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FOREWORD

1. STRUCTURE

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

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

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

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

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

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

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

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

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

SECTION 9 COMPONENT MOUNTING TORQUE
This section shows bolt specifications and standard torque values needed when mounting components to the machine.

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your HYUNDAI distributor for the latest information.

2. HOW TO READ THE SERVICE MANUAL

Distribution and updating

Any additions, amendments or other changes will be sent to HYUNDAI distributors.
Get the most up-to-date information before you start any work.

Filing method

1. See the page number on the bottom of the page.
   File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1
   2 - 3
   - Item number(2. Structure and Function)
   - Consecutive page number for each item.
3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.

   10 - 4
   10 - 4 - 1 ⎤ Added pages
   10 - 4 - 2 ⎦
   10 - 5

Revised edition mark(①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

1. Method of using the Conversion Table to convert from millimeters to inches
   Convert 55mm into inches.
   (1) Locate the number 50in the vertical column at the left side, take this as ⓐ, then draw a horizontal line from ⓐ.
   (2) Locate the number 5in the row across the top, take this as ⓑ, then draw a perpendicular line down from ⓑ.
   (3) Take the point where the two lines cross as ⓒ. This point ⓒ gives the value when converting from millimeters to inches. Therefore, 55mm = 2.165 inches.

2. Convert 550mm into inches.
   (1) The number 550 does not appear in the table, so divide by 10(Move the decimal point one place to the left) to convert it to 55mm.
   (2) Carry out the same procedure as above to convert 55mm to 2.165 inches.
   (3) The original value(550mm) was divided by 10, so multiply 2.165 inches by 10(Move the decimal point one place to the right) to return to the original value.
   This gives 550mm = 21.65 inches.

Millimeters to inches ⓑ 1mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

Kilogram to Pound

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 l = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 l = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

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

kgf/cm² to lbf/in²

1kgf / cm² = 14.2233lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.
A simple way to convert a fahrenheit temperature reading into a centigrade temperature reading or vice verse is to enter the accompanying table in the center or boldface column of figures.
These figures refer to the temperature in either Fahrenheit or Centigrade degrees.
If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.
If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

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

SECTION 1 GENERAL

SECTION 1 GENERAL

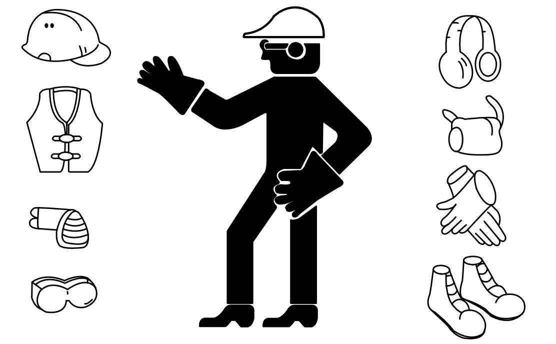
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

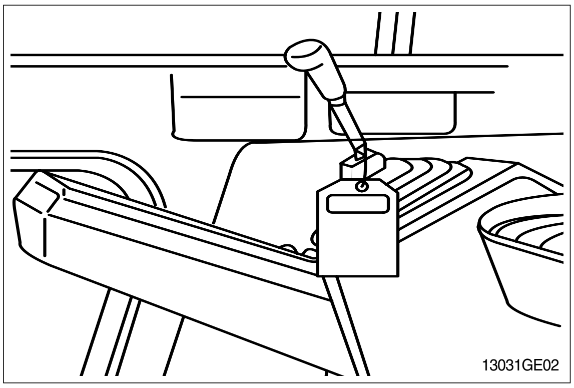
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

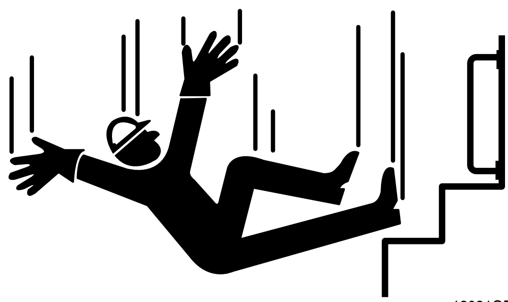
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a「**Do Not Operate**」tag on the right side control lever.



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.



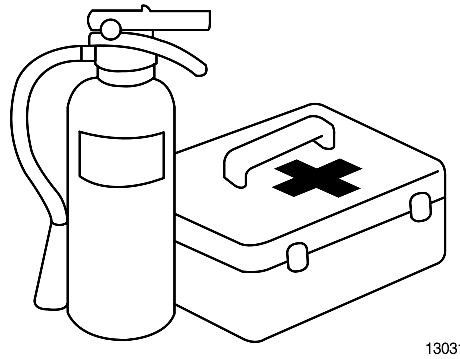
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

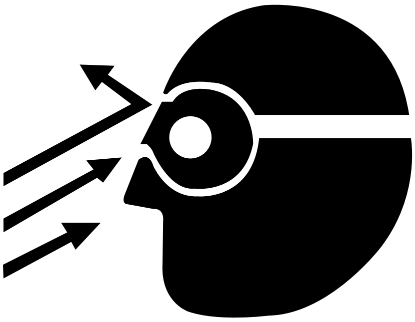
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



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.

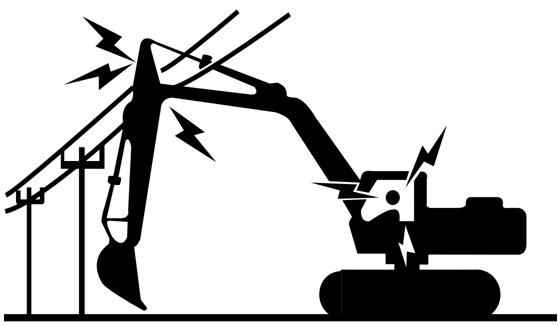
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

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.

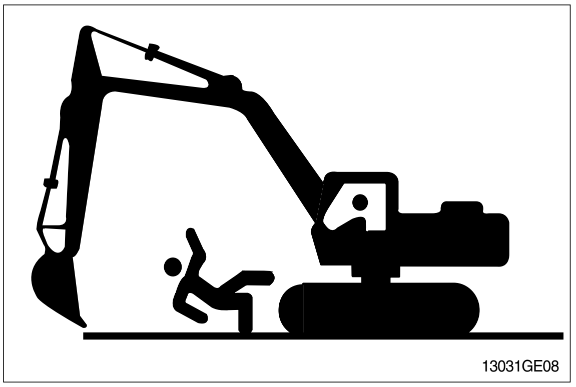


13031GE07

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.



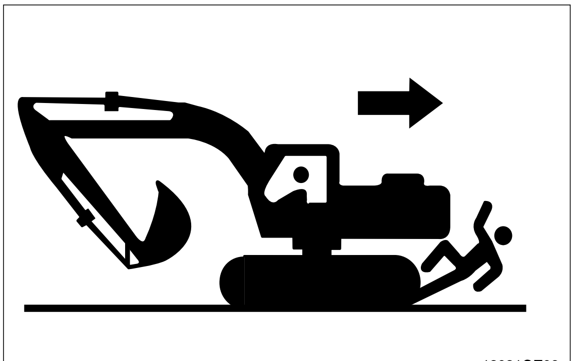
13031GE08

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.

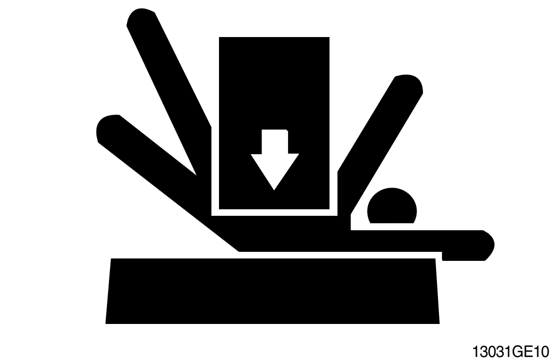
13031GE26

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 1/2 speed without load for 2 minutes.
- Turn key switch to OFF to stop engine. Remove key from switch.
- Move pilot control shutoff lever to locked position.
- Allow engine to cool.

SUPPORT MACHINE PROPERLY

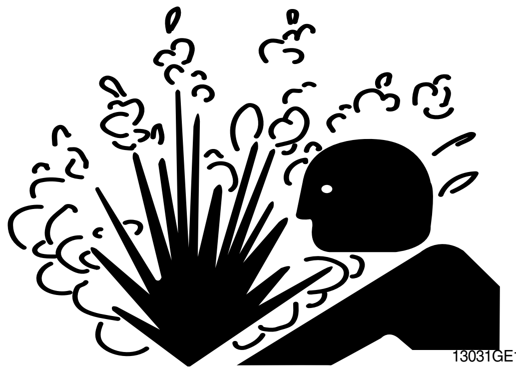


13031GE10

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

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

SERVICE COOLING SYSTEM SAFELY



13031GE11

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

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

HANDLE FLUIDS SAFELY-AVOID FIRES

13031GE12

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.

13031GE13

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

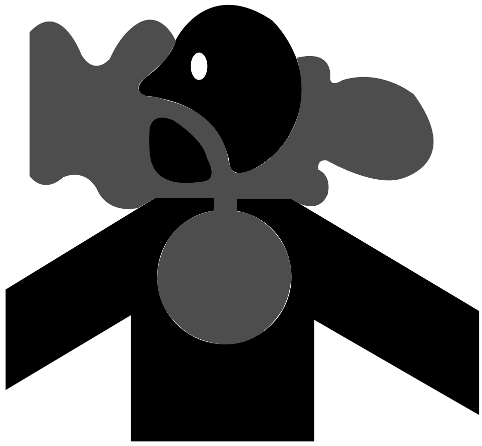
Make sure machine is clean of trash, grease, and debris.

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

BEWARE OF EXHAUST FUMES

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

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



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

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

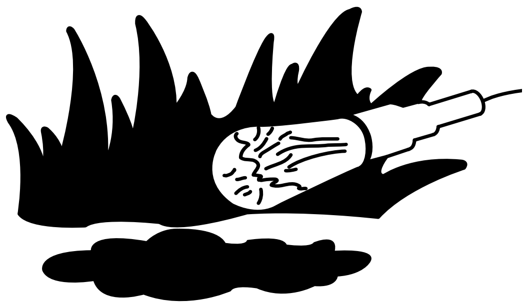
Remove paint before welding or heating:

· If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.

· If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

ILLUMINATE WORK AREA SAFELY

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

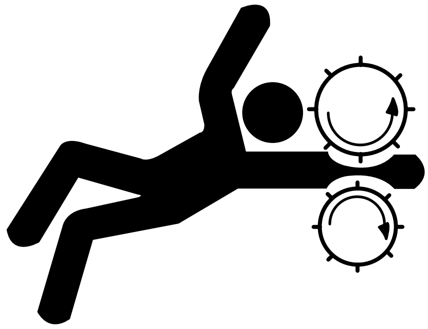


13031GE15

SERVICE MACHINE SAFELY

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

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

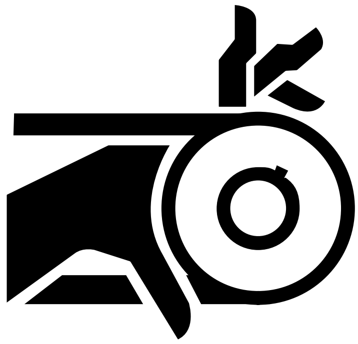


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



13031GE17

AVOID HIGH PRESSURE FLUIDS

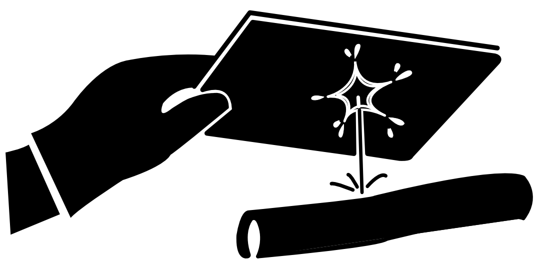
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

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

13031GE20

PREVENT BATTERY EXPLOSIONS

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

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

Do not charge a frozen battery; It may explode. Warm battery to 16°C(60°F).

13031GE21

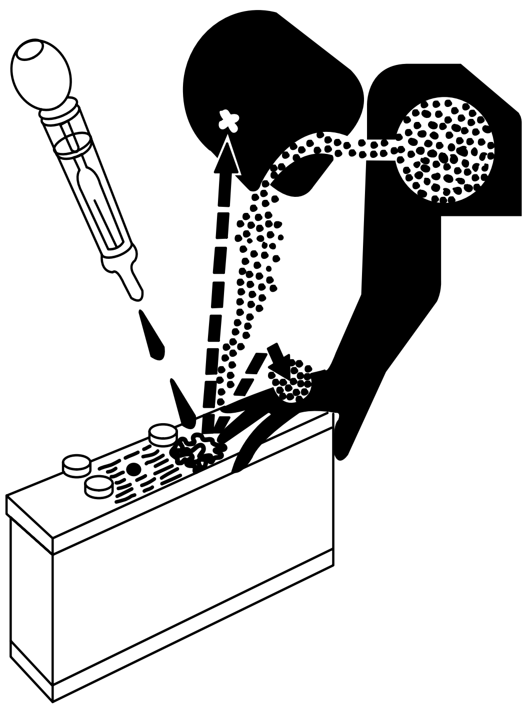
PREVENT ACID BURNS

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

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

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

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



13031GE22

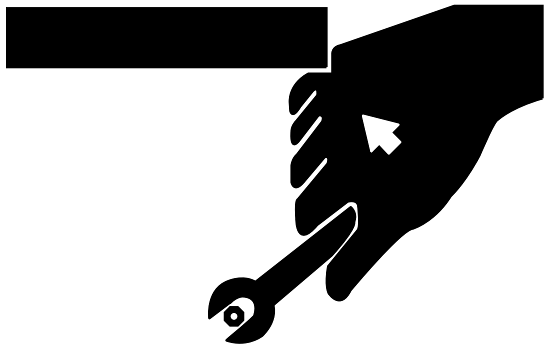
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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



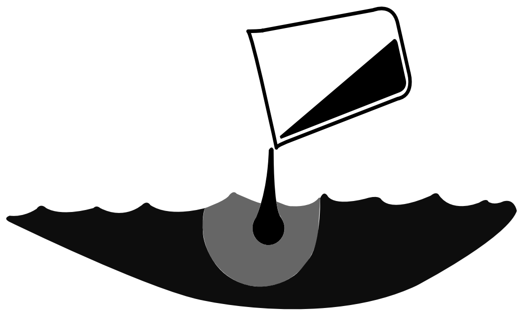
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

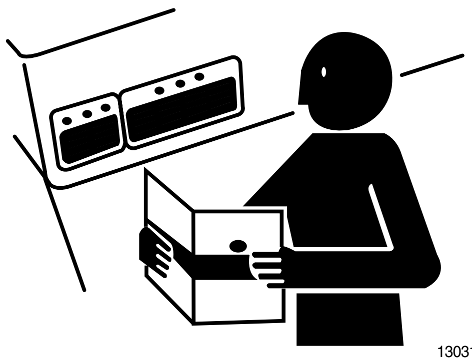
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY SIGNS

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



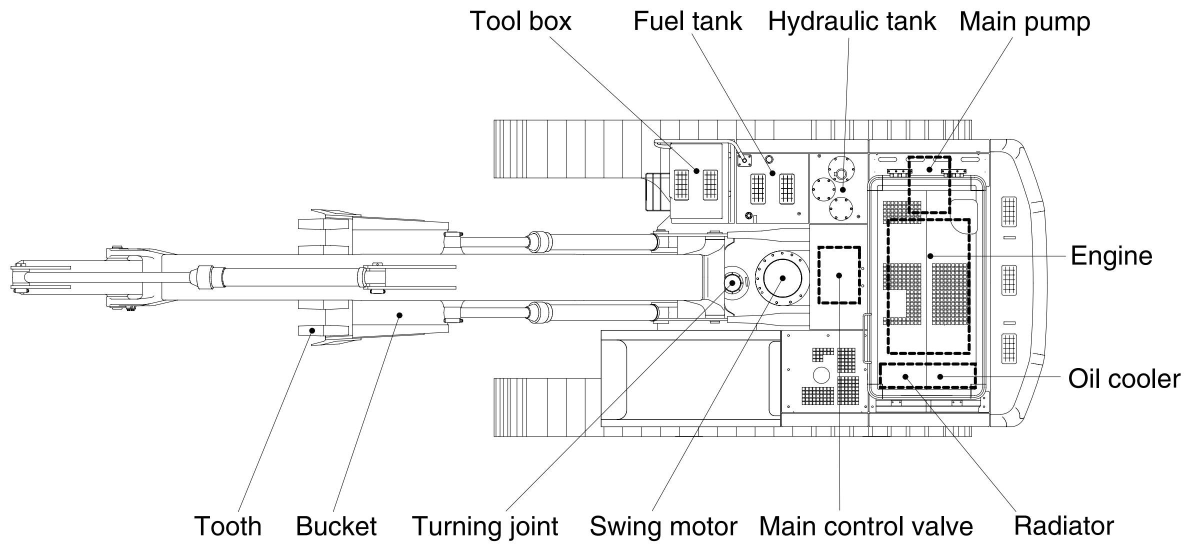
13031GE25

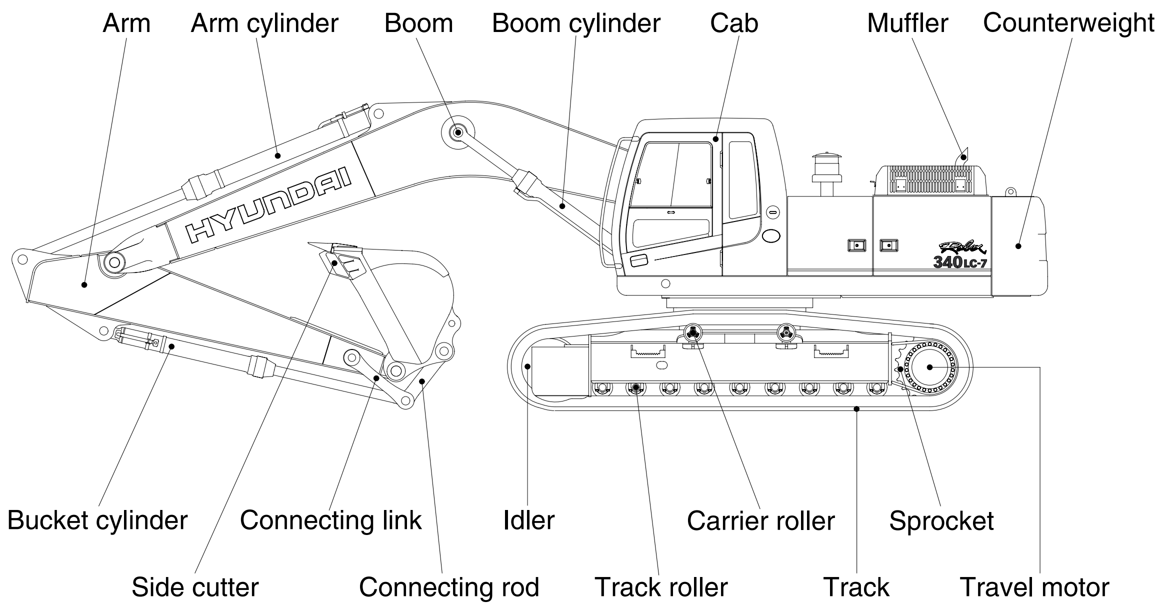
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

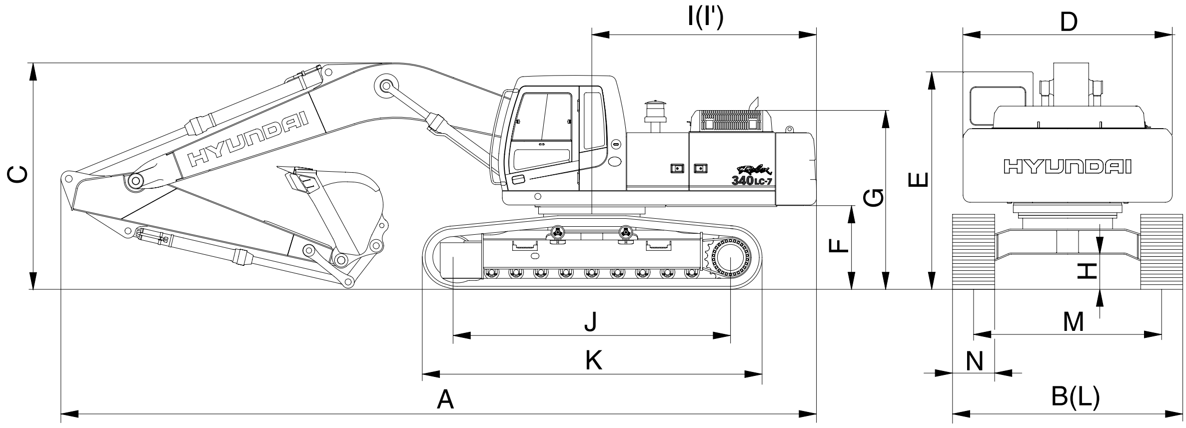




34072SP01

2. SPECIFICATIONS

· 6.45m(21' 2") BOOM, 2.2m(7' 3") ARM

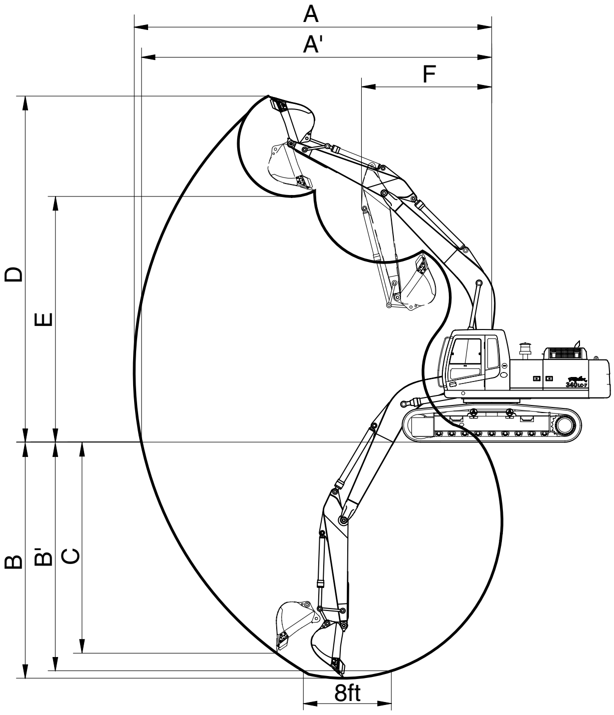


34072SP02

Description		Unit	Specification
Operating weight		kg(lb)	33800(74520)
Bucket capacity(SAE heaped)		m^3(yd^3)	2.10(2.75)
Overall length	A	mm(ft-in)	11430(37' 6")
Overall width, with 600mm shoe	B		3280(10' 9")
Overall height	C		3630(11' 11")
Superstructure width	D		2980(9' 9")
Overall height of cab	E		3090(10' 2")
Ground clearance of counterweight	F		1200(3' 11")
Engine cover height	G		2600(8' 6")
Minimum ground clearance	H		500(1' 8")
Rear-end distance	I		3400(11' 2")
Rear-end swing radius	I'		3460(11' 4")
Distance between tumblers	J		4030(13' 3")
Undercarriage length	K		4940(16' 2")
Undercarriage width	L		3280(10' 9")
Track gauge	M		2680(8' 10")
Track shoe width, standard	N		600(24")
Travel speed(Low/high)		km/hr(mph)	3.3/5.5(2.1/3.4)
Swing speed		rpm	9.9
Gradeability		Degree(%)	35(70)
Ground pressure(600mm shoe)		kgf/cm^2(psi)	0.65(9.24)

3. WORKING RANGE

· 6.45m(21' 2") BOOM



34072SP03

Description		6.45m(21' 2") Arm	
		2.2m(7' 3")Arm	2.65m(8' 8")Arm
Max digging reach	A	10230mm (33' 7")	10730mm (35' 2")
Max digging reach on ground	A'	10010mm (32' 10")	10520mm (34' 6")
Max digging depth	B	6310mm (20' 8")	6830mm (22' 5")
Max digging depth (8ft level)	B'	6110mm (20' 1")	6660mm (21' 10")
Max vertical wall digging depth	C	4320mm (14' 2")	5050mm (16' 7")
Max digging height	D	9830mm (32' 3")	10120mm (33' 2")
Max dumping height	E	6890mm (22' 7")	7040mm (23' 1")
Min swing radius	F	4840mm (15' 11")	4740mm (15' 7")
Bucket digging force	SAE	199.1[217.2] kN	←
		20300[22150] kgf	←
		44750[48820] lbf	←
	ISO	225.6[246.1] kN	←
		23000[25050] kgf	←
		50710[55320] lbf	←
Arm crowd force	SAE	204.0[222.5] kN	156.9[171.2] kN
		20800[22660] kgf	16000[17480] kgf
		45860[50030] lbf	35270[38480] lbf kN
	ISO	211.8[231.1] kN	162.8[177.6] kgf
		21600[23530] kgf	16600[18080] lbf
		47620[51950] lbf	36600[39930] kN

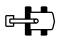
[ ] : Power boost

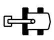
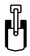
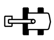
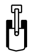
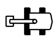
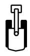
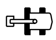
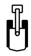
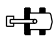
4. WEIGHT

Item	R340LC-7	
	kg	lb
Upperstructure assembly	15300	33730
Main frame weld assembly	2680	5900
Engine assembly	920	2030
Main pump assembly	250	550
Main control valve assembly	200	440
Swing motor assembly	310	680
Hydraulic oil tank assembly	230	510
Fuel tank assembly	230	510
Counterweight	6600	14550
Cab assembly	310	680
Radiator total assy	280	620
Lower chassis assembly	11950	26350
Track frame weld assembly	3970	8750
Swing bearing	435	960
Travel motor assembly	360	790
Turning joint	50	110
Tension cylinder	205	450
Idler	250	550
Sprocket	83	180
Carrier roller	35	80
Track roller	56	120
Track-chain assembly(600mm standard triple grouser shoe)	1880	4150
Front attachment assembly(6.45m boom, 2.2m arm, 2.1m^3 SAE heaped bucket)	6550	14440
6.45m boom assembly	2710	5970
2.2m arm assembly	1125	2480
2.1m^3 SAE heaped bucket	1420	3130
Boom cylinder assembly	280	620
Arm cylinder assembly	380	840
Bucket cylinder assembly	270	570
Bucket control linkage assembly	370	820

5. LIFTING CAPACITIES

1) 6.45m(21' 2") boom, 2.2m(7' 3") arm equipped with 2.10m³(SAE heaped) bucket and 600mm (24") triple grouser shoe.

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

Load point height		Load radius								At max. reach		
		3.0m(10ft)		4.5m(15ft)		6.0m(20ft)		7.5m(25ft)		Capacity		Reach
												m(ft)
7.5m (25ft)	kg lb									*6140 *13540	4950 10910	7.99 (26.2)
6.0m (20ft)	kg lb					*7290 *16070	*7290 *16070	*6760 *14900	5430 11970	*6200 *13670	3890 8580	8.87 (29.1)
4.5m (15ft)	kg lb			*11110 *24490	*11110 *24490	*8480 *18700	7790 17170	*7260 *16010	5230 11530	5520 12170	3340 7360	9.39 (30.8)
3.0m (10ft)	kg lb					*9930 *21890	7200 15870	*7980 *17590	4960 10930	5180 11420	3080 6790	9.61 (31.5)
1.5m (5ft)	kg lb					*11150 *24580	6730 14840	7770 17130	4700 10360	5140 11330	3040 6700	9.56 (31.4)
Ground Line	kg lb			*16550 *36490	10200 22490	10940 24120	6460 14240	7590 16730	4530 9990	5420 11950	3210 7080	9.23 (30.3)
-1.5m (-5ft)	kg lb			*16000 *35270	10250 22600	10870 23960	6400 14110	7540 16620	4490 9900	6150 13560	3680 8110	8.59 (28.2)
-3.0m (-10ft)	kg lb	*19750 *43540	*19750 *43540	*14600 *32190	10480 23100	*10920 *24070	6510 14350			*7140 *15740	4750 10470	7.54 (24.7)
-4.5m (-15ft)	kg lb	*15770 *34770	*15770 *34770	*11820 *26060	10940 24120							

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

2) 6.45m(21' 2") boom, 2.65m(8' 8") arm equipped with 2.10m³(SAE heaped) bucket and 600mm (24") triple grouser shoe.

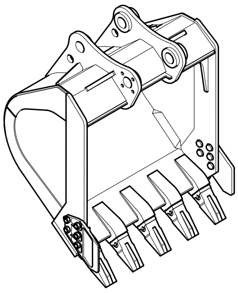
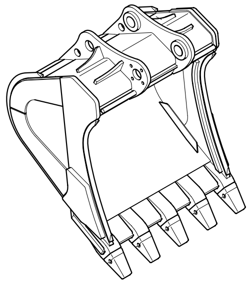
- : Rating over-front
- : Rating over-side or 360 degree

Load point height		Load radius										At max. reach		
		3.0m(10.0ft)		4.5m(15.0ft)		6.0m(20.0ft)		7.5m(25.0ft)		9.0m(30.0ft)		Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m(ft)
7.5m (25.0ft)	kg lb											*5660 *12480	4350 9590	8.53 (28.0)
6.0m (20.0ft)	kg lb							*6280 *13850	5490 12100			5690 12540	3480 7670	9.35 (30.7)
4.5m (15.0ft)	kg lb			*10130 *22330	*10130 *22330	*7920 *17460	7860 17330	*6830 *15060	5250 11570			5050 11130	3010 6640	9.84 (32.3)
3.0m (10.0ft)	kg lb			*13280 *29280	11390 25110	*9400 *20720	7230 15940	*7600 *16760	4950 10910	5800 12790	2480 7670	4740 10450	2780 6130	10.05 (33.0)
1.5m (5.0ft)	kg lb			*15570 *34330	10410 22950	*10730 *23660	6700 14770	7730 17040	4660 10270	5650 12460	3340 7360	4700 10360	2730 6020	10.01 (32.8)
Ground Line	kg lb			*16360 *36070	10050 22160	10850 23920	6370 14040	7510 16560	4450 9810			4930 10870	2870 6330	9.70 (31.8)
-1.5m (-5.0ft)	kg lb	*15210 *33530	*15210 *33530	*16110 *35520	10030 22110	10720 23630	6260 13800	7420 16360	4370 9630			5520 12170	3250 7170	9.10 (29.9)
-3.0m (-10.0ft)	kg lb	*21030 *46360	*21030 *46360	*14990 *33050	10210 22510	10810 23830	6330 13960	7510 16560	4460 9830			*6780 *14950	4080 8990	8.12 (26.6)
-4.5m (-15.0ft)	kg lb	*17350 *38250	*17350 *38250	*12640 *27870	10620 23410	*9240 *20370	6630 14620					*6280 *13850	6120 13490	6.58 (21.6)

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

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET

· General bucket	· Rock-heavy duty bucket
	
2.10m³ SAE heaped bucket	⊙1.44m³ SAE ⊙1.62m³ SAE heaped bucket

Capacity		Width		Weight	6.45m (21' 2") boom	
SAE heaped	CECE heaped	Without side cutter	With side cutter		2.2m (7' 3") arm	2.65m (8' 8") arm
2.10m³ (2.75yd³)	1.90m³ (2.49yd³)	1710mm (67.3")	1830mm (72.0")	1505kg (3320lb)		
⊙1.44m³ (1.88yd³)	1.25m³ (1.64yd³)	1290mm (50.8")	-	1510kg (3330lb)		
⊙1.62m³ (2.12yd³)	1.43m³ (1.87yd³)	1590mm (62.6")	-	1540kg (3400lb)		

⊙ : Rock - Heavy duty bucket

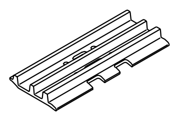
- Applicable for materials with density of 2000kgf/m³ (3370lbf/yd³) or less
- Applicable for materials with density of 1600kgf/m³ (2700lbf/yd³) or less
- Applicable for materials with density of 1100kgf/m³ (1850lbf/yd³) or less

7. UNDERCARRIAGE

1) TRACKS

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

2) TYPES OF SHOES

Model	Shapes		Triple grouser			
						
R340LC-7	Shoe width	mm(in)	600(24)	700(28)	800(32)	900(36)
	Operating weight	kg(lb)	33800(74520)	34400(75840)	34800(76720)	35200(77600)
	Ground pressure	kgf/cm^2(psi)	0.65(9.24)	0.57(8.11)	0.50(7.11)	0.45(6.40)
	Overall width	mm(ft-in)	3280(10' 9")	3380(11' 1")	3480(11' 5")	3580(11' 9")

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	2EA
Track rollers	9EA
Track shoes	48EA

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
600mm triple grouser	Standard	A
700mm triple grouser	Option	B
800mm triple grouser	Option	C
900mm triple grouser	Option	C

※ **Table 2**

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

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	HYUNDAI D6AC-C
Type	4-cycle turbocharged charger air cooled diesel engine
Cooling method	Water cooling
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	130× 140mm(5.12" × 5.51")
Piston displacement	11149cc(680cu in)
Compression ratio	17 : 1
Rated gross horse power(SAE J1995)	276Hp at 1900rpm(206kW at 1900rpm)
Maximum torque	120kgf · m(868lbf · ft) at 1400rpm
Engine oil quantity	27.3 ℓ (7.2U.S. gal)
Dry weight	920kg(2030lb)
Low idling speed	800± 50rpm
High idling speed	2050+ 50rpm
Rated fuel consumption	152.9g/Hp · hr at 1900rpm
Starting motor	24V-5.5kW
Alternator	24V-70A
Battery	2 × 12V × 160Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 149.5cc/rev
Maximum pressure	330kgf/cm² (4690psi)[360kgf/cm² (5120psi)]
Rated oil flow	2 × 254.2 ℓ /min (67.2U.S. gpm/ 55.9U.K. gpm)
Rated speed	1700rpm

[ ]: Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	15cc/rev
Maximum pressure	35kgf/cm²(500psi)
Rated oil flow	25.5 ℓ/min(6.7U.S. gpm/5.6U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	9 spools
Operating method	Hydraulic pilot system
Main relief valve pressure	330kgf/cm²(4690psi) [360kgf/cm²(5120psi)]
Overload relief valve pressure	390kgf/cm²(5550psi)

[ ]: Power boost

5) SWING MOTOR

Item	Specification
Type	Axial piston motor
Capacity	169.4cc/rev
Relief pressure	290kgf/cm²(4120psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	70kgf・m(505lbf・ft)
Brake release pressure	30~50kgf/cm²(430~710psi)
Reduction gear type	2 - stage planetary
Swing speed	9.9rpm

6) TRAVEL MOTOR

Item		Specification	
Type		Variable displacement axial piston motor	
Relief pressure		330kgf/cm²(4700psi)	
Capacity(max / min)	Gear ratio	154.8/88.5cc/rev	72.978
Reduction gear type		3-stage planetary	
Braking system		Automatic, spring applied hydraulic released	
Brake release pressure		9kgf/cm²(128psi)	
Braking torque		40kgf・m(290lbf・ft)	

7) REMOTE CONTROL VALVE

Item		Specification
Type		Pressure reducing type
Operating pressure	Minimum	6.5kgf/cm²(92psi)
	Maximum	26kgf/cm²(370psi)
Single operation stroke	Lever	61mm(2.4in)
	Pedal	123mm(4.84in)

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø 150× ø 105× 1480mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø 160× ø 110× 1685mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø 140× ø 100× 1285mm
	Cushion	Extend only

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

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

9) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
R340LC-7	Standard	600mm(24")	0.65kgf/cm²(9.24psi)	48	3280mm(10' 9")
	Option	700mm(28")	0.57kgf/cm²(8.11psi)	48	3380mm(11' 1")
		800mm(32")	0.50kgf/cm²(7.11psi)	48	3480mm(11' 5")
		900mm(36")	0.45kgf/cm²(6.40psi)	48	3580mm(11' 9")

10) BUCKET

Item		Capacity		Tooth quantity	Width	
		SAE heaped	CECE heaped		Without side cutter	With side cutter
R340LC-7	Standard	2.10m³(2.75yd³)	1.90m³(2.49yd³)	5	1710mm(67.3")	1830mm(72.0")
	Option	⊙1.44m³(1.88yd³)	1.25m³(1.63yd³)	5	1290mm(50.8")	-
		⊙1.62m³(2.12yd³)	1.43m³(1.87yd³)	5	1590mm(62.6")	-

⊙ : Rock - Heavy duty bucket

9. RECOMMENDED OILS

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

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature ˚C (˚F) -20 (-4), -10 (14), 0 (32), 10 (50), 20 (68), 30 (86), 40 (104)
Engine oil pan	Engine oil	27.3(7.2)	SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Gear oil	11(2.9)	SAE 85W-140
Final drive		5.5×2 (1.5×2)	
Hydraulic tank	Hydraulic oil	Tank; 210(55.5) System; 320(84.5)	ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel	600(158)	ASTM D975 NO.1 ASTM D975 NO.2
Fitting (Grease nipple)	Grease	As required	NLGI NO.1 NLGI NO.2
Radiator (Reservoir tank)	Mixture of antifreeze and water 50 : 50	45(12)	Ethylene glycol base permanent type

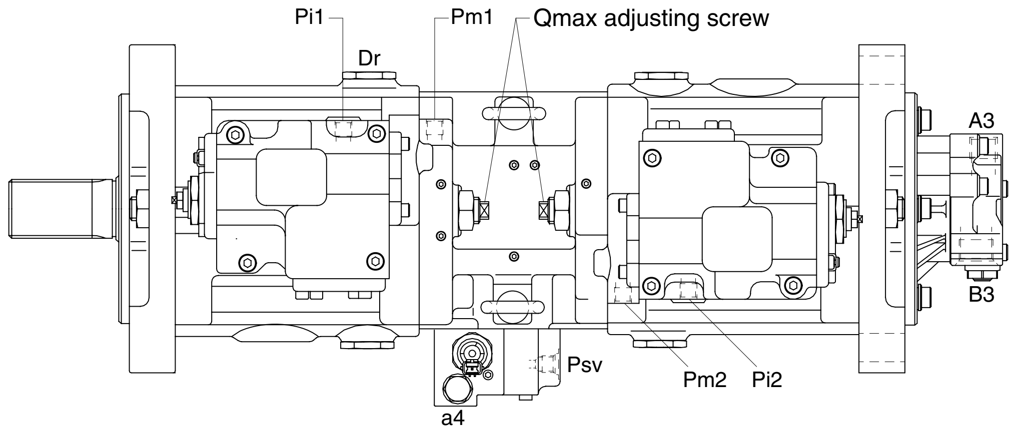
SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material

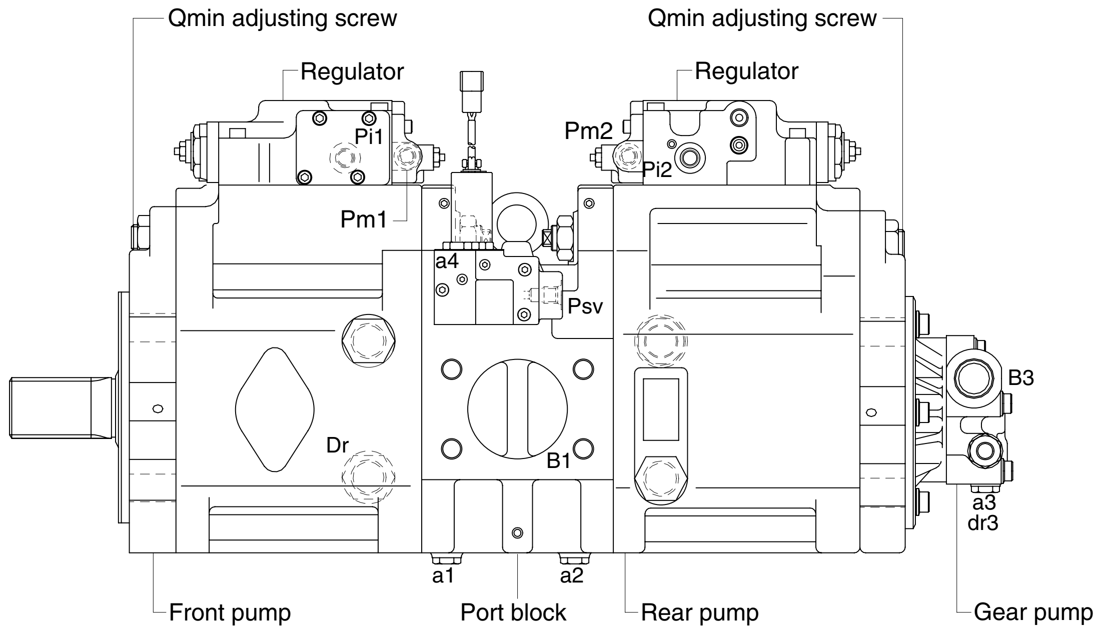
SECTION 2 STRUCTURE AND FUNCTION

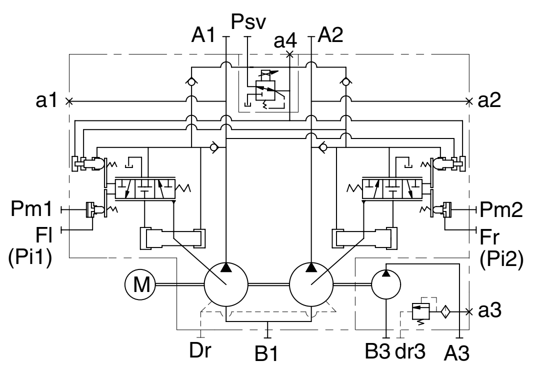
GROUP 1 PUMP DEVICE

1. STRUCTURE

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





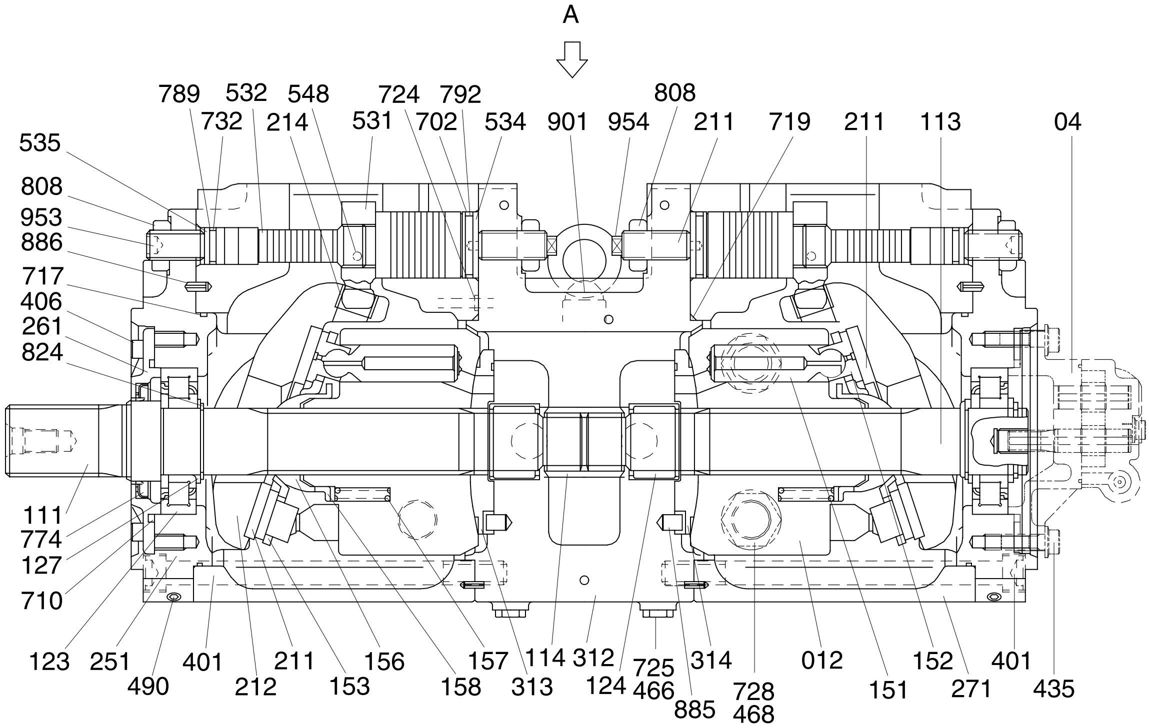


32072ST02

Port	Port name	Port size
A1,2	Delivery port	SAE6000psi 1"
B1	Suction port	SAE2000psi 3"
Dr	Drain port	PF 3/4 - 23
Pi1,i2	Pilot port	PF 1/4 - 15
Pm1,m2	Qmax cut port	PF 1/4 - 15
Psv	Servo assist port	PF 1/4 - 15
a1,2,4	Gauge port	PF 1/4 - 15
a3	Gauge port	PF 1/4 - 14
A3	Gear pump delivery port	PF 1/2 - 19
B3	Gear pump suction port	PF 3/4 - 20.5
dr3	Gear pump drain port	PF 3/8

1) MAIN PUMP(1/2)

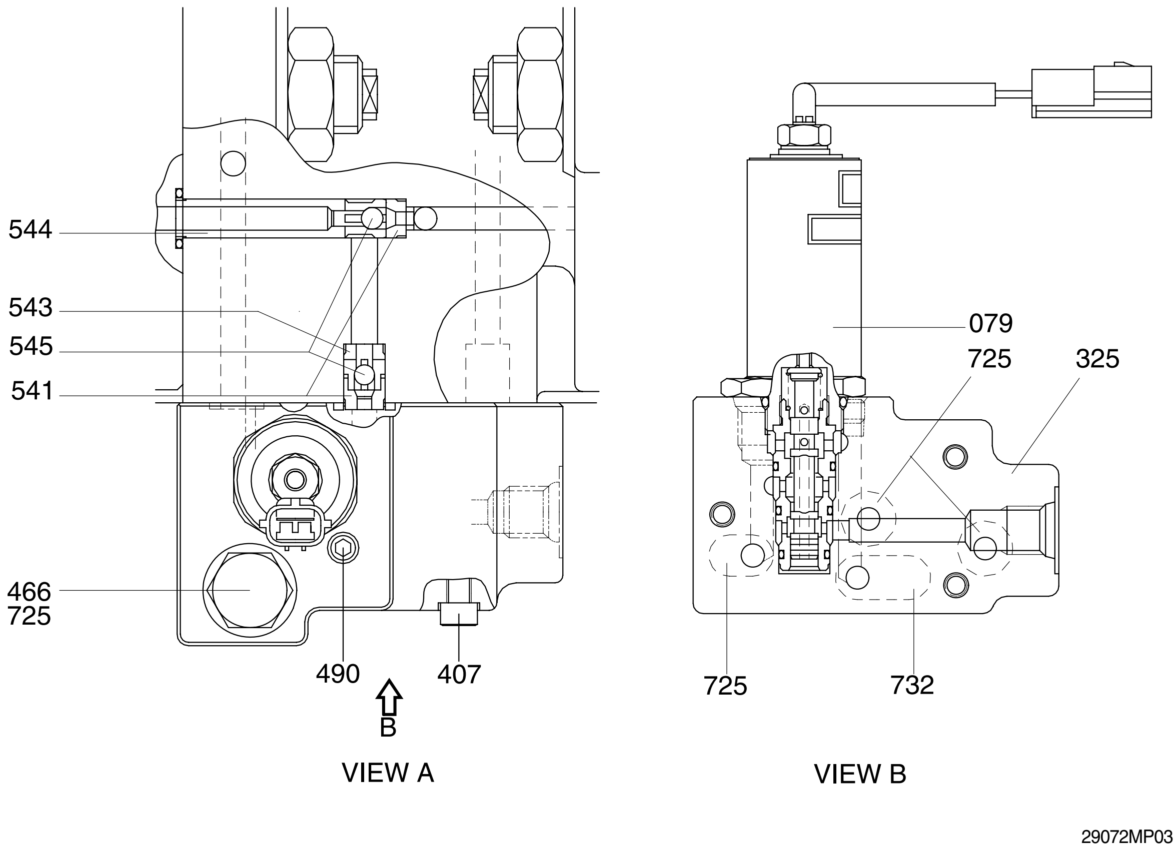
The main pump consists of two piston pumps(front & rear) and valve block.



32072ST03

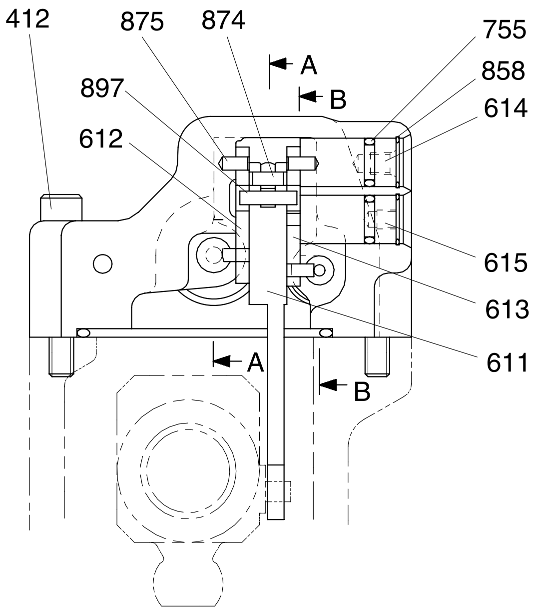
04	Gear pump
111	Drive shaft(F)
113	Drive shaft(R)
114	Spline coupling
123	Roller bearing
124	Needle bearing
127	Bearing spacer
141	Cylinder block
151	Piston
152	Shoe
153	Push plate
156	Bushing
157	Cylinder spring
158	Spacer
211	Shoe plate
212	Swash plate
214	Bushing
251	Swash plate support
261	Seal cover(F)
271	Pump casing
312	Valve block
313	Valve plate(R)
314	Valve plate(L)
401	Hexagon socket bolt
406	Hexagon socket bolt
435	Flange socket bolt
466	VP plug
468	VP plug
490	VP plug
531	Tilting pin
532	Servo piston
534	Stopper(L)
535	Stopper(S)
548	Pin
702	O-ring
710	O-ring
717	O-ring
719	O-ring
724	O-ring
725	O-ring
728	O-ring
732	O-ring
774	Oil seal
789	Back up ring
792	Back up ring
808	Hexagon head nut
824	Snap ring
885	Pin
886	Spring pin
901	Eye bolt
953	Set screw
954	Set screw

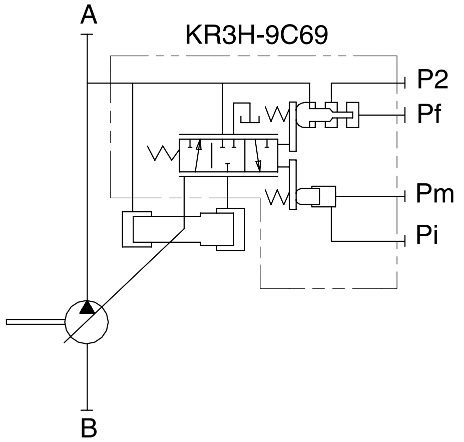
MAIN PUMP(2/2)

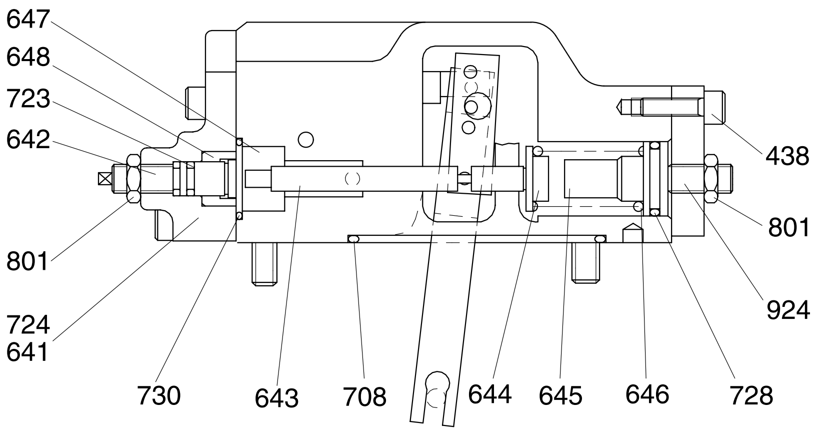


079	Proportional reducing valve	490	Plug	545	Steel ball
325	Casing assy	541	Seat	725	O-ring
407	Hexagon screw	543	Stopper 1	732	O-ring
466	Plug	544	Stopper 2		

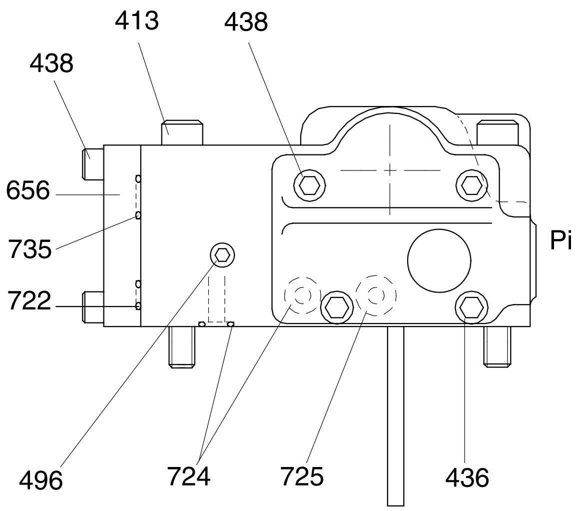
2) REGULATOR(1/2)







SECTION B-B

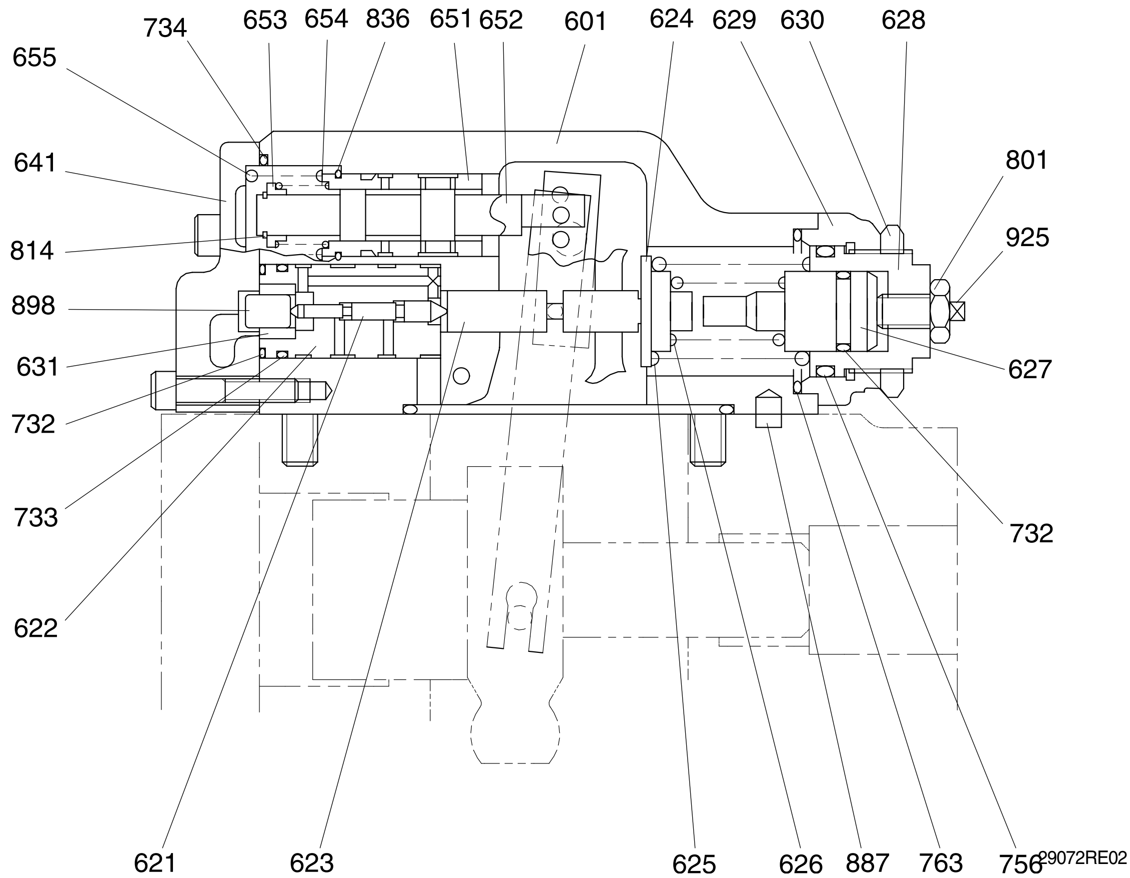


VIEW C

32072ST04

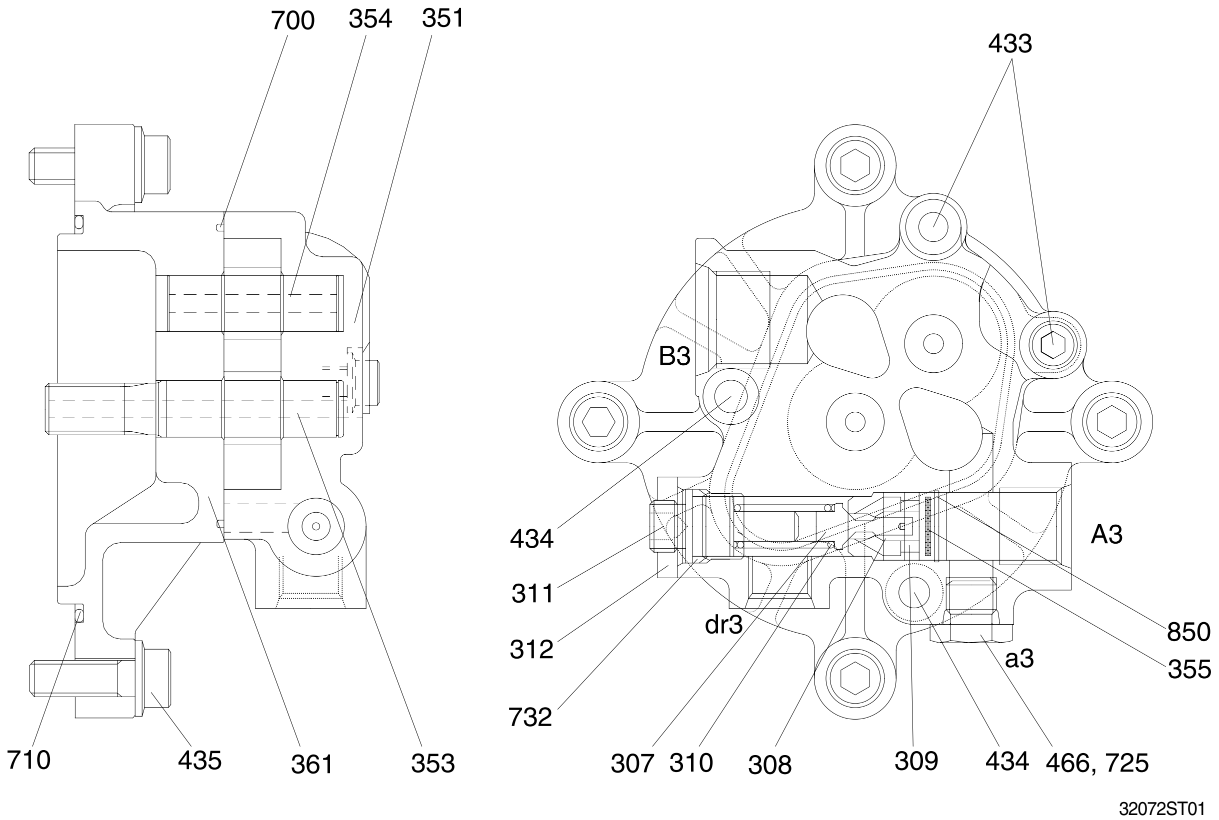
Port	Port name	port size
A	Delivery port	SAE6000psi 1"
B	Suction port	SAE2000psi 3"
Pi	Pilot port	PF 1/4-15
Pm	Qmax cut port	PF 1/4-15

REGULATOR(2/2)



412	Hexagon socket screw	631	Sleeve, pf	730	O-ring
413	Hexagon socket screw	641	Pilot cover	732	O-ring
436	Hexagon socket screw	642	Adjust screw(QMC)	733	O-ring
438	Hexagon socket screw	643	Pilot piston	734	O-ring
496	Plug	644	Spring seat(Q)	735	O-ring
601	Casing	645	Adjust stem(Q)	755	O-ring
611	Feed back lever	646	Pilot spring	756	O-ring
612	Lever(1)	647	Stopper	763	O-ring
613	Lever(2)	648	Piston(QMC)	801	Nut
614	Fulcrum plug	651	Sleeve	814	Snap ring
615	Adjust plug	652	Spool	836	Snap ring
621	Compensator piston	653	Spring seat	858	Snap ring
622	Piston case	654	Return spring	874	Spring pin
623	Compensator rod	655	Set spring	875	Pin
624	Spring seat(C)	656	Block cover	887	Pin
625	Outer spring	708	O-ring	897	Pin
626	Inner spring	722	O-ring	898	Pin
627	Adjust stem(C)	723	O-ring	924	Set screw
628	Adjust screw(C)	724	O-ring	925	Adjust screw(QI)
629	Cover(C)	725	O-ring		
630	Lock nut	728	O-ring		

3) GEAR PUMP



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

2. FUNCTION

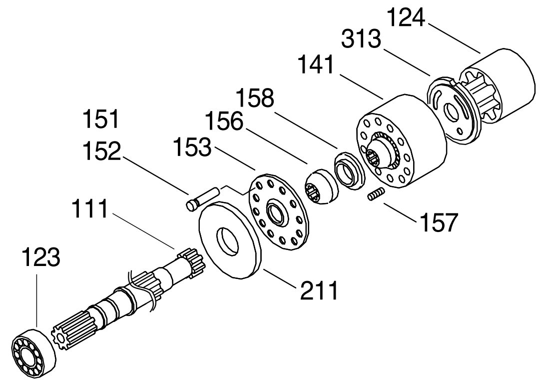
1) MAIN PUMP

The pumps may 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.

(1) Rotary group

The rotary group consists of drive shaft (F)(111), cylinder block(141), piston shoes(151,152), set plate(153), spherical bush(156), spacer(158) 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 the 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 a retainer and a spherical bush. Similarly, the cylinder block is pressed against valve plate(313) by the action of the cylinder spring.



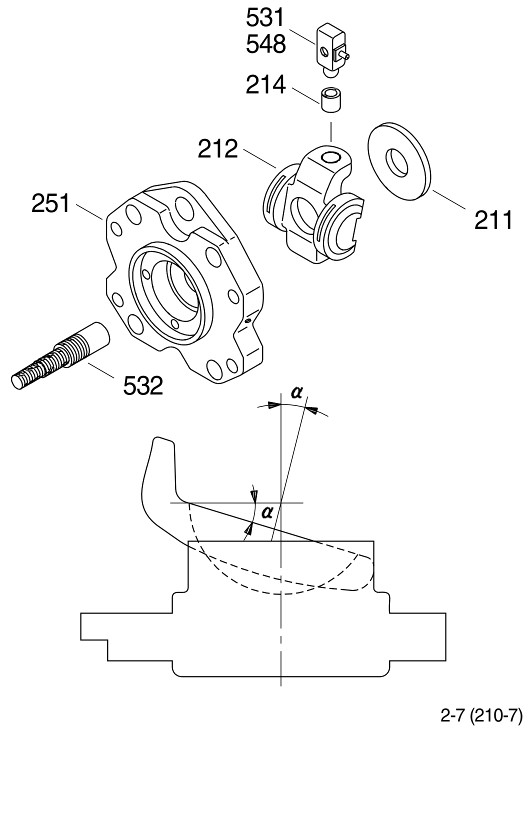
2-7(1) 210-7

(2) Swash plate group

The swash plate group consists of swash plate(212), shoe plate(211), swash plate support(251), tilting bush(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 and left as hydraulic force controlled by the regulator is admitted 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)



2-7 (210-7)

(3) Valve block group

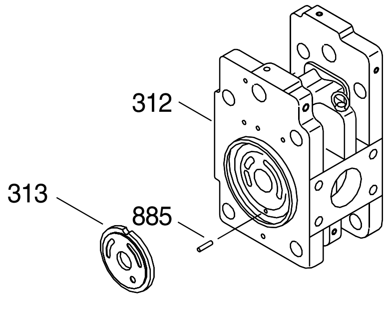
The valve block group consists of valve block(312), valve plate(313) and valve plate pin(885).

The valve plate having two melon-shaped 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.

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(or 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.



2-8 (210-7)

2) REGULATOR

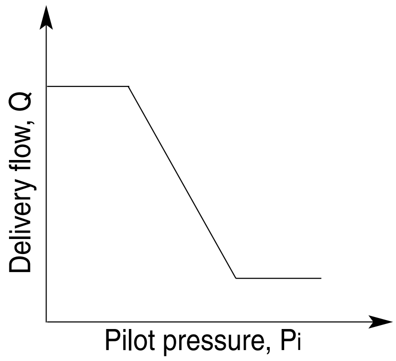
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

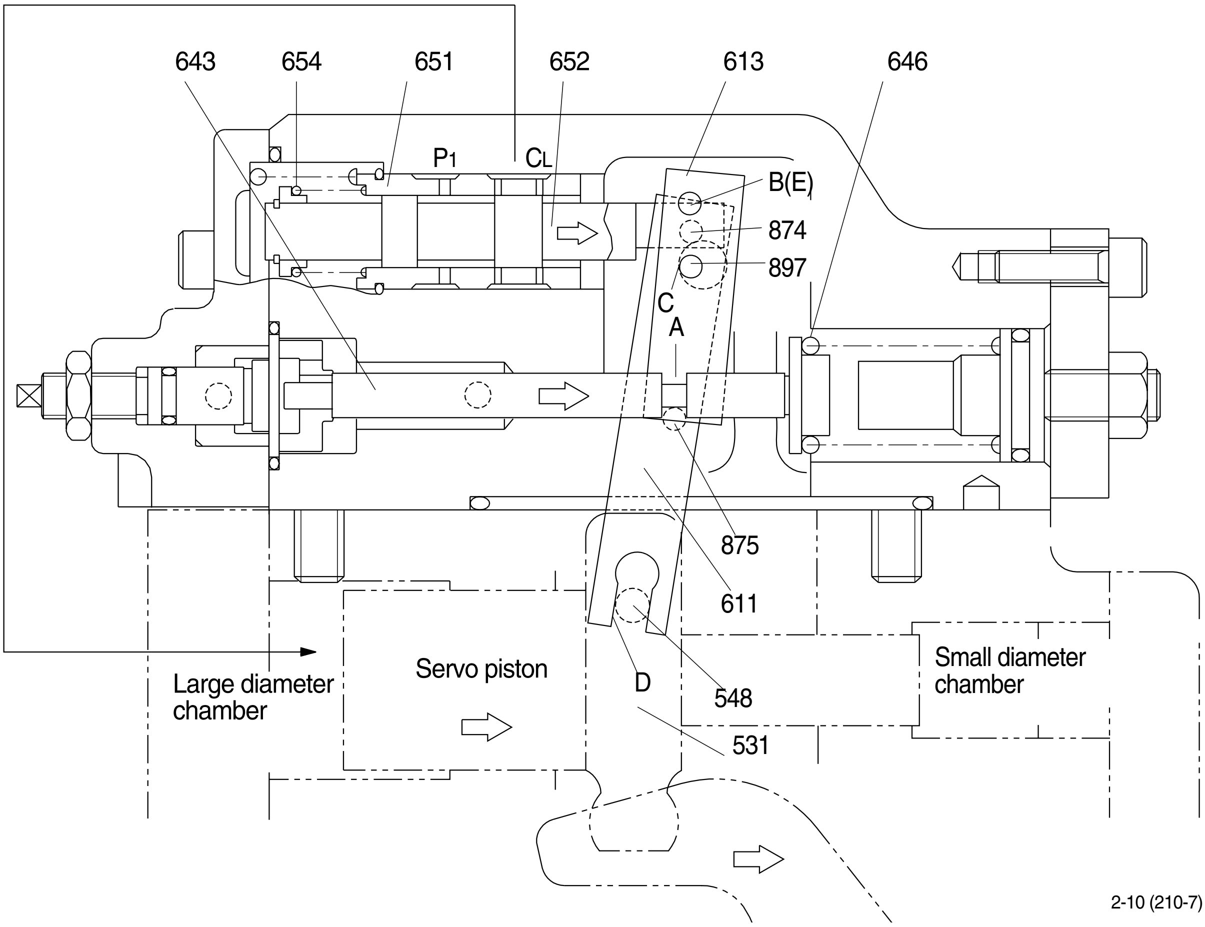
By changing the pilot pressure Pi, the pump tilting angle(delivery flow) is regulated arbitrarily, as shown in the figure.

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

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



① **Flow reducing function**



As the pilot pressure Pi rises, the pilot piston(643) moves to the right to a position where the force of the pilot spring(646) balances with the hydraulic force.

The groove(A) in the pilot piston is fitted with the pin(875) that is fixed to lever 2(613). Therefore, when the pilot piston moves, lever 2 rotates around the fulcrum of point B [Fixed by the fulcrum plug(614) and pin(875)]. Since the large hole section(C) of lever 2 contains a protruding pin(897) fixed to the feedback lever(611), the pin(897) moves to the right as lever 2 rotates. Since the opposing-flat section(D) of the feedback lever is fitted with the pin(548) fixed by the tilting pin(531) that swings the swash plate, the feedback lever rotates around the fulcrum of point D, as the pin(897) moves.

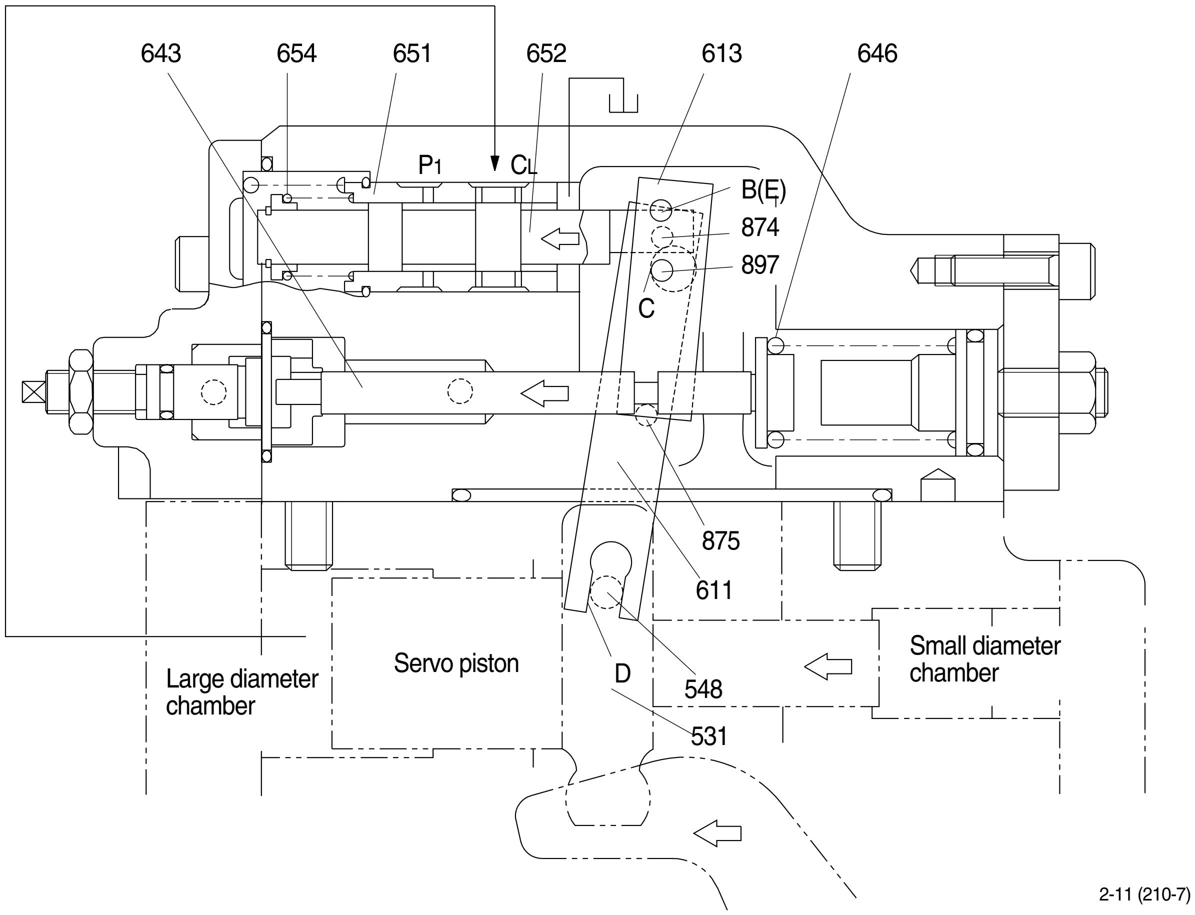
Since the feedback lever is connected with the spool(652) via the pin(874), the spool moves to the right.

The movement of the spool causes the delivery pressure P1 to connect to port CL through the spool and to be admitted to the large diameter section of the servo piston. The delivery pressure P1 that is constantly admitted to the small diameter section of the servo piston moves the servo piston to the right due to the area difference, resulting in decrease of the tilting angle.

When the servo piston moves to the right, point D also moves to the right. The spool is fitted with the return spring(654) and is tensioned to the left at all times, and so the pin(897) is pressed against the large hole section(C) of lever 2.

Therefore, as point D moves, the feedback lever rotates around the fulcrum of point C, and the spool is shifted to the left. This causes the opening between the sleeve(651) and spool(652) to close slowly, and the servo piston comes to a complete stop when it closes completely.

② **Flow increasing function**



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

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

③ **Adjustment of flow control characteristic**

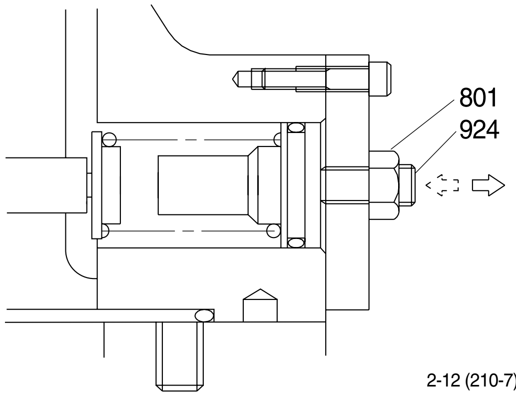
The flow control characteristic can be adjusted with the adjusting screw.

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

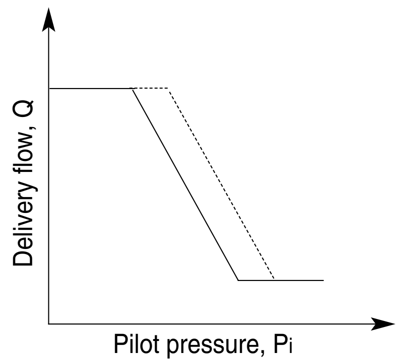
Tightening the screw shifts the control chart to the right as shown in the figure.

※ **Adjusting values are shown in table.**

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)
1750	+1/4	+1.6	+18.4



2-12 (210-7)



(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.

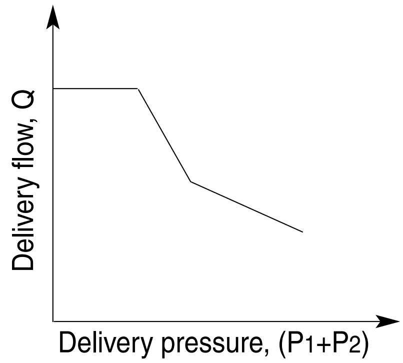
(The input horsepower is constant when the speed is constant.)

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.

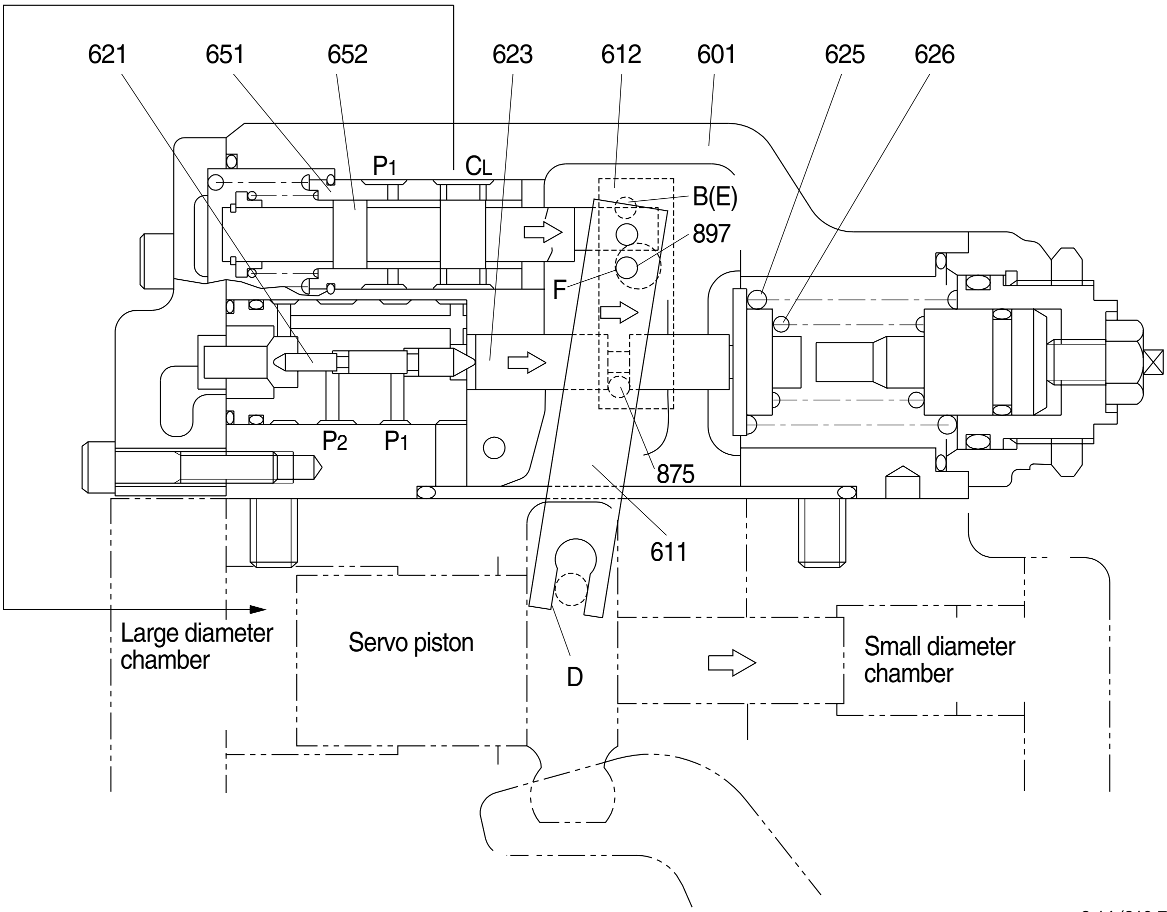
Since this regulator is of the simultaneous total horsepower type, it controls the tilting angles(displacement volumes) of the two pumps to the same value as represented by the following equation :

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

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



2-14 (210-7)

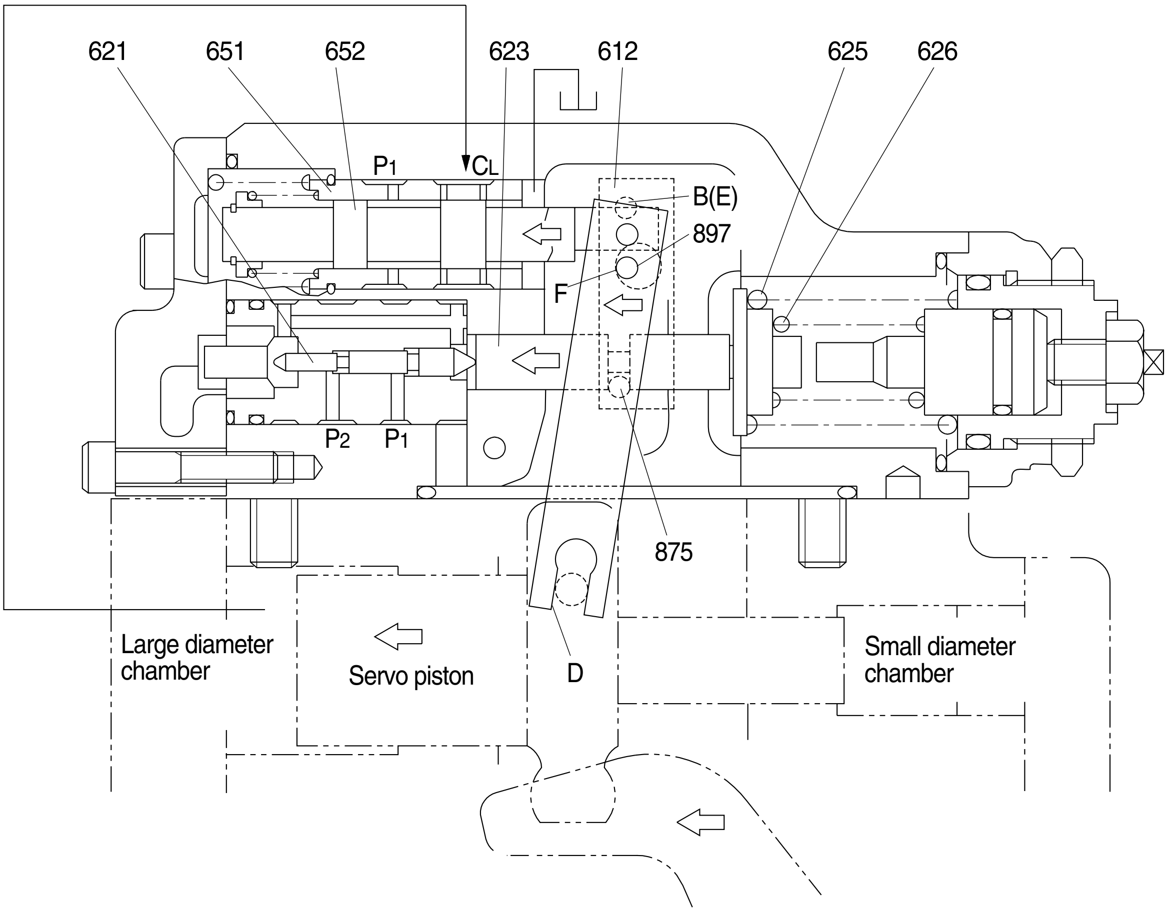
When the self pump delivery pressure P1 or the companion pump delivery pressure P2 rises, it acts on the stepped part of the compensating piston(621). It presses the compensating rod(623) to the right till the force of the outer spring(625) and inner spring(626) balances with the hydraulic force. The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



2-15 (210-7)

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**

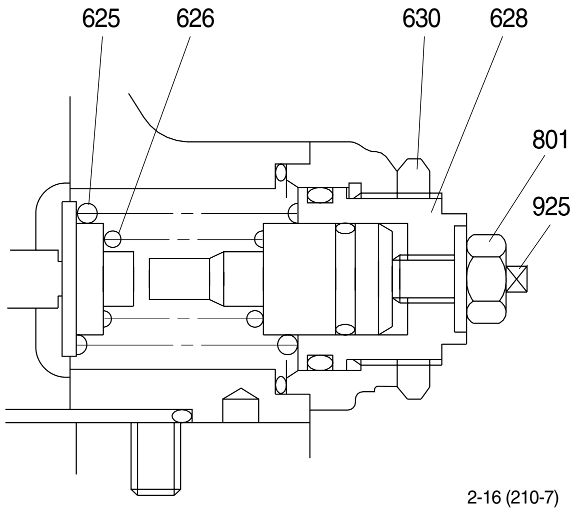
Since the regulator is of total cumulative horsepower type, adjust the adjusting screws of both the front and rear pumps, when changing the horsepower set values. The pressure change values by adjustment are based on two pumps pressurized at the same time, and the values will be doubled when only one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

a. Adjustment of outer spring

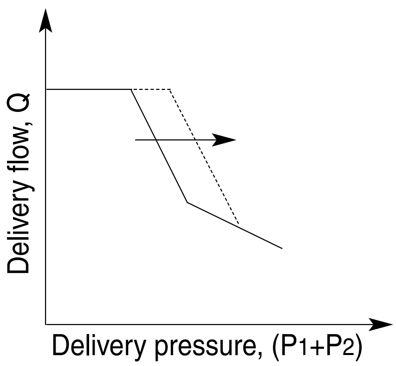
Adjust it by loosening the hexagon nut(630) and by tightening(or loosening) the adjusting screw C(628). Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C by N turns changes the setting of the inner spring(626), return the adjusting screw QI(925) by N×A turns at first.(A=1.59)

※ **Adjusting values are shown in table.**

Speed	Adjustment of outer spring		
	Tightening amount of adjusting screw(628)	Compens-ating control starting pressure change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(kgf · m)
1750	+1/4	+19.2	+8.3



2-16 (210-7)

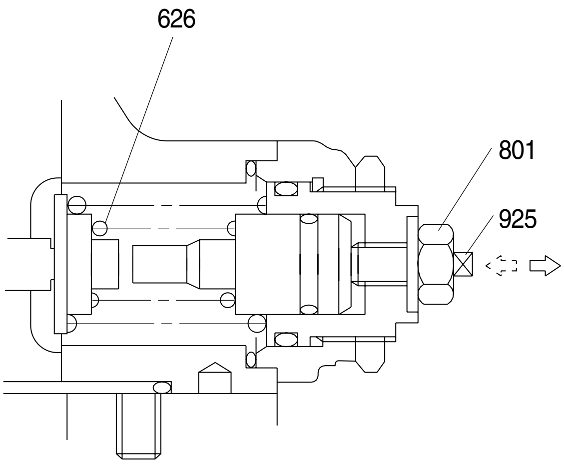


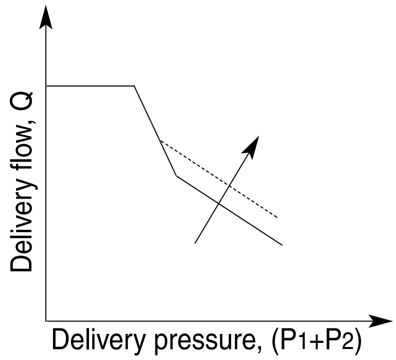
b. Adjustment of inner spring

Adjust it by loosening the hexagon nut (801) and by tightening(or loosening) the adjusting screw QI(925). Tightening the screw increases the flow and then the input horsepower as shown in the figure.

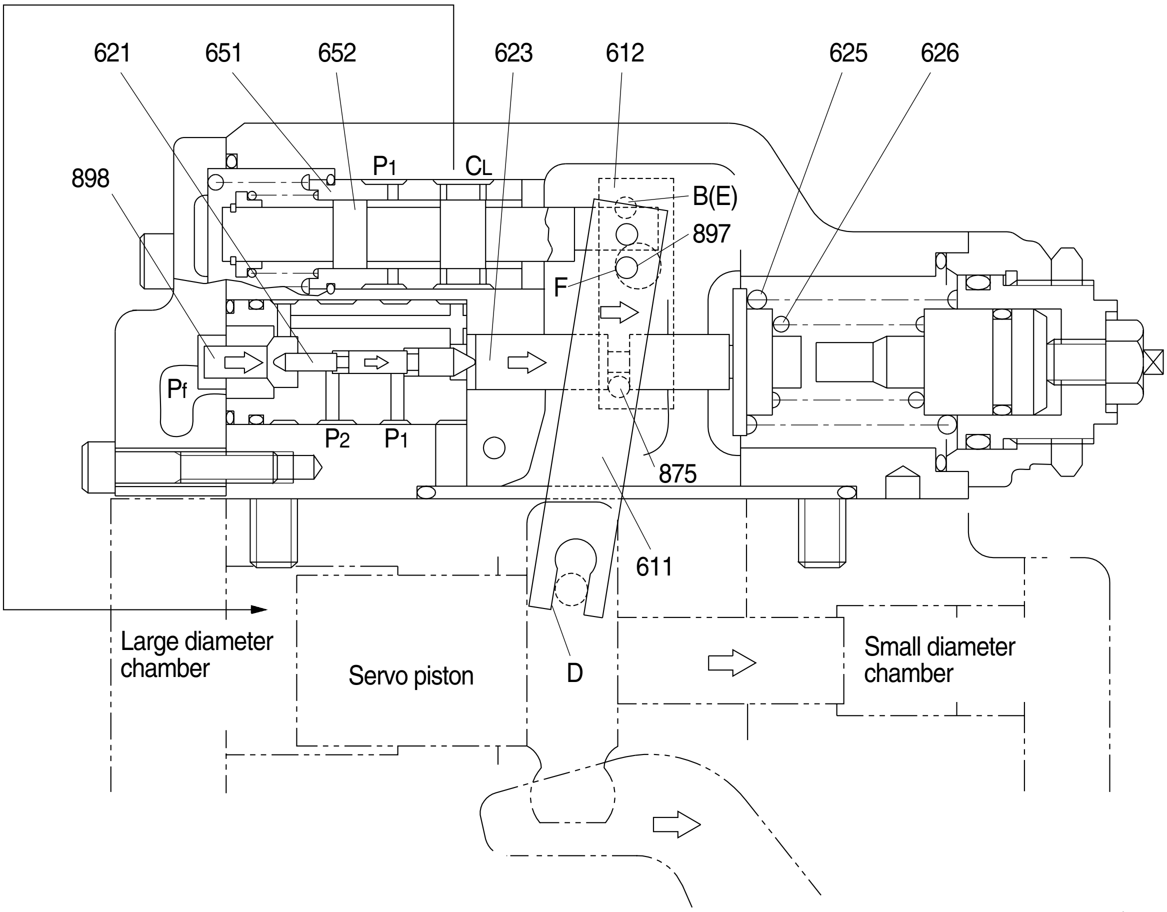
※ **Adjusting valves are shown in table.**

Speed	Adjustment of inner spring		
	Tightening amount of adjusting screw(QI) (925)	Flow change amount	Input torque change amount
(min^{-1})	(Turn)	(lpm)	(kgf · m)
1750	+1/4	+15.9	+8.5

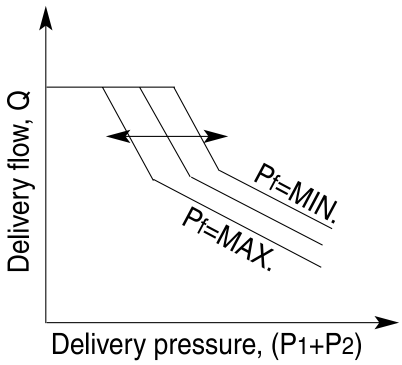




(3) Power shift control



2-18 (210-7)



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.

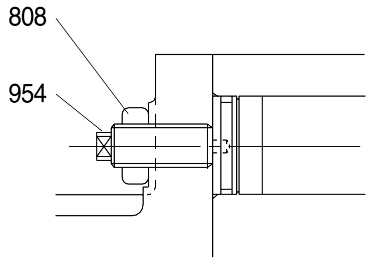
As the power shift pressure Pf rises, the compensating rod(623) moves to the right via the pin(898) and compensating piston(621).

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

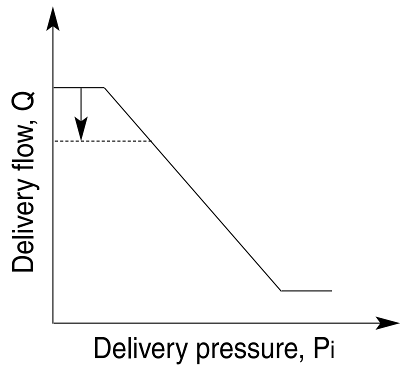
① Adjustment of maximum flow

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.



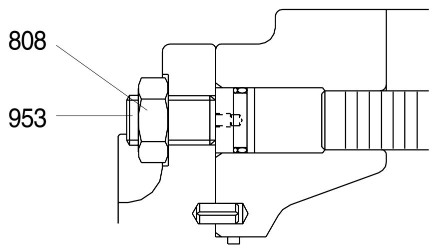
2-19(1) 210-7

Speed	Adjustment of max flow	
	Tightening amount of adjusting screw (954)	Flow change amount
(min^{-1})	(Turn)	(l/min)
1750	+1/4	-6.7

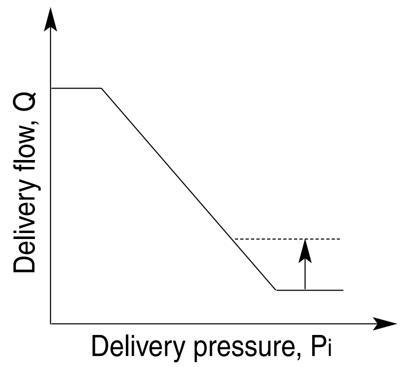


② Adjustment of minimum flow

Adjust it by loosening the hexagon nut(808) and by tightening(or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.
However, remember that, if tightened too much, the required horsepower during the maximum delivery pressure(or during relieving) may increase.

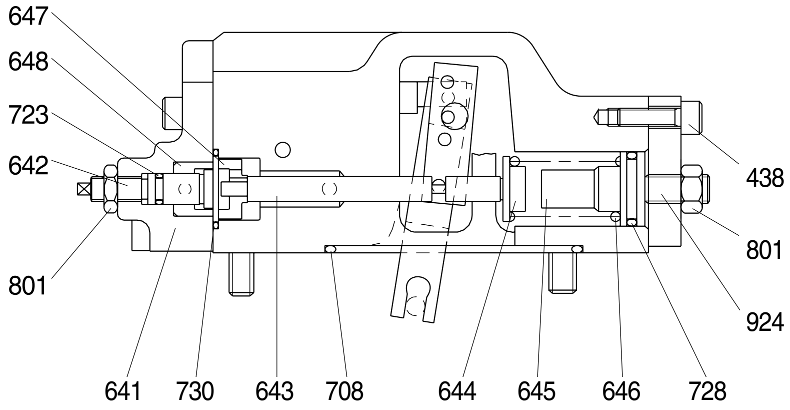


Speed	Adjustment of min flow	
	Tightening amount of adjusting screw (953)	Flow change amount
(min^{-1})	(Turn)	(l/min)
1750	+1/4	+6.7



(5) Qmax cut control

The regulator regulates the maximum delivery flow by inputting the pilot pressure Pm. Since this is a 2-position control method, the maximum delivery flow may be switched in two steps by turning on/off the pilot pressure Pm.(The maximum control flow cannot be controlled in intermediate level.)

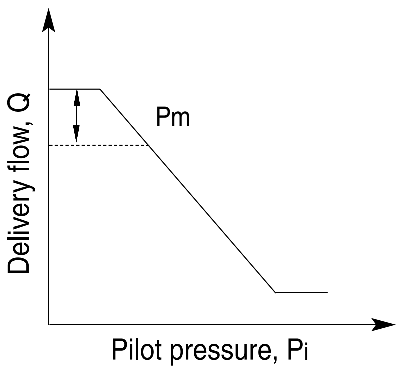


① Functional explanation

As shown in the figure, the pilot pressure Pm switches the maximum flow in two steps.

When the pilot pressure Pm is given, it is admitted to the lefthand side of the piston QMC(648). The piston QMC moves the stopper(647) and pilot piston(643) to the right, overcoming the force of the pilot spring(646), thereby reducing the delivery flow of the pump.

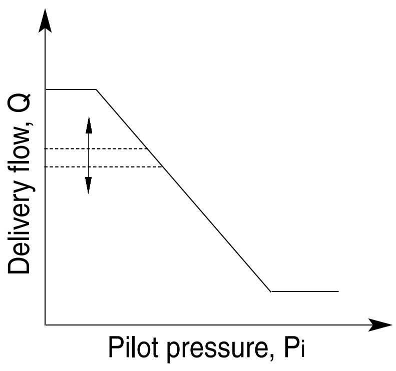
Since the adjusting screw QMC(642) is provided with a flange, the piston QMC stops upon contact with the flange, and the position of the pilot piston at this time determines the maximum flow of the pump.



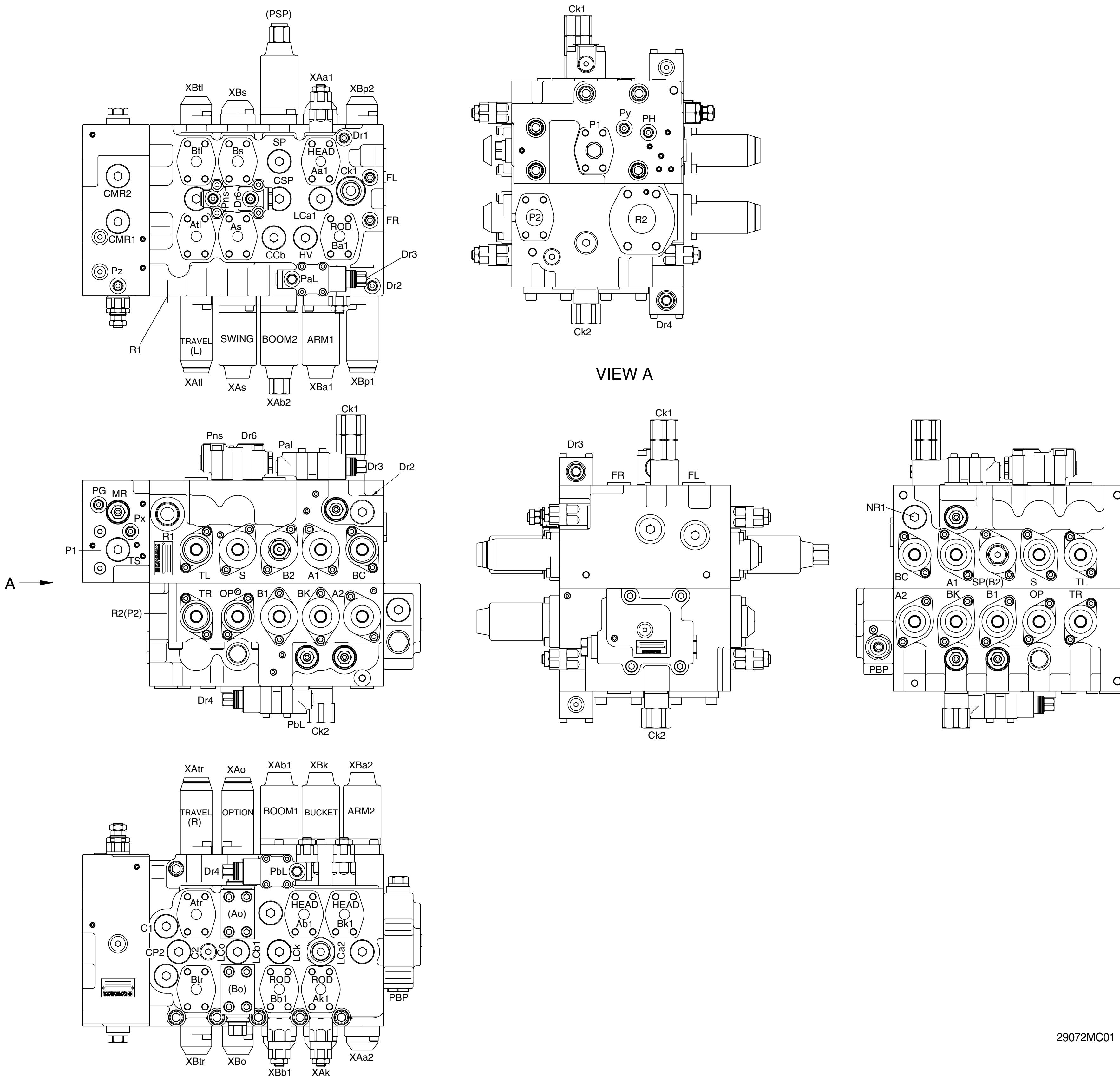
② Adjustment of Qmax cut flow

Adjust it by loosening the hexagon nut(801) and by tightening(or loosening) the adjusting screw QMC(642).

Tightening the screw decreases the Qmax cut flow as shown in the figure.

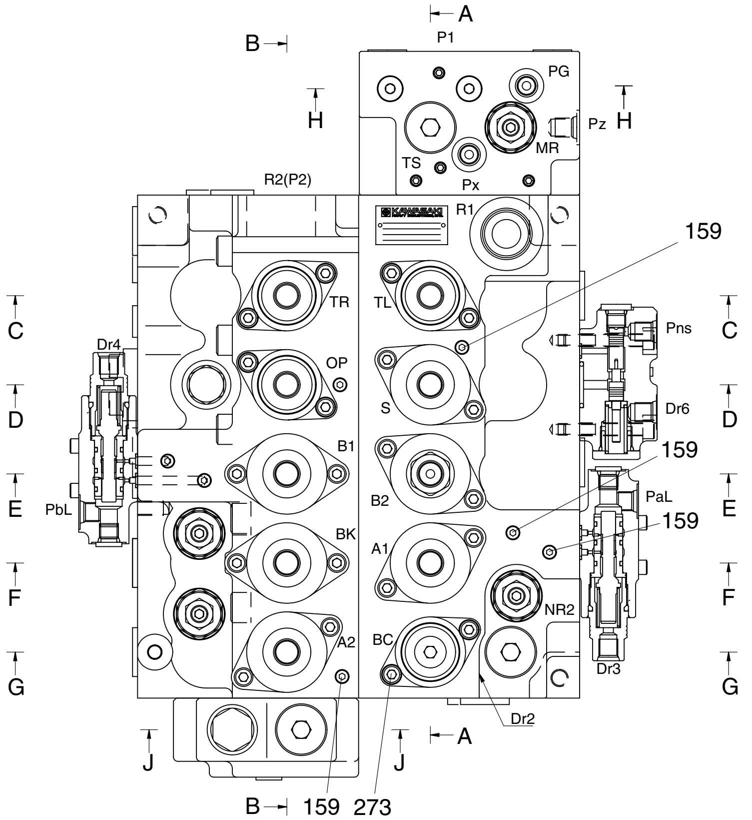


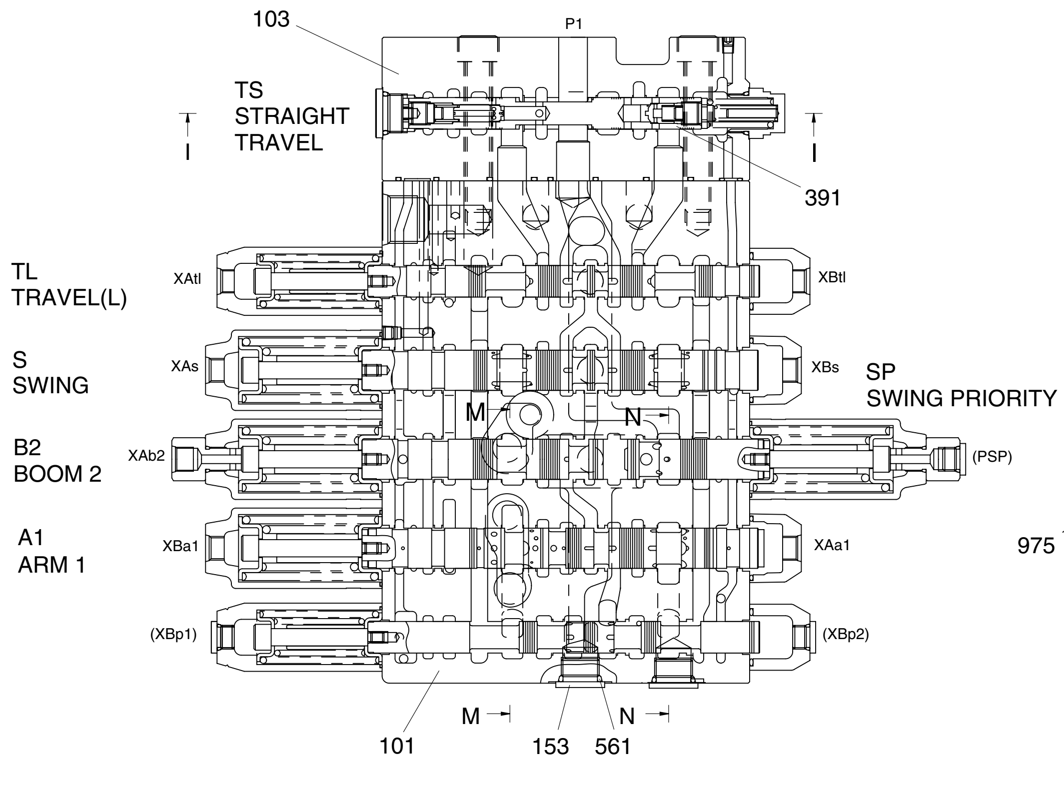
1. STRUCTURE



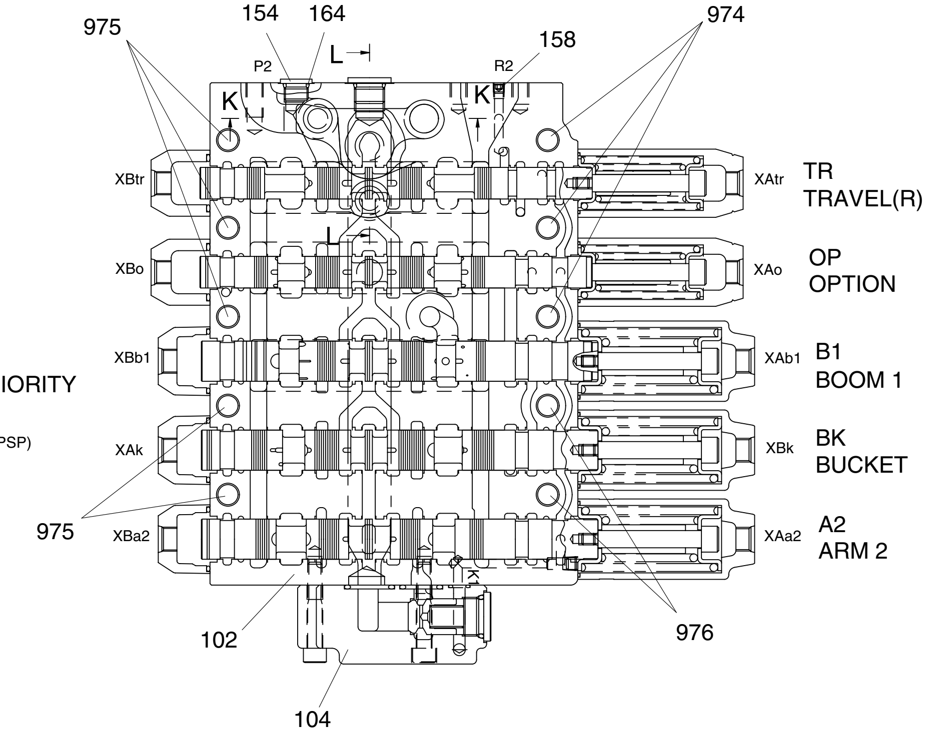
29072MC01

Mark	Port name	Port size	Tightening torque
R1	Make up port for swing	PF 1	20~25kgf · m (115~180lbf · ft)
Ck1 Ck2	Bucket in confluence port Bucket in confluence port	PF 3/4	15~18kgf · m (109~130lbf · ft)
XAtr XBtr XAo XBo XAk XBk XAb1 XBb1 XAa2 XBa2 XAtl XBtl XAs XBs XAa1 XBa1 XAb2 (Psp) (XBp1) (XBp2)	Travel right pilot port Travel right pilot port Option pilot port Option pilot port Bucket out pilot port Bucket in pilot port Boom up pilot port Boom down pilot port Arm in confluence pilot port Arm out confluence pilot port Travel left pilot port Travel left pilot port Swing pilot port Swing pilot port Arm in pilot port Arm out pilot port Boom up confluence pilot port (Swing priority pilot port) (Bucket in confluence pilot port) (Drain port)	PF 3/8	7~8kgf · m (50.6~57.8lbf · ft)
Pz Py PG PH Px Dr1 Dr2 Dr3 Dr4 Dr6 FL FR Pns PaL PbL PBP	Main relief pilot pressure Signal port for travel Pilot pressure port Pilot pressure port Signal for other acutuators Drain port Drain port Drain port Drain port Drain port Negative control signal port(P1 port side) Negative control signal port(P2 port side) Swing logic valve pilot port Lock valve pilot port Lock valve pilot port Drain port	PF 1/4	3.5~3.9kgf · m (25.3~28.2lbf · ft)
Atr Btr (Ao) (Bo) Ak1 Bk1 Ab1 Bb1 Atl Btl As Bs Aa1 Ba1 P1 P2	Travel motor right side port Travel motor right side port Option port Option port Bucket rod side port Bucket head side port Boom head side port Boom rod side port Travel motor left side port Travel motor left side port Swing motor port Swing motor port Arm head side port Arm rod side port Pump port(P1 side) Pump port(P2 side)	M10	5~6.6kgf · m (36.1~47.7lbf · ft)
R2	Return port	M12	8.5~11.5kgf · m (61.5~83.1lbf · ft)

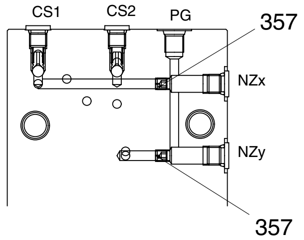




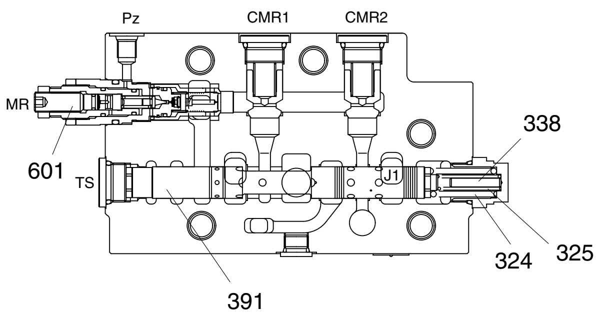
SECTION A-A



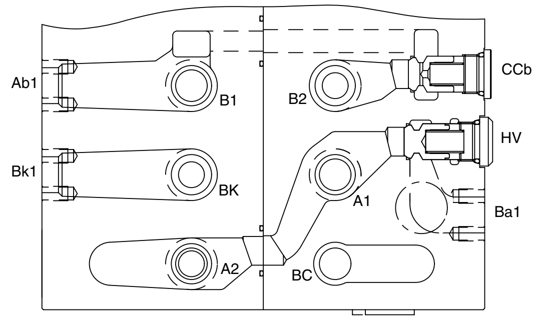
SECTION B-B



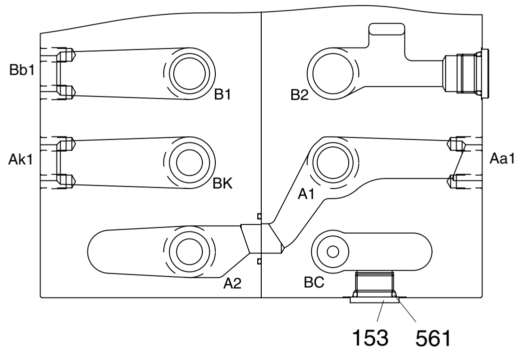
SECTION H-H



SECTION I-I



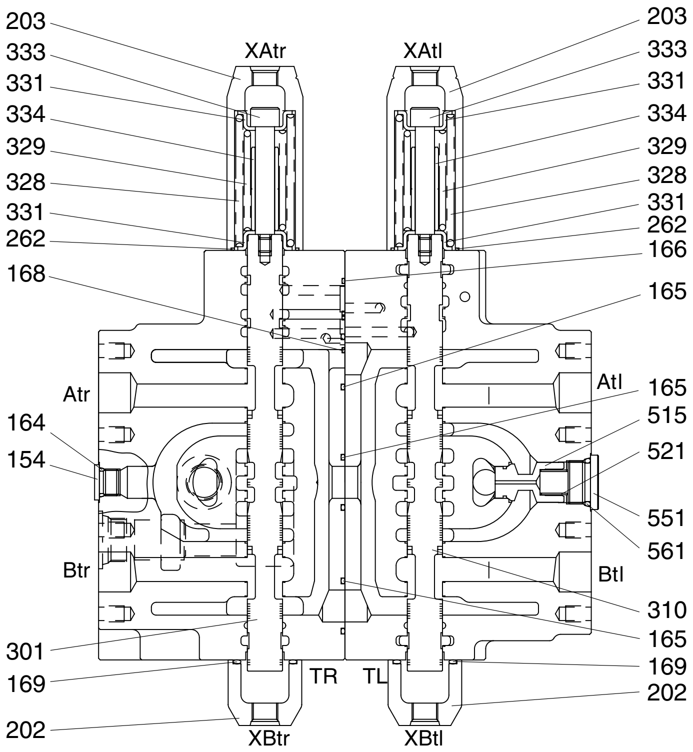
SECTION M-M



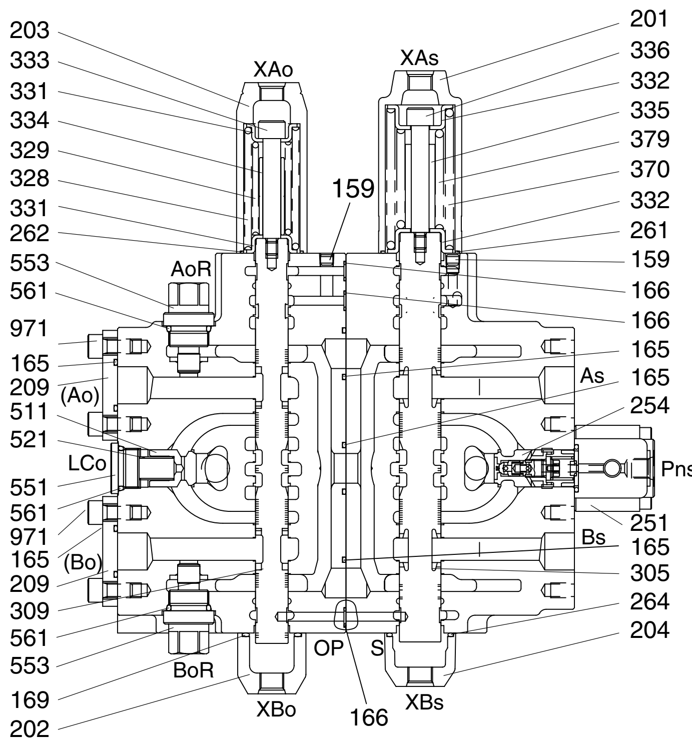
SECTION N-N

29072MC07

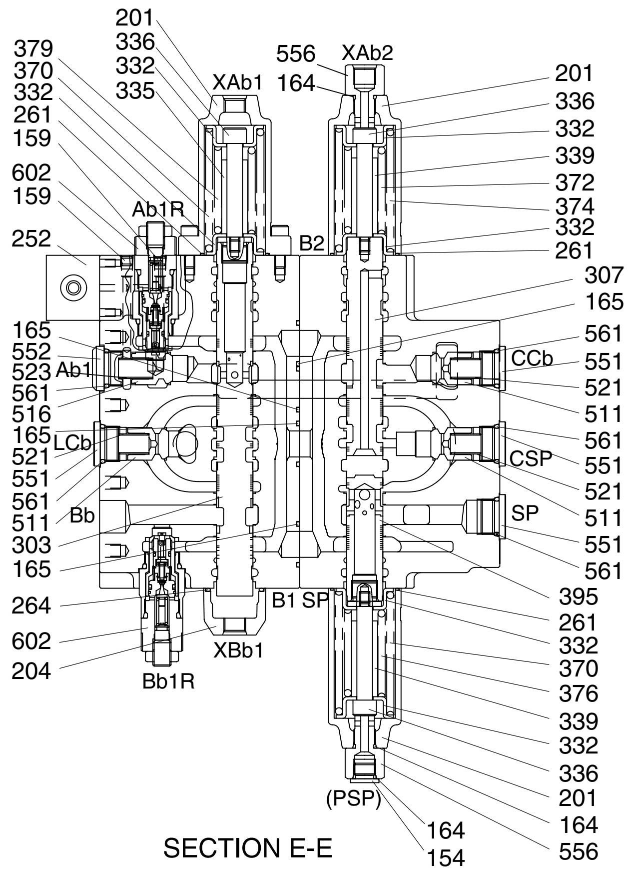
101	Casing A	301	Travel spool	379	Spring
102	Casing B	302	Arm 1 spool assy	391	Straight travel spool
103	Straight travel valve	303	Boom 1 spool assy	392	Bypass cut spool
104	Boom priority valve	304	Bucket spool	395	Swing priority spool
153	Plug	305	Swing spool	401	Spool
154	Plug	306	Arm 2 spool	424	Spring
155	Plug	307	Boom 2 spool	425	Spring
156	Plug	309	Spool(Option)	438	Rod
158	Plug	310	Travel spool	511	Poppet
159	Plug	324	Spring	513	Poppet
163	O-ring	325	Spring	515	Poppet
164	O-ring	328	Spring	516	Poppet
165	O-ring	329	Spring	521	Spring
166	O-ring	331	Spring seat	522	Spring
167	O-ring	332	Spring seat	523	Spring
168	O-ring	333	Bolt	551	Plug
169	O-ring	334	Stopper	552	Plug
201	Cover	335	Stopper	553	Plug
202	Cover	336	Bolt	554	Plug
203	Cover	337	Stopper	555	Check valve assembly
204	Cover	338	Stopper	556	Plug
209	Flange	339	Stopper	561	O-ring
251	Control valve assy	357	Orifice	601	Main relief valve
252	Lock valve assy	370	Spring	602	Port relief valve
254	Swing logic valve assy	372	Spring	611	Nega-con relief valve
261	O-ring	374	Spring	971	Socket screw
262	O-ring	376	Spring	974	Socket screw
264	O-ring	377	Spring	975	Socket screw
273	Socket screw	378	Spring	976	Socket screw



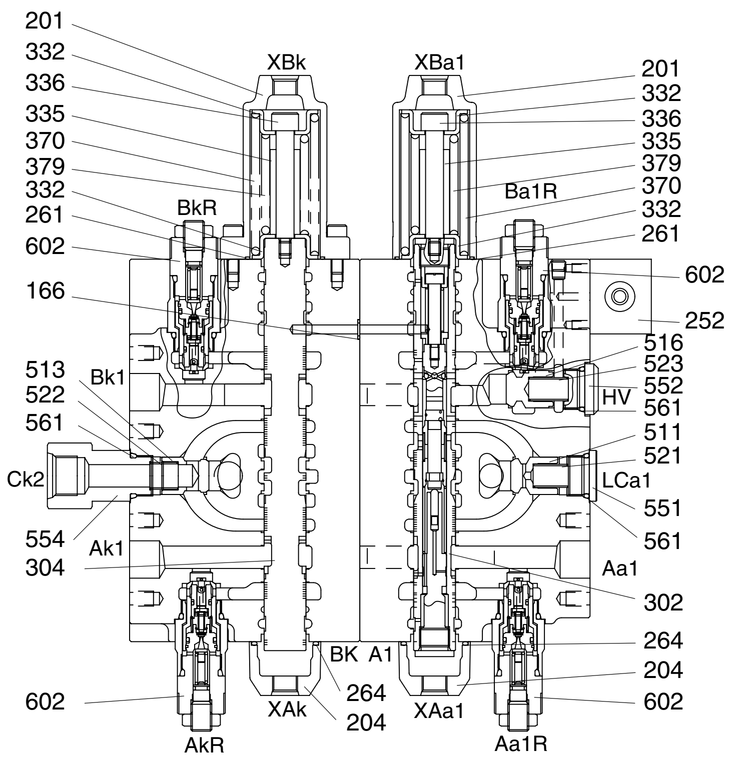
SECTION C-C



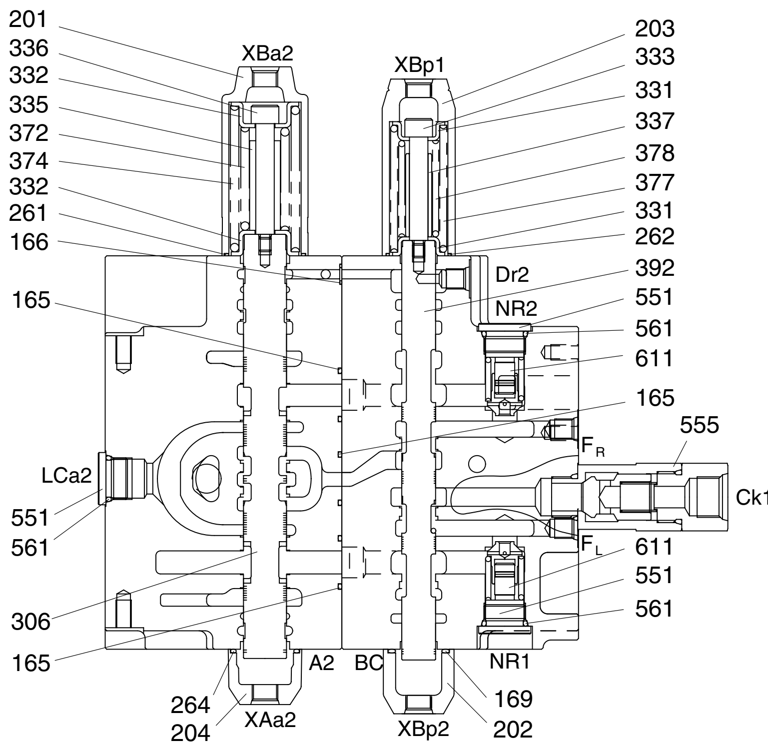
SECTION D-D



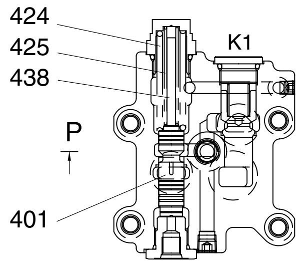
SECTION E-E



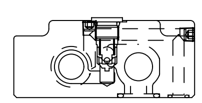
SECTION F-F



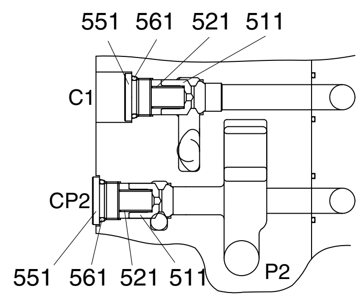
SECTION G-G



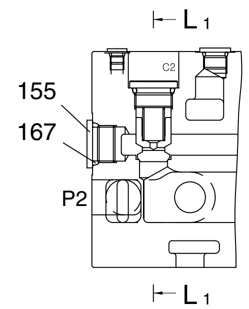
SECTION J-J



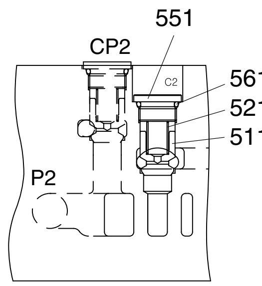
SECTION P-P



SECTION K-K



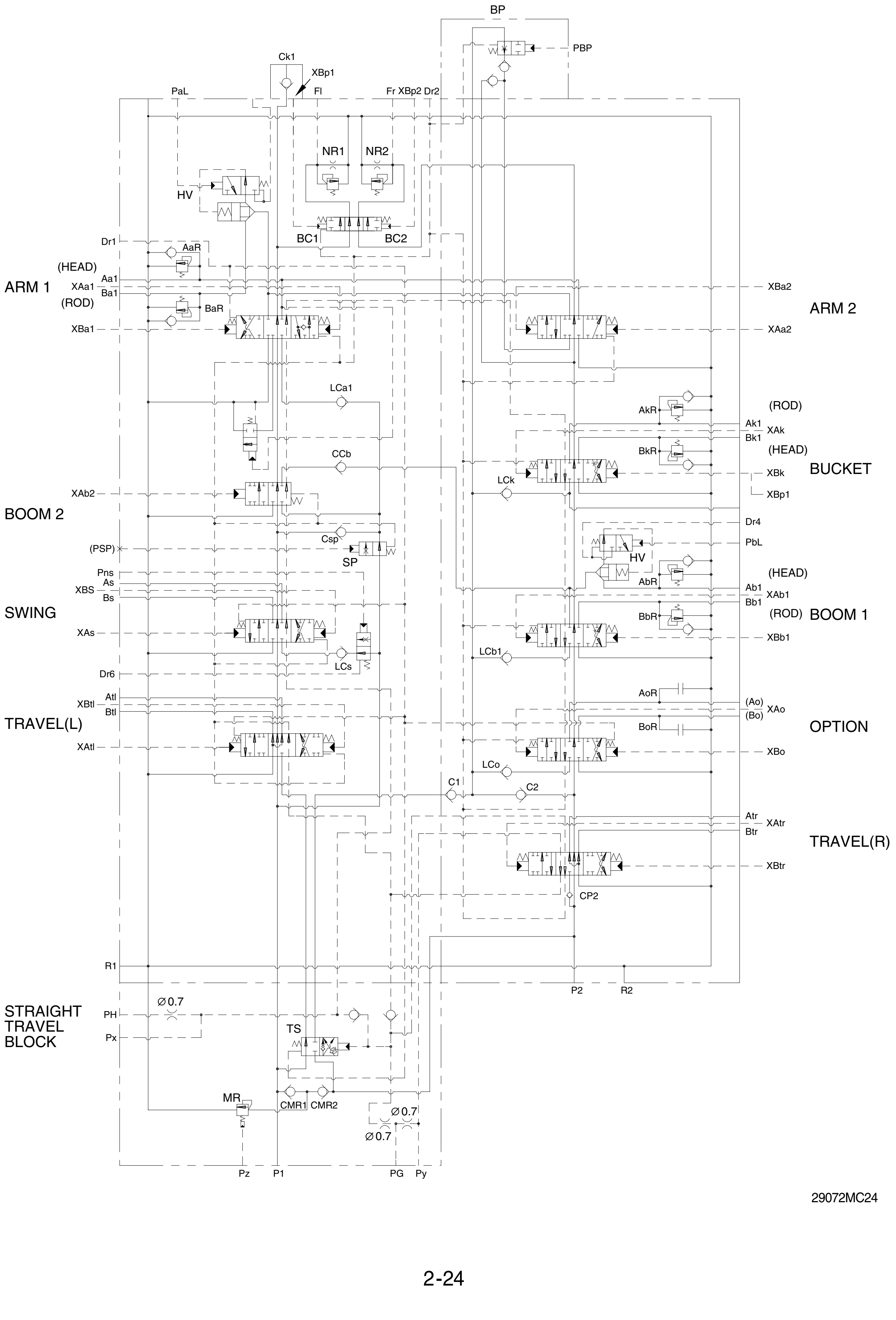
SECTION L-L



SECTION L1-L1

29072MC14

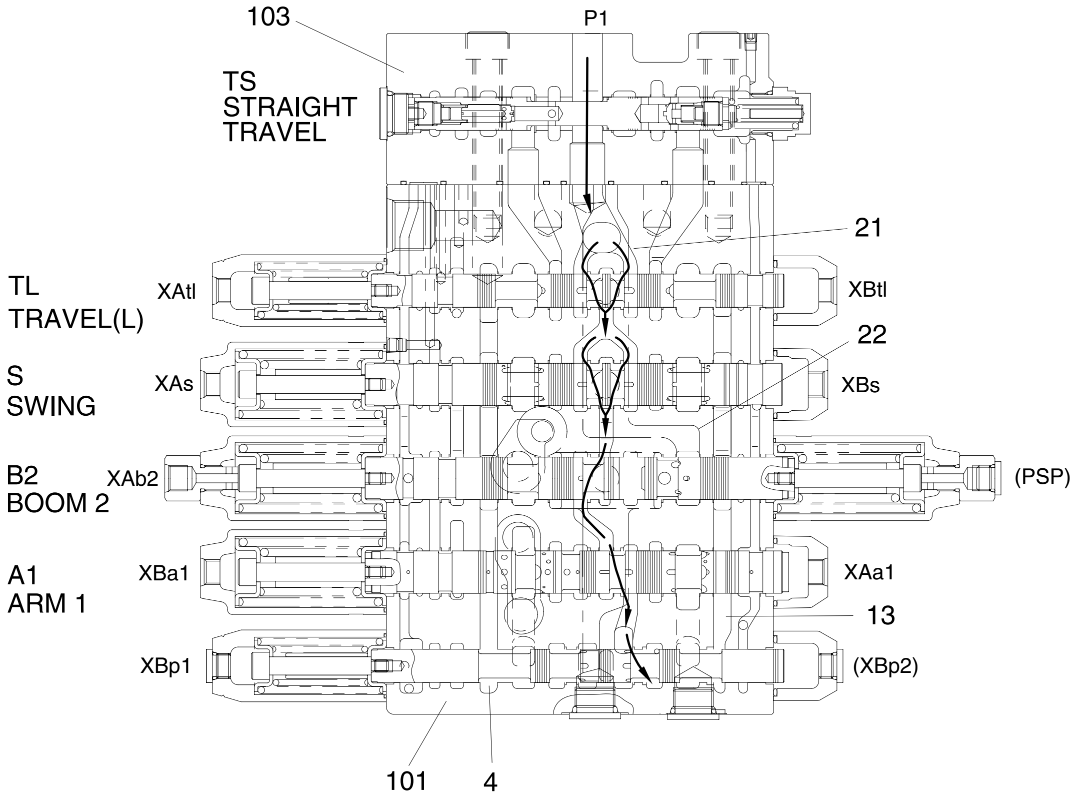
2. HYDRAULIC CIRCUIT



29072MC24

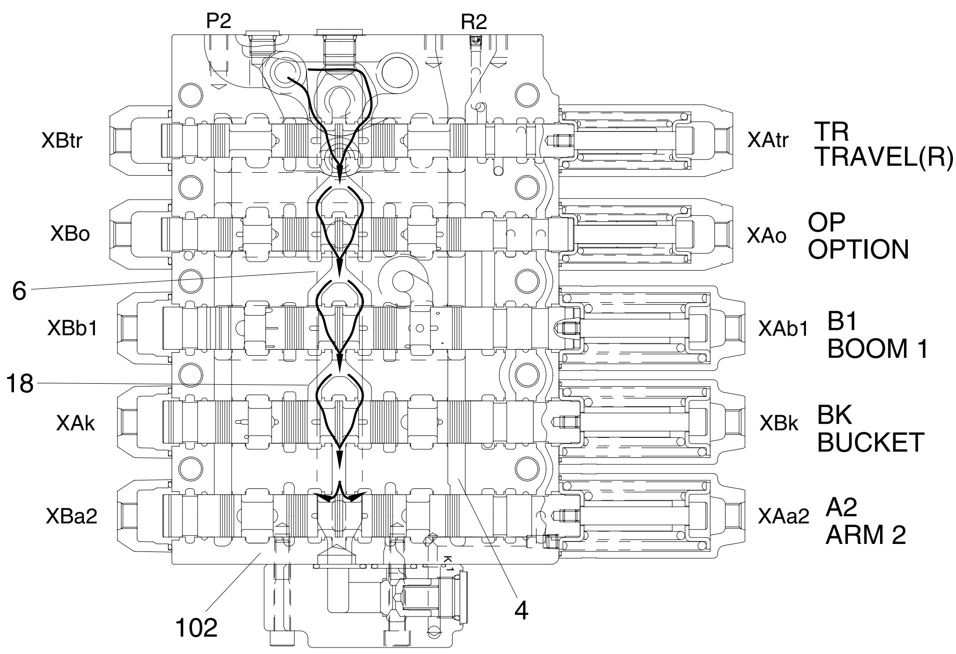
3. FUNCTION

1) CONTROL IN NEUTRAL POSITION



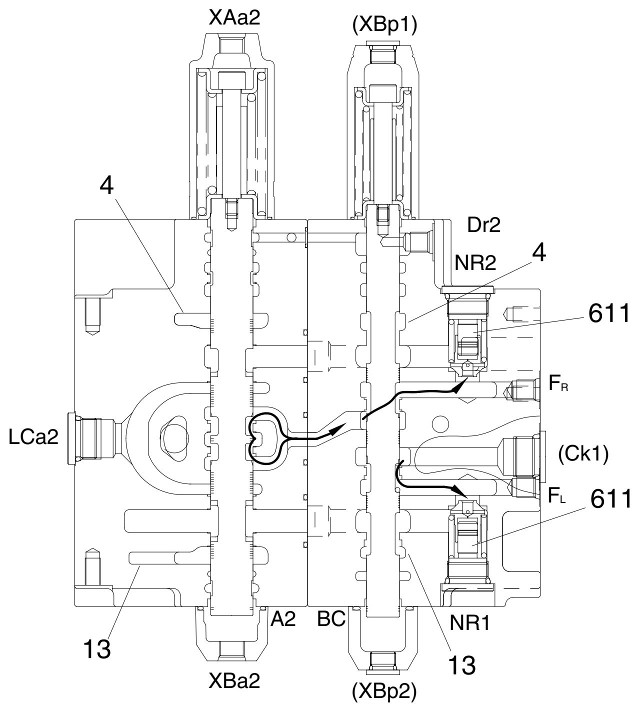
29072MC25

SECTION A-A



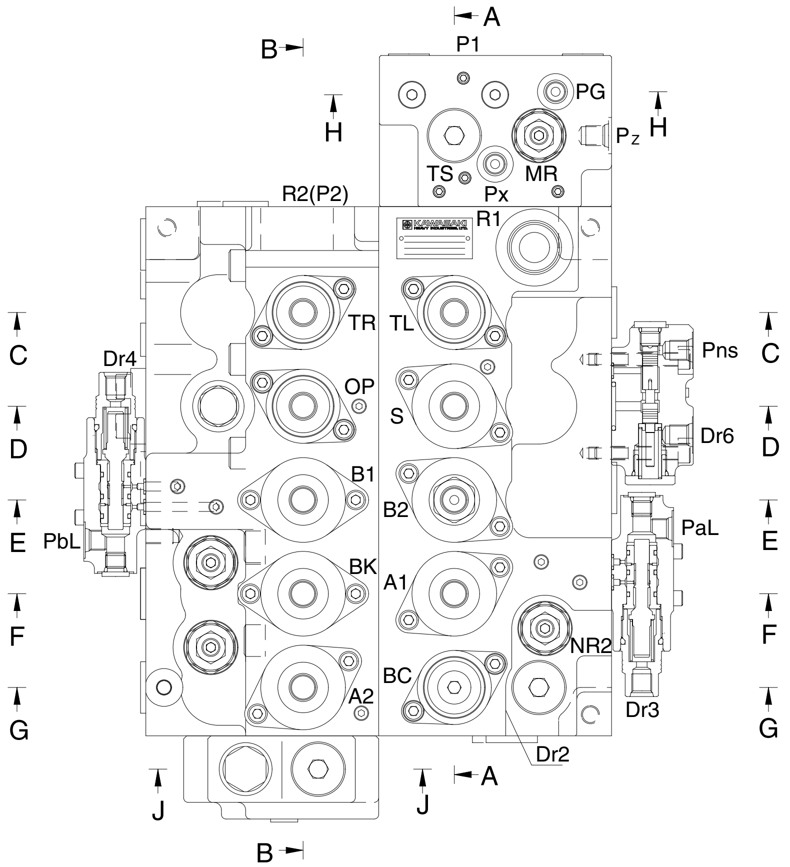
29072MC26

SECTION B-B



29072MC27

SECTION G-G

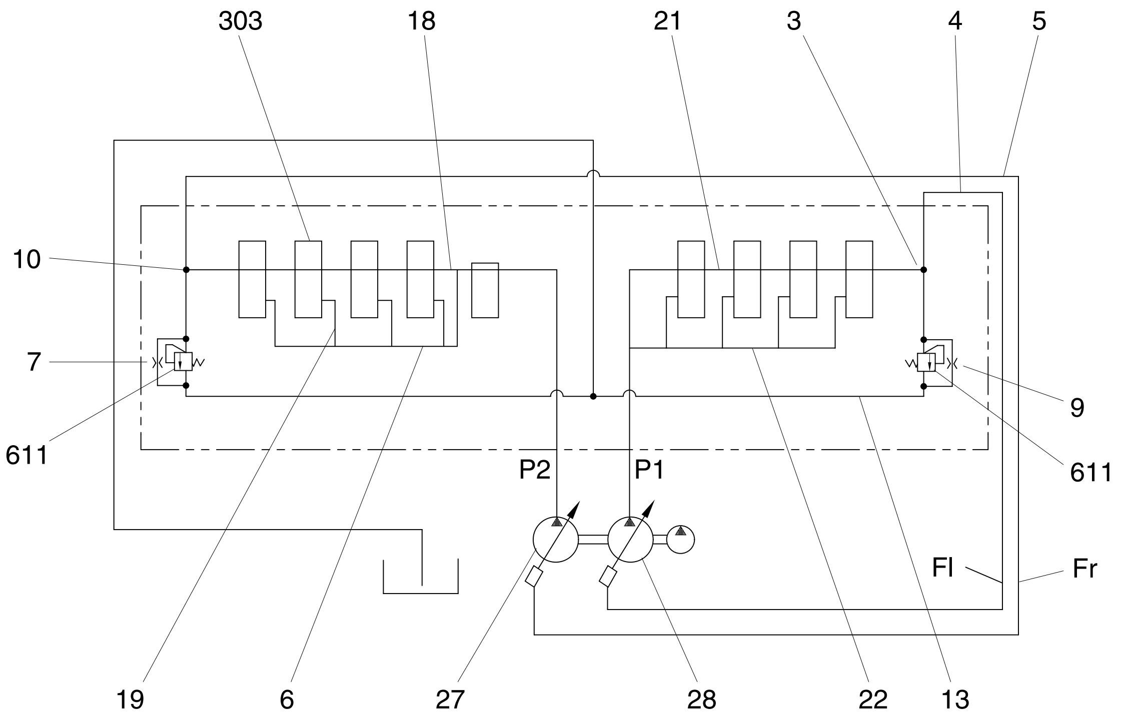


29072MC28

The hydraulic fluid from the pump P1 flows into casing A(101) through the inlet port(P1), through the center bypass(21) and the parallel path(22). The hydraulic fluid from the pump P2 flows into casing B(102) through the inlet port(P2) through the center bypass(18) and the parallel path(6).
The hydraulic fluid from the pump P1 is directed to the tank through the center bypass(21), negative control orifice(NR1), the return path(13) and the return port(R2). The hydraulic fluid from the pump P2 also flows to the tank through the center bypass(18), negative control orifice(NR2), return path (4) and return port(R2). The hydraulic fluid in paths (6) and (22) is blocked and cannot return to the tank.
In case a control lever is operated, the hydraulic fluid from the pump P2 is supplied to the travel right spool(301) from path(18) and to the spools: option(309), boom1(303), bucket(304) and arm2(306) from path(6). Additionally, the hydraulic fluid from the pump P1 is supplied to the travel left spool (310) from path(7) while the swing(305), boom2(307) and arm(302) spools are supplied from path(22).

2) NEGATIVE CONTROL

(1) General operation

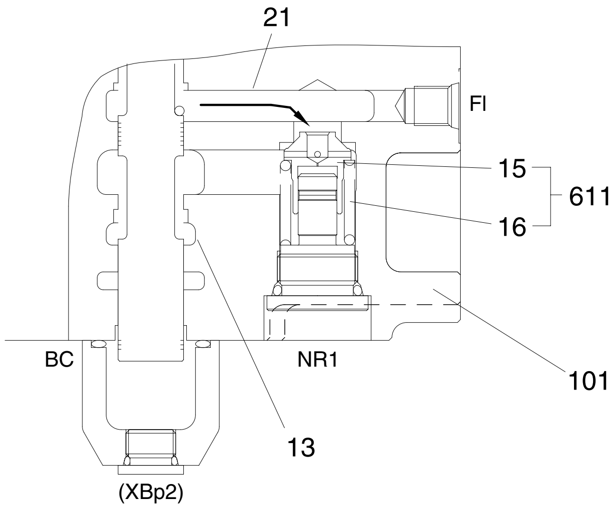


29072MC29

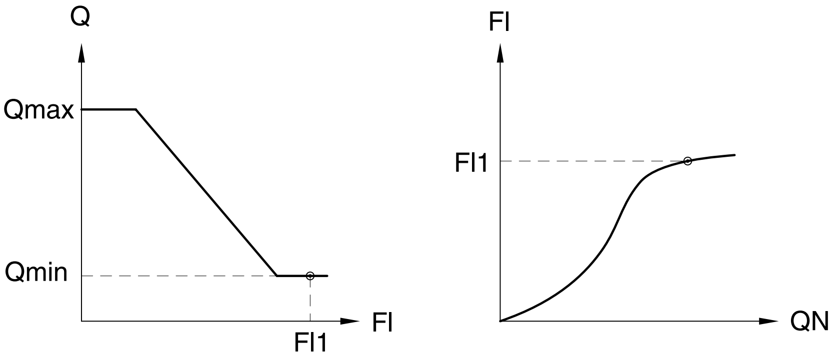
The negative control signal pressure from the center bypass(18, 21) occurs in the following cases and controls the discharge of the pump.

1. Neutral condition when no function is being actuated.
2. The pilot control lever is partially operated.

The hydraulic fluid of the pump P1(28) flows into the return passage(13) through the center bypass (21), the path(3) and orifice(9)(Within the poppet(15)). The restriction caused by this orifice thereby pressurizes path(3). This pressure is transferred as the negative control signal pressure Fl to the pump P1 regulator through the negative control line(4). It controls the pump regulator so as to decrease the discharge of the pump P1(28).



29072MC30

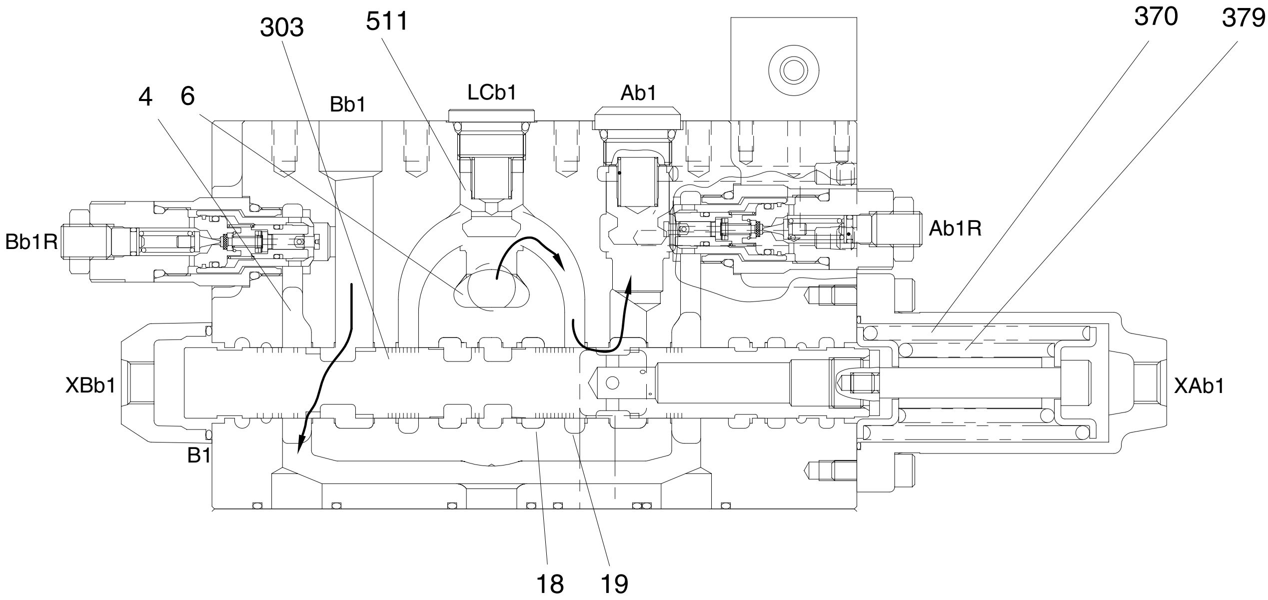


29072MC31

The negative control relief valve(611) consists of poppet(15), spring(16) and casing(101). When the hydraulic fluid in the center bypass increases to the level that the pressure in the path(3) reaches the set pressure of the spring(16), the hydraulic fluid in the path(3) pushes open the poppet (15) and escapes into the return path(13).

In the unloaded state, the hydraulic fluid of the pump P1(28) entirely flows to the tank through the path(21), orifice(9) and the return path(13). Therefore the pressure FI in the path(3) becomes maximum(FI1) because all the discharge is reduced by the orifice(9) which in turn destrokes the pump P1(28) so as to minimize the tilting angle and consequent discharge of the pump P1(28). (Qmin)

(2) Negative control(With fine metering)



29072MC32

In the case, for example, when the pilot control lever for main boom is slightly operated, the pilot pressure XAb1 shifts the main boom spool(303) partially in the left direction. So the path(19) is partially opened and the center bypass(18) is shut slightly. The hydraulic fluid thereby separates. One part flows via the orifice(7) through the path(18) and the other portion flows into the parallel path(6), the path(19) and the port Ab1. The flow from the path(18) through the orifice(7) decreases slightly and the pressure Fr in the path(10) thereby also slightly decreases. As the pressure Fr becomes lower, the discharge of the pump P2(27) increases. With the pilot control lever shifted even more the path(18) is shut off by the shifting of the spool(303) and then the flow through the bypass becomes zero. The pressure in the path(10) becomes zero and the discharge of the pump P2(27) becomes maximum.(Qmax)

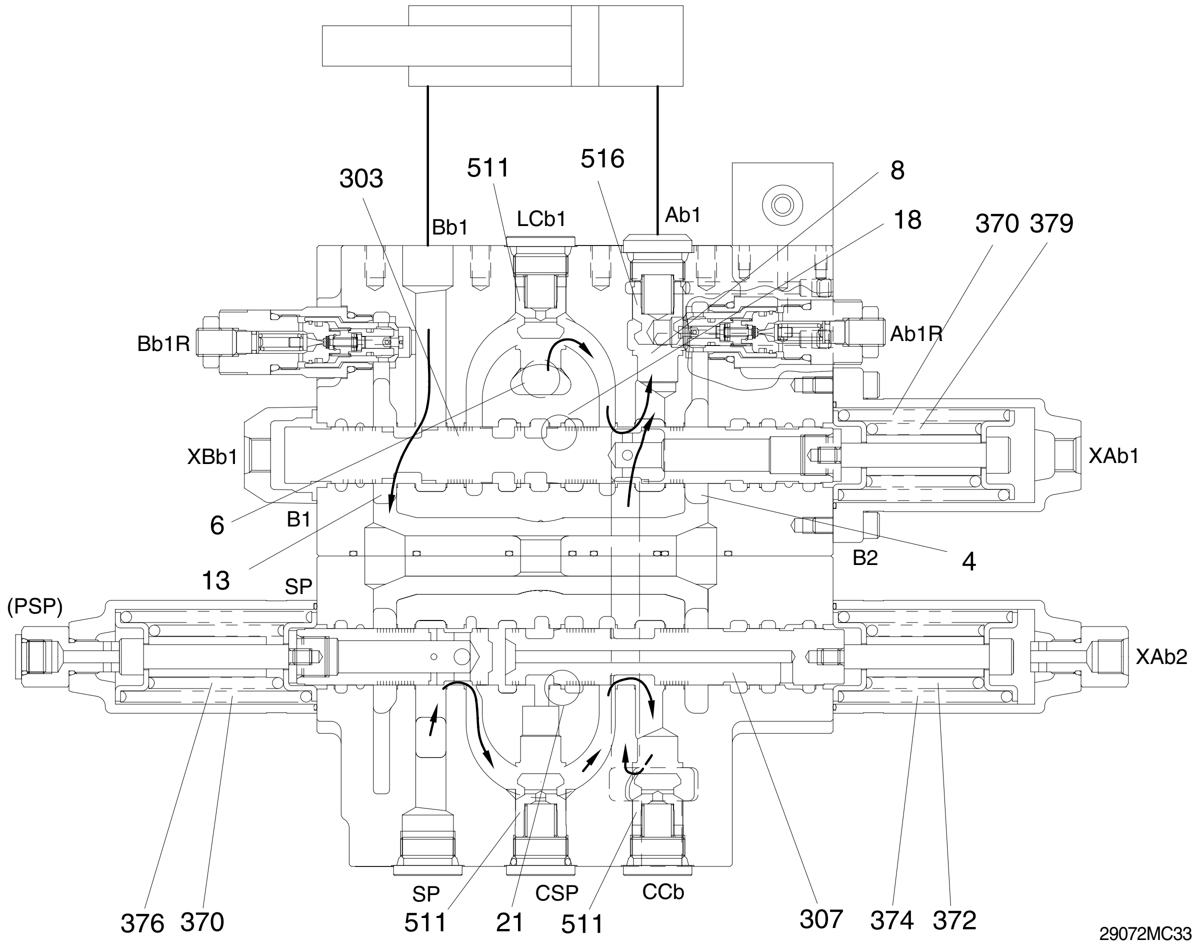
Because the discharge of the pump is adjusted by operating the pilot control lever slightly, the precise moving of the actuator is realized.

For the pump P1(28) the same negative control principle of operation occurs utilizing the orifice(9).

3) EACH SPOOL OPERATION

(1) Boom control

① Boom up operation



The main boom up operation becomes fast because the hydraulic fluid from the pump P2 that is directed to the port P2 is combined in the casing that of the pump P1 which enters port P1. The confluence flow is supplied to the head side of the boom cylinder. In low speed operation, only the boom1 spool(303) operates and is supplied with hydraulic fluid from the pump P2.

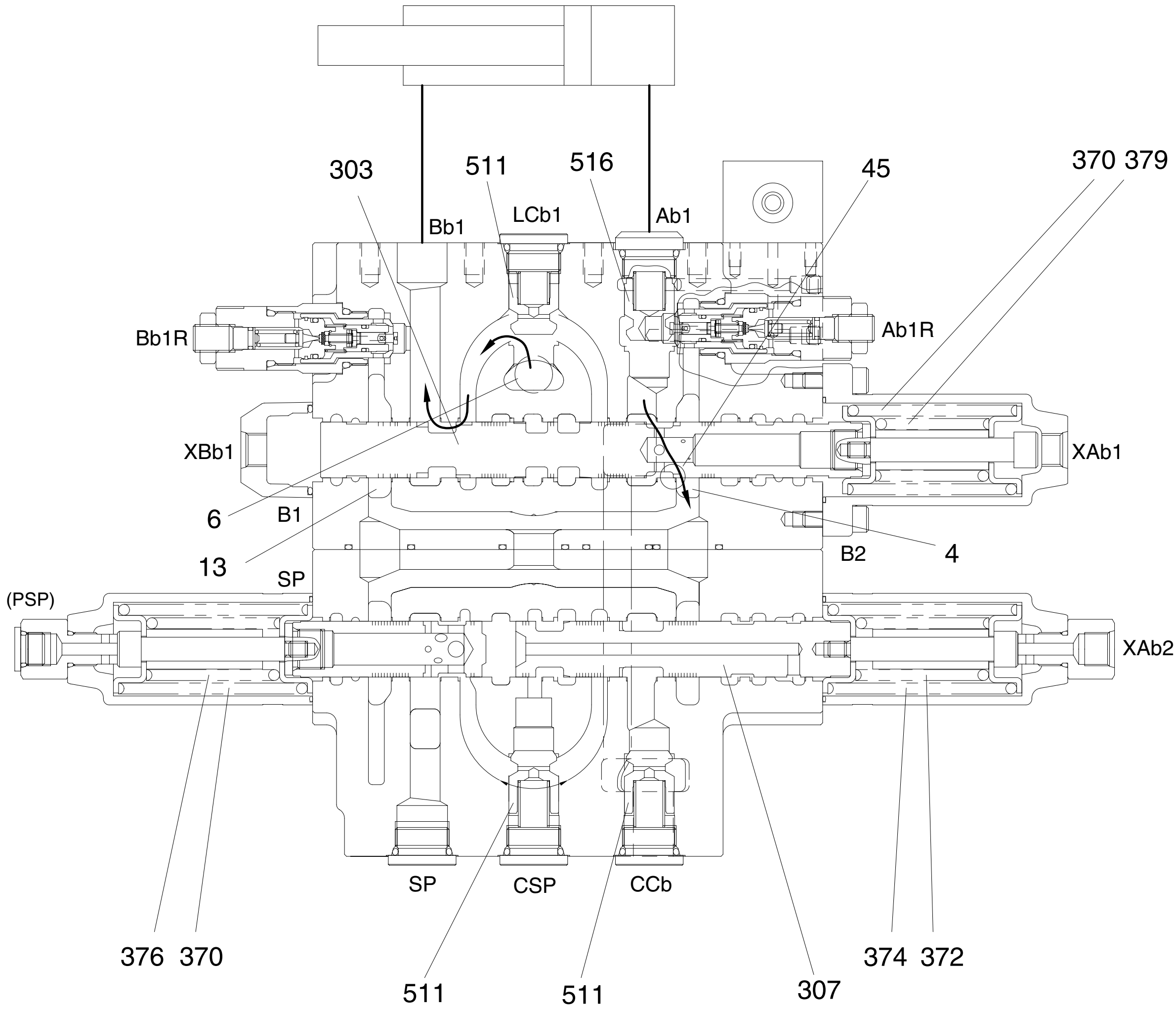
The hydraulic fluid from the pump P2 flows into the boom1 spool(303) through port P2 and parallel path(6). The hydraulic fluid from the pump P1 flows to the boom2 spool(307) through pump port P1 and the parallel path(22).

During the boom up operation, the pilot pressure from the pilot control valve is supplied into the port XAb1 and shifts the boom1 spool(303) in the left direction against the springs (370) and (370). The hydraulic fluid from the pump P2 enters the parallel path(6) and then passes through the load check valve LCb1(511) and boom1 spool(303) and check valve HV(516) then flows into the port Ab1. Following this it flows into the head side of the boom cylinder.

At the same time, the pilot pressure through the port XAb2 shifts the boom2 spool(307) in the left direction against the springs (374) and (372). The hydraulic fluid from the pump P1 enters via the parallel path(22) and center bypass(21), then passes through the load check valve CSP(511), boom2 spool(307) and the load check valve CCb(511). Then flows combine in path(8) and are directed to port Ab1 and the head side of the boom cylinder.

The flow from the rod side of the boom cylinder returns to the boom1 spool(303) through the port Bb1. Thereafter it is directed to the return port R2 through path(13).

② Boom down operation



29072MC34

During the boom down operation, the pilot pressure from the pilot control valve is supplied to port XBb1 and PbL and shifts the boom1 spool(303) in the right direction against the springs (370) and (379).

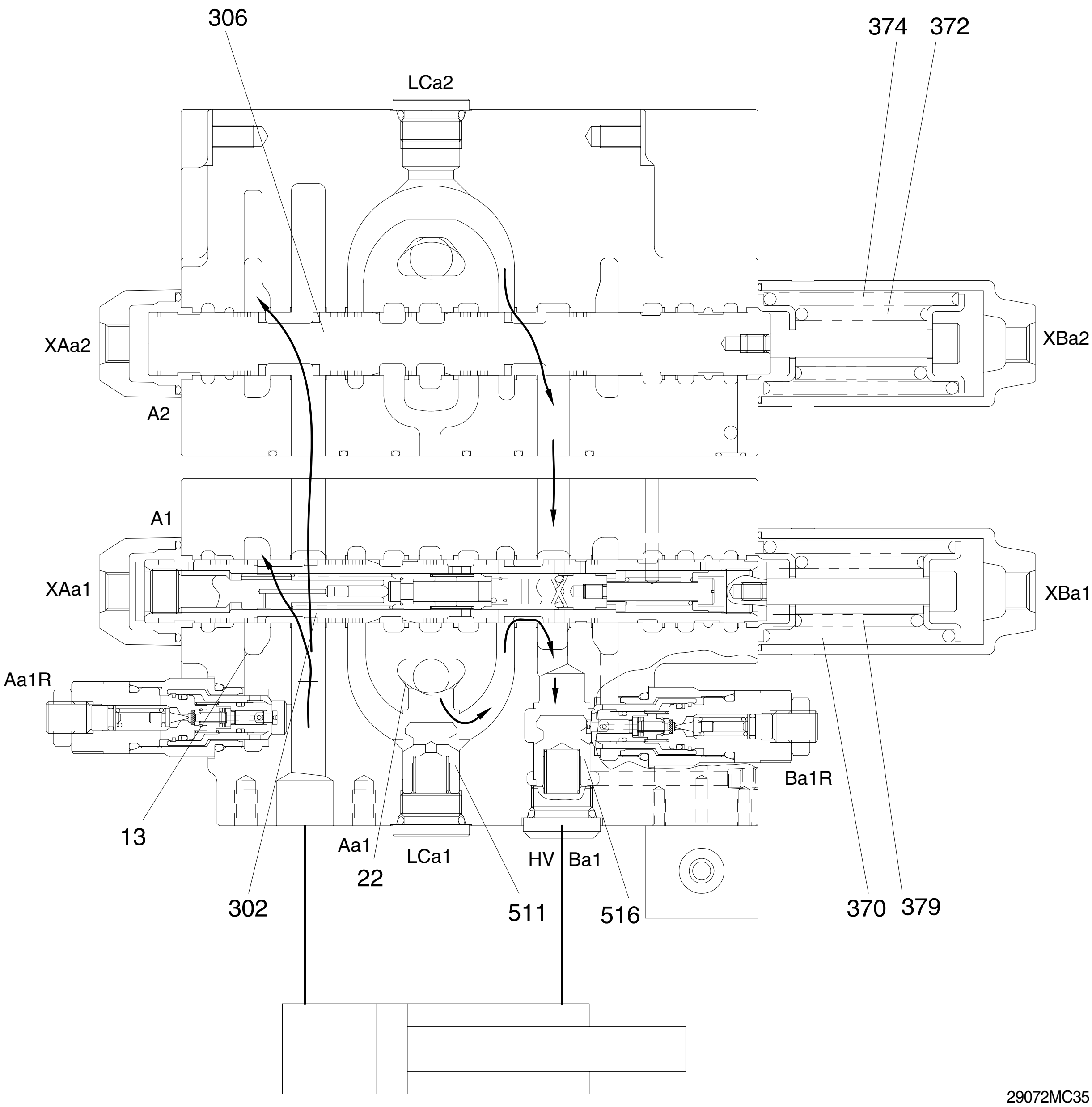
The hydraulic fluid from the pump P2 enters the parallel path(6) and is directed to the port Bb1 through the load check valve LCb1(511). Following this is flows into the rod side of the boom cylinder.

The return flow from the head side of the boom cylinder returns to the boom1 spool(303) through the port Ab1. Thereafter it is directed to the return port R2 through path(4).

Additionally, the return flow is restricted in path(45), which lowers the boom cylinder at a suitable speed.

(2) Arm control

① Arm roll out operation

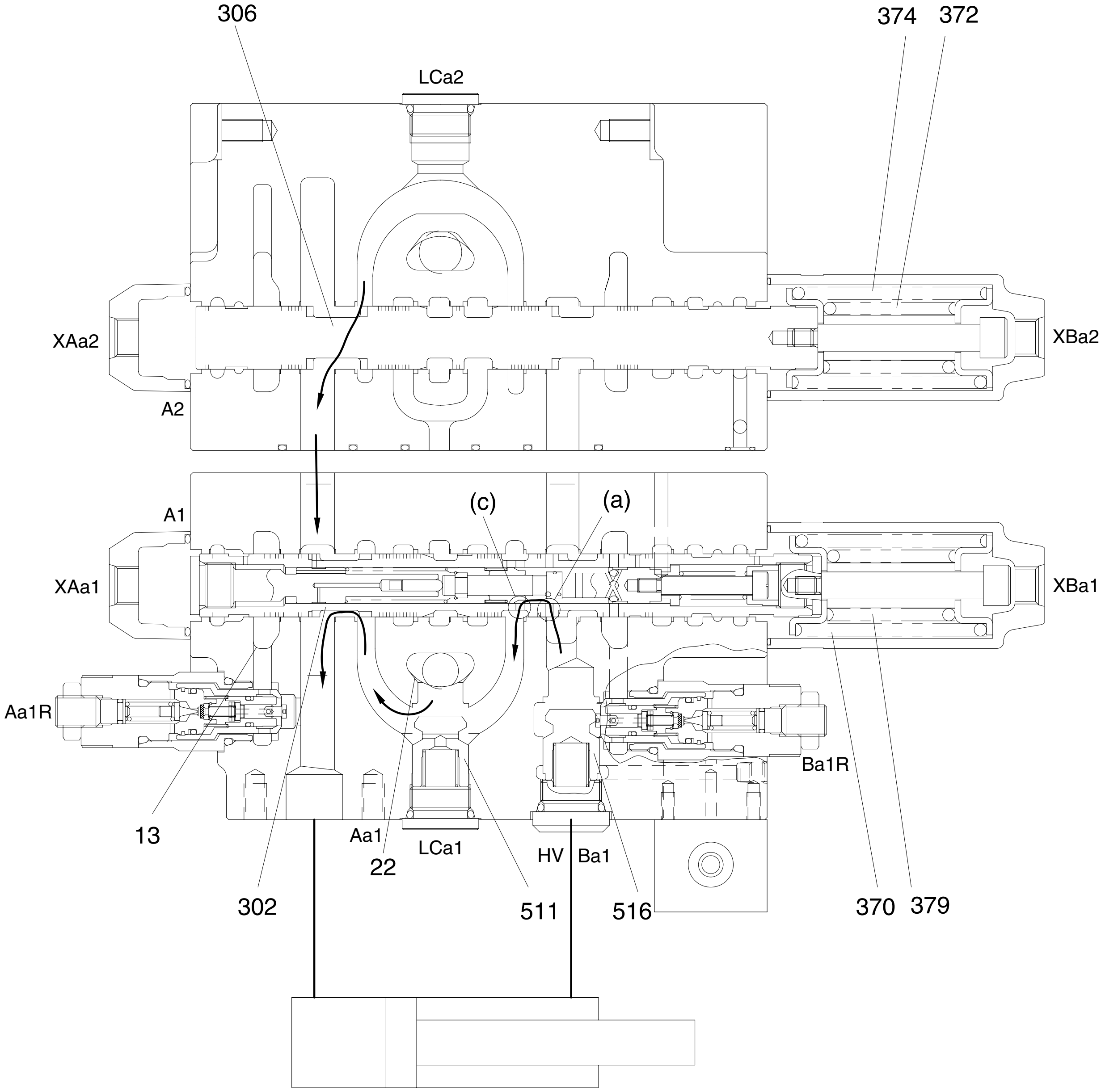


During the arm roll out operation, the pilot pressure from the pilot control valve is supplied to the pilot ports(XBa1& XBa2) and shifts the arm1 spool(302) in the left direction against the springs (370) and (379) and shifts the arm2 spool(306) in the left direction against the springs (374) and (372). The hydraulic fluid from the pump P1 flows through the load check valve LCa1(511), lock valve HV(516), and then through parallel path(22). It is then directed to the rod side of the arm cylinder through the port Ba1.

At the same time, the pilot pressure through the port XBa2 shifts the arm2 spool(306) in the left direction against the springs (374) and (372). The hydraulic fluid from the pump P2 enters via the parallel path(22) and center bypass(21), then passes through the check valve of the boom priority valve(104), arm2 spool(306). The flows are combined and directed to port Ba1 and the rod side of the arm cylinder. The flow from the head side of the arm cylinder returns to the arm1 spool(302) through the port Aa1. Thereafter it is directed to the return port R2 through path(13).

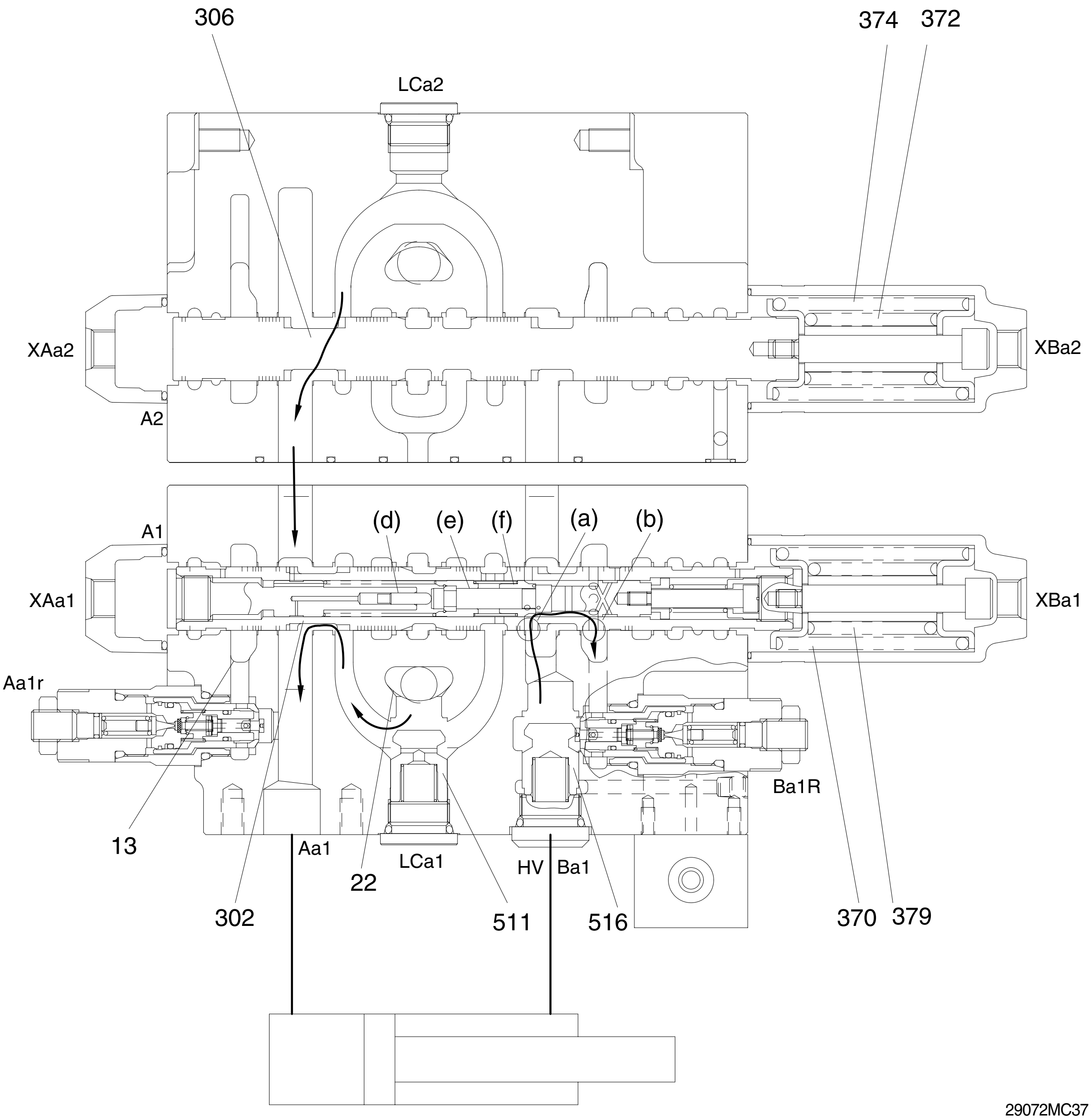
② Arm roll in operation

· During light load only



29072MC36

· **The pressure in the arm cylinder head side increases**

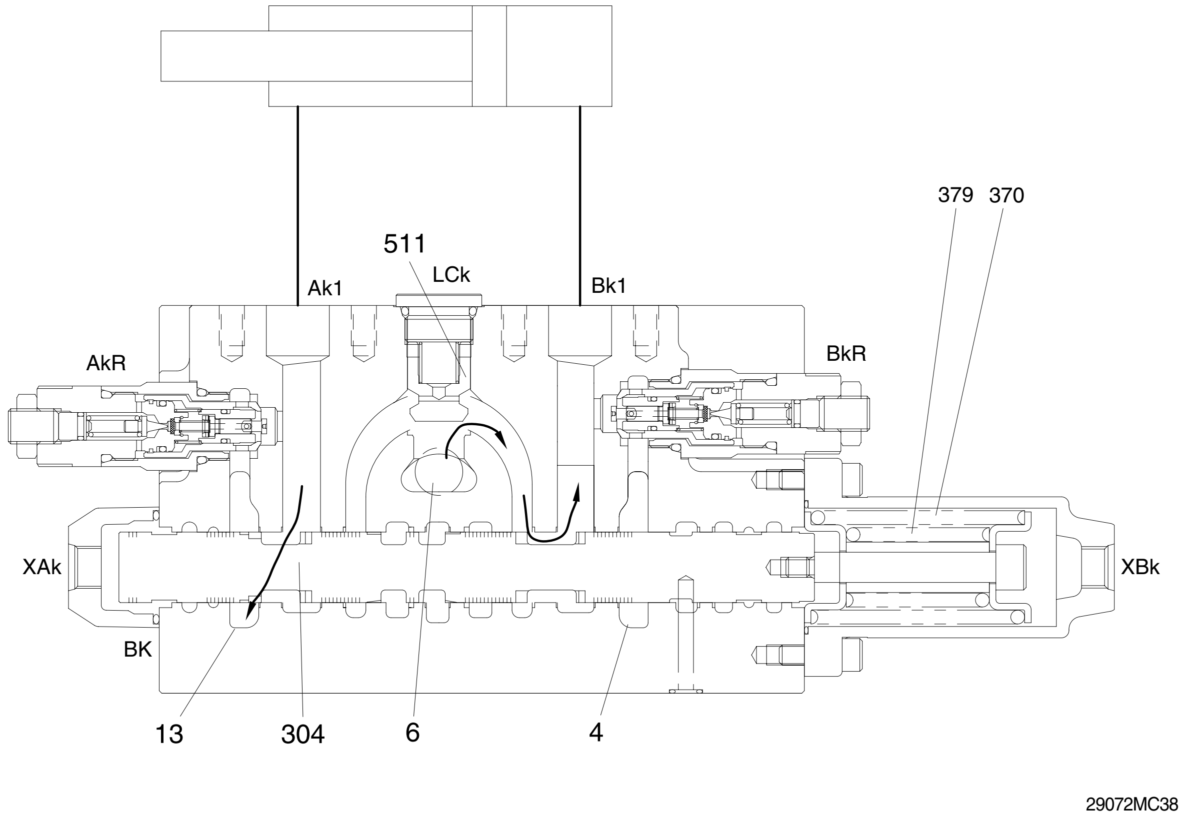


During the arm roll in operation, the pilot pressure from the pilot control valve is supplied to the ports XAa1, XAa2 and PaL and shifts the arm1 spool(302) in the right direction against the springs (370) and (379) and shifts the arm2 spool(306) in the right direction against the springs (384) and (372).
During the arm roll in operation, the hydraulic fluid from the pump P1 flows into the arm1 spool(302) through the parallel path(22). Then it enters into the head side of the arm cylinder through the load check valve LCa1(511), check valve HV(516) and port Aa1.
At the same time, the hydraulic fluid from the pump P2 flows into the arm2 spool(306) through the parallel path(22). Then it enters into the head side of the arm cylinder through the check valve of boom priority valve(104) and port Aa1.

The return flow from the rod side of the arm cylinder is pressurized by self-weight of arms and so on, and returns to port Ba1. The pressurized oil returning to port Ba1 enters into the arm1 spool through the outside of the arm1 spool. During a light load only, it pushes open the sleeve check valve, flows the parallel path reversely from spool hole(c), and joints into port Aa1. This is called the arm regeneration function.
When the pressure in the arm cylinder head side increases, the piston(d) and sub spool(e) are transferred in the right direction, and at the same time the sleeve check valve(f) is from the arm cylinder rod side enters flow port Ba1 through the periphery hole(a) of the arm1 spool into the spool, flows out through the periphery hole(b) of the spool, and returns through the tank port R2 to the hydraulic oil tank.

(3) Bucket control

① Bucket roll in operation

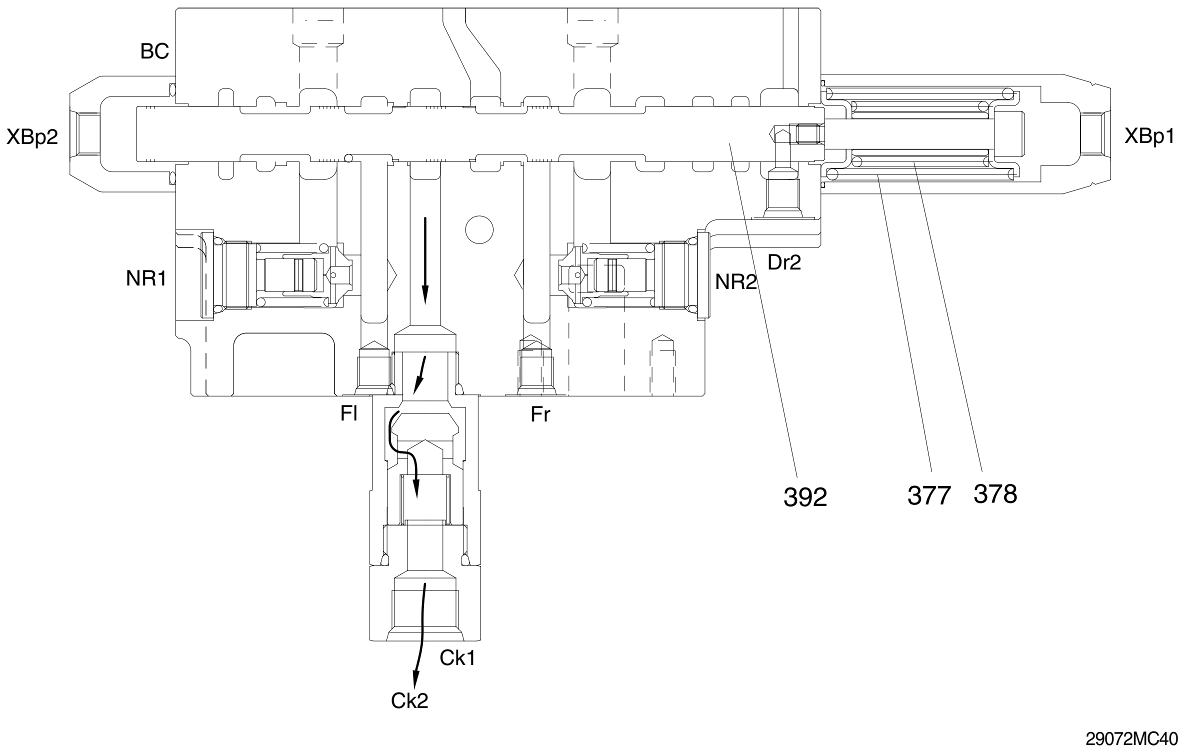


During the bucket roll in operation, the pilot pressure from the pilot control valve is supplied to port XBk and shifts the bucket spool(304) in the left direction against the springs (370) and (379).

The hydraulic fluid from the pump P2 enters the parallel path(6) and is directed to the port Bk1 through the load check valve LCk(511). Following this it flows into the head side of the bucket cylinder.

The retutn flow from the rod side of the bucket cylinder returns to the bucket spool(304) through the port Ak1. Thereafter it is directed to the return port R2 through path(13).

② **Bucket confluence operation**



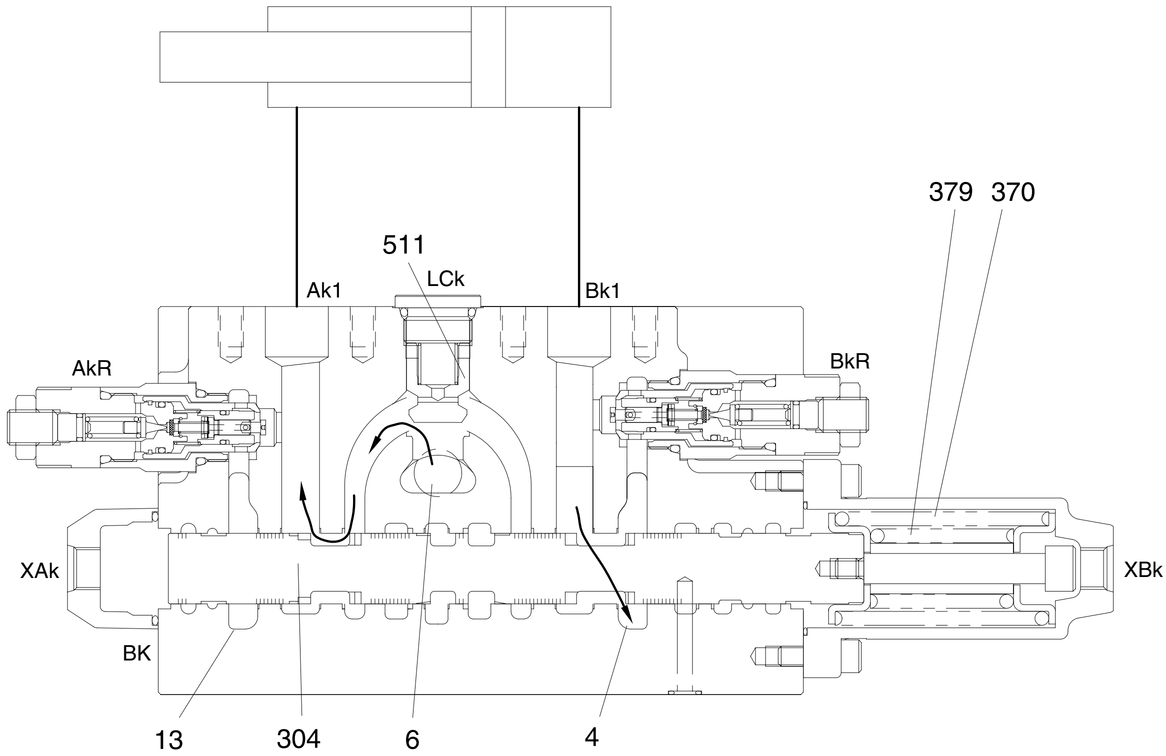
During the bucket roll in operation, the pilot pressure from the pilot control valve is supplied to port XBp1 and shifts the bypass cut spool(392) in the left direction against the springs(392) in the left direction against the springs (377) and (378).

The hydraulic fluid from the pump P1 enters the center bypass path(21).

But bypass path is shut off by the bypass cut spool. Therefore the hydraulic fluid is directed to port Ck2 after passing through the check valve Ck1.

Then the fluid is directed to the bucket spool(304).

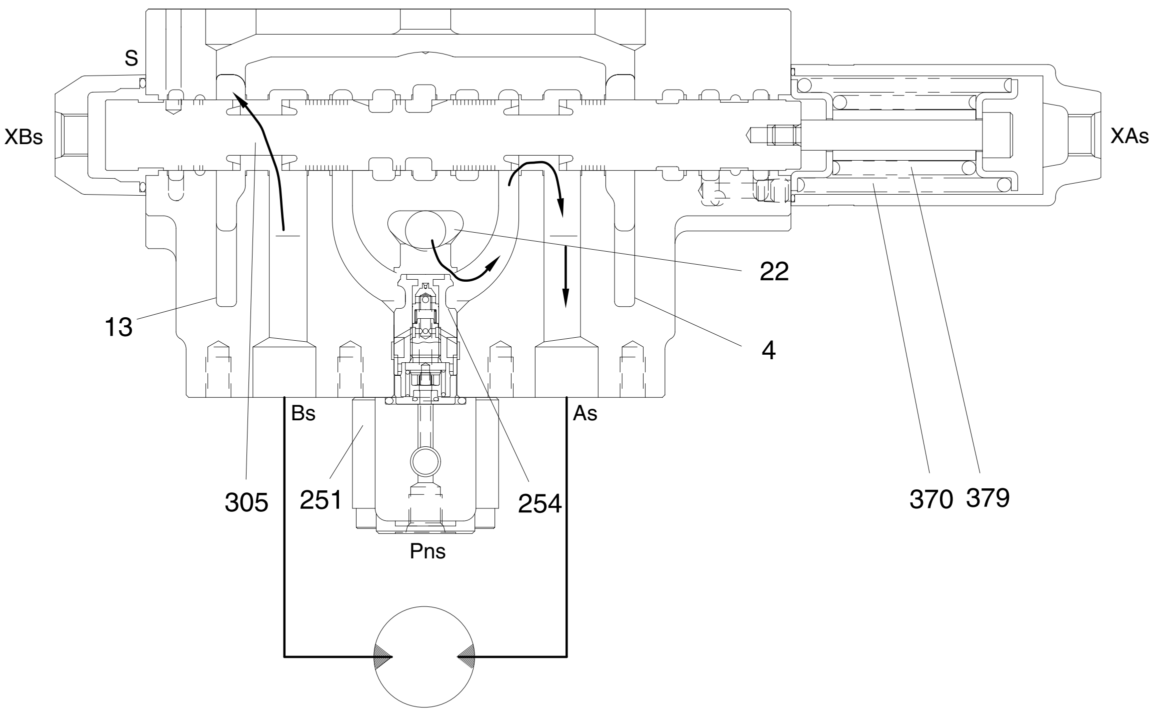
③ Bucket out operation



29072MC39

During the bucket roll out operation, the pilot pressure from the pilot control valve is supplied to port XAk and shifts the bucket spool(304) in the right directed agains the springs (370) and (370).
The hydraulic fluid from the pump P2 enters the parallel path(6) and is directed to the port AK1 through the load check valve LCk(511). Following this it flows into the rod side of the bucket cylinder.
The return flow from the head side of the bucket cylinder returns to the bucket spool(304) through the port Bk1. Thereafter it is directed to the return port R2 through path(4).

(4) Swing control

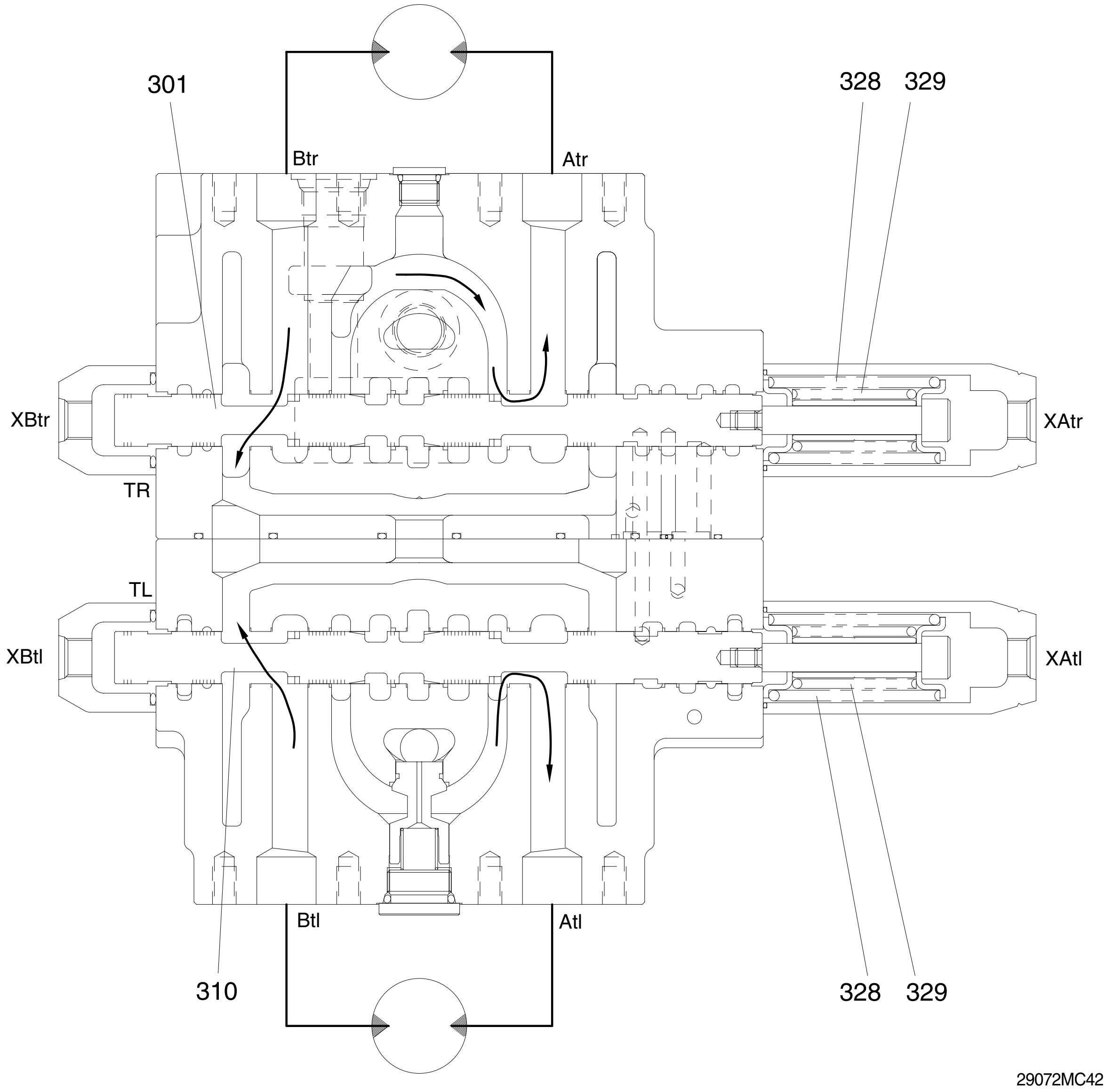


29072MC41

During the swing right or left operation, only the hydraulic fluid of the pump P1 is supplied to the swing motor.

The pilot pressure from the pilot control valve is supplied to the port XAs and shifts the swing spool (305) in the left direction against springs (370) and (379). Hydraulic fluid from the pump P1 flows into the swing spool(305) through the parallel path(22). Then it is directed to the swing motor through the check valve LCs(254) and the port As. As a result, the swing motor turns and the return flow from the swing motor enters port Bs. The flow from the motor returns to the tank port R2 through the swing spool(305) and path(13). In the case of the opposite operation, the operation is similar.

(5) Travel control



During the travel operation, the hydraulic fluid of the pump P1 is supplied to the travel motor and the hydraulic fluid of the pump P2 is supplied to the other travel motor.

The pilot pressure from the pilot control valve is supplied to the port XAtr and XAtl.

And it shifts the travel right spool(301) and travel left spool(310) in the left direction against springs (328) and (329). Hydraulic fluid from the pump P1 flows into the travel left spool(310) through the parallel path and hydraulic fluid from the pump P2 flows into the travel right spool(301). Then they are directed to the each travel motor through port Atl and Atr. As a result, the travel motors turn and the return flow from the travel motors enter port Btl and port Btr. The flow from the motors returns to the tank port R2 through the travel spools(310 and 301).

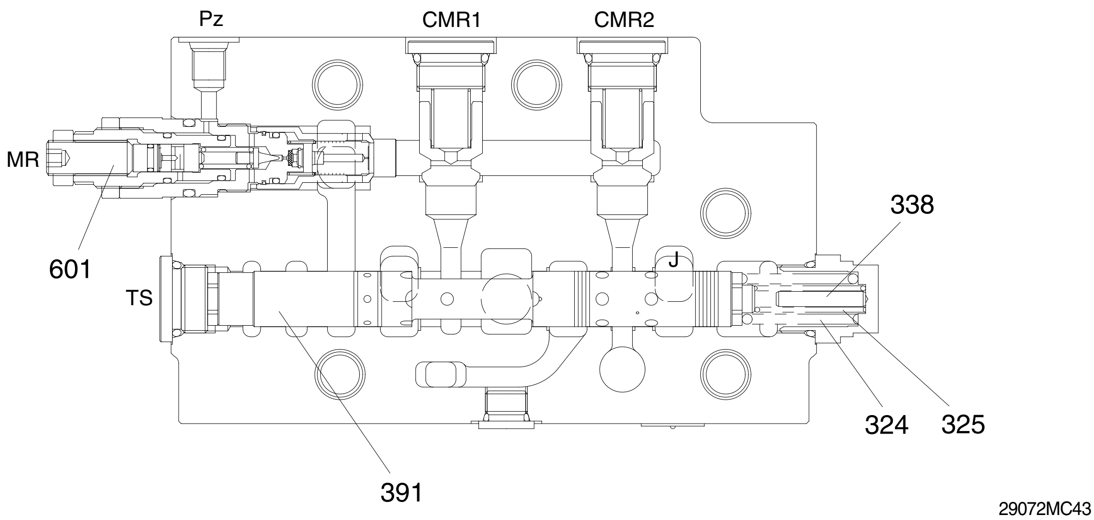
In the case of the opposite operation, the operation is similar.

4) CIRCUIT PRESSURE PROTENCTION

The control valve has two kinds of relief valve to limit the pressure in a circuit.

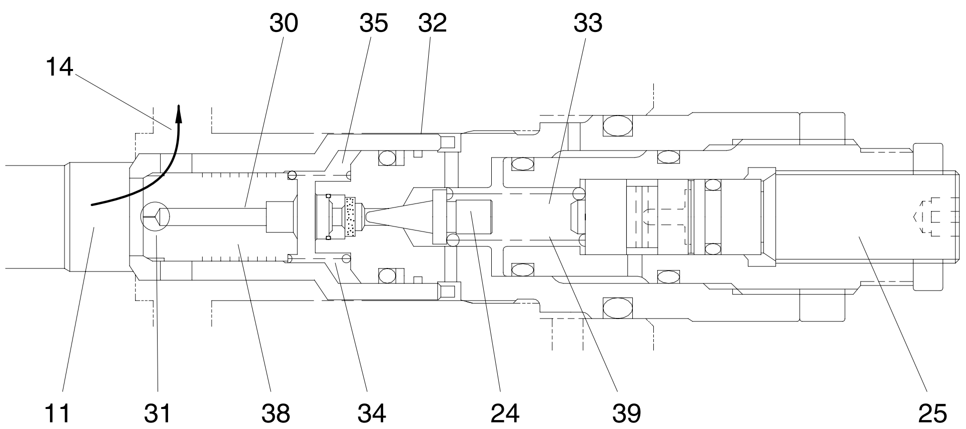
(1) Main relief valve

Limits the pressure of the main hydraulic system.



The hydraulic fluid from the pump P1 and the pump P2 enters the control valve through ports P1 and P2, respectively. From here the flow is directed to the main relief valve(601) through the check valve CMR1 or CMR2(511) and path(11). The pressure in path(11) is limited by the main relief valve(601) to its set pressure.

· **Main relief operation while working**

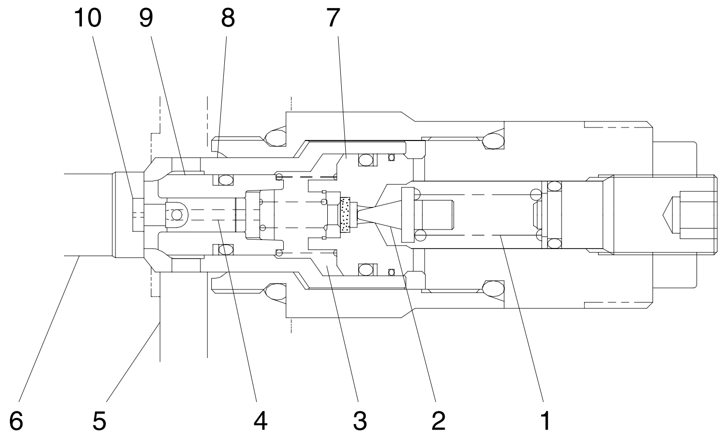


29072MC44

While the pressure in path(11) is lower than the set pressure of main relief valve(601), the poppet (24) is seated and the hydraulic fluid in path(11) can not escape to the return(14). When the pressure in path(11) approaches the pressure setting, poppet(24) opens against the spring(39). As the flow in chamber(33) escapes into the return(14) through path(32), its pressure decreases. At the same time, hydraulic fluid in path(11) flows into path(30) with a pressure drop across orifice(31). Then pressure in spring chamber(35) becomes lower because it bleeds off through path(30). The pressure from path(11) pushes the plunger(38) in the left direction against the spring(34). Then plunger(38) opens and hydraulic fluid in path(11) escapes into the return(14) and maintains the pressure setting. The pressure setting is adjusted with adjustment screw(25).

(2) Port relief valve

Limits the service pressure in a cylinder circuit.



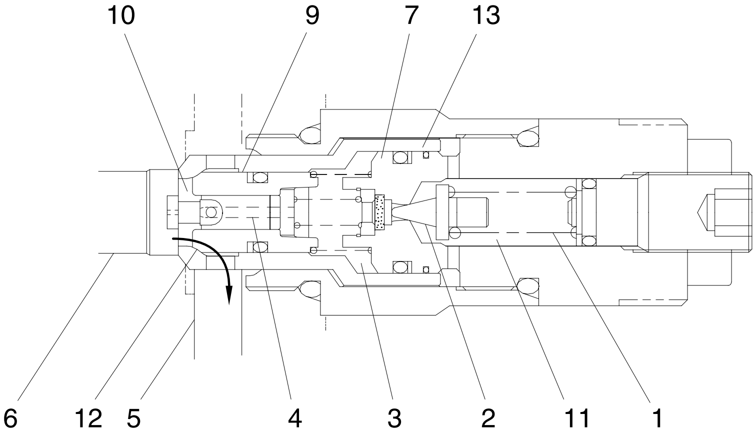
29072MC45

Port relief valves and make up valves are fitted between the cylinders of the working devices(Boom, arm, bucket) and their spools. In the case of an external force acting on the cylinder rod with its spool in neutral, the pressure in the cylinder could become excessive. The port relief valve(602) restricts this pressure to the set pressure of the valve.

Port relief valve(602) have also the additional function of a make up valve. It is possible, under the influence of an external force acting on a cylinder that a condition can occur where insufficient flow is available to match cylinder velocity. If this occurs then a vacuum and thereby cavitation could exist. To eliminate such an occurrence, a make up valve operates to break this vacuum by supplying the return flow into the cylinder.

The hydraulic fluid between the cylinder and its spool flows into the path(6) to pressurize the port relief valve(602). The hydraulic fluid in the path(6) flows into the spring chamber(3) through the path(4) in the piston(10). If the pressure is lower than the pressure setting, the poppet(2) is shut off because the force of the spring(1) overcomes the pressure. So the path(6) and the spring chamber(3) have the same pressure. Because the spring chamber(3) side pressured area of the seat(8) and the plunger(9) is larger than that of the path(6) side, seat(8) and the plunger(9) are pushed in the right direction to be seated securely and then the hydraulic fluid in the path(6) doesn't escape into the return path(5).

① Port relief function

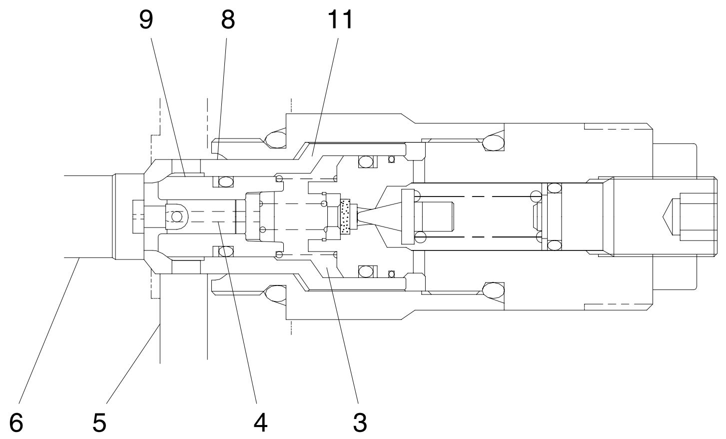


29072MC46

When the pressure in the path(6) is pressurized to the pressure setting, the poppet(2) is pushed open against the spring(1). The hydraulic fluid in the chamber(11) flows into the return path(5) through the path(13) with reducing its pressure. The piston(10) is shifted in the left direction by the pressure in the path(6) and stops on the end of the plug(7).

The hydraulic fluid in the path(6) flows into the chamber(11) through the path(4) in the piston(10) and the spring chamber(3). Because the differential pressure occurs between the pass(6) and the pass(4) by the orifice between the outernal diameter of the end of the piston(10) and the internal diameter of the plunger(9), the pressure in the spring chamber(3) becomes low and therefore the plunger(9) is pushed in the left direction with the path(12) opened so that the hydraulic fluid in the path(6) flows into the return path(5).

② Make up function



29072MC47

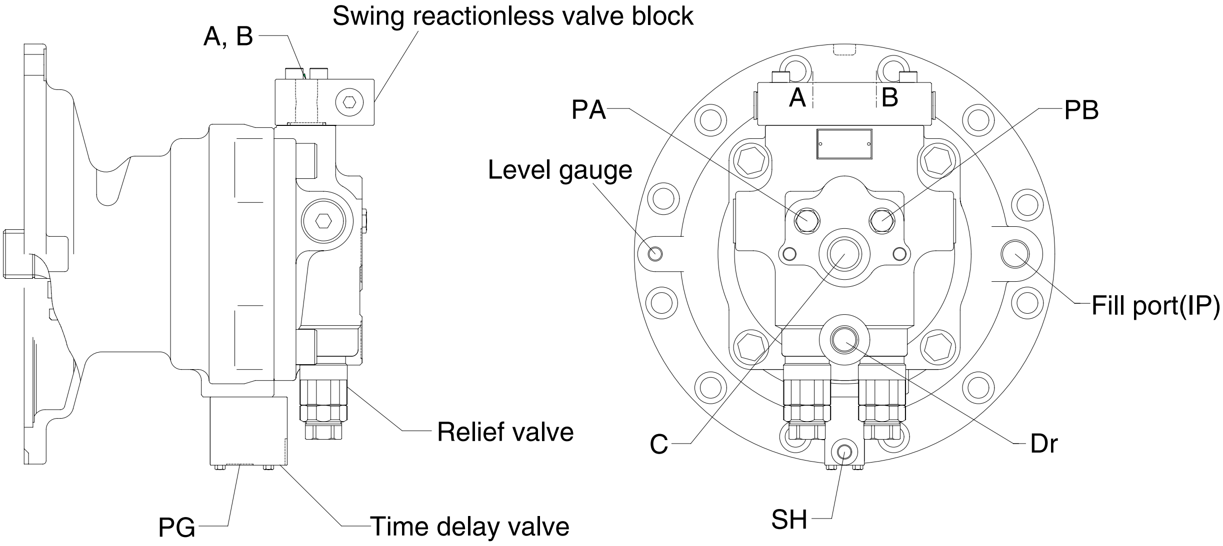
Following this then the case of a port relief valve operating as a make up valve is now explained. In the case that the hydraulic fluid in the cylinder rod(Head) side escapes from the port relief valve (602), then hydraulic fluid needs to be supplied because vacuum occurs in the head(Rod) side. When vacuum occurs in the side of the path(6), it also occurs in the spring chamber(3) through the path(4). The pressure in the side of the return path(5) acts on the seat(8). The seat(8) is shifted in the left direction by the return pressure because the spring chamber(3) sides of the seat(8) and the plunger(9) are under a vacuum. The hydraulic fluid in the return path(5) flows into the path(6) so as to break the vacuum in the path(6) side.

GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

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



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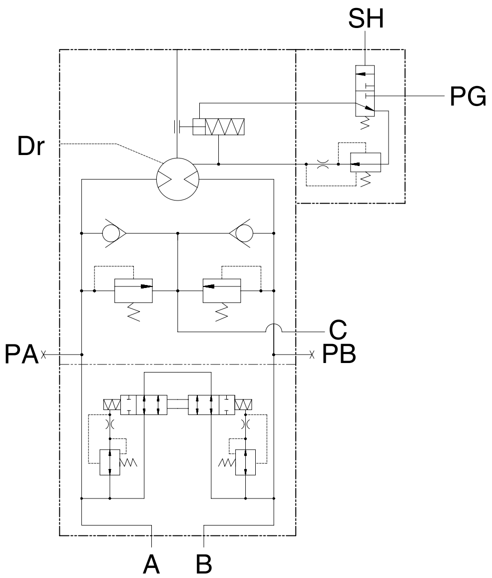
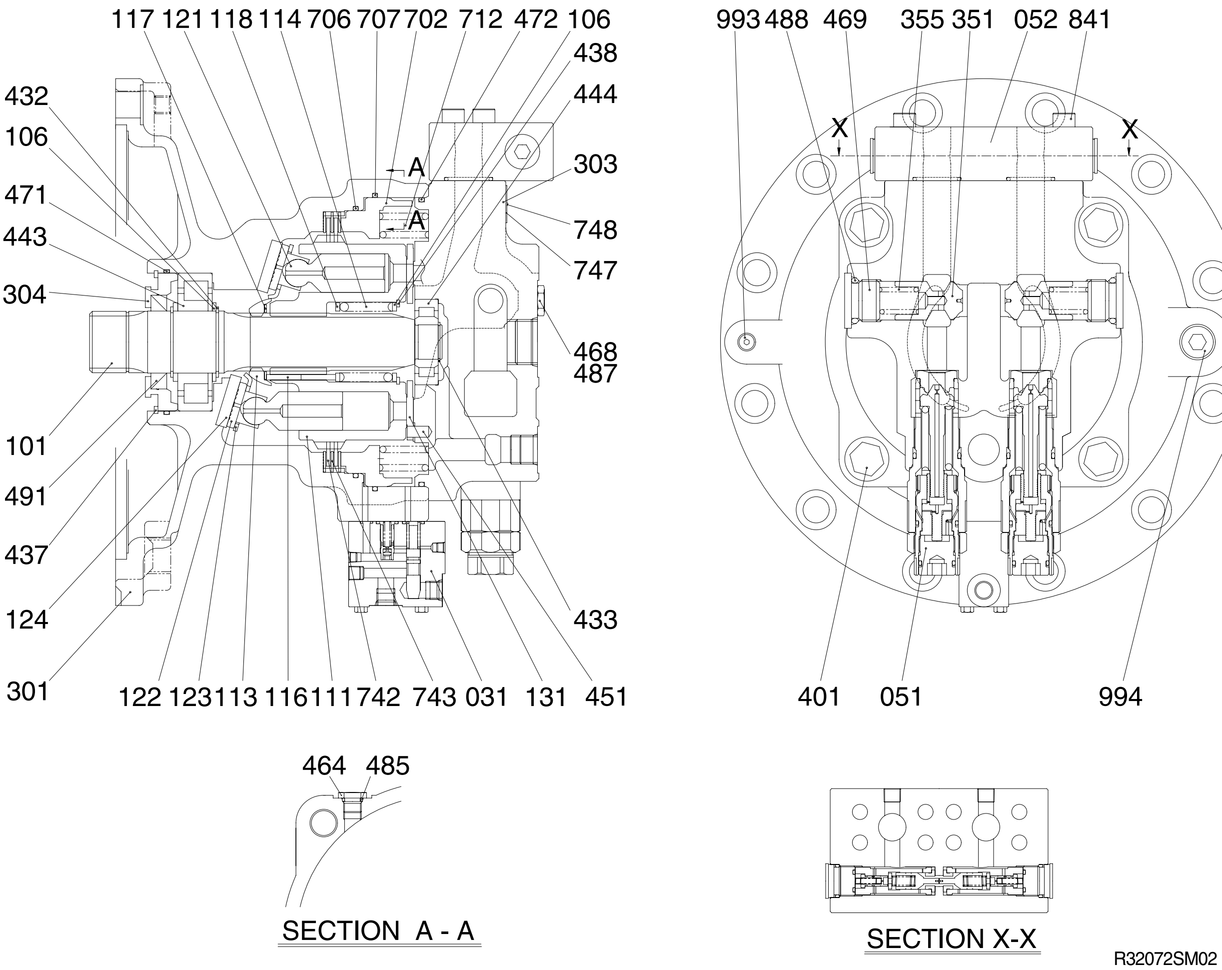


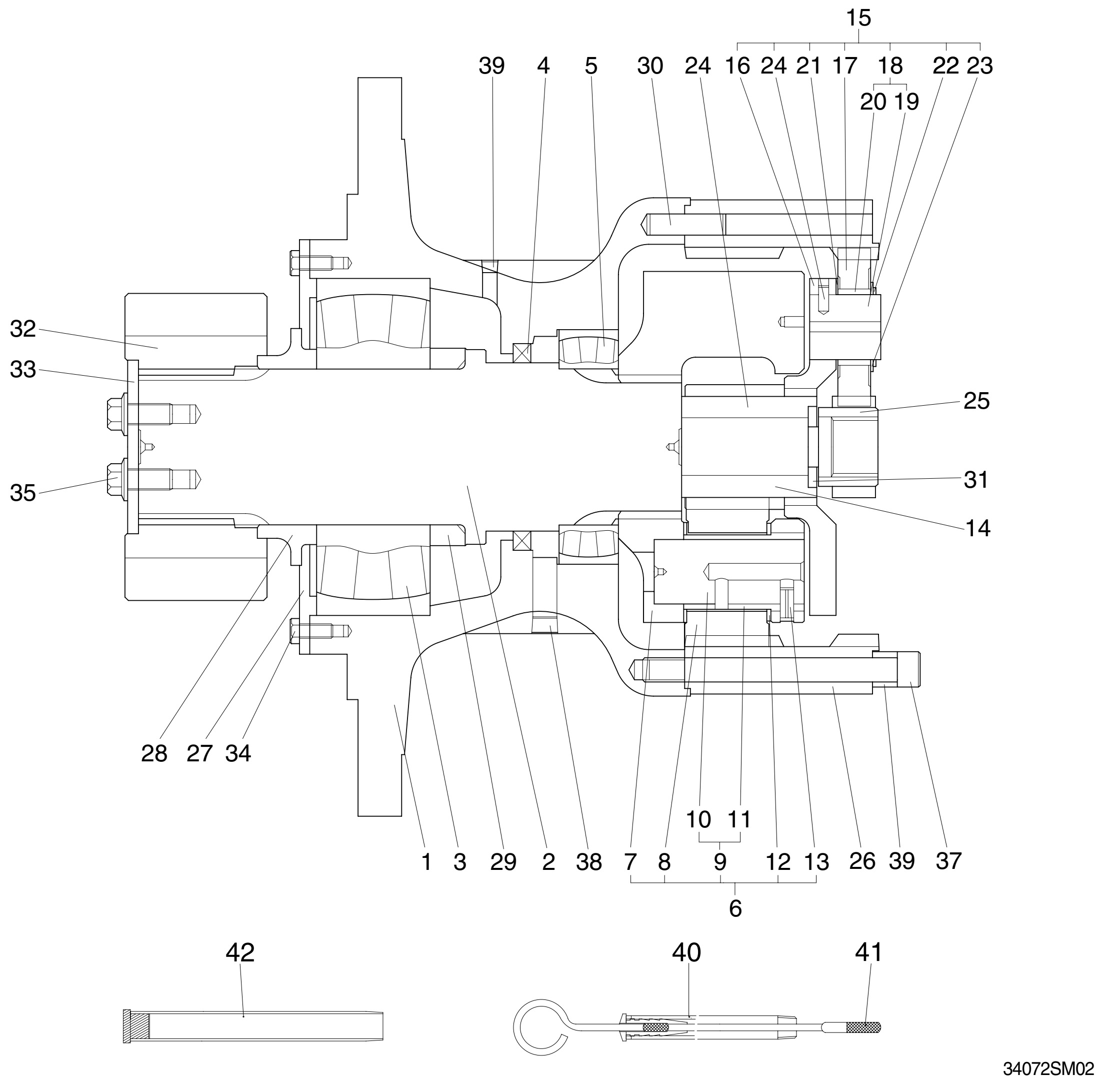
Port	Port name	Port size
A, B	Main port	ø 20
Dr	Drain port	PF 1/2-19
C	Make up port	PF 1-24
PA, PB	Gauge port	PF 1/4-12
PG	Brake release port	PF 1/4-12
SH	Brake pilot port	PF 1/4-12
IP	Gear oil inlet port	PT 3/4-19

1) SWING MOTOR



031	Time delay valve	162	O-ring	468	Plug
051	Relief valve	163	O-ring	469	Plug
052	Valve assy	171	Hexagon screw	471	O-ring
101	Drive shaft	301	Casing	472	O-ring
106	Spacer	303	Casing	485	O-ring
111	Cylinder	304	Front cover	487	O-ring
113	Spherical bush	351	Plunger	488	O-ring
114	Spring	355	Spring	491	Oil seal
116	Push rod	401	Socket bolt	702	Piston
117	Spacer	432	Snap ring	706	O-ring
118	Spacer	433	Snap ring	707	O-ring
121	Piston	437	Snap ring	712	Brake spring
122	Shoe	438	Snap ring	742	Friction plate
123	Retainer	443	Roller bearing	743	Separate plate
124	Shoe plate	444	Needle bearing	841	Socket bolt
131	Valve plate	451	Spring pin	993	Plug
161	O-ring	464	Plug	994	Plug

2) REDUCTION GEAR



1	Casing	15	Carrier assy 1	29	Spacer ring
2	Drive shaft	16	Carrier 1	30	Knock pin
3	Roller bearing	17	Planet gear 1	31	Thrust plate 3
4	Oil seal	18	Pin assy 1	32	Pinion gear
5	Roller bearing	19	Pin 1	33	Lock plate
6	Carrier assy 2	20	Bushing 1	34	Hexagon bolt
7	Carrier 2	21	Side plate 1	35	Hexagon flange bolt
8	Planet gear 2	22	Side plate 2	37	Socket bolt
9	Pin assy 2	23	Stop ring	38	Plug
10	Pin 2	24	Spring pin	39	Plug
11	Bushing 2	25	Sun gear 1	40	Gage pipe
12	Thrust washer	26	Ring gear	41	Gage bar
13	Spring pin	27	Cover plate	42	Air breather assy
14	Sun gear 2	28	Spacer	43	Bushing 1

2. FUNCTION

1) ROTARY PART

When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(131), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(121) upon the return plate(123) which acts upon the swash plate(124) via an hydrostatic bearing. Force F1 perpendicular to swash plate(124) and force F2 perpendicular to cylinder center.

Being transferred to the cylinder block(111) through piston, force F2 causes rotational moment at surroundings of cylinder.

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

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

Where p : Effective difference of pressure(kgf/cm^2)

q : Displacement(cc/rev)

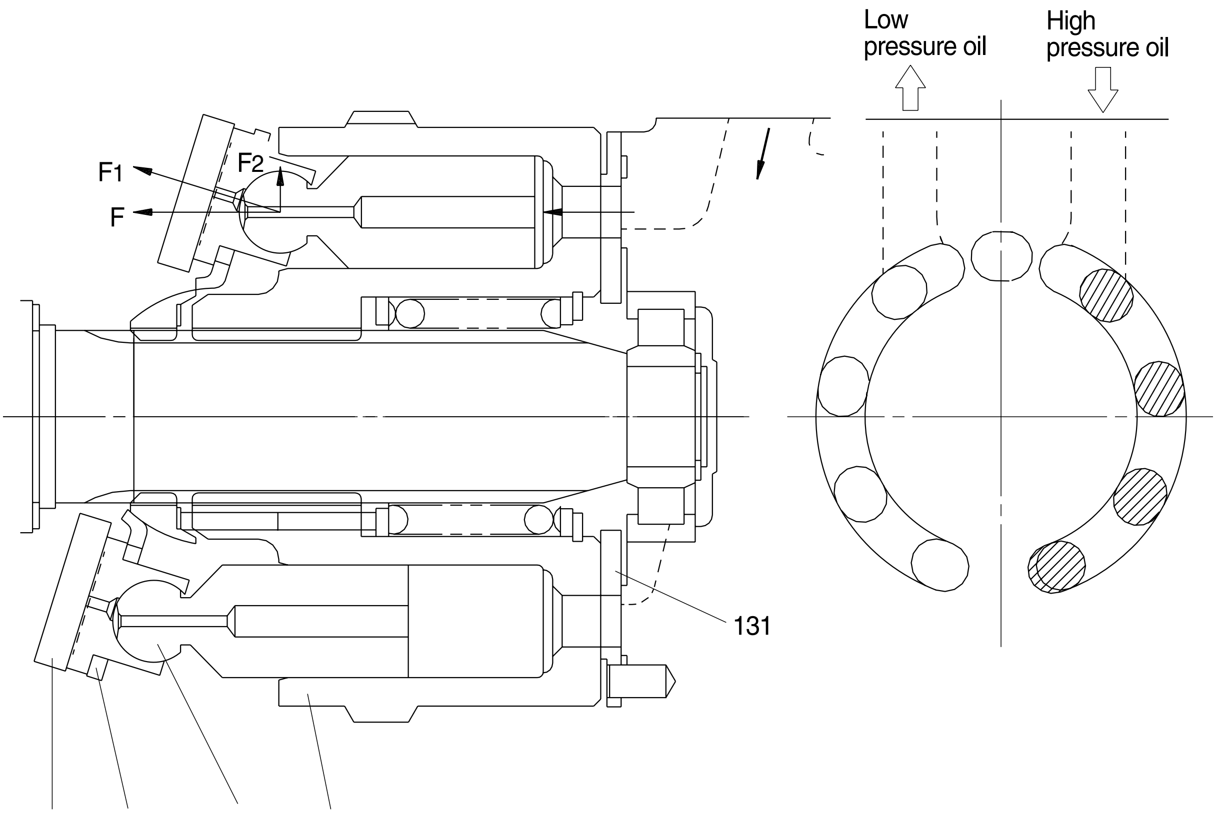
T : Output torque(kgf · cm)

Z : Piston number(9EA)

A : Piston area(cm^2)

θ : Tilting angle of swash plate(degree)

S : Piston stroke(cm)



R290SM05(2)

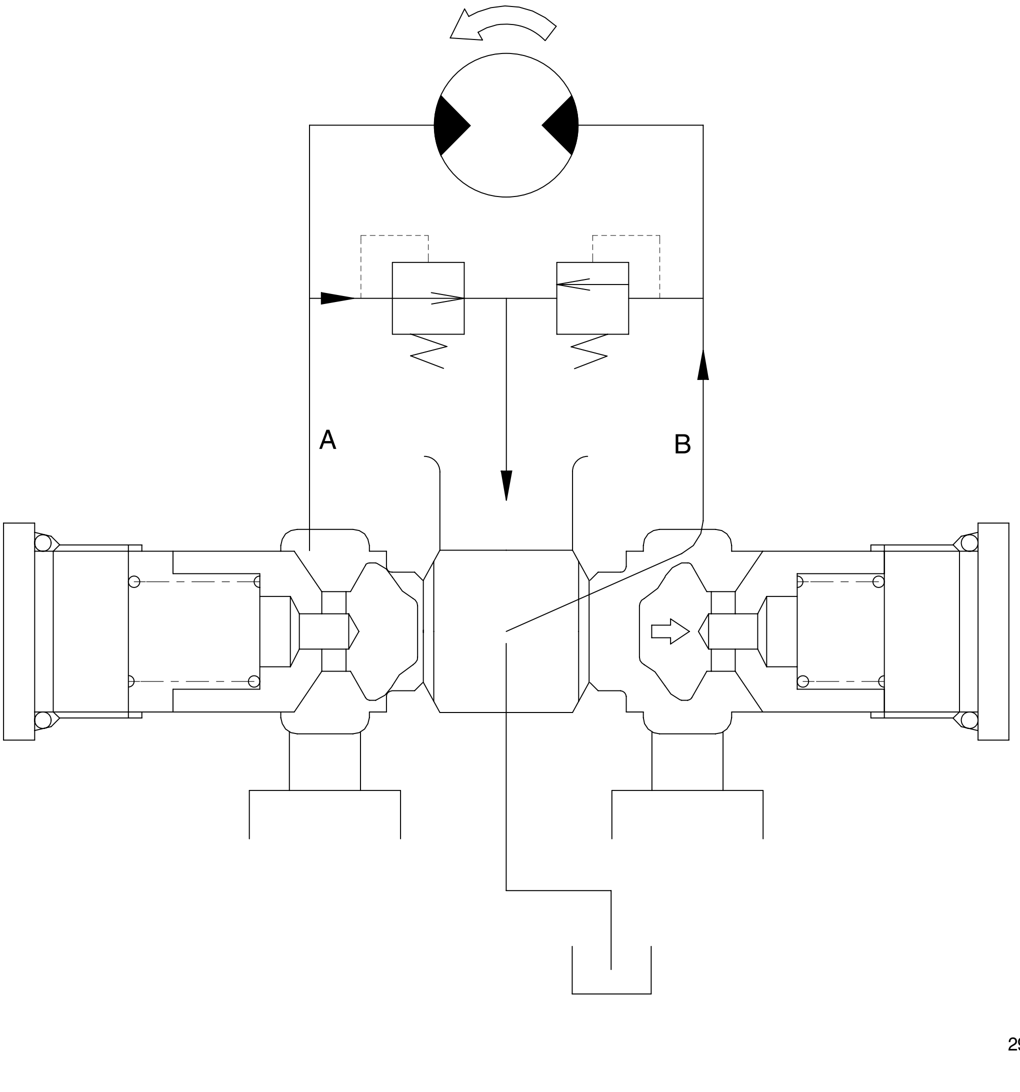
2) MAKE UP VALVE

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.

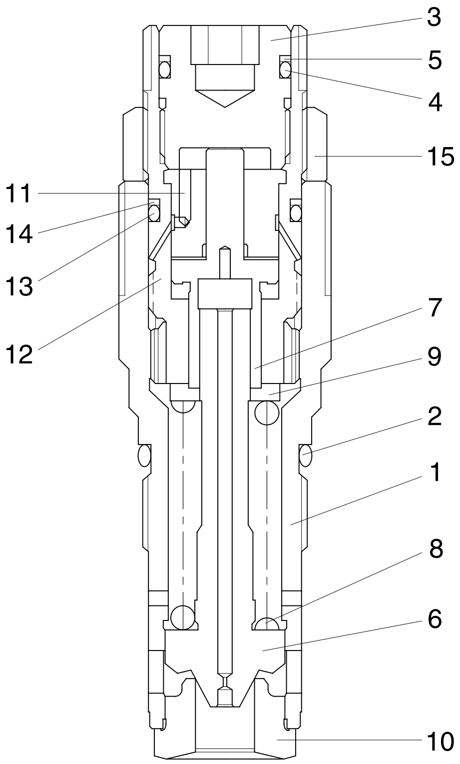
Pressurized oil into the port B, the motor rotate counterclockwise.

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.



29072SM09

3) RELIEF VALVE



1	Body
2	O-ring
3	Plug
4	O-ring
5	Back up ring
6	Plunger
7	Piston
8	Spring
9	Seat spring
10	Seat
11	Sleeve
12	Adjust plug
13	O-ring
14	Back up ring
15	Nut

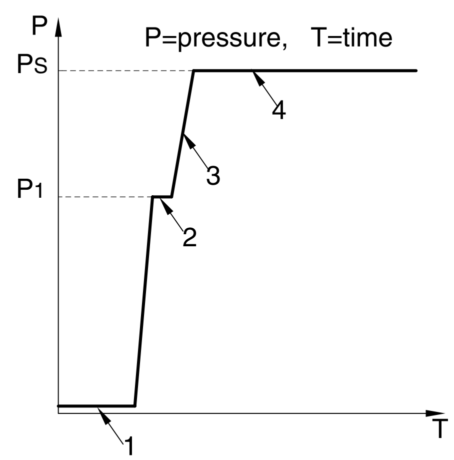
29072SM03

(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.

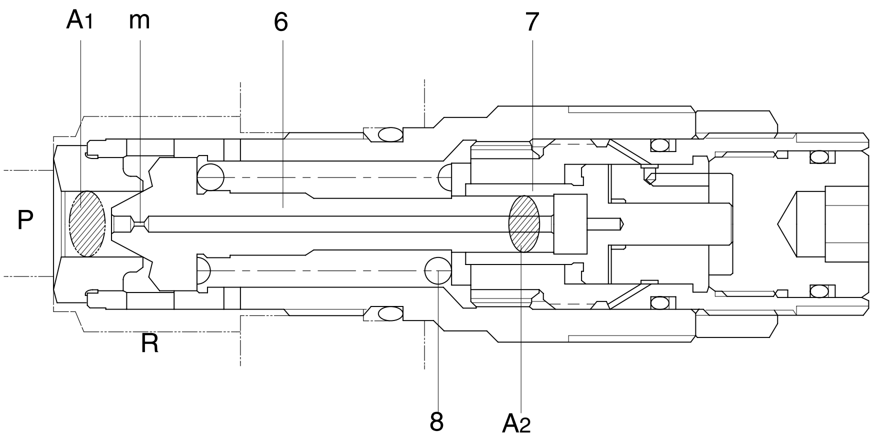
(2) Function of relief valve

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.



29072SM05

① Ports (P,R) at tank pressure.

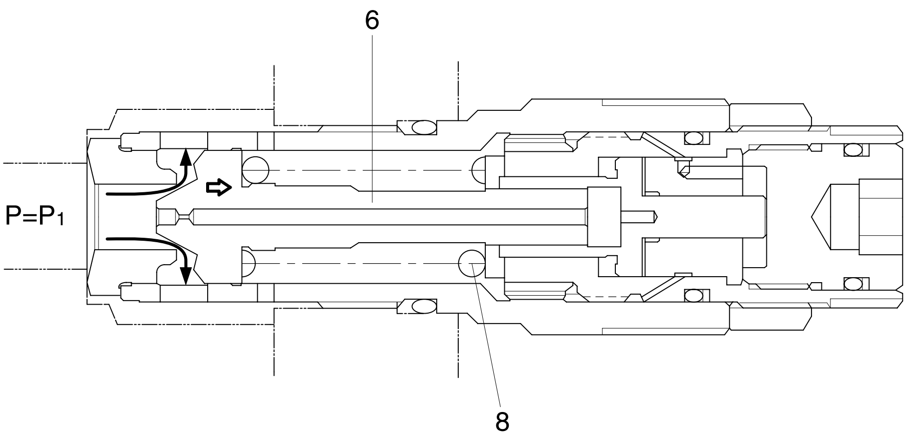


29072SM04

② When hydraulic oil pressure($P \times A_1$) reaches the preset force(F_{SP}) of spring(8), the plunger (6) moves to the right as shown.

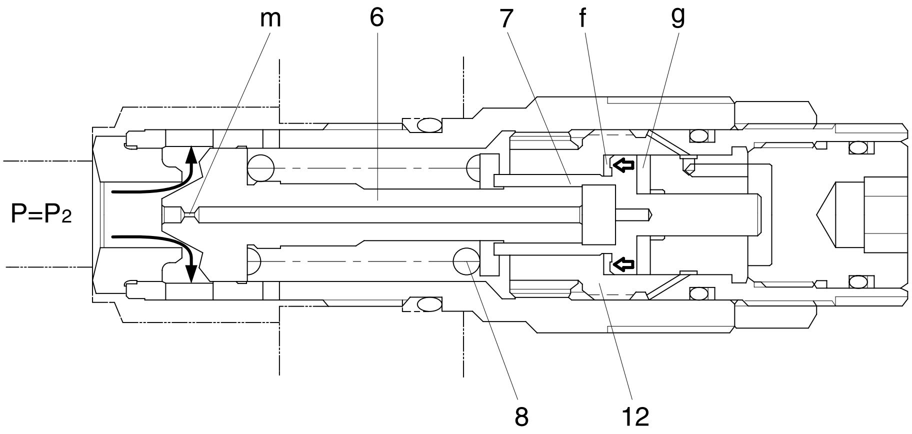
$$P_1 \times A_1 = F_{sp} + P_1 \times A_2$$

$$P_1 = \frac{F_{sp}}{A_1 - A_2}$$



29072SM06

③ When the pressure of chamber g reaches the preset force(Fsp) of spring(8), the piston(7) moves right and stop the piston(7) hits the end of body.

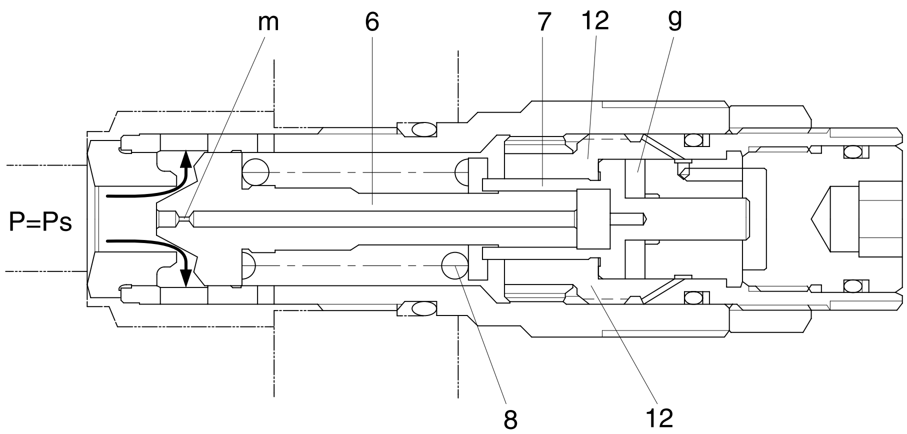


29072SM07

④ When piston(7) hits the end of body, it stops moving to the right any further. As the result, the pressure in chamber(g) equals(Ps).

$Ps \times A_1 = Fsp + Ps \times A_3$

$$Ps = \frac{Fsp}{A_1 - A_3}$$



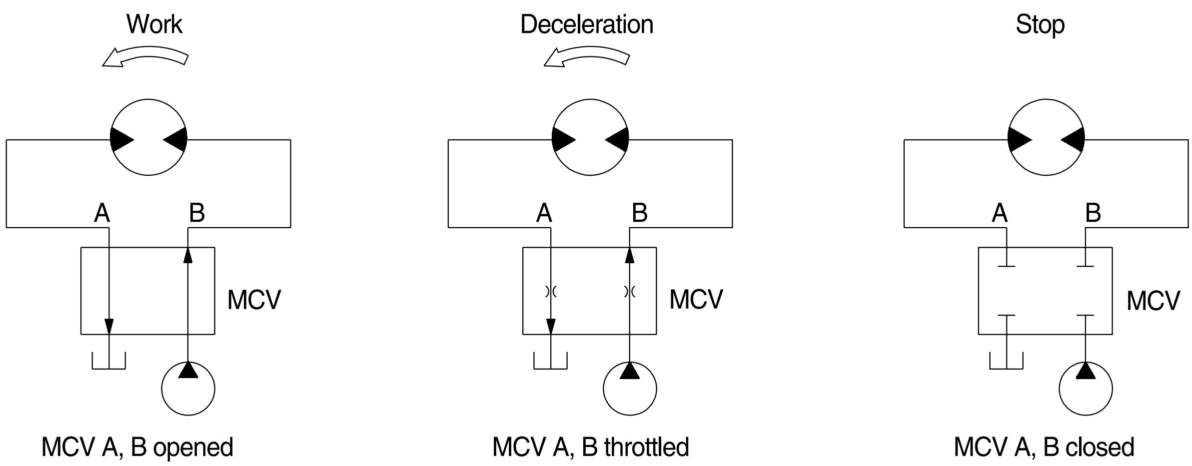
29072SM08

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.



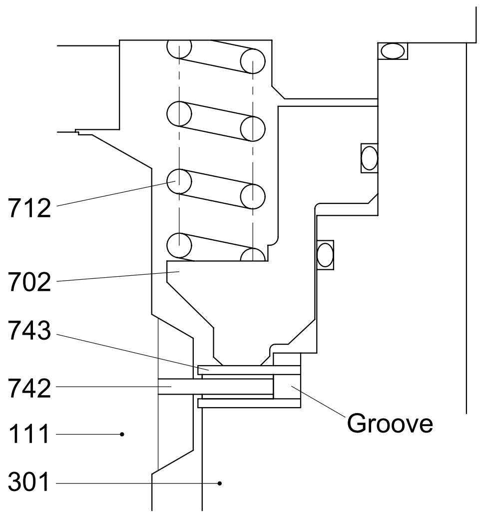
(2) Mechanical swing parking brake system

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

① **Brake assembly**

Circumferential rotation of separate plate(743) is constrained by the groove located at casing(301). When housing is pressed down by brake spring(712) through friction plate(742), separate plate(743) and brake piston(702), friction force occurs there.

Cylinder(111) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.

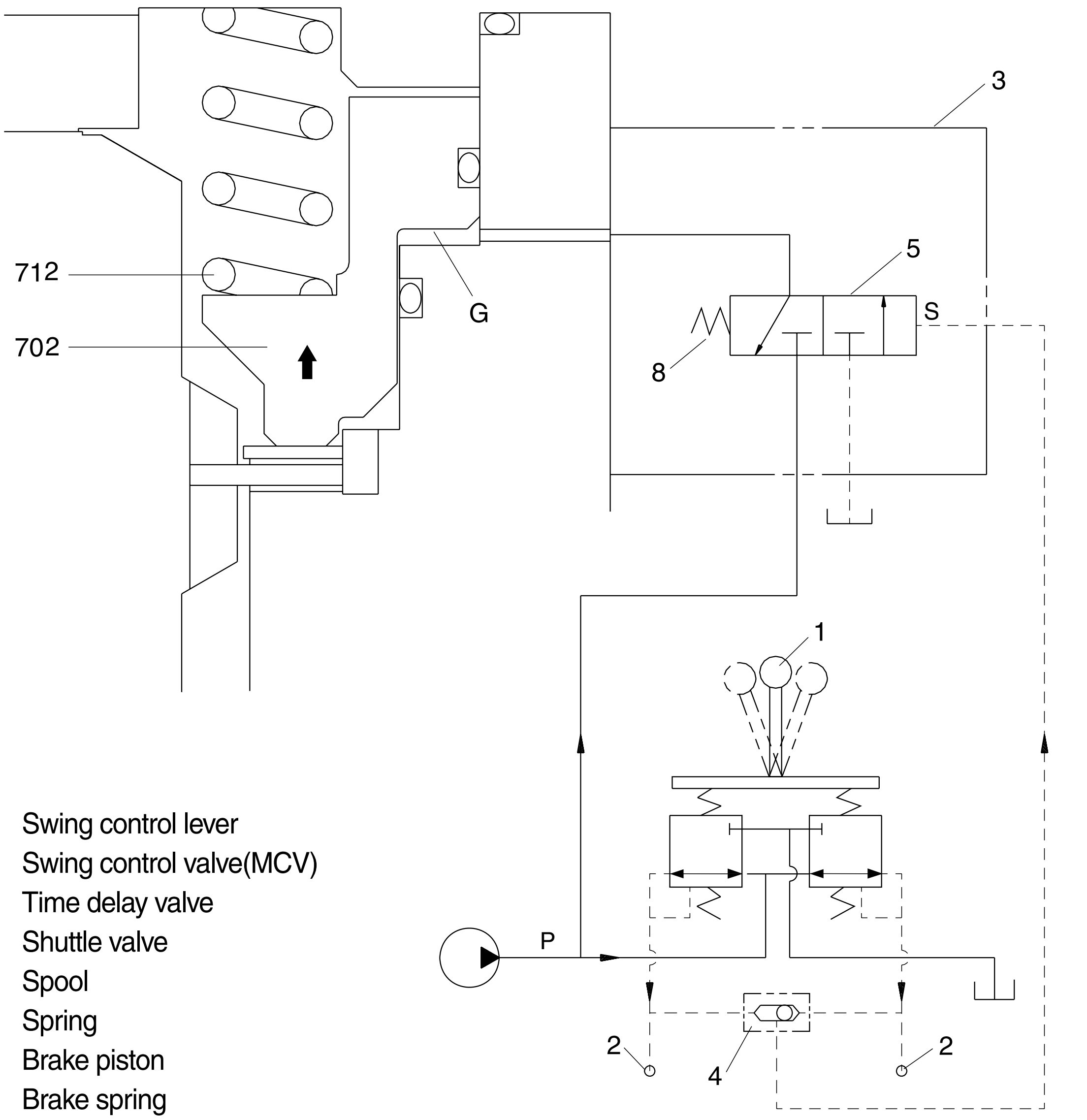


111	Cylinder	712	Brake spring
301	Casing	742	Friction plate
702	Brake piston	743	Separate plate

② **Operating principle**

a. When the swing control lever(1) is set to the swing position, the pilot oil go to the swing control valve(2) and to SH of the time delay valve(3) via the shuttle valve(4), this pressure move spool(5) to the leftward against the force of the spring(8), so pilot pump charged oil(P3) goes to the chamber G.

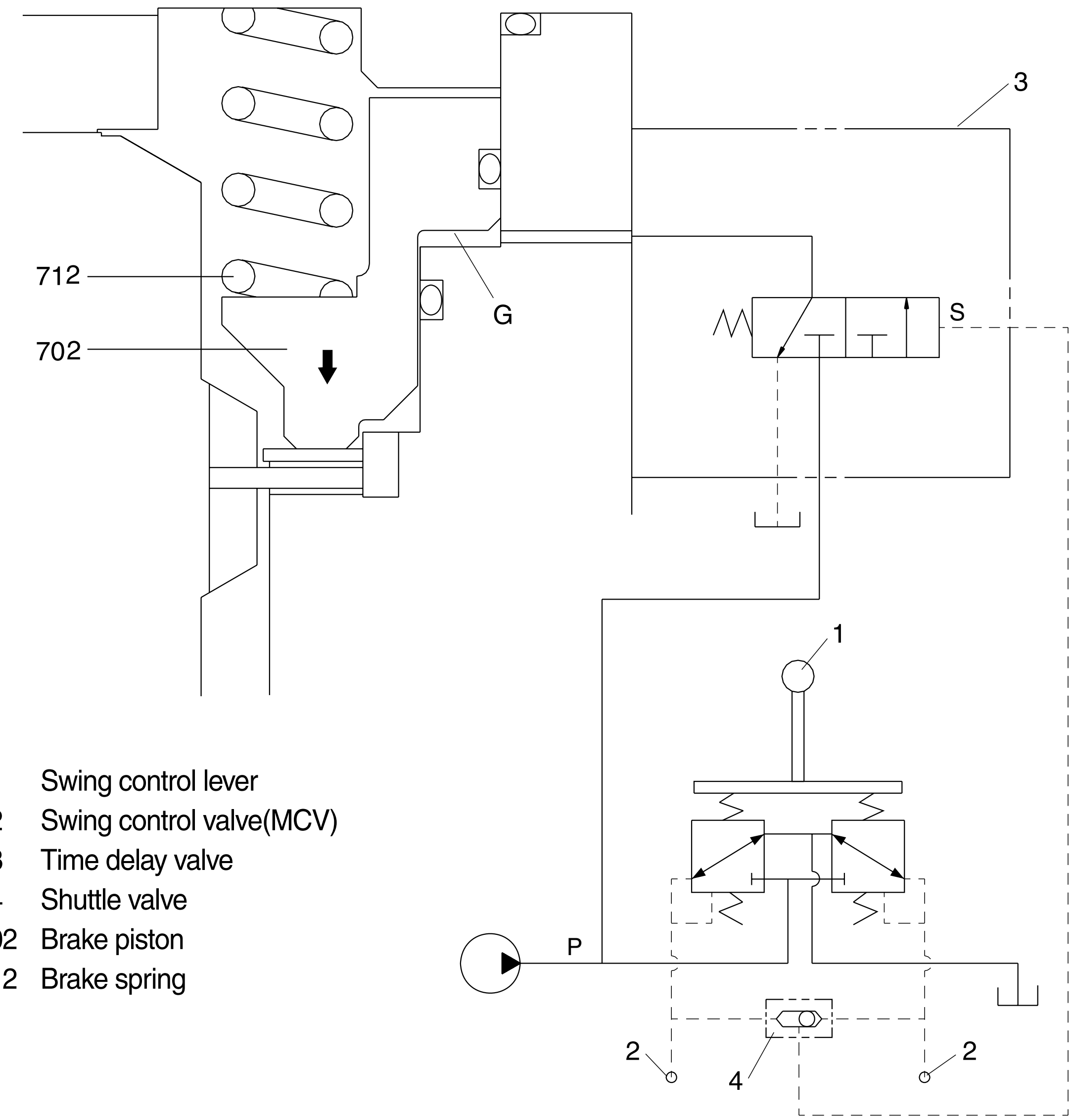
This pressure is applied to move the piston(702) to the upward against the force of the spring(712). Thus, it releases the brake force.



1 Swing control lever
2 Swing control valve(MCV)
3 Time delay valve
4 Shuttle valve
5 Spool
8 Spring
702 Brake piston
712 Brake spring

R290SM07(1)

b. When the swing control lever(1) is set the neutral position, the time delay valve(3) shifts the neutral position and the pilot oil blocked chamber G.
Then, the piston(702) is moved lower by spring(712) force and the return oil from the chamber G is drain.



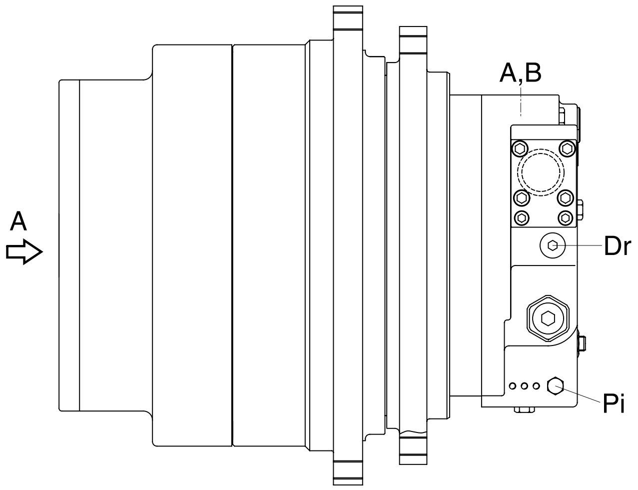
1 Swing control lever
2 Swing control valve(MCV)
3 Time delay valve
4 Shuttle valve
702 Brake piston
712 Brake spring

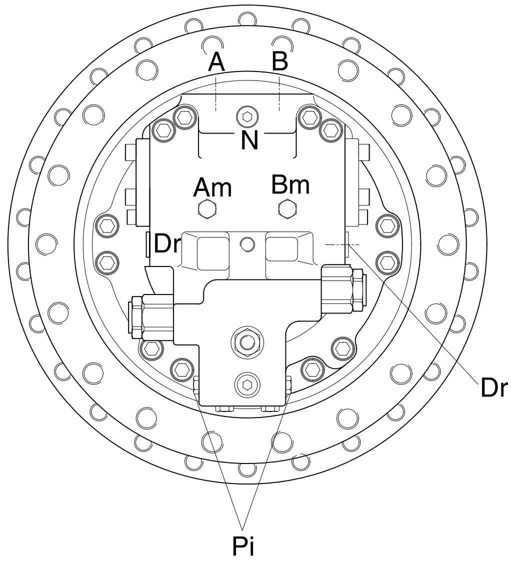
R290SM08(1)

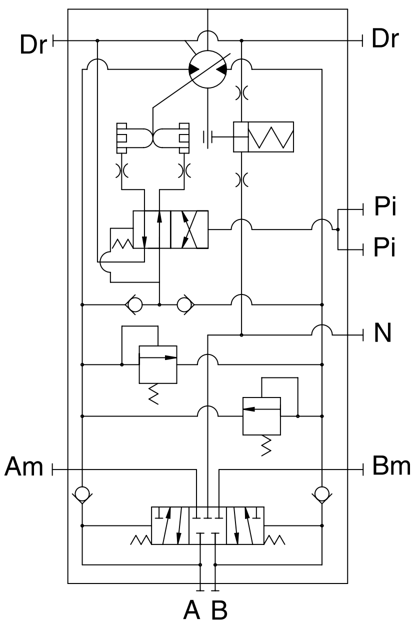
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

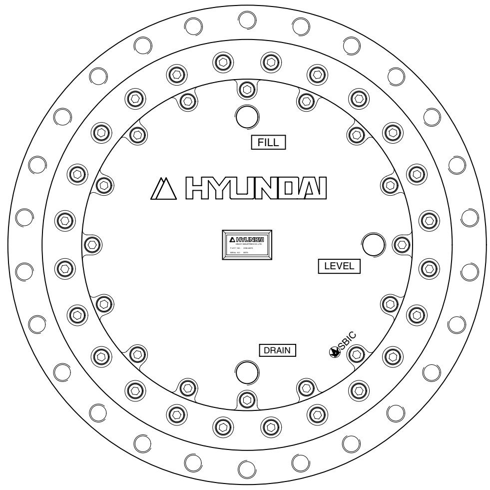
Travel device consists travel motor and gear box.
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.







CIRCUIT DIAGRAM



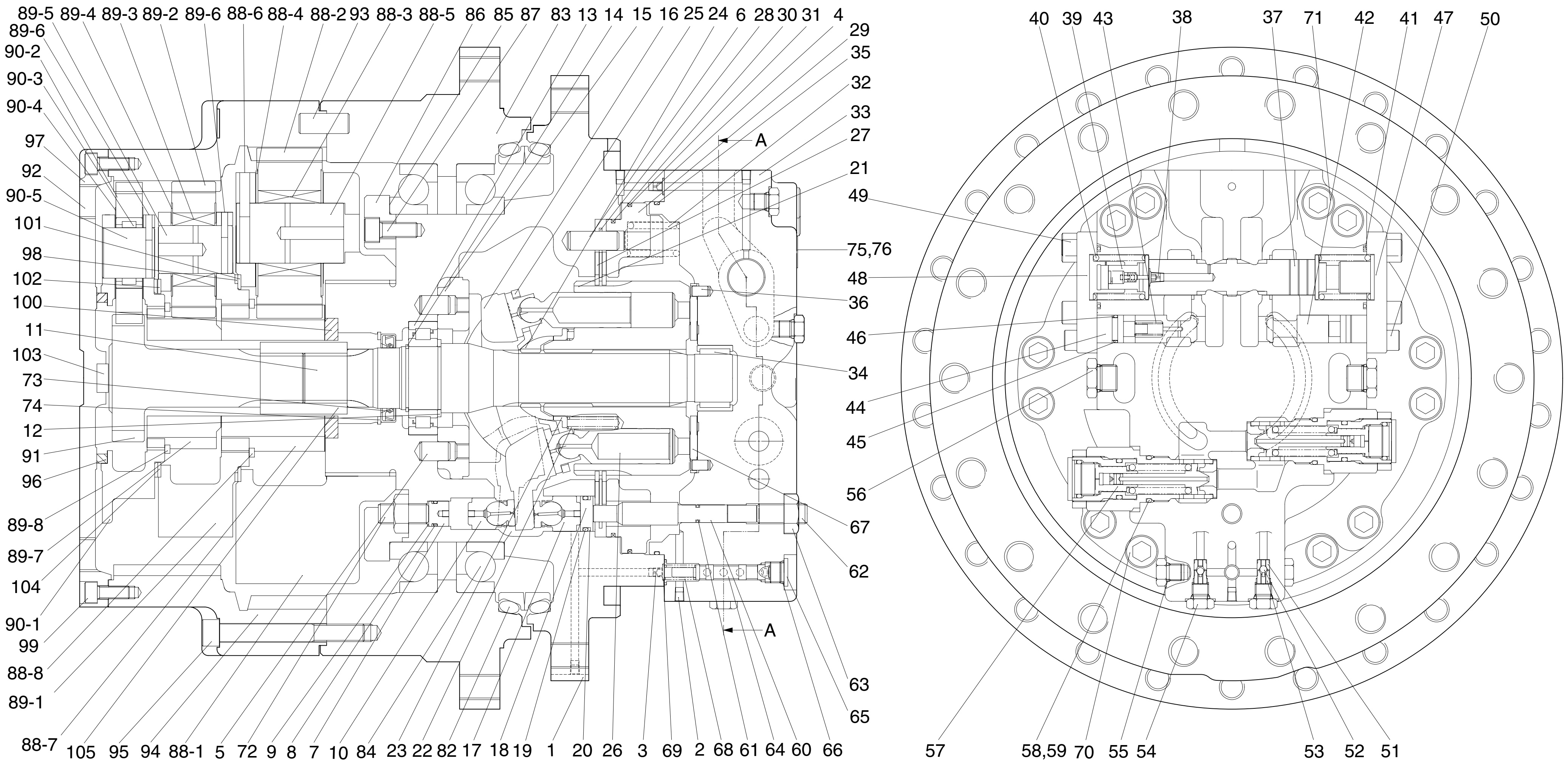
VIEW A

300072TM01A

Port	Port name	Port size
A, B	Valve port	SAE 6000psi 1"
Pi	Pilot port	PF 1/4
Dr	Drain port	PF 1/2
Am, Bm	Gage port	PF 1/4
N	Parking release port	PF 1/4

2. SPECIFICATION

1) TRAVEL MOTOR



SECTION A-A

2907A2TM01

1	Casing
2	Plug
3	Screw
4	Screw
5	Pin
6	Pin
7	Stopper
8	O-ring
9	Back up ring
10	Piston
11	Shaft
12	Spacer
13	Roller bearing
14	Stop ring
15	Support
16	Plate
17	Piston
18	Stopper
19	O-ring
20	Back up ring
21	Cylinder block
22	Cylinder spring
23	Spacer
24	Guide
25	Plate
26	Piston & Shoe assy
27	Plate
28	Plate
29	Brake
30	Ring
31	Ring
32	Spring
33	Valve casing
34	Needle bearing
35	O-ring
36	Pin
37	Spool
38	Screw
39	Damping check
40	Spring
41	O-ring
42	Plunger
43	Spring
44	Stopper
45	O-ring
46	Back up ring
47	Cap
48	Cap
49	Bolt
50	Socket bolt
51	Seat
52	Steel ball
53	Stopper
54	Plug
55	O-ring
56	Plug
57	Relief valve
58	O-ring
59	Back up ring
60	Rod
61	O-ring
62	Lock screw
63	Nut
64	Spool
65	Plug
66	O-ring
67	Valve plate
68	Spring
69	O-ring
70	Socket bolt
71	Socket bolt
72	Lock screw
73	Oil seal
74	Lock ring
82	Floating Seal
83	Housing
84	Bearing
85	Shim
86	Retainer
87	Bolt
88	Carrier No.3
88-1	Carrier No.3
88-2	Planetary gear No.3
88-3	Needle No.3
88-4	Thrust washer No.3
88-5	Pin No.3
88-6	Spring pin No.3
88-7	Sun gear No.3
88-8	Snap ring No.3
89	Carrier No.2
89-1	Carrier No.2
89-2	Planetary gear No.2
89-3	Needle No.2
89-4	Thrust washer No.2
89-5	Pin No.2
89-6	Spring pin No.2
89-7	Sun gear No.2
89-8	Snap ring No.2
90	Carrier No.1
90-1	Carrier No.1
90-2	Planetary gear No.1
90-3	Needle bearing No.1
90-4	Thrust washer No.1
90-5	Pin No.1
91	Sun gear No.1
92	Plug
93	Lock pin
94	Ring gear
95	Bolt
96	Thrust ring No.1
97	Cover
98	Thrust ring No.2
99	Bolt
100	Motor ring
101	Thrust ring No.3
102	Thrust ring No.1
103	Pad
104	Thrust ring No.2
105	Coupling

3. PRINCIPLE OF DRIVING

1) WORKING OF ROTARY GROUP

The high pressurized hydraulic oil which is supplied from a hydraulic pump is flows into a cylinder(21) through the valve casing(33) of motor, and valve plate(67).

The rotary group has a construction that the above high pressurized hydraulic oil is flow only one side of the line Y-Y which connect the upper and lower dead point of the piston(26).

This high pressurized hydraulic oil works on the piston and generating the force F1, F1 = P * A(P : supplied pressure, A : pressure receving area), like following pictures.

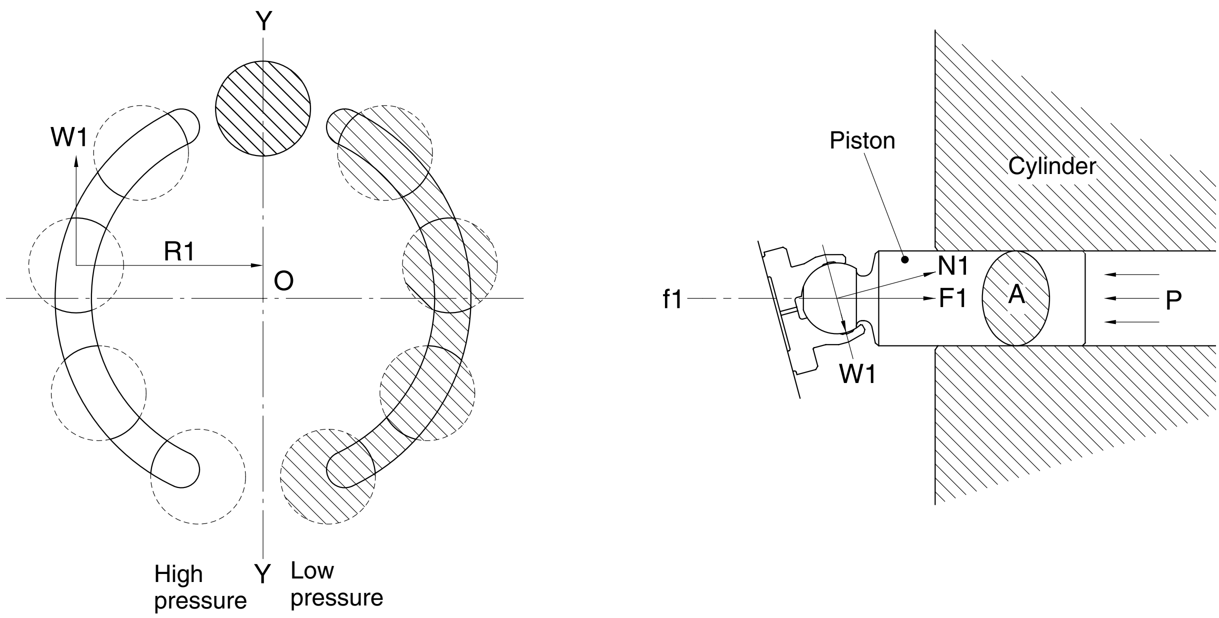
This force, F1, is devided by the swash plate(16) having a tilting angle α into the thrust component N1 and radial component W1.

The W1 generates torque, T = W1 * R1, in respect to the line Y-Y.

This torque generated by each piston on the high pressurized hydraulic oil side is summed up onto a resultant torque Σ(W1 * R1), which prodeces torque for rotation.

This torque transfers the rotation force to the cylinder(21) through the pistons.

Since the cylinder block is spline-coupled with the shaft, the rotation force is transmitted to the shaft accordingly.



2907A2TM07

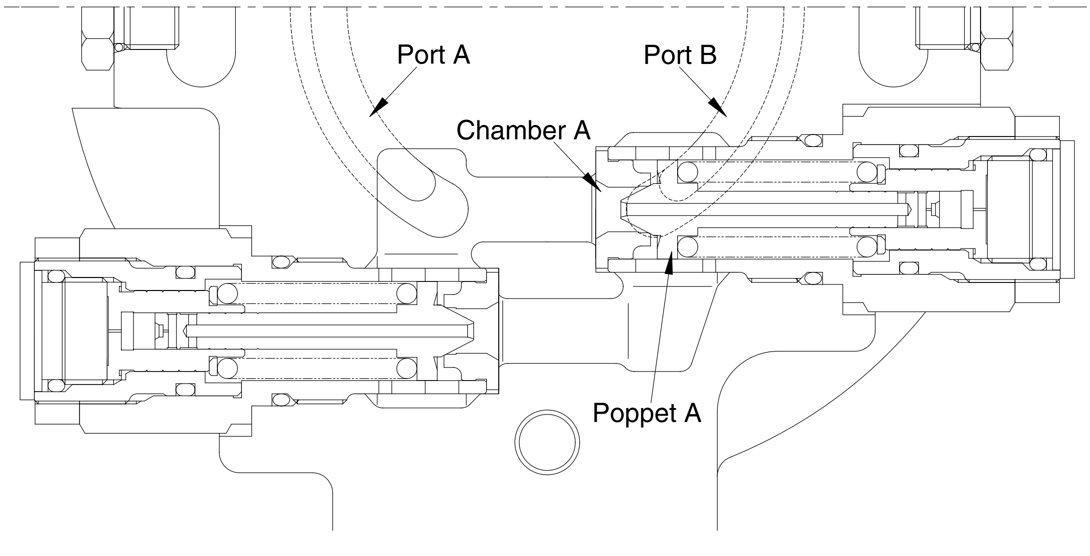
2) WORKING OF RELIEF VALVE

Relief valve carries on two function of following.

(1) Relief valve is to keep the starting pressure of the hydraulic motor at a constant value and bypass to the return line excessive oil generated at the motor inlet depending upon the acceleration speed of the inertia object.

(2) In case of an inertia object stopped, relief valve is generating a break pressure at the outlet and stop it forcedly.

The chamber A is always connect with port A of a motor. When the pressure at port A increase and the force pushing poppet A is higher than the pressure of the spring, then poppet A is pushed up from the contact surface of seat A, and oil flows from chamber A to port B.



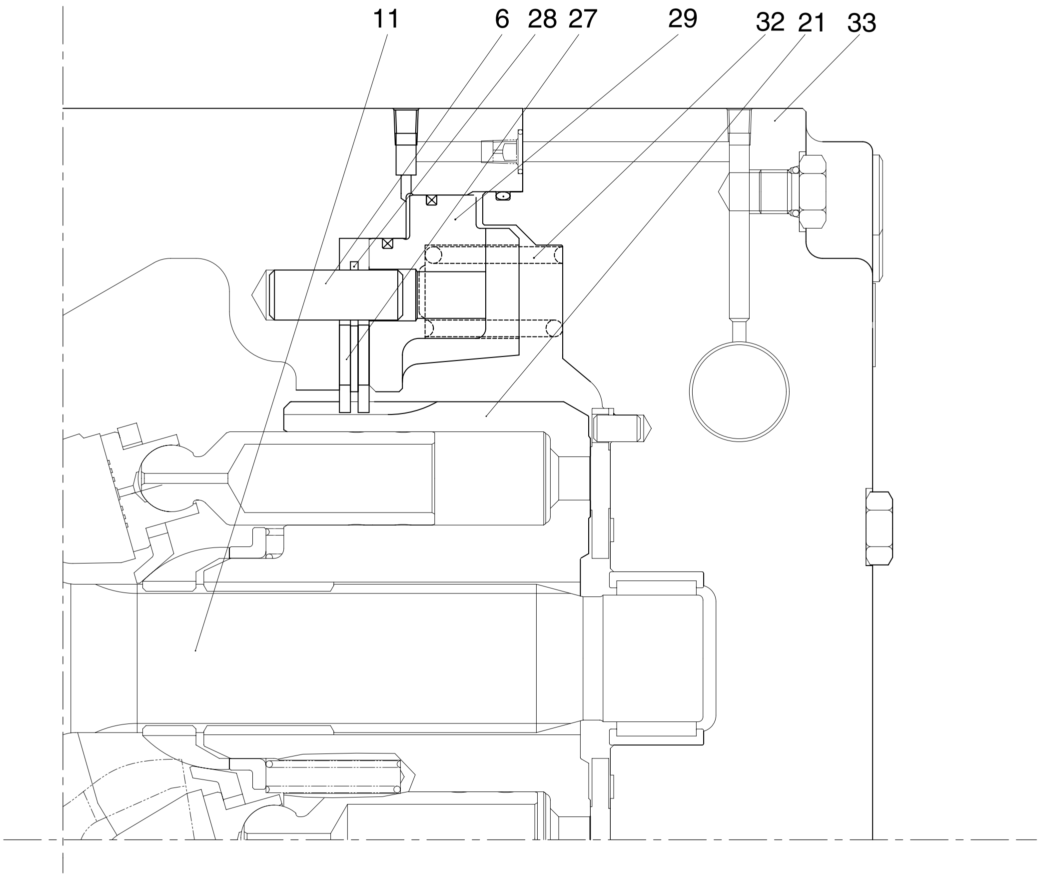
2907A2TM04

3) WORKING OF NEGATIVE BRAKE

The negative brake is released applying to the brake piston(29) the pressure led through built in the valve casing(33) spool. With no pressure working, the brake force is always ensured.

The brake force is generated by the frictional force among a plate(28) fixed by pin(6) and shaft casing, brake piston(29) and a frictional plate(27) connected through spline outside the cylinder block(21).

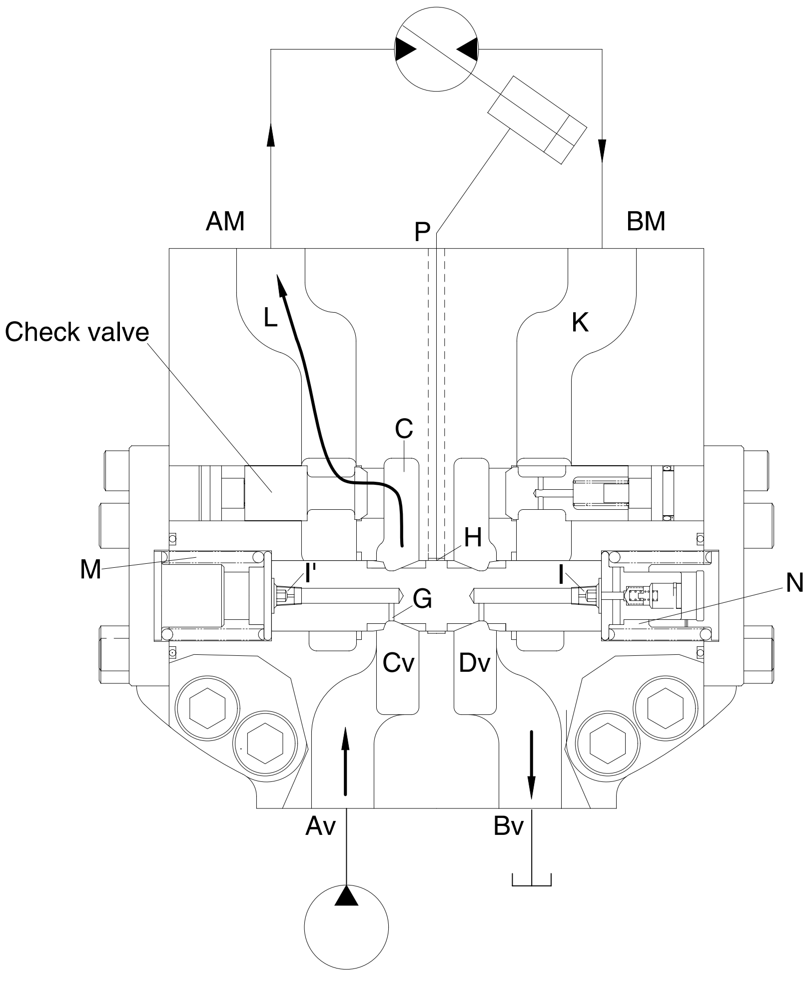
Without pressure being applied to the brake piston, the brake piston is pushed by ten brake springs(32) and the friction plate and separator plate are held between the brake piston and casing. This friction force restrains the shaft(11) spline-coupled with the cylinder block, and thus functions the brake.



300075TM05

4) COUNTERBALANCE VALVE

Av port is connected to a hydraulic pump : Bv port is connected to a tank.
The oil supplied from the hydraulic pump passed through Av → Cv → C sequence, pushed up the poppet of the check valve, passed through L to port AM, and is supplied to the hydraulic motor to turn it. But the brake is operated. Therefore, the pump discharge oil pressure is increases. And the pressure is led via passage G to spring room M. When the pressure in room M exceed the value equivalent to the force of the spring which holds the spool at its neutral position, the spool begins to move right.
The oil in room N is sent to room Dv by orifice I and discharged from Bv port to a tank. So spool moves to the right. The oil flows as the way of K → Dv → Bv sequence. Also according to the oil path as composed way Cv → H → P sequence, the pressure of Av pump is provided to the port P. An working oil in room N is discharged through orifice and a gap. Therefore the switching operation of spool is driving slowly.
When the pump discharge pressure fall, spool moves to the left side by a spring at the side of room N. Also spool moves to the left, the hydraulic oil in room M is sent to Cv room through orifice I' and discharged to the Av port.
When the pressure at port Av fall down to the tank pressure, the pressure of room M is as the same as that the tank pressure and becomes equal to that in room N, and so the spool returns to its neutral position.



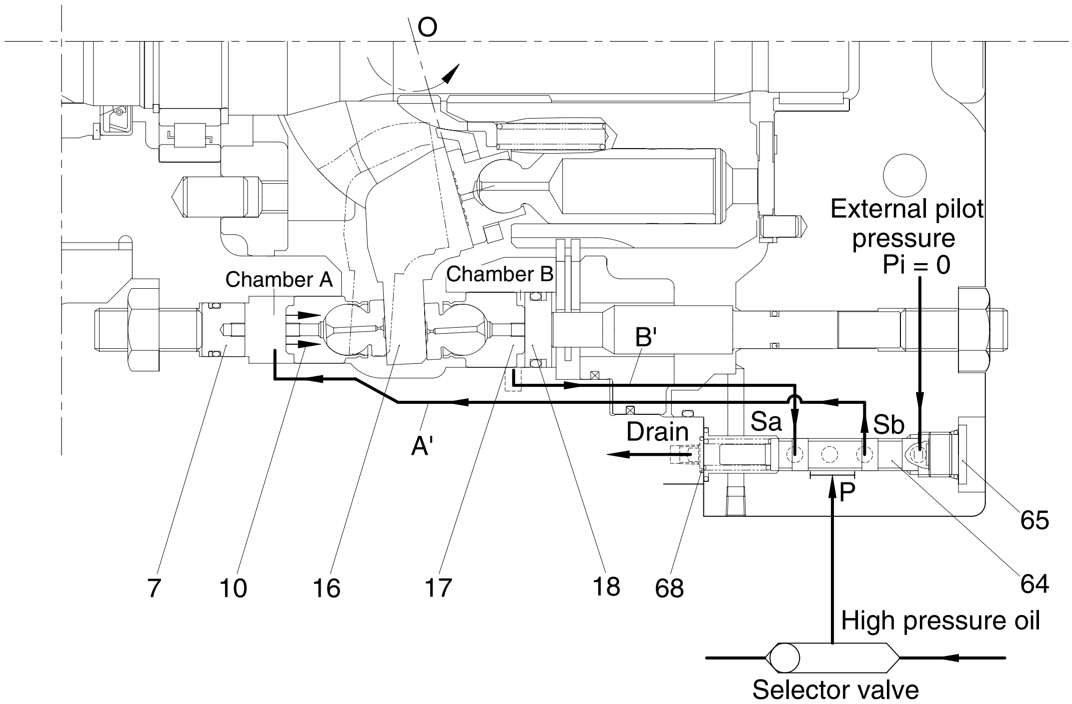
300072TM06

5) WORKING OF DISPLACEMENT CHANGEOVER

The capacity of the travel motor is changed by changing the tilting angle of this swash plate(16).
The tilting angle changes by displacement changeover valve.

(1) External pilot pressure : Pi = 0(Large displacement)

By means of the built-in high pressure selector mechanism in the valve casing(33), the high pressure oil working on the motor function to port P of the displacement-changeover valve.
A the spool(64) assembled in the displacement changeover valve is pressed to plug(65) by the spring(68), the high pressure oil at port P flows to port Sb.
This high pressure oil flows through oil passage(passage A') of valve casing(33) and shaft casing works to chamber A.
This oil in chamber B flows through passage B' and port Sa into the drain line. The displacement changeover piston(17) is pushed right and the swash plate(16) moves in the arrowed direction around rotation center 'O'. The swash plate moves until it touched stopper(18), and then is fixed there.



2907A2TM05

(2) External pilot pressure : Pi $\geq$ 20kgf/cm^2(small displacement)

If the force operating on spool(64) of the displacement changeover valve is stronger than the spring(68), and the spool moves to the left side.

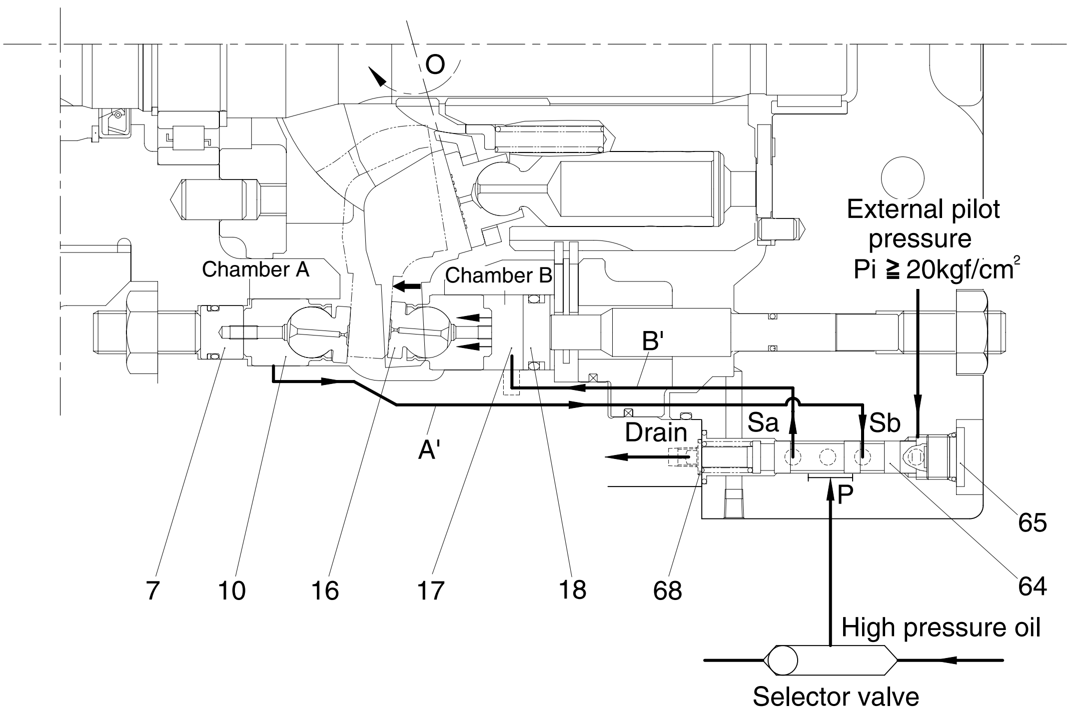
The high pressure oil is works on room B through passage Sa → B' from port P.

The oil in chamber A flows into the drain line through the passage A' → Sb.

The displacement changeover piston(17) is pushed left and the swash plate(16) moves in the arrowed direction around rotation center 'O'. The swash plate moves until it touches stopper(7), and then is fixed there.

If the load increase while the motor is working with its small displacement(Pi $\geq$ 20kgf/cm^2, 2nd speed) until the motor inlet port pressure reaches the preset value, the motor increase its displacement in response to the load, while maintaining the pressure at the preset value(automatic 2 -speed function). As motor inlet port pressure reaches the preset value and then spool(64) moves right side, inlet pressure oil flows into chamber A through port Sb and the swash plate moves until it touches stopper(17). If the load further increase until the displacement of the motor reaches the maximum value, the inlet port pressure increase further.

If the load decreases under this condition, the motor continues reducing its displacement in the reverse sequence. As the load and inlet port pressure decreases and reaches the preset value, spool(64) moves left side by the pilot pressure(Pi). Therefore inlet port pressure flow into chamber B through port Sa and the swash plate moves until it touches stopper(10).



2907A2TM06

6) REDUCTION GEAR

(1) Planetary gear mechanism

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

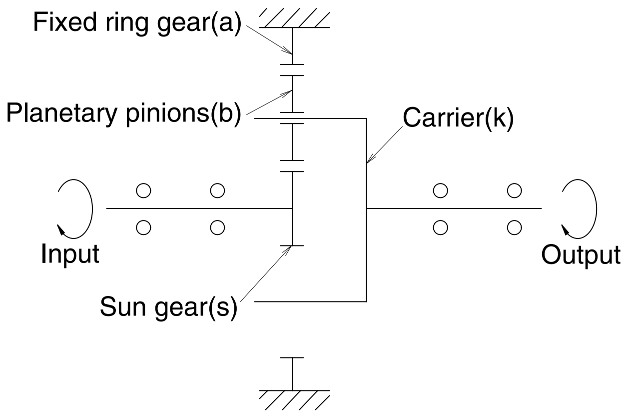
This reduction unit utilizes two stages, planetary reduction system.

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

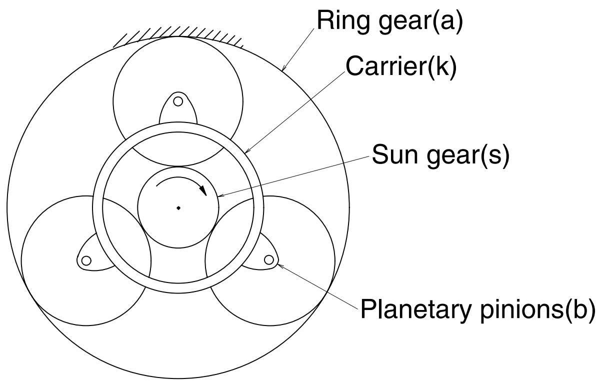
When the sun gear(s) is driven through input shaft, planetary pinions(b), rotating on their center, also move, meshing with fixed ring gear(a), around sun gears(s).

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

This mechanism is called planetary gear mechanism.



29072TM10

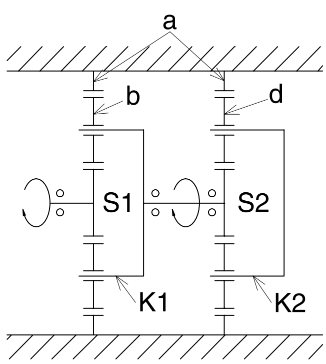


29072TM11

(2) Two stages reduction gear

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.

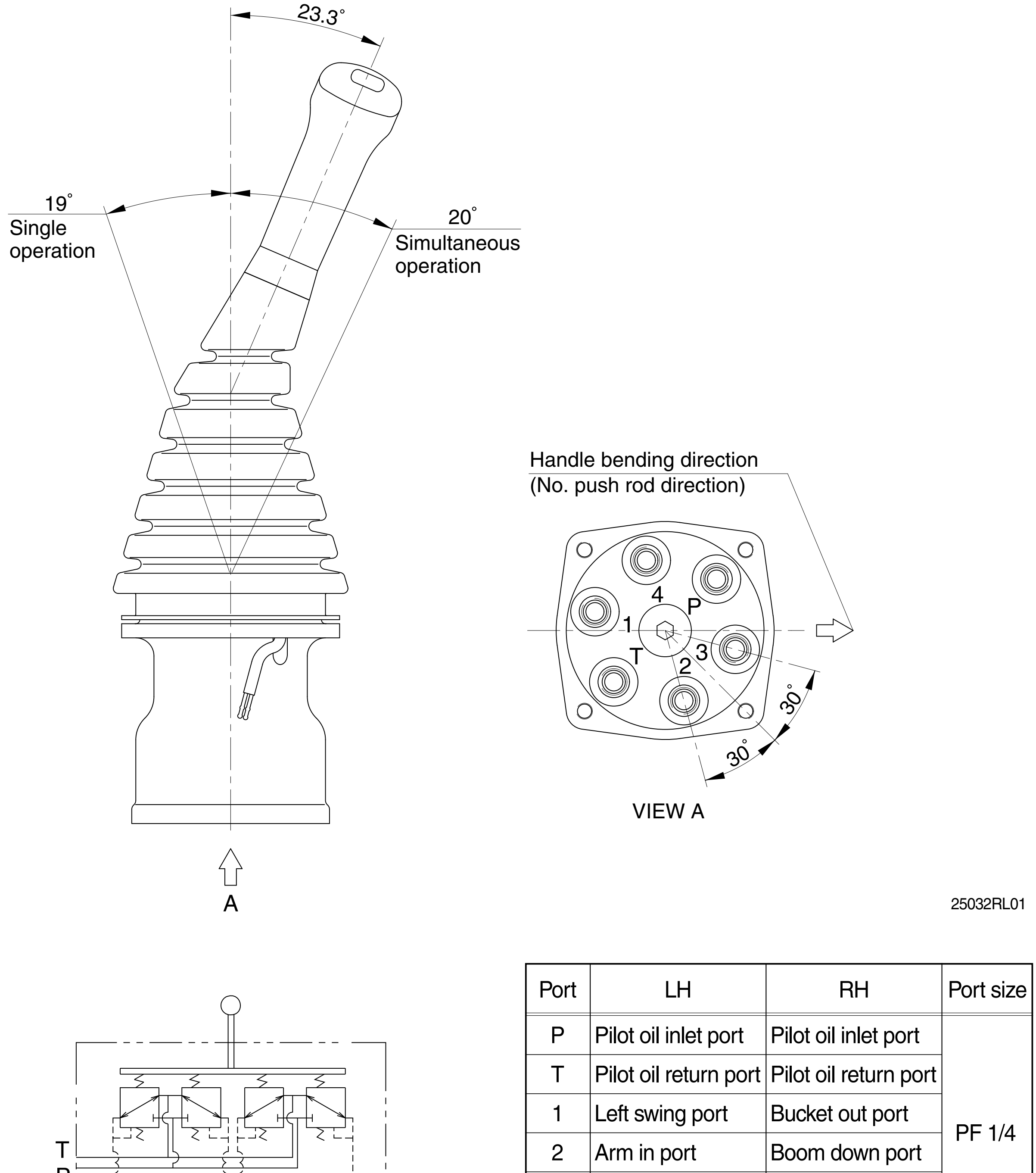


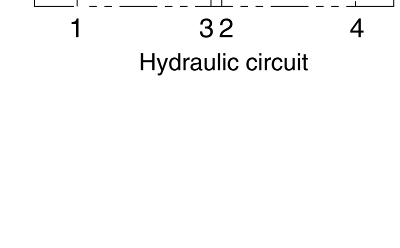
29072TM12

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.





Hydraulic circuit

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

CROSS SECTION

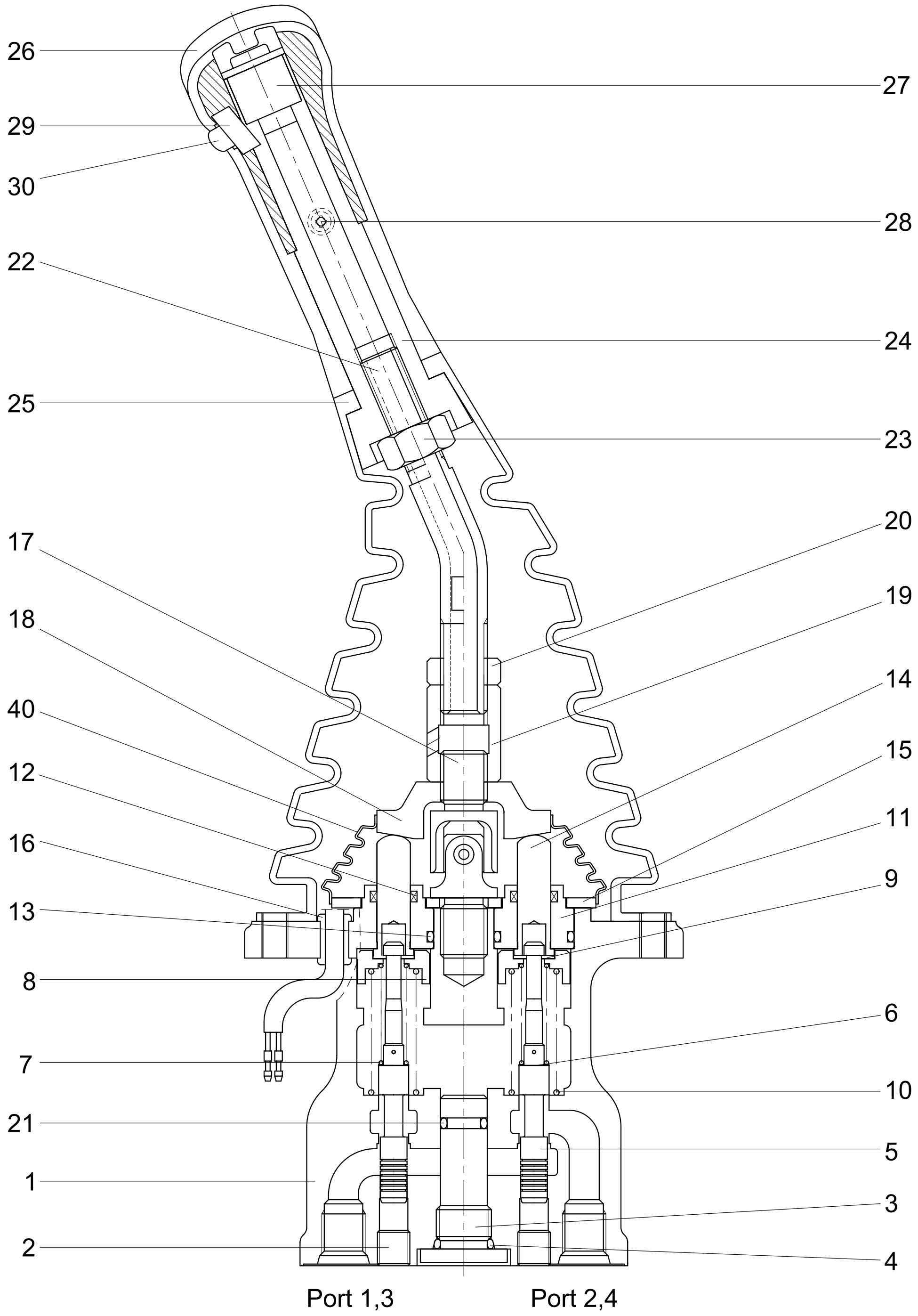
The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool(5), spring(7) for setting secondary pressure, return spring(10), stopper(9), spring seat(8) and shim(6). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5kgf/cm²(Depending on the type). The spool is pushed against the push rod(14) by the return spring.

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

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

CROSS SECTION



14072SF80

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool(5) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring(7) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod(14) is inserted and can slide in the plug(11).

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

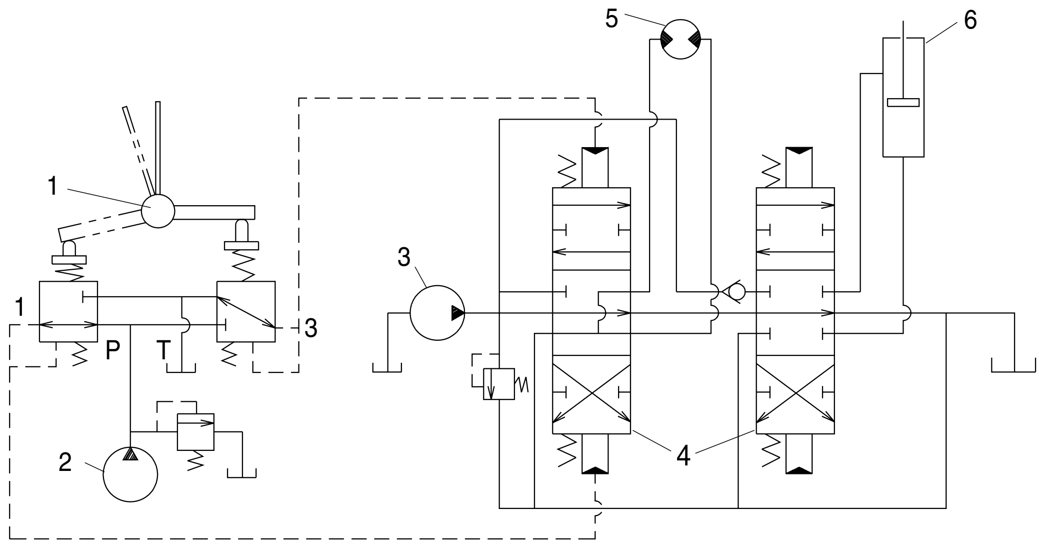
The spring(10) works on the case(1) and spring seat(8) and tries to return the push rod(14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

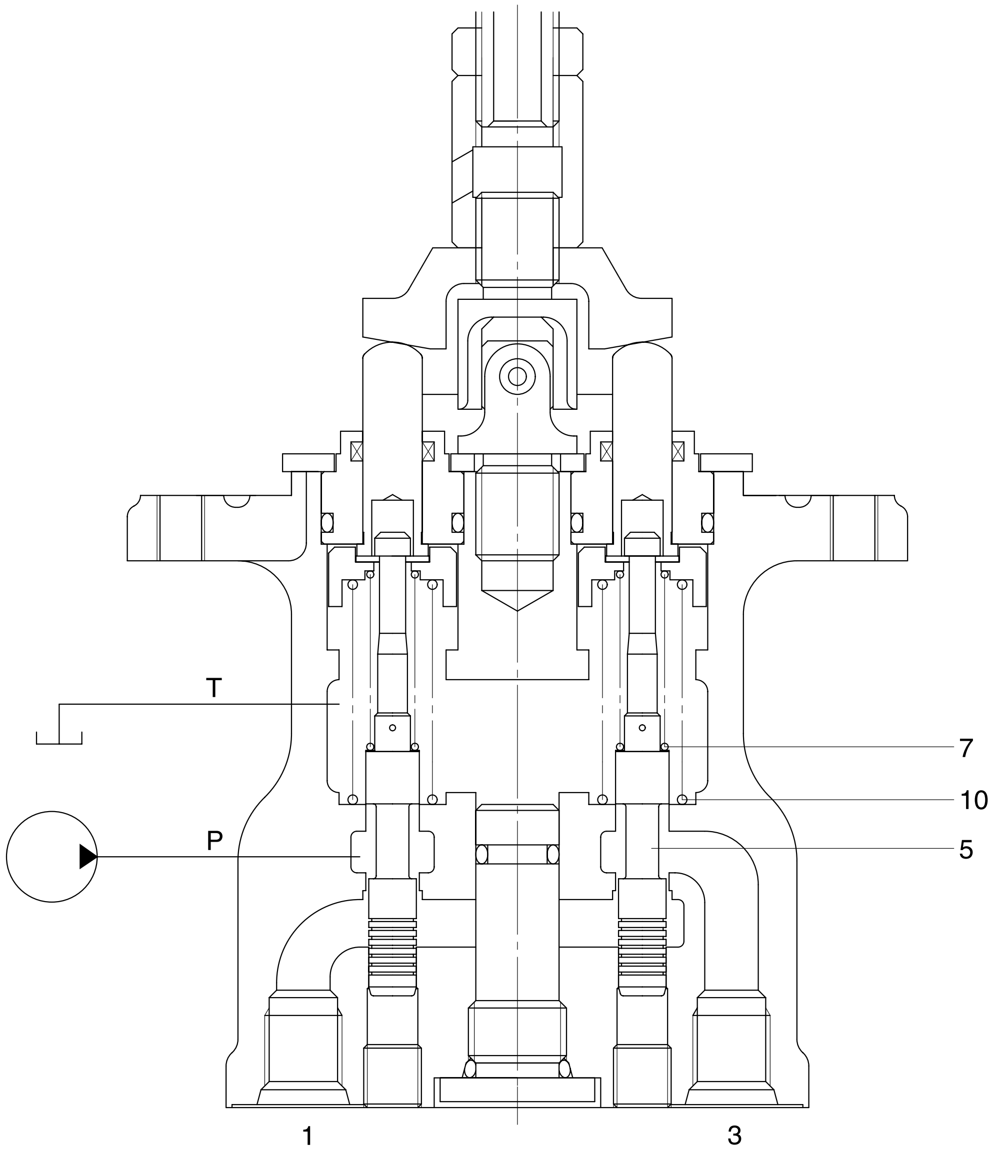
The diagram shown below is the typical application example of the pilot valve.



36072RL01

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

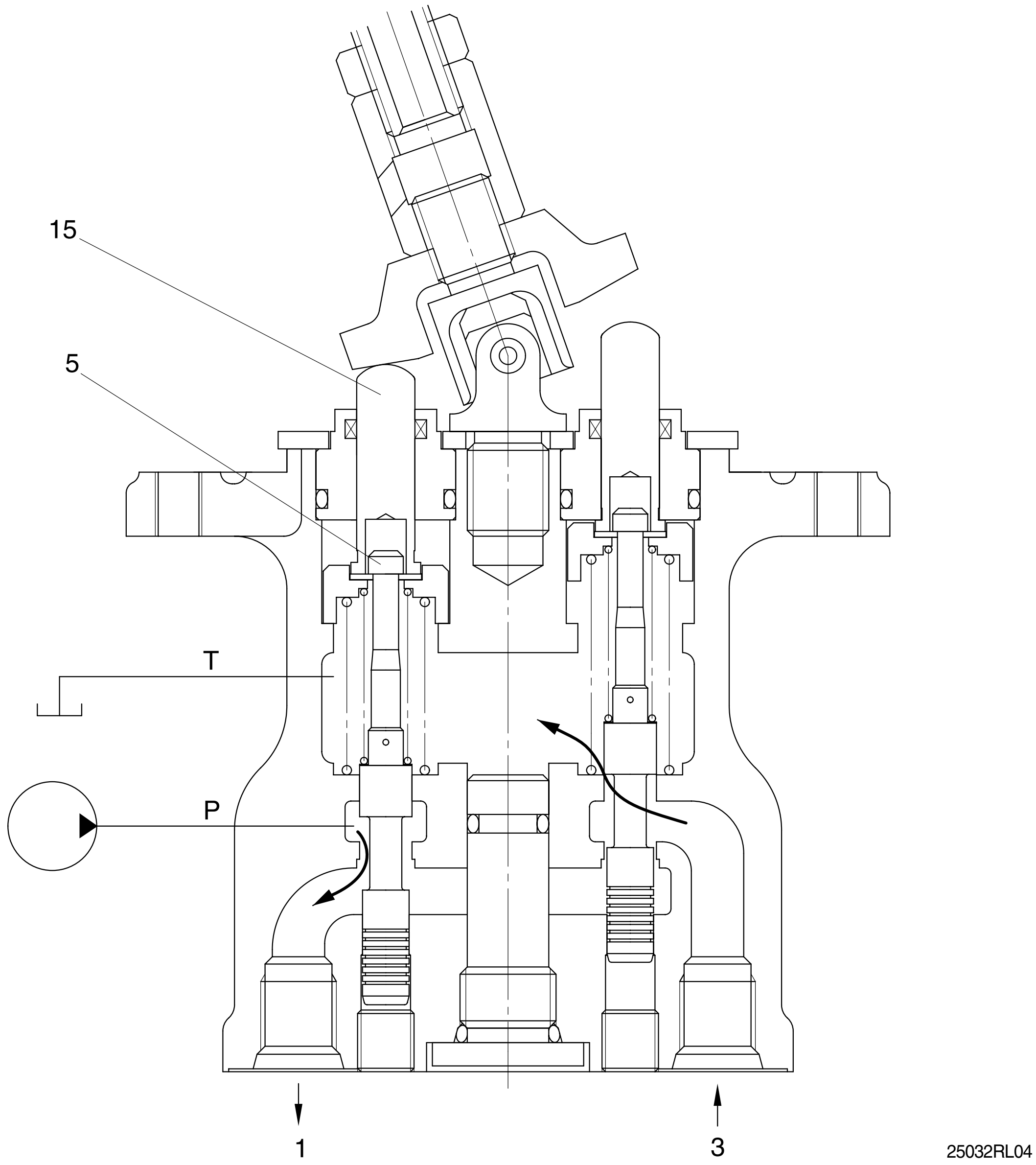
(1) Case where handle is in neutral position



25032RL03

The force of the spring(7) that determines the output pressure of the pilot valve is not applied to the spool(5). Therefore, the spool is pushed up by the spring(10) to the position of port(1, 3) in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where handle is tilted



When the push rod(14) is stroked, the spool(5) moves downwards.

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

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

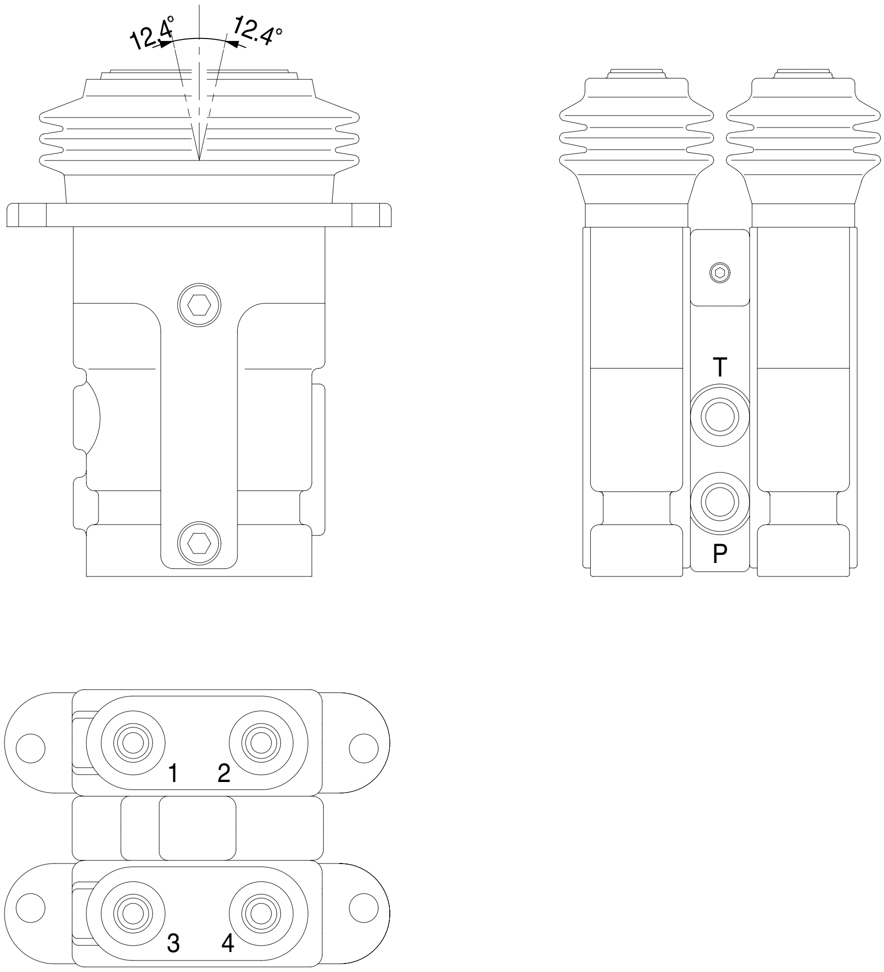
In this manner the secondary pressure is kept at the constant value.

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

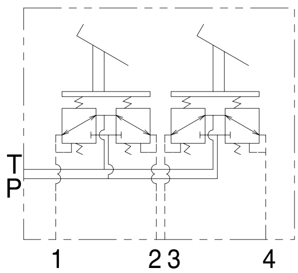
GROUP 6 RCV PEDAL

1. STRUCTURE

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



14072SF73



Hydraulic circuit

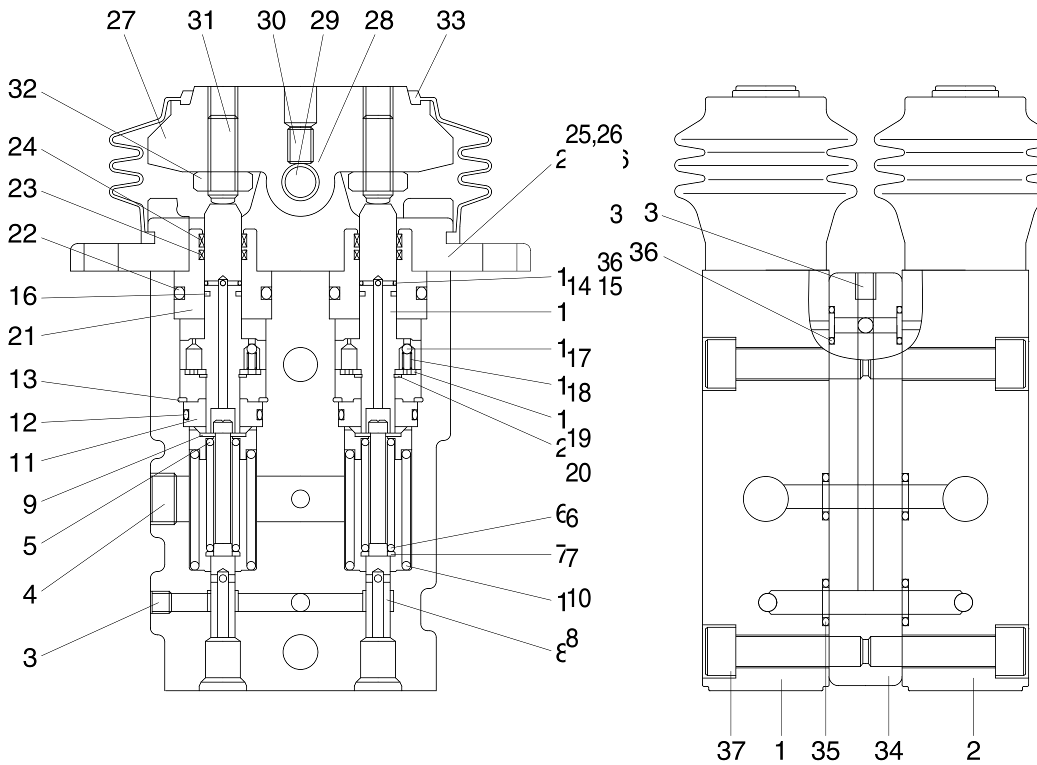
Port	Port	Port size
P	Pilot oil inlet port	
T	Pilot oil return port	
1	Travel(LH, Forward)	PF 1/4
2	Travel(LH, Backward)	
3	Travel(RH, Forward)	
4	Travel(RH, Backward)	

CROSS SECTION

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

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

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



14072SF70

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

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.

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

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

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

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

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

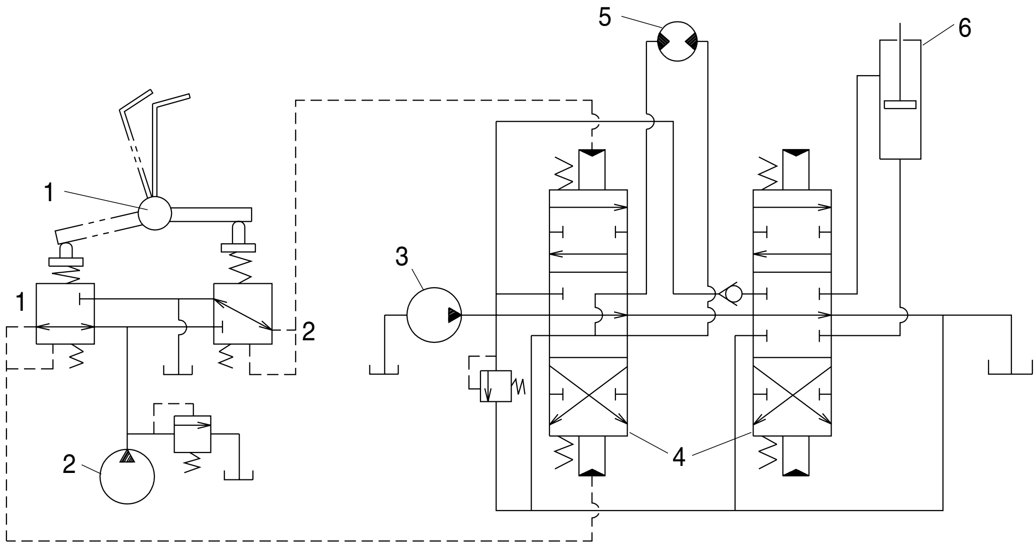
(5) **FUNCTIONS OF MAJOR SECTIONS**

2) The functions of the spool(8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.
The spring(6) works on this spool to determine the output pressure.
The change the deflection of this spring, the push rod(14) is inserted and can slide in the plug(21).
For the purpose of changing th displacement of the push rod through the cam(27) and adjusting nut(32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam(27) center.
The spring(10) works on the casing(1) and spring seat(7) and tries to return the push rod(14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.
This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

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

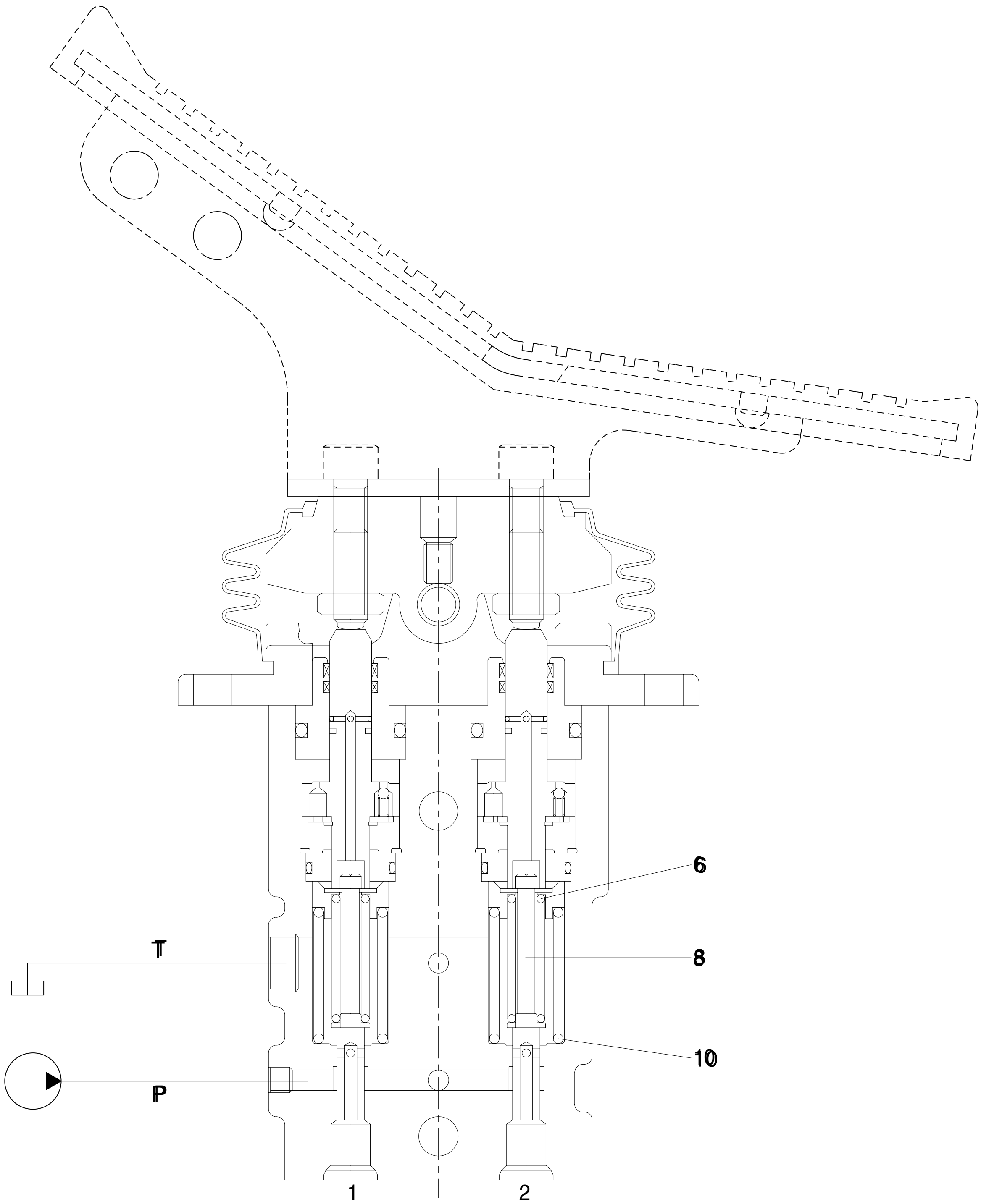
The diagram shown below is the typical application example of the pilot valve.



2-76 (140-7)

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

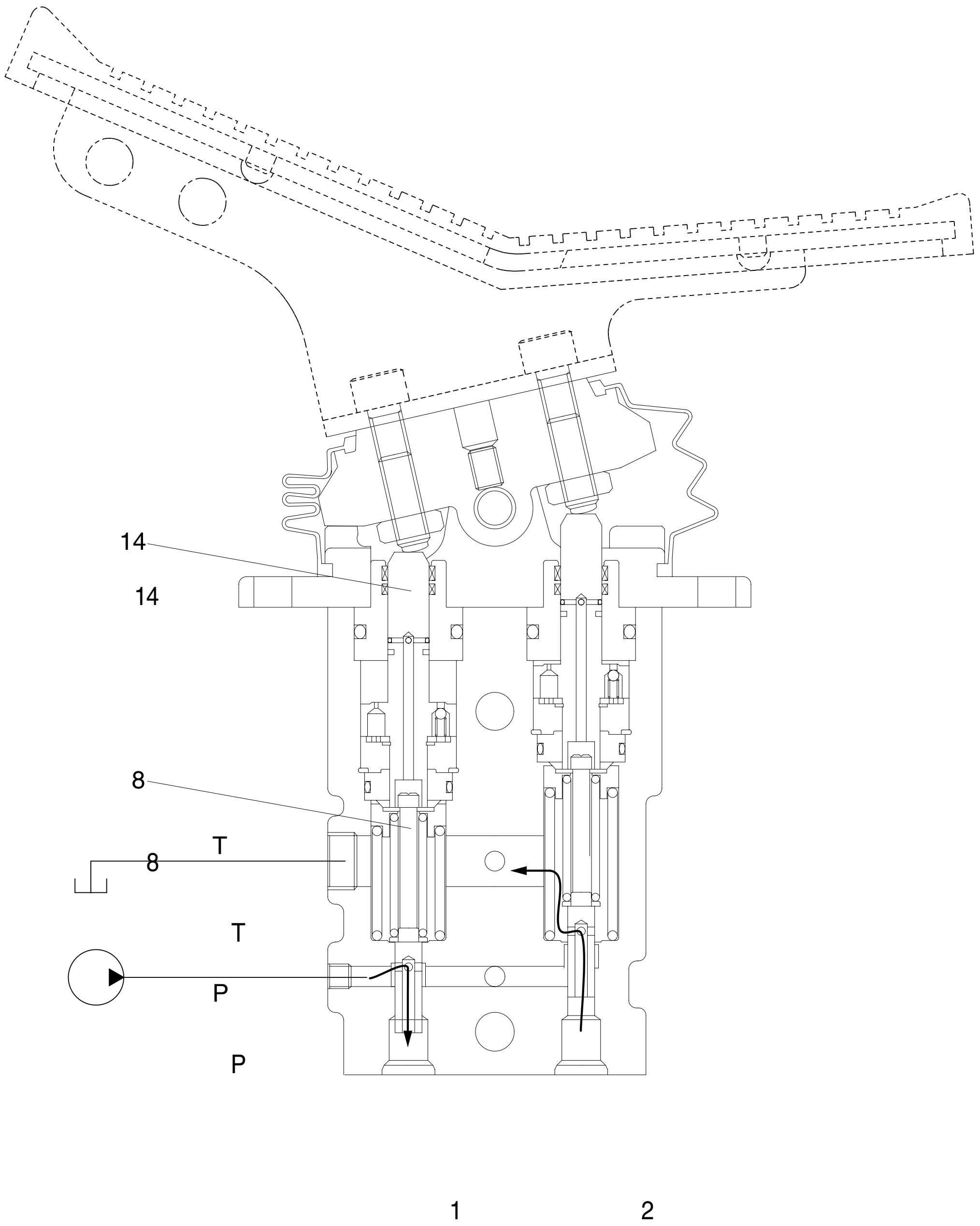
(1) Case where pedal is in neutral position



14072SF74

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

(2) Case where pedal is tilted

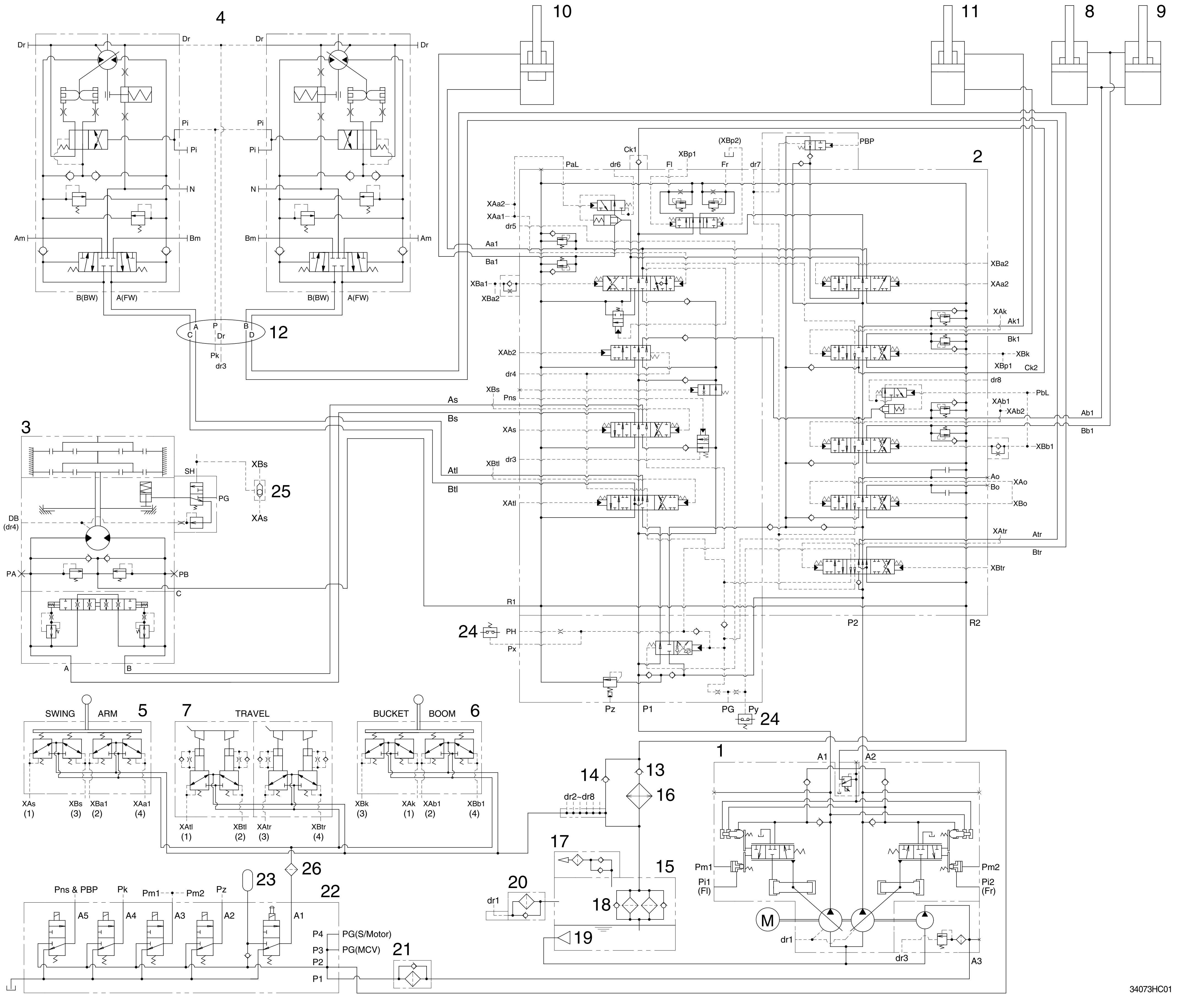


14072SF75

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

SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT



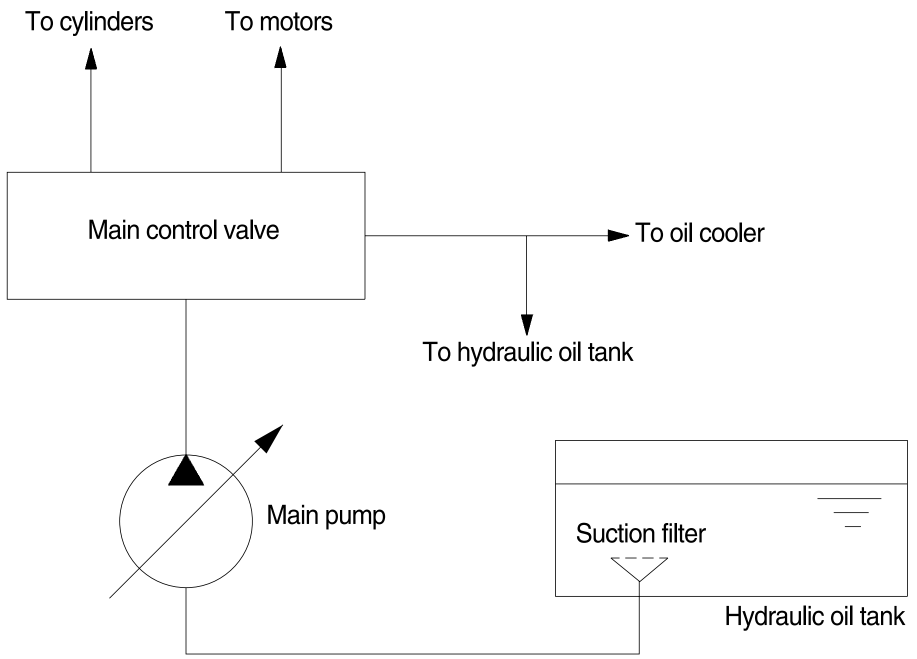
1. Main pump
2. Main control valve
3. Swing motor
4. Travel motor
5. RCV lever(LH)
6. RCV lever(RH)
7. Rcv pedal
8. Boom cylinder(LH)
9. Boom cylinder(RH)
10. Arm cylinder
11. Bucket cylinder
12. Turning joint
13. Check valve
14. Check valve
15. Hydraulic tank
16. Oil cooler
17. Air breather
18. Bypass valve
19. Strainer
20. Spin filter
21. Line filter
22. Solenoid valve
23. Accumulator
24. Pressure switch
25. Shuttle valve
26. Last guard filter

34073HC01

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 tandem axial piston pump is used as the main pump and is driven by the engine at ratio 1.0 of engine speed.

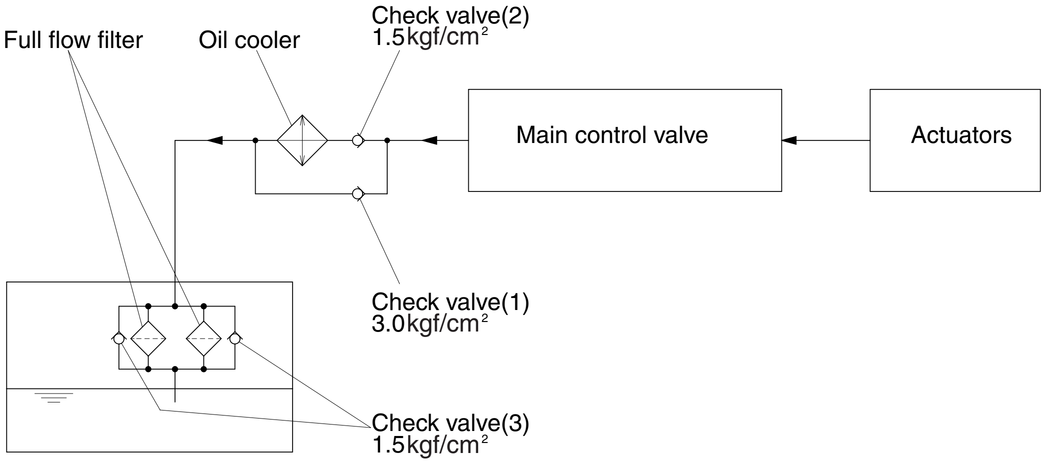
1. SUCTION AND DELIVERY CIRCUIT



3-02 (290-7)

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

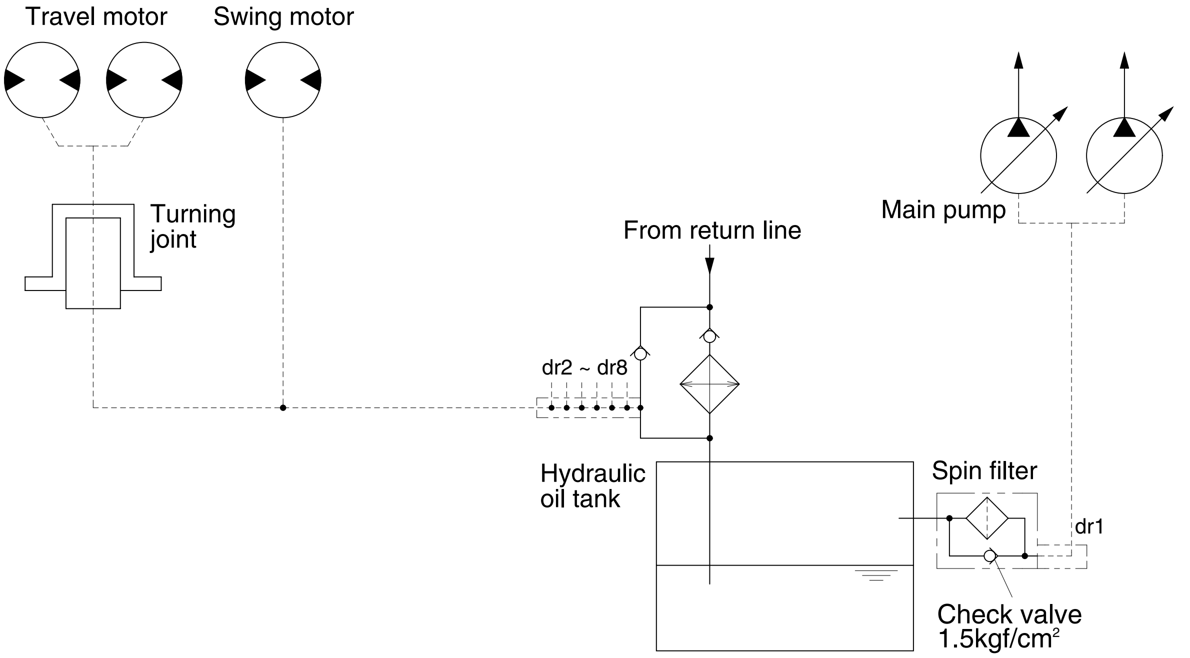
2. RETURN CIRCUIT



R29073CI01

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

3. DRAIN CIRCUIT



R29073CI02

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

1) TRAVEL MOTOR DRAIN CIRCUIT

Oil leaking 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 full flow filter in the hydranlic tank.

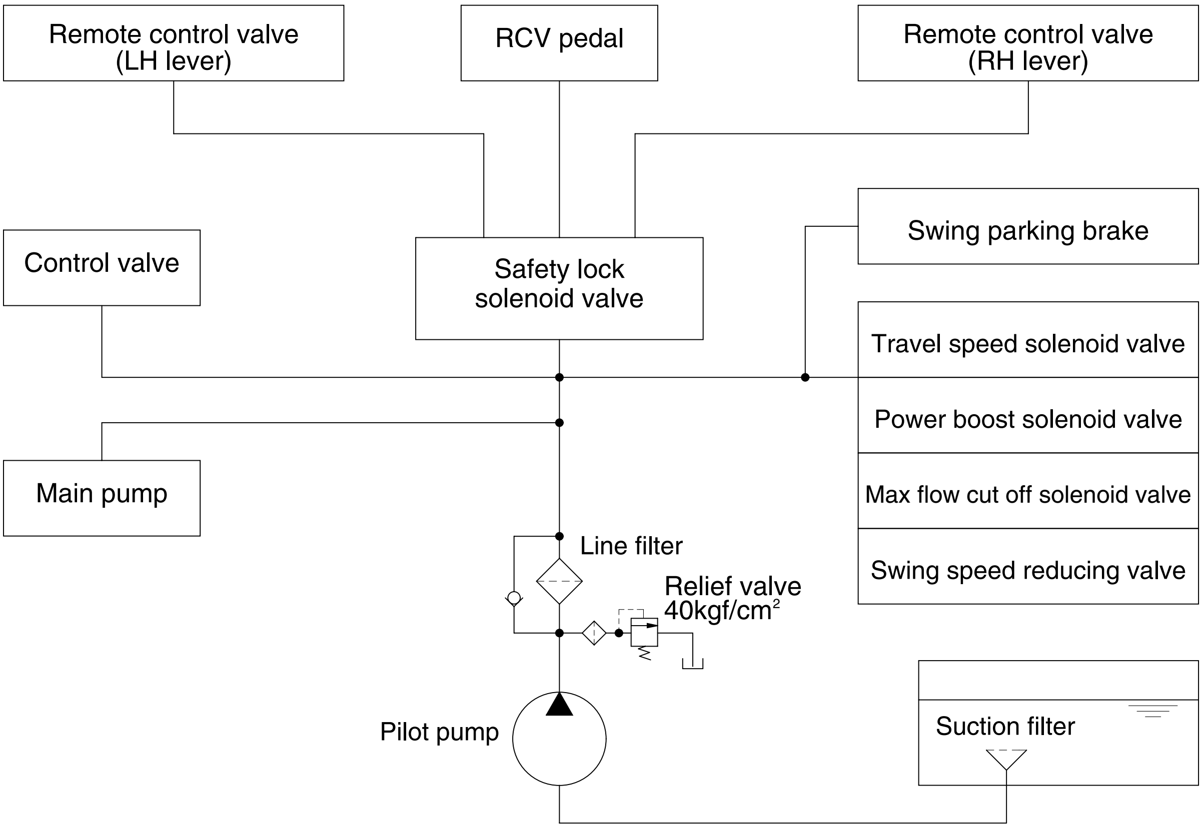
2) SWING MOTOR DRAIN CIRCUIT

Oil leaking from the swing motor come out and return to the hydraulic tank passing through a spin filter.

3) MAIN PUMP DRAIN CIRCUIT

Oil leaking from main pump come out and return to the hydraulic tank passing through spin filter.

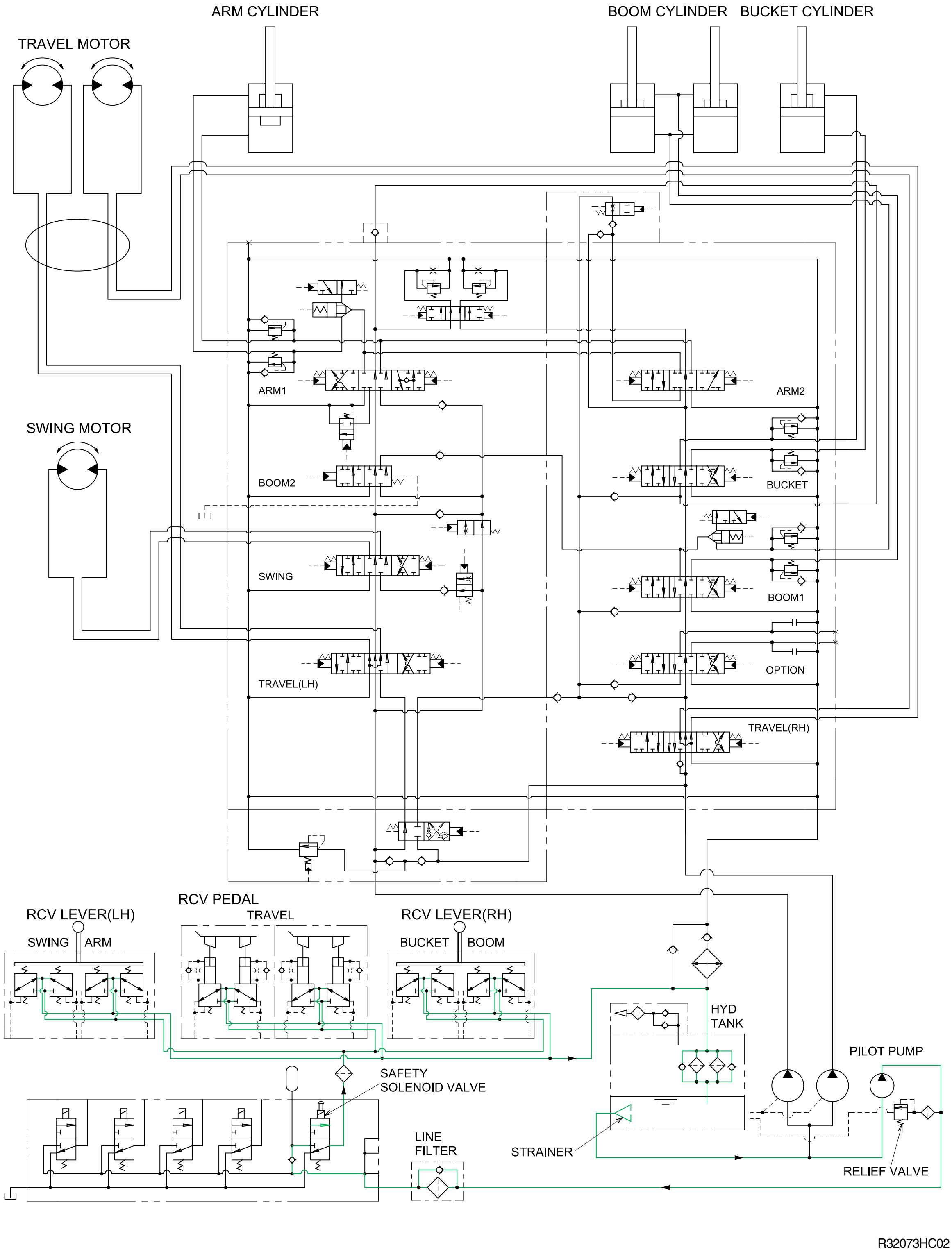
GROUP 3 PILOT CIRCUIT



R29073CI03

The pilot circuit consists of suction circuit, delivery circuit and return circuit.
The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction filter.
The discharged oil from the pilot pump flows to the remote control valve through line filter, EPPR valve, solenoid valve assemblies, swing parking brake, main control valve and safety lock solenoid valve.

1. SUCTION, DELIVERY AND RETURN CIRCUIT

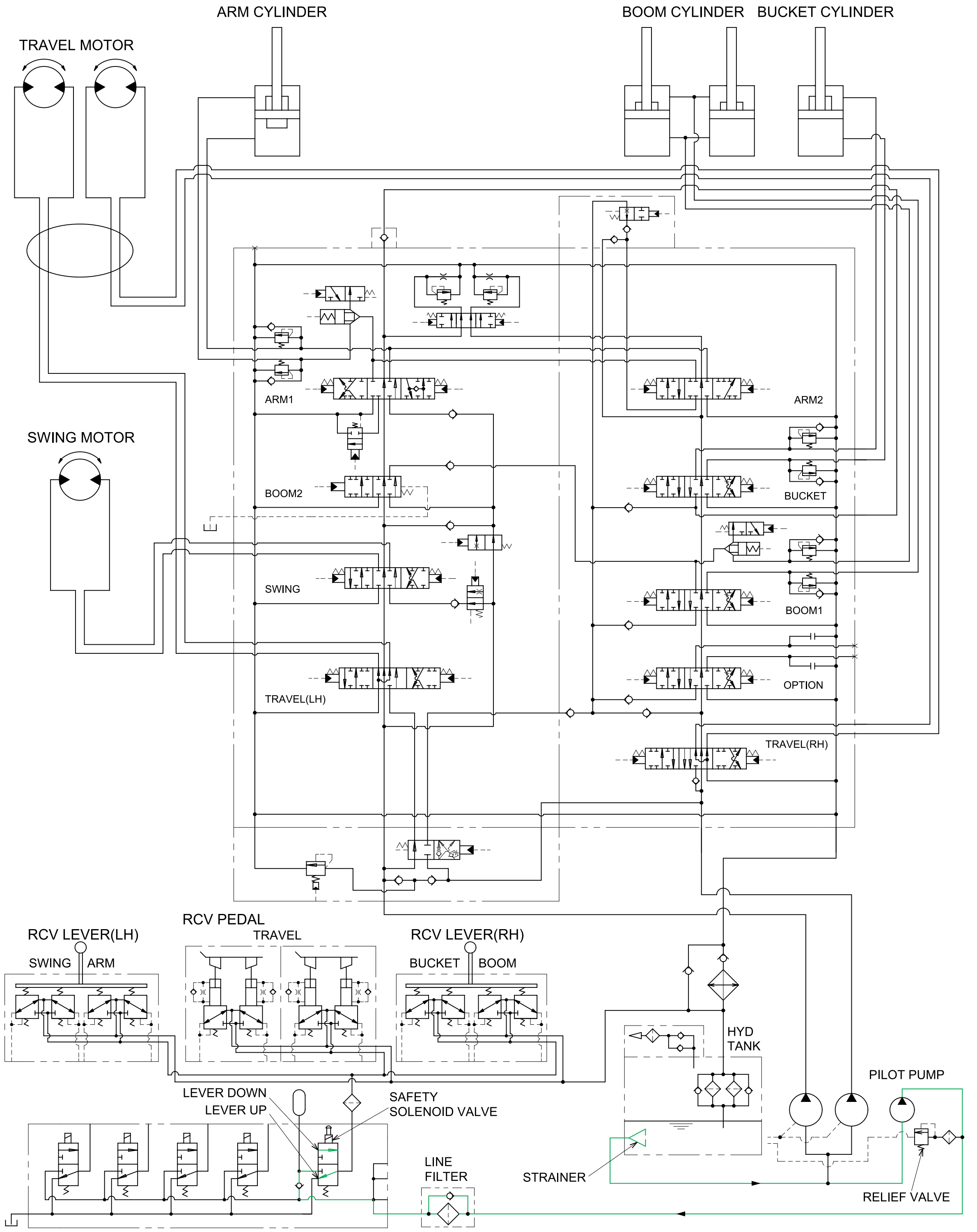


The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

The return oil from remote control valve returned to hydraulic tank.

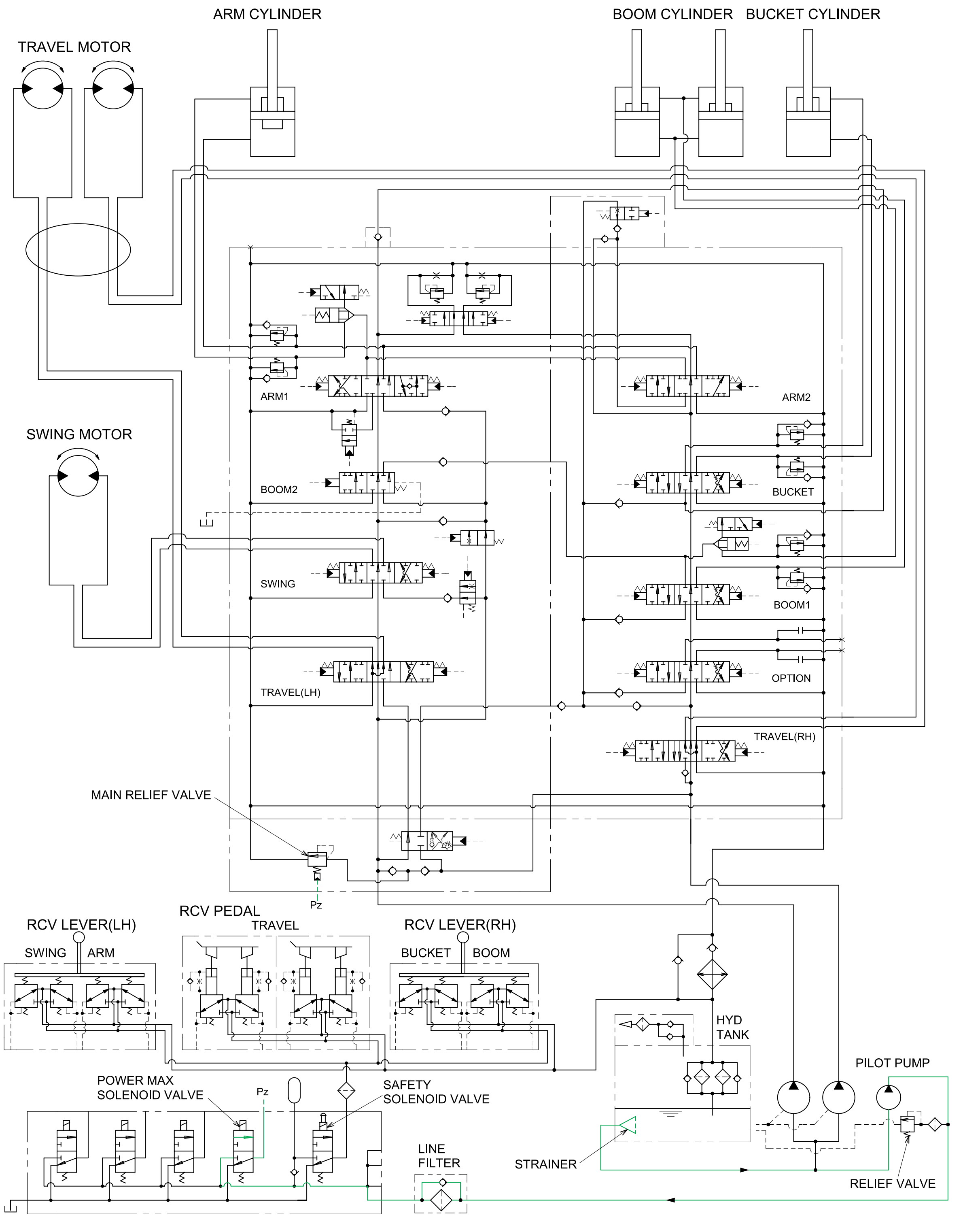
2. SAFETY SOLENOID VALVE(SAFETY LEVER)



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

When the lever of the safety solenoid valve moved upward, oil does not flows into the remote control valve, because of blocked by the spool.

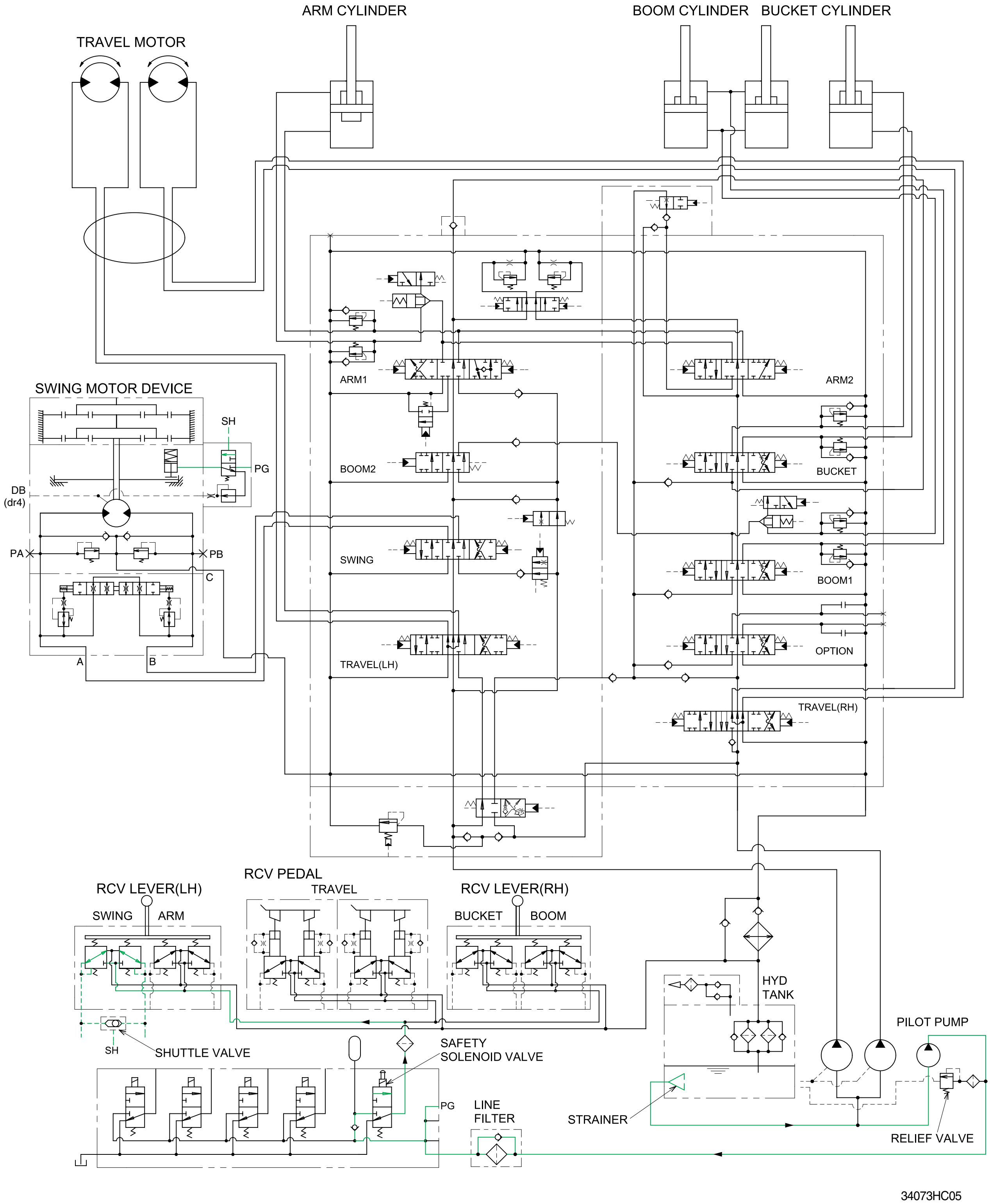
3. MAIN RELIEF PRESSURE CHANGE CIRCUIT



R32073HC04

When the power max switch on the left control lever is pushed ON, the power max solenoid valve is actuated, the discharged oil from the pilot pump into Pz port of the main relief valve of main control valve ; Then the setting pressure of the main control valve is raises from 330kgf/cm² to 360kgf/cm² for increasing the digging power. And even when press continuously, it is canceled after 8 seconds.

4. SWING PARKING BRAKE RELEASE

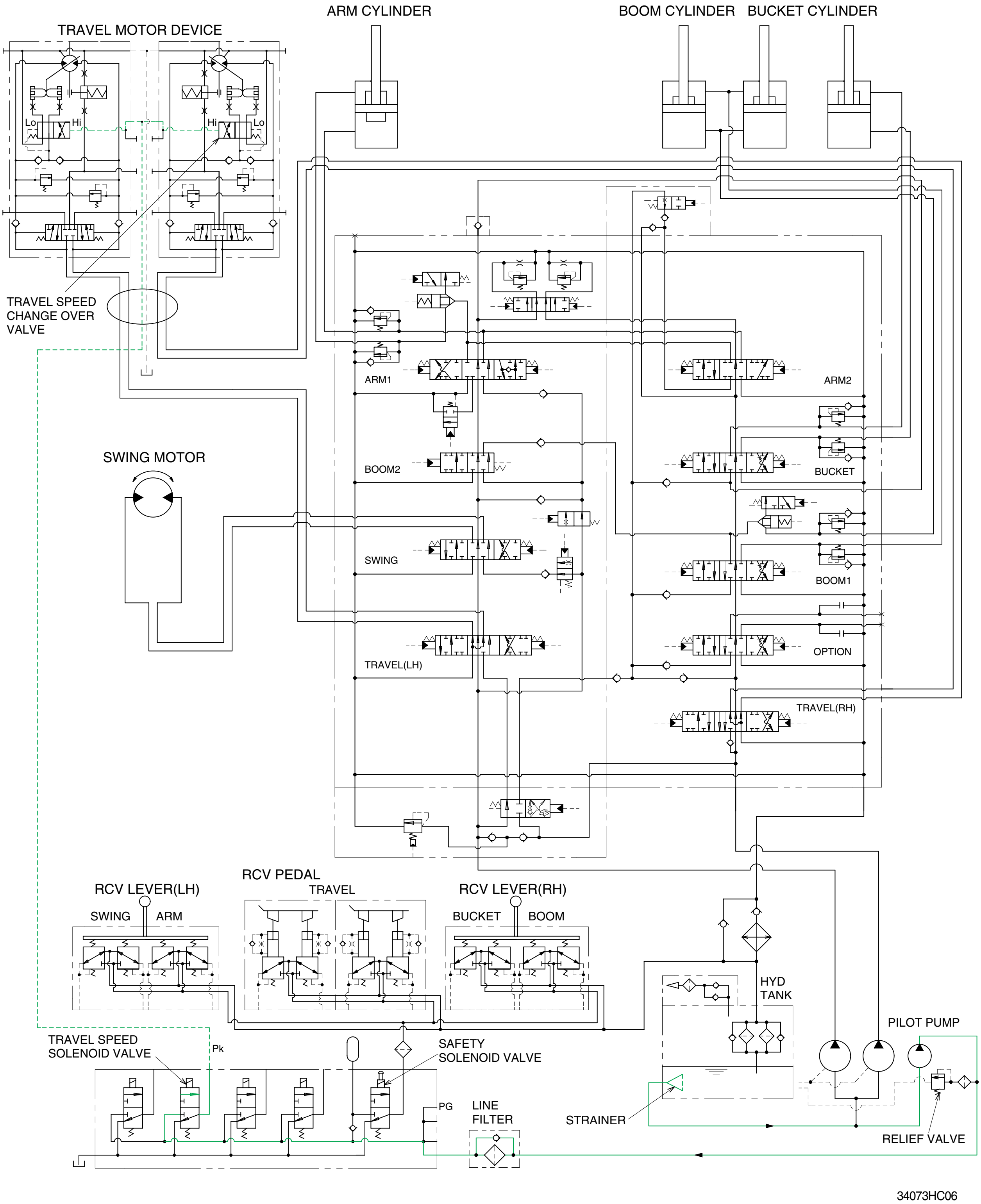


When the swing control lever is operated, the pilot oil flows to SH port of shuttle valve, this pressure move spool so, discharged oil from pilot pump flows to PG port.

This pressure is applied to swing motor disc cylinder, thus the brake released.

When the swing control lever is set neutral position, oil in the swing motor disc cylinder is drain, thus the brake is applied.

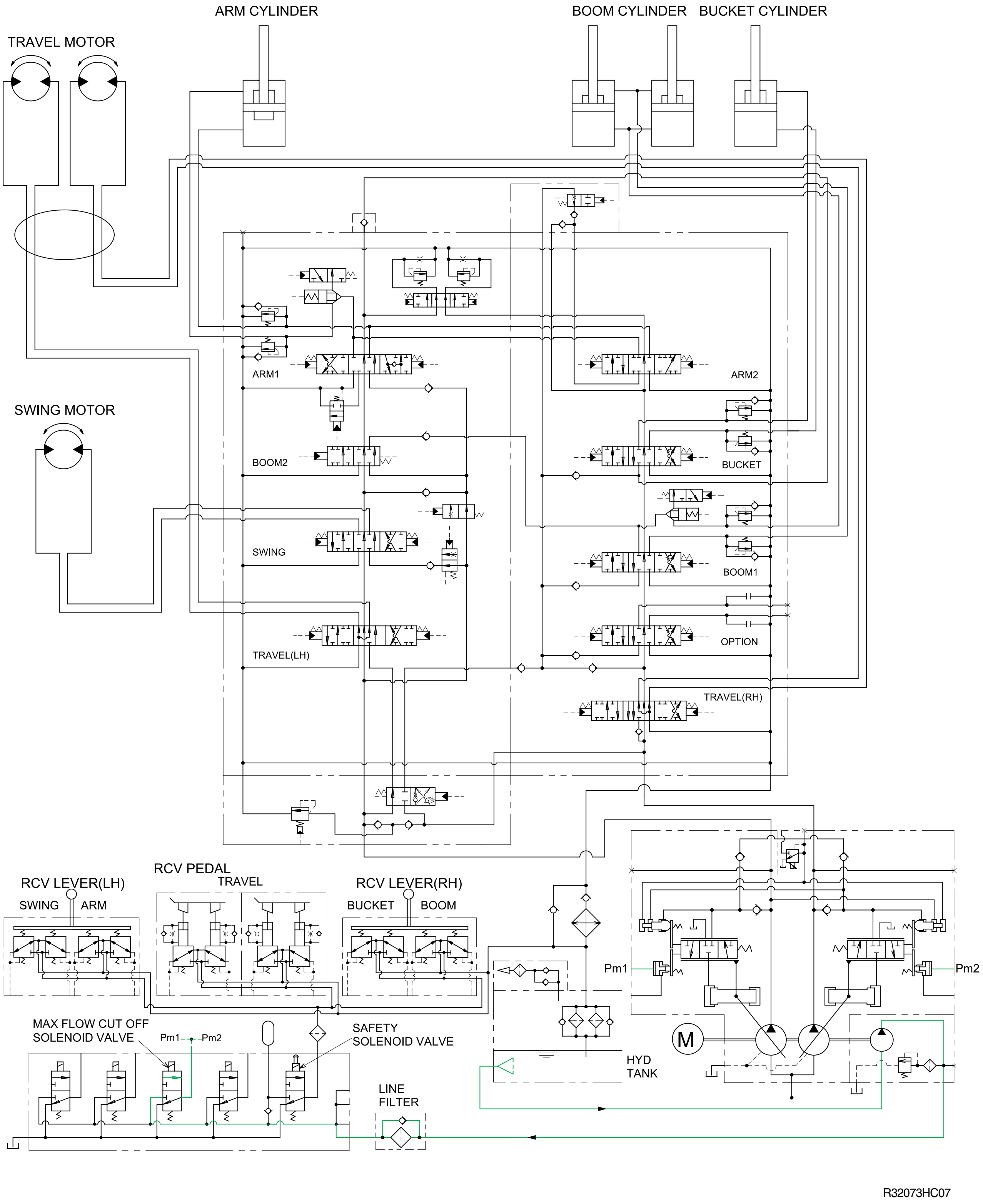
5. TRAVEL SPEED CONTROL PRESSURE



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

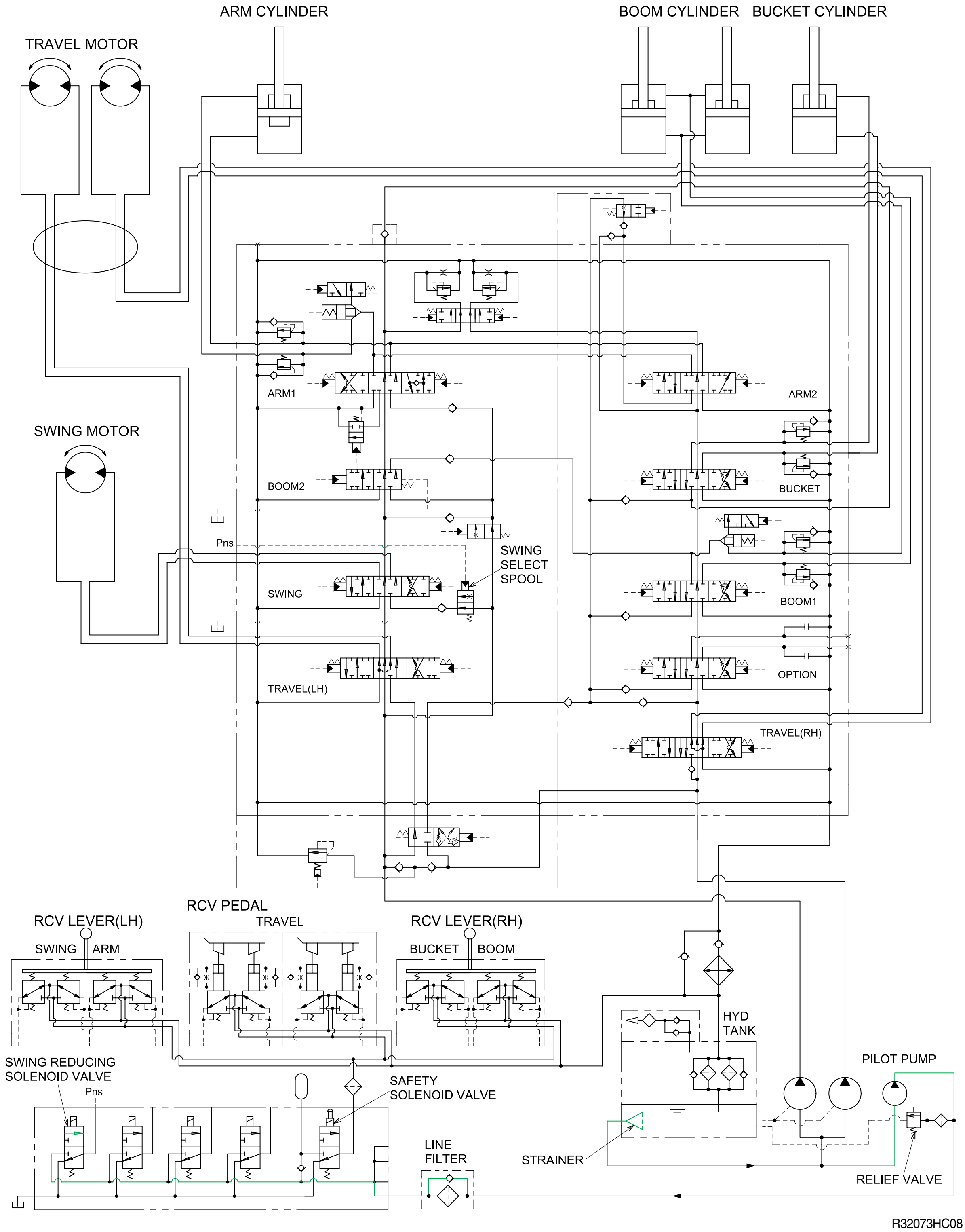
When the travel speed solenoid valve was placed in the Lo position, the oil of Pk port return to the tank and the control piston is returned, thus maximizing the displacement.

6. MAX FLOW CUT OFF SYSTEM



When the breaker operation mode is selected on the cluster, max flow cut off solenoid valve actuates automatically. Thus pilot pressure(Pm1,Pm2) is sent to the regulator and pump discharge volume is decreased.

7. BOOM PRIORITY SYSTEM

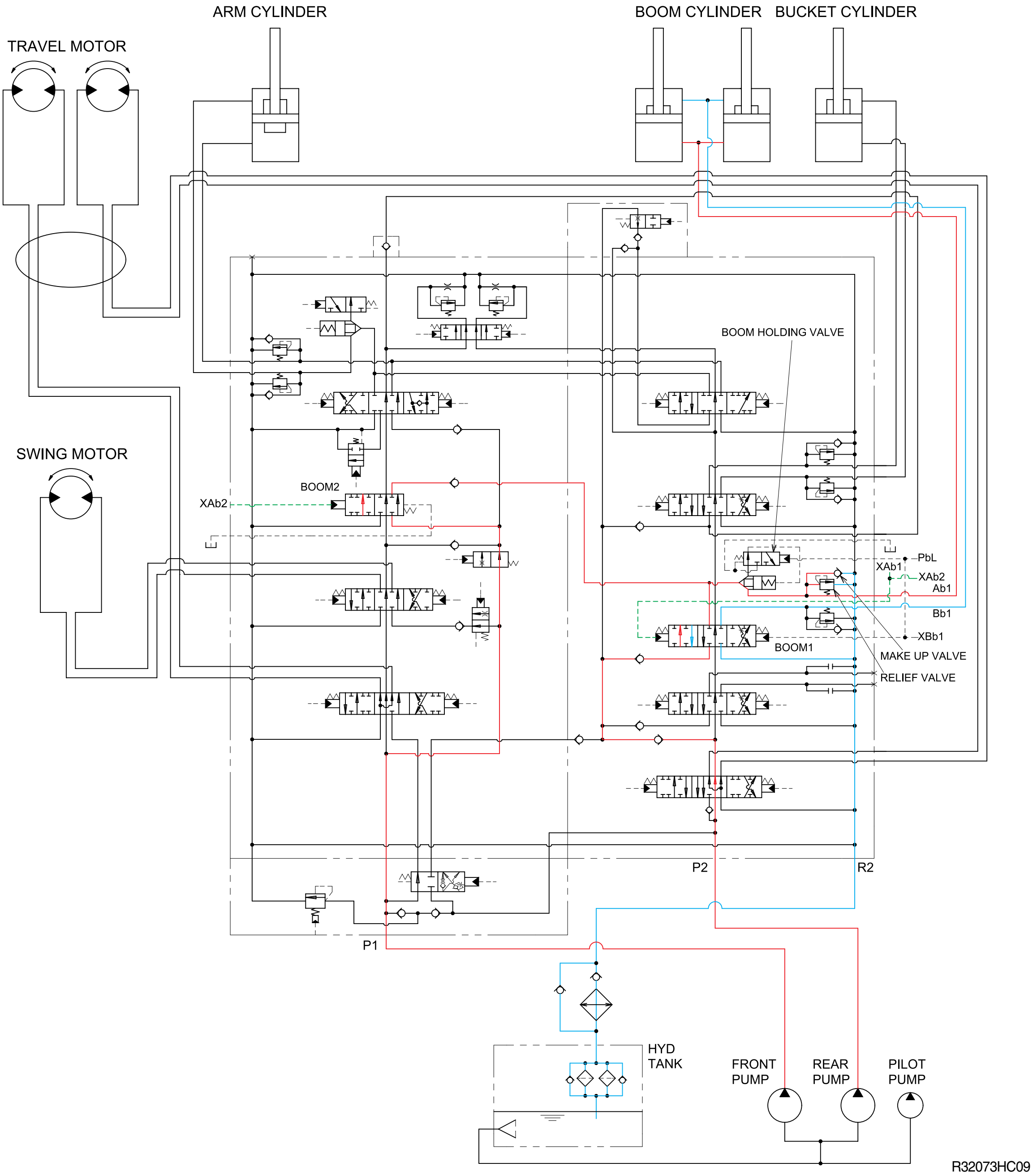


When carrying out the combined operation of swing and boom or arm of the left control valve, the boom or arm speed can be lowered than operating speed of swing. When the heary duty working mode in work mode is selected on the cluster, swing reducing solenoid valve actuates automatically. The oil from pilot pump flows into the solenoid valve through the line filter.

Pns pressure from solenoid valve change the swing select spool and decreases the oil flow rate to the swing section by orifice. This is called the boom priority system.

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION



When the RH 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 front and rear pump flows into the main control valve and then goes to the large chamber of boom cylinders.

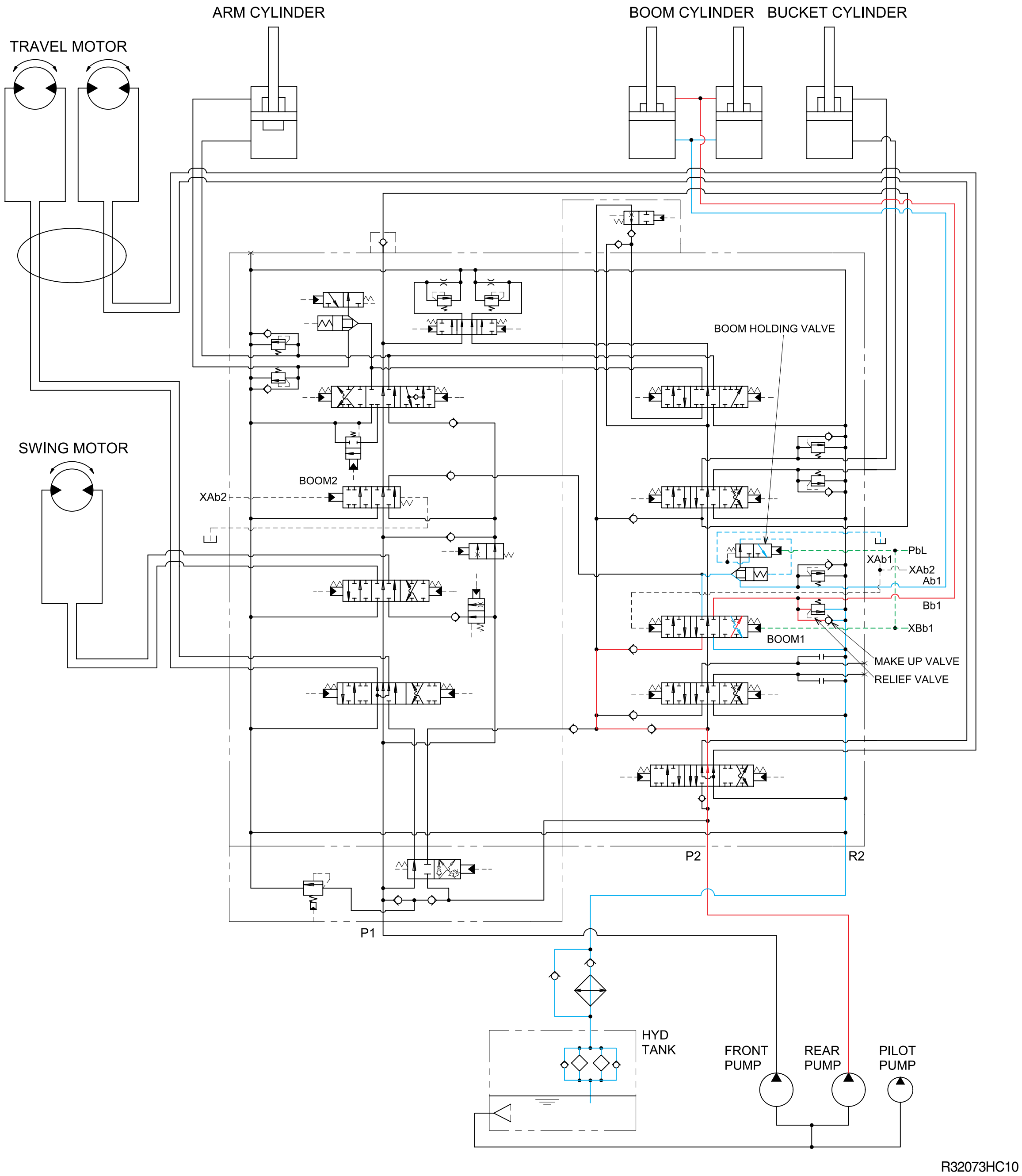
At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up.

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

When the boom is up and the control lever is returned to neutral position, the circuit for the holding pressure at the bottom end of the boom cylinder is closed by the boom holding valve.

This prevents the hydraulic drift of boom cylinder.

2. BOOM DOWN OPERATION



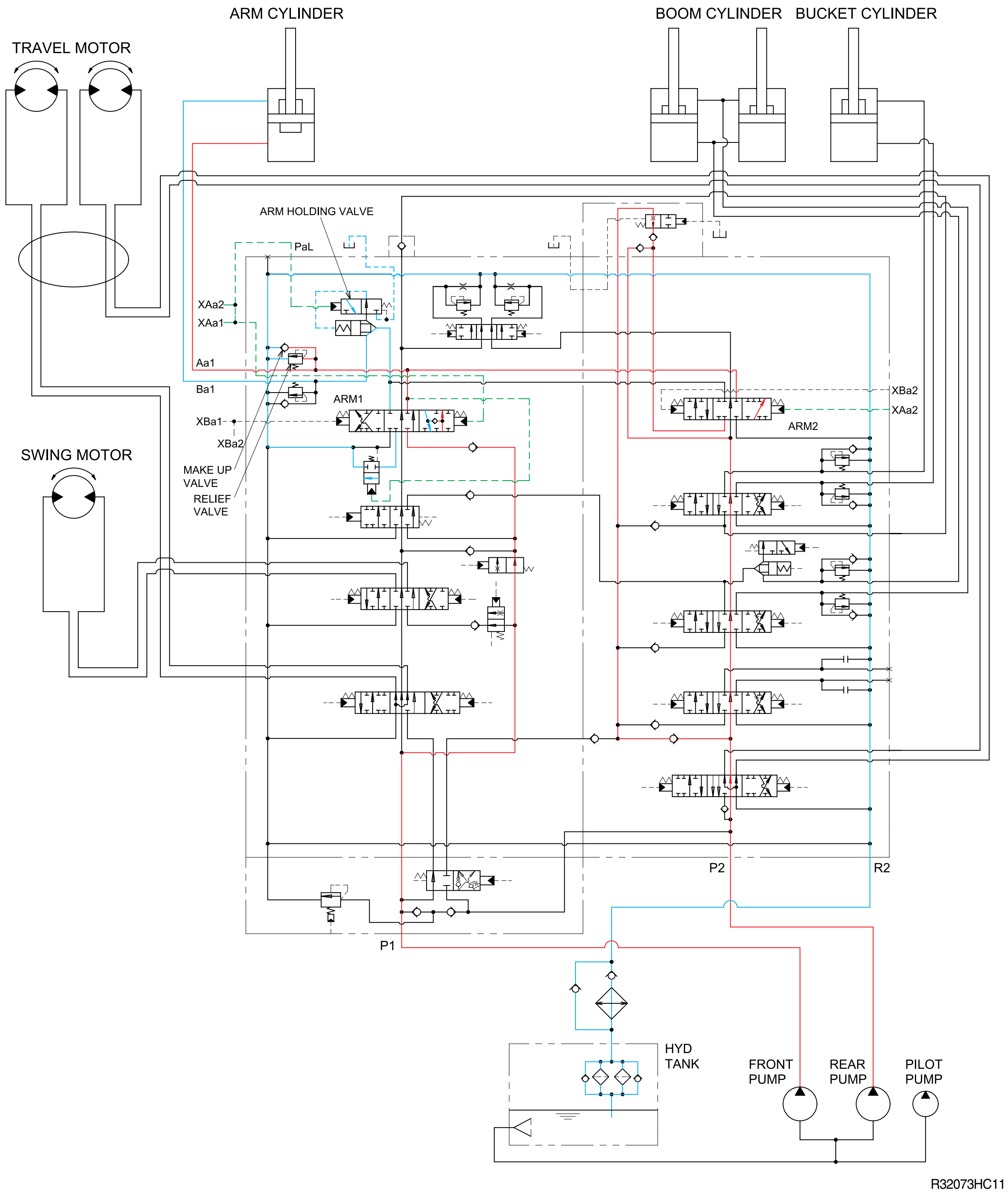
When the RH control lever is pushed forward, the boom spools in the main control valve are moved to the down position by the pilot oil pressure from the remote control valve.

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

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

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

3. ARM ROLL IN OPERATION



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

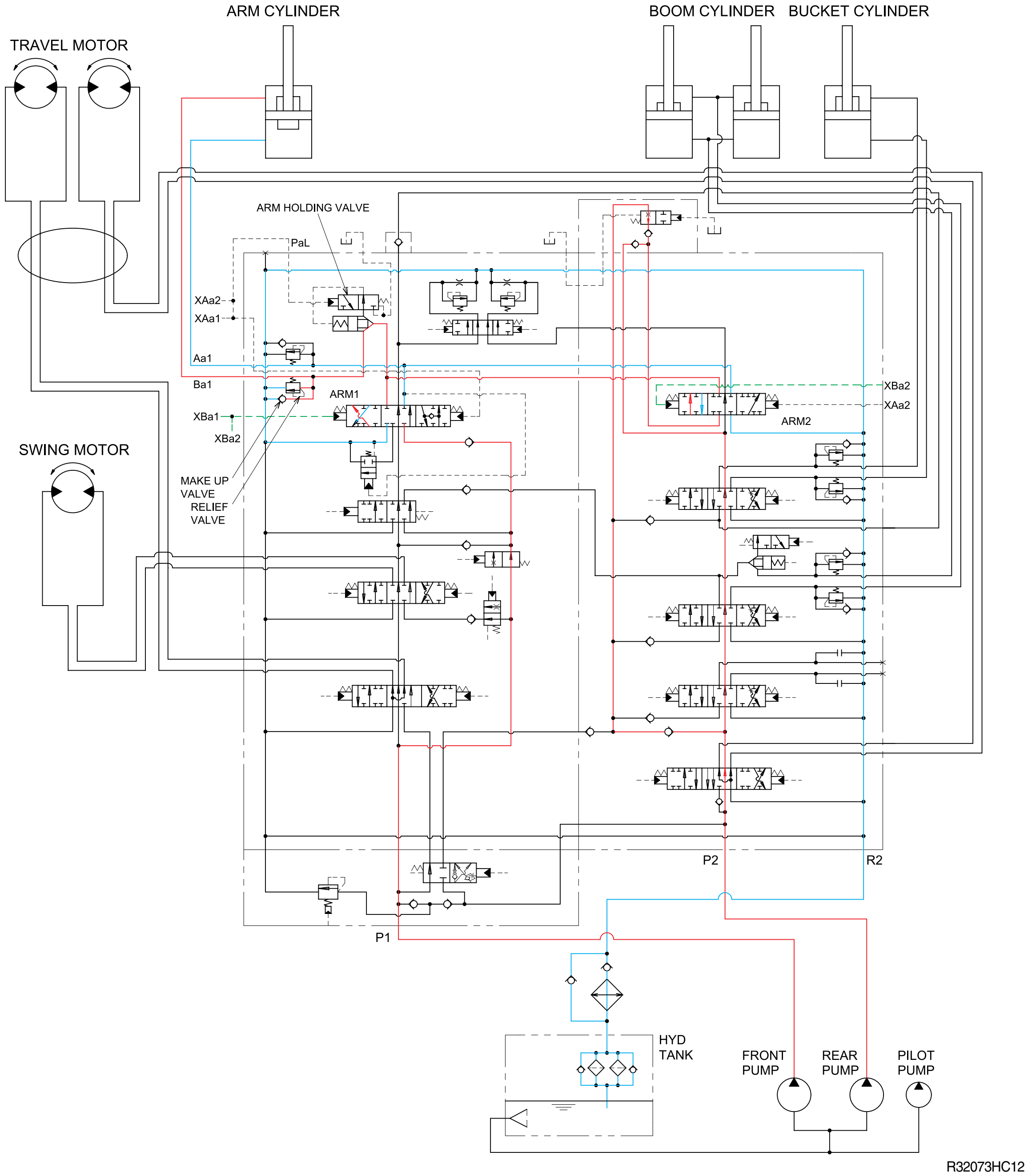
The oil from the front and rear pump flows into the main control valve and then goes to the large chamber of arm cylinder.

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

When the roll in speed of arm is faster, the oil returned from the small chamber of arm cylinder combines with the oil from both pump, and flows into the large chamber of the arm cylinder by a make up valve.

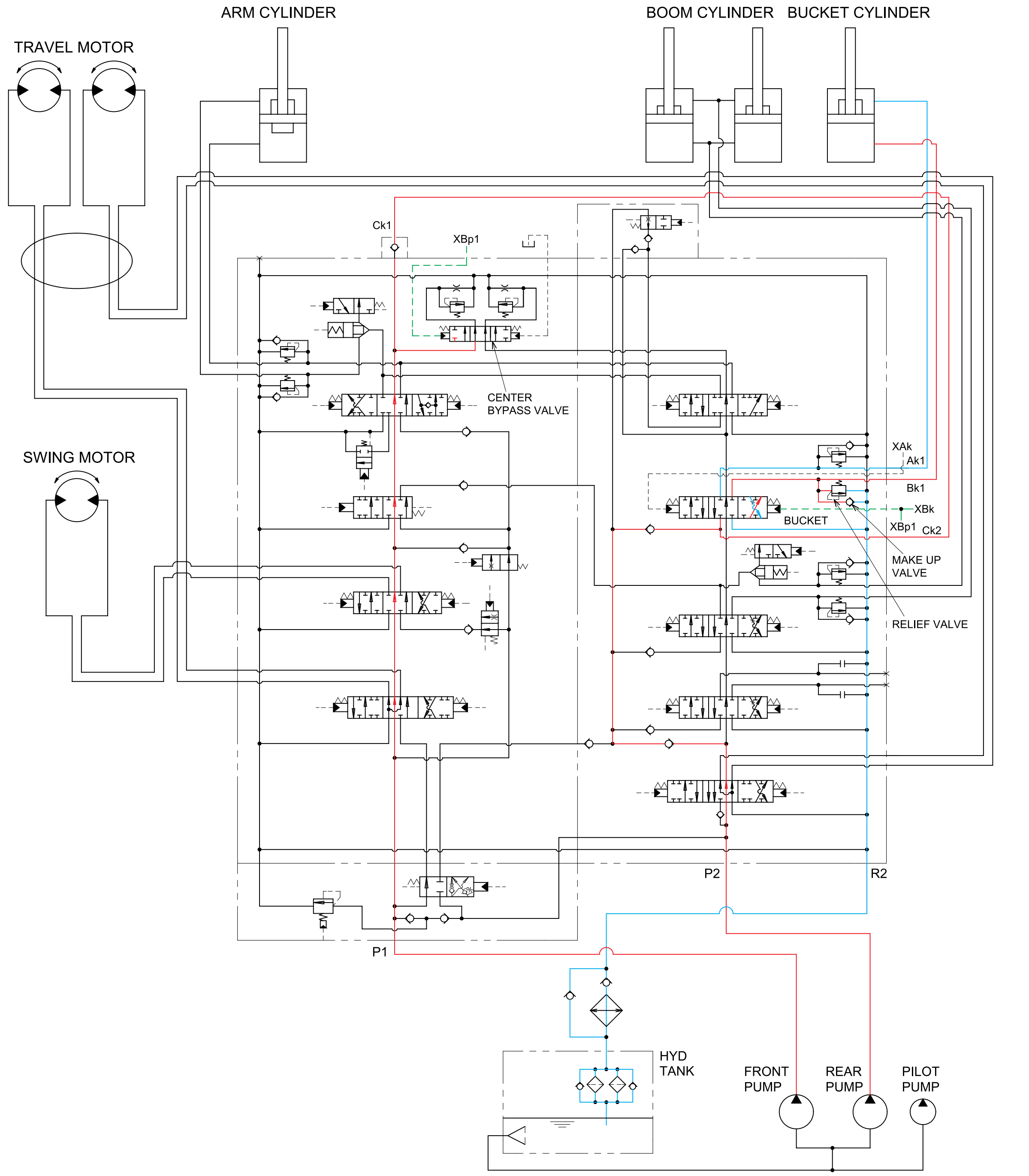
The excessive pressure in the arm cylinder bottom end circuit is prevented by relief valve.

4. ARM ROLL OUT OPERATION



When the LH control lever is pushed forward, the arm spools in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.
The oil from the front and rear pump flows into the main control valve and then goes to the small chamber of arm cylinder. At the same time, the oil from the large chamber of arm cylinder returns to the hydraulic oil tank through the arm spool in the main control valve.
When this happens, the arm roll out. When the roll out speed of arm is faster, the oil returned from the large chamber of arm cylinder combines with the oil from both pump, and flows into the small chamber of the arm cylinder by a make up valve.
The excessive pressure in the arm cylinder rod end circuit is prevented by relief valve.
When the arm is rolled out and the control lever is returned to neutral position, the circuit for the holding pressure at the rod end of the arm cylinder is closed by the arm holding valve.
This prevents the hydraulic drift of arm cylinder.

5. BUCKET ROLL IN OPERATION



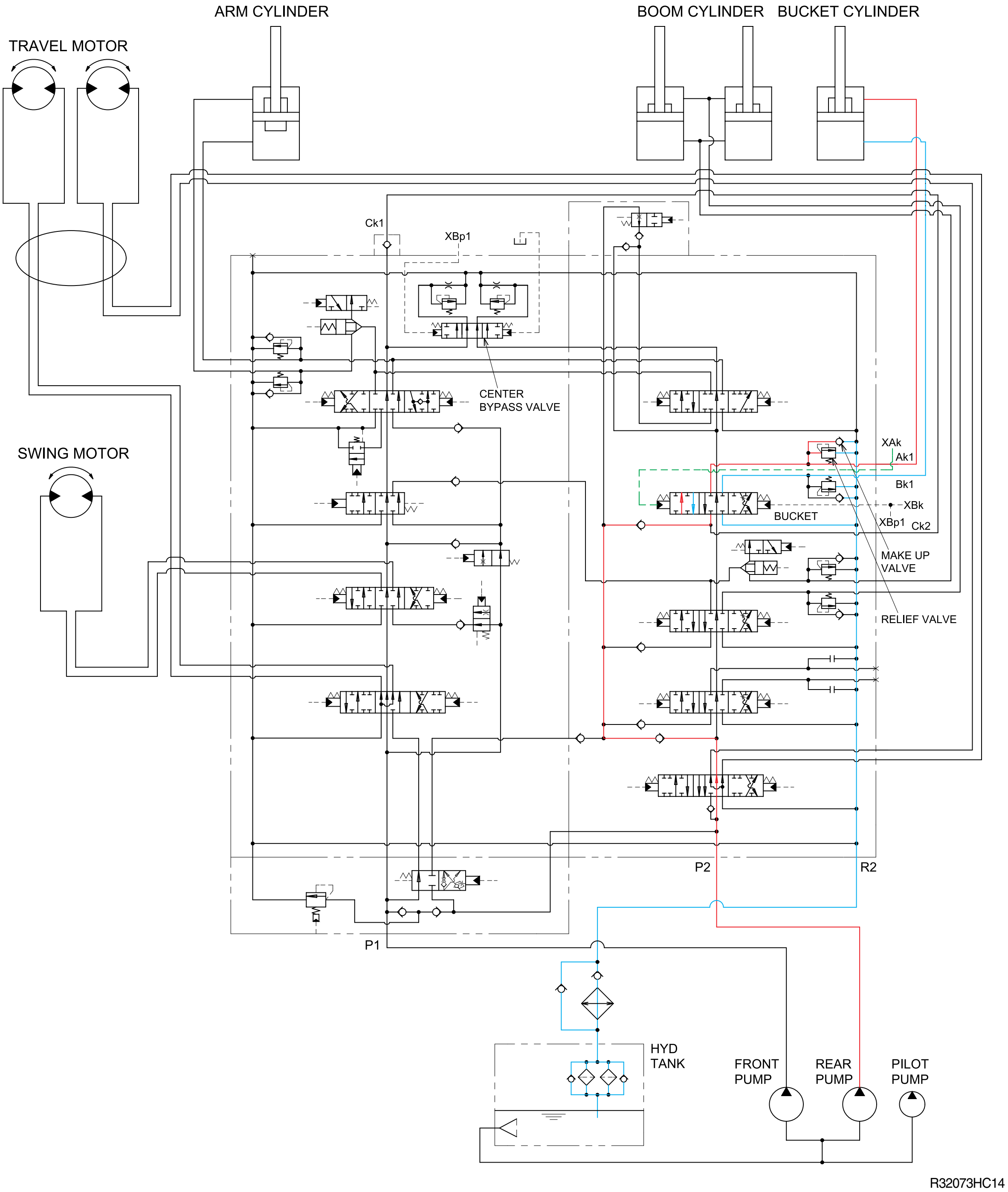
When the RH control lever is manually placed in the bucket roll in position. Then the oil flows from pilot pump through the pilot valve to bucket section of the main control valve. Here the spool position is moved to bucket roll in position.

The center bypass valve is change over by the pilot pressure(XBP1) and then the oil from front pump is joint to the flow of rear pump via confluence passage.

The oil flows from both pump through rod end of the cylinder through the bucket section returned to the hydraulic tank.

The cavitation which will happen to the bottom of the bucket cylinder is prevented by a make up valve, on other hand. The excessive pressure is also prevented by an overload relief valve in the main control valve.

6. BUCKET ROLL OUT OPERATION



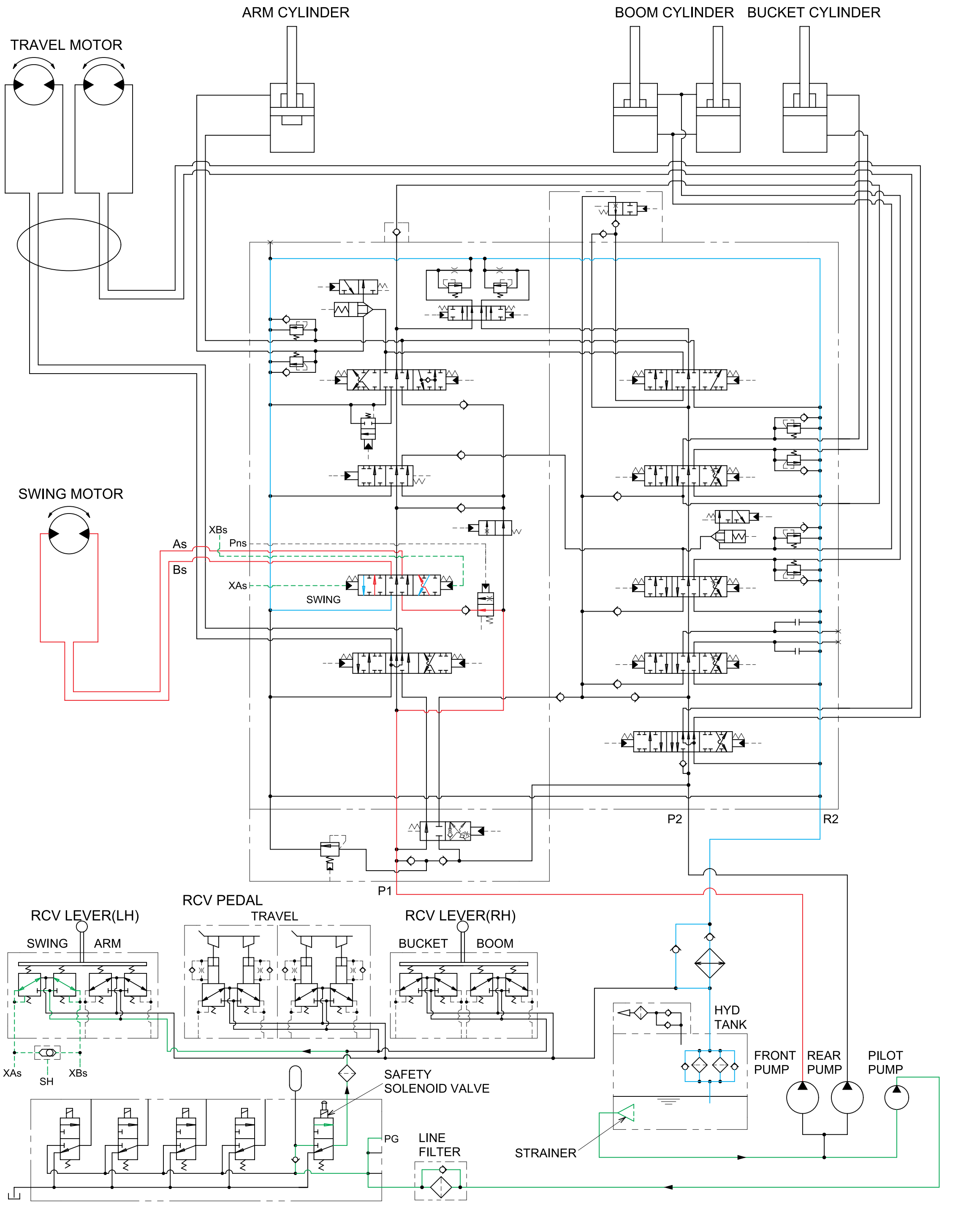
When the RH control lever is manually placed in the bucket roll out position. Then the oil flows from pilot pump through the pilot valve to bucket section of the main control valve. Here the spool position is moved to bucket roll out position.

The oil flows from rear pump through bucket section of main control valve to the rod end of the bucket cylinder, and to roll out bucket.

The return oil flows from the bottom end of the cylinder through the bucket section returned to the hydraulic tank.

The cavitation which will happen to the rod of the bucket cylinder is prevented by a make up valve, on other hand. The excessive pressure is also prevented by an overload relief valve in the main control valve.

7. SWING OPERATION



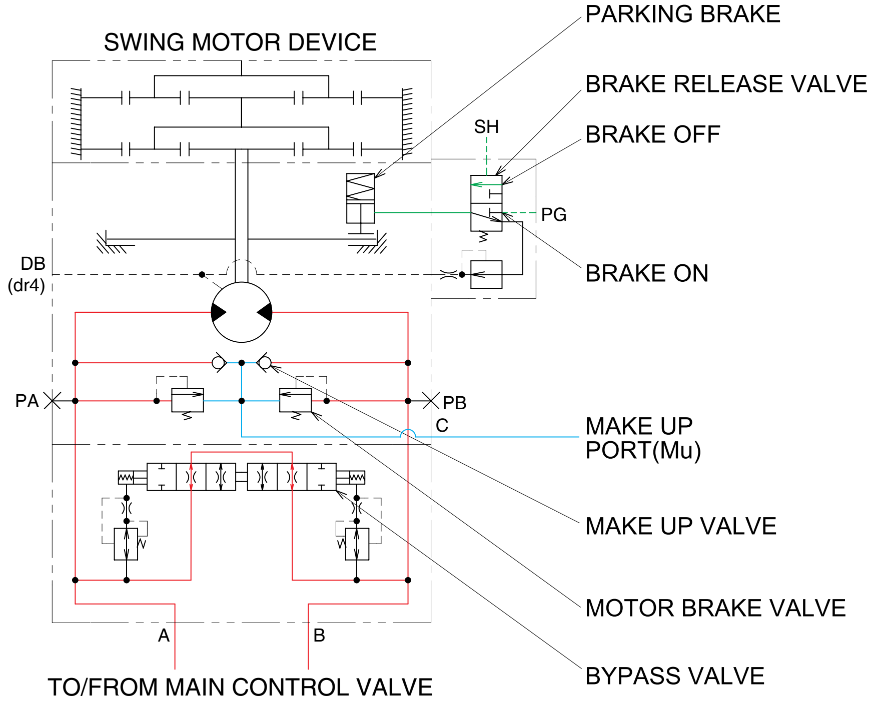
R32073HC15

When the LH control lever is manually placed in the left(Right) swing position. Then the oil flows from front pump through the swing section of the main control valve to swing motor to left(Right) swing the superstructure. The return oil flows from swing motor through the swing section of the main control valve returned to the tank.

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

Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the tank. And the brake is set to "ON". The swing parking brake, make up valve and the overload relief valve are provide in the swing motors. The cavitation which will happen to the swing motor is prevented by the make up valve in the swing motor itself.

SWING CIRCUIT OPERATION



34073HC16

1) MOTOR BRAKE VALVE

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

2) MAKE UP VALVE

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

3) PARKING BRAKE

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

PARKING BRAKE "OFF" OPERATION

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

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

PARKING BRAKE "ON" OPERATION

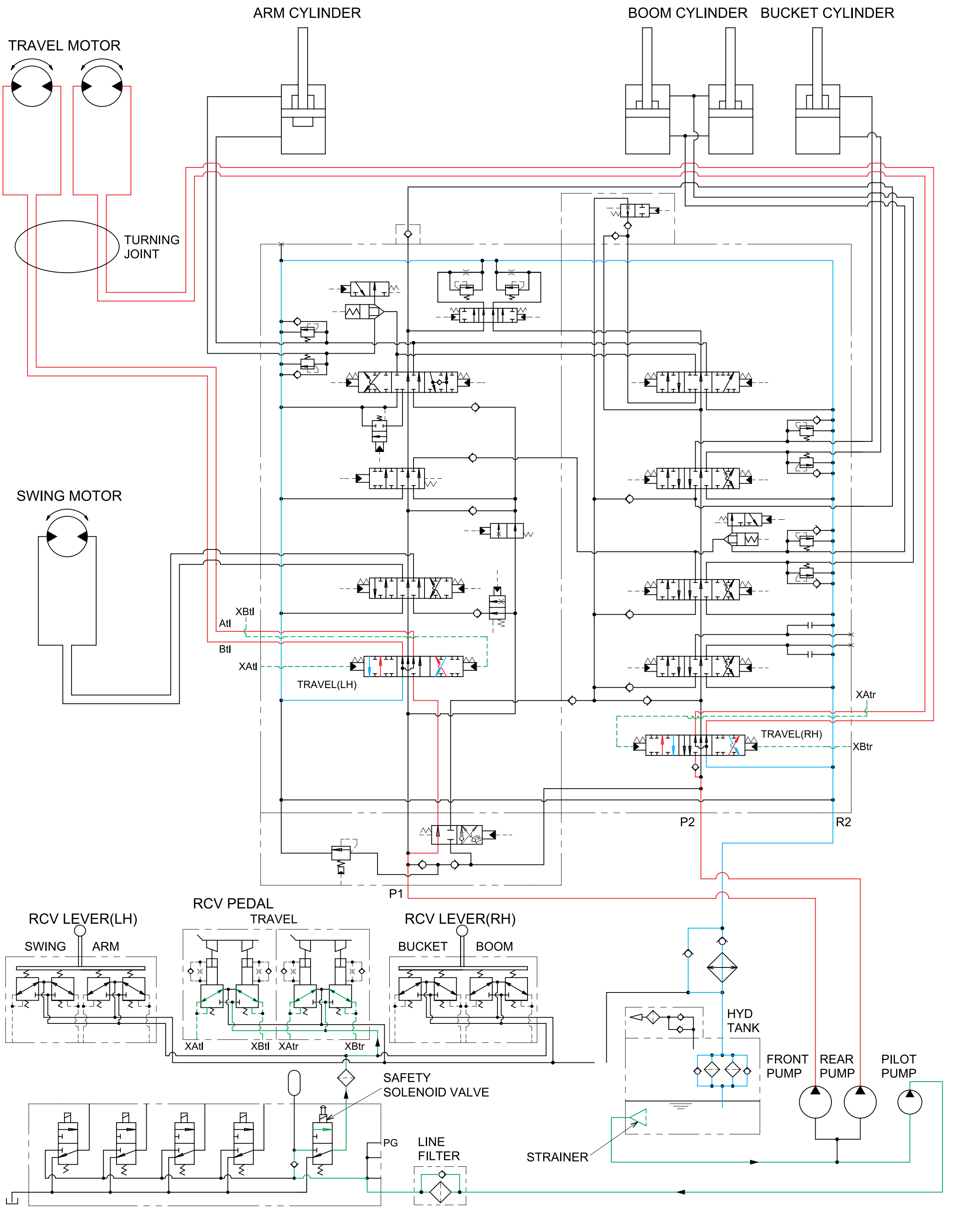
When the control lever placed in the neutral position, the pressure of the pilot oil passage down.

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

BYPASS VALVE

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

8. TRAVEL FORWARD AND REVERSE OPERATION



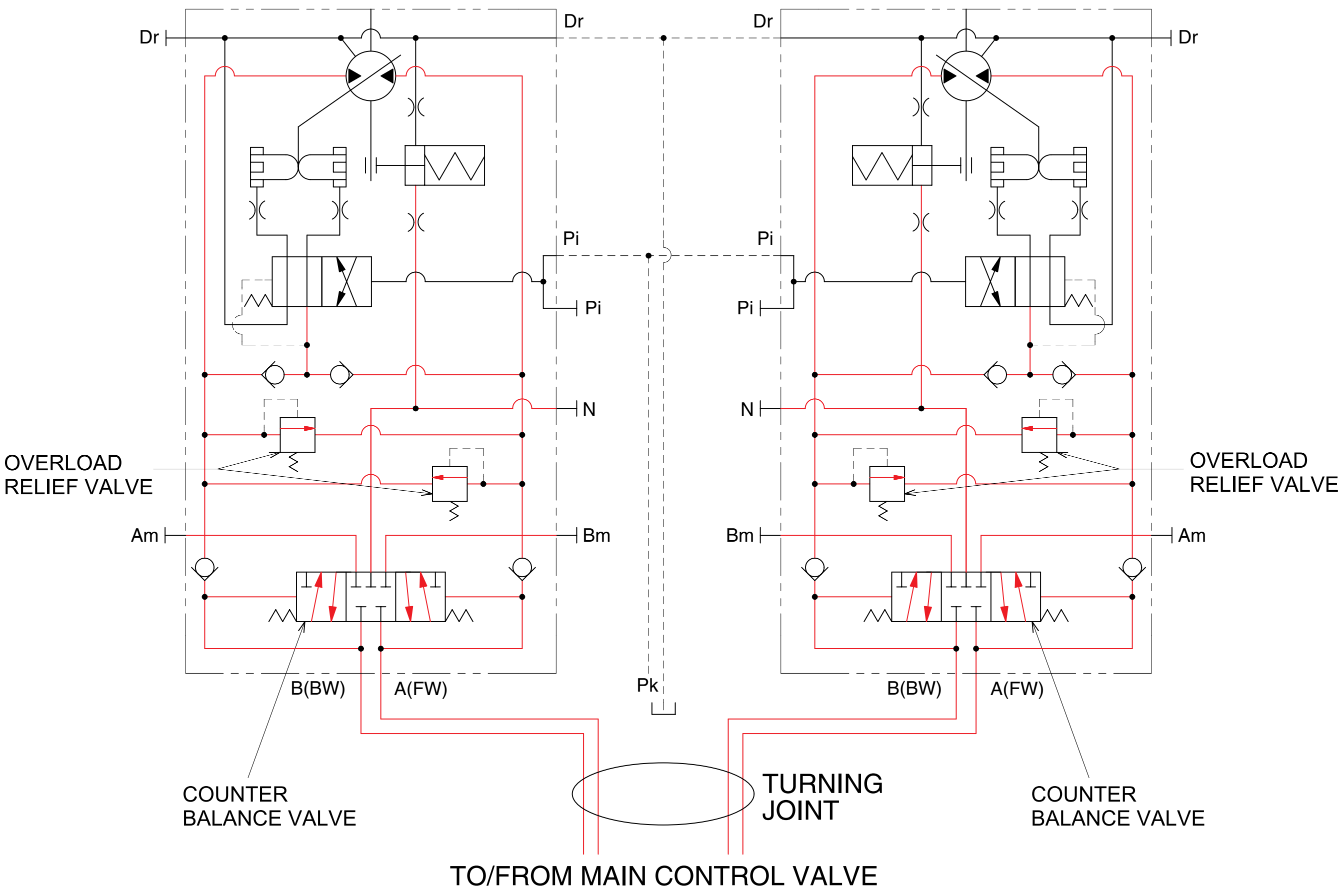
R32073HC17

When the right and left travel levers are manually placed to the forward or reverse position, the oil flows from pilot pump through the pilot valve to travel sections of the main control valve.

Here, spool position is moved to forward and reverse position. The oil flows from rear pump through the travel(RH) section of the main control valve and turning joint to the right travel motor and oil flows from front pump through the travel(LH) section of the main control valve and turning joint to the left travel motor and move the machine forward or reverse.

The return oil flows from both travel motor through the turning joint and travel(RH, LH) sections returned to the tank.

TRAVEL CIRCUIT OPERATION



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

1) COUNTER BALANCE VALVE

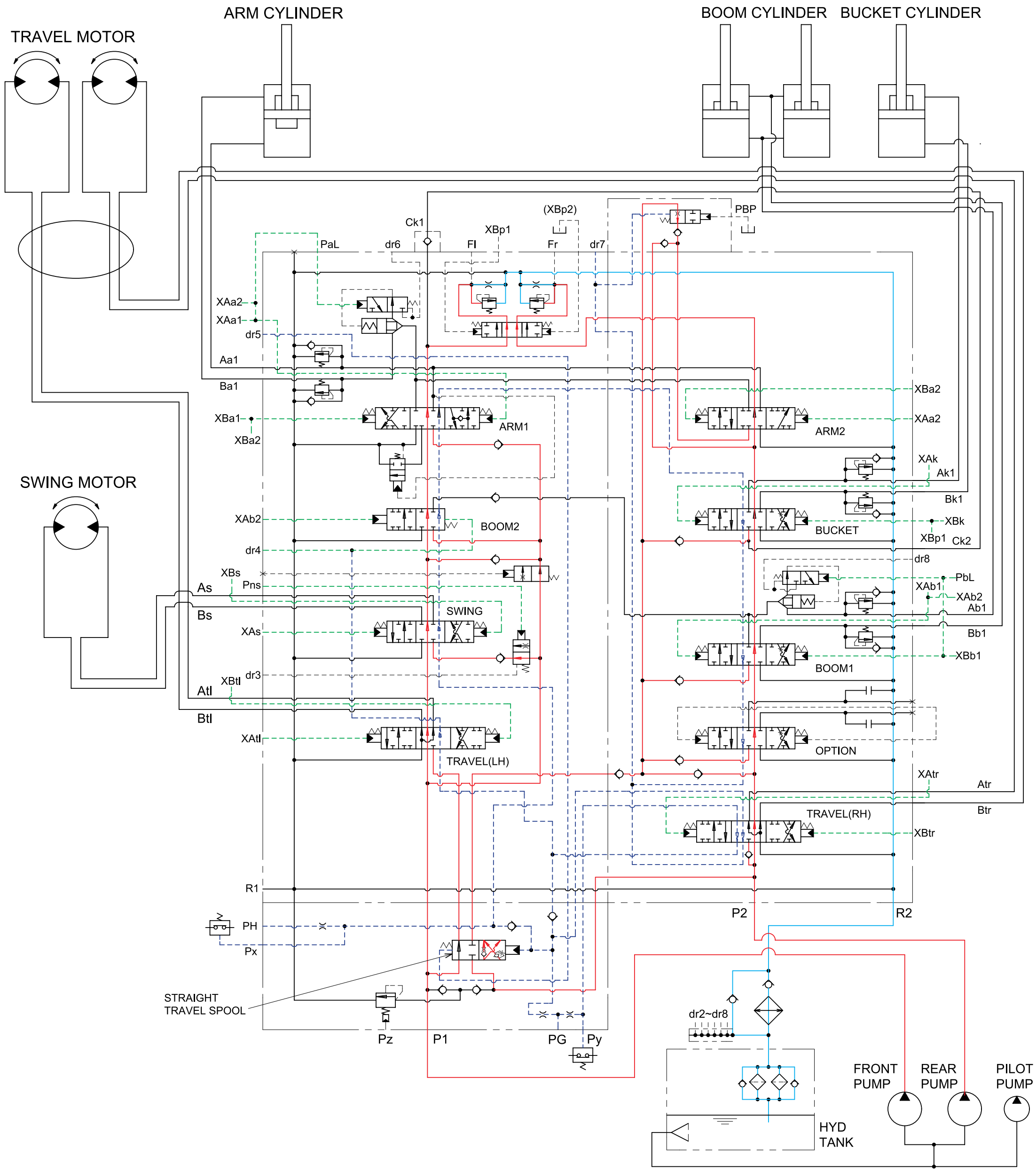
When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 365kgf/cm² 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



R32073HC19

The oil from the front and rear 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.

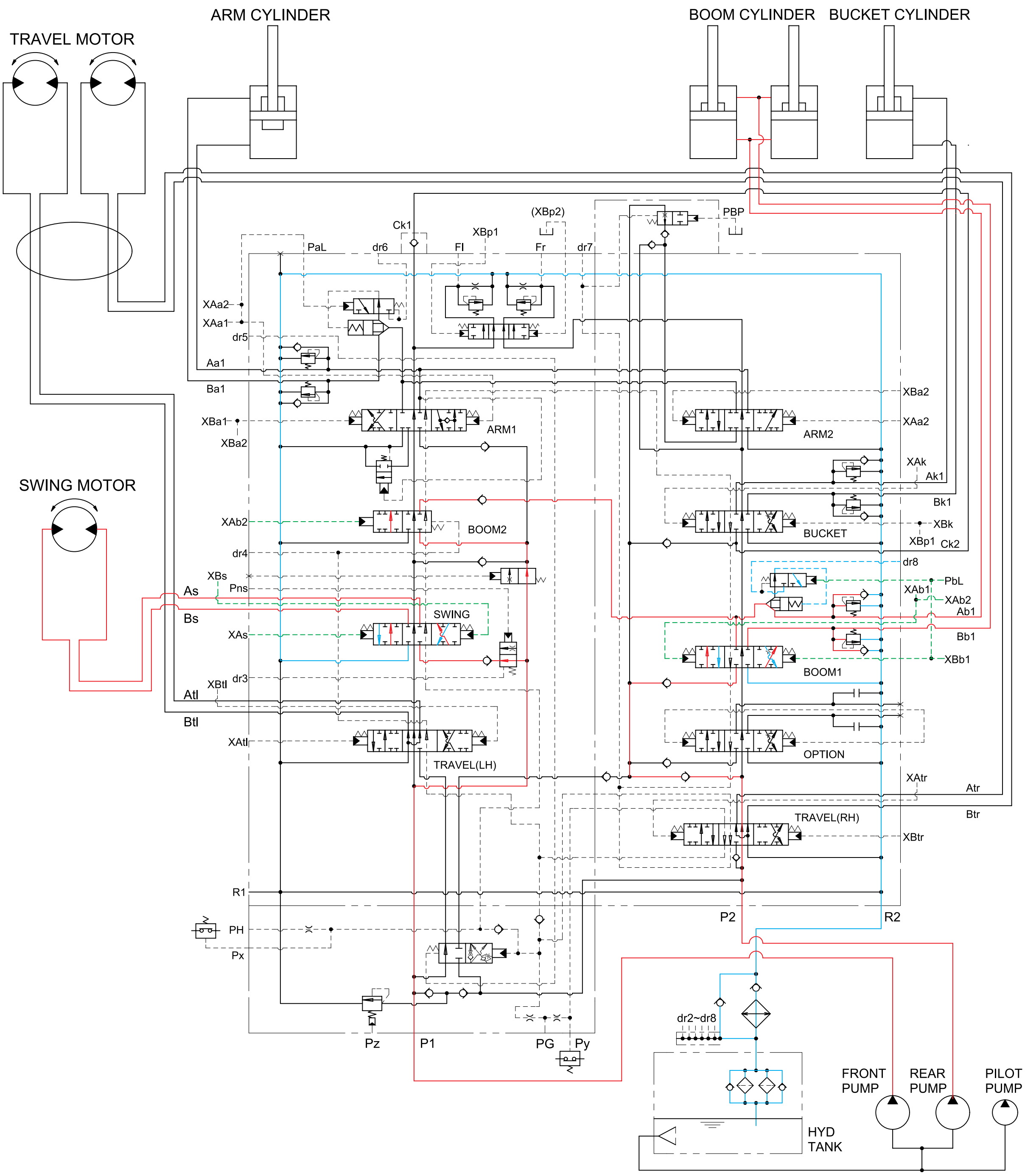
STRAIGHT TRAVEL SPOOL

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

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

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

2. COMBINED SWING AND BOOM OPERATION



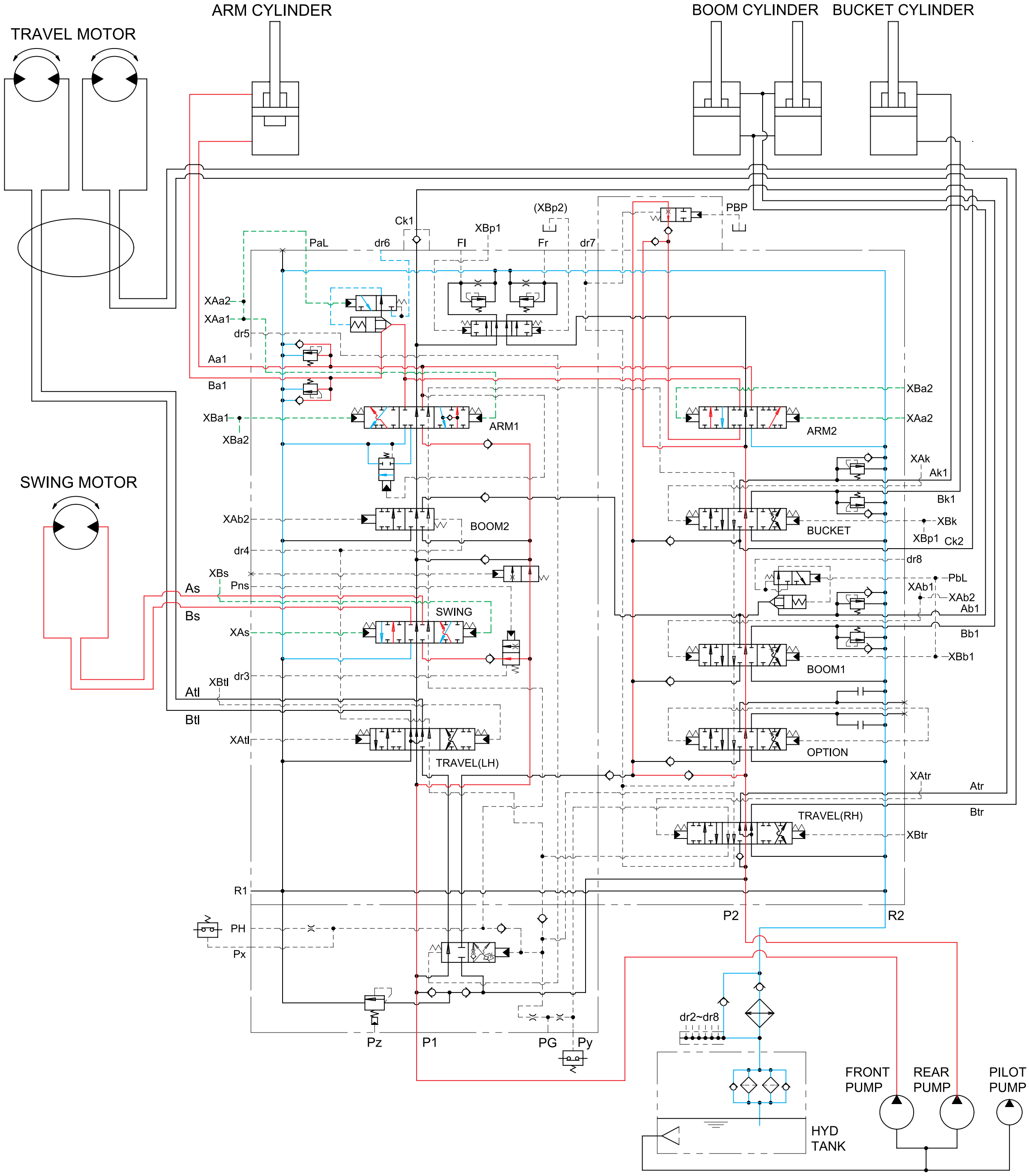
R32073HC20

When the swing and boom functions are operated, simultaneously the swing spool and boom spools changed. The oil flows from the rear pump through boom1 section of the main control valve to boom cylinders and the boom functions.

The oil flows from front pump through swing section to swing motor.

At the same time, the pressure in the boom circuits can be high while the swing pressure is low, therefore the oil flows from front pump to boom cylinders through boom2 section via confluence passage in case boom raise operation.

3. COMBINED SWING AND ARM OPERATION

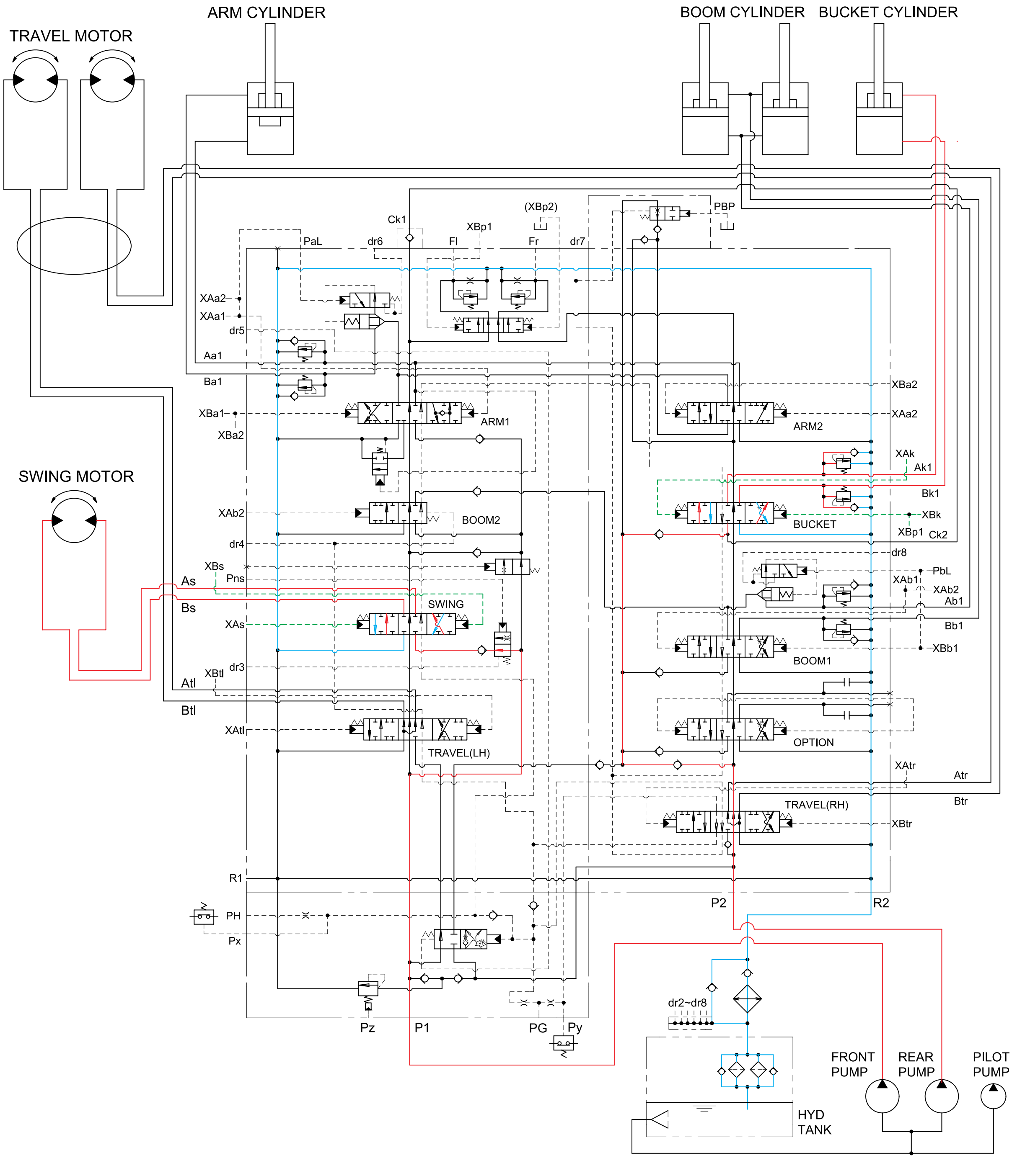


R32073HC21

When the swing and arm functions are operated, simultaneously the swing spool and arm spools changed. The oil flows from the front pump through arm1 and swing section of the main control valve to arm cylinder and swing motor, and the arm and swing functions.

At the same time, the pressure in the arm circuit can be high while the swing pressure is low, therefore the oil flows from rear pump to arm cylinder through arm2 section via confluence passage.

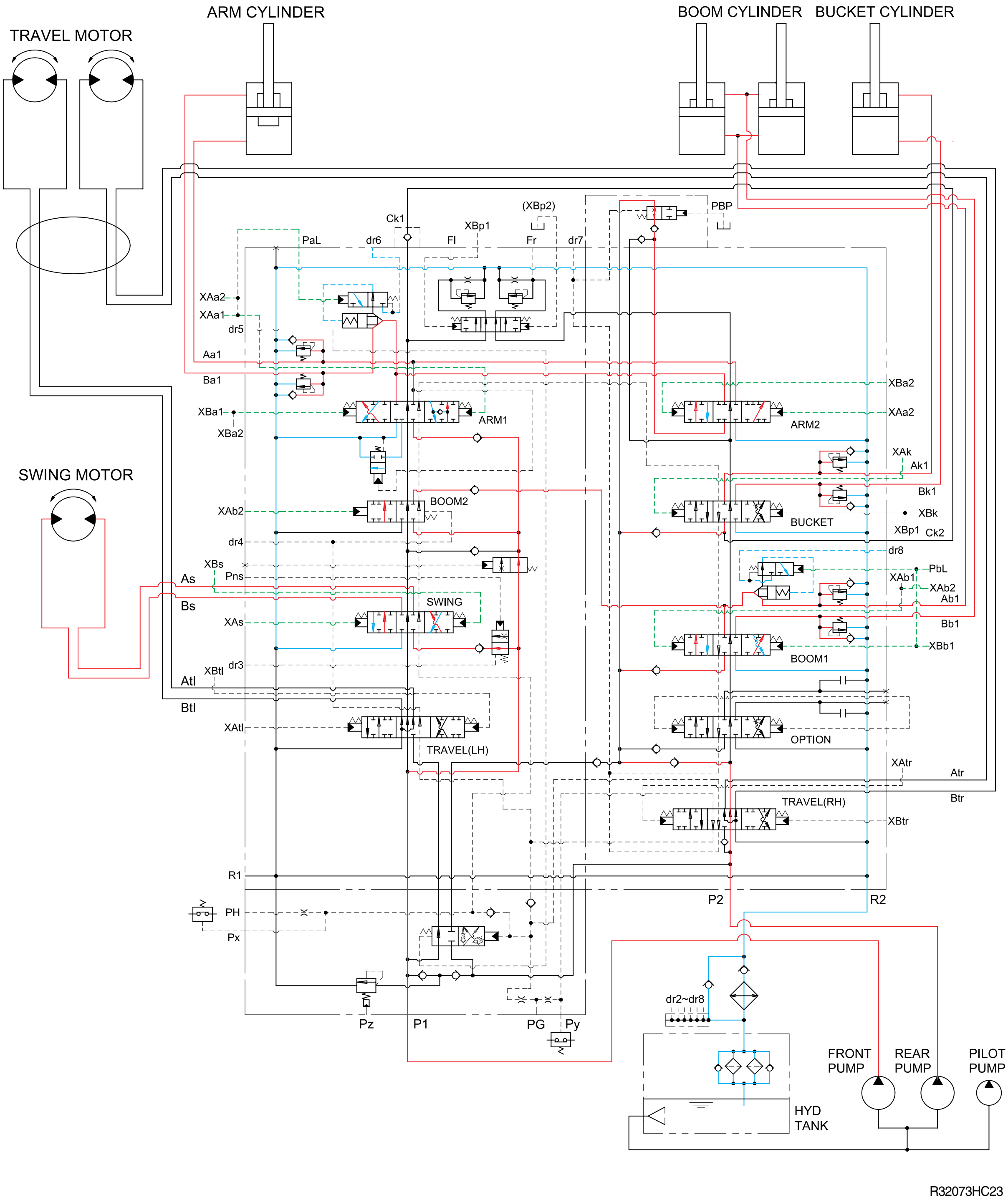
4. COMBINED SWING AND BUCKET OPERATION



R32073HC22

When the swing and bucket functions are operated, the swing and bucket spools changed. The oil flows from the rear pump through the bucket section of the main control valve to the bucket cylinder and the bucket functions. The oil flows from front pump through swing section of the main control valve to the swing motor and swing the superstructure.

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION

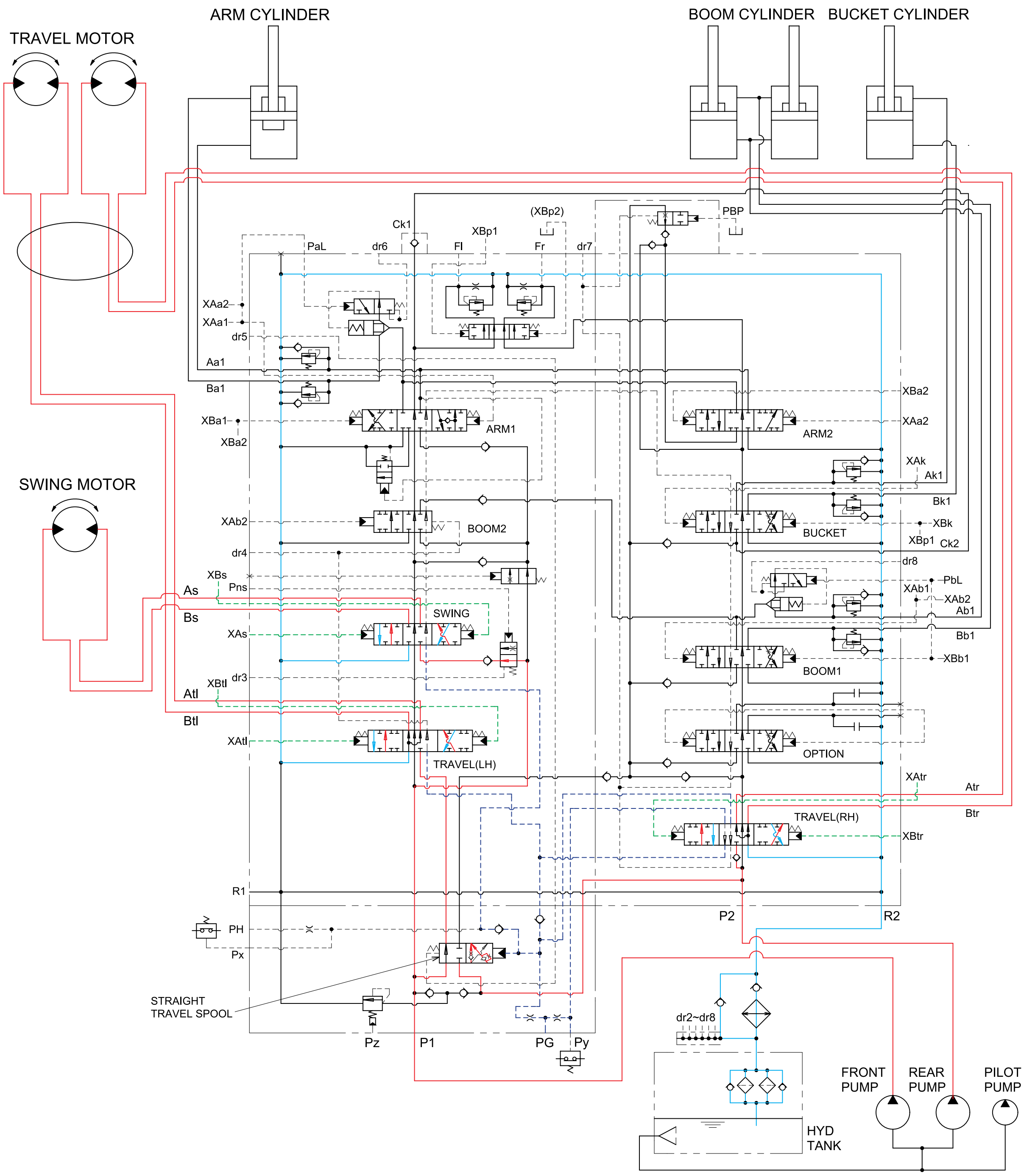


When the swing, boom, arm and bucket functions are operated, the each spools of the main control valve changed.

The oil flows from rear pump through arm2, boom1 and bucket section to boom, arm and bucket cylinders. The oil flows from front pump through swing, boom2 and arm1 section to swing motor, boom and arm cylinder. Then the functions to each actuators.

According to the state of each actuators functioning, the oil flows from front and rear pump through the confluence oil passage to the each actuators.

6. COMBINED SWING AND TRAVEL OPERATION



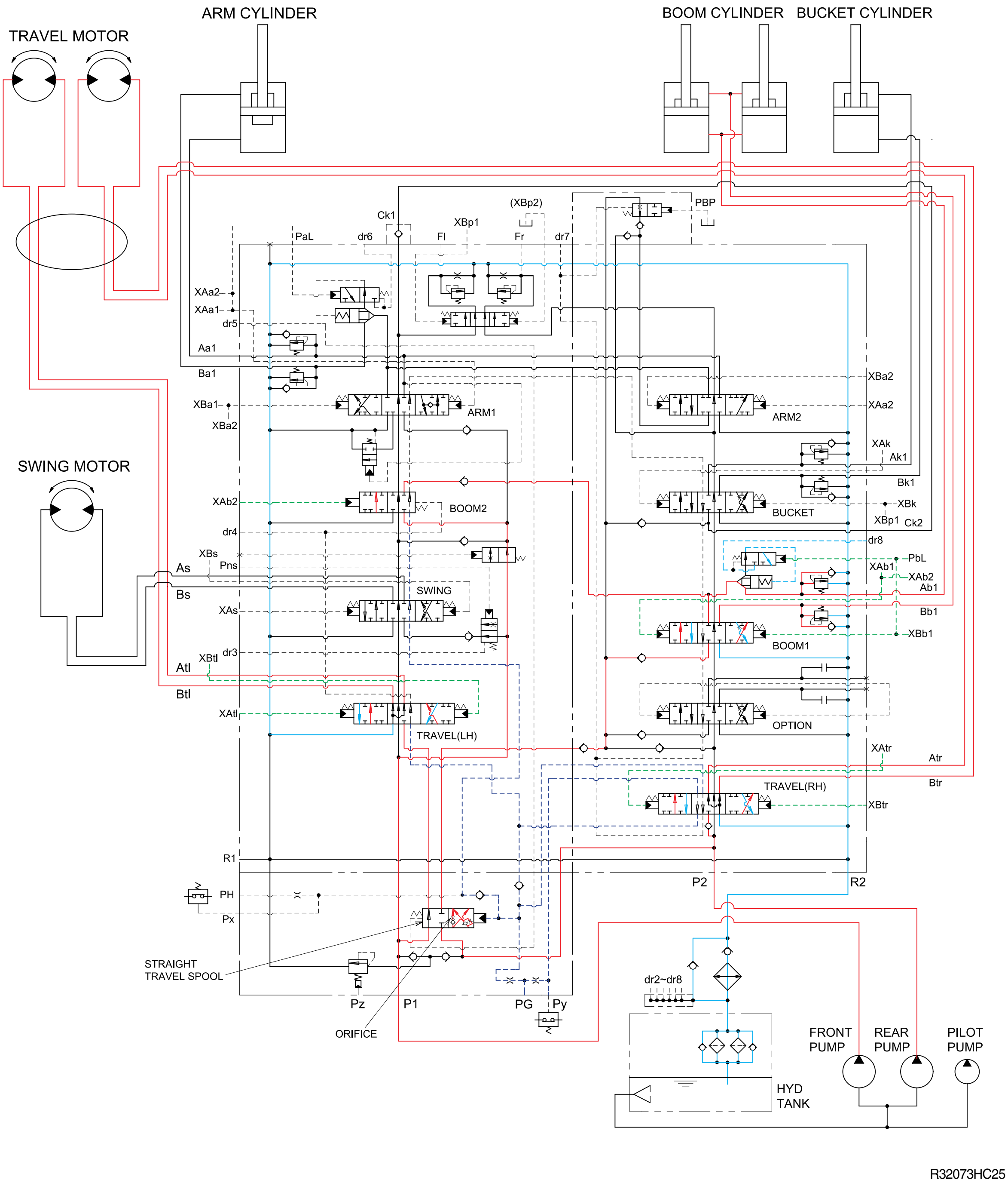
R32073HC24

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. At the same time, the straight travel spool is pushed to the left by the pilot oil pressure from the pilot pump.

The oil from the front pump flows into the swing motor through the swing spool. The oil from the rear pump flows into the travel motor through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool.

The superstructure swings and the machine travels straight.

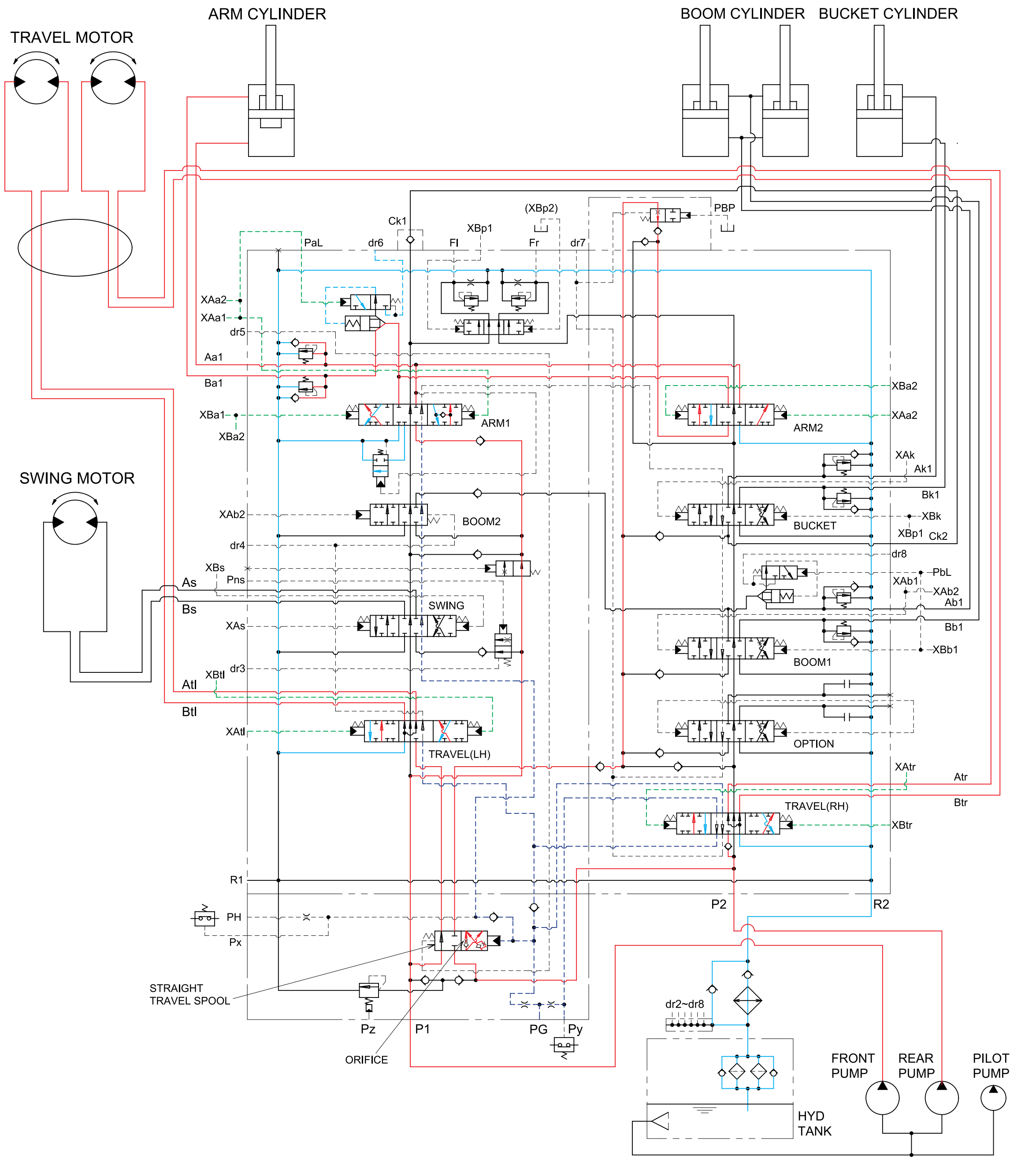
7. COMBINED BOOM AND TRAVEL OPERATION



When the boom and travel functions are operated, simultaneously the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve. At the same time, the straight travel spool is pushed to the left by the pilot oil pressure from the pilot pump. The oil from the front pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence passage in case boom up operation. The oil from the rear pump flows into the travel motors through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool.

When the travel circuit pressure drops lower than boom pressure, as when traveling downhill, boom priority and smoothness are maintained because of the orifice in the straight travel spool. Thus the machine will continue to travel straight.

8. COMBINED ARM AND TRAVEL OPERATION

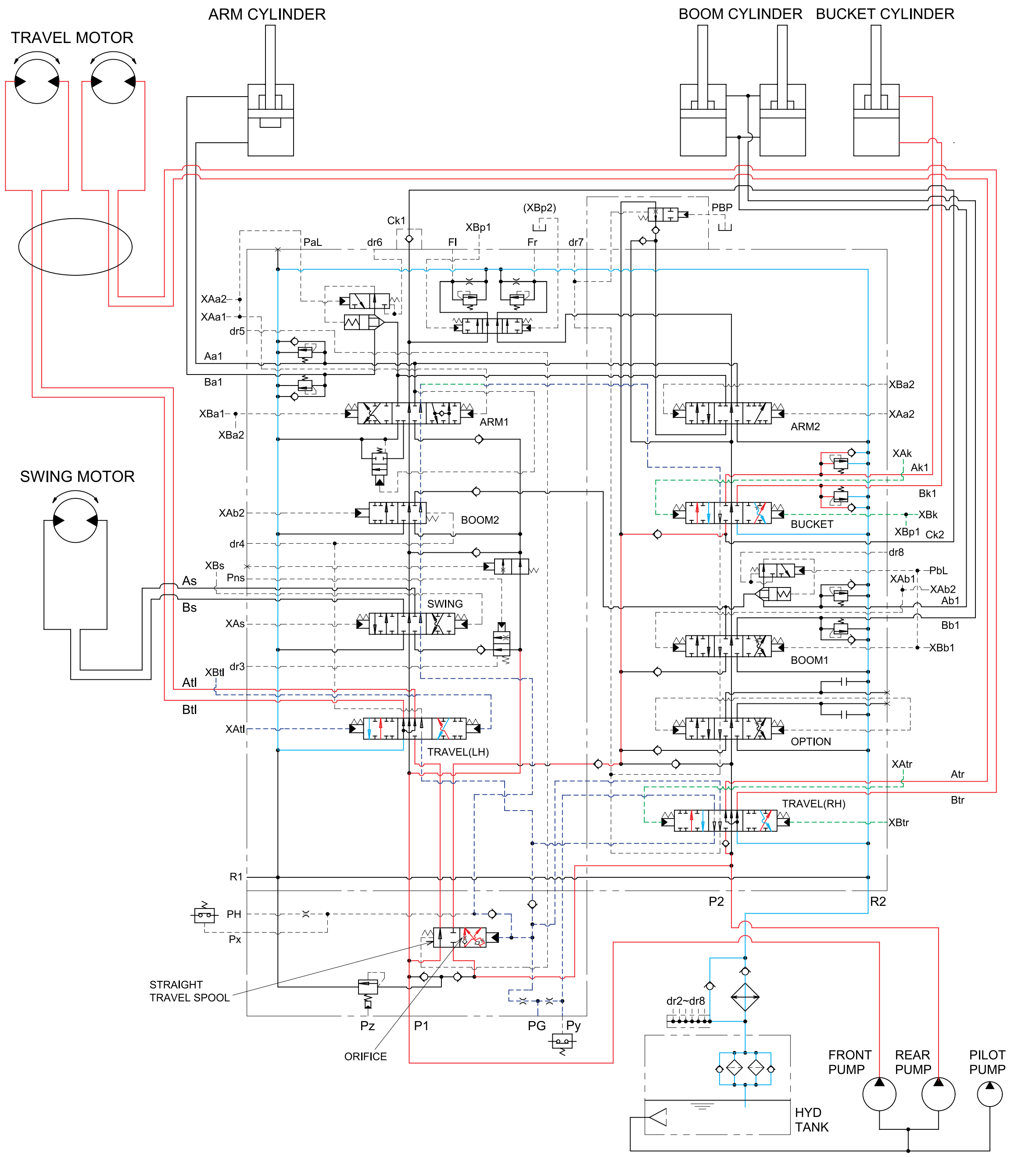


R32073HC26

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. At the same time, the straight travel spool is pushed to the left by the pilot oil pressure from the pilot pump. The oil from the front pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage. The oil from the rear pump flows into the travel motors through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool.

When the travel circuit pressure drops lower than arm pressure, as when traveling downhill, arm priority and smoothness are maintained because of the orifice. Thus the machine will continue to travel straight.

9. COMBINED BUCKET AND TRAVEL OPERATION



R32073HC27

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. At the same time, the straight travel spool is pushed to the left by the pilot oil pressure from the pilot pump. The oil from the front pump flows into the bucket cylinder through the bucket spool via the confluence oil passage. The oil from the rear pump flows into the travel motors through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool of the control valve.

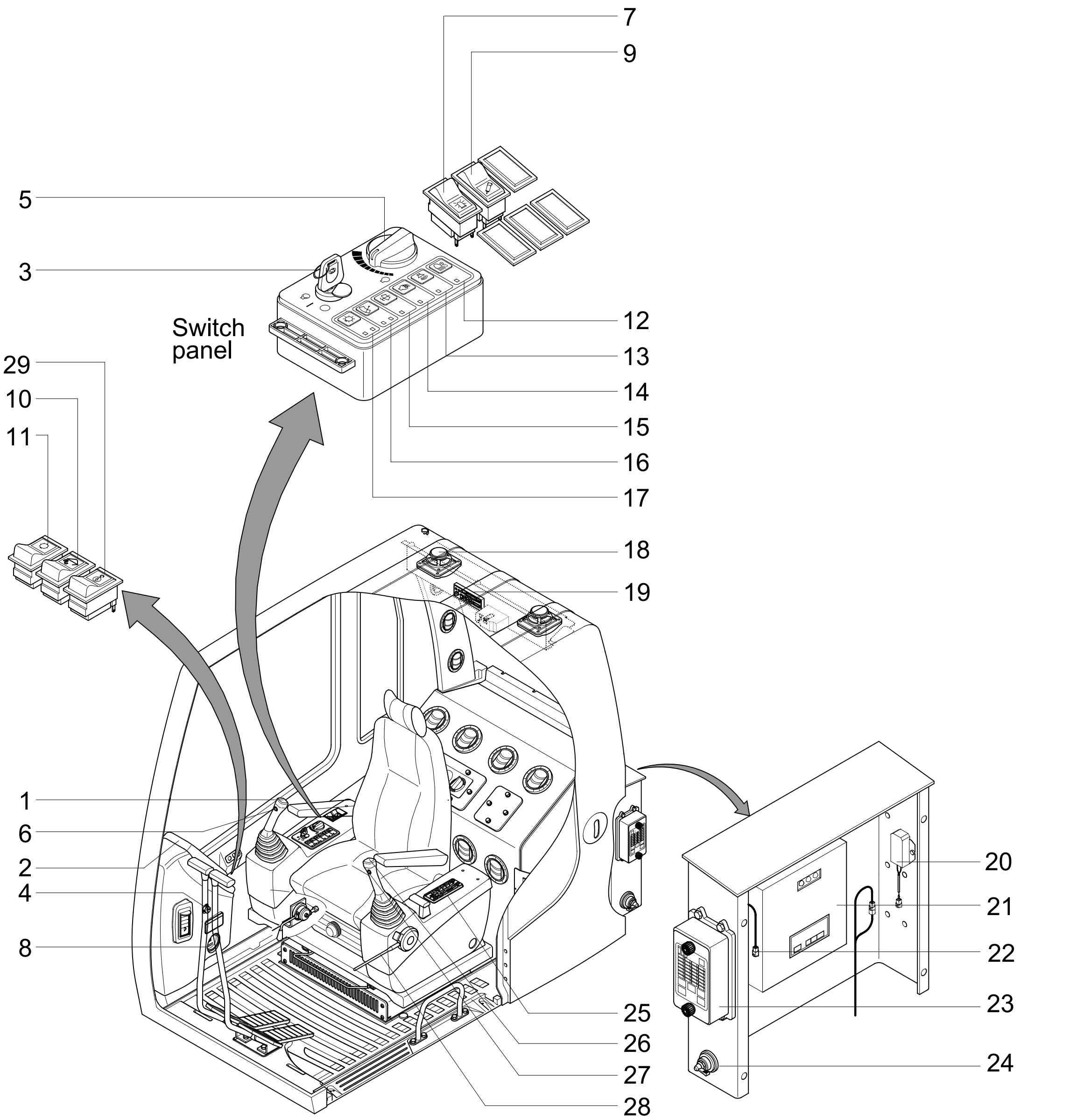
When the travel circuit pressure drops lower than bucket pressure, as when traveling downhill, bucket priority and smoothness are maintained because of the orifice.

In either case, the machine will continue to travel straight.

SECTION 4 ELECTRICAL SYSTEM

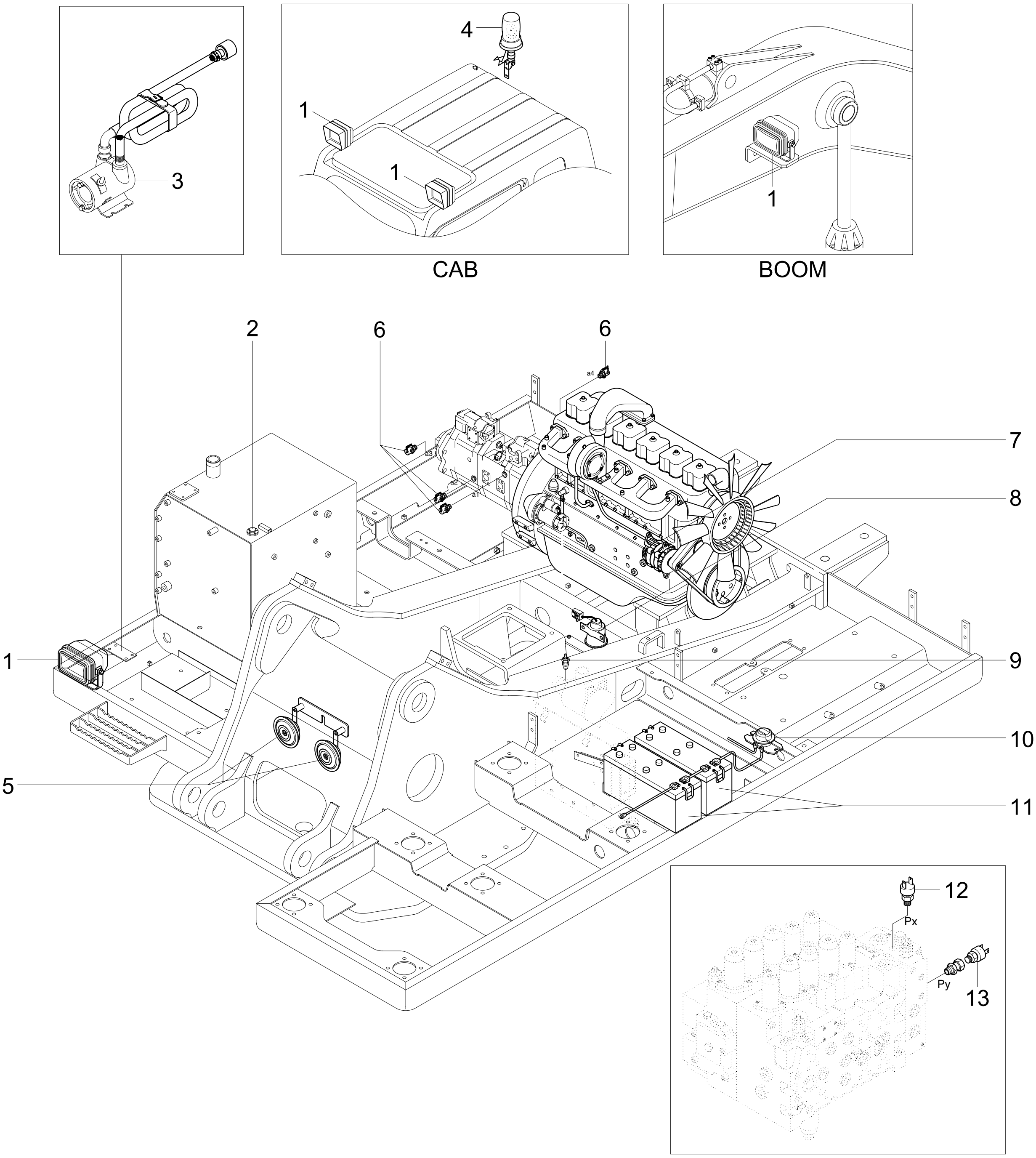
GROUP 1 COMPONENT LOCATION

1. LOCATION 1



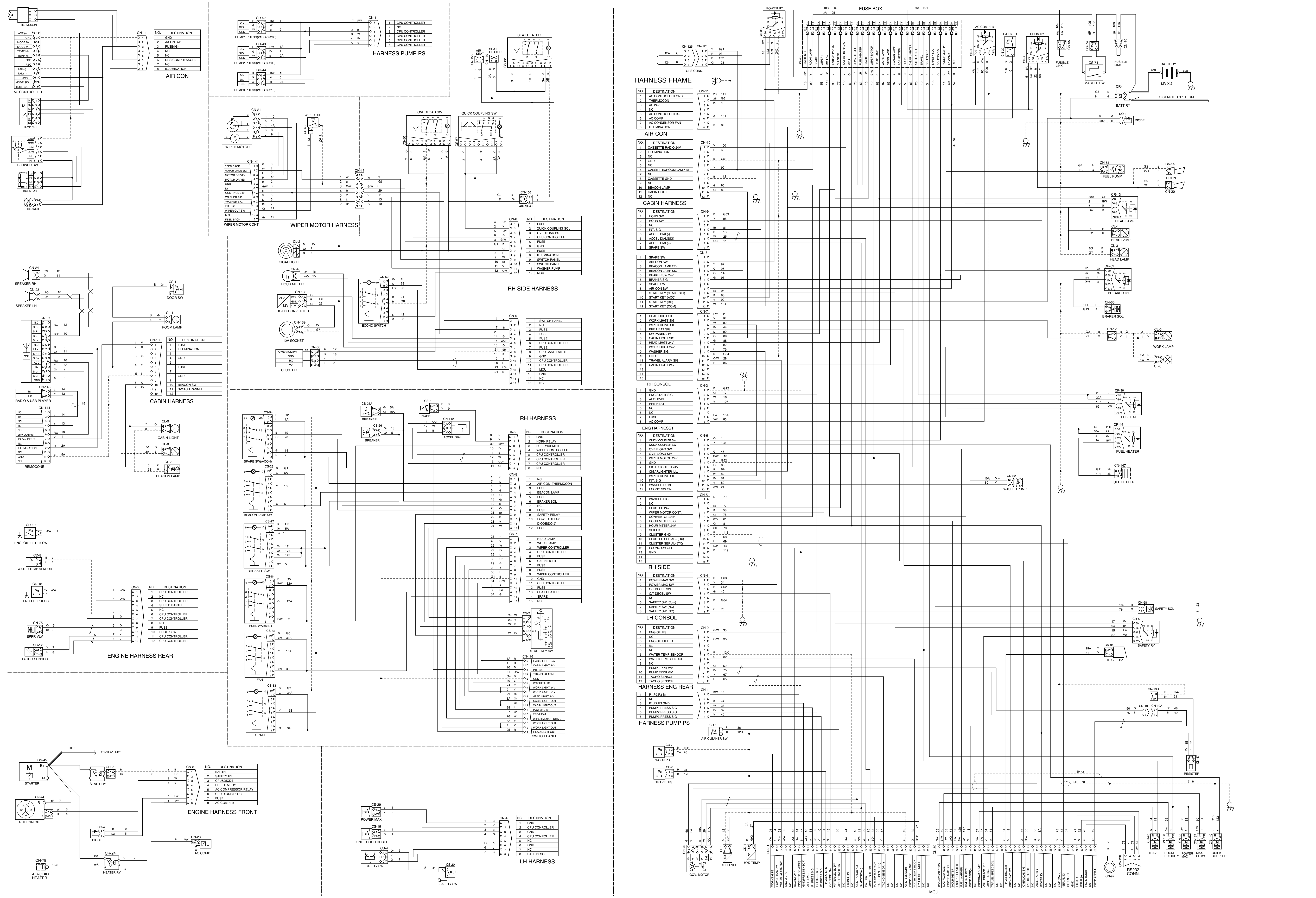
1	Horn switch	11	Econo switch	21	MCU
2	Cluster	12	Cab light switch	22	RS232 serial port
3	Starting switch	13	Travel alarm stop switch	23	Fuse box
4	Cigar lighter	14	Preheat switch	24	Master switch
5	Accel dial	15	Washer switch	25	Aircon & heater switch panel
6	Breaker switch	16	Wiper switch	26	One touch decel switch
7	Beacon switch	17	Main light switch	27	Power max switch
8	Service meter	18	Speaker	28	Safety lever
9	Breaker selection switch	19	Radio & USB player	29	Overload switch
10	Quick clamp switch	20	Resistor		

2. LOCATION 2



34074EL02

1	Lamp	6	Coupling	11	Battery
2	Fuel sender	7	Alternator	12	Attach pressure sensor
3	Fuel filler pump	8	Travel alarm buzzer	13	Travel pressure sensor
4	Beacon lamp	9	Air cleaner switch		
5	Horn	10	Battery relay		


AIR CON
HARNESS PUMP PS
WIPER MOTOR HARNESS
RH SIDE HARNESS
CABIN HARNESS
RH HARNESS
ENGINE HARNESS REAR
ENGINE HARNESS FRONT
LH HARNESS
FUSE BOX
HARNESS FRAME
AIR-CON
CABIN HARNESS
RH CONSOL
ENG HARNESS1
RH SIDE
LH CONSOL
HARNESS ENG REAR
HARNESS PUMP PS
BATTERY
MCU

34074EL03

1. POWER CIRCUIT

The negative terminal of battery is grounded to the machine chassis through master switch.
When the start switch is in the OFF position, the current flows from the positive battery terminal as shown below.

1) OPERATING FLOW

Battery → Battery relay → Fusible link 〔CN-60〕

- → Fuse box 〔No.1〕
  - → I/conn 〔CN-8(12)〕 → Start switch 〔CS-2(1)〕
  - → Power relay 〔CR-35(30)]
- → Fuse box 〔No.2〕 → I/conn 〔CN-10(6)〕
  - → Room lamp 〔CL-1(2)〕 → Door switch 〔CS-1〕
  - → Cassette radio 〔CN-27(11)〕
- → Fuse box 〔No.4〕 → I/conn 〔CN - 5(4)〕 → I/conn 〔CN -17(5)〕
  - → Wiper motor controller 〔CN-141(7)〕
  - → Wiper motor 〔CN-21(4)〕
- → Fuse box 〔No.5〕 → MCU 〔CN-50(7)〕

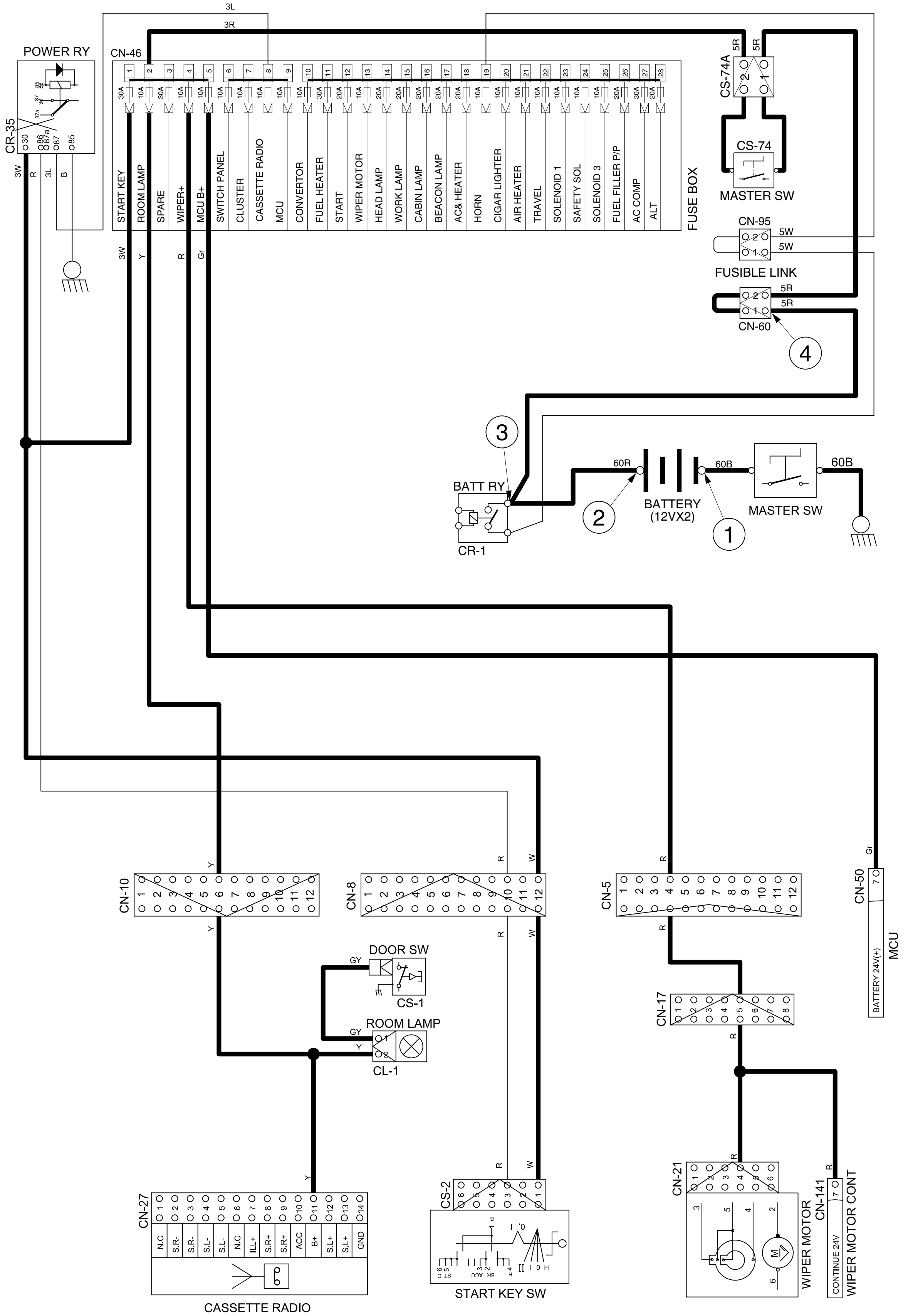
※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (Battery 1EA)	10~12.5V
		② - GND (Battery 2EA)	20~25V
		③ - GND (Battery 2EA)	20~25V
		④ - GND (Fusible link)	20~25V

※ GND : Ground

POWER CIRCUIT



34074EL04

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery(+) terminal → Battery relay〔CR-1〕 → Fusible link〔CS-60〕 → Fuse box〔No.1〕
→ I/conn〔CN-8(12)〕 → Start switch〔CS-2(1)〕

(1) When start key switch is in ON position

→ Start switch ON〔CS-2(2)〕 → I/conn〔CN-8(11)〕 → Battery relay〔CR-1〕
→ Battery relay operating (All power is supplied with the electric component)
→ Start switch ON〔CS-2(3)〕 → I/conn〔CN-8(10)〕 → Power relay〔CR-35(86) → (87)〕
→ Fuse box〔No.8〕

(2) When start key switch is in START position

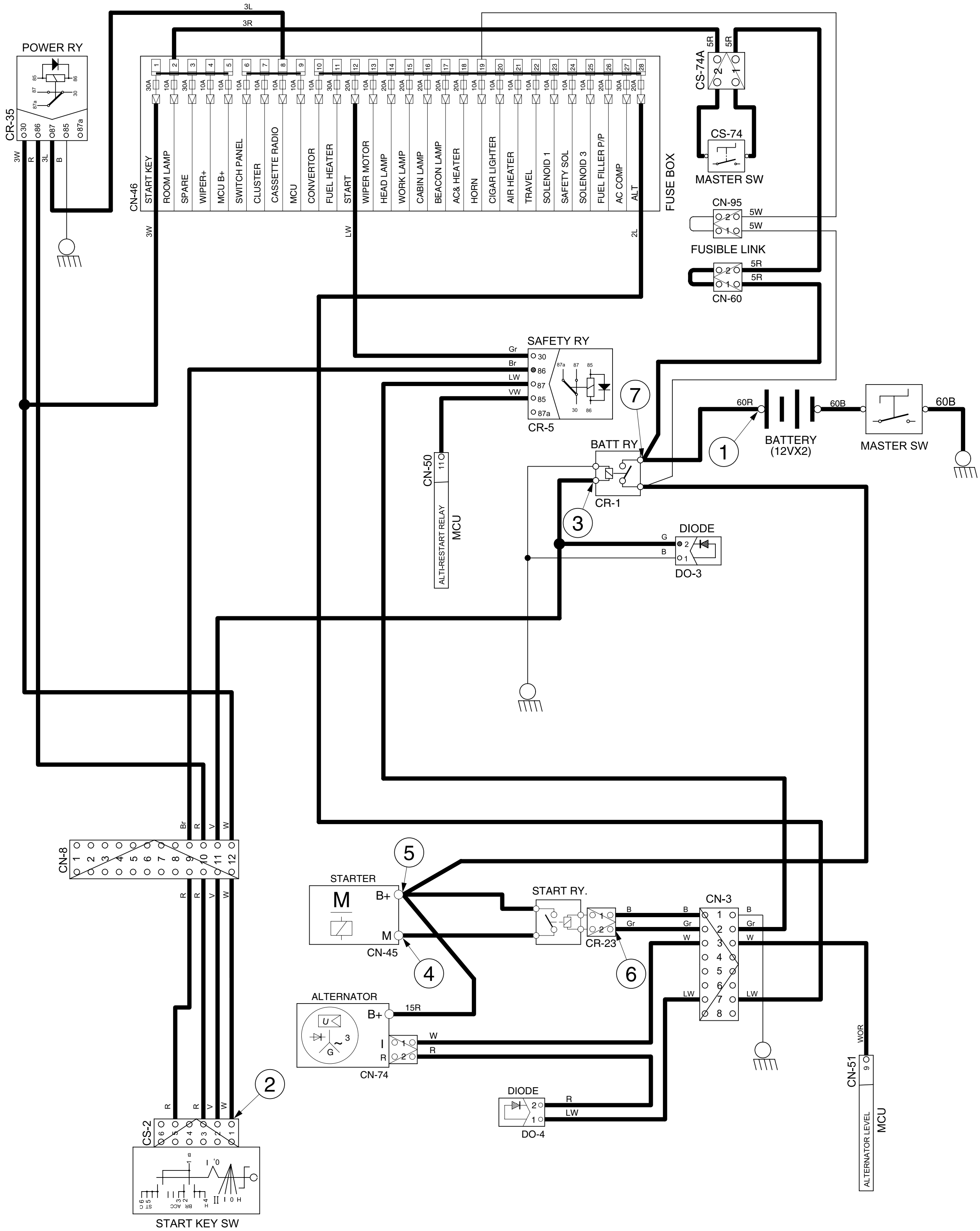
Start switch START〔CS-2(5)〕 → I/conn〔CN-8(9)〕 → Safety relay〔CR-5(86) → (87)〕
→ I/conn〔CN-3(2)〕 → Start relay〔CR-23〕

2) CHECK POINT

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

※ GND : Ground

STARTING CIRCUIT



34074EL05

3. CHARGING CIRCUIT

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

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

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

1) OPERATING FLOW

(1) Warning flow

Alternator "I" terminal 〔CN-74(1)〕 → I/conn 〔CN-3(3)〕 → MCU 〔CN-51(9)〕

Cluster charging warning lamp(Via serial interface)

(2) Charging flow

Alternator "B^+" terminal → Battery relay(M8) → Battery(+) terminal

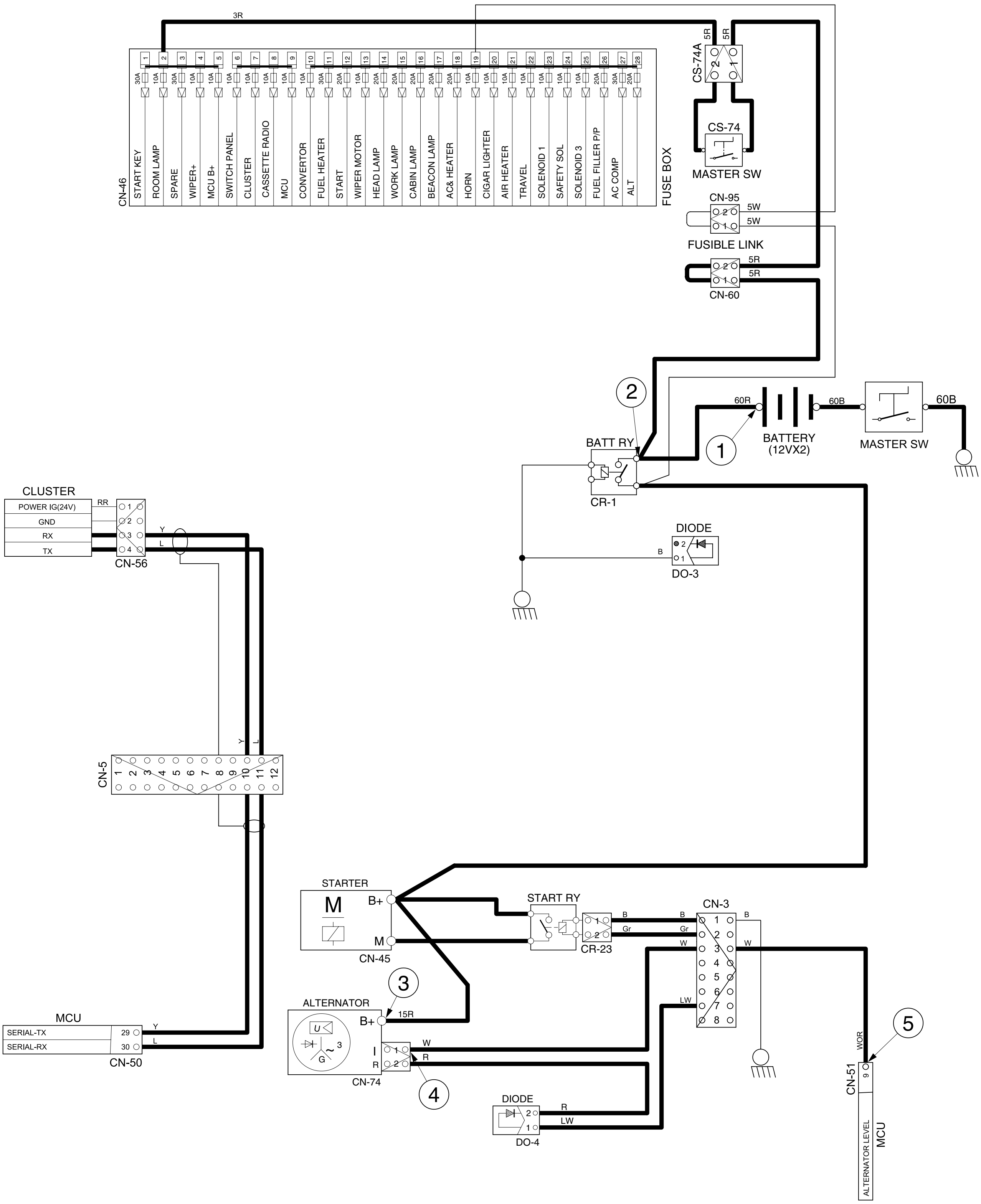
→ Fusible link 〔CS-61〕 → Fuse box

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 I terminal) ⑤ - GND(MCU)	20~30V

※ GND : Ground

CHARGING CIRCUIT



34074EL06

4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.14) → I/conn 〔CN-7(7)〕 → Switch panel 〔CN-116(9)〕
Fuse box (No.15) → I/conn 〔CN-7(8)〕 → Switch panel 〔CN-116(10,11)〕

(1) Head light switch ON

Head light switch ON 〔CN-116(1)〕 → I/conn 〔CN-7(1)] → Head light relay 〔CR-13(86) → (87)]
- → Head light ON 〔CL-4(2), CL-3(2)〕
- → I/conn 〔CN-10(2)〕
  - → Radio & USB player illumination ON 〔CN-27(7)〕
  - → Remoto controller illumination ON 〔CN-144(9)〕
- → I/conn 〔CN-11(8)〕 → AC & Heater controller illumination ON
- → I/conn 〔CN-6(8)〕 → Cigarlight 〔CL-2〕

(2) Work light switch ON

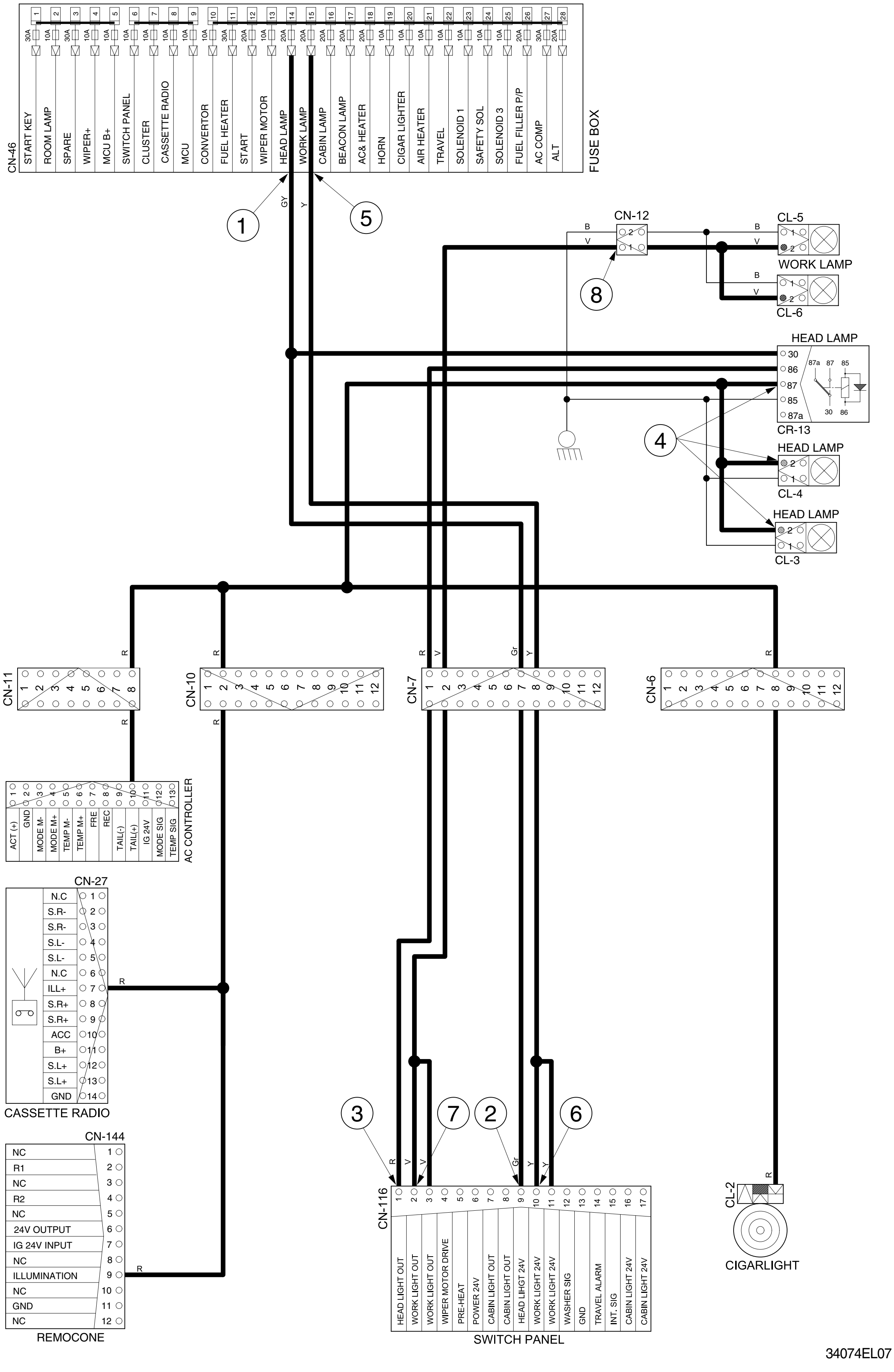
Work light switch ON 〔CN-116(2,3)〕 → I/conn 〔CN-7(2)〕 → I/conn 〔CN-12(1)〕
→ Work light ON 〔CL-5(2), CL-6(2)〕

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND(Fuse box) ② - GND(Switch power input) ③ - GND(Switch power output) ④ - GND(Head light)	20~25V
STOP	ON	⑤ - GND(Fuse box) ⑥ - GND(Switch power input) ⑦ - GND(Switch power output) ⑧ - GND(Work light)	20~25V

※ GND : Ground

HEAD AND WORK LIGHT CIRCUIT



5. BEACON LAMP AND CAB LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.17) → I/conn 〔CN-8(3)〕 → Beacon lamp switch 〔CN-23(6)〕
Fuse box (No.16) → I/conn 〔CN-7(12)〕→ Switch panel 〔CN-116(16, 17)〕

(1) Beacon lamp switch ON

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

(2) Cab light switch ON

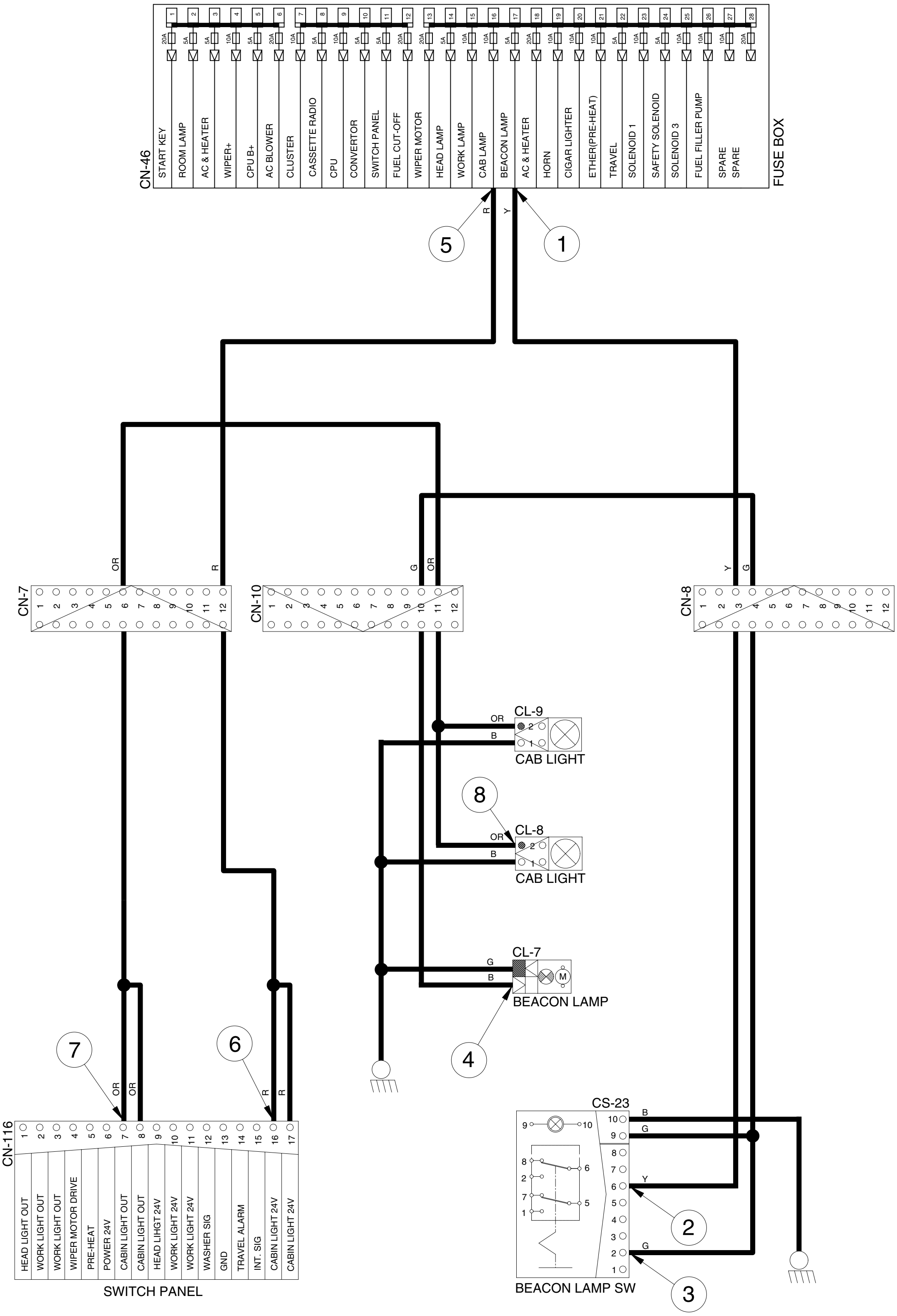
Cab light switch ON 〔CN-116(7, 8)〕 → I/conn 〔CN-7(6)〕 → I/conn 〔CN-10(11)〕
→ Cab light ON 〔CL-8(2), CL-9(2)〕

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND(Fuse box) ② - GND(Switch power input) ③ - GND(Switch power output) ④ - GND(Beacon lamp)	20~25V
STOP	ON	⑤ - GND(Fuse box) ⑥ - GND(Switch power input) ⑦ - GND(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) Key switch ON

Fuse box (No.11) → I/conn 〔CN-7(5)〕 → Switch panel 〔CN-116(6)〕

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

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

(2) Wiper switch ON : 1st step(Intermittent)

Wiper switch ON 〔CN-116(15)〕 → I/conn〔CN-9(4)〕 → I/conn〔CN-6(10)〕 → I/conn〔CN-17(8)〕
Wiper motor controller 〔CN-141(10) → (3)〕 → Wiper motor intermittently operating 〔CN-21(6)〕

(3) Wiper switch ON : 2nd step(Low speed)

Wiper switch ON 〔CN-116(4)〕 → I/conn 〔CN-7(3)〕 → I/conn 〔CN-6(9)〕 → I/conn〔CN-17(2)〕
Wiper motor controller 〔CN-141(2) → (4)〕 → Wiper motor operating 〔CN-21(2)〕

(4) Washer switch ON

Washer switch ON 〔CN-116(12)〕 → I/conn 〔CN-7(9)〕 → I/conn 〔CN-5(1)〕 → I/conn 〔CN-17(7)〕
→ Wiper motor controller 〔CN-141(9) → (8)〕 → I/conn 〔CN-17(6)〕 → I/conn 〔CN-6(11)〕
→ Washer pump 〔CN-22(1)〕 → Washer operating
Fuse box (No.13) → I/conn 〔CN-6(5)〕 → I/conn 〔CN-17(4)〕
→ Wiper motor controller 〔CN-141(6) → (4)〕 → Wiper motor operating 〔CN-21(2), Low speed〕

(5) Auto parking(When switch OFF)

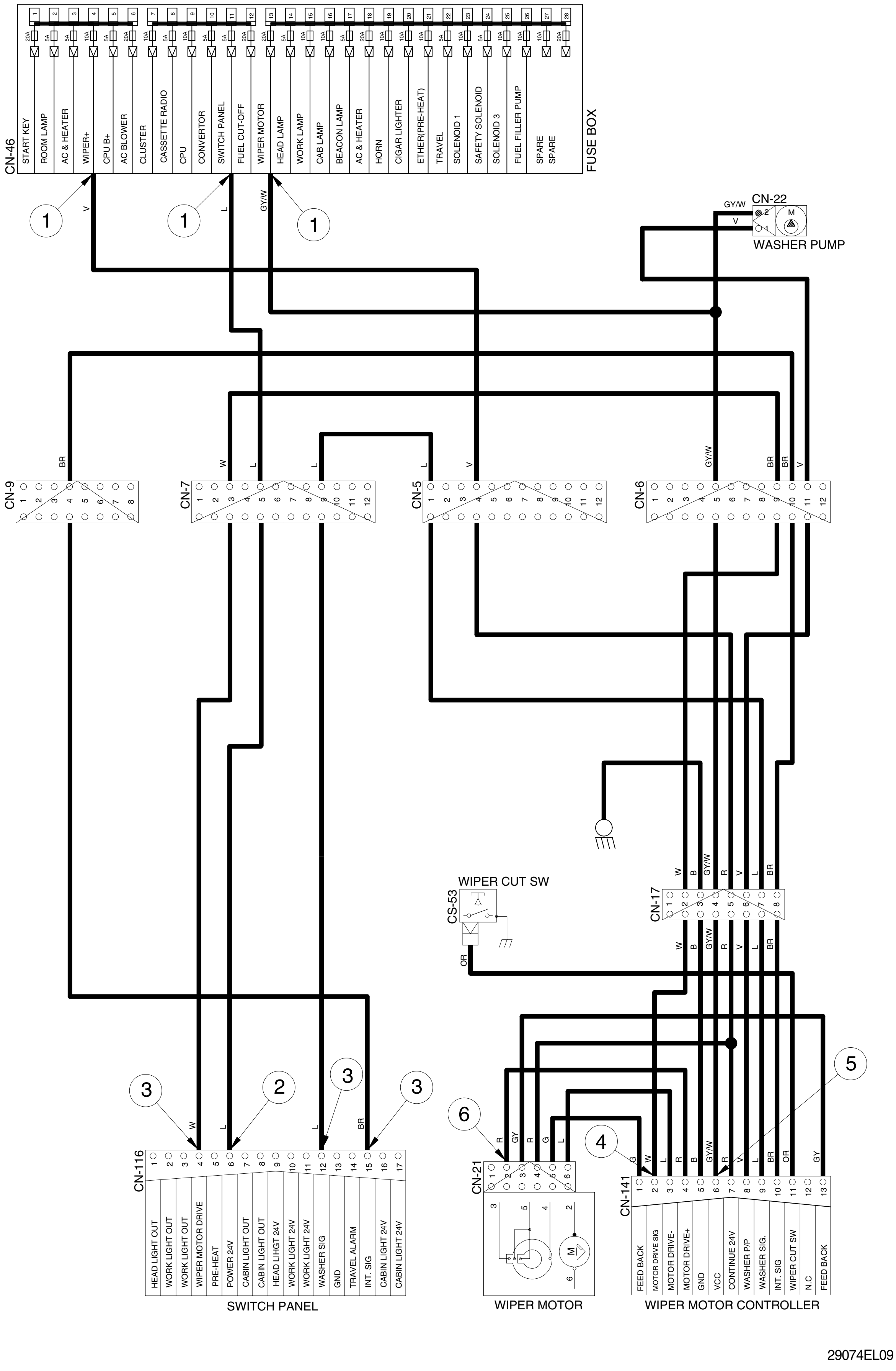
Switch OFF 〔CN-116(15)〕 → Wiper motor parking position by wiper motor controller

2) CHECK POINT

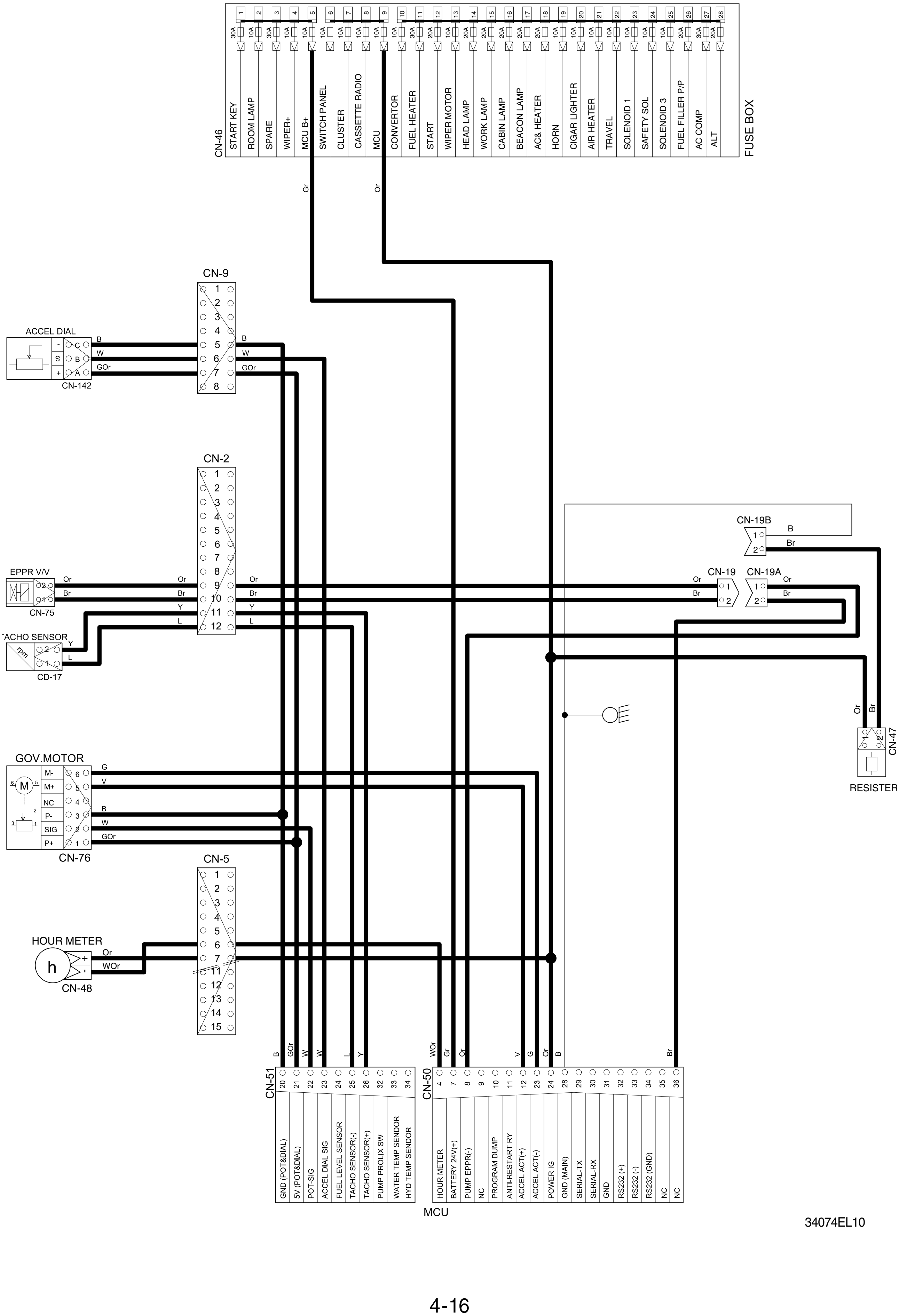
Engine	Start switch	Check point	Voltage
STOP	ON	① - GND(Fuse box) ② - GND(Switch power input) ③ - GND(Switch power output) ④ - GND(Wiper Power input) ⑤ - GND(Wiper power output) ⑥ - GND(Wiper motor)	20~25V

※ GND : Ground

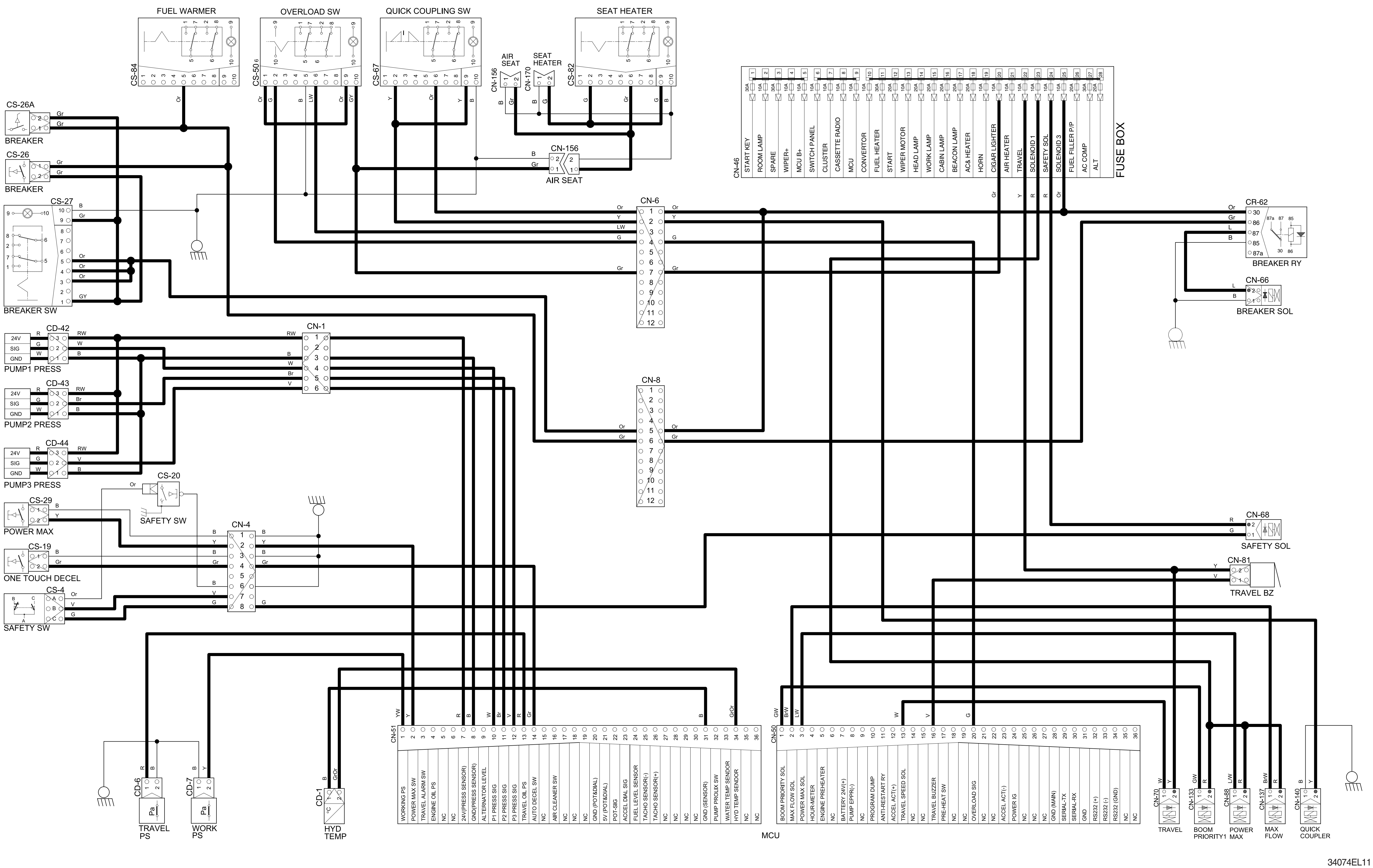
WIPER AND WASHER CIRCUIT



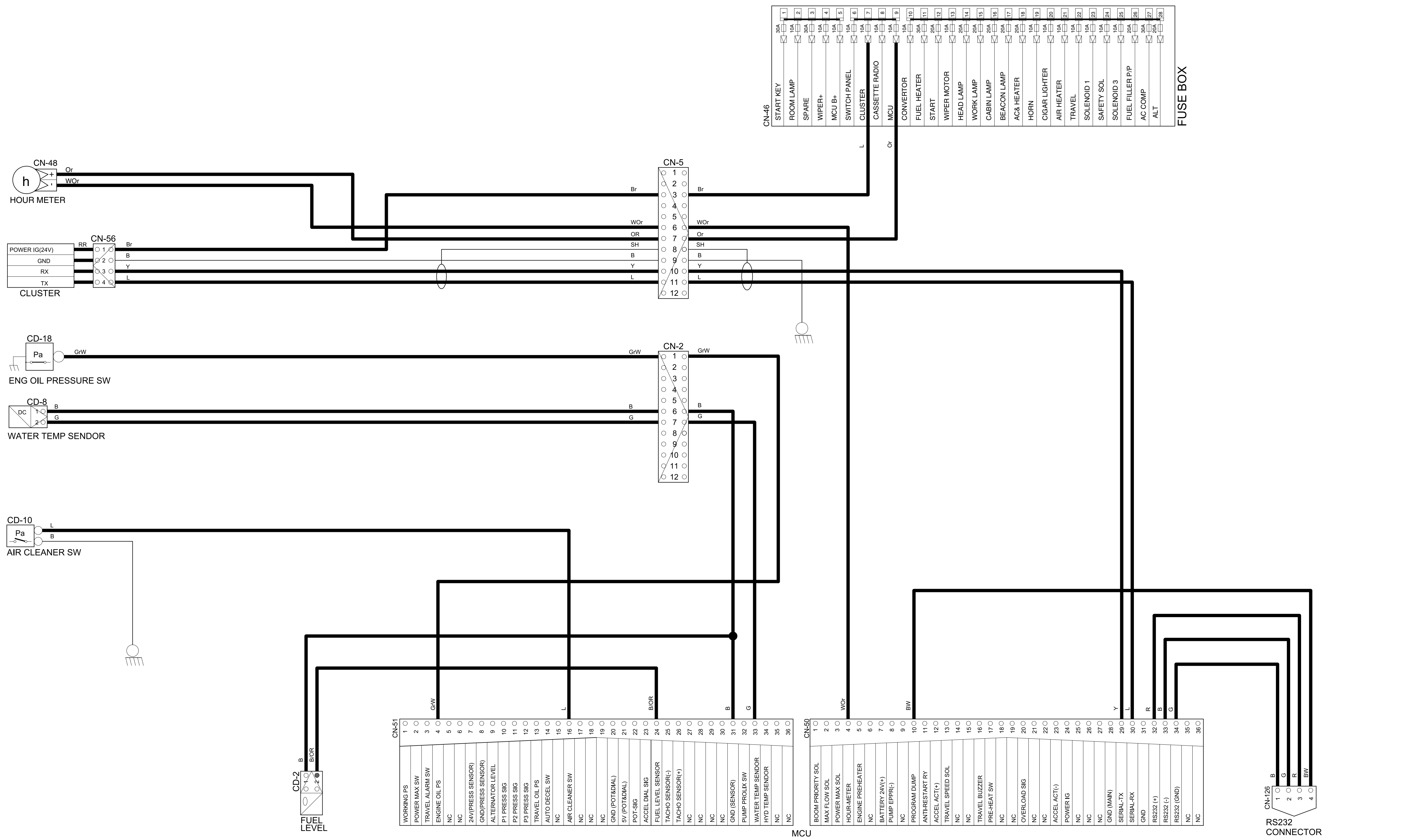
CONTROLLER CIRCUIT



ELECTRIC CIRCUIT FOR HYDRAULIC

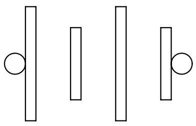
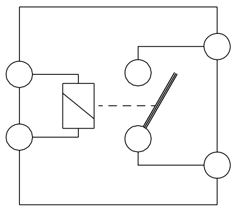
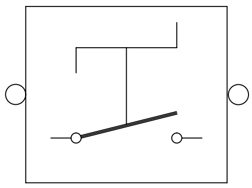
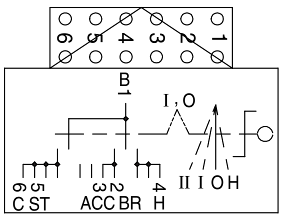
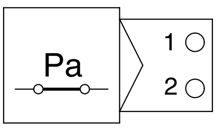


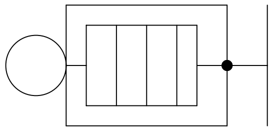
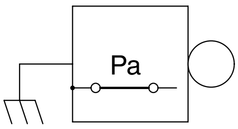
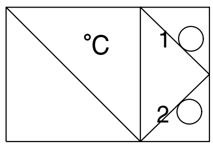
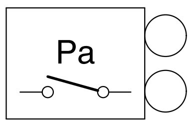
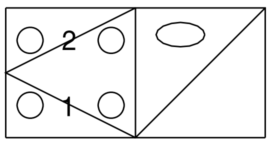
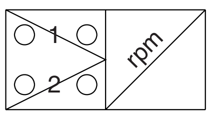
MONITORING CIRCUIT

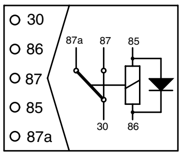
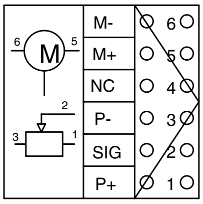
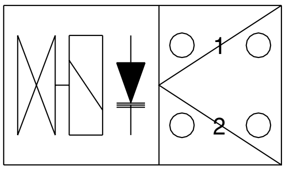
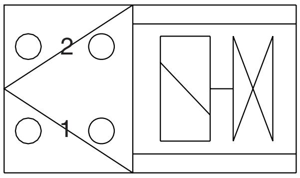
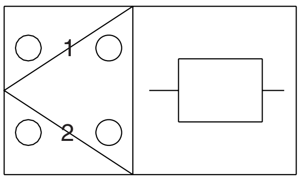
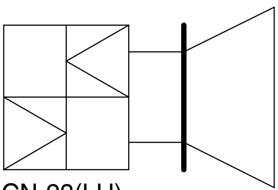


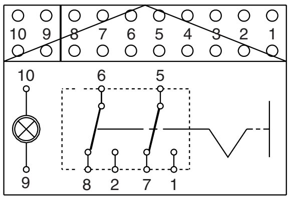
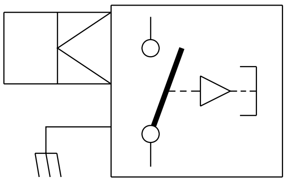
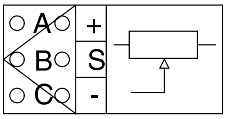
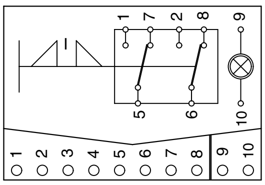
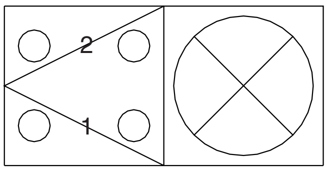
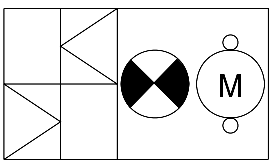
34074EL12

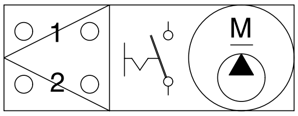
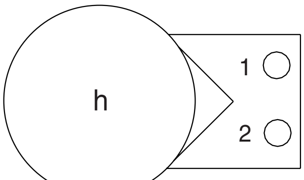
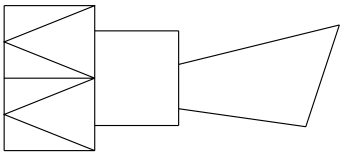
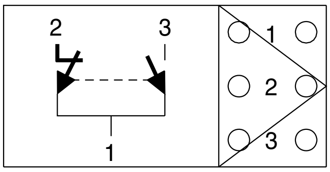
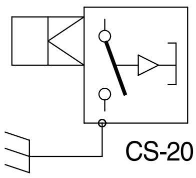
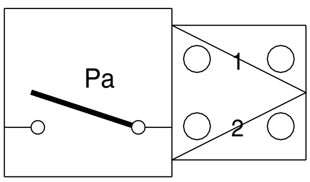
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

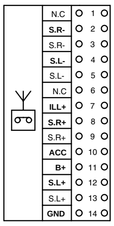
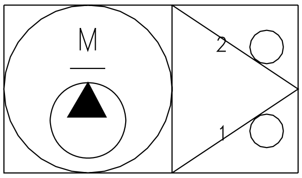
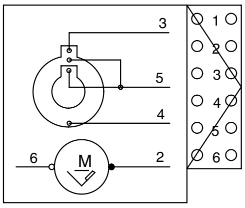
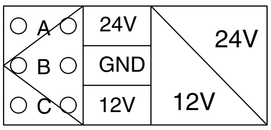
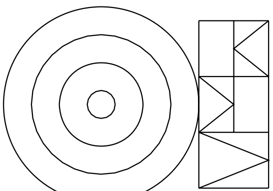
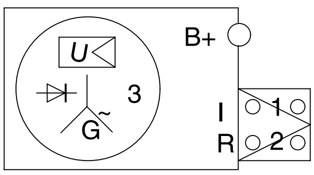
Part name	Symbol	Specifications	Check
Battery		12V × 160Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A(continuity) 1000A(30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50 Ω ※ Check contact Normal : ∞ Ω
Master switch	 CS-74	Continuous : 180AMPS Rush : 1000AMPS	※ Check disconnection Normal : About 0 Ω
Start key	 CS-2	B-BR : 24V 1A B-ACC : 24V 10A B-ST : 24V 40A	※ Check contact OFF : ∞ Ω (For each terminal) ON : 0 Ω (For terminal 1-3 and 1-2) START : 0 Ω (For terminal 1-5)
Pressure switch (Travel, working)	 CD-6 CD-7	10kgf/cm^2 (N.C TYPE)	※ Check contact Normal : 0.1 Ω

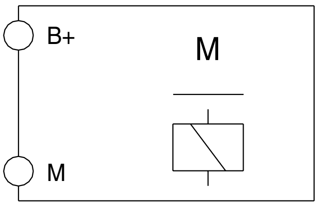
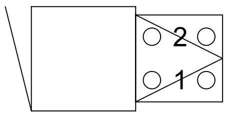
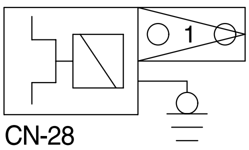
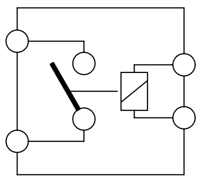
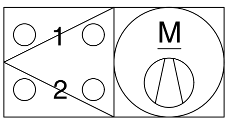
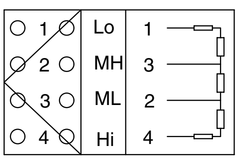
Part name	Symbol	Specifications	Check
Air gird heater	 CN-78	24V 200A	※ Check contact 0.25~0.12 Ω
Pressure switch (For engine oil)	 CD-18	0.5kgf/cm^2 (N.C TYPE)	※ Check resistance Normal : ∞ Ω (CLOSE)
Temperature sensor (Coolant, Hydraulic)	 CD-1 CD-8	-	※ Check resistance 50˚C : 804 Ω 80˚C : 310 Ω 100˚C : 180 Ω
Air cleaner pressure switch	 CD-10	-	※ Check contact High level : ∞ Ω Low level : 0 Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 50 Ω 6/12 : 350 Ω 11/12 : 100 Ω 5/12 : 400 Ω 10/12 : 150 Ω 4/12 : 450 Ω 9/12 : 200 Ω 3/12 : 500 Ω 8/12 : 250 Ω 2/12 : 550 Ω 7/12 : 300 Ω 1/12 : 600 Ω Empty warning : 700 Ω
Tacho sensor	 CD-17	-	※ Check resistance Normal : 300 Ω (For terminal 1-2)

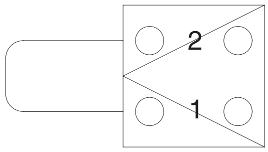
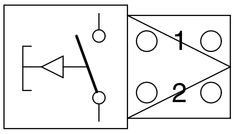
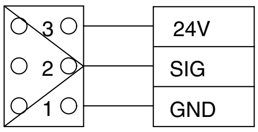
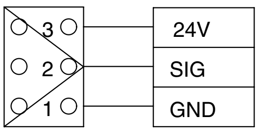
Part name	Symbol	Specifications	Check
Relay	 CR-2 CR-5 CR-7 CR-13 CR-35 CR-36 CR-46 CR-62	24V 16A	※ Check resistance Normal : About 160 Ω (For terminal 85-86) 0 Ω (For terminal 30-87) ∞ Ω (For terminal 30-87)
Accel actuator	 CN-76	-	※ Check resistance Normal : 1~2 Ω (For terminal 5-6) 0.8~1.2kΩ (For terminal 1-3)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-133 CN-137 CN-140	24V 1A	※ Check resistance Normal : 15~25 Ω (For terminal 1-2)
EPPR valve	 CD-75	700mA	※ Check resistance Normal : 15~25 Ω (For terminal 1-2)
Resistor	 CD-47	45 Ω 20W ±5%	※ Check resistance Normal : 45 Ω
Speaker	 CN-23(LH) CN-24(RH)	20W	※ Check disconnection Normal : 0~2 Ω

Part name	Symbol	Specifications	Check
Switch (Locking type)	 CS-23 CS-27 CS-50 CS-52 CS-54 CS-82 CS-83 CS-84	24V 8A	※ Check contact Normal ON : 0 Ω (For terminal 1-5, 2-6) ∞ Ω (For terminal 5-7, 6-8) OFF : ∞ Ω (For terminal 1-5, 2-6) 0 Ω (For terminal 5-7, 6-8)
Door switch Wiper cut switch	 CS-1 CS-53	24V 2W	※Check resistance Normal : About 5MΩ
Accel dial	 CN-142	-	※ Check resist Normal : About 5kΩ (For terminal A-C) Normal : Abowt 5V (For terminal A-C) : 2~4.5V (For terminal C-B)
Switch	 CS-67	24V 8A	※ Check disconnection Normal : 1.0 Ω ON : 0 Ω (For terminal 1-5, 2-6) ∞ Ω (For terminal 5-7, 6-8) OFF : ∞ Ω (For terminal 1-5, 6-8) 0 Ω (For terminal 5-7, 6-8)
Head lamp, Work lamp, Room lamp, Cab lamp	 CL-1 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9	24V 70W (H3 Type) 24V 10W (Room lamp)	※ Check disconnection 24V 70W : About 10 Ω 24V 10W : About 50 Ω
Beacon lamp	 CL-7	21V 70A (H1 type)	※Check disconnection Normal : About 10 Ω

Part name	Symbol	Specifications	Check
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※Check resistance Normal : 1.0 Ω
Hour meter	 CN-48	16~32V	※Check operation Supply power(24V) to terminal No.2 and connect terminal No.1 and ground
Horn	 CN-20, CN-25	DC22~28V 2A	※Check operation Supply power(24V) to each terminal and connect ground.
Safety switch 1	 CS-4	24V 15A (N.C TYPE)	※Check contact Normal : 0 Ω (For terminal 1-2) ∞ Ω (For terminal 1-3) Operating : ∞ Ω (For terminal 1-2) 0 Ω (For terminal 1-3)
Safety switch 2	 CS-20	24V (N.C TYPE)	※Check contact Normal : 0 Ω (One pin to ground)
Receiver dryer	 CN-29	24V 2.5A	※Check contact Normal : ∞ Ω

Part name	Symbol	Specifications	Check
Radio&USB player	 CN-27	24V 2A	※Check voltage 20~25V (For terminal 10-14, 11-14)
Washer pump	 CN-22	24V 3.8A	※Check contact Normal : 10.7 Ω (For terminal 1-2)
Wiper motor	 CN-21	24V 2A	※Check disconnection Normal : 7 Ω (For terminal 2-6)
DC/DC Converter	 CN-138	12V 3A	24V(A-B) 12V (B-C)
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	24V 55A	※Check contact Normal : 0 Ω (For terminal B^+-I) Normal : 24~27.5V

Part name	Symbol	Specifications	Check
Starter	 CN-45	Delco Remy 28MT 24V	※Check contact Normal : 0.1 Ω
Travel alarm	 CN-81	24V 0.5A	※Check contact Normal : 5.2 Ω
Aircon compressor	 CN-28	24V 79W	※Check contact Normal : 13.4 Ω
Start relay	 CR-23	24V 300A	※Check contact Normal : 0.94 Ω (For terminal 1-2)
Blower motor		24V 9.5A	※Check resistance Normal : 2.5 Ω (For terminal 1-2)
Aircon resistor		-	※Check resistance Normal : 1.12 Ω (For terminal 4-2) 2.07 Ω (For terminal 2-3) 3.17 Ω (For terminal 3-1)

Part name	Symbol	Specifications	Check
Fusible link	 CN-60 CN-95	60A	※Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Switch (Power max, one touch decel, horn, breaker)	 CS-5 CS-19 CS-26 CS-26A CS-29	24V 6A	※Check resistance Normal : ∞ Ω
Transducer	 CD-42 CD-43	500bar	0bar : 1V(For terminal 1-2) 500bar : 5V(For terminal 1-2)
Transducer	 CD-44	50bar	0bar : 1V(For terminal 1-2) 50bar : 5V(For terminal 1-2)

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

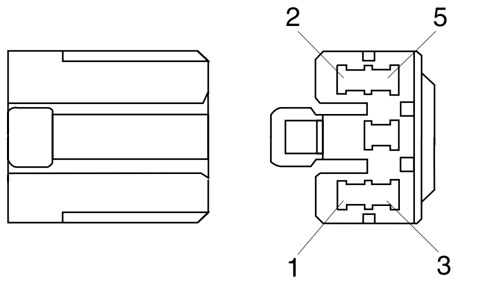
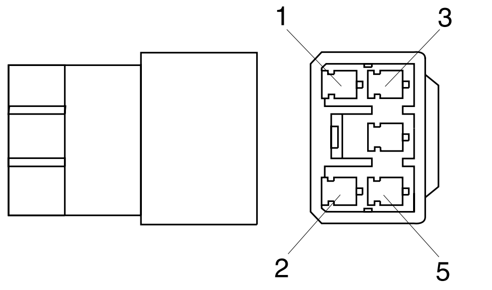
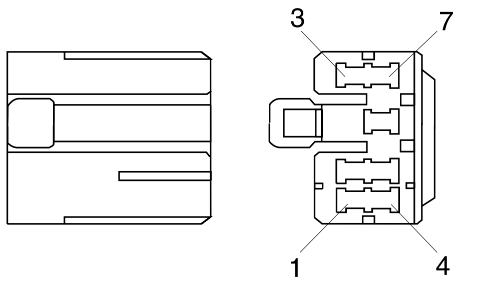
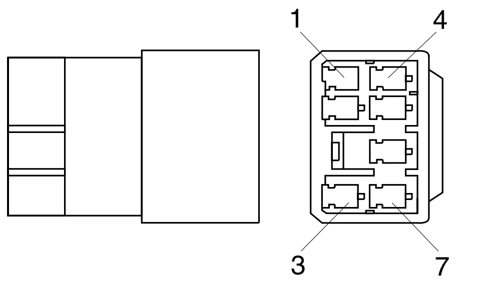
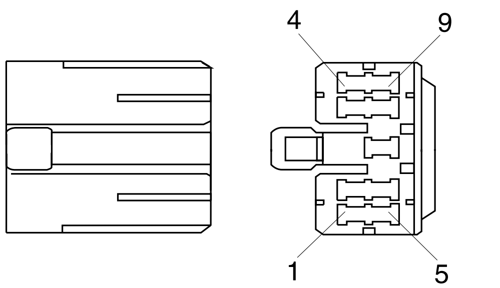
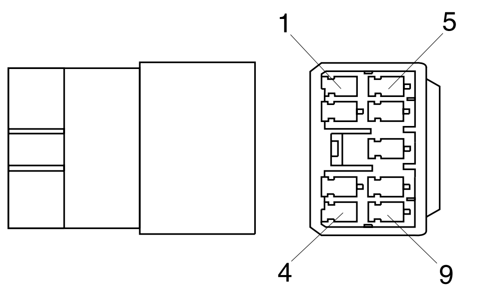
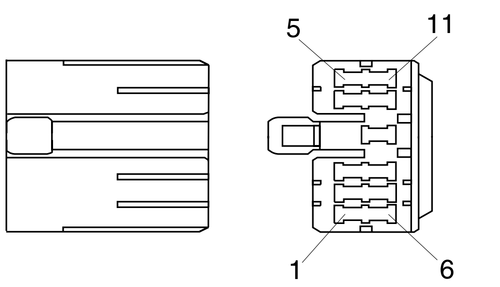
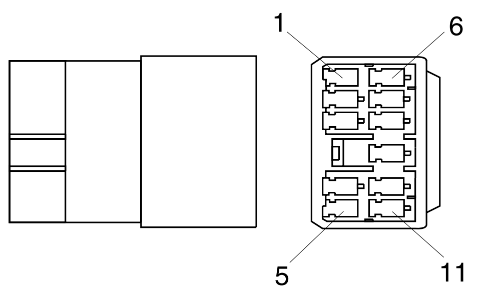
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	6	I/conn(Frame harness-main pump)	S816-006002	S816-106002
CN-2	AMP	12	I/conn(Frame harness-engine harness)	S816-012002	S816-112002
CN-3	AMP	8	I/conn(Frame harness-engine harness)	S816-008002	S816-108002
CN-4	AMP	8	I/conn(Console harness LH-frame harness)	S816-008002	S816-108002
CN-5	AMP	15	I/conn(Side harness RH-frame harness)	2-85262-1	368301-1
CN-6	AMP	12	I/conn(Side harness RH-frame harness)	S816-012002	S816-112002
CN-7	AMP	15	I/conn(Console harness RH-frame harness)	2-85262-1	368301-1
CN-8	AMP	12	I/conn(Wire harness RH-frame harness)	S816-012002	S816-112002
CN-9	AMP	8	I/conn(Wire harness RH-frame harness)	S816-008002	S816-108002
CN-10	DEUTSCH	12	I/conn(Cab harness-frame harness)	DT06S-12S	DT04-12P
CN-11	DEUTSCH	8	I/conn(Air con harness-frame harness)	DT06-8S	DT06-8P
CN-12	DEUTSCH	2	Boom wire harness	DT06-2S-EP06	DT06-2P
CN-16	AMP	6	Pump pressure harness	S816-006002	S816-106002
CN-17	DEUTSCH	8	I/conn(Wiper harness)	DT06-8S	DT04-8P
CN-19	AMP	2	Emergency MCU connector	S816-002002	S816-102002
CN-20	MOLEX	2	Horn	35825-0211	-
CN-21	AMP	6	Wiper motor	925276-0	-
CN-21A	AMP	6	Wiper motor	S816-006202	-
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	35825-0211	-
CN-27	AMP	14	Radio & USB player	173852	-
CN-28	MWP	1	AC compressor	NMWP01F-B	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-45	RING-TERM	-	Start motor B^+	-	S820-412000
CN-46	-	-	Fuse box	S820-106000	-
CN-47	AMP	2	Resistor	S810-002202	S810-102202
CN-48	KET	1	Hour meter	GP890469	-
CN-50	AMP	36	MCU	3441111-1	-
CN-51	AMP	36	MCU	3441111-1	-
CN-56	DEUTSCH	4	Cluster	-	DT04-4P-E004
CN-60	YAZAKI	2	Fusible link	21N4-01320	7122-4125-50
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	DT04-2P

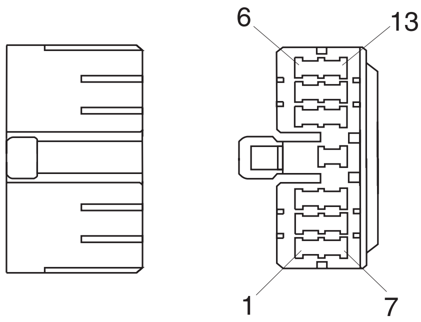
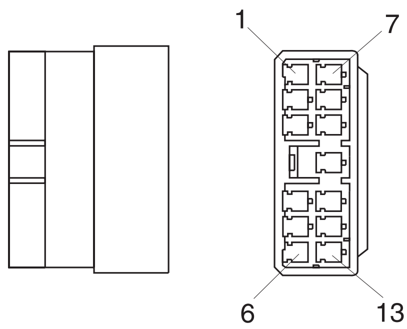
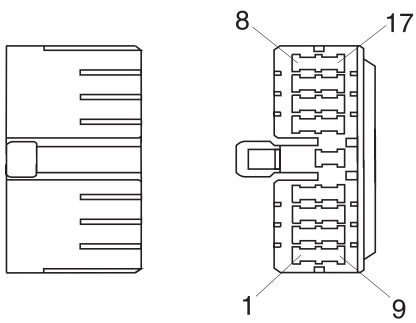
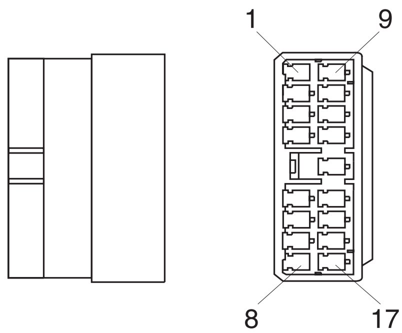
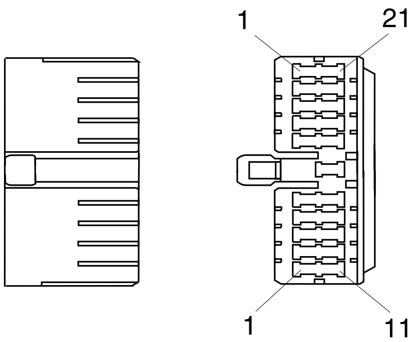
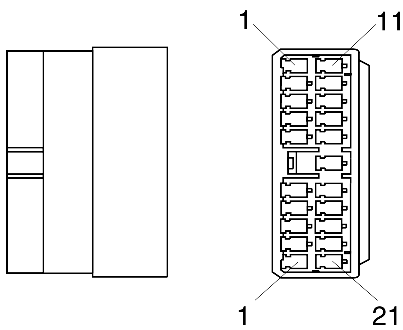
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	DT04-2P
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	DT04-2P
CN-70	DEUTSCH	2	Travel solenoid	DT06-2S-EP06	DT04-2P
CN-74	KET	2	Alternator "I" term	MG640188-4	-
CN-75	AMP	2	EPPR valve	S816-002002	-
CN-76	DEUTSCH	6	DC motor	DT06-6S-EP06	-
CN-81	DEUTSCH	2	Travel buzzer	DT06-2S-EP06	DT04-2P
CN-88	DEUTSCH	2	Power max solenoid	DT06-2S-EP06	DT04-2P
CN-95	YAZAKI	2	Fusible link	S813-130200	21N4-01311
CN-116	PA	17	Switch panel	S811-017002	-
CN-126	DEUTSCH	4	RS 232 connector	DT06-4S-P012	DT04-4P-E004
CN-133	DEUTSCH	2	Boom priority	DT06-2S-EP06	-
CN-137	DEUTSCH	2	Max flow	DT06-2S-EP06	-
CN-138	DEUTSCH	3	DC/DC converter	DT06-3S-P012	-
CN-139	DEUTSCH	2	12V socket	DT06-2S	DT04-2P-E004
CN-140	DEUTSCH	2	Quick clamp	DT06-2S-EP06	-
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-142	DEUTSCH	3	Accel dial	DT06-3S-P012	-
CN-143	KET	2	Radio & USB player(With remocon)	S816-002002	-
CN-144	AMP	12	Remocon-radio & USB player	174045-2	-
CN-147	PACKARD	2	Fuel heater	15300027	-
· Relay					
CR-1	RING-TERM	-	Battery relay	-	S820-104002
CR-13	AMP	4	Head lamp relay	S810-004002	-
CR-23	AMP	2	Start relay	S816-002003	-
CR-24	AMP	1	Pre-heater relay	S822-014000	-
CR-46	AMP	4	Fuel warmer relay	S810-004202	-
CR-62	AMP	4	Breaker relay	S810-004002	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014004	-
CS-2	AMP	6	Start key switch	S814-006000	-
CS-4	DEUTSCH	3	Safety switch	DT06-3S-P012	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P-E004
CS-19	DEUTSCH	2	One touch decel	DT06-2S-P012	DT04-2P-E004
CS-20	AMP	1	Safety switch	S822-014002	-
CS-23	SWF	10	Beacon lamp switch	SWF 593757	-
CS-26	DEUTSCH	2	Breaker switch	DT06-2S-P012	-
CS-26A	AMP	2	Breaker switch	S816-002002	S816-102002

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-27	SWF	10	Breaker switch	SWF 593757	-
CS-29	DEUTSCH	2	Powe max switch	DT06-2S-P012	-
CS-50	SWF	10	Overload switch	SWF 593757	-
CS-52	SWF	10	Econo switch	SWF 593757	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-54	SWF	10	Spear switch	SWF 593757	-
CS-67	SWF	10	Quick clamp switch	SWF 593757	-
CS-74	AMP	2	Master switch	S813-030200	-
CS-82	SWF	2	Fuel warmer switch	SWF 593757	-
CS-83	SWF	2	Seat heater switch	SWF 593757	-
CS-84	SWF	2	Spare switch	SWF 593757	-
· Light					
CL-1	KET	2	Room lamp	MG 610392	-
CL-2	AMP	1	Cigar light	S822-014002	-
CL-4	AMP	2	Head lamp	85202-1	-
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S	DT04-2P-E005
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S	DT04-2P
CL-7	SHUR	1	Beacon lamp	S822-014004	S822-114004
CL-8	DEUTSCH	2	Cab light-LH	DT06-2S	DT04-2P-E005
CL-9	DEUTSCH	2	Cab light-RH	DT06-2S	DT04-2P-E005
· Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	DT04-2P
CD-6	KET	2	Travel pressure switch	MG 640795	-
CD-7	KET	2	Working pressure switch	MG 640795	-
CD-8	AMP	2	Water temp sender	85202-1	-
CD-10	RING-TERM	-	Air cleaner switch	-	S820-104002
CD-17	AMP	2	Tachosensor	S816-002002	S818-120221
CD-18	RING-TERM	1	Engine oil pressure switch	-	S820-104000
CD-19	AMP	1	Engine oil filter switch	S819-010122	-
CD-42	AMP	3	Pump pressure 1	S816-003002	-
CD-43	AMP	3	Pump pressure 2	S816-003002	-
CD-44	AMP	3	Pump pressure 3	S816-003002	-
· Diode					
DO-3	AMP	2	-	21EA-50550	-
DO-4	AMP	2	-	21EA-50550	-

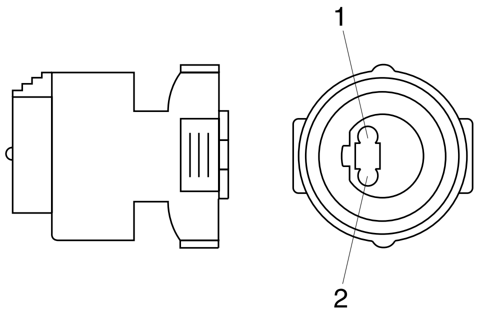
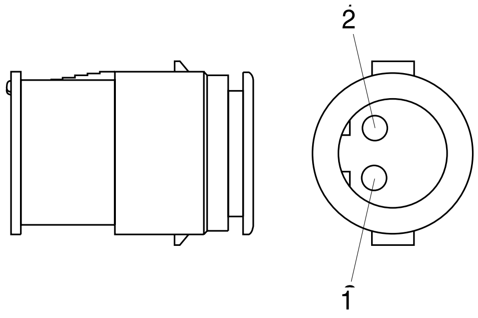
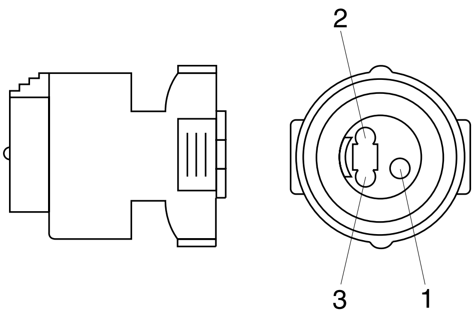
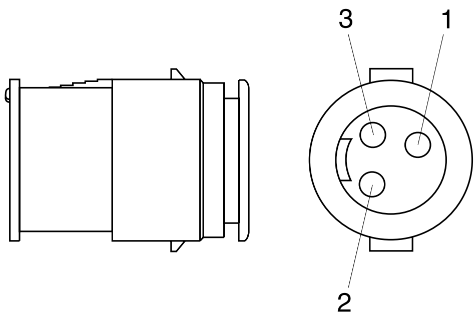
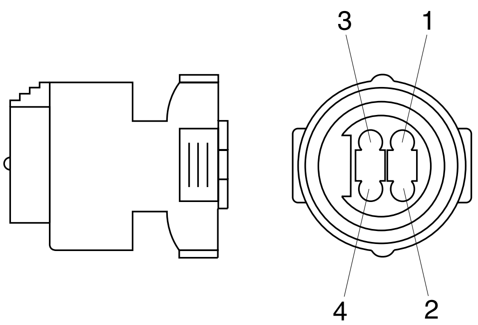
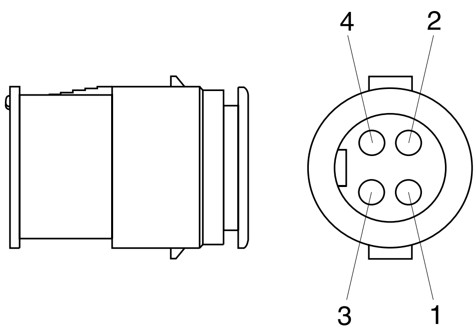
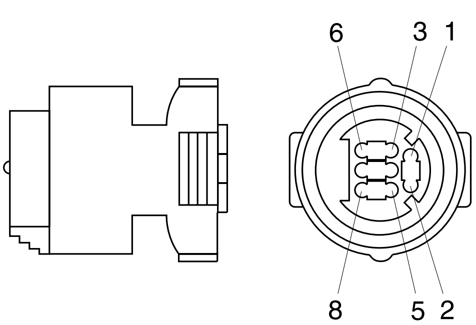
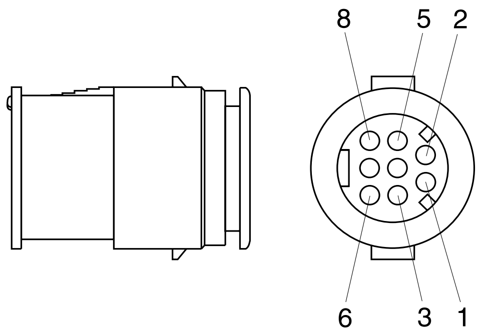
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

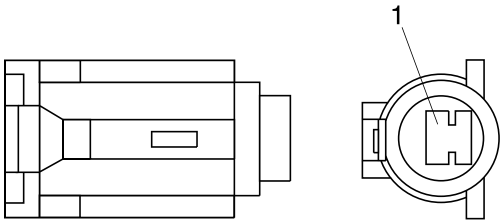
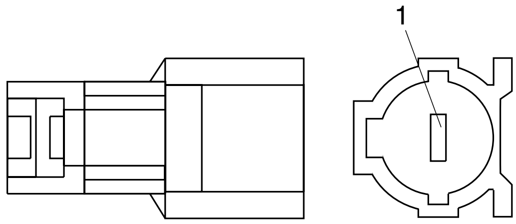
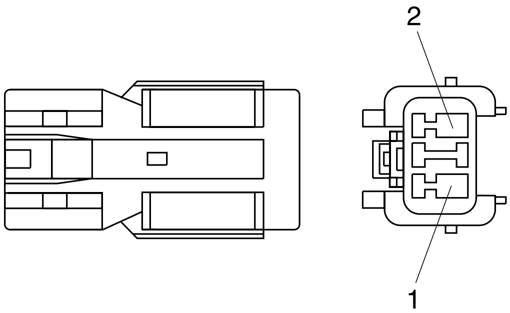
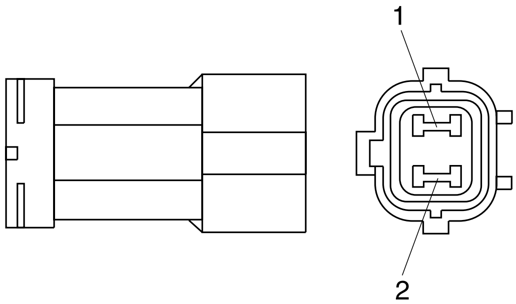
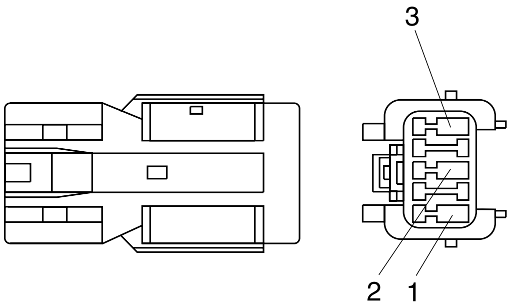
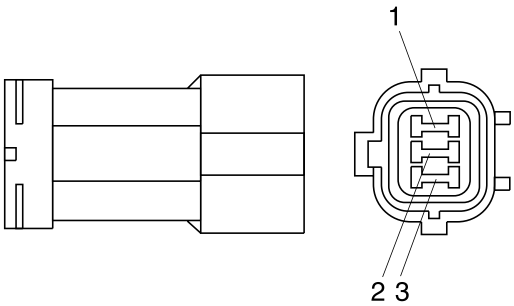
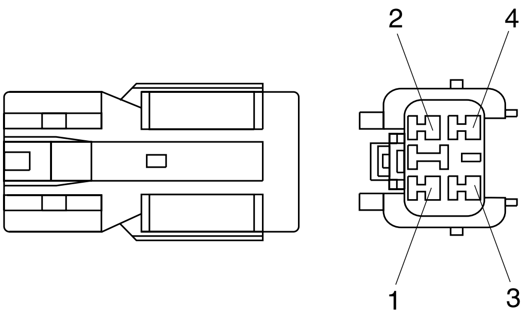
No. of pin	Receptacle connector(Female)	Plug connector(Male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

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

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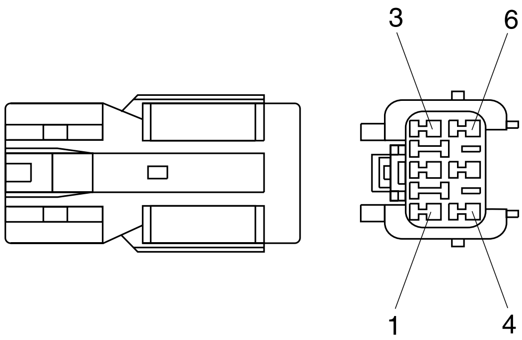
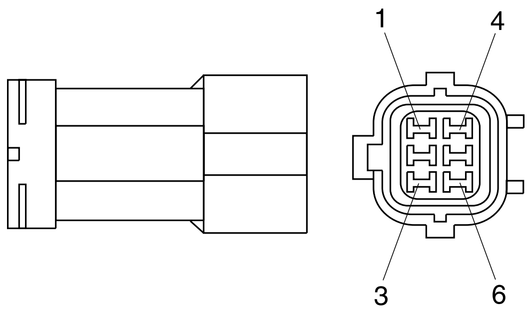
<tr><th>No. of pin</th><th>Receptacle connector(Female)</th><th>Plug connector(Male)</th></tr>
<tr><td>6</td><td>
S814-006000</td><td>
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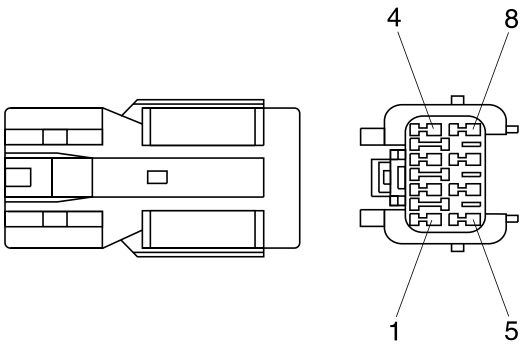
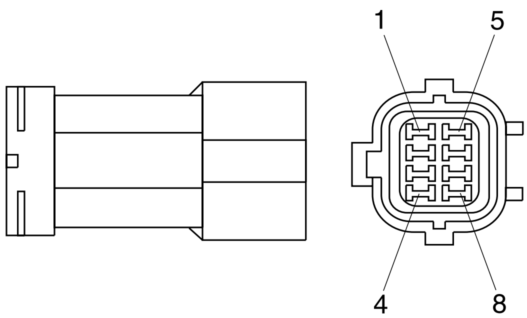
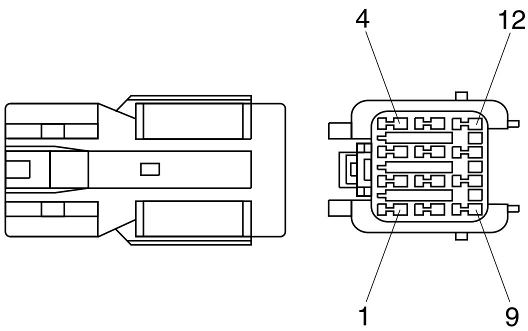
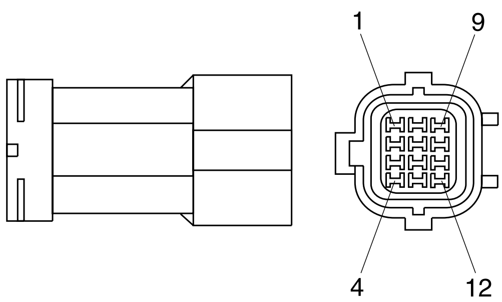
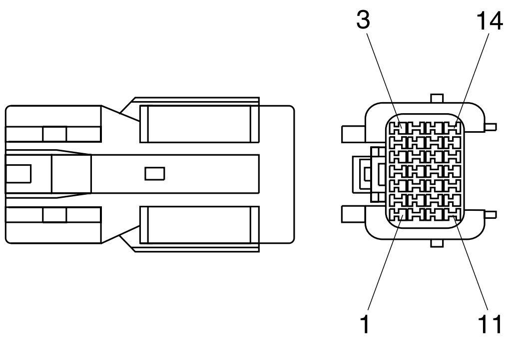
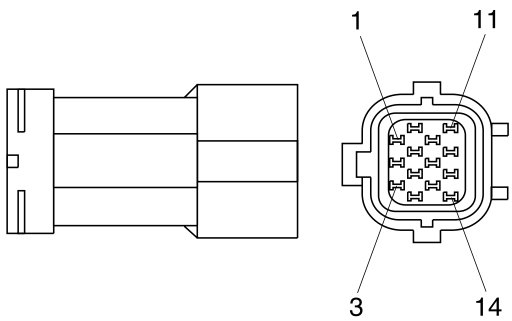
<tr><td>8</td><td>
S814-008000</td><td>
S814-108000</td></tr>
<tr><td>12</td><td>
S814-012000</td><td>
S814-112000</td></tr>
<tr><td>14</td><td>
S814-014000</td><td>
S814-114000</td></tr>
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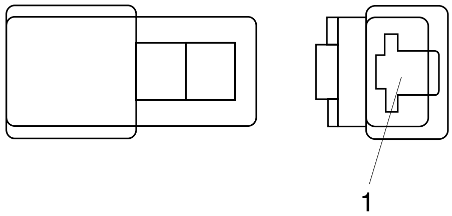
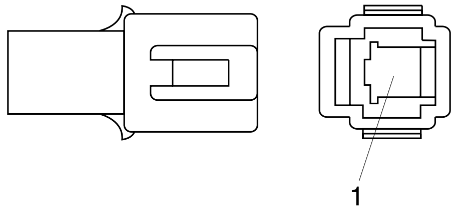
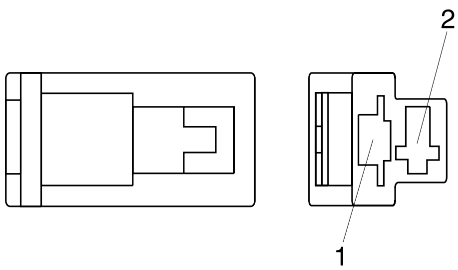
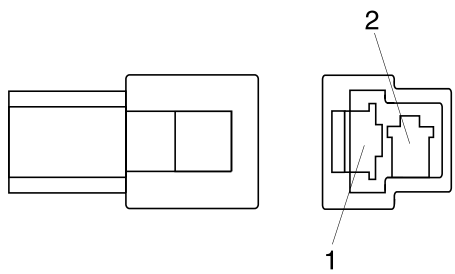
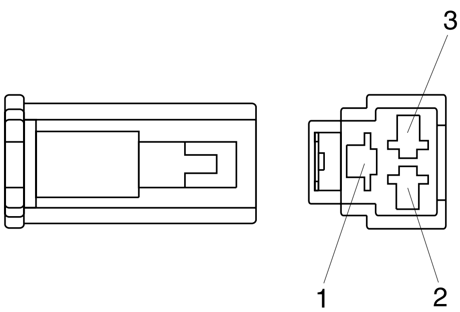
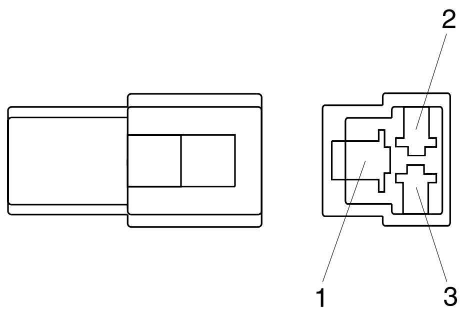
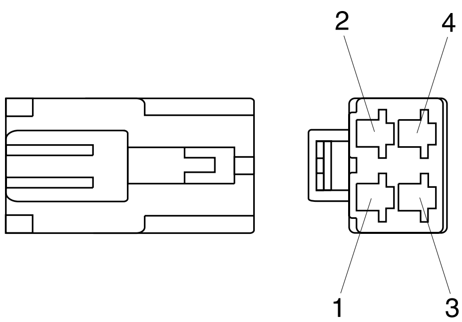
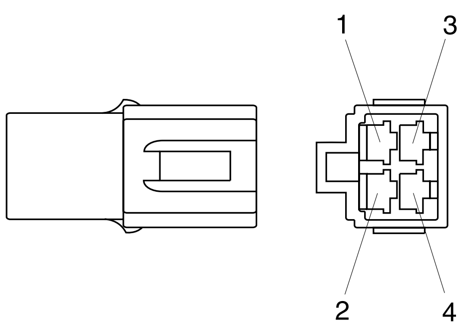
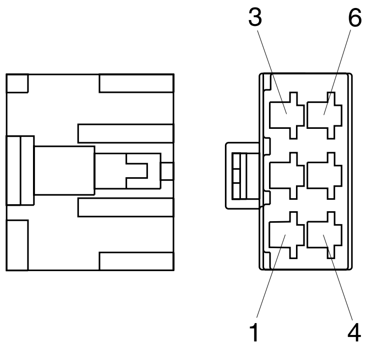
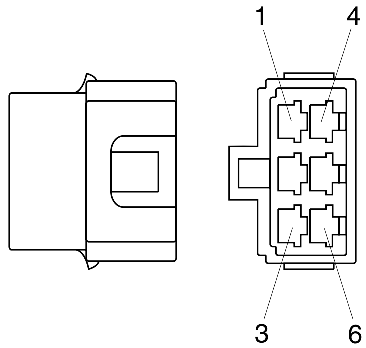
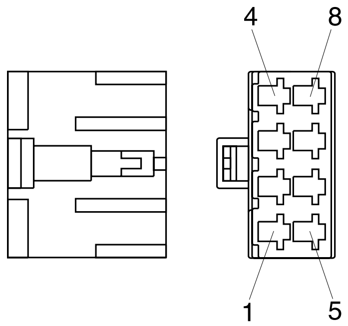
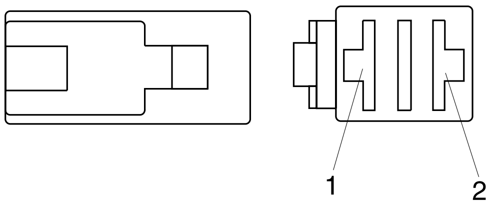
4) CN TYPE CONNECTOR

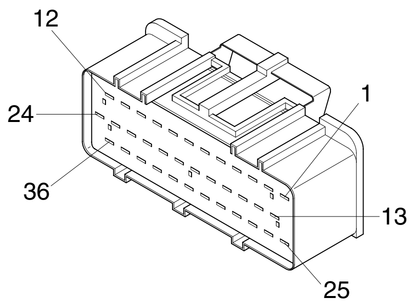
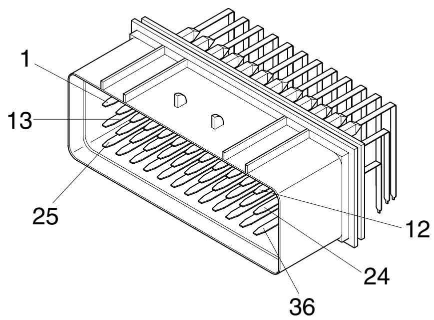
No. of pin	Receptacle connector(Female)	Plug connector(Male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

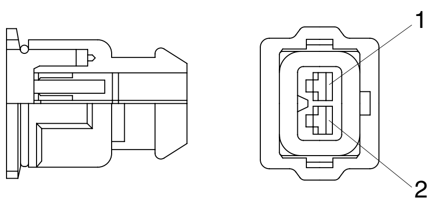
5) 375 FASTEN TYPE CONNECTOR

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

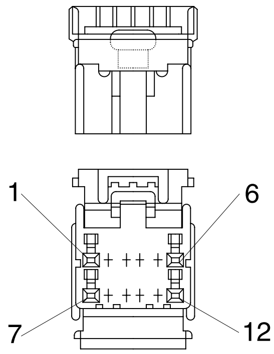
6) AMP ECONOSEAL CONNECTOR

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

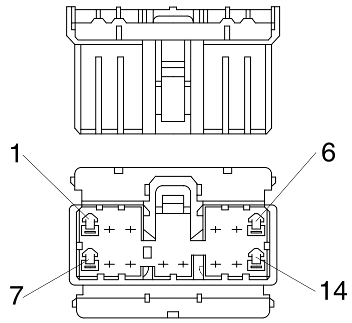
7) AMP TIMER CONNECTOR

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

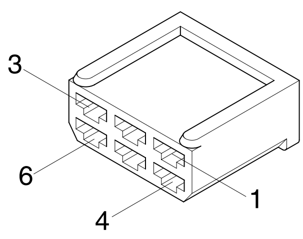
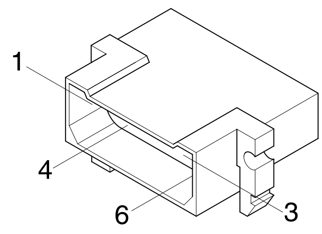
8) AMP 040 MULTILOCK CONNECTOR

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

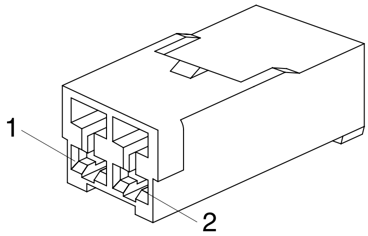
9) AMP 070 MULTILOCK CONNECTOR

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

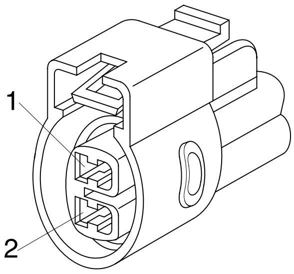
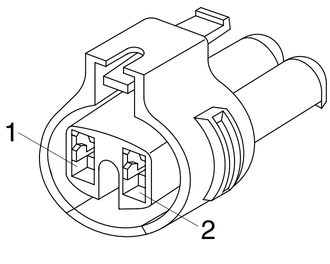
10) AMP FASTIN - FASTON CONNECTOR

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

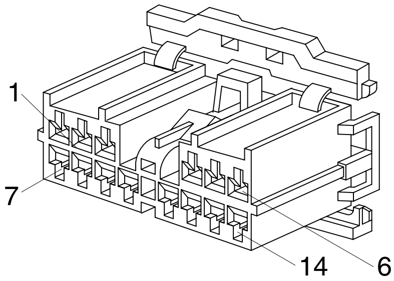
11) KET 090 CONNECTOR

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

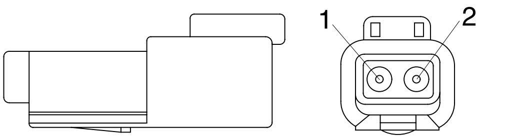
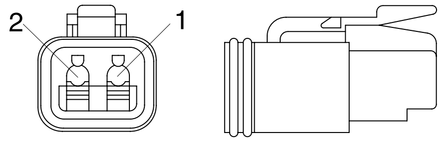
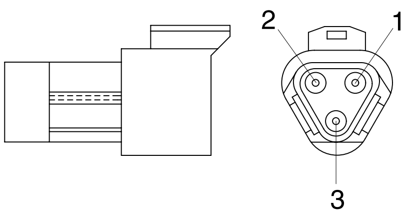
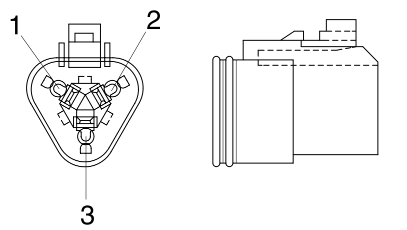
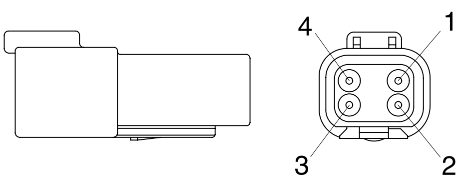
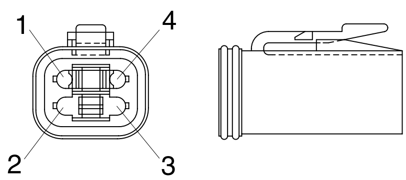
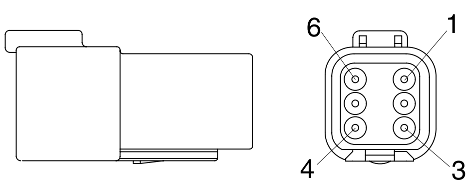
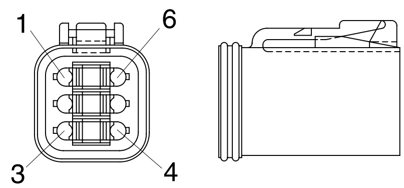
12) KET 090 WP CONNECTORS

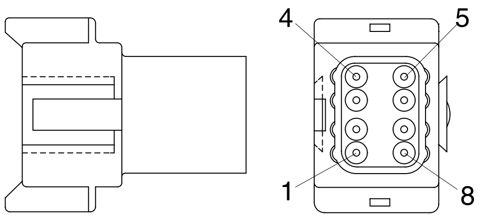
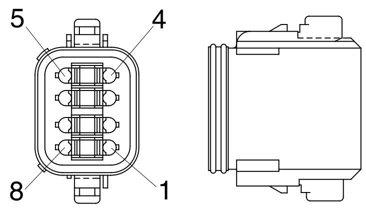
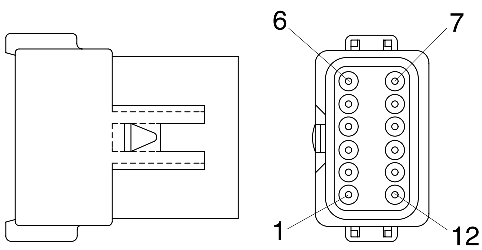
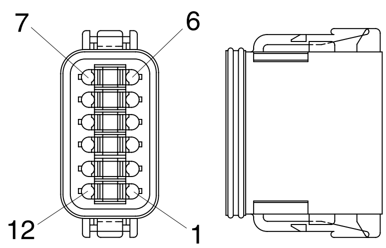
No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 MG640605	
2	 MG640795	

13) KET SDL CONNECTOR

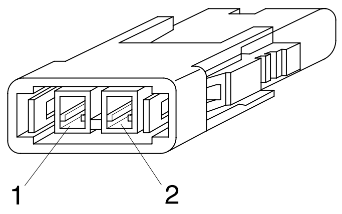
No. of pin	Receptacle connector(Female)	Plug connector(Male)
14	 MG610406	

14) DEUTSCH DT CONNECTORS

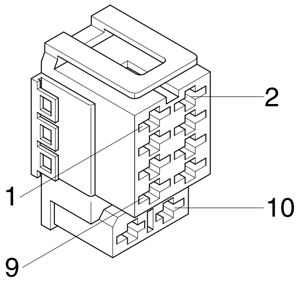
No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 DT06-2S	 DT06-2P
3	 DT06-3S	 DT06-3P
4	 DT06-4S	 DT06-4P
6	 DT06-6S	 DT06-6P

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

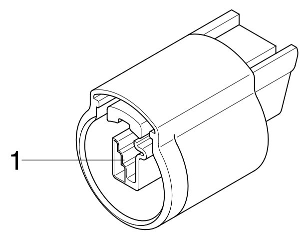
15) MOLEX 2CKTS CONNECTOR

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

16) ITT SWF CONNECTOR

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

17) MWP NMWP CONNECTOR

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

SECTION 5 MECHATRONICS SYSTEM

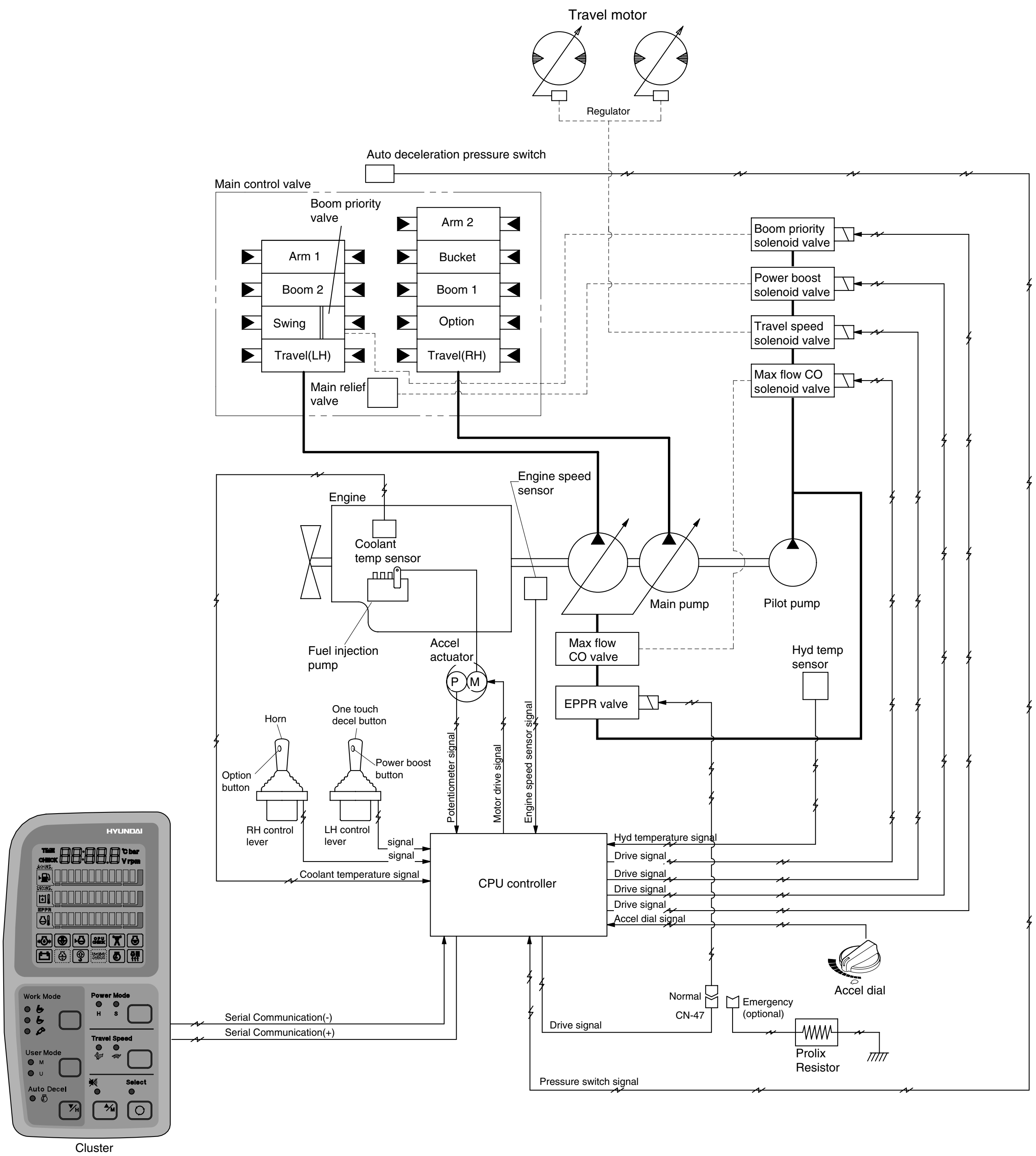
SECTION 5 MECHATRONICS SYSTEM

GROUP 1 OUTLINE

The NEW CAPO(Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, 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 for a CPU controller, a cluster, an accel actuator, an EPPR valve, and other components. The CPU controller and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.

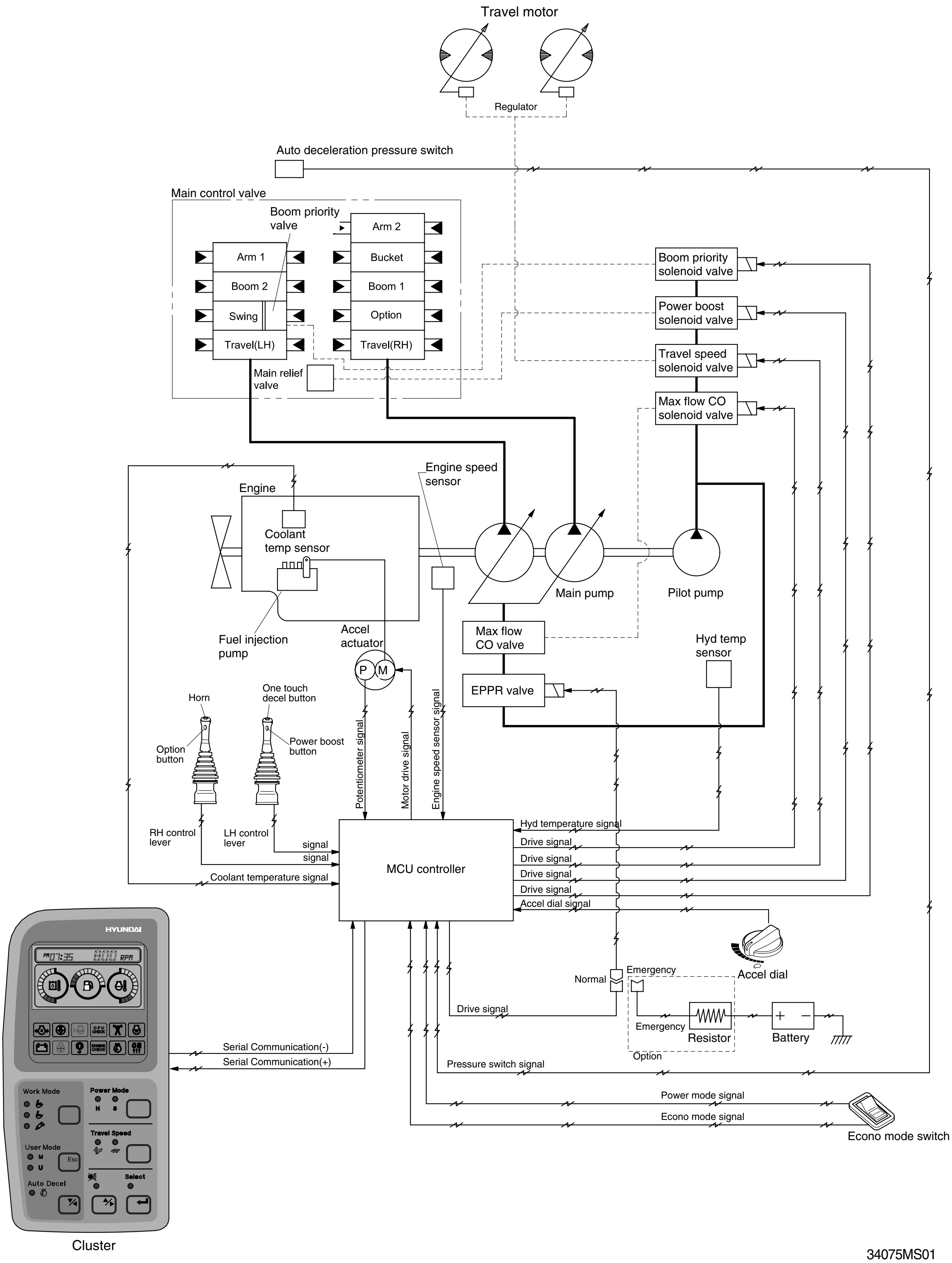
- NEW CAPO SYSTEM
  - Mode selection system
    - Engine control system
    - Pump control system
    - Work mode selection
    - User mode system(MI, MII, -#0007)
    - User mode system(M, U, #0008-)
  - Auto deceleration system
  - Power boost system
  - Travel speed control system
    - Travel speed control system
  - Automatic warming up system
  - Engine overheat prevention system
  - Max flow control system
  - Anti-restart system
  - Self-diagnostic system
    - Controller & cluster protection
    - Open-short diagnosis & error code display
  - Machine monitoring system
    - Machine condition monitoring
    - Electric signal monitoring
  - One touch deceleration system
  - Boom priority system

SYSTEM DIAGRAM(-#0007)



34075MS08

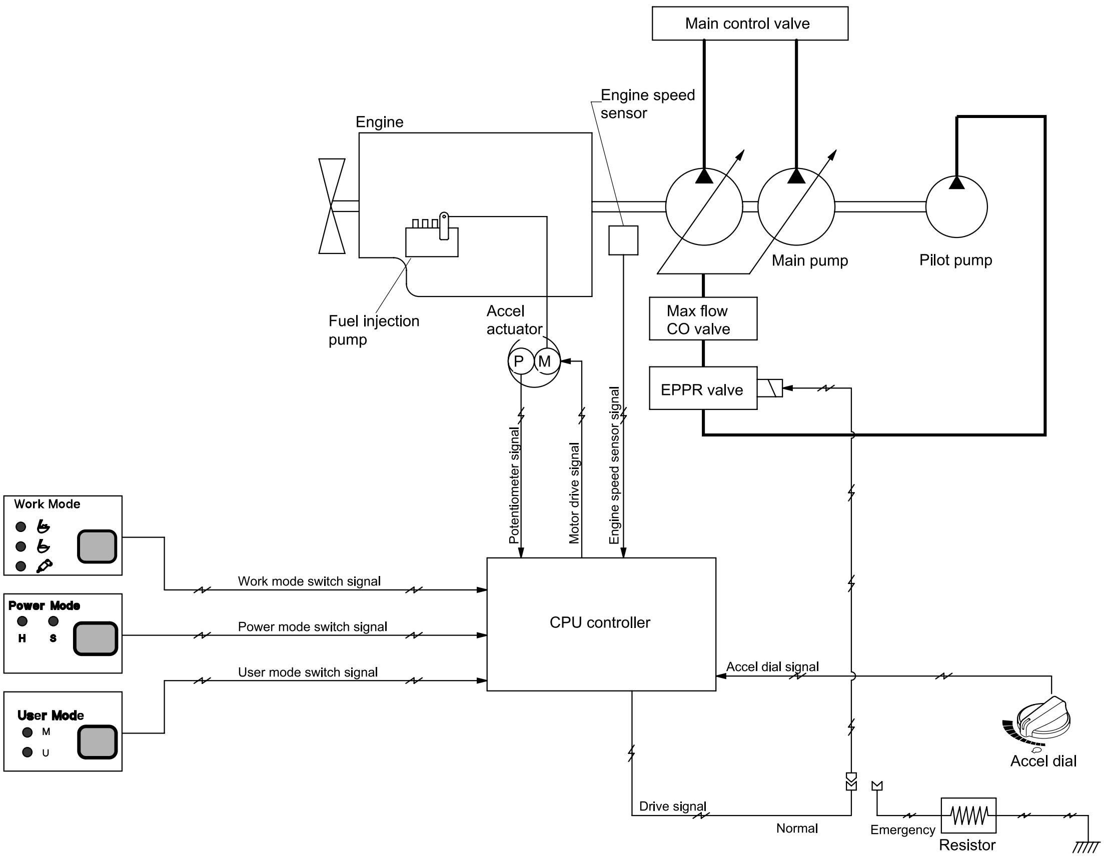
SYSTEM DIAGRAM(#0008-)



34075MS01

GROUP 2 MODE SELECTION SYSTEM(-#0007)

1. POWER MODE SELECTION SYSTEM



34075MS09

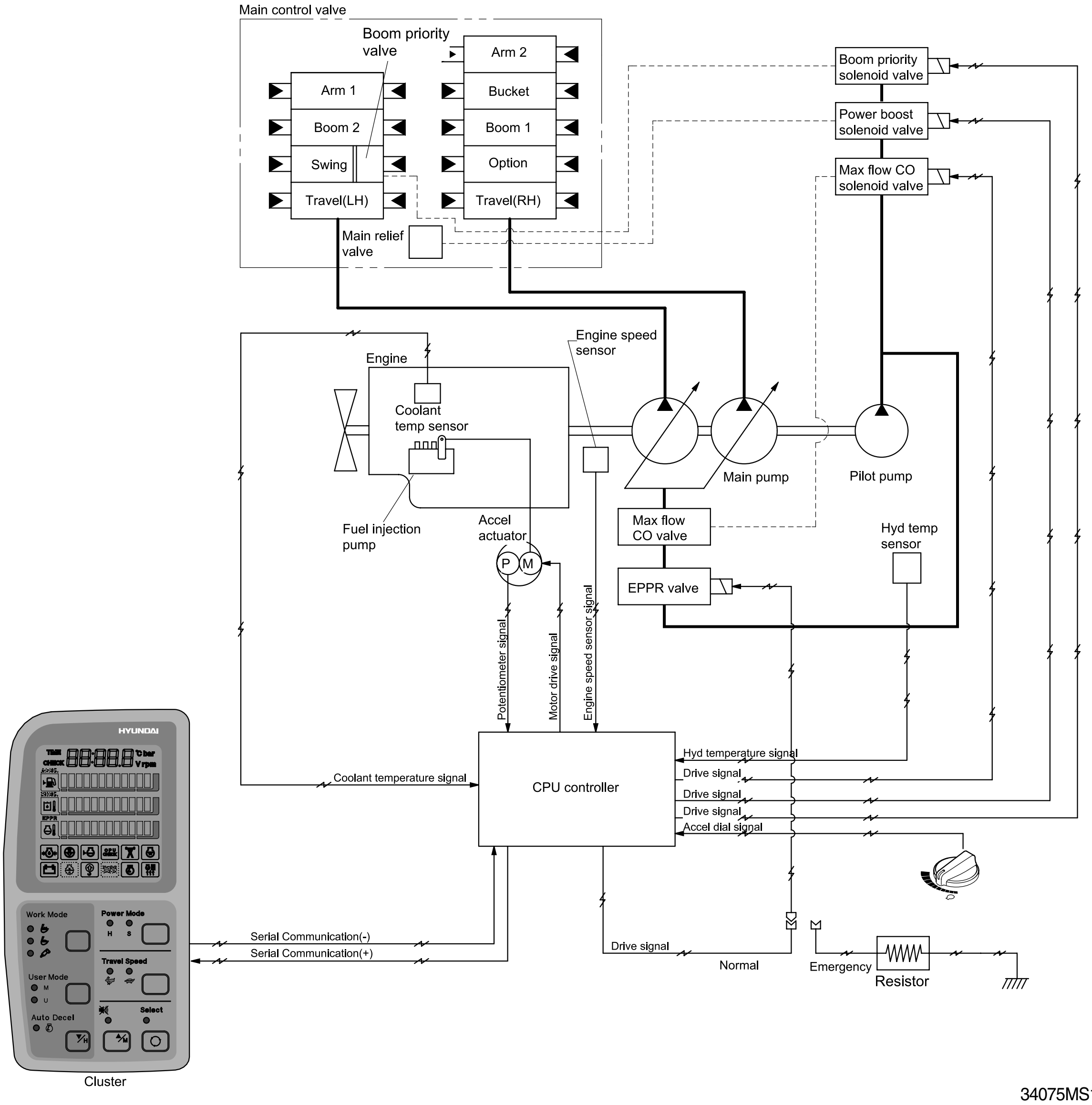
Mode selection system(Micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

The combination of 2 power modes(H, S) 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.

Mode	Application	Power set (%)	Engine rpm		Power shift by EPPR valve			
					Default		Other case	
			Unload	Load	Current (mA)	Pressure (kgf/cm^2)	Current (mA)	Pressure (kgf/cm^2)
M	Maximum Power	95	1900±50	1750	305±30	9	250	5
H	High power	85	1800±50	1650	360±30	12	280	7
S	Standard power	70	1700±50	1550	360±30	12	280	7
AUTO DECEL	Engine deceleration	-	1000±100	-	700±30	35	700±30	35
One touch decel	Engine quick deceleration	-	900±100	-	700±30	35	700±30	35
KEY START	Key switch start position	-	900±100	-	700±30	35	700±30	35

2. WORK MODE SELECTION SYSTEM

3 work modes can be selected for the optional work speed of the machine operation.



34075MS10

1) HEAVY DUTY WORK MODE

The boom priority solenoid is activated to make the boom operation speed faster.

2) GENERAL WORK MODE

When key switch is turned ON, this mode is selected and swing operation speed is faster than heavy duty work mode.

3) BREAKER OPERATION MODE

It sets the pump flow to the optimal operation of breaker by activating the max flow cut-off solenoid.

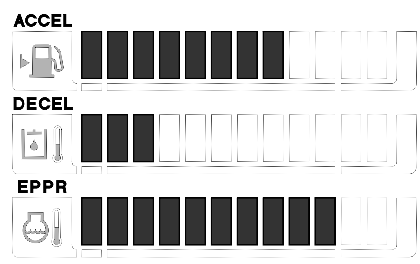
Work mode	Boom priority solenoid	Max flow cut-off solenoid
Heavy duty	ON	OFF
General	OFF	OFF
Breaker	OFF	ON

3. USER MODE SELECTION SYSTEM

An operator can change the engine and pump power and memorize it for his preference.

Mode	Operation
U	High idle rpm, auto decel rpm EPPR pressure can be modulated and memorized separately

HOW TO MODULATE THE MEMORY SET



21074OP03G

1) Each memory mode has a initial set which are mid-range of max engine speed, auto decel rpm, and EPPR valve input current. When you select M or U, cluster LCD displays.

2) To change the engine high idle speed, press the USER mode switch and SELECT switch at the same time and then ACCEL blinks at 0.5 seconds interval.
   - By pressing ▲ or ▼ switch, ▮ will increase or decrease.

3) To change DECEL rpm, press the USER mode switch and SELECT switch once more and then DECEL blinks at 0.5 seconds interval.
   - By pressing ▲ or ▼ switch, ▮ will increase or decrease.

4) To change EPPR current, press the USER mode switch and SELECT switch one more and then EPPR blinks at 0.5 seconds interval.
   - By pressing ▲ or ▼ switch, ▮ will increase or decrease.

   · **LCD segment vs parameter setting**

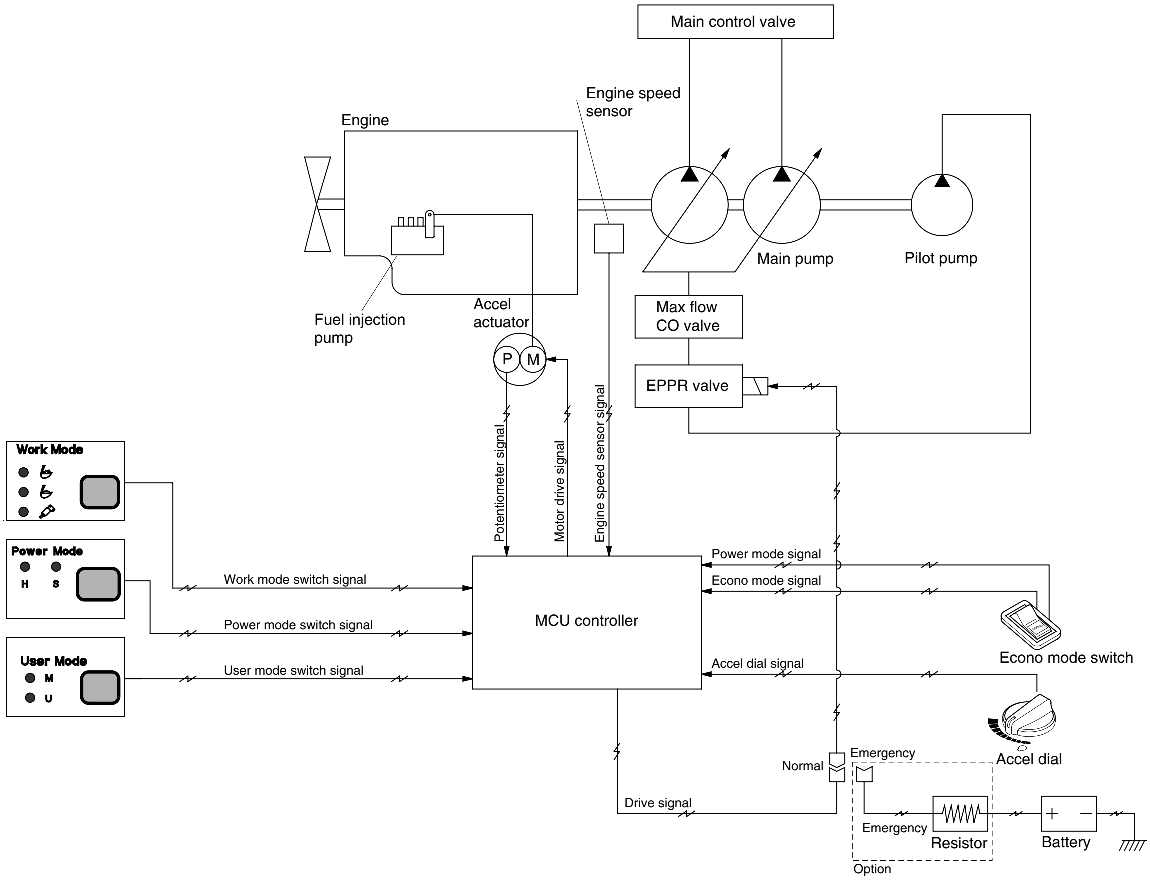
Segment (▮)	ACCEL (rpm)	DECEL (rpm)	EPPR (mA)
1	1500	800	150
2	1550	850	200
3	1600	One touch decel low idle(900)	250
4	1650	950	300
5	1700	Decel rpm(1000)	350
6	1750	1050	400
7	1800	1100	450
8	1850	1150	500
9	1900	1200	550
10	1950	1250	600

5) To memorize the final setting, press the USER mode switch and SELECT switch one more time.

34075MS11

GROUP 2 MODE SELECTION SYSTEM(#0008-)

1. POWER MODE SELECTION SYSTEM



37075MS03

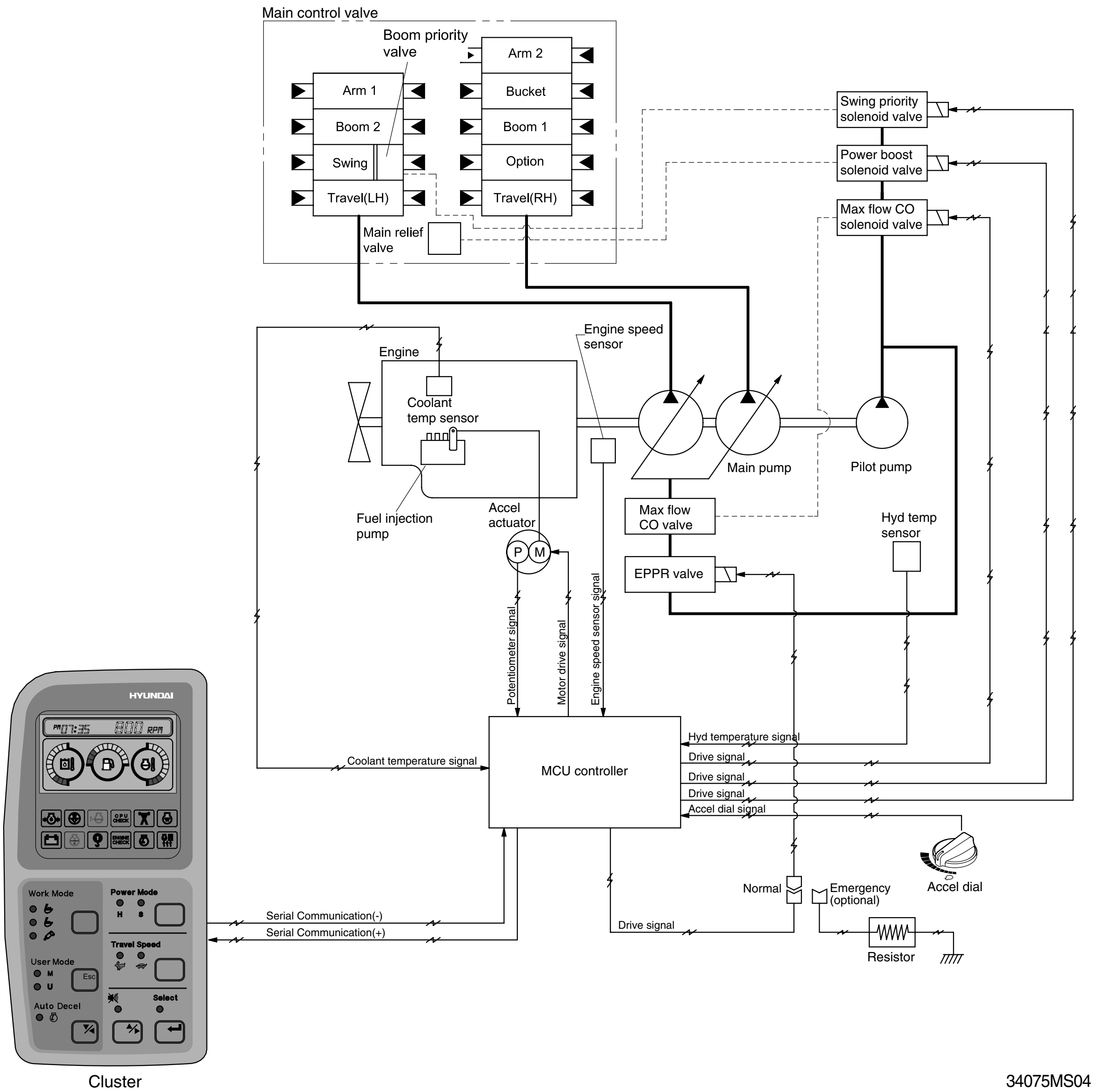
Mode selection system(Micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

The combination of 2 power modes(H, S) 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.

Mode	Application	Power set (%)	Engine rpm		Power shift by EPPR valve			
					Default		Other case	
			Unload	Load	Current (mA)	Pressure (kgf/cm^2)	Current (mA)	Pressure (kgf/cm^2)
M	Maximum Power	95	1900±50	1750	305±30	9	250	5
H	High power	85	1800±50	1650	360±30	12	280	7
S	Standard power	70	1700±50	1550	360±30	12	280	7
AUTO DECEL	Engine deceleration	-	1000±100	-	700±30	35	700±30	35
One touch decel	Engine quick deceleration	-	900±100	-	700±30	35	700±30	35
KEY START	Key switch start position	-	900±100	-	700±30	35	700±30	35

2. WORK MODE SELECTION SYSTEM

3 work modes can be selected for the optional work speed of the machine operation.



1) HEAVY DUTY WORK MODE

The boom priority solenoid is activated to make the boom operation speed faster.

2) GENERAL WORK MODE

When key switch is turned ON, this mode is selected and swing operation speed is faster than heavy duty work mode.

3) BREAKER OPERATION MODE

It sets the pump flow to the optimal operation of breaker by activating the max flow cut-off solenoid.

Work mode	Boom priority solenoid	Max flow cut-off solenoid
Heavy duty	ON	OFF
General	OFF	OFF
Breaker	OFF	ON

3. USER MODE SELECTION SYSTEM

An operator can change the engine and pump power and memorize it for his preference.

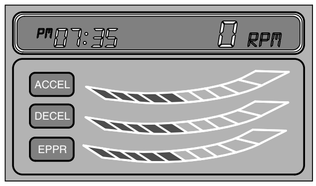
Mode	Operation
U	High idle rpm, auto decel rpm EPPR pressure can be modulated and memorized separately

HOW TO MODULATE THE MEMORY SET

1) Each memory mode has a initial set which are mid-range of max engine speed, auto decel rpm, and EPPR valve input current.

2) High idle rpm, auto decel rpm, EPPR pressure can be modulated and memorized separately in the U-mode.

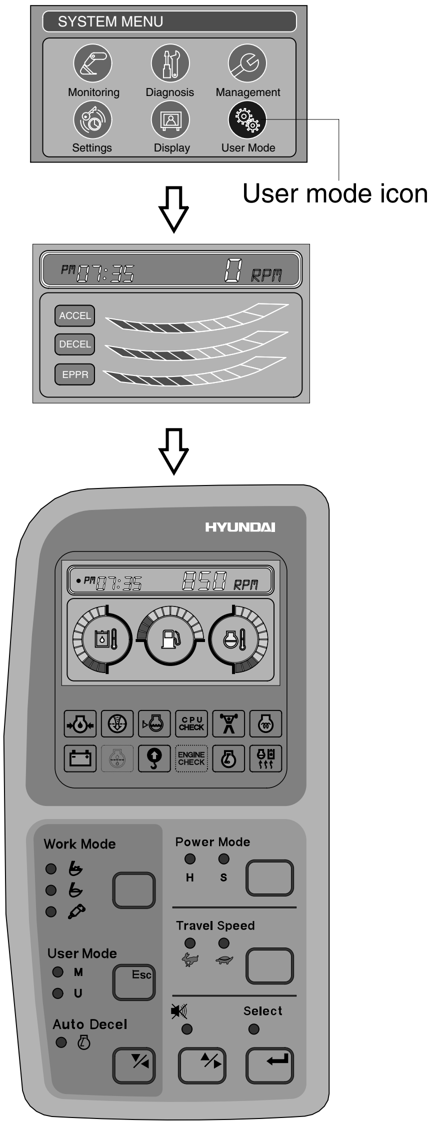
※ **Refer to the page 5-32 for set of user mode.**



2507A4OP08

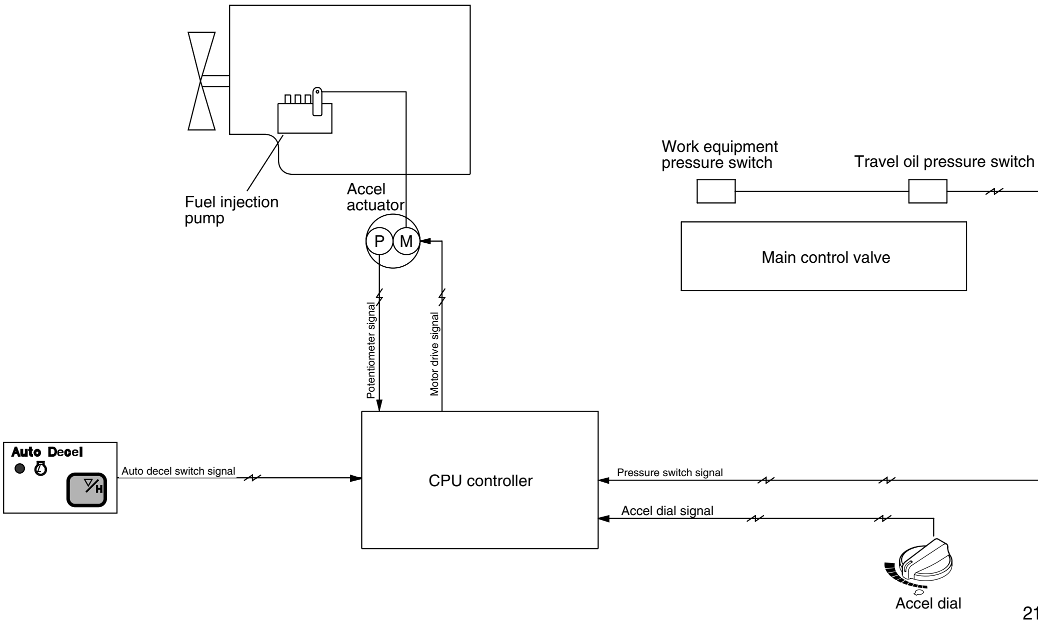
· **LCD segment vs parameter setting**

Segment (▮)	ACCEL (rpm)	DECEL (rpm)	EPPR (mA)
1	1500	800	150
2	1550	850	200
3	1600	One touch decel low idle(900)	250
4	1650	950	300
5	1700	Decel rpm(1000)	350
6	1750	1050	400
7	1800	1100	450
8	1850	1150	500
9	1900	1200	550
10	1950	1250	600



30007A4OP05

GROUP 3 AUTOMATIC DECELERATION SYSTEM

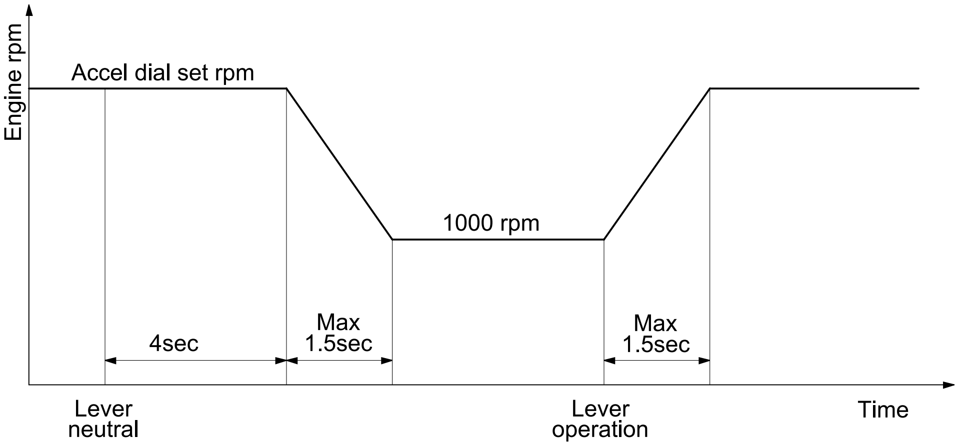


21075MS04

1. WHEN AUTO DECEL LAMP ON

If all the work equipment control levers including swing and travel levers are at neutral for at least 4 seconds, CPU controller drives the governor motor to reduce the engine speed to 1000rpm. 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 decel lamp is turned off by pressing the switch or any control lever is operated, the reduced engine speed rises upto the speed set before deceleration in a second.



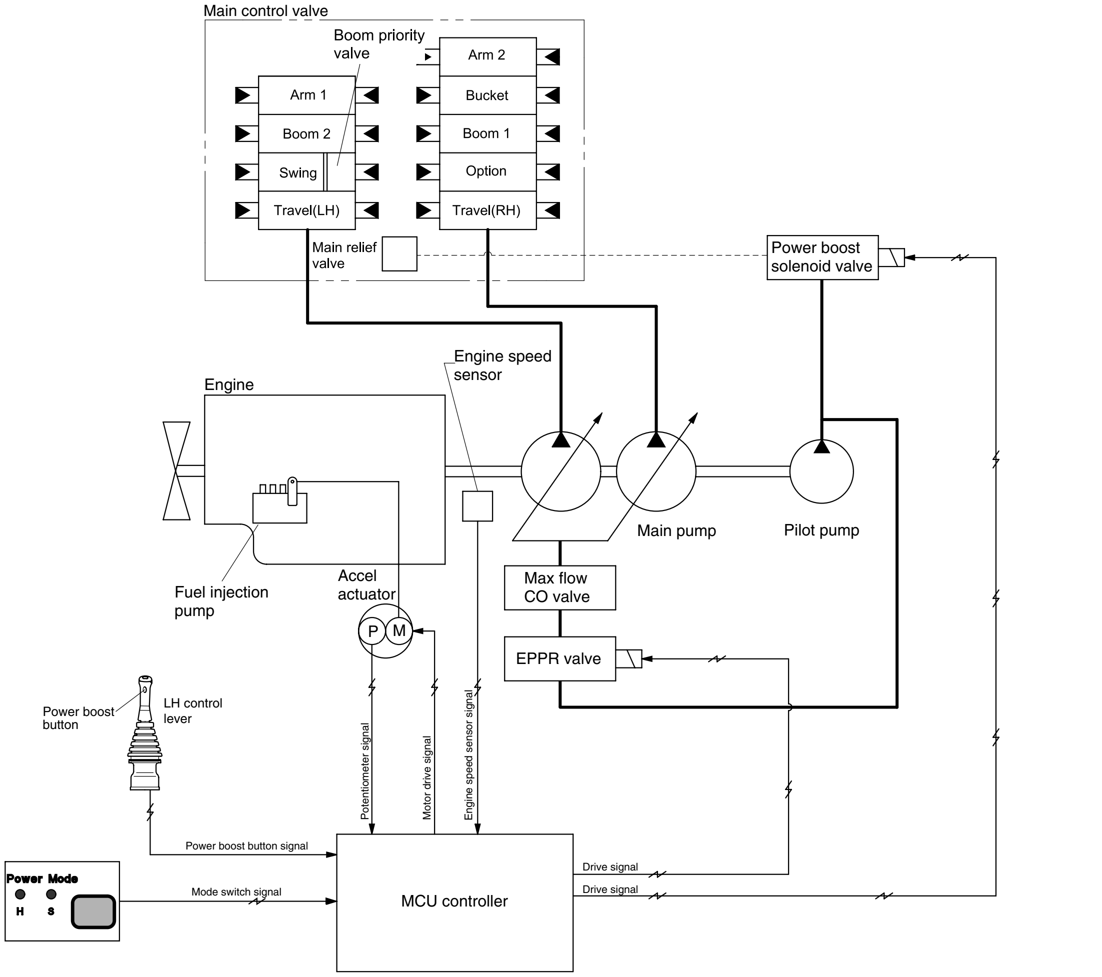
34075MS05

2. WHEN AUTO DECEL LAMP OFF

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

Note : Auto decel function can be activated when accel dial position is over 4.

GROUP 4 POWER BOOST SYSTEM



34075MS02

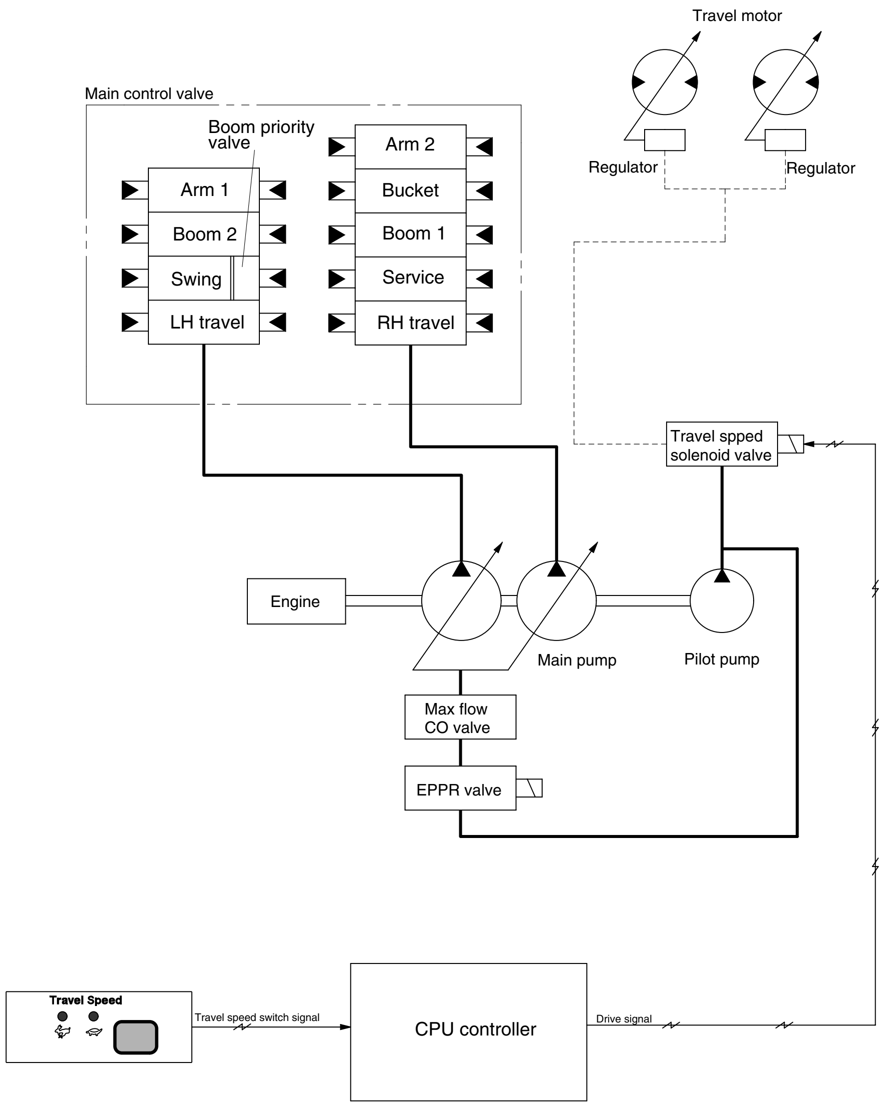
· When the power boost switch on the left control lever knob is pushed ON, the maximum digging power is increased by 10%.

· When the power set is at M, H or S and 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	Power boost switch	
	OFF	ON
Power set	M, H or S	M or H
Main relief valve set pressure	330kgf/cm^2	360kgf/cm^2
Time of operation	-	Even when pressed continuously, it is canceled after 8 sec.

※ Default - Power boost solenoid valve : OFF

GROUP 5 TRAVEL SPEED CONTROL SYSTEM



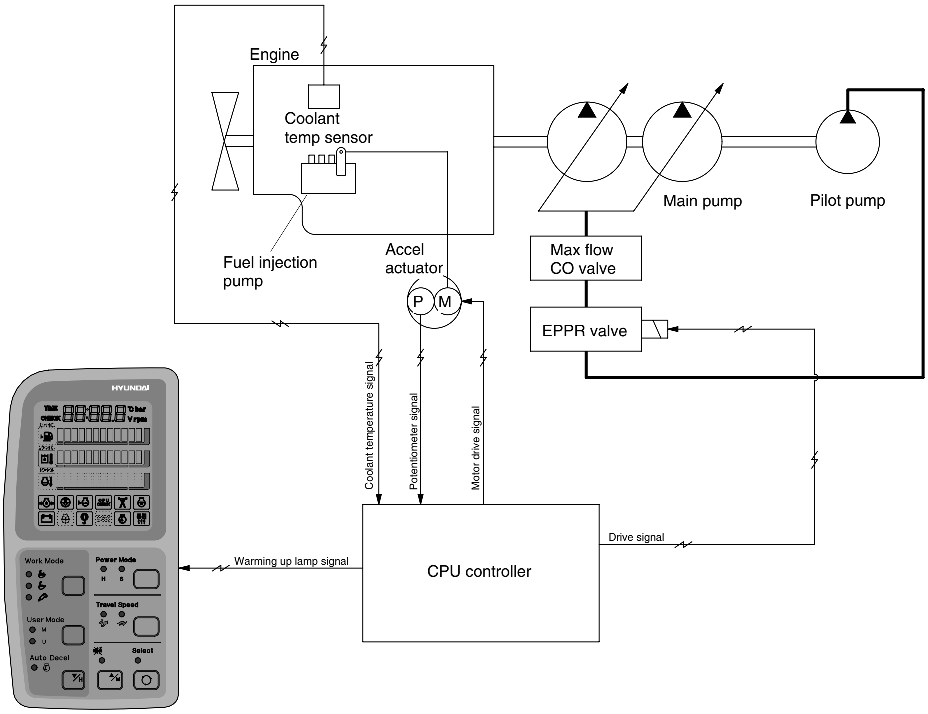
21075MS07

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

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

※ Default : Turtle(Lo)

GROUP 6 AUTOMATIC WARMING UP FUNCTION(-#0007)



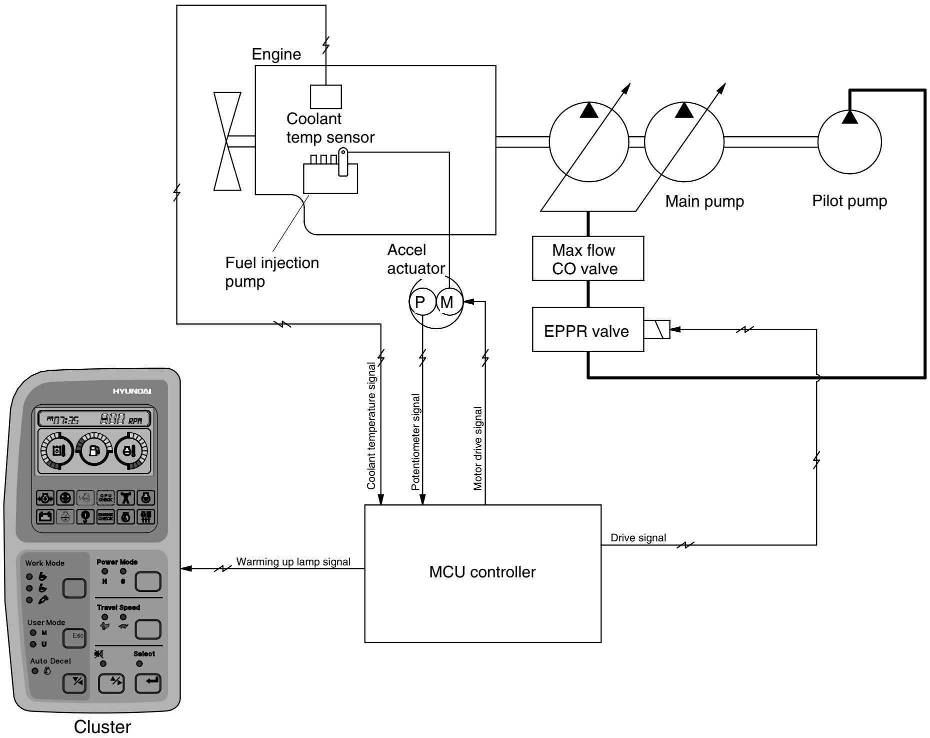
21075MS08

1. CPU controller reads engine coolant temperature through the temperature sensor, and if the coolant temperature is less than 30˚C, it increases the engine speed from key start rpm to 1100rpm. At this time the mode does not change.
2. In case of the coolant temperature increases up to 30˚C, the engine speed is decreased to key start speed. And if an operator changes mode set during the warming up function, the CPU controller cancels the automatic warming up function.

3. LOGIC TABLE

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

GROUP 6 AUTOMATIC WARMING UP FUNCTION(#0008-)



37075MS08

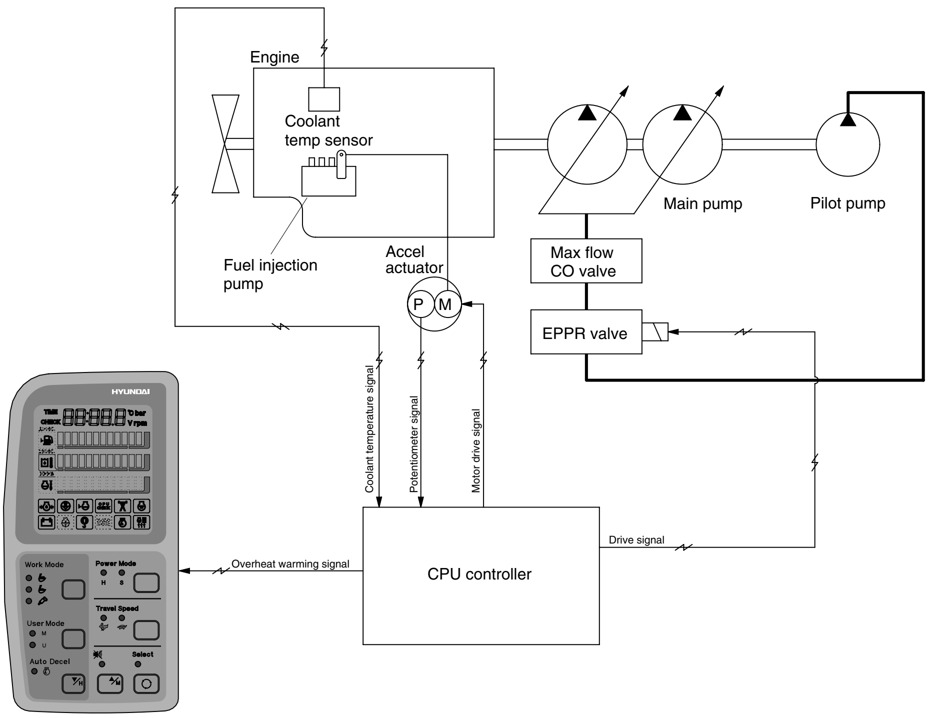
1. MCU controller receives engine coolant temperature through the temperature sensor, and if the coolant temperature is less than 30℃, it increases the engine speed from key start rpm to 1000rpm. At this time the mode does not change.

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

3. LOGIC TABLE

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

GROUP 7 ENGINE OVERHEAT PREVENTION FUNCTION(-#0007)



21075MS09

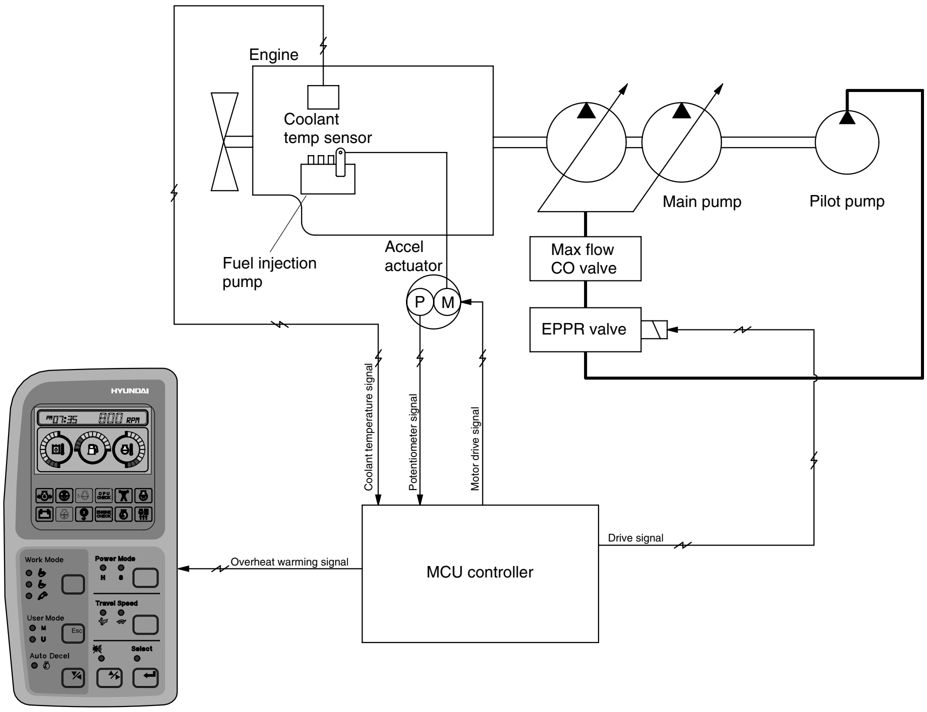
1. CPU controller reads engine coolant temperature through the temperature sensor and when the engine coolant boils up to 110℃, it sends overheat warning signal to the cluster and decrease the engine speed same as accel dial **7** position.

2. If the coolant temperature drops less than 100℃, the CPU controller returns the mode to the mode set before. And if mode set is changed during the function, the CPU controller cancels the function. Even if the overheat prevention function is canceled by mode change, the overheat warning lamp turns OFF only when the coolant temperature is less than 100℃.

3. LOGIC TABLE

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

GROUP 7 ENGINE OVERHEAT PREVENTION FUNCTION(#0008-)



37075MS09

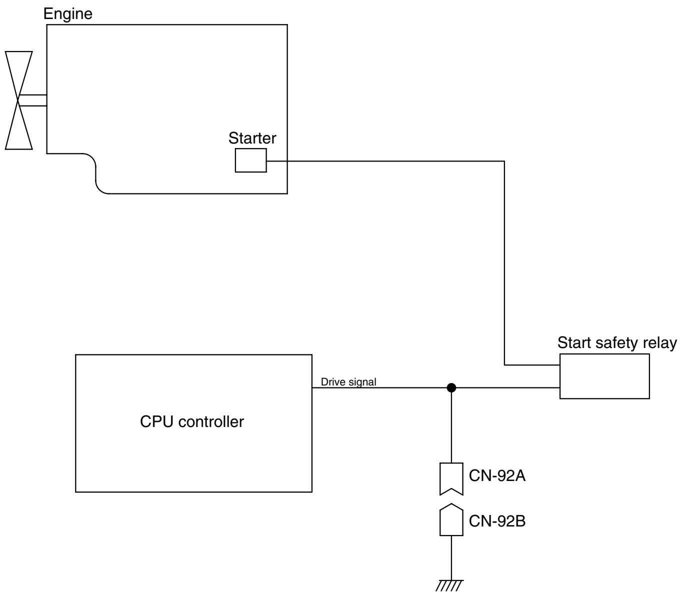
1. MCU controller receives engine coolant temperature through the temperature sensor and when the engine coolant boils up to 110˚C, it sends overheat warning signal to the cluster and decrease the engine speed same as accel dial **7** position.

2. If the coolant temperature drops less than 100˚C, the MCU controller returns the mode to the mode set before. And if mode set is changed during the function, the MCU controller cancels the function. Even if the overheat prevention function is canceled by mode change, the overheat warning lamp turns OFF only when the coolant temperature is less than 100˚C.

3. LOGIC TABLE

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

GROUP 8 ANTI-RESTART SYSTEM



21075MS10

1. ANTI-RESTART FUNCTION

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

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

GROUP 9 SELF-DIAGNOSTIC SYSTEM(-#0007)

1. OUTLINE

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

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

2. CURRENT ERROR DISPLAY

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

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

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

Examples :

1) Communication Error

Co : Er & Buzzer sound

2) No problem

CHECK Er : $\boxed{0}\boxed{0}$

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

CHECK Er : $\boxed{0}\boxed{3}$

$\boxed{0}\boxed{3} \underset{\text{Press ▲}}{\overset{\text{Press ▼}}{\rightleftarrows}} \boxed{0}\boxed{6} \underset{\text{Press ▲}}{\overset{\text{Press ▼}}{\rightleftarrows}} \boxed{1}\boxed{0} \underset{\text{Press ▲}}{\overset{\text{Press ▼}}{\rightleftarrows}} \boxed{4}\boxed{3} \xrightarrow[\text{Press ▲}]{} \text{No change}$

Start

3. RECORDED ERROR DISPLAY

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

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

TIME Er : $\boxed{0}\boxed{3}$

$\boxed{0}\boxed{3} \underset{\text{Press ▲}}{\overset{\text{Press ▼}}{\rightleftarrows}} \boxed{0}\boxed{6} \underset{\text{Press ▲}}{\overset{\text{Press ▼}}{\rightleftarrows}} \boxed{1}\boxed{0} \underset{\text{Press ▲}}{\overset{\text{Press ▼}}{\rightleftarrows}} \boxed{2}\boxed{0} \underset{\text{Press ▲}}{\overset{\text{Press ▼}}{\rightleftarrows}} \boxed{3}\boxed{2} \xrightarrow[\text{Press ▲}]{} \text{No change}$

Start

4. DELETE ALL RECORDED ERROR CODES

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

5. ERROR CODES TABLE

Fault code No.	Description
1	Short circuit in governor motor system
2	Potentiometer circuit is shorted to Vcc(5V) or battery +
3	Short circuit in pump EPPR valve system
4	Short circuit in boom down EPPR valve system
5	Short circuit in travel speed solenoid system
6	Short circuit in power boost solenoid system
7	Short circuit in max flow solenoid system
10	Short circuit in hour-meter system
11	Accel dial circuit is shorted to Vcc(5V) or battery +
12	P1 pressure sensor circuit is shorted to power supply(24V) line
13	P2 pressure sensor circuit is shorted to power supply(24V) line
14	P3 pressure sensor circuit is shorted to power supply(24) line
15	Boom down pressure circuit is shorted to power supply(24V) line
16	Governor motor circuit is open or shorted to ground
17	Potentiometer circuit is open or shorted to ground
18	Pump EPPR valve circuit is open or shorted to ground
19	Boom down EPPR valve circuit is open or shorted to ground
20	Travel speed solenoid circuit is open or shorted to ground
21	Power boost solenoid circuit is open or shorted to ground
22	Max flow solenoid circuit is open or shorted to ground
25	Hour-meter circuit is open or shorted to ground
26	Accel dial circuit is open or shorted to ground
27	P1 pressure sensor circuit is open or shorted to ground
28	P2 pressure sensor circuit is open or shorted to ground
29	P3 pressure sensor circuit is open or shorted to ground
30	Boom down pressure sensor circuit is open or shorted to ground
31	Engine preheater circuit is open or shorted to ground
32	Travel alarm buzzer circuit is open or shorted to ground
33	Alternator circuit is open or shorted to ground
34	Controller input voltage is below 18V
35	Controller input voltage is over 38V
36	Communication error with cluster
37	Engine speed sensor circuit is open or shorted to ground
38	Anti-restart relay circuit is open or shorted to ground
39	Accel actuator does not stop at a target position
40	There is more than 500rpm difference between target speed and actual speed

Fault code No.	Description
41	Hydraulic oil temperature sensor circuit is shorted to ground
42	Fuel level sensor circuit is shorted to ground
43	Coolant temperature sensor circuit is shorted to ground
44	Boom up pressure sensor circuit is shorted to power supply(24V) line
45	Hydraulic oil temperature sensor circuit is open or shorted to battery +
46	Fuel level sensor circuit is open or shorted to battery +
47	Coolant temperature sensor circuit is open or shorted to battery +
48	Boom up pressure sensor circuit is open or shorted to ground
49	Engine preheater circuit is shorted to battery +
51	Boom priority solenoid circuit is open or shorted to ground
56	Travel alarm buzzer circuit is shorted to battery +
58	Boom priority solenoid circuit is shorted to battery +

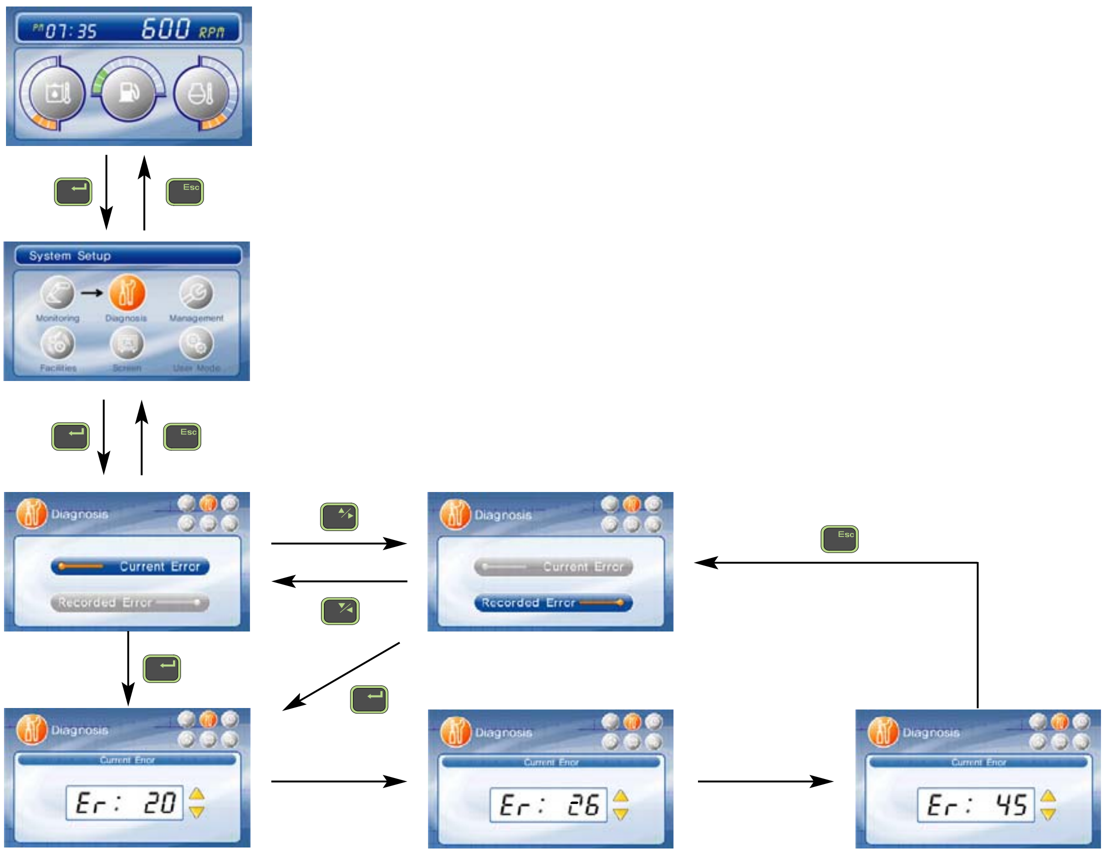
GROUP 9 SELF-DIAGNOSTIC SYSTEM(#0008-)

1. OUTLINE

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

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

2. CURRENT ERROR DISPLAY



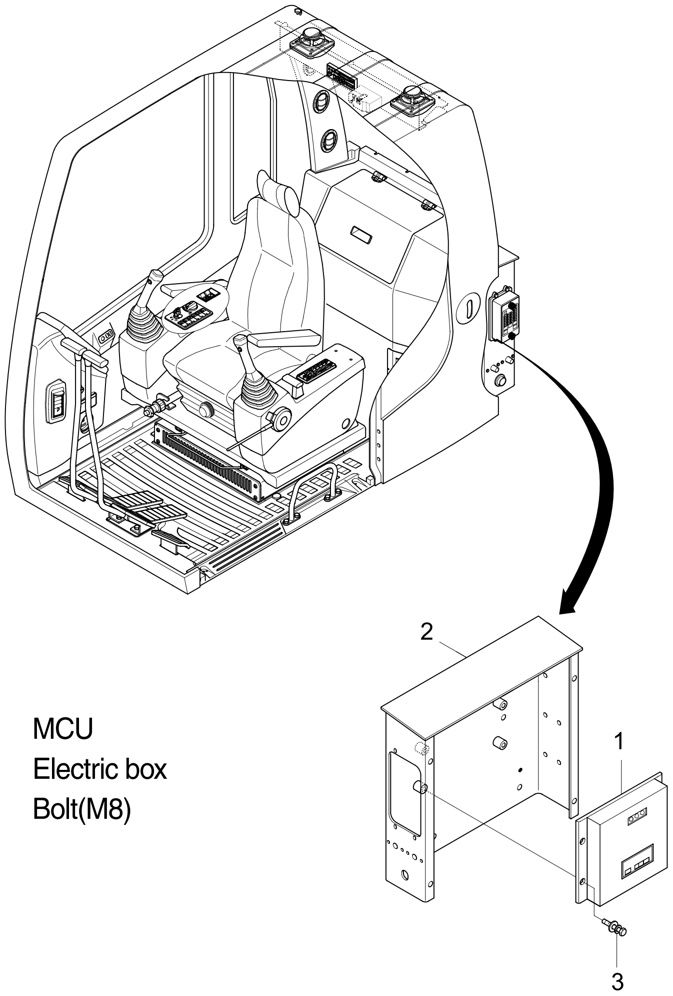
3. ERROR CODES TABLE

Error code No.	Description
1	Short circuit in accel actuator system
2	Potentiometer circuit is shorted to Vcc(5V) or battery +
3	Short circuit in pump EPPR valve system
4	Short circuit in boom down EPPR valve system
5	Short circuit in travel speed solenoid system
6	Short circuit in power boost solenoid system
7	Short circuit in max flow solenoid system
10	Short circuit in hour-meter system
11	Accel dial circuit is shorted to Vcc(5V) or battery +
12	P1 pressure sensor circuit is shorted to power supply(24V) line
13	P2 pressure sensor circuit is shorted to power supply(24V) line
14	P3 pressure sensor circuit is shorted to power supply(24) line
15	Boom down pressure circuit is shorted to power supply(24V) line
16	Accel actuator circuit is open or shorted to ground
17	Potentiometer circuit is open or shorted to ground
18	Pump EPPR valve circuit is open or shorted to ground
19	Boom down EPPR valve circuit is open or shorted to ground
20	Travel speed solenoid circuit is open or shorted to ground
21	Power boost solenoid circuit is open or shorted to ground
22	Max flow solenoid circuit is open or shorted to ground
25	Hour-meter circuit is open or shorted to ground
26	Accel dial circuit is open or shorted to ground
27	P1 pressure sensor circuit is open or shorted to ground
28	P2 pressure sensor circuit is open or shorted to ground
29	P3 pressure sensor circuit is open or shorted to ground
30	Boom down pressure sensor circuit is open or shorted to ground
31	Engine preheater circuit is open or shorted to ground
32	Travel alarm buzzer circuit is open or shorted to ground
33	Alternator circuit is open or shorted to ground
34	Controller input voltage is below 18V

Error code No.	Description
35	Controller input voltage is over 38V
36	Communication error with cluster
37	Engine speed sensor circuit is open or shorted to ground
38	Anti-restart relay circuit is open or shorted to ground
39	Accel actuator does not stop at a target position
40	There is more than 500rpm difference between target speed and actual speed
41	Hydraulic oil temperature sensor circuit is shorted to ground
42	Fuel level sensor circuit is shorted to ground
43	Coolant temperature sensor circuit is shorted to ground
44	Boom up pressure sensor circuit is shorted to power supply(24V) line
45	Hydraulic oil temperature sensor circuit is open or shorted to battery +
46	Fuel level sensor circuit is open or shorted to battery +
47	Coolant temperature sensor circuit is open or shorted to battery +
48	Boom up pressure sensor circuit is open or shorted to ground
49	Engine preheater circuit is shorted to battery +
51	Boom priority solenoid circuit is open or shorted to ground
56	Travel alarm buzzer circuit is shorted to battery +
58	Boom priority solenoid circuit is shorted to battery +

GROUP 10 ENGINE CONTROL SYSTEM

1. MCU MOUNTING



1 MCU
2 Electric box
3 Bolt(M8)

21075MS11

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 controller and cluster are disconnected
Three LED are turned OFF	Trouble on MCU power	· Check if the input power wire (24 V, GND) of controller is disconnected · Check the fuse

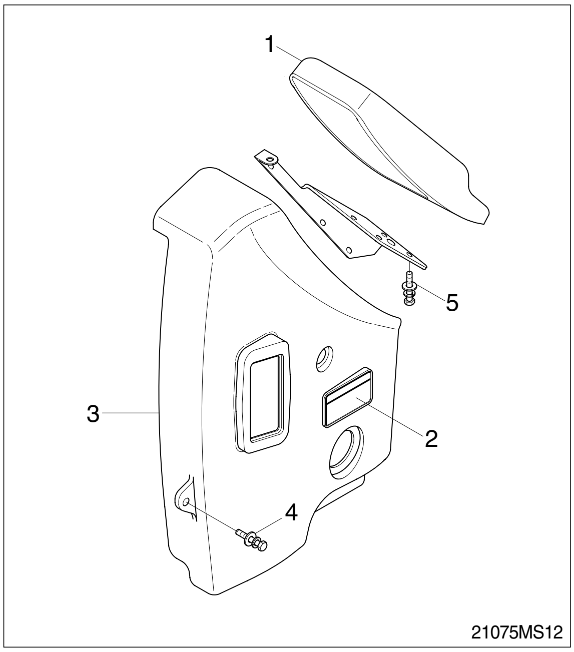
G : green, R : red, Y : yellow

3. EXCHANGE METHOD OF THE ROM

1) Disassemble the ash tray(2).

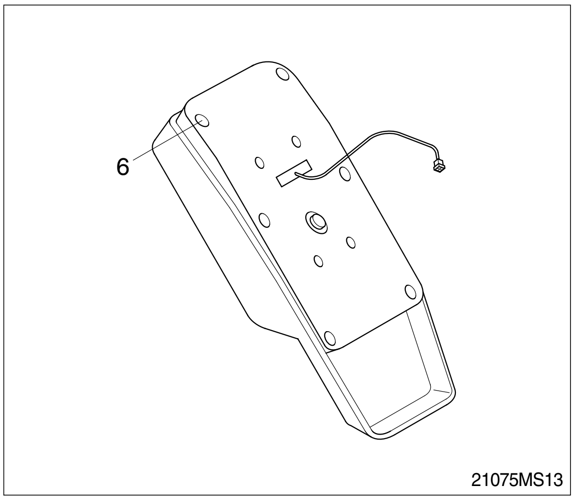
2) Disassemble the wiper motor cover(3).

3) Disassemble the cluster(1).

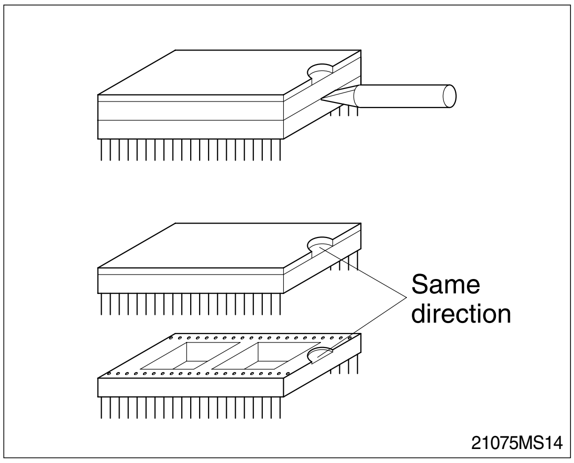


4) Loosen the screws(6EA) located back of the cluster.

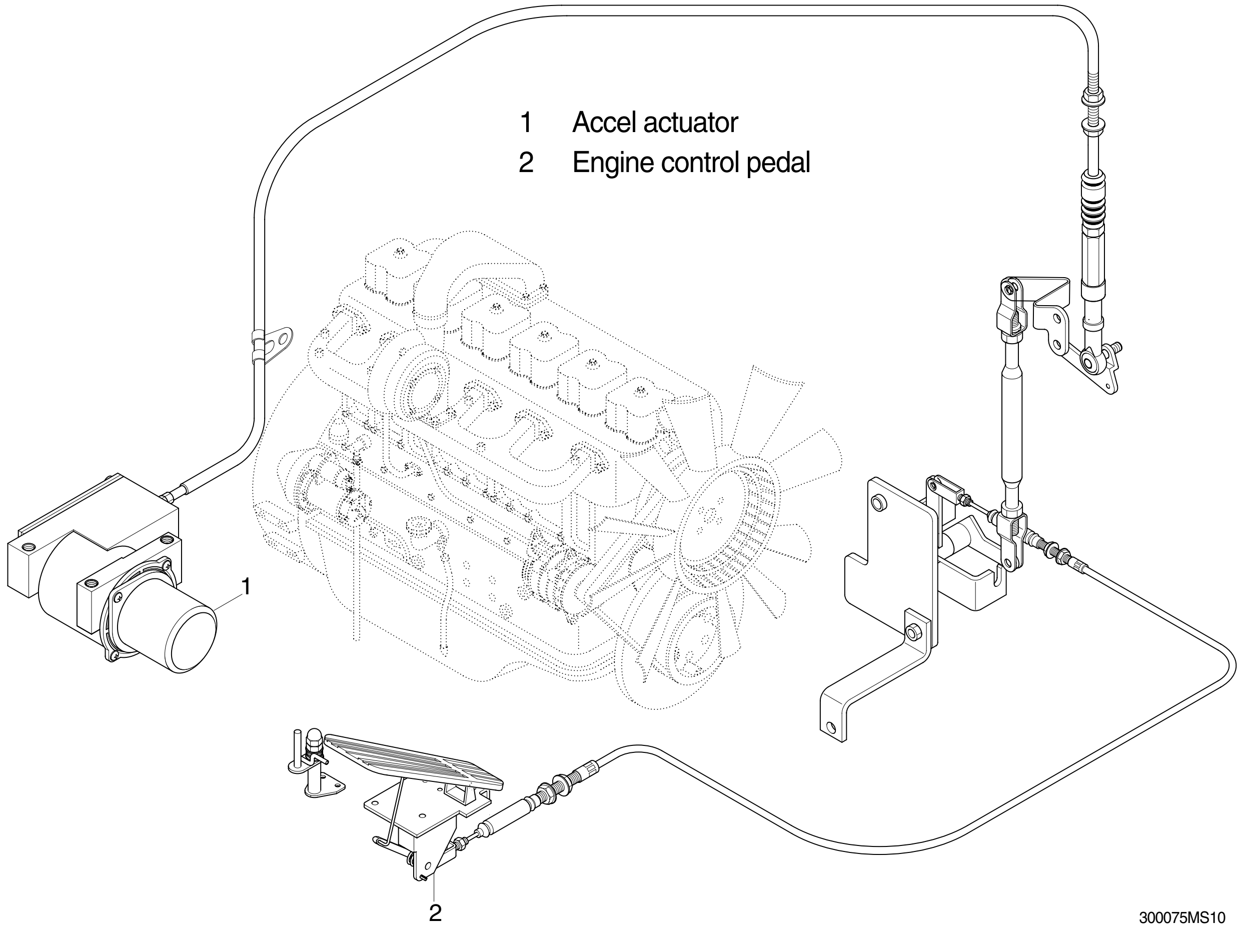
5) Then you can open the upper case of the cluster easily.



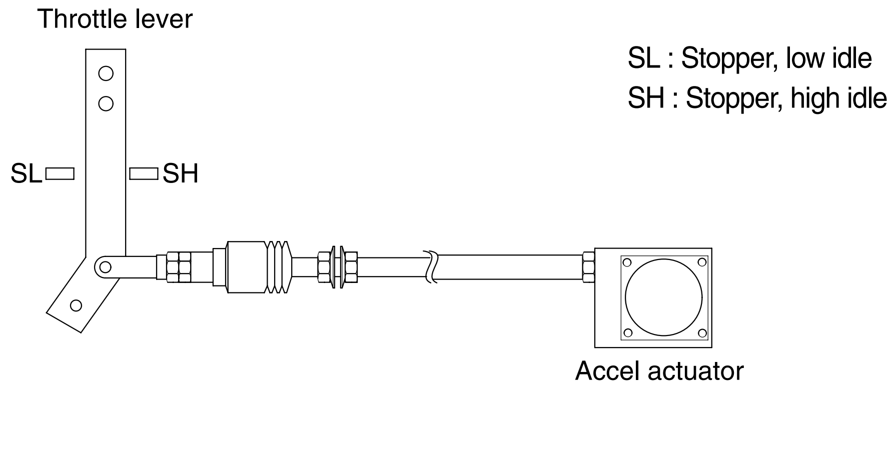
6) Install the new ROM.(Be careful of direction and assmelbe the cluster in the reverse order to removal).



4. ENGINE ACCEL ACTUATOR



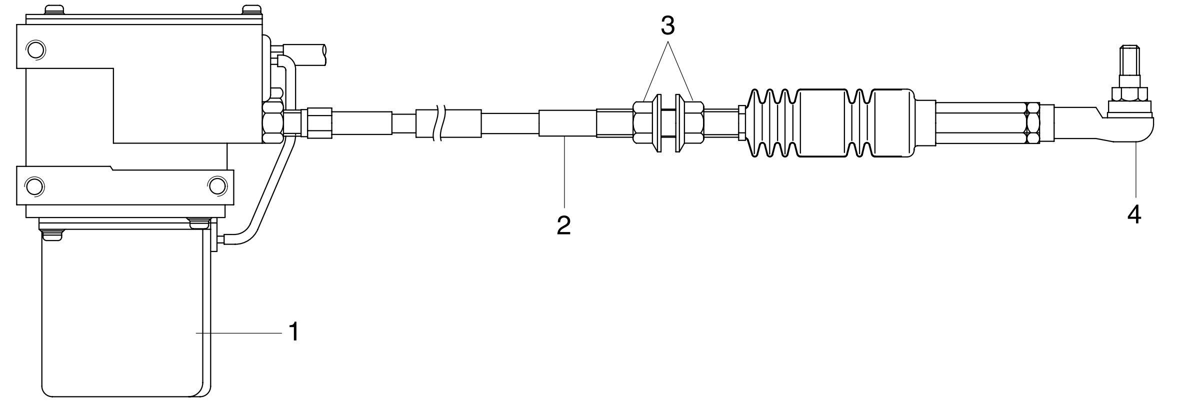
1) ENGINE THROTTLE LEVER

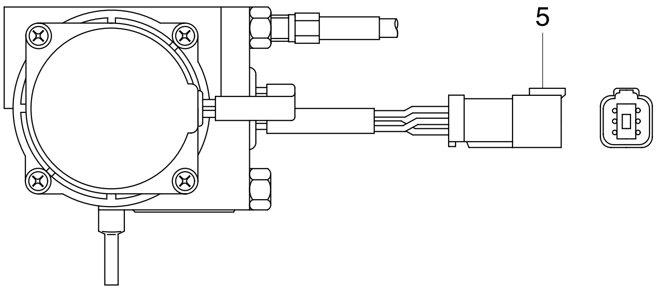


2) EMERGENCY CABLE (Push-pull cable)

It controls engine speed by connecting onto the lever of the injection pump when the malfunction of the MCU controller or the accel actuator happen.

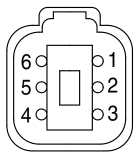
3) ACCEL ACTUATOR





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

5-19(1) 210-7

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

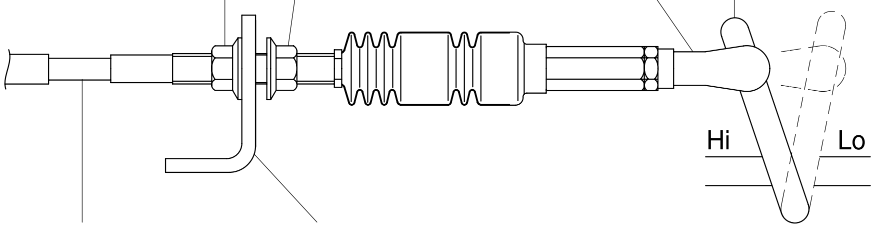
4) ACCEL ACTUATOR CABLE SETTING PROCEDURE

(1) Key OFF

① Connect the ball joint of cable to engine throttle lever.
② Pull the cable to high stopper and put nut **A** edge to yoke of the bracket.
※ Make throttle lever not contact to the edge of high stopper.
③ Turn nut **A** to clockwise until touching to the edge of high stopper.
④ Make 1 turn more to clockwise in condition of the nut **A** contact to the edge of high stopper.

(2) Key START

⑤ Confirm if the engine speed on cluster is same as each mode specification.
⑥ If the engine speed displayed on cluster is highter than each mode specification, then turn the nut **A** to counter clockwise and make the engine speed same to each mode specification.
⑦ If the engine speed displayed on cluster is lower than each mode specification, then turn the nut **A** to clockwise and make the engine speed same to each mode specification.
⑧ Turn nut **B** to clockwise and fix the cable to bracket.

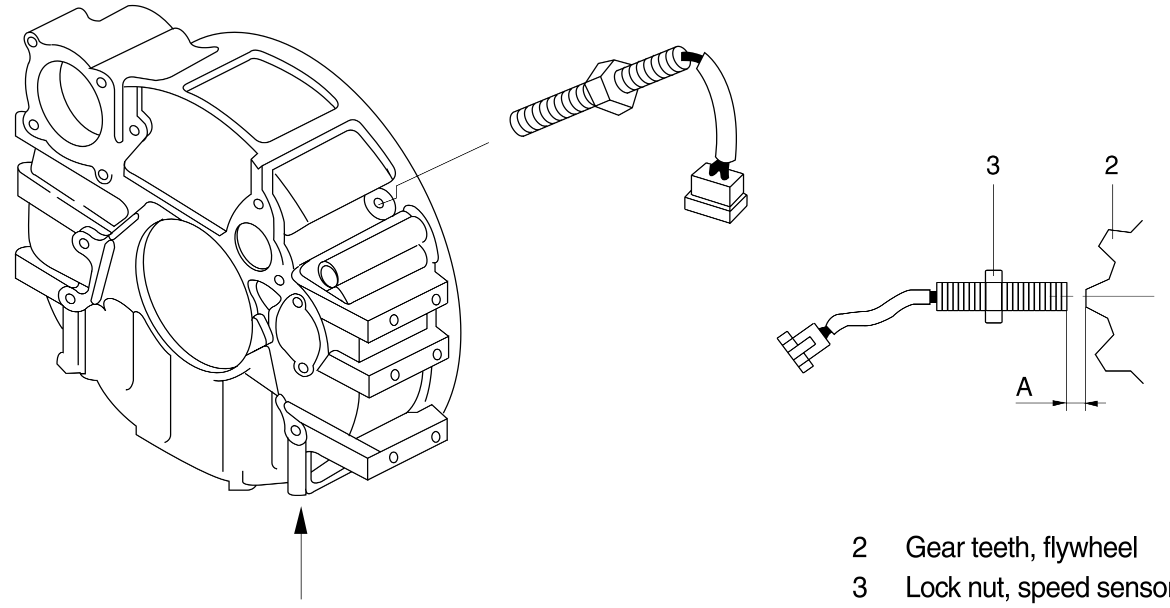


130W5MS05

Mode	RPM
H	1800±50
S	1700±50
Auto decel	1000±100
Key start	900±100

5. ENGINE SPEED SENSOR

1) DETECT ACTUAL ENGINE RPM AND SEND SIGNAL TO TACHOMETER



Flywheel housing

2 Gear teeth, flywheel
3 Lock nut, speed sensor
A Clearance

5-20 (210-7)

2) INSTALLATION

(1) Clean contacting point of sensor.

(2) Loosen lock nut.

(3) Screw speed sensor into flywheel housing.

(4) Turn it back 135° when it contacts with gear teeth.

(5) Tight lock nut and connect wiring.

3) INSPECTION

(1) Check resistance
  · SPEC : 300 Ω

(2) Check voltage while engine run.
  · SPEC : 2~28Vac, dependent on the engine speed(rpm)

GROUP 11 EPPR VALVE(-#0007)

1. COMPOSITION OF EPPR VALVE

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

1) ELECTRO MAGNET VALVE

Receive electric current from CPU controller 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 hydraulic pump flow.
When the electro magnet valve is activated, pilot pressure enters into flow regulator of hydraulic pump.
So, pump flow decreases to prevent engine stall.

3) PRESSURE AND ELECTRIC CURRENT VALUE FOR EACH MODE

Mode		Pressure		Electric current (mA)	Engine rpm (At accel dial 10)
		kgf/cm^2	psi		
Standard (Ver : 1.x)	M	9 ± 3	128 ± 40	305 ± 30	1900 ± 50
	H	12 ± 3	170 ± 40	360 ± 30	1800 ± 50
	S	12 ± 3	170 ± 40	360 ± 30	1700 ± 50
Option (Ver : 2.x)	M	5 ± 3	71 ± 40	250 ± 30	1900 ± 50
	H	7 ± 3	100 ± 40	280 ± 30	1800 ± 50
	S	7 ± 3	100 ± 40	280 ± 30	1700 ± 50
★		17 ± 3	245 ± 40	440 ± 30	-

★ Manually operated condition when prolix resistor is connected in emergency operation.

2. HOW TO SWITCH THE VERSION(1.x ↔ 2.x) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the version(1.x ↔ 2.x).

Step 1. Turn the key switch **ON**.

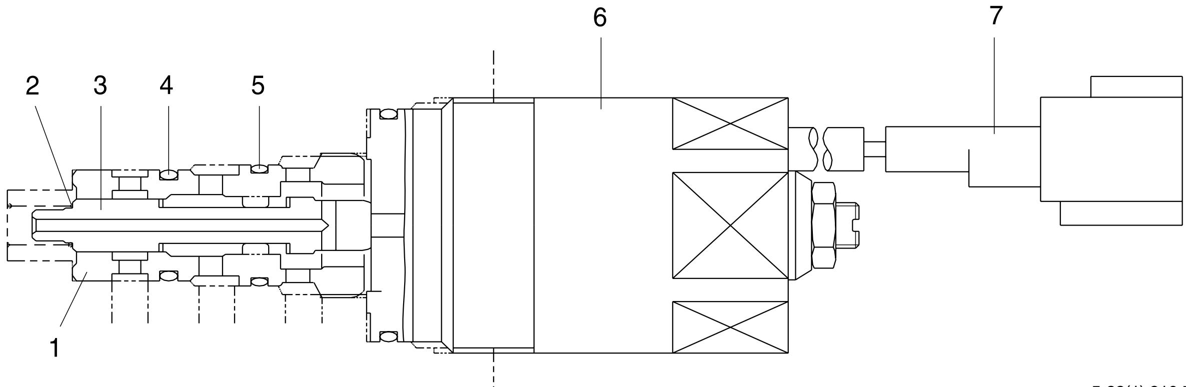
Step 2. Press the **SELECT** switch 3 times.

Step 3. While 7 segment on the cluster shows the version of the CPU controller program, for example **32C1.0** press the buzzer stop switch( ) + travel speed control switch( ) at the same time for 2 seconds.
The display changes to **32C2.0**, and it indicates that version 2.0(Option) is selected.

※ If you want to get back to ver:1.x, go to step 1~3.

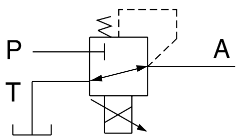
2. OPERATING PRINCIPLE

1) STRUCTURE



5-22(1) 210-7

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

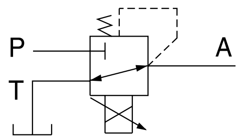


5-22A (210-7)

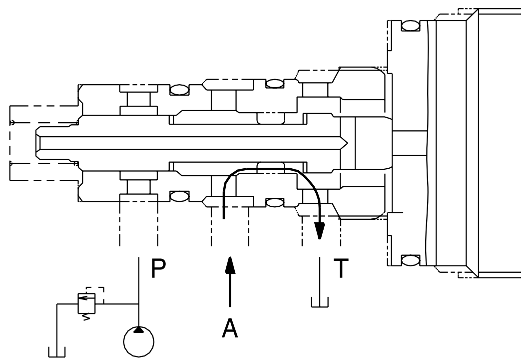
P Pilot oil supply line(Pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at hydraulic pump

2) AT H MODE

Pressure line is blocked and A oil returns to tank.

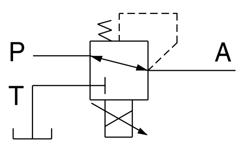


5-22B (210-7)

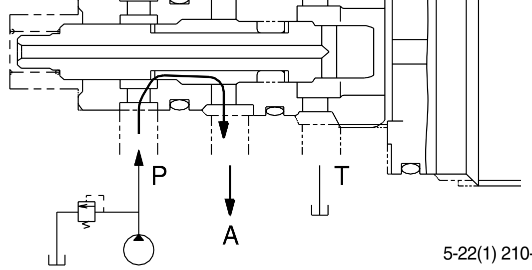


3) AT S MODE

Secondary pressure enters into A.



5-22C (210-7)



5-22(1) 210-7

3. EPPR VALVE CHECK PROCEDURE

1) CHECK ELECTRIC VALUE AT EPPR VALVE

(1) Start engine.

(2) Set S-mode and cancel auto decel mode.

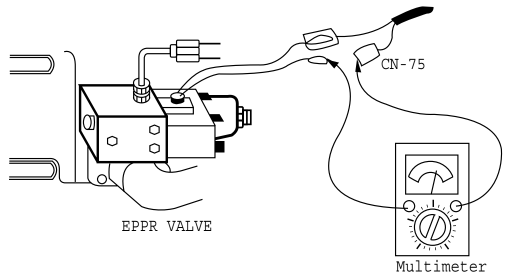
(3) Position the accel dial at 10.

(4) If tachometer show approx 1700±50rpm, disconnect one wire harness from EPPR valve.

(5) Install multimeter as figure.

(6) Check electric current at bucket circuit relief position.

Spec : 200~450mA



5-23(1) 210-7

2) CHECK PRESSURE AT EPPR VALVE

(1) Remove plug and connect pressure gauge as figure.
 · Gauge capacity : 0 to 40-50kgf/cm^2
 (0 to 580-725psi)

(2) Start engine.

(3) Set S-mode and cancel auto decel mode.

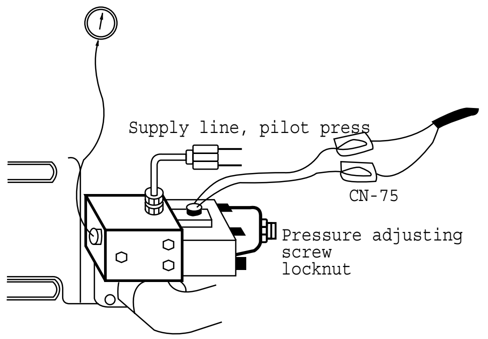
(4) Position the accel dial at 10.

(5) If tachometer show approx 1700±50rpm, 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 : 2~25kgf/cm^2(30~350psi)



5-23(2) 210-7

GROUP 11 EPPR VALVE(#0008-)

1. COMPOSITION OF EPPR VALVE

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

1) ELECTRO MAGNET VALVE

Receive electric current from MCU controller 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 hydraulic pump flow.
When the electro magnet valve is activated, pilot pressure enters into flow regulator of hydraulic pump.
So, pump flow decreases to prevent engine stall.

3) PRESSURE AND ELECTRIC CURRENT VALUE FOR EACH MODE

Mode		Pressure		Electric current (mA)	Engine rpm (At accel dial 10)
		kgf/cm^2	psi		
Standard (Ver : 1.x)	M	9 ± 3	128 ± 40	305 ± 30	1900 ± 50
	H	12 ± 3	170 ± 40	360 ± 30	1800 ± 50
	S	12 ± 3	170 ± 40	360 ± 30	1700 ± 50
Option (Ver : 2.x)	M	5 ± 3	71 ± 40	250 ± 30	1900 ± 50
	H	7 ± 3	100 ± 40	280 ± 30	1800 ± 50
	S	7 ± 3	100 ± 40	280 ± 30	1700 ± 50
★		17 ± 3	245 ± 40	440 ± 30	-

★ Manually operated condition when prolix switch resistor is selected emergency position.

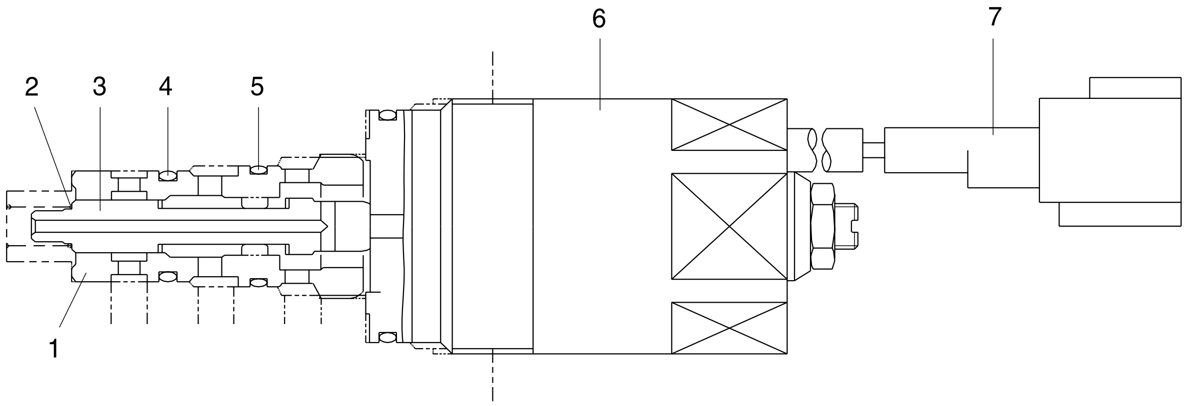
2. HOW TO SWITCH THE VERSION(3.1↔4.1) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the version(3.1 ↔4.1).

- Dual mode
  · Changing the MCU mode

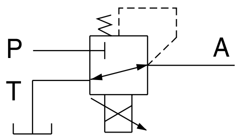
2. OPERATING PRINCIPLE

1) STRUCTURE



5-22(1) 360-7

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



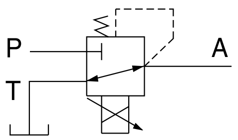
P Pilot oil supply line(Pilot pressure)

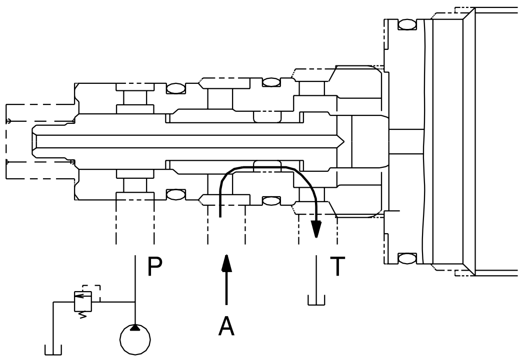
T Return to tank

A Secondary pressure to flow regulator at hydraulic pump

2) AT H MODE

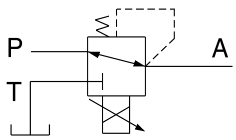
Pressure line is blocked and A oil returns to tank.

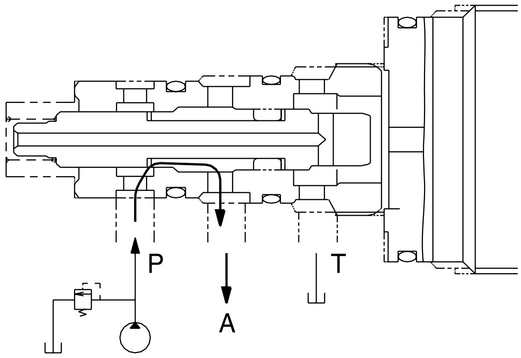




3) AT S MODE

Secondary pressure enters into A.





5-22(2) 360-7

3. EPPR VALVE CHECK PROCEDURE

1) CHECK ELECTRIC VALUE AT EPPR VALVE

(1) Start engine.

(2) Set S-mode and cancel auto decel mode.

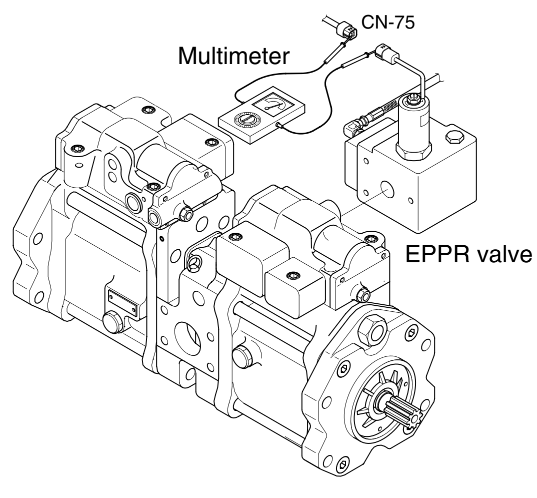
(3) Position the accel dial at 10.

(4) If tachometer show approx 1700±50rpm, disconnect one wire harness from EPPR valve.

(5) Install multimeter as figure.

(6) Check electric current at bucket circuit relief position.

Spec : 200~450mA



2507A5MS08

2) CHECK PRESSURE AT EPPR VALVE

(1) Remove plug and connect pressure gauge as figure.
   · Gauge capacity : 0 to 40-50kgf/cm² (0 to 580-725psi)

(2) Start engine.

(3) Set S-mode and cancel auto decel mode.

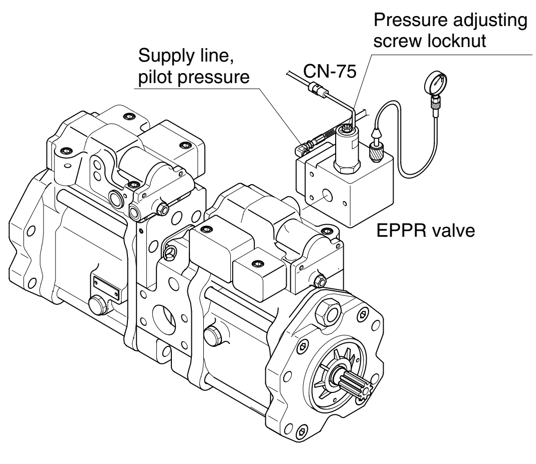
(4) Position the accel dial at 10.

(5) If tachometer show approx 1700±50rpm, 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.

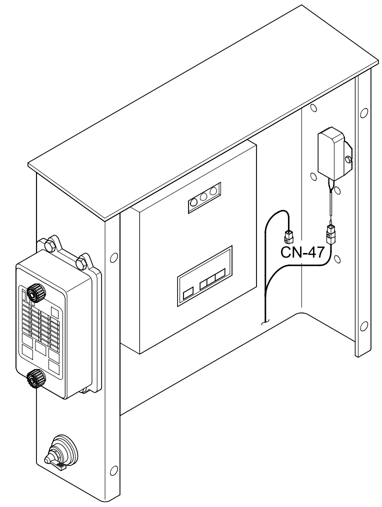
Spec : 2~25kgf/cm²(30~350psi)



2507A5MS09

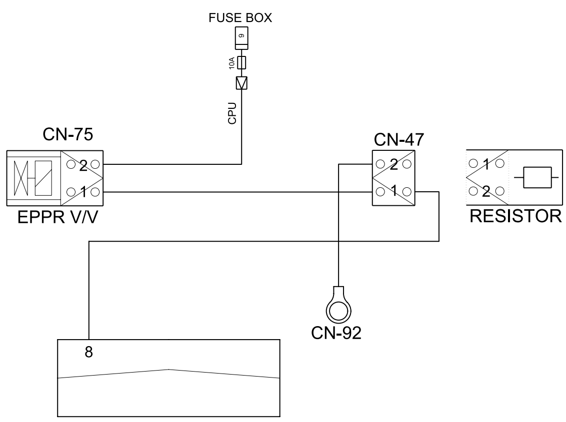
GROUP 12 PROLIX SYSTEM(-#0007)

Is the prolix resistor connected to manual control temporarily when the electronic control system is out of order, until repair work be done.



32075MS15

1. OPERATING PRINCIPLE WIRING DIAGRAM



14075MS19

1) NORMAL

· EPPR valve supply specified amount of pilot pressure to the flow regulator of hydraulic pump and regulate hydraulic pump delivery amount depending upon the signal of CPU controller by selected mode.

2) EMERGENCY

· If prolix resistor is connected with the emergency connector when any abnormality occurs in NEW CAPO system, constant electric current from battery flows to EPPR valve so that EPPR valve can be fixed at the predetermined position.

· In this case excavator can be operated at an equivalent performance to S mode.

GROUP 13 MONITORING SYSTEM(-#0007)

1. OUTLINE

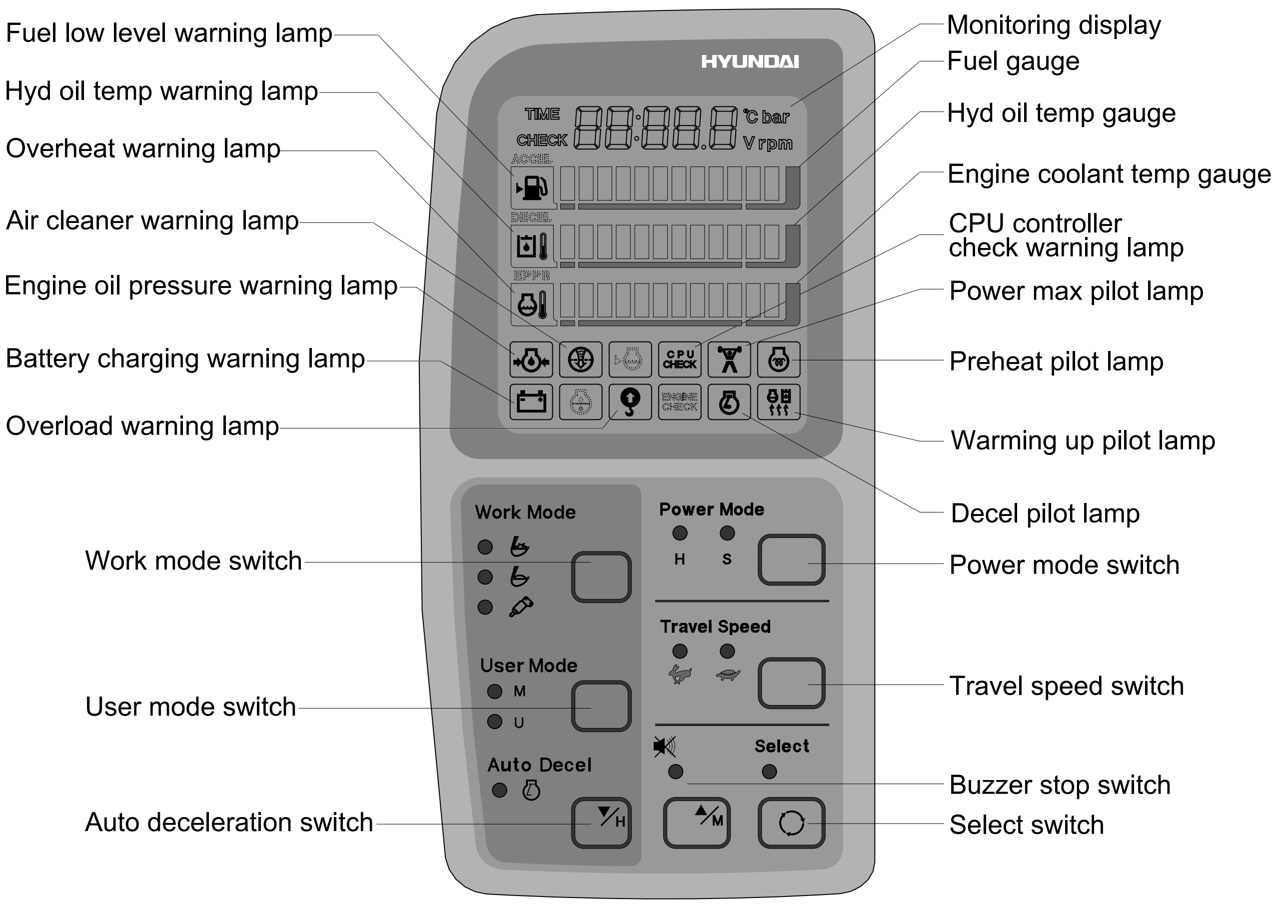
Monitoring system consists of the monitor part and switch part.

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

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

2. CLUSTER

1) MONITOR PANEL



34075MS12

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor initial 5 seconds

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

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

a. Cluster program version : CL : 1.4 ← Indicates program version 1.4 for 2 seconds.
b. Tachometer : 0rpm
c. Fuel gauge : All light up below appropriate level
d. Hydraulic temperature : All light up below appropriate level
e. Engine coolant temperature gauge : All light up below appropriate level
f. Warning lamp
※ During start key **ON** the engine oil pressure lamp and battery charging lamp go on, but it is not abnormal.
※ When engine coolant temperature below 30°C, the warming up lamp lights up.

③ Indicating lamp state

a. Work mode selection : General work
b. Power mode selection : S mode
c. User mode selection : No LED ON
d. Auto decel LED : ON
e. Travel speed pilot lamp : Low(Turttle)

(2) Start of engine

① Check machine condition

a. Tachometer indicates at present rpm
b. Gauge and warning lamp : Indicate at present condition.
※ When normal condition : All warning lamp OFF
c. Work mode selection : General work
d. Power mode selection : S mode
e. User mode selection : No LED ON
f. Auto decel LED : ON
g. Travel speed pilot lamp : Low(Turttle)

② When warming up operation

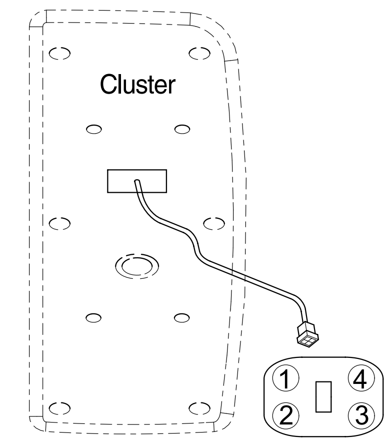
a. Warming up lamp : ON
b. 10 seconds after engine started, engine speed increases to1000 rpm(Auto decel LED : ON)
※ Others same as above ①.

③ When abnormal condition

a. The lamp lights up and the buzzer sounds.
b. If **BUZZER STOP** switch is pressed, buzzer sound is canceled but the lamp light up until normal condition.

3. CLUSTER CONNECTOR

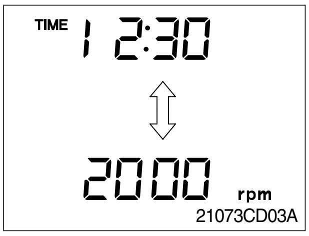
No.	Signal	Input / Output
1	Power IG(24V)	Input(20~32V)
2	GND	Input(0V)
3	Serial-(RX)	Input(Vpp=12V)
4	Serial+(TX)	Output(Vpp=4V)



21075MS16

4. CLUSTER FUNCTION

1) MONITORING DISPLAY

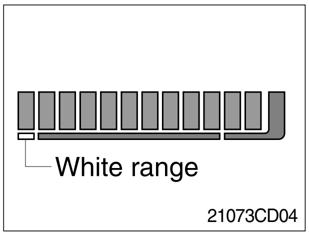


21073CD03A

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

※ Refer to the page 5-33 for details.

2) FUEL GAUGE



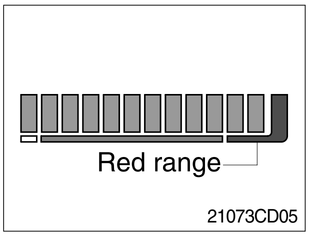
21073CD04

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

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

※ **If the gauge illuminates the white range or warning lamp blinks even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

3) HYDRAULIC OIL TEMPERATURE GAUGE



21073CD05

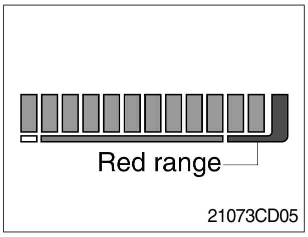
(1) This indicates the temperature of coolant.
- · White range : 30°C(86°F) below
- · Green range : 30-105 °C(86-221°F)
- · Red range : 105°C(221°F) above

(2) The green range illuminates when operating.

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

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

4) ENGINE COOLANT TEMPERATURE GAUGE



21073CD05

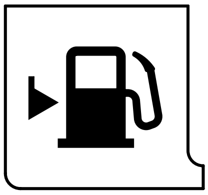
(1) This indicates the temperature of coolant.
- · White range : 30°C(86°F) below
- · Green range : 30-105 °C(86-221°F)
- · Red range : 105°C(221°F) above

(2) The green range illuminates when operating.

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

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

5) FUEL LOW LEVEL WARNING LAMP

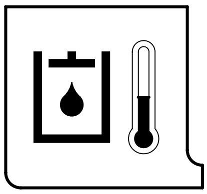


21073CD04A

(1) This lamp blinks and the buzzer sounds when the level of fuel is below 67 ℓ (17.7U.S. gal).

(2) Fill the fuel immediately when the lamp blinks.

6) HYDRAULIC OIL TEMPERATURE WARNING LAMP



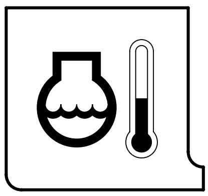
21073CD05A

(1) This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 105°C(221°F).

(2) Check the hydraulic oil level when the lamp blinks.

(3) Check for debris between oil cooler and radiator.

7) OVERHEAT WARNING LAMP

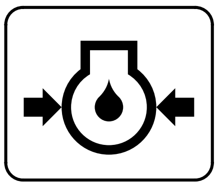


21073CD05A

(1) This lamp blinks and the buzzer sounds when the temperature of coolant is over the normal temperature 105°C(221°F) .

(2) Check the cooling system when the lamp blinks.

8) ENGINE OIL PRESSURE WARNING LAMP

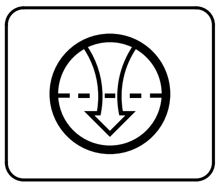


21073CD07

(1) This lamp blinks and the buzzer sounds after starting the engine because of pressure.

(2) If the lamp blinks during engine operation, shut OFF engine immediately. Check oil level.

9) AIR CLEANER WARNING LAMP

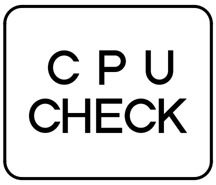


21073CD08

(1) This lamp is operated by the vacuum caused inside when the filter of air cleaner is clogged which supply air to the engine.

(2) Check the filter and clean or replace it when the lamp blinks.

10) MCU CHECK WARMING LAMP



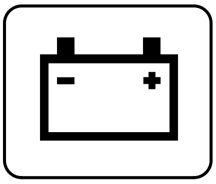
21073CD10

(1) Communication problem between MCU and cluster makes the lamp blinks and the buzzer sounds.

(2) Check if any fuse for MCU brunt off.

(3) If not check the communication line between them.

11) BATTERY CHARGING WARNING LAMP

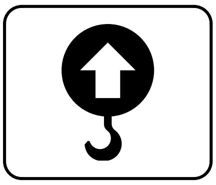


21073CD10

(1) This lamp blinks and the buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.

(2) Check the battery charging circuit when this lamp blinks, during engine operation.

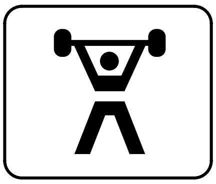
12) OVERLOAD WARNING LAMP



21073CD15

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

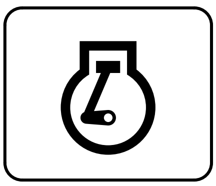
13) POWER MAX PILOT LAMP



21073CD11

(1) The lamp will be ON when pushing power max switch on the LH RCV lever.

14) ONE TOUCH DECEL PILOT LAMP

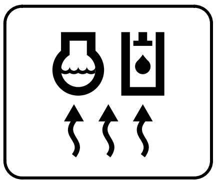


21073CD17

(1) Operating auto decel or one touch decel makes the lamp ON.

(2) The lamp will be ON when pushing one touch decel switch on the LH RCV lever.

15) WARMING UP PILOT LAMP

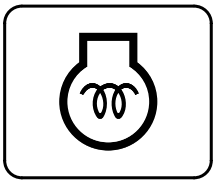


21073CD18

(1) This lamp is turned ON when the coolant temperature is below 30°C (86 °F).

(2) The automatic warming up is cancelled when the engine coolant temperature is above 30 °C, or when 10 minutes have passed since starting.

16) PREHEAT PILOT LAMP

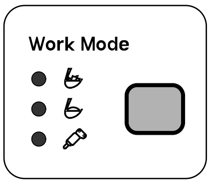


21073CD12

(1) Turning the start key switch ON position starts preheating in cold weather.

(2) Start the engine as this lamp is OFF.

17) WORK MODE SWITCH

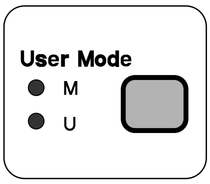


21073CD20

(1) This switch is to select the machine operation mode, which shifts from general operation mode to heavy operation mode and breaker mode in a raw by pressing the switch.
- : Heavy duty work mode
- : General work mode
- : Breaker operation mode

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

18) USER MODE SWITCH

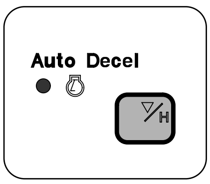


34075MS13

(1) This switch is to select the memory sets, at which you can change the engine and pump power and memorize it into MI and MII mode for your preference.

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

19) AUTO DECELERATION SWITCH

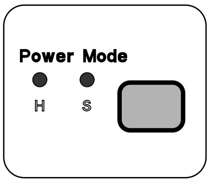


21073CD22

(1) This switch is used to actuate the auto deceleration function so the engine speed is lowered automatically when all control levers and pedals are at neutral position to save the fuel.
- Light ON : Auto deceleration function is selected.
- Light OFF : Auto deceleration function is cancelled so that the engine speed increased to previous setting value.

(2) Operating the auto deceleration function makes the decel indicate lamp on the LCD panel ON.

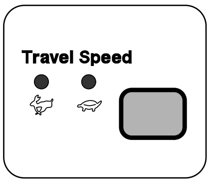
20) POWER MODE SWITCH



21073CD23

(1) The lamp of selected mode is turned ON by pressing the switch( ), when selecting the mode to use.
  · H : This is used for high power work.
  · S : This is used for standard power work.

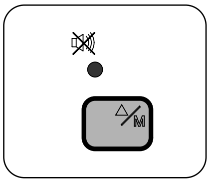
21) TRAVEL SPEED CONTROL SWITCH



21073CD24

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

22) BUZZER STOP SWITCH

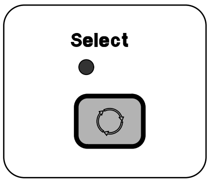


21073CD25

(1) When the starting switch is turned ON first, normally the alarm buzzer sounds for 2 seconds during lamp check operation.

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

23) SELECT SWITCH



21073CD25A

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

※ **Refer to the page 5-33 for details.**

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

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

5. MONITORING DISPLAY

1) OUTLINE

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

<table>
<tr><th rowspan="2">Display group</th><th colspan="3">How to select display mode</th><th rowspan="2">Name</th><th rowspan="2">Display on the cluster</th></tr>
<tr><th>Group selection</th><th colspan="2">Display mode selection</th></tr>
<tr><td rowspan="7">Group 0
(Default)</td><td rowspan="7">Way 1
Key switch
ON or START

Way 2
Touch AUTO DECEL switch while pressing BUZZER STOP at group 1~4.</td><td colspan="2">Initial</td><td>Engine rpm</td><td>950 rpm</td></tr>
<tr><td colspan="2">Touch SELECT 1 time</td><td>Time</td><td>TIME 12:30</td></tr>
<tr><td colspan="2">Touch SECLET 2 times</td><td>Power shift pressure
(EPPR valve)</td><td>EP: 10 bar</td></tr>
<tr><td colspan="2">Touch SELECT 3 times</td><td>MCU model & version</td><td>32:C 1.0</td></tr>
<tr><td>Touch SELECT 4 times</td><td rowspan="3">Option
(Only when a pressure sensor is installed)</td><td>Front pump pressure</td><td>P 1: 100 bar</td></tr>
<tr><td>Touch SELECT 5 times</td><td>Rear pump pressure</td><td>P2:200 bar</td></tr>
<tr><td>Touch SELECT 6 times</td><td>Pilot pressure</td><td>P3:30 bar</td></tr>
<tr><td rowspan="5">Group 1
(Volt, temp, EPPR press, version)</td><td rowspan="5">Touch SELECT switch once while pressing BUZZER STOP.
In this group SELECT LED ON</td><td colspan="2">Default</td><td>Battery voltage(V)</td><td>b:24.8 V</td></tr>
<tr><td colspan="2">Touch SELECT 1 time</td><td>Potentiometer voltage(V)</td><td>Po: 2.5 V</td></tr>
<tr><td colspan="2">Touch SELECT 2 times</td><td>Accel dial voltage(V)</td><td>dL: 3.8 V</td></tr>
<tr><td colspan="2">Touch SELECT 3 times</td><td>Hydraulic oil temperature(℃)</td><td>Hd: 50 ℃</td></tr>
<tr><td colspan="2">Touch SELECT 4 times</td><td>Coolant temperature(℃)</td><td>Ct: 85 ℃</td></tr>
<tr><td rowspan="3">Group 2
(Error code)</td><td rowspan="3">Touch SELECT switch twice while pressing BUZZER STOP.
In this group BUZZER STOP LED blinks</td><td colspan="2">Default</td><td>Current error</td><td>CHECK Er: 03</td></tr>
<tr><td colspan="2">Touch SELECT 1 time</td><td>Recorded error
(Only key switch ON)</td><td>TIME Er: 03</td></tr>
<tr><td colspan="2">Press down(▼) &
SELECT at the same time</td><td>Recorded error deletion
(Only key switch ON)</td><td>TIME Er: 00</td></tr>
<tr><td rowspan="7">Group 3
(Switch input)</td><td rowspan="7">Touch SELECT switch 3 times while pressing BUZZER STOP.
In this group SELECT LED blinks at 0.5sec interval</td><td colspan="2">Default</td><td>Pump prolix switch</td><td>PP:on or oFF</td></tr>
<tr><td colspan="2">Touch SELECT 1 time</td><td>Auto decel pressure switch</td><td>dP:on or oFF</td></tr>
<tr><td colspan="2">Touch SELECT 2 times</td><td>Power boost switch</td><td>Pb:on or oFF</td></tr>
<tr><td colspan="2">Touch SELECT 3 times</td><td>Travel oil pressure switch</td><td>oP:on or oFF</td></tr>
<tr><td colspan="2">Touch SELECT 4 times</td><td>One touch decel switch</td><td>od:on or oFF</td></tr>
<tr><td colspan="2">Touch SELECT 5 times</td><td>Travel alarm switch</td><td>br:on or oFF</td></tr>
<tr><td colspan="2">Touch SELECT 6 times</td><td>Preheat switch</td><td>PH:on or oFF</td></tr>
</table>

Display group	How to select display mode		Name	Display on the cluster
	Group selection	Display mode selection		
Group 4 (Output)	Touch **SELECT** switch **4 times** while pressing **BUZZER STOP.** In this group **SELECT** LED blinks at 1sec interval	Default	Hourmeter	Ho:on or oFF
		Touch **SELECT** 1 time	Neutral relay (Anti-restart relay)	nr:on or oFF
		Touch **SELECT** 2 times	Travel speed solenoid	tS:on or oFF
		Touch **SELECT** 3 times	Power boost solenoid (2-stage relief solenoid)	PS:on or oFF
		Touch **SELECT** 4 times	Boom priority solenoid	bS:on or oFF
		Touch **SELECT** 5 times	Travel alarm	AU:on or oFF
		Touch **SELECT** 6 times	Max flow cut off solenoid	FS:on or oFF
		Touch **SELECT** 7 times	Preheat relay	PA:on or oFF

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

2) DESCRIPTION OF MONITORING DISPLAY

Group	Display	Name	Description
Group 0	**2250 rpm**	Engine speed	It displays current engine speed detected by engine speed sensor from 500 to 3000rpm. Range : 500~3000rpm by 10rpm
	TIME 12 : 30	Time	It displays current time(12 is hour and 30 is minute) Range : Hour(1~12), minute(00~59)
	EP : 10bar	Power shift pressure of EPPR valve	It shows that pump power shift pressure of EPPR valve being controlled by the MCU is 10bar. Range : 00~50bar by 1bar
	34 : C1.0	Model and MCU program version	It shows that machine model(R340LC-7) and the program version of the MCU is 1.0 Version display range : 0.0~9.9 by 0.1
	P1 : 100bar (Option)	Front pump pressure	It displays front pump pressure of 100bar which is detected by pressure sensor. Range : 000~500bar by 10bar
	P2 : 200bar (Option)	Rear pump pressure	It displays rear pump pressure of 200bar which is detected by pressure sensor. Range : 000~500bar by 10bar
	P3 : 30bar (Option)	Pilot pump pressure	It displays pilot pump pressure of 30bar which is detected by pressure sensor. Range : 00~50bar by 1bar
Group 1	**b24 : 8V**	Battery voltage	It shows that battery power of 24.8V is supplied into MCU. Range : 00.0~48.0V by 0.1V
	Po : 2.5V	Potentiometer voltage	It shows that potentiometer signal voltage is 2.5V. Range : 0.0~5.0V by 0.1V
	dL : 3.8V	Accel dial voltage	It shows that accel dial signal voltage is 3.8V. Range : 0.0~5.0V by 0.1V
	Hd : 50°C	Hydraulic oil temperature	It shows that hydraulic oil temperature detected by temperature sensor is 50°C. Range : 0~150°C by 1°C
	Ct : 85°C	Coolant temperature	It shows that coolant oil temperature detected by temperature sensor is 50°C. Range : 0~150°C by 1°C

Group	Display	Name	Description
Group 2	CHECK Er : 03	Current error	It shows that current error of 03(Short circuit in pump EPPR valve system) is diagnosed by self diagnosis system in the CPU controller. If more than 2 errors, when pressing ▼ or ▲ switch, other error codes show. Range : 00~58
	TIME Er : 03	Recorded error	It shows recorded error code of 03 which is diagnosed before. If more than 2 error codes, when pressing ▼ or ▲ switch, other error codes show. Range : 00~58
	TIME Er : 00	Recorded error deletion	It shows all recorded error codes are removed in the MCU controller memory.
Group 3	PP : on or oFF	Pump prolix switch	PP : on Shows that pump prolix switch is turned on(At emergency position). PP : oFF Shows that pump prolix switch is turned off(At normal position).
	dP : on or oFF	Auto decel pressure switch	dP : on Shows that auto decel pressure switch is pressed on (No operation of control lever). dP : oFF Shows that auto decel pressure switch is released off (Operation of control lever).
	Pb : on or oFF	Power boost switch	Pb : on Shows that power boost switch is pressed on (Activated). Pb : oFF Shows that power boost switch is released off (Canceled).
	oP : on or oFF	Travel oil pressure switch	oP : on Shows that travel oil pressure switch is pressed on (No operation of travel control lever). oP : oFF Shows that travel oil pressure switch is released off (Operation of travel control lever).
	od : on or oFF	One touch decel switch	od : on Shows that one touch decel switch is pressed. od : oFF Shows that one touch decel switch is released.
	br : on or oFF	Travel alarm switch	br : on Shows that travel alarm function is selected. br : oFF Shows that travel alarm function is canceled.
	PH : on or oFF	Preheat switch	PH : on Shows that preheat switch is pressed. PH : oFF Shows that preheat switch is released.

Group	Display	Name	Description
Group 4	**Ho : on** or **oFF**	Hourmeter	**Ho : on** Shows that hourmeter is activated by MCU. **Ho : oFF** Shows that hourmeter is turned off.
	nr : on or **oFF**	Neutral relay (Anti-restart relay)	**nr : on** Shows that neutral relay for anti-restarting function is activated(Engine start is possible). **nr : oFF** Shows that neutral relay is turned off to disable the engine restart.
	ts : on or **oFF**	Travel speed solenoid	**ts : on** Shows that travel speed solenoid is activated (High speed). **ts : oFF** Shows that travel speed solenoid is released (Low speed).
	PS : on or **oFF**	Power boost solenoid	**PS : on** Shows that power boost solenoid is activated to maximize the power(Power up). **PS : oFF** Shows that power boost solenoid is turned off(Cancel the power boost function).
	bs : on or **oFF**	Boom priority solenoid	**bs : on** Shows that boom priority solenoid is activated. **bs : oFF** Shows that boom priority solenoid is released.
	Ru : on or **oFF**	Travel alarm	**Ru : on** Shows that travel buzzer is activated. **Ru :oFF** Shows that travel buzzer is canceled.
	FS : on or **oFF**	Max flow cut off solenoid	**FS : on** Shows that max flow cut off solenoid is activated. **FS : oFF** Shows that max flow cut off solenoid is released.
	PR : on or **oFF**	Preheat relay	**PR : on** Shows that preheat relay is activated. **PR : oFF** Shows that preheat relay is released.

GROUP 13 MONITORING SYSTEM(#0008-)

1. OUTLINE

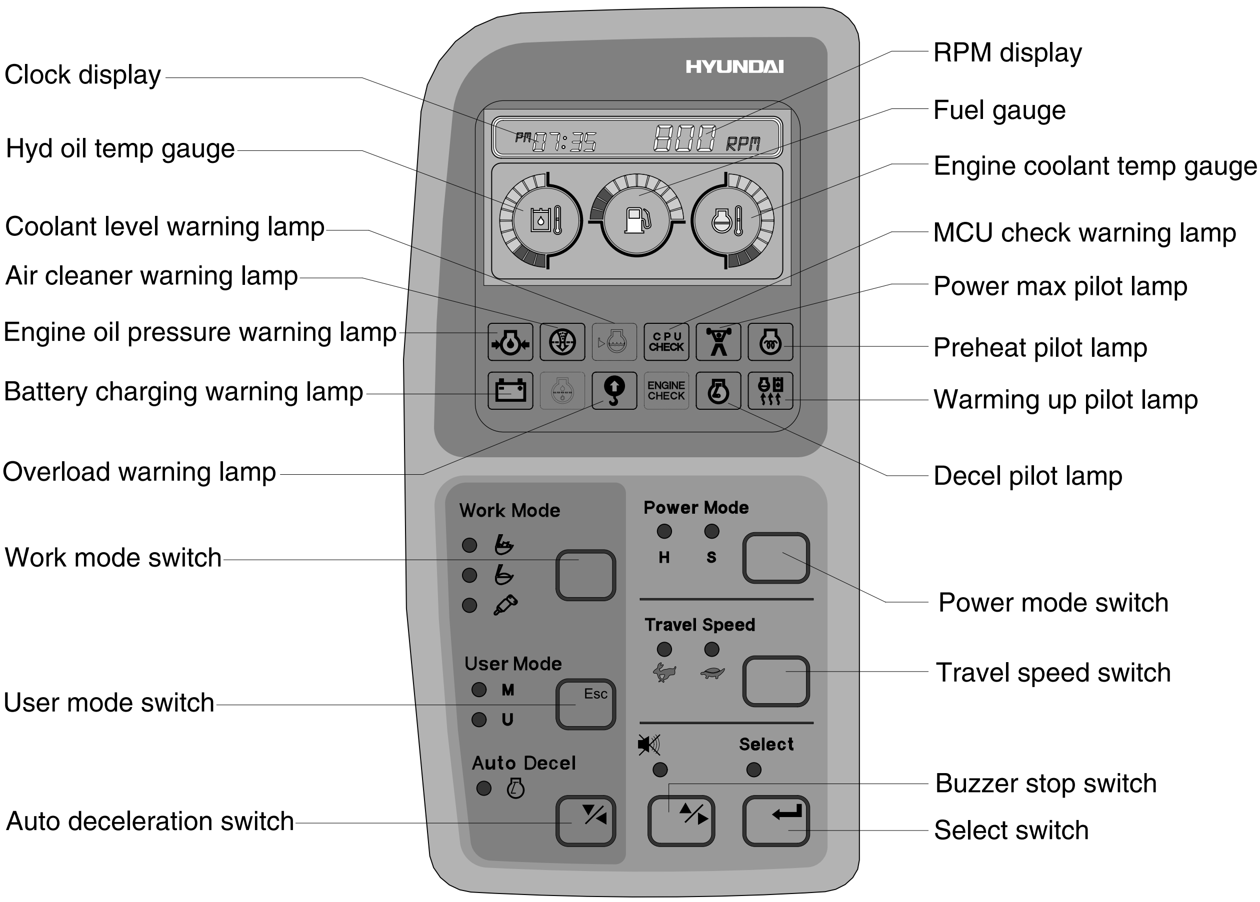
Monitoring system consists of the monitor part and switch part.

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

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

2. CLUSTER

1) MONITOR PANEL



30075MS01

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor initial 5 seconds

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

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

a. Cluster program version : 「1.00」 ← Indicates program version 「1.00」 for 5 seconds.
b. Tachometer : 0rpm
c. Fuel gauge : All light up below appropriate level
d. Hydraulic temperature : All light up below appropriate level
e. Engine coolant temperature gauge : All light up below appropriate level
f. Warning lamp
※ During start key **ON** the engine oil pressure lamp and battery charging lamp go on, but it is not abnormal.
※ When engine coolant temperature below 30°C, the warming up lamp lights up.

③ Indicating lamp state

a. Work mode selection : General work
b. Power mode selection : S mode
c. User mode selection : No LED ON
d. Auto decel LED : ON
e. Travel speed pilot lamp : Low(Turttle)

(2) Start of engine

① Check machine condition

a. Tachometer indicates at present rpm
b. Gauge and warning lamp : Indicate at present condition.
※ When normal condition : All warning lamp OFF
c. Work mode selection : General work
d. Power mode selection : S mode
e. User mode selection : No LED ON
f. Auto decel LED : ON
g. Travel speed pilot lamp : Low(Turttle)

② When warming up operation

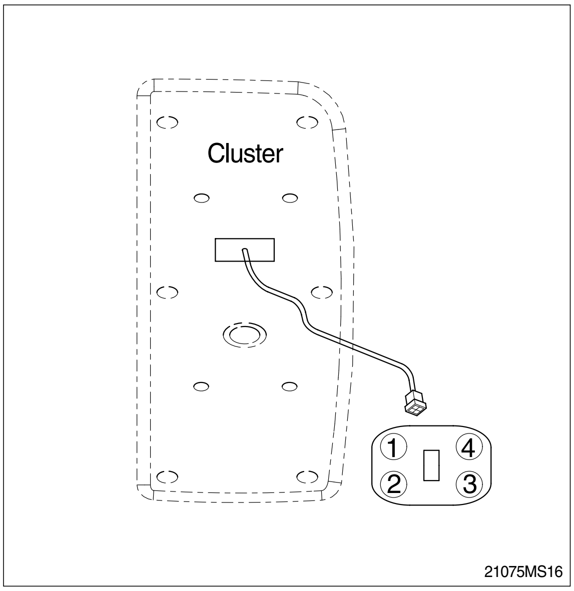
a. Warming up lamp : ON
b. 10 seconds after engine started, engine speed increases to 1000rpm(Auto decel LED : ON)
※ Others same as above ①.

③ When abnormal condition

a. The lamp lights up and the buzzer sounds.
b. If **BUZZER STOP** switch is pressed, buzzer sound is canceled but the lamp light up until normal condition.

3. CLUSTER CONNECTOR

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



4. CLUSTER FUNCTION

1) LCD main operation display

Default screen

1607A3CD02A

Option screen

1607A3CD02B

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

(1) Time display

1607A3CD02C

① This displays the current time.

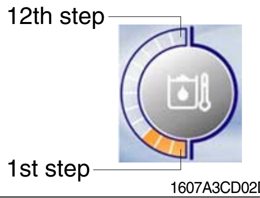
※ **Refer to the page 5-45 to set time for details.**

(2) RPM display

1607A3CD02C

① This displays the engine rpm.

(3) Hydraulic oil temperature gauge



1607A3CD02D

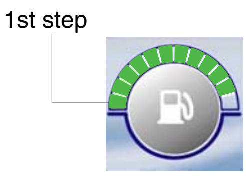
① This gauge indicates the temperature of hydraulic oil in 12 step gauge.
- · 1st step : Below 30°C(86°F)
- · 2nd~10th step : 30-105 °C(86-221°F)
- · 11th~12th step : Above 105°C(221°F)

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

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

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

(4) Fuel level gauge



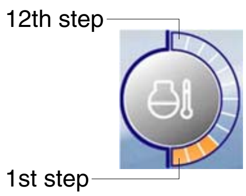
1607A3CD02E

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

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

※ **If the gauge illuminates the 1st step or fuel icon blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

(5) Engine coolant temperature gauge



1607A3CD02F

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

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

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

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

3) Warning of main operation screen

(1) Warning display

① Engine coolant temperature


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

② Fuel level


- This lamp blinks and the buzzer sounds when the level of fuel is below 67 ℓ (17.7 U.S. gal).
- Fill the fuel immediately when the lamp blinks.

③ Hydraulic oil temperature


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

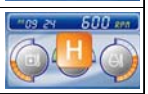
④ All gauge

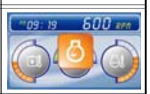

- This lamp blinks and the buzzer sounds when the all gauge is abnormal.
- Check the each system when the lamp blinks.

⑤ Communication error

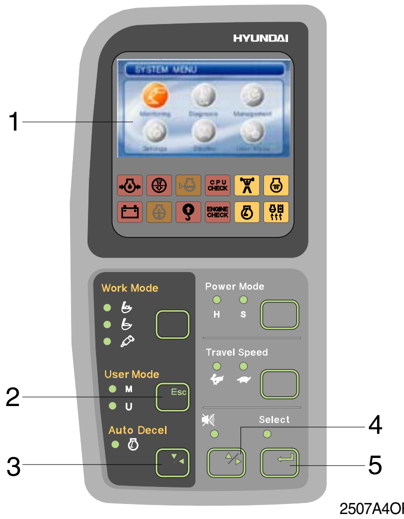
- Communication problem between MCU controller and cluster makes the lamp blinks and the buzzer sounds.
- Check if any fuse for MCU burnt off.
  If not check the communication line between them.

(2) Pop-up icon display

No	Switch	Selected mode	Display
1	Work mode switch	General work mode	
		Heavy duty work mode	
		Breaker operation mode	
2	Power mode switch	High power work mode	
		Standard power work mode	

No	Switch	Selected mode	Display
3	Auto deceleration switch	Light ON	
		Light OFF	
4	Travel speed control switch	Low speed	
		High speed	

4) LCD



2507A4OP95B

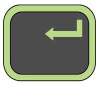
1  : LCD

2 

: Escape,
Return to the previous menu

3  : Down/Left Direction

4  : Up/Right Direction

5  : Select(Enter)
Activate the currently chosen item

(1) Main menu

2507A4OP94

1  : Menu information

2  : Monitoring
- Equipment, Switch, Output

3  : Diagnosis
- Current error, Recorded error

4  : Maintenance

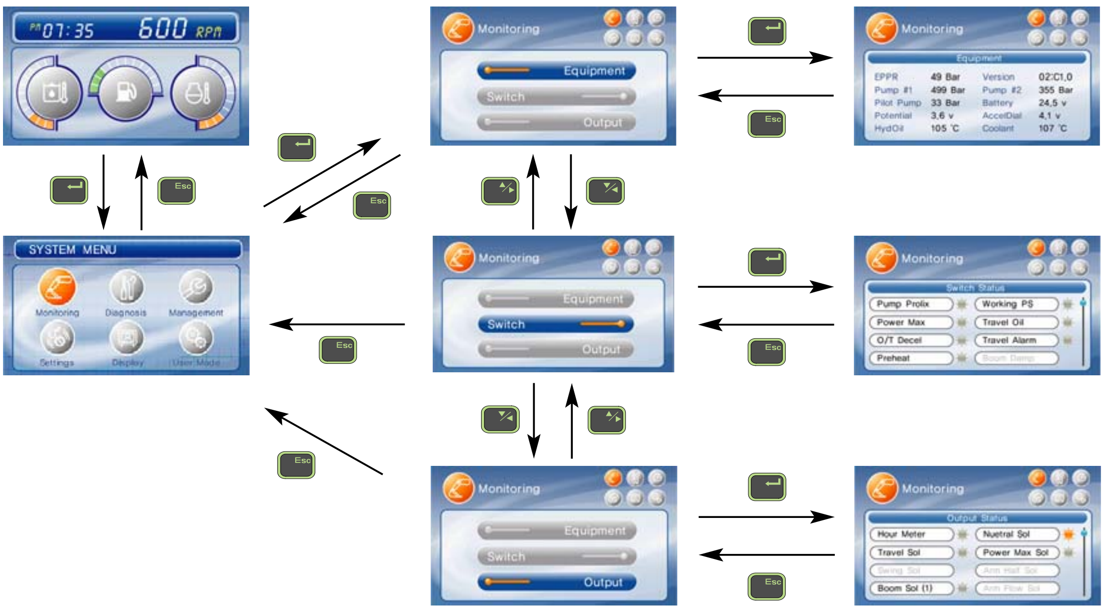
5  : Settings
- Time set, Dual mode
- System lock(Reserved)

6  : Display
- Operation skin, Brightness, Language

7  : User mode

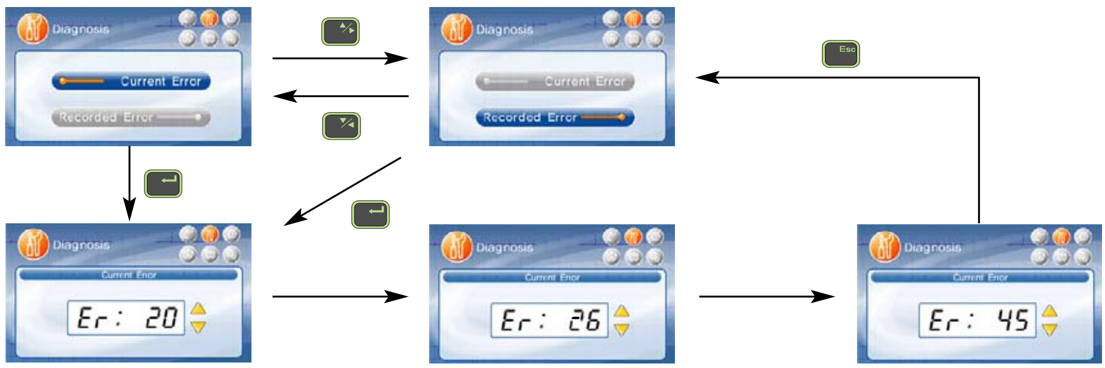
(2) Display map

① Monitoring

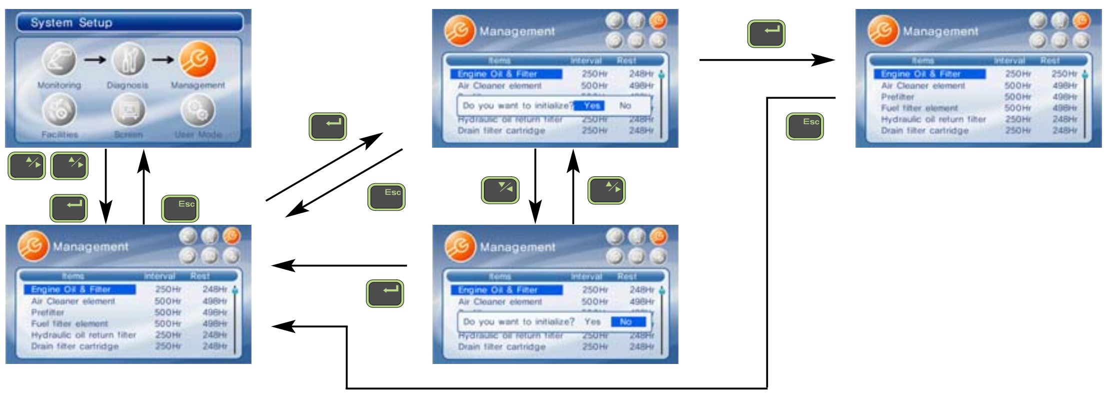


② Diagnosis

- If there are more than 2 error codes, each one can be displayed by pressing or switch respectively.



③ Maintenance



④ Setting

a. Time set

b. System lock - Reserved

c. Dual mode

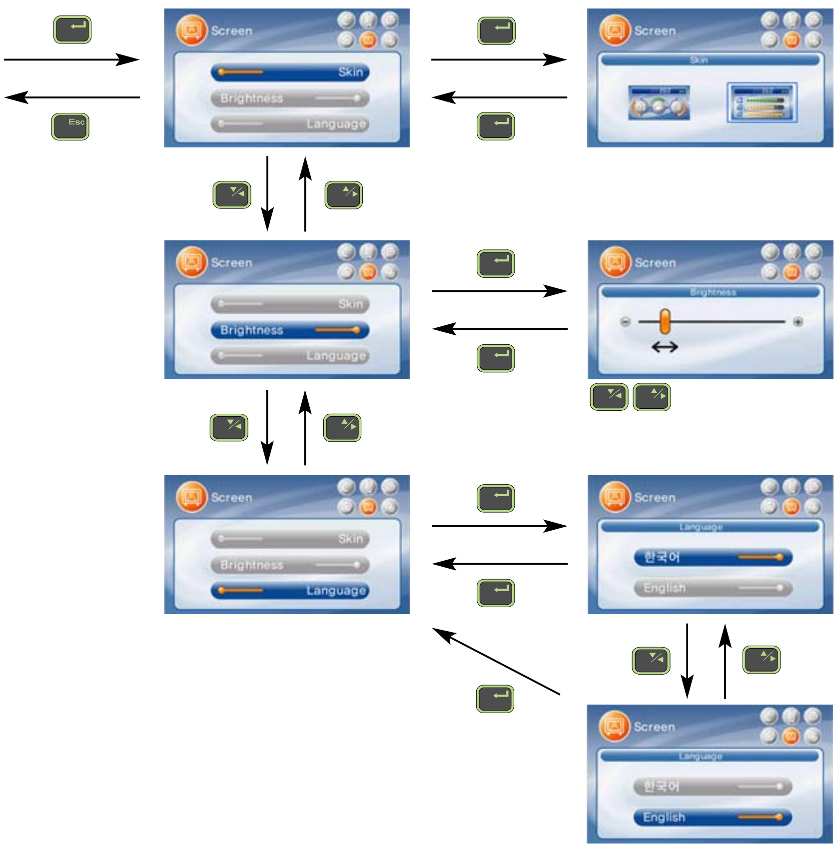
- Changing the MCU mode

⑤ Display

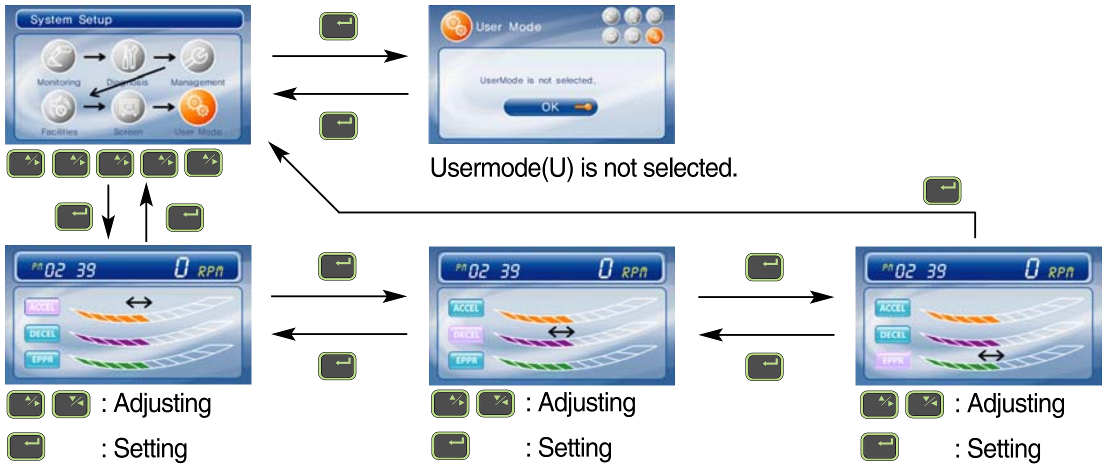
a. Operation skin

b. Brightness

c. Language

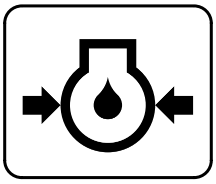


⑥ User mode


System Setup
Monitoring
Diagnosis
Management
Facilities
Screen
User Mode
User Mode
UserMode is not selected.
OK
Usermode(U) is not selected.
ACCEL
DECEL
EPPR
RPM
: Adjusting
: Setting
: Adjusting
: Setting
: Adjusting
: Setting

5) Warning and pilot lamp

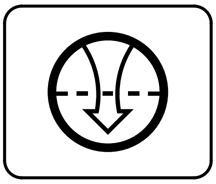
(1) Engine oil pressure warning lamp



21073CD07

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

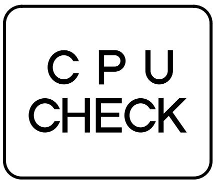
(2) Air cleaner warning lamp



21073CD08

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

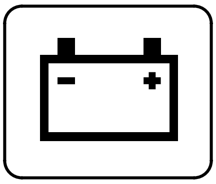
(3) MCU check warning lamp



21073CD10

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

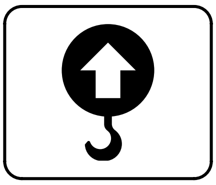
(4) Battery charging warning lamp



21073CD13

① This lamp blinks and the buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
② Check the battery charging circuit when this lamp blinks during engine operation.

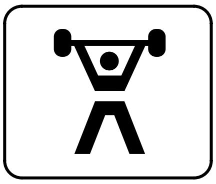
(5) Overload warning lamp (Option)



21073CD15

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

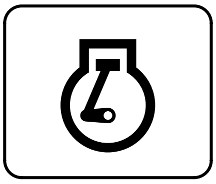
(6) Power max pilot lamp



21073CD11

① The lamp will be ON when pushing power max switch on the LH RCV lever.

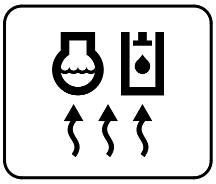
(7) Decel pilot lamp



21073CD17

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

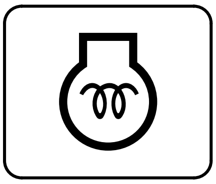
(8) Warming up pilot lamp



21073CD18

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

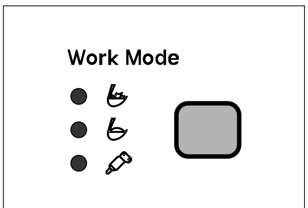
(9) Preheat pilot lamp



21073CD12

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

(10) Work mode switch

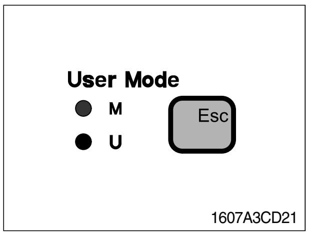


21073CD20

① This switch is to select the machine operation mode, which shifts from general operation mode to heavy operation mode and breaker mode in a raw by pressing the switch.
- : Heavy duty work mode
- : General work mode
- : Breaker operation mode

※ **Refer to the page 5-5-2 for details.**

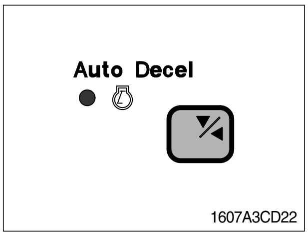
(11) User mode switch



① This switch is to select the maximum power or user mode.
- M : Maximum power
- U : Memorizing operators preferable power setting.

※ **Refer to the page 5-5-3 for details.**

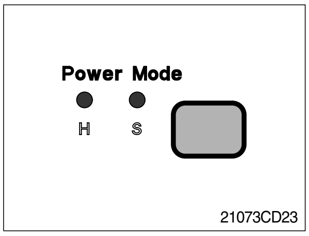
(12) Auto deceleration switch



① This switch is used to actuate or cancel the auto deceleration function.

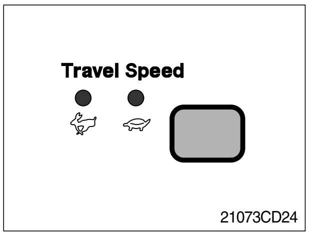
② When the switch actuated and all control levers and pedals are at neutral position, engine speed will be lowered automatically to save fuel consumption.
- Light ON : Auto deceleration function is selected.
- Light OFF : a. Auto deceleration function is cancelled so that the engine speed increased to previous setting value.
  b. One touch decel function is available.

(13) Power mode switch



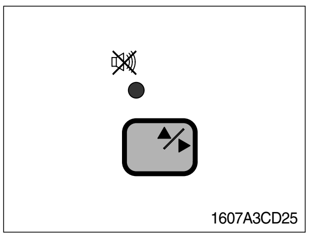
① The lamp of selected mode is turned ON by pressing the switch( ).
- H : High power work.
- S : Standard power work.

(14) Travel speed control switch



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

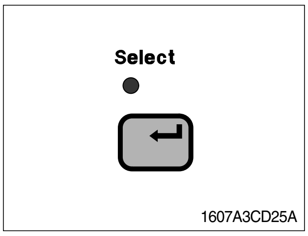
(15) Buzzer stop switch



① When the starting switch is turned ON first, normally the alarm buzzer sounds for 2 seconds during lamp check operation.

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

(16) Select switch



① This switch is used to enter main menu and sub menu of LCD.

※ **Refer to the page 5-43 for details.**

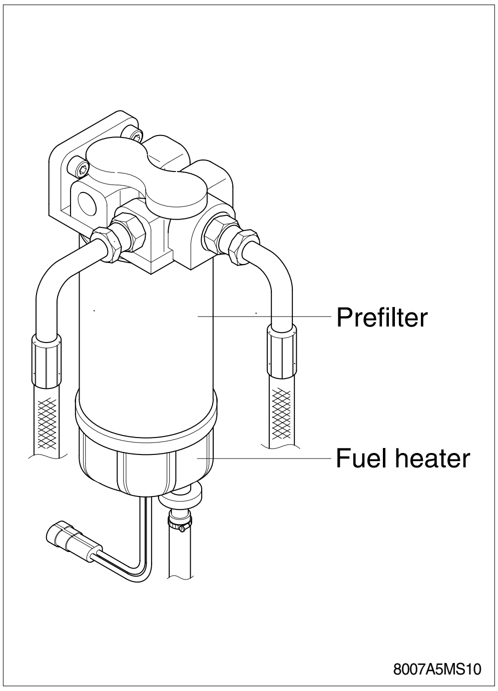
GROUP 13 FUEL WARMER SYSTEM

1. SPECIFICATION

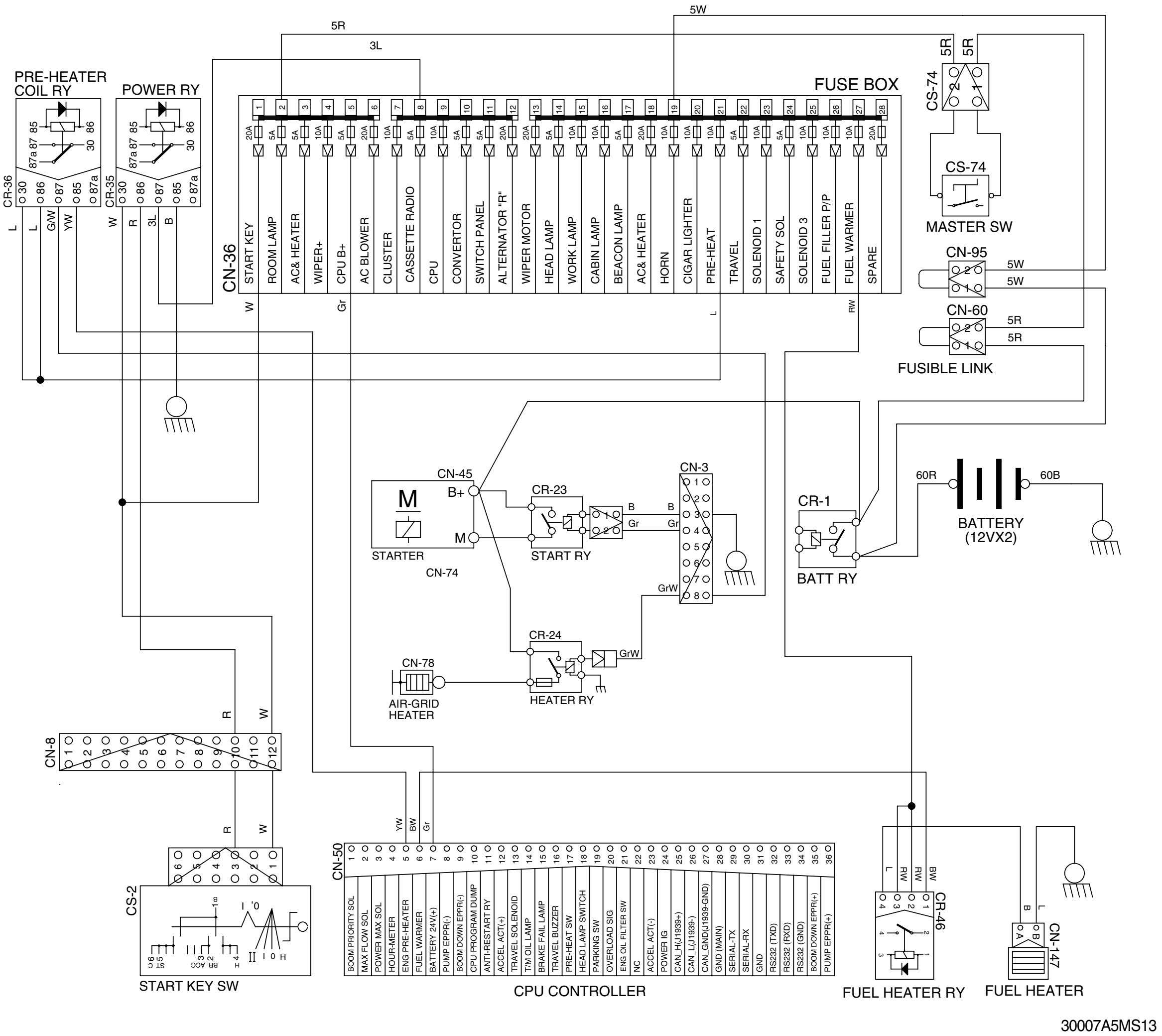
1) Operating voltage : 24±4V
2) Power : 200±50W
3) Current : 15A

2. OPERATION

1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
2) At the first state, the 15A 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 1.5A.
   So, fuel is protected from overheating by this mechanism.



3. ELECTRIC CIRCUIT



SECTION 6 TROUBLESHOOTING

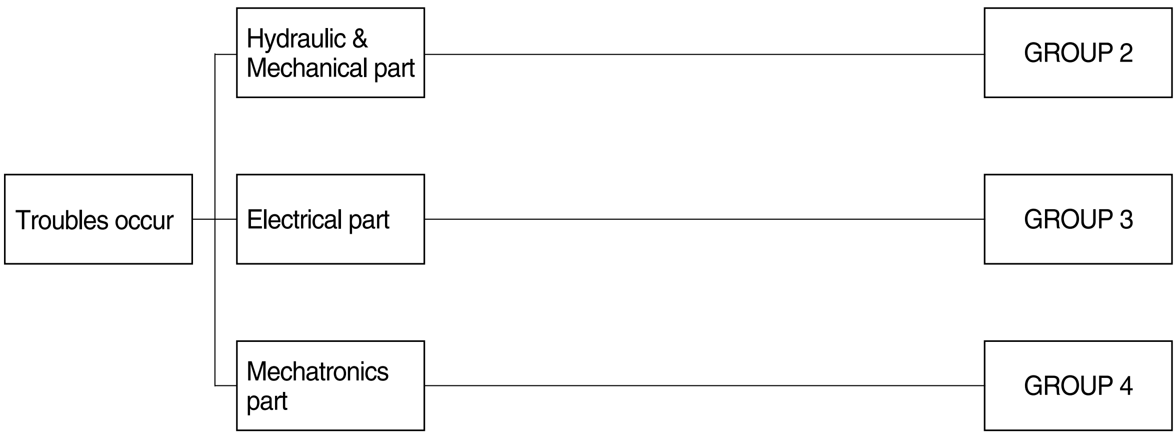
SECTION 6 TROUBLESHOOTING

GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

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

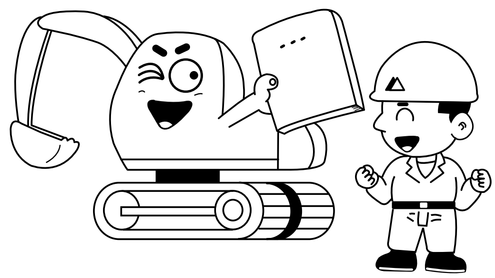


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

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

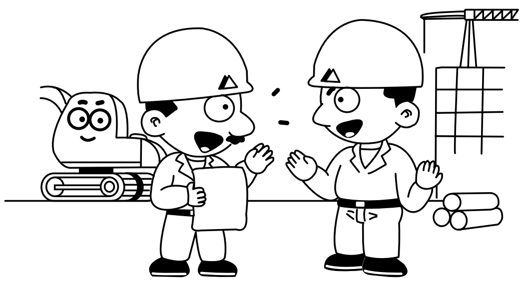


13031SH02

STEP 2. Ask the operator

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

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

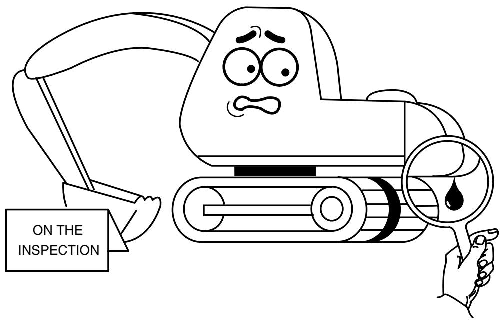


13031SH03

STEP 3. Inspect the machine

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

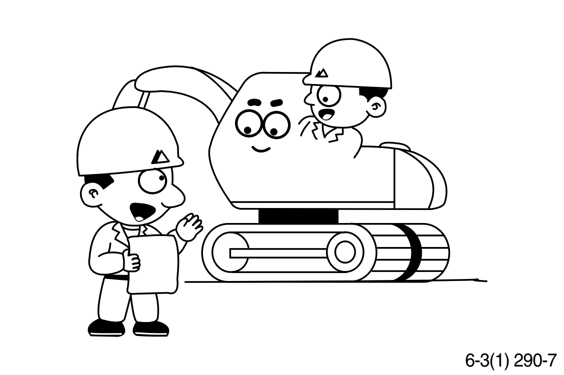
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



6-2(3) 290-7

STEP 4. Inspect the trouble actually on the machine

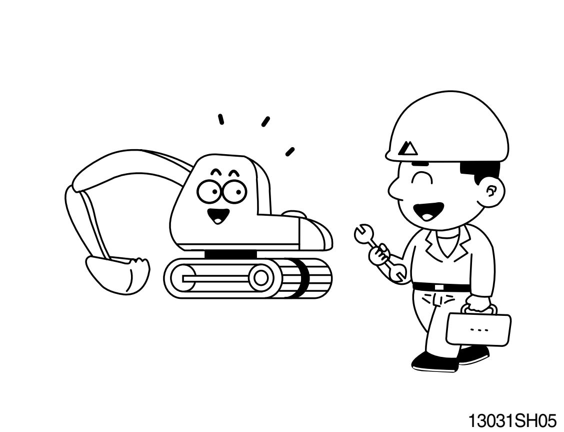
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



6-3(1) 290-7

STEP 5. Perform troubleshooting

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

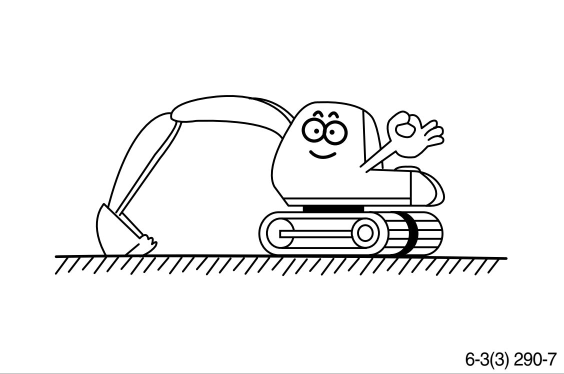


13031SH05

STEP 6. Trace a cause

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

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



6-3(3) 290-7

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

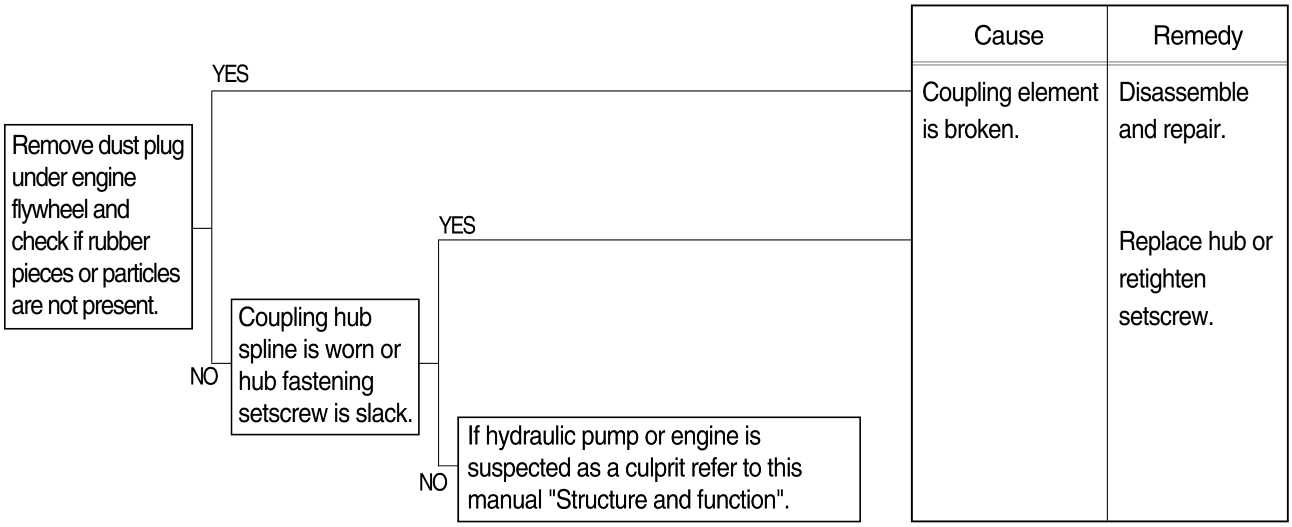
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

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

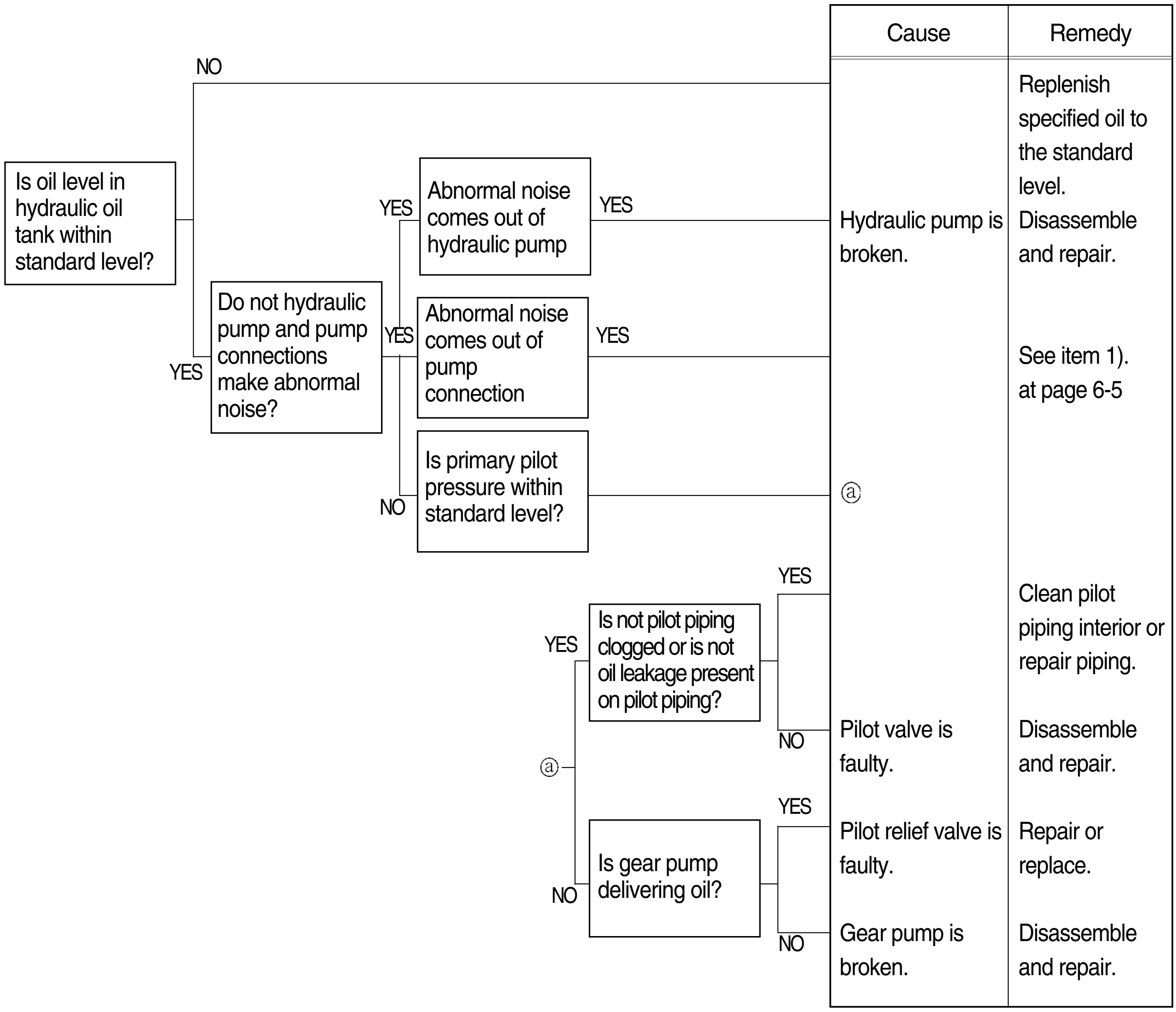
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

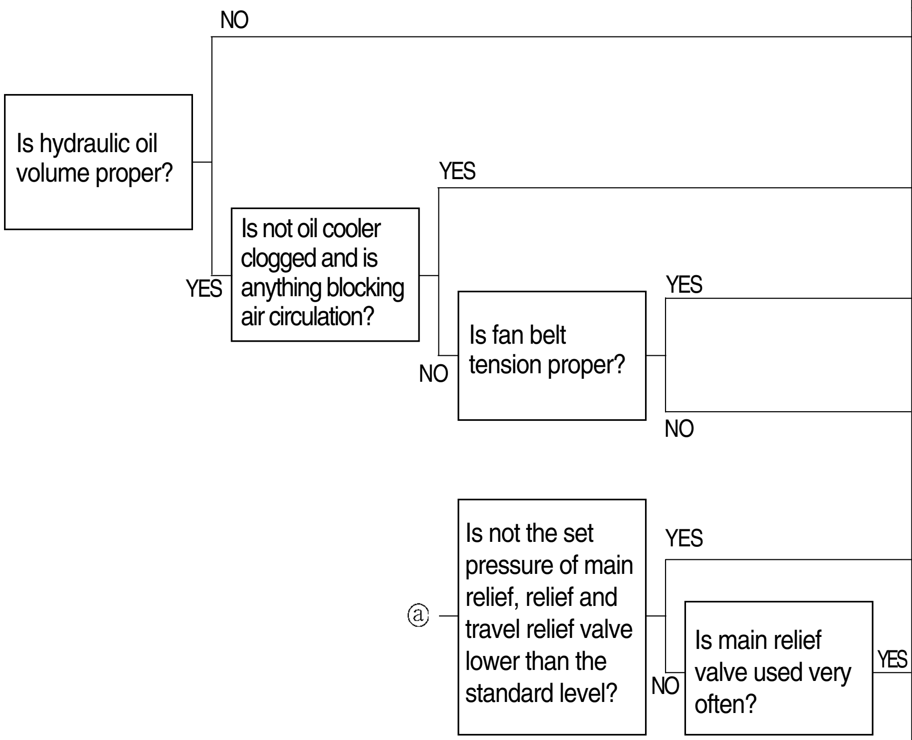


3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

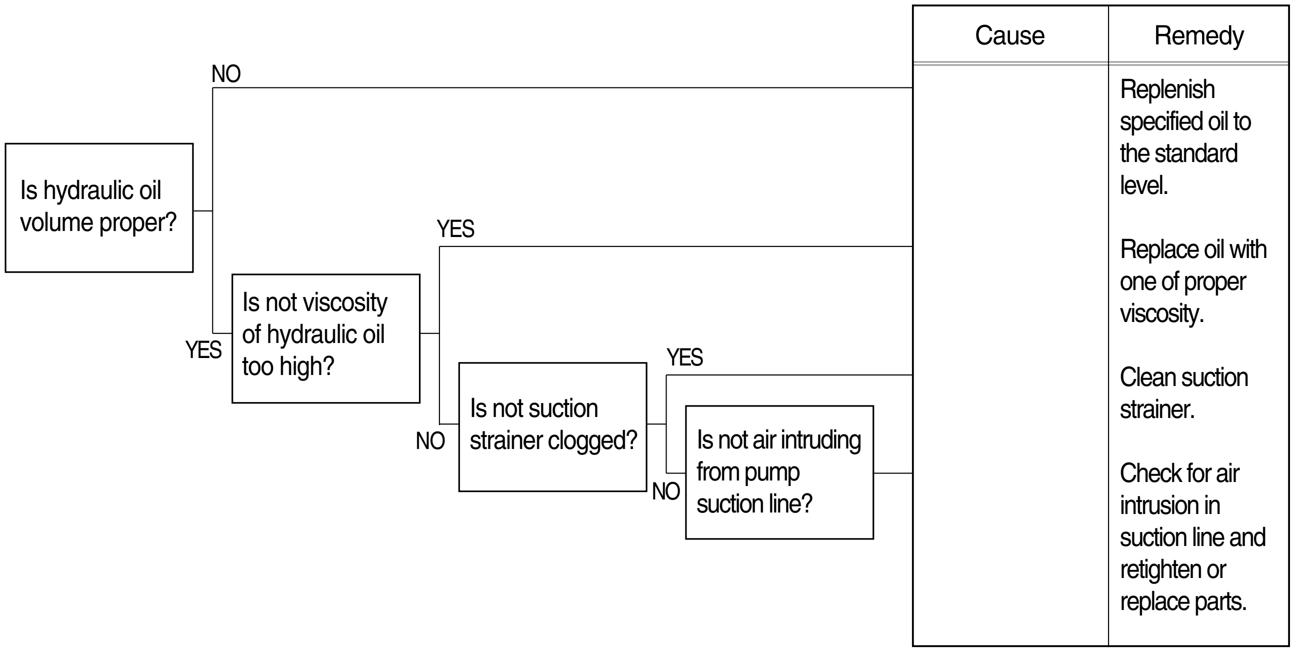
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY

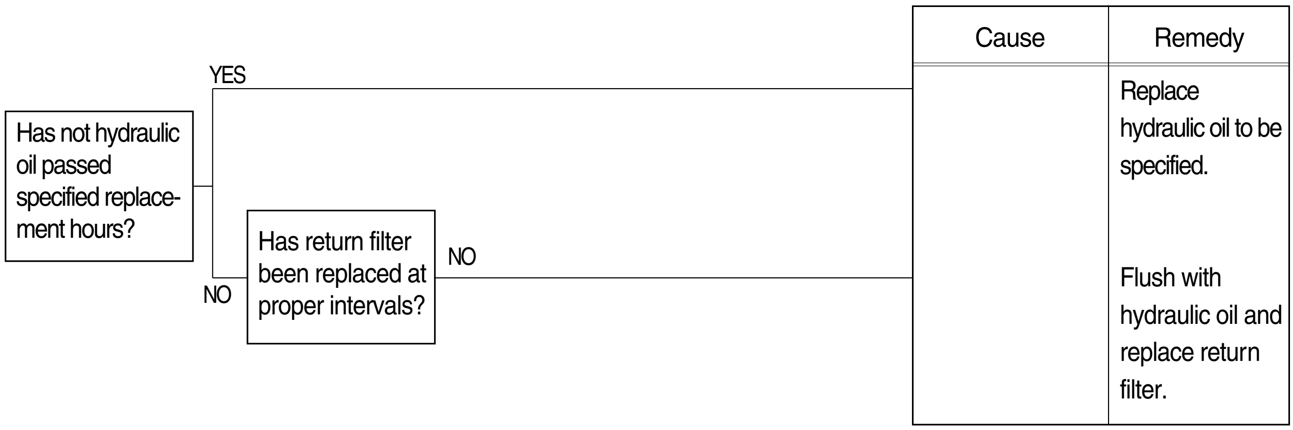


Cause	Remedy
	Replenish specified oil to the standard level.
	Clean oil cooler. Secure air circulation route.
ⓐ	
	Adjust belt tension or replace belt.
	Readjust set pressure.
	Reduce load.

3) CAVITATION OCCURS WITH PUMP

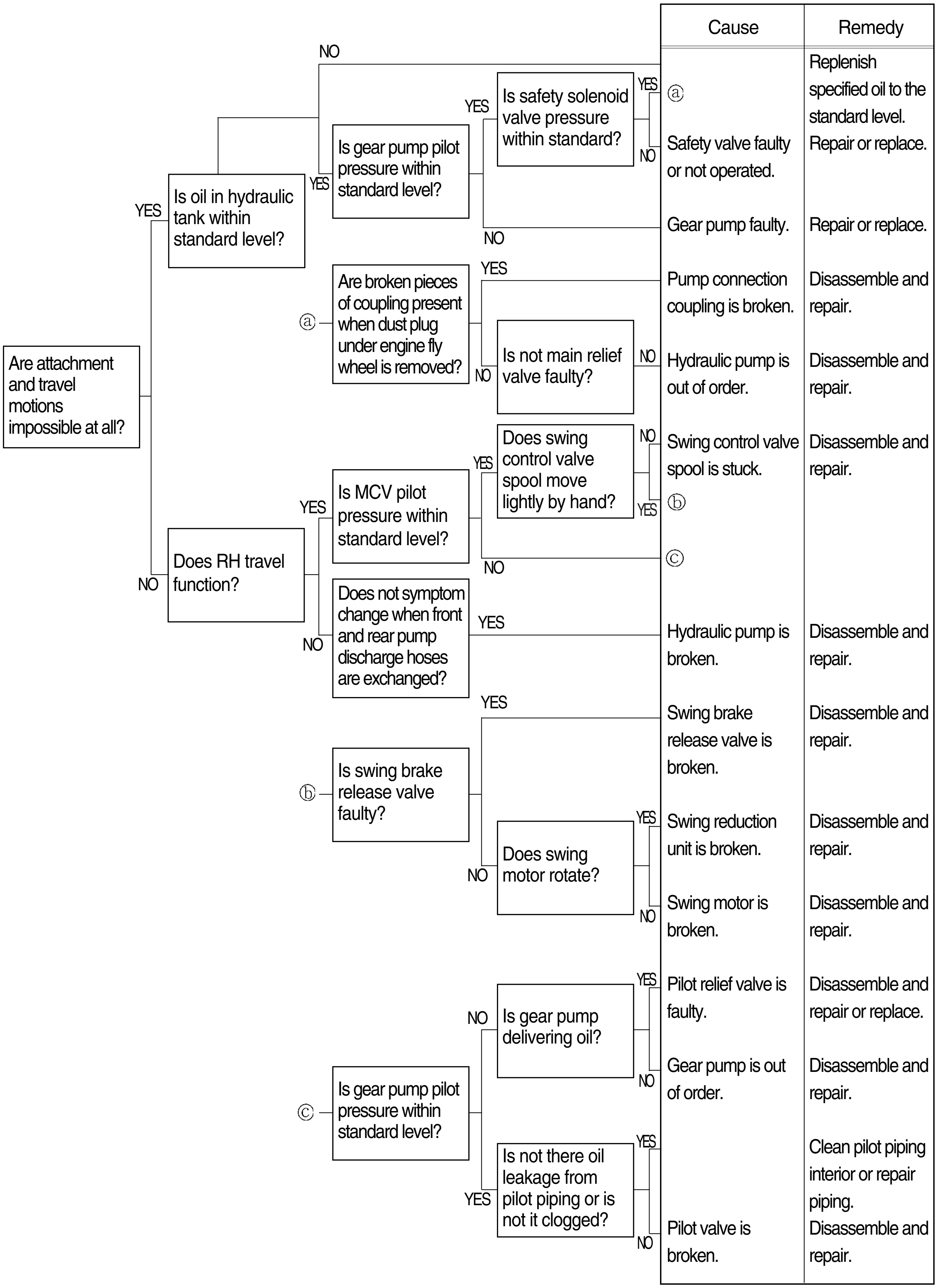


4) HYDRAULIC OIL IS CONTAMINATED

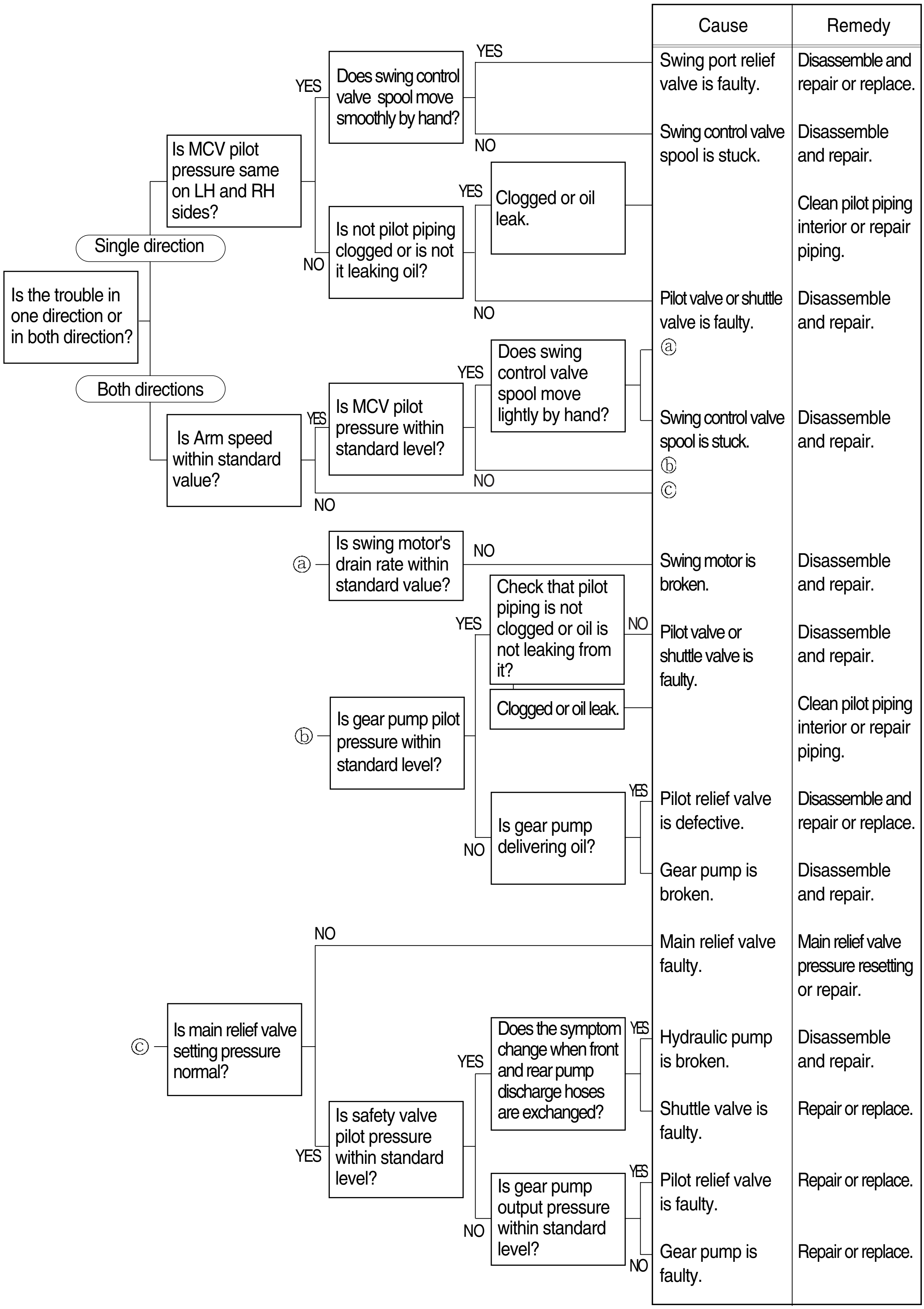


4. SWING SYSTEM

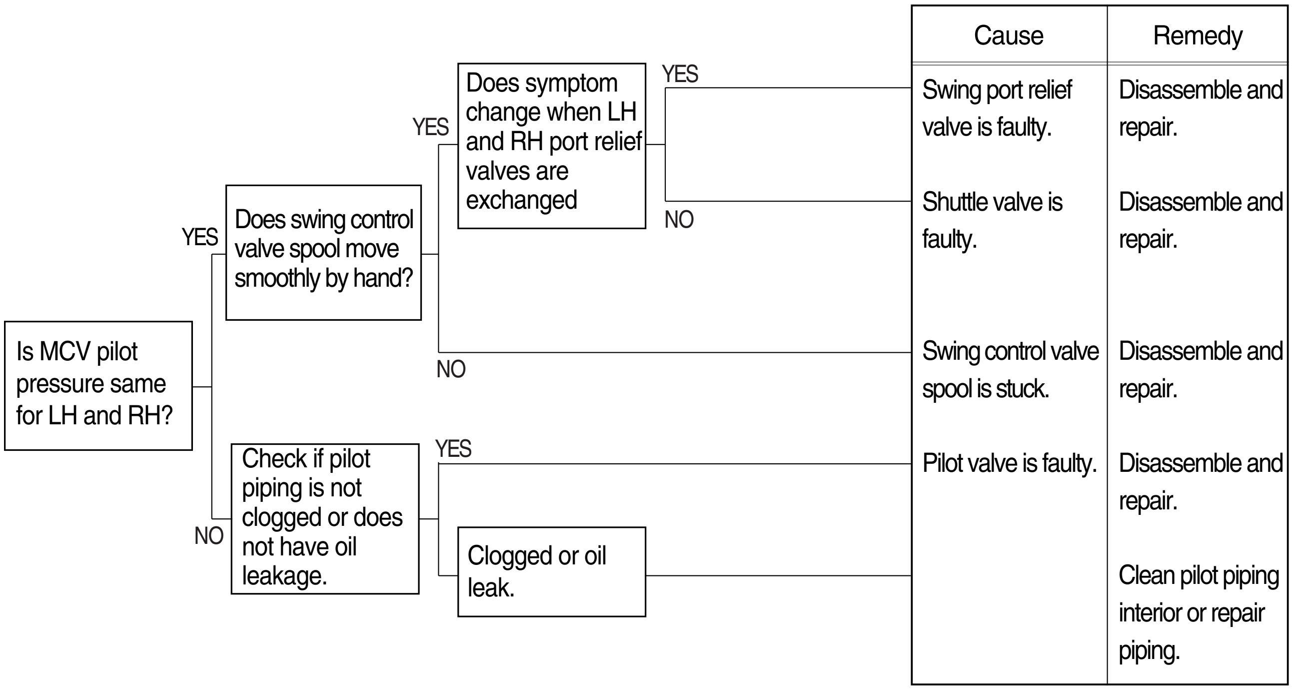
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



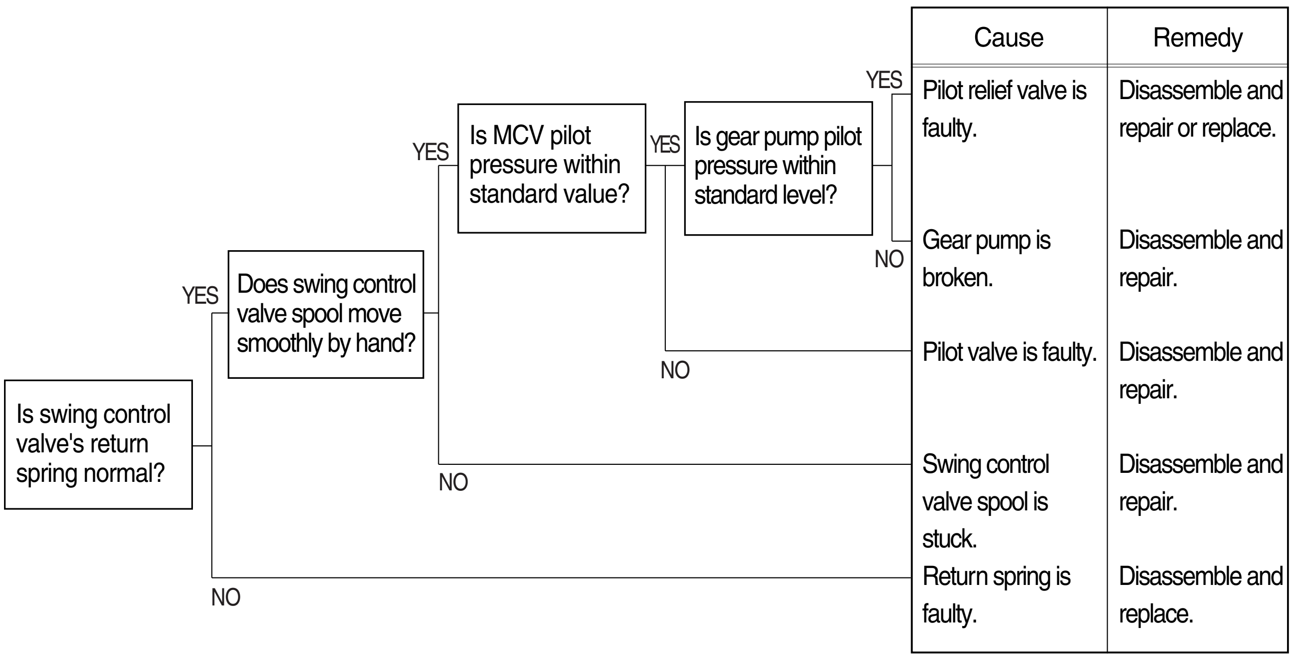
2) SWING SPEED IS LOW



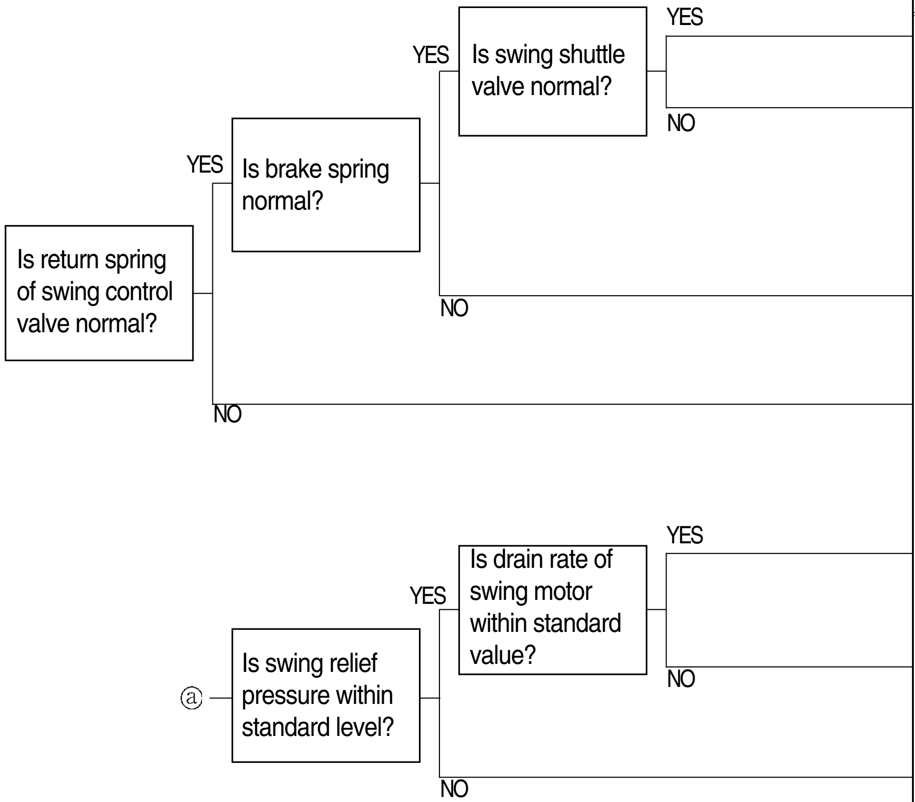
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP



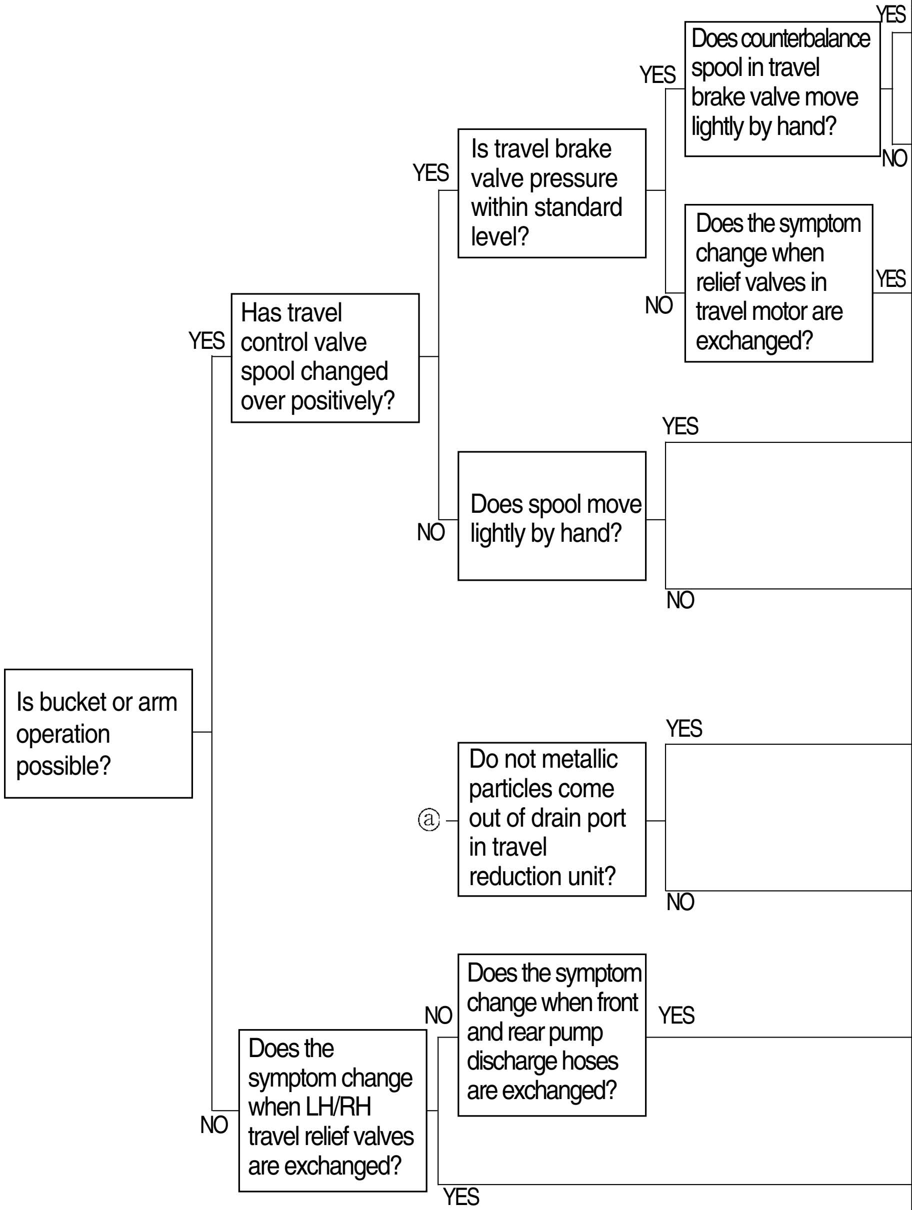
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



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 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.

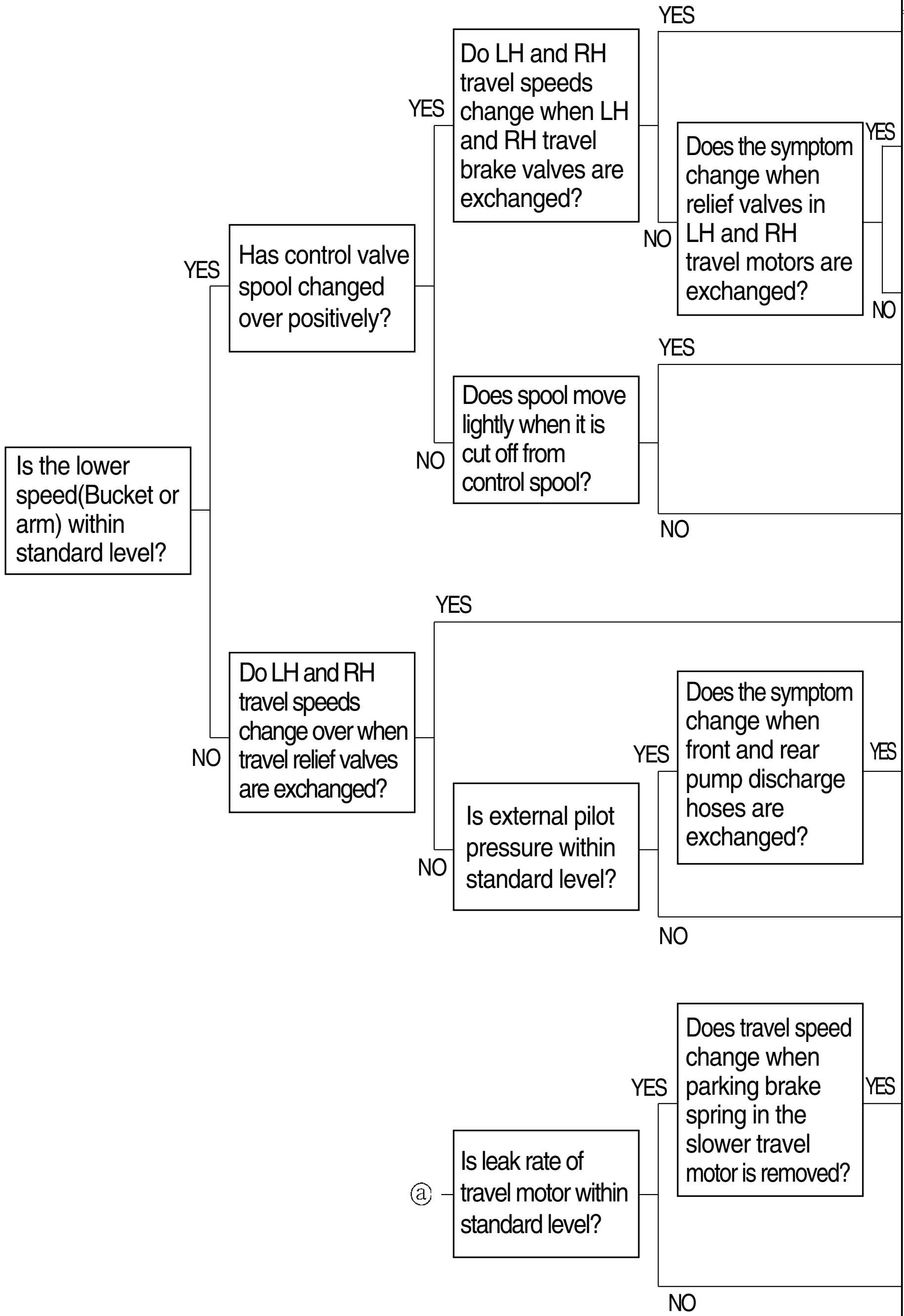
5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



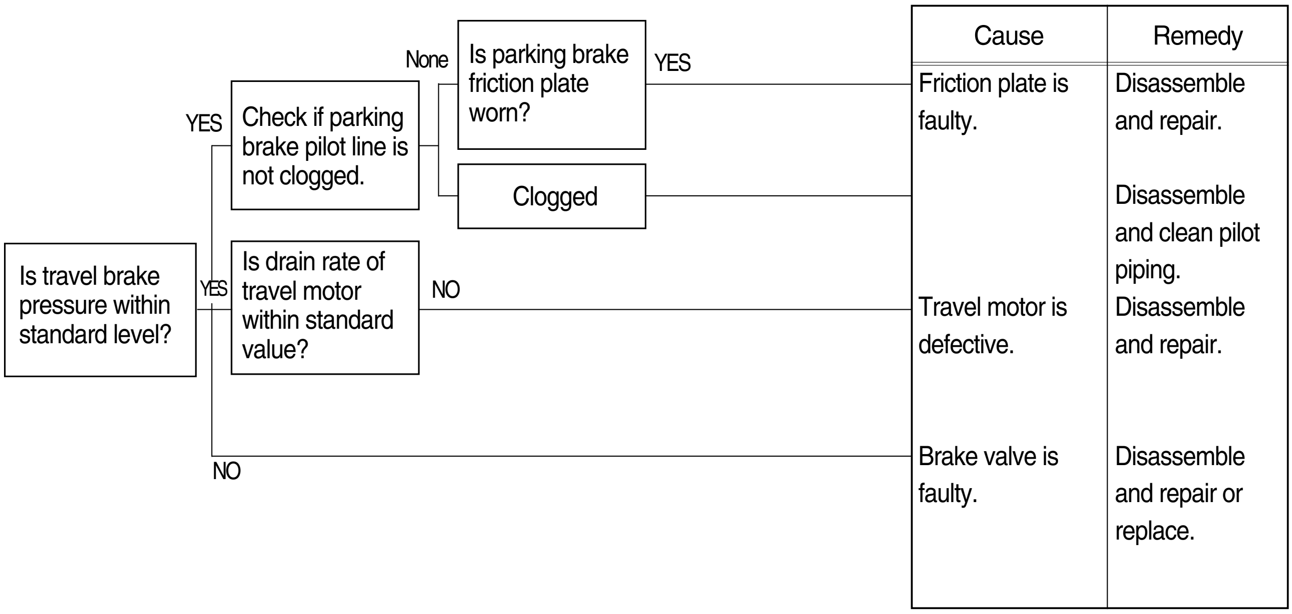
Cause	Remedy
ⓐ	
Counter spool in travel brake valve is stuck.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
Control system is defective.	Disassemble inspect and repair.
Travel control valve spool is stuck.	Disassemble and repair.
Travel reduction 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

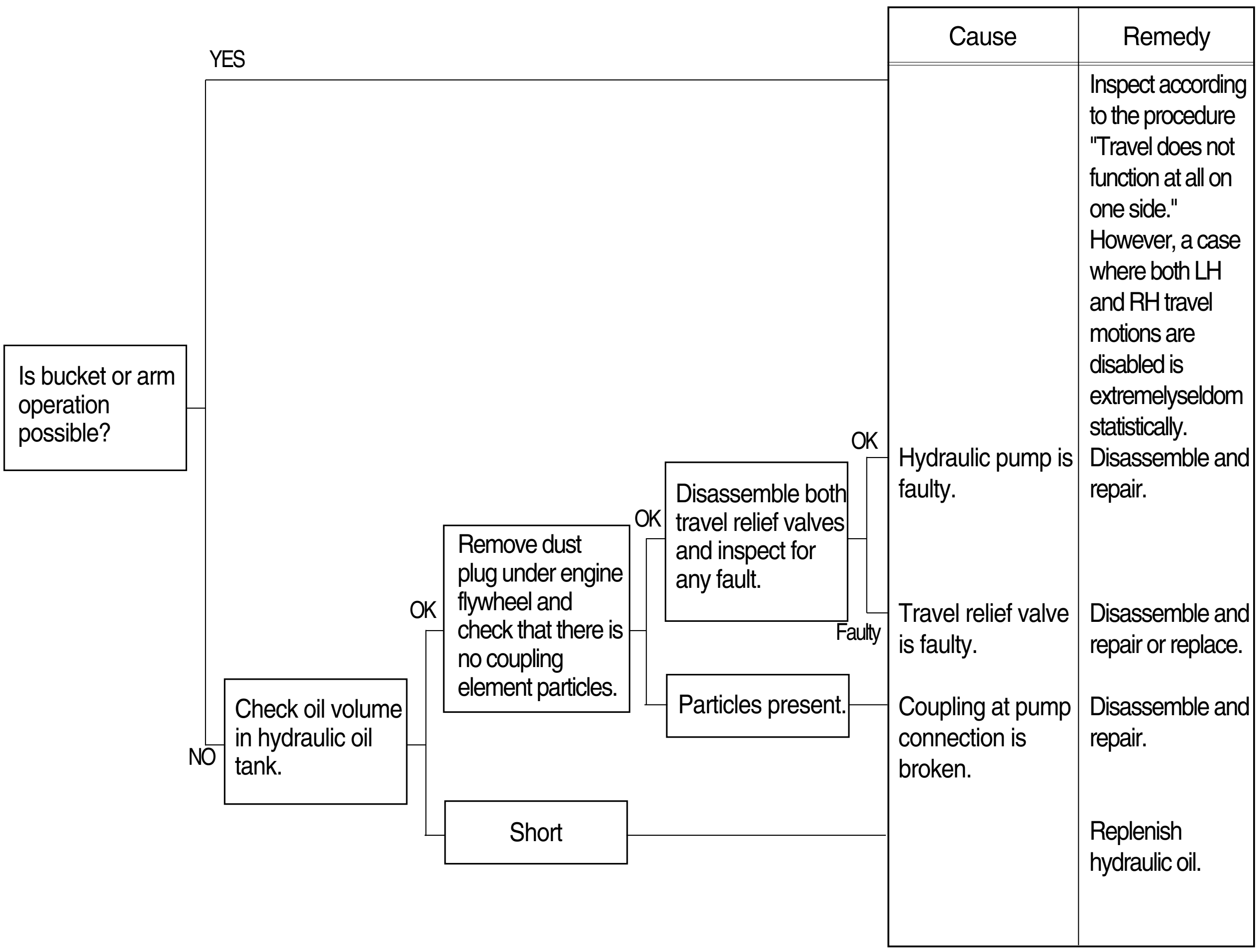


Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
ⓐ	
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble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

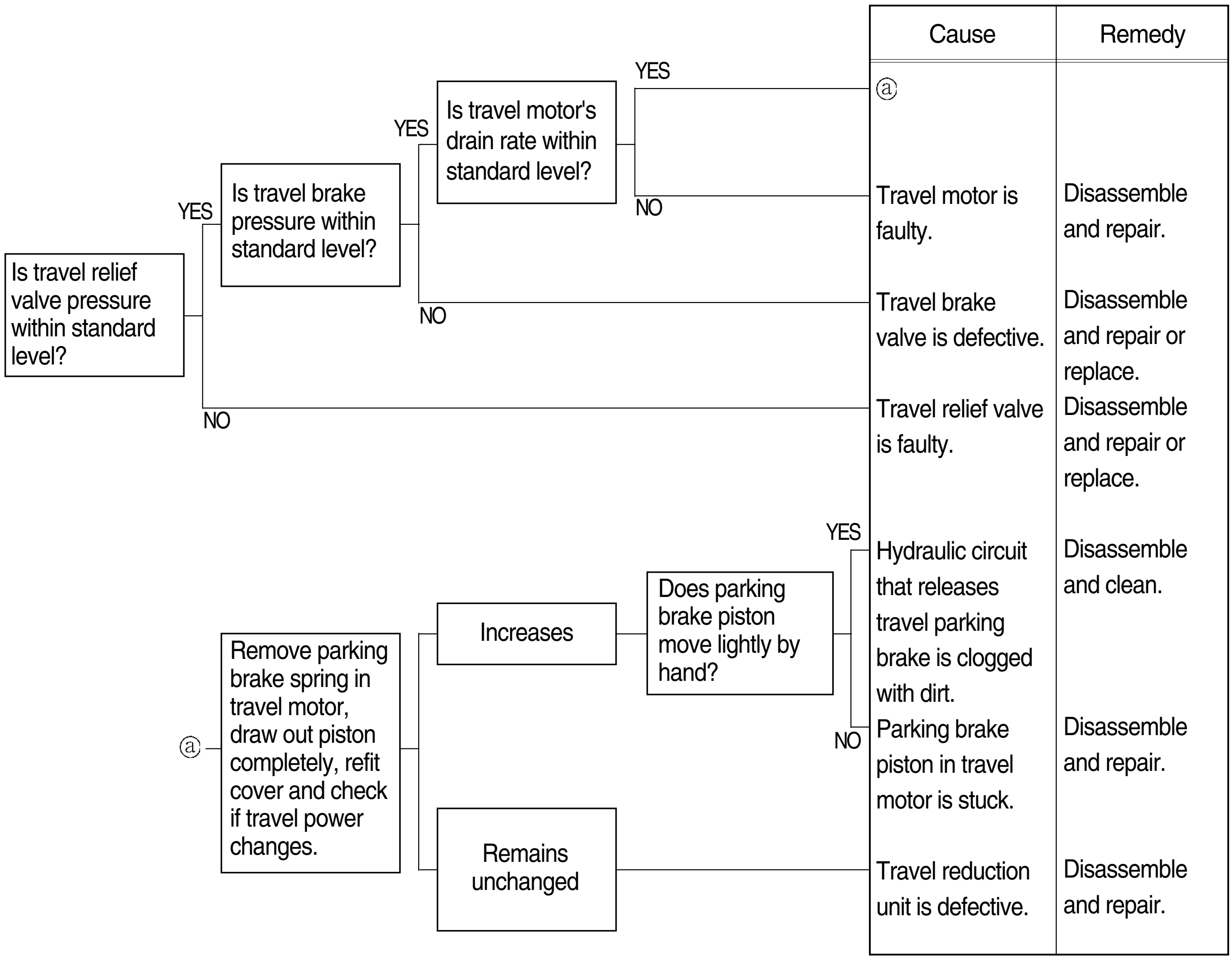
3) MACHINE DOES NOT STOP ON A SLOPE
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

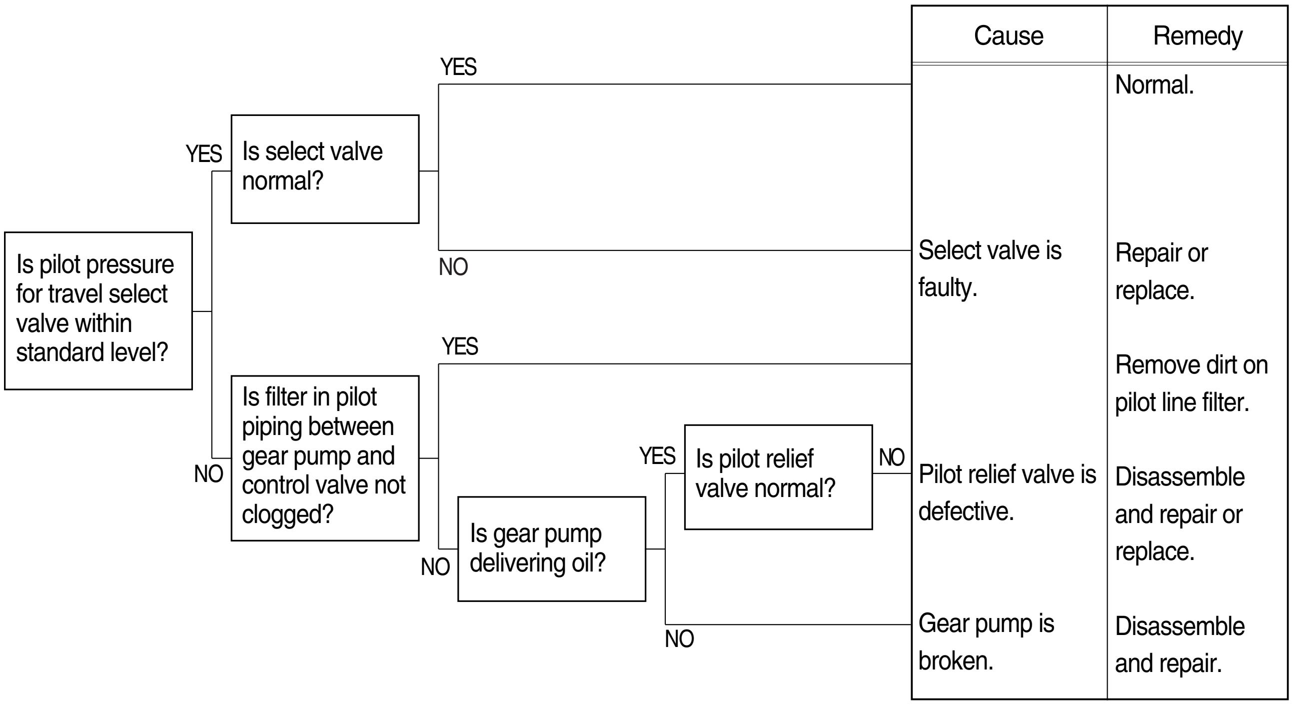


5) TRAVEL ACTION IS POWERLESS(Travel only)



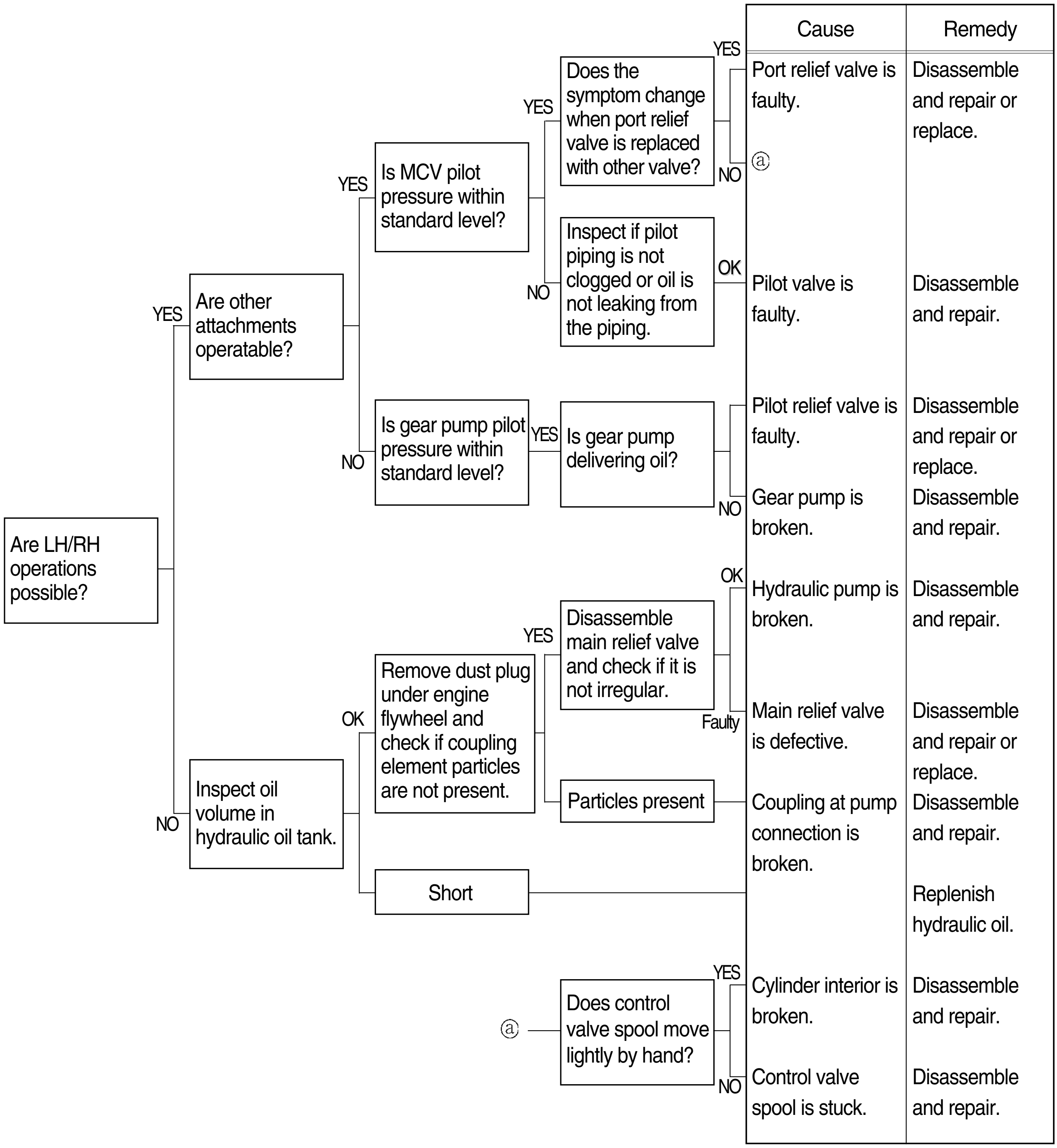
6) MACHINE RUNS RECKLESSLY ON A SLOPE

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

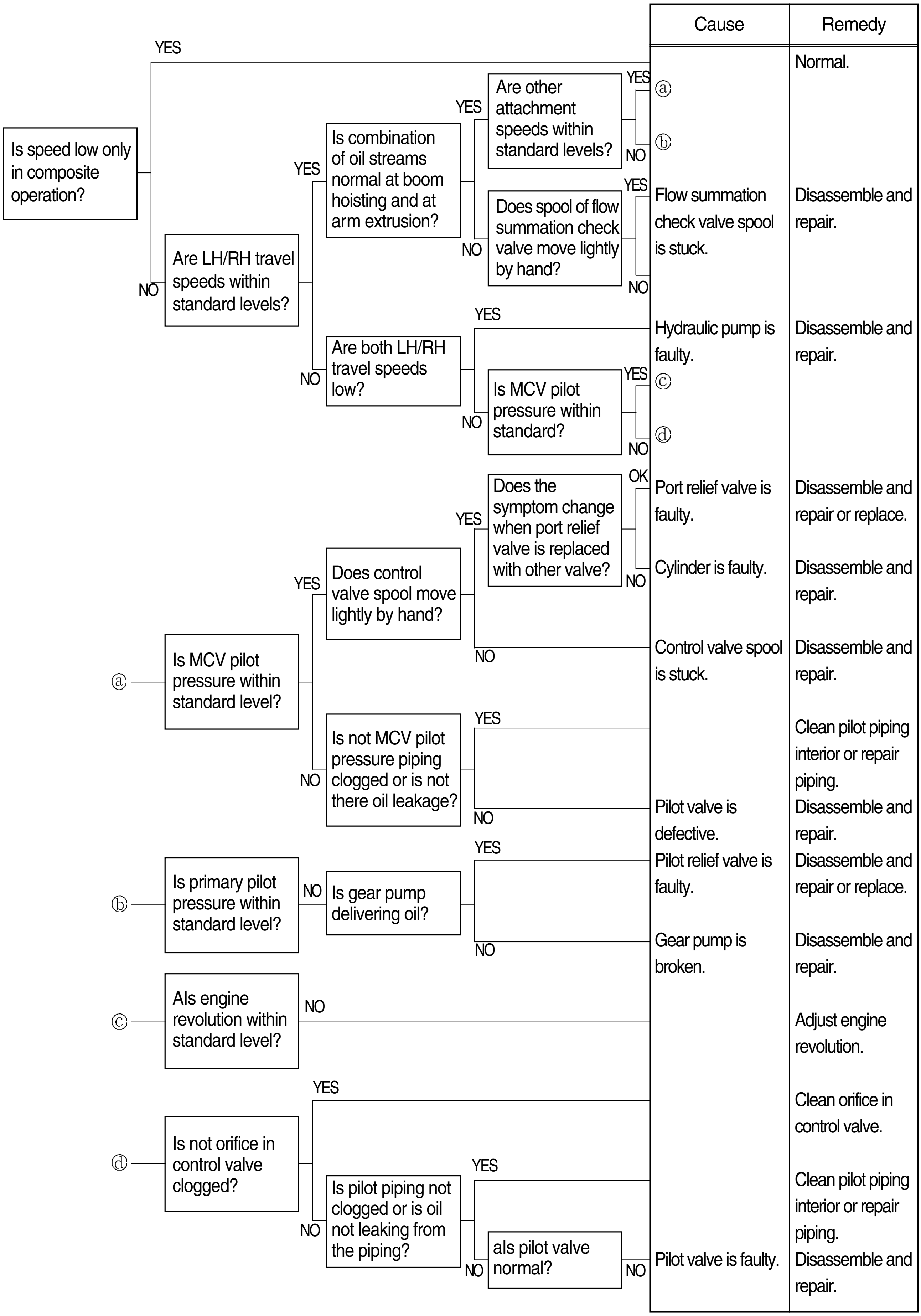


6. ATTACHMENT SYSTEM

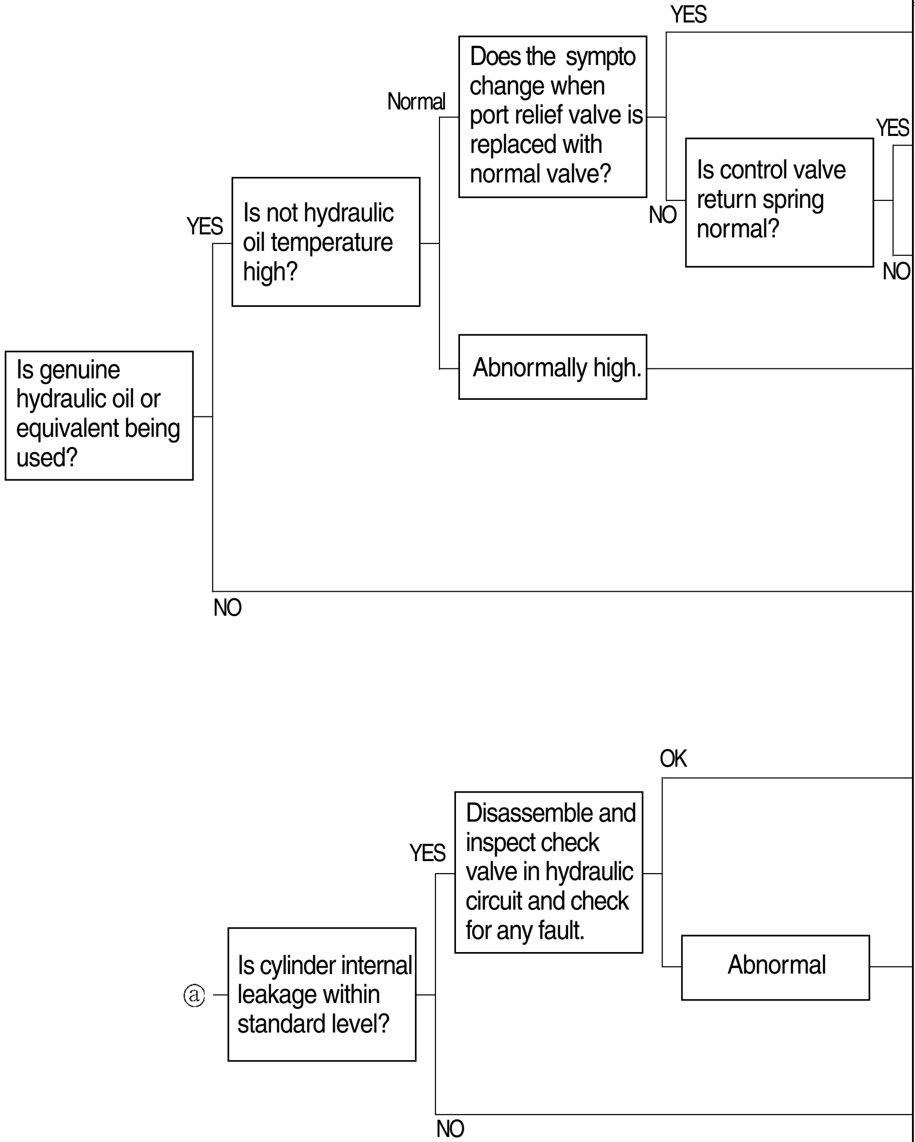
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

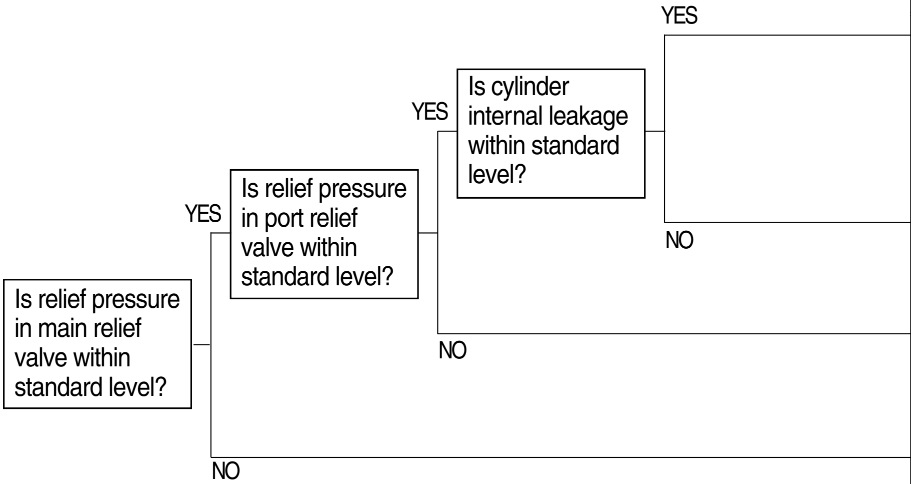


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



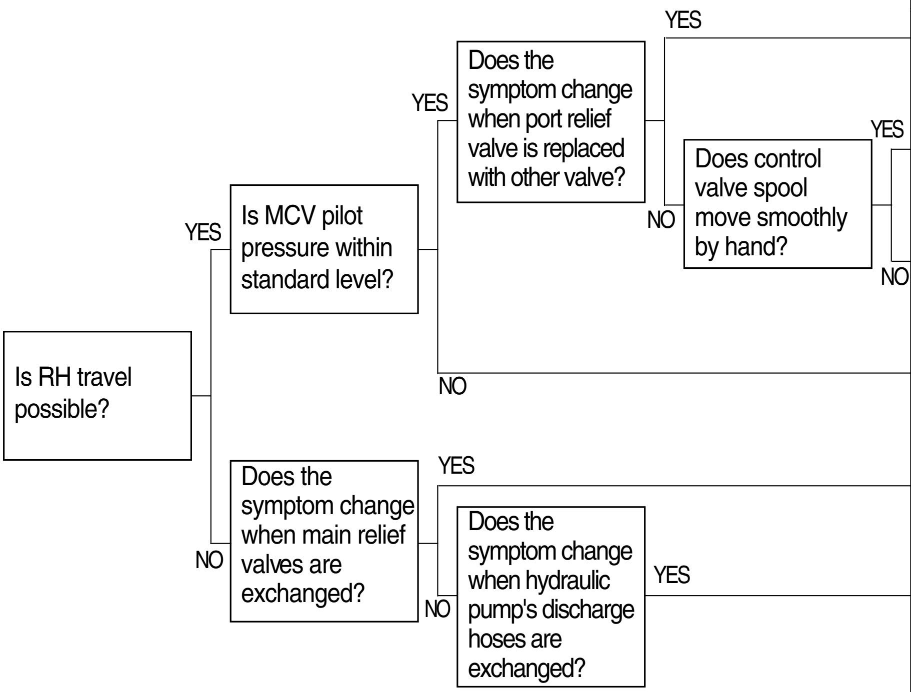
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
ⓐ	
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



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

5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



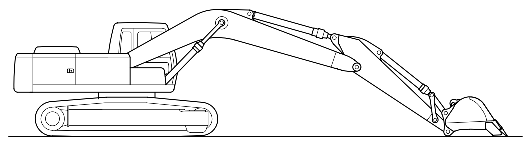
Cause	Remedy
Port relief valve is defective.	Disassemble and repair or replace.
Cylinder interior is broken.	Disassemble and repair.
Control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
Main relief valve is faulty.	Adjust pressure, repair or replace.
Hydraulic pump is broken.	Disassemble and repair.

6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

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

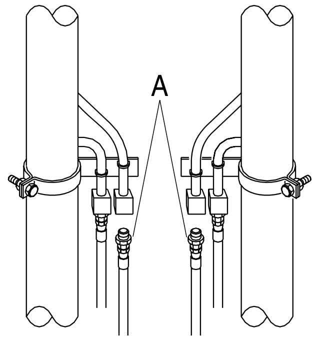
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



R29076TS01

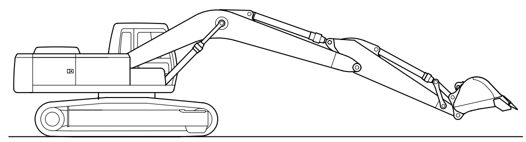
2. Disconnect hose(A) from rod side of boom cylinder and drain oil from cylinders and hose.(Put cups on piping and hose ends)



6-20(2) 290-7

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

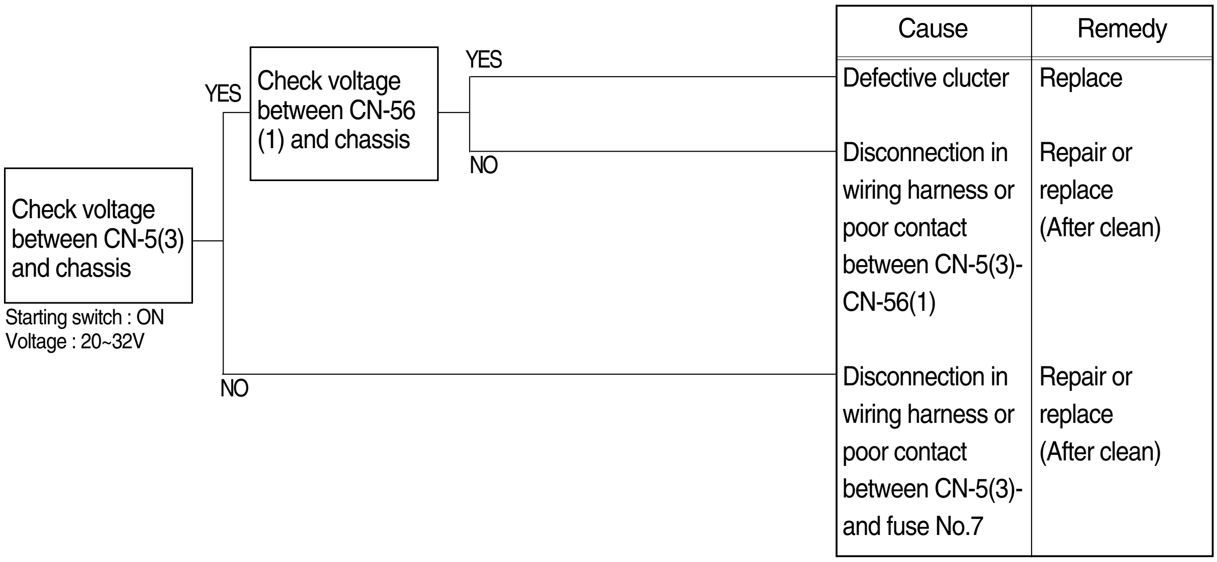
   If oil leaks from piping side and boom cylinder rod is retracted there is an internal leak in the cylinder.
   If no oil leaks from piping side and boom cylinder rod is retracted, there is an internal leak in the control valve.

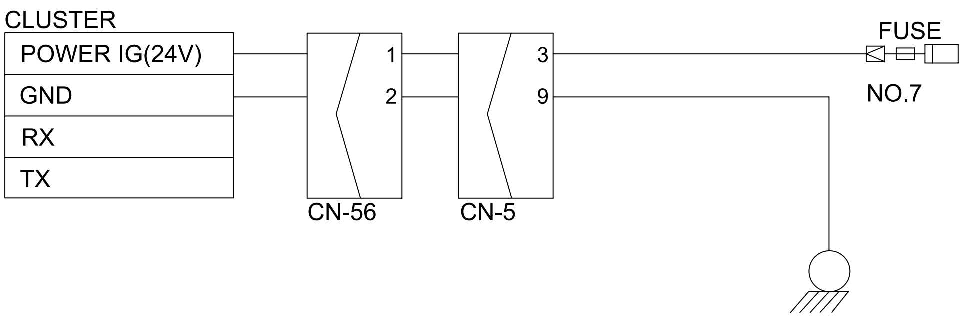


R29076TS01

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





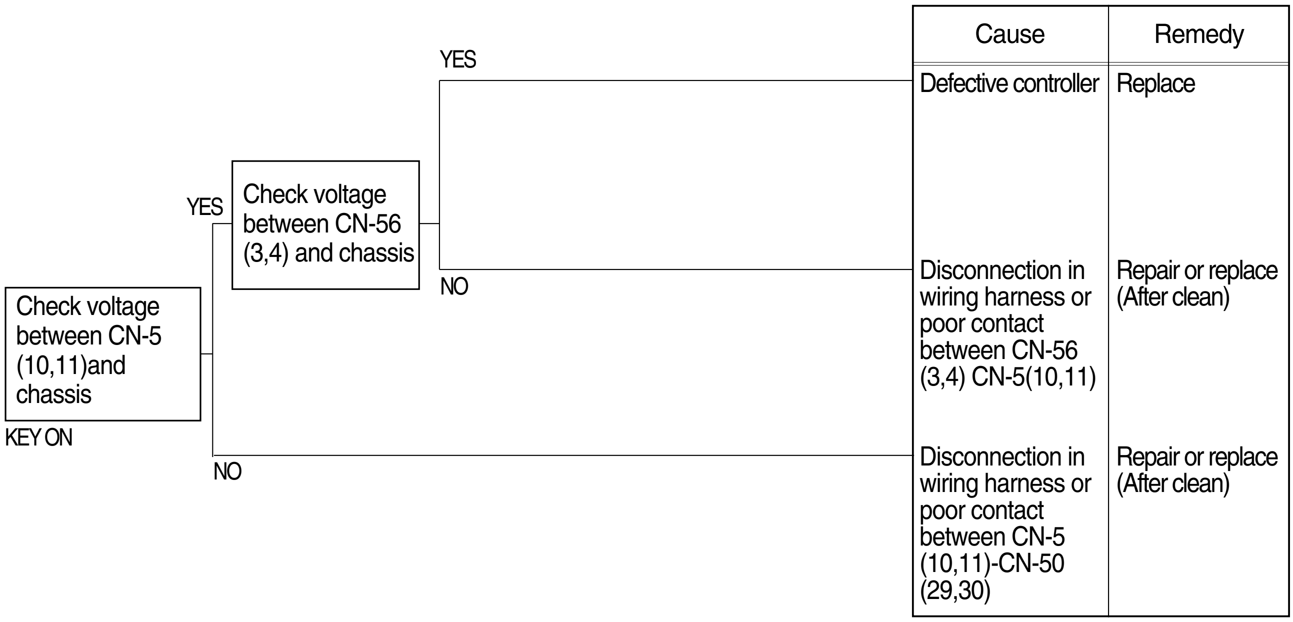
Check voltage

YES	20 ~ 32V
NO	0V

R32076ES01

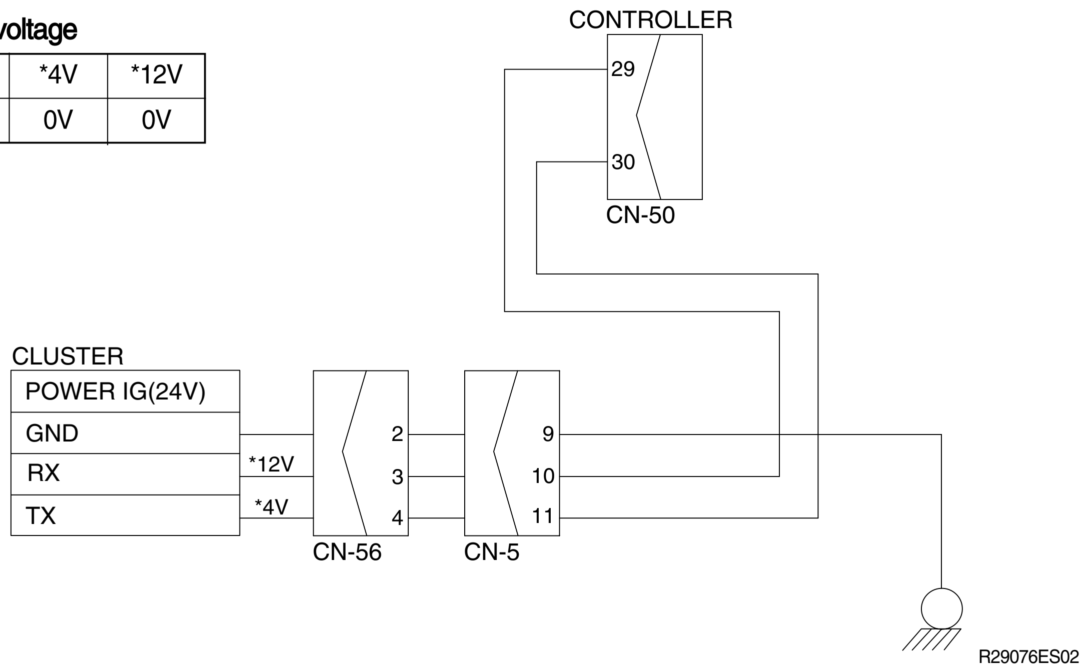
2. COMMUNICATION ERROR "Co : Er" FLASHES ON THE CLUSTER

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



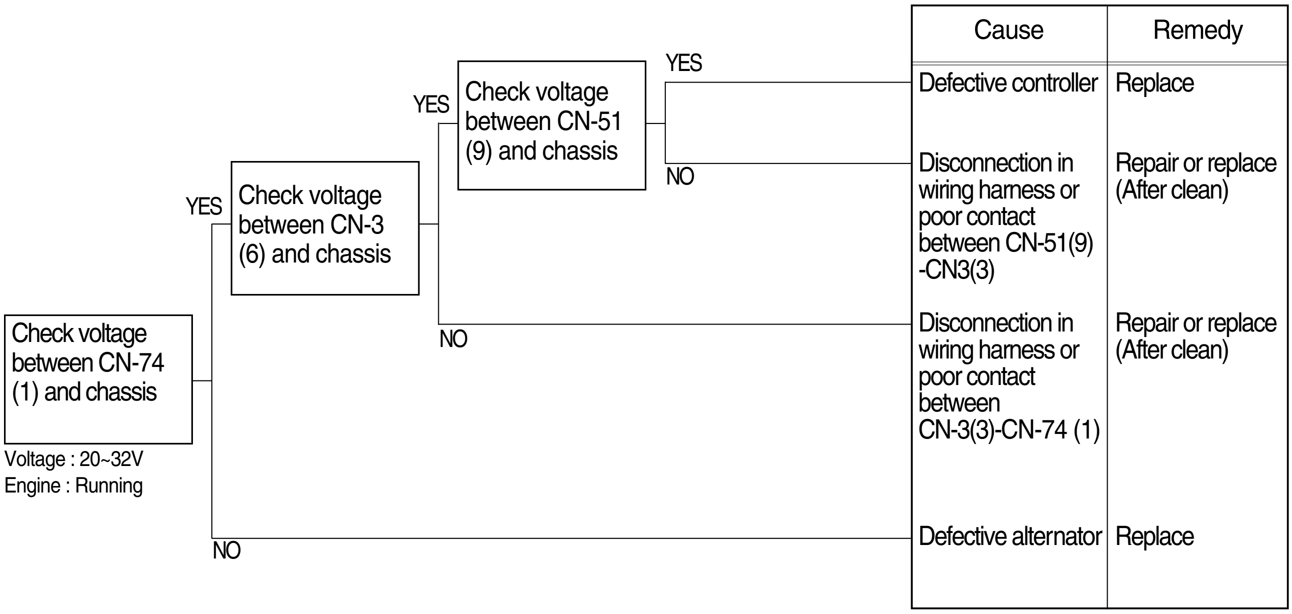
Check voltage

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



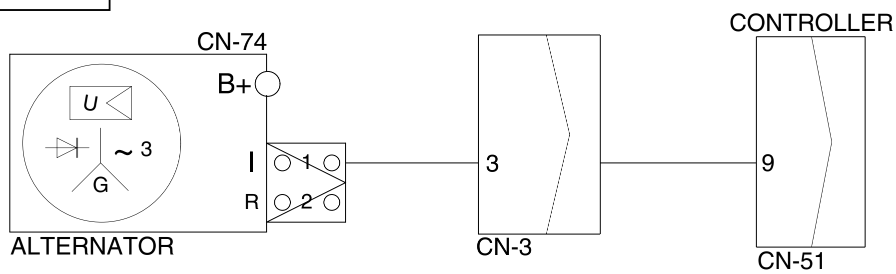
3. BATTERY CHARGING WARNING LAMP LIGHTS UP(Starting switch : ON)

- 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

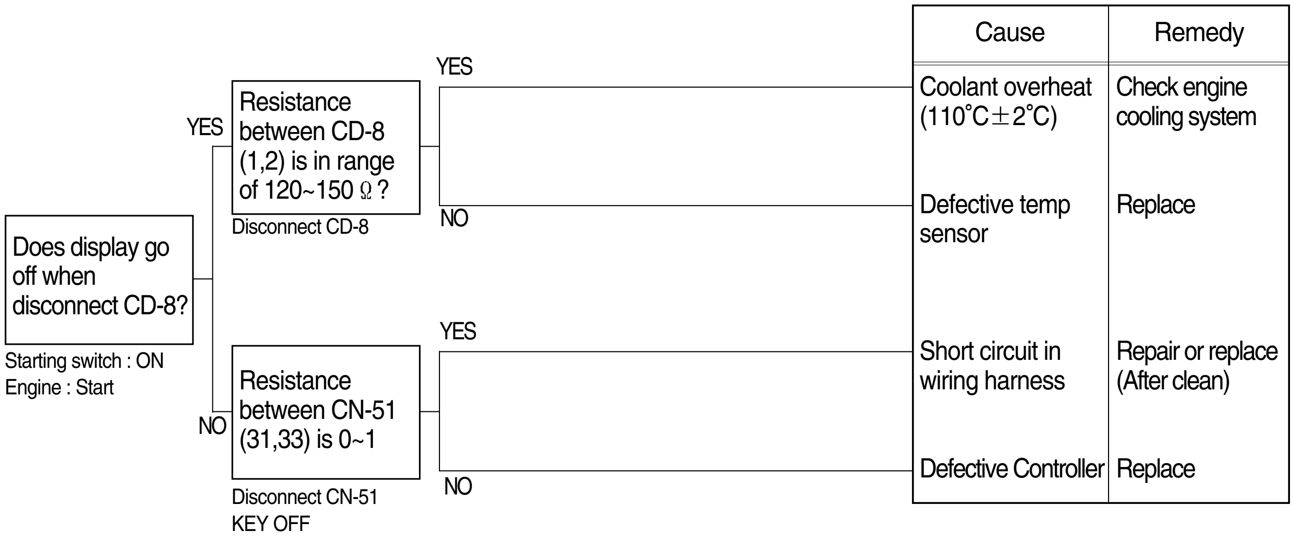
YES	20 ~ 32V
NO	0V



34076ES02

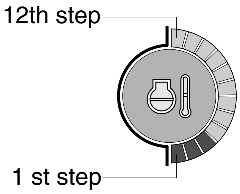
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP(Engine is started)

- 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.



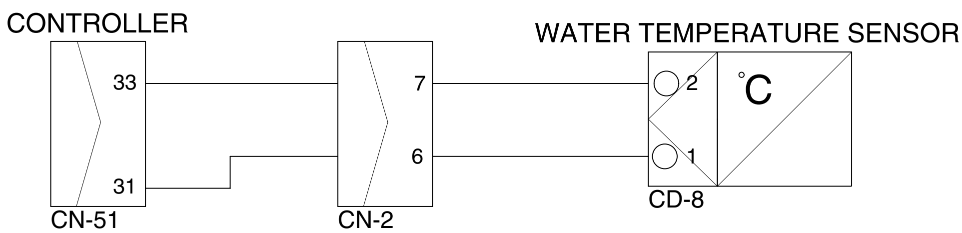
Serial no : -#0007

Serial no : #0008-



Check Table

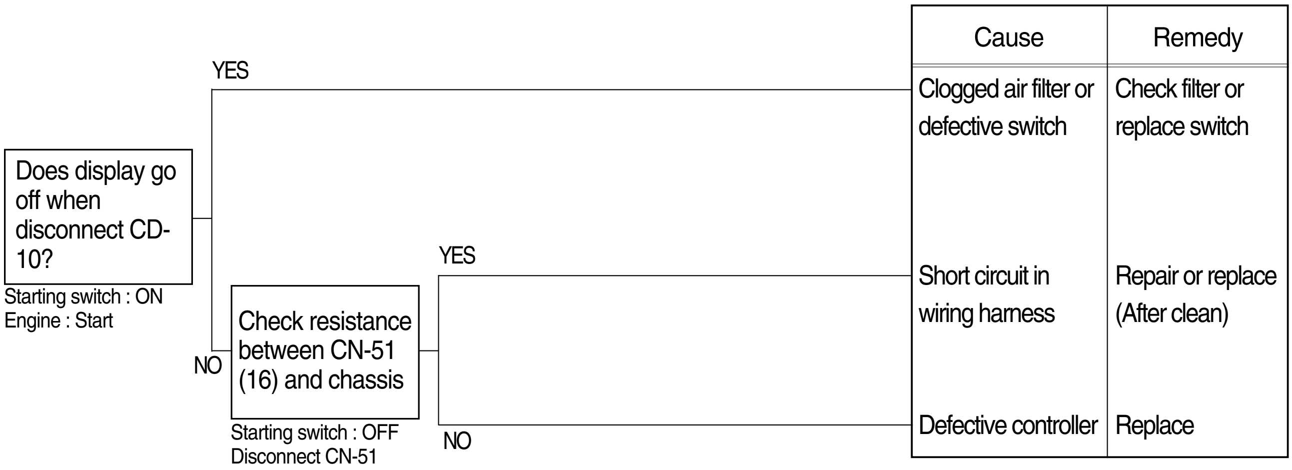
Range	1st step	2nd~10th step	11th~12th step
Temperature	~29℃	30~105℃	105℃ ~



30076ES03

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.



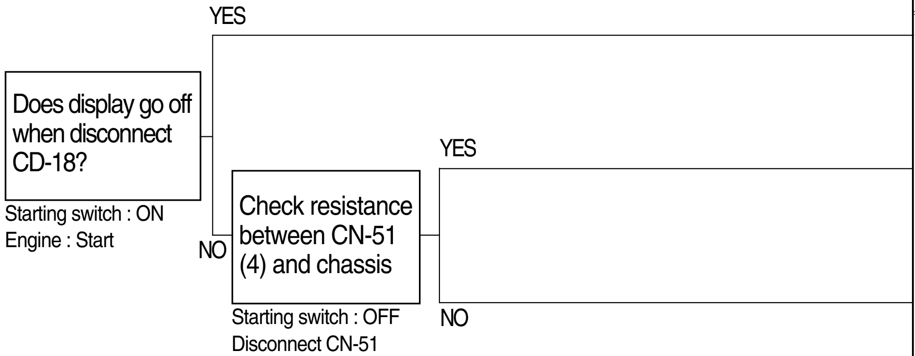
Check resistance

YES	MAX 1Ω
NO	MIN 1MΩ

25036EL05

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

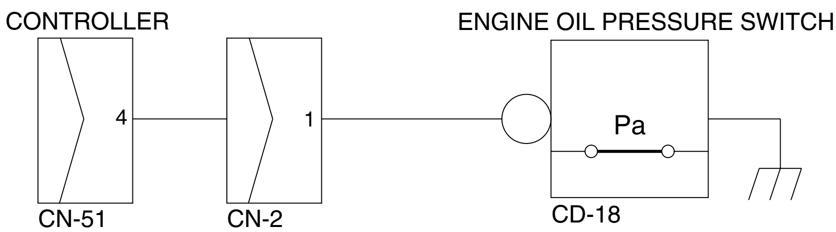
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Engine oil leakage, or defective switch	Check engine oil level or replace switch
Defective controller	Replace
Disconnection in wiring harness or poor contact between CN-51(4)-CD-18	Repair or replace (After clean)

Check resistance

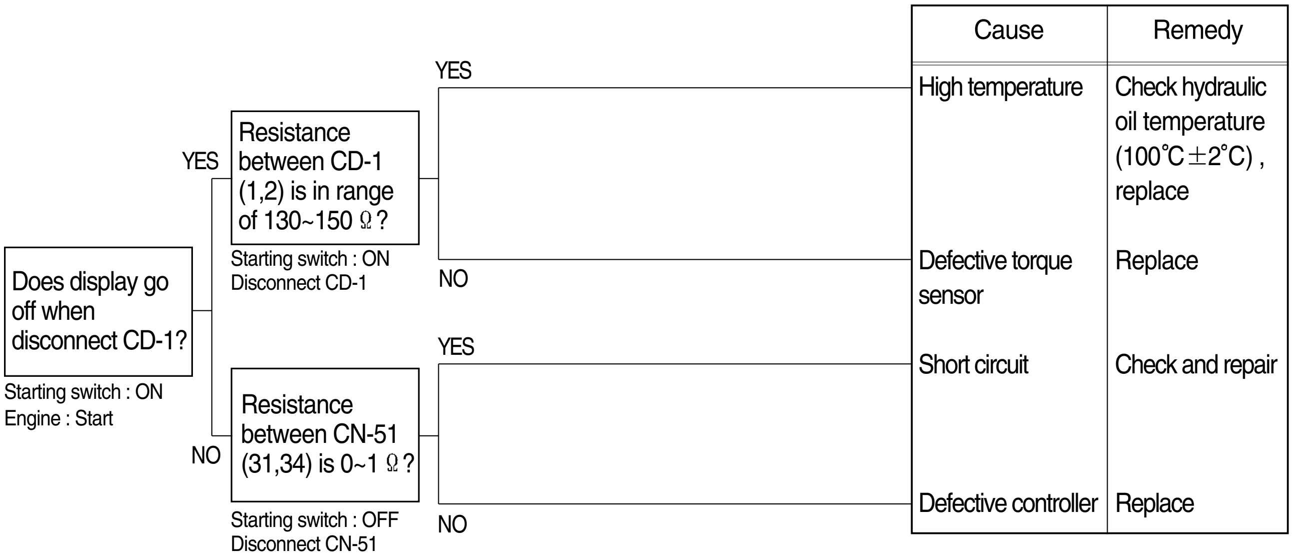
YES	MAX 1Ω
NO	MIN 1MΩ

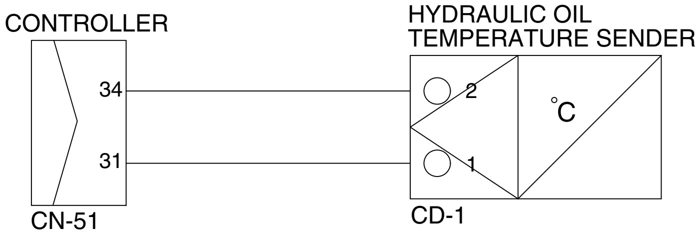


R29076ES03

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.

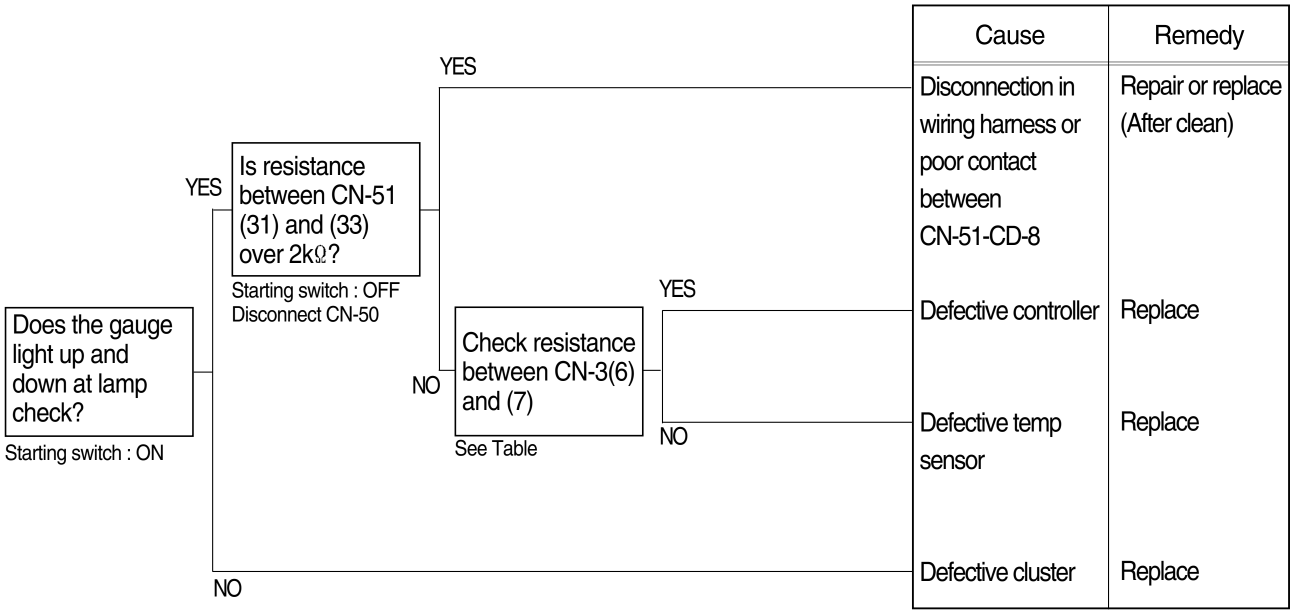




R29076ES04

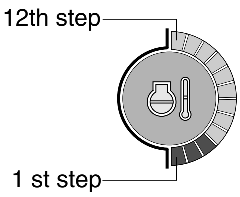
8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

- 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.



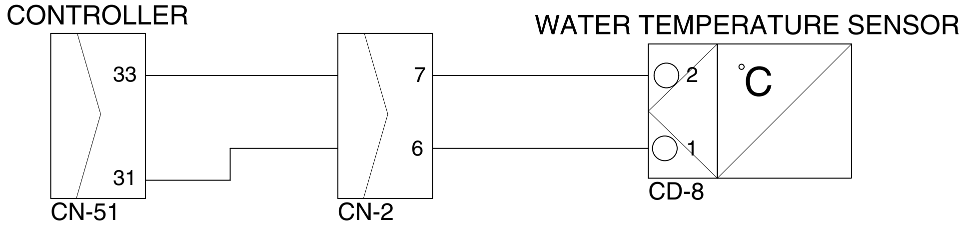
Check Table(-#0007)

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



Check Table(#0008-)

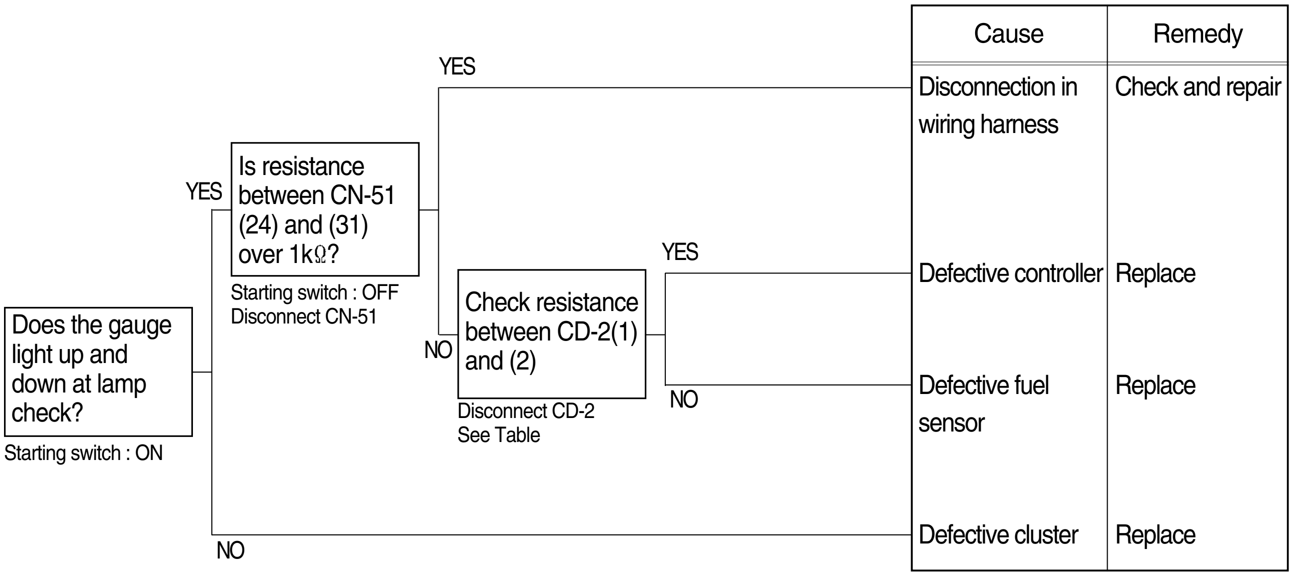
Range	1st step	2nd~10th step	11th~12th step
Temperature	~29° C	30~105℃	105℃ ~



30076ES03

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

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

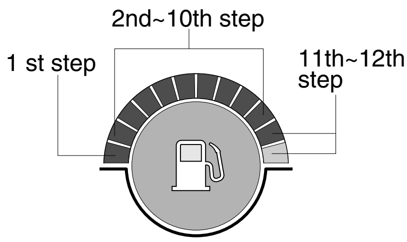


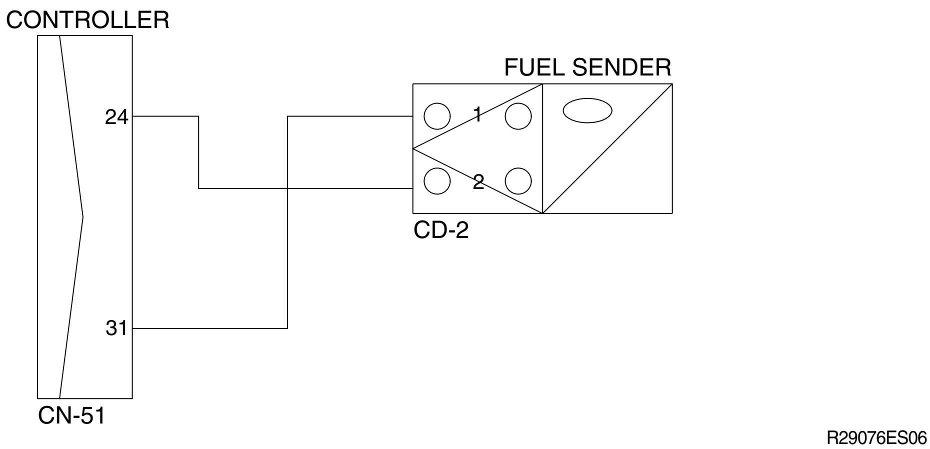
Serial no : -#0007

Check Table

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

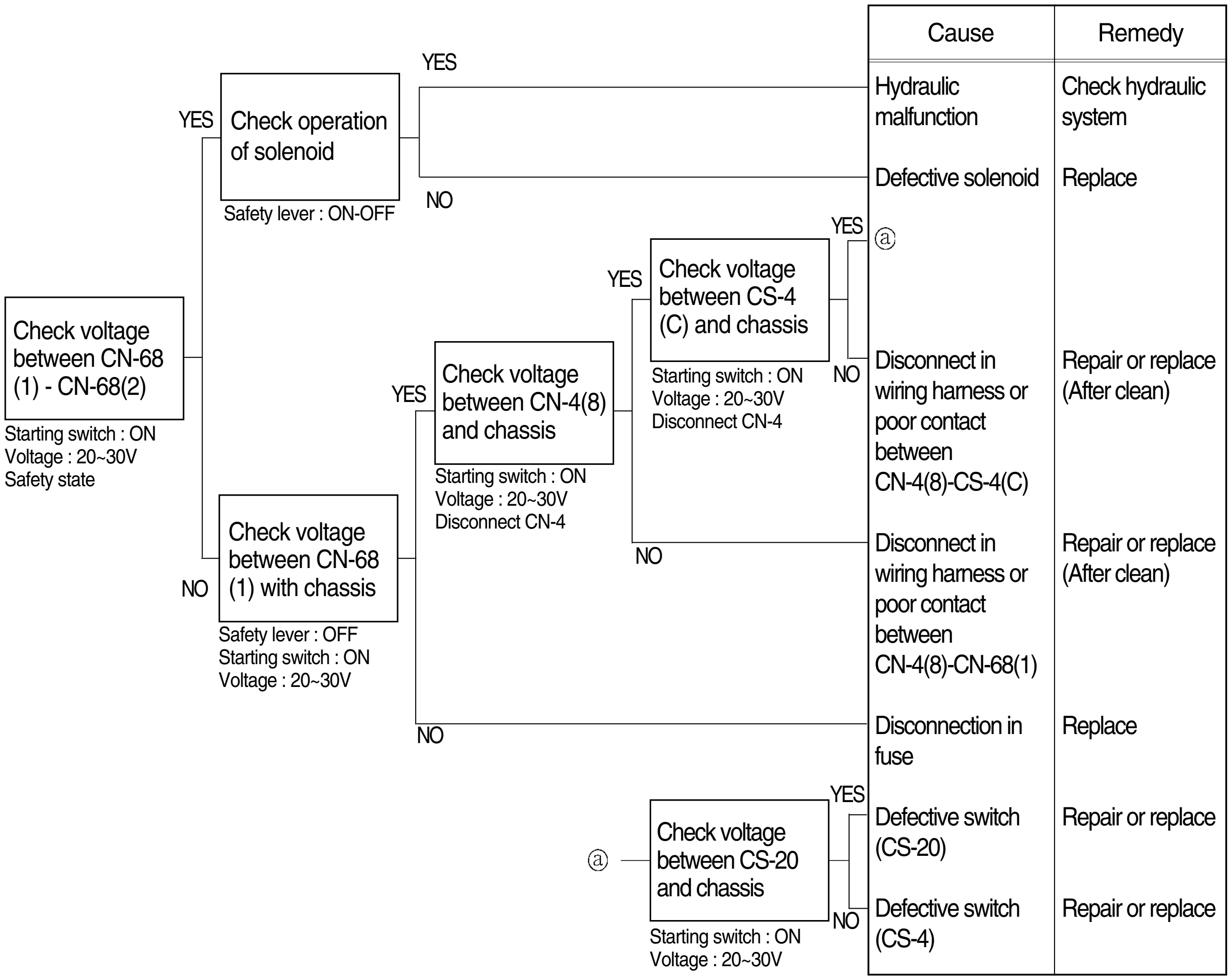
Serial no : #0008-

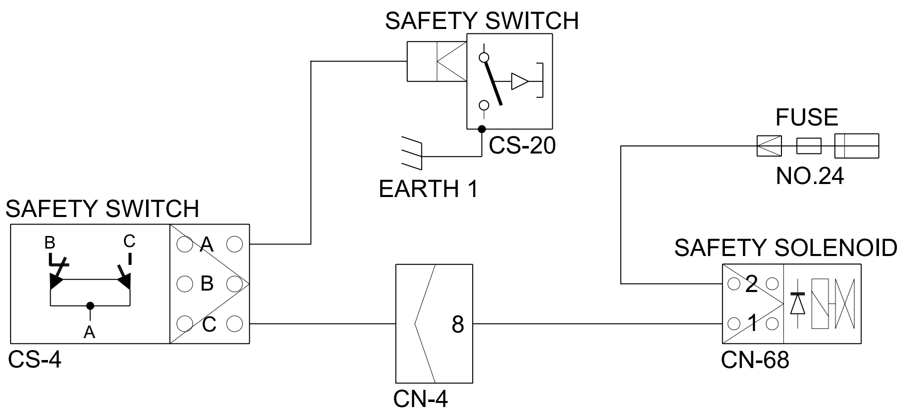




10. WHEN SAFETY SOLENOID DOES NOT OPERATE

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

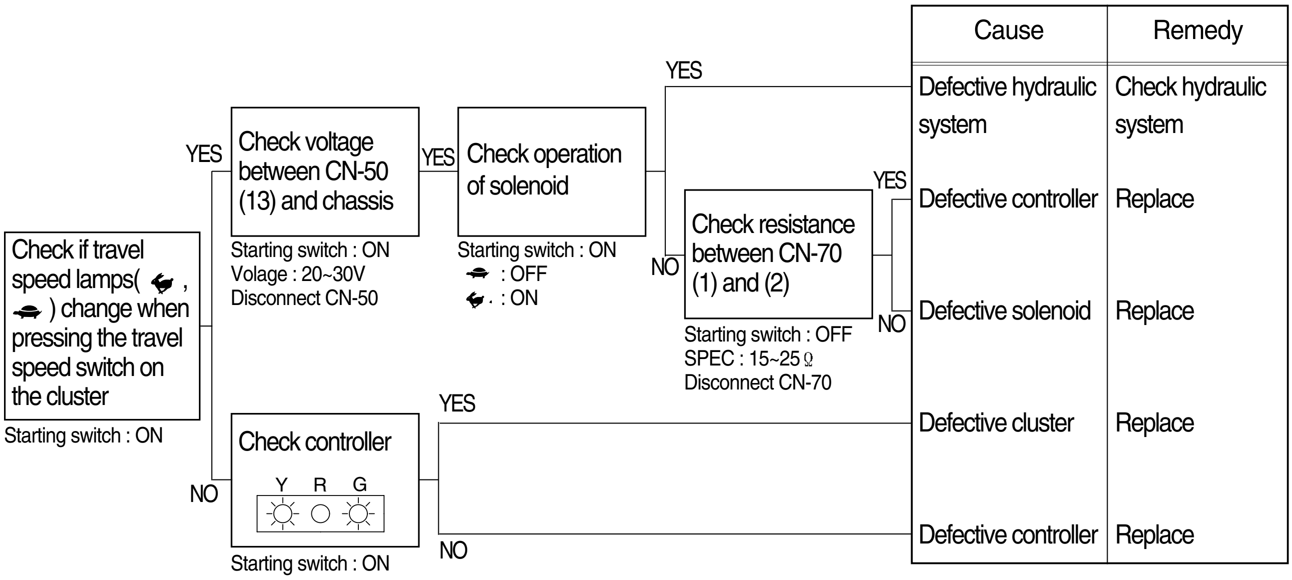


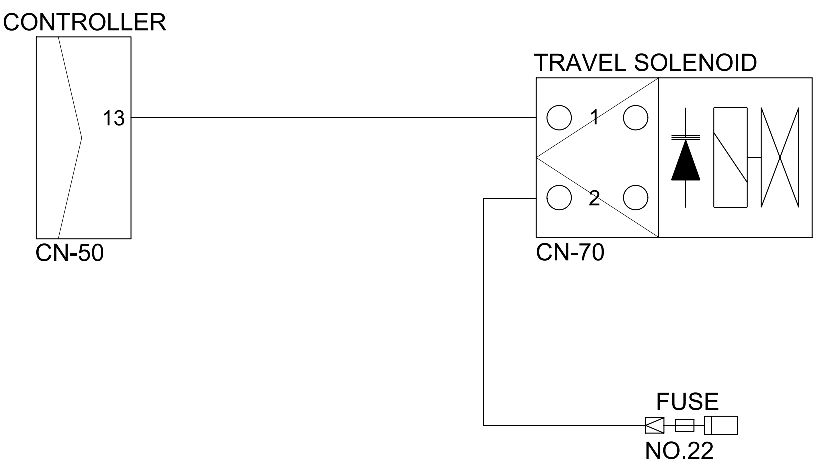


32076TS23

11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.22 .
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

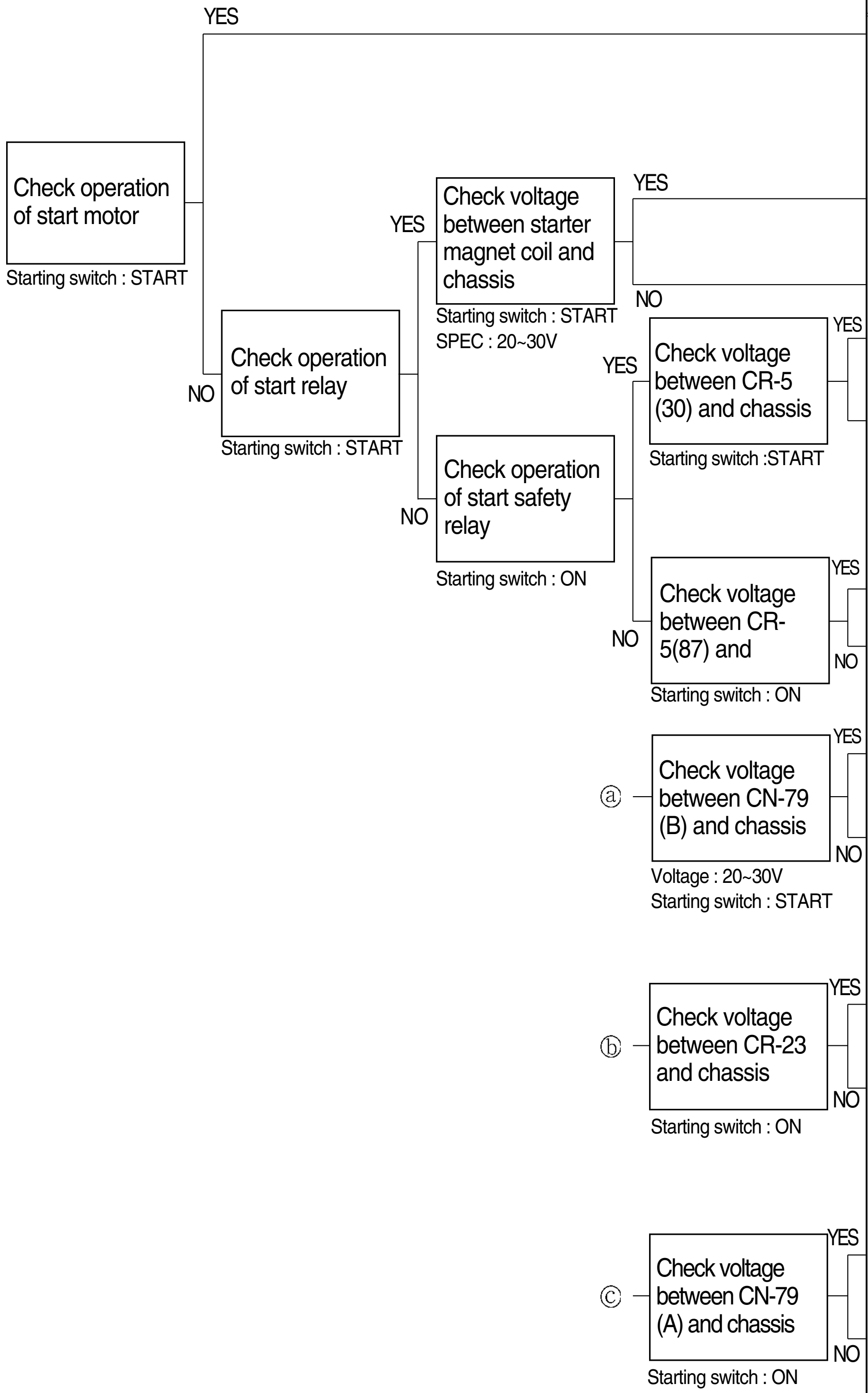




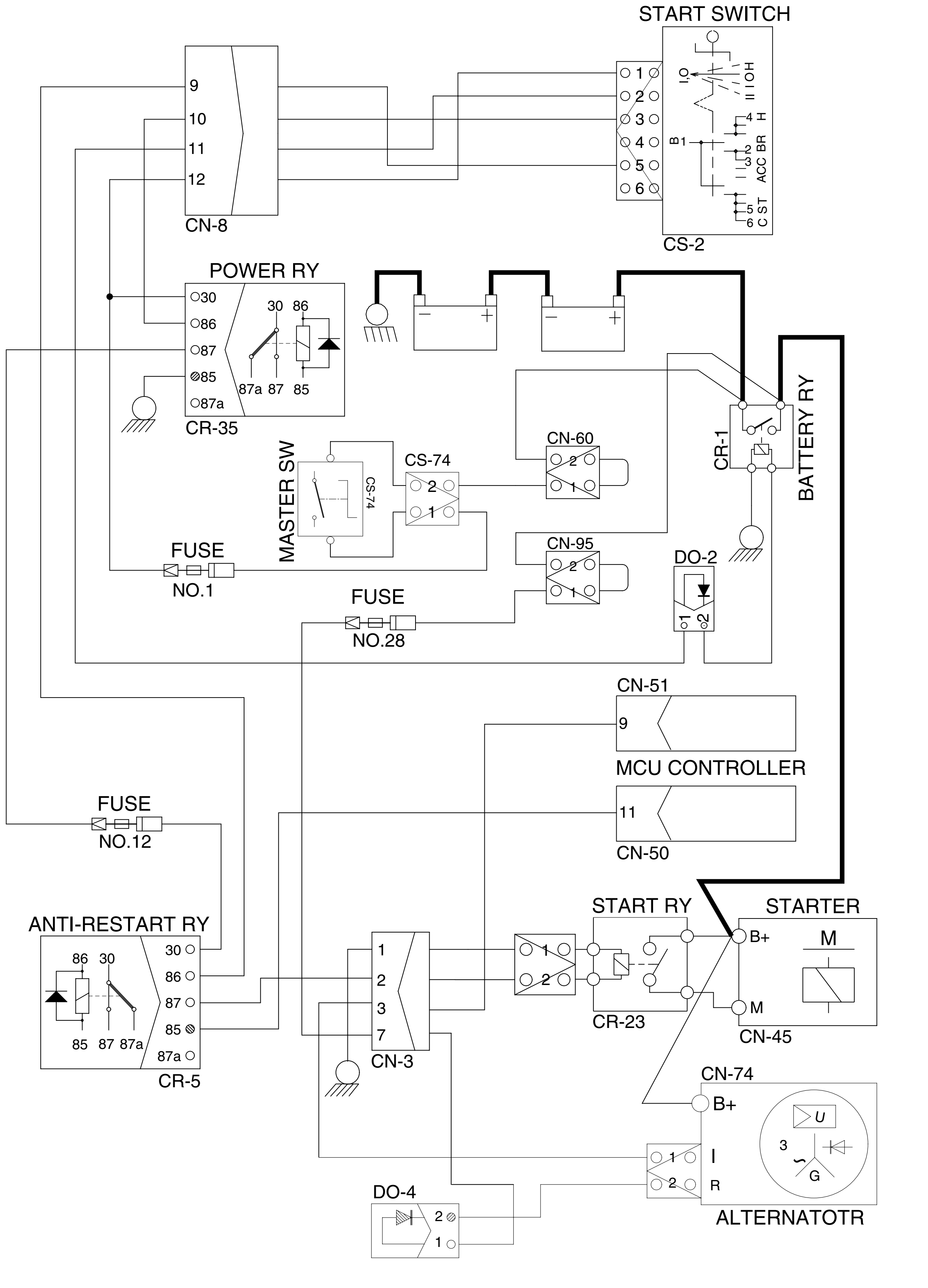
32076TS25

12. WHEN ENGINE DOES NOT START

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



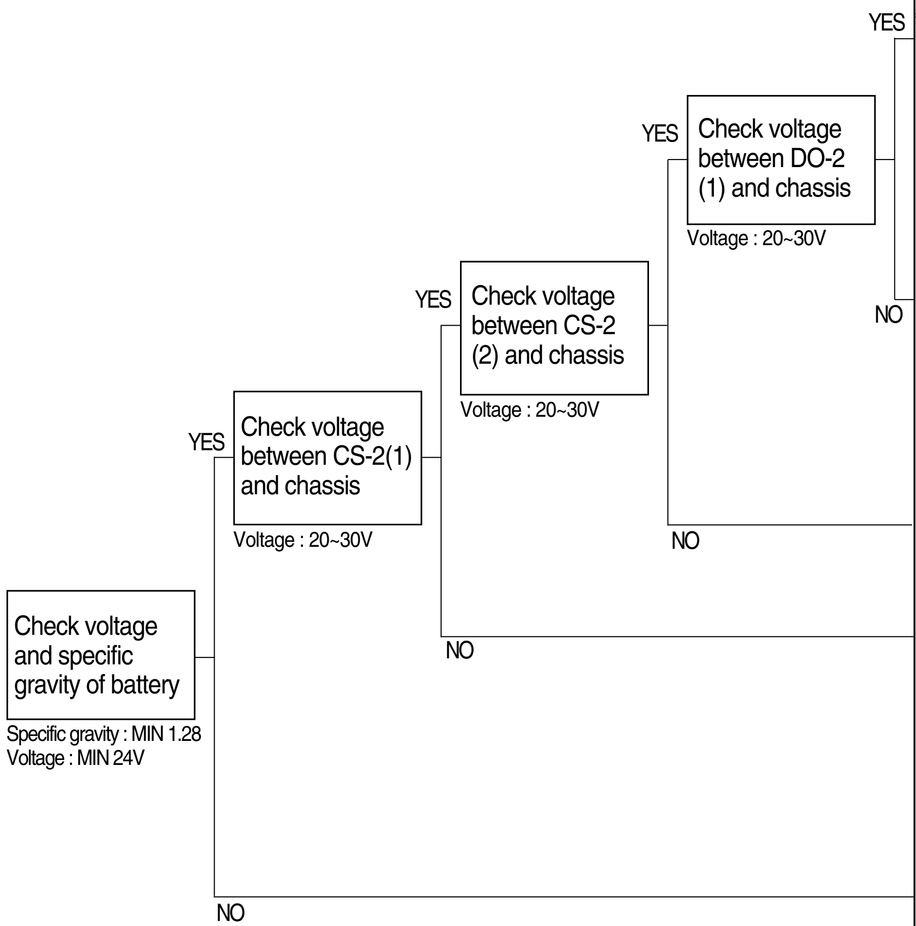
Cause	Remedy
Defective battery	Check engine system charge or replace(After checking specific gravity of battery)
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ, ⓑ	
Disconnection in wiring harness or poor contact between CR-5 (86) and CN-8(9)	Repair or replace (After clean)
Defective relay	Replace
ⓒ	
Defective fuel cut off solenoid	Replace
Disconnection in wiring harness or poor contact between CN-2(4)-CN-79(B)	Repair or replace (After clean)
Defective relay	Replace
Disconnection in wiring harness or poor contact between CR-5(87)-CR-23(2)	Repair or replace (After clean)
Defective fuel cut-off solenoid	Replace
Disconnection in wiring harness or poor contact between CN-2(7) and Fuse No.28	Repair or replace (After clean)



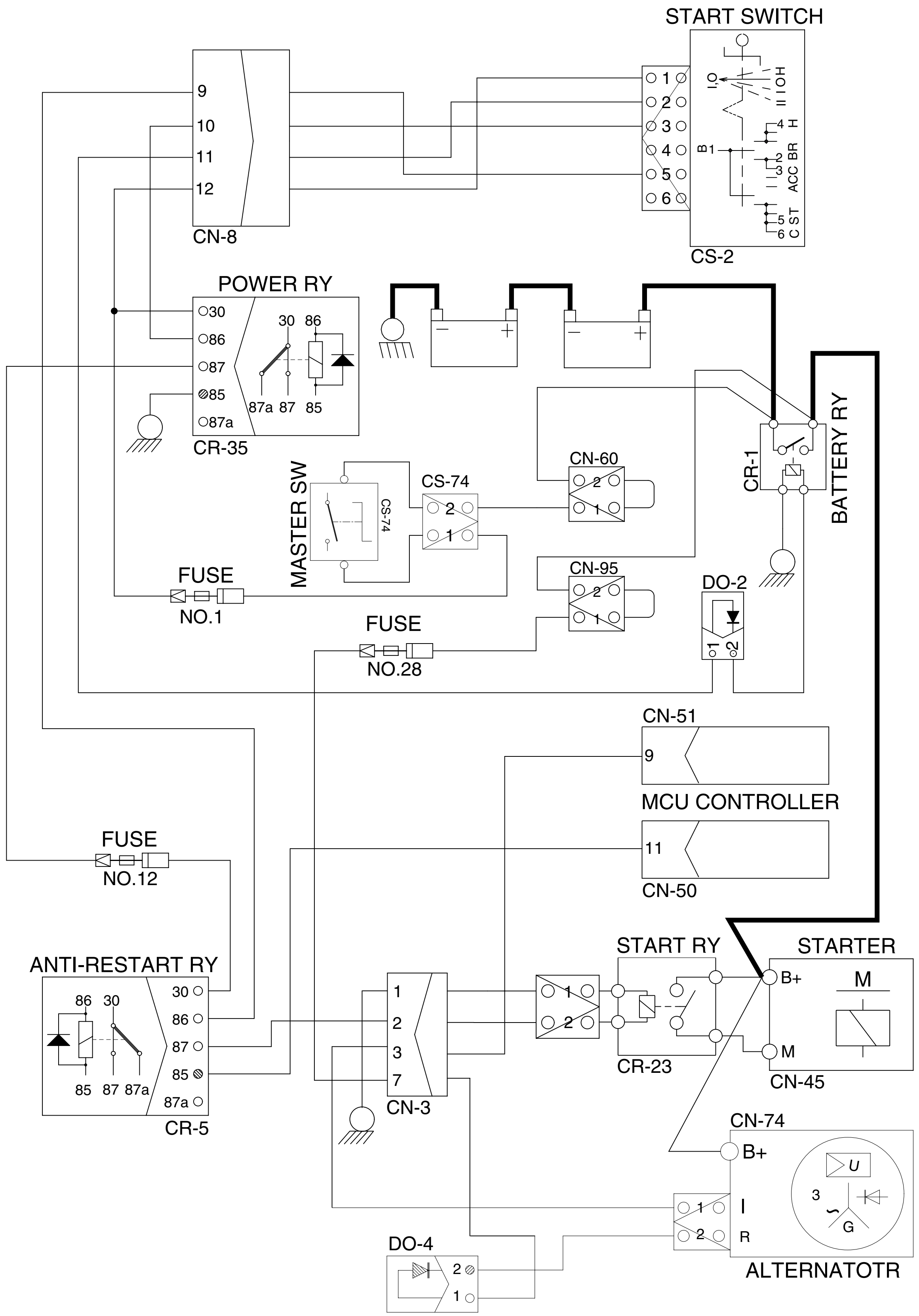
34076ES03

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 and master switch ON.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



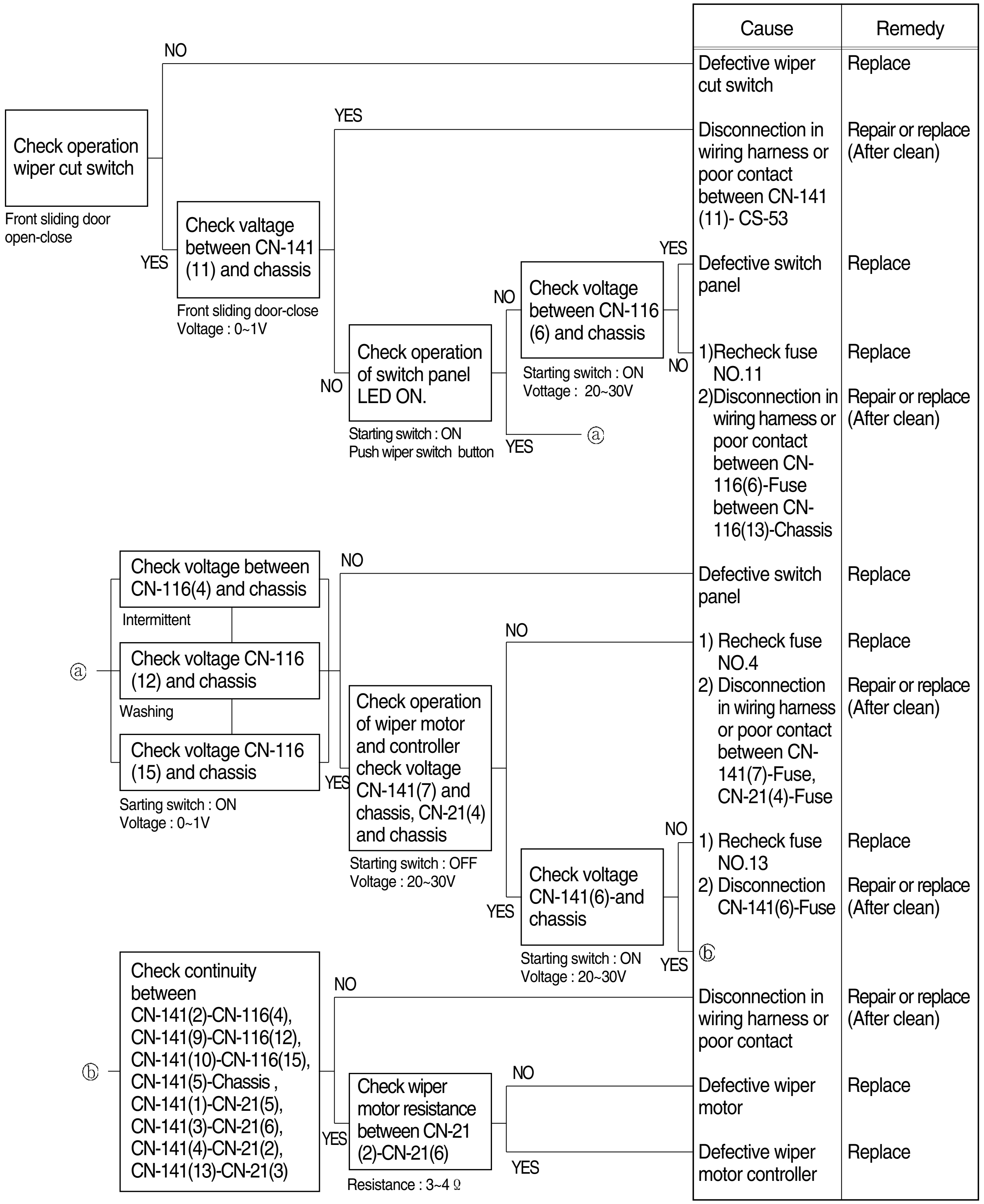
Cause	Remedy
Disconnection in wiring harness or poor contact between DO-2(2)-CR-1 or defective battery relay	Repair or replace (After clean)
Disconnection in wiring harness or poor contact between CS-2(2)-CN-8(11)- DO-2(1)	Replace
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2(1)-CN-8(12)-CN-60-CR-1-Battery	Replace
Battery capacity too low	Charge or replace (After clean)

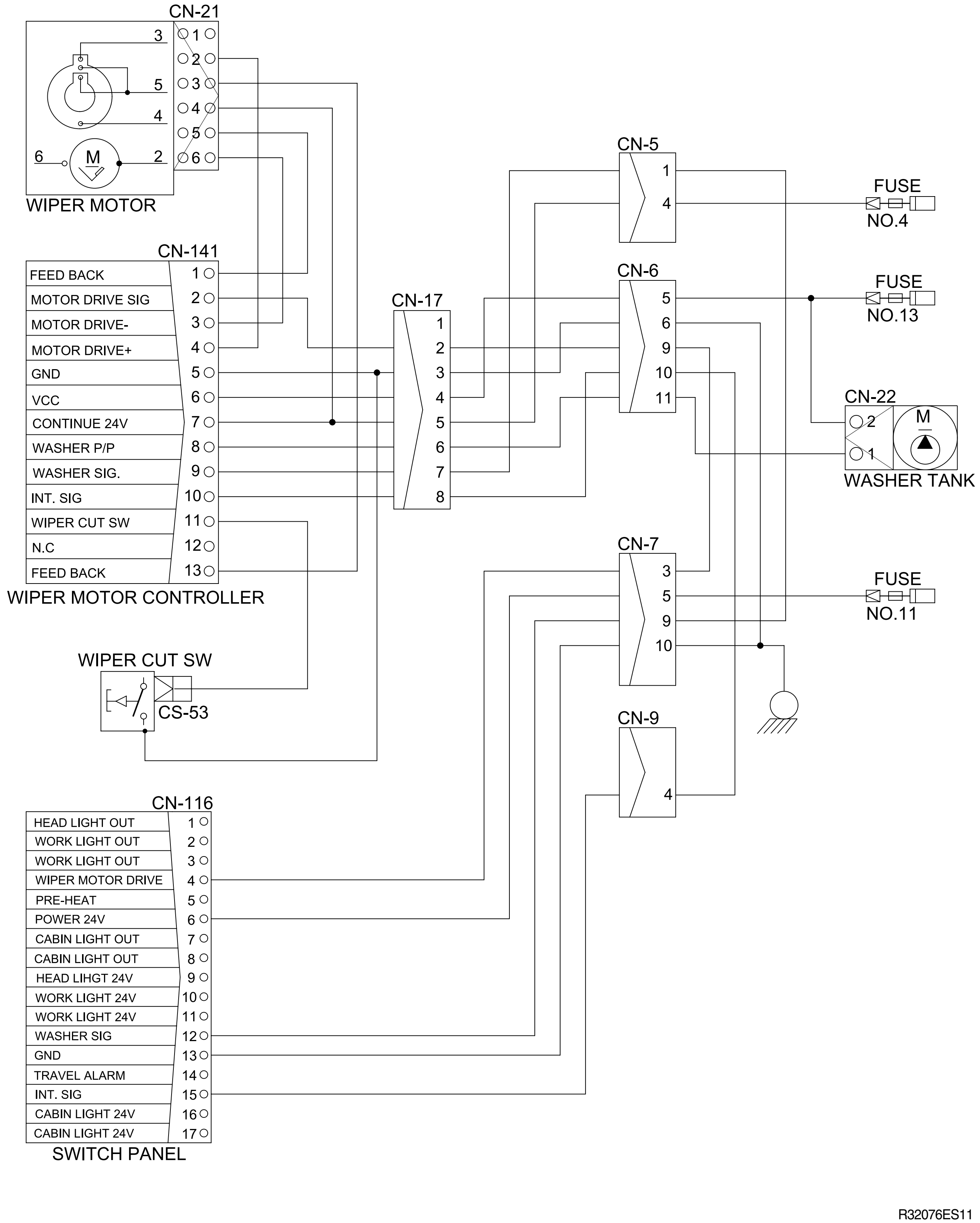


34076ES03

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

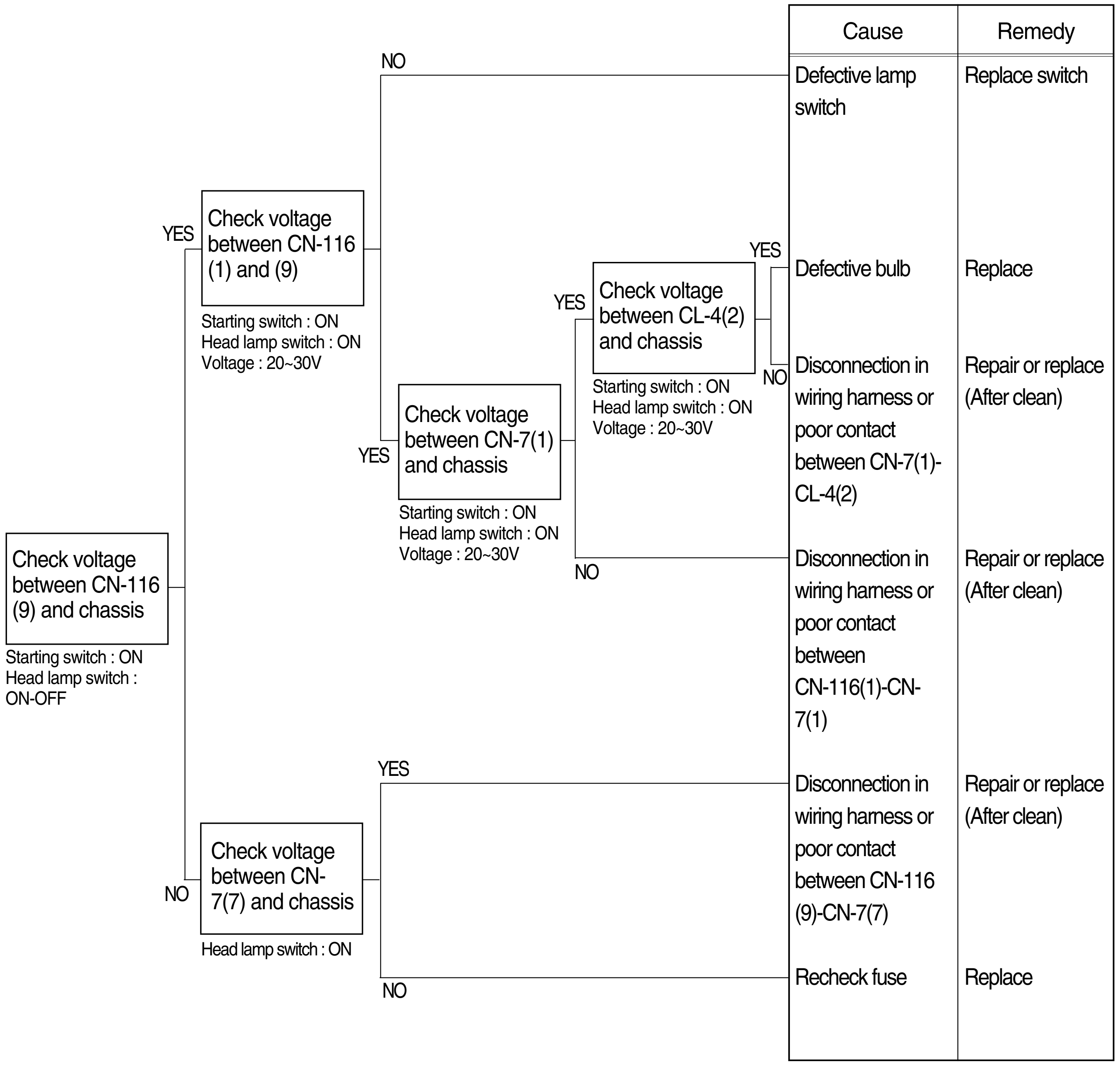
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No.4,11 and 13 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

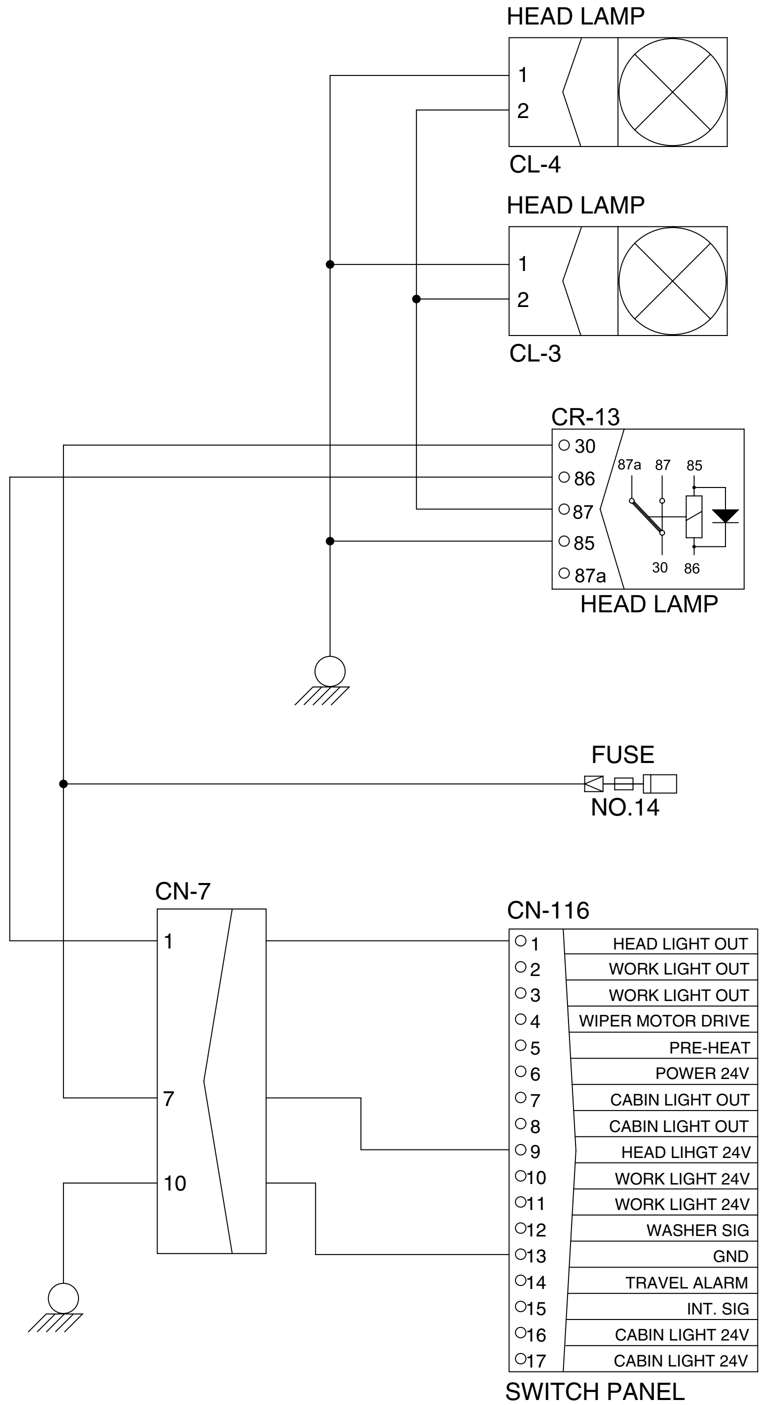




15. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

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

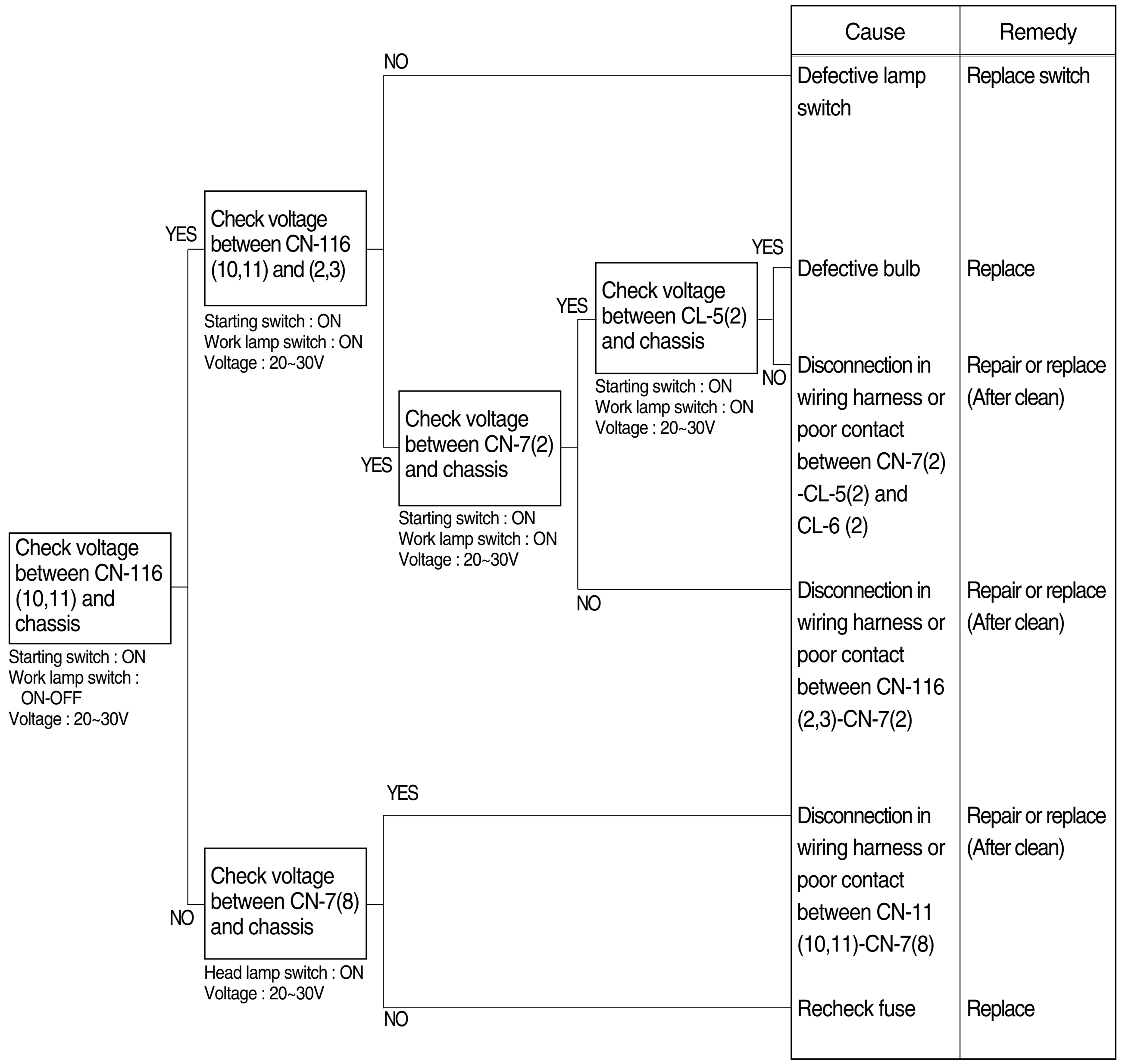


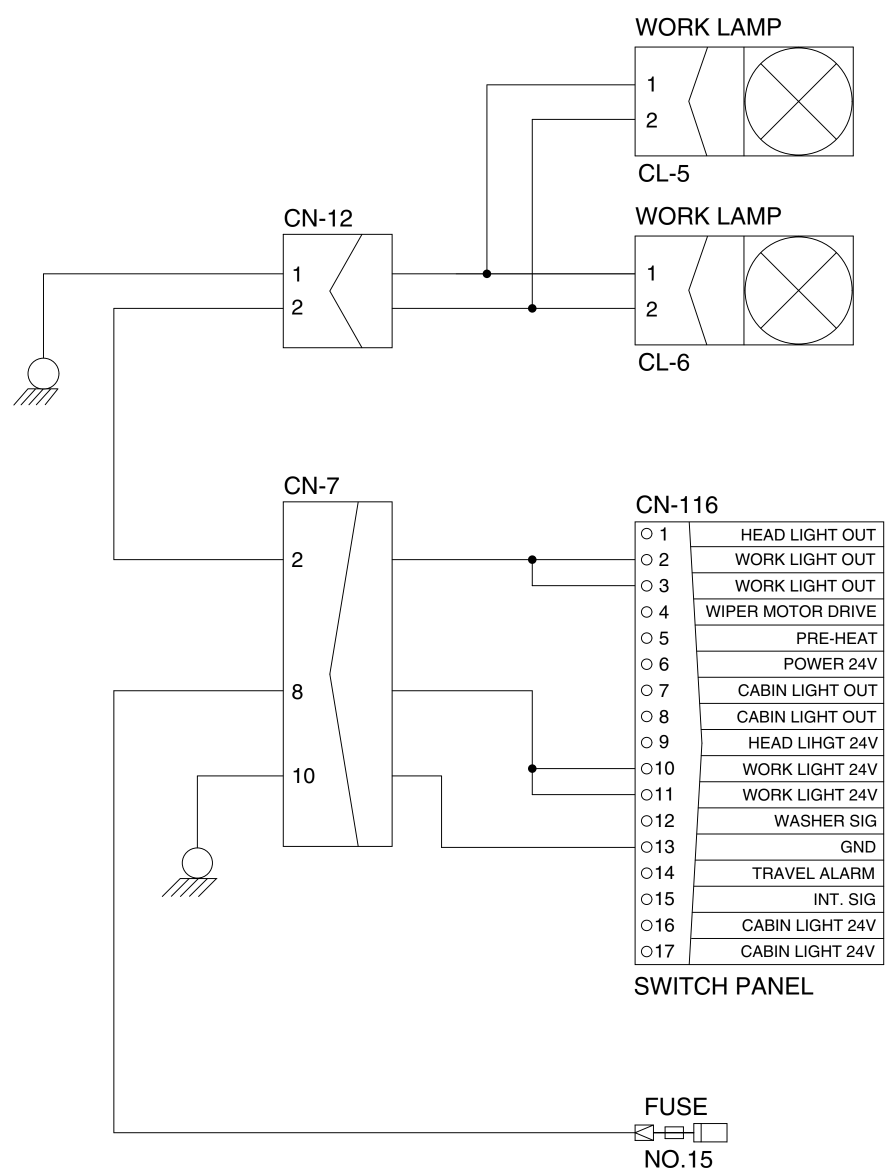


34076ES04

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





R29076ES13

GROUP 4 MECHATRONICS SYSTEM

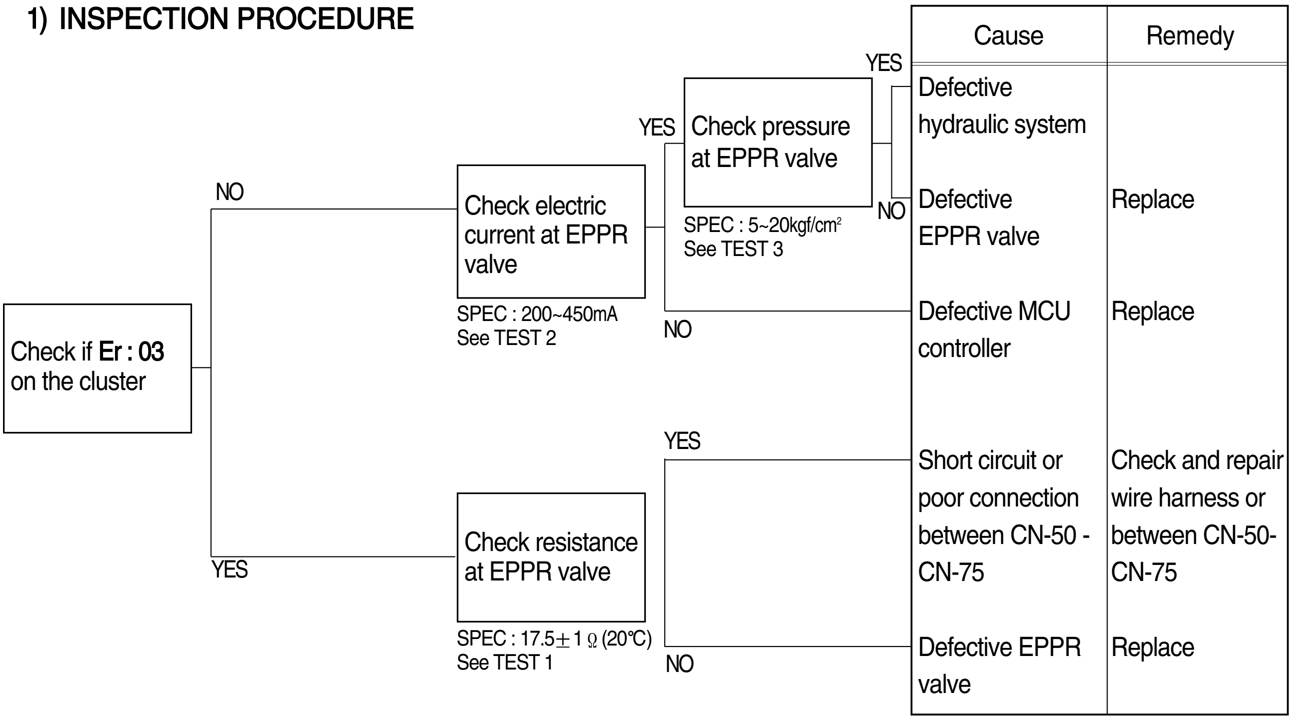
1. ALL ACTUATORS SPEED ARE SLOW

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

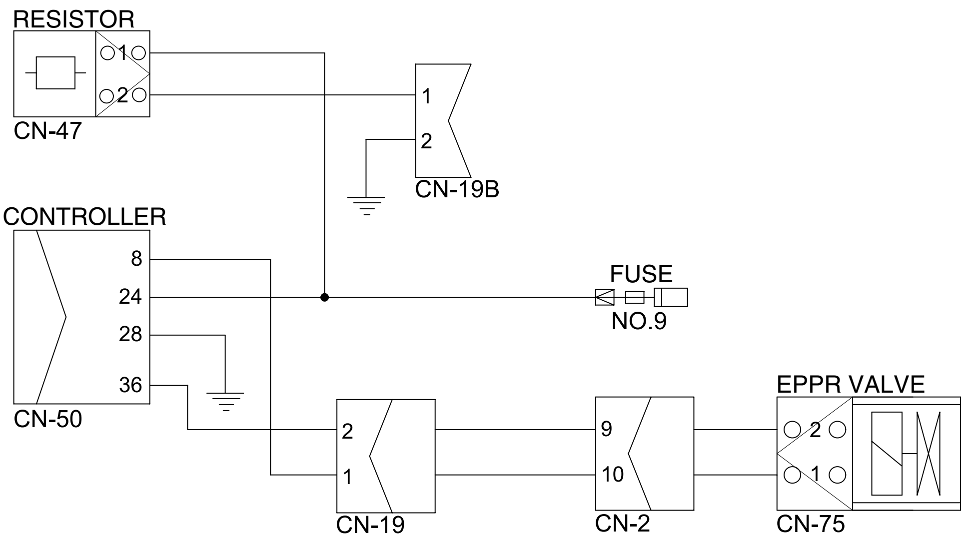
※ Spec : M-mode 1900± 50rpm H-mode 1800± 50rpm S-mode 1700 ± 50rpm

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

1) INSPECTION PROCEDURE



Wiring diagram



30076MS01

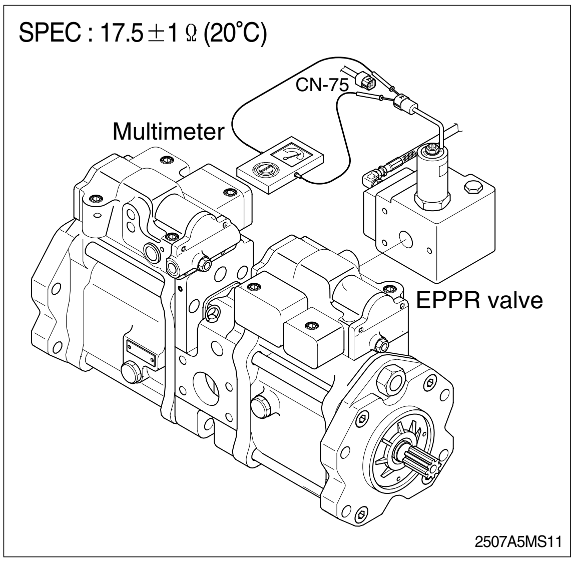
2) TEST PROCEDURE

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

① Starting key OFF.

② Disconnect connector CN-75 from EPPR valve at main hydraulic pump.

③ Check resistance between 2 lines as figure.



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

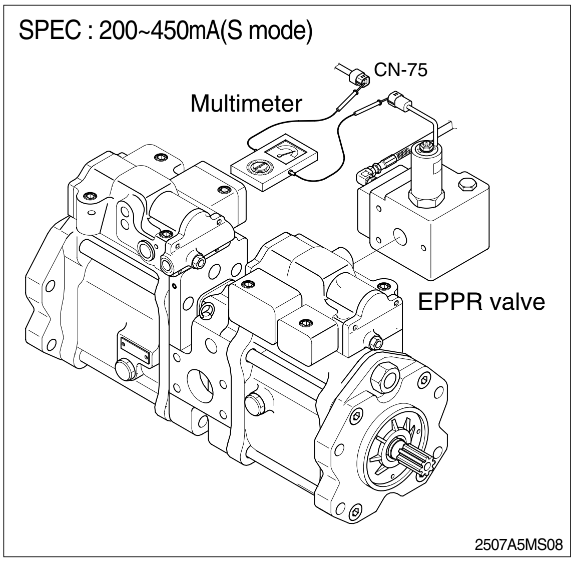
① Install multimeter as figure.

② Start engine.

③ Set the accel dial at "10"(MAX)

④ Set S-mode and cancel auto decel mode.

⑤ If tachometer show approx 1700±50 rpm, check electric current.



(3) **Test 3 :** Check pressure at EPPR valve.

① Remove plug and connect pressure gauge as figure.

· Gauge capacity : 0 to 40~50kgf/cm^2 (0 to 570~710psi)

② Start engine.

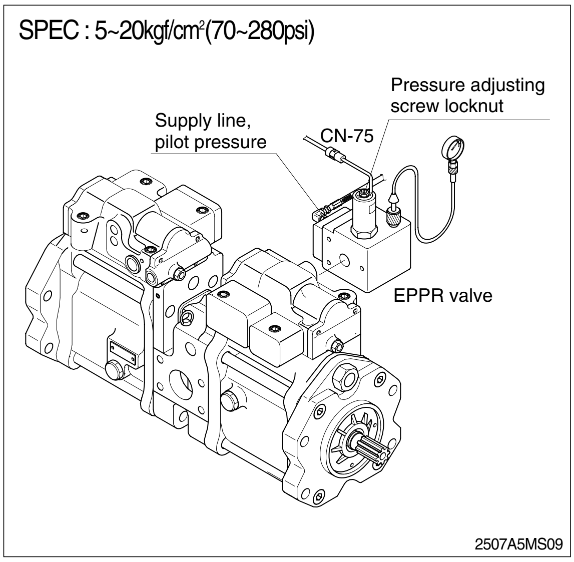
③ Set the accel dial at "10"(Max).

④ Set S-mode and cancel auto decel mode.

⑤ If tachometer show approx 1700±50rpm, check pressure.

⑥ If pressure is not correct, adjust it.

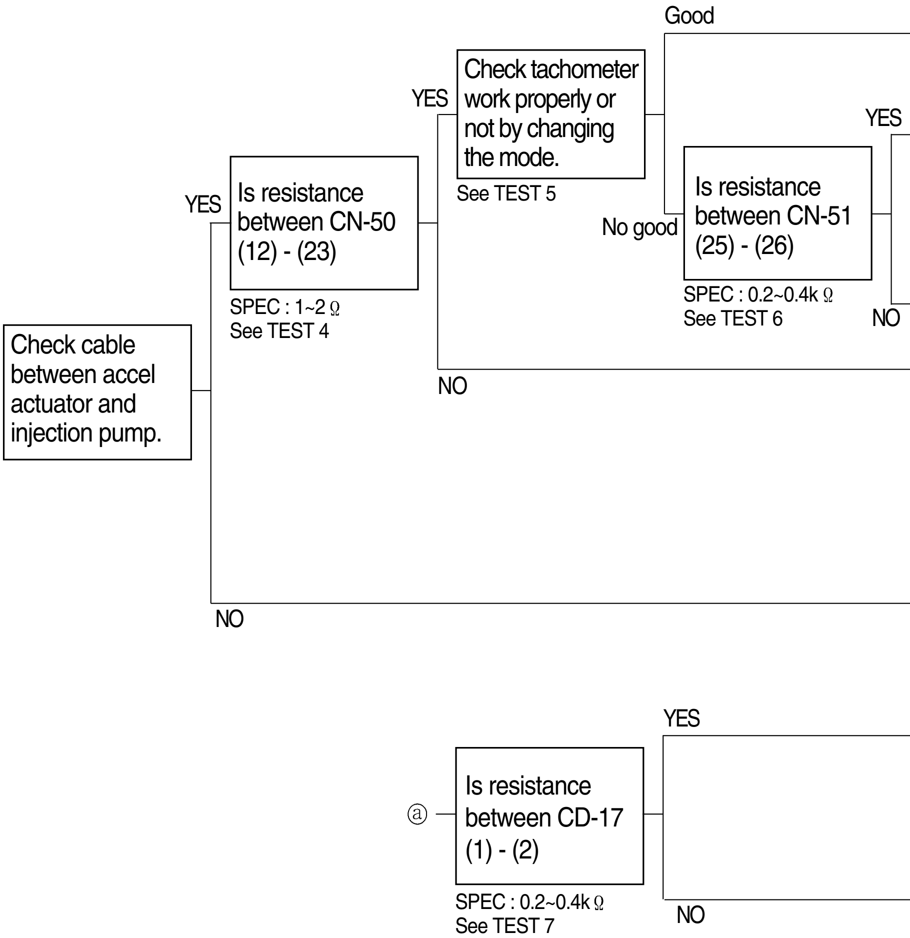
⑦ After adjust, test the machine.



2. ENGINE SPEED IS SLOW AT ALL MODE

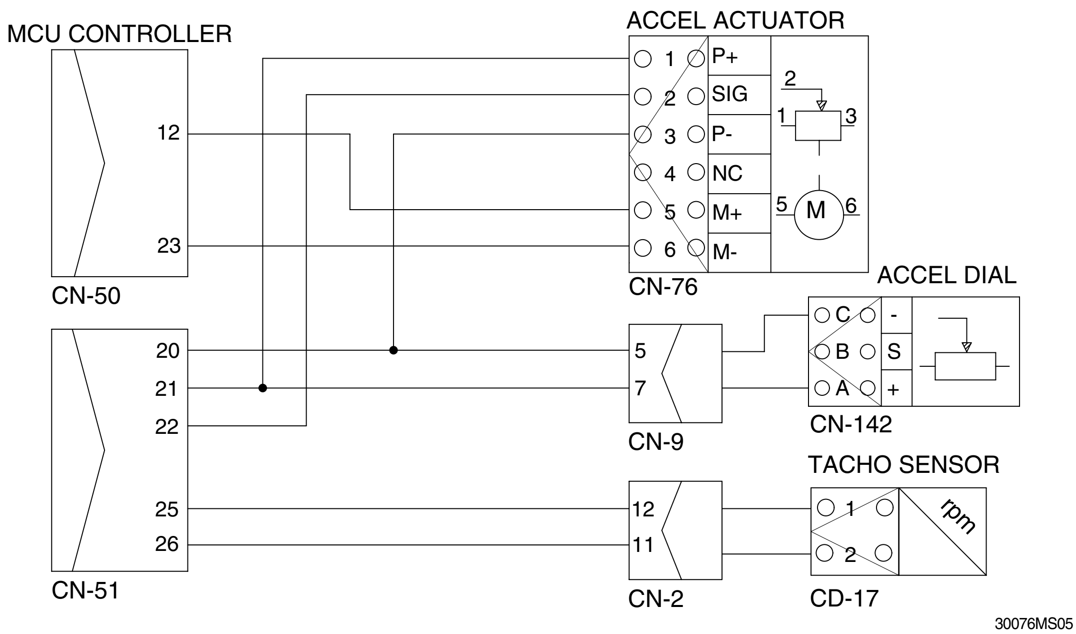
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
If test 7 is good, check TEST 1~4	
Misalignment between speed sensor and fly wheel	Clean speed sensor and adjust See : 5-20page
ⓐ	
Defective accel actuator or short circuit or poor connection between CN-50-CN-76	Replace accel actuator or harness assembly
Improper operation by loosening or interference of cable	Adjust or repair
Short circuit or poor connection between CN-50-CN-2-CD-17	Check and repair
Defective speed sensor	Replace

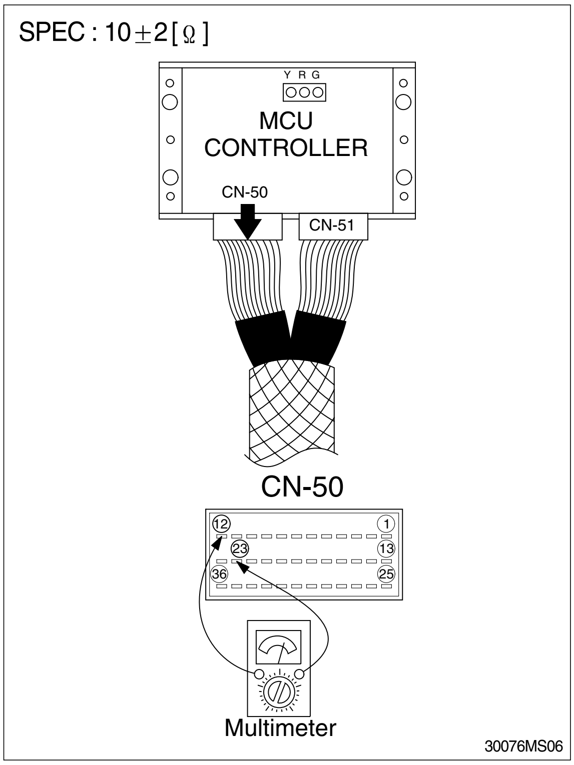
Wiring diagram



2) TEST PROCEDURE

(1) **Test 4 :** Check resistance between CN-50 (12)-(23).

① Starting key OFF
② Disconnect connector CN-50 from MCU controller.
③ Check resistance as figure.



(2) **Test 5 :** Check tachometer(Work properly or not)

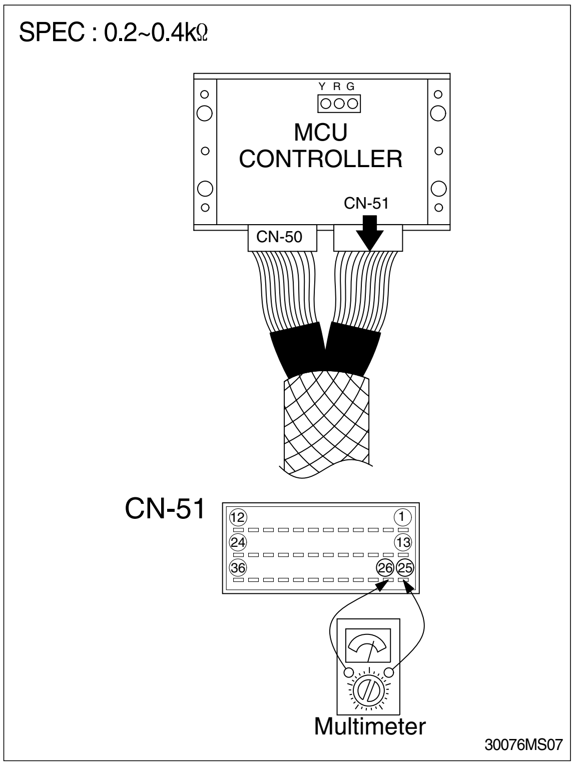
① Start engine.
② Check tachometer reading.

Unit : rpm

Spec		Remark
M mode	1900±50	Check rpm after cancel the Auto decel mode.
H mode	1800±50	
S mode	1700±50	

(3) **Test 6 :** Check resistance between CN-51 (25) and CN-51(26).

① Starting key OFF.
② Disconnect connector CN-51 from MCU controller.
③ Check resistance as figure.

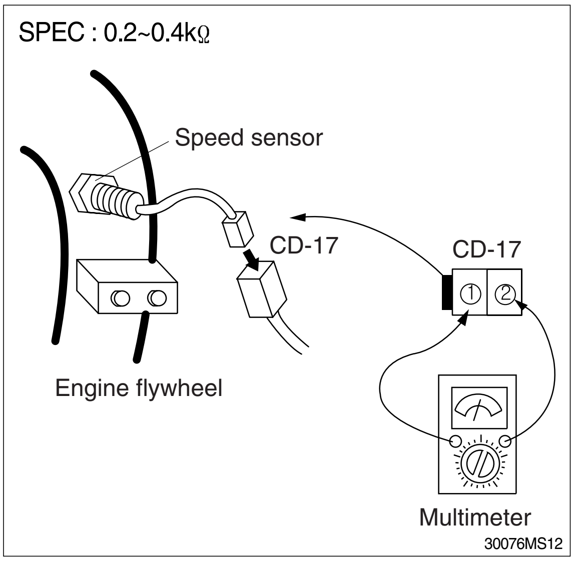


(4) **Test 7 :** Check resistance at speed sensor.

① Starting key OFF.

② Disconnect connector CD-17 of speed sensor at engine flywheel housing.

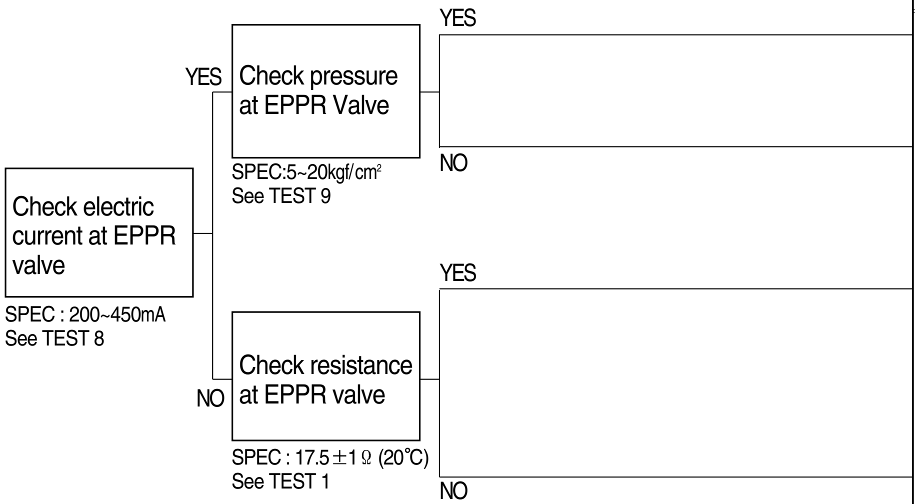
③ Check resistance as figure.



3. ENGINE STALL

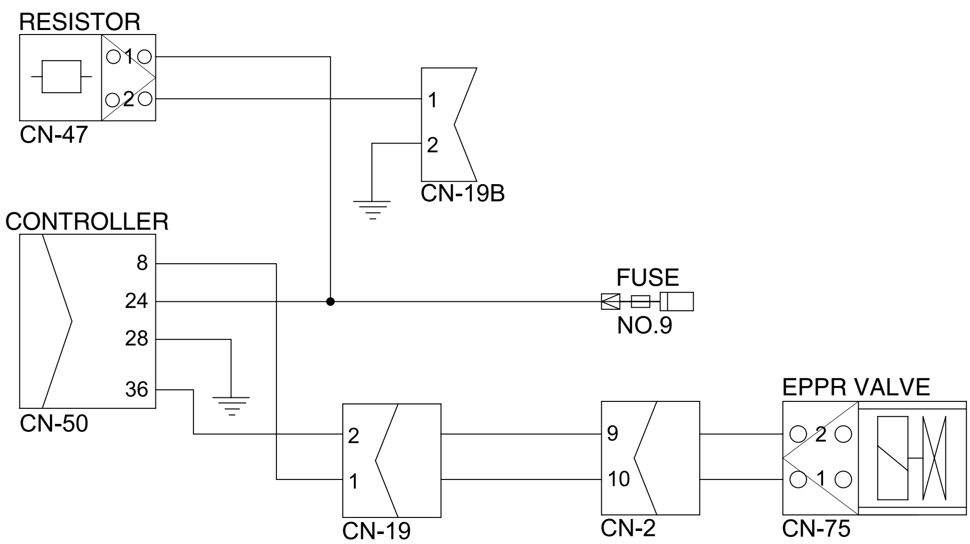
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Not enough engine power	Contact cummins engine dealer
Defective EPPR valve	Replace
Short circuit or poor connection between CN-50 - CN-75	Check and repair wire harness
Defective EPPR valve	Replace

Wiring diagram

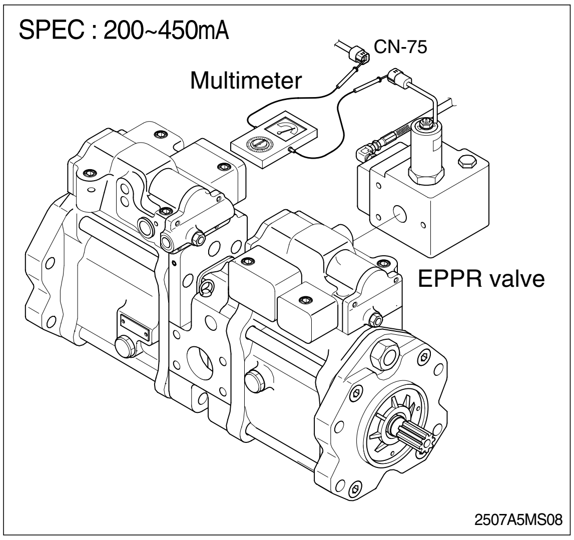


30076MS02

2) TEST PROCEDURE

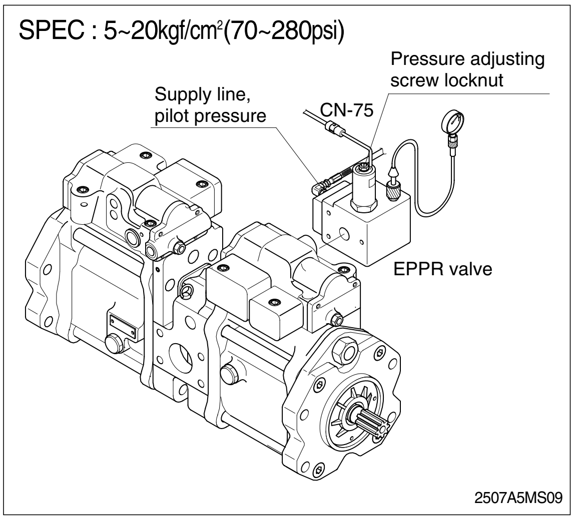
(1) Test 8 : Check electric current at EPPR valve at S-mode

① Install multimeter as figure.
② Start engine.
③ Set the accel dial at "10"(max)
④ Set S-mode with 1700±50rpm.
⑤ Check electric current.



(2) Test 9 : Check pressure at EPPR valve at S-mode

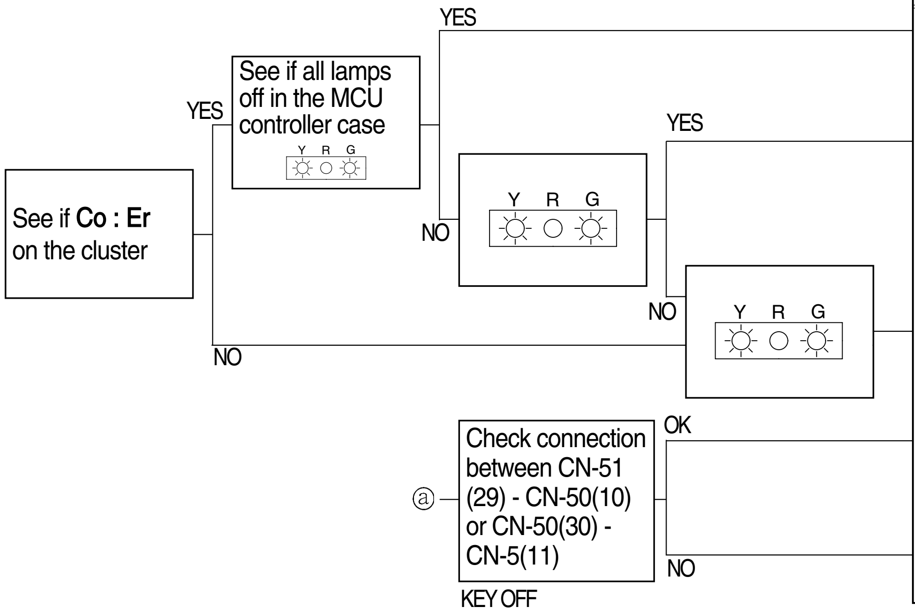
① Connect pressure gauge at EPPR valve.
② Start engine.
③ Set the accel dial at "10"(max)
④ Set S-mode with 1700±50rpm.
⑤ Operate bucket lever completely push or pull.
⑥ Hold arm lever at the end of stroke.
⑦ Check pressure at relief position.



4. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

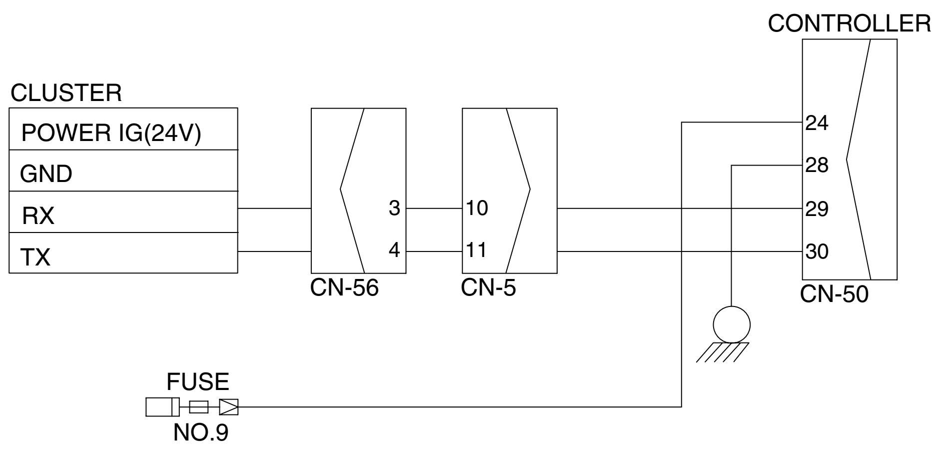
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
No power supply to the MCU controller	Check fuse
MCU failure	Replace
ⓐ	
Cluster failure	Replace
No connection	Check and repair

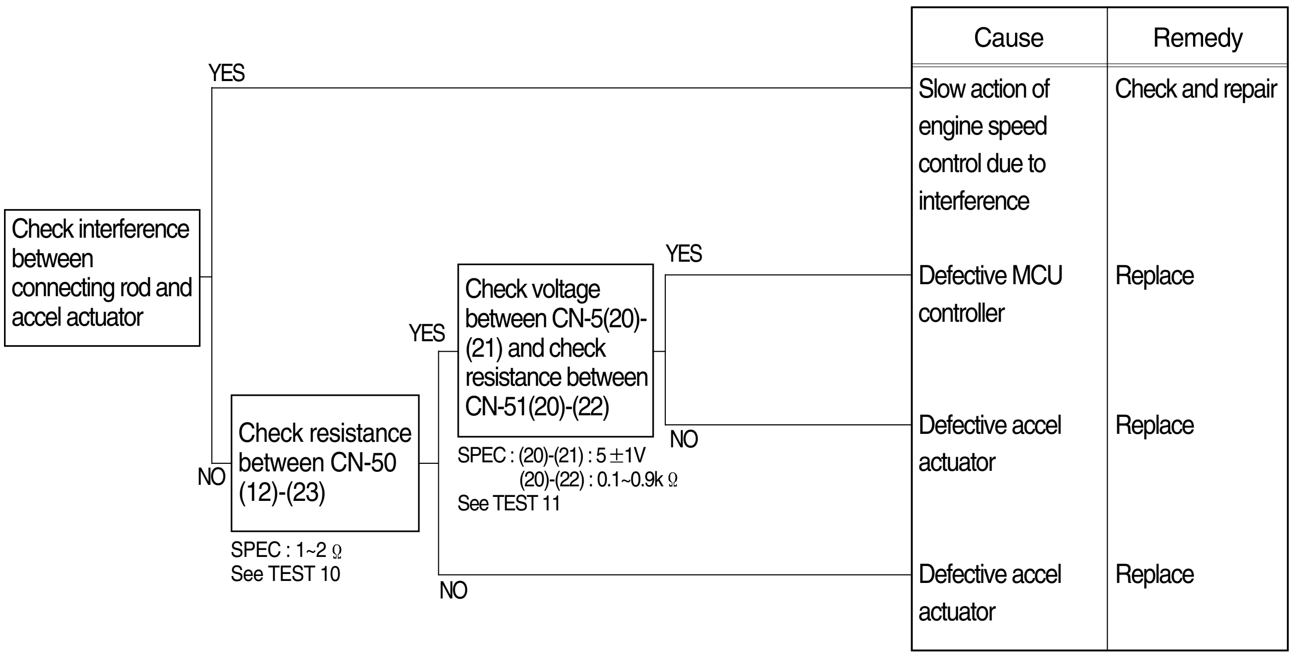
Wiring diagram



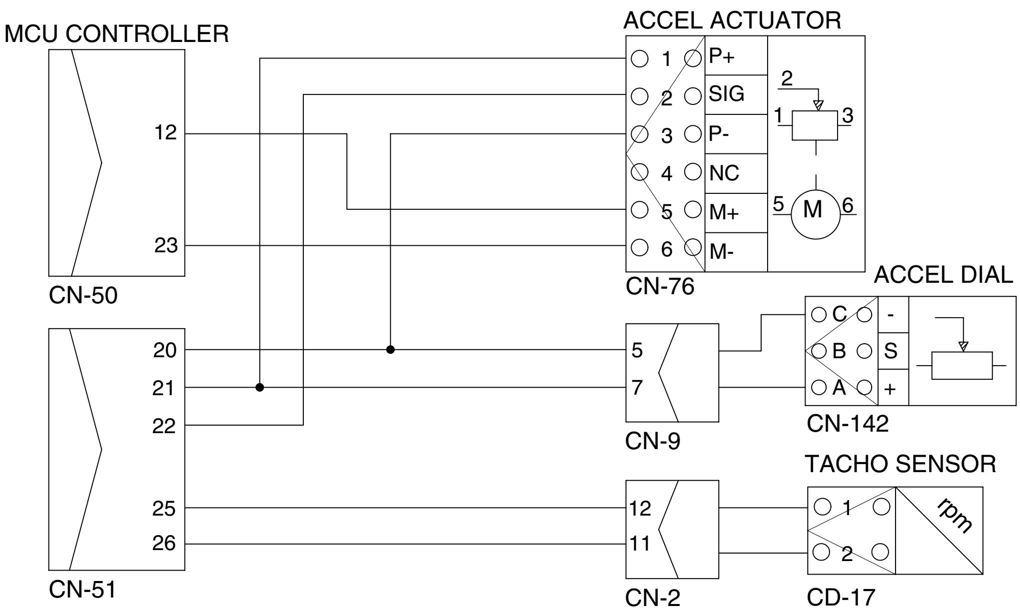
5. SLOW ACTION OF ENGINE SPEED CHANGE WHEN CHANGE THE MODE

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

1) INSPECTION PROCEDURE



Wiring diagram



30076MS05

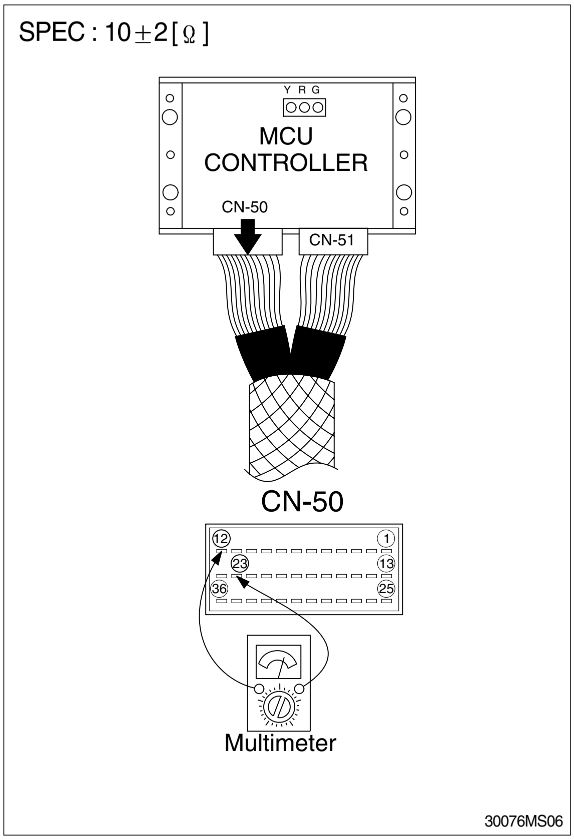
2) TEST PROCEDURE

(1) **Test 10 :** Check resistance.

① Starting key OFF.

② Disconnect connector CN-50 from MCU controller.

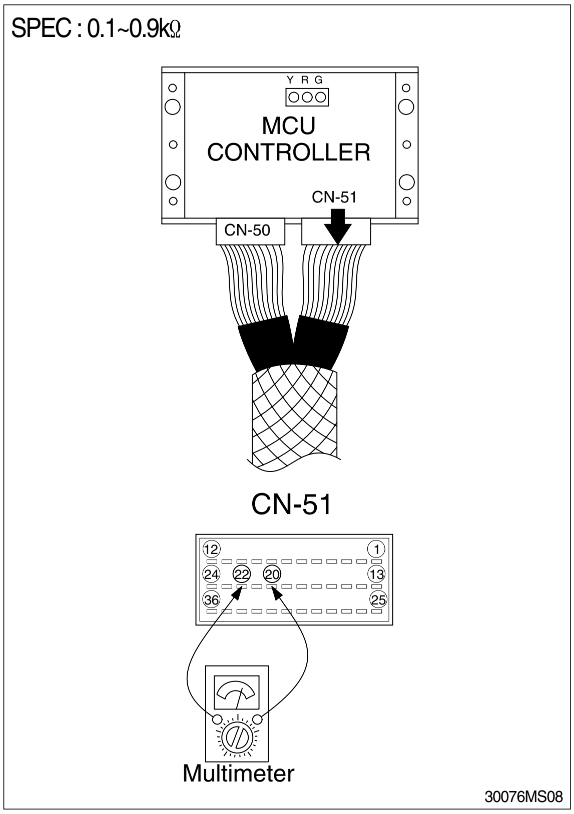
③ Check resistance between CN-50(12)-(23) as figure.



(2) **Test 11 :** Check voltage and resistance.

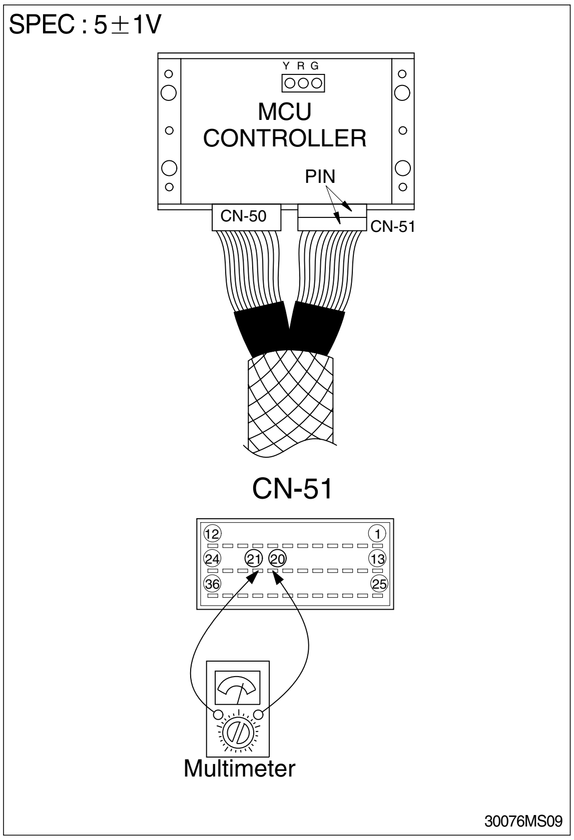
① Check resistance between CN-51(20)-(22).

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



② Check voltage between CN-51(20) and CN-51(21).

- Prepare 2 pieces of thin sharp pin, steel or copper.
- Starting key ON.
- Insert prepared pins to rear side of connectors : One pin to CN-51(20)
  Other pin to CN-51(21)
- Check voltage.



6. AUTO DECEL SYSTEM DOES NOT WORK

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

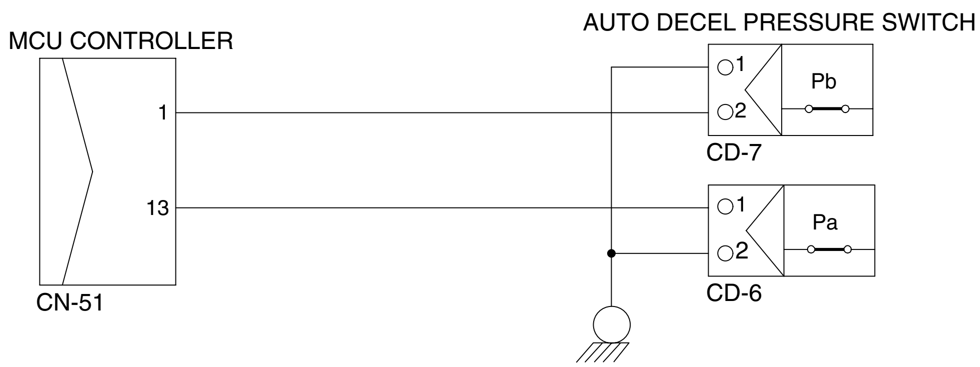
1) INSPECTION PROCEDURE

Check resistance between CN-51 (1)-GND and CN-51(13)-GND

SPEC :
Actuator operating : 11~13V
Actuator stop :0~2V
See TEST 12
See TEST 13

Result	Cause	Remedy
YES	Defective MCU controller	Replace
NO	Short circuit or poor connection between CN-51(1), (13)- pressure switches	Replace or repair
NO	Defective auto decel pressure switch	Replace

Wiring diagram



30076MS10

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-51(1) and ground.

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

② Starting key ON.

③ Insert prepared pin to rear side of connectors : One pin to (1) of CN-51.

④ Check voltage as figure.

(2) Test 13 : Check voltage at CN-51(13)and ground.

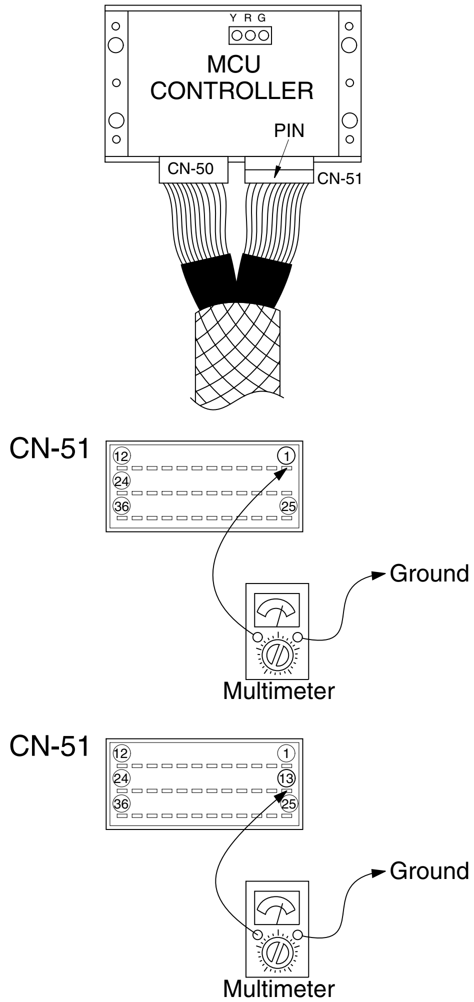
① Prepare 1 piece of thin sharp pin, steel or copper

② Starting key ON.

③ Insert prepared pin to rear side of connectors : One pin to (13) of CN-51

④ Check voltage as figure.

SPEC : Actuator stop : 11~13V
Actuator operating : 0~2V

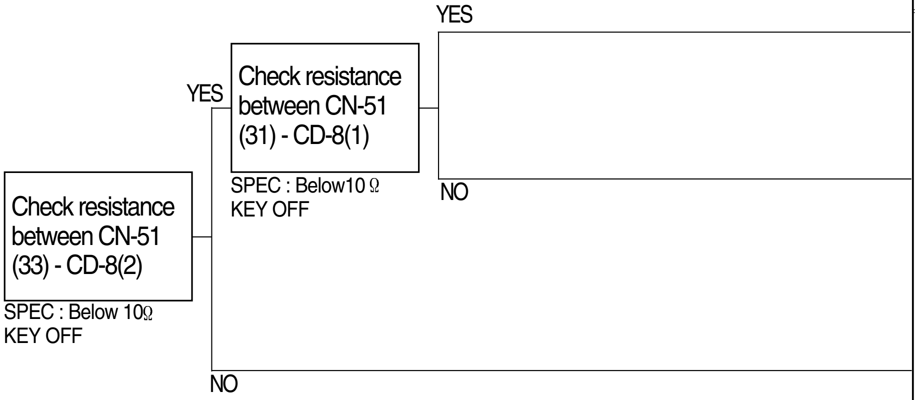


30076MS11

7. MALFUNCTION OF WARMING UP

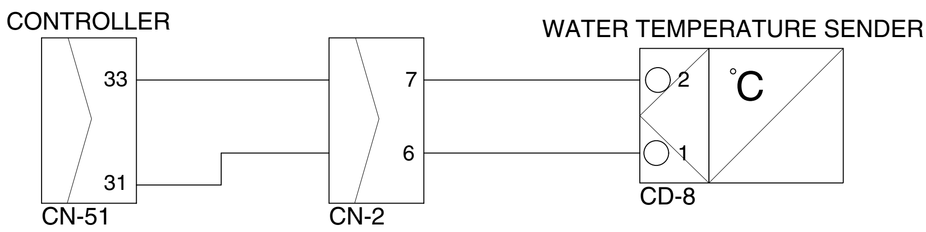
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective cluster or MCU controller or CD-8(Sensor)	Repair or Replace
Poor connection between CN-51(31) - CD-8(1)	Repair
Poor connection between CN-51(33) - CD-8(2)	Repair

Wiring diagram

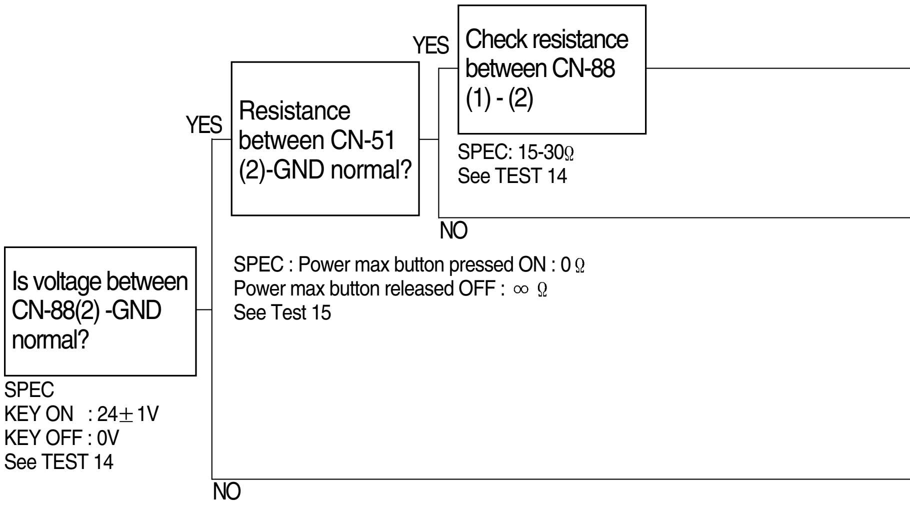


30076MS04

8. MALFUNCTION OF POWER MAX

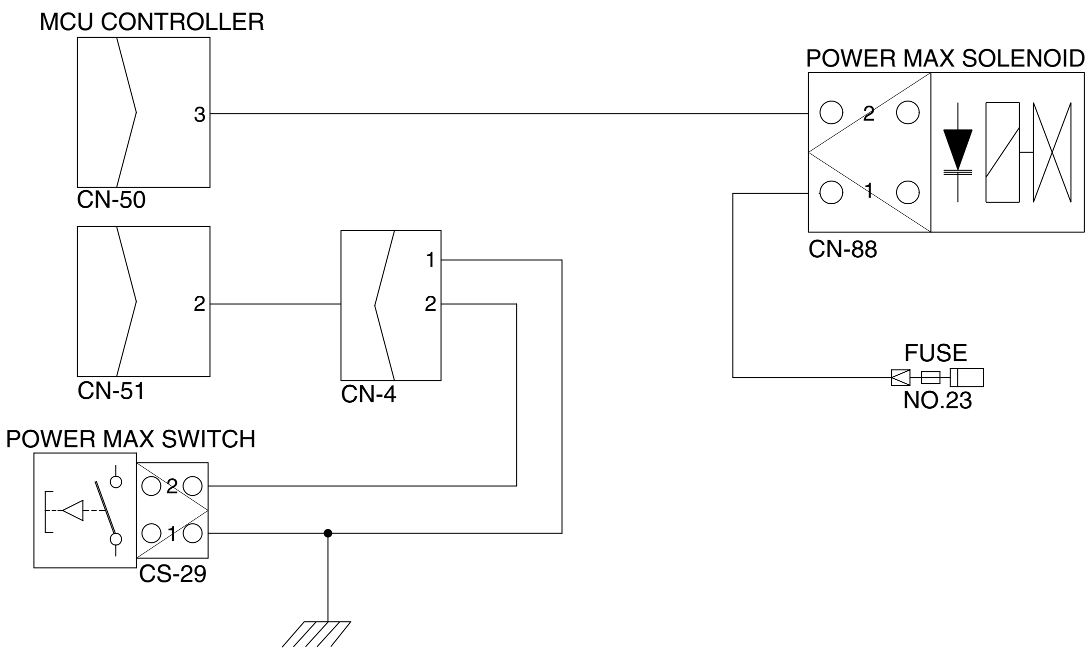
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective power max. solenoid valve	Repair or replace
Short circuit or poor connection between CN-51(2) - CS-29 and CN-50 (3) -CN-88(1)	Repair or replace
Short circuit or poor connection between CN-88(2)- battery relay(+)	Repair or replace

Wiring diagram

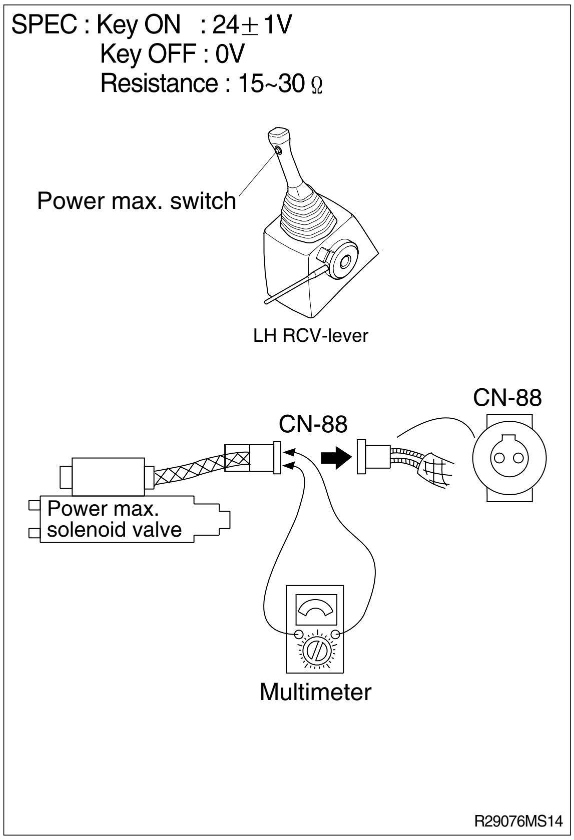


34075MS06

2) TEST PROCEDURE

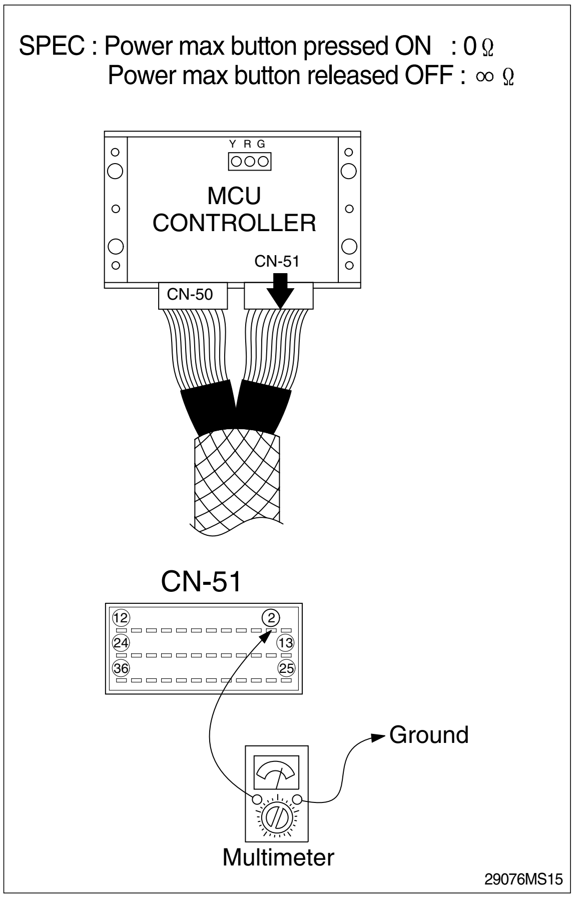
(1) **Test 14:** Check voltage between connector CN-88 - GND.

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



(2) **Test 15:** Check resistance between connector CN-51(2)-GND.

① Starting key OFF.
② Remove MCU controller and disconnect connector CN-51 from MCU controller.
③ Check resistance as figure.



SECTION 7 MAINTENANCE STANDARD

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check:

1) **OPERATIONAL PERFORMANCE OF A NEW MACHINE**

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

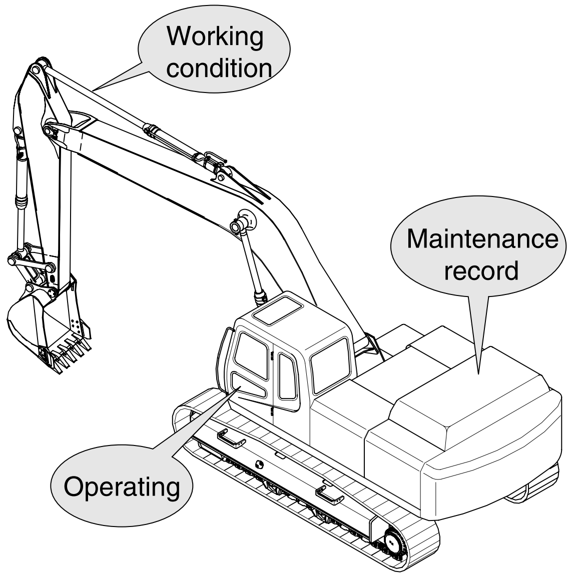
2) **OPERATIONAL PERFORMANCE OF A WORKING MACHINE**

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

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

3) **OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE**

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

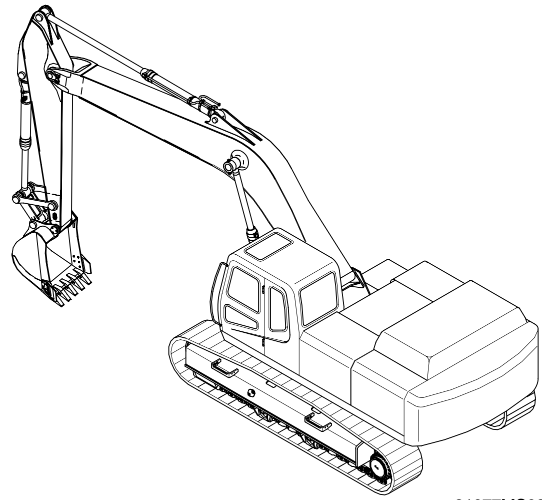


21077MS01

2. TERMINOLOGY

1) STANDARD

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

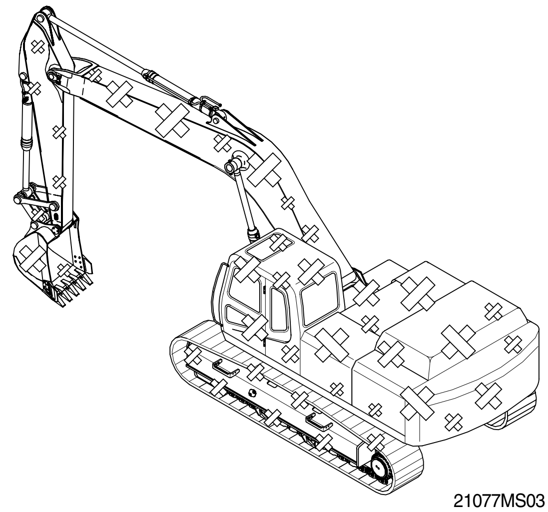


21077MS02

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.



21077MS03

3. OPERATION FOR PERFORMANCE TESTS

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

(1) The machine

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

(2) Test area

① Select a hard, flat surface.

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

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

(3) Precautions

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

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

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

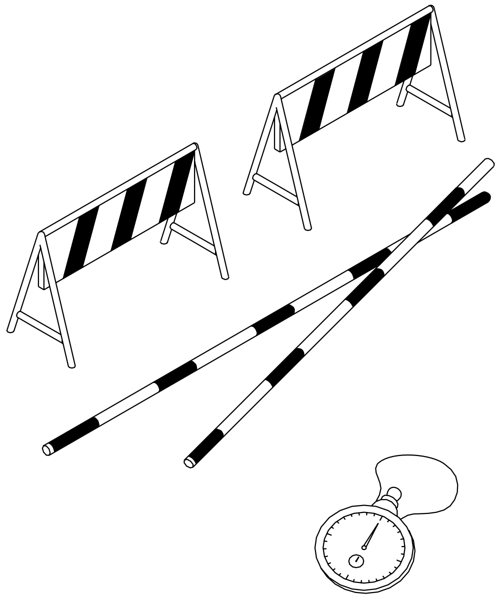
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements

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

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

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



7-3 (210-7)

2) ENGINE SPEED

(1) Measure the engine speed at each power mode

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

(2) Preparation

① Warm up the machine, until the engine coolant temperature reaches 50°C or more, and the hydraulic oil is 50±5°C.
② Set the accel dial at 10(Max) position.
③ Push the H-mode switch and confirm that the fuel injection pump governor lever comes into contact with the high-idle stopper.
④ Measure the engine RPM.

(3) Measurement

① Start the engine. The engine will run at start idle speed. Measure engine speed with a tachometer.
② Measure and record the engine speed at each mode(H, S).
③ Select the H-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.

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
R340LC-7	Start idle	900±100	
	M mode	1900±50	
	H mode	1800±50	
	S mode	1700±50	
	Auto decel	1000±50	

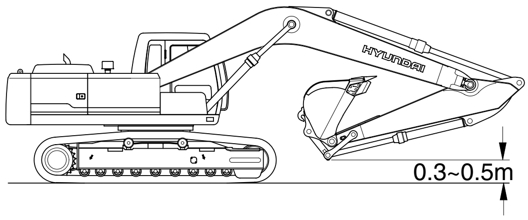
Condition : Set the accel dial at 10(Max) position.

3) TRAVEL SPEED

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

(2) Preparation

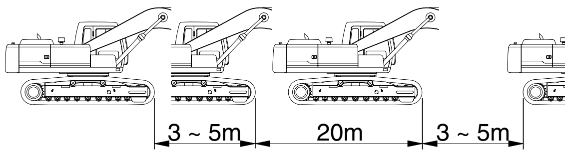
① Adjust the tension of both tracks to be equal.
② Prepare a flat and solid test track 20m in length, with extra length of 3 to 5m on both ends for machine acceleration and deceleration.
③ Hold the bucket 0.3 to 0.5m above the ground with the arm and bucket rolled in.
④ Keep the hydraulic oil temperature at 50±5°C.



290LC7MS01

(3) Measurement

① Measure both the low and high speeds of the machine.
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested, then select the following switch positions.
· Mode selector : H mode
③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.
④ Measure the time required to travel 20m.
⑤ After measuring the forward travel speed, turn the upperstructure 180° and measure the reverse travel speed.
⑥ Repeat steps ④ and ⑤ three times in each direction and calculate the average values.



290LC7MS02

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
R340LC-7	1 Speed	21.8±2.0	27.3	
	2 Speed	13.1±1.0	16.4	

4) TRACK REVOLUTION SPEED

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

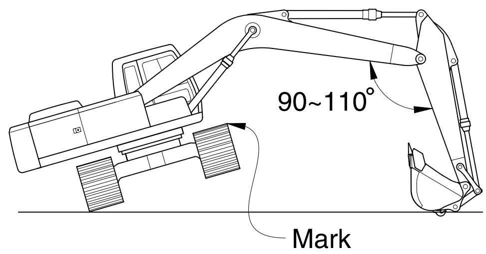
(2) Preparation

① Adjust the tension of both side tracks to be equal.

② On the track to be measured, mark one shoe with chalk.

③ Swing the upperstructure 90° and lower the bucket to raise the track off ground. Keep the boom-arm angle between 90 to 110° as shown. Place blocks under machine frame.

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



21077MS06

(3) Measurement

① Select the following switch positions.

· Travel mode switch : 1 or 2 speed

· Mode selector : H mode

· Auto decel 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
R340LC-7	1 Speed	33.9±2.0	42.4
	2 Speed	20.4±2.0	25.5

5) TRAVEL DEVIATION

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

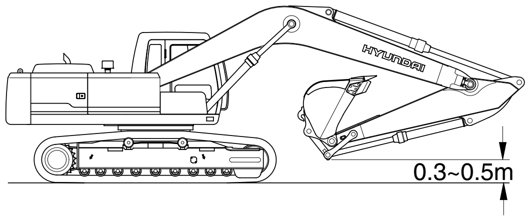
(2) Preparation

① Adjust the tension of both tracks to be equal.

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

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

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



290LC7MS01

(3) Measurement

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

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

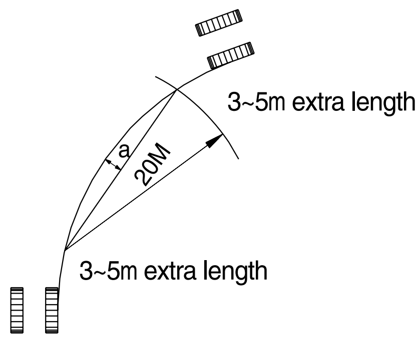
· Mode selector : H mode

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

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

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

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



7-7(2) 210-7

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20m

Model	Standard	Maximum allowable	Remarks
R340LC-7	200 below	250	

6) SWING SPEED

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

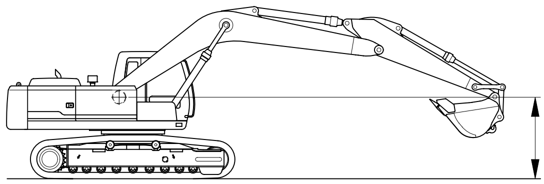
(2) Preparation

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℃.



290LC7MS03

(3) Measurement

① Select the following switch positions.

· Mode selector : H mode

② Operate swing control lever fully.

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

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

(4) Evaluation

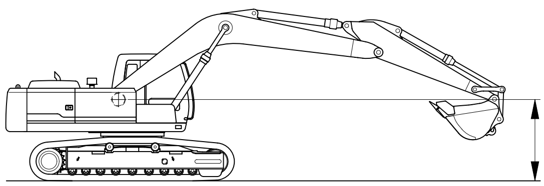
The time required for 3 swings should meet the following specifications.

Unit : Seconds / 3 revolutions

Model	Power selector switch	Standard	Maximum allowable
R340LC-7	H mode	18.2±2.0	22.8

7) SWING FUNCTION DRIFT CHECK

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



290LC7MS03

(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.

(3) Measurement

① Conduct this test in the H mode.

② Select the following switch positions.

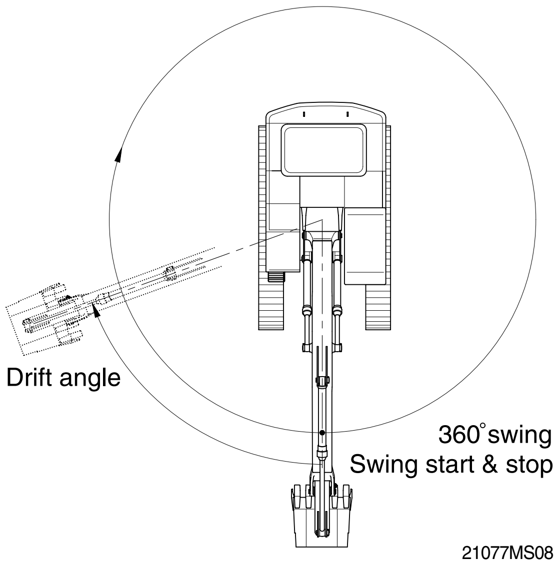
· Mode selector : H mode

③ Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360°.

④ Measure the distance between the two marks.

⑤ Align the marks again, swing 360°, then test the opposite direction.

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



21077MS08

(4) Evaluation

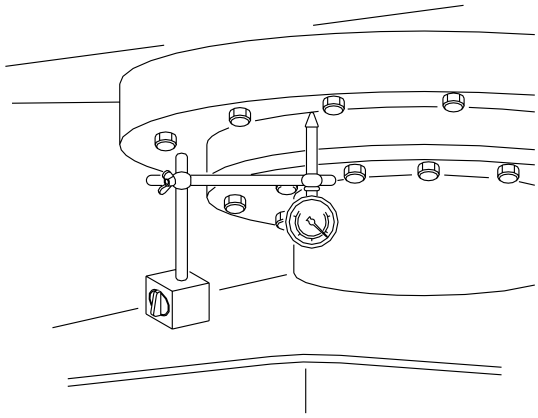
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Mode select switch	Standard	Maximum allowable	Remarks
R340LC-7	H mode	90 below	112.5	

8) SWING BEARING PLAY

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



7-10(1) 210-7

(2) Preparation

① Check swing bearing mounting cap screws for loosening.

② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.

③ Install a dial gauge on the track frame as shown, using a magnetic base.

④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.

⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.

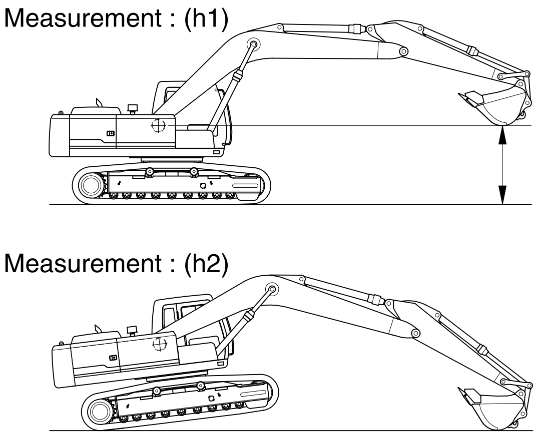
⑥ Bucket should be empty.

(3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading(h1).

② Lower the bucket to the ground and use it to raise the front idler 50cm.
Record the dial gauge reading(h2).

③ Calculate bearing play(H) from this data(h1 and h2) as follows.
H=h2-h1



290LC7MS04

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
R340LC-7	0.5 ~ 1.5	3.0	

9) HYDRAULIC CYLINDER CYCLE TIME

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

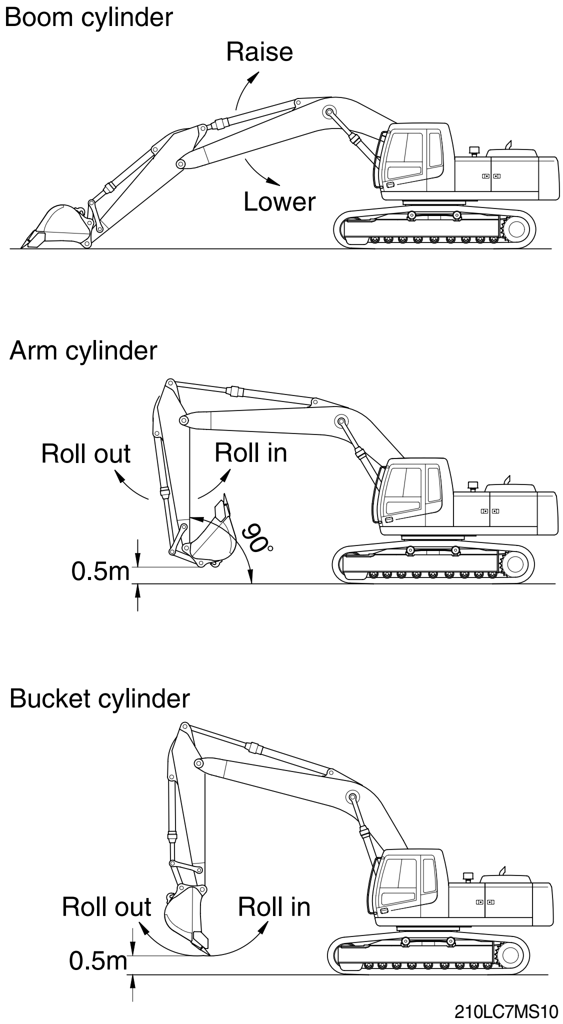
(2) Preparation

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

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

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

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



(3) Measurement

① Select the following switch positions.

· Mode selector : H mode

② To measure cylinder cycle times.

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

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

- 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
R340LC-7	Boom raise	3.5±0.4	4.4	
	Boom lower	3.2±0.4	4.0	
	Arm in	3.8±0.4	4.7	
	Arm out	3.2±0.3	4.0	
	Bucket load	3.0±0.4	3.8	
	Bucket dump	2.6±0.3	3.3	

10) DIG FUNCTION DRIFT CHECK

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

(2) Preparation

① Load bucket fully. Instead of loading the bucket, weight(W) of the following specification can be used.

· $W = M^3 \times 1.5$

Where :

M^3 = Bucket heaped capacity(m^3)

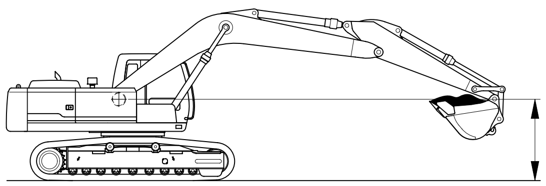
1.5 = Soil specific gravity

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

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



290LC7MS05

(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
R340LC-7	Boom cylinder	10 below	15	
	Arm cylinder	10 below	15	
	Bucket cylinder	40 below	50	

11) CONTROL LEVER OPERATING FORCE

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

(2) Preparation

① Keep the hydraulic oil temperature at 50±5℃.

(3) Measurement

① Start the engine.

② Select the following switch positions.

· Mode selector : H mode

③ Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.

④ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.

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

(4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
R340LC-7	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	1.8 or below	2.25	

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.

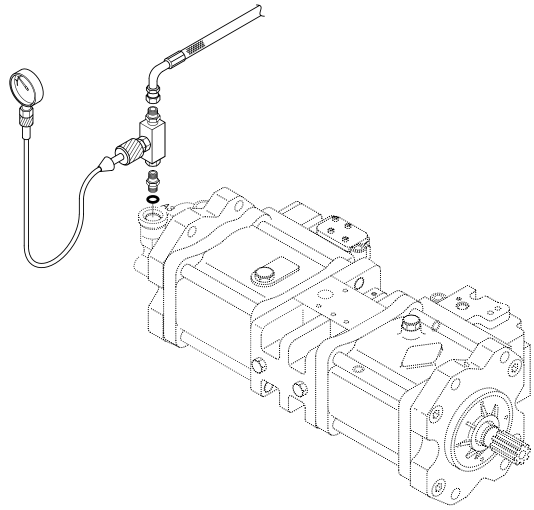
Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
R340LC-7	Boom lever	87±10	109	
	Arm lever	87±10	109	
	Bucket lever	87±10	109	
	Swing lever	87±10	109	
	Travel lever	142±10	178	

13) PILOT PRIMARY PRESSURE

(1) Preparation

① Stop the engine.
② Remove the top cover of the hydraulic tank oil supply port with a wrench.
③ Loosen and remove plug on the pilot pump delivery port and connect pressure gauge.
④ Start the engine and check for oil leakage from the port.
⑤ Keep the hydraulic oil temperature at 50±5℃.



290LC7MS10

(2) Measurement

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

② Measure the primary pilot pressure in the H mode.

(3) Evaluation

The average measured pressure should meet the following specifications:

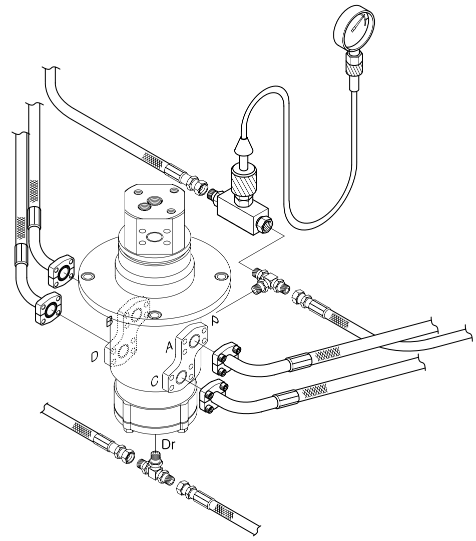
Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
R340LC-7	H mode	35±5	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE

(1) Preparation

① Stop the engine.
② Remove the top cover of the hydraulic tank oil supply port with a wrench.
③ Push the pressure release button to bleed air.
④ To measure the speed selecting pressure: Install a connector and pressure gauge assembly to turning joint P port as shown.
⑤ Start the engine and check for on leakage from the adapter.
⑥ Keep the hydraulic oil temperature at 50±5°C.



21077MS13

(2) Measurement

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

(3) Evaluation

The average measured pressure should be within the following specifications.

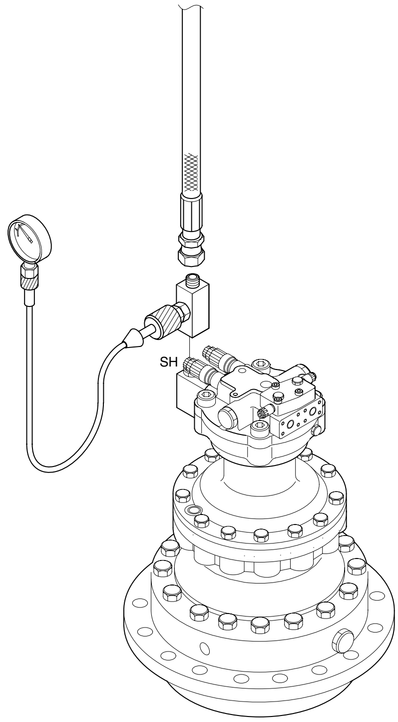
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
R340LC-7	1 Speed	0	-	
	2 Speed	35±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.
② Remove the top cover of the hydraulic tank oil supply port with a wrench.
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.



290LC7MS11

(2) Measurement

① Select the following switch positions.
· Mode selector : H mode
② Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
Repeat step ② three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

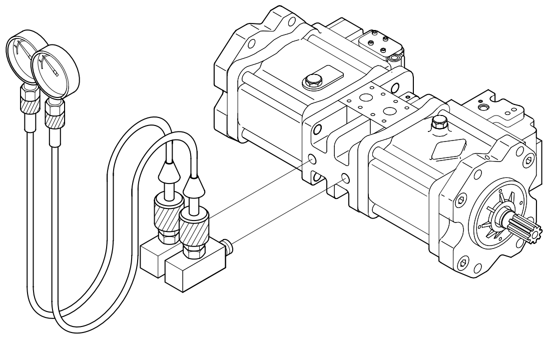
Unit : kgf / cm^2

Model	Description	Standard	Allowable limits	Remarks
R340LC-7	Brake disengaged	35	26~44	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

① Stop the engine.
② Remove the top cover of the hydraulic tank oil supply port with a wrench.
③ Push the pressure release button to bleed air.
④ To measure the main pump pressure. Install a connector and pressure gauge assembly main pump gauge port as shown.
⑤ Start the engine and check for oil leakage from the port.
⑥ Keep the hydraulic oil temperature at 50±5°C.



290LC7MS07

(2) Measurement

① Select the following switch positions.
· Mode selector : H mode
② Measure the main pump delivery pressure in the H mode(High idle).

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
R340LC-7	High ilde	40±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

① Stop the engine.

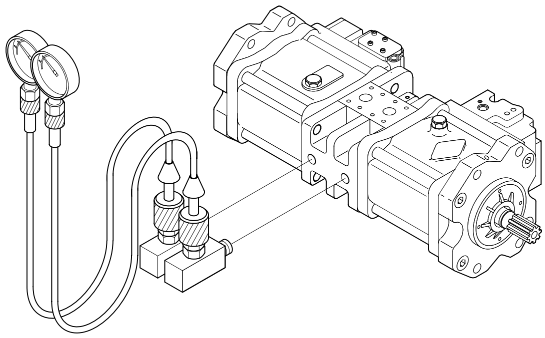
② Remove the top cover of the hydraulic tank oil supply port with a wrench.

③ Push the pressure release button to bleed air.

④ To measure the system relief pressure. Install a connector and pressure gauge assembly main pump gauge port, as shown.

⑤ Start the engine and check for oil leakage from the port.

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



290LC7MS07

(2) Measurement

① Select the following switch positions.

· Mode selector : H mode

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

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

④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.

(3) Evaluation

The average measured pressure should be within the following specifications.

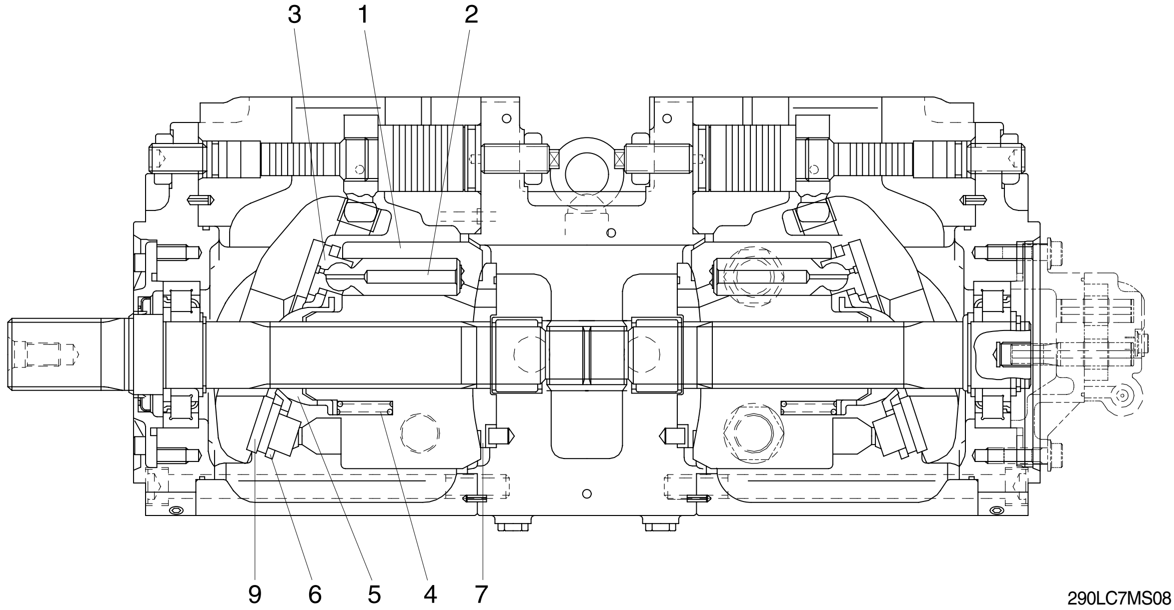
Unit : kgf / cm²

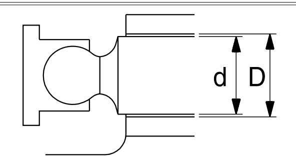
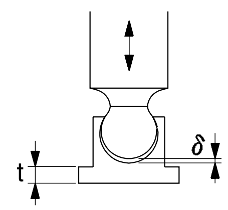
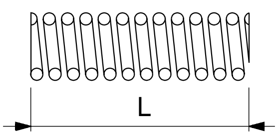
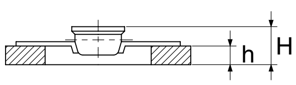
Model	Function to be tested	Standard	Maximum allowable
R340LC-7	Boom, Arm, Bucket	330(360)±10	390±10
	Travel	330±10	-
	Swing	290±10	-

(   ) : Power boost

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP



Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston(1) & cylinder bore(2) (D-d)		0.0375	0.078	Replace piston or cylinder.
Play between piston(1) & shoe caulking section(3) (δ)		0-0.1	0.35	Replace assembly of piston & shoe.
Thickness of shoe (t)		5.4	5.0	
Free height of cylinder spring(4) (L)		40.9	40.1	Replace cylinder spring.
Combined height of set plate(5) & spherical bushing(6) (H-h)		23.8	22.8	Replace retainer or set plate.
Surface roughness for valve plate(Sliding face)(7,8), swash plate (shoe plate area)(9), & cylinder(2)(Sliding face)	Surface roughness necessary to be corrected	3z		Lapping
	Standard surface roughness (Corrected value)	0.4z or lower		

2. MAIN CONTROL VALVE

Part name	Inspection item	Criteria & measure
Casing	· Existence of scratch, rusting or corrosion.	· In case of damage in following section, replace part. - Sliding sections of casing fore and spool, especially land sections applied with holded pressure. - Seal pocket section where spool is inserted. - Seal section of port where O-ring contacts. - Seal section of each relief valve for main, travel, and port. - Other damages that may damage normal functions.
Spool	· Existence of scratch, gnawing, rusting or corrosion. · O-ring seal sections at both ends. · Insert spool in casing hole, rotate and reciprocate it.	· Replacement when its outside sliding section has scratch(Especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of poppet or spring · Insert poppet into casing and function it.	· Correction or replacement when sealing is incomplete. · Normal when it can function lightly without being caught.
Around spring	· Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage. · Rusting, corrosion or deformation of seal plate.	· Correction or replacement. · Correction or replacement.
Main relief valve, port relief valve & negative control relief valve	· External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · Abnormal spring. · O-rings, back up rings and seals.	· Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement. · 100% replacement in general.
Balance plate	· Worn less than 0.03mm · Worn more than 0.03mm · Sliding surface has a seizure(Even through small).	· Lapping · Replace · Replace

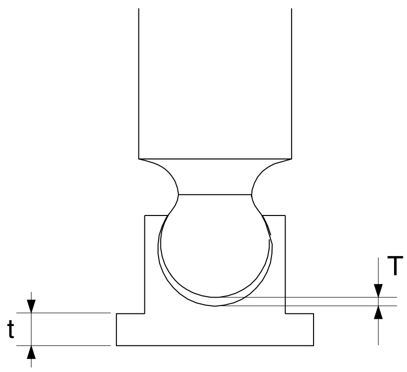
3. SWING DEVICE

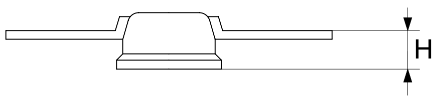
Part name	Inspection item	Remedy
Shoe of piston assembly	· Sliding surface has a damage. · Sliding surface depression( ) dimension less than 0.45mm or has a large damage.	· Lapping · Replace parts or motor
Piston of piston assembly	· Sliding surface has a seizure(Even though small).	· Replace motor
Piston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

4. TRAVEL MOTOR

1) WEARING PARTS

Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.025	0.050	Replace piston or cylinder block
Play between piston and shoe caulking section(T)	0	0.3	Replace assembly of piston and shoe
Thickness of shoe(t)	4.5	4.3	Replace assembly of piston and shoe
Combined height of set plate and ball guide(H-h)	7.3	7.0	Replace set of set plate and ball guide
Thickness of friction plate	3.0	2.6	Replace

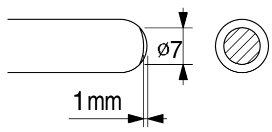




2) SLIDING PARTS

Part name	Standard roughness	Remark
Shoe	0.8S	-
Shoe plate	0.8S	-
Cylinder	0.8S	-
Valve plate	0.8S	-

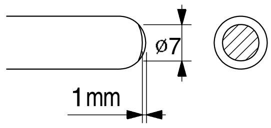
6. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000cc/m at neutral handle position, or more than 2000cc/m during operation.	Conditions : Primary pressure : 30kgf/cm^2 Oil viscosity : 23cSt
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 1mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2mm 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.

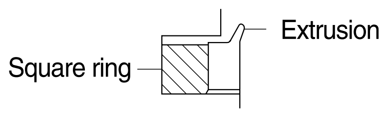
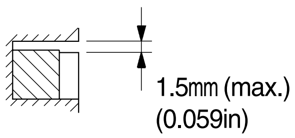
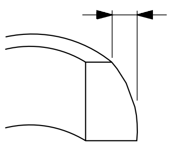
2. When loosening the hexagon socket head cap screw(125), replace the seal washers(121) without fail.

7. 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 : 30kgf/cm^2 Oil viscosity : 23cSt
Spool	This is to be replaced when the sliding surface has worn more than 10μm, 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 1mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2mm 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.

8. TURNING JOINT

Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1mm (0.0039in) in depth due to seizure contamination.	Replace
		· Damaged more than 0.1mm(0.0039in) in depth.	Smooth with oilstone.
	Sliding surface with thrust plate.	· Worn more than 0.5mm(0.02in) or abnormality.	Replace
		· Worn less than 0.5mm(0.02in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5mm)(0.02in).	Smooth
Cover	Sliding surface with thrust plate.	· Worn more than 0.5mm(0.02in) or abnormality.	Replace
		· Worn less than 0.5mm(0.02in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5mm)(0.02in).	Replace
Seal set	-	· Extruded excessively from seal groove square ring. 	Replace
	-	· Slipper ring 1.5mm(0.059in) narrower than seal groove, or narrower than back ring. 	Replace
	-	· Worn more than 0.5mm(0.02in) ~ 1.5mm(MAX.) (0.059in) 	Replace

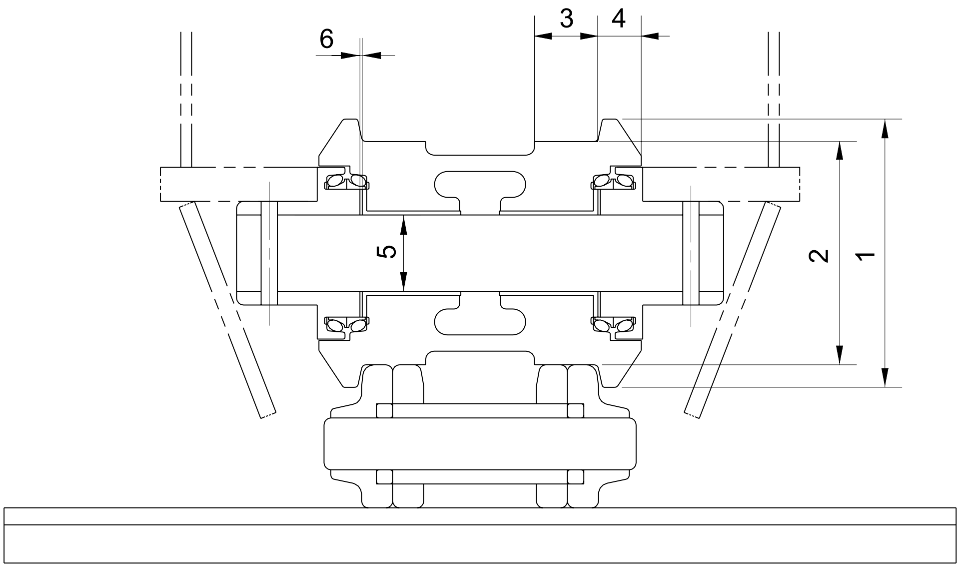
9. CYLINDER

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

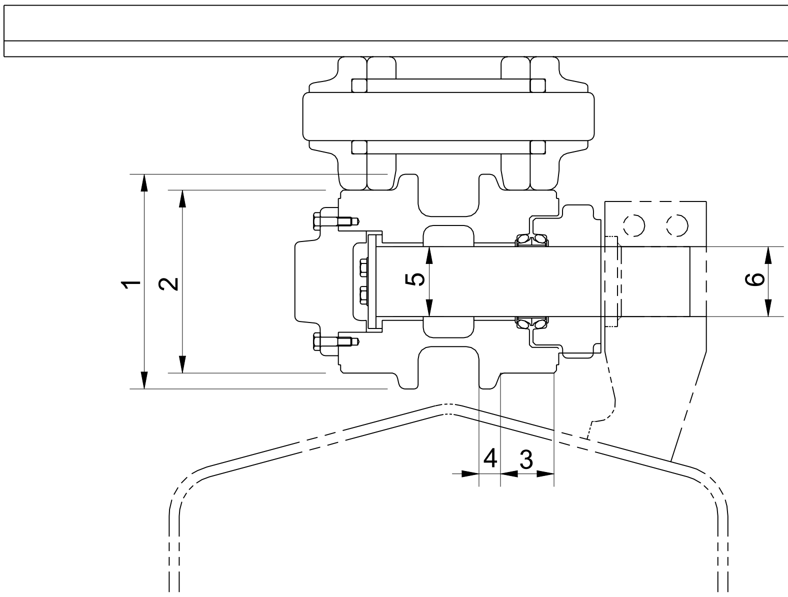


32077MS01

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		ø 216		ø 204		
2	Outside diameter of tread	ø 180		ø 168		
3	Width of tread	51		56		
4	Width of flange	26		21		
5	Clearance between shaft and bushing	Standard size & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		ø 75 $^{0}_{-0.03}$	ø 75.35 $^{+0.05}_{0}$	0.35 to 0.43	2.0	
6	Side clearance of roller (Both side)	Standard clearance		Clearance limit		Replace
		0.16~1.24		2.0		

2) CARRIER ROLLER

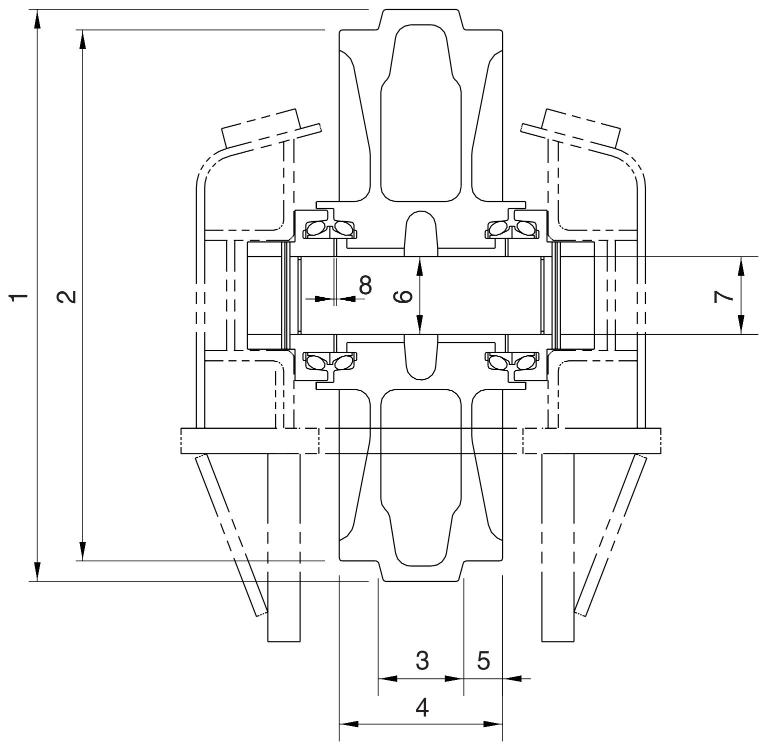


32077MS02

Unit : ㎜

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		ø 200		ø 186		
2	Outside diameter of tread	ø 168		ø 154		
3	Width of tread	54		61		
4	Width of flange	19		12		
5	Clearance between shaft and bushing	Standard size & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		ø $55^{+0.085}_{+0.066}$	ø $55^{+0.37}_{+0.33}$	0.245 to 0.304	2.0	
6	Clearance between shaft and support	ø $58^{\ 0}_{-0.1}$	ø $58^{+0.5}_{+0.3}$	0.3 to 0.6	1.2	Replace

3) IDLER

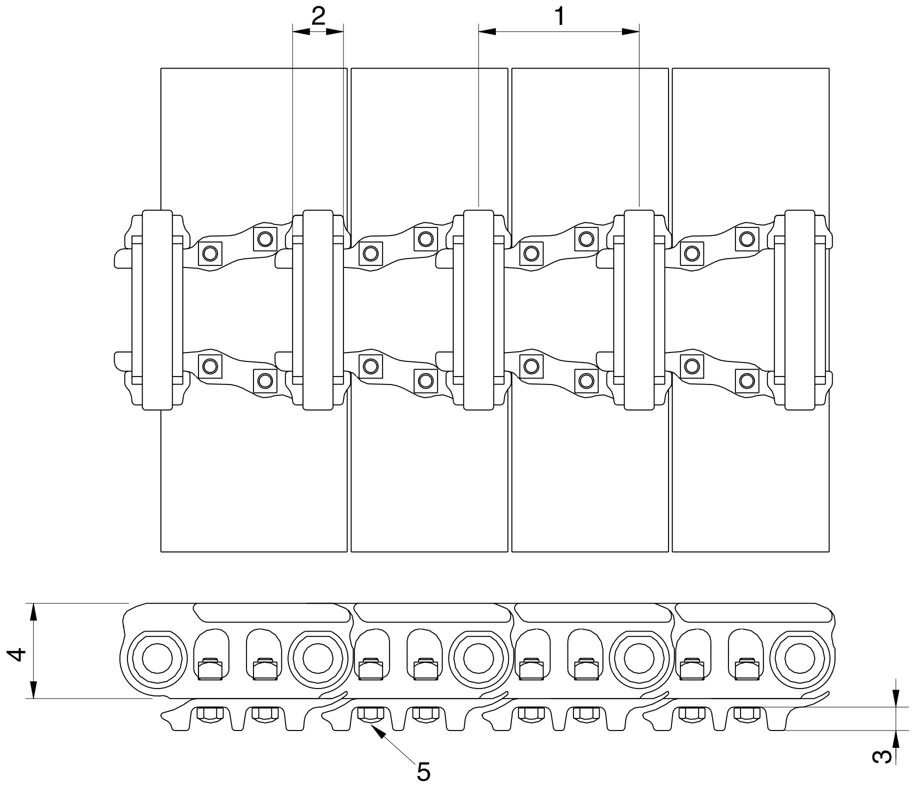


21073MS03

Unit : ㎜

<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 protrusion</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="6">Rebuild or replace</td></tr>
<tr><td colspan="2">ø 646</td><td colspan="2">ø 636</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">ø 594</td><td colspan="2">ø 584</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="2">98</td><td colspan="2">92</td></tr>
<tr><td>4</td><td>Total width</td><td colspan="2">203</td><td colspan="2">-</td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="2">52.5</td><td colspan="2">55.5</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>$\text{ø}\,90\ ^{0}_{-0.035}$</td><td>$\text{ø}\,90.35\ ^{+0.05}_{0}$</td><td>0.35 to 0.435</td><td>2.0</td></tr>
<tr><td>7</td><td>Clearance between shaft and support</td><td>$\text{ø}\,90\ ^{0}_{-0.035}$</td><td>$\text{ø}\,90\ ^{+0.09}_{+0.036}$</td><td>0.036 to 0.125</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</td></tr>
<tr><td colspan="2">0.4 to 1.2</td><td colspan="2">2.0</td></tr>
</table>

4) TRACK

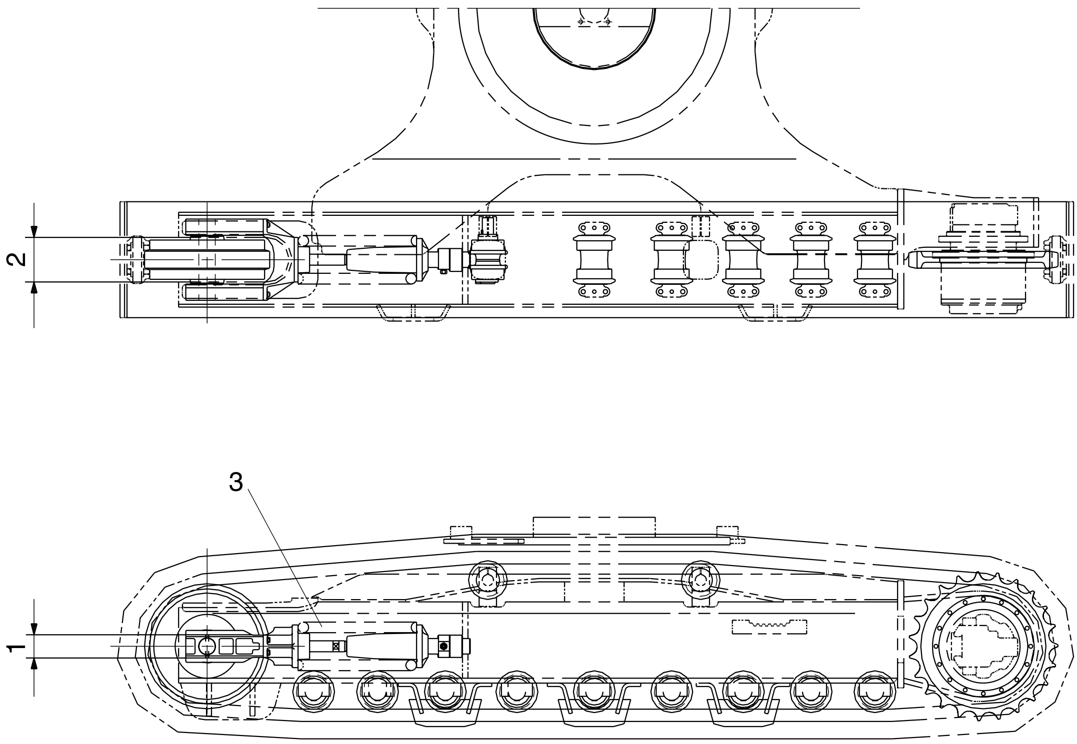


32077MS04

Unit : ㎜

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		216	223	
2	Outside diameter of bushing	ø 66.5	ø 58.5	Rebuild or replace
3	Height of grouser	30	21	
4	Height of link	116	104	
5	Tightening torque	Initial tightening torque : 115±5kgf · m		Retighten

5) TRACK FRAME AND RECOIL SPRING

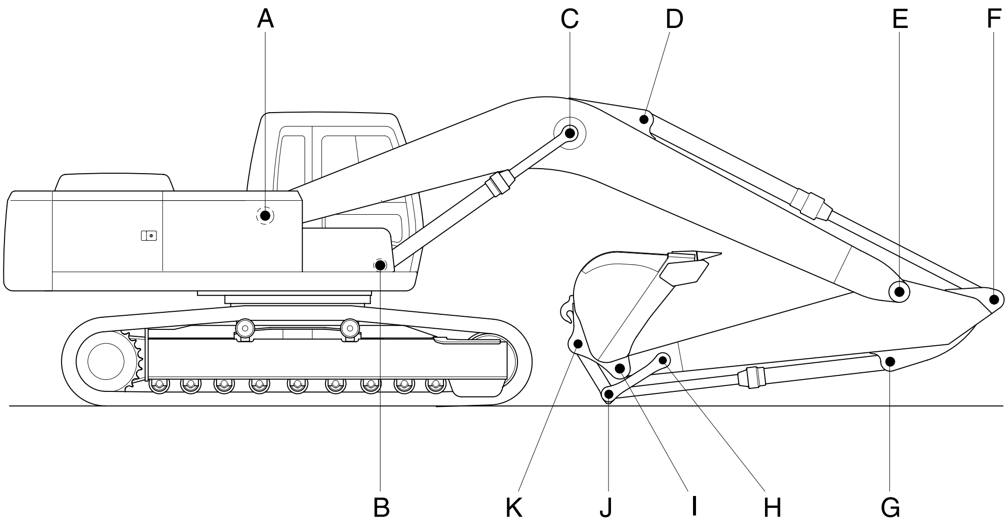


21073MS05

Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="20">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Vertical width of idler guide</td><td colspan="5"></td><td colspan="5">Standard size</td><td colspan="5">Tolerance</td><td colspan="5">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="5">Track frame</td><td colspan="5">132</td><td colspan="5">+2
0</td><td colspan="5">138</td></tr>
<tr><td colspan="5">Idler support</td><td colspan="5">130</td><td colspan="5">0
- 1.5</td><td colspan="5">124</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Horizontal width of idler guide</td><td colspan="5">Track frame</td><td colspan="5">292</td><td colspan="5">+2
0</td><td colspan="5">298</td></tr>
<tr><td colspan="5">Idler support</td><td colspan="5">290</td><td colspan="5">-</td><td colspan="5">286</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Recoil spring</td><td colspan="12">Standard size</td><td colspan="8">Repair limit</td><td rowspan="3">Replace</td></tr>
<tr><td colspan="4">Free length</td><td colspan="4">Installation length</td><td colspan="4">Installation load</td><td colspan="4">Free length</td><td colspan="4">Installation load</td></tr>
<tr><td colspan="4">Ø253 ×690</td><td colspan="4">580</td><td colspan="4">19610kg</td><td colspan="4">-</td><td colspan="4">15210kg</td></tr>
</table>

2. WORK EQUIPMENT



21077MS20

Unit : mm

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	110	109	108.5	110.5	111	Replace
B	Boom Cylinder Head	100	99	98.5	100.5	101	
C	Boom Cylinder Rod	100	99	98.5	100.5	101	
D	Arm Cylinder Head	100	99	98.5	100.5	101	
E	Boom Front	100	99	98.5	100.5	101	
F	Arm Cylinder Rod	100	99	98.5	100.5	101	
G	Bucket Cylinder Head	90	89	88.5	90.5	91	
H	Arm Link	90	89	88.5	90.5	91	
I	Bucket and Arm Link	100	99	98.5	100.5	101	
J	Bucket Cylinder Rod	90	89	88.5	90.5	91	
K	Bucket Link	100	99	98.5	100.5	101	

SECTION 8 DISASSEMBLY AND ASSEMBLY

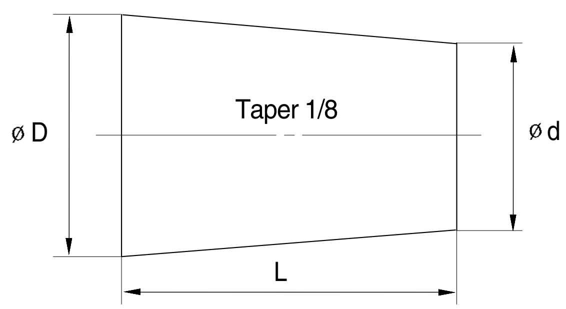
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. COMPLETING WORK

1) If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.
2) If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
3) If the piping or hydraulic equipment, such as hydraulic cylinders, pumps, or motors, have been removed for repair, always bleed the air from the system after reassembling the parts.
4) Add the specified amount of grease(Molybdenum disulphied grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf·m	lbf·ft
1	Engine	Engine mounting bolt(engine-bracket)	M22×2.5	69.6±7.0	503±51
2		Engine mounting bolt(bracket-frame)	M22×2.5	48±2.0	347±14.5
3		Radiator mounting bolt	M16×2.0	22±1.0	159±7.2
4		Coupling mounting socket bolt	M20×2.5	46.5±2.5	336±18.1
5		Main pump housing mounting bolt	M10×1.5	4.8±0.3	35±2.2
6	Hydraulic system	Main pump mounting socket bolt	M20×2.5	42±4.5	304±32.5
7		Main control valve mounting bolt	M16×2.0	19.5±1.3	141±9.4
8		Fuel tank mounting bolt	M20×2.5	46±5.0	333±36
9		Hydraulic oil tank mounting bolt	M20×2.5	46±5.0	333±36
10		Turning joint mounting bolt, nut	M12×1.75	12.3±1.3	88.9±9.4
11	Power train system	Swing motor mounting bolt	M20×2.5	58.4±6.4	422±46.3
12		Swing bearing upper part mounting bolt	M24×3.0	100±10	723±72.3
13		Swing bearing lower part mounting bolt	M24×3.0	100±10	723±72.3
14		Travel motor mounting bolt	M24×3.0	84±8.0	608±57.9
15		Sprocket mounting bolt	M20×2.5	57.9±6.0	419±43.4
16	Under carriage	Carrier roller mounting bolt, nut	M16×2.0	29.7±3.0	215±21.7
17		Track roller mounting bolt	M20×2.5	57.9±6.0	419±43.4
18		Track tension cylinder mounting bolt	M16×1.5	29.7±1.3	215±9.4
19		Track shoe mounting bolt, nut	M22×1.5	123±5.0	890±36.2
20		Track guard mounting bolt	M20×2.5	57.9±6.0	419±43.4
21	Others	Counterweight mounting bolt	M36×3.0	308±46	2228±333
22		Cab mounting bolt	M12×1.75	12.8±3.0	92.6±21.7
23		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 each component disassembly and assembly.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT - Coarse thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60.0
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.0	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8 × 1.0	2.2 ~ 3.4	15.9 ~ 24.6	3.0 ~ 4.4	21.7 ~ 31.8
M10 × 1.2	4.5 ~ 6.7	32.5 ~ 48.5	5.9 ~ 8.9	42.7 ~ 64.4
M12 × 1.25	7.8 ~ 11.6	56.4 ~ 83.9	10.6 ~ 16.0	76.7 ~ 116
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 131	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 195	26.6 ~ 36.0	192 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 391	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 516	70.7 ~ 95.7	511 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 665	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1339	182 ~ 248	1314 ~ 1796
M36 × 3.0	192 ~ 260	1390 ~ 1880	262 ~ 354	1894 ~ 2562

2) PIPE AND HOSE

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

3) FITTING

Thread size	Width across flat(mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	6	43.4
3/4"	36	13	94.0
1"	41	15	109

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

13031GE18

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

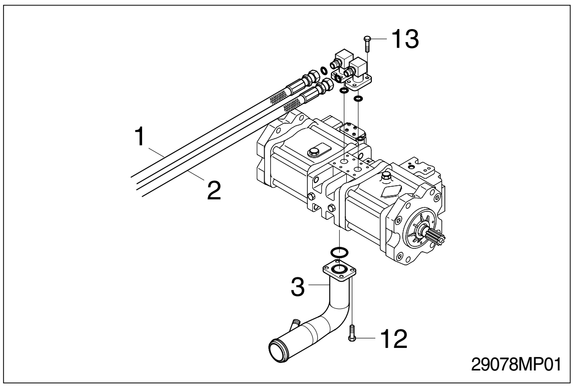
· Hydraulic tank quantity : 210 l

(4) Remove bolts(13) and disconnect pipe (1,2).

(5) Disconnect pilot line hoses(4, 5, 6, 7, 8, 9, 10, 11).

(6) Remove bolts(12) and disconnect pump suction tube (3).

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

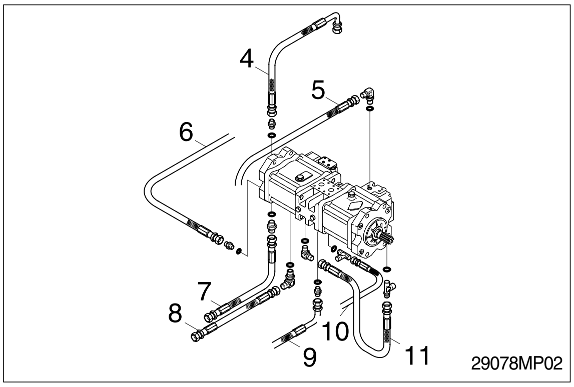


29078MP01

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

· Weight : 155kg(342lb)

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



29078MP02

2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace the return filter with a 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.

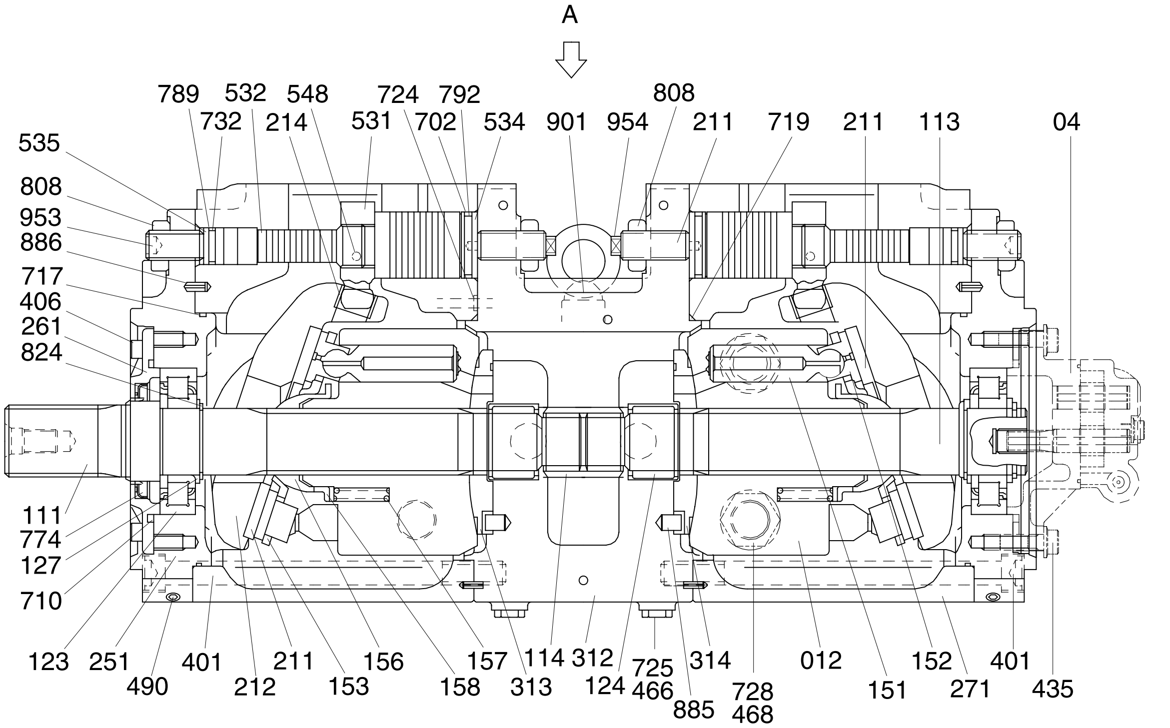
④ Tighten plug.

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

(8) Confirmed the hydraulic oil level and check the hydraulic oil leaks or not.

2. MAIN PUMP(1/2)

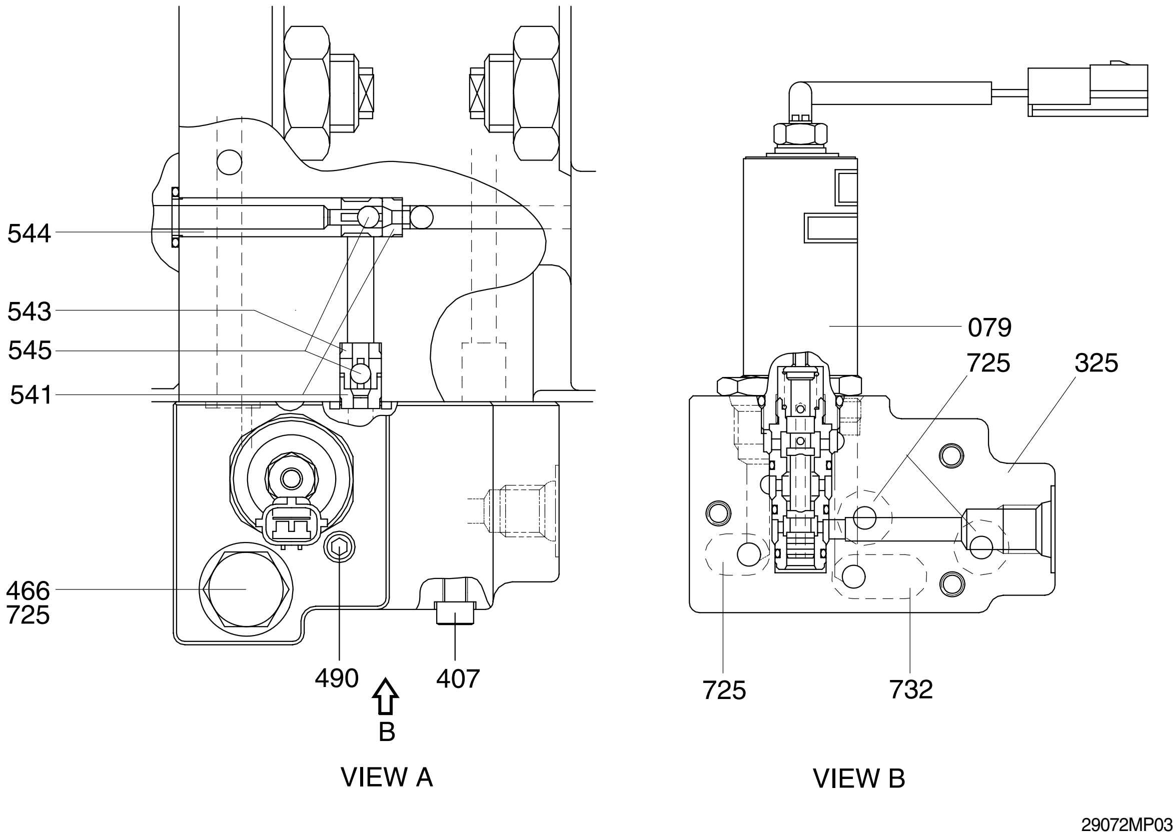
1) STRUCTURE



32072ST03

04	Gear pump	261	Seal cover(F)	710	O-ring
111	Drive shaft(F)	271	Pump casing	717	O-ring
113	Drive shaft(R)	312	Valve block	719	O-ring
114	Spline coupling	313	Valve plate(R)	724	O-ring
123	Roller bearing	314	Valve plate(L)	725	O-ring
124	Needle bearing	401	Hexagon socket bolt	728	O-ring
127	Bearing spacer	406	Hexagon socket bolt	732	O-ring
141	Cylinder block	435	Flange socket bolt	774	Oil seal
151	Piston	466	VP plug	789	Back up ring
152	Shoe	468	VP plug	792	Back up ring
153	Push plate	490	VP plug	808	Hexagon head nut
156	Bushing	531	Tilting pin	824	Snap ring
157	Cylinder spring	532	Servo piston	885	Pin
158	Spacer	534	Stopper(L)	886	Spring pin
211	Shoe plate	535	Stopper(S)	901	Eye bolt
212	Swash plate	548	Pin	953	Set screw
214	Bushing	702	O-ring	954	Set screw
251	Swash plate support				

MAIN PUMP(2/2)

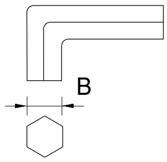
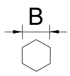


079	Proportional reducing valve	490	Plug	545	Steel ball
325	Casing assy	541	Seat	725	O-ring
407	Hexagon screw	543	Stopper 1	732	O-ring
466	Plug	544	Stopper 2		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="4">Part name</th></tr>
<tr><td rowspan="6">Allen wrench
</td><td>B</td><td>Hexagon socket head bolt</td><td>PT plug (PT thread)</td><td>PO plug (PF thread)</td><td>Hexagon socket head setscrew</td></tr>
<tr><td>4</td><td>M 5</td><td>BP-1/16</td><td>-</td><td>M 8</td></tr>
<tr><td>5</td><td>M 6</td><td>BP1/ 8</td><td>-</td><td>M10</td></tr>
<tr><td>6</td><td>M 8</td><td>BP-1/ 4</td><td>PO-1/4</td><td>M12, M14</td></tr>
<tr><td>8</td><td>M10</td><td>BP-3/ 8</td><td>PO-3/8</td><td>M16, M18</td></tr>
<tr><td>17</td><td>M20, M22</td><td>BP-1</td><td>PO-1, 1 1/4, 1 1/2</td><td>-</td></tr>
<tr><td rowspan="6">Double ring spanner, socket wrench, double(Single) open end spanner
</td><td>-</td><td>Hexagon head bolt</td><td colspan="2">Hexagon head bolt</td><td>VP plug (PF thread)</td></tr>
<tr><td>19</td><td>M12</td><td colspan="2">M12</td><td>VP-1/4</td></tr>
<tr><td>24</td><td>M16</td><td colspan="2">M16</td><td>-</td></tr>
<tr><td>27</td><td>M18</td><td colspan="2">M18</td><td>VP-1/2</td></tr>
<tr><td>30</td><td>M20</td><td colspan="2">M20</td><td>-</td></tr>
<tr><td>36</td><td>-</td><td colspan="2">-</td><td>VP-3/4</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="4">Medium size, 1 set</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="4">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="4">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="4">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="4">Steel bar of key material approx. 10×8×200</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="4">Capable of tightening with the specified torques</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	115.7	0.47	12
	M16	24.0	173.6	0.55	14
	M18	34.0	245.9	0.55	14
	M20	44.0	318.3	0.67	17
PT plug(Material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/16	0.7	5.1	0.16	4
	PT 1/ 8	1.05	7.59	0.20	5
	PT 1/ 4	1.75	12.66	0.24	6
	PT 3/ 8	3.5	25.3	0.31	8
	PT 1/ 2	5.0	36.2	0.39	10
PF plug(Material : S45C)	PF 1/ 4	3.0	21.7	0.24	6
	PF 1/ 2	10.0	72.3	0.39	10
	PF 3/ 4	15.0	108.5	0.55	14
	PF 1	19.0	137.4	0.67	17
	PF 1 1/4	27.0	195.3	0.67	17
	PF 1 1/2	28.0	202.5	0.67	17

3) DISASSEMBLY

(1) Select place suitable to disassembling.

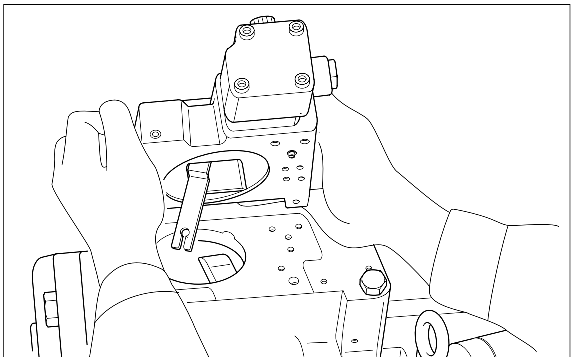
※ Select clean place.

※ Spread rubber sheet, cloth or so on, on overhaul workbench top to prevent parts from being damaged.

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

(3) Remove drain port plug(468) and let oil out of pump casing.(Front and rear pump).

(4) Remove hexagon socket head bolts(412, 413) and remove regulator.
Remove hexagon socket head bolts(416) and remove gear pump.

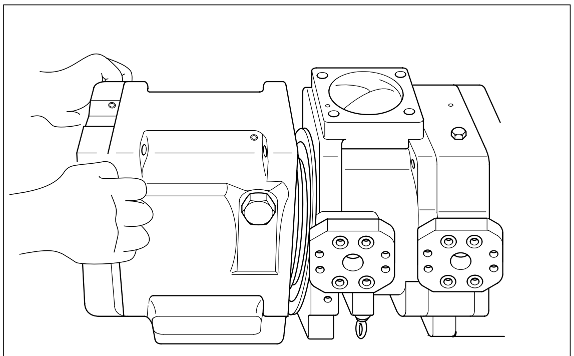


MP01 (290-7)

(5) Loosen hexagon socket head bolts(401) fixing swash plate support(251), pump casing(271) and valve block(312).

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

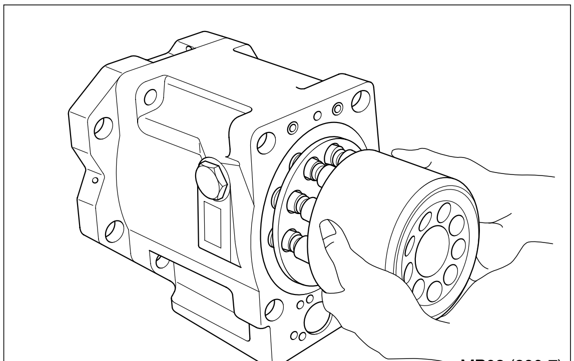
※ Before bringing this surface down, spread rubber sheet on workbench without failing to prevent this surface from being damaged.



MP02 (290-7)

(7) Pull cylinder(141) out of pump casing (271) straightly over drive shaft(111). Pull out also pistons(151), set plate(153), spherical bush(156) and cylinder springs (157) simultaneously.

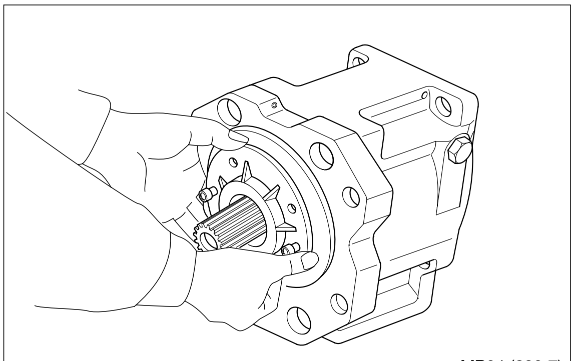
※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.



MP03 (290-7)

(8) Remove hexagon socket head bolts(406) and then seal cover(F) (261).
Fit bolt into pulling out tapped hole of seal cover(F), and cover can be removed easily.

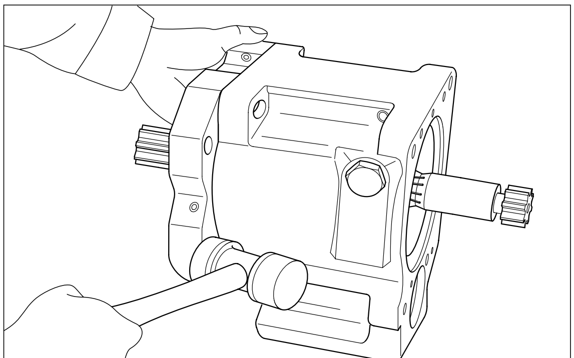
※ Since oil seal is fitted on seal cover(F), take care not to damage it when removing cover.



MP04 (290-7)

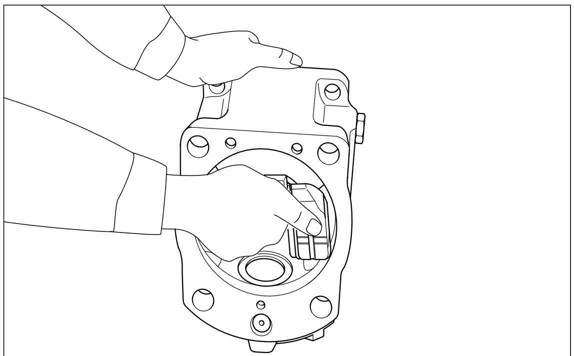
(9) Remove hexagon socket head bolts(408) and then seal cover(R, 262).
In case of fitting a gear pump, first, remove gear pump.

(10) Tapping lightly fitting flange section of swash plate support(251) on its pump casing side, separate swash plate support from pump casing.



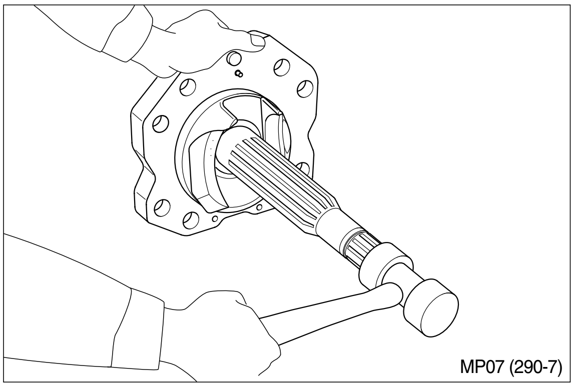
MP05 (290-7)

(11) Remove shoe plate(211)and swash plate(212) from pump casing(271).



MP06 (290-7)

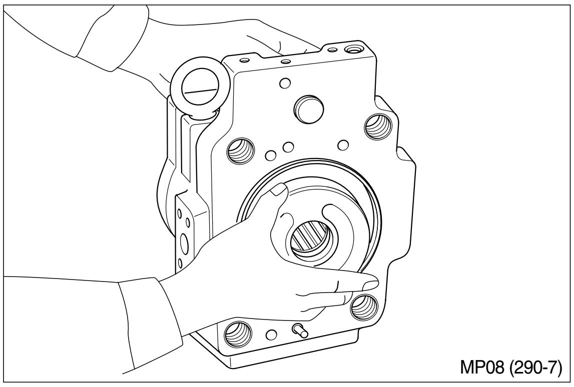
(12) Tapping lightly shaft's end of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



MP07 (290-7)

(13) Remove valve plates(313, 314) from valve block(312).

※ These may be removed in work 6.



MP08 (290-7)

(14) If necessary, remove stopper(L, 534), stopper(S, 535), servo piston(532) and tilting pin(531) from pump casing(271), and needle bearing(124) and splined coupling(114) from valve block(312).

※ In removing tilting pin, use a protector to prevent pin head from being damaged.

※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.

※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.

※ Do not loosen hexagon nuts of valve block and swash plate support.
Once loosened, flow setting will be changed.

4) ASSEMBLY

(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.

② Clean each part fully with cleaning oil and dry it with compressed air.

③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.

④ In principle, replace seal parts, such as O-rings, oil seals, etc.

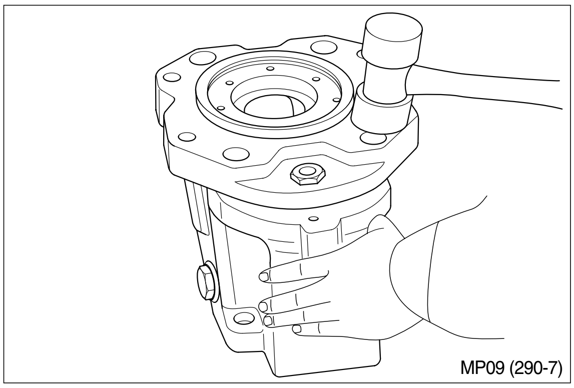
⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in Section 2-3.

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

(2) Fit swash plate support(251) to pump casing(271), tapping the former lightly with a hammer.

※ After servo piston, tilting pin, stopper(L) and stopper(S) are removed, fit them soon to pump casing in advance for reassembling.

※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply lock-tight(Medium strength) to their threaded sections.

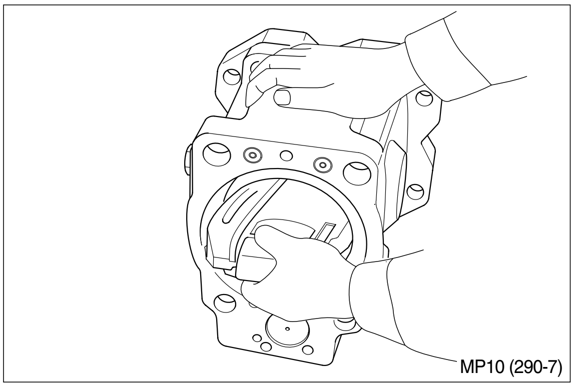


MP09 (290-7)

(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin(531), and fit swash plate (212) to swash plate support(251) correctly.

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

※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



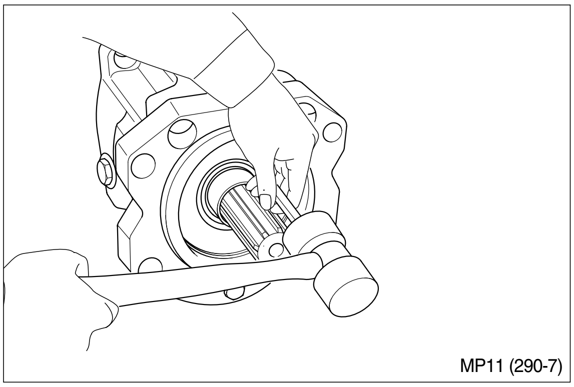
MP10 (290-7)

(4) To swash plate support(251), fit drive shaft (111) set with bearing(123), bearing spacer(127) and snap ring(824).

※ Do not tap drive shaft with hammer or so on.

※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.

※ Fit them fully, using steel bar or so on.



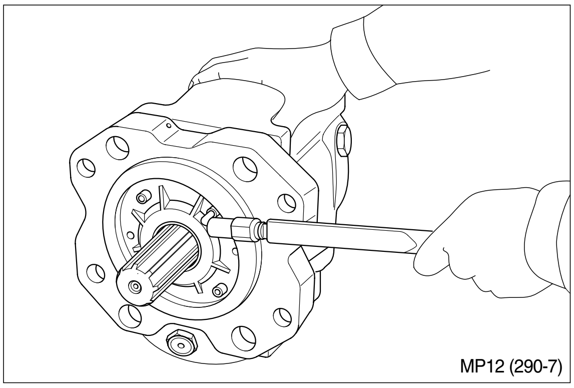
MP11 (290-7)

(5) Assemble seal cover(F, 261) to pump casing(271) and fix it with hexagon socket head bolts(406).

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

※ Assemble oil seal, taking full care not to damage it.

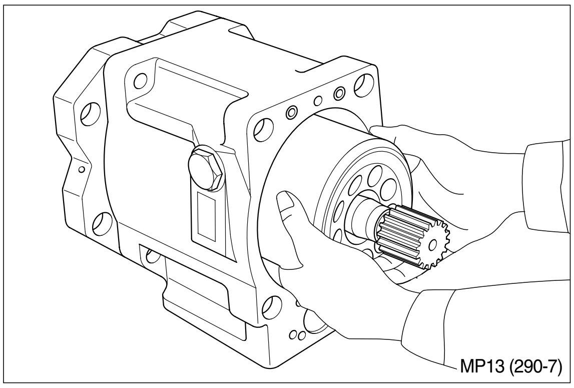
※ For tandem type pump, fit rear cover(263) and seal cover(262).



MP12 (290-7)

(6) Assemble piston cylinder subassembly 〔Cylinder(141), piston subassembly(151, 152), set plate(153), spherical bush(156), spacer(158) and cylinder spring(157).〕

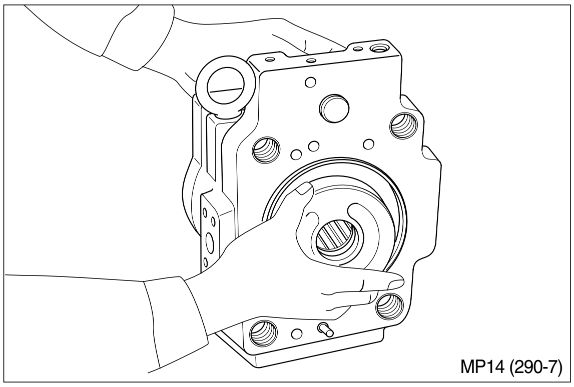
Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.



MP13 (290-7)

(8) Fit valve plate(313) to valve block(312), entering pin into pin hole.

※ Take care not to mistake suction / delivery directions of valve plate.

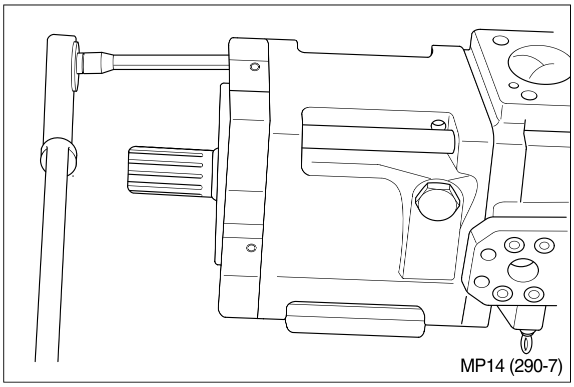


MP14 (290-7)

(8) Fit valve block(312) to pump casing (271) and tighten hexagon socket head bolts(401).

※ At first assemble this at rear pump side, and this work will be easy.

※ Take care not to mistake direction of valve block.



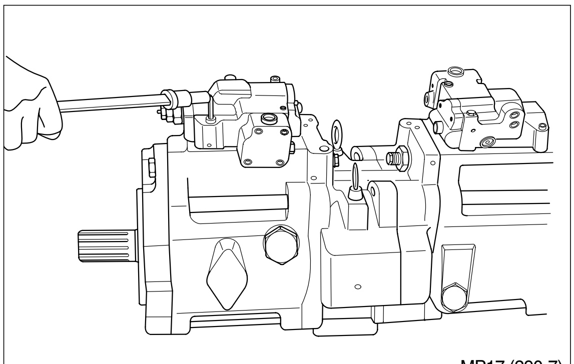
MP14 (290-7)

※ Clockwise rotation(Viewed from input shaft side)

※ Fit block with regulator up and with delivery flange left, viewed from front side.

(9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).

※ Take care not to mistake regulator of front pump for that of rear pump.



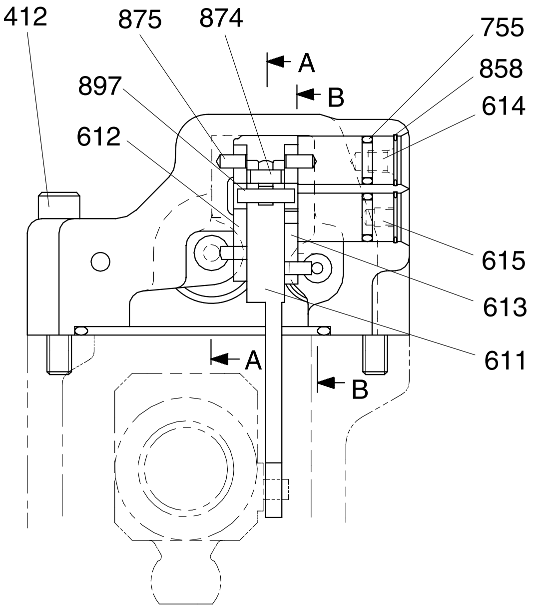
MP17 (290-7)

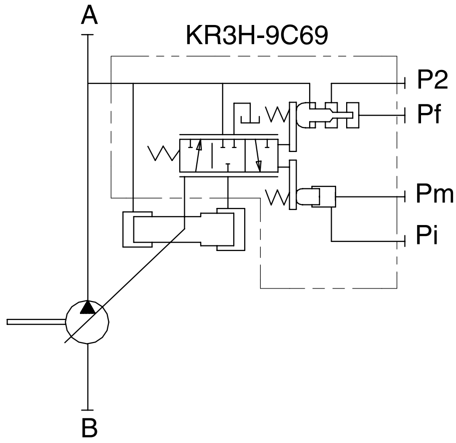
(10) Fit drain port plug(468).

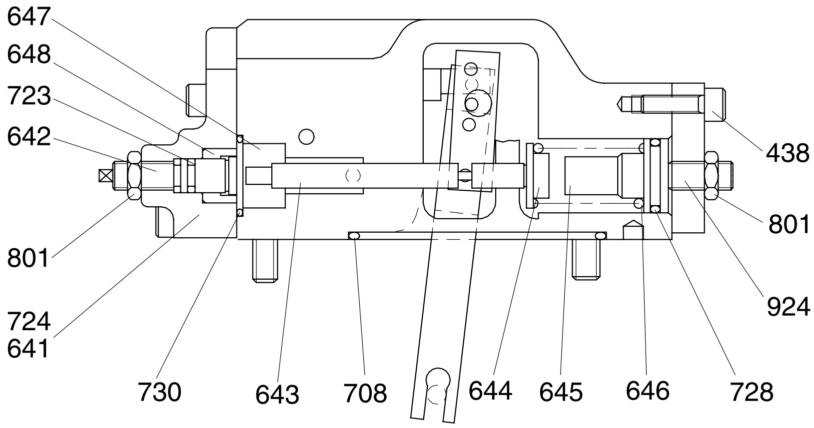
This is the end of reassembling procedures.

3. REGULATOR

1) STRUCTURE(1/2)

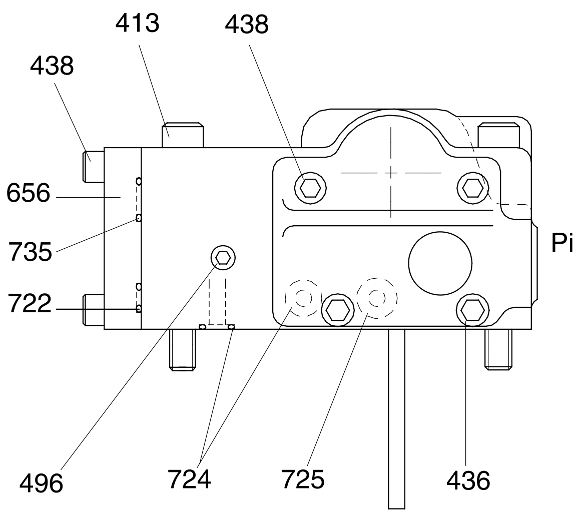






SECTION B-B

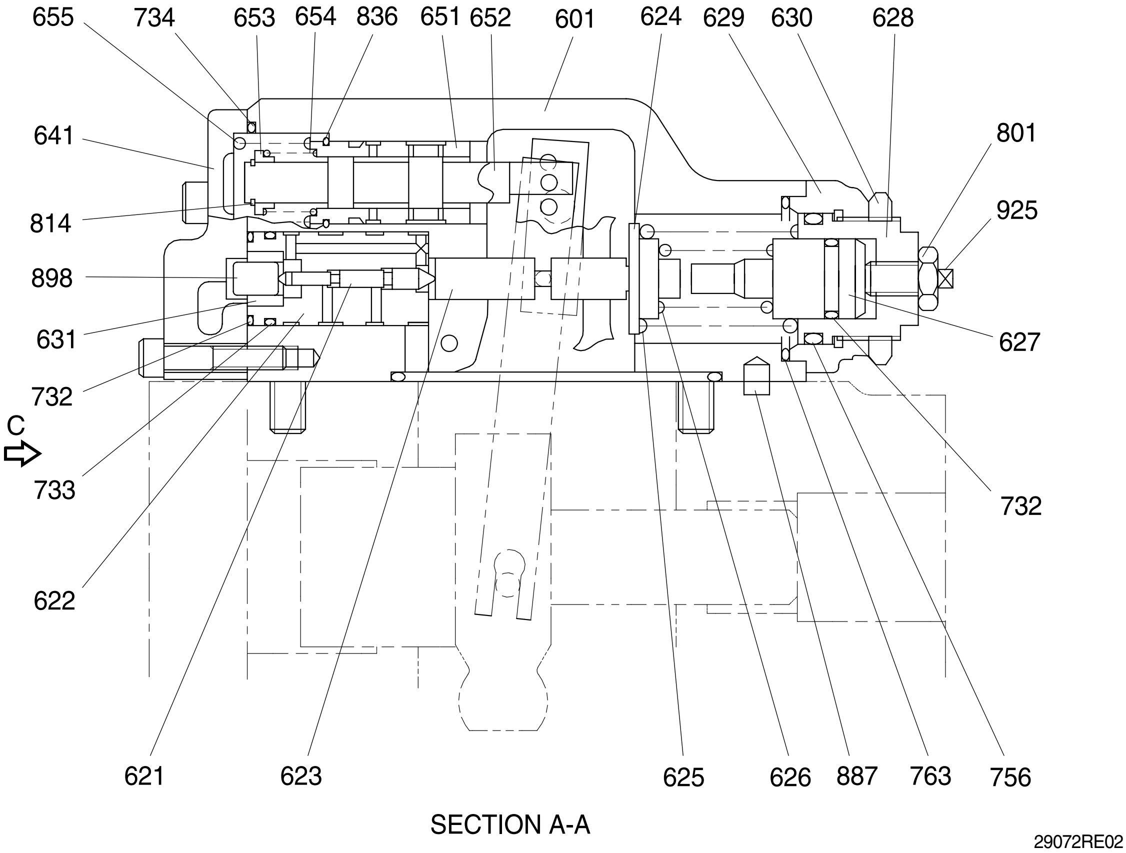
32072ST04



VIEW C

Port	Port name	port size
A	Delivery port	SAE6000psi 1"
B	Suction port	SAE2000psi 3"
Pi	Pilot port	PF 1/4-15
Pm	Qmax cut port	PF 1/4-15

REGULATOR(2/2)



412	Hexagon socket screw
413	Hexagon socket screw
436	Hexagon socket screw
438	Hexagon socket screw
496	Plug
601	Casing
611	Feed back lever
612	Lever(1)
613	Lever(2)
614	Fulcrum plug
615	Adjust plug
621	Compensator piston
622	Piston case
623	Compensator rod
624	Spring seat(C)
625	Outer spring
626	Inner spring
627	Adjust stem(C)
628	Adjust screw(C)
629	Cover(C)
630	Lock nut
631	Sleeve, pf
641	Pilot cover
642	Adjust screw(QMC)
643	Pilot piston
644	Spring seat(Q)
645	Adjust stem(Q)
646	Pilot spring
647	Stopper
648	Piston(QMC)
651	Sleeve
652	Spool
653	Spring seat
654	Return spring
655	Set spring
656	Block cover
708	O-ring
722	O-ring
723	O-ring
724	O-ring
725	O-ring
728	O-ring
730	O-ring
732	O-ring
733	O-ring
734	O-ring
735	O-ring
755	O-ring
756	O-ring
763	O-ring
801	Nut
814	Snap ring
836	Snap ring
858	Snap ring
874	Spring pin
875	Pin
887	Pin
897	Pin
898	Pin
924	Set screw
925	Adjust screw(QI)

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			
Allen wrench	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
	4	M 5	BP-1/16	-	M 8
	5	M 6	BP1/ 8	-	M10
	6	M 8	BP-1/ 4	PO-1/4	M12, M14
Socket wrench, double(single) open end	-	Hexagon head bolt	Hexagon nut	VP plug (PF thread)	
	6	M 8	M 8	-	
Adjustable angle wrench		Small size, Max 36mm			
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.			
Pincers		-			
Bolt		M4, Length : 50mm			

(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	115.7	0.47	12
PT plug(Material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/16	0.7	5.1	0.16	4
	PT 1/ 8	1.05	7.59	0.20	5
	PT 1/ 4	1.75	12.66	0.24	6
PF plug(Material : S45C)	PT 1/ 4	3.0	21.7	0.24	6

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 not 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.

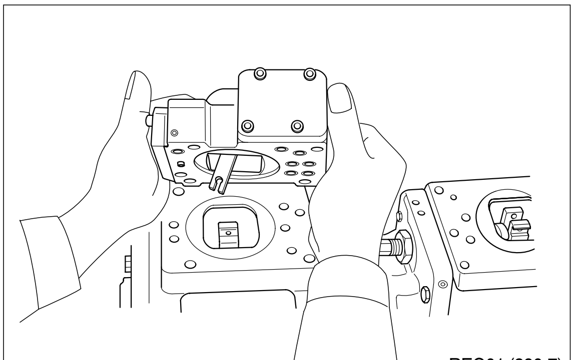
※ Choose a clean place.

※ 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.



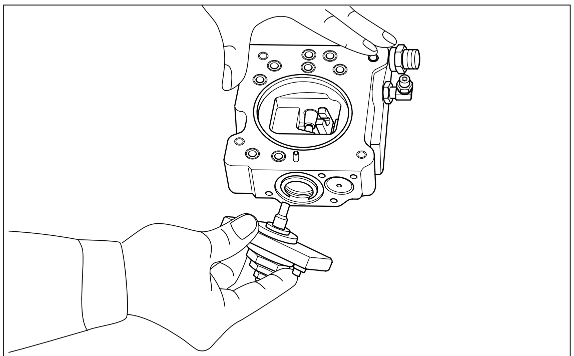
REG01 (290-7)

(4) Remove hexagon socket head screw (438) and remove cover(C,629).

※ Cover(C) is fitted with adjusting screw (C,QI)(628, 925), adjusting ring(C, 627), lock nut(630), hexagon nut(801) and adjusting screw(924).

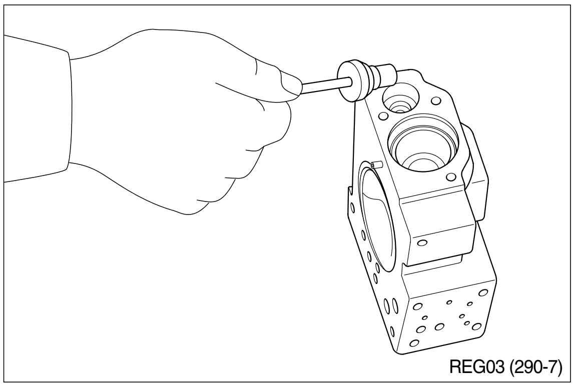
Do not loosen these screws and nuts.

If they are loosened, adjusted pressure-flow setting will vary.



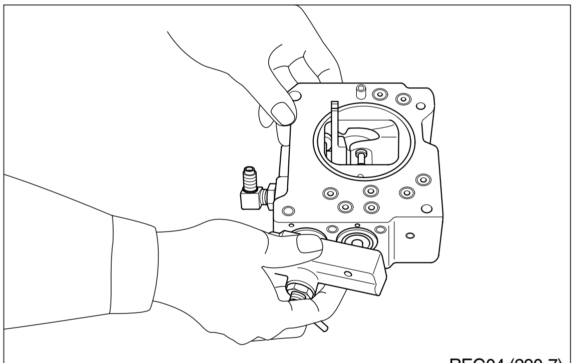
REG02 (290-7)

(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.



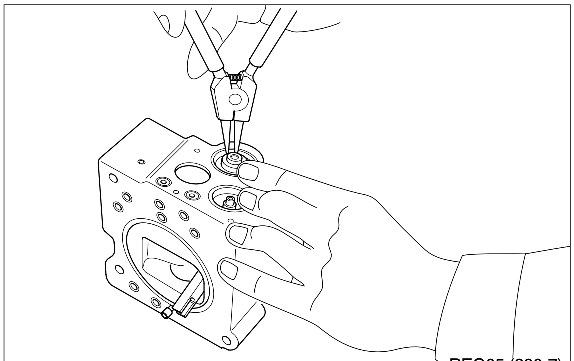
REG03 (290-7)

(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.



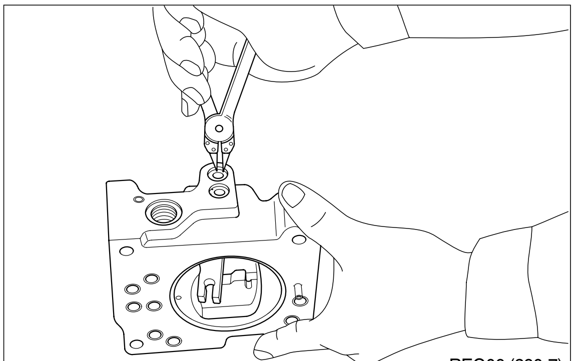
REG04 (290-7)

(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.

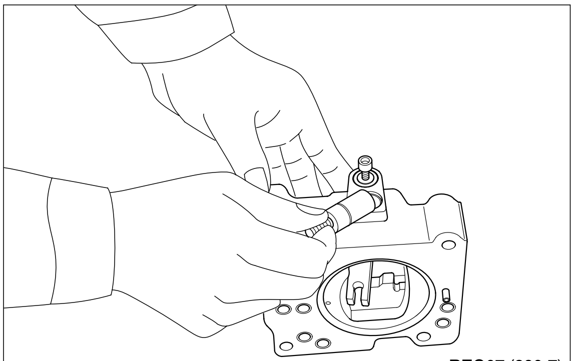


REG05 (290-7)

(8) Remove locking ring(858) and take out fulcrum plug(614) and adjusting plug (615).
※ Fulcrum plug(614) and adjusting plug (615) can easily be taken out with M6 bolt.



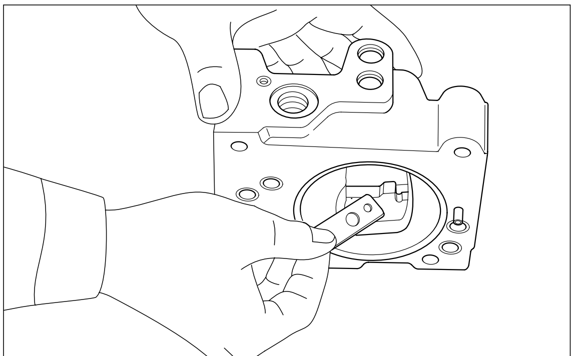
REG06 (290-7)



REG07 (290-7)

(9) Remove lever(2, 613). Do not draw out pin(875).

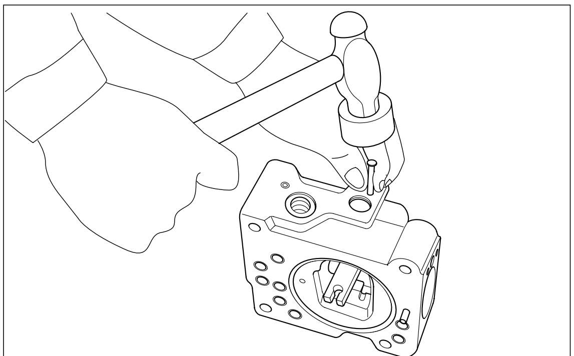
※ Work will be promoted by using pincers or so on.



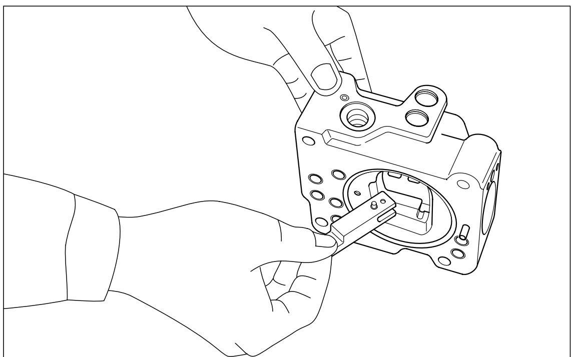
REG08 (290-7)

(10) Draw out pin(874) and remove feedback lever(611).

※ Push out pin(874, 4mm in dia.) from above with slender steel bar so that it may not interfere with lever(1, 612).



REG09 (290-7)



REG10 (290-7)

(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 operation.

4) ASSEMBLY

(1) For assembly, reverse disassembly procedures, but pay attention to the following items.

① Always repair parts that were scored at disassembly.
Get replacement parts ready beforehand.

② 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.

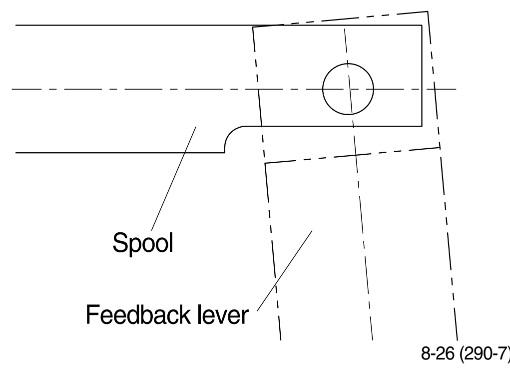
(2) Put compensating rod(623) into compensating hole of casing(601).

(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.

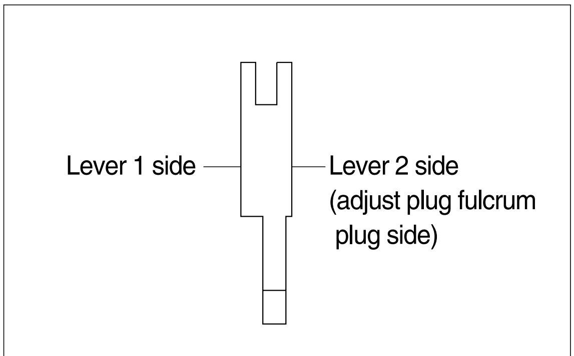
※ Confirm that spool and sleeve slide smoothly in casing without binding.

※ Pay attention to orientation of spool.



8-26 (290-7)

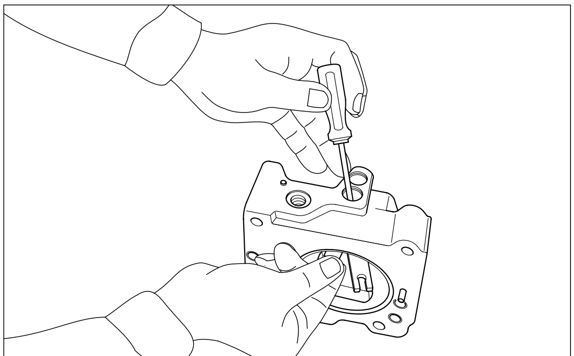
(5) Fit feedback lever(611), matching its pin hole with pin hole in spool.
Then insert pin(874).
※ Insert pin in feedback lever a little to ease operation.
※ Take care not to mistake direction of feedback lever.



8-27 (290-7)

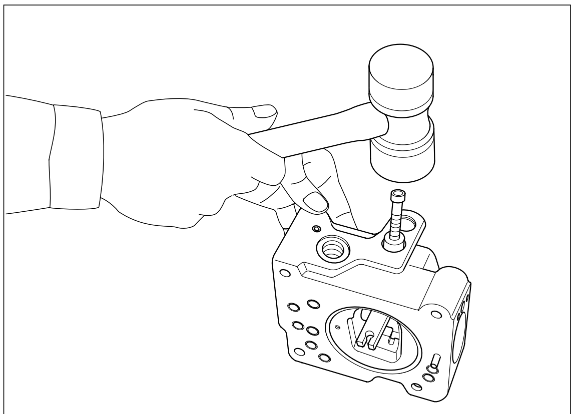
(6) Put pilot piston(643) into pilot hole of casing.
※ Confirm that pilot piston slides smoothly without binding.

(7) Put pin force-fitted in lever(2, 613) into groove of pilot piston.
Then fix lever(2).

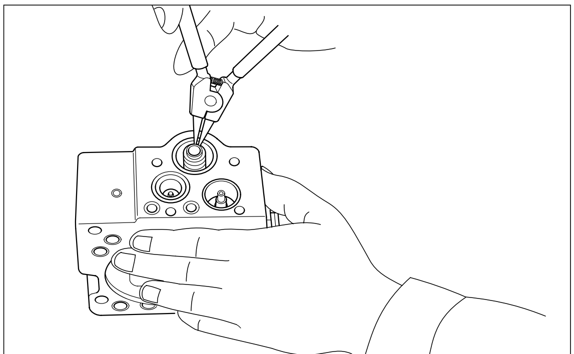

REG11 (290-7)

(8) Fit fulcrum plug(614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever(2).
Then fix locking ring(858).

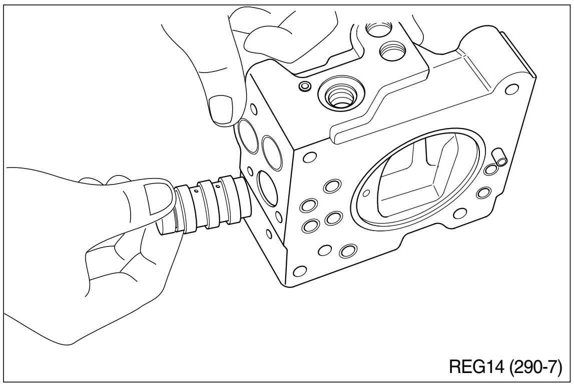
(9) Insert adjusting plug(615) and fit locking ring.
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.


REG12 (290-7)

(10) Fit return spring(654) and spring seat (653) into spool hole and attach snap ring (814).

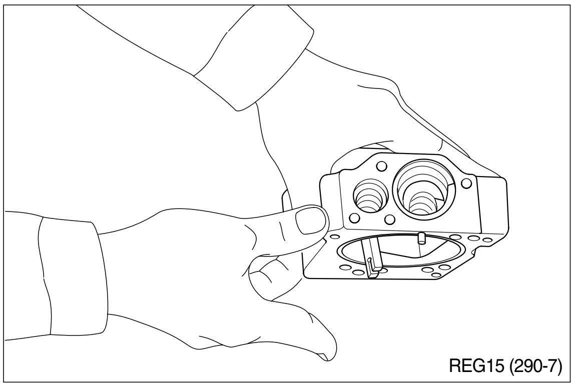

REG13 (290-7)

(11) Fit set spring(655) to spool hole and put compensating piston(621) and piston case(622) into compensating hole.
Fit pilot cover(641) and tighten it with hexagonal socket head screws(436, 438).



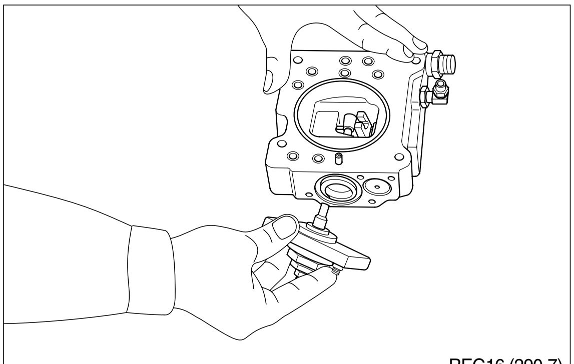
REG14 (290-7)

(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.



REG15 (290-7)

(13) Install cover(C, 629) fitted with adjusting screws(628, 925), 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.



REG16 (290-7)

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove bolts and disconnect pipe.

(5) Disconnect pilot line hoses.

(6) Disconnect pilot piping.

(7) Sling the control valve assembly and remove the control valve mounting bolt.

· Weight : 200kg(425lb)

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

2) INSTALL

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

(2) Bleed the air from below items.

① Cylinder(Boom, arm, bucket)

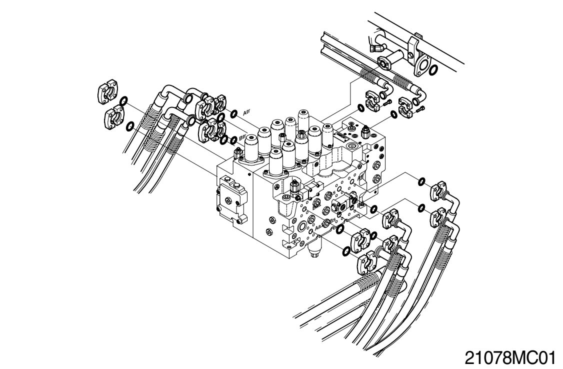
② Swing motor

③ Travel motor

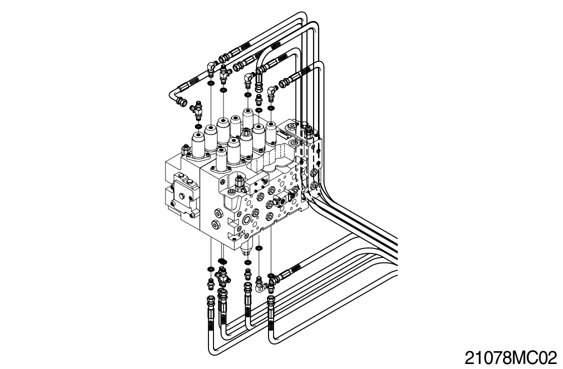
※ See each item removal and install.

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

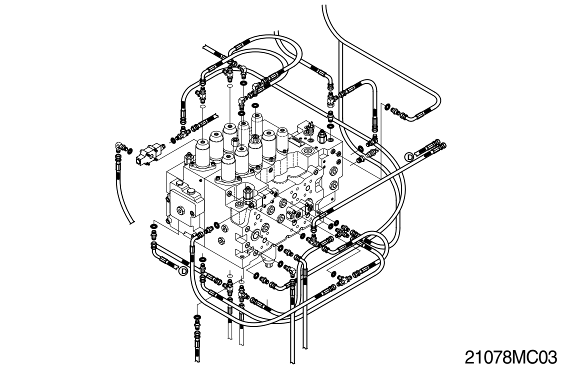
13031GE18



21078MC01

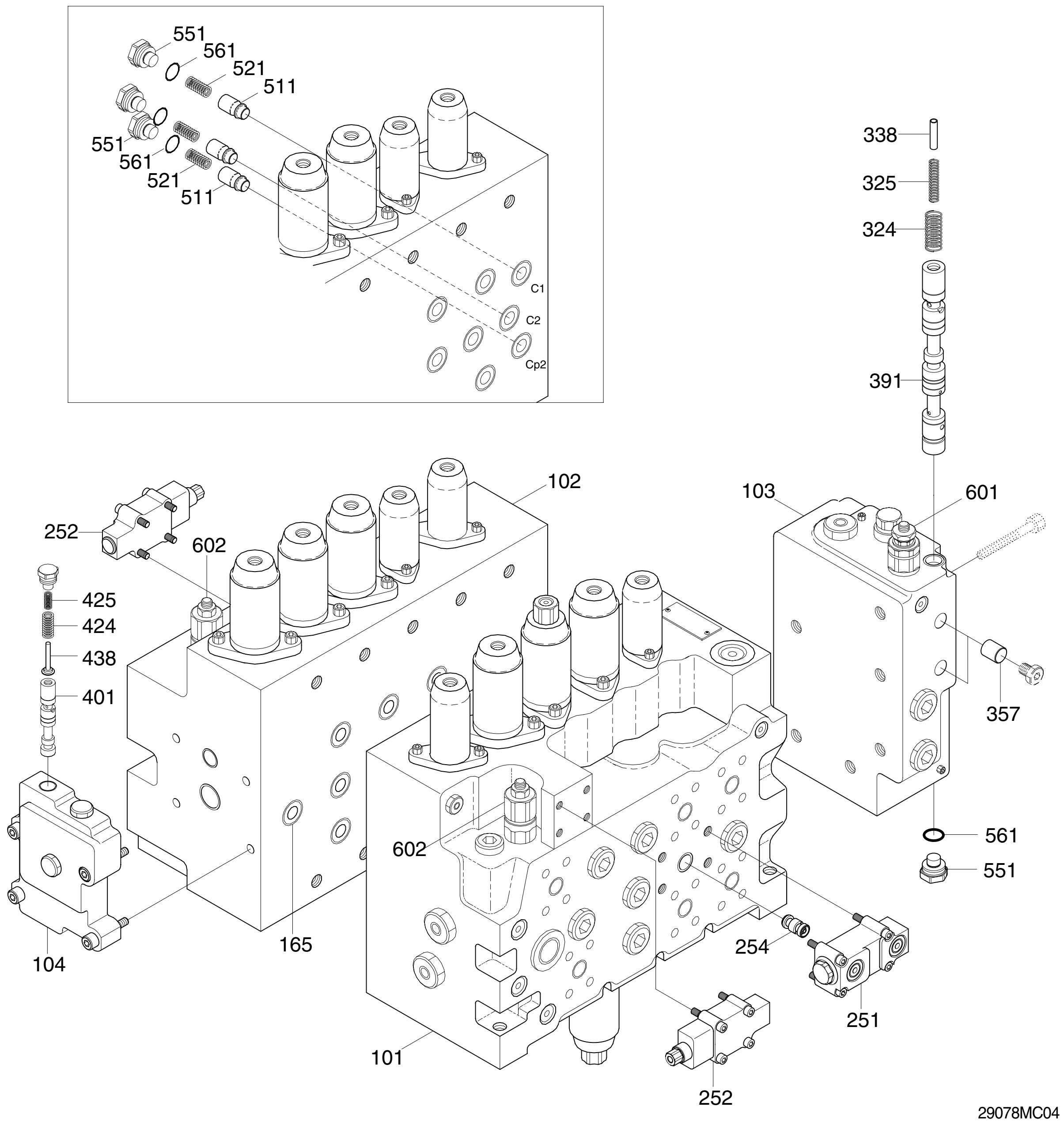


21078MC02



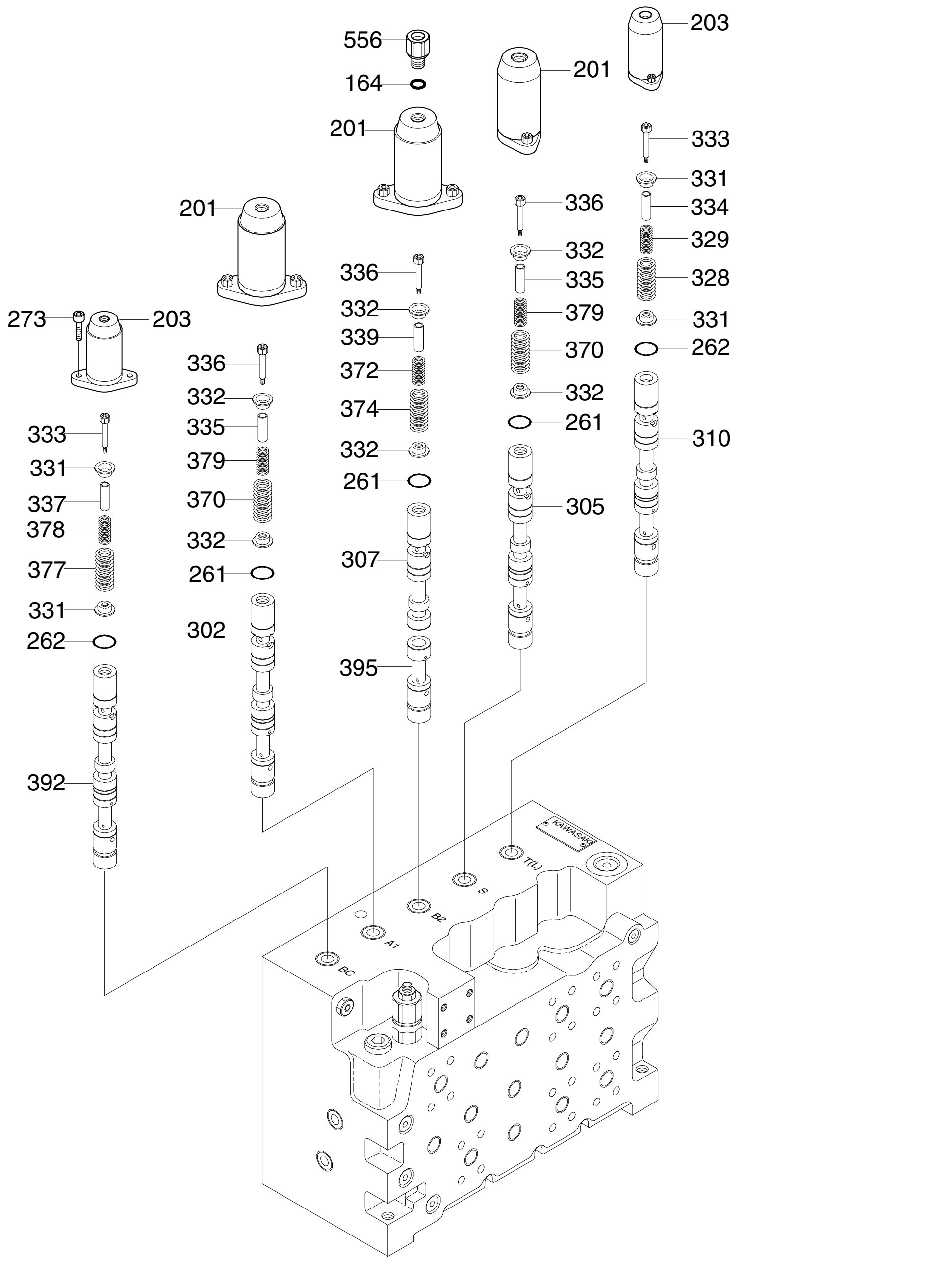
21078MC03

2. STRUCTURE(1/5)



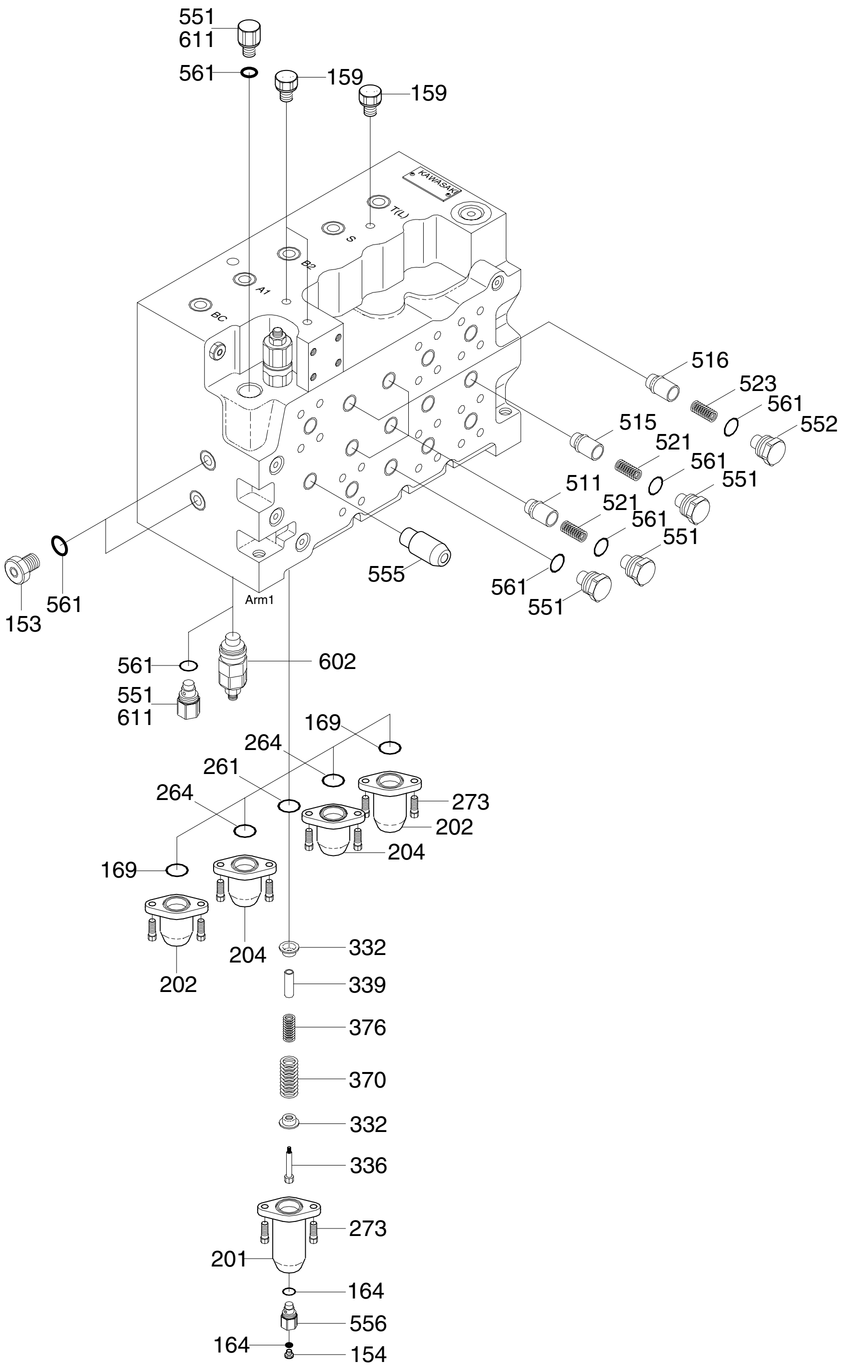
101	Casing A	324	Spring	438	Rod
102	Casing B	325	Spring	511	Poppet
103	Block	338	Stopper	521	Spring
104	Block	357	Oriffice	551	Plug
165	O-ring	391	Travel spool	561	O-ring
251	Control valve	401	Bypass cut spool	601	Main relief valve
252	Lock valve	424	Spring	602	Port relief valve
254	Logic valve	425	Spring		

STRUCTURE(2/5)



164	O-ring	329	Spring	372	Spring
201	Cover	331	Seat	374	Spring
203	Cover	332	Seat	377	Spring
261	O-ring	333	Bolt	378	Spring
273	Socket screw	334	Stopper	379	Spring
302	Arm 1 spool	335	Stopper	392	Bypass cut spool
305	Swing spool	336	Bolt	395	Priority spool
307	Boom 2 spool	337	Stopper	556	Plug
310	Travel spool LH	339	Stopper		
328	Spring	370	Spring		

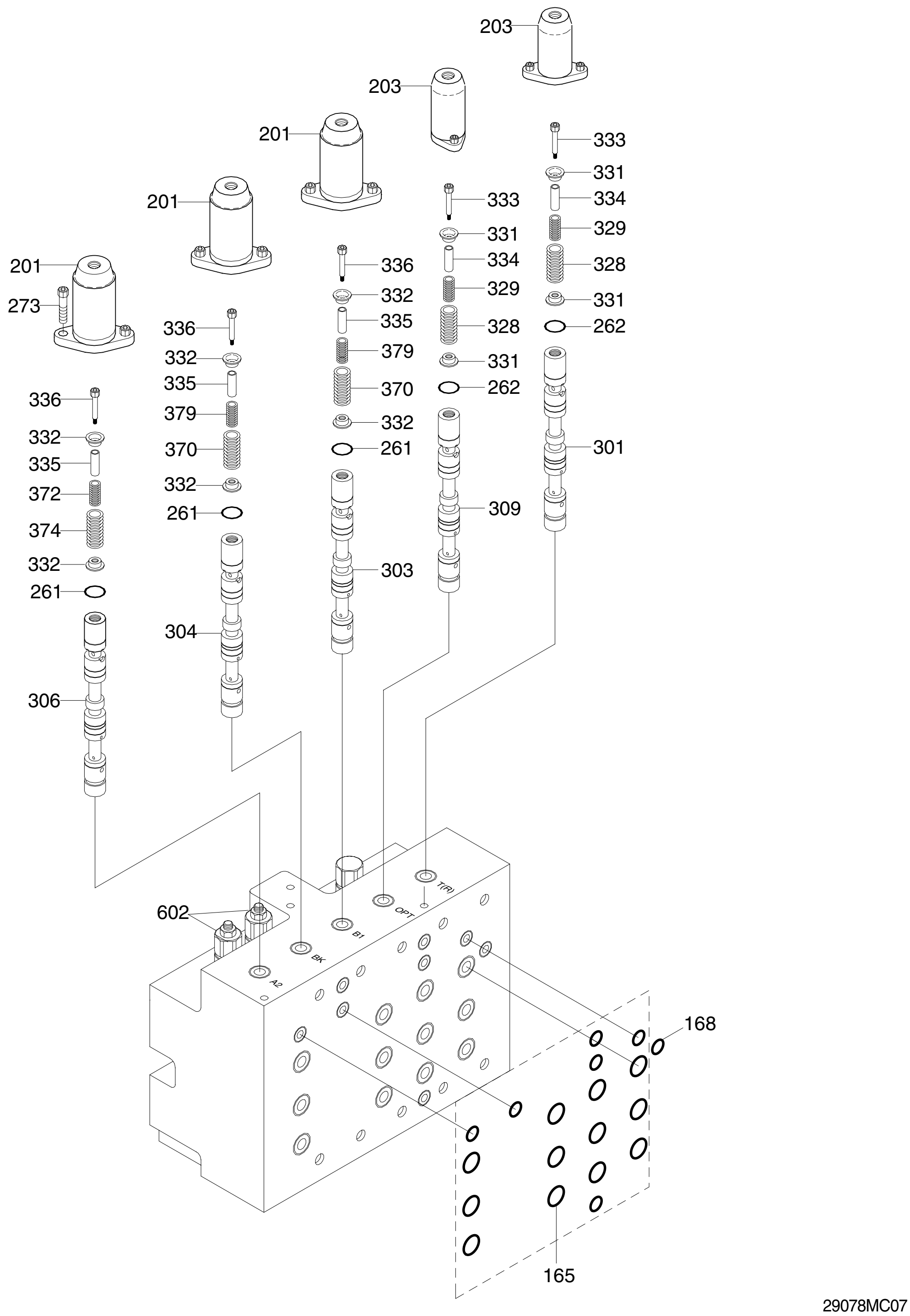
STRUCTURE(3/5)



29078MC06

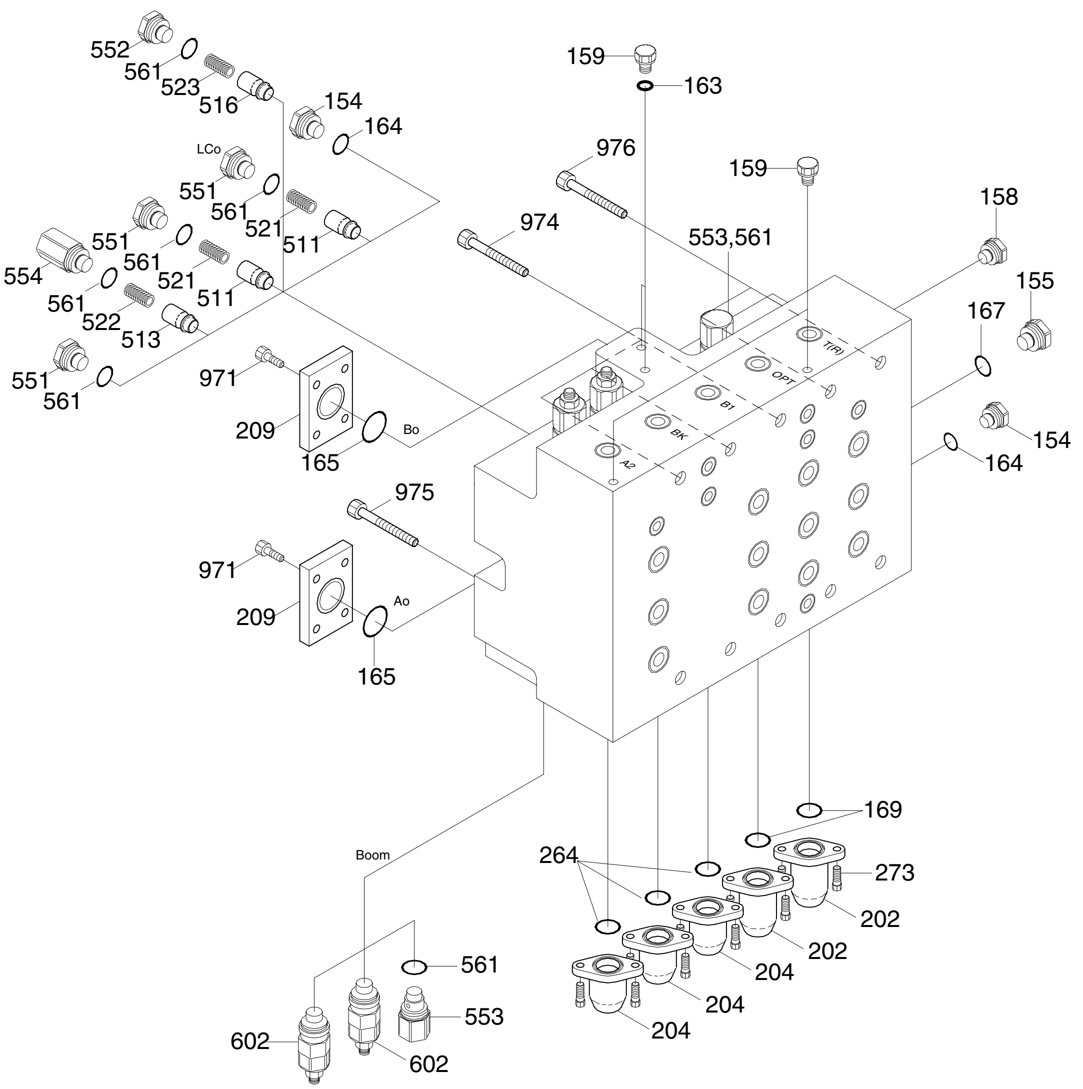
153	Plug	273	Socket screw	521	Spring
154	Plug	332	Seat	523	Spring
159	Plug	336	Bolt	551	Plug
164	O-ring	339	Stopper	552	Plug
169	O-ring	370	Spring	555	Check valve
201	Cover	376	Spring	556	Plug
202	Cover	551	Poppet	561	O-ring
204	Cover	515	Poppet	602	Port relief valve
261	O-ring	516	Poppet	611	Main relief valve
264	O-ring				

STRUCTURE(4/5)



165	O-ring	303	Boom 1 spool	334	Stopper
166	O-ring	304	Plug	335	Stopper
168	O-ring	306	Arm 2 spool	336	Bolt
201	Cover	309	Spool(Option)	370	Spring
203	Cover	328	Spring	372	Spring
261	O-ring	329	Spring	374	Spring
262	O-ring	331	Seat	379	Spring
273	Socket screw	332	Seat	602	Port relief valve
301	Travel spool RH	333	Bolt		

STRUCTURE(5/5)



29078MC08

154	Plug	204	Cover	551	Plug
155	Plug	209	Flange	552	Plug
158	Plug	264	O-ring	553	Plug
159	Plug	273	Socket screw	554	Plug
163	O-ring	551	Poppet	561	O-ring
164	O-ring	513	Poppet	602	Port relief valve
165	O-ring	516	Poppet	971	Screw
167	O-ring	521	Spring	974	Screw
169	O-ring	522	Spring	975	Screw
202	Cover	523	Spring	976	Screw

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)

3) DISASSEMBLY

The figure in ( ) shown after the part name in explanation sentence shows its number in the construction figures.

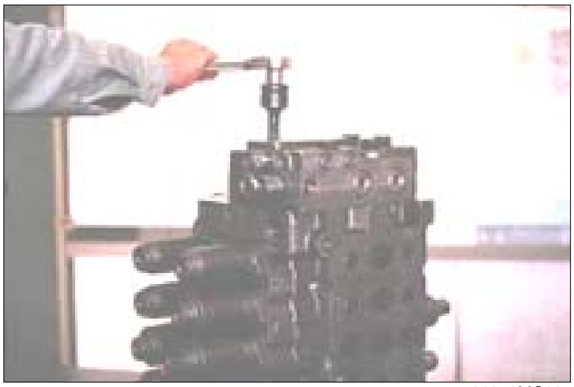
(1) Place control valve on working bench.

※ Disassemble the valve in a clean and dry environment and pay careful attention not to damage the sealing flange faces.

(2) Travel straight valve block

Loosen hexagon socket head bolts to and remove straight travel valve block(103) in its assembled state.

· Hexagon wrench : 14mm



21078MC09

(3) Main spool

① Loosen hexagon socket head bolts(273) and remove spring cover(201, 203).

· Hexagon wrench : 6mm

21078MC10

② Remove spool, springs, stopper, spring seats and spacer bolt in spool assembly condition from casing.

※ When extracting each spool assembly from its casing, pay attention not to damage the casing.

21078MC11

(4) Covers

Loosen hexagon socket head bolts(273) and then remove the spool cover(202, 204).

· Hexagon wrench : 6mm

21078MC12

(5) Removal of port relief

Remove port relief valves(602) from casing.

· Socket wrench : 32mm

21078MC13

(6) Removal of plug(Option section)

Remove plugs(553) from casing.

· Socket wrench : 27mm

(7) Lock valve

Loosen hexagon socket head bolts and remove lock valve(252).

· Hexagon wrench : 5mm

21078MC14

(8) Negative control relief valve

① Remove plug(551).

· Hexagon wrench : 12mm

21078MC15

② Remove poppet(611), spring(621) and damping rod(631).

21078MC16

(9) Swing logic valve and check valve

① Loosen hexagon socket head bolts(251) and remove logic valve(251) and take check valve(254).

② Remove plug(551) or (552) and take out poppet(511) or (515, 516) and spring (521) or (523).

· Hexagon wrench : 6, 12mm

21078MC17

(10) Boom priority valve

Loosen hexagon socket head bolts(104) and remove boom priority valve(104).

· Hexagon wrench : 10mm

(11) 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 casing and block are smooth and free of dust, dent, rust etc.
c. Correct dents and damages and check seat faces within the casing, if any, by lapping.
※ Pay careful attention not to leave any lapping agent within the casing.
d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from 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 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 comments

① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures and photographs shown in the previous disassembly section.

② Figure in ( ) shown after the part name in the explanation refers to the reference identity number shown on the construction figure shown in the spares section.

③ **Cautions in assembling seal**

a. Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.

b. Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.

c. Do not stretch seals so much as to deform them permanently.

d. In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.

e. Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque as shown on the corss section drawings of the spares section.

(2) Check valve

① Assemble poppets(511, 515, 516) and spring(521, 523).

② Put O-rings(561) on to plugs(551, 552).

③ Tighten plugs(551, 552) to the specified torque.

- Hexagon wrench : 12mm
- Tightening torque : 23~27kgf · m(166~195lbf · ft)

(3) Negative control relief valve

① Assemble the poppets, springs and damping rods(611×2) together into casing A(101).

② Put O-ring(561) on to plug(551) and tighten the latter to its specified torque.

- Hexagon wrench : 12mm
- Tightening torque : 23~27kgf · m(166~195lbf · ft)

(4) Lock valve

① Put O-rings onto the casing.

② Tighten hexagon socket head bolts to their specified torques.

- Hexagon wrench : 5mm
- Tightening torque : 1~1.4kgf · m(7.23~10.12lbf · ft)

(5) Assembly of main relief, port relief valves

① Install main relief valve(601), port relief valve(602) into the casing and tighten to the specified torque.

Components	Tools	Tightening torque	
		kgf · m	lbf · ft
Main relief valve	Spanner 32mm	7~8	50.6~57.8
Port relief valve	Socket wrench 32mm	7~8	50.6~57.8

(6) Main spools

① Carefully insert the previously assembled spool assemblies into their respective bores within of casing A(101) and casing B(102).

※ Fit spool assemblies into casing A(101) and casing B(102) carefully and slowly. Do not under any circumstances push them forcibly in.

(7) Covers

① Fit spool covers(202, 204) to the nonspring assembly end of the spool, and tighten the hexagonal socket head bolts(273) to the specified torque.

- · Hexagon wrench : 6mm
- · Tightening torque : 2.5~3.5kgf · m(18~25.3lbf · ft)

※ Confirm that O-rings(169, 264) have been fitted.

② Fit spring covers(201, 203) to the spring end for the spools, and tighten hexagon socket head bolts(273) to the specified torque.

- · Hexagon wrench : 6mm
- · Tightening torque : 2.5~3.5kgf · m(18~25.3lbf · ft)

※ Confirm that O-rings(261, 262) have been fitted.

(8) Travel straight valve, swing logic valve and boom priority valve

① Put O-rings onto the casing.

② Tighten hexagon socket head bolts to their specified torques.

Components	Tools	Tightening torque	
		kgf · m	lbf · ft
Travel straght valve	Hexagon wrench 14mm	28~32	202~231
Swing logic valve	Hexagon wrench 6mm	2.5~3.5	18~25.3
Boom priority valve	Hexagon wrench 10mm	8.5~11.5	61.5~83.1

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(3) Disconnect pipe assy(2, 3).

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

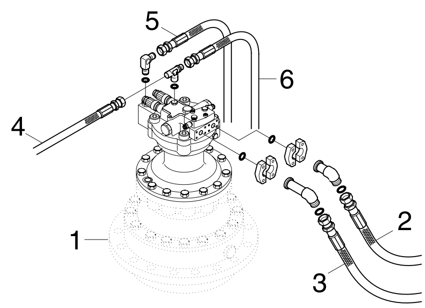
(5) Sling the swing motor assembly(1)and remove the swing motor mounting bolts(9).

- · Motor device weight : 58kg(130lb)
- · Tightening torque : 58.4kgf · m (422.4lbf · ft)

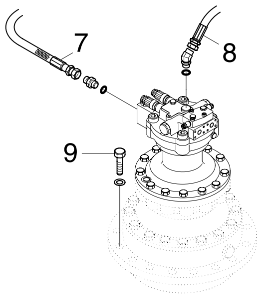
(6) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.

13031GE18



29078SM01



29078SM02

2) INSTALL

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

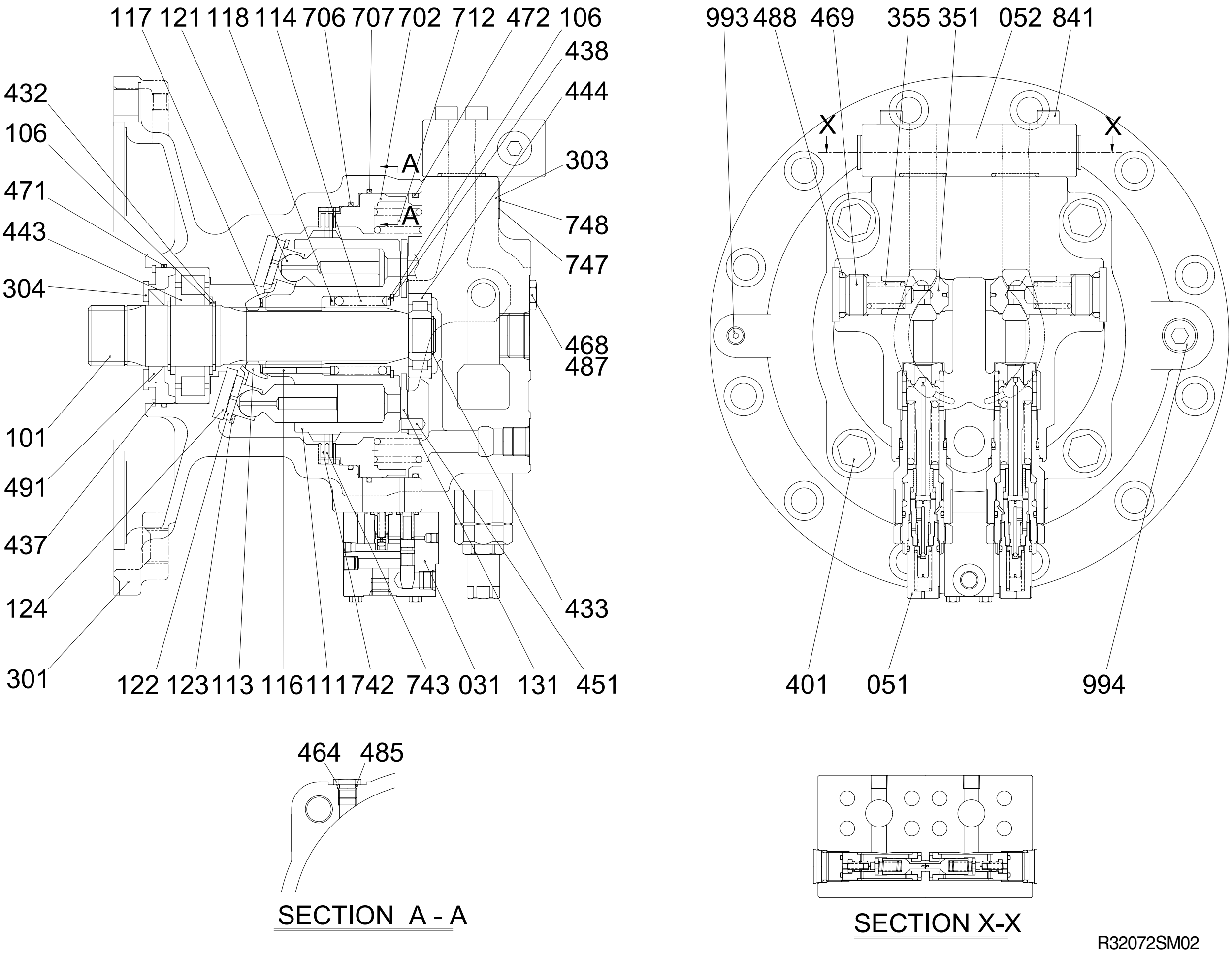
(2) Bleed the air from the swing motor.

① Remove the air vent plug.
② Pour in hydraulic oil until it over flows 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) Confirmed the hydraulic oil level and check the hydraulic oil leak or not.

2. SWING MOTOR

1) STRUCTURE



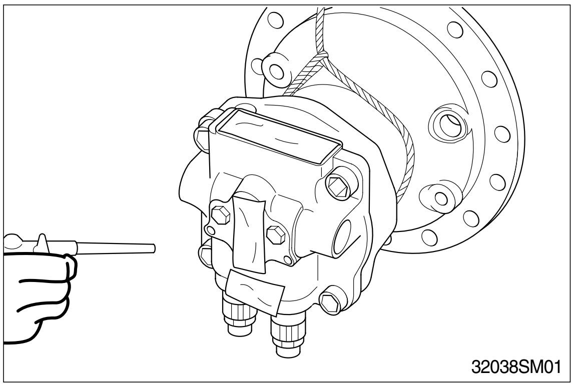
R32072SM02

031	Time delay valve	162	O-ring	468	Plug
051	Relief valve	163	O-ring	469	Plug
052	Valve assy	171	Hexagon screw	471	O-ring
101	Drive shaft	301	Casing	472	O-ring
106	Spacer	303	Casing	485	O-ring
111	Cylinder	304	Front cover	487	O-ring
113	Spherical bush	351	Plunger	488	O-ring
114	Spring	355	Spring	491	Oil seal
116	Push rod	401	Socket bolt	702	Piston
117	Spacer	432	Snap ring	706	O-ring
118	Spacer	433	Snap ring	707	O-ring
121	Piston	437	Snap ring	712	Brake spring
122	Shoe	438	Snap ring	742	Friction plate
123	Retainer	443	Roller bearing	743	Separate plate
124	Shoe plate	444	Needle bearing	841	Socket bolt
131	Valve plate	451	Spring pin	993	Plug
161	O-ring	464	Plug	994	Plug

2) DISASSEMBLY

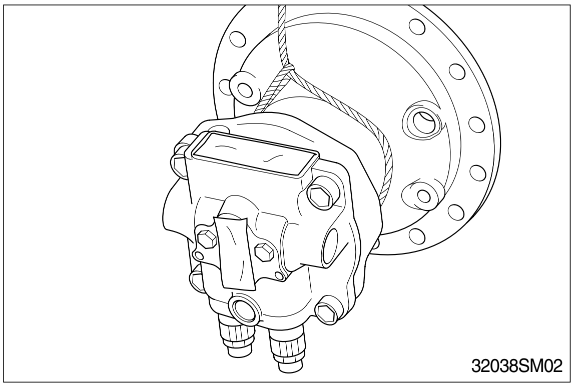
(1) Lift the motor out. Clean the motor in kerosene and dry with compressed air.

※ To avoid dust inside the motor, mask all the ports of the motor with tapes.



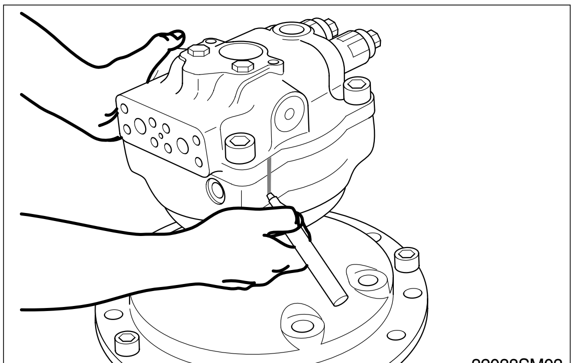
32038SM01

(2) Loosen the drain plug to discharge oil in the casing(301).



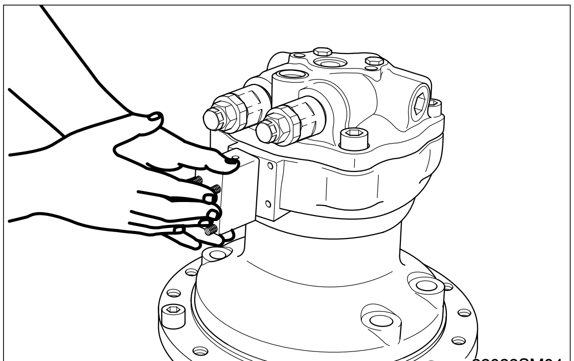
32038SM02

(3) Fix the drive shaft(101) on the workbench with the end of output shaft down. Put matching marks on casing (301) and valve casing(303) for easy reassembly.



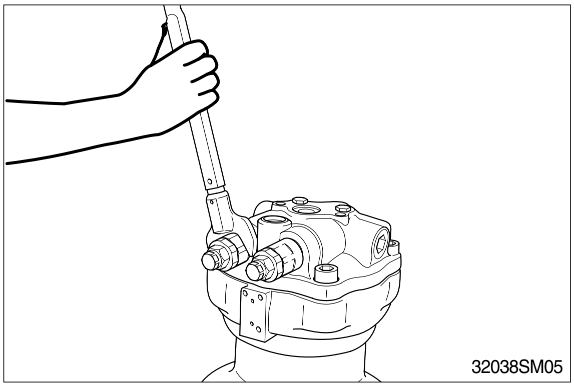
32038SM03

(4) Remove the valve(031).



32038SM04

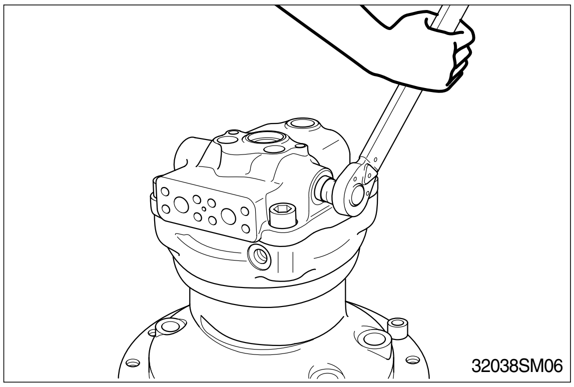
(5) Remove the relief valve(051) from valve casing(303).



32038SM05

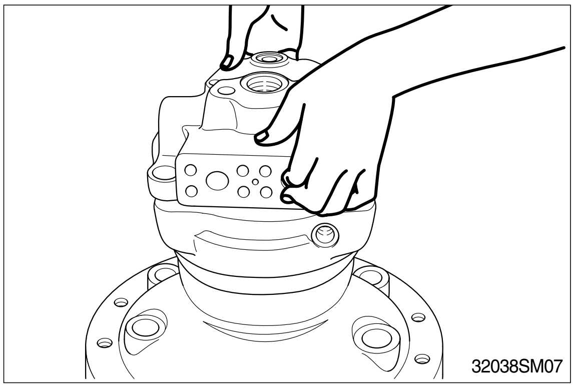
(6) Remove plug(469) from valve casing (303) and spring(355), plunger(351).

※ Be careful not to damage the plunger seat assembly.



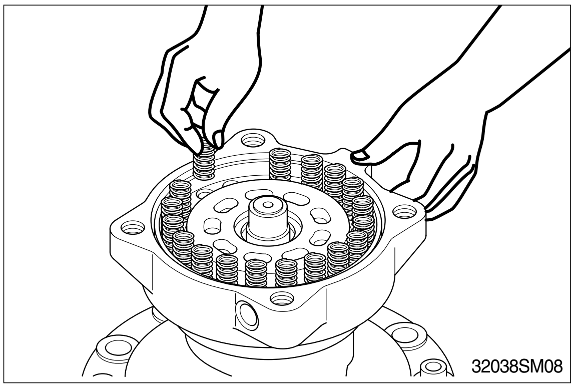
32038SM06

(7) Remove valve casing(303) from casing (301). Then, remove the valve plate(131) from valve casing(303) with care.



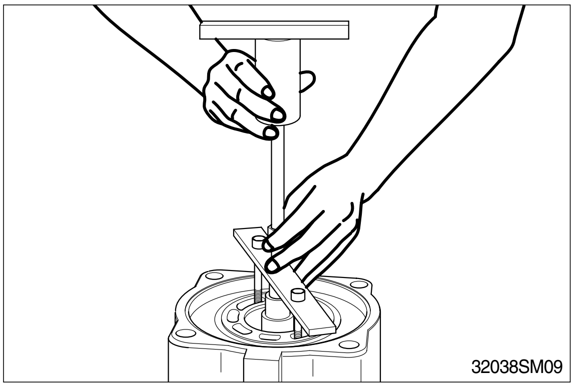
32038SM07

(8) Remove the brake spring(712) from brake piston(702).



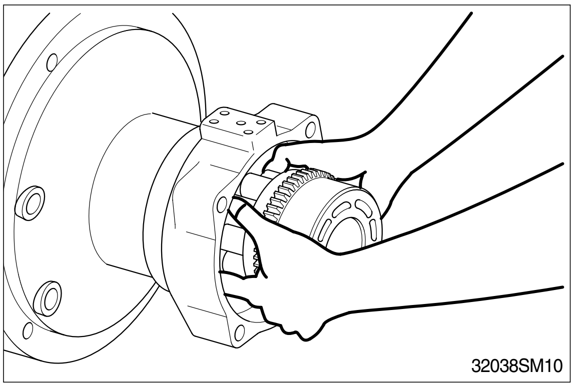
32038SM08

(9) Remove brake piston(702) from casing (301).

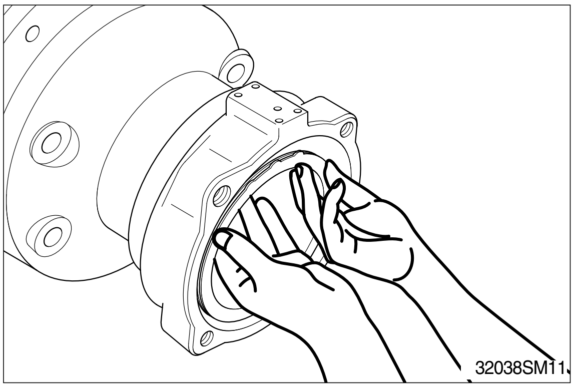

32038SM09

(10) Remove the cylinder(111) from the output shaft (101) with the motor positioned horizontally. Remove piston(121), pushing plate(123), retainer(113), spacer (117) and shoe plate(124).

※ If shoe plate would not removed easily, try again after procedure(14).

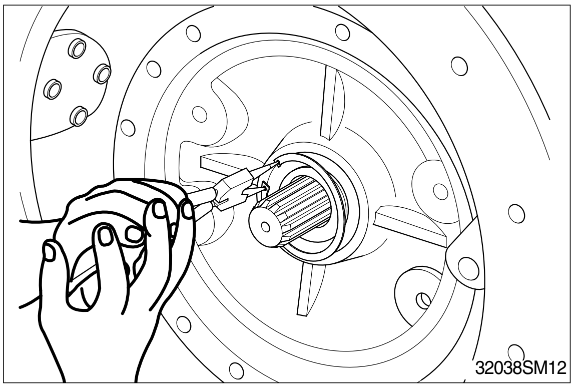

32038SM10

(11) Remove friction plate(742) and separate plate(743) from casing(301).

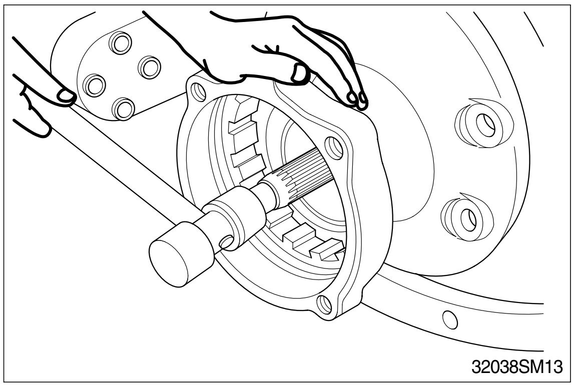

32038SM11

(12) Remove snap ring(437) with plier and remove the front cover(304) from casing(301).

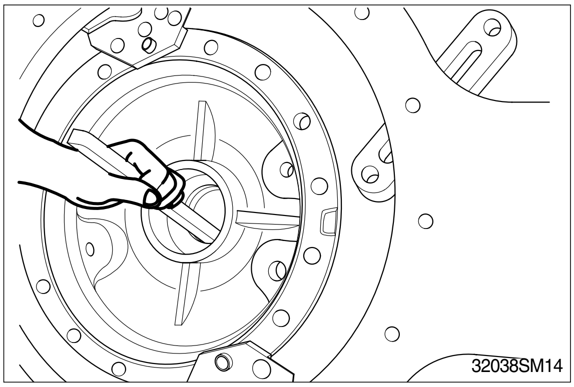
※ Front cover could be removed with sliding shaft if necessary.


32038SM12

(13) Remove drive shaft(101) from casing (301).



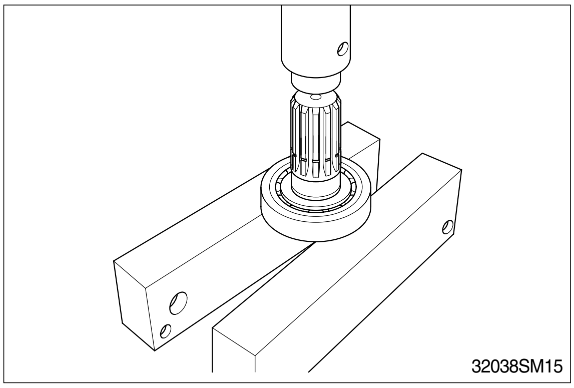
(14) Remove the shoe plate(124) from casing (301).

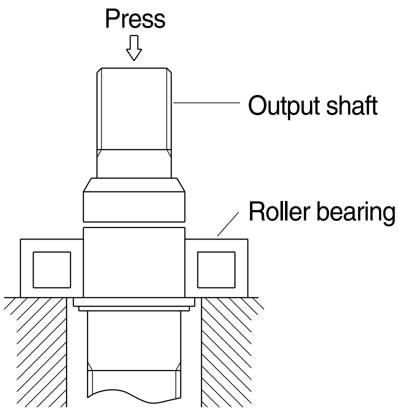


(15) Proceed with following job only when necessary.

① Remove the snap ring(432), spacer(106) from drive shaft(101) and remove the cone of roller bearing(443) by press.

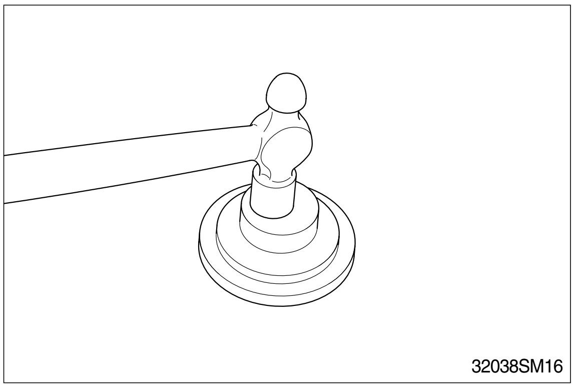
※ Do not reuse bearings.



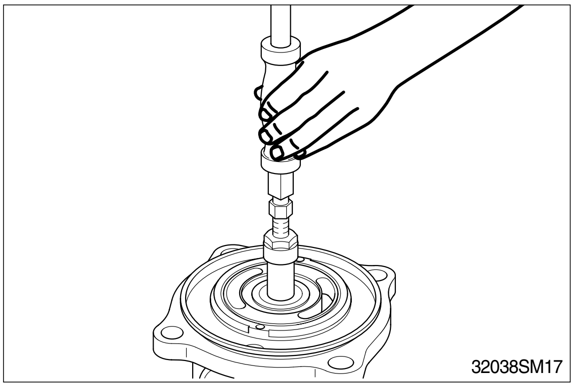


8-47 (290-7)

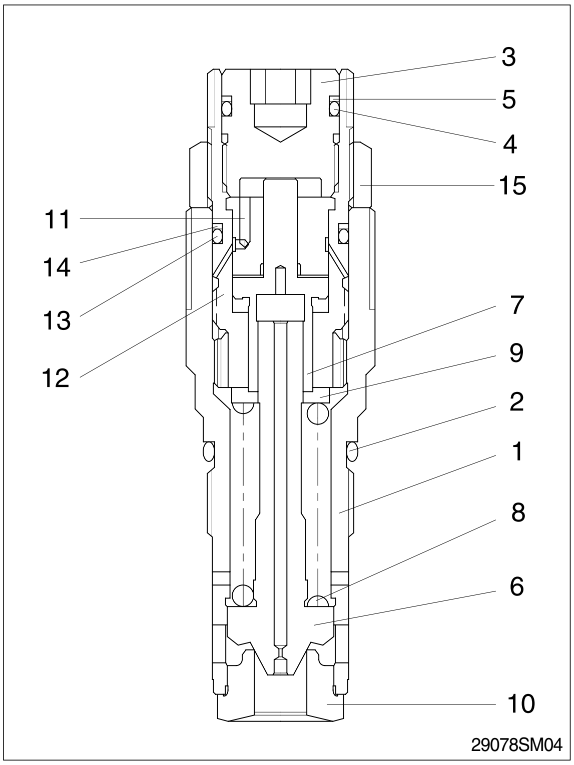
② Remove oil seal(491) from front cover (304).



③ Remove the roller bearing(444) from the valve casing(303) by using slide hammer bearing puller.



④ When disassembling the relief valve, release the plug(3).
Remove the piston(7), spring seat(9), spring(8) and plunger(6) with the body(1) downwards.
※ Do not release the lock nut(15).

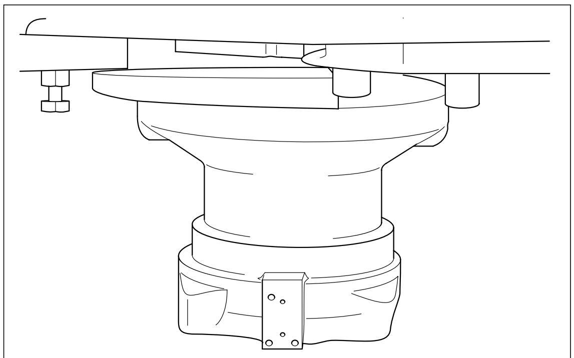


This completes disassembly.

3) **ASSEMBLY**

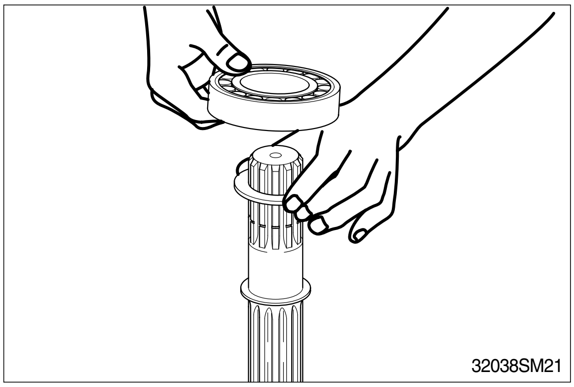
Do the reassembly in the reverse procedure of the disassembly.

(1) Place the casing(301) on the workbench with the valve casing(303) downward.

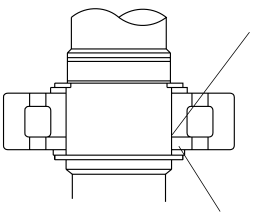


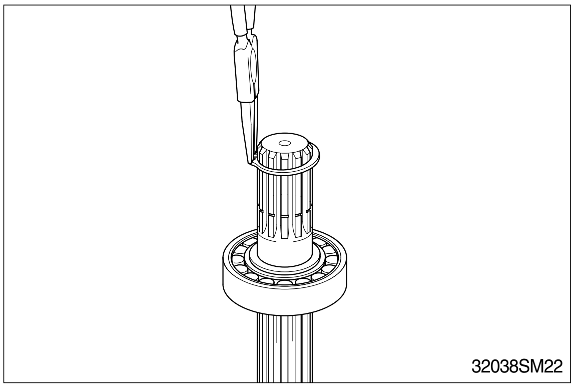
32038SM20

(2) When reassembling the roller bearing, install the snap ring(432), and spacer(106) to the drive shaft(101). Insert the collar and cone of the roller bearing(443). Install the spacer(106) and stop ring(432). Install stop ring(433) to the output shaft (101) by heating the cone of the roller bearing(444).



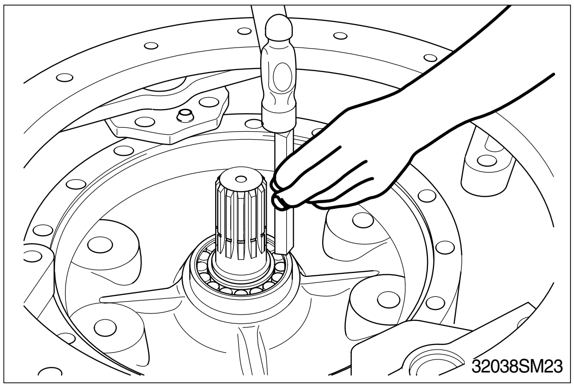
32038SM21





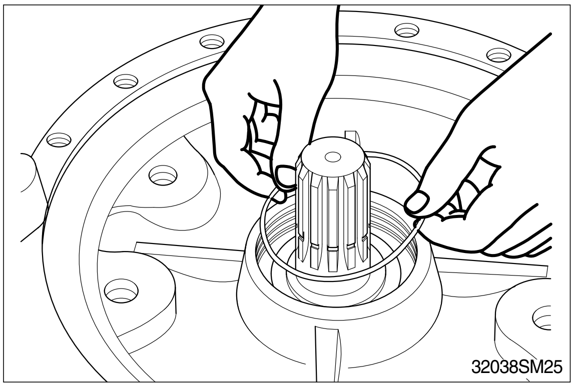
32038SM22

(3) Insert the drive shaft(101) into the casing (301) with the end of output shaft upward and tap the outer race of roller bearing with the hammer.



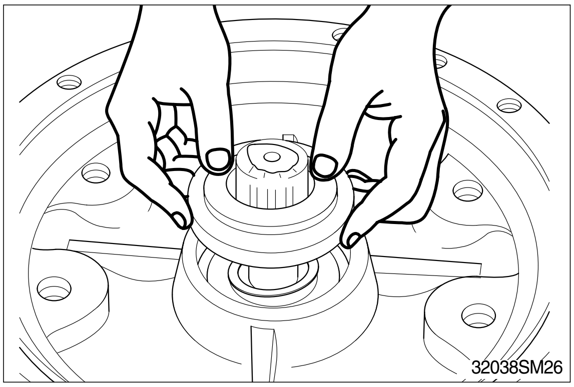
32038SM23

(4) Tack O-ring(471) to the casing(301).

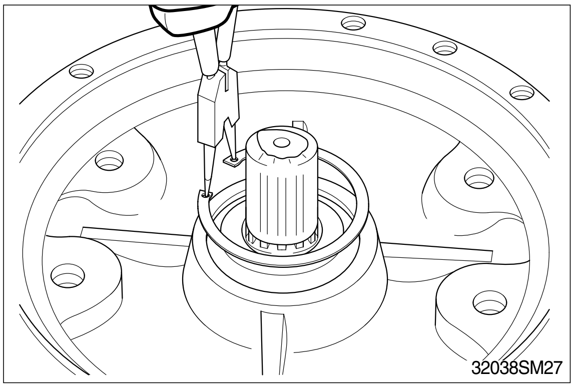


(5) Reassemble the front cover(304) to the casing(301).

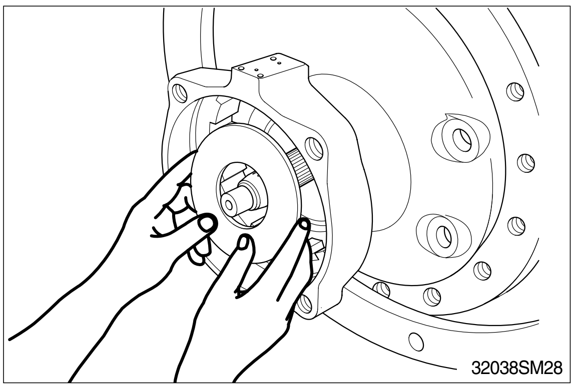
※ Apply grease to the rib of oil seal to avoid damage to the rib.



(6) Install the snap ring(437) to the casing (301).

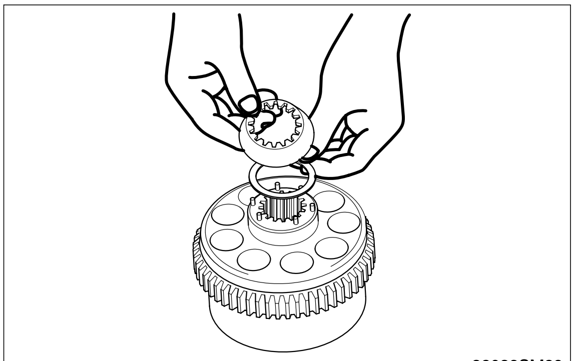


(7) Insert the shoe plate(124) with the casing (301) position horizontally.



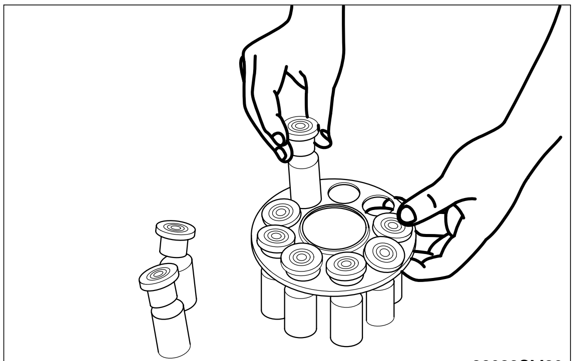
(8) Insert the push rod(116) into the cylinder (111). Place the retainer(113) assembled with spacer(117) onto the cylinder.

※ Insert two push rods in each hole.



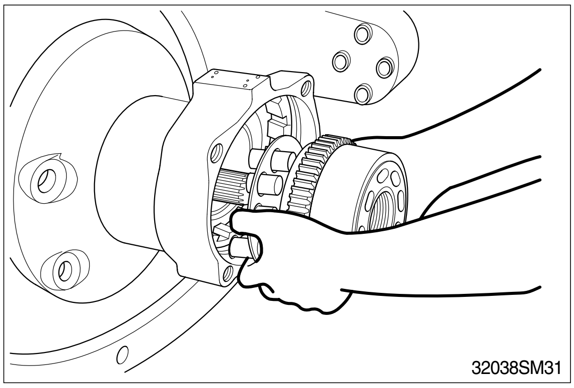
32038SM29

(9) Install the piston sub-assembly(121, 122) to the set plate(123).



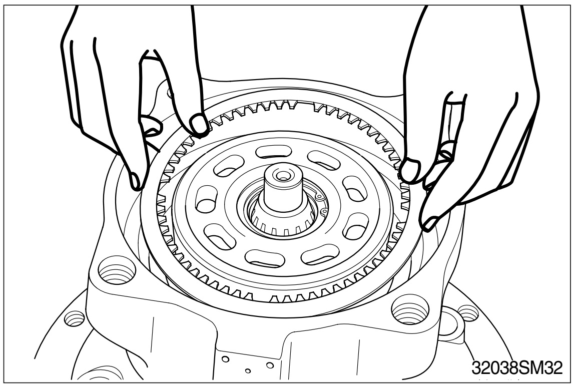
32038SM30

(10) Reassemble the piston assembly(121, 122) to the cylinder(111).



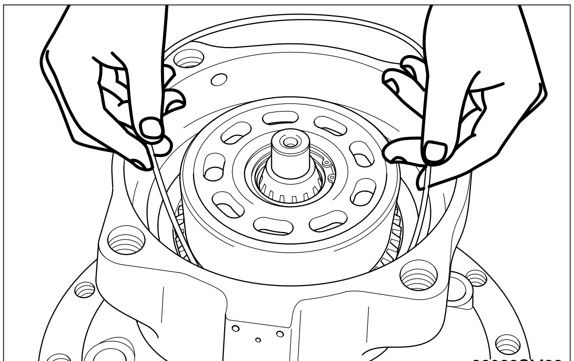
32038SM31

(11) Place the casing(301) under the front cover(304) and reassemble 3 sheets of separate plate(743) and then 2 sheets of friction plate(742) to the casing(301).



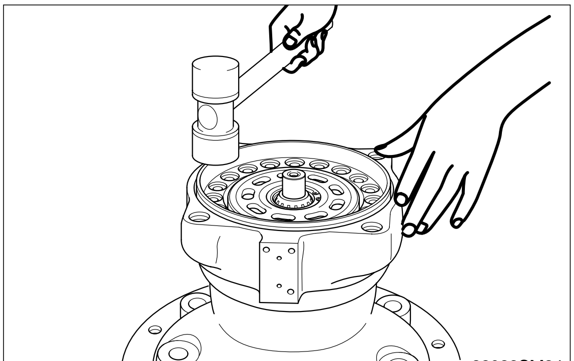
32038SM32

(12) Insert O-ring(706, 707) inside the casing (301).



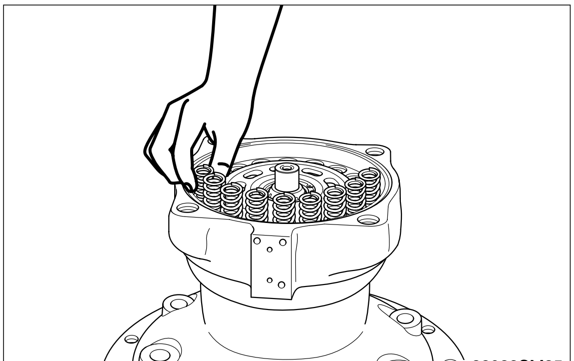
32038SM33

(13) Reassemble brake piston(702) to the casing(301).



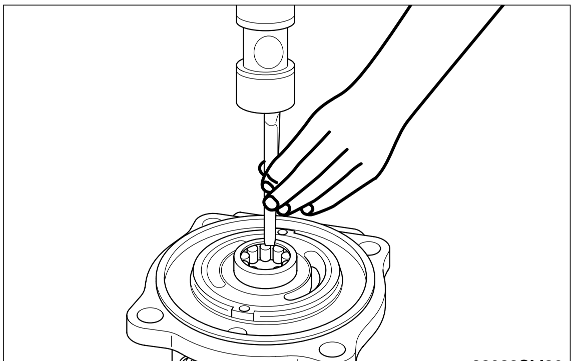
32038SM34

(14) Reassemble brake spring(712) to the brake piston(702).



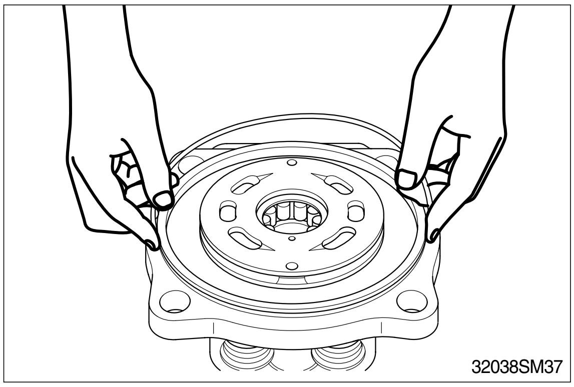
32038SM35

(15) When assembling the roller bearing(444), insert the roller bearing(444) into valve casing(303) by hammering.

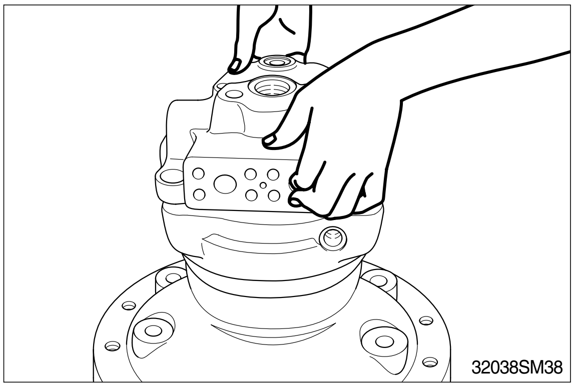


32038SM36

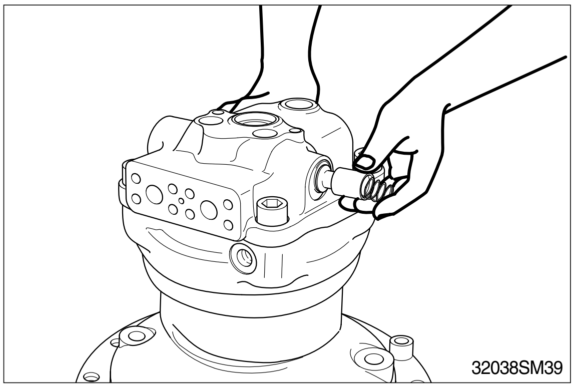
(16) Reassemble valve plate(131) to the valve casing(303) and reassemble O-ring(472).



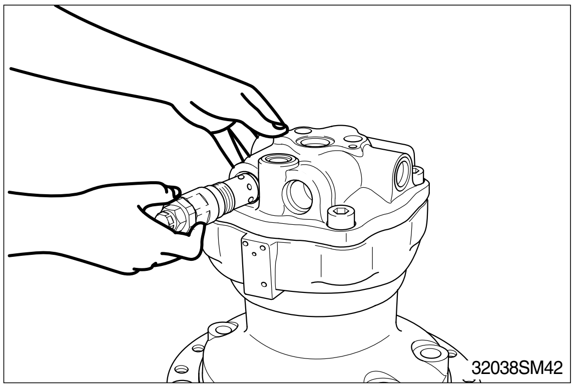
(17) Connect the valve casing(303) with the casing(301) and tighten the hexagon screw(401).



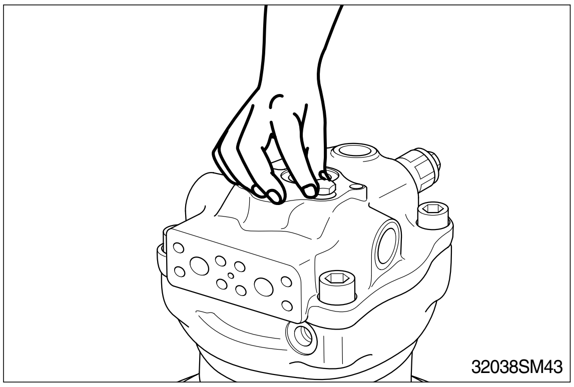
(18) Insert plunger(351) and spring(355) in the valve casing and install O-ring(488). Tighten plug(469) to the valve casing.



(19) Insert O-rings(051-1) to the relief valve (051) and reassemble them to valve casing(303).



(20) Tighten the plug(468) to valve casing(303) with O-ring(487) and tighten the plug(464) to casing(301) with O-ring(485).



32038SM43

(21) Connect the valve casing(303) with the casing(301).

This completes assembly.

3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

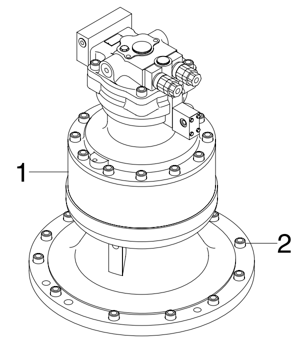
13031GE18

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

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

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 230 kg (507 lb)

2) INSTALL

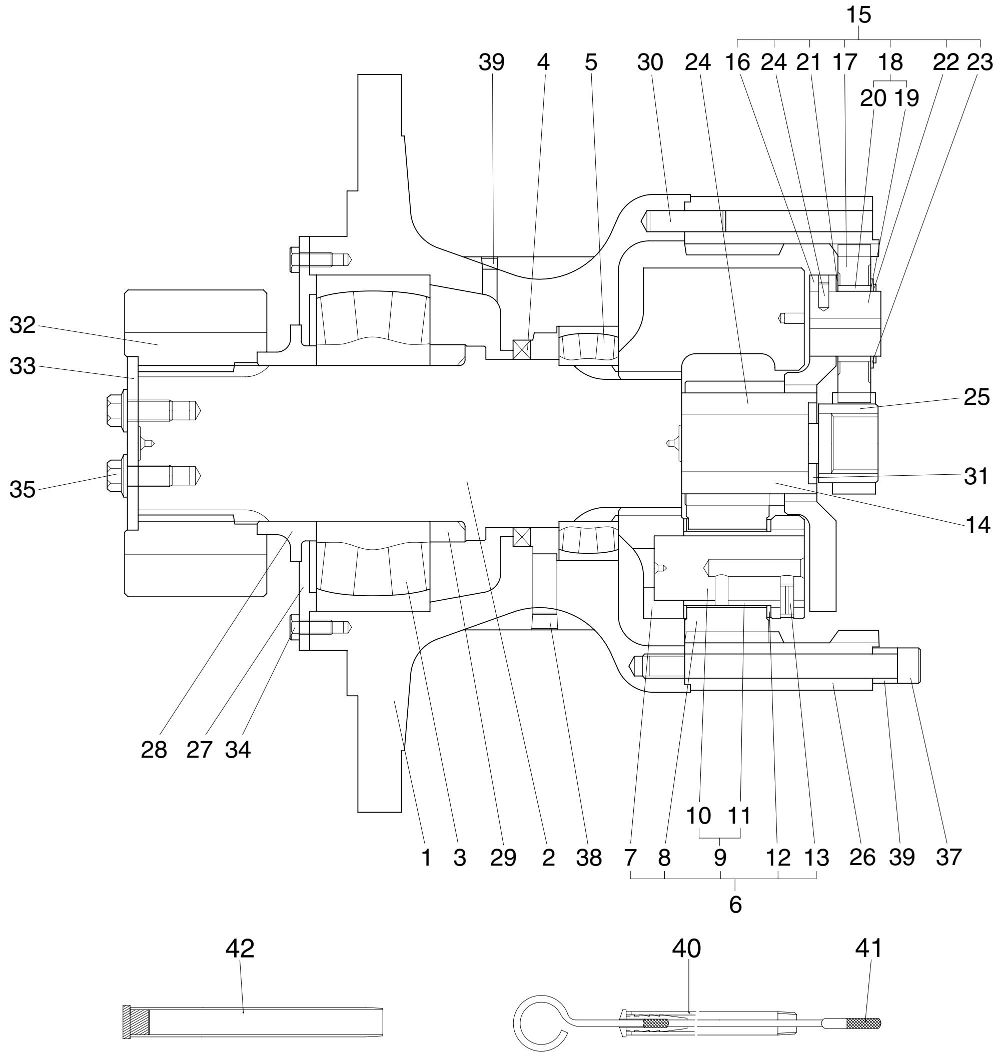


29098SR00

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

4. REDUCTION GEAR

1) STRUCTURE



34072SM02

1	Casing	15	Carrier assy 1	29	Spacer ring
2	Drive shaft	16	Carrier 1	30	Knock pin
3	Roller bearing	17	Planet gear 1	31	Thrust plate 3
4	Oil seal	18	Pin assy 1	32	Pinion gear
5	Roller bearing	19	Pin 1	33	Lock plate
6	Carrier assy 2	20	Bushing 1	34	Hexagon bolt
7	Carrier 2	21	Side plate 1	35	Hexagon flange bolt
8	Planet gear 2	22	Side plate 2	37	Socket bolt
9	Pin assy 2	23	Stop ring	38	Plug
10	Pin 2	24	Spring pin	39	Plug
11	Bushing 2	25	Sun gear 1	40	Gage pipe
12	Thrust washer	26	Ring gear	41	Gage bar
13	Spring pin	27	Cover plate	42	Air breather assy
14	Sun gear 2	28	Spacer	43	Bushing 1

2) DISASSEMBLY

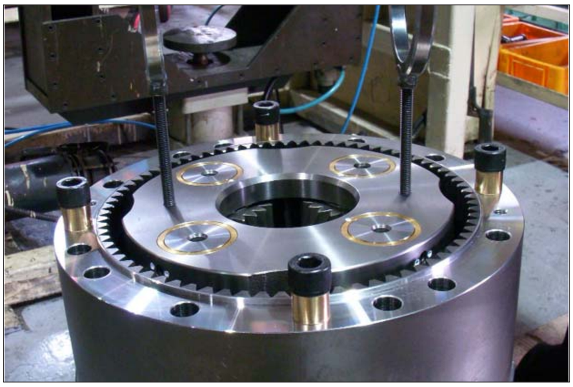
(1) Removal of swing motor
Loosen the hexagonal socket bolt (37) and remove swing motor.

29098SR02

(2) Removal of No.1 sun gear (25), No.3 thrust plate (32).
Install eye-bolt M10 to thread hole of No.1 carrier and remove No.1 carrier assembly (15) itself.

29098SR31

(3) Removal of No.2 sun gear (14)
Install eye-bolt M10 to thread hole of No.2 carrier and remove No.2 carrier assembly (6) itself.

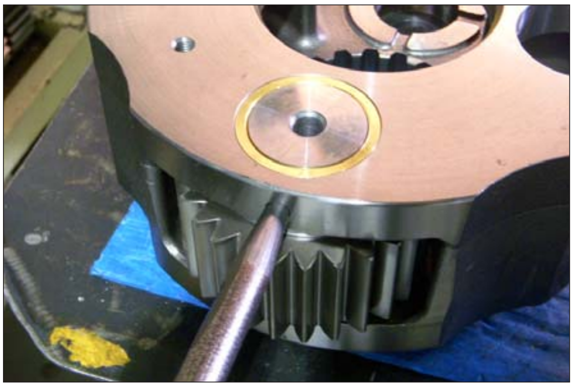


29098SR03A

(4) Disassembly of No.2 carrier assembly (6)

① Place the proper tool on spring pin (13), and then insert spring pin (13) until the center of No.2 pin (10) with hammer.

※ Do not reuse spring pin (13) after removal.

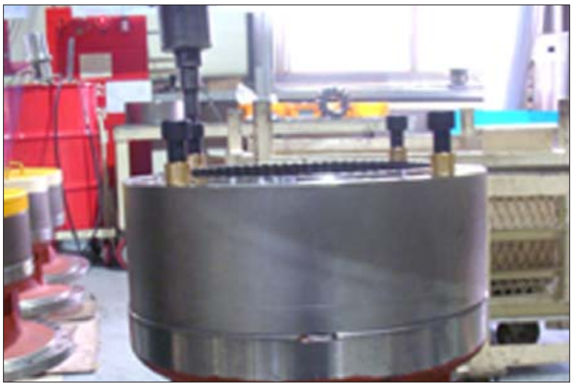


29098SR04

② Remove No.2 pin assy (9) and then pull out No.2 planet gear (8) and thrust washer (12) with hands.


29098SR05

(5) Removal of ring gear(26)
Remove ring gear (26) from casing (1).
※ Liquid gasket is applied on contacting surface of ring gear (26) and casing (1) to prevent gear oil from leaking.
Therefore, remove ring gear (26) from casing (1) by minus screw driver through grooves of casing (1).


29098SR06

(6) Removal of pinion gear (32)
Remove hexagon head bolt (35), lock plate(33), pinion gear (32), spacer(28) and cover plate (27) when pinion gear (32) is not disassembled from drive shaft (2) easily. Use rubber hammer to the pinion gear (32).


29098SR07


29098SR08

(7) Removal of drive shaft (2)

① Install a support under flange surface area of casing (1).
Install hydraulic press to the end surface of drive shaft (2) and remove the drive shaft (2) with roller bearing (3) and spacer ring (29).

29098SR09

② Remove roller bearing (3) and spacer ring (29) from drive shaft (2).

29098SR10

③ Remove roller bearing (5), oil seal (4) from casing (1)

※ Do not reuse oil seal (4).

※ Drive shaft assembly is only disassembled when roller bearing is needed to be replaced due to wear, oil leaking.

29098SR11

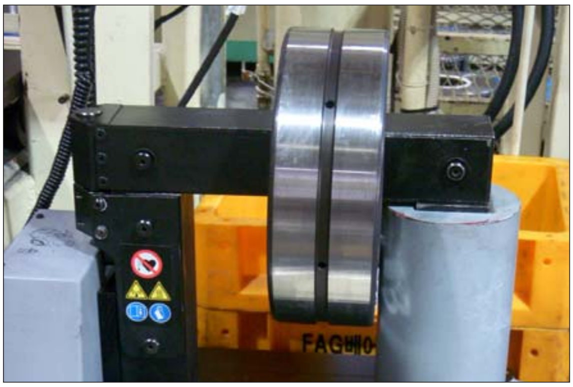
3) ASSEMBLY

(1) Assembly of drive shaft (2) and parts

① After assemble spacer ring (29) to drive shaft (2) hydraulic press fit roller bearing (3) to drive shaft (2).

② Heat roller bearing up to 80~90˚C plus surrounding temperature and remove magnetism for 5 minutes.
Assemble it to drive shaft (2) with hydraulic press and then assemble spacer ring (29) in this order.

※ Pay attention to the assembling direction of spacer ring (29).



29098SR12

29098SR13

(2) Installation of oil seal(4)

Remove oil from oil seal (4) and the surface area of casing (1) to which oil seal (4) is to be assembled.

Assemble oil seal to the casing (1) with press fitting jig and then apply grease to the rib of oil seal (4).

29098SR14

29098SR15

(3) Assembly of drive shaft (2) and parts

① Place the output parts of casing (1) upward.
Install eye-bolt M16 into the thread hole of the output end surface of drive shaft assembly.

② Lift drive shaft assembly using the eye-bolts and then assemble that to casing (1).

29098SR16

(4) Install of roller bearing (5)
Place the output part of casing assembly down ward.
Heat roller bearing (5) up to 80~90˚C plus surrounding temperature and remove magnetism for 5 minutes assemble it the drive shaft (2).

29098SR17

(5) Assembly of pinion gear (32)

① Assemble cover plate (27), hexagon bolt (35) to casing (1).

29098SR18

② After assemble spacer (28), pinion gear (32) and lock plate (33) tighten hexagon bolt (35).

29098SR19

(6) Assembly of ring gear (26)

① Remove oil from mating surfaces between casing (1) and ring gear (26) and from knock pin (30). Liquid gasket (three bond No. 1194 equivalent) around socket bolt (37) hole at casing.

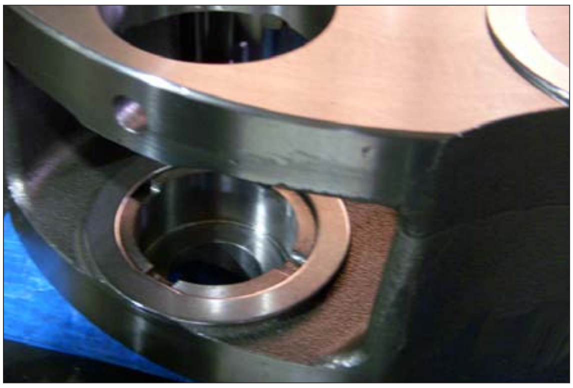
29098SR22

② Assemble ring gear (26) to casing assembly correctly using lock pin hole as guide.

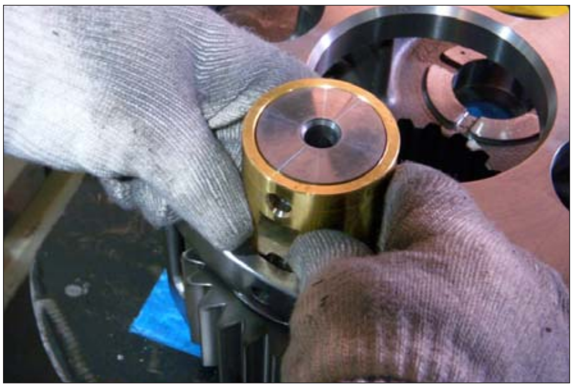
29098SR23

(7) Assembly of No.2 carrier assembly (6)

① Assemble No.2 planet gear (8) to No.2 carrier (7) with thrust washer (12) and insert No.2 pin (10) correctly and No.2 pin (10) is around with spring pin hole at No.2 carrier (7).



29098SR24



29098SR25

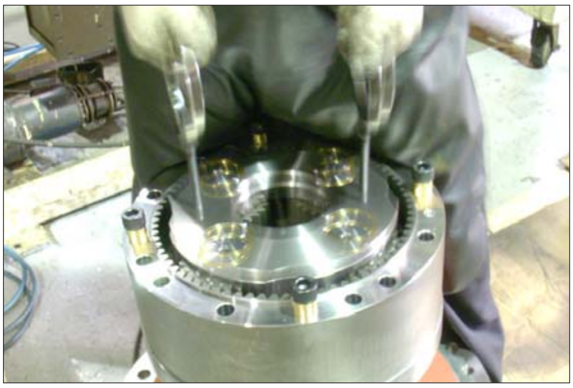
② Insert spring pin (13) into No.2 carrier (7) hole and No.2 pin (10) hole.

29098SR26

29098SR27

(8) Assembly of No.2 carrier assembly (6)

① Install eye bolt into thread hole M10 of No.2 carrier (7) and lift No.2 carrier assembly (6) using the eye-bolt.
And then insert No.2 carrier assembly (6) being engaged with internal teeth of ring gear (26).
Rotate carrier assembly lightly so that splines of drive shaft (2) are engaged.



29098SR28

② Insert No.2 sun gear (14) into No.2 planet gear (8).

29098SR29

(9) Assembly of No.1 carrier assembly (15)

① Mount eye bolt into thread hole M10 of No.1 carrier assembly (15) and lift the assembly using the eye-bolt and then insert No.1 carrier assembly (15) being engaged with internal teeth of ring gear (26).

② Rotate No.1 carrier assembly (15) lightly so that No.2 sun gear (14) is engaged with teeth No.1 carrier assembly (15).

29098SR30

③ Insert No.1 sun gear (25) into No.1 planet gear (17).

29098SR31

(10) Check smoothness of gear rotation by turning No.1 carrier assy (15).

29098SR32

(11) Assembly of swing motor

① Remove oil from mating surfaces between ring gear (26) and swing motor and apply liquid gasket (three bond No.1194 equivalent) around socket bolt hole at ring gear.

Assemble swing motor and tighten socket bolt (37) with 18mm hexagonal socket.

· Tightening torque : 34 kgf·m (246 lbf·ft)

GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

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

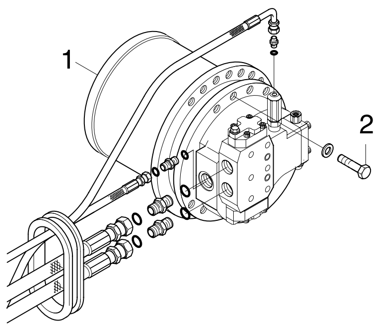
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(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.

(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly**.



29078TM01

(5) Remove the cover.

(6) Remove the hose.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly(1).

(9) Remove the mounting bolts(2), then remove the travel device assembly.
· Weight : 305kg(670lb)

2) INSTALL

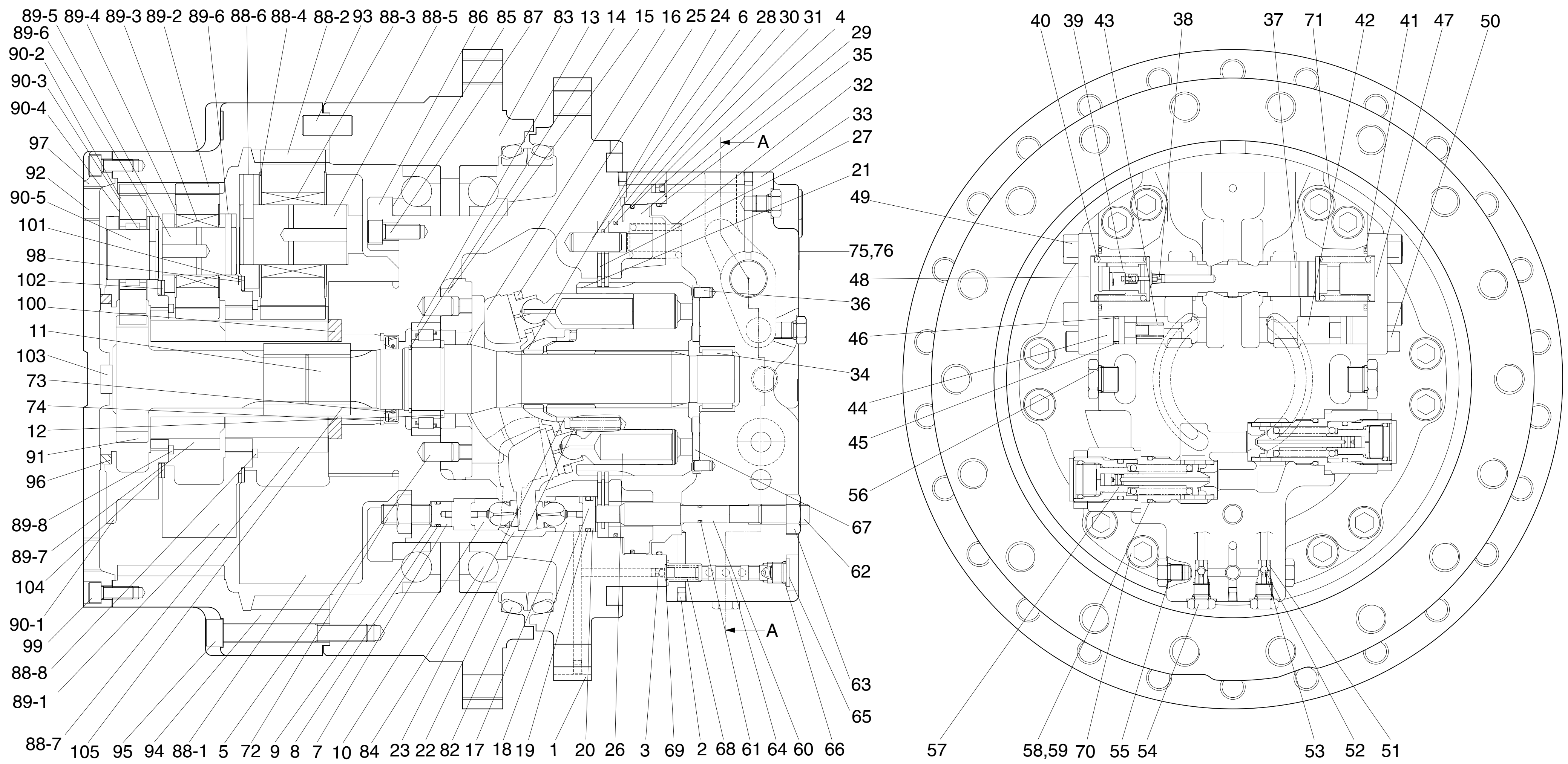
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

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

2. TRAVEL MOTOR

1) STRUCTURE



SECTION A-A

2907A2TM01

1	Casing	16	Plate	31	Ring	46	Back up ring	61	O-ring	83	Housing	89-1	Carrier No.2	92	Plug
2	Plug	17	Piston	32	Spring	47	Cap	62	Lock screw	84	Bearing	89-2	Planetary gear No.2	93	Lock pin
3	Screw	18	Stopper	33	Valve casing	48	Cap	63	Nut	85	Shim	89-3	Needle No.2	94	Ring gear
4	Screw	19	O-ring	34	Needle bearing	49	Bolt	64	Spool	86	Retainer	89-4	Thrust washer No.2	95	Bolt
5	Pin	20	Back up ring	35	O-ring	50	Socket bolt	65	Plug	87	Bolt	89-5	Pin No.2	96	Thrust ring No.1
6	Pin	21	Cylinder block	36	Pin	51	Seat	66	O-ring	88	Carrier No.3	89-6	Spring pin No.2	97	Cover
7	Stopper	22	Cylinder spring	37	Spool	52	Steel ball	67	Valve plate	88-1	Carrier No.3	89-7	Sun gear No.2	98	Thrust ring No.2
8	O-ring	23	Spacer	38	Screw	53	Stopper	68	Spring	88-2	Planetary gear No.3	89-8	Snap ring No.2	99	Bolt
9	Back up ring	24	Guide	39	Damping check	54	Plug	69	O-ring	88-3	Needle No.3	90	Carrier No.1	100	Motor ring
10	Piston	25	Plate	40	Spring	55	O-ring	70	Socket bolt	88-4	Thrust washer No.3	90-1	Carrier No.1	101	Thrust ring No.3
11	Shaft	26	Piston & Shoe assy	41	O-ring	56	Plug	71	Socket bolt	88-5	Pin No.3	90-2	Planetary gear No.1	102	Thrust ring No.1
12	Spacer	27	Plate	42	Plunger	57	Relief valve	72	Lock screw	88-6	Spring pin No.3	90-3	Needle bearing No.1	103	Pad
13	Roller bearing	28	Plate	43	Spring	58	O-ring	73	Oil seal	88-7	Sun gear No.3	90-4	Thrust washer No.1	104	Thrust ring No.2
14	Stop ring	29	Brake	44	Stopper	59	Back up ring	74	Lock ring	88-8	Snap ring No.3	90-5	Pin No.1	105	Coupling
15	Support	30	Ring	45	O-ring	60	Rod	82	Floating Seal	89	Carrier No.2	91	Sun gear No.1		

2) TOOL AND TIGHTENING TORQUE

(1) Tools

Name of tools	B-size	Name of part applied
Hexagonal L-Wrench	4	Plug(2), Orifice screw(3, 4, 38)
	8	Hex socket bolt(50), Lock screw(62, 72), Plug(65)
	10	Hex socket bolt(49)
	46	Hex(57)
Socket wrench/spanner	19	Hp plug(54)
	24	Hex nut(63)
	27	Hp plug(56)
Snap-ring plier(for holes, axis)		Ring stop(14), Ring lock(74)
Solder hammer		Needle bearing(34), Pin(5, 6, 36)
Torque wrench		Size : 500, 3000
Jig for assembling oil seal		Oil seal(73)
Induction heating apparatus for bearing		Roller bearing(13)

(2) Tightening torque

NO.	Part name	Standard	Size	Torque	
				kgf・m	lbf・ft
2	Plug	NPTF 1/16	4	7~11	50.63~79.5
3, 4, 38	Orifice screw	NPTF 1/16	4	7	50.63
49	Hex socket bolt	M12	10	100	723.3
50	Hex socket bolt	M10	8	67	484.6
54	Plug	PF 1/4	19	37	267.6
56	Plug	PF 1/2	27	110	795.6
57	Relief valve	HEX 46	46	170~190	1230~1374
63	Nut	M16	24	240	1736
65	Plug	PF 3/8	8	75	542.4
70, 72	Hex socket bolt	M16	14	240	1736
71	Hex socket bolt	M16	14	240	1736

2. DISASSEMBLING

1) GENERAL INSTRUCTIONS

(1) Generally, hydraulic equipment is precisely manufactured and clearances between each parts are very narrow. Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather. Tools and kerosene to wash parts should also be clean and handled with great care.

(2) When motor is removed from the host machine, wash around the ports sufficiently and put the plugs so that no dust and/or water may invade. Take off these plugs just before the piping works when re-attach it to the host machine.

(3) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in advance.

(4) The piston can be inserted to whichever cylinder block for the initial assembling.
However, their combination should not be changed if they are once used. To reuse them, put the matching mark on both pistons and cylinder block before disassembling.

⚠ **Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

2) DISASSEMBLEING TRAVEL MOTOR

(1) Fix a hydraulic motor on jig with four pieces of bolts(M16×60L).

※ When rotating jig up to 90° in disassembling and assembling, fix a motor making drain plug(56) faced to the bottom.

300072TM20

(2) After disassembling drain plug(56), let an oil in a case of a motor discharged.

※ Check whether manufactured chips or metal dust are added in a drain oil.

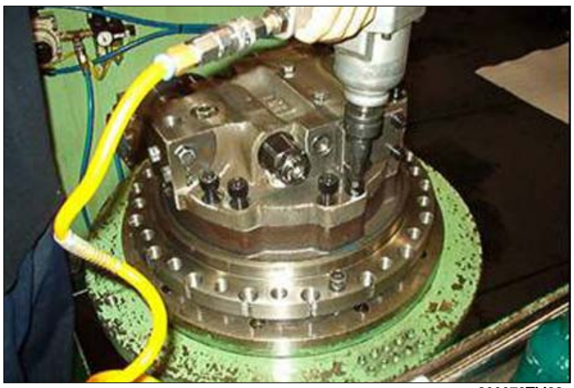
300072TM21

300072TM21A

(3) In order to making the out-put axis of a hydraulic motor faced upward, disassemble ring lock(74) with a plier after rotating jig up to 90° in disassembling and assembling.

300072TM22

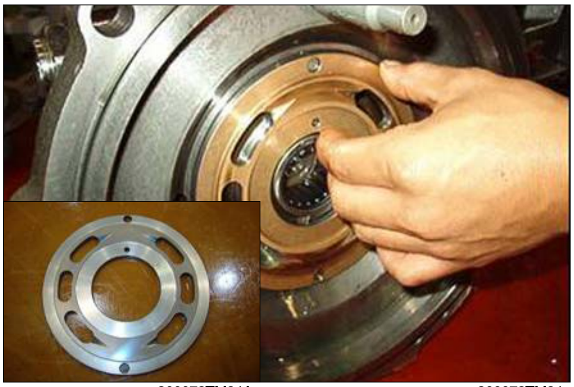
(4) Disassemble hexgon socket bolts(70, 71) holding valve casing.



300072TM23

(5) After detaching valve casing sub, disassemble valve plate(67).

※ In case of serious abrasion of valve plate, exchange it to a new one.



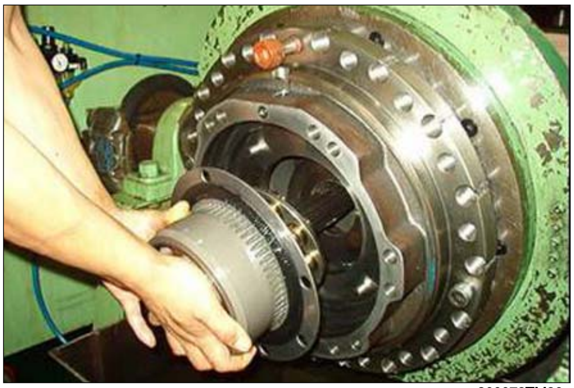
300072TM24A 300072TM24

(6) After taking brake spring(32) and then bonding two pieces of M16 bolts to brake piston(29), disassemble it pulling it upward.

※ There are 10 pieces of brake spring.

300072TM25
300072TM25A
300072TM25B

(7) First, rotate jig in disassembling and assembling up to 90°, then let a motor faced toward the horizon. then disassemble a cylinder and piston sub.



300072TM26

(8) disassemble stopper L(18) and piston swash(17).

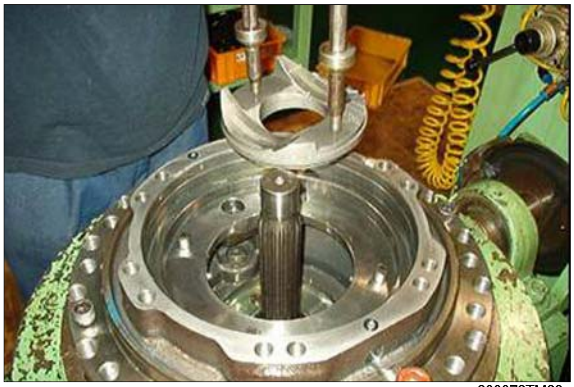
※ Piston swash : Use M5 bolt

300072TM27

(9) Disassemble swash plate(16).

300072TM28

(10) After put M12 into support(15), disassemble support.



300072TM29

(11) disassemble piston swash(10) and stopper(7).

300072TM30

(12) In order to making the turning axis(11) faced upward, put it way from shaft casing tapping the bottom of the turning axis with hammer, after rotating jig up to 90° in disassembling and assembling.

※ Try to deal with roller bearing(13) without any damage.

300072TM31

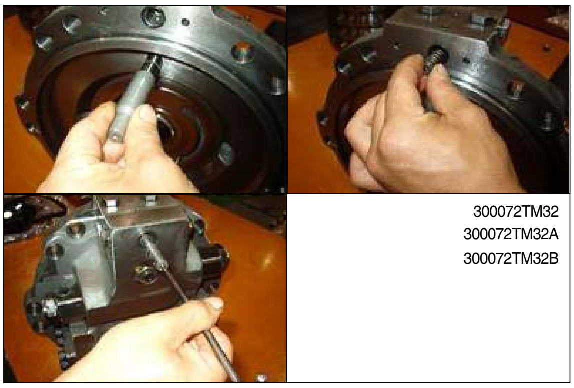
(13) Disassemble valve casing sub.

※ Try to deal with needle bearing(3) without any damage.

① Disassemble plowing road(60), automatic changeover spring(68), and automatic changeover spool(64).

※ Do not touch hexagon nut(63) for controlling the amount of an oil and lock screw(62).

If there is any abnormality on plowing spool and spring, exchange them to new ones.



300072TM32
300072TM32A
300072TM32B

② After unloading hexagon socket bolts(49, 50) and taking caps(47,48) away, disassemble parts of counter balance valve(37~46).

※ In disassembling counter balance valve, be careful of figuring out the directions such as the right or the left of finger.

If there is any abnormality in spool spring check, exchange it to new one.

300072TM33
300072TM33A
300072TM33B
300072TM33C
300072TM33D

(14) Disassemble cylinder sub.

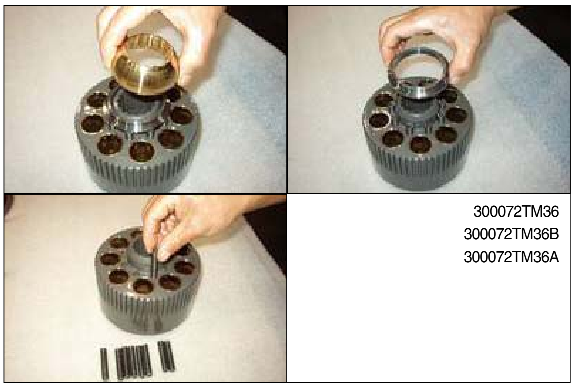
① Disassemble set plate(25) and piston(26) sub.

300072TM34

② Disassemble friction plate(27) and lee plate(28) in cylinder block(21).

300072TM35

③ Dismantle ball guide(24), spacer(23), and cylinder spring(22).



300072TM36
300072TM36B
300072TM36A

3) ASSEMBLING TRAVEL MOTOR

(1) Assemble the sub of a turning axis.

① After assembling bearing spacer(12) into a turning axis(11), have cylinder roller bearing(13) thermal-reacted.

a. In the thermal reaction of cylinder roller bearing, use and induction heating apparatus and adjust the temperature as about 100°C.

b. Deal moisturized copper part oil seal in a turning axis without any damage of it.

300072TM51
300072TM51A
300072TM51B

(2) Assemble ring stop(14) with a plier.

※ Be careful of the direction of ring stop. (The direction of round is the side of bearing)

300072TM52

(3) Assemble valve casing sub.

① Bond seven pieces of plug(2) in valve casing(33) with standard torque.

② After taping plug with seal taper and spread rock tight, assemble it.

· Tightening torque : 7~11kgf · m
(50.63~79.5lbf · ft)

300072TM53

(4) Compress pin(36) into.

※ Using a hammer, make the height of pin 5mm from the a contact surface of valve plate.

300072TM54

(5) Assemble needle bearing(34).

300072TM55

(6) Assemble seat(51), ball(52), stopper(53), and hp plug(54) with O-ring(55), respectively.

① Be careful of the procedure and direction of assembling seat and stopper.

· Tightening torque : 37kgf · m (267.6lbf · ft)

300072TM56

300072TM56A

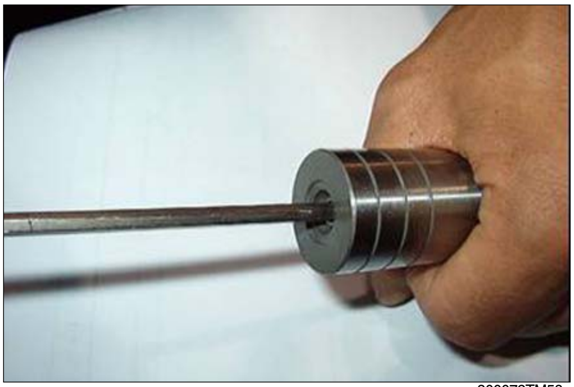
(7) Assemble hp plug(54) set up with O-ring(55).

· 5sites

· Tightening torque : 37kgf · m (267.6lbf · ft)

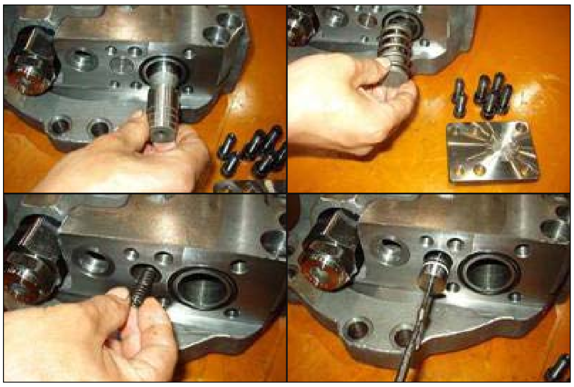
300072TM57

(8) Bond orifice screw(38) on the right and left side of spool c.b(37) with a standard torque.
· Tightening torque : 7kgf · m (50.63lbf · ft)



300072TM58

(9) Insert hold spool c.b(37) and damper check(39) into valve casing.



300072TM59 300072TM59A
300072TM59B 300072TM59C

(10) Bond cap R(47) and cap L(48) with hexagon socket bolts(49, 50).

① Remember not to exchange cap R, L each other in assembling.
Tightening torque
· M12 : 100kgf · m (item 49)
· M10 : 67kgf · m (item 50)

300072TM60

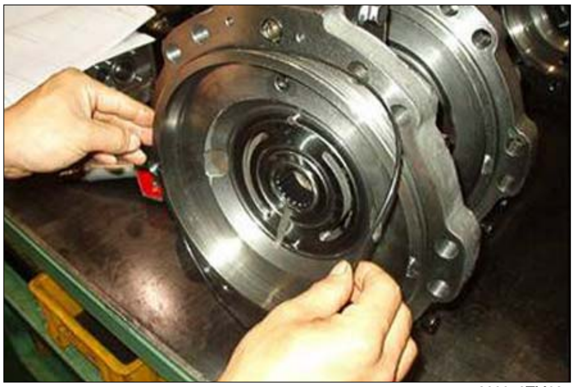
(11) After fastening with torque, insert automatic plowing spool(04), spring(68) and O-ring(69).
· Tightening torque : 75kgf · m
(542.4lbf · ft)

300072TM61 300072TM61A

(12)Assemble swash road(60) inserted by O-ring(61).

300072TM62

(13)Insert O-ring(32) into valve casing.



300072TM63

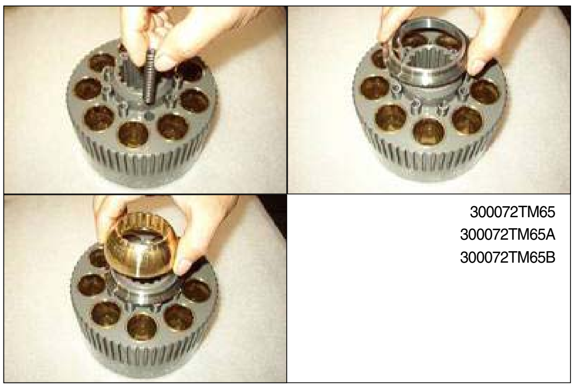
(14)Bond drain plug(30) inserted by O-ring(31) with standard torque.

· Tightening torque : 100kgf · m (723.3lbf · ft)

300072TM64

(15)Assemble cylinder sub.

① Assemble cylinder spring(22), spacer (23), and spherical surface bush(24) into cylinder(21).
Set the position of spline of spherical surface bush and cylinder.



300072TM65
300072TM65A
300072TM65B

(16) Assemble friction plate(27) and separated plate(28) into cylinder.


300072TM66

(17) After insert piston shoe(26) into set plate(25), assemble it into cylinder.


300072TM67 300072TM67A

(18) Using jig, compress oil seal(73) into shaft casing(01).


300072TM68

(19) Assemble the body of a motor.

① Bond seven piece of plug(02) in shaft casing plug with standard torque.

a. After taping plug with seal taper and spread rock tight, assemble it.

· Tightening torque : 7~11kgf · m (50.63~79.5lbf · ft)


300072TM69 300072TM69A

(20)Using a hammer and a handle, compress pin(5, 6).

① Pin(5) : Set the height as 10㎜ from the contact surface of a plate supporter. - 2pieces.

Pin(6) : Set the height as 19㎜ from the manufactured surface of shaft casing. - 4pieces.

300072TM70

300072TM70A

(21)Assemble sub of a turning axis.

300072TM71

(22)Assemble plate supporter(15) with M12 bolt.

※ Be careful of the direction of plate supporter driven.

300072TM72

(23)Assemble plate(16) into plate supporter.

① Spread grease in moisturized copper part of plate.

② Confirm the soft movement of plate.

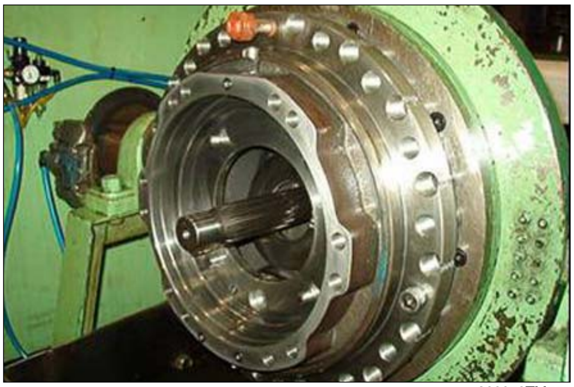
300072TM73

(24) Assemble stopper L(36) combined by plowing piston(35) and O-ring(42).

300072TM74 300072TM74A

(25) Rotating dismantling and assembling jig up to 90° make shaft from perpendicular to horizontal.

※ Be careful that plate is not segregated from plate supporter.



300072TM75

(26) Assemble cylinder sub.

※ Adjusting pin into holes of separated plate, assemble it.

300072TM76

(27) Rotating dismantling and assembling jig up to 90°, make the direction of shaft from the horizon to the perpendicular.

300072TM77

(28)Assemble piston ring(30), piston ring 252(30) and 278(31) into brake piston(29).

300072TM78

(29)Assemble brake piston into shaft casing.

※ Be careful of the direction of assembling brake piston.

300072TM79

(30)Assemble brake spring(32).

※ Quantity : Spring-10pieces, Holes-11pieces

※ Do not assemble on the top of brake piston.

300072TM80

(31)Insert O-ring(69), after fastening orifice screw(4) with standard torque.

· Quantity and size : (4)2 pieces- ø 1.0
(56)1pieces- ø 1.5

· Tightening torque : 7kgf · m (50.63lbf · ft)

300072TM81

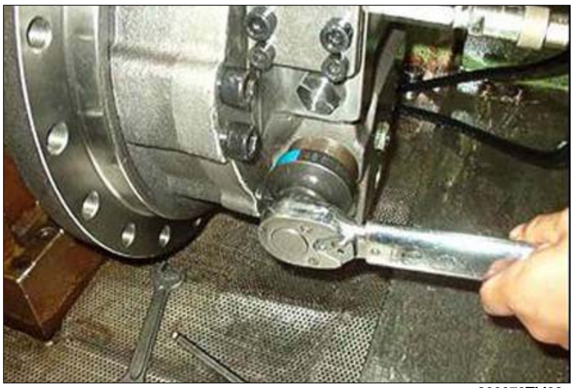
(32) After inserting valve plate(67) into valve casing, bond it into shaft casing with hexagon socket bolt(70).

① Spread grease on the back side of valve plate, in order for valve plate to be adhered well.
② Use a crane in assembling it into valve plate shaft casing.
③ Set holes, ø5, of valve plate heading toward the port of the inlet and outlet of valve casing.
④ Spread grease in the side of plowing spool of plowing spring in order that plowing spring can not be detached.

· Tightening torque : 240kgf · m (1736lbf · ft)
· Tightening torque : 180±10kgf · m (1302±72.3lbf · ft)


300072TM82

(33) Bond relief valve(57) with standard torque.


300072TM83

(34) Unloosen four pieces of bolts(M20×50L) fixing a motor and remove the motor away from jig.


300072TM84

3. DISASSEMBLING REDUCTION UNIT

1) Preparation for disassembling

300078RD01

(1) The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.

(2) Locate reducer in order for drain port to be at the lowest level loosen taper screw plug of drain port, and drain oil from reduction gear.

※ While oil is still hot, inside of the unit may be pressurized.

⚠ Take care of the hot oil gushing out of the unit when loosening the plug.

(3) Mark for mating

Put marks on each mating parts when disassembling so as to reassemble correctly as before.

2) Setting reduction unit(or whole propelling unit) on work stand for disassembling

(1) Remove hexagon socket head bolts(M10, 19) at 3 places from cover(17) almost equally each other, and then install eye bolts(M10).

Lift up the unit using them and place it on work stand with cover upward.

※ Take great care not th pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

3) Removing cover

(1) Remove the rest of hexagon socket head bolts(M10, 19) that secure ring gear.

Loosen all the socket bolts and then, disassemble cover.

(2) As the cover(17) is adhered to ring gear(14), dissemble ring gear(14) and cover(17) by lightly hammering slantwise upward using sharpen punch inserted between the cover and ring gear.

4) Removing NO.1 carrier sub assy

(1) Remove No.1 sun gear

※ Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.

300078RD02

(2) Screw three eye bolt(M10, 15) in No.1 carrier and lift up and remove No.1 carrier assy.

300078RD03

5) Removing No. 2 carrier sub assy

(1) Remove No.2 sun gear

※ Be sure to maintain it vertical with the ground when disassembling No.2 sun gear.

300078RD04

(2) Screw three M10 eye bolt in No.2 carrier and lift up and remove No.2 carrier assy.

300078RD05

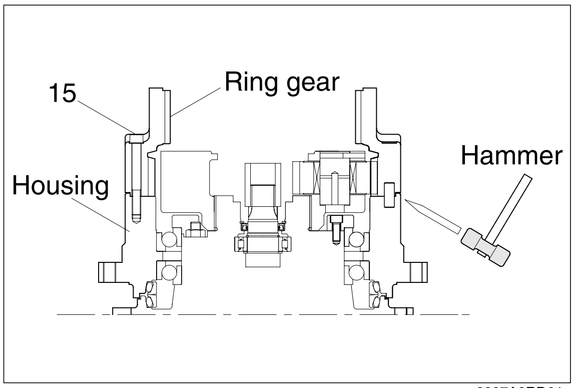
6) Removing ring gear

(1) Remove hexagon socket head bolts(M14, 15) that secure ring gear and housing.

300078RD06

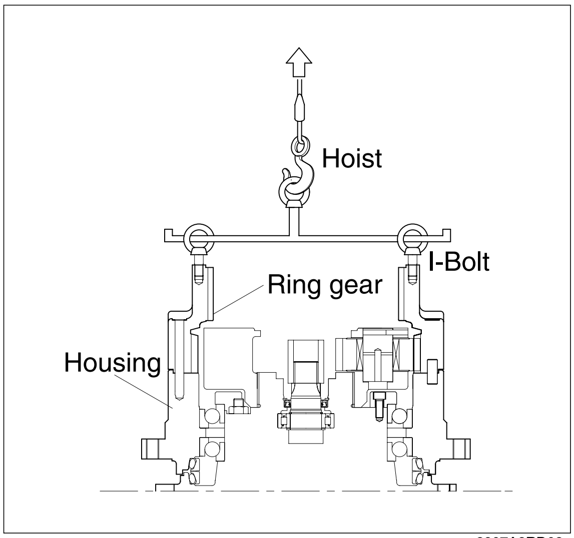
(2) As the ring gear(14) is adhered to housing(3), disassemble ring gear(14) and housing(3) by lightly hammering slantwise upward using sharpen punch inserted between the ring gear and housing.

※ Carefully disassembling ring gear not to make scratch on it.



2907A8RD01

(3) Screw three eye bolt(M10) in ring gear and lift up and remove it.



2907A8RD02

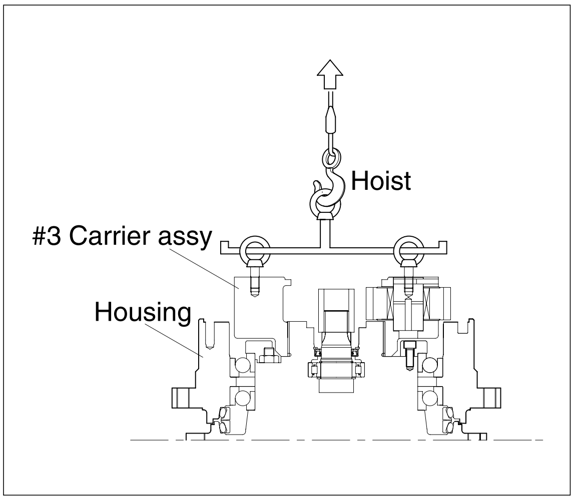
7) Remove No.3 carrier sub assy

(1) Removing No.3 sun gear

※ Be sure to maintain it vertical with the ground when disassembling No.3 sun gear.

300078RD09

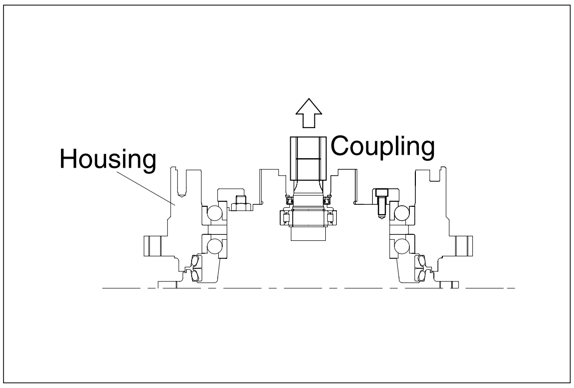
(2) Screw three eye bolt(M10) in No.3 carrier and lift up and remove No.3 carrier assy.



2907A8RD03

8) Remove coupling

(1) Remove coupling



2907A8RD04

9) Remove motor ring

(1) Remove motor ring using hand.

300078RD12

10) Removing retainer & shim

(1) Remove hexagon socket(M12) head bolts that retainer and motor.

(2) Remove retainer & shim.

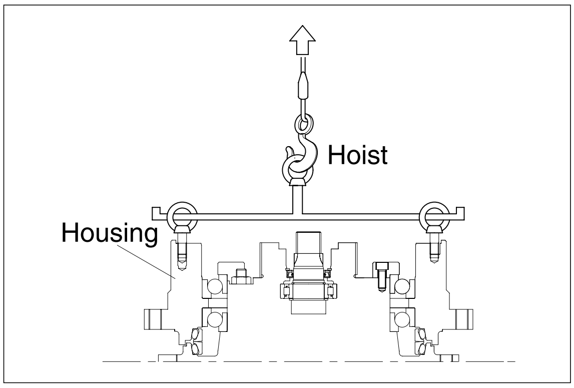
300078RD13

11) Removing housing sub assy

(1) Screw eye bolt(M14) in housing and lift up housing assembly including angular bearing and floating seal.

12) Removing floating seal

(1) Lift up a piece of floating seal of motor side.



2907A8RD05

13) Dissembling housing assembly

(1) After turning housing, lift up a piece of floating seal from housing and then remove it.

※ Don't disassemble angular bearing.

300078RD15

14) Dissembling No.1 carrier

(1) Remove thrust ring(16) from carrier.

(2) Knock spring pin(89-6) fully into No.1 pin(90-5).

(3) Remove planetary, thrust washer, No.1 pin, bearing from carrier.

300078RD15

15) Disassembling No.2,3 carrier

(1) Disassemble(14) carriers, using the same method for No.1 carrier assembly.

6. ASSEMBLING REDUCTION GEAR

- **General precautions**

  Clean every part by kerosene and dry them by air blow.

  Surfaces to be applied by locktite must be decreased by solvent.

  Check every part for any abnormals.

  Each hexagon socket head bolt should be used with locktite No. 242 applied on its threads.

  Apply gear oil slightly on each part before assembling.

  Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

Inspection before reassembling

Thrust washer

· Check if there are seizure, abnormal wear or uneven wear.

· Check if wear is over the allowable limit.

Gears

· Check if there are pitting or seizure on the tooth surface.

· Check if there are cracks on the root of tooth by die check.

Bearings

· Rotate by hand to see if there are something unusual such as noise or uneven rotation.

Floating seal

· Check flaw or score on sliding surface or on O-rings.

1) Assembling No.1 carrier

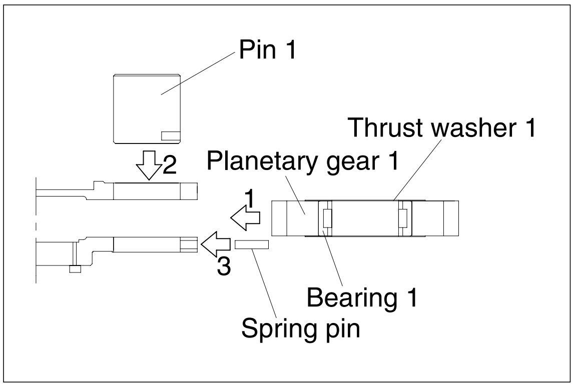
(1) Put No.1 carrier(90-1) on a flat place.

(2) Install No.1 needle bearing(90-3) into No.1 planetary gear(90-2), put 2 ea of No.1 thrust washer(90-4) on both sides of bearing, and then install it into carrier.

(3) Install No.1 pin(90-5) into No.1 carrier where the holes for No.1 pin(90-5) are to be in line with those of No.1 carrier, and then, install spring pins into the holes.

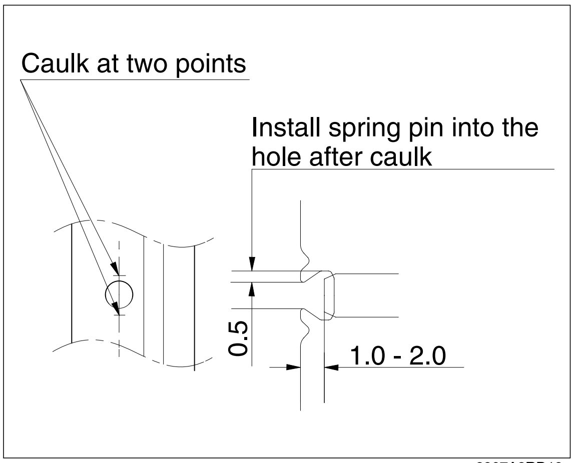
(4) Caulk carrier holes as shown on the picture.

(5) Assembly ring thrust(96) into carrier.



2907A8RD06

300078RD15



2907A8RD19

2) Assembling No.2 carrier

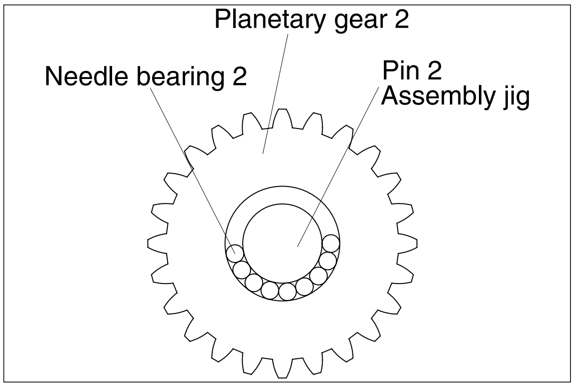
(1) Make No.2 planetary gear(89-2) vertical, assemble 8-9 ea of No.2 needle(89-3), and then, assemble the remaining No.2 needle by use of the assembly jig for No.2 pin(89-5).

(2) Remove out the assembly jig for No.2 pin and assemble 2 ea of No.2 thrust washer(89-4) into No.2 carrier(89-1).

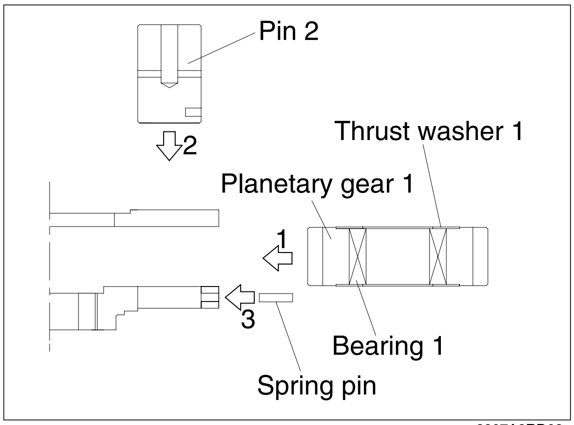
(3) Insert No.2 pin(89-5) into carrier where the holes of No.2 pin(89-5) are in line with those of carrier.

(4) Hammer spring pin(89-6) to insert into carrier hole and No.2 pin hole, and then, caulk. Assemble 2 sets using the same method.

(5) Assemble ring thrust(98) into carrier.



2907A8RD07



2907A8RD08

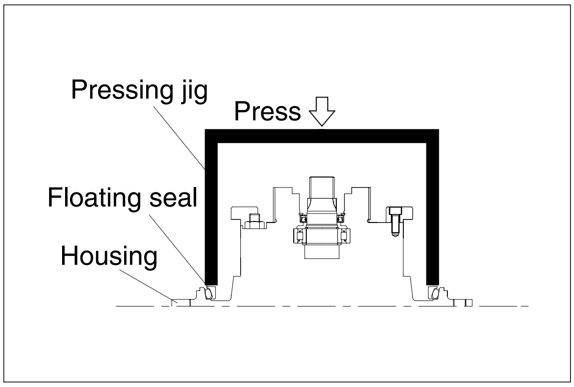
3) Assembling No.3 carrier

(1) Assemble 4 sets, using the same method for assembly of No.2 carrier.

4) Installing floating seal

(1) Assemble floating seal into motor by use of pressing jig.

(2) Grease the contact parts for floating seal which is assembled into motor.

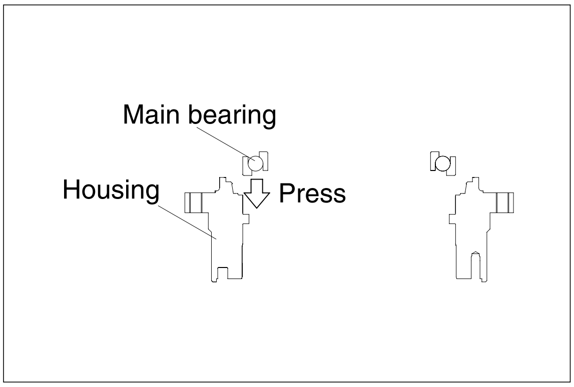


2907A8RD09

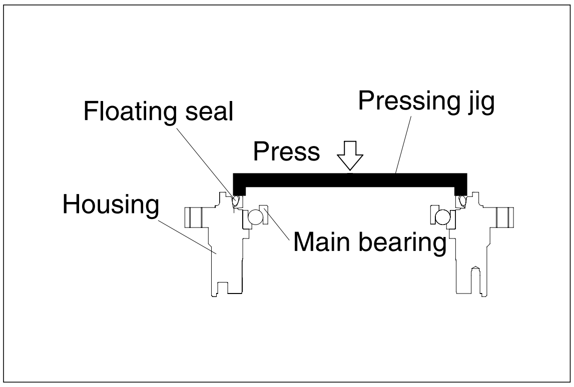
300078RD21

5) Assembling housing

(1) Heat housing at 60~70°C while clearing it out and then, assemble bearing.
(2) Assemble floating seal into housing by use of pressing jig as shown on the picture.
※ Be sure to maintain it vertical with the ground when assembling bearing and floating seal.



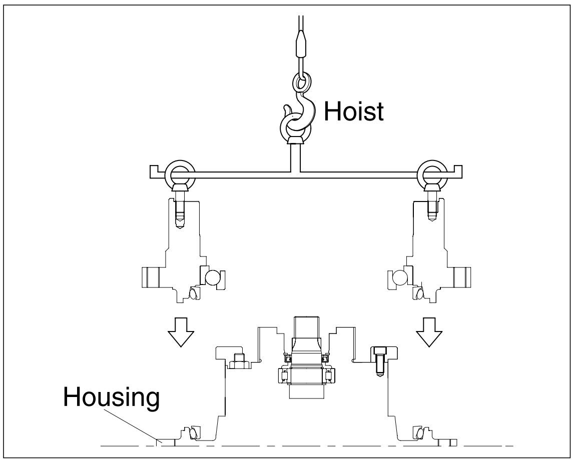
2907A8RD10



2907A8RD11

6) Installing housing assembly

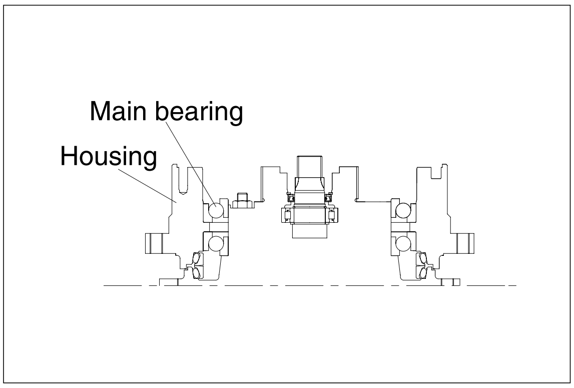
(1) Install 2 ea of eye bolt(M14) into housing assembly.
(2) Assemble housing into motor by use of hoist and eye bolt.
※ Be sure to tighten eye bolt deep enough.



2907A8RD12

7) Installing main bearing

(1) Heat main bearing at 60~70°C and then, install.
※ Be sure to maintain it vertical with the ground when assembling bearing.

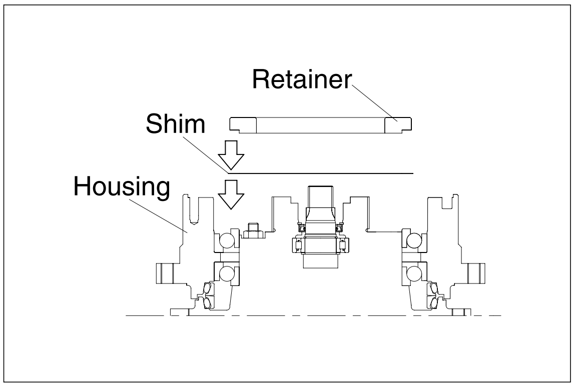


2907A8RD13

8) Installing retainer(86) and shim(85)

(1) Measure clearance between main bearing and retainer by use of jig to decide the thickness of shim and select and appropriate shim, and then, assemble retainer.

(2) Apply locktite(#242) on hexagon socket head bolt(M12), and then, bolt.

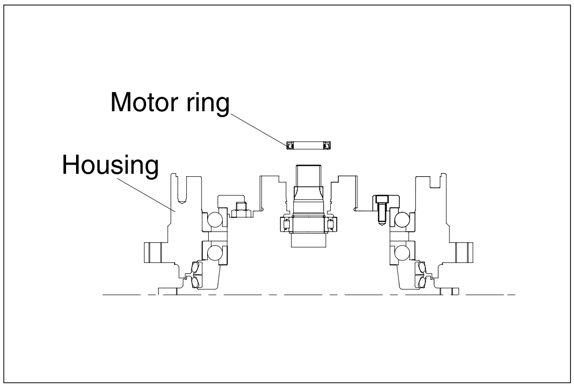


2907A8RD14

300078RD13

9) Installing motor ring

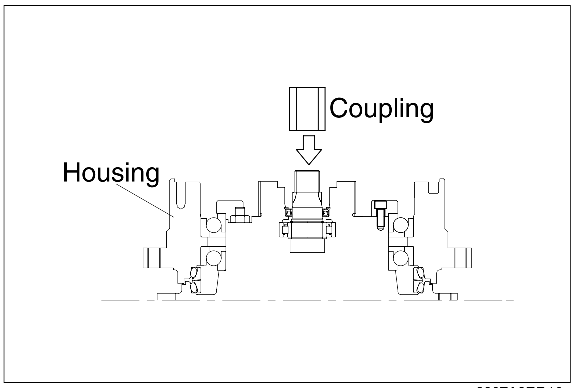
(1) Insert motor ring into motor to install.



2907A8RD15

10) Installing coupling

(1) Install coupling on spline of the motor.



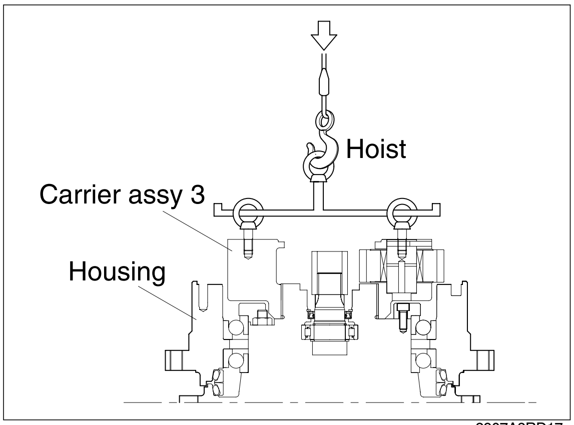
2907A8RD16

11) Installing No.3 carrier sub assy

(1) Install eye bolt(M10) on No.3 carrier assembly.

(2) Lift No.3 carrier assembly and then, assemble it into reducer.

※ Match it vertical with the spline of the motor and the, slowly lower.



2907A8RD17

12) Installing ring gear

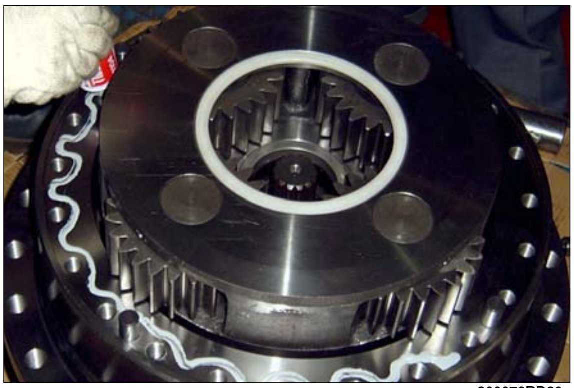
(1) Apply three bond #1104(Locktite #515) on housing for ring gear without gap.

(2) Insert lock pin into housing hole.

(3) Install eye bolt(M12) on the tap for cover of ring gear.

(4) Lift ring gear and then, assemble into housing.

(5) Apply locktite to hexagon socket bolt(M14) and then, bolt, having appropriate torque.


300078RD30

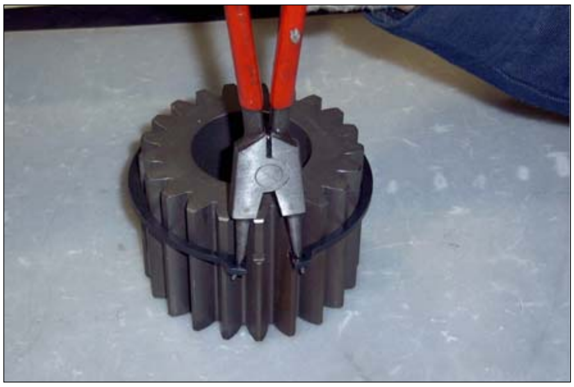

300078RD31


300078RD06

13) Installing No.3 sun gear(88-7)

(1) Install snap ring(88-8) in No.3 sun gear(88-7) by use if snap ring flier.

(2) Install No.3 sun gear on the spline of No.3 carrier, matching teeth of them.



300078RD32

300078RD09

14) Installing No.2 carrier sub assy

(1) Install eye bolt(M10) on No.2 carrier assembly.

(2) Lift No.2 carrier assembly and then, slowly put it down on ring gear.

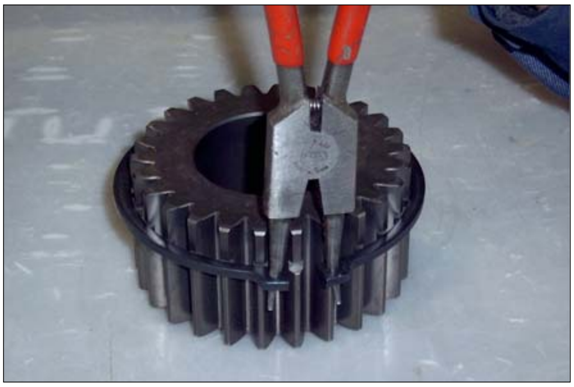
(3) Rotate planetary gear by hands and install in ring gear.

300078RD05

15) Installing No.2 sun gear(89-7)

(1) Install snap ring(89-8) on No.2 sun gear(89-7) by use of snap ring flier.

(2) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.



300078RD33

300078RD04

16) Installing No.1 carrier sub assy

(1) Install eye bolt(M10) on No.1 carrier assembly.

(2) Lift No.1 carrier assembly and then, put it down on ring gear slowly.

(3) Rotate planetary gear by hands to install on ring gear, matching their teeth.

300078RD03

17) Installing No.1 sun gear(91)

(1) Put down No.1 sun gear on No.1 carrier, maintaining it vertical with spline of coupling.

(2) Install No.1 sun gear on No.1 planetary gear, matching their teeth.

300078RD02

18) Installing cover(97)

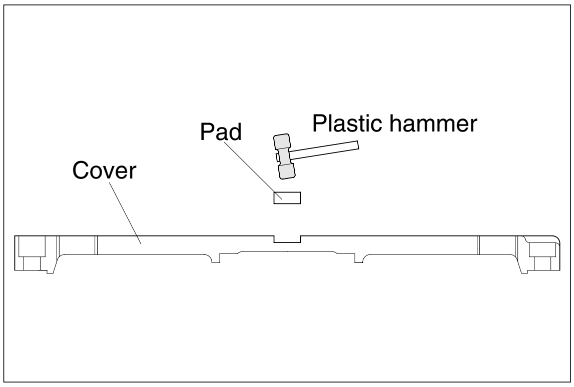
(1) Beat pad with plastic hammer, and press it into the center of cover.

(2) Apply three bond #104(locktite #515) on the ring gear for without gap.

(3) Put cover on ring gear, apply locktite(#242) in hexagon socket head bolt(M10), and then, bolt.

(4) Fill gear oil(8L) into drain port.

(5) Apply sealing tape(teflon) on PT3/4 plug and then, bolt.



2908ARD18

300078RD35

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

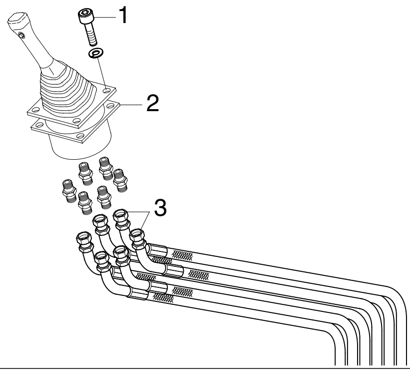

13031GE18

(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.



21078DA06

(4) Loosen the socket bolt(1).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses(3).

(7) Remove the pilot valve assembly(2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.

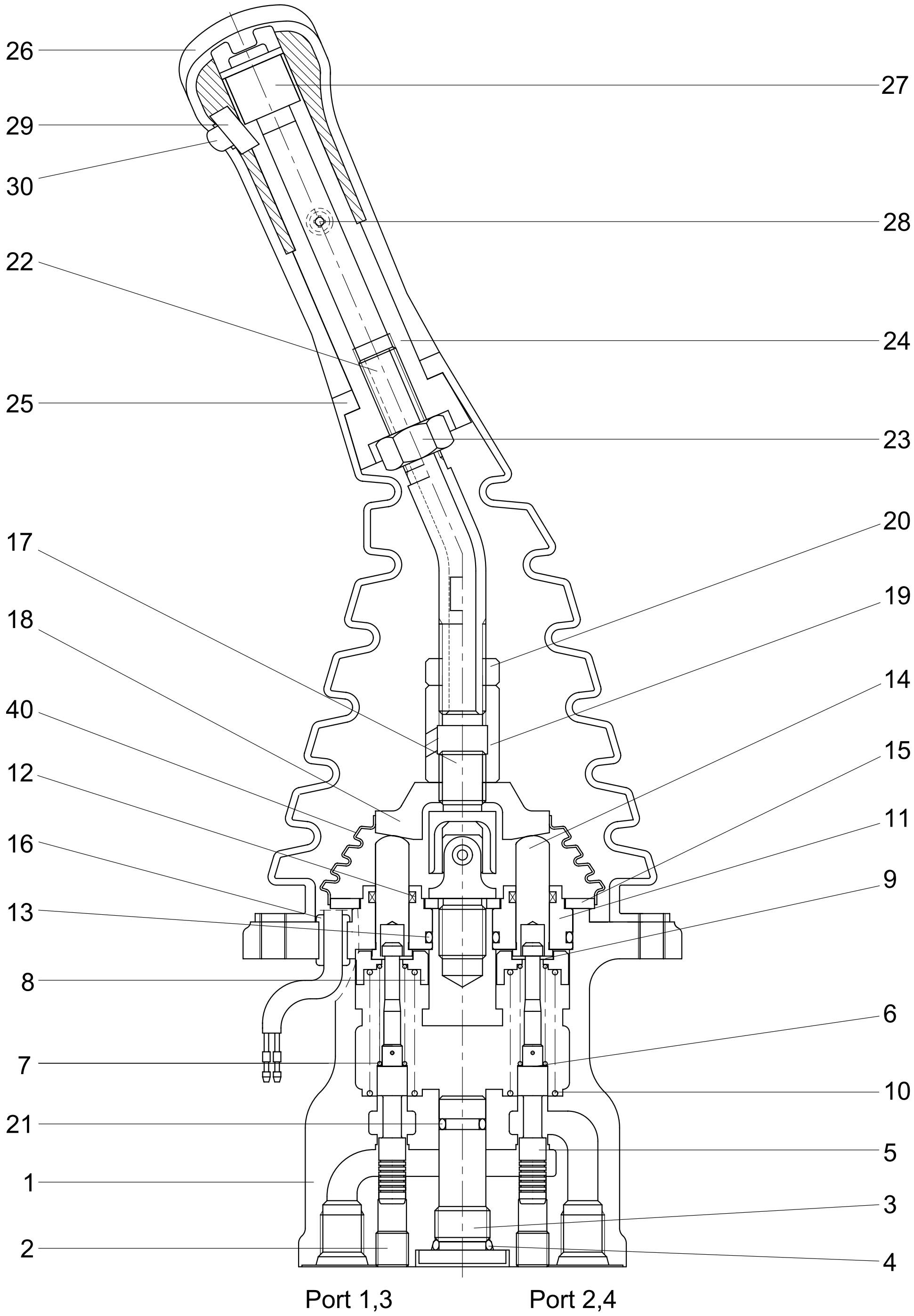
2) INSTALL

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

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

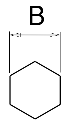


14072SF80

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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

<table>
<tr><th>Tool name</th><th colspan="2">Remark</th></tr>
<tr><td>Allen wrench</td><td>6</td><td rowspan="3">
</td></tr>
<tr><td rowspan="2">Spanner</td><td>22</td></tr>
<tr><td>27</td></tr>
<tr><td>(+) Driver</td><td colspan="2">Length 150</td></tr>
<tr><td>(-) Driver</td><td colspan="2">Width 4~5</td></tr>
<tr><td>Torque wrench</td><td colspan="2">Capable of tightening with the specified torques</td></tr>
</table>

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Plug	2	PT 1/8	3.0	21.7
Joint	18	M14	3.5	25.3
Swash plate	19	M14	5.0±0.35	36.2±2.5
Adjusting nut	20	M14	5.0±0.35	36.2±2.5
Lock nut	21	M14	5.0±0.35	36.2±2.5
Screw	29	M 3	0.05	0.36

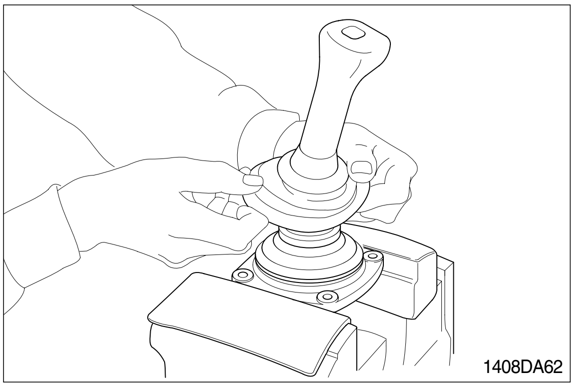
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

※ Put blind plugs into all ports

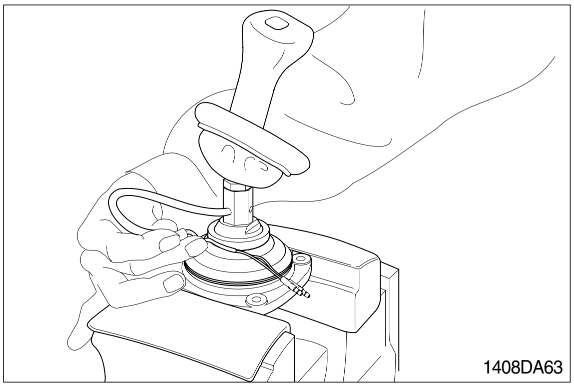
(2) Fix pilot valve in a vise with copper(or lead) sheets.

(3) Remove end of boot(25) from case(1) and take it out upwards.



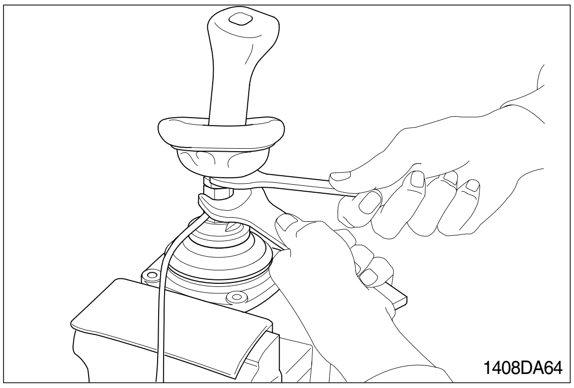
1408DA62

※ For valve with switch, remove cord also through hole of casing.



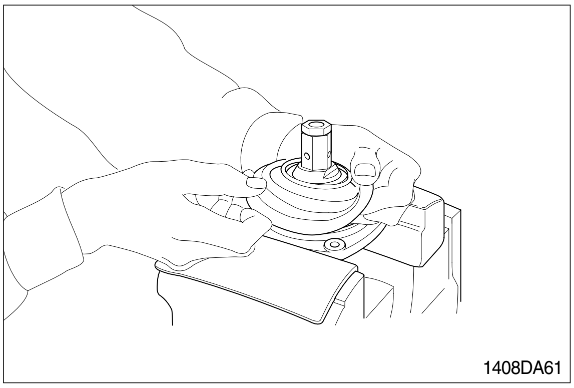
1408DA63

(4) Loosen lock nut(20) and adjusting nut(19) with spanners on them respectively, and take out handle section as one body.



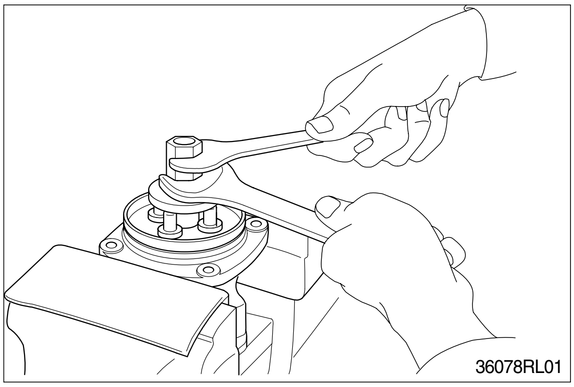
1408DA64

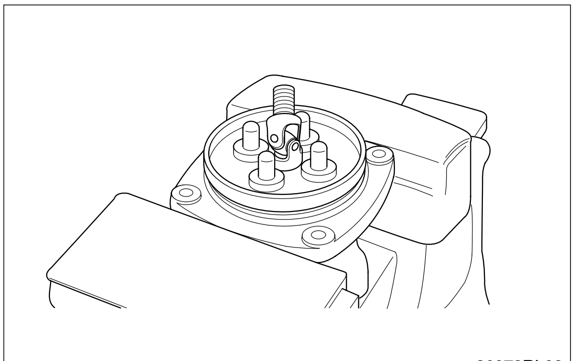
(5) Remove the boot(40)



1408DA61

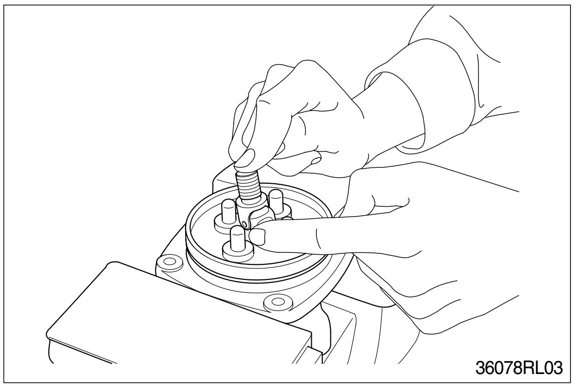
(6) Loosen adjusting nut(19) and plate(18) with spanners on them respectively, and remove them.

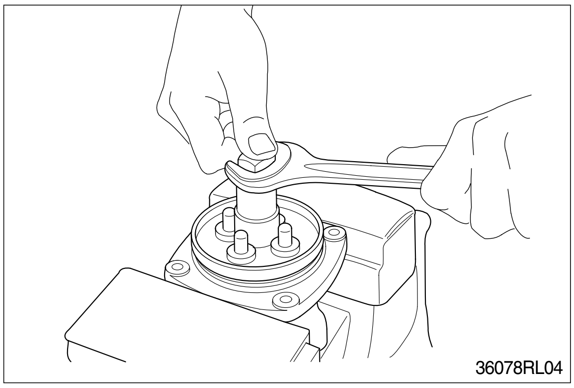

36078RL01


36078RL02

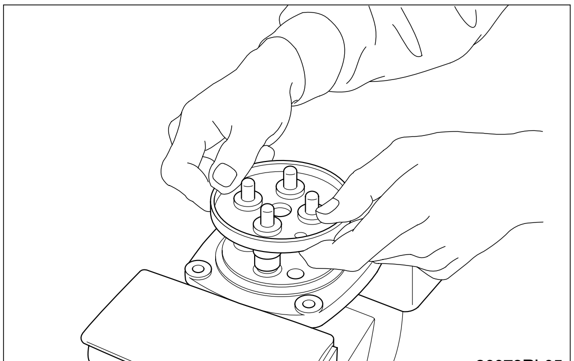
(7) Turn joint anticlockwise to loosen it, utilizing jig(Special tool).

※ When return spring(10) is strong in force, plate(15), plug(11) and push rod(14) will come up on loosening joint.
Pay attention to this.


36078RL03


36078RL04

(8) Remove plate(15).

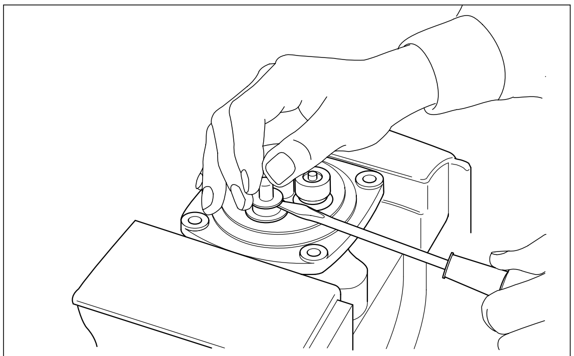


36078RL05

(9) When return spring(10) is weak in force, plug(11) stays in casing because of sliding resistance of O-ring.

※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

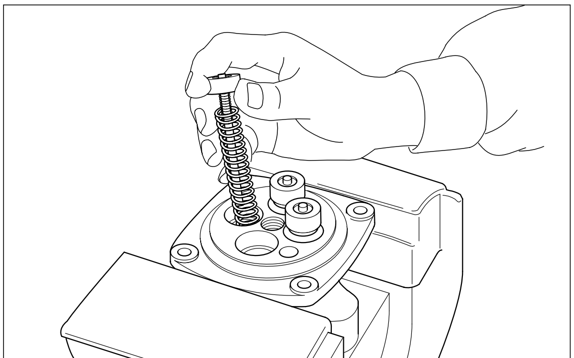
※ During taking out, plug may jump up due to return spring(10) force.
Pay attention to this.



36078RL06

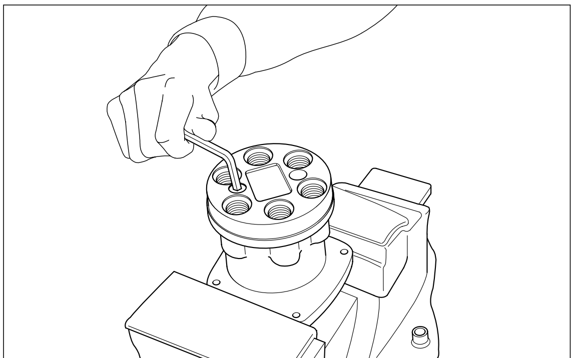
(10) Remove reducing valve subassembly and return spring(10) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



36078RL07

(11) Loosen hexagon socket head plug(2) with hexagon socket screw key.



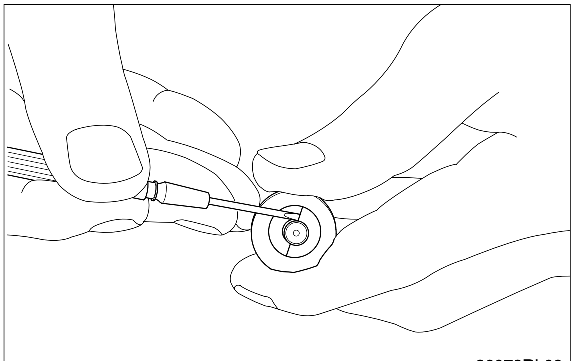
36078RL08

(12) For disassembling reducing valve section, stand it vertically with spool(5) bottom placed on flat workbench. Push down spring seat(8) and remove two pieces of semicircular stopper(9) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

※ Record original position of spring seat(8, 31).

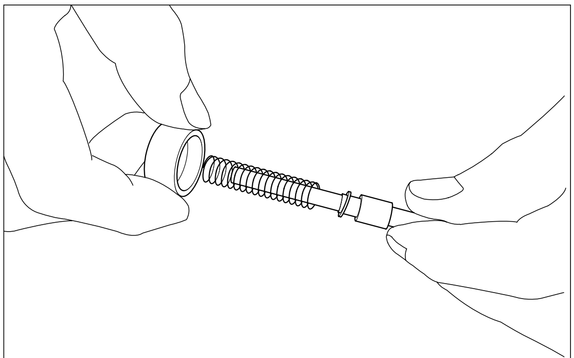
※ Do not push down spring seat more than 6mm.



36078RL09

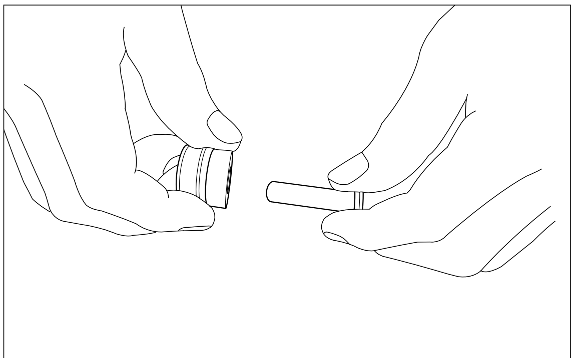
(13) Separate spool(5), spring seat(8), spring(7) and shim(6) individually.

※ Until being assembled, they should be handled as one subassembly group.



36078RL10

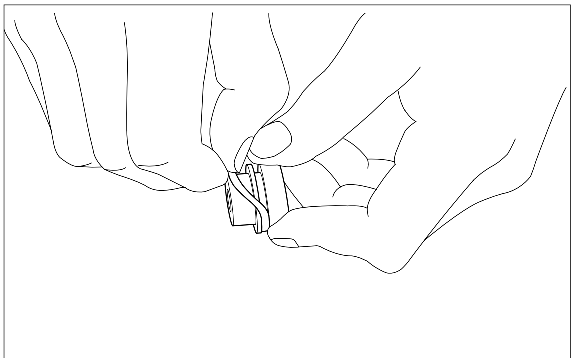
(14) Take push rod(14) out of plug(11).



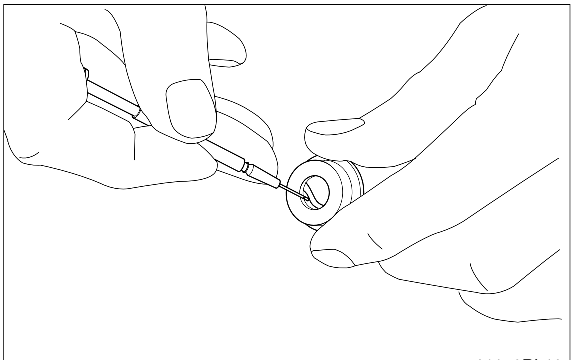
36078RL11

(15) Remove O-ring(13) and seal(12) from plug(11).

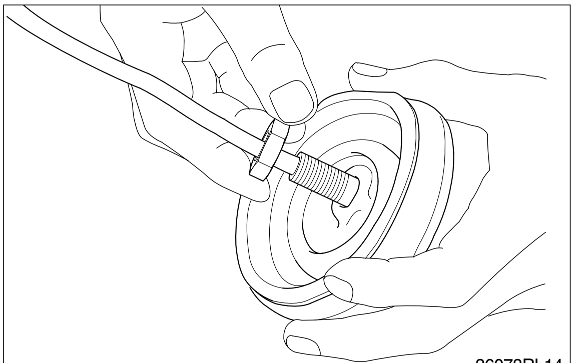
Use small minus screwdriver or so on to remove this seal.

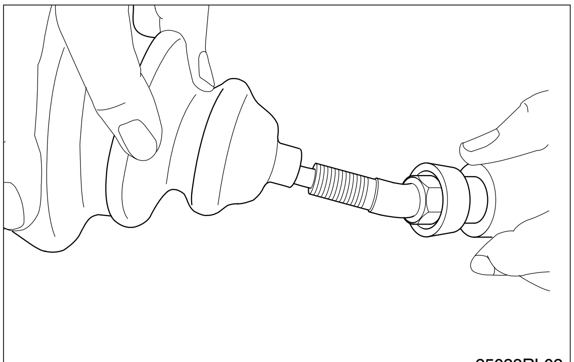


36078RL12


36078RL13

(16) Remove lock nut(20) and then boot(25).


36078RL14


25038RL02

(17) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (Rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides(Finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

(18) Rust prevention of parts.

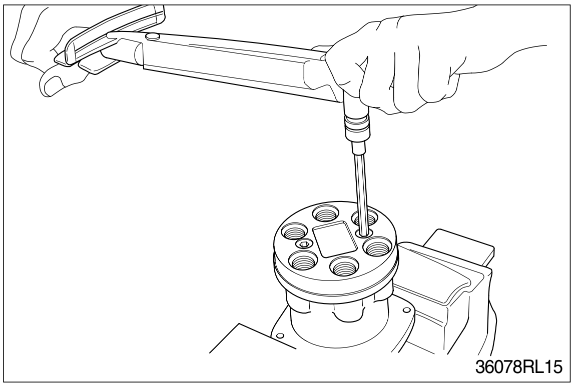
Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

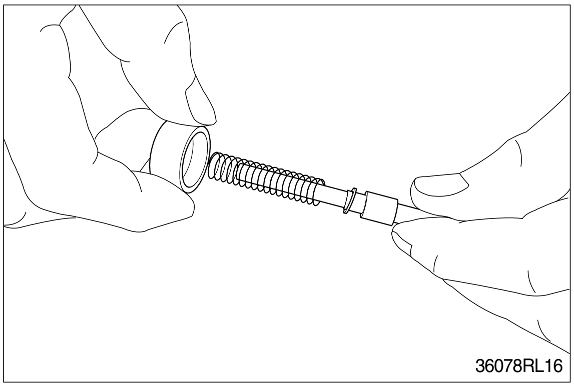
(1) Tighten hexagon socket head plug(2) to the specified torque.

※ Tighten two bolts alternately and slowly.



36078RL15

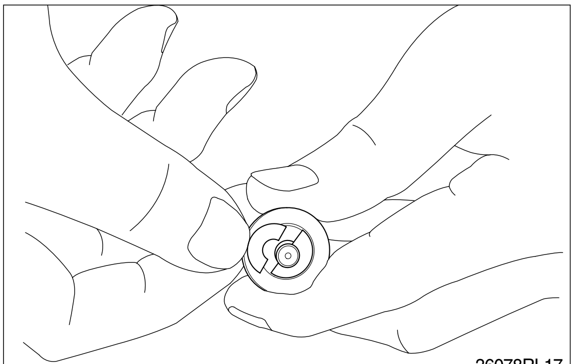
(2) Put shim(6), springs(7) and spring seat(8) onto spool(5) in this order.



36078RL16

(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper(9) on spring seat without piling them on.

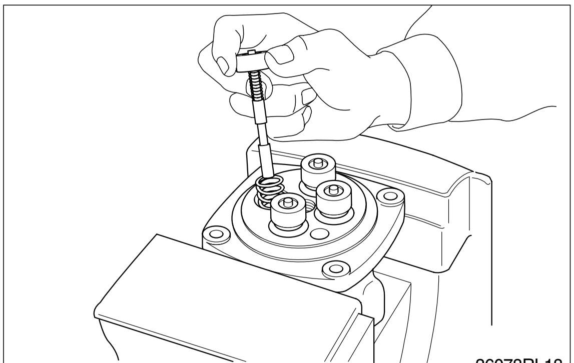
※ Assemble stopper(9) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.



36078RL17

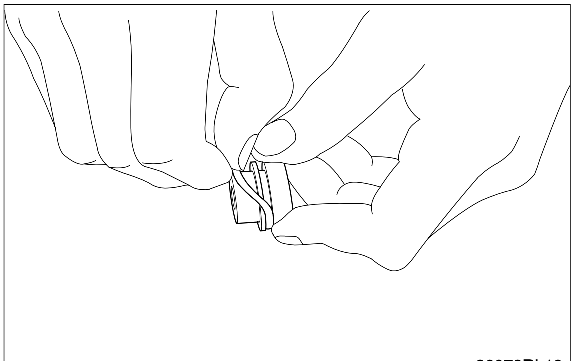
(4) Assemble spring(10) into casing(1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



36078RL18

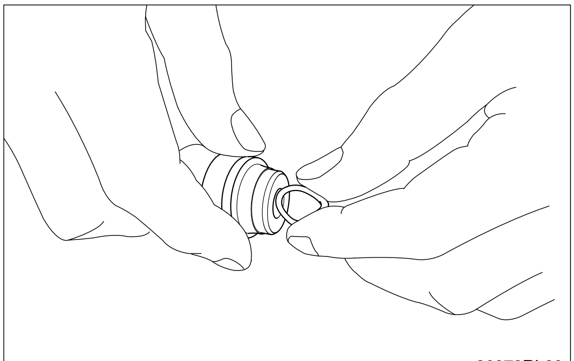
(5) Assemble O-ring(13) onto plug(11).



36078RL19

(6) Assemble seal(12) to plug(11).

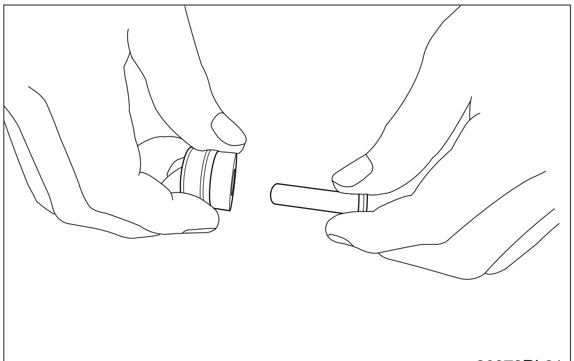
※ Assemble seal in such lip direction as shown below.



36078RL20

(7) Assemble push rod(14) to plug(11).

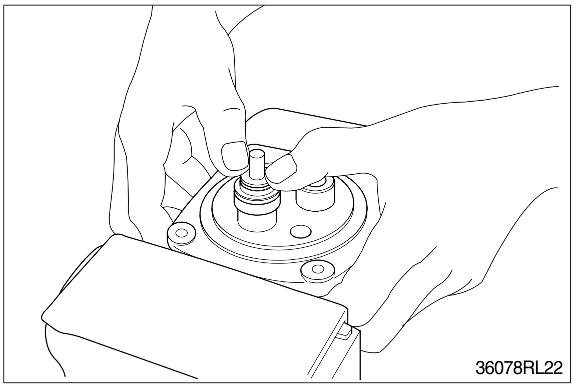
※ Apply working oil on push-rod surface.



36078RL21

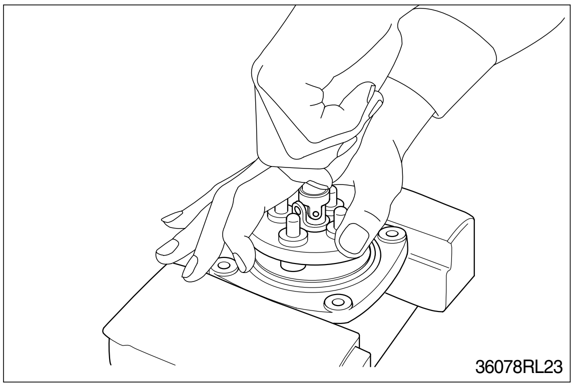
(8) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



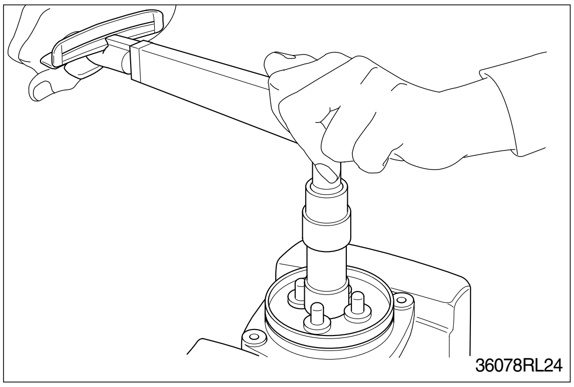
36078RL22

(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate(15), and tighten joint(17) temporarily.



(10) Fit plate(15).

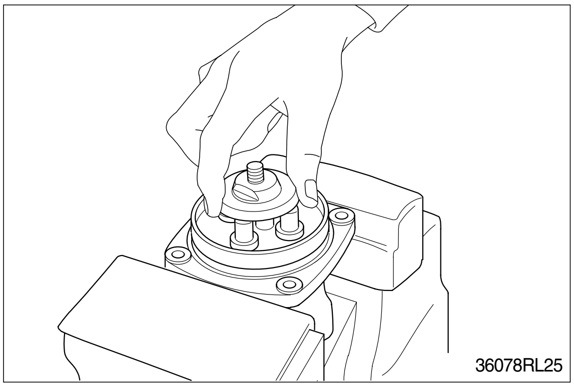
(11) Tighten joint(17) with the specified torque to casing, utilizing jig.



(12) Assemble swash plate(18) to joint(17).

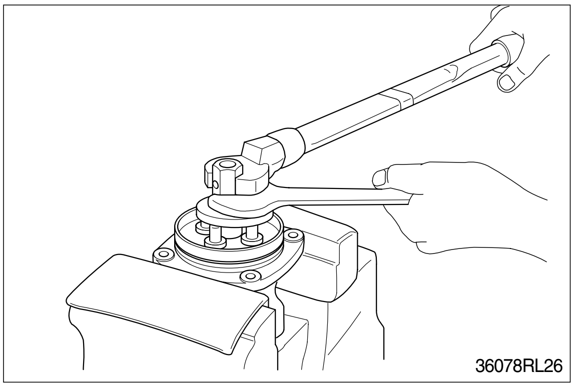
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

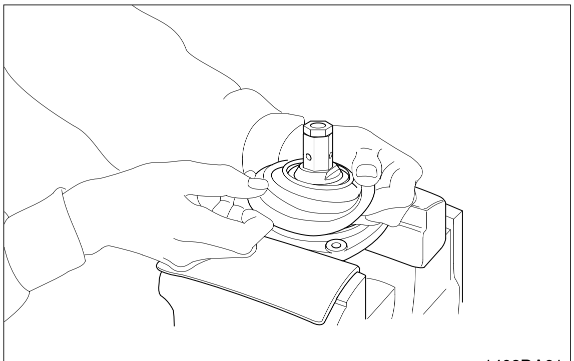


(13) Assemble adjusting nut(19), apply spanner to width across flat of plate(18) to fix it, and tighten adjusting nut to the specified torque.

※ During tightening, do not change position of disk.

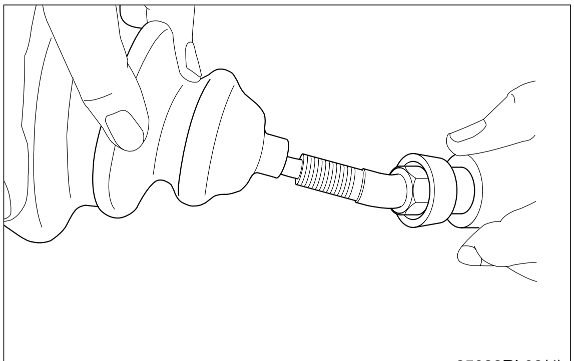


(14) Fit boot(40) to plate.

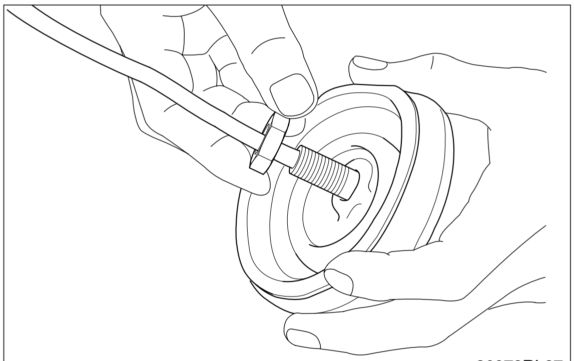


1408DA61

(15) Fit boot(25) and lock nut(20), and handle subassembly is assembled completely.

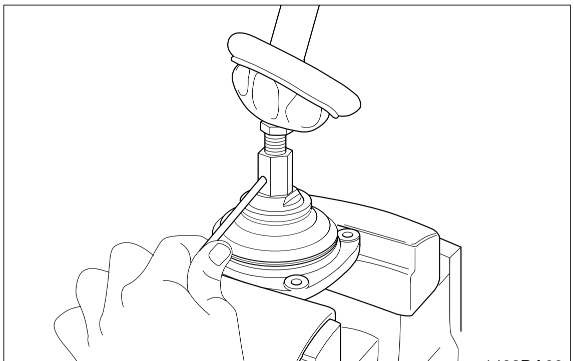


25038RL02(4)



36078RL27

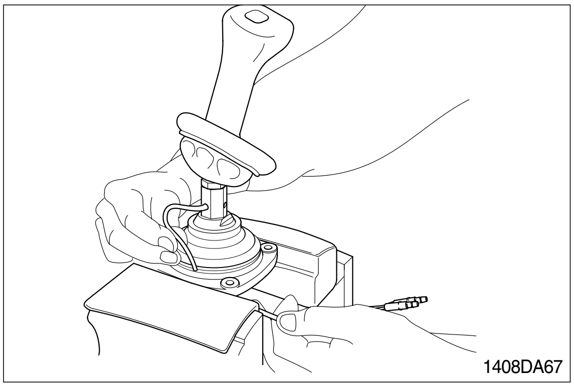
(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



1408DA66

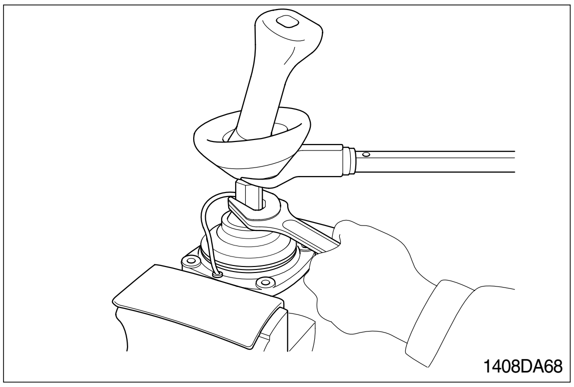
(17) Assemble bushing(16) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.



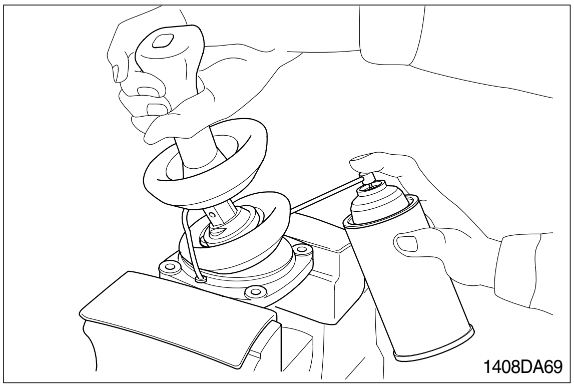
1408DA67

(18) Determine handle direction, tighten lock nut(20) to specified torque to fix handle.



1408DA68

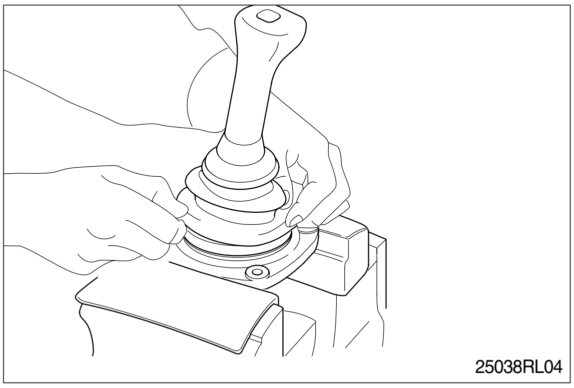
(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



1408DA69

(20) Assemble lower end of bellows to casing.

(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



25038RL04

GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

13031GE18

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

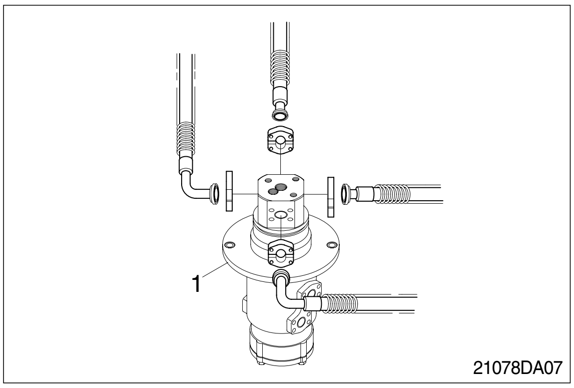
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(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 .



21078DA07

(5) Sling the turning joint assembly (1) and remove the mounting bolt(2).

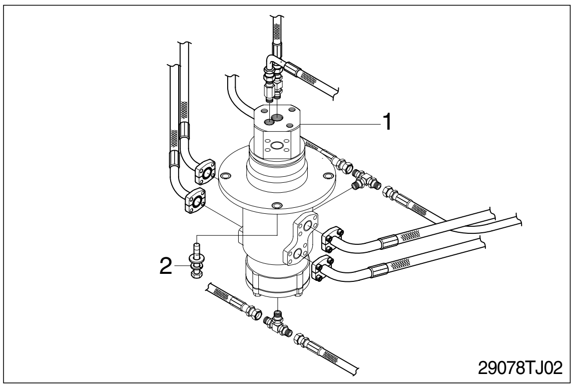
· Weight : 54kg(119lb)

· Tightening torque : 12± 1.3kgf · m (88± 9.4lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

2) INSTALL



29078TJ02

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

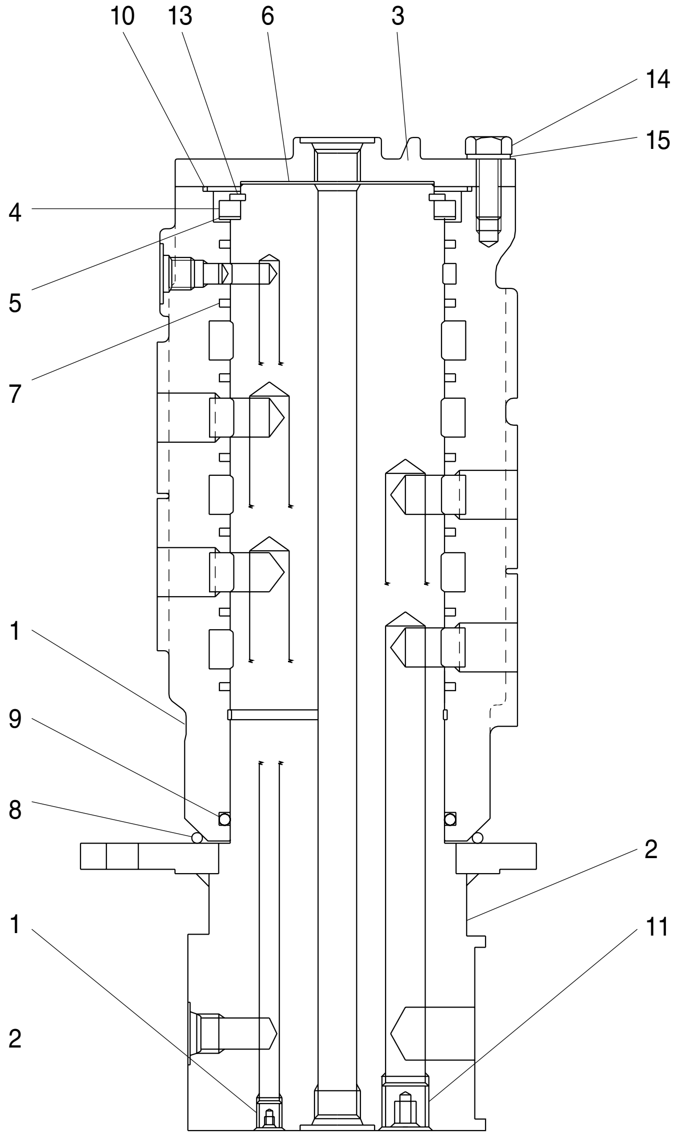
※ Take care of turning joint direction.

※ 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



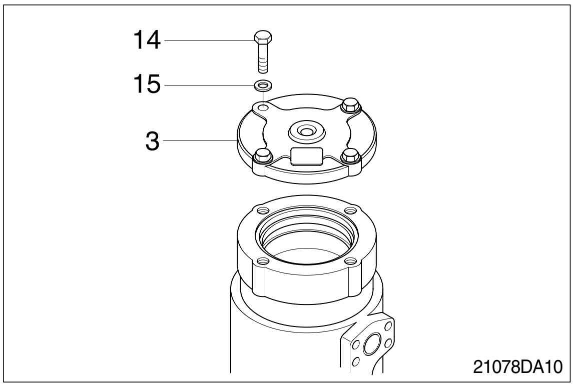
29078TJ02

1	Hub	6	Shim	11	Wear ring
2	Shaft assembly	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

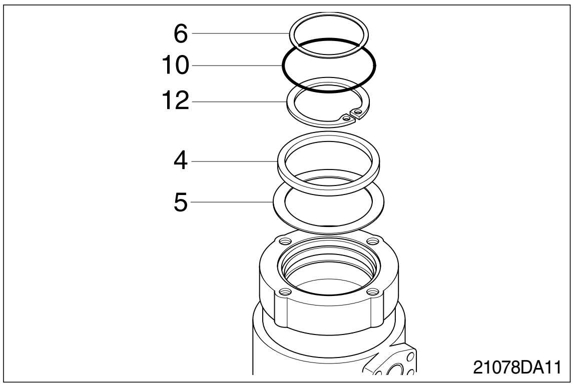
※ Before the disassembly, clean the turning joint.

(1) Remove bolts(14), washer(15) and cover(3).



(2) Remove shim(6) and O-ring(10).

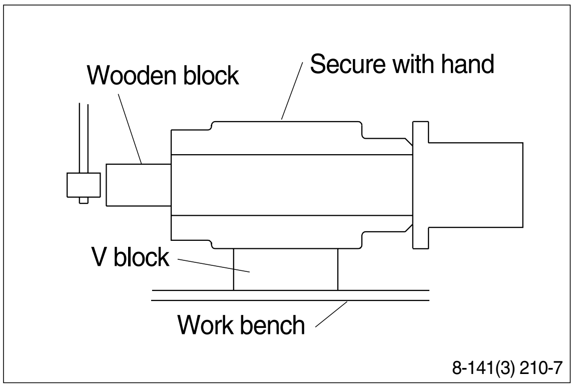
(3) Remove retainer ring(12), spacer(4) and shim(5).



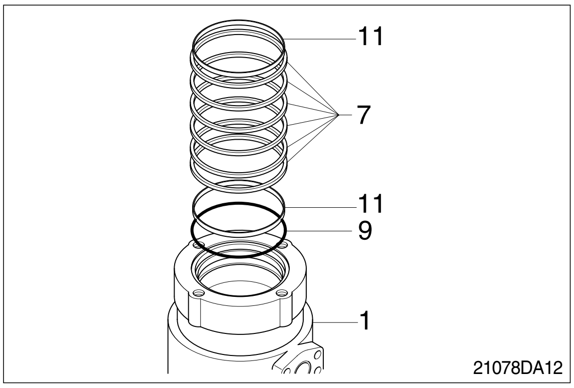
(4) Place body(1) on a V-block and by using a wood buffer at the shaft end, hit out shaft(2) to about 1/2 from the body with a hammer.

※ Take care not to damage the shaft(2) when remove body(1) or rest it sideway.

※ Put a fitting mark on body(1) and shaft(2).



(5) Remove six slipper seals(7) and O-ring(9), two ring wear(11) from body(1).



3) ASSEMBLY

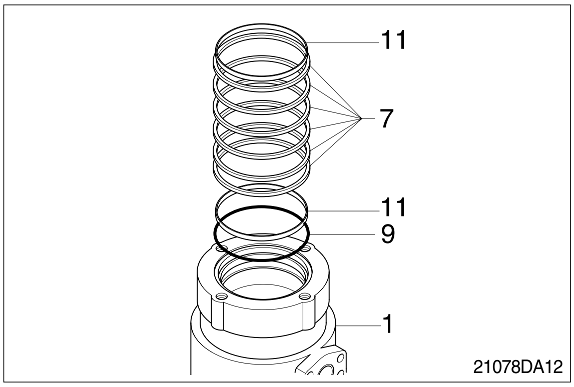
※ Clean all parts.

※ As a general rule, replace oil seals and O-ring.

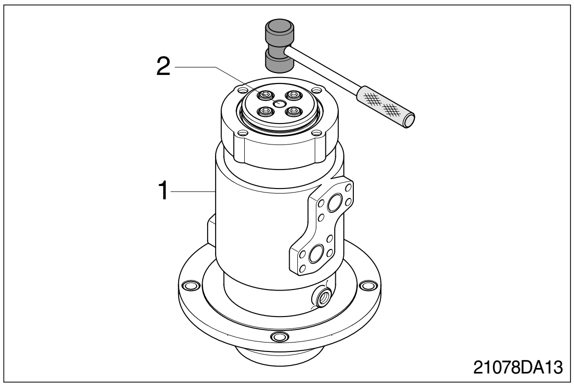
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix seven slipper seal(7) and O-ring(9), two ring wear(11) to body(1).

(2) Fit O-ring(8) to shaft(2).



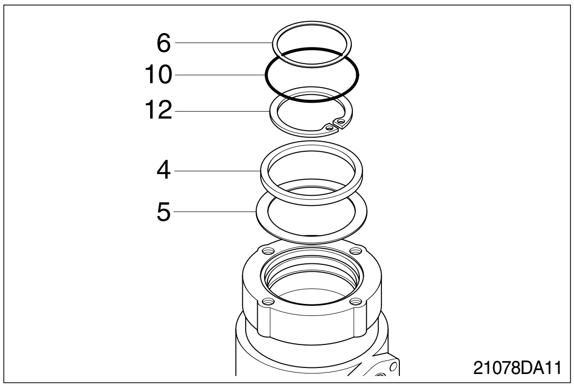
(3) Set shaft(2) on block, tap body(1) with a plastic hammer to install.



(4) Fit shim(5), spacer(4) and retainer ring (12) to shaft(2).

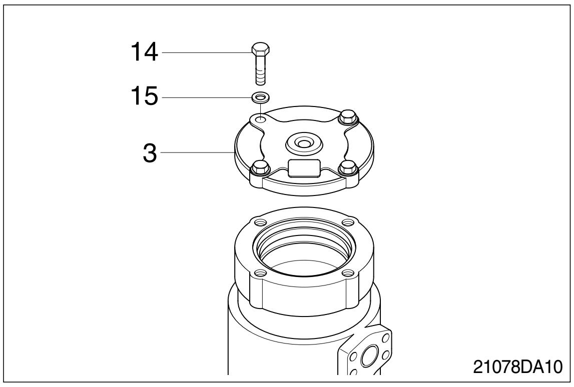
(5) Fit O-ring(10) to body(1).

(6) Fit shim(6) to shaft(2).



(7) Install cover(3) to body(1) and tighten bolts(14).

· Torque : 10~12.5kgf · m(72.3~90.4lbf · ft)



GROUP 9 BOOM, ARM AND BUCKET CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

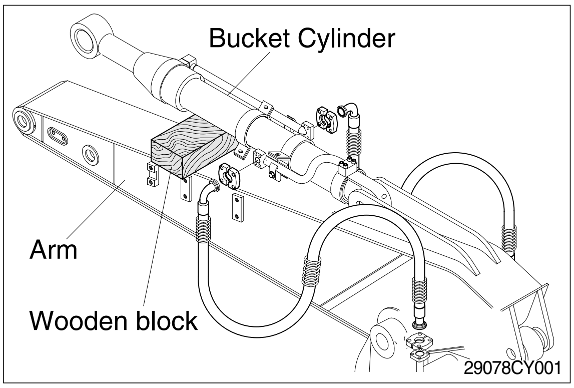
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

13031GE18

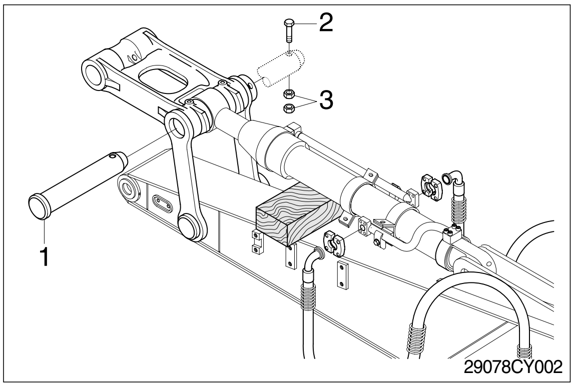
① Set block between bucket cylinder and arm.



29078CY001

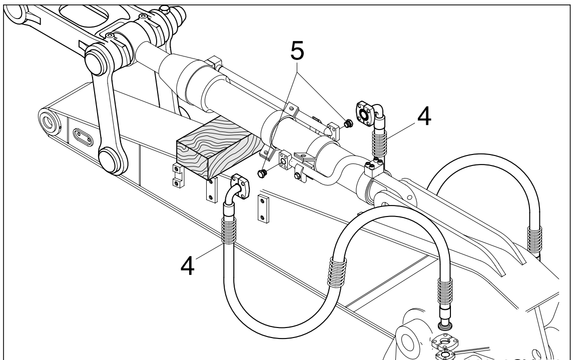
② Remove bolt(2), nut(3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



29078CY002

③ Disconnect bucket cylinder hoses(4) and put plugs(5) on cylinder pipe.

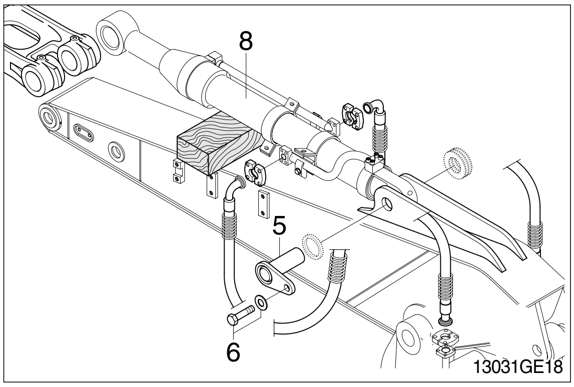


29078CY003

④ Sling bucket cylinder assembly(8) and remove bolt(6) then pull out pin (5).

⑤ Remove bucket cylinder assembly(8).

· Weight : 270kg(570lb)



(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.

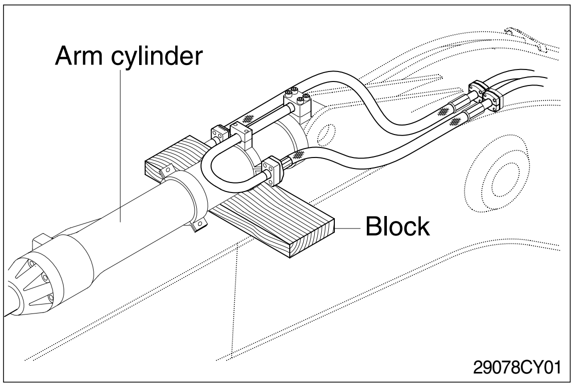
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ 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

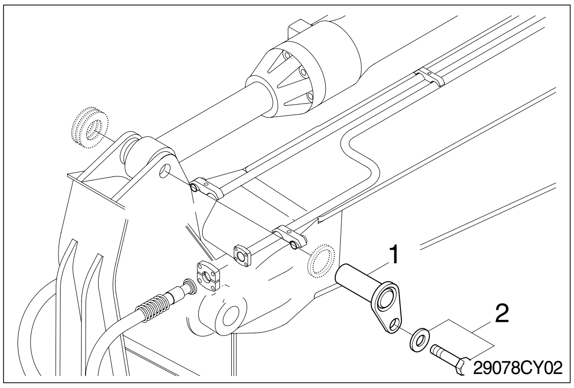
① Set block between arm cylinder and boom.



29078CY01

② Remove bolt(2) and pull out pin(1).

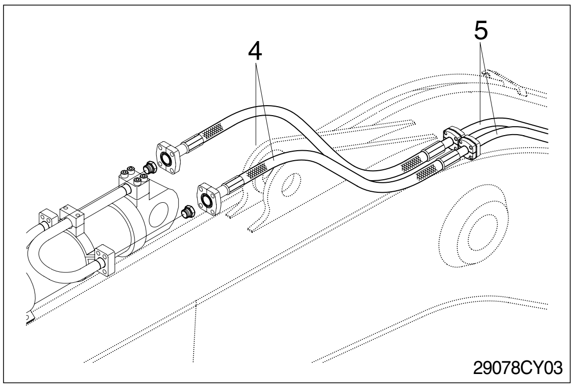
※ Tie the rod with wire to prevent it from coming out.



29078CY02

③ Disconnect arm cylinder hoses(4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings(5).

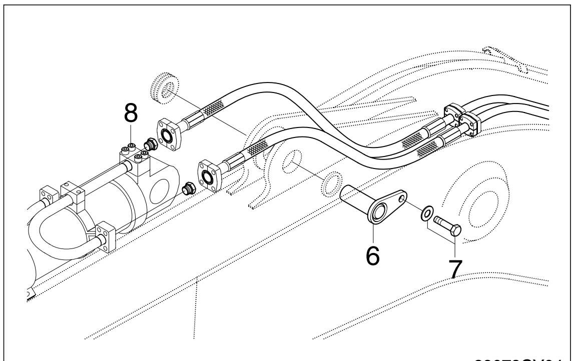


29078CY03

⑤ Sling arm assembly(8) and remove bolt (7) then pull out pin(6).

⑥ Remove arm cylinder assembly(8).

· Weight : 380㎏(840lb)



29078CY04

(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

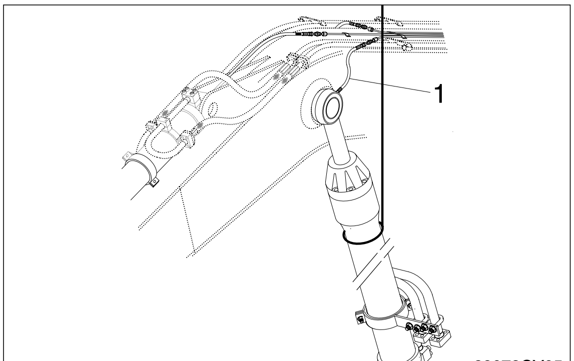
⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

13031GE18

① Disconnect greasing hoses(1).

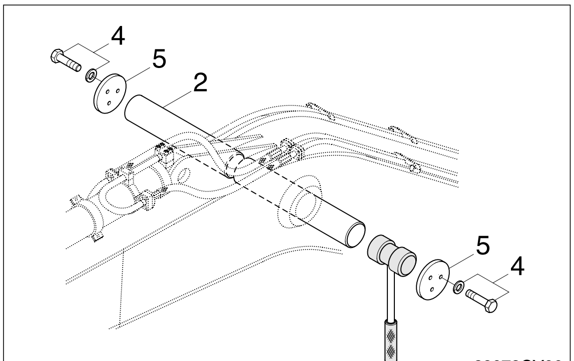
② Sling boom cylinder assembly.



29078CY05

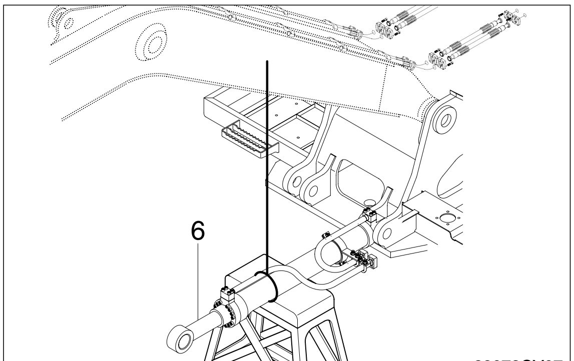
③ Remove bolt(4), stop plate(5) and pull out pin(2).

※ Tie the rod with wire to prevent it from coming out.



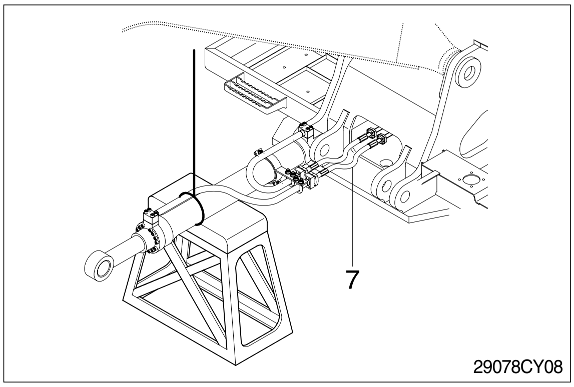
29078CY06

④ Lower the boom cylinder assembly(6) on a stand.



29078CY07

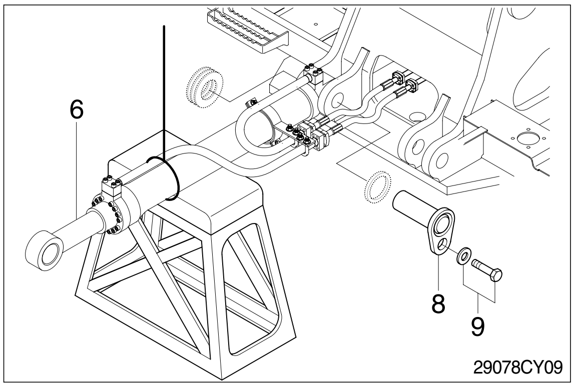
⑤ Disconnect boom cylinder hoses(7) and put plugs on cylinder pipe.



⑥ Remove bolt(9) and pull out pin(8).

⑦ Remove boom cylinder assembly(6).

· Weight : 290㎏(620lb)



(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.

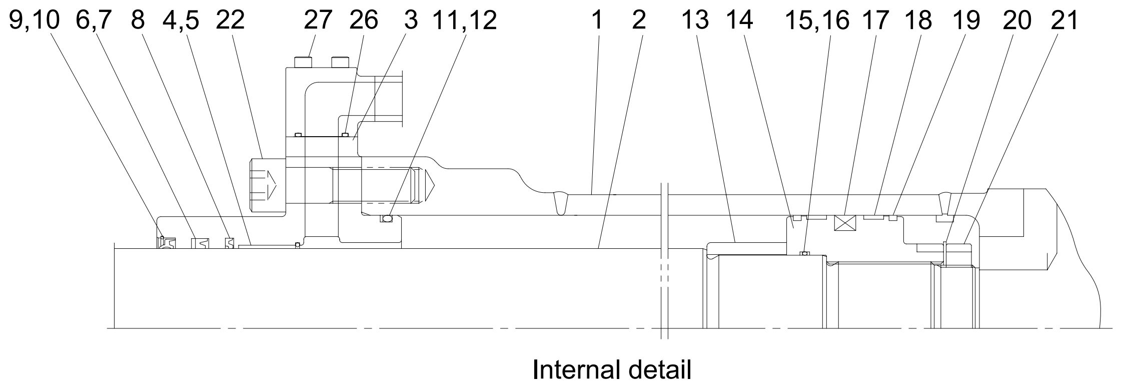
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

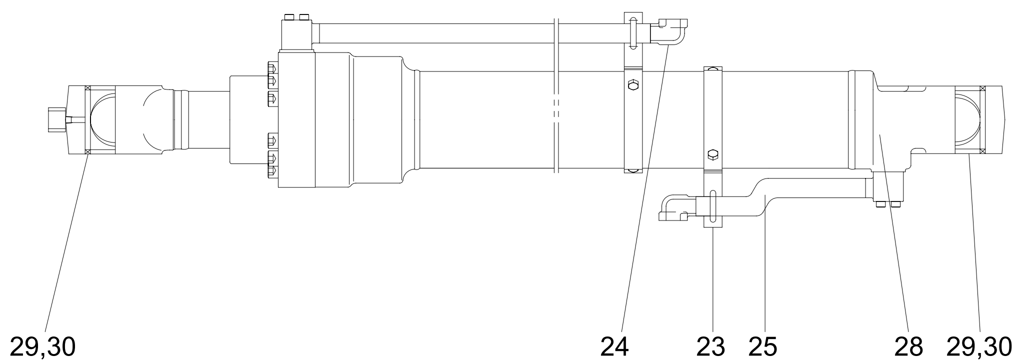
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder



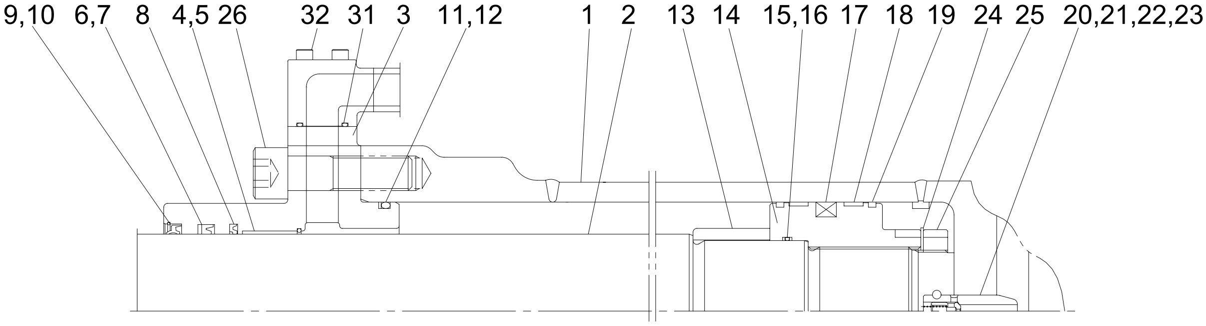
32078BY01



32078BY02

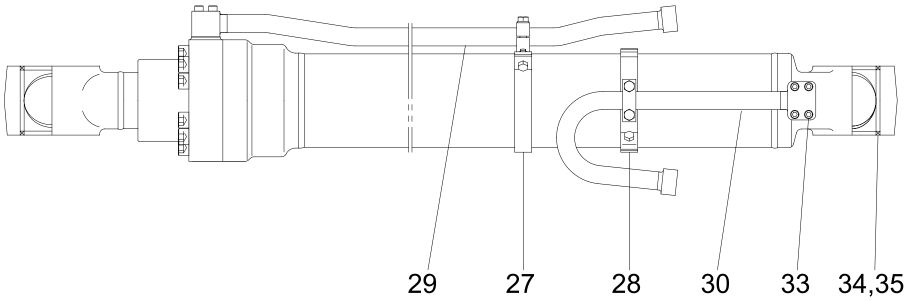
1	Tube assembly	12	Back up ring	22	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	23	Band assembly
3	Gland	14	Piston	24	Pipe assembly
4	DD2 bushing	15	O-ring	25	Pipe assembly
5	Snap ring	16	Back up ring	26	O-ring
6	Rod seal	17	Piston seal	27	Hexagon socket head bolt
7	Back up ring	18	Wear ring	28	Hexagon socket head bolt
8	Buffer ring	19	Dust ring	29	Pin bushing
9	Dust wiper	20	Lock washer	30	Dust seal
10	Snap ring	21	Lock nut		
11	O-ring				

(2) Arm cylinder



Internal detail

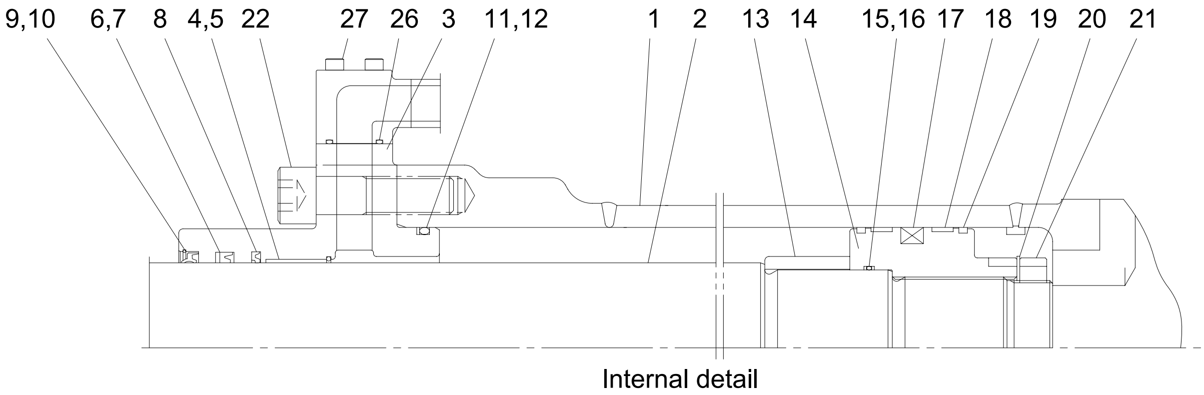
32078AC01



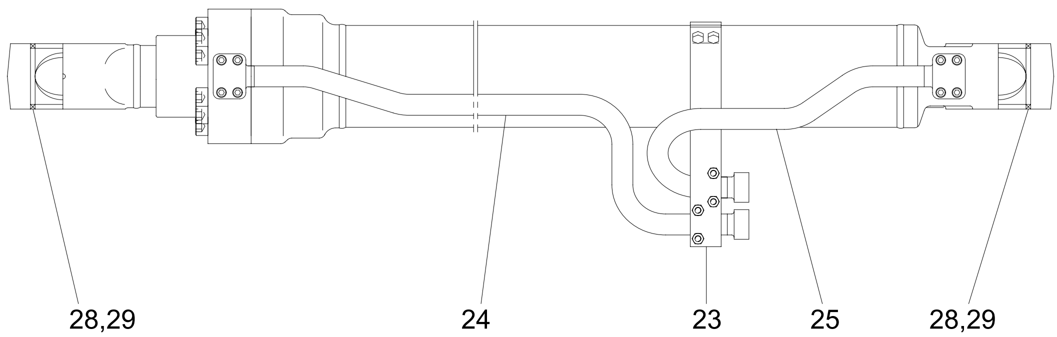
32078AC02

1	Tube assembly	13	Cushion ring	25	Lock nut
2	Rod assembly	14	Piston	26	Hexagon socket head bolt
3	Gland	15	O-ring	27	Band assembly
4	DD2 bushing	16	Back up ring	28	Band assembly
5	Snap ring	17	Piston seal	29	Pipe assembly
6	Rod seal	18	Wear ring	30	Pipe assembly
7	Back up ring	19	Dust ring	31	O-ring
8	Buffer ring	20	Cushion spear	32	Hexagon socket head bolt
9	Dust wiper	21	Check valve	33	Hexagon socket head bolt
10	Snap ring	22	Coil spring	34	Pin bushing
11	O-ring	23	Stop ring	35	Dust seal
12	Back up ring	24	Lock washer		

(3) Boom cylinder



32078BC01

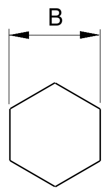


32078BC02

1	Tube assembly	11	O-ring	21	Lock nut
2	Rod assembly	12	Back up ring	22	Hexagon socket head bolt
3	Gland	13	Cushion ring	23	Band assembly
4	DD2 bushing	14	Piston	24	Pipe assembly
5	Snap ring	15	O-ring	25	Pipe assembly
6	Rod seal	16	Back up ring	26	O-ring
7	Back up ring	17	Piston seal	27	Hexagon socket head bolt
8	Buffer ring	18	Wear ring	28	Pin bushing
9	Dust wiper	19	Dust ring	29	Dust seal
10	Snap ring	20	Lock washer		

2) TOOLS AND TIGHTENING TORQUE

(1)

Allen wrench	6	
	8	
	14	
	17	
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	M18	32.0±3.0	232±21.7
	Boom cylinder	22	M18	46.0±5.0	333±36.2
	Arm cylinder	26	M20	46.0±5.0	333±36.2
Socket head bolt	Bucket cylinder	27	M12	9.4±1.0	68.0±7.2
	Boom cylinder	27	M12	9.4±1.0	68.0±7.2
	Arm cylinder	32	M12	9.4±1.0	68.0±7.2
		33	M10	5.4±0.5	39.1±3.6
Lock nut	Bucket cylinder	21	M70	100±10.0	723±72.3
	Boom cylinder	21	M70	100±10.0	723±72.3
	Arm cylinder	25	M80	100±10.0	723±72.3
Piston	Bucket cylinder	14	-	150±15.0	1085±109
	Boom cylinder	14	-	150±15.0	1085±109
	Arm cylinder	14	-	150±15.0	1085±109

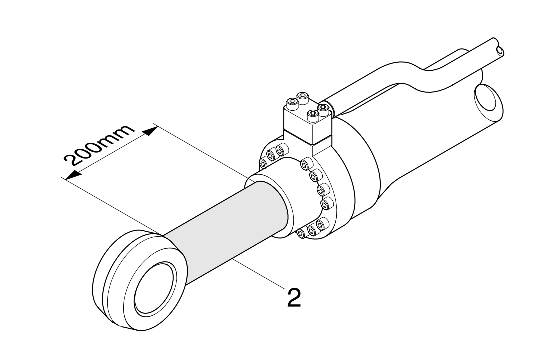
3) DISASSEMBLY

(1) Remove cylinder head and piston rod

① Hold the clevis section of the tube in a vise.

※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

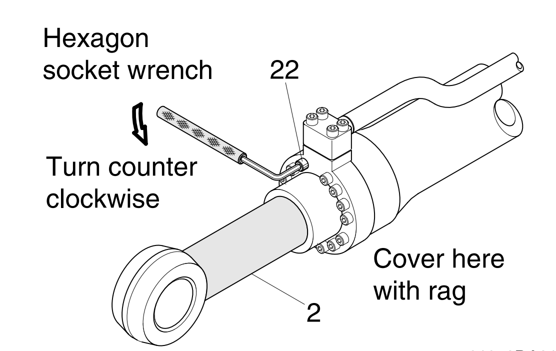
② Pull out rod assembly(2) about 200㎜ (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



21078DA30

③ Loosen and remove socket bolts(22) of the gland in sequence.

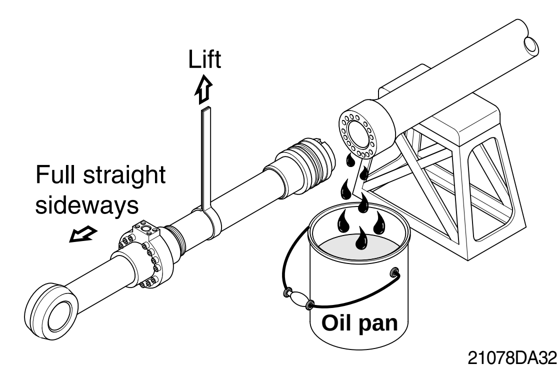
※ Cover the extracted rod assembly(2) with rag to prevent it from being accidentally damaged during operation.



21078DA31

④ Draw out cylinder head and rod assembly together from tube assembly(1).

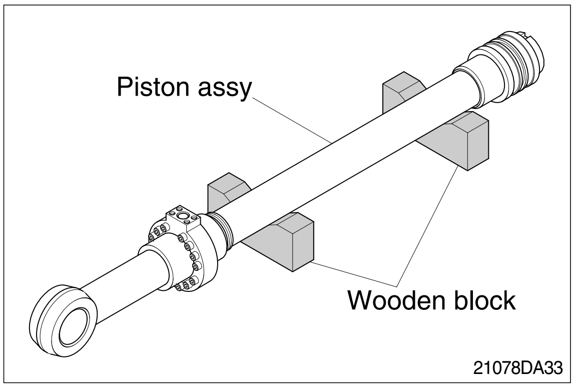
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly(2) with a crane or some means and draw it out. However, when rod assembly(2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



21078DA32

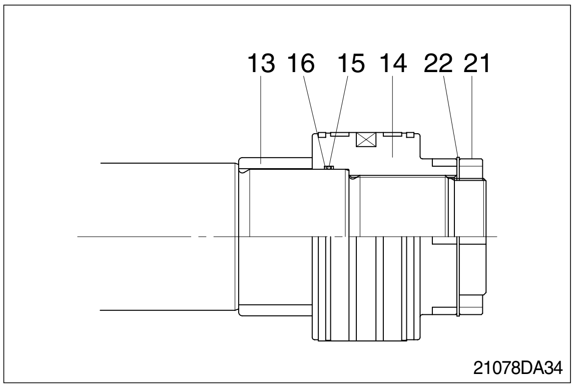
Note that the plated surface of rod assembly(2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.
※ Cover a V-block with soft rag.

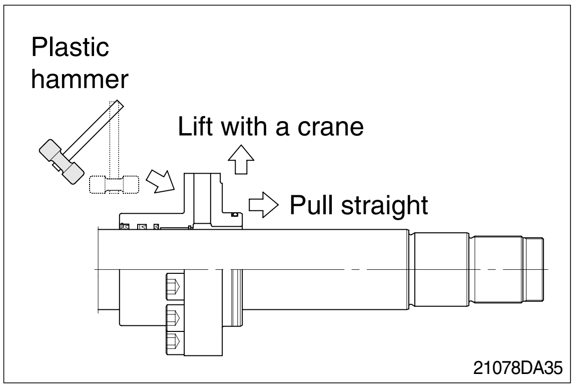


(2) Remove piston and cylinder head

① Remove lock nut(21).
※ Since lock nut(20) and lock washer(20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the lock nut(21) and lock washer (20).
② Remove piston assembly(14), back up ring(16), and O-ring(15).



③ Remove the cylinder head assembly from rod assembly(2).
※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.
※ Pull it straight with cylinder head assembly lifted with a crane.
Exercise care so as not to damage the lip of rod bushing(4) and packing (5,6,7,8,9,10) by the threads of rod assembly(2).

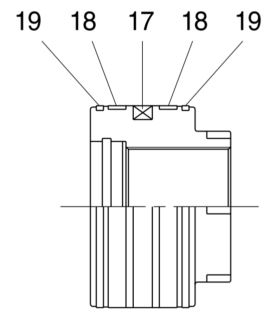


(3) Disassemble the piston assembly

① Remove wear ring(18).

② Remove dust ring(19) and piston seal (17).

※ Exercise care in this operation not to damage the grooves.



8-156(1) 210-7

(4) Disassemble cylinder head assembly

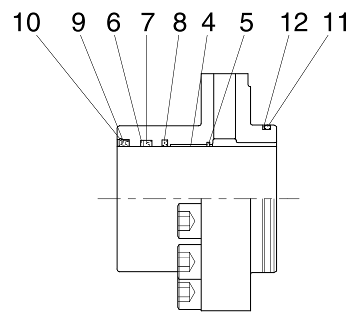
① Remove back up ring(12) and O-ring (11).

② Remove snap ring(10), dust wiper(9).

③ Remove back up ring(7), rod seal(6) and buffer ring(8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.



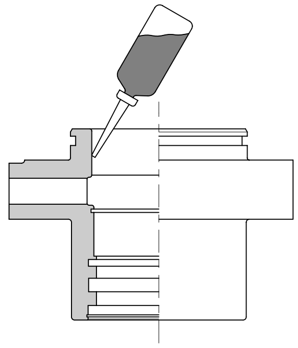
21078DA36

3) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

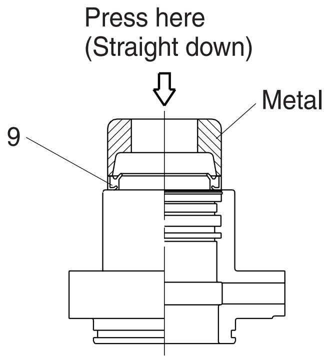
① Coat the inner face of gland(3) with hydraulic oil.



21078DA37

② Coat dust wiper(9) with grease and fit dust wiper(9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

③ Fit snap ring(9) to the stop face.

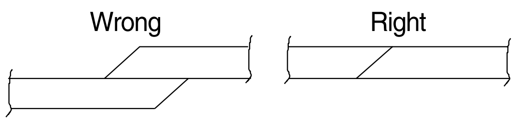


8-157(2) 210-7

④ Fit back up ring(7), rod seal(6) and buffer ring(8) to corresponding grooves, in that order.

※ Coat each packing with hydraulic oil before fitting it.

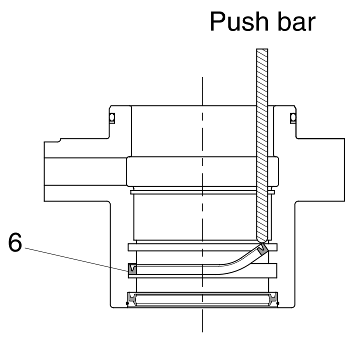
※ Insert the backup ring until one side of it is inserted into groove.



8-157(3) 210-7

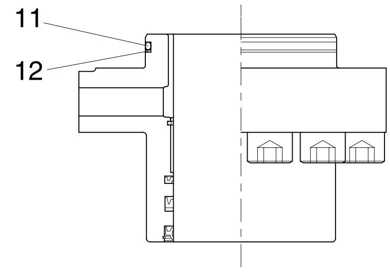
※ Rod seal(6) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting rod seal(6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



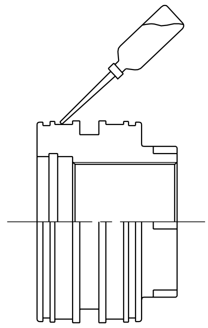
21078DA38

⑤ Fit back up ring(12) to gland(3).
※ Put the backup ring in the warm water of 30~50°C.
⑥ Fit O-ring(11) to gland(3).

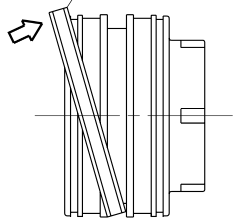


21078DA39

(2) Assemble piston assembly
※ Check for scratches or rough surfaces. If found smooth with an oil stone.
① Coat the outer face of piston(14) with hydraulic oil.

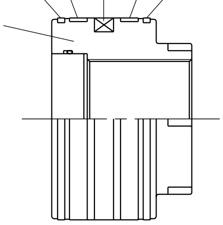

8-158(2) 210-7

② Fit piston seal(17) 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.



8-158(3) 210-7

③ Fit wear ring(18) and dust ring(19) to piston(14).



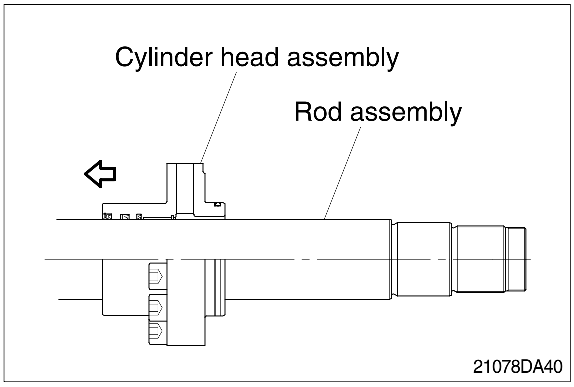
8-158(4) 210-7

(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

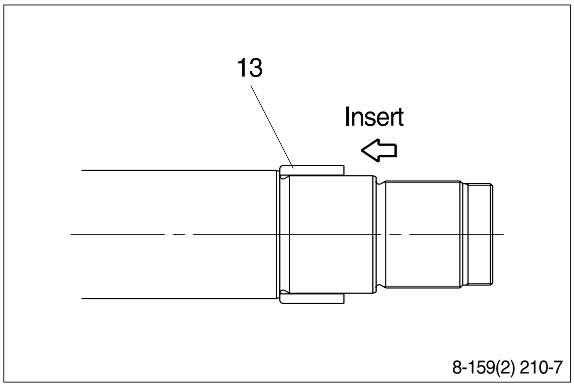
② Apply hydraulic oil to the outer surface of rod assembly(2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



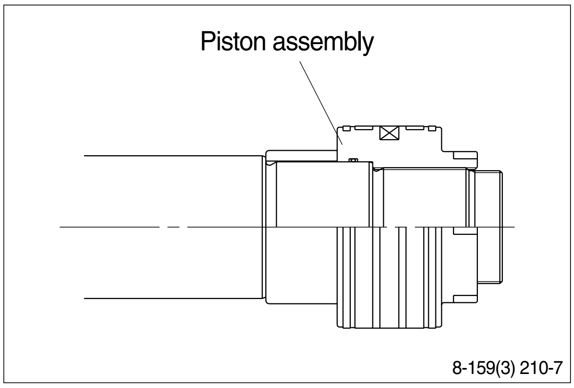
④ Insert cushion ring(13) to rod assembly.

※ Note that cushion ring(13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

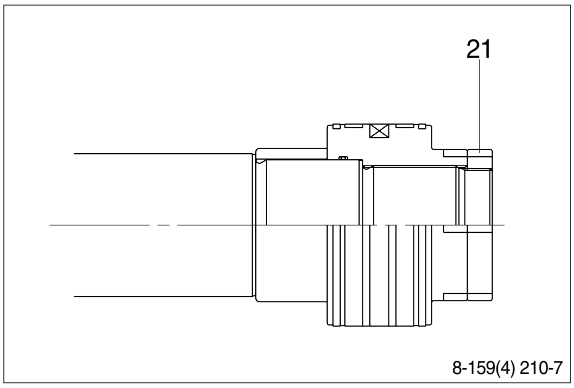
· Tightening torque : 150±15.0kgf · m
(1085±109lbf · ft)



⑥ Fit lock nut to piston.

· Tightening torque :

Item		kgf · m	lbf · ft
Bucket	21	100±10	723.3±72.3
Boom	21	100±10	723.3±72.3
Arm	25	100±10	723.3±72.3



(3) Overall assemble

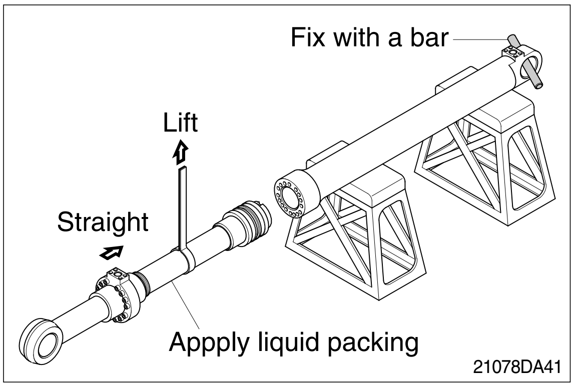
① Place a V-block on a rigid work bench. Mount the tube assembly(1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

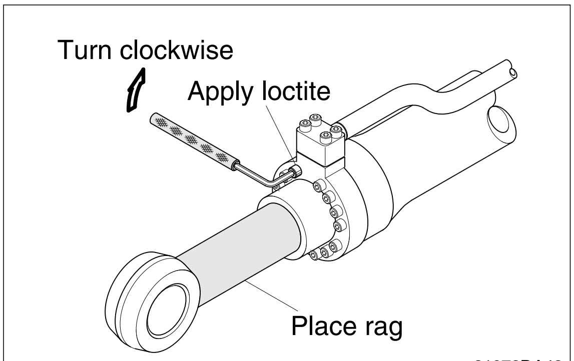
※ Be careful not to damage piston seal by thread of tube assembly.

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.



21078DA41



21078DA42

GROUP 10 UNDERCARRIAGE

1. TRACK LINK

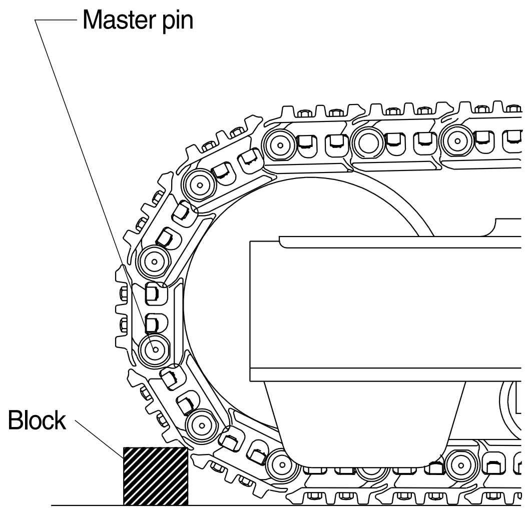
1) REMOVAL

(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

(3) Push out master pin by using a suitable tool.

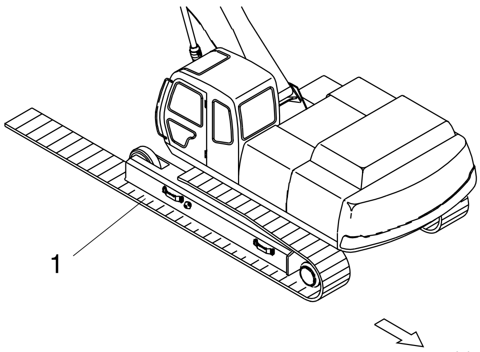


8-161(1) 210-7

(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.

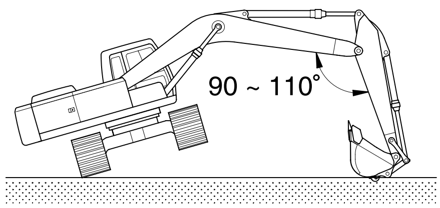


8-161(2) 210-7

2) INSTALL

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

※ Adjust the tension of the track link.

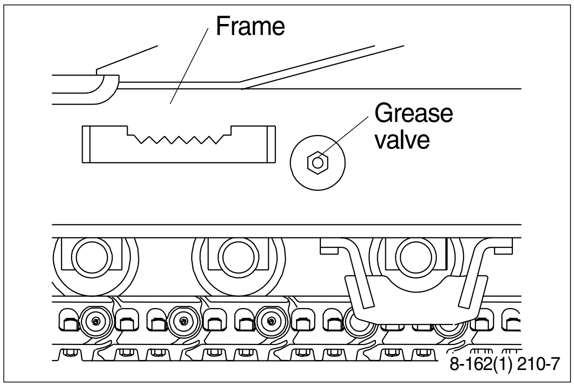


8-161(3) 210-7

2. CARRIER ROLLER

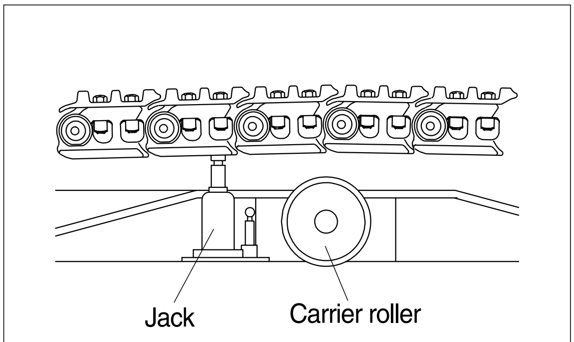
1) REMOVAL

(1) Loosen tension of the track link.



8-162(1) 210-7

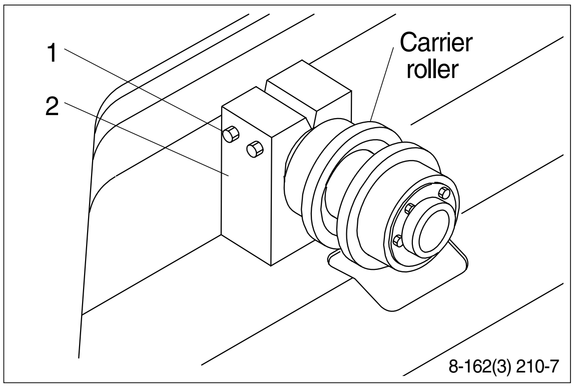
(2) Jack up the track link height enough to permit carrier roller removal.



8-162(2) 210-7

(3) Loosen the lock nut (1).

(4) Open bracket(2) with a screwdriver, push out from inside, and remove carrier roller assembly.
  · Weight : 48kg(88lb)



8-162(3) 210-7

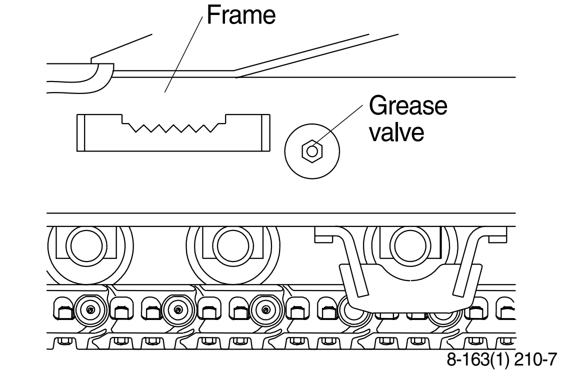
2) INSTALL

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

3. TRACK ROLLER

1) REMOVAL

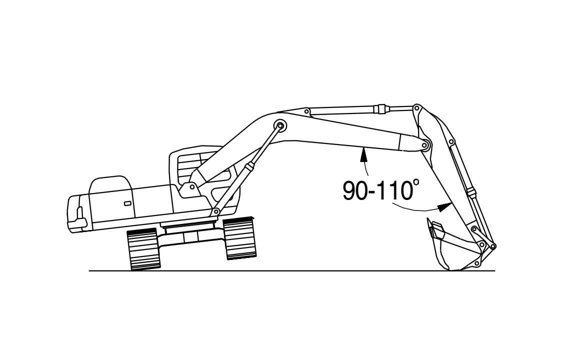
(1) Loosen tension of the track link.



8-163(1) 210-7

(2) Using the work equipment, push up track frame on side which is to be removed.

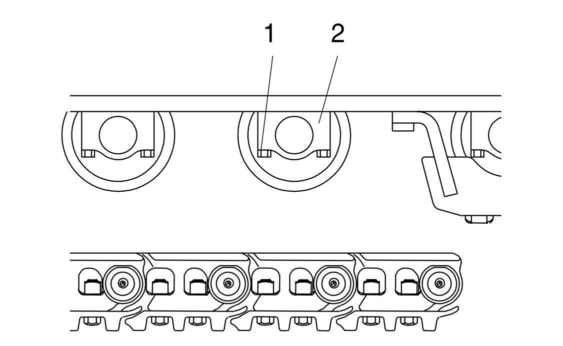
※ After jack up the machine, set a block under the unit.



8-163(2) 210-7

(3) Remove the mounting bolt(1) and draw out the track roller(2).

· Weight : 54kg(119lb)



8-163(3) 210-7

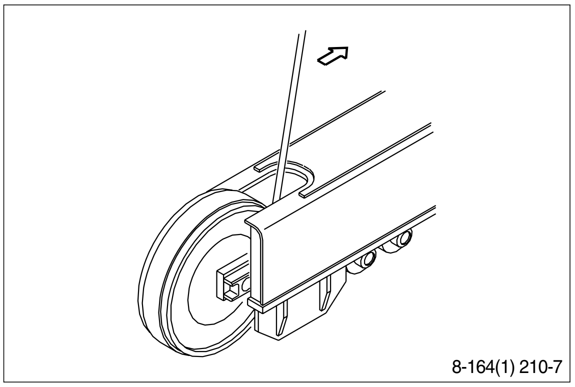
2) INSTALL

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

4. IDLER AND RECOIL SPRING

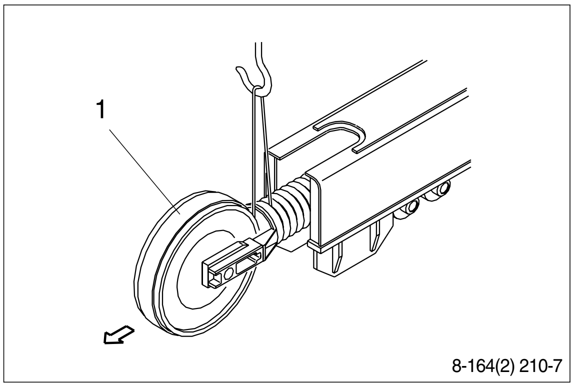
1) REMOVAL

(1) Remove the track link.
For detail, see **removal of track link**.



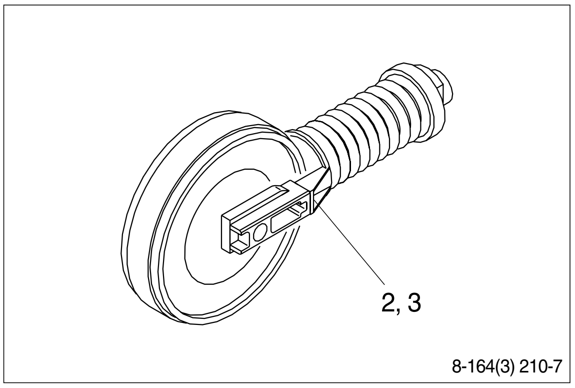
8-164(1) 210-7

(2) Sling the recoil spring(1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 457㎏(1010lb)



8-164(2) 210-7

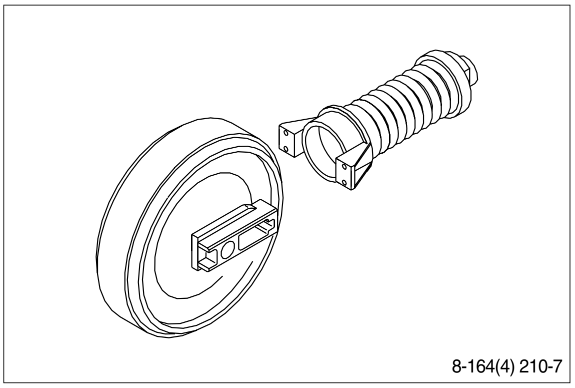
(3) Remove the bolts(2), washers(3) and separate ilder from recoil spring.



8-164(3) 210-7

2) INSTALL

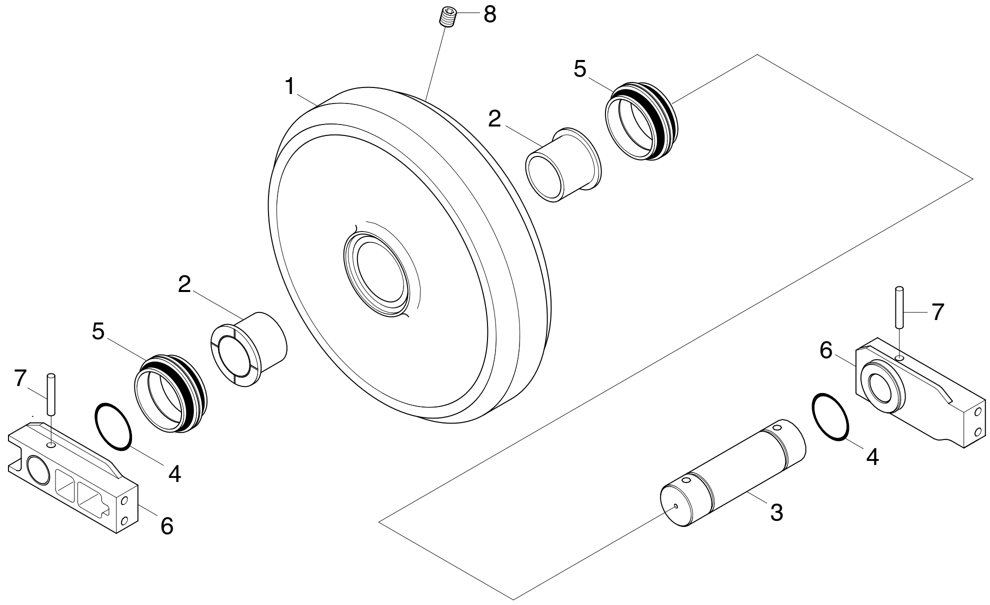
(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



8-164(4) 210-7

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



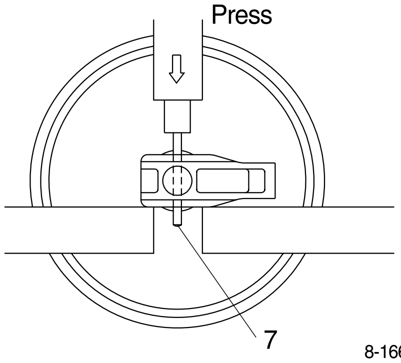
29078ID01

1	Shell	4	O-ring	7	Spring pin
2	Bushing	5	Seal assembly	8	Plug
3	Shaft	6	Bracket		

(2) Disassembly

① Remove plug and drain oil.

② Draw out the spring pin(7), using a press.

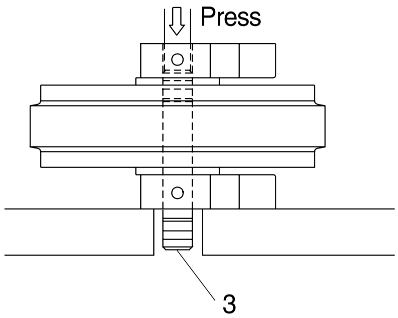


8-166(1) 210-7

③ Pull out the shaft(2) with a press.

④ Remove seal(5) from shell(1) and bracket(6).

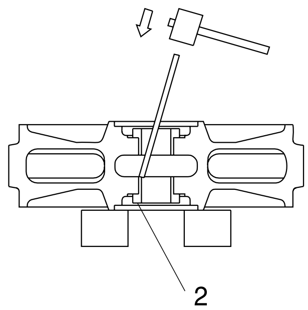
⑤ Remove O-ring(4) from shaft.



8-166(2) 210-7

⑥ Remove the bushing(2) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.



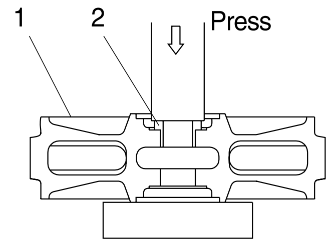
8-166(3) 210-7

(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

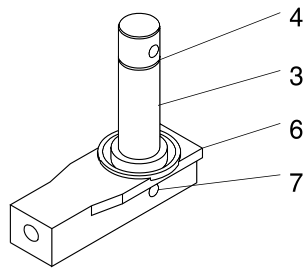
① Cool up bushing(2) fully by some dry ice and press it into shell(1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1) 210-7

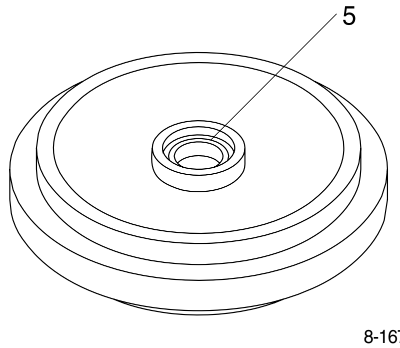
② Coat O-ring(4) with grease thinly, and install it to shaft(3).

③ Insert shaft(3) into bracket(6) and drive in the spring pin(7).



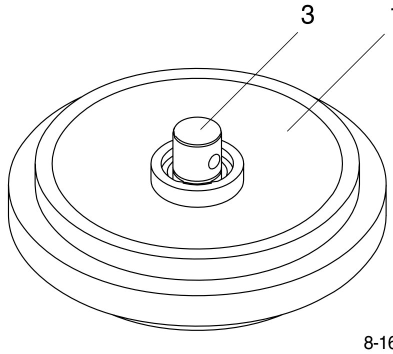
8-167(2) 210-7

④ Install seal(5) to shell(1) and bracket(6).



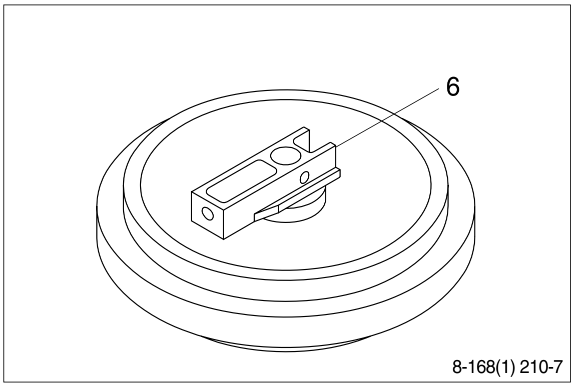
8-167(3) 210-7

⑤ Install shaft(3) to shell(1).

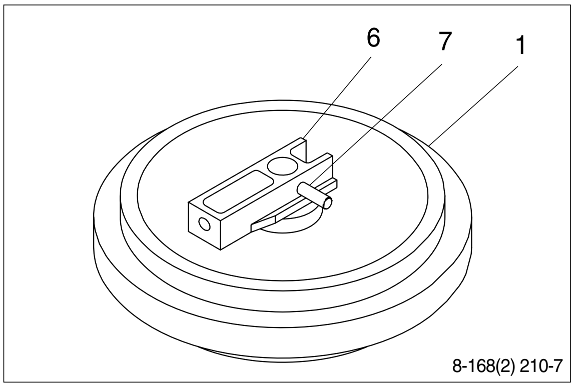


8-167(4) 210-7

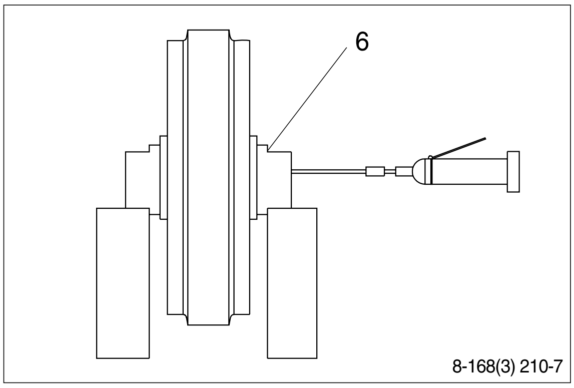
⑥ Install bracket(6) attached with seal(5).



⑦ Knock in the spring pin(7) with a hammer.

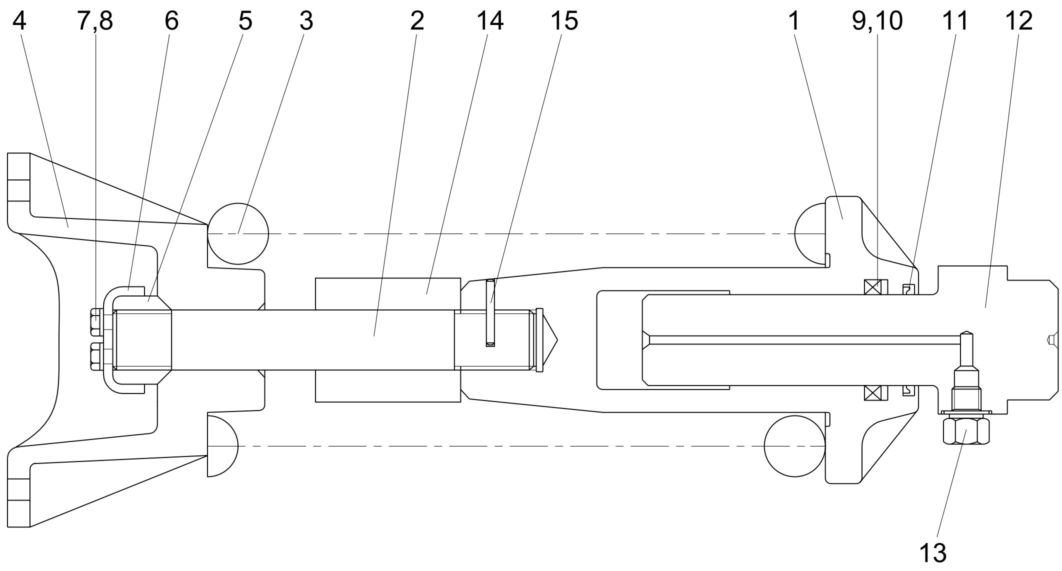


⑧ Lay bracket(6) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



36078UC02

1	Body	6	Lock plate	11	Dust seal
2	Tie bar	7	Bolt	12	Rod assembly
3	Spring	8	Spring washer	13	Grease valve
4	Bracket	9	Rod seal	14	Stopper tube
5	Lock nut	10	Back up ring	15	Spring pin

(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.

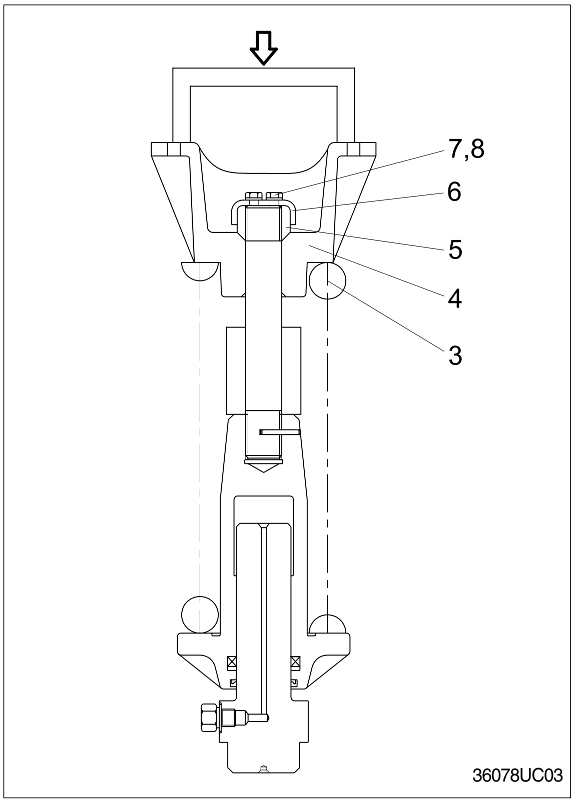
· Spring set load : 19012㎏(41826㏐)

② Remove bolt(7), spring washer(8) and lock plate(6).

③ Remove lock nut(5).

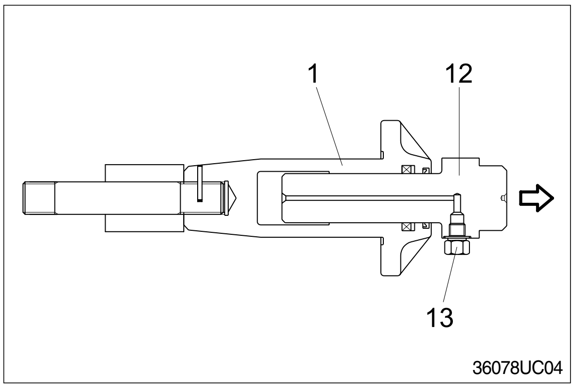
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove bracket(4) and spring(3).

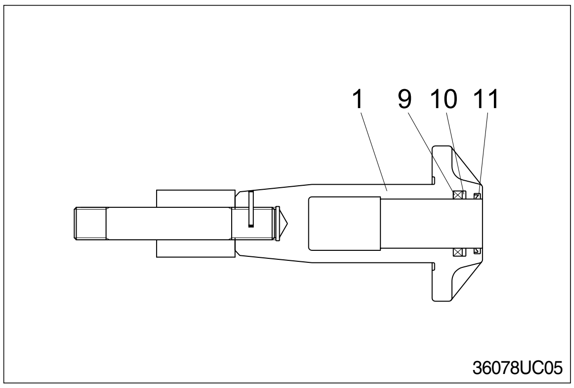


⑤ Remove rod(12) from body(1).

⑥ Remove grease valve(13) from rod(12).



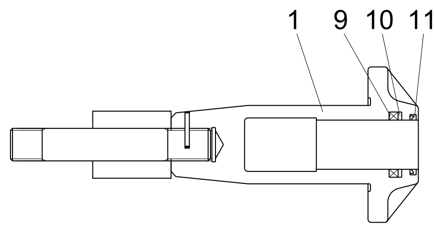
⑦ Remove rod seal(9), back up ring(10) and dust seal(11).



(3) Assembly

① Install dust seal(11), back up ring(10) and rod seal(9) to body(1).

※ When installing dust seal(11) and rod seal(9), take full care so as not to damage the lip.

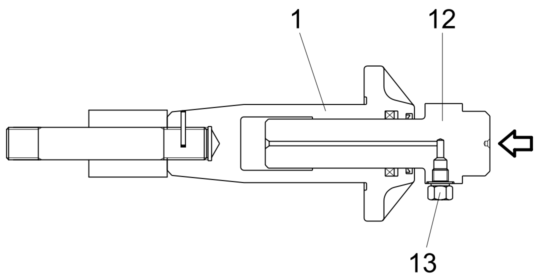


36078UC05

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±1.0kgf · m (94±7.2lbf · ft)



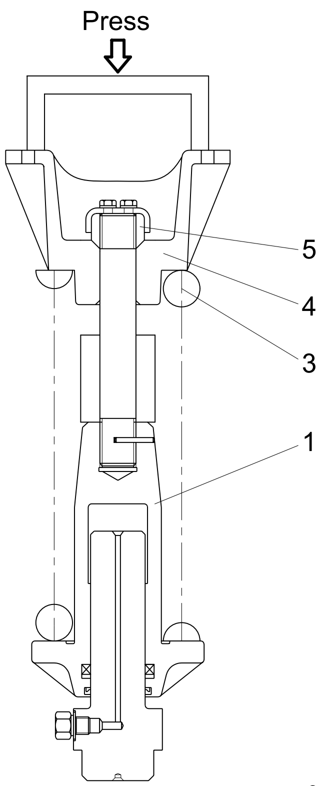
36078UC06

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.

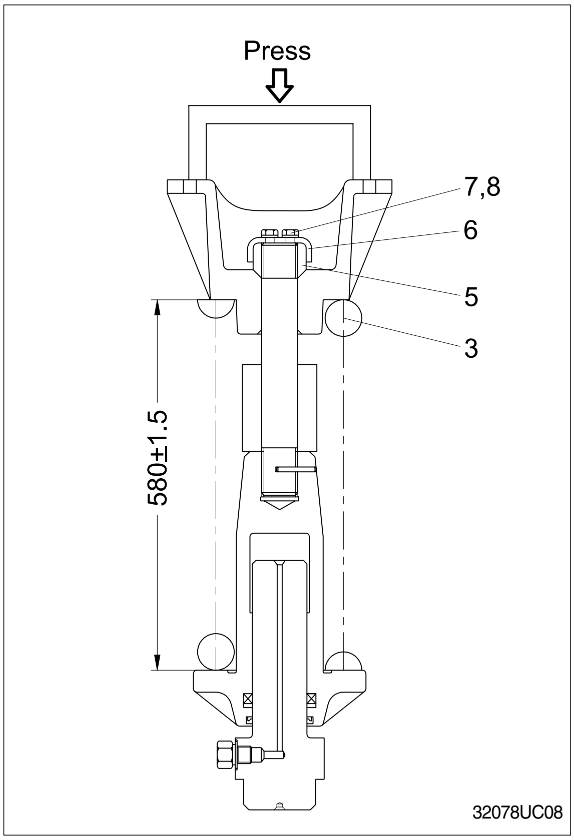
※ During the operation, pay attention specially to prevent the press from slipping out.



36078UC07

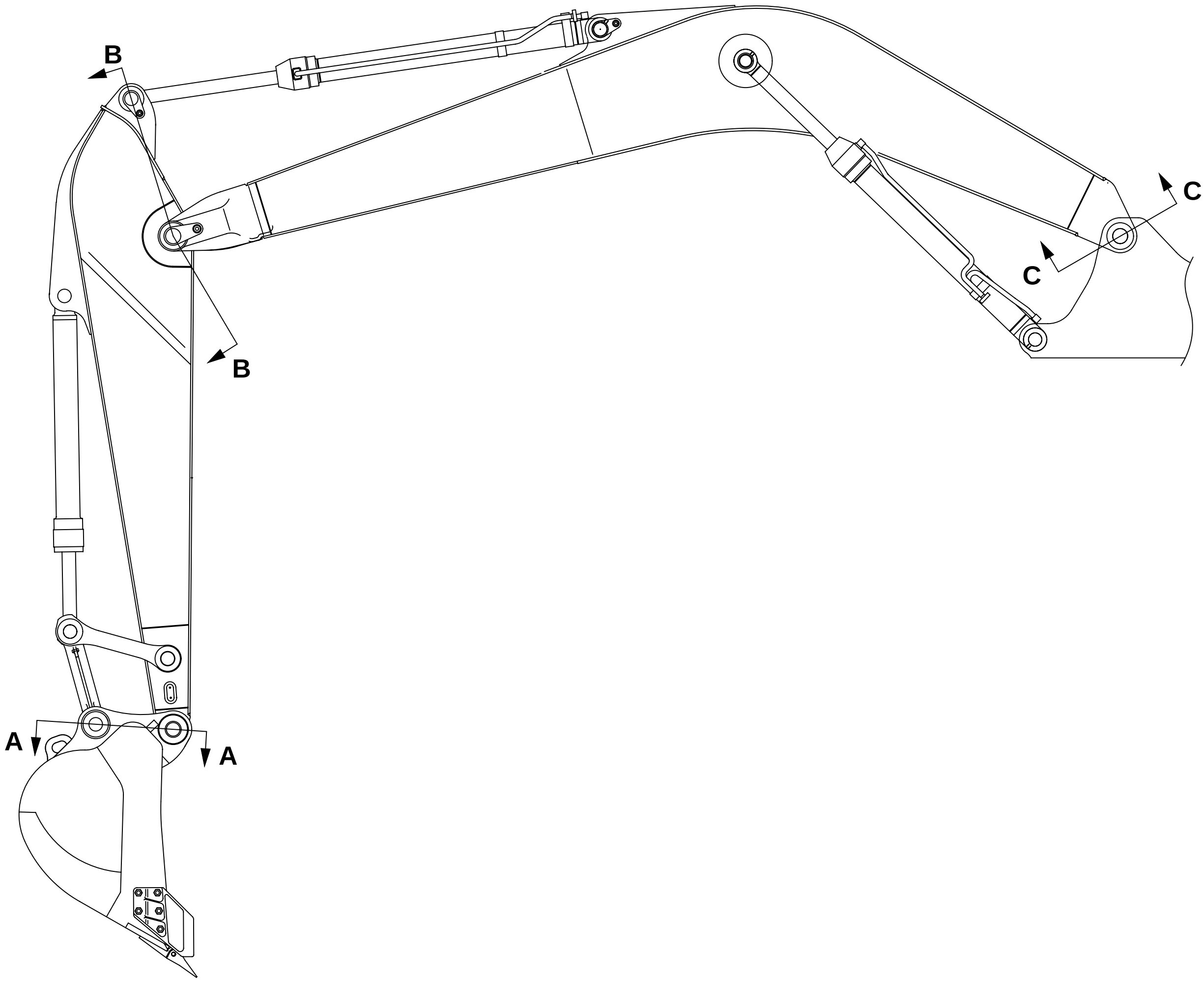
⑥ Lighten the press load and confirm the set length of spring(3).

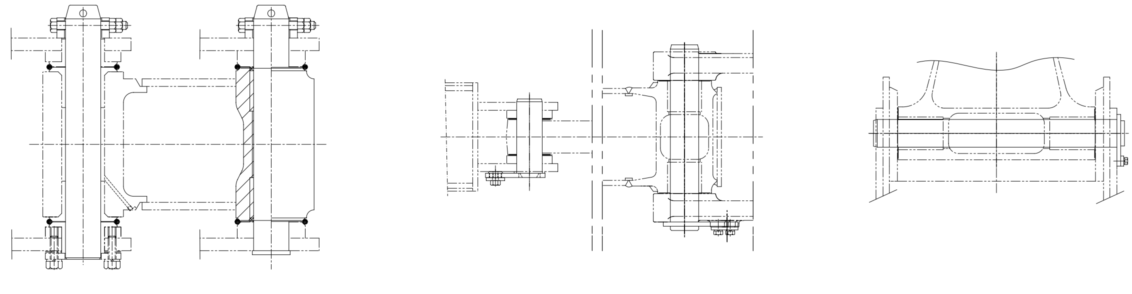
⑦ After the setting of spring(3), install lock plate(6), spring washer(8) and bolt(7).



GROUP 11 WORK EQUIPMENT

1. STRUCTURE





SECTION A

SECTION B

SECTION C

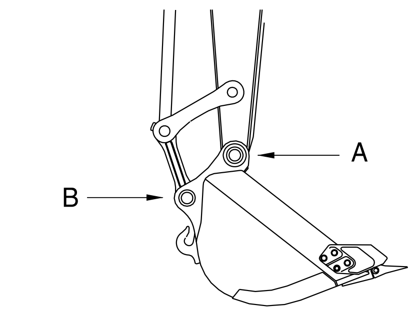
29078WE01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

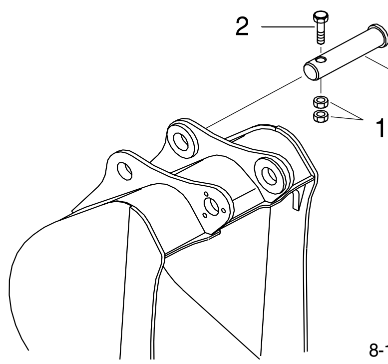
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



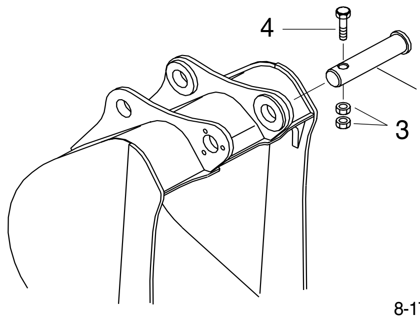
8-174(1) 210-7

② Remove nut(1), bolt(2) and draw out the pin(A).



8-174(2) 210-7

③ Remove nut(3), bolt(4) and draw out the pin(B).



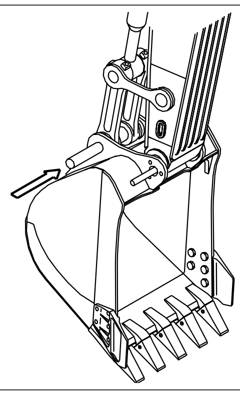
8-174(3) 210-7

(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.**



8-174(4) 210-7

2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

① Remove bucket assembly.
For details, see **removal of bucket assembly.**

② Disconnect bucket cylinder hose(1).

⚠ Fit blind plugs in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

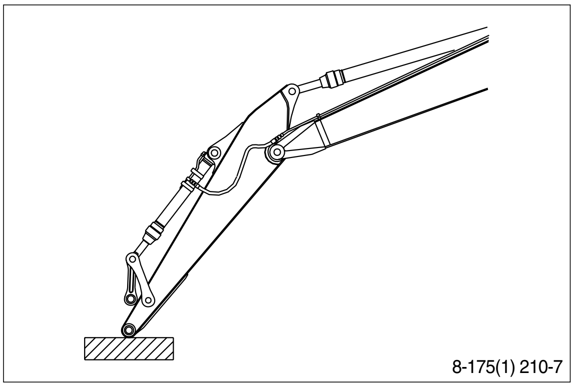
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

※ Tie the rod with wire to prevent it from coming out.

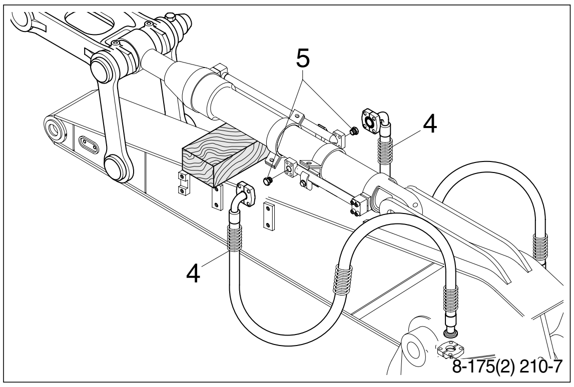
④ For details, see **removal of arm cylinder assembly.**
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt(2), plate(3) and pull out the pin(4) then remove the arm assembly.
· Weight : 1140kg(2510lb)

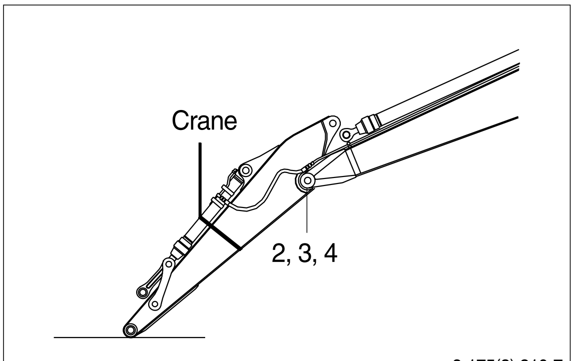
※ When lifting the arm assembly, always lift the center of gravity.



8-175(1) 210-7



8-175(2) 210-7



8-175(3) 210-7

(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

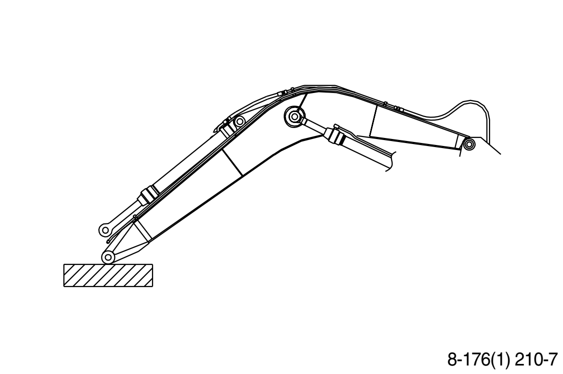
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

① Remove arm and bucket assembly.
For details, see **removal of arm and bucket assembly.**

② Remove boom cylinder assembly from boom.
For details, see **removal of arm cylinder assembly.**



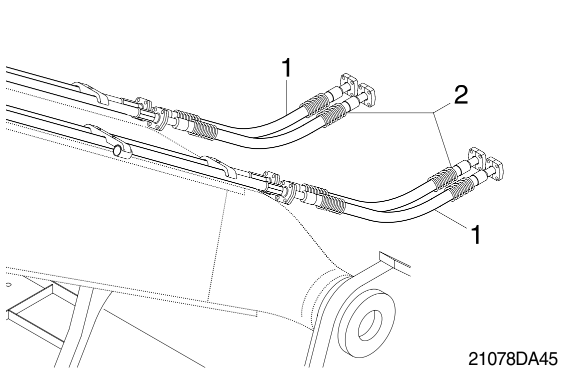
8-176(1) 210-7

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.

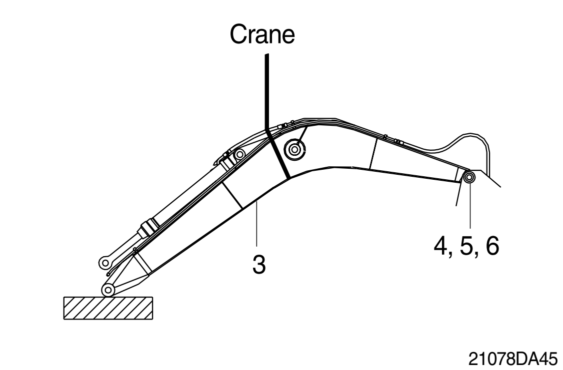
⑤ Sling boom assembly(3).



21078DA45

⑥ Remove bolt(4), plate(5) and pull out the pin(6) then remove boom assembly.
· Weight : 2590㎏(5710㏖)

※ When lifting the boom assembly always lift the center of gravity.



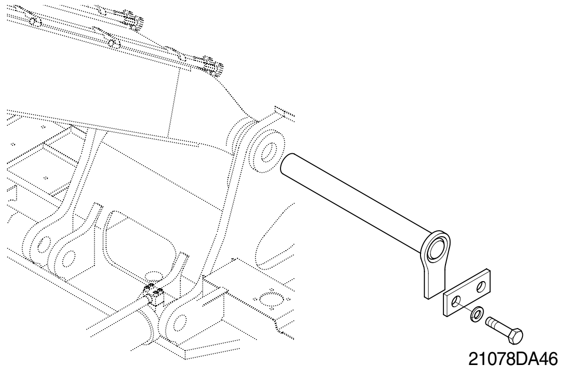
21078DA45

(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.



21078DA46

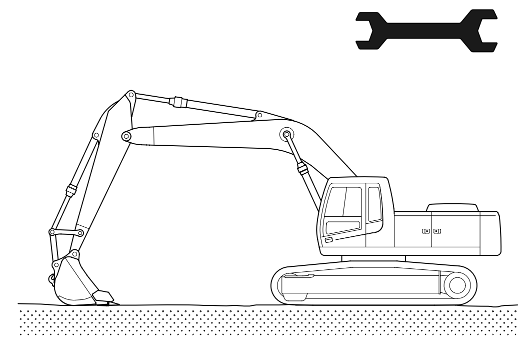
SECTION 9 COMPONENT MOUNTING TORQUE

GROUP 1 INTRODUCTION GUIDE

1. This section shows bolt specifications and standard torque values needed when mounting components to the machine.
2. Use genuine Hyundai spare parts.
   We expressly point out that Hyundai will not accept any responsibility for defects resulted from non-genuine parts.
   In such cases Hyundai cannot assume liability for any damage.

※ **Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.**

※ **Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.**



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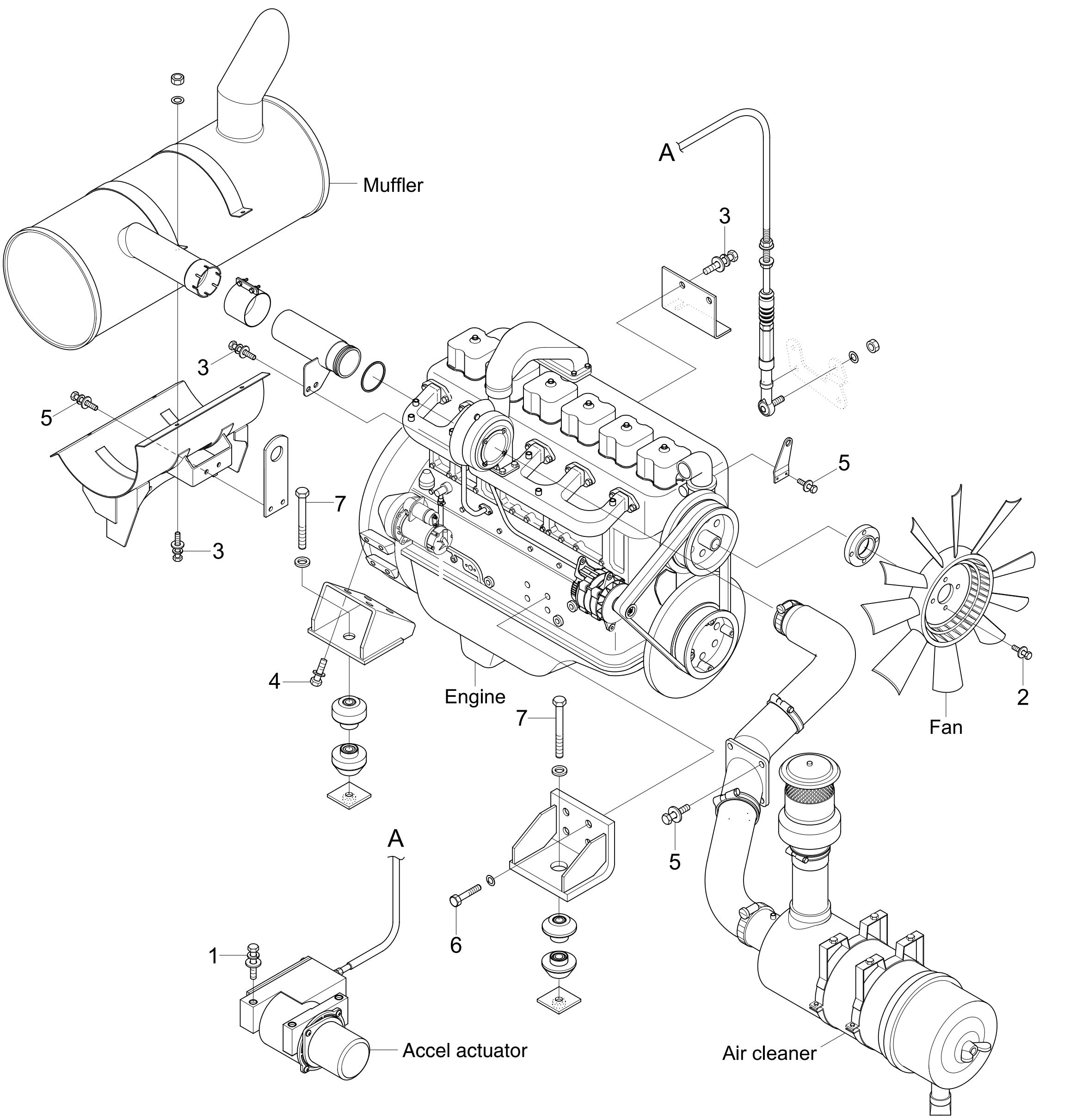
GROUP 2 ENGINE SYSTEM

ENGINE AND ACCESSORIES MOUNTING

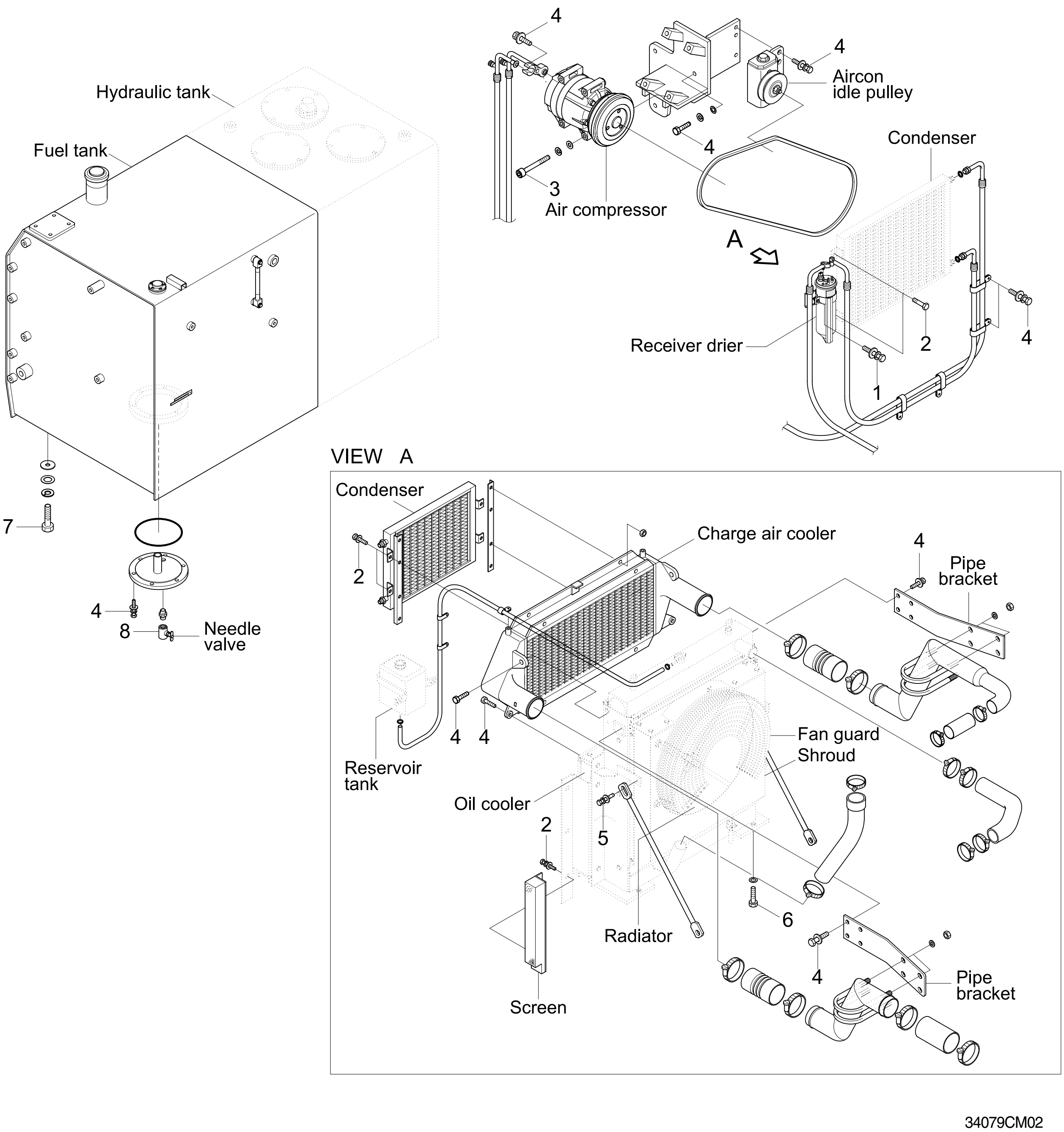


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	4.4±0.9	31.8±6.5
3	M10×1.5	6.9±1.4	49.9±10.1
4	M12×1.75	7.5±1.0	54.2±7.2

Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.8±3.0	92.6±21.7
6	M14×2.0	14.5±2.5	105±18
7	M22×2.5	48±2.0	347±14.5
-	-	-	-

COOLING SYSTEM AND FUEL TANK MOUNTING



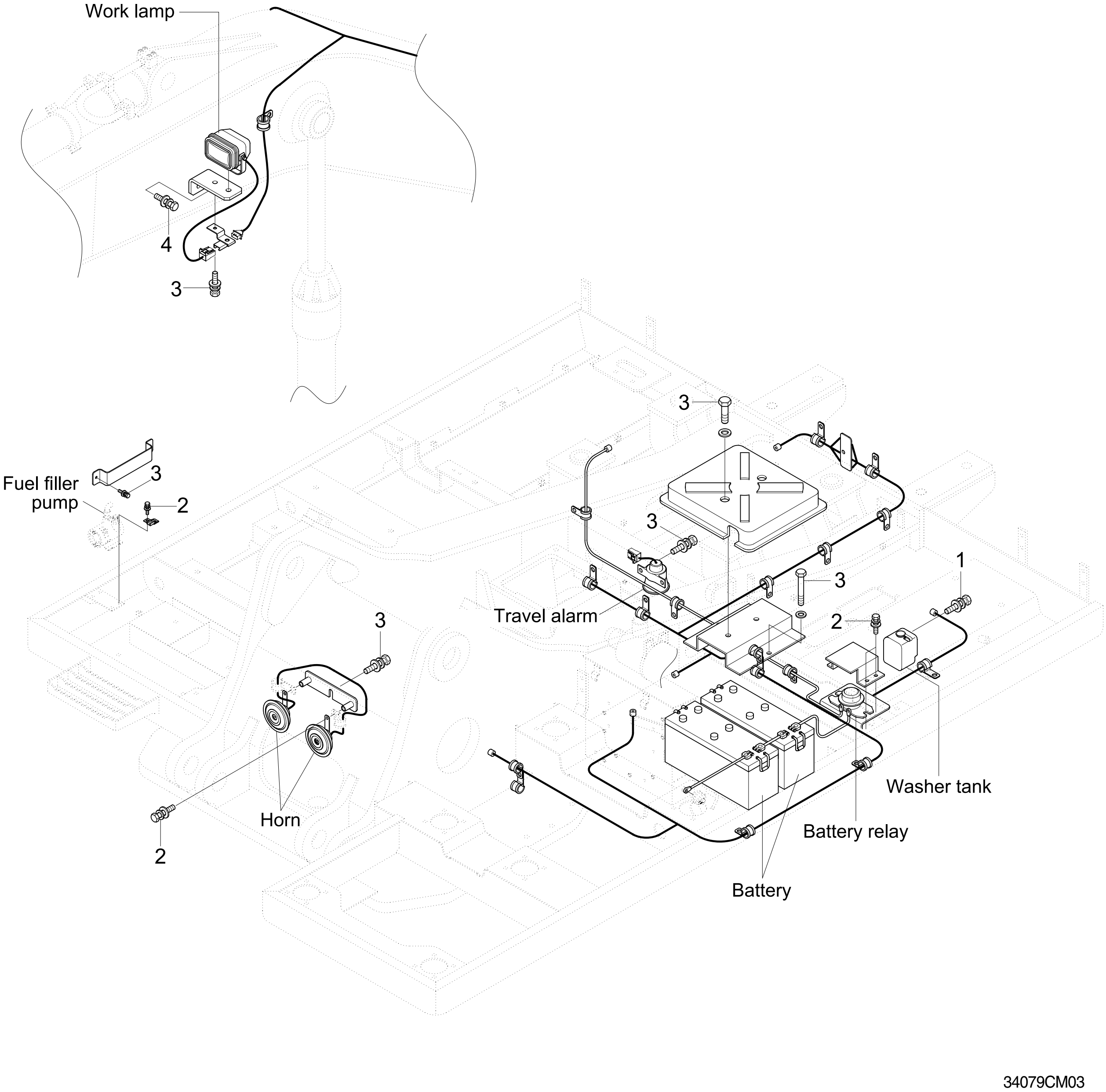
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M 8×1.25	4.05±0.8	29.3±5.8
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.8±3.0	92.6±21.7
6	M16×2.0	29.7±4.5	215±32.5
7	M20×2.5	45±5.1	325±36.9
8	-	2.3±0.6	16.6±4.3

GROUP 3 ELECTRIC SYSTEM

ELECTRIC COMPONENTS MOUNTING 1

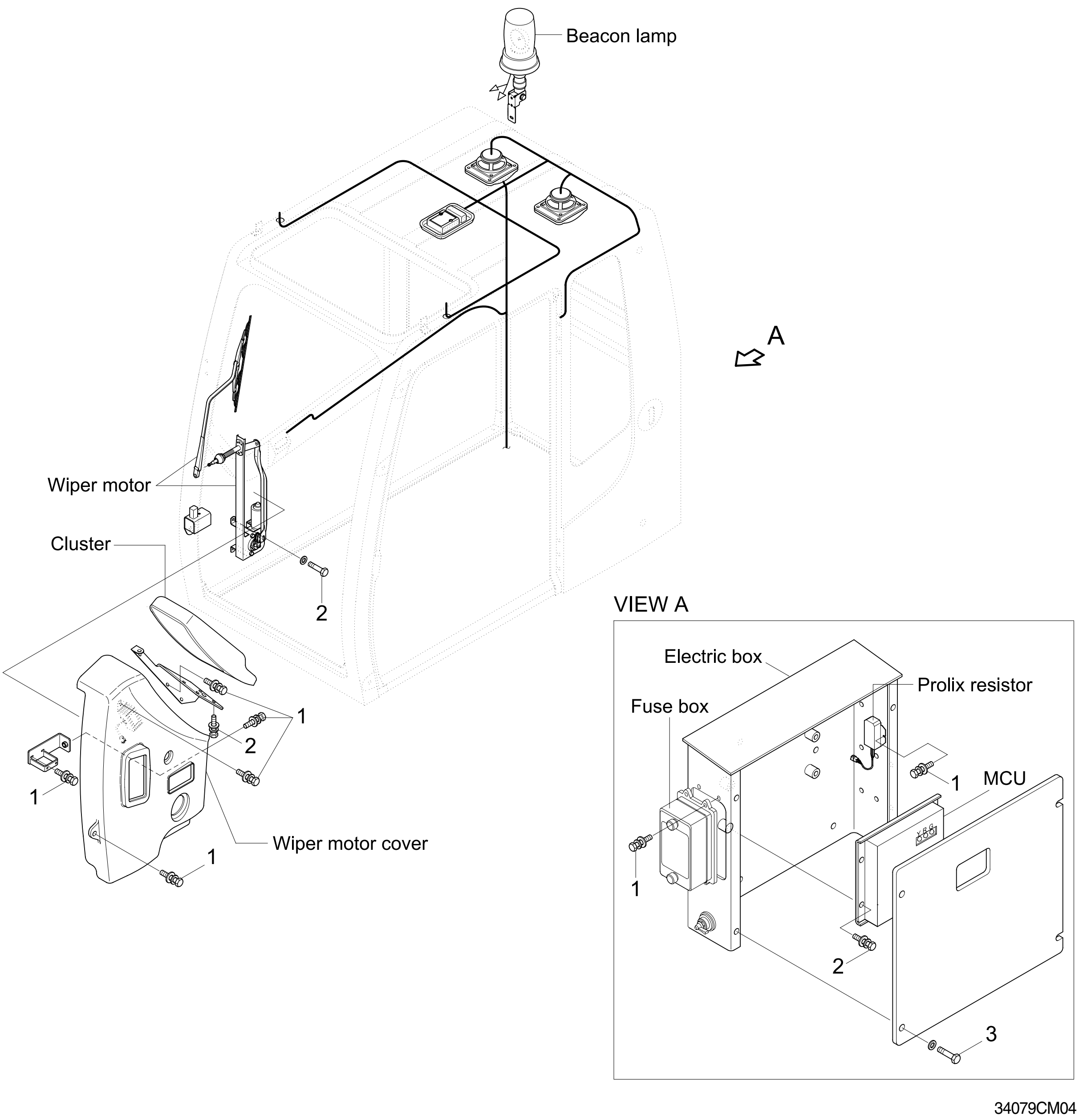


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1
4	M12×1.75	12.8±3.0	92.6±21.7

ELECTRIC COMPONENTS MOUNTING 2



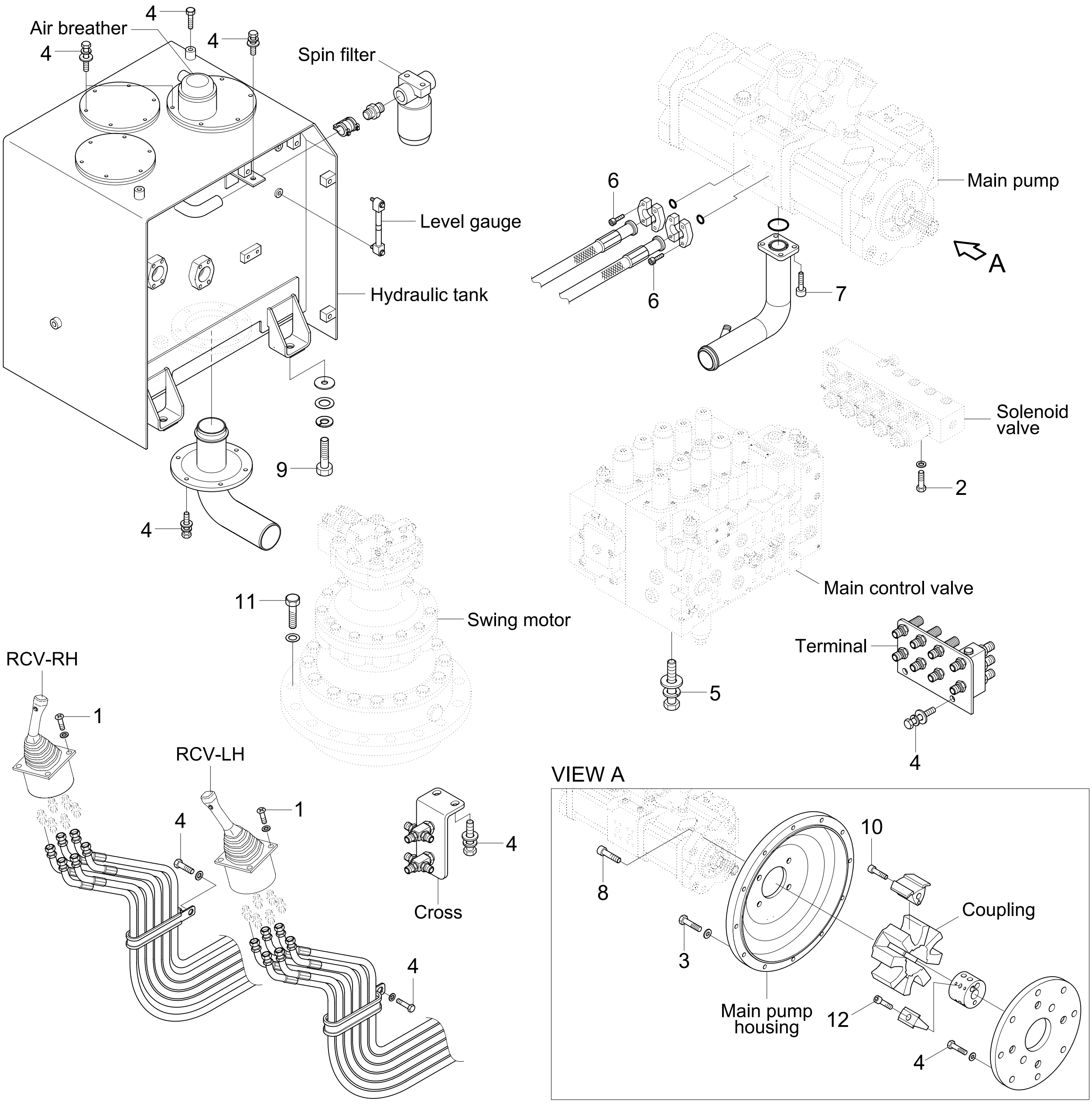
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1
-	-	-	-

GROUP 4 HYDRAULIC SYSTEM

HYDRAULIC COMPONENTS MOUNTING 1

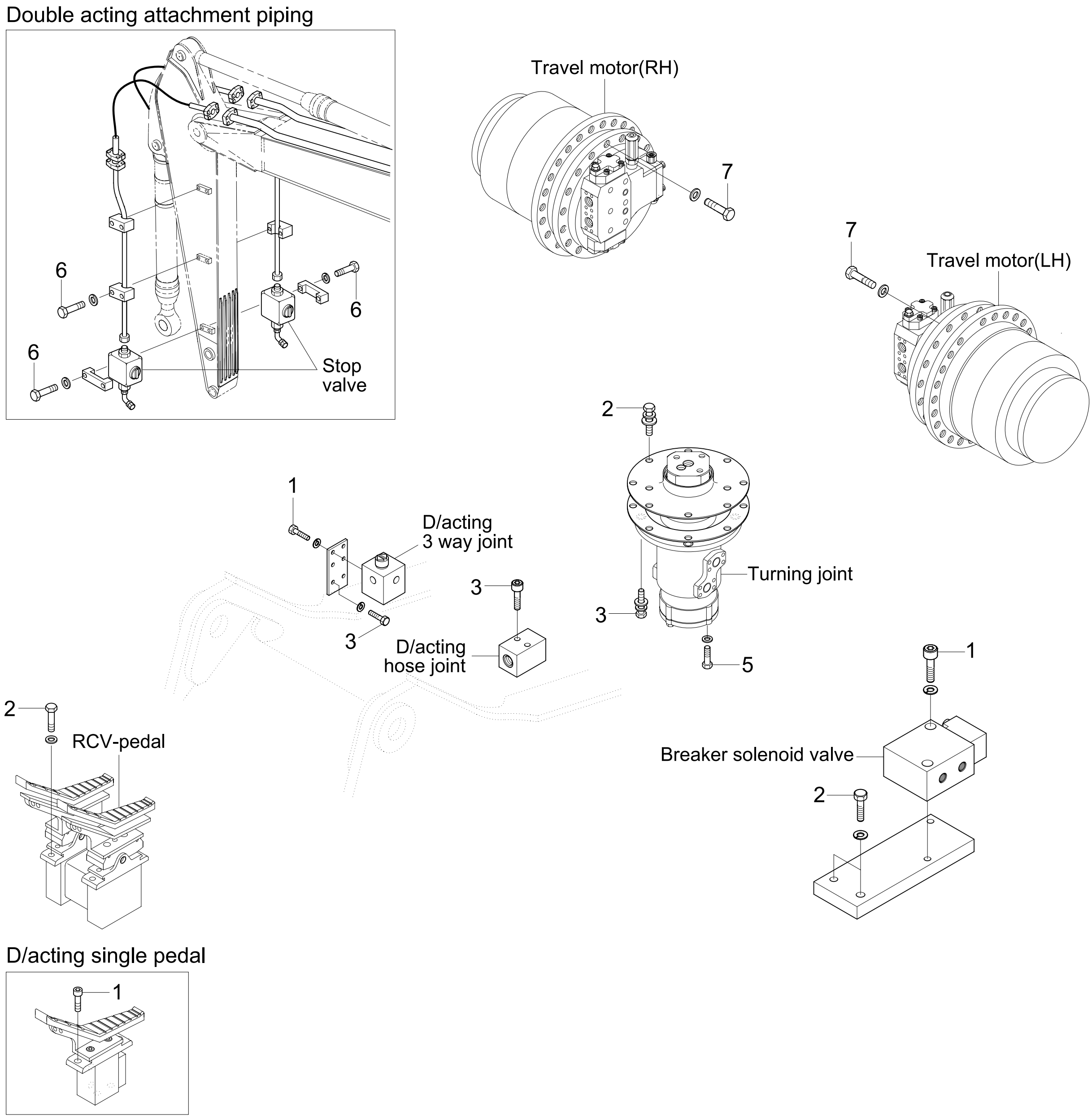


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	4.8±0.5	34.7±3.6
3	M10×1.5	4.8±0.3	34.7±2.2
4	M10×1.5	6.9±1.4	49.9±10.1
5	M12×1.75	12.2±1.3	88.9±9.4
6	M12×1.75	14.7±2.2	106±15.9

Item	Size	kgf · m	lbf · ft
7	M16×2.0	29.7±4.5	215±32.5
8	M20×2.5	42±4.5	304±32.5
9	M20×2.5	46±5.0	333±36
10	M20×2.5	46.5±2.5	336±18.1
11	M20×2.5	58.4±6.4	422±46.3
12	M20×2.5	21±1.0	152±7.2

HYDRAULIC COMPONENTS MOUNTING 2



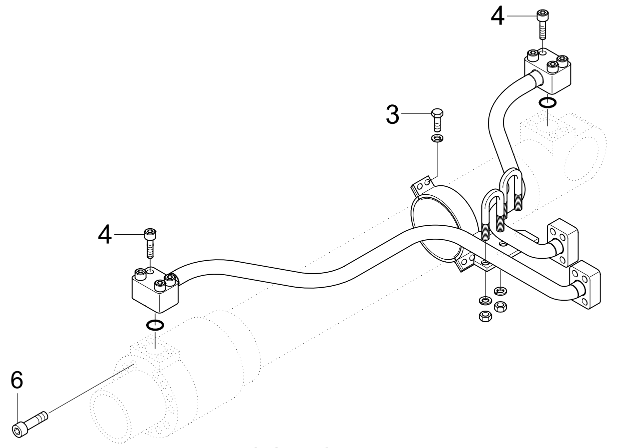
34079CM06

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	4.05±0.8	29.3±5.8
2	M10×1.5	6.9±1.4	49.9±10.1
3	M12×1.75	12.8±3.0	92.6±21.7
4	M12×1.75	9.4±1.0	68±7.2

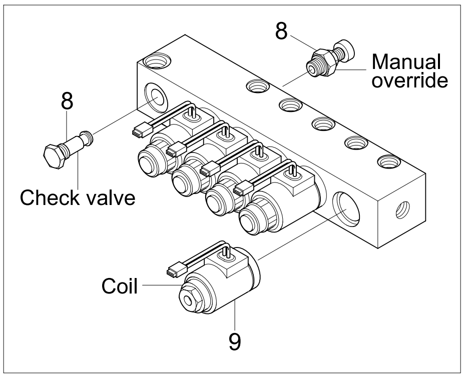
Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.3±1.3	89±9.4
6	M16×2.0	29.7±4.5	215±32.5
7	M24×3.0	84±8	608±57.9
-	-	-	-

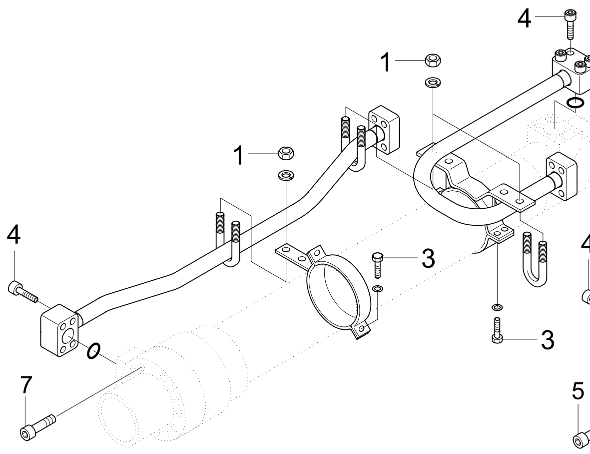
HYDRAULIC COMPONENTS MOUNTING 3



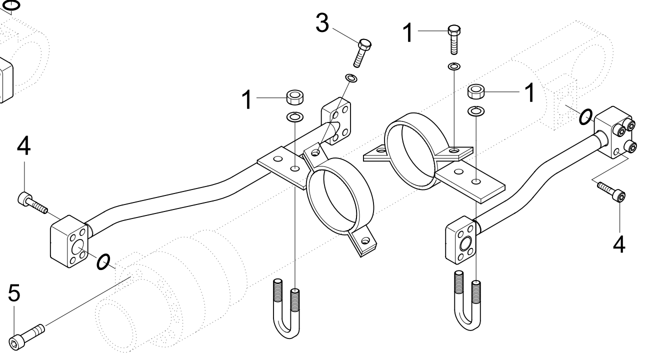
BOOM CYLINDER

Solenoid valve





ARM CYLINDER



BUCKET CYLINDER

34079CM07

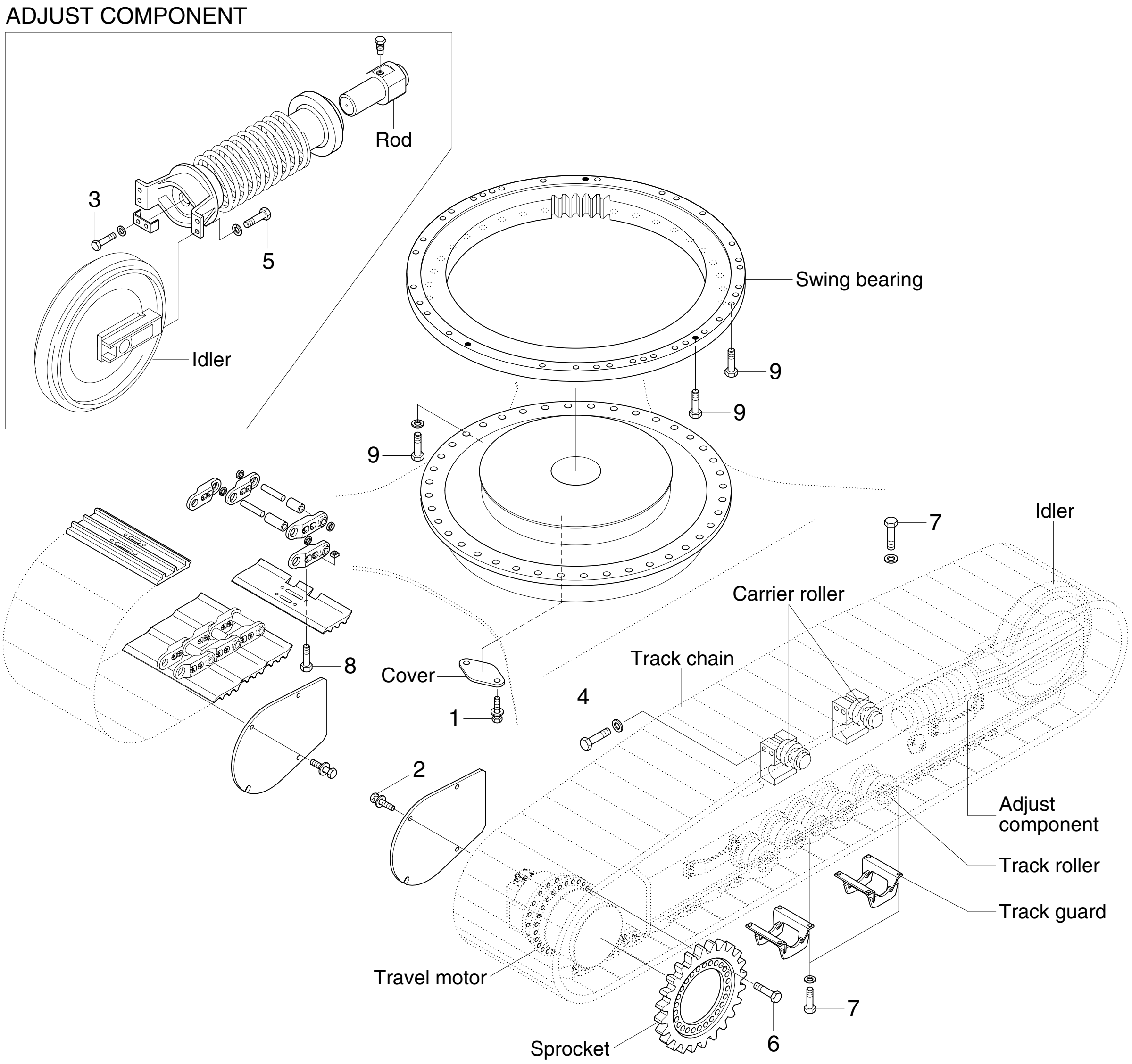
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	3.2±0.3	23.1±2.2
2	M10×1.5	5.4±0.5	39.1±3.6
3	M12×1.75	5.5±0.6	39.8±4.3
4	M12×1.75	9.4±1.0	68.0±7.2
5	M18×2.5	32±3.0	232±21.7

Item	Size	kgf · m	lbf · ft
6	M20×2.5	46±5.0	333±36.2
7	M22×2.5	63±6.3	456±45.6
8	M22×2.5	4.1	29.6
9	M27×3.0	5.1	36.9
-	-	-	-

GROUP 5 UNDERCARRIAGE

UNDERCARRIAGE MOUNTING



29079CM08

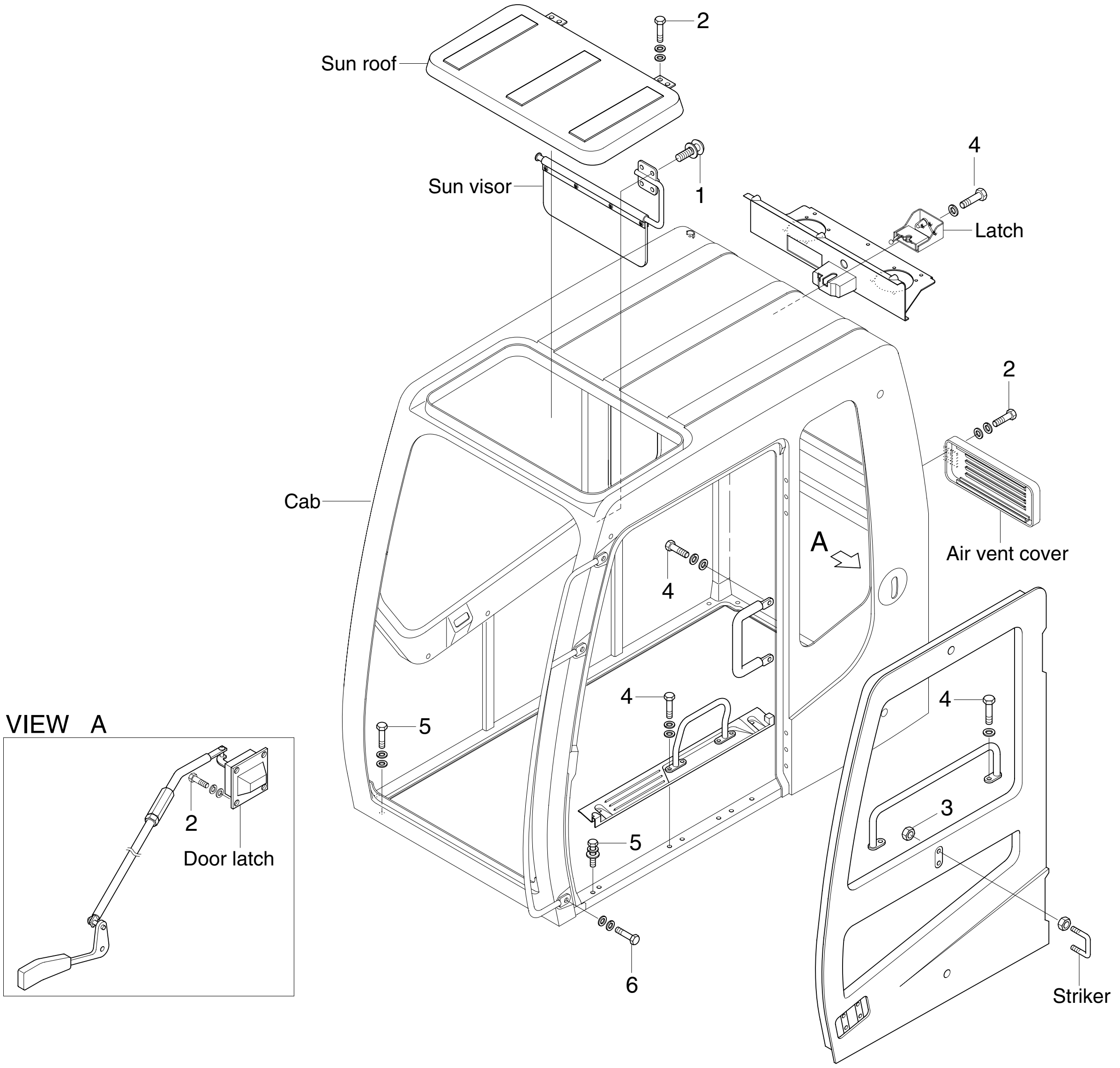
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7
3	M12×1.25	15±0.5	108±3.6
4	M16×2.0	29.7±3.0	215±21.7
5	M16×1.5	29.7±4.7	215±34.0

Item	Size	kgf · m	lbf · ft
6	M20×2.5	57.9±6.0	419±43.3
7	M20×2.5	57.9±8.7	419±62.9
8	M22×1.5	115±5.0	831±36.2
9	M24×3.0	97.8±10	707±72.3
-	-	-	-

GROUP 6 STRUCTURE

CAB AND ACCESSORIES MOUNTING



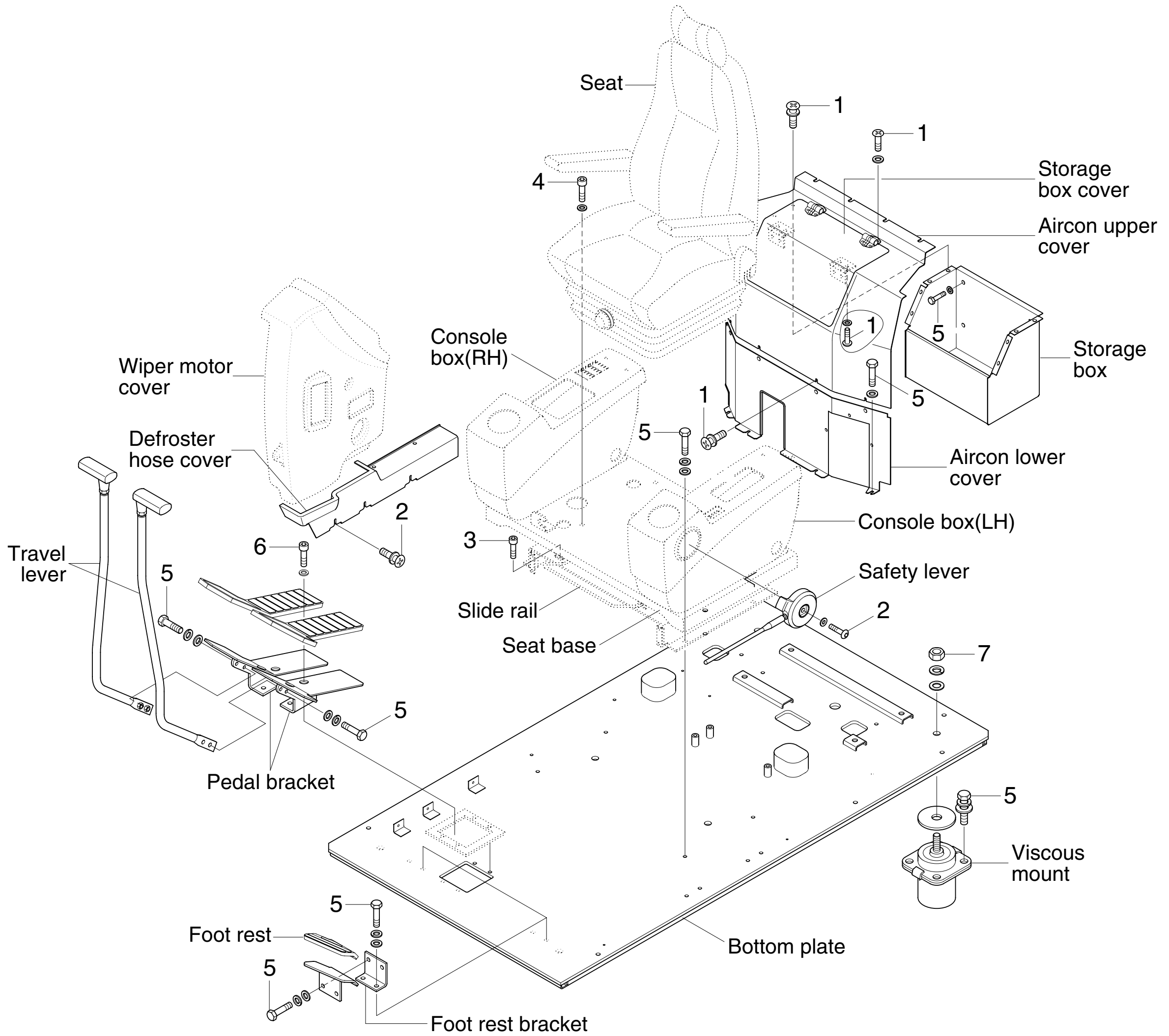
36079CM09

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	0.49±0.1	3.5±0.7
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.5	4.7±0.9	34±6.5

Item	Size	kgf · m	lbf · ft
4	M10×1.5	6.9±1.4	49.9±10.1
5	M12×1.75	12.8±3.0	92.6±21.7
6	M16×2.0	29.7±4.5	215±32.5

CAB INTERIOR MOUNTING



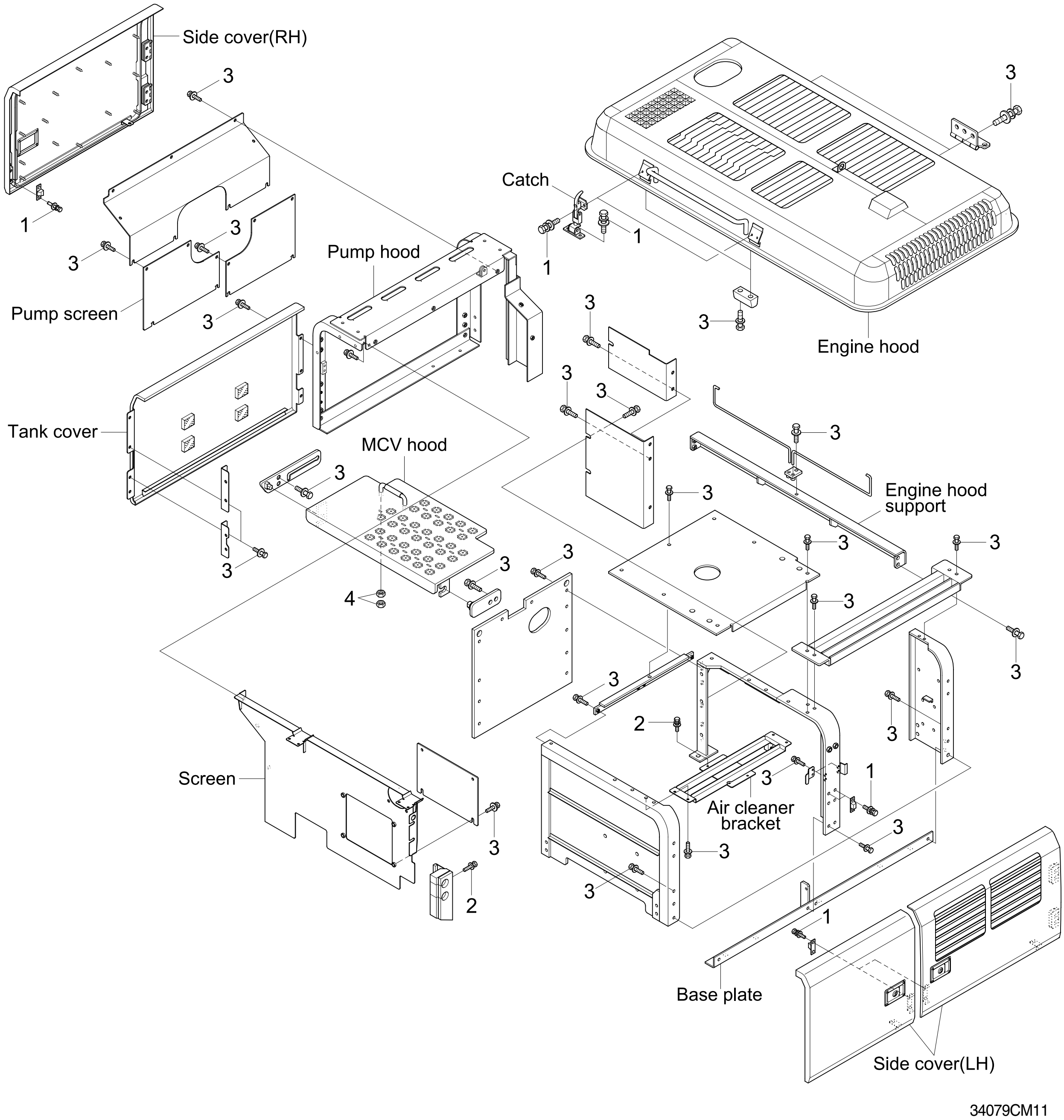
36079CM10

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6 × 1.0	0.49 ± 0.1	3.5 ± 0.7
2	M 6 × 1.0	1.05 ± 0.2	7.6 ± 1.4
3	M 8 × 1.25	3.43 ± 0.7	24.8 ± 5.1
4	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

Item	Size	kgf · m	lbf · ft
5	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
6	M10 × 1.5	8.27 ± 1.7	59.8 ± 12.3
7	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
-	-	-	-

COWLING MOUNTING

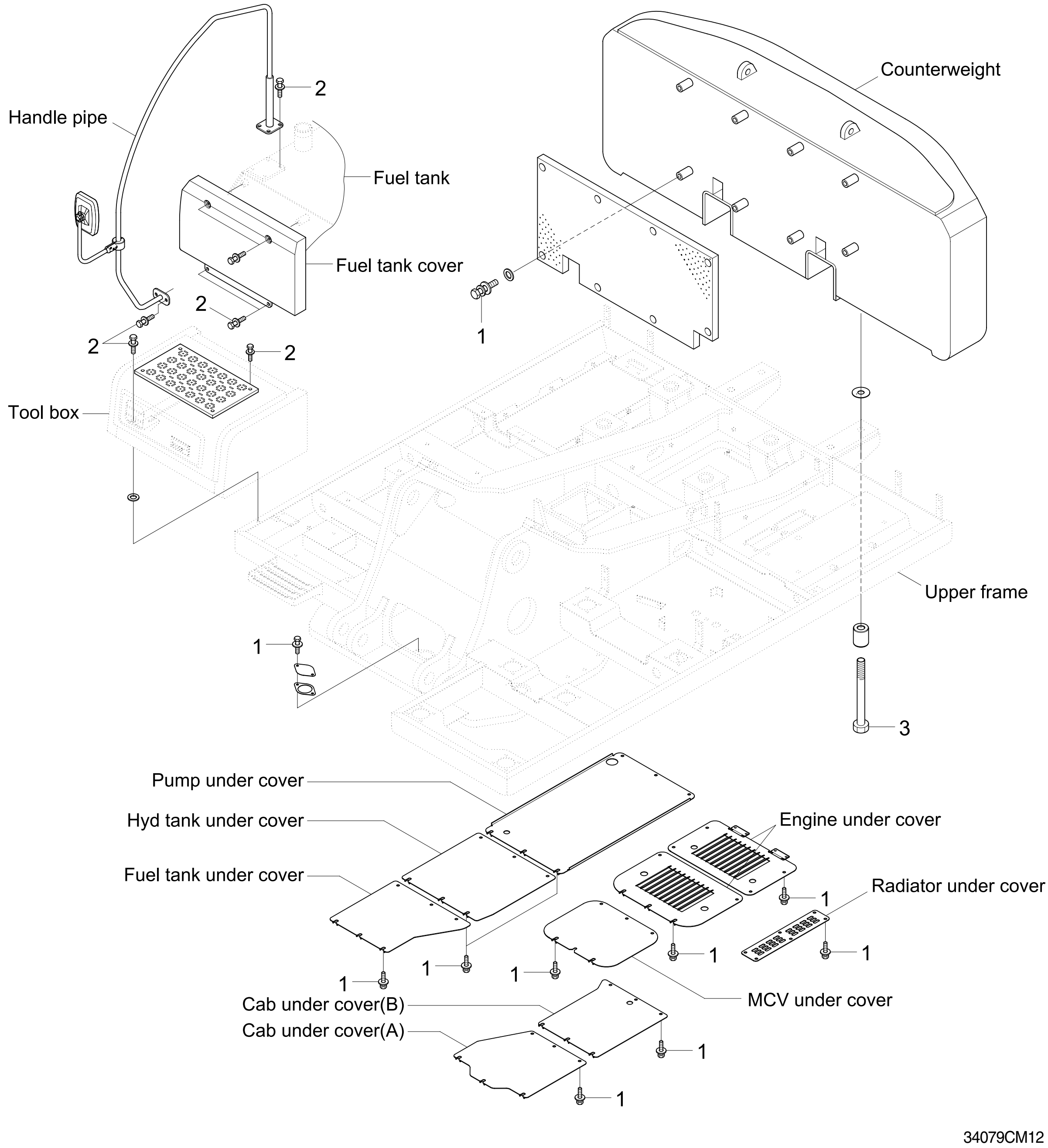


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M16×2.0	29.7±4.5	215±32.5

COUNTERWEIGHT AND COVERS MOUNTING

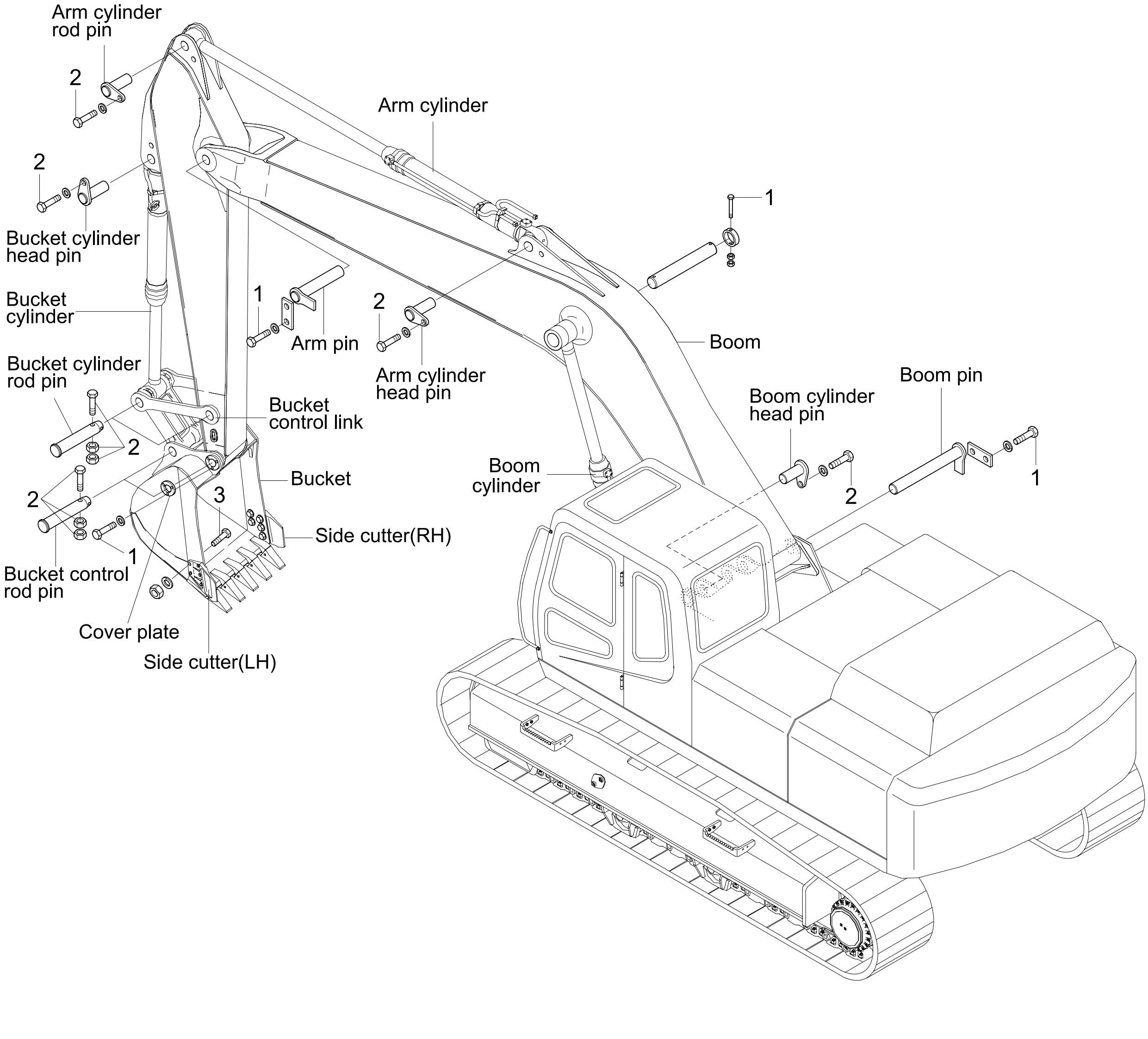


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
3	M36×3.0	308±46	2228±333
-	-	-	-

GROUP 7 WORK EQUIPMENT



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M16×2.0	29.7±4.5	215±32.5
2	M20×2.5	57.9±8.7	419±62.9

Item	Size	kgf · m	lbf · ft
3	M22×2.5	77.4±11.6	560±83.9
-	-	-	-