
42	O-ring
43	O-ring
44	Back up ring
45	Plug

2) REDUCTION GEAR





VIEW A

130ZF2SM03

1	Casing	12	No.2 pin	23	Stop ring
2	Drive shaft	13	No.2 bushing	24	No. 1 sun gear
3	Cover plate	14	No.2 sun gear	25	Stop ring
4	Spacer	15	No.1 carrier assy	26	Side plate No.1
5	Roller bearing	16	No.1 carrier	27	Ring gear
6	Roller bearing	17	No.1 planet gear	28	Knock pin
7	Oil seal	18	No.1 pin assy	29	Hexagonal bolt
8	No.2 carrier assy	19	No.1 pin	30	Socket bolt
9	No.2 carrier	20	No.1 bushing	31	Plug
10	No.2 planet gear	21	Thrust washer	32	Plug
11	No.2 pin assy	22	Spring pin		

2. PRINCIPLE OF DRIVING

※ Descriptions are based on the type 1 of the swing motor.

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (8) through valve casing (22) of motor and valve plate (20).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston (12).

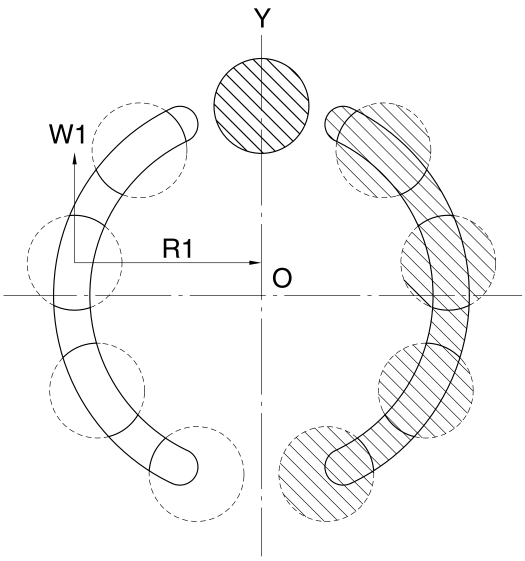
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : fluid pressure area), like following pictures, working on a piston.

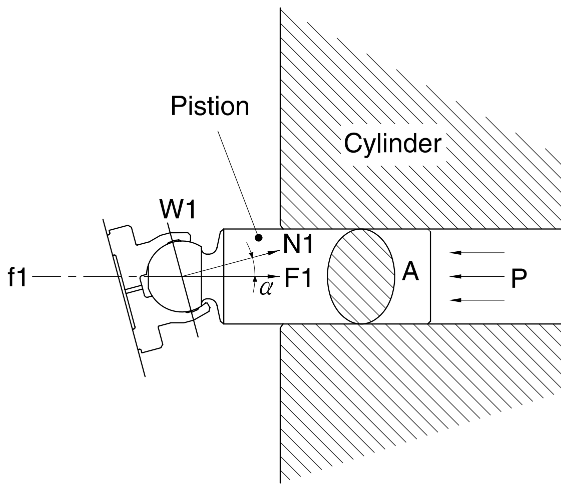
This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate of a tilt angle, α.

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





140WF8TM05

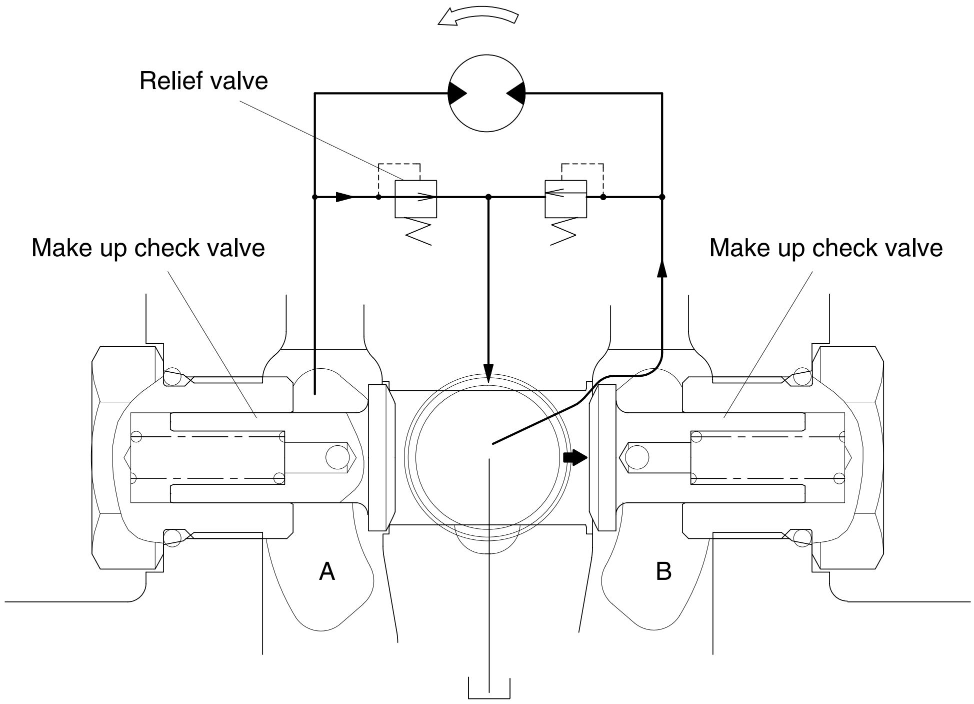
2) MAKE UP VALVE

In the system using this type of motor, there is no counter balance 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.

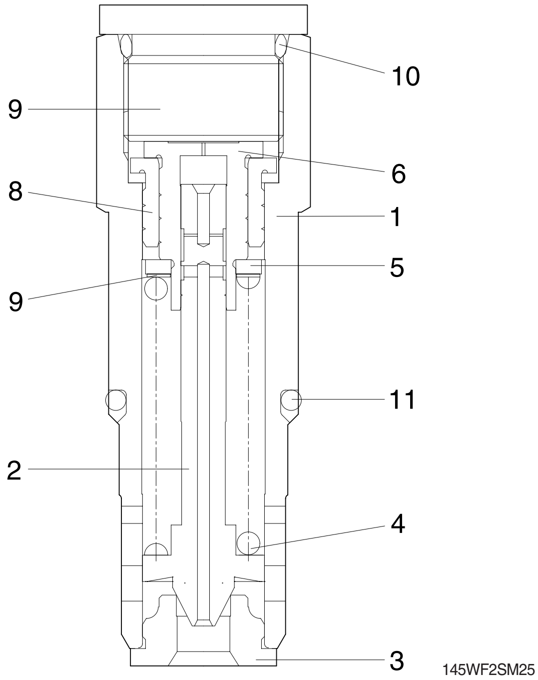
Pressurized oil into the port B, the motor rotate counterclockwise.

If the plunger of MCV moves neutral position, 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.



140WF2SM04

3) RELIEF VALVE



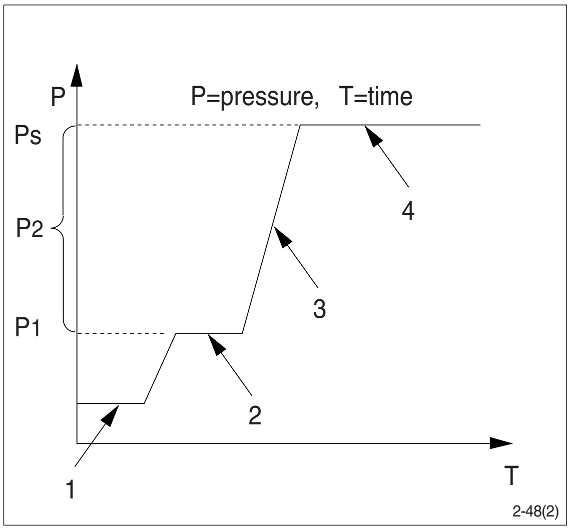
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(1) Construction of relief valve

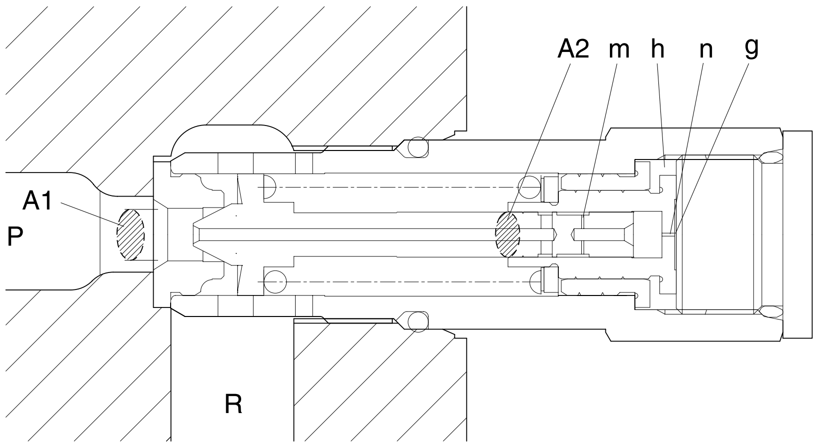
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(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.



① Ports (P,R) at tank pressure.

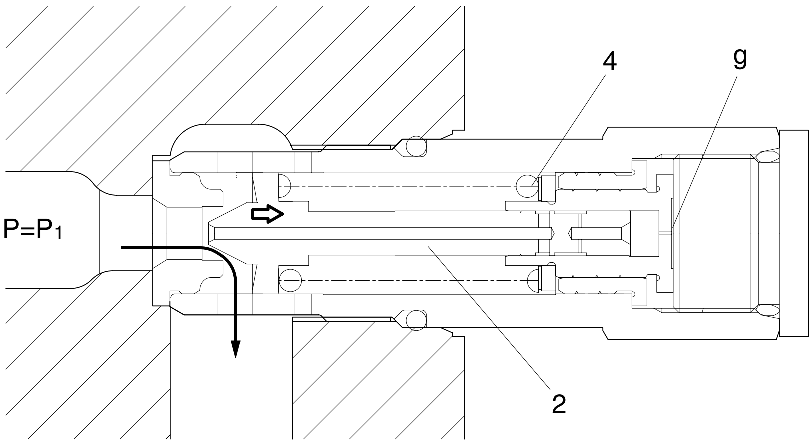


145WF2SM26

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.

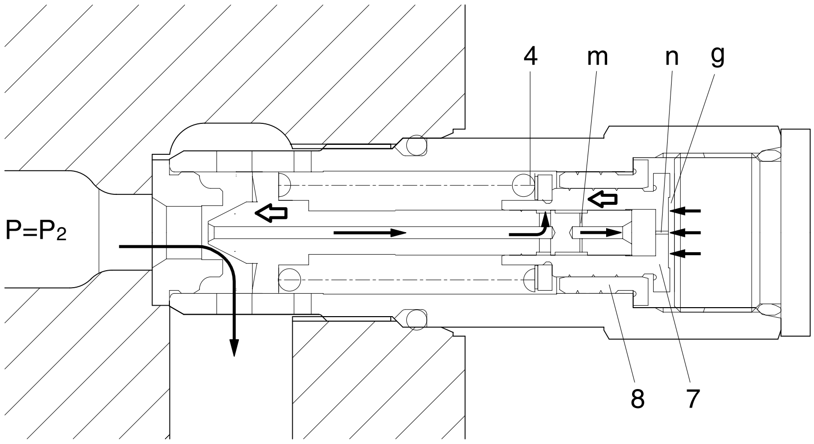
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



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).

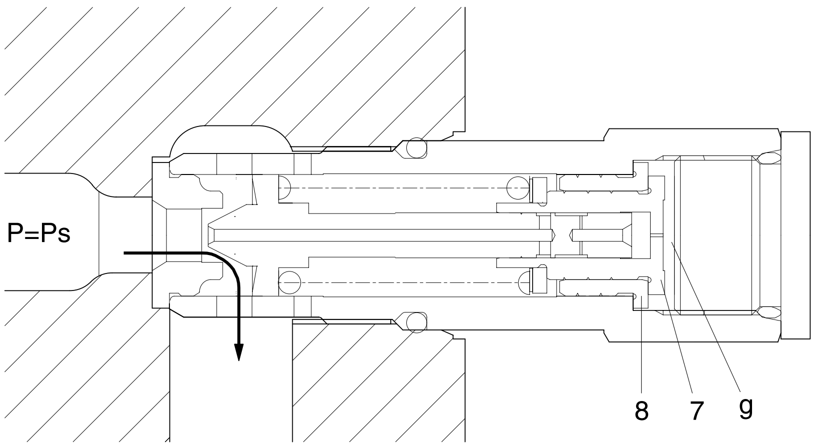


145WF2SM28

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).

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

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



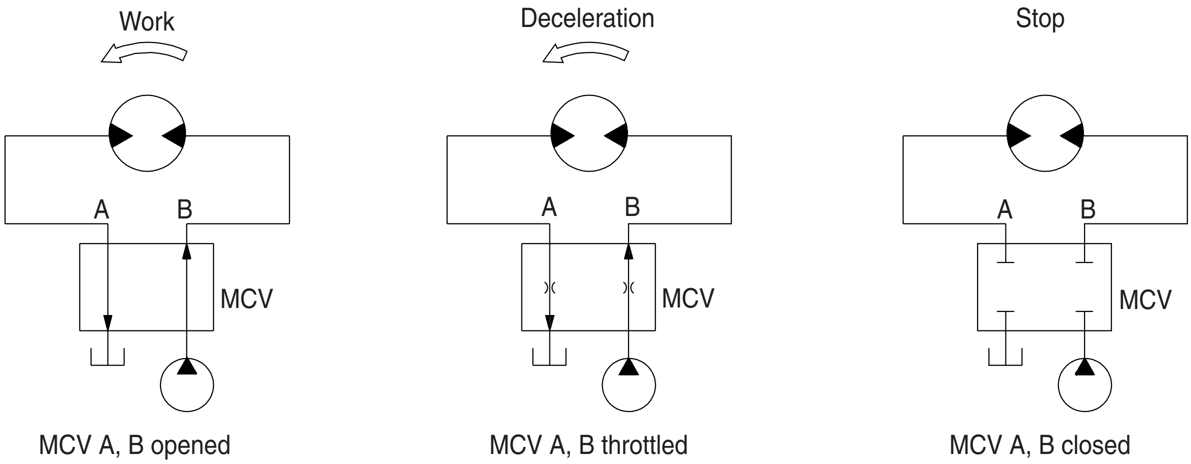
145WF2SM29

4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



2-48(1)

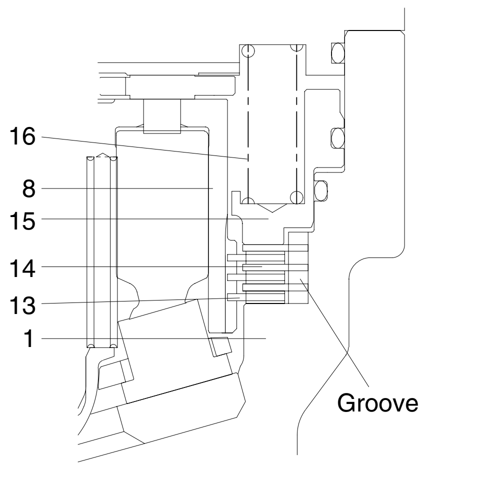
(2) Mechanical swing parking brake system

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

① Brake assembly

Circumferential rotation of separate plate (14) is constrained by the groove located at casing (1). When housing is pressed down by brake spring (16) through friction plate (13), separate plate (14) and parking piston (15), friction force occurs between friction plate and separate plate.

Friction force constrains motion of cylinder block (8). When hydraulic force exceeds spring force, brake is released.

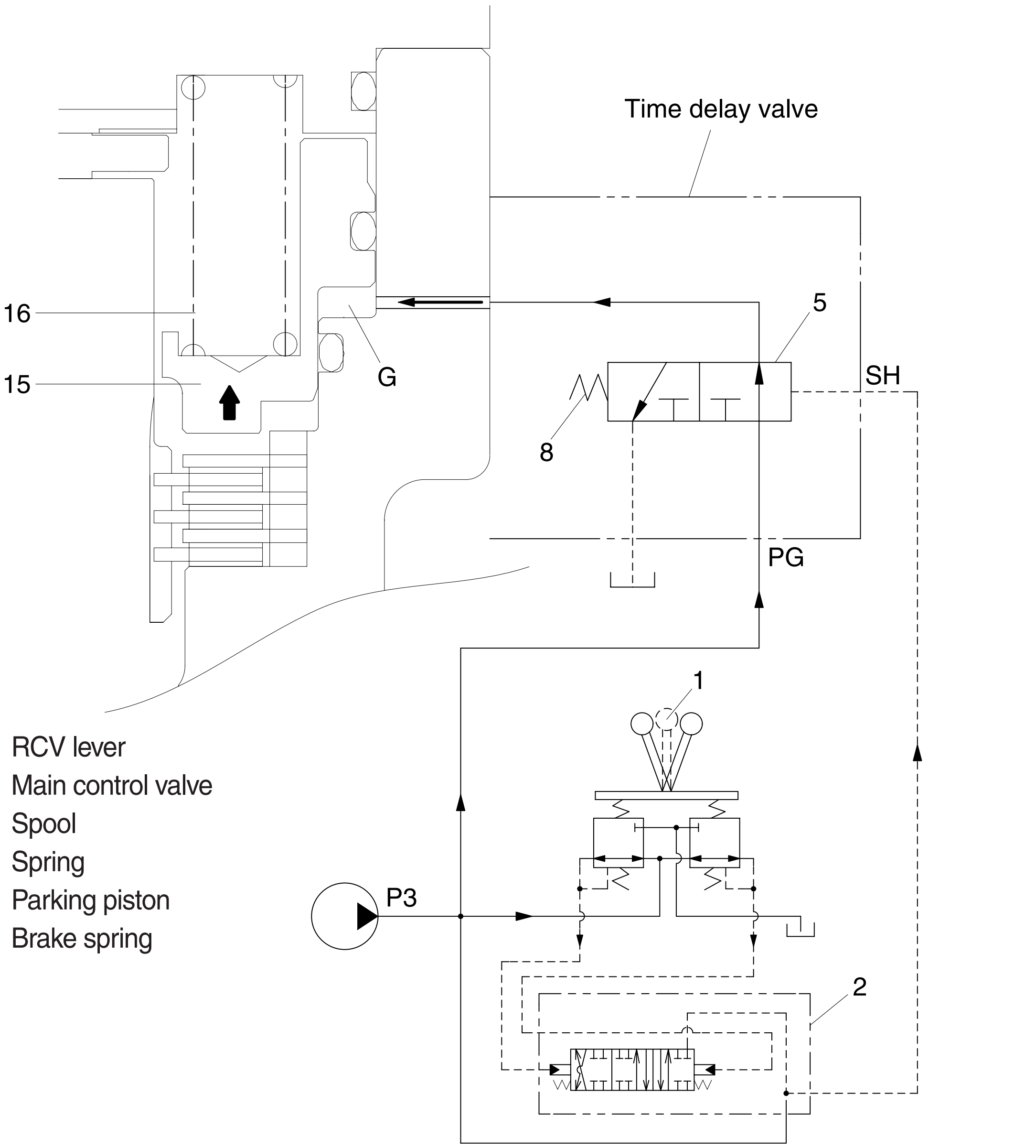


140WF2SM35

1	Casing	14	Separate plate
8	Cylinder block	15	Parking piston
13	Friction plate	16	Brake spring

② Operating principle

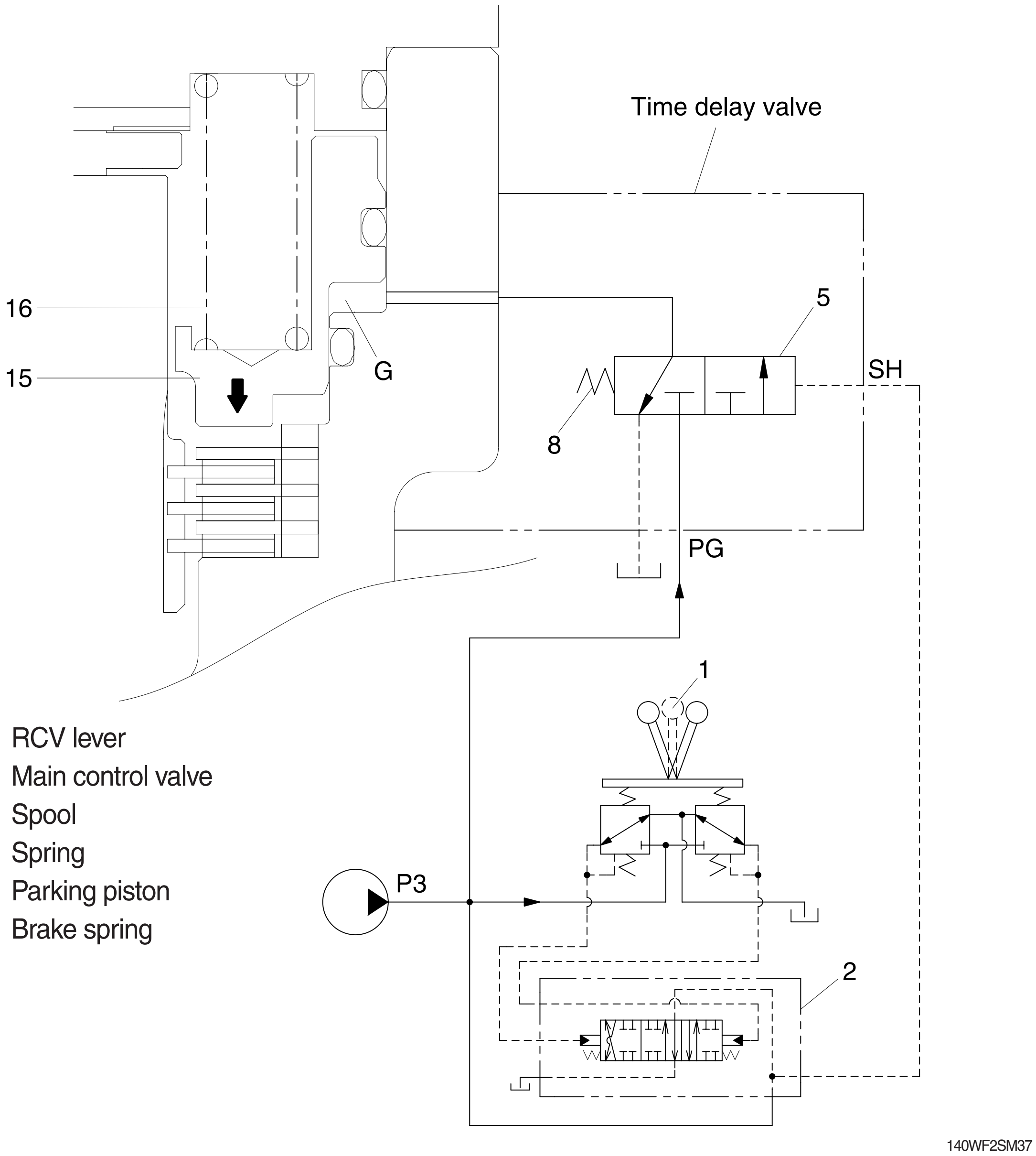
a. When one of the RCV lever (1) is set to the operation position, the each spool is shifted to left or right and the pilot oil flow is blocked. Then the pilot oil go to SH of the time delay valve (35). This pressure moves spool (5) to the leftward against the force of the spring(8), so pilot pump charged oil (P3) goes to the chamber G through port PG.
This pressure is applied to move the parking piston (15) to the upward against the force of the brake spring (16). Thus, it releases the brake force.



140WF2SM36

1	RCV lever
2	Main control valve
5	Spool
8	Spring
15	Parking piston
16	Brake spring

b. When all of the RCV lever (1) are set the neutral position, the spool (5) returns to right.
Then, the parking piston (15) is moved lower by spring force and the return oil from the chamber G flows back to tank port.
At this time, the brake works.



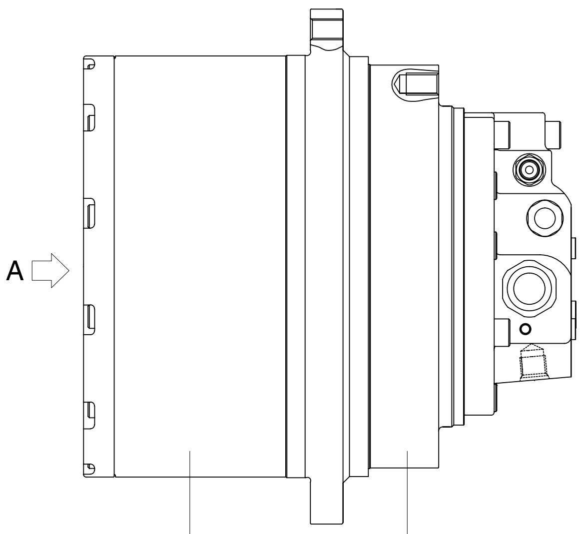
1	RCV lever
2	Main control valve
5	Spool
8	Spring
15	Parking piston
16	Brake spring

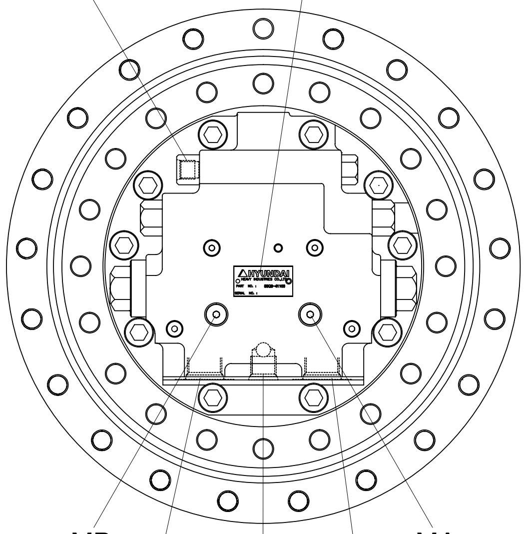
GROUP 4 TRAVEL DEVICE

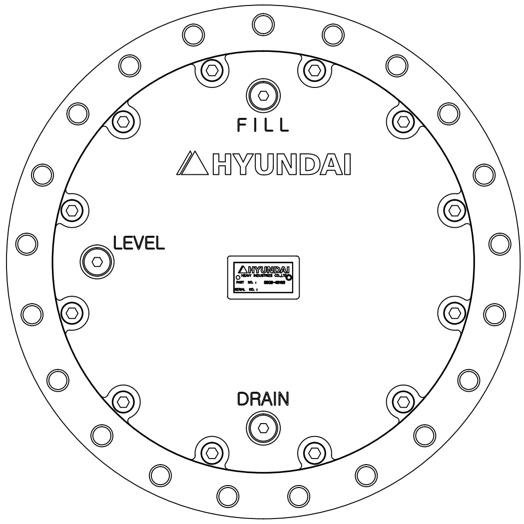
1. CONSTRUCTION

Travel device consists travel motor and gear box.

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

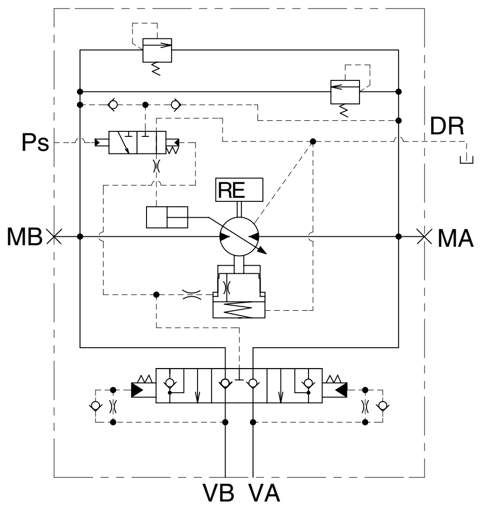






VIEW A

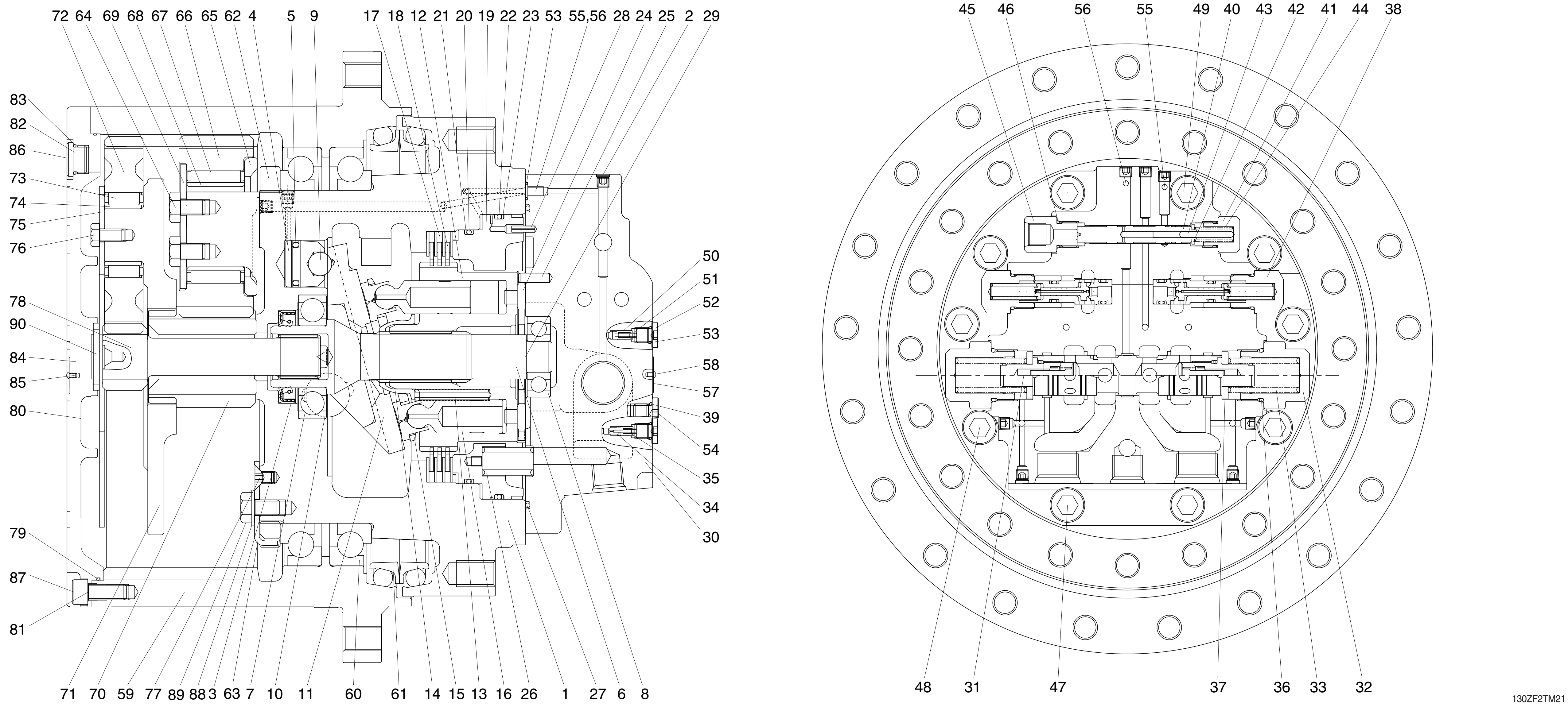
130ZF2TM20



Hydraulic circuit

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



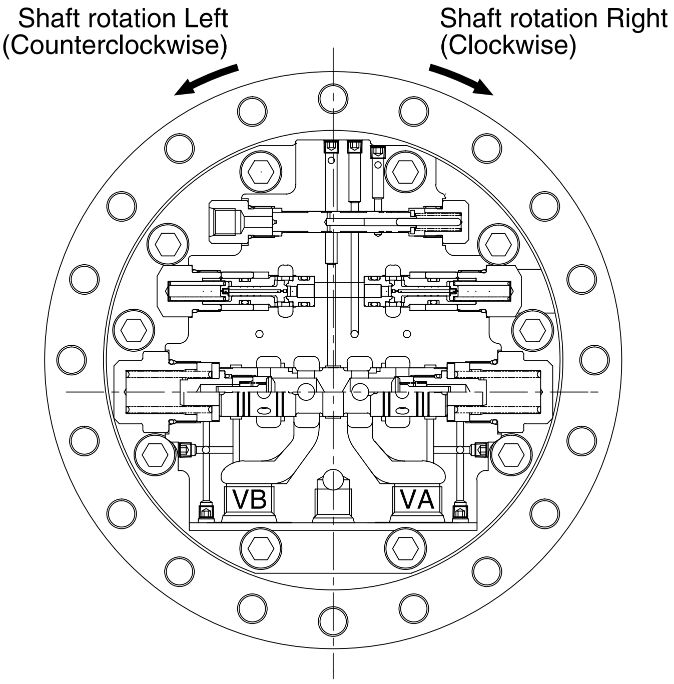
1	Casing	19	Parking piston	37	Spring seat	55	Restrictor	73	Needle bearing No.1
2	Plug	20	O-ring	38	Relief valve assy	56	Restrictor	74	Inner race No. 1
3	Oil seal	21	Back up ring	39	O-ring	57	Name plate	75	Thrust plate No. 1
4	Piston	22	O-ring	40	Spool	58	Rivet	76	Hexagon head bolt
5	Piston seal	23	Back 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 No. 2	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 No.2	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 No. 2	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

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)

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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.

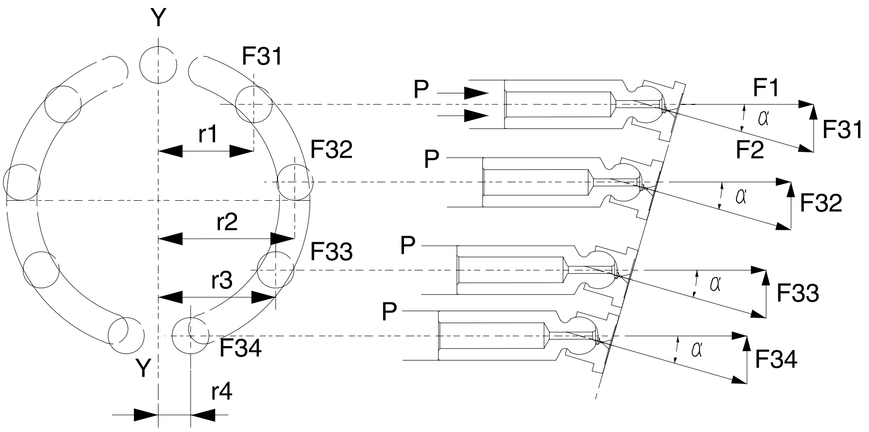
F1 = P $\times$ A (P : pressure, A : area of piston section)

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).



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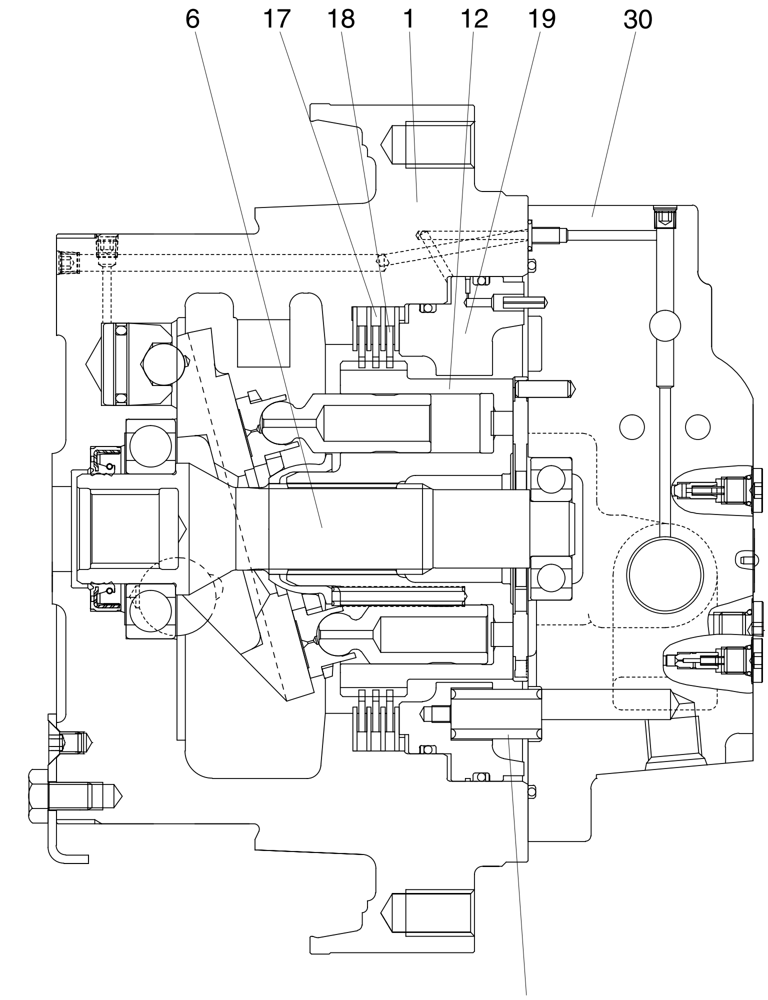
2) PARKING BRAKE

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).



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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.

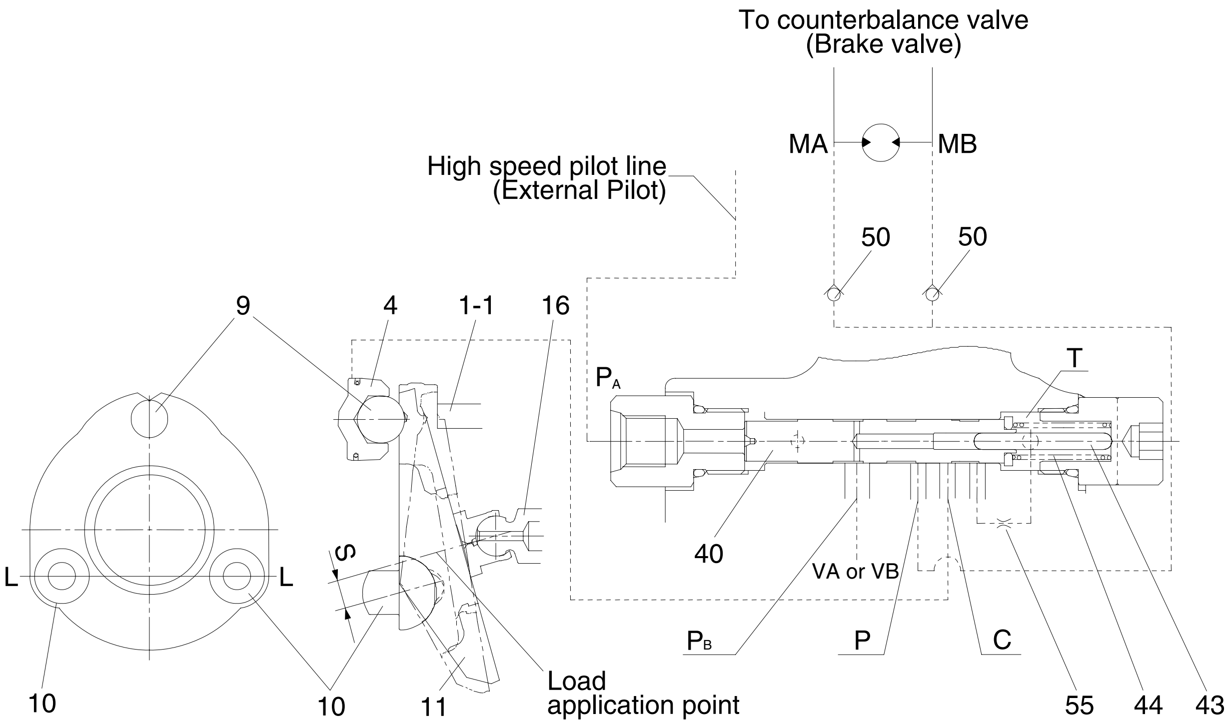
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

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.



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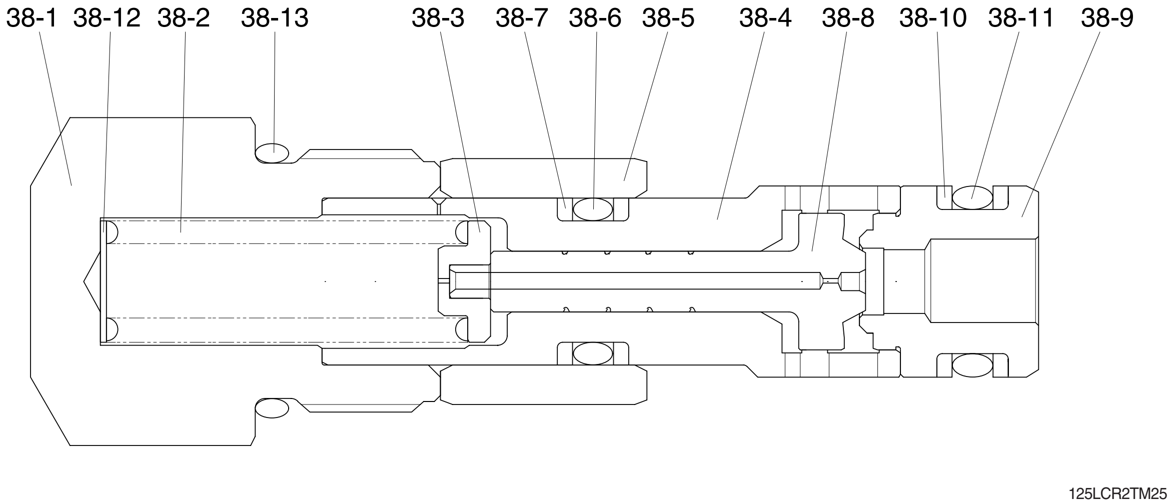
4) OVERLOAD RELIEF VALVE

(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.



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		

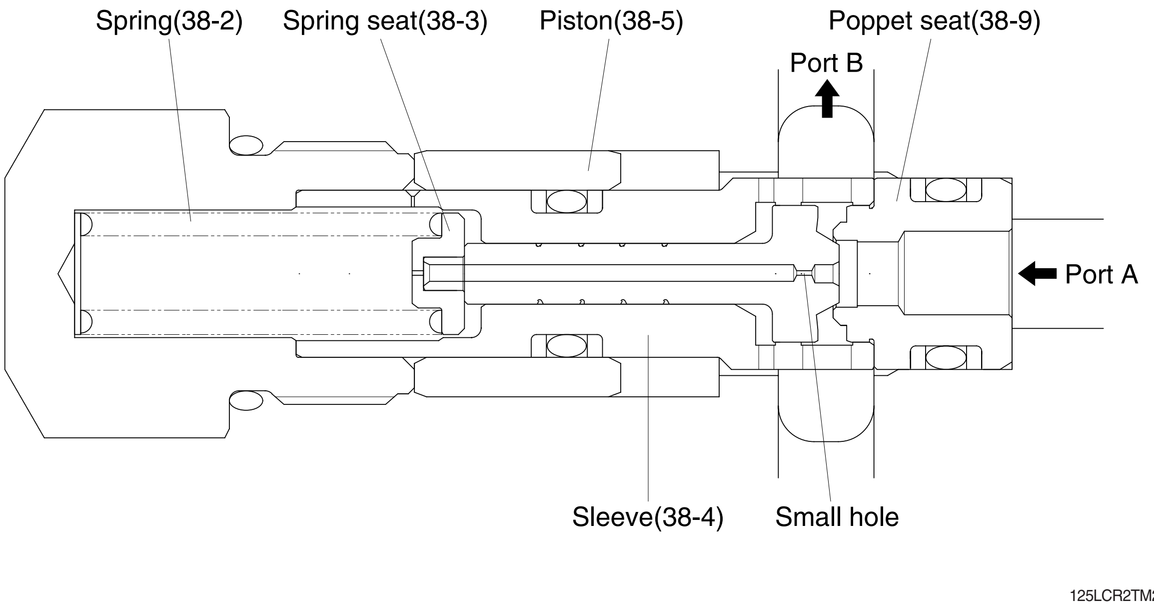
(2) Operation

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.



5) BRAKE VALVE

(1) Structure

The brake valve portion mainly consists of the following parts:

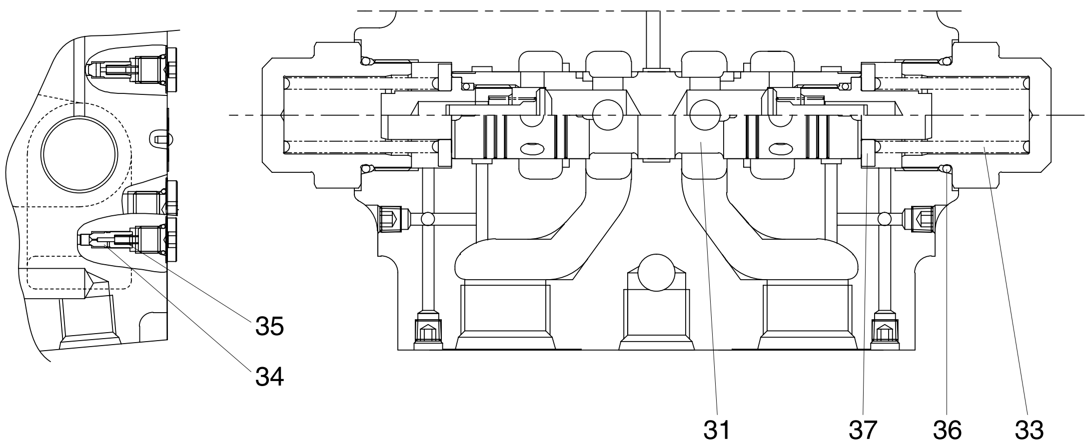
① Spool

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 2-66, (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

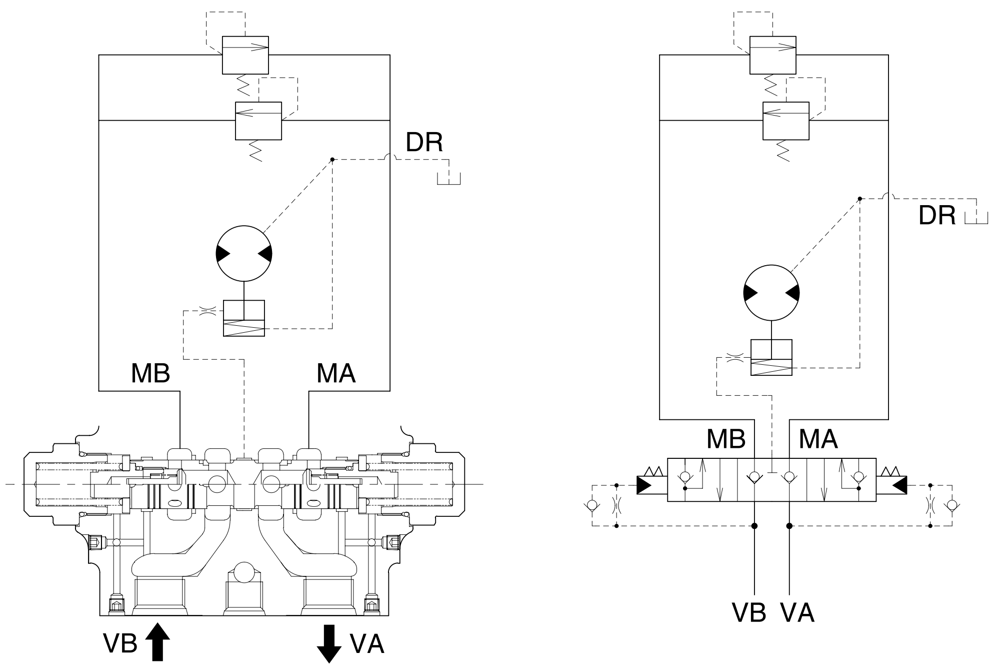
(2) Operation

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.



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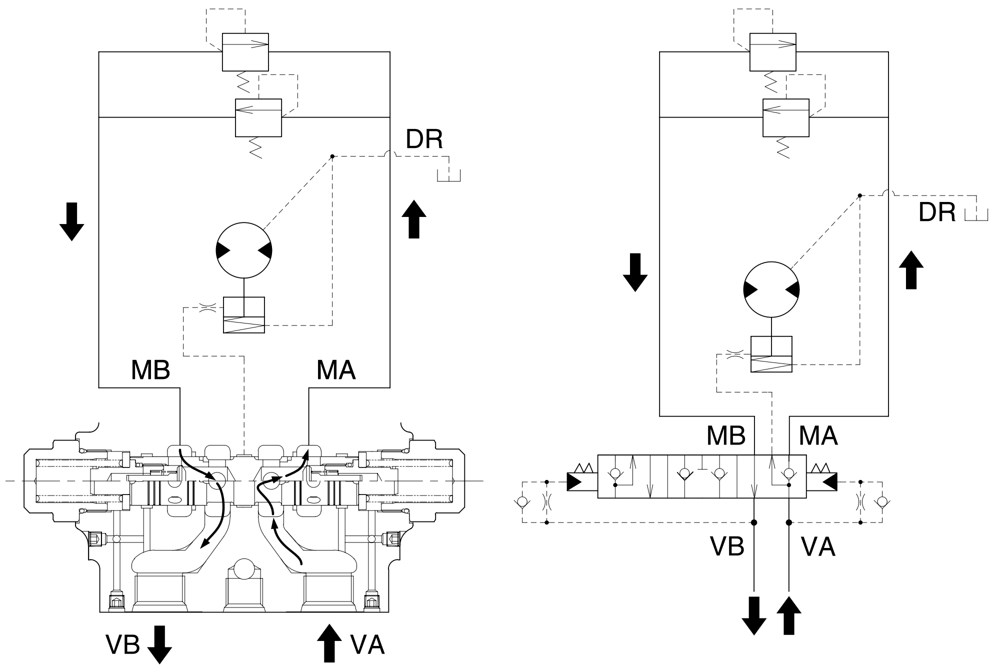
② **Accelerating operation**

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.



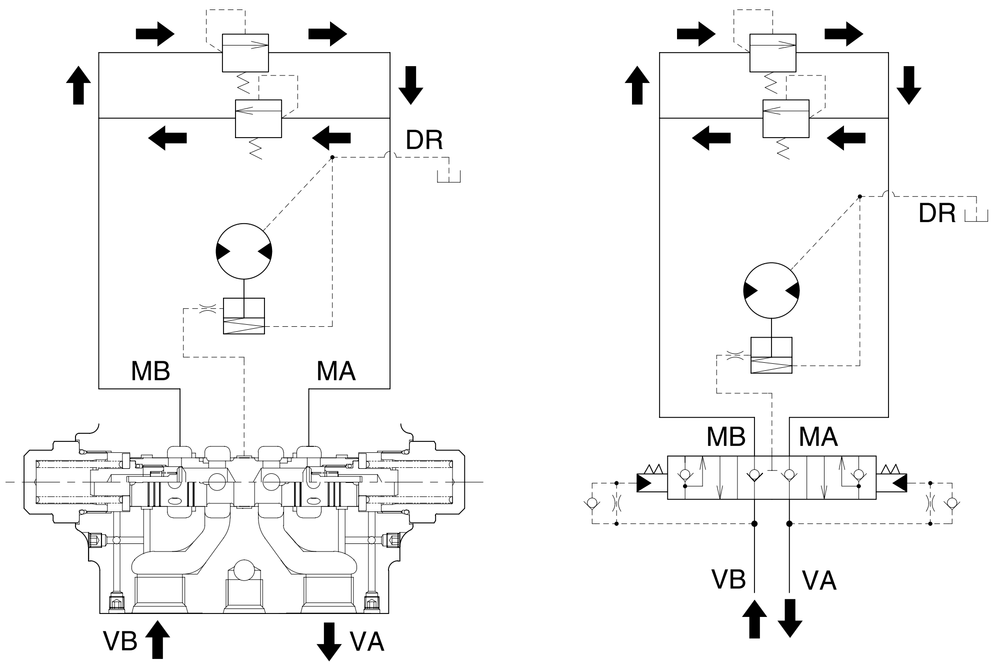
125LCR2TM30

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.



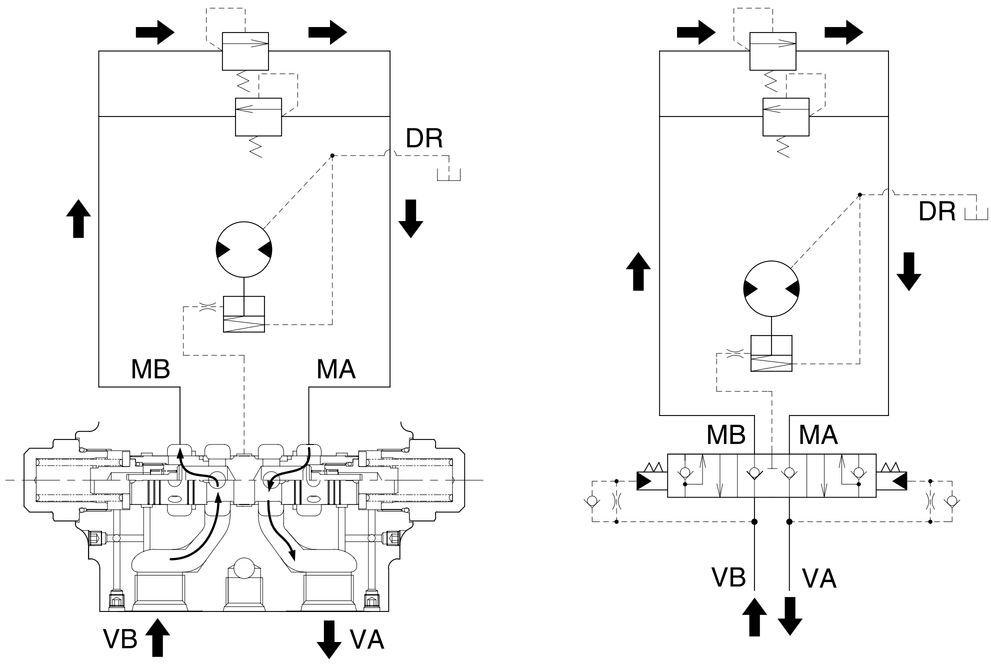
125LCR2TM31

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).



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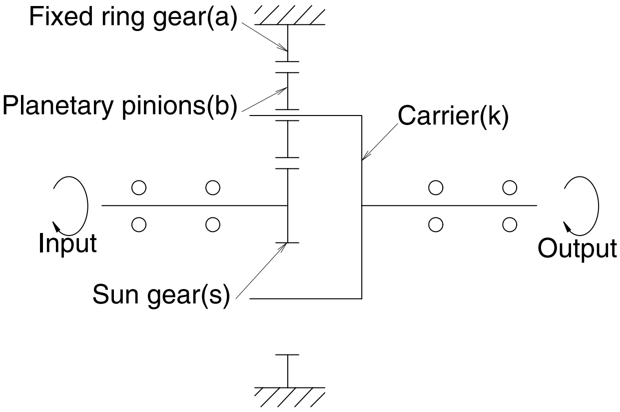
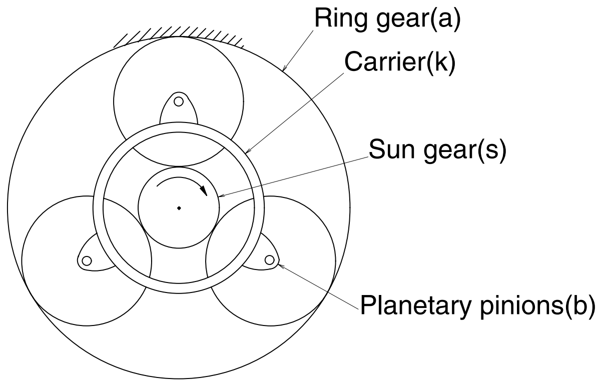
6) REDUCTION GEAR

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.

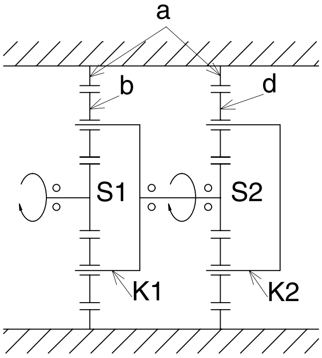


29072TM10



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

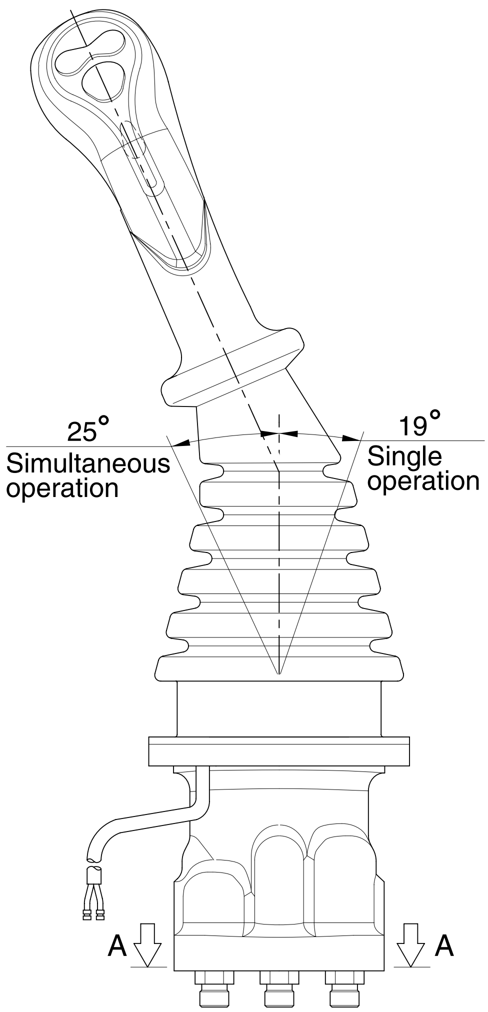
GROUP 5 RCV LEVER

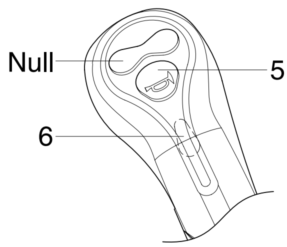
1. STRUCTURE

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, M3

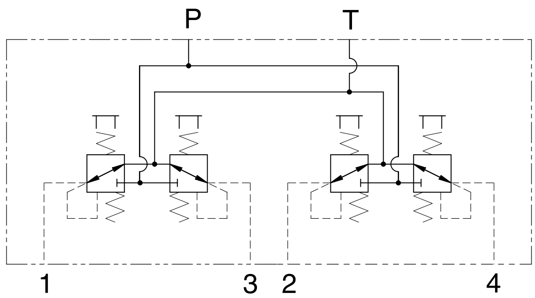




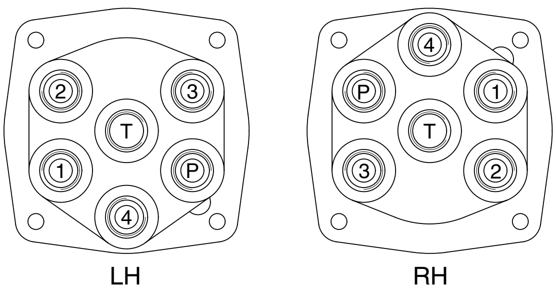
TYPE M1, M3

Switches

Type	No.	LH	RH
M1, M3	5	One touch decel	Horn
	6	Power boost	Breaker



Hydraulic circuit



LH RH

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	

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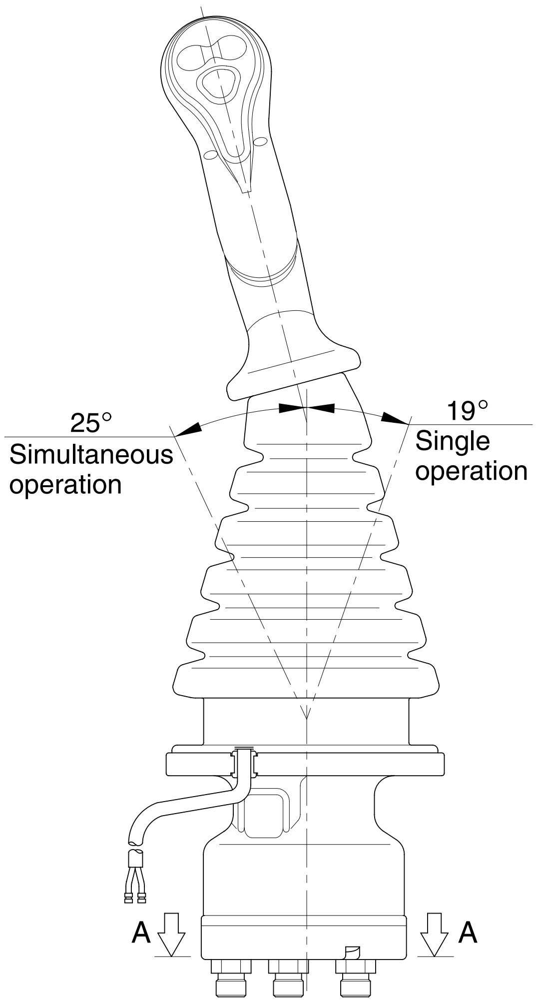
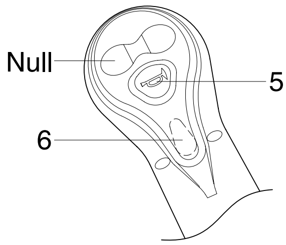
2) TYPE M2

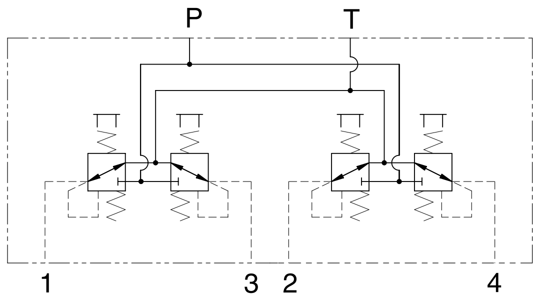




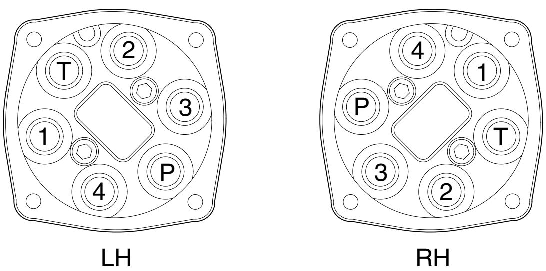
TYPE M2

Switches

Type	No.	LH	RH
M2	5	One touch decel	Horn
	6	Power boost	Breaker



Hydraulic circuit



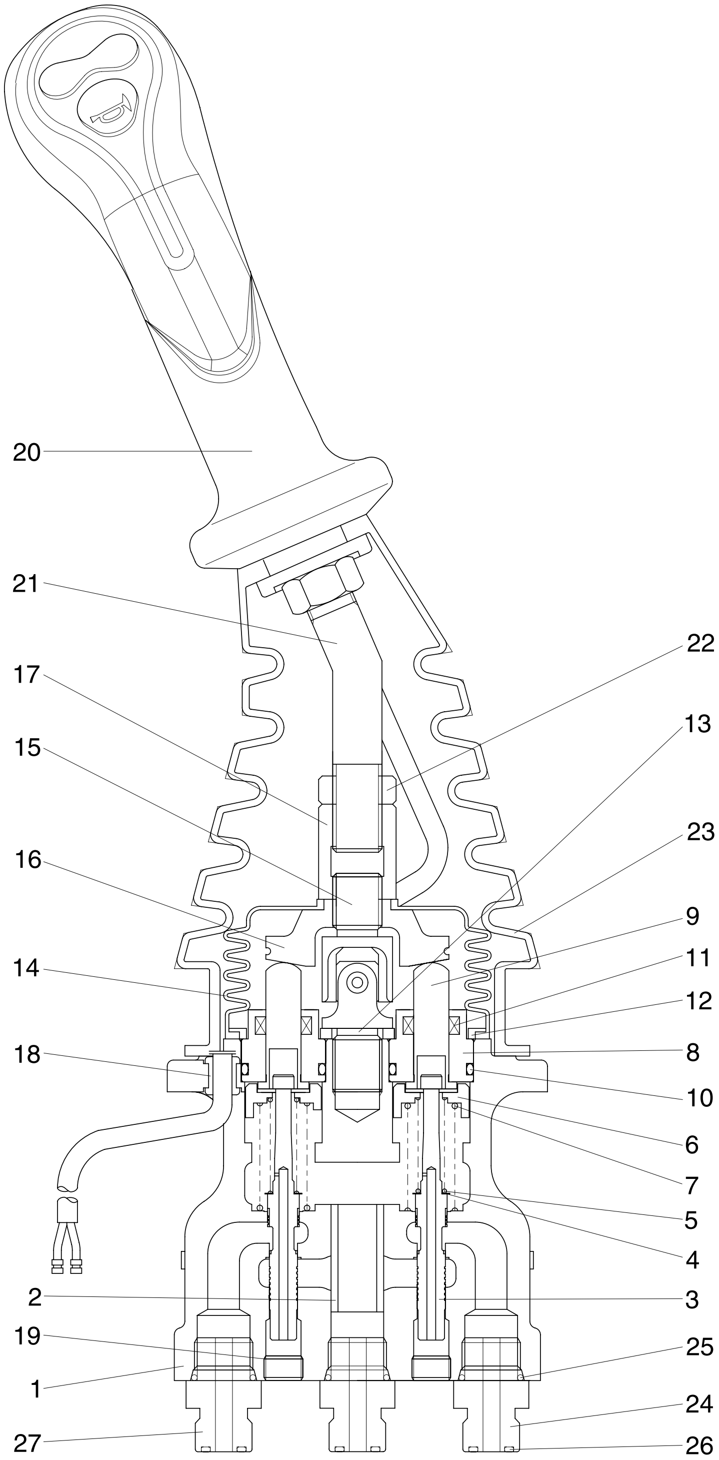
VIEW A-A

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	

130ZF2RL05

3) CROSS SECTION



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	O-ring
26	O-ring
27	Connector

300L2RL06

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.

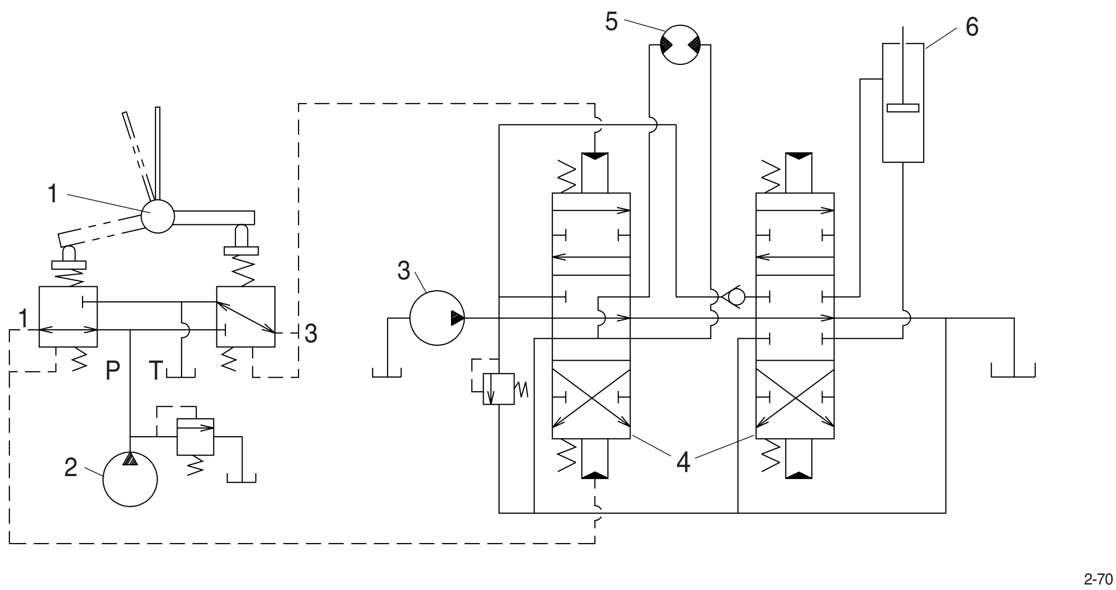
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

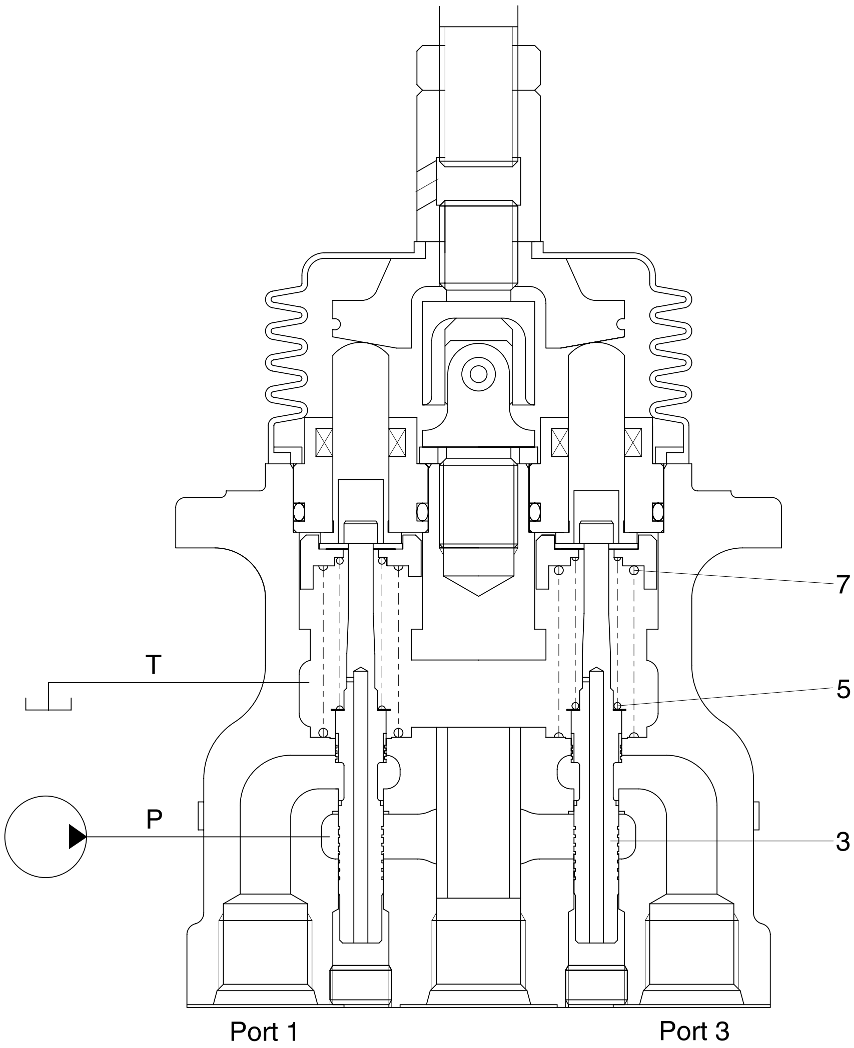
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

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



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

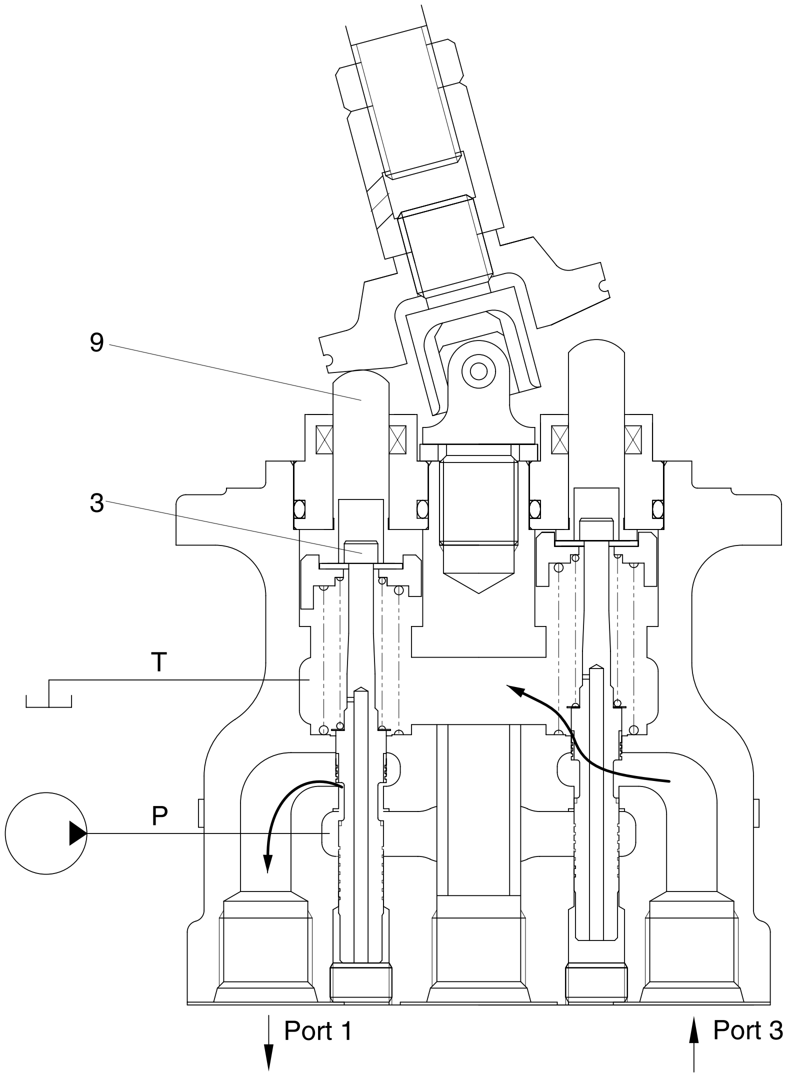
(1) Case where handle is in neutral position



300L2RL03

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



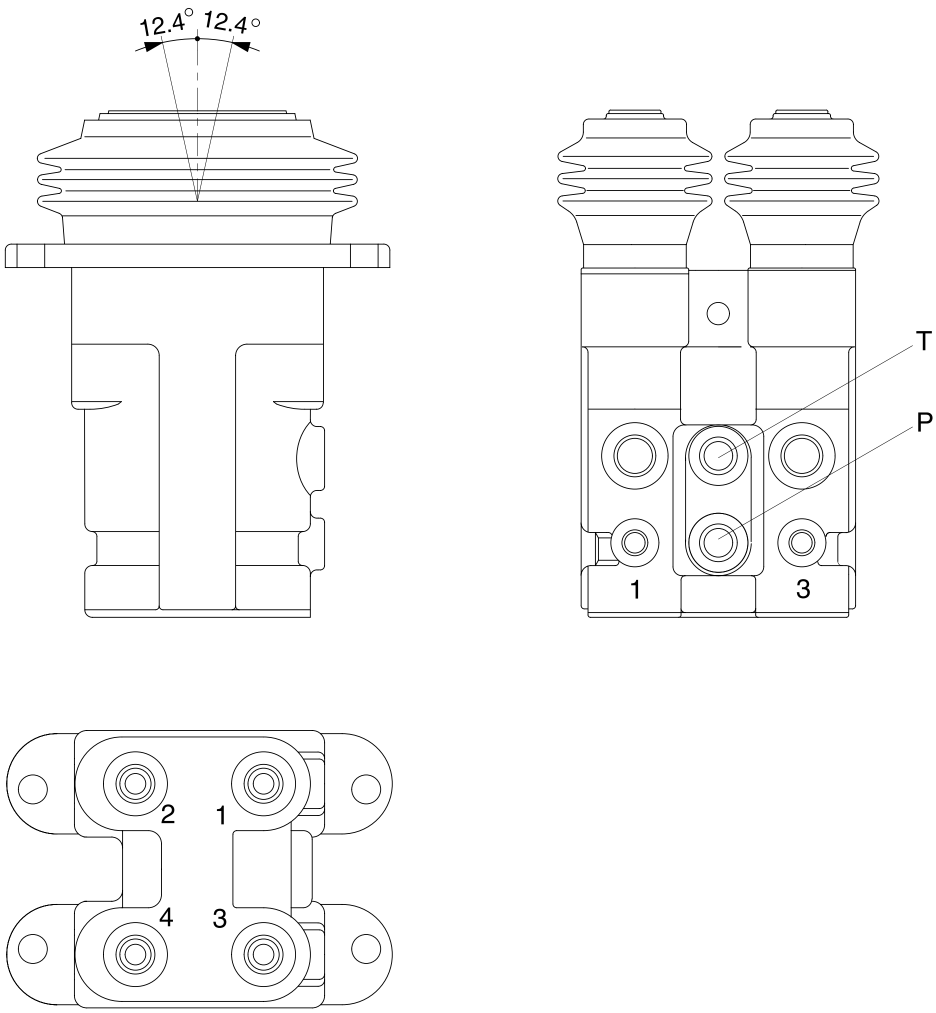
300L2RL04

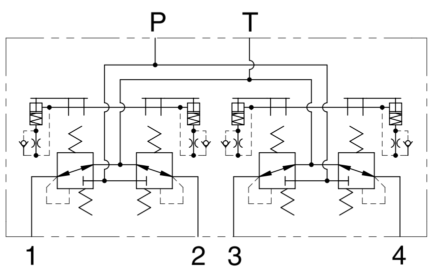
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle,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

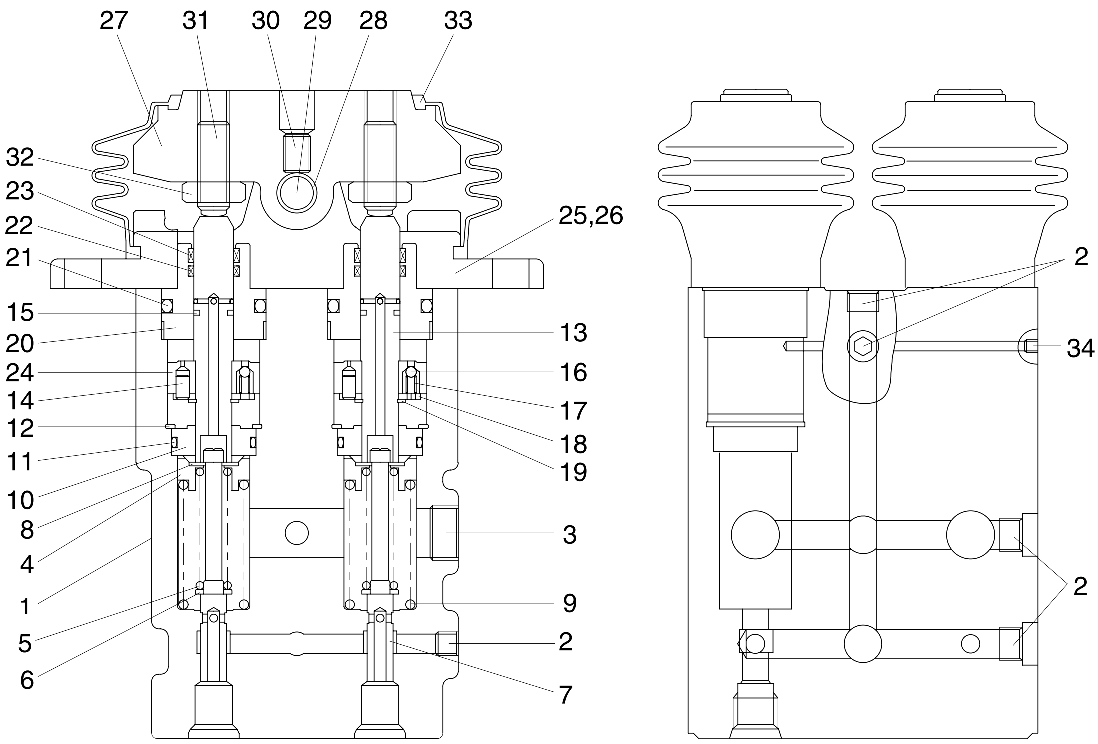
130ZF2RP01

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 (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.



130ZF2RP02

1	Body	13	Push rod	25	Cover
2	Plug	14	Spring pin	26	Wrench 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	19	Snap ring	31	Set screw
8	Stopper	20	Plug	32	Hex nut
9	Spring	21	O-ring	33	Bellows
10	Rod guide	22	Rod seal	34	Expand
11	O-ring	23	Dust seal	35	Name plate
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 (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

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

The change the deflection of this spring, the push rod (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.

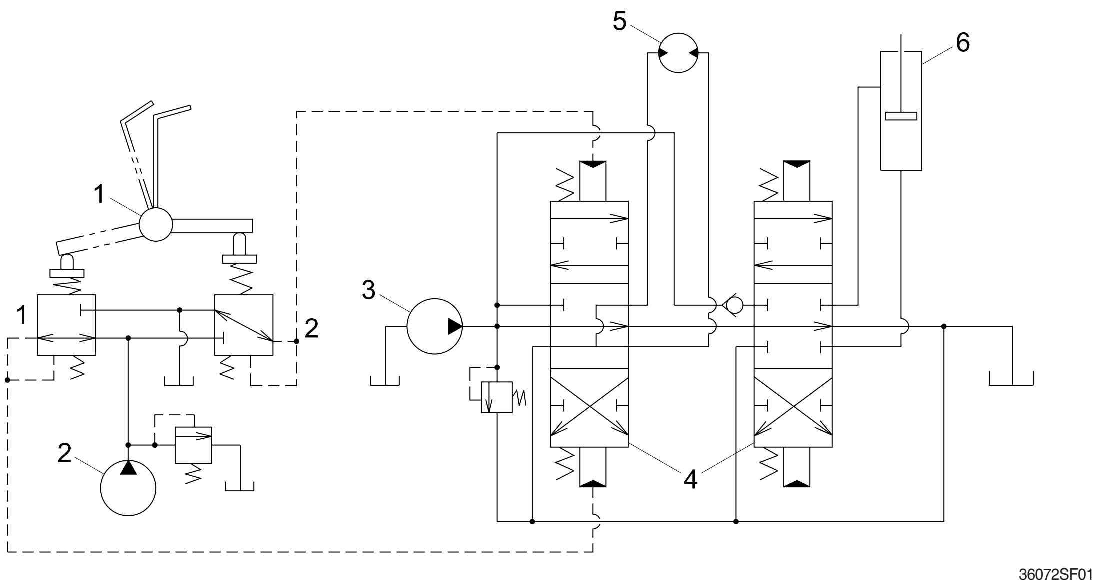
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

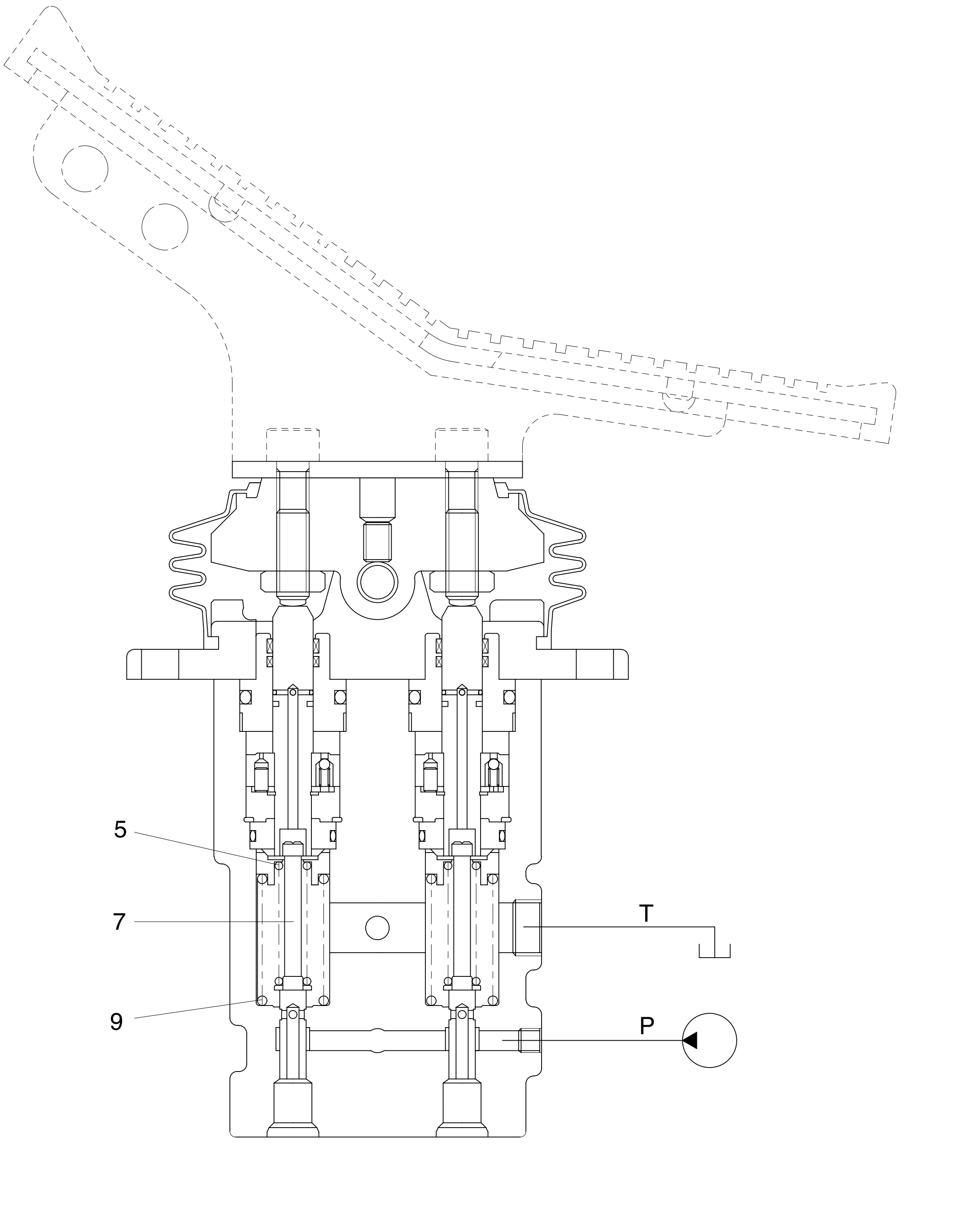
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

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



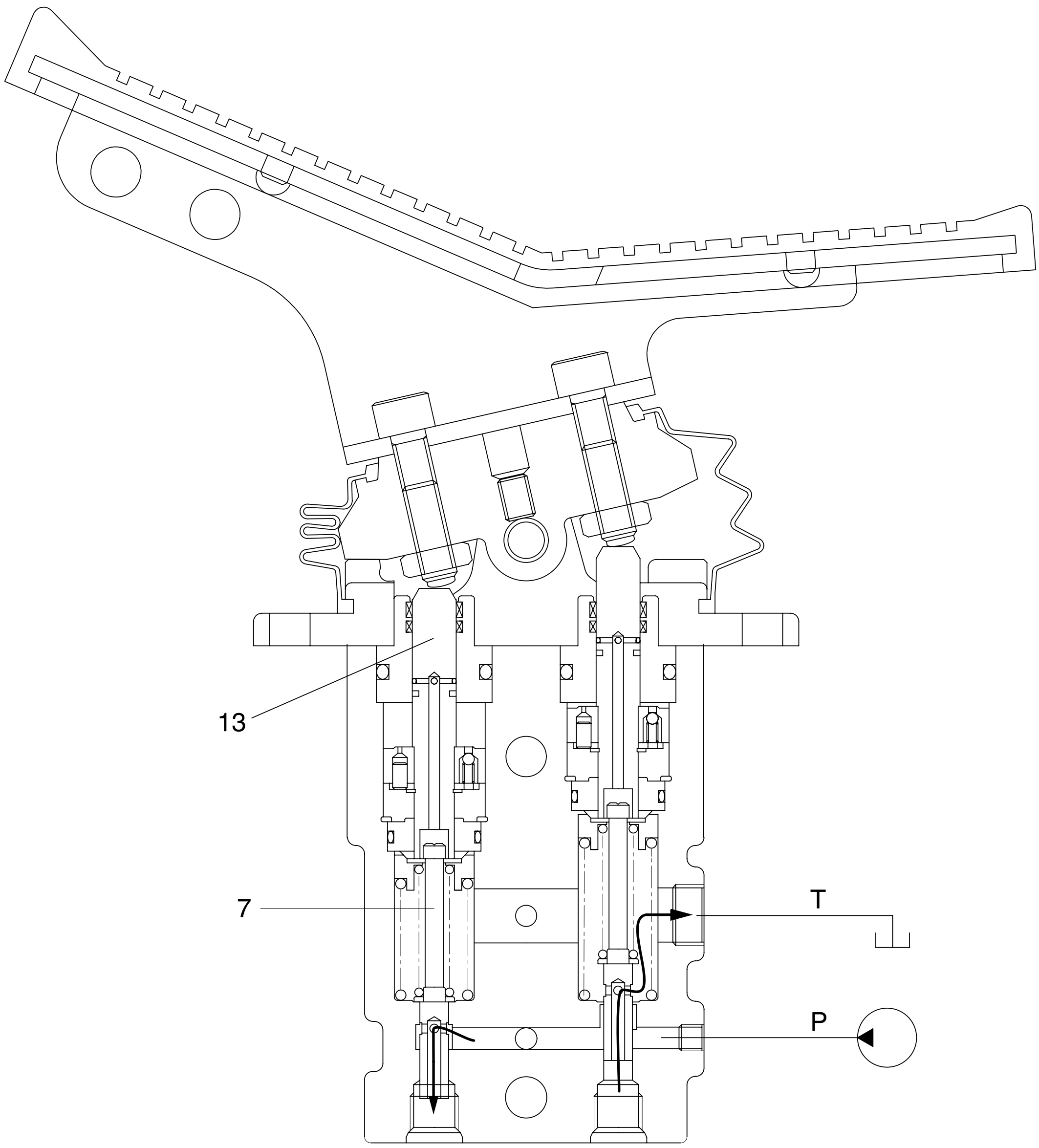
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(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 (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



130ZF2RP04

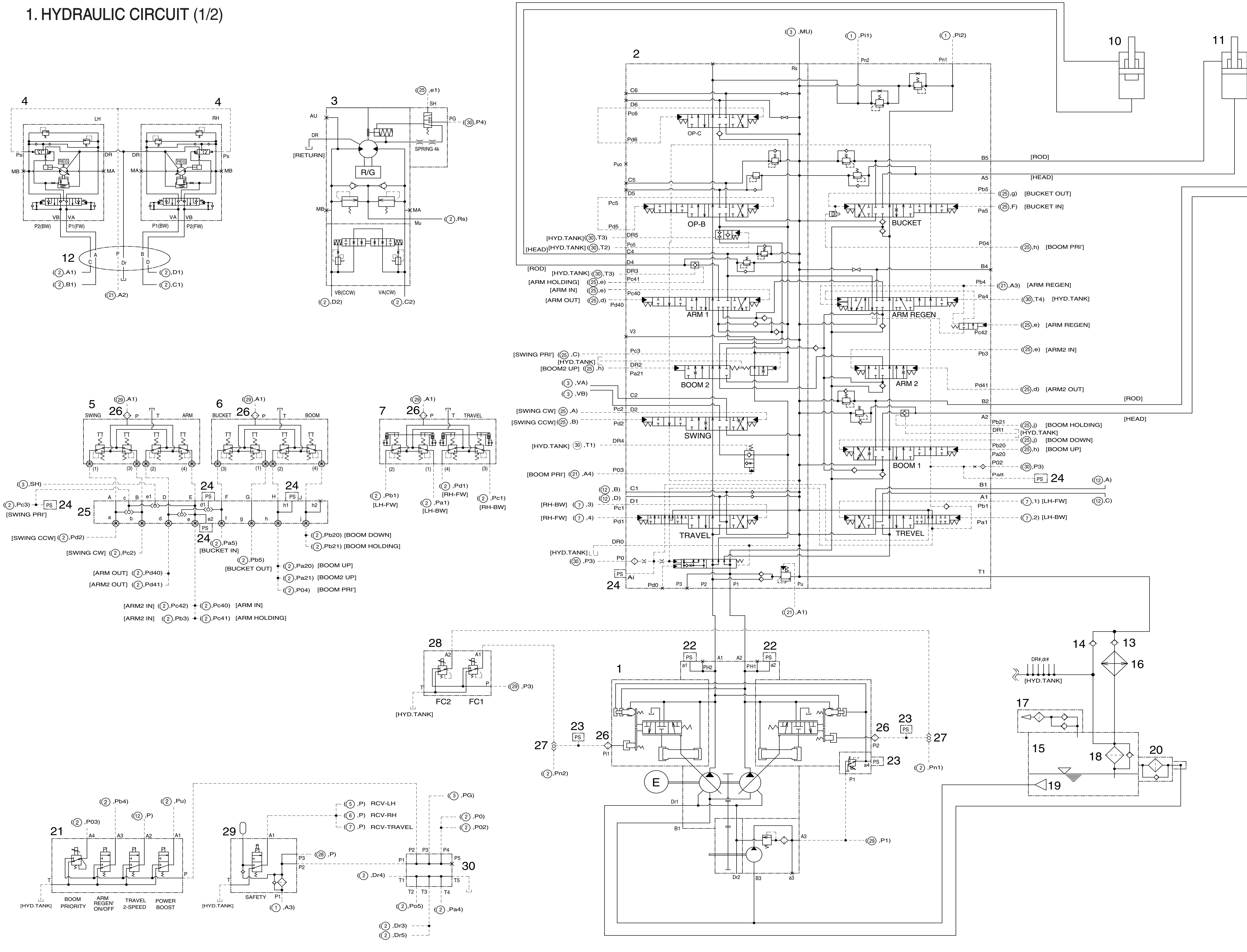
When the push rod (13) is stroked, the spool (7) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, 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 ······ 3-2
Group 3 Pilot Circuit ······ 3-5
Group 4 Single Operation ······ 3-14
Group 5 Combined Operation ······ 3-26

GROUP 1 HYDRAULIC CIRCUIT

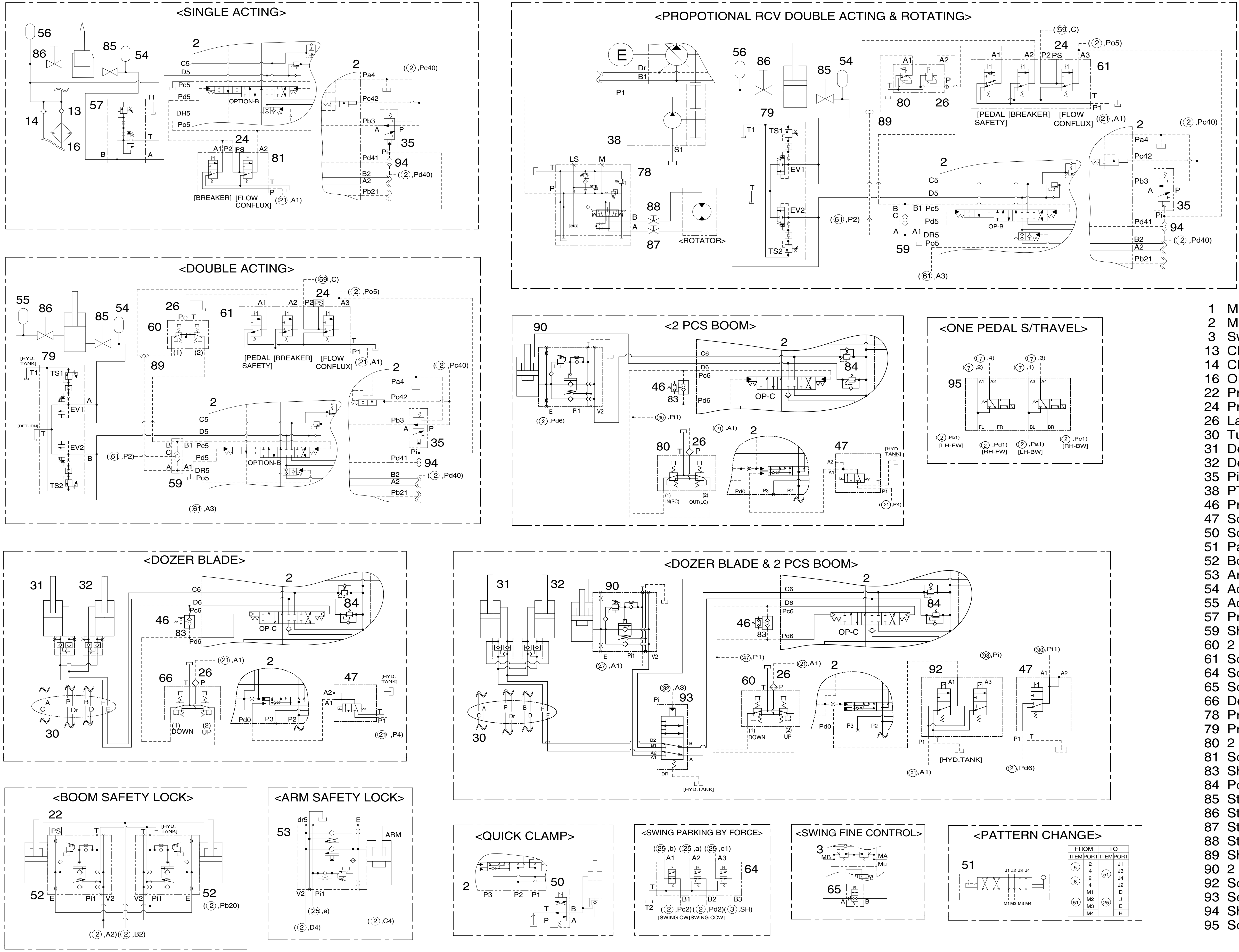
1. HYDRAULIC CIRCUIT (1/2)



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 Check valve
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Return filter w/bypass valve
19 Suction strainer
20 Drain filter
21 4 cartridge valve
22 Pressure sensor
23 Pressure sensor
24 Pressure sensor
25 Shuttle block
26 Last guard filter
27 Shuttle valve
28 2 EPPR cartridge valve
29 1 cartridge valve
30 Block

130ZF3HC01A

2. HYDRAULIC CIRCUIT (2/2)



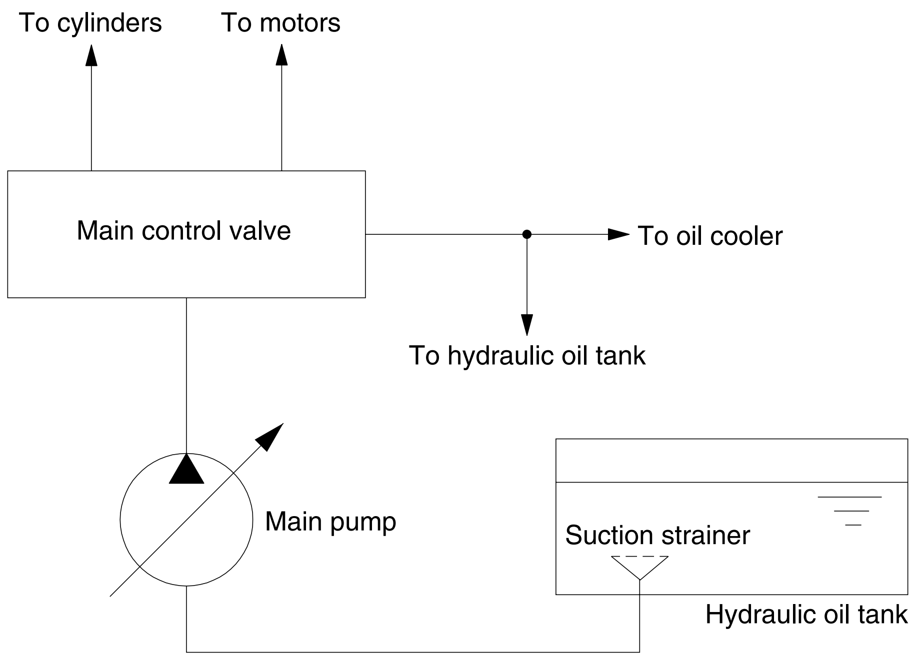
1 Main pump
2 Main control valve
3 Swing unit
13 Check valve
14 Check valve
16 Oil cooler
22 Pressure sensor (option)
24 Pressure sensor (option)
26 Last guard filter (option)
30 Turning joint (option)
31 Dozer cylinder (RH, option)
32 Dozer cylinder (LH, option)
35 Pilot selector valve (option)
38 PTO pump (option)
46 Pressure switch (option)
47 Solenoid valve (option)
50 Solenoid valve (option)
51 Pattern change valve (option)
52 Boom cylinder valve (LH/RH,option)
53 Arm cylinder valve (option)
54 Accumulator (option)
55 Accumulator (option)
57 Proportional relief valve (option)
59 Shuttle valve (option)
60 2 way pedal (option)
61 Solenoid valve (option)
64 Solenoid valve (option)
65 Solenoid valve (option)
66 Dozer pedal (option)
78 Proportional valve (option)
79 Proportional relief valve (option)
80 2 EPPR valve (option)
81 Solenoid valve (option)
83 Shuttle tee (option)
84 Port rrelied valve (option)
85 Stop valve (option)
86 Stop valve (option)
87 Stop valve (option)
88 Stop valve (option)
89 Shuttle tee (option)
90 2 pcs boom cylinder (option)
92 Solenoid valve (option)
93 Selector valve (option)
94 Shuttle tee (option)
95 Solenoid valve (option)

130ZF3HC01B

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.

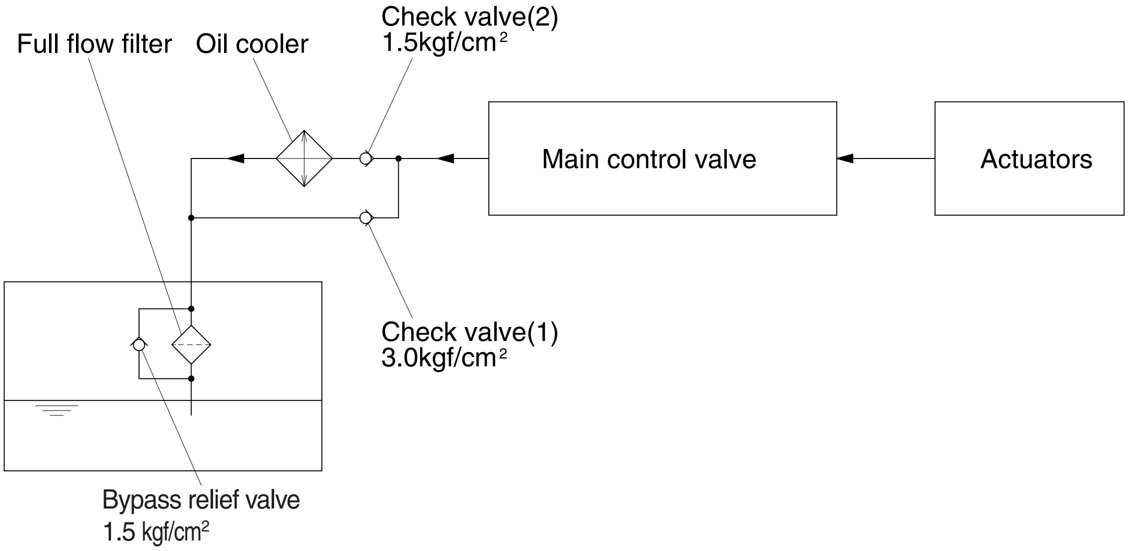
1. SUCTION AND DELIVERY CIRCUIT



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.

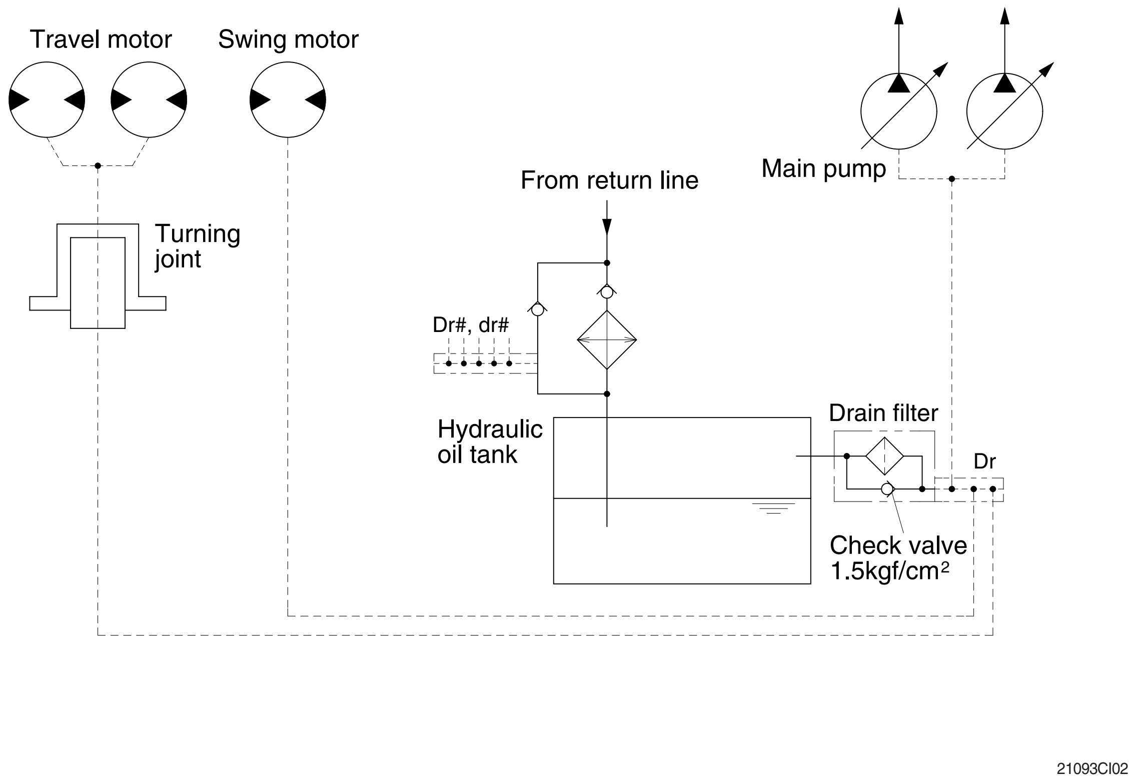
2. RETURN CIRCUIT



21073CI01

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

3. DRAIN CIRCUIT



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.
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.

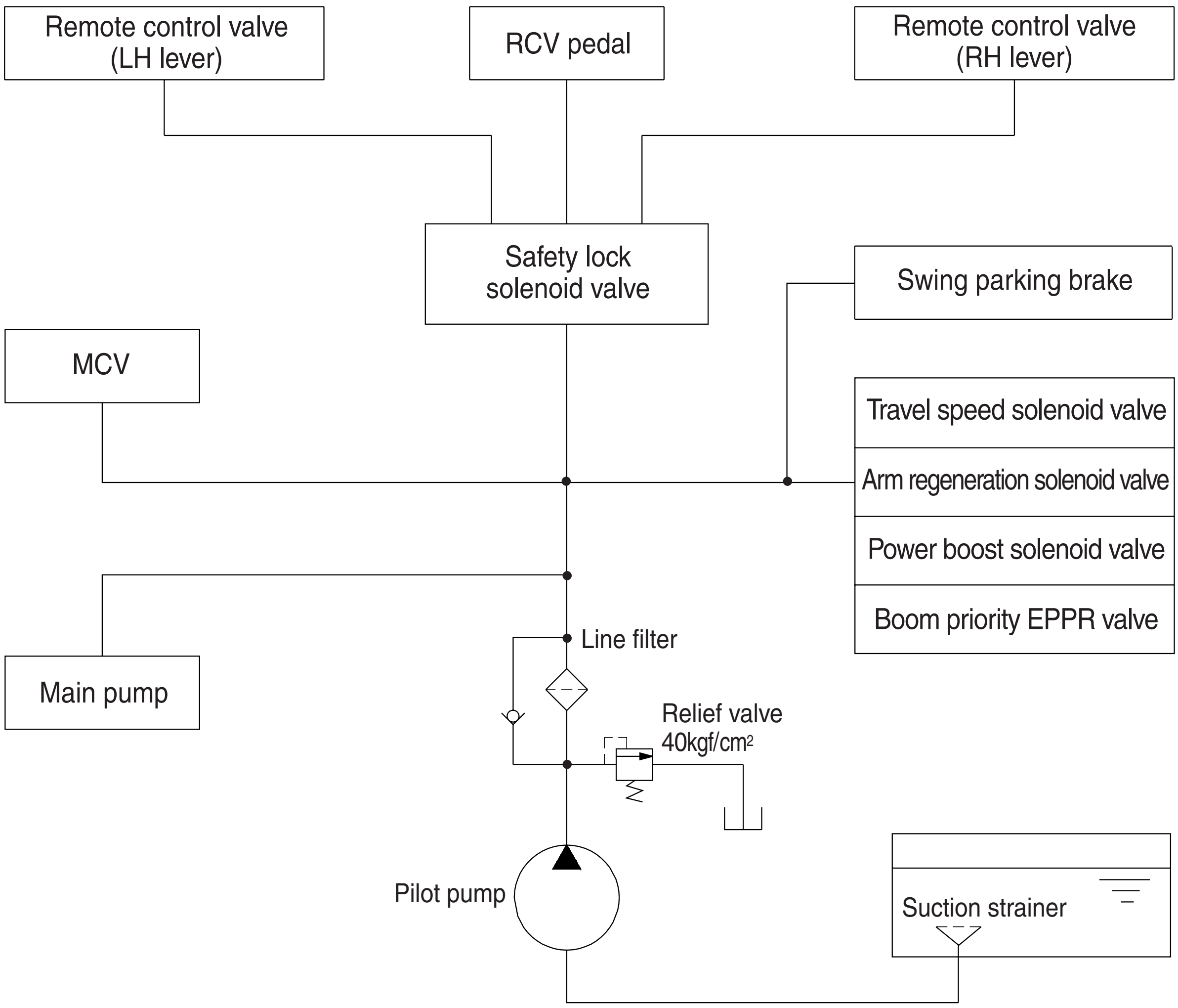
2) SWING MOTOR DRAIN CIRCUIT

Oil leaked from the swing motor returns to the hydraulic tank passing through a drain filter.

3) MAIN PUMP DRAIN CIRCUIT

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

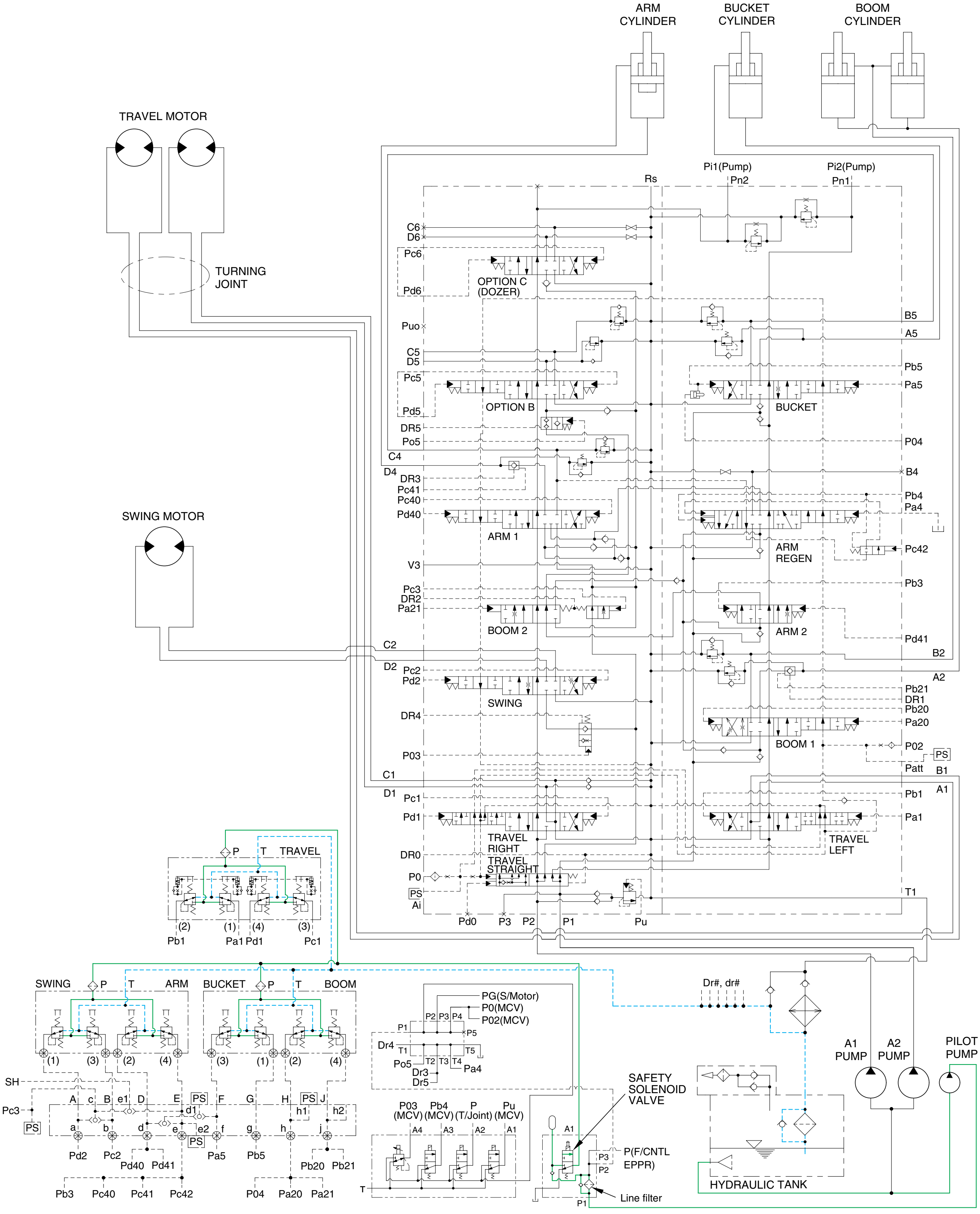
GROUP 3 PILOT CIRCUIT



(210-7) 3-05

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 line filter, EPPR valve, solenoid valve assemblies, swing parking brake, main control valve and safety lock solenoid valve.

1. SUCTION, DELIVERY AND RETURN CIRCUIT



130ZF3HC02

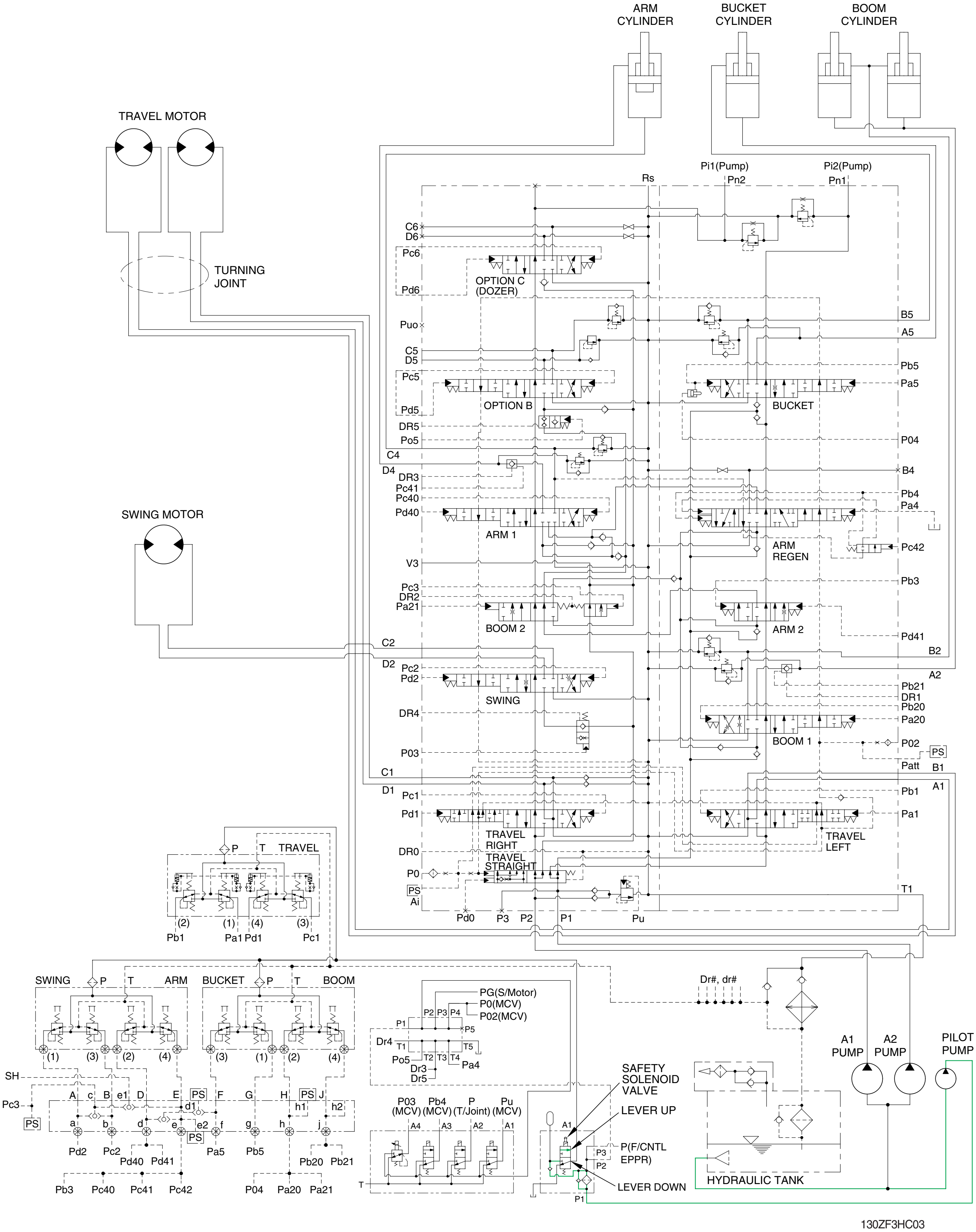
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve. The oil is filtered by the line filter.

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.

The return oil flow into the hydraulic tank.

2. SAFETY VALVE (SAFETY LEVER)

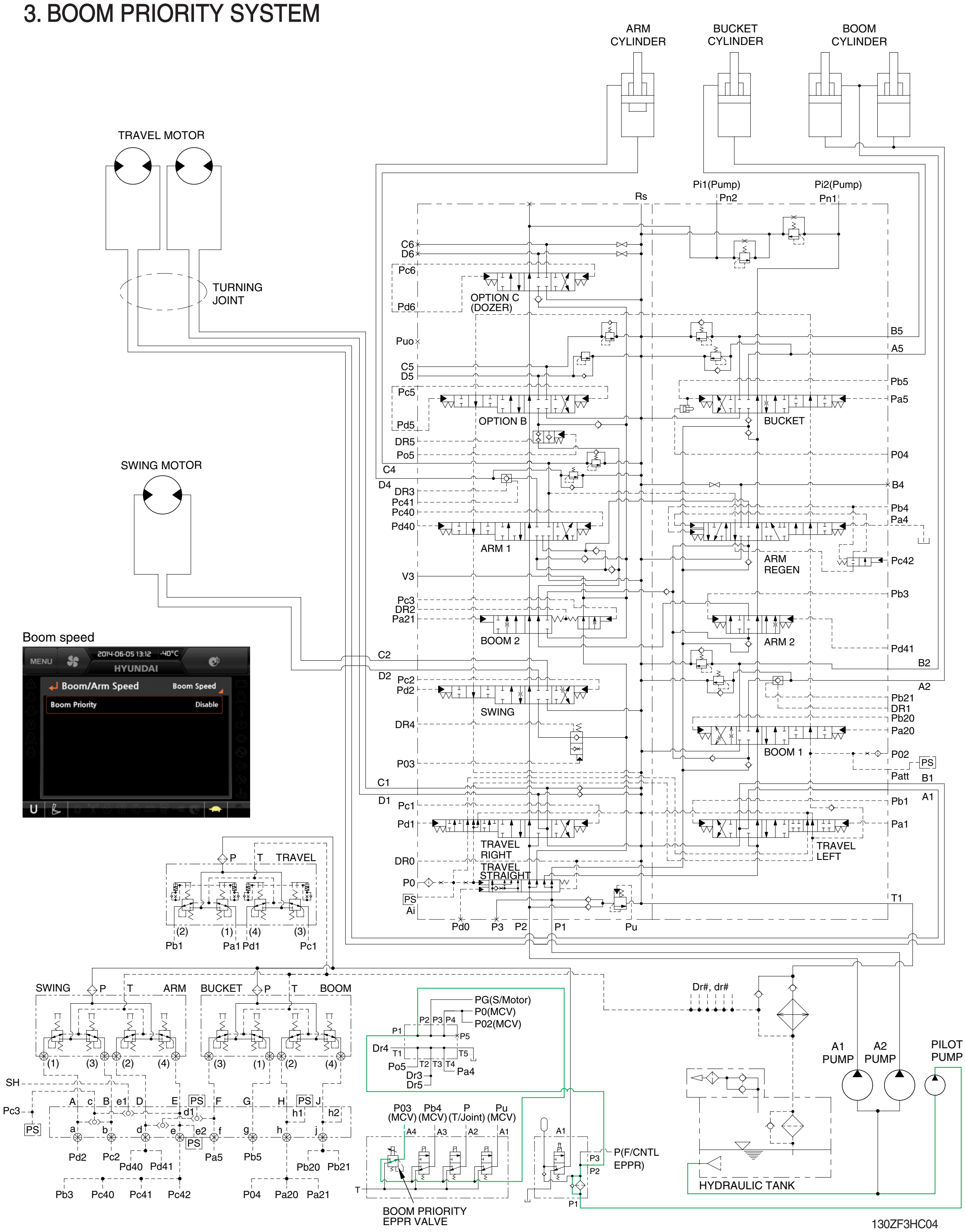


130ZF3HC03

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

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

3. BOOM PRIORITY SYSTEM



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

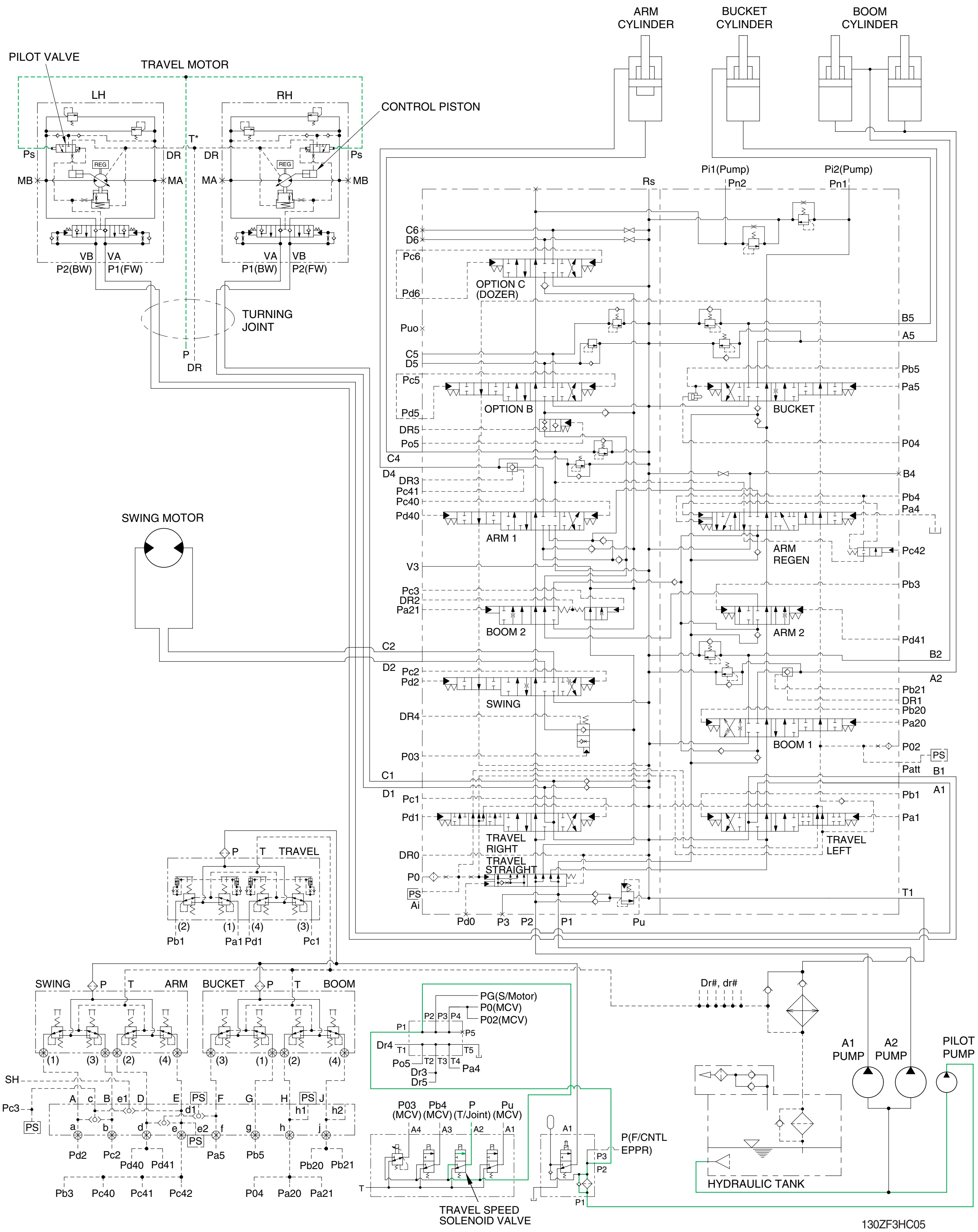
To increase working efficiency, swing speed reducing system is used.

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 3-20 of the operator's manual.

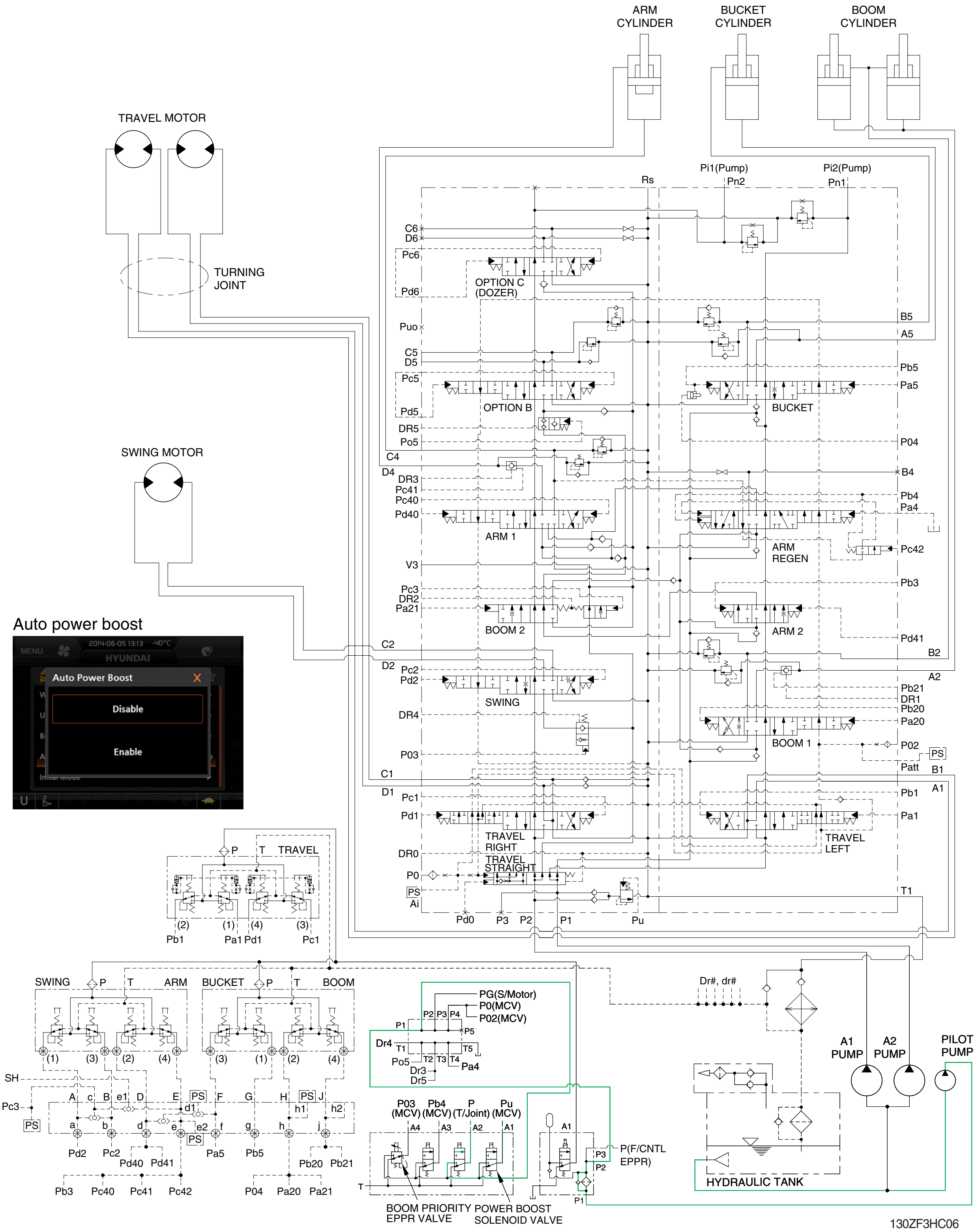
4. TRAVEL SPEED CONTROL SYSTEM



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.

5. MAIN RELIEF PRESSURE CHANGE SYSTEM



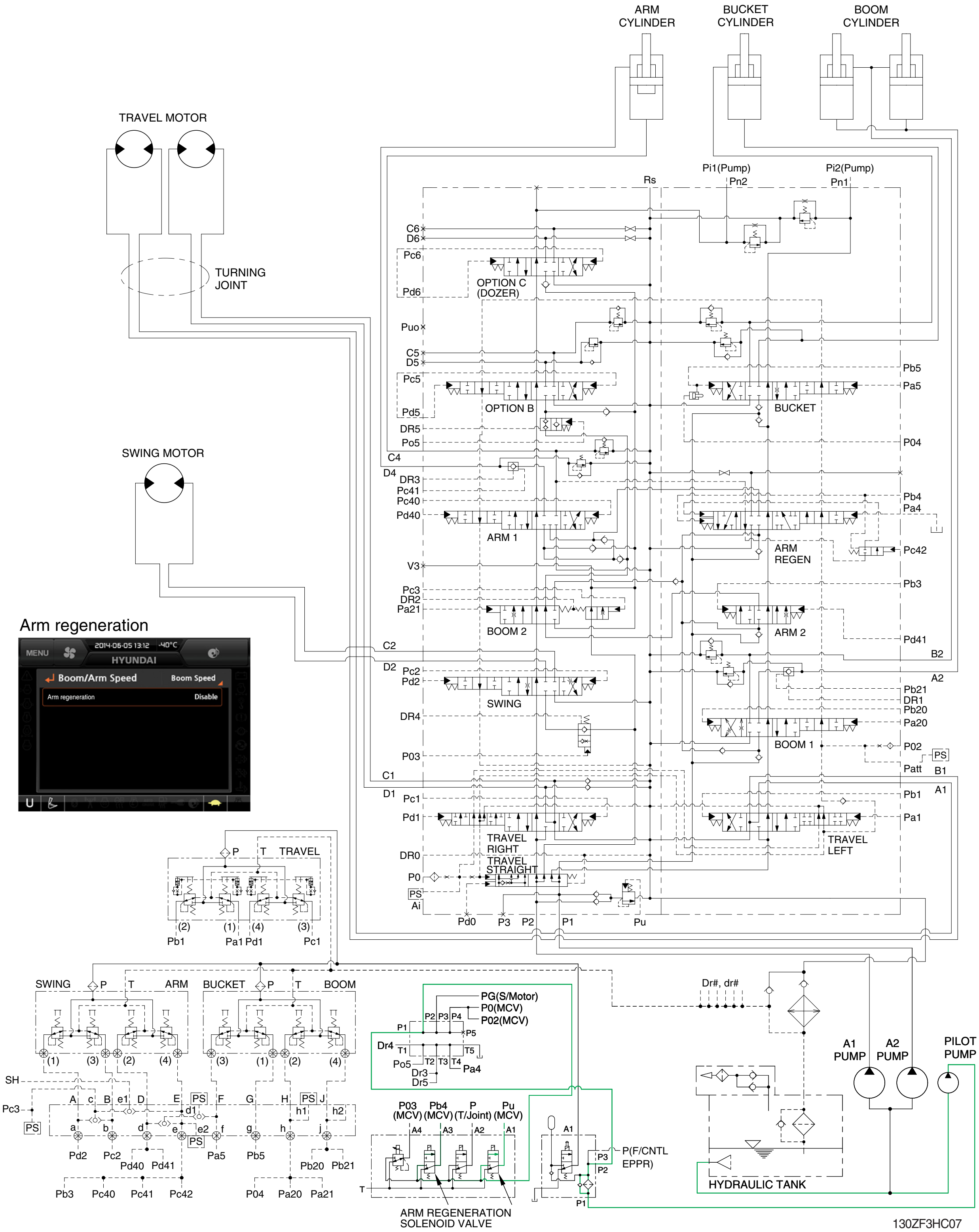
Auto power boost

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 330 kgf/cm^2 (4690 psi) to 360 kgf/cm^2 (5120 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 360 kgf/cm^2 (5120 psi) as working condition by the MCU. It is operated max 8 seconds.

6. ARM REGENERATION CUT SYSTEM



130ZF3HC07

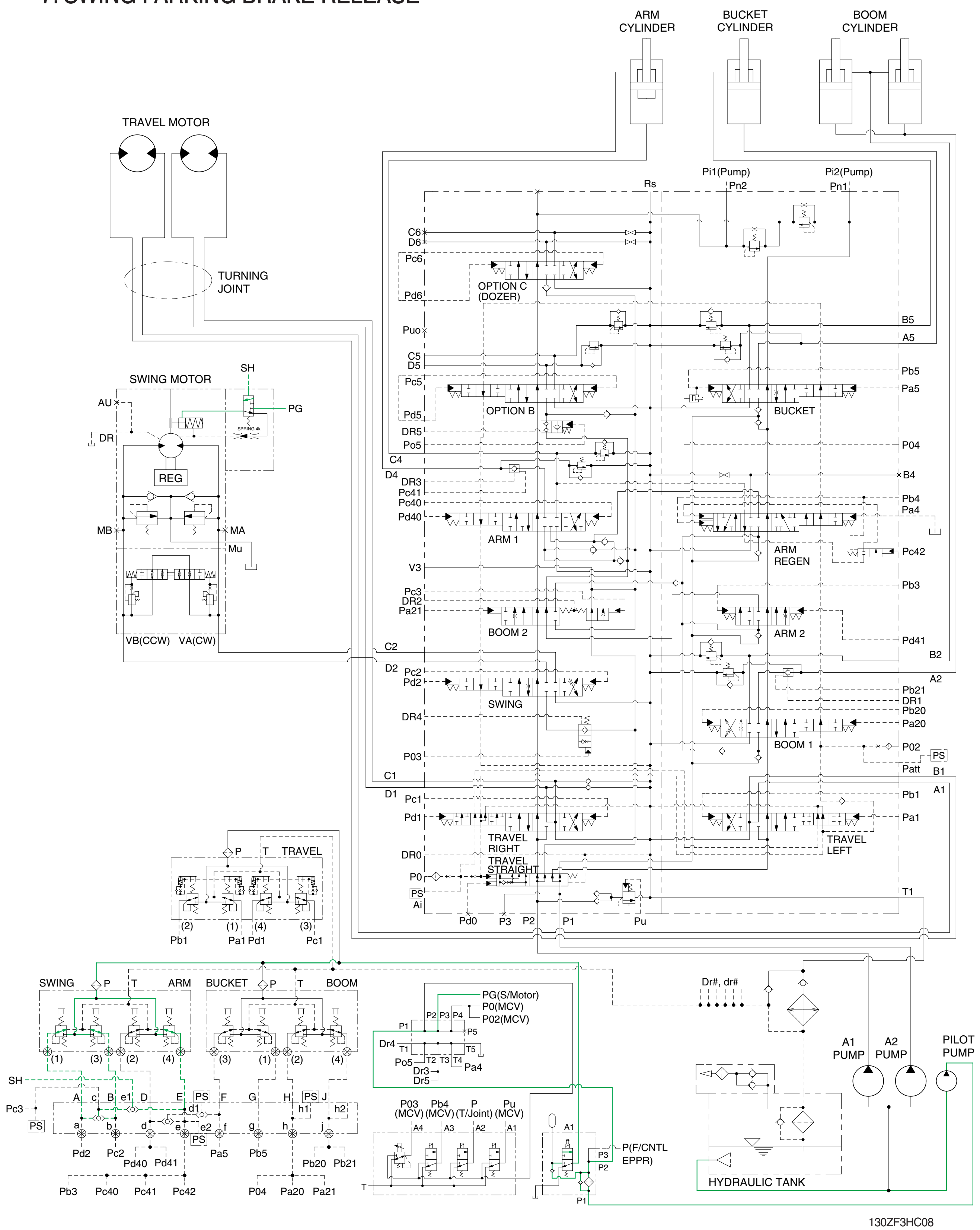
When the arm regeneration is selected to disable on the cluster, the arm regeneration solenoid valve is activated. The pilot oil from pilot pump flow into **Pb4** port in main control valve through solenoid valve and the arm regeneration spool is shifted to left.

Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

When the arm regeneration is selected to enable on the cluster, the arm regeneration function is activated and arm in operation speed is increased.

Refer to page 3-37 for the arm regeneration function.

7. SWING PARKING BRAKE RELEASE

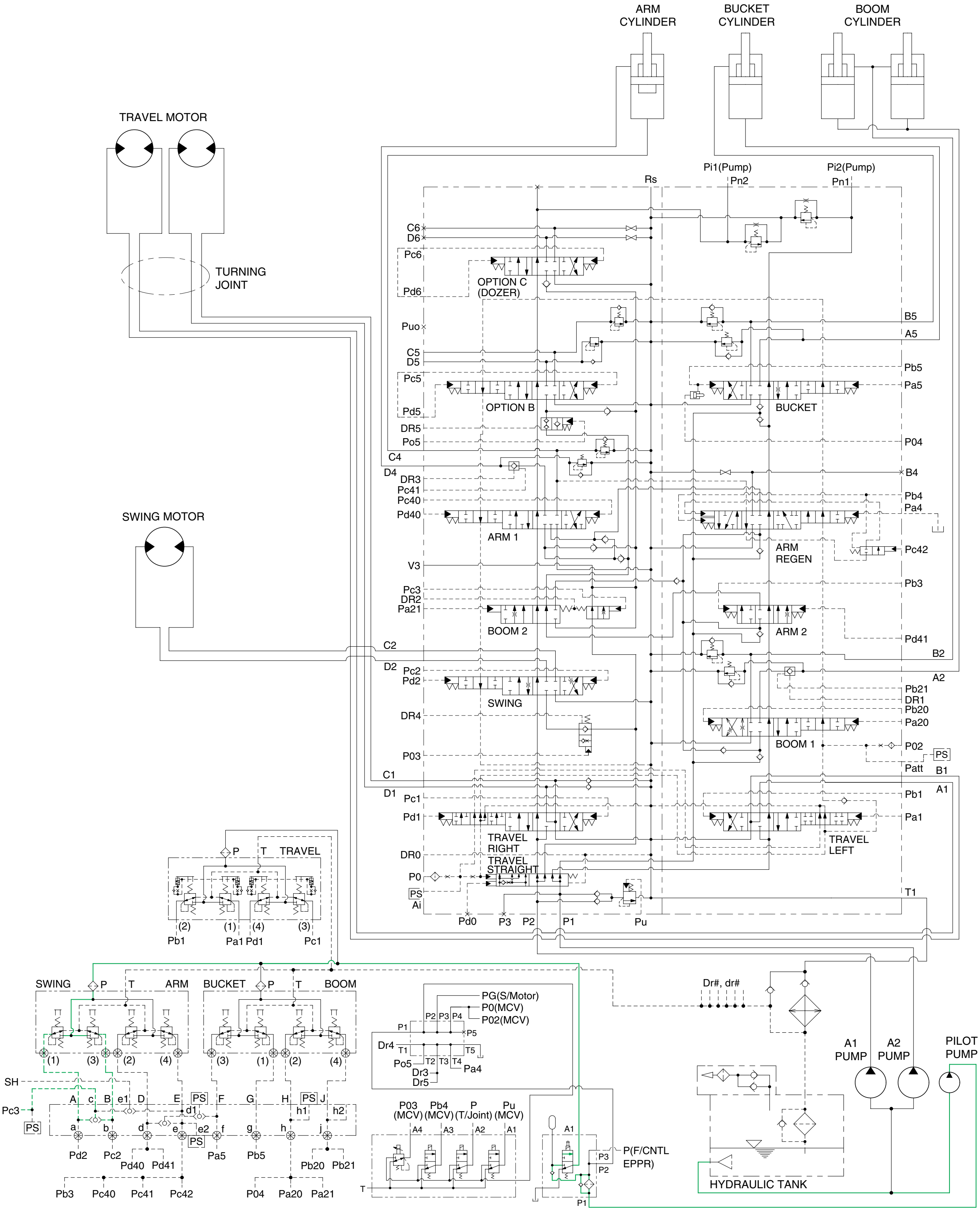


When the swing control lever or arm in control lever is tilted, the pilot oil flows into SH port through shuttle valve.

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.

8. SWING PRIORITY SYSTEM



130ZF3HC09

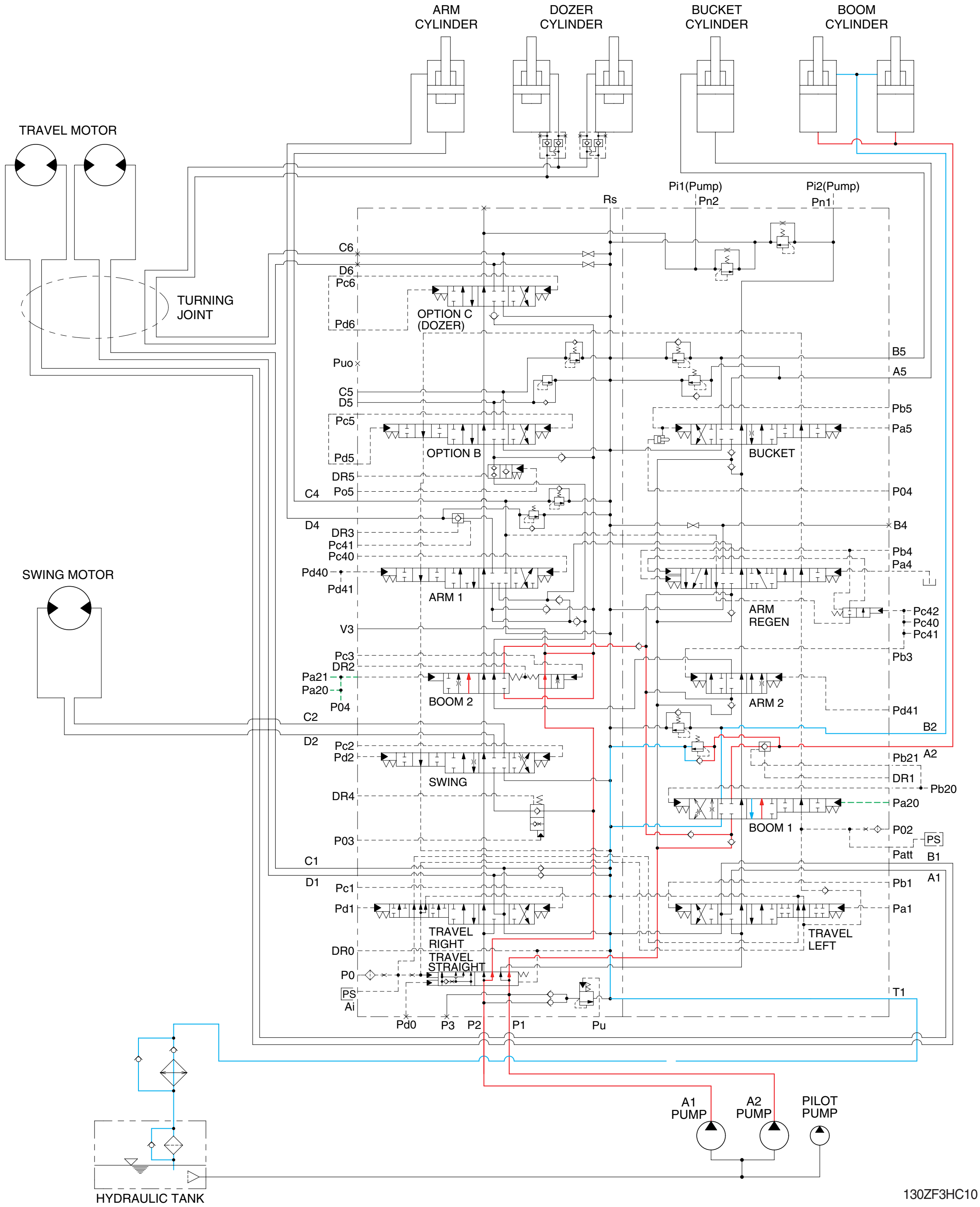
When carrying out the combined operation of swing and arm of the left control valve, the swing speed can be lowered than operating speed of arm.

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.

GROUP 4 SINGLE OPERATION

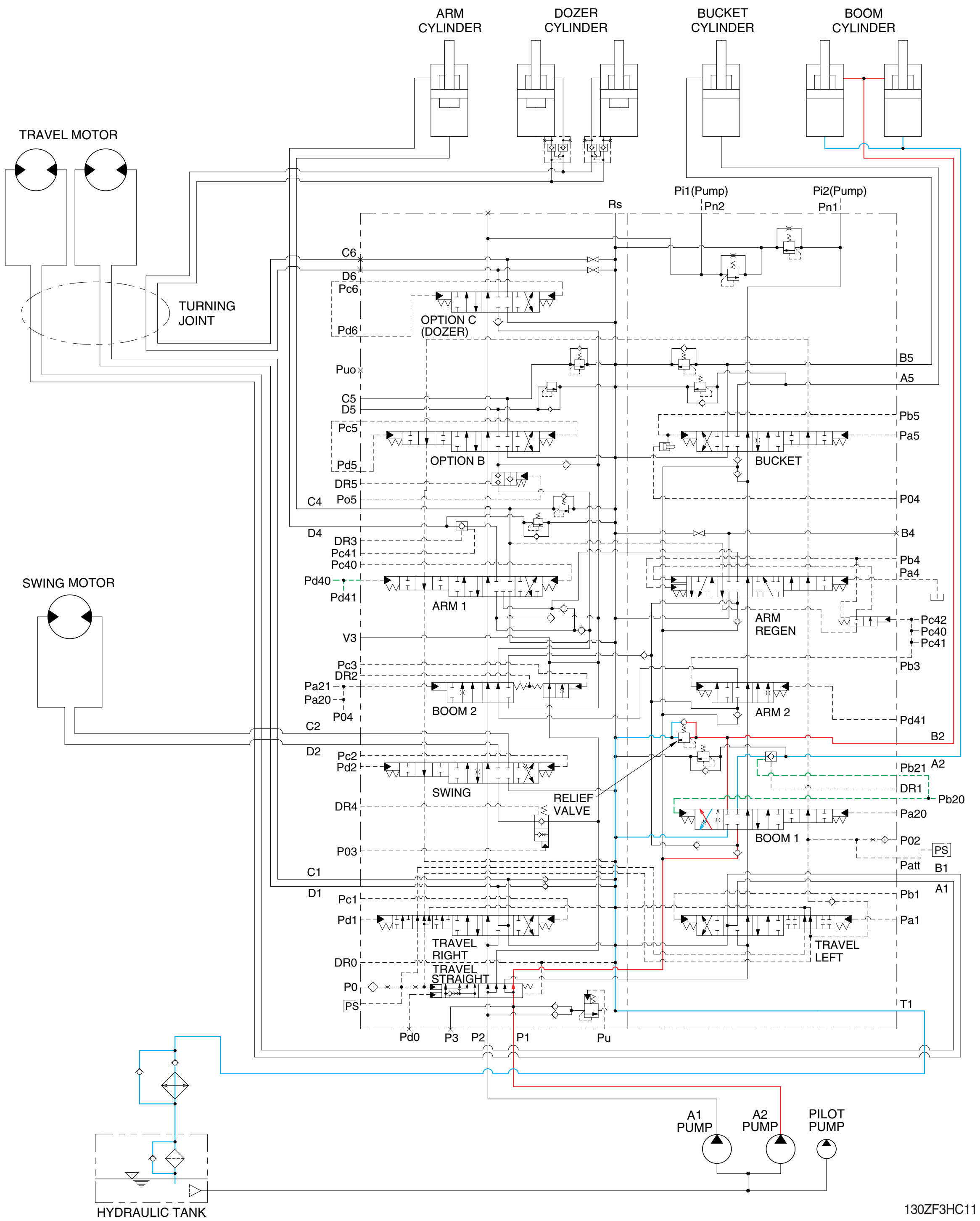
1. BOOM UP OPERATION



130ZF3HC10

When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure from the remote control valve.
The oil from the A1 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 cylinder.

2. BOOM DOWN OPERATION



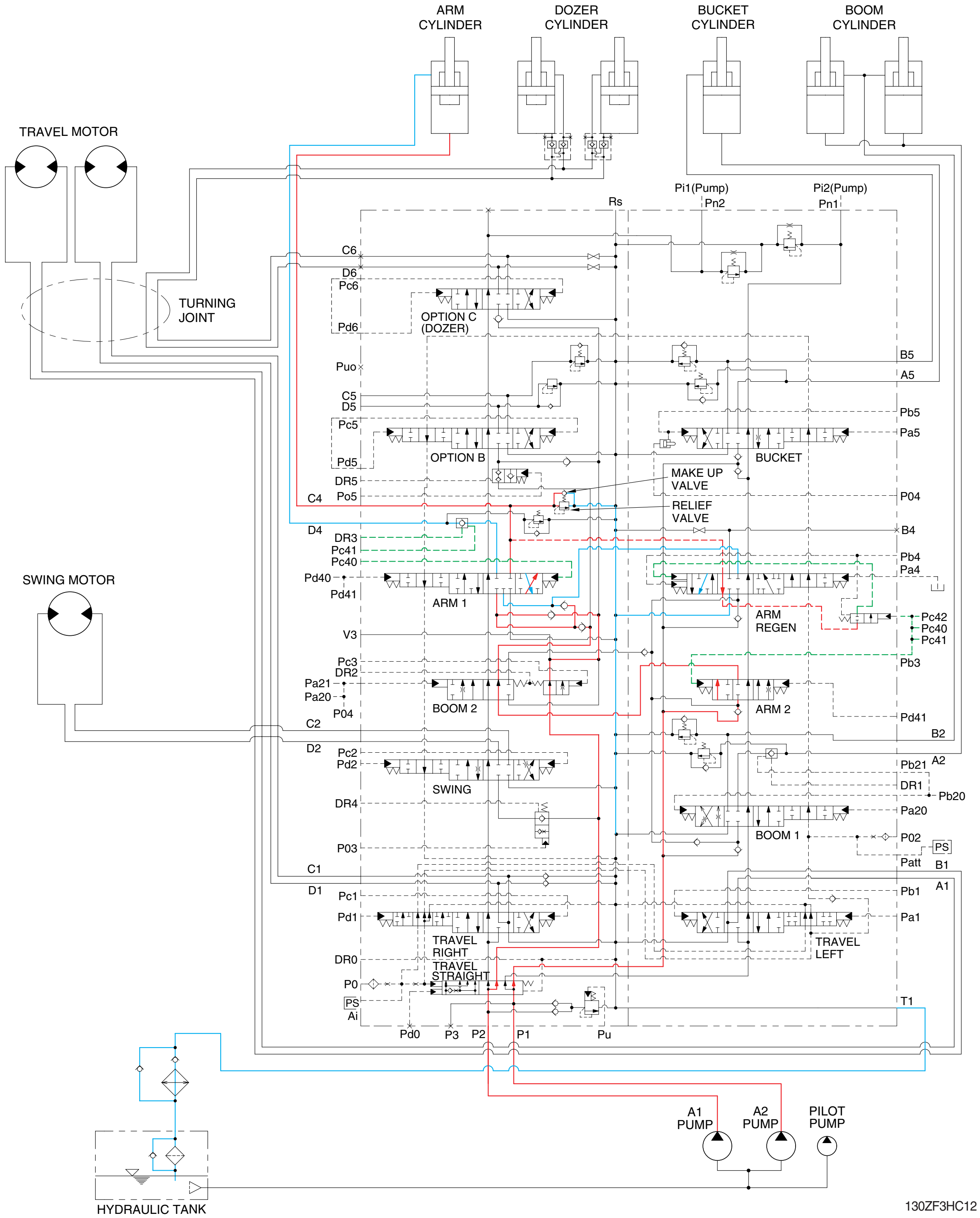
When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure from the remote control valve.

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.

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 from the remote control valve.

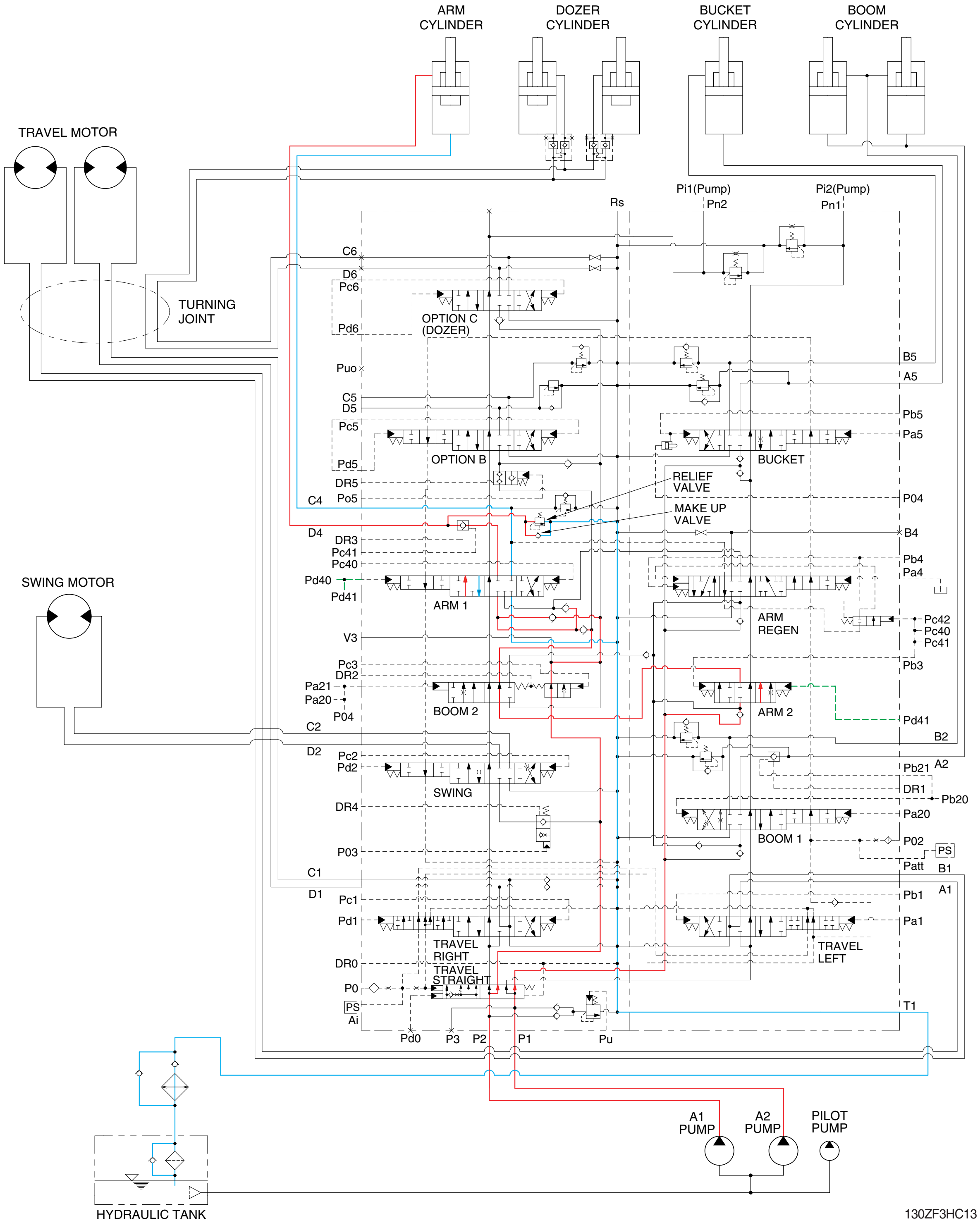
The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

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.

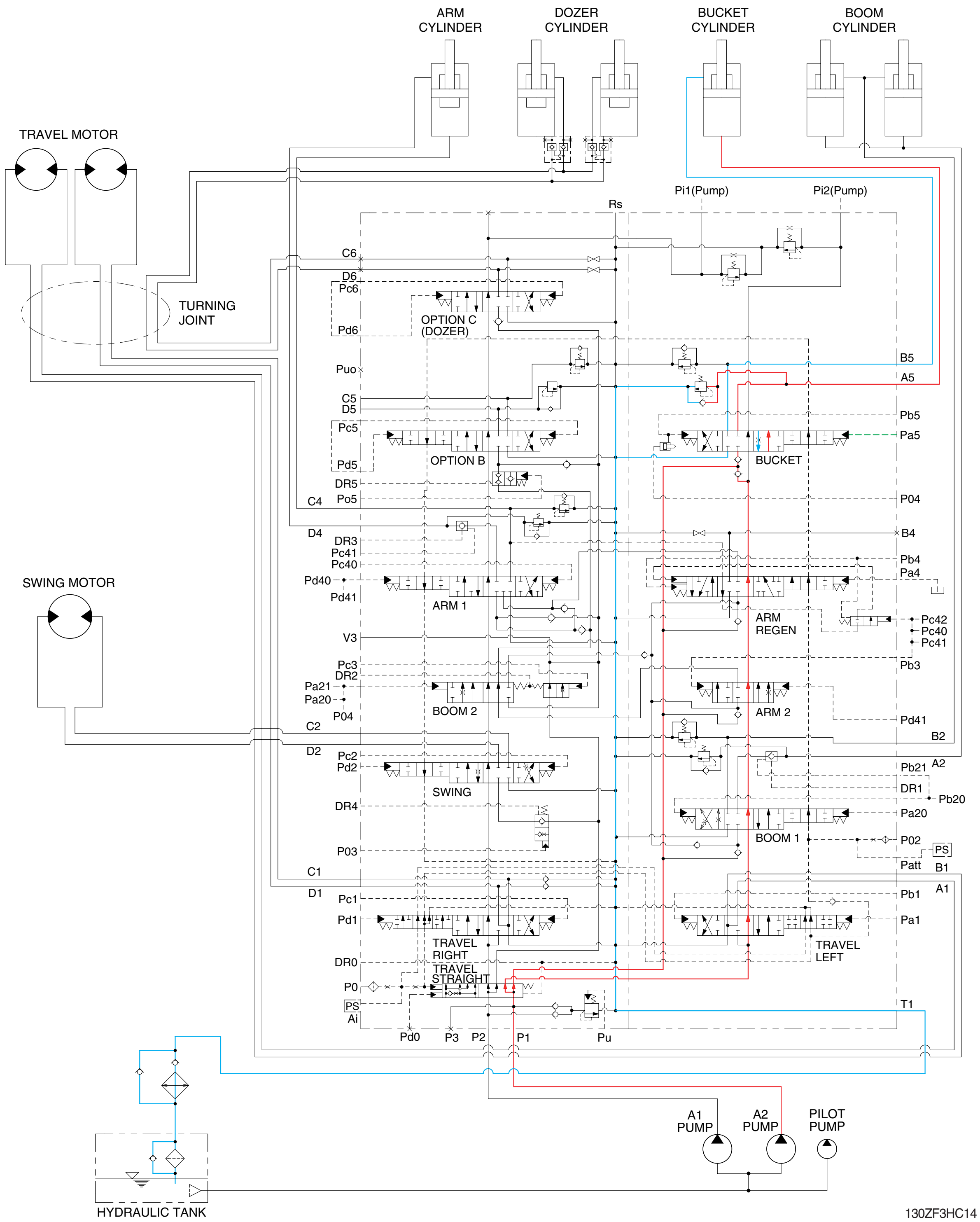
4. ARM OUT OPERATION



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 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.

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 from the remote control valve.

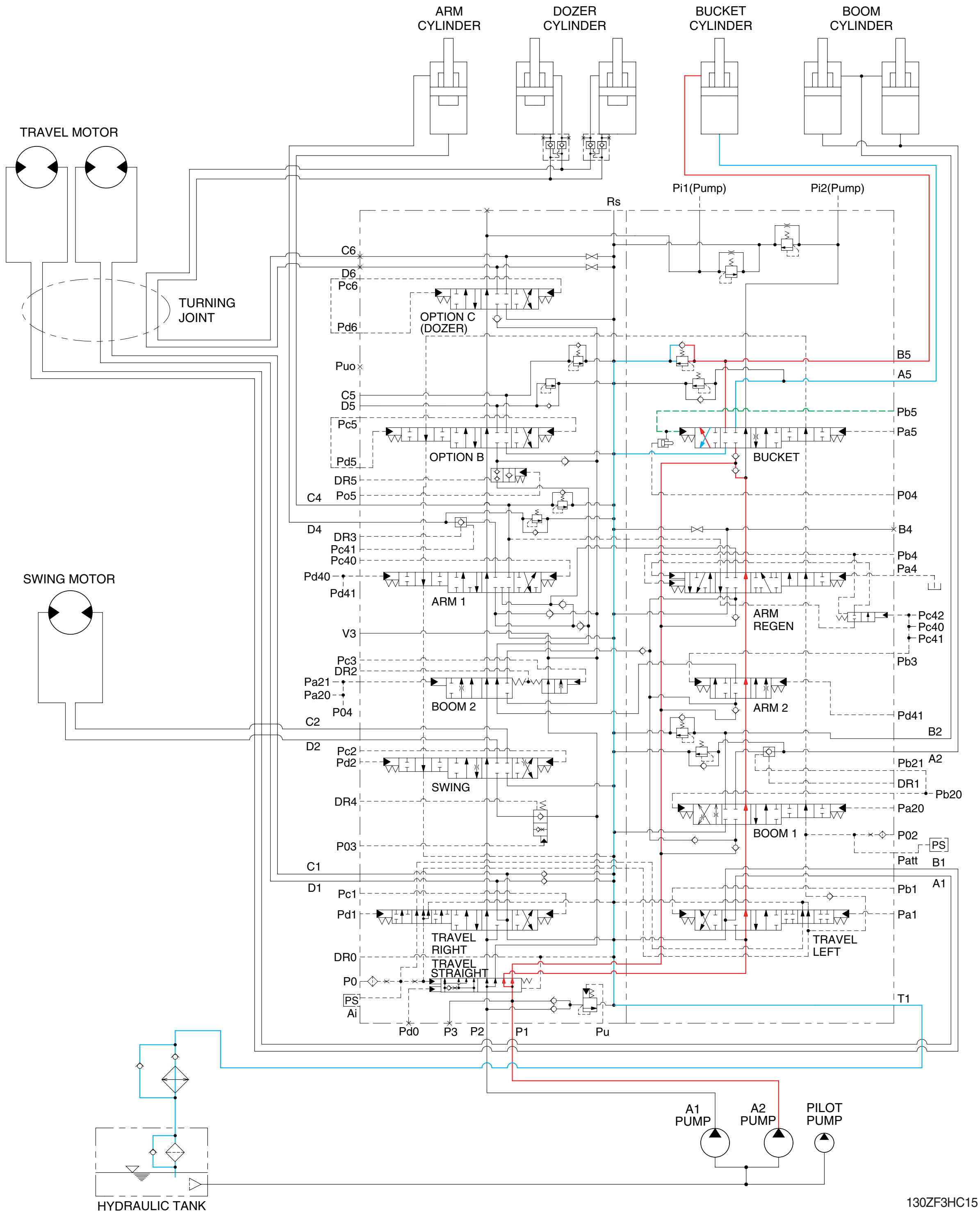
The oil from the A2 pump flows into the main control valve and then goes to the large chamber of bucket cylinder.

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.

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 from the remote control valve.

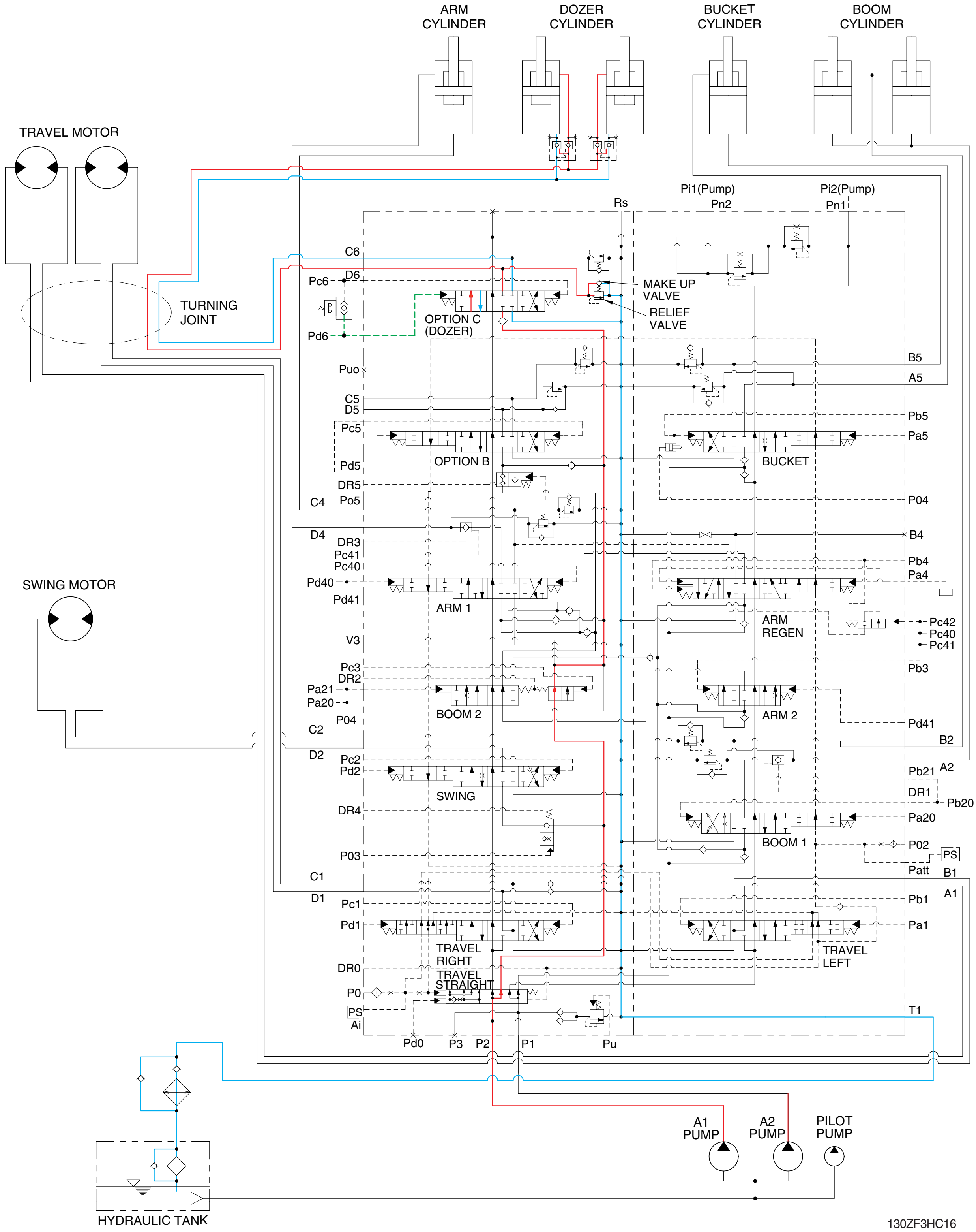
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

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.

7. DOZER UP OPERATION

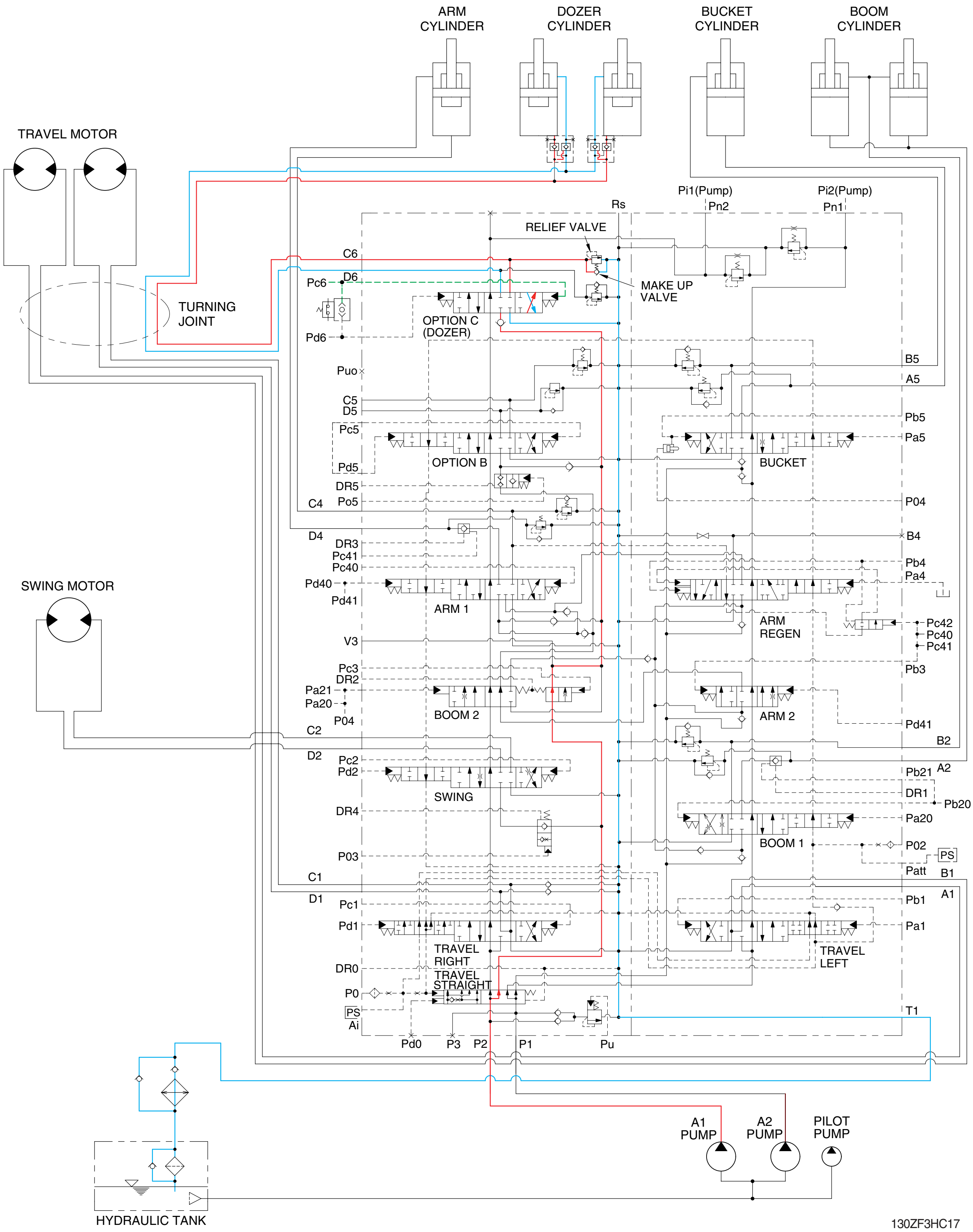


When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.

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.

8. DOZER DOWN OPERATION

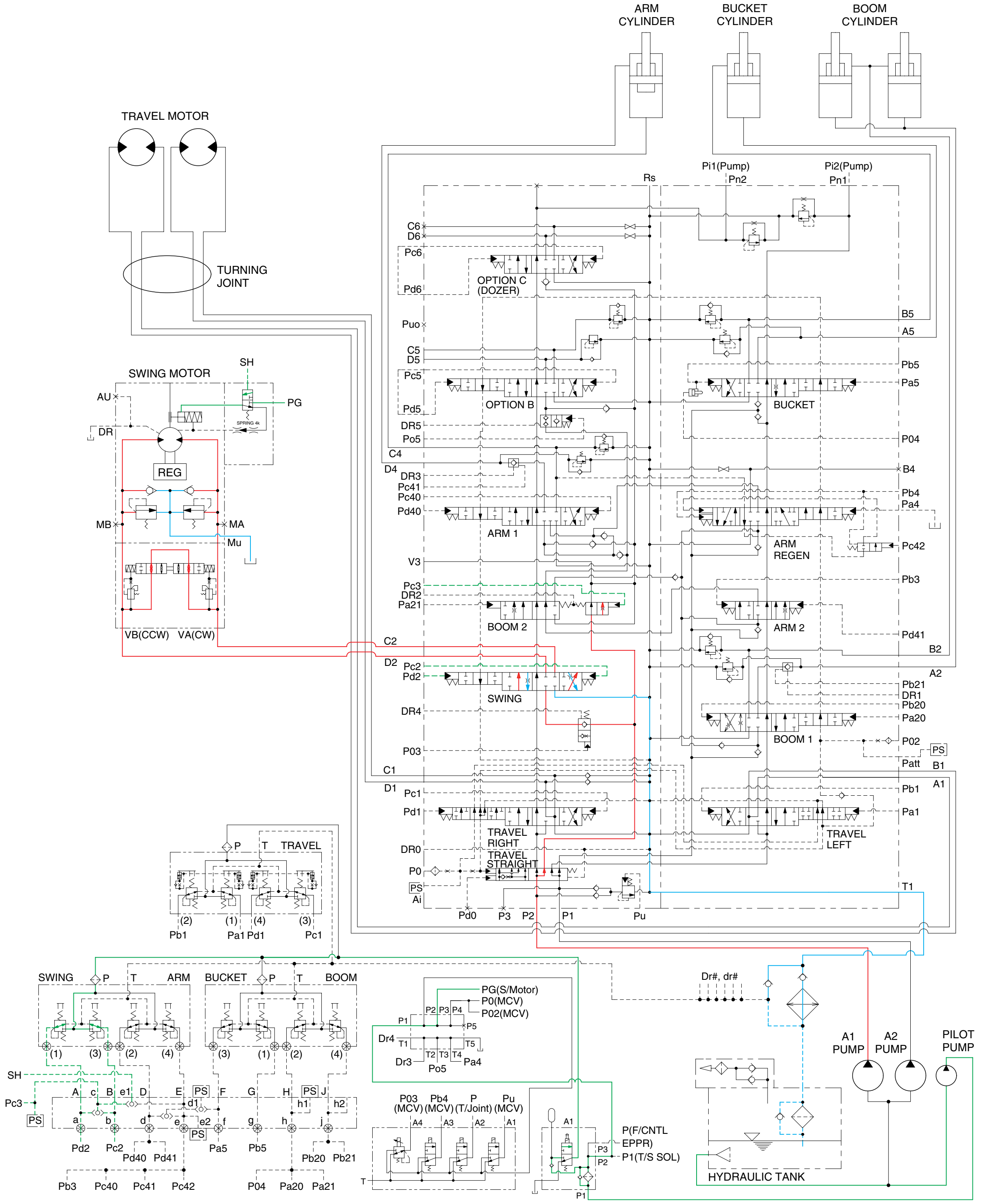


When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

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.

9. SWING OPERATION



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

Also the swing operation preference function is operated by the pilot pressure Pc3 (refer to page 3-13).

The oil from the A1 pump flows into the main control valve and then goes to the swing motor.

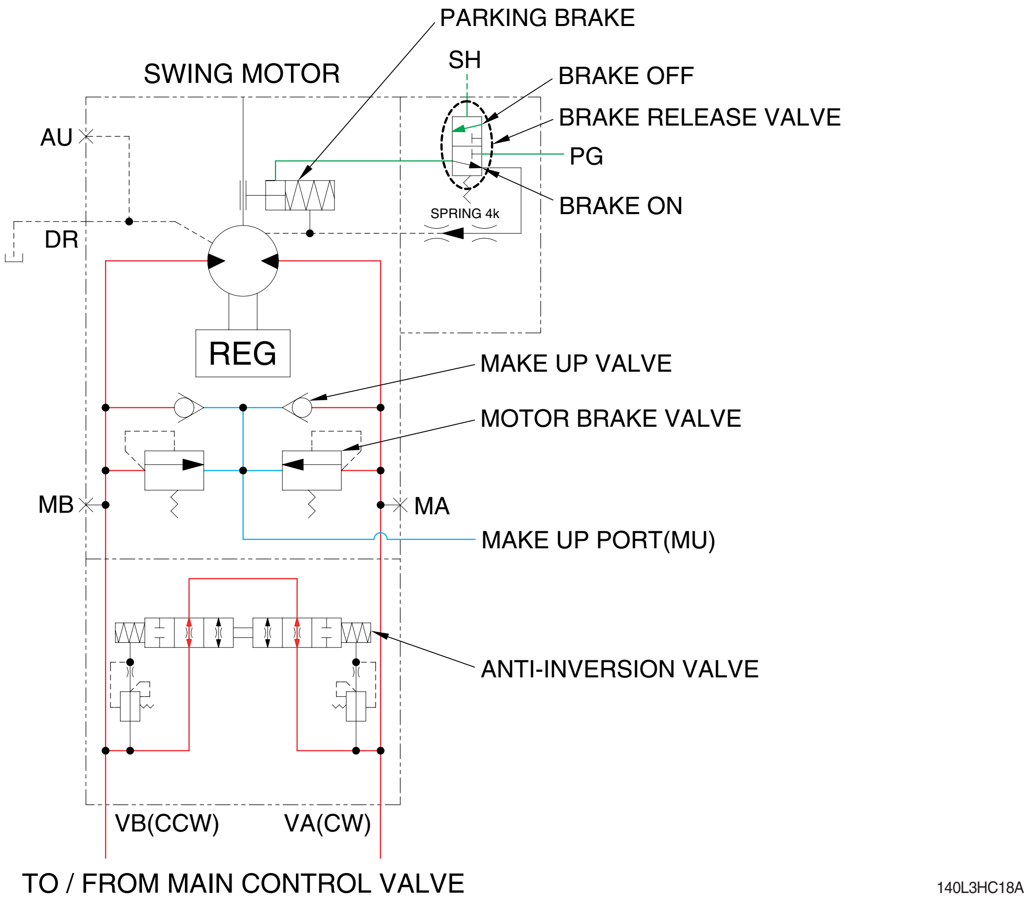
At the same time, the return oil from the swing motor returns to the hydraulic oil tank through the swing spool in the main control valve.

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.

SWING CIRCUIT OPERATION



1) MOTOR BRAKE VALVE

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

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.

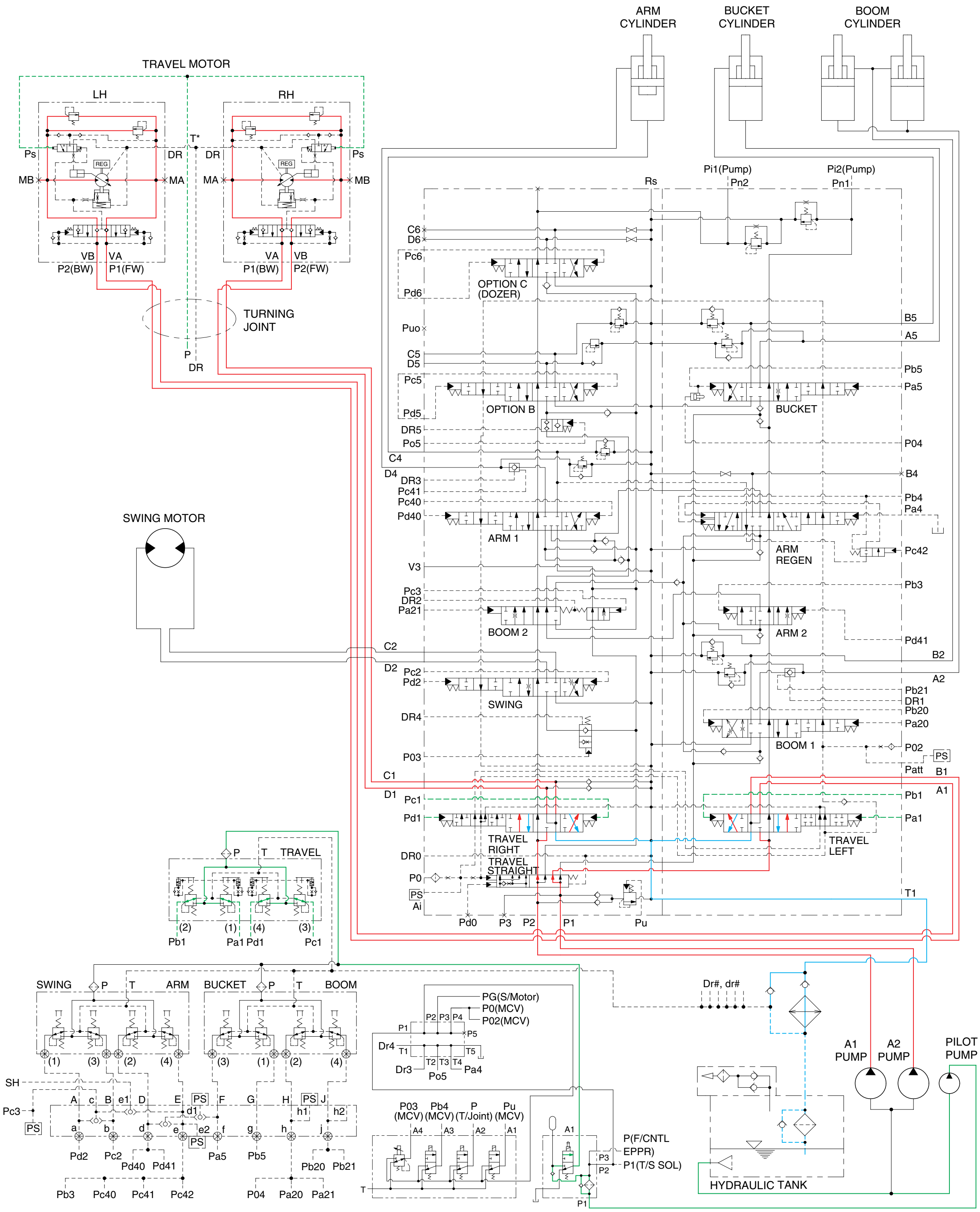
PARKING BRAKE "ON" OPERATION

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.

10. TRAVEL FORWARD AND REVERSE OPERATION



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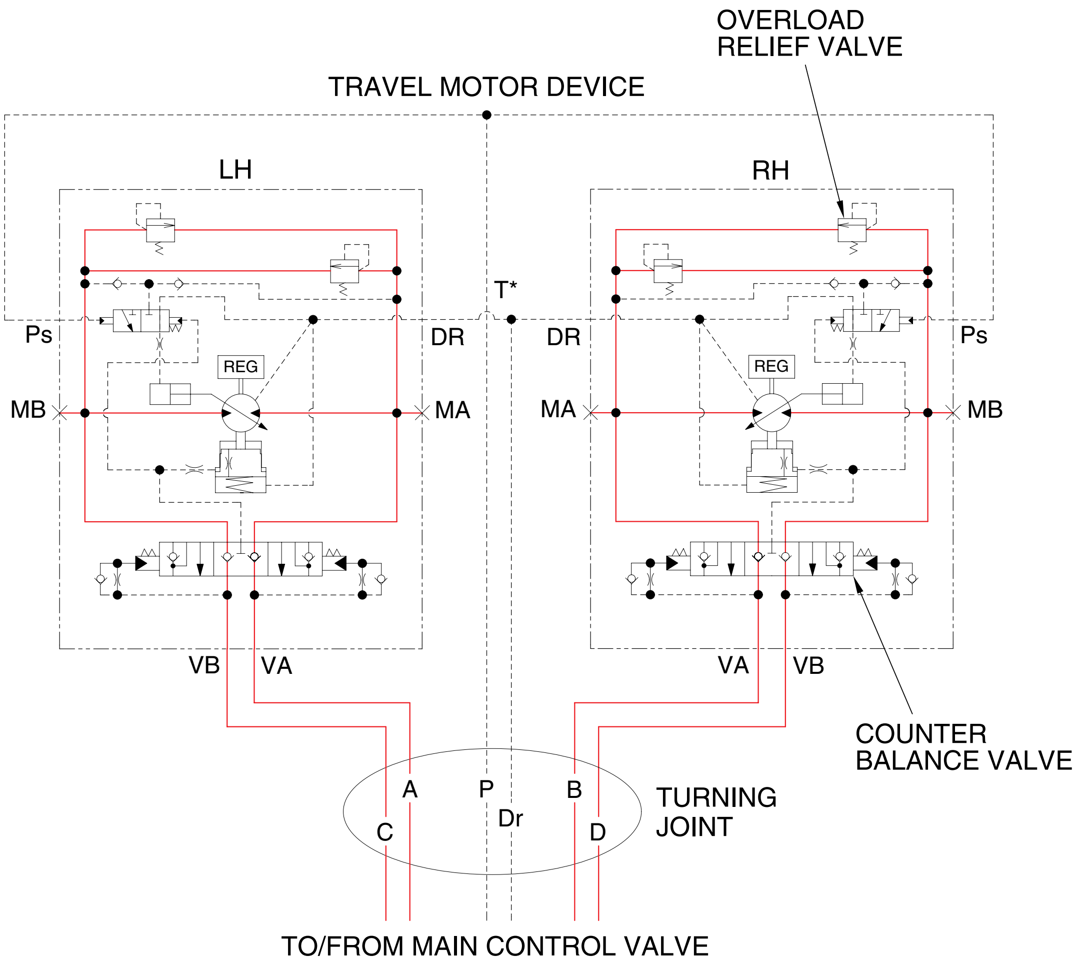
When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by the pilot oil pressure from the remote control valve.

The oil from the 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.

TRAVEL CIRCUIT OPERATION



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

1) COUNTER BALANCE VALVE

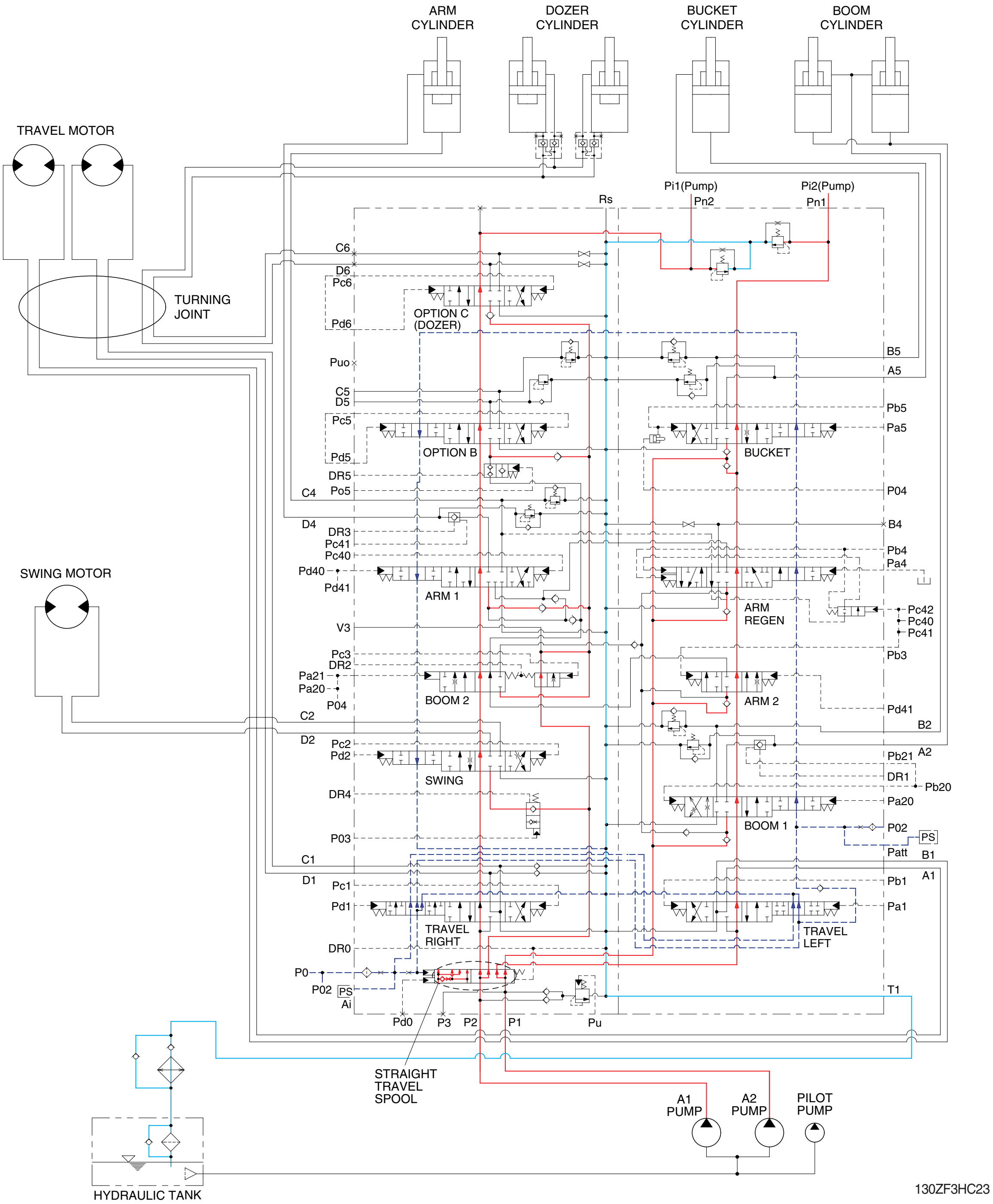
When stopping the motor of slope descending, this valve to prevent the motor over run.

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.

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.

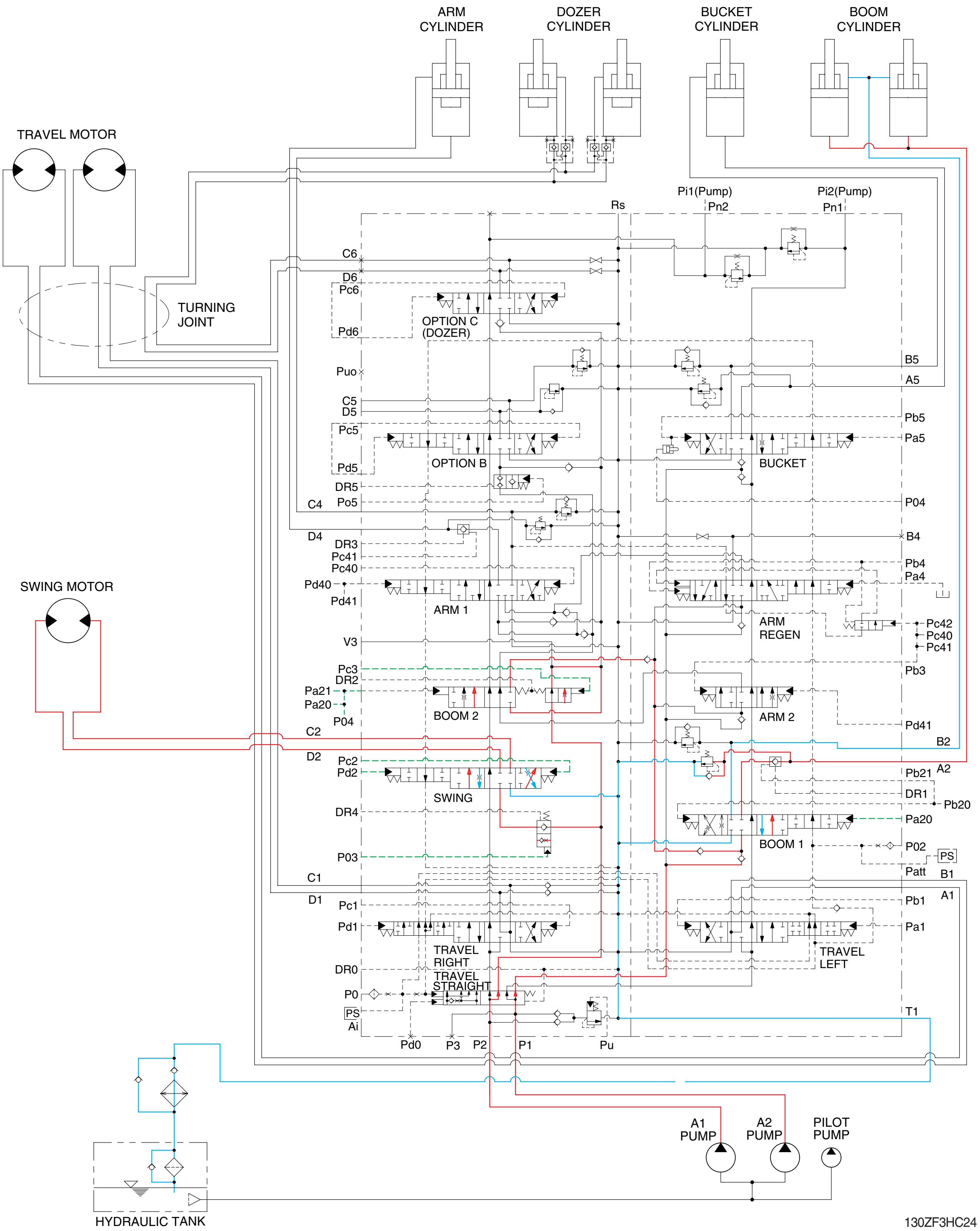
STRAIGHT TRAVEL SPOOL

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.

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

2. COMBINED SWING AND BOOM 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 from the remote control valve.

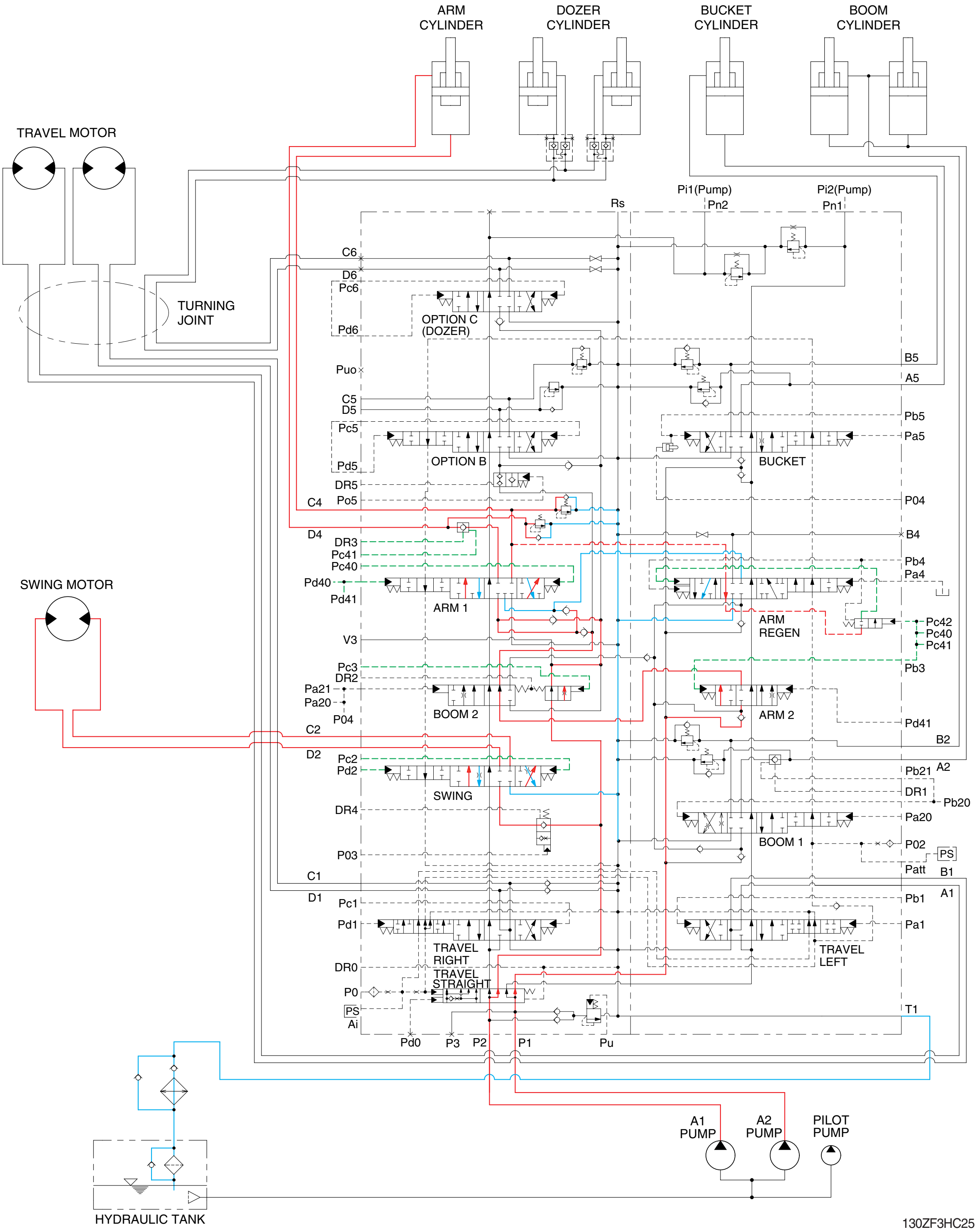
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

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 3-8 for the boom priority system.

3. COMBINED SWING AND ARM OPERATION



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

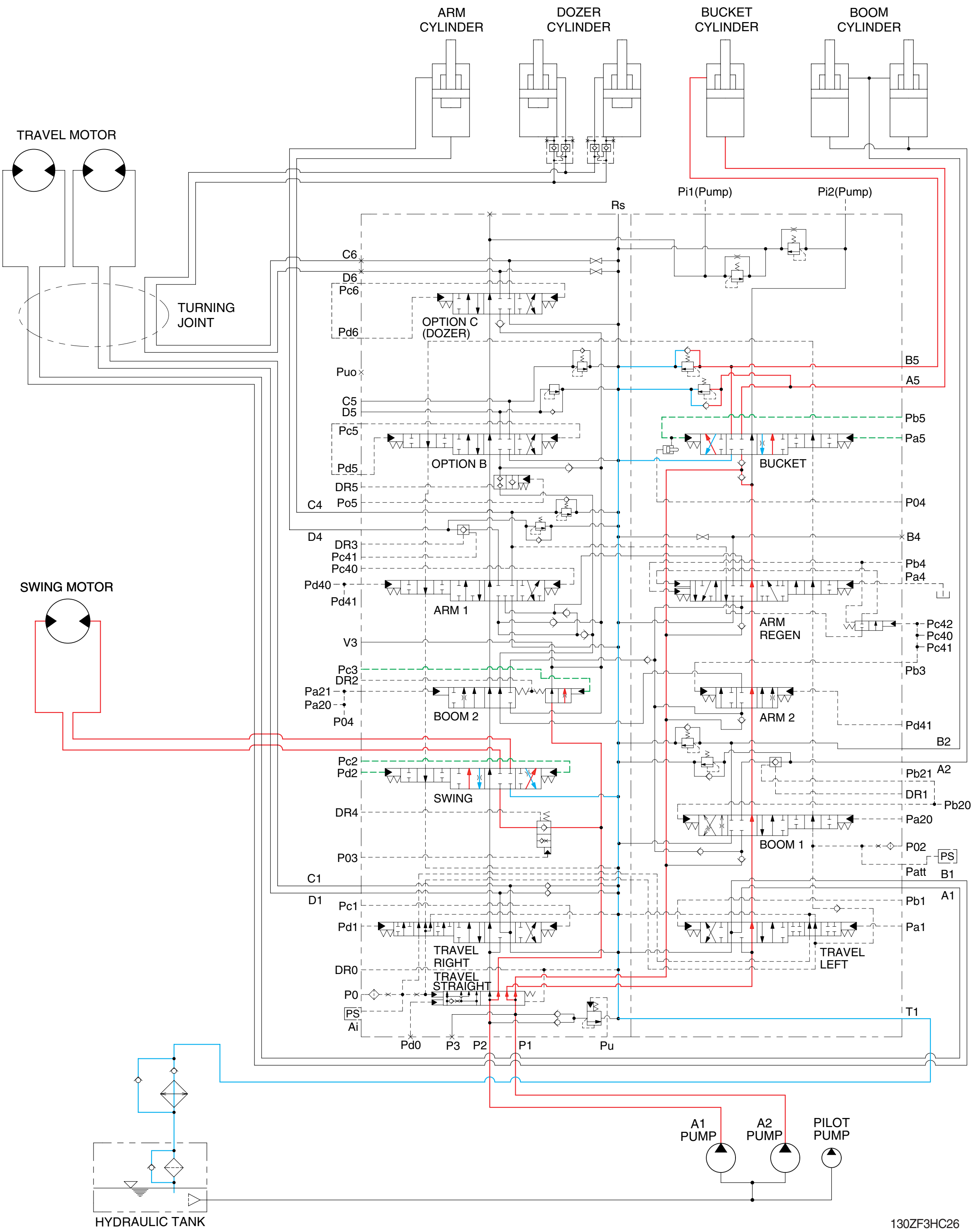
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

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 3-13 for the swing operation preference function.

4. COMBINED SWING AND BUCKET OPERATION



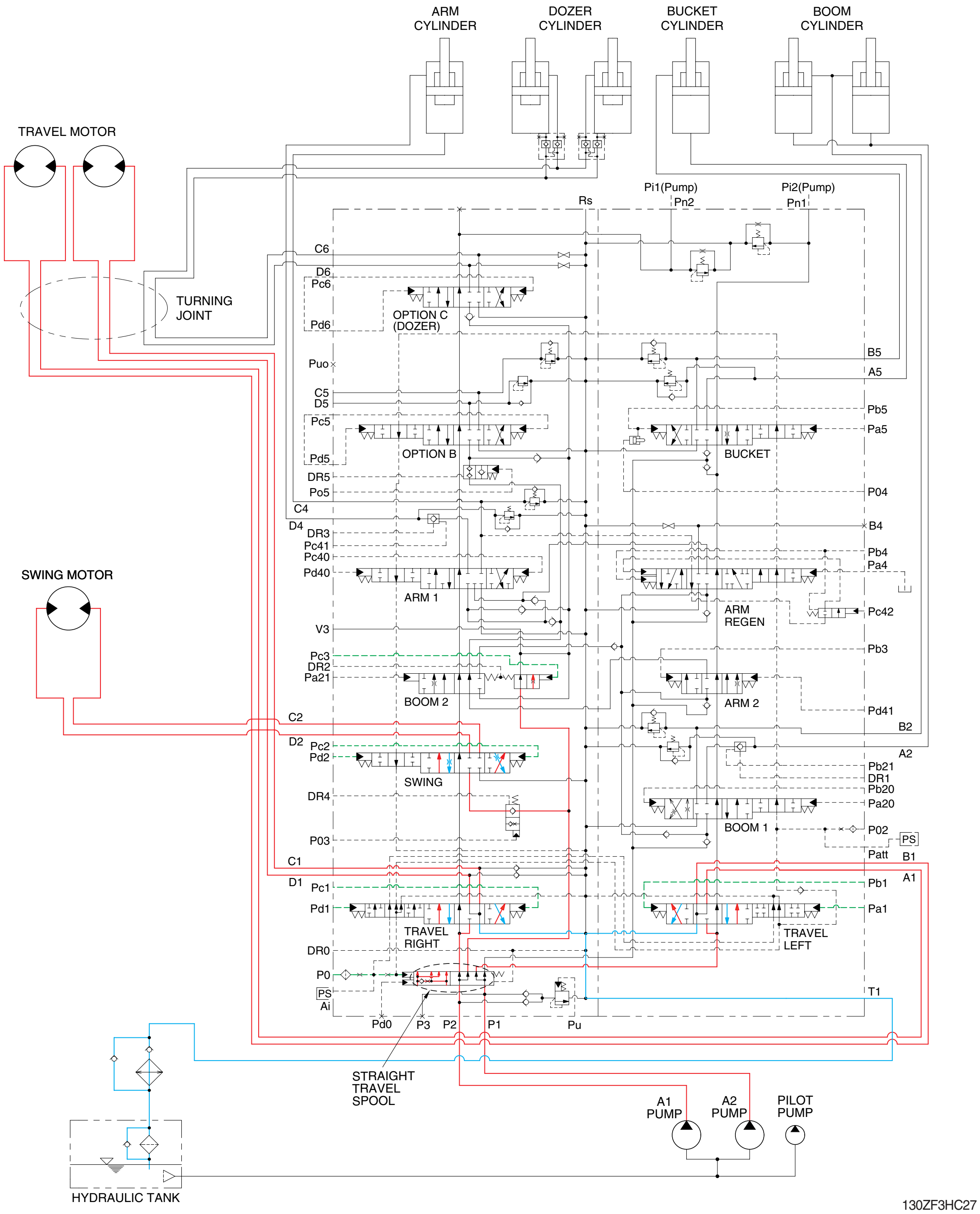
When the swing and bucket functions are operated simultaneously, the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the 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.

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 from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump.

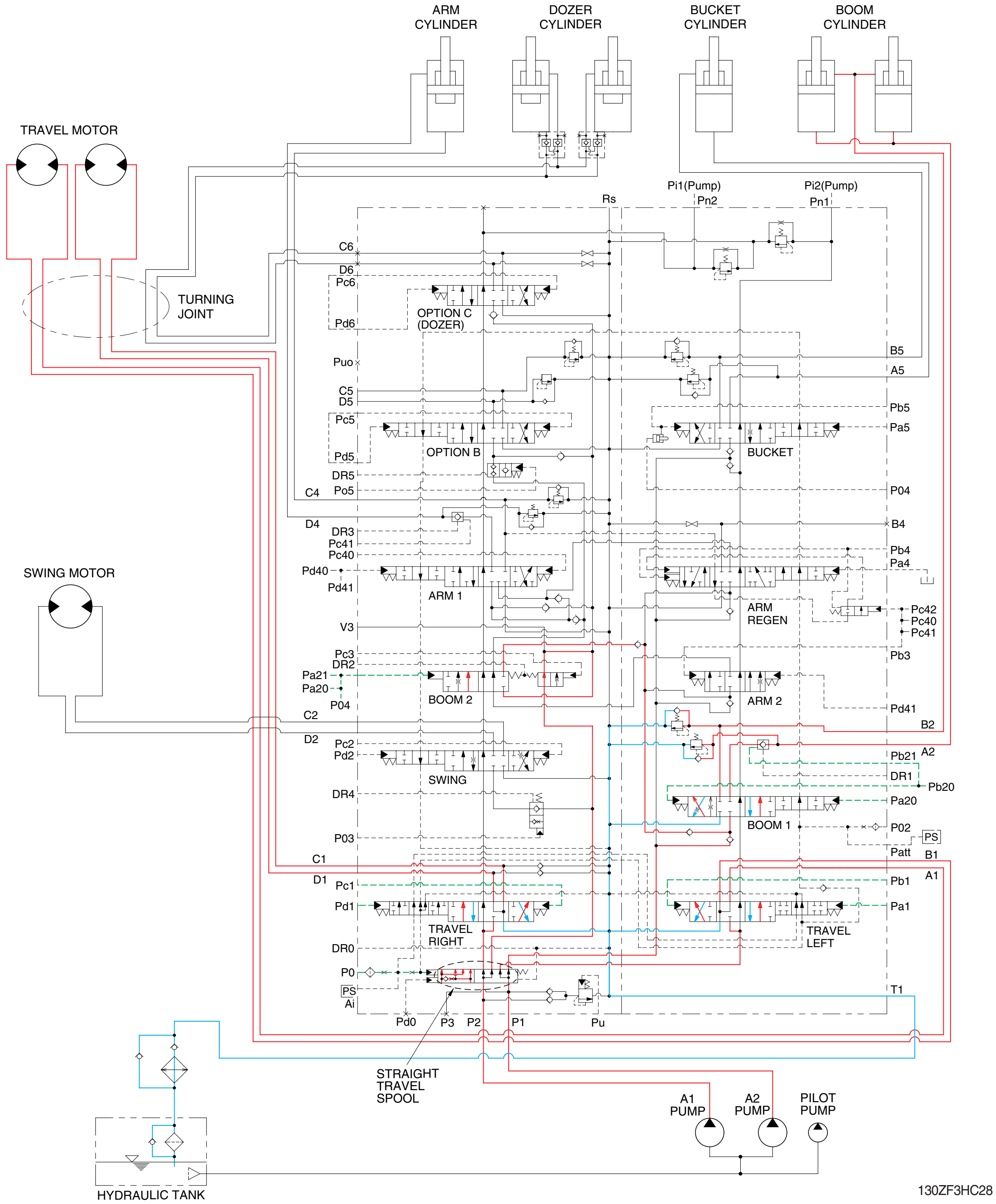
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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.

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 from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

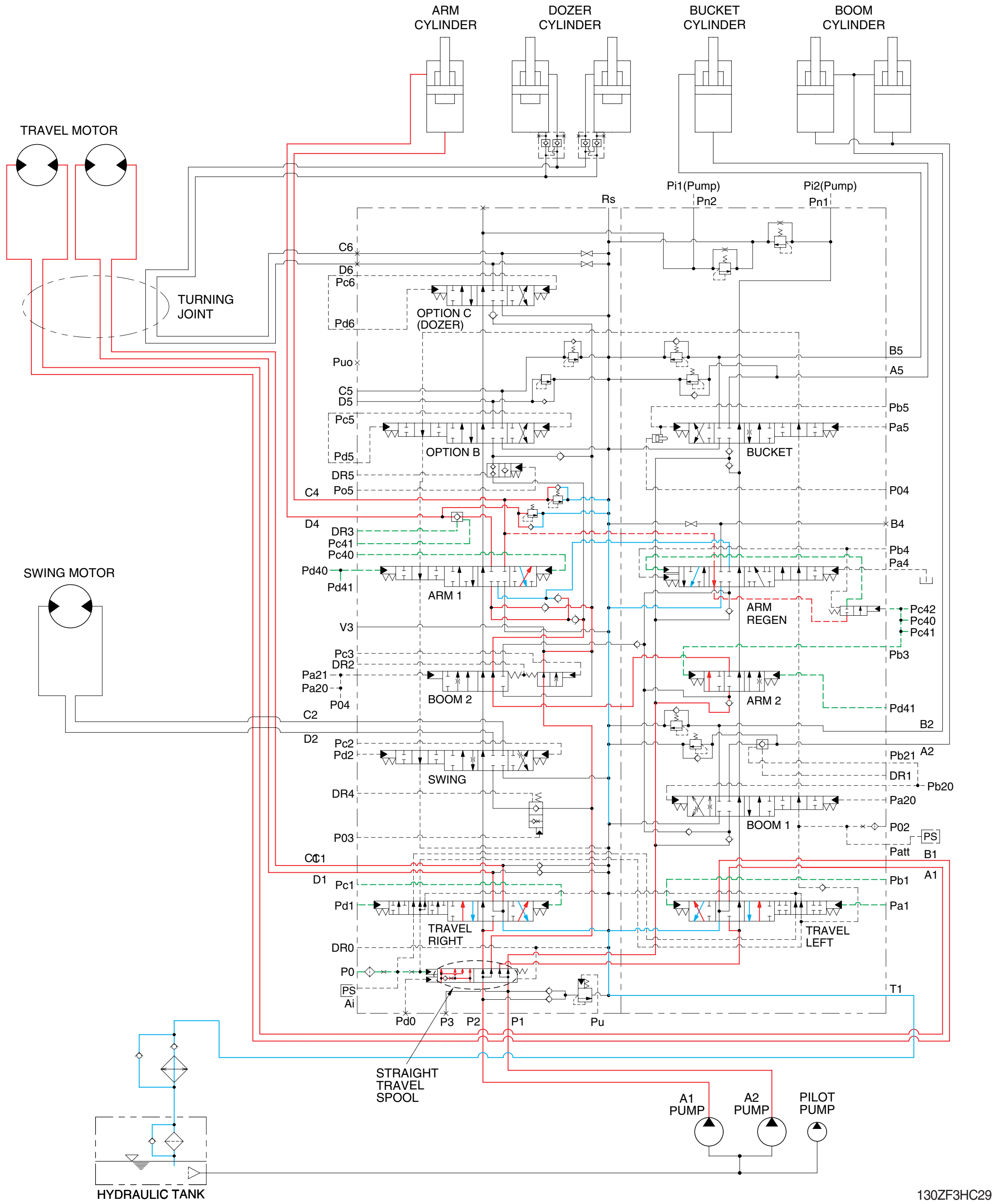
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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.

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 from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

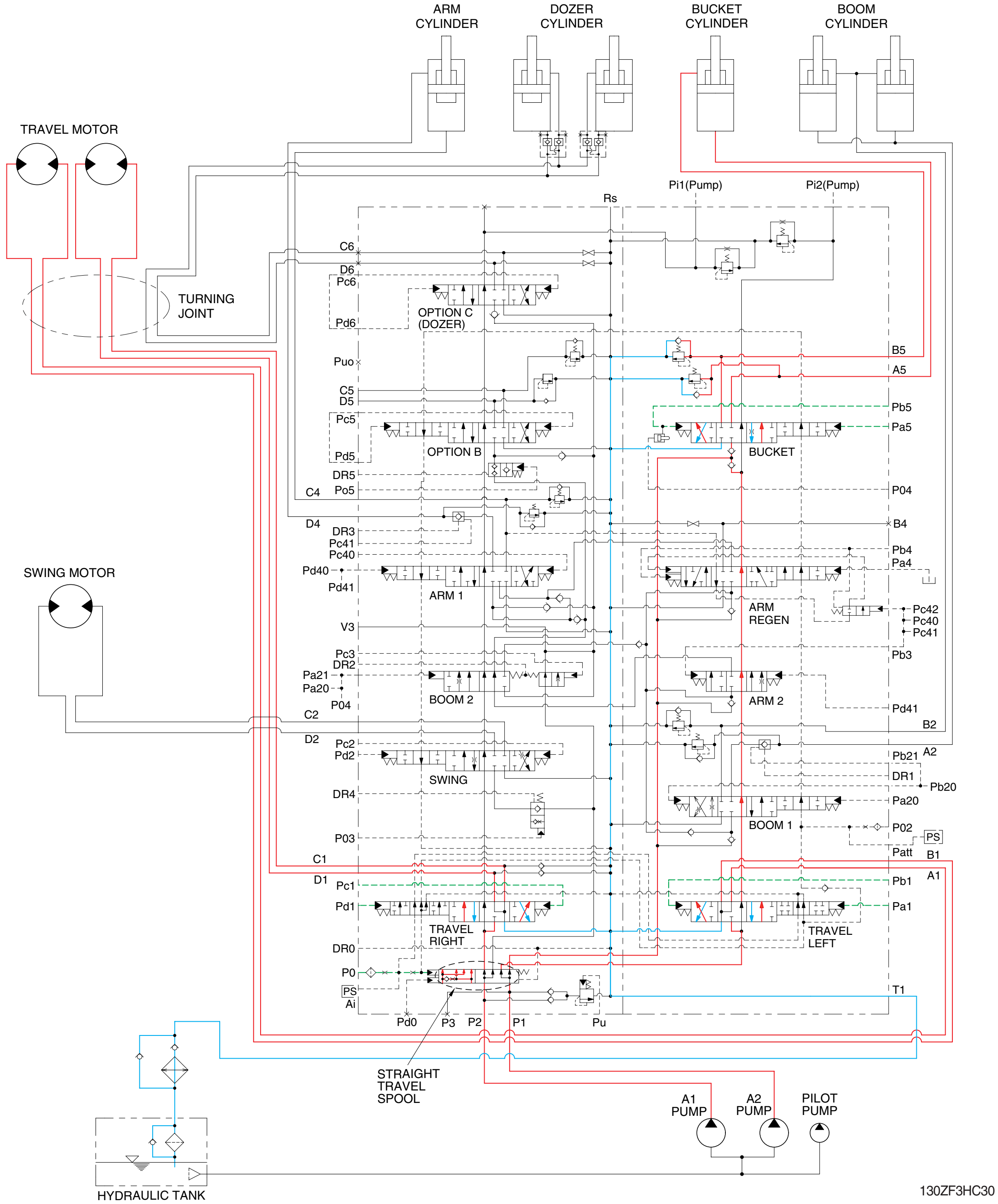
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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.

8. COMBINED BUCKET AND TRAVEL OPERATION



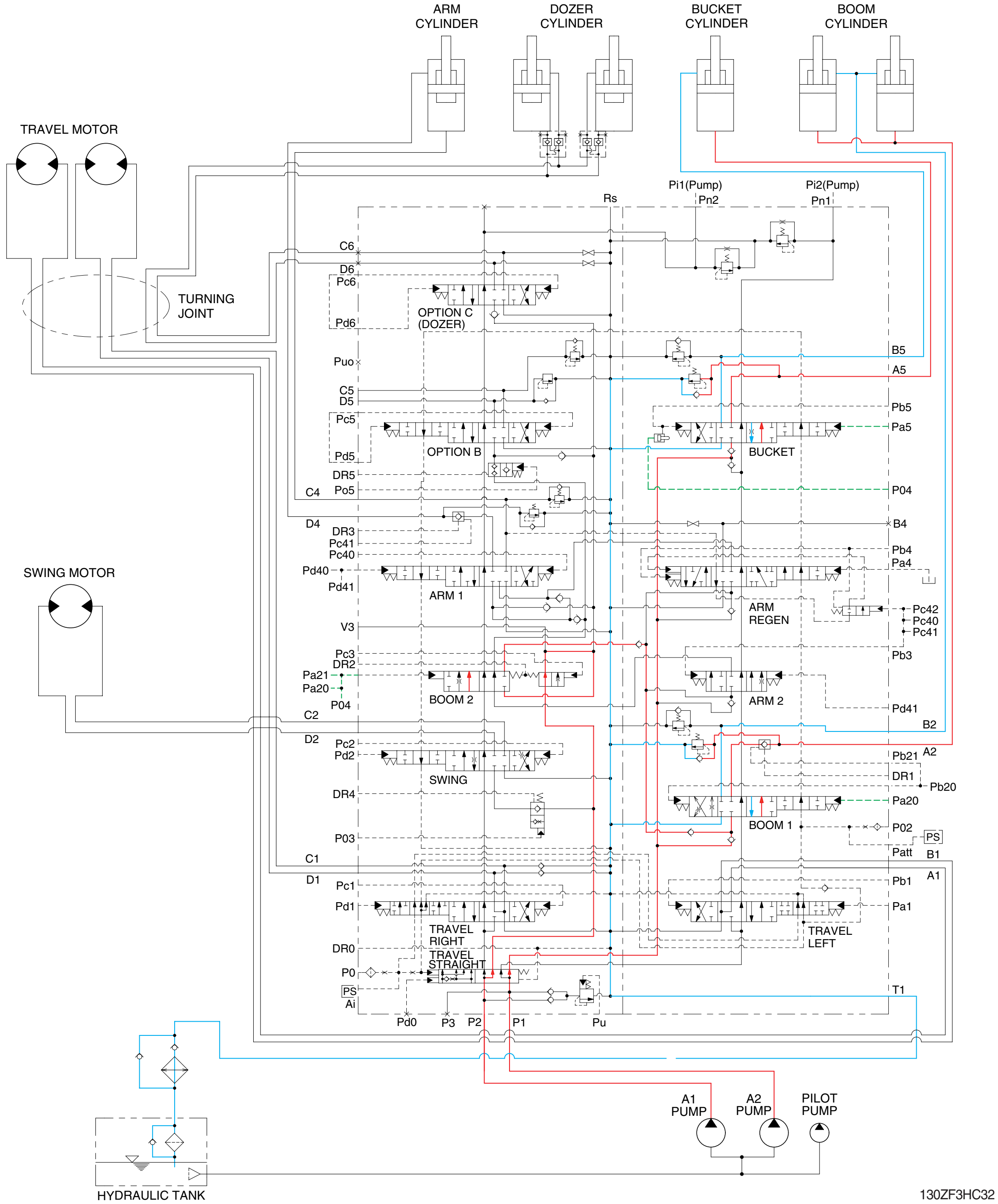
When the bucket and travel functions are operated simultaneously, the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure from pilot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

9. COMBINED BOOM UP AND BUCKET OPERATION



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

The oil from the 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.

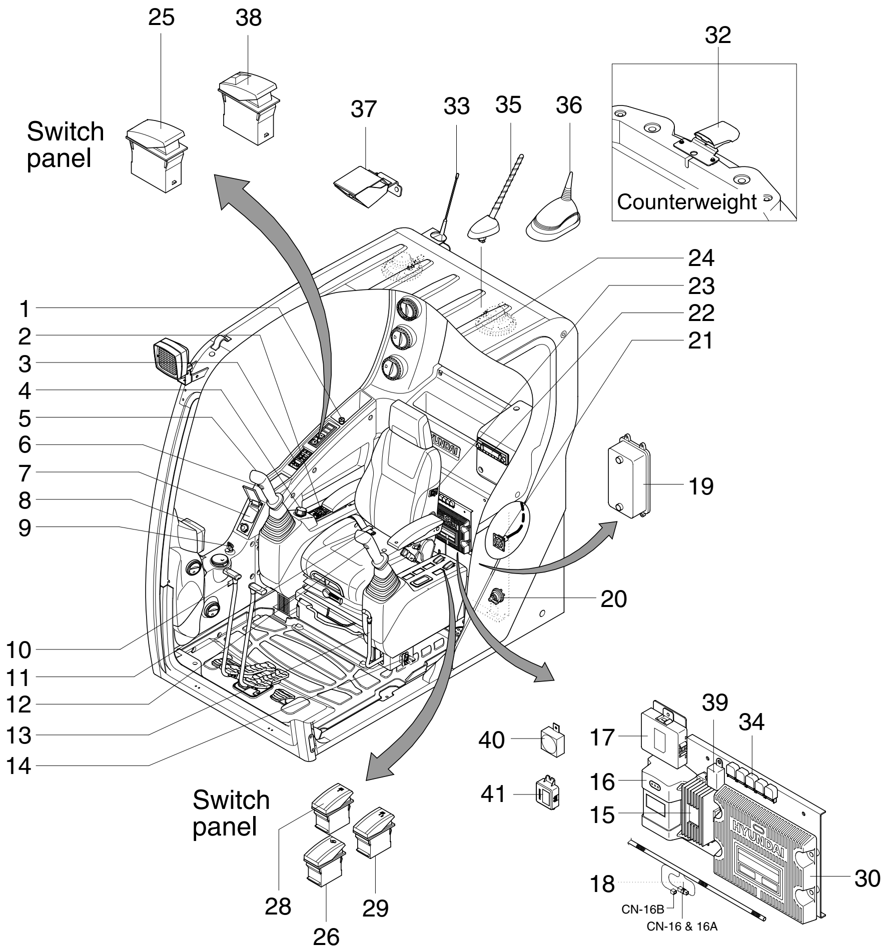
The boom and bucket are operated.

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

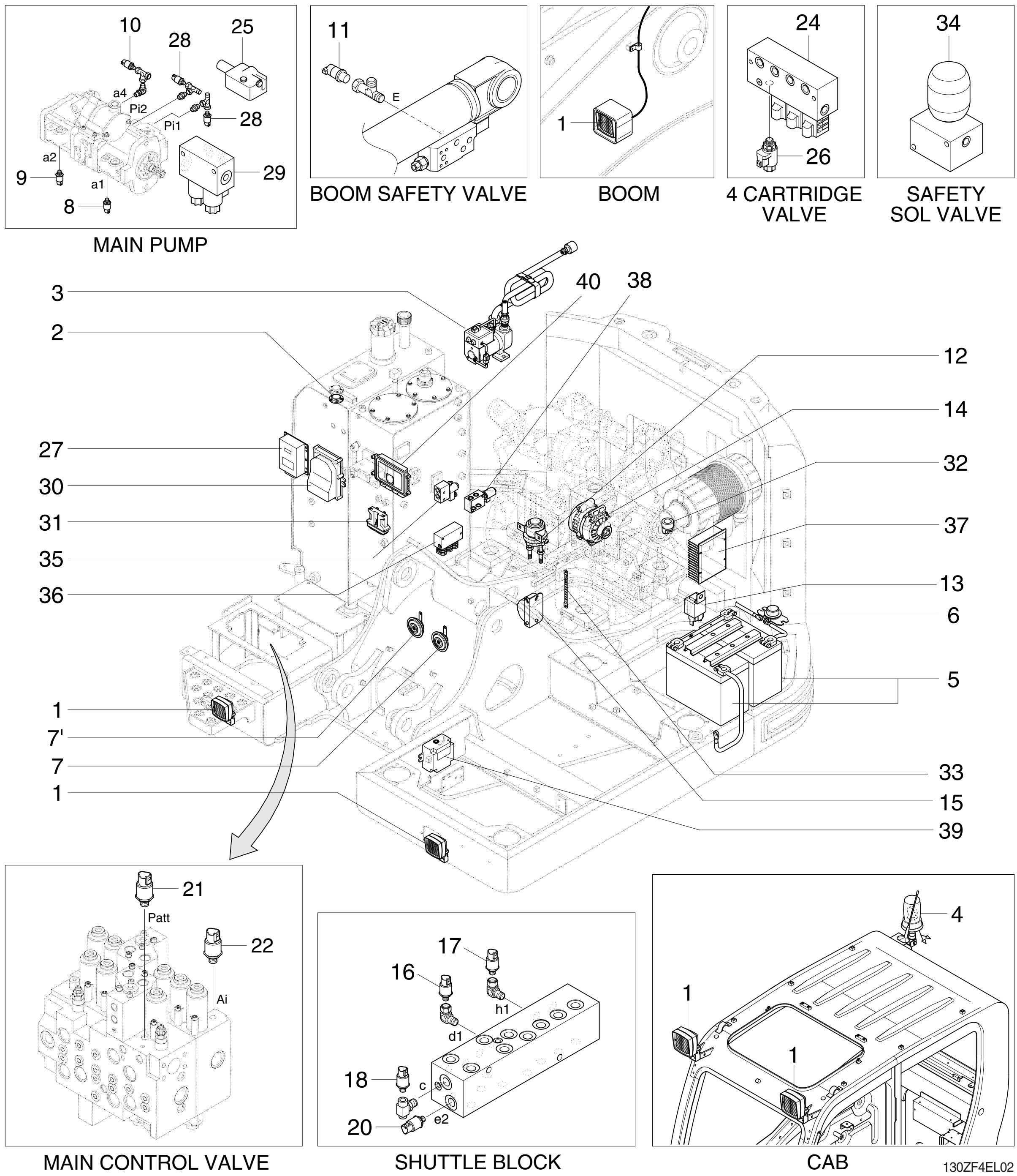
1. LOCATION 1



130ZF4EL01

1	Cigar lighter	14	Emergency engine stop switch	28	Swing fine switch
2	Aircon and heater switch	15	DC/DC converter	29	Swing lock switch
3	Remote controller	16	Remote controller unit	30	Machine control unit
4	Accel dial switch	17	Handsfree control unit	32	Around view camera (rear)
5	Horn switch	18	Emergency engine connector	33	Satellite antenna
6	Breaker operation switch	19	Fuse box assy	34	Relay - 5P
7	USB & socket assy	20	Master switch	35	Intergrated or AM/FM antenna
8	Cluster	21	RS232 & J1939 service socket	36	Mobile antenna
9	Start switch	22	Radio & USB player	37	Around view camera (front)
10	Service meter	23	Heated seat switch	38	DPF switch
11	One touch decel switch	24	Speaker	39	Power relay
12	Power max switch	25	Option attachment switch	40	Warning buzzer
13	Safety lever	26	Quick clamp switch	41	Smart key reader

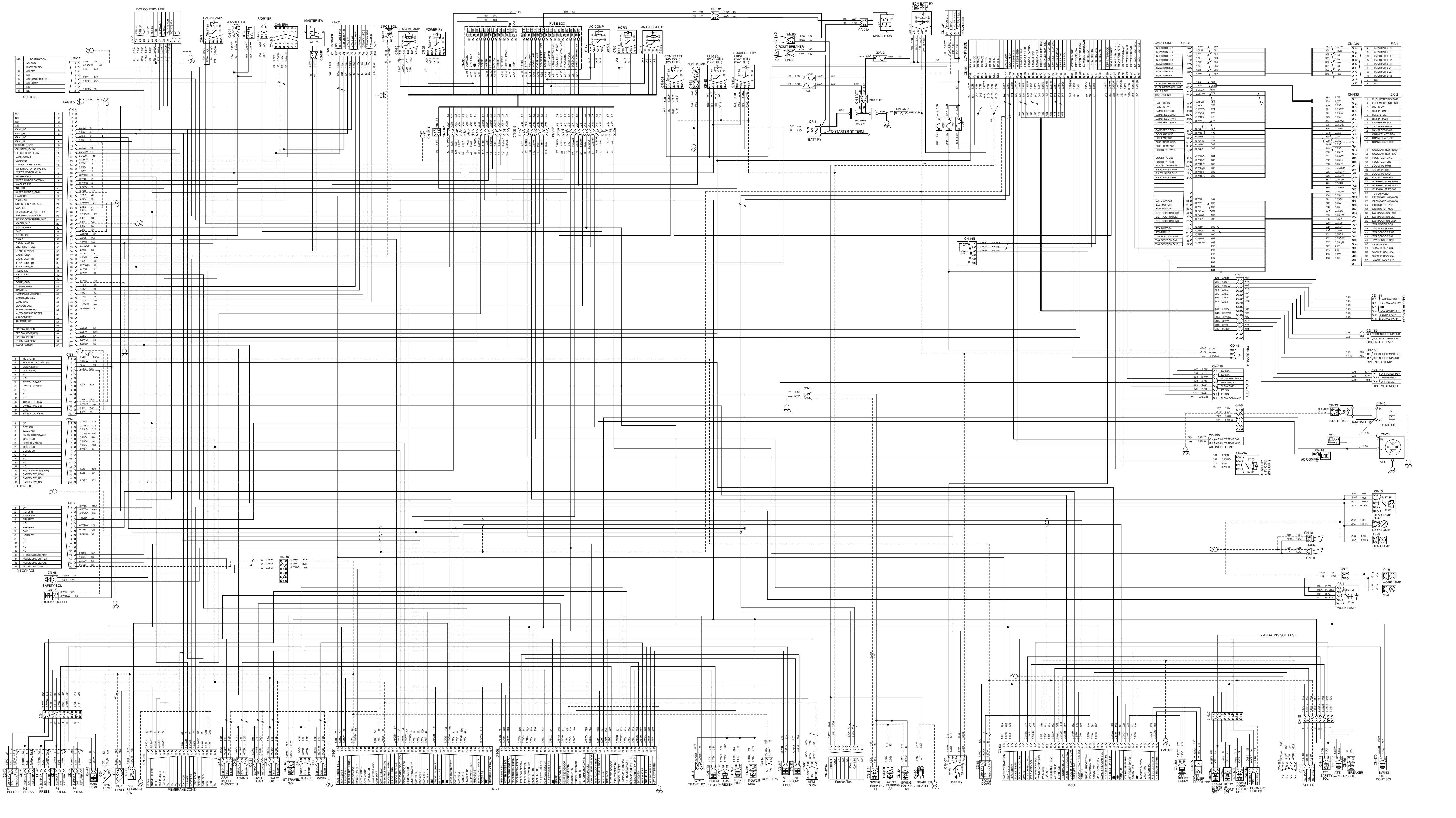
2. LOCATION 2



1	Work lamp	13	Power relay	28	Nega-control pressure sensor
2	Fuel sender	14	Alternator	29	Flow control EPPR valve
3	Fuel filler pump	15	Travel alarm buzzer	30	Relay drive unit
4	Beacon lamp	16	Arm/Bucket in pressure sensor	31	PVG 32 controller
5	Battery	17	Boom up pressure sensor	32	Air cleaner indicator
6	Battery relay	18	Swing pressure sensor	33	Earth strap
7	Horn - high	20	Arm in pressure sensor	34	Safety solenoid valve
7'	Horn - low	21	Attach pressure sensor	35	Swing fine solenoid valve
8	P1 pressure sensor	22	Travel pressure sensor	36	Swing lock solenoid valve
9	P2 pressure sensor	24	4 cartridge valve	37	Electric equalizer
10	EPPR pressure sensor	25	Pump EPPR valve	38	Quick clamp solenoid valve
11	Overload pressure sensor	26	Boom priority EPPR valve	39	Button key control unit
12	Start relay	27	Machine control unit - option	40	Around view camera controller

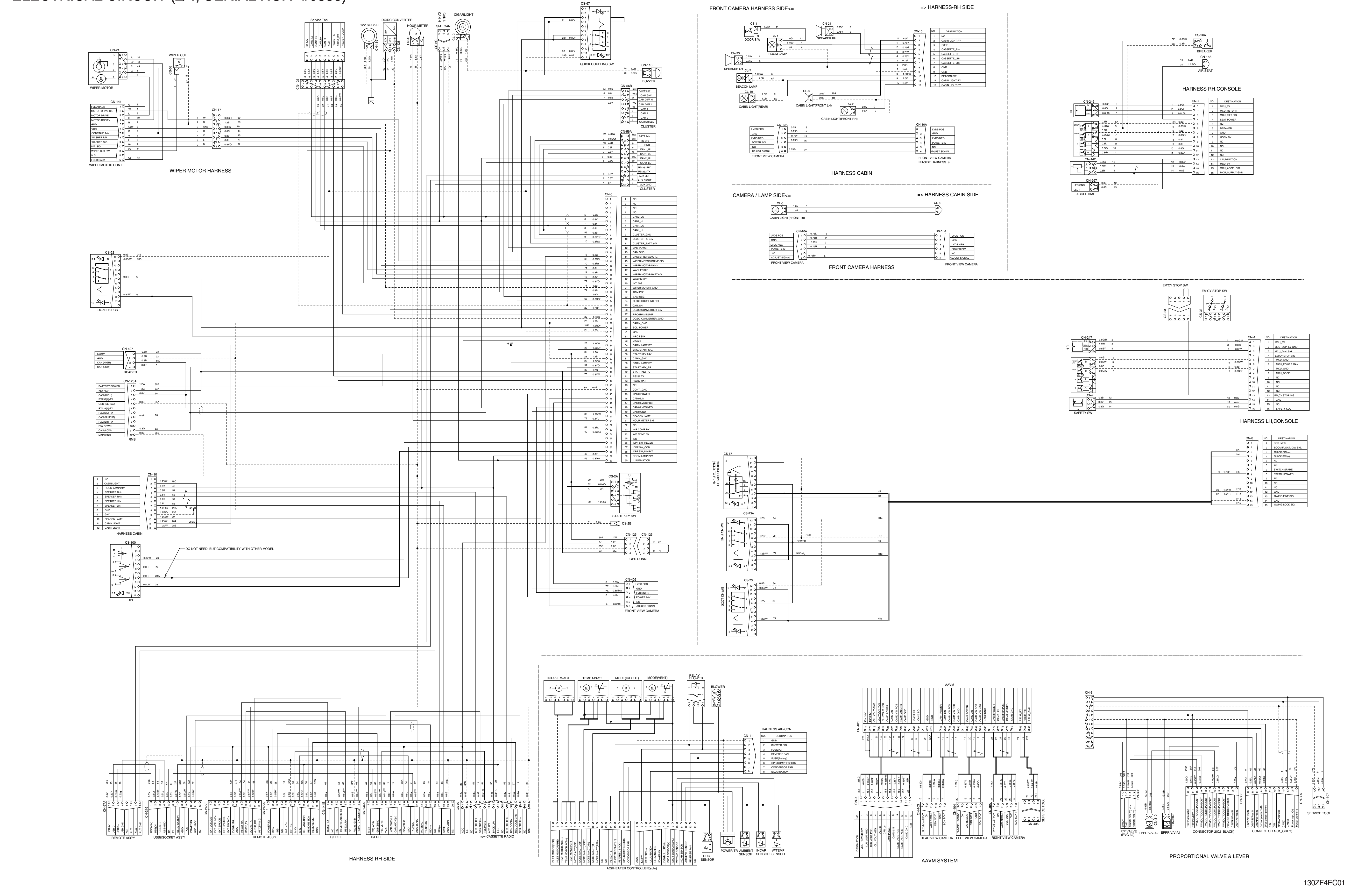
GROUP 2 ELECTRICAL CIRCUIT

· ELECTRICAL CIRCUIT (1/4, SERIAL NO. : -#0333)

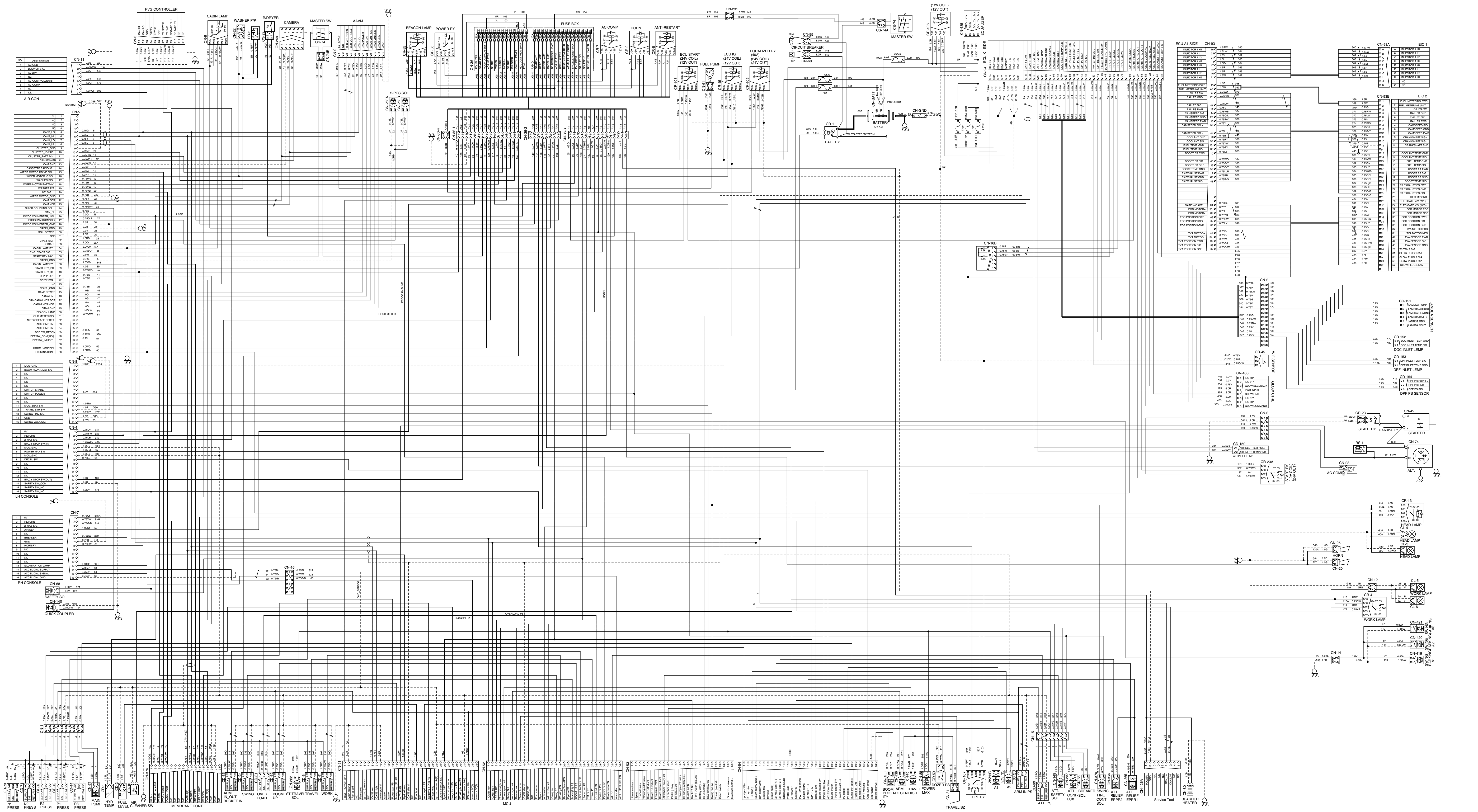


130ZF4EC01

· ELECTRICAL CIRCUIT (2/4, SERIAL NO. : -#0333)

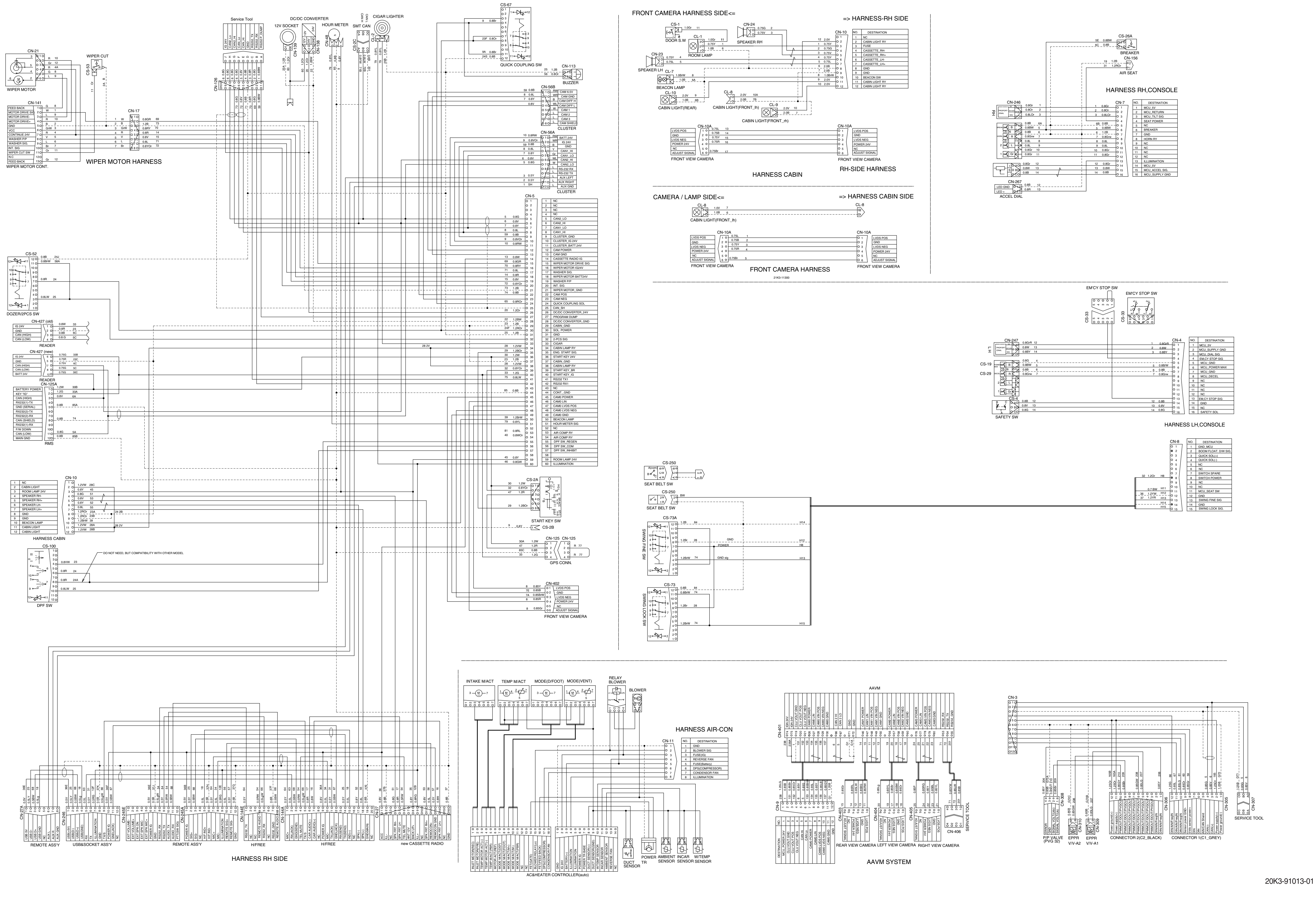


· ELECTRICAL CIRCUIT (3/4, SERIAL NO. : #0334-)



20K3-91026-00

· ELECTRICAL CIRCUIT (4/4, SERIAL NO. : #0334-)



MEMORANDUM

1. POWER CIRCUIT

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

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

1) OPERATING FLOW

Battery → Battery relay[CR-1] → Circuit breaker [CN-60] → Master switch [CS-74A] → I/conn [CN-231 (2)]

→ Fuse box [No.1] → I/conn [CN-36-4 (2)] → Equalizer relay [CR-105 (30)]

→ Fuse box [No.2] → I/conn [CN-36-1 (7)] → Master switch [CS-74B] → I/conn [CN-5 (36)]

→ Start switch [CS-2A (1)]

→ RMS [CN-125A (1)]

→ GPS connection [CN-125 (1)]

→ Power relay [CR-35 (30)]

→ Fuse box [No.3] → I/conn [CN-36-1 (8)] → I/conn [CN-5 (59)]

→ I/conn [CN-10 (3)] → Room lamp [CL-1 (2)] → Door switch [CS-1]

→ Radio & USB player [CN-27 (8)]

→ Hour meter [CN-48 (1)]

→ Fuse box [No.4] → I/conn [CN-36-2 (2)] → I/conn [CN-11 (5)] → AC & Heater controller (3)

→ Blower relay (3)

→ Fuse box [No.6] → I/conn [CN-36-1 (11)] → I/conn [CN - 5 (18)] → I/conn [CN -17 (5)]

→ Wiper motor controller [CN-141 (7)]

→ Wiper motor [CN-21 (4)]

→ Fuse box [No.7] → I/conn [CN-36-1 (12)] → I/conn [CN-5 (11)] → Cluster [CN -56A (1)]

→ Fuse box [No.8] → I/conn [CN-36-1 (13)] → MCU [CN-51 (1)]

→ MCU [CN-53 (1)]

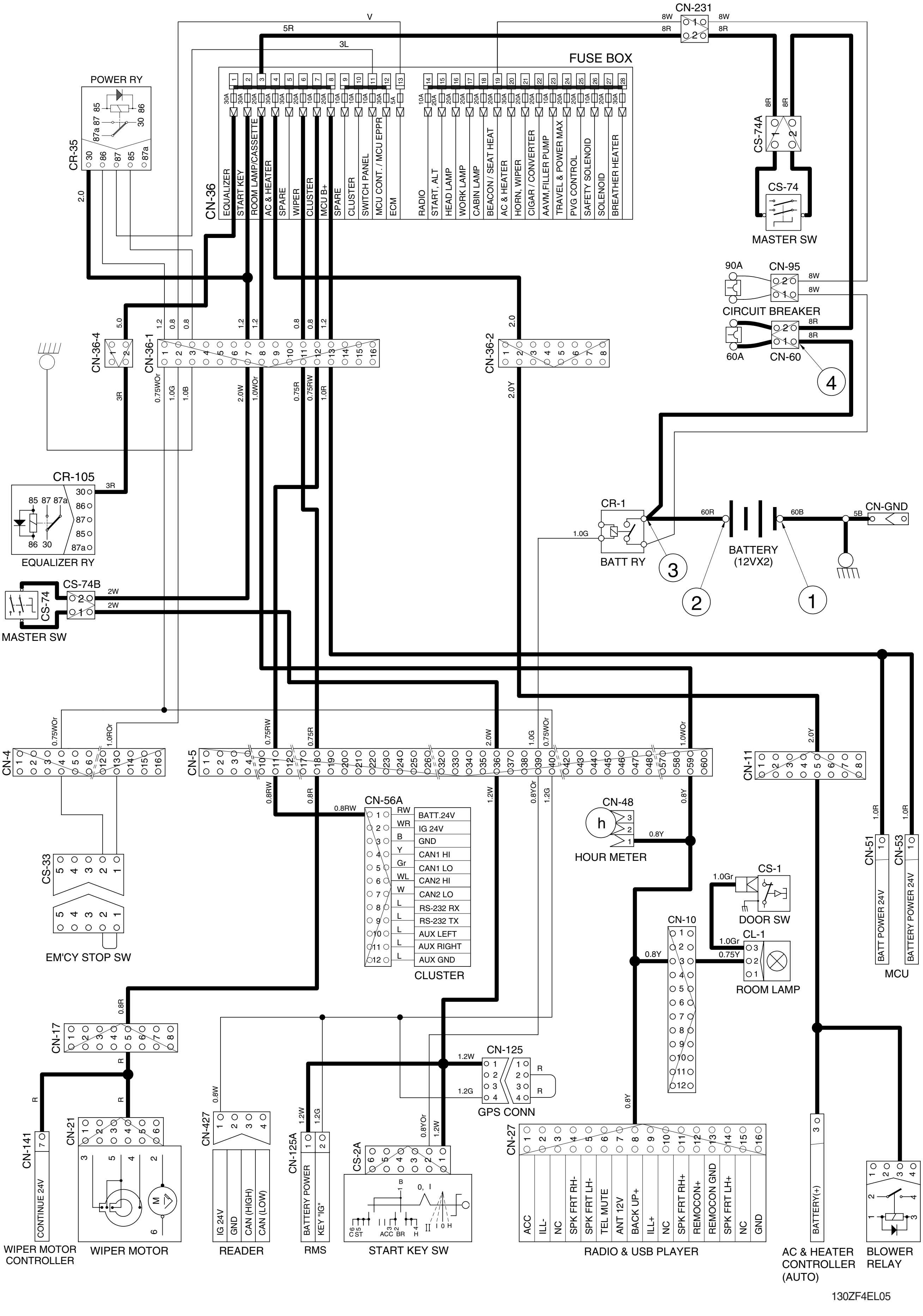
※ I/conn : Intermediate connector

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 (circuit breaker)	20~25V

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74A]
→ I/conn [CN-231 (2)] → Fuse box [No.2] → I/conn [CN-36-1 (7)] → Master switch [CS-74B]
→ I/conn [CN-5 (36)] → Start switch [CS-2A (1)]

(1) When start key 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)] → I/conn [CN-36-1 (1)] → Power relay [CR-35 (86)→(87)] Fuse
→ box [No.9~12]
→ I/conn [CN-4 (4)] → Emergency engine stop sw [CS-33 (2)→(1)]
→ I/conn [CN-4 (13)] → I/conn [CN-36-1 (2)] → Fuse box [No. 13]
→ I/conn [CN-36-1 (6)] → ECM IG [CR-45 (86)]

→ Reader [CN-427 (1)]
→ RMS [CN-125A (2)]

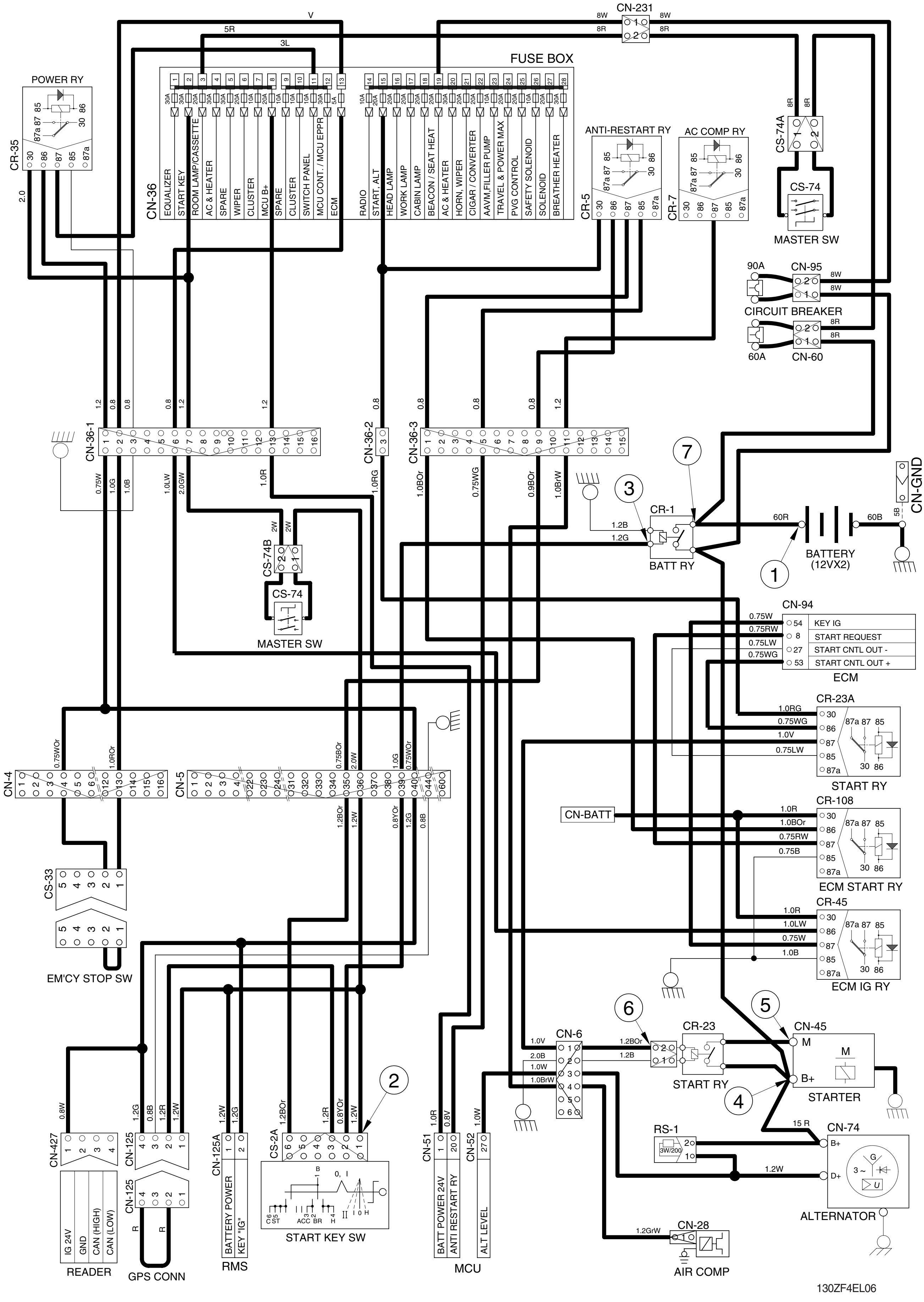
(2) When start key switch is in START position

Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → I/conn [CN-36-3 (9)]
→ Anti-restart relay [CR-5 (86)→(87)] → I/conn [CN-36-3 (1)] → ECM start relay [CR-106 (86)→(87)]
→ ECM [CN-94 (8)→(53)] → Start relay [CR-23A (86)→(87)] → I/conn [CN-6 (1)]
→ Start relay [CR-23 (2)] → Starter motor operating

2) CHECK POINT

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

STARTING CIRCUIT



3. CHARGING CIRCUIT

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

Charging current generated by operating the alternator flows into the battery through the battery relay [CR-1].

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

1) OPERATING FLOW

(1) Warning flow

Alternator [CN-74 (D+)] → I/conn [CN-6 (3)] → MCU alternator level [CN-52 (27)]
→ Cluster charging warning lamp (via CAN interface)

(2) Charging flow

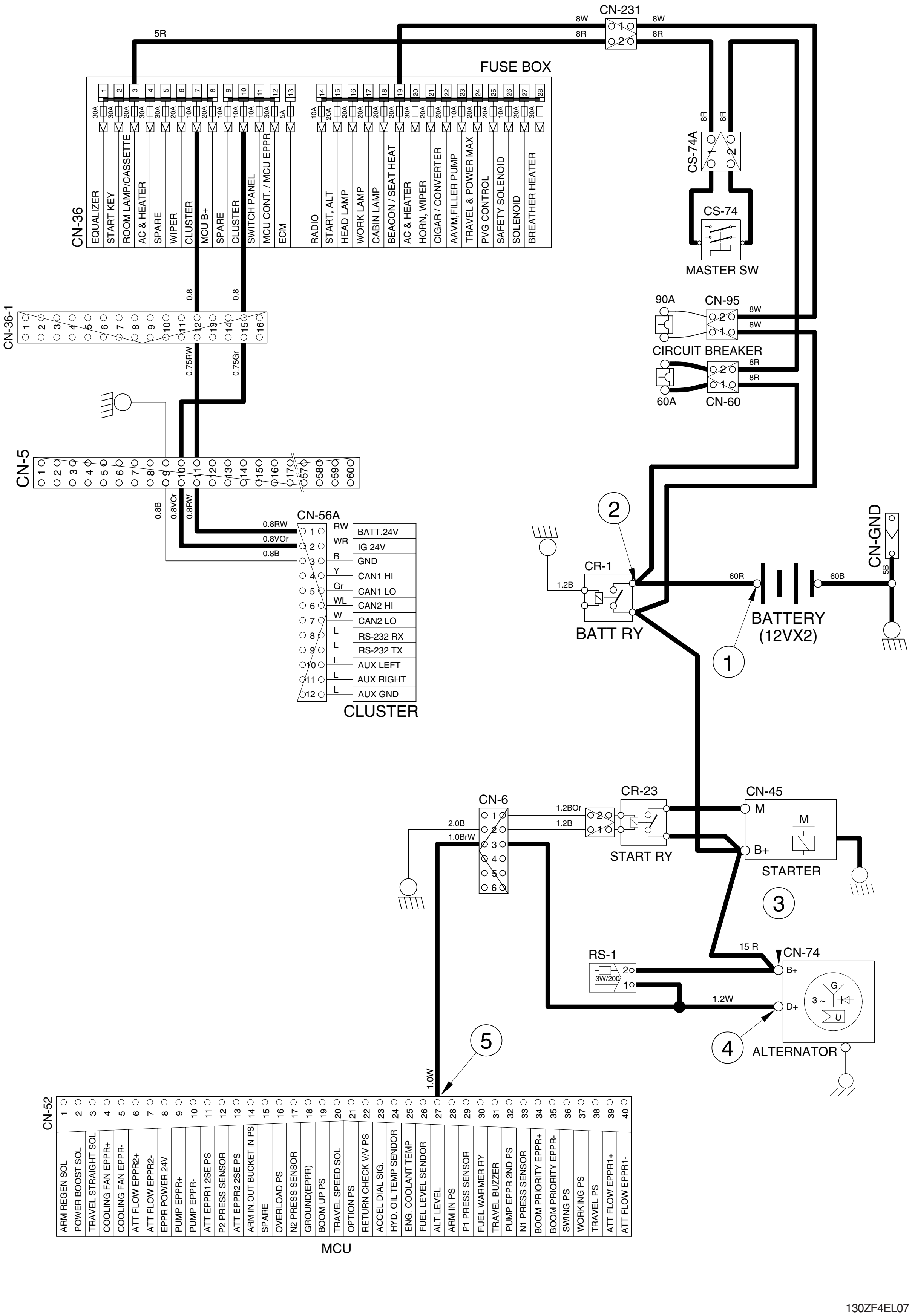
Alternator "B+" terminal → Starter motor [CN-45 (B+)]
→ Battery relay → Battery (+) terminal
→ Circuit breaker [CN-60] → Master switch [CS-74A] → I/conn [CN-231 (2)]
→ Fuse box [No. 1~8]
→ Circuit breaker [CN-95] → I/conn [CN-231 (1)] → Fuse box [No. 14~28]

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 D+ terminal) ⑤ - GND (MCU)	20~25V

※ GND : Ground

CHARGING CIRCUIT



4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.16) → I/conn [CN-36-2 (4)] → Head light relay [CR-13 (30, 86)]
Fuse box (No.17) → I/conn [CN-36-2 (5)] → Work light relay [CR-4 (30, 86)]
Fuse box (No.11) → I/conn [CN-36-1 (16)] → 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 (2)]
→ I/conn [CN-7 (13)] → Accel dial LED ON [CN-267 (2)]
→ I/conn [CN-5 (60)] → Radio & USB player illumination ON [CN-27 (9)]
→ Remote controller illumination ON [CN-245A (9)]
→ USB & socket illumination ON [CN-246 (7)]
→ Cigar lighter [CL-2]
→ I/conn [CN-11 (8)] → AC & heater controller illumination ON (4)

(2) Work light switch ON

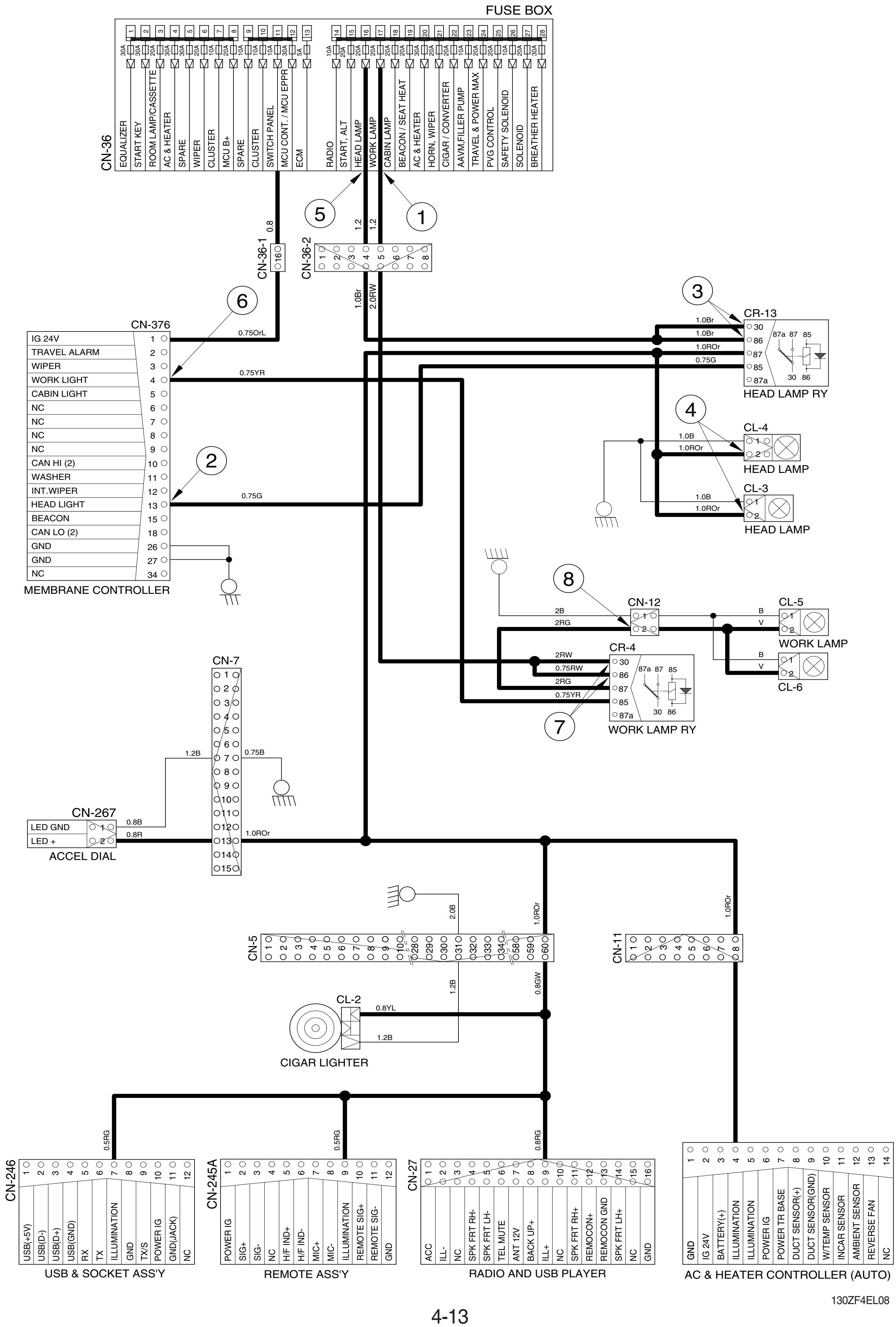
Work light switch ON [CN-376 (4)] → Work light relay [CR-4 (85) → (87)]
→ I/conn [CN-12 (2)] → Work light ON [CL-5 (2), CL-6 (2)]

2) CHECK POINT

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

※ GND : Ground

HEAD AND WORK LIGHT CIRCUIT



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5. BEACON LAMP AND CAB LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.19) → Beacon lamp relay [CR-85 (30, 86)]
Fuse box (No.18) → I/conn [CN-36-2 (6)] → Cab light relay [CR-9 (30, 86)]
Fuse box (No.11) → I/conn [CN-36-1 (16)] → Membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-376 (15)] → I/conn [CN-36-1 (9)]
→ Beacon lamp relay [CR-85 (85)→(87)]→ I/conn [CN-36-3 (7)]
→ I/conn [CN-5 (50)] → I/conn [CN-10 (10)] → Beacon lamp ON [CL-7]

(2) Cab light switch ON

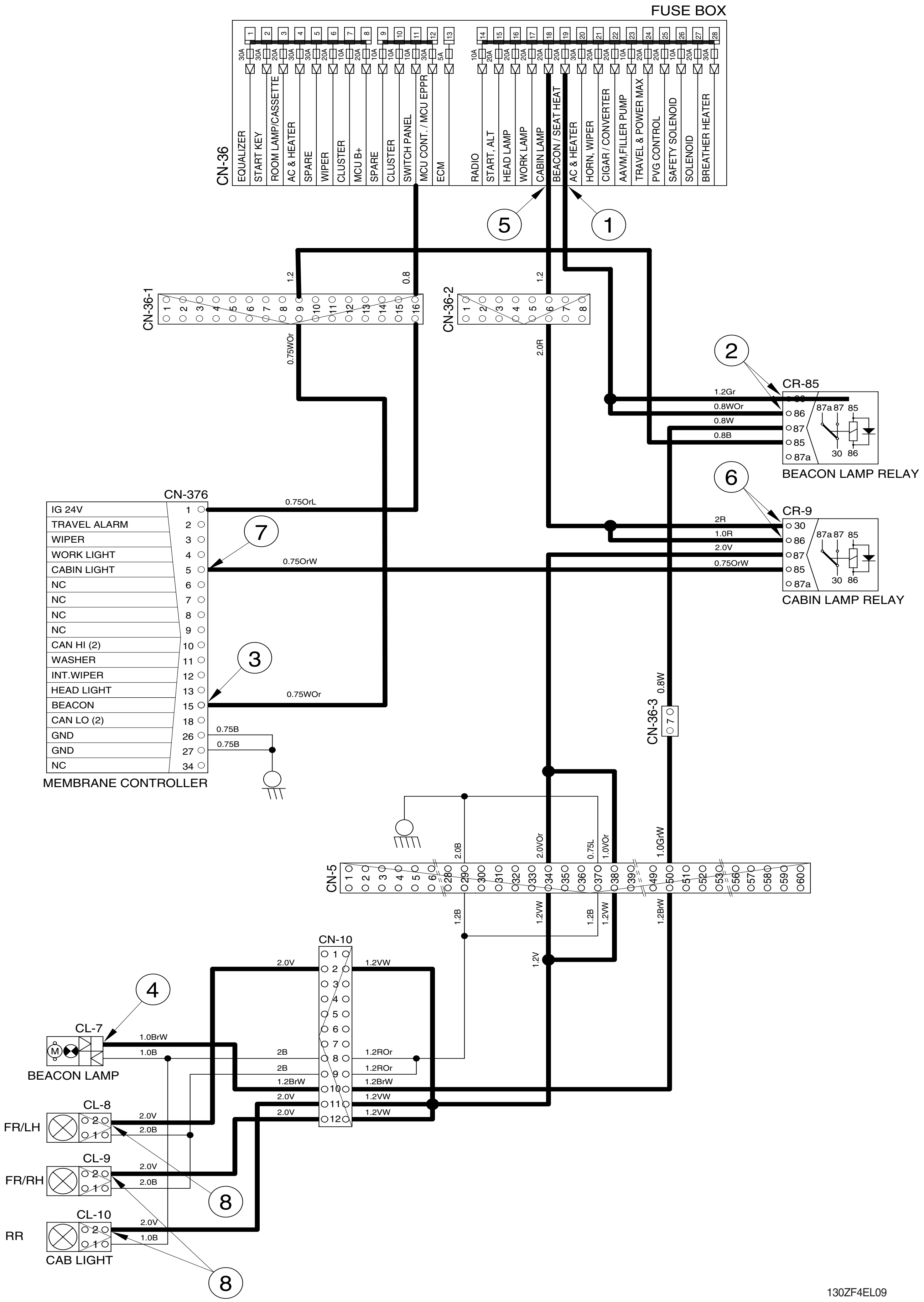
Cab light switch ON [CN-376 (5)] → Cab lamp relay [CR-9 (85)→(87)]
→ I/conn [CN-5 (34, 38)] → I/conn [CN-10 (2)] → Cab light (FR / LH) ON [CL-8 (2)]
→ I/conn [CN-10 (12)] → Cab light (FR / RH) ON [CL-9 (2)]
→ I/conn [CN-10 (11)] → Cab light (RR) ON [CL-10 (2)]

2) CHECK POINT

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

※ GND : Ground

BEACON LAMP AND CAB LIGHT CIRCUIT



6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

Fuse box (No.11) → I/conn [CN-36-1 (16)] → Membrane controller [CN-376 (1)]

Fuse box (No.6) → I/conn [CN-36-1 (11)] → I/conn [CN-5 (18)] → I/conn [CN-17 (5)]

→ Wiper motor controller [CN-141 (7)]

→ Wiper motor [CN-21 (4)]

Fuse box (No.21) → I/conn [CN-36-1 (4)] → I/conn [CN-5 (16)] → I/conn [CN-17 (4)]

→ Wiper motor controller [CN-141 (6)]

→ Washer pump [CN-22 (2)]

(2) Wiper switch ON (Intermittent)

Wiper switch ON [CN-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 pump 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)

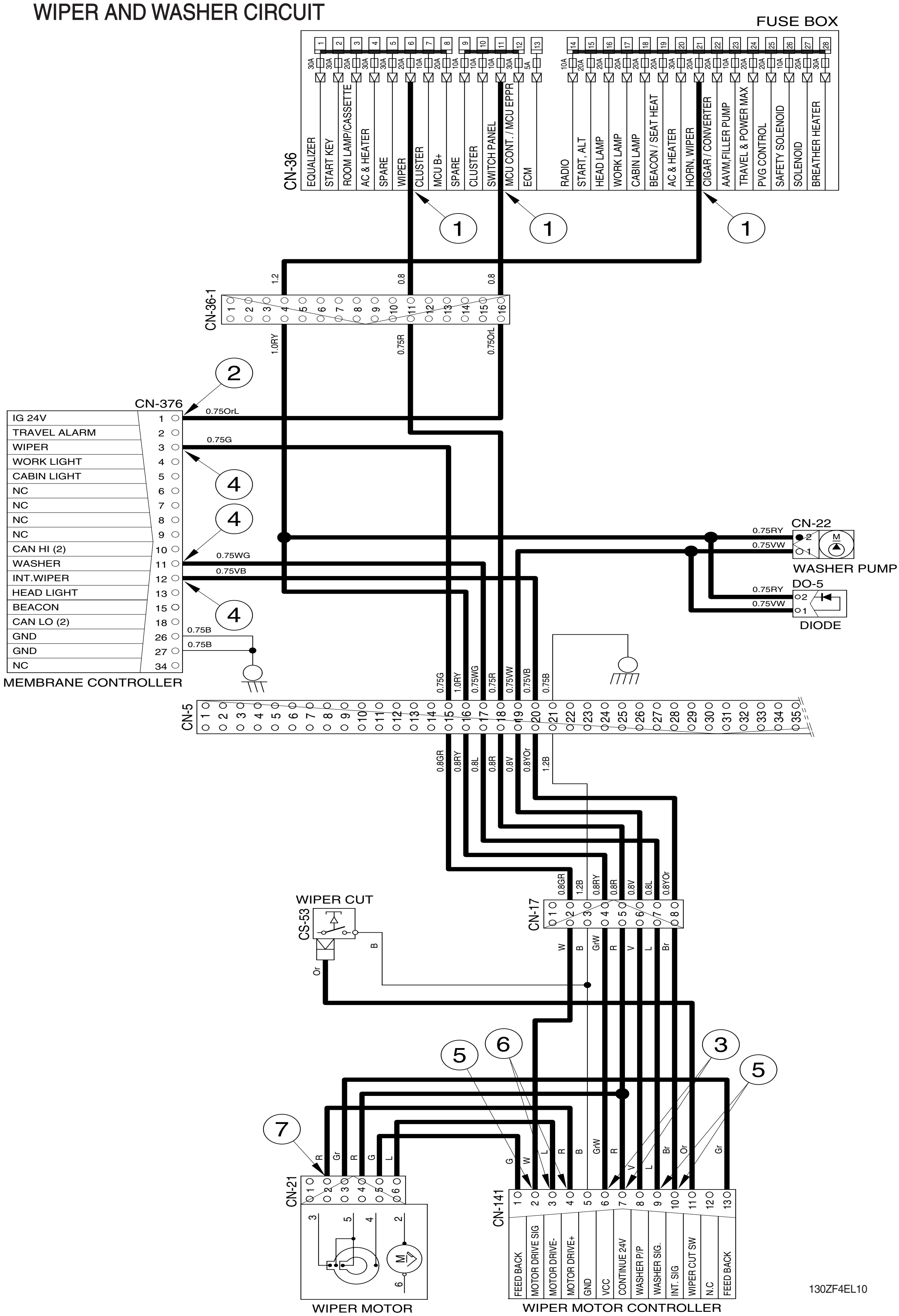
Switch OFF [CN-376 (3, 12)] → Wiper motor parking position by wiper motor controller

3) CHECK POINT

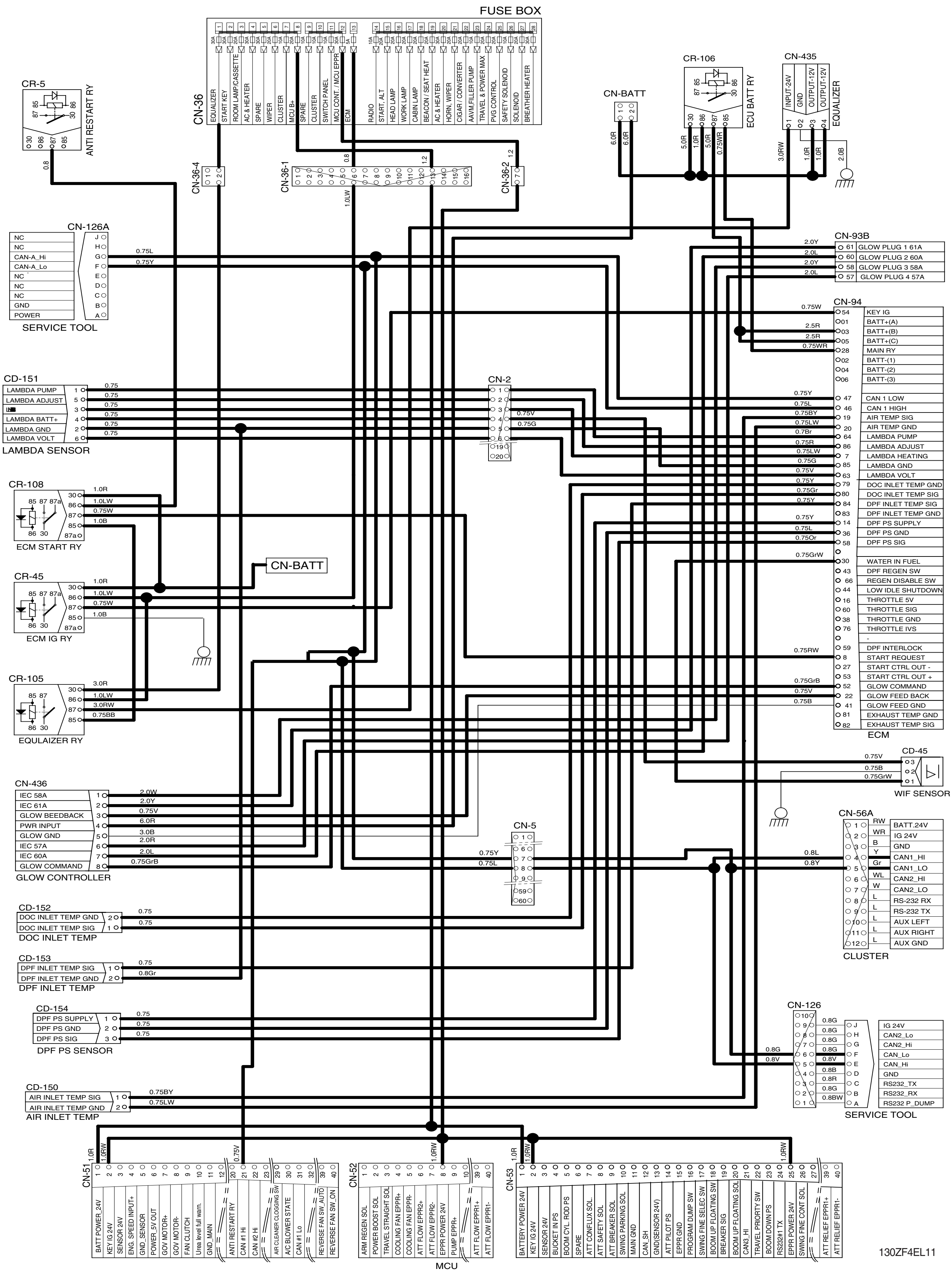
Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box)	20~25V
		② - GND (switch power input)	
		③ - GND (wiper power input)	
		④ - GND (switch power output)	0 ~ 5V
		⑤ - GND (wiper power input)	
		⑥ - GND (wiper power output)	24V
		⑦ - GND (wiper motor)	0 or 24V

※ GND : Ground

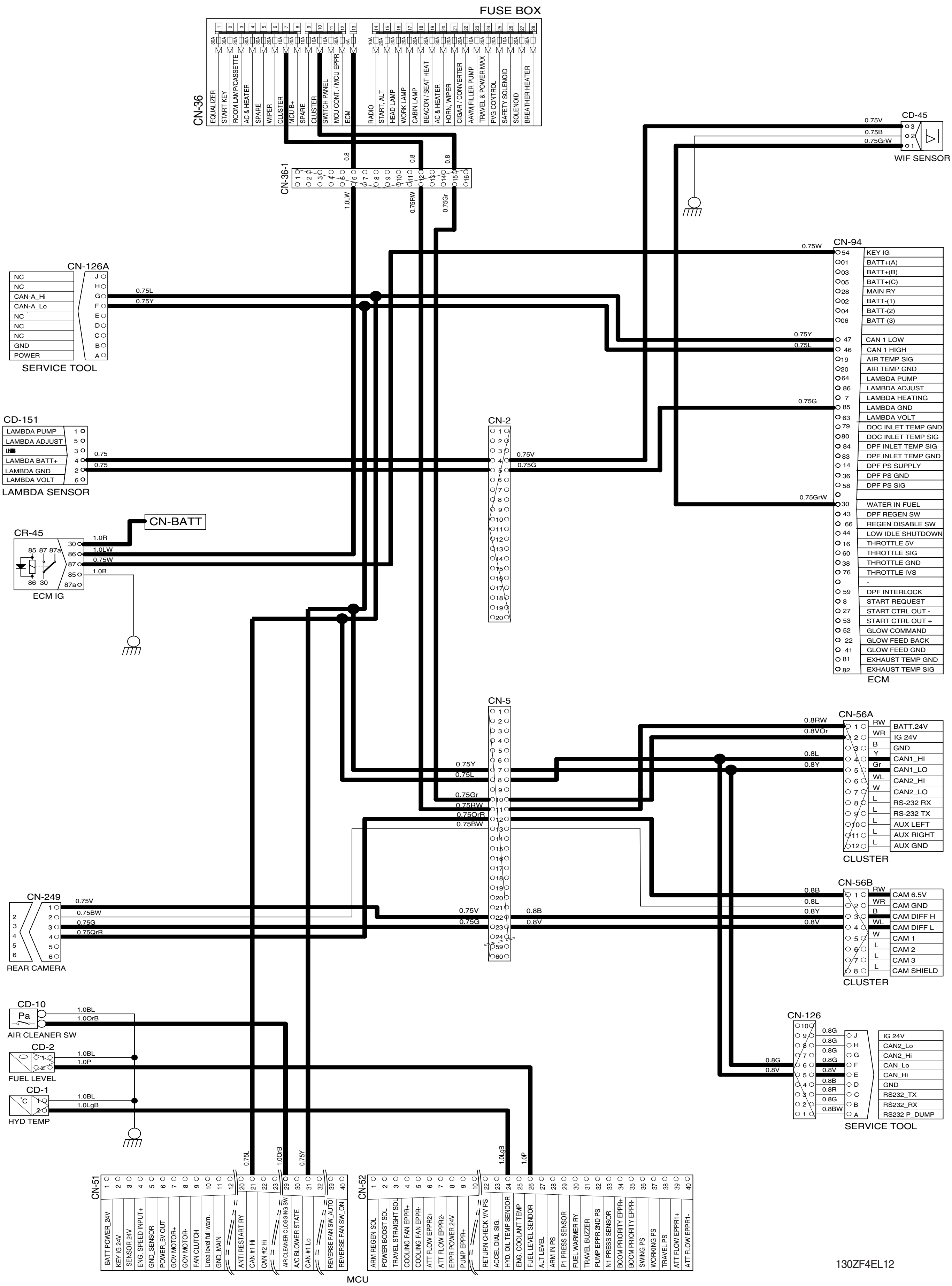
WIPER AND WASHER CIRCUIT



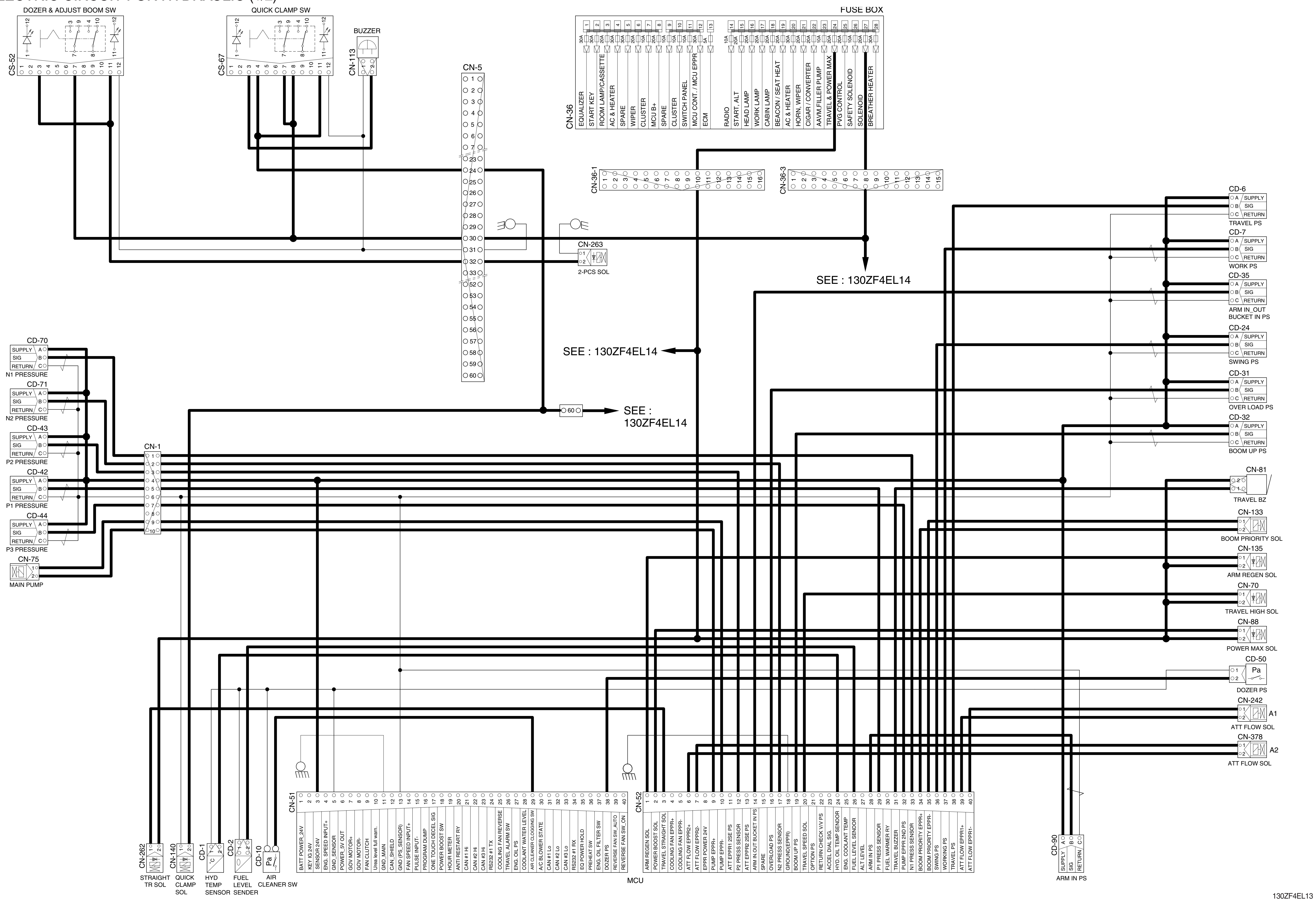
CONTROLLER CIRCUIT



MONITORING CIRCUIT



ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)



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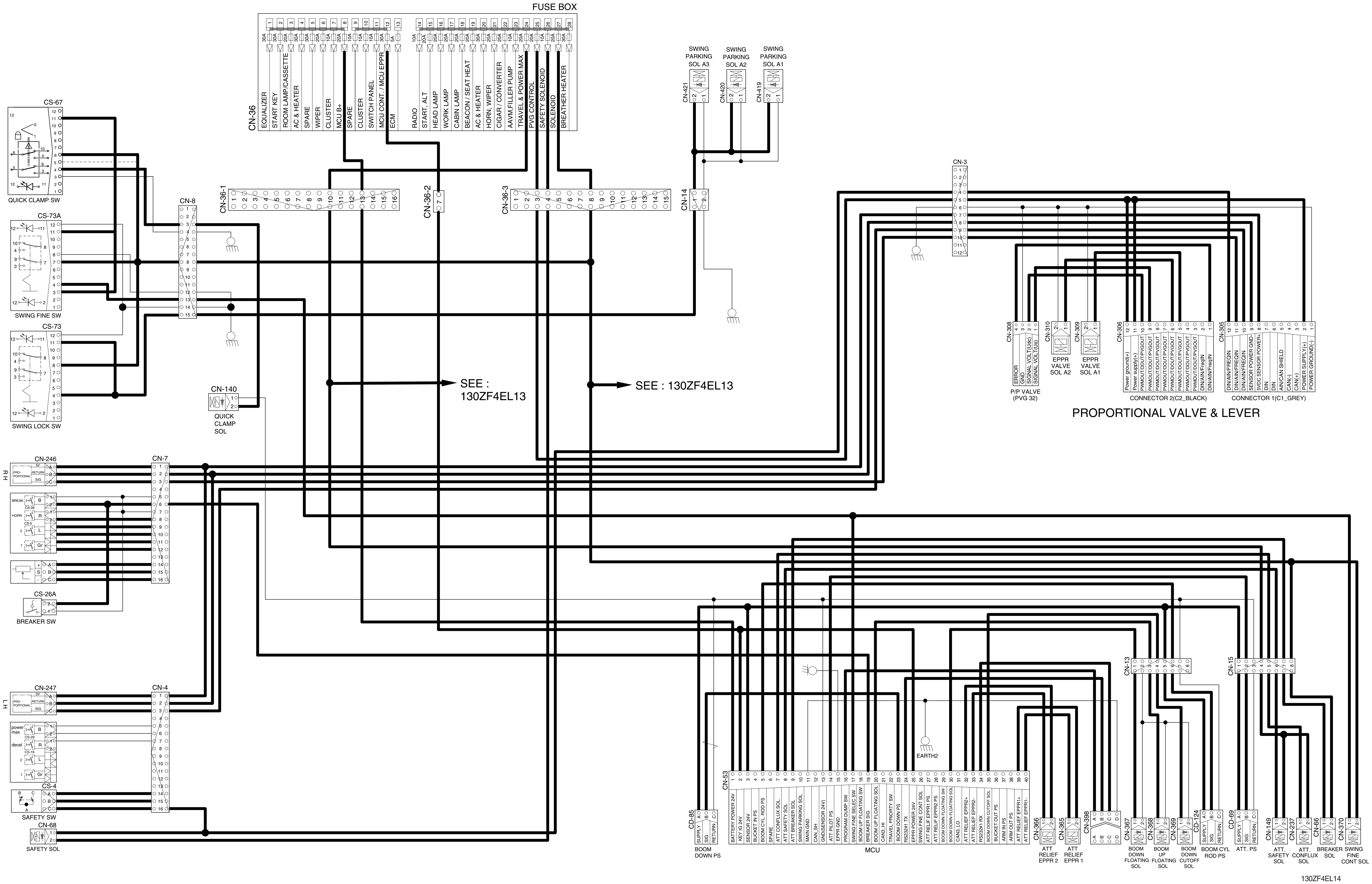
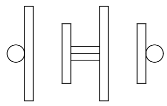
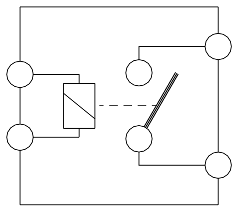
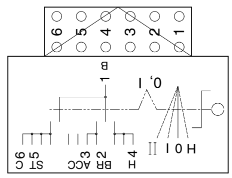
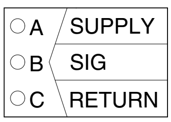
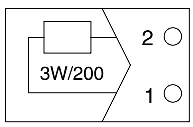
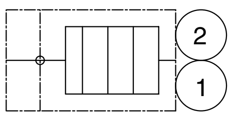
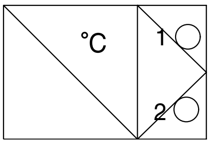
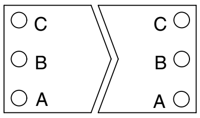
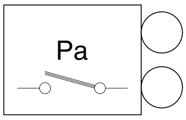
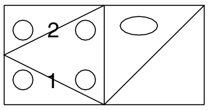
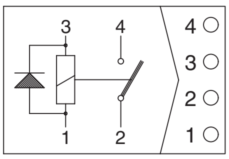
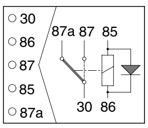
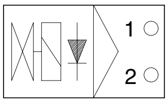
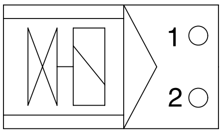
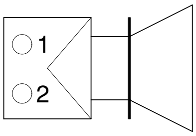
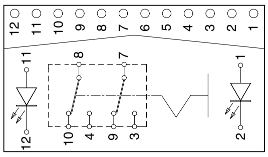
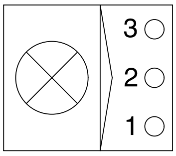
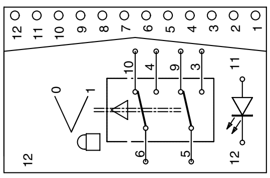
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

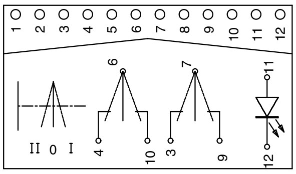
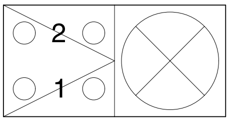
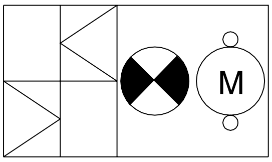
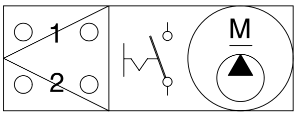
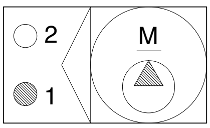
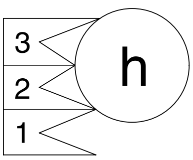


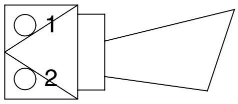
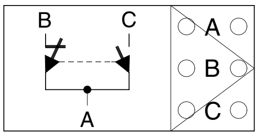
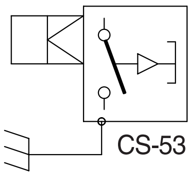
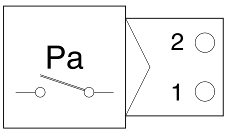
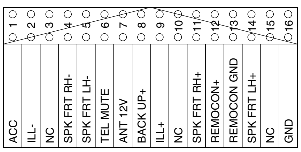
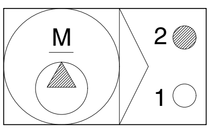
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

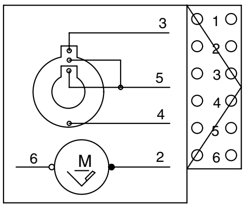
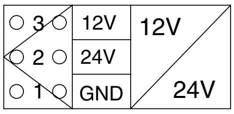
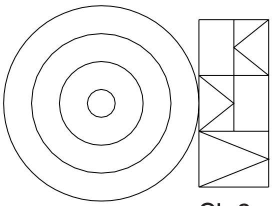
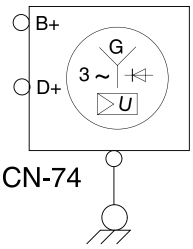
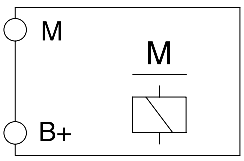
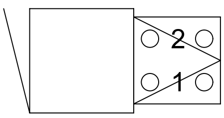
Part name	Symbol	Specifications	Check
Battery		12V × 100Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30 seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Start key	 CS-2A	B-BR : 24V 1A B-ACC : 24V 10A B-C : 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-42 CD-43 CD-44 CD-69 CD-70 CD-71 CD-85 CD-86 CD-87 CD-90 CD-91 CD-124	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 RS-1	3W 200Ω	※ Check resistance 1-2 : 200Ω
Breather heater	 CN-80	24V	-

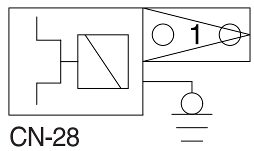
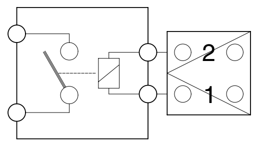
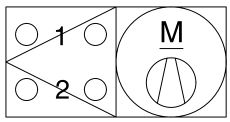
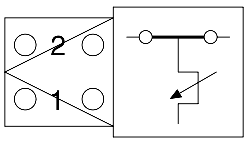
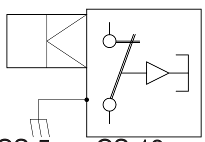
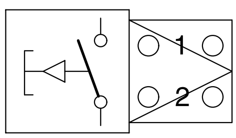
Part name	Symbol	Specifications	Check
Temperature sensor (hydraulic)	 CN-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
SMT CAN	 CS-2C	-	-
Air cleaner pressure switch	 CD-10	N.O TYPE	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel level sender	 CD-2	-	※ Check resistance Full : 50Ω 6/12 : 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)	 CR-46	24V 16A	※ Check resistance Normal : About 200Ω (for terminal 1-3) ∞Ω (for terminal 2-4)
Relay	 CR-2 CR-4 CR-5 CR-7 CR-9 CR-13 CR-23A CR-35 CR-36 CR-45 CR-85 CR-95 CR-101 CR-105 CR-106 CR-107 CR-108	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω (for terminal 30-87a) ∞Ω (for terminal 30-87)

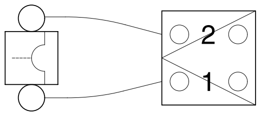
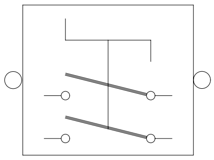
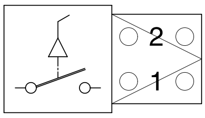
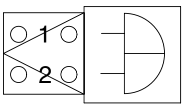
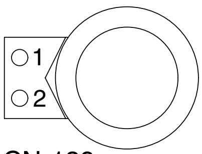
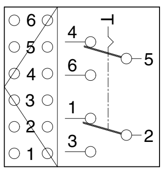
Part name	Symbol	Specifications	Check
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-135 CN-140 CN-149 CN-237 CN-262 CN-263 CN-367 CN-368 CN-369 CN-370 CN-419 CN-420 CN-421	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-133 CN-242 CN-309 CN-310 CN-365 CN-366 CN-378	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	20W 86±2dB	※ Check resistance Normal : A few Ω
Switch (locking type)	 CS-52 CS-67 CS-73 CS-73A CS-99	24V 1.5A	※ Check contact Normal ON : 0 Ω(for terminal 7-3) ∞Ω(for terminal 7-9) OFF : ∞Ω(for terminal 7-3) 0 Ω(for terminal 7-9)
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0Ω ON : 0Ω(For terminal 1-2) ∞Ω(For terminal 1-3) OFF : ∞Ω(For terminal 1-2) 0Ω(For terminal 1-3)
Switch (quick clamp)	 CS-67	24V	※ Check contact Normal ON : 0 Ω(for terminal 5-3) ∞Ω(for terminal 5-9) OFF : ∞Ω(for terminal 5-3) 0 Ω(for terminal 7-9)

Part name	Symbol	Specifications	Check
Switch (DPF)	 CS-100	24V	※ Check contact Normal Ⅰ : 0 Ω (for terminal 6-10) 0 : ∞ Ω (for terminal 6-4, 6-10) Ⅱ : ∞ Ω (for terminal 6-10)
Head lamp, Work lamp, Cab lamp	 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	 CL-7	24V 70W (H1 Type) 2.4W (LED Type)	※ Check disconnection Normal : A few Ω
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Fuel feed pump	 CN-145	24V	-
Hour meter	 CN-48	16~32V	※ Check operation Supply power(24V) to terminal No.2 and connect terminal No.1 and ground

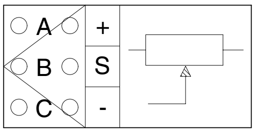
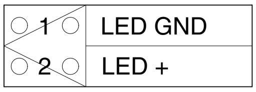
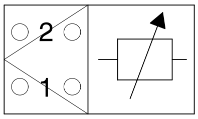
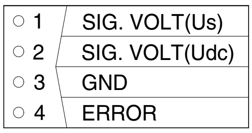
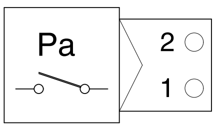
Part name	Symbol	Specifications	Check
Horn	 CN-20 CN-25	22~28V 2A	※ Check operation Supply power(24V) to each terminal and connect ground.
Safety switch	 CS-4	24V 15A (N.C TYPE)	※ Check contact Normal : 1.0Ω ON : 0Ω (for terminal A-B) ∞Ω (for terminal A-C) OFF : ∞Ω (for terminal A-B) 0Ω (for terminal A-C)
Wiper cut switch	 CS-53	24V (N.O TYPE)	※ Check contact Normal : 0Ω (one pin to ground)
Receiver dryer	 CN-29	24V 2.5A (N.O TYPE)	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27	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)

Part name	Symbol	Specifications	Check
Wiper motor	 CN-21	24V 2A	※ Check disconnection Normal : 7Ω (for terminal 2-6)
DC/DC Converter	 CN-138	24V 3A	※ Check voltage 24V (for terminal 1-2) 12V (for terminal 1-3)
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	Delco Remy 24V 65A	※ Check contact Normal : 0Ω (for terminal B^+-D^+) Normal : 24~27.5V
Starter	 CN-45	24V 4.5kW	※ Check contact Normal : 0.1Ω
Travel alarm	 CN-81	24V 0.5A	※ Check contact Normal : 5.2Ω

Part name	Symbol	Specifications	Check
Air conditioner 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)
Blower motor		24V 14A	※ Check resistance Normal : 2.5Ω (for terminal 1-2)
Air conditioner duct sensor (switch)		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω (for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch	 CS-5 CS-19 CS-1 CS-26 CS-29	24V 2W	※ Check resistance Normal : About 5MΩ
Switch (power max, one touch decel, horn, breaker)		24V 6A	※ Check resistance Normal : ∞Ω

Part name	Symbol	Specifications	Check
Circuit breaker	 CN60 CN-95	CN-60 : 60A CN-95 : 90A	※ 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
Breaker pedal switch	 CS-26A	-	-
Quick clamp buzzer	 CN-113	24V 80mA Min 65dB	-
12V Socket	 CN-139	12V 10A	-
Engine emergency stop switch	 CS-33	24V	※ Check contact Normal 0Ω(for terminal 1-2)

Part name	Symbol	Specifications	Check
Air inlet temperature sensor	1 AIR INLET TEMP 2 AIR INLET GND CN-150	-	-
DOC inlet temperature sensor	2 DOC INLET TEMP GND 1 DOC INLET TEMP SIG CN-152	-	-
DPF inlet temperature sensor	1 DPF INLET TEMP SIG 2 DPF INLET TEMP GND CN-153	-	-
DPF pressure sensor	1 DPF PS SUPPLY 2 DPF PS GND 3 DPF PS SIG CD-154	-	-
WIF sensor	1 2 CL-40	-	※ Check disconnection Normal : 68.8~4.94Ω
Proportional valve sensor	Proportional 5V A RETURN B SIG C CN-246(RH) CN-247(LH)	-	-

Part name	Symbol	Specifications	Check
Accel dial	 CN-142	5V, 8mA	-
Accel dial LED	 CN-267	24V	-
Temperature sensor (A/C incar, A/C ambient, water)	 CN-429	-	-
Proportional valve sensor	 CN-308	-	-
Dozer act pressure switch	 CD-50	N.O type	※Check resistance Normal : ∞Ω (open)

Part name	Symbol	Specifications	Check
Camera	○ 1 LVDS POS ○ 2 GND ○ 3 LVDS NEG ○ 4 POWER 24V ○ 5 NC ○ 6 ADJUST SIGNAL CN-249 CN-402 CN-403 CN-404 CN-405	7V 100mA	-
Equalizer	○ 1 INPUT-24V ○ 2 GND ○ 3 OUTPUT-12V ○ 4 OUTPUT-12V CN-435	-	-
LAMBDA sensor	○ 1 LAMBDA PUMP ○ 5 LAMBDA ADJUST ○ 3 LAMBDA HEATING ○ 4 LAMBDA BATT+ ○ 2 LAMBDA GND ○ 6 LAMBDA VOLT CD-151	-	-
PVG 32 controller	○ 1 CAN HI ○ 2 CAN LO ○ 3 GND ○ 4 SAFETY ○ 5 KEY IG ○ 6 GND ○ 7 5V POWER ○ 8 5V GND ○ 9 ROTATE / LH ○ 10 ROTATE /RH ○ 11 NC ○ 12 NC CN-3	-	-

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	10	I/conn (Frame harness-Pump PS harness)	S816-010002	S816-110002
CN-2	AMP	16	I/conn (Engine harness-Frame 2 harness)	368047-1	368050-1
CN-3	-	26	I/conn (Frame harness-Engine harness)	1897009-2	1897013-2
CN-3A	TYCO	12	I/conn (Frame harness-PVG controller harness)	174661-2	368537-1
CN-4	AMP	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	DEUTSCH	6	I/conn (Frame harness-Engine harness)	DT06-6S	DT04-6P
CN-7	AMP	16	I/conn (Console harness RH-Frame harness)	368047-1	368050-1
CN-8	AMP	15	I/conn (Console harness LH-Frame harness)	2-85262-1	368301-1
CN-9	DEUTSCH	12	I/conn (Frame harness- AAVM harness)	DT06-12S	DT04-12PA-P021
CN-10	TYCO	12	I/conn (Cab harness-Side harness RH)	368542-1	368507-1
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E005
CN-13	AMP	8	I/conn (Frame harness-Boom floating harness)	174982-2	174984-2
CN-14	DEUTSCH	2	I/conn (Frame harness-Swing parking harness)	DT06-2S-EP06	DT04-2P-E005
CN-15	AMP	8	I/conn (Frame harness-2 way harness)	174982-2	174984-2
CN-16	AMP	6	Emergency engine start & speed control	-	S816-106002
CN-16A	AMP	6	Emergency engine start & speed control	S816-006002	-
CN-16B	AMP	6	Emergency engine start & speed control	S816-006002	S816-106002
CN-17	DEUTSCH	8	I/conn (Side harness RH-Wiper harness)	DT06-8S-EP06	DT04-8P
CN-20	MOLEX	2	Horn	36812-0211	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	MOLEX	2	Horn	36812-0211	-
CN-27	KUM	16	Radio & USB player	PK145-16017	-
CN-27A	AMP	8	Radio & USB player	-	S816-108002
CN-28	KUM	1	Air conditioner compressor	NMWP01F-B	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36-1	AMP	16	To fuse box	368047-1	-
CN-36-2	KET	8	To fuse box	MG610051	-
CN-36-3	-	15	To fuse box	2-85262-1	-
CN-36-4	KET	2	To fuse box	MG610557-5	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
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-53	DEUTSCH	40	MCU (option)	DRC26-40SA	-
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	YAZAKI	2	Circuit breaker	-	7122-4125-50
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	-
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid	DT06-2S-EP06	-
CN-74	RING-TERM	1	Alternator "D^+" terminal	-	S820-105000
CN-75	AMP	2	Pump EPPR valve	S816-002002	-
CN-80	FEP	-	Breather heater	4212110	-
CN-81	DEUTSCH	2	Travel buzzer	DT06-2S-EP06	DT04-2P-E005
CN-88	DEUTSCH	2	Power max solenoid	DT06-2S-EP06	-
CN-93A	DELPHI	10	EIC 1	15326600	-
CN-93B	AMP	62	EIC 2	1-148883-1	-
CN-93	-	60	ECU A1	284742-1	-
CN-94	-	94	ECU K1	284743-1	-
CN-95	-	2	Circuit breaker	-	S813-130201
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	GPS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	9	RMS	DT06-12S-EP06	HD10-9-96P
CN-126	AMP	10	I/conn (Service tool-Frame harness)	S816-010002	S816-110002
CN-126A	-	9	Service tool	-	HD10-9-96P
CN-133	DEUTSCH	2	Boom priority solenoid	DT06-2S-EP06	-
CN-135	DEUTSCH	2	Arm regeneration 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-142	DEUTSCH	3	Accel dial	DT06-3S-EP06	-
CN-144A	KET	20	Handsfree	MG610240	-
CN-144E	-	8	Handsfree	175964-2	-
CN-145	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	-
CN-149	DEUTSCH	2	Attach safety solenoid	DT06-2S-EP06	-
CN-156	-	2	Air seat heat	-	S816-102002

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-157	AMP	1	Antena power	S822-014002	-
CN-231	-	2	To fuse box	S813-030201	-
CN-237	DEUTSCH	2	Attach conflux solenoid	DT06-2S-EP06	-
CN-242	DEUTSCH	2	Attach EPPR 1	DT06-2S-EP06	-
CN-245	FCI	2	PTC power	-	-
CN-245A	AMP	12	Remote controller assy	368542-1	-
CN-245E	AMP	12	Remote controller assy	174045-2	-
CN-246	AMP	12	USB & socket assy	174045-2	-
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-246	DEUTSCH	8	USB & socket assy	DT06-08SA-EP06	DT04-8P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	6	Rear view camera	-	DT04-6P
CN-259	AMP	6	Camera	S816-006002	S816-106002
CN-262	DEUTSCH	2	Straight travel solenoid	DT06-2S-EP06	-
CN-263	DEUTSCH	2	2 Piece solenoid	DT06-2S-EP06	-
CN-267	AMP	2	Accel dial LED	S816-002002	-
CN-305	DEUTSCH	12	To PVG controller	DTM06-12SA	-
CN-306	DEUTSCH	12	To PVG controller	DTM06-12SB	-
CN-307	DEUTSCH	3	Proportional-Service tool	DT06-3S-EP06	DT04-3P-E005
CN-308	AMP	4	Proportional-PVG32	2-967059-1	-
CN-309	DEUTSCH	2	Proportional-EPPR valve A1	DT06-2S-EP06	-
CN-310	DEUTSCH	2	Proportional-EPPR valve A2	DT06-2S-EP06	-
CN-365	DEUTSCH	2	Attach relief EPPR valve 1	DT06-2S-EP06	-
CN-366	DEUTSCH	2	Attach relief EPPR valve 2	DT06-2S-EP06	DT04-2P-E005
CN-367	DEUTSCH	2	Boom down floating solenoid	DT06-2S-E005	-
CN-368	DEUTSCH	2	Boom up floating solenoid	DT06-2S-E005	-
CN-369	DEUTSCH	2	Boom down cut off solenoid	DT06-2S-E005	-
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	DT04-2P-E005
CN-376	AMP	34	Relay drive unit	4-1437290-1	-
CN-378	DEUTSCH	2	Attach EPPR 2	DT06-2S-EP06	-
CN-398	DEUTSCH	4	Service tool	DT06-4S	-
CN-398	DEUTSCH	4	Service tool	DT06-4S	-
CN-401	FCI	90	AAVM controller	A2C00021583	-
CN-403	DEUTSCH	6	Rear view camera	-	DT04-6P-EP14
CN-404	DEUTSCH	6	LH view camera	-	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	-	DT04-6P-EP14
CN-406	DEUTSCH	3	RS 232	DT06-3S-EP06	DT04-3P-E005
CN-419	DEUTSCH	2	Swing parking solenoid-A1	DT06-2S-EP06	-

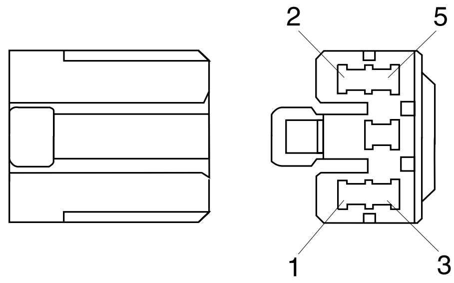
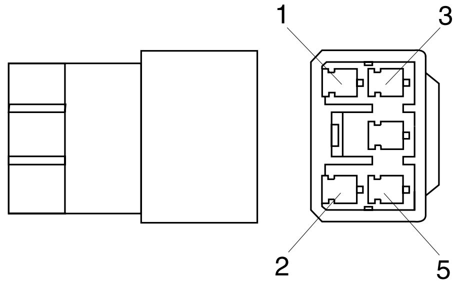
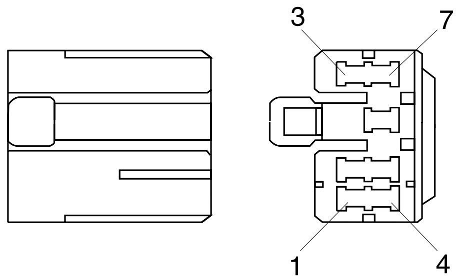
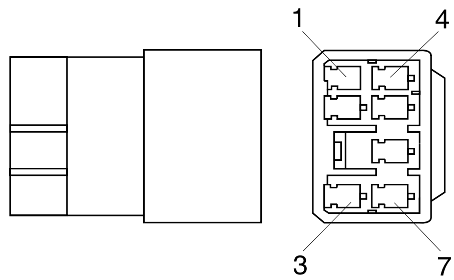
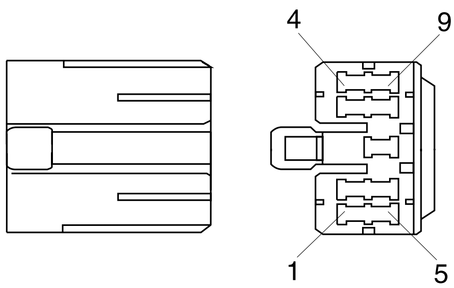
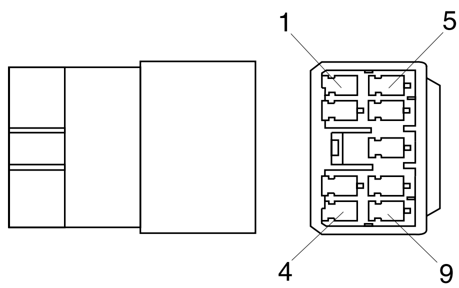
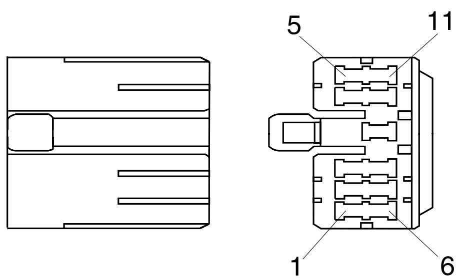
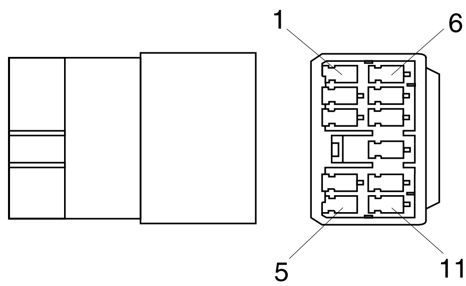
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-420	DEUTSCH	2	Swing parking solenoid-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking solenoid-A3	DT06-2S-EP06	-
CN-423	DEUTSCH	4	Tank header unit	DT06-4S	-
CN-425	AMP	2	SCR temperature sensor	282080-1	-
CN-426	AMP	2	DOC temperature sensor	282080-1	-
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
		12		5557-12R	5559-12P
CN-435	DEUTSCH	4	Equalizer	DT06-4S	-
CN-438	FIC	8	Glow plug controller	240PC089S0015	-
CN-BATT	YAZAKI	2	Battery B+	7222-4220-30	-
CN-GND	KET	1	Earth	DT640944-5	-
CN-J7A	AMP	6	NOx sensor (tail)	776433-2	-
CN-J7B	AMP	6	NOx sensor (turbo out)	776433-1	-
· Relay					
CR-1	RING-TERM	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Work lamp relay	8JA 003 526-001	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	8JA 003 526-001	-
CR-13	-	5	Head lamp relay	8JA 003 526-001	-
CR-23	KET	2	Start relay	-	MG640322
CR-23A	-	-	Start relay	MG612017-5	-
CR-24	RING TERM	1	Preheat relay	S822-014000	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-45	-	5	ECU IG relay	8JA 003 526-001	-
CR-85	-	5	Beacon lamp relay	8JA 003 526-001	-
CR-95	-	5	Feed pump relay	8JA 003 526-001	-
CR-105	-	5	Equalizer	8JA 003 526-001	-
CR-106	-	5	ECU battery relay	MG612017-5	-
CR-107	-	5	DPF relay	8JA 003 526-001	-
CR-108	-	5	ECU start relay	8JA 003 526-001	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	-
CS-2A	WP	6	Start key switch	S814-006100	-
CS-2B	DEUTSCH	3	Start button	DT06-3S-EP06	DT04-3P-E005
CS-4	AMP	3	Safety switch	S816-003002	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P-E005

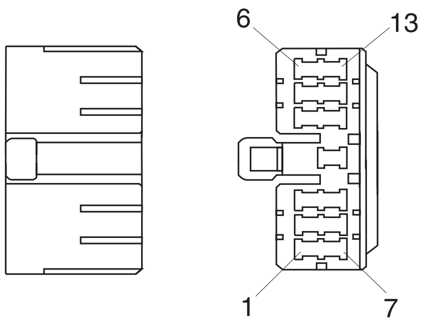
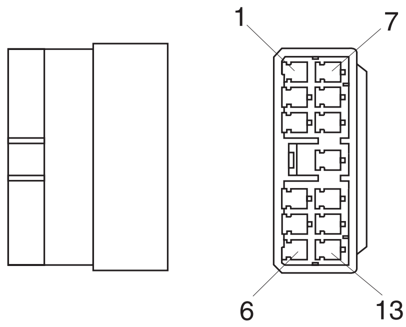
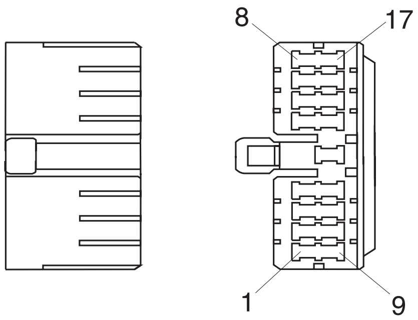
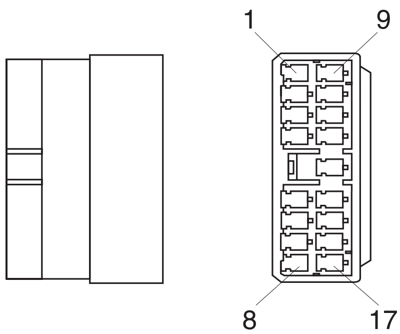
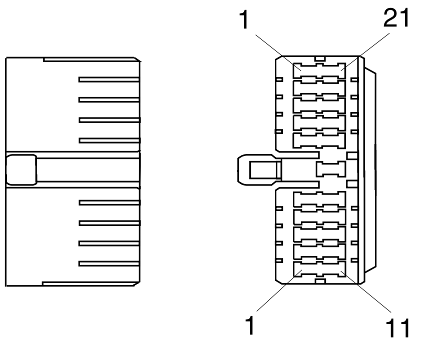
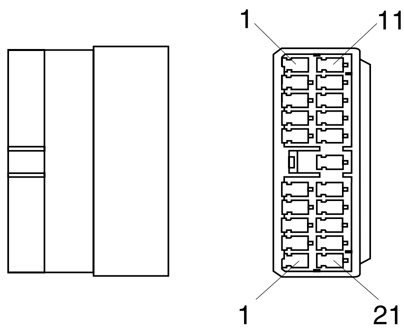
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-19	DEUTSCH	2	One touch decel switch	-	DT04-2P-E005
CS-26	DEUTSCH	2	Breaker switch	DT06-2S-EP06	-
CS-26A	AMP	2	Breaker pedal switch	S816-002002	S816-102002
CS-29	DEUTSCH	2	Power max switch	DT06-2S-EP06	-
CS-33	AMP	6	Emergency engine stop switch	S816-006002	S816-106002
CS-52	SWF	12	Adjust & dozer switch	SWF589790	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-67	SWF	12	Quick clamp switch	SWF589790	-
CS-73	SWF	12	Swing lock switch	SWF589790	-
CS-73A	SWF	12	Swing fine switch	SWF589790	-
CS-74A	AMP	2	Master switch	S813-030201	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-83	SWF	12	Spare switch	SWF589790	-
CS-99	SWF	12	Air compressor switch	SWF589790	-
CS-100	SWF	12	Spare switch	SWF589790	-
CS-107	SWF	12	Travel straight switch	SWF589790	-
CS-111	SWF	12	Boom floating switch	SWF589790	-
· 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	-
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S	-
CL-7	SHUR	1	Beacon lamp	S822-014002	S822-114002
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-rear	DT06-2S-EP06	DT04-2P
· 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-16	DELPHI	3	Water level sensor	12110293	-
CD-24	DEUTSCH	3	Swing pressure sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload pressure sensor	DT06-3S-EP06	DT04-3P-E004
CD-32	DEUTSCH	3	Boom up pressure sensor	DT06-3S-EP06	-
CD-35	DEUTSCH	3	Arm in/out pressure sensor	DT06-3S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CD-42	DEUTSCH	3	Pump pressure sensor 1	DT06-3S-EP06	-
CD-43	DEUTSCH	3	Pump pressure sensor 2	DT06-3S-EP06	-
CD-44	DEUTSCH	3	Pump pressure sensor 3	DT06-3S-EP06	-
CD-45	AMP	3	WIF sensor	282191-1	-
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 sensor	DT06-3S-EP06	-
CD-86	DEUTSCH	3	Arm out pressure sensor	DT06-3S-E005	-
CD-87	DEUTSCH	3	Bucket out pressure sensor	DT06-3S-E005	-
CD-90	DEUTSCH	3	Arm in pressure sensor	DT06-3S-EP06	-
CD-91	DEUTSCH	3	Bucket in pressure sensor	DT06-3S-E005	-
CD-98	AMP	2	Air inlet temperature sensor	776427-1	-
CD-98A	AMP	2	Air intake temperature sensor	776427-1	-
CD-124	DEUTSCH	3	Boom cylinder rod pressure snensor	DT06-3S-E005	-
CD-150	AMP	2	Air inlet temperature sensor	85202-1	-
CD-151	BOSCH	6	Lambda snensor	1 928 404900	-
CD-152	BOSCH	2	DOC inlet temperature sensor	1 928 403876	-
CD-153	BOSCH	2	DPF inlet temperature sensor	1 928 403876	-
CD-154	BOSCH	3	DPF pressure snensor	1 928 403966	-

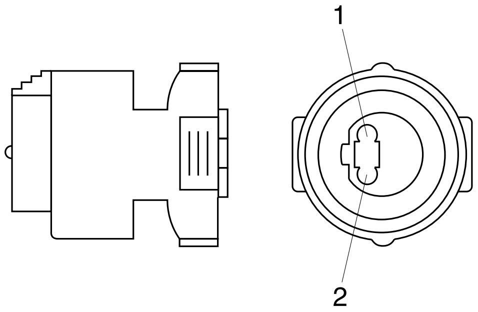
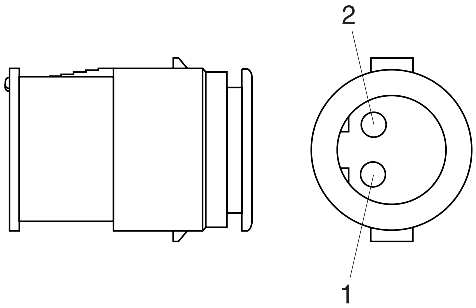
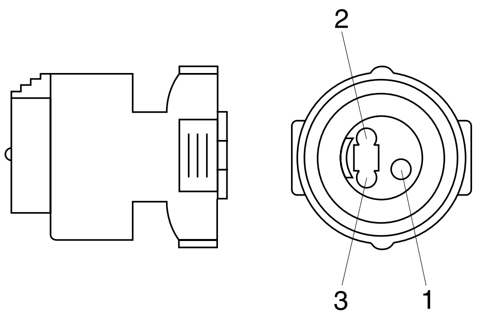
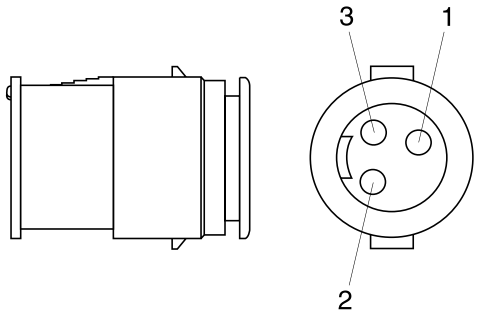
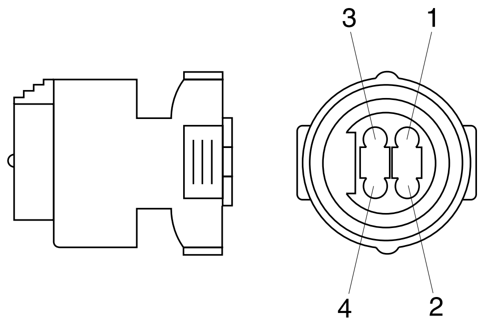
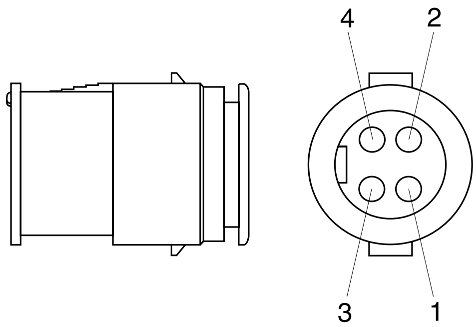
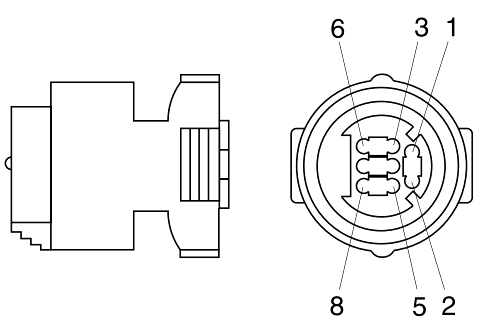
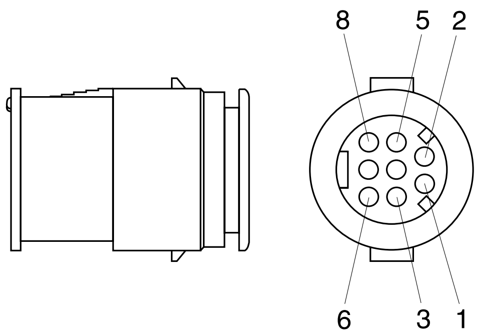
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

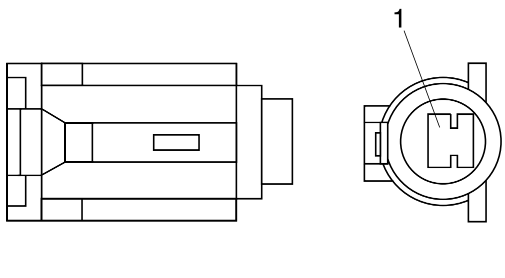
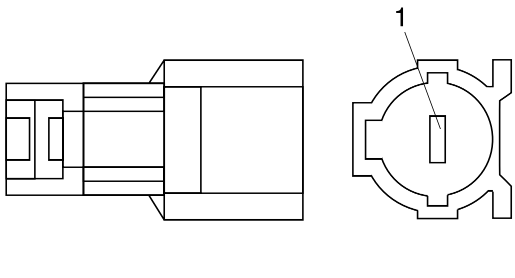
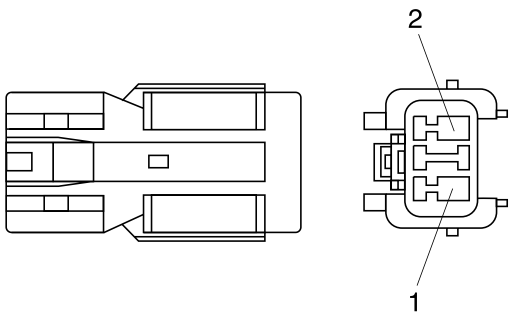
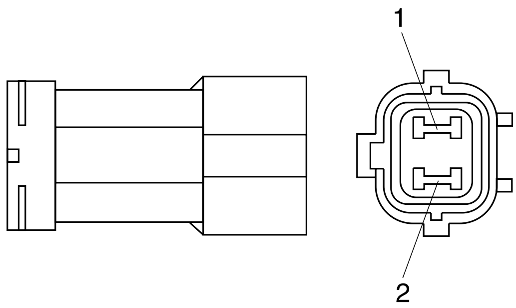
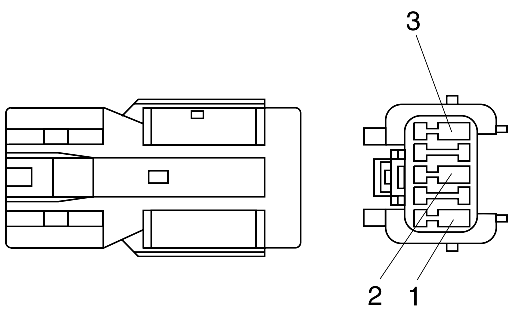
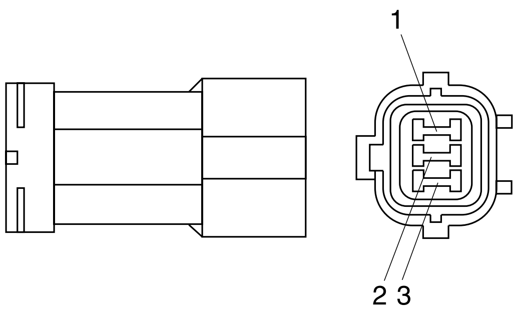
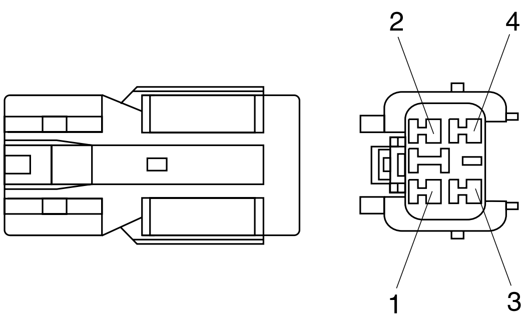
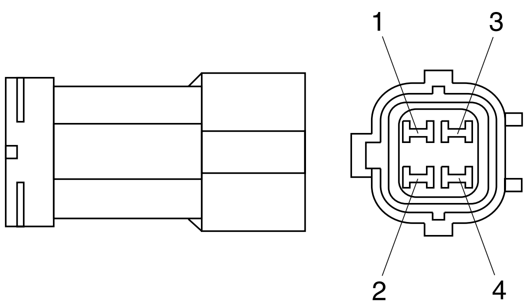
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

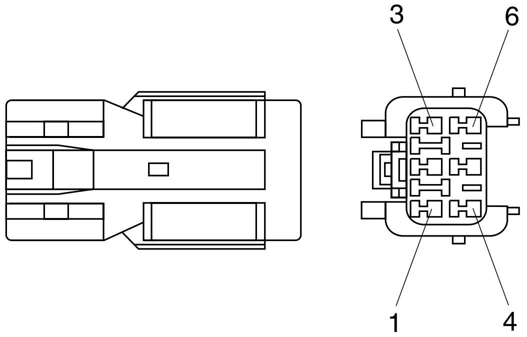
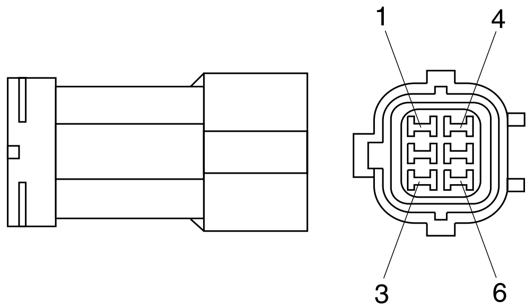
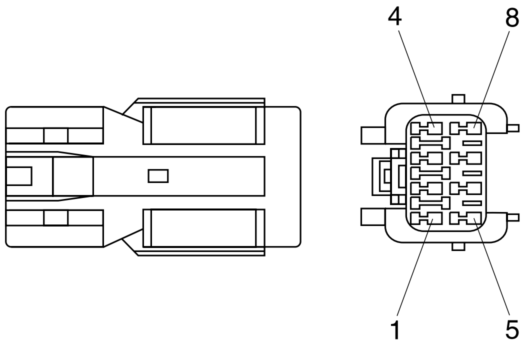
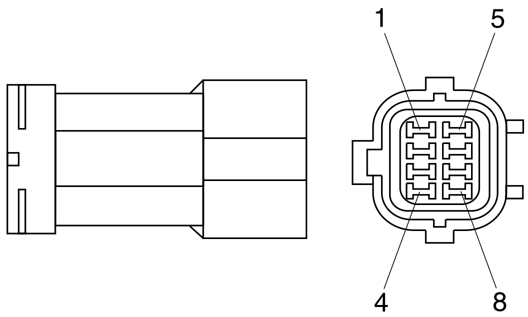
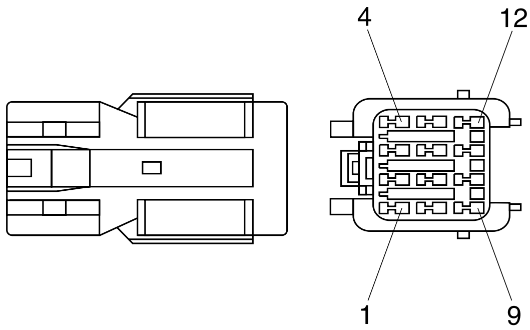
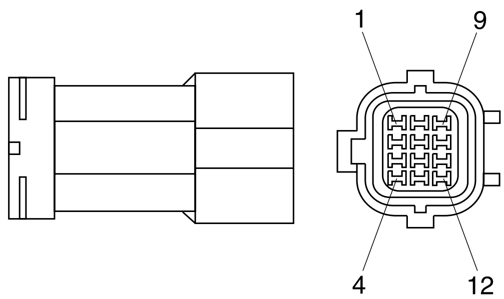
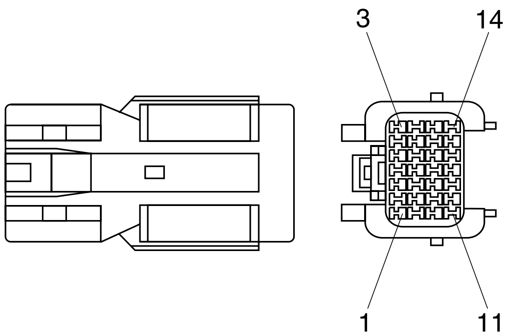
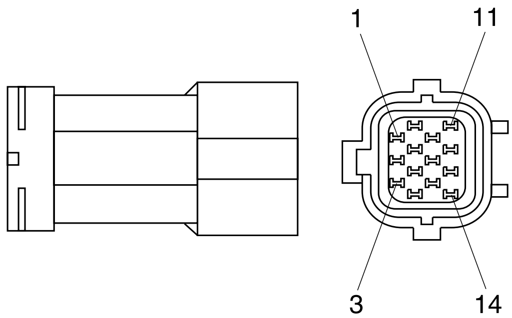
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

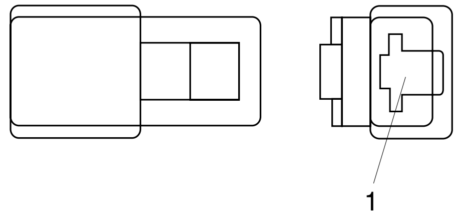
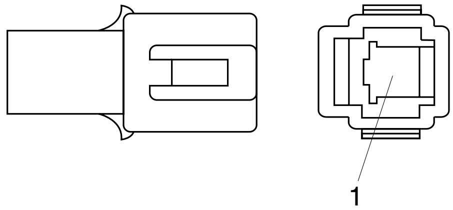
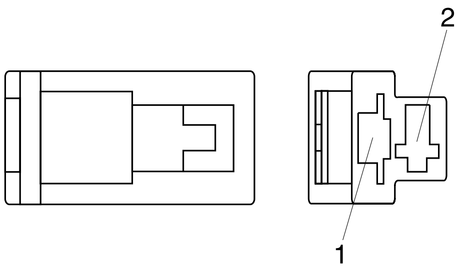
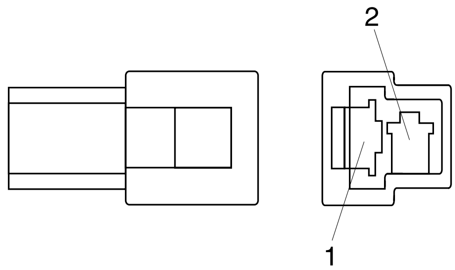
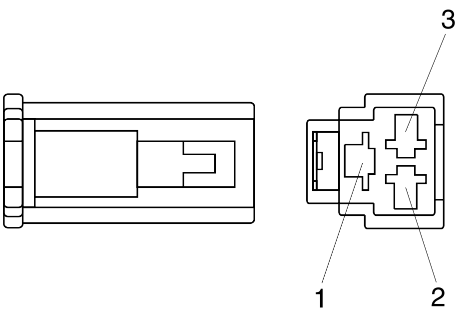
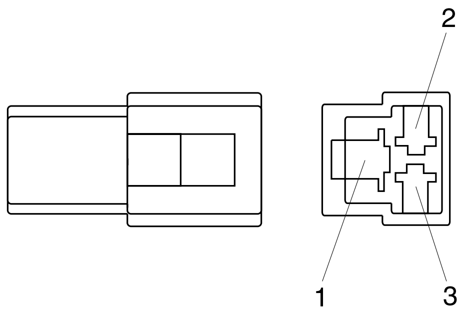
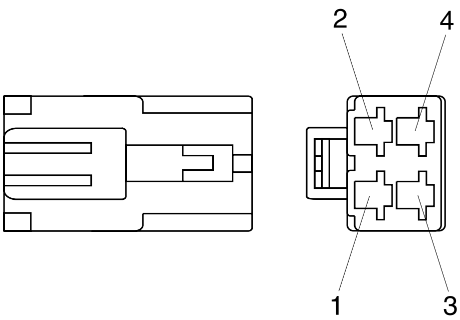
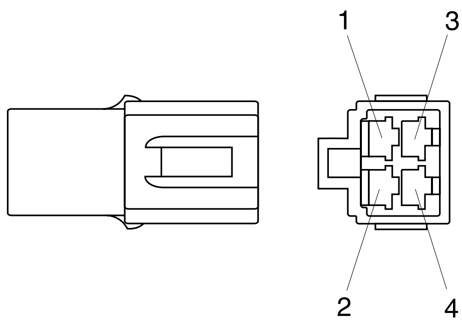
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

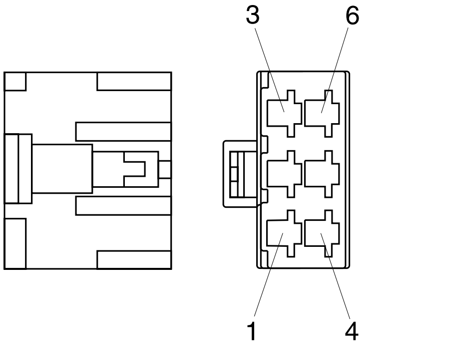
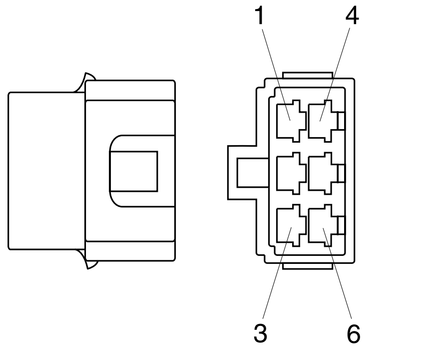
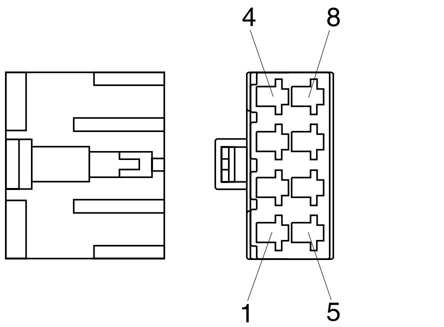
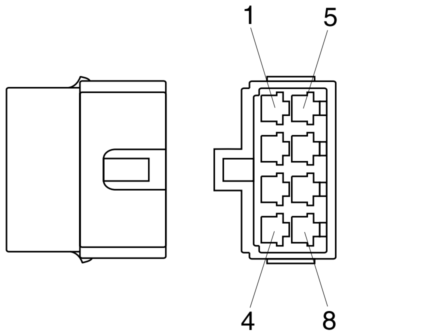
3) SWP TYPE CONNECTOR

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

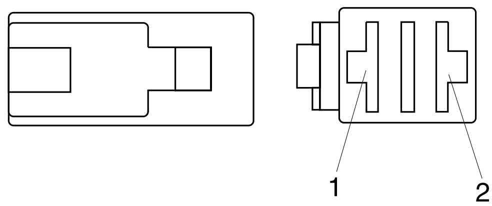
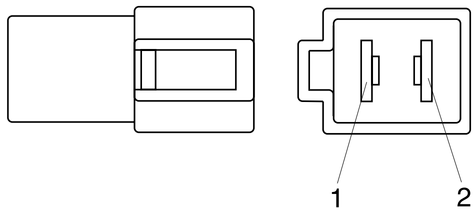
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

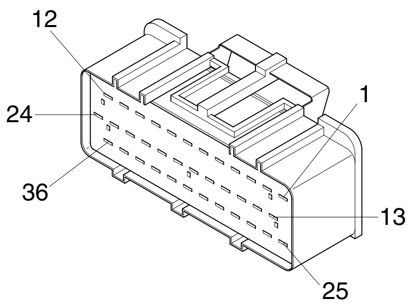
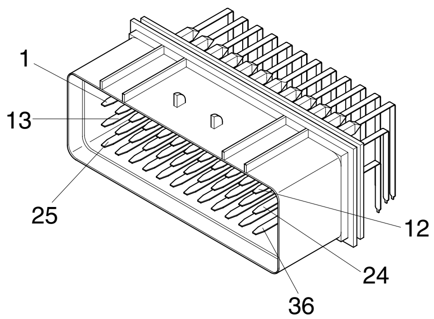
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

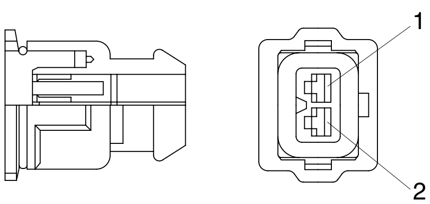
5) 375 FASTEN TYPE CONNECTOR

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

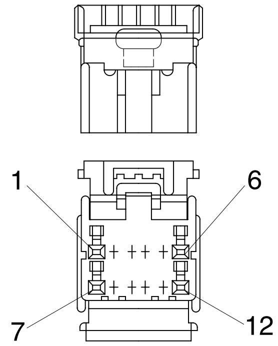
6) AMP ECONOSEAL CONNECTOR

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

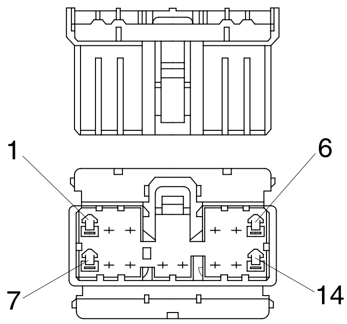
7) AMP TIMER CONNECTOR

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

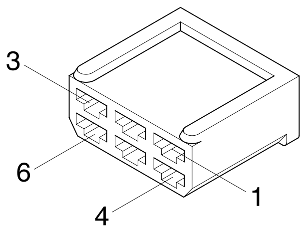
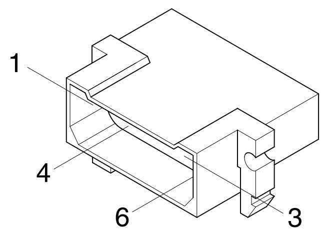
8) AMP 040 MULTILOCK CONNECTOR

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

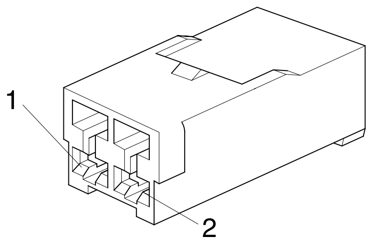
9) AMP 070 MULTILOCK CONNECTOR

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

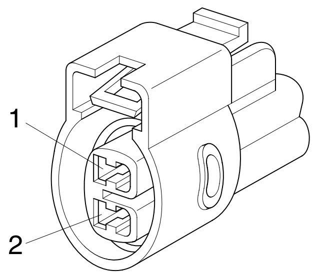
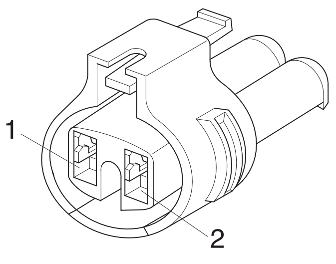
10) AMP FASTIN - FASTON CONNECTOR

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

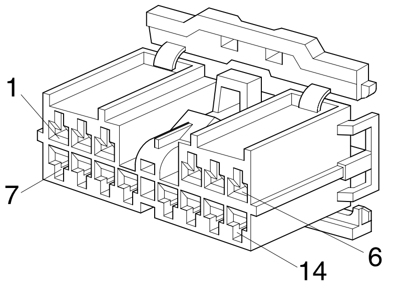
11) KET 090 CONNECTOR

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	

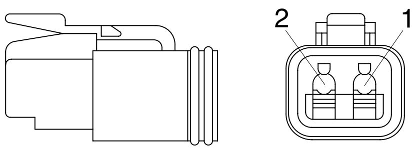
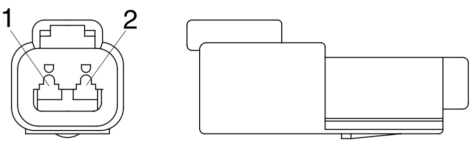
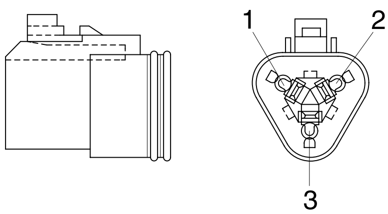
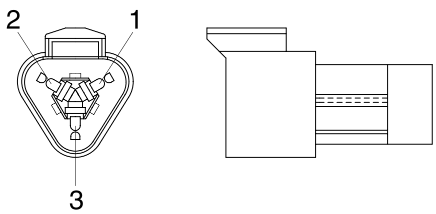
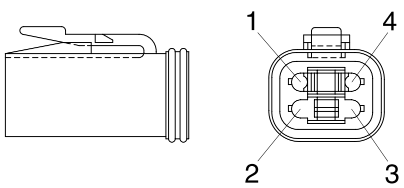
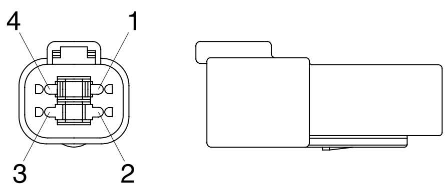
14) DEUTSCH DT CONNECTORS

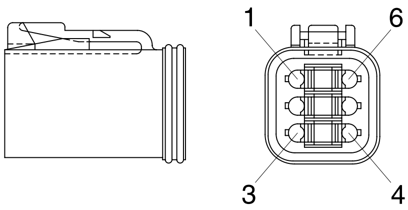
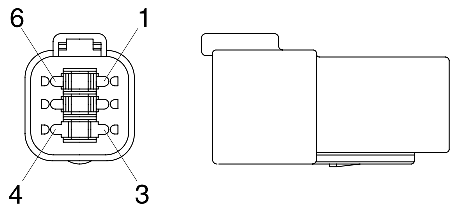
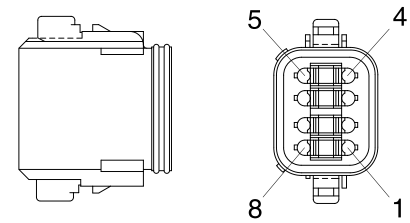
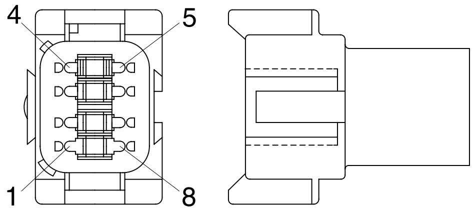
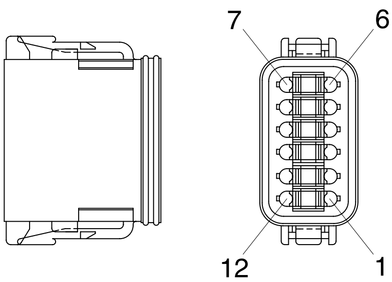
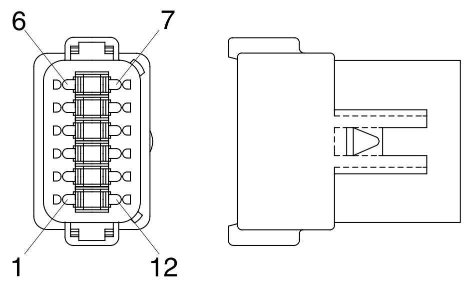
DT 06 - 3S - ★★★★

- ★★★★ : 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

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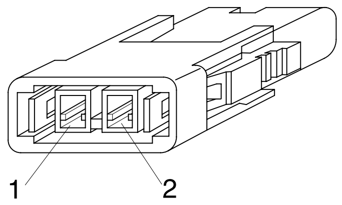
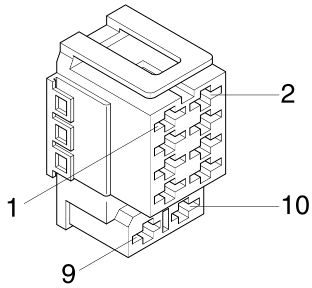
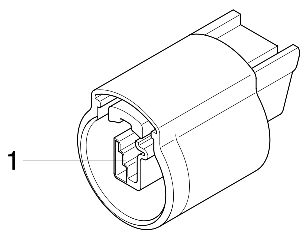
2	 35215-0200	

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

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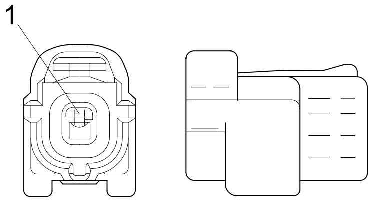
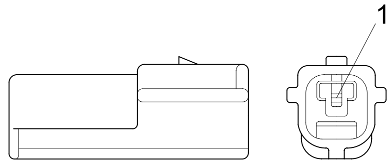
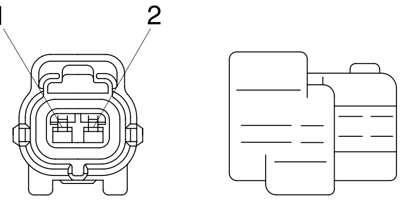
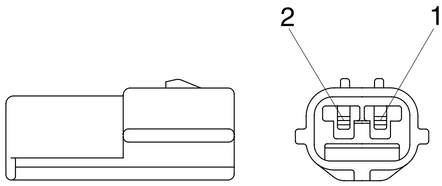
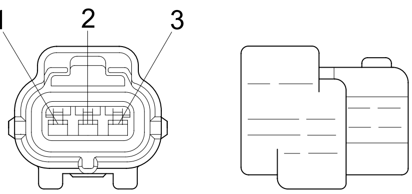
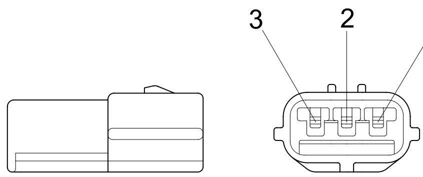
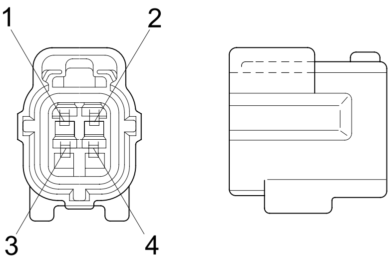
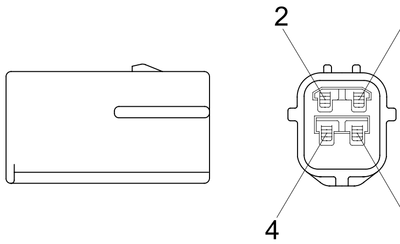
1	 S816-001002	 S816-101002
2	 S816-002002	 S816-102002
3	 S816-003002	 S816-103002
4	 S816-004002	 S816-104002

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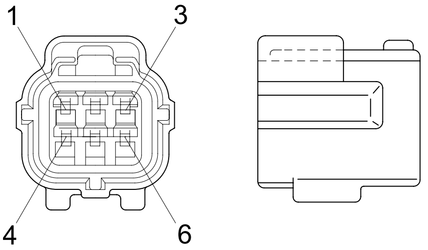
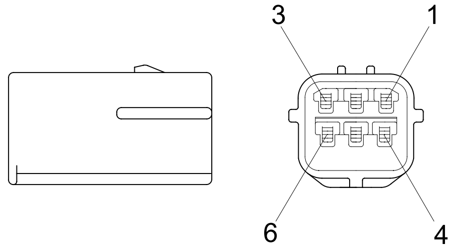
<tr><td>6</td><td>

S816-006002</td><td>

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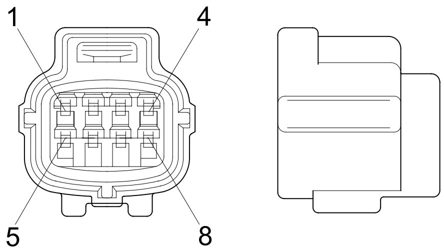
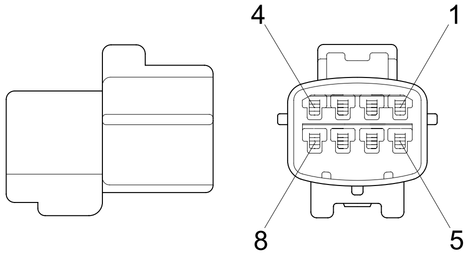
<tr><td>8</td><td>

S816-008002</td><td>

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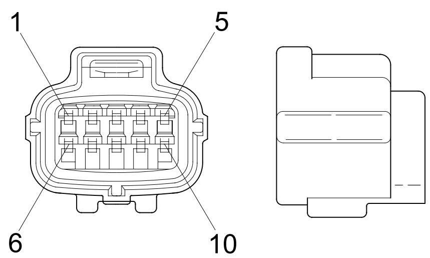
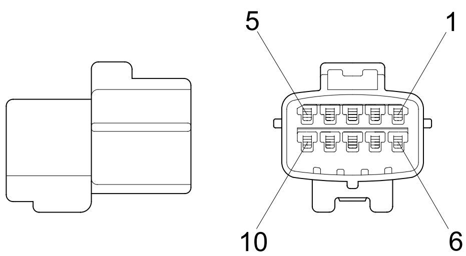
<tr><td>10</td><td>

S816-010002</td><td>

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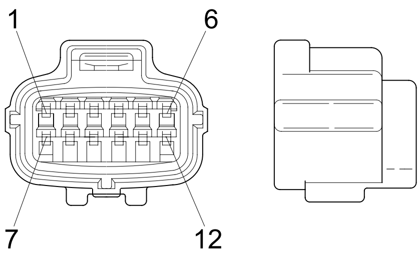
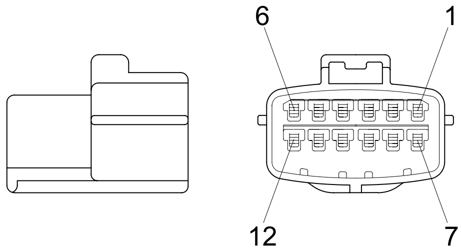
<tr><td>12</td><td>

S816-012002</td><td>

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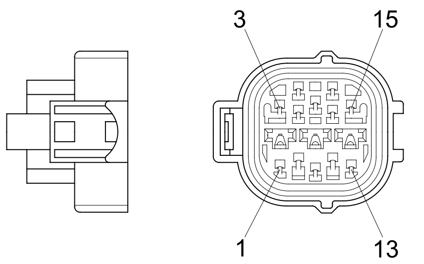
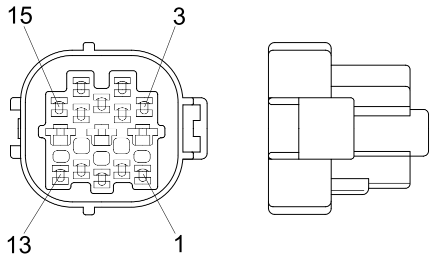
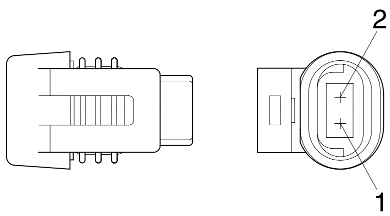
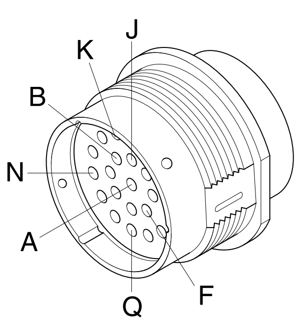
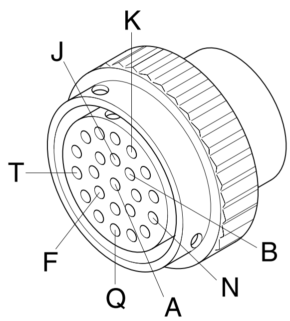
No. of pin	Receptacle connector (female)	Plug connector (male)
15	 368301-1	 2-85262-1

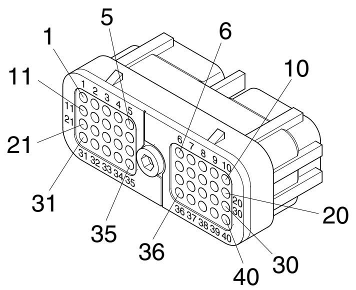
19) METRI-PACK TYPE CONNECTOR

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

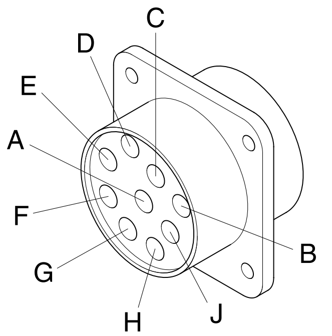
20) DEUTSCH HD30 CONNECTOR

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

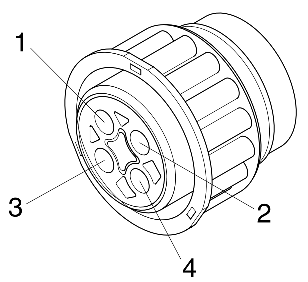
21) DEUTSCH MCU CONNECTOR

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

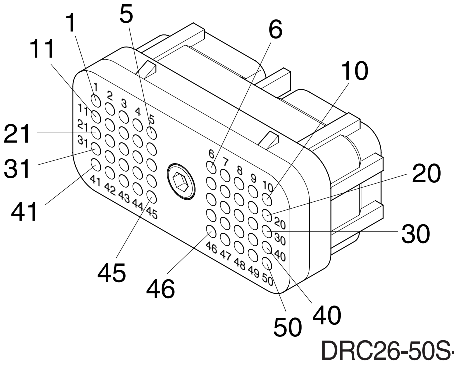
22) DEUTSCH SERVICE TOOL CONNECTOR

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

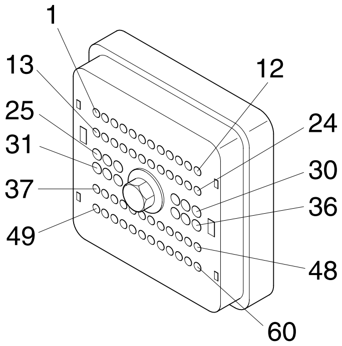
23) AMP FUEL WARMER CONNECTOR

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

24) DEUTSCH ENGINE ECM CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
50	 DRC26-50S-04	

25) DEUTSCH INTERMEDIATE CONNECTOR

No. of pin	Receptacle connector (Female)	Plug connector (Male)
60	 DRB16-60SAE-L018	

SECTION 5 MECHATRONICS SYSTEM

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SECTION 5 MECHATRONICS SYSTEM

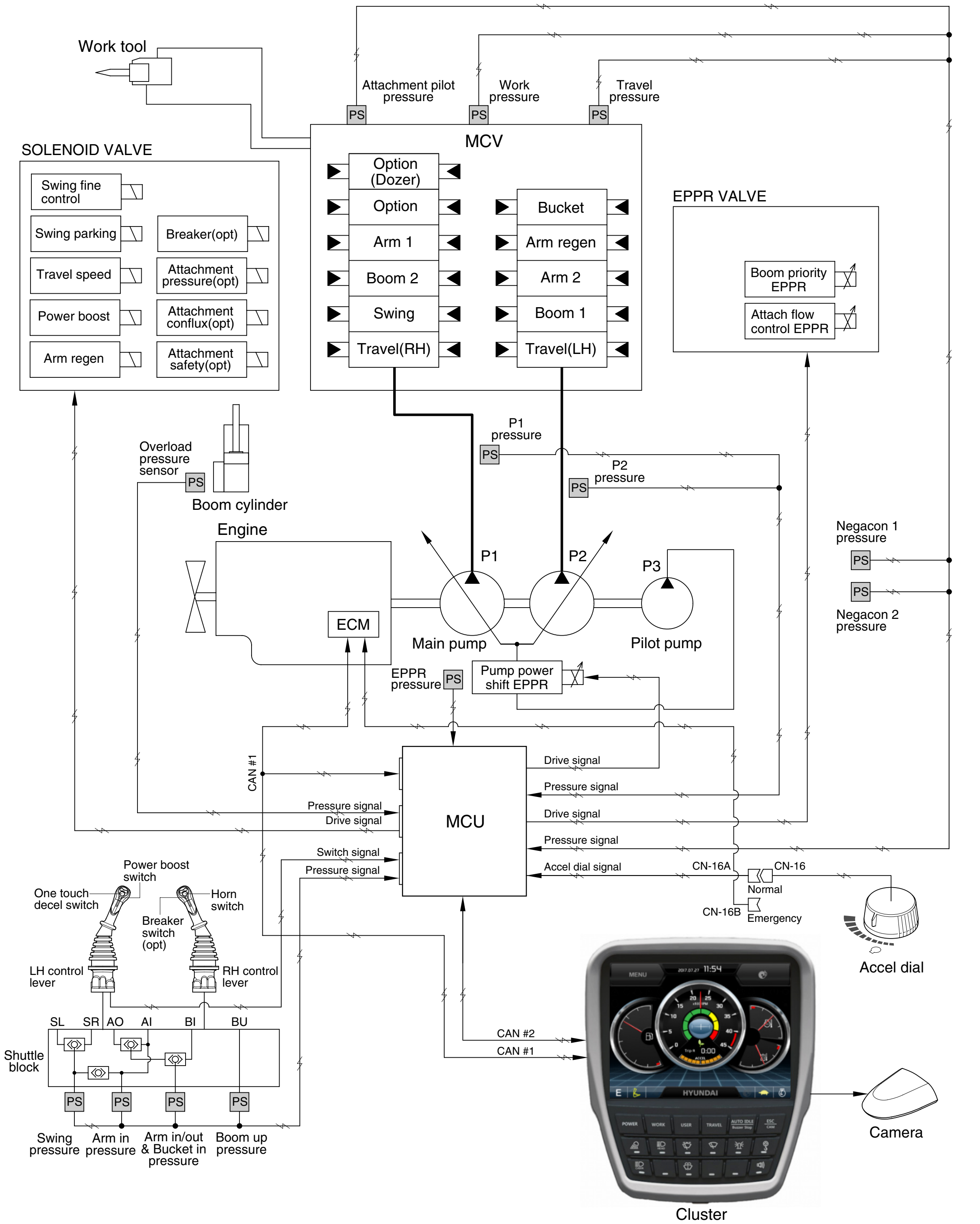
GROUP 1 OUTLINE

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

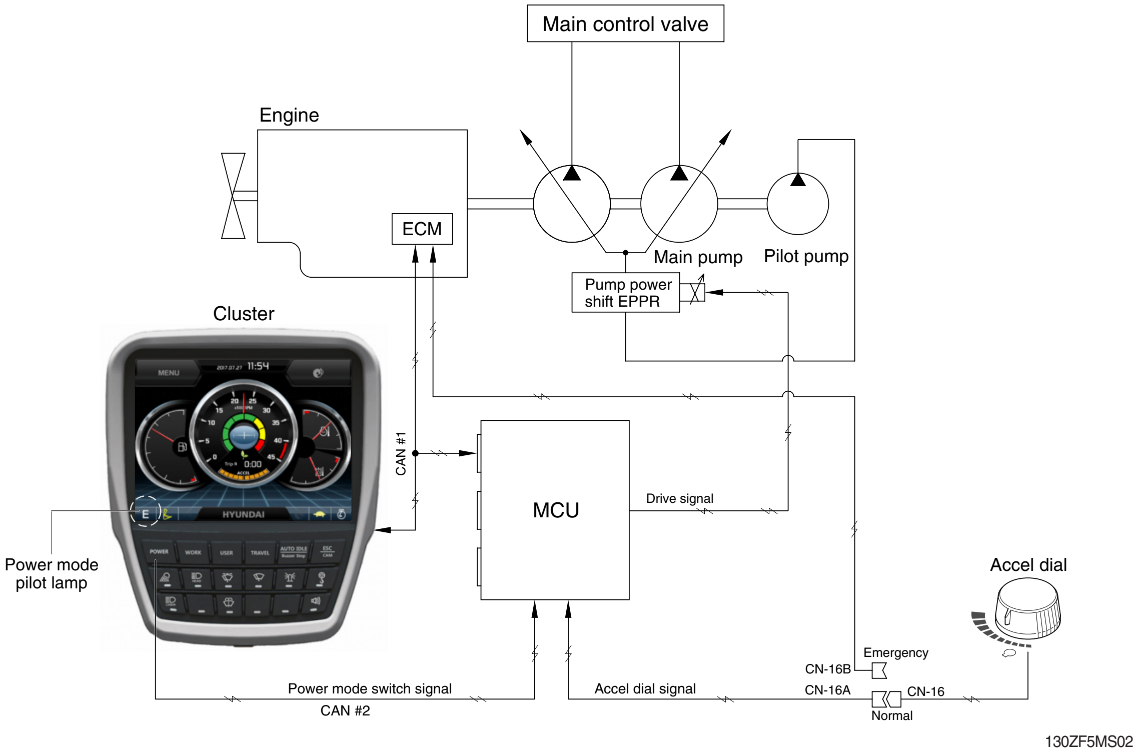
SYSTEM DIAGRAM



130ZF5MS01

GROUP 2 MODE SELECTION SYSTEM

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.

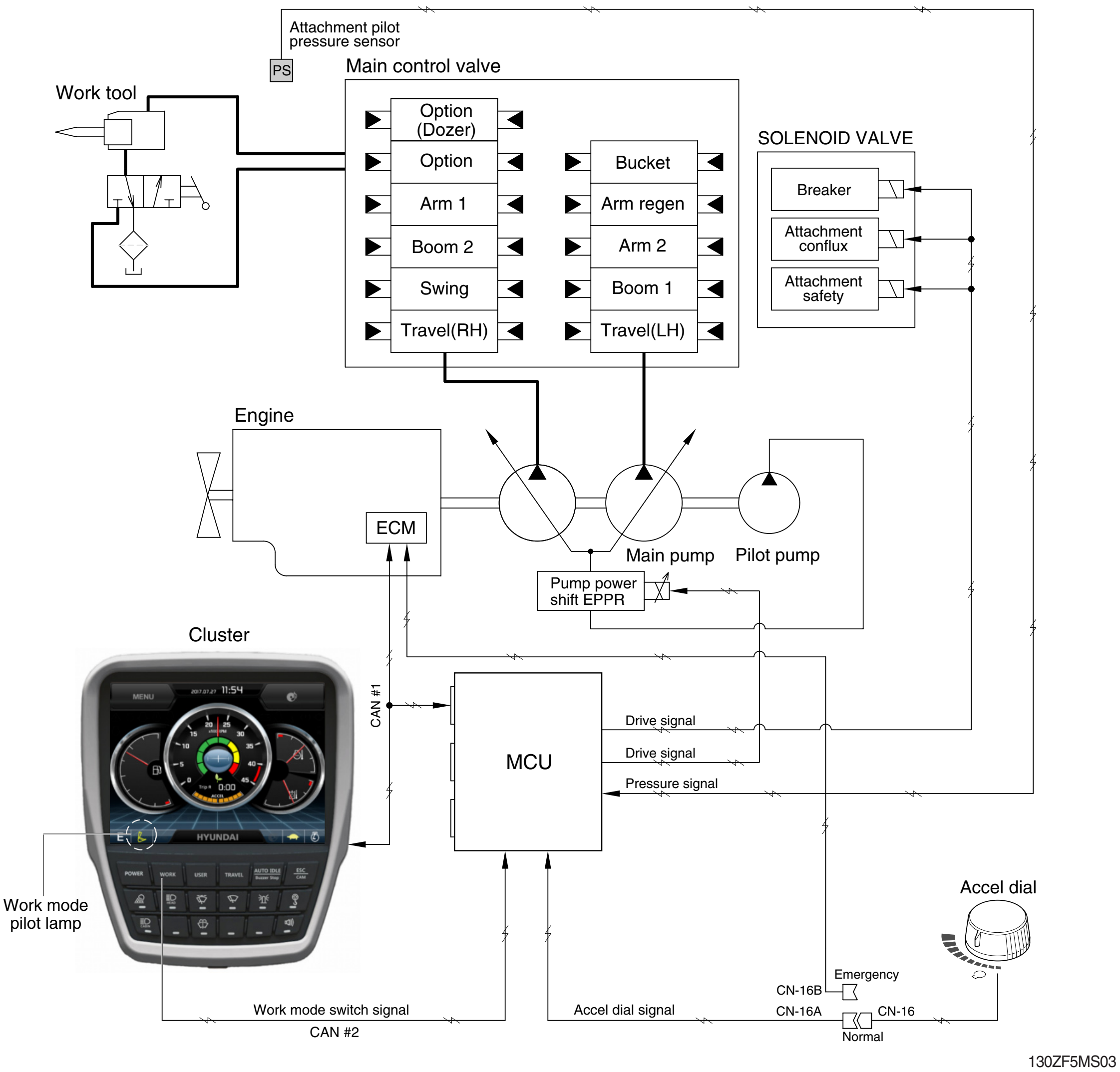
Power mode	Application	Engine rpm				Power shift by EPPR valve			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm^2)	Current (mA)	Pressure (kgf/cm^2)
P	Heavy duty power	1850±50	1950±50	2100±50	2050±50	290±30	8 (3)	160±30	0 (0)
S	Standard power	1750±50	1850±50	2000±50	1950±50	330±30	10 (5)±3	250±30	5 (5)±3
E	Economy operation	1650±50	1750±50	1750±50	1850±50	360±30	12 (7)±3	330±30	10 (5)±3
AUTO DECEL	Engine deceleration	1100±100	-	1100±100	-	700±30	38±3	700±30	38±3
One touch decel	Engine quick deceleration	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3
KEY START	Key switch start position	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3

※ Power shift (Standard/Option) can be changed by "Service menu" in "Management" on the cluster.

※ ( ) : Load

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.

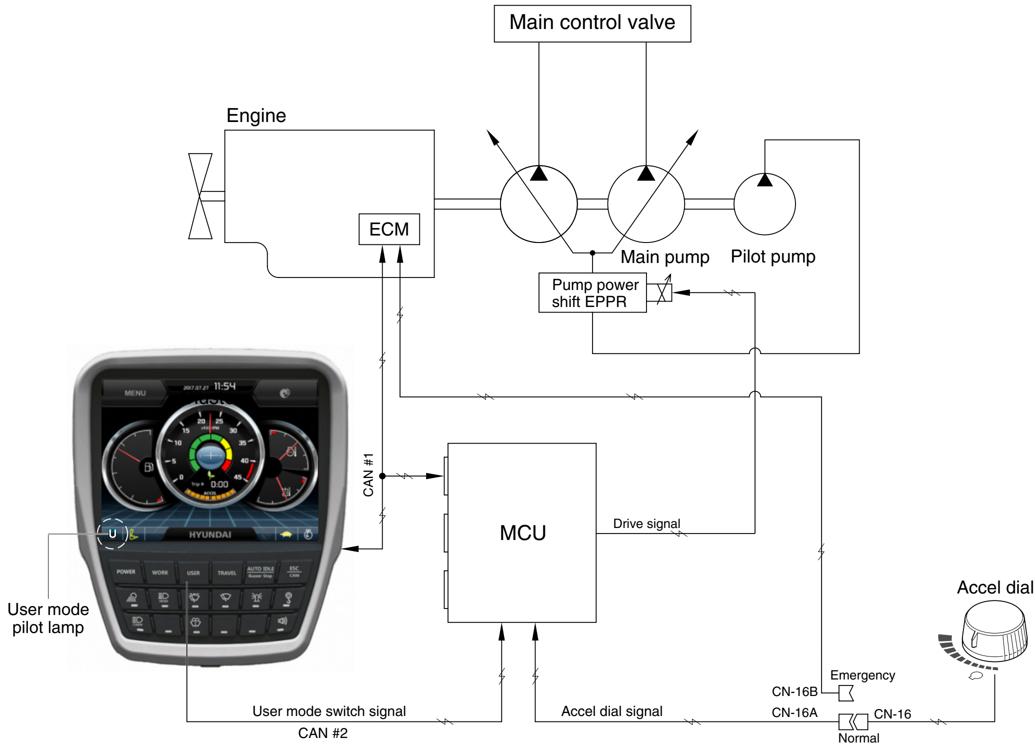
2) ATT WORK MODE (breaker, crusher)

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



130ZF5MS04

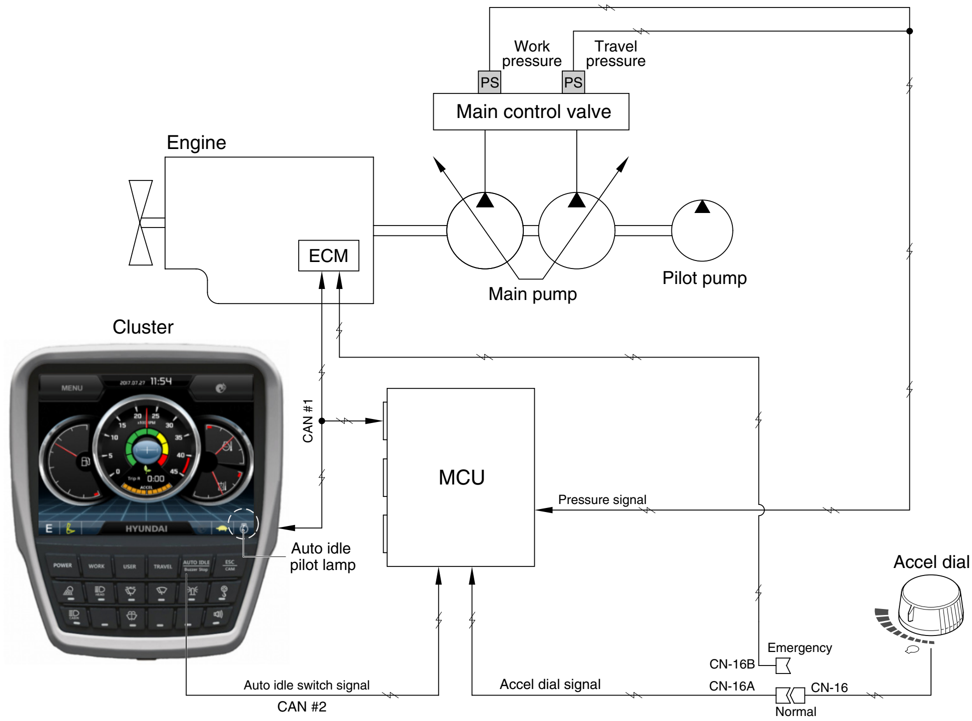
1) Engine speed, idle speed and pump power shift pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift pressure (bar)
1	1300	1000	0
2	1400	1050	3
3	1500	1100 (Auto decel)	6
4	1600	1130	9
5	1700	1150	12
6	1800	1180	16
7	1900	1200	20
8	2000	1230	26
9	2050	1250	32
10	2100	1280	38

※ Refer to the page 5-76.

GROUP 3 AUTOMATIC DECELERATION SYSTEM

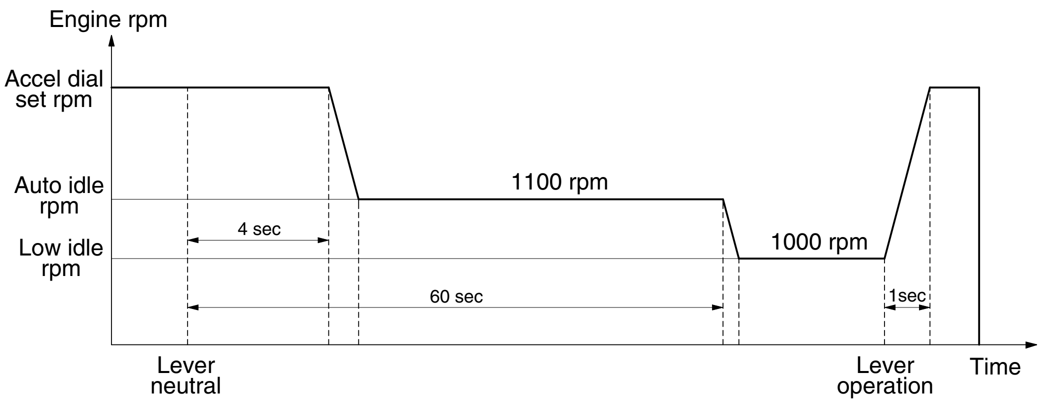


130ZF5MS05

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 1100 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.



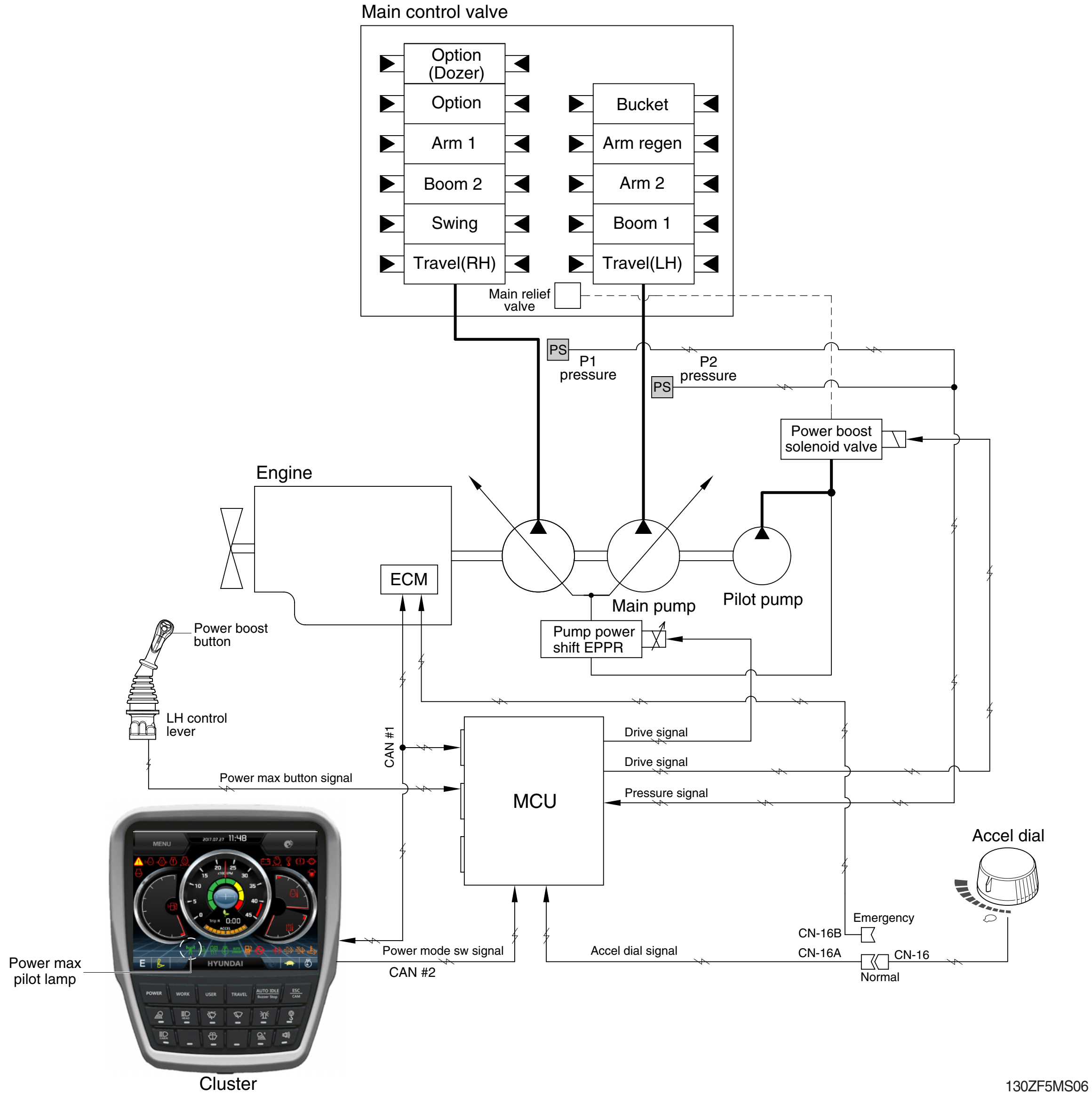
140L5MS01

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



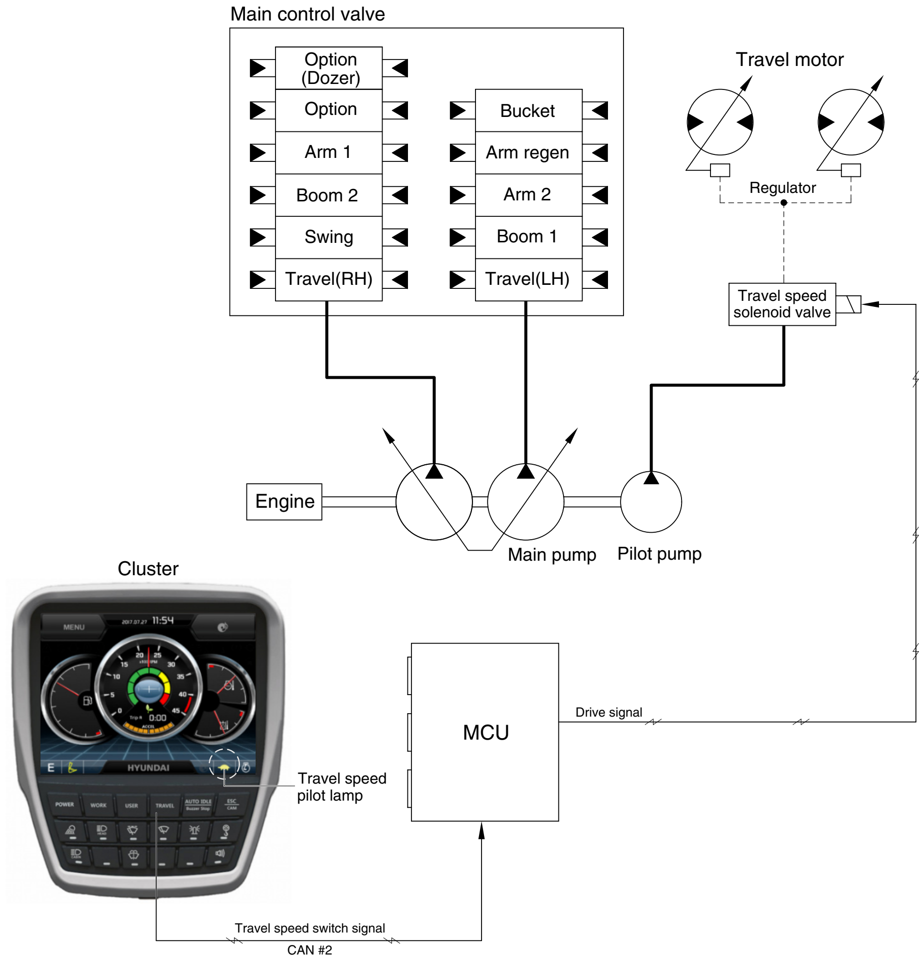
· When the power boost switch on the left control lever is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· 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



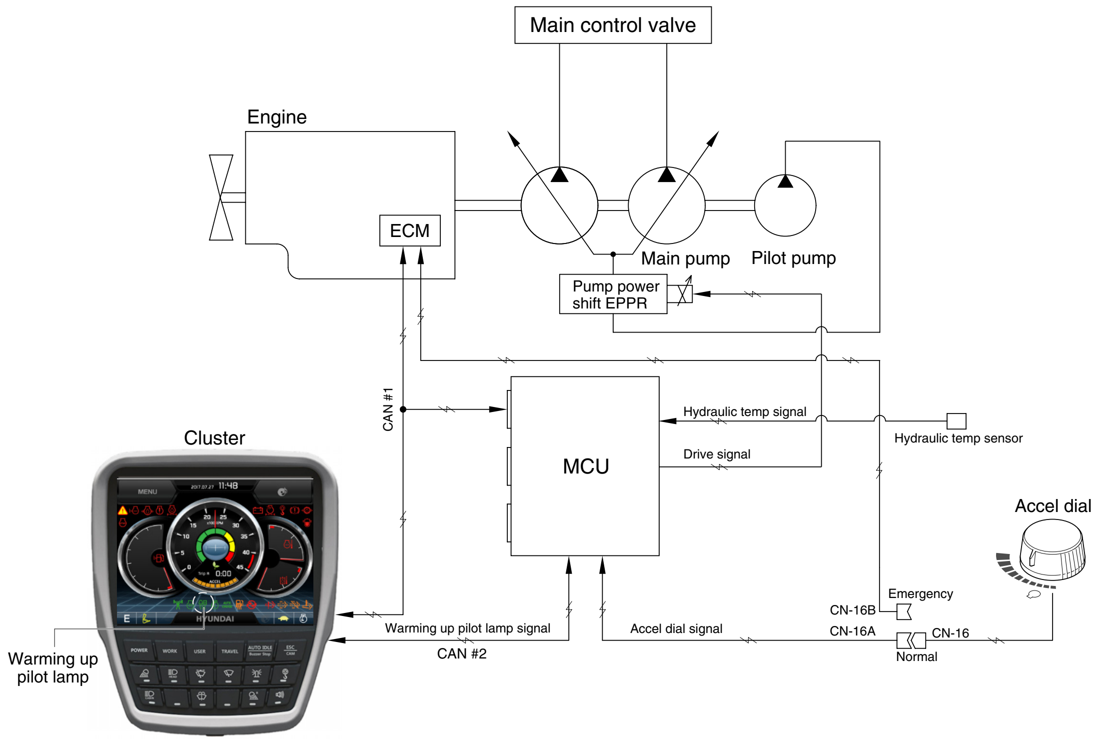
130ZF5MS07

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



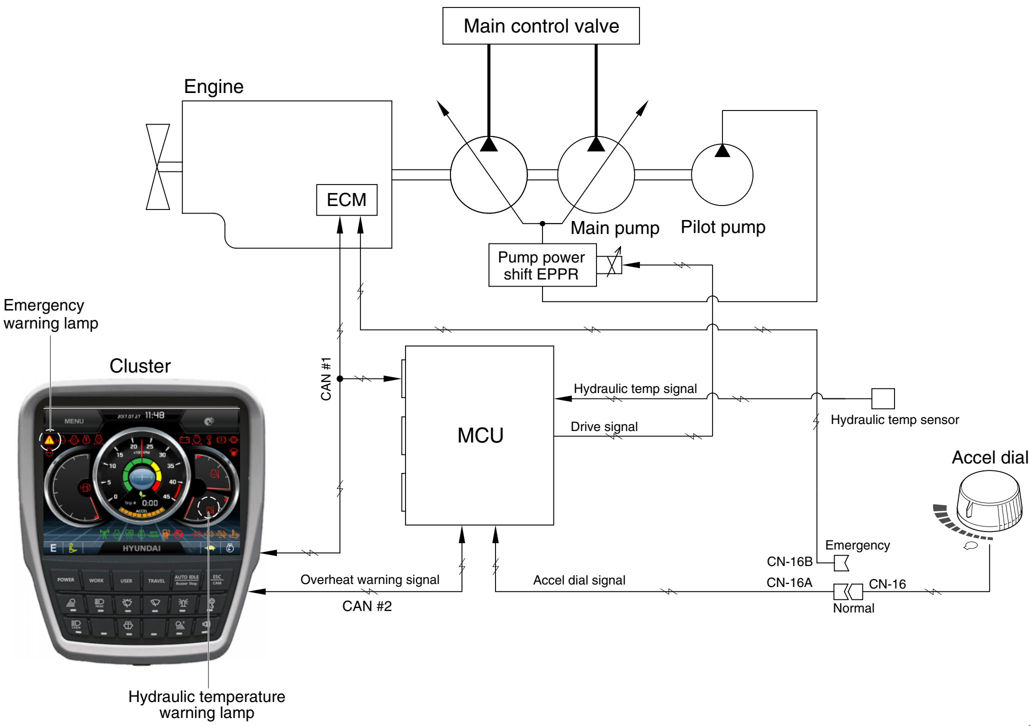
130ZF5MS08

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 1000 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



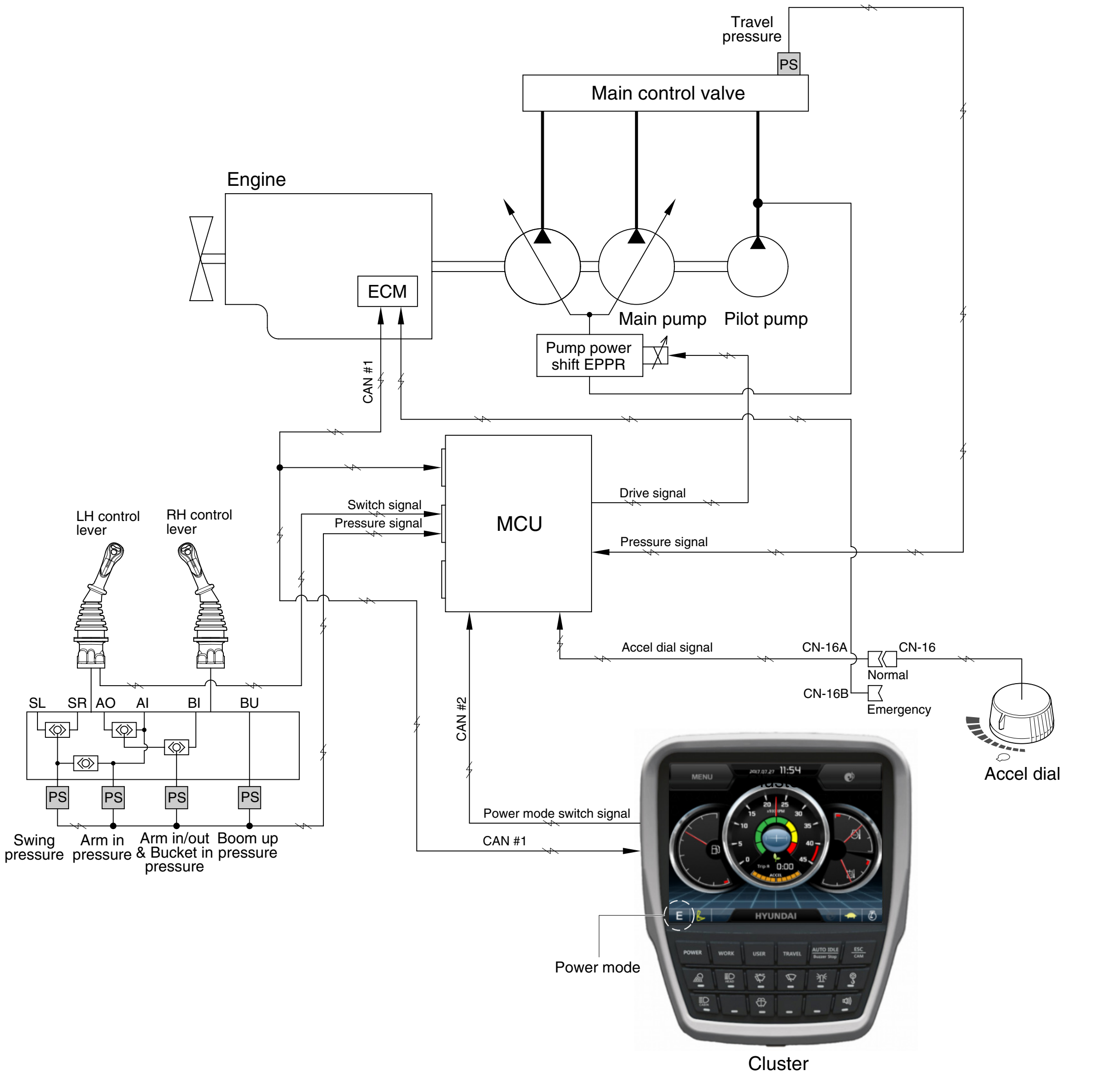
130ZF5MS09

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



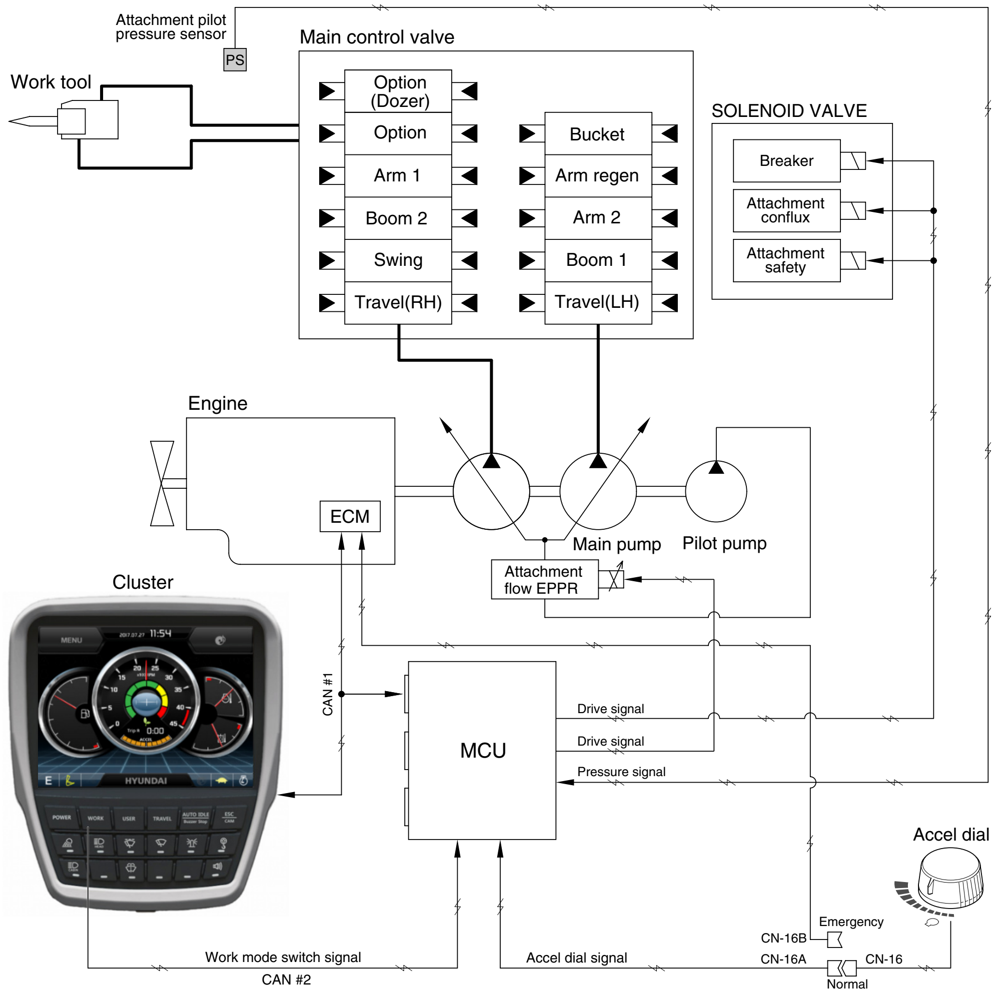
130ZF5MS10

· 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



130ZF5MS11

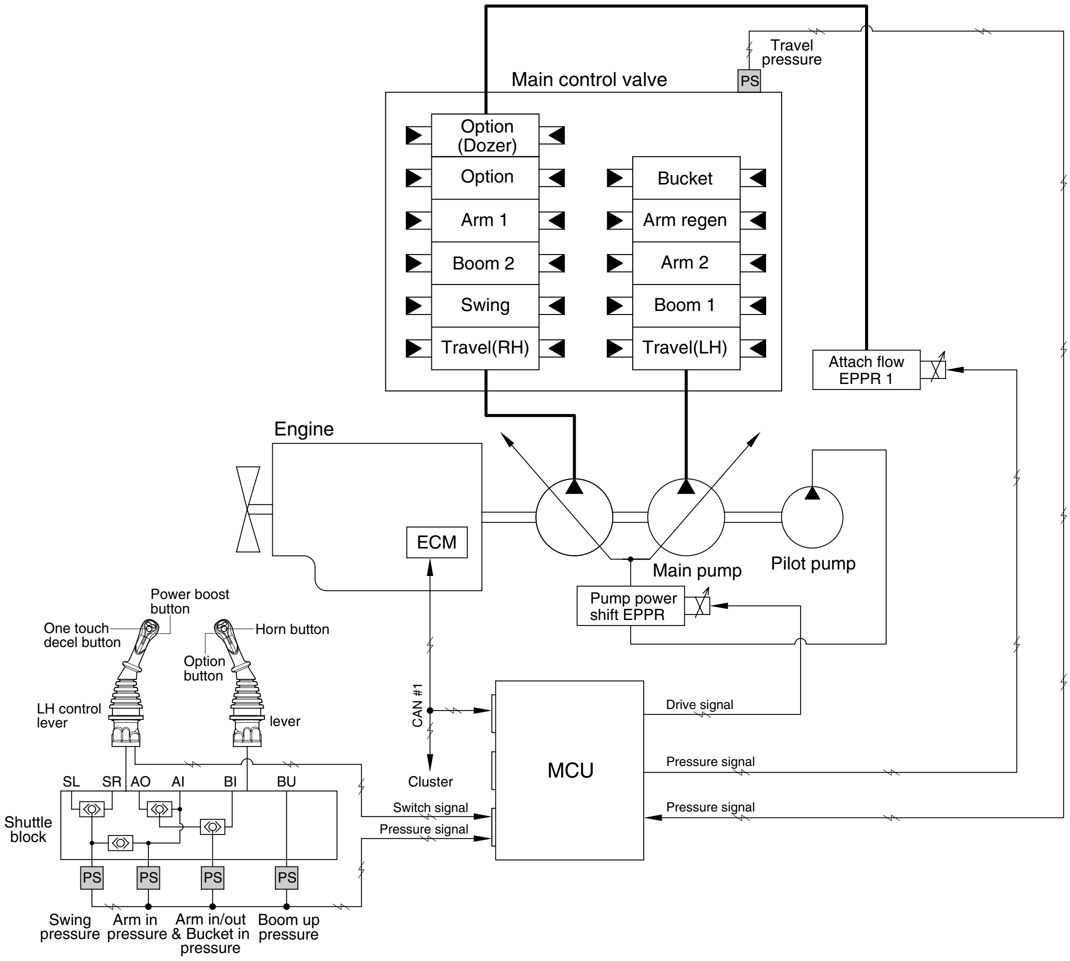
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

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

※ Refer to the page 5-76 for the attachment kinds and max flow.

★ When breaker operating switch is pushed.

GROUP 10 INTELLIGENT POWER CONTROL SYSTEM



145ZF5MS13

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

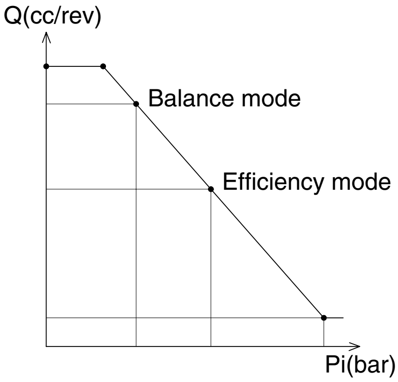
★1 AND condition

★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"

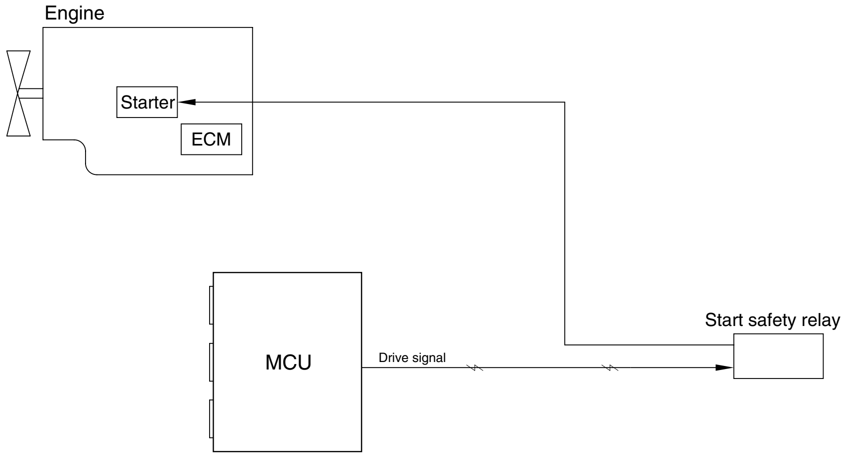
290F3CD311



130ZF5MS19

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



300L5MS12

1. ANTI-RESTART FUNCTION

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

GROUP 12 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

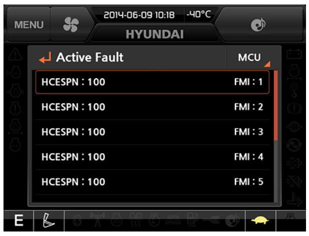
When any abnormality occurs in the ADVANCED CAPO system caused by electric parts malfunction and by open or short circuit, the MCU diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

2. MONITORING

1) Active fault

290F3CD120

290F3CD121

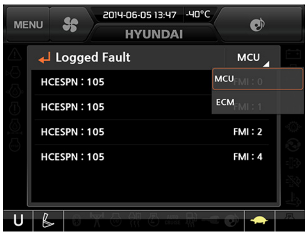


290F3CD125

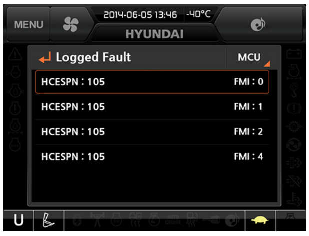
· The active faults of the MCU, engine ECM or air conditioner can be checked by this menu.

2) Logged fault

290F3CD128



290F3CD123

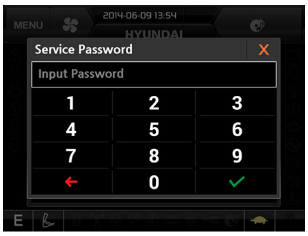


290F3CD124

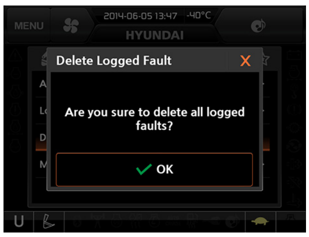
· The logged faults of the MCU, engine ECM or air conditioner can be checked by this menu.

3) Delete logged fault

290F3CD134



290F3CD126



290F3CD127

· The logged faults of the MCU, engine ECM or air conditioner can be deleted by this menu.

3. MACHINE ERROR CODES TABLE

<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">101</td><td>3</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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 (#5) Checking Open/Short</td></tr>
<tr><td rowspan="4">105</td><td>0</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="4">108</td><td>0</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V</td><td></td><td>●</td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</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
120	0	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 1 (P1) 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				
121	0	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 2 (P2) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-52 (#12) Checking Open/Short 2. CD-43 (#A) – CN-51 (#3) Checking Open/Short 3. CD-43 (#C) – CN-51 (#13) Checking Open/Short				
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#16) Checking Open/Short 2. CD-31 (#A) – CN-51 (#3) Checking Open/Short 3. CD-31 (#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">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-52 (#33) 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-52 (#17) 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 (#19) 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-53 (#23) Checking Open/Short 2. CD-85 (#A) – CN-53 (#3) Checking Open/Short 3. CD-85 (#C) – CN-53 (#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-52 (#28) Checking Open/Short 2. CD-90 (#A) – CN-51 (#3) Checking Open/Short 3. CD-90 (#C) – CN-51 (#13) Checking Open/Short			
133	0	10 seconds continuous, Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Arm In/Out & Bucket In Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-52 (#14) Checking Open/Short 2. CD-35 (#A) – CN-51 (#3) Checking Open/Short 3. CD-35 (#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">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-53 (#14) Checking Open/Short
2. CD-69 (#A) – CN-53 (#3) Checking Open/Short
3. CD-69 (#C) – CN-53 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="3">139</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>

※ 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">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 (#10) 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 (#34) Checking Open/Short
2. CN-133 (#1) – CN-52 (#35) 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">143</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</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>

※ 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">164</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) – CN-45 (#B+ term) 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) – 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
167	4	(Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 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 ≤ 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 ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – driving in 1/2 transmission operation failure (Checking list) 1. CN-70 (#1) – CN-52(#20) Checking Open/Short 2. CN-70 (#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
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. CD-237 (#1) – CN-53 (#7) Checking Open/Short 2. CD-237 (#2) – CR-35 (#87) Checking Open/Short				
170	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				

※ 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">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. CD-149 (#1) – CN-53 (#8) Checking Open/Short
2. CD-149 (#2) – CR-35 (#87) Checking Open/Short</td></tr>
<tr><td rowspan="3">179</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>

※ 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">181</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 $\leq$ 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 $\leq$ 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 $\geq$ 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 $\leq$ 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 (#39) Checking Open/Short
2. CN-242 (#1) – CN-52 (#40) 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
189	5	(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	●		
189	6	(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	●		
189	(Results / Symptoms) 1. Control Function – Option attachment flow control operation failure (Checking list) 1. CN-243 (#2) – CN-52 (#6) Checking Open/Short 2. CN-243 (#1) – CN-52 (#7) Checking Open/Short				
196	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
196	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
196	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
196	(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				
200	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V	●		
200	1	10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V	●		
200	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V	●		
200	(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				

※ 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">205</td><td>0</td><td>(Mounting pressure sensor)
10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>(Mounting pressure sensor)
10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(Mounting pressure sensor)
10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="3">218</td><td>4</td><td>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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</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">220</td><td>4</td><td>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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="3">221</td><td>5</td><td>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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</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">222</td><td>5</td><td>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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="3">301</td><td>3</td><td>10 seconds continuous, Fuel Level Measurement Voltage > 3.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Fuel Level Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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 (#5) Checking Open/Short</td></tr>
<tr><td rowspan="3">325</td><td>4</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Fuel warmer operation failure
(Checking list)
1. CR-46 (#85) – CN-52 (#30) Checking Open/Short
2. CR-46 (#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

<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">501</td><td>0</td><td>10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage > 5.2V</td><td></td><td></td><td>●</td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Transmission Oil Press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td>●</td></tr>
<tr><td>4</td><td>10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="4">503</td><td>0</td><td>10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage > 5.2V</td><td></td><td></td><td>●</td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Brake Oil Press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td>●</td></tr>
<tr><td>4</td><td>10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="4">505</td><td>0</td><td>10 seconds continuous, Working Brake Press. Sensor Measurement Voltage > 5.2V</td><td></td><td></td><td>●</td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Working Brake Press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td>●</td></tr>
<tr><td>4</td><td>10 seconds continuous, Working Brake Press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(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</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
514	4	(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			●
	6	(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			●
	(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				
517	4	(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			●
	6	(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			●
	(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				

※ 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	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	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	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	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 D^+ Measurement Voltage < 18V (In case 12v goods, Alternator Node I 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 (#15) – 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 (#31) Checking Open/Short
2. CN-81 (#2) – CN-45 (#B+ term) 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 (#8) – CN-51 (#22) Checking Open/Short
2. CN-11 (#7) – CN-51 (#32) 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 (#22) Checking Open/Short
2. CN-56A (#6) – CN-51 (#32) 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
841	2	10 seconds continuous, ECM Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – ECM operation failure (Checking list) 1. CN-93 (#22) – CN-51 (#21) Checking Open/Short 2. CN-93 (#46) – CN-51 (#31) Checking Open/Short				
845	2	(When mounting the I/O Controller 1) 60 seconds continuous, I/O Controller 1 Communication Data Error	●		
	(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				
848	2	(When mounting the Haptic Controller) 60 seconds continuous, Haptic Controller Communication Data Error	●		
	(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				
850	2	(When mounting the RMCU) 60 seconds continuous, RMCU communication Data Error	●		
	(Resuluts / Symptoms) 1. Control Function – RMCU operation failure (Checking list) 1. CN-125 (#3) – CN-51 (#22) Checking Open/Short 2. CN-125 (#11) – CN-51 (#32) Checking Open/Short				
861	2	(When mounting the I/O Controller 2) 60 seconds continuous, I/O Controller 2 communication Data Error	●		
	(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				

※ 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">866</td><td>2</td><td>(When mounting the AAVM)
60 seconds continuous, AAVM communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – AAVM operation failure
(Checking list)
1. CN-401 (#86) – CN-51 (#22) Checking Open/Short
2. CN-401 (#87) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">867</td><td>2</td><td>60 seconds continuous, RDU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="2">868</td><td>2</td><td>60 seconds continuous, Switch Controller communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Switch Controller operation failure
(Checking list)
1. CN-56A (#7) – CN-51 (#22) Checking Open/Short
2. CN-56A (#6) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">869</td><td>2</td><td>(When mounting the BKCU)
60 seconds continuous, BKCU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

J1939 Code	Description	Refer to Procedure
27-3	Engine Exhaust Gas Recirculation Valve Position : Voltage Above Normal	Valve Position - Test
27-4	Engine Exhaust Gas Recirculation Valve Position : Voltage Below Normal	Valve Position - Test
29-3	Accelerator Pedal Position 2 : Voltage Above Normal	Speed Control - Test
29-4	Accelerator Pedal Position 2 : Voltage Below Normal	Speed Control - Test
51-3	Engine Throttle Valve 1 Position : Voltage Above Normal	Valve Position - Test
51-4	Engine Throttle Valve 1 Position : Voltage Below Normal	Valve Position - Test
91-3	Accelerator Pedal Position 1 : Voltage Above Normal	Speed Control - Test
91-4	Accelerator Pedal Position 1 : Voltage Below Normal	Speed Control - Test
97-15	Water in Fuel Indicator : High - least severe (1)	Fuel Contains Water
100-2	Engine Oil Pressure : Erratic, Intermittent, or Incorrect	Switch Circuits - Test (Oil Pressure Switch)
100-17	Engine Oil Pressure : Low - least severe (1)	Oil Pressure Is Low
102-3	Engine Intake Manifold #1 Pressure : Voltage Above Normal	Sensor Signal (Analog, Active) - Test
102-4	Engine Intake Manifold #1 Pressure : Voltage Below Normal	Sensor Signal (Analog, Active) - Test
102-20	Engine Intake Manifold #1 Pressure : Data Drifted High	Sensor Signal (Analog, Active) - Test
102-21	Engine Intake Manifold #1 Pressure : Data Drifted Low	Sensor Signal (Analog, Active) - Test
105-3	Engine Intake Manifold #1 Temperature : Voltage Above Normal	Sensor Signal (Analog, Passive) - Test
105-4	Engine Intake Manifold #1 Temperature : Voltage Below Normal	Sensor Signal (Analog, Passive) - Test
107-2	Engine Air Filter 1 Differential Pressure : Erratic, Intermittent, or Incorrect	Switch Circuits - Test (Air Filter Restriction Switch)
107-15	Engine Air Filter 1 Differential Pressure : High - least severe (1)	Inlet Air Is Restricted
107-16	Engine Air Filter 1 Differential Pressure : High - moderate severity (2)	Inlet Air Is Restricted

※ Some fault codes are not applied to this machine.

J1939 Code	Description	Refer to Procedure
108-3	Barometric Pressure : Voltage Above Normal	Sensor Signal (Analog, Active) - Test
108-4	Barometric Pressure : Voltage Below Normal	Sensor Signal (Analog, Active) - Test
110-3	Engine Coolant Temperature : Voltage Above Normal	Sensor Signal (Analog, Passive) - Test
110-4	Engine Coolant Temperature : Voltage Below Normal	Sensor Signal (Analog, Passive) - Test
110-15	Engine Coolant Temperature : High - least severe (1)	Coolant Temperature Is High
110-16	Engine Coolant Temperature : High - moderate severity (2)	Coolant Temperature Is High
152-2	Number Of ECU Resets : Erratic, Intermittent, or Incorrect	ECM Memory - Test
157-0	Engine Injector Metering Rail #1 Pressure : High - most severe (3)	Fuel Rail Pressure Problem
157-2	Engine Injector Metering Rail #1 Pressure : Erratic, Intermittent, or Incorrect	Fuel Rail Pressure Problem
157-3	Engine Injector Metering Rail #1 Pressure : Voltage Above Normal	Sensor Signal (Analog, Active) - Test
157-4	Engine Injector Metering Rail #1 Pressure : Voltage Below Normal	Sensor Signal (Analog, Active) - Test
157-10	Engine Injector Metering Rail #1 Pressure : Abnormal Update Rate	Sensor Signal (Analog, Active) - Test
157-16	Engine Injector Metering Rail #1 Pressure : High - moderate severity (2)	Fuel Rail Pressure Problem
157-17	Engine Injector Metering Rail #1 Pressure : Low - least severe (1)	Fuel Rail Pressure Problem
157-18	Engine Injector Metering Rail #1 Pressure : Low - moderate severity (2)	Fuel Rail Pressure Problem
166-2	Engine Rated Power : Erratic, Intermittent, or Incorrect	ECM Memory - Test
166-14	Engine Rated Power : Special Instuction	ECM Memory - Test
168-3	Battery Potential / Power Input 1 : Voltage Above Normal	Electrical Power Supply - Test
168-4	Battery Potential / Power Input 1 : Voltage Below Normal	Electrical Power Supply - Test
172-3	Engine Air Inlet Temperature : Voltage Above Normal	Sensor Signal (Analog, Passive) - Test
172-4	Engine Air Inlet Temperature : Voltage Below Normal	Sensor Signal (Analog, Passive) - Test
173-3	Engine Exhaust Gas Temperature : Voltage Above Normal	Sensor Signal (Analog, Passive) - Test

※ Some fault codes are not applied to this machine.

J1939 Code	Description	Refer to Procedure
173-4	Engine Exhaust Gas Temperature : Voltage Below Normal	Sensor Signal (Analog, Passive) - Test
174-3	Engine Fuel Temperature 1 : Voltage Above Normal	Sensor Signal (Analog, Passive) - Test
174-4	Engine Fuel Temperature 1 : Voltage Below Normal	Sensor Signal (Analog, Passive) - Test
190-8	Engine Speed : Abnormal Frequency, Pulse Width, or Period	Speed/Timing - Test
190-15	Engine Speed : High - least severe (1)	Engine Overspeeds
558-2	Accelerator Pedal 1 Low Idle Switch : Erratic, Intermittent, or Incorrect	Idle Validation - Test
593-31	Engine Idle Shutdown has Shutdown Engine	This code indicates that an engine idle shutdown is about to occur. This code does not represent a fault. If equipped, the warning lamp will come on.
594-31	Engine Idle Shutdown Driver Alert Mode	This code indicates that an engine idle shutdown has oc- curred. This code does not represent a fault. If equipped, the warning lamp will flash and the shutdown lamp will come on.
623-5	Red Stop Lamp : Current Below Normal	Indicator Lamp - Test
623-6	Red Stop Lamp : Current Above Normal	Indicator Lamp - Test
624-5	Amber Warning Lamp : Current Below Normal	Indicator Lamp - Test
624-6	Amber Warning Lamp : Current Above Normal	Indicator Lamp - Test
630-2	Calibration Memory : Erratic, Intermittent, or Incorrect	Injector Data Incorrect - Test
637-11	Engine Timing Sensor : Other Failure Mode	Speed/Timing - Test
639-9	J1939 Network #1 : Abnormal Update Rate	Data Link - Test
639-14	J1939 Network #1 : Special Instruction	Data Link - Test
651-5	Engine Injector Cylinder #01 : Current Below Normal	Injector Solenoid - Test
651-6	Engine Injector Cylinder #01 : Current Above Normal	Injector Solenoid - Test
651-20	Engine Injector Cylinder #01 : Data Drifted High	Injector Data Incorrect - Test
651-21	Engine Injector Cylinder #01 : Data Drifted Low	Injector Data Incorrect - Test
652-5	Engine Injector Cylinder #02 : Current Below Normal	Injector Solenoid - Test
652-6	Engine Injector Cylinder #02 : Current Above Normal	Injector Solenoid - Test
652-20	Engine Injector Cylinder #02 : Data Drifted High	Injector Data Incorrect - Test

※ Some fault codes are not applied to this machine.

J1939 Code	Description	Refer to Procedure
652-21	Engine Injector Cylinder #02 : Data Drifted Low	Injector Data Incorrect - Test
653-5	Engine Injector Cylinder #03 : Current Below Normal	Injector Solenoid - Test
653-6	Engine Injector Cylinder #03 : Current Above Normal	Injector Solenoid - Test
653-20	Engine Injector Cylinder #03 : Data Drifted High	Injector Data Incorrect - Test
653-21	Engine Injector Cylinder #03 : Data Drifted Low	Injector Data Incorrect - Test
654-5	Engine Injector Cylinder #04 : Current Below Normal	Injector Solenoid - Test
654-6	Engine Injector Cylinder #04 : Current Above Normal	Injector Solenoid - Test
654-20	Engine Injector Cylinder #04 : Data Drifted High	Injector Data Incorrect - Test
654-21	Engine Injector Cylinder #04 : Data Drifted Low	Injector Data Incorrect - Test
676-5	Engine Glow Plug Relay : Current Below Normal	Glow Plug Starting Aid - Test
676-6	Engine Glow Plug Relay : Current Above Normal	Glow Plug Starting Aid - Test
676-19	Engine Glow Plug Relay : Data Error	Glow Plug Starting Aid - Test
677-3	Engine Starter Motor Relay : Voltage Above Normal	Relay - Test (Start Relay)
677-5	Engine Starter Motor Relay : Current Below Normal	Relay - Test (Start Relay)
677-6	Engine Starter Motor Relay : Current Above Normal	Relay - Test (Start Relay)
723-8	Engine Speed Sensor #2 : Abnormal Frequency, Pulse Width, or Period	Speed/Timing - Test
970-31	Engine Auxiliary Shutdown Switch	This code indicates that the shutdown switch for the engine has been activated. The ECM will disable fuel injection until the switch has been deactivated. No troubleshooting is required.
976-2	PTO Governor State : Erratic, Intermittent, or Incorrect	Power Take-Off - Test
1041-2	Start Signal Indicator : Erratic, Intermittent, or Incorrect	Relay - Test (Start Relay)
1076-2	Engine Fuel Injection Pump Fuel Control Valve : Erratic, Intermittent, or Incorrect	Solenoid Valve - Test
1076-5	Engine Fuel Injection Pump Fuel Control Valve : Current Below Normal	Solenoid Valve - Test
1076-6	Engine Fuel Injection Pump Fuel Control Valve : Current Above Normal	Solenoid Valve - Test
1081-5	Engine Wait to Start Lamp : Current Below Normal	Indicator Lamp - Test
1081-6	Engine Wait to Start Lamp : Current Above Normal	Indicator Lamp - Test

※ Some fault codes are not applied to this machine.

J1939 Code	Description	Refer to Procedure
1110-31	Engine Protection System has Shutdown Engine	The engine protection system has shutdown the engine. Troubleshoot all other diagnostic codes in order to clear this code.
1127-16	Engine Turbocharger 1 Boost Pressure : High - moderate severity (2)	Intake Manifold Air Pressure Is High
1127-18	Engine Turbocharger 1 Boost Pressure : Low - moderate severity (2)	Intake Manifold Air Pressure Is Low
1188-5	Engine Turbocharger Wastegate Actuator 1 Position : Current Below Normal	Solenoid Valve - Test
1188-6	Engine Turbocharger Wastegate Actuator 1 Position : Current Above Normal	Solenoid Valve - Test
1209-3	Engine Exhaust Gas Pressure : Voltage Above Normal	Sensor Signal (Analog, Active) - Test (Exhaust Gas Pres- sure Sensor)
1209-4	Engine Exhaust Gas Pressure : Voltage Below Normal	Sensor Signal (Analog, Active) - Test (Exhaust Gas Pres- sure Sensor)
1221-2	Continuously Monitored Systems Support/Status ; Erratic, Intermittent, or Incorrect	ECM Memory - Test
1221-14	Continuously Monitored Systems Support/Status ; Special Instruction	Another diagnostic code has requested engine speed limitation. The warning lamp will flash. The engine speed is limited to 1200 rpm. Troubleshoot all other diagnostic codes. If this code is the only active diagnostic code, replace the ECM. Refer to Troubleshooting, “ECM - Replace”
1239-0	Engine Fuel Leakage 1 : High - most severe (3)	Fuel Rail Pressure Problem
1485-7	ECM Main Relay : Not Responding Properly	Relay - Test (ECM Main Relay)
1485-14	ECM Main relay : Special Instruction	Relay - Test (ECM Main Relay)
2791-5	Engine Exhaust Gas Recirculation (EGR) Valve Control : Current Below Normal	Motorized Valve - Test
2791-6	Engine Exhaust Gas Recirculation (EGR) Valve Control : Current Above Normal	Motorized Valve - Test
2791-7	Engine Exhaust Gas Recirculation (EGR) Valve Control : Not Responding Properly	Motorized Valve - Test
2797-6	Engine Injector Group 1 : Current Above Normal	Injector Solenoid - Test
2797-7	Engine Injector Group 1 : Not Responding Properly	Injector Solenoid - Test
2798-6	Engine Injector Group 2 : Current Above Normal	Injector Solenoid - Test
2840-12	ECU Instance : Failure	ECM Memory - Test
2840-14	ECU Instance : Special Instruction	Relay - Test (ECM Main Relay)

※ Some fault codes are not applied to this machine.

J1939 Code	Description	Refer to Procedure
2880-2	Engine Operator Primary Intermediate Speed Select : Erratic, Intermittent, or Incorrect	Mode Selection - Test/Switch Circuits - Test (Throttle Switch)
2880-3	Engine Operator Primary Intermediate Speed Select : Voltage Above Normal	Mode Selection - Test/Switch Circuits - Test (Throttle Switch)
2880-4	Engine Operator Primary Intermediate Speed Select : Voltage Below Normal	Mode Selection - Test/Switch Circuits - Test (Throttle Switch)
2970-2	Accelerator Pedal 2 Low Idle Switch : Erratic, Intermittent, or Incorrect	Idle Validation - Test
3217-3	Aftertreatment #1 Intake O2 : Voltage Above Normal	Oxygen Level - Test
3217-4	Aftertreatment #1 Intake O2 : Voltage Below Normal	Oxygen Level - Test
3217-5	Aftertreatment #1 Intake O2 : Current Below Normal	Oxygen Level - Test
3217-6	Aftertreatment #1 Intake O2 : Current Above Normal	Oxygen Level - Test
3217-12	Aftertreatment #1 Intake O2 : Failure	Oxygen Level - Test
3217-13	Aftertreatment #1 Intake O2 : Out of Calibration	Oxygen Level - Test
3217-15	Aftertreatment #1 Intake O2 : High - least severe (1)	Oxygen Level - Test
3219-15	Aftertreatment #1 Intake Gas Sensor at Temperature : High - least severe (1)	Oxygen Level - Test
3219-17	Aftertreatment #1 Intake Gas Sensor at Temperature : Low - least severe (1)	Oxygen Level - Test
3222-3	Aftertreatment #1 Intake Gas Sensor Heater : Voltage Above Normal	Oxygen Level - Test
3222-4	Aftertreatment #1 Intake Gas Sensor Heater : Voltage Below Normal	Oxygen Level - Test
3222-5	Aftertreatment #1 Intake Gas Sensor Heater : Current Below Normal	Oxygen Level - Test
3242-0	Particulate Trap Intake Gas Temperature : High - most severe (3)	Sensor Signal (Analog, Passive) - Test
3242-3	Particulate Trap Intake Gas Temperature : Voltage Above Normal	Sensor Signal (Analog, Passive) - Test
3242-4	Particulate Trap Intake Gas Temperature : Voltage Below Normal	Sensor Signal (Analog, Passive) - Test
3251-0	Particulate Trap Differential Pressure : High - most severe (3)	Diesel Particulate Filter Collects Excessive Soot
3251-3	Particulate Trap Differential Pressure : Voltage Above Normal	Sensor Signal (Analog, Active) - Test
3251-4	Particulate Trap Differential Pressure : Voltage Below Normal	Sensor Signal (Analog, Active) - Test

※ Some fault codes are not applied to this machine.

J1939 Code	Description	Refer to Procedure
3251-7	Particulate Trap Differential Pressure : Not Responding Properly	Diesel Particulate Filter Has Differential Pressure Problem
3251-10	Particulate Trap Differential Pressure : Abnormal Rate of Change	Diesel Particulate Filter Has Differential Pressure Problem
3251-16	Particulate Trap Differential Pressure : High - moderate severity (2)	Diesel Particulate Filter Collects Excessive Soot
3251-17	Particulate Trap Differential Pressure : Low - least severe (1)	Diesel Particulate Filter Has Differential Pressure Problem
3251-18	Particulate Trap Differential Pressure : Low - moderate severity (2)	Diesel Particulate Filter Has Differential Pressure Problem
3358-10	Engine Exhaust Gas Recirculation 1 Intake Pressure : Abnormal Rate of Change	NRS Mass Flow Rate Problem
3509-2	Sensor Supply Voltage 1 : Erratic, Intermittent, or Incorrect	Sensor Supply - Test
3510-2	Sensor Supply Voltage 2 : Erratic, Intermittent, or Incorrect	Sensor Supply - Test
3511-2	Sensor Supply Voltage 3 : Erratic, Intermittent, or Incorrect	Sensor Supply - Test
3697-5	Particulate Trap Lamp Command : Current Below Normal	Indicator Lamp - Test
3697-6	Particulate Trap Lamp Command : Current Above Normal	Indicator Lamp - Test
3698-5	Exhaust System High Temperature Lamp Command : Current Below Normal	Indicator Lamp - Test
3698-6	Exhaust System High Temperature Lamp Command : Current Above Normal	Indicator Lamp - Test
3702-5	Diesel Particulate Filter Active Regeneration Inhibited Status : Current Below Normal	Indicator Lamp - Test
3702-6	Diesel Particulate Filter Active Regeneration Inhibited Status : Current Above Normal	Indicator Lamp - Test
3719-0	Aftertreatment 1 Diesel Particulate Filter Soot Load Percent : High - most severe (3)	Diesel Particulate Filter Collects Excessive Soot
3719-16	Aftertreatment 1 Diesel Particulate Filter Soot Load Percent : High - moderate severity (2)	Diesel Particulate Filter Collects Excessive Soot
4765-3	Aftertreatment #1 Diesel Oxidation Catalyst Intake Gas Temperature : Voltage Above Normal	Sensor Signal (Analog, Passive) - Test
4765-4	Aftertreatment #1 Diesel Oxidation Catalyst Intake Gas Temperature : Voltage Below Normal	Sensor Signal (Analog, Passive) - Test

※ Some fault codes are not applied to this machine.

J1939 Code	Description	Refer to Procedure
5055-17	Engine Oil Viscosity : Low - least severe (1)	Oil Contains Fuel
5055-18	Engine Oil Viscosity : Low - moderate severity (2)	Oil Contains Fuel
5099-5	Engine Oil Pressure Low Lamp Data - Current Below Normal	Indicator Lamp - Test
5099-6	Engine Oil Pressure Low Lamp Data - Current Above Normal	Indicator Lamp - Test
5246-15	Aftertreatment SCR Operator Inducement Severity : High - least severe (1)	See Operator Inducement Codes
5246-16	Aftertreatment SCR Operator Inducement Severity : High - moderate severity (2)	See Operator Inducement Codes
5319-31	"Aftertreatment 1 Diesel Particulate Filter Incomplete Regeneration"	Diesel Particulate Filter Active Regeneration Was Interrupted
5324-7	Engine Glow Plug 1 : Not Responding Properly	Glow Plug Starting Aid - Test
5325-7	Engine Glow Plug 2 : Not Responding Properly	Glow Plug Starting Aid - Test
5326-7	Engine Glow Plug 3 : Not Responding Properly	Glow Plug Starting Aid - Test
5327-7	Engine Glow Plug 4 : Not Responding Properly	Glow Plug Starting Aid - Test
5357-31	Engine Fuel Injection Quantity Error for Multiple Cylinders	ECM Memory - Test
5419-5	Engine Throttle Actuator #1 : Current Below Normal	Motorized Valve - Test
5419-6	Engine Throttle Actuator #1 : Current Above Normal	Motorized Valve - Test
5419-7	Engine Throttle Actuator #1 : Not Responding Properly	Motorized Valve - Test
5571-2	High Pressure Common Rail Fuel Pressure Relief Valve : Erratic, Intermittent, or Incorrect	Fuel Rail Pressure Problem
5571-7	High Pressure Common Rail Fuel Pressure Relief Valve : Not Responding Properly	Fuel Rail Pressure Problem
5571-10	High Pressure Common Rail Fuel Pressure Relief Valve : Abnormal Rate of Change	Fuel Rail Pressure Problem
5571-14	High Pressure Common Rail Fuel Pressure Relief Valve : Special Instruction	Fuel Rail Pressure Problem
5571-16	High Pressure Common Rail Fuel Pressure Relief Valve : High - moderate severity (2)	Fuel Rail Pressure Problem
5826-15	Emission Control System Operator Inducement Severity : High - least severe (1)	See “Operator Inducement Codes”
5826-16	Emission Control System Operator Inducement Severity : High - moderate severity (2)	See “Operator Inducement Codes”

※ Some fault codes are not applied to this machine.

※ Operator Inducement Codes

· If any of the diagnostic codes listed in table below are active, a 5246 or a 5826 diagnostic code will also be active.

· When a 5246 or a 5826 diagnostic code is active, the engine will be derated.

· In order to clear an active 5246 or a 5826 diagnostic code, first troubleshoot any active codes that are listed in table below. Once all other codes are cleared, cycle the start switch in order to clear the 5246 or 5826 diagnostic code.

J1939 Codes

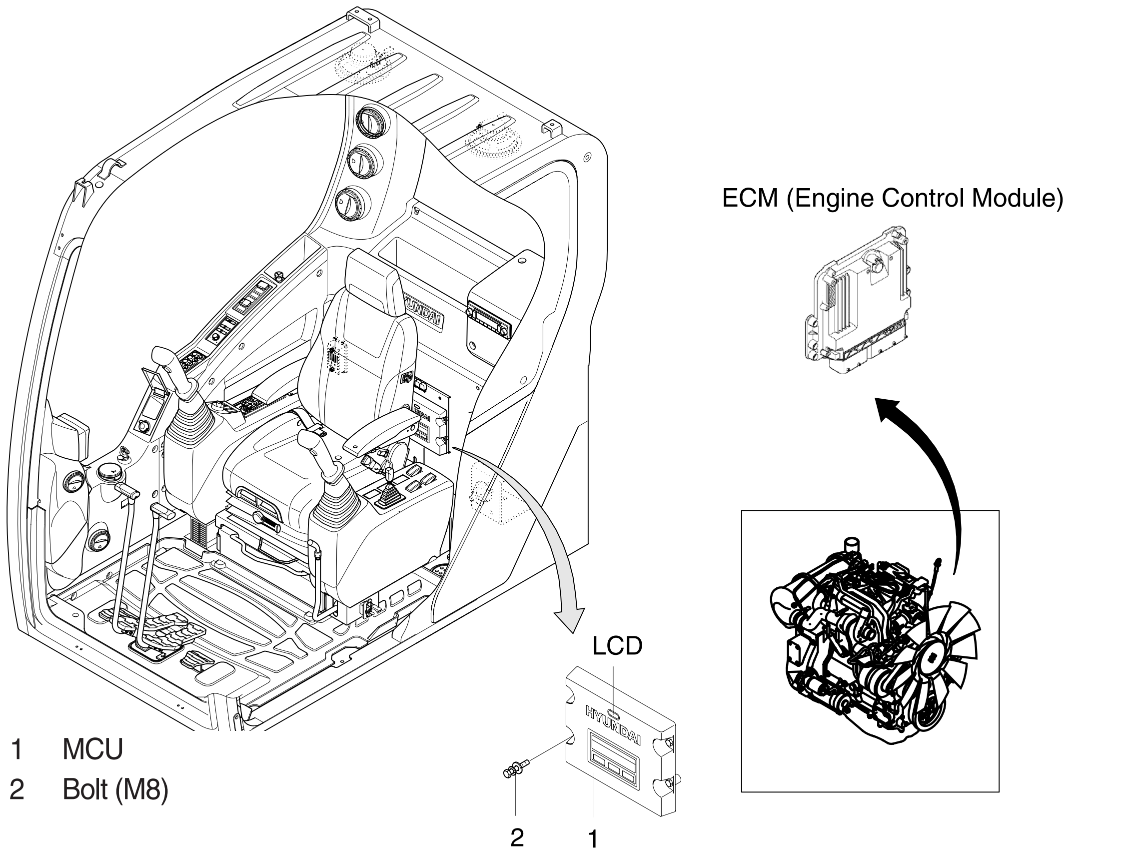
27-3	27-4	102-3	102-4	102-20	102-21	105-3
105-4	108-3	108-4	157-0	157-2	157-16	157-18
173-3	173-4	1076-5	1076-6	1188-5	1209-3	1209-4
1239-0	2791-5	2791-6	2791-7	3251-3	3251-4	3251-7
3251-10	3251-18	3358-10	3509-2	3510-2	3511-2	4765-3
4765-4	5319-31	5419-7	5571-7	5571-16		

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 13 ENGINE CONTROL SYSTEM

1. MCU and ECM (Engine Control Module)



130ZF5MS101

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 14 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.

(3) Pressure and electric current value for each mode

Mode		Pressure		Electric current (mA)	Engine rpm (at accel dial 10)
		kgf/cm²	psi		
Standard	P	8	114	290 ± 30	1850 ± 50
	S	10 ± 3	142 ± 40	330 ± 30	1750 ± 50
	E	12 ± 3	171 ± 40	360 ± 30	1650 ± 50
Option	P	0	0	160 ± 30	2100 ± 50
	S	5 ± 3	73 ± 40	250 ± 30	2000 ± 50
	E	10 ± 3	142 ± 40	330 ± 30	1750 ± 50

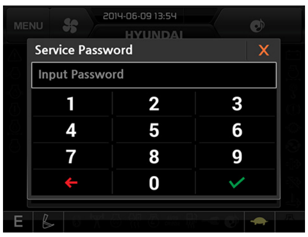
2) HOW TO SWITCH THE POWER SHIFT (STANDARD ↔ OPTION) ON THE CLUSTER

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

- Management
  · Service menu

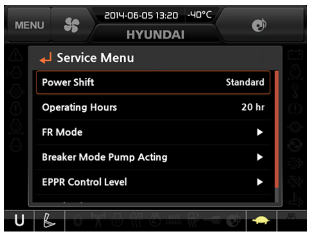
290F3CD149

→



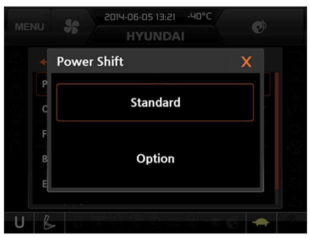
Enter the password 290F3CD126

→



290F3CD150

↓

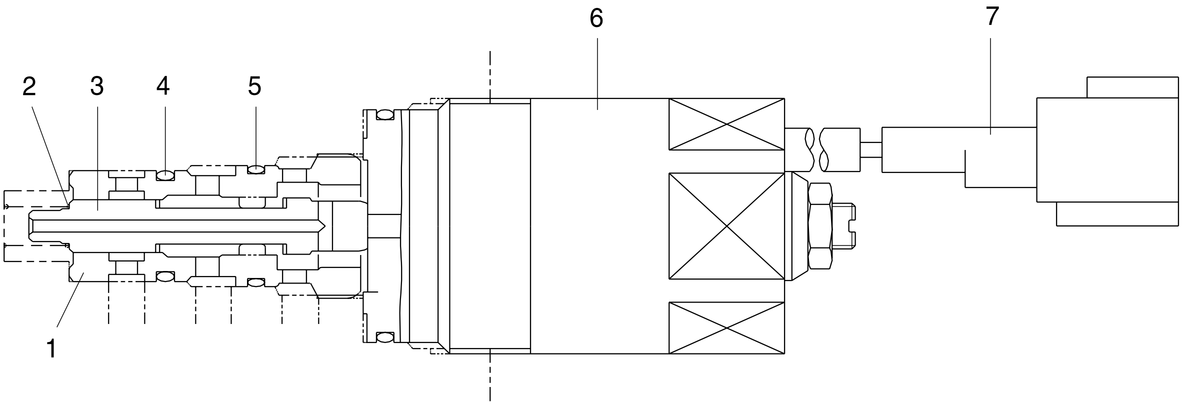


290F3CD151

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

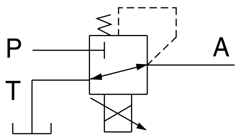
3) OPERATING PRINCIPLE

(1) Structure



5-22(1)

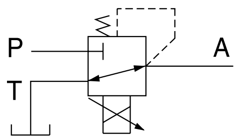
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

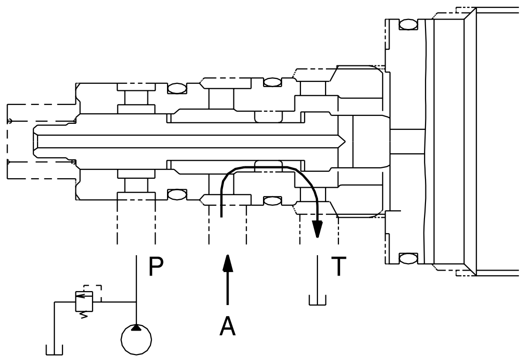


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

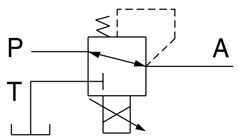
Pressure line is blocked and A oil returns to tank.

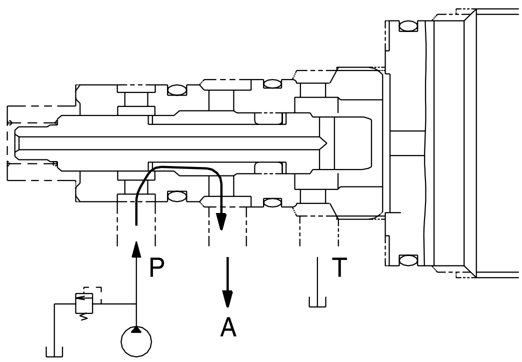




(3) Operating

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.

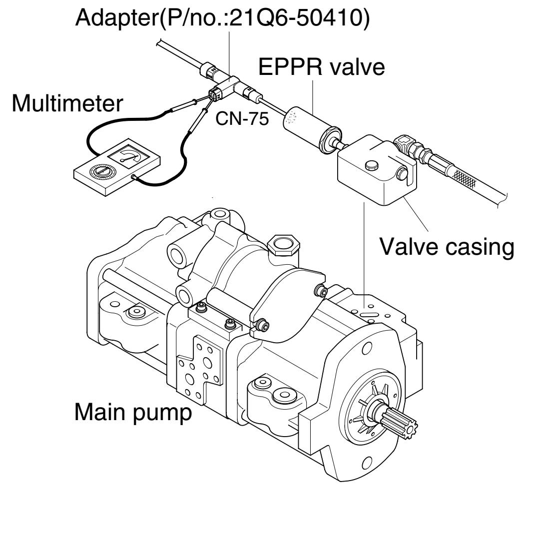
④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

⑥ If rpm display show approx 1750±50 rpm check electric current at bucket circuit relief position.

⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA



(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.

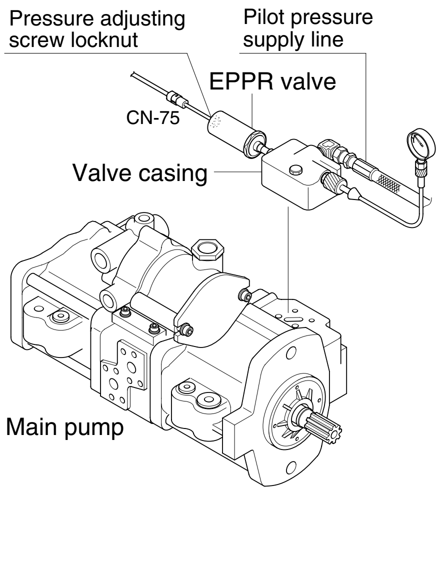
④ Position the accel dial at 10.

⑤ If tachometer show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

⑦ After adjust, test the machine.

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



2. BOOM PRIORITY EPPR VALVE

1) COMPOSITION

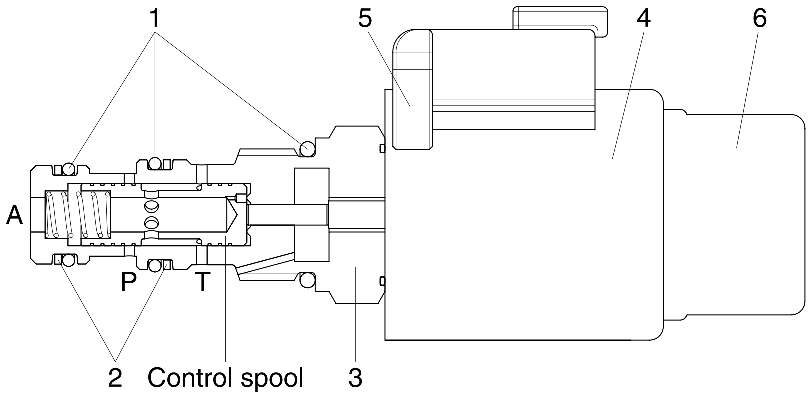
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

2) CONTROL

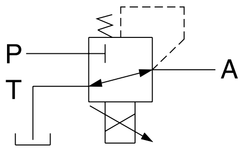
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at 30Ω and 24 V.

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.

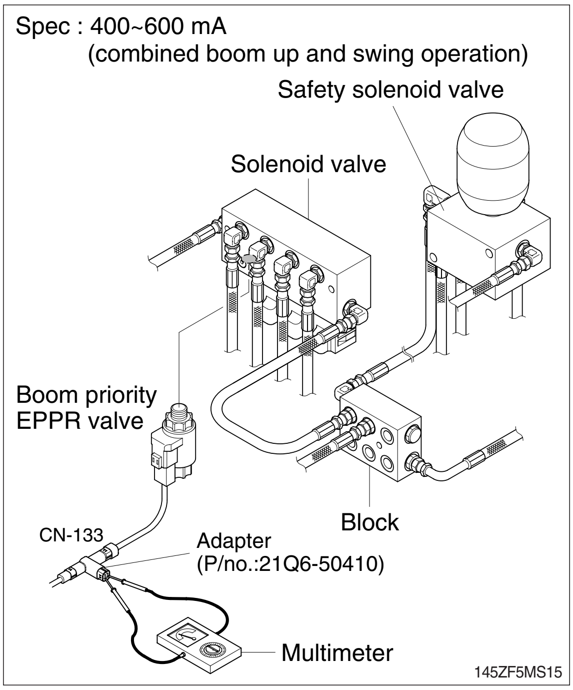
② Insert the adapter to CN-133 and install multimeter as figure.

③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ If rpm display approx 1750±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)

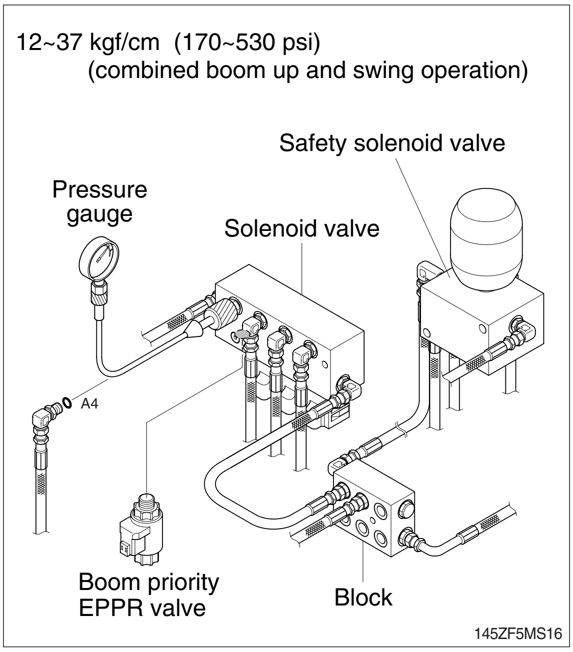
② Start engine.

③ Set S-mode and cancel auto decel mode.

④ If rpm display approx 1750±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 15 MONITORING SYSTEM

1. STRUCTURE

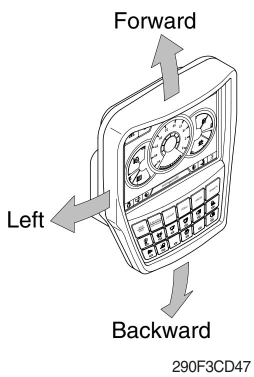
The cluster consists of LCD and switches as shown below. The LCD is to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection.
Also, The LCD is to set and display for modes, monitoring and utilities with the switches.
The switches or touch screen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

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

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

※ The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem.
The warning lamp lights up or blinks until the problem is cleared. Refer to page 5-60 for details.

※ This cluster is adjustable.
· Vertical (forward/backward) : each 15°
· Horizontal (left only) : 8°



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

e. DEF/AdBlue® Level gauge : White range

③ Indicating lamp state

a. Power mode pilot lamp : E mode or U mode

b. Work mode pilot lamp : General operation mode (bucket)

c. Travel speed pilot lamp : Low (turtle)

(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 to 1000 rpm.

※ Others same as above.

③ When abnormal condition

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

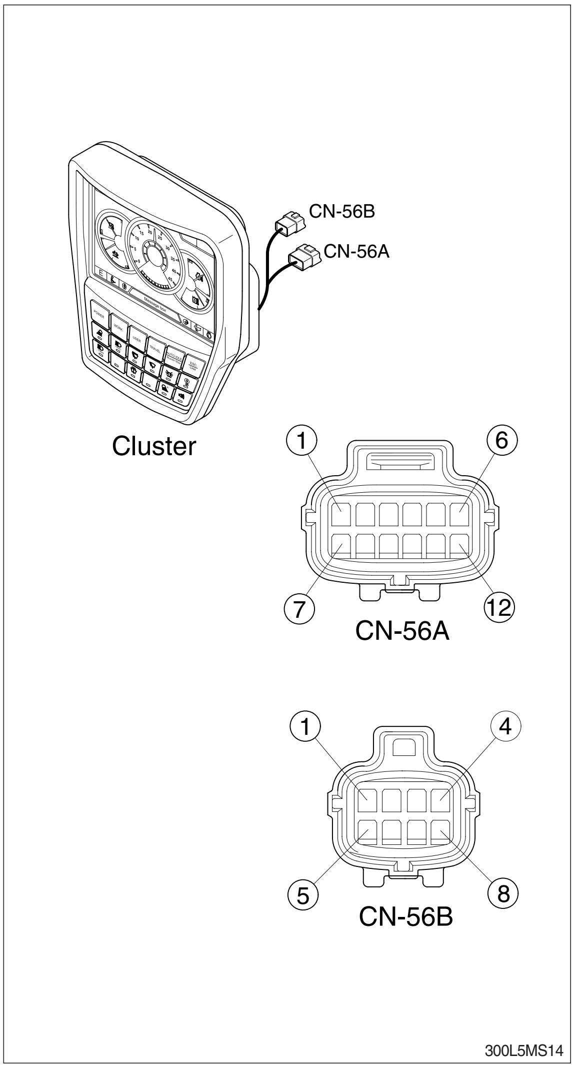
b. If BUZZER STOP switch is pressed, buzzer sound is canceled but the warning lamp lights up or blinks until normal condition.

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

3) CLUSTER CONNECTOR

(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	0~5Vdc
11	Aux right	0~5Vdc
12	Aux GND	-



(2) CN-56B

No.	Name	Signal
1	CAM 6.5V	6.3~6.7Vdc
2	CAM GND	-
3	CAM DIFF (H)	0~5Vdc
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

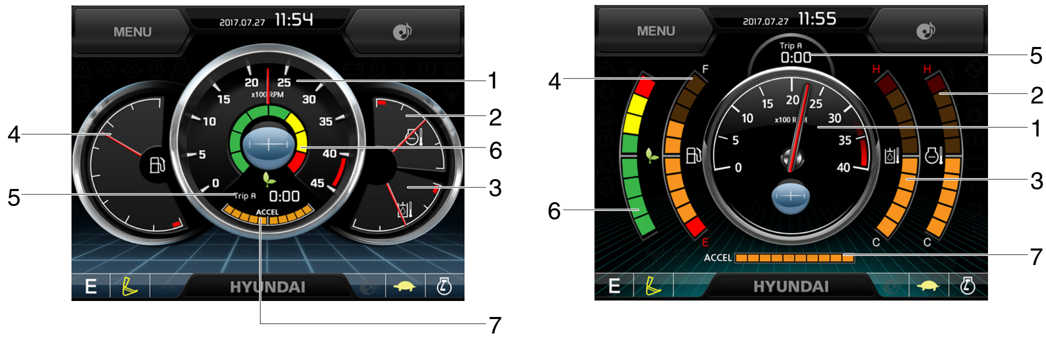
NTSC : National Television System Committee

2) GAUGE

(1) Operation screen

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

Default   Option



130ZF3CD207

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

※ Operation screen type can be set by the screen type menu of the display.
Refer to page 5-86 for details.

(2) RPM / Speed gauge

290F3CD49

① This display the engine speed.

(3) Engine coolant temperature gauge

290F3CD53

① This gauge indicates the temperature of coolant.

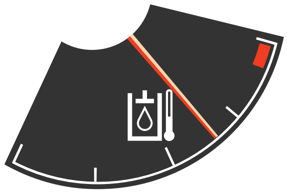
· White range : 40-107˚C (104-225˚F)

· Red range : Above 107˚C (225˚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 on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

(4) Hydraulic oil temperature gauge



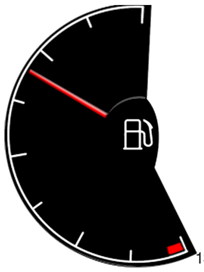
290F3CD54

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

② If the indicator is in the red range or lamp 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 on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

(5) Fuel level gauge



130ZF3CD255

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

② Fill the fuel when 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, check the electric device as that can be caused by the 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 operators can be careful with fuel economy.

② The fuel consumption rate or machine load is higher, the number of segment is increased.

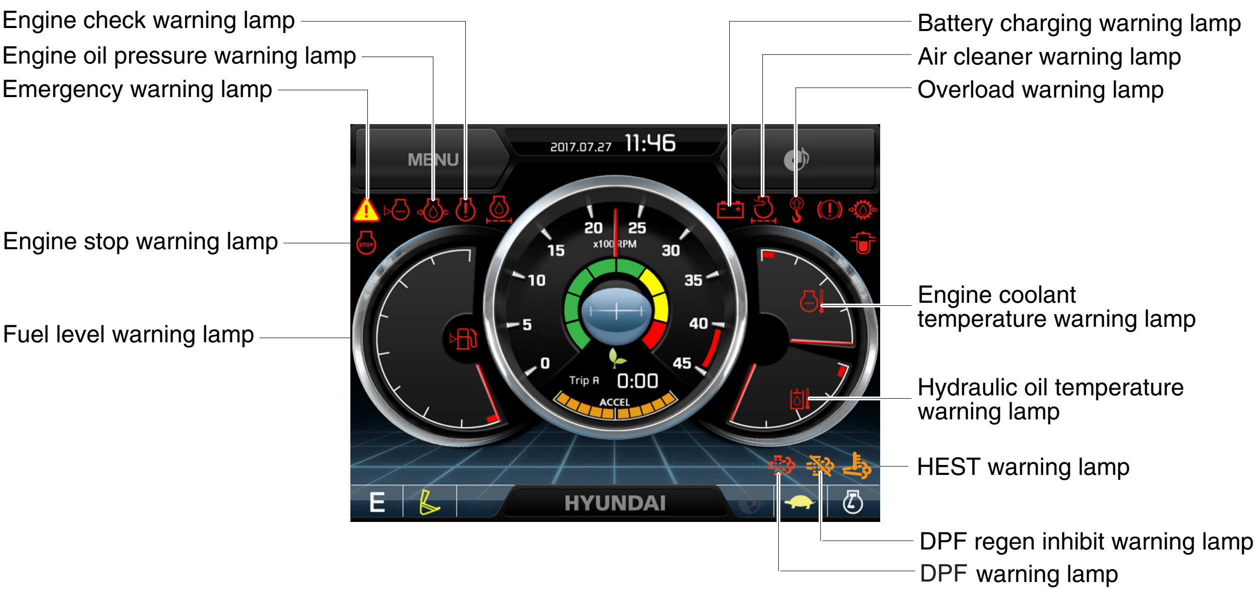
③ The color of Eco gauge indicates operation status.
 · White : Idle operation
 · Green : Economy operation
 · Yellow : Non-economy operation at a medium level.
 · Red : Non-economy operation at a high level.

(8) Accel dial gauge

290F3CD59

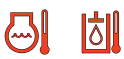
① This gauge indicates the level of accel dial.

3) WARNING LAMPS



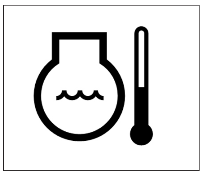
130ZF3CD203

※ 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 and blinks, and the buzzer stops when ; - the buzzer stop switch  is pushed - the lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position and light ON, and the buzzer stops when 2 seconds elapsed. ※ Refer to page 5-65 for details.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	※ Refer to page 5-61 for details.

※ Refer to page 5-72 for the buzzer stop switch. 

(1) Engine coolant temperature warning lamp



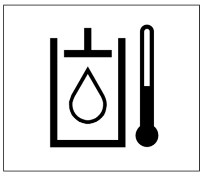
290F3CD61

① Engine coolant temperature warning is indicated two steps.
- 103˚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. And the buzzer stops and , lamps keep blink.

③ Check the cooling system when the lamps keep blink.

(2) Hydraulic oil temperature warning lamp



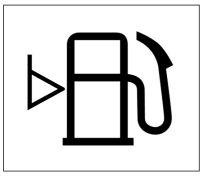
290F3CD62

① Hydraulic oil temperature warning is indicated two 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. And the buzzer stops and , lamps keep blink.

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

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the level of fuel is below 31 ℓ (8.2 U.S. gal).

② Fill the fuel immediately when the lamp blinks.

(4) Emergency warning lamp

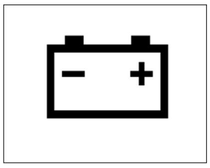
290F3CD64

① This warning lamp pops up and the buzzer sounds when each of the below warnings is happened.
- 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. And the buzzer stops.**

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

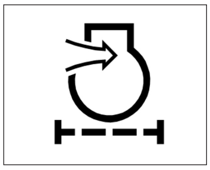
(5) Battery charging warning lamp



290F3CD67

① This warning lamp pops up and buzzer sounds when the battery charging voltage is low.
② Check the battery charging circuit when this lamp blinks.

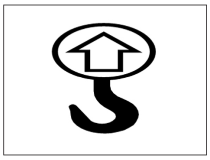
(6) Air cleaner warning lamp



290F3CD68

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

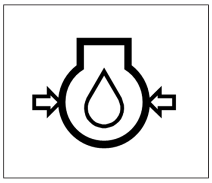
(7) Overload warning lamp (opt)



290F3CD69

① When the machine is overload, the overload warning lamp pops up and buzzer sounds during the overload switch is ON. (if equipped)
② Reduce the machine load.

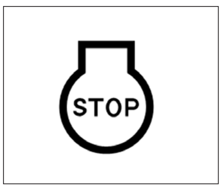
(8) Engine oil pressure warning lamp



290F3CD65

① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.
② If the lamp ON, shut OFF the engine immediately. Check oil level.
※ But, when key-on status, the lamp is ON for initial lamp check.
③ If the lamp blinks, engine oil change and oil life reset are required.
※ Refer to page 5-64 for details.

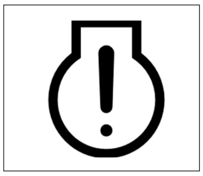
(9) Engine stop warning lamp



290F3CD252

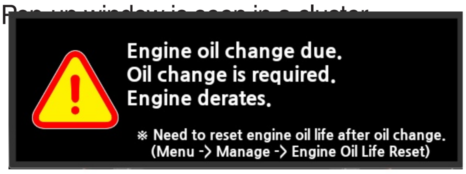
① This warning lamp pops up and the buzzer sounds when when the engine oil pressure is low.
② If the lamp blinks, shut OFF the engine immediately. Check oil level.
※ Refer to page 5-64 for details.

(10) Engine check warning lamp



290F3CD66

① The engine check warning lamp will activate as following condition.
  a. The engine oil pressure is low.
  b. The engine oil life has exceeded the maximum service limit.
② Also, the engine stop warning lamp and engine oil pressure warining lamp will activated as table below

Engine warning lamp			State description
Engine check	Engine stop	Engine oil pressure	
			
Off	Off	Off	Oil pressure and oil life OK
On	On	On (Engine running)	Low oil pressure during engine operation
Off	Off	Flash (2 Hz)	The engine oil change due soon. Triggered at *480 hours from last oil change reset. Pop-up window is seen in a cluster.  130ZF3CD103
On	Off	Flash (2 Hz)	The engine oil life has reached the maximum recommended life. Triggered by the oil life algorithm. Pop-up window is seen in a cluster.  130ZF3CD104
Flash	Off	Flash (2 Hz)	The engine oil life has exceeded the maximum allowable life for the monitored operating conditions. Engine derates. Triggered by the oil life algorithm. P  130ZF3CD105
Off	Off	Flash (1 Hz)	Oil life reset confirmed. Flashes at 1 Hz until key cycle is reset

* Recommended time period between oil service intervals is 500 hrs.

※ Method of the engine oil life reset

Once engine oil is changed, the oil life reset is required. To perform oil life reset, follow the procedure as below.

(1) Turn the starting switch on without engine running.

(2) Then press "Menu" → "Manage" → "Engine Oil Life Reset"

(3) Press OK and Put "User Password".

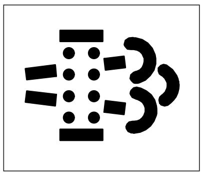
130ZF3CD101

(4) When the oil life reset is completed, the pop-up window below is seen, and oil pressure warning lamp flashes at 1 Hz until starting switch cycle is reset.

(5) Turn the starting switch off and then starting switch on again to perform starting switch cycle reset.

130ZF3CD102

(11) DPF (Diesel Particulate Filter) warning lamp



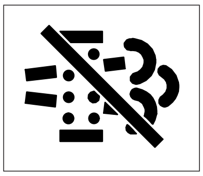
130ZF3CD219

① This warning lamp lights ON or BLINK when the regeneration is needed.
② When this lamp lights ON or BLINK, press the DPF switch to manual regeneration position (I) at least 2 seconds to initiate the manual DPF regeneration.
③ When the manual regeneration is started, the DPF lamp will be turned off and HEST lamp will be ON.

※ **Consequences of delaying regeneration**
- Poor performance caused by increasing exhaust gas pressure.
- Higher fuel consumption
- Shorter filter lifetime

※ **Refer to the operator's manual page 3-39 for the DPF switch operation.**

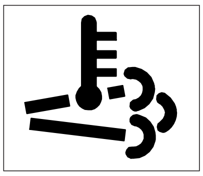
(12) DPF regeneration inhibit warning lamp



130ZF3CD220

① This warning lamp lights ON or BLINK when pressing the DPF switch at inhibit position (II) at least 2 seconds.
② When this lamp lights ON or BLINK, the automatic or manual regeneration does not occur.
③ To clear the Inhibit lamp, pressing the DPF switch once again at inhibit position (II) at least 2 seconds.

(13) HEST (High Exhaust System Temperature) warning lamp



130ZF3CD221

① This warning lamp indicate high temperature of the exhaust system due to DPF regeneration.
② The lamp will also illuminate during the manual DPF regeneration.
③ When this lamp is illuminated, be sure the exhaust pipe outlet is not directed at any surface or material that can be melted, burn, or explode.

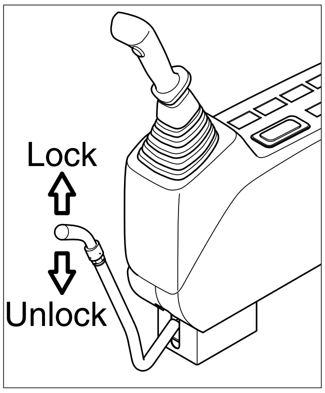
⚠ **The exhaust gas temperature could reach 650 °C [1200 °F], which is hot enough to ignite or melt common materials, and to cause burns.**

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

※ Below chart shows the lamp statuses at each conditions.

Condition	Engine check lamp	Engine stop warning lamp	DPF warning lamp	HEST warning lamp	DPF regen inhibit warning lamp	State description
Normal (soot low)	OFF	OFF	OFF	OFF	OFF	Normal operation (passive regeneration)
Regeneration disabled	OFF	OFF	OFF	OFF	ON	Regeneration disabled due to DPF regeneration inhibit switch activated
Regeneration	OFF	OFF	OFF	ON	OFF	High exhaust temperature lamp ON during active or manual regeneration. The lamp will turn OFF 1 min after regeneration is completed.
Soot midium	OFF	OFF	ON	OFF	OFF	DPF above 130% soot loading, warns the operator that regen-eration is required.
Soot high	Blink	OFF	ON	OFF	OFF	DPF above 180% soot loading. Engine power derates depen-dent on soot load. Regeneration is required.
Soot full	Blink	ON	ON	OFF	OFF	DPF above 250% soot loading. Engine will be locked at low idle. Contact the HD Hyundai Con-struction Equipment service center or a local dealer.

※ Manual DPF regeneration

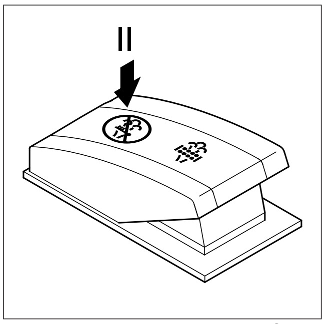


235F3CD55

(1) Manual DPF regeneration can be performed when the below conditions are met.

① Engine running > 10 seconds
② Coolant temperature > 65 ˚C
③ Engine at low idle
④ Soot load >130% (when DPF lamp is ON)
⑤ Safety lever = Lock position

⚠ **Manual DPF Regeneration must be performed when the machine is in a fireproof area.**

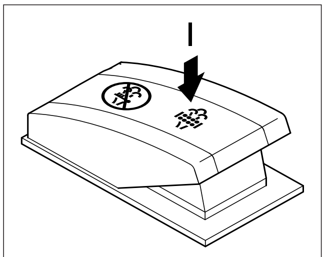


130ZF3CD10-3

※ **To stop a manual DPF regeneration before it has completed, set the DPF switch to Inhibit position (II) or turn OFF the engine.**

(2) **Procedure**

① Park a machine in a fireproof area.
② Set the engine at a low idle.
③ Push the DPF switch to manual regeneration position (I) at least 2 seconds to initiate the manual DPF regeneration.

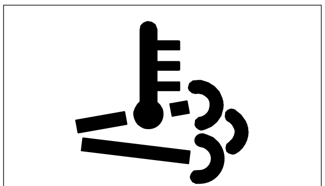


130ZF3CD10-4

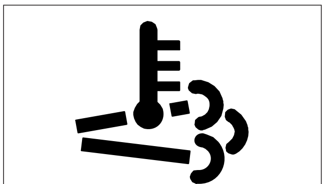
※ **Refer to the operator's manual page 3-39 for the DPF switch operation.**

※ **The engine speed will accelerate automatically from low idle to 2000 rpm at a rate of 100 rpm/s. The engine speed shall be maintained for a period of 15 to 25 minutes depending on the initial soot load. Once the regeneration has completed the engine will drop to low idle.**

④ The HEST warning lamp will light ON during the DPF regeneration.


130ZF3CD221

HEST warning lamp ON


130ZF3CD221

HEST warning lamp OFF

⑤ The HEST warning lamp will light OFF 1 minute after the DPF regeneration is completed.

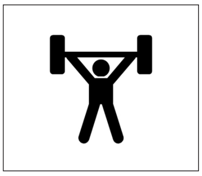
4) PILOT LAMPS

130ZF3CD274

(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 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

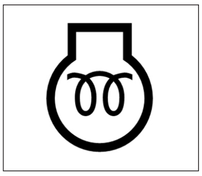
(2) Power max pilot lamp



290F3CD78

① The lamp will be ON when pushing power max switch on the LH RCV lever.
② The power max function is operated maximum 8 seconds.
※ Refer to the operator's manual page 3-38 for power max function.

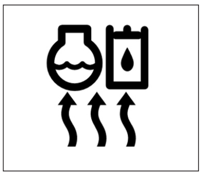
(3) Preheat pilot lamp



290F3CD79

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

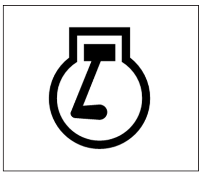
(4) Warming up pilot lamp



290F3CD80

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

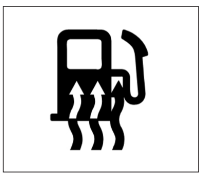
(5) Decel pilot lamp



290F3CD81

① Operating one touch decel switch on the RCV lever makes the lamp ON.
② Also, the lamp will be ON and engine speed will be lowered automatically to save fuel consumption when all levers and pedals are at 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 3-37.

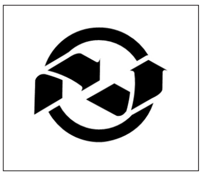
(6) Fuel warmer pilot lamp



290F3CD82

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

(7) Maintenance pilot lamp



290F3CD83

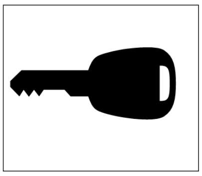
① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.
② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.
※ Refer to the page 5-81.

(8) Entertainment pilot lamp

290F3CD84

① This lamp is on when audio or video files are playing.
※ Refer to the page 5-87.

(9) Smart key pilot lamp (opt)



290F3CD214

① This lamp is ON when the engine is started by the start button.
② This lamp is red when the a authentication fails, green when succeeds.
※ Refer to the page 5-82.

5) SWITCHES

130ZF3CD286

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-68 for details.

(1) Power mode switch

290F3CD76

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

② The pilot lamp changes E → S → P → E in 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 4-7 for details.

(3) User mode switch

290F3CD89

① This switch is used to memorize the current machine operating status in the MCU and activate the memorized user mode.
- · Memory : Automatically saved after key OFF.
- · Action : Push this switch.
- · Cancel : Push this switch once more.

② Refer to the page 5-76 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. Machine stability may be adversely affected.

⚠ Personal injury 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.

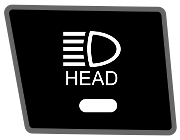
(7) Work light switch

290F3CD93

① This switch is used to operate the work light.

② The pilot lamp is turned ON when operating the switch.

(8) Head light switch



290F3CD94

① This switch is used to operate the head light.
② The pilot lamp is turned ON when operating the switch.

(9) Intermittent wiper switch


290F3CD95

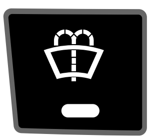
① This switch is used to wipe operates intermittently.
② The pilot lamp is turned ON when operating the switch.

(10) Wiper switch


290F3CD96

① This switch is used to operate the window wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp is turned ON when operating the switch.
※ **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

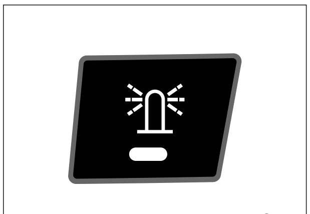
① The washer liquid is sprayed and the wiper is operated only while pressing this switch.
② The pilot lamp is turned ON when operating the switch.

(12) Cab light switch

290F3CD99

① This switch turns ON the cab light on the cab.
② The pilot lamp is turned ON when operating the switch.

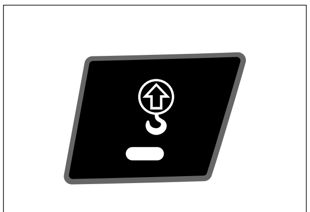
(13) Beacon switch



290F3CD97

① This switch turns ON the rotary light on the cab.
② The pilot lamp is turned ON when operating the switch.

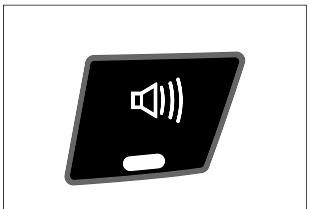
(14) Overload switch



290F3CD98

① When this switch turned ON, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.
② When it turned OFF, buzzer stops and warning lamp goes out.
⚠ **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.**

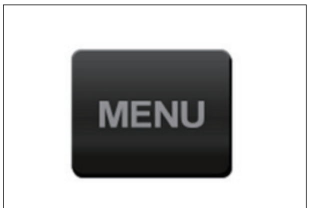
(15) Travel alarm switch



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.

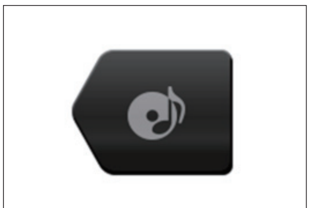
(16) Main menu quick touch switch



290F3CD217

① This switch is to activate the main menu in the cluster.
※ **Refer to the page 5-75.**

(17) Entertainment quick touch switch



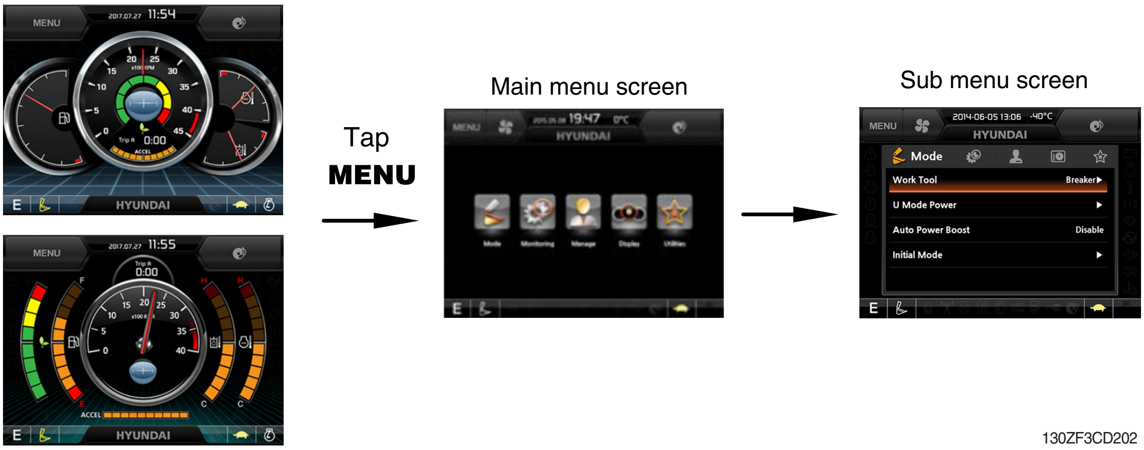
290F3CD218

① This switch is to activate the entertainment control menu in the cluster.
※ **Refer to the page 5-87.**

6) MAIN MENU

※ You can select or set the menu by touch screen.
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.

· Operation screen



130ZF3CD202

(1) Structure

No	Main menu	Sub menu	Description
1	 Mode 290F3CD103	Work tool U mode power Boom/Arm speed Auto power boost IPC mode Auto engine shutdown (option) Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed, Arm speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode, Accel initial mode / step Switch function
2	 Monitoring 290F3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, Engine ECM MCU, Engine ECM All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 290F3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update Engine oil life reset	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor, Switch controller, RMCU, Relay drive unit, FATC A/S phone number, A/S phone number change Power shift, Operating hour, IPC mode, Breaker mode pump acting, EPPR current level, Overload pressure Clinometer setting Cluster, ETC device Reset
4	 Display 290F3CD106	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, Chinese, ETC A type, B type
5	 Utilities 290F3CD107	Entertainment Tripmeter Camera	Play Video, Audio, Smart terminal. 3 kinds (A, B, C) Number of active, Display order

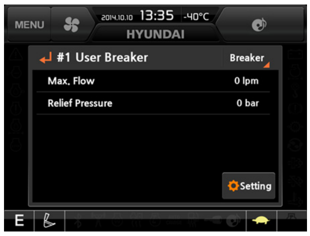
(2) Mode setup

① Work tool

290F3CD108

290F3CD253

A



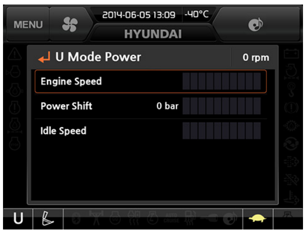
290F3CD254

B

· Select on 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.
    Relief pressure - Set the relief pressure.

② U mode power

290F3CD111



290F3CD112

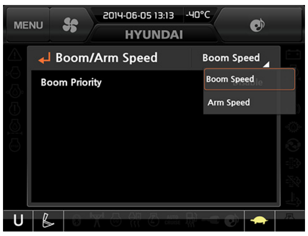
· Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
· U-mode can be activated by user mode switch.

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	1000	0
2	1400	1050	3
3	1500	1100 (auto decel)	6
4	1600	1130	9
5	1700	1150	12
6	1800	1180	16
7	1900	1200	20
8	2000	1230	26
9	2050	1250	32
10	2100	1280	38

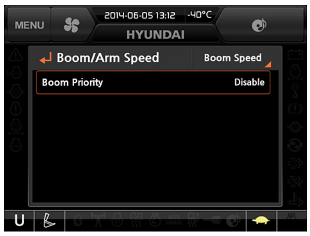
※One touch decel & low idle : 1000 rpm

③ Boom/Arm speed

290F3CD113



290F3CD114



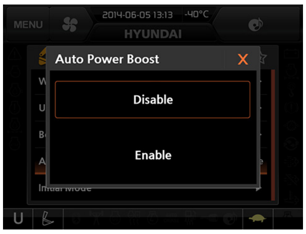
290F3CD115

· 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

· Arm speed
  - Arm regeneration function can be activated or cancelled.
    Enable - Arm in speed is up.
    Disable - Normal operation.

④ Auto power boost

210WF3CD118



290F3CD117

· 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.
Disable - Not operated.

⑤ IPC mode

290F3CD310

290F3CD311

130ZF3CD256

290F3CD312

130ZF3CD258

290F3CD313

130ZF3CD259

· The IPC mode can be selected by this menu.
- Speed mode
- Balance mode (default)
- Efficiency mode

· This mode is applied only general operation mode of the work tool mode.

※ Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to the page 5-87.

⑥ Automatic engine shutdown (option)

210WF3CD11

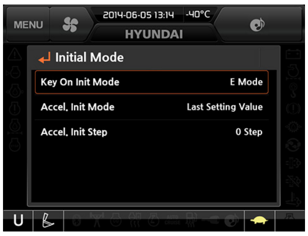
210WF3CD12

130ZF3CD213

· 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

290F3CD122



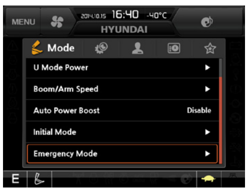
290F3CD119

· Key on initial mode
 - Selected the power mode is activated when the engine is started.

· Accel initial mode
 - Last setting value
 - User setting value

· Accel initial step
 - 0~9 step

⑧ Emergency mode



290F3CD248

290F3CD249

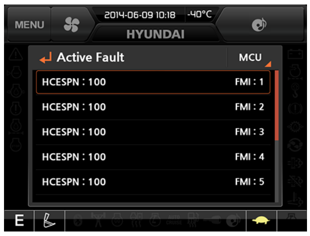
· This mode can be use when the switches are abnormal on the cluster.
· The cluster switches will be selected by touched each icon.

(3) Monitoring

① Active fault

290F3CD120

290F3CD121

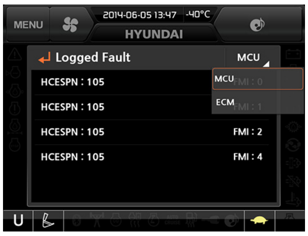


290F3CD125

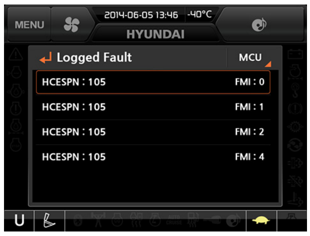
· The active faults of the MCU or engine ECM can be checked by this menu.

② Logged fault

290F3CD128



290F3CD123

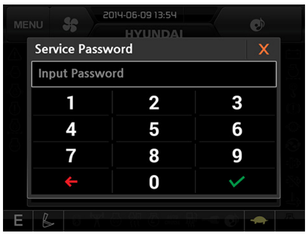


290F3CD124

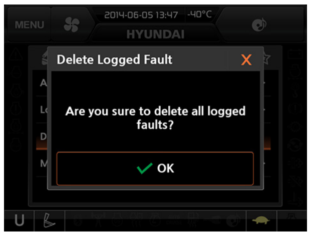
· The logged faults of the MCU or engine ECM can be checked by this menu.

③ Delete logged fault

290F3CD134



290F3CD126

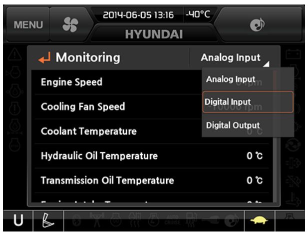


290F3CD127

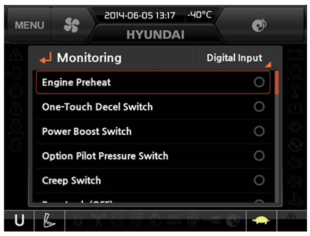
· The logged faults of the MCU or engine ECM can be deleted by this menu.

④ Monitoring

290F3CD172



290F3CD188



290F3CD189

· 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 ● are light ON.

(4) Management

① Fuel rate information

210WF3CD14

210WF3CD15

A

· General record (A)

- Average fuel rate (left) (from "Reset" to now)
  Fuel consumption devided 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

· 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 for 12 hours earlier data.
- All hourly records deletion by "Reset".

C

· 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.
- Automatic deletion for 7 days earlier data.
- All daily records deletion by "Reset".

D

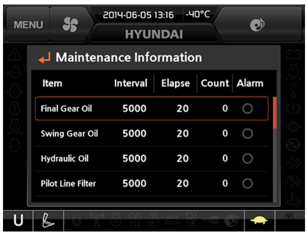
210WF3CD16

· Mode record (D)

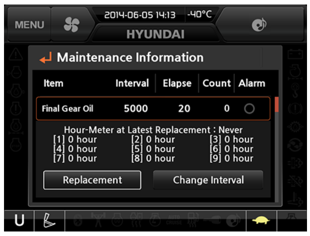
- Average fuel rate for each power mode/accel dial (at least 7) from "Reset" to now.
- No record during idle.
- All mode records deletion by "Reset".

② Maintenance information

290F3CD131



290F3CD132



290F3CD133

- 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 or replace interval can be changed in the unit of 50 hours.
- Change or relpace interval

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

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

220S3CD143A

Enter the new password again

220S3CD142A

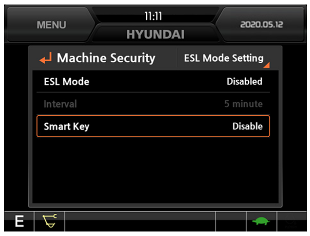
Enter the new password

※ Before first use, please set user password and owner password in advance for machine security.

- Smart key

220S3CD190A

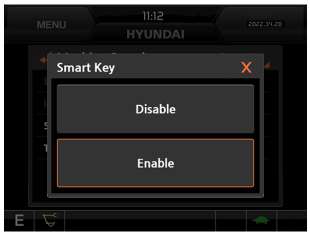
220S3CD135A



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.

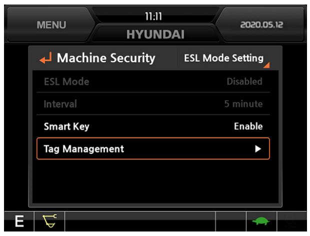


235F3CD002

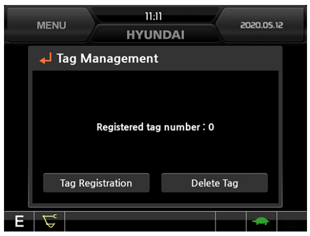
- Tag management

· 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.

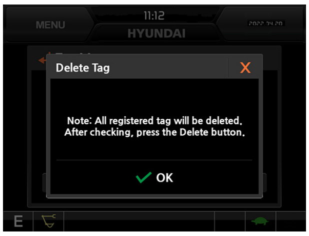


235F3CD003



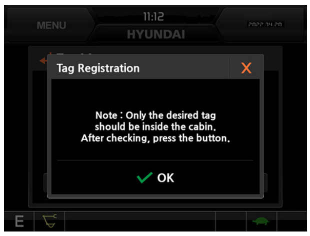
235F3CD004

Deleting



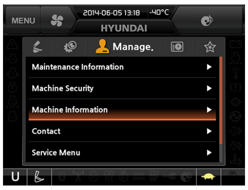
235F3CD006

Registering

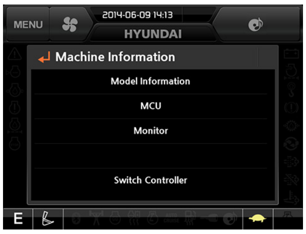


235F3CD005

④ Machine Information



290F3CD144

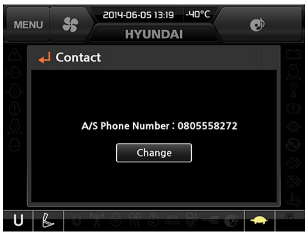


290F3CD145

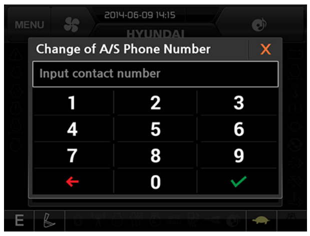
· This can confirm the identification of the model information (ECU), MCU, monitor, switch controller, RMCU, relay driver unit, FATC (air conditioner controller), AAVM (opt).

⑤ Contact (A/S phone number)

290F3CD146



290F3CD147

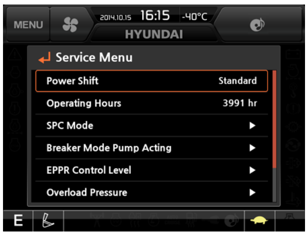


290F3CD148

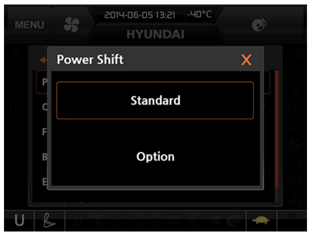
Enter the new A/S phone number

⑥ Service menu

290F3CD149



290F3CD250



290F3CD151

· 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 (1 pump/2 pump)
· EPPR current level (attach flow EPPR 1 & 2, boom priority EPPR, attach relief pressure EPPR 1& 2)
· Overload pressure : 100 ~ 350 bar

⑦ Clinometer

290F3CD152

290F3CD153

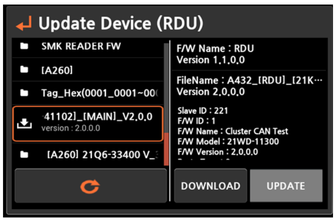
· When the machine is on the flatland, if tap the "initialization", the values of X, Y reset "0".
· You can confirm tilt of machine in cluster's operating screen.

⑧ Update (cluster & ETC devices)

210WF3CD17

210WF3CD18

210WF3CD19



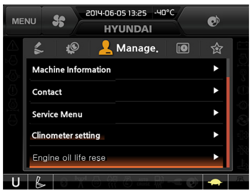
380F3CD06

380F3CD04

· ETC devices and cluster can be updated through CAN 2 network.

· Insert USB memory stick which includes program files, start download.

⑨ Engine oil life reset



130ZF3CD100

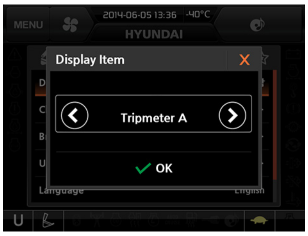
130ZF3CD101

130ZF3CD102

(5) Display

① Display item

290F3CD154



290F3CD155

130ZF3CD256

· The center display type of the LCD can be selected by this menu.
· The engine speed or each of the tripmeter (A,B,C) is displayed on the center display.

② Clock

290F3CD157

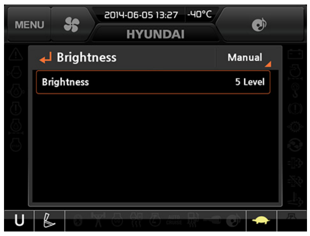
290F3CD158

· The first line's three spots "**/**/****" represent Month/Day/Year each.
· The second line shows the current time. (0:00~23:59)

③ Brightness

290F3CD159

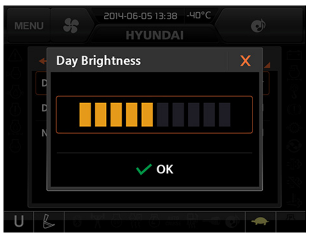
290F3CD160



290F3CD139

290F3CD141

290F3CD191

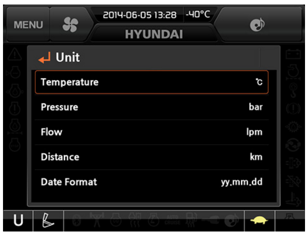


290F3CD192

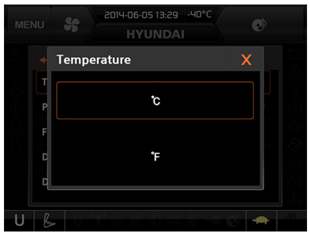
· If "Auto" is chosen, brightness for day and night can be differently set up. Also by using the bar in lower side, users can define which time interval belongs to day and night.
(in bar figure, white area represents night time while orange shows day time)

④ Unit

290F3CD161



290F3CD162



290F3CD193

- 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

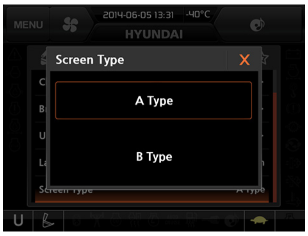
290F3CD163

290F3CD164

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

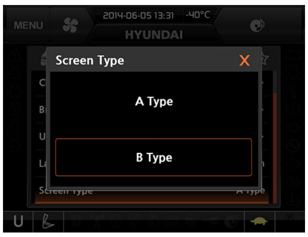
⑥ Screen type

290F3CD165



A Type (Default) 290F3CD166

130ZF3CD256

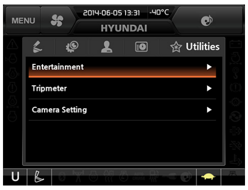


B Type (Option) 290F3CD194

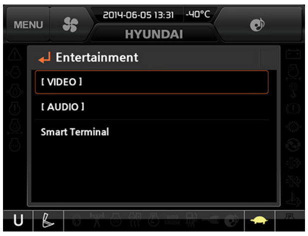
130ZF3CD257

(6) Utilities

① Entertainment



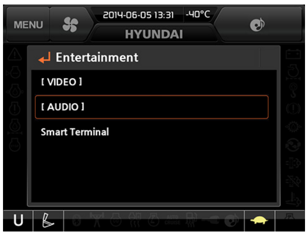
290F3CD195



A

290F3CD196

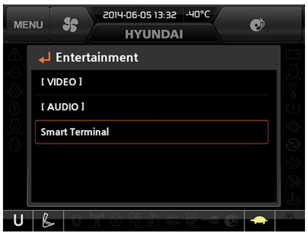
210WF3CD219



B

290F3CD197

210WF3CD220



C

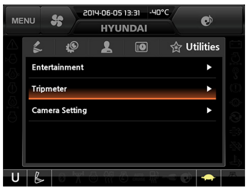
290F3CD198

210WF3CD199

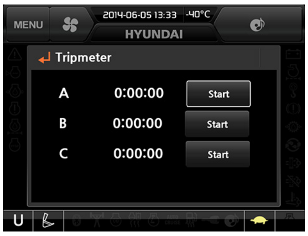
210WF3CD22

- Video (A) : This menu operates the video play function.
  mp4, mkv, avi files and so on.
- Audio (B) : This menu operates the play music.
  mp3, mp4 files and so on.
- Smart terminal (C) : The menu features a smartphone and operates the miracast.

② Tripmeter



290F3CD168

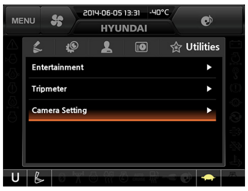


290F3CD169

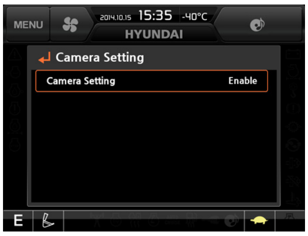
· Maximum 3 kinds of tripmeters can be used at the same time.
· Each tripmeter can be turned on by choosing "Start" while it also can be turned off by choosing "Stop".
· If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

③ Camera setting

· If the rear camera is not installed on the machine, set disable.
· If the rear camera installed on the machine, set enable.



290F3CD200



290F3CD255

290F3CD256

· In the operation screen, rear camera screen show up when ESC/CAM button is pushed.

290F3CD156

290F3CD221

④ AAVM (All Around View Monitoring, option)

· The AAVM buttons of the cluster consist of ESC/CAM and AUTO IDLE/Buzzer stop.

Buzzer stop switch
Escape switch

130ZF3CD244

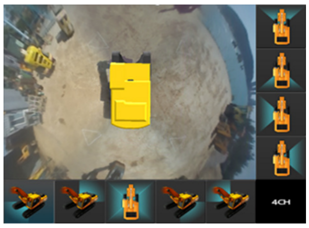
- Escape button

· It will enter into the AAVM mode from the beginning screen if the AAVM is installed.

· While in the AAVM mode, select the ESC button to return to the beginning screen.

130ZF3CD256

The beginning screen



AAVM mode

290F3CD222

- Buzzer stop button

· In AAVM mode, it detects surrounding pedestrians or objects and the warning buzzer sounds.

· User can turn OFF the warning sound by pressing buzzer stop button.

290F3CD246

· When the worker or pedestrian go to the blue line (radius 5 m), an external danger area of equipping on the cluster screen, the warning buzzer sounds and it displays the blue rectangular box for the recognition of the worker and pedestrian.
At this time, the operator should stop work immediately, and stop the buzzer by pressing the buzzer stop button. And then, please work after you check whether the danger factors are solved.

290F3CD247

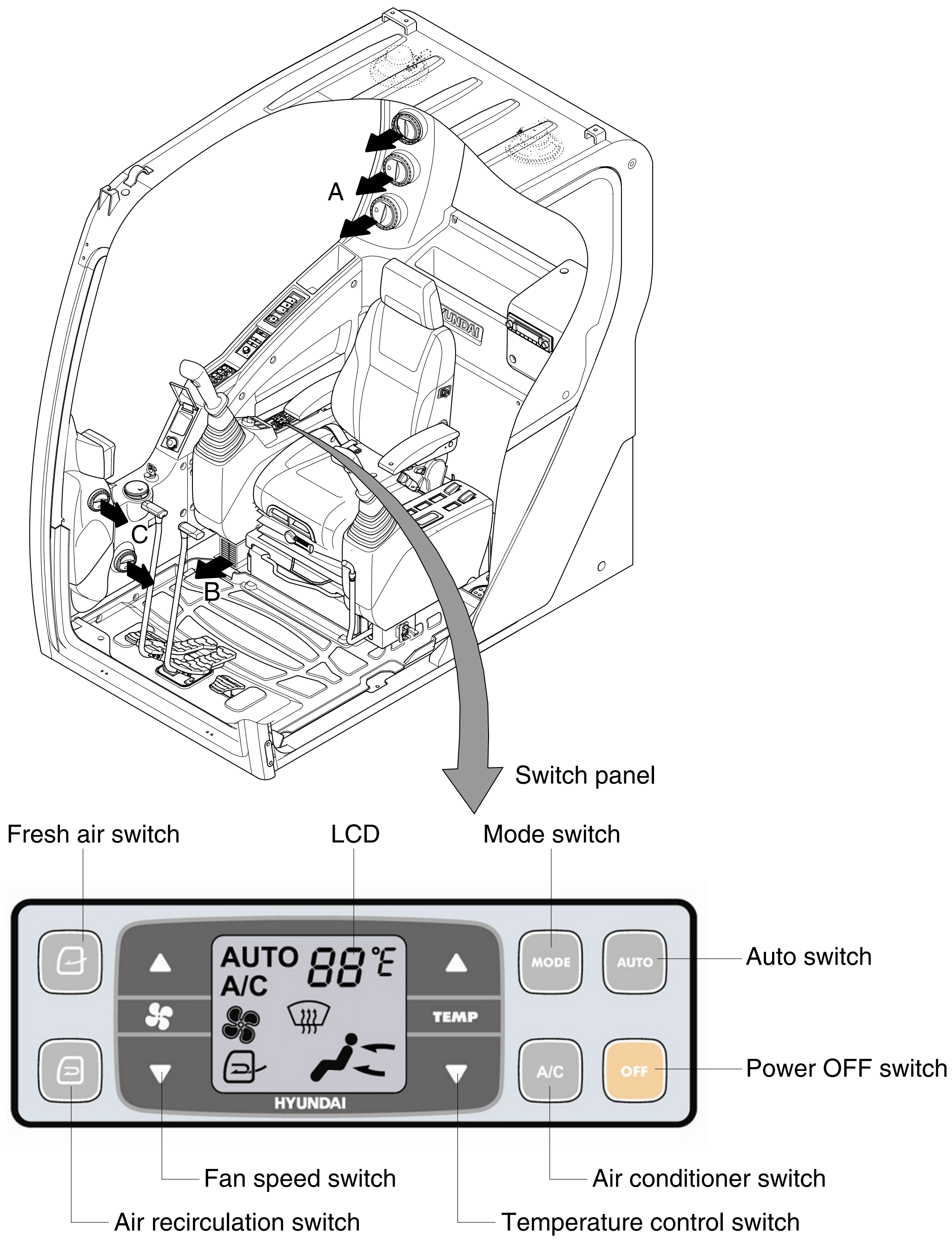
· When the worker or pedestrian go inside of red line (radius 3 m), an internal danger area of equipping on the cluster screen, the warning buzzer sounds and it displays the red rectangular box for the recognition of the worker and pedestrian.
At this time, the operator should stop work immediately, and stop the buzzer by pressing the buzzer stop button. And then, please work after you check whether the danger factors are solved.

※ In AAVM mode, a touch screen of the LCD is available only. The multimodal dial of the haptic controller is not available.

(7) AIR CONDITIONER AND HEATER

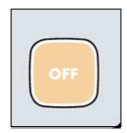
Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

· Location of air flow ducts



145ZF3CD06

1) POWER OFF SWITCH



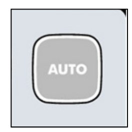
370073CD54

(1) This switch makes the system and the LED OFF.
Just before the power OFF, set values are stored.

(2) Default setting values

Function	Air conditioner	In/outlet	LCD	Temperature	Mode
Value	OFF	Inlet	OFF	Previous sw OFF	Previous sw OFF

2) AUTO SWITCH

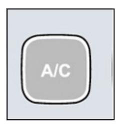


370073CD52

(1) Turn the starting switch to ON position, LCD lights ON.
Auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

(2) This switch can restart system after system OFF.

3) AIR CONDITIONER SWITCH (compressor switch)



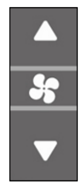
370073CD53

(1) This switch turns the compressor and the LCD ON.

(2) In accordance with the temperature sensed by duct (evaporator) sensor, compressor turns ON or OFF automatically.

※ Air conditioner operates to remove vapor and drains water through a drain hose. Water can be sprayed into the cab in case that the drain cock at the ending point of drain hose has a problem.
In this case, exchange the drain cock.

4) FAN SPEED SWITCH



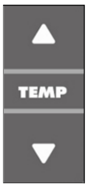
370074CD56

(1) Fan speed is controlled automatically by setted temperature.

(2) This switch controls fan speed manually.
- There are 8 up/down steps to control fan speed.
- The maximum step or the minimum step beeps 5 times.

(3) This switch makes the system ON.

5) TEMPERATURE CONTROL SWITCH



370074CD57

(1) Setting temperature indication
① Type A : 17~32˚C, scale : 1˚C
② Type B : Lo, 18~31˚C, Hi, scale : 1˚C

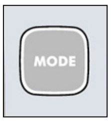
(2) Max cool and max warm beeps 5 times.

(3) The max cool or the max warm position operates as following table.

Temperature	Compressor	Fan speed	In/Outlet	Mode
Max cool	ON	Max (Hi)	Recirculation	Vent
Max warm	OFF	Max (Hi)	Fresh	Foot

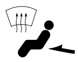
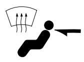
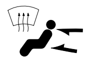
(4) Temperature unit can be changed between celsius (˚C) and fahrenheit (˚F)
① Default status (˚C)
② Push Up/Down temperature control switch simultaneously more than 5 second displayed temperature unit change (˚C → ˚F)

6) MODE SWITCH



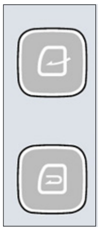
370074CD50

(1) Operating this switch, it beeps and displays symbol of each mode in order. (Vent → Vent/Foot → Def/Foot → Def/Vent → Def/Vent/Foot)

Mode switch		Vent	Vent/Foot	Def/Foot	Def/Vent	Def/Vent/Foot
						
Outlet	A	●	●		●	●
	B		●	●		●
	C			●	●	●

(2) When defroster mode operating, FRESH AIR/AIR RECIRCULATION switch turns to FRESH AIR mode and air conditioner switch turns ON.

7) FRESH AIR/AIR RECIRCULATION SWITCH

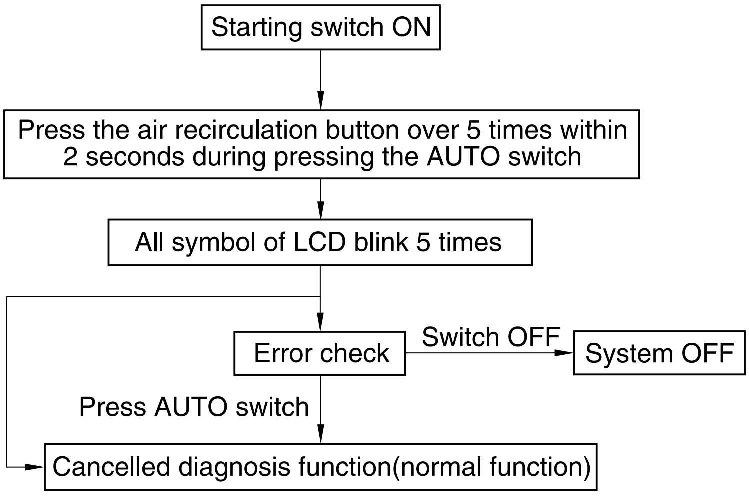


36073CD58

(1) It is possible to change the air-inlet method.
① Fresh air ( )
Inhaling air from the outside.
※ Check out the fresh air filter periodically to keep a good efficiency.
② Air recirculation ( )
It recycles the heated or cooled air to increase the energy efficiency.
※ Change air occasionally when using recirculation for a long time.
※ Check out the recirculation filter periodically to keep a good efficiency.

8) SELF DIAGNOSIS FUNCTION

(1) Procedure



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(2) Error check

- The corresponding error code flickers on the setup temperature display panel, the other symbol will turn OFF.
- Error code flickers every 0.5 second.
- If error code is more than two, each code flickers 2 times in sequence.
- Error code

Error code	Description	Error code	Description
11	Cabin inside sensor	16	Mode actuator 1
12	Ambient sensor	17	Mode actuator 2
14	Duct (evaporator) sensor	18	Intake actuator
15	Temp actuator	-	-

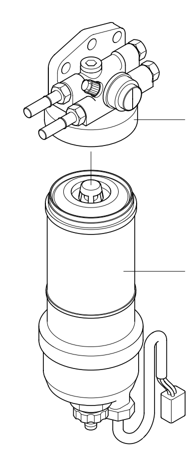
(3) Fail safe function

Error description	Fail safe function
Cabin inside sensor (11)	25˚C alternate value control
Ambient sensor (12)	20˚C alternate value control
Duct (evaporator) sensor (14)	1˚C alternate value control
Temp actuator (15)	If opening amount is 0 %, the alternate value is 0 %
	If not, the alternate value is 100 %
Mode actuator 1, 2 (16, 17)	The alternate value is vent

GROUP 16 FUEL WARMER SYSTEM

1. SPECIFICATION

1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A

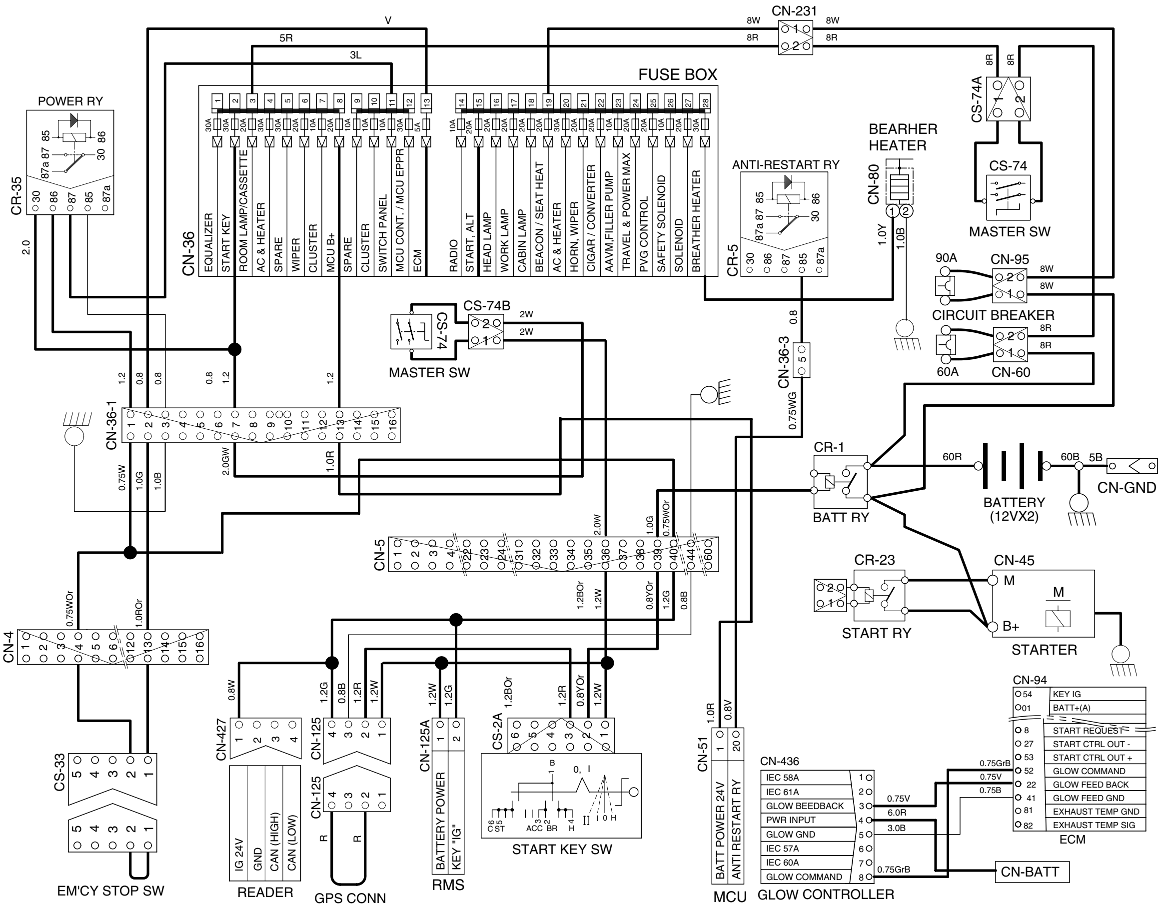


130ZF5MS104

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



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SECTION 6 TROUBLESHOOTING

Group 1 Before Troubleshooting 6-1
Group 2 Hydraulic and Mechanical System 6-4
Group 3 Electrical System 6-24
Group 4 Mechatronics System 6-40

SECTION 6 TROUBLESHOOTING

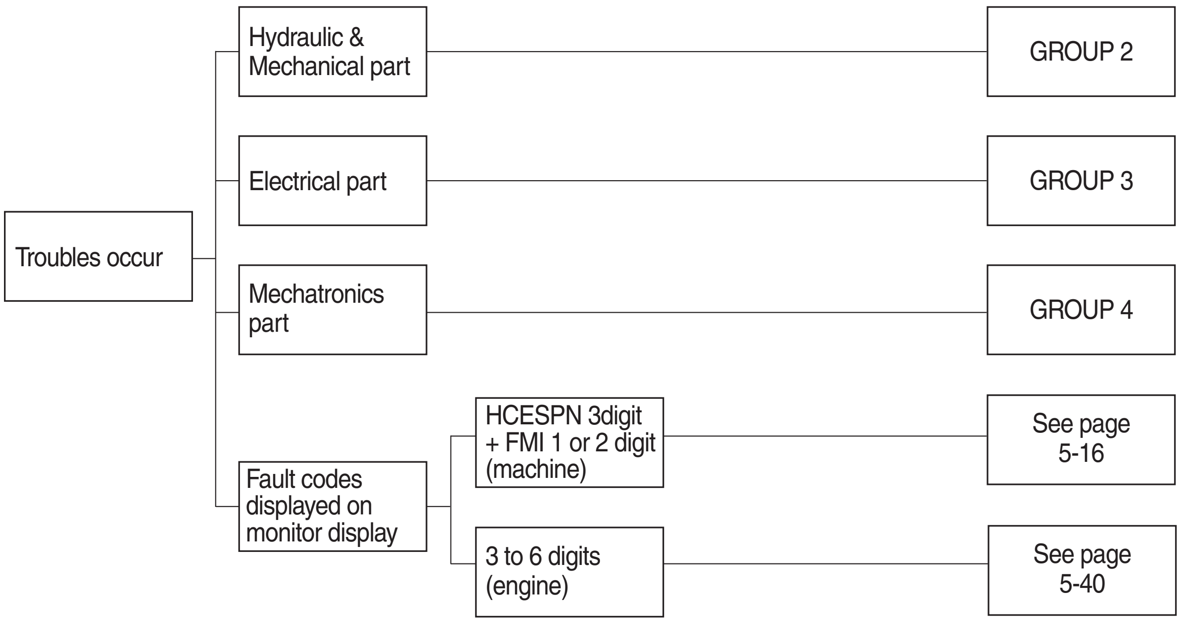
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

When a trouble is occurred in the machine, this section will help service men repair the machine with easy.

The trouble of machine is parted Hydraulic & Mechanical system, Electrical system and Mechatronics system. At each system part, service men can check the machine according to the troubleshooting process diagram.

※ **Before carring out troubleshooting procedure, check monitoring menu in the cluster.**

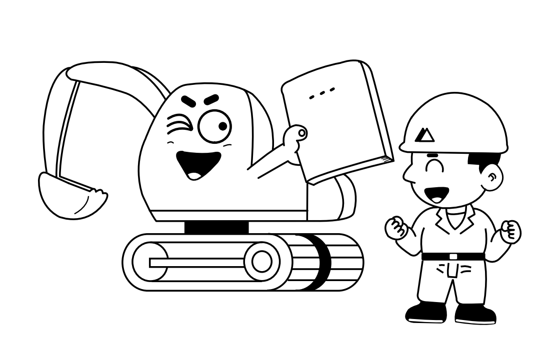


2. DIAGNOSING PROCEDURE

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.

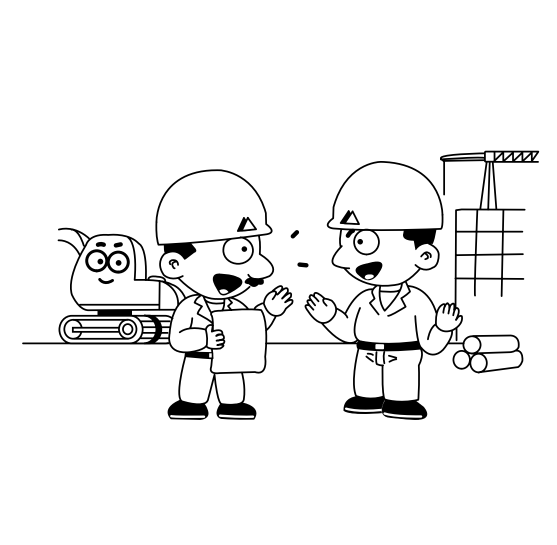


13031SH02

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.

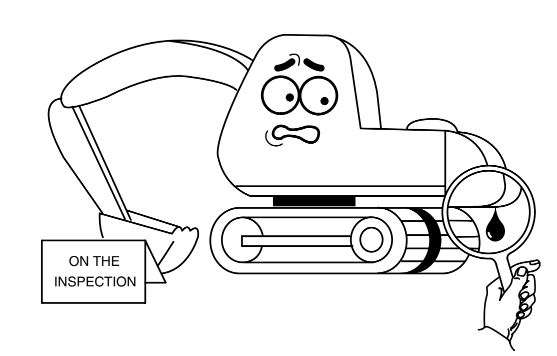


13031SH03

STEP 3. Inspect the machine

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

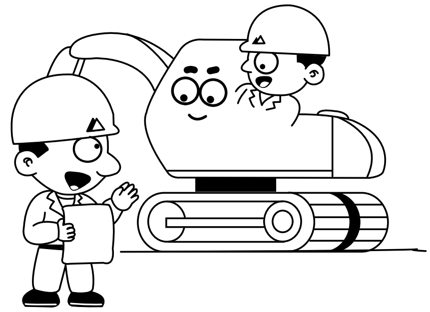
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(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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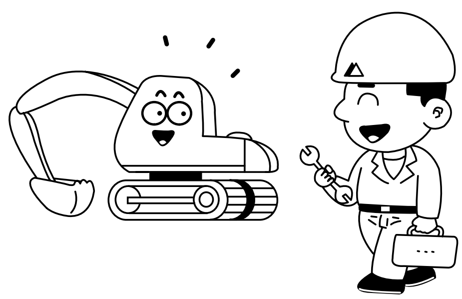
STEP 5. Perform troubleshooting

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.



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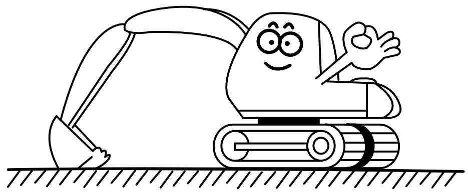
STEP 6. Trace a cause

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

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



(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.

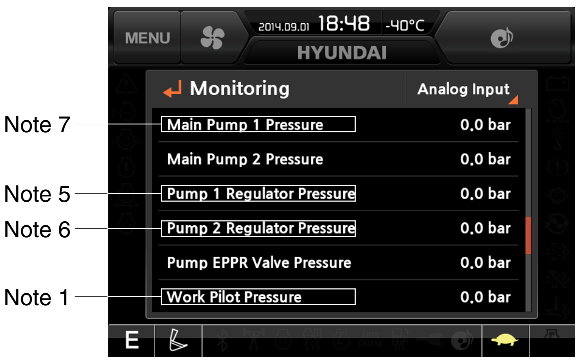
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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?

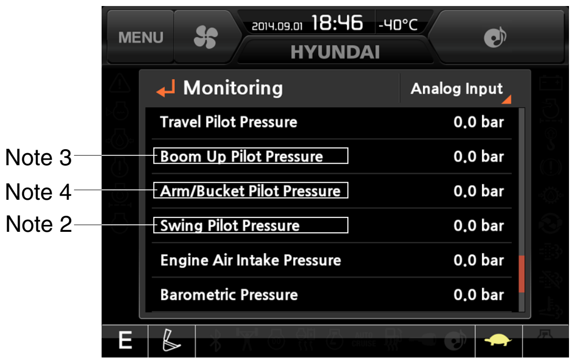
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

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

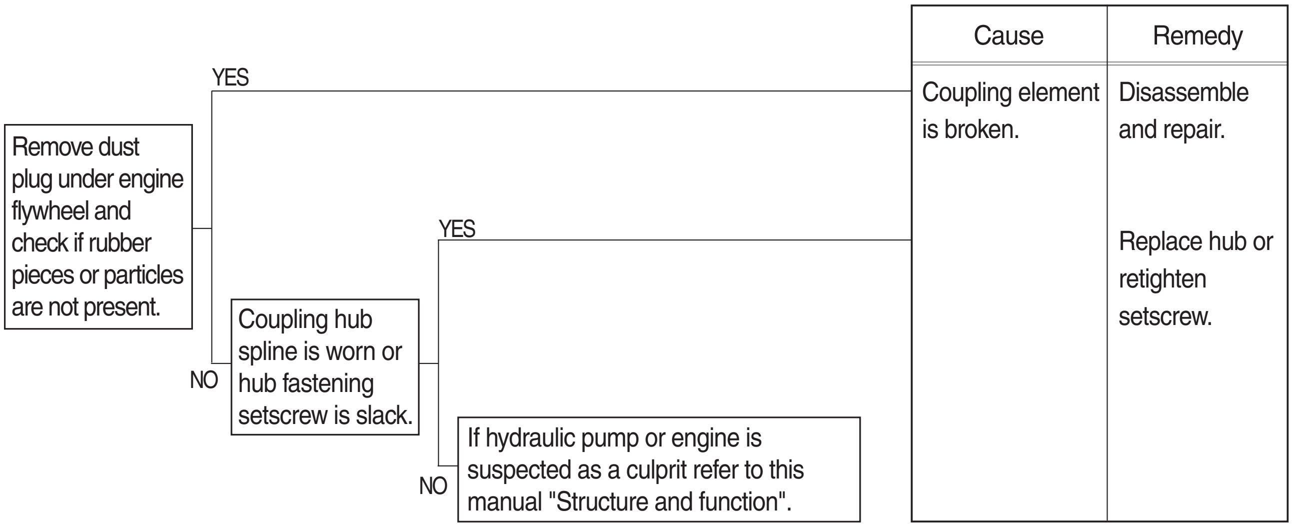
300L6HS01

(2) Specification

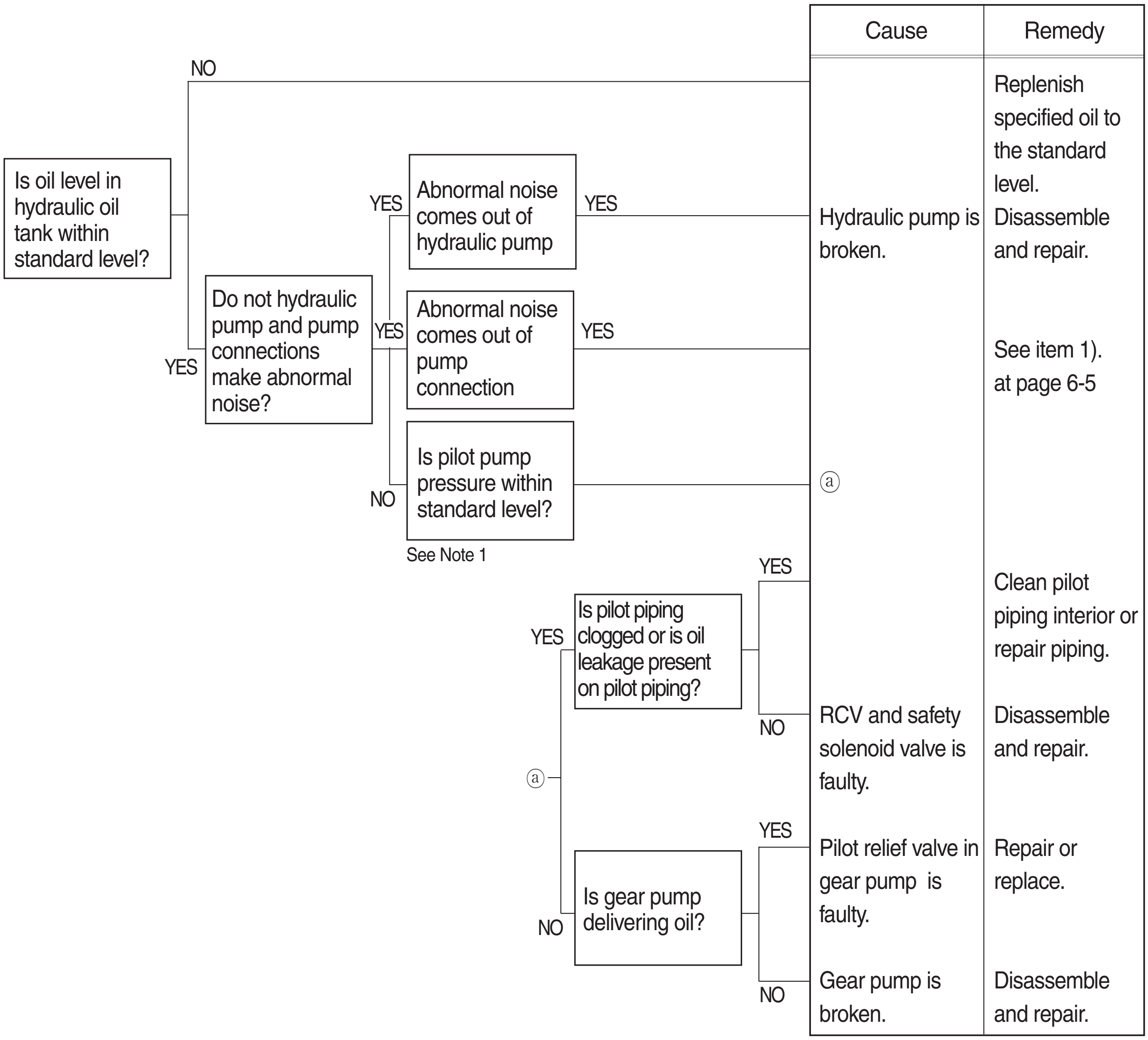
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	330 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

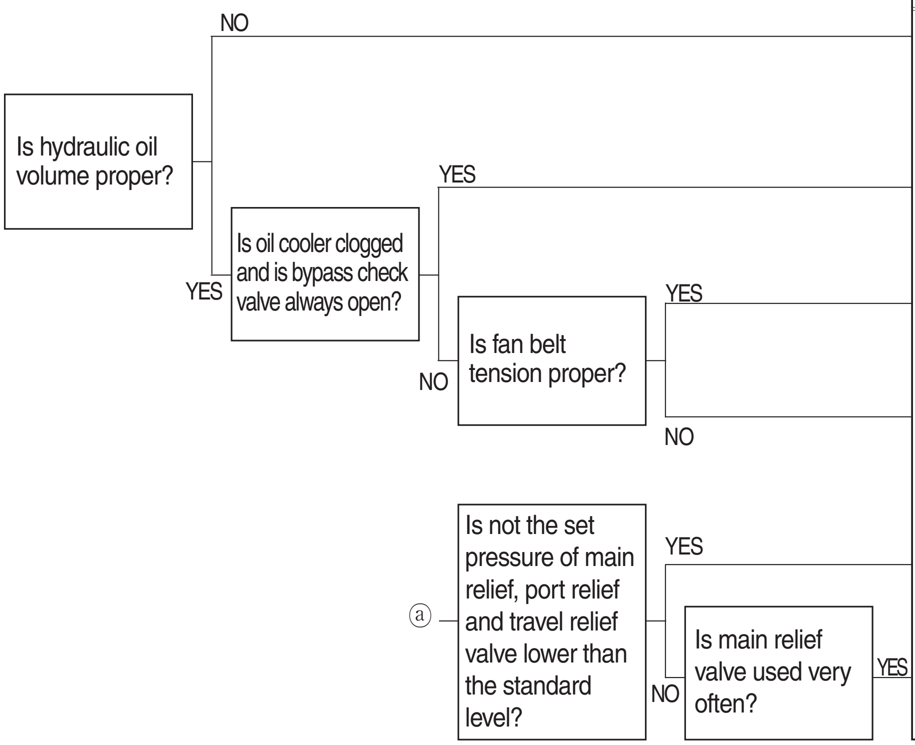


3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

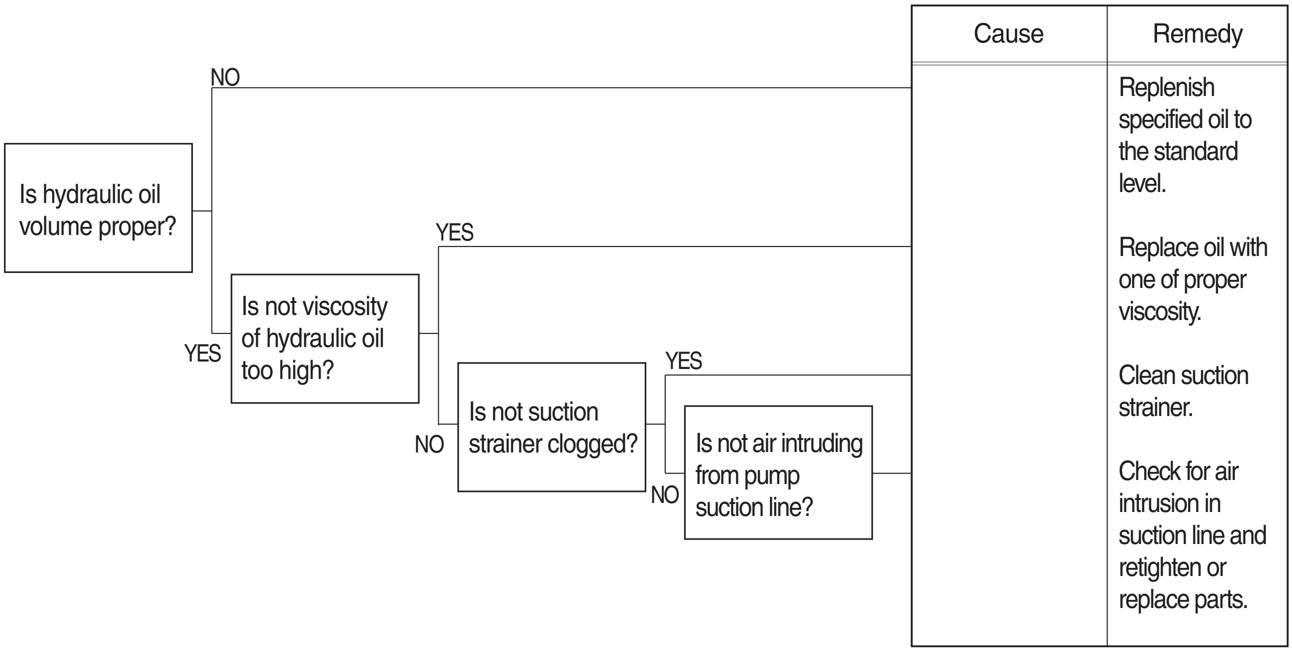
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY

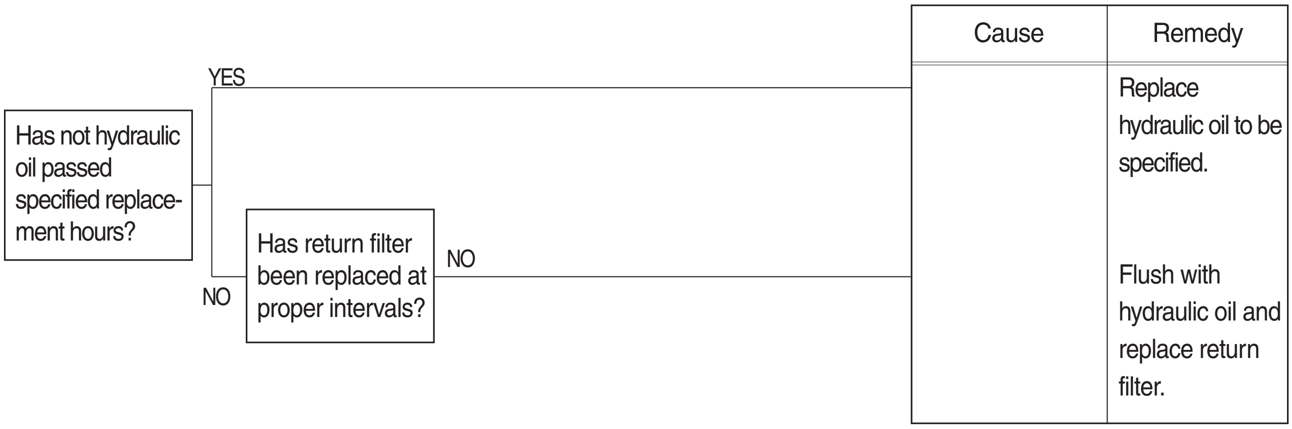


Cause	Remedy
	Replenish specified oil to the standard level.
Oil cooler clogged. Bypass check valve is defective. ⓐ	Clean oil cooler. Replace
	Adjust belt tension or replace belt.
	Readjust set pressure.
	Reduce load.

3) CAVITATION OCCURS WITH PUMP

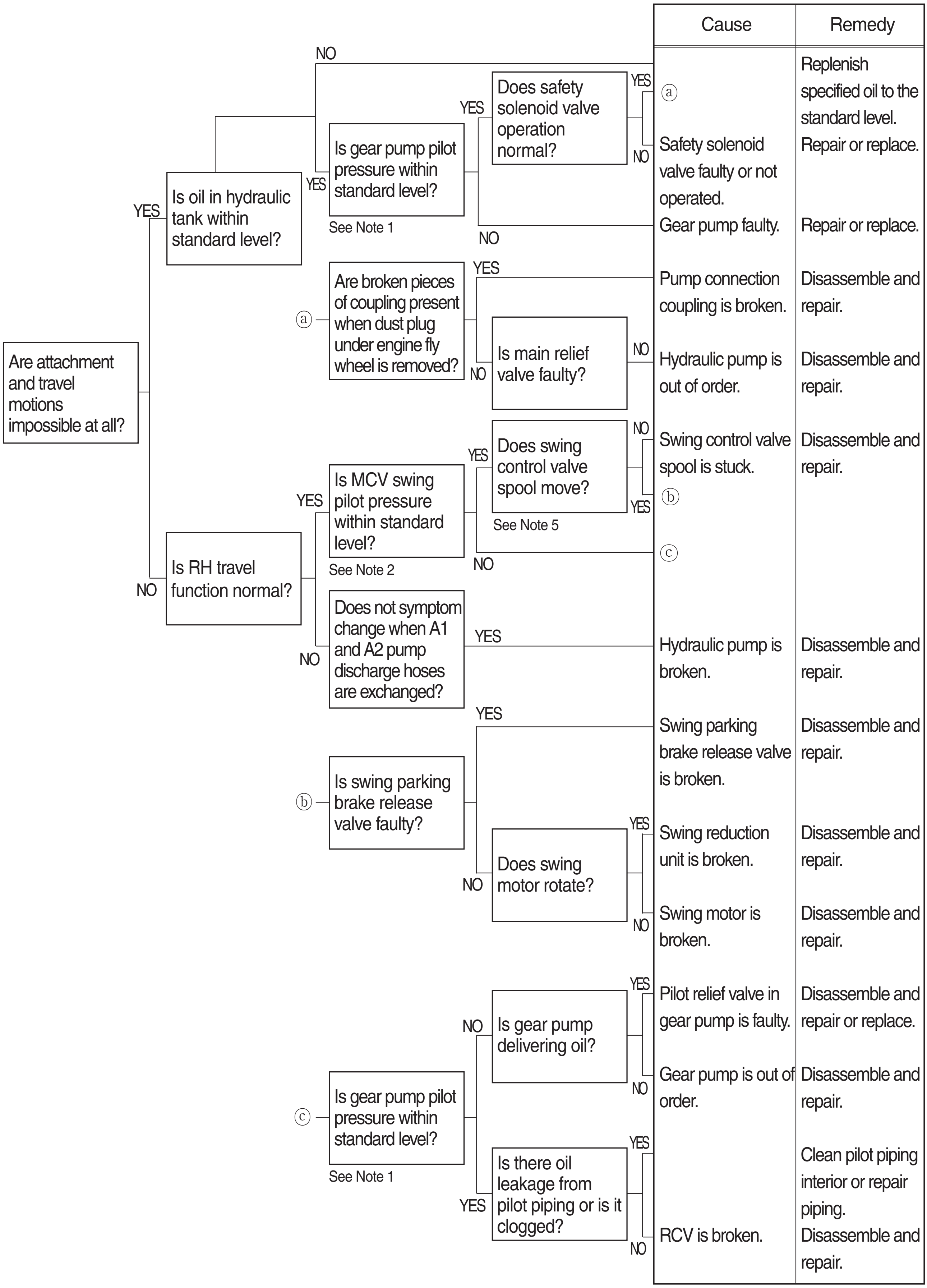


4) HYDRAULIC OIL IS CONTAMINATED

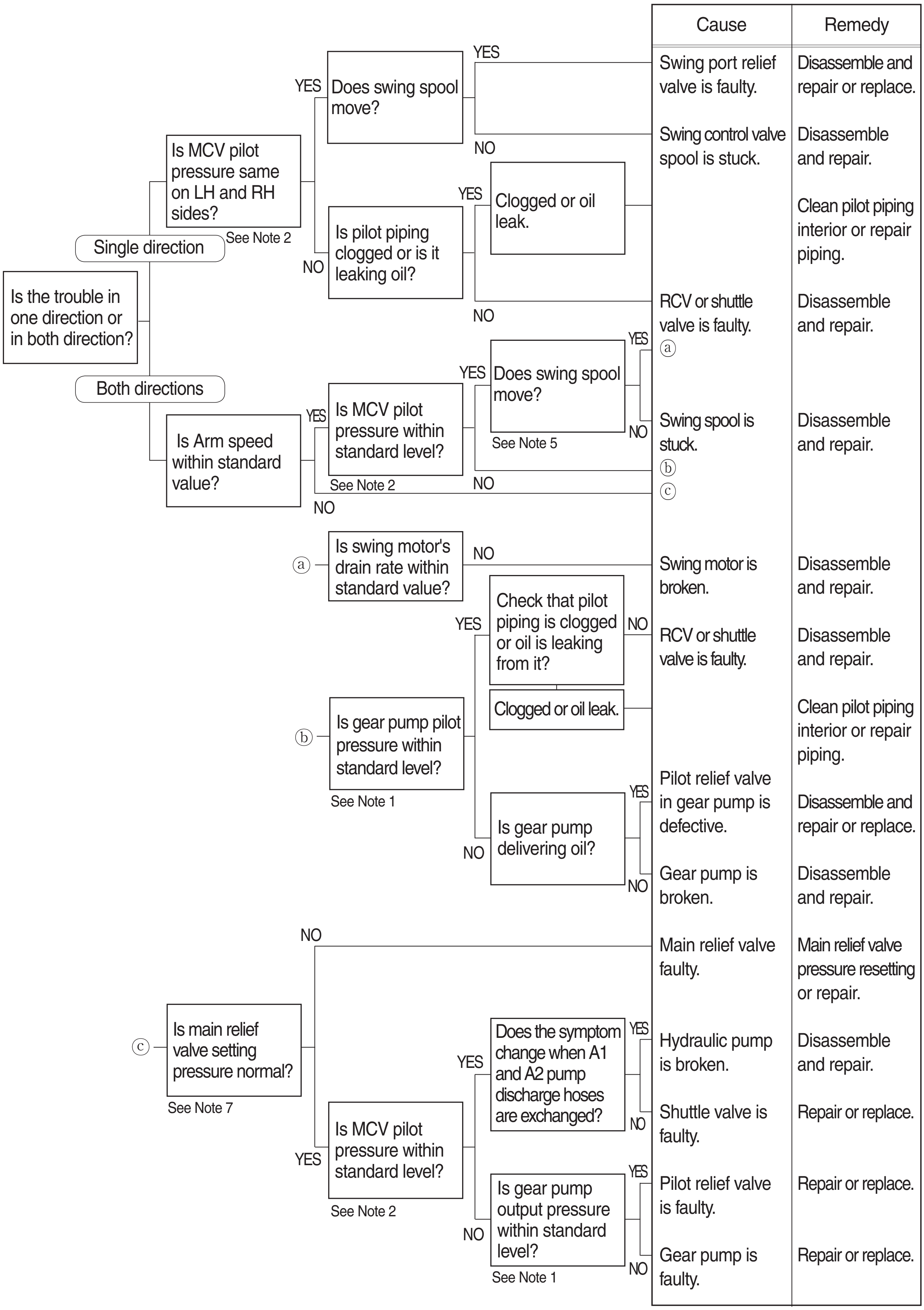


4. SWING SYSTEM

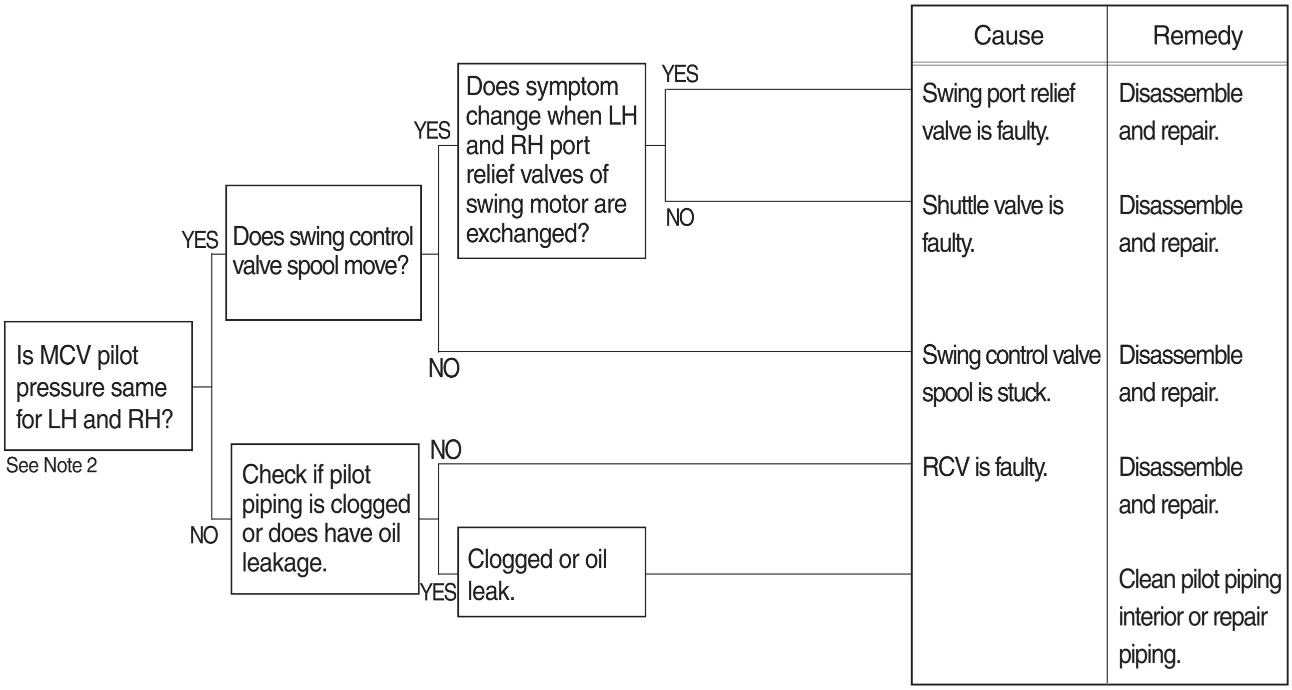
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



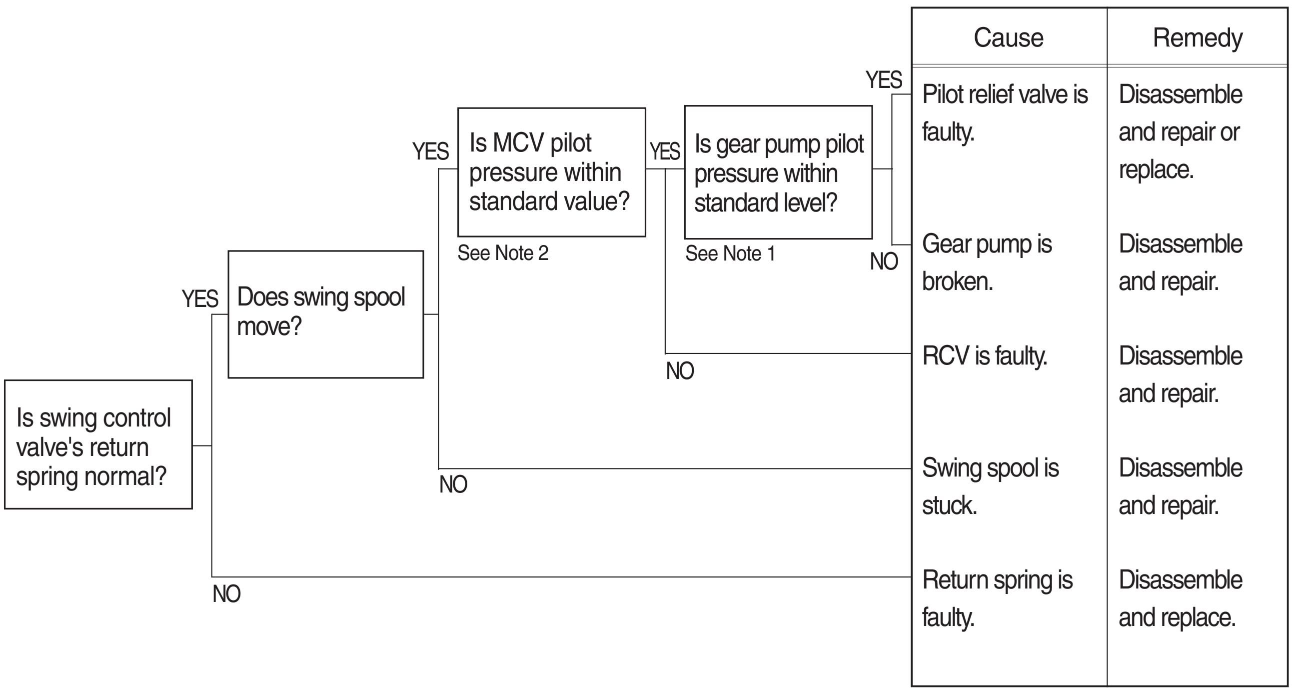
2) SWING SPEED IS LOW



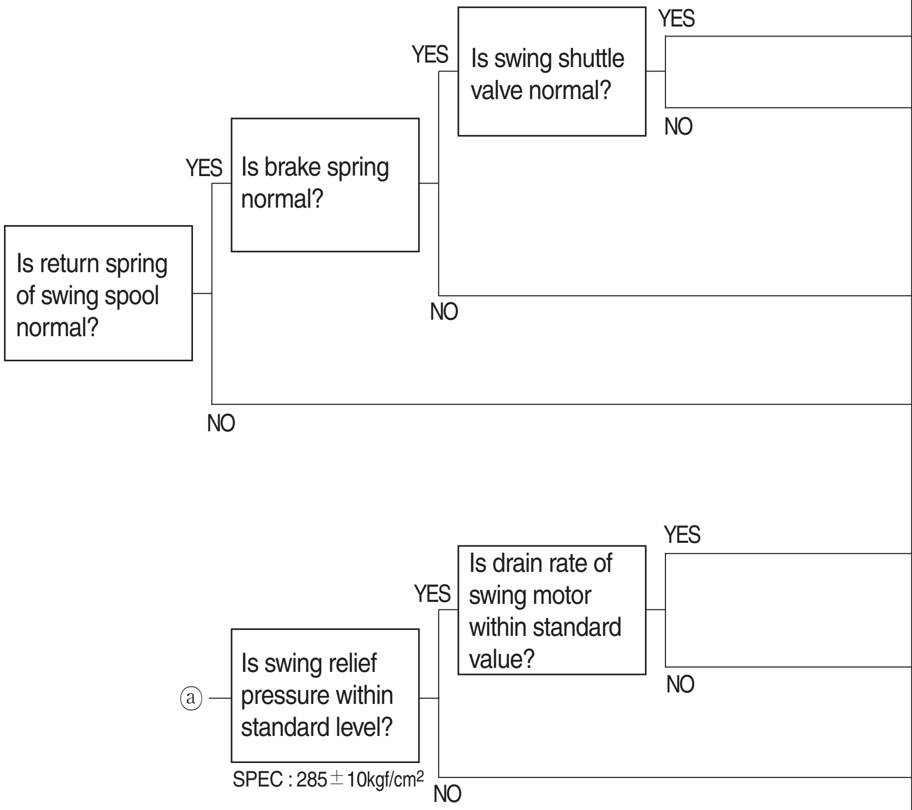
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP



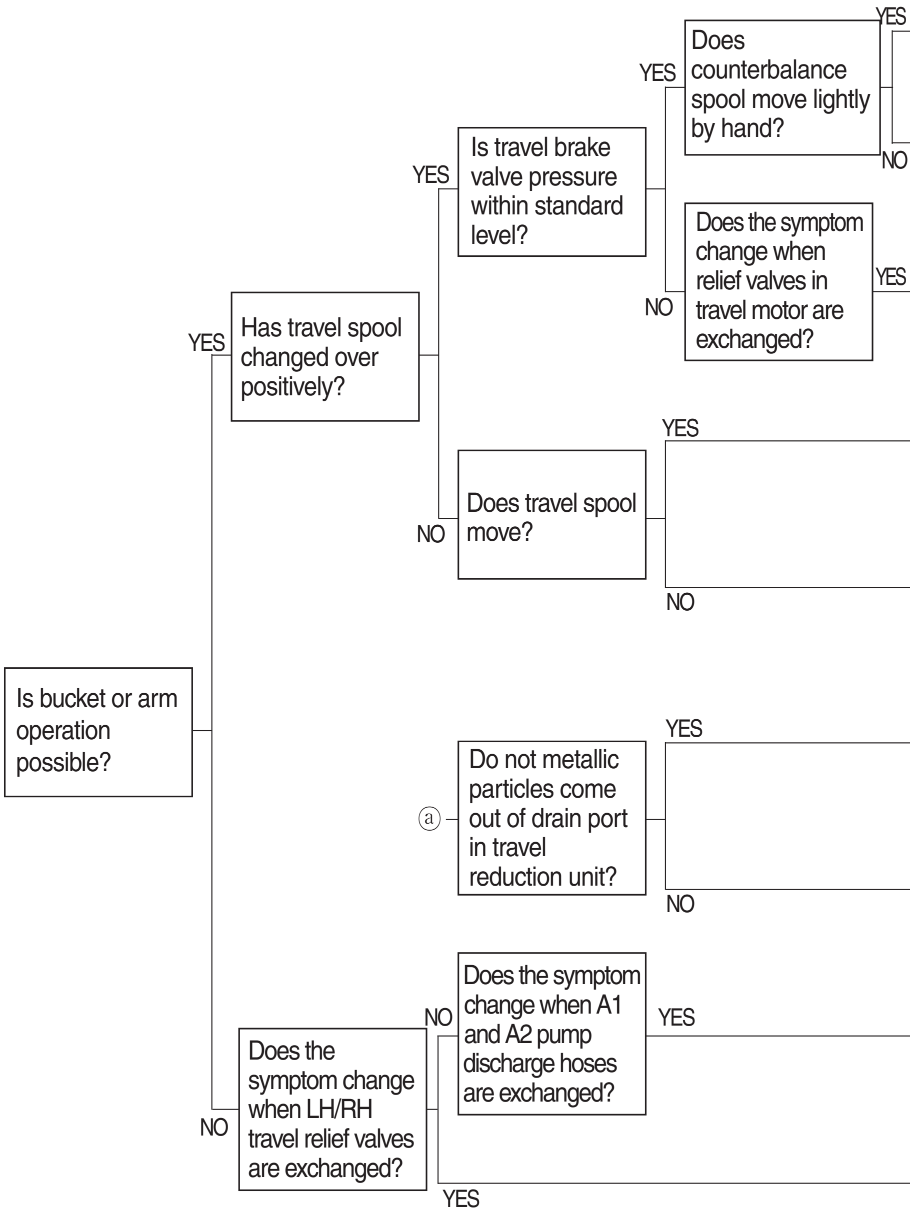
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



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

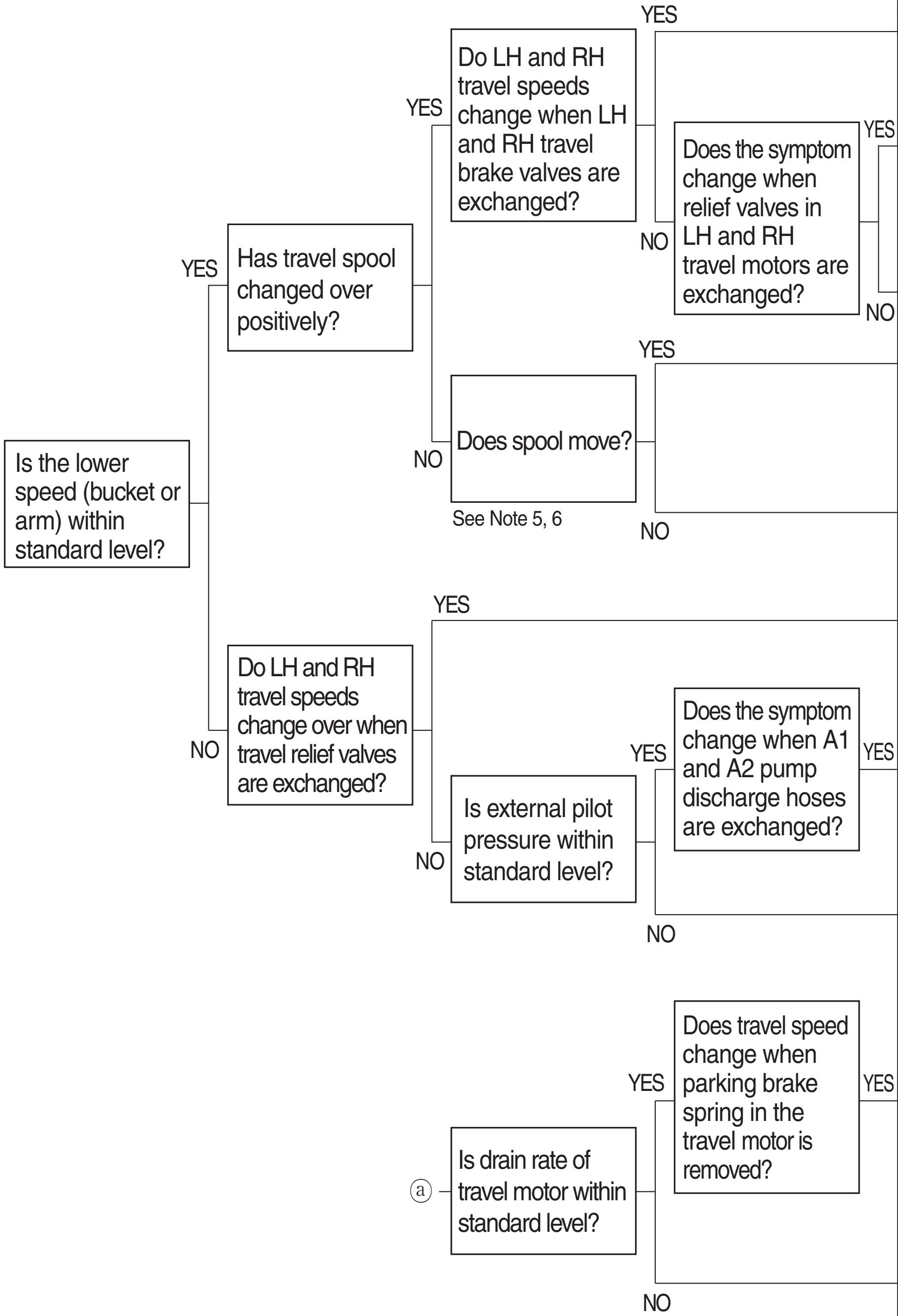
5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



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

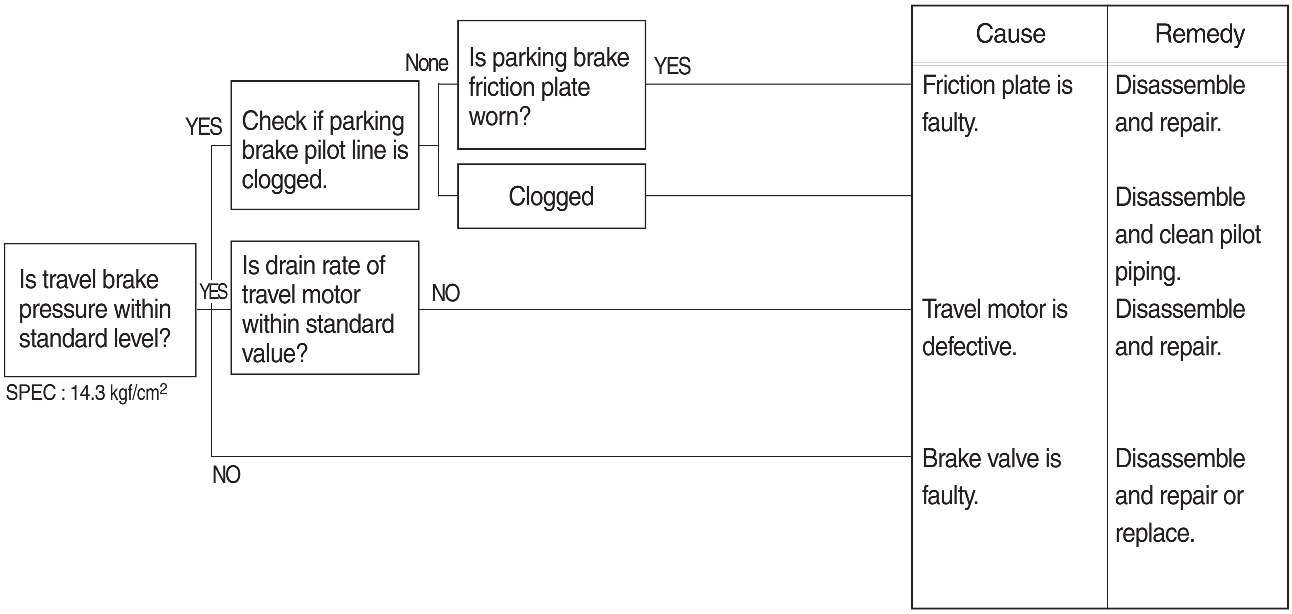
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



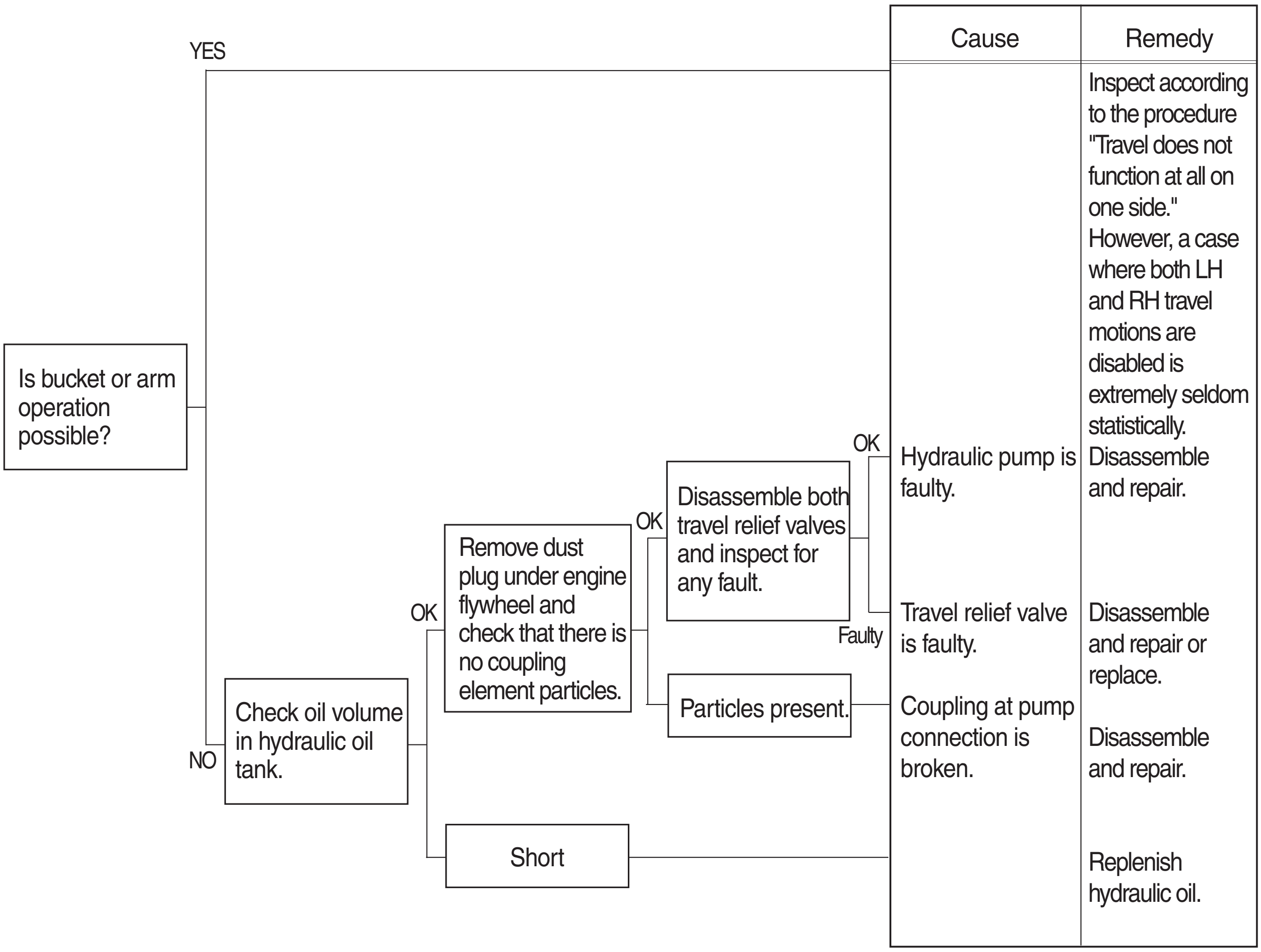
Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
ⓐ	
Control system is faulty.	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble 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

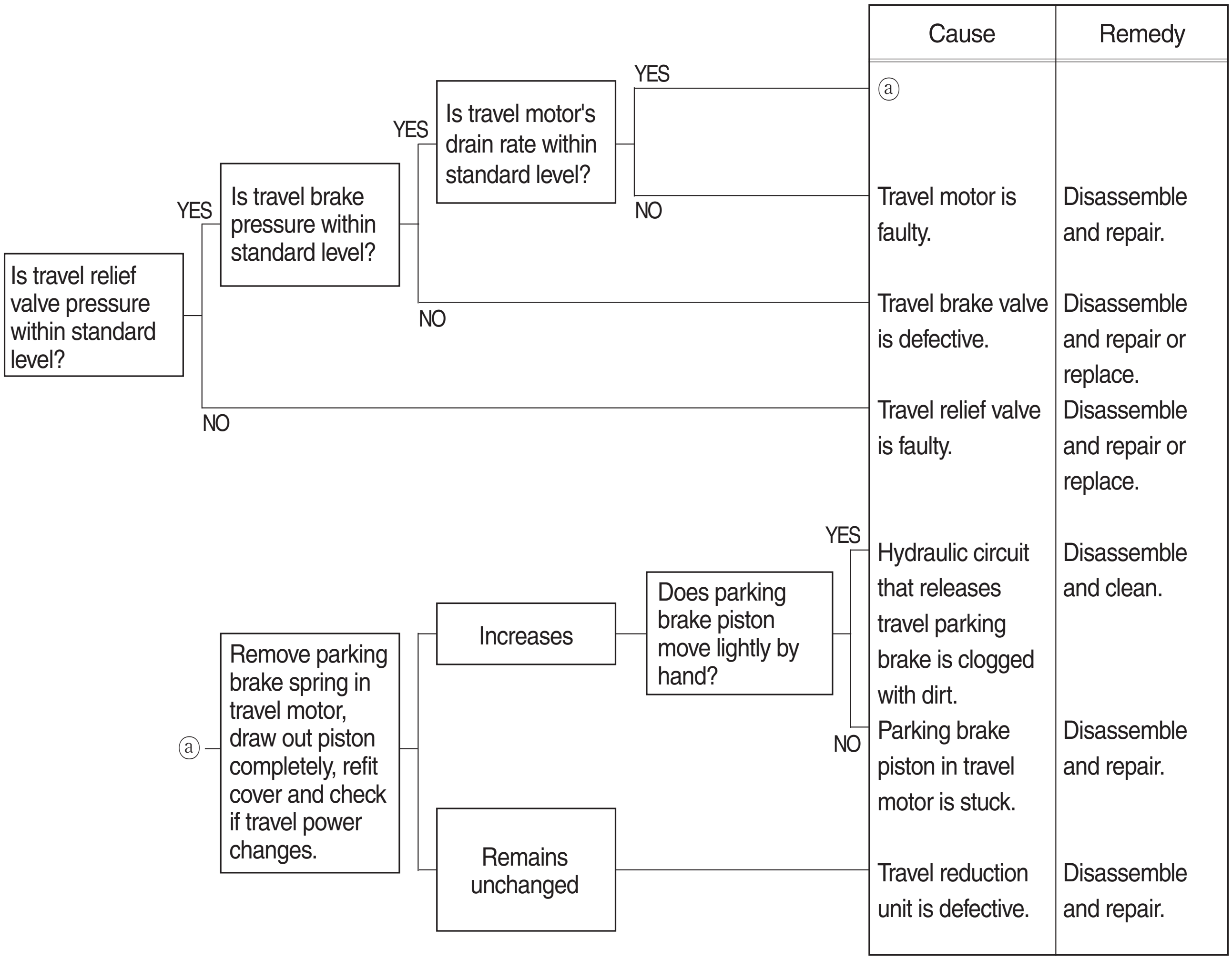
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

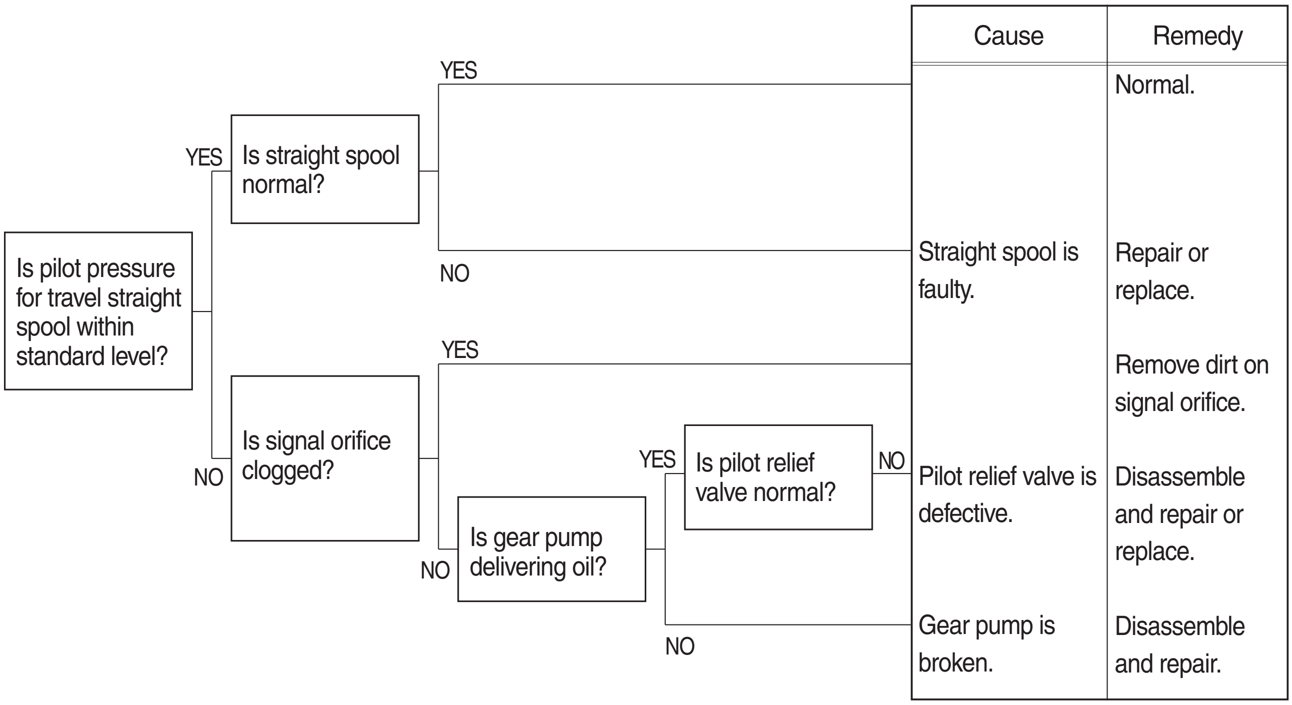


5) TRAVEL ACTION IS POWERLESS (travel only)



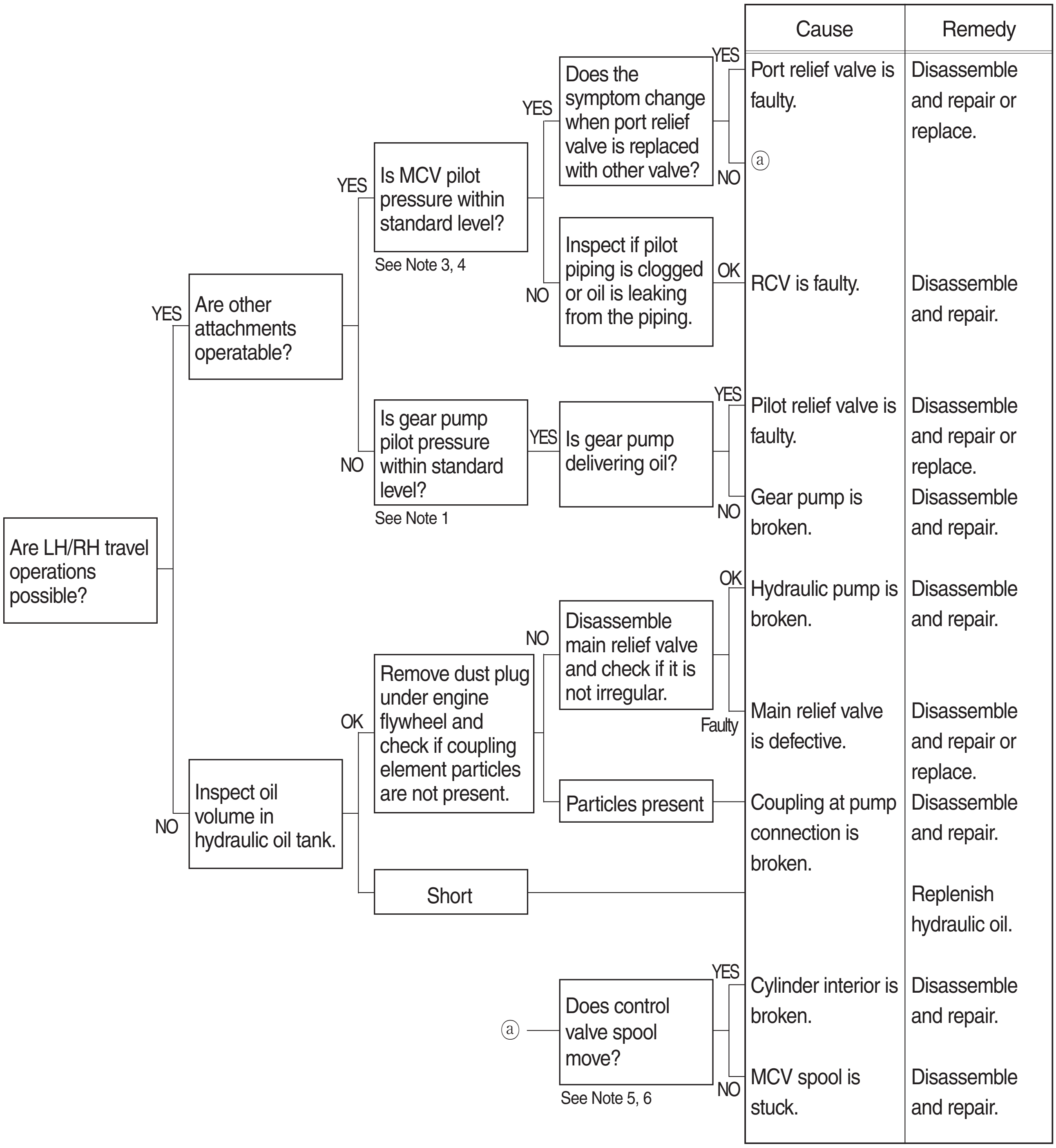
6) MACHINE RUNS RECKLESSLY ON A SLOPE

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

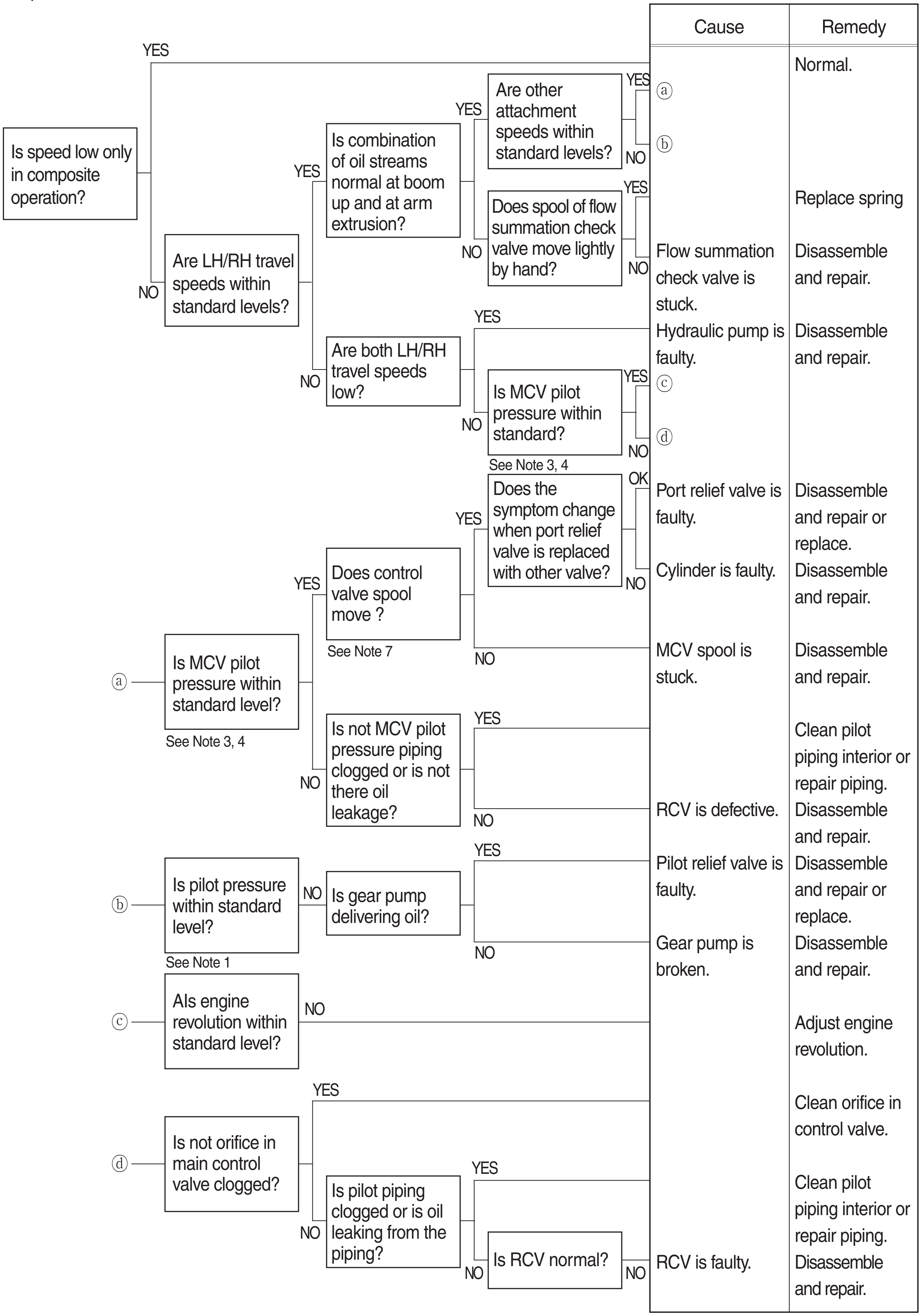


6. ATTACHMENT SYSTEM

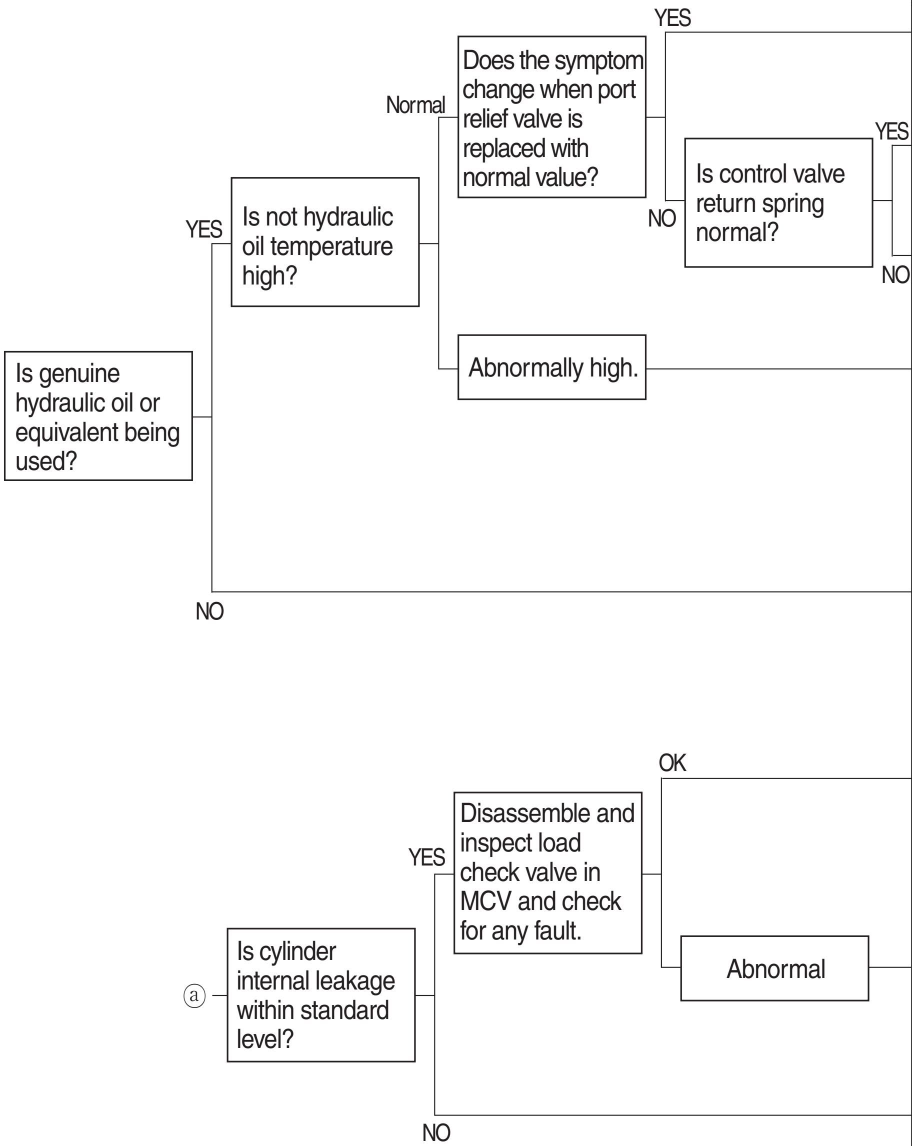
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

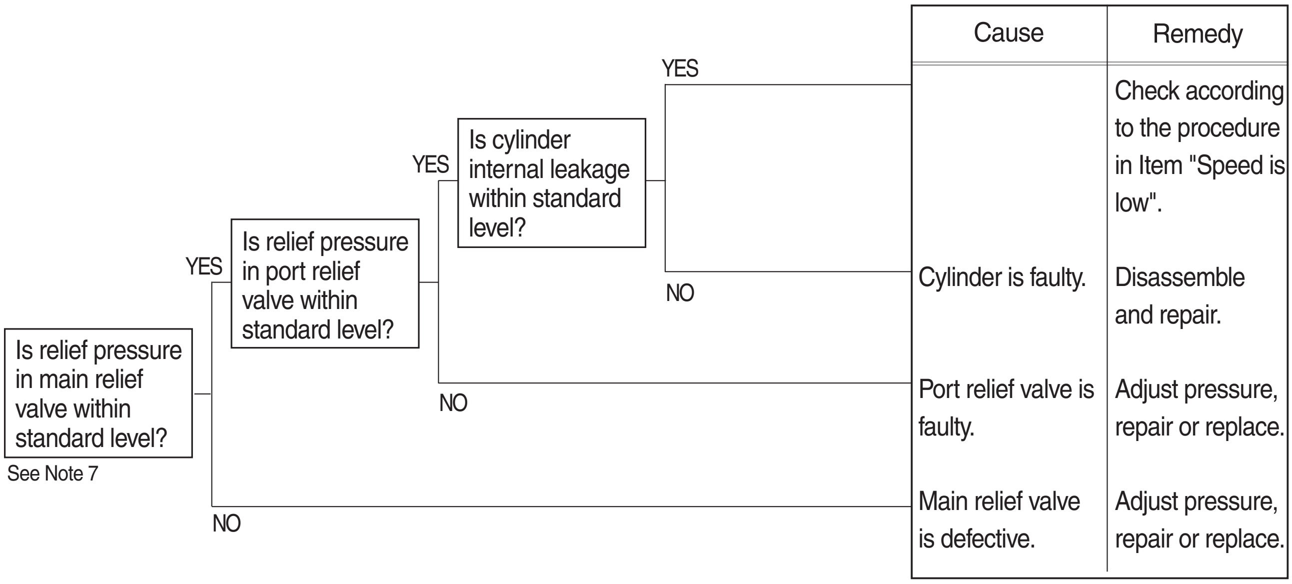


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS

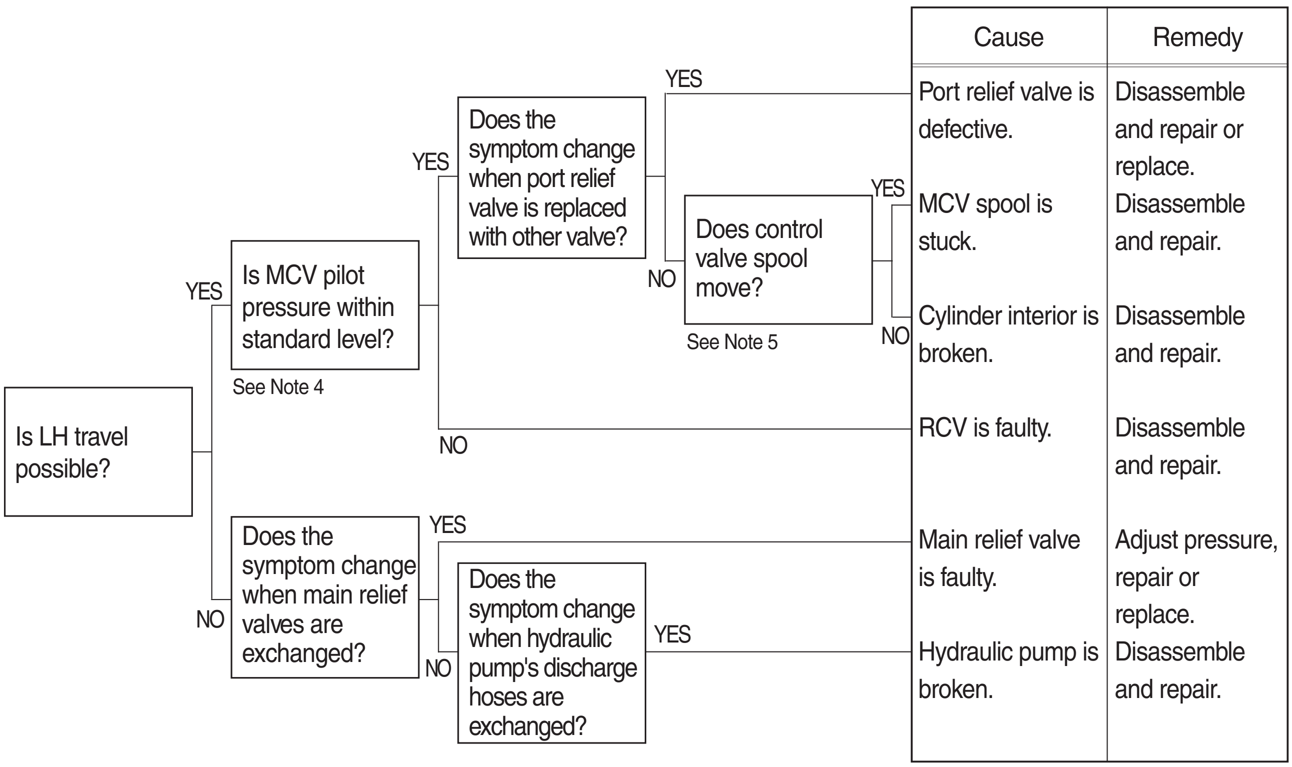


Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



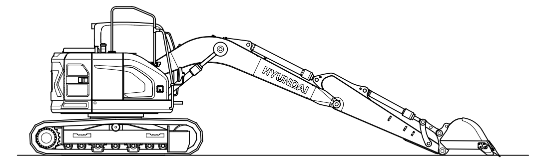
6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

Is boom foot pin greased sufficiently?

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

※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



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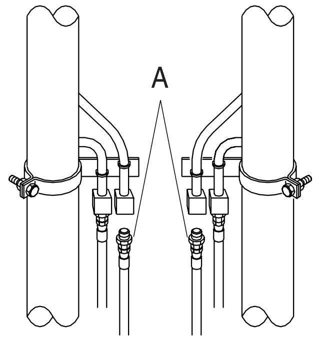
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



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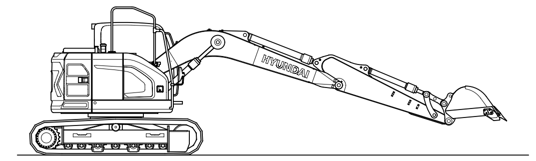
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

   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.



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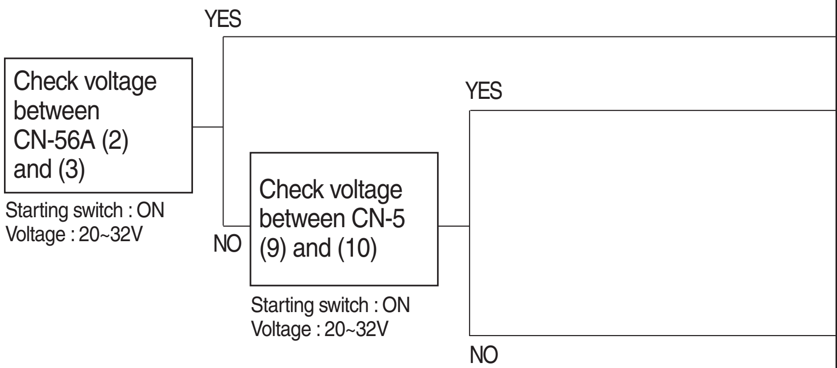
GROUP 3 ELECTRICAL SYSTEM

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. 7, 10.

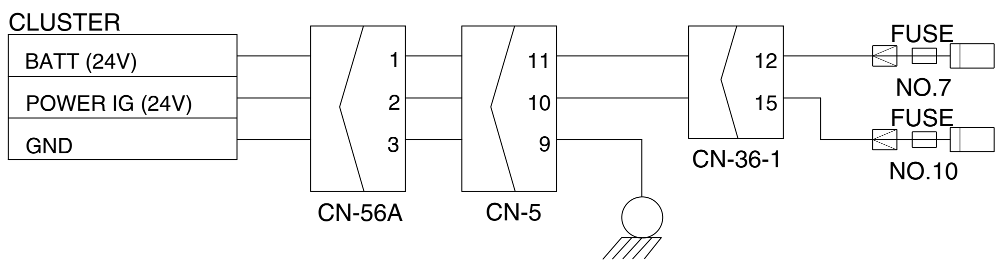
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



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. 7, 10	Repair or replace (after clean)

Check voltage

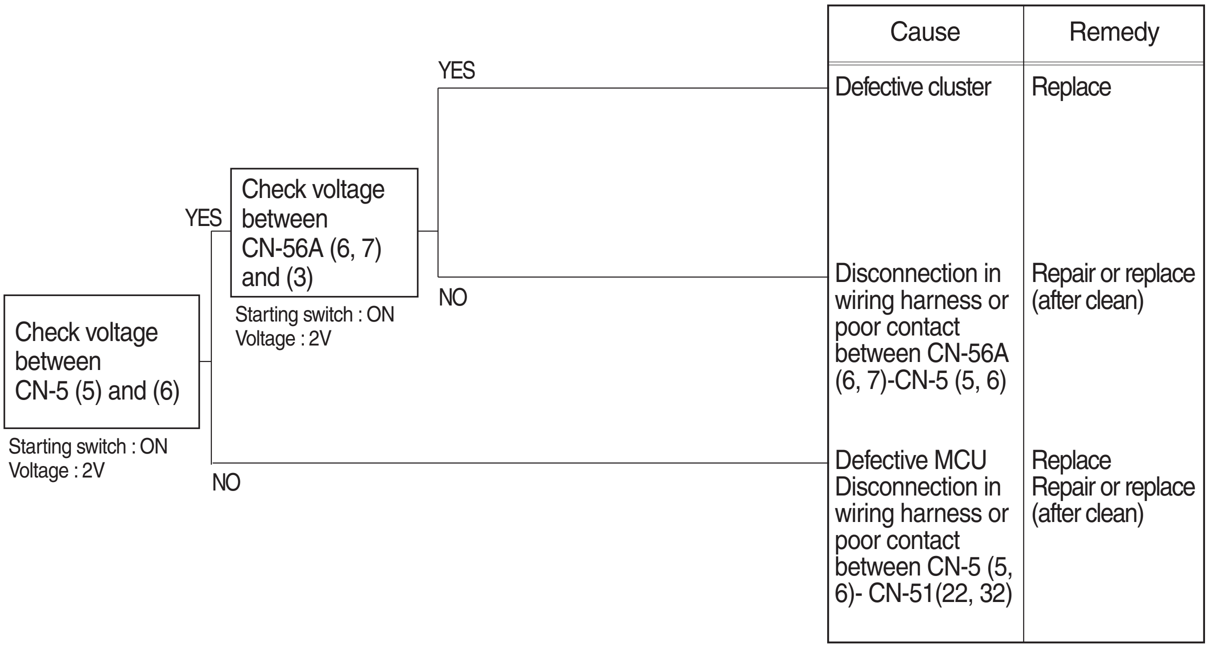
YES	20~32V
NO	0V



145LCR6ES01

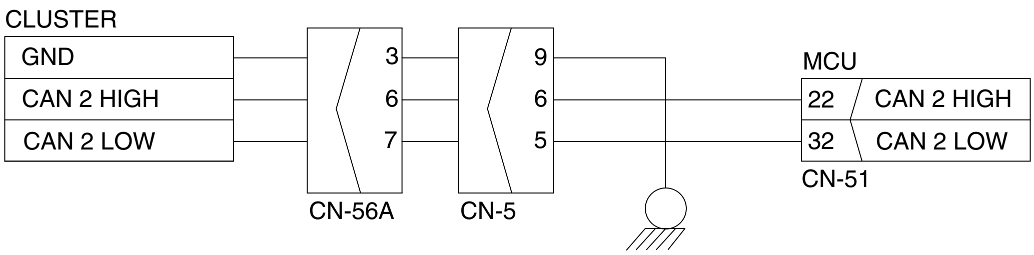
2. COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

· 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

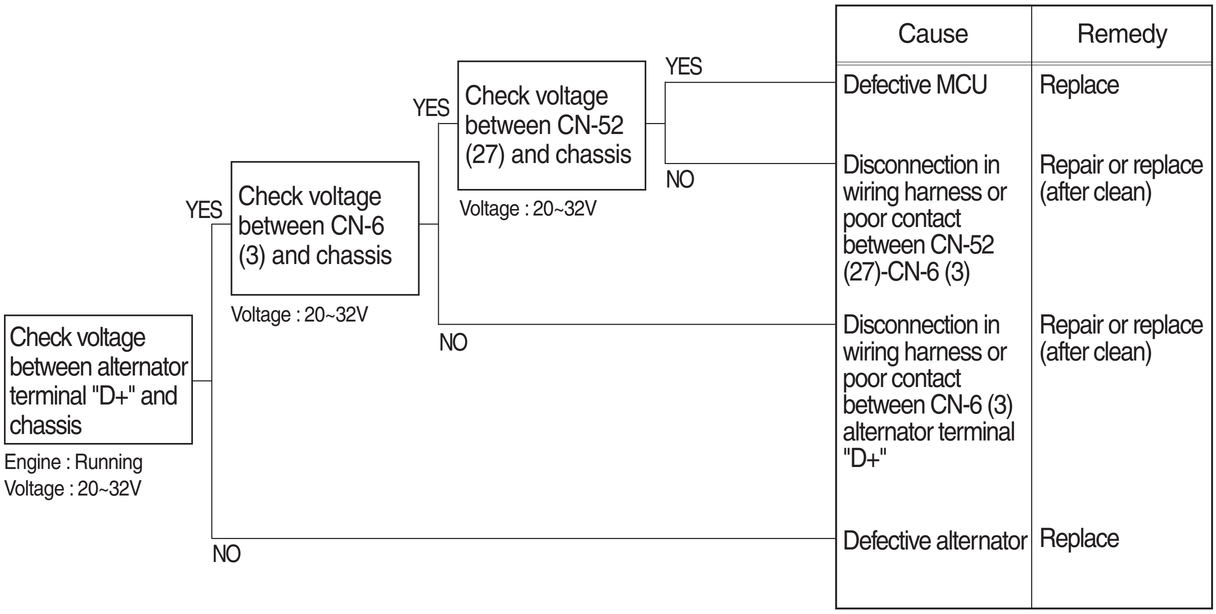
YES	2V
NO	0V



300L6ES02

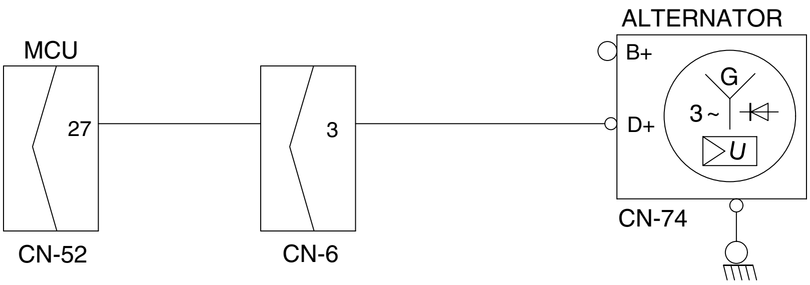
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

· 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

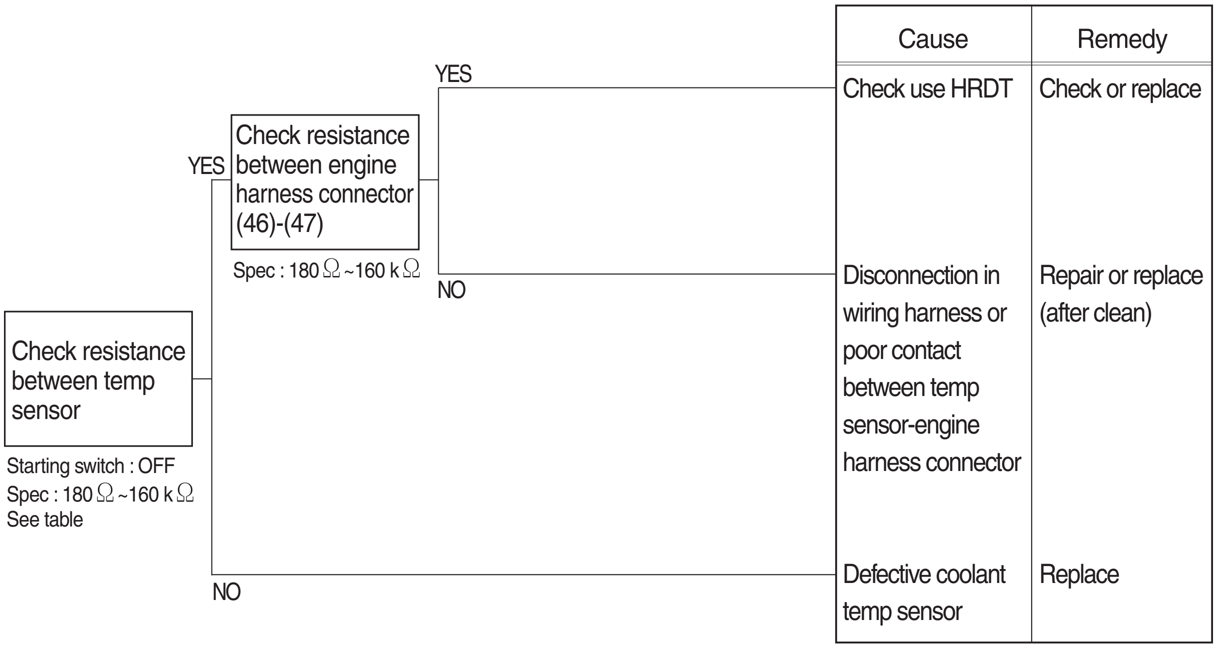
YES	20~32V
NO	0V



130ZF6ES02

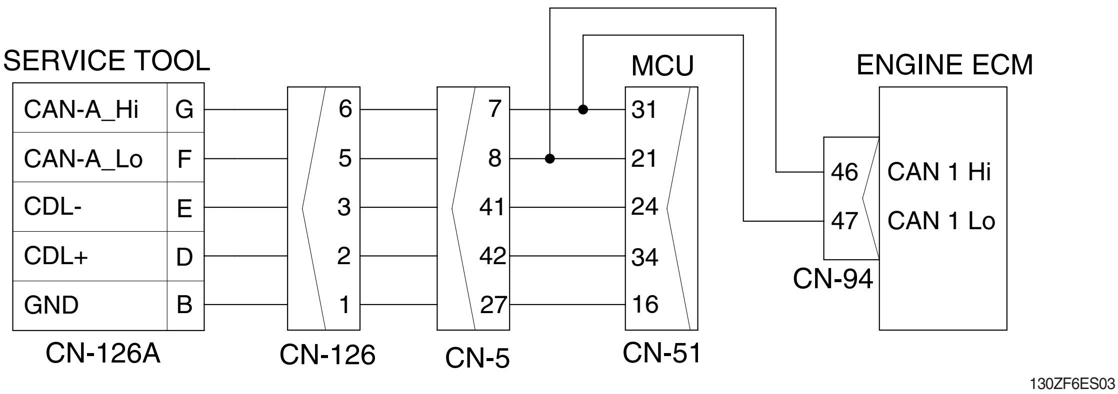
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

· 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.



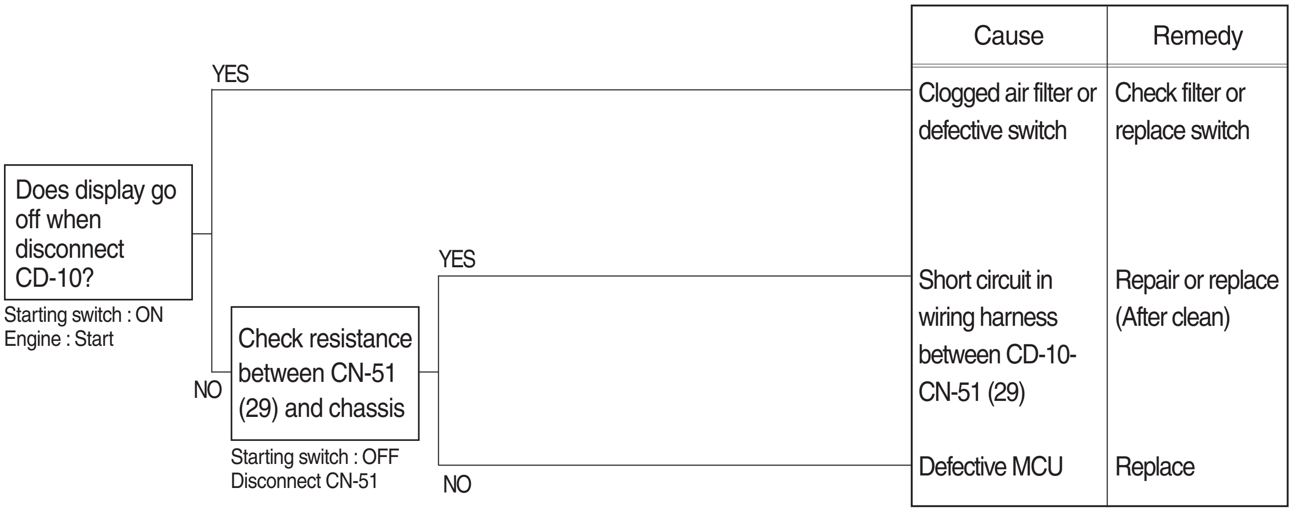
Check Table

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



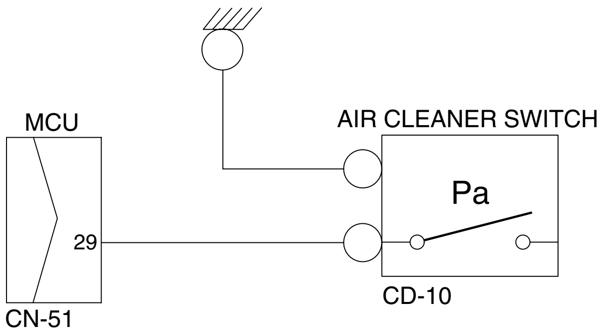
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

· 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

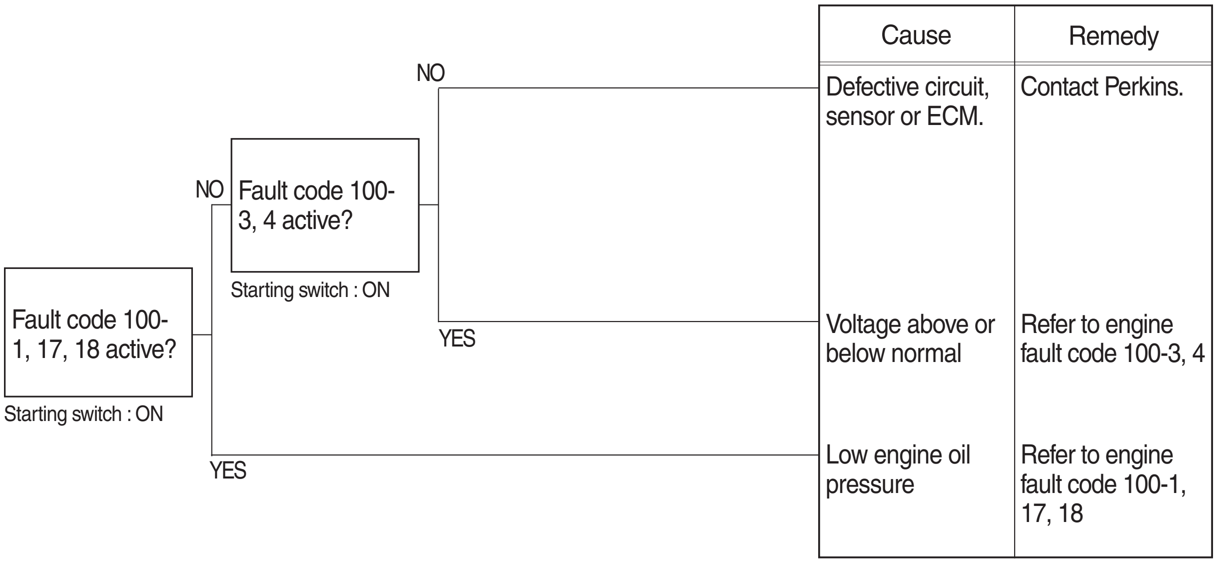
YES	MAX 1Ω
NO	MIN 1MΩ

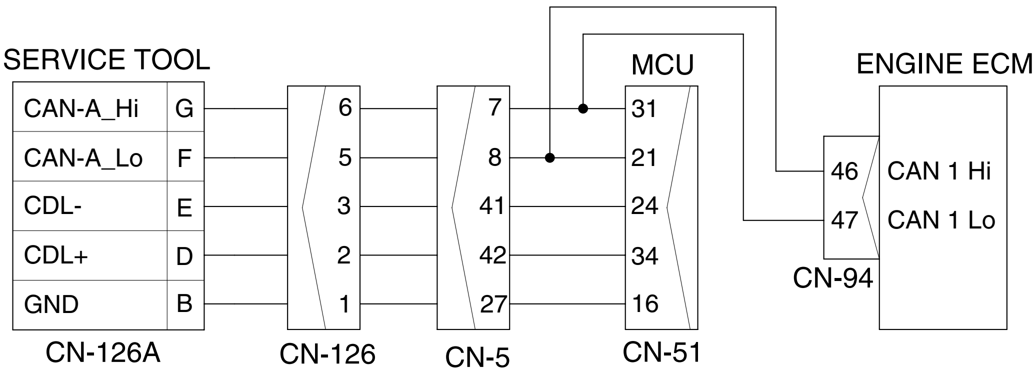


300L6ES06

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.

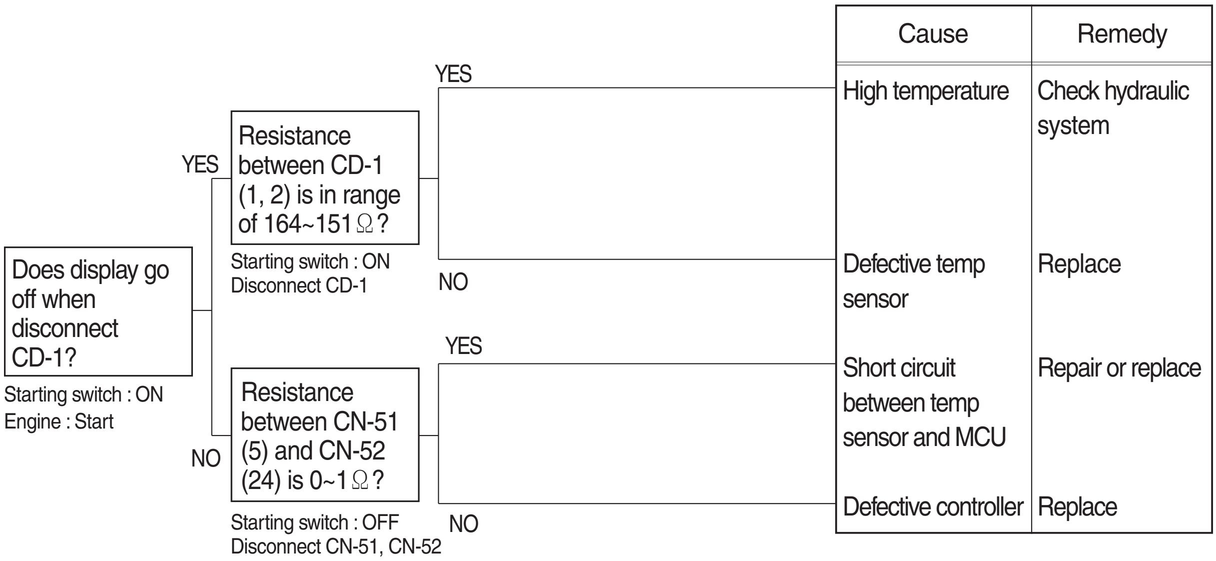


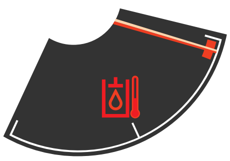


130ZF6ES03

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

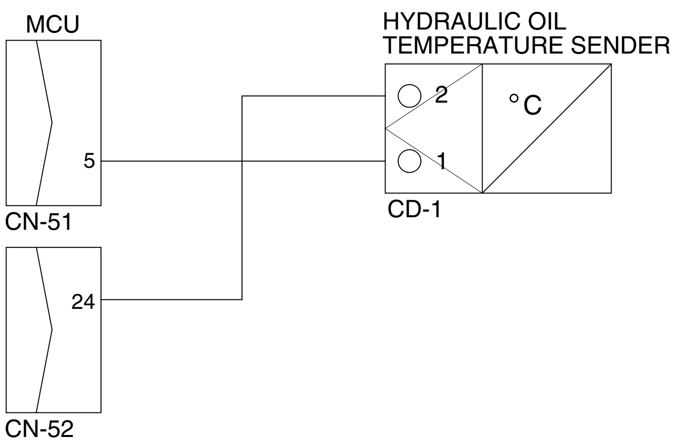
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

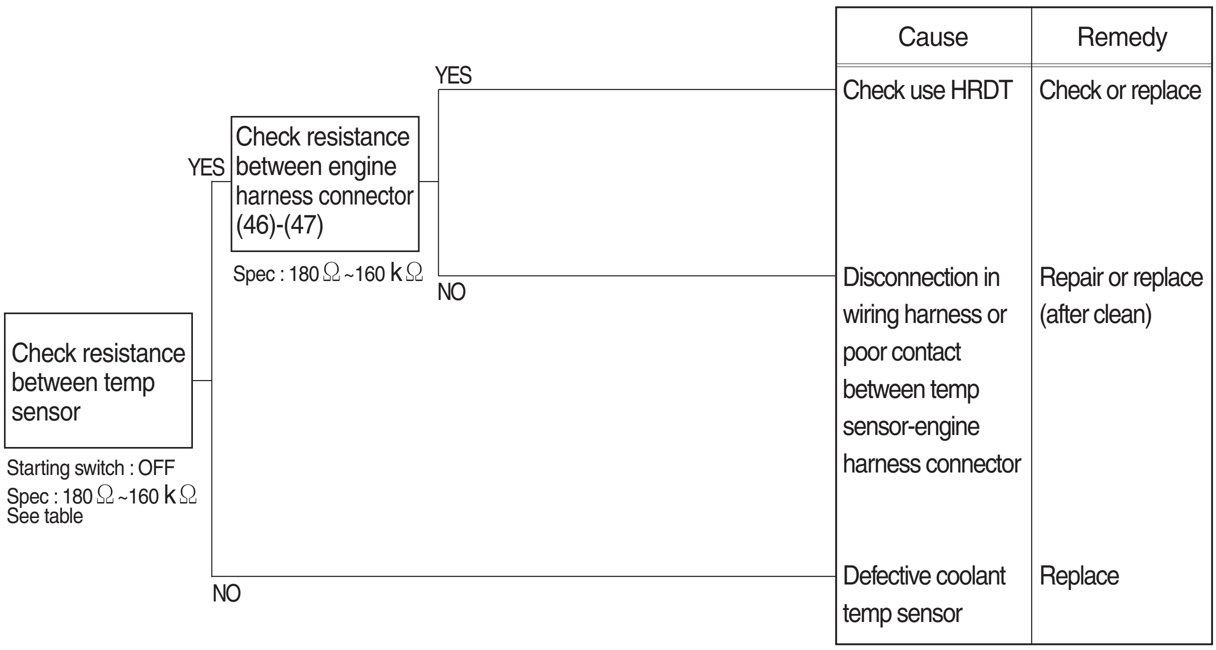
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 0.151



300L6ES08

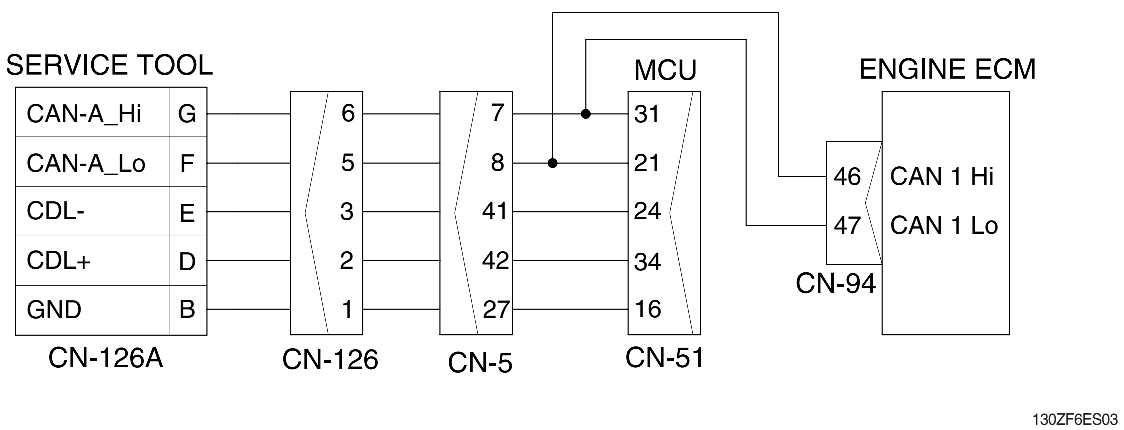
8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

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



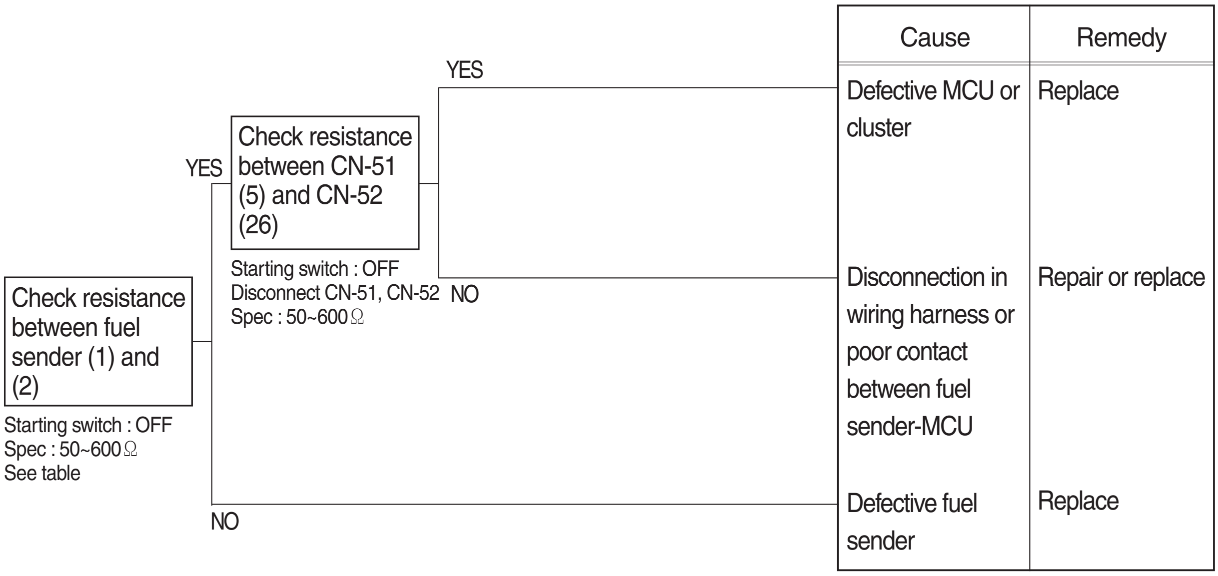
Check Table

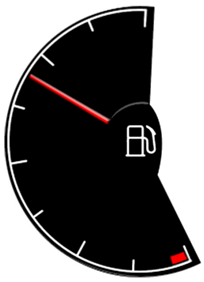
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



9. WHEN FUEL GAUGE DOES NOT OPERATE (HCESPN 301, FMI 3 or 4)

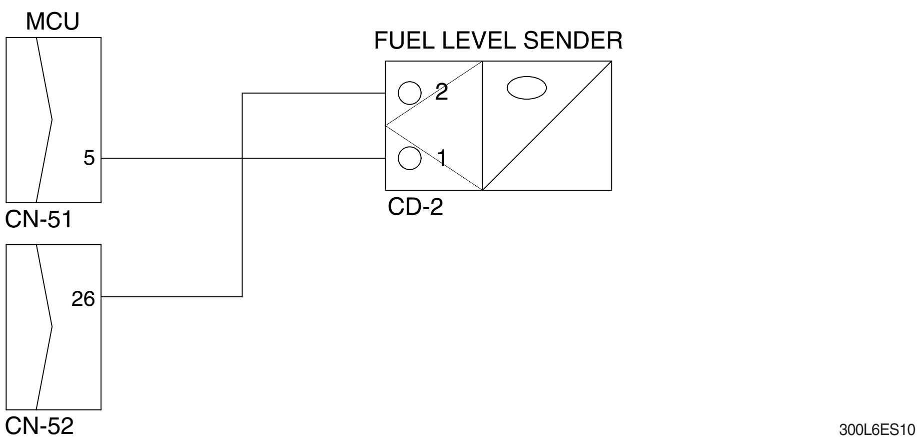
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





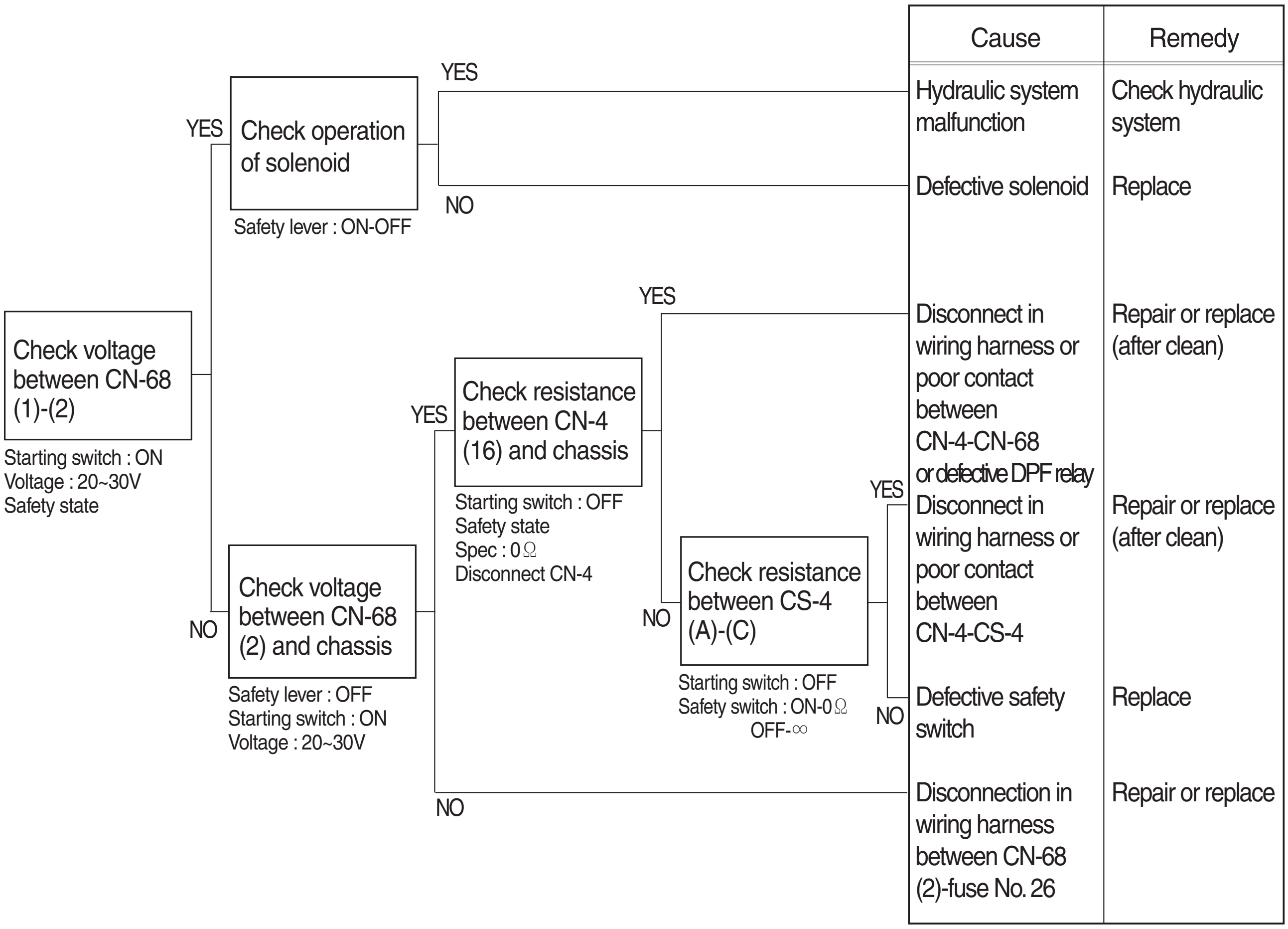
Check Table

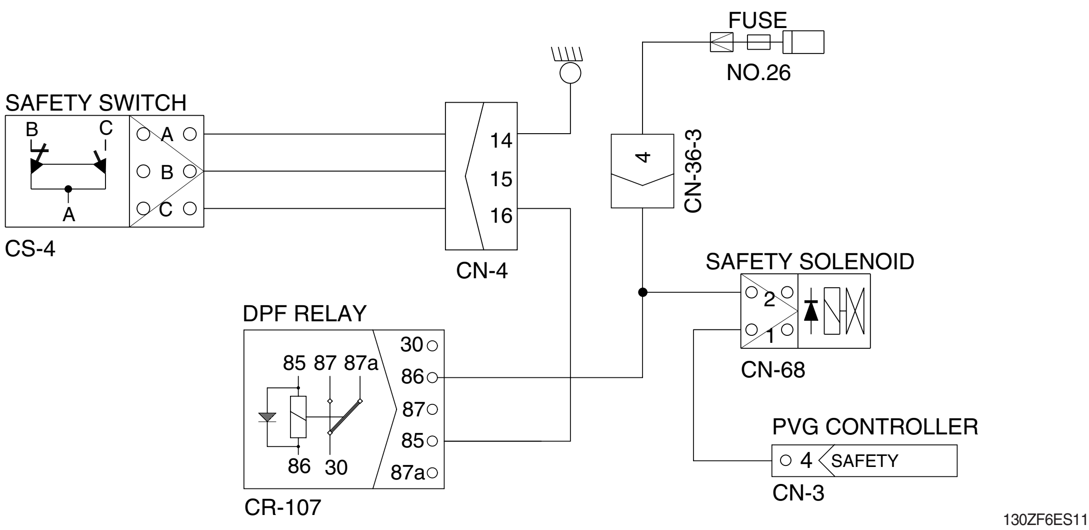
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-



10. WHEN SAFETY SOLENOID DOES NOT OPERATE

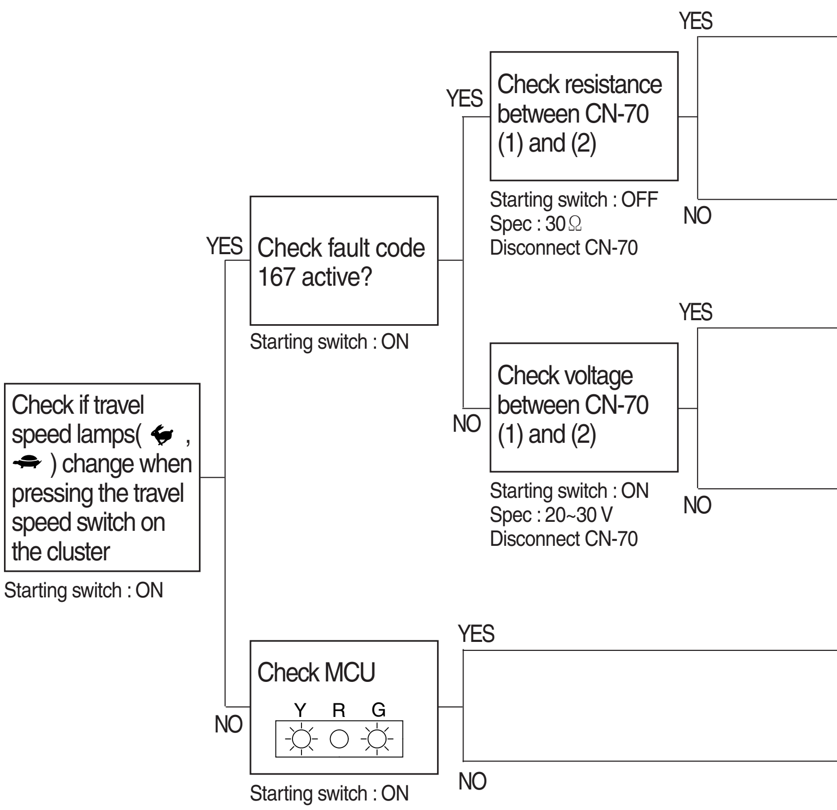
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 26.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



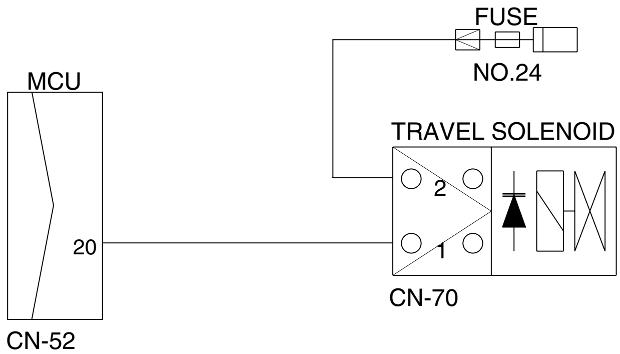


11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE (HCESPN 167, FMI 4 or 6)

· 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. 24.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



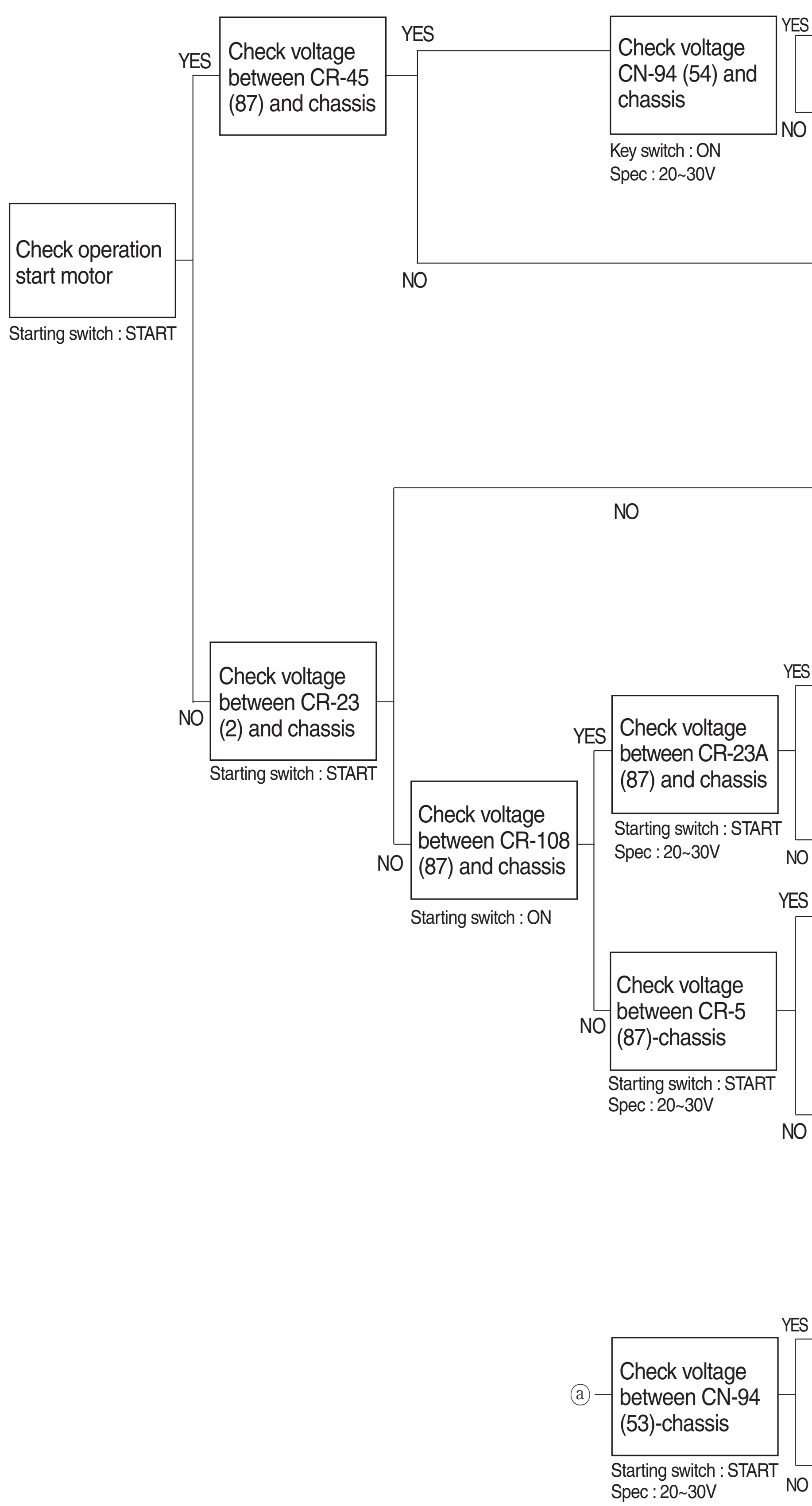
Cause	Remedy
Disconnection in wiring harness or poor contact between CN-70-CN-52	Repair or replace
Defective solenoid	Replace
Defective hydraulic system	Check hydraulic system
Disconnection in wiring harness or poor contact between CN-70-fuse No. 24	Repair or replace
Defective cluster	Replace
Defective MCU	Replace



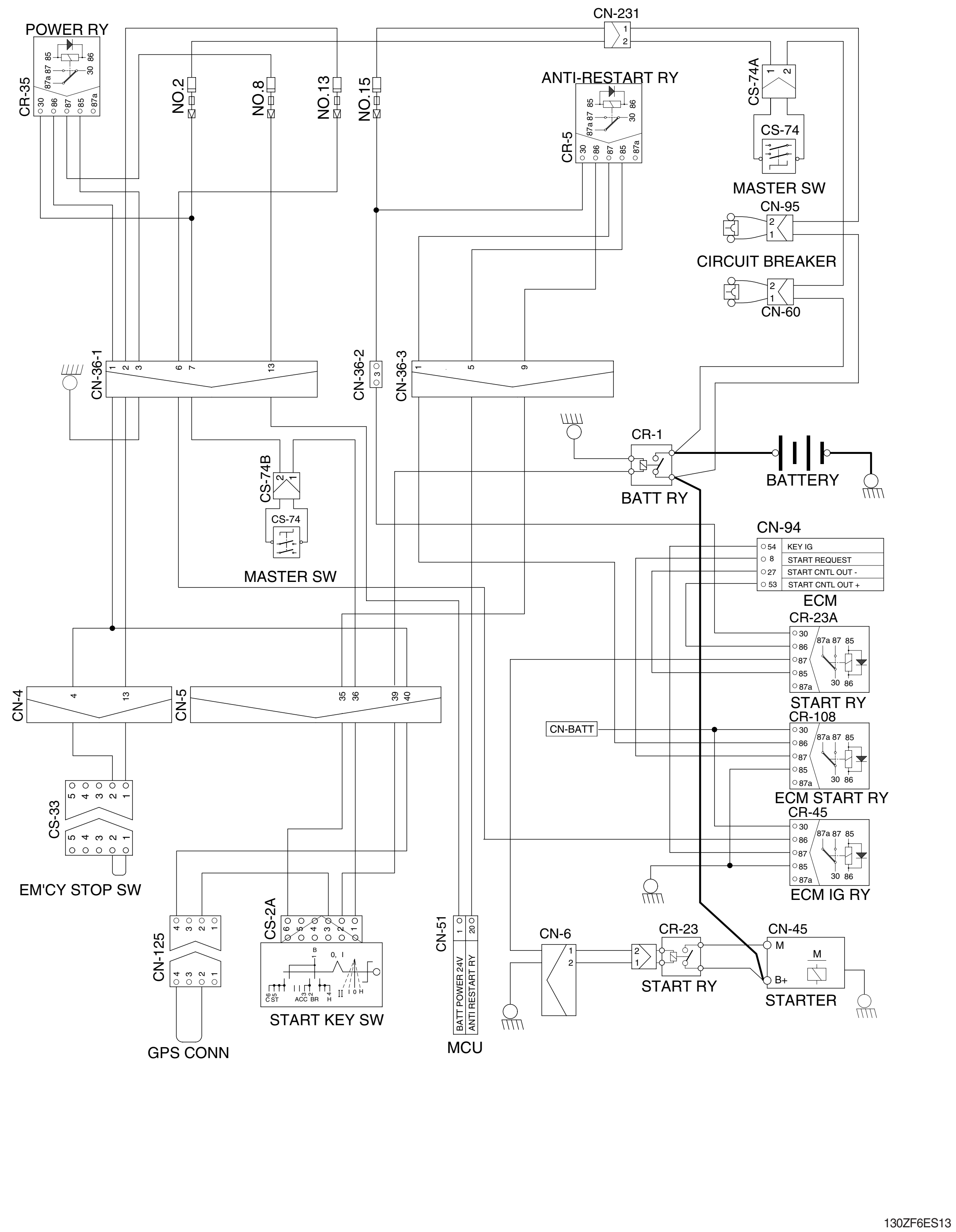
145LCR6ES12

12. WHEN ENGINE DOES NOT START ([- +] lights up condition)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 2, 3, 11, 15, 19.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

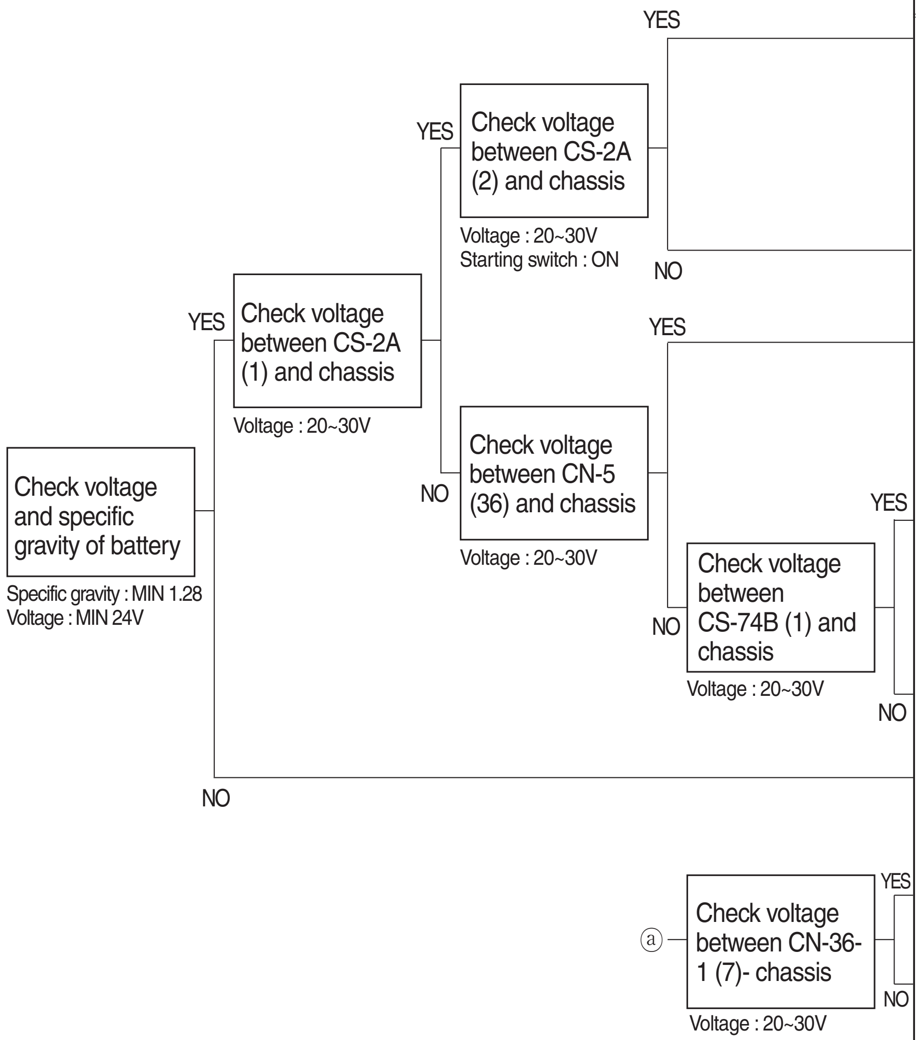


Cause	Remedy
Defective ECM or battery	Replace
Disconnection in wiring harness or poor contact between 45 (87)-CN-94 (54)	Repair or replace
Defective ECM IG relay or disconnection in wiring harness or poor contact between CR-45 (86)-fuse No.13	Repair or replace
Defective start relay or start motor or disconnection in wiring harness or poor contact between CR-23 (2)-CN-45 (M)	Replace Repair or replace
Disconnection in wiring harness or poor contact between CR-23A (87)-CR-23 (2)	Repair or replace
ⓐ	
Defective ECM start relay or disconnection in wiring harness or poor contact between CR-5 (85)-CR-108 (86)	Repair or replace
Defective anti-restart relay or disconnection in wiring harness or poor contact between CN-51 (20)-CR-5 (85)	Repair or replace
Disconnection in wiring harness or poor contact between CN-94 (53)-CR-23A (86)	Repair or replace
Defective ECM	Replace

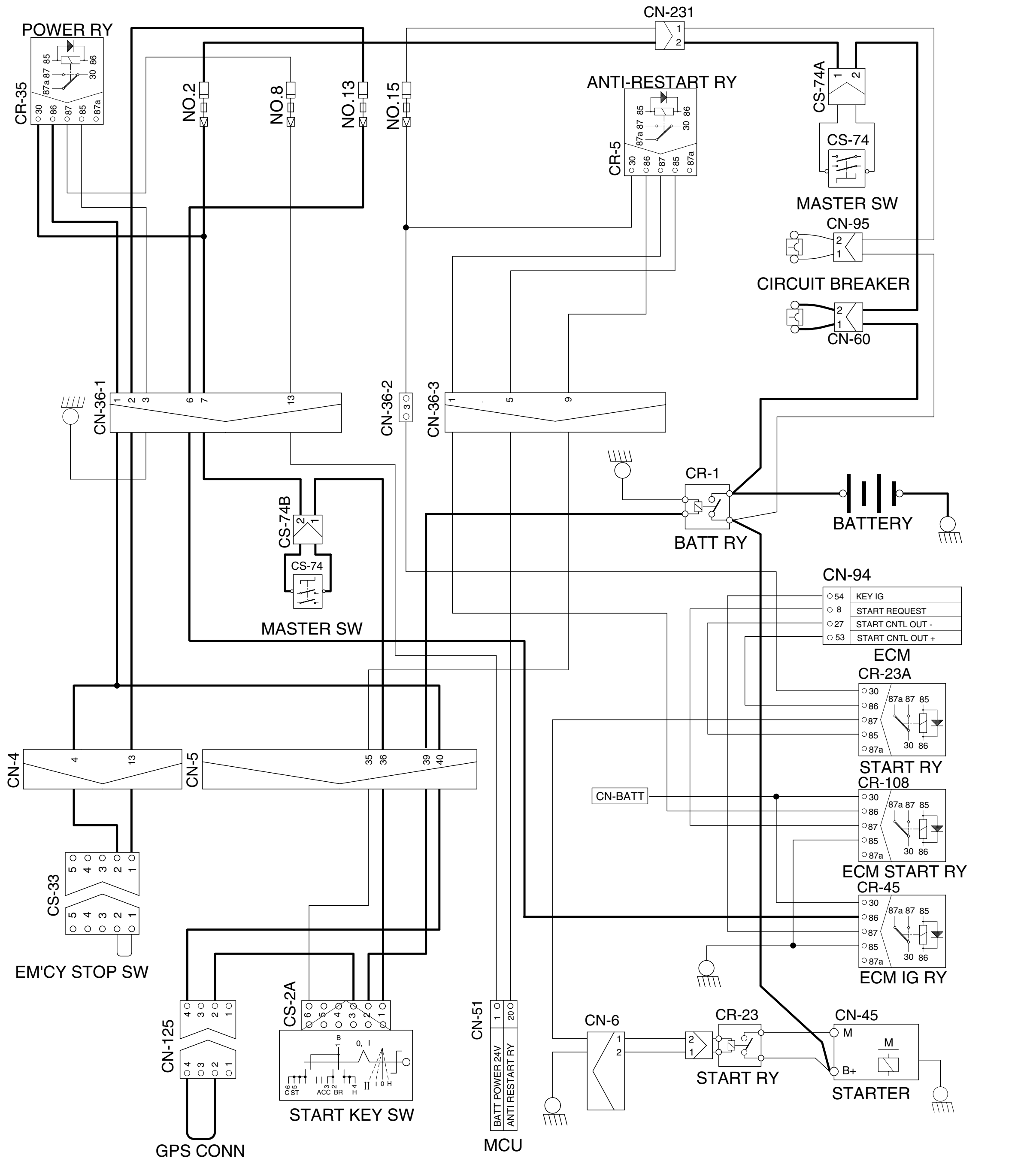


13. WHEN STARTING SWITCH ON DOES NOT OPERATE

· 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 open circuit of circuit breaker (CN-60, CN-95).
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



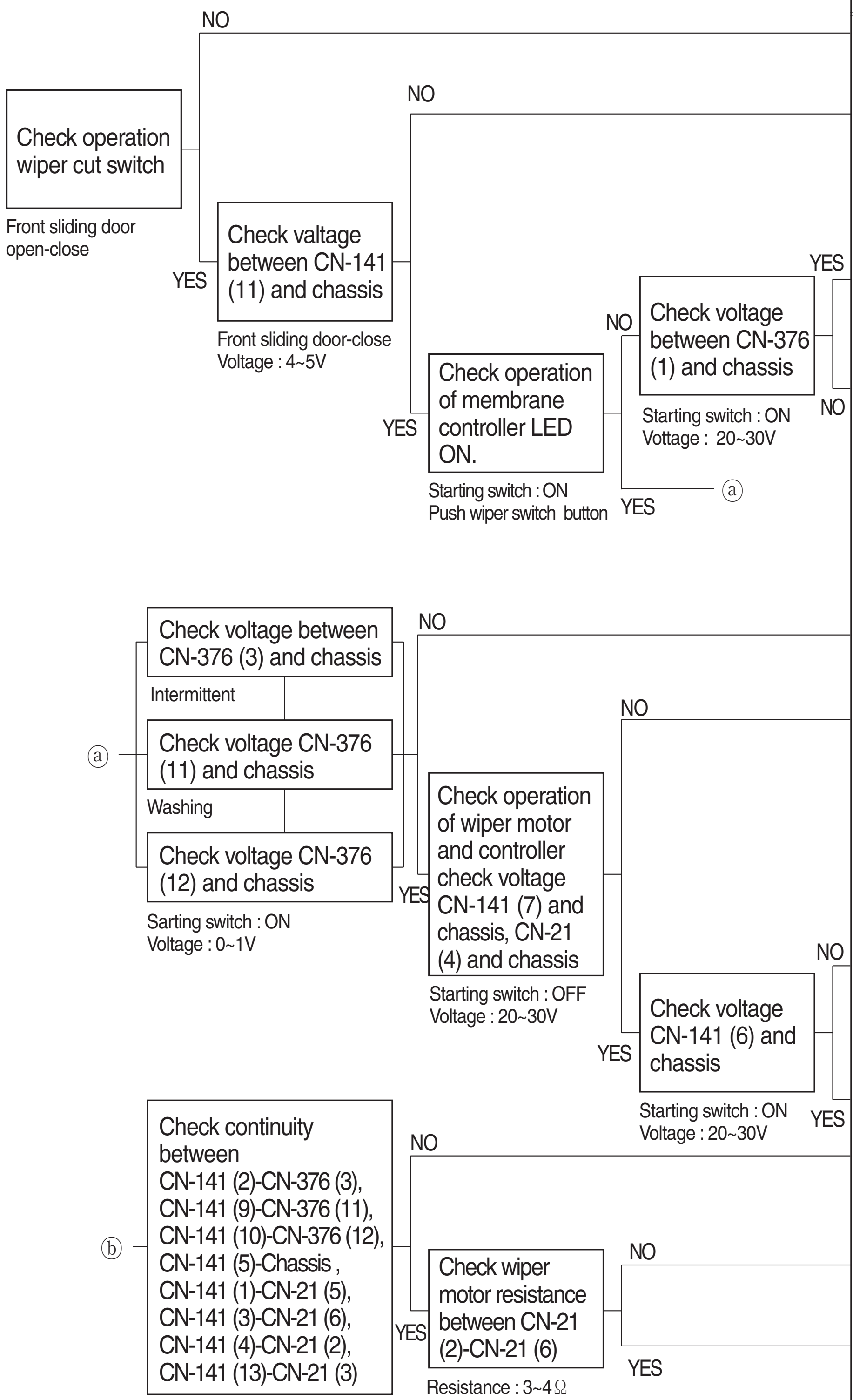
Cause	Remedy
Disconnection in wiring harness or defective battery relay	Repair or replace (after clean)
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2A (1)-CN-5 (36)	Replace
Disconnection in wiring harness or poor contact between CS-74B (1) -CN-5 (36)	Charge or replace (after clean)
ⓐ	
Battery capacity too low	Charge or replace (after clean)
Defective master switch	Replace
Disconnection in wiring harness or poor contact between CN-36-1 (7)-fuse No.2	Charge or replace (after clean)
Recheck fuse No.2	Replace



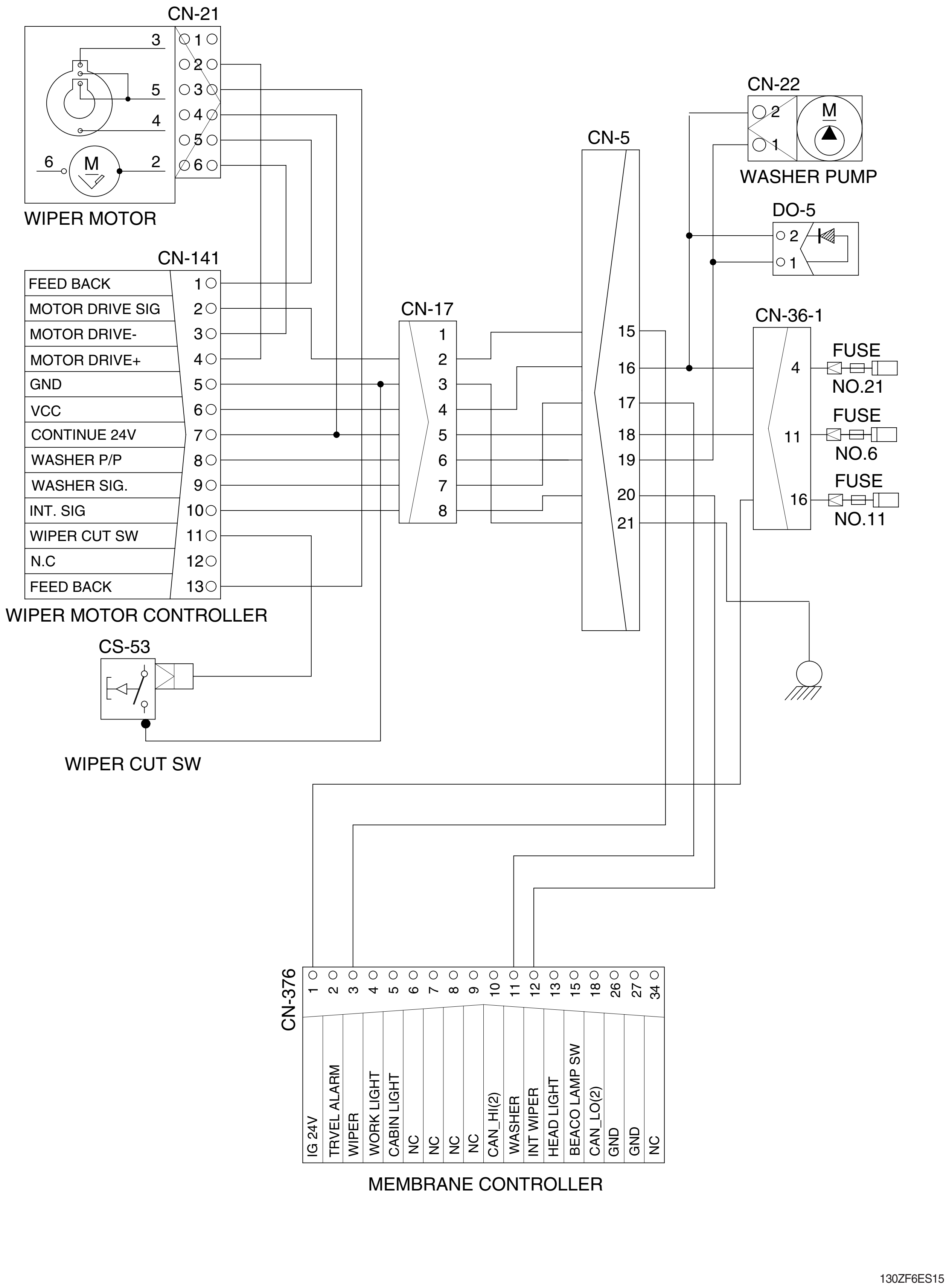
130ZF6ES14

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No. 6, 11 and 21 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



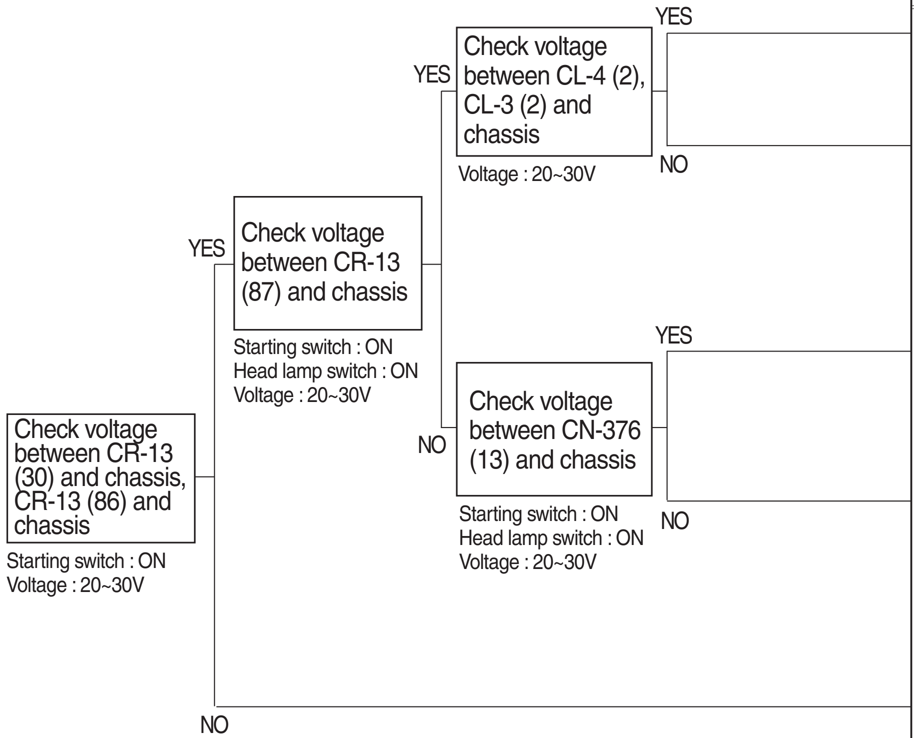
Cause	Remedy
Defective wiper cut switch	Replace
Short circuit in wiring harness or poor contact between CN-141 (11)- CS-53	Repair or replace (after clean)
Defective membrane controller	Replace
1)Recheck fuse No.11	Replace
2)Disconnection in wiring harness or poor contact between CN-376(1)-Fuse	Repair or replace (after clean)
Defective membrane controller	Replace
1) Recheck fuse No.6	Replace
2) Disconnection in wiring harness or poor contact between CN-141(7)-Fuse, CN-21(4)-Fuse	Repair or replace (after clean)
1) Recheck fuse No.21	Replace
2) Disconnection CN-141(6)-Fuse	Repair or replace (after clean)
ⓑ	
Disconnection in wiring harness or poor contact	Repair or replace (after clean)
Defective wiper motor	Replace
Defective wiper motor controller	Replace



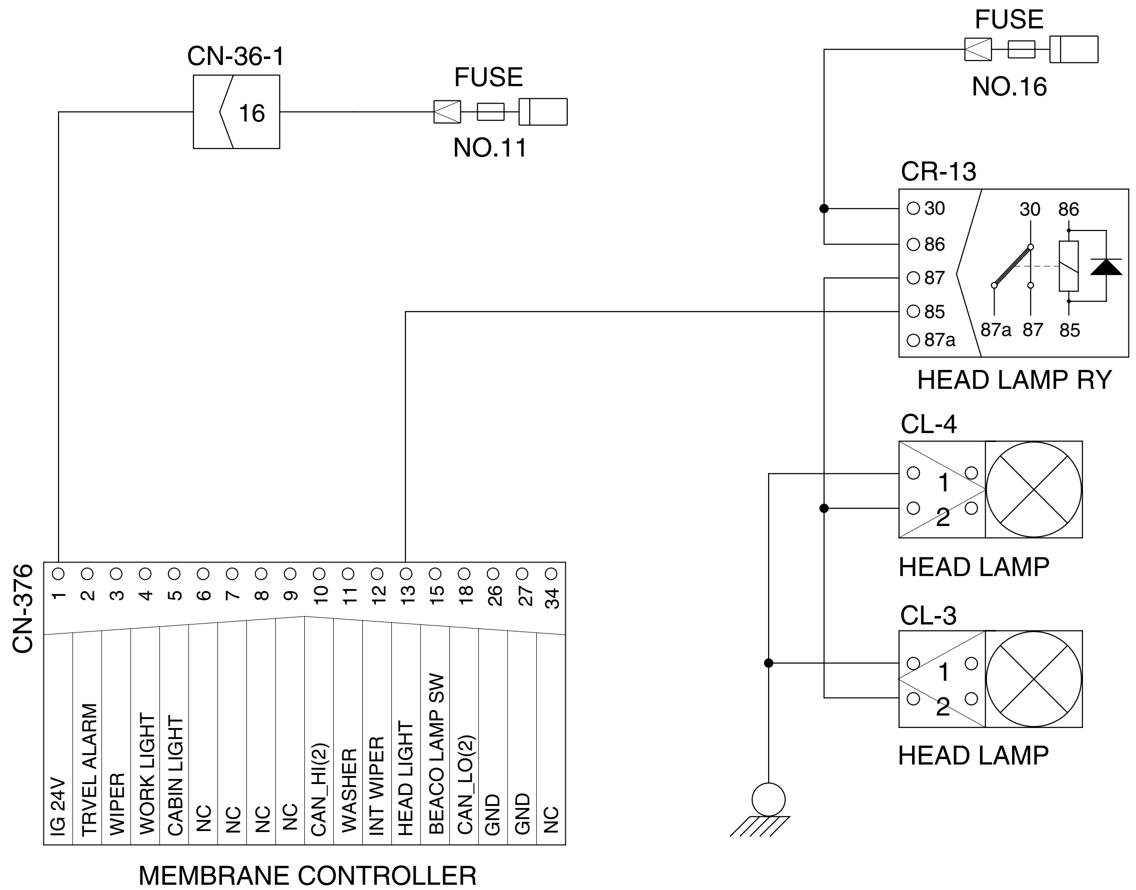
130ZF6ES15

15. 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.16.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



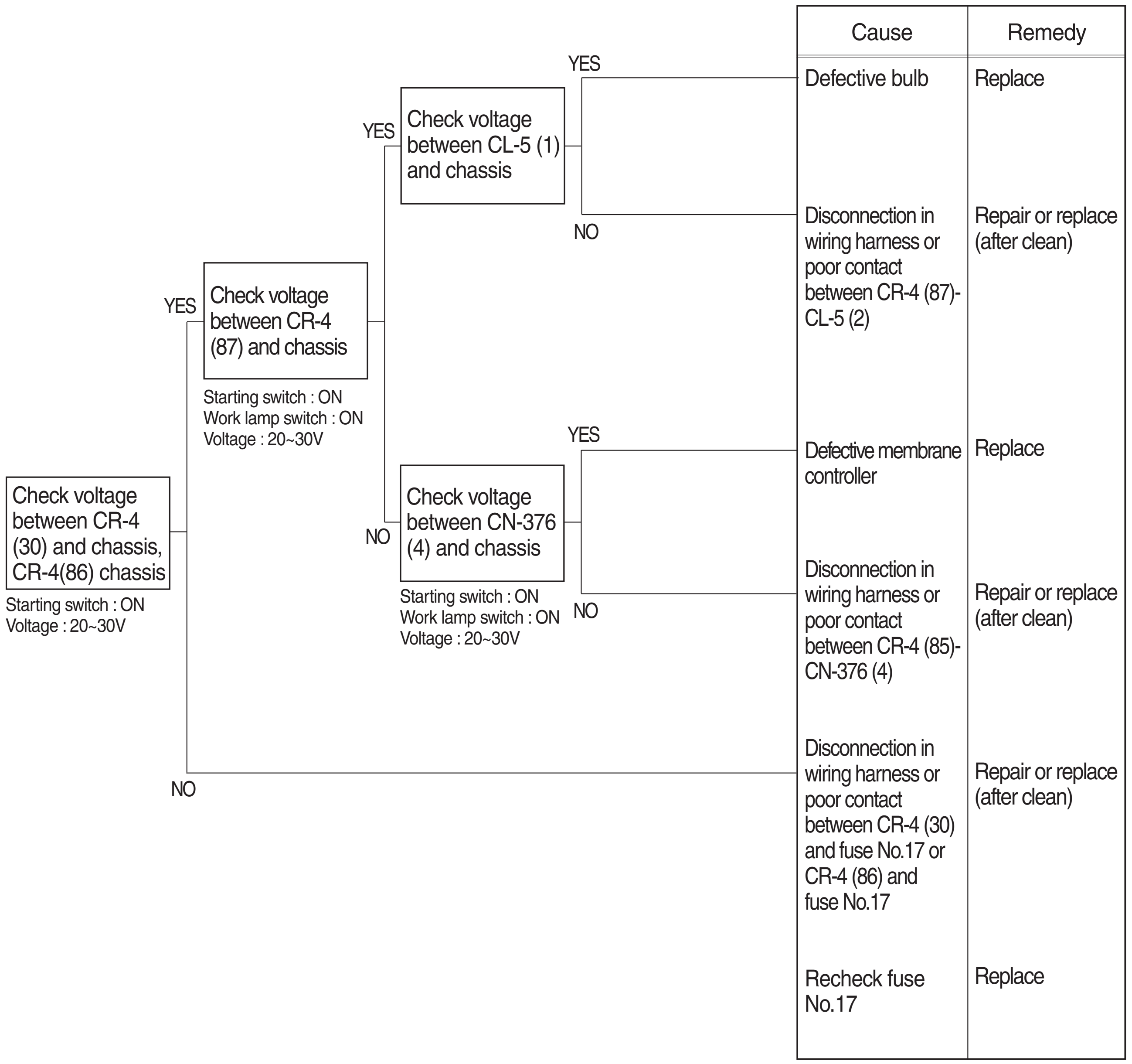
Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-13 (87)-CL-4 (2) or CR -13 (87)-CL-3 (2)	Repair or replace (after clean)
Defective membrane controller	Replace
Disconnection in wiring harness or poor contact between CN-376 (13)-CR-13 (87)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-13 (30) and fuse No.16 or CR-13 (86) - fuse No.16	Repair or replace (after clean)
Recheck fuse No. 16	Replace

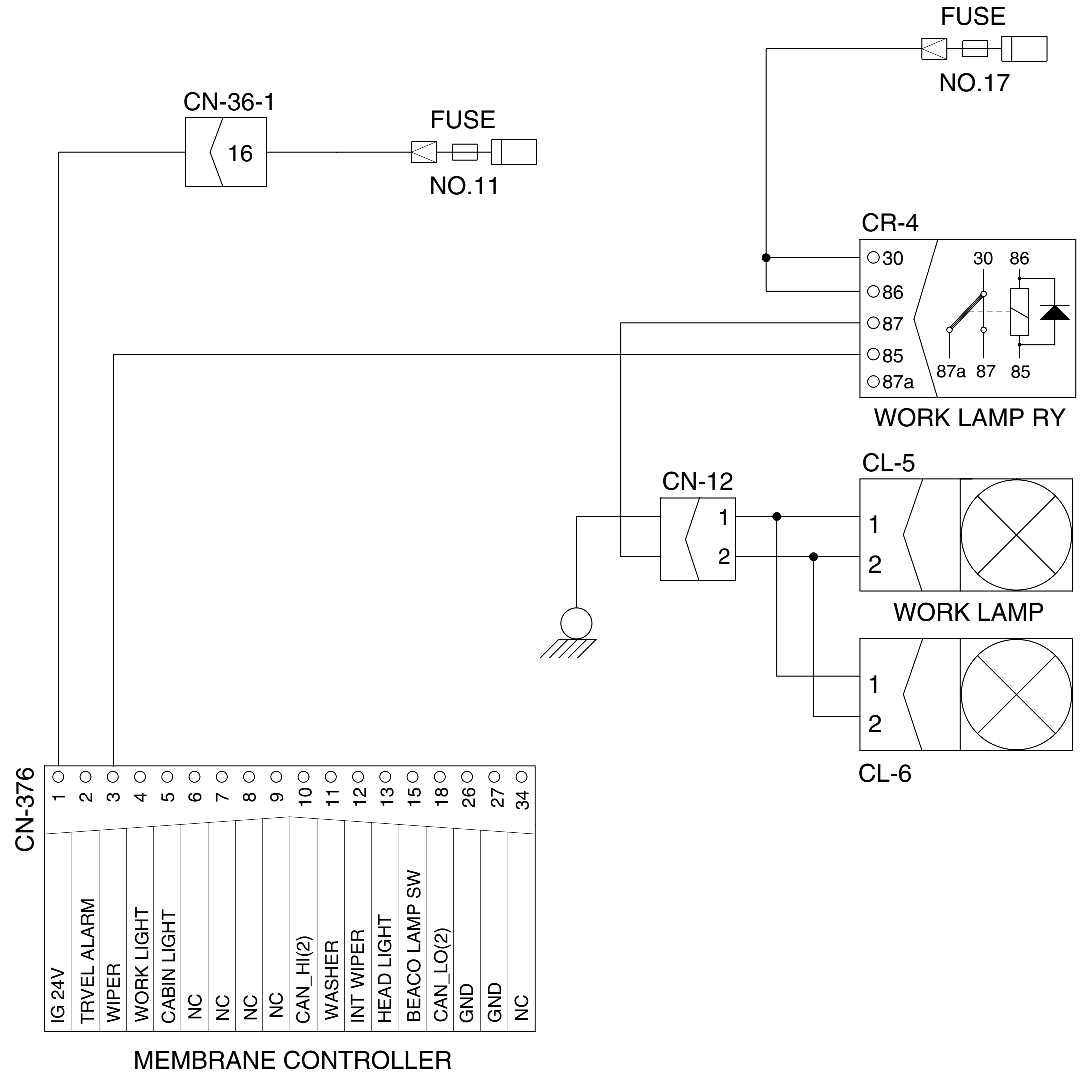


130ZF6ES16

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

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





130ZF6ES17

GROUP 4 MECHATRONICS SYSTEM

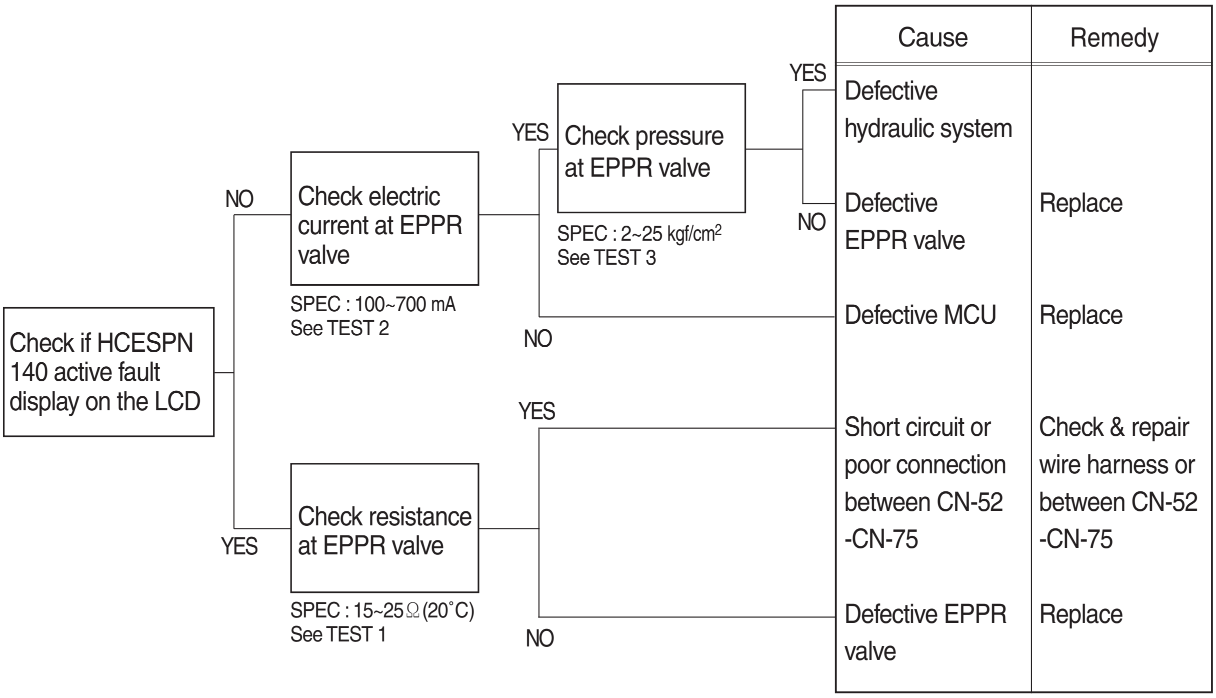
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.

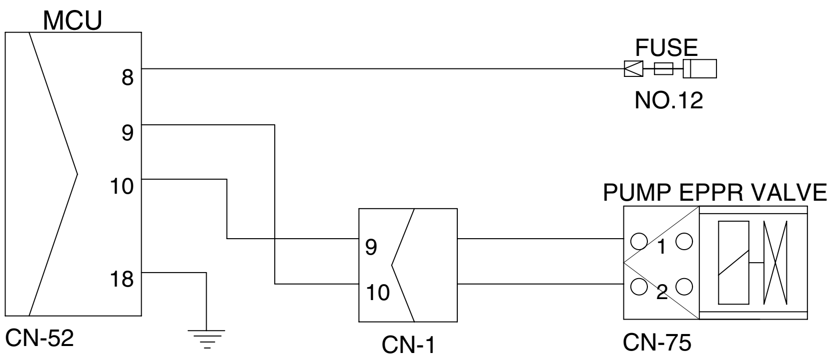
※ Spec : P-mode 1850 ± 50 rpm S -mode 1750 ± 50 rpm E-mode 1650 ± 50 rpm

※ Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

1) INSPECTION PROCEDURE



Wiring diagram

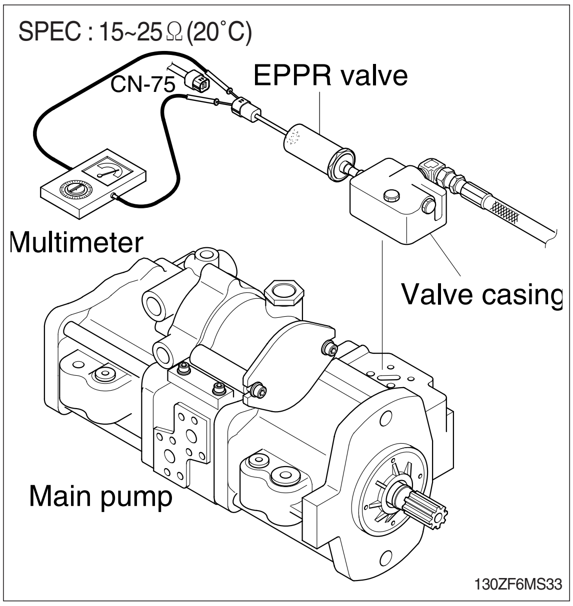


140L6MS01

2) TEST PROCEDURE

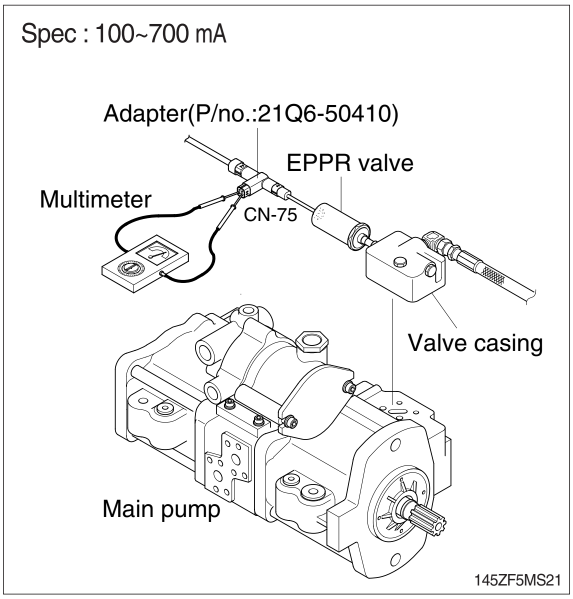
(1) Test 1 : Check resistance at connector CN-75.

① Starting switch OFF.
② Disconnect connector CN-75 from EPPR valve at main hydraulic pump.
③ Check resistance between 2 lines as figure.



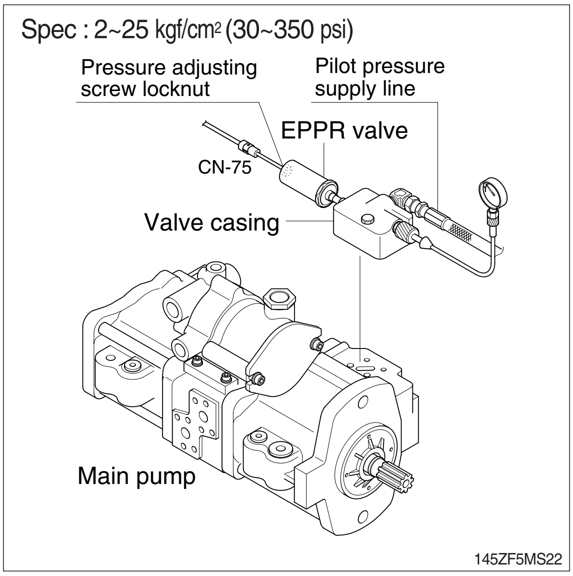
(2) Test 2 : Check electric current at EPPR valve.

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 multimodal dial at 10.
⑥ If tachometer show approx 1750±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.

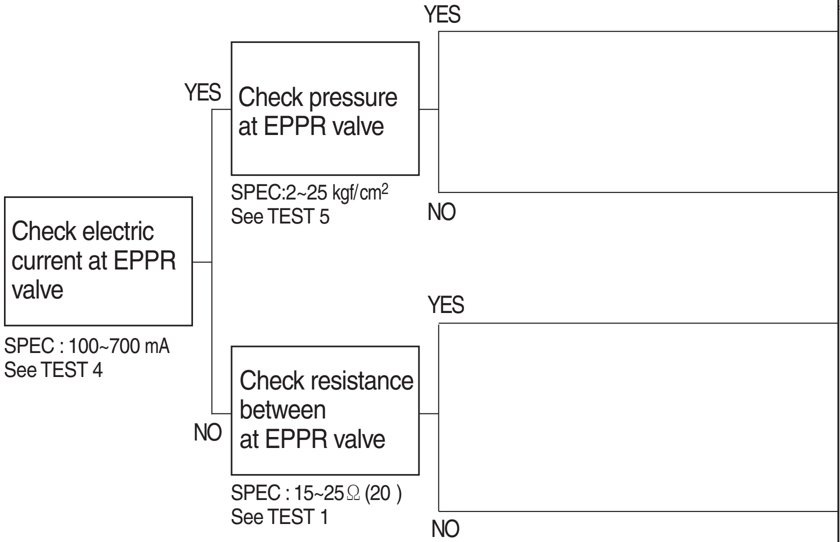
① Remove plug and connect pressure gauge as figure.
 · Gauge capacity : 0 to 50 kgf/cm^2
  (0 to 725 psi)
② Start engine.
③ Set S-mode and cancel auto decel mode.
④ Position the multimodal dial at 10.
⑤ If tachometer show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.



2. ENGINE STALL

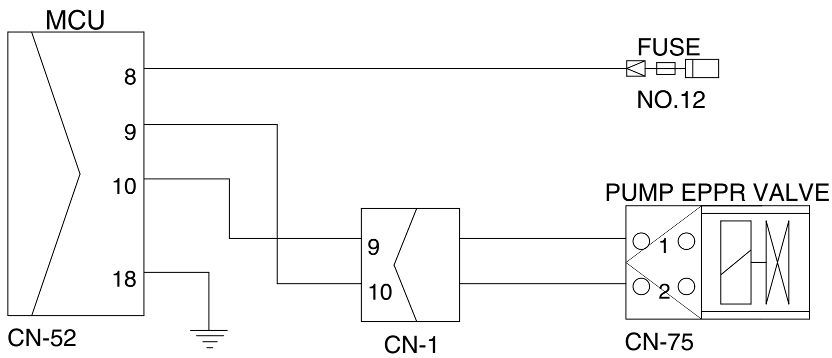
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Not enough engine power	Check engine fault Contact cummins
Defective EPPR valve	Replace
Short circuit or poor connection between CN-52 - CN-75	Check and repair wire harness
Defective EPPR valve	Replace

Wiring diagram



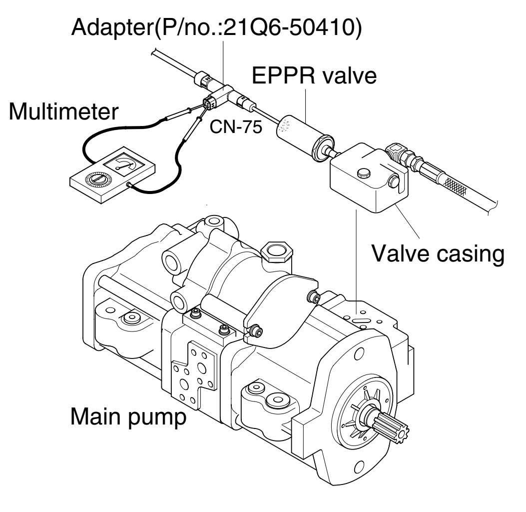
140L6MS01

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 multimodal dial at 10.
⑥ If rpm show approx 1750±50 rpm disconnect one wire harness from EPPR valve.
⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA

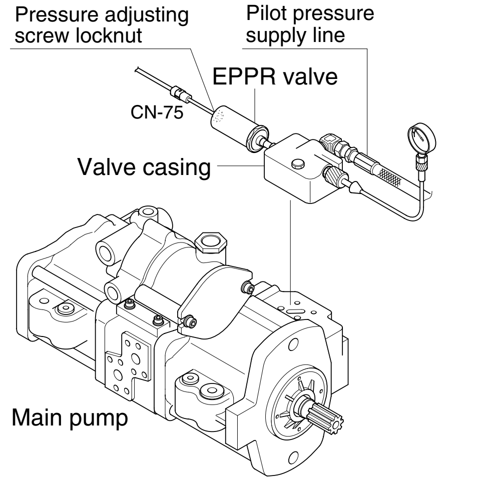


145ZF5MS21

(2) Test 5 : 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 multimodal dial at 10.
⑤ If rpm show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.

SPEC : 2~25 kgf/cm^2 (30~350 psi)

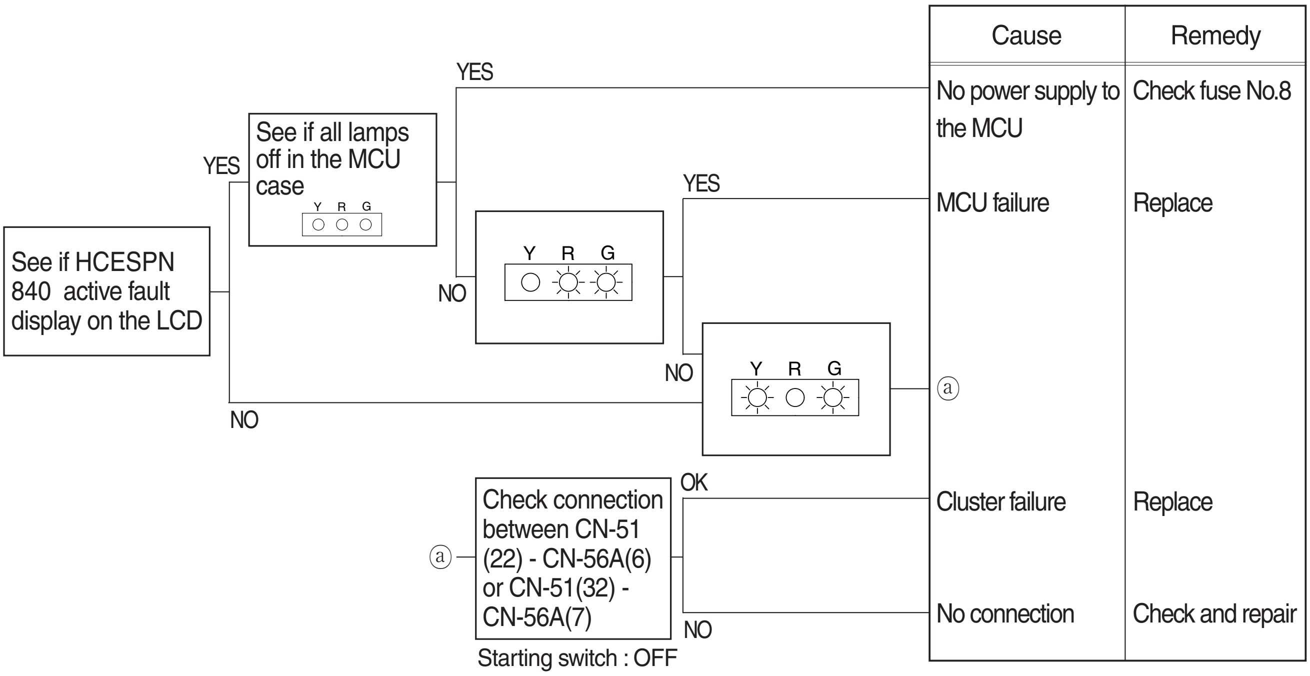


145ZF5MS22

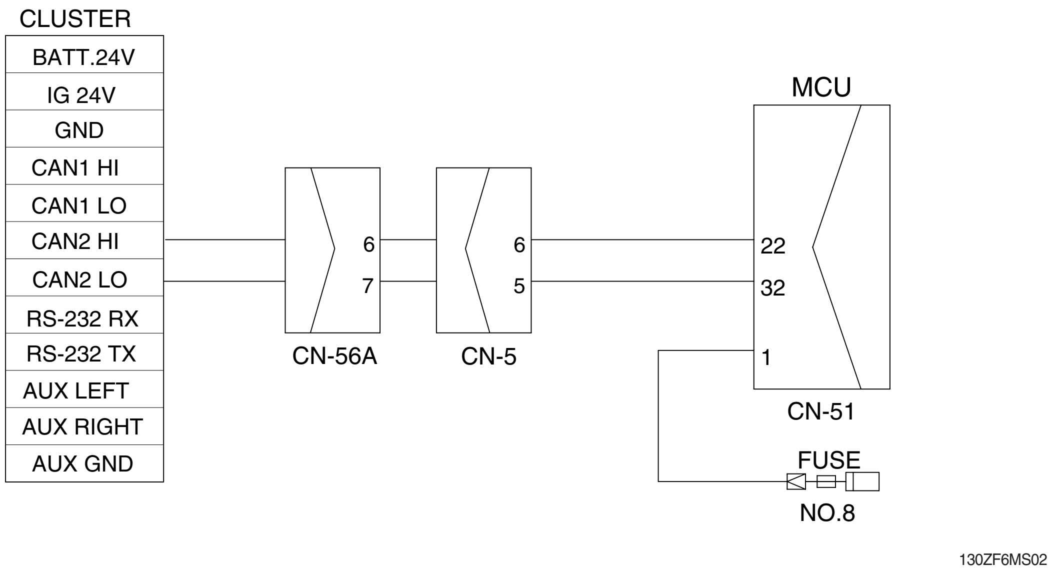
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

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

1) INSPECTION PROCEDURE



Wiring diagram

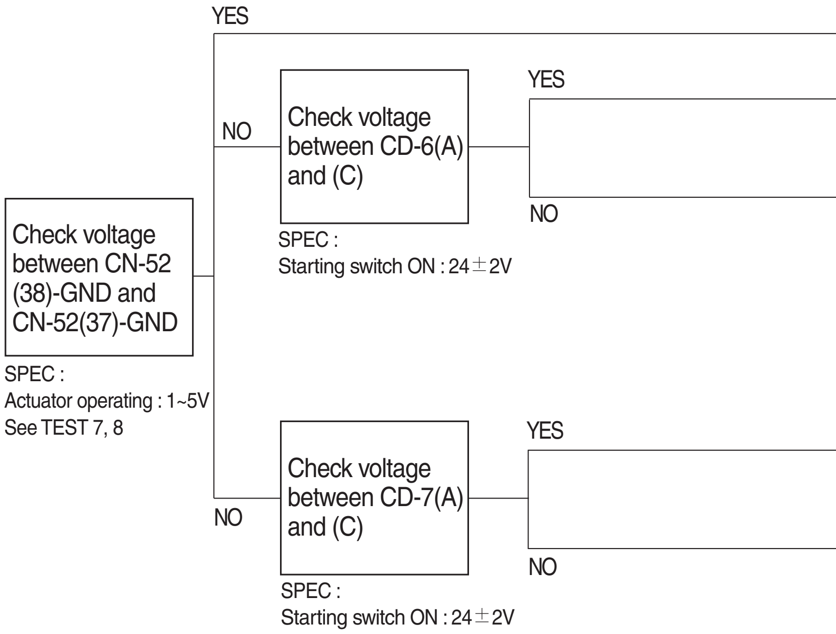


4. AUTO DECEL SYSTEM DOES NOT WORK

· Fault code : HCESPN 105, FMI 0~4 (work pressure sensor)
HCESPN 108, FMI 0~4 (travel oil pressure sensor)

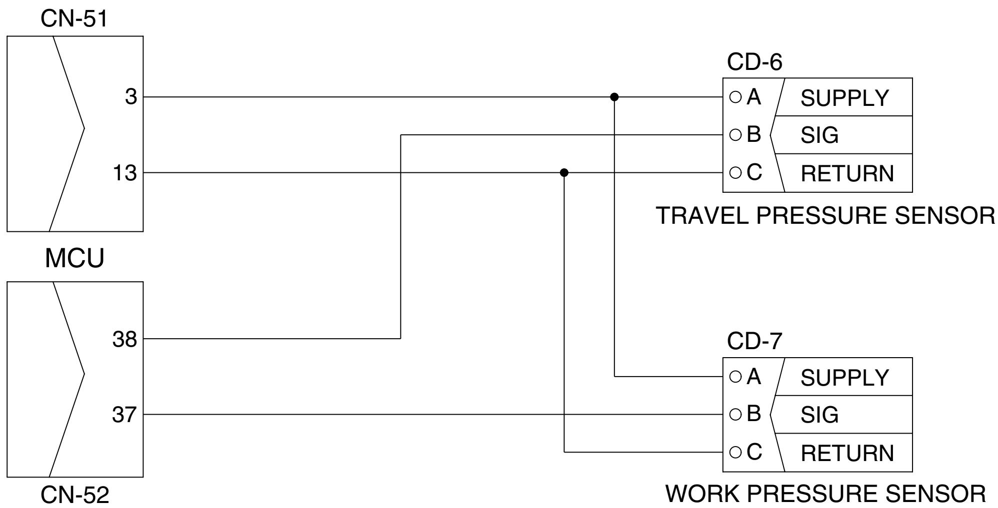
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Defective travel pressure switch	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



300L6MS03

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 ON.

④ Check voltage as figure.

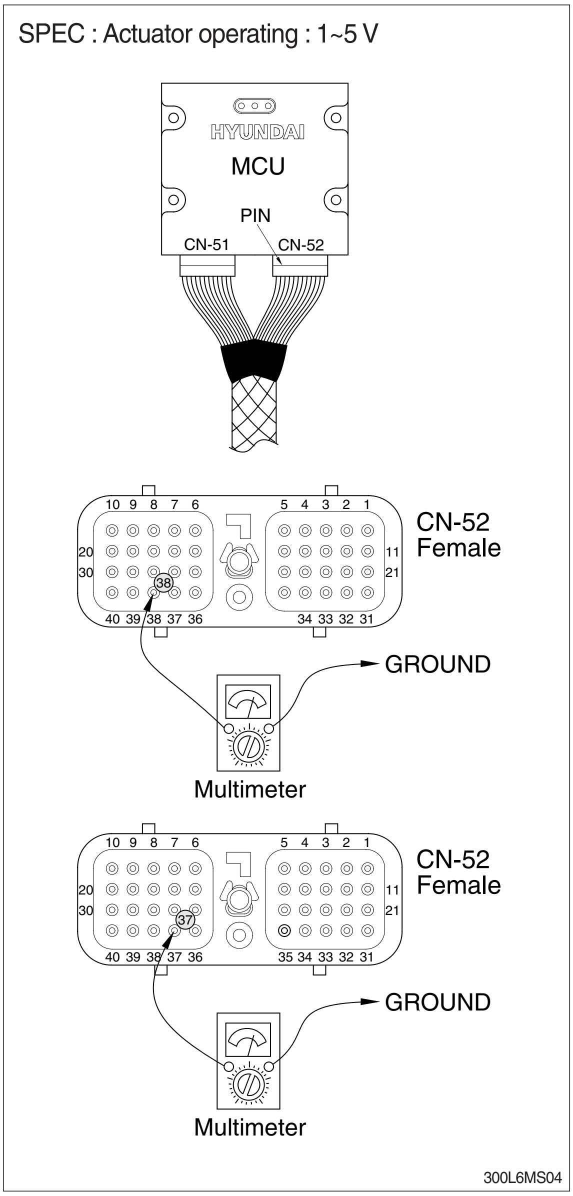
(2) Test 8 : Check voltage at CN-52 (37) and ground.

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.

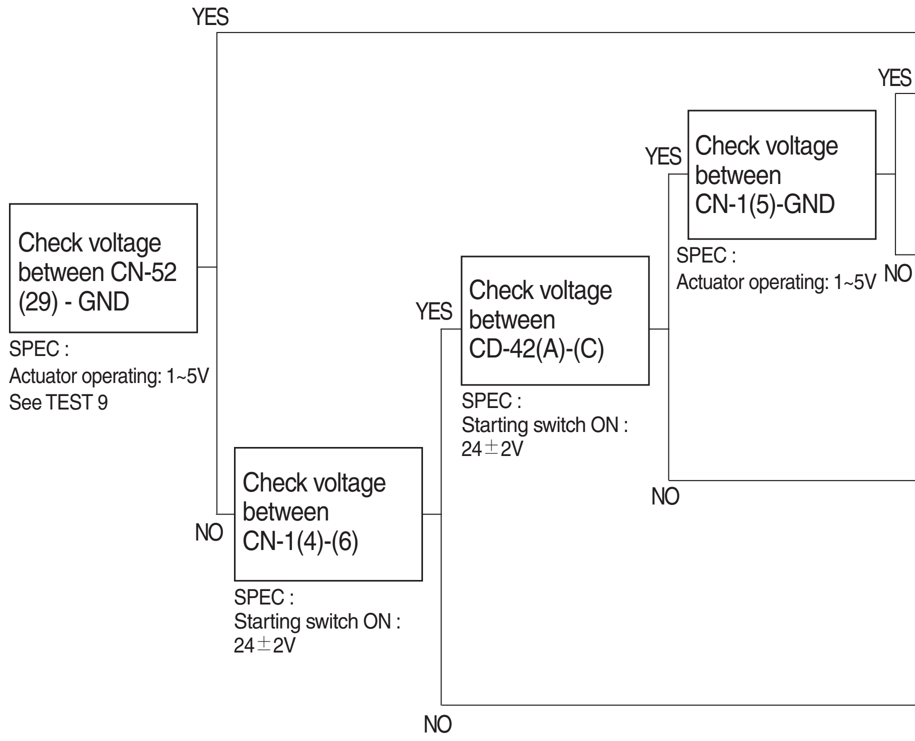


5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

· Fault code : HCESPN 120, FMI 0~4

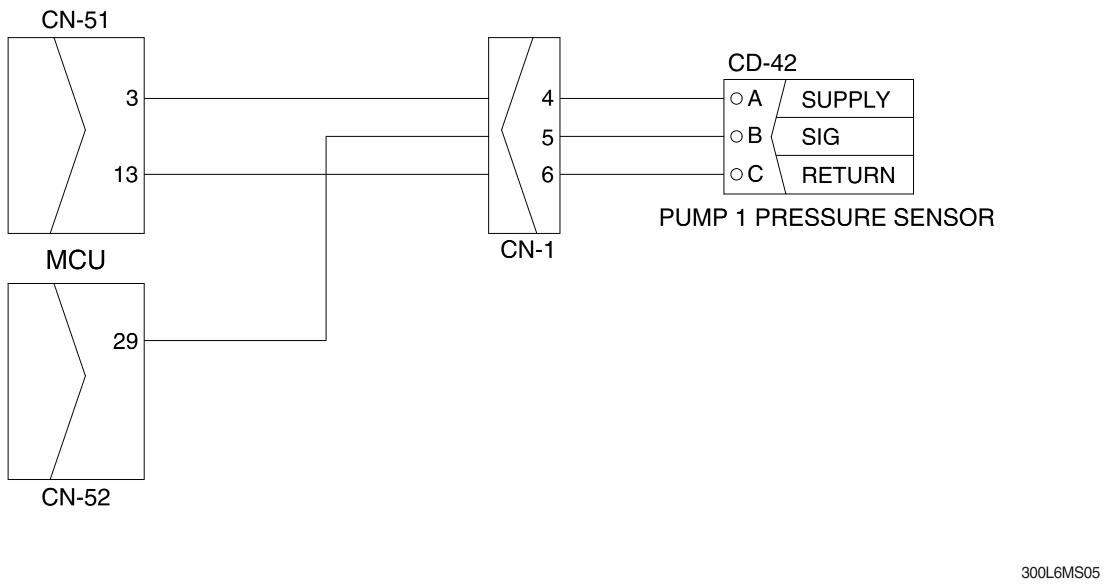
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(29)-CN-1(5)	Replace or repair
Detective P1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1(5)-CD-42(B)	Replace or repair
Short circuit or poor connection between CD-42(A)-CN-1(4) or CD-42(C)-CN-1(6)	Replace or repair
Short circuit or poor connection between CN-1(4)-CN-51(3) or CN-1(6) - CN-51(13)	Replace or repair

Wiring diagram



2) TEST PROCEDURE

(1) **Test 9** : Check voltage at CN-52 (29) and ground.

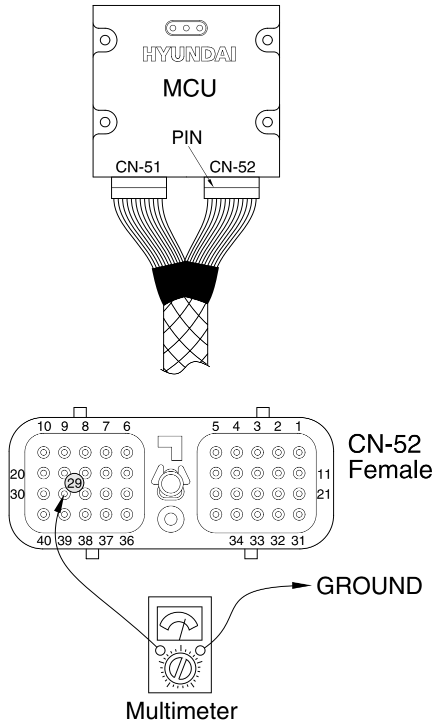
① Prepare 1 piece of thin sharp pin, steel or copper.

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



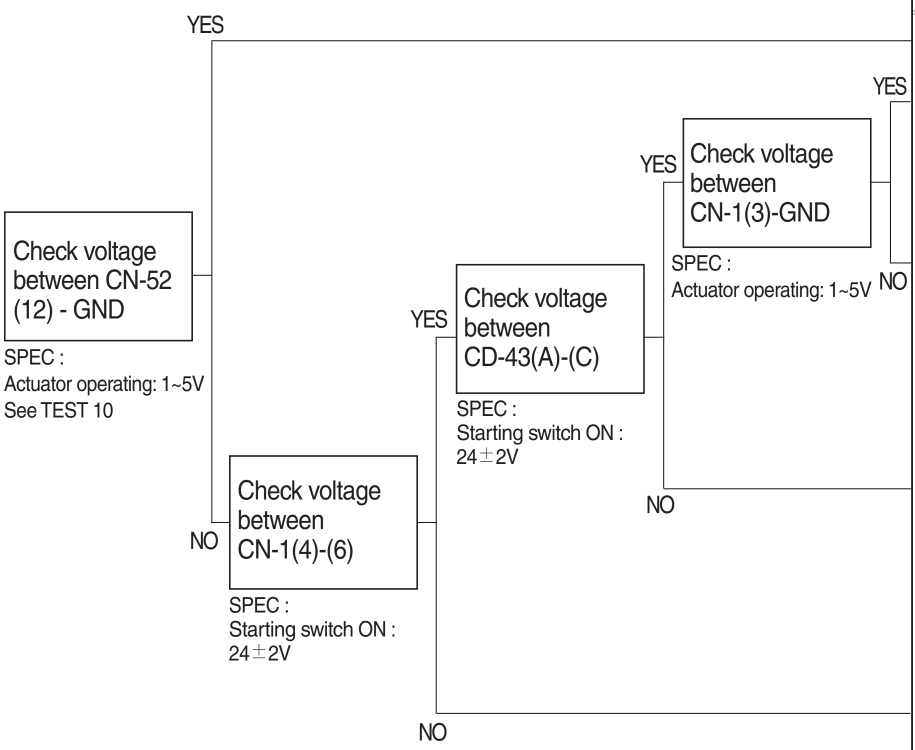
300L6MS06

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

· Fault code : HCESPN 121, FMI 0~4

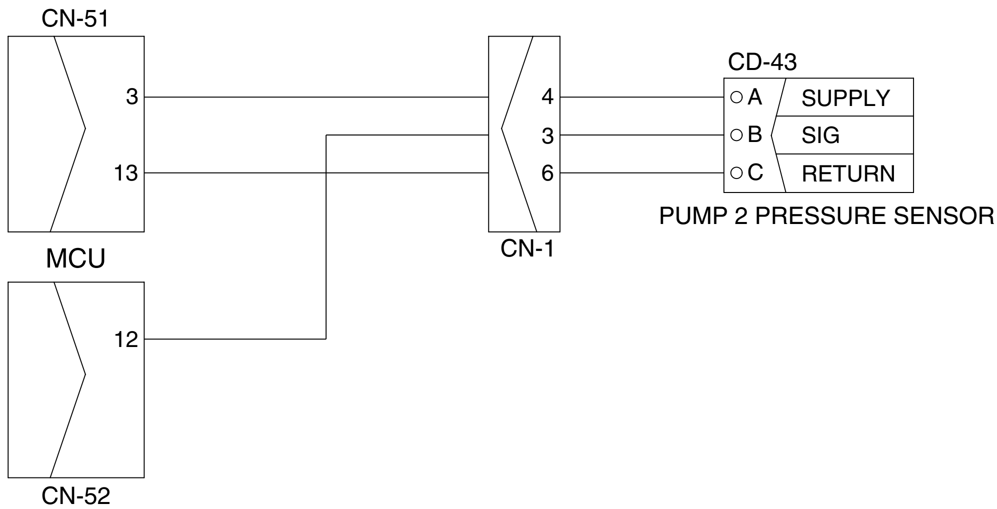
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(12)-CN-1(3)	Replace or repair
Detective P2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1(3)-CD-43(B)	Replace or repair
Short circuit or poor connection between CD-43(A)-CN-1(4) or CD-43(C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1(4)-CN-51(3) or CN-1 (6) - CN-51(13)	Replace or repair

Wiring diagram



300L6MS07

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-52 (12) and ground.

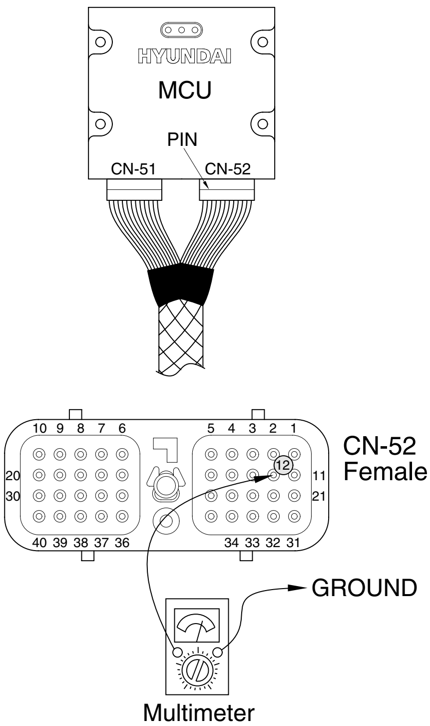
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (12) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

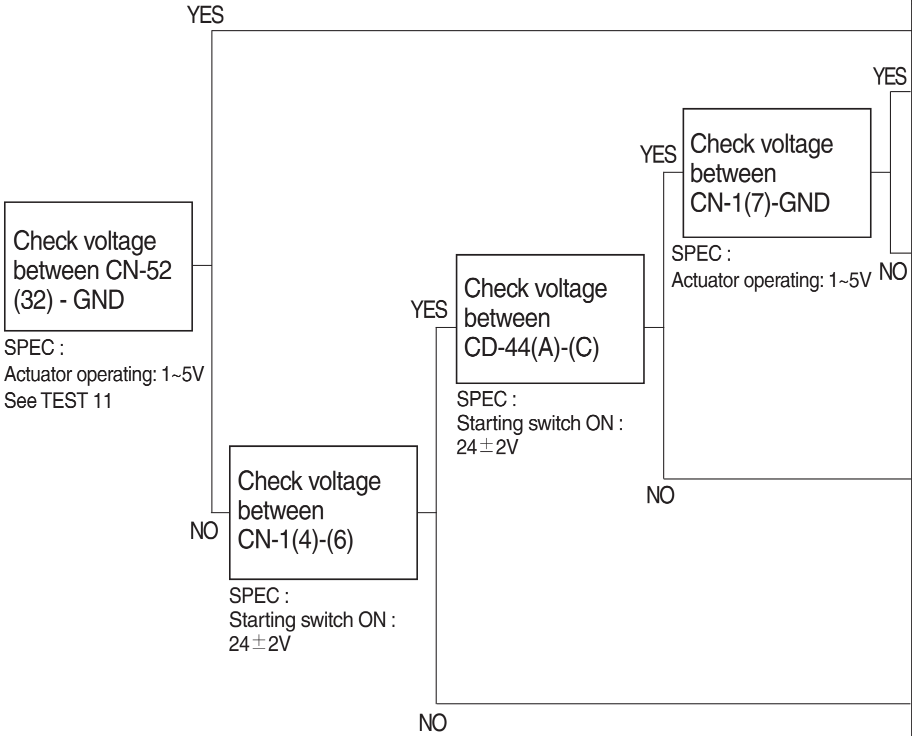


300L6MS08

7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR

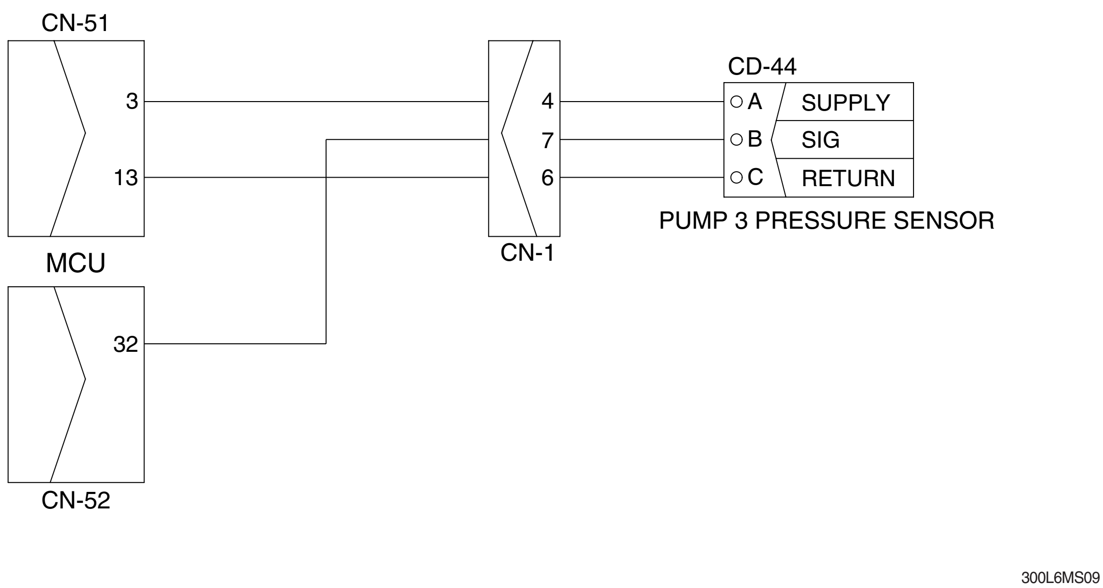
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(32)-CN-1(7)	Replace or repair
Detective P3 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1(7)-CD-44(B)	Replace or repair
Short circuit or poor connection between CD-44(A)-CN-1(4) or CD-44(C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1(4)-CN-51(3) or CN-1 (6) - CN-51(13)	Replace or repair

Wiring diagram



2) TEST PROCEDURE

(1) Test 11 : Check voltage at CN-52 (32) and ground.

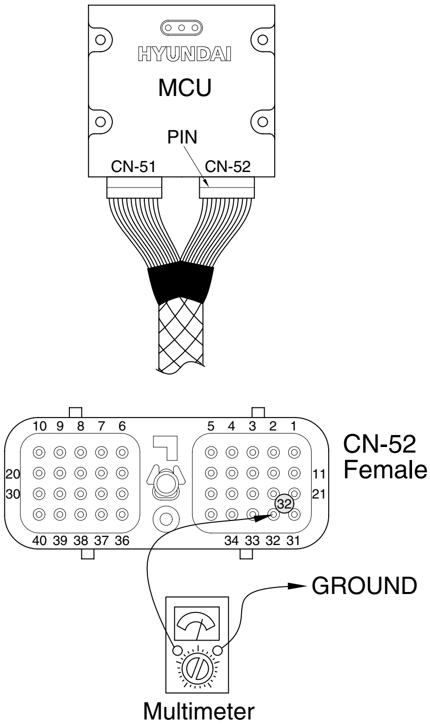
① Prepare 1 piece of thin sharp pin, steel or copper.

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



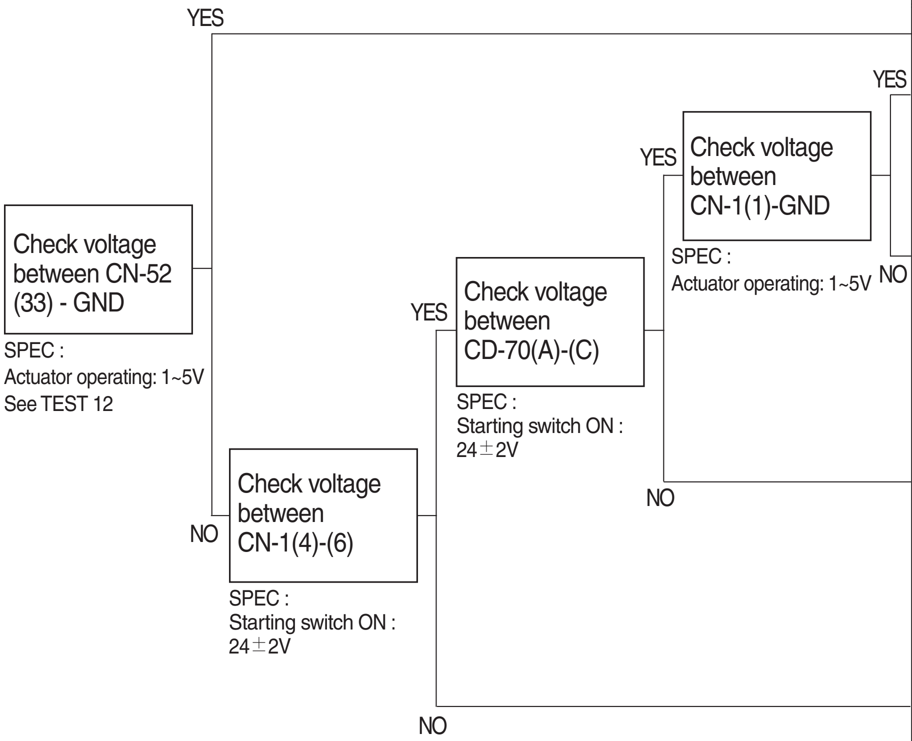
300L6MS10

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

· Fault code : HCESPN 123, FMI 0~4

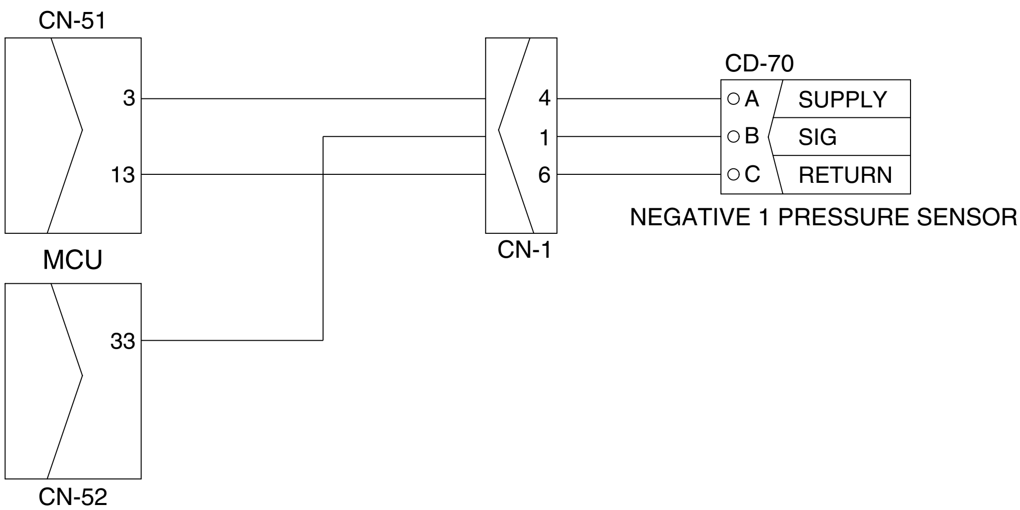
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(33)-CN-1(1)	Replace or repair
Detective N1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1(1)-CD-70(B)	Replace or repair
Short circuit or poor connection between CD-70(A)-CN-1(4) or CD-70(C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1(4)-CN-51(3) or CN-1 (6) - CN-51(13)	Replace or repair

Wiring diagram



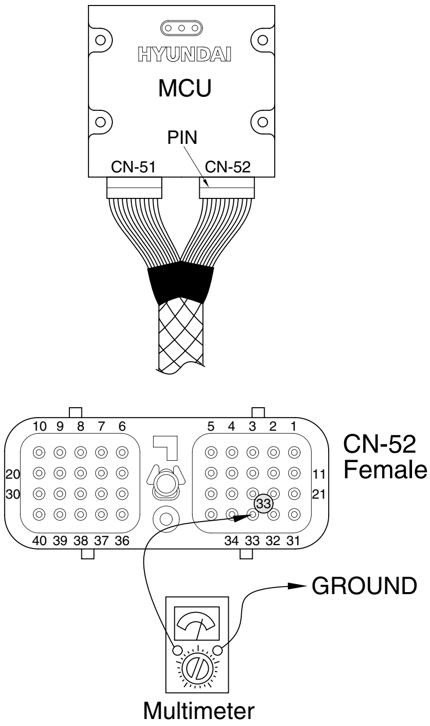
300L6MS11

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-52 (33) 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 (33) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



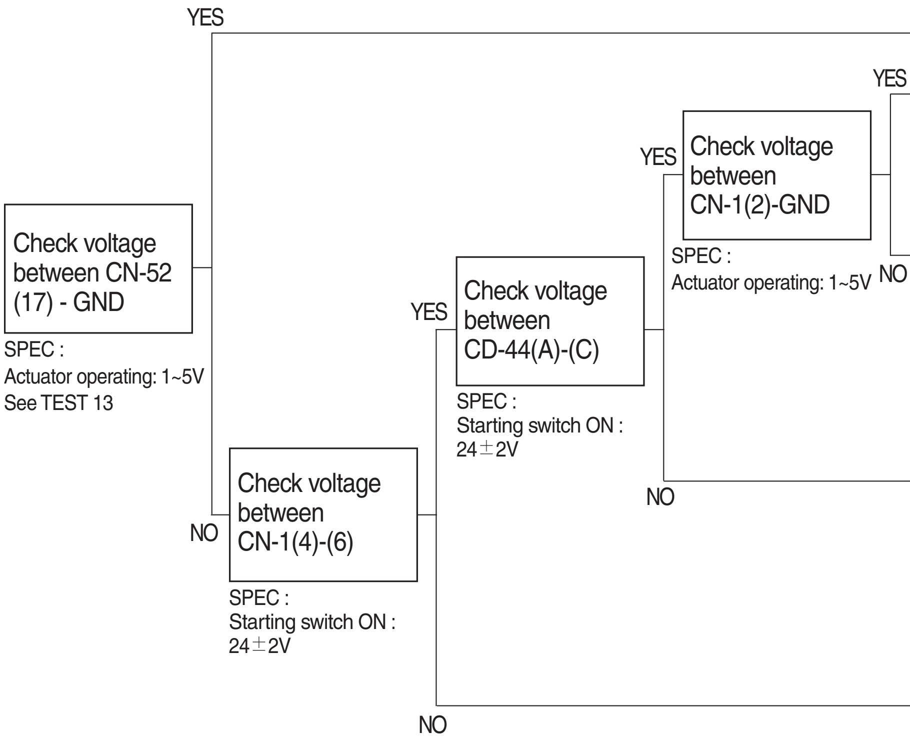
300L6MS12

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

· Fault code : HCESPN 124, FMI 0~4

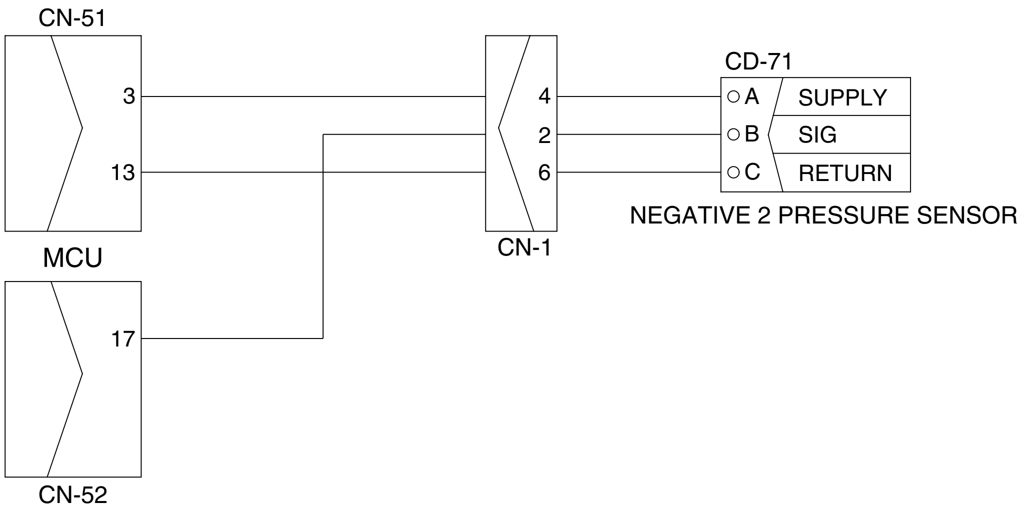
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(17)-CN-1(2)	Replace or repair
Detective N2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1(2)-CD-71(B)	Replace or repair
Short circuit or poor connection between CD-71(A)-CN-1(4) or CD-71(C)-CN-1(6)	Replace or repair
Short circuit or poor connection between CN-1(4)-CN-51(3) or CN-1 (6) - CN-51(13)	Replace or repair

Wiring diagram



300L6MS13

2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-52 (17) and ground.

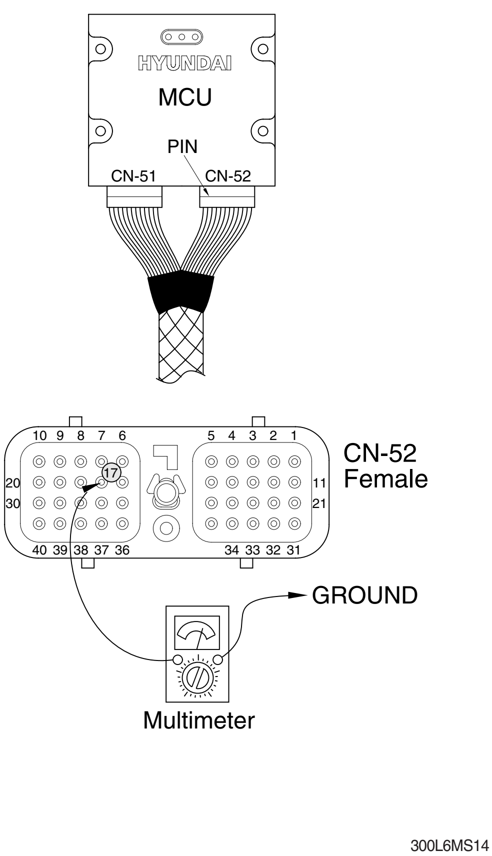
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (17) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

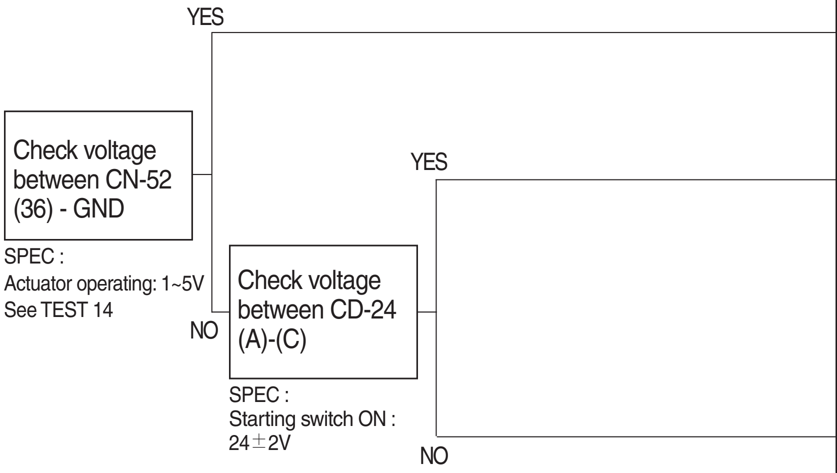


10. MALFUNCTION OF SWING PRESSURE SENSOR

· Fault code : HCESPN 135, FMI 0~4

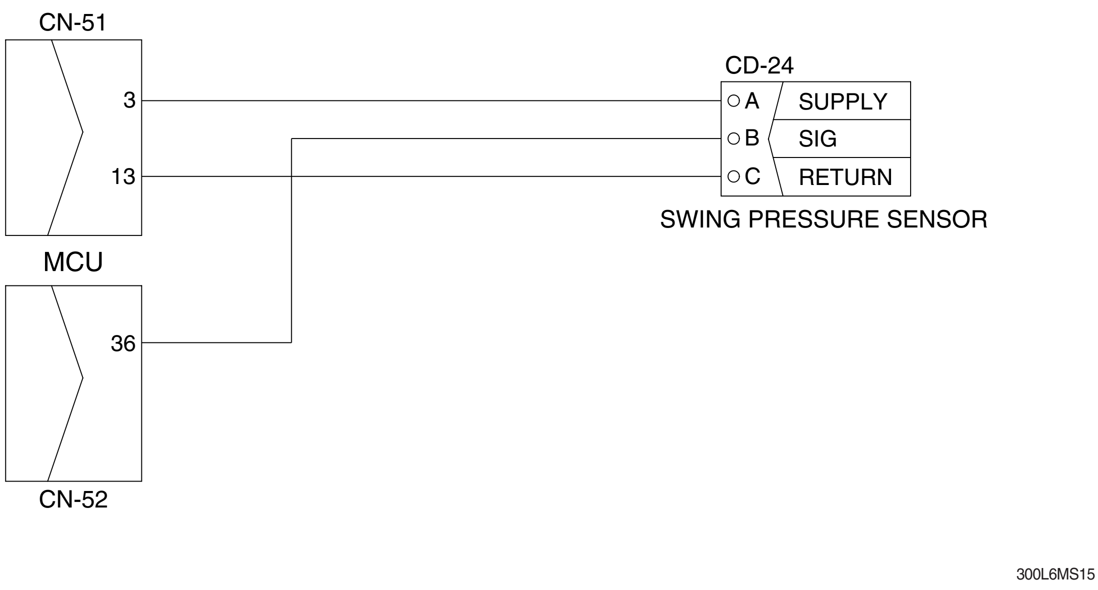
※ Before carrying out below procedure, check all the related connectors are properly inserted.

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



2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (36) and ground.

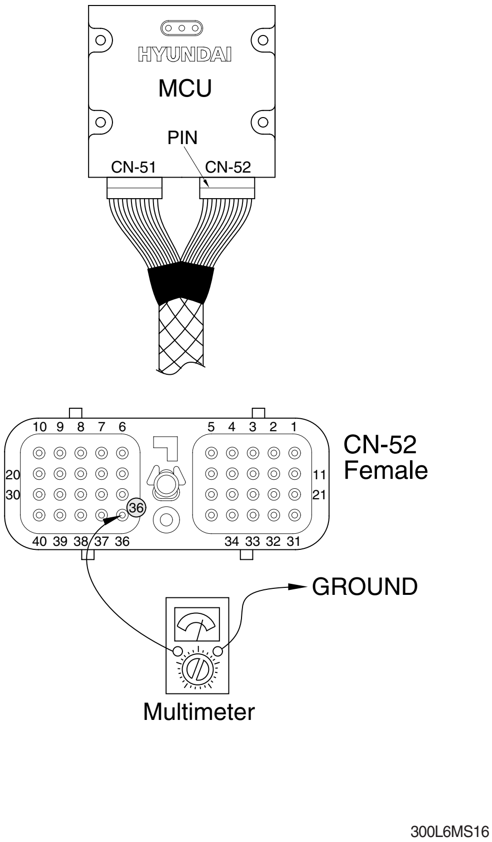
① Prepare 1 piece of thin sharp pin, steel or copper.

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

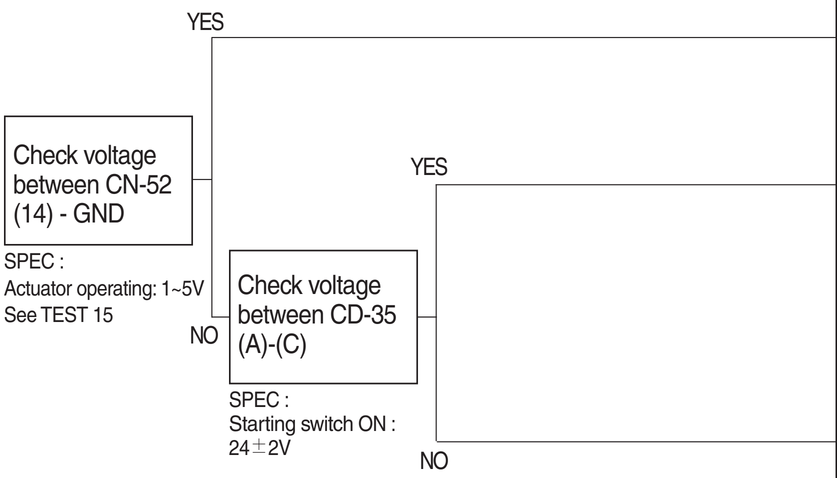


11. MALFUNCTION OF ARM IN/OUT & BUCKET IN PRESSURE SENSOR

· Fault code : HCESPN 133, FMI 0~4

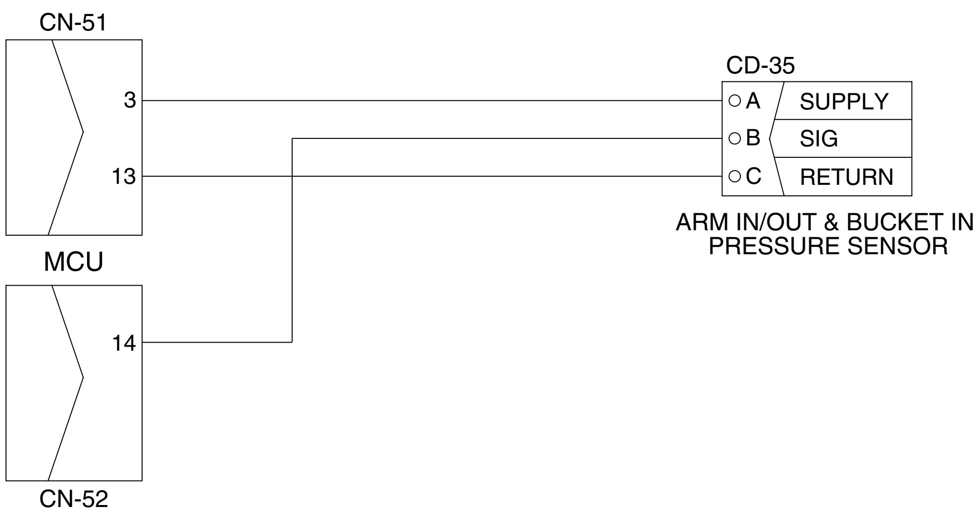
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Detective arm in/out & bucket in pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (14)-CD-35 (B)	Replace or repair
Short circuit or poor connection between CD-35 (A)-CN-51(3) or CD-35(C)- CN-51 (13)	Replace or repair

Wiring diagram



300L6MS17

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-52 (14) and ground.

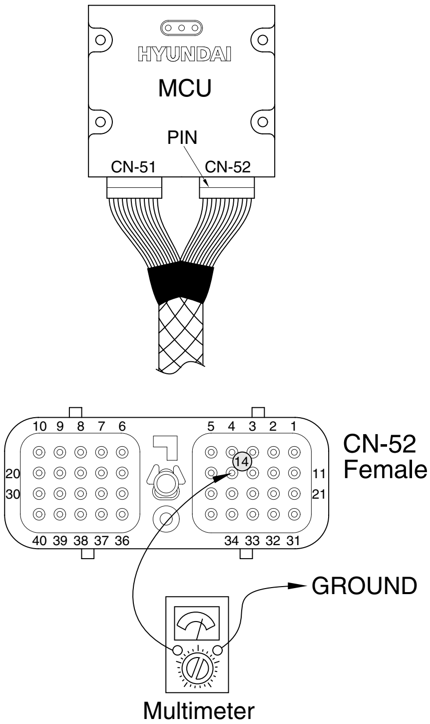
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (14) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



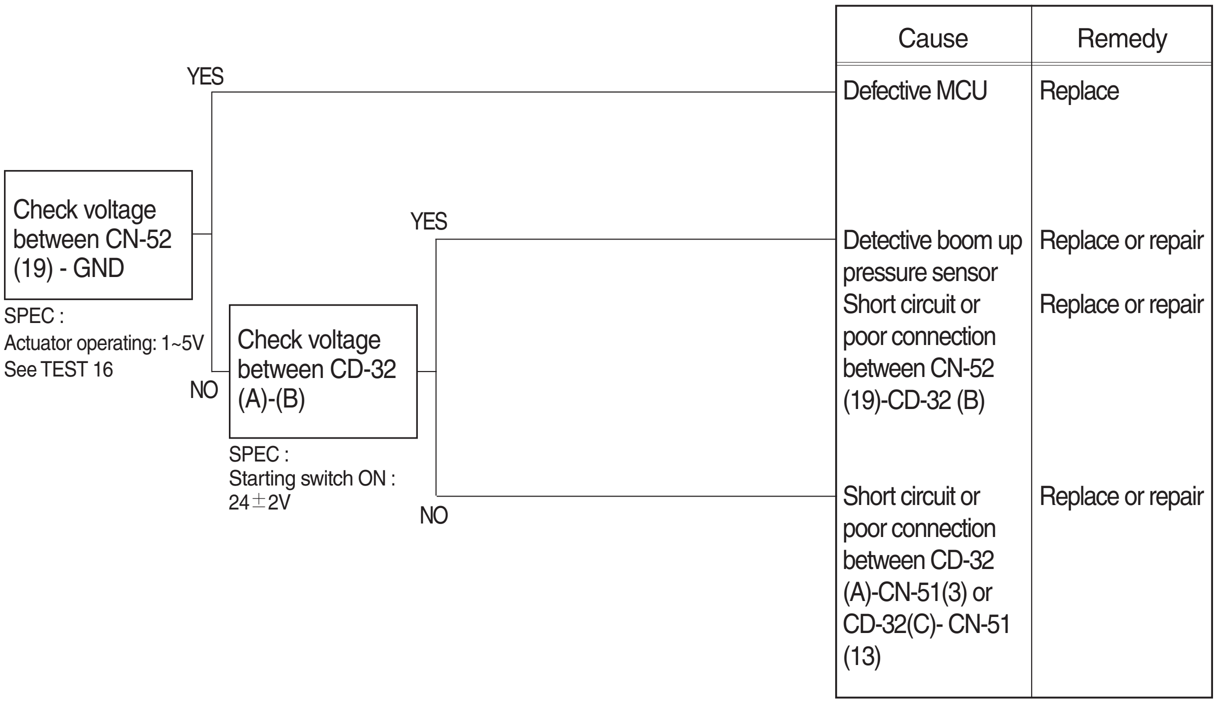
300L6MS18

12. MALFUNCTION OF BOOM UP PRESSURE SENSOR

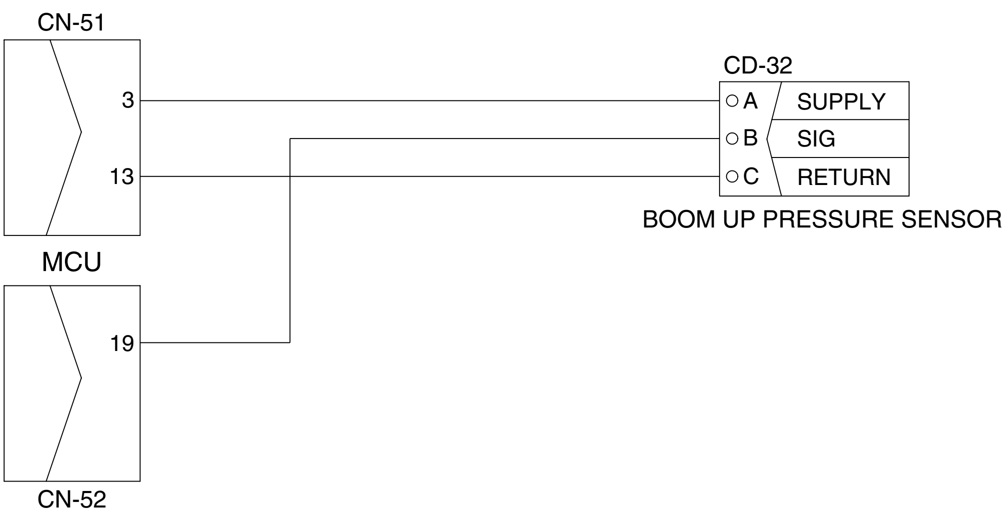
· Fault code : HCESPN 127, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300L6MS19

2) TEST PROCEDURE

(1) Test 16 : Check voltage at CN-52 (19) and ground.

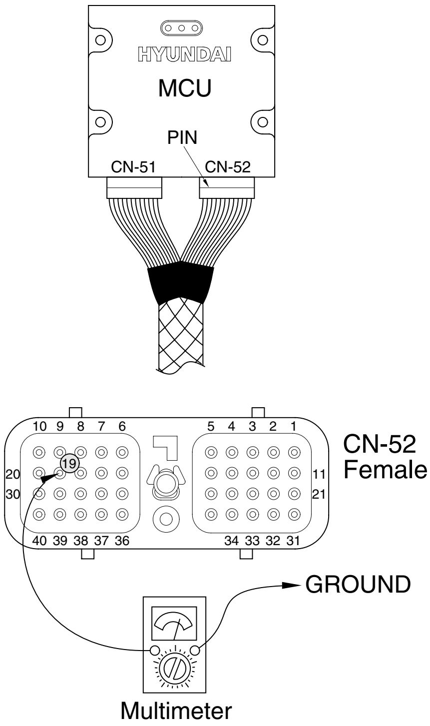
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (19) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



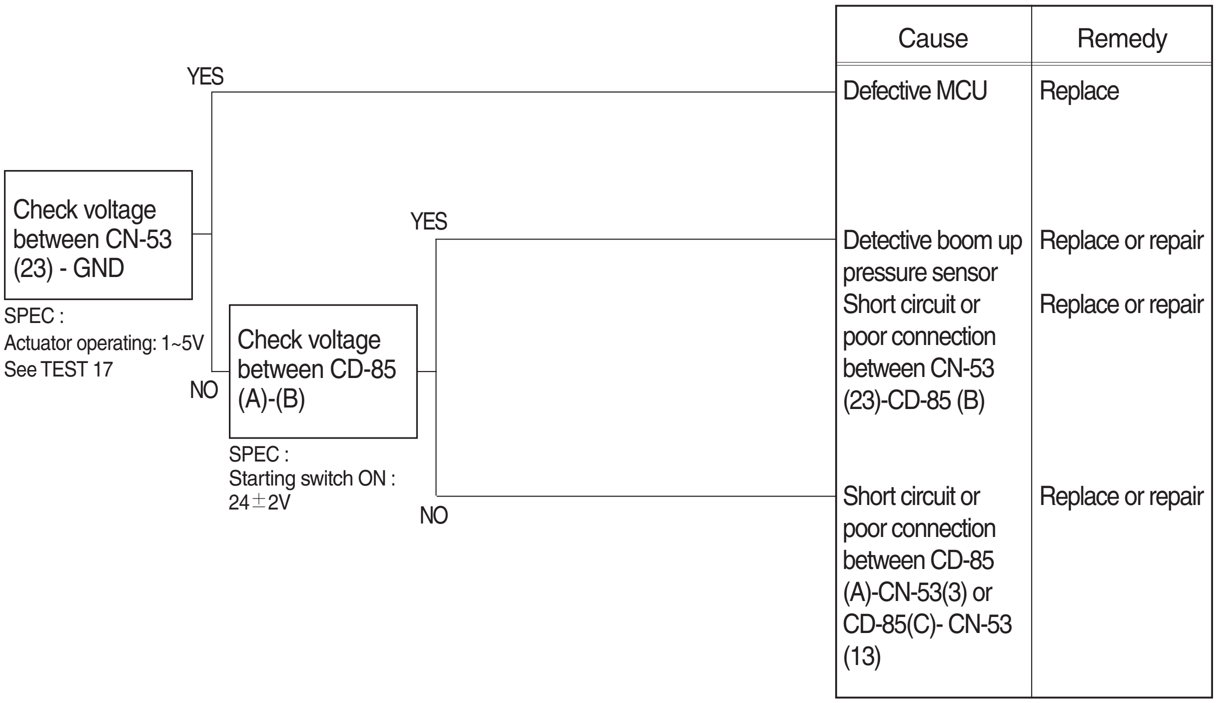
300L6MS20

13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

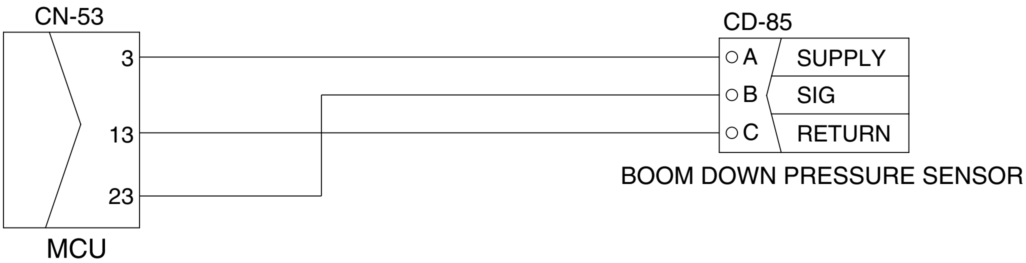
· Fault code : HCESPN 128, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



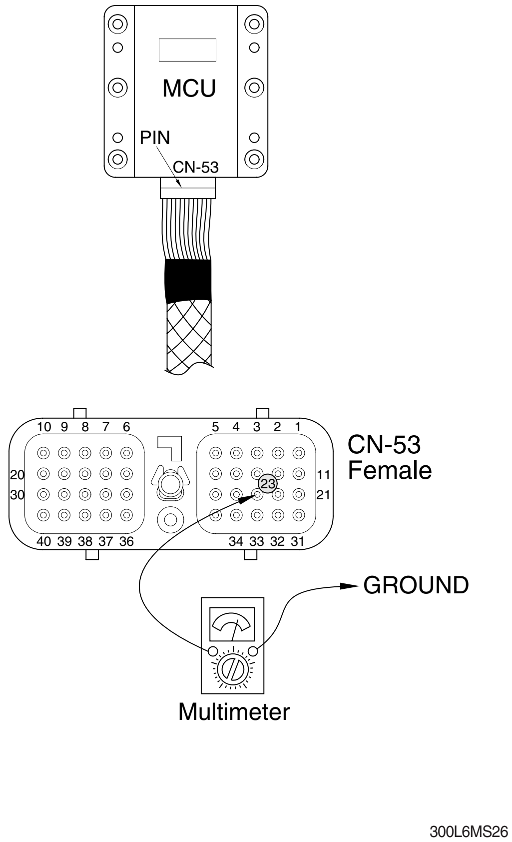
300L6MS25

2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-53 (23) 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 (23) of CN-53.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

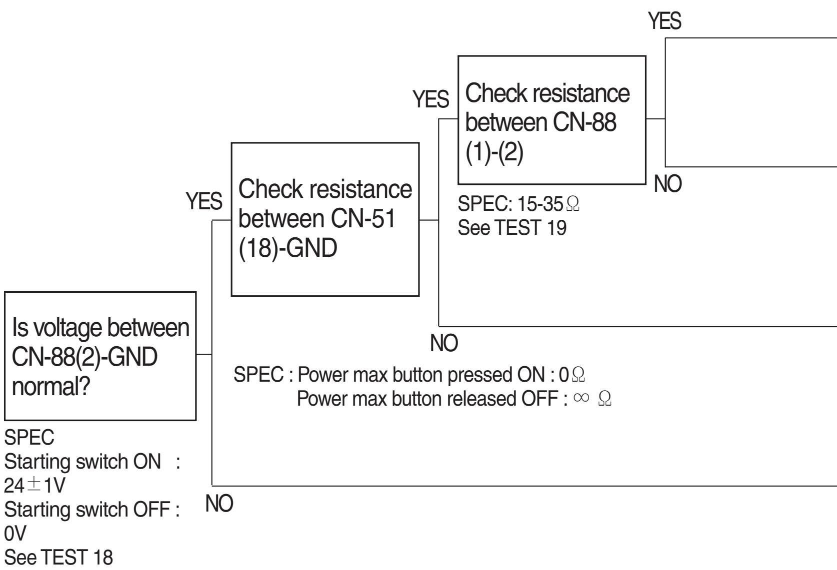


14. MALFUNCTION OF POWER MAX

· Fault code : HCESPN 166, FMI 4 or 6

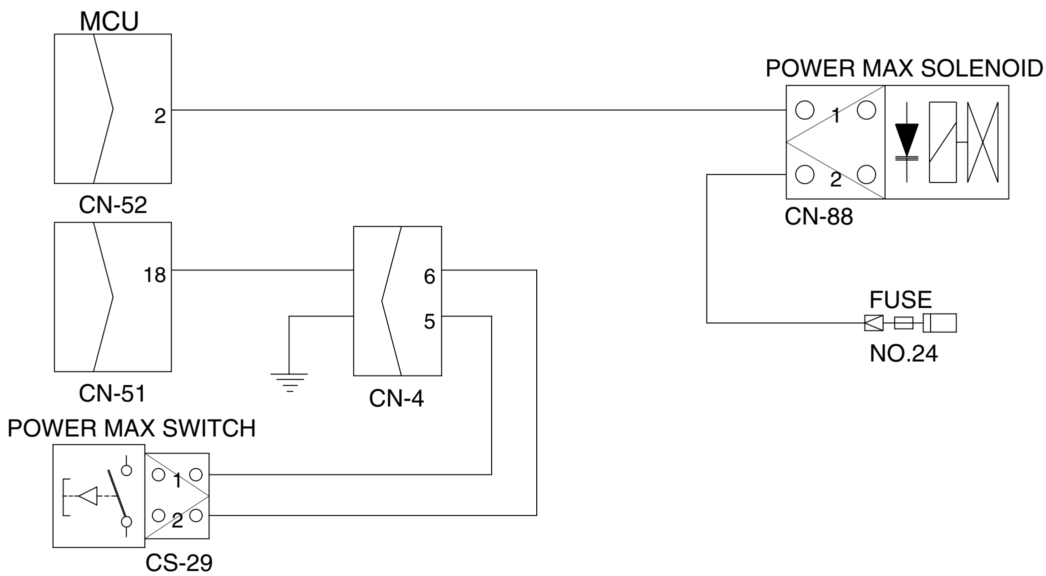
※ Before carrying out below procedure, check all the related connectors are properly inserted.

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	Repair or replace
Short circuit or poor connection between CN-88(2)-Fuse No. 24	Repair or replace

Wiring diagram

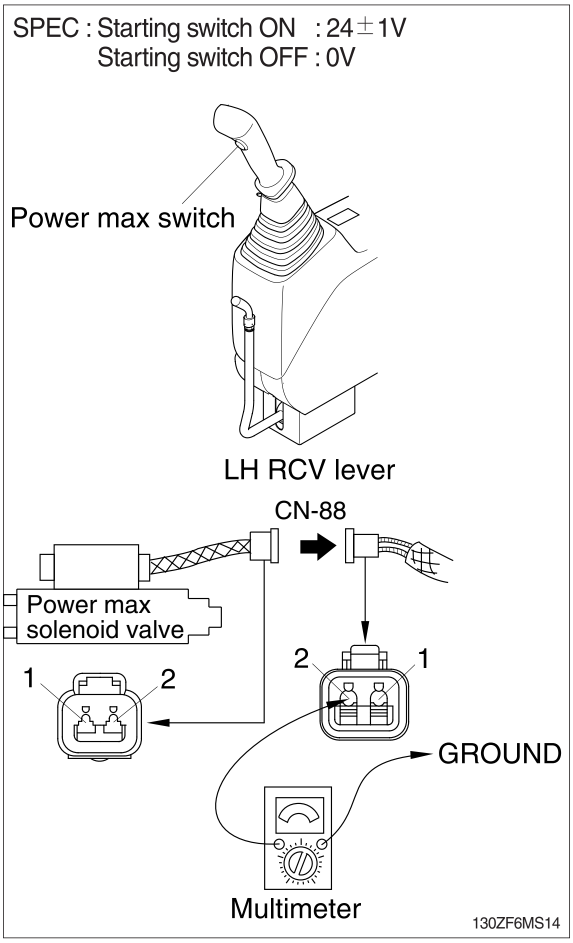


130ZF6MS03

2) TEST PROCEDURE

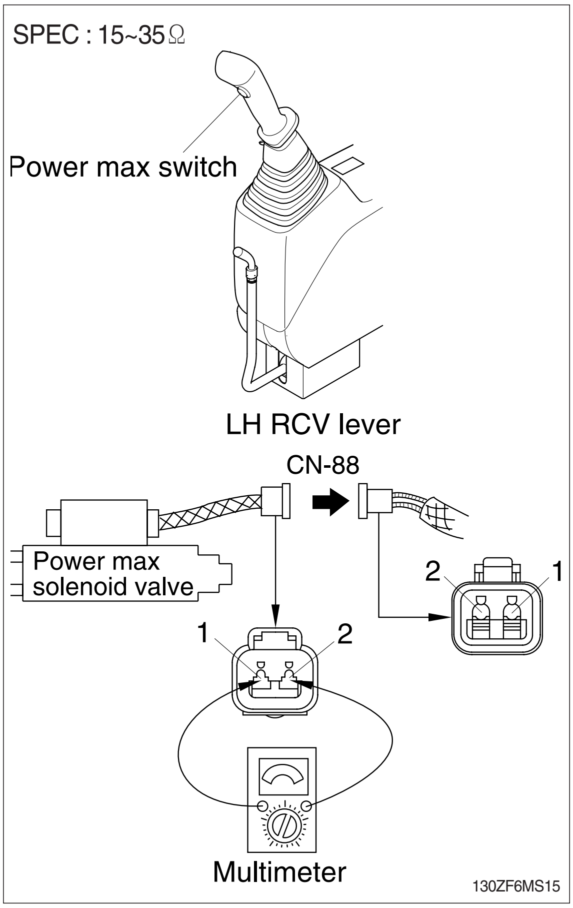
(1) Test 18: Check voltage between connector CN-88 (2) - GND.

① Disconnect connector CN-88 from power max solenoid valve.
② Start switch ON.
③ Check voltage as figure.



(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.



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.

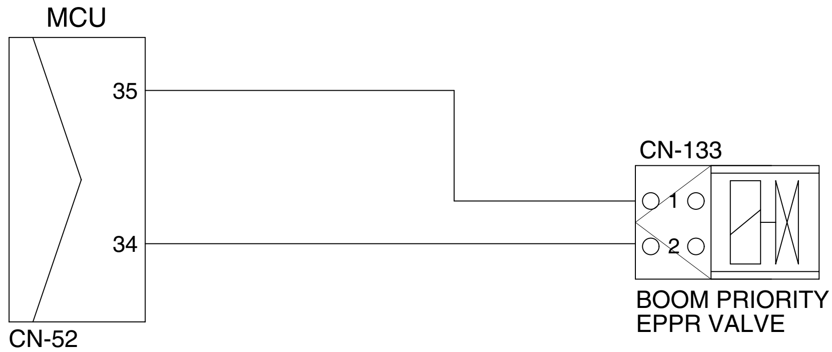
1) INSPECTION PROCEDURE

Check resistance between CN-133(1)-(2)

SPEC : 20~30V
Starting switch : ON

	Cause	Remedy
YES	Short circuit or poor connection between CN-52(35)-CN-133 (1) or CN-52(34)-CN-133(2)	Repair or replace
NO	Defective EPPR valve	Repair or replace

Wiring diagram



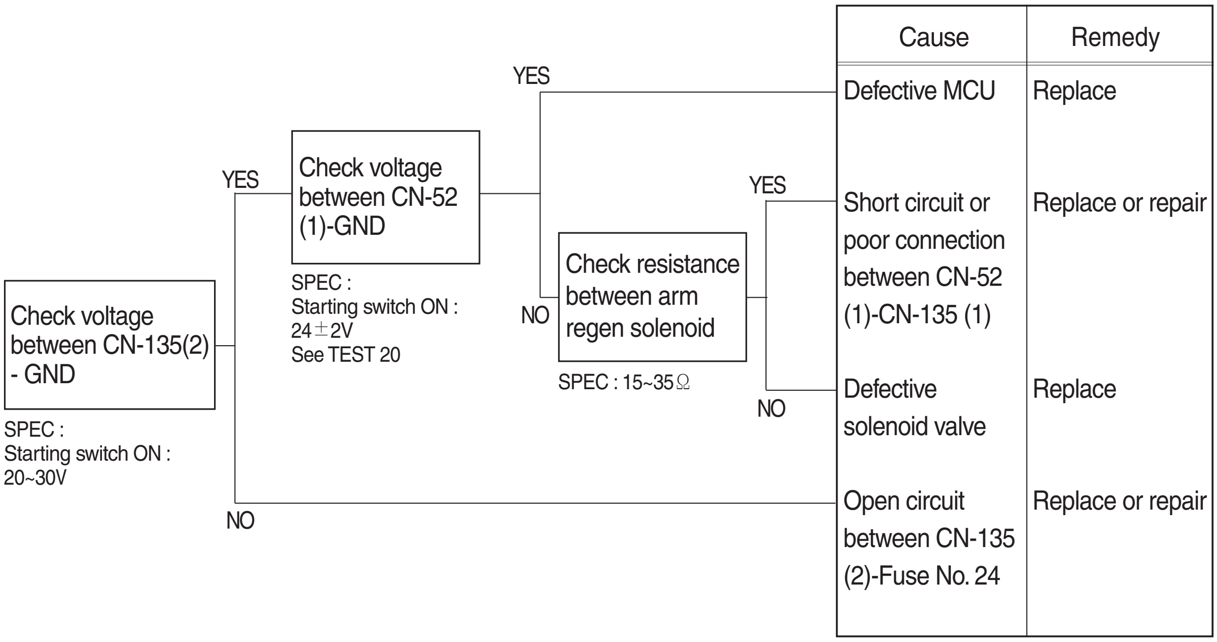
300L6MS23

16. MALFUNCTION OF ARM REGENERATION SOLENOID

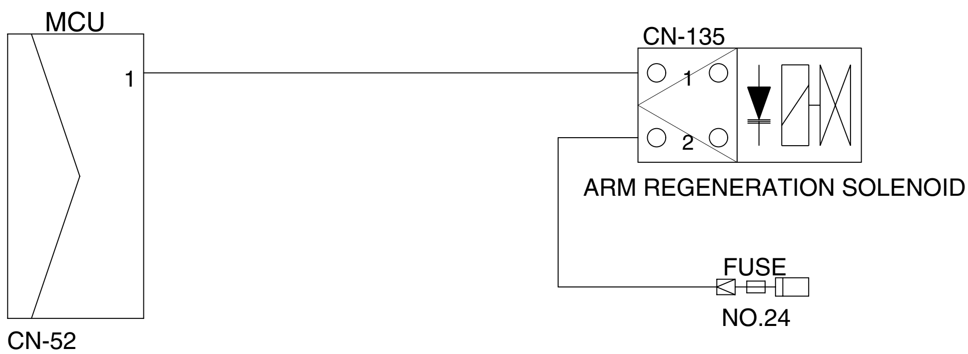
· Fault code : HCESPN 170, FMI 4 or 6

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

1) INSPECTION PROCEDURE



Wiring diagram



145LCR6MS04

2) TEST PROCEDURE

(1) Test 20 : Check voltage at CN-52 (1) and ground.

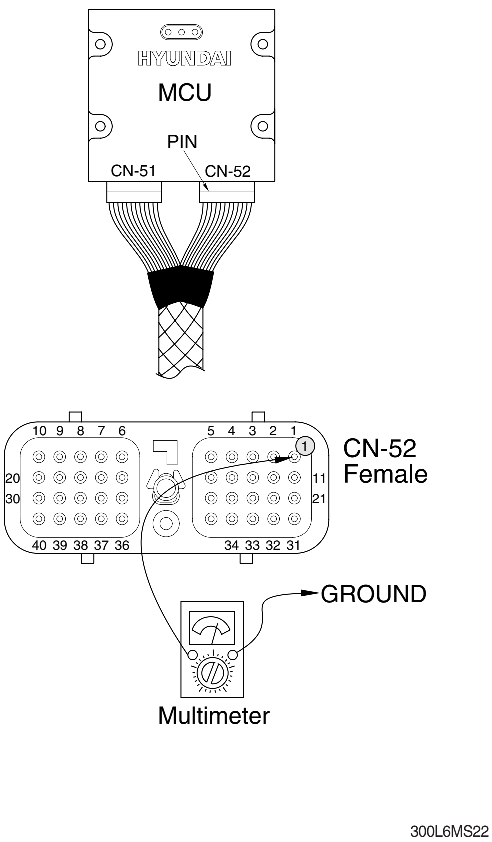
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (1) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Starting switch ON : 24±2 V



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

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.

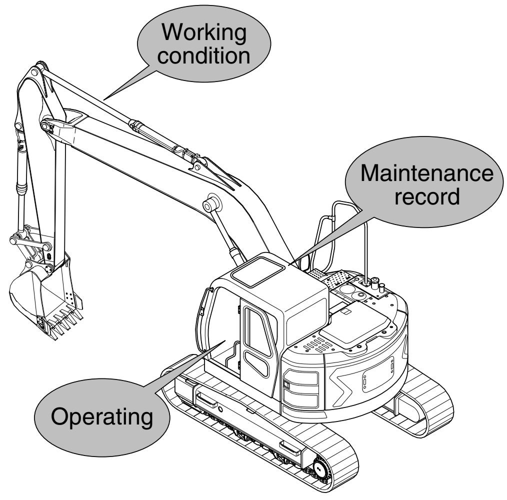
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

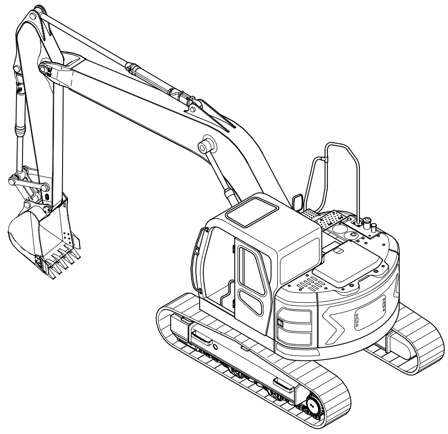


130ZF7MS01

2. TERMINOLOGY

1) STANDARD

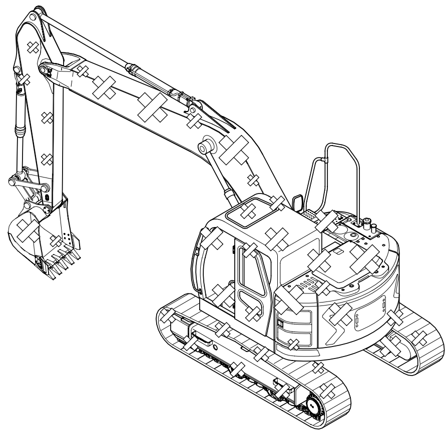
Specifications applied to the brand-new machine, components and parts.



130ZF7MS02

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.



130ZF7MS03

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.

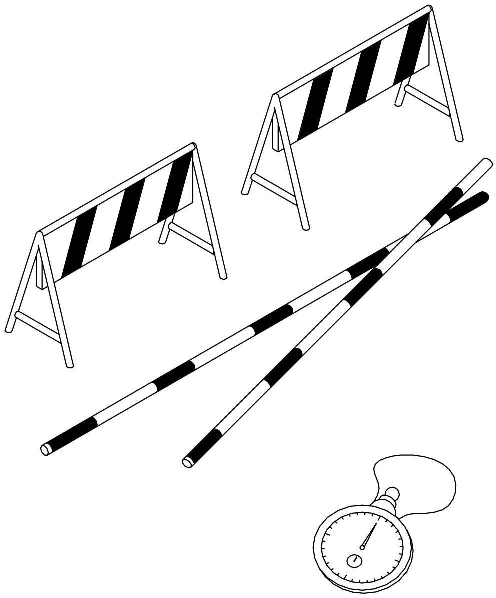
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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 multimodal dial at 10 (Max) position.

③ Measure the engine RPM.

(3) Measurement

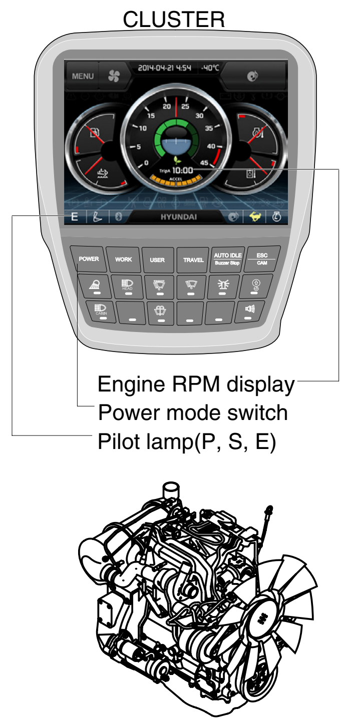
① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.

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

③ Select the P-mode.

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

⑤ Measure and record the auto deceleration speed.



130ZF7MS04

(4) Evaluation

The measured speeds should meet the following specifications.

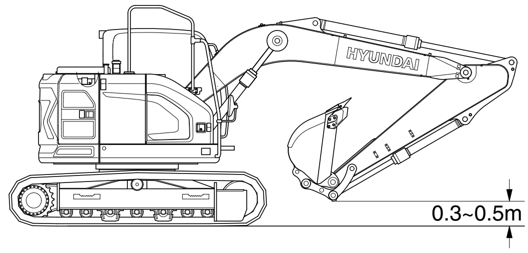
Unit : rpm

Model	Engine speed	Standard	Remarks
HX130CR HX130LCR	Start idle	1000±100	
	P mode	1850±50	
	S mode	1750±50	
	E mode	1650±50	
	Auto decel	1100±100	
	One touch decel	1000±100	

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

3) TRAVEL SPEED

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



145ZF7MS04

(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.

(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.

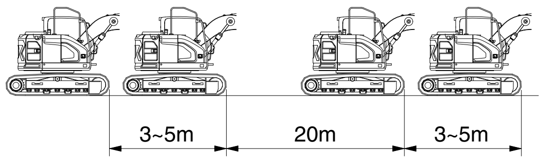
· Power mode switch : P mode

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.



145ZF7MS05A

(4) Evaluation

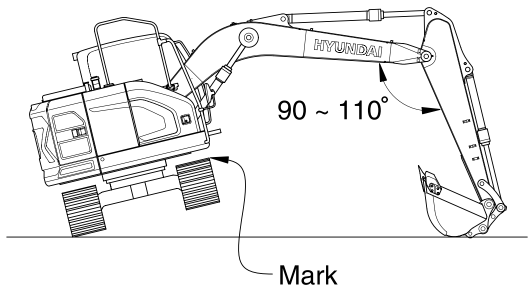
The average measured time should meet the following specifications.

Unit : Seconds / 20 m

Model	Travel speed	Standard	Maximum allowable	Remarks
HX130CR HX130LCR	1 Speed	22.0±2.0	27.9	
	2 Speed	13.2±1.0	17.0	

4) TRACK REVOLUTION SPEED

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



145ZF7MS06

(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.

(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
HX130CR HX130LCR	1 Speed	24.3±2.0	32.6
	2 Speed	14.2±1.0	19.8

5) TRAVEL DEVIATION

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

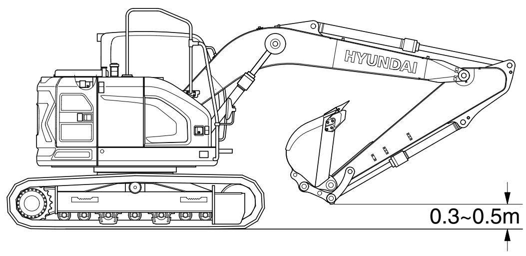
(2) Preparation

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.



145ZF7MS04

(3) Measurement

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

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

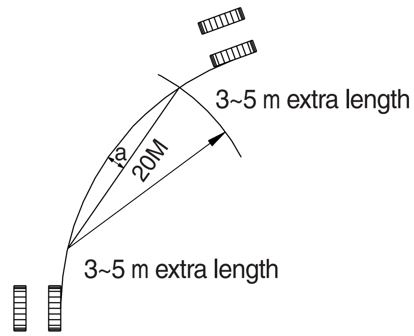
· Power mode switch : P mode

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
HX130CR HX130LCR	200 below	240	

6) SWING SPEED

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

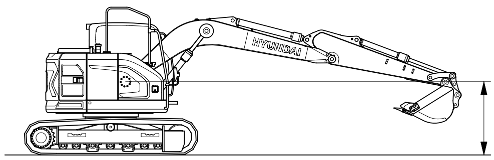
(2) Preparation

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.



145ZF7MS07

(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

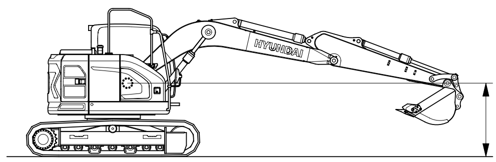
Model	Power mode switch	Standard	Maximum allowable
HX130CR HX130LCR	P mode	14.3±1.5	17.4

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

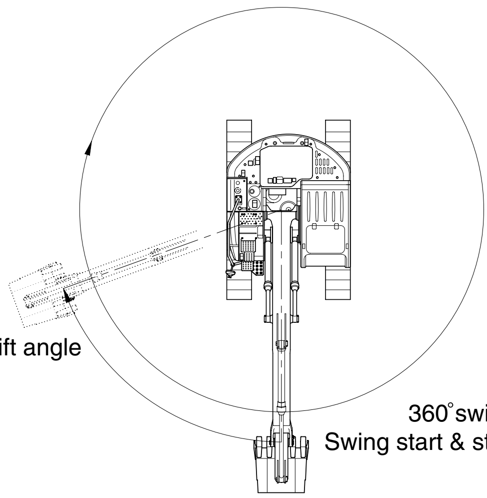
① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.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



145ZF7MS07

(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.



130ZF7MS08

(4) Evaluation

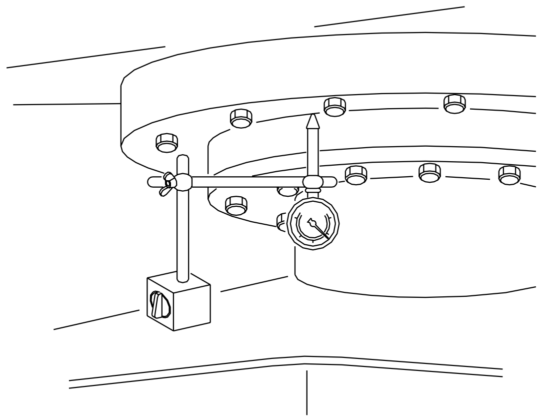
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX130CR HX130LCR	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.



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(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.

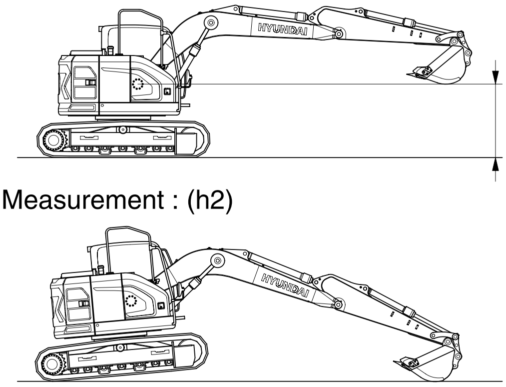
⑥ Bucket should be empty.

(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



145ZF7MS09

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX130CR HX130LCR	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.

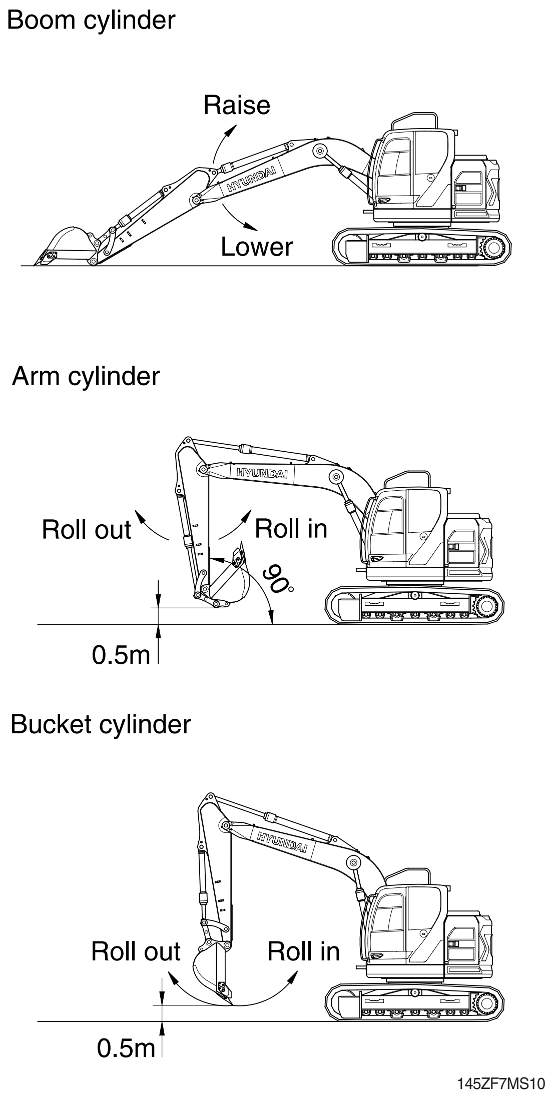
④ Keep the hydraulic oil temperature at 50±5˚C.

(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

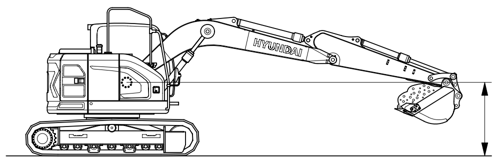
The average measured time should meet the following specifications.

Unit : Seconds

Model	Function		Standard	Maximum allowable	Remarks
HX130CR HX130LCR	Boom raise		3.4±0.4	4.5	
	Boom lower		2.3±0.4	3.3	
	Arm in	Regen ON	2.7±0.4	4.3	
		Regen OFF	2.9±0.4	3.9	
	Arm out		2.9±0.3	5.4	
	Bucket in		3.7±0.4	4.7	
	Bucket out		2.4±0.3	3.1	

10) DIG FUNCTION DRIFT CHECK

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



145ZF7MS11

(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.

(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
HX130CR HX130LCR	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
HX130CR HX130LCR	Boom lever	1.5 or below	1.7	
	Arm lever	1.5 or below	1.7	
	Bucket lever	1.5 or below	1.7	
	Swing lever	1.5 or below	1.7	
	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
HX130CR HX130LCR	Boom lever	85±10	115	
	Arm lever	85±10	115	
	Bucket lever	85±10	115	
	Swing lever	85±10	115	
	Travel lever	139±10	178	

13) PILOT PRIMARY PRESSURE

(1) Preparation

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

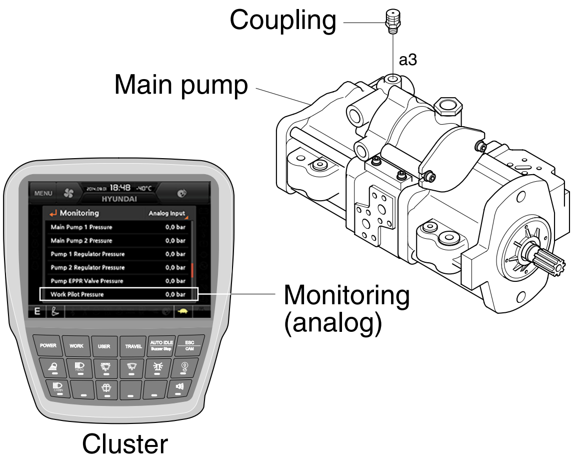
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Auto decel switch : OFF

② Measure the primary pilot pressure by the monitoring menu of the cluster.



130ZF7MS12

(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX130CR HX130LCR	P mode	38^{+2}_{0}	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation

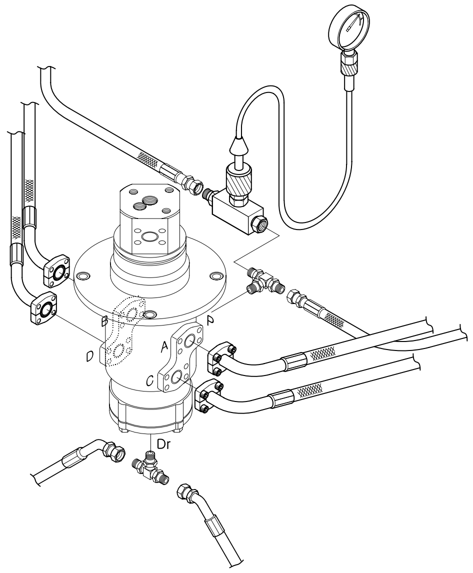
① Stop the engine.

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.



130ZF7MS13

(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.

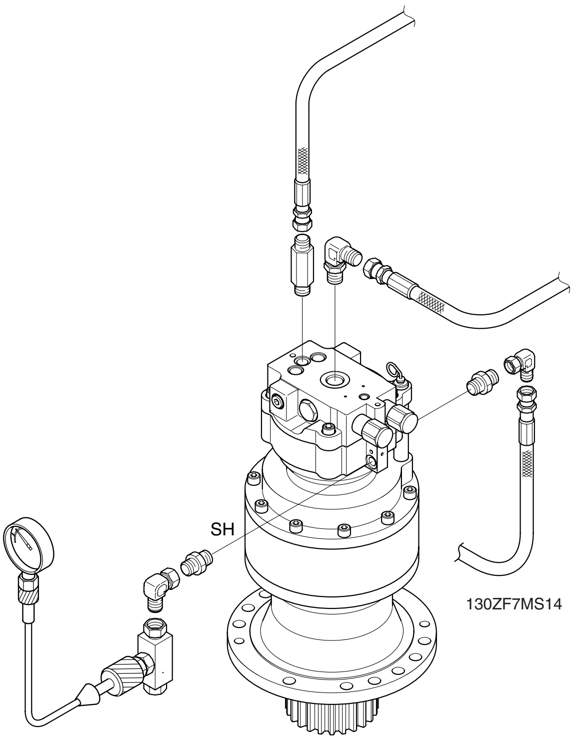
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX130CR HX130LCR	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.



130ZF7MS14

(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
HX130CR HX130LCR	Brake disengaged	40	Over 9	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

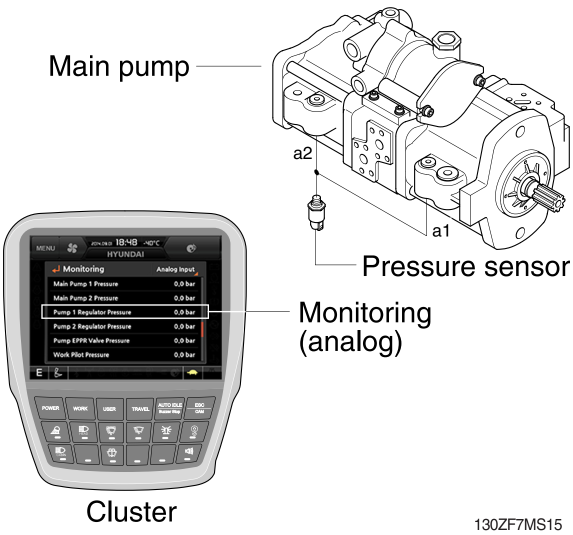
① Keep the hydraulic oil temperature at 50±5˚C.

(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).



130ZF7MS15

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX130CR HX130LCR	High idle	34±3	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

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

(2) Measurement

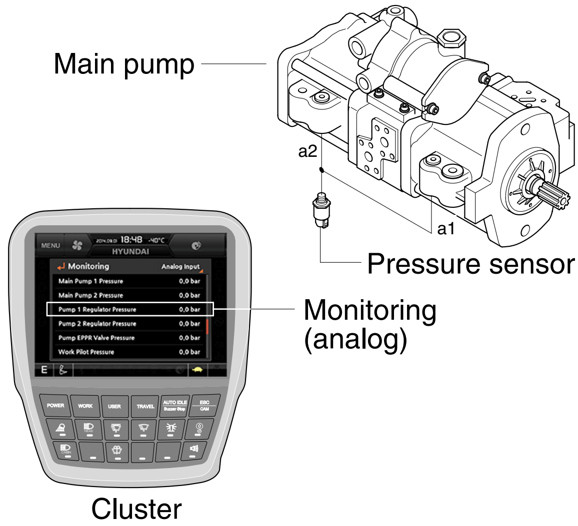
① Select the following switch positions.

· 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.



130ZF7MS15

(3) Evaluation

The average measured pressure should be within the following specifications.

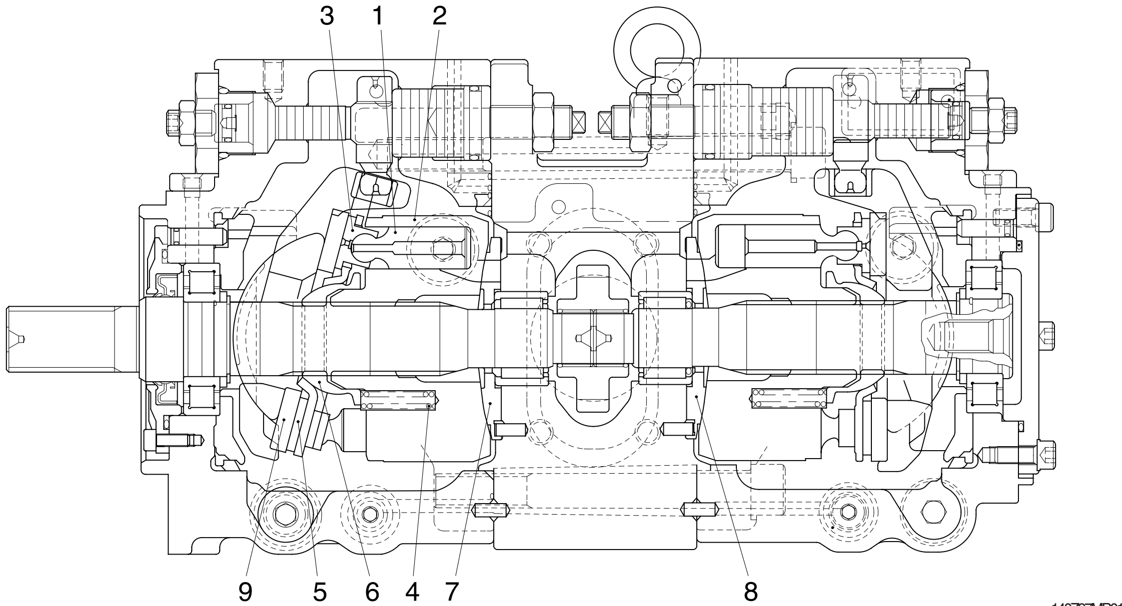
Unit : kgf / cm^2

Model	Function to be tested		Standard	Port relief setting at 20 lpm
HX130CR HX130LCR	Boom, Arm, Bucket		330 (360)±10	380±10
	Travel		330±10	-
	Swing	Type 1	260±10	-
		Type 2	285±10	

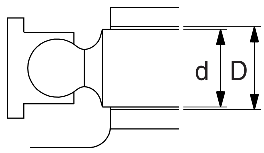
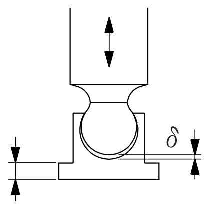
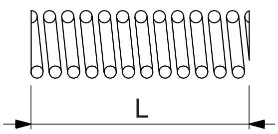
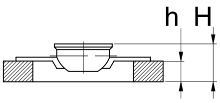
( ) : Power boost

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		

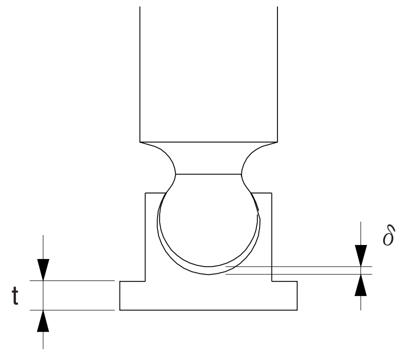
2. MAIN CONTROL VALVE

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.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section).
	· O-ring seal sections at both ends.	· Replacement when its sliding section has scratch.
	· Insert spool in casing hole, rotate and reciprocate it.	· Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of poppet or spring	· Correction or replacement when sealing is incomplete.
	· Insert poppet into casing and function it.	· Normal when it can function lightly without being caught.
Around spring	· Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage.	· Correction or replacement.
	· Rusting, corrosion or deformation of seal plate.	· Correction or replacement.
Main relief valve, port relief valve & negative control relief valve	· External rusting or damage.	· Replacement.
	· Contacting face of valve seat.	· Replacement when damaged.
	· Contacting face of poppet.	· Replacement when damaged.
	· Abnormal spring.	· Replacement.
	· O-rings, back up rings and seals.	· 100% replacement in general.

3. SWING DEVICE

1) WEARING PARTS

Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.041	0.060	Replace piston or cylinder block
Thickness of valve plate	6	5.88	Replace
Play between piston and shoe caulking section (δ)	0.025	0.1	Replace assembly of piston and shoe
Thickness of shoe (t)	6.6	6.5	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H-h)	17.6	17.3	Replace set of retainer plate and sperical bushing
Thickness of friction plate	2.94	2.7	Replace



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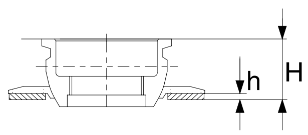

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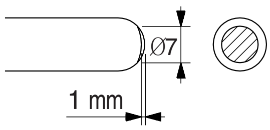
2) SLIDING PARTS

Part name	Standard roughness	Allowable roughness	Remark
Shoe	Rmax=1S (Ra=0.2a) (LAPPING)	4S (Ra=0.1a)	
Shoe plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Cylinder	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Valve plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	2S (Ra=0.5a)	

4. TRAVEL MOTOR

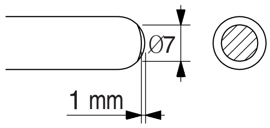
Problem		Cause	Remedy
Does not start	Pressure is not developed	· Pump failure · Control valve malfunction	· Check if action other than traveling is available. If faulty, repair. · Check if spool moves correctly. Repair if necessary.
	Pressure is developed	· Brake valve failure -Sleeve stick -Check valve 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.	

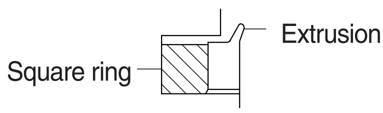
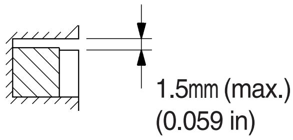
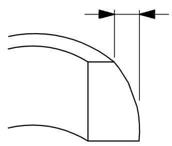
Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

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

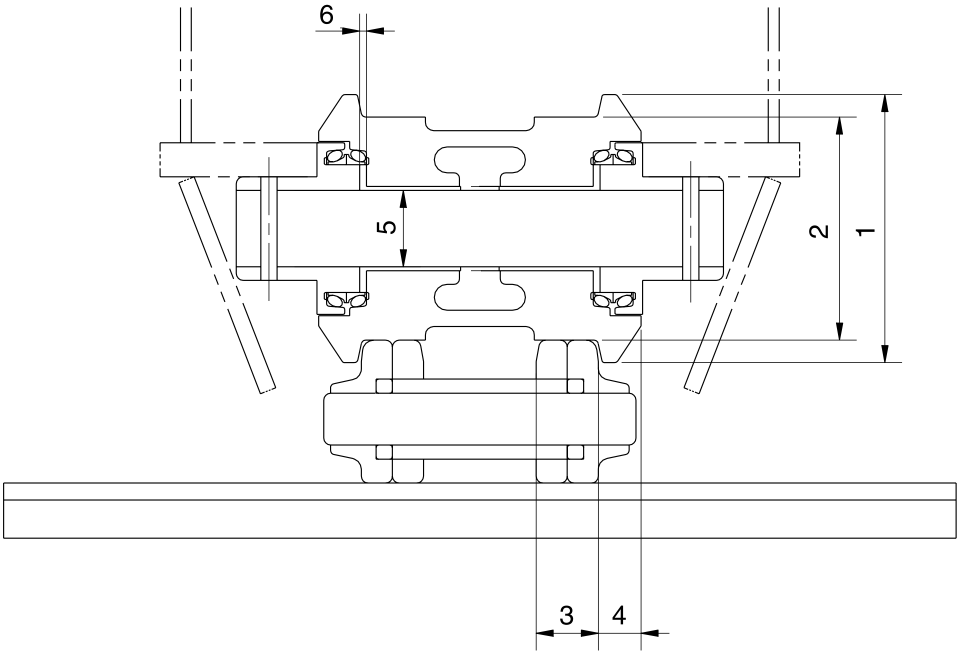
8. CYLINDER

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) TRACK ROLLER



21037MS01

Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="4">Rebuild or replace</td></tr>
<tr><td colspan="2">Ø190</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø150</td><td colspan="2">Ø138</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">36.5</td><td colspan="2">42.5</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">26.5</td><td colspan="2">-</td><td></td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td rowspan="2">Standard size</td><td>tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft / Hole</td></tr>
<tr><td>Ø65</td><td>Shaft: -0.25 -0.35; Hole: +0.12 +0.075</td><td>0.325 to 0.47</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Side clearance of roller (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="2">0.1 to 1.3</td><td colspan="2">2.0</td></tr>
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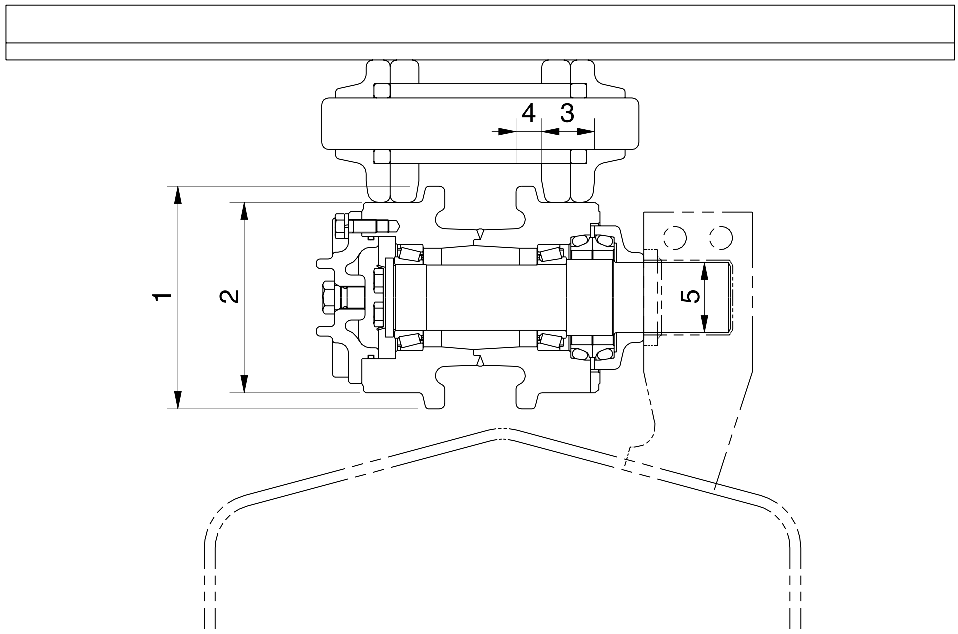
2) CARRIER ROLLER



21037MS02

Unit : mm

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<tr><td colspan="2">Ø175</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø151</td><td colspan="2">Ø141</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">37.25</td><td colspan="2">42.25</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">18.25</td><td colspan="2">-</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Ø41.27 $^{0}_{+0.05}$</td><td>Ø41.5 $^{+0.2}_{-0.1}$</td><td>0.13 to 0.48</td><td>1.2</td></tr>
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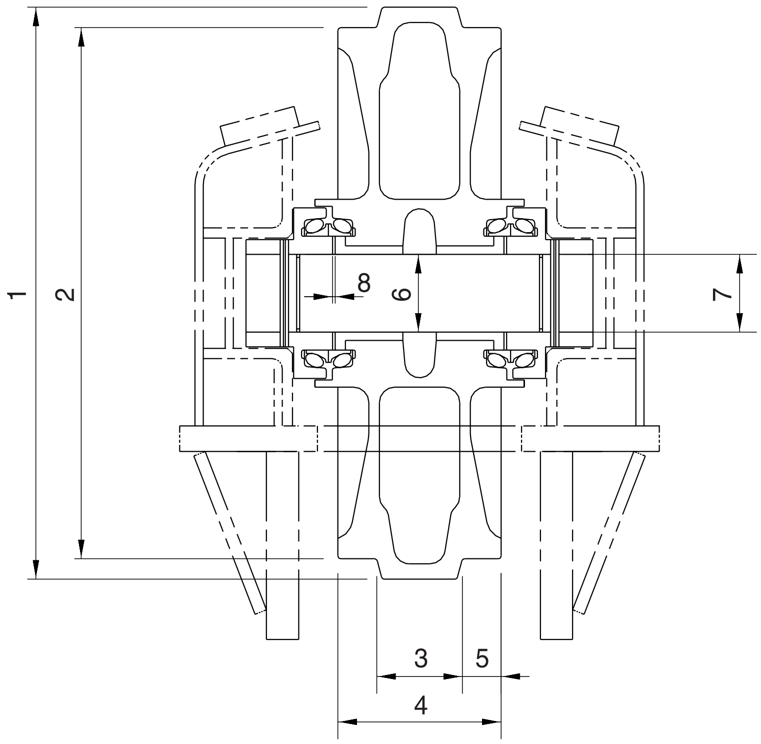
3) IDLER



21037MS03

Unit : mm

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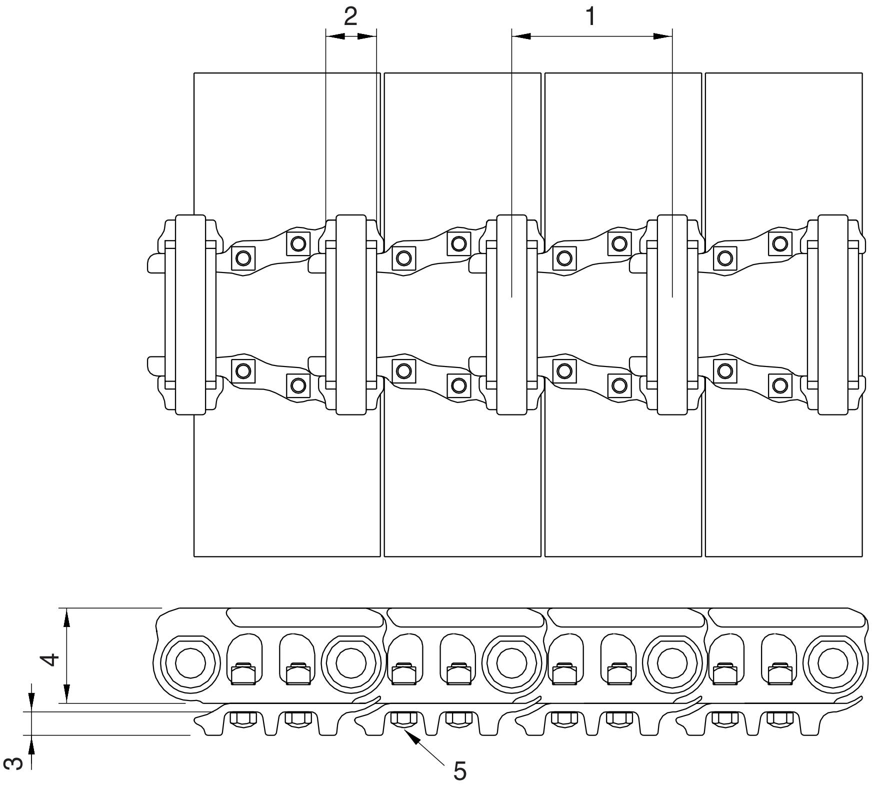
<tr><td colspan="2">Ø552</td><td colspan="2">-</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø507</td><td colspan="2">Ø497</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="2">67</td><td colspan="2">-</td></tr>
<tr><td>4</td><td>Total width</td><td colspan="2">135</td><td colspan="2">-</td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="2">34</td><td colspan="2">39</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Ø70 $^{0}_{-0.03}$</td><td>Ø70.3 $^{+0.05}_{0}$</td><td>0.3 to 0.38</td><td>2.0</td></tr>
<tr><td>7</td><td>Clearance between shaft and support</td><td>Ø70 $^{0}_{-0.03}$</td><td>Ø70 $^{+0.07}_{+0.03}$</td><td>0.03 to 0.1</td><td>1.2</td><td>Replace</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Side clearance of idler (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace bushing</td></tr>
<tr><td colspan="2">0.25 to 1.15</td><td colspan="2">2.0</td></tr>
</table>

4) TRACK

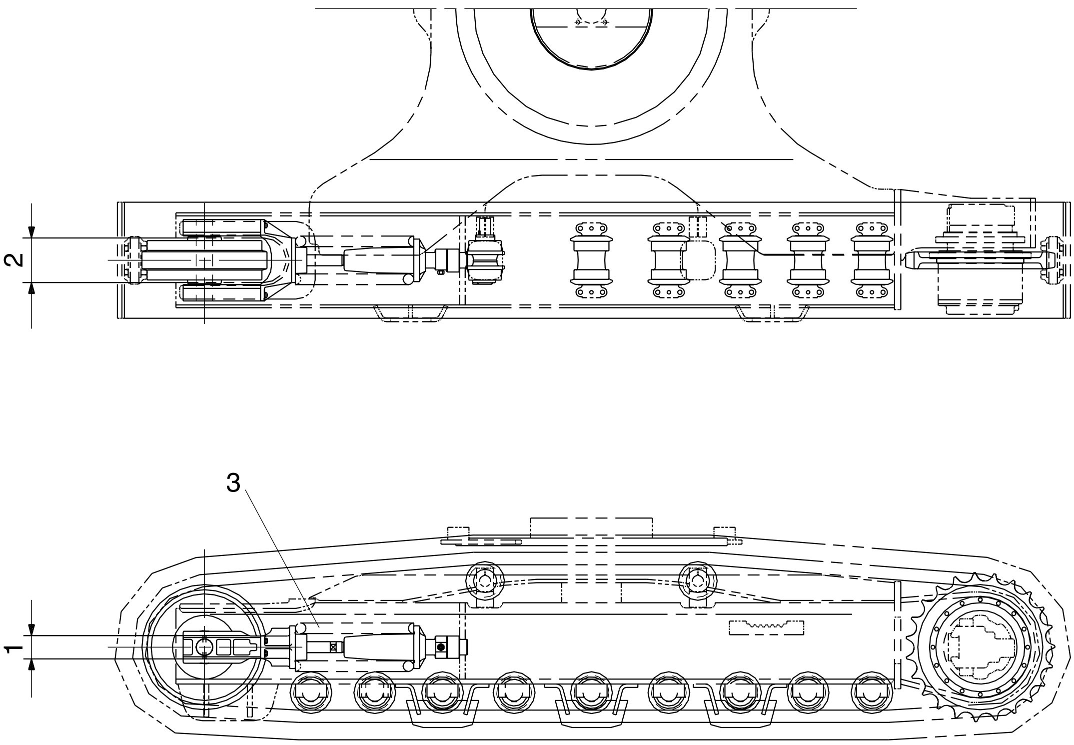


21037MS04

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



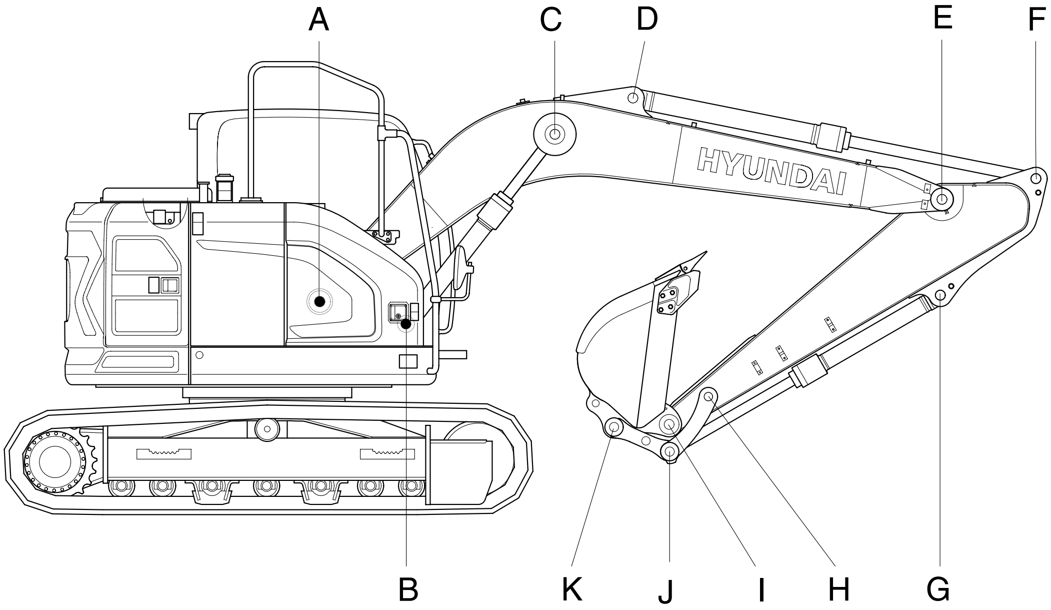
21037MS05

Unit : ㎜

No.	Check item	Criteria				Remedy
			Standard size	Tolerance	Repair limit	
1	Vertical width of idler guide	Track frame	103	+2 0	107	Rebuild or replace
		Idler support	100	0 - 0.5	98	
2	Horizontal width of idler guide	Track frame	192	+2 0	196	
		Idler support	190	-	188	

No.	Check item	Standard size			Repair limit		Remedy
		Free length	Installation length	Installation load	Free length	Installation load	
3	Recoil spring	Ø192×470	405	8,497kg	–	6,978kg	Replace

2. WORK EQUIPMENT



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	65	64	63.5	65.5	66	〃
E	Boom Front	70	69	68.5	70.5	71	〃
F	Arm Cylinder Rod	65	64	63.5	65.5	66	〃
G	Bucket Cylinder Head	65	64	63.5	65.5	66	〃
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	65	64	63.5	65.5	66	〃
K	Bucket Link	65	64	63.5	65.5	66	〃

SECTION 8 DISASSEMBLY AND ASSEMBLY

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Group 4 Main Control Valve ········ 8-32
Group 5 Swing Device ········ 8-46
Group 6 Travel Device ········ 8-99
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Group 11 Work Equipment ········ 8-181

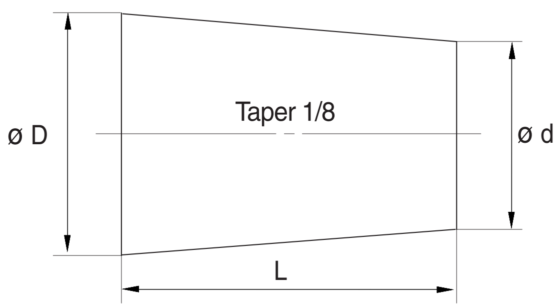
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

1) Lower the work equipment completely to the ground.
   If the coolant contains antifreeze, dispose of it correctly.
2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
3) When draining oil, prepare a container of adequate size to catch the oil.
4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.
6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
7) Check the number and thickness of the shims, and keep in a safe place.
8) When raising components, be sure to use lifting equipment of ample strength.
9) When using forcing screws to remove any components, tighten the forcing screws alternately.
10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.
11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.
12) If the part is not under hydraulic pressure, the following corks can be used.

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. COMPLETING WORK

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

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

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

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket, FR)	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
2		Engine mounting bolt (engine-bracket, RR)	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
3		Engine mounting bolt (bracket-frame, FR)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
4		Engine mounting bolt (bracket-frame, RR)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Fuel tank mounting bolt	M20 × 2.5	57.8 ± 5.8	418 ± 42.0
6		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
7		Coupling mounting socket bolt	M18 × 2.5	32.0 ± 1.6	231 ± 11.6
		Coupling mounting clamp bolt	M16 × 2.0	11.0 ± 1.0	79.6 ± 7.2
8	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
9		Main pump mounting socket bolt	M16 × 2.0	35.6 ± 7.1	257 ± 5.1
10		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
11		Hydraulic oil tank mounting bolt	M20 × 2.5	57.8 ± 5.8	418 ± 42.0
12		Turning joint mounting bolt, nut	M14 × 2.0	19.6 ± 2.9	142 ± 21.0
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 × 2.0	29.7 ± 3.0	215 ± 21.7
16		Travel motor mounting bolt	M16 × 2.0	23 ± 2.5	166 ± 18.1
17		Sprocket mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
19		Track roller mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
20		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
21		Track shoe mounting bolt, nut	M16 × 1.5	25.5 ± 2.5	184 ± 18.1
22		Track guard mounting bolt	M16 × 2.0	29.6 ± 3.2	214 ± 23.1
23	Others	Counterweight mounting bolt	M36 × 3.0	308 ± 46	2228 ± 333
24		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
25		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

※ 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	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

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	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

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	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

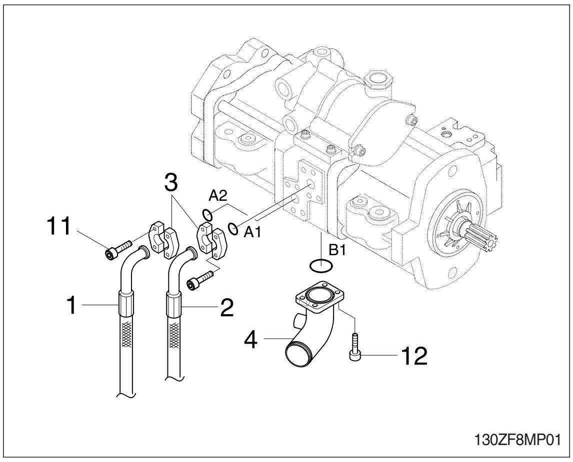
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

· Hydraulic tank quantity : 79 ℓ (20.9 U.S. gal)

(5) Remove socket bolts (11) and disconnect hoses (1,2).
Tightening torque : 6.9±1.4 kgf · m
(49.9±10.1 lbf · ft)



(6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10).
Tightening torque : 12.8±3.0 kgf · m
(92.6±21.7 lbf · ft)

(7) Remove socket bolts (12) and disconnect pump suction pipe (4).

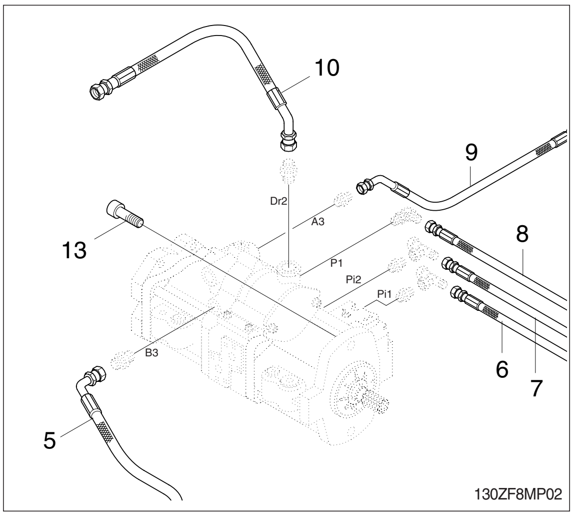
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(8) Sling the pump assembly and remove the pump mounting socket bolts (13).

· Weight : 90 kg (200 lb)

· Mounting socket bolt (13)
Tightening torque : 35.6±7.1 kgf · m
(257±51.4 lbf · ft)

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



2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

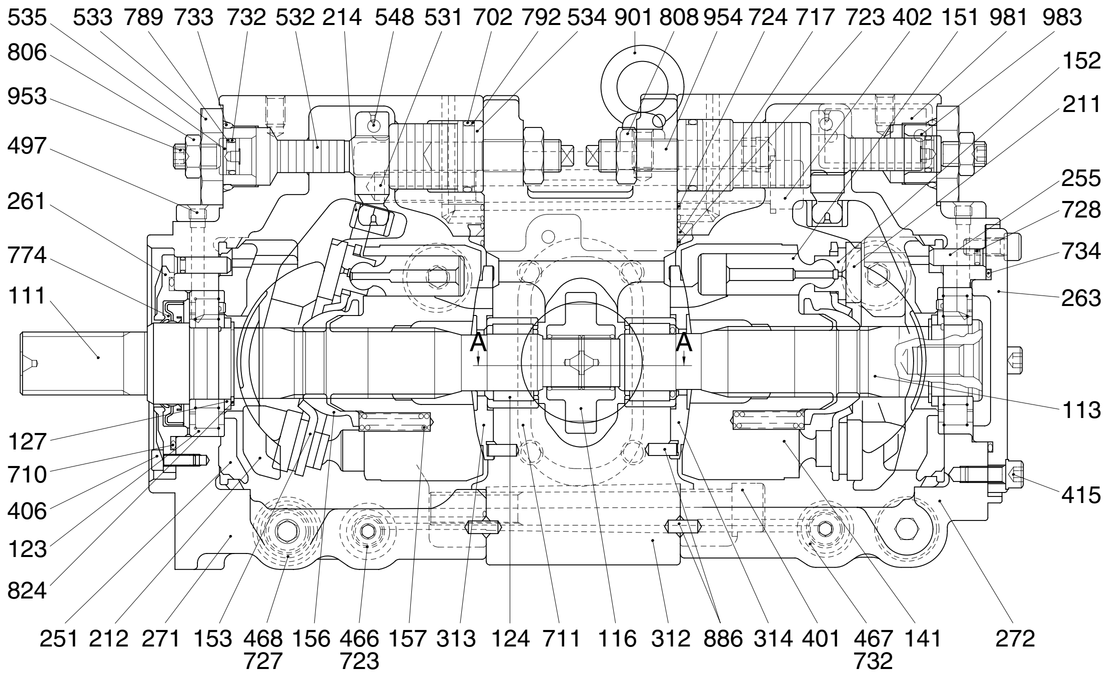
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(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 (1/3)

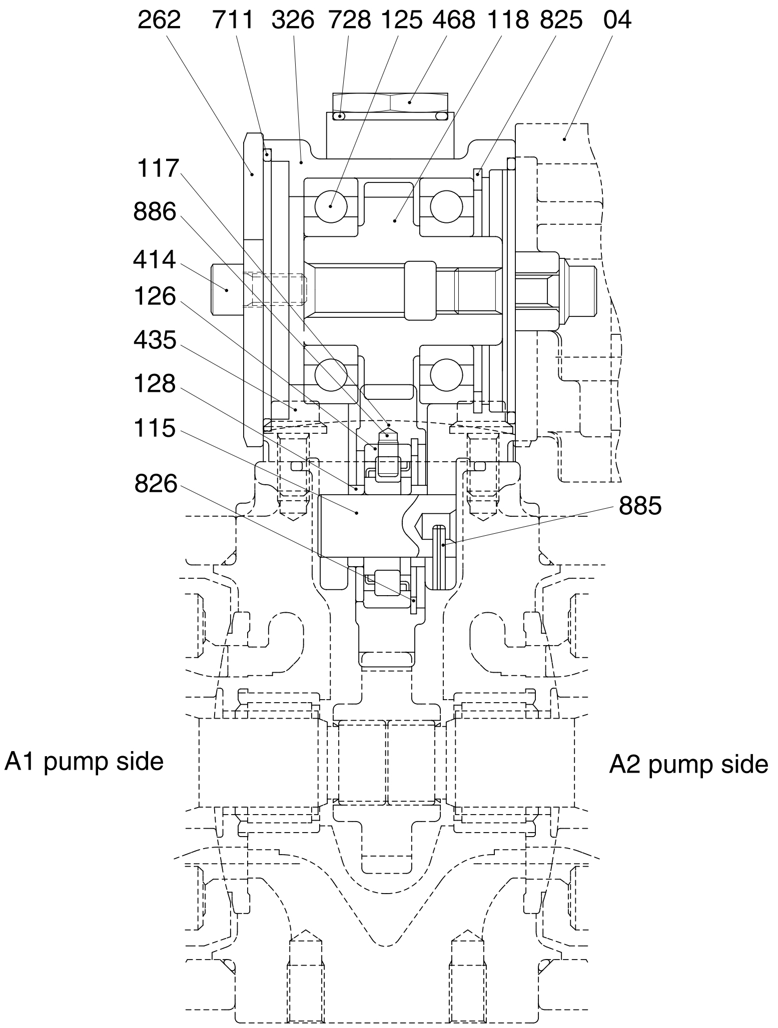
1) STRUCTURE



130ZF2MP02

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 Bushing
251 Support
255 Lock pin
261 Seal cover (F)
263 Seal cover (R)
271 Pump casing (F)
272 Pump casing (R)
312 Valve block
313 Valve plate (R)
314 Valve plate (L)
401 Hexagon socket bolt
402 Hexagon socket bolt
406 Hexagon socket bolt
415 Hexagon socket bolt
466 Plug
467 plug
468 Plug
497 Plug
531 Tilting pin
532 Servo piston
533 Plug
534 Stopper (L)
535 Stopper (S)
548 Pin
702 O-ring
710 O-ring
711 O-ring
717 O-ring
723 O-ring
724 Square ring
728 O-ring
732 O-ring
733 O-ring
734 O-ring
774 Oil seal
789 Back up ring
792 Back up ring
806 Nut
808 Hexagon head nut
824 Snap ring
886 Spring pin
901 Eye bolt
953 Set screw
954 Set screw
981 Plate
983 Pin

MAIN PUMP (2/3)

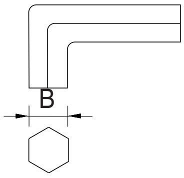


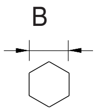
04	Gear pump	128	Bearing spacer	711	O-ring
115	Idler shaft	262	Cover	728	O-ring
117	Gear No. 2	326	Gear case	825	Retainer ring
118	Gear No. 3	414	Hexagon socket bolt	826	Retainer ring
125	Ball bearing	435	Flange socket bolt	885	Spring pin
126	Roller bearing	468	Plug	886	Pin

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)	ROH/VP/UNF plug (PF screw)	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	PF-1/4	M12, M14
	8	M10	BP-3/8	PF-3/8	M16, M18
	10	M12	BP-1/2	PF-1/2	M20
	14	M16, M18	BP-3/4	PF-3/4	-
	17	M20, M22	BP-1	PF-1	-

Name	B	Hexagon bolt	Hexagon nut	VP plug (PF screw)
Double ring spanner, socket wrench, double (single) open end spanner 	-	Hexagon bolt	Hexagon nut	VP plug (PF screw)
	19	M12	M12	PF-1/4
	24	M16	M16	-
	27	M18	M18	PF-1/2
	30	M20	M20	-
	41	-	-	PF-1

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 1.5 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 3/8	7.55	54.6	0.31	8
	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

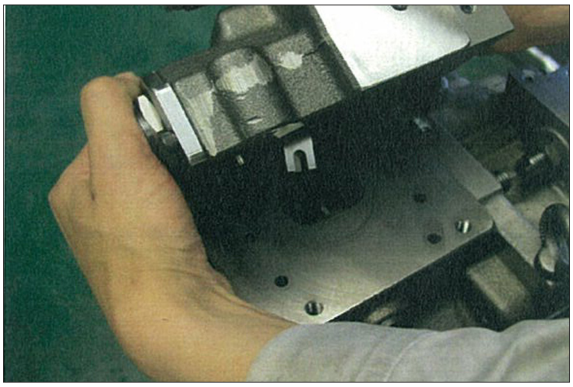
3) DISASSEMBLY

(1) Select place suitable to disassembling.
※ Select clean place.
※ Spread rubber sheet, cloth or so on overhaul workbench top to prevent parts from being damaged.

(2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.

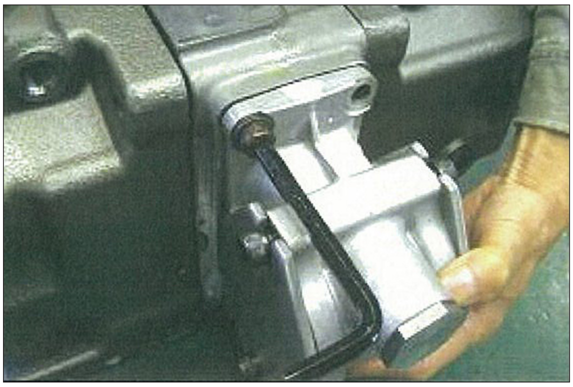
(3) Remove drain port plug (468) and drain oil pump casing (271, 272).

(4) Remove hexagon socket head bolts (412, 413) and remove regulator.



140Z98MP11

(5) Place pump horizontally on workbench with its regulator fitting surface down, and remove flange socket (435) and remove PTO unit (05).
※ Be careful about the attaching direction of the PTO unit (05).
※ Before bringing regulator fitting surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.

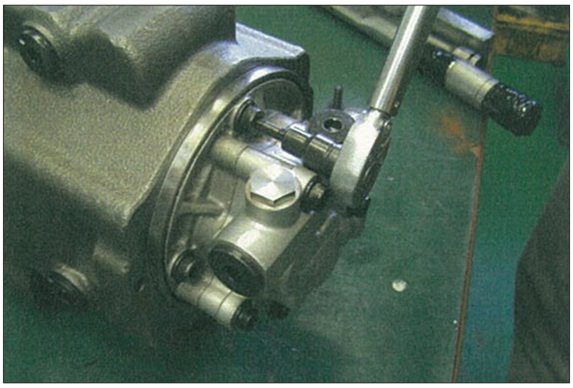


140Z98MP12

(6) In case the pump is provided without the PTO unit (05), remove the cover (262) with the hexagon socket head cap screws (414).

140Z98MP13

(7) Remove flange socket (435) and remove gear pump (04).



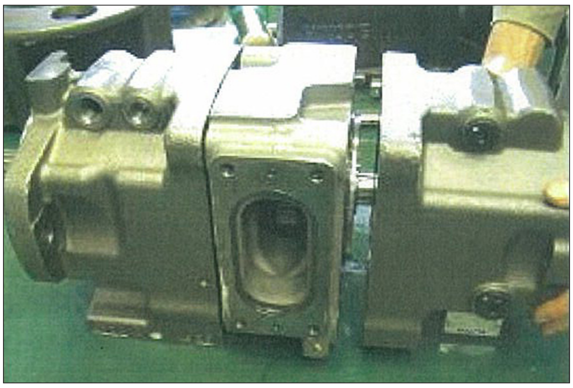
140Z98MP14

(8) Loosen hexagon socket head bolt (401) which tighten pump casing (271, 272) and valve block (312).

140Z98MP15

(9) Place pump horizontally on workbench with its regulator fitting surface down, and separate pump casing (271,272) from valve block (312).

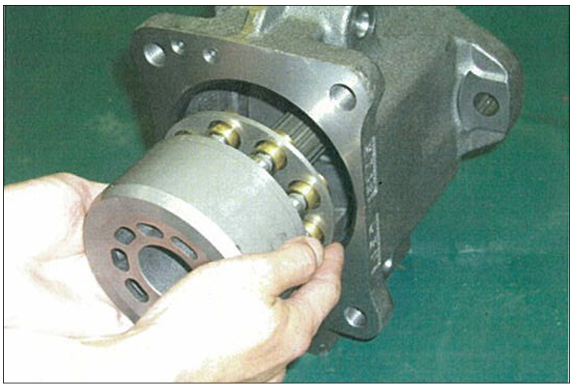
※ Remove 1st gear (116) when separating pump casing from valve block (312) too.



140Z98MP16

(10) Pull out cylinder (141), pistons (151), set screw (153), spherical bush (156) and cylinder springs (157) simultaneously from pump casing (271, 272) straightly over drive shaft (111, 113).

※ Take care not to damage sliding surface of cylinder (141), spherical bush (156), shoes (152), swash plate (212), etc.

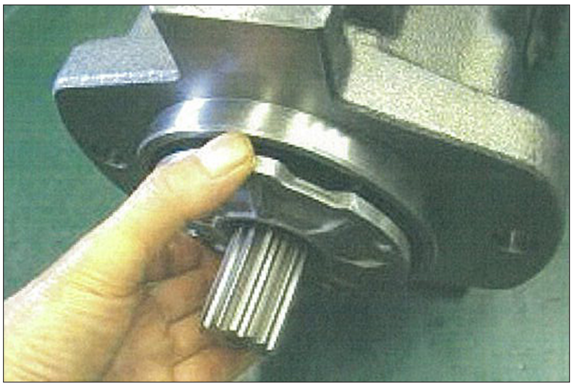


140Z98MP17

(11) Remove hexagon socket head bolts (406) and then seal cover (F, 261).

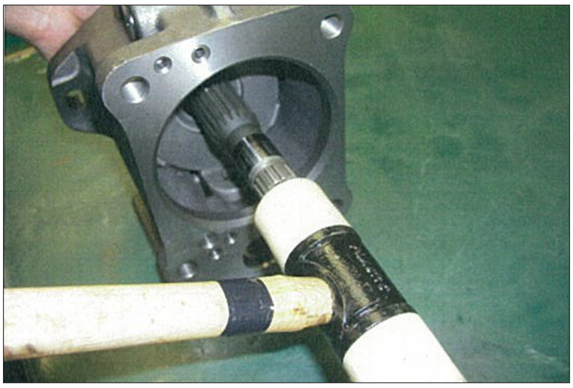
※ In the case removing it is difficult, and hooking pull thin rod into notch, and the cover can be removed easily.

※ Since oil seal is fitted on seal cover (F) (261), take care not to damage it at removing the cover.



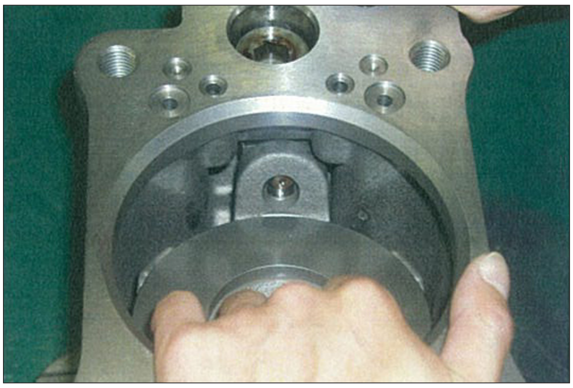
140Z98MP18

(12) Tapping shaft ends of drive shaft (111, 113) lightly with plastic hammer, remove it from pump casing (271, 272).



140Z98MP19

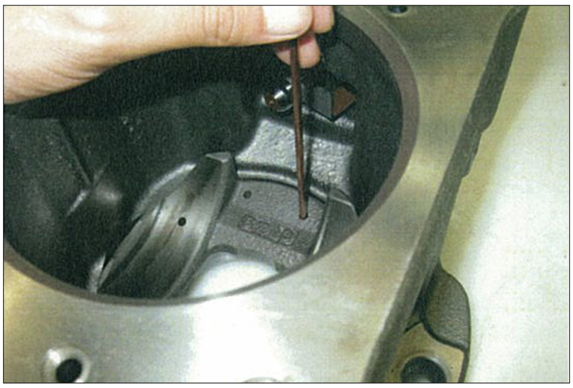
(13) Remove shoe plate (211) and swash plate (212) from pump casing (271, 272).



140Z98MP20

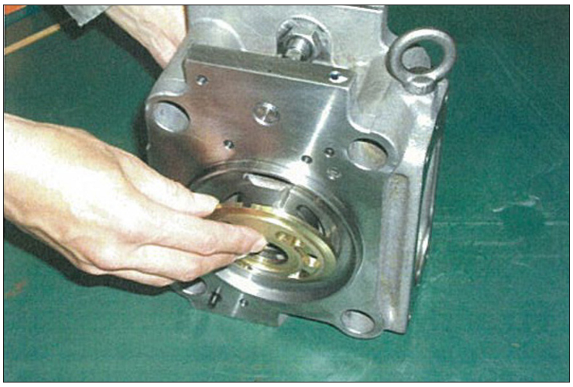
(14) Insert thin steel bar into the hole and remove the lock pin (255) from pump casing (271, 272).

※ When holding with thin steel bar, do not confuse the unlocking hole with the arc shaped oil passage.



140Z98MP21

(15) Remove valve plate (313, 314) from valve block (312).
※ These may be removed in Work 8.



140Z98MP22

If necessary, remove stopper (L) (534), Qmin. plug (533), servo piston (532) and tilting pin (531) from pump casing (271, 272), and needle bearing (124) from valve block.
※ When removing tilting pin, use a protector to prevent pin head from being damaged.
※ Since lock tight is applied to fitting areas of tilting pin (531) and servo piston (532), take care not to damage servo piston (532).
※ Do not remove needle bearing (124) as far as possible, except the case that considered to be out of its life span.
※ Do not loosen hexagon nuts of valve block (312) and Qmin. plug (533).
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 repair 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.

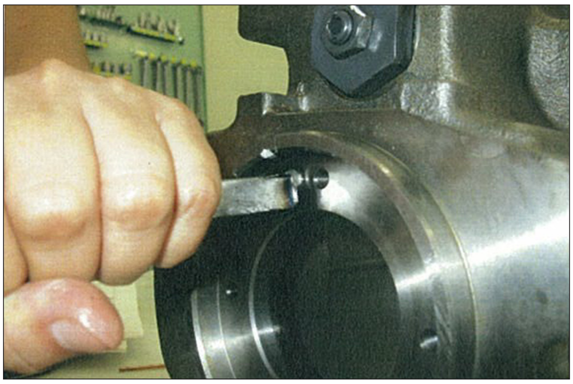
⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.

⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

(2) Insert the lock pin (255) after the swash plate support (251) into the pump casing (271, 272), and fit the lock pin (255) into the hole of the swash plate support (251).

※ In case the servo piston, tilting pin, stopper (L), stopper (S), and Qmin. plug have been removed, attached then to the pump casing in advance.

※ In the tightening work of the servo piston and the tilting pin, use the tool not to damaged the head of the tilting pin and the feed back pin. Besides, apply loctite (of medium strength) to the thread portion.



140Z98MP23

(3) Fit tilting bush (214) of swash plate (212) to tilting pin (531), and fit swash plate (212) with shoe plate (211) to swash plate support (251) correctly.

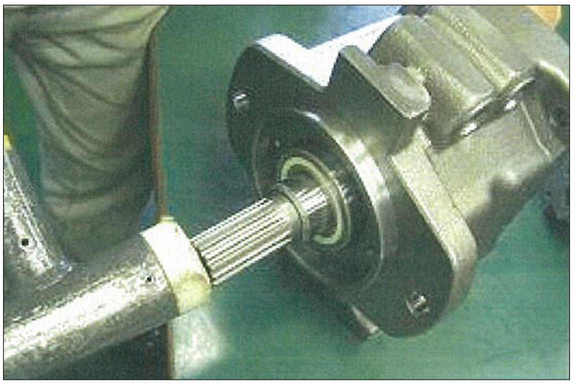
※ Confirm with fingers of both hands that swash plate can be removed smoothly.

※ Apply grease to sliding sections of swash plate (212) and swash plate support (251), and drive shaft (111, 113) can be fitted easily.

※ Take care not to damage shoe plate (211) surface.

140Z98MP24

(4) To pump casing (271, 272), fit drive shaft (111, 113) set with bearing (123), bearing spacer (127) and stop ring (824).

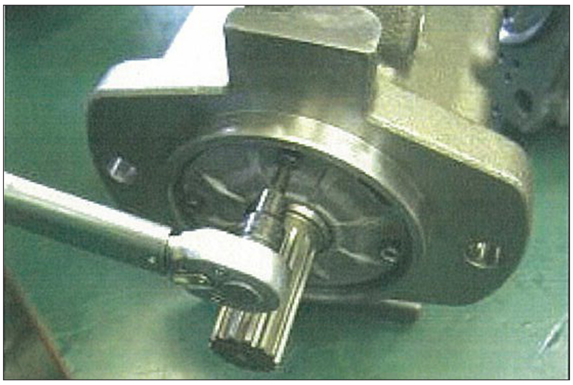


140Z98MP25

(5) In assemble of front pump, assemble seal cover (F) (261) to pump casing (271) and fix it with hexagon socket head bolt (406).

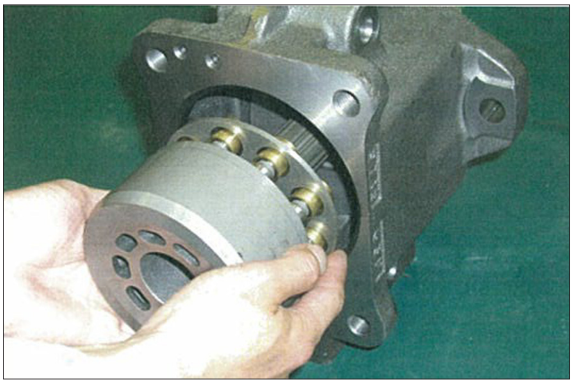
※ Apply grease lightly to oil seal in seal cover (F) (261).

※ For assemble oil seal (774), taking full care not to damage it.



140Z98MP26

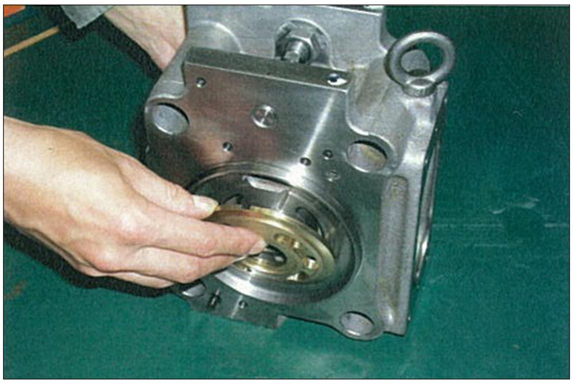
(6) Assemble piston cylinder subassembly [cylinder (141), piston subassembly (151, 152), set plate (153), spherical bush (156) and cylinder spring (157)]. Fitting spline phases of cylinder, spherical bush (156) and drive shaft (111, 113), insert piston cylinder subassembly into pump casing (271, 272).



140Z98MP27

(7) Fit valve plate (313, 314) to valve block (312), spring pin (886) into pin hole.

※ Take care not to mistake suction / delivery direction of valve plate (312).

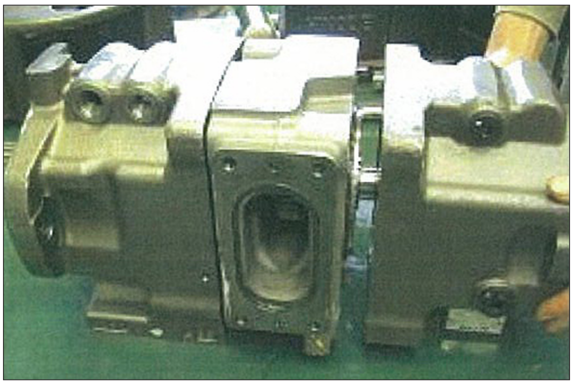


140Z98MP28

(8) Place pump horizontally on workbench with its regulator fitting surface down, and attach pump casing (271, 272) to valve block (312). Fit 1st gear (116) simultaneously.

※ Before bringing regulator fitting surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.

※ Take care not to mistake direction of valve block (312). [Clockwise rotation (viewed from input shaft side)]. Fit the valve block (312) with suction flange left when regulator side below, viewed from front side.

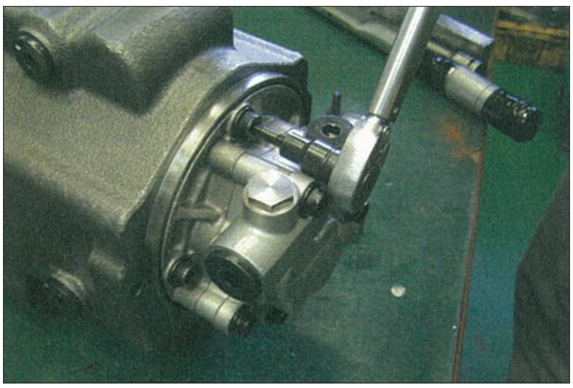


140Z98MP29

(9) Fix valve block (312) to pump casing (271, 272) with hexagon socket head bolts (401).

140Z98MP30

(10) Fit gear pump (04) to pump casing (272) with hexagon socket head bolts (435).

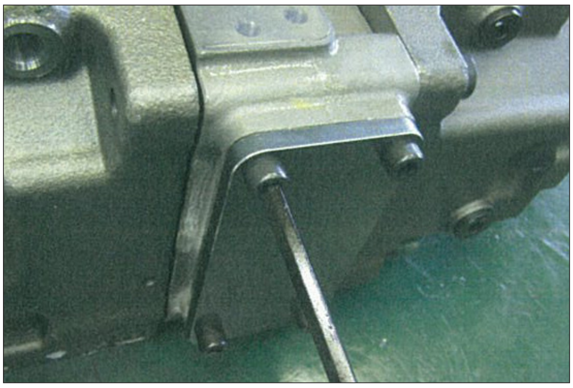


140Z98MP31

(11) Attach the PTO unit (05) by fastening the flange socket (435) to the valve block (312).

140Z98MP32

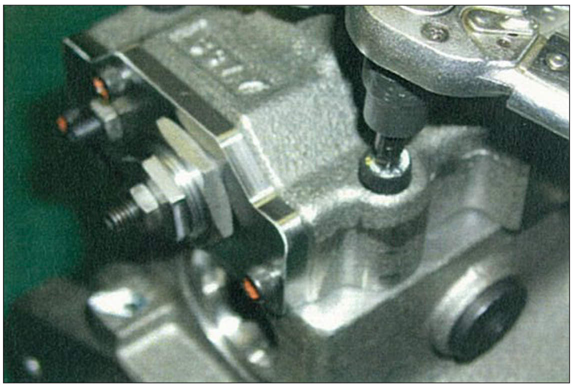
(12) In case the pump is not provided with the PTO unit (05), attach the cover (262) with the hexagon socket head cap screw (414).



140Z98MP33

(13) Putting feedback lever (611) of regulator into feedback pin (548) of tilting pin (531), fit regulator with hexagon socket head bolt (415).

※ Take care not to mix up regulator of front pump and that of rear pump.



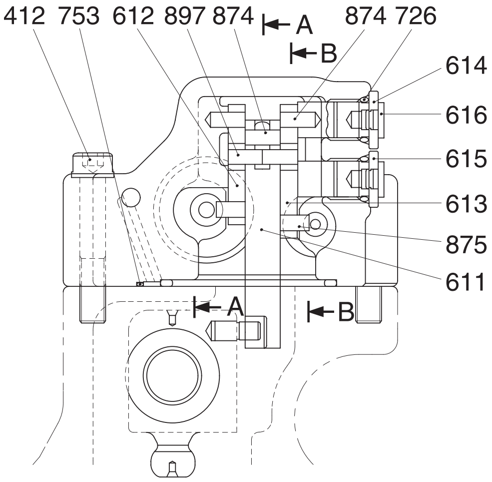
140Z98MP34

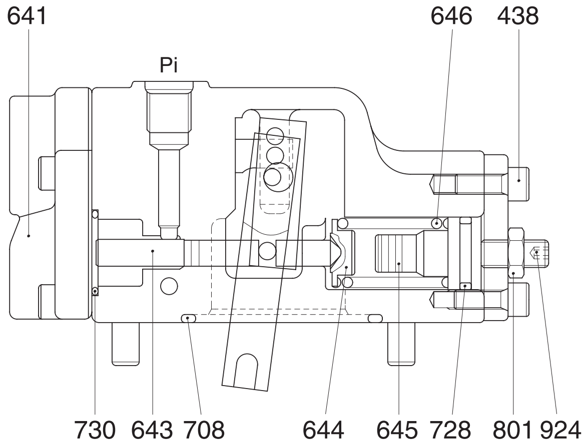
(14) Fit drain port plug (468).

This is the end of reassembling procedures.

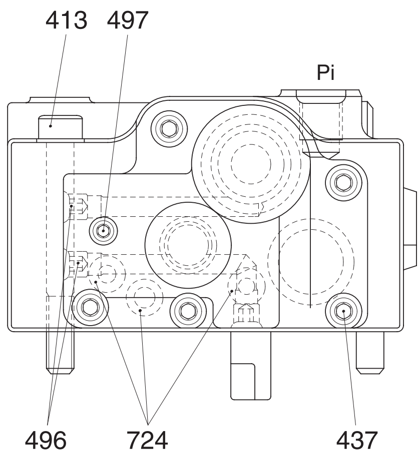
3. REGULATOR

1) STRUCTURE (1/2)

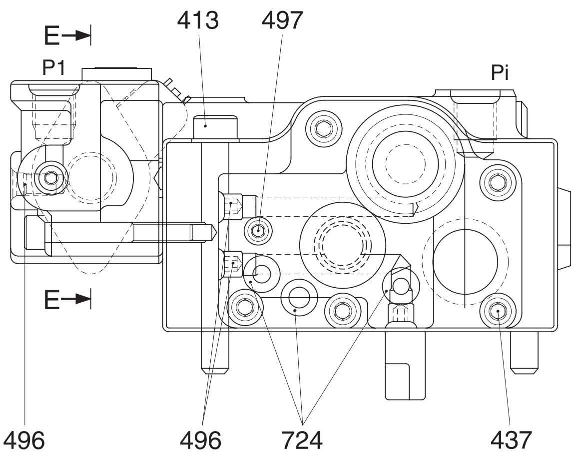




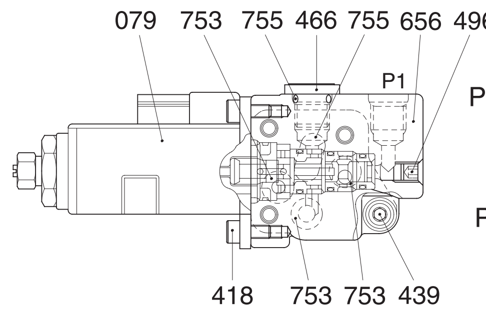
SECTION B-B



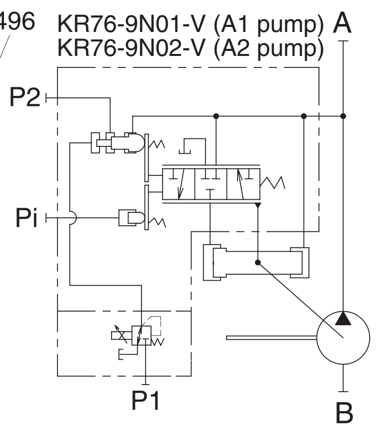
VIEW C (A1 pump)



VIEW C (A2 pump)

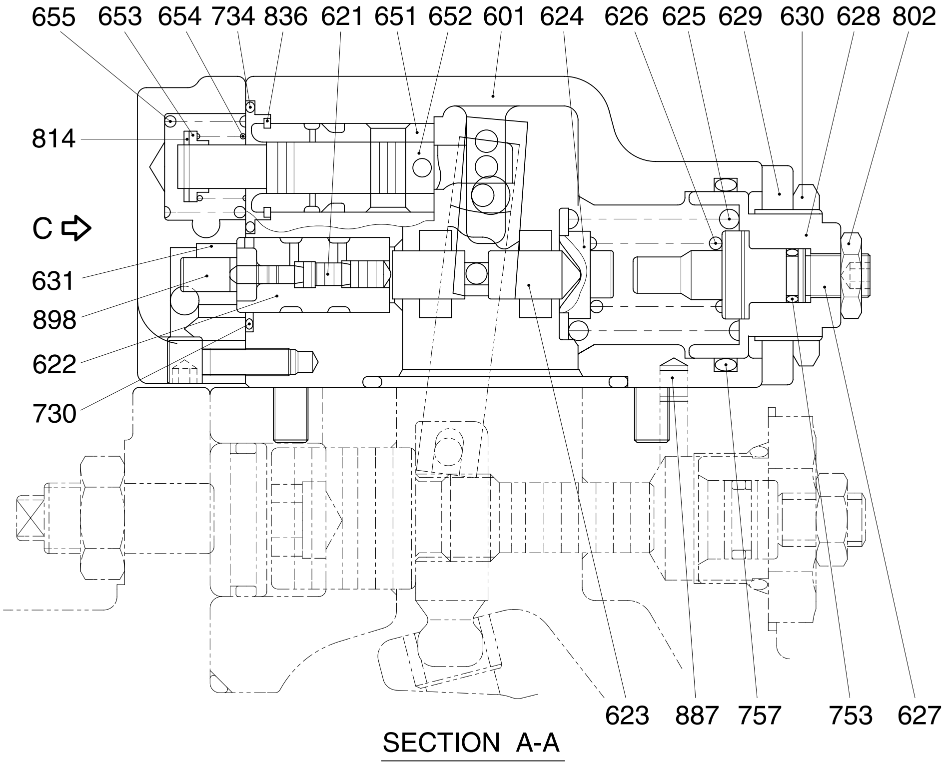


SECTION E-E



130ZF2MP04

REGULATOR (3/3)



079	EPPR valve assembly	624	Spring seat (C)	708	O-ring
412	Hexagon socket screw	625	Outer spring	724	Square ring
413	Hexagon socket screw	626	Inner spring	725	O-ring
418	Hexagon socket screw	627	Adjust stem (C)	728	O-ring
437	Hexagon socket screw	628	Adjust screw (C)	730	O-ring
438	Hexagon socket screw	629	Cover (C)	734	O-ring
439	Hexagon socket screw	630	Lock nut	753	O-ring
466	Plug	631	Sleeve, Pf	755	O-ring
496	Plug	641	Pilot cover	757	O-ring
497	Plug	643	Pilot piston	801	Nut
601	Casing	644	Spring seat (Q)	802	Nut
611	Feed back lever	645	Adjust stem (Q)	814	Snap ring
612	Lever 1	646	Pilot spring	836	Snap ring
613	Lever 2	651	Sleeve	874	Pin
614	Center plug	652	Spool	875	Pin
615	Adjust plug	653	Spring seat	887	Pin
616	Plug	654	Return spring	897	Pin
621	Compensator piston	655	Set spring	898	Pin
622	Piston case	656	Block cover	924	Set screw
623	Compensator rod				

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><td colspan="2">Tool name & size</td><td colspan="12">Part name</td></tr>
<tr><td>Name</td><td>B</td><td colspan="3">Hexagon socket head bolt</td><td colspan="3">PT plug (PT thread)</td><td colspan="3">PO plug (PF thread)</td><td colspan="3">Hexagon socket head setscrew</td></tr>
<tr><td rowspan="3">Allen wrench</td><td>4</td><td colspan="3">M5</td><td colspan="3">BP-1/16</td><td colspan="3">-</td><td colspan="3">M 8</td></tr>
<tr><td>5</td><td colspan="3">M6</td><td colspan="3">BP-1/8</td><td colspan="3">-</td><td colspan="3">M10</td></tr>
<tr><td>6</td><td colspan="3">M8</td><td colspan="3">BP-1/4</td><td colspan="3">PO-1/4</td><td colspan="3">M12, M14</td></tr>
<tr><td rowspan="2">Double ring spanner, socket wrench, double (single) open end spanner</td><td>-</td><td colspan="4">Hexagon head bolt</td><td colspan="4">Hexagon nut</td><td colspan="4">VP plug (PF thread)</td></tr>
<tr><td>6</td><td colspan="4">M 8</td><td colspan="4">M 8</td><td colspan="4">-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="12">Small size, Max 36 mm</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="12">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="12">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="12">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="12">4×100 mm</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="12">Capable of tightening with the specified torques</td></tr>
<tr><td colspan="2">Pincers</td><td colspan="12">-</td></tr>
<tr><td colspan="2">Bolt</td><td colspan="12">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.

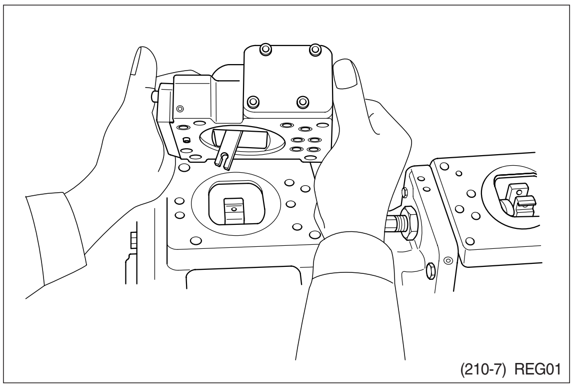
※ Choose a clean place.

※ 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.

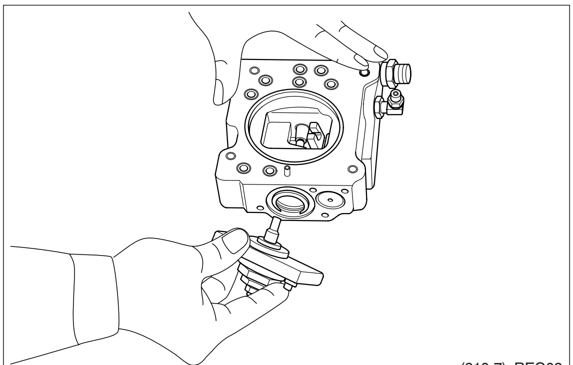


(210-7) REG01

(4) Remove hexagon socket head screw (438) and remove cover (C,629)

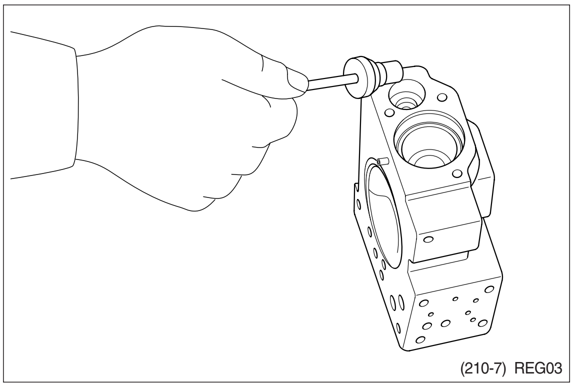
※ Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

※ Do not loosen these screws and nuts. If they are loosened, adjusted pressure-flow setting will vary.



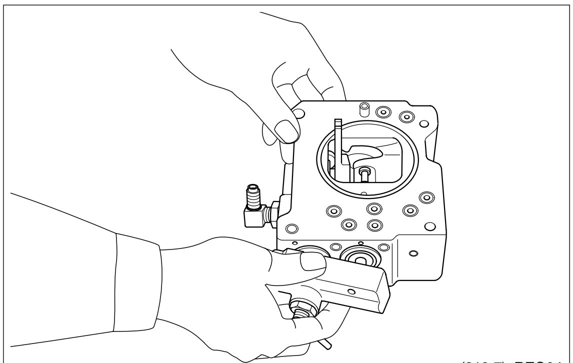
(210-7) REG02

(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.



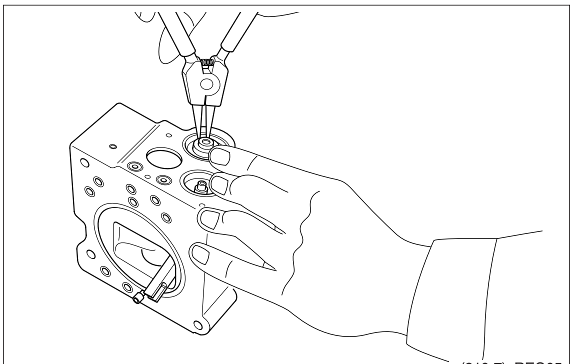
(210-7) REG03

(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.



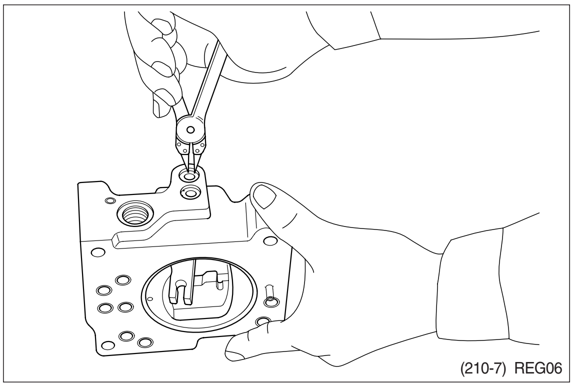
(210-7) REG04

(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.

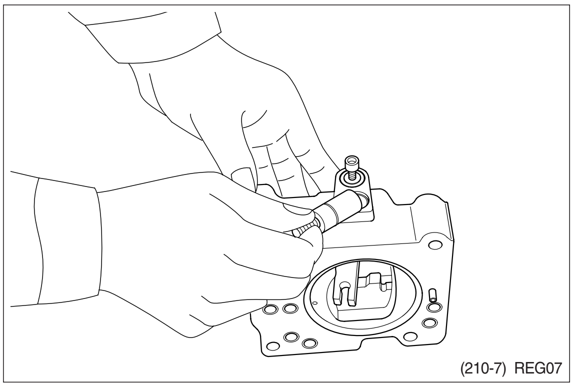


(210-7) REG05

(8) Remove prevention plug (616) and take out center plug (614) and adjusting plug (615).
※ Center plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.



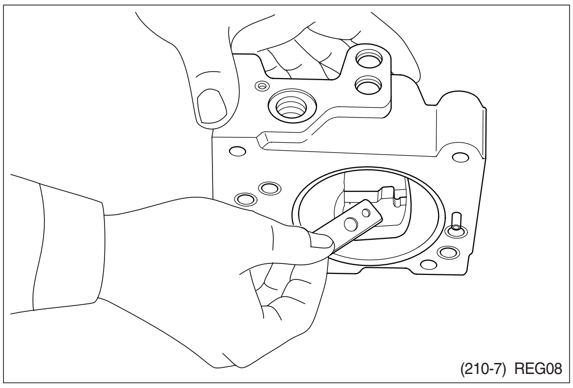
(210-7) REG06



(210-7) REG07

(9) Remove lever 2 (613). Do not draw out pin (875).

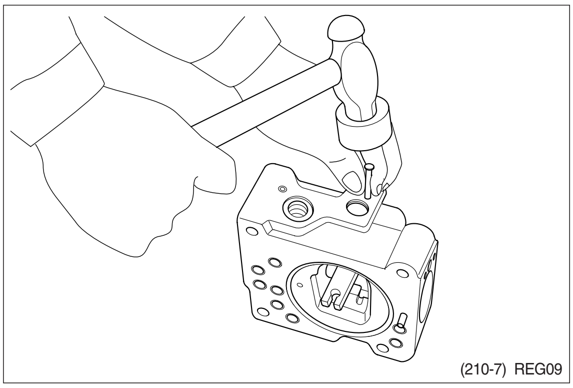
※ Work will be promoted by using pincers or so on.



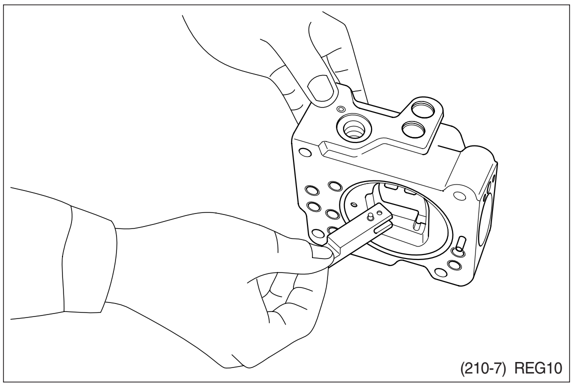
(210-7) REG08

(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.

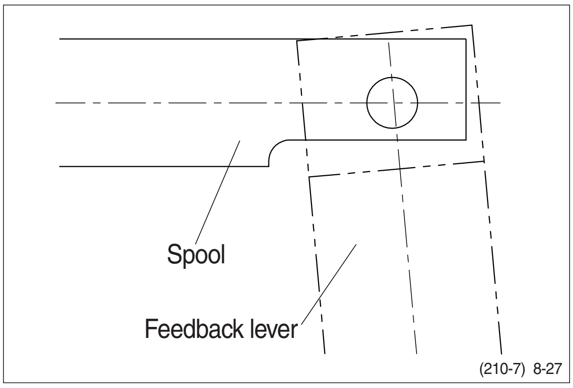
(2) Put compensating rod (623) into compensating hole of casing (601).

(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.

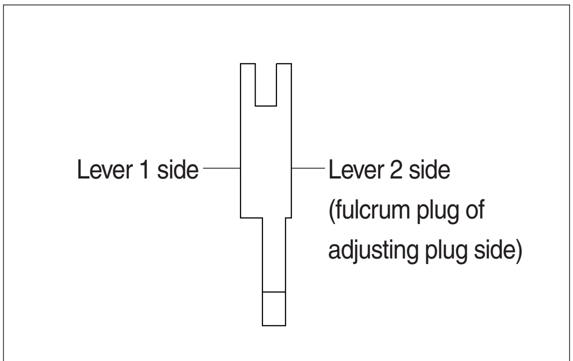
※ Pay attention to orientation of spool.



(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.

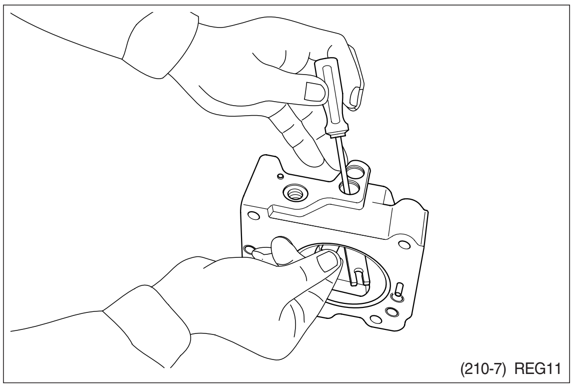


(210-7) 8-28

(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.

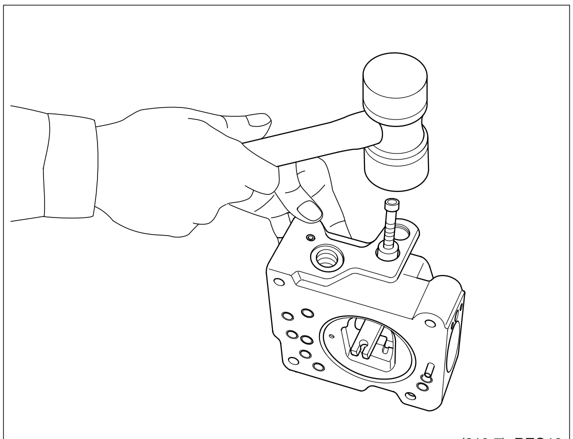


(210-7) REG11

(8) Fit center plug (614) so that pin force-fitted in center plug (614) can be put into pin hole of lever 2.
Then install prevention plug (858).

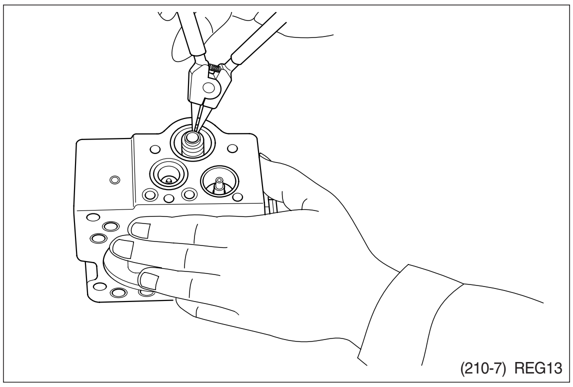
(9) Insert adjusting plug (615) and fit locking ring.

※ 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.



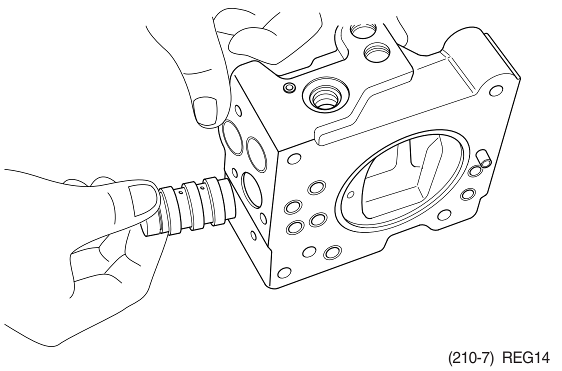
(210-7) REG12

(10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



(210-7) REG13

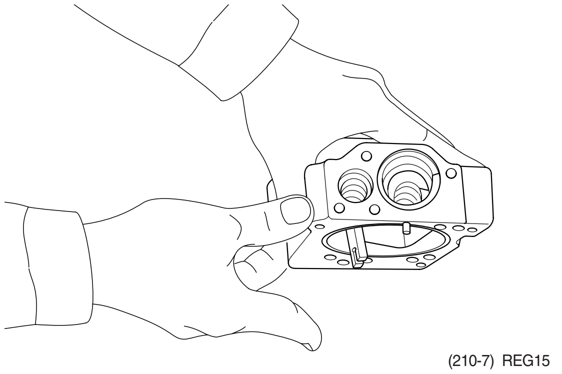
(11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (437, 438).



(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.

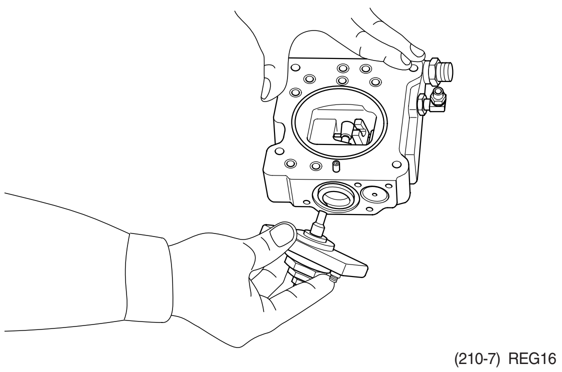
※ When fitting spring seat, take care not to mistake direction of spring seat.



(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

13031GE18

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

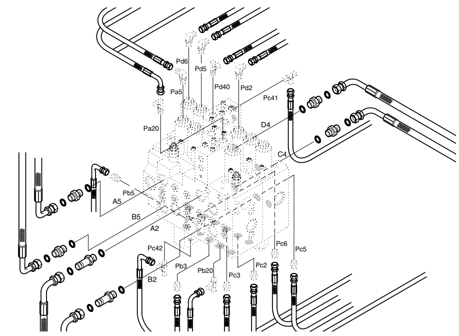
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(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.

(4) Remove the wirings for the pressure sensor and so on.



130ZF8MC01

(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

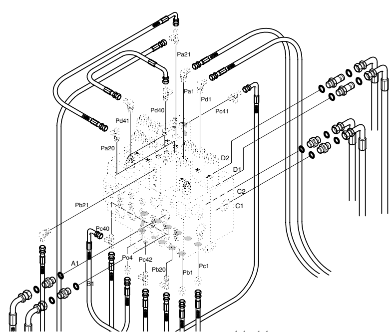
(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.

· Weight : 80 kg (175 lb)

· Mounting bolt

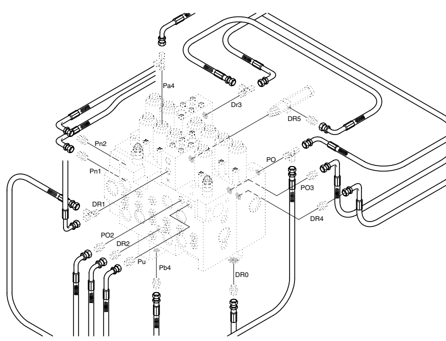
Tightening torque : 12.2±1.3 kgf.m
(88.2±9.4 lbf.ft)



130ZF8MC02

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

2) INSTALL



130ZF8MC03

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

(2) Bleed the air from below items.

① Cylinder (Boom, arm, bucket)

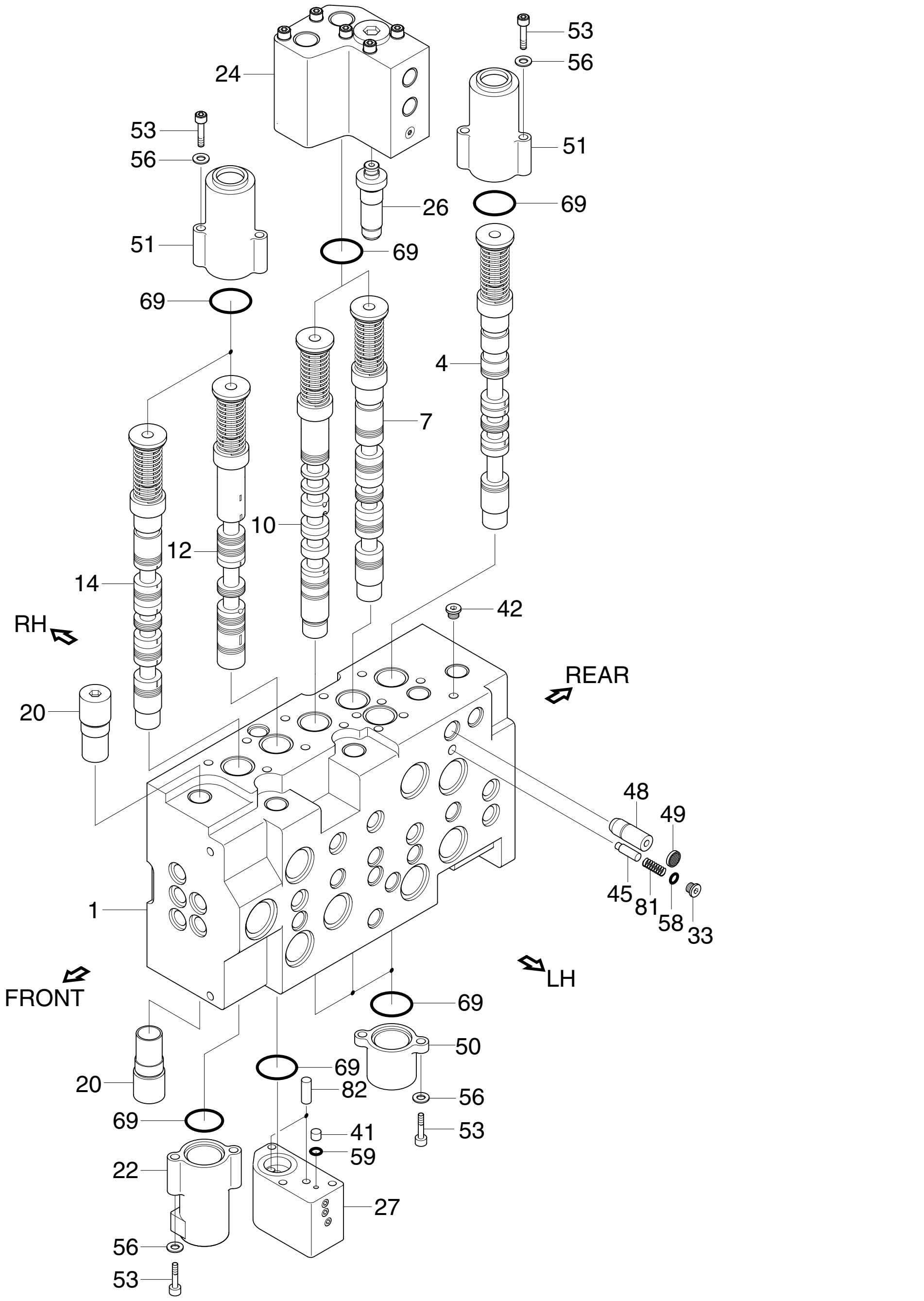
② Swing motor

③ Travel motor

※ See each item removal and install.

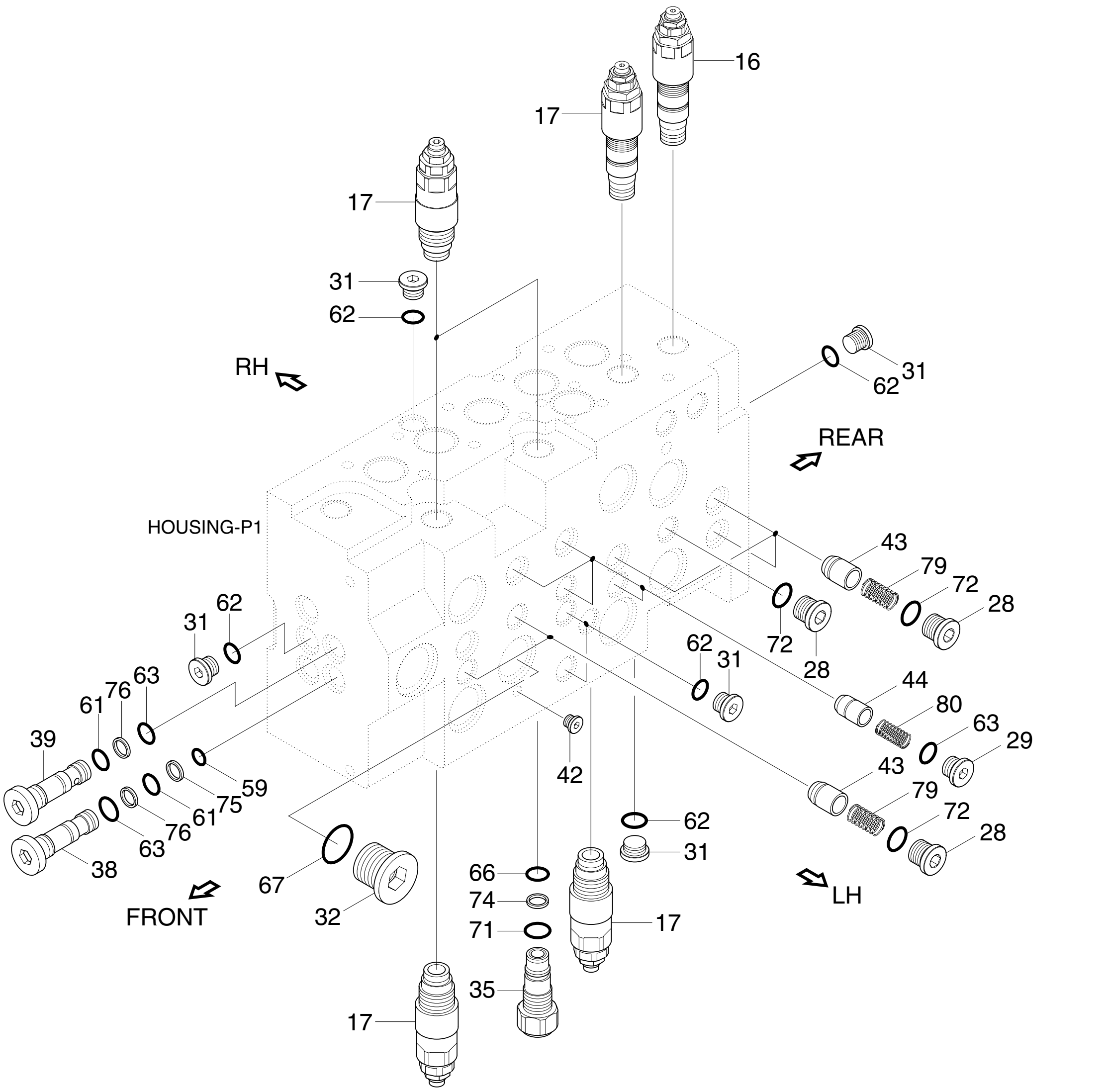
(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.

2. STRUCTURE (1/4)



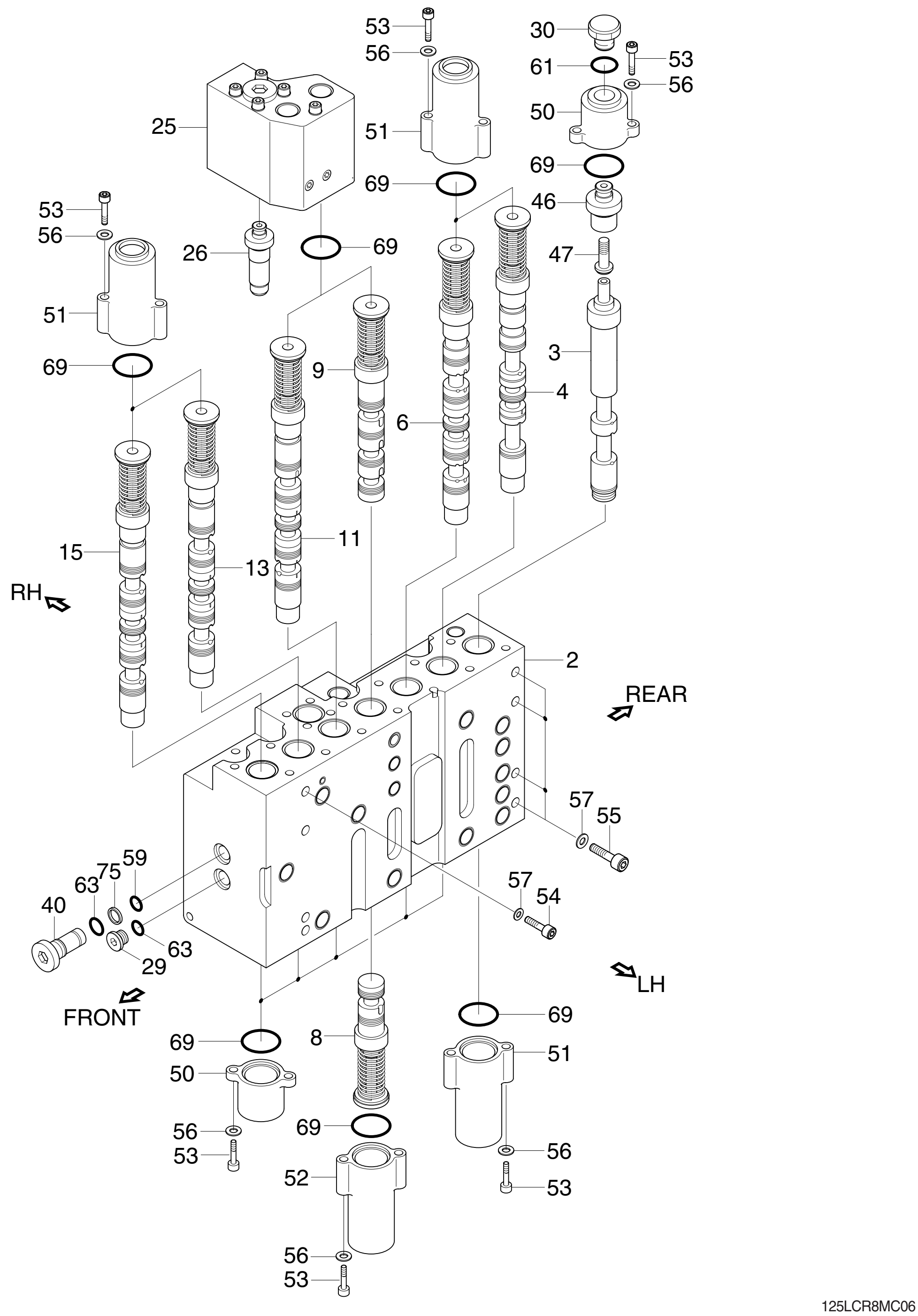
1	Housing-P1	26	Lock valve kit B	51	Pilot B1 cap
4	Spool assy-travel (LH)	27	Regeneration block	53	Socket head bolt
7	Spool assy-boom 1	33	Plug	56	Plain washer
10	Spool assy-arm 2	41	Orifice	58	O-ring
12	Spool assy-arm regen	42	Plug	59	O-ring
14	Spool assy-bucket	45	Poppet	69	O-ring
20	Nega con relief valve	48	Orifice	81	Spring
22	Bucket stroke limiter	49	Coin type filter	82	Pin
24	Holding valve kit A1	50	Pilot A cap		

STRUCTURE (2/4)



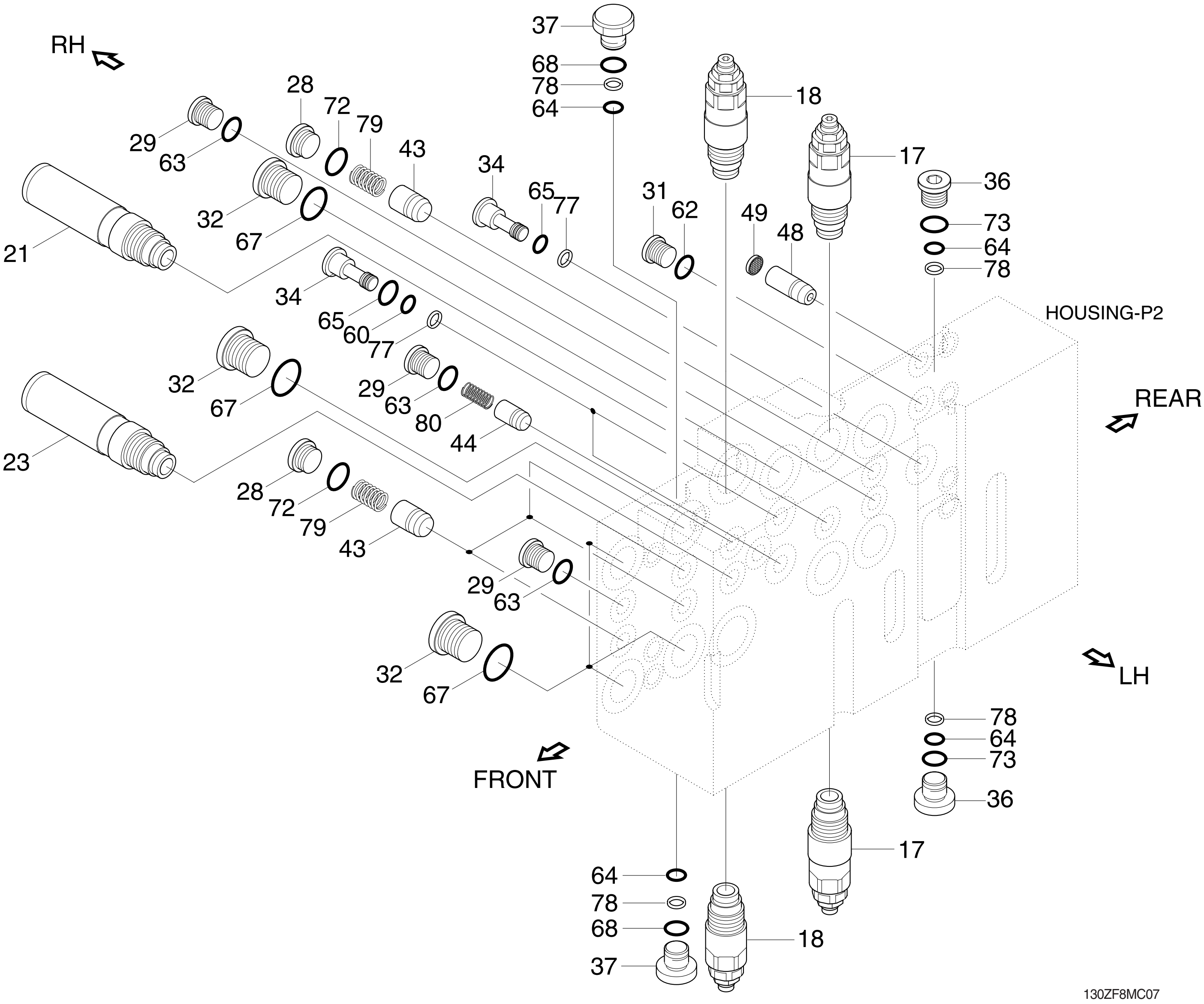
16	Main relief valve	42	Plug	71	O-ring
17	Overload relief valve	43	Poppet 1	72	O-ring
28	Plug	44	Poppet 2	74	Back up ring
29	Plug	59	O-ring	75	Back up ring
31	Plug	61	O-ring	76	Back up ring
32	Plug	62	O-ring	79	Spring
35	Plug	63	O-ring	80	Spring
38	Plug	66	O-ring		
39	Plug	67	O-ring		

STRUCTURE (3/4)



2	Housing-P2	26	Lock valve kit B	54	Socket head bolt
3	Spool assy-straight travel	29	Plug	55	Socket head bolt
4	Spool assy-travel(RH)	30	Plug	56	Plain washer
6	Spool assy-swing	40	Plug	57	Spring washer
8	Spool assy-swing priority	46	Sleeve	59	O-ring
9	Spool assy-boom 2	47	Piston	61	O-ring
11	Spool assy-arm 1	50	Pilot A cap	63	O-ring
13	Spool assy-option B	51	Pilot B1 cap	69	O-ring
15	Spool assy-option C	52	Pilot B2 cap	75	Back up ring
25	Holding valve kit A2	53	Socket head bolt		

STRUCTURE (4/4)



17	Overload relief valve	37	Plug	67	O-ring
18	Overload relief valve	43	Poppet 1	68	O-ring
21	Swing logic valve	44	Poppet	72	O-ring
23	ON/OFF valve-option	48	Orifice	73	O-ring
28	Plug	49	Coin type filter	77	Back up ring
29	Plug	60	O-ring	78	Back up ring
31	Plug	62	O-ring	79	Spring
32	Plug	63	O-ring	80	Spring
34	Plug	64	O-ring		
36	Plug	65	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 (travel right, travel left)

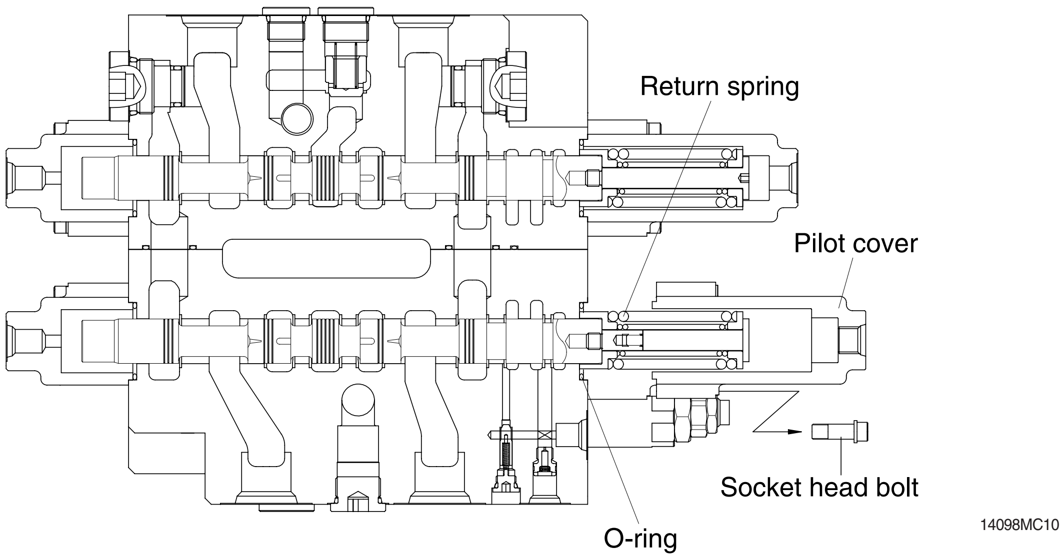
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)

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.



(2) **Disassembly of spools with holding valve** (boom 1, Arm 1 spool)

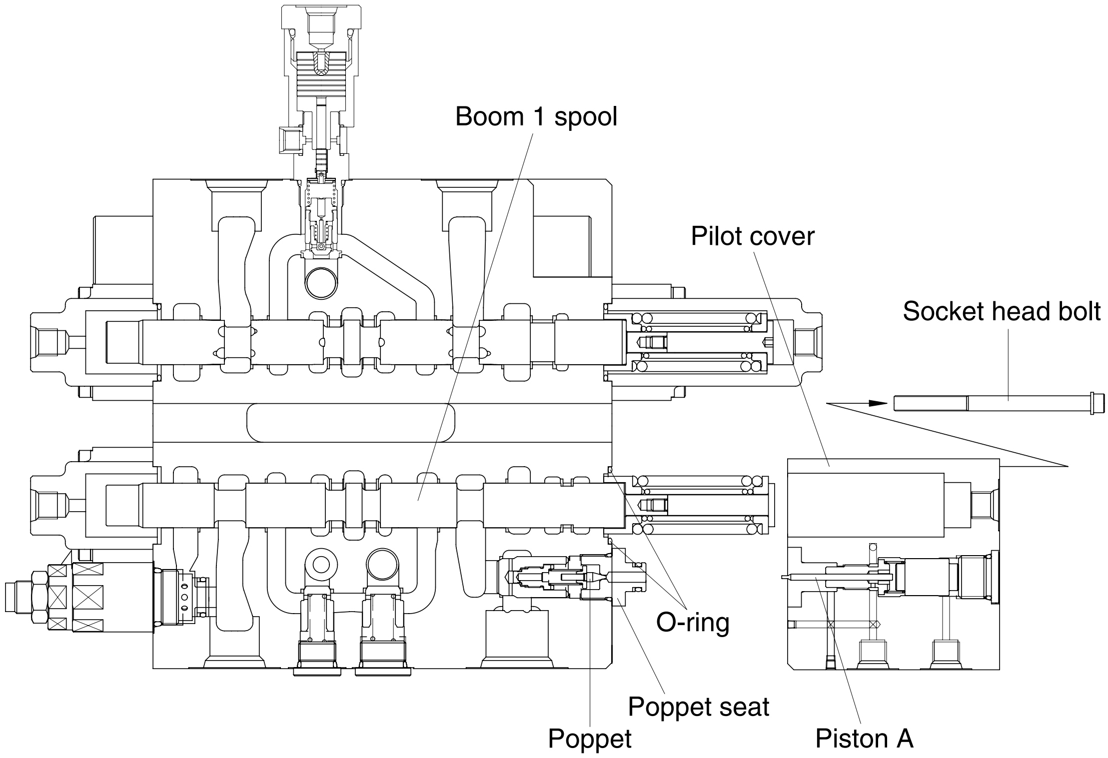
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 ㎜)

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.



125LCR8MC11

(3) Disassembly of the holding valve

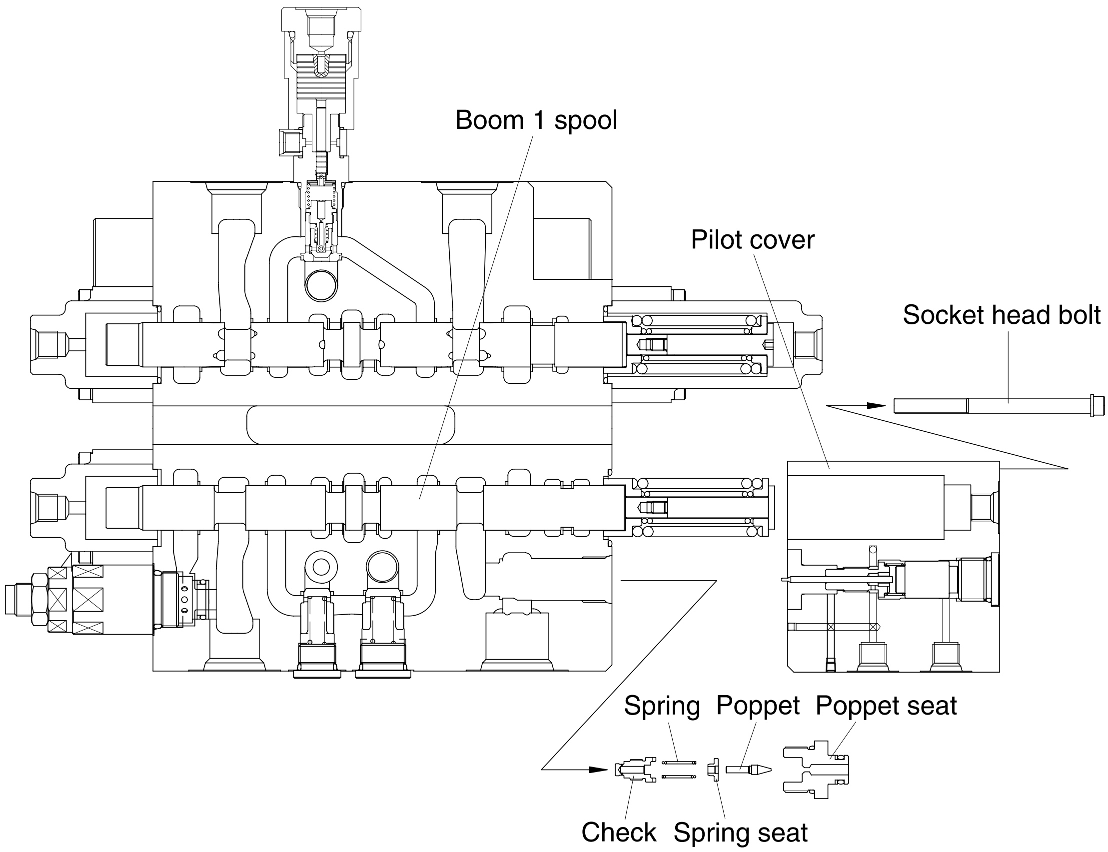
① Remove the pilot cover with the holding valve as described on previous page.

※ 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.



125LCR8MC12

(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.

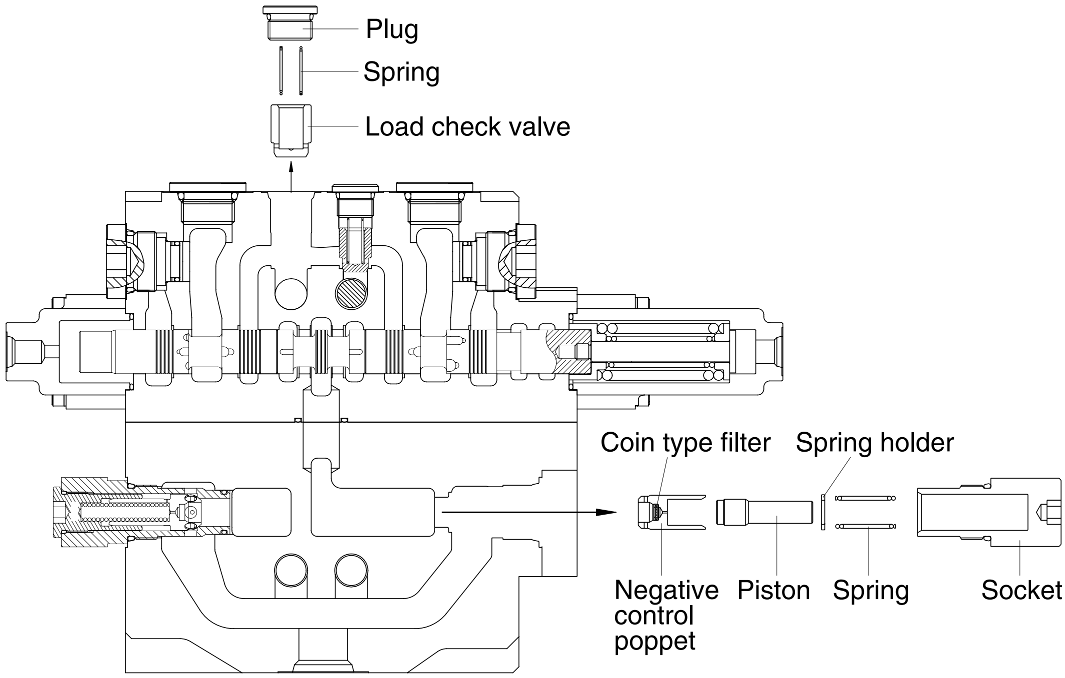
b. Loosen the plug (hexagon wrench : 10 ㎜).

c. Remove the spring and the load check valve with pincers or magnet.

② The negative relief valve

a. Loosen the socket (spanner : 32 ㎜).

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.

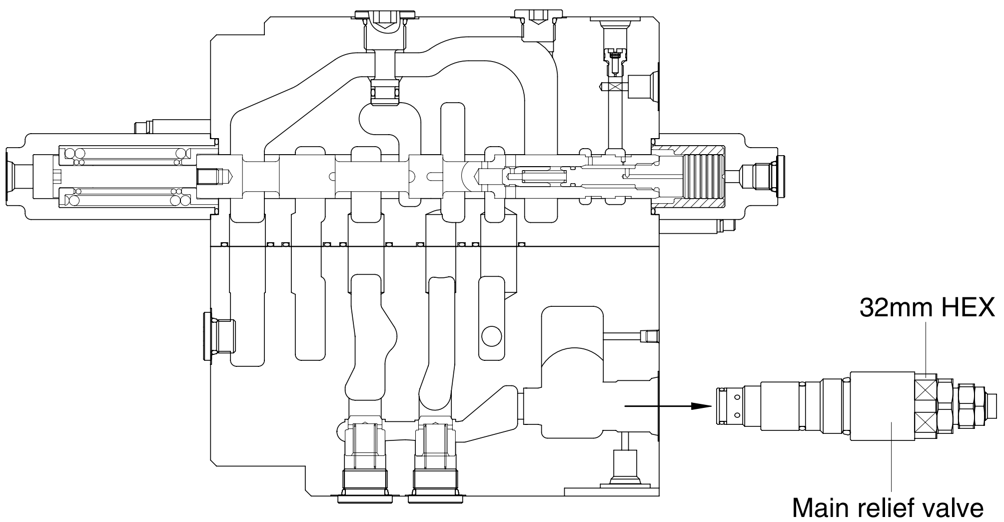
② Remove the main relief valve.
(spanner : 32 mm)

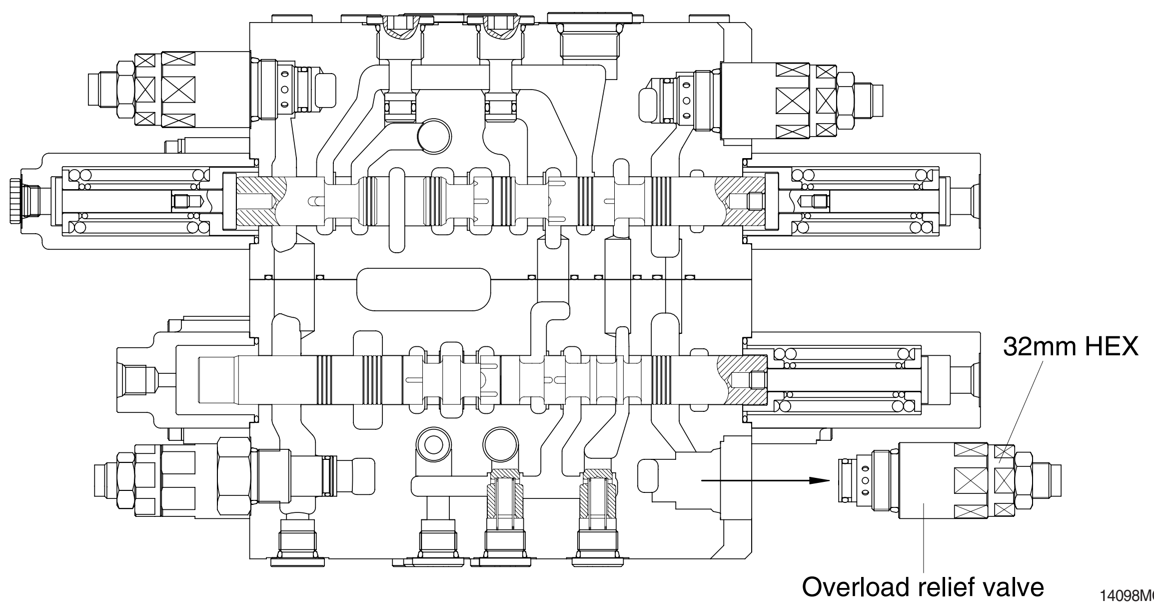
③ Remove the overload relief valve.
(spanner : 32 mm)

※ 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.





14098MC14

(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 (TYPE 1)

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

13031GE18

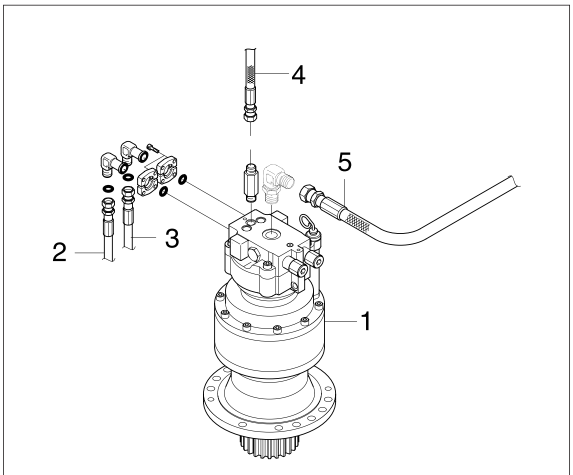
(4) Disconnect hose assembly (2).

(5) Disconnect pilot and grease line hoses (3, 4, 5, 6, 7, 8).

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

· Motor device weight : 34 kg (75 lb)

· Tightening torque :17.5±1.8 kgf · m
(127±13.0 lbf · ft)



130ZF8SM01

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.

2) INSTALL

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

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

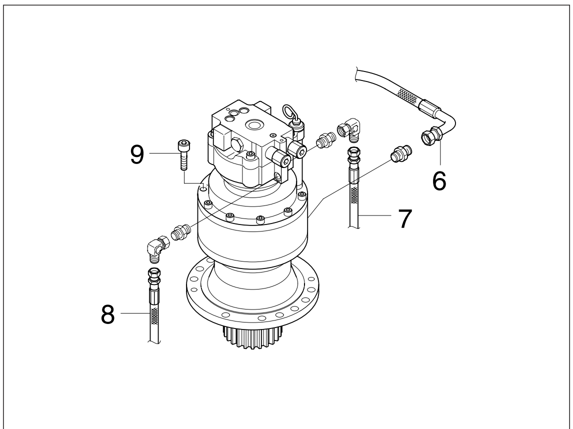
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

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

⑤ Tighten plug fully.

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



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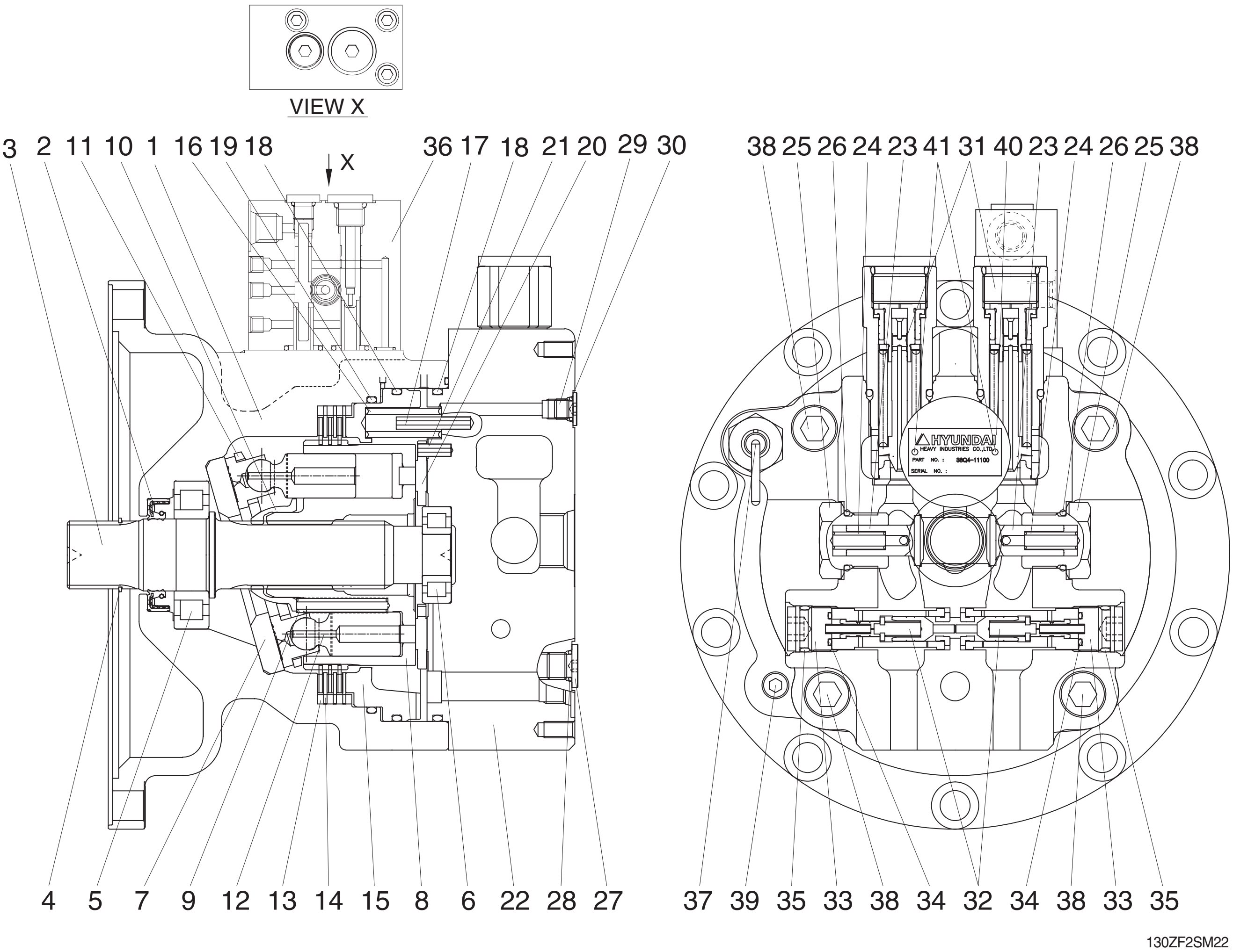
2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE

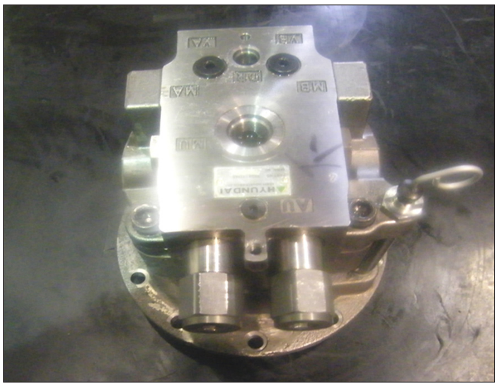


1	Casing	15	Parking piston	29	Plug
2	Oil seal	16	Spring	30	O-ring
3	Shaft	17	Spring pin	31	Relief valve assy
4	Snap ring	18	O-ring	32	Anti-rotating valve assy
5	Roller bearing	19	O-ring	33	Plug
6	Roller bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	O-ring
8	Cylinder block	22	Valve casing	36	Time delay valve assy
9	Spring	23	Check valve	37	Level gauge assy
10	Ball guide	24	Spring	38	Socket bolt
11	Retainer plate	25	Plug	39	Plug
12	Piston assy	26	O-ring	40	Name plate
13	Friction plate	27	Plug	41	Rivet
14	Separate plate	28	O-ring		

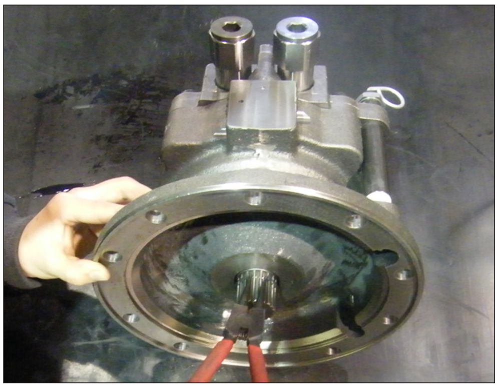
2) DISASSEMBLY

(1) For easy assembly, put motor on worktable with the spline side of shaft (3) facing downwards.

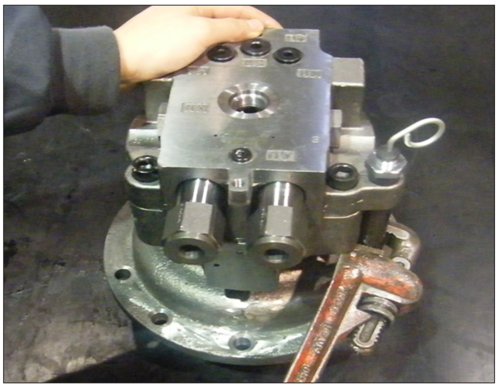
※ Lay rubber plate on worktable and take care not to damage the components.



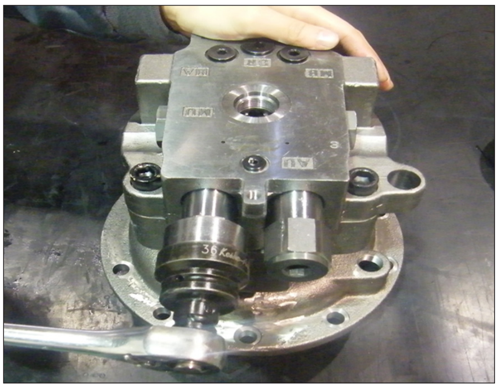
(2) Remove snap ring (4) using snap ring plier.



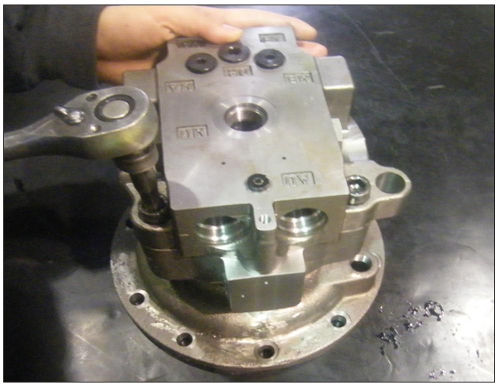
(3) Disassemble level gauge assembly (37) using pipe wrench.



(4) Disassemble two sets of relief valve assembly (31) using 36 mm socket wrench.



(5) Unscrew socket bolt (38) (4EA) using 12 mm hexagon wrench.



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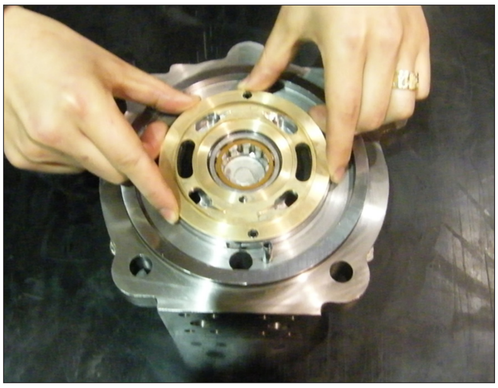
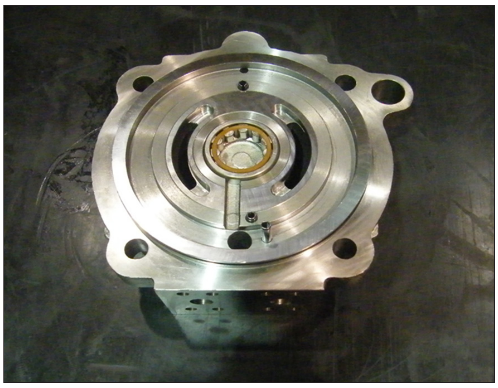
(6) Remove valve plate (20) from valve casing.
※ Take care not to drop the valve plate (20).



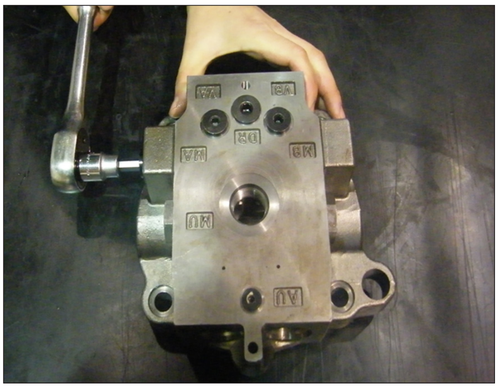
125LCR8SM08

(7) Remove O-ring (18) from valve casing.



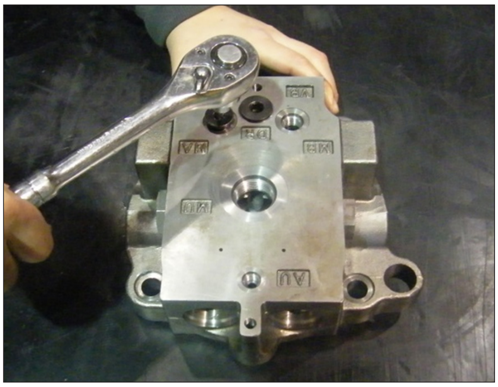
125LCR8SM09

(8) Remove plug (33) using 10 mm hexagon wrench and take out anti-rotating valve assembly (32). (same for the set on opposite side)



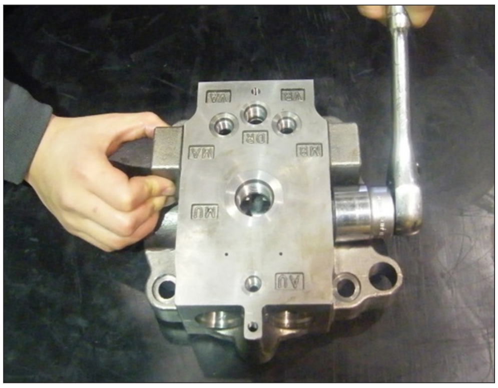
125LCR8SM10

(9) Remove plug (29) (1EA), plug (27) (2EA) using 4 mm, 6 mm hexagon wrench.



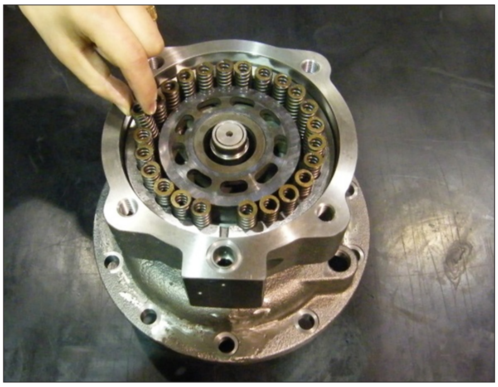
125LCR8SM11

(10) Remove plug (25) using 32 mm socket wrench and separate spring ; spring (24) and check valve (23). (same for the set on opposite side)



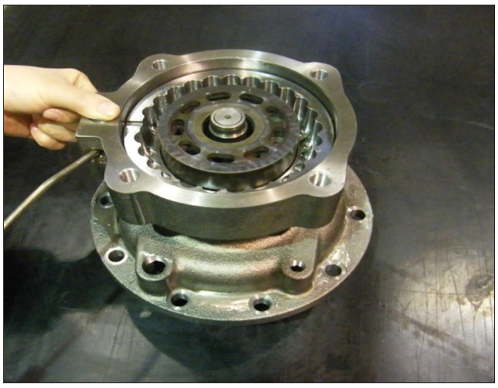
125LCR8SM12

(11) Remove spring (16) (24EA) from parking piston.



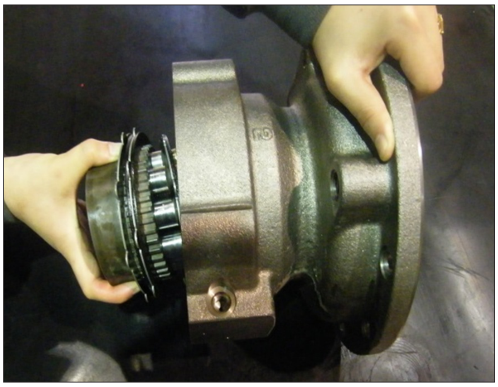
125LCR8SM15

(12) Disassemble parking piston (15) from casing using air gun.



125LCR8SM16

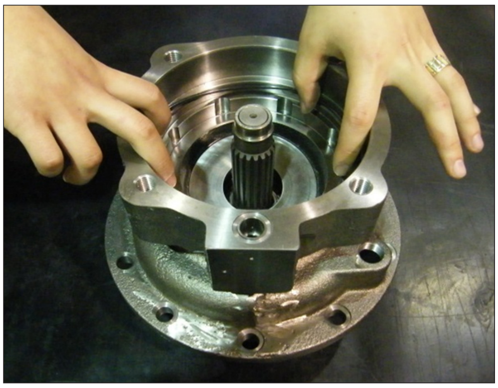
(13) Lay casing down horizontally and remove cylinder block assembly from shaft.
And remove all friction plate (13) and separator plate (14).


125LCR8SM17

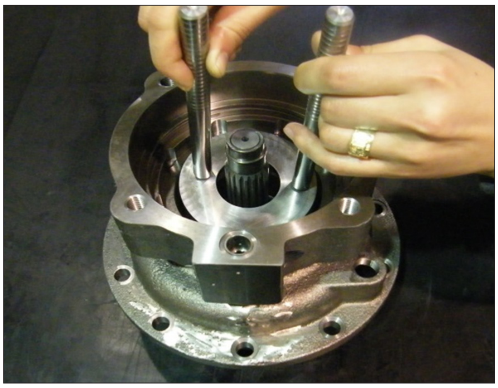
(14) Separate piston assembly (12), ball guide (10), retainer plate (11) and cylinder spring (9).


125LCR8SM18

(15) Remove O-ring (19) from casing.


125LCR8SM19

(16) Use a magnet to separate swash plate (7) from casing.
※ Sliding surface should be carefully treated to avoid scratches and damage.

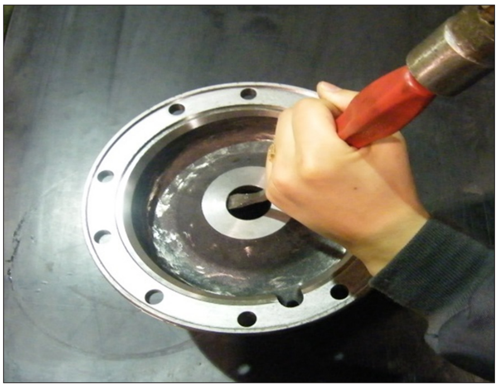

125LCR8SM20

(17) Disassemble shaft (3) and cylinderical roller bearing (5).

※ Do not remove cylinderical roller 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.



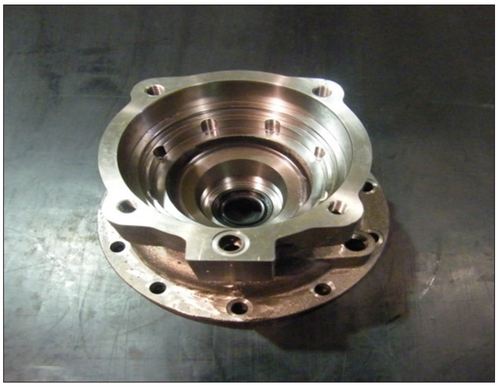
125LCR8SM22

3) ASSEMBLY

※ Even though assembly is accomplished by reversing disassembly steps, be careful of the following.

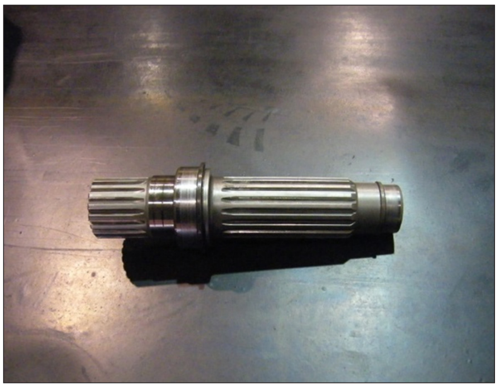
① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
② All parts should be cleaned with cleaner, dried with compressed air.
③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
④ Replacement of O-ring 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.



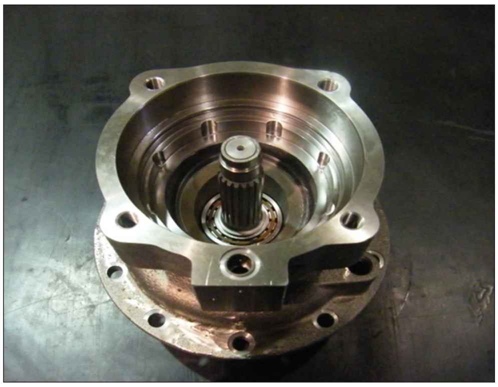
125LCR8SM23

(2) Mount cylinderical roller bearing (5, 6) on shaft (3) using shrink fitting method.



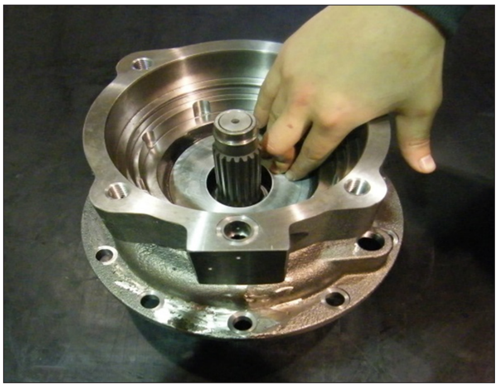
125LCR8SM24

(3) Assemble shaft assembly in casing using urethane hammer.
※ Take care not to damage oil seal.



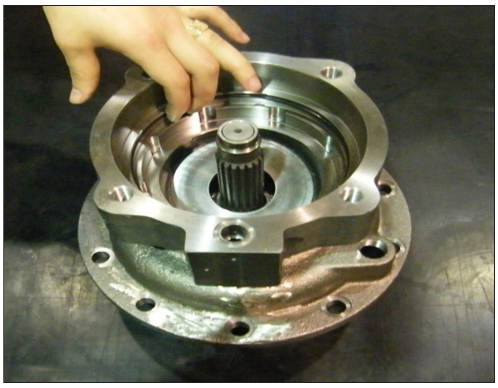
125LCR8SM25

(4) Insert swash plate (7).
※ Take care not to damage sliding surface.



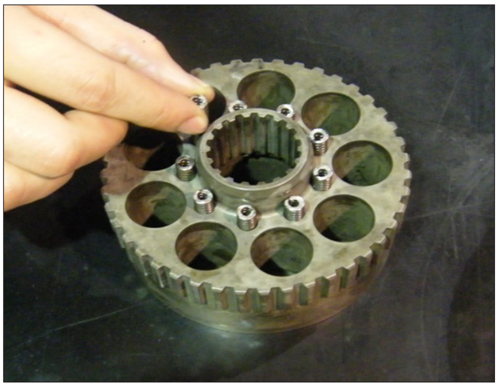
125LCR8SM26

(5) After applying grease on O-ring (19), insert O-ring in casing (1).



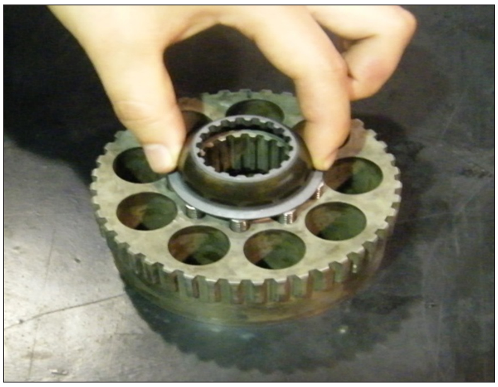
125LCR8SM27

(6) Assemble cylinder spring (9) (9EA) in cylinder block (8).



125LCR8SM28

(7) Assemble ball guide (10) in cylinder block.
※ Take care not to damage sliding surface of cylinder block.



125LCR8SM29

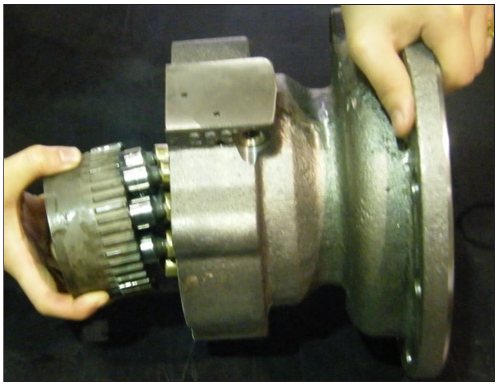
(8) Insert piston assembly (12) in retainer plate (11).
※ Do not mix piston with other piston (9EA/1set).
※ Spread sufficient amount of hydraulic oil on piston assembly.

125LCR8SM30

(9) Place all 9 pistons simultaneously into the holes of cylinder block.
※ Take care not to damage sliding surface.

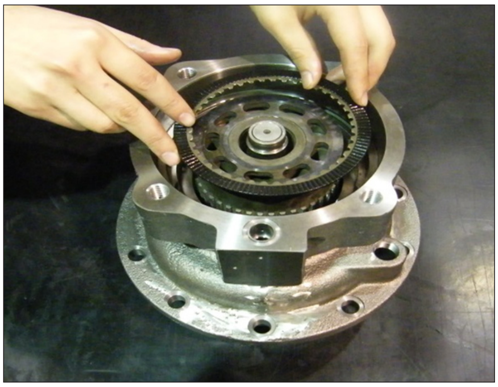
125LCR8SM31

(10) Lay casing down horizontally and put cylinder block assembly in casing.
※ Check whether cylinder block assembly rotates smoothly.



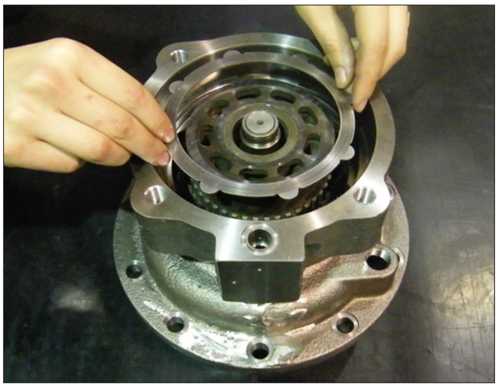
125LCR8SM32

(11) Put friction plate (13) in casing.



125LCR8SM33

(12) Put separator plate (14) in casing.
※ Put friction plate and separator plate alternately.

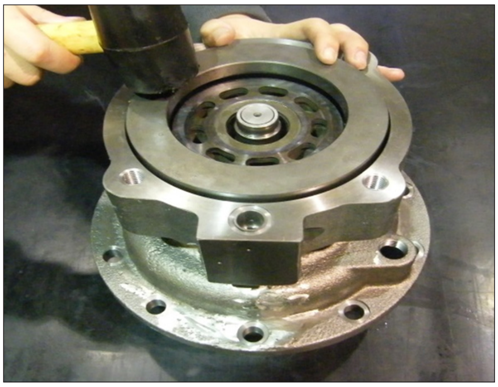


125LCR8SM34

(13) Assemble O-ring (18) in parking piston (15).
※ Apply grease on O-ring.

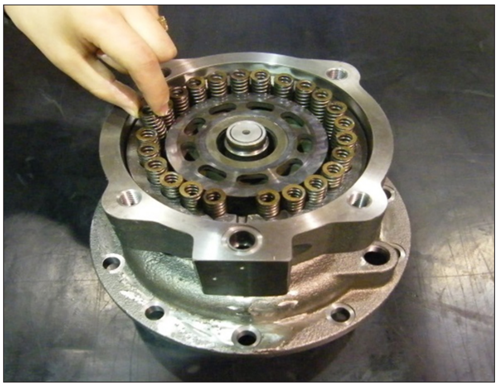
125LCR8SM35

(14) Assemble parking piston (15) in casing using jig.
※ Pay attention to the hole location of parking piston.



125LCR8SM36

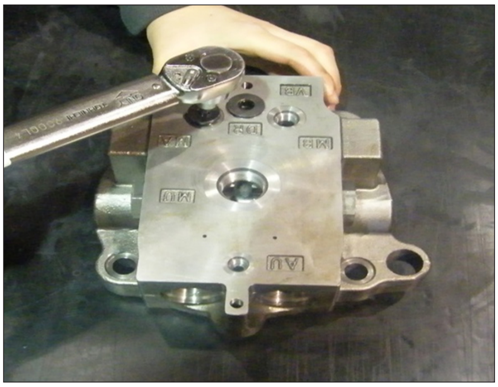
(15) Put spring (16) (24EA) in each hole of parking piston.



125LCR8SM37

(16) Assemble plug (27) using 6 mm hexagon wrench.

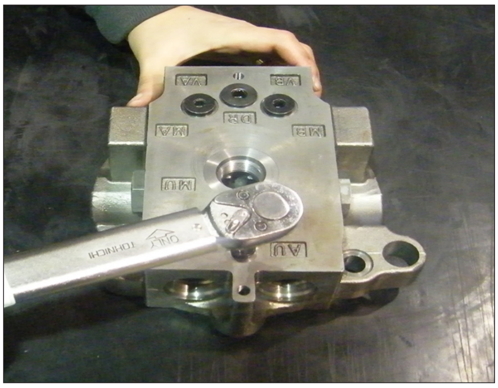
※ Tightening torque : 4.5±0.45 kgf · m
(32.5±3.3 lbf · ft)



125LCR8SM41

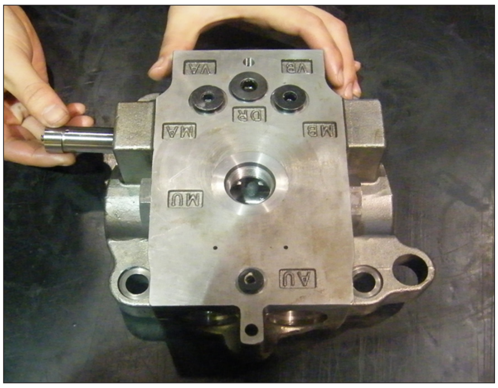
(17) Assemble plug (29) using 4 mm hexagon wrench.

※ Tightening torque : 3.0±0.3 kgf · m
(2.2± lbf · ft)



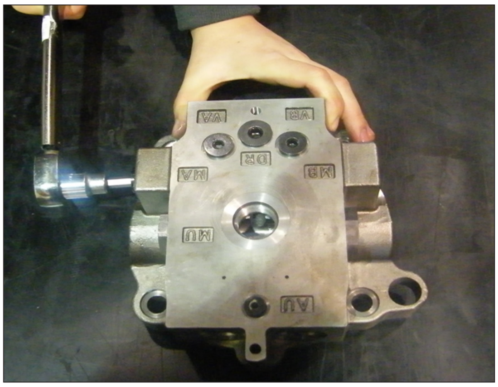
125LCR8SM42

(18) Assemble anti-rotating valve assembly (32) in valve casing.



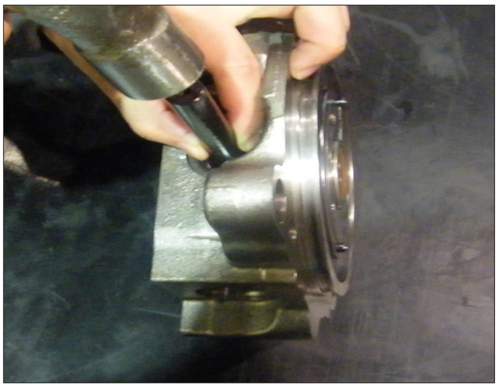
125LCR8SM43

(19) Assemble plug (33) using 32 mm hexagon wrench.
※ Tightening torque : 14.0±1.0 kgf · m
(101±7.2 lbf · ft)



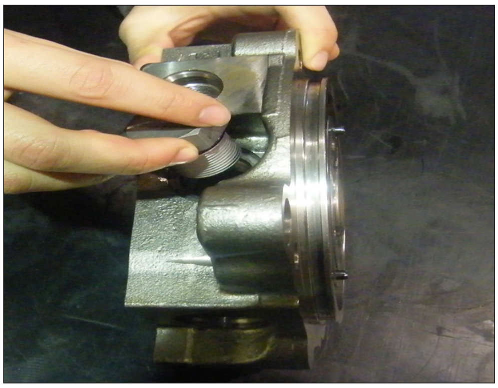
125LCR8SM44

(20) Caulk check valve (23) using jig. (same for the set on opposite side)



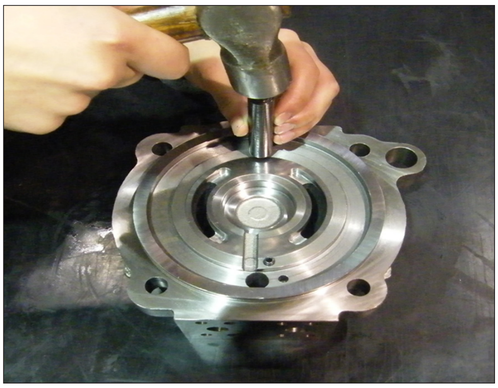
125LCR8SM45

(21) Assemble spring (24), plug (25). (in that order) (same for the set on opposite side)
※ Tightening torque : 25±2.5 kgf · m
(181±18.1 lbf · ft)



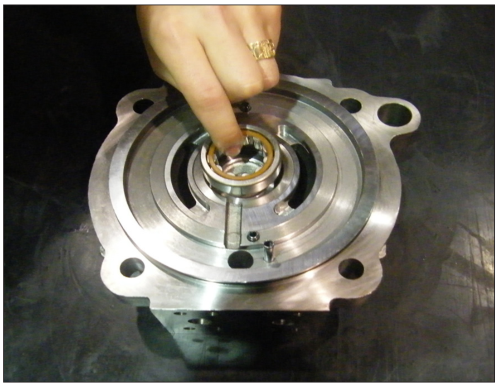
125LCR8SM46

(22) Assemble spring pin (21) in valve casing using jig.

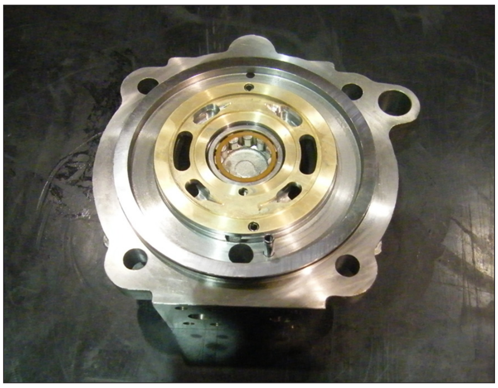


125LCR8SM47

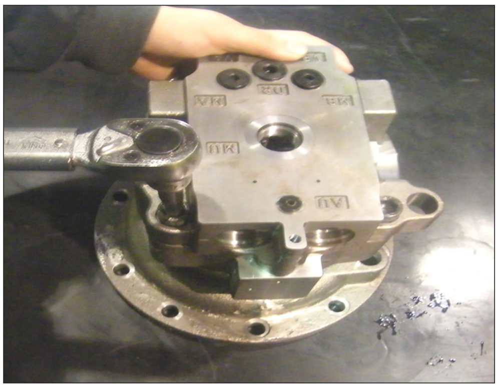
(23) Assemble O-ring (18) & cylinderical roller bearing (6) in valve casing.
※ Use jig (press fit or cold shrink fit).


125LCR8SM48

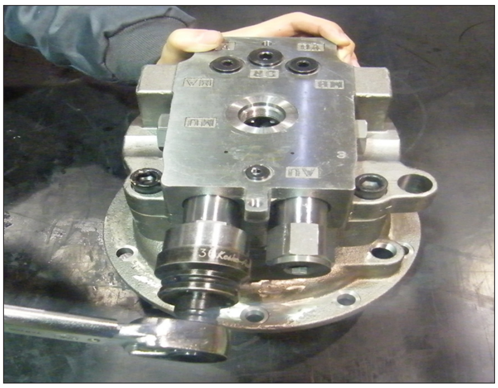
(24) Apply grease on steel side of valve plate (20) to prevent plate from sliding.
Assemble valve plate with the copper side facing upwards.
※ Pay attention to the assembly direction.
※ Take care not to damage sliding surface.


125LCR8SM49

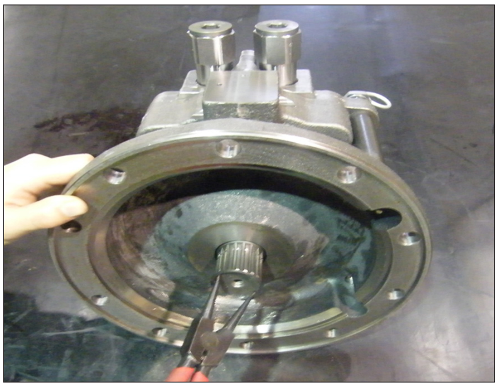
(25) Assemble valve casing by matching its holes and pins of casing and parking piston. And tighten socket bolt (38) (4EA) using 12 ㎜ hexagon wrench.
※ Tightening torque : 17.5±1.7 kgf · m
(127±12.7 lbf · ft)
※ Make sure valve plate stays in place.
※ When tightening bolts, make sure mating surfaces between casing and valve casing maintain parallel to each other.


125LCR8SM50

(26) Assemble relief valve assembly (31) using 36 ㎜ socket wrench in valve casing.
※ Spread grease on O-ring part of relief valve assembly.
※ Tightening torque : 18.0±1.8 kgf · m
(130±13.0 lbf · ft)

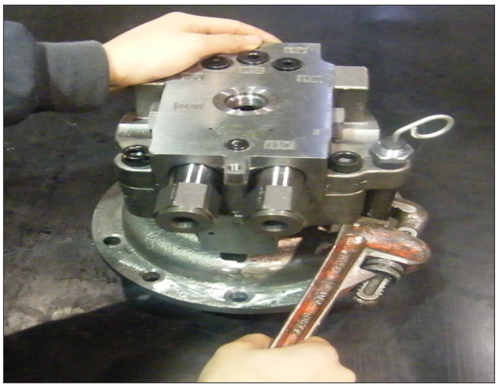

125LCR8SM51

(27) Assemble snap ring (4) in shaft by using snap ring plier.



125LCR8SM52

(28) Wrap teflon tape 2 or 3 times around the tap part of level gauge assembly (37).
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.

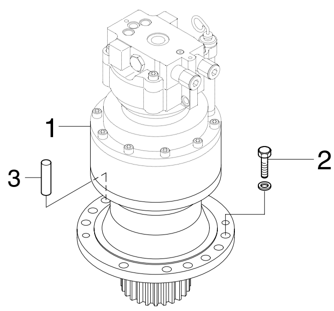
(2) Sling reduction gear assembly (1) and remove dowel pin (3) and mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 75 kg (165 lb)

13031GE18

2) INSTALL

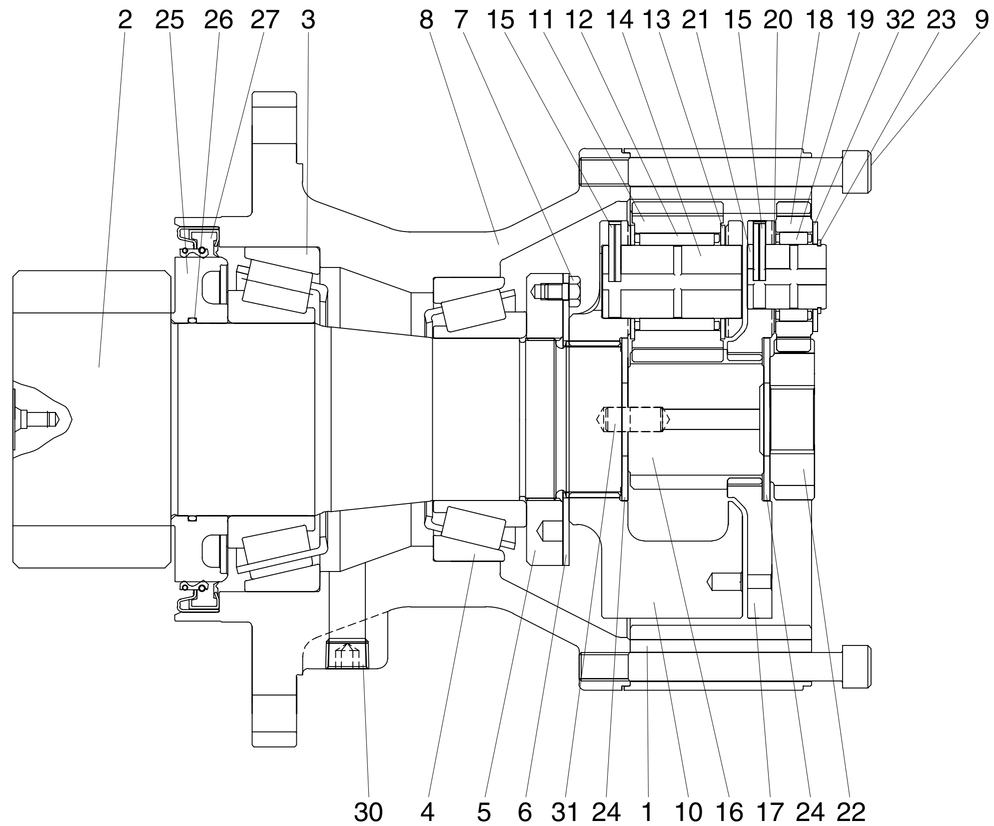
(1) Carry out installation in the reverse order to removal.
· Tightening torque : 29.6 ±3.2 kgf · m (214±23.1 lbf · ft)



130ZF8SM03

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

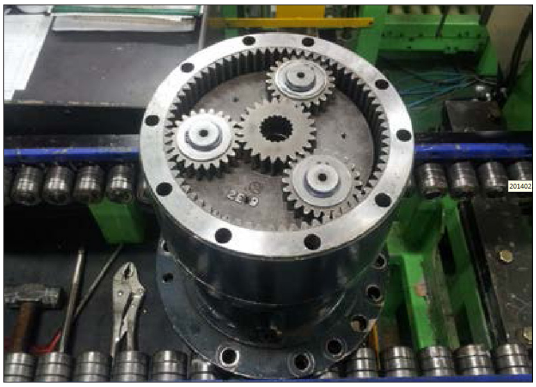


125LCR2SM23

1	Ring gear	11	Planetary gear No. 2	21	Carrier pin No. 1
2	Drive shaft	12	Needle bearing No. 2	22	Sun gear No. 1
3	Taper roller bearing	13	Thrust washer No. 2	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 No. 1	31	Parallel pin
10	Carrier No. 2	20	Thrust washer No. 1	32	Thrust washer No. 1

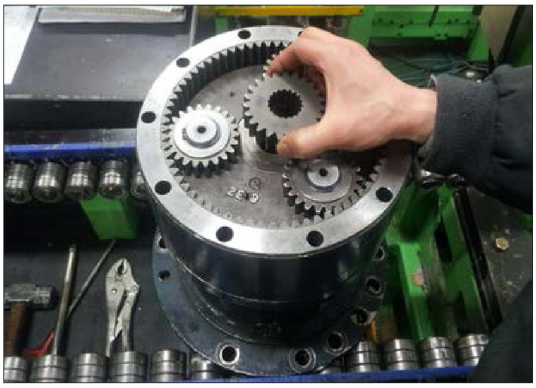
2) DISASSEMBLY

(1) Remove the swing motor, and then place swing reduction gear on the bench.



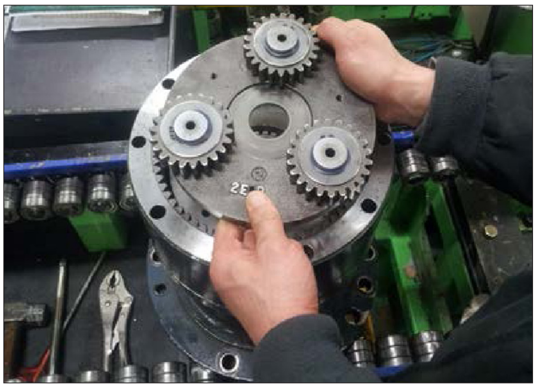
125LCR8SM60

(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

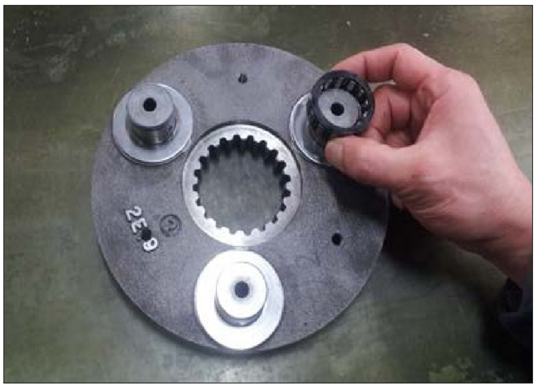
(6) Disassemble planetary gear No.1 (18). (3 pcs)

125LCR8SM65

(7) Disassemble thrust plate (24).

125LCR8SM66

(8) Disassemble needle bearing No.1 (19). (3 pcs)



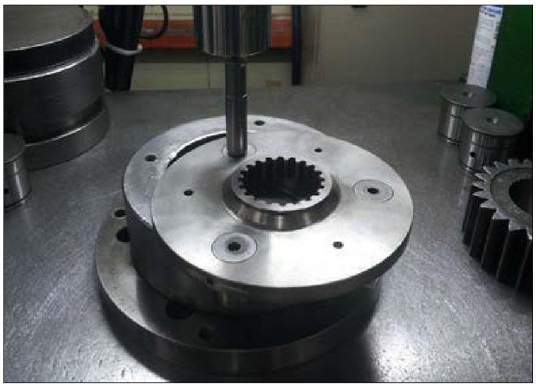
125LCR8SM67

(9) Disassemble thrust washer No.1 (lower) (20). (3 pcs)

125LCR8SM68

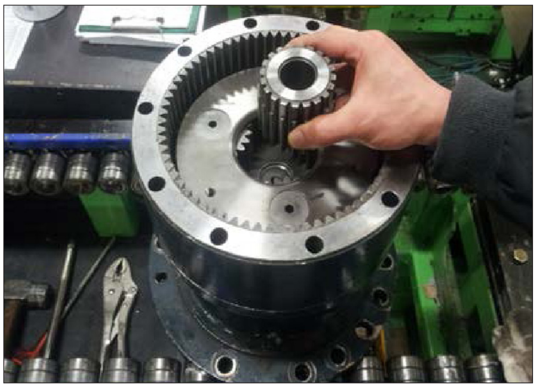
(10) After placing spring pin (15) to center of carrier pin No.1 (21) with a jig, disassemble it. (3 pcs)

※ 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

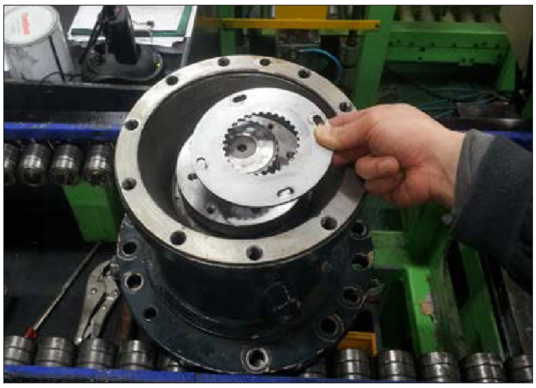
(17) Disassemble needle bearing No.2 (12). (3 pcs)

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.

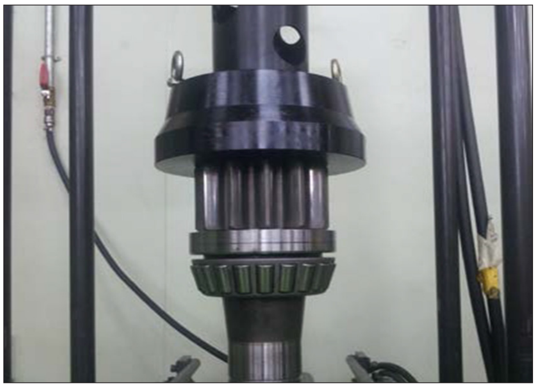
125LCR8SM79

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.

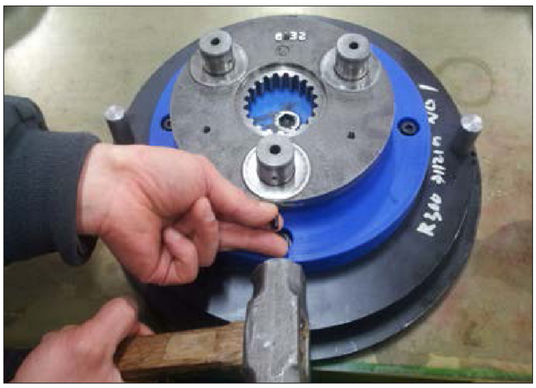
① Repair the damaged part when disassemblying and prepare parts for exchange in advance.
② All parts should be cleaned with cleaner, dried with compressed air.
③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.
④ Replacement of O-ring 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

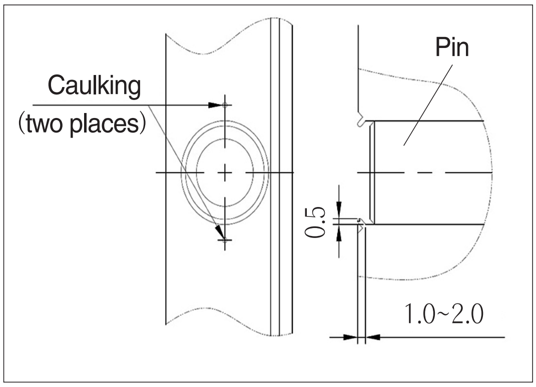
(2) After drilling Ø6 hole, assemble spring pin (15).(3 pcs)



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.

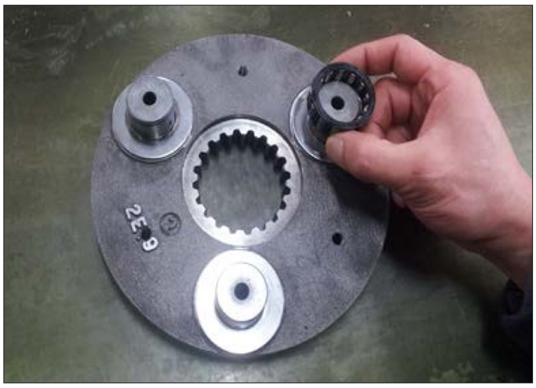


125LCR8SM86

(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)

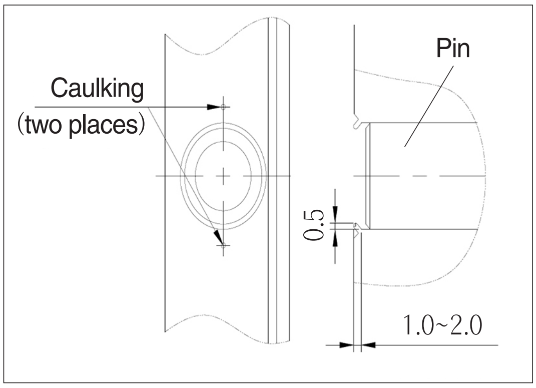
125LCR8SM97

(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 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).

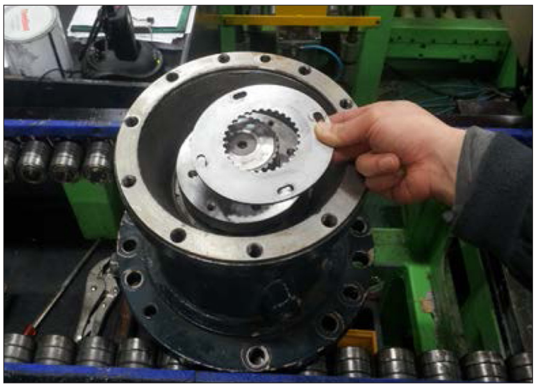
125LCR8SM106

(24) Assemble ring nut (5) by using the jig.

※ Tightening torque : 3.5±0.4 kgf · m
(25.3±2.9 lbf · ft)

125LCR8SM107

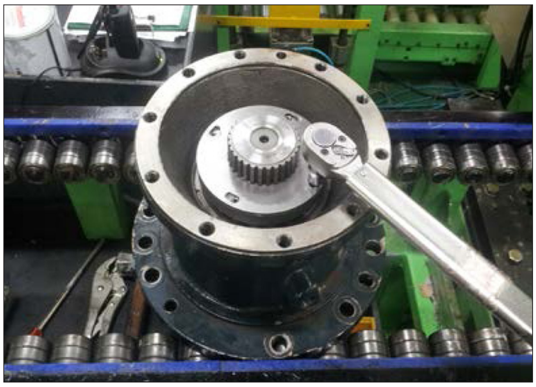
(25) Place lock plate (6) on the ring nut.



125LCR8SM108

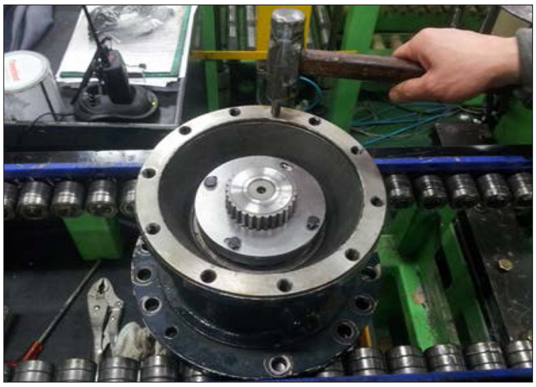
(26) After spreading loctite #242, assemble the bolt (7) (4 pcs).

※ Tightening torque : 2.5±0.25 kgf · m
(18.1±1.8 lbf · ft)



125LCR8SM109

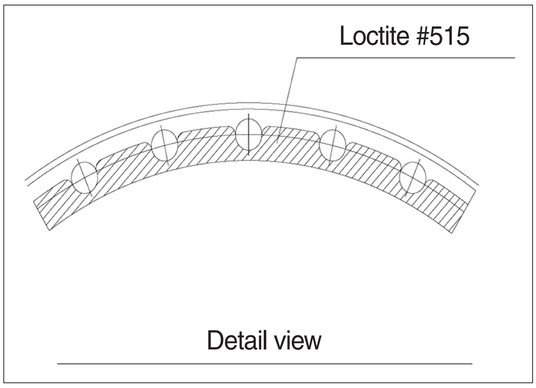
(27) Press parallel pin (31) by using press machine.



125LCR8SM110

(28) Spread the loctite #515 on the casing with reference to the right detail view.

※ Loctite should not flow into casing.



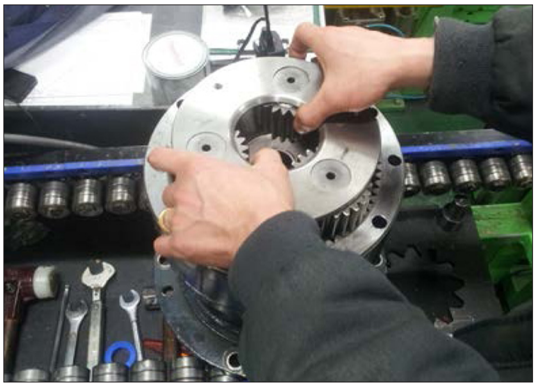
125LCR8SM111

(29) Assemble ring gear (1) in accordance with a pin hole on casing.

※ Be careful of damage of the ring gear.

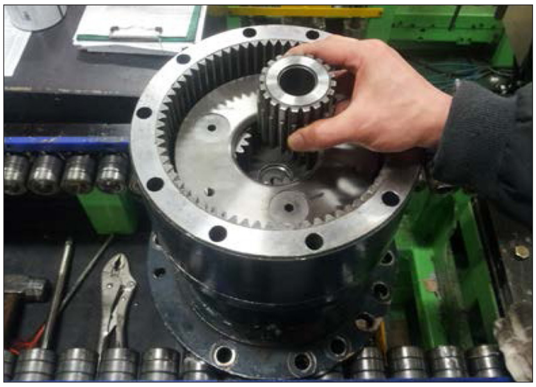
125LCR8SM112

(30) Assemble carrier No.2 sub assembly.



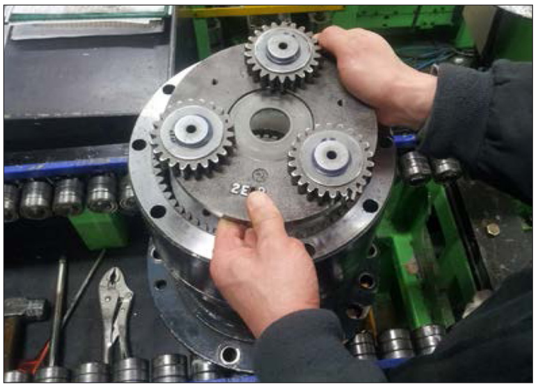
125LCR8SM113

(31) Assemble sun gear No.2 (16).



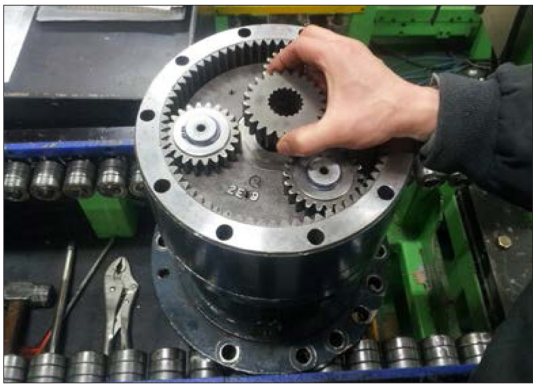
125LCR8SM114

(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

GROUP 5 SWING DEVICE (TYPE 2)

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.


13031GE18

(4) Disconnect hose assembly (2).

(5) Disconnect pilot and grease line hoses (3, 4, 5, 6, 7, 8).

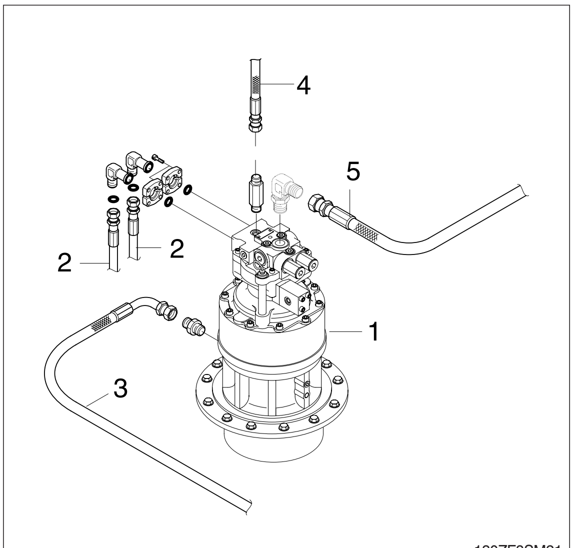
(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).

· Motor device weight : 32kg (71lb)

· Tightening torque : 23.5±4.0 kgf · m (170±28.9 lbf · ft)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.



130ZF8SM21

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.

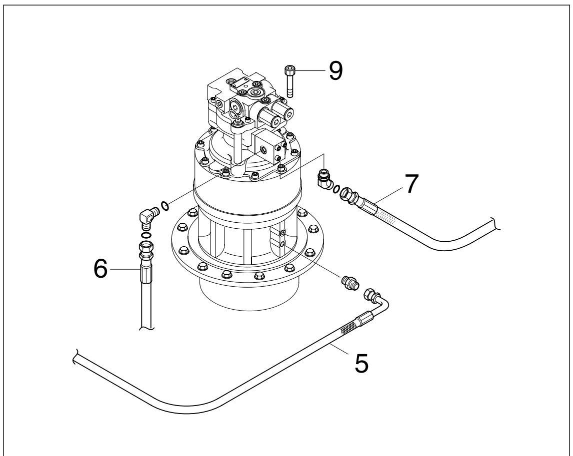
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

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

⑤ Tighten plug fully.

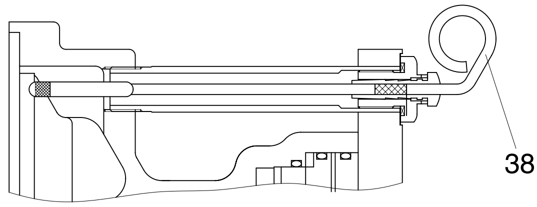
(3) Confirm the hydraulic oil level and check



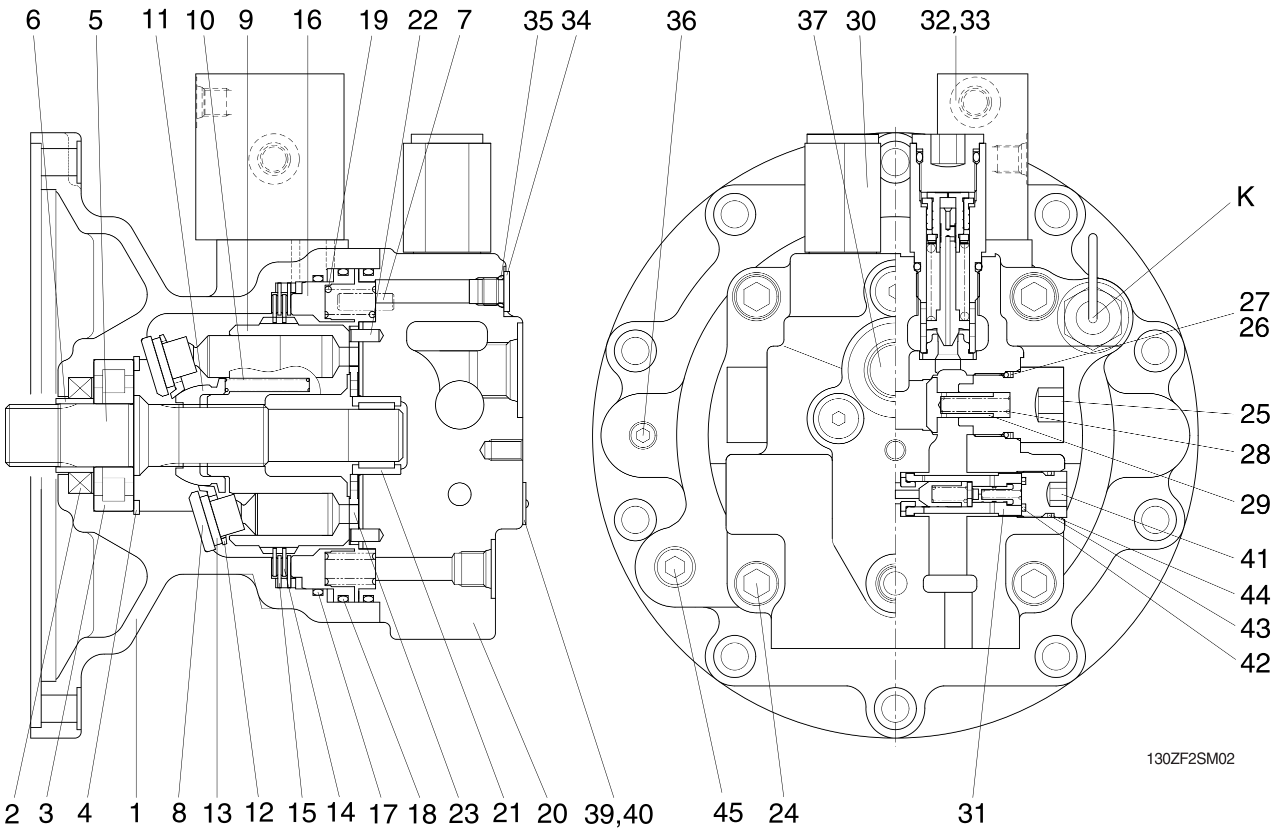
130ZF8SM22

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



DETAIL K



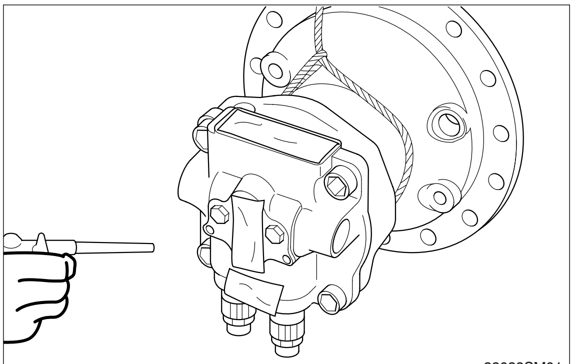
130ZF2SM02

1	Body	16	Brake piston	31	Anti-rotating valve
2	Oil seal	17	O-ring	32	Time delay valve
3	Roller bearing	18	O-ring	33	Wrench bolt
4	Snap ring	19	Brake spring	34	Plug
5	Drive shaft	20	Rear cover	35	O-ring
6	Bushing	21	Needle bearing	36	Plug
7	Pin	22	Pin	37	Plug
8	Shoe plate	23	Valve plate	38	Level gauge
9	Cylinder block	24	Wrench bolt	39	Name plate
10	Spring	25	Plug	41	Plug
11	Ball guide	26	Back up ring	42	O-ring
12	Set plate	27	O-ring	43	O-ring
13	Piston assembly	28	Spring	44	Back up ring
14	Friction plate	29	Check	45	Plug
15	Separate plate	30	Relief valve		

2) DISASSEMBLY

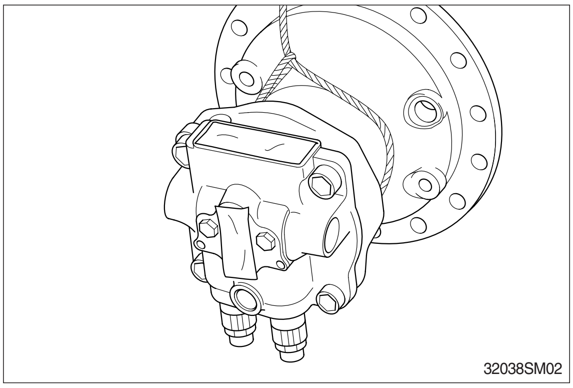
(1) Lift the motor out. Clean the motor in kerosene and dry with compressed air.

※ To avoid dust inside the motor, mask all the ports of the motor with tapes.



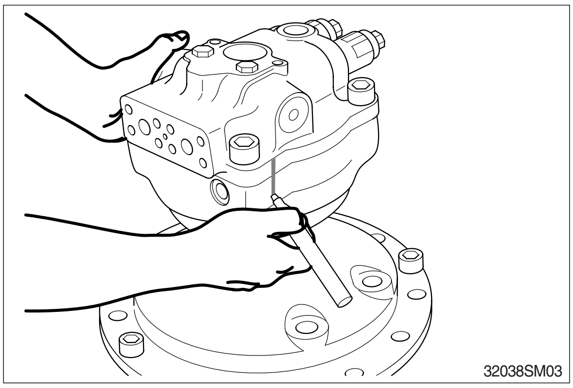
32038SM01

(2) Loosen the drain plug to discharge oil in the body(1).



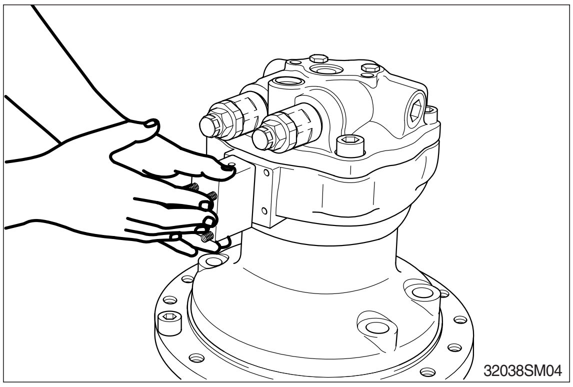
32038SM02

(3) Fix the drive shaft (5) on the workbench with the end of output shaft down. Put matching marks on body (1) and valve rear cover (20) for easy reassembly.



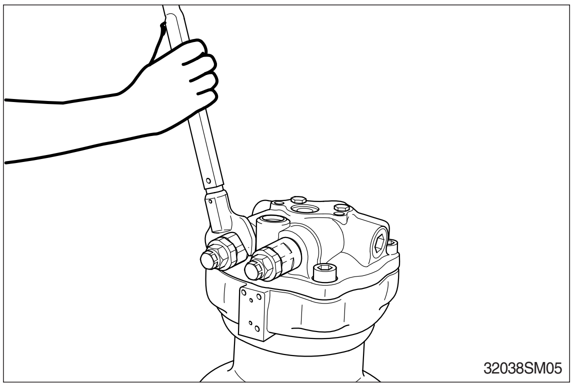
32038SM03

(4) Remove the valve (32).



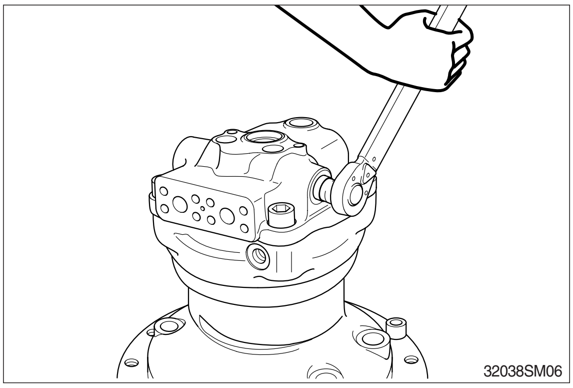
32038SM04

(5) Remove the relief valve (30) from rear cover (20).

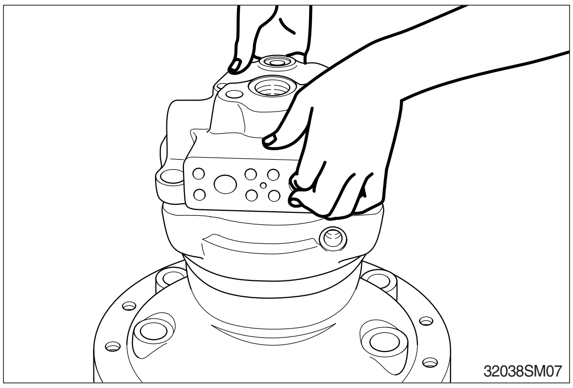


(6) Remove plug (25) from rear cover (20) and spring (28), check (29).

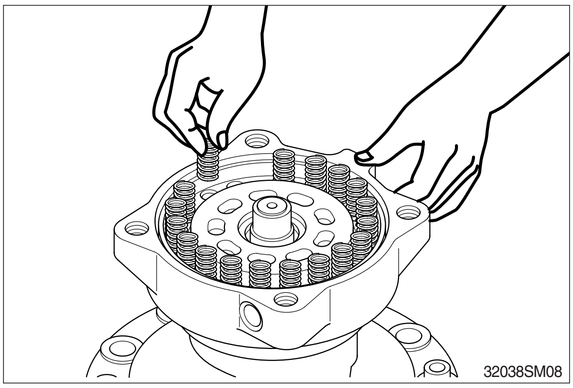
※ Be careful not to damage the check seat assembly.



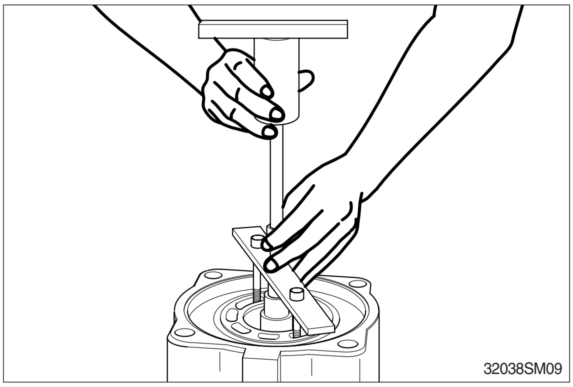
(7) Remove rear cover (20) from body (1). Then, remove the valve plate (23) from rear cover (20) with care.



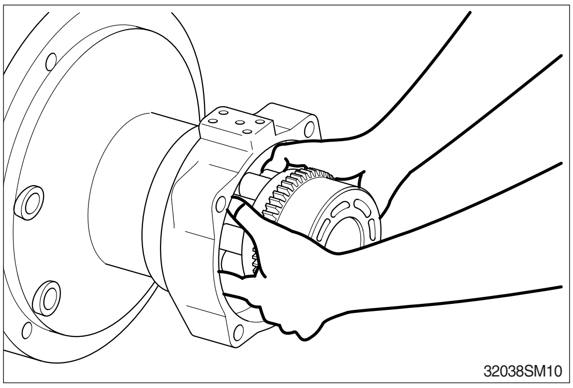
(8) Remove the brake spring (19) from brake piston (16).



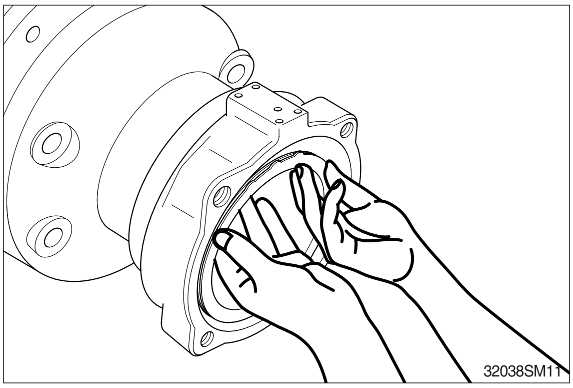
(9) Remove brake piston (16) from body (1).



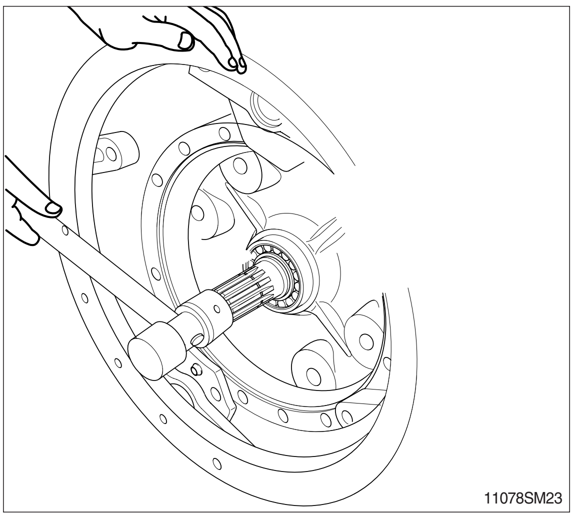
(10) Remove the cylinder (9) from the drive shaft (5) with the motor positioned horizontally. Remove ball guide (11), set plate (12), piston (13) and shoe plate (8).



(11) Remove friction plate (14) and separate plate (15) from body (1).

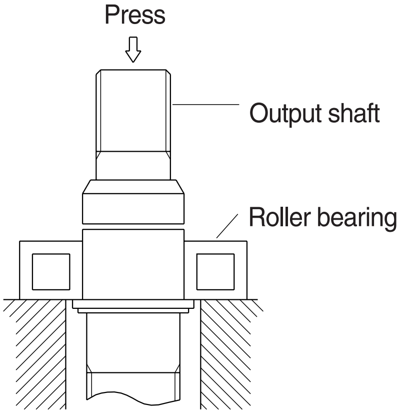


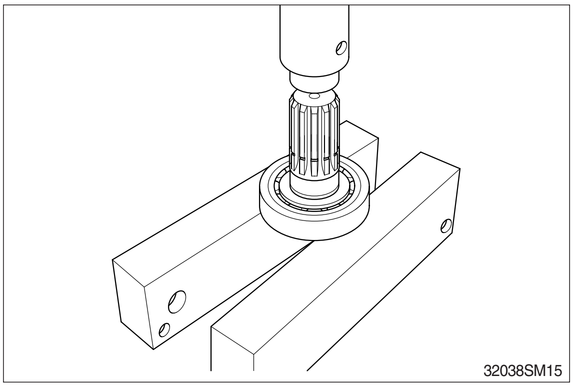
(12) Remove snap ring (4) and remove drive shaft (5) from body (1).



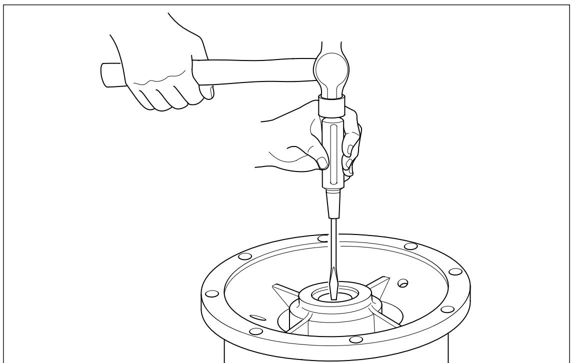
(13) Remove the cone of roller bearing (3) by press.

※ Do not reuse bearings.

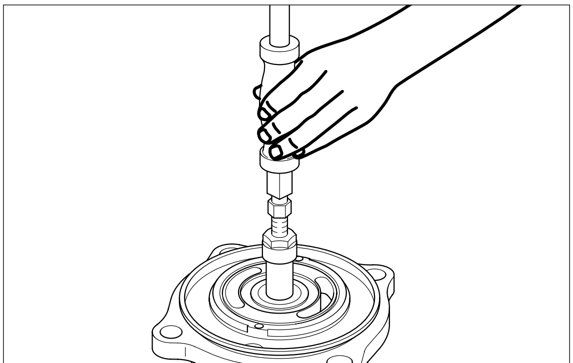



32038SM15

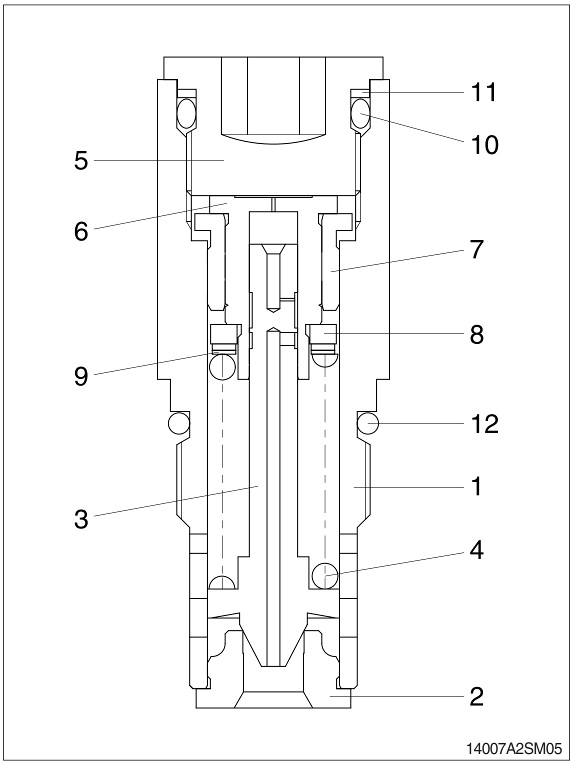
(14) Remove bushing (6) and oil seal (2) from body (1).


25038SM05

(15) Remove the needle bearing (21) from the rear cover (20) by using slide hammer bearing puller.


32038SM17

(16) When disassembling the relief valve, release the adjusting screw (5).
Remove the piston (6), spring seat (8), spring (4) and plunger (3) with the body (1) downwards.

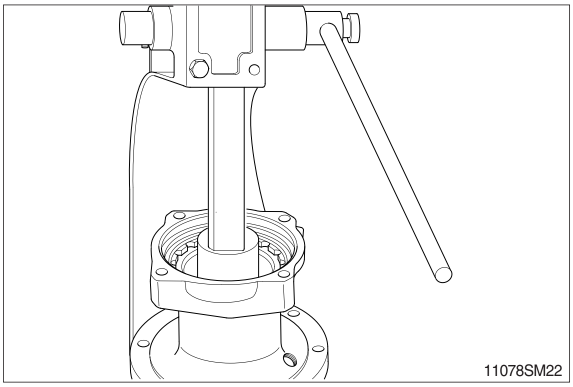


This completes disassembly.

3) ASSEMBLY

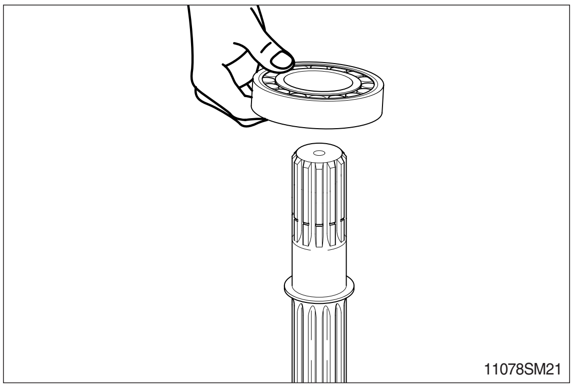
Do the reassembly in the reverse procedure of the disassembly.

(1) Apply three bond of white color on outer surface of oil seal (2) and insert it to the body (1).



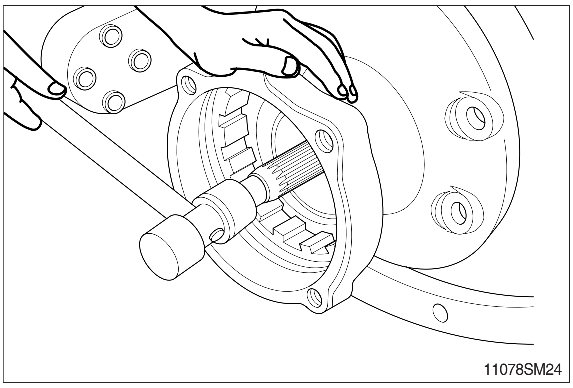
11078SM22

(2) Install the roller bearing (3) to the drive shaft (5).



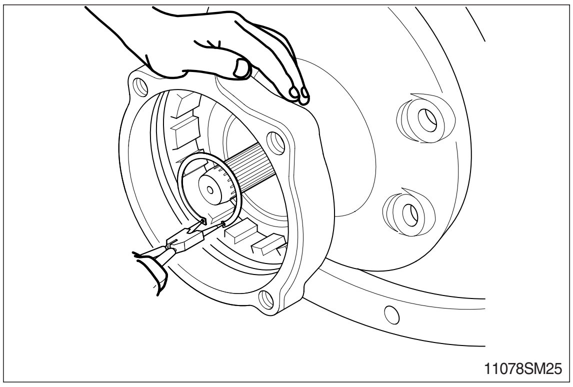
11078SM21

(3) Insert the drive shaft (5) into the body (1) with the plastic hammer lightly.



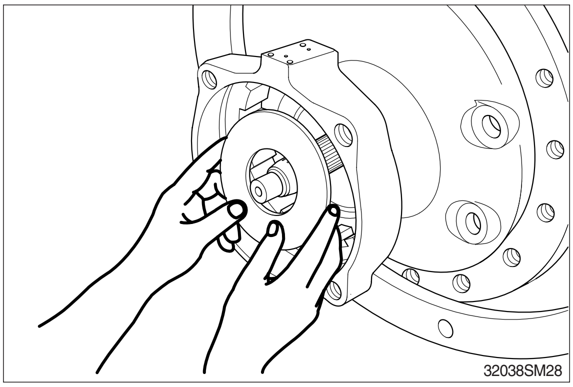
11078SM24

(4) Install the snap ring (4) to the body (1).

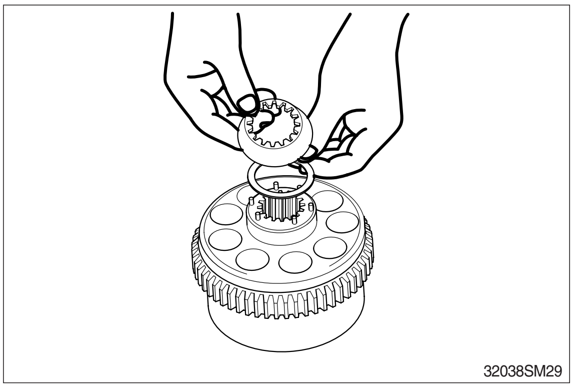


11078SM25

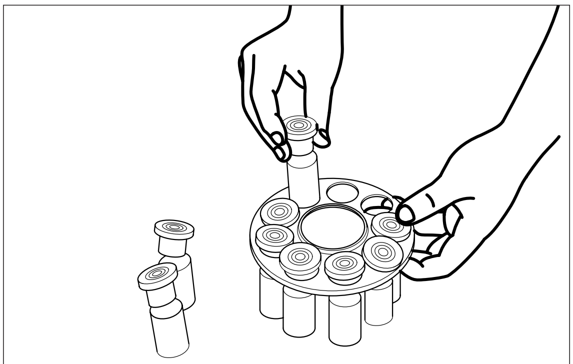
(5) Insert the shoe plate (8) with the body (1) position horizontally.


32038SM28

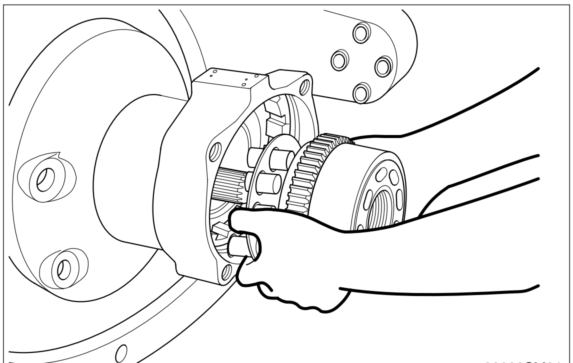
(6) Insert the ball guide (11) into the cylinder (9).


32038SM29

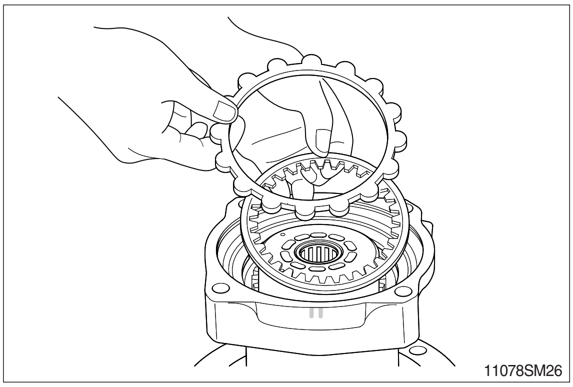
(7) Install the piston sub-assembly (13) to the set plate (12).


32038SM30

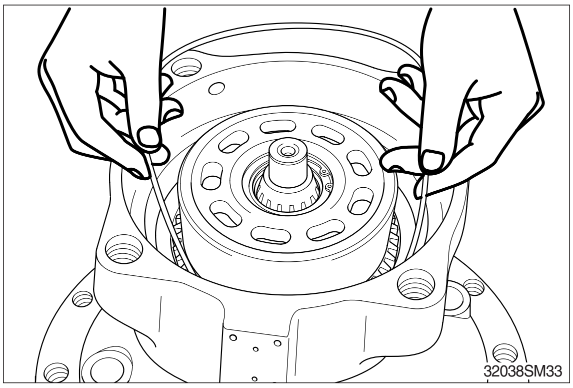
(8) Reassemble the piston assembly (9) to the body (1).


32038SM31

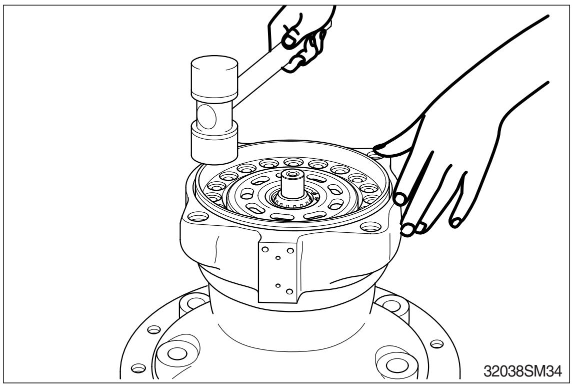
(9) Assembly friction plate (14) and separate plate (15) to the body (1).


11078SM26

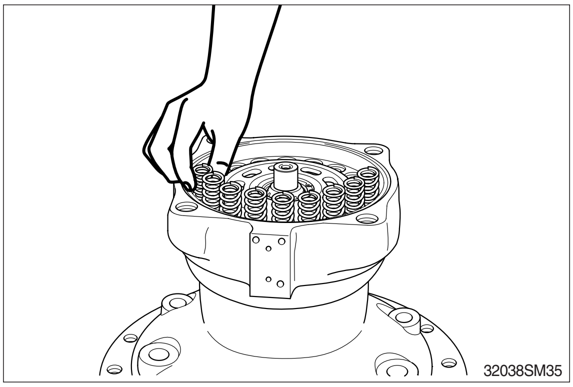
(10) Insert O-ring (17) inside the body (1).


32038SM33

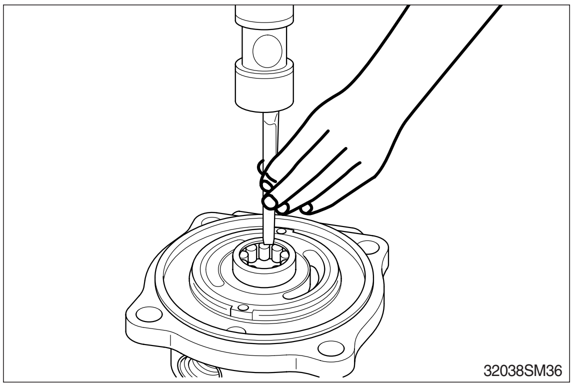
(11) Reassemble brake piston (16) to the body (1).


32038SM34

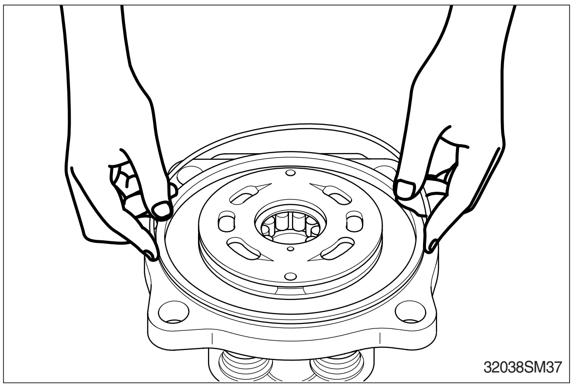
(12) Reassemble brake spring (19) to the brake piston (16).


32038SM35

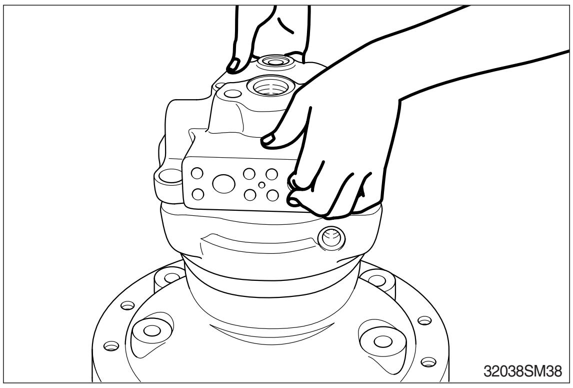
(13) When assembling the needle bearing (21), insert the needle bearing (21) into rear cover (20) by hammering.


32038SM36

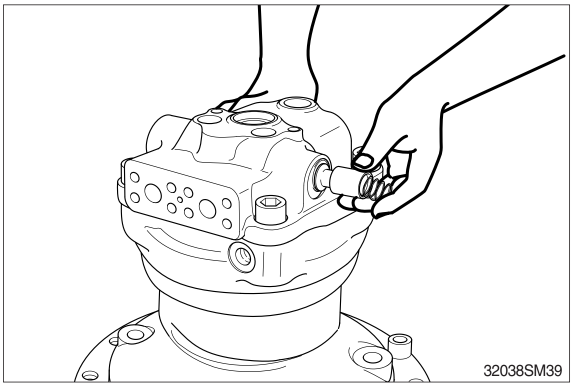
(14) Reassemble valve plate (23) to the rear cover (20) and reassemble O-ring (18).


32038SM37

(15) Connect the rear cover (20) with the body (1) and tighten the wrench bolt (24).

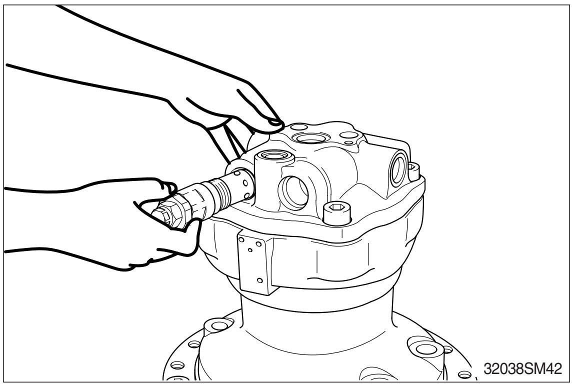

32038SM38

(16) Insert check (29) and spring (28) in the valve casing and install O-ring (27) and back up ring (26). Tighten plug (25) to the rear cover (20).


32038SM39

(17) Insert O-rings to the relief valve (30) and reassemble them to rear cover (20).

This completes assembly.



3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

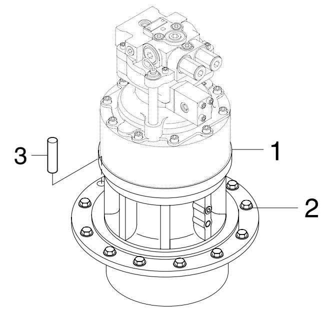

13031GE18

(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 : 60 kg (132 lb)

2) INSTALL

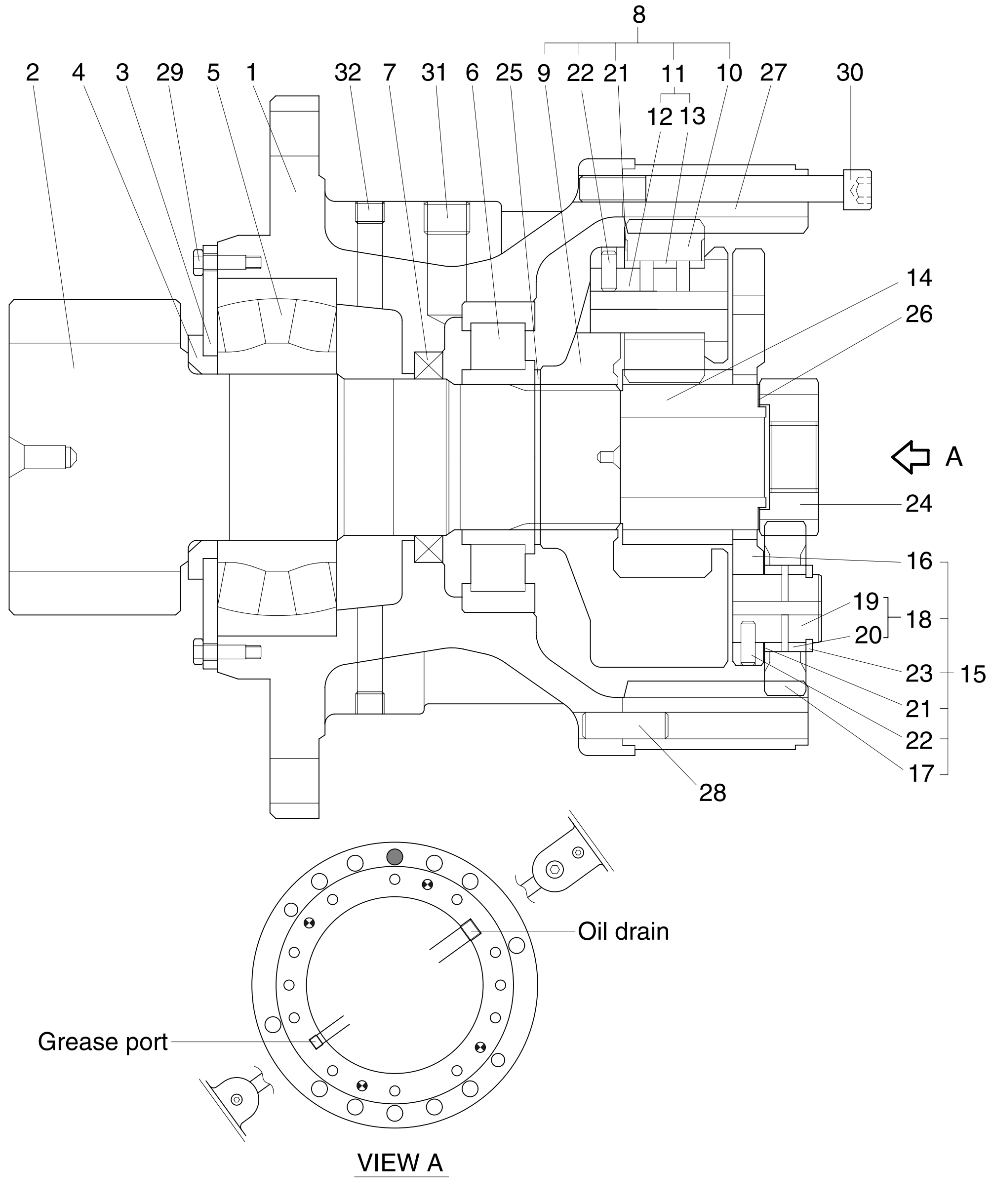


130ZF8SM23

(1) Carry out installation in the reverse order to removal.
· Tightening torque : 29.6±3.2 kgf · m (214±23.1 lbf · ft)

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



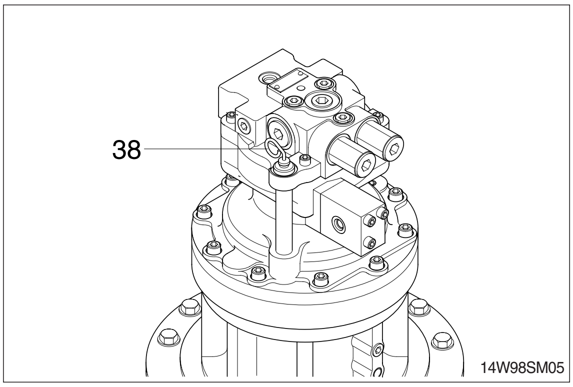
130ZF2SM03

1	Casing	12	No.2 pin	23	Stop ring
2	Drive shaft	13	No.2 bushing	24	No. 1 sun gear
3	Cover plate	14	No.2 sun gear	25	Stop ring
4	Spacer	15	No.1 carrier assy	26	Side plate No.1
5	Roller bearing	16	No.1 carrier	27	Ring gear
6	Roller bearing	17	No.1 planet gear	28	Knock pin
7	Oil seal	18	No.1 pin assy	29	Hexagonal bolt
8	No.2 carrier assy	19	No.1 pin	30	Socket bolt
9	No.2 carrier	20	No.1 bushing	31	Plug
10	No.2 planet gear	21	Thrust washer	32	Plug
11	No.2 pin assy	22	Spring pin		

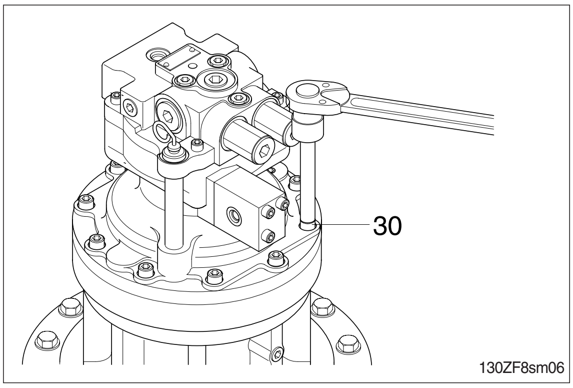
2) DISASSEMBLY

(1) Remove level gauge (38) from the swing motor casing.

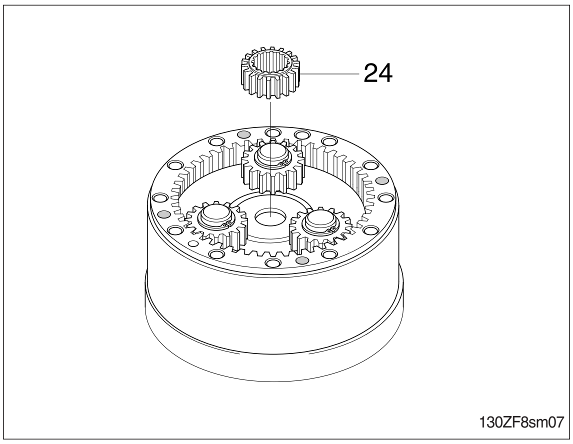
※ Pour the gear oil out of reduction gear into the clean bowl to check out the friction decrease.



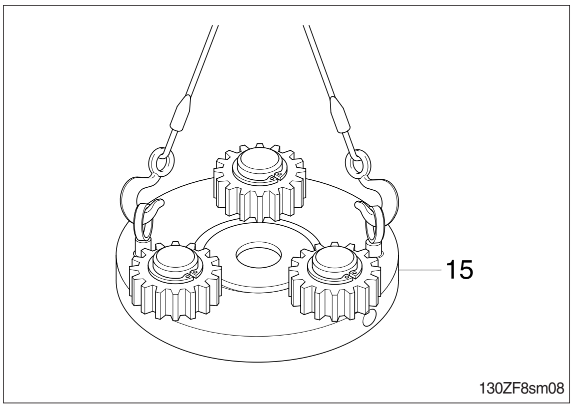
(2) Loosen the socket bolts (30) to separate swing motor from reduction gear.



(3) Remove sun gear 1 (24).



(4) Tighten two M10 eye bolts to carrier 1 assy (15) and lift up and remove carrier 1 (15) as subassembly.



(5) Disassembling carrier 1 assembly (15).

① Remove stop ring (23).

② Remove planet gear 1(17) from the carrier 1 (16).

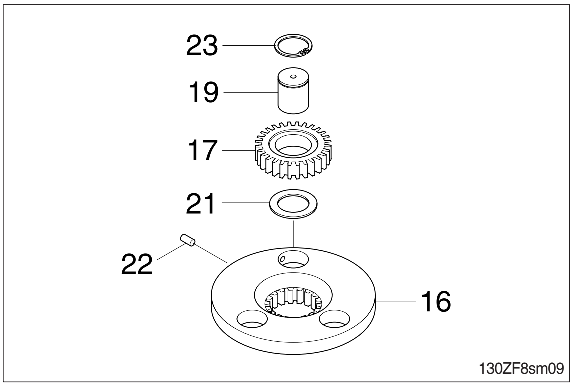
③ Using M8 solid drill, crush spring pin (22) so that the pin 1 (19) can be removed by hammering.

④ Remove thrust washer (21).

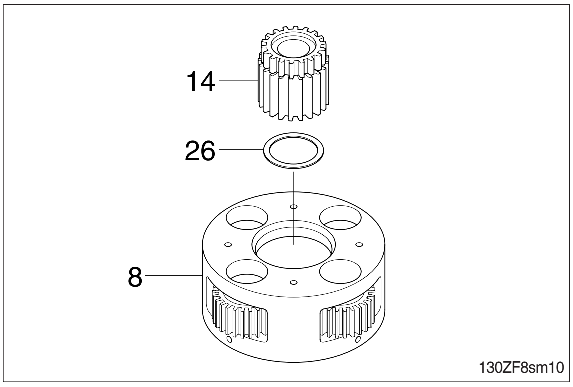
※ Do not reuse spring pin (22).

※ Do not remove pin 1 (19), carrier 1 (16) and spring pin (22) but in case of replacement.

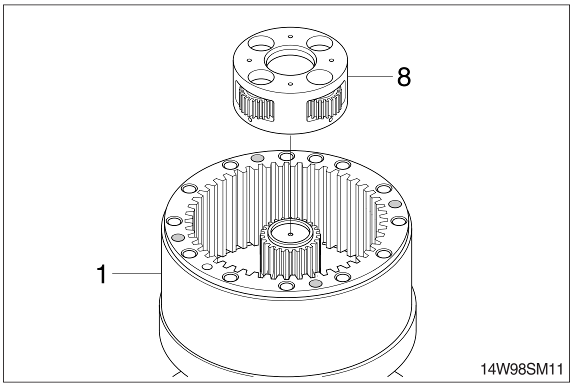
※ Put matching marks on the planet gear 1 (17) and the pin 1 (19) for easy reassembly.



(6) Remove sun gear 2 (14) and side plate 1 (26) from carrier 2 assy (8).



(7) Remove carrier 2 assembly (8) from casing (1).



(8) Disassembling carrier 2 assembly (8).

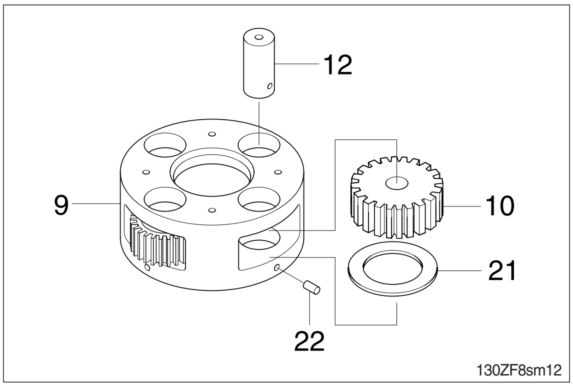
① Using M8 solid drill, crush spring pin (22) so that the pin 2 (12) can be removed.

※ Do not reuse spring pin (22).

② Remove pin 2 (12), planet gear 2 (10) and thrust washer (21) from the carrier 2 (9).

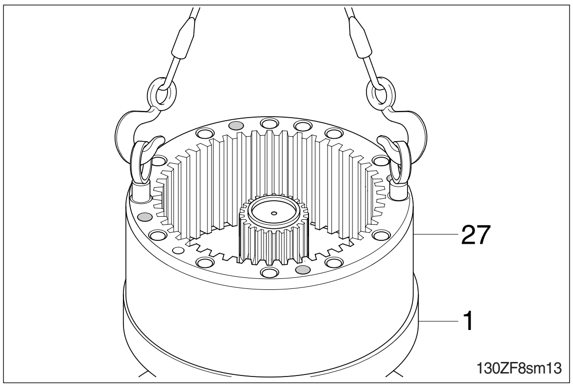
※ Put matching marks on the planet gear 2 (10) and the pin 2 (22) for easy reassembly.

※ Do not disassemble pin 2 (12), carrier 2 (9) and spring pin (22) but in case of replacement.



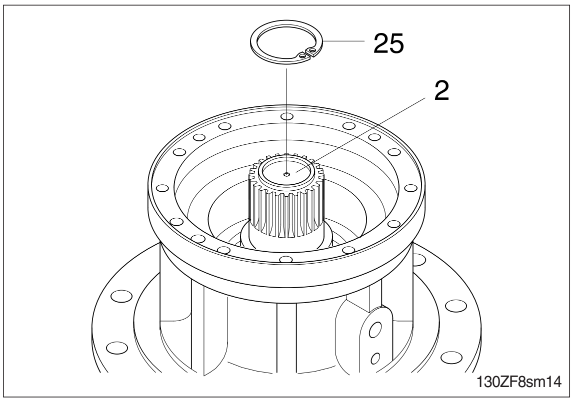
130ZF8sm12

(9) Tighten two M16 eyebolt to the ring gear (27) and then lift the ring gear (27) out of casing (1).



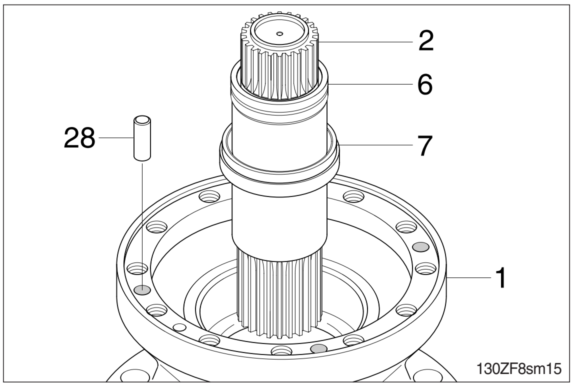
130ZF8sm13

(10) Remove stop ring (25) from the drive shaft (2).



130ZF8sm14

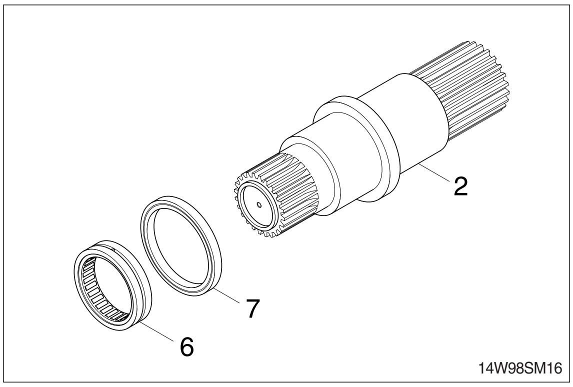
(11) Remove drive shaft (2) with roller bearing (6) and oil seal (7) assembled.
Remove knock pin (28) from the casing (1).



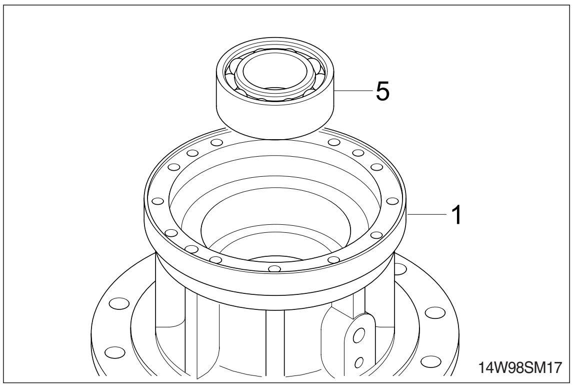
130ZF8sm15

(12) Remove roller bearing (6) and oil seal (7) from the drive shaft (2).

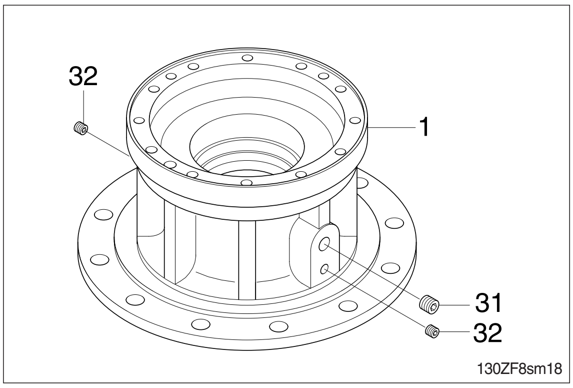
※ Do not reuse oil seal (7) once removed.



(13) Using the bearing disassembly tool, remove roller bearing (5).

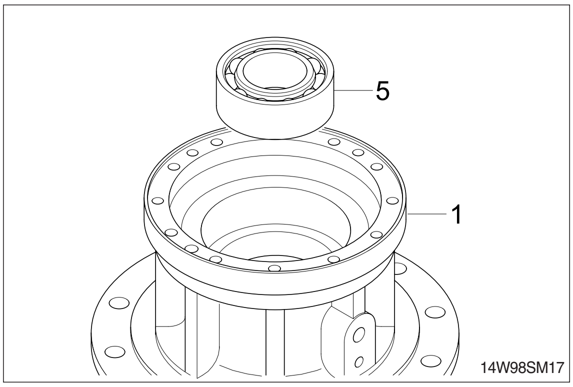


(14) Remove plugs (31, 32) from the casing (1).

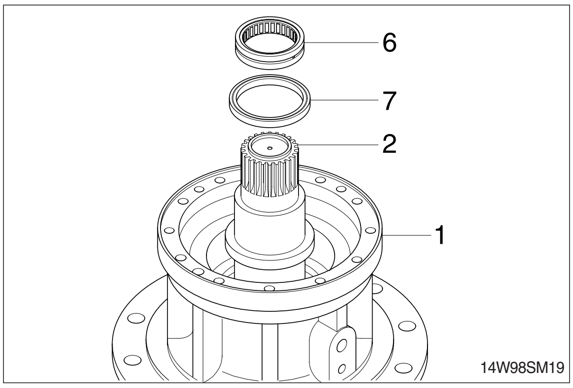


3) ASSEMBLY

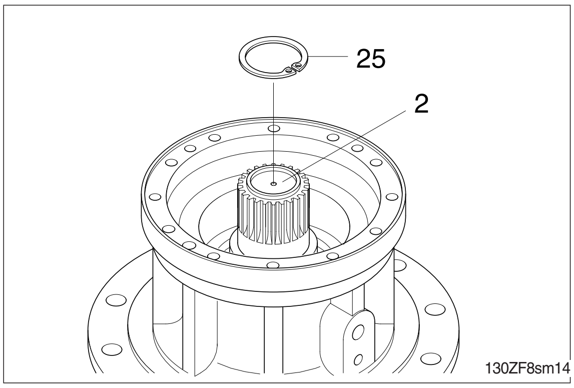
(1) Assemble roller bearing (5) inside the casing (1).



(2) Assemble the drive shaft (2) into the casing (1) and then install oil seal (7) and roller bearing (6).



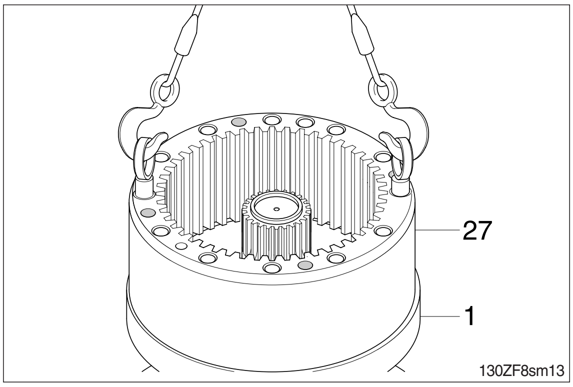
(3) Install stop ring (25) on top of drive shaft (2).



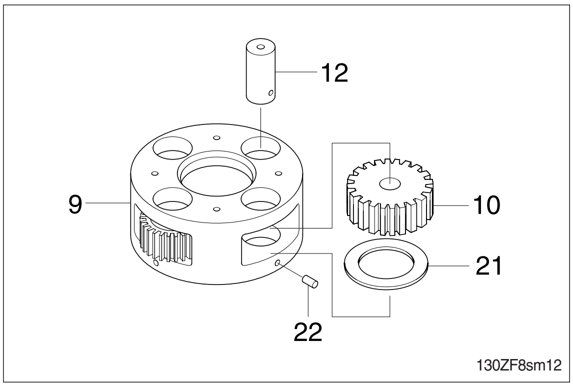
(4) Apply loctite to the tapped holes of casing (1).

(5) Tighten 2 M16 eye bolts to the ring gear (27) and lift up and then assemble it onto the casing (1).

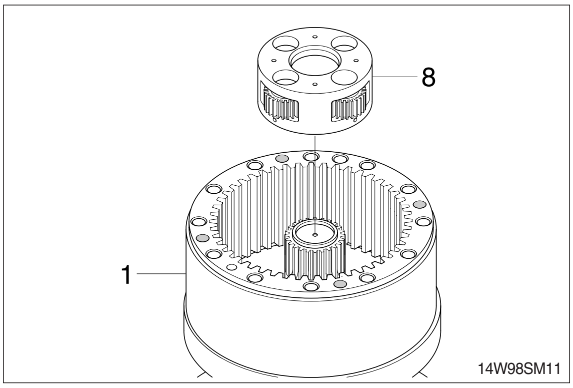
※ Don't fail to coincide the knock pin (28) holes.



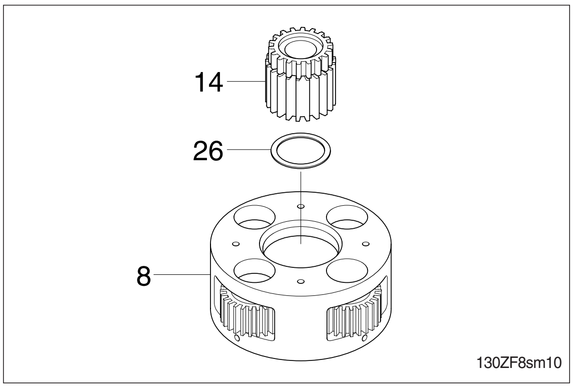
(6) Assembling carrier 2 assembly (8).
① Install the planet gear 2 (10) and thrust washer inside the carrier 2 (9).
② Assemble the pin 2 (12) to the carrier 2 (9) and then press the spring pin (22) by hammering.
③ Punch 2 points of the spring pin (22) lip.
※ Take care not to mistake the matching marks of each part.



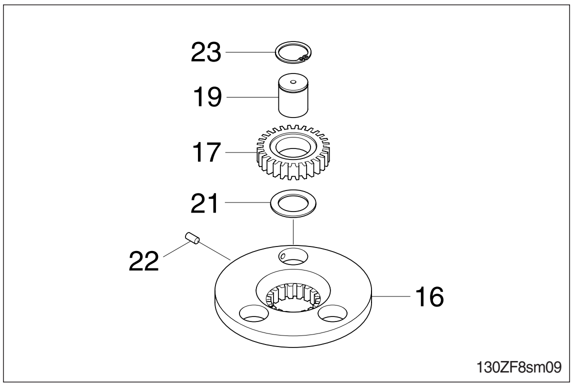
(7) Assemble carrier 2 assembly (8) correctly to the casing (1).



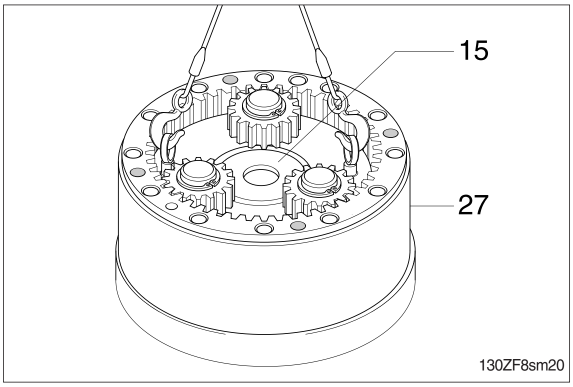
(8) Assemble sun gear 2 (14) and side plate 1 (26) to the center of the carrier 2 assembly (8).



(9) Assembling carrier 1 assembly (12).
① Assemble the pin1 (19) to the carrier 1 (16) and then press the spring pin (22) by hammering.
② Punch 2 points of the spring pin's (22) lip.
③ Assemble thrust washer (21), planet gear 1 (17), and then stop ring (23) to the pin 1 (14).
※ Take care not to mistake the matching marks of each part.

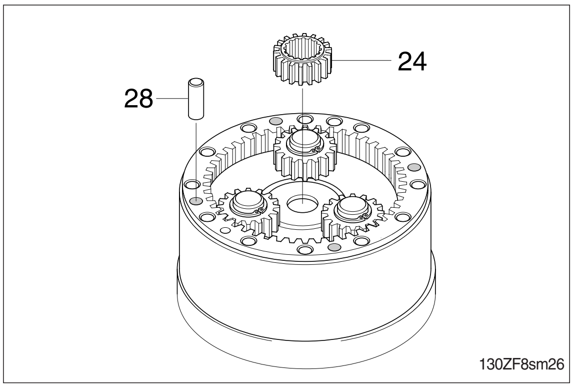


(10) Assemble carrier 1 assembly (12) into the ring gear (27).



(11) Hammer 4 knock pins (28) around the ring gear (27).

(12) Assemble sun gear 1 (24) to the drive shaft of the swing reduction gear.

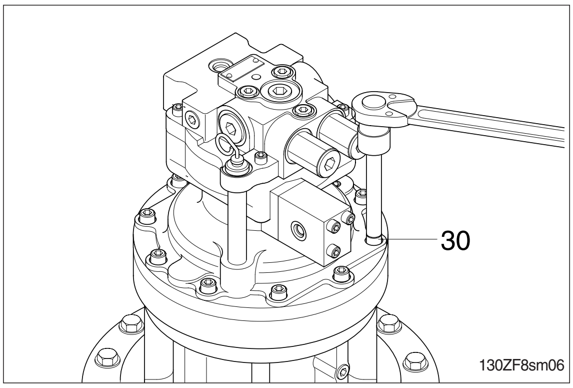


(13) Apply loctite to the tapped holes of the ring gear (27) and then mount swing motor onto the ring gear (27).

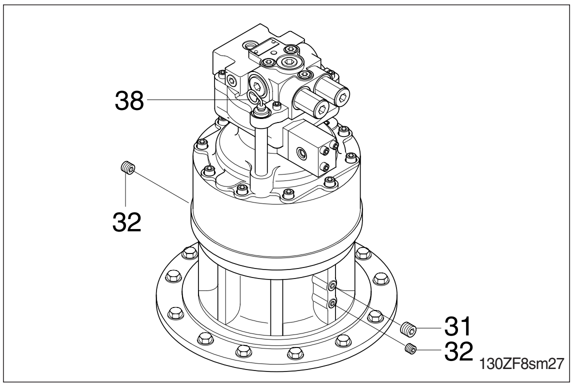
※ Don't fail to coincide the gauge bar hole.

(14) Tighten socket bolts (30) around the swing motor assembly.

· Tightening torque : 13.5 kgf · m (98 lbf · ft)



(15) Assemble plugs (31, 32) and level gauge (38).



GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

13031GE18

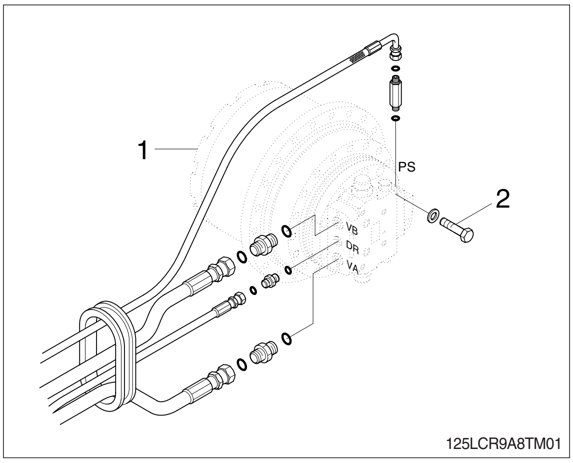
(1) Swing the work equipment 90˚and lower it completely to the ground.

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



125LCR9A8TM01

(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 : 140 kg (310 lb)
· Tightening torque : 23±2.5 kgf · m
(166±18.1 lbf · ft)

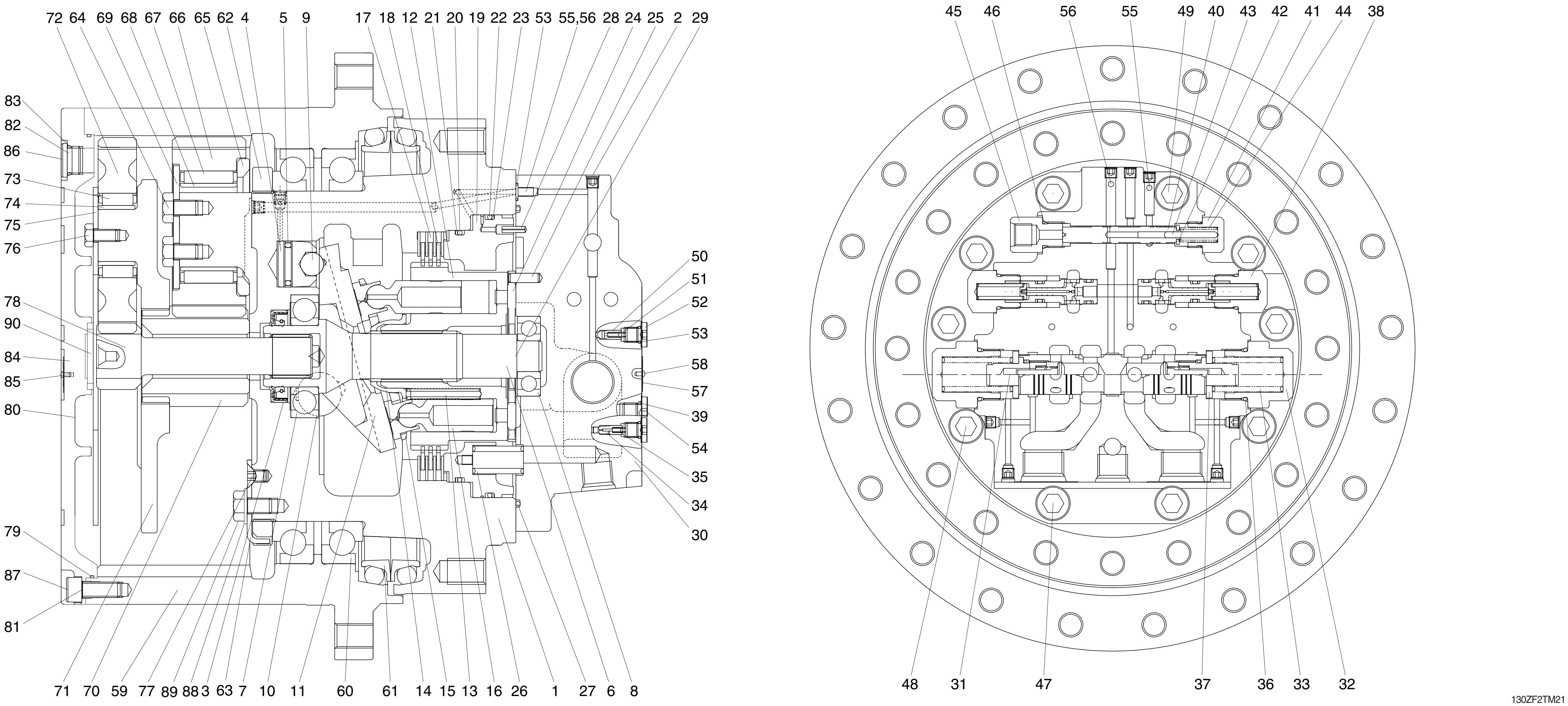
2) INSTALL

(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



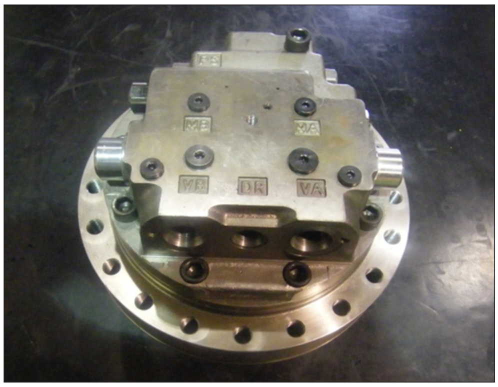
130ZF2TM21

1	Casing	19	Parking piston	37	Spring seat	55	Restrictor	73	Needle bearing No.1
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 No. 1
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 No. 2	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 No.2	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 No. 2	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

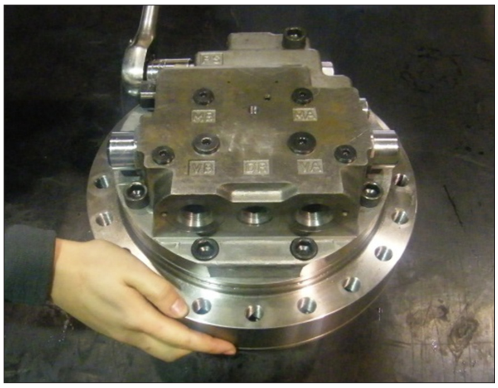
(1) Choose a clean place, remove contaminants (dust, etc) and cleans motor before placing it on worktable.

※ Lay the rubber plate on worktable and take care not to damage the component.



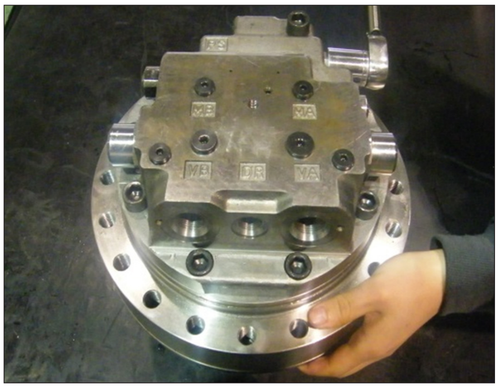
125LCR8TM02

(2) Remove the connector (45) using 21 mm socket wrench.



125LCR8TM03

(3) Remove plug (41) using 21 mm socket wrench.

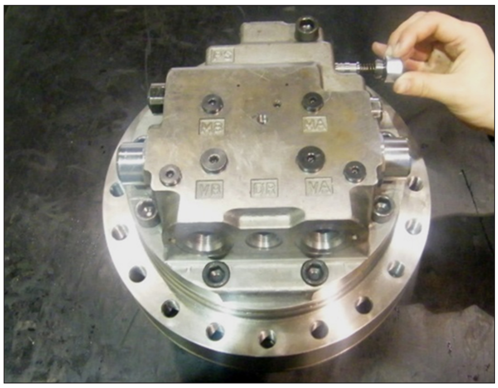


125LCR8TM04

(4) Disassemble parallel pin (43) and spring (44).

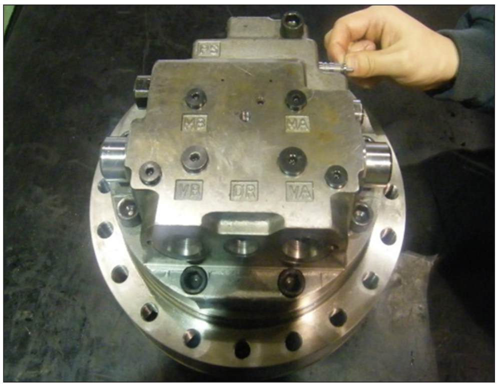
※ Do not lose spring.

※ Do not mix spring with other springs.



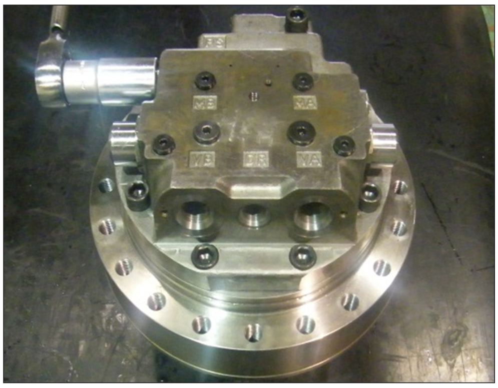
125LCR8TM05

(5) Remove spring seat (42) and spool (40).



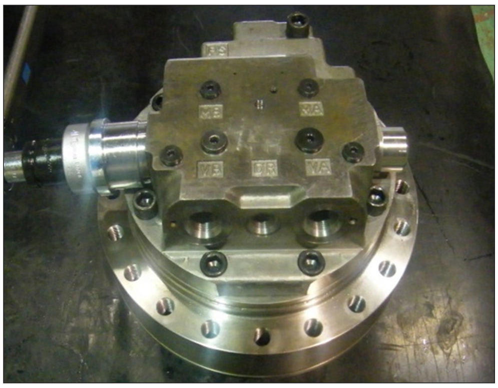
125LCR8TM06

(6) Disassemble relief valve assembly (38) using 26 mm socket wrench. (2 sets)



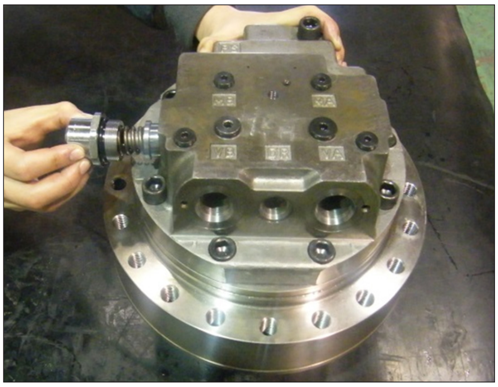
125LCR8TM07

(7) Disassemble cover (32) using 41 mm socket wrench.



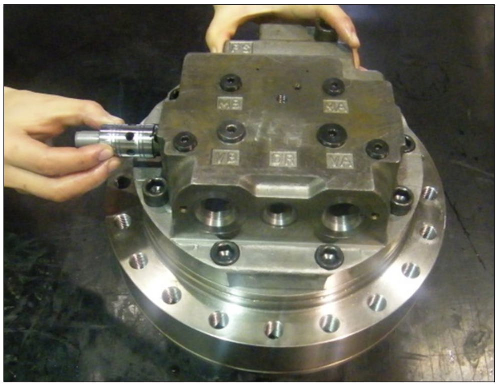
125LCR8TM08

(8) Disassemble spring seat (37) and spring (33). (2 sets)



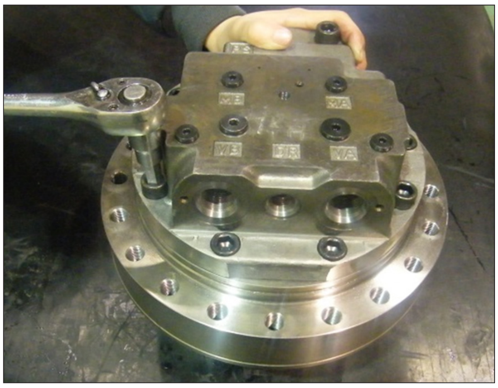
125LCR8TM09

(9) Separate main spool assembly (31) from rear cover.



125LCR8TM10

(10) Unscrew socket bolt (47) (1EA), (48) (3EA), (49) (6EA) from rear cover.



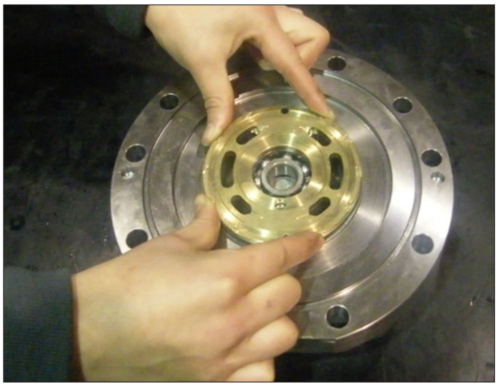
125LCR8TM11

(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.



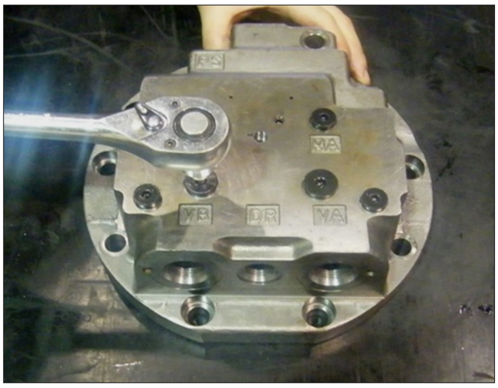
125LCR8TM13

(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

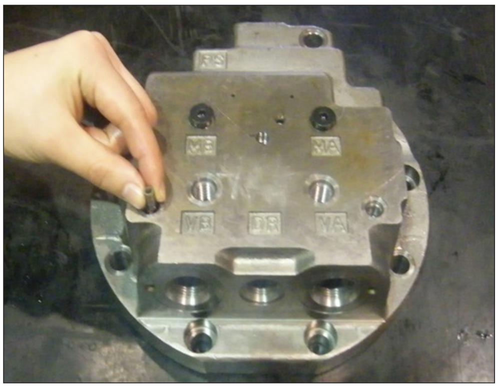
(15) Remove restrictor (34) and spring (35). (2 sets)

※ Do not confuse restrictor (34) and check valve (50).

※ Do not confuse spring (35) and spring (51).

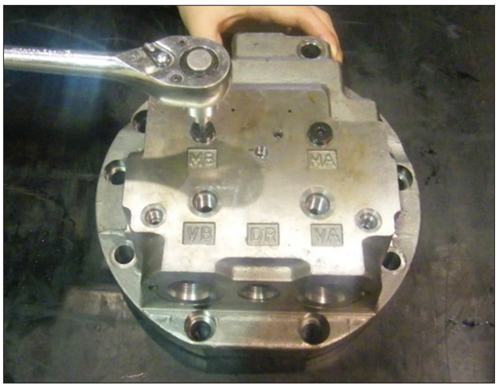
※ Do not lose spring.

※ Do not mix spring with other springs.



125LCR8TM16

(16) Remove plug (52) using 5 ㎜ hexagon wrench.



125LCR8TM17

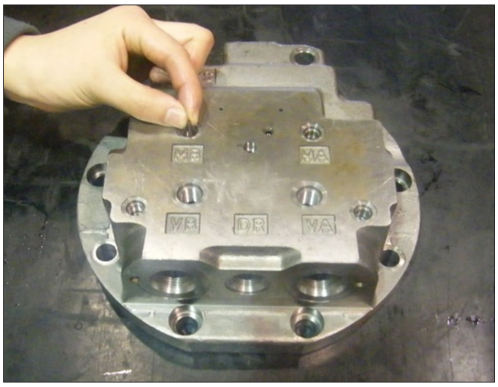
(17) Remove check valve (50) and spring (51). (2 sets)

※ 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

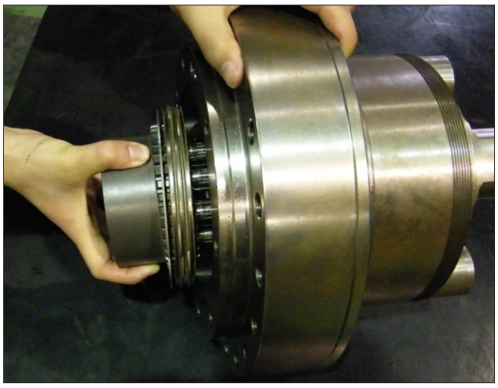
(20) From parking piston, separate O-ring (22) and back-up ring (23).

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).

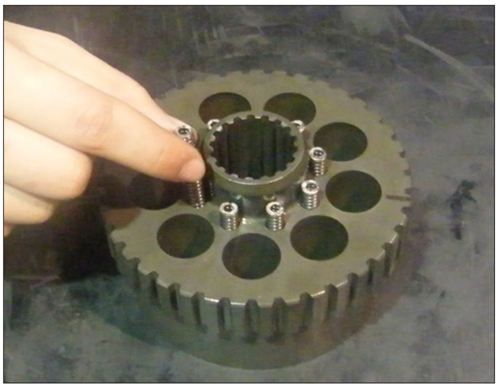
※ Take care not to damage sliding surface of each component.

125LCR8TM24

(24) Disassemble ball guide (14) and spring (13) (9EA).

※ Do not lose spring.

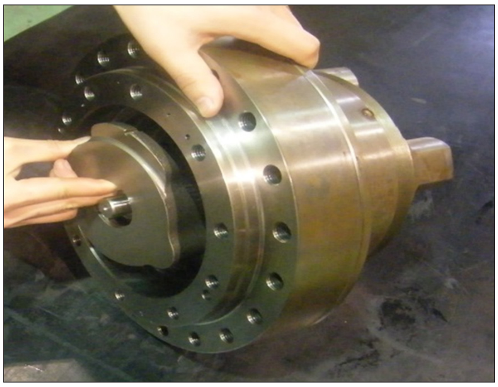
※ Do not mix spring with other springs.



125LCR8TM25

(25) Disassemble swash plate (11) and pivot (10).

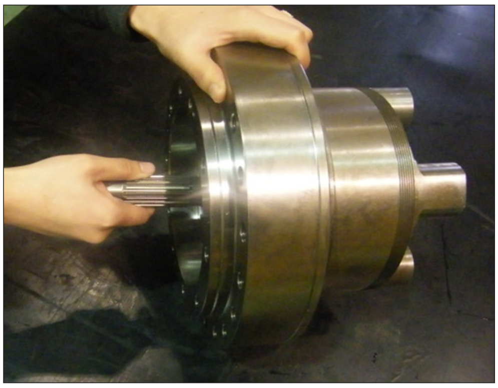
※ Take care not to damage sliding surface.



125LCR8TM26

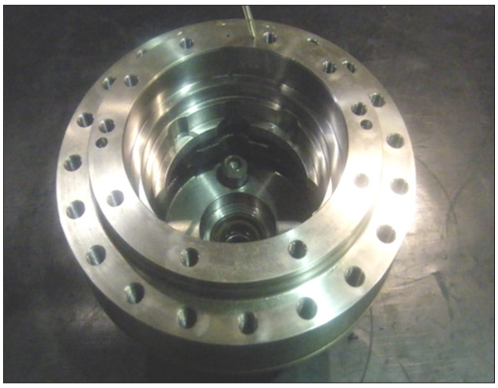
(26) Disassemble shaft (6) and ball bearing (7).

※ 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.

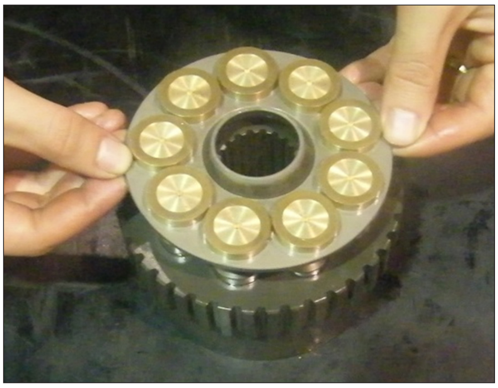
125LCR8TM37

(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.

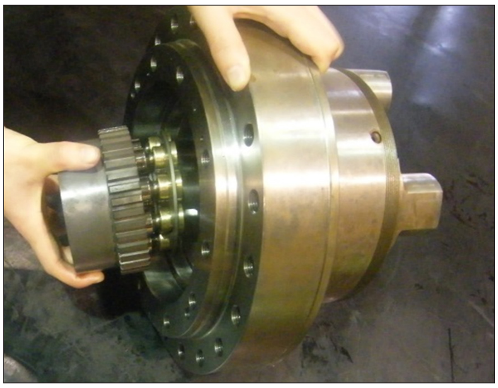


125LCR8TM38

(9) Lay casing down horizontally and assemble cylinder block assembly by matching its spline with shaft.

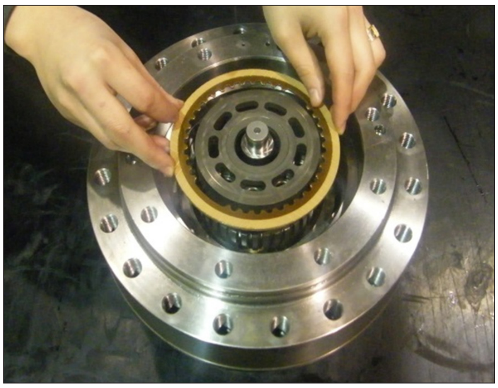
※ Make sure swash plate stays in place.

※ 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

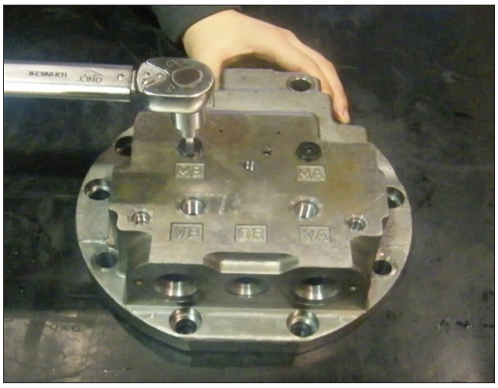
(14) Insert parallel pin (29) (2EA) in casing.

125LCR8TM44

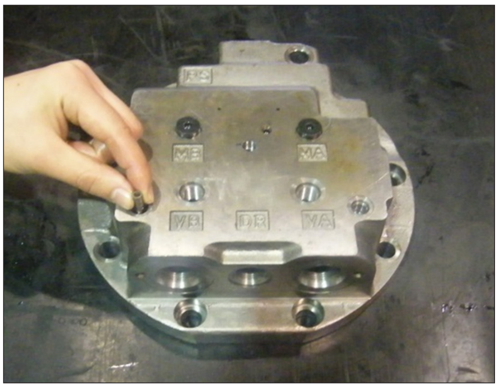
(15) Assemble check valve (50) and spring (51) in order.
※ Do not confuse check valve (50) and restrictor (34).
※ Do not confuse spring (51) and spring (35)


125LCR8TM45

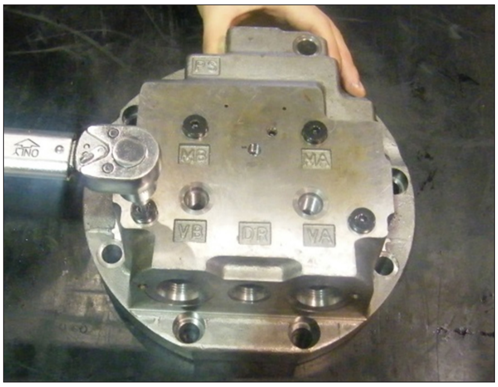
(16) Clamp plug (52) using 5 mm hexagon wrench.
※ Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)


125LCR8TM46

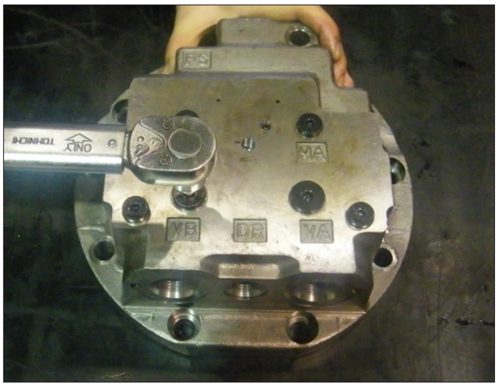
(17) Assemble restrictor (34) and spring (35) in order.
※ Do not confuse check valve (50) and restrictor (34).
※ Do not confuse spring (51) and spring (35).


125LCR8TM47

(18) Clamp plug (52).
※ Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)

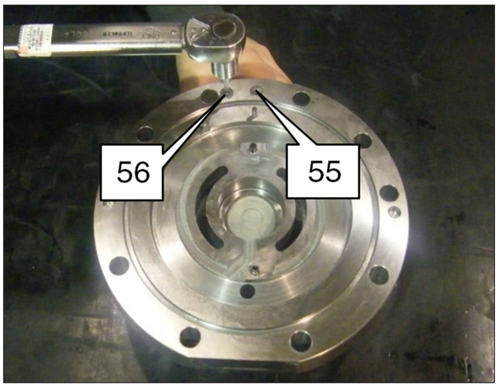

125LCR8TM48

(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

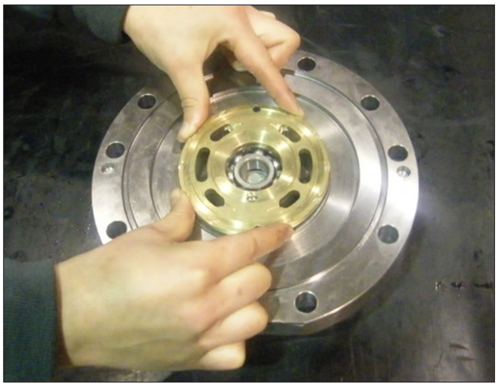
(21) Assemble ball bearing (8) in rear cover using jig.


125LCR8TM51

(22) Insert spring pin (25) (2ea) and (28) in rear cover using jig.

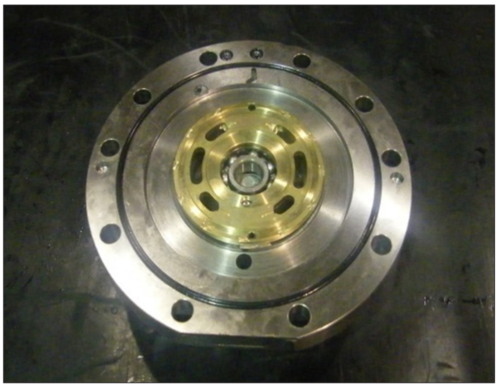

125LCR8TM52

(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.

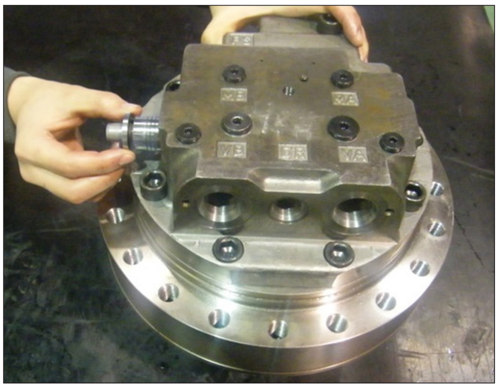


125LCR8TM54

(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

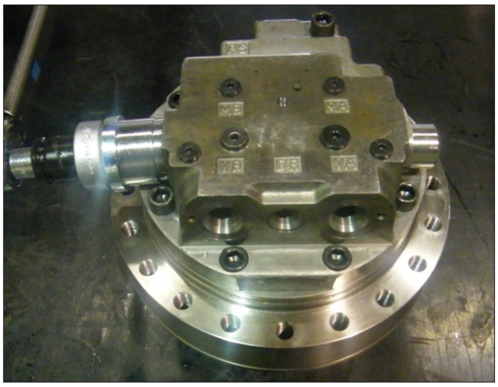
(26) Assemble main spool assembly (31), spring seat (37) and spring (33) in rear cover.



125LCR8TM56

(27) Settle cover (32).

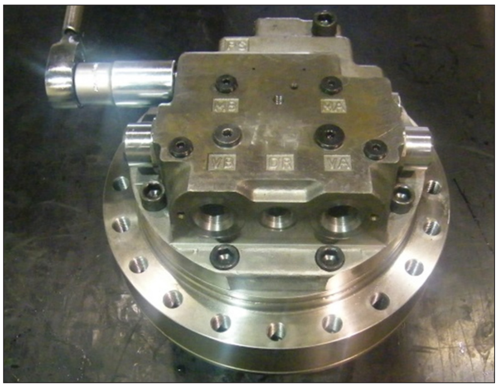
※ Tightening torque : 15±1.5 kgf · m
(108±10.8 lbf · ft)



125LCR8TM57

(28) Insert relief valve (38) in rear cover.

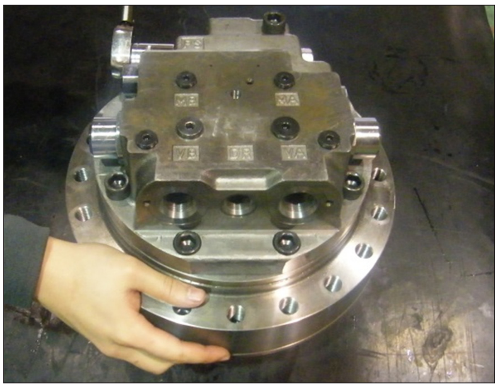
※ Tightening torque : 15±1.8 kgf · m
(108±13.0 lbf · ft)



125LCR8TM58

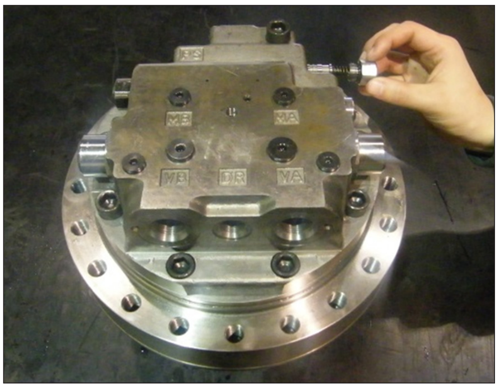
(29) After clamping connector (45) to rear cover, assemble spool (40).

※ 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).

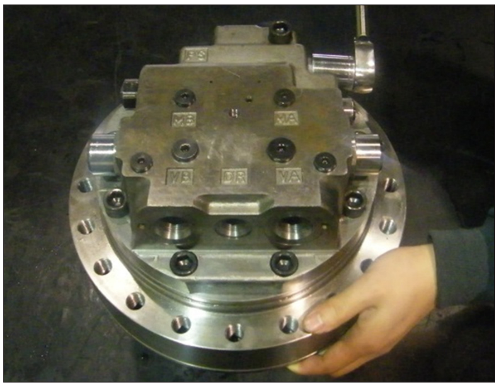


125LCR8TM60

(31) After assembling spring (44) in order, clamp plug (41).

※ Tightening torque : 5.5±0.5 kgf · m

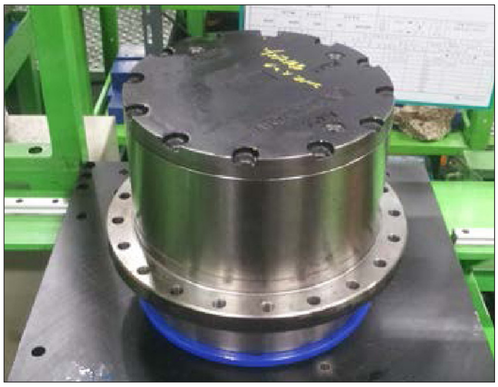
(39.8±3.6 lbf · ft)



125LCR8TM61

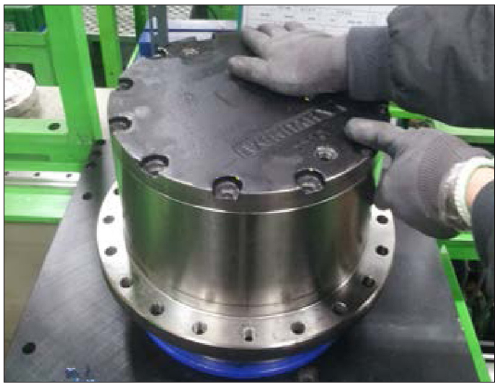
3. TRAVEL REDUCTION GEAR DISASSEMBLY

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

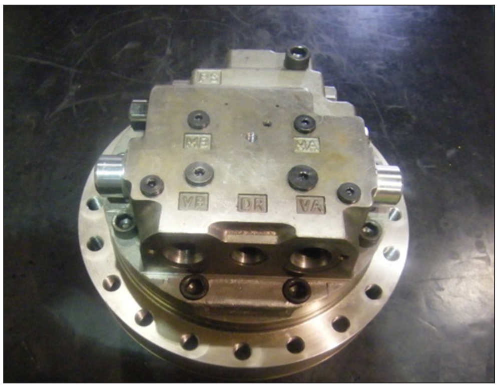
5) Disassemble M8 bolt (76) from the carrier assembly. (3 pcs)

125LCR8TM74

6) Disassemble thrust plate No.1 (75) from the carrier assembly.

125LCR8TM75

7) Disassemble planetary gear No.1 (72).(3 pcs)



125LCR8TM76

8) Disassemble needle bearing (73).(3 pcs)

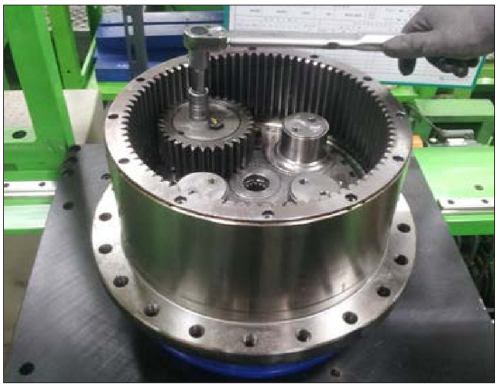
※ Do not disassemble inner race in the absence of abnormalities.

125LCR8TM77

9) Disassemble Sun gear No.2 (70).

125LCR8TM78

10) Disassemble M10 bolt (64).(4 pcs)



125LCR8TM79

11) Disassemble thrust washer No.2 (65).(4 pcs)

125LCR8TM80

12) Disassemble planetary gear No.2 (66).(4 pcs)

125LCR8TM81

13) Disassemble needle bearing No.2 (67).(4 pcs)

125LCR8TM82

14) Disassemble thrust plate No.2 (69).(4 pcs)

※ Do not disassemble inner race in the absence of abnormalities.

125LCR8TM83

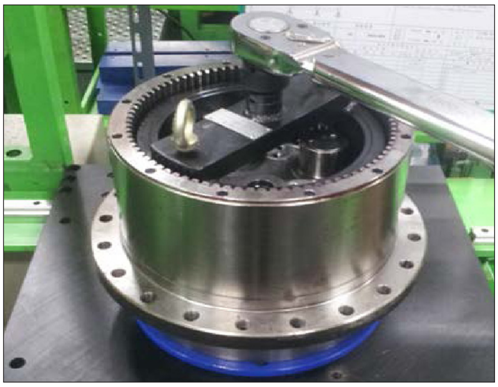
15) Disassemble M10 bolt (89), plain washer (88) and M8 screw (77).

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.

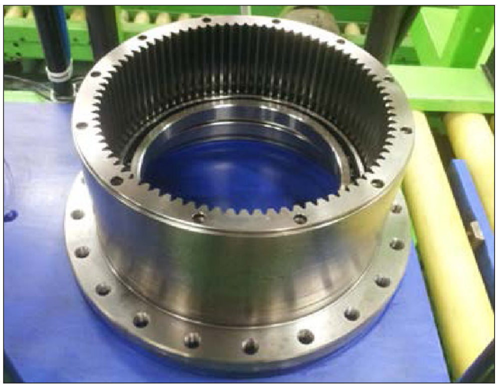
125LCR8TM87

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 No.1 (73).(3 pcs)

125LCR8TM91

3) Assemble planetary gear No.1 (72) of which groove is faced downward. (3 places)

125LCR8TM92

4) Assemble thrust plate No.1 (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)

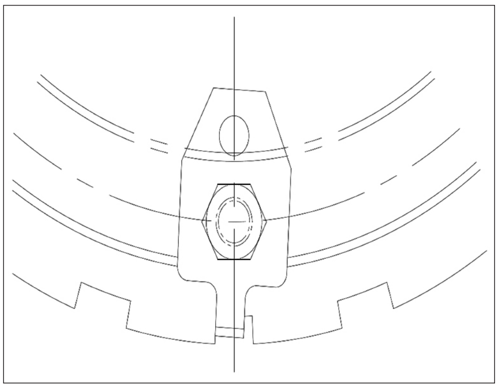
※ Tightening torque (M10) : 5.5 ± 0.6 kgf · m (39.8 ± 4.3 lbf · ft)

※ 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 No.2 (69).(4 pcs)

125LCR8TM105

16) Assemble needle bearing No.2 (67).(4 pcs)

125LCR8TM106

17) Assemble planetary gear No.2 (66).(4 pcs)

※ Grooves of planetary gear will be facingup.

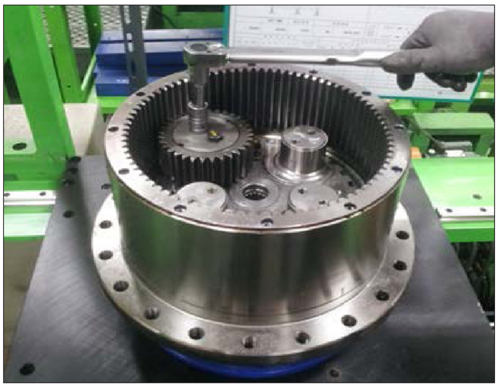
125LCR8TM107

18) Assemble thrust washer No.2 (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

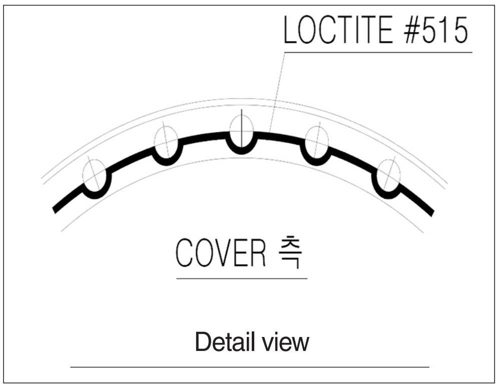
21) Assemble carrier No.1 assembly.

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.



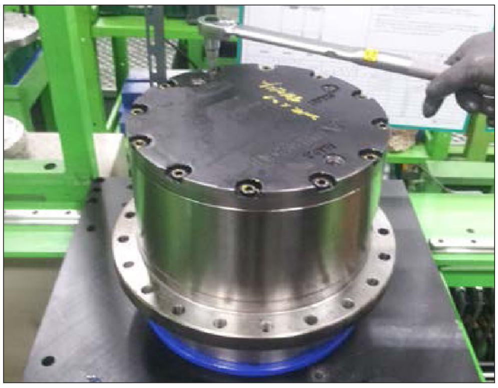
125LCR8TM114

24) Place cover (80) to fit the bolt holes.

125LCR8TM115

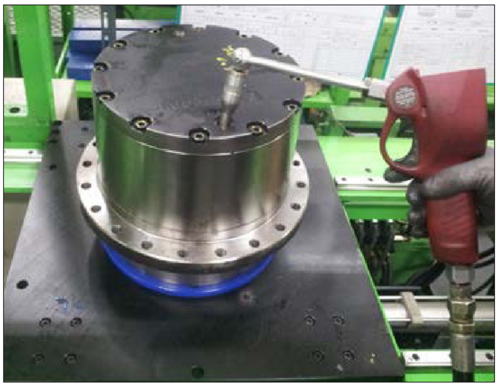
25) After spreading loctite #242, assemble the M10 bolt (81).(12 pcs)

※ 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

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

13031GE18

(4) Loosen the bolt (1).

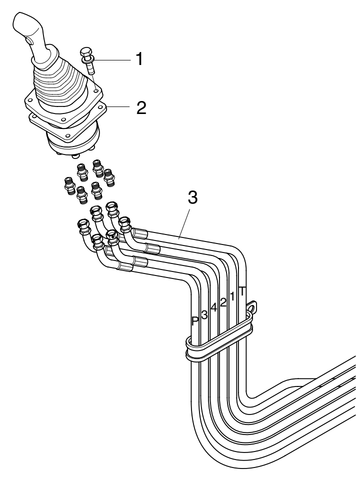
· Tightening torque : 2.5±0.5 kgf · m (18.1±3.6 lbf · ft)

(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.



130ZF8RL01

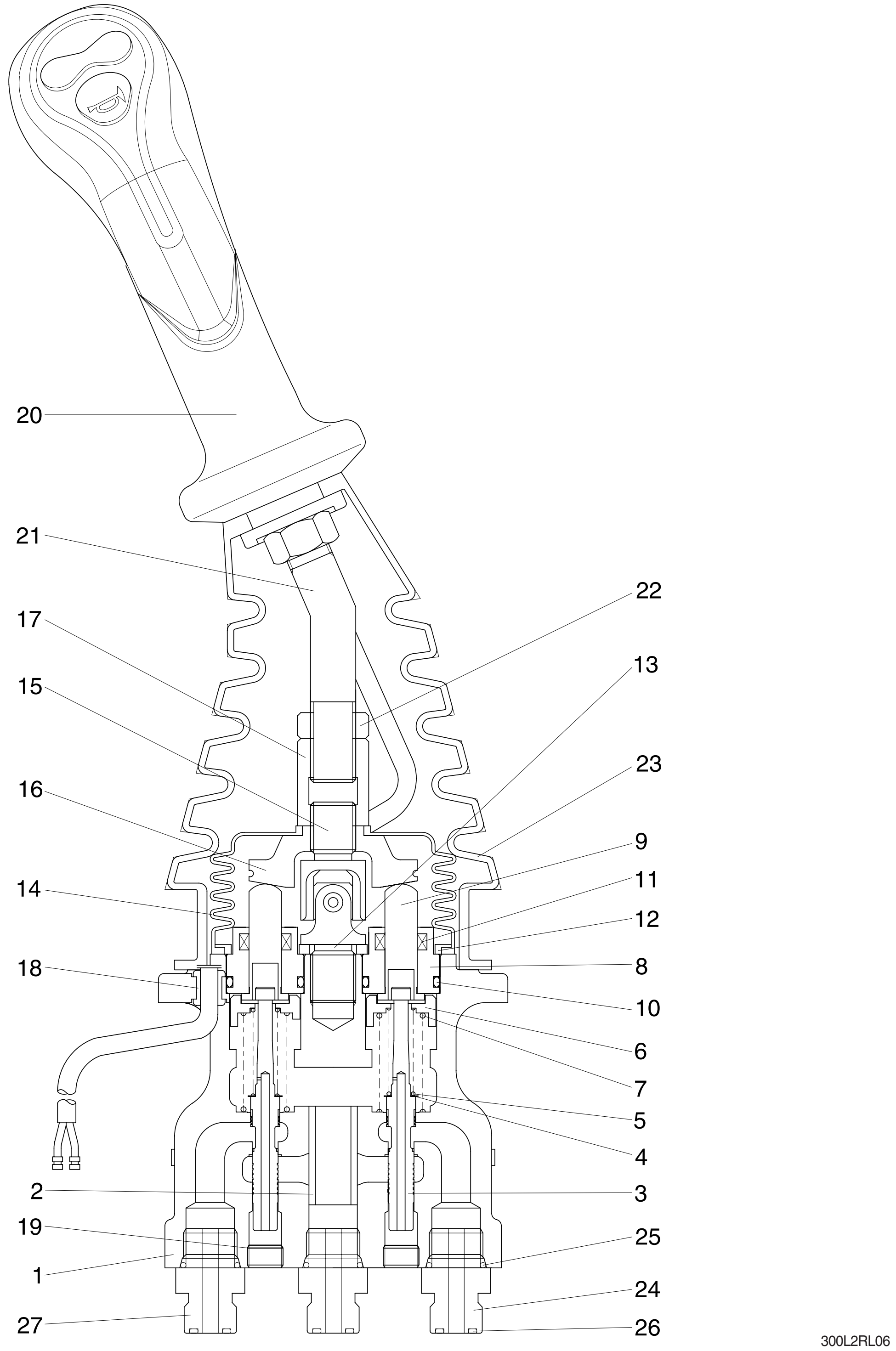
2) INSTALL

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

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

2. DISASSEMBLY AND ASSEMBLY

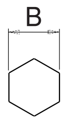
1) STRUCTURE



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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
Spanne	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	3.5	25.3
Swash plate	16	M14	5.0±0.35	36.2±2.5
Adjusting nut	17	M14	5.0±0.35	36.2±2.5
Lock nut	22	M14	5.0±0.35	36.2±2.5

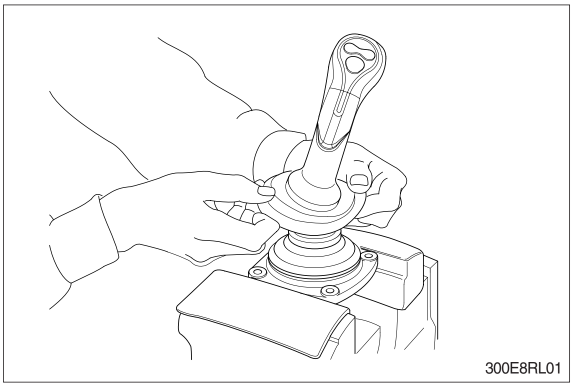
3) DISASSEMBLY

※ Procedures are based on the type M1.

(1) Clean pilot valve with kerosene.
※ Put blind plugs into all ports

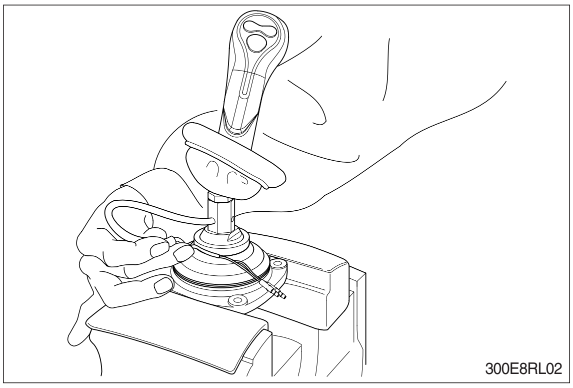
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (23) from case (1) and take it out upwards.



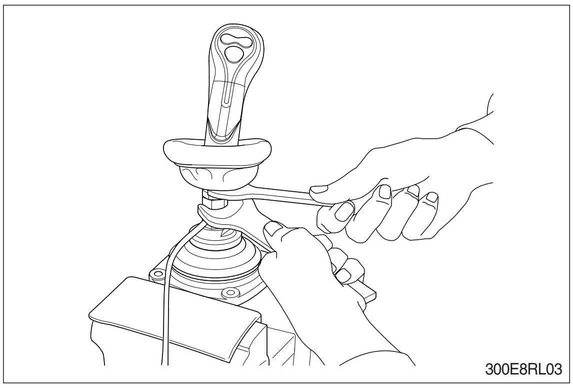
300E8RL01

※ For valve with switch, remove cord also through hole of casing.



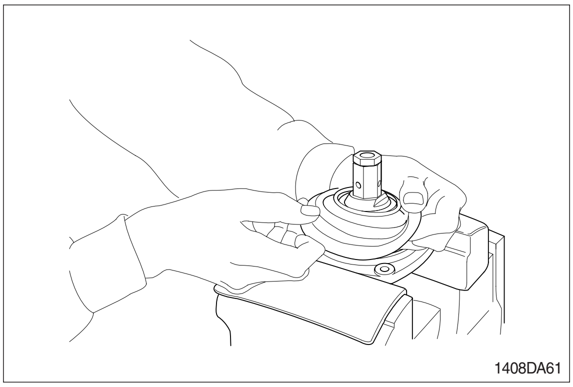
300E8RL02

(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).



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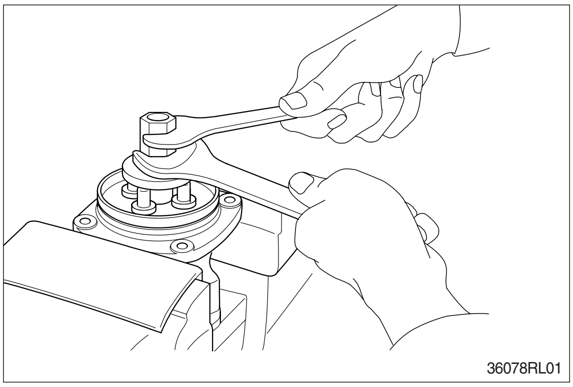
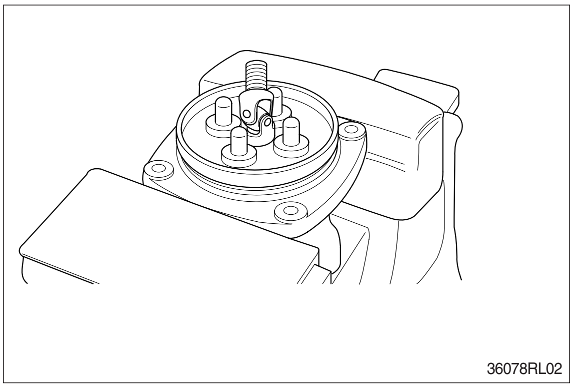
(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.



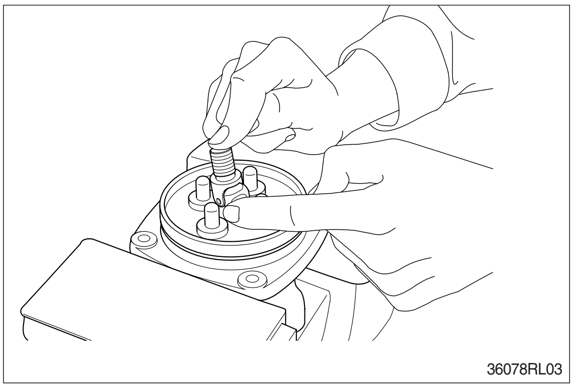
36078RL01



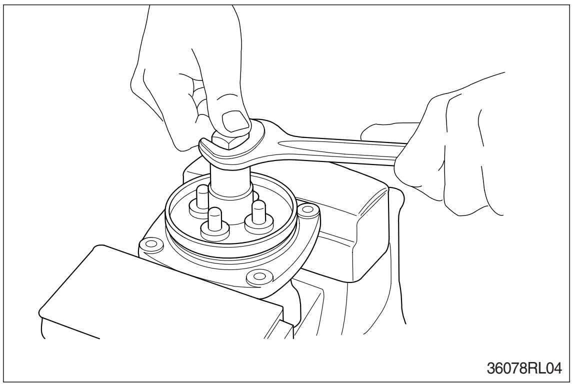
36078RL02

(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.

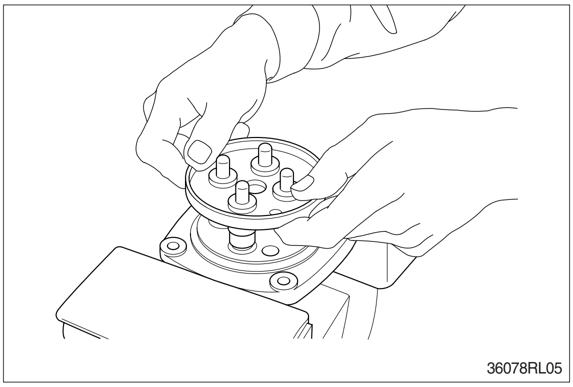


36078RL03



36078RL04

(8) Remove plate (12).

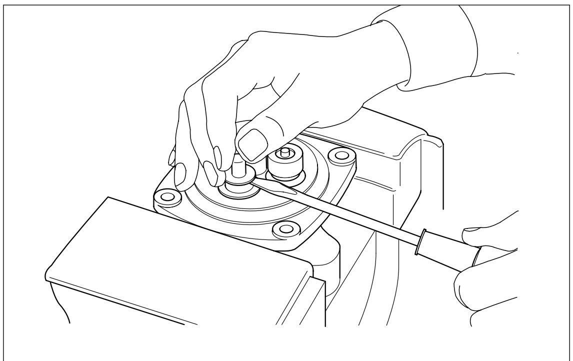


36078RL05

(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.

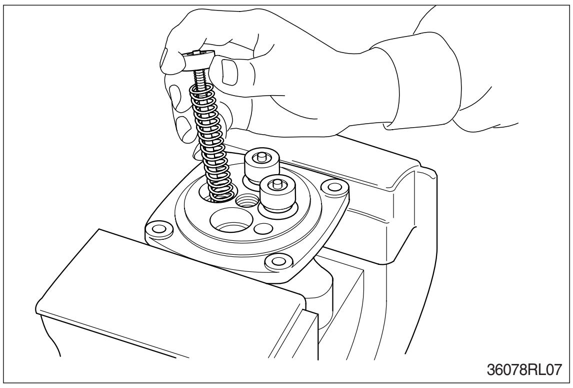
※ During taking out, plug may jump up due to return spring (7) force.
Pay attention to this.



36078RL06

(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



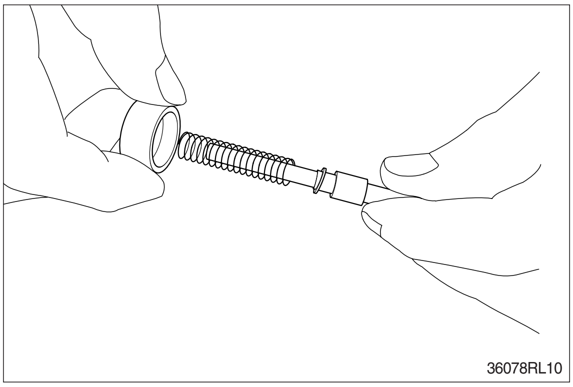
36078RL07

(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

※ Pay attention not to damage spool surface.

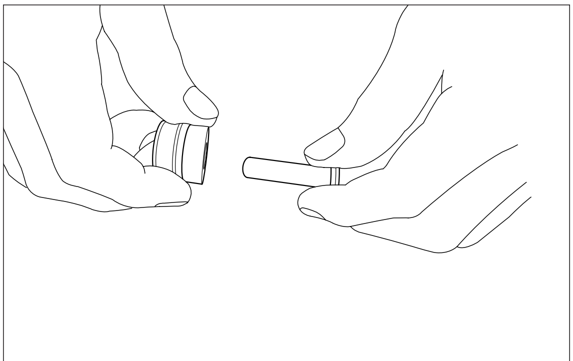
※ Record original position of spring seat (6).

※ Until being assembled, they should be handled as one subassembly group.



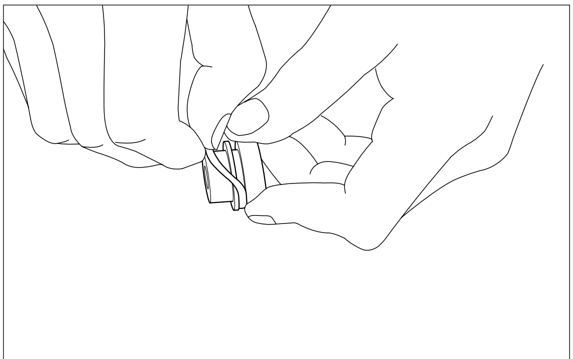
36078RL10

(12) Take push rod (9) out of plug (8).

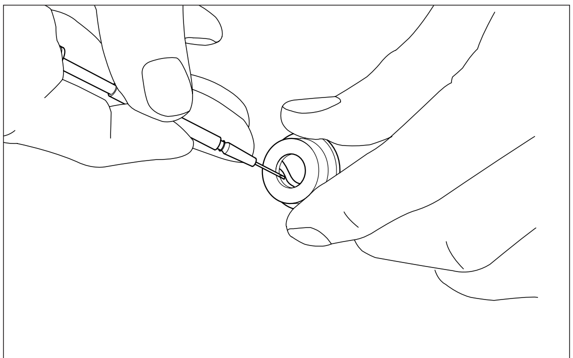


36078RL11

(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.

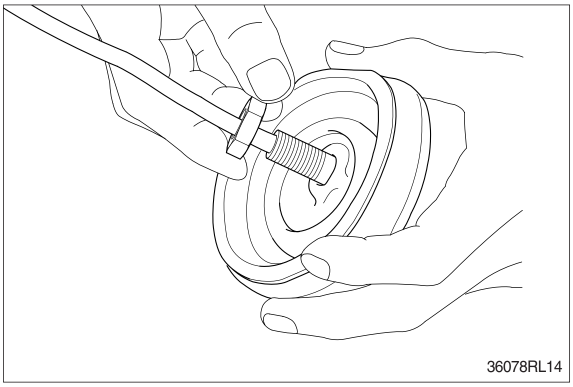


36078RL12

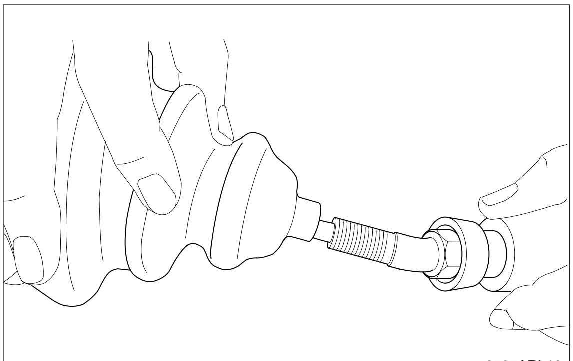


36078RL13

(14) Remove lock nut (22) and then boot (23).



36078RL14



2507ARL10

(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.

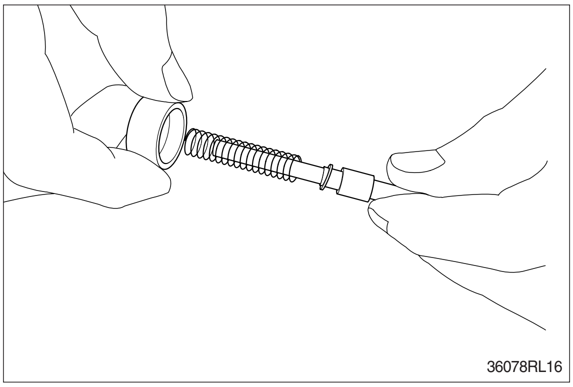
(16) Rust prevention of parts

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.

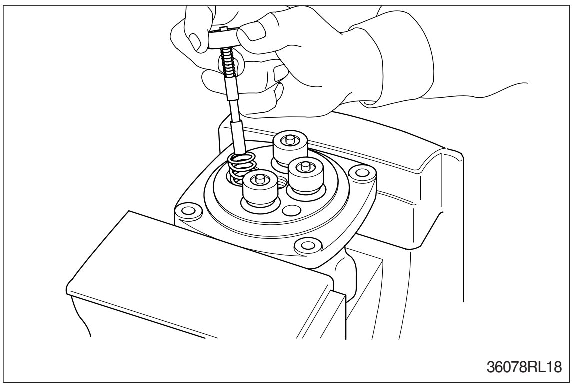
4) ASSEMBLY

(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.

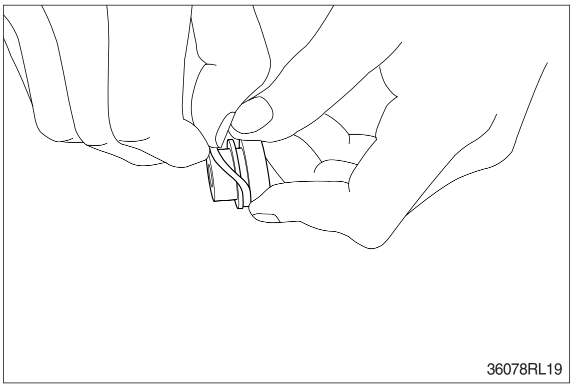


(2) Assemble spring (7) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

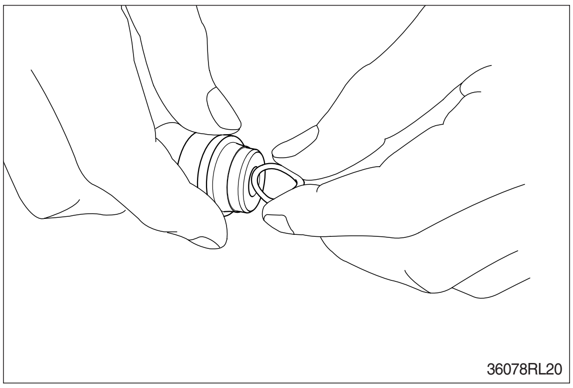


(3) Assemble O-ring (10) onto plug (8).

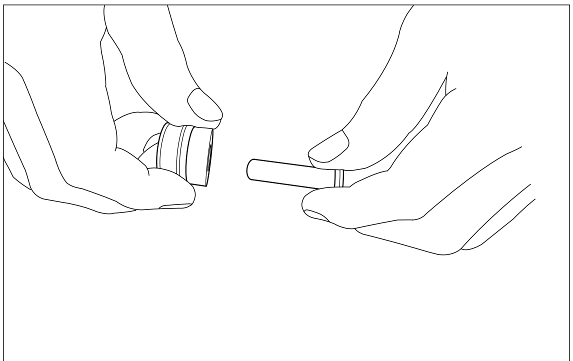


(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.

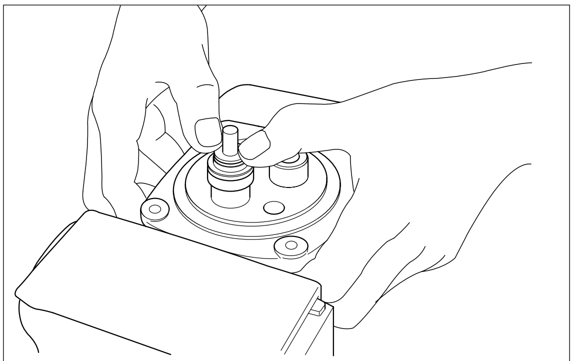


(5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.



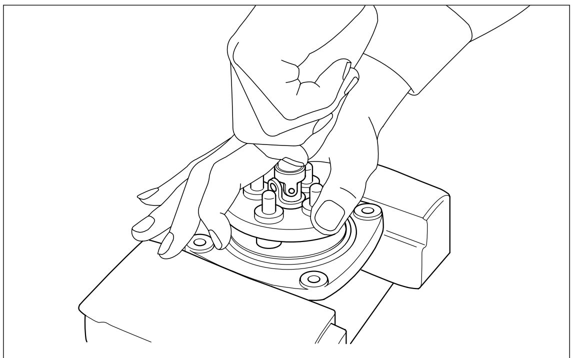
36078RL21

(6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



36078RL22

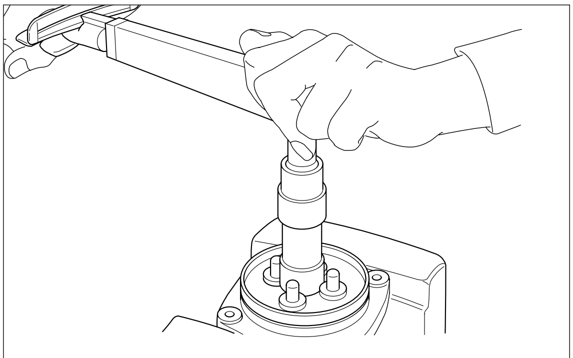
(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



36078RL23

(8) Fit plate (12).

(9) Tighten joint (15) with the specified torque to casing, utilizing jig.

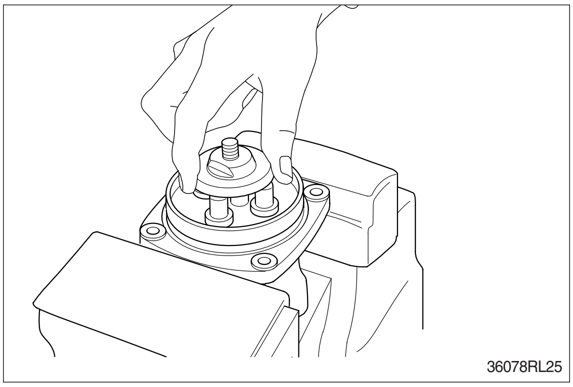


36078RL24

(10) Assemble swash plate (16) to joint (15).

※ Screw it to position that it contacts with 4 push rods evenly.

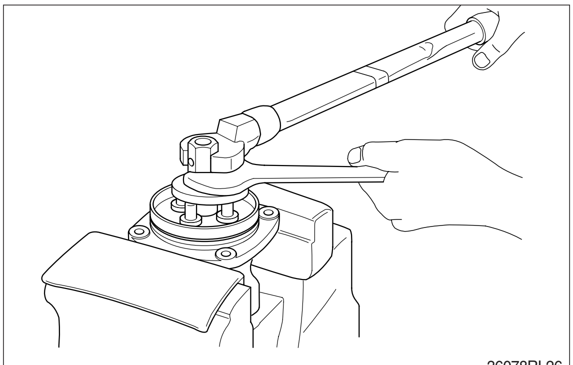
※ Do not screw it over.



36078RL25

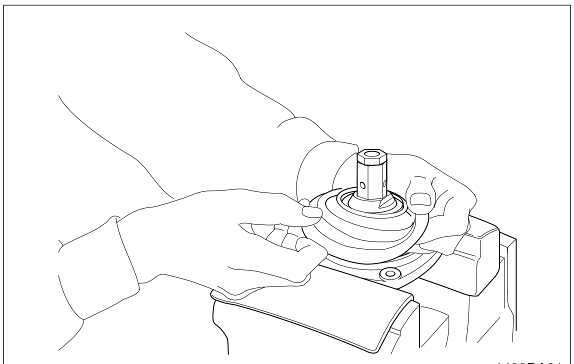
(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

※ During tightening, do not change position of disk.



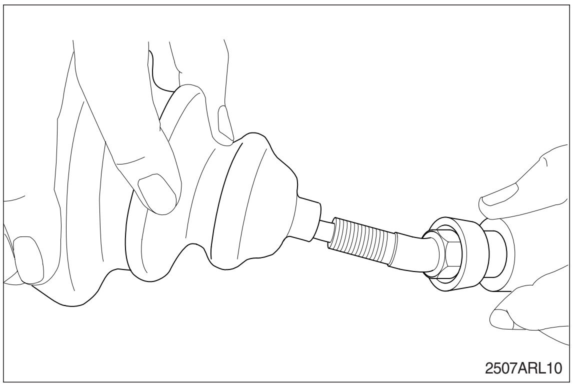
36078RL26

(12) Fit boot (14) to plate.

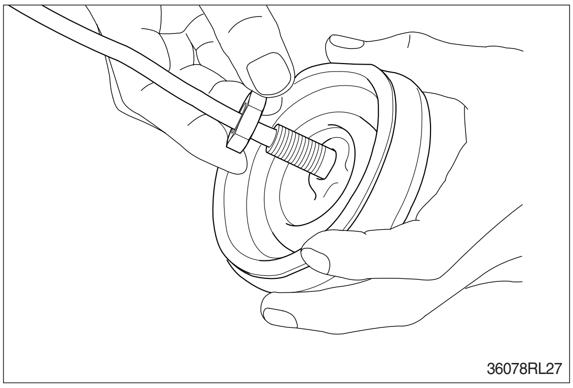


1408DA61

(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.

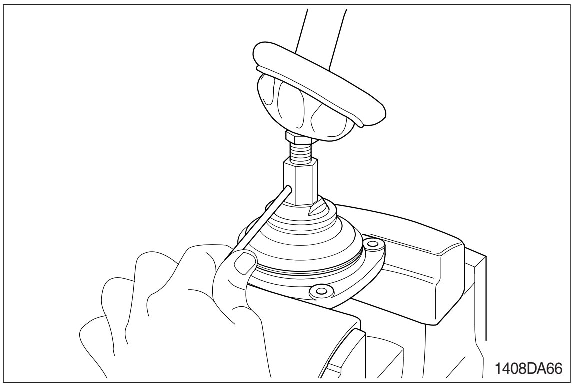


2507ARL10



36078RL27

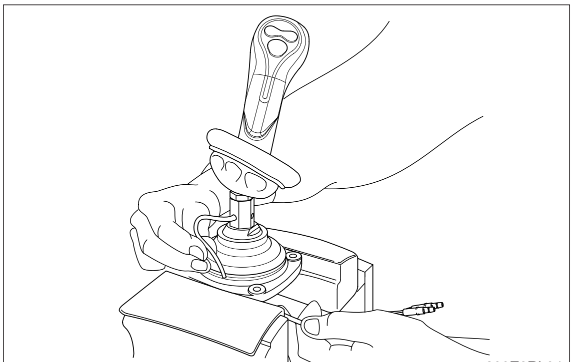
(14) Pull out cord and tube through adjusting nut hole provided in direction 60 ° to 120 ° from casing hole.



1408DA66

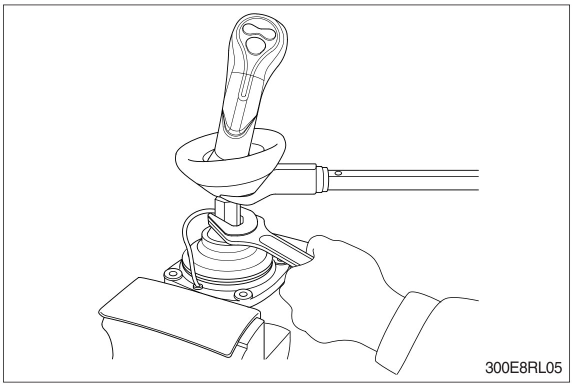
(15) Assemble bushing (18) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.

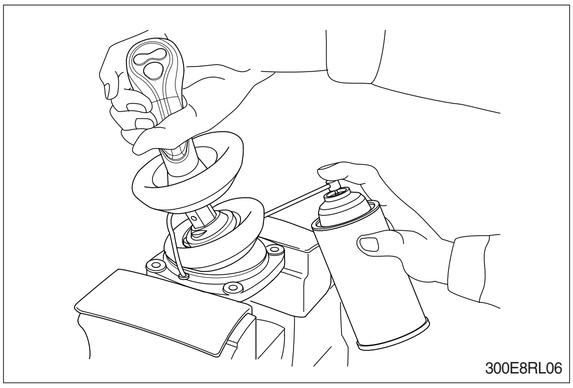


300E8RL04

(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

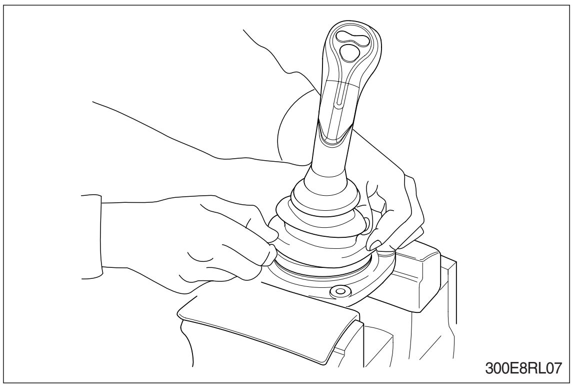


(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(18) Assemble lower end of bellows to casing.

(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

13031GE18

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

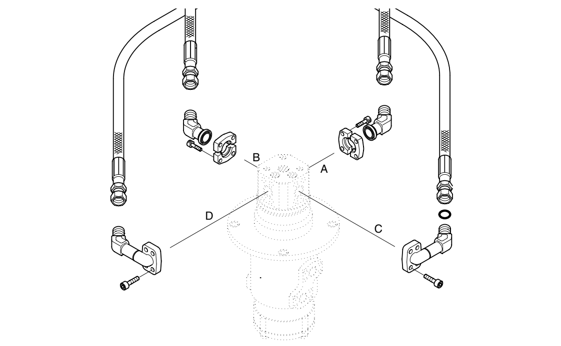
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(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.

(4) Disconnect all hoses.



130ZF8TJ01

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

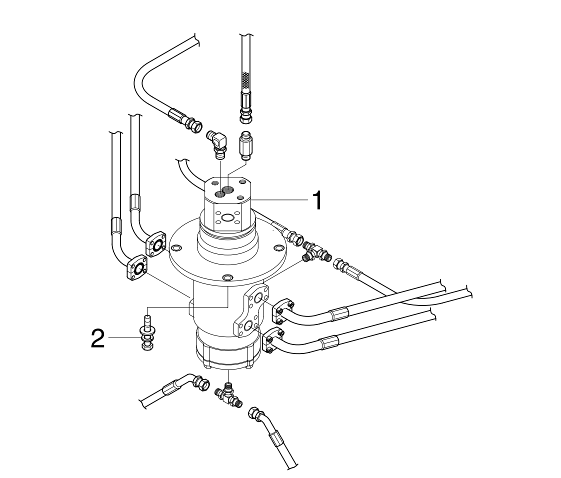
· Weight : 50 kg (110 lb)

· Tightening torque : 19.6±2.9 kgf · m (142±21.0 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

2) INSTALL



130ZF8TJ02

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

※ Take care of turning joint direction.

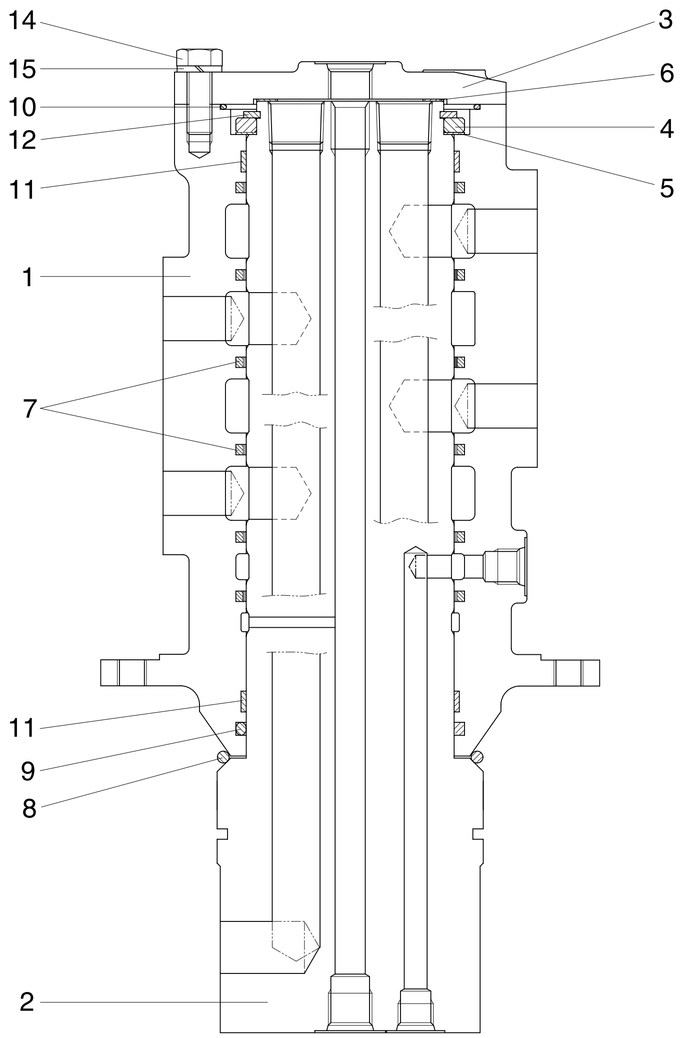
※ Assemble hoses to their original positions.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

※ Descriptions are based on the without dozer blade.



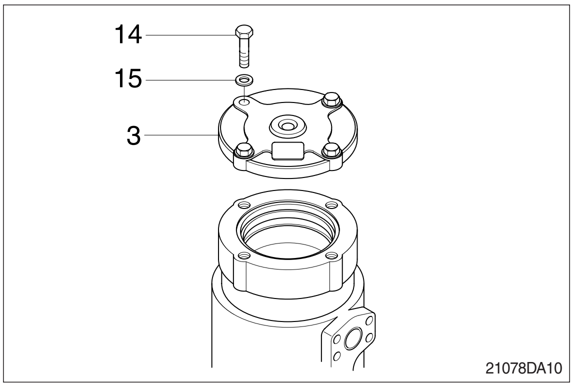
14098TJ03

1	Hub	6	Shim	11	Wear ring
2	Shaft	7	Slipper seal	12	Retainer ring
3	Cover	8	O-ring	13	Plug
4	Spacer	9	O-ring	14	Hexagon bolt
5	Shim	10	O-ring	15	Spring washer

2) DISASSEMBLY

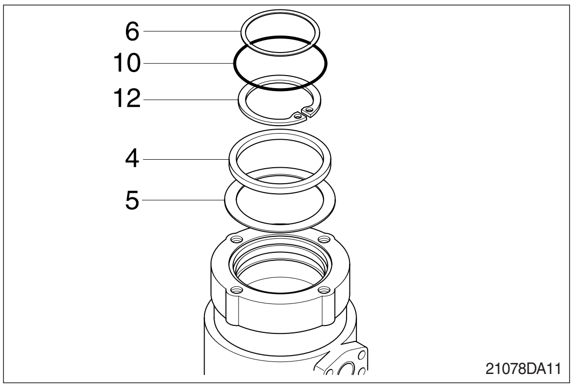
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (14), washer (15) and cover (3).



(2) Remove shim (6) and O-ring (10).

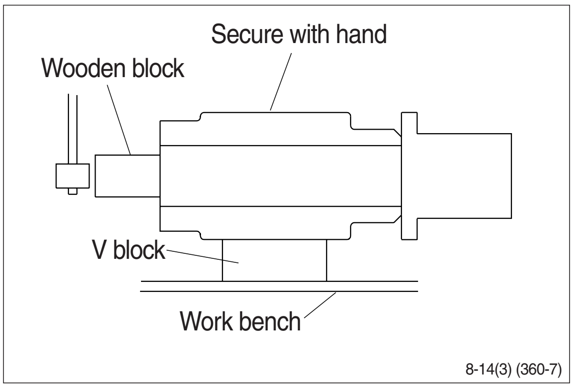
(3) Remove retainer ring (12), spacer (4) and shim (5).



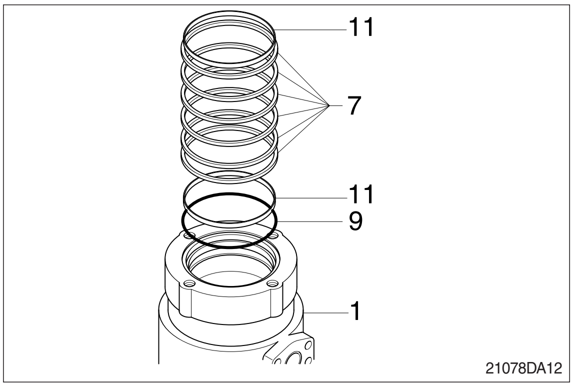
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



(5) Remove six slipper seals (7) and O-ring (9), two wear ring (11) from hub (1).

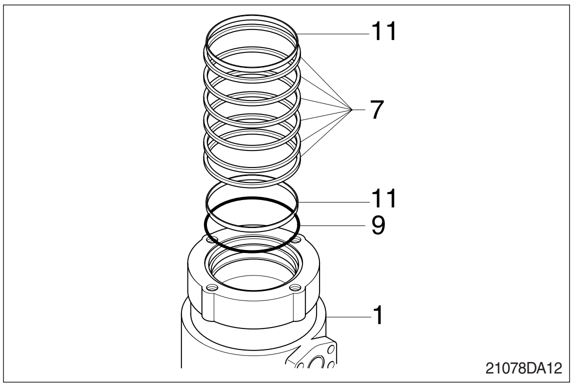


3) ASSEMBLY

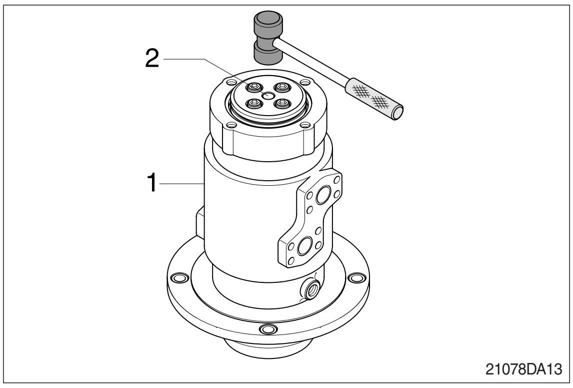
※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix seven slipper seal (7) and O-ring (9), two wear ring (11) to hub (1).

(2) Fit O-ring (8) to shaft (2).



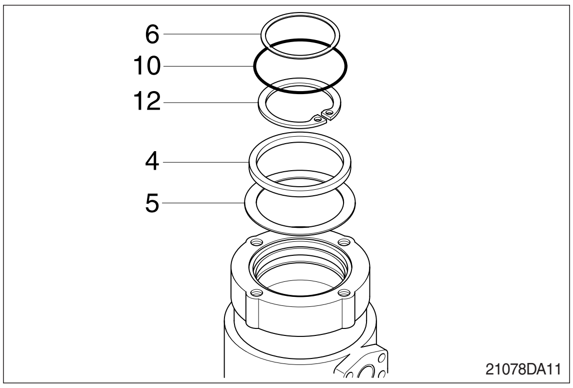
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



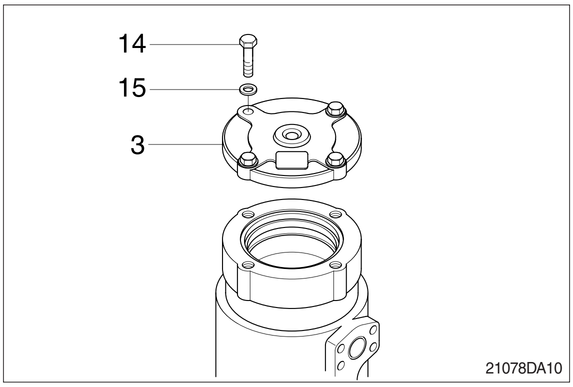
(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

(5) Fit O-ring (10) to hub (1).

(6) Fit shim (6) to shaft (2).



(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, BUCKET AND DOZER CYLINDERS

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

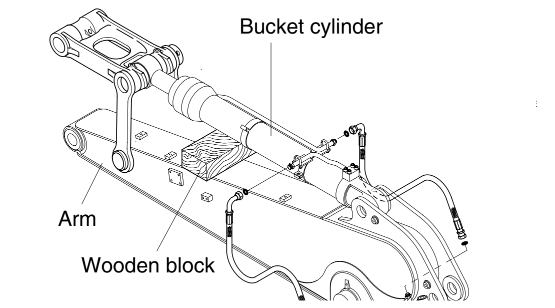
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **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

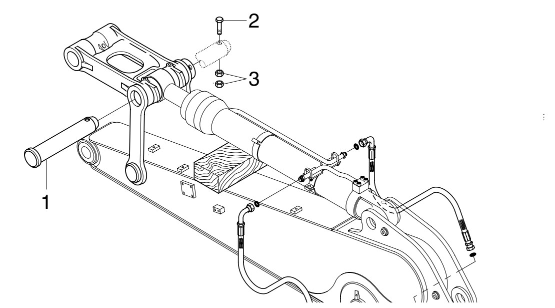
① Set block between bucket cylinder and arm.



130ZF8DA80

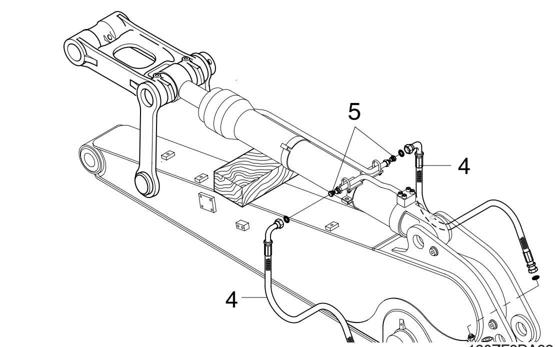
② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



130ZF8DA81

③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.

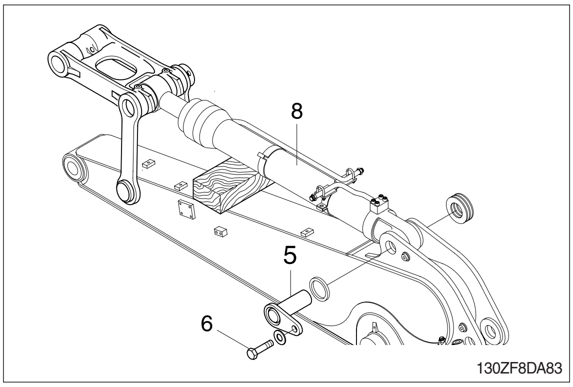


130ZF8DA82

④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

· Weight : 78 ㎏ (172 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the bucket cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) ARM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

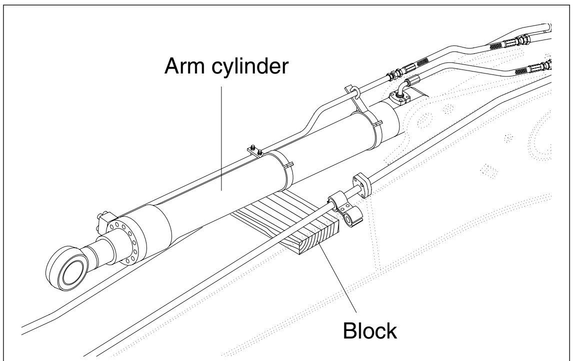
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.


13031GE18

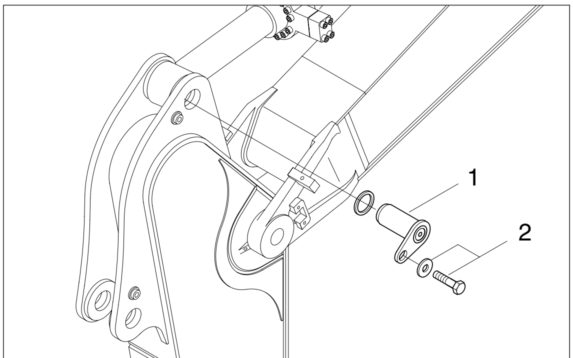
① Set block between arm cylinder and boom.



130ZF8CY18

② Remove bolt (2) and pull out pin (1).

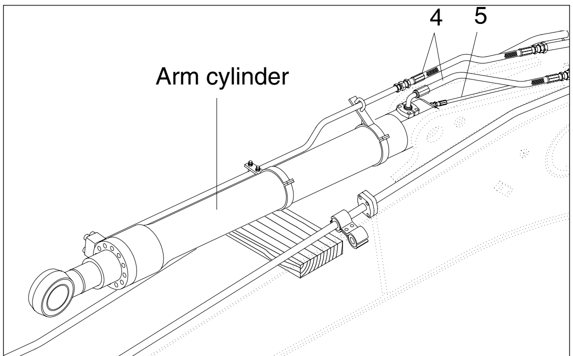
※ Tie the rod with wire to prevent it from coming out.



130ZF8CY19

④ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

⑤ Disconnect greasing pipings (6).

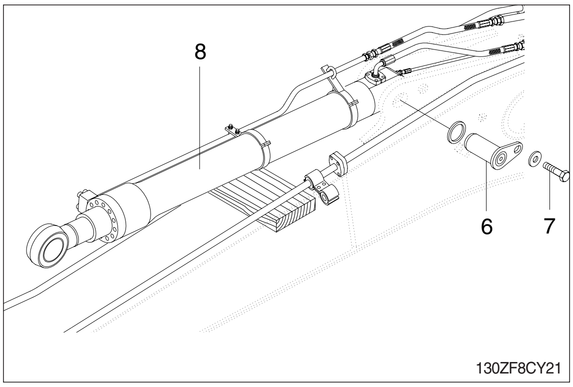


130ZF8CY20

⑥ Sling arm cylinder assembly (8) and remove bolt (7) then pull out pin (6).

⑦ Remove arm cylinder assembly (8).

· Weight : 118 ㎏ (260 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

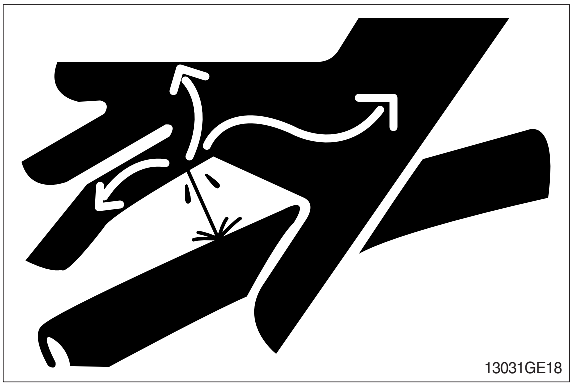
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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


13031GE18

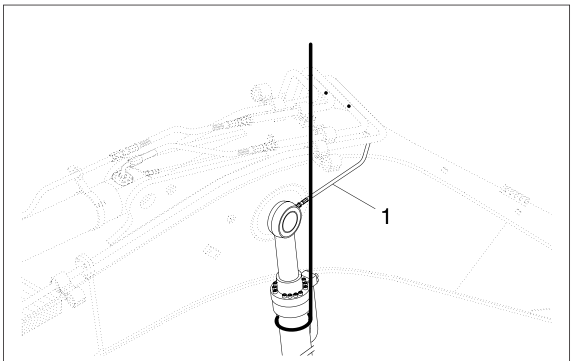
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Disconnect greasing hoses (1).

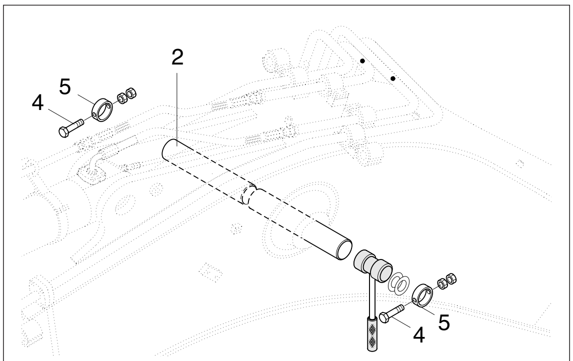
② Sling boom cylinder assembly.



130ZF8CY22

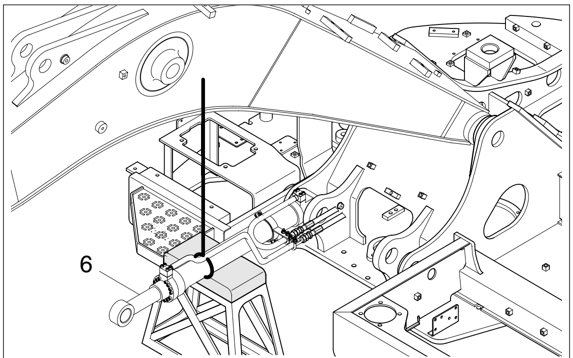
③ Remove bolt (4), stopper (5) and pull out pin (2).

※ Tie the rod with wire to prevent it from coming out.



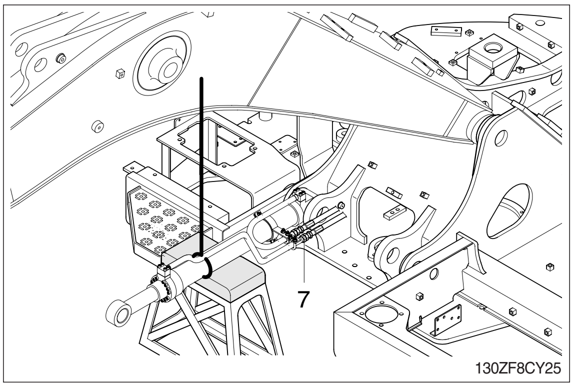
130ZF8CY23

④ Lower the boom cylinder assembly (6) on a stand.



130ZF8CY24

⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.

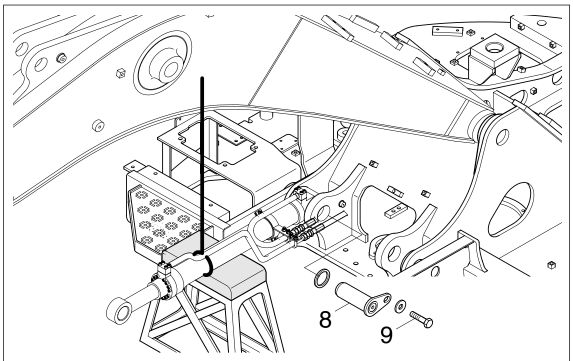


130ZF8CY25

⑥ Remove bolt (9) and pull out pin (8).

⑦ Remove boom cylinder assembly (6).

· Weight : 96 ㎏ (212 ℔)



130ZF8CY26

(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.**

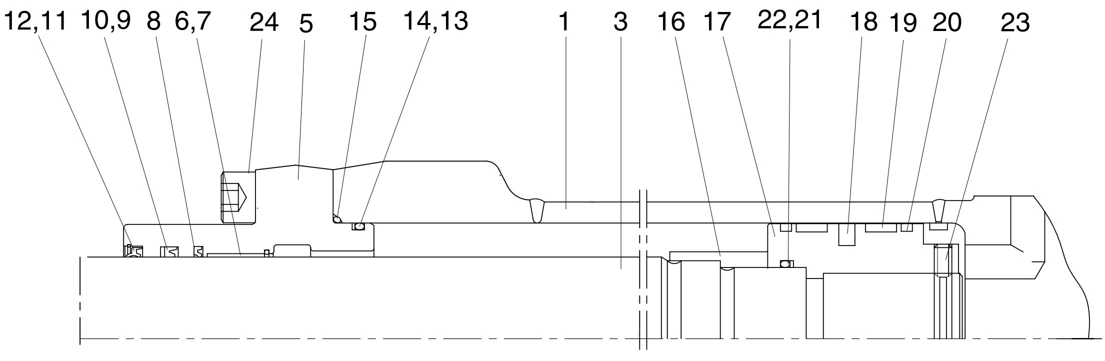
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

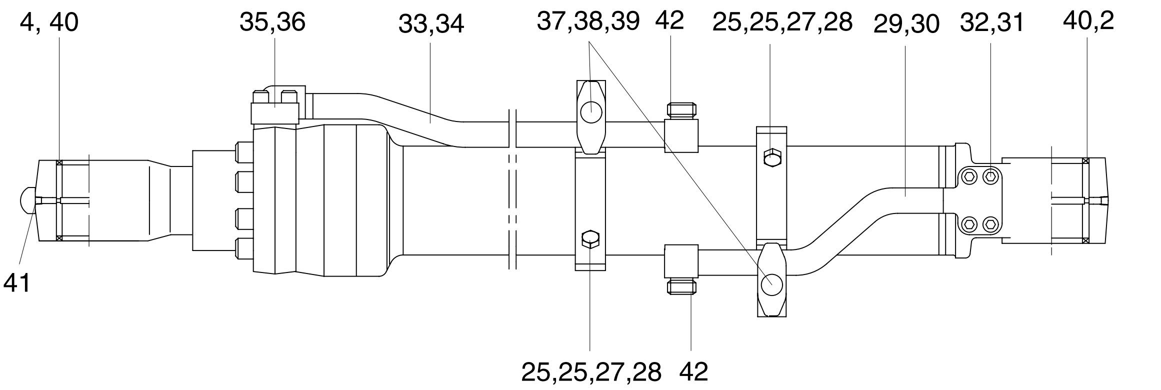
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder

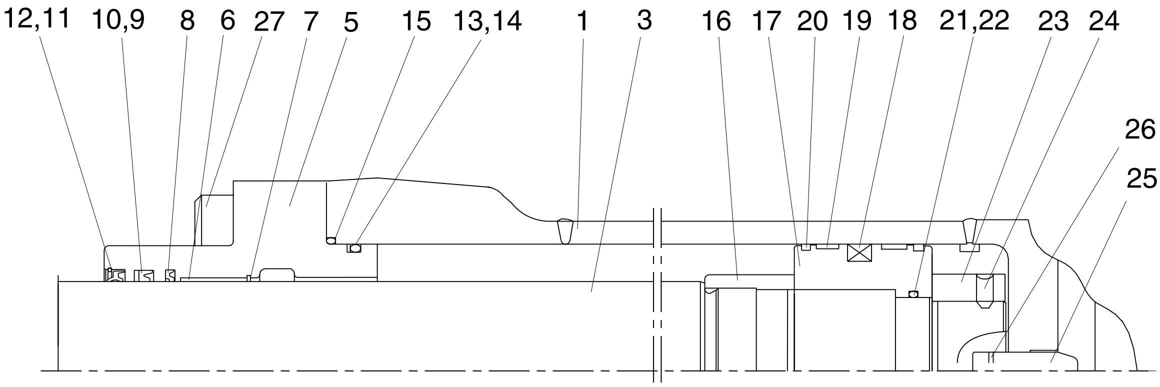


Internal detail

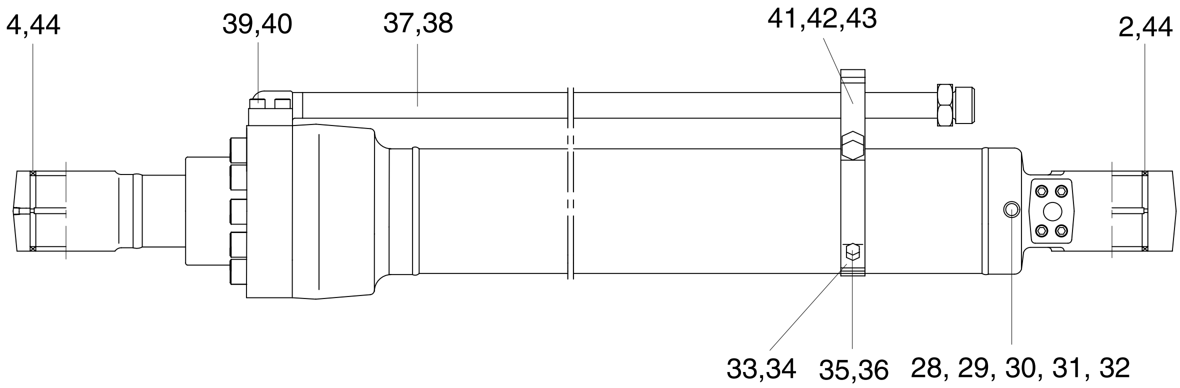


1	Tube assembly	15	O-ring	29	O-ring
2	Pin bushing	16	Cushion ring	30	Pipe assembly
3	Rod assembly	17	Piston	31	Spring washer
4	Pin bushing	18	Piston seal	32	Hexagon socket bolt
5	Rod cover	19	Wear ring	33	O-ring
6	Rod bushing	20	Dust ring	34	Pipe assembly
7	Retaining ring	21	O-ring	35	Spring washer
8	Buffer seal	22	Back up ring	36	Hexagon socket bolt
9	U-packing	23	Set screw	37	Clamp
10	Back up ring	24	Hexagon socket bolt	38	Spring washer
11	Dust wiper	25	Pipe band assembly	39	Hexagon bolt
12	Retaining ring	26	Pipe band	40	Pin wiper
13	O-ring	27	Spring washer	41	Grease nipple
14	Back up ring	28	Hexagon bolt	42	O-ring

(2) Arm cylinder



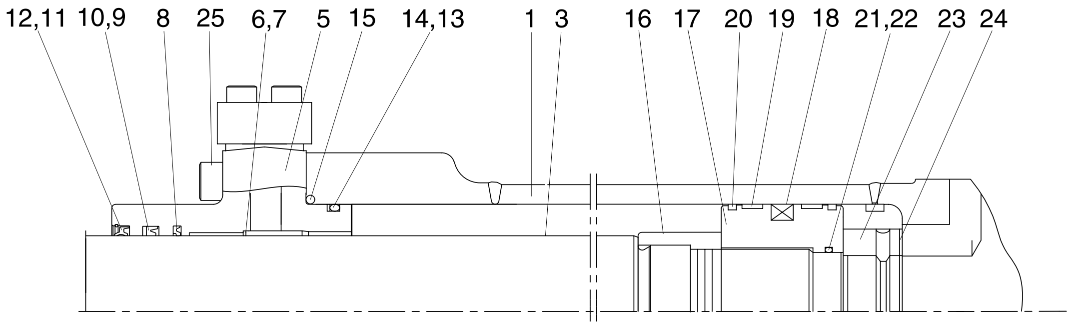
Internal detail



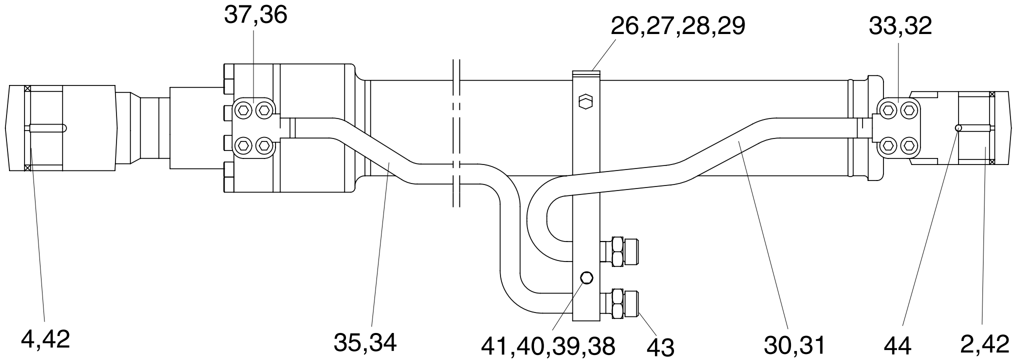
130ZF8CY02

1	Tube assembly	16	Cushion ring	31	O-ring
2	Pin bushing	17	Piston	32	Plug
3	Rod assembly	18	Piston seal	33	Pipe band assembly
4	Pin bushing	19	Wear ring	34	Pipe band
5	Rod cover	20	Dust ring	35	Spring washer
6	Rod bushing	21	O-ring	36	Hexagon bolt
7	Retaining ring	22	Back up ring	37	Pipe assembly
8	Buffer seal	23	Piston nut	38	O-ring
9	U-packing	24	Set screw	39	Spring washer
10	Back up ring	25	Cushion plunger	40	Hexagon socket bolt
11	Dust wiper	26	Stop ring	41	Clamp
12	Retaining ring	27	Hexagon socket bolt	42	Spring washer
13	O-ring	28	Check	43	Hexagon bolt
14	Back up ring	29	Spring	44	Pin wiper
15	O-ring	30	Bracket	45	O-ring

(3) Boom cylinder



Internal detail

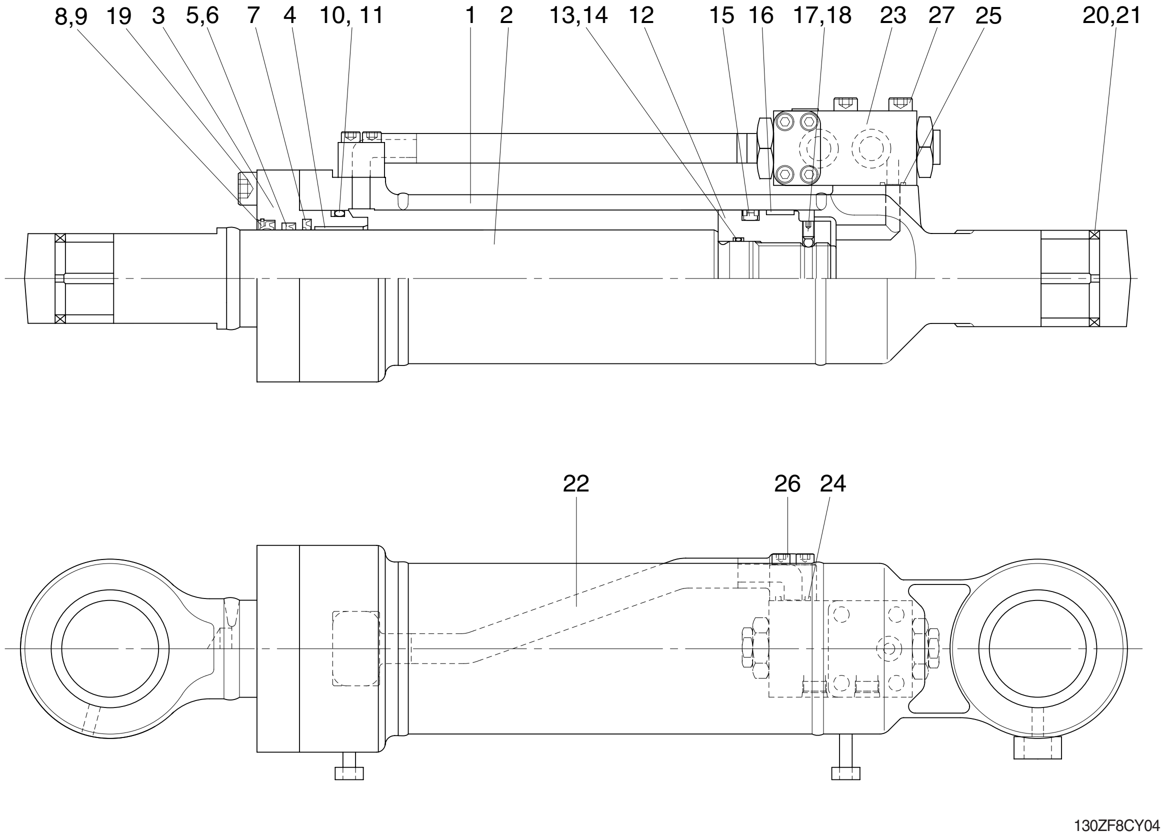


130ZF8CY03

1	Tube assembly	16	Cushion ring	31	O-ring
2	Pin bushing	17	Piston	32	Spring washer
3	Rod assembly	18	Piston seal	33	Hexagon socket bolt
4	Pin bushing	19	Wear ring	34	Pipe assembly
5	Rod cover	20	Dust ring	35	O-ring
6	Rod bushing	21	O-ring	36	Spring washer
7	Retaining ring	22	Back up ring	37	Hexagon socket bolt
8	Buffer seal	23	Piston nut	38	Hexagon nut
9	U-packing	24	Set screw	39	Clamp
10	Back up ring	25	Hexagon socket bolt	40	Spring washer
11	Dust wiper	26	Pipe band assembly	41	Hexagon bolt
12	Retaining ring	27	Pipe band	42	Pin wiper
13	O-ring	28	Spring washer	43	O-ring
14	Back up ring	29	Hexagon bolt	44	Hex plug
15	O-ring	30	Pipe assembly		

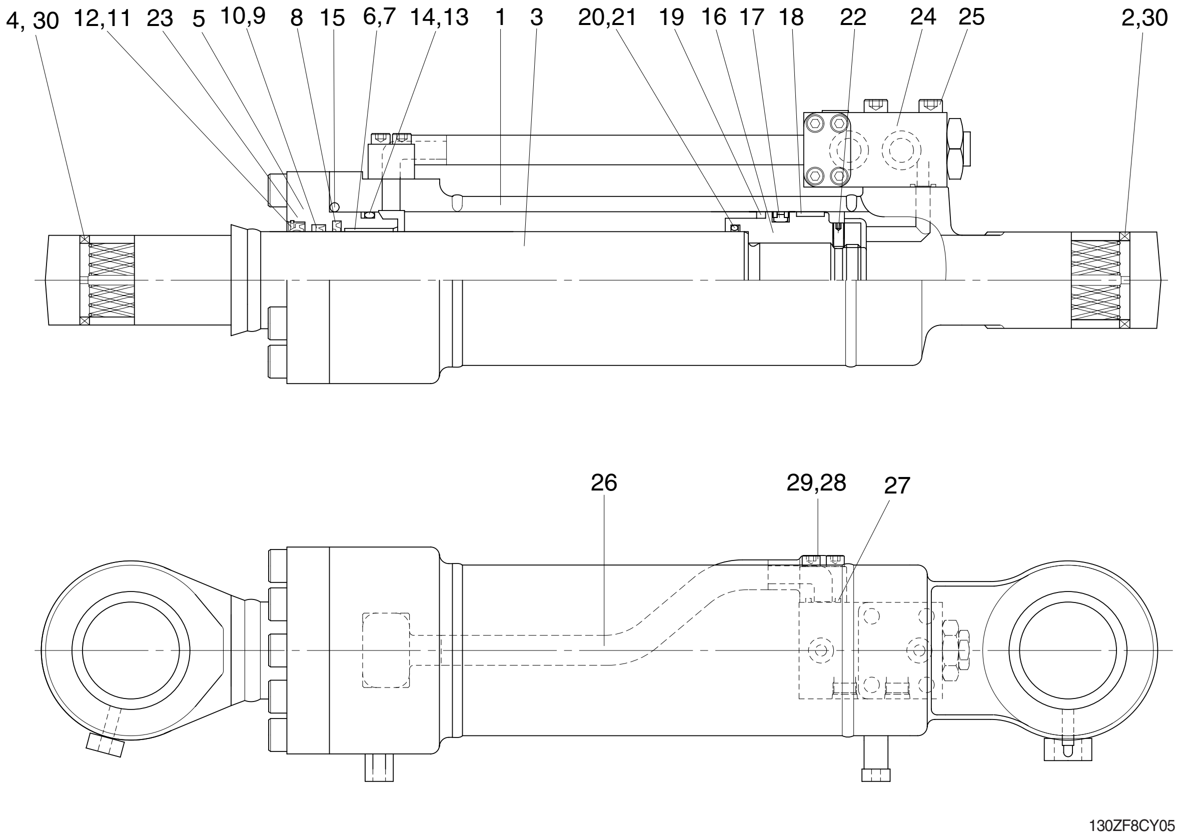
(4) Dozer cylinder

① Type 1



1	Tube assembly	10	O-ring	19	Hexagon socket head bolt
2	Rod assembly	11	Back up ring	20	Pin bushing
3	Gland	12	Piston	21	Dust seal
4	Dry bearing	13	O-ring	22	Pipe assembly
5	Rod seal	14	Back up ring	23	Double pilot check valve
6	Back up ring	15	Piston seal	24	O-ring
7	Buffer ring	16	Wear ring	25	O-ring
8	Dust wiper	17	Steel ball	26	Hexagon socket head bolt
9	Retaining ring	18	Set screw	27	Hexagon socket head bolt

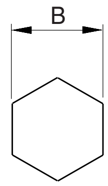
② Type 2



1	Tube assembly	12	Retaining ring	23	Hexagon socket bolt
2	Pin bushing	13	O-ring	24	Check valve
3	Rod assembly	14	Back up ring	25	Hexagon socket bolt
4	Pin bushing	15	O-ring	26	Pipe assembly
5	Rod cover	16	Piston	27	O-ring
6	Rod bushing	17	Piston seal	28	Spring washer
7	Retaining ring	18	Wear ring	29	Hexagon socket bolt
8	Buffer seal	19	Dust ring	30	Pin wiper
9	U-packing	20	O-ring	31	Grease nipple
10	Back up ring	21	Back up ring		
11	Dust wiper	22	Set screw		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	4	
	6	
	8	
	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	M14	17.9±1.8	129±13.0
	Boom cylinder		25	M14	19±1.0	137±7.2
	Arm cylinder		27	M14	19±1.0	137±7.2
	Dozer cylinder	Type 1	19	M16	23±2.0	166±14.5
		Type 2	23	M14	23.5±0.5	170±3.6
Pipe mounting socket head bolt	Bucket cylinder		25	M10	6.5±0.7	47.0±5.1
	Boom cylinder		33, 37	M8	3.25±0.25	23.5±1.8
	Arm cylinder		40	M10	5.75±0.25	41.6±1.8
	Dozer cylinder	Type 1	26	M8	2.7±0.3	19.5±2.2
			27	M10	5.4±0.5	39.1±3.6
		Type 2	25	M10	5.75±0.25	41.6±1.8
			29	M8	3.25±0.25	23.5±1.8
Piston nut	Boom cylinder		23	M48	130±13	940±94
	Arm cylinder		23	M55	130±13	940±94
Piston	Bucket cylinder		14	M50	125±12.5	904±90.4
	Boom cylinder		17	M60	75±7.5	542±54.2
	Arm cylinder		17	M65	75±7.5	542±54.2
	Dozer cylinder Rear	Type 1	12	-	150±15	1085±108
		Type 2	16	M58	130±13	940±94
Set screw	Bucket cylinder		21	M8	2±0.2	14.5±1.4
	Boom cylinder		24	M8	1.5	10.8
	Arm cylinder		24	M8	1.5	10.8
	Dozer cylinder	Type 1	18	M8	2.7±0.3	19.5±2.2
		Type 2	22	M8	1.5	10.8

3) DISASSEMBLY

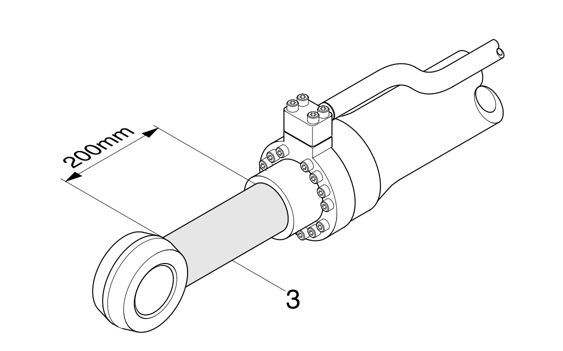
(1) Remove cylinder head and piston rod

※ Procedures are based on the boom cylinder.

① Hold the clevis section of the tube in a vise.

※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

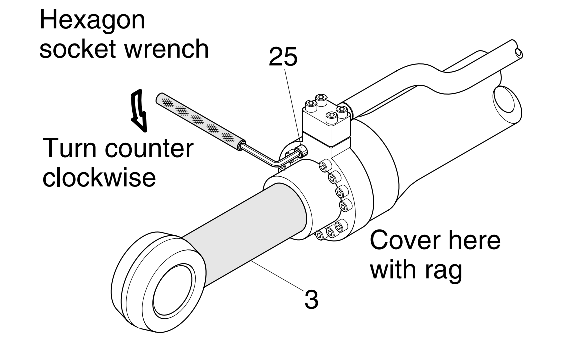
② Pull out rod assembly (3) about 200 mm (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



125LCR8DA30

③ Loosen and remove socket bolts (25) of the gland in sequence.

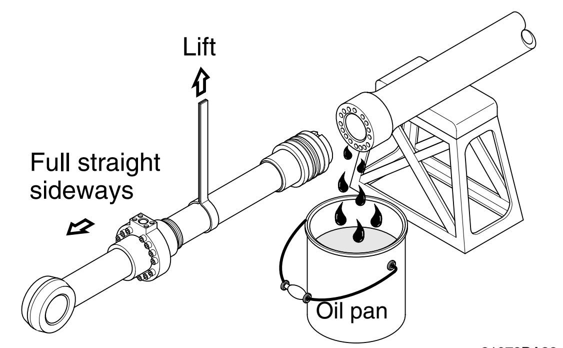
※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



125LCR8DA31

④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (3) with a crane or some means and draw it out. However, when rod assembly (3) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.

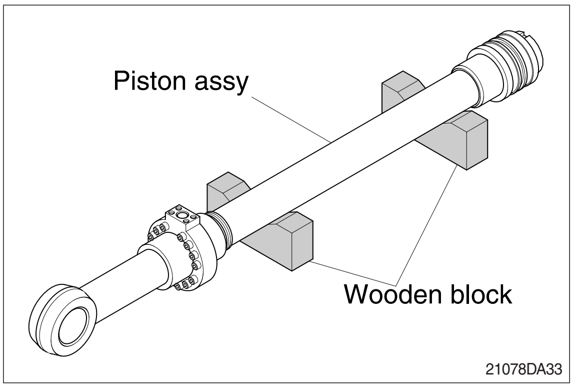


21078DA32

Note that the plated surface of rod assembly (1) 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.

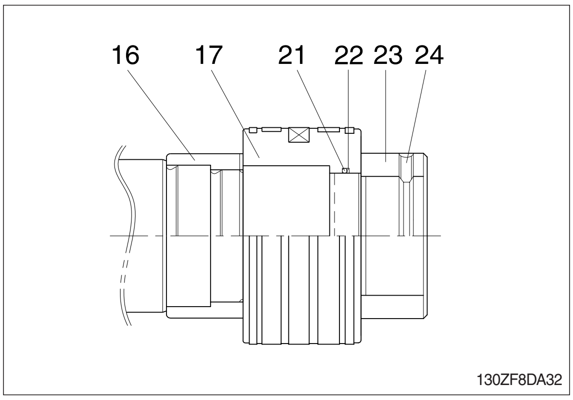


(2) Remove piston and cylinder head

① Remove set screw (24) and lock nut (23).

※ Since set screw (24) and piston nut (23) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock set screw (24) and piston nut (23).

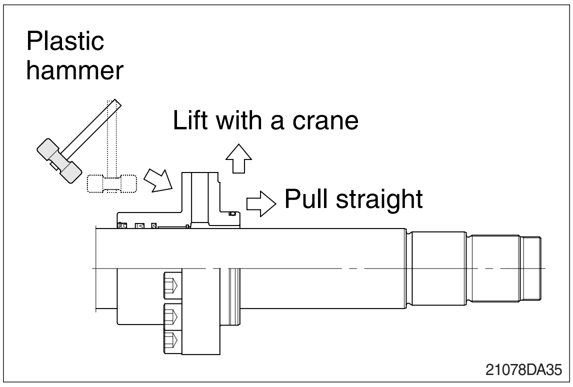
② Remove piston assembly (17), back up ring (22), and O-ring (21).



③ Remove the cylinder head assembly from rod assembly (3).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.
Exercise care so as not to damage the lip of pin bushing (4) and packing (8,9,10,11,12) by the threads of rod assembly (3).

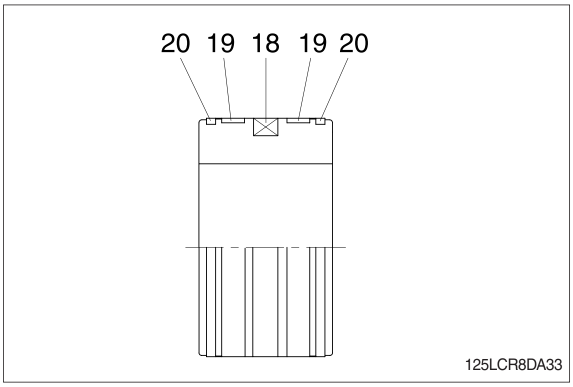


(3) Disassemble the piston assembly

① Remove wear ring (19).

② Remove dust ring (20) and piston seal (18).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

① Remove back up ring (14) and O-ring (13) and O-ring (15).

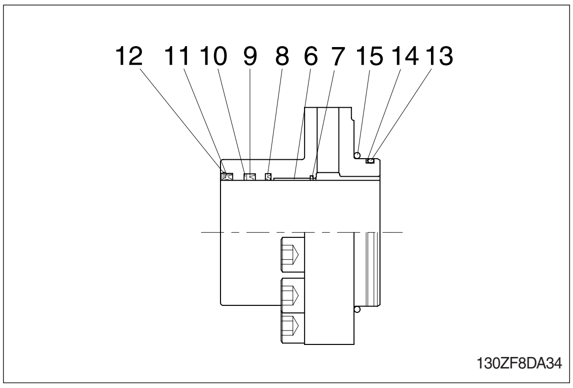
② Remove snap ring (12), dust wiper (11).

③ Remove back up ring (10), U-packing (9) and buffer seal (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

※ Do not remove bushing (6).

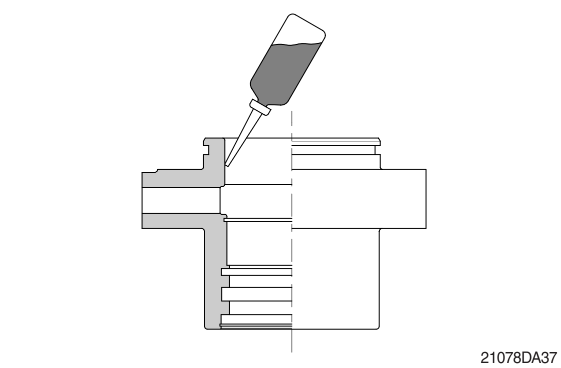


3) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

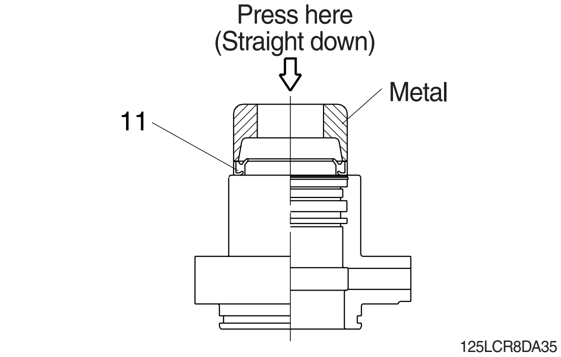
① Coat the inner face of rod cover (5) with hydraulic oil.



21078DA37

② Coat dust wiper (11) with grease and fit dust wiper (11) 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 (12) to the stop face.

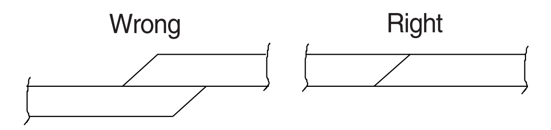


125LCR8DA35

④ Fit back up ring (10), U-packing (9) and buffer seal (8) to corresponding grooves, in that order.

※ Coat each packing with hydraulic oil before fitting it.

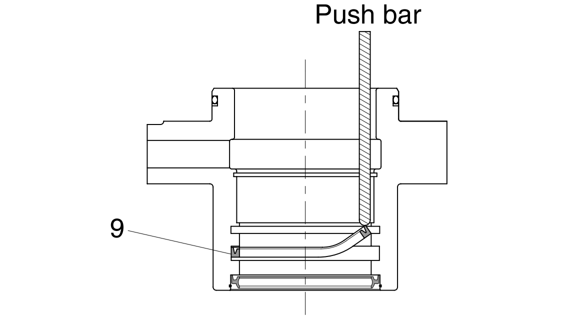
※ Insert the backup ring until one side of it is inserted into groove.



8-157(3)

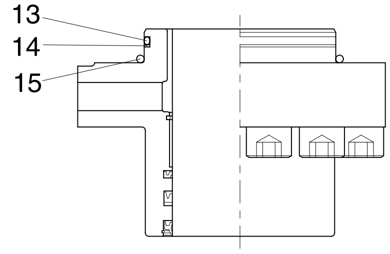
※ U-packing (9) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting U-packing (9) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



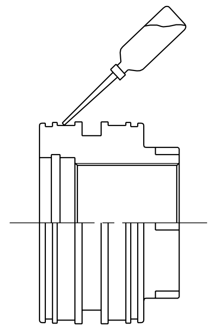
125LCR8DA36

⑤ Fit back up ring (14) to rod cover (5).
※ Put the backup ring in the warm water of 30~50˚C.
⑥ Fit O-ring (13) and O-ring (15) to rod cover (5).



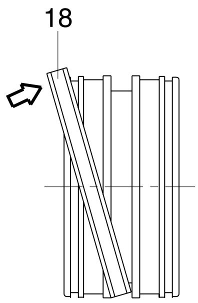
130ZF8DA37

(2) Assemble piston assembly
※ Check for scratches or rough surfaces. If found smooth with an oil stone.
① Coat the outer face of piston (17) with hydraulic oil.



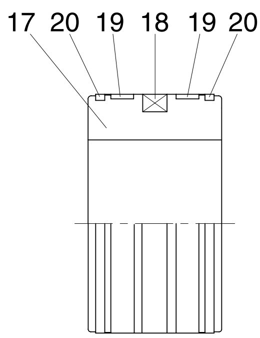
8-158(2)

② Fit piston seal (18) to piston.
※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.
※ After assembling the piston seal, press its outer diameter to fit in.



125LCR8DA38

③ Fit wear ring (19) and dust ring (20) to piston (17).



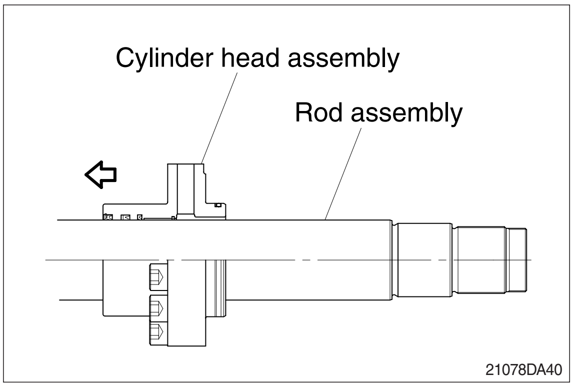
125LCR8DA39

(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

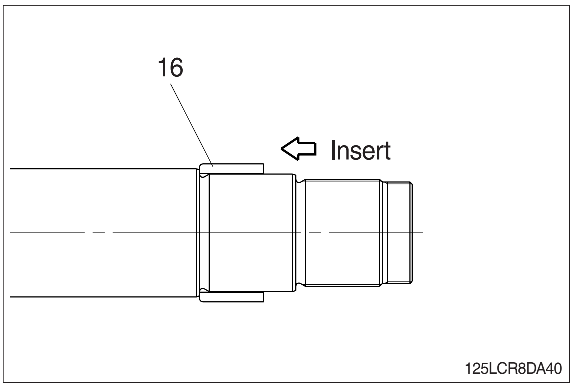
② Apply hydraulic oil to the outer surface of rod assembly (3), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (16) to rod assembly.

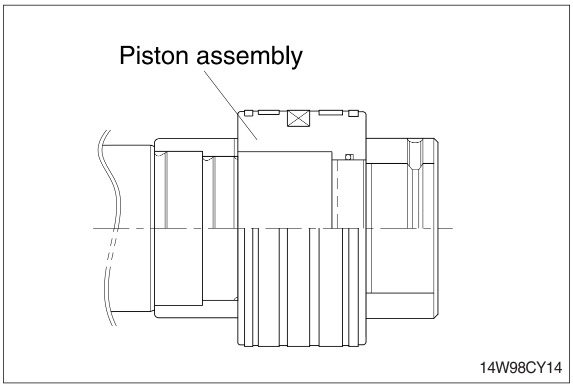
※ Note that cushion ring (16) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque :

Item		kgf · m	lbf · ft
14	Bucket	125±12.5	904±90.4
17	Boom	75±7.5	542±54.2
	Arm	75±7.5	542±54.2

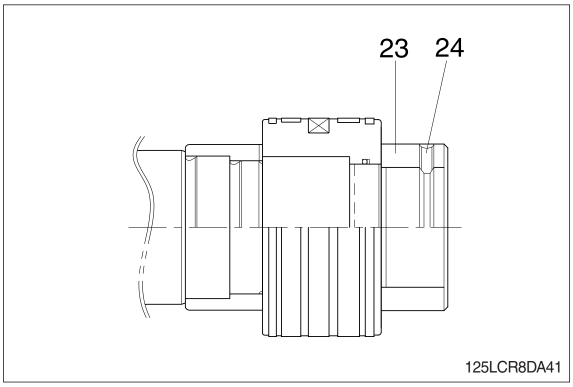


⑥ Boom and arm cylinder

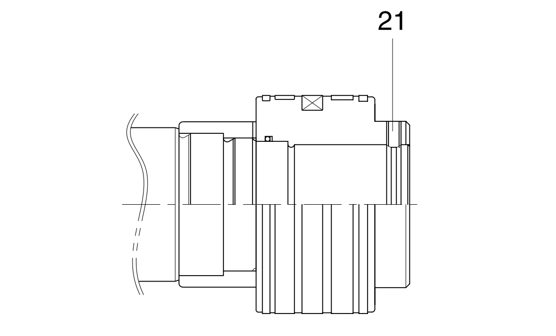
Fit piston nut (23) and tighten the set screw (24).

· Tightening torque

Item		kgf · m	lbf · ft
23	Boom	130±13	940±94
	Arm		
24		1.5	10.8



⑦ Bucket cylinder
Tighten the set screw (21).
· Tightening torque
1.5 kgf·m (10.8 lbf·ft)



130ZF8DA45

(3) Overall assemble

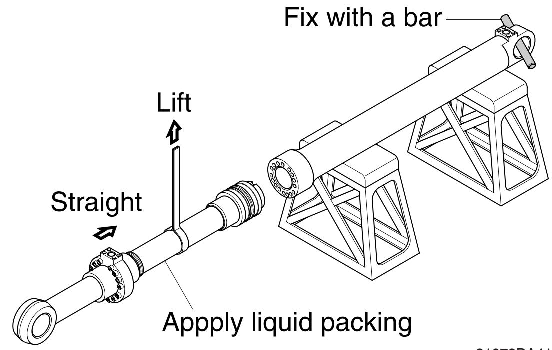
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

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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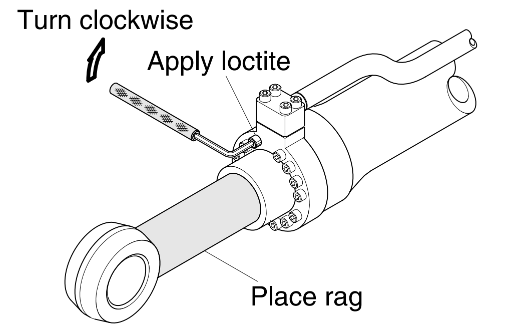


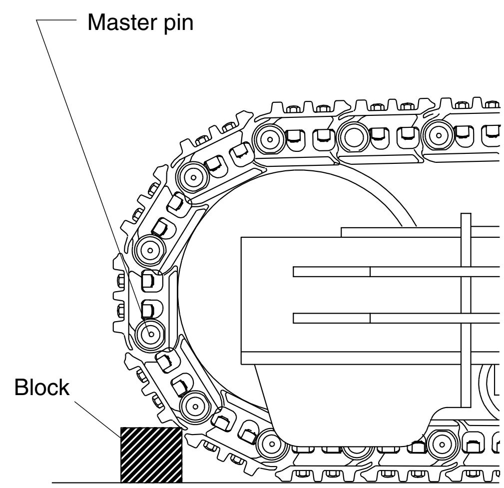
21078DA42

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.



130ZF8UC01

(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.

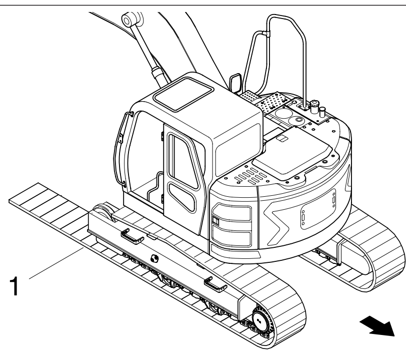
※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the 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.

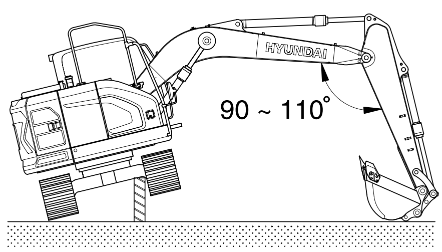


130ZF8UC04

2) INSTALL

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

※ Adjust the tension of the track link.

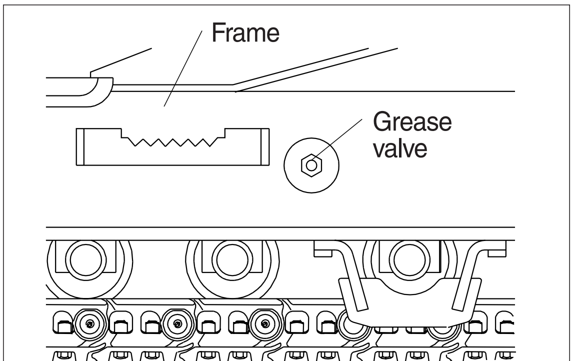


130ZF8UC05

2. CARRIER ROLLER

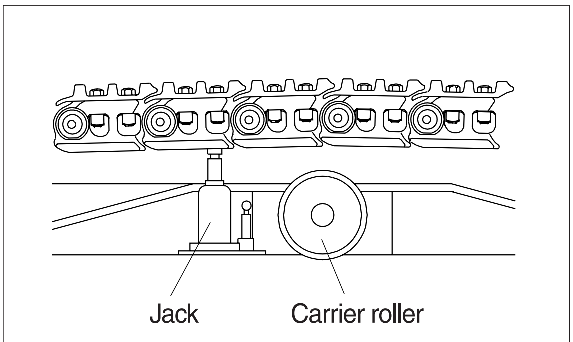
1) REMOVAL

(1) Loosen tension of the track link.



8-162(1)

(2) Jack up the track link height enough to permit carrier roller removal.

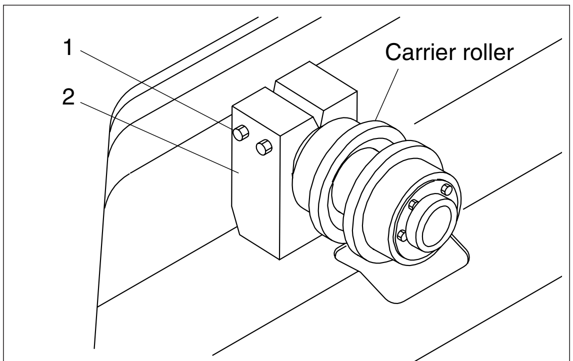


8-162(2)

(3) Loosen the lock nut (1).

(4) Open bracket(2) with a screwdriver, push out from inside, and remove carrier roller assembly.

· Weight : 12 kg (26 lb)



130ZF8UC07

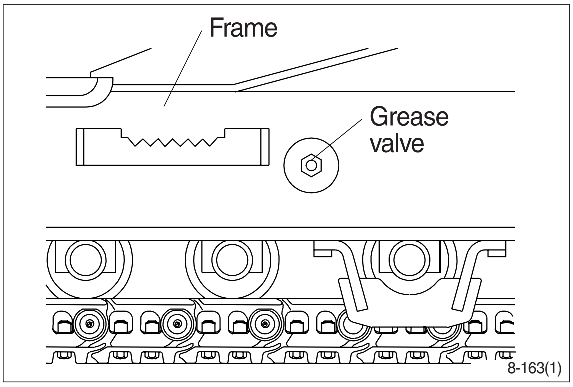
2) INSTALL

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

3. TRACK ROLLER

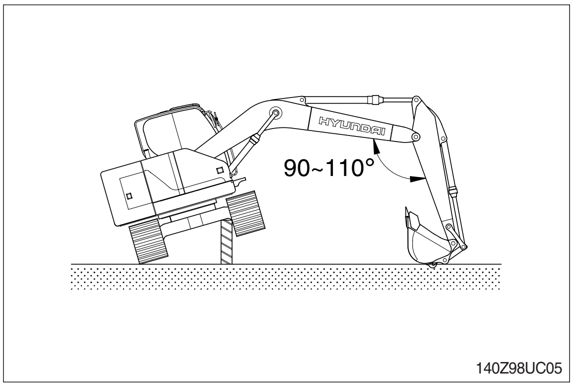
1) REMOVAL

(1) Loosen tension of the track link.



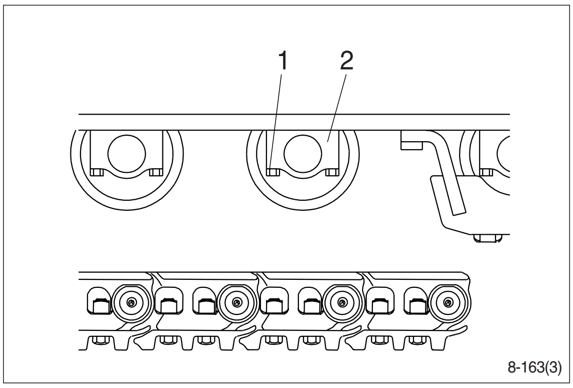
(2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the track roller (2).

· Weight : 24 ㎏ (53 ℔)



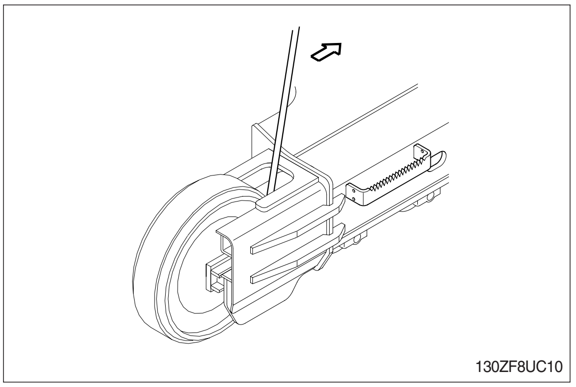
2) INSTALL

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

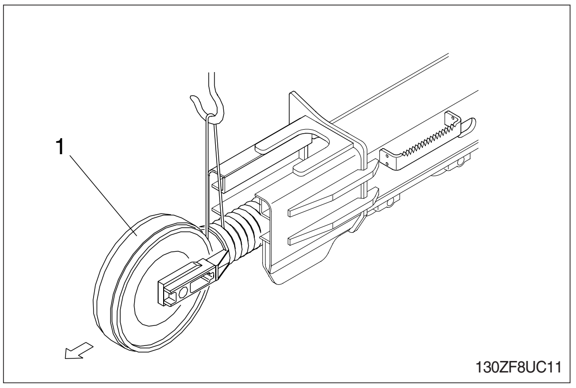
4. IDLER AND RECOIL SPRING

1) REMOVAL

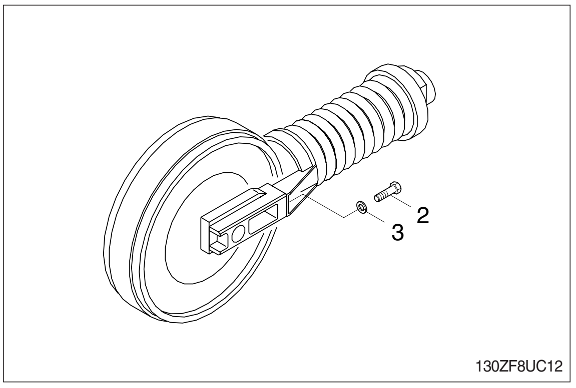
(1) Remove the track link.
For detail, see removal of track link.



(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 215 kg (474 lb)

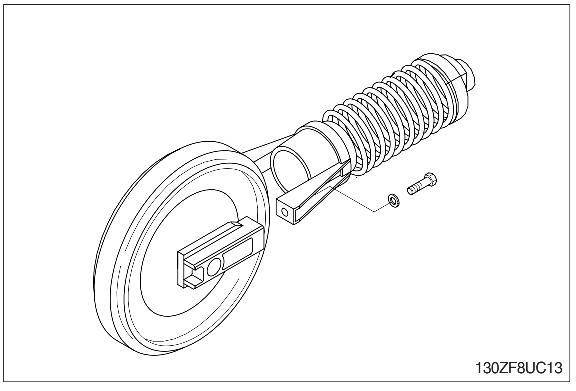


(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.
· Tightening torque : 29.7±3.0 kgf · m
(215±21.7 lbf · ft)



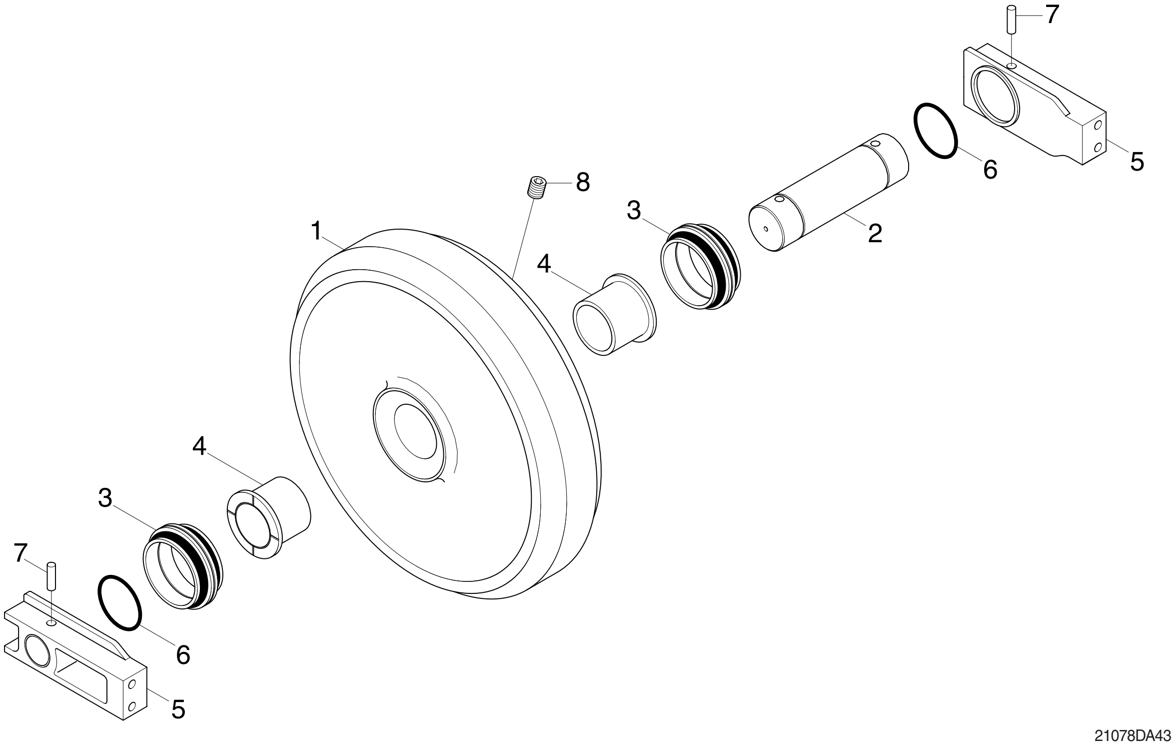
2) INSTALL

(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

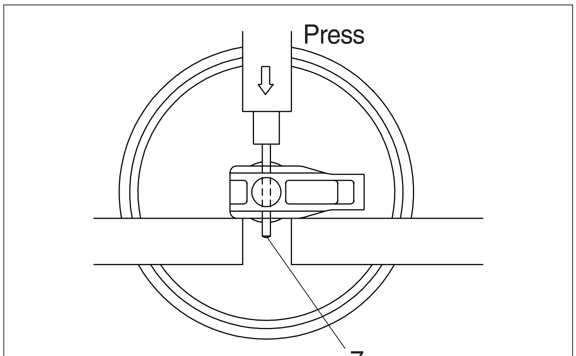


1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Bracket	8	Plug
3	Seal assembly	6	O-ring		

(2) Disassembly

① Remove plug and drain oil.

② Draw out the spring pin (7), using a press.

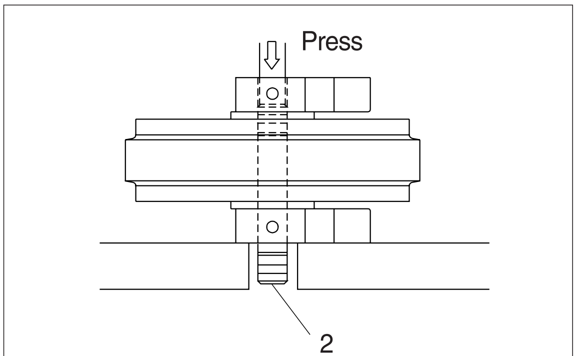


8-166(1)

③ Pull out the shaft (2) with a press.

④ Remove seal (3) from idler (1) and bracket (5).

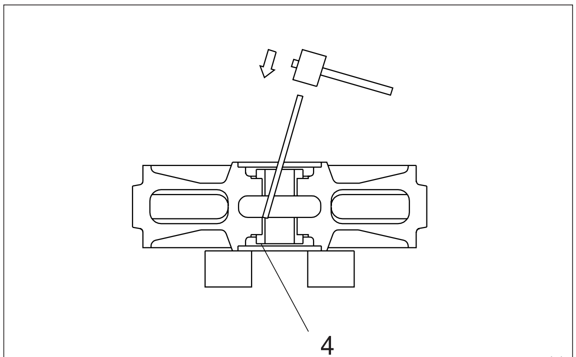
⑤ Remove O-ring (6) from shaft.



8-166(2)

⑥ Remove the bushing (4) from idler, using a special tool.

Only remove bushing if replacement is necessity.



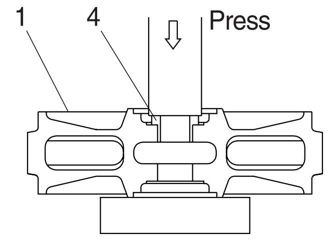
8-166(3)

(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

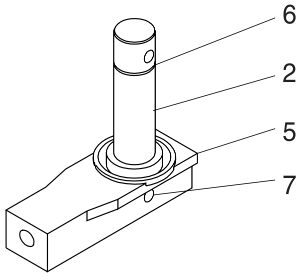
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1)

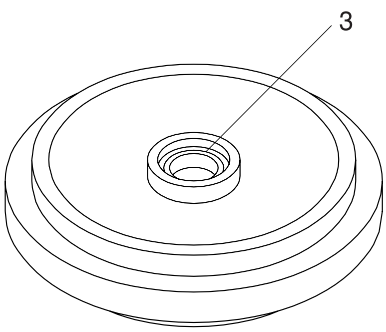
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



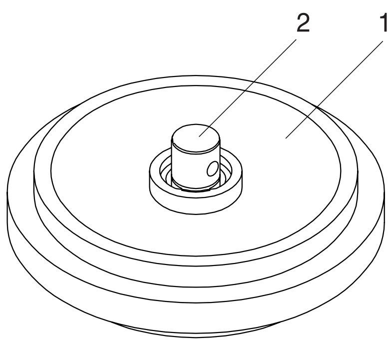
8-167(2)

④ Install seal (3) to shell (1) and bracket (5).



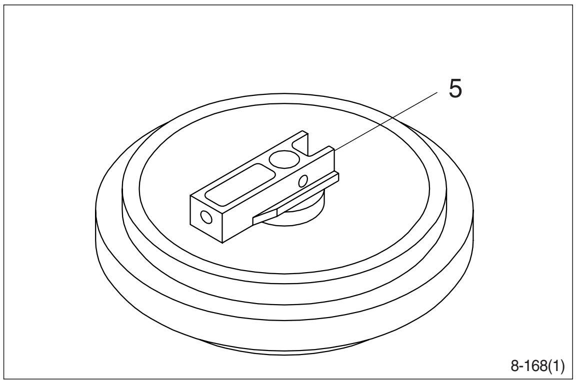
8-167(3)

⑤ Install shaft (2) to shell (1).



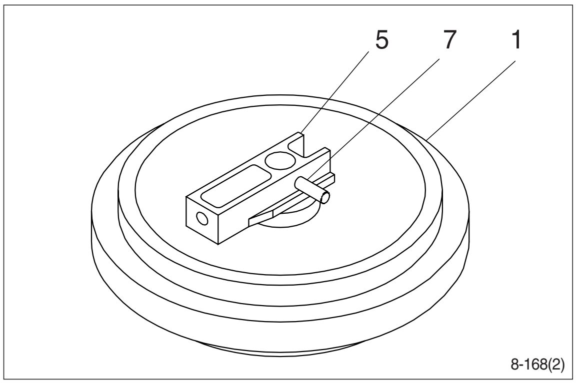
8-167(4)

⑥ Install bracket (5) attached with seal (3).



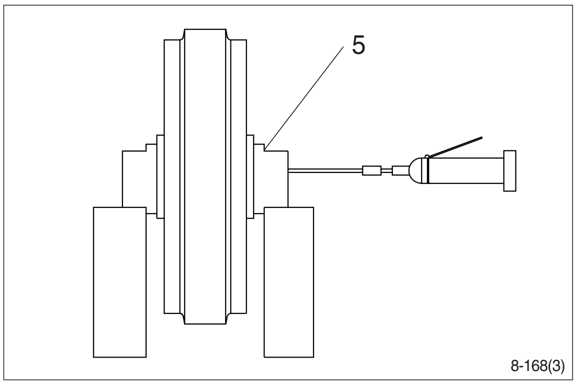
8-168(1)

⑦ Knock in the spring pin (7) with a hammer.



8-168(2)

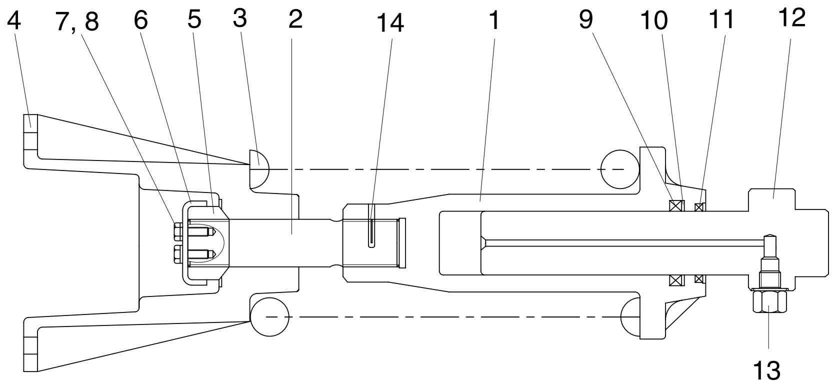
⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



8-168(3)

4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



130ZF8UC30

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 packing	14	Spring pin
5	Lock nut	10	Back up ring		

(2) Disassembly

① Apply pressure on spring (3) with a press.

※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

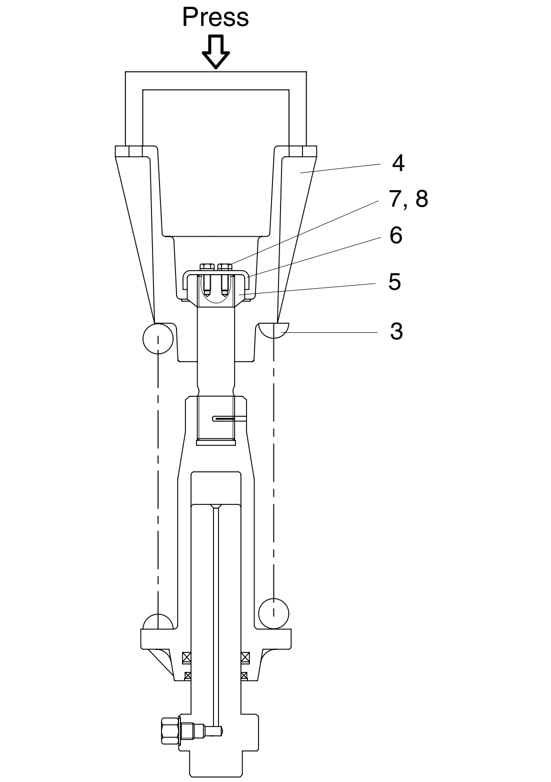
· Spring set load : 8497 ㎏ (18733 ℔)

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.

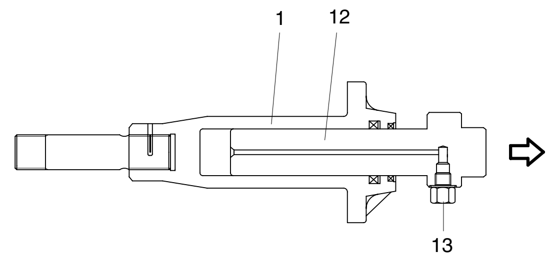
④ Lighten the press load slowly and remove bracket (4) and spring (3).



130ZF8UC31

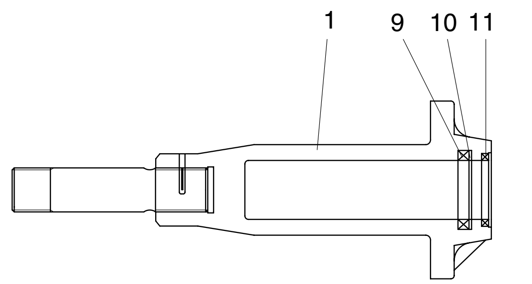
⑤ Remove rod (12) from body (1).

⑥ Remove grease valve (13) from rod (12).



130ZF8UC32

⑦ Remove rod seal (9), back up ring (10) and dust seal (11).

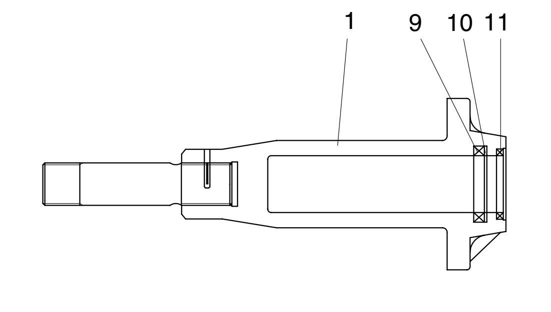


130ZF8UC33

(3) Assembly

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.

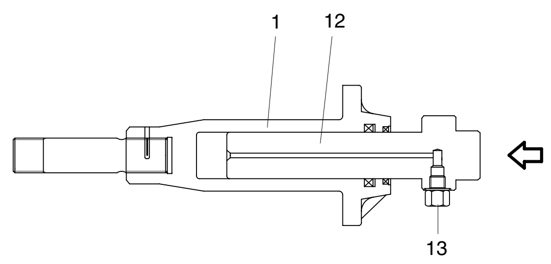


130ZF8UC33

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)



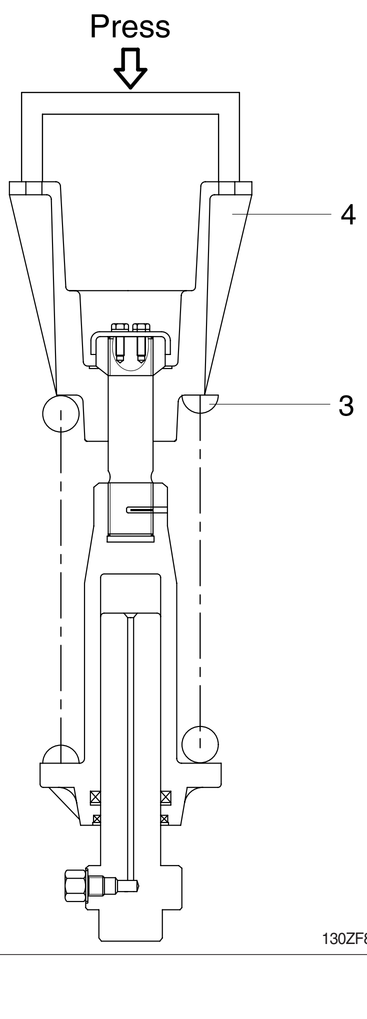
130ZF8UC34

④ Install spring (3) and bracket (4) to body (1).

⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).

※ Apply sealant before assembling.

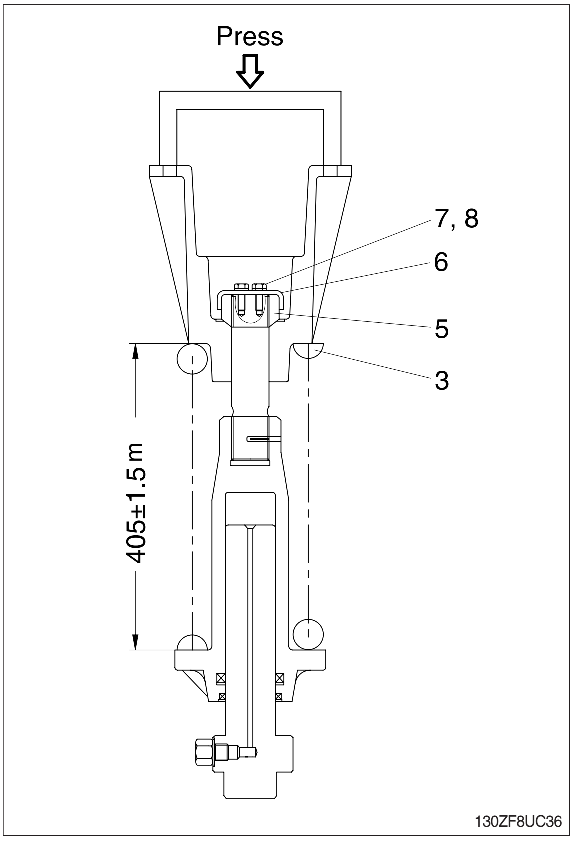
※ During the operation, pay attention specially to prevent the press from slipping out.



130ZF8UC35

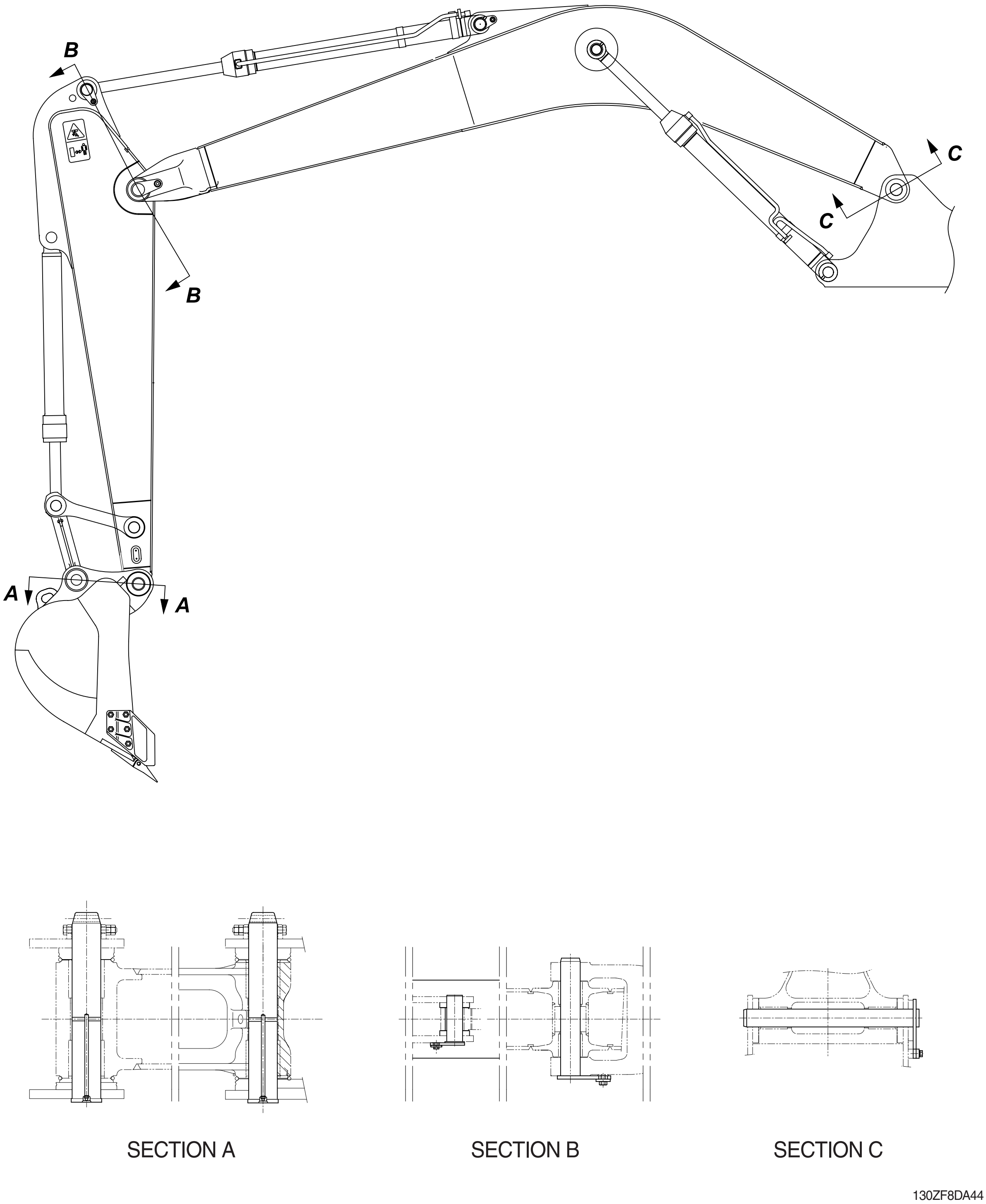
⑥ Lighten the press load and confirm the set length of spring (3).

⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).



GROUP 11 WORK EQUIPMENT

1. STRUCTURE

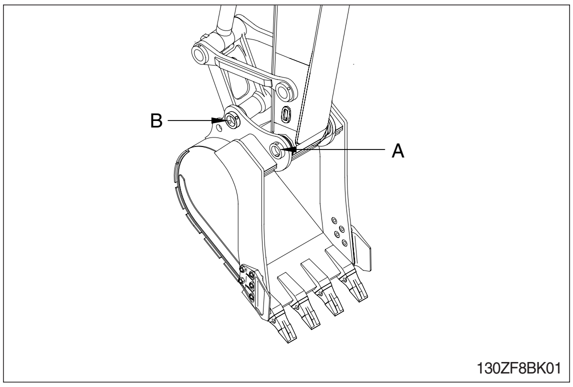


2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

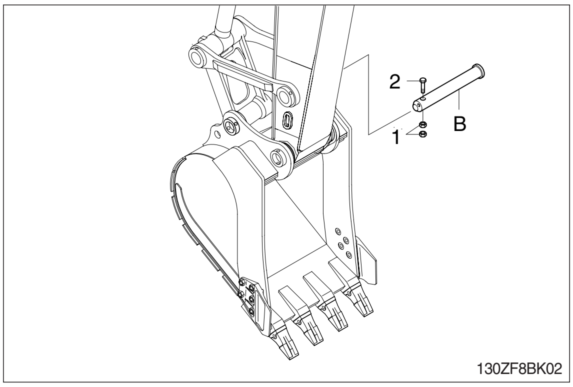
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



130ZF8BK01

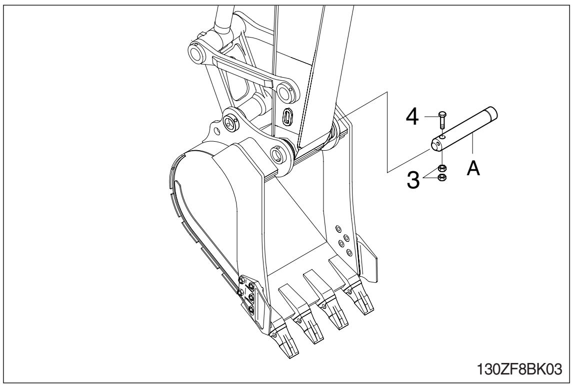
② Remove nut (1), bolt (2) and draw out the pin (B).



130ZF8BK02

③ Remove nut (3), bolt (4) and draw out the pin (A) then remove the bucket assembly.

· Weight (0.45 m^3) : 430 kg (948 lb)



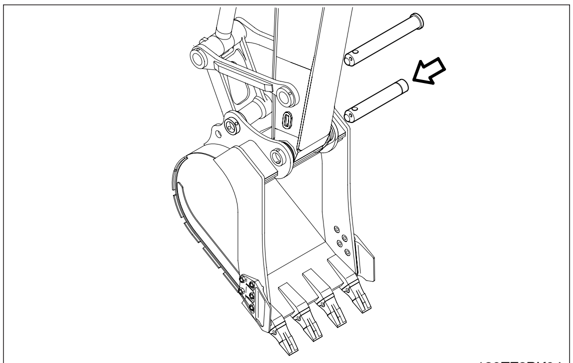
130ZF8BK03

(2) Install

① Carry out installation in the reverse order to removal.

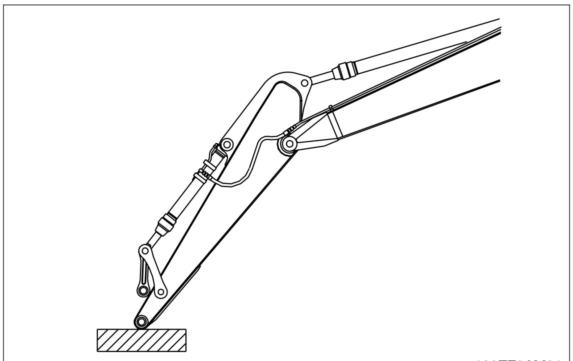
⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Adjust the bucket clearance.
For detail, see operation manual.


130ZF8BK04

2) ARM ASSEMBLY

(1) Removal


130ZF8AM01

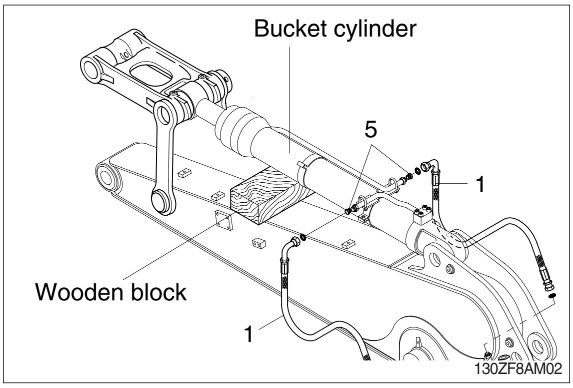
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

① Remove bucket assembly.
For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (1).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**



130ZF8AM02

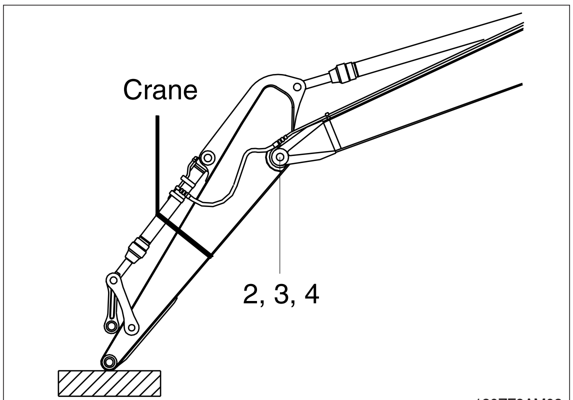
③ Sling bucket cylinder assembly, remove spring, pin stopper and pull out pin.

※ Tie the rod with wire to prevent it from coming out.

④ For details, see removal of bucket 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 : 385 kg (850 lb)
When lifting the arm assembly, always lift the center of gravity.



130ZF8AM03

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

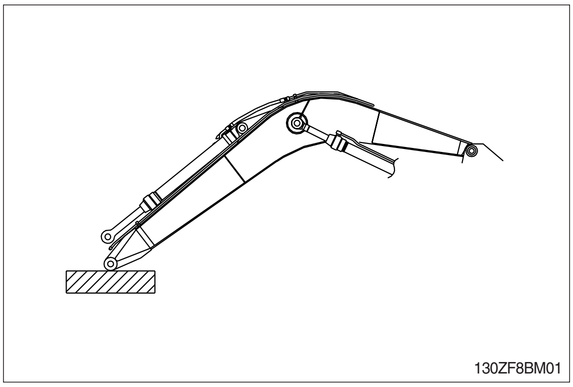
※ Bleed the air from the cylinder.

3) BOOM ASSEMBLY

(1) Removal

① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.

② Remove boom cylinder assembly from boom.
For details, see removal of boom cylinder assembly.

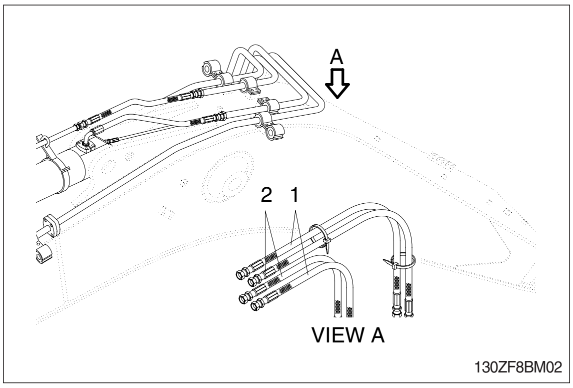


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

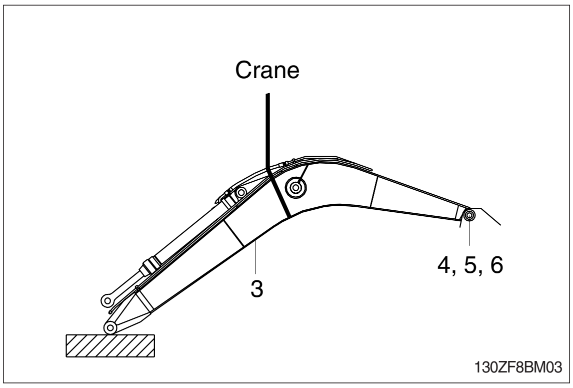
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· Weight (2.26 ㎜) : 345 ㎏ (761 ㏐)

※ When lifting the boom assembly always lift the center of gravity.



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

※ Bleed the air from the cylinder.