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1. STRUCTURE

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

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

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

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

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

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

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

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

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

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

2. HOW TO READ THE SERVICE MANUAL

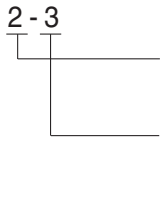
Distribution and updating

Any additions, amendments or other changes will be sent to HD Hyundai Construction Equipment distributors.

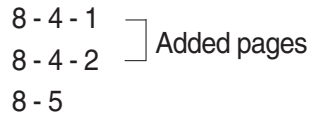
Get the most up-to-date information before you start any work.

Filing method

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



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



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 50 in the vertical column at the left side, take this as ⓐ, then draw a horizontal line from ⓐ.

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

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

2. Convert 550 mm into inches.

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

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

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

Millimeters to inches

1 mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

Kilogram to Pound

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 ℓ = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 ℓ = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

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

kgf/cm² to lbf/in²

1kgf / cm² = 14.2233lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

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

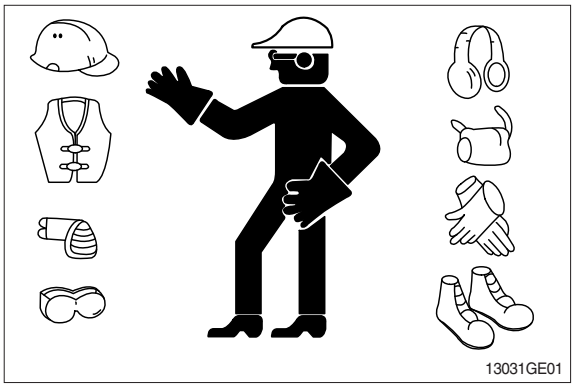
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

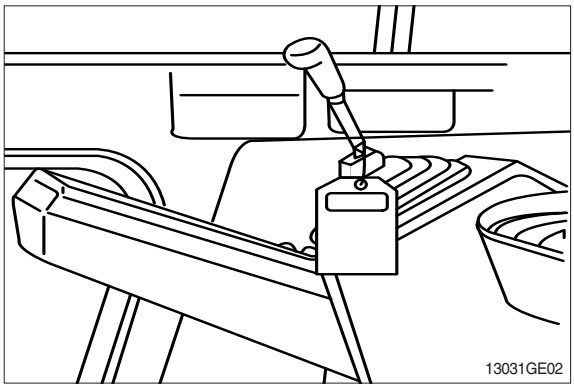
WEAR PROTECTIVE CLOTHING

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



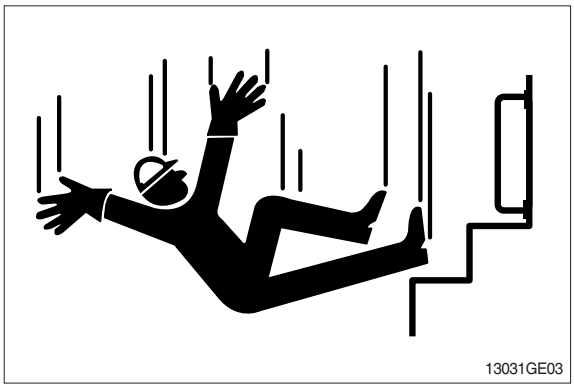
WARN OTHERS OF SERVICE WORK

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



USE HANDHOLDS AND STEPS

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

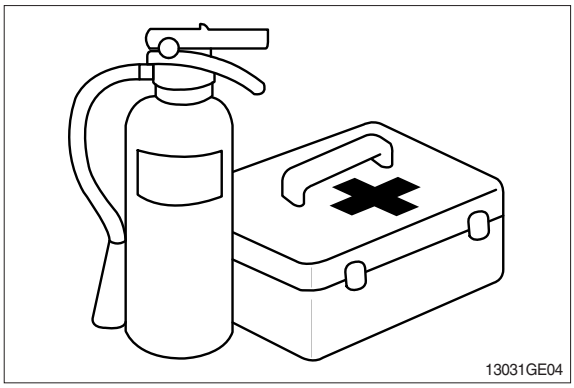


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

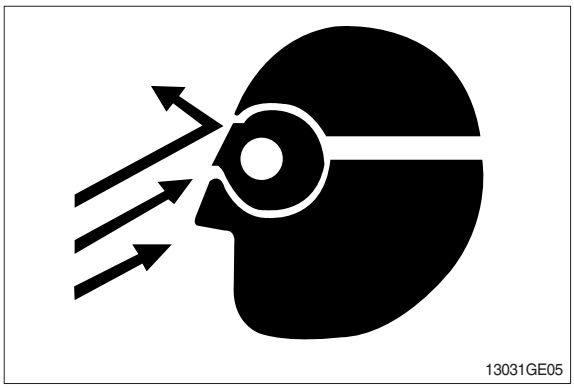
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

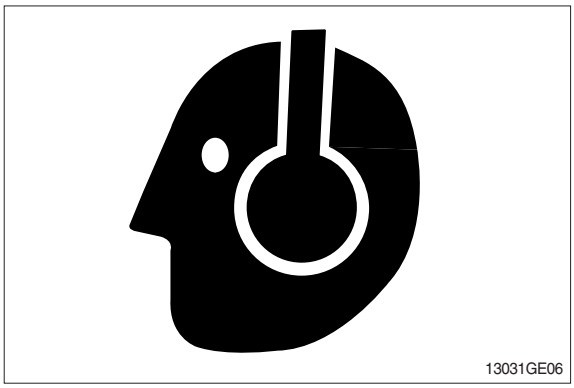
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

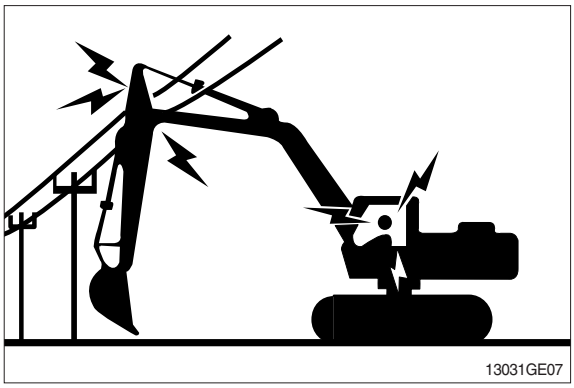
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

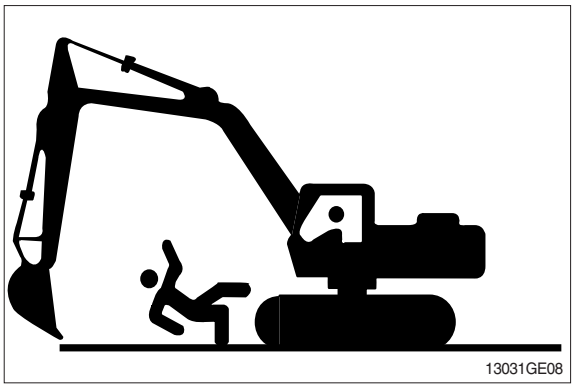
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



KEEP RIDERS OFF EXCAVATOR

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

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

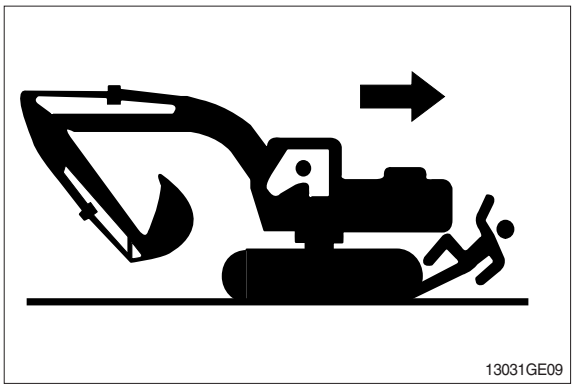

13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

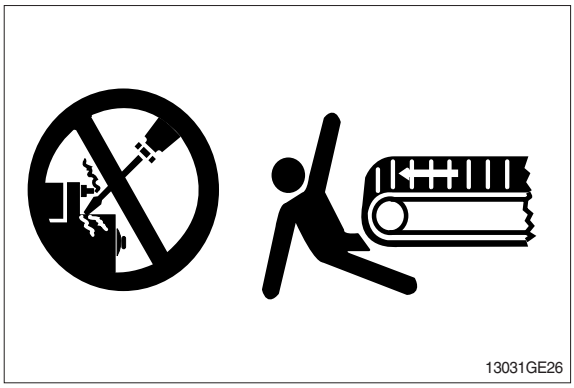
Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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


13031GE26

PARK MACHINE SAFELY

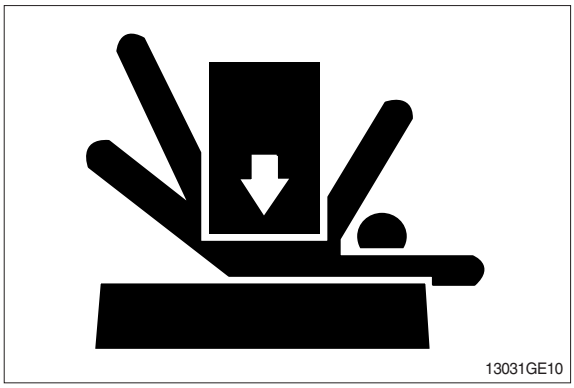
Before working on the machine:

- Park machine on a level surface.
- Lower bucket to the ground.
- Turn auto idle switch off.
- Run engine at 1/2 speed without load for 2 minutes.
- Turn key switch to OFF to stop engine. Remove key from switch.
- Move pilot control shutoff lever to locked position.
- Allow engine to cool.

SUPPORT MACHINE PROPERLY

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

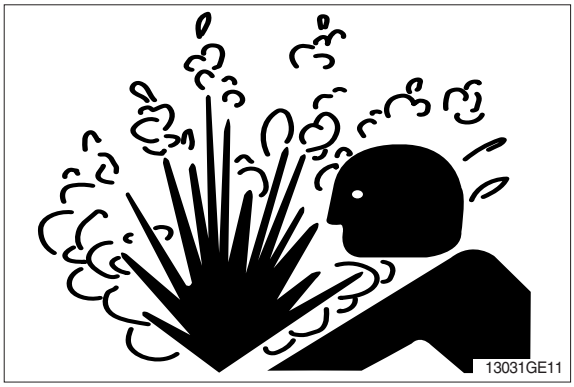
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

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


13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

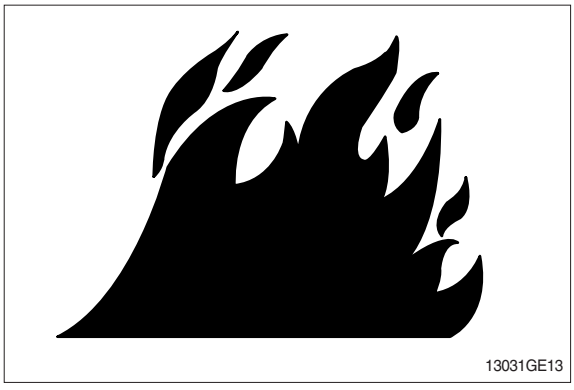
Handle fuel with care; It is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.
Fill fuel tank outdoors.

13031GE12

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

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

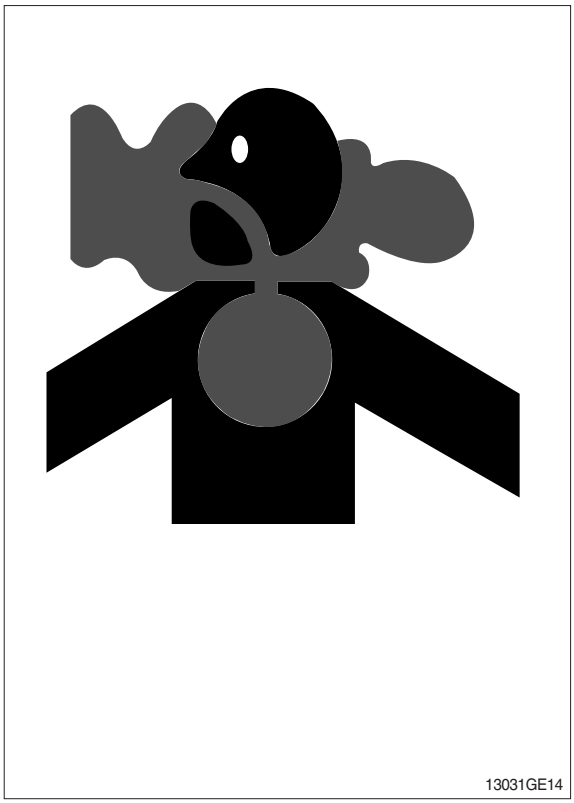
Do not store oily rags; They can ignite and burn spontaneously.


13031GE13

BEWARE OF EXHAUST FUMES

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

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


13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

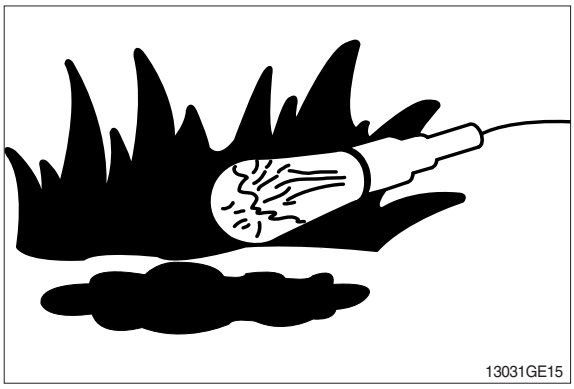
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

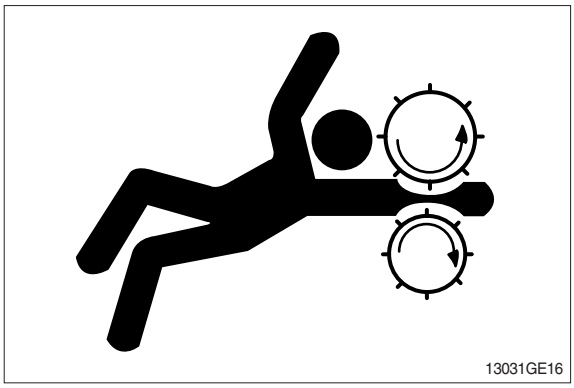
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.


13031GE15

SERVICE MACHINE SAFELY

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

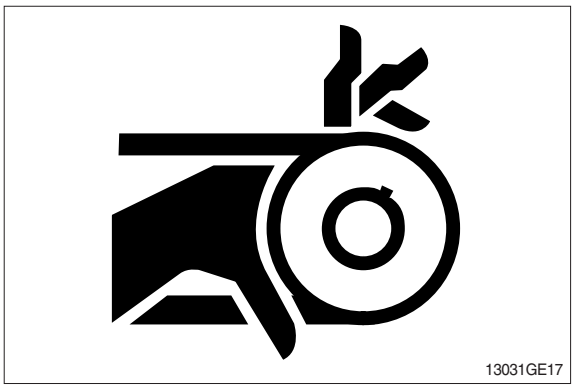
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



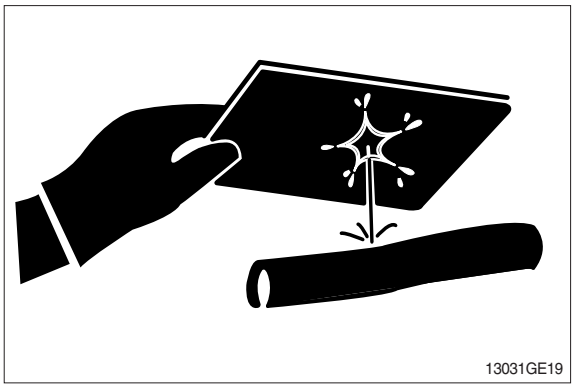
AVOID HIGH PRESSURE FLUIDS

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

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

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

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



AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

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

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 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:

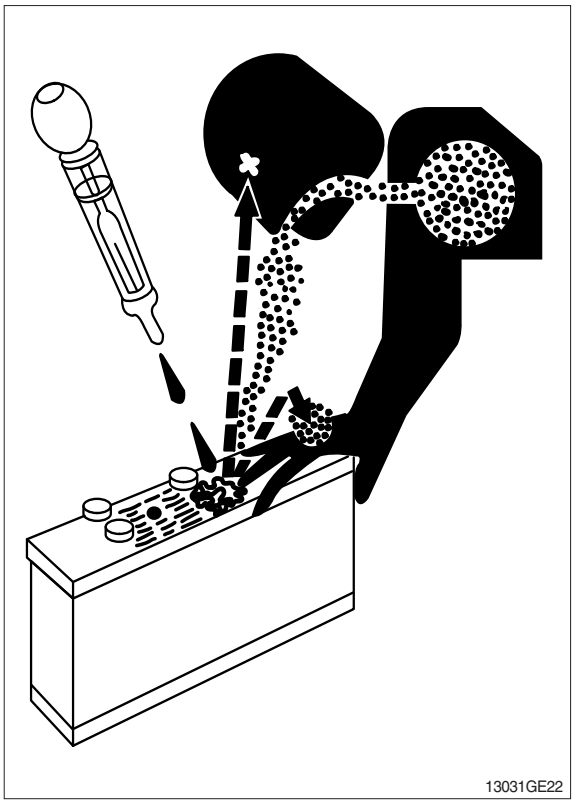
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

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.



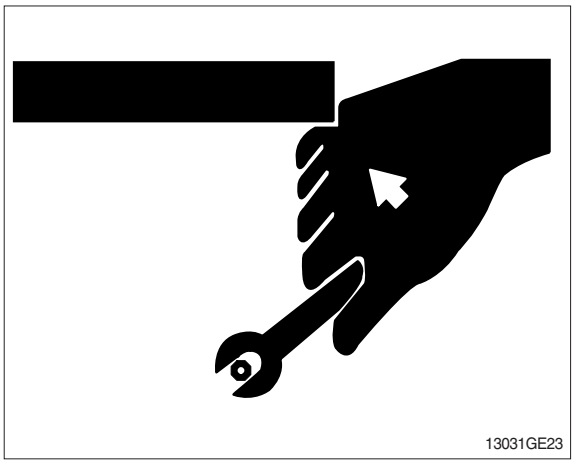
USE TOOLS PROPERLY

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.)

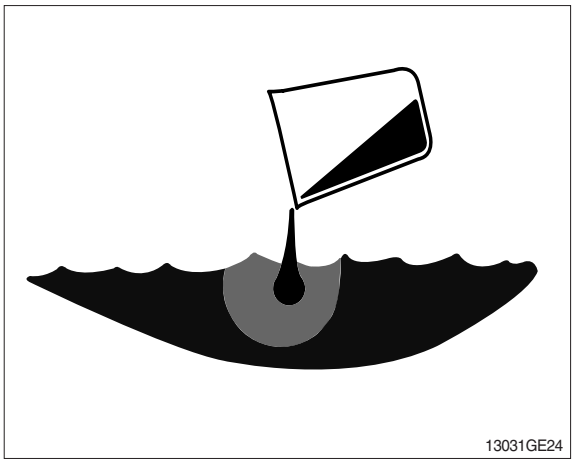


DISPOSE OF FLUIDS PROPERLY

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

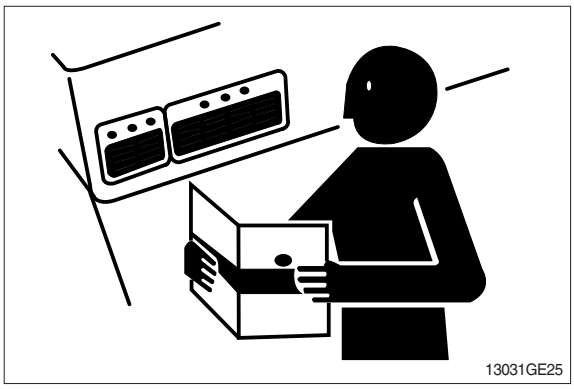
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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



REPLACE SAFETY SIGNS

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

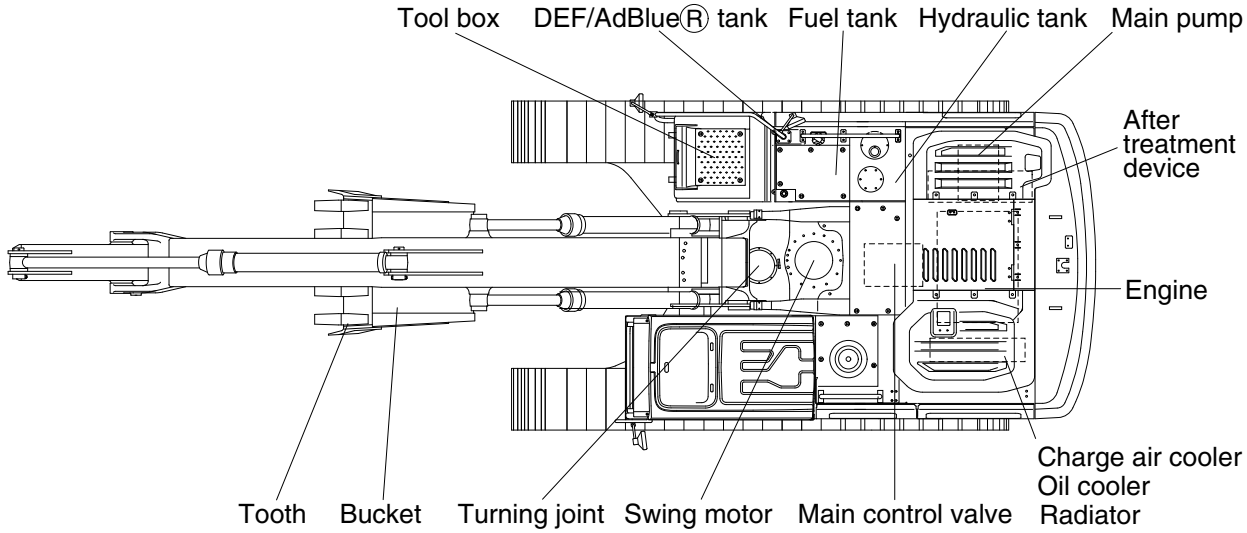


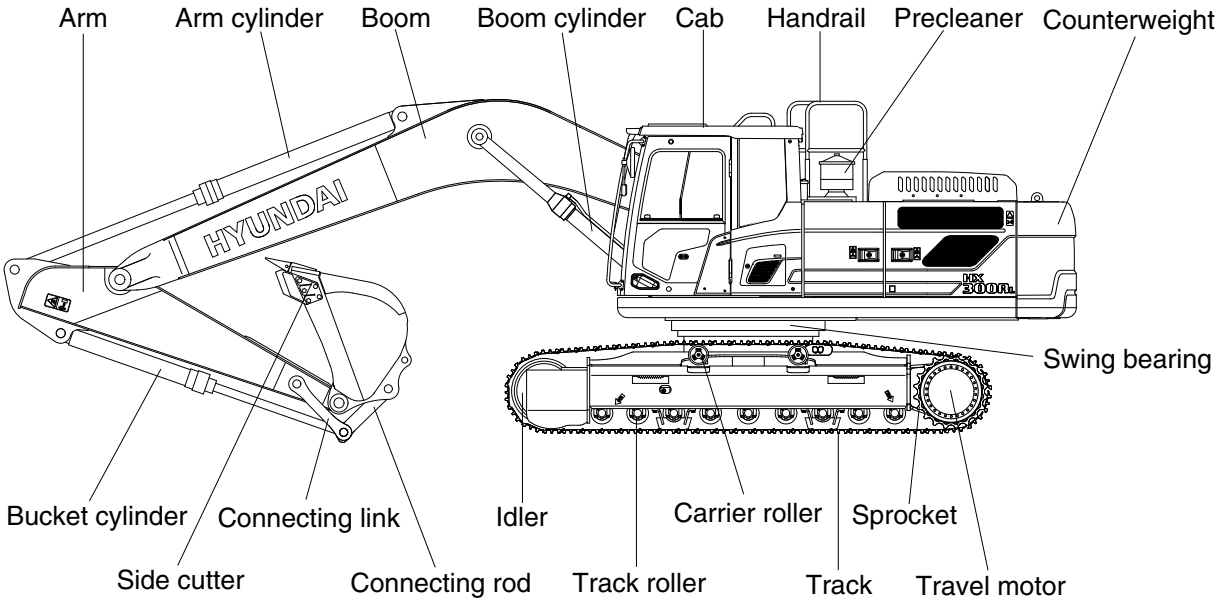
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

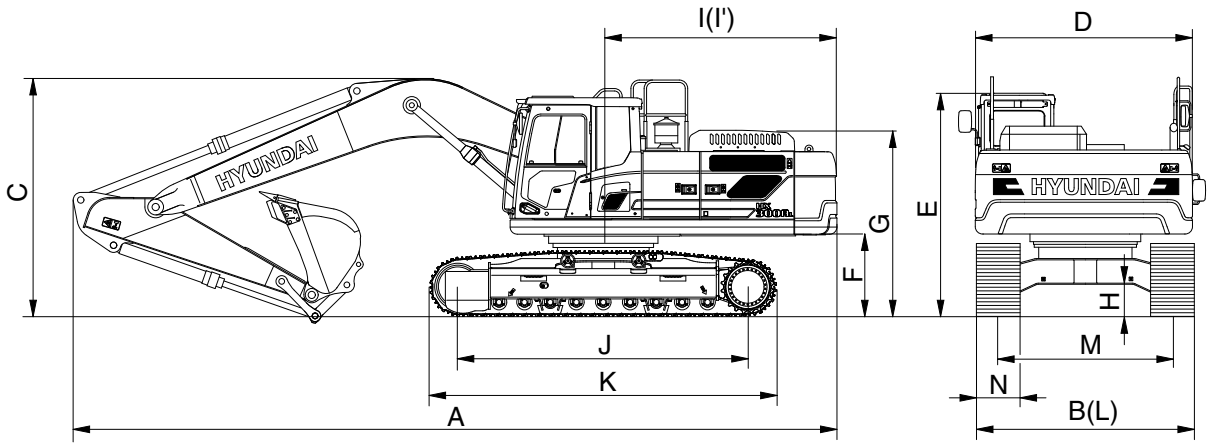




300A2SP01

2. SPECIFICATIONS

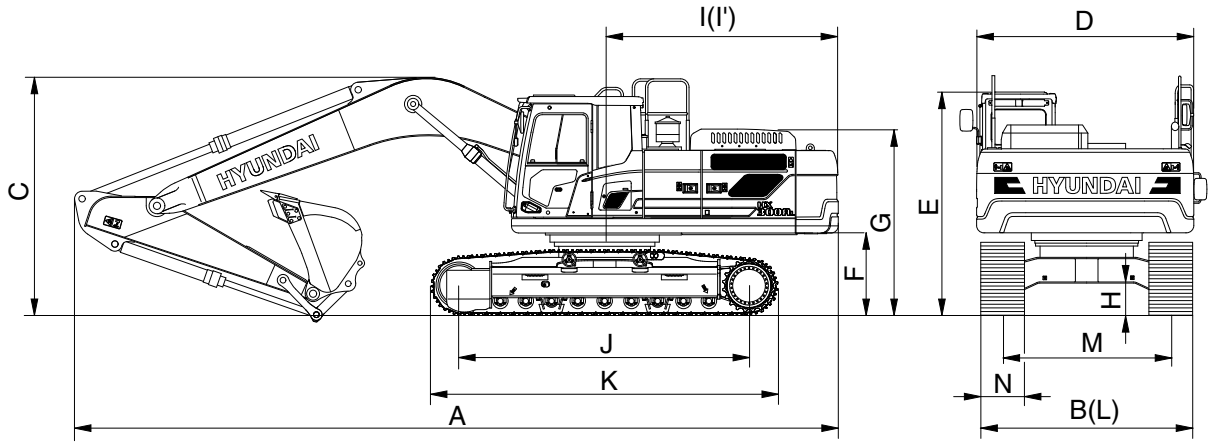
1) HX300A L, MONO BOOM



300A2SP02

Description		Unit		Specification			
		m (ft-in)	Boom	6.25 (20' 6")			
			Arm	3.10 (10' 2")	2.10 (6' 11")	2.50 (8' 2")	3.75 (12' 4")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		30520 (67290)	30310 (66820)	30400 (67020)	30640 (67550)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.27 (1.66)	1.27 (1.66)	1.27 (1.66)	1.27 (1.66)
Overall length	A	mm (ft-in)		10560 (34' 8")	10710 (35' 2")	10670 (35' 0")	10630 (34' 11")
Overall width	B			3400 (11' 2")	3400 (11' 2")	3400 (11' 2")	3400 (11' 2")
Overall height of boom	C			3335 (10' 11")	3580 (11' 9")	3485 (11' 5")	3535 (11' 7")
Superstructure width	D			2980 (9' 10")	2980 (9' 10")	2980 (9' 10")	2980 (9' 10")
Overall height of cab	E			3125 (10' 3")	3125 (10' 3")	3125 (10' 3")	3125 (10' 3")
Ground clearance of counterweight	F			1180 (3' 10")	1180 (3' 10")	1180 (3' 10")	1180 (3' 10")
Overall height of engine hood	G			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")
Overall height of guardrail	G'			3330 (10' 11")	3330 (10' 11")	3330 (10' 11")	3330 (10' 11")
Minimum ground clearance	H			500 (1' 8")	500 (1' 8")	500 (1' 8")	500 (1' 8")
Rear-end distance	I			3120 (10' 3")	3120 (10' 3")	3120 (10' 3")	3120 (10' 3")
Rear-end swing radius	I'			3210 (10' 7")	3210 (10' 7")	3210 (10' 7")	3210 (10' 7")
Distance between tumblers	J			4040 (13' 3")	4040 (13' 3")	4040 (13' 3")	4040 (13' 3")
Undercarriage length	K			4940 (16' 2")	4940 (16' 2")	4940 (16' 2")	4940 (16' 2")
Undercarriage width	L			3200 (10' 6")	3200 (10' 6")	3200 (10' 6")	3200 (10' 6")
Track gauge	M			2600 (8' 7")	2600 (8' 7")	2600 (8' 7")	2600 (8' 7")
Track shoe width, standard	N			600 (1' 12")	600 (1' 12")	600 (1' 12")	600 (1' 12")
Travel speed (low/high)		km/hr (mph)		3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)
Swing speed		rpm		11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.59 (8.35)	0.58 (8.3)	0.59 (8.32)	0.60 (8.52)
Max traction force		kg (lb)		27405 (60418)	27405 (60418)	27405 (60418)	27405 (60418)

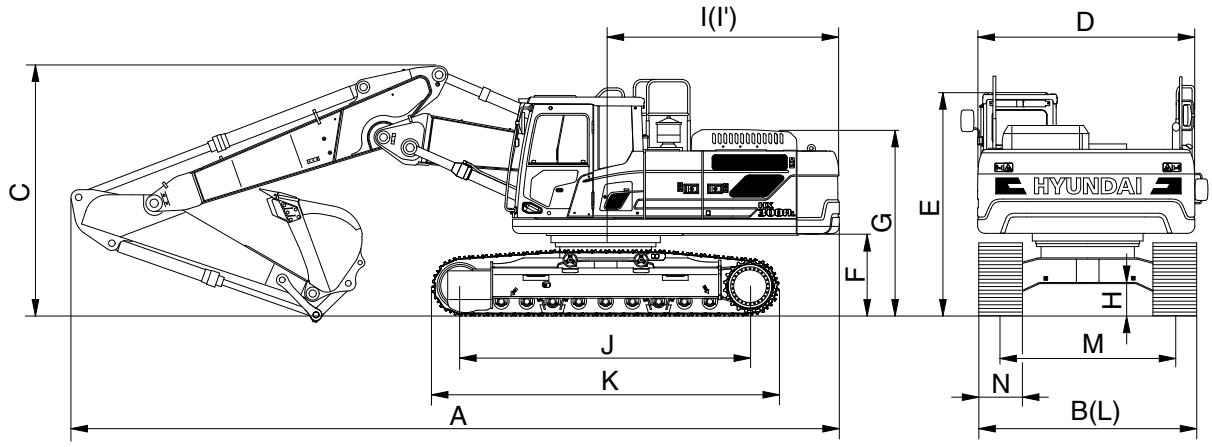
2) HX300A NL, MONO BOOM



300A2SP04

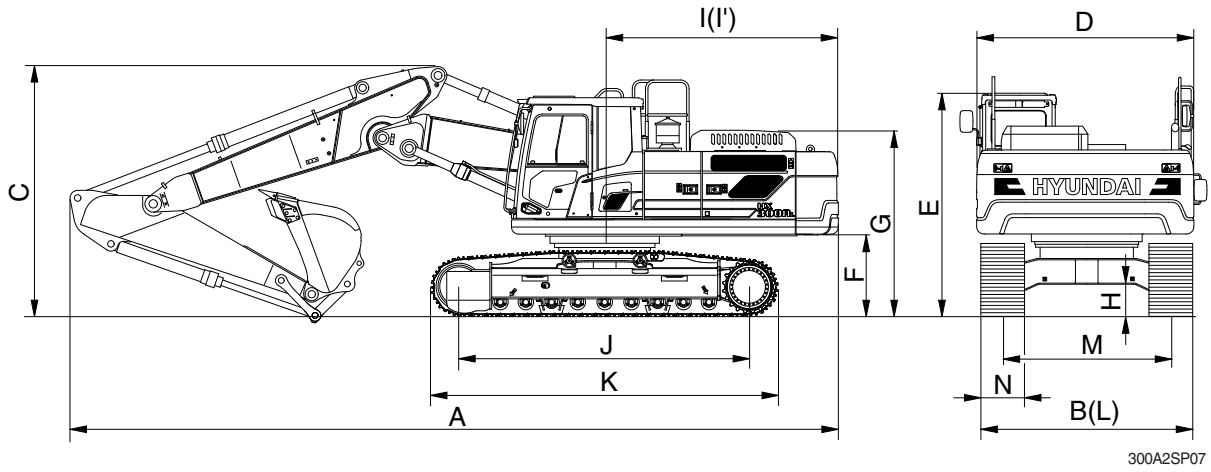
Description		Unit		Specification			
		m (ft-in)	Boom	6.25 (20' 6")			
			Arm	3.10 (10' 2")	2.10 (6' 11")	2.50 (8' 2")	3.75 (12' 4")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		30400 (67020)	30200 (66580)	30280 (66760)	30530 (67310)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.27 (1.66)	1.27 (1.66)	1.27 (1.66)	1.27 (1.66)
Overall length	A	mm (ft-in)		10560 (34' 8")	10710 (35' 2")	10670 (35' 0")	10630 (34' 11")
Overall width	B			3190 (10' 6")	3190 (10' 6")	3190 (10' 6")	3190 (10' 6")
Overall height of boom	C			3335 (10' 11")	3580 (11' 9")	3485 (11' 5")	3535 (11' 7")
Superstructure width	D			2980 (9' 10")	2980 (9' 10")	2980 (9' 10")	2980 (9' 10")
Overall height of cab	E			3125 (10' 3")	3125 (10' 3")	3125 (10' 3")	3125 (10' 3")
Ground clearance of counterweight	F			1180 (3' 10")	1180 (3' 10")	1180 (3' 10")	1180 (3' 10")
Overall height of engine hood	G			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")
Overall height of handrail	G'			3330 (10' 11")	3330 (10' 11")	3330 (10' 11")	3330 (10' 11")
Minimum ground clearance	H			500 (1' 8")	500 (1' 8")	500 (1' 8")	500 (1' 8")
Rear-end distance	I			3120 (10' 3")	3120 (10' 3")	3120 (10' 3")	3120 (10' 3")
Rear-end swing radius	I'			3210 (10' 7")	3210 (10' 7")	3210 (10' 7")	3210 (10' 7")
Distance between tumblers	J			4040 (13' 3")	4040 (13' 3")	4040 (13' 3")	4040 (13' 3")
Undercarriage length	K			4940 (16' 2")	4940 (16' 2")	4940 (16' 2")	4940 (16' 2")
Undercarriage width	L			2990 (9' 10")	2990 (9' 10")	2990 (9' 10")	2990 (9' 10")
Track gauge	M			2400 (7' 10")	2400 (7' 10")	2400 (7' 10")	2400 (7' 10")
Track shoe width, standard	N			600 (1' 12")	600 (1' 12")	600 (1' 12")	600 (1' 12")
Travel speed (low/high)		km/hr (mph)		3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)
Swing speed		rpm		11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.59 (8.32)	0.58 (8.27)	0.58 (8.29)	0.59 (8.36)
Max traction force		kg (lb)		27405 (60418)	27405 (60418)	27405 (60418)	27405 (60418)

3) HX300A L, 2-PIECE BOOM



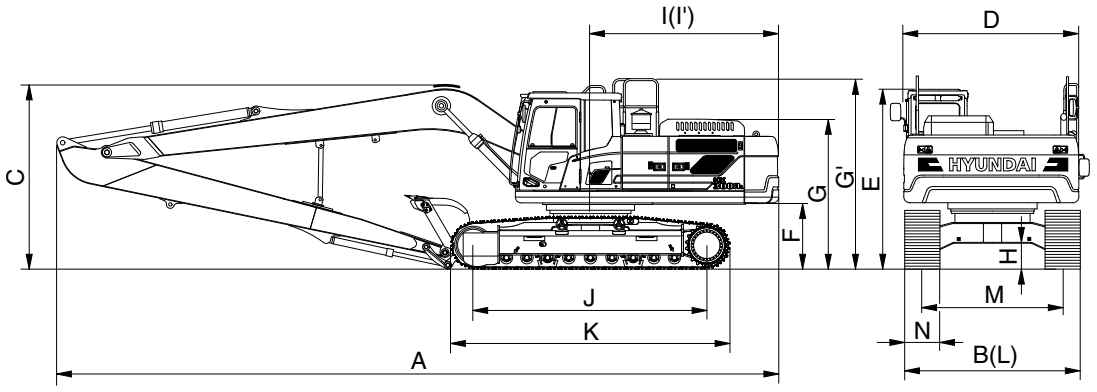
Description		Unit		Specification			
		m (ft-in)	Boom	6.25 (20' 6")			
			Arm	3.10 (10' 0")	2.10 (6' 11")	2.50 (8' 2")	3.75 (12' 4")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		33670 (74230)	33470 (73790)	33550 (73970)	33800 (74520)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.27 (1.66)	1.27 (1.66)	1.27 (1.66)	1.27 (1.66)
Overall length	A	mm (ft-in)		10635 (34' 11")	10700 (35' 1")	10695 (35' 1")	10615 (34' 10")
Overall width	B			3400 (11' 2")	3400 (11' 2")	3400 (11' 2")	3400 (11' 2")
Overall height of boom	C			3490 (11' 5")	3510 (11' 6")	3495 (11' 6")	3735 (12' 3")
Superstructure width	D			2980 (9' 10")	2980 (9' 10")	2980 (9' 10")	2980 (9' 10")
Overall height of cab	E			3125 (10' 3")	3125 (10' 3")	3125 (10' 3")	3125 (10' 3")
Ground clearance of counterweight	F			1180 (3' 10")	1180 (3' 10")	1180 (3' 10")	1180 (3' 10")
Overall height of engine hood	G			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")
Overall height of guardrail	G'			3330 (10' 11")	3330 (10' 11")	3330 (10' 11")	3330 (10' 11")
Minimum ground clearance	H			500 (1' 8")	500 (1' 8")	500 (1' 8")	500 (1' 8")
Rear-end distance	I			3120 (10' 3")	3120 (10' 3")	3120 (10' 3")	3120 (10' 3")
Rear-end swing radius	I'			3210 (10' 7")	3210 (10' 7")	3210 (10' 7")	3210 (10' 7")
Distance between tumblers	J			4040 (13' 3")	4040 (13' 3")	4040 (13' 3")	4040 (13' 3")
Undercarriage length	K			4940 (16' 2")	4940 (16' 2")	4940 (16' 2")	4940 (16' 2")
Undercarriage width	L			3200 (10' 6")	3200 (10' 6")	3200 (10' 6")	3200 (10' 6")
Track gauge	M			2600 (8' 7")	2600 (8' 7")	2600 (8' 7")	2600 (8' 7")
Track shoe width, standard	N			600 (1' 12")	600 (1' 12")	600 (1' 12")	600 (1' 12")
Travel speed (low/high)		km/hr (mph)		3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)
Swing speed		rpm		11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.65 (9.22)	0.64 (9.16)	0.65 (9.18)	0.65 (9.18)
Max traction force		kg (lb)		27405 (60418)	27405 (60418)	27405 (60418)	27405 (60418)

4) HX300A NL, 2-PIECE BOOM



Description		Unit		Specification			
		m (ft-in)	Boom	6.25 (20' 6")			
			Arm	3.10 (10' 0")	2.10 (6' 11")	2.50 (8' 2")	3.75 (12' 4")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		33550 (73970)	33350 (73520)	33430 (73700)	33680 (74250)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.27 (1.66)	1.27 (1.66)	1.27 (1.66)	1.27 (1.66)
Overall length	A	mm (ft-in)		10635 (34' 11")	10700 (35' 1")	10695 (35' 1")	10615 (34' 10")
Overall width	B			3190 (10 '6")	3190 (10 '6")	3190 (10 '6")	3400 (11' 2")
Overall height of boom	C			3490 (11' 5")	3510 (11' 6")	3495 (11' 6")	3735 (12' 3")
Superstructure width	D			2980 (9' 10")	2980 (9' 10")	2980 (9' 10")	2980 (9' 10")
Overall height of cab	E			3125 (10' 3")	3125 (10' 3")	3125 (10' 3")	3125 (10' 3")
Ground clearance of counterweight	F			1180 (3' 10")	1180 (3' 10")	1180 (3' 10")	1180 (3' 10")
Overall height of engine hood	G			2600 (8' 6")	2600 (8' 6")	2600 (8' 6")	2600 (8' 6")
Overall height of guardrail	G'			3330 (10' 11")	3330 (10' 11")	3330 (10' 11")	3330 (10' 11")
Minimum ground clearance	H			500 (1' 8")	500 (1' 8")	500 (1' 8")	500 (1' 8")
Rear-end distance	I			3120 (10' 3")	3120 (10' 3")	3120 (10' 3")	3120 (10' 3")
Rear-end swing radius	I'			3210 (10' 7")	3210 (10' 7")	3210 (10' 7")	3210 (10' 7")
Distance between tumblers	J			4040 (13' 3")	4040 (13' 3")	4040 (13' 3")	4040 (13' 3")
Undercarriage length	K			4940 (16' 2")	4940 (16' 2")	4940 (16' 2")	4940 (16' 2")
Undercarriage width	L			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Track gauge	M			2400 (7' 10")	2400 (7' 10")	2400 (7' 10")	2400 (7' 10")
Track shoe width, standard	N			600 (1' 12")	600 (1' 12")	600 (1' 12")	600 (1' 12")
Travel speed (low/high)		km/hr (mph)		3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)	3.4/6.1 (2.1/3.8)
Swing speed		rpm		11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.65 (9.22)	0.64 (9.16)	0.65 (9.18)	0.65 (9.18)
Max traction force		kg (lb)		27405 (60418)	27405 (60418)	27405 (60418)	27405 (60418)

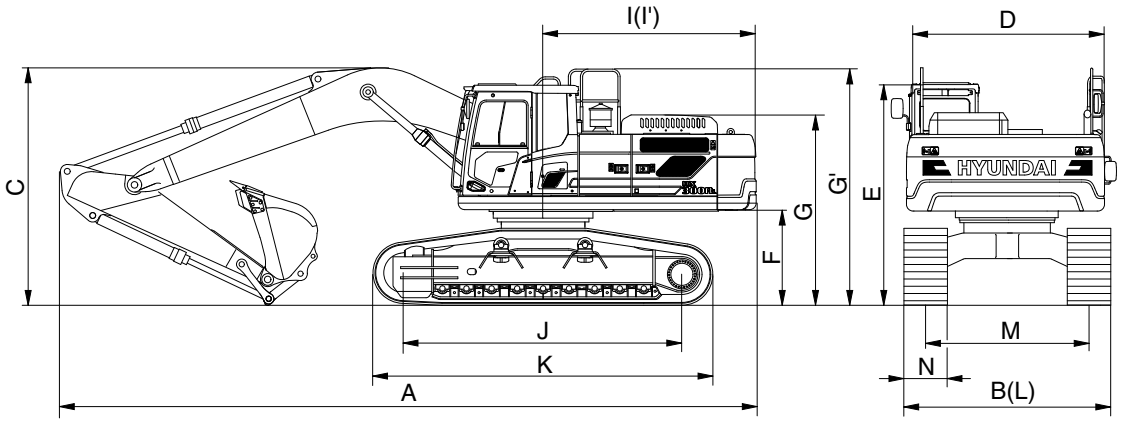
5) HX300A LR



300A2SP05

Description		Unit		Specification
		m (ft-in)	Boom	10.2 (33' 6")
			Arm	7.85 (25' 9")
		mm (in)	Shoe	800 (32)
Operating weight		kg (lb)		33590 (74050)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		0.52 (0.68)
Overall length	A	mm (ft-in)		14600 (47' 11")
Overall width	B			3400 (11' 2")
Overall height of boom	C			3560 (11' 8")
Superstructure width	D			2980 (9' 10")
Overall height of cab	E			3125 (10' 3")
Ground clearance of counterweight	F			1180 (3' 10")
Overall height of engine hood	G			2600 (8' 6")
Overall height of guardrail	G'			3330 (10' 11")
Minimum ground clearance	H			500 (1' 8")
Rear-end distance	I			3120 (10' 3")
Rear-end swing radius	I'			3210 (10' 7")
Distance between tumblers	J			4040 (13' 3")
Undercarriage length	K			4940 (16' 2")
Undercarriage width	L			3400 (11' 2")
Track gauge	M			2600 (8' 7")
Track shoe width, standard	N			800 (2' 7")
Travel speed (low/high)		km/hr (mph)		3.4/6.1 (2.1/3.8)
Swing speed		rpm		11.2
Gradeability		Degree (%)		35 (70)
Ground pressure		kgf/cm^2 (psi)		0.48 (6.90)
Max traction force		kg (lb)		27405 (60418)

6) HX300A HW, MONO BOOM

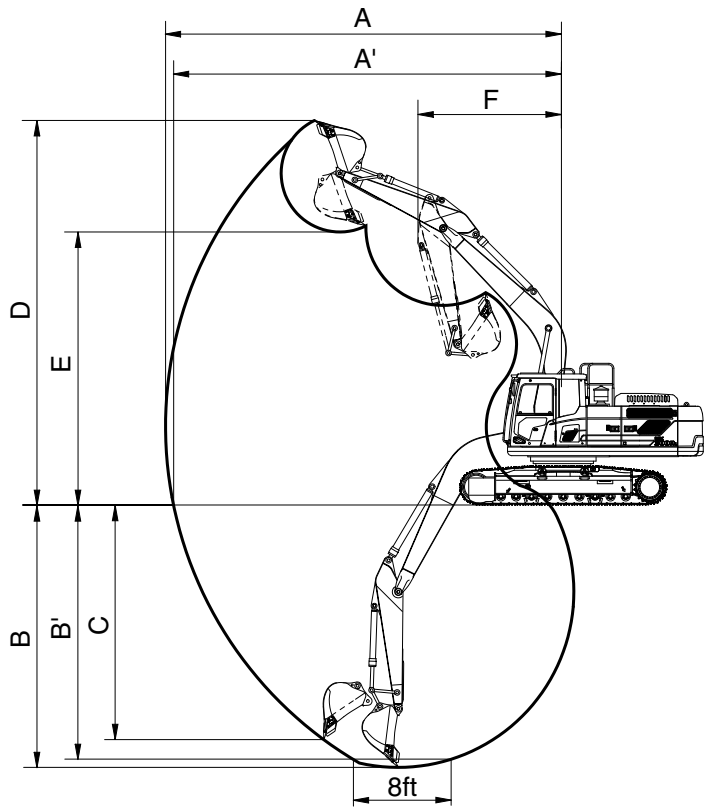


300A2SP06

Description		Unit		Specification				
		m (ft-in)	Boom	6.25 (20' 6")				10.2 (33' 6")
			Arm	3.10(10' 2")	2.10(6' 11")	2.50(8' 2")	3.75(12' 4")	7.85(25' 9")
		mm (in)	Shoe	700 (28)				
Operating weight		kg (lb)		34810(76740)	34610(76300)	34690(76480)	34940(77030)	33590(74050)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.27(1.66)	1.27(1.66)	1.27(1.66)	1.27(1.66)	0.52(0.68)
Overall length	A	mm (ft-in)		10410(34' 2")	10680(35' 0")	10595(34' 9")	10510(34' 6")	14470(47' 6")
Overall width	B			3670(12' 1")	3670(12' 1")	3670(12' 1")	3670(12' 1")	3670(12' 1")
Overall height of boom	C			3385(11' 1")	3715(12' 2")	3590(11' 9")	3520(11' 7")	3610(11' 10")
Superstructure width	D			2980(9' 9")	2980(9' 9")	2980(9' 9")	2980(9' 9")	2980(9' 9")
Overall height of cab	E			3430(11' 3")	3430(11' 3")	3430(11' 3")	3430(11' 3")	3430(11' 3")
Ground clearance of counterweight	F			1490(4' 11")	1490(4' 11")	1490(4' 11")	1490(4' 11")	1490(4' 11")
Overall height of engine hood	G			2910(9' 7")	2910(9' 7")	2910(9' 7")	2910(9' 7")	2910(9' 7")
Overall height of guardrail	G'			3640(11' 11")	3640(11' 11")	3640(11' 11")	3640(11' 11")	3640(11' 11")
Minimum ground clearance	H			765(2' 6")	765(2' 6")	765(2' 6")	765(2' 6")	765(2' 6")
Rear-end distance	I			3120(10' 3")	3120(10' 3")	3120(10' 3")	3120(10' 3")	3120(10' 3")
Rear-end swing radius	I'			3210(10' 7")	3210(10' 7")	3210(10' 7")	3210(10' 7")	3210(10' 7")
Distance between tumblers	J			4030(13' 3")	4030(13' 3")	4030(13' 3")	4030(13' 3")	4030(13' 3")
Undercarriage length	K			4940(16' 2")	4940(16' 2")	4940(16' 2")	4940(16' 2")	4940(16' 2")
Undercarriage width	L			3570(11' 9")	3570(11' 9")	3570(11' 9")	3570(11' 9")	3570(11' 9")
Track gauge	M			2870(9' 5")	2870(9' 5")	2870(9' 5")	2870(9' 5")	2870(9' 5")
Track shoe width, standard	N			700(2' 4")	700(2' 4")	700(2' 4")	700(2' 4")	700(2' 4")
Travel speed (low/high)		km/hr (mph)		2.9/4.8(1.8/3.0)	2.9/4.8(1.8/3.0)	2.9/4.8(1.8/3.0)	2.9/4.8(1.8/3.0)	2.9/4.8(1.8/3.0)
Swing speed		rpm		11.2	11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35(70)	35(70)	35(70)	35(70)	35(70)
Ground pressure		kgf/cm^2 (psi)		0.57(8.15)	0.57(8.1)	0.57(8.12)	0.58(8.18)	0.58(8.18)
Max traction force		kg (lb)		31613(69695)	31613(69695)	31613(69695)	31613(69695)	31613(69695)

3. WORKING RANGE AND DIGGING FORCE

1) HX300A L/NL, MONO BOOM

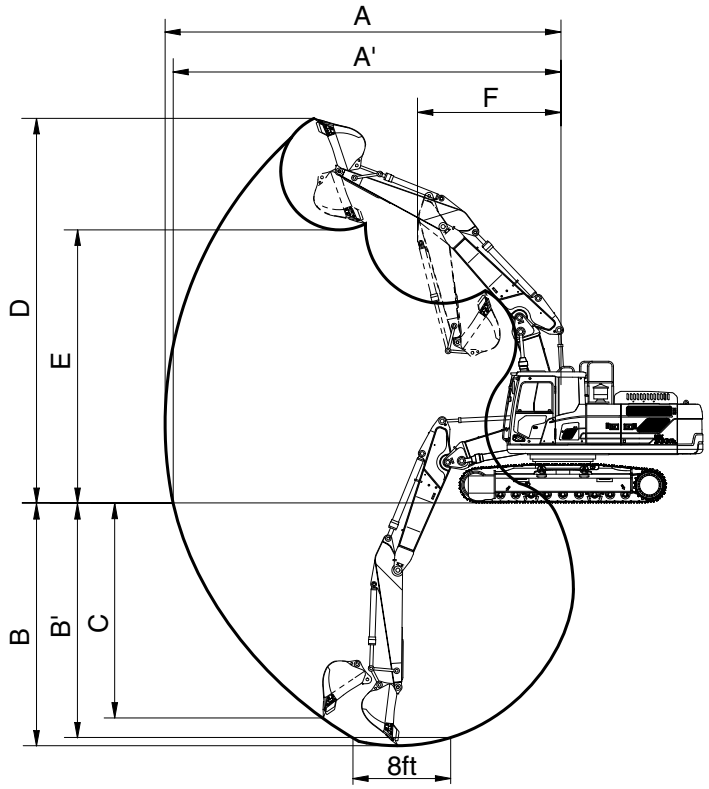


300A2SP10

Description	m (ft-in)	Boom	6.25 (20' 6")			
		Arm	2.10 (6' 11")	2.50 (8' 2")	3.10 (10' 2")	3.75 (12' 4")
Max digging reach	mm (ft-in)	A	9945 (32' 8")	10255 (33' 8")	10815 (35' 6")	11345 (37' 3")
Max digging reach on ground		A'	9720 (31' 11")	10035 (32' 11")	10610 (34' 10")	11145 (36' 7")
Max digging depth		B	6225 (20' 5")	6625 (21' 9")	7225 (23' 8")	7880 (25' 10")
Max digging depth (8 ft level)		B'	6000 (19' 8")	6410 (21' 0")	7045 (23' 1")	7705 (25' 3")
Max vertical wall digging depth		C	5715 (18' 9")	6135 (20' 2")	6725 (22' 1")	7305 (24' 0")
Max digging height		D	10080 (33' 1")	10100 (33' 2")	10405 (34' 2")	10485 (34' 5")
Max dumping height		E	6975 (22' 11")	7040 (23' 1")	7335 (24' 1")	7450 (24' 5")
Min swing radius		F	4185 (13' 9")	3780 (12' 5")	4095 (13' 5")	4150 (13' 7")
Bucket digging force	kN	SAE	163.5 [177.5]	163.5 [177.5]	163.5 [177.5]	163.6 [177.6]
	kgf		16670 [18100]	16670 [18100]	16670 [18100]	16680 [18110]
	lbf		36750 [39900]	36750 [39900]	36750 [39900]	36770 [39930]
	kN	ISO	189.9 [206.1]	189.9 [206.1]	189.9 [206.1]	190.0 [206.2]
	kgf		19360 [21020]	19360 [21020]	19360 [21020]	19370 [21030]
	lbf		42680 [46340]	42680 [46340]	42680 [46340]	42700 [46360]
Arm digging force	kN	SAE	176.0 [191.1]	151.0 [164.0]	125.0 [135.7]	111.5 [121.0]
	kgf		17950 [19490]	15400 [16720]	12750 [13840]	11370 [12340]
	lbf		39570 [42970]	33950 [36860]	28110 [30510]	25070 [27210]
	kN	ISO	185.9 [201.9]	158.5 [172.1]	130.3 [141.5]	115.6 [125.5]
	kgf		18960 [20590]	16160 [17550]	13290 [14430]	11790 [12800]
	lbf		41800 [45390]	35630 [38690]	29300 [31810]	25990 [28220]

[ ] : Power boost

2) HX300A L/NL, 2-PIECE BOOM

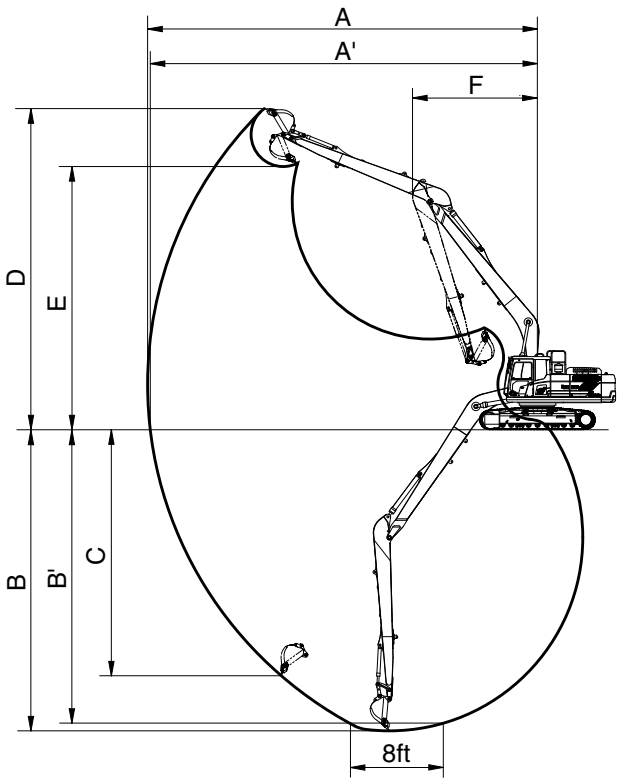


300A2SP11

Description	m (ft-in)	Boom	6.25 (20' 6")			
		Arm	2.10 (6' 11")	2.50 (8' 2")	3.10 (10' 2")	3.75 (12' 4")
Max digging reach	mm (ft-in)	A	10040 (32' 11")	10375 (34' 0")	10955 (35' 11")	11510 (37' 9")
Max digging reach on ground		A'	9815 (32' 2")	10155 (33' 4")	10750 (35' 3")	11315 (37' 1")
Max digging depth		B	5970 (19' 7")	6340 (20' 10")	6935 (22' 9")	7545 (24' 9")
Max digging depth (8 ft level)		B'	5855 (19' 3")	6230 (20' 5")	6380 (20' 11")	7455 (24' 6")
Max vertical wall digging depth		C	4020 (13' 2")	4430 (14' 6")	4920 (16' 2")	5580 (18' 4")
Max digging height		D	11475 (37' 8")	11700 (38' 5")	12180 (40' 0")	12540 (41' 2")
Max dumping height		E	8245 (27' 1")	8470 (27' 9")	8950 (29' 4")	9310 (30' 7")
Min swing radius		F	3315 (10' 11")	3150 (10' 4")	2980 (9' 9")	3185 (10' 5")
Bucket digging force	kN	SAE	163.5 [177.5]	163.5 [177.5]	163.5 [177.5]	163.6 [177.6]
	kgf		16670 [18100]	16670 [18100]	16670 [18100]	16680 [18110]
	lbf		36750 [39900]	36750 [39900]	36750 [39900]	36770 [39930]
	kN	ISO	189.9 [206.1]	189.9 [206.1]	189.9 [206.1]	190.0 [206.2]
	kgf		19360 [21020]	19360 [21020]	19360 [21020]	19370 [21030]
	lbf		42680 [46340]	42680 [46340]	42680 [46340]	42700 [46360]
Arm digging force	kN	SAE	176.0 [191.1]	151.0 [164.0]	125.0 [135.7]	111.5 [121.0]
	kgf		17950 [19490]	15400 [16720]	12750 [13840]	11370 [12340]
	lbf		39570 [42970]	33950 [36860]	28110 [30510]	25070 [27210]
	kN	ISO	185.9 [201.9]	158.5 [172.1]	130.3 [141.5]	115.6 [125.5]
	kgf		18960 [20590]	16160 [17550]	13290 [14430]	11790 [12800]
	lbf		41800 [45390]	35630 [38690]	29300 [31810]	25990 [28220]

[ ] : Power boost

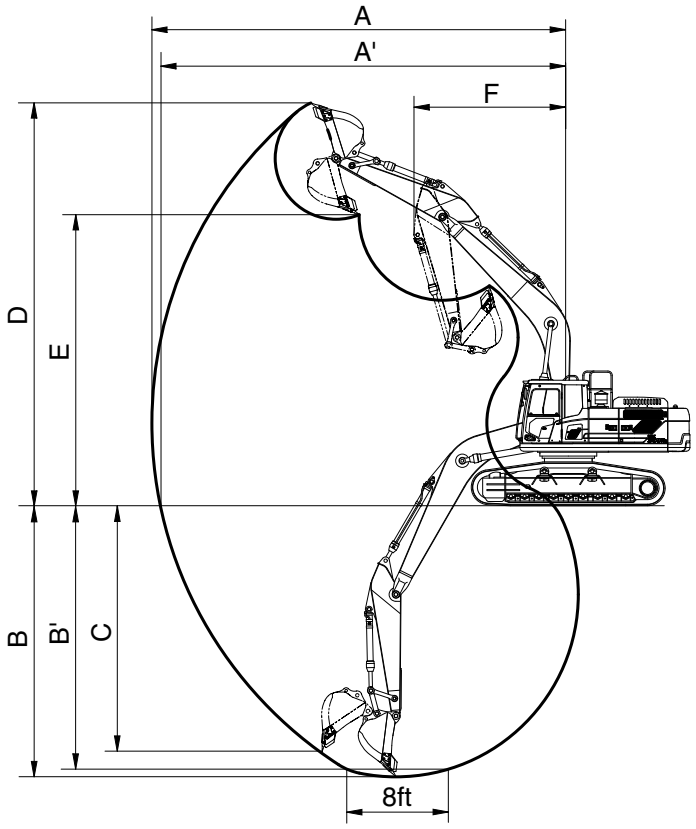
3) HX300A LR



300A2SP12

Description	m (ft-in)	Boom	10.2 (33' 6")
		Arm	7.85 (25' 9")
Max digging reach	mm (ft-in)	A	18530 (60' 10")
Max digging reach on ground		A'	18410 (60' 5")
Max digging depth		B	14740 (48' 4")
Max digging depth (8 ft level)		B'	14660 (48' 1")
Max vertical wall digging depth		C	13700 (44' 11")
Max digging height		D	14590 (47' 10")
Max dumping height		E	12270 (40' 3")
Min swing radius		F	6270 (20' 7")
Bucket digging force	kN	SAE	70.6
	kgf		7200
	lbf		15870
	kN	ISO	82.4
	kgf		8400
	lbf		18520
Arm digging force	kN	SAE	47.1
	kgf		4800
	lbf		10580
	kN	ISO	48.1
	kgf		4900
	lbf		10800

4) HX300A HW



300A2SP13

Description	m (ft-in)	Boom	6.25 (20' 6")				10.2 (33' 6")
		Arm	2.10 (6' 11")	2.50 (8' 2")	3.10 (10' 2")	3.75 (12' 4")	7.85 (25' 9")
Max digging reach	mm (ft-in)	A	9945 (32' 8")	10255 (33' 8")	10815 (35' 6")	11345 (37' 3")	18530 (60' 10")
Max digging reach on ground		A'	9635 (31' 7")	9955 (32' 8")	10535 (34' 7")	11075 (36' 4")	18370 (60' 3")
Max digging depth		B	5880 (19' 3")	6285 (20' 7")	6885 (22' 7")	7535 (24' 9")	14420 (47' 4")
Max digging depth (8 ft level)		B'	5660 (18' 7")	6070 (19' 11")	6705 (22' 0")	7360 (24' 2")	14340 (47' 1")
Max vertical wall digging depth		C	5370 (17' 7")	5795 (19' 0")	6385 (20' 11")	6965 (22' 10")	13380 (43' 11")
Max digging height		D	10420 (34' 2")	10440 (34' 3")	10745 (35' 3")	10825 (35' 6")	14910 (48' 11")
Max dumping height		E	7315 (24' 0")	7380 (24' 3")	7675 (25' 2")	7790 (25' 7")	12590 (41' 4")
Min swing radius		F	4185 (13' 9")	3780 (12' 5")	4095 (13' 5")	4150 (13' 7")	6270 (20' 7")
Bucket digging force	kN	SAE	163.5 [177.5]	163.5 [177.5]	163.5 [177.5]	163.6 [177.6]	70.6
	kgf		16670 [18100]	16670 [18100]	16670 [18100]	16680 [18110]	7200
	lbf		36750 [39900]	36750 [39900]	36750 [39900]	36770 [39930]	15870
	kN	ISO	189.9 [206.1]	189.9 [206.1]	189.9 [206.1]	190.0 [206.2]	82.4
	kgf		19360 [21020]	19360 [21020]	19360 [21020]	19370 [21030]	8400
	lbf		42680 [46340]	42680 [46340]	42680 [46340]	42700 [46360]	18520
Arm digging force	kN	SAE	176.0 [191.1]	151.0 [164.0]	125.0 [135.7]	111.5 [121.0]	47.1
	kgf		17950 [19490]	15400 [16720]	12750 [13840]	11370 [12340]	4800
	lbf		39570 [42970]	33950 [36860]	28110 [30510]	25070 [27210]	10580
	kN	ISO	185.9 [201.9]	158.5 [172.1]	130.3 [141.5]	115.6 [125.5]	48.1
	kgf		18960 [20590]	16160 [17550]	13290 [14430]	11790 [12800]	4900
	lbf		41800 [45390]	35630 [38690]	29300 [31810]	25990 [28220]	10800

[ ] : Power boost

4. WEIGHT

Item	HX300A L		HX300A NL		HX300A LR		HX300A HW	
	kg	lb	kg	lb	kg	lb	kg	lb
Upperstructure assembly								
· Main frame weld assembly	2,839	6,259	2,839	6,259	2,839	6,259	2,853	6,290
· Engine assembly	583	1,285	583	1,285	583	1,285	583	1,285
· Aftertreatment assembly	77	169	77	169	77	169	77	169
· Main pump assembly	181	399	181	399	181	399	181	399
· Main control valve assembly	220	485	220	485	220	485	220	485
· Swing motor assembly	345	761	345	761	345	761	345	761
· Hydraulic oil tank WA	205	451	205	451	205	451	205	451
· Fuel tank WA	235	518	235	518	235	518	235	518
· Counterweight	5,100	11,244	5,100	11,244	7,000	15,432	5,100	11,244
· Cab assembly	570	1,257	570	1,257	570	1,257	570	1,257
Lower chassis assembly								
· Track frame weld assembly	3,875	8,543	3,756	8,281	3,875	8,543	6,600	14,551
· Swing bearing	500	1,102	500	1,102	500	1,102	500	1,102
· Travel motor assembly (2EA)	886	1,954	886	1,954	886	1,954	886	1,954
· Turning joint	54	117	54	117	54	117	54	117
· Sprocket (2EA)	170	375	170	375	170	375	180	397
· Track recoil spring (2EA)	450	992	450	992	450	992	450	992
· Idler (2EA)	500	1,102	500	1,102	500	1,102	500	1,102
· Carrier roller (2EA)	140	309	140	309	140	309	240	529
· Track roller (18EA)	1,070	2,359	1,070	2,359	1,070	2,359	1,070	2,359
· Track-chain assembly (600 mm triple grouser shoe) (2EA)	3,760	8,289	3,760	8,289	-	-	-	-
· Track-chain assembly (700 mm triple grouser shoe) (2EA)	4,330	9,546	-	-	-	-	-	-
· Track-chain assembly (700 mm double grouser shoe) (2EA)	-	-	-	-	-	-	5,240	11,552
· Track-chain assembly (800 mm triple grouser shoe) (2EA)	4,710	10,384	-	-	4,710	10,384	-	-
· Track-chain assembly (900 mm standard triple grouser shoe) (2EA)	5,090	11,221	-	-	-	-	-	-
Front attachment assembly								
· 6.25 m boom assembly	2,400	5,291	2,400	5,291	2,400	5,291	2,400	5,291
· 3.05 m arm assembly	1,070	2,359	1,070	2,359	1,070	2,359	1,070	2,359
· 1.27 m^3 SAE heaped bucket	1,130	2,491	1,130	2,491	1,130	2,491	1,130	2,491
· 10.2 m boom assembly	3,150	6,944	3,150	6,944	3,150	6,944	3,150	6,944
· 7.85 m arm assembly	1,425	3,142	1,425	3,142	1,425	3,142	1,425	3,142
· 0.52 m^3 SAE heaped bucket	470	1,036	470	1,036	470	1,036	470	1,036
· Boom cylinder assembly (2EA)	540	1,190	540	1,190	540	1,190	540	1,190
· Arm cylinder assembly	360	793	360	793	360	793	360	793
· Bucket cylinder assembly	220	485	220	485	140	308	220	485
· Bucket control linkage total	280	617	280	617	130	287	280	617

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

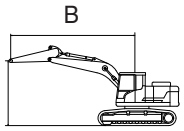
※ Refer to Transportation for actual weight information and Specifications for operating weight.

5. LIFTING CAPACITIES

1) HX300A L

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	3100	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
7.5 m (24.6 ft)	kg													*5100	*5100	7.39
	lb													*11240	*11240	(24.3)
6.0 m (19.7 ft)	kg							*6460	*6460	*6340	*6340			*4910	*4910	8.31
	lb							*14240	*14240	*13980	*13980			*10820	*10820	(27.3)
4.5 m (14.8 ft)	kg					*9190	*9190	*7590	*7590	*6850	6360			*4930	4850	8.87
	lb					*20260	*20260	*16730	*16730	*15100	14020			*10870	10690	(29.1)
3.0 m (9.8 ft)	kg					*12250	*12250	*9040	8480	*7600	6130	*6240	4650	*5110	4520	9.15
	lb					*27010	*27010	*19930	18700	*16760	13510	*13760	10250	*11270	9960	(30.0)
1.5 m (4.9 ft)	kg					*14720	12110	*10420	8080	*8370	5910	7020	4540	*5480	4410	9.18
	lb					*32450	26700	*22970	17810	*18450	13030	15480	10010	*12080	9720	(30.1)
0.0 m (0.0 ft)	kg					*15870	11770	*11360	7810	*8960	5750			*6120	4510	8.95
	lb					*34990	25950	*25040	17220	*19750	12680			*13490	9940	(29.4)
-1.5 m (-4.9 ft)	kg	*7050	*7050	*10400	*10400	*15990	11690	*11720	7700	8960	5680			*7230	4850	8.45
	lb	*15540	*15540	*22930	*22930	*35250	25770	*25840	16980	19750	12520			*15940	10690	(27.7)
-3.0 m (-9.8 ft)	kg	*12200	*12200	*16800	*16800	*15240	11790	*11370	7740	*8720	5740			*8500	5620	7.62
	lb	*26900	*26900	*37040	*37040	*33600	25990	*25070	17060	*19220	12650			*18740	12390	(25.0)
-4.5 m (-14.8 ft)	kg			*18600	*18600	*13310	12070	*9770	7960					*9020	7420	6.33
	lb			*41010	*41010	*29340	26610	*21540	17550					*19890	16360	(20.8)

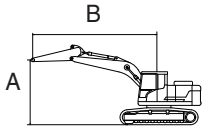
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	2100	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg lb					*7600 *16760	*7600 *16760			*7720 *17020	*7720 *17020	6.27 (20.6)
6.0 m (19.7 ft)	kg lb					*7840 *17280	*7840 *17280			*7680 *16930	6640 14640	7.33 (24.0)
4.5 m (14.8 ft)	kg lb					*8890 *19600	8790 19380	*7890 *17390	6310 13910	*7810 *17220	5740 12650	7.96 (26.1)
3.0 m (9.8 ft)	kg lb					*10230 *22550	8390 18500	*8480 *18700	6130 13510	*8040 *17730	5310 11710	8.28 (27.2)
1.5 m (4.9 ft)	kg lb					*11340 *25000	8080 17810	*9070 *20000	5970 13160	7990 17610	5190 11440	8.31 (27.3)
0.0 m (0.0 ft)	kg lb					*11910 *26260	7930 17480	9160 20190	5880 12960	8290 18280	5360 11820	8.06 (26.4)
-1.5 m (-4.9 ft)	kg lb			*15680 *34570	12010 26480	*11810 *26040	7910 17440			*9150 *20170	5910 13030	7.49 (24.6)
-3.0 m (-9.8 ft)	kg lb	*18840 *41540	*18840 *41540	*14240 *31390	12200 26900	*10750 *23700	8050 17750			*9550 *21050	7210 15900	6.54 (21.4)
-4.5 m (-14.8 ft)	kg lb			*10850 *23920	*10850 *23920					*9590 *21140	*9590 *21140	4.96 (16.3)

Note 1. Lifting capacity are based on ISO 10567.

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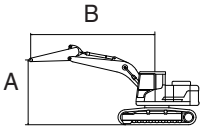
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	2500	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg					*6850	*6850			*7060	*7060	6.68
	lb					*15100	*15100			*15560	*15560	(21.9)
6.0 m (19.7 ft)	kg					*7240	*7240	*7060	6410	*7090	6160	7.68
	lb					*15960	*15960	*15560	14130	*15630	13580	(25.2)
4.5 m (14.8 ft)	kg			*10470	*10470	*8320	*8320	*7410	6280	*7260	5360	8.29
	lb			*23080	*23080	*18340	*18340	*16340	13850	*16010	11820	(27.2)
3.0 m (9.8 ft)	kg			*13530	12550	*9700	8360	*8070	6080	*7510	4970	8.59
	lb			*29830	27670	*21380	18430	*17790	13400	*16560	10960	(28.2)
1.5 m (4.9 ft)	kg					*10920	8010	*8740	5890	7490	4840	8.62
	lb					*24070	17660	*19270	12990	16510	10670	(28.3)
0.0 m (0.0 ft)	kg			*16100	11760	*11640	7800	9050	5770	7740	4980	8.38
	lb			*35490	25930	*25660	17200	19950	12720	17060	10980	(27.5)
-1.5 m (-4.9 ft)	kg	*10830	*10830	*15790	11780	*11740	7750	9030	5750	8500	5440	7.84
	lb	*23880	*23880	*34810	25970	*25880	17090	19910	12680	18740	11990	(25.7)
-3.0 m (-9.8 ft)	kg	*20070	*20070	*14630	11940	*11020	7850			*9180	6490	6.93
	lb	*44250	*44250	*32250	26320	*24290	17310			*20240	14310	(22.7)
-4.5 m (-14.8 ft)	kg	*16260	*16260	*11980	*11980					*9570	9290	5.47
	lb	*35850	*35850	*26410	*26410					*21100	20480	(17.9)

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4. *Indicates load limited by hydraulic capacity.

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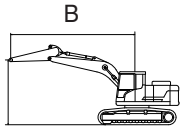
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	3750	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
9.0 m (29.5 ft)	kg													*4560	*4560	6.76
	lb													*10050	*10050	(22.2)
7.5 m (24.6 ft)	kg									*5430	*5430			*4210	*4210	8.04
	lb									*11970	*11970			*9280	*9280	(26.4)
6.0 m (19.7 ft)	kg									*5590	*5590			*4090	*4090	8.89
	lb									*12320	*12320			*9020	*9020	(29.2)
4.5 m (14.8 ft)	kg							*6690	*6690	*6170	*6170	*5660	4770	*4130	*4130	9.42
	lb							*14750	*14750	*13600	*13600	*12480	10520	*9110	*9110	(30.9)
3.0 m (9.8 ft)	kg					*10750	*10750	*8190	*8190	*6990	6150	*6380	4640	*4290	4120	9.68
	lb					*23700	*23700	*18060	*18060	*15410	13560	*14070	10230	*9460	9080	(31.8)
1.5 m (4.9 ft)	kg					*13550	12250	*9700	8110	*7850	5890	*6850	4500	*4600	4010	9.71
	lb					*29870	27010	*21380	17880	*17310	12990	*15100	9920	*10140	8840	(31.9)
0.0 m (0.0 ft)	kg			*6600	*6600	*15230	11720	*10860	7770	*8580	5690	6870	4400	*5120	4070	9.50
	lb			*14550	*14550	*33580	25840	*23940	17130	*18920	12540	15150	9700	*11290	8970	(31.2)
-1.5 m (-4.9 ft)	kg	*6790	*6790	*10200	*10200	*15840	11520	*11480	7590	8860	5570	*6220	4350	*5990	4330	9.03
	lb	*14970	*14970	*22490	*22490	*34920	25400	*25310	16730	19530	12280	*13710	9590	*13210	9550	(29.6)
-3.0 m (-9.8 ft)	kg	*10680	*10680	*14930	*14930	*15540	11540	*11470	7560	8850	5560			*7570	4910	8.25
	lb	*23550	*23550	*32910	*32910	*34260	25440	*25290	16670	19510	12260			*16690	10820	(27.1)
-4.5 m (-14.8 ft)	kg	*15430	*15430	*20490	*20490	*14220	11750	*10560	7690					*8510	6160	7.08
	lb	*34020	*34020	*45170	*45170	*31350	25900	*23280	16950					*18760	13580	(23.2)
-6.0 m (-19.7 ft)	kg					*11010	*11010							*9190	*9190	5.23
	lb					*24270	*24270							*20260	*20260	(17.2)

Note 1. Lifting capacity are based on ISO 10567.

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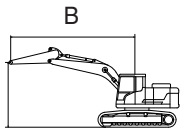
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A LR	LONG REACH	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		10200	7850	7000	800	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)																						At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		12.0 m (39.4 ft)		13.5 m (44.3 ft)		15.0 m (49.2 ft)		16.5 m (54.1 ft)		Capacity		Reach
																										m (ft)
13.5 m	kg																							*800	*800	12.92
44.3 ft	lb																							*1760	*1760	(42.4)
12.0 m	kg																	*1060	*1060					*750	*750	14.12
39.4 ft	lb																	*2340	*2340					*1650	*1650	(46.3)
10.5 m	kg																	*1360	*1360	*770	*770			*720	*720	15.07
34.4 ft	lb																	*3000	*3000	*1700	*1700			*1590	*1590	(49.5)
9.0 m	kg																	*1540	*1540	*1150	*1150			*700	*700	15.83
29.5 ft	lb																	*3400	*3400	*2540	*2540			*1540	*1540	(51.9)
7.5 m	kg																	*1710	*1710	*1400	*1400			*700	*700	16.41
24.6 ft	lb																	*3770	*3770	*3090	*3090			*1540	*1540	(53.8)
6.0 m	kg															*2070	*2070	*1910	*1910	*1600	*1600	*960	*960	*710	*710	16.83
19.7 ft	lb															*4560	*4560	*4210	*4210	*3530	*3530	*2120	*2120	*1570	*1570	(55.2)
4.5 m	kg													*2620	*2620	*2430	*2430	*2170	*2170	*1810	*1810	*1180	*1180	*730	*730	17.12
14.8 ft	lb													*5780	*5780	*5360	*5360	*4780	*4780	*3990	*3990	*2600	*2600	*1610	*1610	(56.2)
3.0 m	kg					*7990	*7990			*4550	*4550	*3870	*3870	*3420	*3420	*2970	*2970	*2520	*2520	*2030	*2030	*1340	*1340	*760	*760	17.26
9.8 ft	lb					*17610	*17610			*10030	*10030	*8530	*8530	*7540	*7540	*6550	*6550	*5560	*5560	*4480	*4480	*2950	*2950	*1680	*1680	(56.6)
1.5 m	kg					*4090	*4090	*7100	*7100	*5420	*5420	*4460	*4460	*3840	3630	*3420	2950	*2960	2430	*2270	2010	*1450	*1450	*810	*810	17.28
4.9 ft	lb					*9020	*9020	*15650	*15650	*11950	*11950	*9830	*9830	*8470	8000	*7540	6500	*6530	5360	*5000	4430	*3200	*3200	*1790	*1790	(56.7)
0.0 m	kg			*1270	*1270	*3050	*3050	*7210	7130	*6190	5360	*5000	4210	*4230	3390	*3710	2780	*3340	2300	*2500	1920	*1480	*1480	*870	*870	17.16
0.0 ft	lb			*2800	*2800	*6720	*6720	*15900	15720	*13650	11820	*11020	9280	*9330	7470	*8180	6130	*7360	5070	*5510	4230	*3260	*3260	*1920	*1920	(56.3)
-1.5 m	kg	*1320	*1320	*1820	*1820	*3130	*3130	*5930	*5930	*6800	5000	*5460	3940	*4580	3190	*3980	2630	*3540	2200	*2680	1840	*1380	*1380	*950	*950	16.90
-4.9 ft	lb	*2910	*2910	*4010	*4010	*6900	*6900	*13070	*13070	*14990	11020	*12040	8690	*10100	7030	*8770	5800	*7800	4850	*5910	4060	*3040	*3040	*2090	*2090	(55.5)
-3.0 m	kg	*1960	*1960	*2450	*2450	*3590	*3590	*5880	*5880	*7230	4760	*5820	3750	*4870	3040	*4200	2520	3590	2110	*2700	1790	*1070	*1070	*1050	*1050	16.51
-9.8 ft	lb	*4320	*4320	*5400	*5400	*7910	*7910	*12960	*12960	*15940	10490	*12830	8270	*10740	6700	*9260	5560	7910	4650	*5950	3950	*2360	*2360	*2310	*2310	(54.2)
-4.5 m	kg	*2620	*2620	*3140	*3140	*4230	*4230	*6350	6280	*7490	4630	*6060	3630	5000	2940	4160	2440	3530	2060	*2460	1760			*1200	*1200	15.96
-14.8 ft	lb	*5780	*5780	*6920	*6920	*9330	*9330	*14000	13850	*16510	10210	*13360	8000	11020	6480	9170	5380	7780	4540	*5420	3880			*2650	*2650	(52.4)
-6.0 m	kg	*3310	*3310	*3900	*3900	*5040	*5040	*7170	6270	*7590	4590	6130	3570	4950	2890	4120	2410	3510	2040	*1790	1760			*1400	*1400	15.25
-19.7 ft	lb	*7300	*7300	*8600	*8600	*11110	*11110	*15810	13820	*16730	10120	13510	7870	10910	6370	9080	5310	7740	4500	*3950	3880			*3090	*3090	(50.0)
-7.5 m	kg	*4060	*4060	*4760	*4760	*6010	*6010	*8340	6350	*7510	4610	6130	3580	4950	2900	4130	2410	*3340	2060					*1690	*1690	14.34
-24.6 ft	lb	*8950	*8950	*10490	*10490	*13250	*13250	*18390	14000	*16560	10160	13510	7890	10910	6390	9110	5310	*7360	4540					*3730	*3730	(47.0)
-9.0 m	kg	*4900	*4900	5740	5740	*7210	*7210	*9080	6500	*7240	4710	5960	3650	*5000	2950	4190	2480							*2150	*2150	13.20
-29.5 ft	lb	*10800	*10800	12650	12650	*15900	*15900	*20020	14330	*15960	10380	13140	8050	*11020	6500	9240	5470							*4740	*4740	(43.3)
-10.5 m	kg	*5840	*5840	6910	6910	*8770	*8770	*8360	6740	*6720	4880	5540	3780	*4600	3080									*3010	2680	11.75
-34.4 ft	lb	*12870	*12870	15230	15230	*19330	*19330	*18430	14860	*14820	10760	12210	8330	*10140	6790									*6640	5910	(38.6)
-12.0 m	kg			*8380	*8380	*9270	*9270	*7220	7080	*5810	5140	*4710	4020											*4130	3580	9.86
-39.4 ft	lb			*18470	*18470	*20440	*20440	*15920	15610	*12810	11330	*10380	8860											*9110	7890	(32.4)

Note 1. Lifting capacity are based on ISO 10567.

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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

4. *Indicates load limited by hydraulic capacity.

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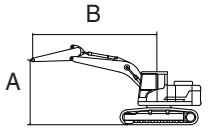
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6255	2100	7500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)						At max. reach		
		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
										m (ft)
9.0 m (29.5 ft)	kg	*11670	*11670					*11610	*11610	4.66
	lb	*25730	*25730					*25600	*25600	(15.3)
7.5 m (24.6 ft)	kg	*11100	*11100	*9800	*9800			*9680	8830	6.39
	lb	*24470	*24470	*21610	*21610			*21340	19470	(21.0)
6.0 m (19.7 ft)	kg	*12130	*12130	*9970	9710			*8880	6900	7.43
	lb	*26740	*26740	*21980	21410			*19580	15210	(24.4)
4.5 m (14.8 ft)	kg			*10720	9350	*8920	6720	*8320	6000	8.06
	lb			*23630	20610	*19670	14820	*18340	13230	(26.4)
3.0 m (9.8 ft)	kg			*11500	8930	*9240	6540	*8160	5580	8.37
	lb			*25350	19690	*20370	14420	*17990	12300	(27.5)
1.5 m (4.9 ft)	kg			*11840	8620	*9310	6380	*8080	5470	8.40
	lb			*26100	19000	*20530	14070	*17810	12060	(27.6)
0.0 m (0.0 ft)	kg			*11450	8480	*8910	6300	*7770	5670	8.15
	lb			*25240	18700	*19640	13890	*17130	12500	(26.7)
-1.5 m (-4.9 ft)	kg	*12630	*12630	*10200	8490	*7490	6350	*7230	6260	7.60
	lb	*27840	*27840	*22490	18720	*16510	14000	*15940	13800	(24.9)
-3.0 m (-9.8 ft)	kg			*7600	*7600					
	lb			*16760	*16760					

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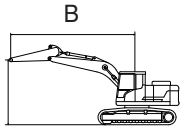
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6255	2500	7500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg			*10650	*10650					*8830	*8830	5.25
	lb			*23480	*23480					*19470	*19470	(17.2)
7.5 m (24.6 ft)	kg			*10350	*10350	*9190	*9190			*7670	*7670	6.83
	lb			*22820	*22820	*20260	*20260			*16910	*16910	(22.4)
6.0 m (19.7 ft)	kg	*10740	*10740	*11410	*11410	*9490	*9490	*8260	6840	*7240	6370	7.81
	lb	*23680	*23680	*25150	*25150	*20920	*20920	*18210	15080	*15960	14040	(25.6)
4.5 m (14.8 ft)	kg			*13370	*13370	*10280	9360	*8520	6700	*7170	5580	8.41
	lb			*29480	*29480	*22660	20640	*18780	14770	*15810	12300	(27.6)
3.0 m (9.8 ft)	kg					*11150	8910	*8990	6490	*7360	5200	8.71
	lb					*24580	19640	*19820	14310	*16230	11460	(28.6)
1.5 m (4.9 ft)	kg					*11650	8540	*9170	6300	*7620	5090	8.74
	lb					*25680	18830	*20220	13890	*16800	11220	(28.7)
0.0 m (0.0 ft)	kg			*14330	12590	*11470	8350	*8950	6180	*7440	5250	8.50
	lb			*31590	27760	*25290	18410	*19730	13620	*16400	11570	(27.9)
-1.5 m (-4.9 ft)	kg			*13300	12650	*10470	8320	*7970	6180	*7050	5740	7.97
	lb			*29320	27890	*23080	18340	*17570	13620	*15540	12650	(26.1)
-3.0 m (-9.8 ft)	kg			*10530	*10530	*8340	*8340			*6210	*6210	7.08
	lb			*23210	*23210	*18390	*18390			*13690	*13690	(23.2)

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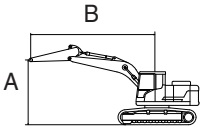
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6255	3100	7500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
10.5 m (34.4 ft)	kg											*7560	*7560	3.77
	lb											*16670	*16670	(12.4)
9.0 m (29.5 ft)	kg					*6420	*6420					*5630	*5630	6.18
	lb					*14150	*14150					*12410	*12410	(20.3)
7.5 m (24.6 ft)	kg					*7910	*7910	*5390	*5390			*4990	*4990	7.56
	lb					*17440	*17440	*11880	*11880			*11000	*11000	(24.8)
6.0 m (19.7 ft)	kg			*8240	*8240	*8650	*8650	*7740	6960			*4740	*4740	8.46
	lb			*18170	*18170	*19070	*19070	*17060	15340			*10450	*10450	(27.8)
4.5 m (14.8 ft)	kg			*12370	*12370	*9730	9520	*8070	6780	*4800	*4800	*4680	*4680	9.01
	lb			*27270	*27270	*21450	20990	*17790	14950	*10580	*10580	*10320	*10320	(29.6)
3.0 m (9.8 ft)	kg			*14600	13710	*10740	9040	*8640	6540	*6840	4970	*4780	4730	9.29
	lb			*32190	30230	*23680	19930	*19050	14420	*15080	10960	*10540	10430	(30.5)
1.5 m (4.9 ft)	kg			*15820	12910	*11460	8610	*9060	6320	*7050	4870	*5040	4630	9.32
	lb			*34880	28460	*25260	18980	*19970	13930	*15540	10740	*11110	10210	(30.6)
0.0 m (0.0 ft)	kg			*15590	12580	*11570	8350	*9040	6160	*6640	4810	*5510	4750	9.09
	lb			*34370	27730	*25510	18410	*19930	13580	*14640	10600	*12150	10470	(29.8)
-1.5 m (-4.9 ft)	kg	*9290	*9290	*14280	12540	*10920	8260	*8450	6100			*6330	5120	8.60
	lb	*20480	*20480	*31480	27650	*24070	18210	*18630	13450			*13960	11290	(28.2)
-3.0 m (-9.8 ft)	kg			*11940	*11940	*9310	8330	*6770	6190			*6110	5920	7.79
	lb			*26320	*26320	*20530	18360	*14930	13650			*13470	13050	(25.5)

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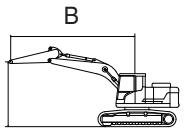
2) HX300A NL

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	2100	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg					*7600	*7600			*7720	*7720	6.27
(24.6 ft)	lb					*16760	*16760			*17020	*17020	(20.6)
6.0 m	kg					*7840	*7840			*7680	6110	7.33
(19.7 ft)	lb					*17280	*17280			*16930	13470	(24.0)
4.5 m	kg					*8890	8060	*7890	5800	*7810	5270	7.96
(14.8 ft)	lb					*19600	17770	*17390	12790	*17220	11620	(26.1)
3.0 m	kg					*10230	7670	*8480	5620	*8040	4870	8.28
(9.8 ft)	lb					*22550	16910	*18700	12390	*17730	10740	(27.2)
1.5 m	kg					*11340	7370	*9070	5470	7960	4750	8.31
(4.9 ft)	lb					*25000	16250	*20000	12060	17550	10470	(27.3)
0.0 m	kg					*11910	7210	9130	5370	8260	4900	8.06
(0.0 ft)	lb					*26260	15900	20130	11840	18210	10800	(26.4)
-1.5 m	kg			*15680	10830	*11810	7200			*9150	5400	7.49
(-4.9 ft)	lb			*34570	23880	*26040	15870			*20170	11900	(24.6)
-3.0 m	kg	*18840	*18840	*14240	11010	*10750	7330			*9550	6580	6.54
(-9.8 ft)	lb	*41540	*41540	*31390	24270	*23700	16160			*21050	14510	(21.4)
-4.5 m	kg			*10850	*10850					*9590	*9590	4.96
(-14.8 ft)	lb			*23920	*23920					*21140	*21140	(16.3)

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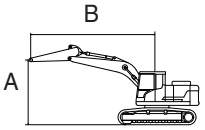
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	2500	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg					*6850	*6850			*7060	*7060	6.68
	lb					*15100	*15100			*15560	*15560	(21.9)
6.0 m (19.7 ft)	kg					*7240	*7240	*7060	5890	*7090	5660	7.68
	lb					*15960	*15960	*15560	12990	*15630	12480	(25.2)
4.5 m (14.8 ft)	kg			*10470	*10470	*8320	8060	*7410	5770	*7260	4920	8.29
	lb			*23080	*23080	*18340	17770	*16340	12720	*16010	10850	(27.2)
3.0 m (9.8 ft)	kg			*13530	11350	*9700	7640	*8070	5570	*7510	4550	8.59
	lb			*29830	25020	*21380	16840	*17790	12280	*16560	10030	(28.2)
1.5 m (4.9 ft)	kg					*10920	7290	*8740	5380	7460	4430	8.62
	lb					*24070	16070	*19270	11860	16450	9770	(28.3)
0.0 m (0.0 ft)	kg			*16100	10580	*11640	7090	9020	5260	7710	4540	8.38
	lb			*35490	23320	*25660	15630	19890	11600	17000	10010	(27.5)
-1.5 m (-4.9 ft)	kg	*10830	*10830	*15790	10600	*11740	7040	9000	5240	8470	4960	7.84
	lb	*23880	*23880	*34810	23370	*25880	15520	19840	11550	18670	10930	(25.7)
-3.0 m (-9.8 ft)	kg	*20070	*20070	*14630	10760	*11020	7130			*9180	5920	6.93
	lb	*44250	*44250	*32250	23720	*24290	15720			*20240	13050	(22.7)
-4.5 m (-14.8 ft)	kg	*16260	*16260	*11980	11120					*9570	8450	5.47
	lb	*35850	*35850	*26410	24520					*21100	18630	(17.9)

Note 1. Lifting capacity are based on ISO 10567.
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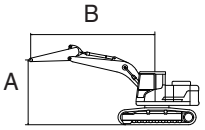
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	3100	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
7.5 m (24.6 ft)	kg													*5100	*5100	7.39
	lb													*11240	*11240	(24.3)
6.0 m (19.7 ft)	kg							*6460	*6460	*6340	6000			*4910	*4910	8.31
	lb							*14240	*14240	*13980	13230			*10820	*10820	(27.3)
4.5 m (14.8 ft)	kg					*9190	*9190	*7590	*7590	*6850	5840			*4930	4450	8.87
	lb					*20260	*20260	*16730	*16730	*15100	12870			*10870	9810	(29.1)
3.0 m (9.8 ft)	kg					*12250	11670	*9040	7750	*7600	5620	*6240	4250	*5110	4140	9.15
	lb					*27010	25730	*19930	17090	*16760	12390	*13760	9370	*11270	9130	(30.0)
1.5 m (4.9 ft)	kg					*14720	10920	*10420	7360	*8370	5400	7000	4150	*5480	4030	9.18
	lb					*32450	24070	*22970	16230	*18450	11900	15430	9150	*12080	8880	(30.1)
0.0 m (0.0 ft)	kg					*15870	10590	*11360	7100	*8960	5240			*6120	4110	8.95
	lb					*34990	23350	*25040	15650	*19750	11550			*13490	9060	(29.4)
-1.5 m (-4.9 ft)	kg	*7050	*7050	*10400	*10400	*15990	10520	*11720	6990	8930	5170			*7230	4430	8.45
	lb	*15540	*15540	*22930	*22930	*35250	23190	*25840	15410	19690	11400			*15940	9770	(27.7)
-3.0 m (-9.8 ft)	kg	*12200	*12200	*16800	*16800	*15240	10610	*11370	7020	*8720	5230			*8500	5130	7.62
	lb	*26900	*26900	*37040	*37040	*33600	23390	*25070	15480	*19220	11530			*18740	11310	(25.0)
-4.5 m (-14.8 ft)	kg			*18600	*18600	*13310	10880	*9770	7240					*9020	6760	6.33
	lb			*41010	*41010	*29340	23990	*21540	15960					*19890	14900	(20.8)

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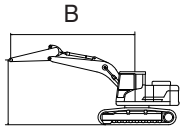
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	3750	6500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
9.0 m (29.5 ft)	kg													*4560	*4560	6.76
	lb													*10050	*10050	(22.2)
7.5 m (24.6 ft)	kg									*5430	*5430			*4210	*4210	8.04
	lb									*11970	*11970			*9280	*9280	(26.4)
6.0 m (19.7 ft)	kg									*5590	*5590			*4090	*4090	8.89
	lb									*12320	*12320			*9020	*9020	(29.2)
4.5 m (14.8 ft)	kg							*6690	*6690	*6170	5890	*5660	4370	*4130	4030	9.42
	lb							*14750	*14750	*13600	12990	*12480	9630	*9110	8880	(30.9)
3.0 m (9.8 ft)	kg					*10750	*10750	*8190	7840	*6990	5630	*6380	4250	*4290	3760	9.68
	lb					*23700	*23700	*18060	17280	*15410	12410	*14070	9370	*9460	8290	(31.8)
1.5 m (4.9 ft)	kg					*13550	11050	*9700	7380	*7850	5380	*6850	4110	*4600	3660	9.71
	lb					*29870	24360	*21380	16270	*17310	11860	*15100	9060	*10140	8070	(31.9)
0.0 m (0.0 ft)	kg			*6600	*6600	*15230	10540	*10860	7050	*8580	5180	6850	4000	*5120	3710	9.50
	lb			*14550	*14550	*33580	23240	*23940	15540	*18920	11420	15100	8820	*11290	8180	(31.2)
-1.5 m (-4.9 ft)	kg	*6790	*6790	*10200	*10200	*15840	10350	*11480	6870	8830	5070	*6220	3960	*5990	3940	9.03
	lb	*14970	*14970	*22490	*22490	*34920	22820	*25310	15150	19470	11180	*13710	8730	*13210	8690	(29.6)
-3.0 m (-9.8 ft)	kg	*10680	*10680	*14930	*14930	*15540	10370	*11470	6850	8820	5060			*7570	4470	8.25
	lb	*23550	*23550	*32910	*32910	*34260	22860	*25290	15100	19440	11160			*16690	9850	(27.1)
-4.5 m (-14.8 ft)	kg	*15430	*15430	*20490	*20490	*14220	10570	*10560	6980					*8510	5610	7.08
	lb	*34020	*34020	*45170	*45170	*31350	23300	*23280	15390					*18760	12370	(23.2)
-6.0 m (-19.7 ft)	kg					*11010	*11010							*9190	8880	5.23
	lb					*24270	*24270							*20260	19580	(17.2)

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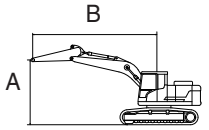
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6255	2100	7500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)						At max. reach		
		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
										m (ft)
9.0 m (29.5 ft)	kg	*11670	*11670					*11610	*11610	4.66
	lb	*25730	*25730					*25600	*25600	(15.3)
7.5 m (24.6 ft)	kg	*11100	*11100	*9800	9060			*9680	8130	6.39
	lb	*24470	*24470	*21610	19970			*21340	17920	(21.0)
6.0 m (19.7 ft)	kg	*12130	*12130	*9970	8930			*8880	6350	7.43
	lb	*26740	*26740	*21980	19690			*19580	14000	(24.4)
4.5 m (14.8 ft)	kg			*10720	8580	*8920	6180	*8320	5510	8.06
	lb			*23630	18920	*19670	13620	*18340	12150	(26.4)
3.0 m (9.8 ft)	kg			*11500	8170	*9240	6000	*8160	5120	8.37
	lb			*25350	18010	*20370	13230	*17990	11290	(27.5)
1.5 m (4.9 ft)	kg			*11840	7860	*9310	5840	*8080	5020	8.40
	lb			*26100	17330	*20530	12870	*17810	11070	(27.6)
0.0 m (0.0 ft)	kg			*11450	7720	*8910	5760	*7770	5190	8.15
	lb			*25240	17020	*19640	12700	*17130	11440	(26.7)
-1.5 m (-4.9 ft)	kg	*12630	11650	*10200	7740	*7490	5810	*7230	5730	7.60
	lb	*27840	25680	*22490	17060	*16510	12810	*15940	12630	(24.9)
-3.0 m (-9.8 ft)	kg			*7600	*7600					
	lb			*16760	*16760					

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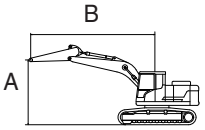
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6255	2500	7500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg			*10650	*10650					*8830	*8830	5.25
	lb			*23480	*23480					*19470	*19470	(17.2)
7.5 m (24.6 ft)	kg			*10350	*10350	*9190	9140			*7670	7340	6.83
	lb			*22820	*22820	*20260	20150			*16910	16180	(22.4)
6.0 m (19.7 ft)	kg	*10740	*10740	*11410	*11410	*9490	8970	*8260	6290	*7240	5860	7.81
	lb	*23680	*23680	*25150	*25150	*20920	19780	*18210	13870	*15960	12920	(25.6)
4.5 m (14.8 ft)	kg			*13370	13120	*10280	8590	*8520	6150	*7170	5120	8.41
	lb			*29480	28920	*22660	18940	*18780	13560	*15810	11290	(27.6)
3.0 m (9.8 ft)	kg					*11150	8140	*8990	5950	*7360	4770	8.71
	lb					*24580	17950	*19820	13120	*16230	10520	(28.6)
1.5 m (4.9 ft)	kg					*11650	7780	*9170	5760	*7620	4660	8.74
	lb					*25680	17150	*20220	12700	*16800	10270	(28.7)
0.0 m (0.0 ft)	kg			*14330	11340	*11470	7590	*8950	5650	*7440	4800	8.50
	lb			*31590	25000	*25290	16730	*19730	12460	*16400	10580	(27.9)
-1.5 m (-4.9 ft)	kg			*13300	11400	*10470	7570	*7970	5650	*7050	5250	7.97
	lb			*29320	25130	*23080	16690	*17570	12460	*15540	11570	(26.1)
-3.0 m (-9.8 ft)	kg			*10530	*10530	*8340	7700			*6210	*6210	7.08
	lb			*23210	*23210	*18390	16980			*13690	*13690	(23.2)

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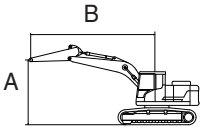
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3100	7500	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
10.5 m (34.4 ft)	kg											*7560	*7560	3.77
	lb											*16670	*16670	(12.4)
9.0 m (29.5 ft)	kg					*6420	*6420					*5630	*5630	6.18
	lb					*14150	*14150					*12410	*12410	(20.3)
7.5 m (24.6 ft)	kg					*7910	*7910	*5390	*5390			*4990	*4990	7.56
	lb					*17440	*17440	*11880	*11880			*11000	*11000	(24.8)
6.0 m (19.7 ft)	kg			*8240	*8240	*8650	*8650	*7740	6410			*4740	*4740	8.46
	lb			*18170	*18170	*19070	*19070	*17060	14130			*10450	*10450	(27.8)
4.5 m (14.8 ft)	kg			*12370	*12370	*9730	8740	*8070	6230	*4800	4640	*4680	4630	9.01
	lb			*27270	*27270	*21450	19270	*17790	13730	*10580	10230	*10320	10210	(29.6)
3.0 m (9.8 ft)	kg			*14600	12430	*10740	8270	*8640	6000	*6840	4560	*4780	4330	9.29
	lb			*32190	27400	*23680	18230	*19050	13230	*15080	10050	*10540	9550	(30.5)
1.5 m (4.9 ft)	kg			*15820	11650	*11460	7850	*9060	5780	*7050	4460	*5040	4240	9.32
	lb			*34880	25680	*25260	17310	*19970	12740	*15540	9830	*11110	9350	(30.6)
0.0 m (0.0 ft)	kg			*15590	11330	*11570	7600	*9040	5620	*6640	4400	*5510	4340	9.09
	lb			*34370	24980	*25510	16760	*19930	12390	*14640	9700	*12150	9570	(29.8)
-1.5 m (-4.9 ft)	kg	*9290	*9290	*14280	11300	*10920	7510	*8450	5570			*6330	4680	8.60
	lb	*20480	*20480	*31480	24910	*24070	16560	*18630	12280			*13960	10320	(28.2)
-3.0 m (-9.8 ft)	kg			*11940	11440	*9310	7570	*6770	5660			*6110	5410	7.79
	lb			*26320	25220	*20530	16690	*14930	12480			*13470	11930	(25.5)

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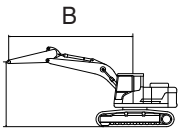
3) HX300A HW

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	2100	6500	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg					*7540	*7540			*7690	*7690	6.56
	lb					*16620	*16620			*16950	*16950	(21.5)
6.0 m (19.7 ft)	kg			*9320	*9320	*8030	*8030	*7700	*7700	*7700	*7700	7.50
	lb			*20550	*20550	*17700	*17700	*16980	*16980	*16980	*16980	(24.6)
4.5 m (14.8 ft)	kg					*9190	*9190	*8010	7670	*7860	6880	8.06
	lb					*20260	*20260	*17660	16910	*17330	15170	(26.4)
3.0 m (9.8 ft)	kg					*10520	10250	*8620	7490	*8110	6470	8.31
	lb					*23190	22600	*19000	16510	*17880	14260	(27.3)
1.5 m (4.9 ft)	kg					*11520	9960	*9170	7340	*8430	6420	8.28
	lb					*25400	21960	*20220	16180	*18580	14150	(27.1)
0.0 m (0.0 ft)	kg					*11950	9830	*9410	7260	*8820	6730	7.96
	lb					*26350	21670	*20750	16010	*19440	14840	(26.1)
-1.5 m (-4.9 ft)	kg			*15450	15130	*11680	9850			*9240	7560	7.31
	lb			*34060	33360	*25750	21720			*20370	16670	(24.0)
-3.0 m (-9.8 ft)	kg	*18160	*18160	*13730	*13730	*10230	10050			*9620	9520	6.25
	lb	*40040	*40040	*30270	*30270	*22550	22160			*21210	20990	(20.5)

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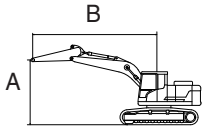
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited by hydraulic capacity.

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	2500	6500	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
7.5 m (24.6 ft)	kg					*6860	*6860			*7050	*7050	6.95
	lb					*15120	*15120			*15540	*15540	(22.8)
6.0 m (19.7 ft)	kg					*7440	*7440	*7090	*7090	*7120	*7120	7.85
	lb					*16400	*16400	*15630	*15630	*15700	*15700	(25.7)
4.5 m (14.8 ft)	kg			*11160	*11160	*8630	*8630	*7550	*7550	*7310	6440	8.38
	lb			*24600	*24600	*19030	*19030	*16640	*16640	*16120	14200	(27.5)
3.0 m (9.8 ft)	kg					*10010	*10010	*8230	7430	*7580	6070	8.62
	lb					*22070	*22070	*18140	16380	*16710	13380	(28.3)
1.5 m (4.9 ft)	kg			*13010	*13010	*11140	9870	*8870	7250	*7920	6010	8.59
	lb			*28680	*28680	*24560	21760	*19550	15980	*17460	13250	(28.2)
0.0 m (0.0 ft)	kg			*16100	14830	*11720	9700	*9240	7140	*8320	6260	8.28
	lb			*35490	32690	*25840	21380	*20370	15740	*18340	13800	(27.2)
-1.5 m (-4.9 ft)	kg	*12820	*12820	*15610	14890	*11660	9680	*9060	7150	*8790	6960	7.67
	lb	*28260	*28260	*34410	32830	*25710	21340	*19970	15760	*19380	15340	(25.2)
-3.0 m (-9.8 ft)	kg	*19430	*19430	*14210	*14210	*10670	9830			*9290	8540	6.66
	lb	*42840	*42840	*31330	*31330	*23520	21670			*20480	18830	(21.8)
-4.5 m (-14.8 ft)	kg			*10920	*10920					*9570	*9570	5.01
	lb			*24070	*24070					*21100	*21100	(16.4)

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4. *Indicates load limited by hydraulic capacity.

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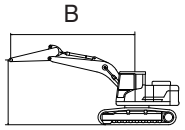
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	3100	6500	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
9.0 m (29.5 ft)	kg													*5480	*5480	6.35
	lb													*12080	*12080	(20.8)
7.5 m (24.6 ft)	kg									*5690	*5690			*5040	*5040	7.64
	lb									*12540	*12540			*11110	*11110	(25.1)
6.0 m (19.7 ft)	kg							*6670	*6670	*6420	*6420			*4900	*4900	8.46
	lb							*14700	*14700	*14150	*14150			*10800	*10800	(27.8)
4.5 m (14.8 ft)	kg					*9860	*9860	*7900	*7900	*7000	*7000			*4950	*4950	8.96
	lb					*21740	*21740	*17420	*17420	*15430	*15430			*10910	*10910	(29.4)
3.0 m (9.8 ft)	kg					*12910	*12910	*9380	*9380	*7780	7480	*6540	5710	*5180	*5180	9.18
	lb					*28460	*28460	*20680	*20680	*17150	16490	*14420	12590	*11420	*11420	(30.1)
1.5 m (4.9 ft)	kg					*15090	*15090	*10680	9930	*8530	7260	*6980	5610	*5600	5480	9.15
	lb					*33270	*33270	*23550	21890	*18810	16010	*15390	12370	*12350	12080	(30.0)
0.0 m (0.0 ft)	kg			*6210	*6210	*15970	14820	*11500	9700	*9060	7120			*6320	5670	8.87
	lb			*13690	*13690	*35210	32670	*25350	21380	*19970	15700			*13930	12500	(29.1)
-1.5 m (-4.9 ft)	kg	*8220	*8220	*11710	*11710	*15900	14790	*11710	9620	*9170	7070			*7580	6190	8.30
	lb	*18120	*18120	*25820	*25820	*35050	32610	*25820	21210	*20220	15590			*16710	13650	(27.2)
-3.0 m (-9.8 ft)	kg	*13460	*13460	*18580	*18580	*14930	14930	*11160	9690					*8620	7330	7.38
	lb	*29670	*29670	*40960	*40960	*32910	32910	*24600	21360					*19000	16160	(24.2)
-4.5 m (-14.8 ft)	kg			*17550	*17550	*12590	*12590							*9120	*9120	5.94
	lb			*38690	*38690	*27760	*27760							*20110	*20110	(19.5)

Note 1. Lifting capacity are based on ISO 10567.

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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

4. *Indicates load limited by hydraulic capacity.

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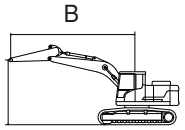
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6245	3750	6500	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
9.0 m (29.5 ft)	kg													*4450	*4450	7.10
	lb													*9810	*9810	(23.3)
7.5 m (24.6 ft)	kg									*5420	*5420			*4170	*4170	8.27
	lb									*11950	*11950			*9190	*9190	(27.1)
6.0 m (19.7 ft)	kg									*5690	*5690	*4240	*4240	*4090	*4090	9.03
	lb									*12540	*12540	*9350	*9350	*9020	*9020	(29.6)
4.5 m (14.8 ft)	kg							*7010	*7010	*6340	*6340	*5970	5840	*4150	*4150	9.50
	lb							*15450	*15450	*13980	*13980	*13160	12870	*9150	*9150	(31.2)
3.0 m (9.8 ft)	kg					*11450	*11450	*8550	*8550	*7190	*7190	*6480	5700	*4350	*4350	9.71
	lb					*25240	*25240	*18850	*18850	*15850	*15850	*14290	12570	*9590	*9590	(31.9)
1.5 m (4.9 ft)	kg					*14040	*14040	*10000	9950	*8040	7240	*6950	5570	*4700	*4700	9.68
	lb					*30950	*30950	*22050	21940	*17730	15960	*15320	12280	*10360	*10360	(31.8)
0.0 m (0.0 ft)	kg			*7330	*7330	*15460	14740	*11050	9640	*8710	7050	*7310	5470	*5280	5140	9.41
	lb			*16160	*16160	*34080	32500	*24360	21250	*19200	15540	*16120	12060	*11640	11330	(30.9)
-1.5 m (-4.9 ft)	kg	*7640	*7640	*11160	*11160	*15840	14590	*11540	9490	*9040	6950			*6270	5540	8.88
	lb	*16840	*16840	*24600	*24600	*34920	32170	*25440	20920	*19930	15320			*13820	12210	(29.1)
-3.0 m (-9.8 ft)	kg	*11650	*11650	*16240	*16240	*15340	14660	*11360	9500	*8800	6970			*8020	6380	8.03
	lb	*25680	*25680	*35800	*35800	*33820	32320	*25040	20940	*19400	15370			*17680	14070	(26.3)
-4.5 m (-14.8 ft)	kg	*16730	*16730	*19660	*19660	*13720	*13720	*10140	9680					*8670	8260	6.74
	lb	*36880	*36880	*43340	*43340	*30250	*30250	*22350	21340					*19110	18210	(22.1)

Note 1. Lifting capacity are based on ISO 10567.

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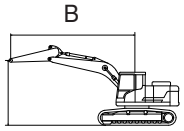
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300A HW	LONG REACH	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		10200	7850	7000	700	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)																						At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		12.0 m (39.4 ft)		13.5 m (44.3 ft)		15.0 m (49.2 ft)		16.5 m (54.1 ft)		Capacity		Reach
13.5 m	kg																							*790	*790	13.22
44.3 ft	lb																							*1740	*1740	(43.4)
12.0 m	kg																	*1150	*1150					*740	*740	14.36
39.4 ft	lb																	*2540	*2540					*1630	*1630	(47.1)
10.5 m	kg																	*1400	*1400	*880	*880			*710	*710	15.26
34.4 ft	lb																	*3090	*3090	*1940	*1940			*1570	*1570	(50.1)
9.0 m	kg																	*1580	*1580	*1220	*1220			*700	*700	15.97
29.5 ft	lb																	*3480	*3480	*2690	*2690			*1540	*1540	(52.4)
7.5 m	kg																	*1750	*1750	*1450	*1450	*720	*720	*700	*700	16.52
24.6 ft	lb																	*3860	*3860	*3200	*3200	*1590	*1590	*1540	*1540	(54.2)
6.0 m	kg															*2140	*2140	*1970	*1970	*1650	*1650	*1010	*1010	*710	*710	16.91
19.7 ft	lb															*4720	*4720	*4340	*4340	*3640	*3640	*2230	*2230	*1570	*1570	(55.5)
4.5 m	kg													*2780	*2780	*2530	*2530	*2240	*2240	*1860	*1860	*1220	*1220	*740	*740	17.16
14.8 ft	lb													*6130	*6130	*5580	*5580	*4940	*4940	*4100	*4100	*2690	*2690	*1630	*1630	(56.3)
3.0 m	kg					*8610	*8610	*6030	*6030	*4750	*4750	*4000	*4000	*3520	*3520	*3120	*3120	*2610	*2610	*2090	*2090	*1370	*1370	*770	*770	17.28
9.8 ft	lb					*18980	*18980	*13290	*13290	*10470	*10470	*8820	*8820	*7760	*7760	*6880	*6880	*5750	*5750	*4610	*4610	*3020	*3020	*1700	*1700	(56.7)
1.5 m	kg					*3650	*3650	*7380	*7380	*5610	*5610	*4590	*4590	*3930	*3930	*3490	*3490	*3080	2980	*2330	*2330	*1460	*1460	*820	*820	17.26
4.9 ft	lb					*8050	*8050	*16270	*16270	*12370	*12370	*10120	*10120	*8660	*8660	*7690	*7690	*6790	6570	*5140	*5140	*3220	*3220	*1810	*1810	(56.6)
0.0 m	kg			*1380	*1380	*3010	*3010	*6720	*6720	*6350	*6350	*5110	5110	*4320	4140	*3780	3410	*3390	2860	*2550	2410	*1470	*1470	*880	*880	17.11
0.0 ft	lb			*3040	*3040	*6640	*6640	*14820	*14820	*14000	*14000	*11270	11270	*9520	9130	*8330	7520	*7470	6310	*5620	5310	*3240	*3240	*1940	*1940	(56.1)
-1.5 m	kg	*1470	*1470	*1950	*1950	*3210	*3210	*5850	*5850	*6910	6160	*5550	4850	*4660	3940	*4030	3270	*3590	2750	*2700	2340	*1330	*1330	*970	*970	16.83
-4.9 ft	lb	*3240	*3240	*4300	*4300	*7080	*7080	*12900	*12900	*15230	13580	*12240	10690	*10270	8690	*8880	7210	*7910	6060	*5950	5160	*2930	*2930	*2140	*2140	(55.2)
-3.0 m	kg	*2110	*2110	*2600	*2600	*3720	*3720	*5950	*5950	*7310	5940	*5880	4670	*4920	3800	*4240	3160	*3740	2680	*2670	2290			*1080	*1080	16.40
-9.8 ft	lb	*4650	*4650	*5730	*5730	*8200	*8200	*13120	*13120	*16120	13100	*12960	10300	*10850	8380	*9350	6970	*8250	5910	*5890	5050			*2380	*2380	(53.8)
-4.5 m	kg	*2770	*2770	*3310	*3310	*4400	*4400	*6510	*6510	*7530	5830	*6100	4560	*5100	3710	*4390	3100	*3850	2630	*2350	2270			*1240	*1240	15.82
-14.8 ft	lb	*6110	*6110	*7300	*7300	*9700	*9700	*14350	*14350	*16600	12850	*13450	10050	*11240	8180	*9680	6830	*8490	5800	*5180	5000			*2730	*2730	(51.9)
-6.0 m	kg	*3480	*3480	*4090	*4090	*5240	*5240	*7400	*7400	*7580	5810	*6180	4530	*5190	3680	*4450	3070	3870	2620	*1550	*1550			*1450	*1450	15.06
-19.7 ft	lb	*7670	*7670	*9020	*9020	*11550	*11550	*16310	*16310	*16710	12810	*13620	9990	*11440	8110	*9810	6770	8530	5780	*3420	*3420			*3200	*3200	(49.4)
-7.5 m	kg	*4240	*4240	*4970	*4970	*6260	*6260	*8660	8060	*7470	5850	*6120	4550	*5140	3690	*4390	3090	*3000	2650					*1770	*1770	14.10
-24.6 ft	lb	*9350	*9350	*10960	*10960	*13800	*13800	*19090	17770	*16470	12900	*13490	10030	*11330	8140	*9680	6810	*6610	5840					*3900	*3900	(46.3)
-9.0 m	kg	*5100	*5100	*5980	*5980	*7530	*7530	*8940	8240	*7150	5960	*5890	4630	*4940	3760	*4160	3170							*2300	*2300	12.90
-29.5 ft	lb	*11240	*11240	*13180	*13180	*16600	*16600	*19710	18170	*15760	13140	*12990	10210	*10890	8290	*9170	6990							*5070	*5070	(42.3)
-10.5 m	kg	*6080	*6080	*7210	*7210	*9200	*9200	*8150	*8150	*6560	6160	*5390	4790	*4450	3910									*3320	*3320	11.37
-34.4 ft	lb	*13400	*13400	*15900	*15900	*20280	*20280	*17970	*17970	*14460	13580	*11880	10560	*9810	8620									*7320	*7320	(37.3)
-12.0 m	kg			*8780	*8780	*8810	*8810	*6870	*6870	*5530	*5530	*4430	*4430											*4180	*4180	9.35
-39.4 ft	lb			*19360	*19360	*19420	*19420	*15150	*15150	*12190	*12190	*9770	*9770											*9220	*9220	(30.7)

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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
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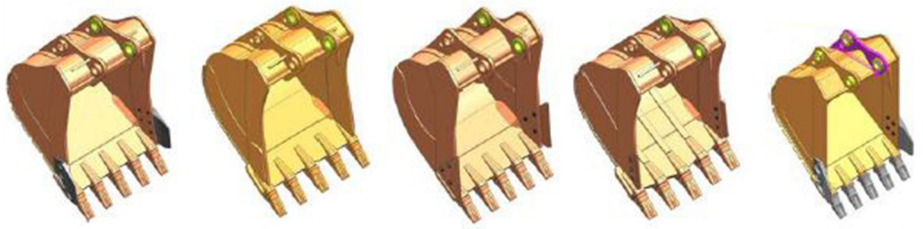
6. BUCKET SELECTION GUIDE

1) BUCKET SELECTION



General bucket | Heavy duty (without side cutter) | Heavy duty (with side cutter) | Rock heavy duty | Long reach

Type	Capacity		Width		Weight	Tooth	MONO				2-PIECE			L/Reach
							Recommendation							
	SAE Heaped	CECE heaped	Without side cutter	With side cutter			6.25 m (20' 6") Boom				6.25 m (20' 6") Boom			10.2 m (33' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	mm (in)	kg (lb)	EA	2.10 m (6' 11') Arm	2.50 m (8' 2") Arm	3.10 m (10' 2") Arm	3.75 m (12' 4") Arm	2.10 (6' 11") Arm	2.50 m (8' 2") Arm	3.10 m (10' 2") Arm	7.85 m (25' 9") Arm
General bucket	1.27 (1.66)	1.10 (1.44)	1280 (50.4")	1440 (56.7")	1090 (2400)	5	●	●	●	●	●	●	●	X
	1.51 (1.98)	1.30 (1.70)	1490 (58.7")	1650 (65.0')	1215 (2680)	6	●	●	◐	◐	●	●	●	X
	1.75 (2.29)	1.50 (1.96)	1700 (66.9")	1860 (73.2")	1315 (2900)	6	●	◐	■	■	●	◐	◐	X
	1.50 (1.96)	1.32 (1.73)	1260 (49.6")	1425 (56.1")	1085 (2390)	5	●	●	●	◐	●	●	●	X
	1.74 (2.28)	1.54 (2.01)	1360 (53.5")	1525 (60.0")	1195 (2630)	6	●	◐	◐	■	●	●	◐	X
	1.85 (2.42)	1.61 (2.11)	1590 (62.6")	1785 (70.3")	1325 (2920)	6	◐	◐	■	▲	●	◐	■	X
Heavy duty	1.23 (1.61)	1.10 (1.44)	1205 (47.4")	1260 (49.6")	1085 (2390)	5	●	●	●	●	●	●	●	X
	1.47 (1.92)	1.32 (1.73)	1405 (55.3")	1460 (57.5")	1185 (2610)	5	●	●	●	◐	●	●	●	X
Rock heavy duty	1.45 (1.90)	1.29 (1.69)	1380 (54.3")	1440 (56.7")	1505 (3320)	5	●	●	◐	X	●	●	●	X
	1.57 (2.05)	1.40 (1.83)	1480 (58.3')	1540 (60.6")	1565 (3450)	5	●	●	◐	X	●	●	◐	X
Long reach	0.52 (0.68)	0.45 (0.59)	870 (34.3")	1020 (40.2")	455 (1000)	5	X	X	X	X	X	X	X	◐

● Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐ Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■ Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲ Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X Not recommended

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

7. UNDERCARRIAGE

1) TYPES OF SHOES

Model	Description	Unit		Triple grouser								Double grouser	
	width	mm	(in)	600	(24)	700	(28)	800	(32)	900	(36)	700	(28)
HX300A L	Operating weight	kg	(lb)	30520	67290	31080	68520	31450	69340	31840	70200	-	-
	Ground pressure	kgf/cm²	(psi)	0.59	8.35	0.51	7.29	0.45	6.46	0.41	5.85	-	-
	Link quantity	EA		48		48		48		48		-	
HX300A NL	Operating weight	kg	(lb)	30400	67020	-	-	-	-	-	-	-	-
	Ground pressure	kgf/cm²	(psi)	0.59	8.32	-	-	-	-	-	-	-	-
	Link quantity	EA		48		-		-		-		-	
HX300A LR	Operating weight	kg	(lb)	-	-	-	-	33590	74050	-	-	-	-
	Ground pressure	kgf/cm²	(psi)	-	-	-	-	0.48	6.90	-	-	-	-
	Link quantity	EA		-		-		48		-		-	
HX300A HW	Operating weight	kg	(lb)	-	-	-	-	-	-	-	-	34810	76740
	Ground pressure	kgf/cm²	(psi)	-	-	-	-	-	-	-	-	0.57	8.15
	Link quantity	EA		-		-		-		-		48	

2) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

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

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

Table 1

Track shoe	Specification	Category
600 mm triple grouser	Standard	A
700 mm triple grouser	Option	B
700 mm double grouser	Option	B
800 mm triple grouser	Option	C
900 mm triple grouser	Option	C

Table 2

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

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Maker / Model	Cummins / B6.7
Type	4-cycle, turbocharged, charge air cooled, electronic controlled diesel engine
Cooling method	Water cooled
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	107 × 124 mm (4.21" × 4.88")
Displacement	6.7 ℓ (408 cu in)
Compression ratio	17.3 : 1
Gross power	260 Hp (194 kW) at 2200 rpm
Net power	255 Hp (190 kW) at 2200 rpm
Max. power	282 Hp (210 kW) at 1800 rpm
Peak Torque	1350 N·m (996 lbf·ft) at 1300 rpm
Engine oil quantity	24.4 ℓ (6.4 U.S. gal)
Wet weight	583 kg (1285 lb)
Starter motor	24 V-4.8 kW
Alternator	24 V-95 A

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 154 cc/rev
Maximum pressure	350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]
Rated oil flow	2 × 285 ℓ/min (75.3 U.S. gpm / 62.7 U.K. gpm)

[ ] : Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	15 cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	27.75 ℓ /min (7.3 U.S. gpm/6.1 U.K. gpm)

4) MAIN CONTROL VALVE

Item		Specification
Type		10 spools
Operating method		Hydraulic pilot system
Main relief valve pressure		350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)] *1 350 kgf/cm^2 (4980 psi) [Not applied power boost]
Port relief valve pressure	Boom	400 kgf/cm^2 (5690 psi)
	Arm	400 kgf/cm^2 (5690 psi), *1 250 kgf/cm^2 (3560 psi)
	Bucket	400 kgf/cm^2 (5690 psi), *1 270 kgf/cm^2 (3840 psi)

[ ] : Power boost *1 : Long reach only

5) SWING MOTOR

Item	Specification
Type	Axial piston motor
Capacity	156.9 cc/rev
Relief pressure	300 kgf/cm^2 (4270 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	84.4 kgf · m (610 lbf · ft) over
Brake release pressure	36.6 kgf/cm^2 (519 psi) below
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Capacity	282.6/156.9 cc/rev
Relief pressure	350 kgf/cm^2 (4980 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	134 kgf · m (969 lbf · ft)
Brake release pressure	17 kgf/cm^2 (242 psi)
Reduction gear type	2-stage planetary

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Stroke	Ø140 × 1465 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Stroke	Ø150 × 1670 mm
	Cushion	Extend and retract
Adjust cylinder (2-piece boom)	Bore dia × Stroke	Ø170 × 1341 mm
	Cushion	N/A
Bucket cylinder	Bore dia × Stroke	Ø135 × 1150 mm
	Cushion	Extend only
Bucket cylinder (Long reach)	Bore dia × Stroke	Ø100 × 870 mm
	Cushion	Extend only

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

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

9. RECOMMENDED OILS

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

We recommend that you use only HD Hyundai Construction Equipment genuine lubricating oils and grease officially approved by HD Hyundai Construction Equipment.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature ˚C(˚F) -50 (-58) -30 (-22) -20 (-4) -10 (14) 0 (32) 10 (50) 20 (68) 30 (86) 40 (104)
Engine oil pan	Engine oil	24.4 (6.4)	★SAE 0W-40 SAE 5W-40 SAE 15W-40
DEF/ AdBlue® tank	Mixture of urea and deionized water	70 (18.5)	ISO 22241, High-purity urea + deionized water (32.5:67.5)
Swing drive	Gear oil	11 (2.9)	★SAE 75W-90
Final drive		7.8×2 (2.1×2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank 190 (50.2) System 330 (87.2)	★ISO VG 15 ISO VG 32 ISO VG 46, HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	500 (132)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (reservoir tank)	Mixture of antifreeze and soft water★2	40 (10.6)	Ethylene glycol base permanent type (50 : 50) ★Ethylene glycol base permanent type (60 : 40)

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material
DEF : Diesel Exhaust Fluid, DEF compatible with AdBlue®

★ : Cold region (Russia, CIS, Mongolia)
★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm
★2 : Soft water
City water or distilled water
★3 : HD Hyundai Construction Equipment Bio Hydraulic Oil

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

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

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

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

SECTION 2 STRUCTURE AND FUNCTION

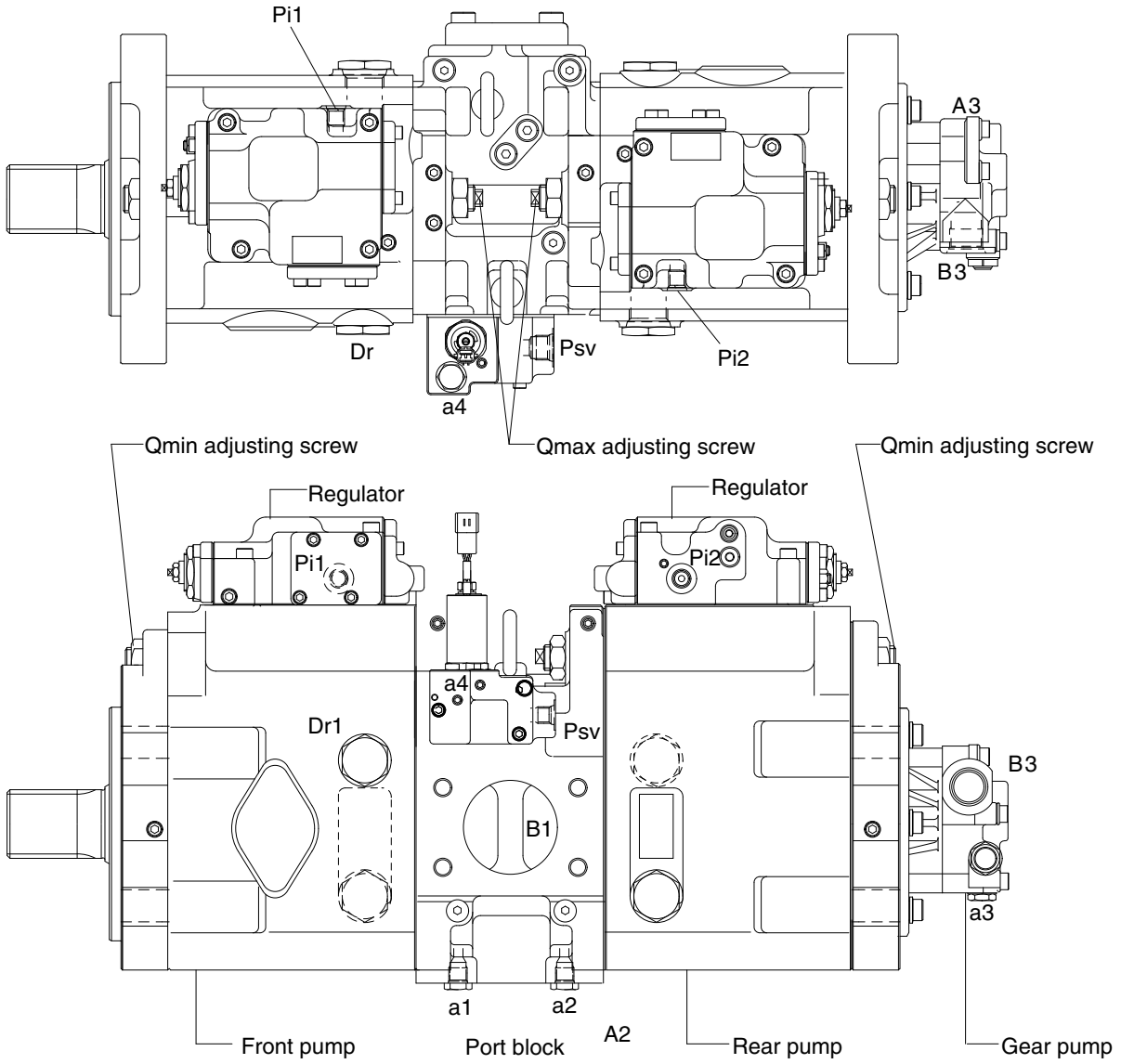
Group 1 Pump Device (machine serial no. : -#0315) ····· 2-1
Pump Device (machine serial no. : #0316-) ····· 2-19-1
Group 2 Main Control Valve (machine serial no. : -#0559) ····· 2-20
Main Control Valve (machine serial no. : #0560-) ····· 2-55-1
Group 3 Swing Device (machine serial no. : -#0114) ····· 2-56
Swing Device (machine serial no. : #0115-) ····· 2-66-1
Group 4 Travel Device (type 1) ····· 2-67
Travel Device (type 2, machine serial no. : -#0900) ····· 2-81
Travel Device (type 2, machine serial no. : #0901-) ····· 2-93-1
Group 5 RCV Lever ····· 2-94
Group 6 RCV Pedal ····· 2-101

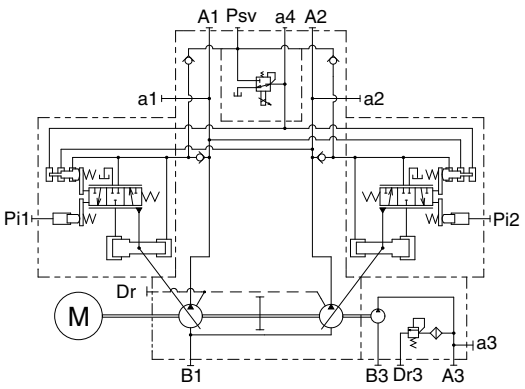
GROUP 1 PUMP DEVICE (MACHINE SERIAL NO. : -#0315)

1. STRUCTURE

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

1) OUTLINE



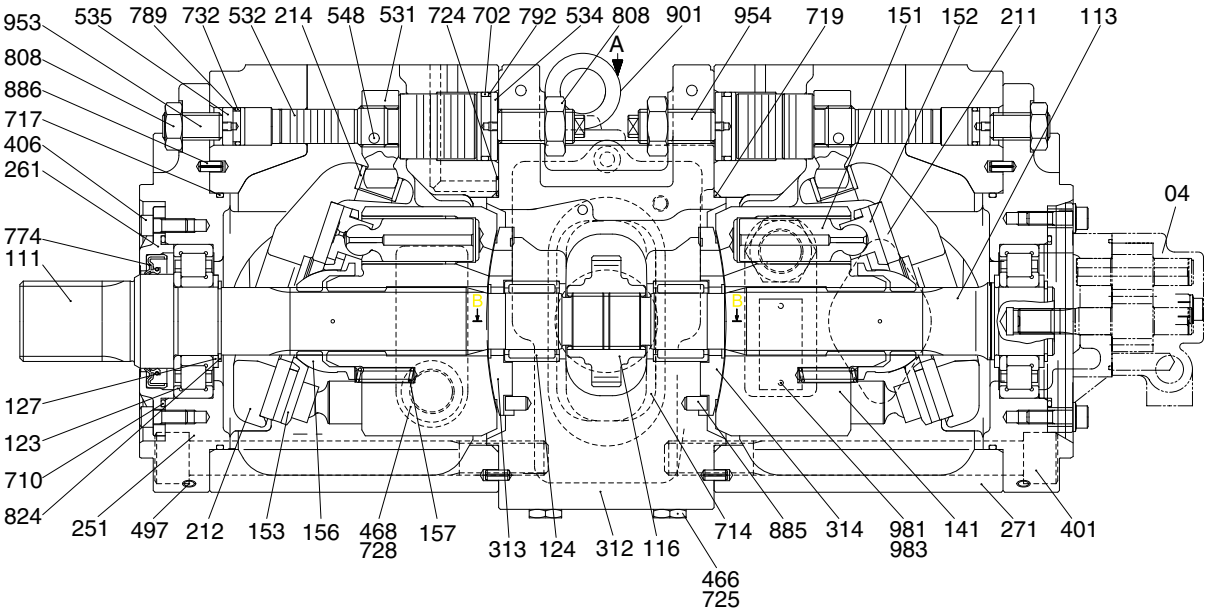


300S2MP01

Port	Port name	Port size
A1, 2	Delivery port	SAE6000 psi 1"
B1	Suction port	SAE2500 psi 3"
Dr	Drain port	PF 3/4 - 23
Pi1, i2	Pilot 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 - 15

2) MAIN PUMP (1/2)

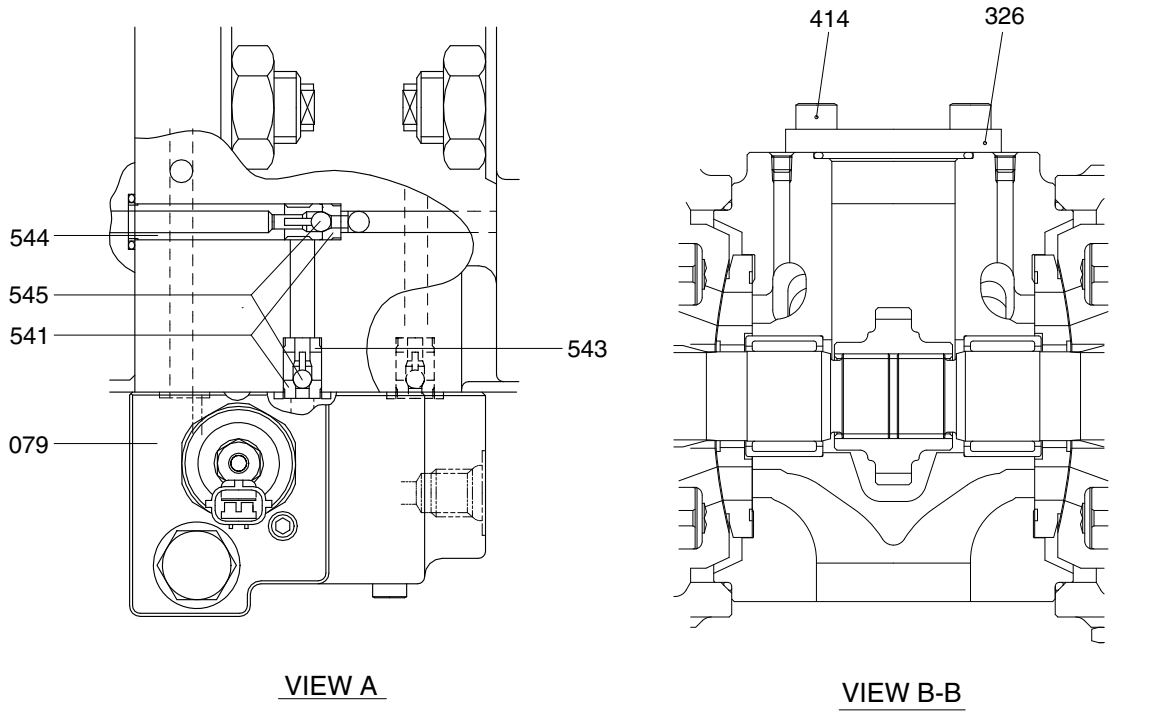
The main pump consists of two piston pumps (front & rear) and valve block.



300S2MP03

04	Gear pump	313	Valve plate (R)	717	O-ring
111	Drive shaft (F)	314	Valve plate (L)	719	O-ring
113	Drive shaft (R)	401	Hexagon socket bolt	723	O-ring
114	1st gear	406	Hexagon socket bolt	724	Square ring
123	Roller bearing	465	ROH plug	725	O-ring
124	Needle bearing	466	VP plug	728	O-ring
127	Bearing spacer	468	VP plug	732	O-ring
141	Cylinder block	497	MH plug	774	Oil seal
151	Piston	531	Tilting pin	789	Back up ring
152	Shoe	532	Servo piston	792	Back up ring
153	Set plate	534	Stopper (L)	806	Hexagon head nut
156	Spherical bushing	535	Stopper (S)	808	Hexagon head nut
157	Cylinder spring	541	Seat	824	Snap ring
211	Shoe plate	543	Stopper 1	885	Valve plate pin
212	Swash plate	544	Stopper 2	886	Spring pin
214	Tilting bushing	545	Steel ball	901	Eye bolt
251	Swash plate support	548	Feedback pin	953	Set screw
261	Seal cover (F)	702	O-ring	954	Set screw
271	Pump casing	710	O-ring		
312	Valve block	714	O-ring		

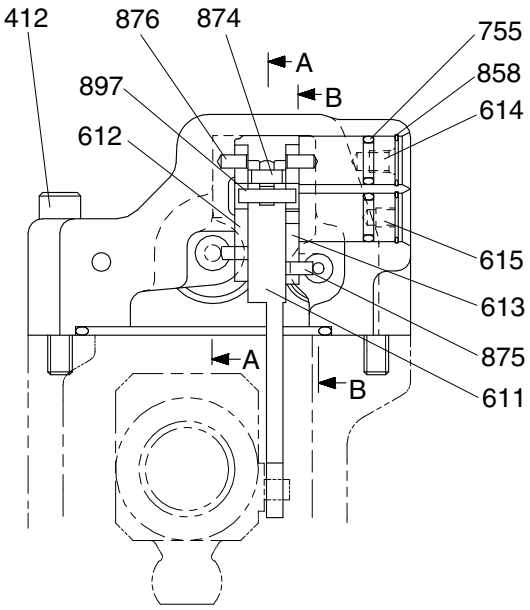
MAIN PUMP (2/2)

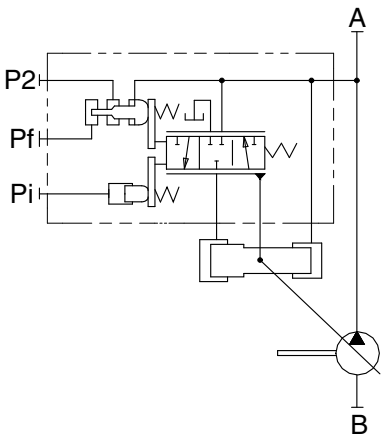


300S2MP04

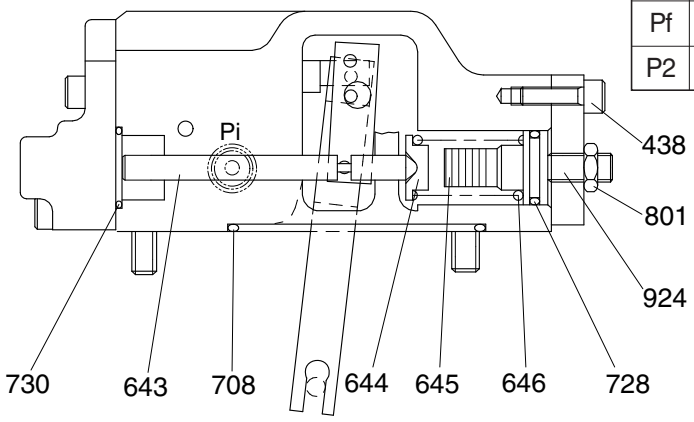
079	Proportional reducing valve	541	Seat	544	Stopper 2
326	Cover	543	Stopper 1	545	Steel ball
414	Hexagon socket bolt				

2) REGULATOR (1/2)

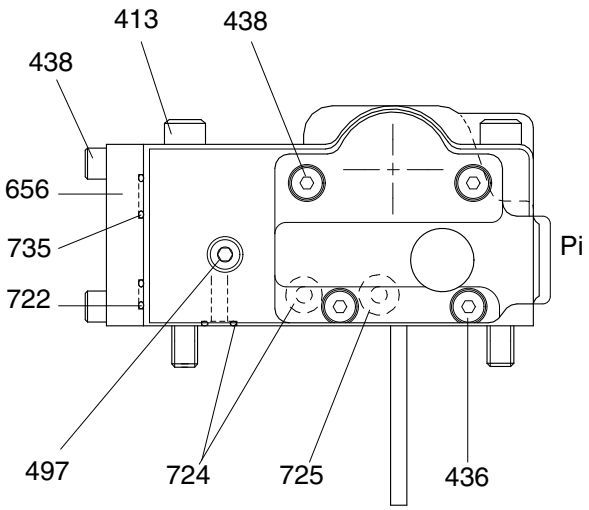




Port	Port name	Port size
A	Delivery port	SAE 6000 PSI 1"
B	Suction port	SAE 2500 PSI 3"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



SECTION B-B

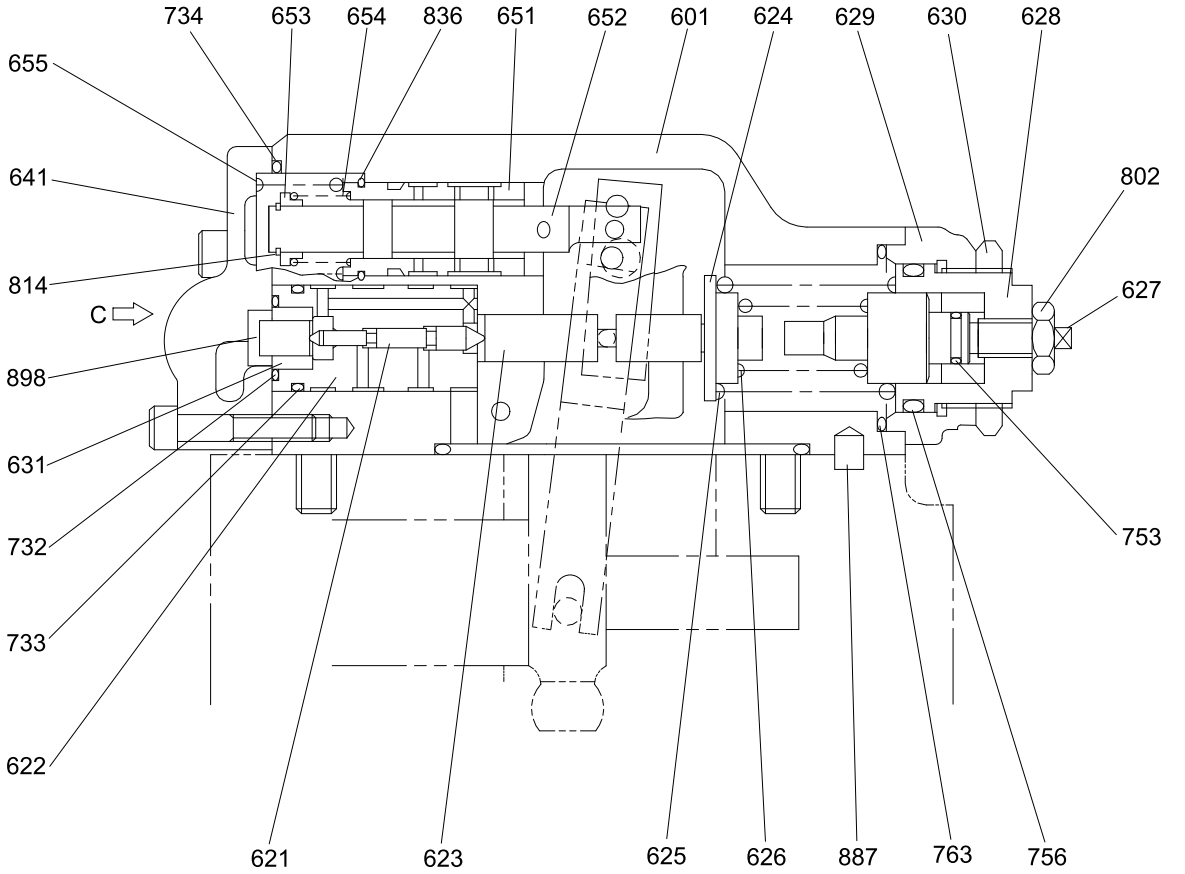


VIEW C

300S2MP06

412 Hexagon socket screw
413 Hexagon socket screw
436 Hexagon socket screw
438 Hexagon socket screw
497 Plug
611 Feed back lever
612 Lever (1)
613 Lever (2)
614 Fulcrum plug
615 Adjust plug
643 Pilot piston
644 Spring seat (Q)
645 Adjust stem (Q)
646 Pilot spring
656 Block cover
708 O-ring
722 O-ring
724 O-ring
725 O-ring
728 O-ring
730 O-ring
735 O-ring
755 O-ring
801 Nut
858 Snap ring
874 Pin
875 Pin
876 Pin
897 Pin
924 Set screw

REGULATOR (2/2)

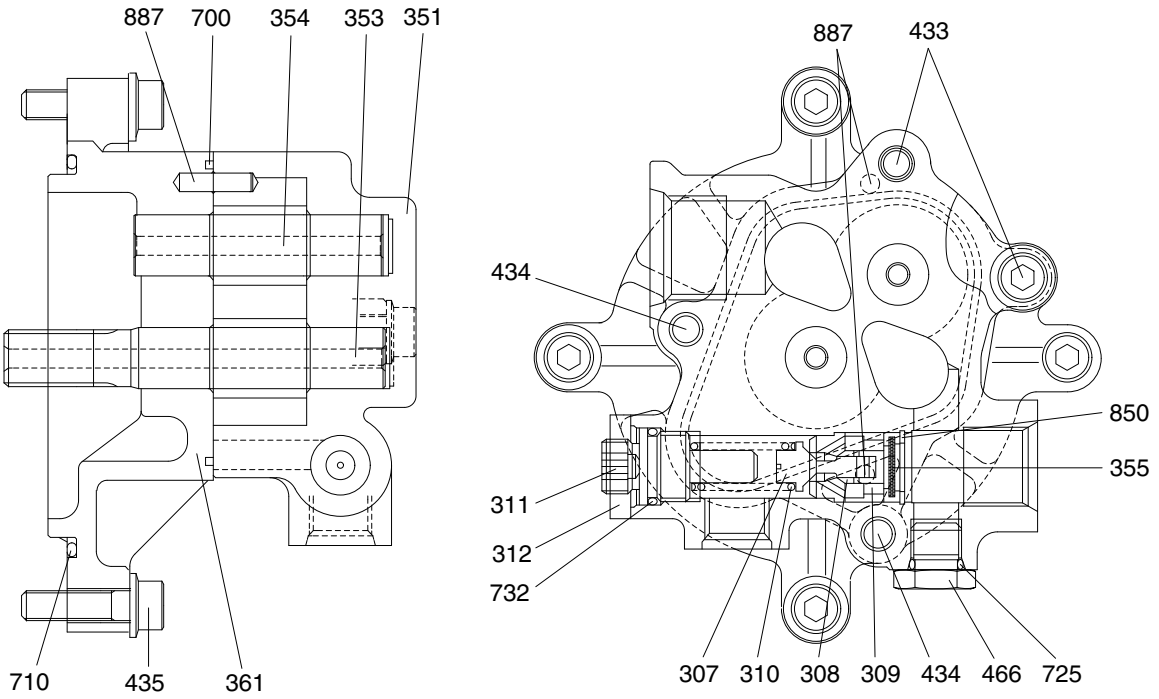


SECTION A-A

300S2MP07

601	Casing	630	Lock nut	734	O-ring
621	Compensator piston	631	Sleeve, pf	753	O-ring
622	Piston case	641	Pilot cover	756	O-ring
623	Compensator rod	651	Sleeve	763	O-ring
624	Spring seat (C)	652	Spool	802	Nut
625	Outer spring	653	Spring seat	814	Snap ring
626	Inner spring	654	Return spring	836	Snap ring
627	Adjust stem (C)	655	Set spring	887	Pin
628	Adjust screw (C)	732	O-ring	898	Pin
629	Cover (C)	733	O-ring		

3) GEAR PUMP



300S2MP08

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

2. FUNCTION

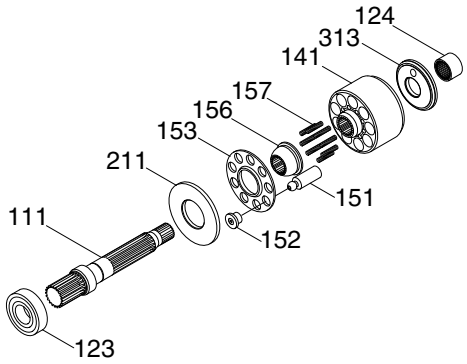
1) MAIN PUMP

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), 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.



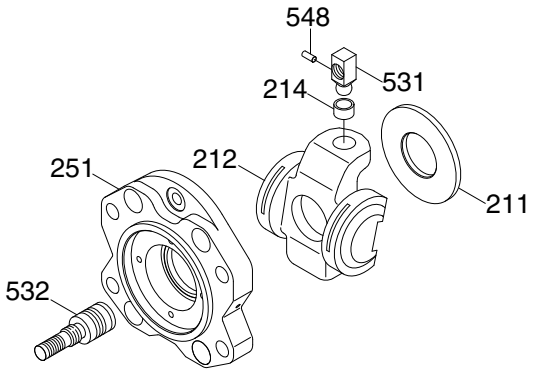
29092MP06

(2) Swash plate group

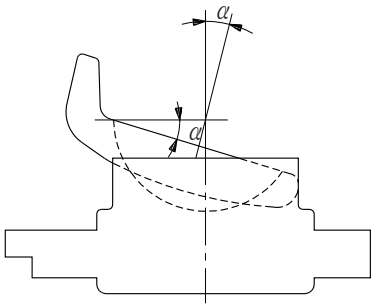
The swash plate group consists of swash plate (212), shoe plate (211), swash plate support (251), tilting bush (214), tilting pin (531) and servo piston (532).

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)



29092MP07



2-7

(3) Valve block group

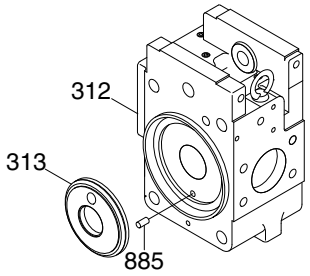
The valve block group consists of valve block (312), valve plate (313) and valve plate pin (885).

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.



29092MP08

2) REGULATOR

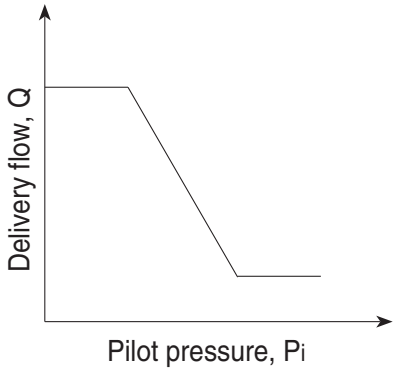
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

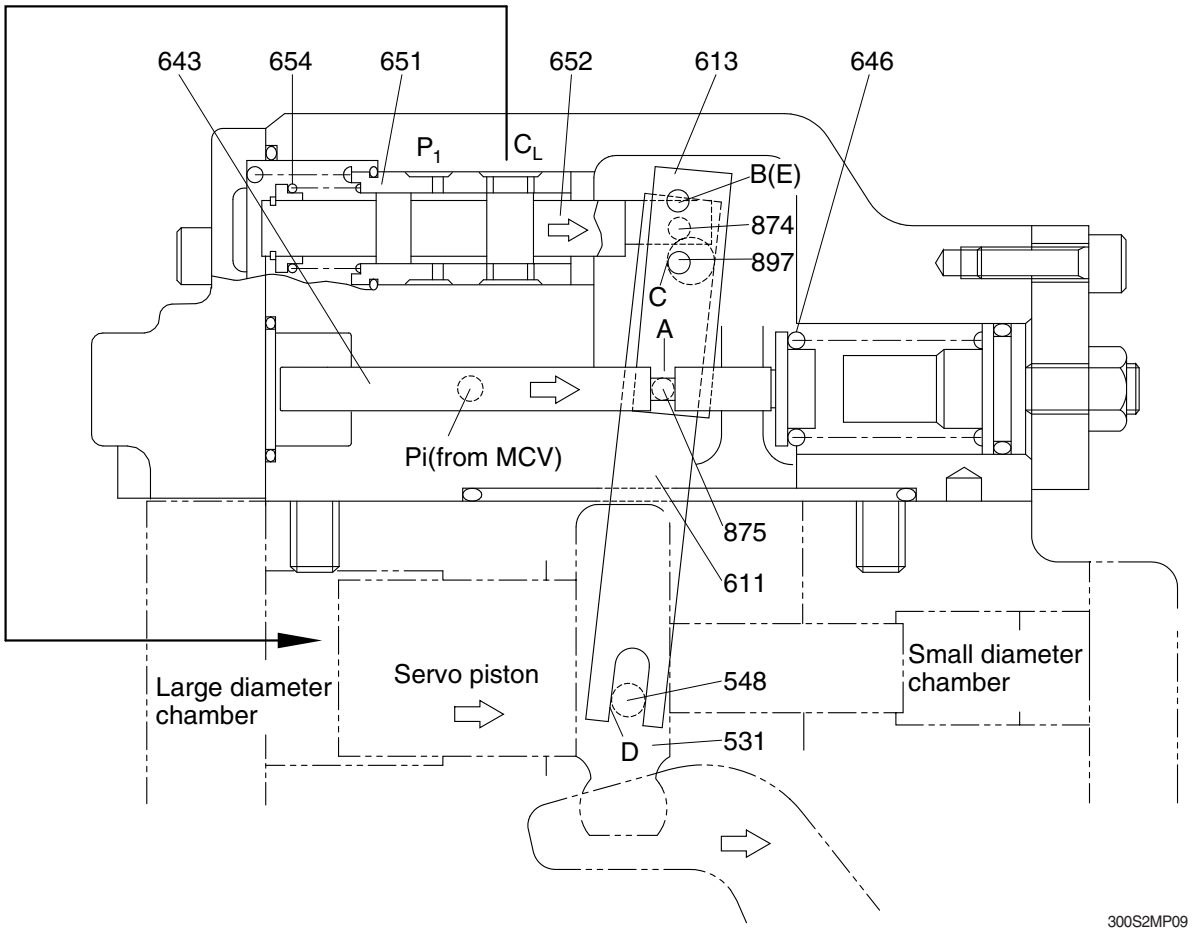
By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

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.

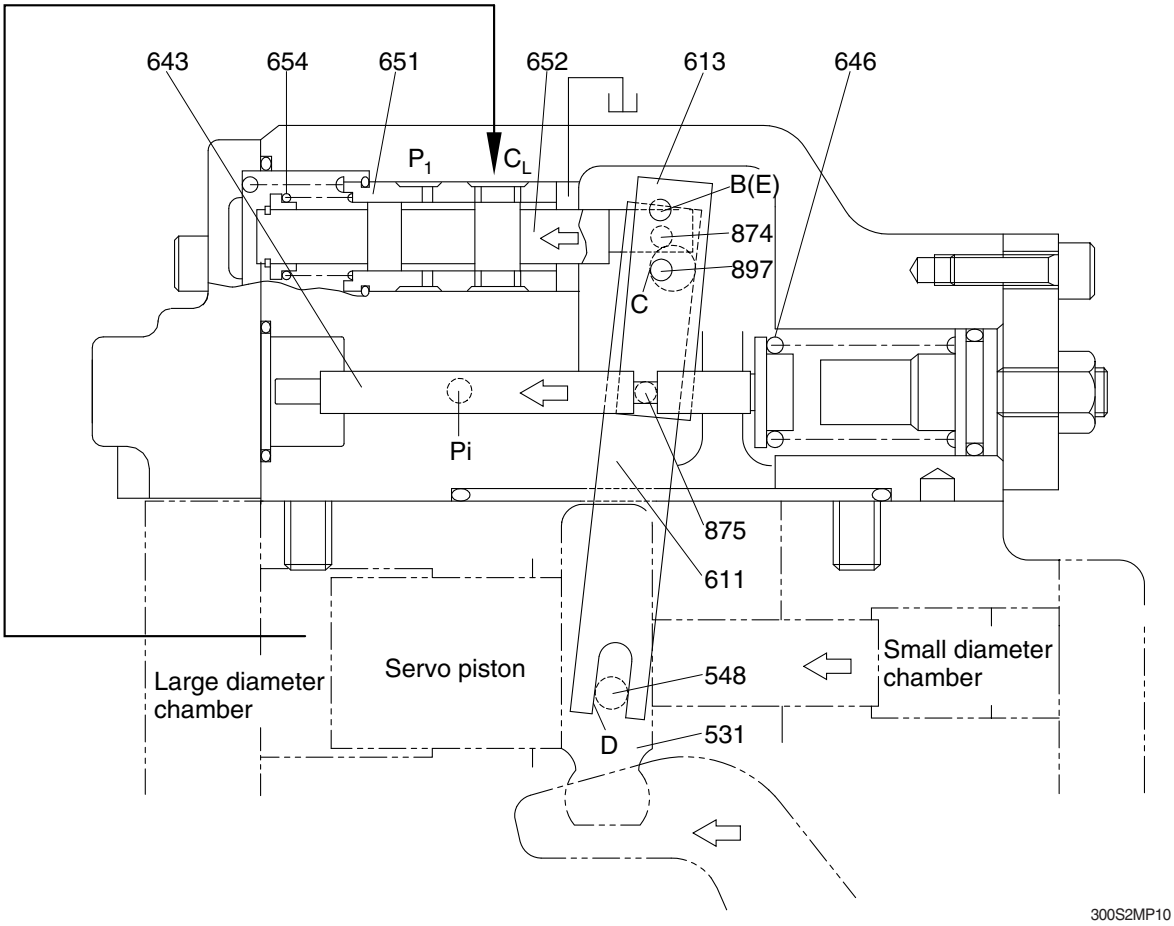
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.

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

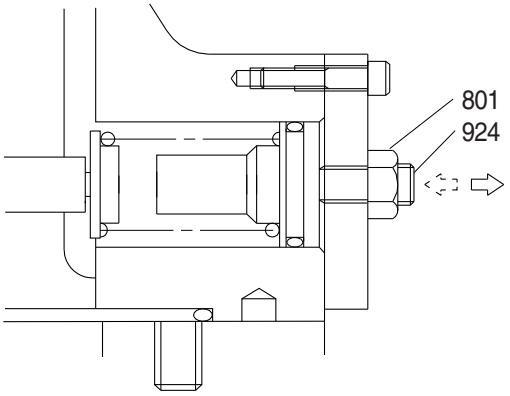


As the pilot pressure Pi decreases, the pilot piston (643) moves to the left by the action of the pilot spring (646) and causes lever 2 (613) to rotate around the fulcrum of point B. Since the pin (897) is pressed against the large hole section (C) of lever 2 by the action of the return spring (654) 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.

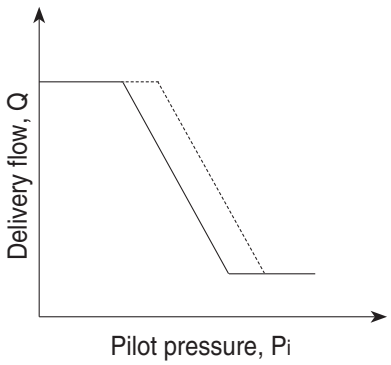
As the servo piston moves, point D also moves to the left, the feedback lever rotates around the fulcrum of point C, and the spool moves to the right till the opening between the spool and sleeve is closed.

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.



2-12



※ Adjusting values are shown in table.

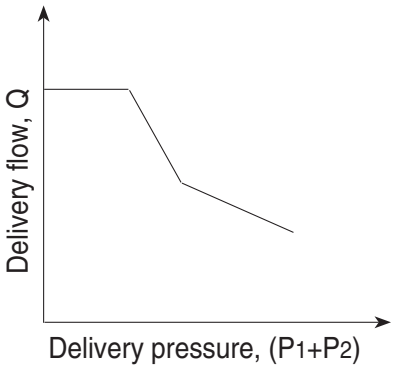
Speed	Adjustment of flow control characteristic		
	Tightening amount of adjusting screw (924)	Flow control starting pressure change amount	Flow change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(ℓ /min)
1800	+1/4	+0.7	+14.6

(2) Total horsepower control

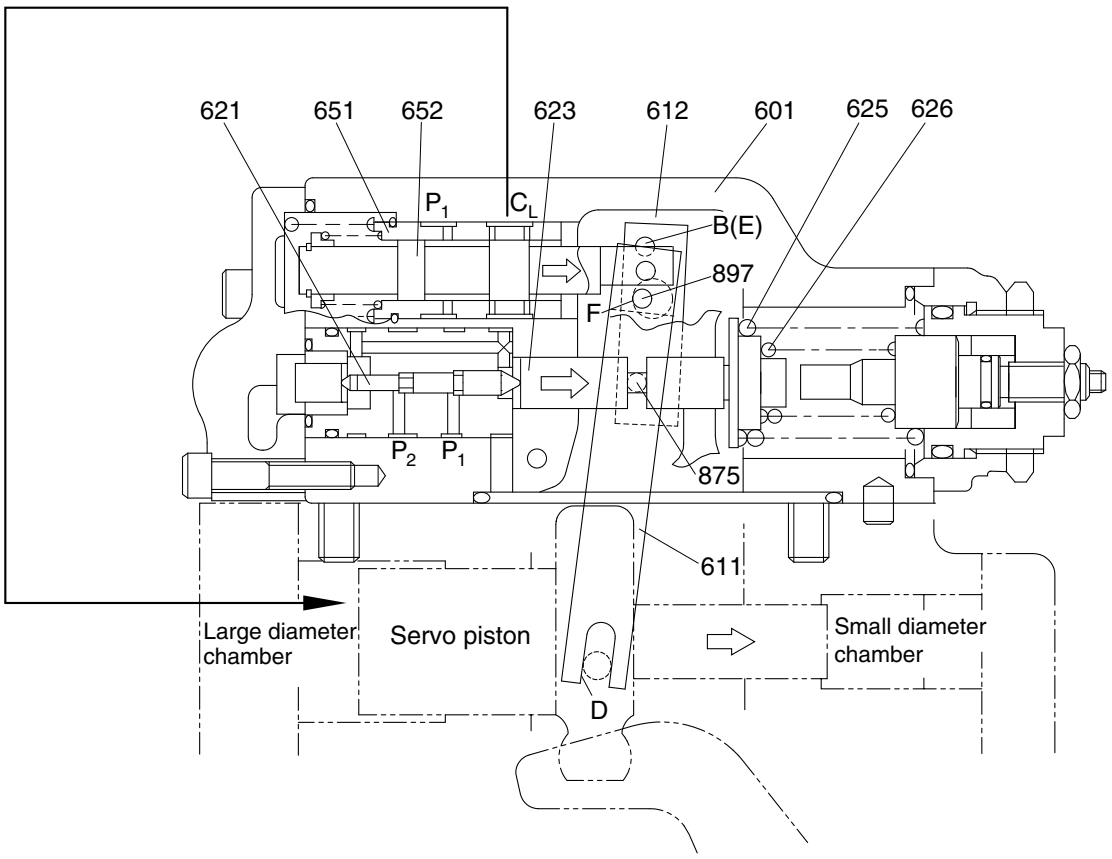
The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.
(The input horsepower is constant when the speed is constant.)
Since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

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

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



① Overload preventive function



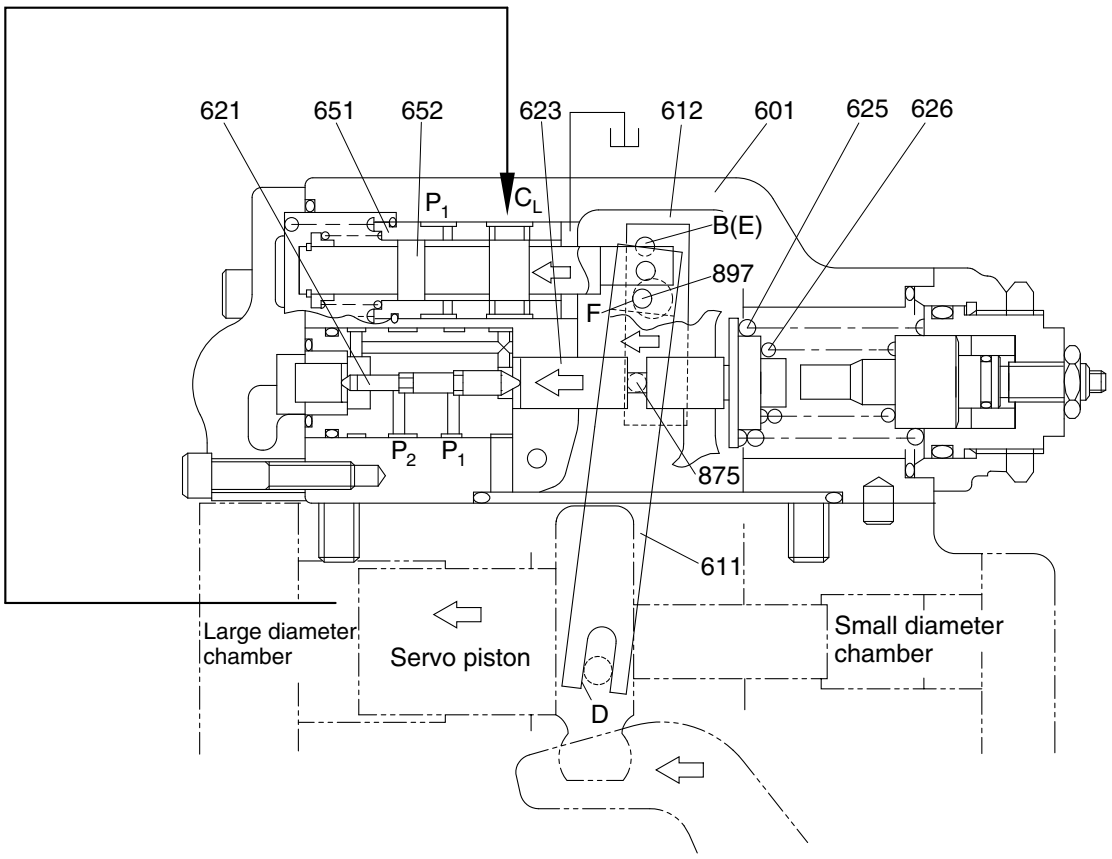
300S2MP11

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



300S2MP12

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

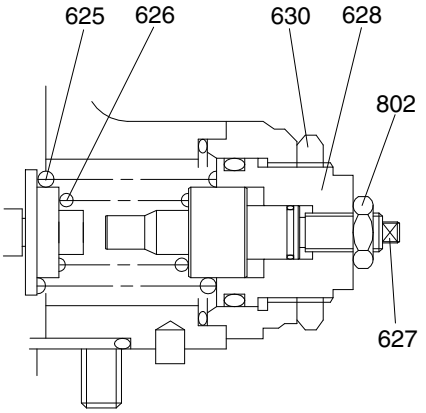
As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections (C & F) of levers 1 and 2. However, since sections C and F have the pins (∅4) protruding from the large hole (∅8), only the lever lessening the tilting angle contacts the pin (897) ; the hole (∅8) 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

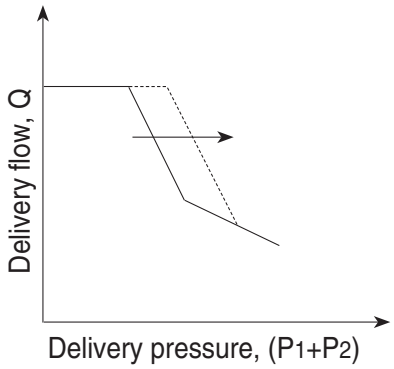
Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628). Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C by N turns changes the setting of the inner spring (626), return the adjusting screw QI (627) by N × A turns at first. (A=1.59)



8007A2MP03

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

Speed	Adjustment of outer spring		
	Tightening amount of adjusting screw (C) (628)	Compensating control starting pressure change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(kgf · m)
1800	+1/4	+19	+5.6



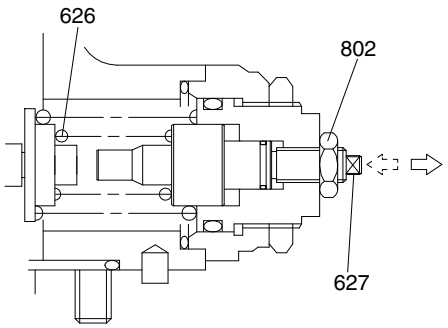
b. Adjustment of inner spring

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

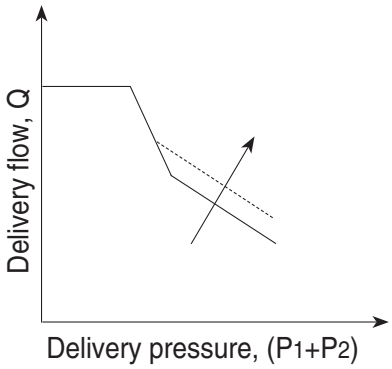
Tightening the screw increases the flow and then the input horsepower as shown in the figure.

※ Adjusting valves are shown in table.

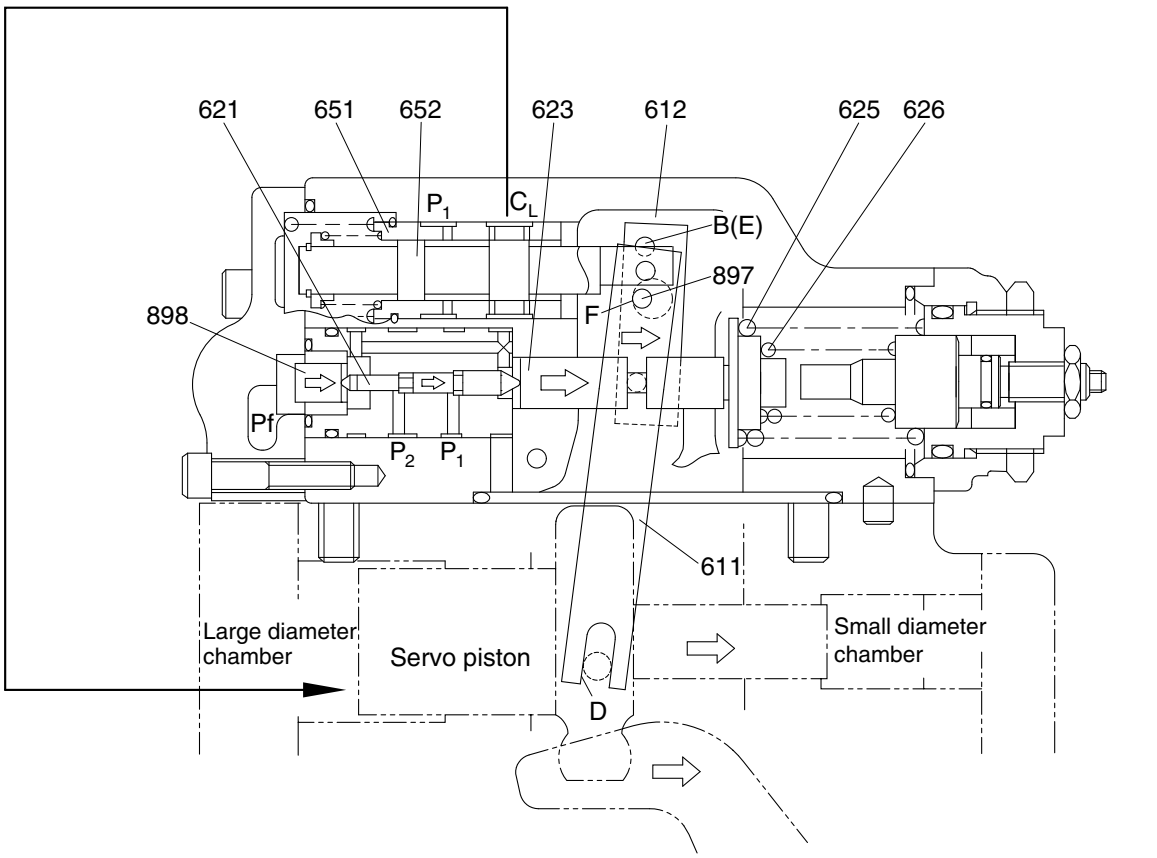
Speed	Adjustment of inner spring		
	Tightening amount of adjusting screw (QI) (627)	Flow change amount	Input torque change amount
(min^{-1})	(Turn)	(kgf/cm^2)	(kgf · m)
1800	+1/4	+12.6	+5.7



8007A2MP04

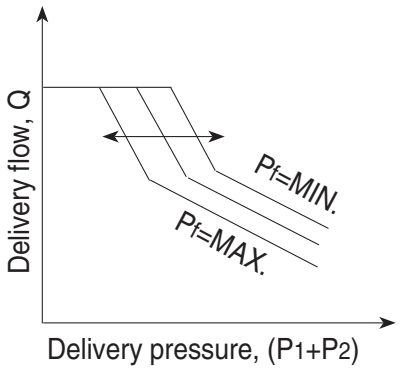


(3) Power shift control



300S2MP13

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



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

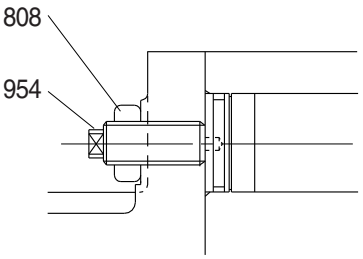
(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

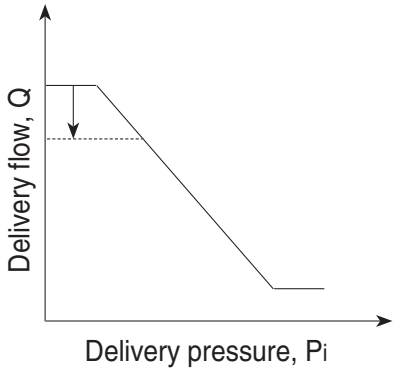
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the set screw (954).

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

Speed (min -1)	Adjustment of max flow	
	Tightening amount of adjusting screw (954) (Turn)	Flow change amount (ℓ /min)
1800	+1/4	-5.6



2-19(1)

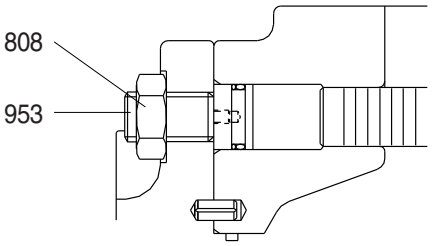


② Adjustment of minimum flow

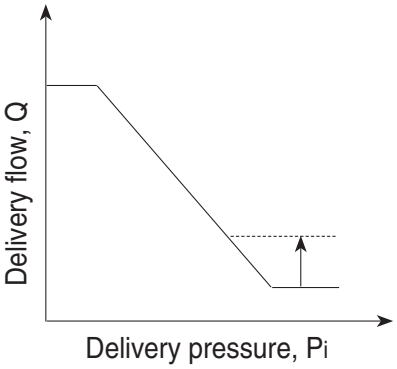
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

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

Speed (min -1)	Adjustment of min flow	
	Tightening amount of adjusting screw (953) (Turn)	Flow change amount (ℓ /min)
1800	+1/4	+4.5



2-19(2)

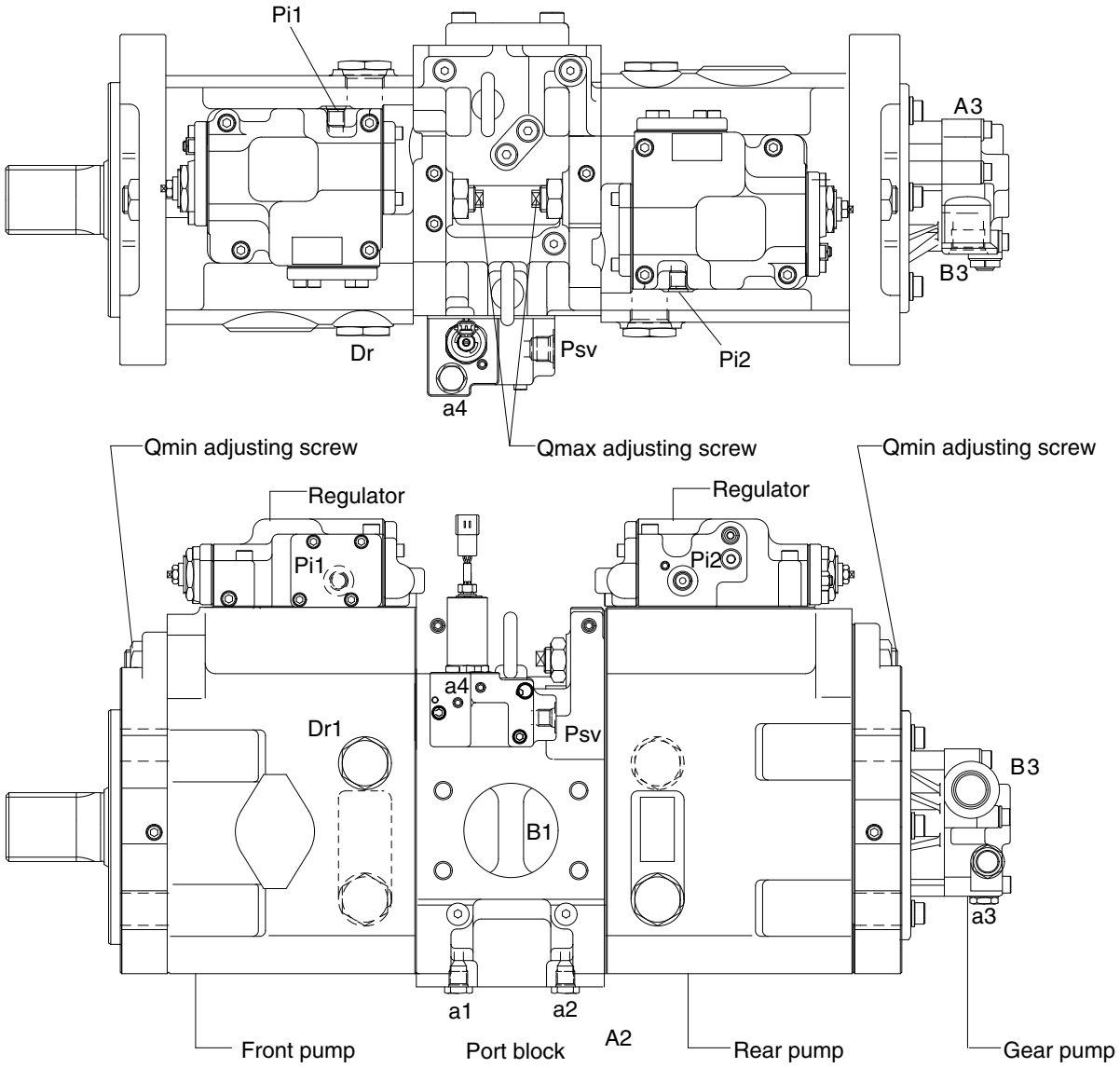


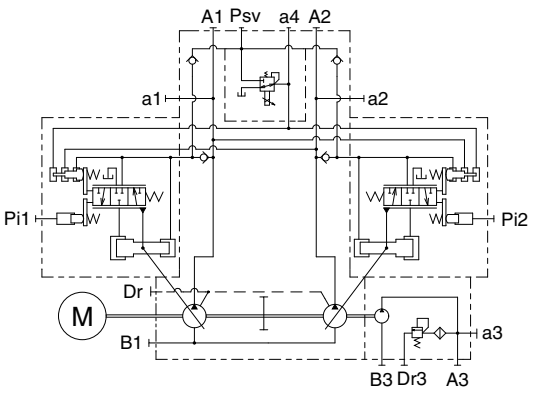
GROUP 1 PUMP DEVICE (MACHINE SERIAL NO. : #0316-)

1. STRUCTURE

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

1) OUTLINE



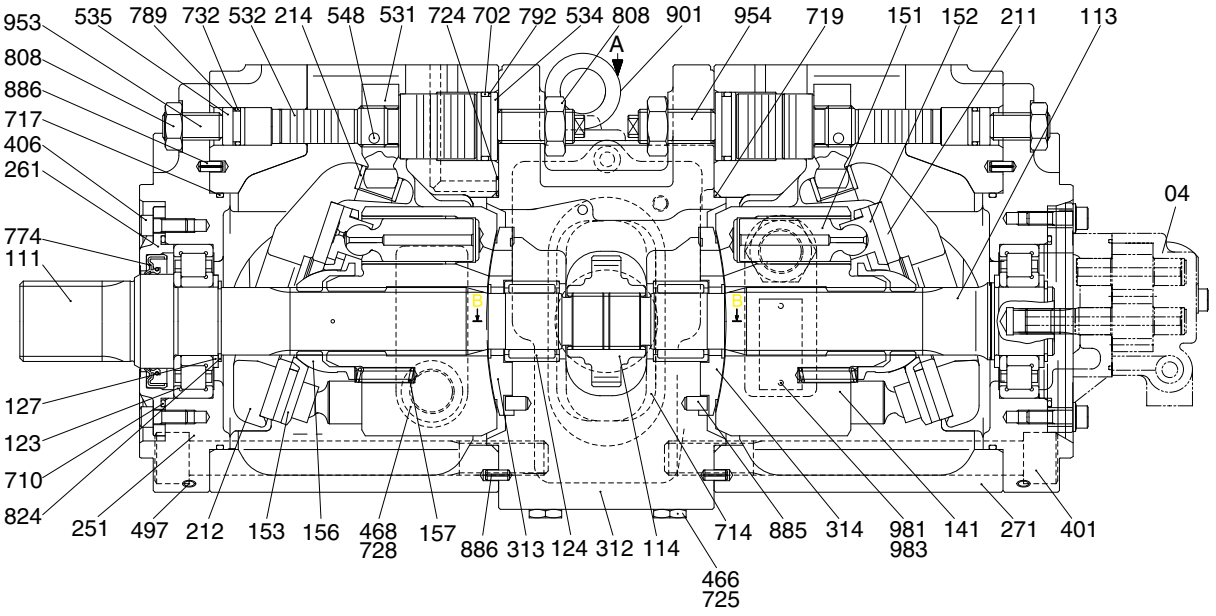


320A2MP01

Port	Port name	Port size
A1, 2	Delivery port	SAE6000 psi 1"
B1	Suction port	SAE2500 psi 3"
Dr	Drain port	PF 3/4 - 23
Pi1, i2	Pilot 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 - 15

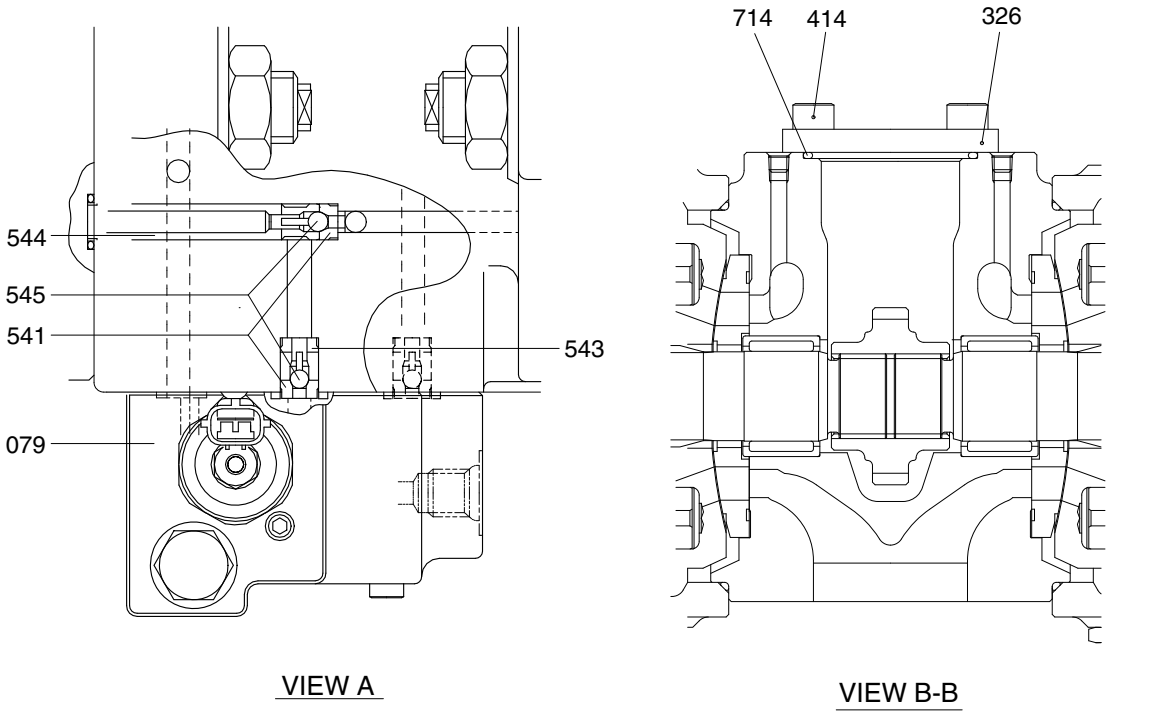
2) MAIN PUMP (1/2)

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



04	Gear pump	312	Valve block	710	O-ring
111	Drive shaft (F)	313	Valve plate (R)	714	O-ring
113	Drive shaft (R)	314	Valve plate (L)	717	O-ring
114	1st gear	401	Hexagon socket bolt	719	O-ring
123	Roller bearing	406	Hexagon socket bolt	723	O-ring
124	Needle bearing	465	ROH plug	724	Square ring
127	Bearing spacer	466	VP plug	725	O-ring
141	Cylinder block	468	VP plug	728	O-ring
151	Piston	497	MH plug	732	O-ring
152	Shoe	531	Tilting pin	774	Oil seal
153	Set plate	532	Servo piston	789	Back up ring
156	Spherical bushing	534	Stopper (L)	792	Back up ring
157	Cylinder spring	535	Stopper (S)	808	Hexagon head nut
211	Shoe plate	541	Seat	824	Snap ring
212	Swash plate	543	Stopper 1	885	Valve plate pin
214	Tilting bushing	544	Stopper 2	886	Spring pin
251	Swash plate support	545	Steel ball	901	Eye bolt
261	Seal cover (F)	548	Feedback pin	953	Set screw
271	Pump casing	702	O-ring	954	Set screw

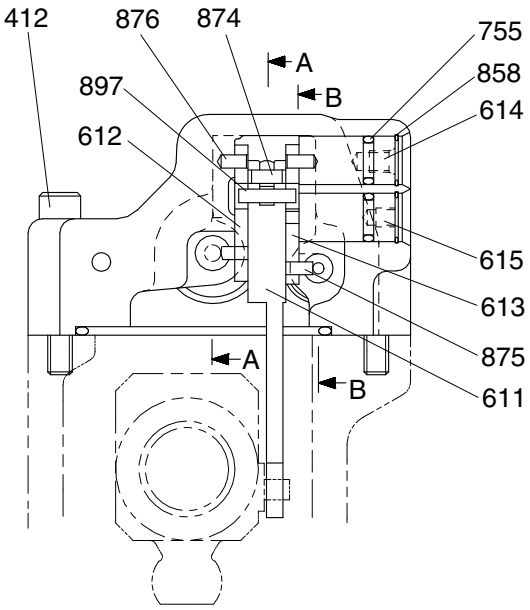
MAIN PUMP (2/2)

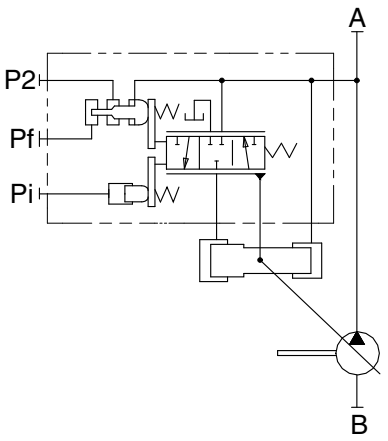


320A2MP04

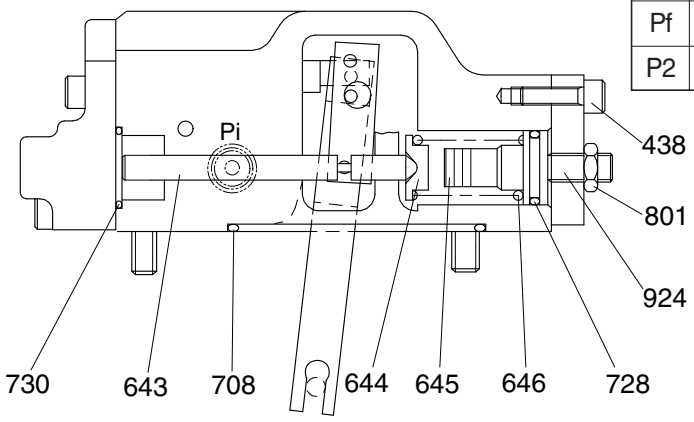
079	Proportional reducing valve	541	Seat	545	Steel ball
326	Cover	543	Stopper 1	741	O-ring
414	Hexagon socket bolt	544	Stopper 2		

2) REGULATOR (1/2)

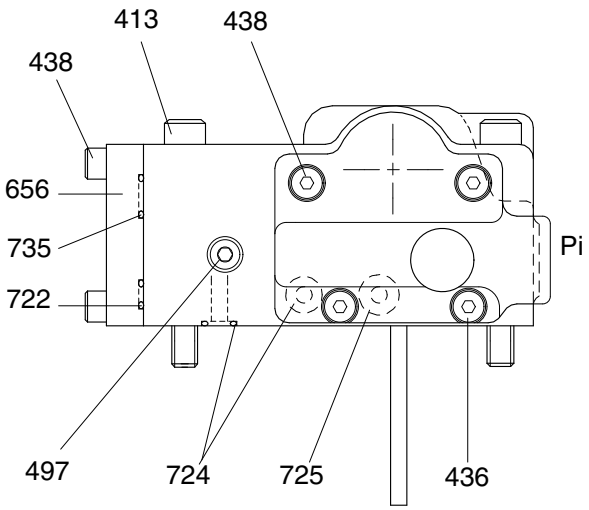




Port	Port name	Port size
A	Delivery port	SAE 6000 PSI 1"
B	Suction port	SAE 2500 PSI 3"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



SECTION B-B

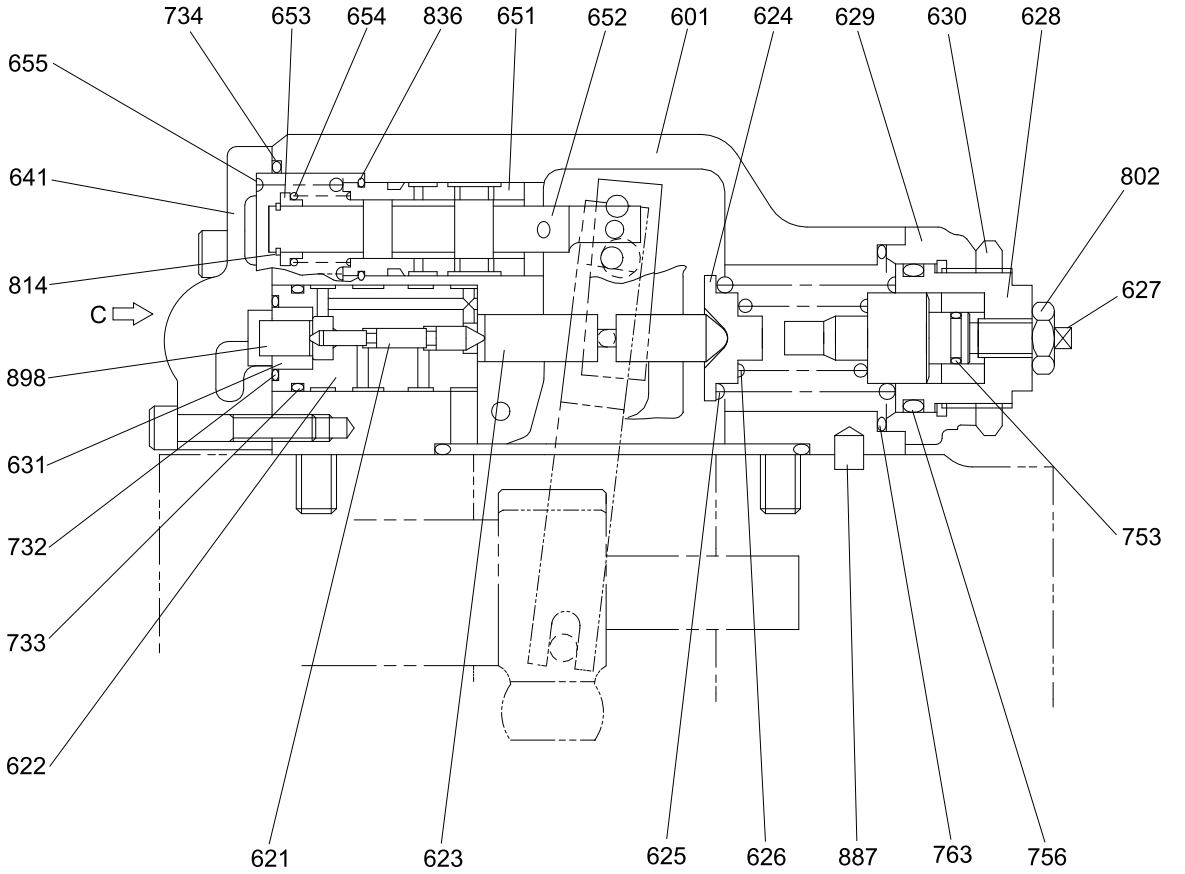


VIEW C

320A2MP06

412 Hexagon socket screw
413 Hexagon socket screw
436 Hexagon socket screw
438 Hexagon socket screw
497 Plug
611 Feed back lever
612 Lever (1)
613 Lever (2)
614 Fulcrum plug
615 Adjust plug
643 Pilot piston
644 Spring seat (Q)
645 Adjust stem (Q)
646 Pilot spring
656 Block cover
708 O-ring
722 O-ring
724 Square ring
725 O-ring
728 O-ring
730 O-ring
735 O-ring
755 O-ring
801 Nut
858 Snap ring
874 Pin
875 Pin
876 Pin
897 Pin
924 Set screw

REGULATOR (2/2)

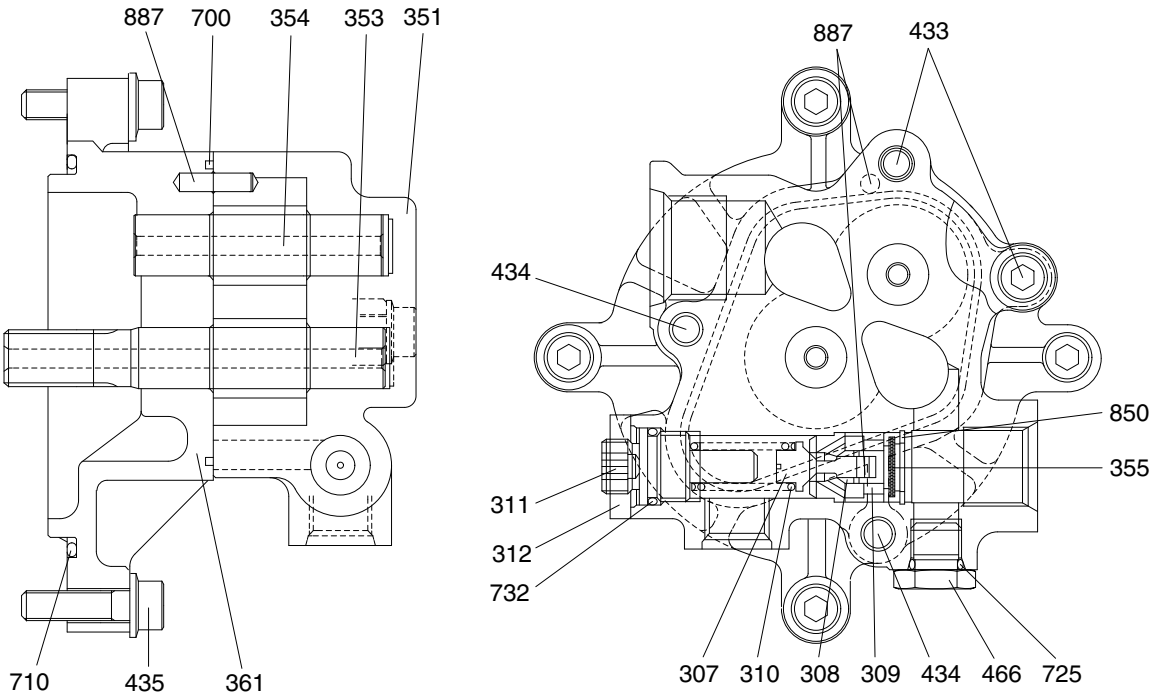


SECTION A-A

320A2MP07

601	Casing	630	Lock nut	734	O-ring
621	Compensator piston	631	Sleeve, pf	753	O-ring
622	Piston case	641	Pilot cover	756	O-ring
623	Compensator rod	651	Sleeve	763	O-ring
624	Spring seat (C)	652	Spool	802	Nut
625	Outer spring	653	Spring seat	814	Snap ring
626	Inner spring	654	Return spring	836	Snap ring
627	Adjust stem (C)	655	Set spring	887	Pin
628	Adjust screw (C)	732	O-ring	898	Pin
629	Cover (C)	733	O-ring		

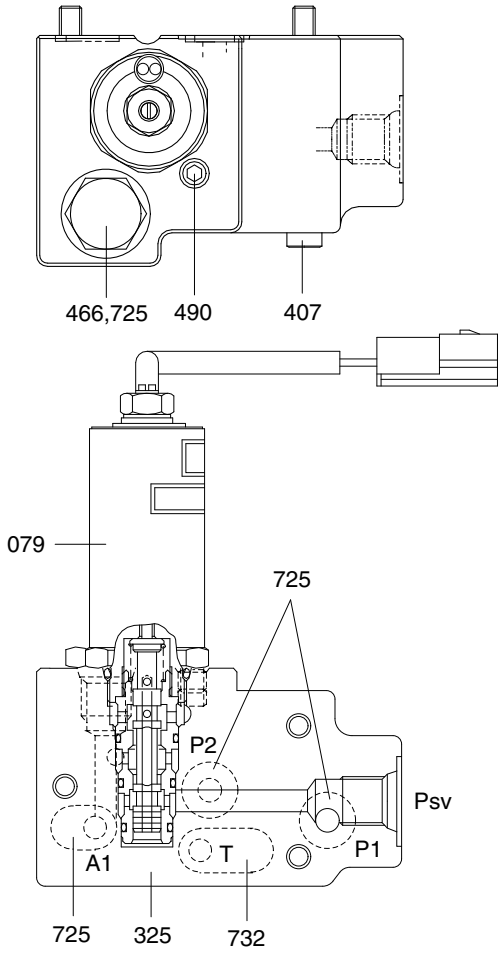
3) GEAR PUMP

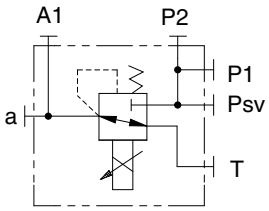


320A2MP08

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

4) EPPR VALVE AND CASING SUB



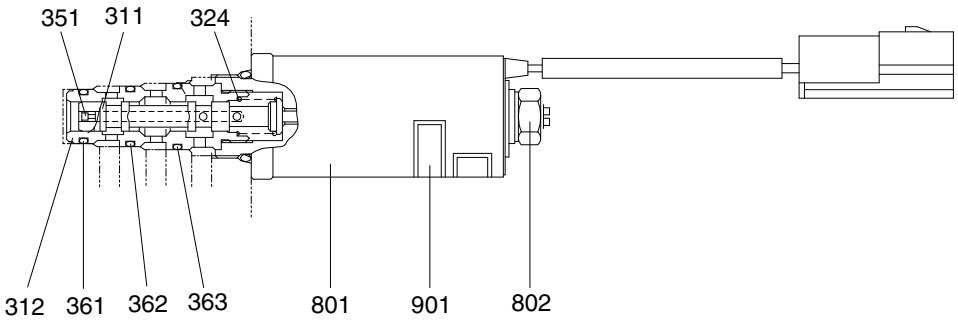


Hydraulic circuit

320A2MP09

079 EPPR valve assy	466 VP plug	725 O-ring
325 Valve casing	490 Plug	732 O-ring
407 Hexagon socket head screw		

5) EPPR VALVE ASSY



320A2MP10

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

2. FUNCTION

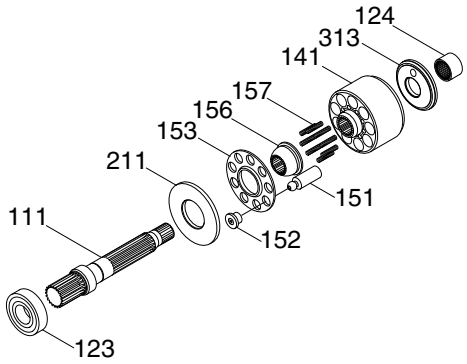
1) MAIN PUMP

The pumps may 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), 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.



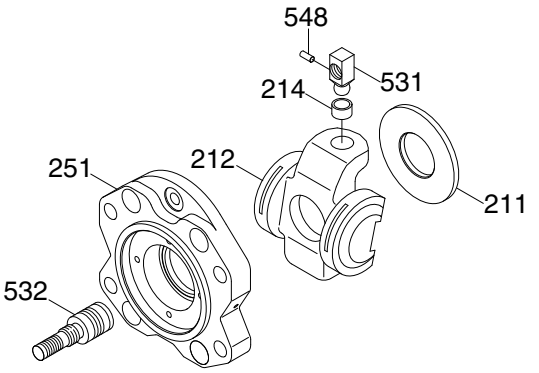
29092MP06

(2) Swash plate group

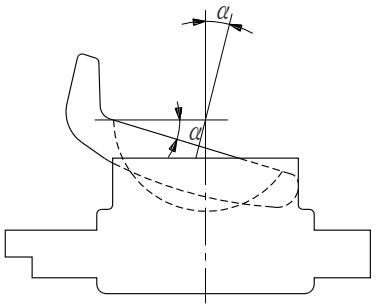
The swash plate group consists of swash plate (212), shoe plate (211), swash plate support (251), tilting bush (214), tilting pin (531) and servo piston (532).

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)



29092MP07



2-7

(3) Valve block group

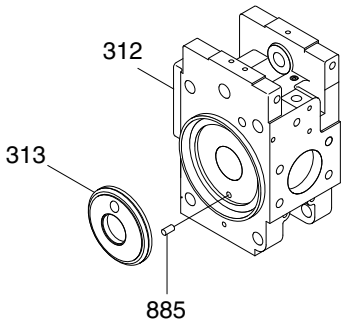
The valve block group consists of valve block (312), valve plate (313) and valve plate pin (885).

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.



320A2MP15

2) REGULATOR

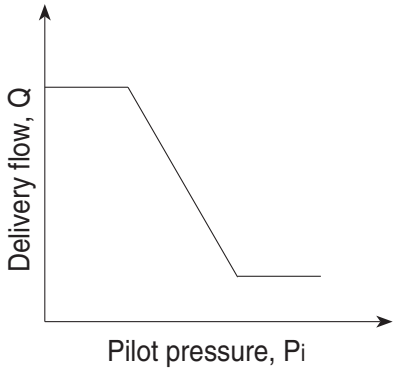
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

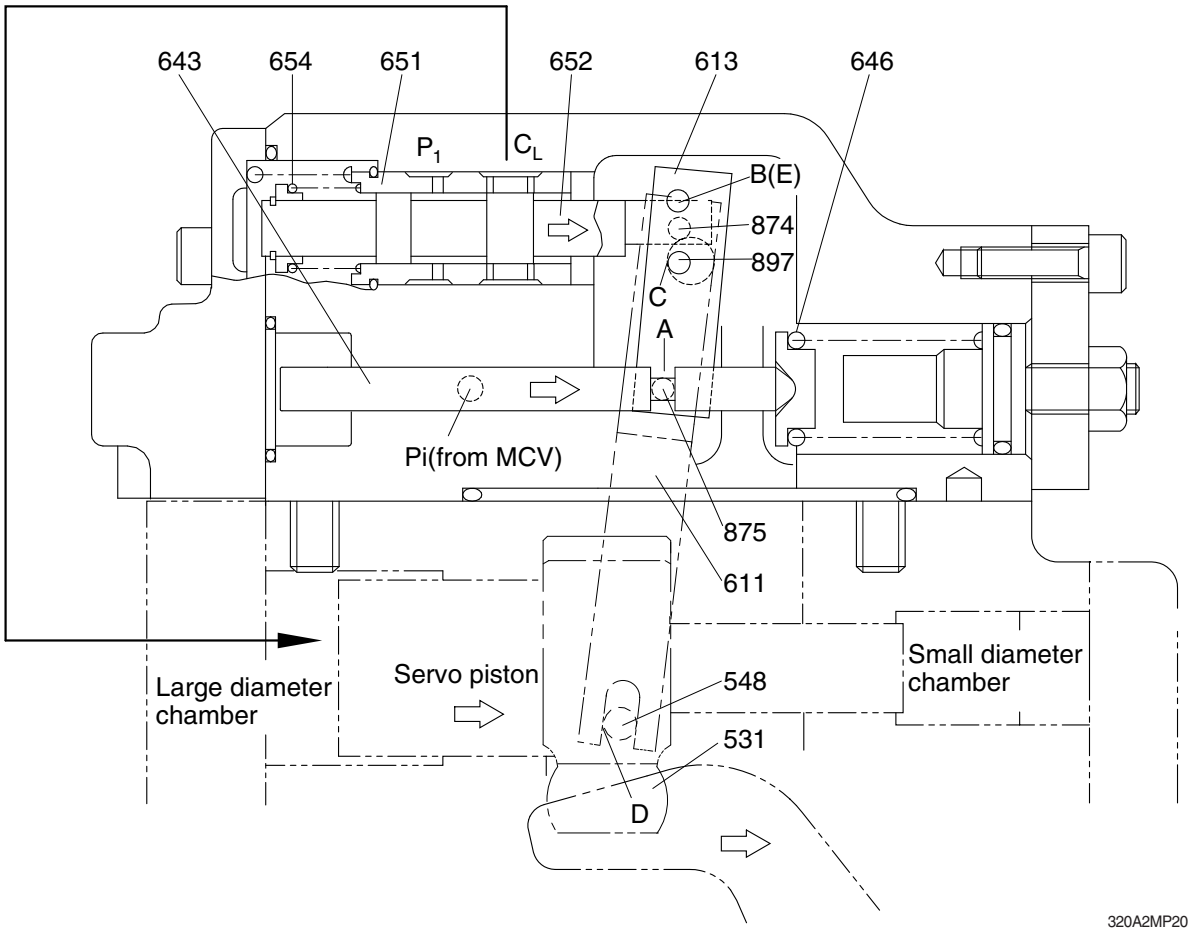
By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

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.

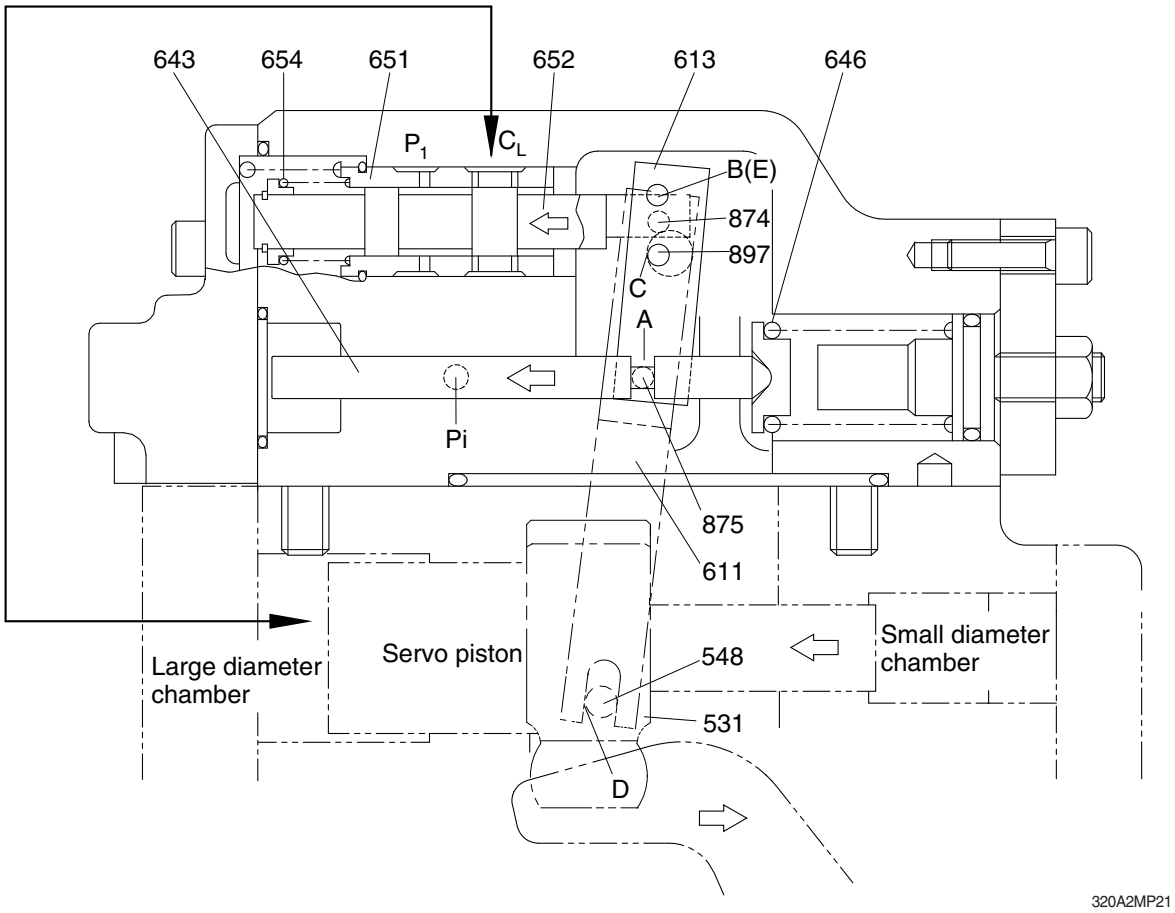
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.

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

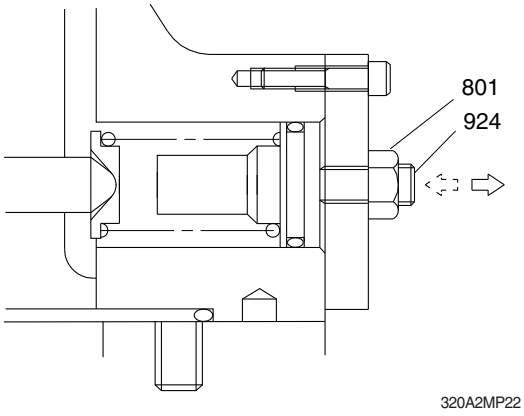


As the pilot pressure Pi decreases, the pilot piston (643) moves to the left by the action of the pilot spring (646) and causes lever 2 (613) to rotate around the fulcrum of point B. Since the pin (897) is pressed against the large hole section (C) of lever 2 by the action of the return spring (654) 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.

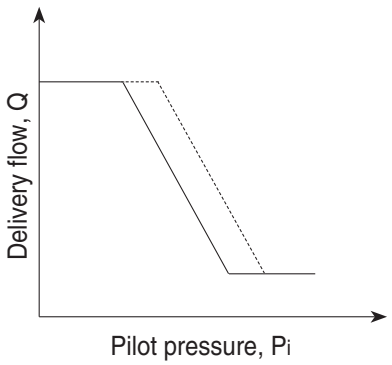
③ Adjustment of flow control characteristic

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)
1800	+1/4	+0.7	+14.6

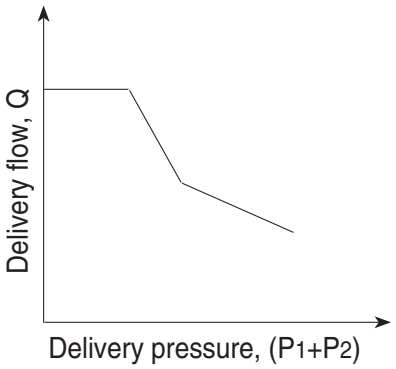


(2) Total horsepower control

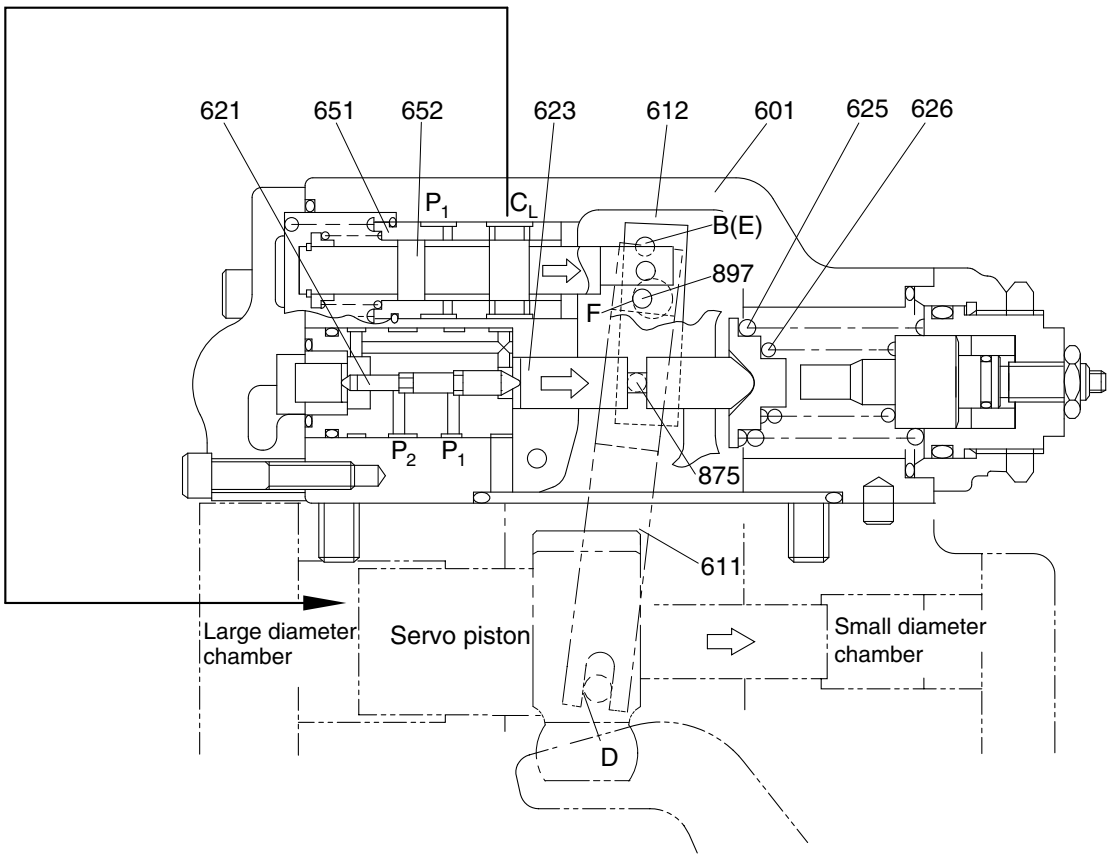
The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.
(The input horsepower is constant when the speed is constant.)
Since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

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

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



① Overload preventive function



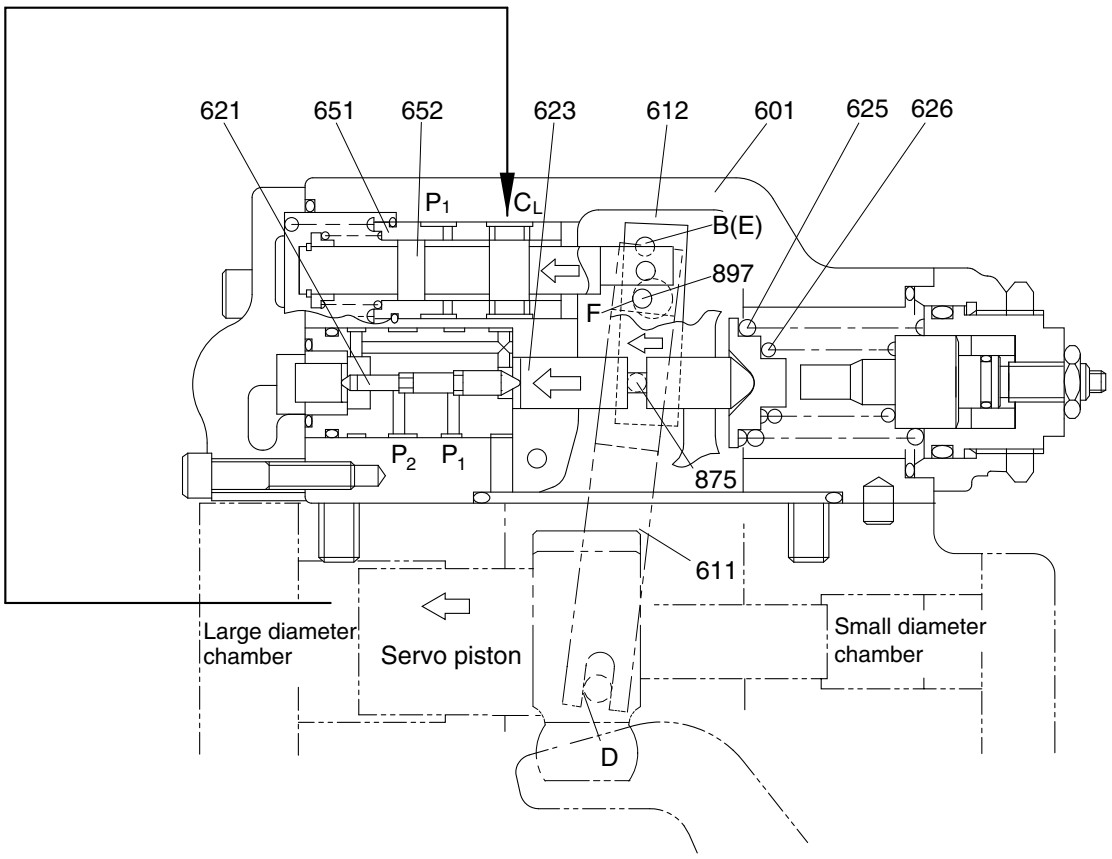
320A2MP23

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



320A2MP24

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

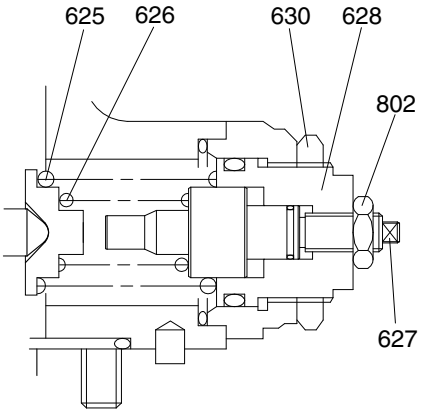
As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections (C & F) of levers 1 and 2. However, since sections C and F have the pins (∅4) protruding from the large hole (∅8), only the lever lessening the tilting angle contacts the pin (897) ; the hole (∅8) 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

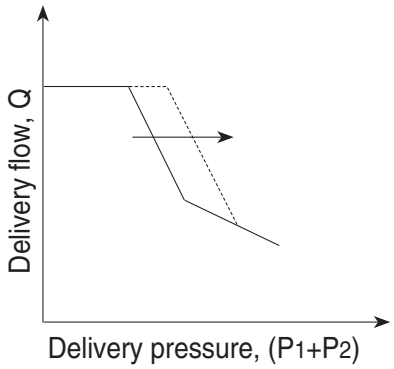
Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628). Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C by N turns changes the setting of the inner spring (626), return the adjusting screw QI (627) by N × A turns at first. (A=1.59)



320A2MP25

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

Speed	Adjustment of outer spring		
	Tightening amount of adjusting screw (C) (628)	Compensating control starting pressure change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(kgf · m)
1800	+1/4	+19	+5.6



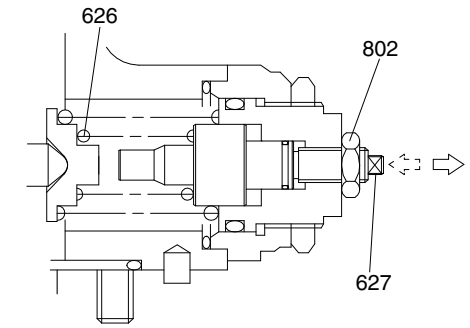
b. Adjustment of inner spring

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

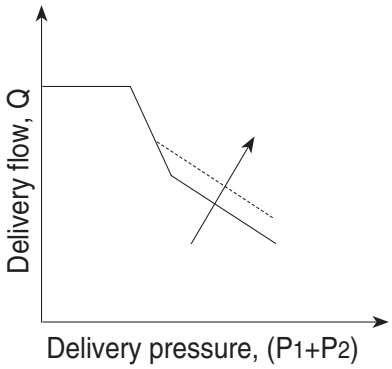
Tightening the screw increases the flow and then the input horsepower as shown in the figure.

※ Adjusting valves are shown in table.

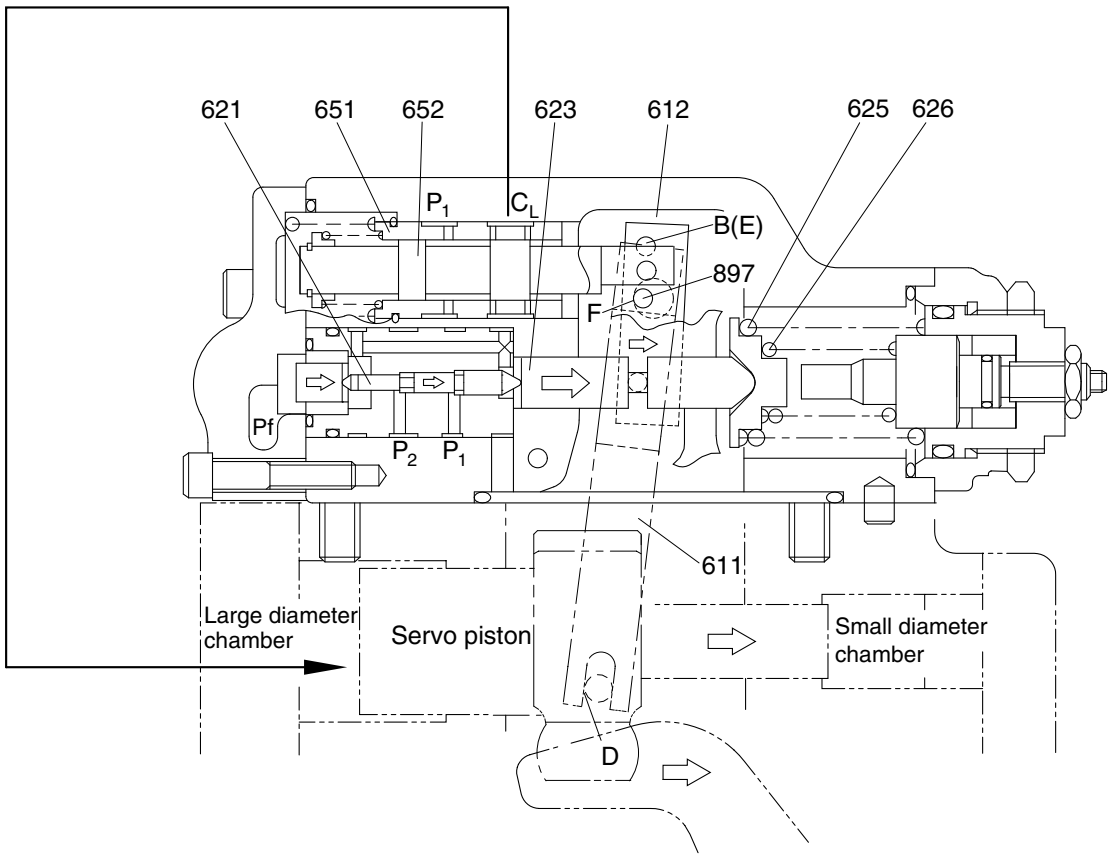
Speed	Adjustment of inner spring		
	Tightening amount of adjusting screw (QI) (627)	Flow change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(kgf · m)
1800	+1/4	+12.6	+5.7



320A2MP26

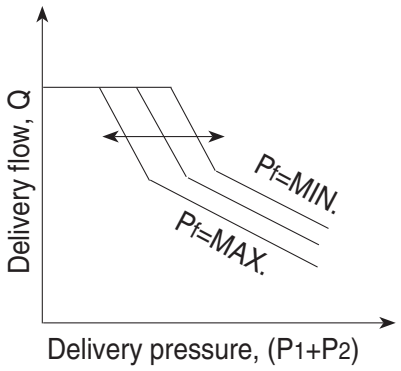


(3) Power shift control



320A2MP27

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



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

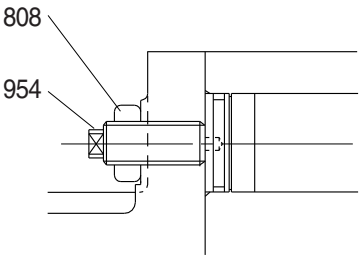
(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

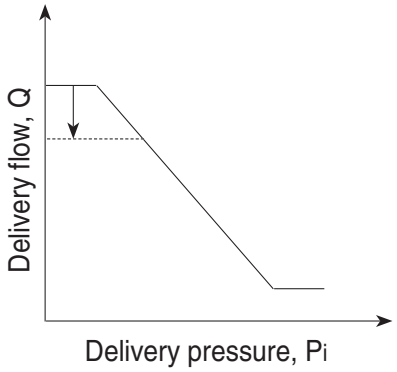
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the set screw (954).

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

Speed (min -1)	Adjustment of max flow	
	Tightening amount of adjusting screw (954) (Turn)	Flow change amount (ℓ /min)
1800	+1/4	-5.6



2-19(1)

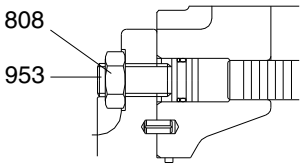


② Adjustment of minimum flow

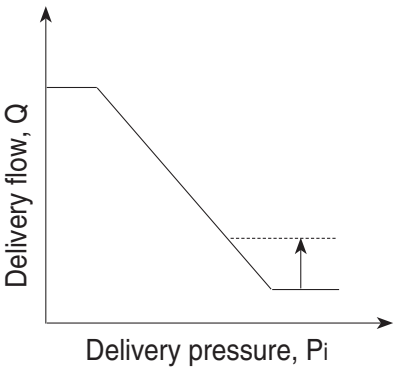
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

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

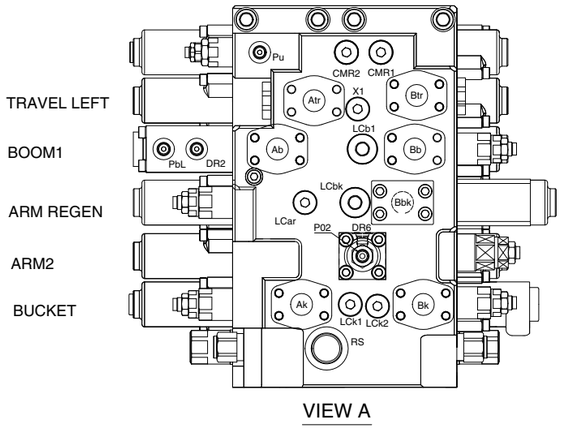
Speed (min -1)	Adjustment of min flow	
	Tightening amount of adjusting screw (953) (Turn)	Flow change amount (ℓ /min)
1800	+1/4	+4.5



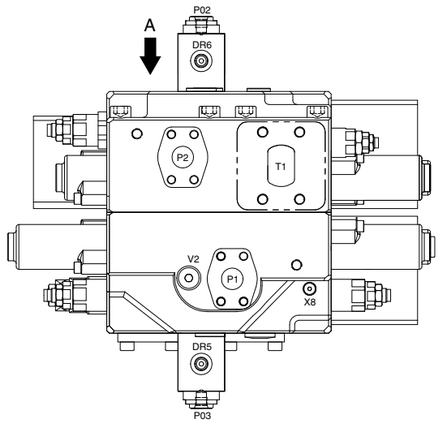
320A2MP28

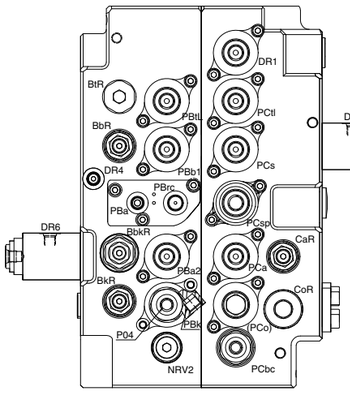


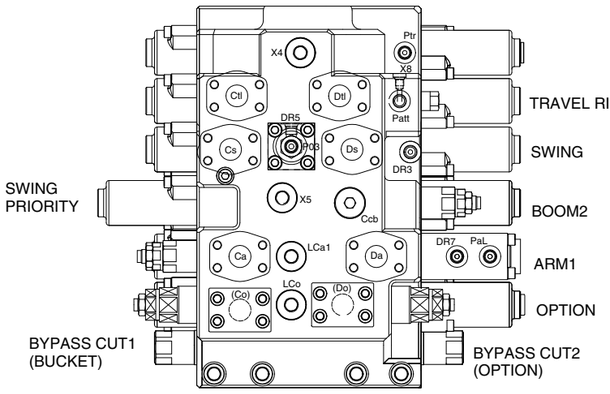
1. STRUCTURE (1/8)

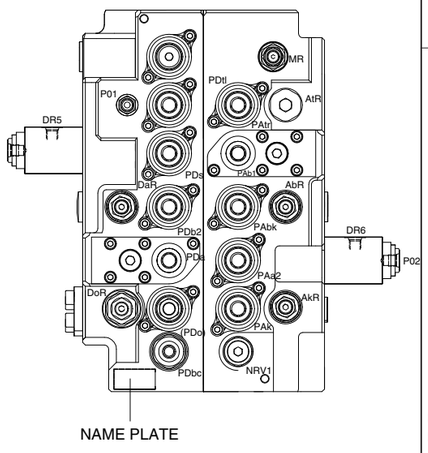


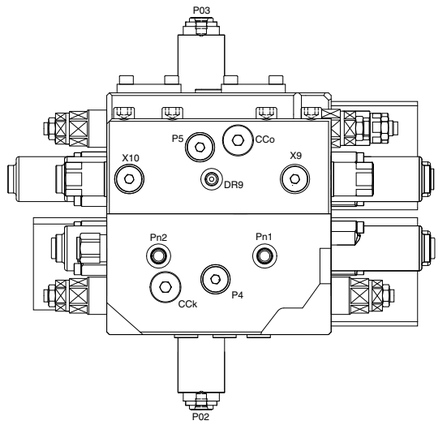
VIEW A







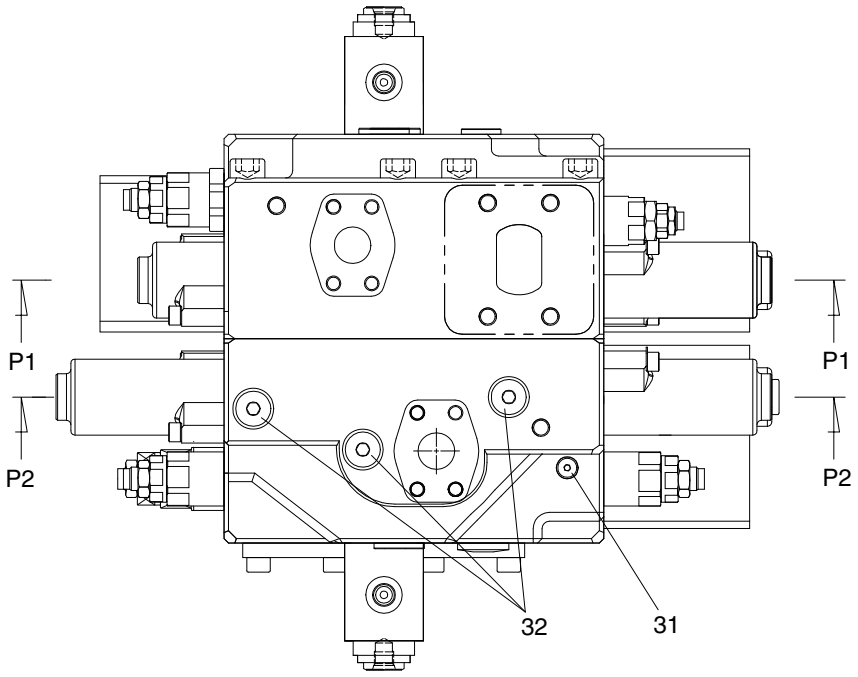




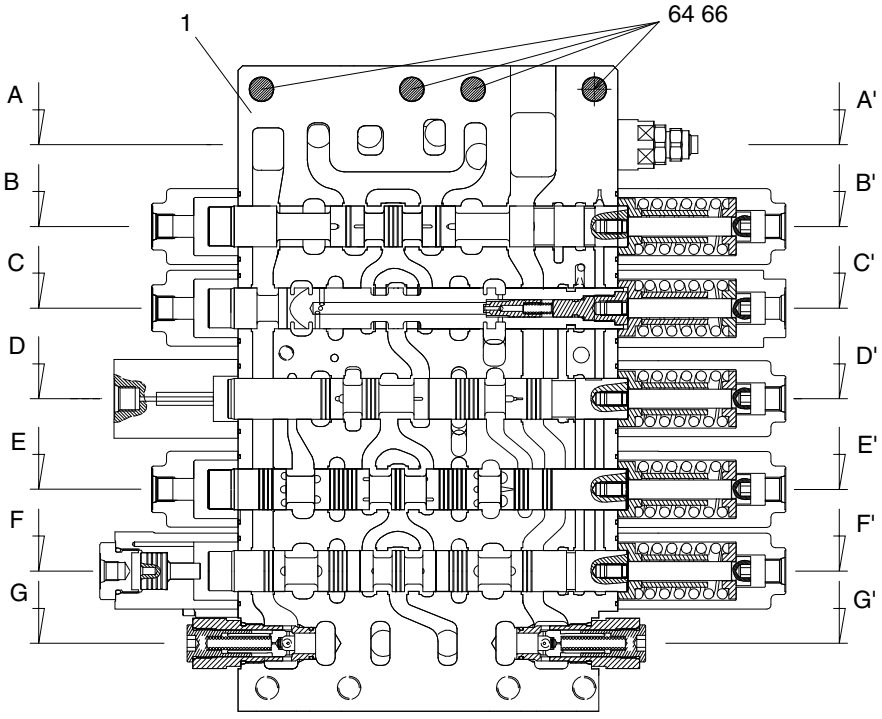
300A2MC01A

Mark	Port name	Port size	Tightening torque
Rs	Make up for swing motor	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt	Auto idle signal-attachment	PF1/4	3.5~4.0 kgf · m (25.3~28.9 lbf · ft)
PbL	Lock valve pilot port (boom)		
PCbc	Bucket in confluence pilot port		
PDbc	Option confluence pilot port		
P01	Pilot signal port		
P02	Pilot signal port		
P03	Swing logic pilot port		
P04	Bucket parallel orifice pilot port		
(P05)	Option B confluence pilot port		
PBa	Arm in regen-cut signal selector port		
PaL	Lock valve pilot port (arm)		
Ptr	Auto idle signal-travel		
Pu	Power boost		
DR1	Drain port		
DR2	Drain port		
DR3	Drain port		
DR4	Drain port		
DR5	Drain port		
DR6	Drain port		
DR7	Drain port		
DR9	Drain port		
(P4)	-	PF1/2	10~12 kgf · m (72.3~86.8 lbf · ft)
(P5)	-		
PAtr	Travel pilot port-RH (FW)	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
PBtr	Travel pilot port-RH (BW)		
PCtl	Travel pilot port-LH (BW)		
PDtl	Travel pilot port-LH (FW)		
PAb1	Boom up pilot port		
PDb2	Boom up confluence pilot port		
PBb1	Boom down pilot port		
PCs	Swing pilot port (LH)		
PDs	Swing pilot port (RH)		
PBa2	Arm in confluence pilot port		
PCsp	Swing priority pilot port		
PAbk	Option A pilot port (breaker)		
PBrc	Arm in regeneration cut port		
PCa	Arm in pilot port		
PDa	Arm out pilot port		
PAa2	Arm out confluence pilot port		
PAk	Bucket in pilot port		
PBk	Bucket out pilot port		
(PCo)	Option B pilot port		
(PDo)	Option B pilot port		
Pn1	Negative control signal port (A2 port side)		
Pn2	Negative control signal port (A1 port side)		
(V2)	Carry-over port		
Atr	Travel motor port-LH (FW)	M10	5.0~6.5 kgf · m (36.2~47.0 lbf · ft)
Btr	Travel motor port-LH (BW)		
CtL	Travel motor port-RH (BW)		
DtL	Travel motor port-RH (FW)		
Ab	Boom up port		
Bb	Boom down port		
Cs	Swing motor port (LH)		
Ds	Swing motor port (RH)		
(Bbk)	Option A port (breaker)		
Ca	Arm in port		
Da	Arm out port		
Ak	Bucket in port		
Bk	Bucket out port		
(Co)	Option B port		
(Do)	Option B port		
P1	Pump port (A2 side)		
P2	Pump port (A1 side)		
T1	Return port	M12	8.0~11.0 kgf · m (57.9~79.6 lbf · ft)

STRUCTURE (2/8)



TOP VIEW

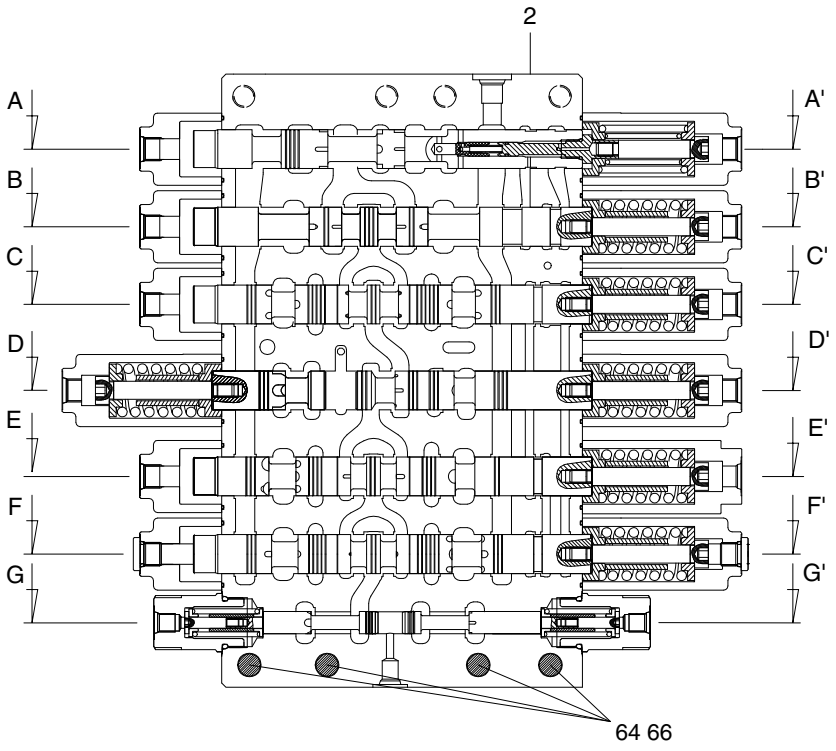


P1 BLOCK SPOOL SECTION

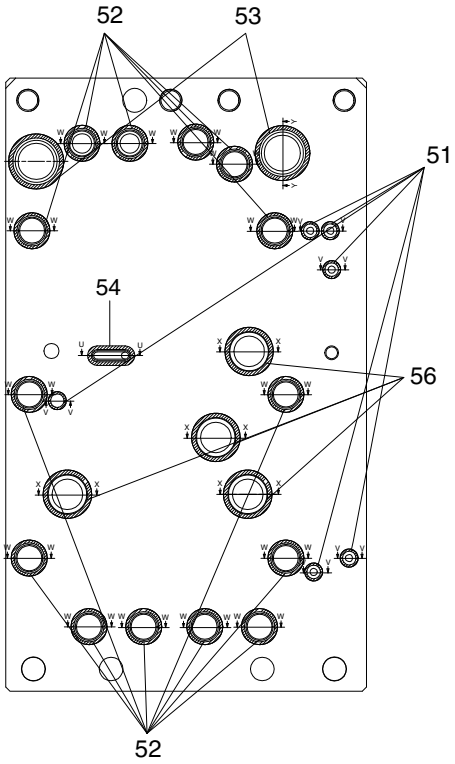
300A2MC02

1	Housing P1
31	Plug kit
32	Plug kit
64	Hex socket head bolt
66	Spring washer

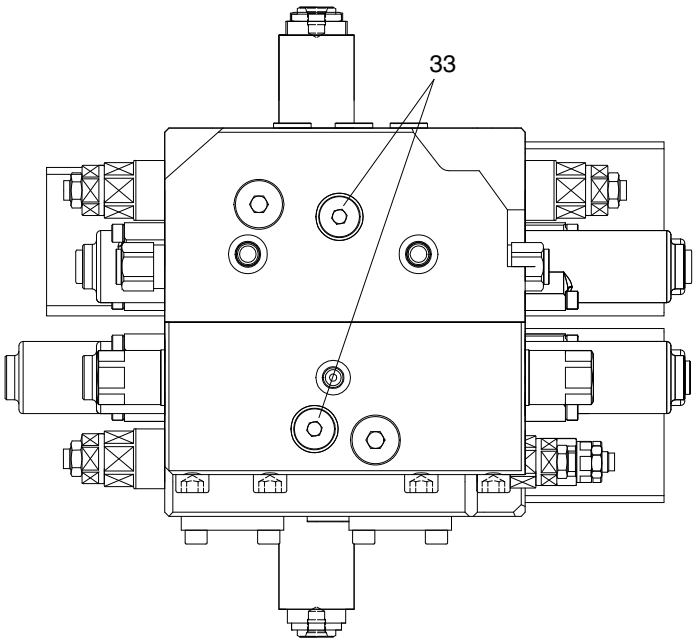
STRUCTURE (3/8)



P2 BLOCK SPOOL SECTION



CONTACT FACE

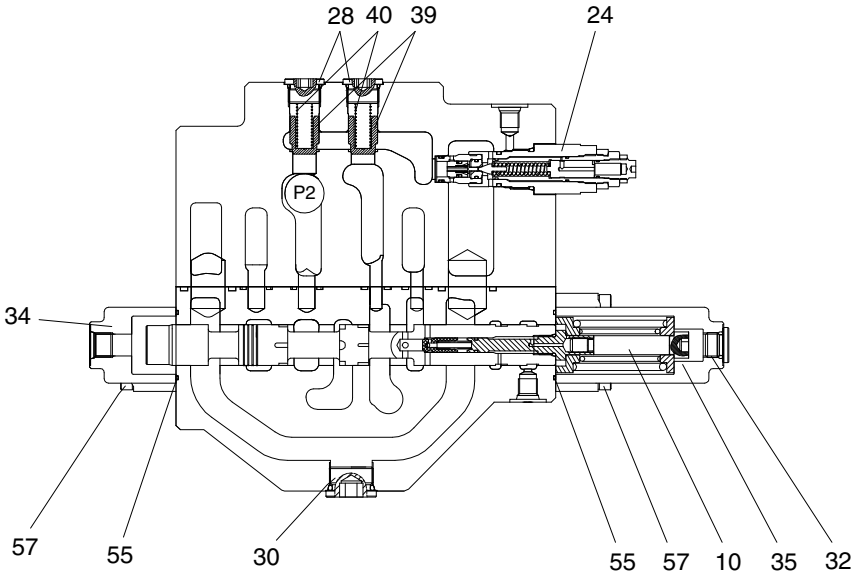


BOTTOM VIEW

300A2MC03

2	Housing 2
33	Plug kit
51	O-ring
52	O-ring
53	O-ring
54	O-ring
56	O-ring
64	Hex socket head bolt
66	Spring washer

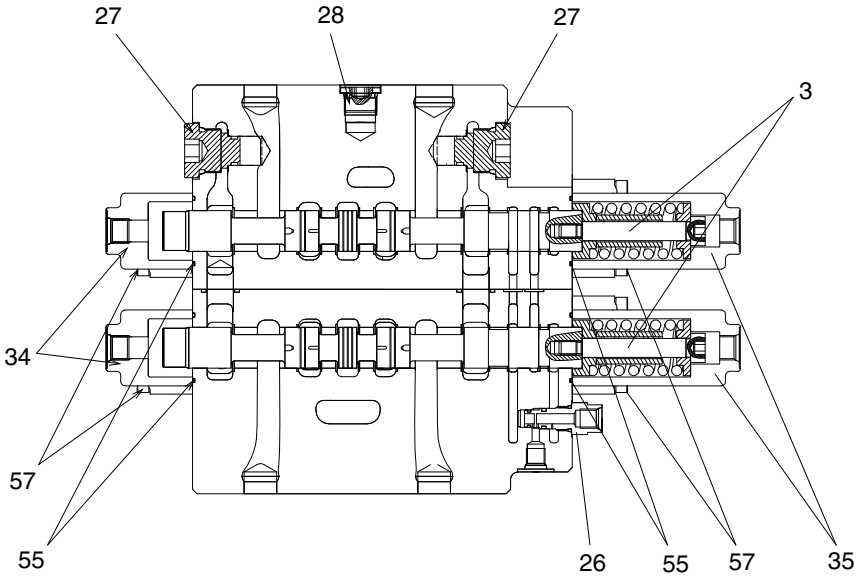
STRUCTURE (4/8)



A-A' (STRAIGHT TRAVEL AND SUPPLY)

220S2MC04

10 Travel straight spool kit
24 Main relief valve
28 Plug kit
30 Plug kit
32 Plug kit
34 Pilot cover A
35 Pilot cover B
39 Check valve poppet 2
40 Check valve spring 2
55 O-ring
57 Hex socket head bolt

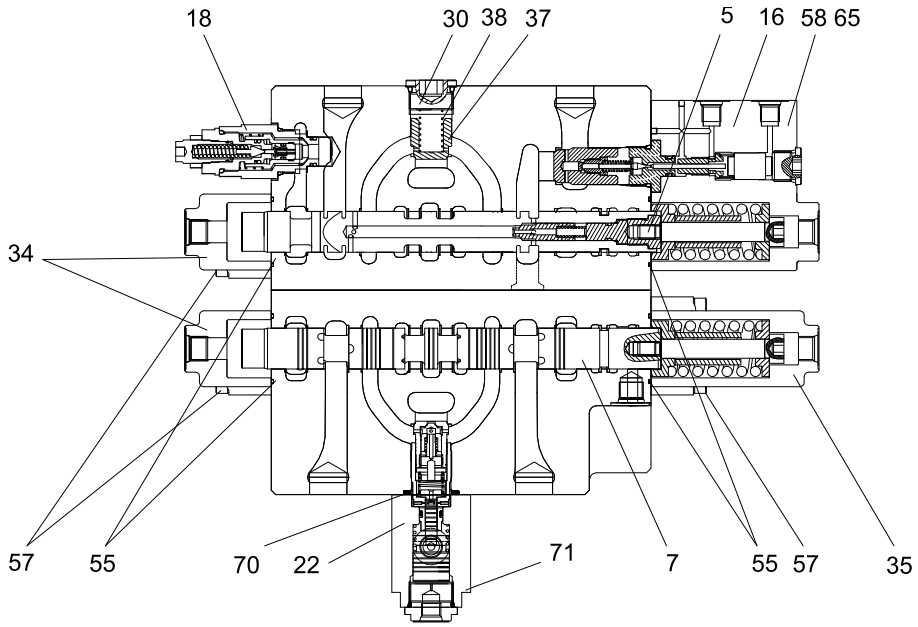


B-B' (TRAVEL RIGHT AND LEFT)

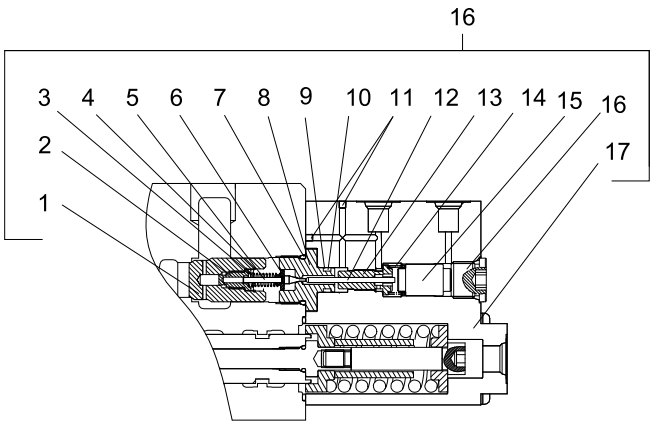
220S2MC05

3 Travel spool kit
26 Orifice signal plug
27 ORV plug
28 Plug kit
34 Pilot cover A
35 Pilot cover B
55 O-ring
57 Hex socket head bolt

STRUCTURE (5/8)



C-C' (SWING AND BOOM1)

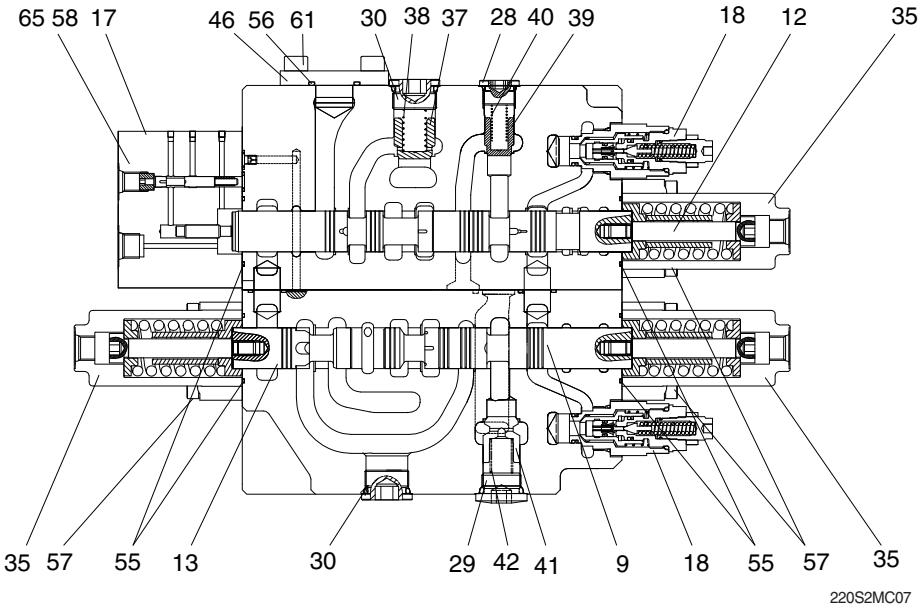


HOLDING VALVE

300A2MC06

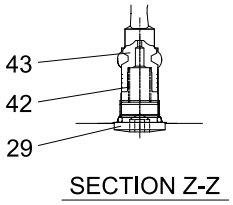
5	Boom 1 spool kit	16-9	Back up ring	30	Plug kit
7	Swing spool kit	16-10	O-ring	34	Pilot cover A
16	Holding valve assy	16-11	Plug	35	Pilot cover B
16-1	Main poppet	16-12	Pilot piston	37	Check valve poppet 1
16-2	Restrictor	16-13	Piston guide	38	Check valve spring 1
16-3	Pilot spring	16-14	Spring	55	O-ring
16-4	C-ring	16-15	Main piston	57	Hex socket head bolt
16-5	Pilot poppet	16-16	Plug	58	Hex socket head bolt
16-6	Poppet guide	16-17	Block	65	Spring washer
16-7	O-ring	18	Overload relief valve	70	O-ring
16-8	Poppet seat	22	Swing logic valve	71	Hex socket head bolt

STRUCTURE (6/8)

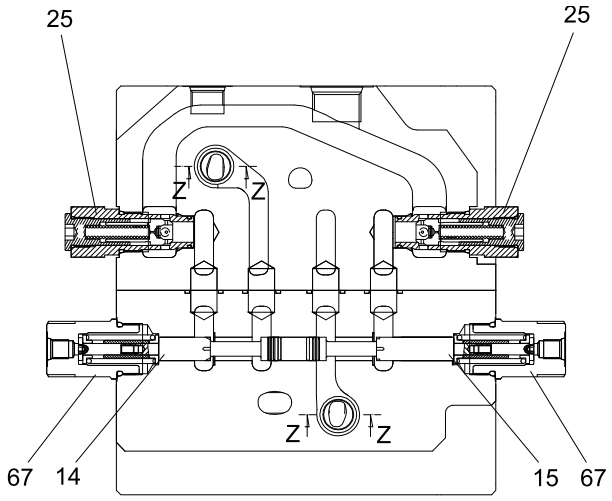


D-D' (SWING PRI, BOOM 2 & ARM REGEN)

9 Boom 2 spool kit
12 Arm regen spool kit
13 Swing priority spool kit
17 Regen valve
18 Overload relief valve
28 Plug kit
29 Plug kit
30 Plug kit
35 Pilot cover B
37 Check valve poppet 1
38 Check valve spring 1
39 Check valve poppet 2
40 Check valve spring 2
41 Check valve poppet 3
42 Check valve spring 3
46 Flange
55 O-ring
56 O-ring
57 Hex socket head bolt
58 Hex socket head bolt
61 Hex socket head bolt
65 Spring washer



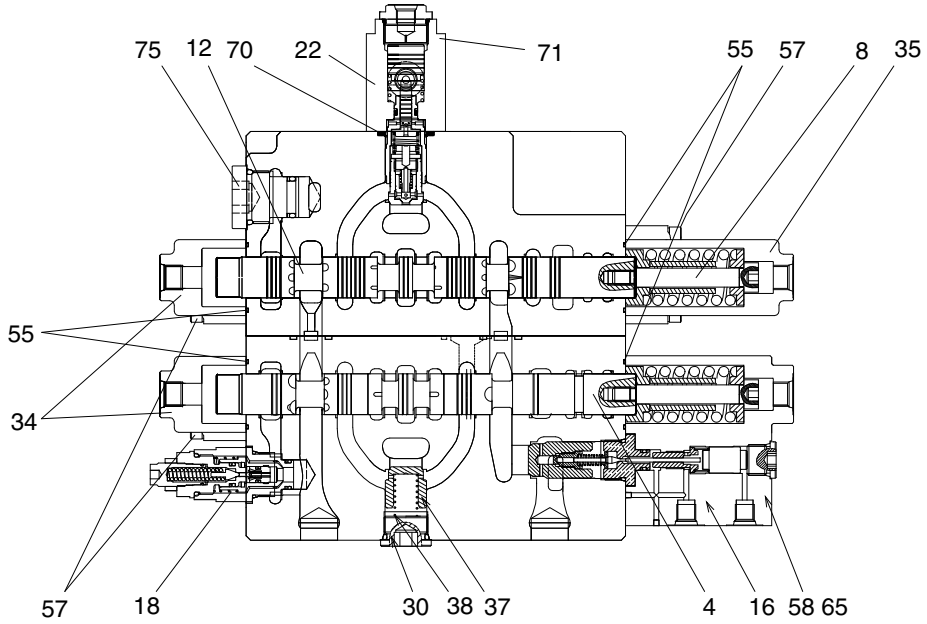
SECTION Z-Z



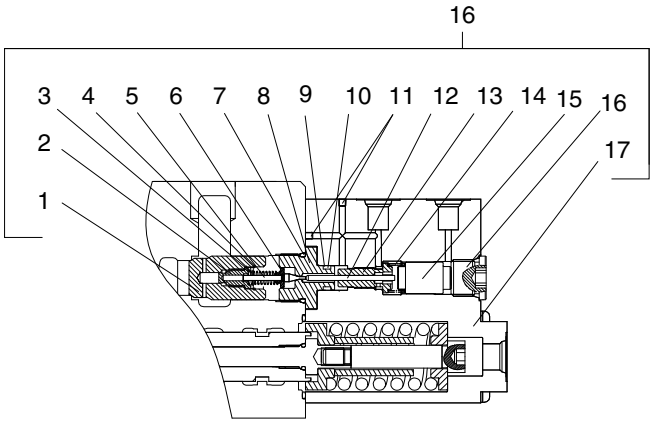
G-G' (BYPASS CUT & NEGATIVE CONTROL)

14 Bypass cut 1 spool kit (bucket)
15 Bypass cut 2 spool kit (option)
25 Negacon valve
29 Plug kit
42 Check valve spring 3
43 Check valve poppet 4
67 Bypass cut plug

STRUCTURE (7/8)



E-E' (ARM 1 & ARM 2)

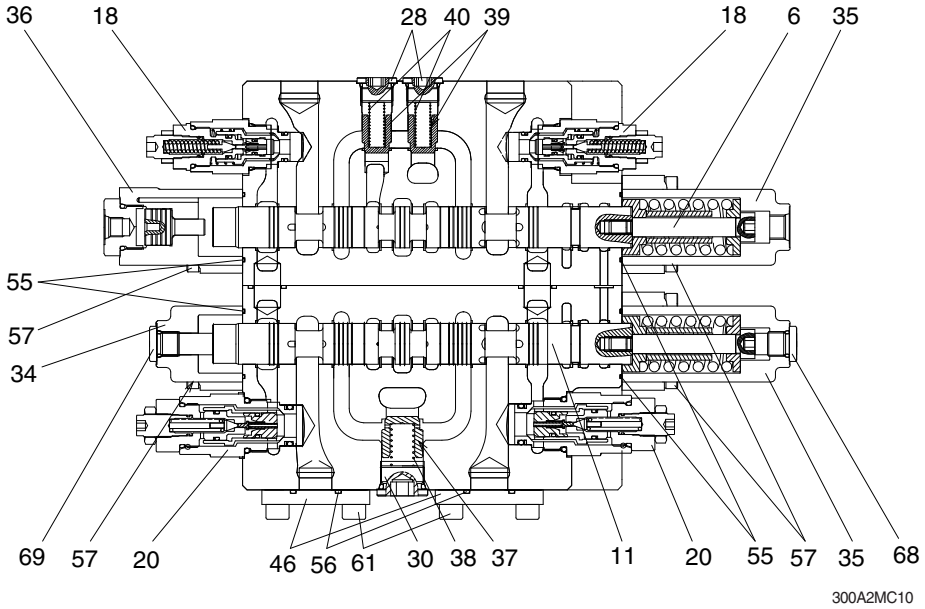


HOLDING VALVE

300A2MC09

4	Arm 1 spool kit	16-9	Back up ring	34	Pilot cover A
8	Arm 2 spool kit	16-10	O-ring	35	Pilot cover B
12	Arm regen spool kit	16-11	Plug	37	Check valve poppet 1
16	Holding valve assy	16-12	Pilot piston	38	Check valve spring 1
16-1	Main poppet	16-13	Piston guide	55	O-ring
16-2	Restrictor	16-14	Spring	57	Hex socket head bolt
16-3	Pilot spring	16-15	Main piston	58	Hex socket head bolt
16-4	C-ring	16-16	Plug	65	Spring washer
16-5	Pilot poppet	16-17	Block	70	O-ring
16-6	Poppet guide	18	Overload relief valve	71	Hex socket head bolt
16-7	O-ring	22	Swing logic valve	75	Plug
16-8	Poppet seat	30	Plug kit		

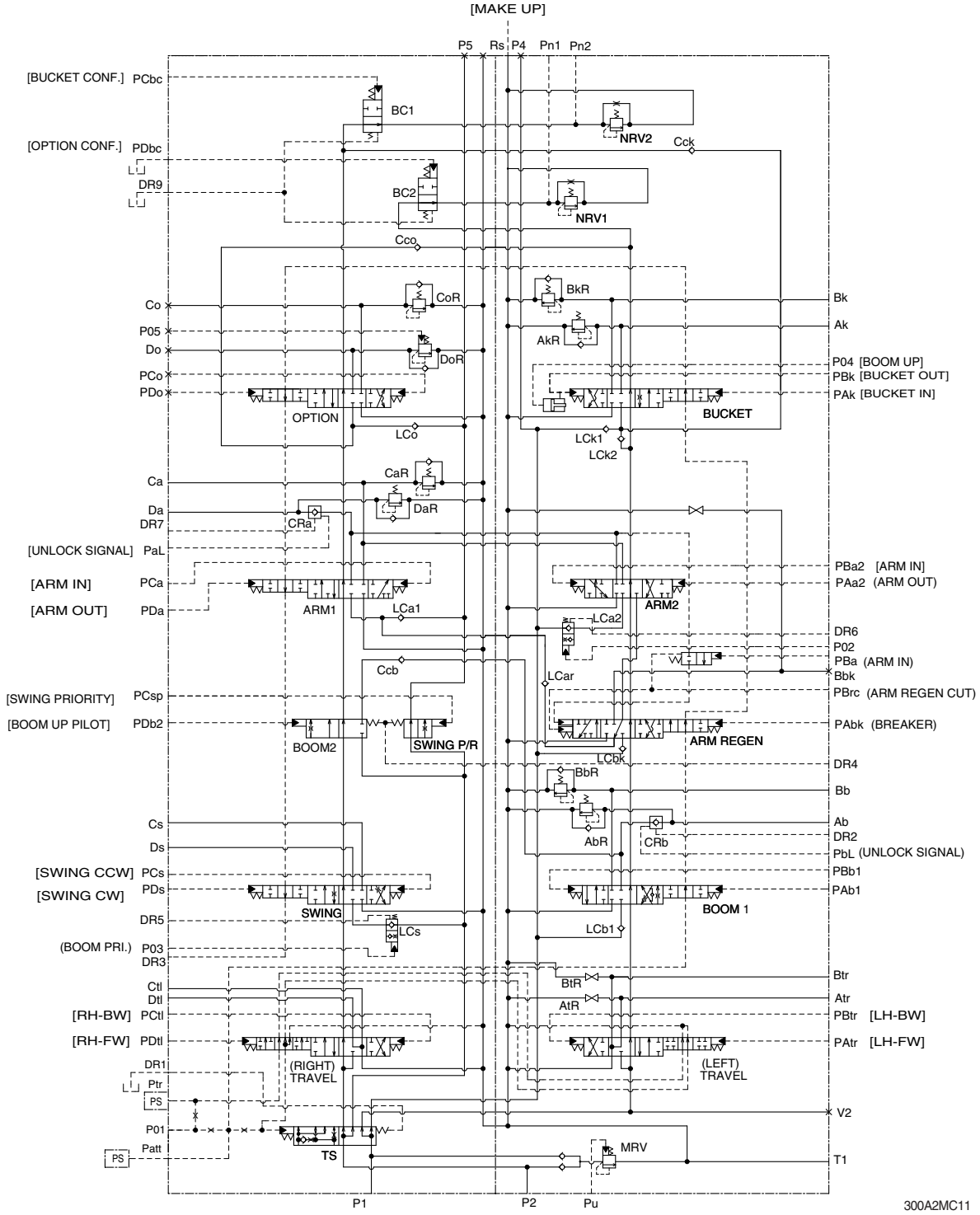
STRUCTURE (8/8)



F-F' (OPTION & BUCKET)

6	Bucket spool kit
11	Option spool kit
18	Overload relief valve
20	Overload relief valve
28	Plug kit
30	Plug kit
34	Pilot cover A
35	Pilot cover B
36	Pilot cover (stroke limit)
37	Check valve poppet 1
38	Check valve spring 1
39	Check valve poppet 2
40	Check valve spring 2
46	Flange
55	O-ring
56	O-ring
57	Hex socket head bolt
61	Hex socket head bolt
68	Plug kit 1
69	Plug kit 2

2. HYDRAULIC CIRCUIT



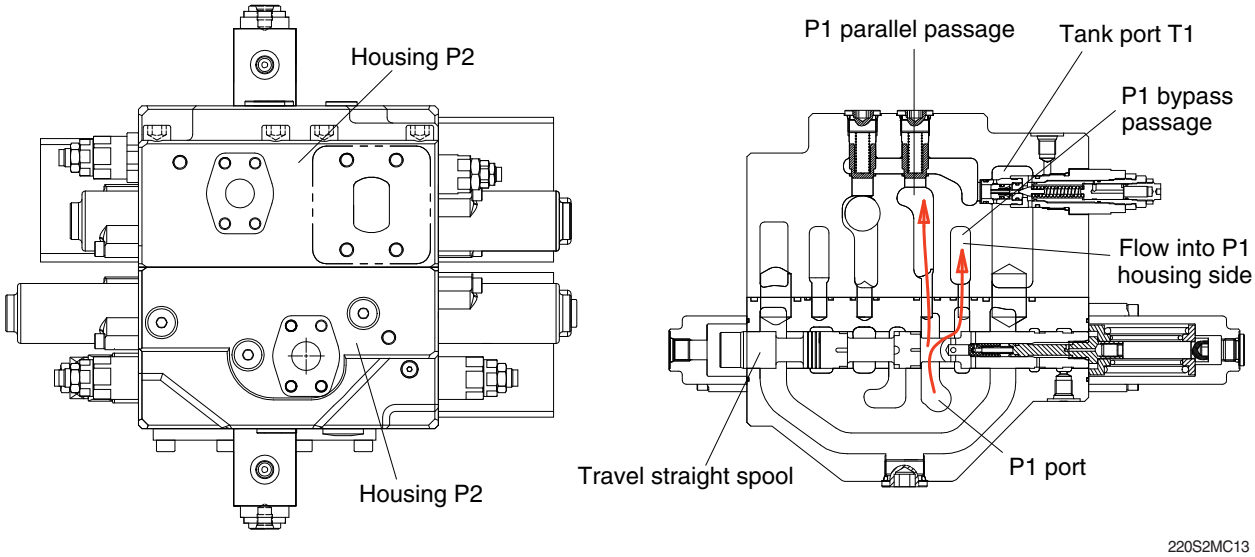
3. FUNCTION

1) CONTROL IN NEUTRAL POSITION

(1) P1 housing side

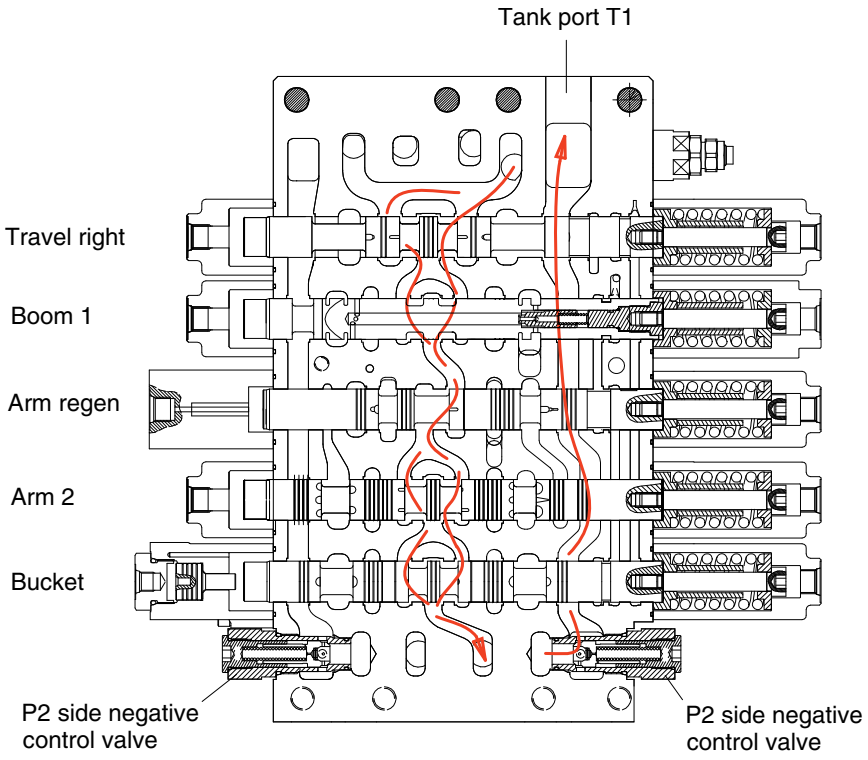
The pressurized oil discharged from hydraulic pump flows into the main control valve through the inlet port P1 and pass the land of the straight travel spool into the P1 bypass passage and P1 parallel passage.

When the straight travel spool is neutral, the P1 side bypass passage is not cut-off and the pressurized oil is directed to the tank port T1 through the bypass passage of spools (travel right -> boom 1 -> arm regeneration -> arm 2 -> bucket), the negative control valve of P1 and tank passage.

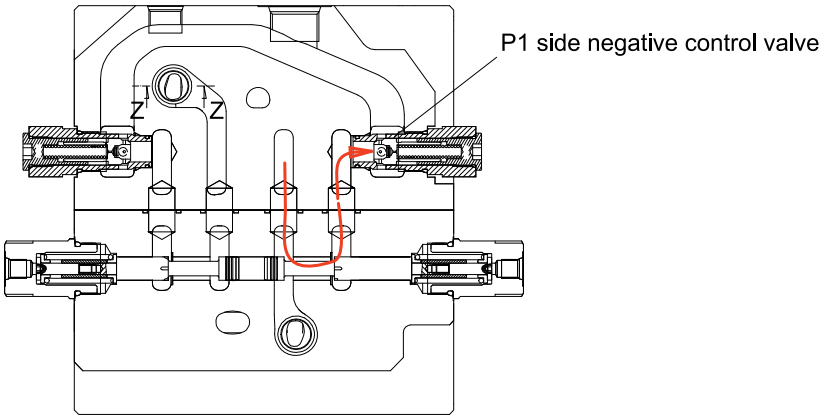


TOP VIEW

A-A' (STRAIGHT TRAVEL AND SUPPLY)



P1 BLOCK SPOOL SECTION

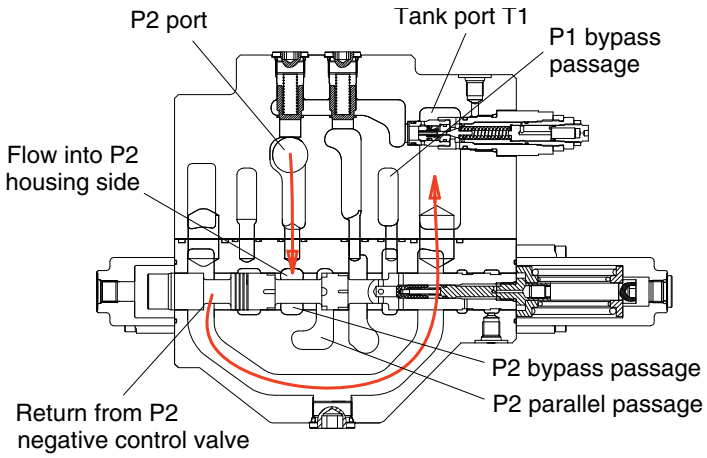


G-G' (BYPASS CUT & NEGATIVE CONTROL) 300A2MC15

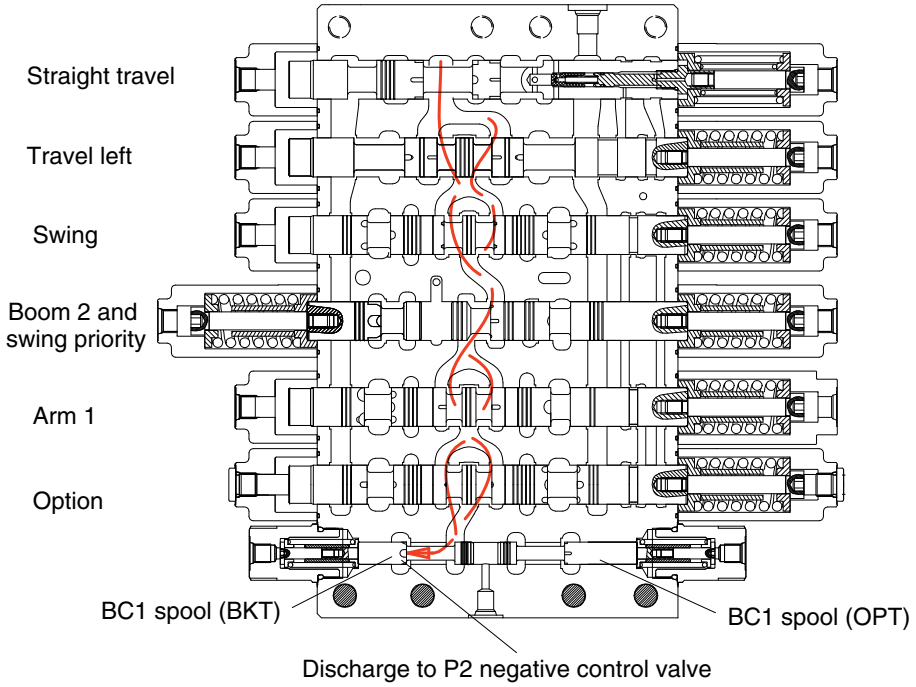
(2) P2 housing side

The pressurized oil discharged from hydraulic pump flows into the main control valve through the inlet port P2 and pass the land of the straight travel spool into the P2 bypass passage and P2 parallel passage.

When the straight travel spool is neutral, the P2 side bypass passage is not cut-off and the pressurized oil is directed to the tank port T1 through the bypass passage of spools (travel left -> swing -> boom 2 and swing priority -> arm 1 -> option), the negative control valve of P2 and tank passage.



A-A' (STRAIGHT TRAVEL AND SUPPLY) 220S2MC16



P2 BLOCK SPOOL SECTION 300A2MC17

2) TRAVEL OPERATION

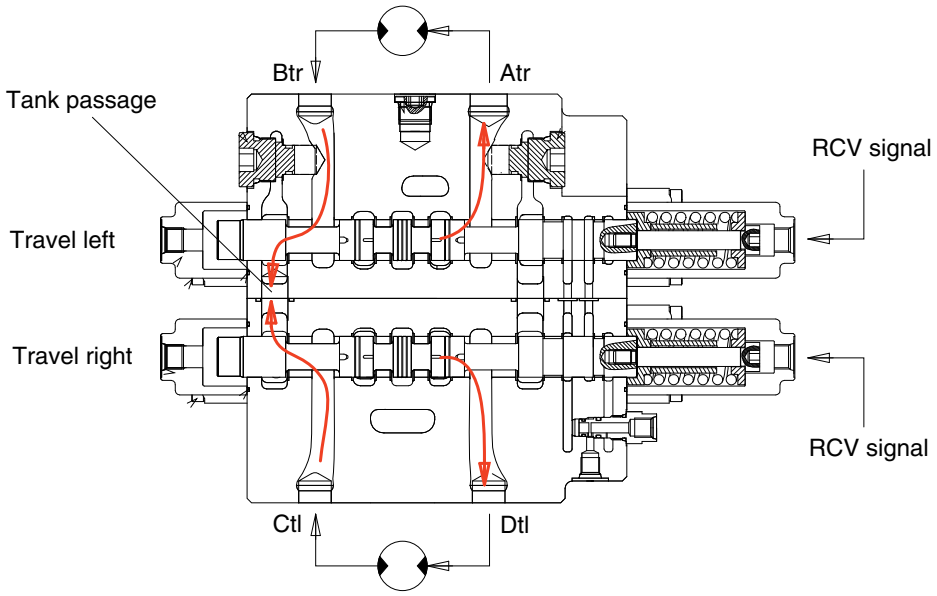
(1) Travel forward operation

During the travel forward operation, the pilot secondary pressure from the remote control valve is supplied to the spring side of pilot port and it shifts travel spools to the left direction.

The pressurized oil from the pump flows into the bypass passage of the travel spools through the land of the straight travel spool.

When the travel spools is shifted and the bypass passage is shut-off. The pressurized oil flowed into bypass passage is supplied to the travel motors through opened port Atr and Dtl.

On the other hand, the return oil from the travel motors flows into main control valve inside through the port Btr and Ctl and return to the tank passage.



B-B' (TRAVEL RIGHT AND LEFT) 220S2MC18

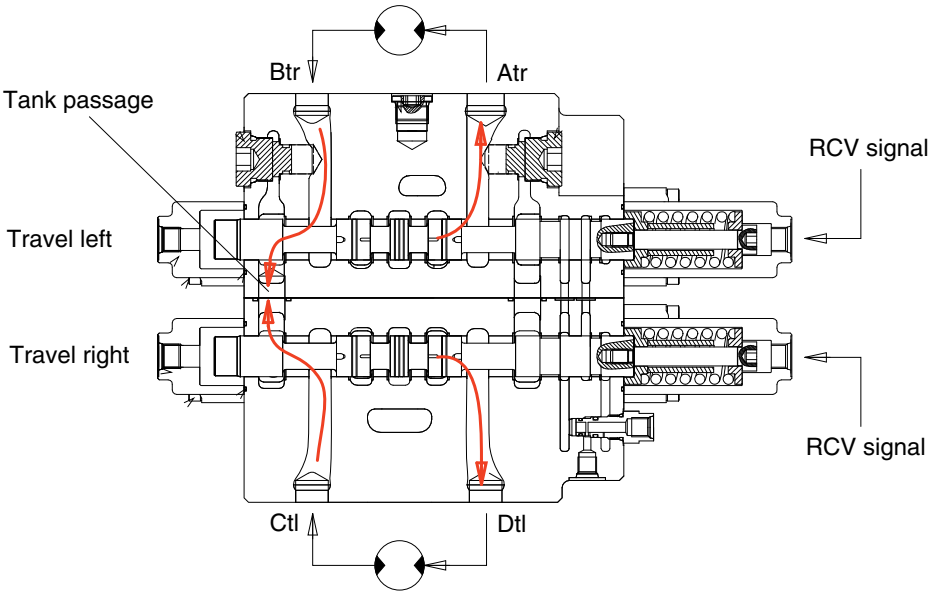
(2) Travel backward operation

During the travel backward operation, the pilot secondary pressure from the remote control valve is supplied to the against pilot port of the spring side and it shifts travel spools to the right direction.

The pressurized oil from the pump flows into the bypass passage of the travel spools through the land of the straight travel spool.

When the travel spools are shifted and the bypass passage is shut-off. The pressurized oil flowed into bypass passage is supplied to the travel motors through opened port Btr and Ctl.

On the other hand, the return oil from the travel motors flows into main control valve inside through the port Atr and Dtl and return to the tank passage.



B-B' (TRAVEL RIGHT AND LEFT)

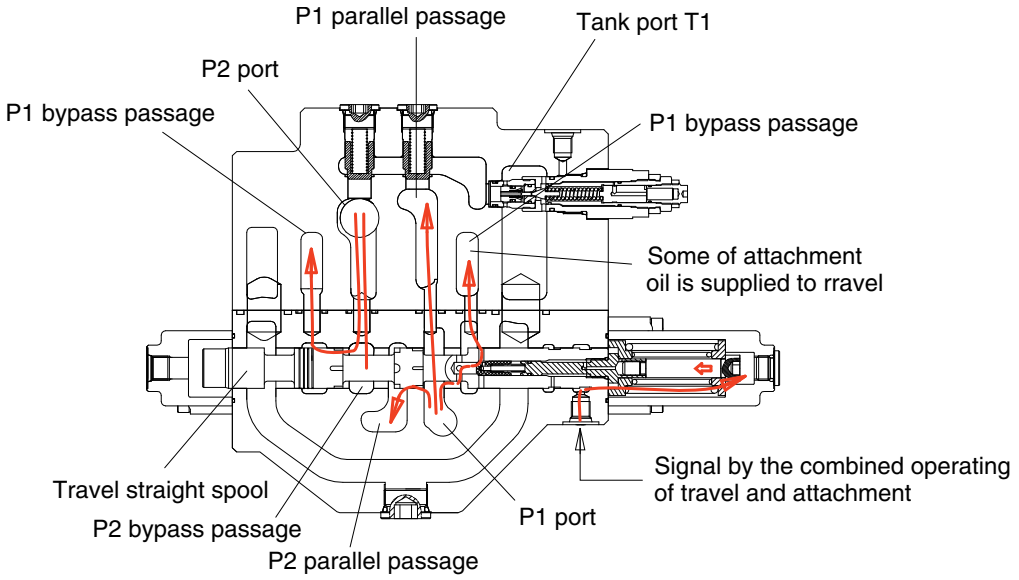
220S2MC19

(3) Travel straight function

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

In normal conditions, travel straight spool keeps neutral conditions, the pressurized oil of the P1 and P2 pumps is supplied to each passage independently.

When the attachment spool is operated under the travel operation of both sides, the pilot pressure is supplied to the spring side port of the travel straight spool and then the travel straight spool is shifted to the left direction.



A-A' (STRAIGHT TRAVEL AND SUPPLY) 220S2MC20

After changeover of the travel straight spool, the pressurized oil discharged from the P1 pump is connected with P2 port oil and is supplied to the attachment line through both parallel passage of the P1 and P2.

Also, some of the pressurized oil open the check valve of the spool inside through side of the travel straight spool and is connected with the bypass passage of the P2 side.

On the other hand, the pressurized oil discharged from the P2 pump is connected with P1 port oil and is supplied to the travel line through both parallel passage of the P1 and P2.

Accordingly the attachment spool is operated under the travel operation of both sides, the pressurized oil discharged from P2 pump is mainly supplied to left and right travel line and the pressurized oil discharged from P1 pump is mainly supplied to attachment line.

As a result, simultaneous operation of both travel spools and attachment is not influenced to the travel operation of the both sides and the machine keeps straight travel.

3) BOOM OPERATION

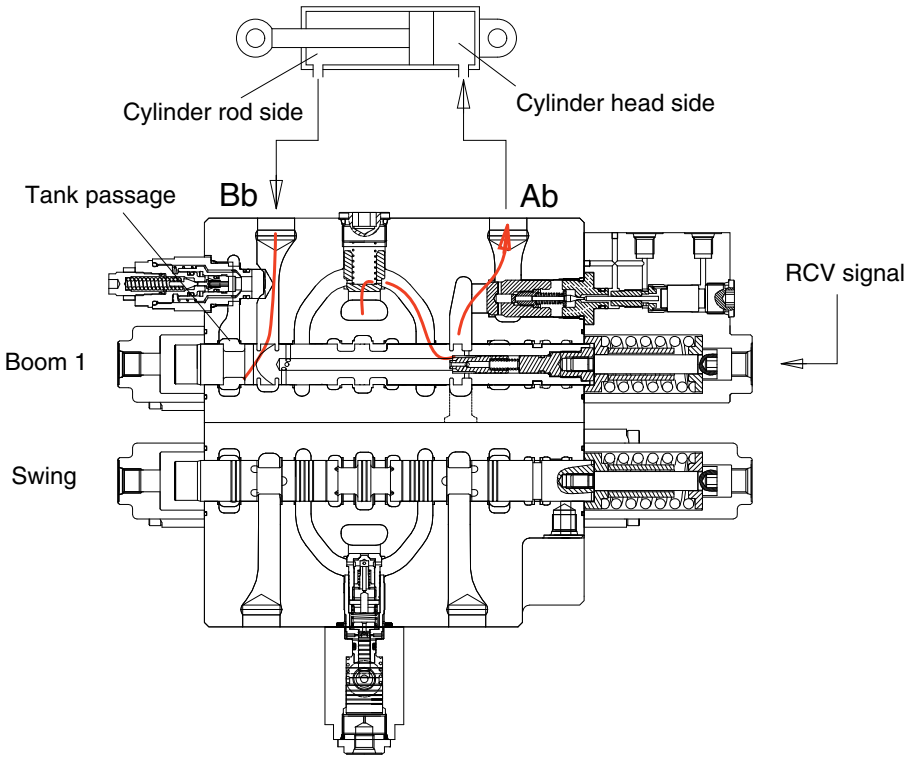
(1) Boom up operation

During the boom up operation, the pilot secondary pressure from the RCV is supplied to the port of the spring side and shifts the boom 1 spool to the left direction. The P1 bypass passage is shut off by the movement of the boom 1 spool and the pressurized oil from P2 port is entered P1 parallel passage and then passes through the load check valve, bridge passage and boom holding valve then flows into the head side of the boom cylinder via Ab port. (In this case, the boom holding valve is free flow condition)

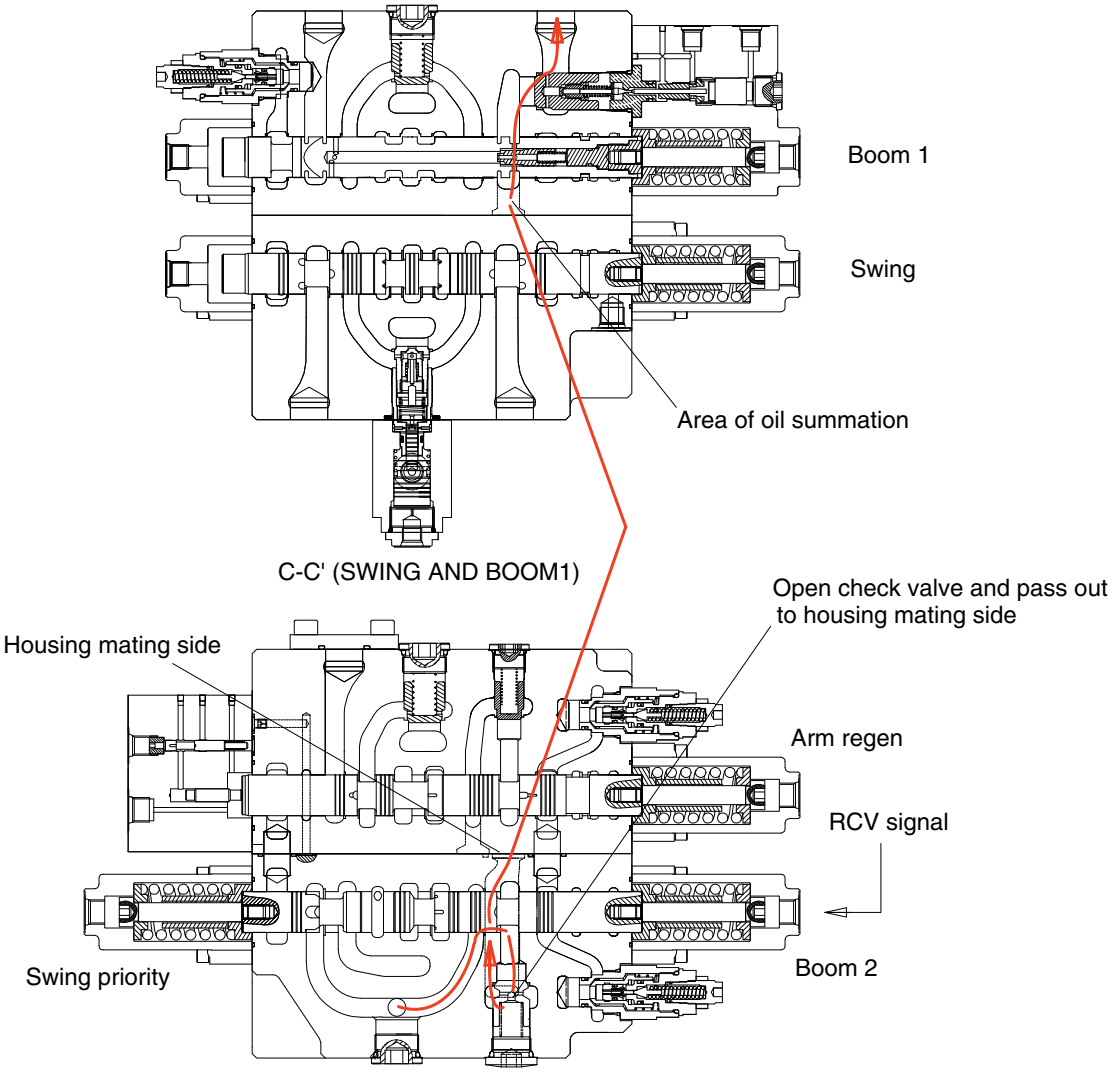
At the same time, the pilot secondary pressure from RCV is supplied to the port of the spring side of boom 2 and shifts the boom 2 spool. The bypass passage is shut off by the movement of the boom 2 spool and the pressurized oil from P2 port entered boom summation passage via the P2 parallel passage, notch of the boom 2 spool, the check valve.

The oil from boom 2 spool combined with the boom 1 spool oil and is supplied Ab port.

At the same time, the return oil from rod side of the boom cylinders flows the boom 1 spool through the Bb port and return to the hydraulic oil tank through the tank passage.



C-C' (SWING AND BOOM1) 300A2MC21


Boom 1
Swing
Area of oil summation
C-C' (SWING AND BOOM1)
Open check valve and pass out
to housing mating side
Housing mating side
Arm regen
RCV signal
Boom 2
Swing priority
D-D' (SWING PRI, BOOM 2 & ARM REGEN)
300A2MC22

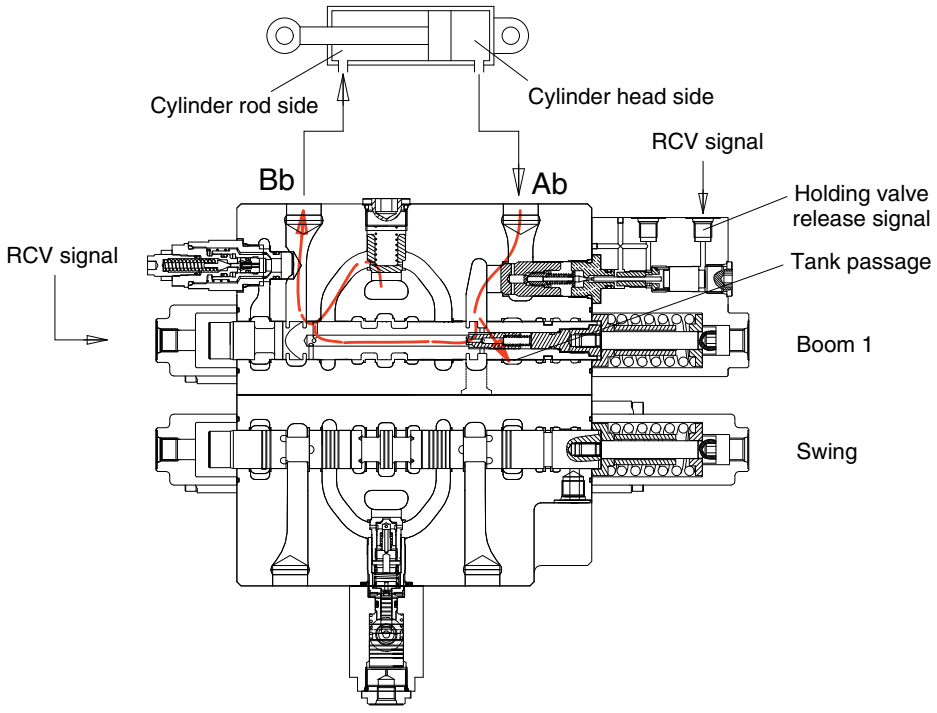
(2) Boom down operation

During the boom down operation, the pilot secondary pressure from the RCV is supplied to the against port of the spring side and shifts the boom 1 spool to the right direction. The P1 bypass passage is shut off by the movement of the boom 1 spool and the pressurized oil from P1 port is entered P1 parallel passage and then passes through the load check valve and bridge passage then flows into the rod side of the boom cylinder via Bb port.

At the same time, the return oil from head side of the boom cylinders flows the boom 1 spool through the Ab port and the boom holding valve and return to the hydraulic oil tank through the tank passage.

At this time, some of the return oil from the boom head side passes to the connected passage of the boom 1 spool inside and flows into the P1 parallel passage. (Boom spool inside regeneration function). At this time, the boom holding valve is open status and the operation principles are described following page.

During the boom down operation, the flow is not combined.



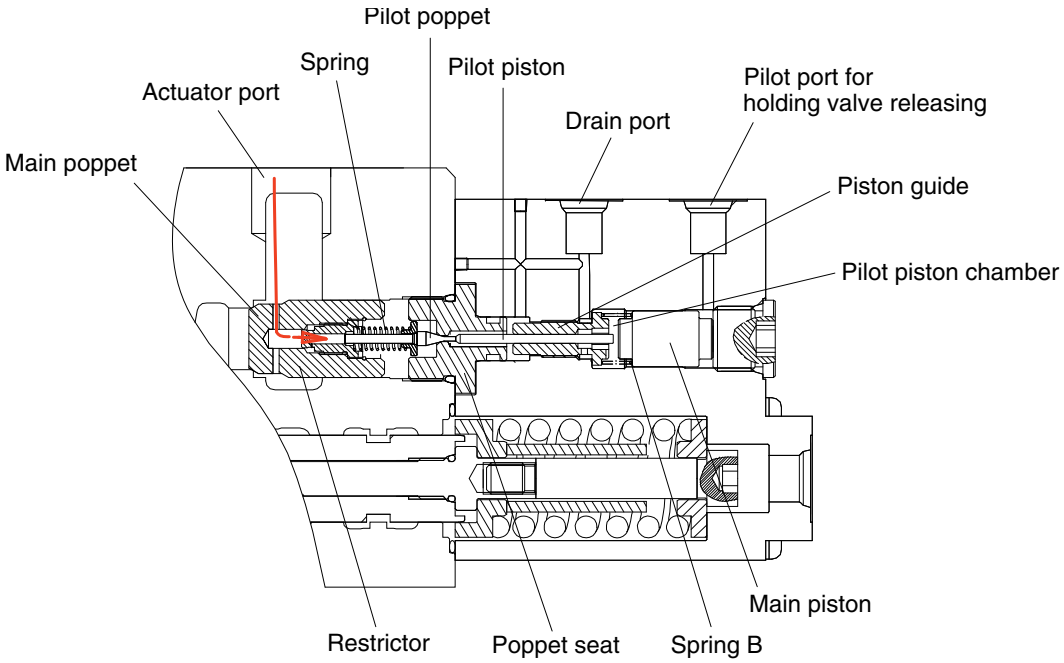
C-C' (SWING AND BOOM1)

300A2MC23

4) HOLDING VALVE OPERATION

(1) Holding operation

At neutral condition, the pilot piston chamber is connected to drain port through the pilot port.
And the main piston is seated by the spring B.
Also, the pressurized oil from the actuator entered to inside of the holding valve through the periphery hole of the main poppet, crevice of the main poppet and the restrictor and the periphery hole of the restrictor.
Then, this pressured oil pushed the pilot poppet to the poppet seat and the main poppet to the seat of body.
So the pressurized oil from the holding side of the actuator is not escaped and the actuator is not moved.



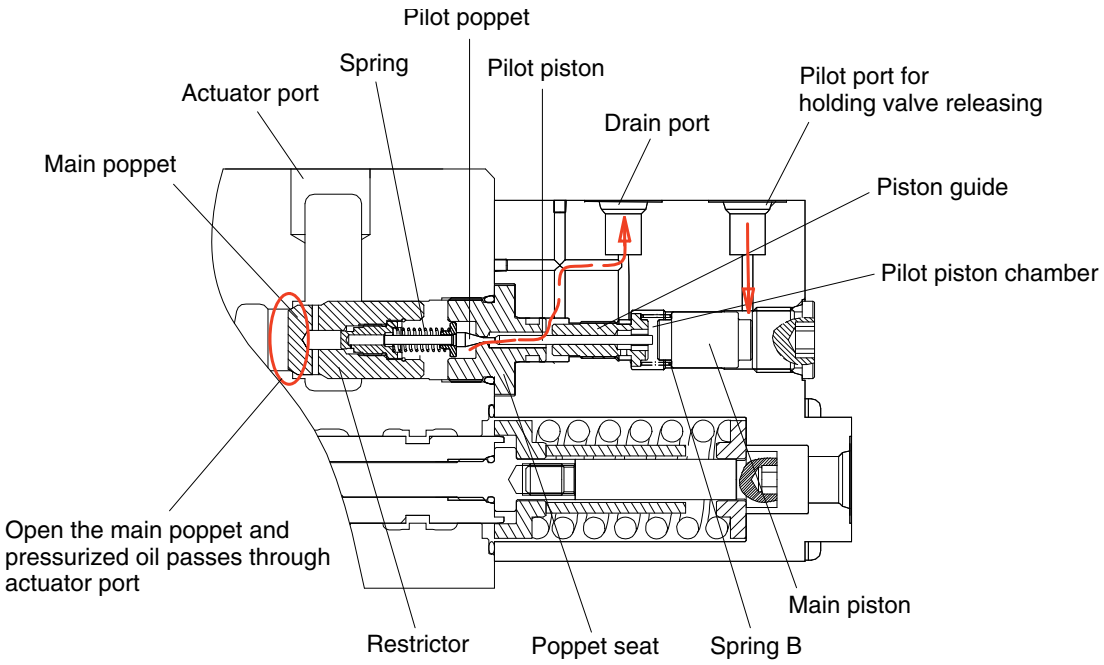
HOLDING VALVE BLOCK SECTION 220S2MC24

(2) Releasing holding operation

The pilot pressure is supplied to the pilot port for releasing holding valve and shifts the main piston to the left direction against the spring B and shifts the pilot poppet to the left direction through the pilot piston and open the passage for the drain.

At same time, the return oil from actuator returns to the drain port through the periphery hole of main poppet, crevice of the main poppet and the restrictor, the periphery hole of the restrictor, inside of holding valve, crevice of the pilot poppet and the drain passage of the holding valve.

After above operation, pressure of inside of holding valve is decreased and the main poppet is opened by the return oil of the actuator and the return oil from actuator returns to the tank passage through the notch of spool.



HOLDING VALVE BLOCK SECTION

220S2MC25

5) BUCKET OPERATION

(1) Bucket in operation

① Bucket operation only

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

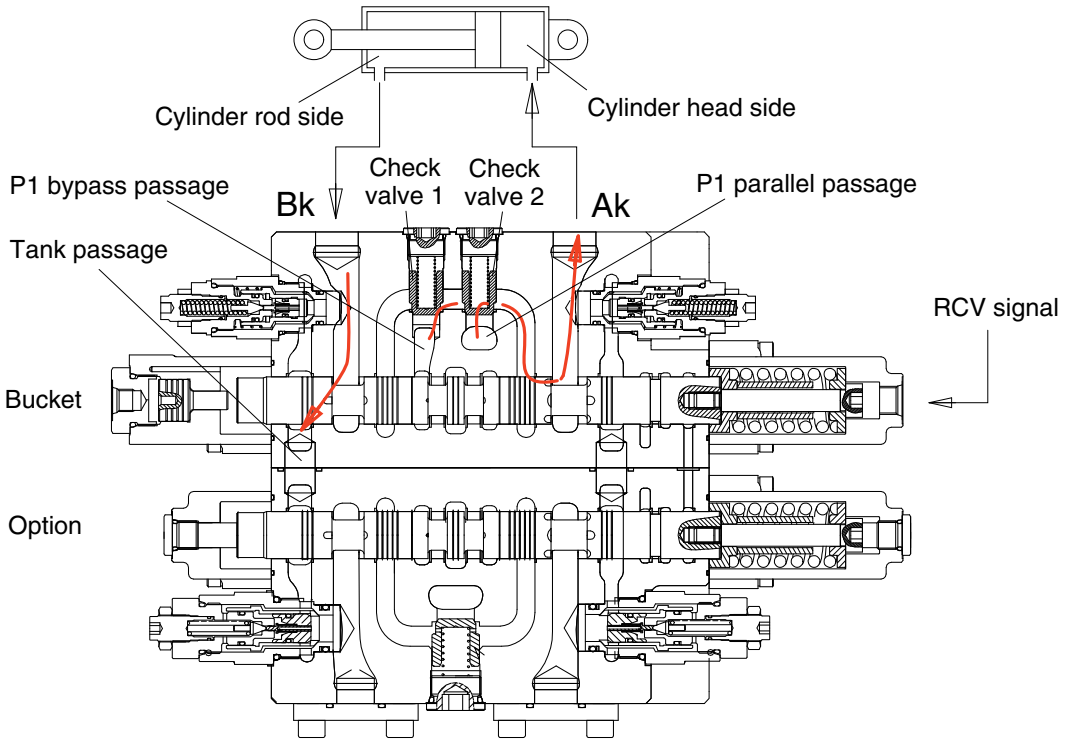
The P1 bypass passage is shut off by the movement of the bucket spool and the pressurized oil from P1 port entered P1 parallel passage and is directed to the Ak port through the check valve 2. At the same time, the pressurized oil from P1 bypass passage is directed to the AK port through the check valve 1.

The return oil from the rod side of the bucket cylinder (Bk port) returns to the hydraulic oil tank through the tank passage.

② Combined operation

When combined operation of the bucket and other actuators, mostly same as above operation but the fluid from P1 bypass passage is empty by the upstream operation such as the arm or boom operation.

So only the fluid from P1 parallel passage is supplied to the Ak port.



F-F' (OPTION AND BUCKET)

300A2MC26

(2) Bucket slow operation (incase bucket in)

This function is used to speed up of the boom or arm by reducing the bucket speed when the bucket operation with boom or arm operation simultaneously.

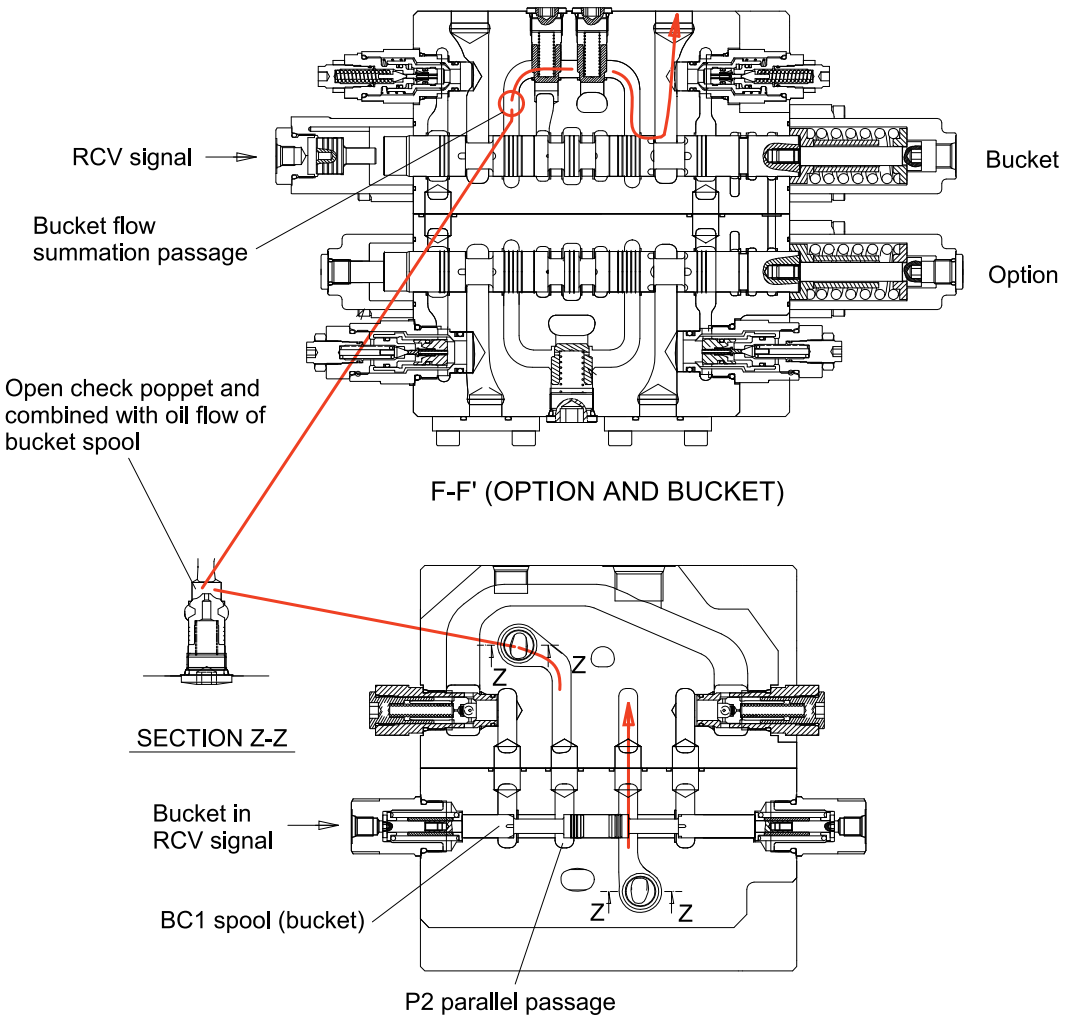
The bucket slow pilot pressure is supplied the pilot port of the BC1 spool and the piston is shifted to the right and then the bucket spool stroke is limited and the oil passage from P1 to the bucket cylinder is reduced and the oil flow of the bucket spool is reduced.

Bucket flow summation function, bypass cut-off 1 spool

During the bucket in operation, the pilot secondary pressure from the RCV is supplied to port of the spring side and shifts the BC1 (bucket) spool to the right direction.

The P2 parallel passage is shut off by the movement of the BC1 spool and the pressurized oil from P2 port opens the check poppet and combined with the flow of the bucket spool.

(Only bucket in operation)



FLOW SUMMATION BY THE SHIFTING OF THE BC1 SPOOL

300A2MC27

(3) Bucket out operation

① Bucket operation only

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

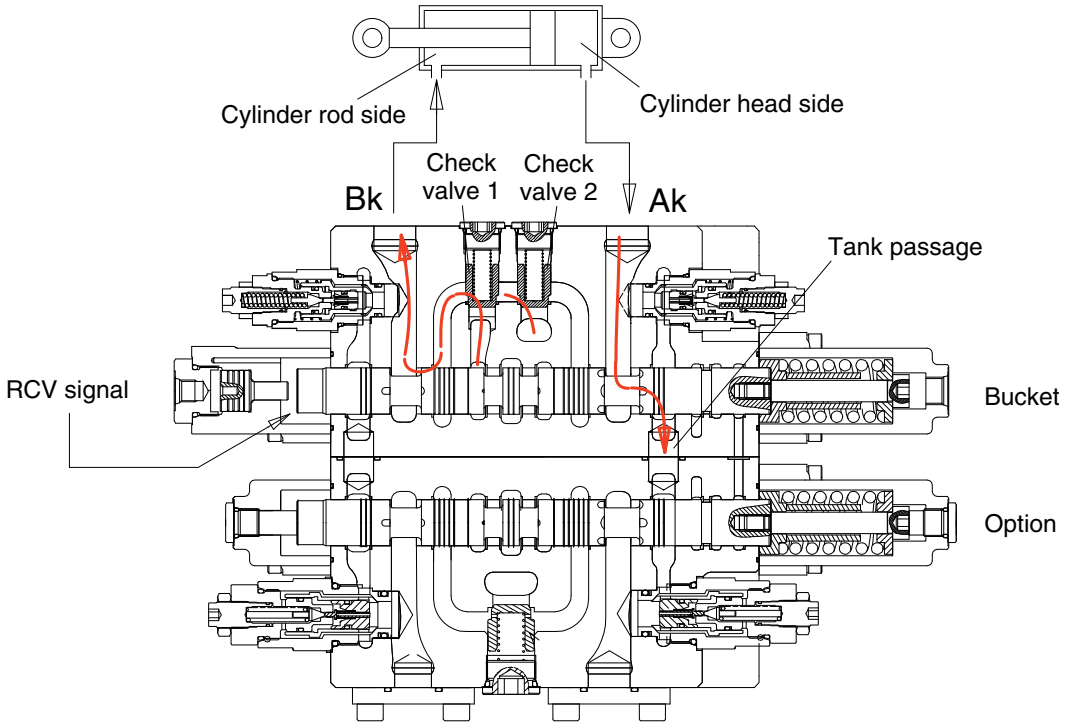
The P1 bypass passage is shut off by the movement of the bucket spool and the pressurized oil from P1 port entered P1 parallel passage and is directed to the Bk port through the check valve 2.

At the same time, the pressurized oil from P1 bypass passage is directed to the Bk port through the check valve 1.

The return oil from the head side of the bucket cylinder (Ak port) returns to the hydraulic oil tank through the tank passage.

② Combined operation

When combined operation of the bucket and other actuators, exactly same as above operation.



F-F' (OPTION AND BUCKET)

300A2MC28

6) SWING OPERATION

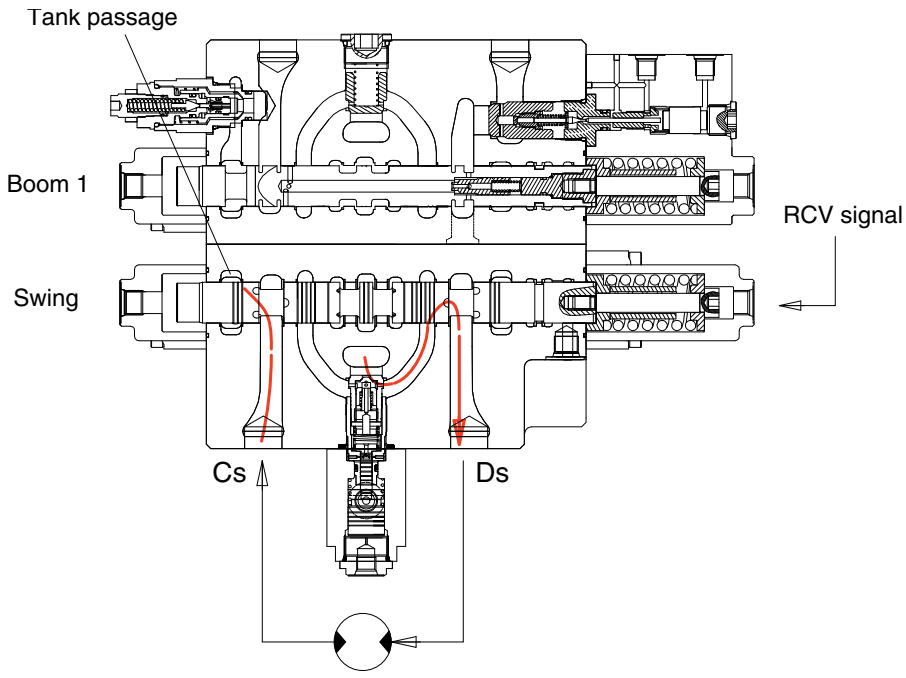
(1) Swing left and right operation

During the swing left operation, the pilot secondary pressure from the RCV is supplied to the port of the spring side and shifts the swing spool in left direction. The P2 bypass passage is shut off by the movement of the swing spool and the pressurized oil from P2 port flows into the P2 parallel passage and open the load check valve and is supplied to swing motor through the Ds port.

As the result, the return oil from the swing motor flows into the main control inside through Cs port and returns to the hydraulic oil tank through the swing spool and the tank passage.

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

Accordingly, the pressurized oil from P2 parallel passage flows into swing motor through the Cs port and returns to the hydraulic oil tank through the Ds port and the tank passage.



C-C' (SWING AND BOOM1)

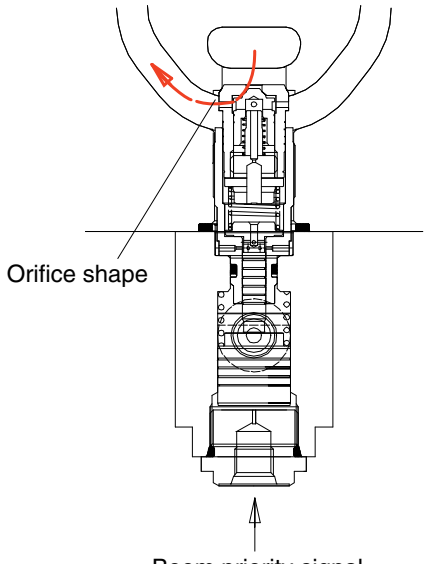
300A2MC29

(2) Boom priority function

This function is used to speed up of the boom by reducing the swing speed when the swing operation with boom operation simultaneously.

The boom priority signal is supplied the pilot port and the poppet of the swing logic valve is closed and then the pressurized oil from P2 port is reduced by the oil leaking through the orifice.

As a result, the swing speed is slowed.



SWING LOGIC VALVE

220S2MC30

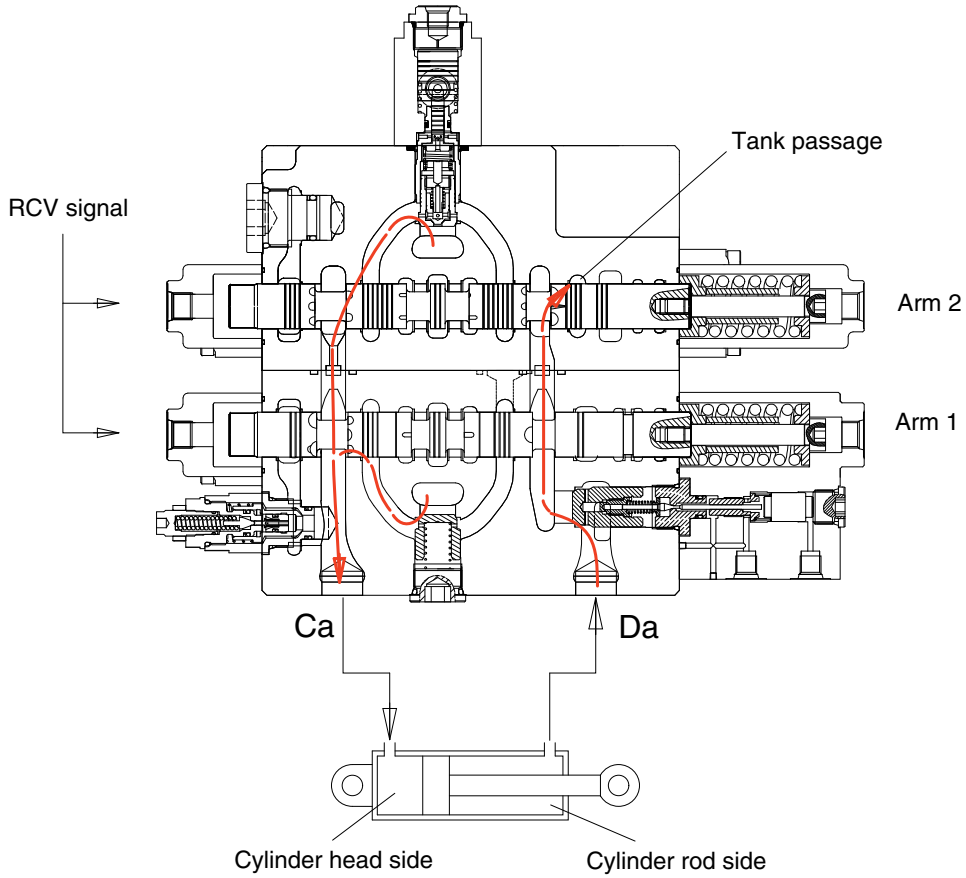
7) ARM OPERATION

(1) Arm in operation

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

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

At the same time, the pilot secondary pressure from the RCV is supplied to the port of spring opposite side and shifts the arm 2 spool in the right direction. The P2 bypass passage is shut off by the movement of the arm 2 spool and the pressurized oil from the P1 port flows into the arm summation passage through P1 parallel passage, the check valve and the notch of the arm 2 spool.



E-E' (ARM 1 AND ARM 2)

220S2MC31

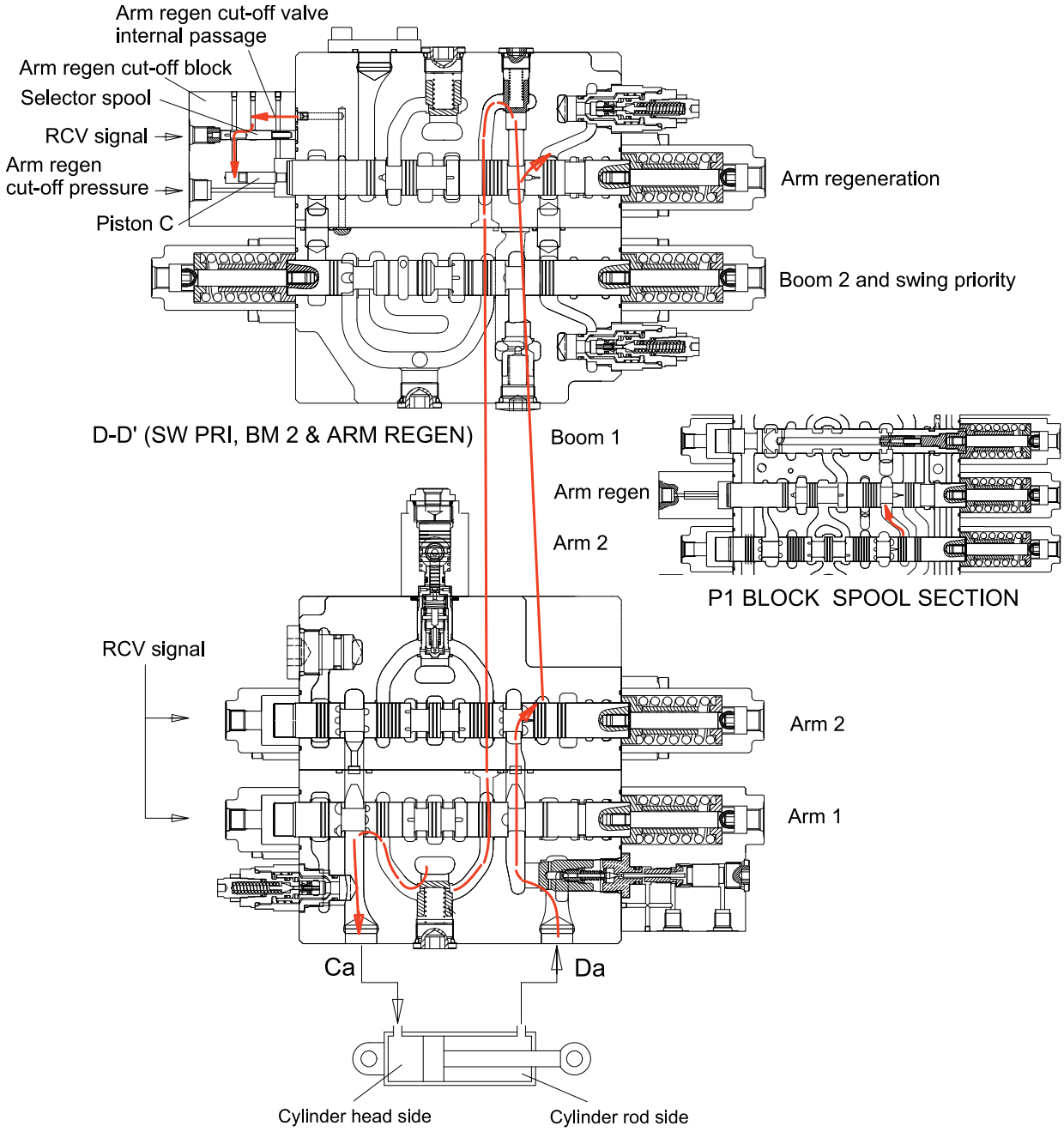
ARM REGENERATION

The return oil from the arm cylinder rod side passes the arm holding valve (open condition) through the Da port and the notch of the arm 1 and arm 2, and swing priority spool. And some of the oil return to the tank passage through the notch of the arm regeneration spool and most of the oil is supplied to the head side of the arm cylinder through internal summation passage.

This is called the arm regeneration function.

The amount of regeneration fluid is changed by movement of the arm regeneration spool. A few fluids of the oil that is supplied to the head side of the arm cylinder passes the selector spool (in this case, the selector spool is opened by the arm in pilot pressure) built in the arm regeneration block through internal passage and is pushed the piston C.
The amount of the regeneration oil from the rod side of the arm cylinder to the tank passage is increased by the movement of the piston C and the arm regeneration spool to the right direction and the arm regeneration flow is decreased as much increased oil.
The pressure of the arm cylinder head increases, then, the arm regeneration flow decreases.

Furthermore, the arm regeneration cut-off pressure is supplied to the port of the spring opposite side and the arm regeneration spool is moved to the right direction fully. The flow from the arm cylinder rod to the tank passage is maximum condition.



ARM REGENERATION PASSAGE

220S2MC32

(2) Arm out operation

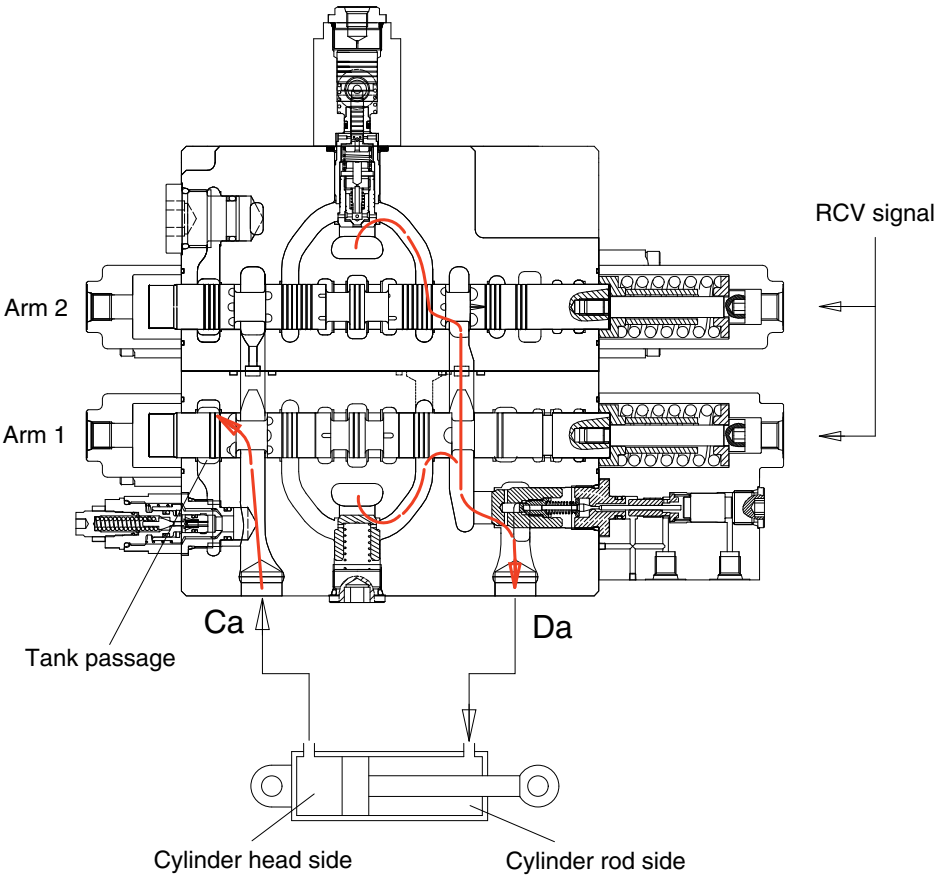
During arm out operation, the pilot secondary pressure from the RCV is supplied to the port of the spring side and shifts the arm 1 spool to the left direction.

The bypass passage is shut off by the movement of the arm 1 spool and the pressurized oil from the P2 port flows into arm 1 spool through the P2 parallel passage. Then it enters into the arm cylinder rod side through the load check, bridge passage, arm holding valve (oped status) and the port Da.

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

The bypass passage is shut off by the movement of the arm 2 spool and the pressurized oil from the P2 port through the P2 parallel passage. Then it combined with the flow of the arm 1 passage through P1 parallel passage, the check valve, bridge passage, the notch of the arm 1 and the arm holding valve (open status).

On the other hand, the return flow from the arm cylinder head side returns to the hydraulic tank through the port Ca, the notch of the arm 1 spool and tank passage.



E-E' (ARM 1 AND ARM 2)

220S2MC33

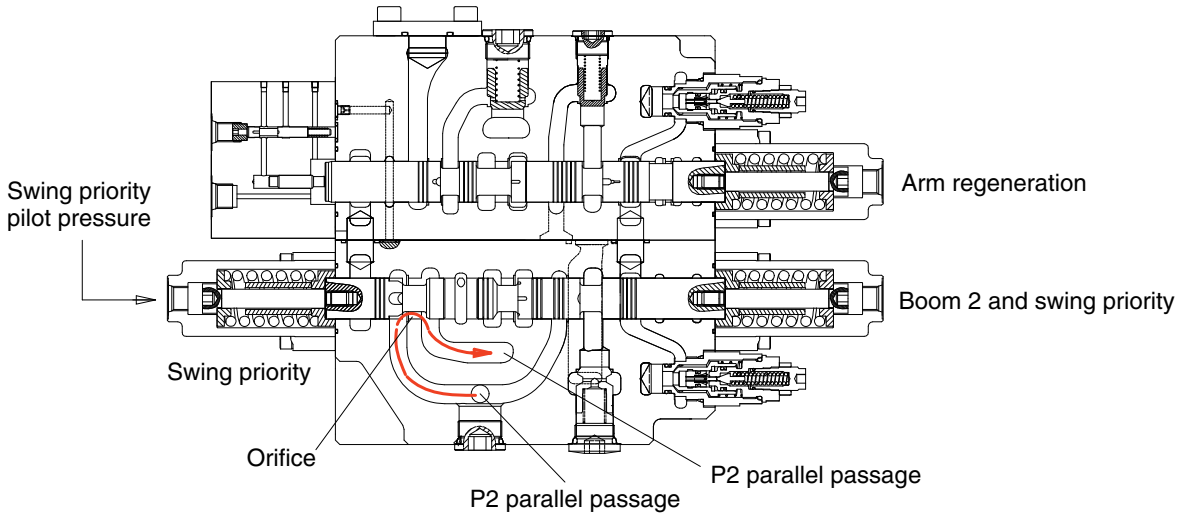
8) OPERATION OF SWING PRIORITY SPOOL

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

The pressurized oil from the P2 port flows into the P2 parallel passage through the notch of the swing priority spool.

When the swing priority spool is neutral condition, the passage is same as normal condition. But due to shifting of the swing priority spool, the orifice is formed between the notch of the swing priority spool and the land of the block housing and then the fluid to the swing side more then the downstream of the swing spool such as the arm 1 and option spool.

As a result, the flow is supplied to the swing operation most preferential.



D-D' (SWING PRI, BOOM 2 & ARM REGENERATION) 220S2MC34

9) OPERATION OF OPTION SPOOL

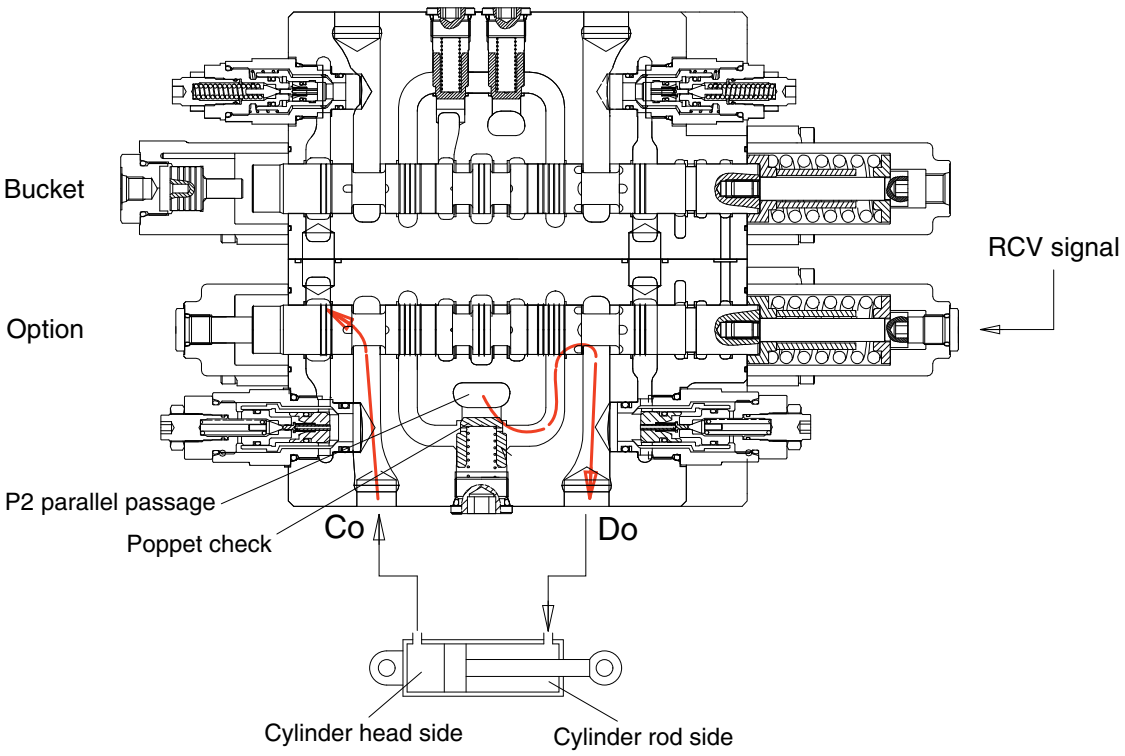
(1) 1-way operation

※ The pilot pressure is supplied to the port of the spring side and shifts spool to the left direction. The pilot secondary pressure from the RCV is supplied to the port of the spring opposite side of the option spool, the P2 bypass passage is shut off by the movement of the option spool and the pressurized oil from the P2 port flows into the actuator through the P2 parallel passage, the check valve, bridge passage and the Do port.

(2) 2-way operation

※ Shifts spool to the left and right direction.

- When the spool shifts to the left, same as 1-way operation.
- When the spool shifts to the right, the pressurized oil from the P2 port flows into the actuator through the P2 parallel passage, the check valve, bridge passage and the Co port.



F-F' (OPTION AND BUCKET)

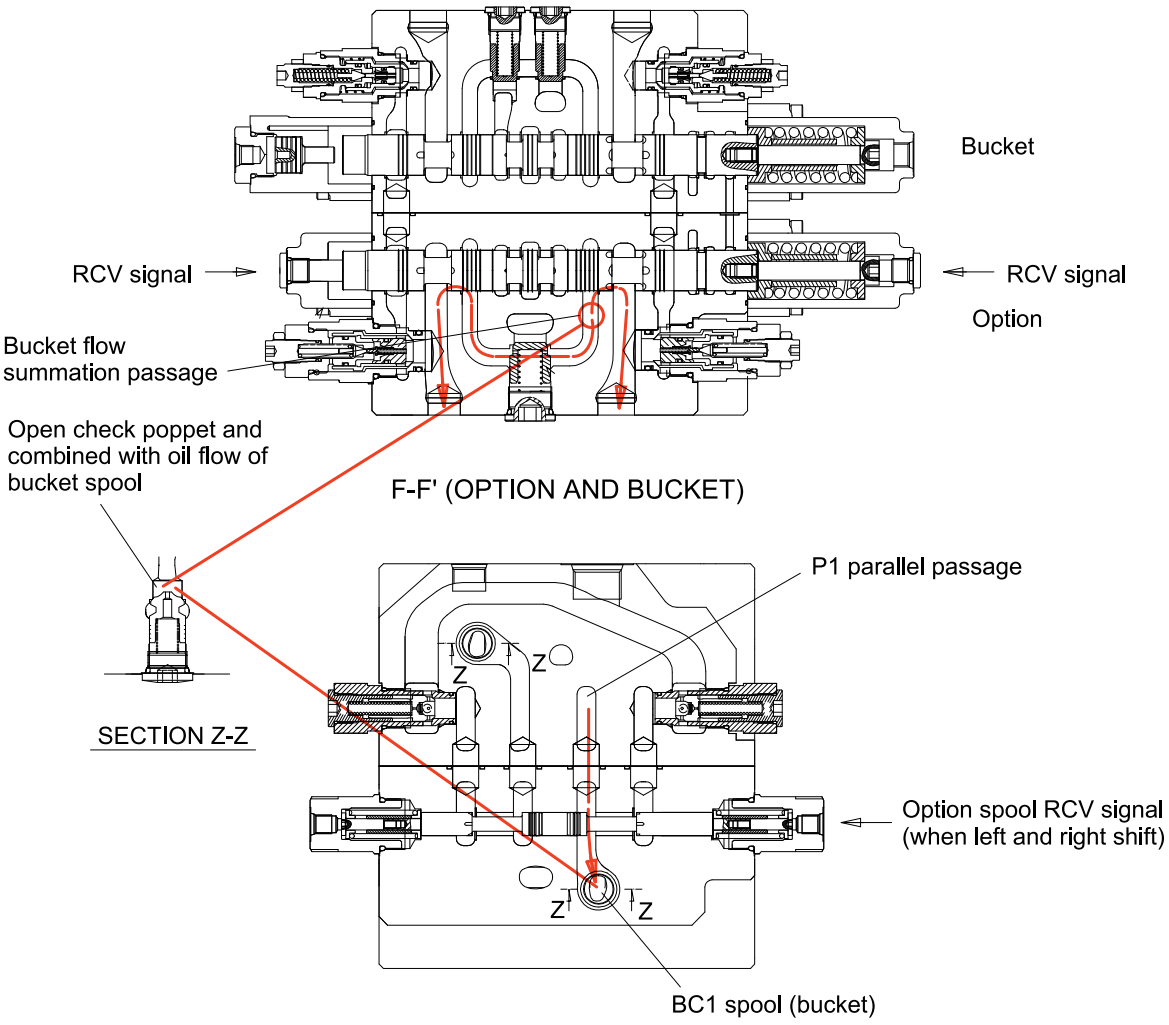
300A2MC35

Option flow summation function, bypass cut-off 2 spool

During the 2-way option operation, the pilot secondary pressure from the RCV is supplied to port of the spring side and shifts the BC2 (option) spool.

The P1 parallel passage is shut off by the movement of the BC2 spool and the pressurized oil from P1 port opens the check poppet and combined with flow of the option spool.

(Only bucket in operation)



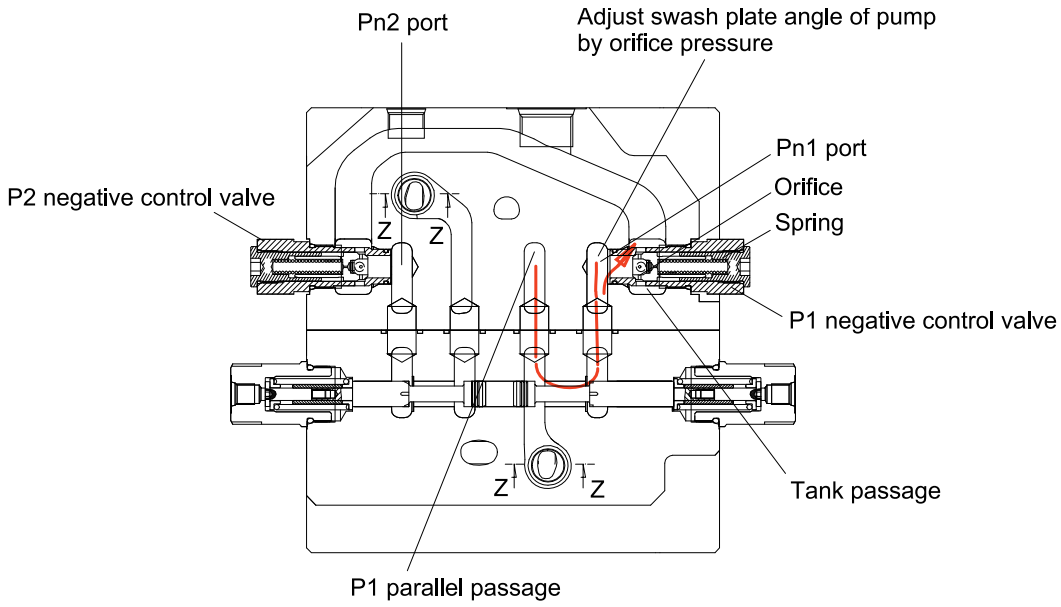
FLOW SUMMATION BY THE SHIFTING OF THE BC2 SPOOL

300A2MC36

10) OPERATION OF NEGATIVE CONTROL VALVE

When no function is being actuated on P1 side, the hydraulic fluid from the P2 port, flows into the tank passage through the P1 bypass passage and the orifice of the negative control valve.
The negative control pressure caused by this operation is transferred to the regulator of the piston pump through the Pn1 port.
This pressure controls the swash plate angle of the pump to the minimum and minimize the flow of the P1 side.
When one or more spools are shifted, the P1 bypass passage is shut-off and the flow is almost zero.
Accordingly, the negative control pressure that is supplied to the pump through Pn1 port is lowered and the swash plate angle becomes maximum and the flow of the P1 side becomes maximum.
On the other hand, the negative control pressure is increased and high than the setting pressure of the spring, the negative control valve is opened and the flow passes to the hydraulic tank and functions as a relief valve.

The operation of the negative control valve of the P2 side is same as that of the P1 side.



OPERATION OF NEGATIVE CONTROL VALVE

300A2MC37

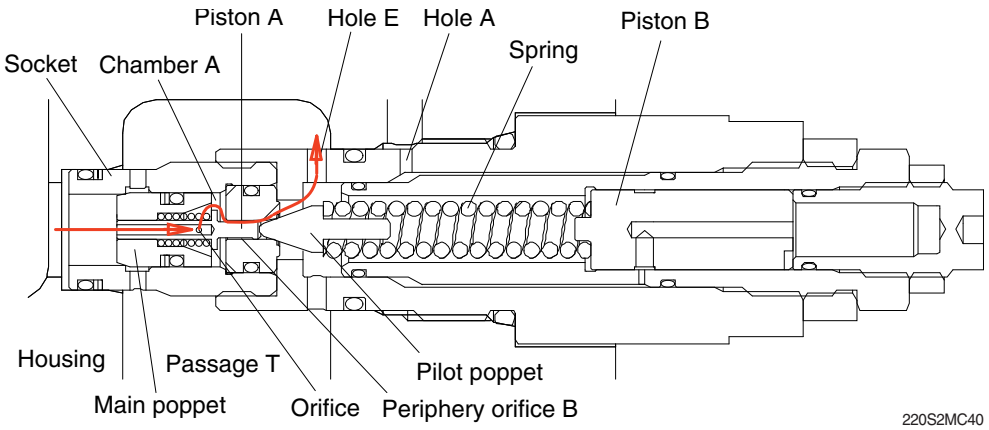
11) OPERATION OF MAIN RELIEF VALVE

(1) Neutral

The pressurized oil passes through the internal passage of the piston A, fitted in the main poppet and the orifice A and is filled up in the chamber A of the inside and seats the main poppet against socket and socket against the housing securely.

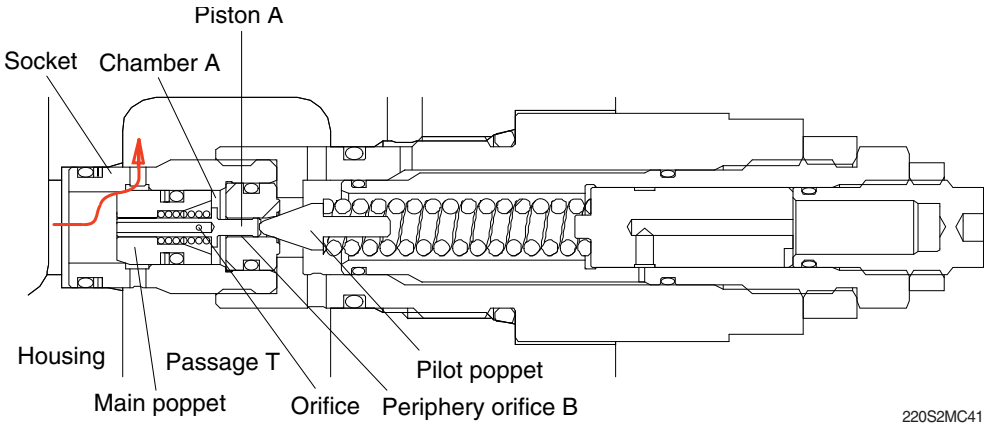
(2) When operation (relief)

① When the pressurized oil flowed in the chamber A through the orifice becomes equal to the set pressure of the spring, the hydraulic oil apply to the main poppet through the piston and pushes open the pilot poppet and flows to tank passage through the piston A internal passage, orifice A, chamber A, periphery orifice B and the hole E.



OPERATION 1 OF MAIN RELIEF VALVE

② The pressure in chamber A is lowered by moving of the pilot poppet and the main poppet is opened. As a result, the pressurized oil flows out to the tank passage through the hole of the socket side.



OPERATION 2 OF MAIN RELIEF VALVE

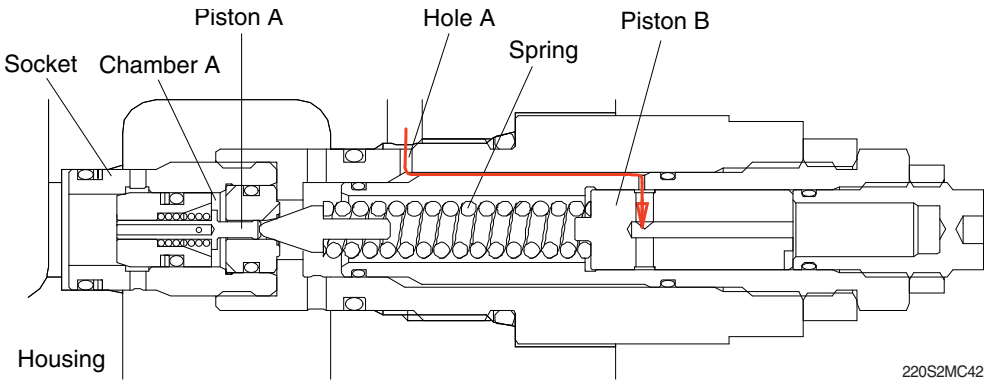
(3) When retraction (return)

On the other hand, the pressure of the pressurized oil becomes lower than set pressure of the spring, the main poppet is seated by spring force. Then the pressure of the chamber A becomes equal to the pressure of the P port and the main poppet is seated to the seat of the socket. The valve returns to the initial condition.

Power boost function

During power boost operation, the pilot pressure for the power boost enters inside of the piston B through the hole A, the crevice passage and the side hole of the piston B.

It pushes the piston to the left direction and the set pressure of the spring is increased.

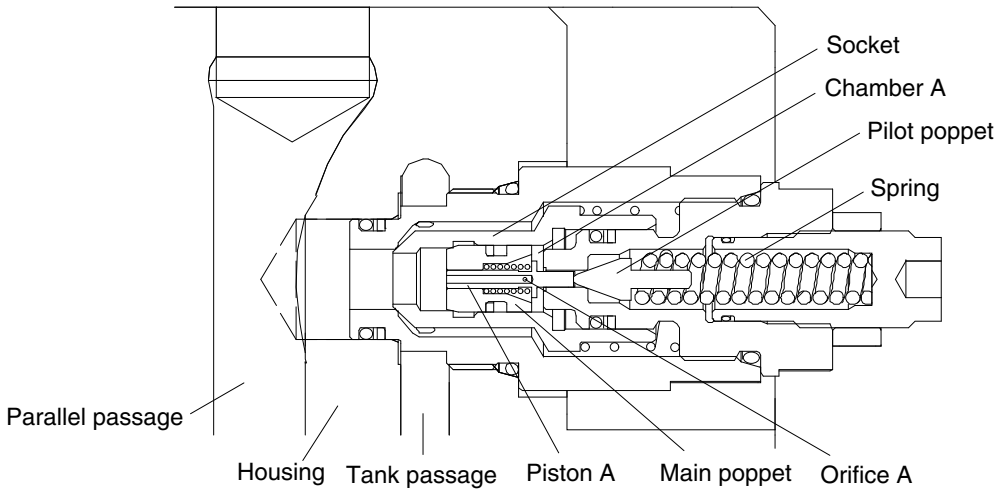


OPERATION 3 OF MAIN RELIEF VALVE

12) OPERATION OF PORT RELIEF VALVE

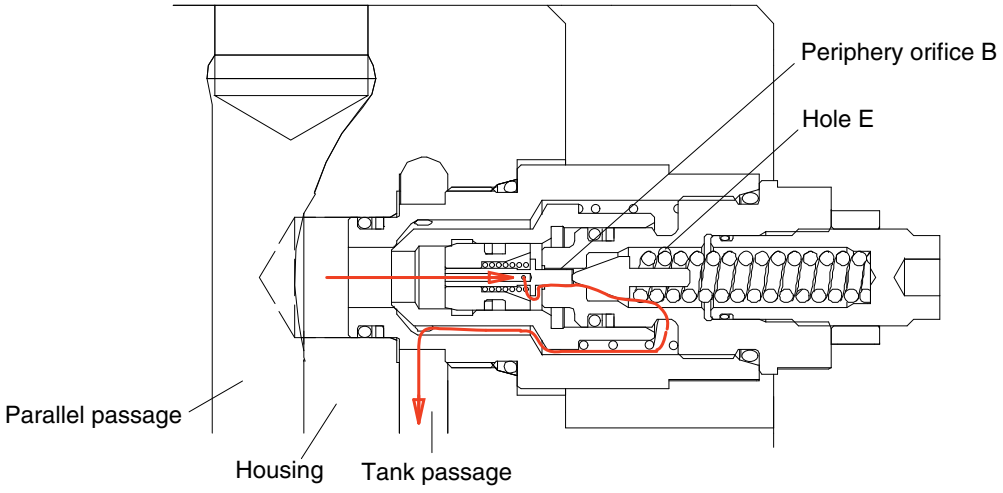
(1) Function as relief valve

① The pressurized oil passes through the internal passage of the piston A, fitted in the main poppet and the orifice A and is filled up in the chamber A of the inside and seats the main poppet against socket and socket against the housing securely.



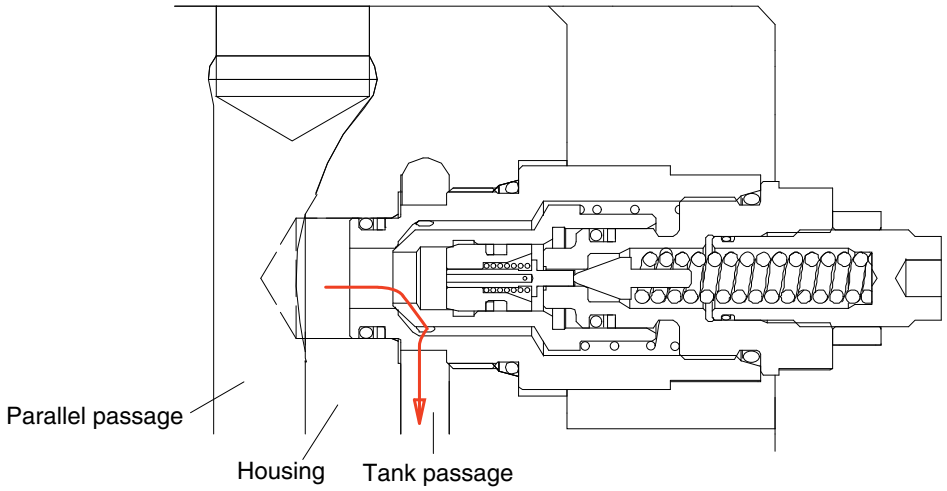
PORT RELIEF VALVE 220S2MC43

② When the pressurized oil from the actuators becomes equal to the set pressure of the spring, the hydraulic oil apply to the pilot poppet and pushes the pilot poppet to the right direction and flows to tank passage through the piston A internal passage, orifice A, chamber A, periphery orifice B and the hole E.



OPERATION 1 OF PORT RELIEF VALVE 220S2MC44

③ The pressure in chamber A is lowered by moving of the pilot poppet and the main poppet is opened. As a result, the pressurized oil from the actuator port flows out to the tank passage through the hole of the socket side.

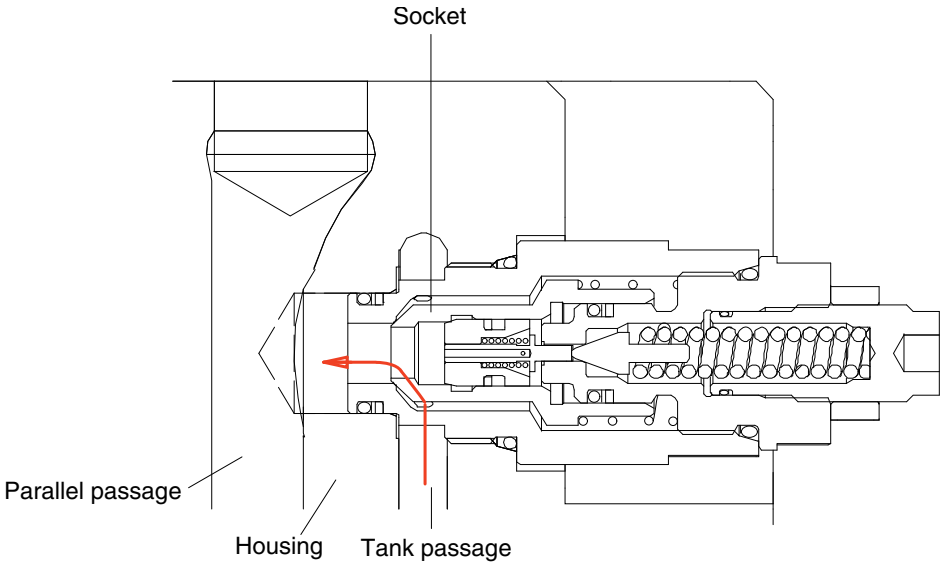


OPERATION 2 OF PORT RELIEF VALVE 220S2MC45

④ On the other hand, the pressure of the actuator becomes lower than set pressure of the spring, the pilot poppet is seated by spring force. Then the pressure of the chamber A becomes equal to the pressure of the actuator port and the main poppet is seated to the seat of the socket. The valve returns to the initial condition.

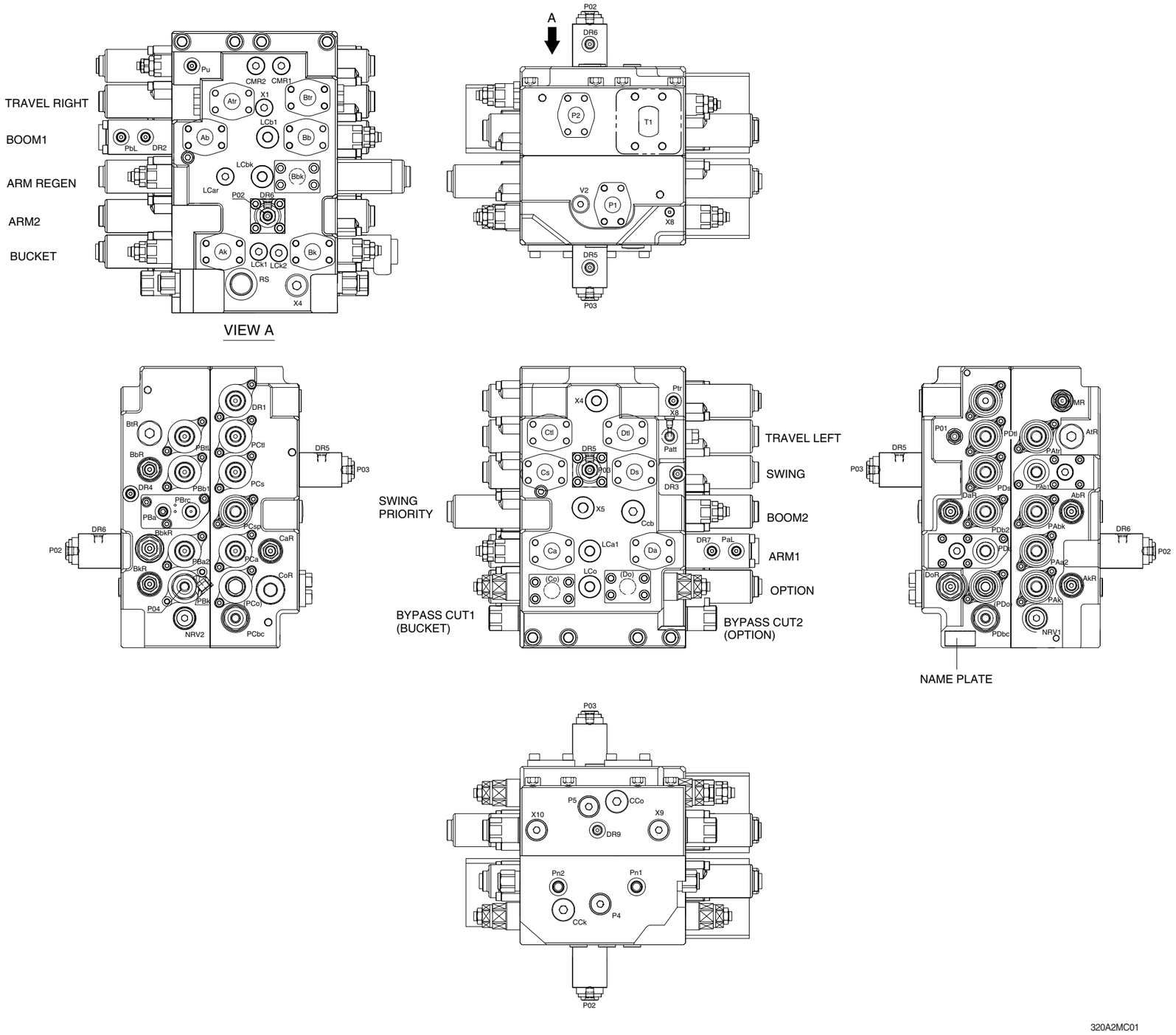
Make up function

When negative pressure exists at the actuator port, the oil is supplied through tank passage. When the pressure at tank passage becomes higher than that of at the actuator port, it pushed the socket moves in the right direction. Then, the gap between the housing and socket is opened and pressurized oil from the tank passage flows into parallel passage side.



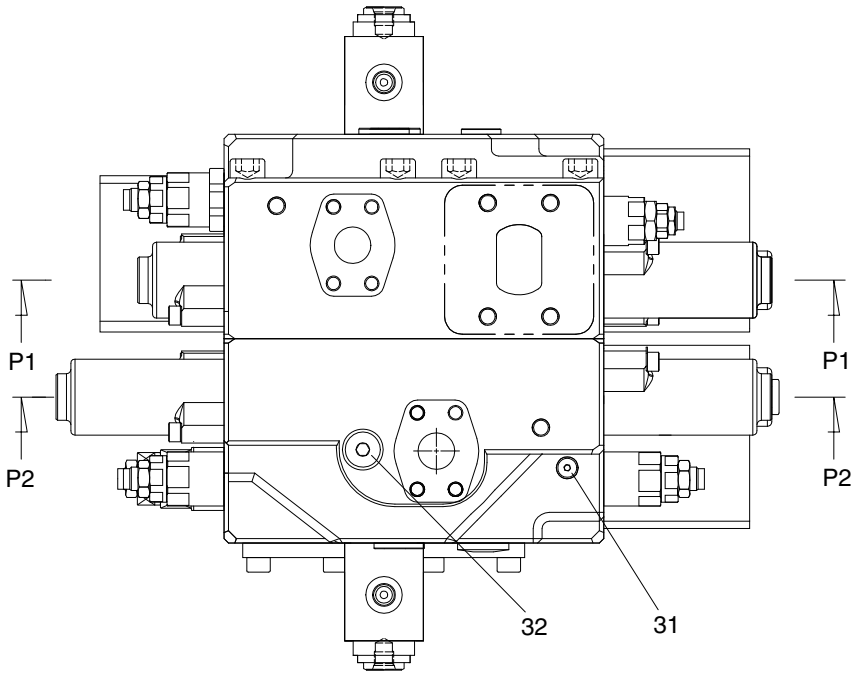
MAKE UP FUNCTION OF PORT RELIEF VALVE 220S2MC46

1. STRUCTURE (1/8)

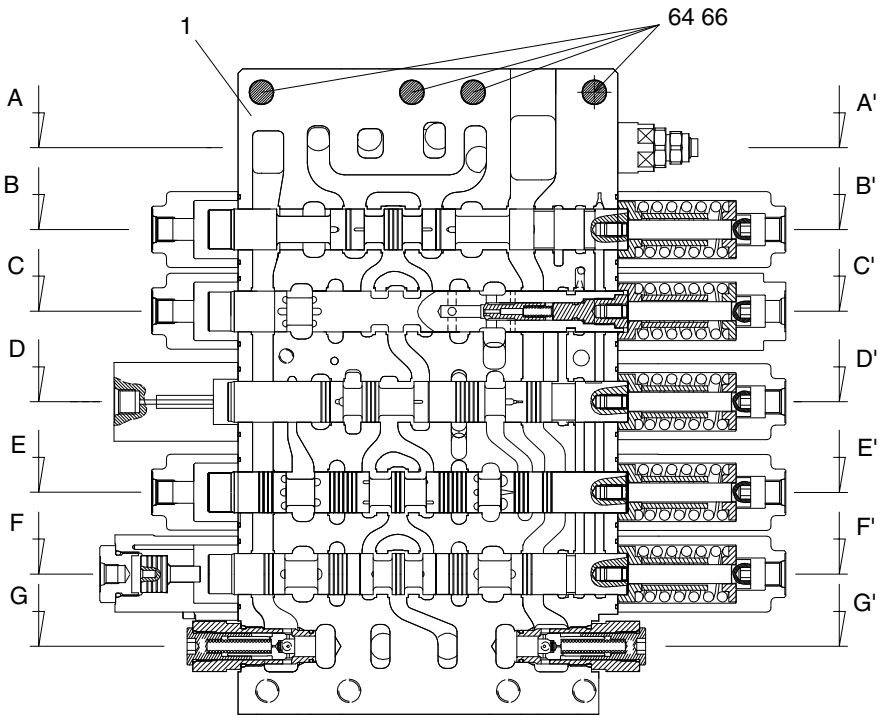


Mark	Port name	Port size	Tightening torque
Rs	Make up for swing motor	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt	Auto idle signal-attachment	PF1/4	3.5~4.0 kgf · m (25.3~28.9 lbf · ft)
PbL	Lock valve pilot port (boom)		
PCbc	Bucket in confluence pilot port		
PDbc	Option confluence pilot port		
P01	Pilot signal port		
P02	Pilot signal port		
P03	Swing logic pilot port		
P04	Bucket parallel orifice pilot port		
(P05)	Option B confluence pilot port		
PBa	Arm in regen-cut signal selector port		
PaL	Lock valve pilot port (arm)		
Ptr	Auto idle signal-travel		
Pu	Power boost		
DR1	Drain port		
DR2	Drain port		
DR3	Drain port		
DR4	Drain port		
DR5	Drain port		
DR6	Drain port		
DR7	Drain port		
DR9	Drain port		
(P4)	-	PF1/2	10~12 kgf · m (72.3~86.8 lbf · ft)
(P5)	-		
PAtr	Travel pilot port-RH (FW)	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
PBtr	Travel pilot port-RH (BW)		
PCtl	Travel pilot port-LH (BW)		
PDtl	Travel pilot port-LH (FW)		
PAb1	Boom up pilot port		
PDb2	Boom up confluence pilot port		
PBb1	Boom down pilot port		
PCs	Swing pilot port (LH)		
PDs	Swing pilot port (RH)		
PBa2	Arm in confluence pilot port		
PCsp	Swing priority pilot port		
PAbk	Option A pilot port (breaker)		
PBrc	Arm in regeneration cut port		
PCa	Arm in pilot port		
PDa	Arm out pilot port		
PAa2	Arm out confluence pilot port		
PAk	Bucket in pilot port		
PBk	Bucket out pilot port		
(PCo)	Option B pilot port		
(PDo)	Option B pilot port		
Pn1	Negative control signal port (A2 port side)		
Pn2	Negative control signal port (A1 port side)		
(V2)	Carry-over port		
Atr	Travel motor port-LH (FW)	M10	5.0~6.5 kgf · m (36.2~47.0 lbf · ft)
Btr	Travel motor port-LH (BW)		
CtL	Travel motor port-RH (BW)		
DtL	Travel motor port-RH (FW)		
Ab	Boom up port		
Bb	Boom down port		
Cs	Swing motor port (LH)		
Ds	Swing motor port (RH)		
(Bbk)	Option A port (breaker)		
Ca	Arm in port		
Da	Arm out port		
Ak	Bucket in port		
Bk	Bucket out port		
(Co)	Option B port		
(Do)	Option B port		
P1	Pump port (A2 side)		
P2	Pump port (A1 side)		
T1	Return port	M12	8.0~11.0 kgf · m (57.9~79.6 lbf · ft)

STRUCTURE (2/8)



TOP VIEW

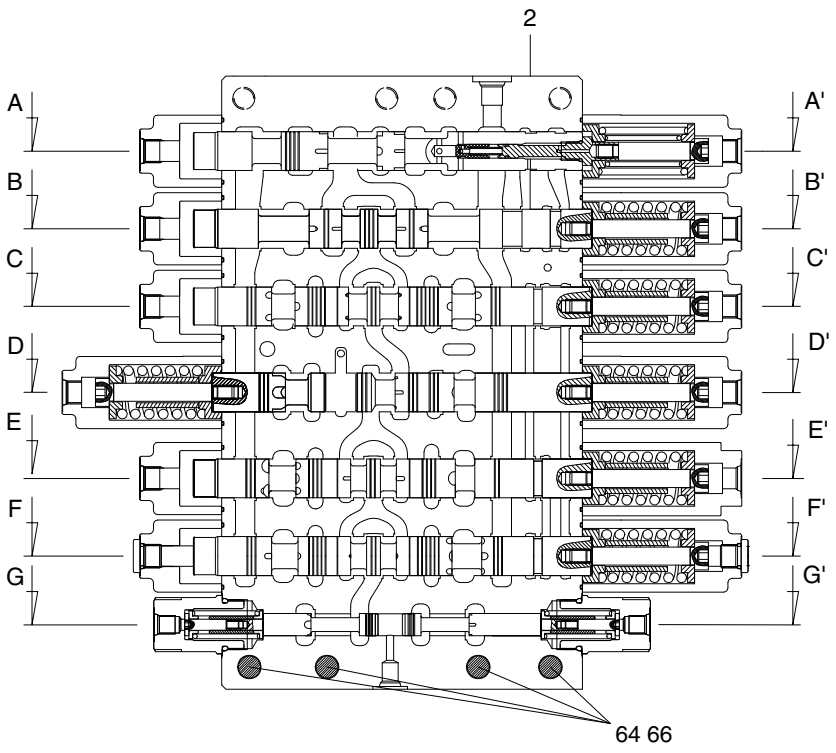


P1 BLOCK SPOOL SECTION

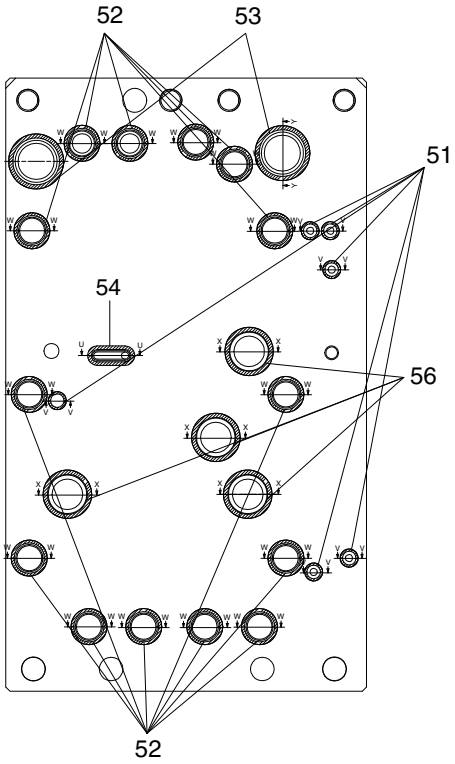
320A2MC02

1	Housing P1
31	Plug kit
32	Plug kit
64	Hex socket head bolt
66	Spring washer

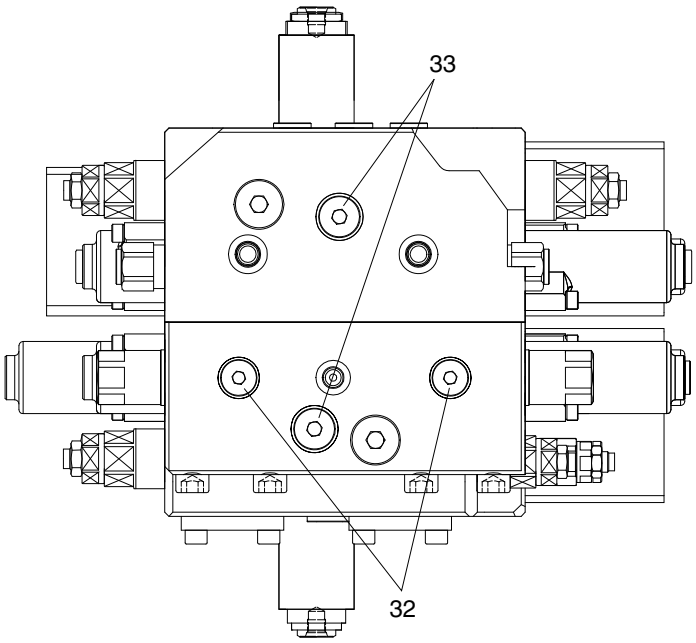
STRUCTURE (3/8)



P2 BLOCK SPOOL SECTION



CONTACT FACE

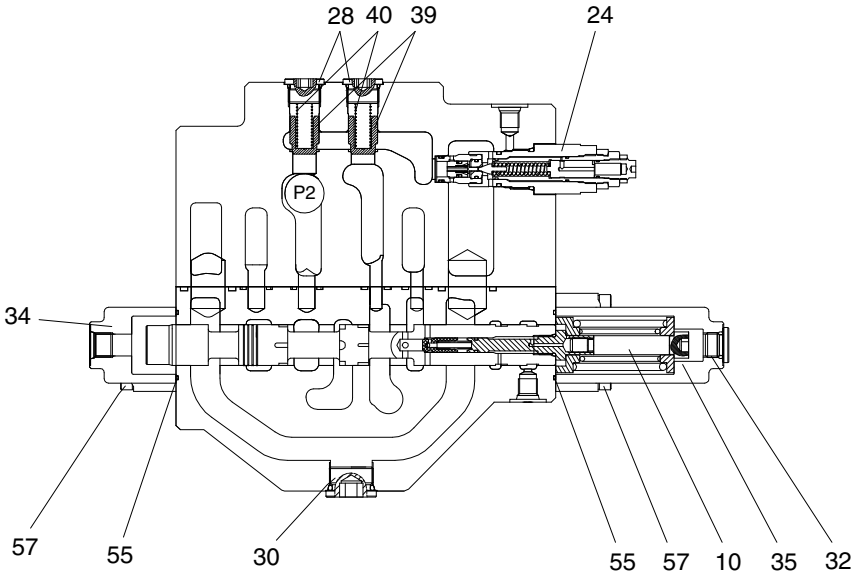


BOTTOM VIEW

320A2MC03

2	Housing 2
32	Plug
33	Plug kit
51	O-ring
52	O-ring
53	O-ring
54	O-ring
56	O-ring
64	Hex socket head bolt
66	Spring washer

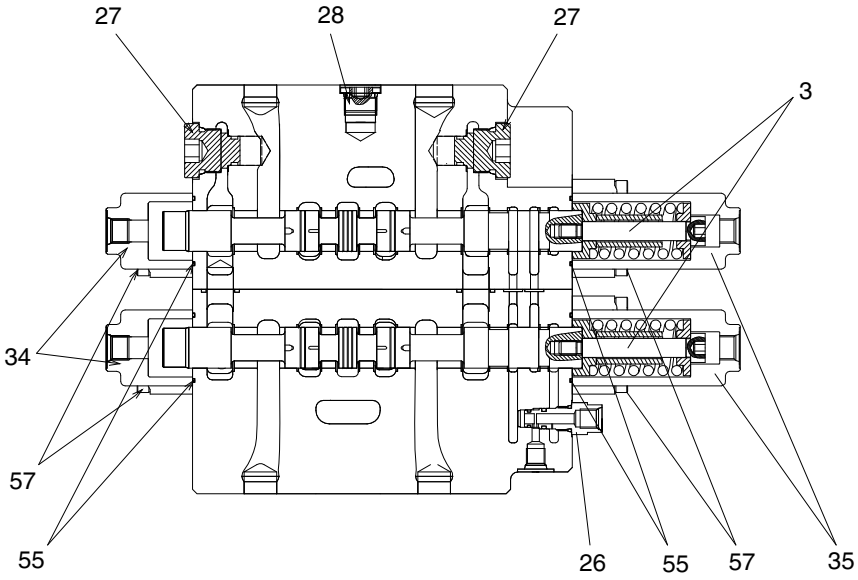
STRUCTURE (4/8)



A-A' (STRAIGHT TRAVEL AND SUPPLY)

220S2MC04

10 Travel straight spool kit
24 Main relief valve
28 Plug kit
30 Plug kit
32 Plug kit
34 Pilot cover A
35 Pilot cover B
39 Check valve poppet 2
40 Check valve spring 2
55 O-ring
57 Hex socket head bolt

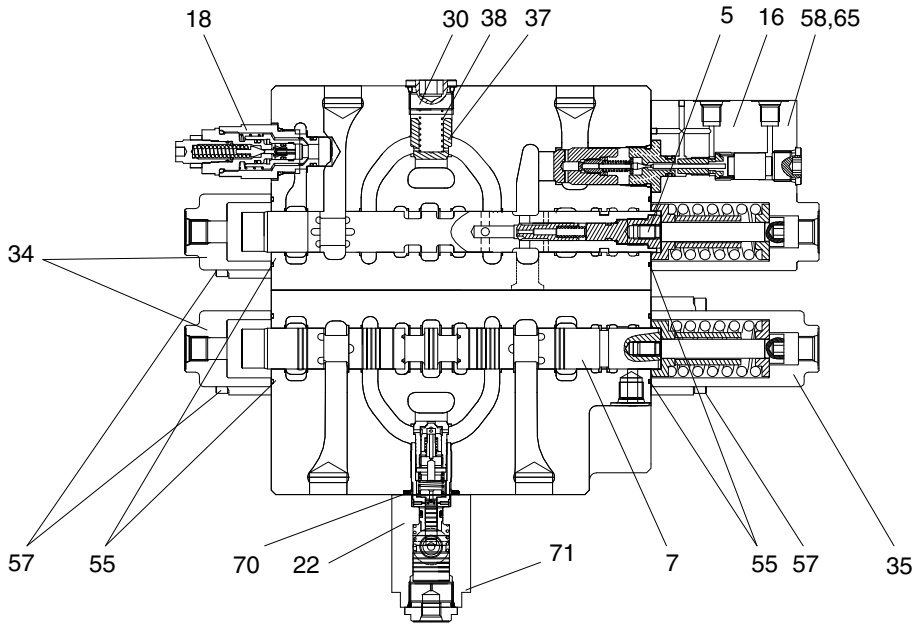


B-B' (TRAVEL RIGHT AND LEFT)

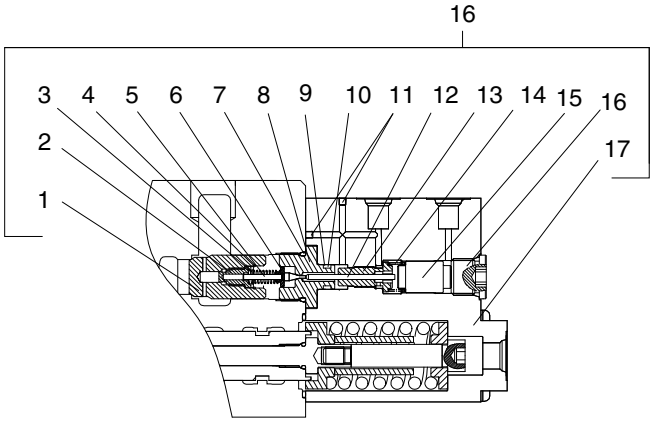
220S2MC05

3 Travel spool kit
26 Orifice signal plug
27 ORV plug
28 Plug kit
34 Pilot cover A
35 Pilot cover B
55 O-ring
57 Hex socket head bolt

STRUCTURE (5/8)



C-C' (SWING AND BOOM1)

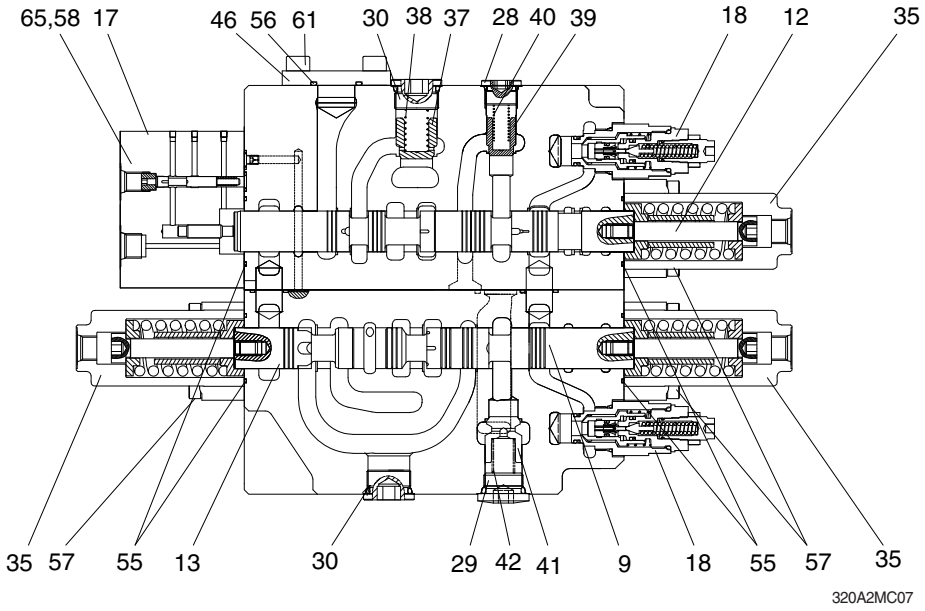


HOLDING VALVE

320A2MC06

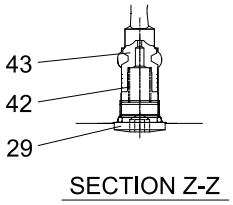
5	Boom 1 spool kit	16-9	Back up ring	30	Plug kit
7	Swing spool kit	16-10	O-ring	34	Pilot cover A
16	Holding valve assy	16-11	Plug	35	Pilot cover B
16-1	Main poppet	16-12	Pilot piston	37	Check valve poppet 1
16-2	Restrictor	16-13	Piston guide	38	Check valve spring 1
16-3	Pilot spring	16-14	Spring	55	O-ring
16-4	C-ring	16-15	Main piston	57	Hex socket head bolt
16-5	Pilot poppet	16-16	Plug	58	Hex socket head bolt
16-6	Poppet guide	16-17	Block	65	Spring washer
16-7	O-ring	18	Overload relief valve	70	O-ring
16-8	Poppet seat	22	Swing logic valve	71	Hex socket head bolt

STRUCTURE (6/8)

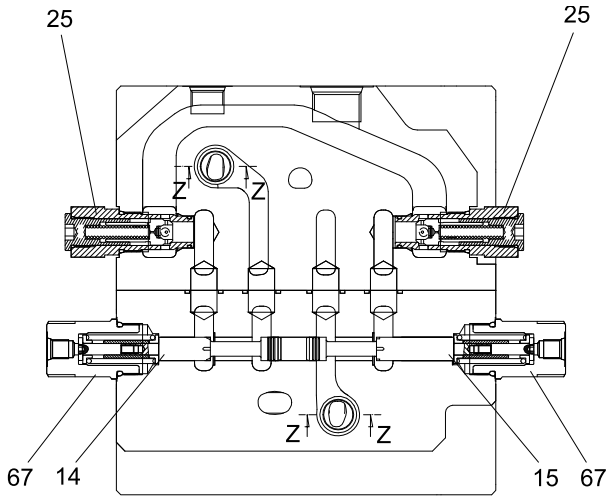


D-D' (SWING PRI, BOOM 2 & ARM REGEN)

9 Boom 2 spool kit
12 Arm regen spool kit
13 Swing priority spool kit
17 Regen valve
18 Overload relief valve
28 Plug kit
29 Plug kit
30 Plug kit
35 Pilot cover B
37 Check valve poppet 1
38 Check valve spring 1
39 Check valve poppet 2
40 Check valve spring 2
41 Check valve poppet 3
42 Check valve spring 3
46 Flange
55 O-ring
56 O-ring
57 Hex socket head bolt
58 Hex socket head bolt
61 Hex socket head bolt
65 Spring washer



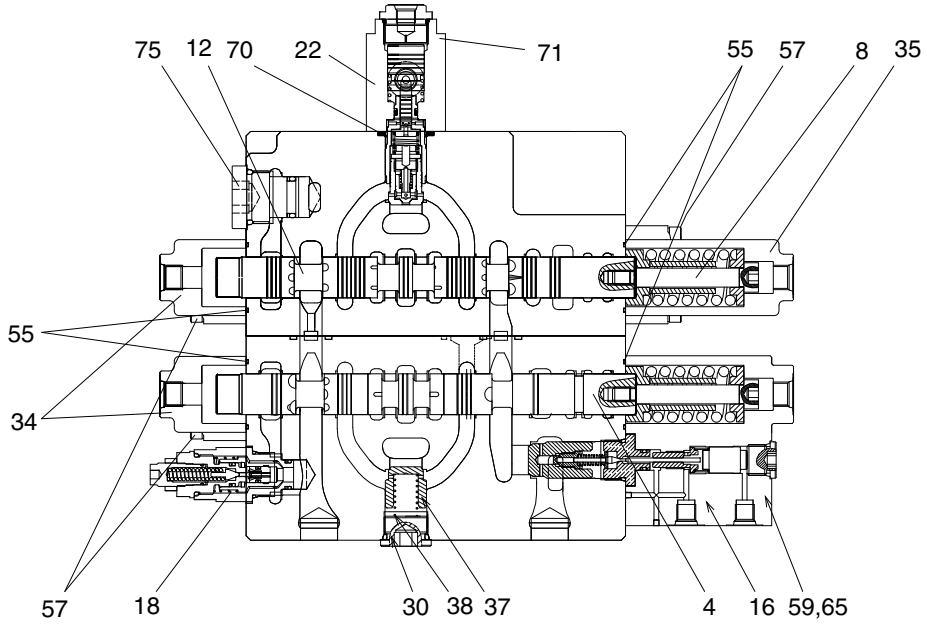
SECTION Z-Z



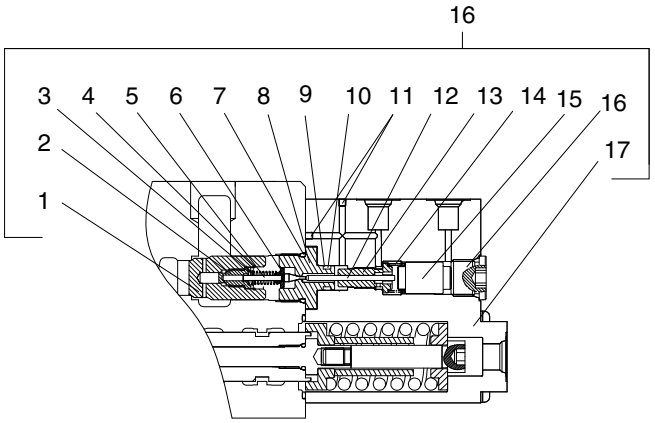
G-G' (BYPASS CUT & NEGATIVE CONTROL)

14 Bypass cut 1 spool kit (bucket)
15 Bypass cut 2 spool kit (option)
25 Negacon valve
29 Plug kit
42 Check valve spring 3
43 Check valve poppet 4
67 Bypass cut plug

STRUCTURE (7/8)



E-E' (ARM 1 & ARM 2)

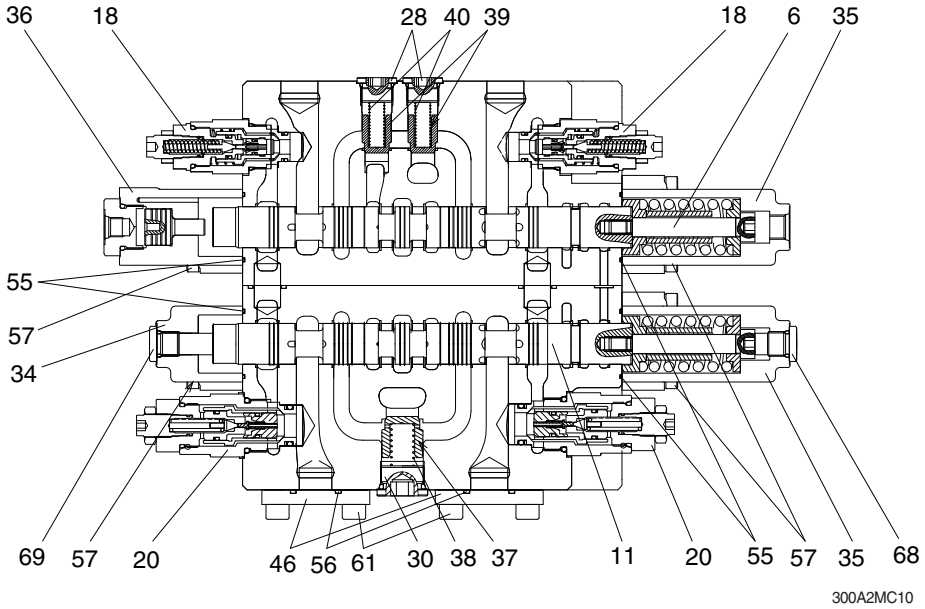


HOLDING VALVE

320A2MC09

4	Arm 1 spool kit	16-9	Back up ring	34	Pilot cover A
8	Arm 2 spool kit	16-10	O-ring	35	Pilot cover B
12	Arm regen spool kit	16-11	Plug	37	Check valve poppet 1
16	Holding valve assy	16-12	Pilot piston	38	Check valve spring 1
16-1	Main poppet	16-13	Piston guide	55	O-ring
16-2	Restrictor	16-14	Spring	57	Hex socket head bolt
16-3	Pilot spring	16-15	Main piston	59	Hex socket head bolt
16-4	C-ring	16-16	Plug	65	Spring washer
16-5	Pilot poppet	16-17	Block	70	O-ring
16-6	Poppet guide	18	Overload relief valve	71	Hex socket head bolt
16-7	O-ring	22	Swing logic valve	75	Plug
16-8	Poppet seat	30	Plug kit		

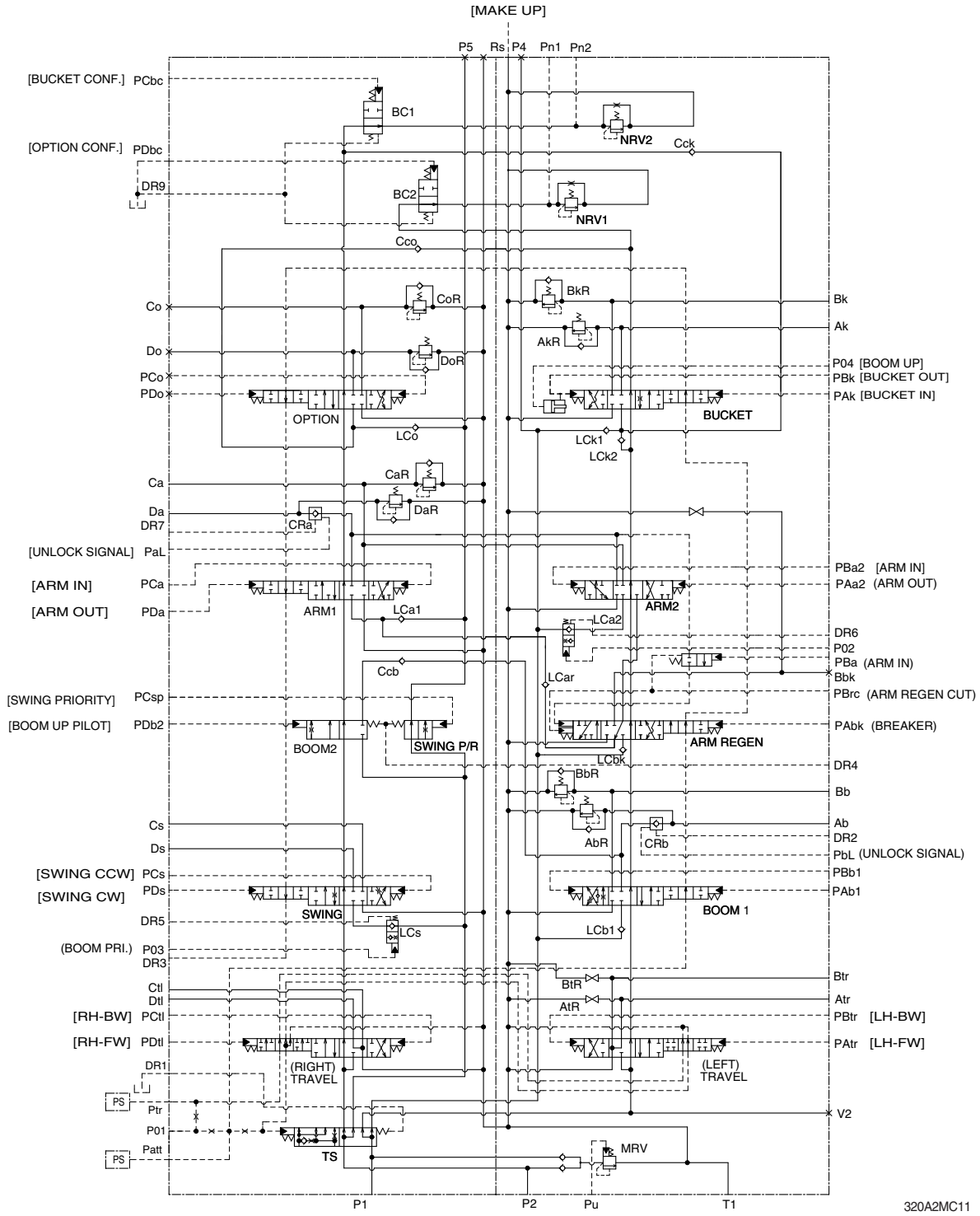
STRUCTURE (8/8)



F-F' (OPTION & BUCKET)

6	Bucket spool kit
11	Option spool kit
18	Overload relief valve
20	Overload relief valve
28	Plug kit
30	Plug kit
34	Pilot cover A
35	Pilot cover B
36	Pilot cover (stroke limit)
37	Check valve poppet 1
38	Check valve spring 1
39	Check valve poppet 2
40	Check valve spring 2
46	Flange
55	O-ring
56	O-ring
57	Hex socket head bolt
61	Hex socket head bolt
68	Plug kit 1
69	Plug kit 2

2. HYDRAULIC CIRCUIT



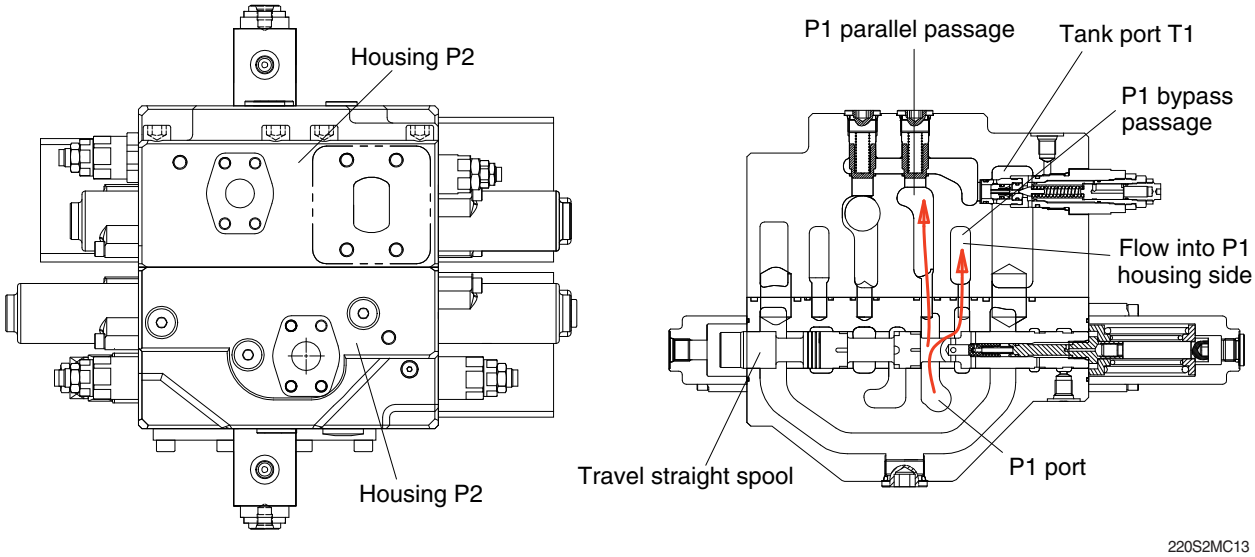
3. FUNCTION

1) CONTROL IN NEUTRAL POSITION

(1) P1 housing side

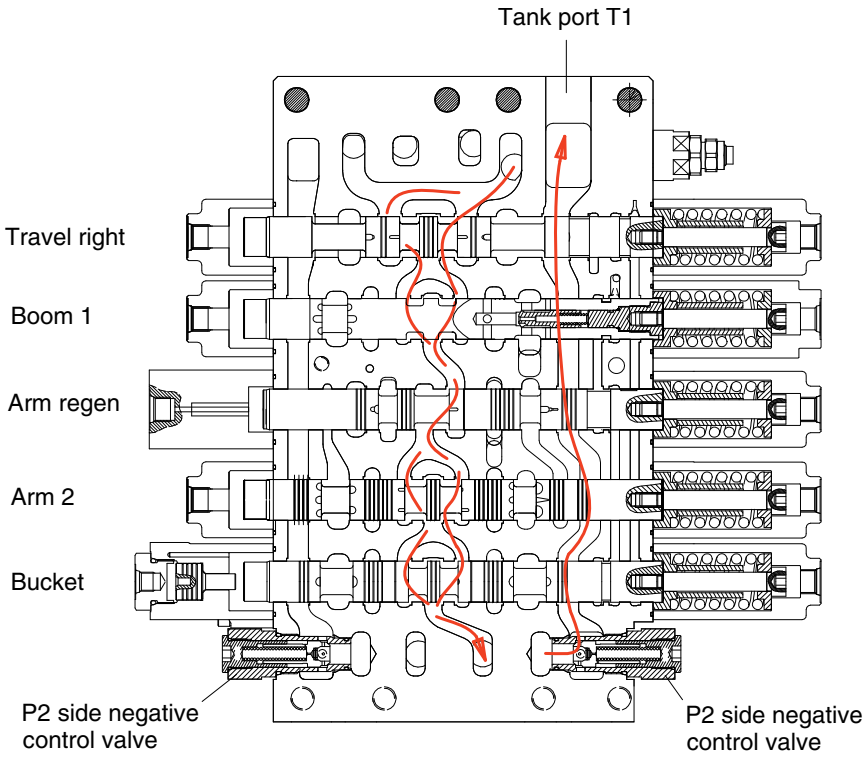
The pressurized oil discharged from hydraulic pump flows into the main control valve through the inlet port P1 and pass the land of the straight travel spool into the P1 bypass passage and P1 parallel passage.

When the straight travel spool is neutral, the P1 side bypass passage is not cut-off and the pressurized oil is directed to the tank port T1 through the bypass passage of spools (travel right -> boom 1 -> arm regeneration -> arm 2 -> bucket), the negative control valve of P1 and tank passage.

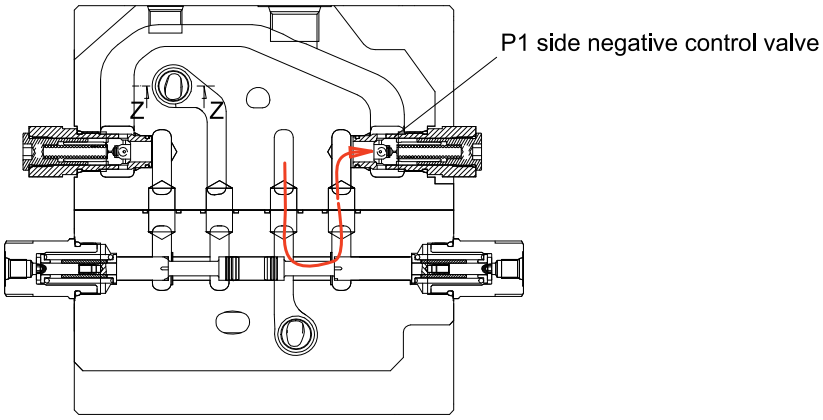


TOP VIEW

A-A' (STRAIGHT TRAVEL AND SUPPLY)



P1 BLOCK SPOOL SECTION

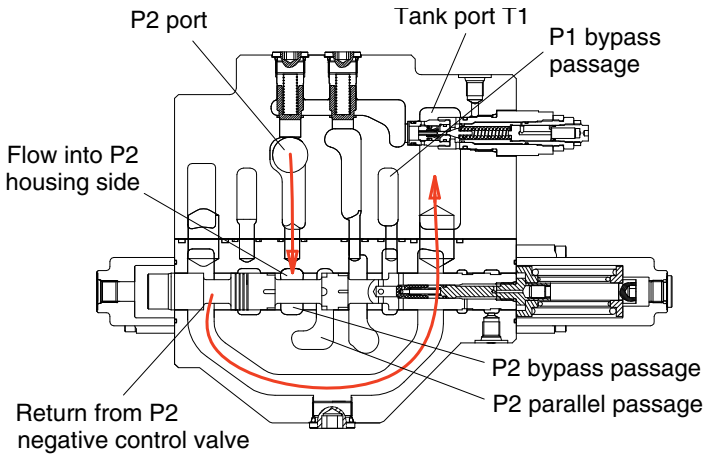


G-G' (BYPASS CUT & NEGATIVE CONTROL) 300A2MC15

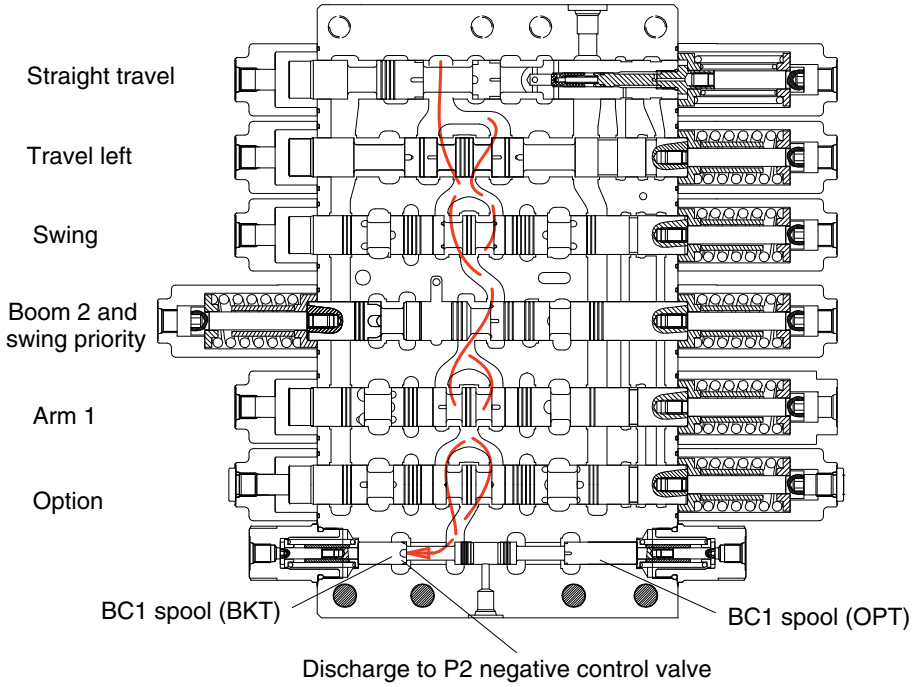
(2) P2 housing side

The pressurized oil discharged from hydraulic pump flows into the main control valve through the inlet port P2 and pass the land of the straight travel spool into the P2 bypass passage and P2 parallel passage.

When the straight travel spool is neutral, the P2 side bypass passage is not cut-off and the pressurized oil is directed to the tank port T1 through the bypass passage of spools (travel left -> swing -> boom 2 and swing priority -> arm 1 -> option), the negative control valve of P2 and tank passage.



A-A' (STRAIGHT TRAVEL AND SUPPLY) 220S2MC16



P2 BLOCK SPOOL SECTION 300A2MC17

2) TRAVEL OPERATION

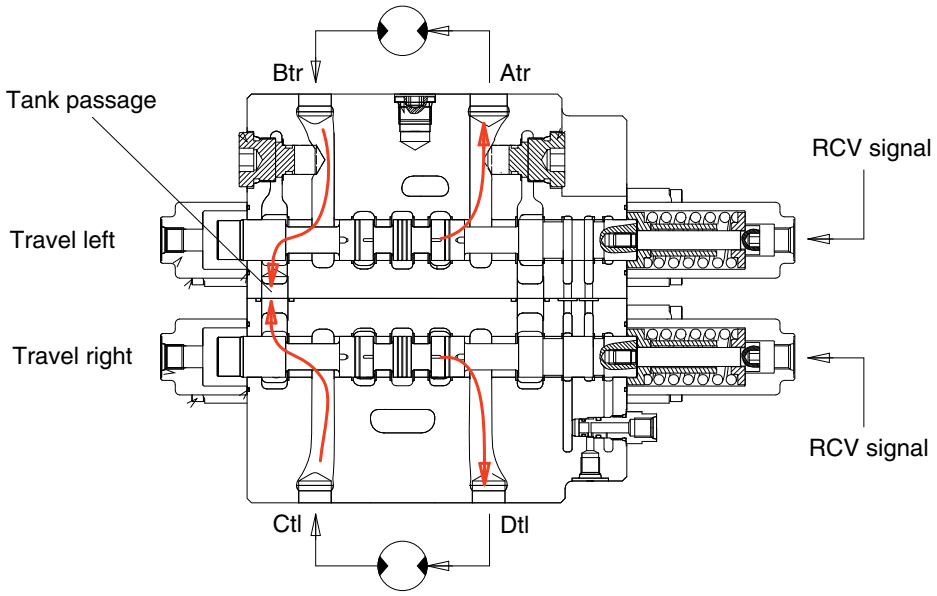
(1) Travel forward operation

During the travel forward operation, the pilot secondary pressure from the remote control valve is supplied to the spring side of pilot port and it shifts travel spools to the left direction.

The pressurized oil from the pump flows into the bypass passage of the travel spools through the land of the straight travel spool.

When the travel spools is shifted and the bypass passage is shut-off. The pressurized oil flowed into bypass passage is supplied to the travel motors through opened port Atr and Dtl.

On the other hand, the return oil from the travel motors flows into main control valve inside through the port Btr and Ctl and return to the tank passage.



B-B' (TRAVEL RIGHT AND LEFT) 220S2MC18

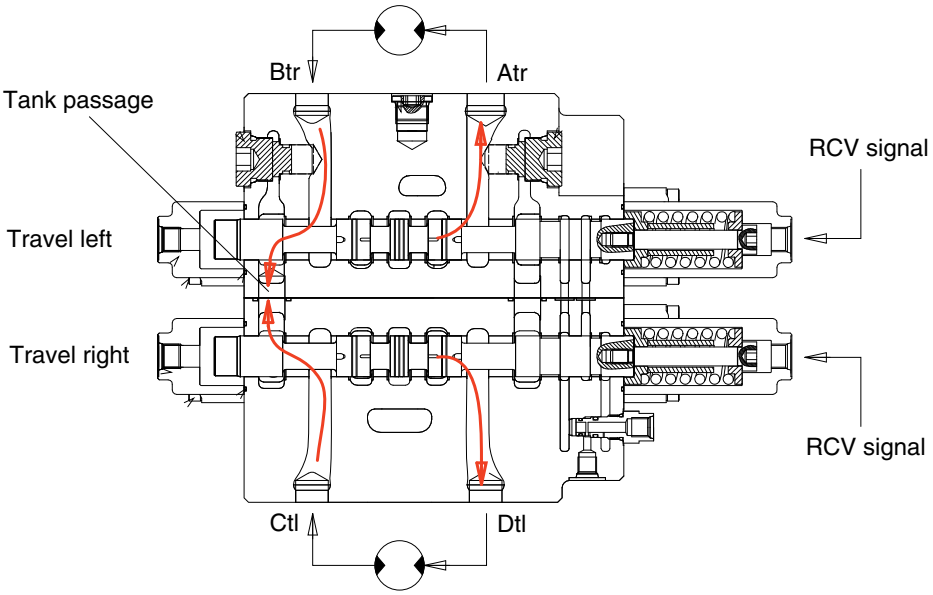
(2) Travel backward operation

During the travel backward operation, the pilot secondary pressure from the remote control valve is supplied to the against pilot port of the spring side and it shifts travel spools to the right direction.

The pressurized oil from the pump flows into the bypass passage of the travel spools through the land of the straight travel spool.

When the travel spools are shifted and the bypass passage is shut-off. The pressurized oil flowed into bypass passage is supplied to the travel motors through opened port Btr and Ctl.

On the other hand, the return oil from the travel motors flows into main control valve inside through the port Atr and Dtl and return to the tank passage.



B-B' (TRAVEL RIGHT AND LEFT)

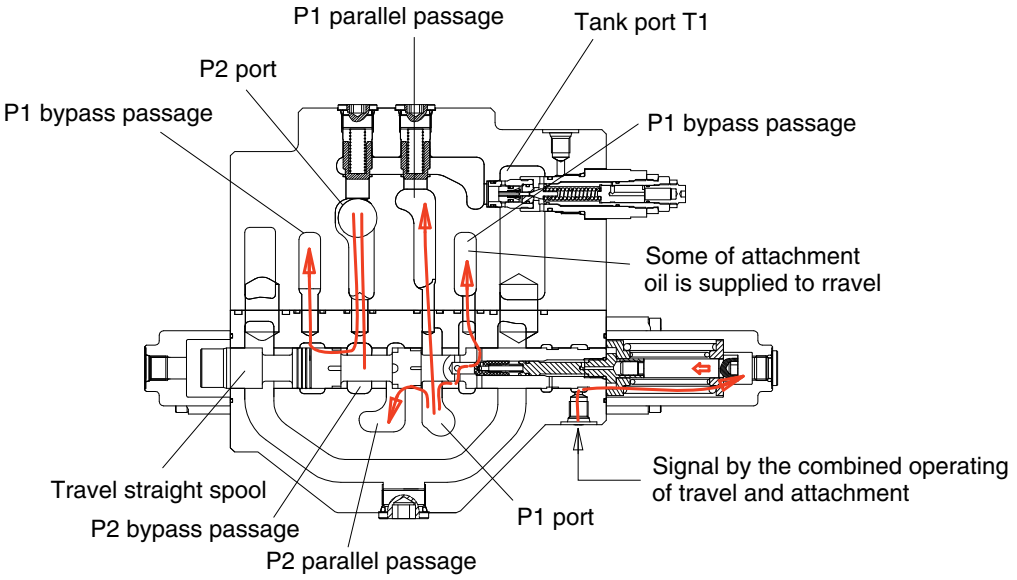
220S2MC19

(3) Travel straight function

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

In normal conditions, travel straight spool keeps neutral conditions, the pressurized oil of the P1 and P2 pumps is supplied to each passage independently.

When the attachment spool is operated under the travel operation of both sides, the pilot pressure is supplied to the spring side port of the travel straight spool and then the travel straight spool is shifted to the left direction.



A-A' (STRAIGHT TRAVEL AND SUPPLY) 220S2MC20

After changeover of the travel straight spool, the pressurized oil discharged from the P1 pump is connected with P2 port oil and is supplied to the attachment line through both parallel passage of the P1 and P2.

Also, some of the pressurized oil open the check valve of the spool inside through side of the travel straight spool and is connected with the bypass passage of the P2 side.

On the other hand, the pressurized oil discharged from the P2 pump is connected with P1 port oil and is supplied to the travel line through both parallel passage of the P1 and P2.

Accordingly the attachment spool is operated under the travel operation of both sides, the pressurized oil discharged from P2 pump is mainly supplied to left and right travel line and the pressurized oil discharged from P1 pump is mainly supplied to attachment line.

As a result, simultaneous operation of both travel spools and attachment is not influenced to the travel operation of the both sides and the machine keeps straight travel.

3) BOOM OPERATION

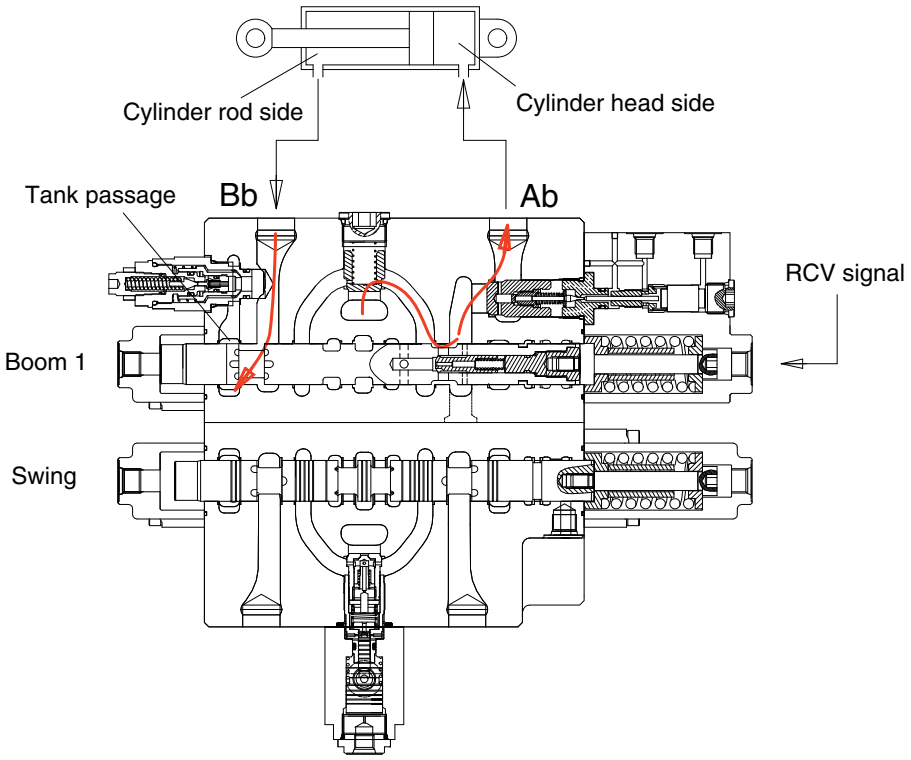
(1) Boom up operation

During the boom up operation, the pilot secondary pressure from the RCV is supplied to the port of the spring side and shifts the boom 1 spool to the left direction. The P1 bypass passage is shut off by the movement of the boom 1 spool and the pressurized oil from P2 port is entered P1 parallel passage and then passes through the load check valve, bridge passage and boom holding valve then flows into the head side of the boom cylinder via Ab port. (In this case, the boom holding valve is free flow condition)

At the same time, the pilot secondary pressure from RCV is supplied to the port of the spring side of boom 2 and shifts the boom 2 spool. The bypass passage is shut off by the movement of the boom 2 spool and the pressurized oil from P2 port entered boom summation passage via the P2 parallel passage, notch of the boom 2 spool, the check valve.

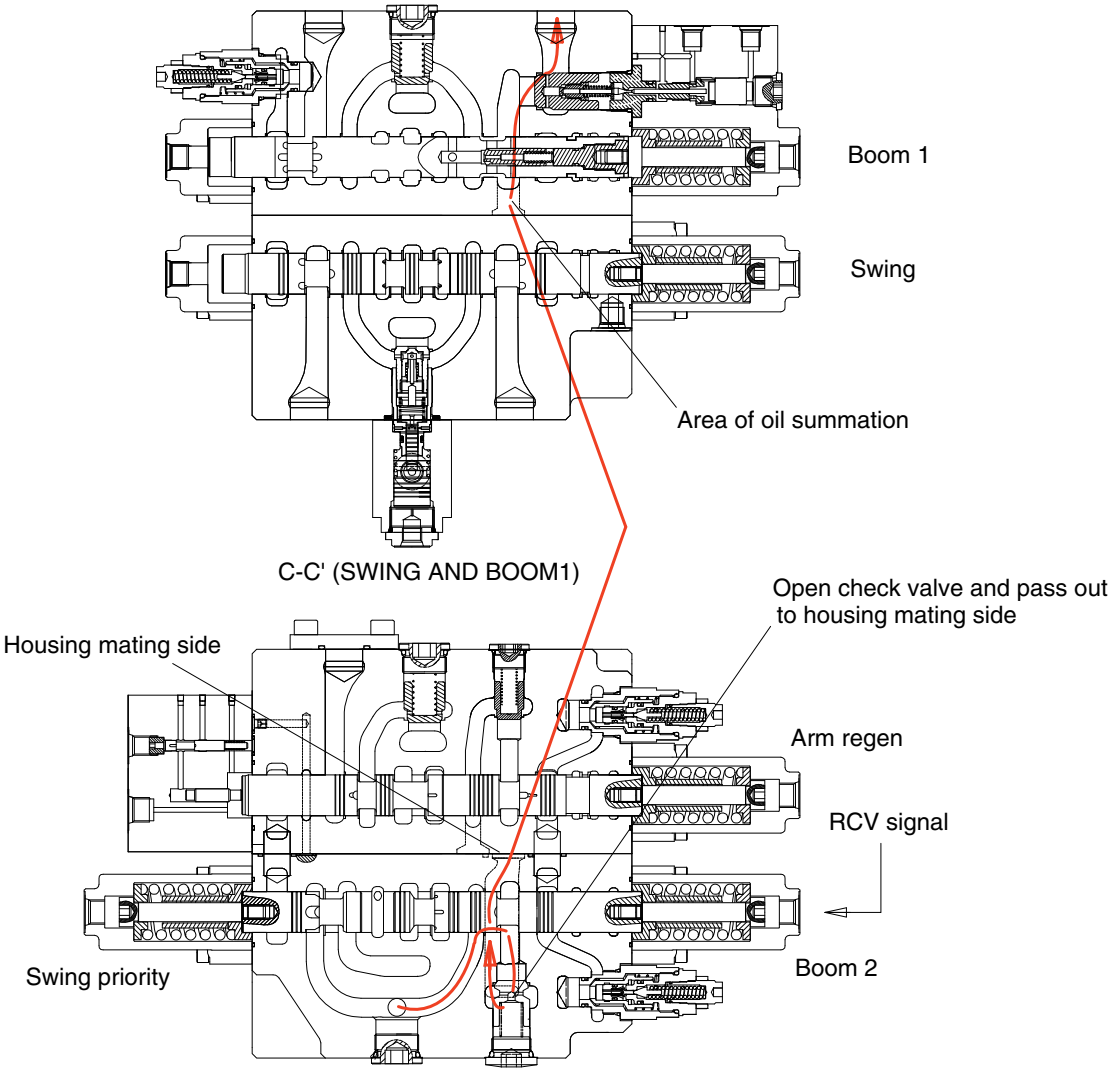
The oil from boom 2 spool combined with the boom 1 spool oil and is supplied Ab port.

At the same time, the return oil from rod side of the boom cylinders flows the boom 1 spool through the Bb port and return to the hydraulic oil tank through the tank passage.



C-C' (SWING AND BOOM1)

320A2MC21


Boom 1
Swing
Area of oil summation
C-C' (SWING AND BOOM1)
Open check valve and pass out
to housing mating side
Housing mating side
Arm regen
RCV signal
Boom 2
Swing priority
D-D' (SWING PRI, BOOM 2 & ARM REGEN)
320A2MC22

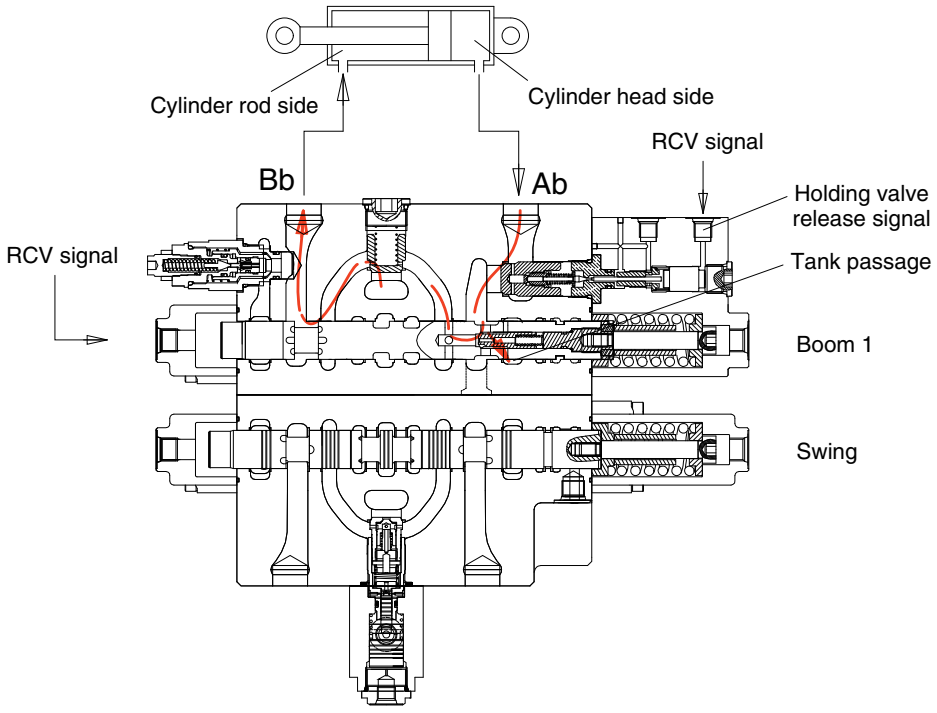
(2) Boom down operation

During the boom down operation, the pilot secondary pressure from the RCV is supplied to the against port of the spring side and shifts the boom 1 spool to the right direction. The P1 bypass passage is shut off by the movement of the boom 1 spool and the pressurized oil from P1 port is entered P1 parallel passage and then passes through the load check valve and bridge passage then flows into the rod side of the boom cylinder via Bb port.

At the same time, the return oil from head side of the boom cylinders flows the boom 1 spool through the Ab port and the boom holding valve and return to the hydraulic oil tank through the tank passage.

At this time, some of the return oil from the boom head side passes to the connected passage of the boom 1 spool inside and flows into the P1 parallel passage. (Boom spool inside regeneration function). At this time, the boom holding valve is open status and the operation principles are described following page.

During the boom down operation, the flow is not combined.



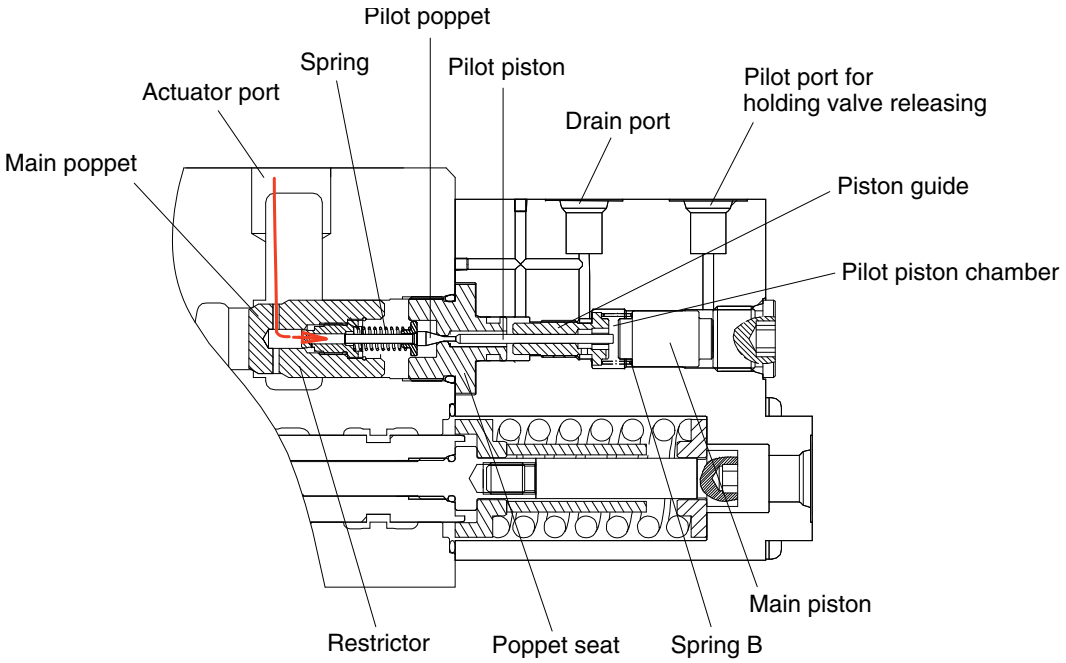
C-C' (SWING AND BOOM1)

320A2MC23

4) HOLDING VALVE OPERATION

(1) Holding operation

At neutral condition, the pilot piston chamber is connected to drain port through the pilot port.
And the main piston is seated by the spring B.
Also, the pressurized oil from the actuator entered to inside of the holding valve through the periphery hole of the main poppet, crevice of the main poppet and the restrictor and the periphery hole of the restrictor.
Then, this pressured oil pushed the pilot poppet to the poppet seat and the main poppet to the seat of body.
So the pressurized oil from the holding side of the actuator is not escaped and the actuator is not moved.



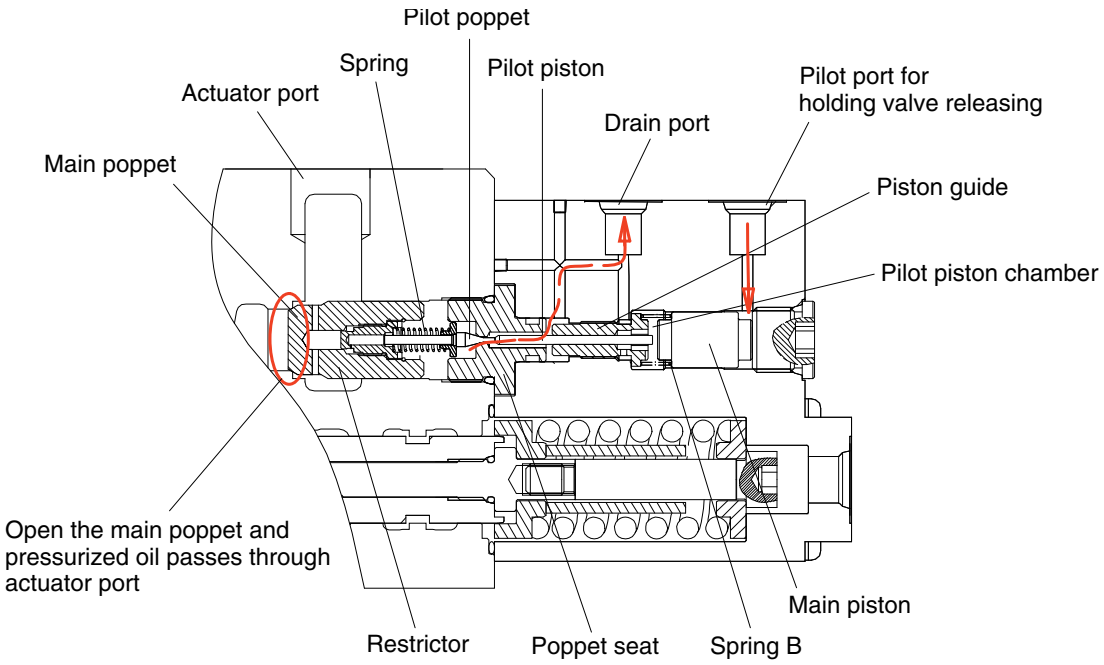
HOLDING VALVE BLOCK SECTION 220S2MC24

(2) Releasing holding operation

The pilot pressure is supplied to the pilot port for releasing holding valve and shifts the main piston to the left direction against the spring B and shifts the pilot poppet to the left direction through the pilot piston and open the passage for the drain.

At same time, the return oil from actuator returns to the drain port through the periphery hole of main poppet, crevice of the main poppet and the restrictor, the periphery hole of the restrictor, inside of holding valve, crevice of the pilot poppet and the drain passage of the holding valve.

After above operation, pressure of inside of holding valve is decreased and the main poppet is opened by the return oil of the actuator and the return oil from actuator returns to the tank passage through the notch of spool.



HOLDING VALVE BLOCK SECTION

220S2MC25

5) BUCKET OPERATION

(1) Bucket in operation

① Bucket operation only

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

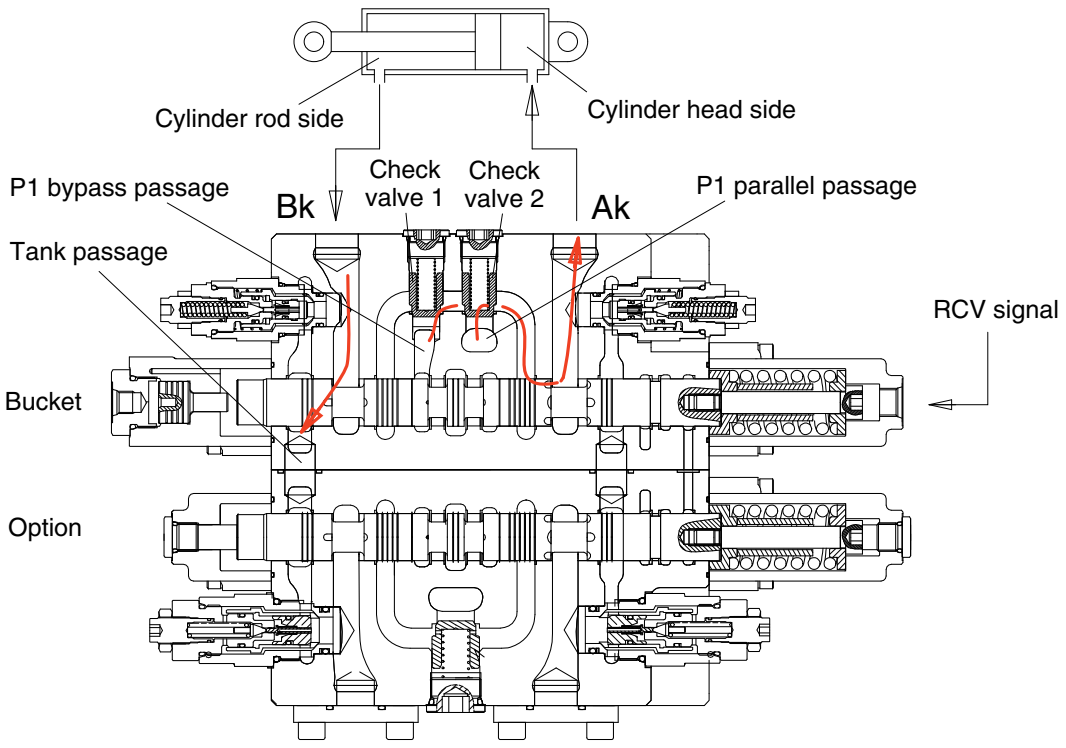
The P1 bypass passage is shut off by the movement of the bucket spool and the pressurized oil from P1 port entered P1 parallel passage and is directed to the Ak port through the check valve 2. At the same time, the pressurized oil from P1 bypass passage is directed to the AK port through the check valve 1.

The return oil from the rod side of the bucket cylinder (Bk port) returns to the hydraulic oil tank through the tank passage.

② Combined operation

When combined operation of the bucket and other actuators, mostly same as above operation but the fluid from P1 bypass passage is empty by the upstream operation such as the arm or boom operation.

So only the fluid from P1 parallel passage is supplied to the Ak port.



F-F' (OPTION AND BUCKET)

300A2MC26

(2) Bucket slow operation (incase bucket in)

This function is used to speed up of the boom or arm by reducing the bucket speed when the bucket operation with boom or arm operation simultaneously.

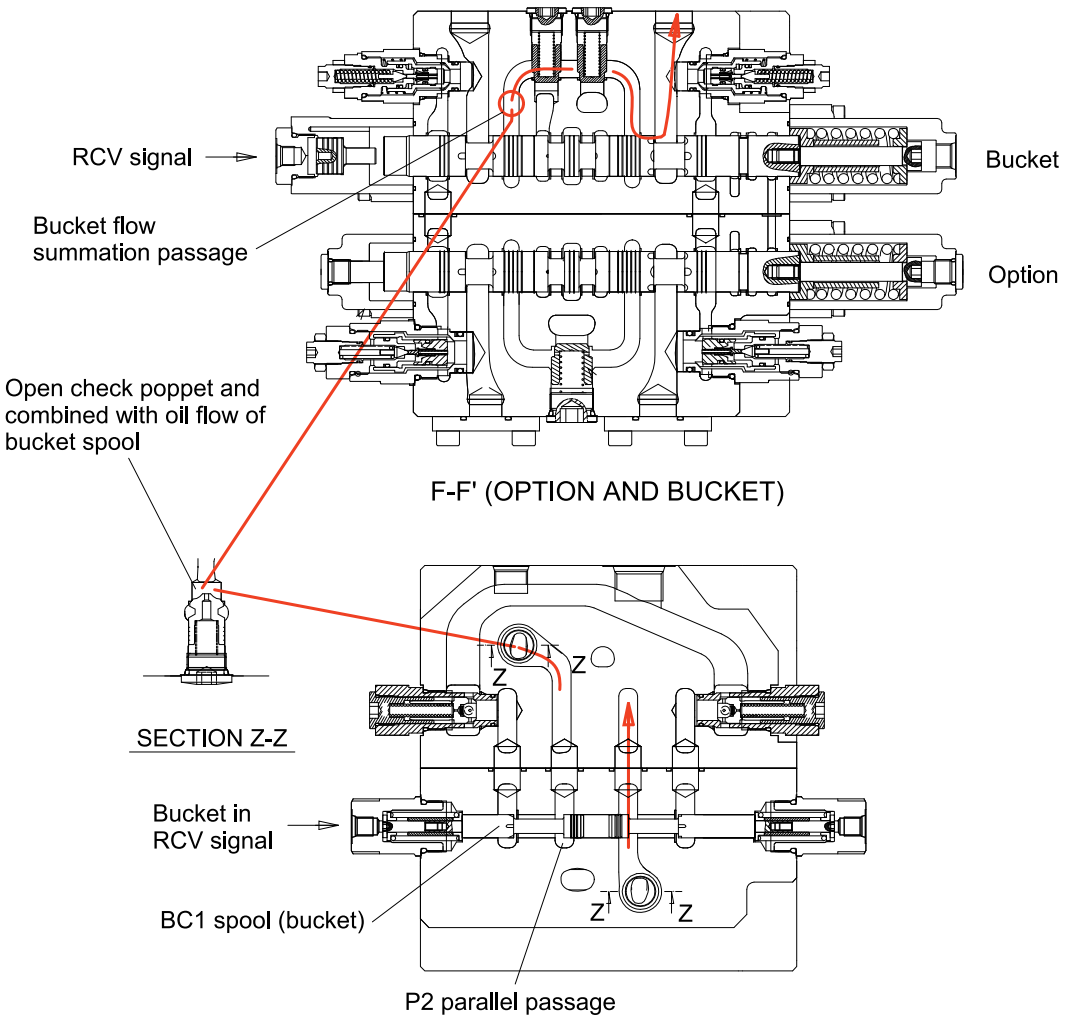
The bucket slow pilot pressure is supplied the pilot port of the BC1 spool and the piston is shifted to the right and then the bucket spool stroke is limited and the oil passage from P1 to the bucket cylinder is reduced and the oil flow of the bucket spool is reduced.

Bucket flow summation function, bypass cut-off 1 spool

During the bucket in operation, the pilot secondary pressure from the RCV is supplied to port of the spring side and shifts the BC1 (bucket) spool to the right direction.

The P2 parallel passage is shut off by the movement of the BC1 spool and the pressurized oil from P2 port opens the check poppet and combined with the flow of the bucket spool.

(Only bucket in operation)



FLOW SUMMATION BY THE SHIFTING OF THE BC1 SPOOL

300A2MC27

(3) Bucket out operation

① Bucket operation only

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

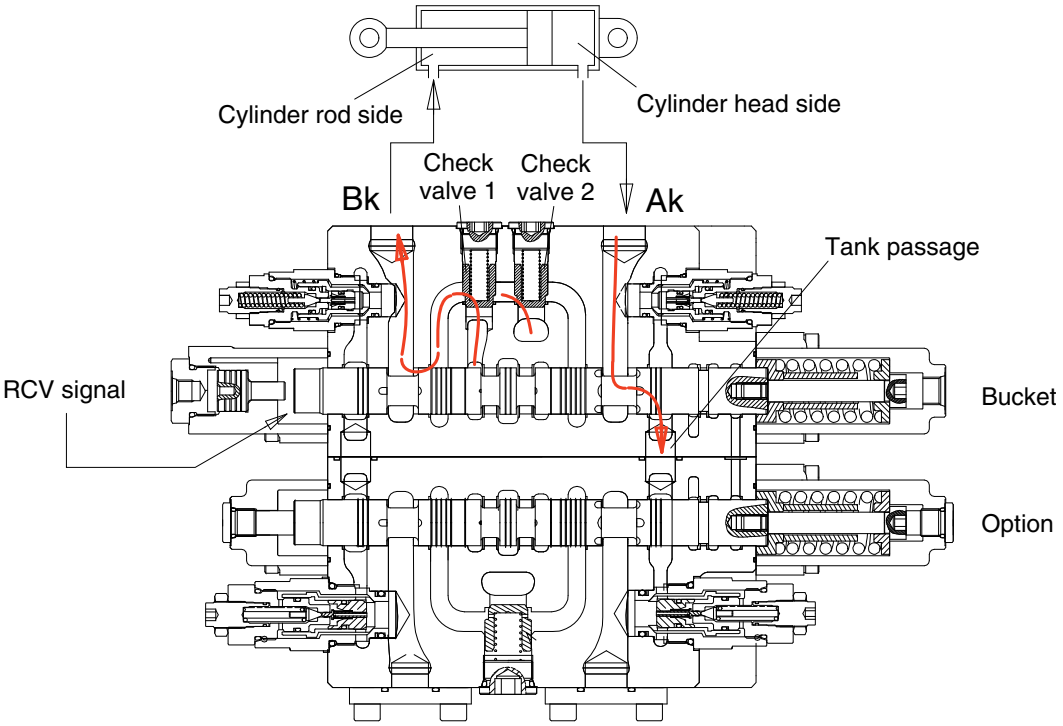
The P1 bypass passage is shut off by the movement of the bucket spool and the pressurized oil from P1 port entered P1 parallel passage and is directed to the Bk port through the check valve 2.

At the same time, the pressurized oil from P1 bypass passage is directed to the Bk port through the check valve 1.

The return oil from the head side of the bucket cylinder (Ak port) returns to the hydraulic oil tank through the tank passage.

② Combined operation

When combined operation of the bucket and other actuators, exactly same as above operation.



F-F' (OPTION AND BUCKET)

300A2MC28

6) SWING OPERATION

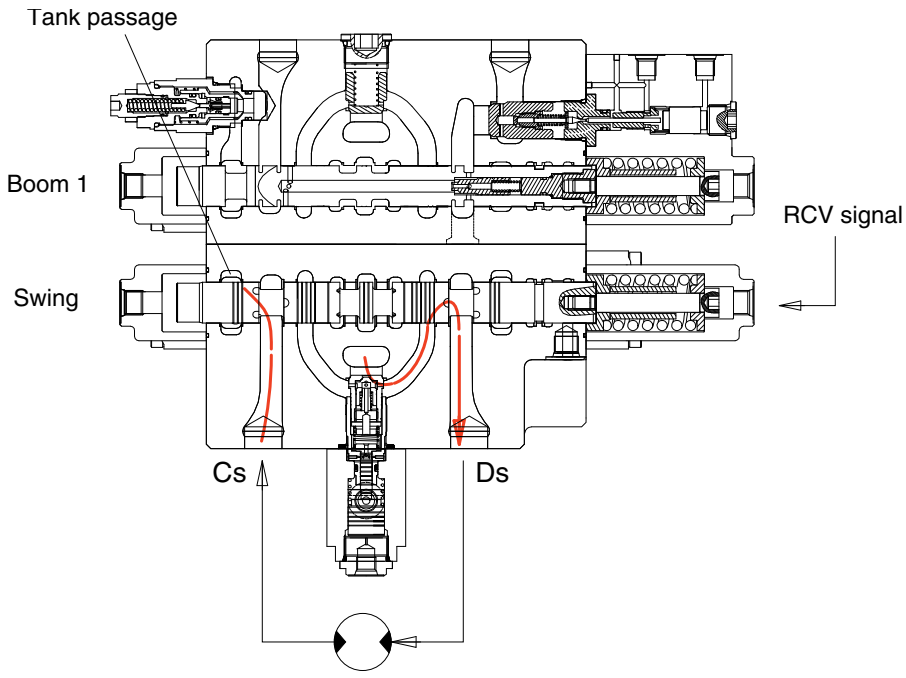
(1) Swing left and right operation

During the swing left operation, the pilot secondary pressure from the RCV is supplied to the port of the spring side and shifts the swing spool in left direction. The P2 bypass passage is shut off by the movement of the swing spool and the pressurized oil from P2 port flows into the P2 parallel passage and open the load check valve and is supplied to swing motor through the Ds port.

As the result, the return oil from the swing motor flows into the main control inside through Cs port and returns to the hydraulic oil tank through the swing spool and the tank passage.

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

Accordingly, the pressurized oil from P2 parallel passage flows into swing motor through the Cs port and returns to the hydraulic oil tank through the Ds port and the tank passage.



C-C' (SWING AND BOOM1)

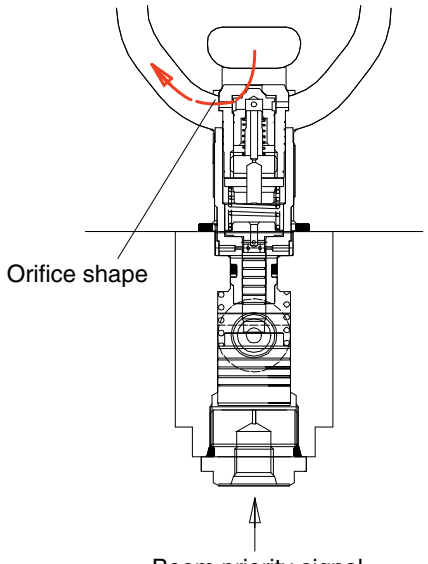
300A2MC29

(2) Boom priority function

This function is used to speed up of the boom by reducing the swing speed when the swing operation with boom operation simultaneously.

The boom priority signal is supplied the pilot port and the poppet of the swing logic valve is closed and then the pressurized oil from P2 port is reduced by the oil leaking through the orifice.

As a result, the swing speed is slowed.



SWING LOGIC VALVE

220S2MC30

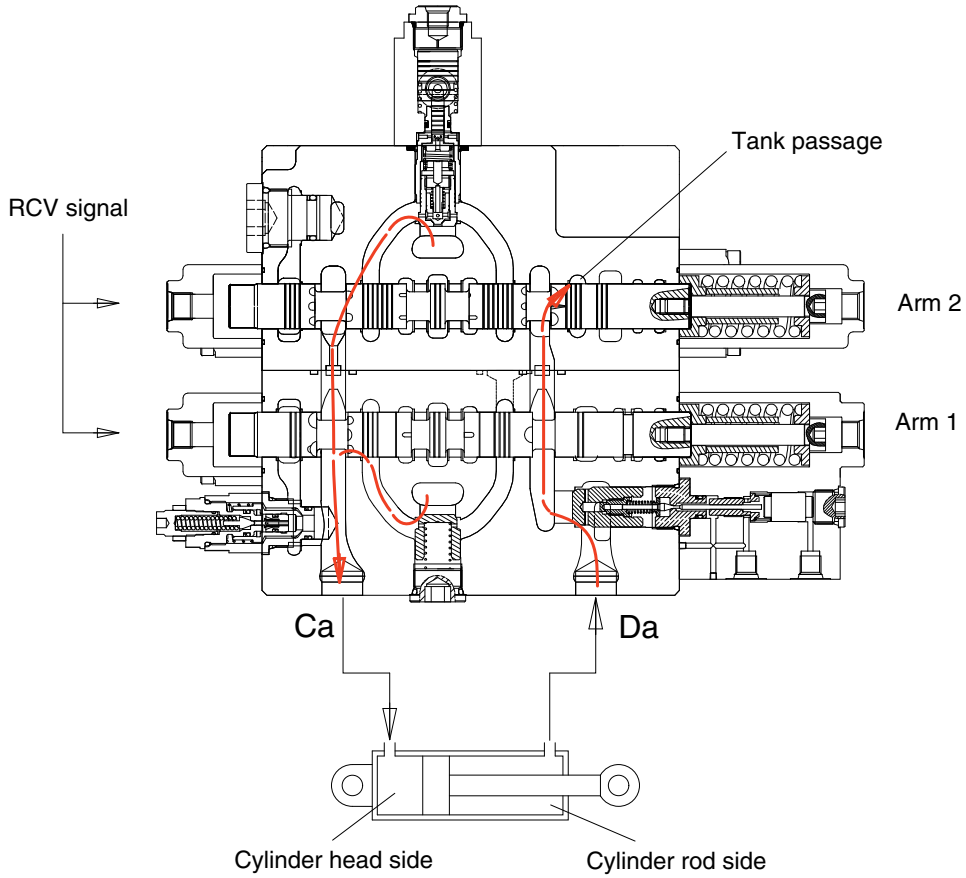
7) ARM OPERATION

(1) Arm in operation

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

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

At the same time, the pilot secondary pressure from the RCV is supplied to the port of spring opposite side and shifts the arm 2 spool in the right direction. The P2 bypass passage is shut off by the movement of the arm 2 spool and the pressurized oil from the P1 port flows into the arm summation passage through P1 parallel passage, the check valve and the notch of the arm 2 spool.



E-E' (ARM 1 AND ARM 2)

220S2MC31

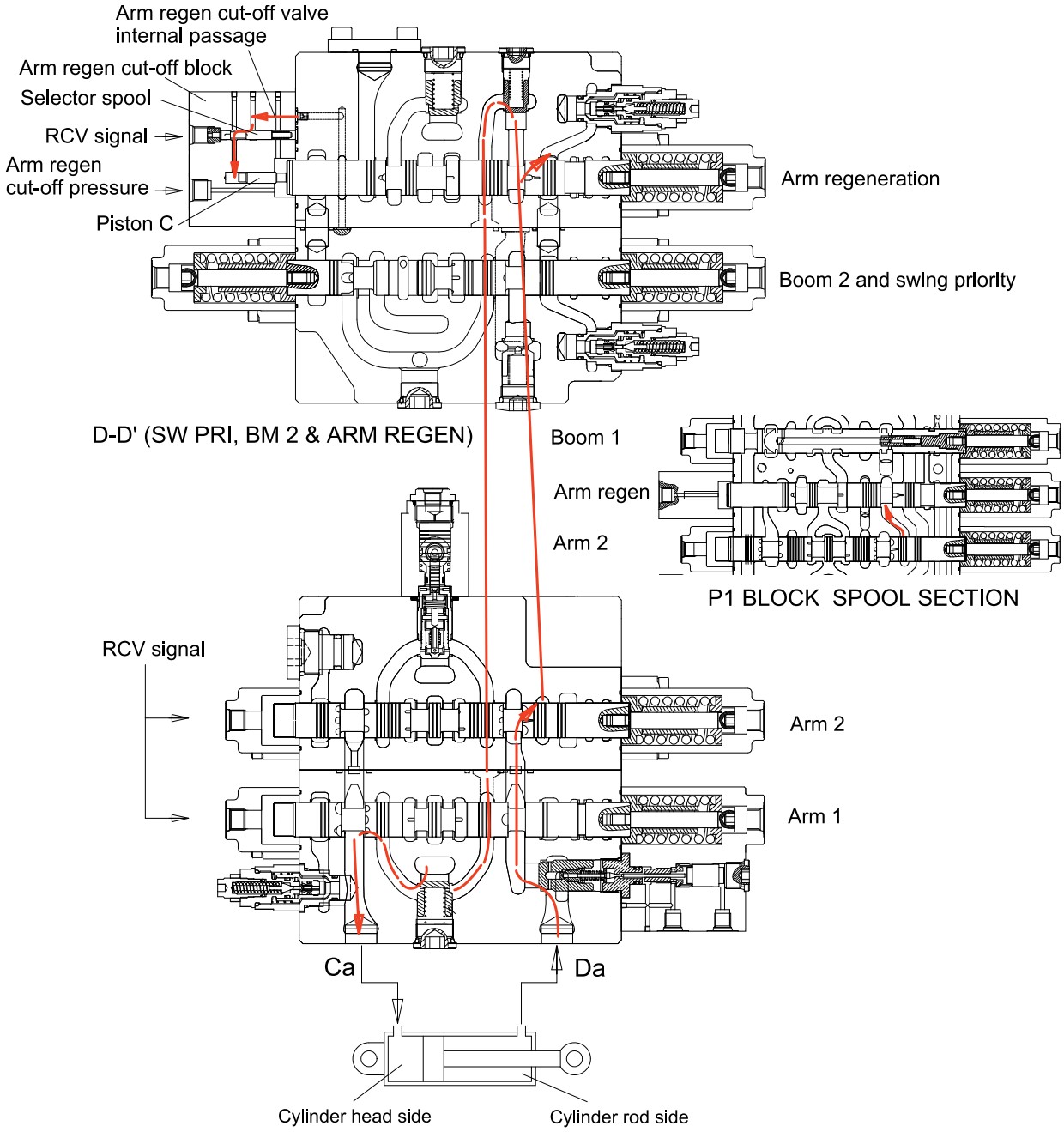
ARM REGENERATION

The return oil from the arm cylinder rod side passes the arm holding valve (open condition) through the Da port and the notch of the arm 1 and arm 2, and swing priority spool. And some of the oil return to the tank passage through the notch of the arm regeneration spool and most of the oil is supplied to the head side of the arm cylinder through internal summation passage.

This is called the arm regeneration function.

The amount of regeneration fluid is changed by movement of the arm regeneration spool. A few fluids of the oil that is supplied to the head side of the arm cylinder passes the selector spool (in this case, the selector spool is opened by the arm in pilot pressure) built in the arm regeneration block through internal passage and is pushed the piston C.
The amount of the regeneration oil from the rod side of the arm cylinder to the tank passage is increased by the movement of the piston C and the arm regeneration spool to the right direction and the arm regeneration flow is decreased as much increased oil.
The pressure of the arm cylinder head increases, then, the arm regeneration flow decreases.

Furthermore, the arm regeneration cut-off pressure is supplied to the port of the spring opposite side and the arm regeneration spool is moved to the right direction fully. The flow from the arm cylinder rod to the tank passage is maximum condition.



ARM REGENERATION PASSAGE

220S2MC32

(2) Arm out operation

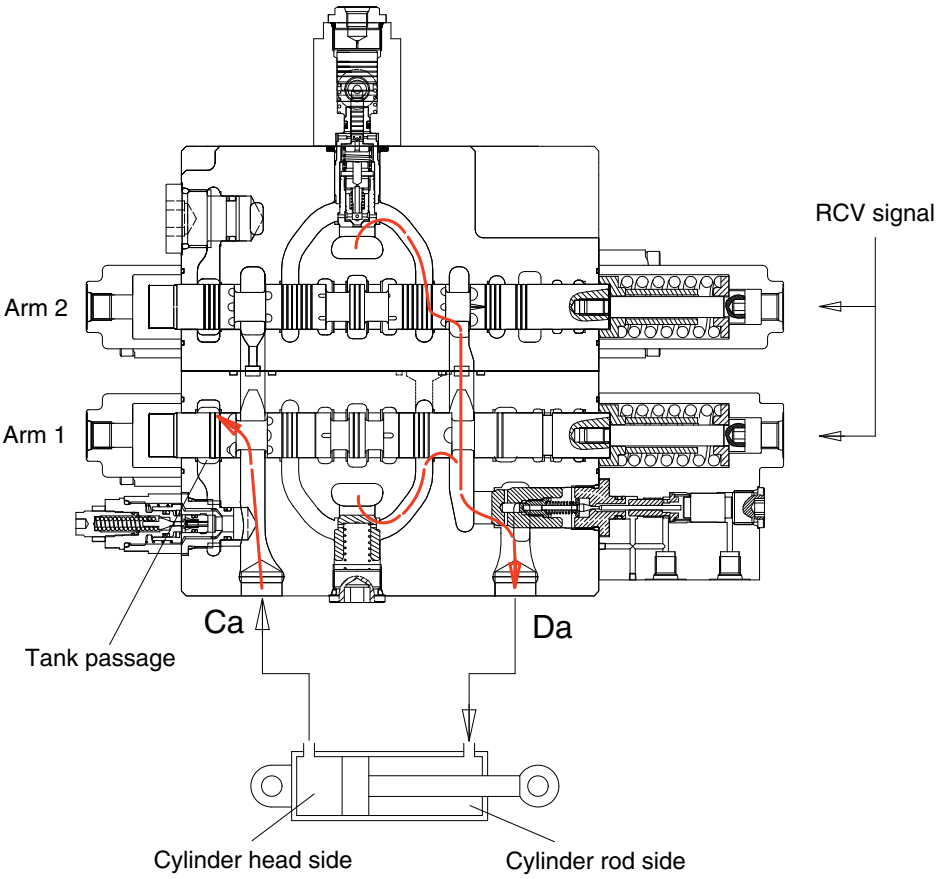
During arm out operation, the pilot secondary pressure from the RCV is supplied to the port of the spring side and shifts the arm 1 spool to the left direction.

The bypass passage is shut off by the movement of the arm 1 spool and the pressurized oil from the P2 port flows into arm 1 spool through the P2 parallel passage. Then it enters into the arm cylinder rod side through the load check, bridge passage, arm holding valve (oped status) and the port Da.

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

The bypass passage is shut off by the movement of the arm 2 spool and the pressurized oil from the P2 port through the P2 parallel passage. Then it combined with the flow of the arm 1 passage through P1 parallel passage, the check valve, bridge passage, the notch of the arm 1 and the arm holding valve (open status).

On the other hand, the return flow from the arm cylinder head side returns to the hydraulic tank through the port Ca, the notch of the arm 1 spool and tank passage.



E-E' (ARM 1 AND ARM 2)

220S2MC33

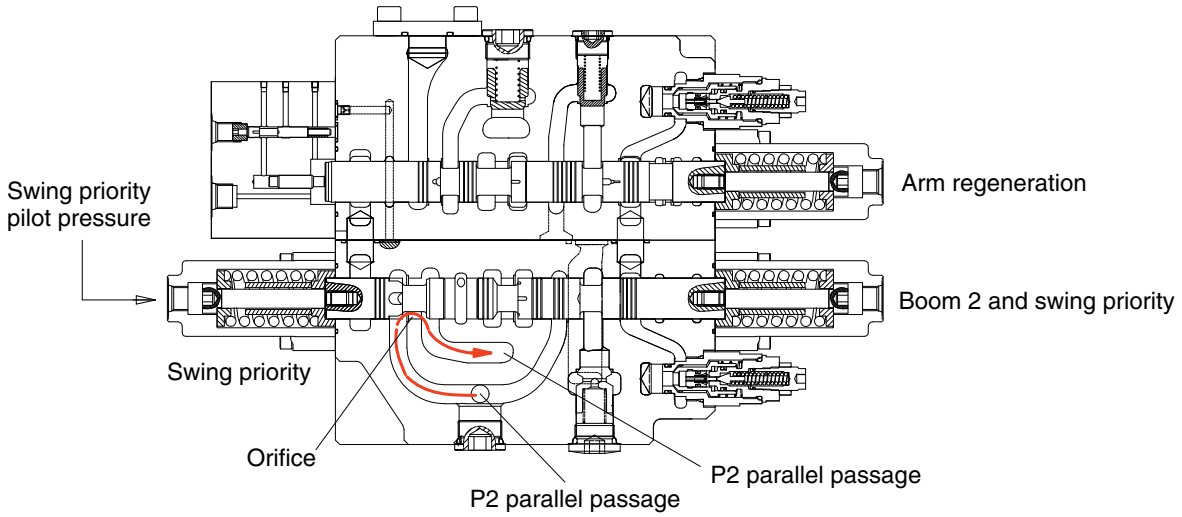
8) OPERATION OF SWING PRIORITY SPOOL

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

The pressurized oil from the P2 port flows into the P2 parallel passage through the notch of the swing priority spool.

When the swing priority spool is neutral condition, the passage is same as normal condition. But due to shifting of the swing priority spool, the orifice is formed between the notch of the swing priority spool and the land of the block housing and then the fluid to the swing side more then the downstream of the swing spool such as the arm 1 and option spool.

As a result, the flow is supplied to the swing operation most preferential.



D-D' (SWING PRI, BOOM 2 & ARM REGENERATION) 220S2MC34

9) OPERATION OF OPTION SPOOL

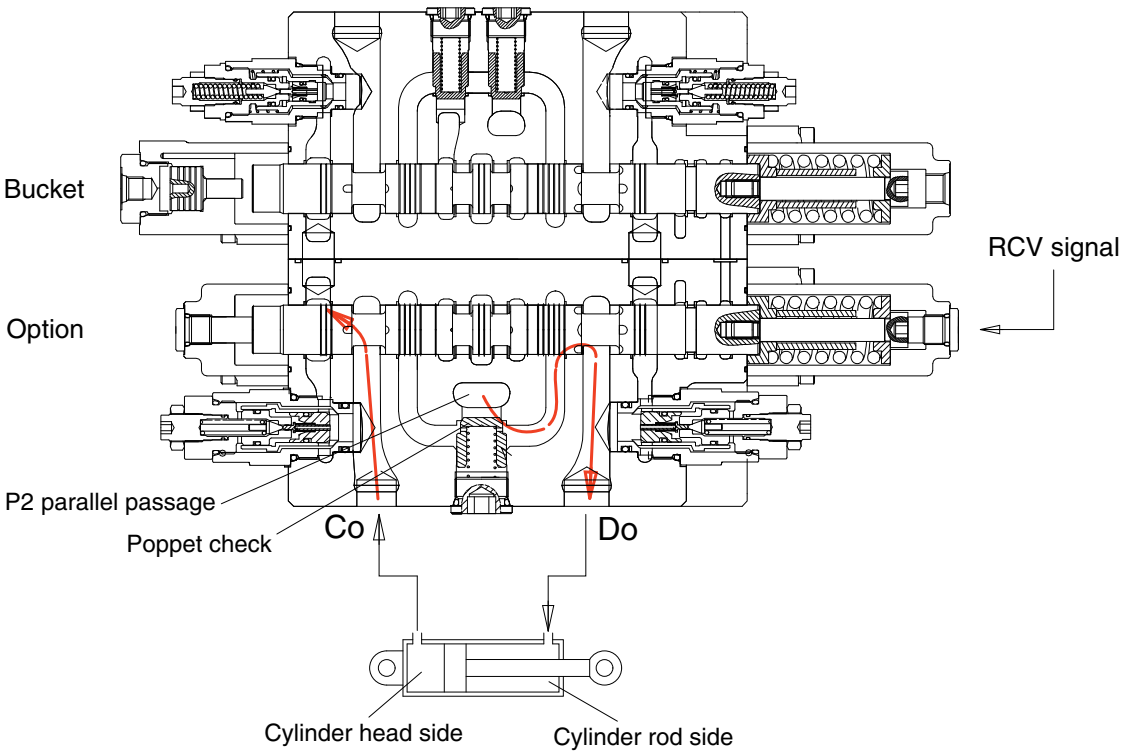
(1) 1-way operation

※ The pilot pressure is supplied to the port of the spring side and shifts spool to the left direction. The pilot secondary pressure from the RCV is supplied to the port of the spring opposite side of the option spool, the P2 bypass passage is shut off by the movement of the option spool and the pressurized oil from the P2 port flows into the actuator through the P2 parallel passage, the check valve, bridge passage and the Do port.

(2) 2-way operation

※ Shifts spool to the left and right direction.

- When the spool shifts to the left, same as 1-way operation.
- When the spool shifts to the right, the pressurized oil from the P2 port flows into the actuator through the P2 parallel passage, the check valve, bridge passage and the Co port.



F-F' (OPTION AND BUCKET)

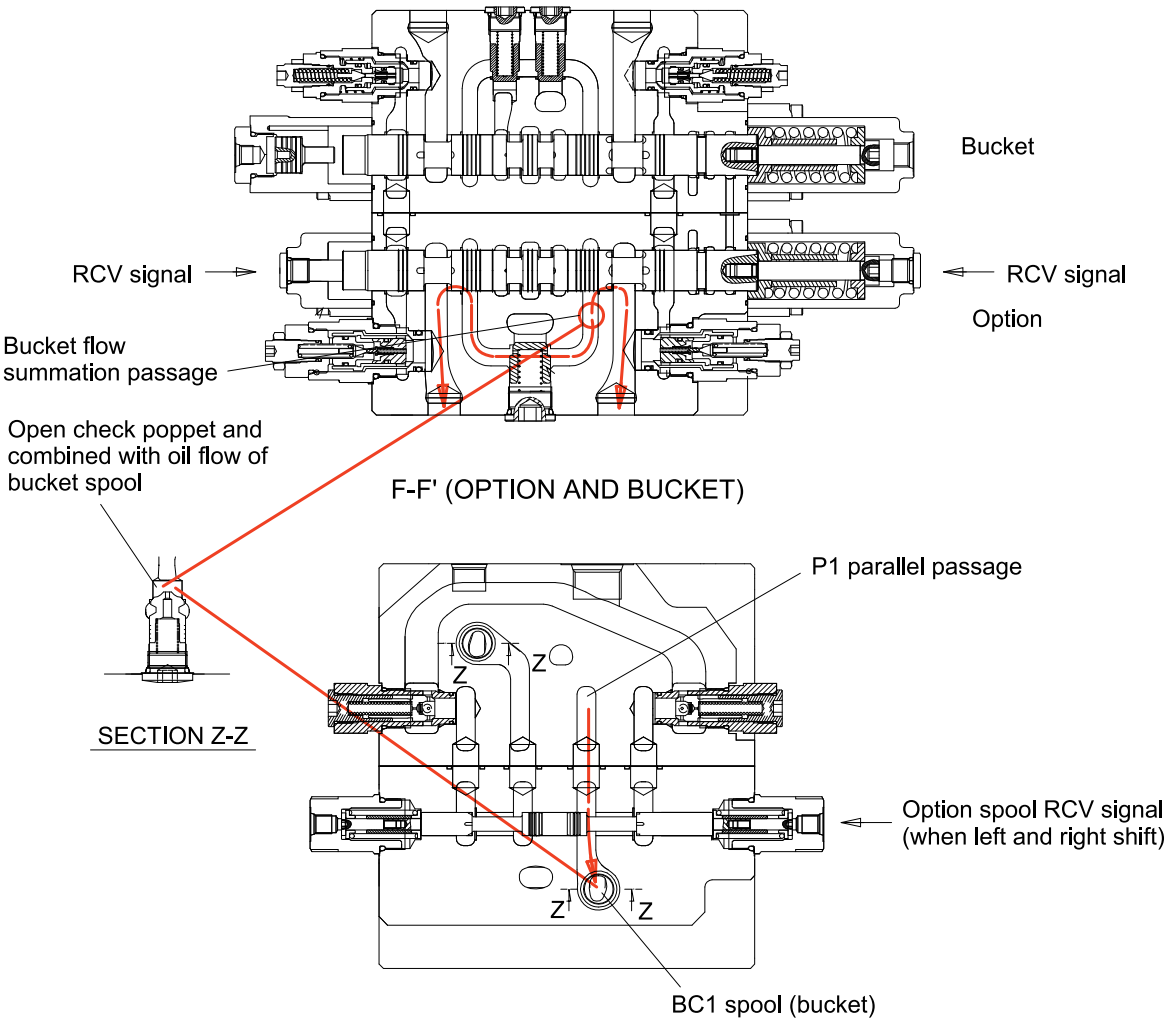
300A2MC35

Option flow summation function, bypass cut-off 2 spool

During the 2-way option operation, the pilot secondary pressure from the RCV is supplied to port of the spring side and shifts the BC2 (option) spool.

The P1 parallel passage is shut off by the movement of the BC2 spool and the pressurized oil from P1 port opens the check poppet and combined with flow of the option spool.

(Only bucket in operation)



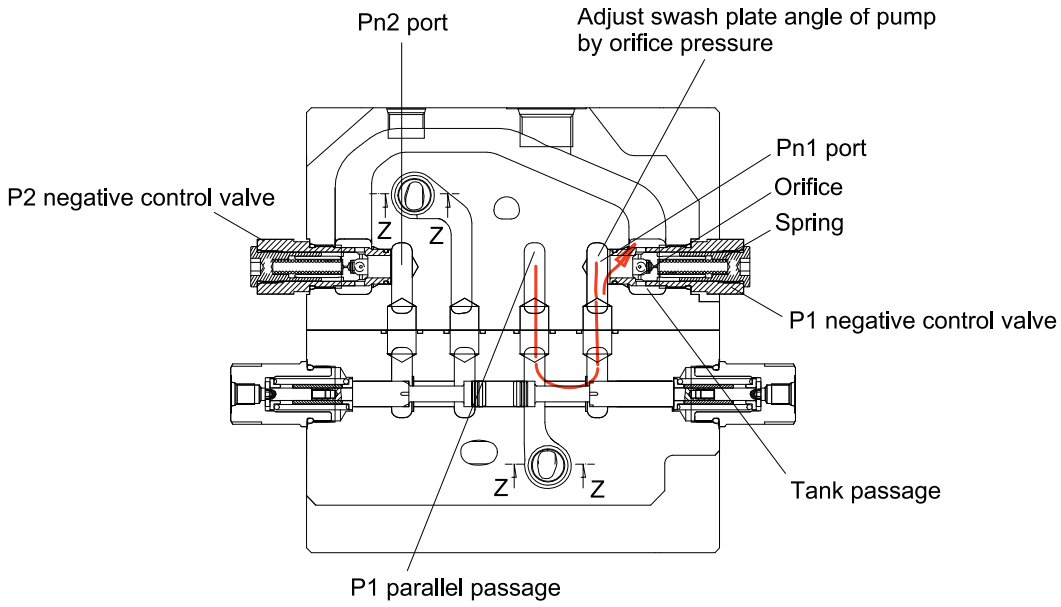
FLOW SUMMATION BY THE SHIFTING OF THE BC2 SPOOL

300A2MC36

10) OPERATION OF NEGATIVE CONTROL VALVE

When no function is being actuated on P1 side, the hydraulic fluid from the P2 port, flows into the tank passage through the P1 bypass passage and the orifice of the negative control valve.
The negative control pressure caused by this operation is transferred to the regulator of the piston pump through the Pn1 port.
This pressure controls the swash plate angle of the pump to the minimum and minimize the flow of the P1 side.
When one or more spools are shifted, the P1 bypass passage is shut-off and the flow is almost zero.
Accordingly, the negative control pressure that is supplied to the pump through Pn1 port is lowered and the swash plate angle becomes maximum and the flow of the P1 side becomes maximum.
On the other hand, the negative control pressure is increased and high than the setting pressure of the spring, the negative control valve is opened and the flow passes to the hydraulic tank and functions as a relief valve.

The operation of the negative control valve of the P2 side is same as that of the P1 side.



OPERATION OF NEGATIVE CONTROL VALVE

300A2MC37

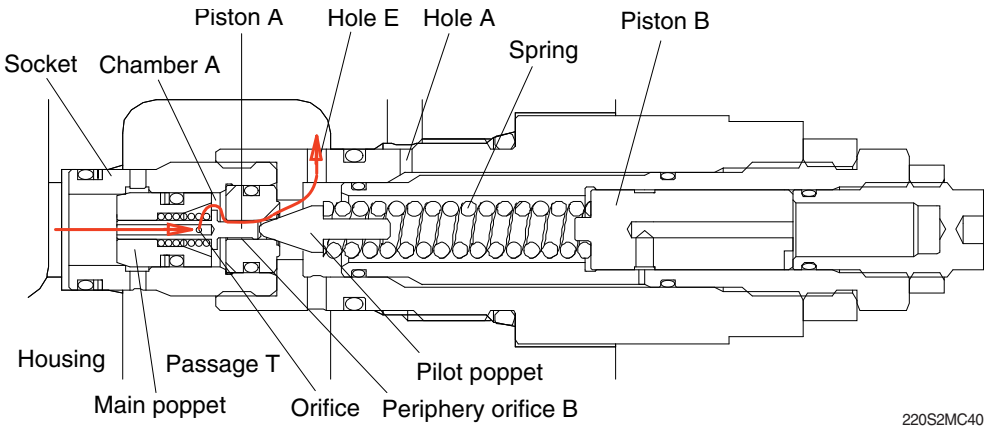
11) OPERATION OF MAIN RELIEF VALVE

(1) Neutral

The pressurized oil passes through the internal passage of the piston A, fitted in the main poppet and the orifice A and is filled up in the chamber A of the inside and seats the main poppet against socket and socket against the housing securely.

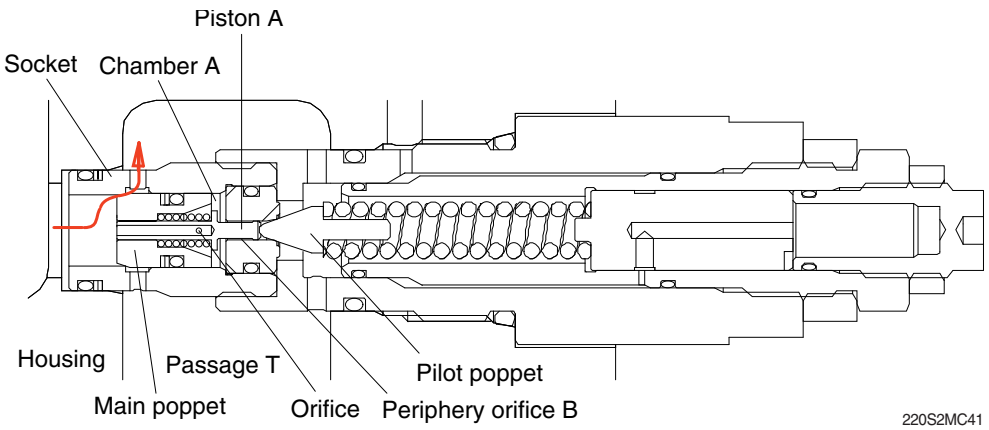
(2) When operation (relief)

① When the pressurized oil flowed in the chamber A through the orifice becomes equal to the set pressure of the spring, the hydraulic oil apply to the main poppet through the piston and pushes open the pilot poppet and flows to tank passage through the piston A internal passage, orifice A, chamber A, periphery orifice B and the hole E.



OPERATION 1 OF MAIN RELIEF VALVE

② The pressure in chamber A is lowered by moving of the pilot poppet and the main poppet is opened. As a result, the pressurized oil flows out to the tank passage through the hole of the socket side.



OPERATION 2 OF MAIN RELIEF VALVE

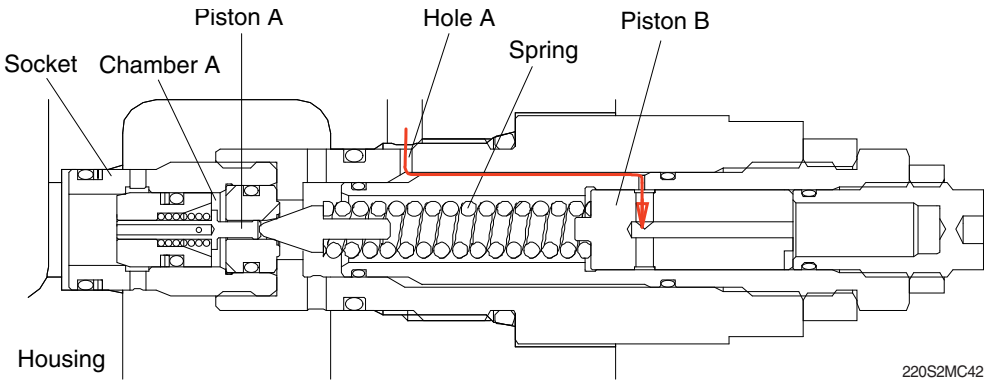
(3) When retraction (return)

On the other hand, the pressure of the pressurized oil becomes lower than set pressure of the spring, the main poppet is seated by spring force. Then the pressure of the chamber A becomes equal to the pressure of the P port and the main poppet is seated to the seat of the socket. The valve returns to the initial condition.

Power boost function

During power boost operation, the pilot pressure for the power boost enters inside of the piston B through the hole A, the crevice passage and the side hole of the piston B.

It pushes the piston to the left direction and the set pressure of the spring is increased.

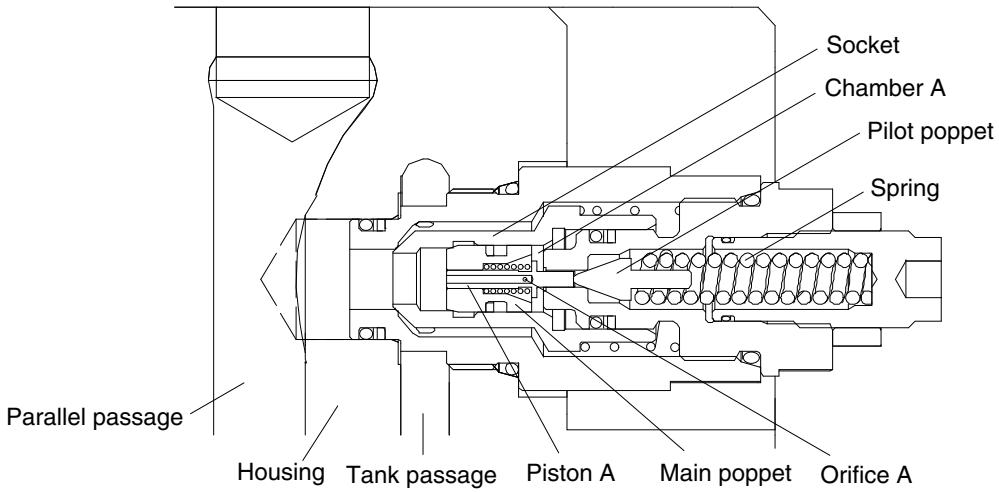


OPERATION 3 OF MAIN RELIEF VALVE

12) OPERATION OF PORT RELIEF VALVE

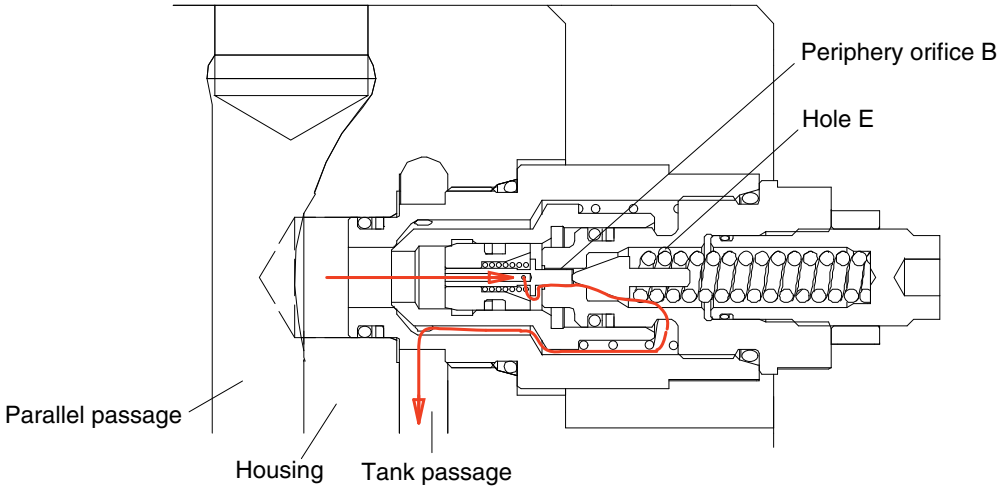
(1) Function as relief valve

① The pressurized oil passes through the internal passage of the piston A, fitted in the main poppet and the orifice A and is filled up in the chamber A of the inside and seats the main poppet against socket and socket against the housing securely.



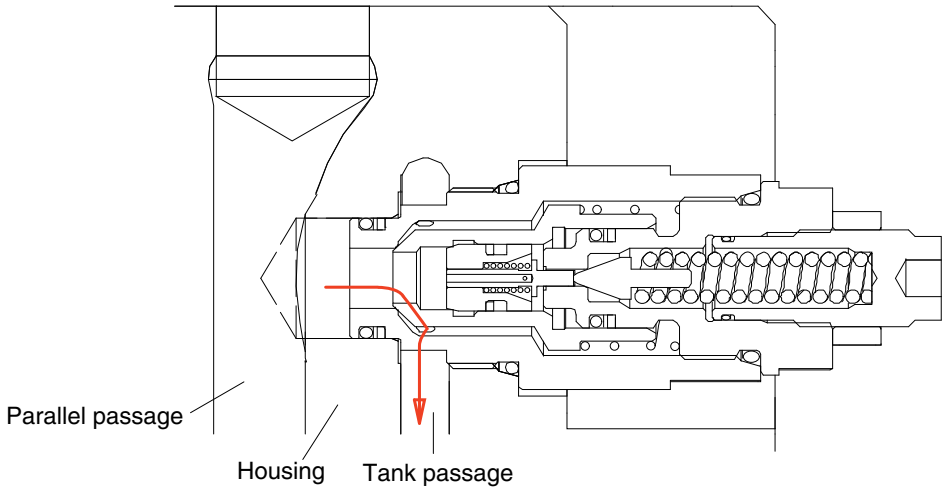
PORT RELIEF VALVE 220S2MC43

② When the pressurized oil from the actuators becomes equal to the set pressure of the spring, the hydraulic oil apply to the pilot poppet and pushes the pilot poppet to the right direction and flows to tank passage through the piston A internal passage, orifice A, chamber A, periphery orifice B and the hole E.



OPERATION 1 OF PORT RELIEF VALVE 220S2MC44

③ The pressure in chamber A is lowered by moving of the pilot poppet and the main poppet is opened. As a result, the pressurized oil from the actuator port flows out to the tank passage through the hole of the socket side.

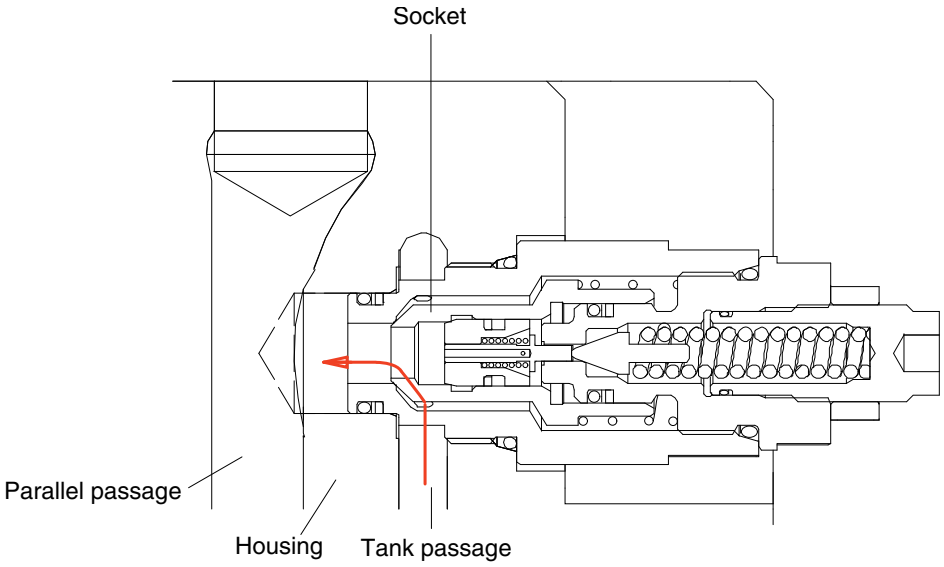


OPERATION 2 OF PORT RELIEF VALVE 220S2MC45

④ On the other hand, the pressure of the actuator becomes lower than set pressure of the spring, the pilot poppet is seated by spring force. Then the pressure of the chamber A becomes equal to the pressure of the actuator port and the main poppet is seated to the seat of the socket. The valve returns to the initial condition.

Make up function

When negative pressure exists at the actuator port, the oil is supplied through tank passage. When the pressure at tank passage becomes higher than that of at the actuator port, it pushed the socket moves in the right direction. Then, the gap between the housing and socket is opened and pressurized oil from the tank passage flows into parallel passage side.



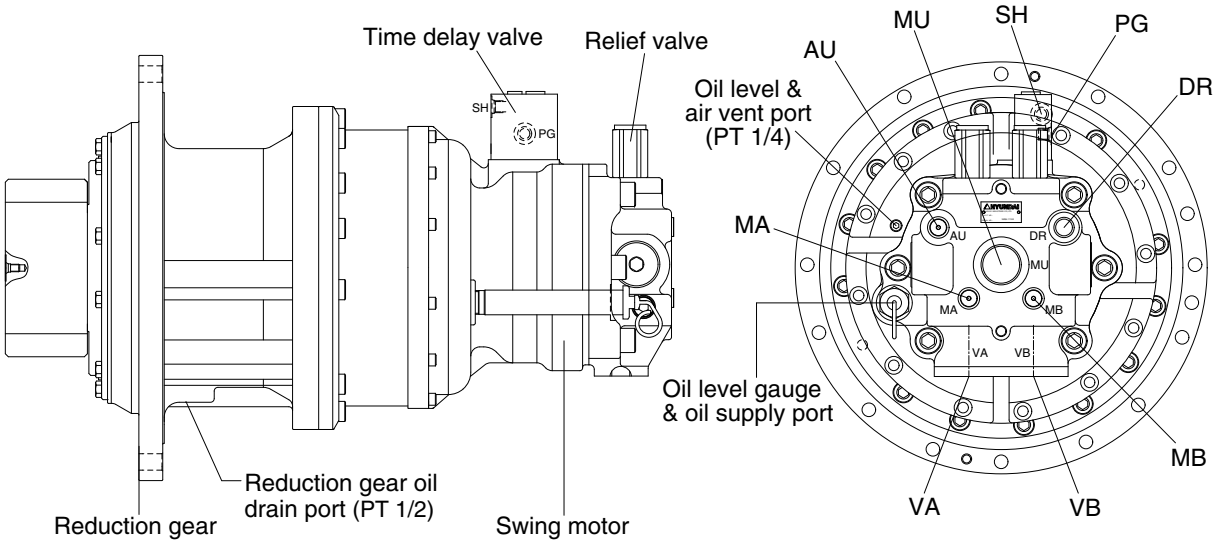
MAKE UP FUNCTION OF PORT RELIEF VALVE 220S2MC46

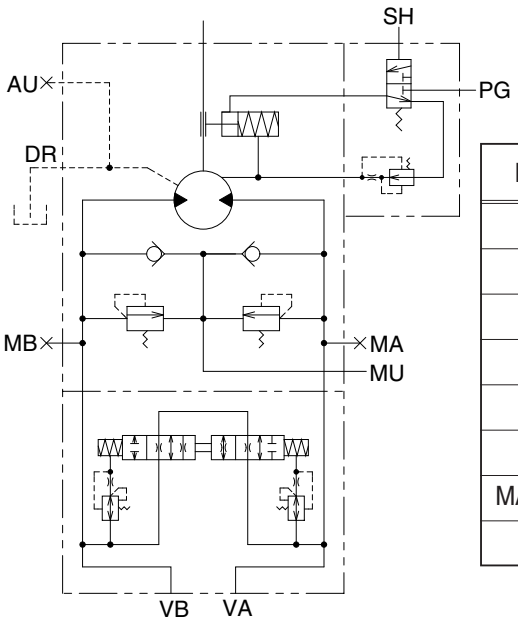
GROUP 3 SWING DEVICE (MACHINE SERIAL NO. : -#0114)

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.



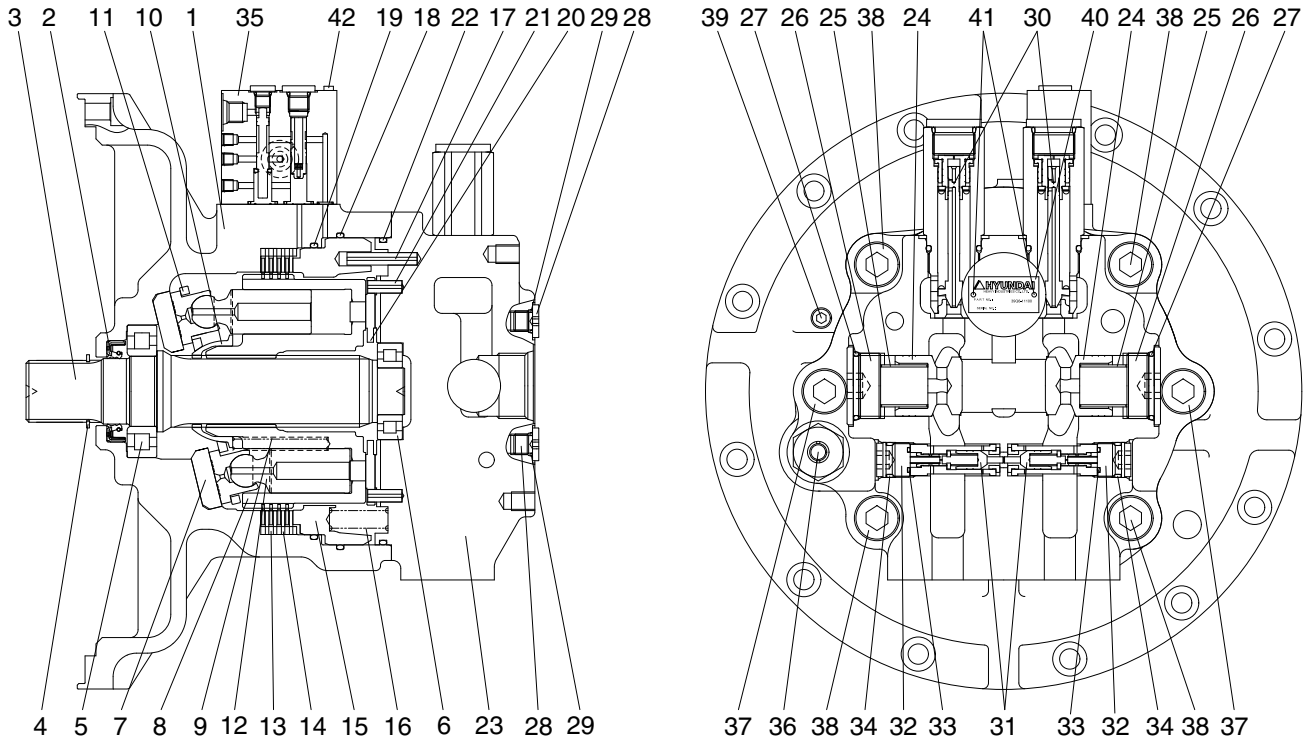


Hydraulic circuit

Port	Port name	Port size
VA	Main port	Ø20
VB	Main port	Ø20
DR	Drain port	PF 1/2
MU	Make up port	PF 1 1/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
MA, MB	Gauge port	PF 1/4
AU	Air vent port	PF 1/4

300L2SM01

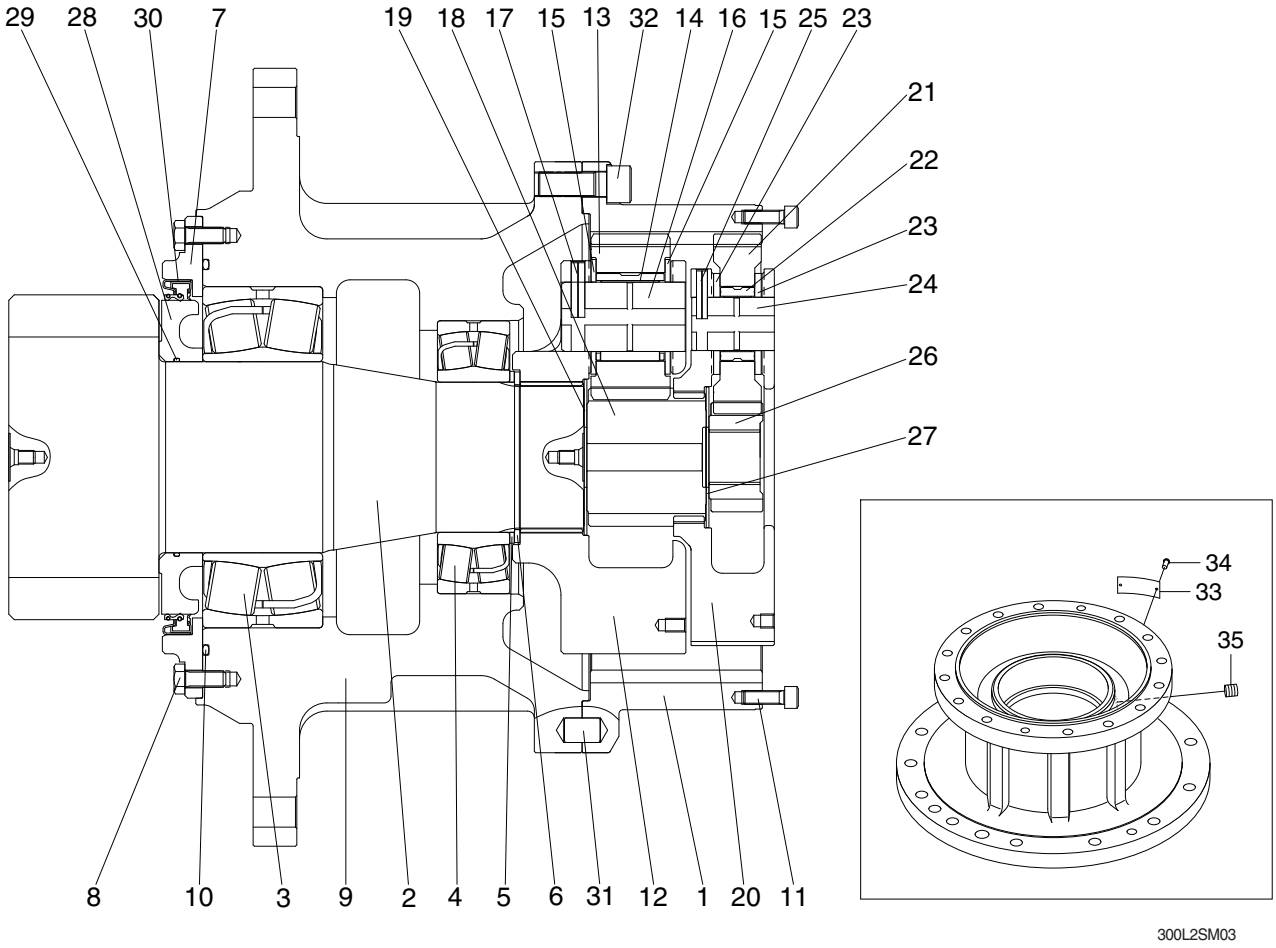
1) SWING MOTOR



300L2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Needle bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Time delay valve assy
8	Cylinder block	22	O-ring	36	Level gauge
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) REDUCTION GEAR



300L2SM03

1	Ring gear	13	Planetary gear 2	25	Spring pin 1
2	Drive shaft	14	Needle bearing 2	26	Sun gear 1
3	Bearing	15	Thrust washer 2	27	Thrust plate 1
4	Bearing	16	Carrier pin 2	28	Sleeve
5	Thrust plate	17	Spring pin 2	29	O-ring
6	Snap ring	18	Sun gear 2	30	Oil seal
7	Cover	19	Thrust plate 2	31	Parallel pin
8	Hex head bolt	20	Carrier 1	32	Hex socket head bolt
9	Casing	21	Planetary gear 1	33	Name plate
10	O-ring	22	Needle bearing 1	34	Rivet
11	Hex socket head bolt	23	Thrust washer 1	35	Plug
12	Carrier 2	24	Carrier pin 1		

2. PRINCIPLE OF DRIVING

2.1 Generating the turning force

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (8) through valve casing of motor (1), and valve plate (20).

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

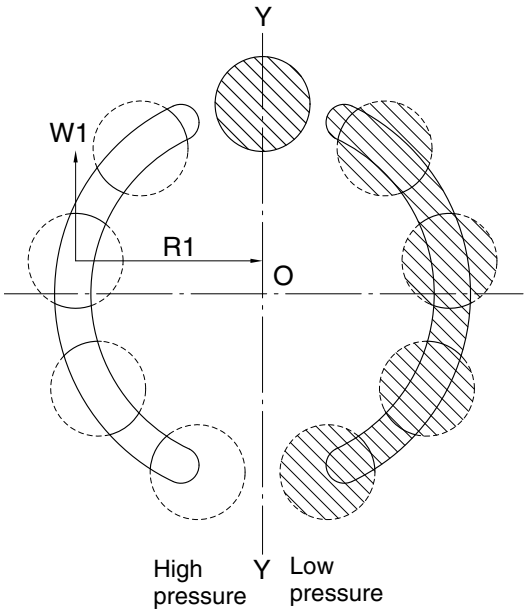
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

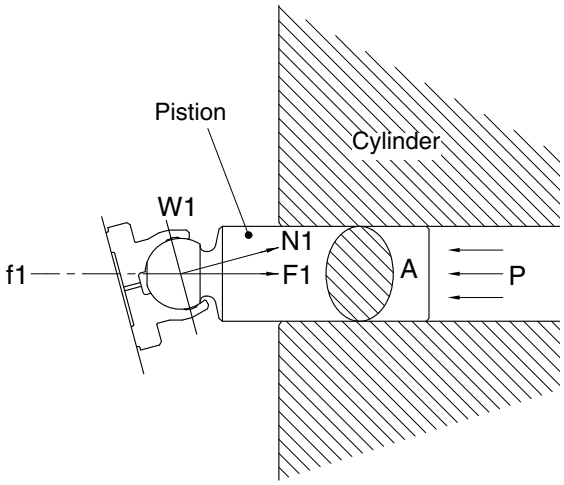
This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate of a tilt angle, α.

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

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

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





21078TM05

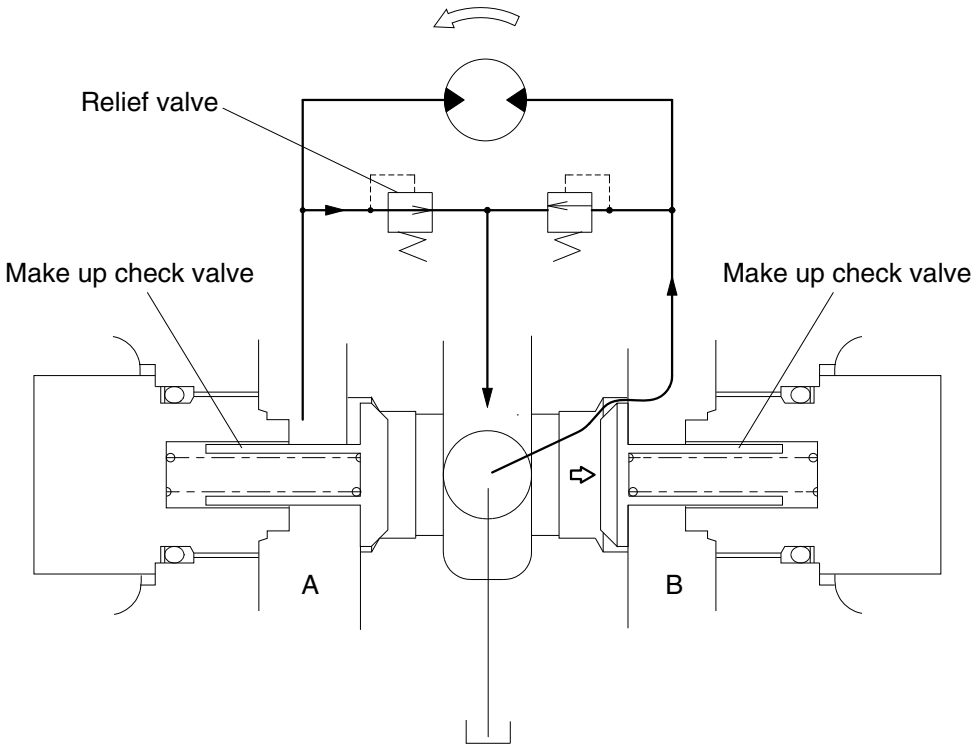
2) MAKE UP VALVE

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.

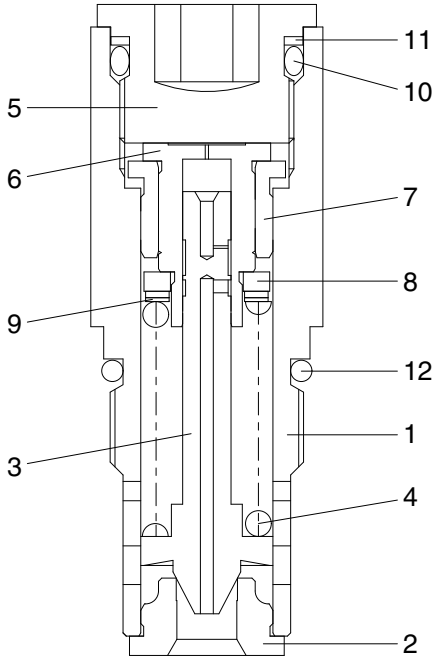
Pressurized oil into the port B, the motor rotate counterclockwise.

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.



21092SM04

3) RELIEF VALVE



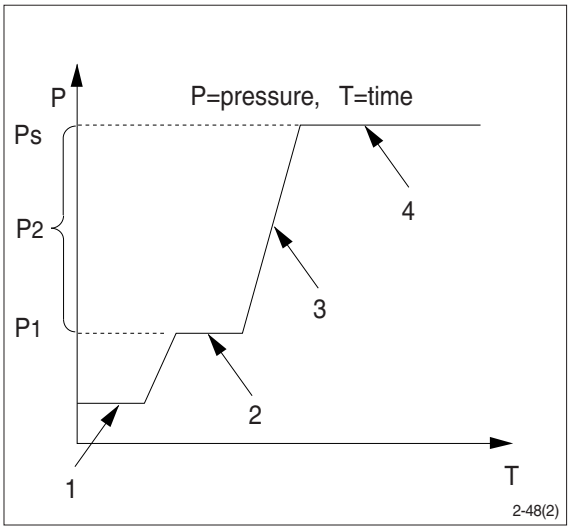
1	Body
2	Seat
3	Plunger
4	Spring
5	Adjusting screw
6	Piston
7	Bushing
8	Spring seat
9	Shim
10	O-ring
11	Back up ring
12	O-ring

(1) Construction of relief valve

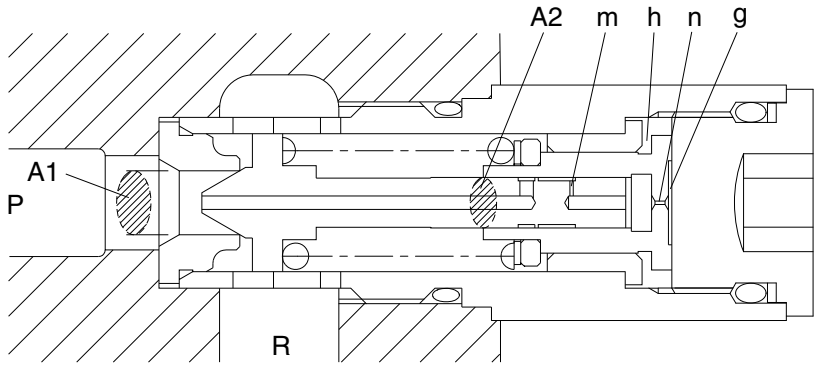
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(2) Function of relief valve

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



① Ports (P,R) at tank pressure.

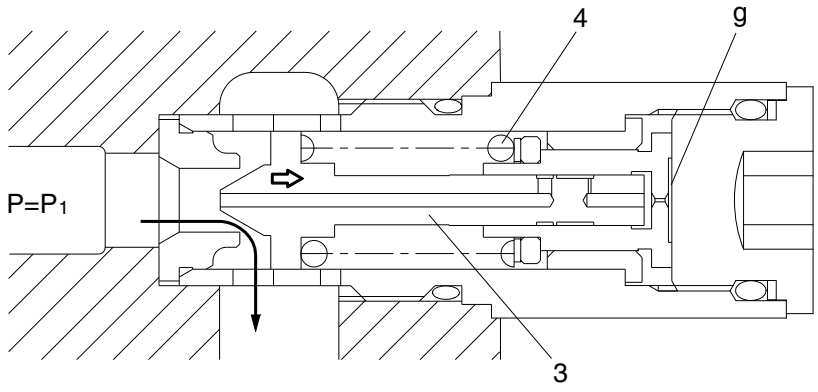


14007A2SM06

② When hydraulic oil pressure ($P \times A_1$) reaches the preset force (F_{SP}) of spring (4), the plunger (3) moves to the right as shown.

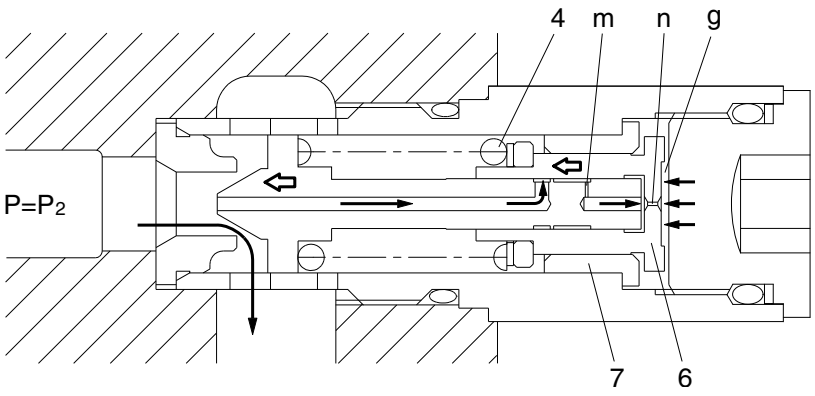
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



14007A2SM07

③ The oil flow chamber g via orifice m and n. When the pressure of chamber g reaches the preset force (F_{SP}) of spring (4), the piston (6) moves left and stop the piston (6) hits the bottom of bushing (7).

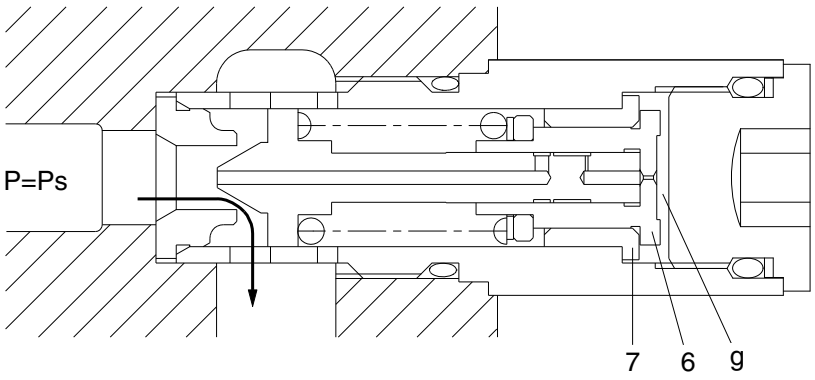


14007A2SM08

④ When piston (6) hits the bottom of bushing (7), it stops moving to the left any further. As the result, the pressure in chamber (g) equals (Ps).

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

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



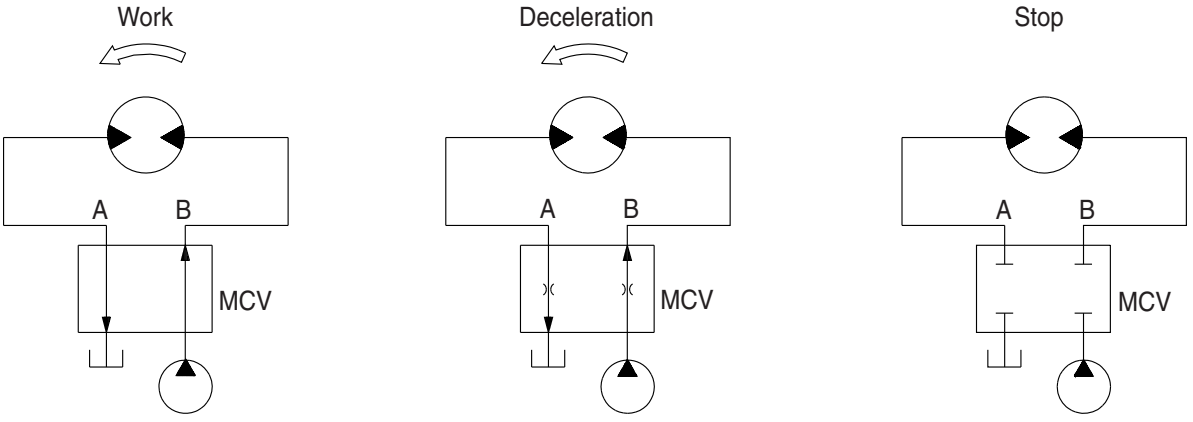
14007A2SM09

4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



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

2-48(1)

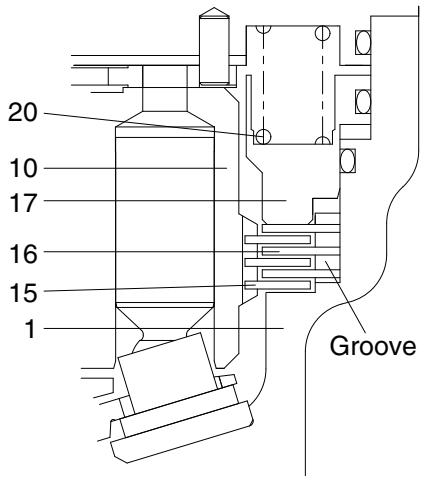
(2) Mechanical swing parking brake system

This is function as a parking brake only when all of the RCV lever (except swing, arm in) are not operated.

① BRAKE ASSEMBLY

Circumferential rotation of separate plate (16) is constrained by the groove located at housing (1). When housing is pressed down by brake spring (20) through friction plate (15), separate plate (16) and brake piston (17), friction force occurs there.

Cylinder block (10) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.

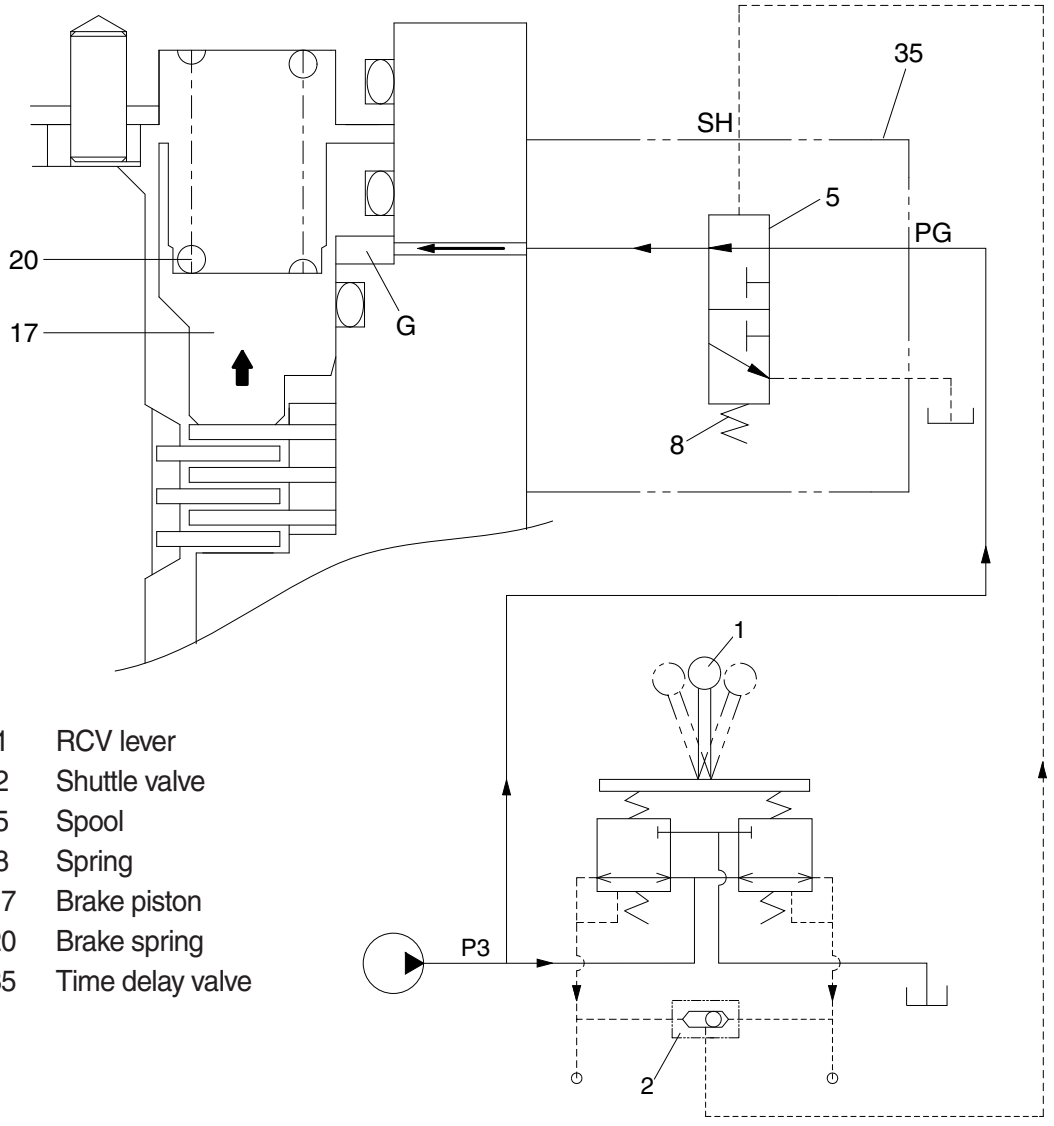


21092SM15

1	Housing	16	Separate plate
10	Cylinder block	17	Brake piston
15	Friction plate	20	Spring

② OPERATING PRINCIPLE

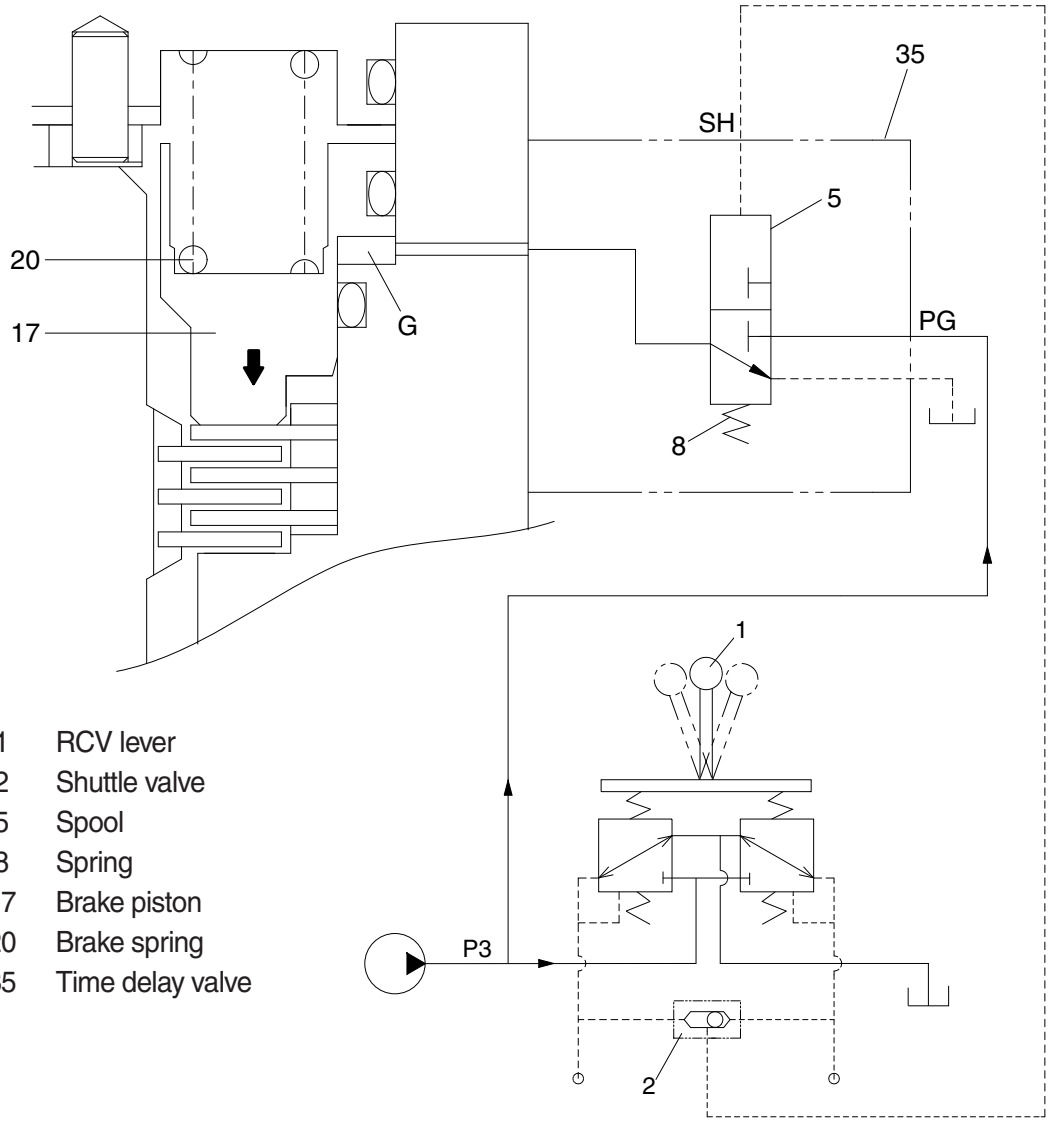
a. When the RCV lever (1) is set to the swing or arm in operating position, the pilot oil go to SH of the time delay valve (35).
This pressure moves spool (5) to the leftward against the force of the spring(8), so pilot pump charged oil (P3) goes to the chamber G through port PG.
This pressure is applied to move the piston (17) to the upward against the force of the spring (20). Thus, it releases the brake force.



1 RCV lever
2 Shuttle valve
5 Spool
8 Spring
17 Brake piston
20 Brake spring
35 Time delay valve

300L2SM04

b. When all of the RCV lever (1) are set the neutral position, the spool (5) returns to the top.
Then, the brake piston (17) is moved lower by spring force and the return oil from the chamber G flows back to tank port.
At this time, the brake works.



1 RCV lever
2 Shuttle valve
5 Spool
8 Spring
17 Brake piston
20 Brake spring
35 Time delay valve

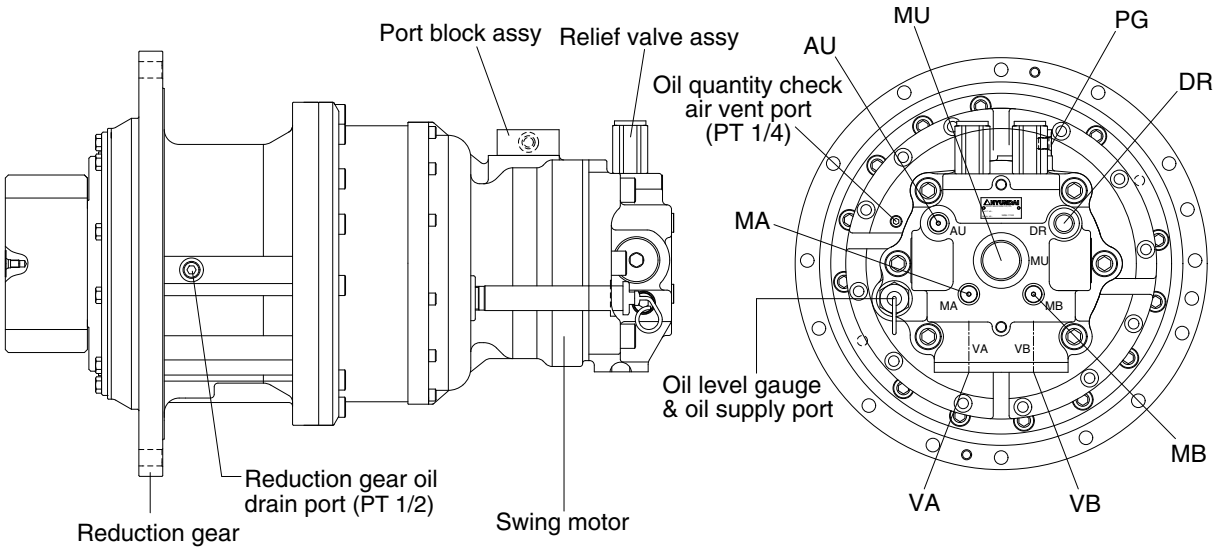
300L2SM05

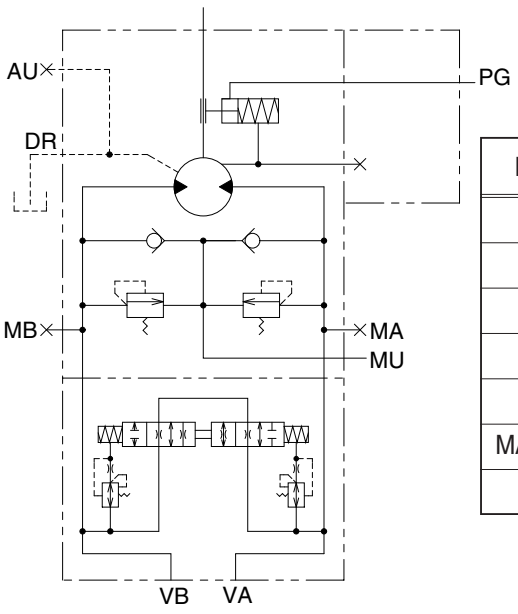
GROUP 3 SWING DEVICE (MACHINE SERIAL NO. : #0115-)

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

Swing motor include mechanical parking valve, relief valve, make up valve and port block assy.



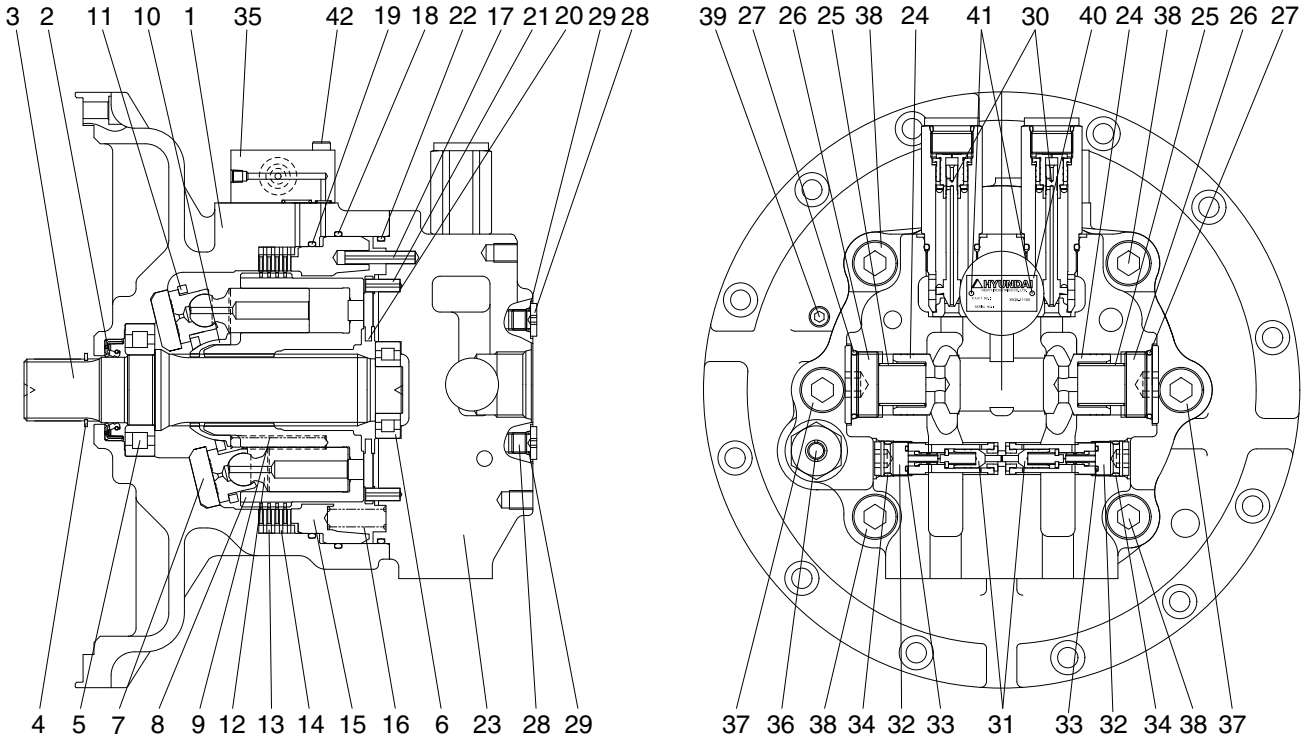


Hydraulic circuit

Port	Port name	Port size
VA	Main port	Ø20
VB	Main port	Ø20
DR	Drain port	PF 1/2
MU	Make up port	PF 1 1/4
PG	Brake release port	PF 1/4
MA, MB	Gauge port	PF 1/4
AU	Air vent port	PF 1/4

320A2SM01

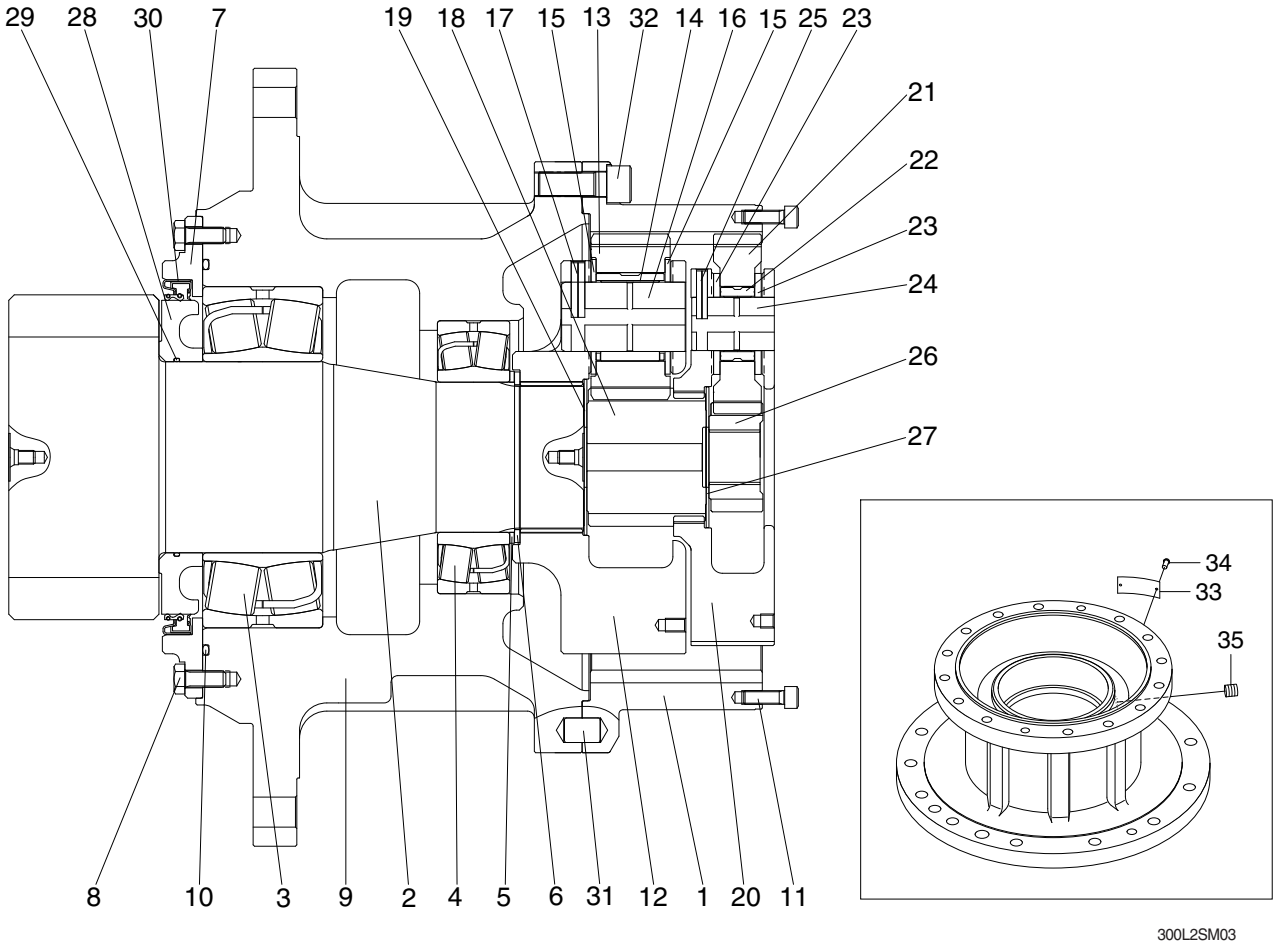
1) SWING MOTOR



320A2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Roller bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Port block assy
8	Cylinder block	22	O-ring	36	Level gauge
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) REDUCTION GEAR



300L2SM03

1	Ring gear	13	Planetary gear 2	25	Spring pin 1
2	Drive shaft	14	Needle bearing 2	26	Sun gear 1
3	Bearing	15	Thrust washer 2	27	Thrust plate 1
4	Bearing	16	Carrier pin 2	28	Sleeve
5	Thrust plate	17	Spring pin 2	29	O-ring
6	Snap ring	18	Sun gear 2	30	Oil seal
7	Cover	19	Thrust plate 2	31	Parallel pin
8	Hex head bolt	20	Carrier 1	32	Hex socket head bolt
9	Casing	21	Planetary gear 1	33	Name plate
10	O-ring	22	Needle bearing 1	34	Rivet
11	Hex socket head bolt	23	Thrust washer 1	35	Plug
12	Carrier 2	24	Carrier pin 1		

2. PRINCIPLE OF DRIVING

2.1 Generating the turning force

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (8) through valve casing of motor (1), and valve plate (20).

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

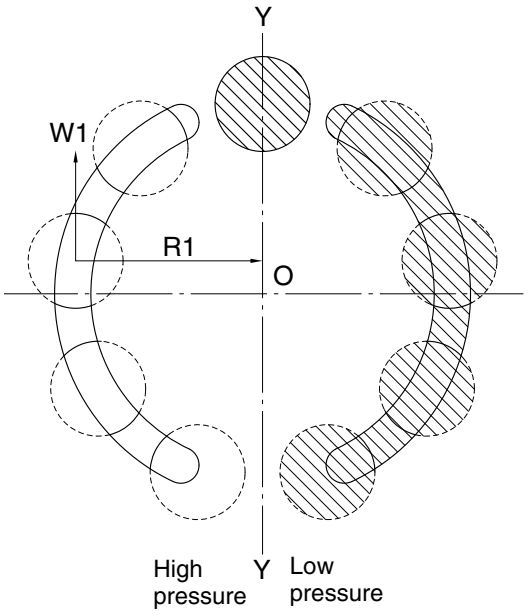
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

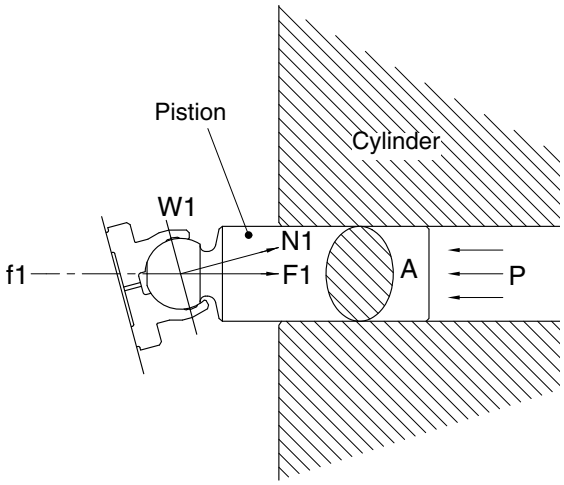
This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate of a tilt angle, α.

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

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

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





21078TM05

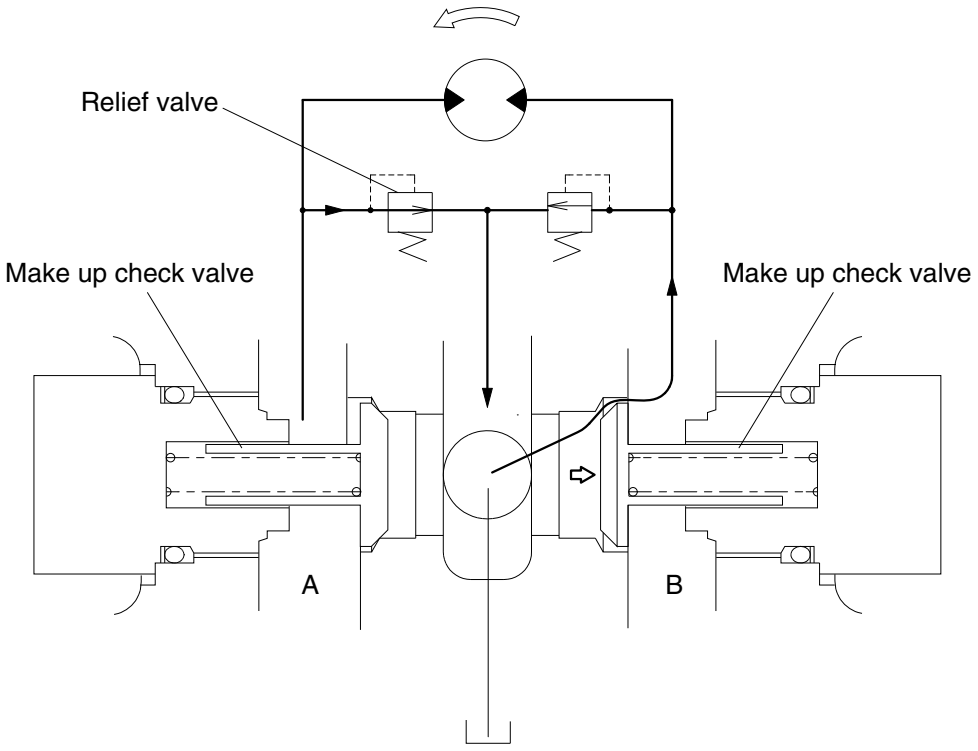
2) MAKE UP VALVE

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.

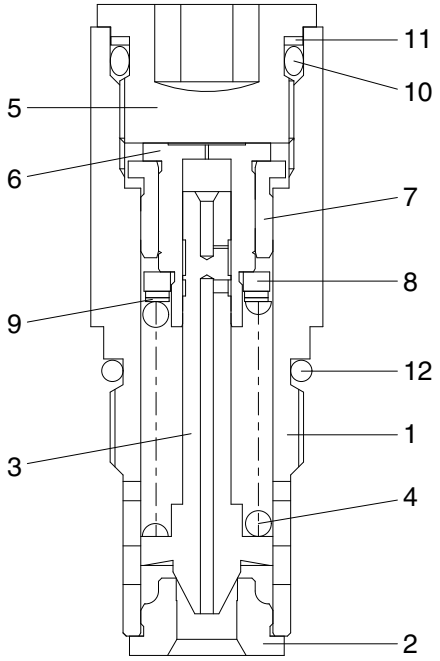
Pressurized oil into the port B, the motor rotate counterclockwise.

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.



21092SM04

3) RELIEF VALVE



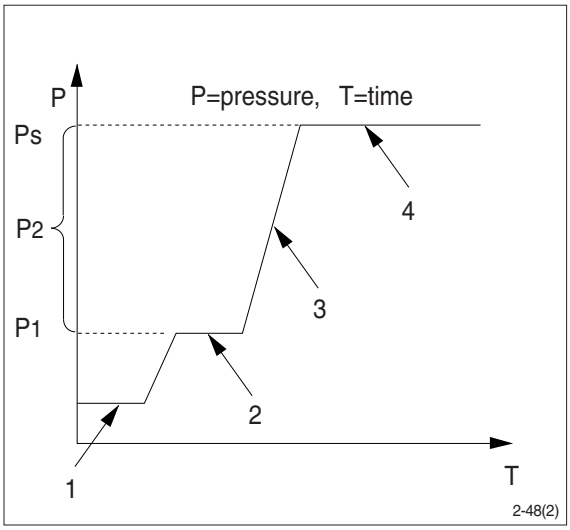
1	Body
2	Seat
3	Plunger
4	Spring
5	Adjusting screw
6	Piston
7	Bushing
8	Spring seat
9	Shim
10	O-ring
11	Back up ring
12	O-ring

(1) Construction of relief valve

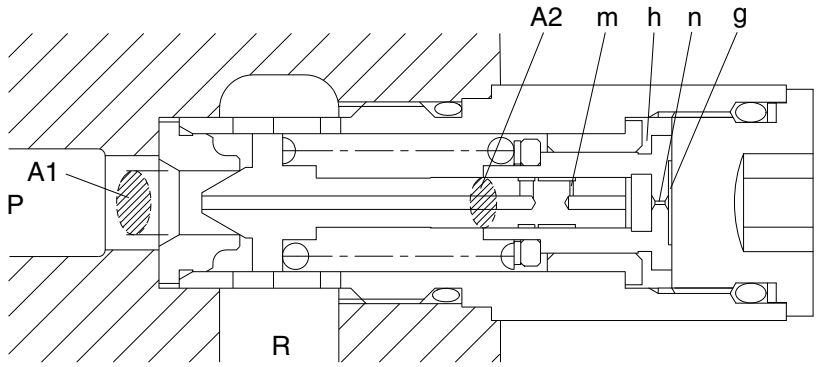
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(2) Function of relief valve

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



① Ports (P,R) at tank pressure.

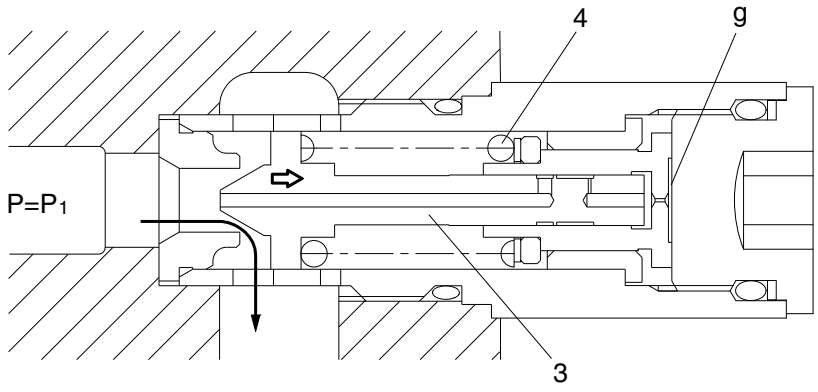


14007A2SM06

② When hydraulic oil pressure ($P \times A_1$) reaches the preset force (F_{SP}) of spring (4), the plunger (3) moves to the right as shown.

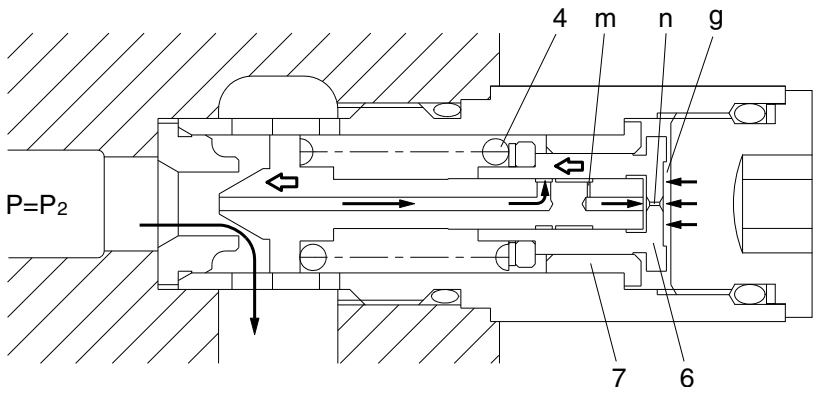
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



14007A2SM07

③ The oil flow chamber g via orifice m and n. When the pressure of chamber g reaches the preset force (F_{SP}) of spring (4), the piston (6) moves left and stop the piston (6) hits the bottom of bushing (7).

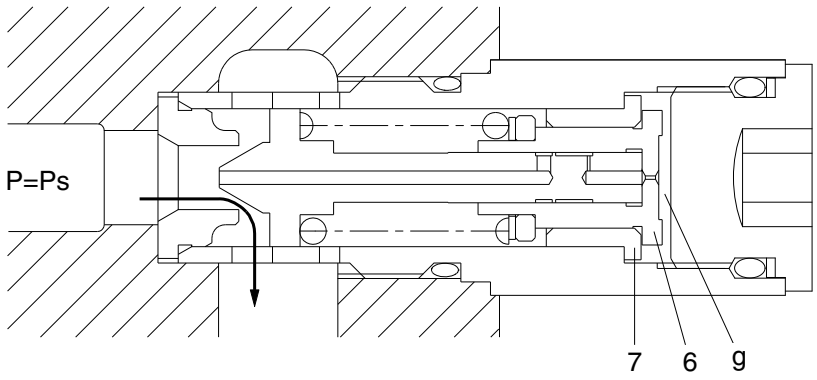


14007A2SM08

④ When piston (6) hits the bottom of bushing (7), it stops moving to the left any further. As the result, the pressure in chamber (g) equals (Ps).

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

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



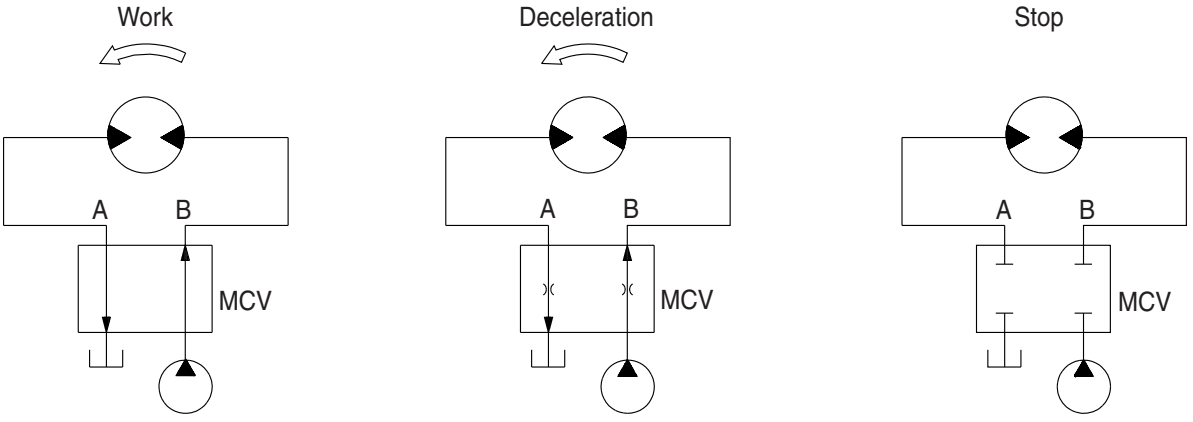
14007A2SM09

4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



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

2-48(1)

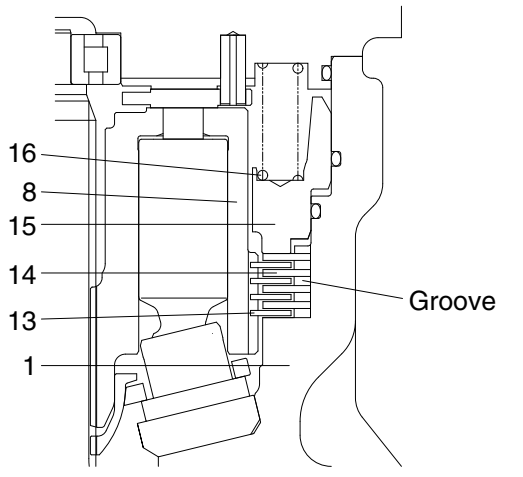
(2) Mechanical swing parking brake system

This is function as a parking brake only when all of the RCV lever (except swing, arm in) are not operated.

① BRAKE ASSEMBLY

Circumferential rotation of separate plate (16) is constrained by the groove located at housing (1). When housing is pressed down by brake spring (20) through friction plate (15), separate plate (16) and brake piston (17), friction force occurs there.

Cylinder block (10) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



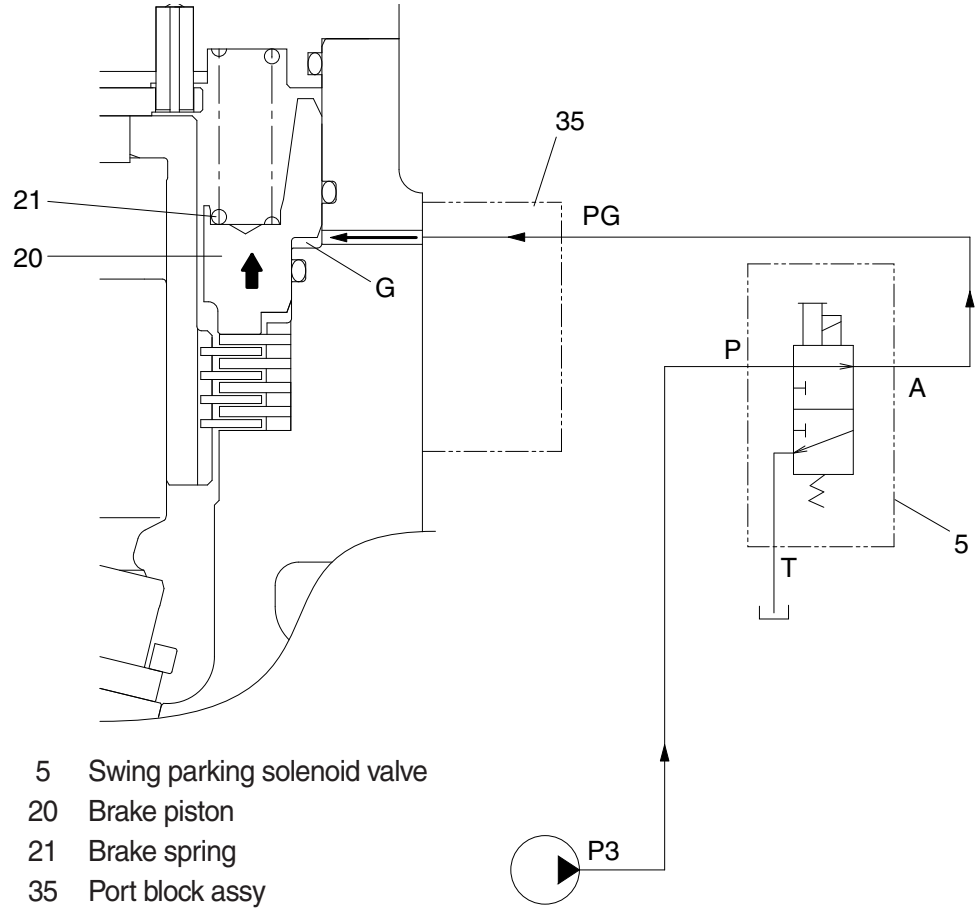
320A2SM35

1	Housing	16	Separate plate
10	Cylinder block	17	Brake piston
15	Friction plate	20	Spring

② Operating principle

a. When any of the swing, arm in, travel and boom up function is operated, the swing parking solenoid valve (5) is shifted to the swing position, so pilot pump charged oil (P3) goes to the chamber G through port PG.
This pressure is applied to move the brake piston (20) to the upward against the force of the brake spring (21). Thus, it releases the brake force.

b. Stop operation and a few second has been elapsed, the swing parking solenoid valve (5) is shifted to the swing parking position and swing brake works.



5 Swing parking solenoid valve
20 Brake piston
21 Brake spring
35 Port block assy

320A2SM10

③ Electric control swing prarking system

a. A safety is ensured by recognizing the swing operation and canceling the swing parking only under specific conditions by releasing parking electronically.

b. After receiving the RCV pressure, the MCU applies the parking release signal.

c. Depending on each RCV operation, there is a time difference between re-entry into swing parking.

Mode	Fine swing switch	RCV operation	Parking delay time
Work mode	ON or OFF (No condition)	Swing	5 sec
		Arm in	1 sec
	ON	Boom up	2 sec
		Travel	3 sec
	OFF	Boom up / Travel	Not applied

③ **Manual override function**

When the swing parking solenoid valve or related electric system is malfunction, the swing parking brake is not released even if the swing lever is operated.

To release the swing parking brake, the manual override function is needed.

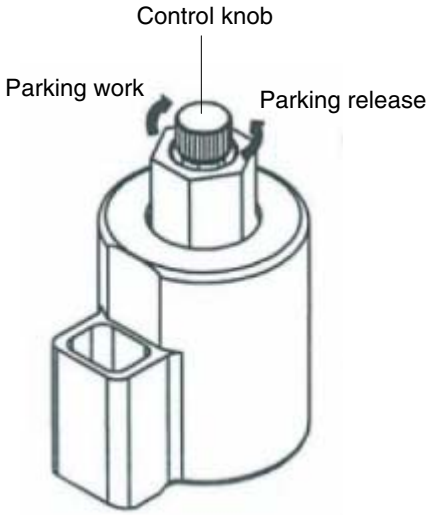
※ **Manual override solenoid valve**

a. Use hand only to turn the control knob (do not use a tool).

b. **Parking brake release**
Turn the control knob to counterclockwise fully (about 2.5 mm)

c. **Parking brake work**
Turn the control knob to clockwise fully.

※ **Be careful not damage the control knob by using a tool or tightening forcibly.**
It can cause malfunction of the solenoid valve.



Swing parking solenoid valve

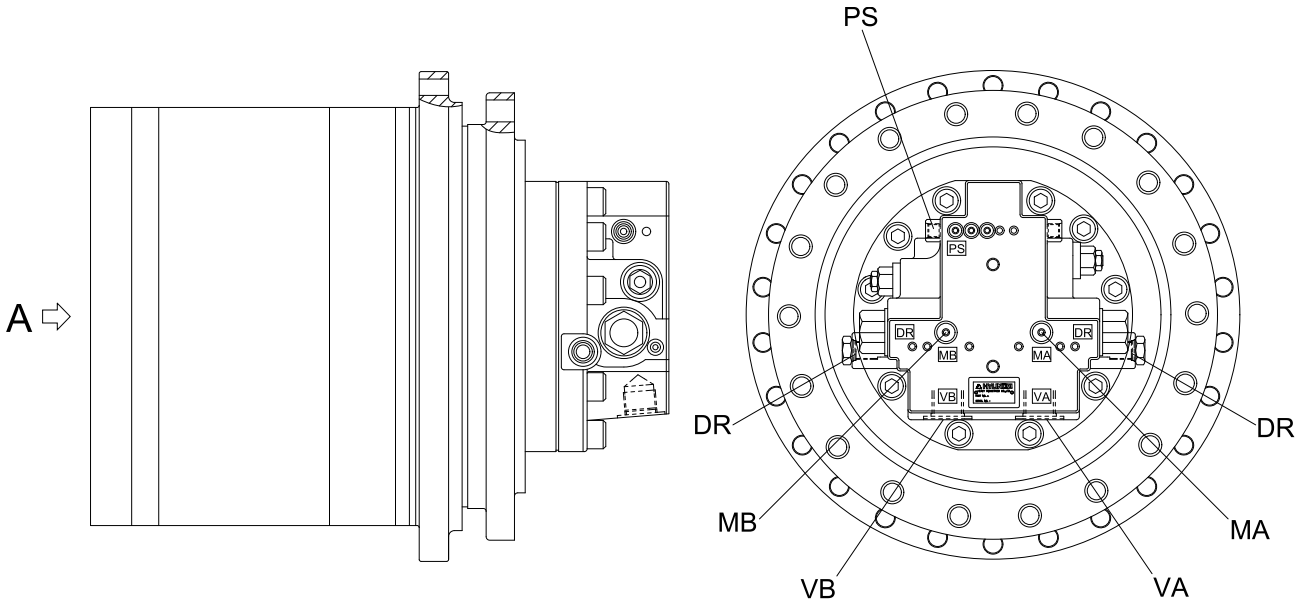
160A2SM11

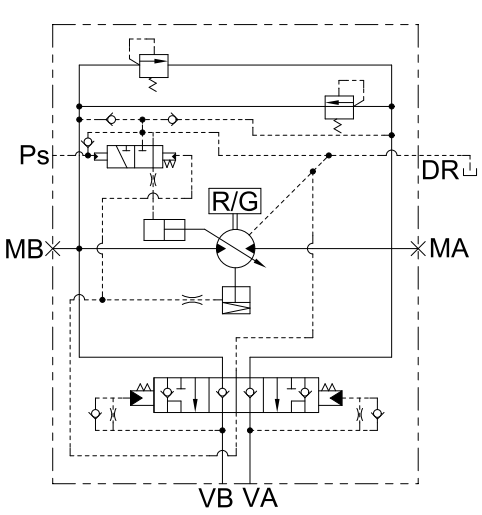
GROUP 4 TRAVEL DEVICE (TYPE 1)

1. CONSTRUCTION

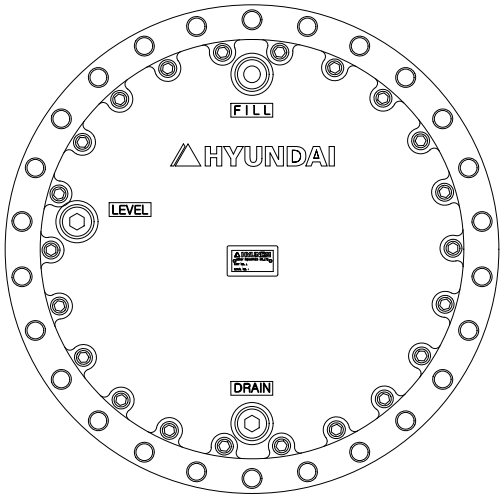
Travel device consists travel motor and gear box.

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





HYDRAULIC CIRCUIT



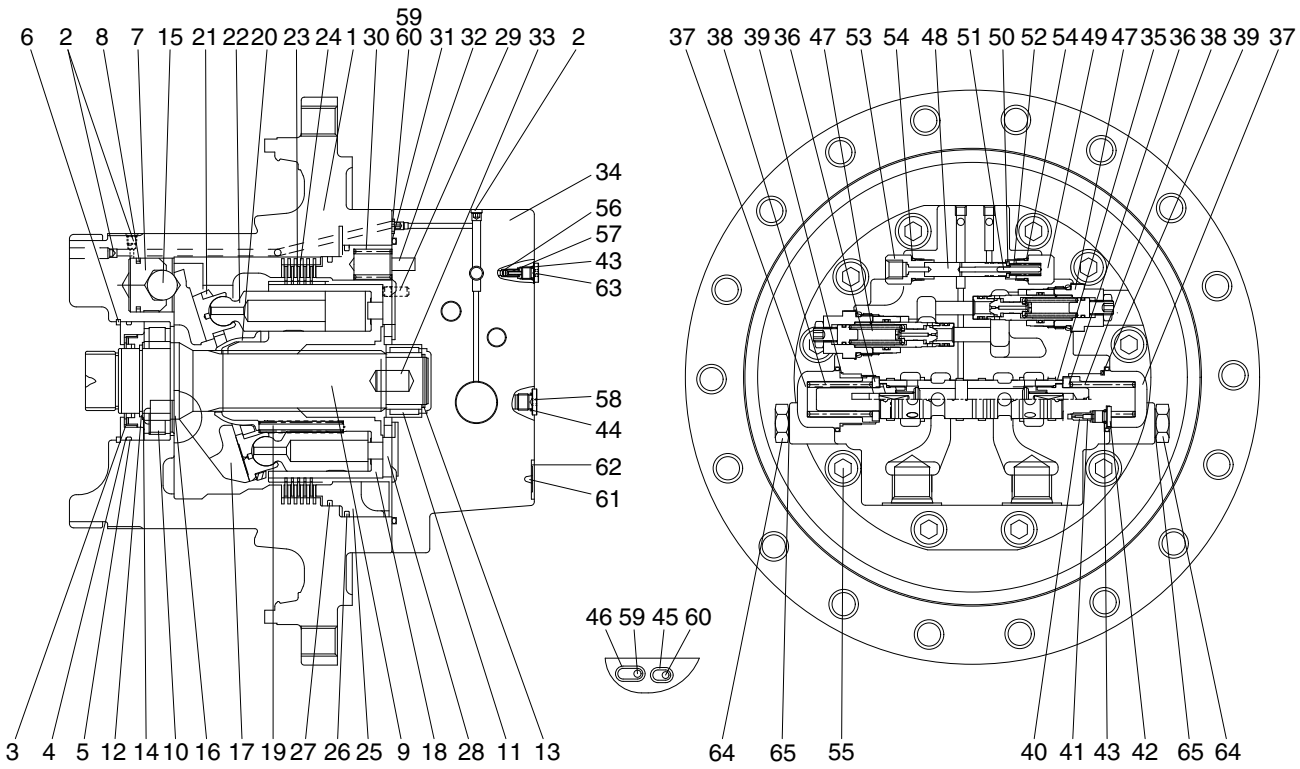
VIEW A

300A2TM01

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

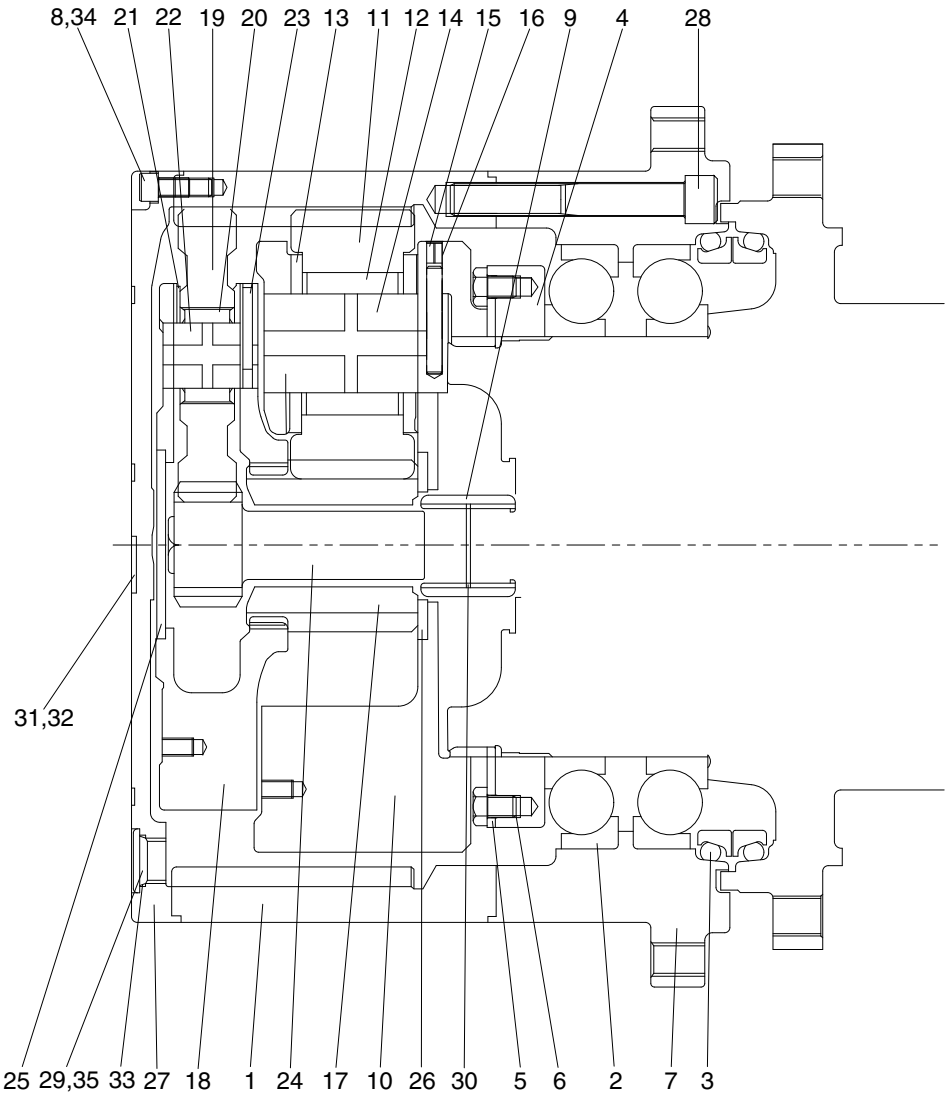
2. SPECIFICATION

1) TRAVEL MOTOR



1	Casing	23	Friction plate	45	O-ring
2	Plug	24	Separate plate	46	O-ring
3	Oil seal	25	Parking piston	47	Relief valve assy
4	Thrust block	26	D-ring	48	Spool
5	O-ring	27	D-ring	49	Plug
6	Retainer ring	28	Valve plate	50	Spring seat
7	Piston	29	Parallel pin	51	Parallel pin
8	Piston seal	30	Spring	52	Spring
9	Shaft	31	O-ring	53	Connector
10	Cylinder roller bearing	32	Spring pin	54	O-ring
11	Needle bearing	33	Parallel pin	55	Hexagon socket head bolt
12	Retainer ring	34	Rear cover	56	Check valve
13	Retainer ring	35	Main spool kit	57	Spring
14	Thrust plate	36	Spring seat	58	Plug
15	Steel ball	37	Plug	59	Restrictor
16	Pivot	38	Spring	60	Restrictor
17	Swash plate	39	O-ring	61	Name plate
18	Rotary block	40	Restrictor	62	Rivet
19	Spring	41	Spring	63	Plug
20	Ball guide	42	Plug	64	Plug
21	Retainer plate	43	O-ring	65	O-ring
22	Piston assy	44	O-ring		

2) TRAVEL REDUCTION GEAR



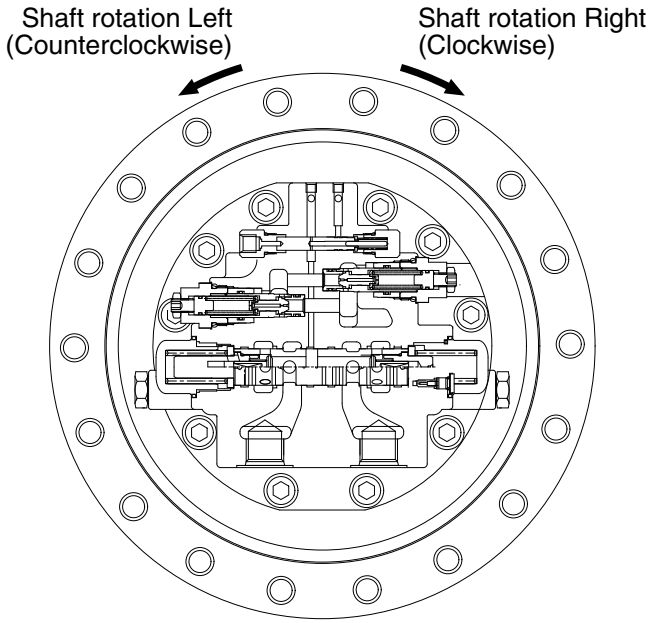
300L2TM03

1	Ring gear	13	Thrust washer 2	25	Thrust plate
2	Ball bearing	14	Carrier pin 2	26	Thrust plate
3	Floating seal assy	15	Spring pin 2	27	Cover
4	Ring nut	16	Solid pin 2	28	Hexagon socket head bolt
5	Lock plate	17	Sun gear 2	29	Plug
6	Hexagon socket head bolt	18	Carrier 1	30	Retainer ring
7	Housing	19	Planetary gear 1	31	Name plate
8	Hexagon socket head bolt	20	Needle bearing 1	32	Rivet
9	Coupling	21	Thrust washer 1	33	O-ring
10	Carrier 2	22	Carrier pin 1	34	Rubber cap
11	Planetary gear 2	23	Spring pin 1	35	Rubber cap
12	Needle bearing 2	24	Sun gear 1		

3. OPERATION

1) MOTOR

High pressure oil delivered form hydraulic pump is led to inlet port that is provided in the brake valve portion and, through the rear cover (34) and valve plate (28), led to cylinder block (18).
The oil flow and direction of shaft rotation are indicated in table.



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

300L2TM04

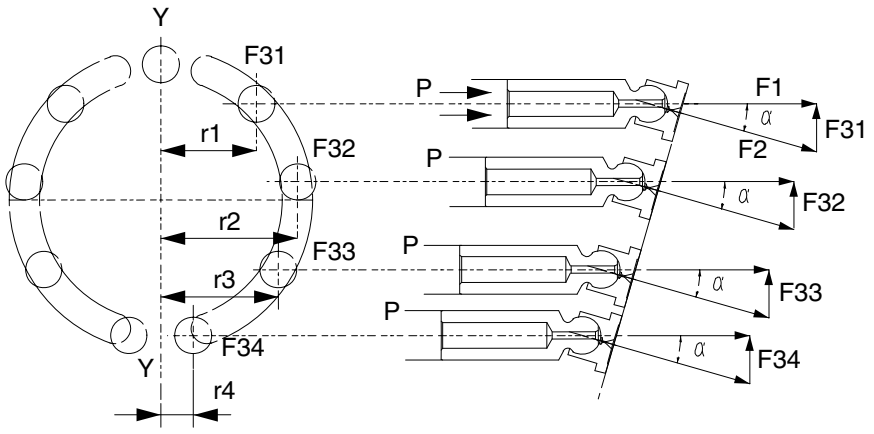
As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

F1 = P × A (P : pressure, A : area of piston section)

The swash plate (17) with inclined angle of α divides this force F1 into thrust force F2 and radial force F31-34.
This radial force is applied to axis Y-Y as turning force and generate drive torque of T.

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

This drive torque is transmitted via cylinder block (18) to driving shaft (9).

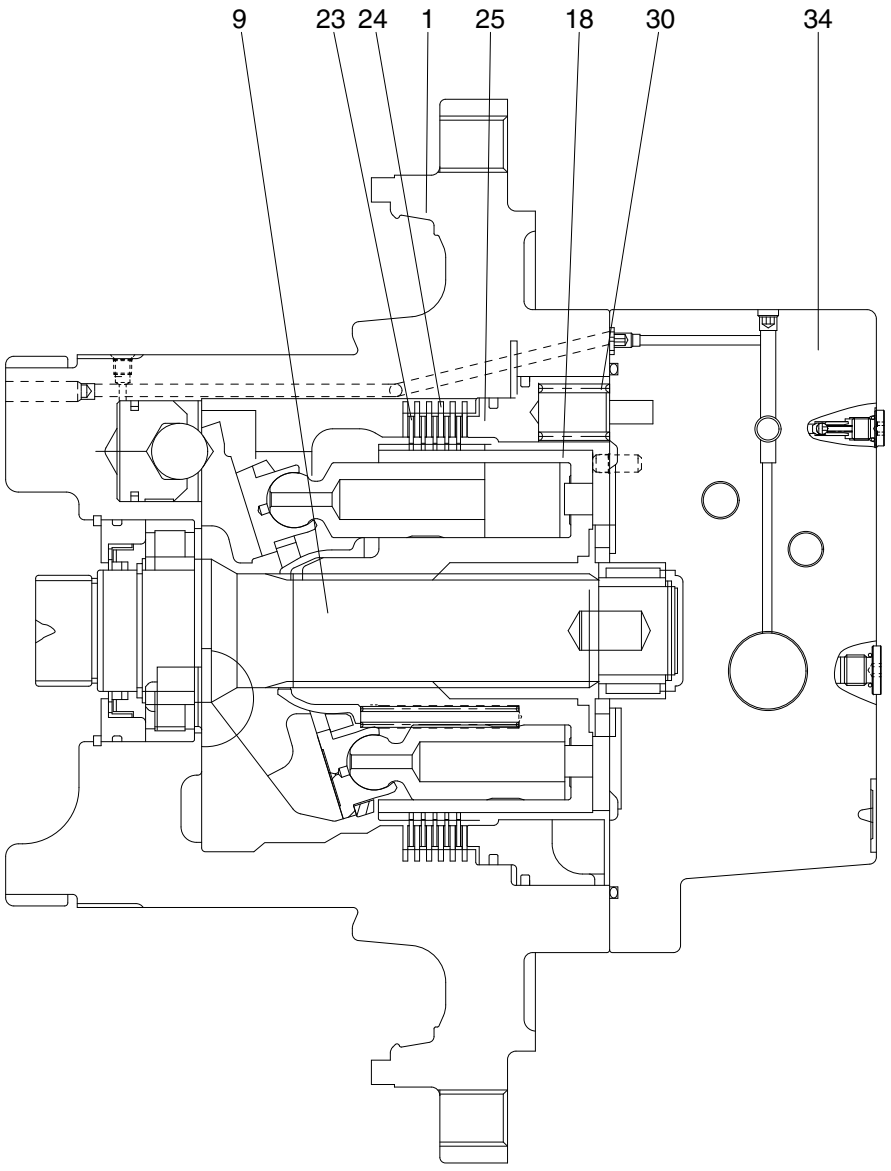


29092TM07

2) PARKING BRAKE

Parking brake is released when high pressure oil selected by the brake valve portion that is connected directly to the rear cover (34), is applied to the parking piston (25).
Otherwise the braking torque is always applied.

This braking torque is generated by the friction between the separated plates (24), inserted into the casing (1), and friction plates (23), coupled to cylinder block (18) by the outer splines.
When no pressure is activated on the parking piston (25), it is pushed by the brake springs (30) and it pushes friction plates (23) and separated plates (24) towards casing (1) and generates the friction force which brakes the rotation of cylinder block (18) and hence the shaft (9).



2609A2TM05

3) CAPACITY CONTROL MECHANISM

Figure typically shows the capacity control mechanism.

When high speed pilot line is charged with the pressure P_A that overcome the spring (52), the spring (52) is compressed and spool (48) shifts to the right to connect the port P and port C.

Then, the highest pressure is selected by the check valve (56) from inlet and outlet pressure of the motor and high speed pilot line pressure and pushes shifter piston (7). As a result, swash plate (17) turns around the line L which connect the two pivots (16) as shown by dotted lines. The turn stops at the stopper (1-1) of casing and swash plate (17) keeps the position.

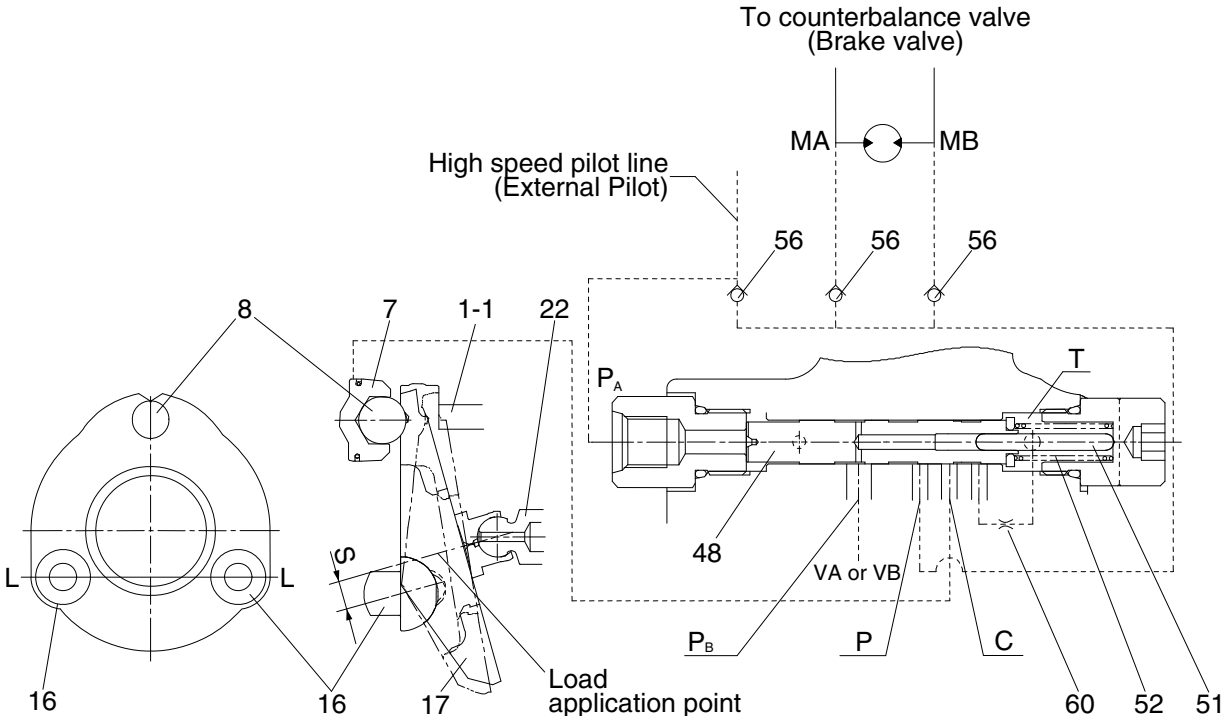
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

When no pressure is in the high speed pilot line P_A, spool (35) is pushed back by the spring (52) and pressure that pressed the shifter piston (7) is released to the hydraulic tank through restrictor (60).

Here, nine pistons are there and they equally spaced on the swash plate (17). The force that summed up those of pistons comes to almost the center of the swash plate (17) as shown. Since the pivots (16) are off-set by S from the center, the rotating force of product S and the force moves swash plate (17) to the former position and the speed returns to low.

When the power demand exceeds the engine power, such as in steep slope climbing or turning at high speed mode, the system step down to the low speed automatically. The mechanism is that: pump pressure is led to the port P_B and this pressure activate on pin (51). When the pressure at P_B exceeds predetermined value, spool (48) returns to the left by the counter-pressure against pin (51) and the pressure on the shifter piston (7) through port C is released to the tank and the motor comes to low speed.

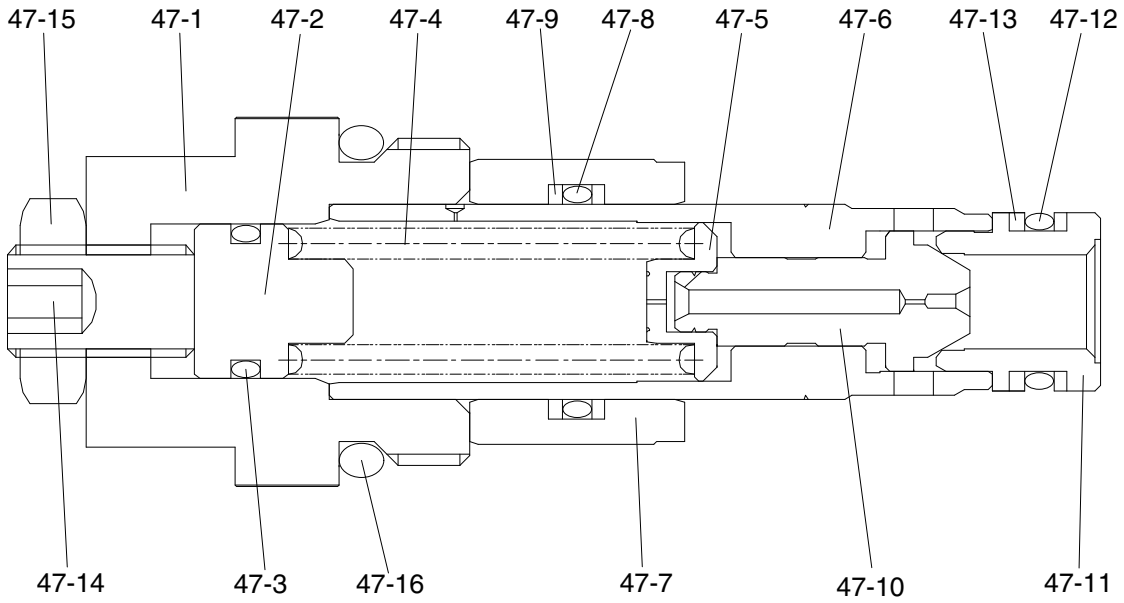
When P_B goes down, the spool (48) moves to the right and the speed become high.



4) OVERLOAD RELIEF VALVE

(1) Structure

This valve is screwed in the motor rear cover (34) and consists of : plug (47-1) that is screwed and fixed in the rear cover (34), poppet (47-10) and supports the poppet seat (47-11), spring (47-4) that is operating relief valve setting pressure and supports the spring seat (47-5), that is inserted in the sleeve (47-6), screw (47-14) that is adjust the spring force, nut (47-15) that fix screw (47-14), piston (47-7) that reduce the shock.



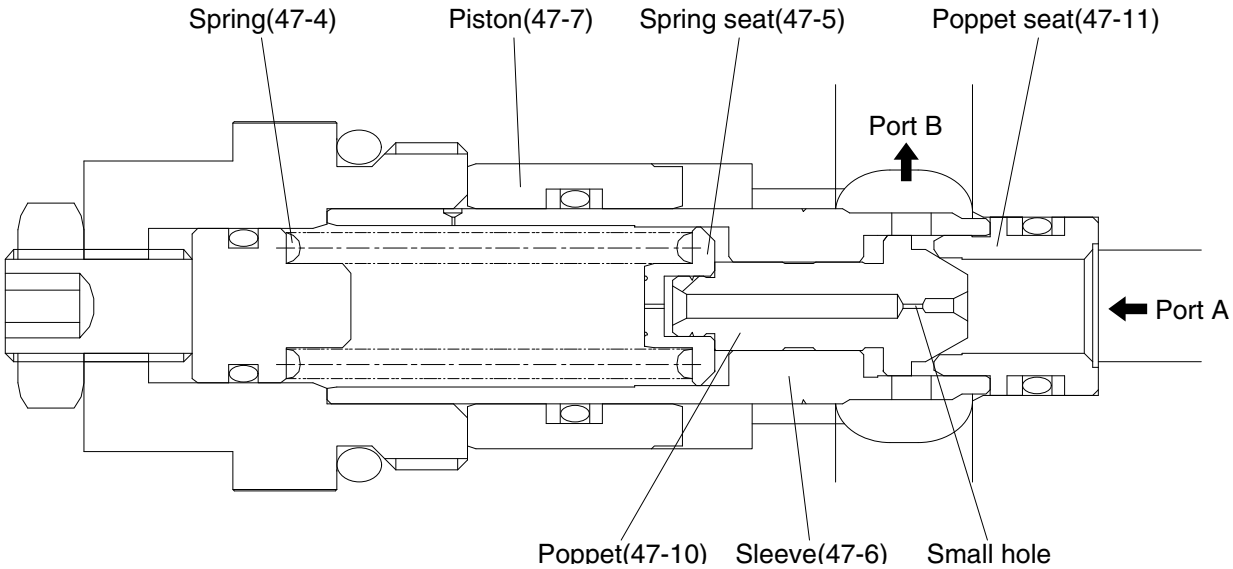
47-1 Plug
47-2 Guide
47-3 O-ring
47-4 Spring
47-5 Spring seat
47-6 Sleeve
47-7 Piston
47-8 O-ring
47-9 Back-up ring
47-10 Poppet
47-11 Poppet seat
47-12 O-ring
47-13 Back-up ring
47-14 Socket screw
47-15 Hexagon nut
47-16 O-ring

(2) Operation

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

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

When starting, "A" port pressure of overload valve increases, this pressure is applied to the effective diameter of poppet (47-10) which seats on the poppet seat (47-11) and, at the same time, is delivered, via small hole, to the spring seat (47-5) located inside the sleeve (47-6) and the seat bore pressure increases up to "A" port pressure. The poppet (47-10) opposes to spring (47-4) by the force of the pressure exerted on the area difference between poppet seat's effective diameter and spring seat bore and keep the predetermined pressure.
When hydraulically braking, the piston (47-7) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (47-7) through the small hole in the poppet (47-10) and piston (47-7) moves rightward until it touches the stopper in rear cover. In this while, the poppet (47-10) maintains "A" port pressure at comparatively low against the spring (47-4) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.



2609A2TM08

5) BRAKE VALVE

(1) Structure

The brake valve portion mainly consists of the following parts:

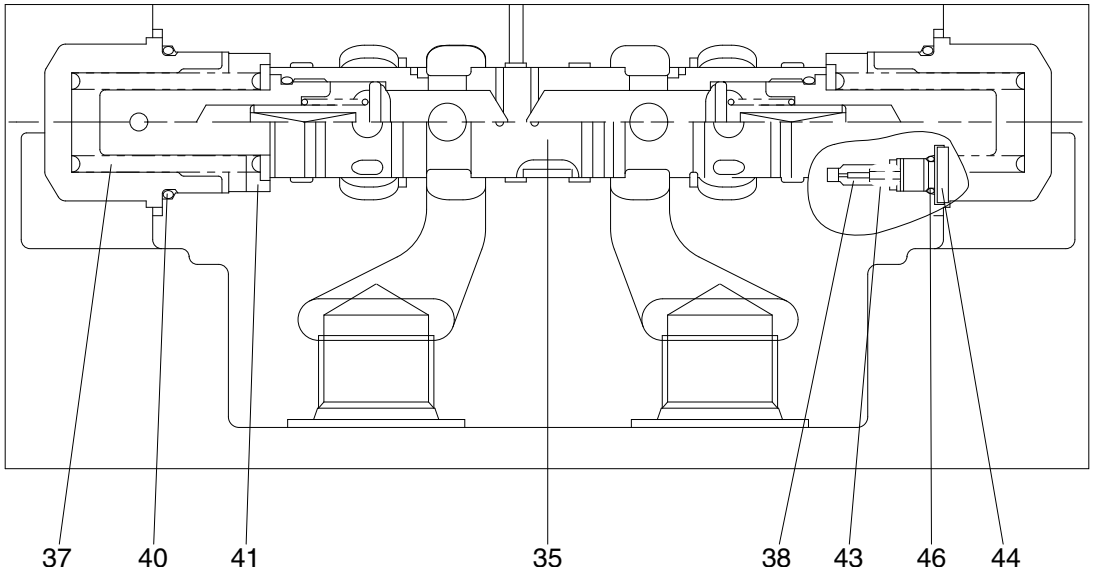
① **Spool**

By shifting the spool (35), the discharged oil from hydraulic motor is automatically shut off or restricted according to the condition and give the effect of holding, accelerating, stopping and counterbalance operations.

(See page 2-74, (2) Operation)

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

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



2609A2TM09

35	Main spool	40	O-ring	44	O-ring
37	Spring	41	Spring seat	46	Plug
38	Restrictor	43	Restrictor spring		

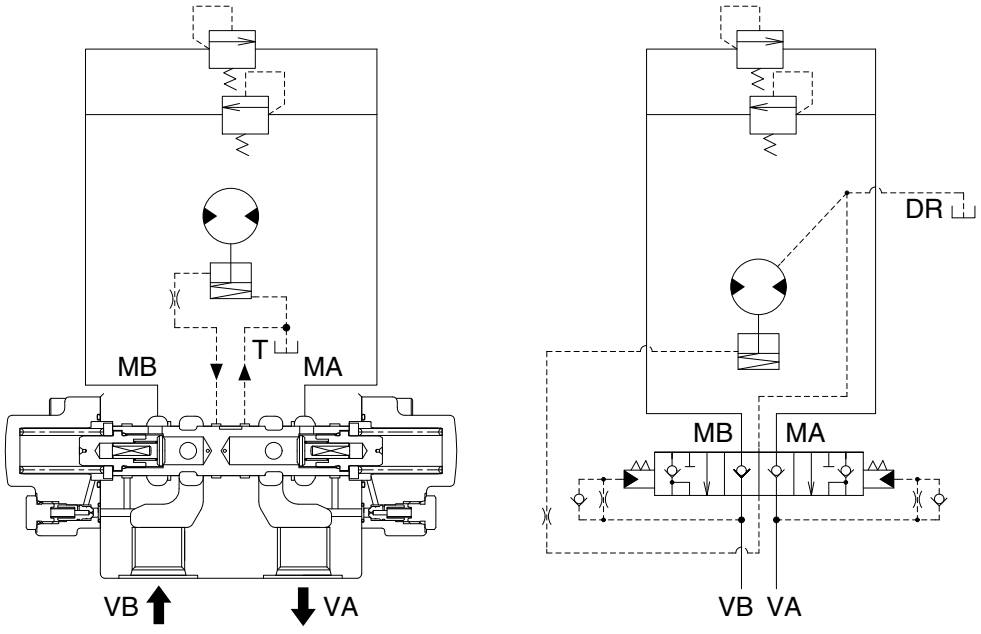
(2) Operation

① Holding operation

When the control valve is at neutral position, VA and VB ports are connected to the tank, and the spring (38) located on both spool ends holds the spool (35) at central position.
Therefore, the passages from VA to MA and VB to MB are closed, which result in closing MA and MB ports connected to hydraulic motor.

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

In case the brake should be released for some reason, pressure is built on MA or MB port. But, due to oil leakage inside hydraulic motor or so, high-pressure oil escapes from the closed circuit and motor rotates a bit. So, the cavitation tends to occur in the lower pressure side of the closed circuit. Then, the check valve, built in the spool (35), operates to avoid the cavitation and opens the passage from VA to MA or from VB to MB. Then the oil equivalent to the leakage is sucked from the tank line to the closed circuit.



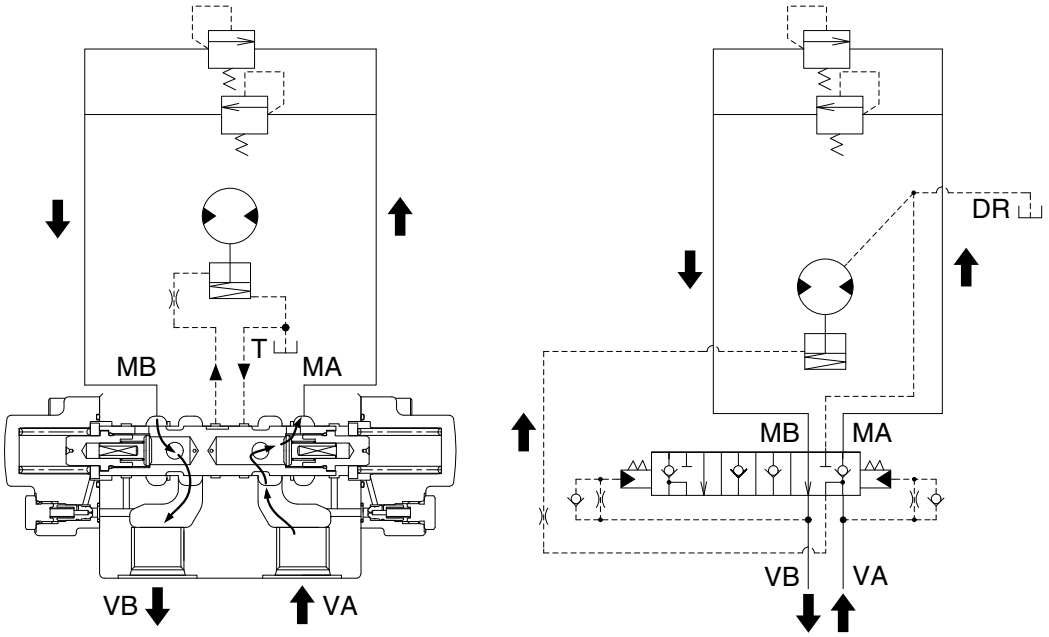
25092TM29

② Accelerating operation

When VA and VB ports are connected respectively to pump and tank by operating the control valve, hydraulic oil from pump is forwarded through VA port to push open the check valve provided inside spool (35), and oil flows to motor via MA port to rotate the motor.

Therefore, the pressure increases and negative brake is released by the pressure supplied from pump. At the same time, the pressure of pilot chamber increases to push and move the spool (35) leftwards, overcoming the spring (38) force. Thus, the return line from MB to VB opens to rotate the motor.

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



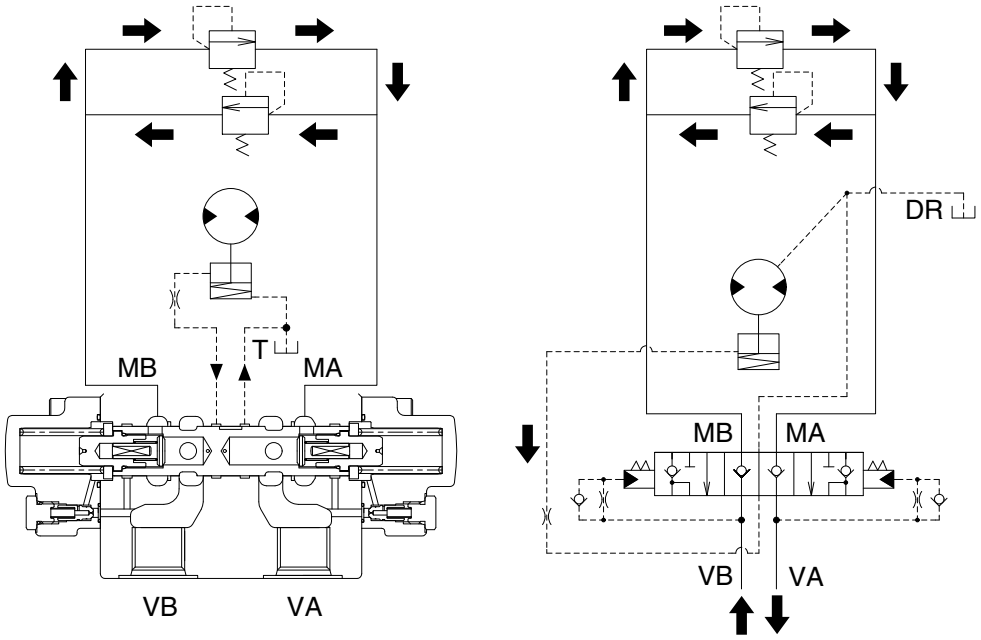
25092TM30

③ Stopping operation

Returning the control valve to neutral position while running the motor, the oil supply is cut off and VA and VB ports are connected to the tank line. Then the pressure of the pilot chamber located on both spool ends become equal, and the spool (35) returns to the neutral position by spring (38) force. Thus, the passage from MA to VA is closed.

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

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



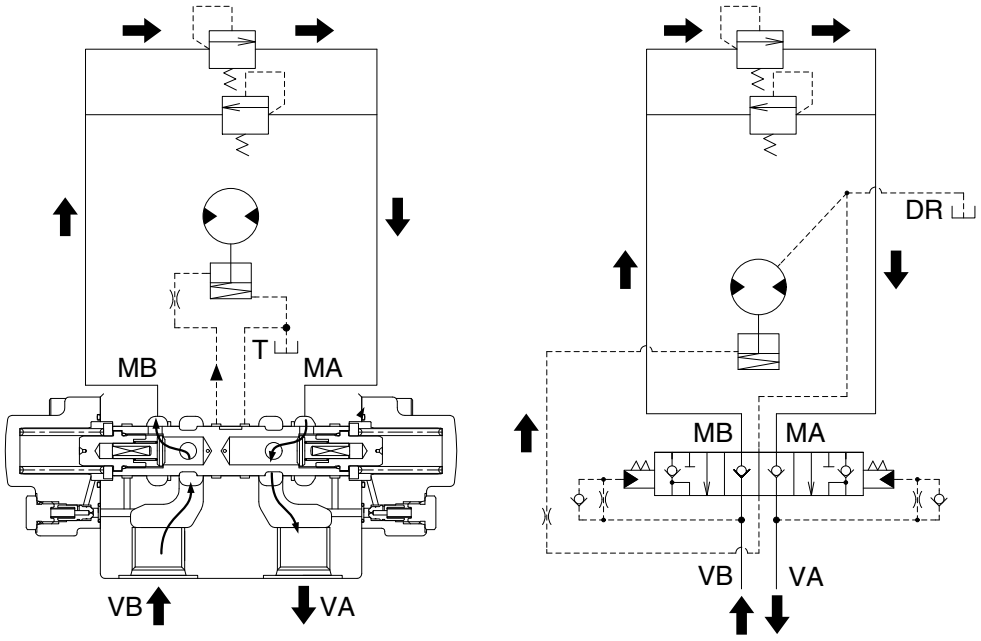
25092TM31

④ Counterbalance operation

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

In case the hydraulic oil is gradually decreased from pump to VB port, the drive shaft of hydraulic motor tends to rotate faster than that matched to the volume of oil supply.
Consequently, the pilot chamber pressure on MB to VB side decreases and the spring (38) force moves the spool (35) leftwards towards neutral position.
Therefore, the area of passage from MA to VA becomes smaller and the pressure on MA side rises due to increased resistance in the passage and the motor receives hydraulic braking effect.

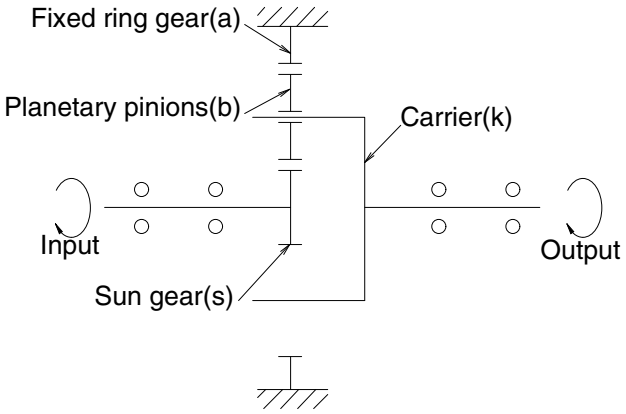
If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and spool (35) moves rightwards to enlarge the area of passage from MA to VA. Therefore the braking effect becomes smaller and the rotational speed of motor is controlled to correspond to the volume of supplied oil.
In order to give stable counterbalance operation, the restrictors (40) are set in the pilot chamber to damp the spool (35) movement.
The parking brake is released during pressure adjusting action of the spool (35).



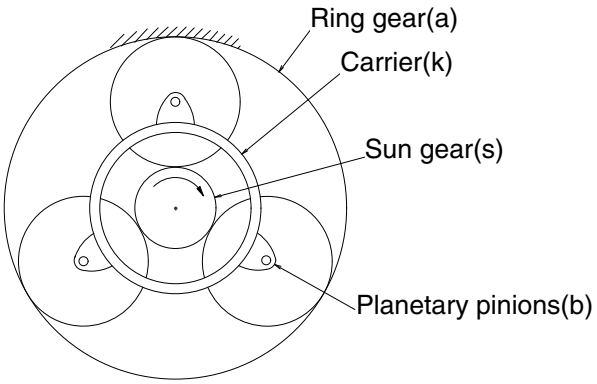
25092TM32

6) REDUCTION GEAR

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force.
This reduction unit utilizes two stages, planetary reduction system.
Planetary reduction system consists of sun gear, planetary gears, (planetary) carriers, and ring gear.
When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).
This movement is transferred to carrier (k) and deliver the torque.
This mechanism is called planetary gear mechanism.

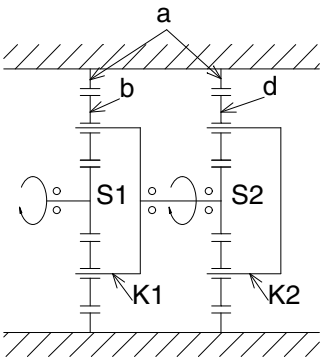


29072TM10



29072TM11

When the sun gear **S1** is driven by input shaft, planetary action occurs among gears **S1**, **a** and **b** and revolution of gear **b** transfers the rotation of carrier **K1** to second sun gear **S2**, and also evokes planetary action between gear **S2, a** and **d**.
This time, because carrier **K2** is fixed to frame, gear **d** drives ring gear **a** and then ring gear **a** rotates to drive sprocket.



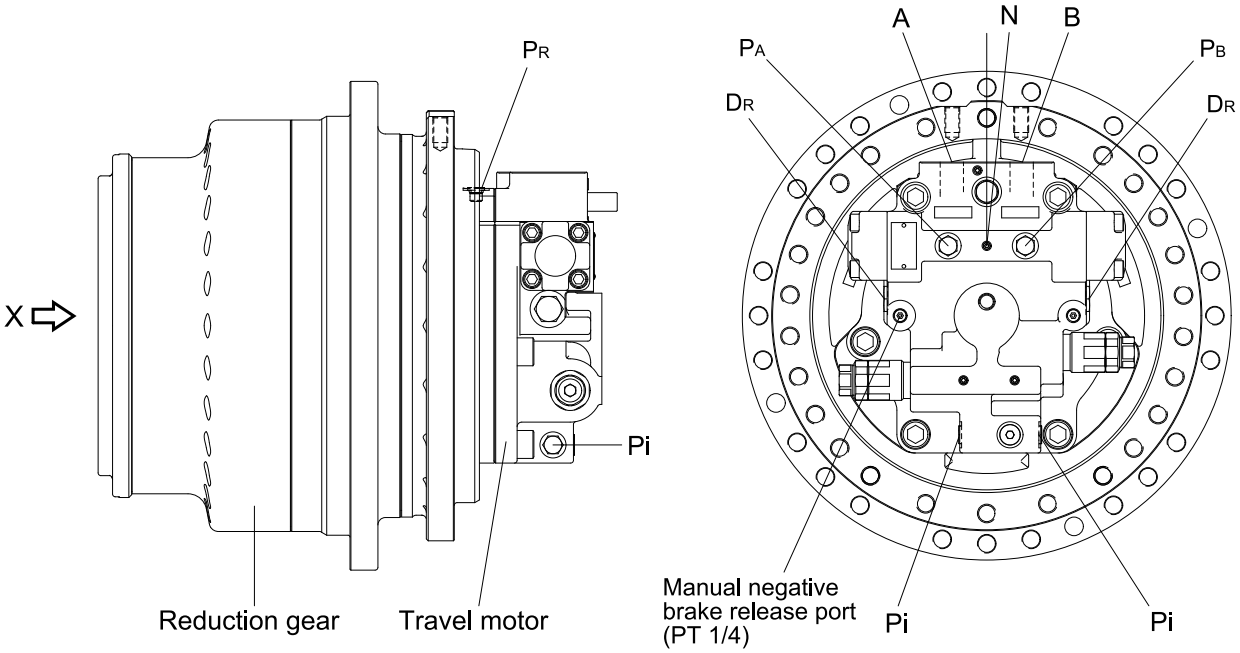
29072TM12

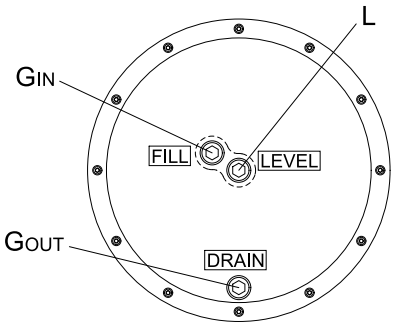
■ TRAVEL DEVICE (TYPE 2, HIGH WALKER, MACHINE SERIAL NO. : -#0900))

1. CONSTRUCTION

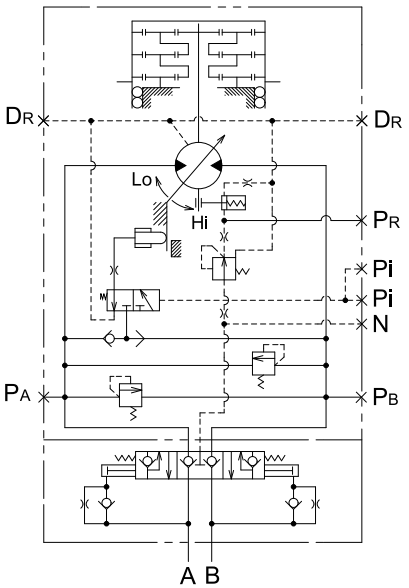
Travel device consists travel motor and reduction gear.

Travel motor include counterbalance valve, cross over relief valve.





VIEW X

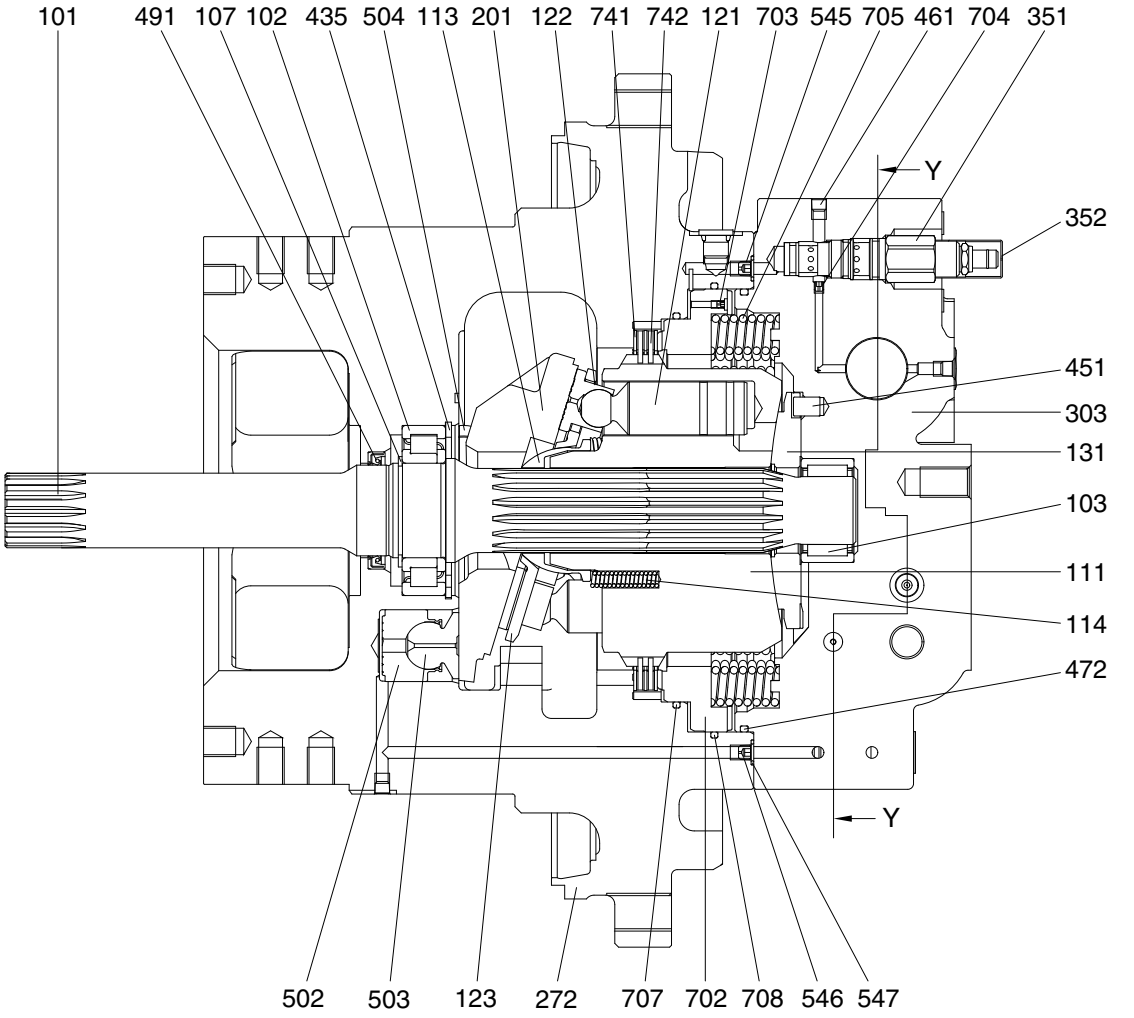


Hydraulic circuit

300A2TM05

Port	Port name	Port size
A	Main port	SAE 6000 psi 1"
B	Main port	SAE 6000 psi 1"
Pi	Pilot port	PF 1/4-15
DR	Drain port	PF 1/2-19
N	Negative brake release port	NPTF 1/16
PA, PB	Pressure gauge port	PF 1/4-15
PR	Brake release pressure gauge port	PF 1/4-15
L	Level gauge	PF 1/2-15.5
GIN	Gear oil inlet port	PF 1/2-15.5
GOUT	Gear oil drain port	PF 1/2-15.5

1) TRAVEL MOTOR (1/2)

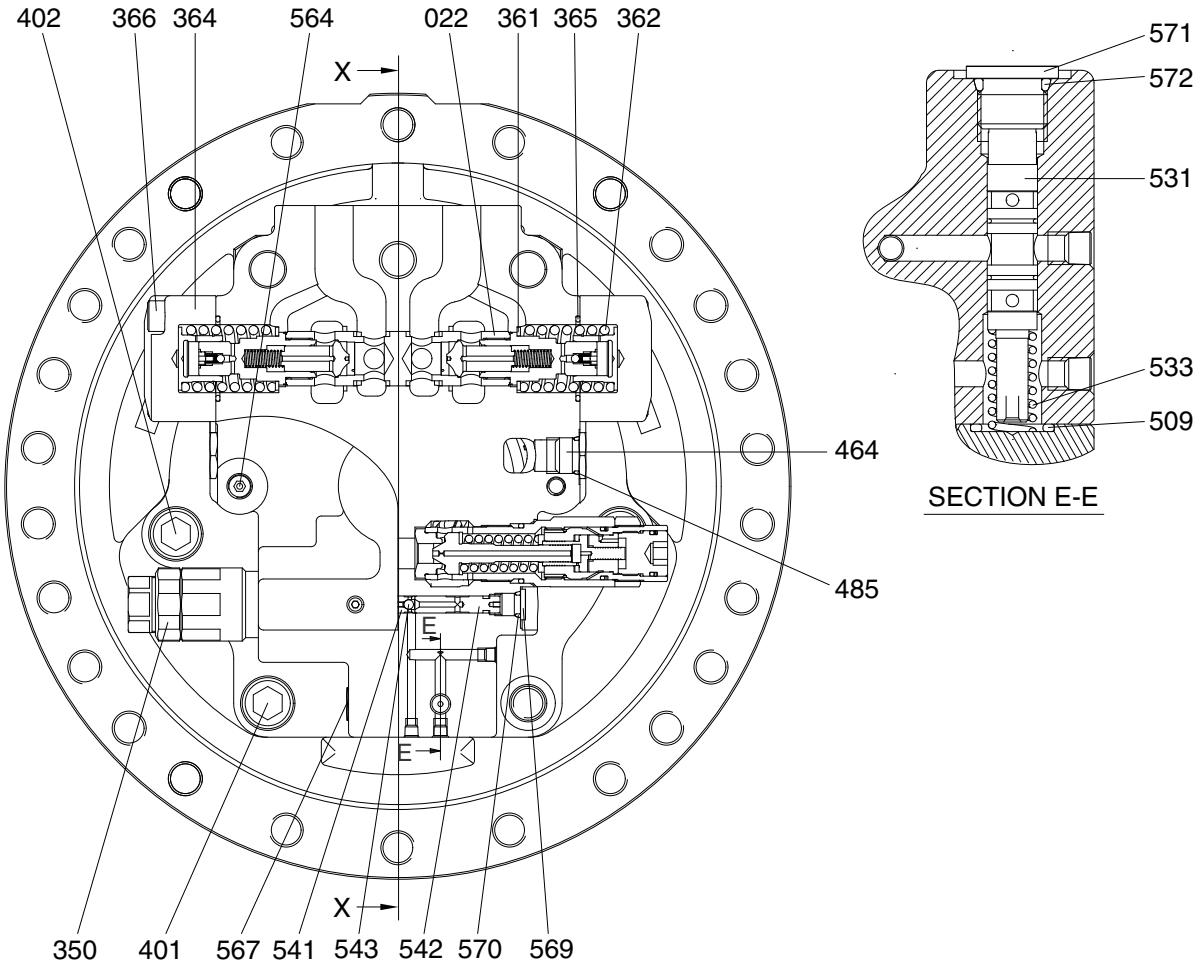


SECTION X-X

300A2TM02

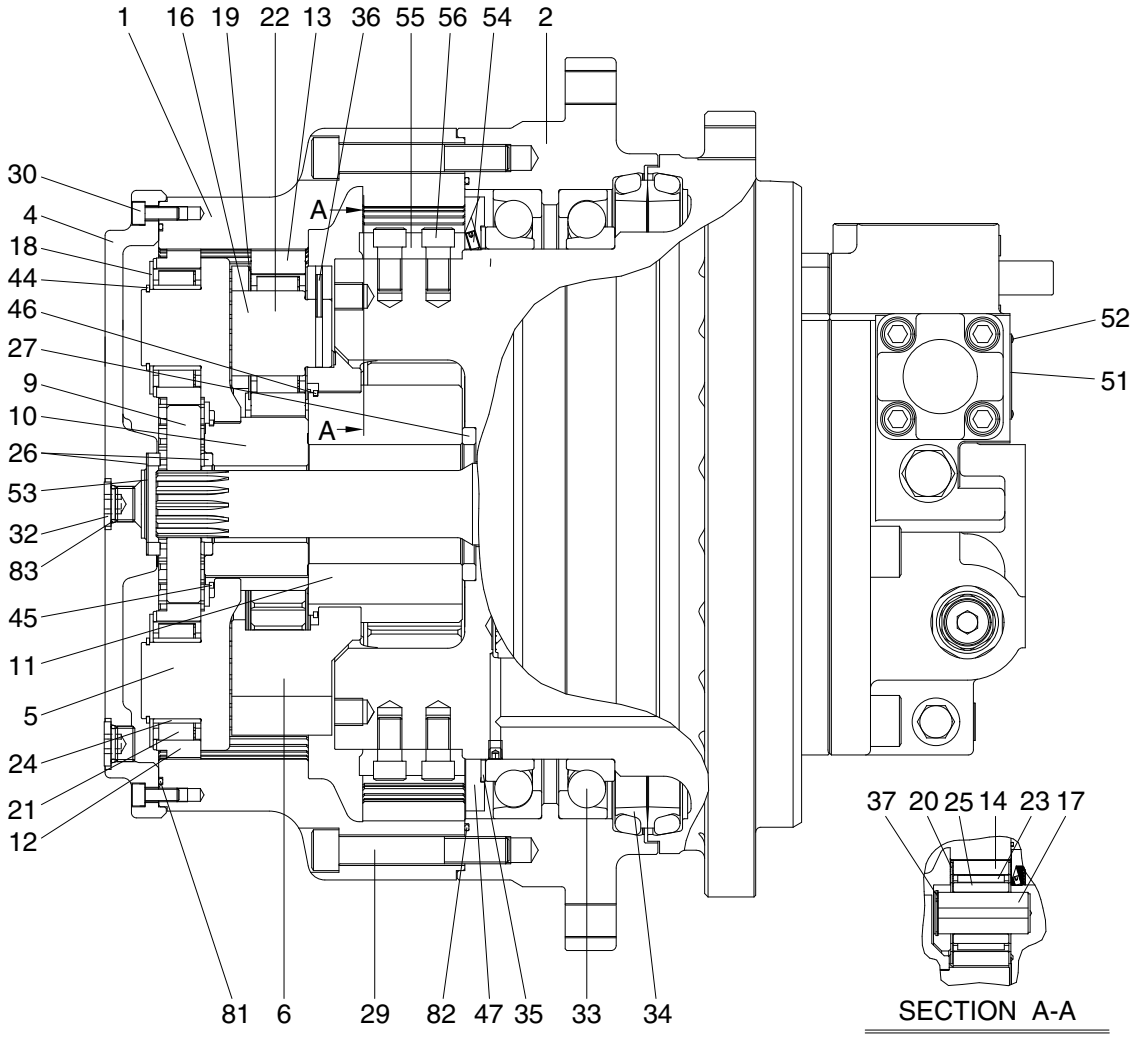
101	Drive shaft	272	Shaft casing	545	Orifice
102	Roller bearing	303	Valve casing	546	Orifice
103	Needle bearing	351	Reducing valve	547	O-ring
107	Snap ring	352	Cover	702	Brake piston
111	Cylinder block	435	Snap ring	703	Orifice
113	Spherical bushing	451	Pin	704	Orifice
114	Cylinder spring	461	Plug	705	Brake spring
121	Piston	472	O-ring	707	O-ring
122	Shoe	491	Oil seal	708	O-ring
123	Set plate	502	Piston	741	Separation plate
131	Valve plate	503	Shoe	742	Friction plate
201	Swash plate	504	Pivot ball		

TRAVEL MOTOR (2/2)



022	Counterbalance spool	402	Hex socket bolt	543	Steel ball
350	Relief valve	464	VP plug	564	Plug
361	Washer	485	O-ring	567	VP plug
362	Counterbalance spring	509	O-ring	569	RO plug
364	Counterbalance cover	531	Tilting spool	570	O-ring
365	O-ring	533	Tilting spring	571	RO plug
366	Hex socket bolt	541	Seat	572	O-ring
401	Hex socket bolt	542	Stopper		

2) REDUCTION GEAR

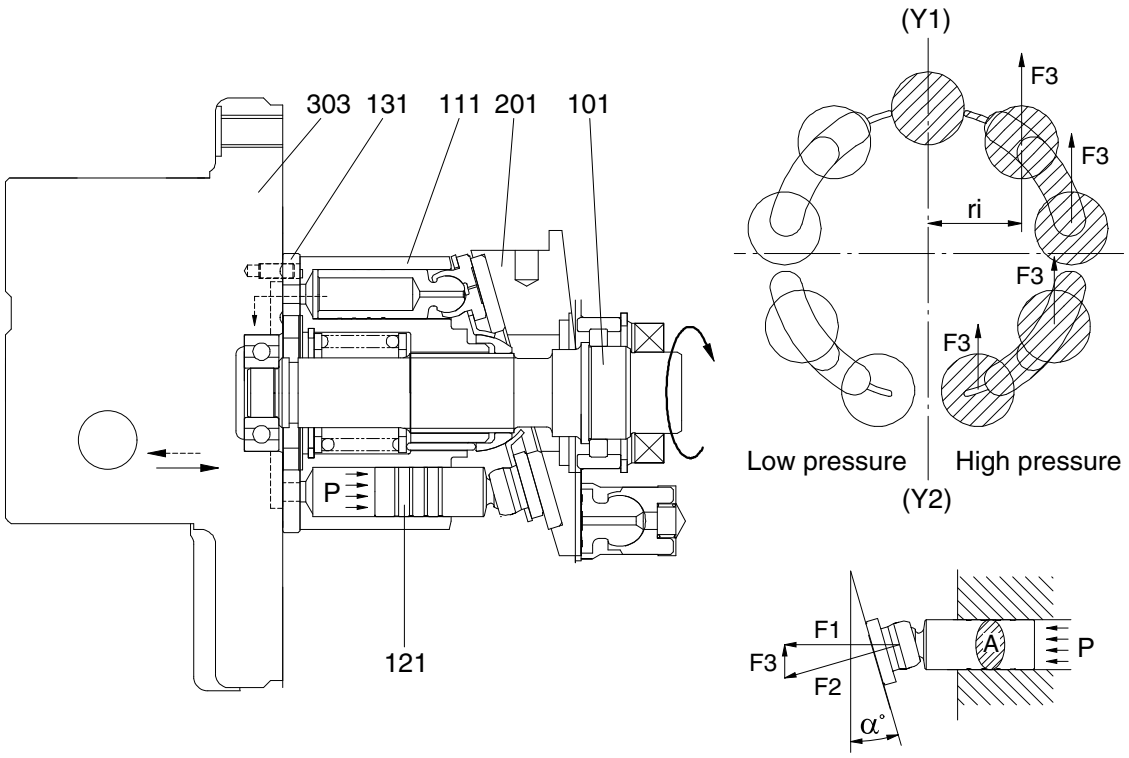


300A2TR01

1	Ring gear	20	Side plate	37	Snap ring
2	Housing	21	Needle cage	44	Snap ring
4	Side cover	22	Needle cage	45	Clip
5	Carrier 1	23	Needle cage	46	W clip
6	Carrier 2	24	Inner ring	47	Nutring
9	Sun gear 1	25	Floating bushing	51	Name plate
10	Sun gear 2	26	Thrust ring	52	Rivet
11	Sun gear 3	27	Thrust ring	53	Washer
12	Planetary gear 1	29	Socket bolt	54	Set screw
13	Planetary gear 2	30	Socket bolt	55	Nutring stopper
14	Planetary gear 3	32	RO plug	56	Hex socket bolt
16	Pin 2	33	Angular bearing	81	O-ring
17	Pin 3	34	Floating seal	82	O-ring
18	Side plate	35	Shim	83	O-ring
19	Side plate	36	Spring pin		

2. FUNCTION

1) GENERATION OF TORQUE



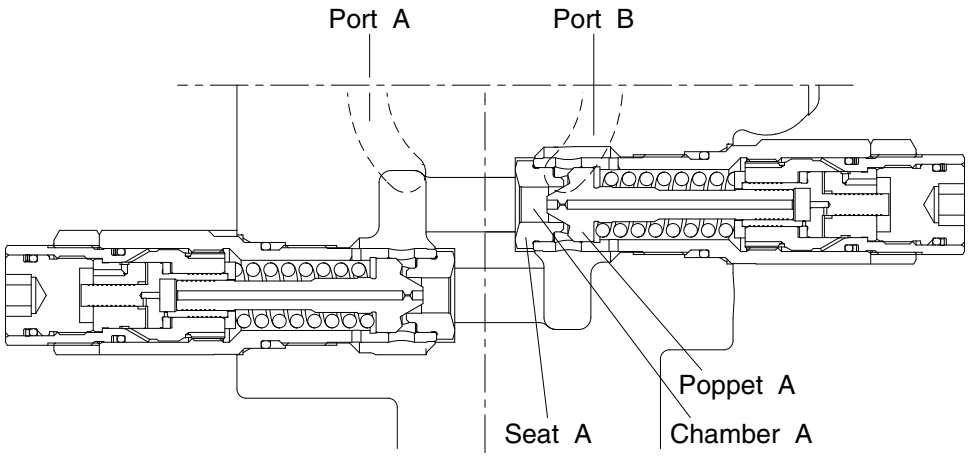
The pressurized oil delivered from the hydraulic pump flows to valve casing (303) of the motor, passes through the brake valve mechanism, and is introduced into cylinder block (111) via valve plate (131). This oil constructively introduced only to one side of (Y1)- (Y2) connecting the upper and lower dead points of stroke of piston (121). The pressurized oil led to one side in cylinder block (111) pushes each piston (121) four or five and generates a forec [F (kgf) = P (kgf/cm^2) × A (cm^2)].
This force acts on swash plate (201), and is resolves into components (F2 and F3) because swash plate (201) is fixed at an angle (α) with the axis of drive shaft (101).
Radial component (F3) generates respective torques (T=F3×ri) for (Y1)- (Y2). This residual of torque [T=S (F3×ri)] rotates cylinder block (111) via piston (121).
Since the cylinder block (111) is spline coupled with drive shaft (101).
So the drive shaft (101) rotates and the torque is transmitted.

2) RELIEF VALVE

The relief valve mainly has the following two functions :

(1) 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 driven inertia.

(2) To generate a brake pressure at the outlet during stopping of the driven inertia, and stop it forcedly.

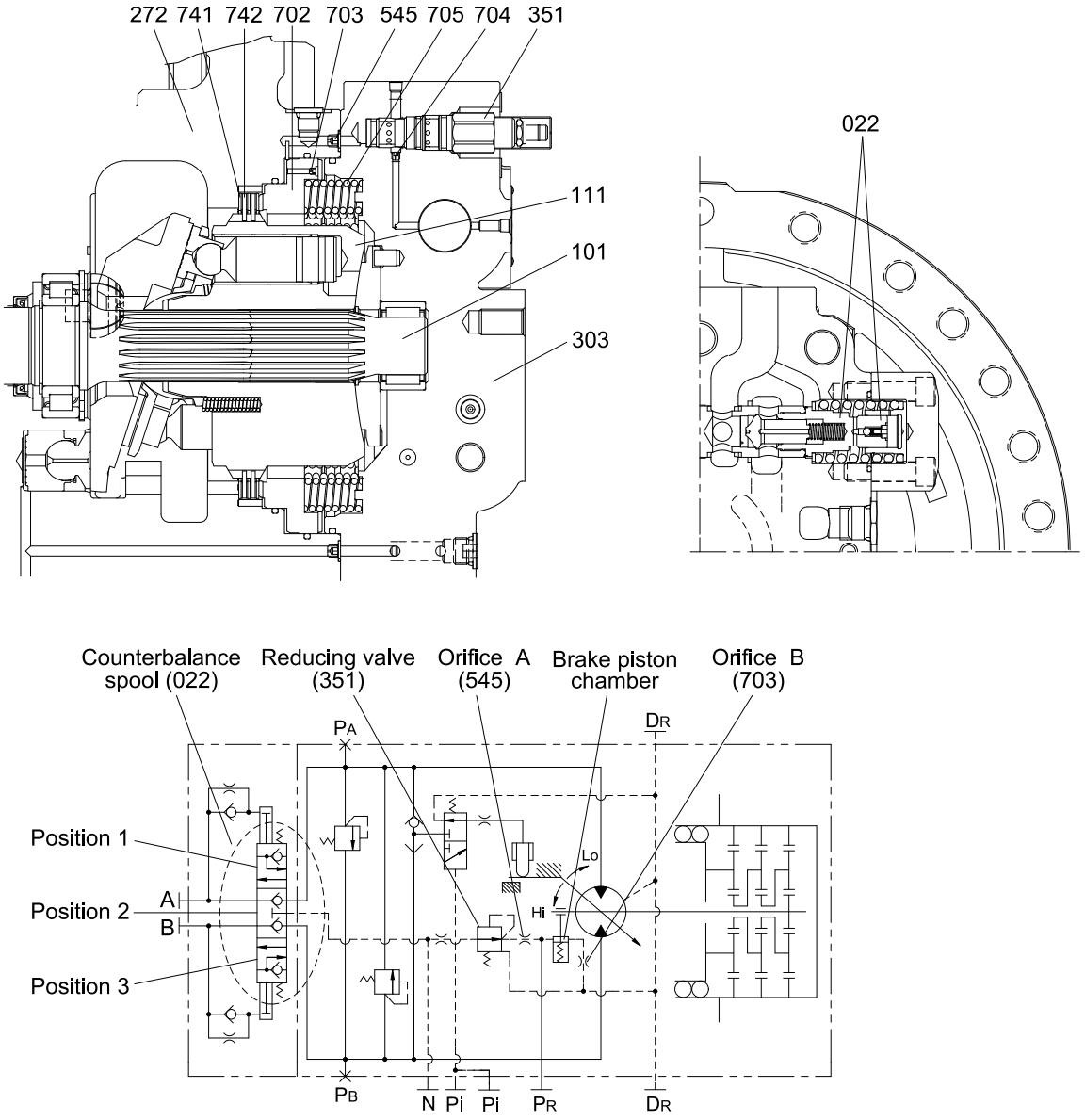


3607A2TM06

The chamber A is always connected to the port A of the motor.
When the pressure at port A increases and the force pushing poppet A is higher than the set 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.

3) NEGATIVE BRAKE

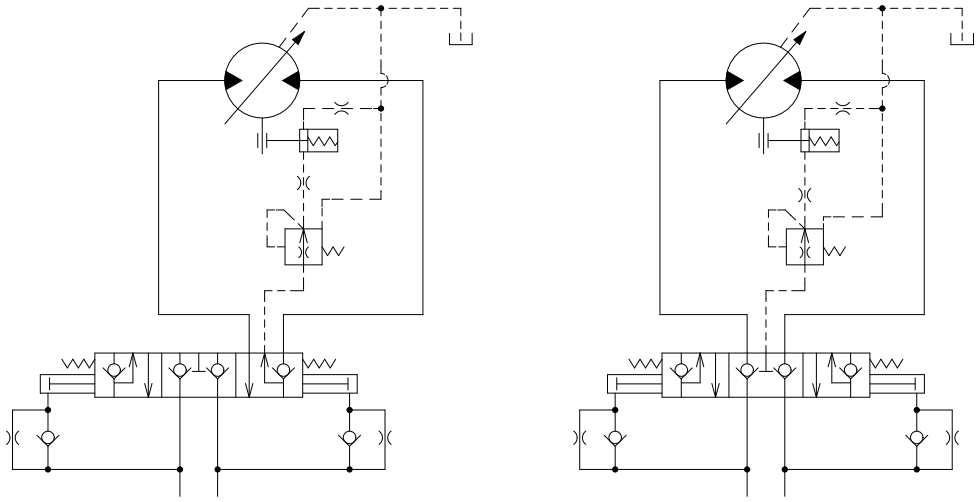
The negative brake is released applying to the brake piston (702) the pressure led through the built-in counterbalance spool sub-assembly (022).
With no pressure working, the brake force is always ensured.



300A2TM06

The brake force is the friction force generated on the surfaces of the friction plates (742) spline-coupled with the cylinder block (111), when their rotation is restricted by the shaft casing (272), separation plate (741), and brake piston (702).
Without pressure being applied to the brake piston, the brake piston is pushed by fourteen brake springs (705), and the friction plate and separation plate are held between the brake and shaft casing. This holding force functions as the friction force. This friction force restrains the shaft (101) spline-coupled with the cylinder block, and this function is the brake.

4) PRESSURE RELEASE VALVE (Flow control valve)



3607A2TM08A

This brake is of a backpressure-insensitive type. In other words, since the counterbalance spool used be overlapped at the neutral position, the pressure release valve prevents the circuit backpressure from working into the brake chamber when the machine stops traveling and works, and so the specified brake torque is available even on a slope.

During normal traveling, the pressure coming through the counterbalance valve is applied to the brake chamber to release the break, and is also applied to the pressure release valve section.

This pressure release valve is of a constant differential pressure type, and irrespective of the working pressure, the passing flow is constant and approximately 1 to 2 ℓ / min.

When the condition changes from traveling to stop, the counterbalance spool returns to its neutral position. The brake piston is pushed by the brake spring, and the oil in the brake chamber flow to the motor drain line via the pressure release valve. Then the brake torque is generated.

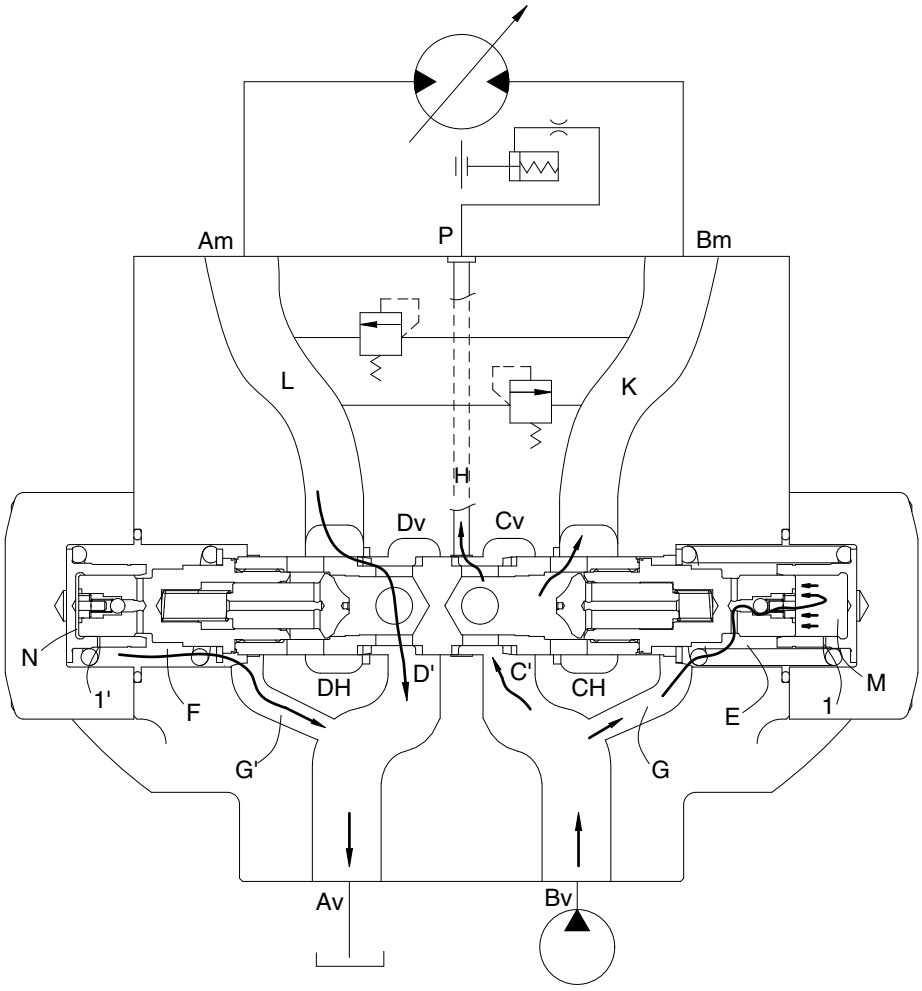
5) RELEASING METHOD OF NEGATIVE BRAKE

In releasing the negative brake without applying the brake releasing pressure, follow the procedures shown below.

Details of work	Tools
Remove two plugs (564) from the valve casing (303). (For their position, see the attached installation dimension) Tighten an M10 screw of 135 mm in length into a tapped hole of the brake piston (702). Then the condition having the brake release pressure is attained and the brake is released.	Socket wrench 6 mm 8 mm

Note : Even with the negative brake released, the hydraulic motor will not turn. When it is difficult to generate the working pressure due to failure of the pump or so, and the whole machine is to be pulled for transportation without removing the hydraulic motor, connect pressure measurement ports A_M and B_M with a short hose or something. Then the machine can be pulled slowly.

6) COUNTERBALANCE VALVE



Suppose port Bv is connected to the hydraulic pump and Port Av, to the tank. The oil supplied from the hydraulic pump passes through Bv, Cv and C' in sequence, pushes up the poppet of the check valve, passes through K to Port Bm, and is supplied to the hydraulic motor to turn it.

Therefore, the pump discharge oil pressure increases, and the pressure is led via passage G to spring room E and via the ball check valve to dumping room M. When the pressure in rooms E and M exceeds the value equivalent to the force of the spring which holds the spool at its neutral position, the spool begins to move left. Since the working oil in room N flows into room F via throttle 1' or clearance 2' and that in room F is discharged via passage G' through port Av to the tank, the spool moves left to have passage L-Dm-D'-Dv composed. In addition, passage Cv-H-P is also composed, and the pump discharge pressure in port Bv is led to port P.

Because of the throttle or clearance provided for the working oil flow from room N, this changeover motion of the spool is comparatively slow.

When the pump discharge pressure is higher, the spool movement is larger and the above opening area of the spool is larger.

When the pump discharge pressure falls, pressures in rooms E and M fall and the spool will move right due to the spring on the room F side.

Since working oil in room M flows to room E via throttle 1 and that in room E, to port Bv via passage G, the spool moves right.

When the pressure at port Bv falls down to the tank pressure, the pressure in room E also falls to the tank pressure and becomes equal to that in room F, and so the spool returns to its neutral position.

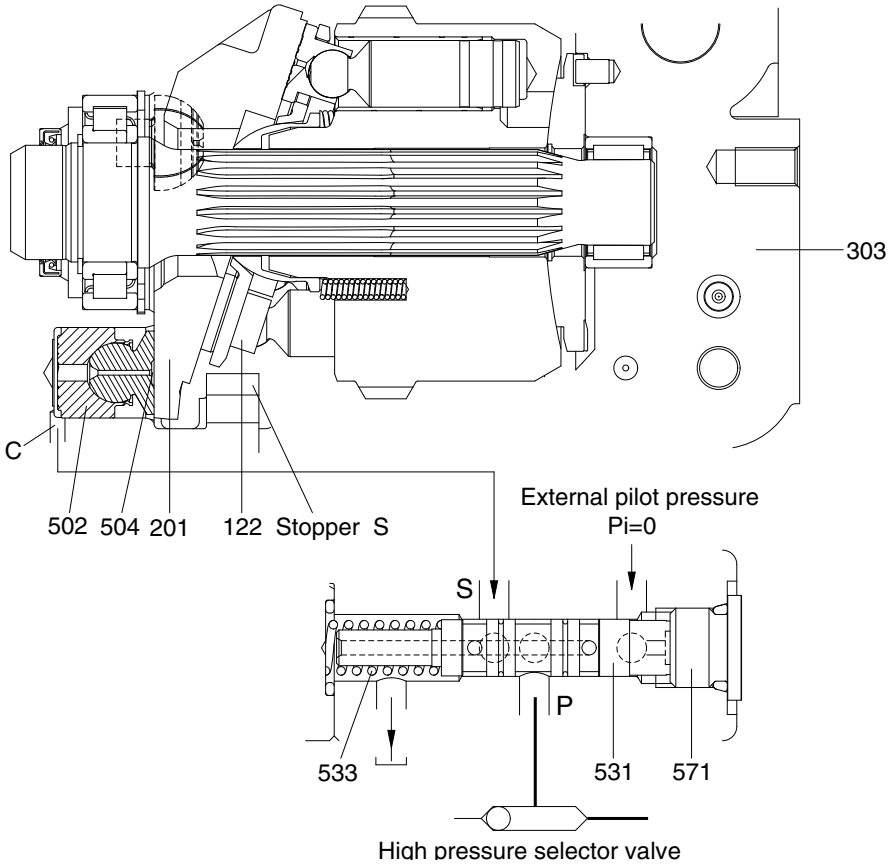
7) DISPLACEMENT CHANGEOVER SECTION

As a supporting mechanism for the swash plate (201) on which the shoes (122) slide, the pillar system is adopted to support the load with semi-cylindrical sliding bearings provided at both ends of the mechanism.

The capacity is changed by changing the tilting angle of this swash plate.

This is a mechanism that swash plate was pushed by tilting position, and the tilting angle of the swash plate is decided in two positions (large and small) by controlling the flows to and from these piston rooms with the displacement changeover valve section.

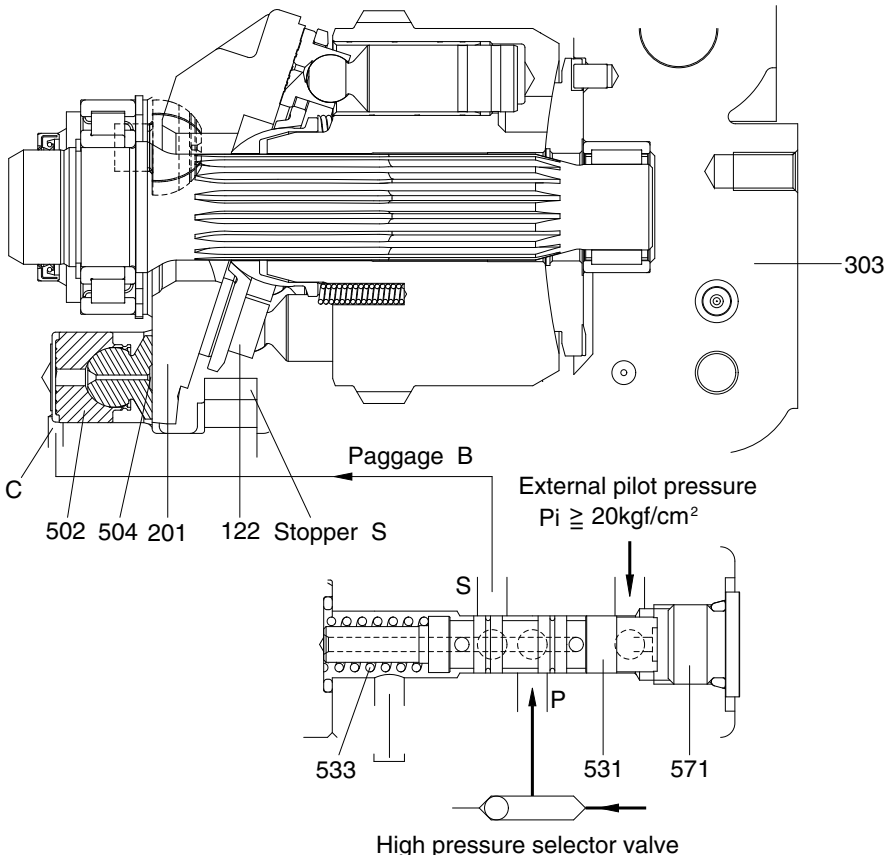
(1) External pilot pressure : $P_i = 0$ ..... Large displacement



3607A2TM04

By means of the built-in high pressure selector mechanism in the valve casing (303), the high pressure oil working on the motor functions to port P of the displacement-changeover valve. This pressure becomes the servo pressure. Since the spool (531) assembled in the displacement changeover valve is pressed to plug (571) by thy spring (533), the high pressure oil at port P is enclosed.

(2) External pilot pressure : Pi ≧ 20 kgf/cm² ——— small displacement

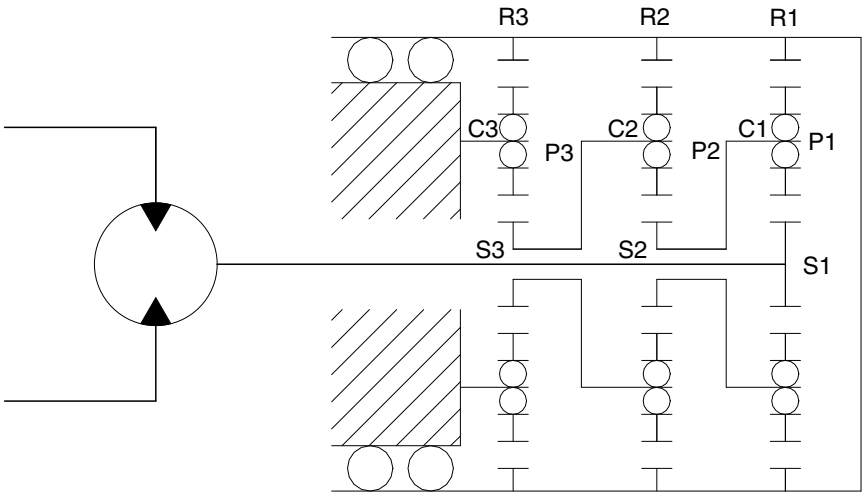


3607A2TM05

The force working on the spool (531) of the displacement-changeover valve becomes higher than that of the spring (533), and the spool moves left. The high pressure oil flows from port P of the displacement-changeover valve through port S and passage B to room C where it works.
The displacement changeover piston (502) is pushed light by the high pressure oil and the swash plate moves in the arrowed direction. The swash plate moves until it touched stopper S, and then is fixed there.

8) REDUCTION GEAR

The reduction gear is composed of a three-stage planetary gear mechanism shown in the following figure. Since the sun gear is designed to have a floating mechanism, errors of the gears and carrier pin hole pitches will not affect the gears' lives heavily.



3607A2TRG04

The input rotation of the hydraulic motor is transmitted to No. 1 sun gear (S1) and this drives No. 1 planetary gears (P1). This No. 1 planetary gears (P1) drive No.1 ring gear (R1) with the same force as the meshing tangential force with No. 1 sun gear (S1), and also No. 1 carrier (C1) with the same force as the meshing reaction force. In other words, No. 1 planetary gears (P1) revolve rotating. This rotation of No. 1 carrier (C1) becomes the output of the 1st stage, and is transmitted directly to No. 2 sun gear (S2).
(No. 1 carrier is spline-coupled with No. 2 sun gear.) Similarly the revolution of No. 2 planetary gear (P2) are transmitted via No.2 carrier (C2) to No. 3 sun gear (S3). Since No. 3 carrier (C3) supporting No. 3 planetary gears (P3) are fixed, No. 3 planetary gears (P3) do not revolve, but rotates to drive No. 3 ring gear (R3).
Therefore, the rotating case is driven by the overall driving torque of No1, 2 and 3 ring gears.
This reduction ratio is expressed as shown below:

$$i = \frac{(Z_{S1} + Z_{R1})\,(Z_{S2} + Z_{R2})\,(Z_{S3} + Z_{R3})}{Z_{S1} \cdot Z_{S2} \cdot Z_{S3}} - 1$$

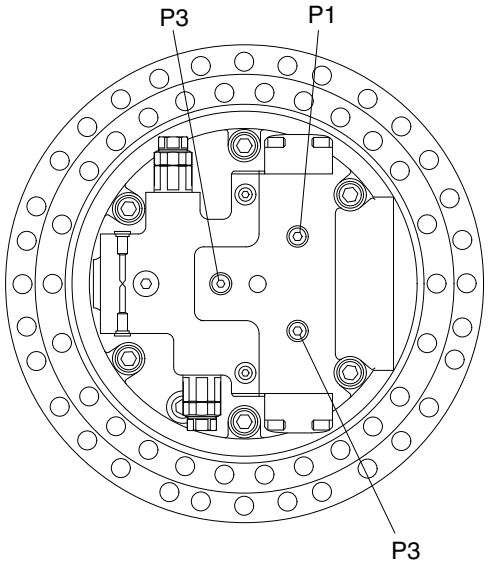
where Z : Number of teeth of each gear
The direction of rotation is reverse to that of the input shaft.

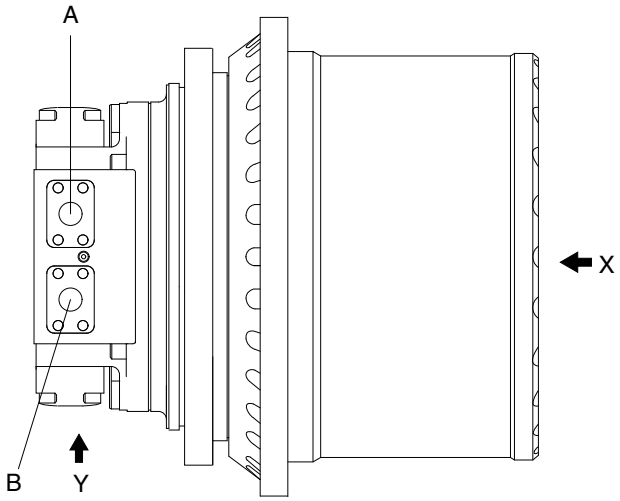
TRAVEL DEVICE (TYPE 2, HIGH WALKER, MACHINE SERIAL NO. : #0901-)

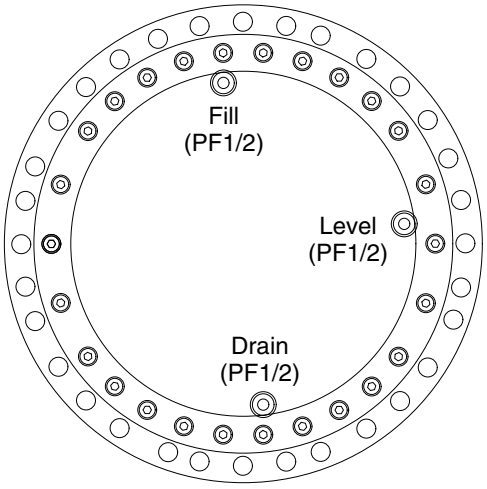
1. CONSTRUCTION

Travel device consists travel motor and gear box.

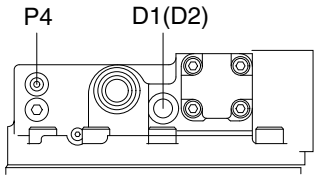
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.





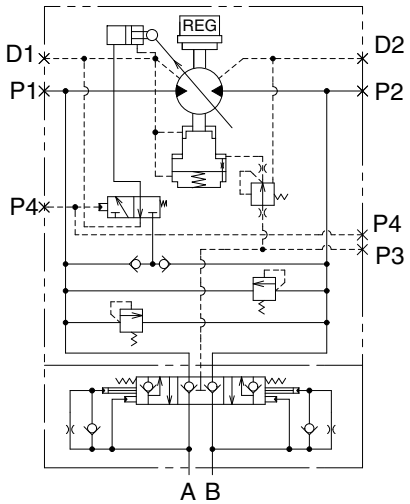


VIEW X



VIEW Y

Port	Port name	Port size
A, B	Main port	SAE 6000 psi 1"
P1, P2	Pressure gauge port	PF 1/4-15
P3	Brake release port	PF 1/4-15
P4	Speed shift port	PF 1/4-15
D1, D2	Drain port	PF 1/2-19

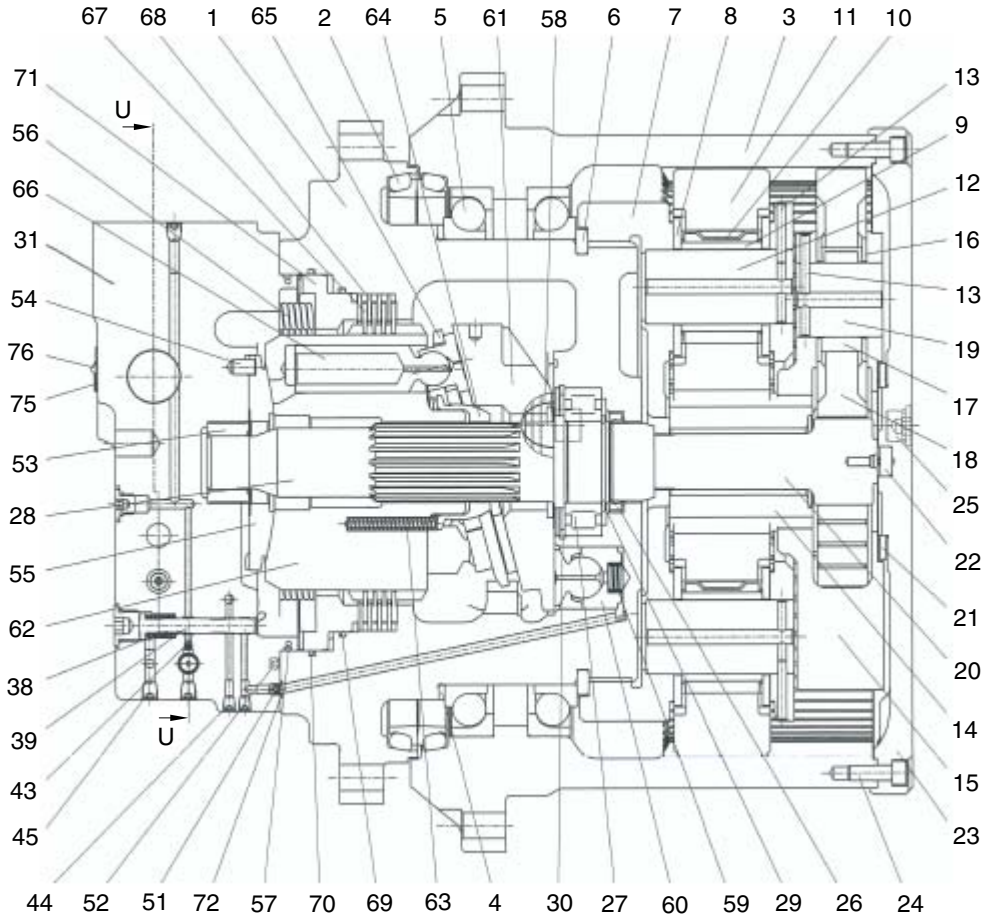


Hydraulic circuit

320A2TM01E

2. STRUCTURE

1) TRAVEL MOTOR (1/2)

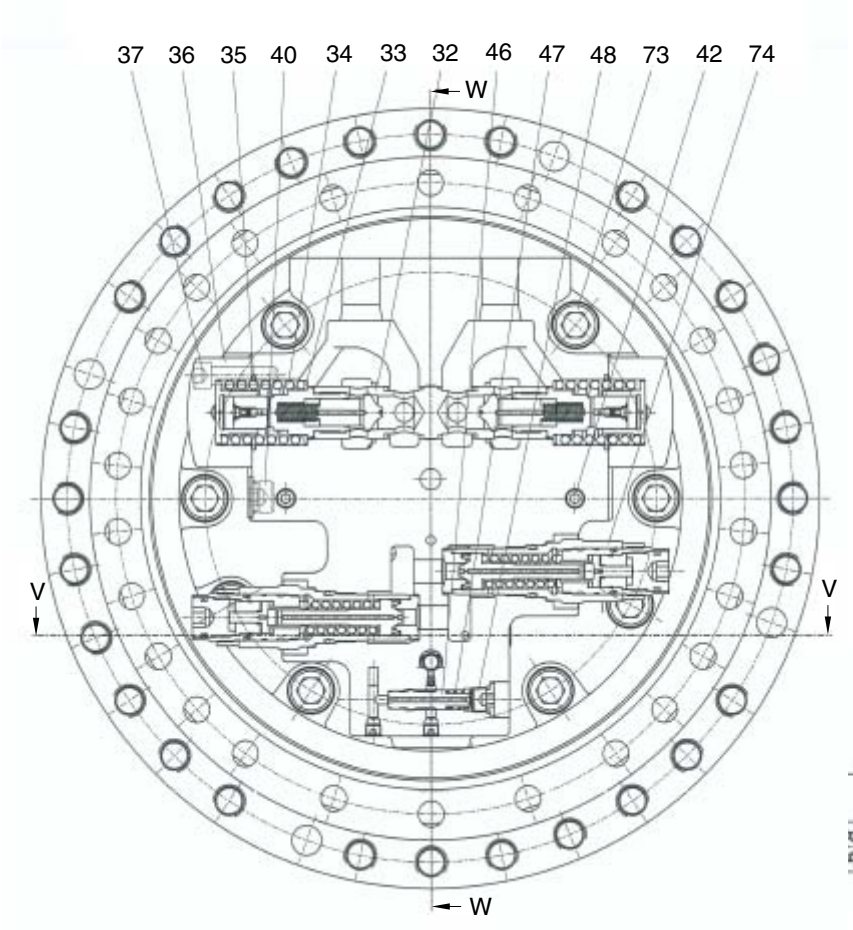


320A2TM02

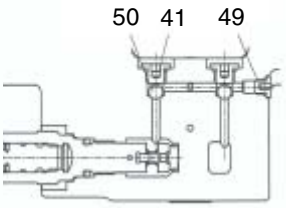
SECTION W-W

1	Casing	21	Thrust plate	55	Timing plate
2	Floating seal	22	Thrust washer	56	Spring
3	Hub	23	Cover	57	O-ring
4	Distance piece	24	Socket bolt	58	Pivot
5	Ball bearing	25	Plug	59	2 speed piston spring
6	Shim plate	26	Shaft seal	60	1 speed spring
7	Carrier no.2	27	Roller bearing	61	Swash plate
8	Thrust washer	28	Drive shaft	62	Cylinder block
9	Floating bushing	29	Snap ring	63	Cylinder block spring
10	Needle roller bearing	30	Snap ring	64	Spherical bus
11	Planetary gear	31	Valve casing	65	Retainer plate
12	Shaft	38	2 speed spring	66	Piston
13	Spring pin	39	Spool	67	Friction plate
14	Sun gear	43	Orifice	68	Separation plate
15	Carrier no.1	44	Plug	69	O-ring
16	Thrust washer	45	Plug	70	O-ring
17	Needle bearing	51	Orifice	71	Brake piston
18	Planetary gear	52	Orifice	72	O-ring
19	Shaft	53	Needle bearing	75	Name plate
20	Drive gear	54	Parallel pin	76	Screw

TRAVEL MOTOR (2/2)



SECTION U-U



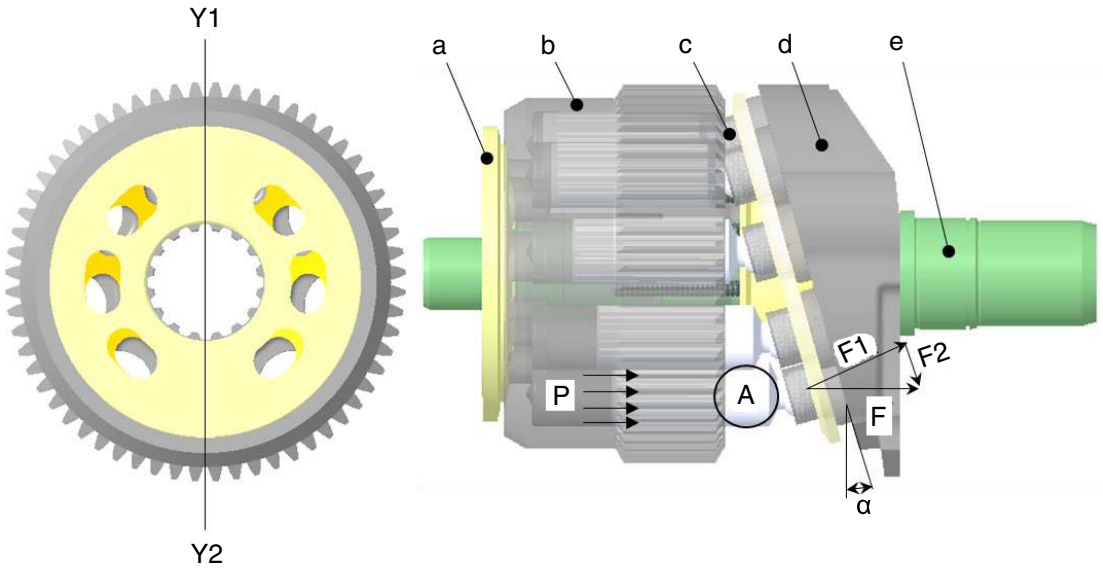
SECTION V-V

320A2TM03

32	Counterbalance spool	40	Plug	49	Plug
33	Counterbalance washer	41	Plug	50	Steel ball
34	Counterbalance main spring	42	Plug	73	Socket bolt
35	O-ring	46	Reducing valve	74	Relief valve
36	Cover	47	Reducing spring		
37	Socket bolt	48	Plug		

3. OPERATION

1) HYDRAULIC MOTOR



300L2TM04

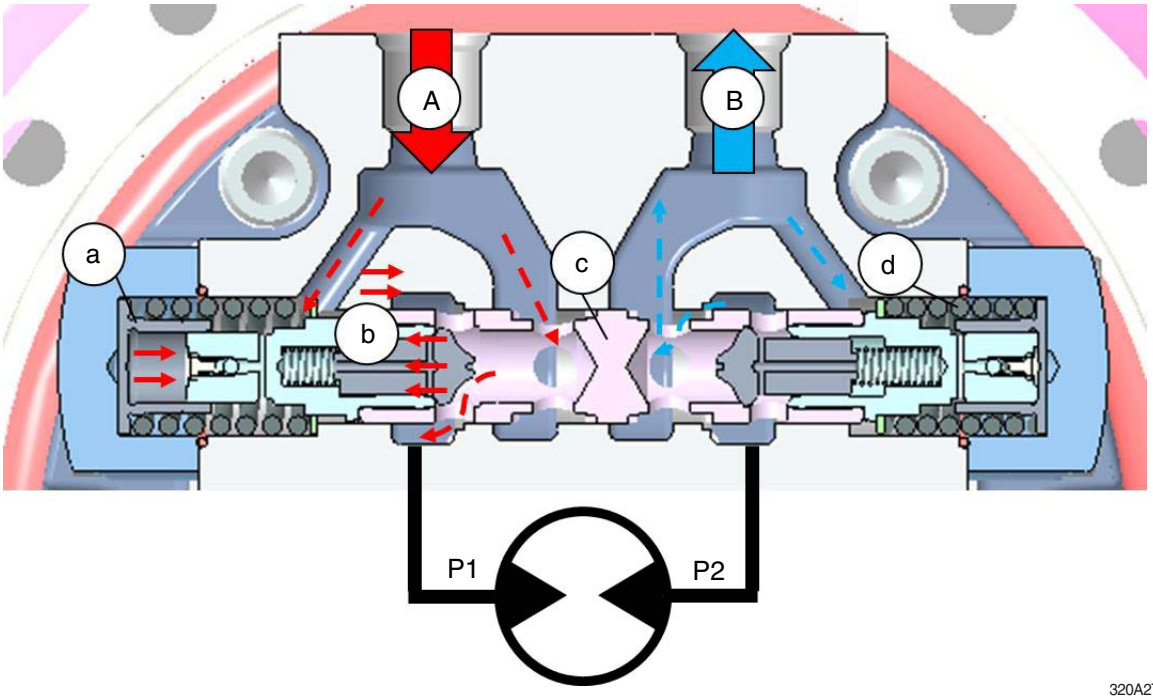
(1) The fluid supplied from the main control valve flows into the cylinder block (b) through the valve plate (a) of the hydraulic motor. This time, half of the fluid will flow in and half will flow out based on Y1-Y2 connecting the top dead center (TDC) and the bottom dead center (BDC) of the piston (c) stroke.

(2) Then, the fluid will act on the piston (c) and push the swash plate (d) with the force of P (supply pressure) x A (piston area) to generate reaction force F.

(3) F is divided into the forces F1 and F2 by the swash plate (d) tilted at an angle α and the rotational force is generated by F2.

(4) The rotational force is applied with the resultant force generated by each piston in the direction in which the fluid flows to rotate the cylinder block (b) and the rotational force is transmitted to the drive shaft (e) connected with a spline.

2) COUNTERBALANCE VALVE



320A2TM06

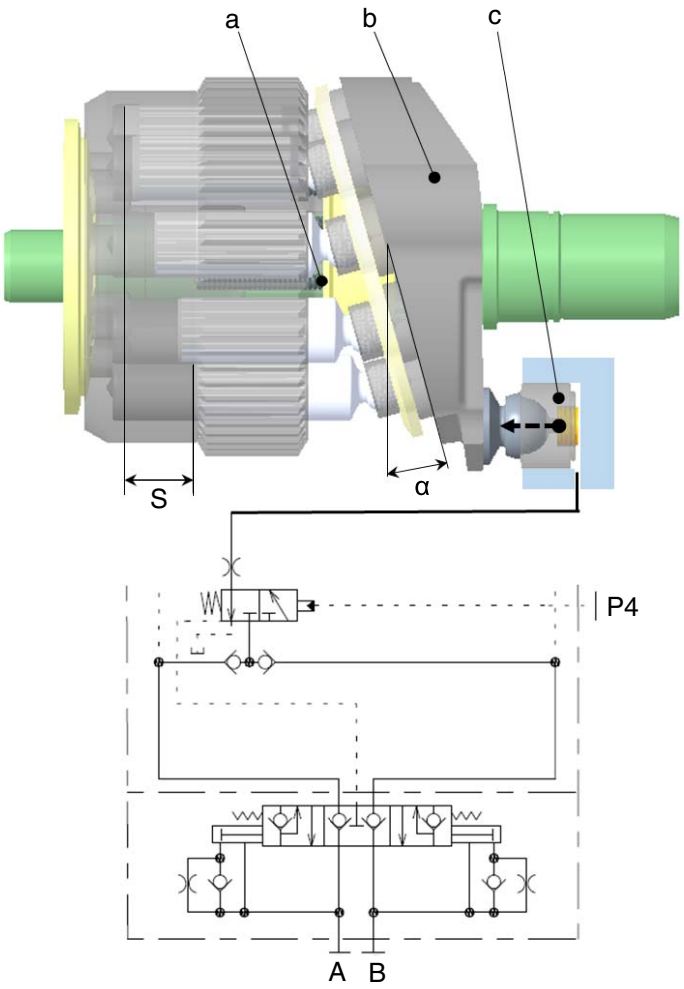
(1) If a fluid is supplied to port A through the main control valve, the check valve (b) is pushed to the left to feed the inlet flow path (P1) and rotate the hydraulic motor.

(2) At the same time, the fluid passing through the orifice (a) pushes the counterbalance spool (c) in the right direction. If the pushing force is greater than the opposite spring (d) force, the counterbalance spool (c) will move.

(3) The fluid discharged by the rotation of the hydraulic motor will pass through the outlet flow path (P2) and the notch of the counterbalance spool (c) and emitted to the port B. This time, a decrease in the pressure of the fluid supplied to port A results in a decrease in the force pushing the counterbalance spool (c) will return to the neutral direction by the spring (d) force on the opposite side.

(4) Repeat this process to control the fluid emitting from the hydraulic motor and avoid overruns.

3) 2-SPEED SHIFT

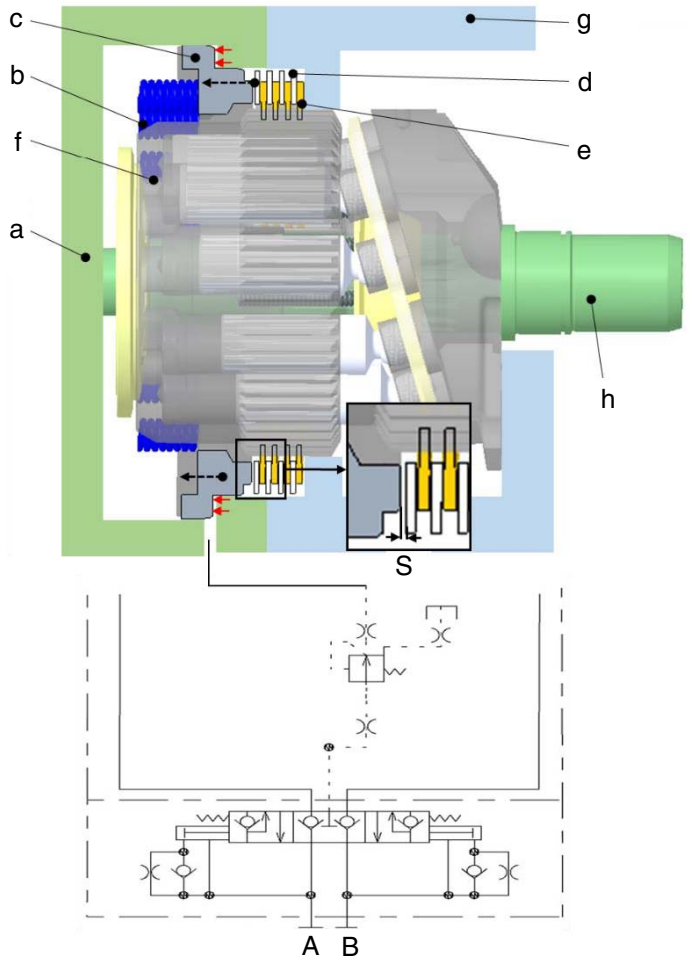


320A2TM07

(1) If the pilot pressure (P4) is supplied at the specified pressure to shift the rotating hydraulic motor to a higher gear, the shafting piston (c) pushed the swash plate (b), resulting a reduction of the swivel angle α. The smaller the swivel angle α, the shorted the stroke length s of the piston (a) and the smaller the stroke volume.

(2) This results in a faster rotational speed and a lower torque of the hydraulic motor.
If the pilot pressure (P4) is less than the specified pressure, the force pushing the swash plate (b) of the shifting piston (c) will weaken and return to the original state. As the swivel angle α increase, the stroke length of the piston (a) becomes longer, which results in a slower rotational speed and higher torque of the hydraulic motor.

4) PARKING BRAKE

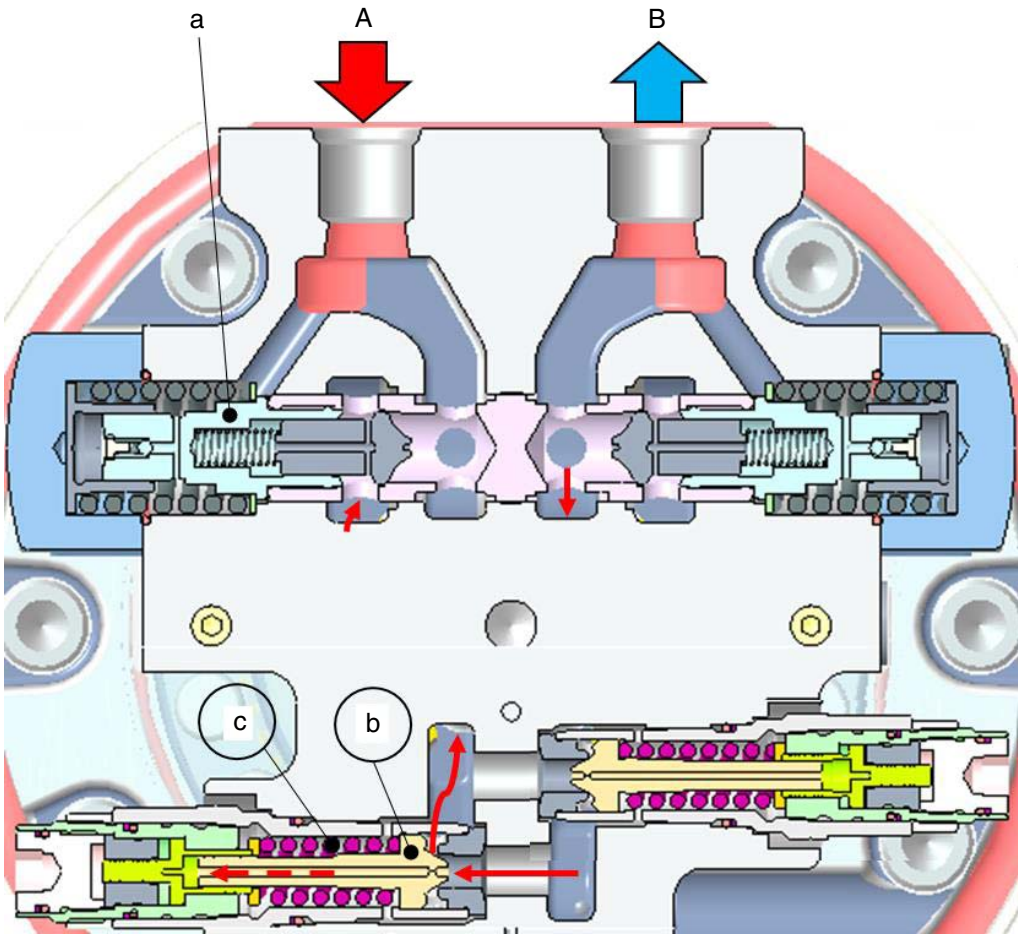


320A2TM08

(1) If no fluid is supplied to the hydraulic motor, the parking brake will engage automatically. The parking brake pressed the separation plate (d) fixed to the motor casing (g) and the friction plate (e) grooved to the cylinder block (f) into the brake piston (c) by the force of the brake spring (b) assembled between the valve casing (a) and the brake piston (c). This prevents the rotation of the cylinder block (f) and the drive shaft (h) connected with the spline.

(2) If a fluid is supplied to the hydraulic motor, the fluid passing through the counterbalance spool will pass through the flow path of the motor casing (g) and force will be applied to the brake piston (c) in the opposite direction to the brake spring (b). If a fluid is supplied exceeding the specified level, the brake spring (b) is compressed as far as the displacement s. This will release the compression between the friction plate (e) and the separation plate (d) and allow the drive shaft (h) to rotate.

5) RELIEF VALVE



320A2TM09

(1) The counterbalance valve (a) slides to the neutral position and blocks the flow path between the inlet (A) and outlet (B) when the motor stops while rotating.

(2) The internal pressure on the outlet (B) increases due to the motor inertia. The force what applied on the poppet (b) opens the poppet (b) when the force applied on the poppet is greater than the spring (c) setting force.

(3) At this time, some of fluid flows to the drain and the fluid slows toward the inlet (A) to prevent cavitation.

(4) The spring (c) on the poppet (b) returns to the original position and block the flow path due to decreased internal pressure on the outlet (B) by drained fluid.

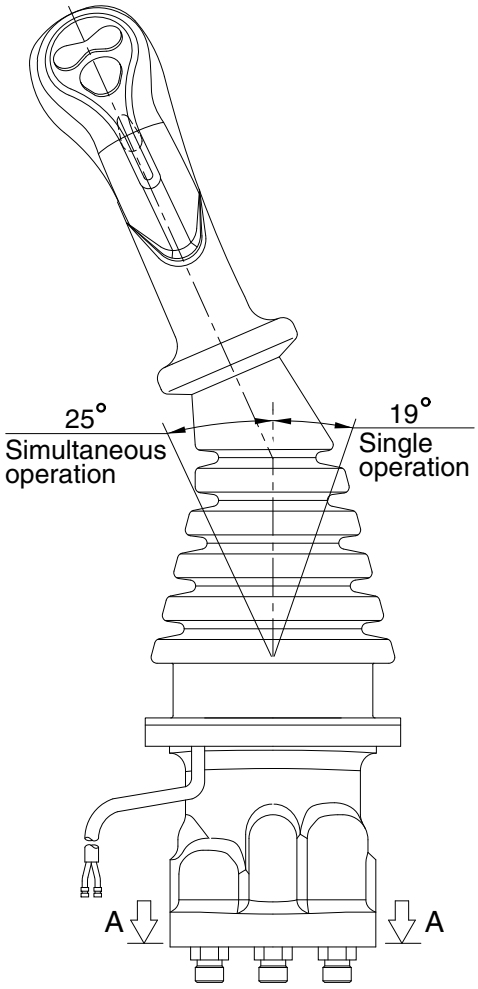
GROUP 5 RCV LEVER

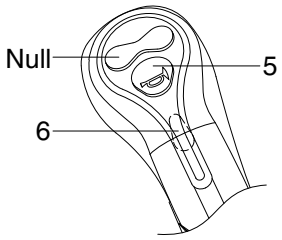
1. STRUCTURE

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

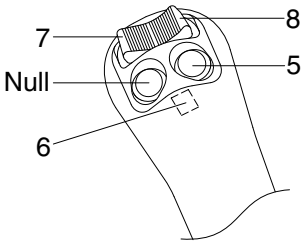
※ Refer to the parts manual for the types of the RCV lever.

1) TYPE M1, M10





TYPE M1, M10

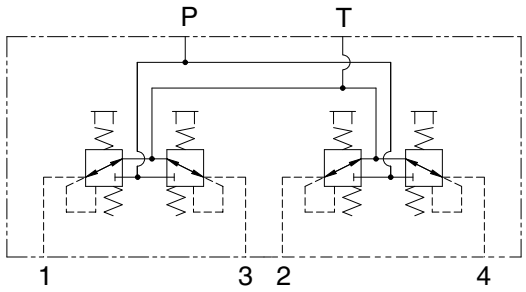


NONE

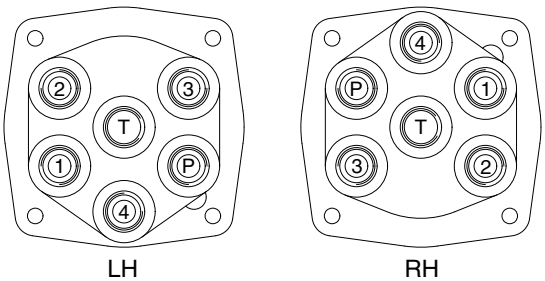
Switches

Type	No.	LH	RH
M1, M10	5	One touch decel	Horn
	6	Power boost	Breaker
None	5	One touch decel	Horn
	6	Power boost	Null
	7	CCW rotation	Close
	8	CW rotation	Open

※ Number 7 and 8 : Option attachment



Hydraulic circuit



LH RH

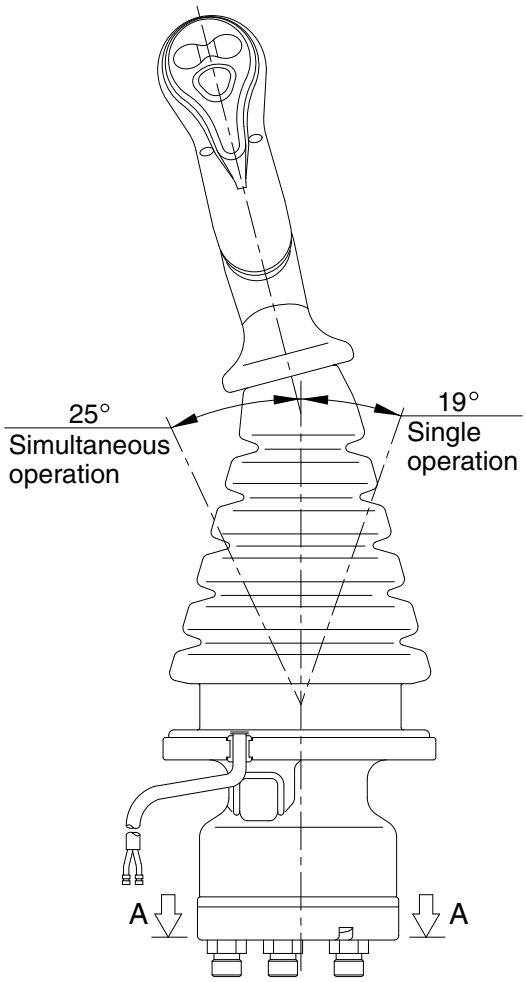
VIEW A-A

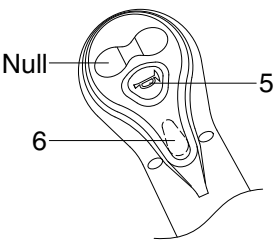
Pilot ports

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

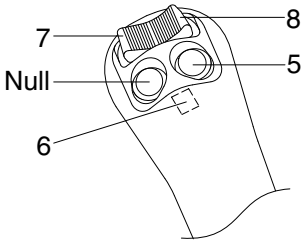
480A2RL01

2) TYPE M11, M12





TYPE M12

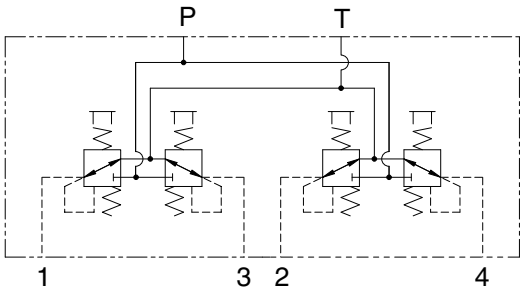


TYPE M11

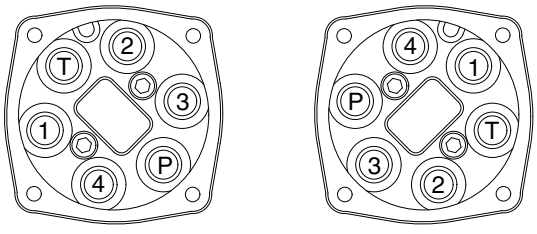
Switches

Type	No.	LH	RH
M12	5	One touch decel	Horn
	6	Power boost	Breaker
M11	5	One touch decel	Horn
	6	Power boost	Null
	7	CCW rotation	Close
	8	CW rotation	Open

※ Number 7 and 8 : Option attachment



Hydraulic circuit



LH RH

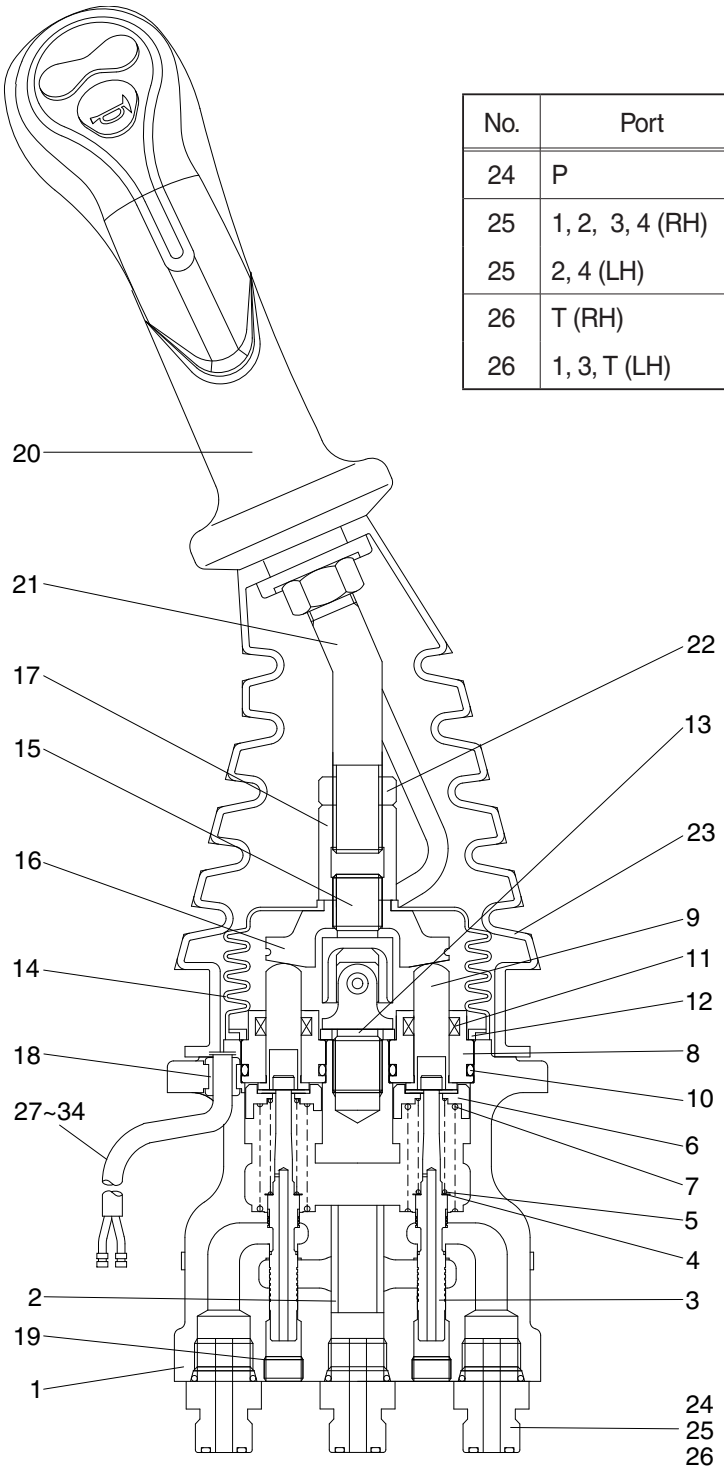
VIEW A-A

Pilot ports

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

480A2RL05

3) CROSS SECTION



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

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

210S2RL06

Item numbers are based on the type M1.

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

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

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

Item numbers are based on the type M1.

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

The spring (5) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (9) is inserted and can slide in the plug (8).

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

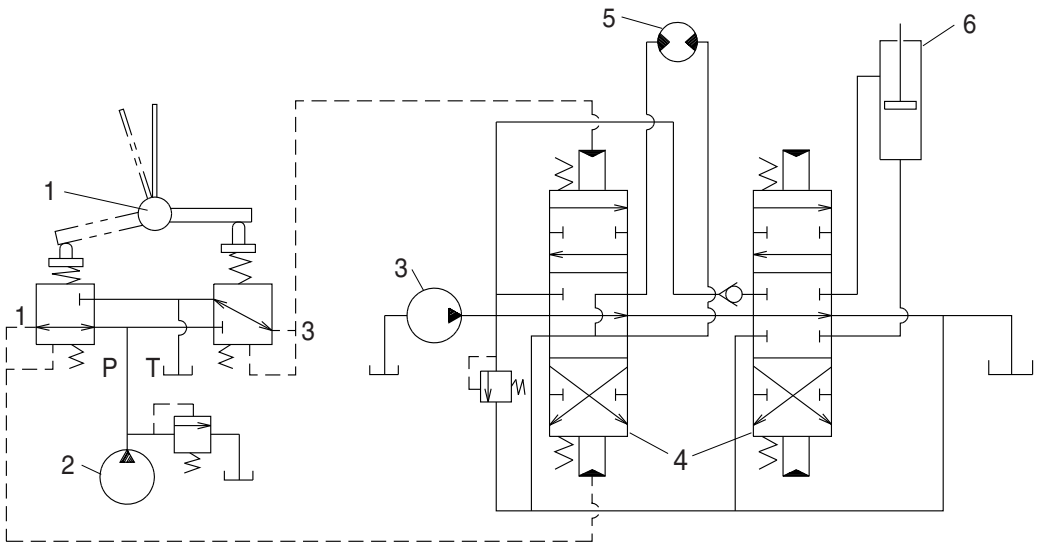
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

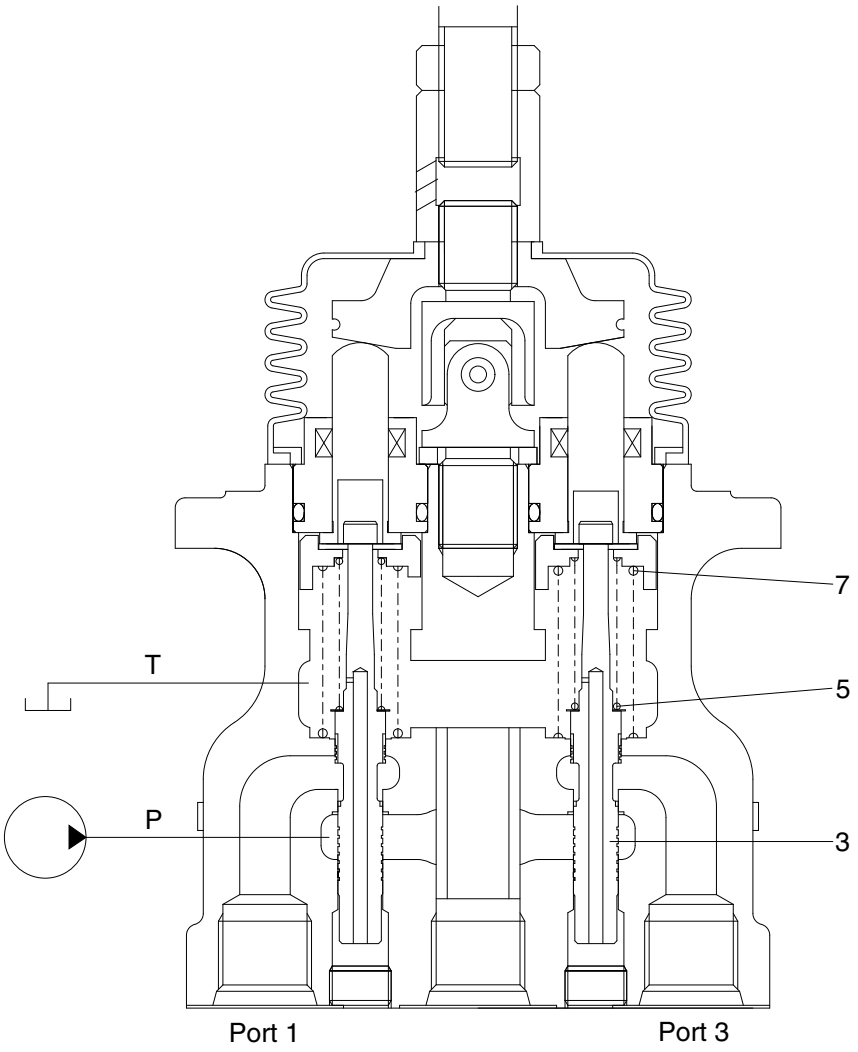
The diagram shown below is the typical application example of the pilot valve.



2-70

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

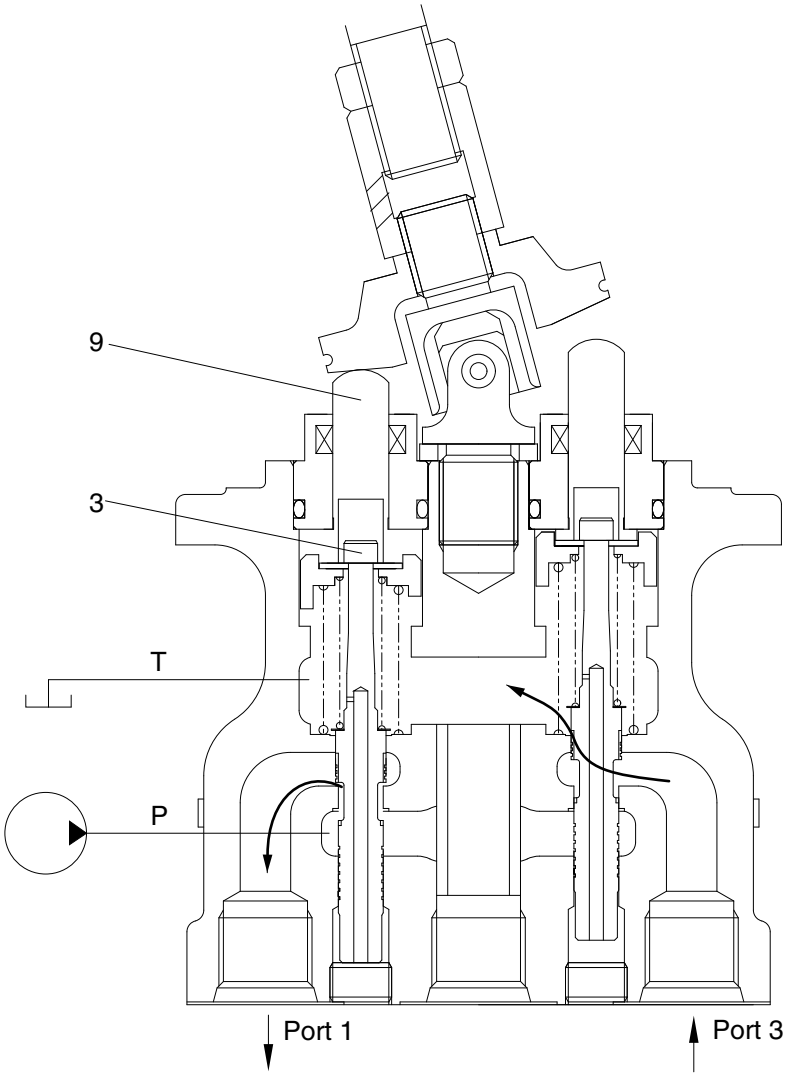
(1) Case where handle is in neutral position



300L2RL03

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

(2) Case where handle is tilted



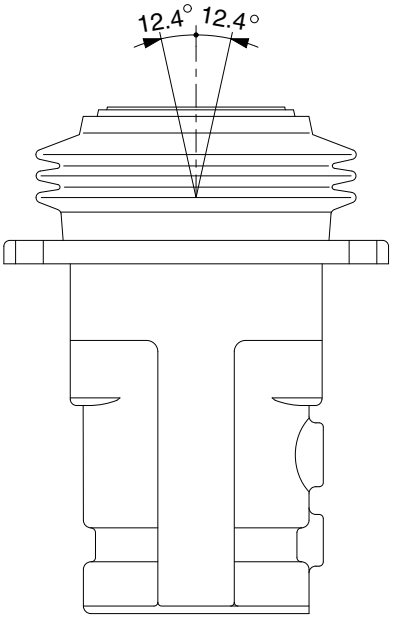
300L2RL04

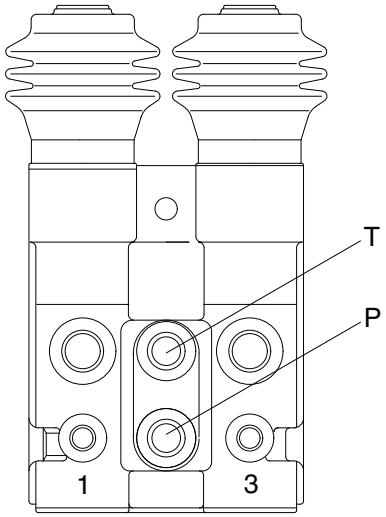
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (1). If it decreases lower than the set pressure, port P is connected with port (1) and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

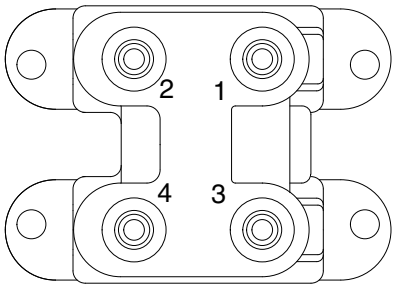
GROUP 6 RCV PEDAL

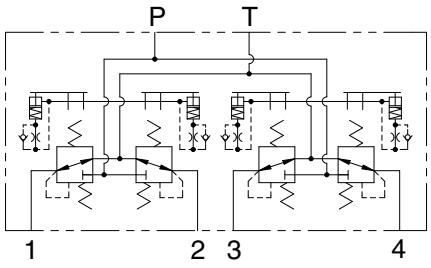
1. STRUCTURE

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









Hydraulic circuit

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

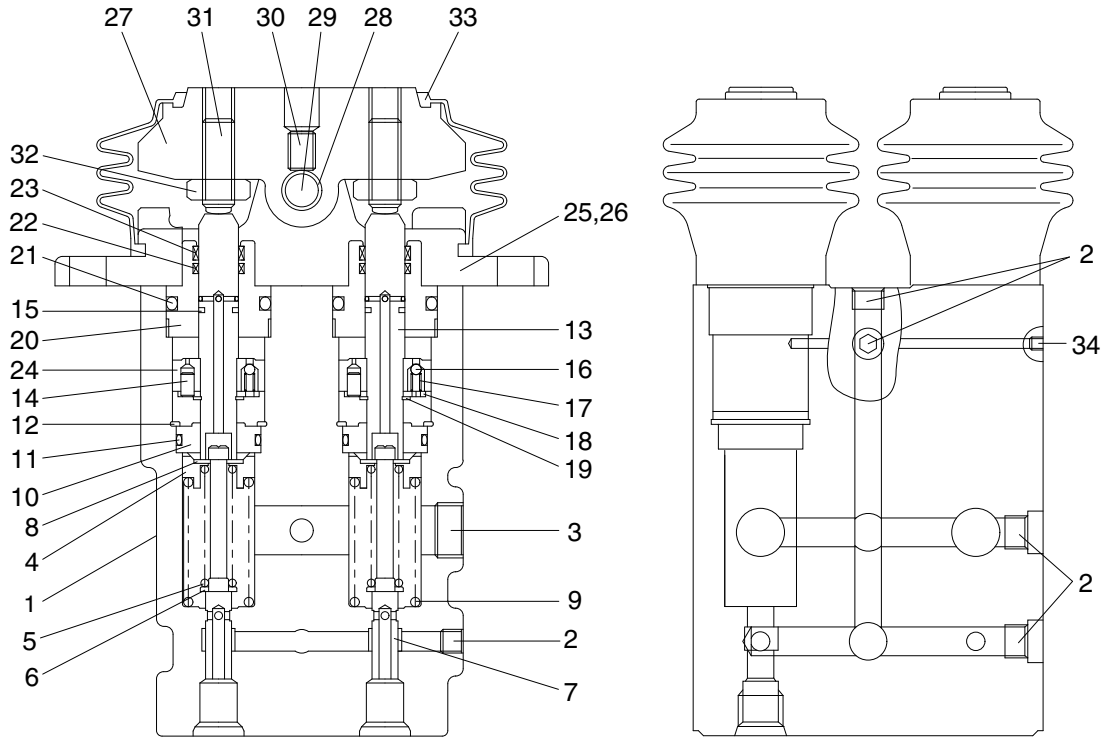
130ZF2RP01

CROSS SECTION

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

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

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



130ZF2RP02

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

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (7) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (5) works on this spool to determine the output pressure.

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

For the purpose of changing th displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

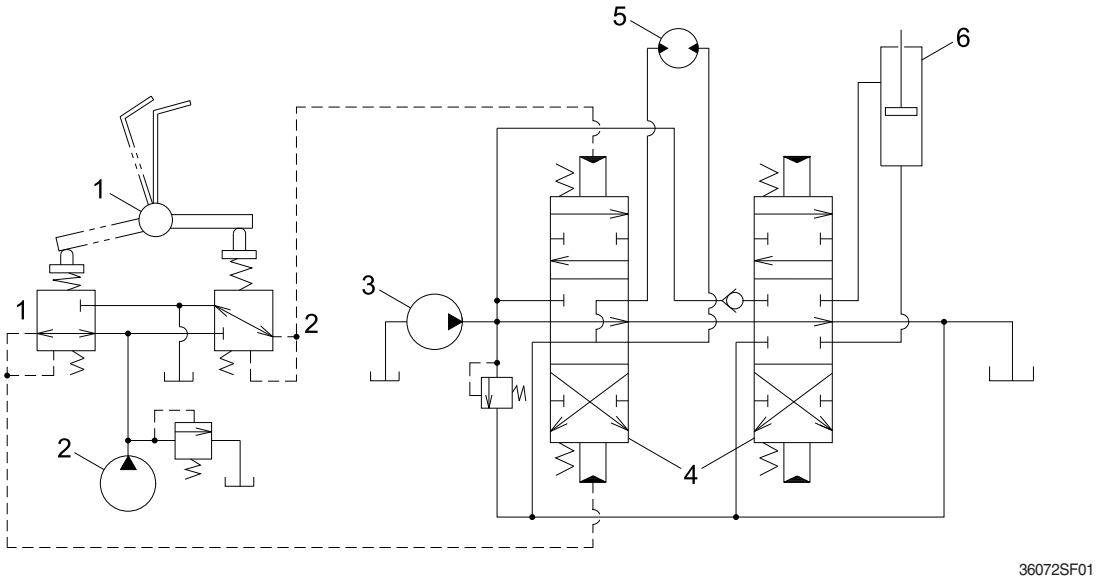
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

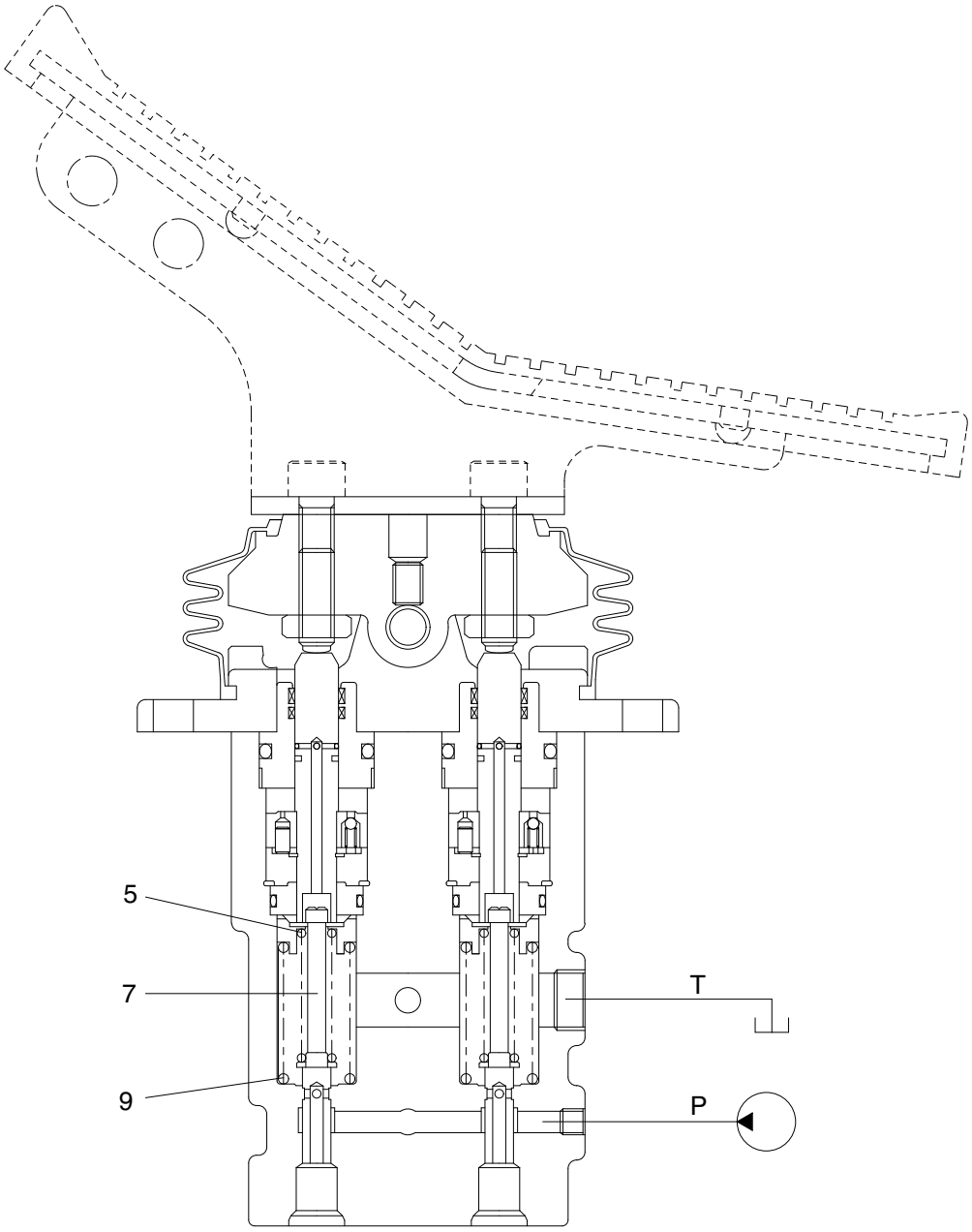
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

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



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

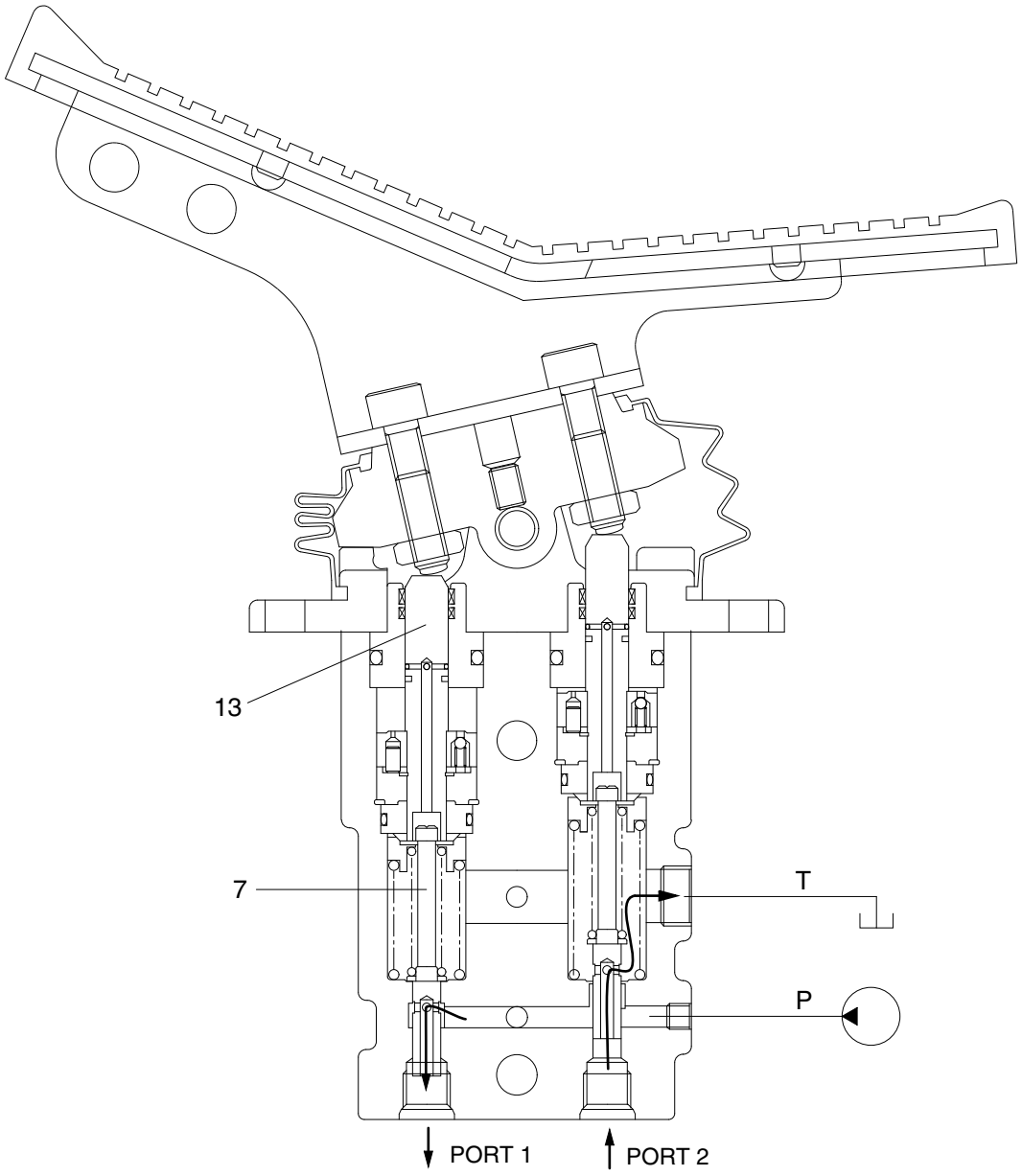
(1) Case where pedal is in neutral position



130ZF2RP03

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

(2) Case where pedal is tilted



220F2RP04

When the push rod (13) is stroked, the spool (7) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.

SECTION 3 HYDRAULIC SYSTEM

HYDRAULIC SYSTEM (OLD VERSION)

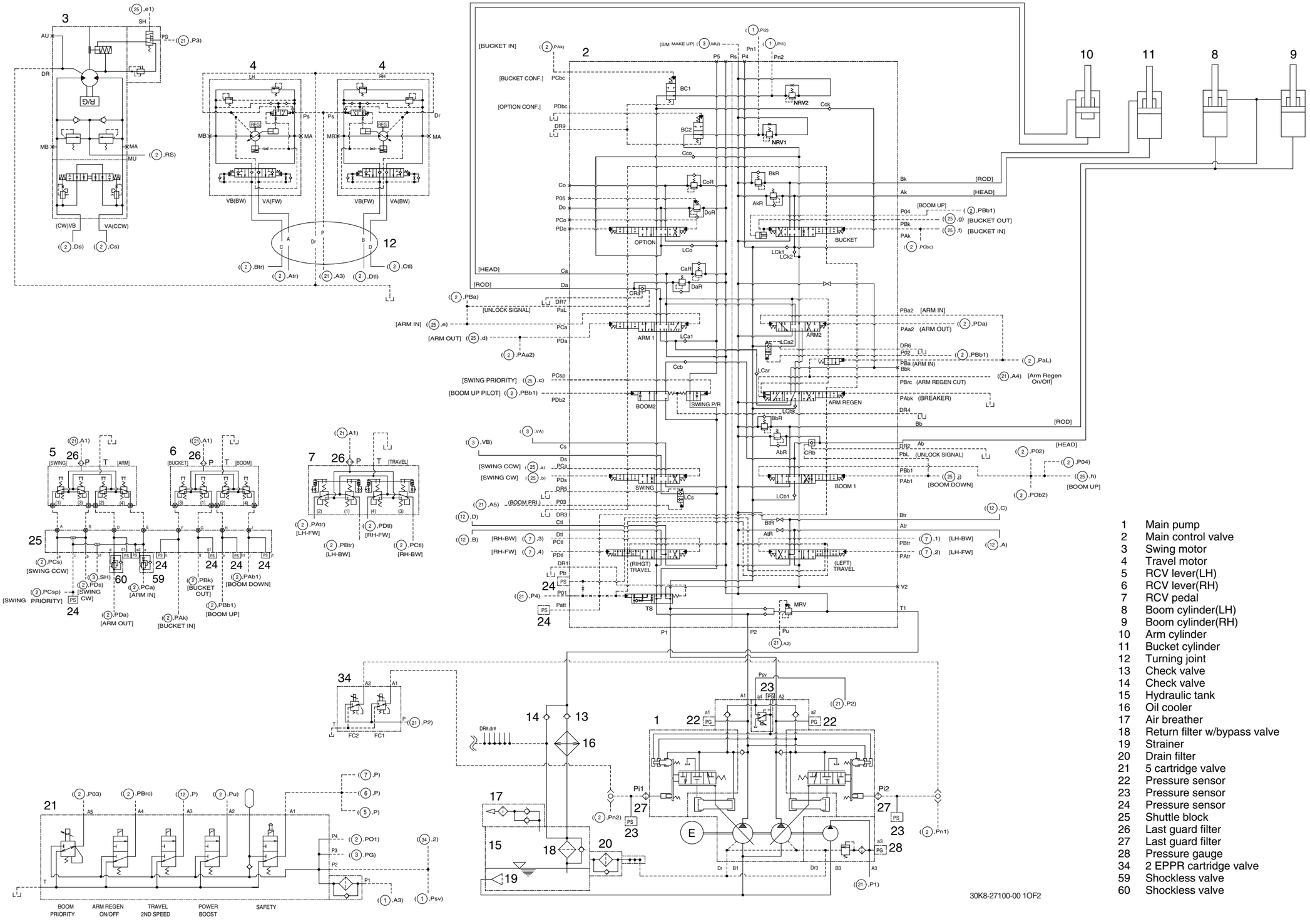
Group 1 Hydraulic Circuit ····· 3-1
Group 2 Main Circuit ····· 3-3
Group 3 Pilot Circuit ····· 3-6
Group 4 Single Operation ····· 3-19
Group 5 Combined Operation ····· 3-29

HYDRAULIC SYSTEM (CURRENT VERSION)

Group 1 Hydraulic Circuit ····· 3-38-1
Group 2 Main Circuit ····· 3-38-4
Group 3 Pilot Circuit ····· 3-38-7
Group 4 Single Operation ····· 3-38-20
Group 5 Combined Operation ····· 3-38-30

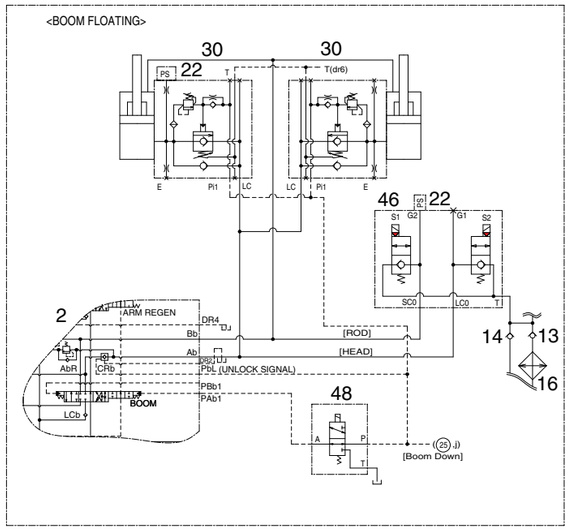
GROUP 1 HYDRAULIC CIRCUIT (OLD VERSION)

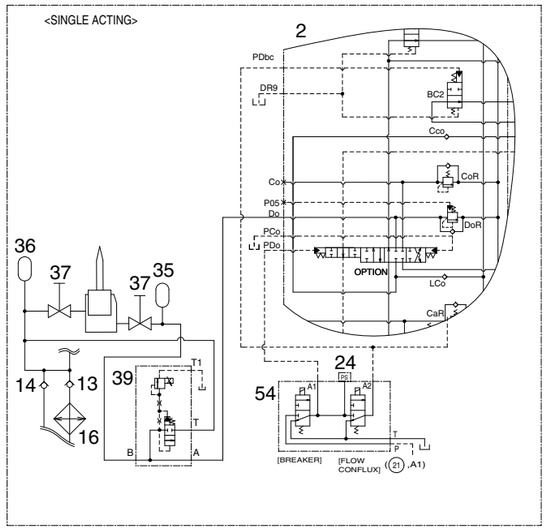
1. HYDRAULIC CIRCUIT (1/2)

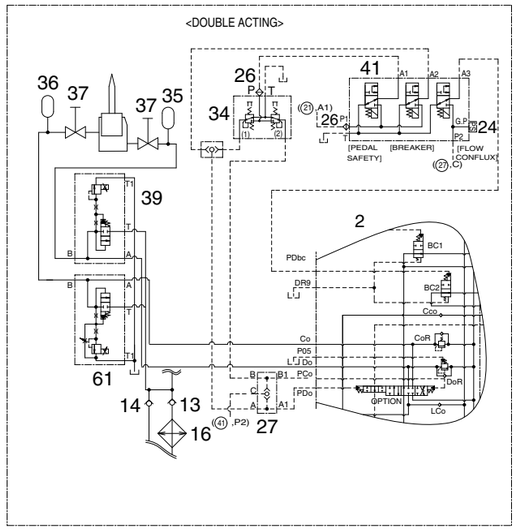


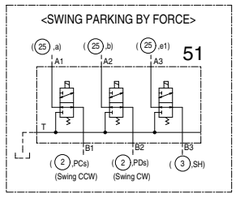
1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever(LH)
6 RCV lever(RH)
7 RCV pedal
8 Boom cylinder(LH)
9 Boom cylinder(RH)
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
13 Check valve
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Return filter w/bypass valve
19 Strainer
20 Drain filter
21 5 cartridge valve
22 Pressure sensor
23 Pressure sensor
24 Pressure sensor
25 Shuttle block
26 Last guard filter
27 Last guard filter
28 Pressure gauge
34 2 EPPR cartridge valve
59 Shockless valve
60 Shockless valve

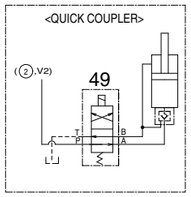
2. HYDRAULIC CIRCUIT (2/2)

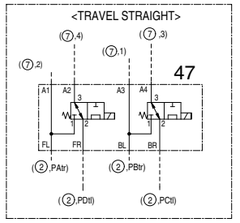


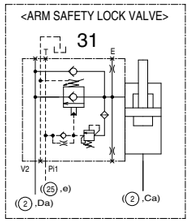


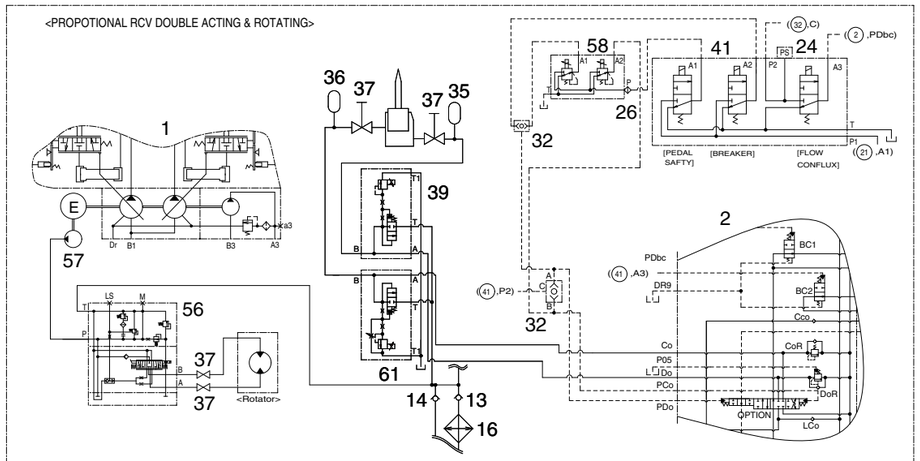


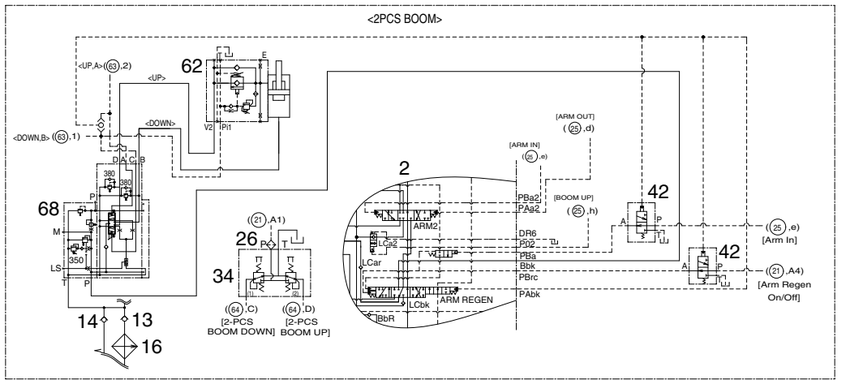


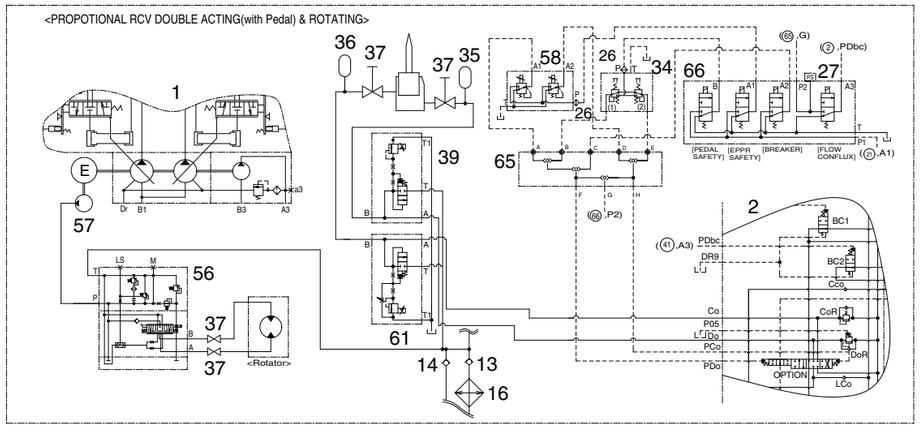


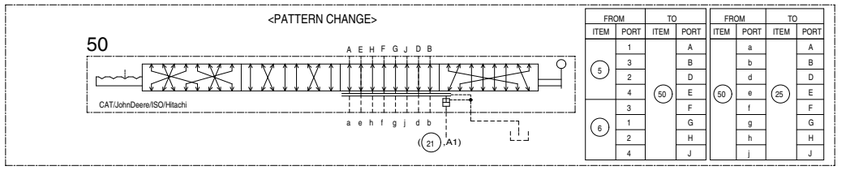






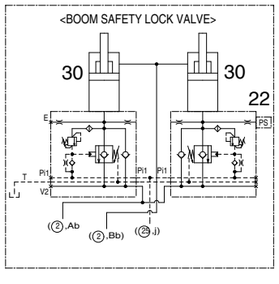


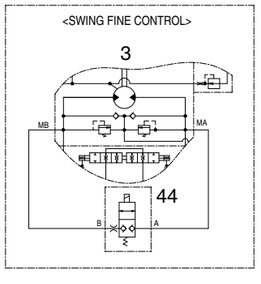




FROM		TO	
ITEM	PORT	ITEM	PORT
5	1	50	A
	3		B
	2		D
	4		E
6	3		F
	1		G
	2		H
	4		J

FROM		TO	
ITEM	PORT	ITEM	PORT
50	a	25	A
	b		B
	d		D
	e		E
	f		F
	g		G
	h		H
	j		J





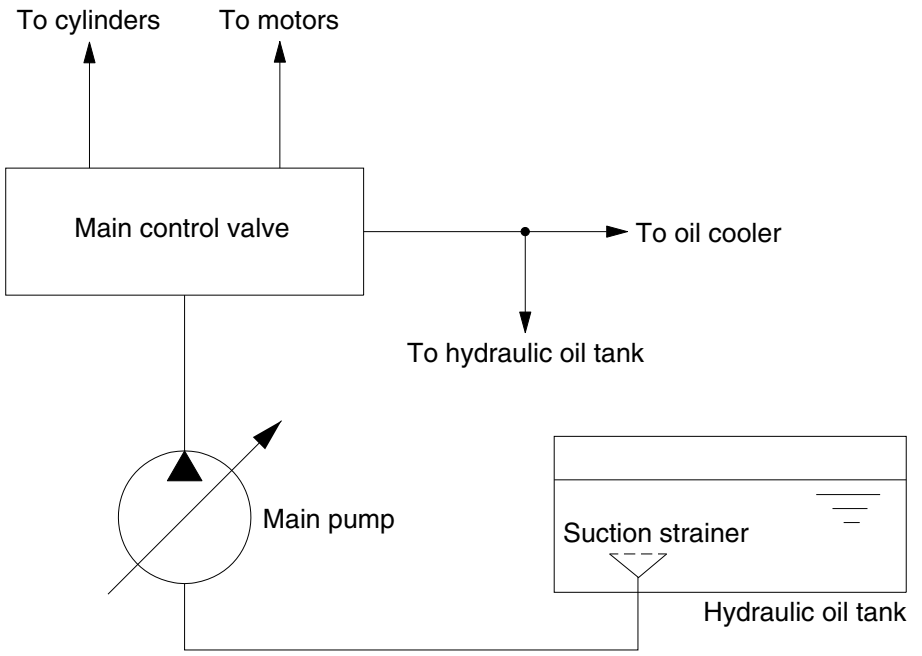
1 Main pump
2 Main control valve
3 Swing motor
8 Boom cylinder(LH)
9 Boom cylinder(RH)
10 Arm cylinder
13 Check valve
14 Check valve
16 Oil cooler
22 Pressure sensor
24 Pressure sensor
26 Last guard filter
27 5 shuttle assy(option)
30 Boom safety valve(option)
31 Arm safety valve(option)
34 2 way pedal(option)
35 Accumulator(option)
36 Accumulator(option)
37 Stop valve(option)
39 Proportional relief valve(option)
41 Solenoid valve(option)
42 Pilot selector valve(option)
44 Solenoid valve(option)
46 Float cartridge valve(option)
47 Solenoid valve(option)
48 Solenoid valve(option)
49 Solenoid valve(option)
50 Pattern change valve(option)
51 Solenoid valve(option)
56 Proportional valve(option)
57 Gear pump(option)
58 2-EPPR valve(option)
61 Proportional relief valve(option)
62 Boom safety valve(option)
63 Solenoid valve(option)
65 Shuttle block(option)
66 Solenoid valve(option)
68 Control valve(option)

30K8-27100-00 2OF2A

GROUP 2 MAIN CIRCUIT (OLD VERSION)

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

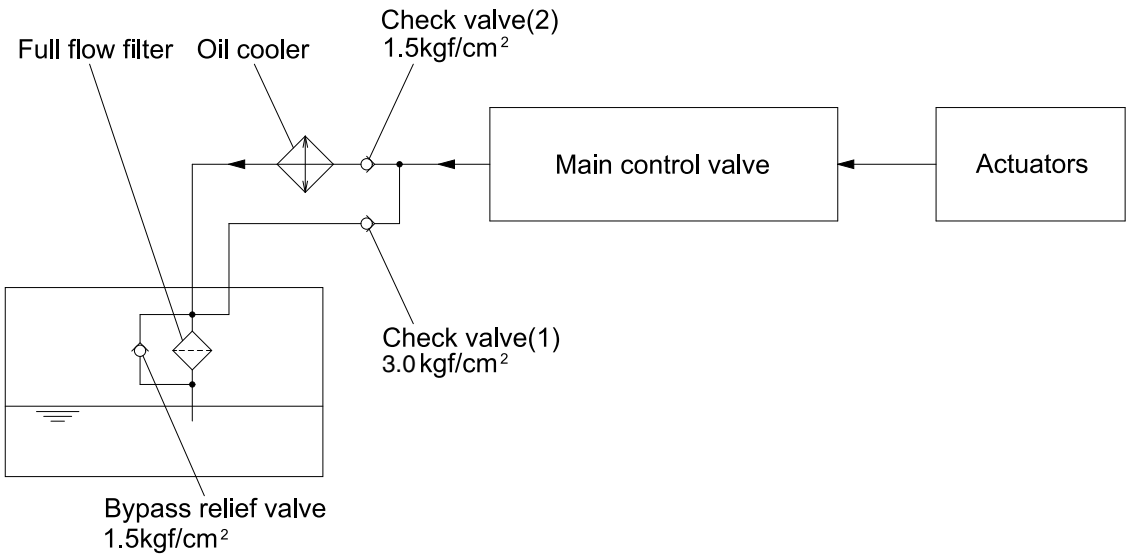


140L3CI01

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

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

2. RETURN CIRCUIT



220F3CI01

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 1.5 kgf/cm² (21 psi) and 3.0 kgf/cm² (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. The oil pressure exceeds 3.0 kgf/cm² (43 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).

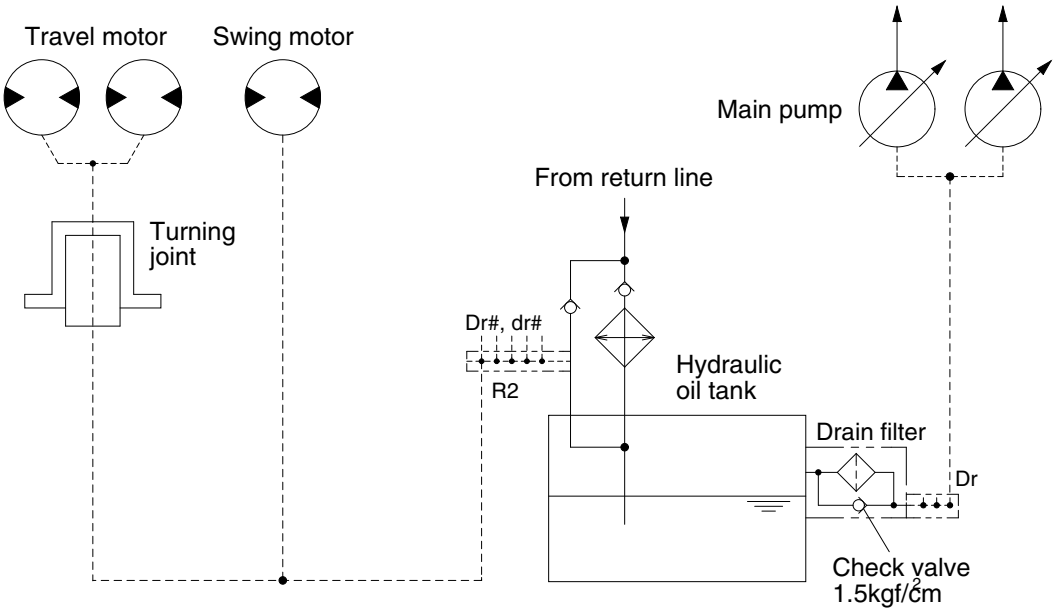
The full-flow filter and bypass relief valve are provided in the hydraulic tank.

The oil 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 1.5 kgf/cm² (21 psi) differential pressure.

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

3. DRAIN CIRCUIT



300A3CI02

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

1) TRAVEL AND SWING MOTOR DRAIN CIRCUIT

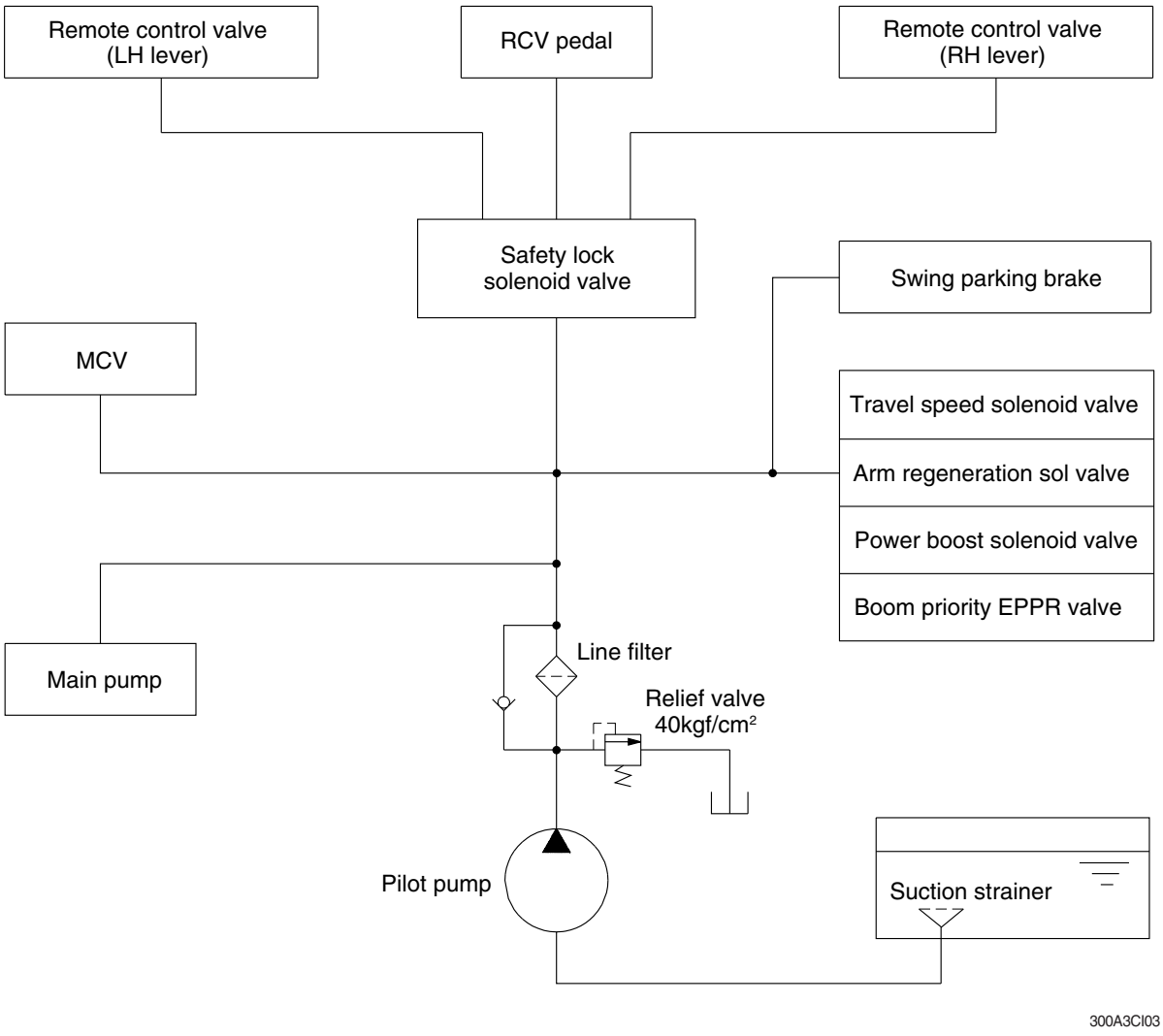
Oil leaking from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and join with oil leak line of the swing motor and return to the hydraulic tank after being filtered by return filter.

2) MAIN PUMP DRAIN CIRCUIT

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

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

GROUP 3 PILOT CIRCUIT (OLD VERSION)



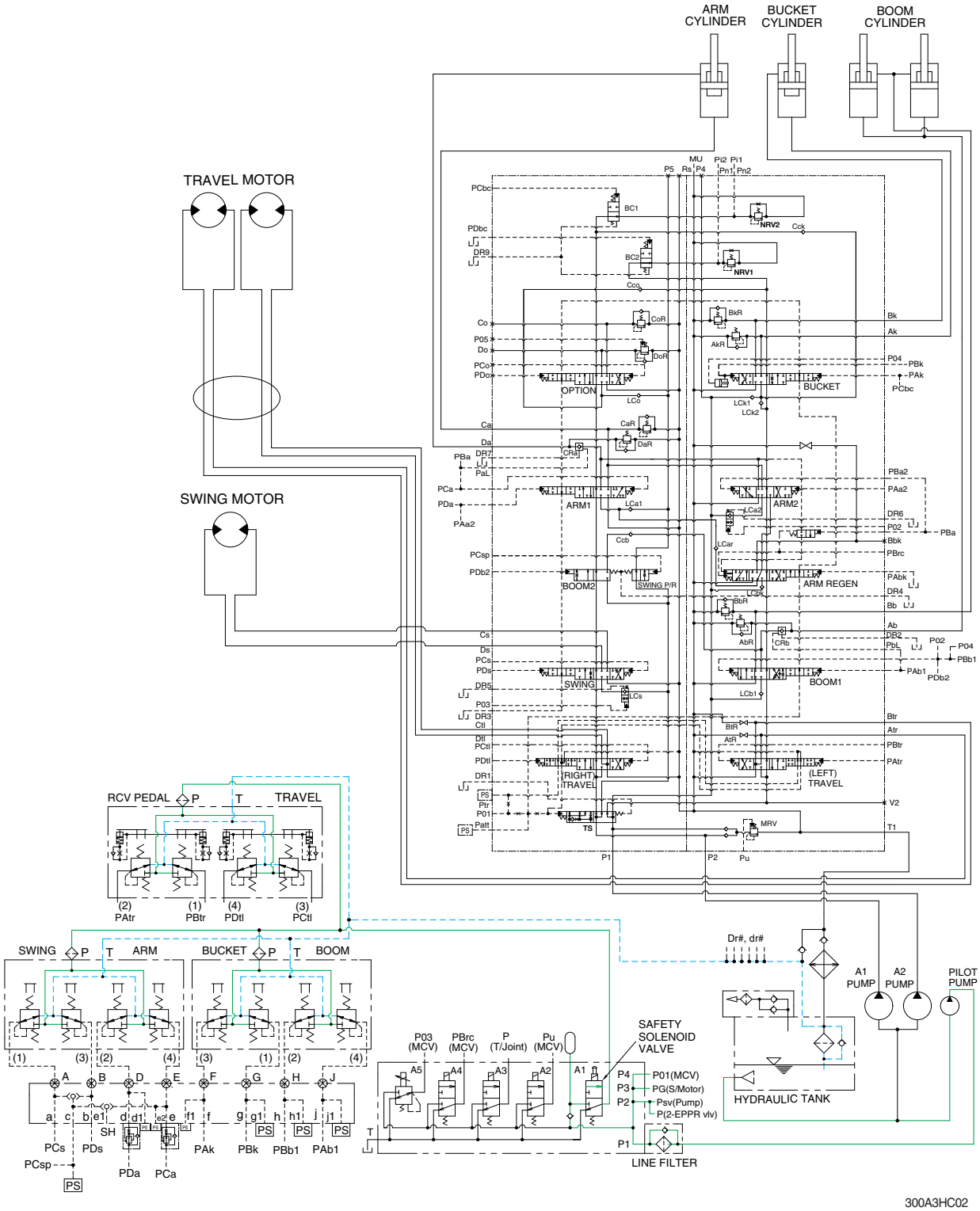
The pilot circuit consists of suction circuit, delivery circuit and return circuit.

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

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

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



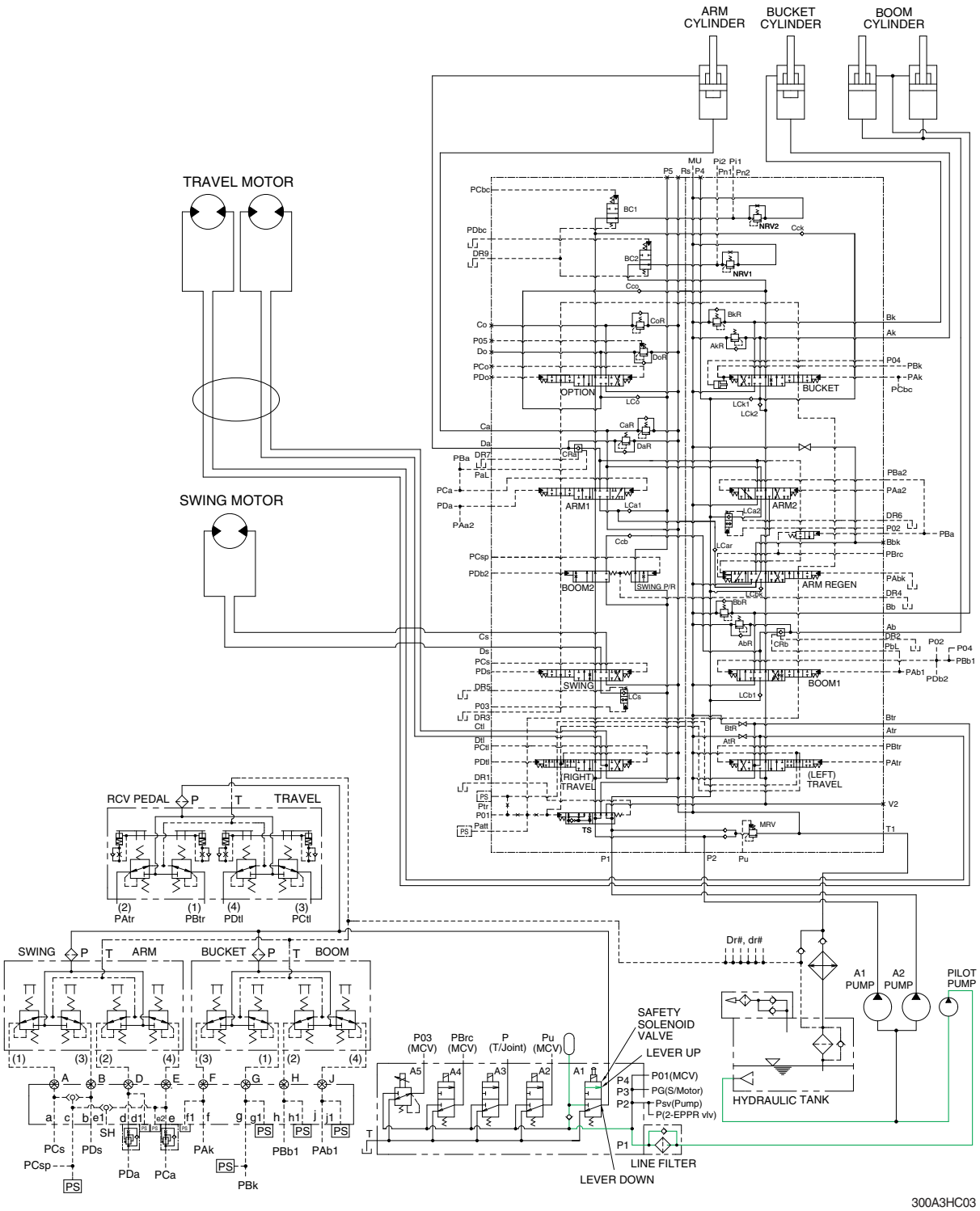
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

The return oil flow into the hydraulic tank through return filter.

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

2. SAFETY VALVE (SAFETY LEVER)

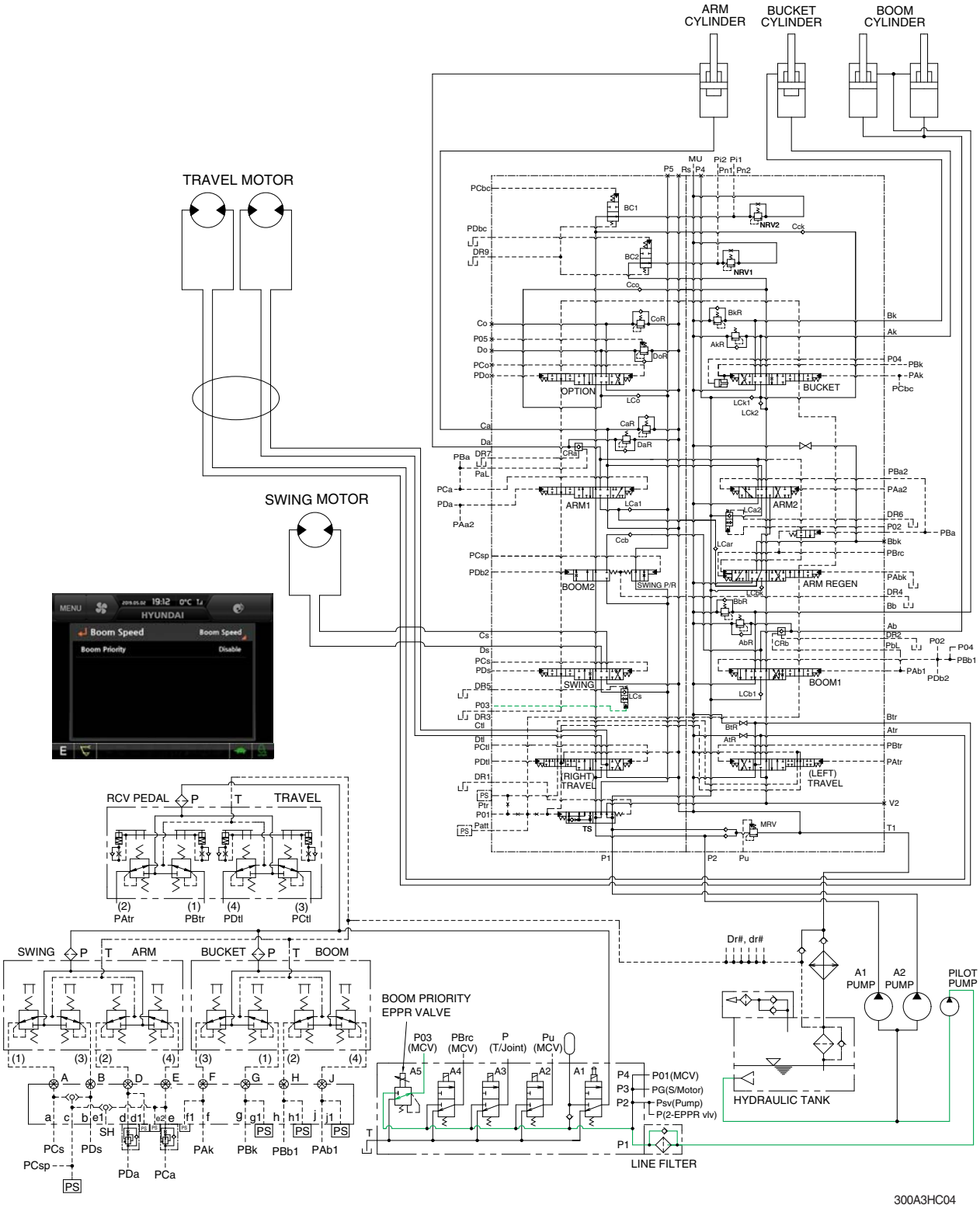


When the lever of the safety solenoid valve is moved upward, oil flows into the remote control valve through solenoid valve and line filter.

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

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

3. BOOM PRIORITY SYSTEM



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

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

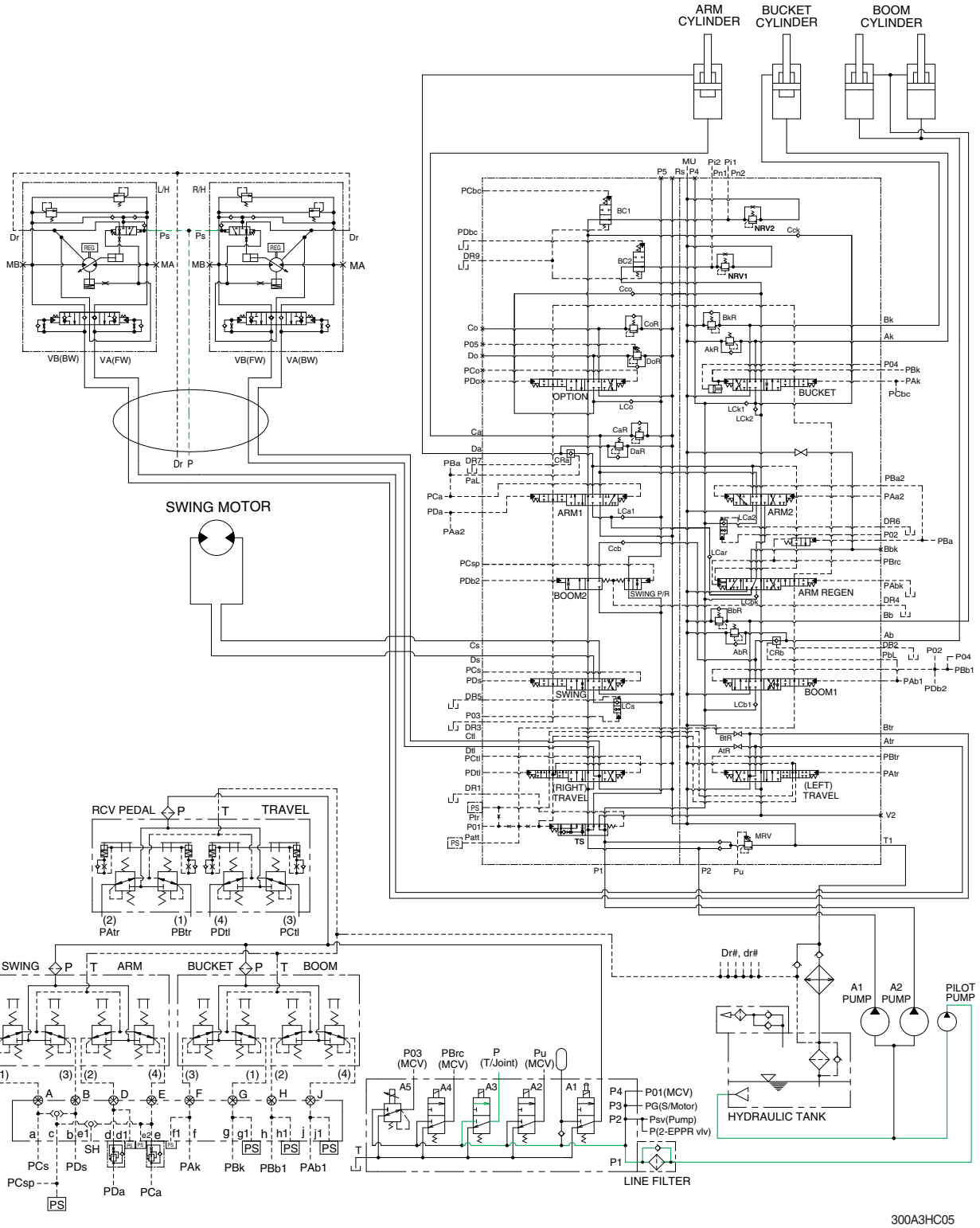
The pilot oil from pilot pump flow into **P03** port in main control valve through boom priority EPPR valve. **P03** oil pressure moves swing reducing spool to lower position and oil flow rate to the swing motor decreased.

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

The boom up speed can be adjusted by the cluster. Refer to page 3-19 of the operator's manual.

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

4. TRAVEL SPEED CONTROL SYSTEM

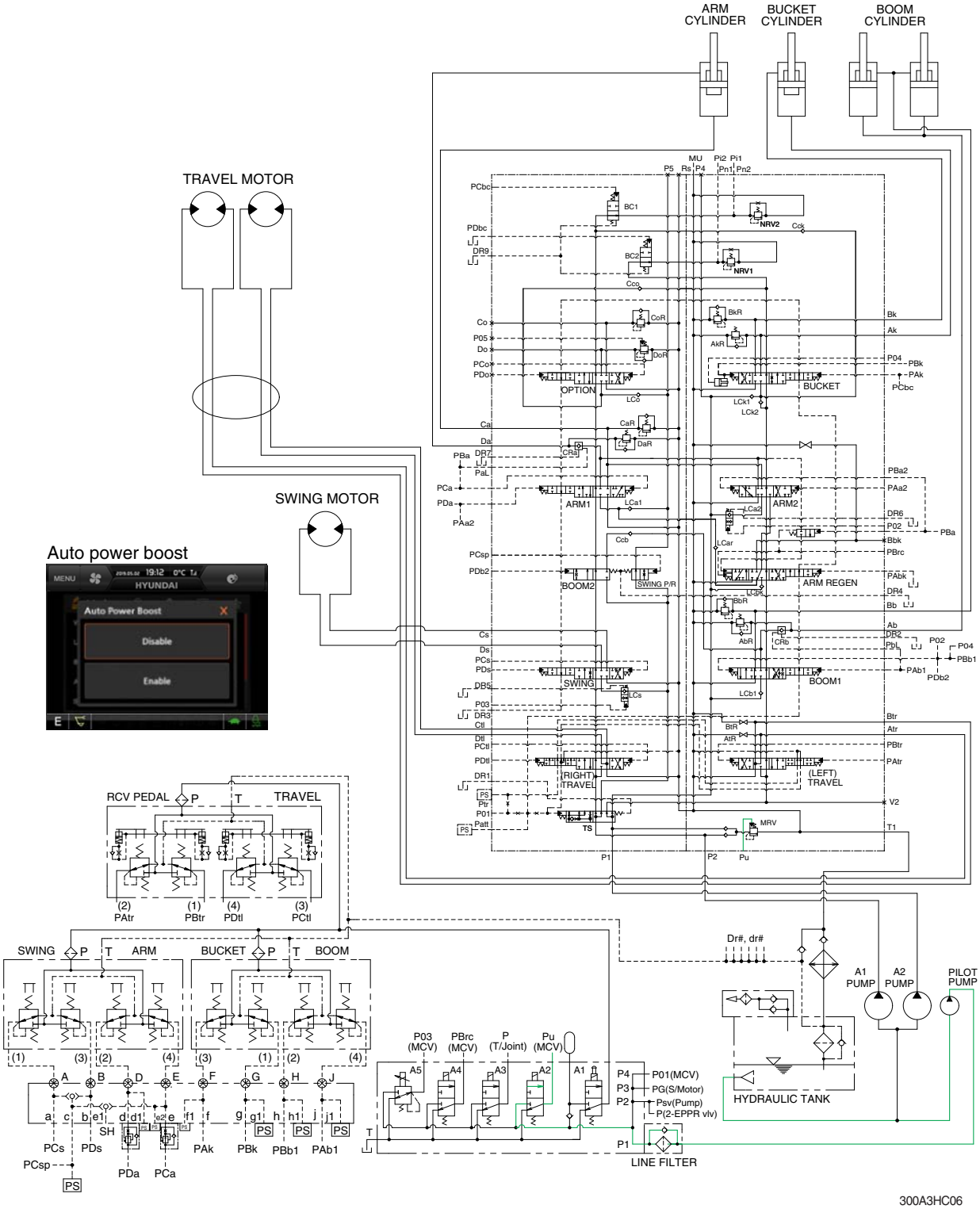


When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston is pushed, thus minimizing the displacement.

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

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

5. MAIN RELIEF PRESSURE CHANGE SYSTEM



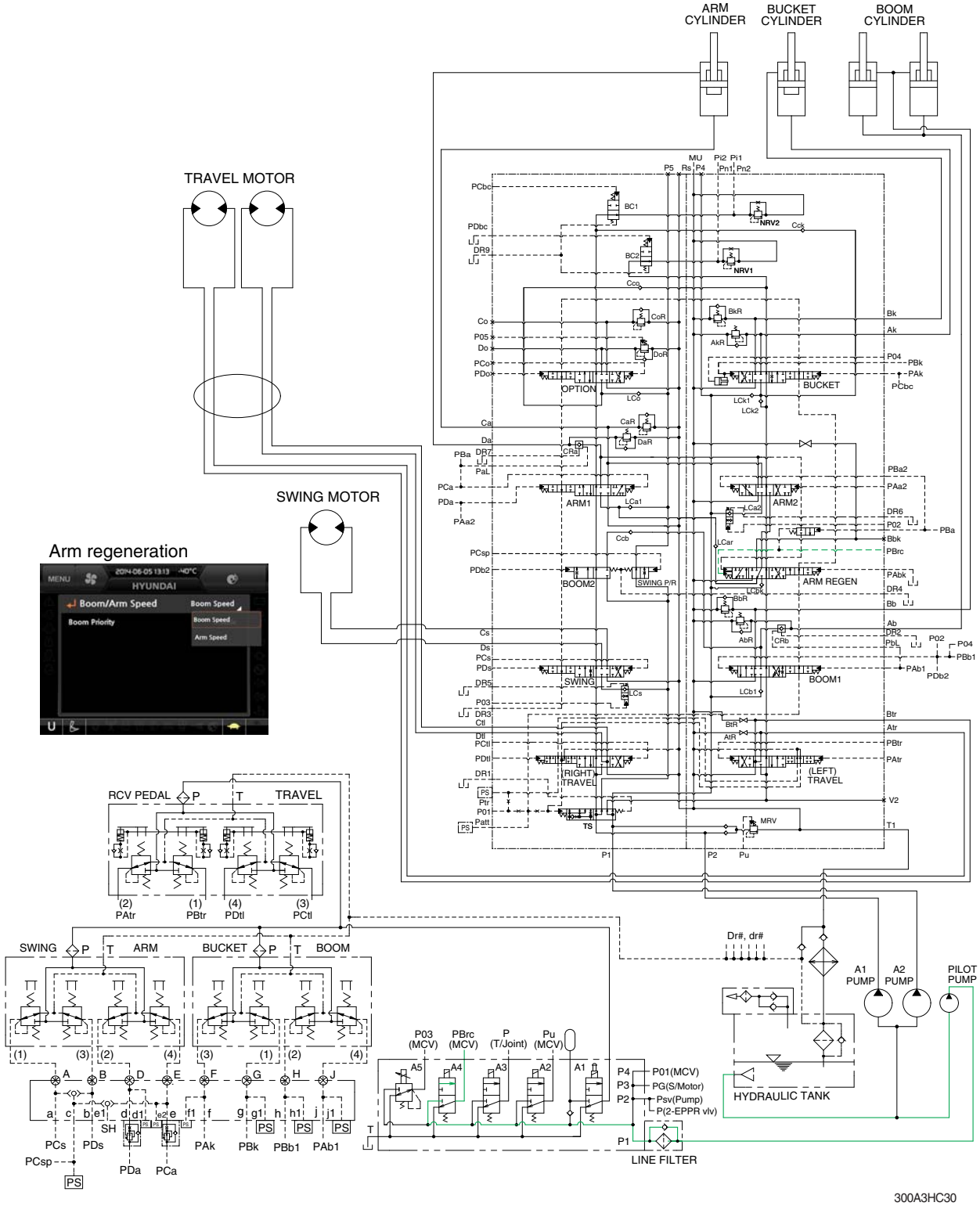
When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pu** port of the main relief valve of main control valve; then the setting pressure of the main relief valve is raised from 350 kgf/cm² (4980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

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

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

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

6. ARM REGENERATION CUT SYSTEM



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

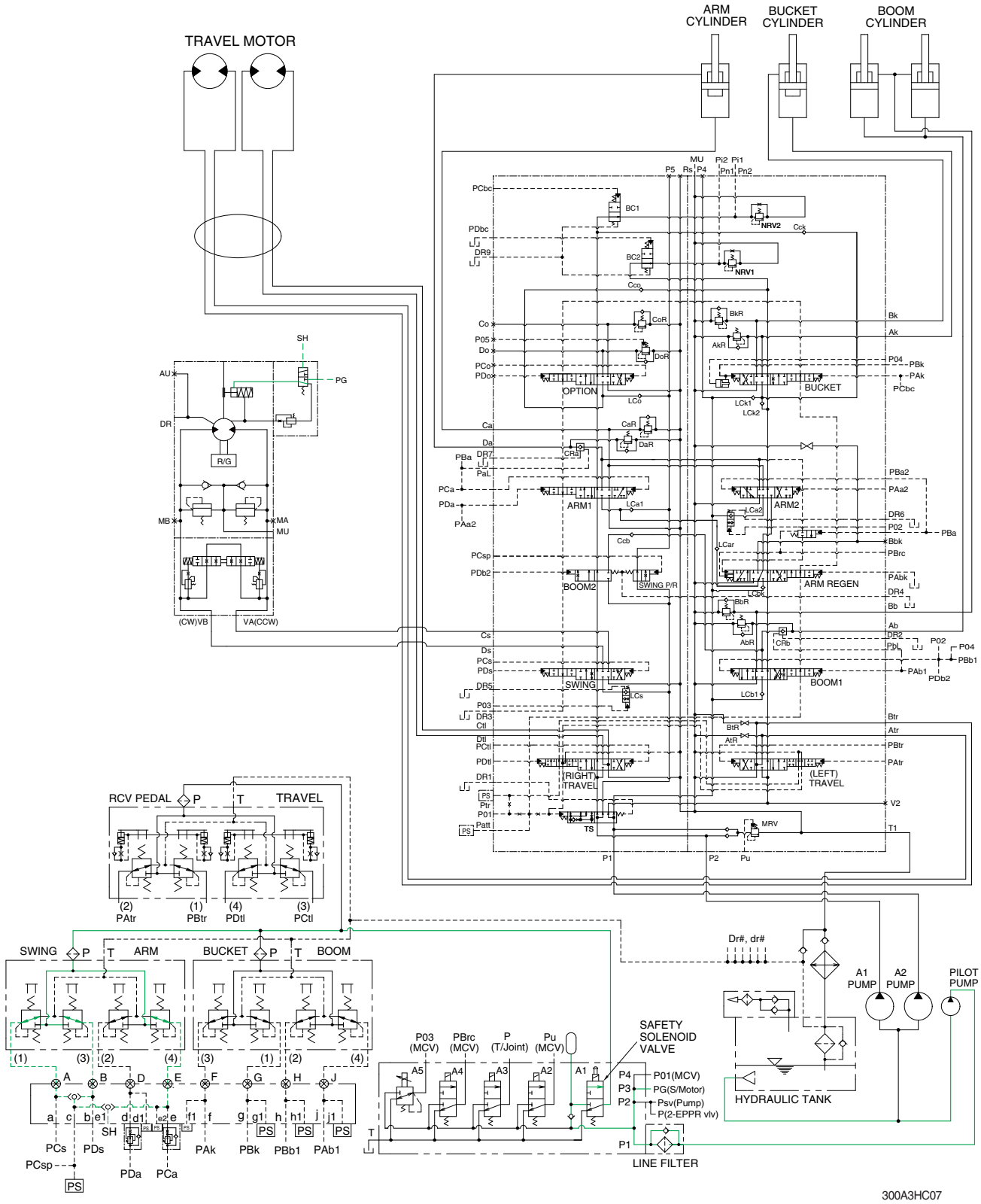
Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

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

Refer to page 2-45, 46 for the arm regeneration function.

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

7. SWING PARKING BRAKE RELEASE

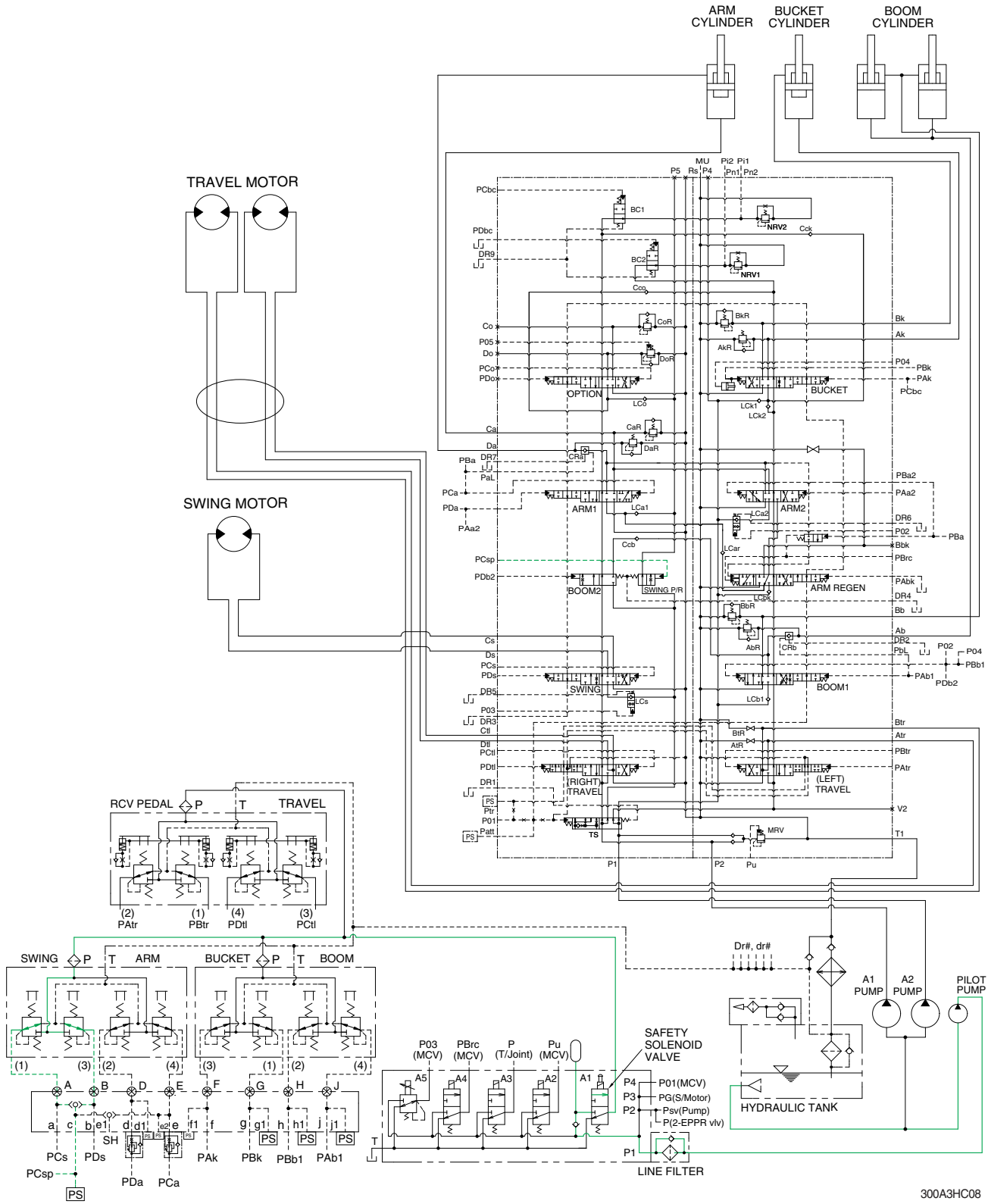


When the RCV lever (swing or arm in) is tilted, the pilot oil flows into **SH** port through shuttle valve. This pressure moves spool of the swing brake valve so, discharged oil from pilot valve flows to swing motor **PG** port. This pressure is applied to swing motor disc, thus the brake is released.

When the RCV lever (swing or arm in) is set in the neutral position, oil in the swing motor disc cylinder is drained, thus the brake is applied.

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

8. SWING PRIORITY SYSTEM



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

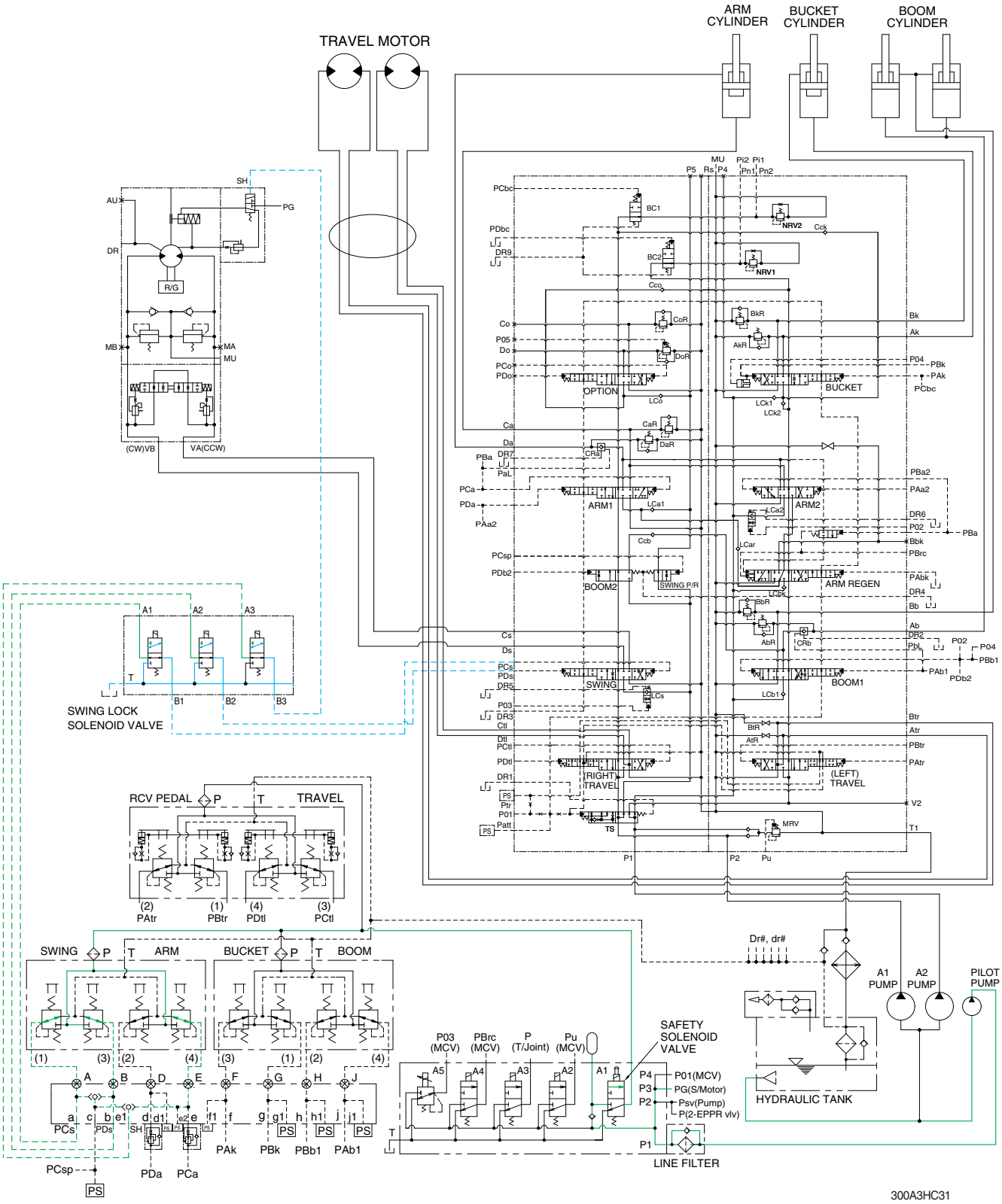
PCsp pressure from the swing shuttle block change the swing priority spool and decreases the oil flow rate to the next section to make the swing operation most preferential.

This is called the swing priority system.

For details, refer to page 2-51.

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

9. SWING LOCK SYSTEM

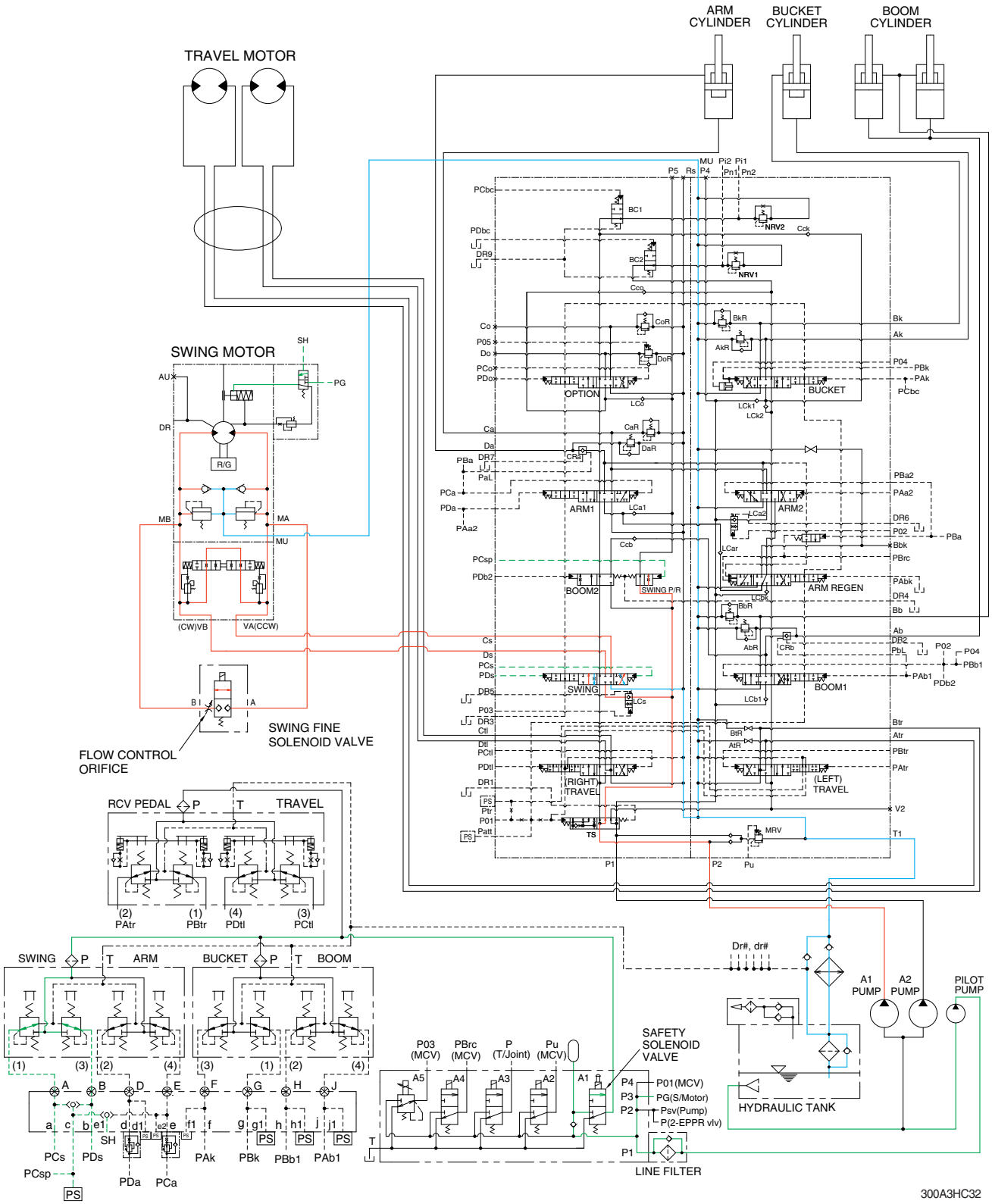


When the swing lock switch on the switch panel is pressed ON position, the swing lock solenoid valves are activated. The pilot oil from swing remote control valve to the swing spool and swing brake release shut off and the swing spool and swing brake release pilot LOCK port connect to the hydraulic tank.

Then swing operation is not available.

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

10. FREE/FINE SWING SYSTEM

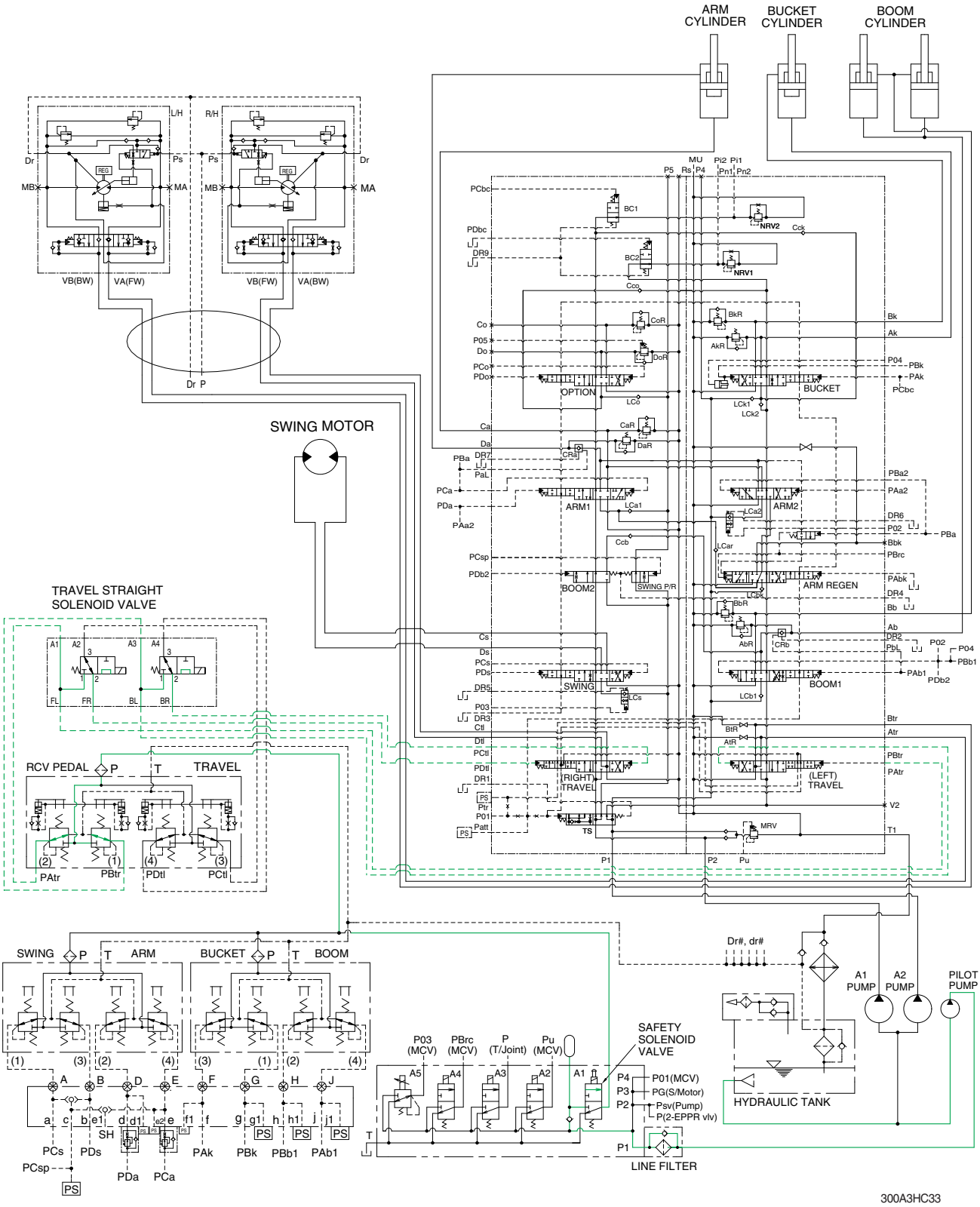


When the free/fine swing switch on the switch panel is pressed ON position, the swing fine solenoid valve is activated . The main pump side passage of the swing motor is connected to the return passage and some oil of the pump passage flows to the return passage through the swing fine solenoid and the flow oil quantity controlled by orifice.

Then free/fine swing operation is available.

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

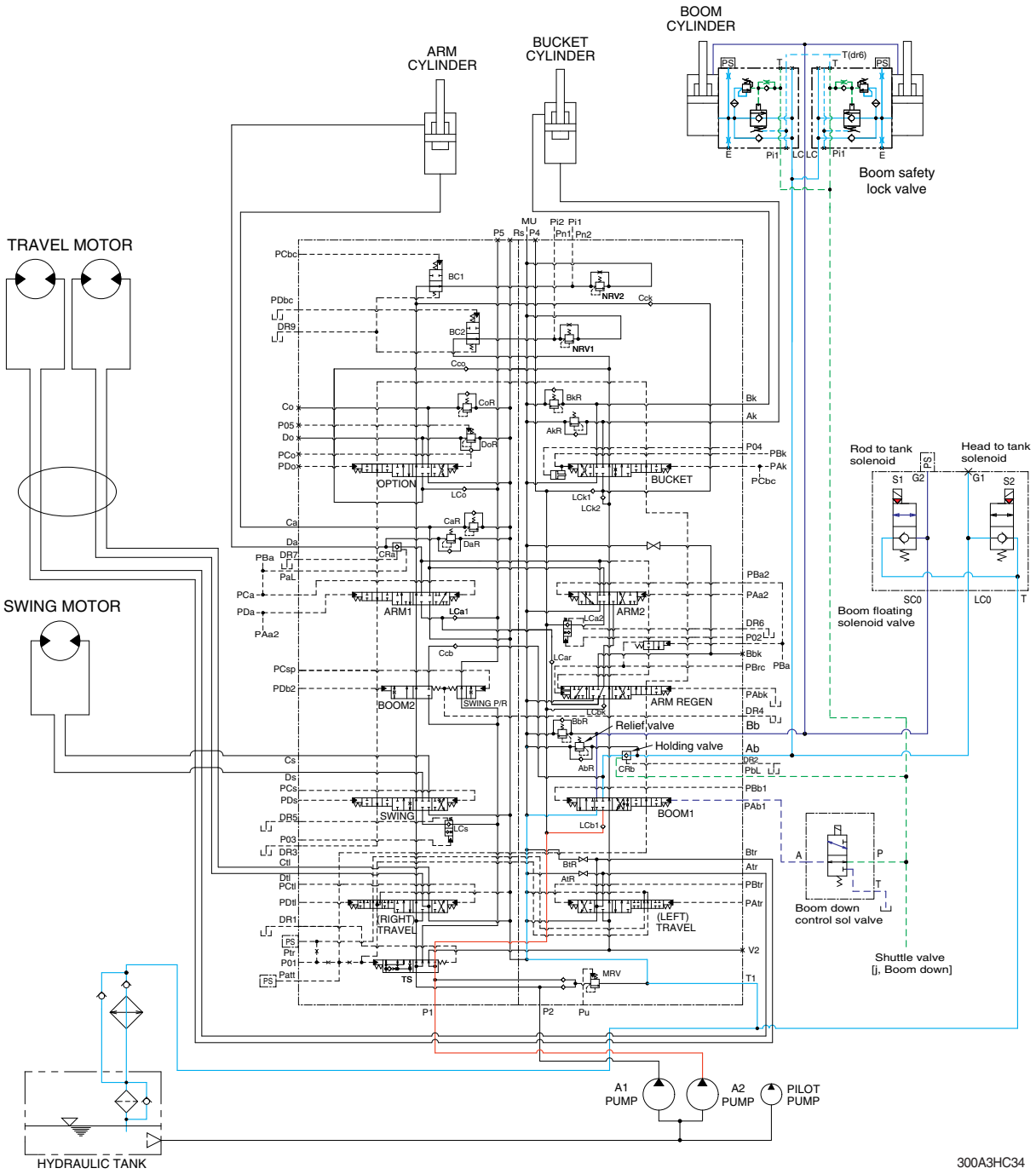
11. TRAVEL STRAIGHT SYSTEM



When the travel straight switch on the switch panel is pressed ON position, the travel straight solenoid valves are activated . The pilot oil from the left travel control valve flow into the left travel spool and right travel spool by the internal connection of the travel straight solenoid valve.
Then the travel straight operation is available by the left travel pedal.

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

12. BOOM FLOATING SYSTEM

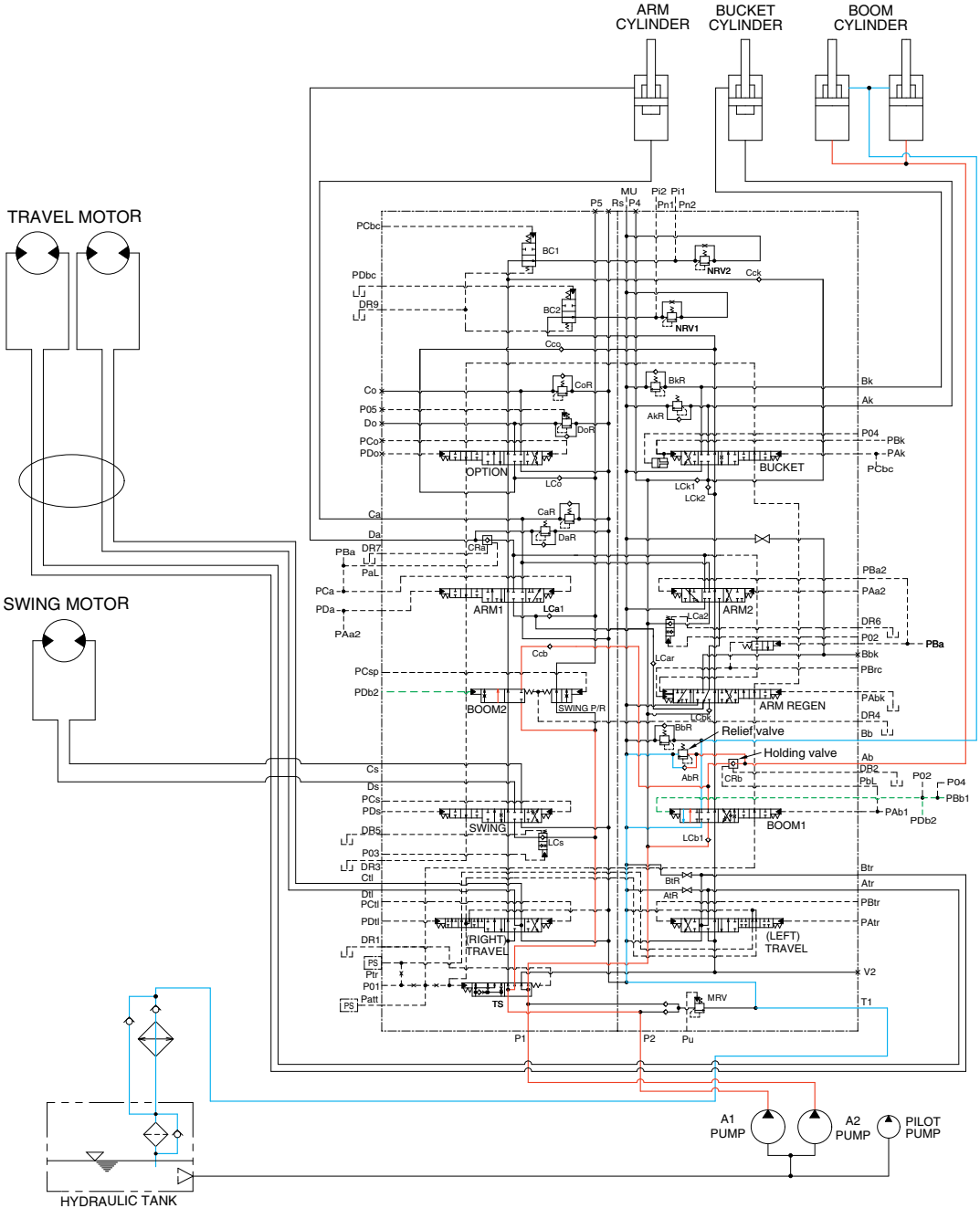


Smooth and convenient boom movement is accomplished by only arm control lever operation.
The boom floating solenoid values are equipped in the rod and head of boom cylinder that are controlled to act as floating mode.
"Rod to tank solenoid" and "Head to tank solenoid" are active. So the hydraulic oil of rod and head goes to tank, and floating is accomplished. In the mode, boom down cut-off solenoid is active so that boom down pilot pressure is cut.
For more details, refer to page 5-13.

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

GROUP 4 SINGLE OPERATION (OLD VERSION)

1. BOOM UP OPERATION



When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure (PBb1, PDb2) from the remote control valve.

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

At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom 1 spool in the main control valve. When this happens, the boom goes up.

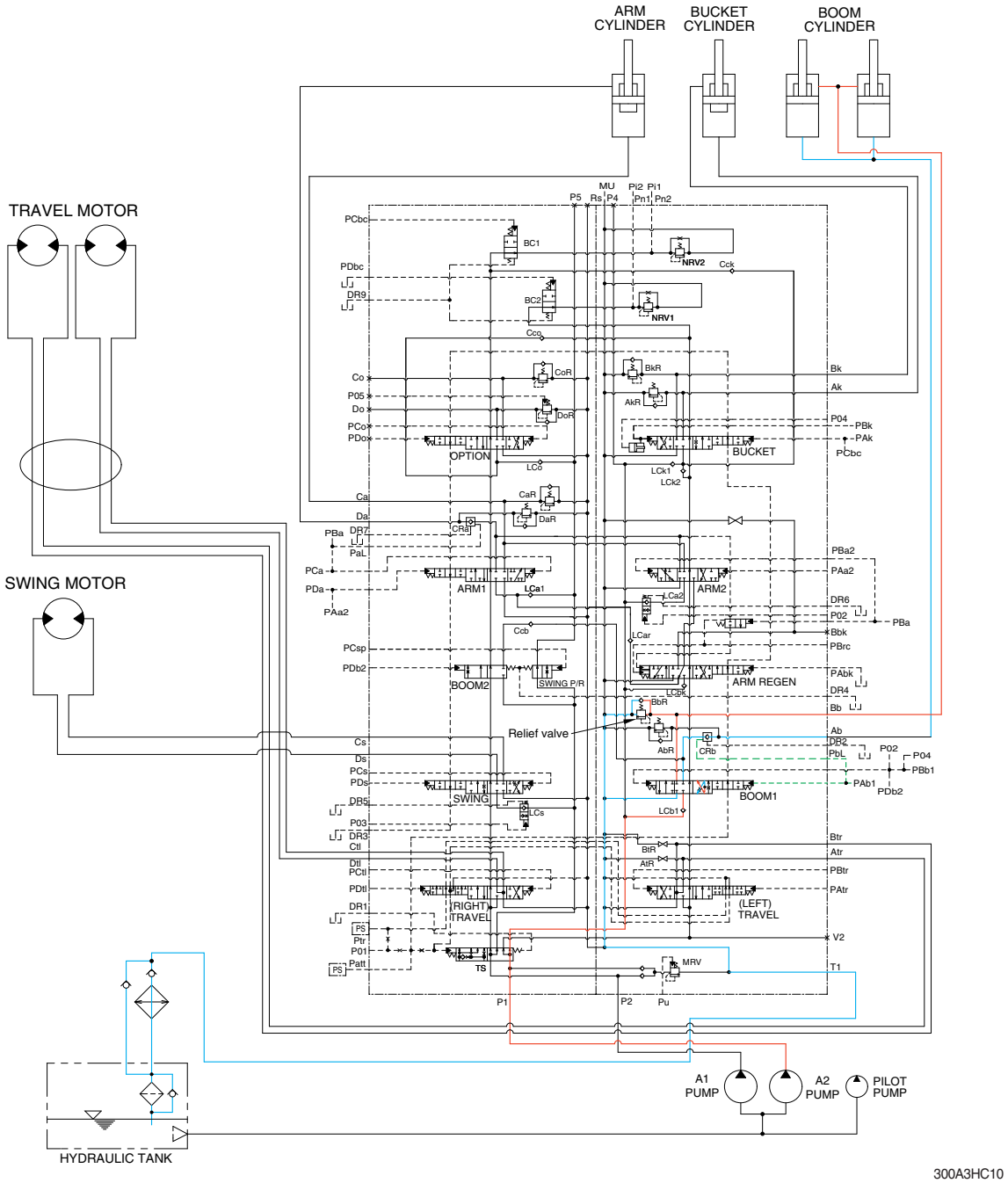
The excessive pressure in the boom cylinder head side is prevented by relief valve.

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

This prevents the hydraulic drift of boom cylinder.

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

2. BOOM DOWN OPERATION



When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure (PAb1) from the remote control valve.

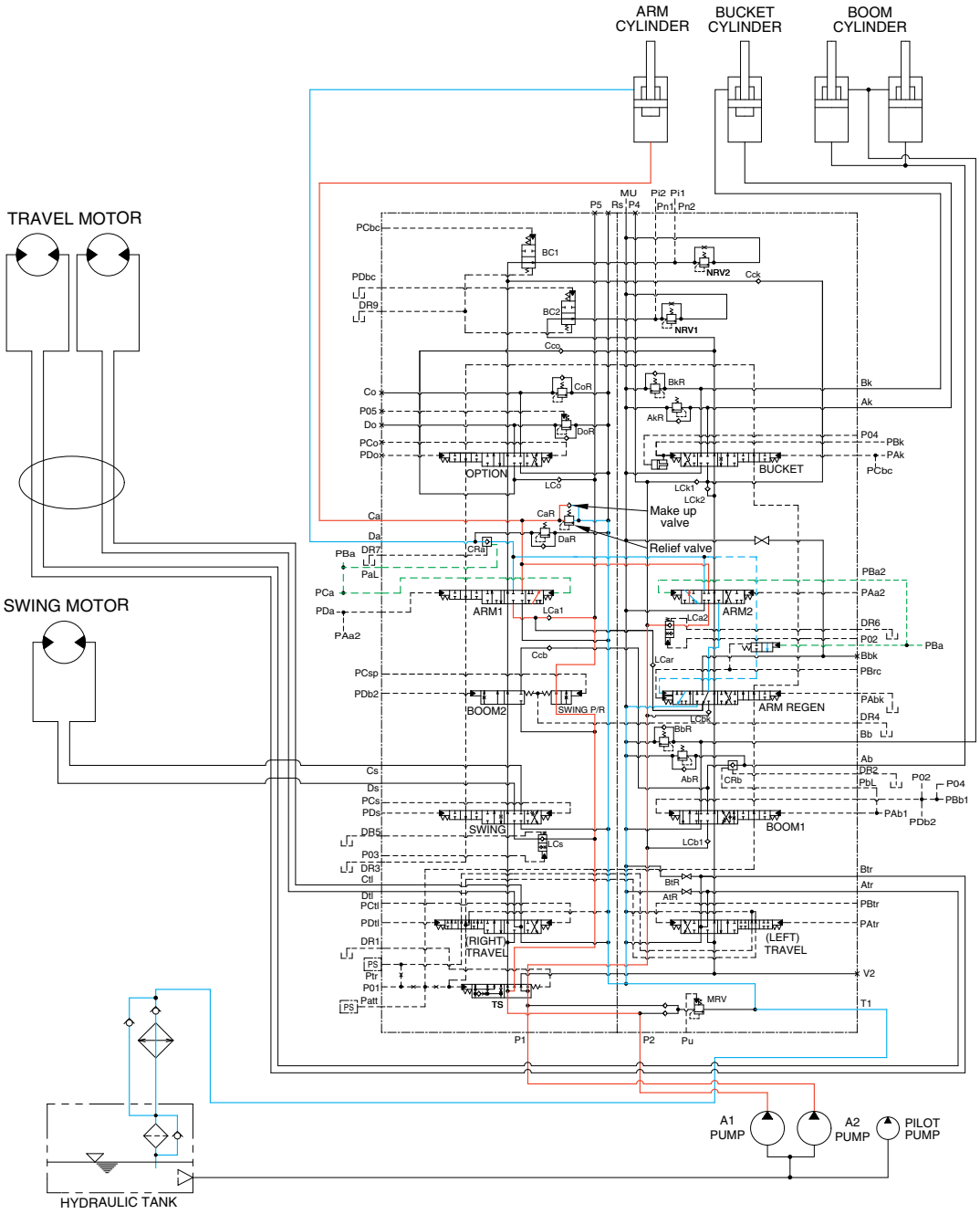
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 spool in the main control valve.

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

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

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

3. ARM IN OPERATION



300A3HC11

When the left 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 (PCa, PBa2) from the remote control valve.

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

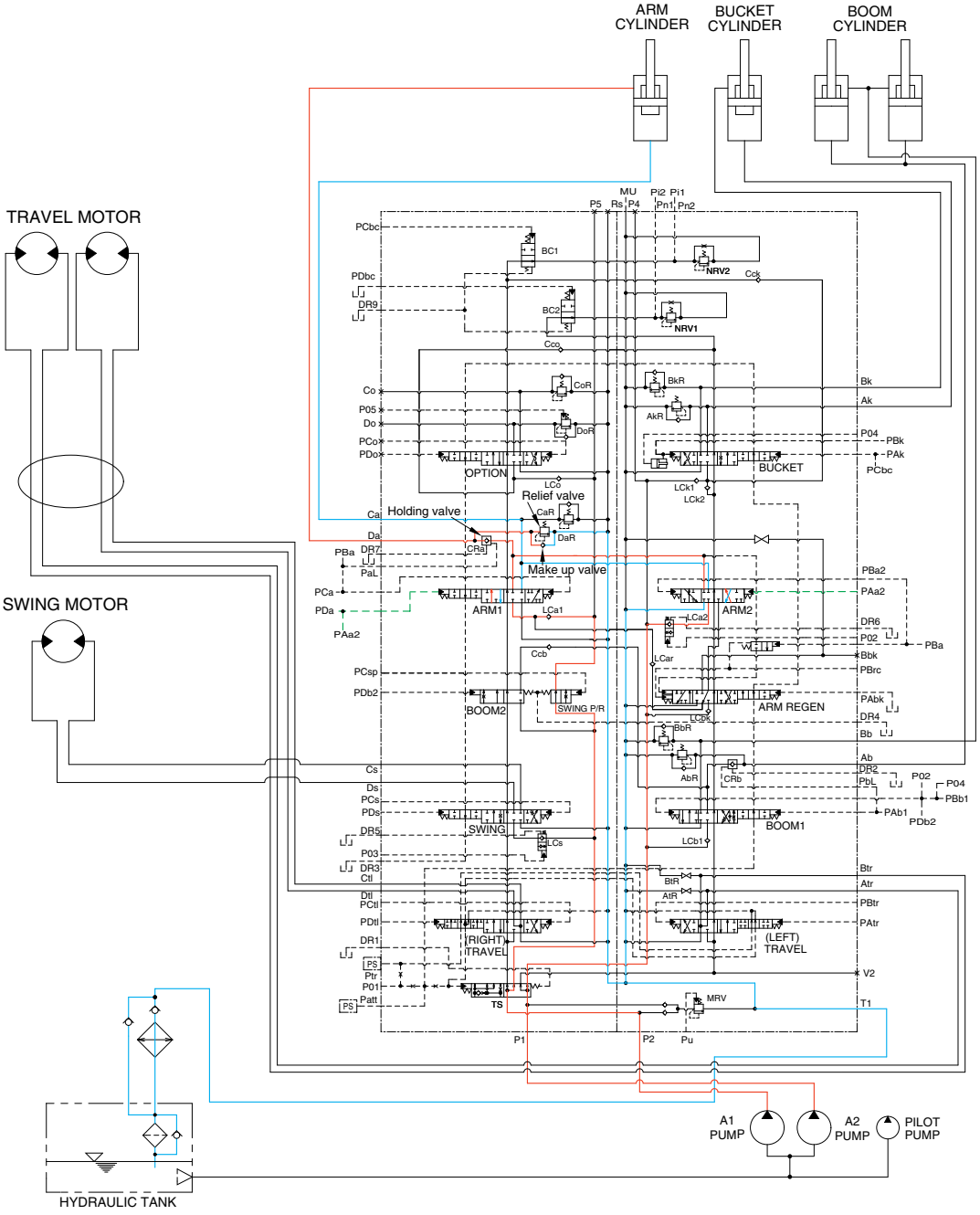
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 2 spool in the main control valve. When this happens, the arm rolls in.

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

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

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

4. ARM OUT OPERATION



When the left control lever is pushed forward, the arm spools in the main control valve are moved to the roll out position by the pilot oil pressure (PDa, PAa2) from the remote control valve.

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

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

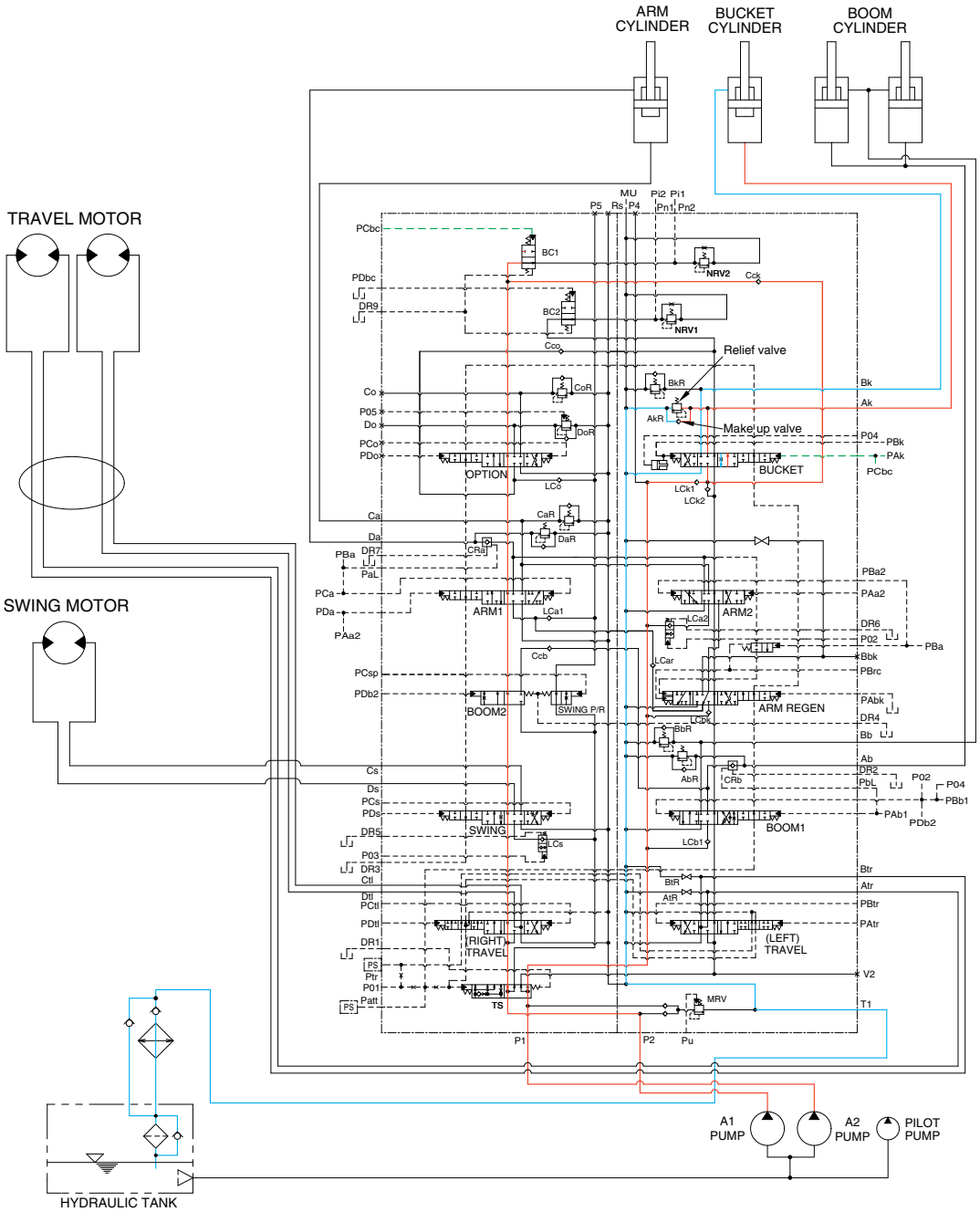
The excessive pressure in the arm cylinder rod side is prevented by relief valve.

When the arm is roll out and the control lever is returned to neutral position, the circuit for the holding pressure at the rod side of the arm cylinder is closed by the arm holding valve.

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

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

5. BUCKET IN OPERATION



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

The oil from the A2 pump flows into the main control valve and then goes to the large chamber of bucket cylinder. The oil form the A1 pump flows into the large chamber of bucket cylinder through confluence oil passage in the main control valve by bypass cut pilot pressure (PCbc).

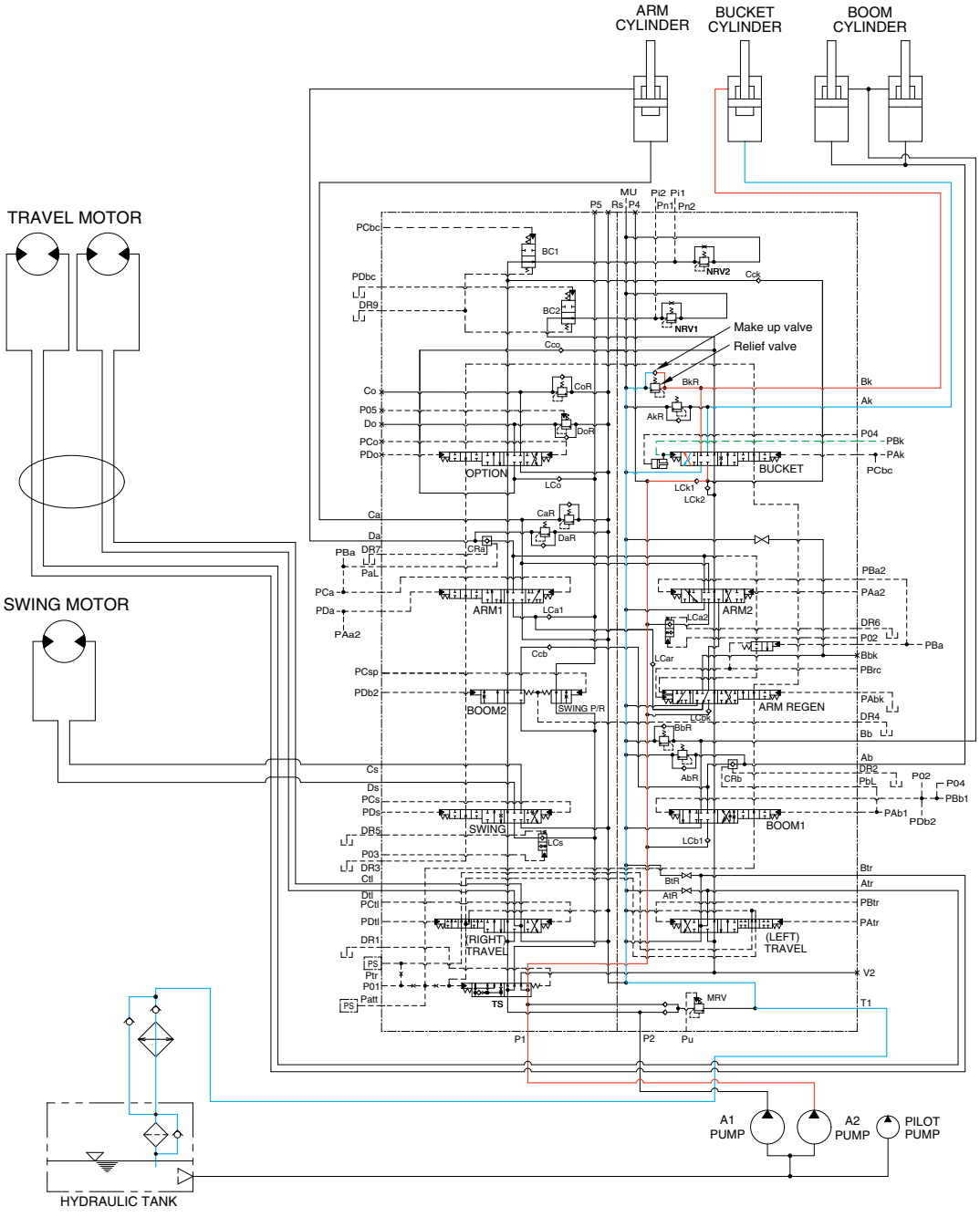
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

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

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

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

6. BUCKET OUT OPERATION



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

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

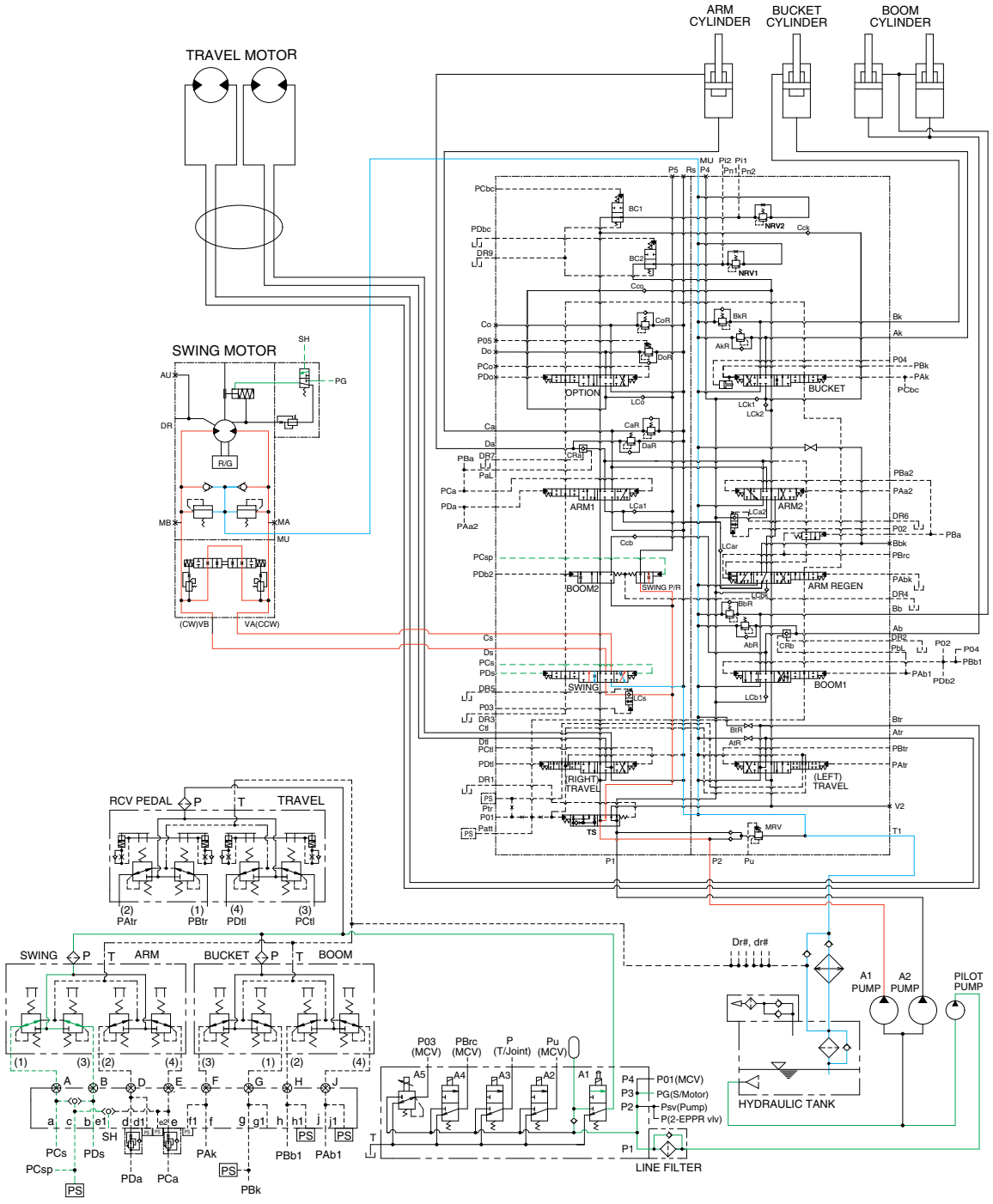
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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

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

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

7. SWING OPERATION



300A3HC15

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

Also the swing operation preference function is operated by the pilot pressure PCsp (refer to page 2-51).

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

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

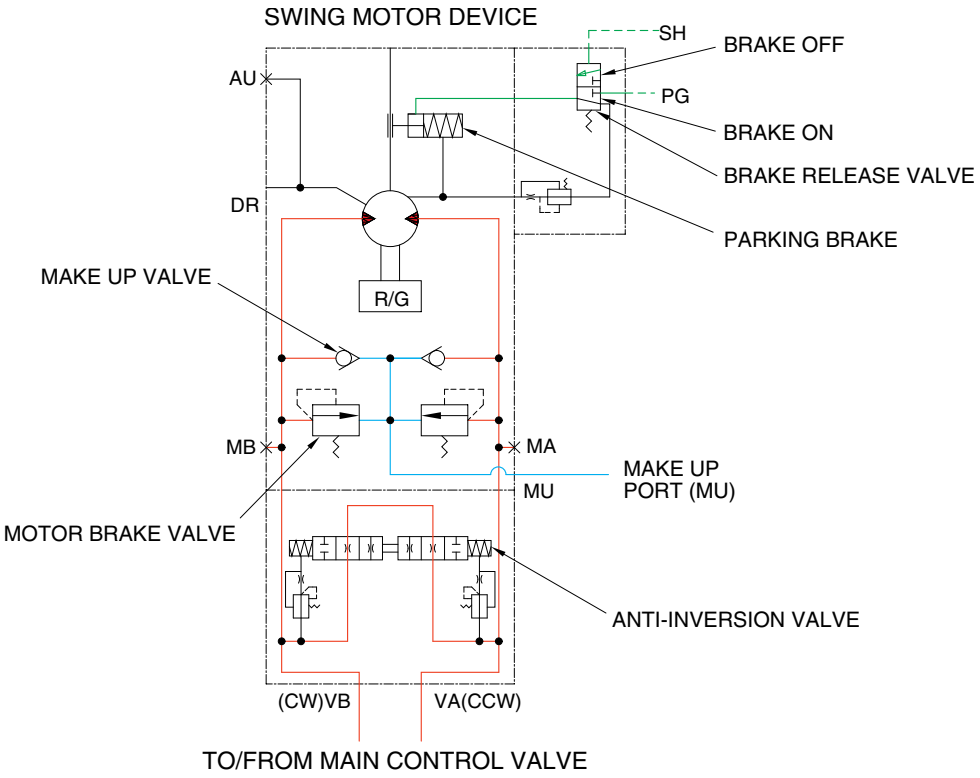
When this happens, the upper structure swings to the left or right.

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

The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

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

SWING CIRCUIT OPERATION



220S3HC15A

1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation and controls the swing motor operating pressure to 300 kgf/cm^2 (4270 psi).

2) MAKE UP VALVE

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

3) PARKING BRAKE

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

PARKING BRAKE "OFF" OPERATION

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

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

PARKING BRAKE "ON" OPERATION

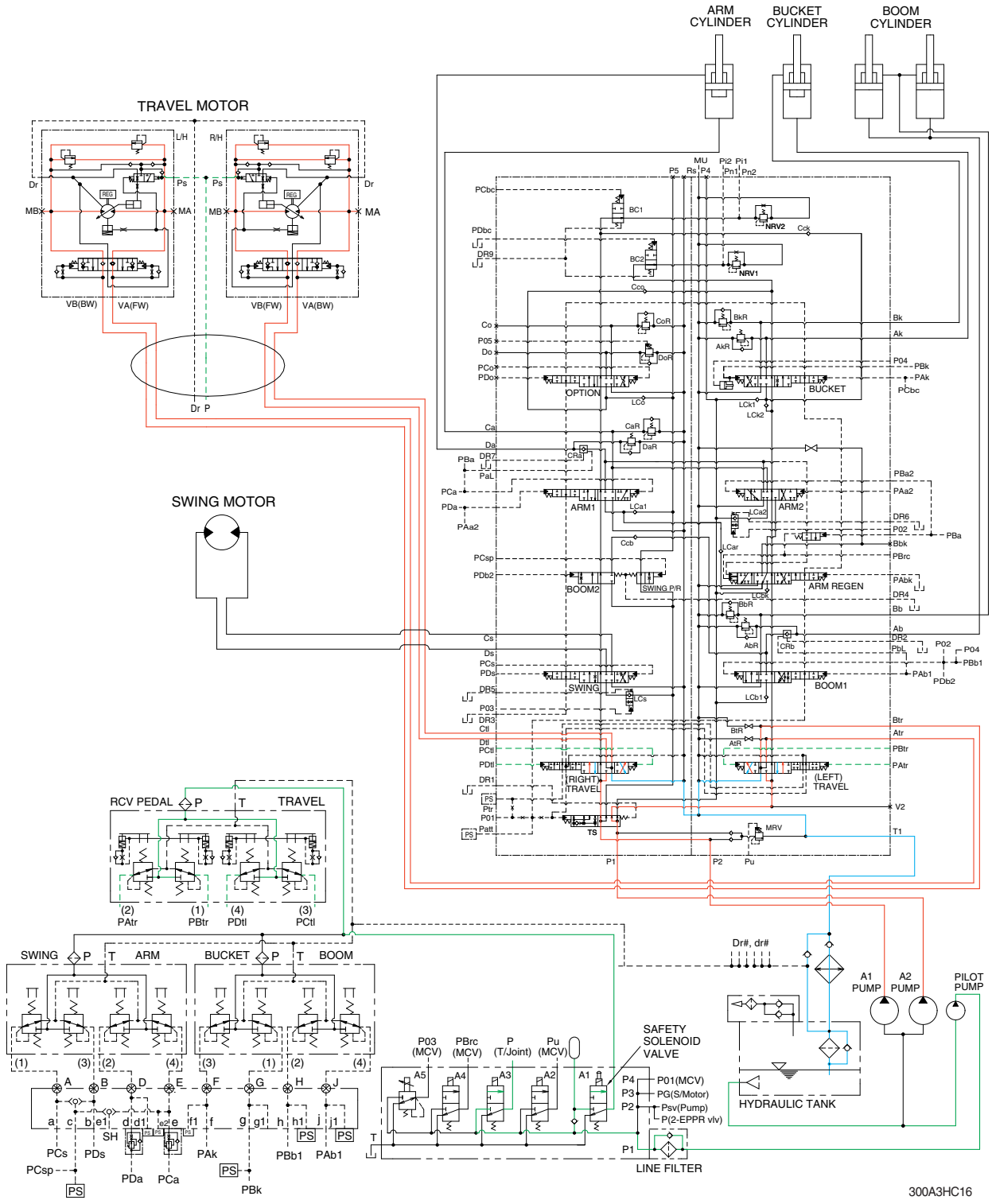
When the swing control lever and arm in control lever placed in the neutral position, the pressure of the pilot oil passage down. Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the tank. And the brake is set to "ON".

4) ANTI-INVERSION VALVE

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

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

8. TRAVEL FORWARD AND REVERSE OPERATION



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

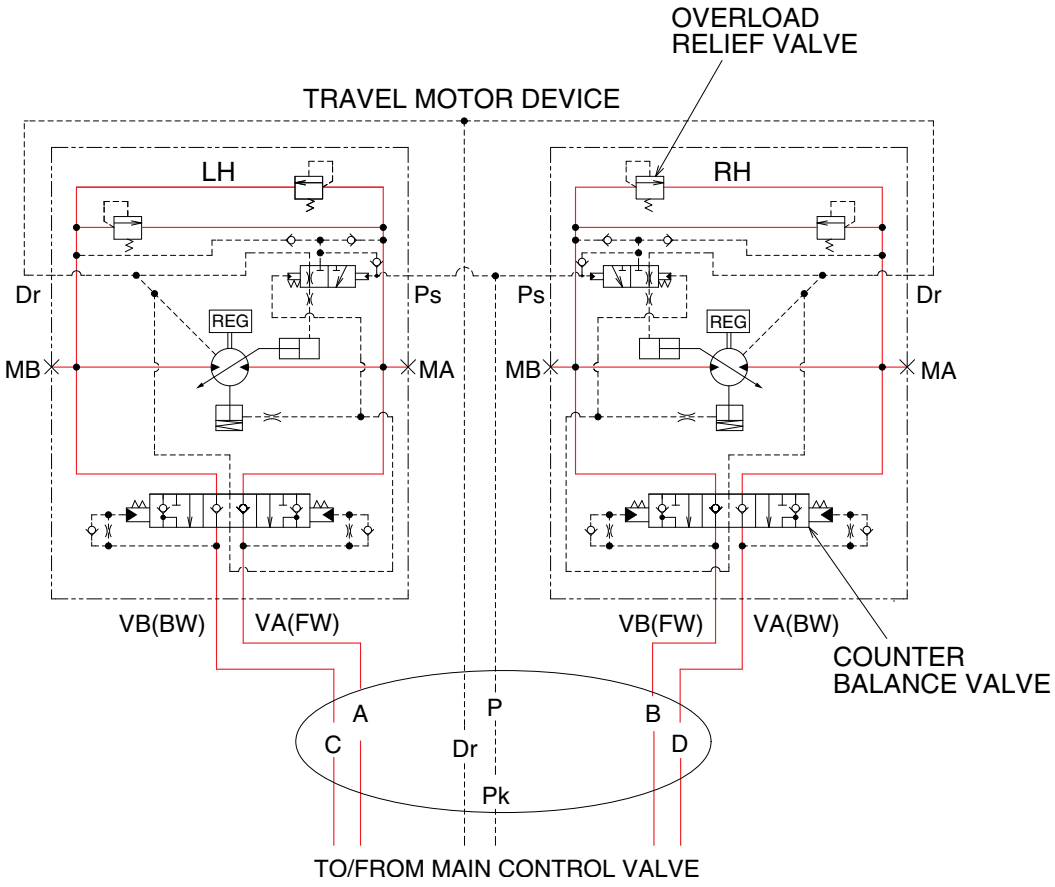
The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

The return oil from both travel motors returns to the hydraulic oil tank through the turning joint and the travel spools in the main control valve.

When this happens, the machine moves to the forward or reverse.

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

TRAVEL CIRCUIT OPERATION



260L3HC16A

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

1) COUNTER BALANCE VALVE

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

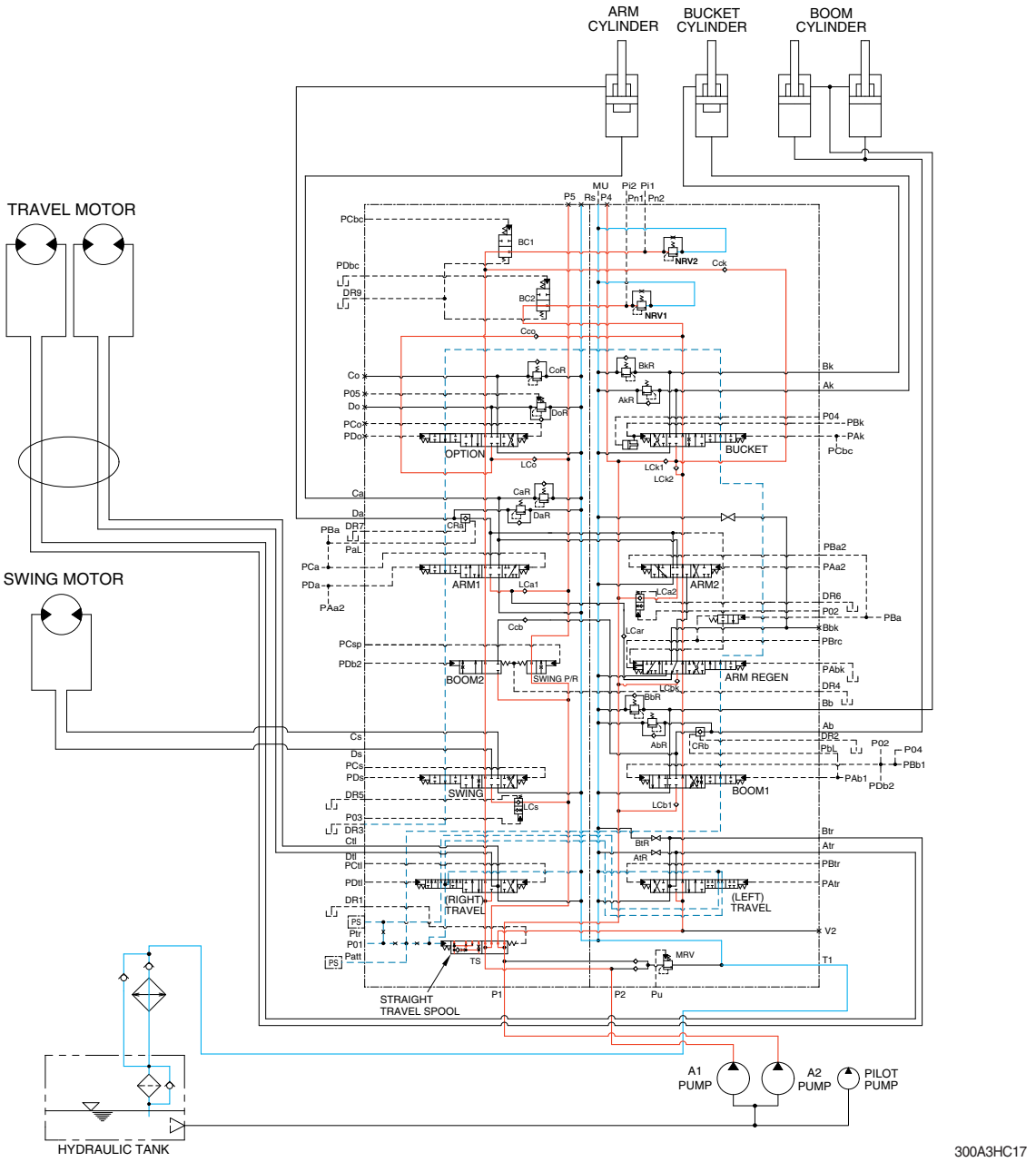
2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 350 kgf/cm^2 (4980 psi) to prevent high pressure generated at a time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

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

GROUP 5 COMBINED OPERATION (OLD VERSION)

1. OUTLINE



300A3HC17

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

STRAIGHT TRAVEL SPOOL

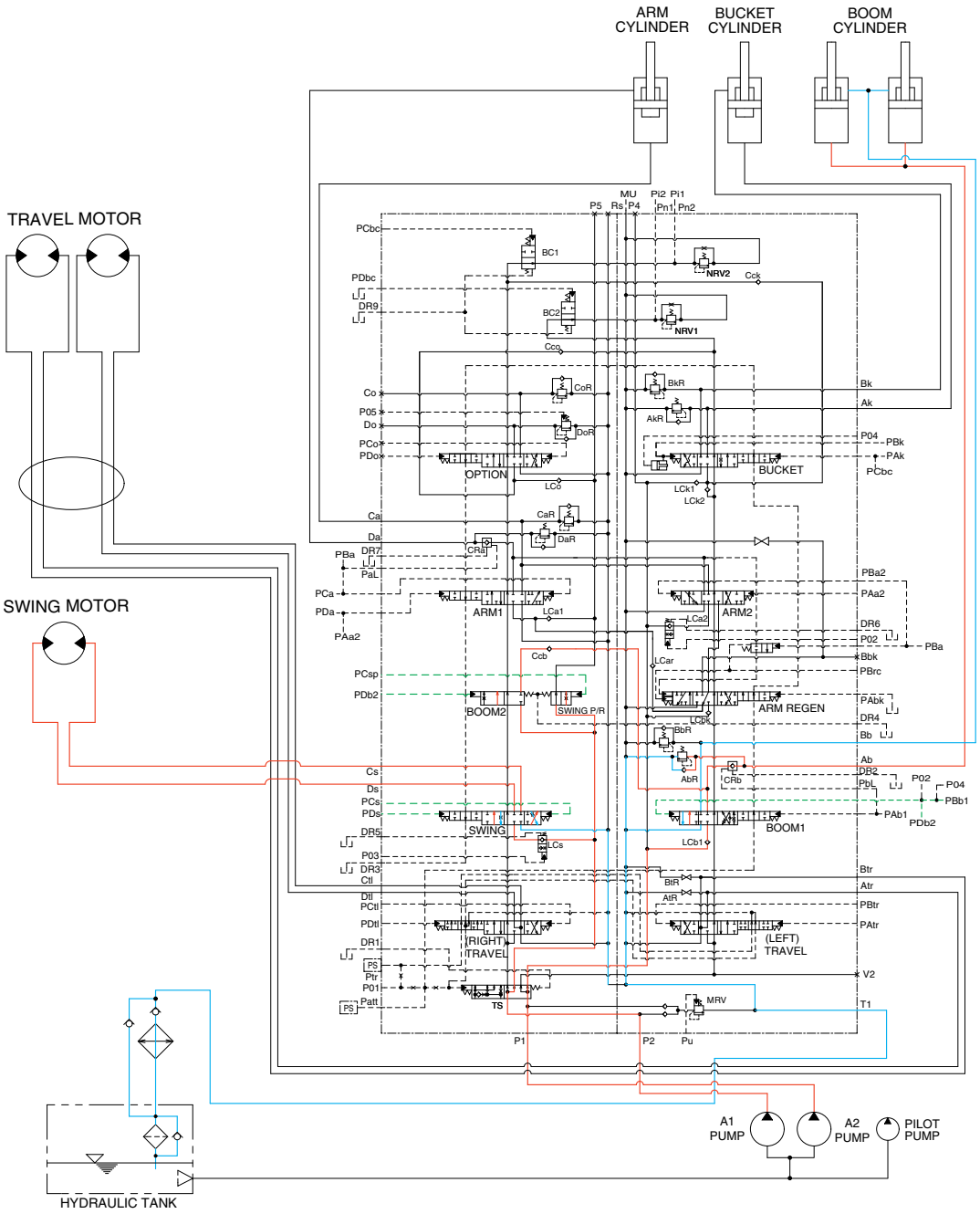
This straight travel spool for straight travel is provided in the main control valve.

If any actuator is operated when traveling, the straight travel spool is pushed to the right by the pilot oil pressure (P01).

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

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

2. COMBINED SWING AND BOOM UP OPERATION



300A3HC18

When the swing and boom up functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure (PCs, PDs, PBb1) from the remote control valve.

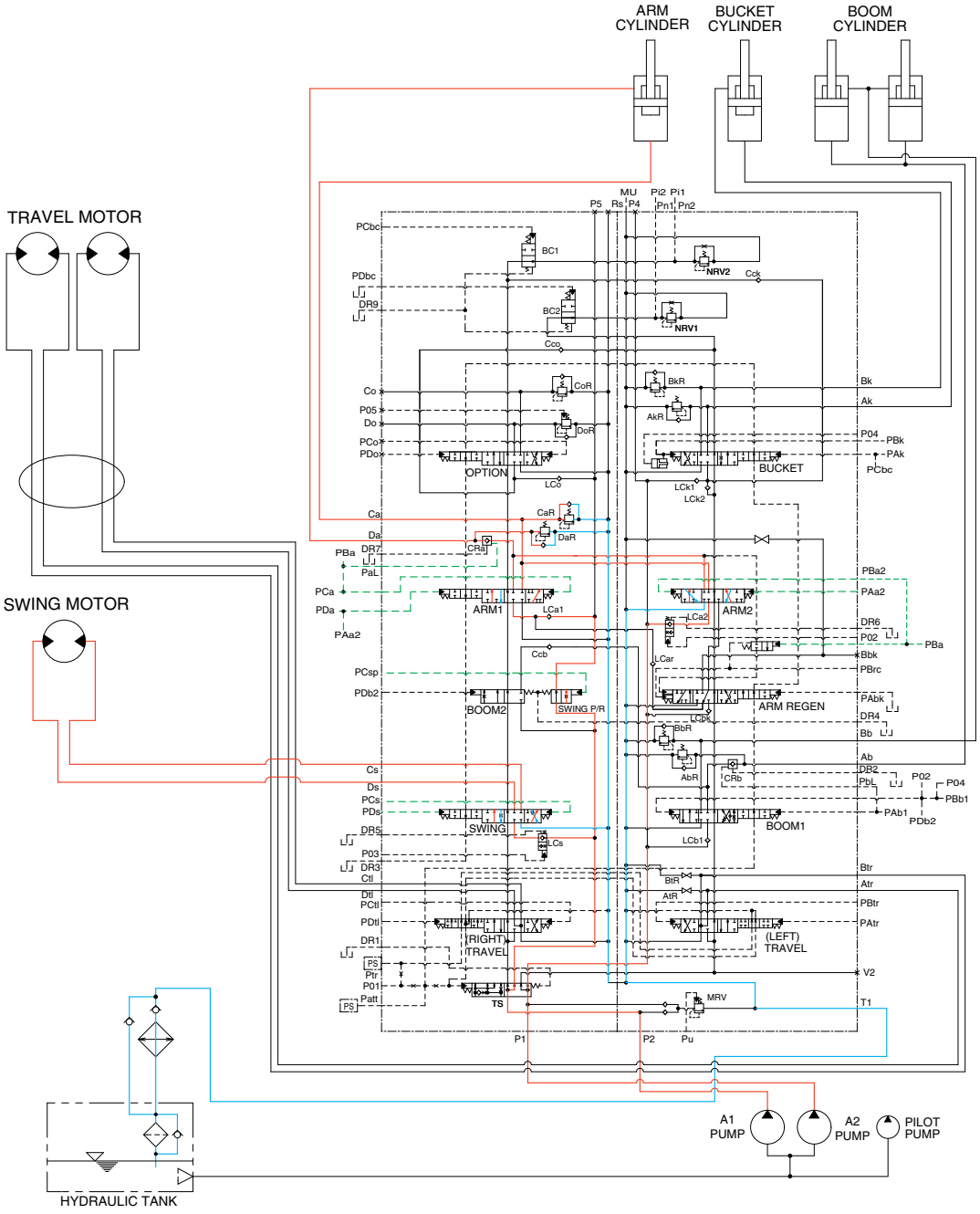
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

The oil from the A2 pump flows into the boom cylinders through the boom 1 spool in the right control valve. The upper structure swings and the boom is operated.

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

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

3. COMBINED SWING AND ARM OPERATION



300A3HC19

When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure (PCs, PDs, PCa, PDa, PAa2, PBa2) from the remote control valve.

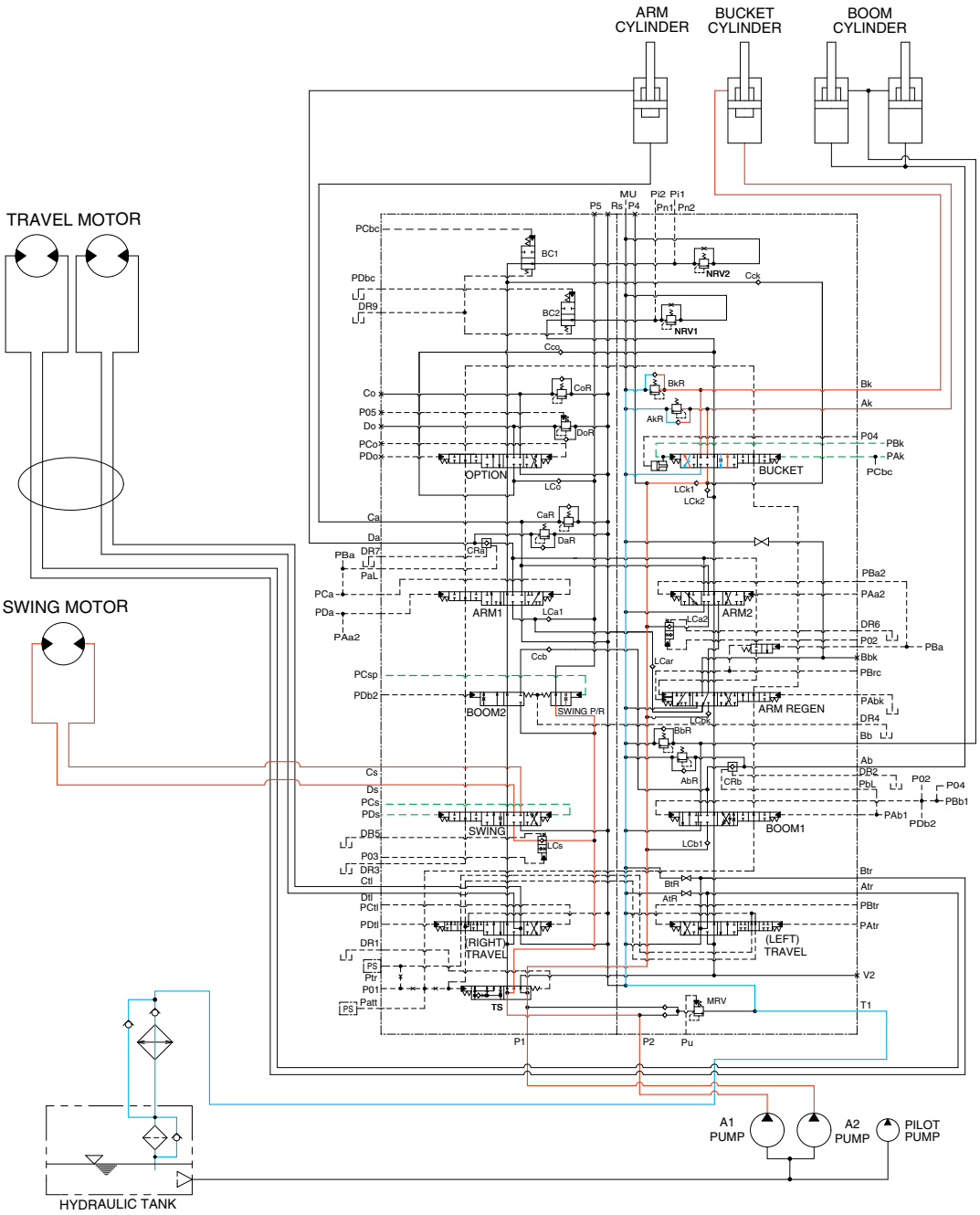
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

The oil from the A2 pump flows into the arm cylinder through the arm 2 spool of the right control valve. The upper structure swings and the arm is operated.

Refer to page 2-51 for the swing operation preference function.

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

4. COMBINED SWING AND BUCKET OPERATION



300A3HC20

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

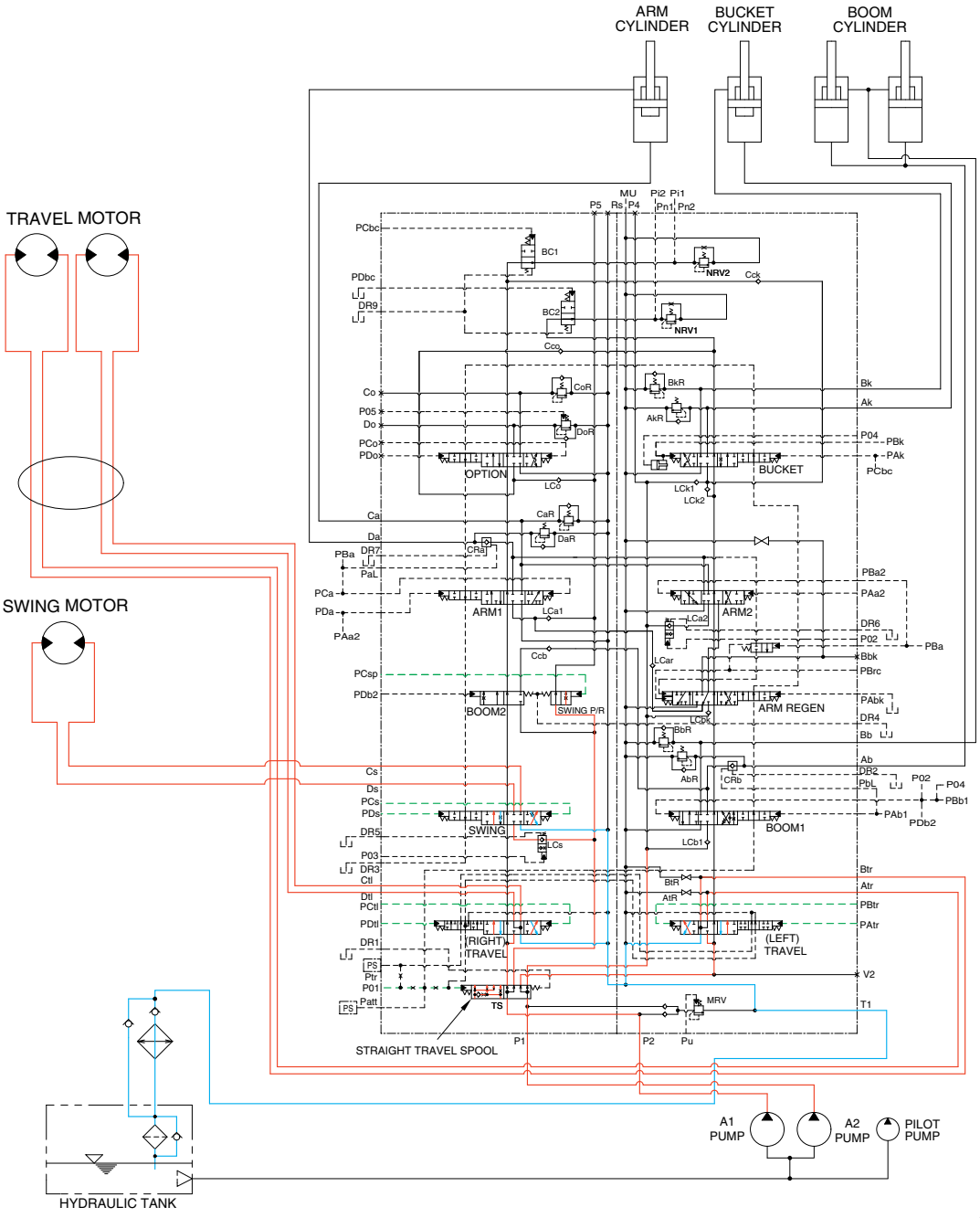
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

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

The upper structure swings and the bucket is operated.

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

5. COMBINED SWING AND TRAVEL OPERATION



300A3HC21

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 (PCs, PDs, PAtr, PBtr, PCtl, PDtl) from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump.

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

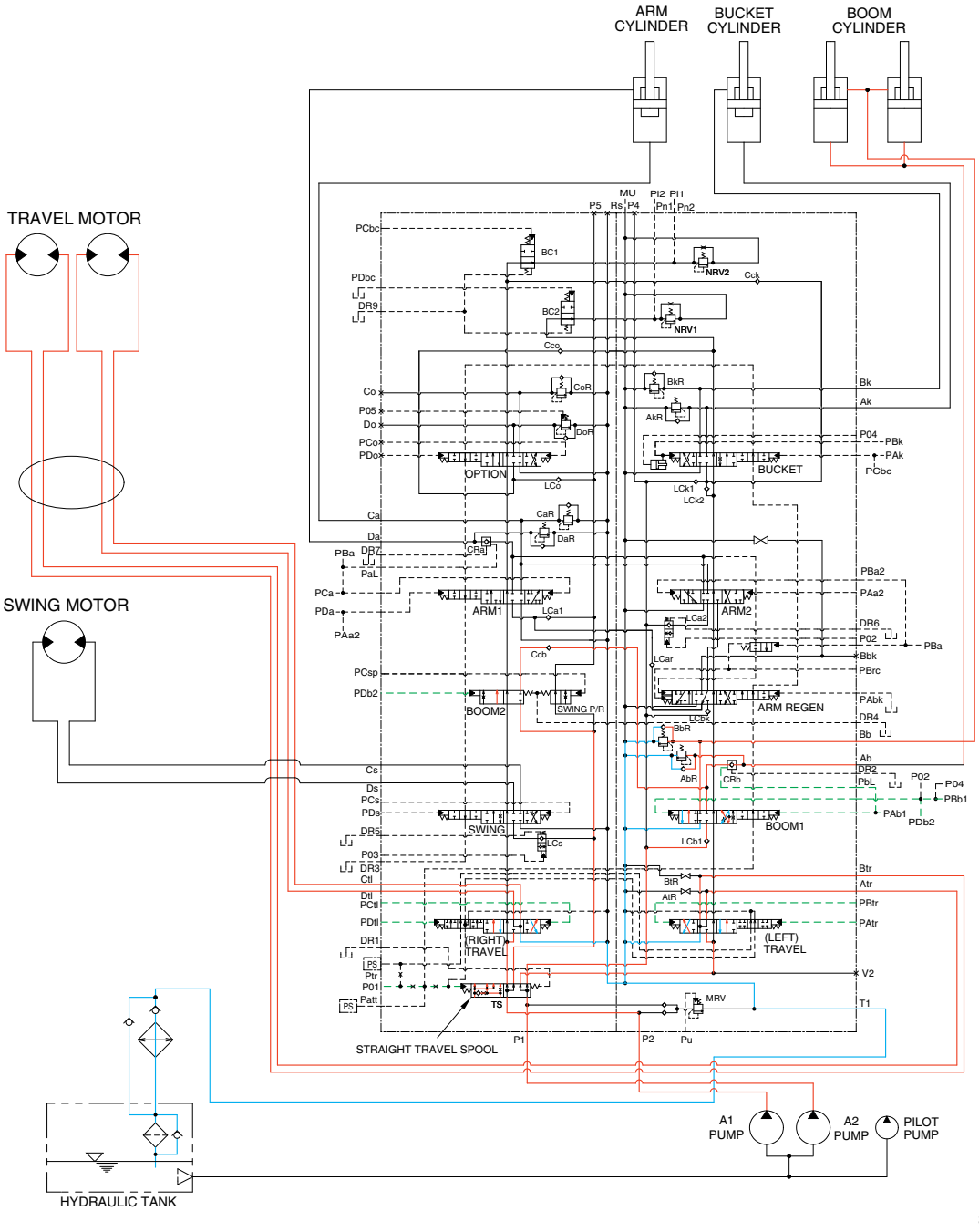
The oil from the A2 pump flows into the swing motor in the straight travel spool.

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

The upper structure swings and the machine travels straight.

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

6. COMBINED BOOM AND TRAVEL OPERATION



When the boom and travel functions are operated, simultaneously the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (PAb1, PBb1, PDb2, PAtr, PBtr, PCtl, PDtl) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

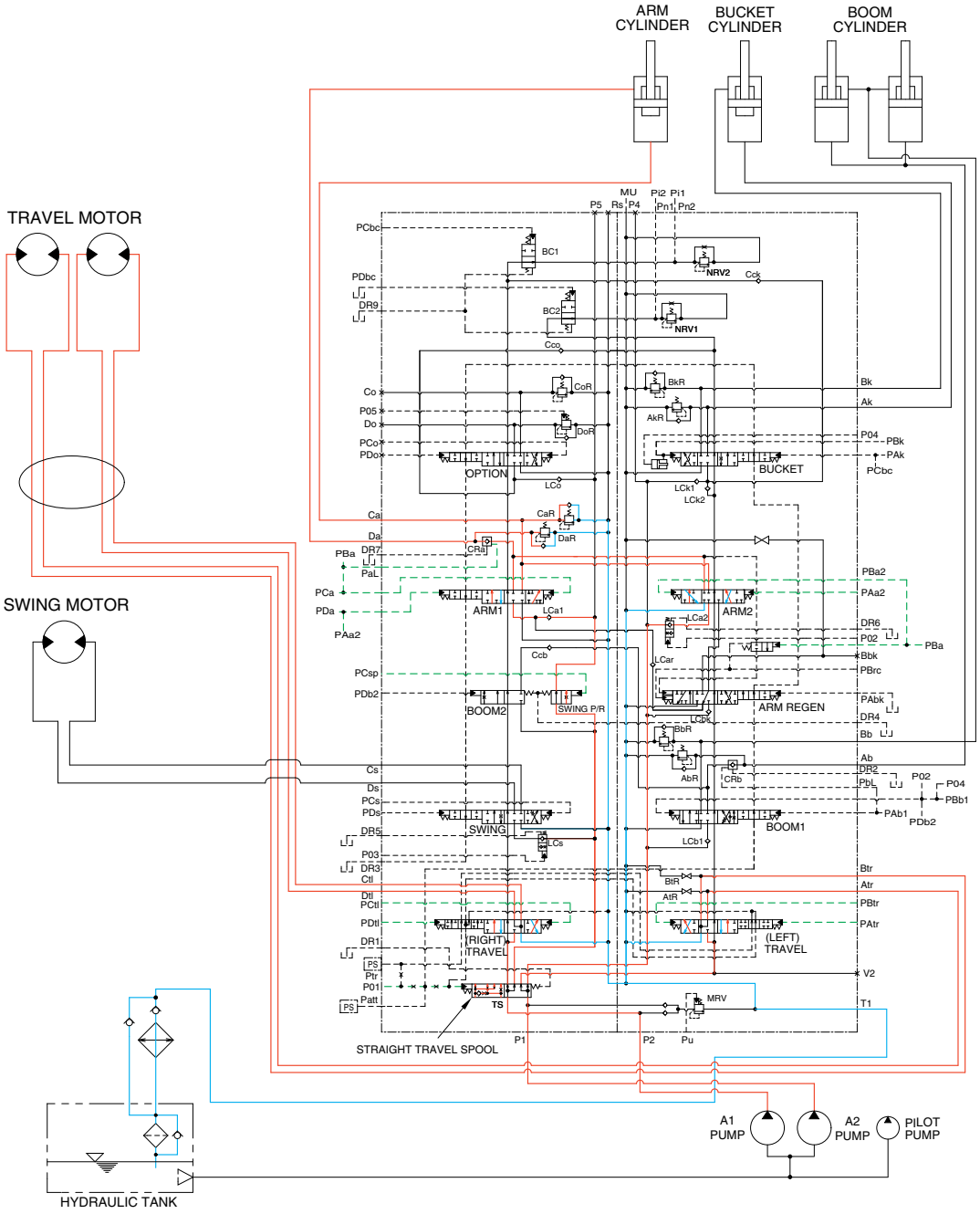
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence oil passage in case boom up operation. When the pressure of the travel motors is lower than the pressure of the boom cylinders, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The boom is operated and the machine travels straight.

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

7. COMBINED ARM AND TRAVEL OPERATION



When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (PCa, PDa, PAa2, PBa2, PAtr, PBtr, PCtl, PDtl) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

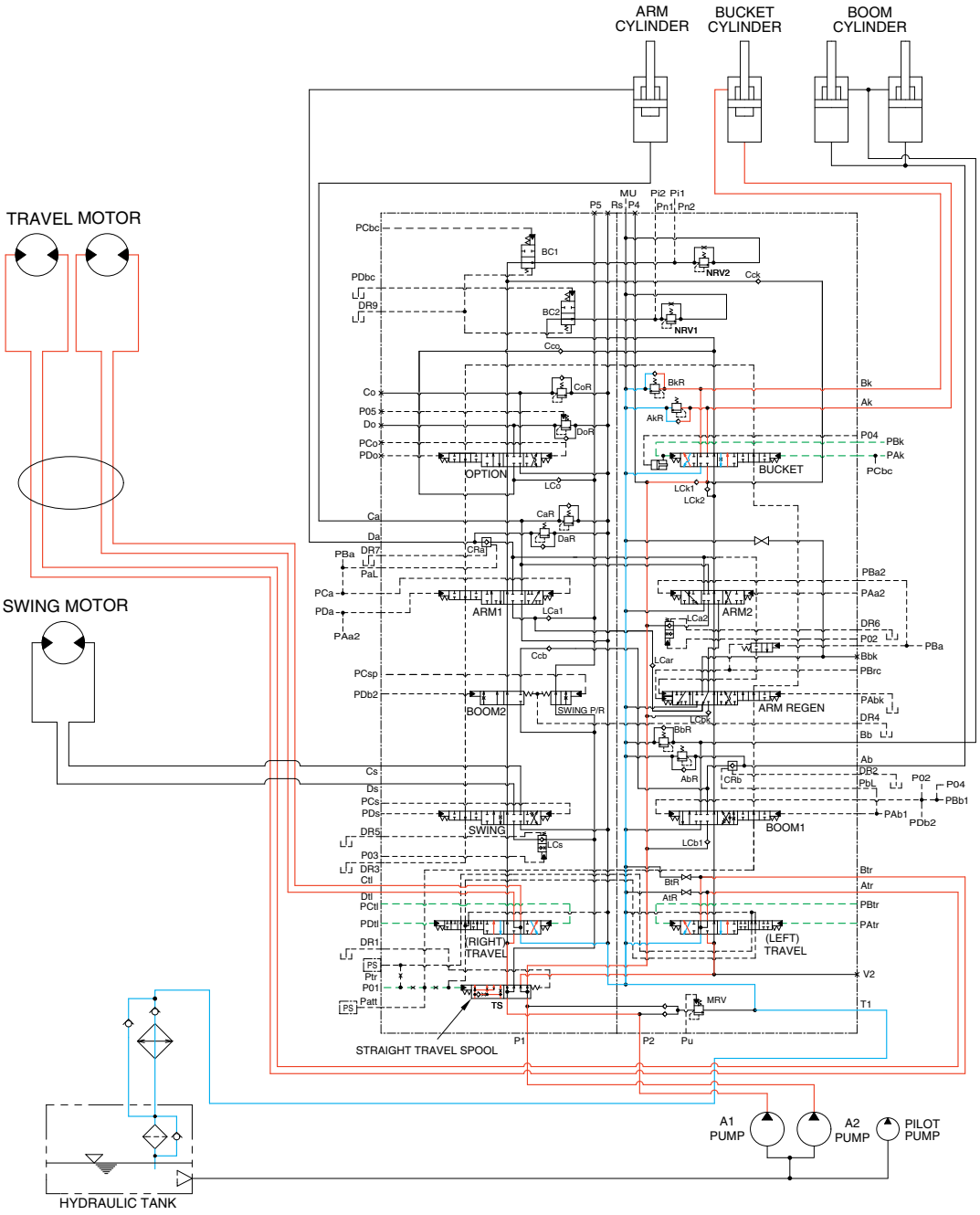
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage. When the pressure of the travel motors is lower than the pressure of the arm cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The arm is operated and the machine travels straight.

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

8. COMBINED BUCKET AND TRAVEL OPERATION



300A3HC24

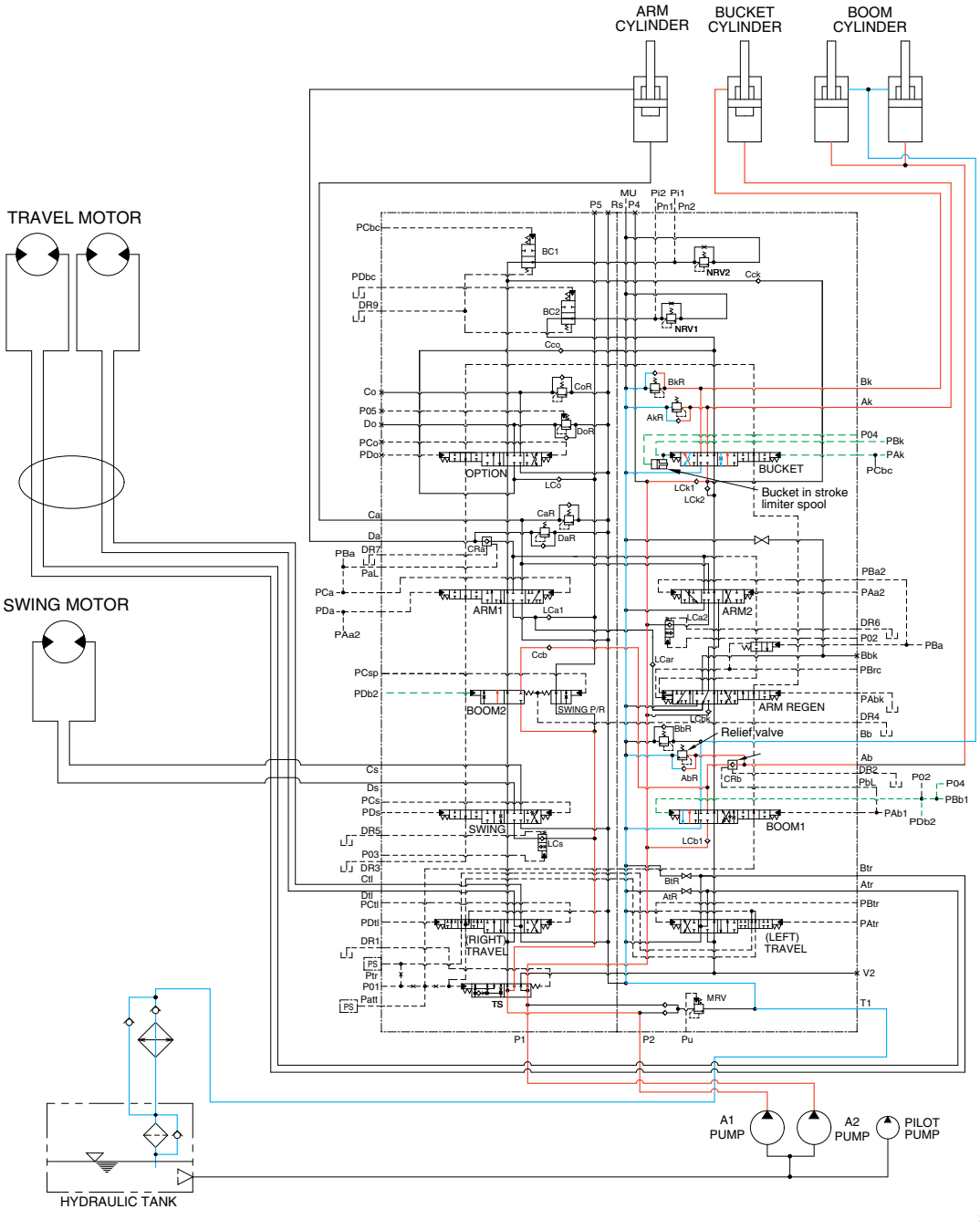
When the bucket and travel functions are operated, simultaneously the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (PAk, PBk, PAtr, PBtr, PCtl, PDtl) from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure from pilot pump. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool of the control valve.

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

The bucket is operated and the machine travels straight.

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

9. COMBINED BOOM UP AND BUCKET OPERATION



When the boom up and bucket functions are operated, simultaneously each spool in the main control valve is moved to the functional position by the pilot oil pressure (PBb1, PDb1, PAk, PBk) from the remote control valve.

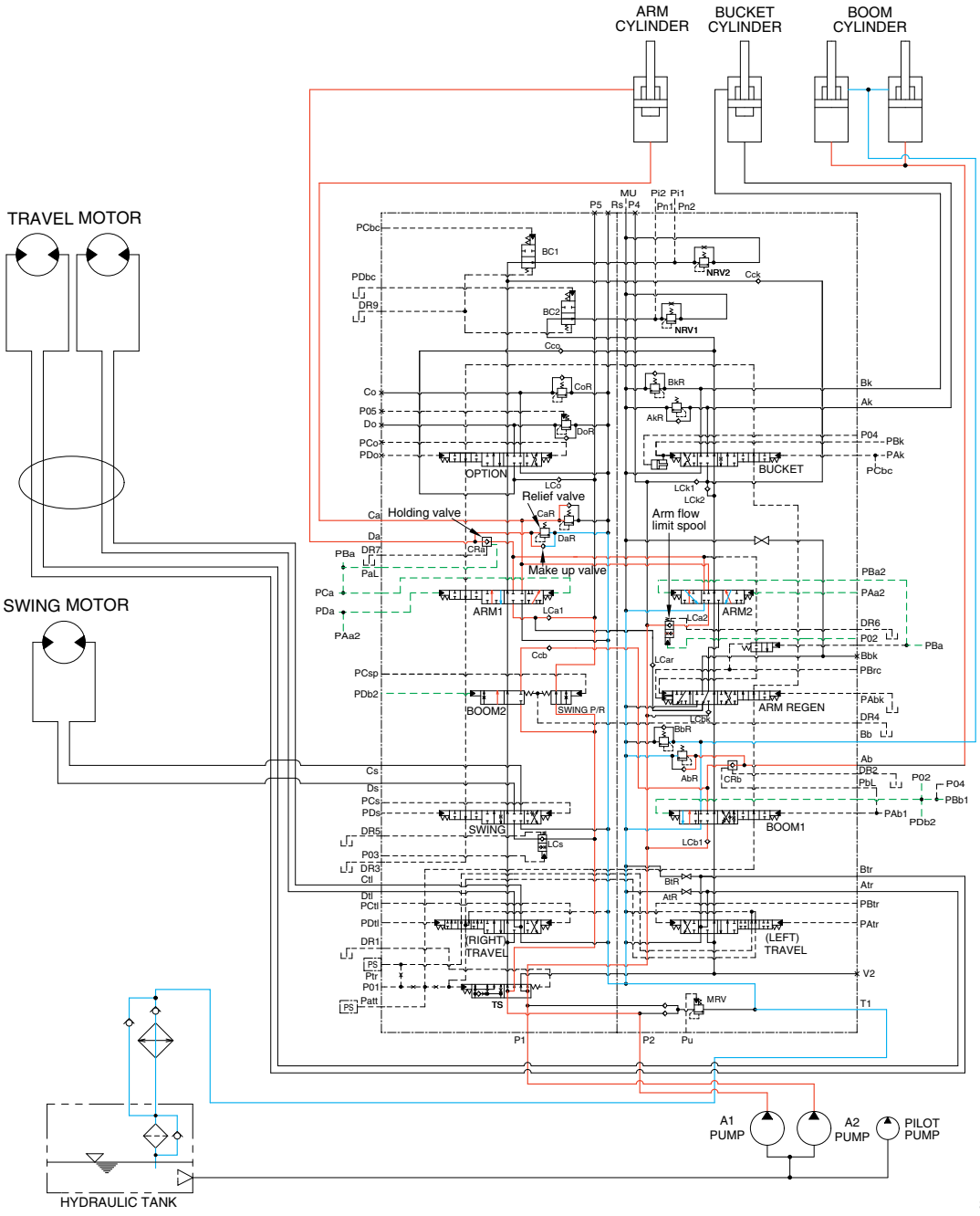
The oil from the A1 pump flows into the boom cylinders through the boom 2 spool in the left control valve. The oil from the A2 pump flows into the boom cylinders and bucket cylinder through the boom 1 spool, bucket spool and the parallel and confluence oil passage in the right control valve.

Also, when the boom up and bucket in functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure P04 and then the bucket spool transfers in the half stroke not full stroke (refer to page 2-43). Therefore, the most of pressurized oil flows into boom 1 spool than the bucket spool to make the boom up operation more preferential.

The boom and bucket are operated.

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

10. COMBINED BOOM UP AND ARM OPERATION



When the boom up and arm functions are operated, simultaneously each spool in the main control valve is moved to the functional position by the pilot oil pressure (PBb1, PDb1, PCa, PDa, PAa2, PBa2) from the remote control valve.

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

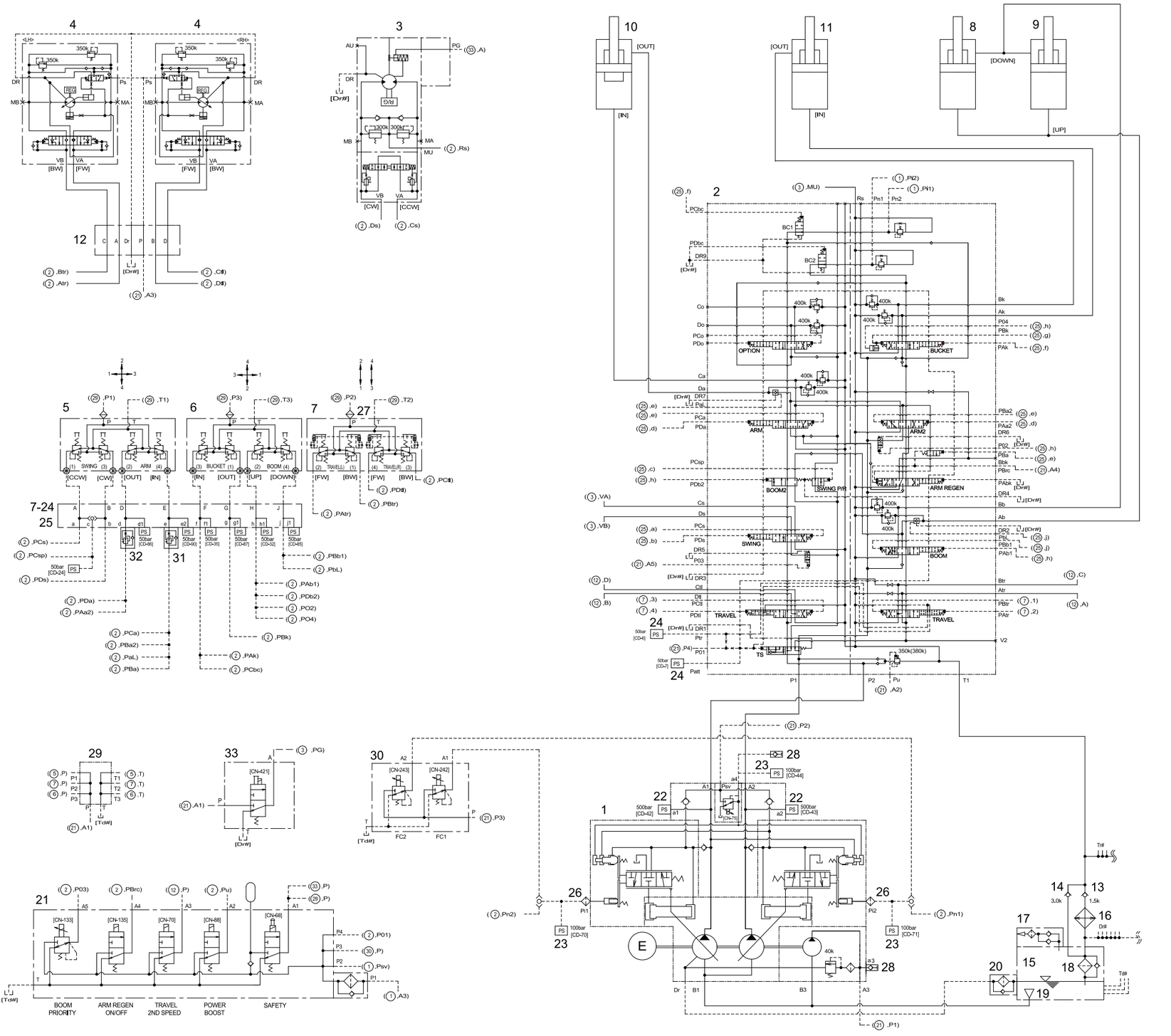
Also, when the boom up and arm functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure P02 and then the flow into arm 2 spool is reduced by shifting of the arm in flow limit spool. Therefore, the most of pressurized oil flows into boom 1 spool than the arm 2 spool to make the boom up operation more preferential.

The boom and arm are operated.

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

HYDRAULIC CIRCUIT (CURRENT VERSION)

1. HYDRAULIC CIRCUIT (1/3)



1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever (LH)
6 RCV lever (RH)
7 RCV pedal
8 Boom cylinder (LH)
9 Boom cylinder (RH)
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
13 Return check valve
14 Return check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Return filter w/bypass valve
19 Strainer
20 Drain filter
21 5-cartridge valve
22 Pressure sensor
23 Pressure sensor
24 Pressure sensor
25 Terminal block
26 Last guard filter
27 Last guard filter
28 Screw coupling
29 Cross assy
30 2-EPPR valve
31 Shockless valve
32 Shockless valve
33 Solenoid valve

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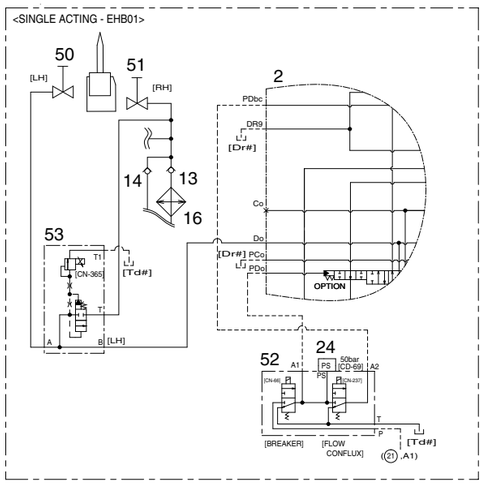
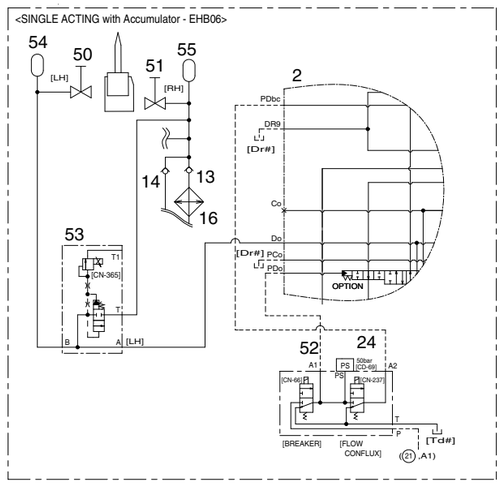
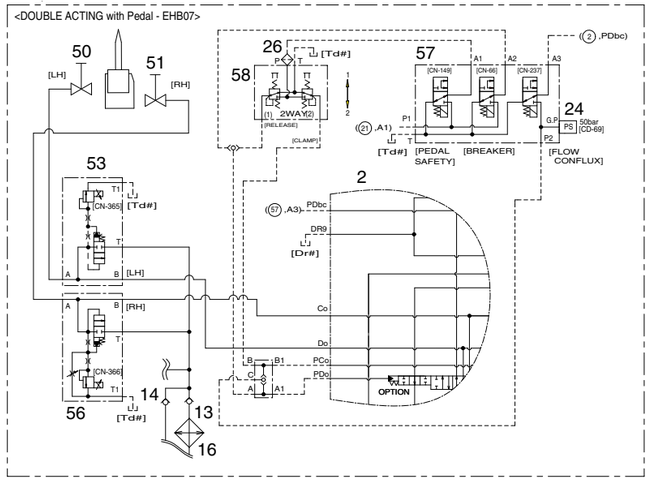
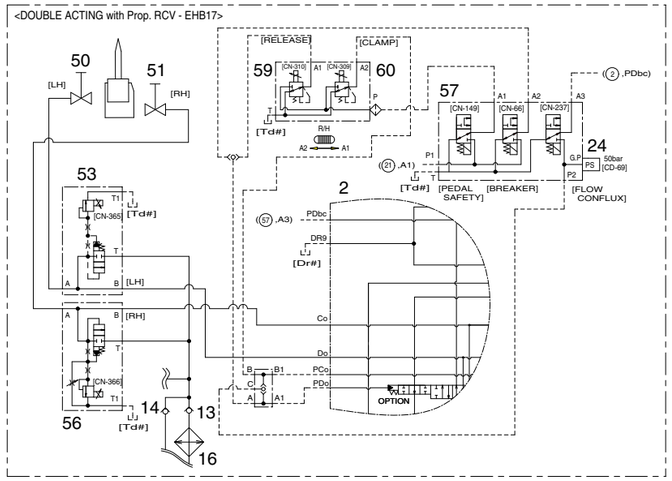
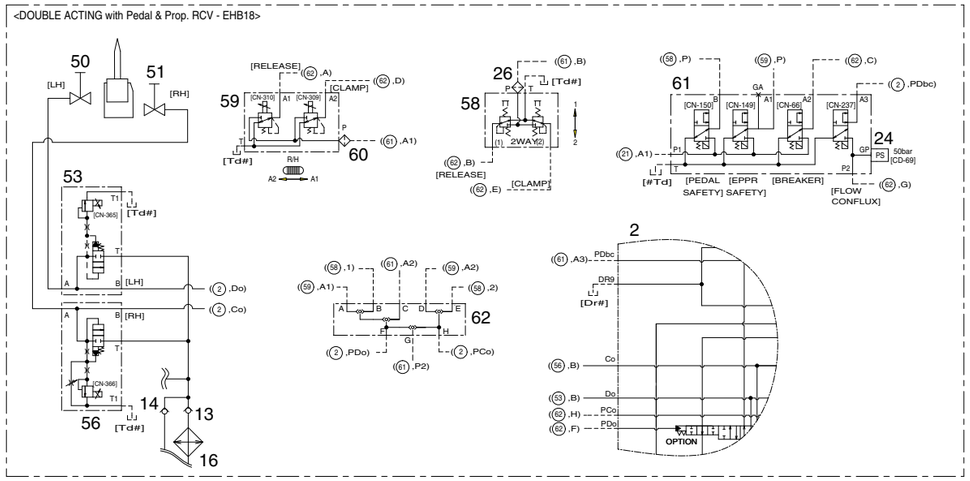
2. HYDRAULIC CIRCUIT (2/3)

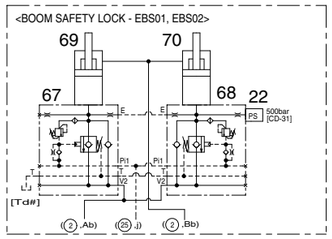


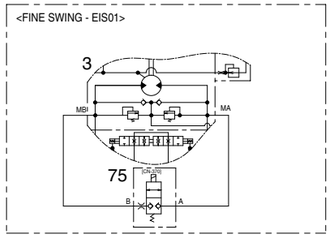


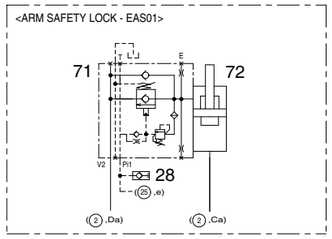


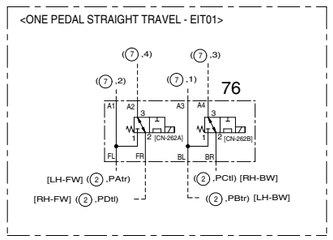


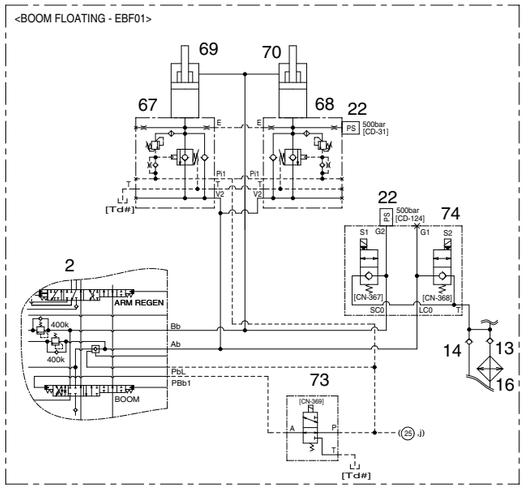


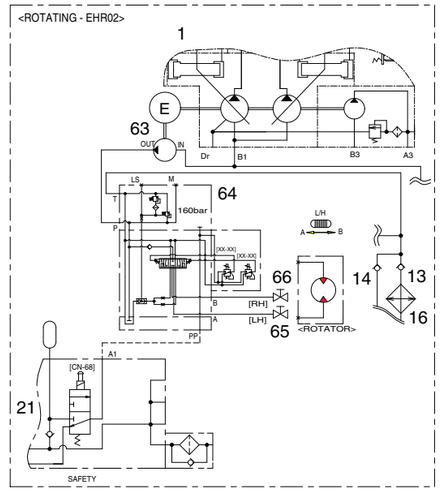










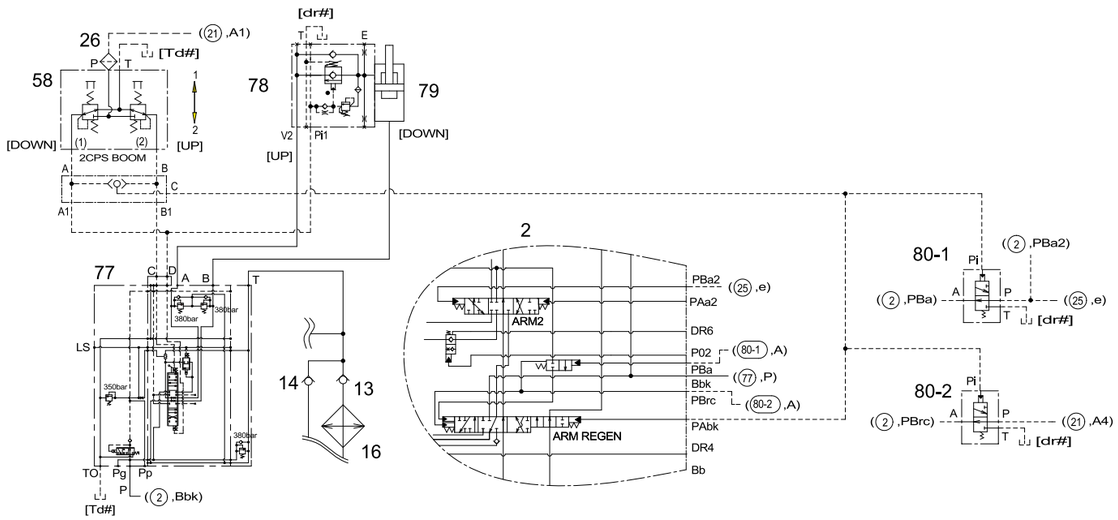


1 Main pump
2 Main control valve
3 Swing motor
13 Check valve
14 Check valve
16 Oil cooler
22 Pressure sensor
24 Pressure sensor
26 Last guard filter
28 Screw coupling
30 Boom cylinder-safety (option)
31 Arm cylinder-safety (option)
35 Accumulator (option)
36 Accumulator (option)
37 Stop valve (option)
39 Proportional relief valve (option)
41 3-solenoid cartridge valve (option)
42 Pilot select valve (option)
44 Solenoid valve (option)
46 Boom floating valve (option)
47 Solenoid valve (option)
48 Solenoid valve (option)
49 Solenoid valve (option)
50 Stop valve (option)
51 Stop valve (option)
52 Solenoid valve (option)
53 Proportional relief valve (option)
54 Accumulator (option)
55 Accumulator (option)
56 Proportional relief valve (option)
57 Solenoid valve (option)
58 Double acting pedal (option)
59 EPPR valve (option)
60 Last guard filter (option)
61 Solenoid valve (option)
62 Terminal block (option)
63 Gear pump (option)
64 Proportional relief valve (option)
65 Stop valve (option)
66 Stop valve (option)
67 Safety lock valve (option)
68 Safety lock valve (option)
69 Boom cylinder-LH (option)
70 Boom cylinder-RH (option)
71 Safety lock valve (option
72 Arm cylinder (option)
73 Solenoid valve (option)
74 Boom floating valve (option)
75 Solenoid valve (option)
76 Solenoid valve (option)

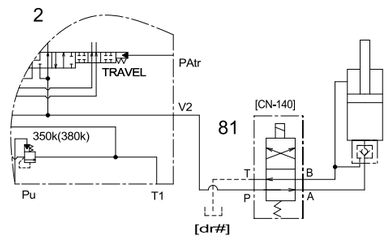
30K8-27100-03E 2OF3

3. HYDRAULIC CIRCUIT (3/3)

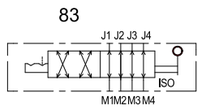
<2PCS BOOM - EHB09>



<QUICK COUPLER - EHQ01>

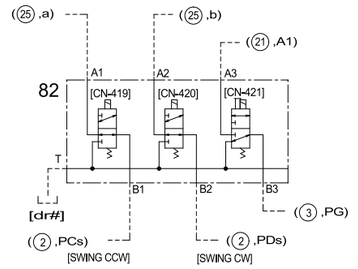


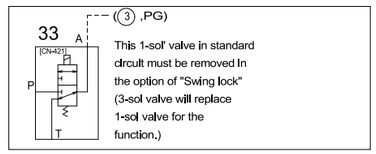
<PATTERN CHANGE - EPV01>



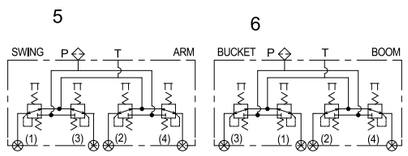
FROM		TO	
ITEM	PORT	ITEM	PORT
5	2	83	J1
	4		J3
6	2		J4
	4		J2
83	M1	25	D
	M2		J
	M3		E
	M4		H

<SWING LOCK - ELO01>



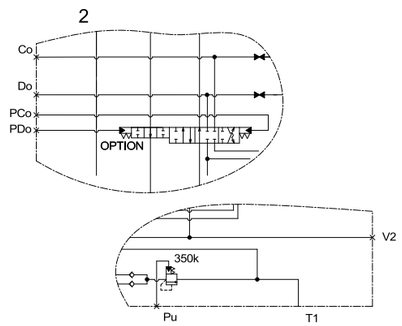


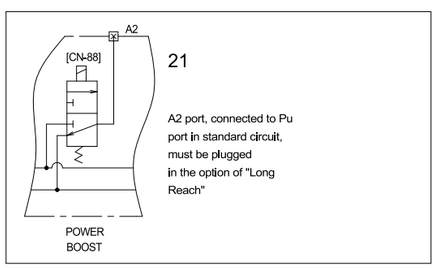
<RCV LEVER(LH/RH) OPTION >



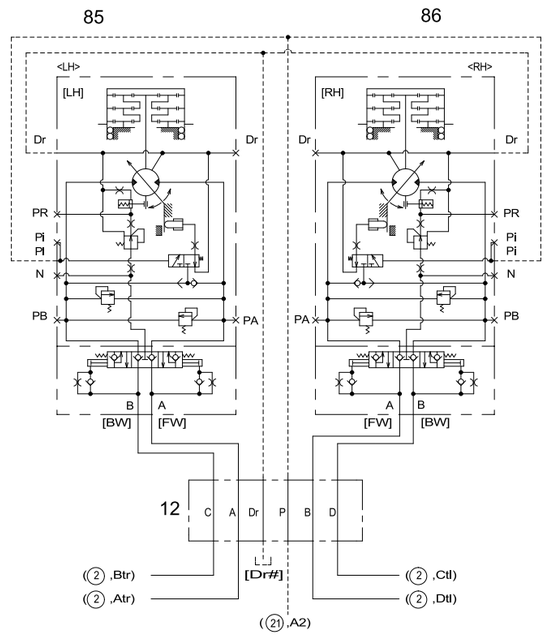
PART NO.				OPTION CODE	REMARKS	
	LH		RH		PRODUCER	MODULATION
5	31K9-21011		31K9-21021	ERR00, EJA01	EATON	X
	31K9-21131		31K9-21141	ERR01, EJA01	EATON (DAEHYUN)	RH/LH
	31K9-20370		31K9-20380	ERR00, EJA11	YOUNG DONG	X
	31K9-21360		31K9-21320	ERR01, EJA11	YOUNG DONG (DAEHYUN)	RH/LH
	31K9-21410		31K9-21420	ERR00, EJA21	KPM (DAEHYUN)	X
	31K9-21430		31K9-21440	ERR01, EJA21	KPM (DAEHYUN)	RH/LH
	31K9-20350		31K9-20360	ERR00, EJA12	YOUNG DONG	X

<LONG REACH - EBG06>





<HIGH WALKER - EFM06>



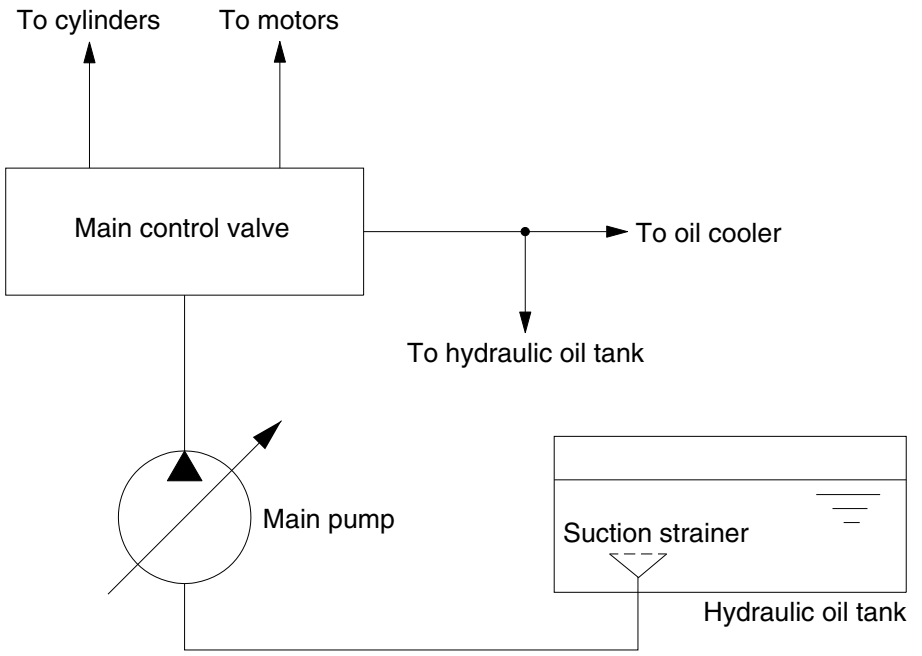
30K8-27100-03E 3OF3

2	Main control valve
5	RCV lever (option)
6	RCV lever (option)
12	Turning joint
13	Return check valve
14	Return check valve
15	Hydraulic tank
26	Last guard filter
33	Solenoid valve
58	Double acting pedal (option)
77	Control valve (option)
78	Safety lock valve (option)
79	Adjusting cylinder (option)
80-1	Pilot selector valve (option)
80-2	Pilot selector valve (option)
81	Solenoid valve (option)
82	Solenoid valve (option)
83	Selector valve (option)
84	Main control valve (option)
85	Travel motor (option)

GROUP 2 MAIN CIRCUIT (CURRENT VERSION)

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

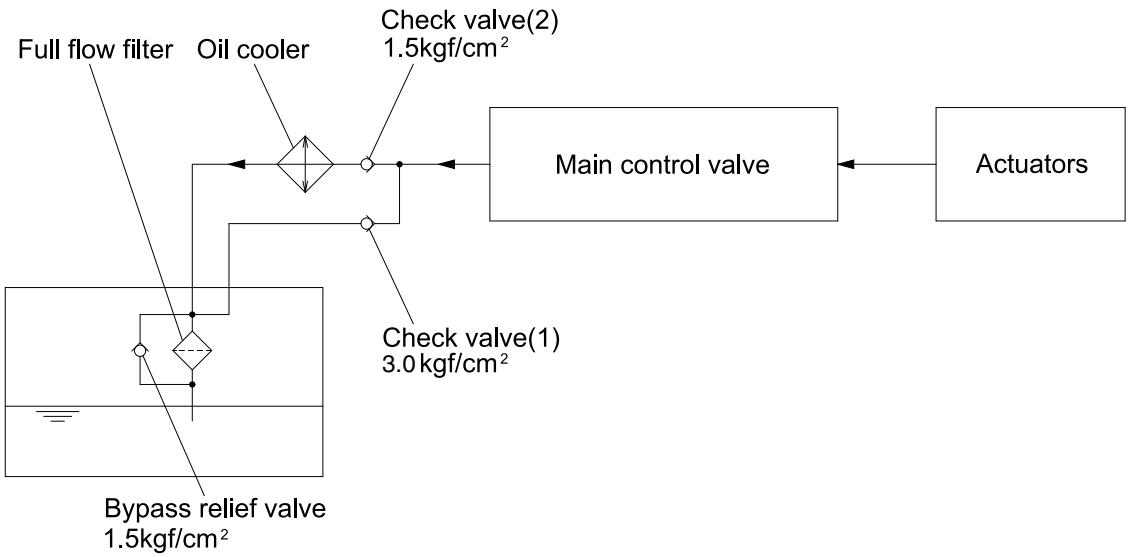


140L3CI01

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

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

2. RETURN CIRCUIT



220F3CI01

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 1.5 kgf/cm² (21 psi) and 3.0 kgf/cm² (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. The oil pressure exceeds 3.0 kgf/cm² (43 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).

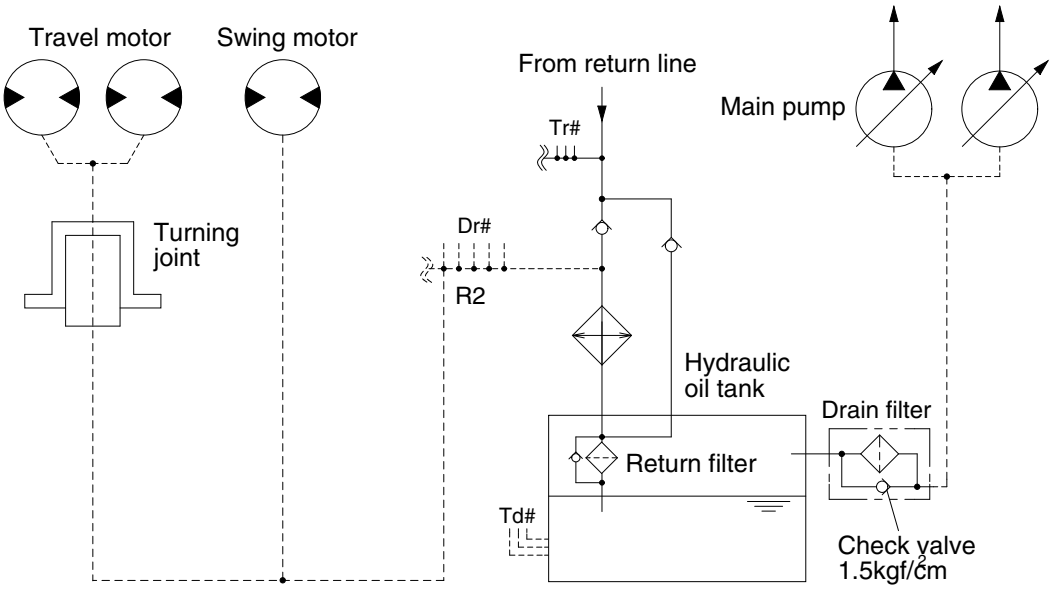
The full-flow filter and bypass relief valve are provided in the hydraulic tank.

The oil 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 1.5 kgf/cm² (21 psi) differential pressure.

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

3. DRAIN CIRCUIT



320A3CI02E

Besides internal leaks from the motors and main pump, the oil for lubrication circulates. These oil have to be fed to the hydraulic tank passing through drain filter and return filter.
When the drain oil pressure exceed 1.5 kgf/cm² (21 psi), the oil returns to the hydraulic tank directly.

1) TRAVEL AND SWING MOTOR DRAIN CIRCUIT

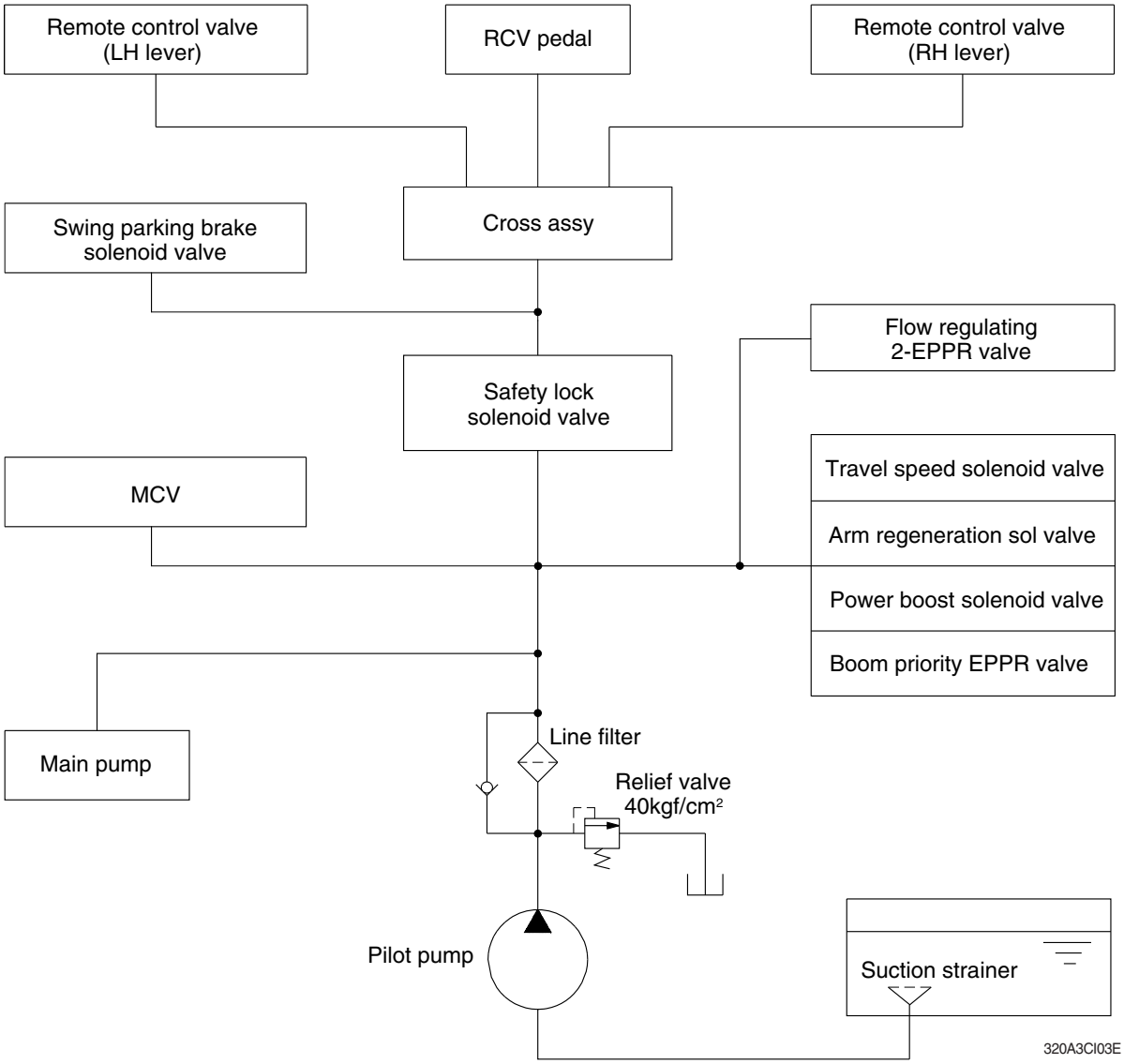
Oil leaking from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and join with oil leak line of the swing motor and return to the hydraulic tank after being filtered by return filter.

2) MAIN PUMP DRAIN CIRCUIT

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

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

GROUP 3 PILOT CIRCUIT (CURRENT VERSION)



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

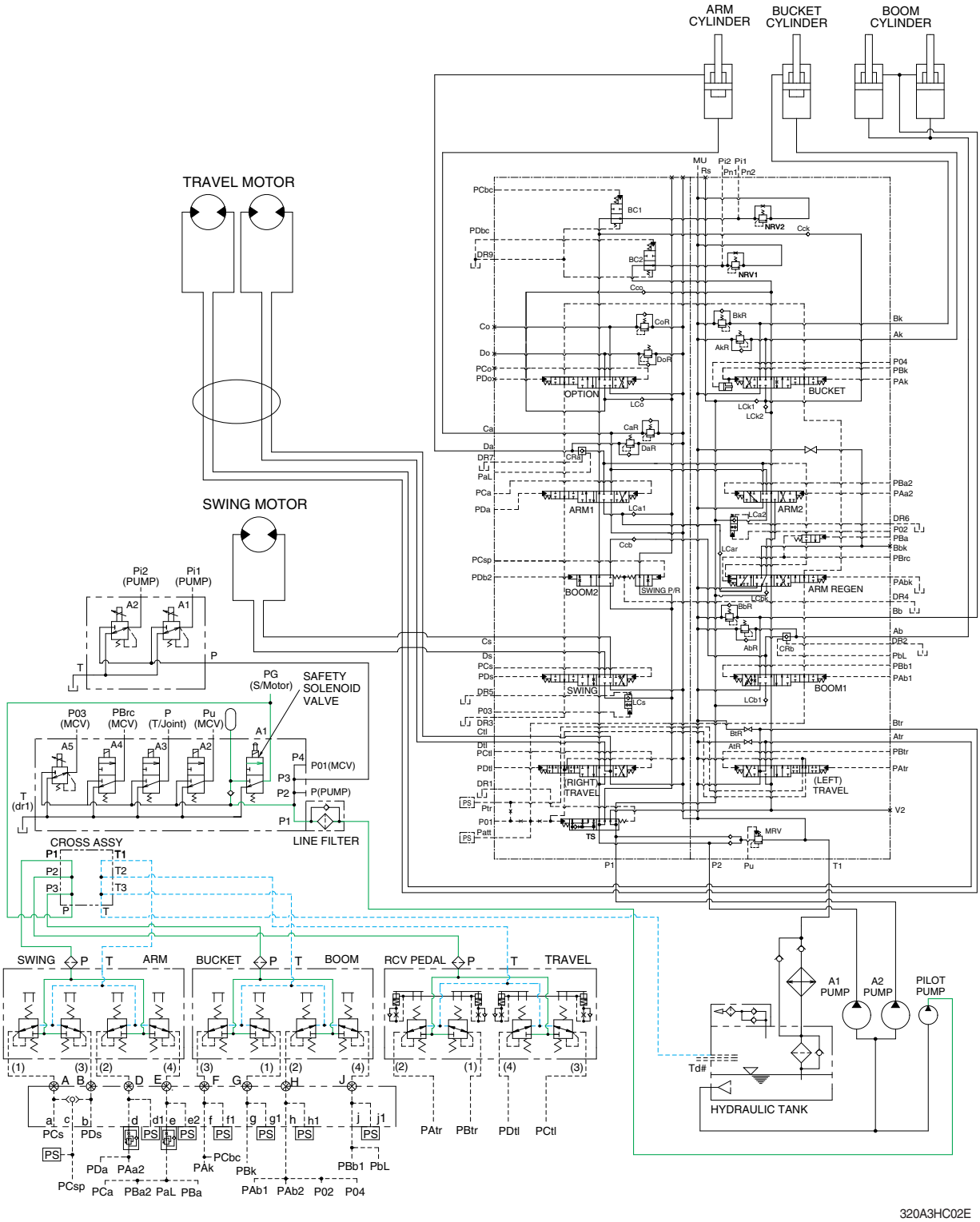
The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction strainer.

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

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

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



320A3HC02E

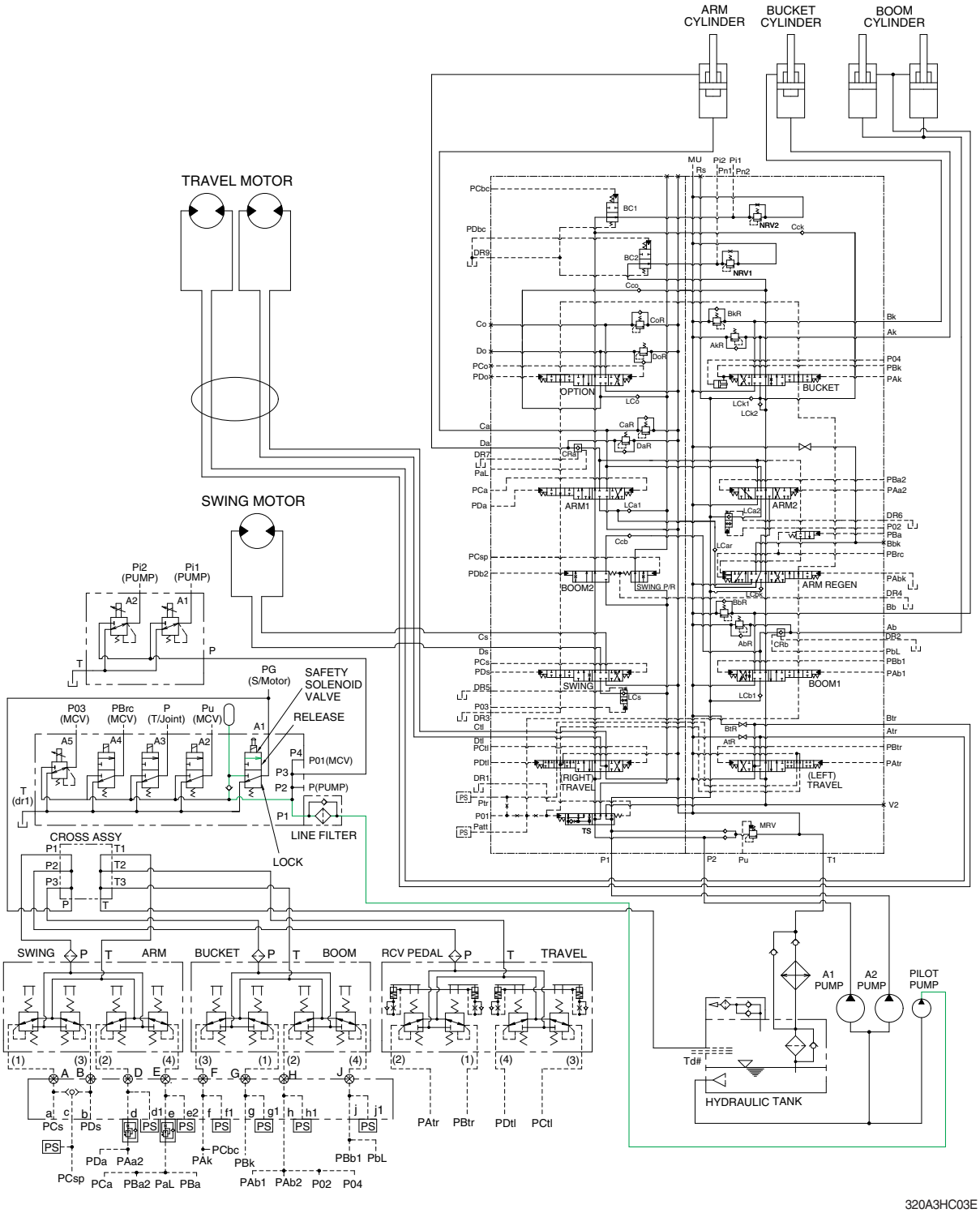
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

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

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

2. SAFETY VALVE (SAFETY KNOB)



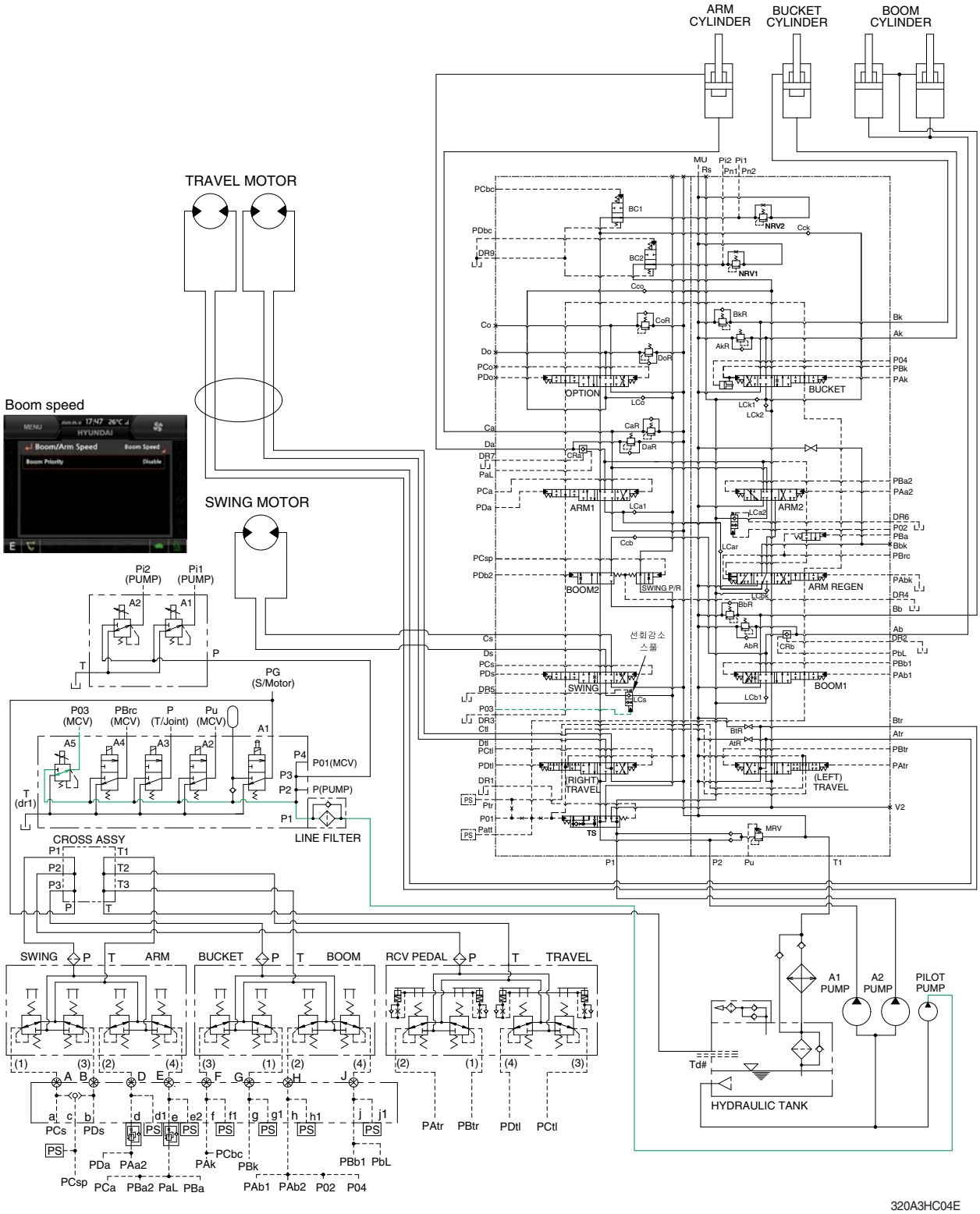
320A3HC03E

When the knob of the safety solenoid valve is moved in the release position, oil flows into the remote control valve through the line filter, safety solenoid valve and cross assy.

When the knob of the safety solenoid valve is moved in the lock position, oil does not flow into the remote control valve, because of the blocked port.

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

3. BOOM PRIORITY SYSTEM



320A3HC04E

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

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

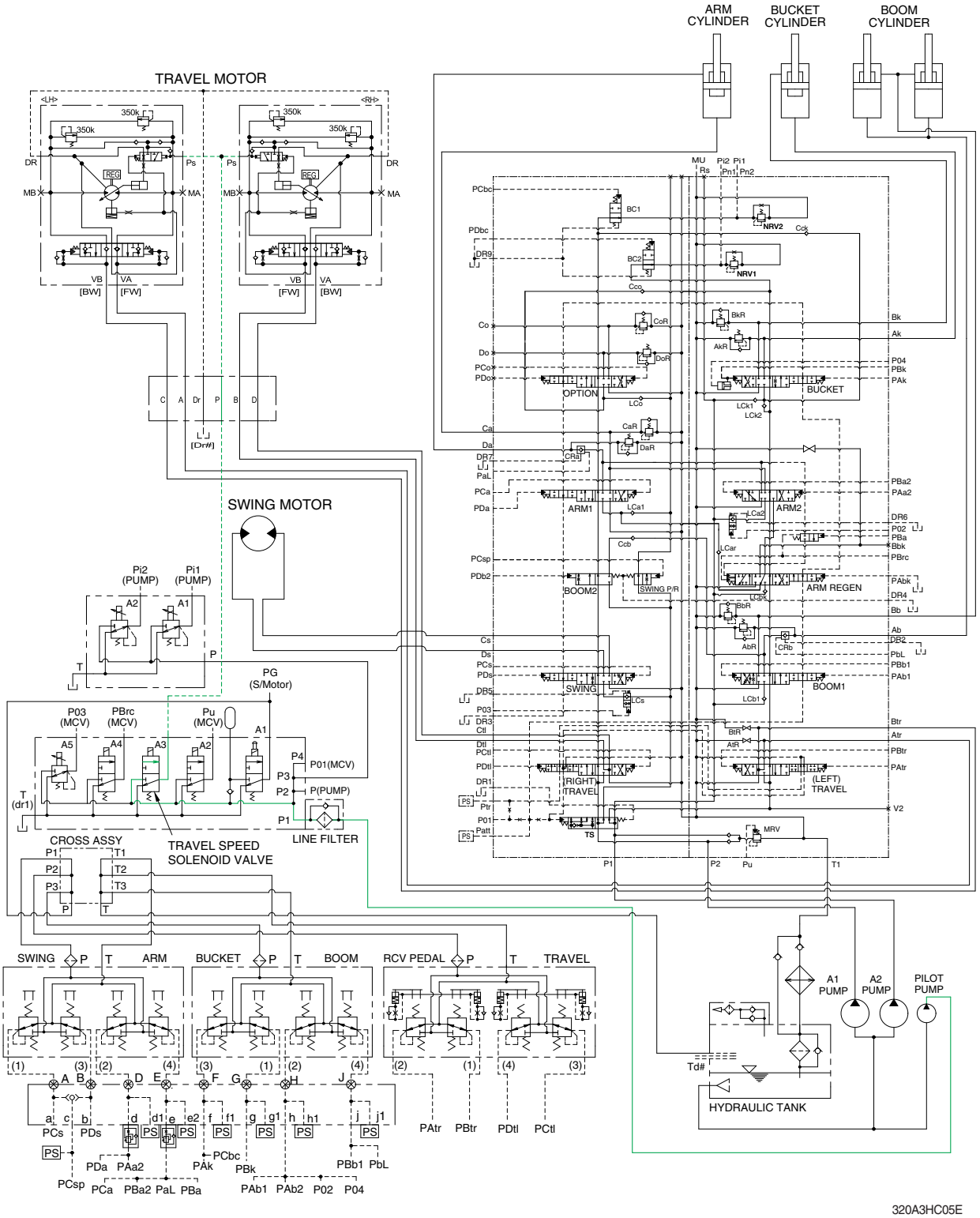
The pilot oil from pilot pump flow into **P03** port in main control valve through boom priority EPPR valve. **P03** oil pressure moves swing reducing spool to lower position and oil flow rate to the swing motor decreased.

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

The boom up speed can be adjusted by the cluster. Refer to page 3-23 of the operator's manual.

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

4. TRAVEL SPEED CONTROL SYSTEM

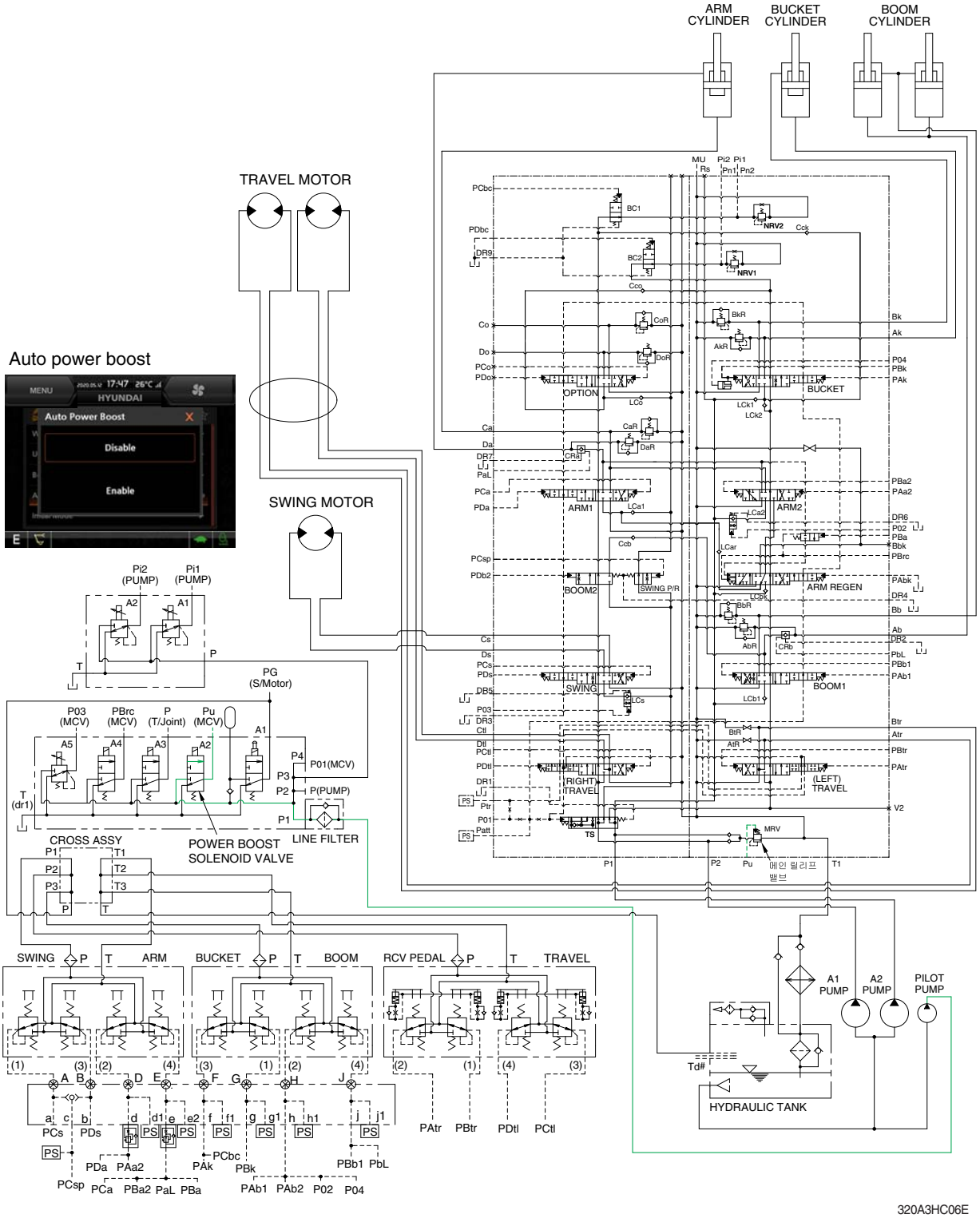


If the travel speed switch of the cluster is pressed, the solenoid valve is activated and the pressure oil from pilot pump through line filter flows to port Ps of travel speed change over valve, and the control piston are pushed left and right, thus minimizing the displacement.

If the travel speed switch of the cluster is pressed again, the solenoid valve is deactivated and the oil of Ps port return to the tank and the control piston is returned, thus maximizing the displacement.

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

5. MAIN RELIEF PRESSURE CHANGE SYSTEM



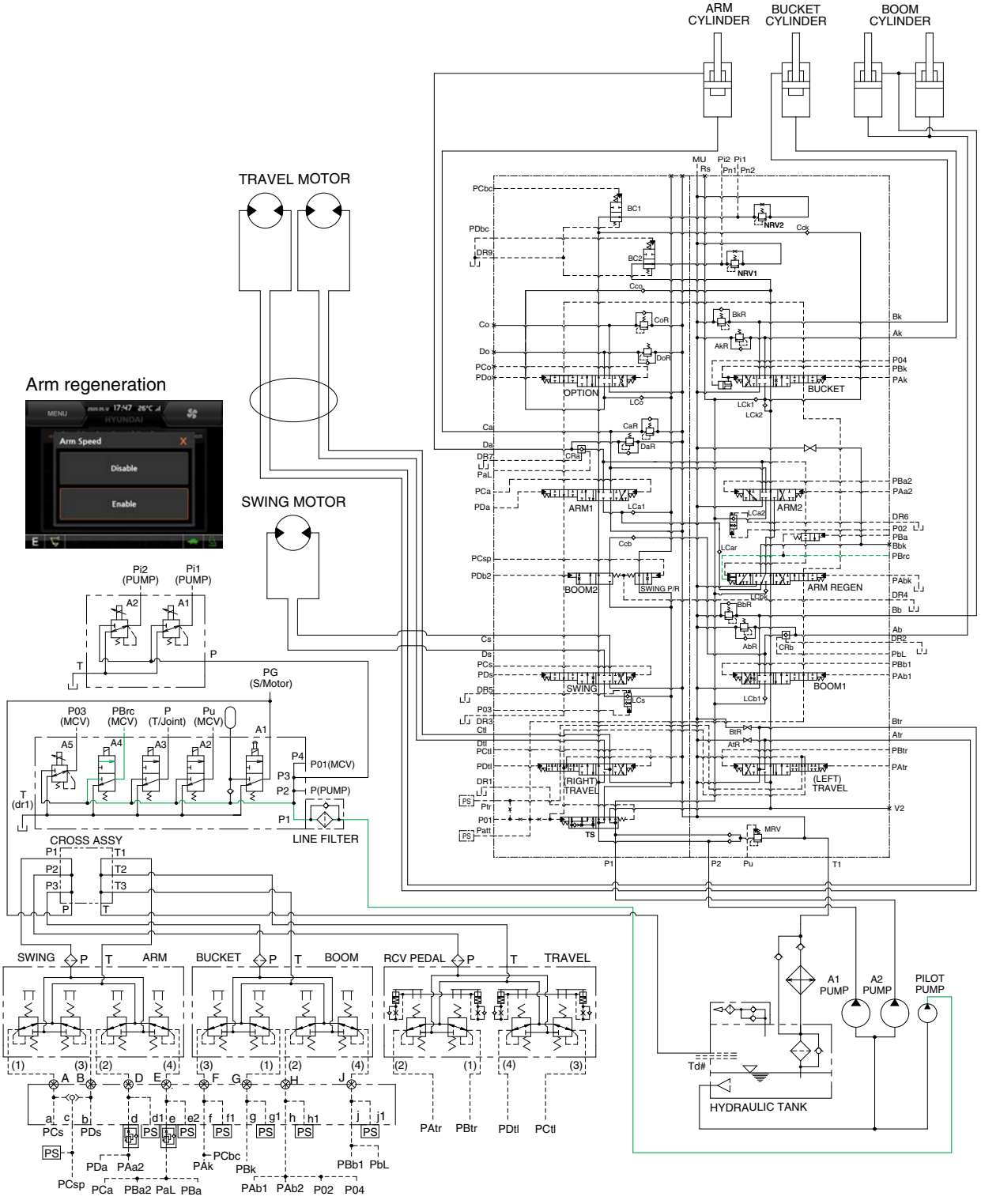
When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pu** port of the main relief valve of main control valve; then the setting pressure of the main relief valve is raised from 350 kgf/cm² (4980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

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

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

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

6. ARM REGENERATION CUT SYSTEM



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

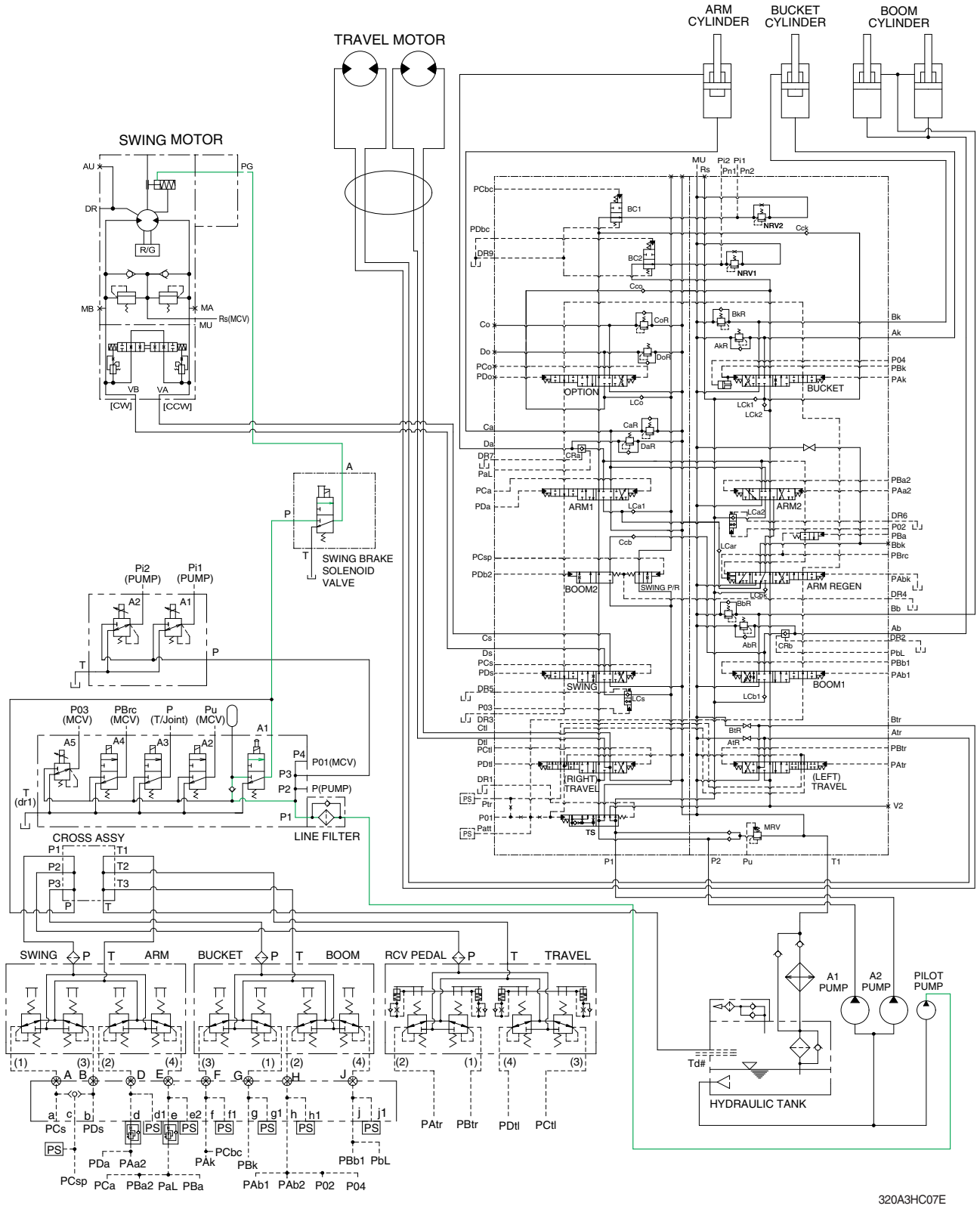
Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

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

Refer to page 2-45, 46 for the arm regeneration function.

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

7. SWING PARKING BRAKE RELEASE



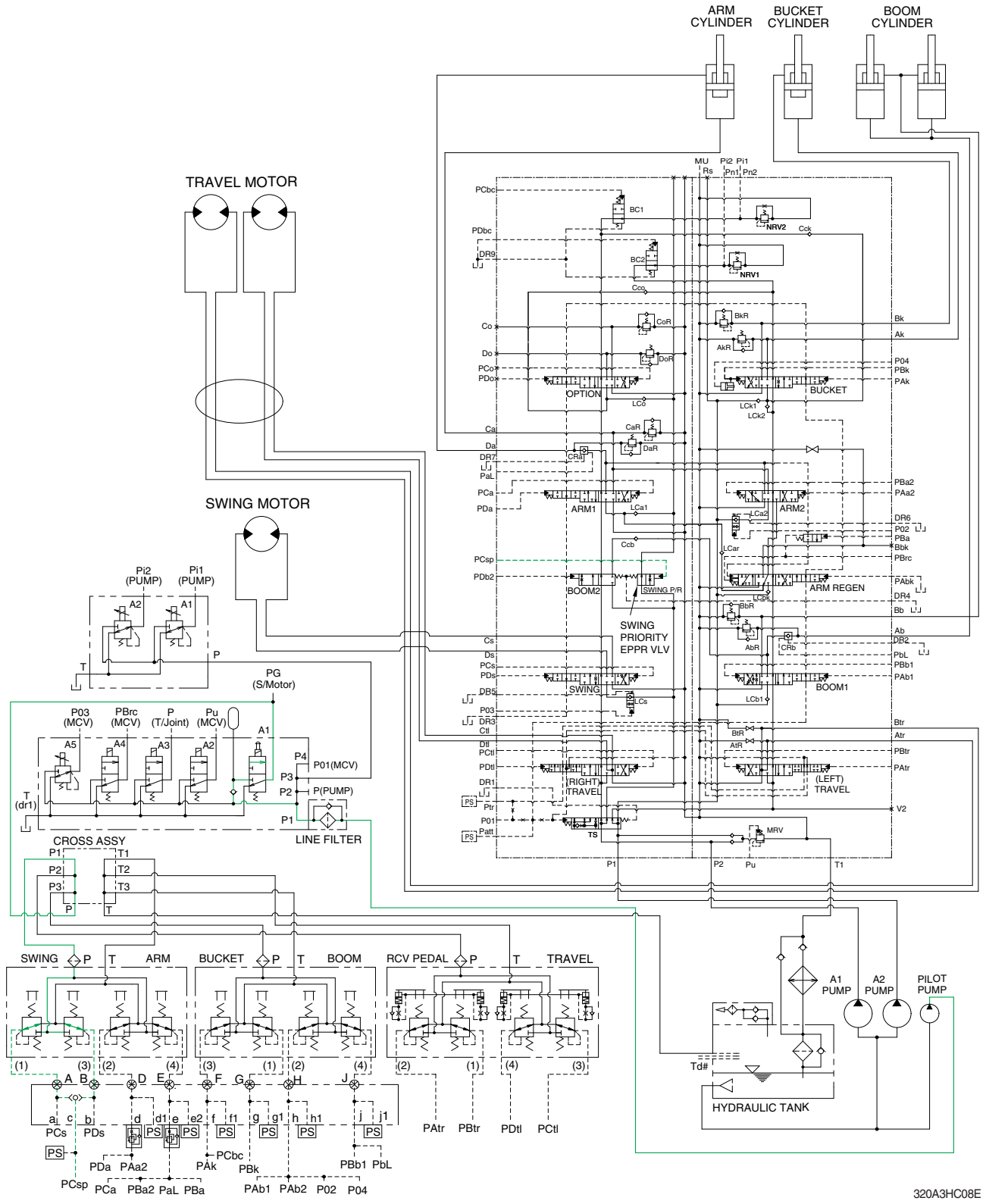
When any of the swing, arm in, boom up or travel lever is tilted, the swing brake solenoid valve is shifted to the downward by the MCU that senses the pilot pressure of the RCV control lever.

The discharged oil from pilot pump flows to swing motor PG port through the swing brake solenoid valve. This pressure is applied to swing motor disc, thus the brake is released.

When all of the RCV levers are set in the neutral position, the swing brake solenoid valve is shifted to the upward, oil in the swing motor disc cylinder is drained through the the swing brake solenoid valve, thus the brake is applied. For details, refer to page 2-60.

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

8. SWING PRIORITY SYSTEM (VS ARM)



320A3HC08E

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

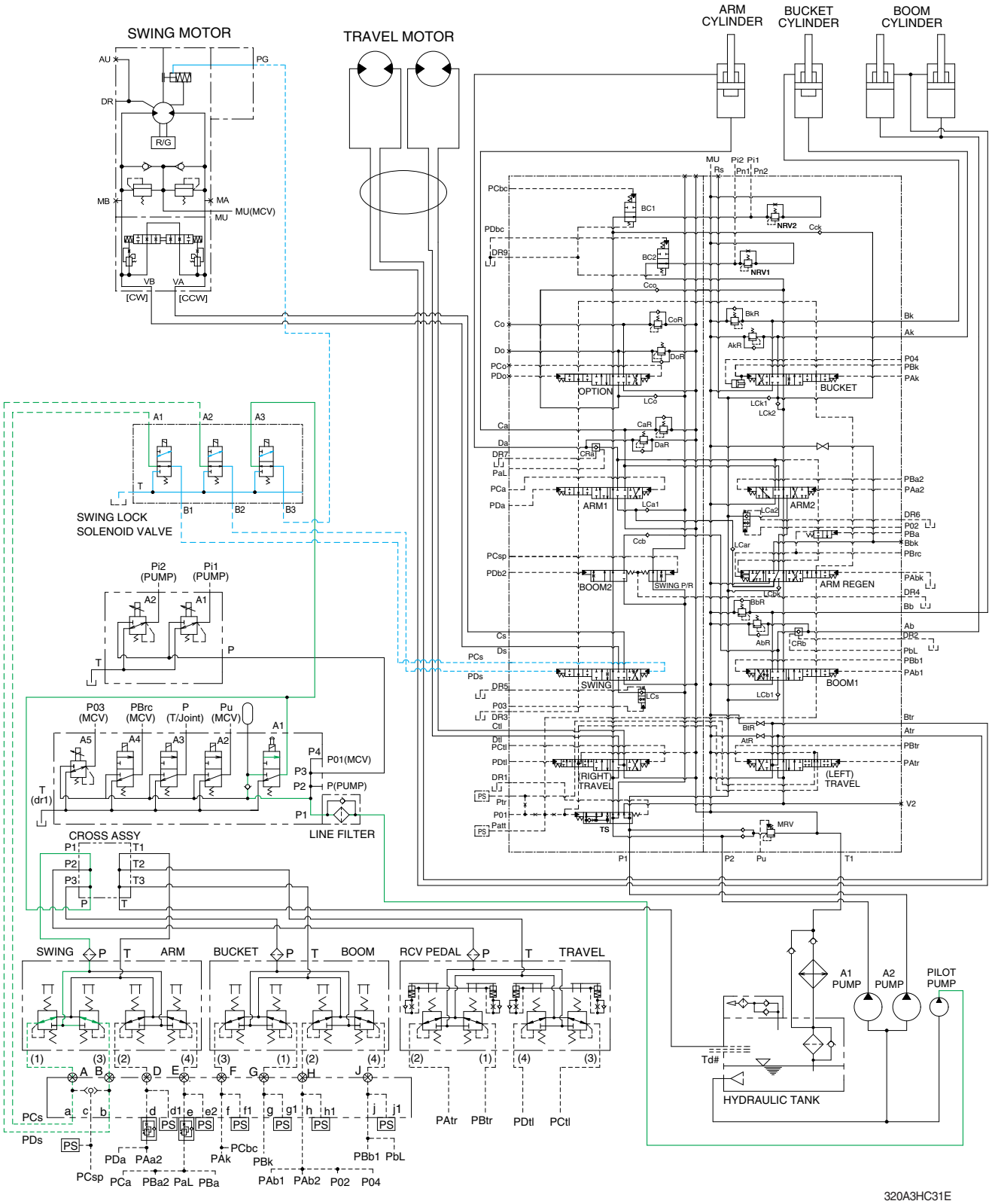
PCsp pressure from the swing shuttle block change the swing priority EPPR valve and decreases the oil flow rate to the next section to make the swing operation most preferential.

This is called the swing priority system.

For details, refer to page 2-51.

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

9. SWING LOCK SYSTEM

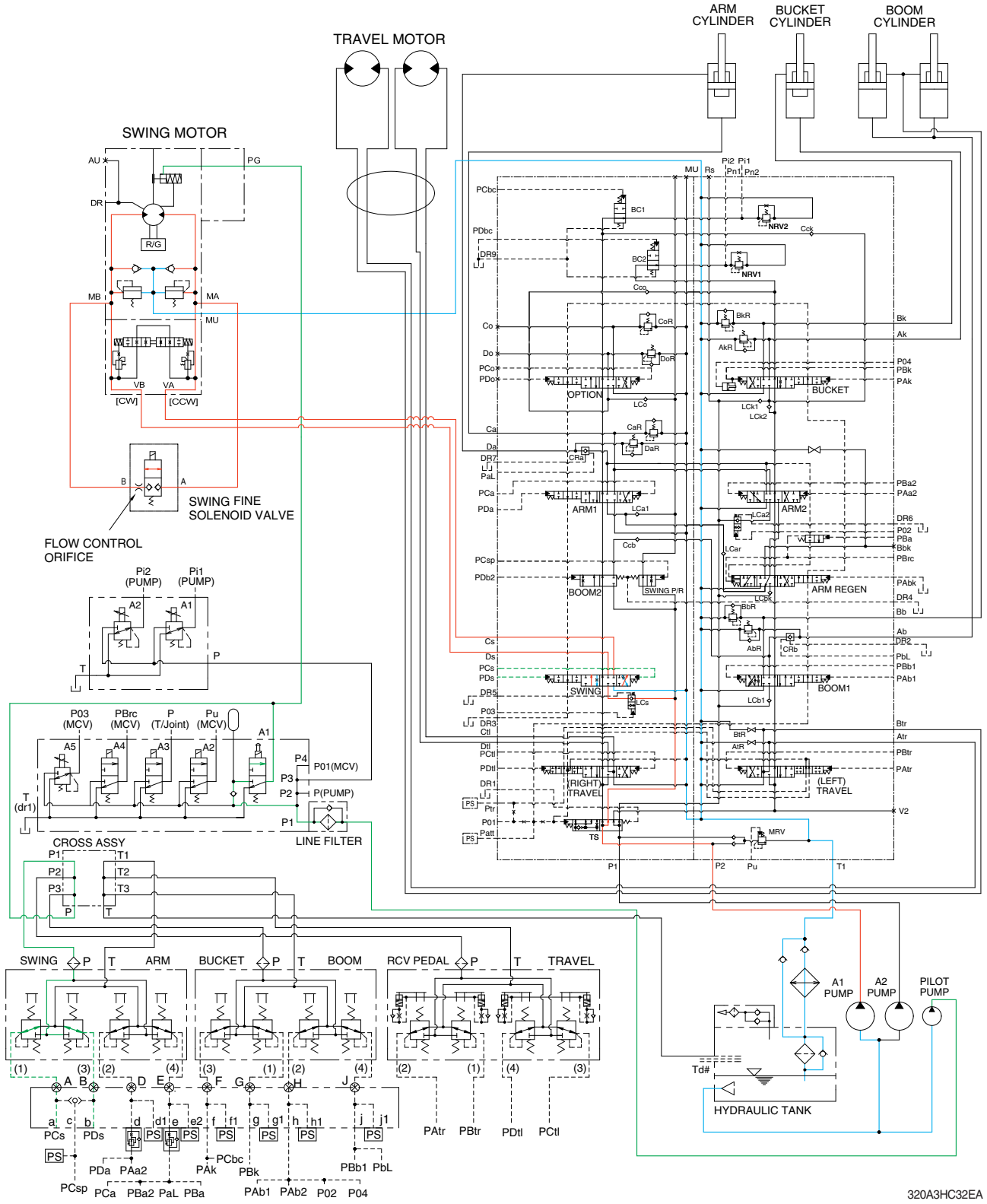


When the swing lock switch on the switch panel is pressed ON position, the swing lock solenoid valves are activated. The pilot oil from swing remote control valve to the swing spool and swing brake release shut off and the swing spool and swing brake release pilot LOCK port connect to the hydraulic tank.

Then swing operation is not available.

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

10. FINE SWING SYSTEM



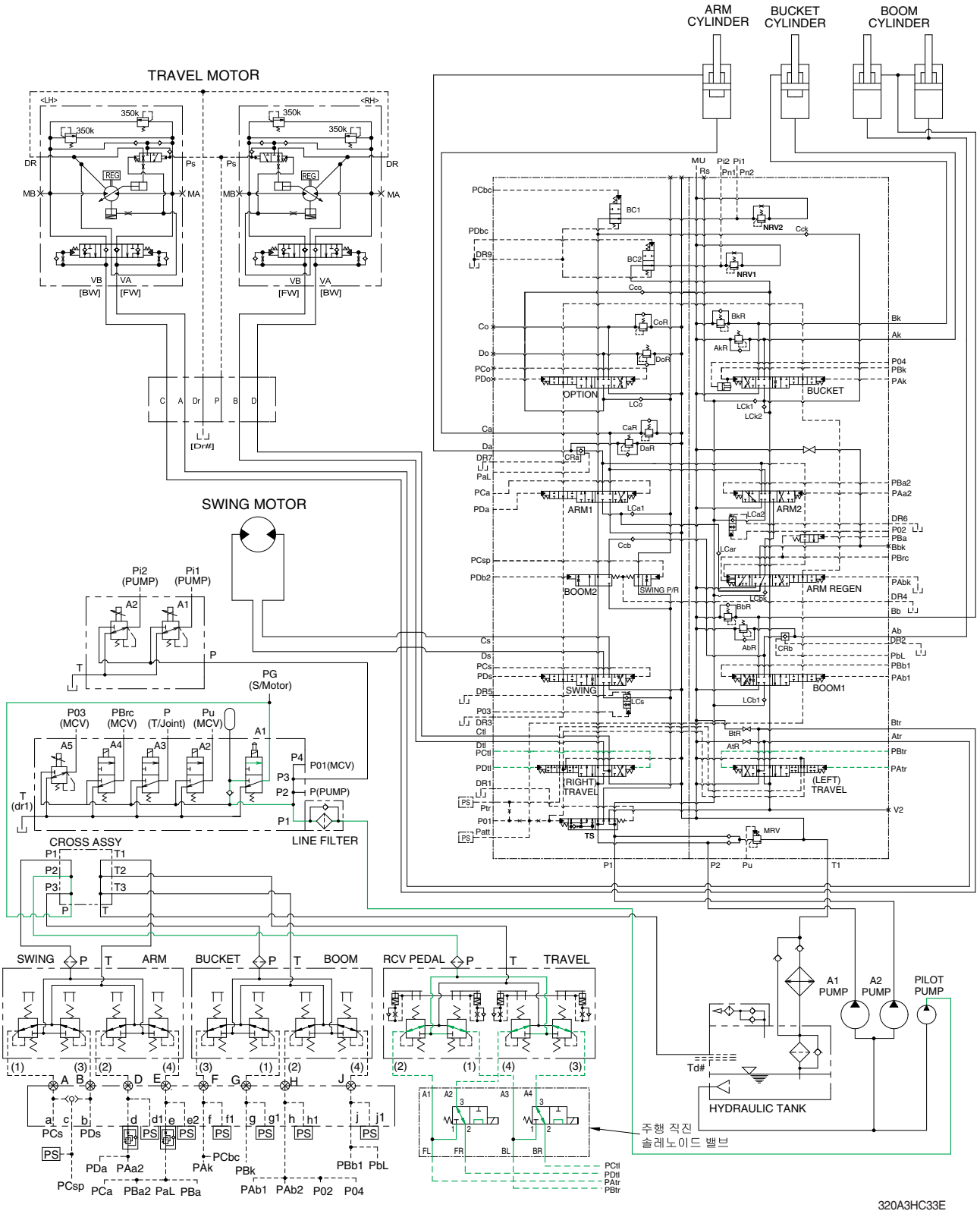
When the fine swing switch on the switch panel is pressed ON position, the swing fine solenoid valve is activated. The main pump side passage of the swing motor is connected to the return passage and some oil of the pump passage flows to the return passage through the swing fine solenoid and the flow oil quantity controlled by orifice. Then fine swing operation is available.

The activation time and detailed conditions of the valve are shown in the table below.

Function	Action	Swing fine solenoid valve operation time	Parking lock time
Cushion	Swing	Swing operation start ~ Swing operation end + 2 seconds	End + 5 seconds
Free	Boom up	Boom up operation start ~ Boom up operation end + 2 seconds	End + 2 seconds
	Travel	Travel operation start ~ Travel operation end + 2 seconds	End + 3 seconds

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

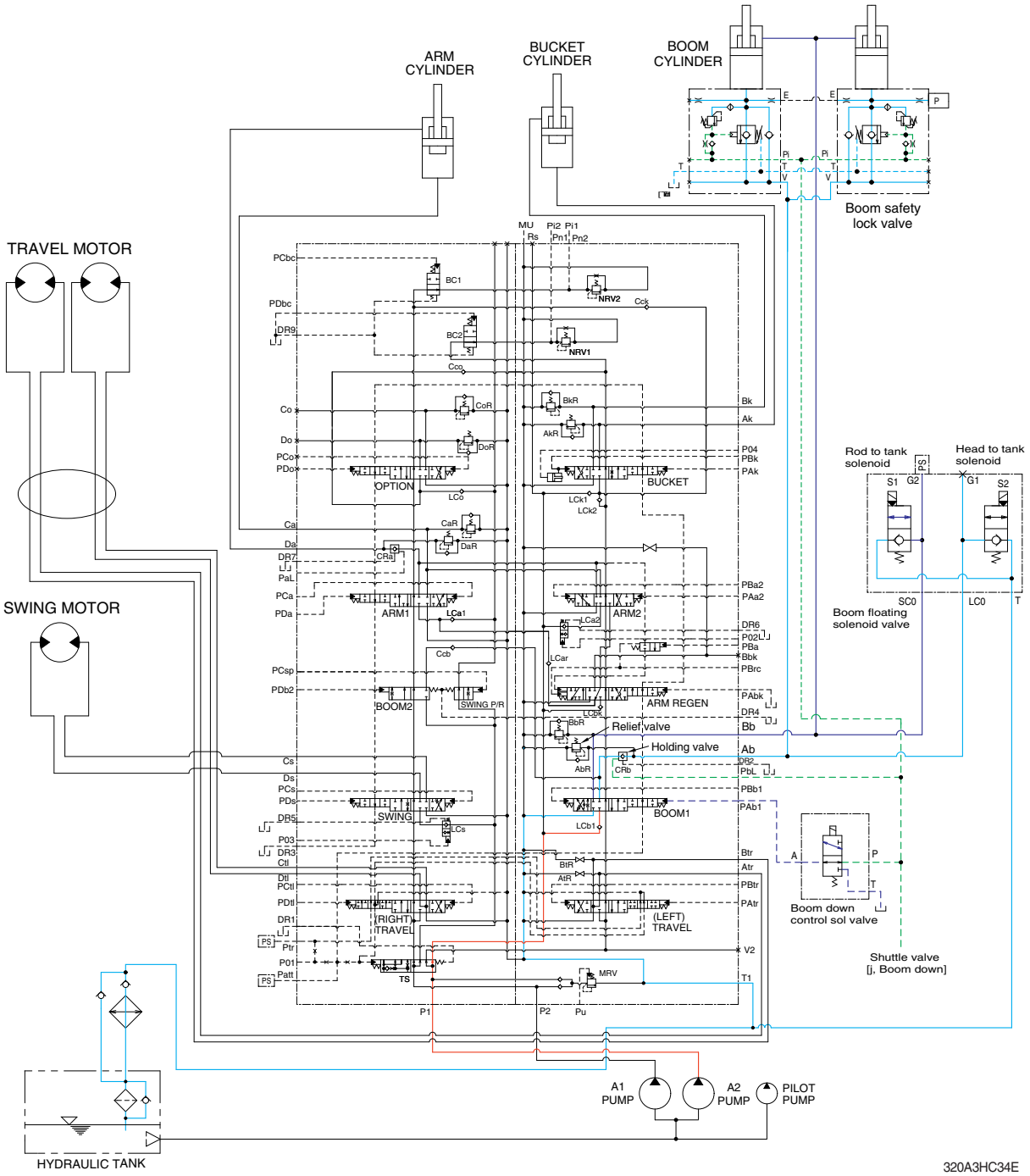
11. TRAVEL STRAIGHT SYSTEM



When the travel straight switch on the switch panel is pressed ON position, the travel straight solenoid valves are activated . The pilot oil from the left travel control valve flow into the left travel spool and right travel spool by the internal connection of the travel straight solenoid valve.
Then the travel straight operation is available by one of the left or right travel pedal.

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

12. BOOM FLOATING SYSTEM

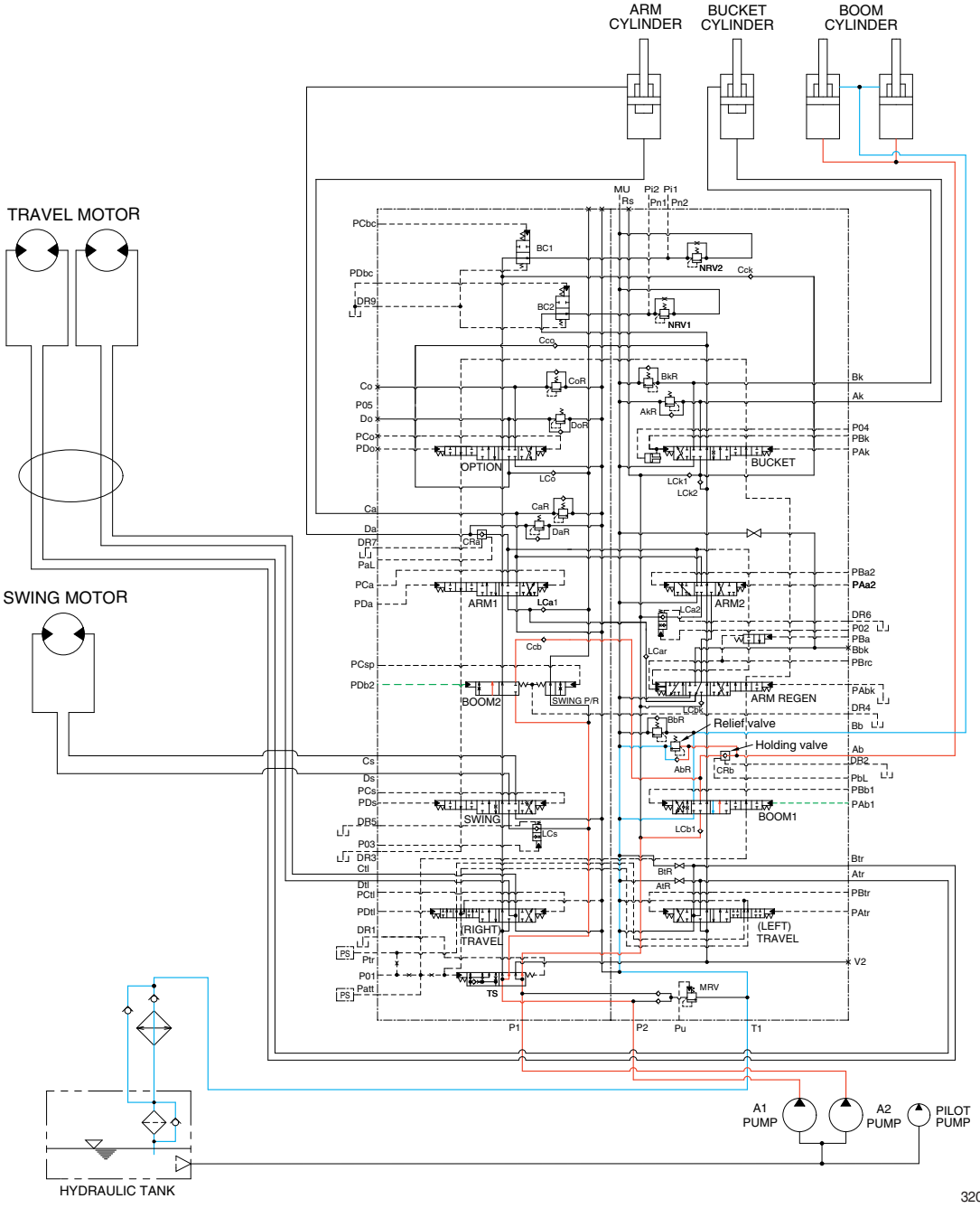


Smooth and convenient boom movement is accomplished by only arm control lever operation.
The boom floating solenoid values are equipped in the rod and head of boom cylinder that are controlled to act as floating mode.
"Rod to tank solenoid" and "Head to tank solenoid" are active. So the hydraulic oil of rod and head goes to tank, and floating is accomplished. In the mode, boom down cut-off solenoid is active so that boom down pilot pressure is cut.
For more details, refer to page 5-13.

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

GROUP 4 SINGLE OPERATION (CURRENT VERSION)

1. BOOM UP OPERATION



When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure (PAb1, PDb2) from the remote control valve.

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

At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom 1 spool in the main control valve. When this happens, the boom goes up.

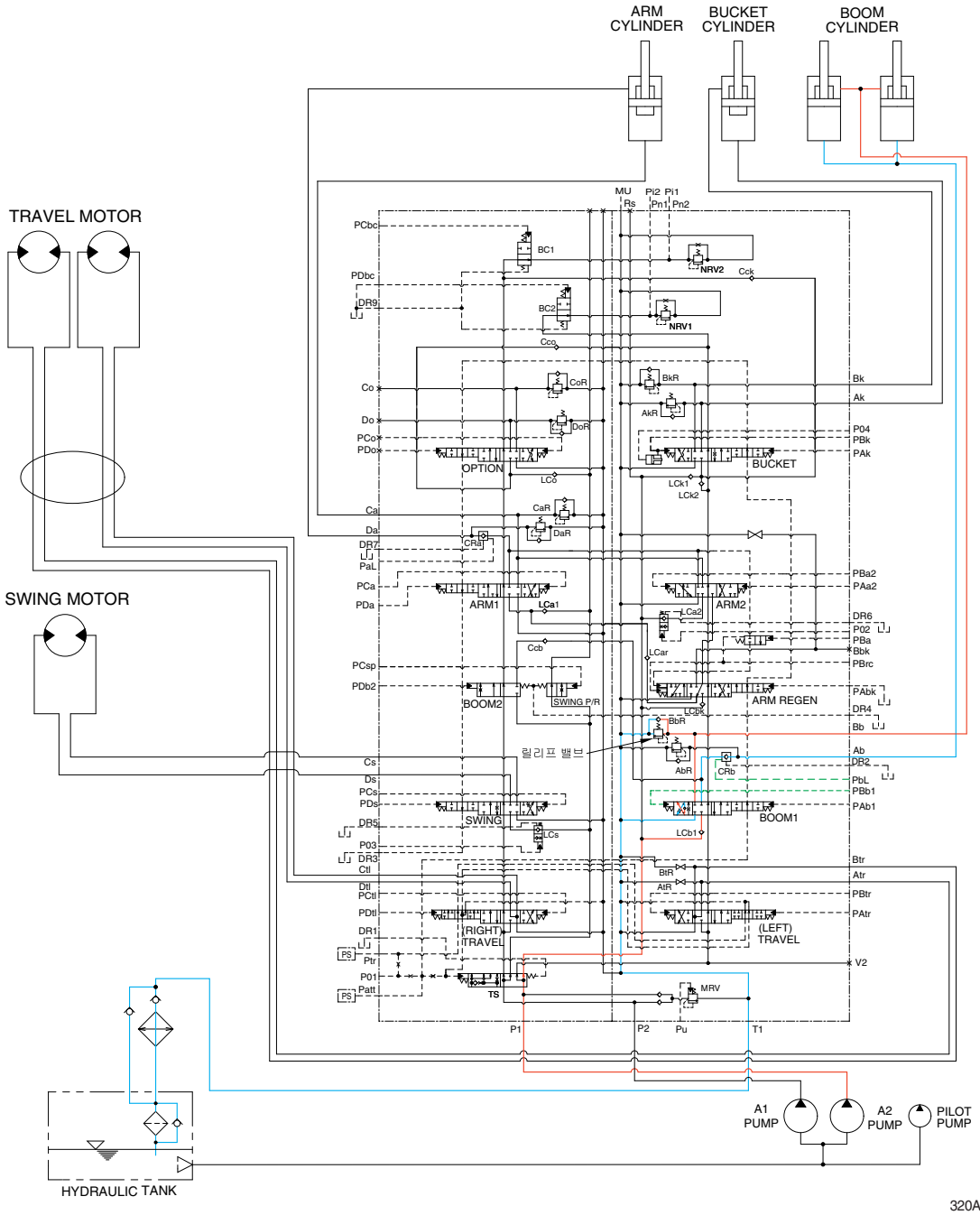
The excessive pressure in the boom cylinder head side is prevented by relief valve.

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

This prevents the hydraulic drift of boom cylinder.

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

2. BOOM DOWN OPERATION



When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure (PBb1, PbL) from the remote control valve.

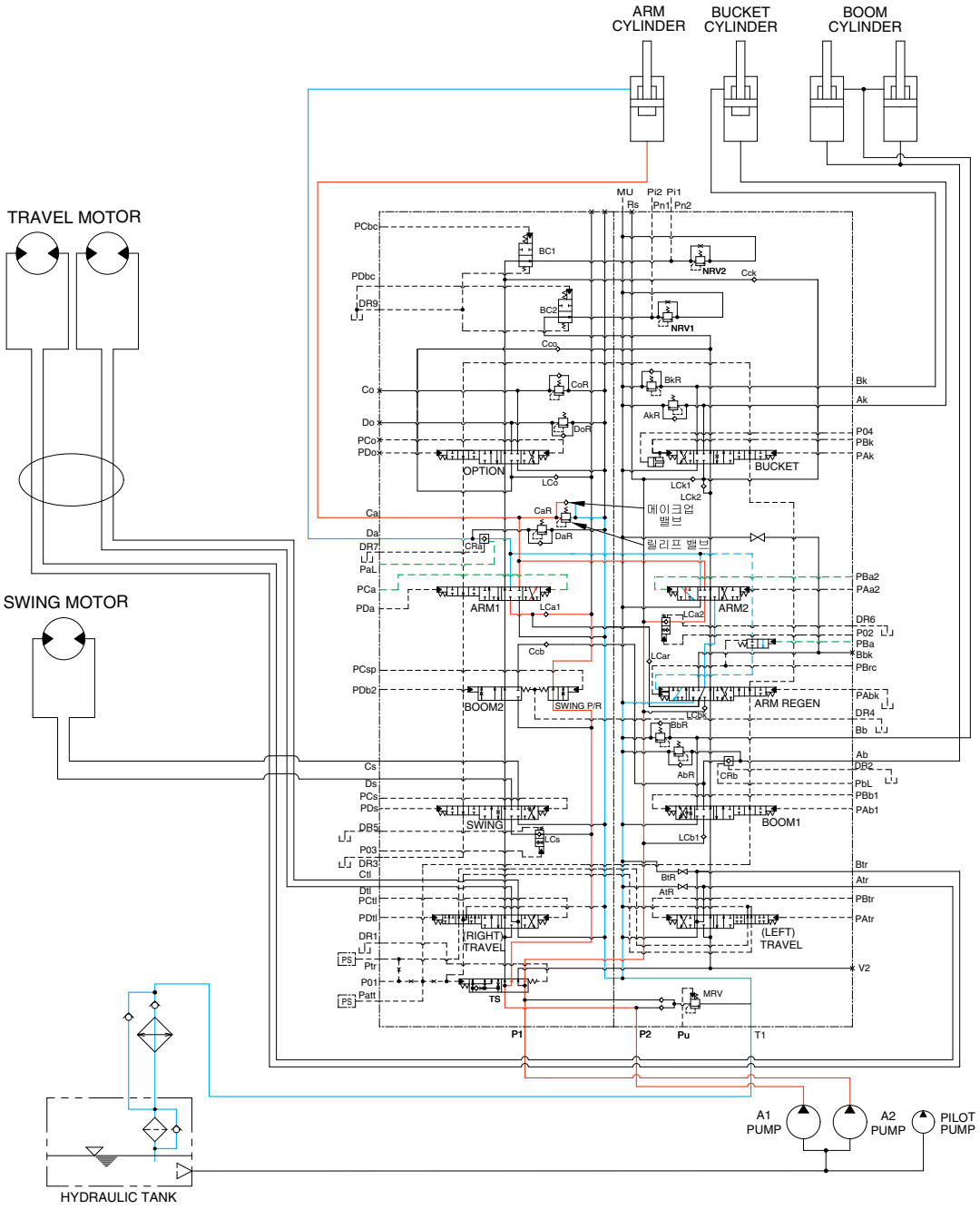
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 spool in the main control valve.

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

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

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

3. ARM IN OPERATION



320A3HC11E

When the left 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 (PCa, PBa2) from the remote control valve.

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

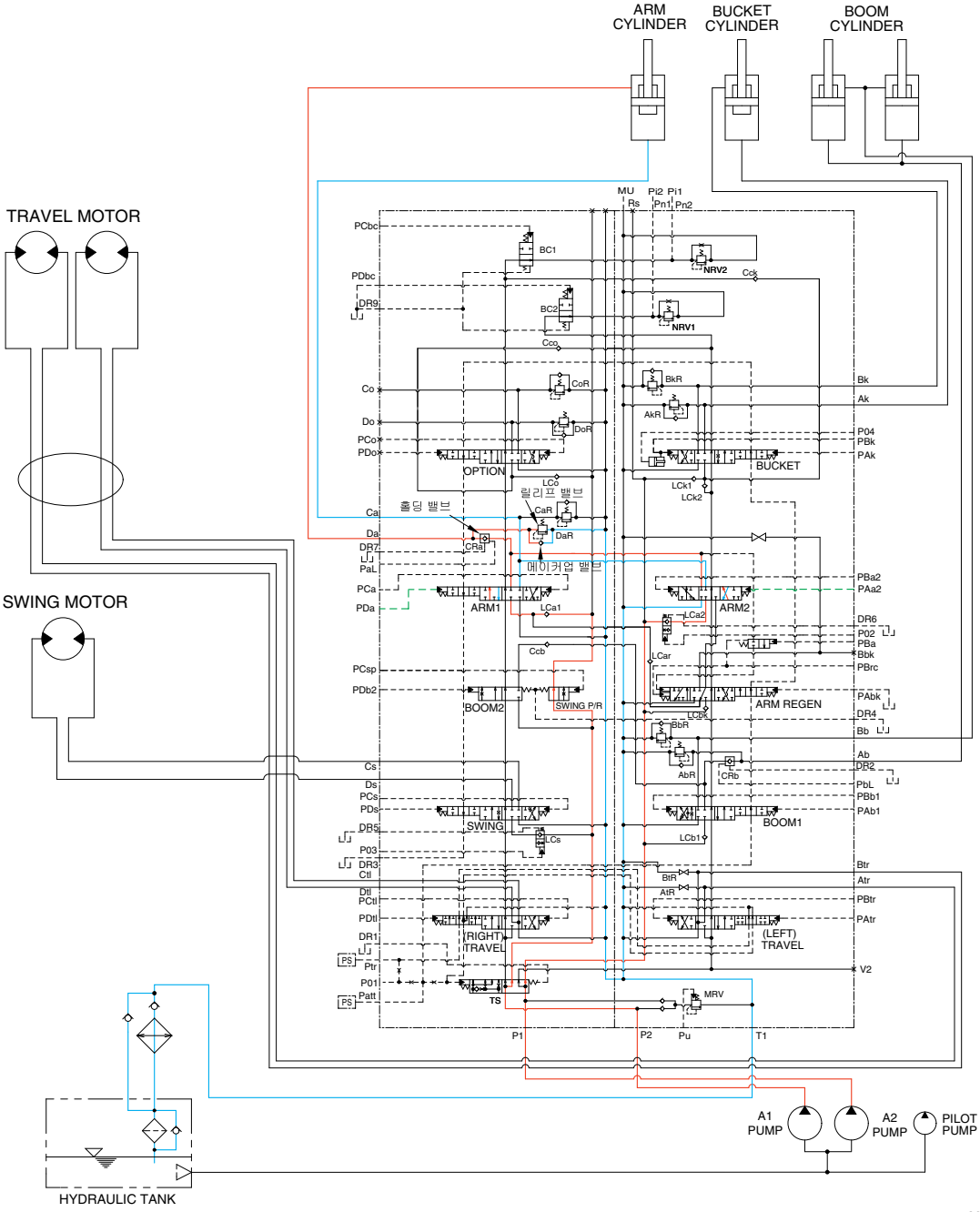
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 2 spool in the main control valve. When this happens, the arm rolls in.

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

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

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

4. ARM OUT OPERATION



When the left control lever is pushed forward, the arm spools in the main control valve are moved to the roll out position by the pilot oil pressure (PDa, PAa2) from the remote control valve.

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

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

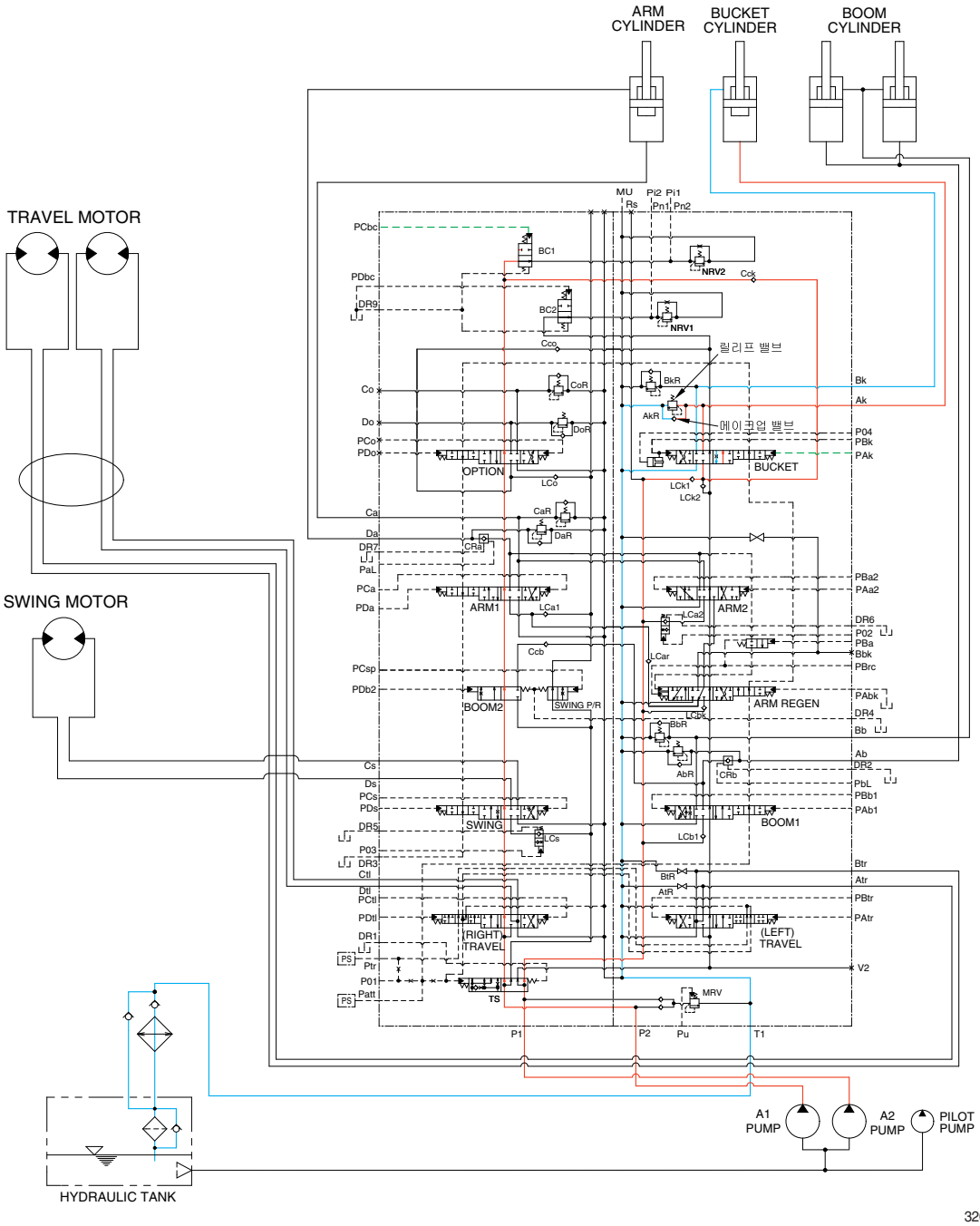
The excessive pressure in the arm cylinder rod side is prevented by relief valve.

When the arm is roll out and the control lever is returned to neutral position, the circuit for the holding pressure at the rod side of the arm cylinder is closed by the arm holding valve.

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

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

5. BUCKET IN OPERATION



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

The oil from the A2 pump flows into the main control valve and then goes to the large chamber of bucket cylinder. The oil form the A1 pump flows into the large chamber of bucket cylinder through confluence oil passage in the main control valve by bypass cut pilot pressure (PCbc).

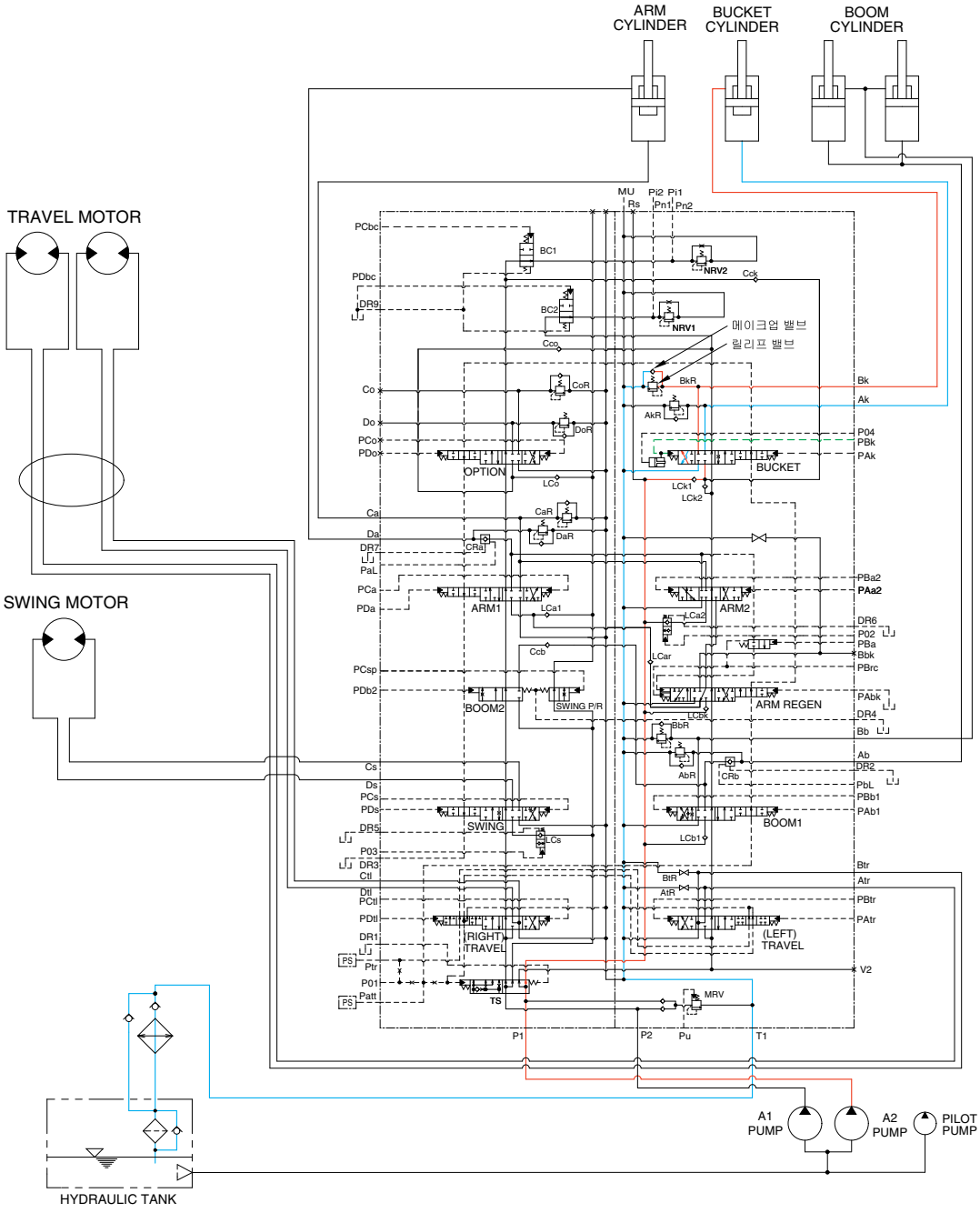
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

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

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

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

6. BUCKET OUT OPERATION



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

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

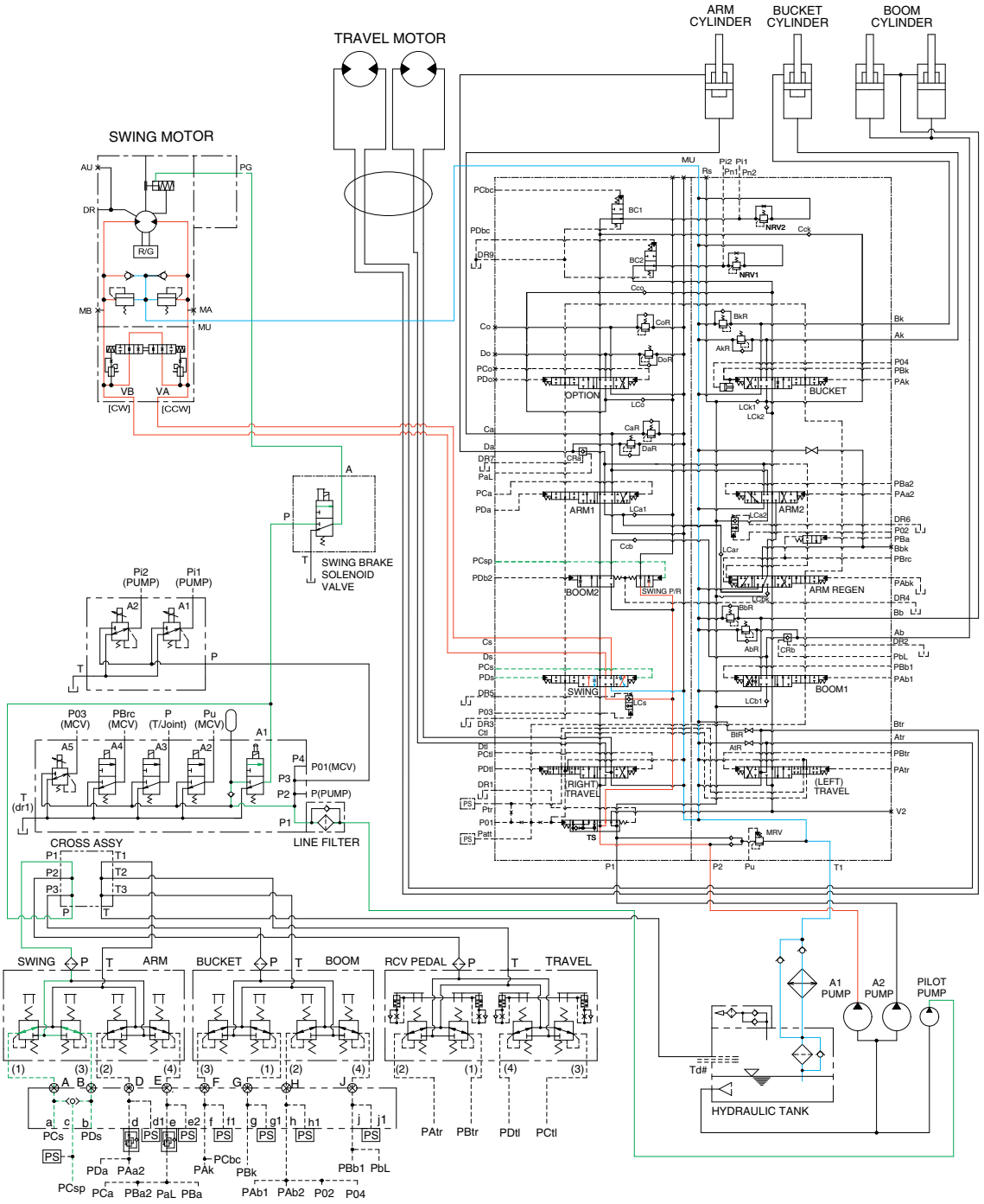
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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

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

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

7. SWING OPERATION



320A3HC15E

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

Also the swing operation preference function is operated by the pilot pressure PCsp (refer to page 2-51).

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

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

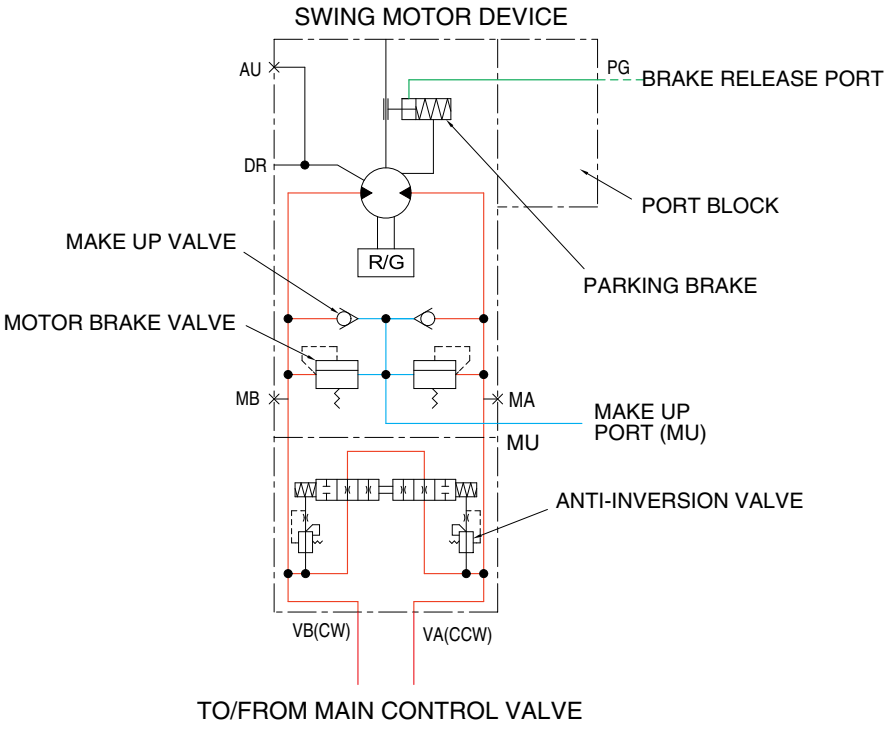
When this happens, the upper structure swings to the left or right.

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

The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

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

SWING CIRCUIT OPERATION



320A3HC36E

1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation and controls the swing motor operating pressure to 300 kgf/cm^2 (4270 psi).

2) MAKE UP VALVE

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

3) PARKING BRAKE

This is function as a parking brake only when any of the swing, arm in, boom up or travel control lever is not operated.

PARKING BRAKE "OFF" OPERATION

When any of the swing, arm in, travel or boom up control lever is tilted, the swing brake solenoid valve is energized by the MCU that senses the swing pilot oil pressure.

The discharged oil from pilot pump flows to swing motor PG port through the swing brake solenoid valve. This pressure is applied to swing parking brake piston, thus the brake is released.

PARKING BRAKE "ON" OPERATION

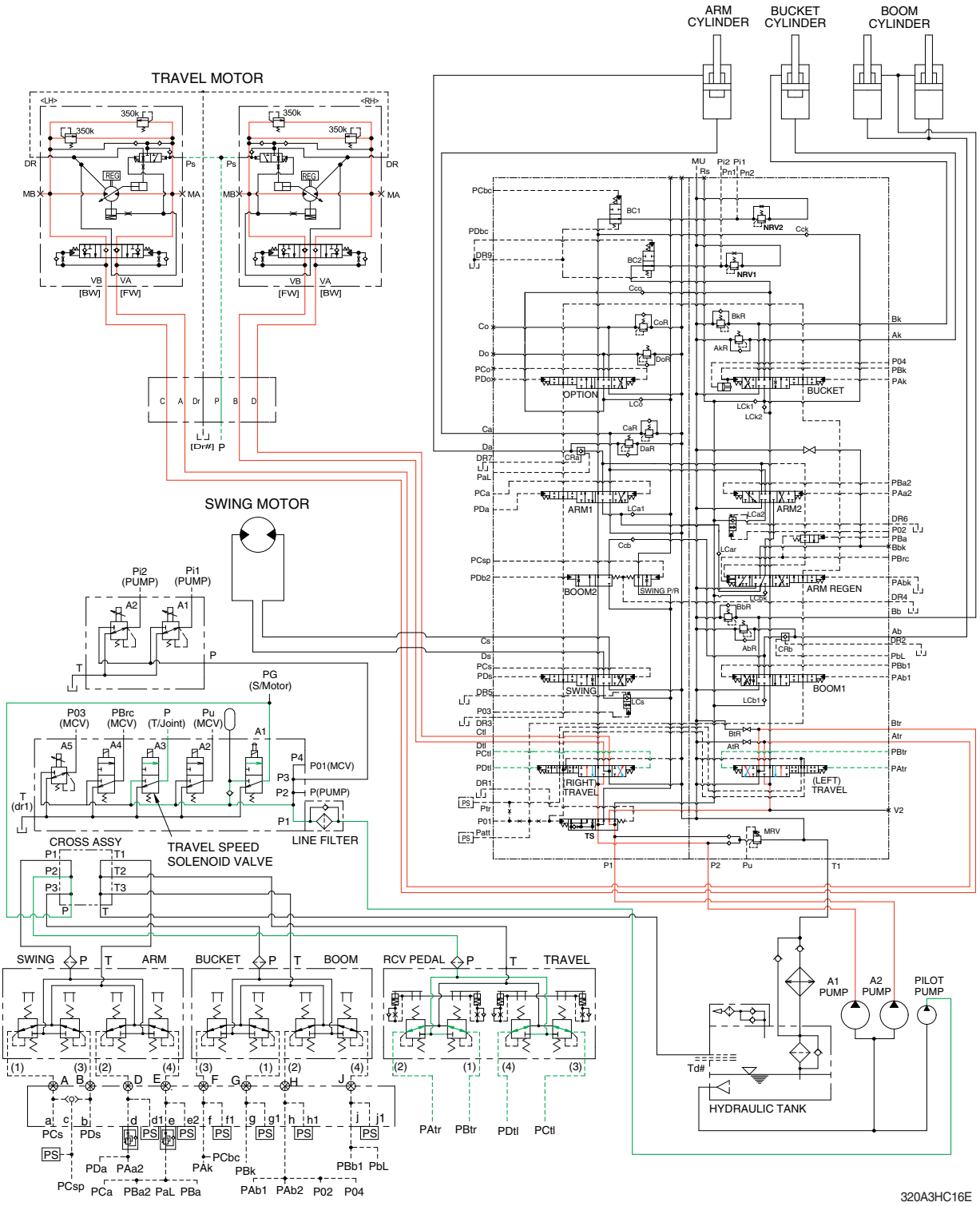
When all of the RCV levers are set in the neutral position, the swing brake solenoid valve is de-energized, oil in the swing parking brake chamber is drained through the the swing brake solenoid valve, thus the brake is applied by spring force.

4) ANTI-INVERSION VALVE

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

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

8. TRAVEL FORWARD AND REVERSE OPERATION



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

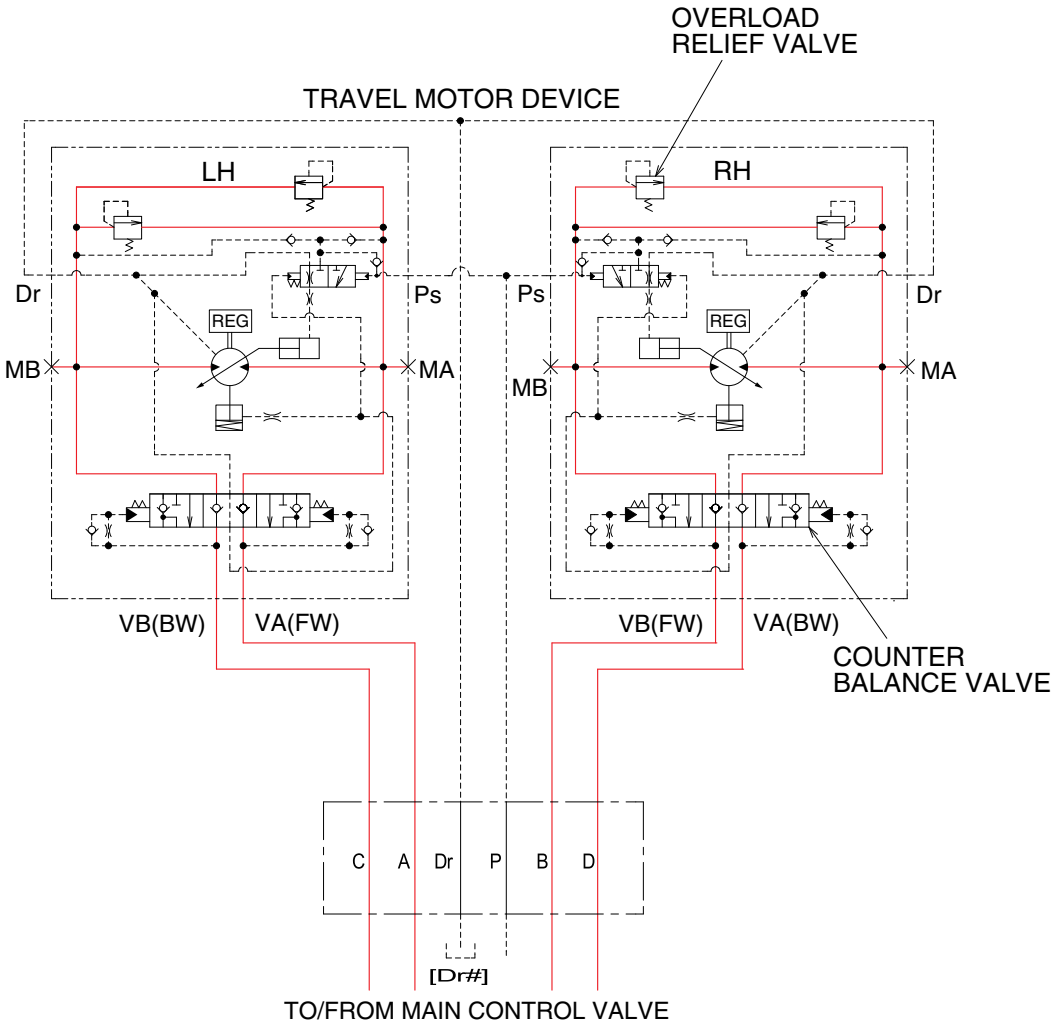
The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

The return oil from both travel motors returns to the hydraulic oil tank through the turning joint and the travel spools in the main control valve.

When this happens, the machine moves to the forward or reverse.

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

TRAVEL CIRCUIT OPERATION



320A3HC37E

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

1) COUNTER BALANCE VALVE

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

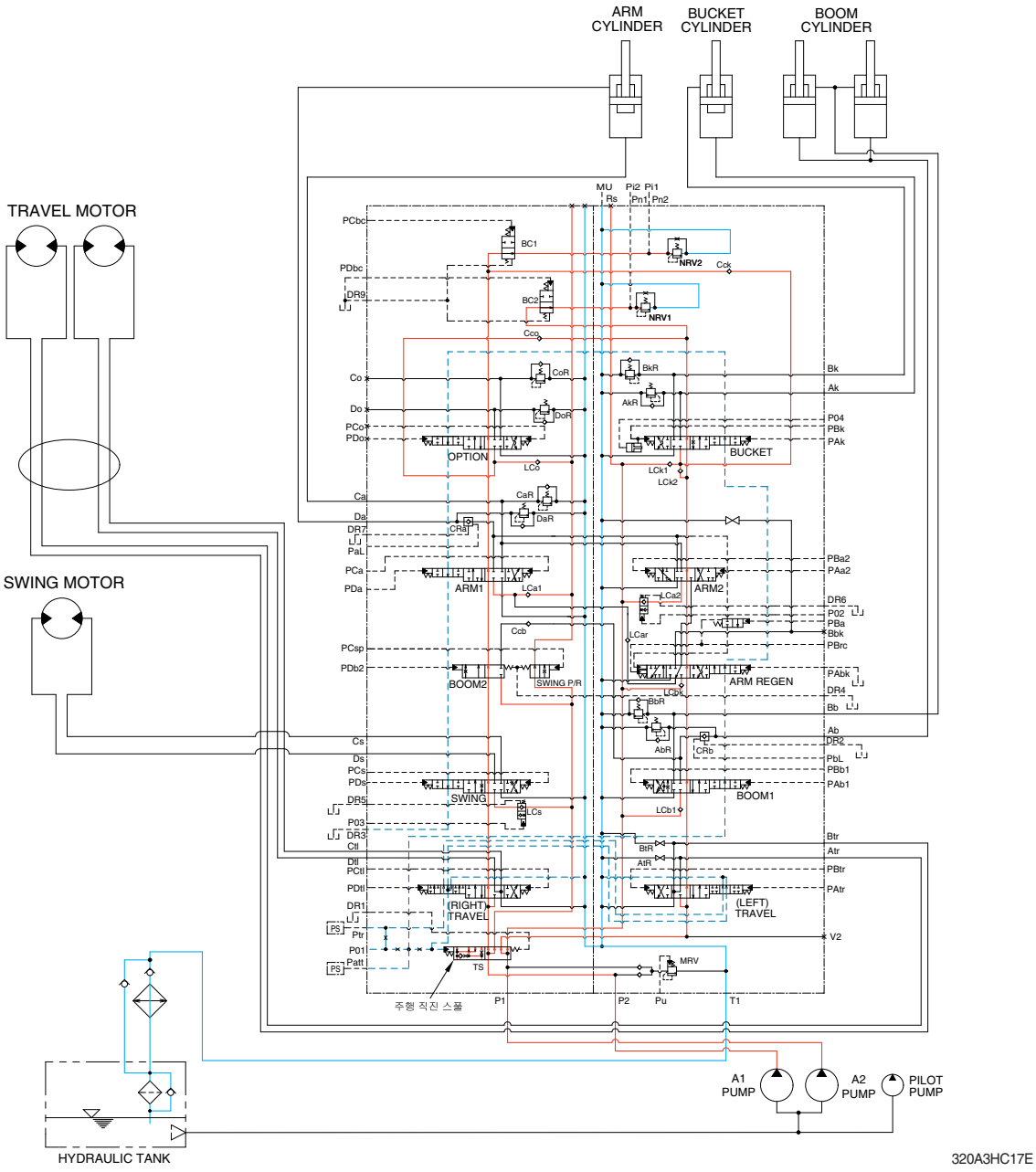
2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 350 kgf/cm^2 (4980 psi) to prevent high pressure generated at a time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

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

GROUP 5 COMBINED OPERATION (CURRENT VERSION)

1. OUTLINE



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

STRAIGHT TRAVEL SPOOL

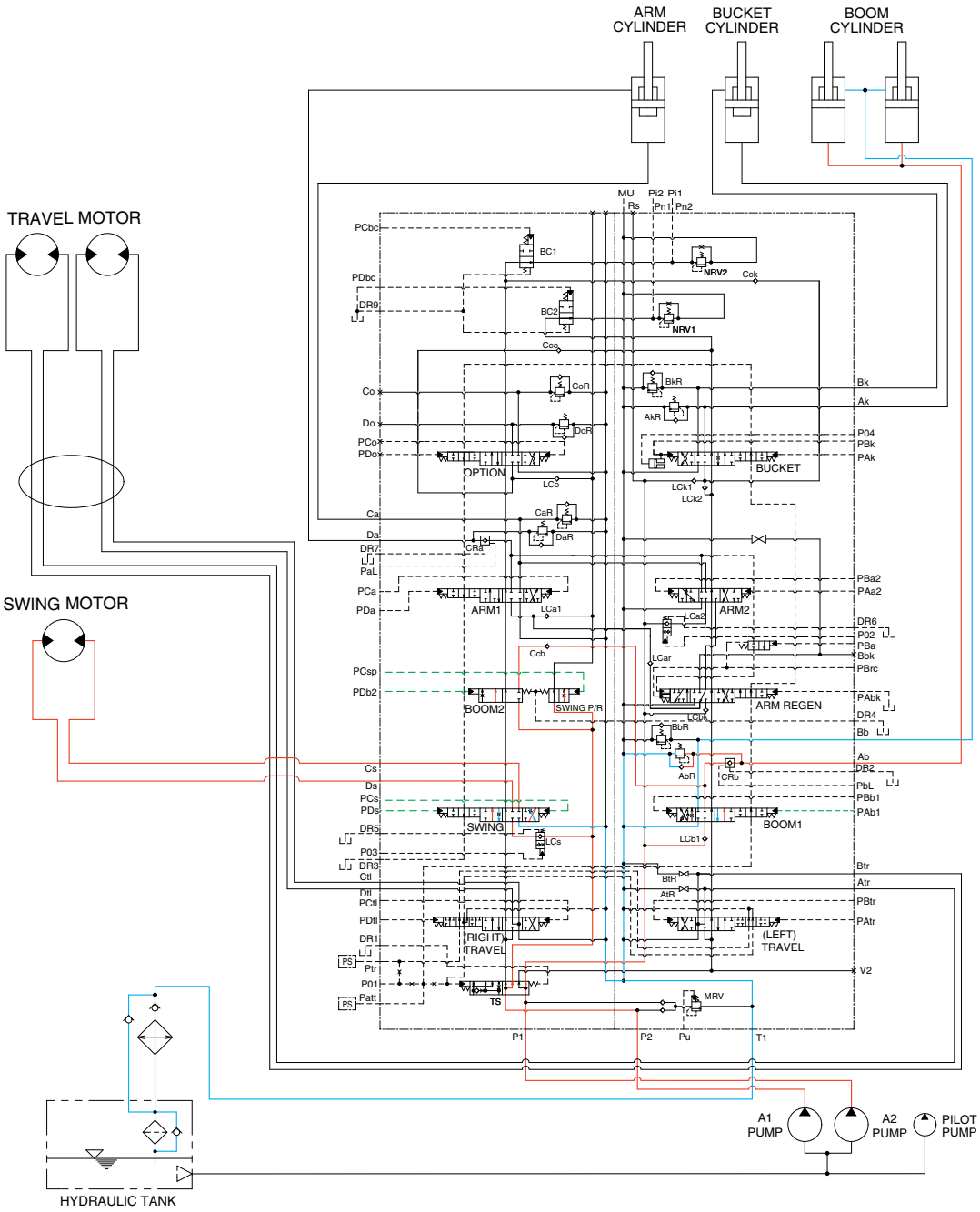
This straight travel spool for straight travel is provided in the main control valve.

If any actuator is operated when traveling, the straight travel spool is pushed to the right by the pilot oil pressure (P01).

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

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

2. COMBINED SWING AND BOOM UP OPERATION



320A3HC18E

When the swing and boom up functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure (PCs, PDs, PAb1, PDb2) from the remote control valve.

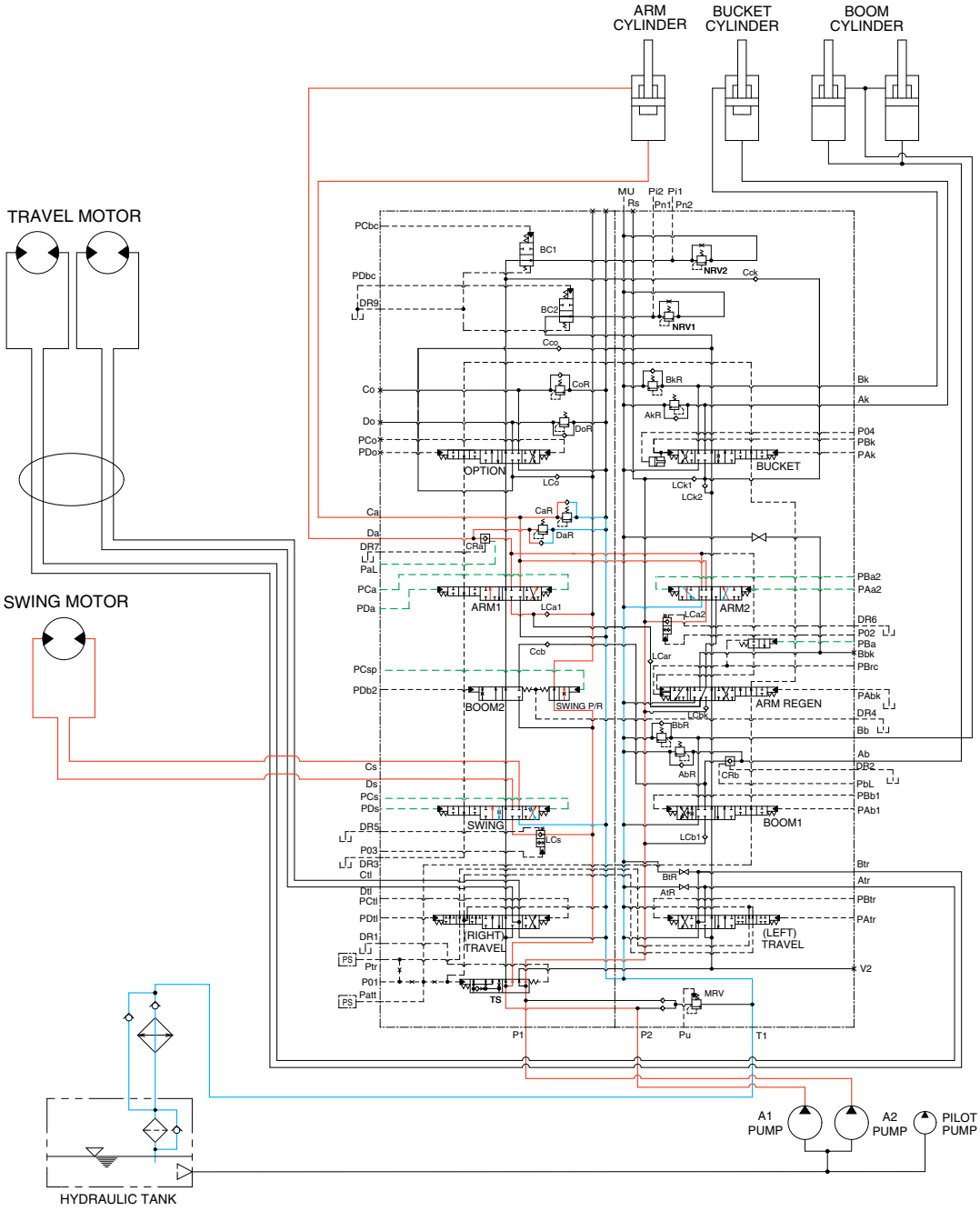
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

The oil from the A2 pump flows into the boom cylinders through the boom 1 spool in the right control valve. The upper structure swings and the boom is operated.

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

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

3. COMBINED SWING AND ARM OPERATION



320A3HC19E

When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure (PCs, PDs, PCa, PDa, PAa2, PBa2) from the remote control valve.

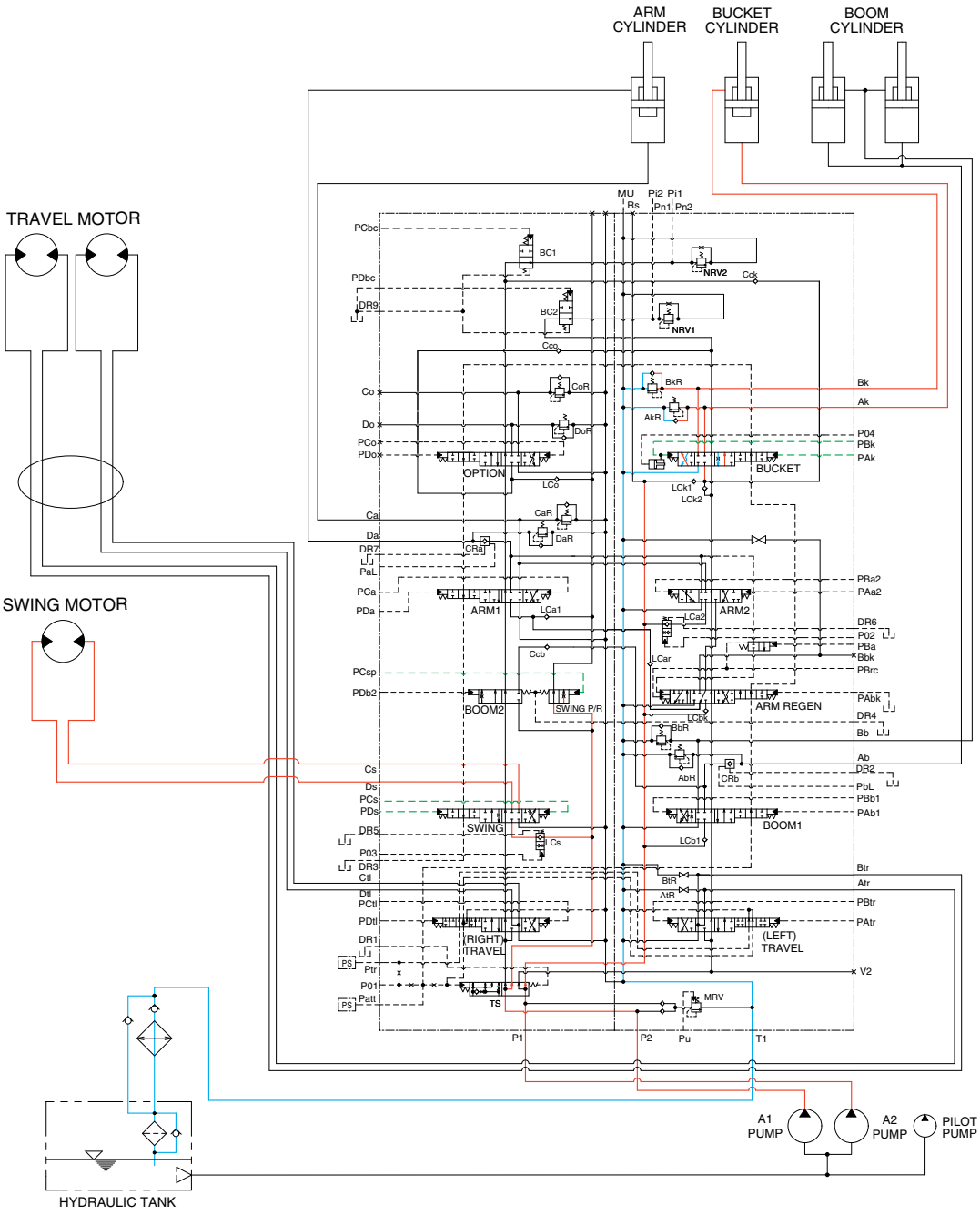
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

The oil from the A2 pump flows into the arm cylinder through the arm 2 spool of the right control valve. The upper structure swings and the arm is operated.

Refer to page 2-51 for the swing operation preference function.

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

4. COMBINED SWING AND BUCKET OPERATION



320A3HC20E

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

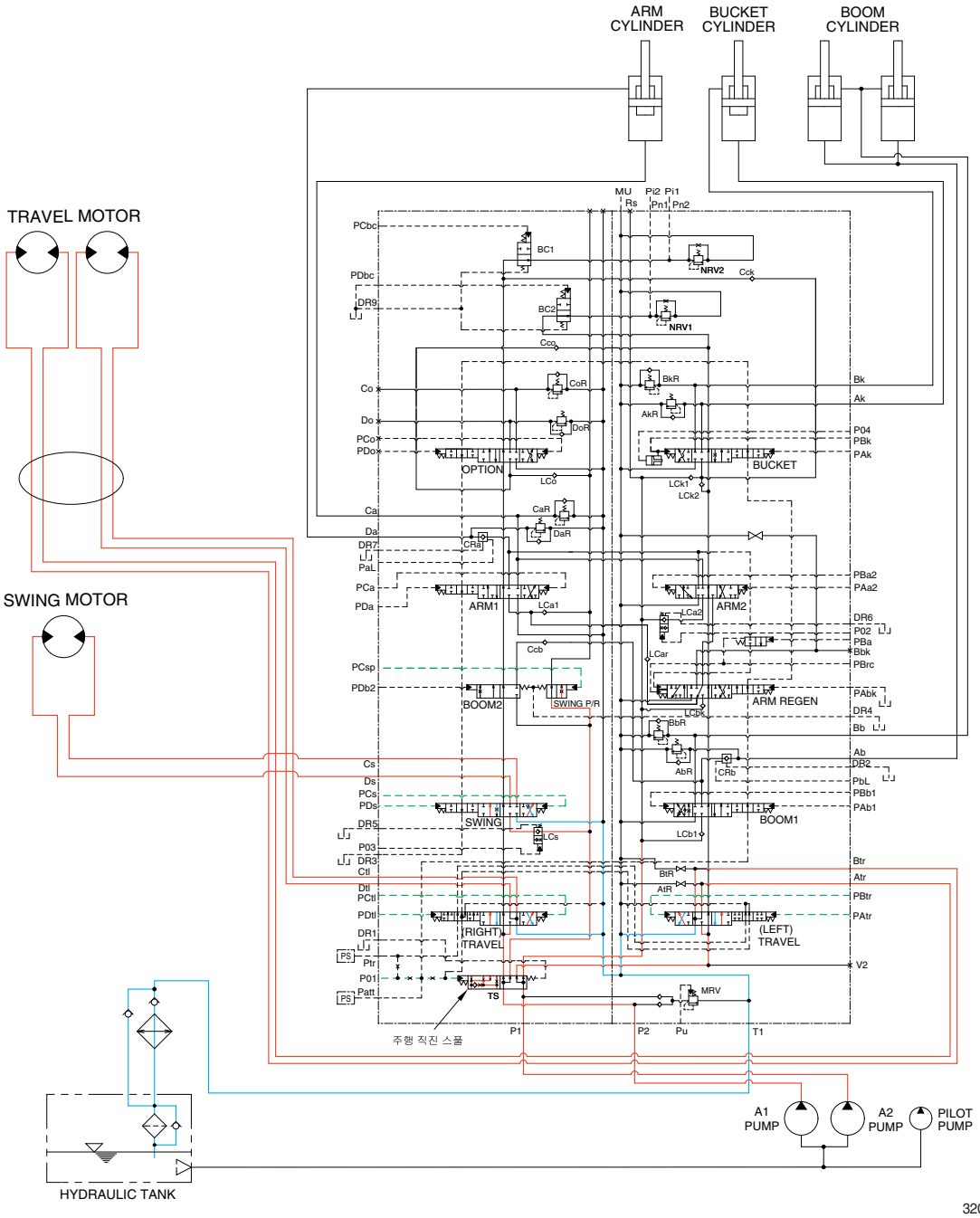
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

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

The upper structure swings and the bucket is operated.

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

5. COMBINED SWING AND TRAVEL OPERATION



320A3HC21E

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 (PCs, PDs, PAtr, PBtr, PCtl, PDtl) from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump.

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

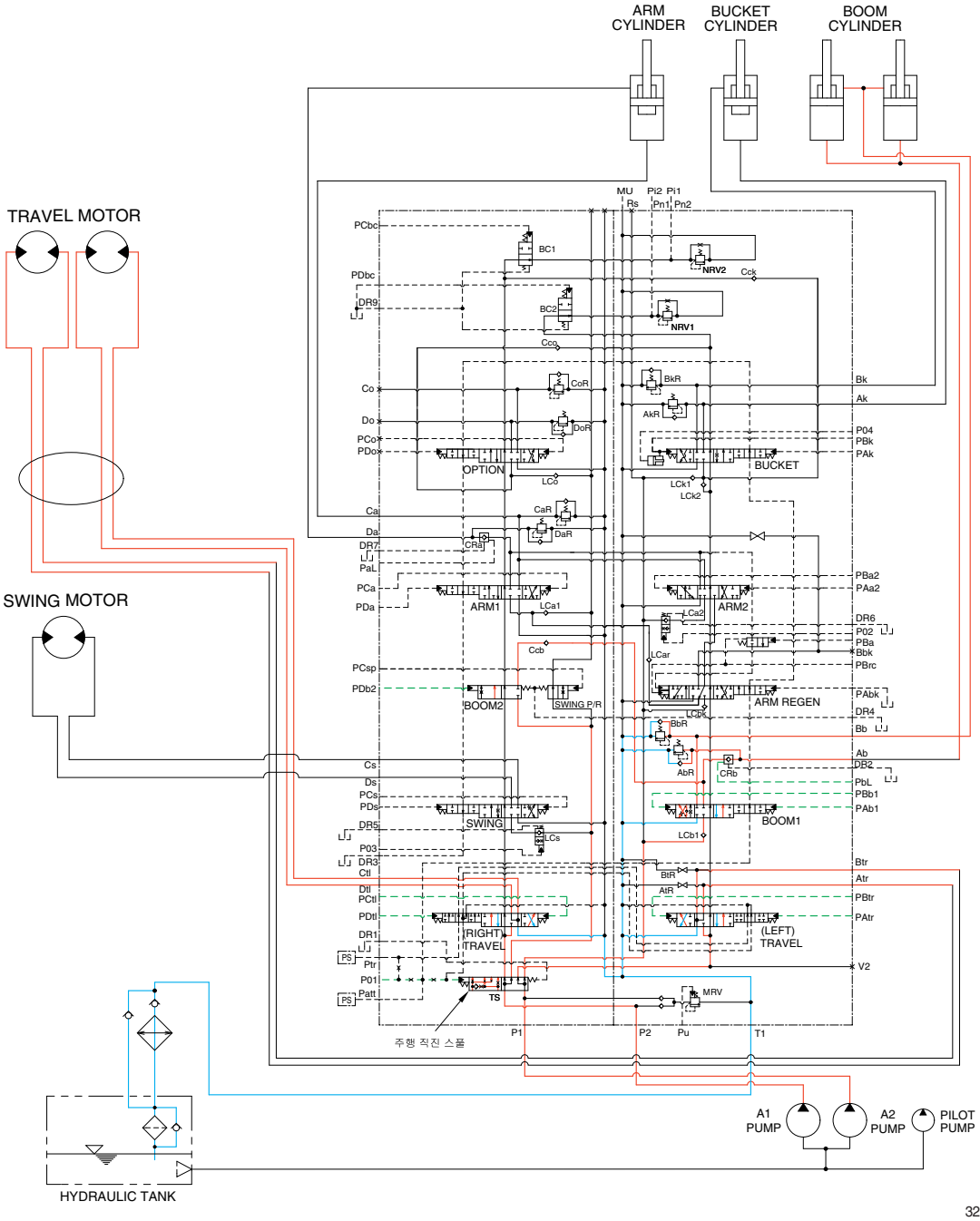
The oil from the A2 pump flows into the swing motor in the straight travel spool.

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

The upper structure swings and the machine travels straight.

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

6. COMBINED BOOM AND TRAVEL OPERATION



320A3HC22E

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 (PAb1, PBb1, PDb2, PAtr, PBtr, PCtl, PDtl) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

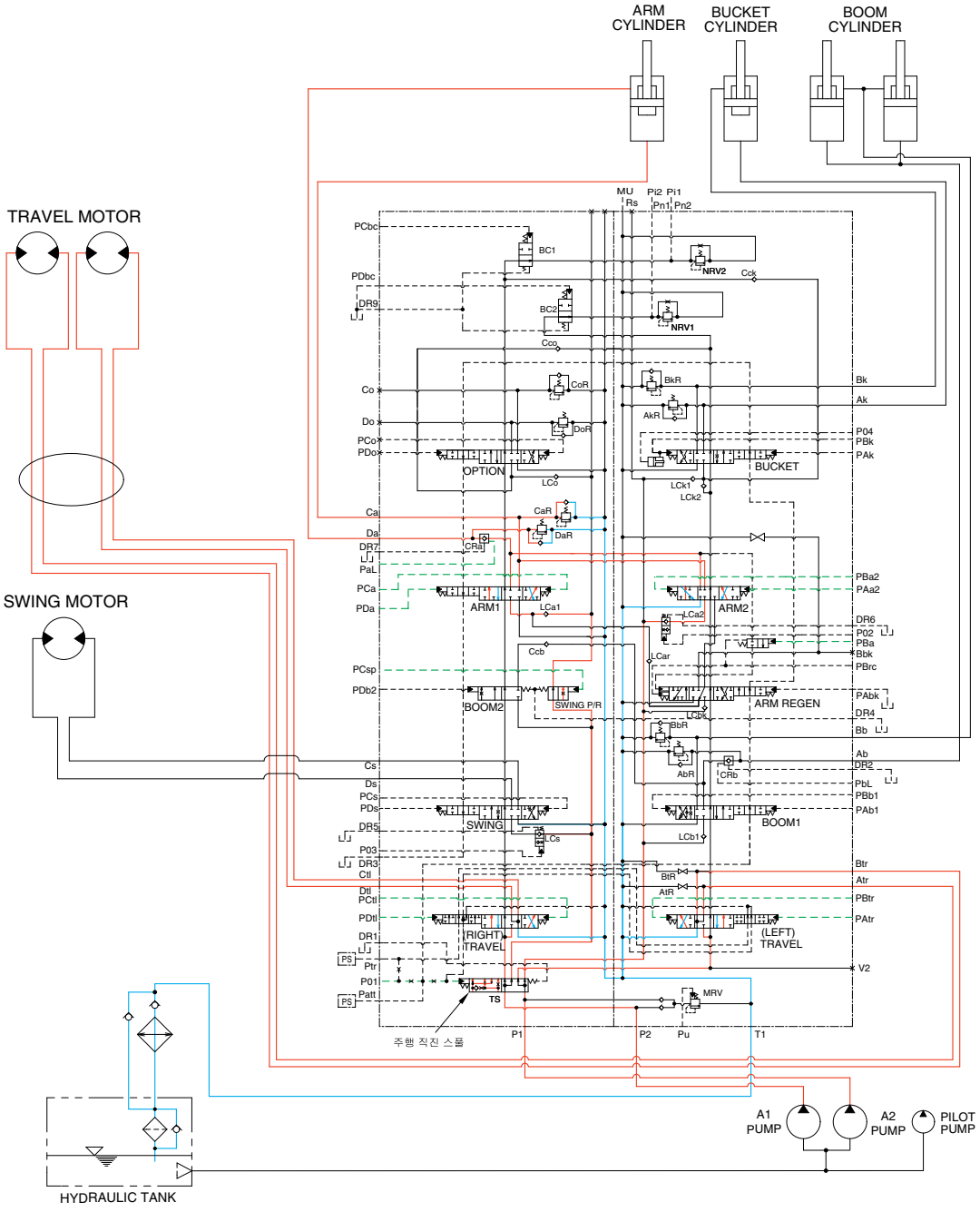
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence oil passage in case boom up operation. When the pressure of the travel motors is lower than the pressure of the boom cylinders, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The boom is operated and the machine travels straight.

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

7. COMBINED ARM AND TRAVEL OPERATION



When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (PCa, PDa, PAa2, PBa2, PAtr, PBtr, PCtl, PDtl) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

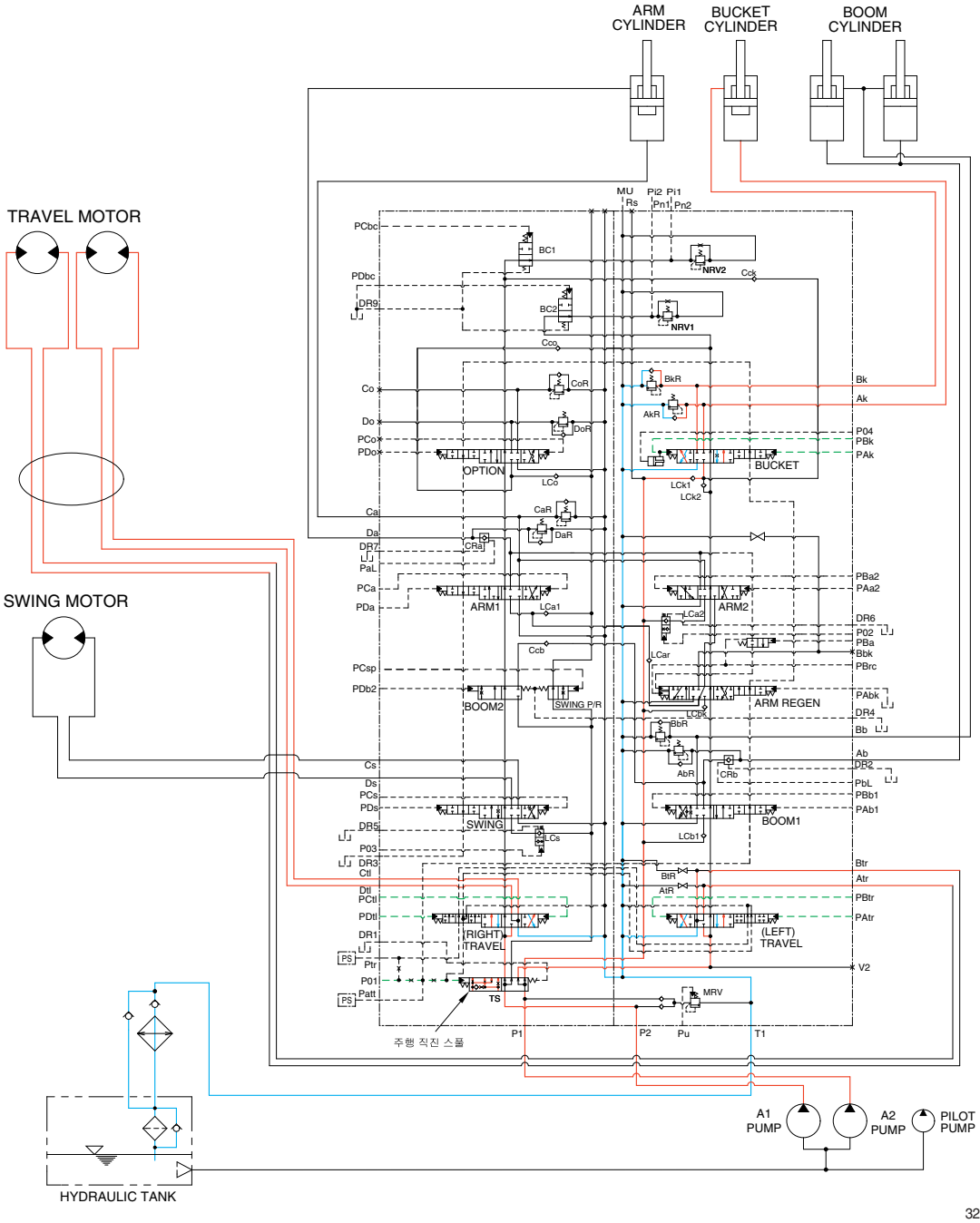
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage. When the pressure of the travel motors is lower than the pressure of the arm cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The arm is operated and the machine travels straight.

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

8. COMBINED BUCKET AND TRAVEL OPERATION



320A3HC24E

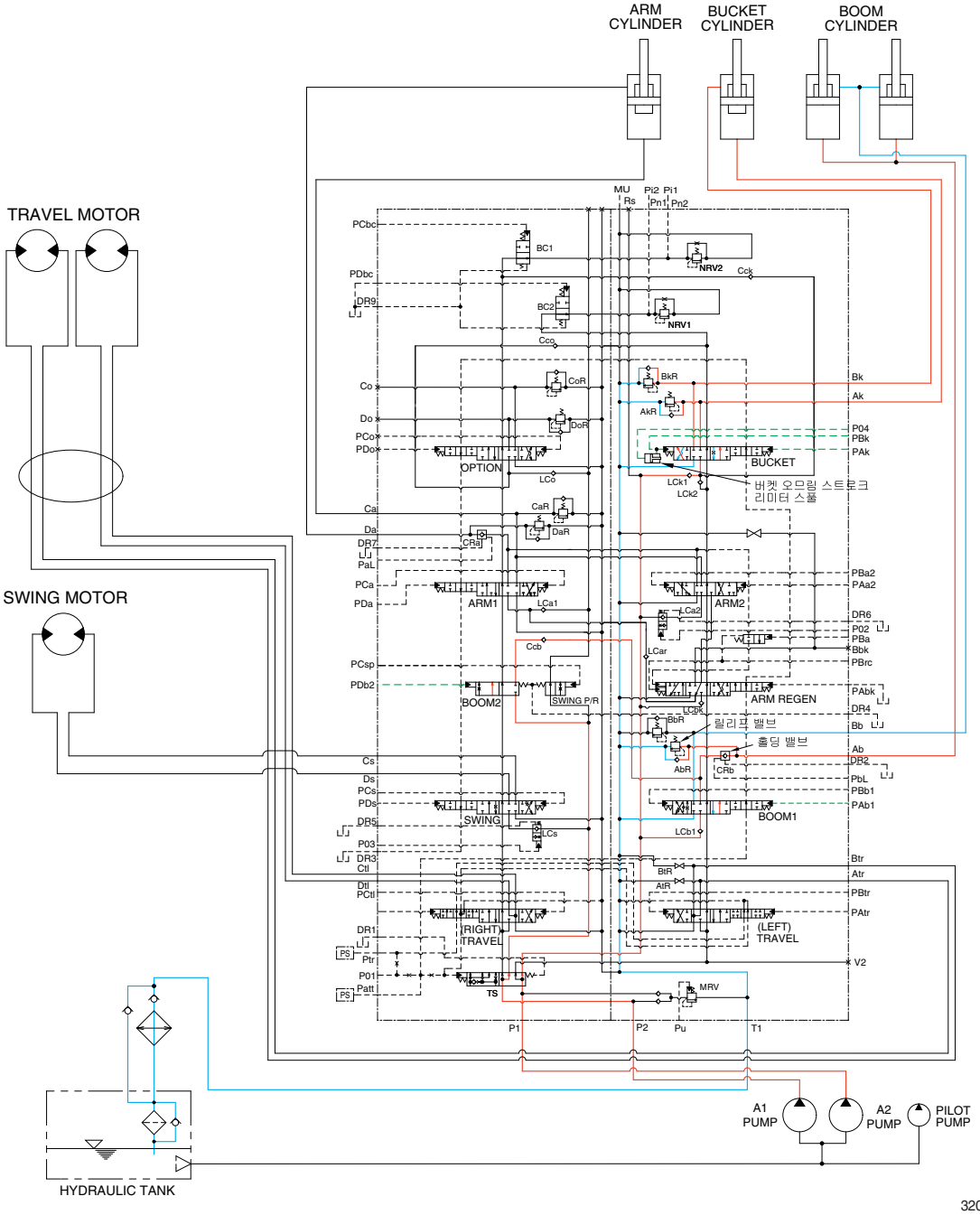
When the bucket and travel functions are operated, simultaneously the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (PAk, PBk, PAtr, PBtr, PCtl, PDtl) from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure from pilot pump. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool of the control valve.

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

The bucket is operated and the machine travels straight.

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

9. COMBINED BOOM UP AND BUCKET OPERATION



When the boom up and bucket functions are operated, simultaneously each spool in the main control valve is moved to the functional position by the pilot oil pressure (PAb1, PDb2, PDb1, PAk, PBk)from the remote control valve.

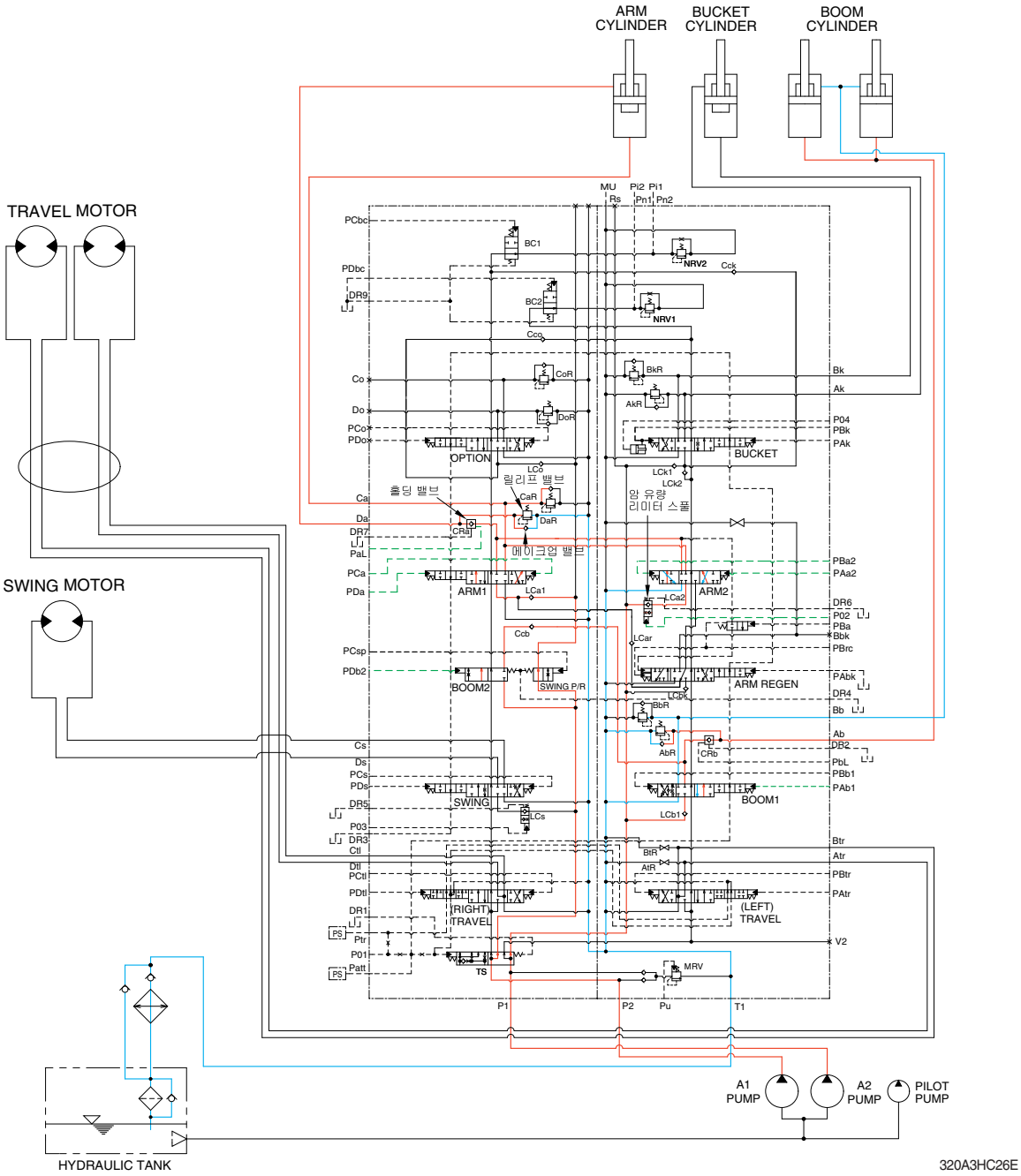
The oil from the A1 pump flows into the boom cylinders through the boom 2 spool in the left control valve. The oil from the A2 pump flows into the boom cylinders and bucket cylinder through the boom 1 spool, bucket spool and the parallel and confluence oil passage in the right control valve.

Also, when the boom up and bucket in functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure P04 and then the bucket spool transfers in the half stroke not full stroke (refer to page 2-43). Therefore, the most of pressurized oil flows into boom 1 spool than the bucket spool to make the boom up operation more preferential.

The boom and bucket are operated.

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

10. COMBINED BOOM UP AND ARM OPERATION



When the boom up and arm functions are operated, simultaneously each spool in the main control valve is moved to the functional position by the pilot oil pressure (PAb1, PDb2, PCa, PDa, PAa2, PBa2) from the remote control valve.

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

Also, when the boom up and arm functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure P02 and then the flow into arm 2 spool is reduced by shifting of the arm in flow limit spool. Therefore, the most of pressurized oil flows into boom 1 spool than the arm 2 spool to make the boom up operation more preferential.

The boom and arm are operated.

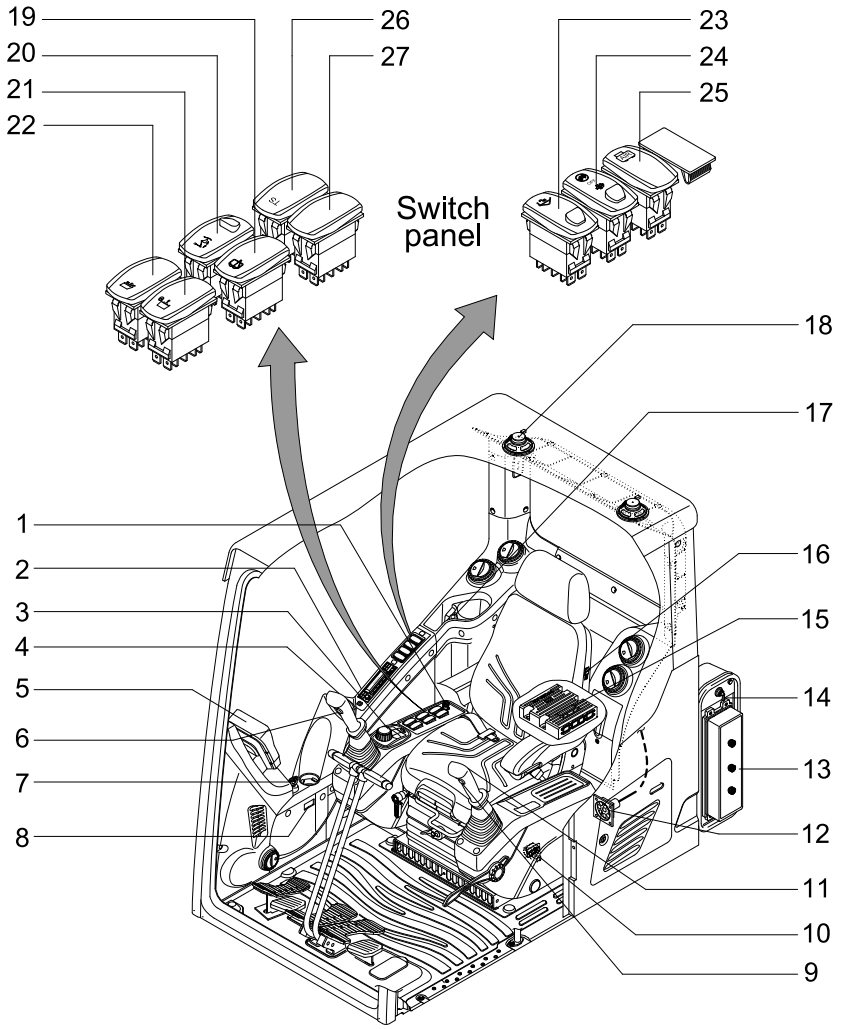
※ The circuit diagram may differ from the equipment, so please check before a repair.

SECTION 4 ELECTRICAL SYSTEM

Group 1 Component Location 4-1
Group 2 Electrical Circuit 4-3
Group 3 Electrical Component Specification 4-23
Group 4 Connectors 4-36

GROUP 1 COMPONENT LOCATION

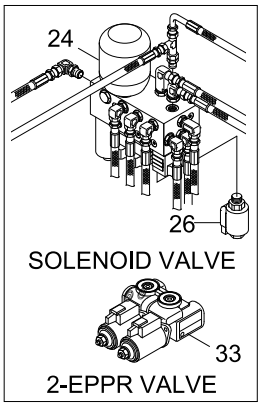
1. LOCATION 1

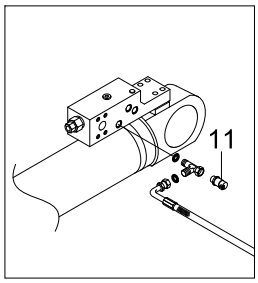


300A4EL01

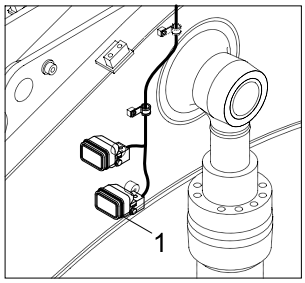
1	Cigar lighter	10	Emergency engine stop switch	19	Lower wiper & washer switch
2	Radio & USB player	11	One touch decel switch	20	Boom floating switch
3	Jog dial module	12	RS232 & J1939 service socket	21	Swing lock switch
4	Horn switch	13	Fuse & relay box	22	Free/fine swing switch
5	Cluster	14	Master switch	23	Quick coupler switch
6	Breaker operation switch	15	Machine control unit	24	Exhaust system cleaning switch
7	Starting switch	16	Seat heater switch	25	Air compressor switch
8	Service meter	17	Service socket	26	Travel straight switch
9	Power max switch	18	Speaker	27	Option attach switch

2. LOCATION 2

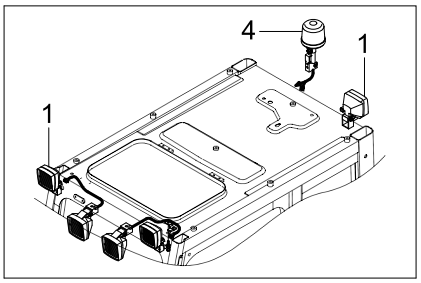




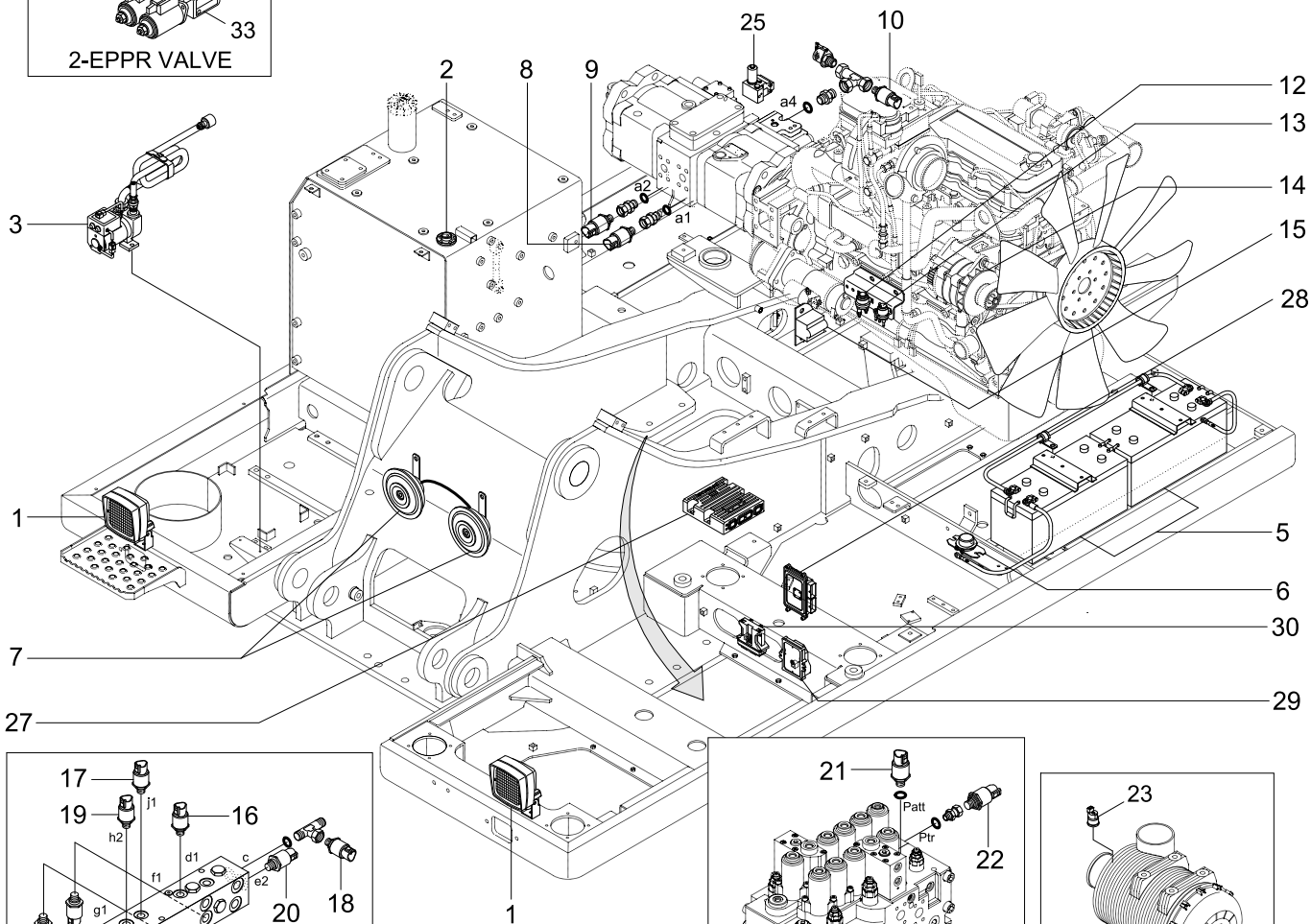
BOOM SAFETY VALVE

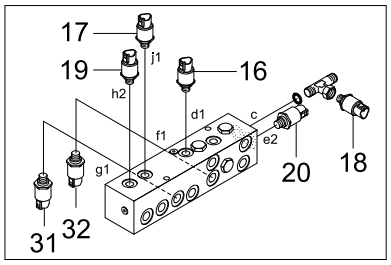


BOOM

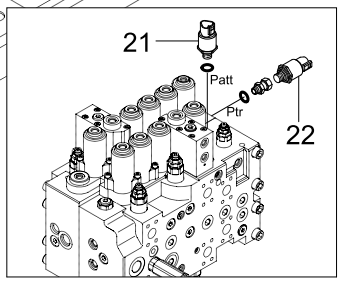


CAB

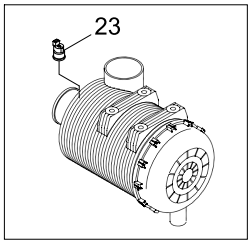




SHUTTLE BLOCK



MAIN CONTROL VALVE



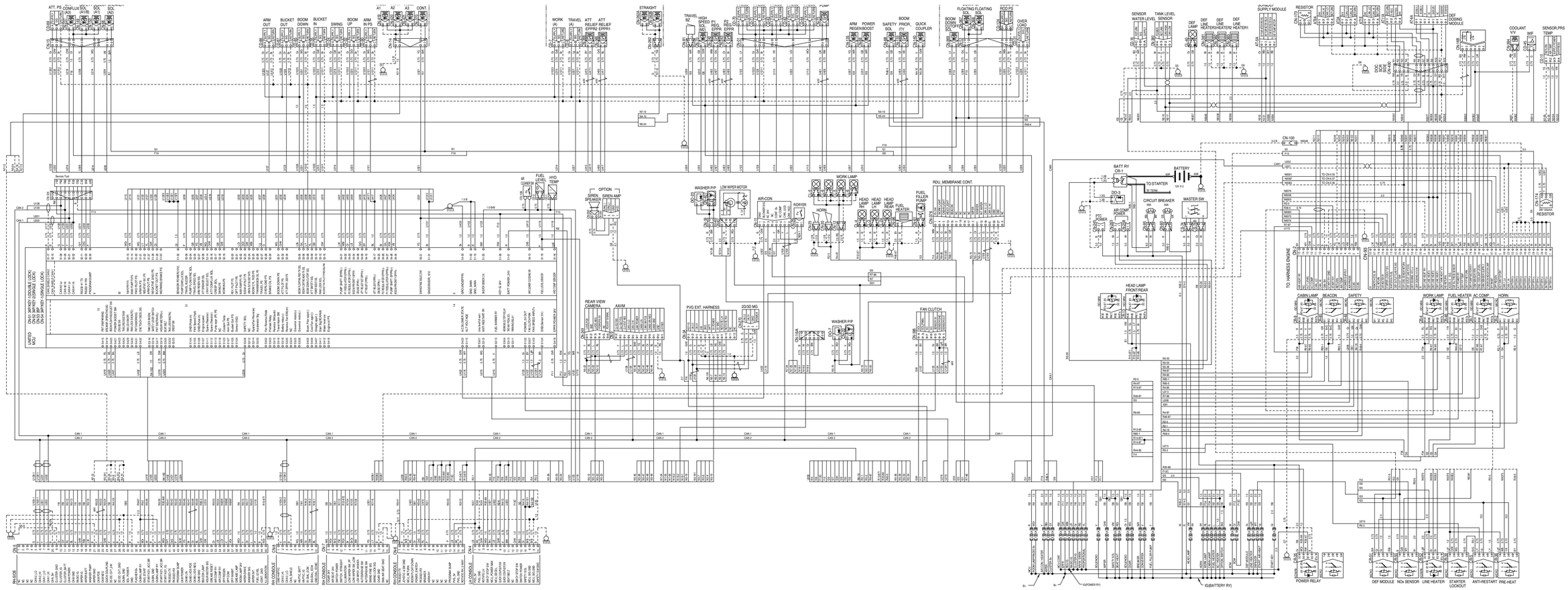
AIR CLEANER

300A4EL02

1	Lamp	12	Start relay	23	Air cleaner sensor (-#00142)
2	Fuel sender	13	Heater relay	24	Solenoid valve
3	Fuel filler pump	14	Alternator	25	Pump EPPR valve
4	Beacon lamp	15	Travel alarm buzzer	26	Boom priority EPPR valve
5	Battery	16	Arm out pressure sensor	27	MCU assy
6	Battery relay	17	Boom up pressure sensor	28	AAVM controller
7	Horn	18	Swing pressure sensor	29	DRU assy
8	P1 pressure sensor	19	Boom down pressure sensor	30	PVG32 controller
9	P2 pressure sensor	20	Arm in pressure sensor	31	Bucket out pressure sensor
10	EPPR pressure sensor	21	Attach pressure sensor	32	Bucket in pressure sensor
11	Overload pressure sensor	22	Travel pressure sensor	33	2-EPPR valve

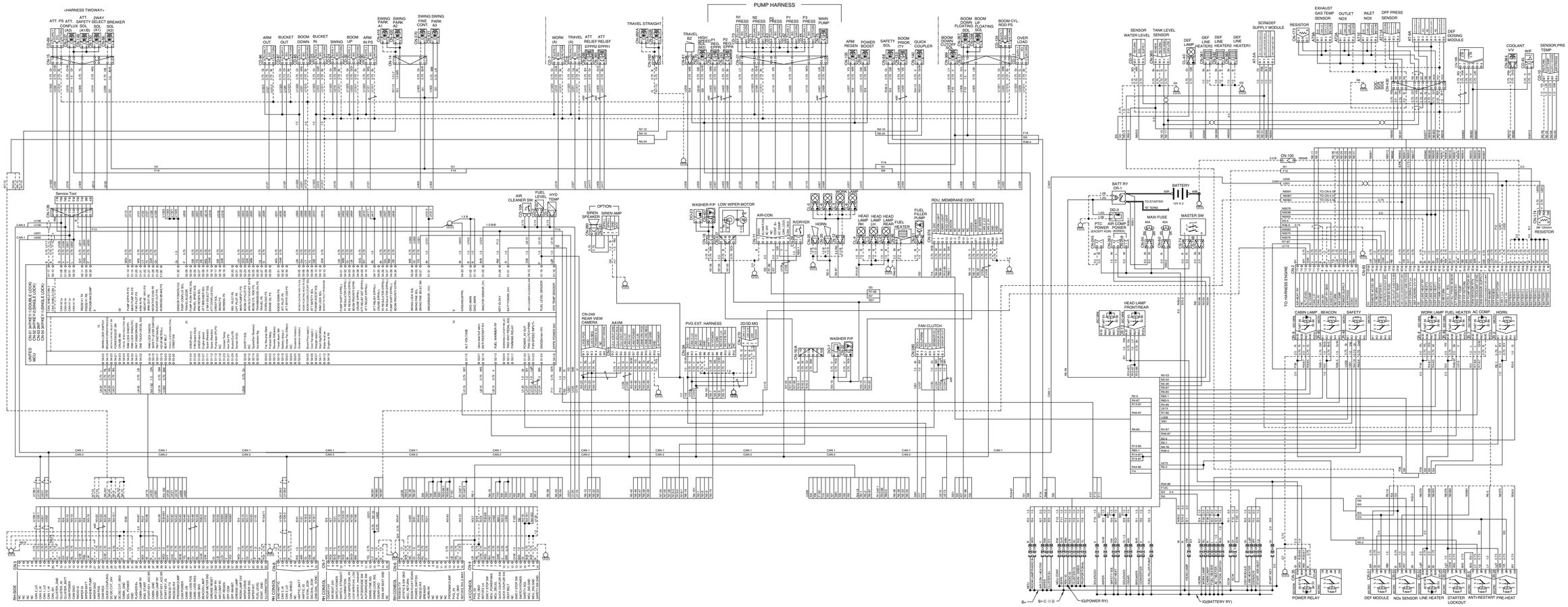
· ELECTRICAL CIRCUIT (1/4)

- MACHINE SERIAL NO. : -#0114



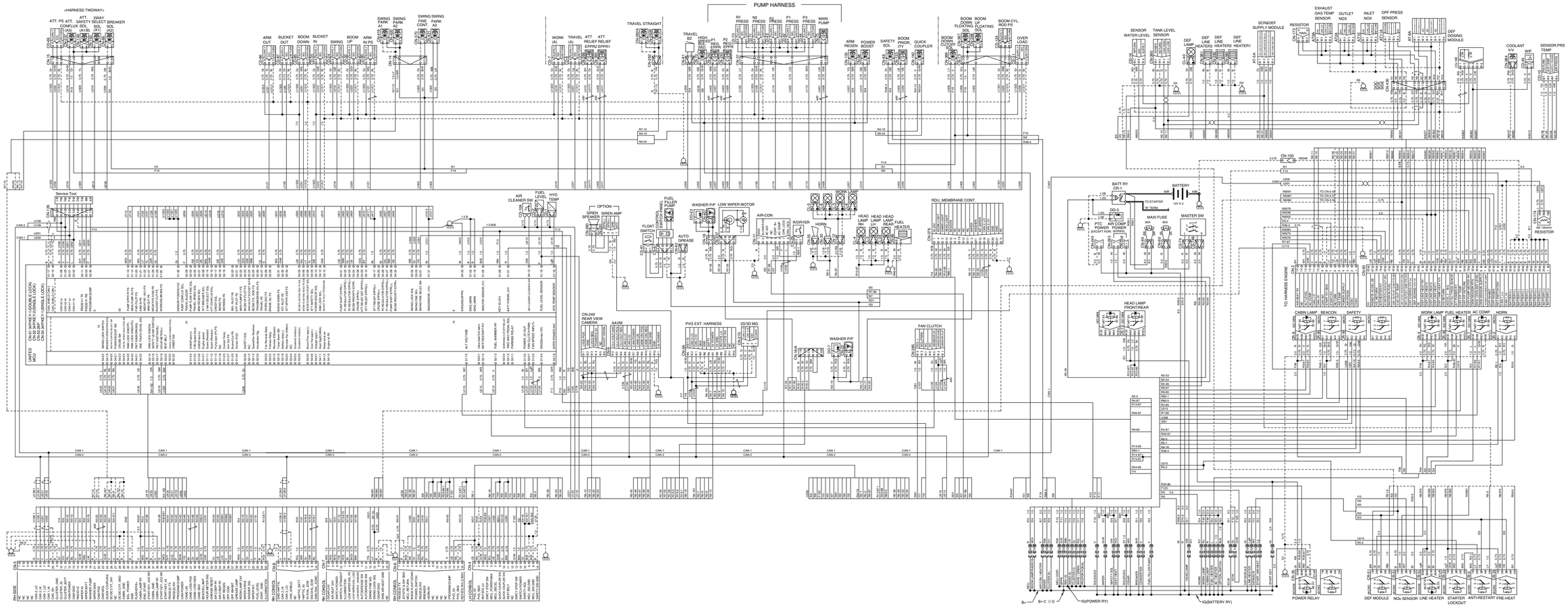
20K8-95200-02

- MACHINE SERIAL NO. : #0115-#0599



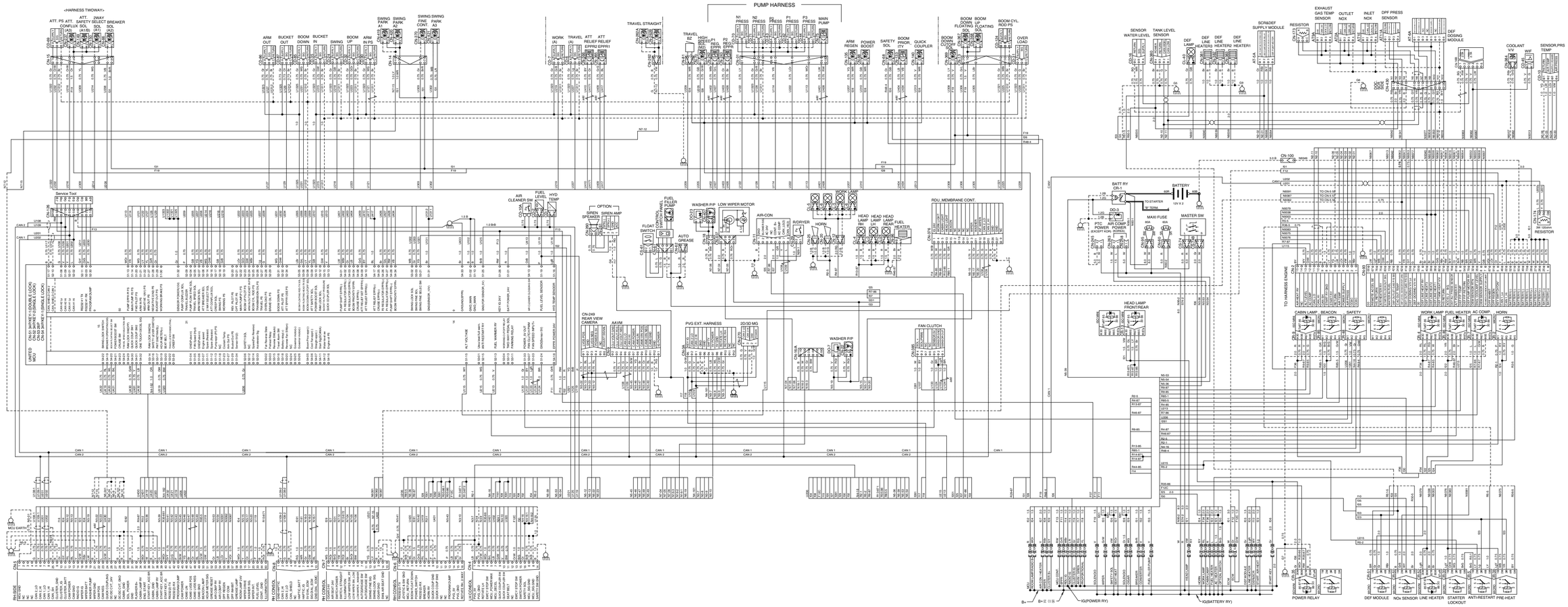
20K8-95201-01

- MACHINE SERIAL NO. : #0600-#0944



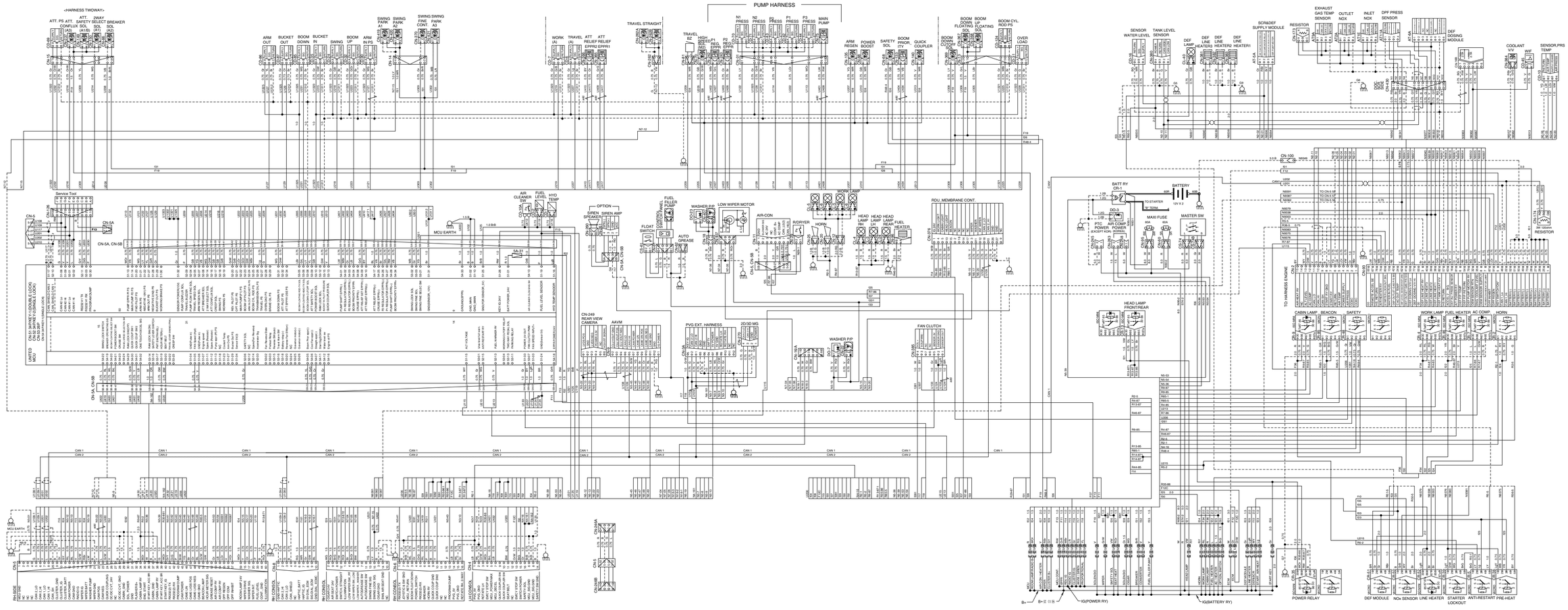
20K8-95202-00

- MACHINE SERIAL NO. : #0945-#1431



20K8-95203-00

- MACHINE SERIAL NO. : #1432-#1470



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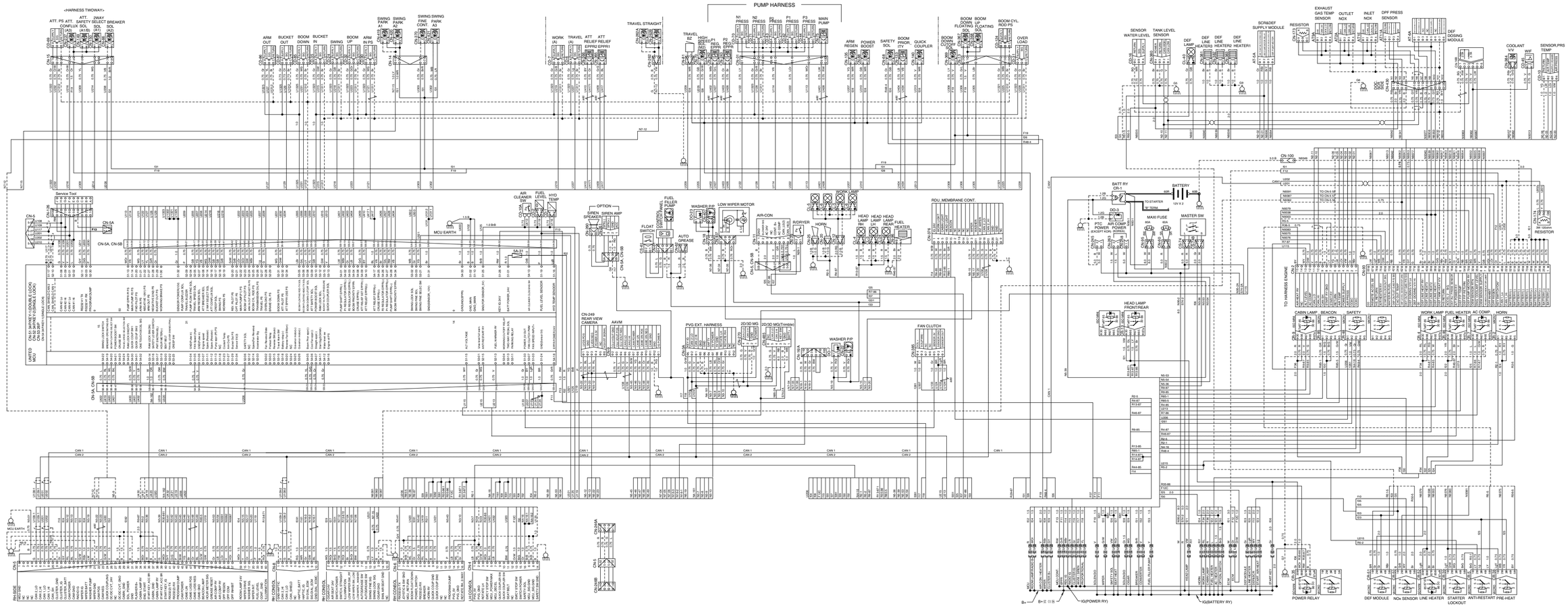
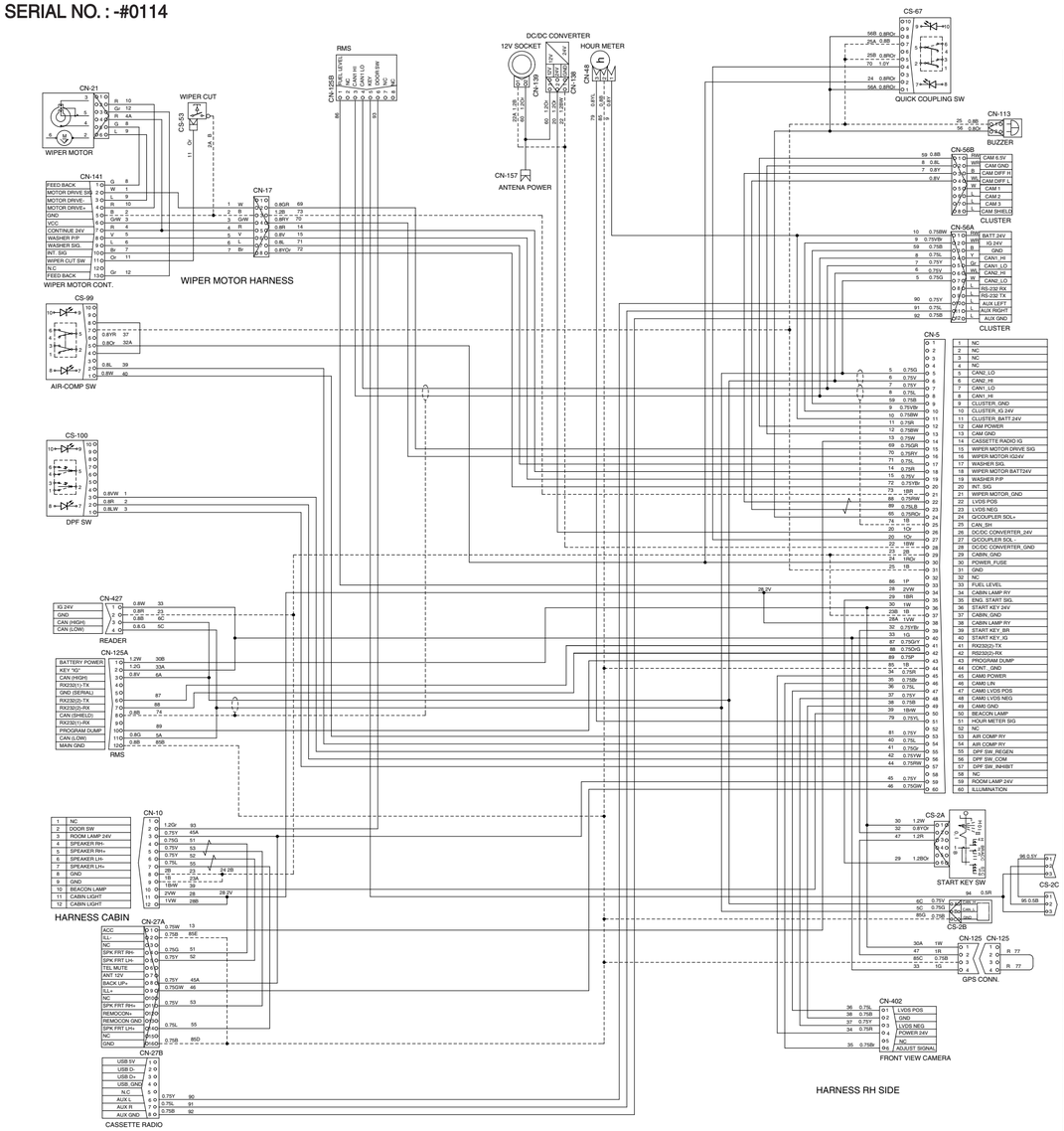
- MACHINE SERIAL NO. : #1471-

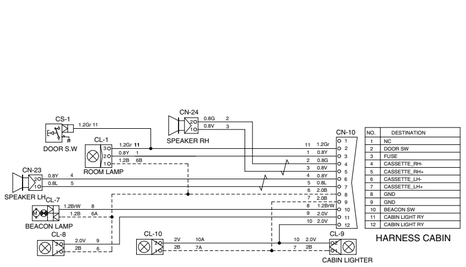


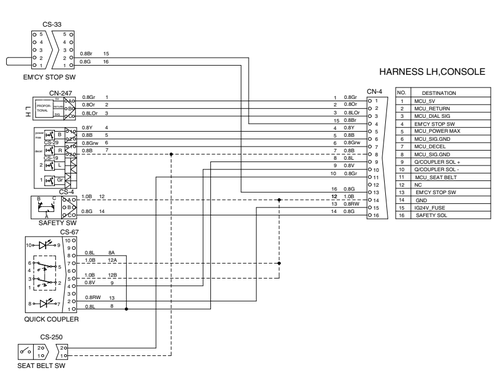
20K8-95205-00

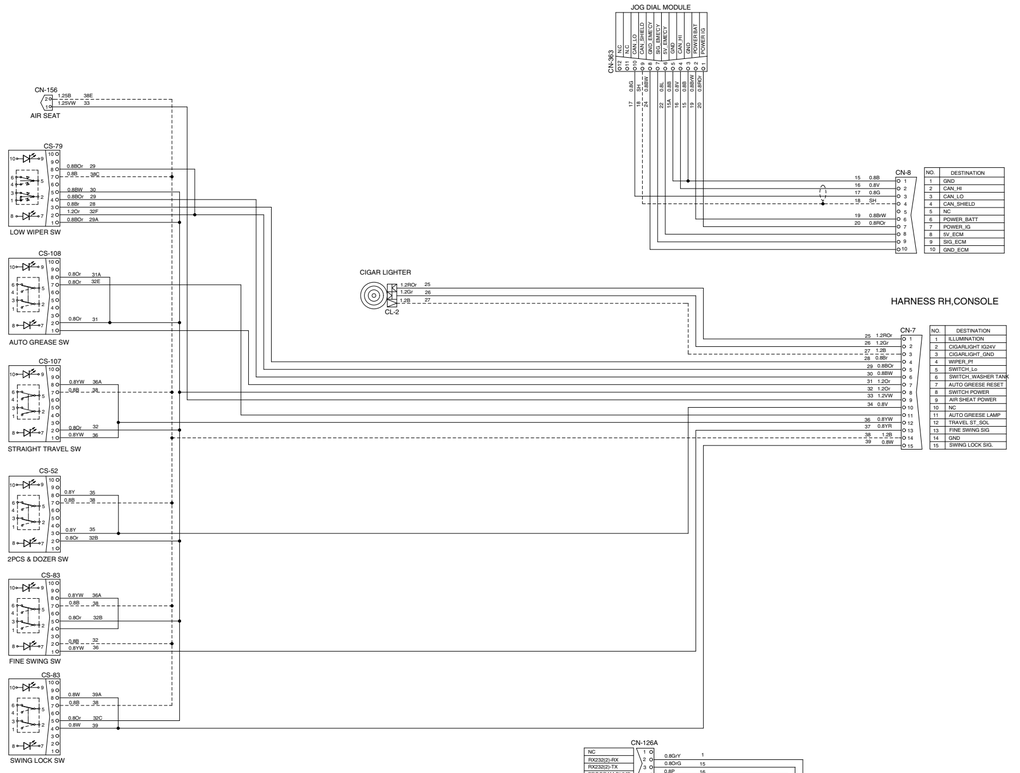
· ELECTRICAL CIRCUIT (2/4)

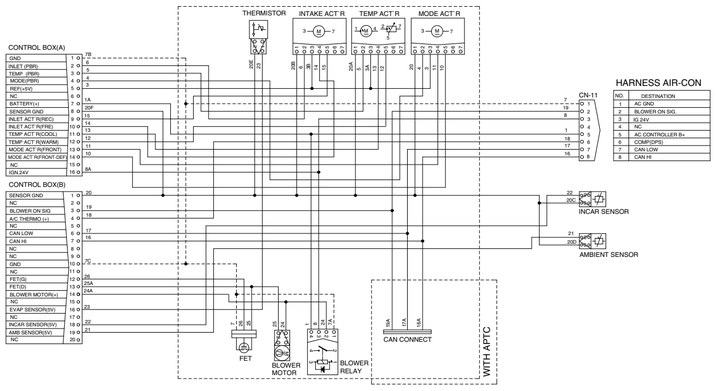
- MACHINE SERIAL NO. : -#0114

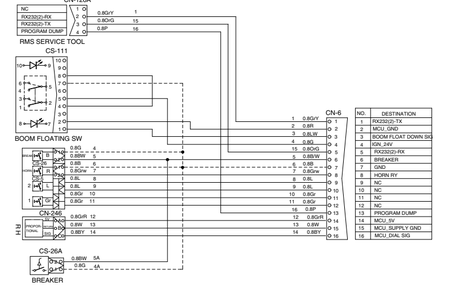












20K8-95100-02

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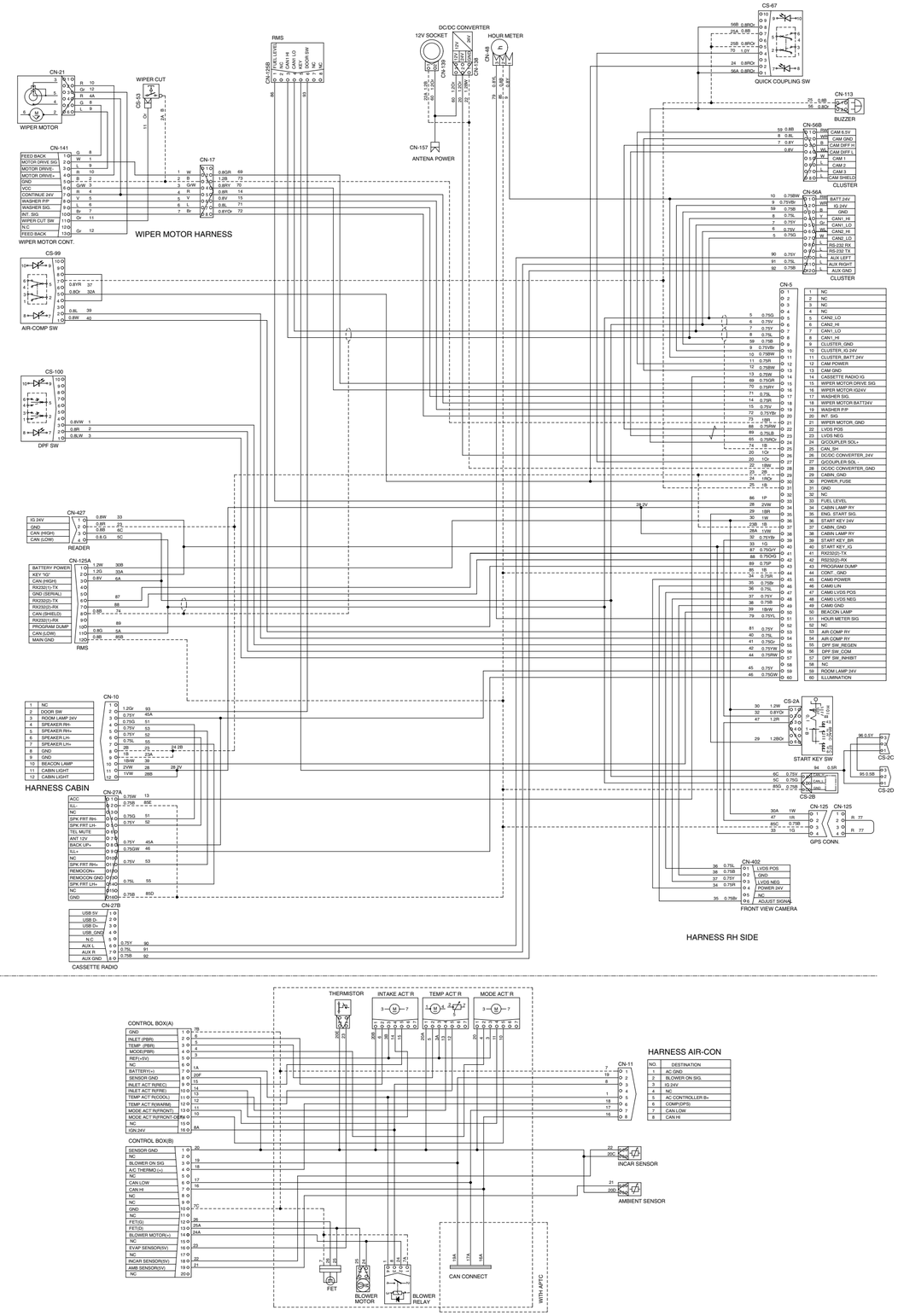

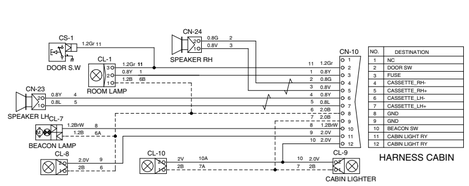

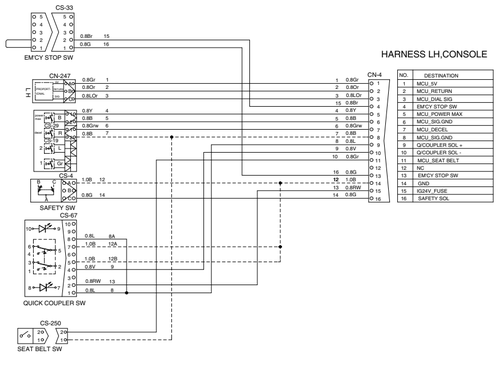

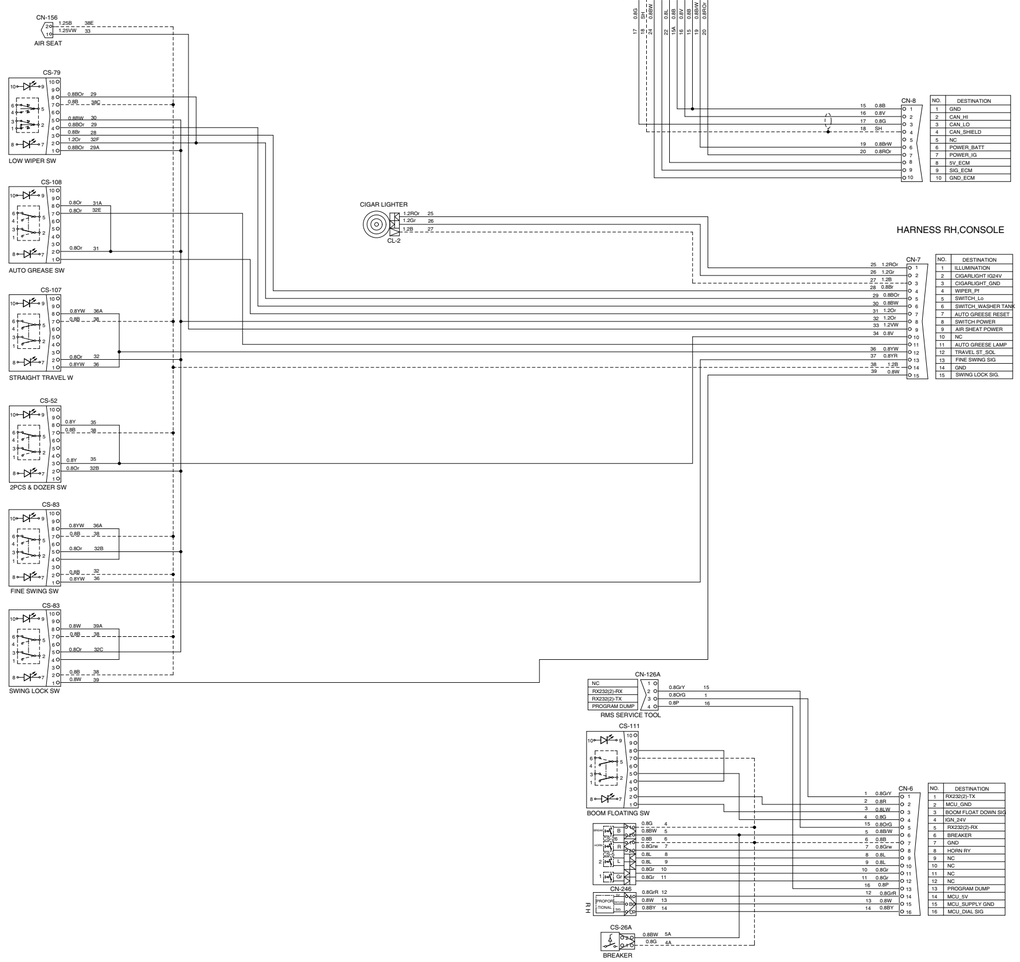

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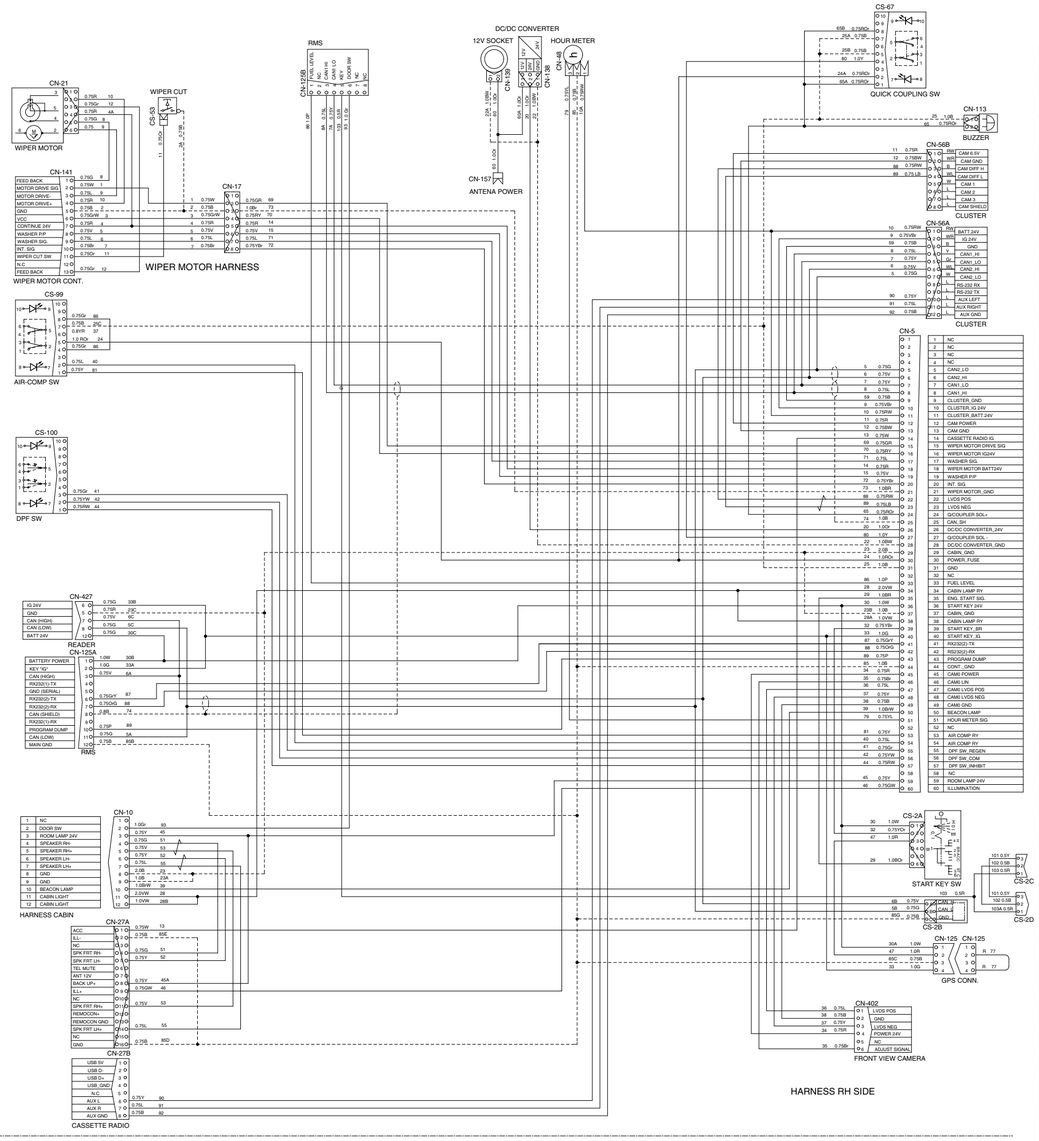

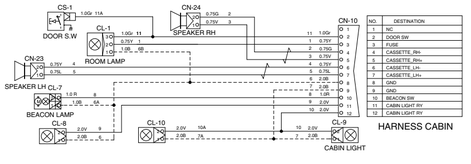

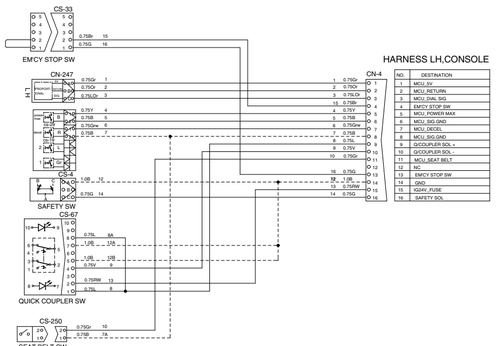

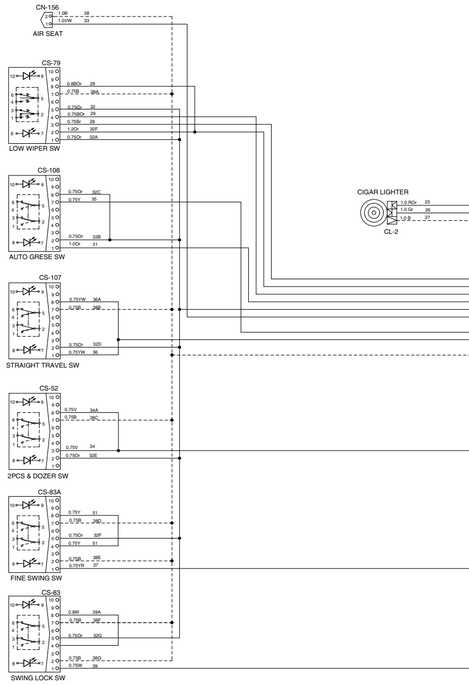

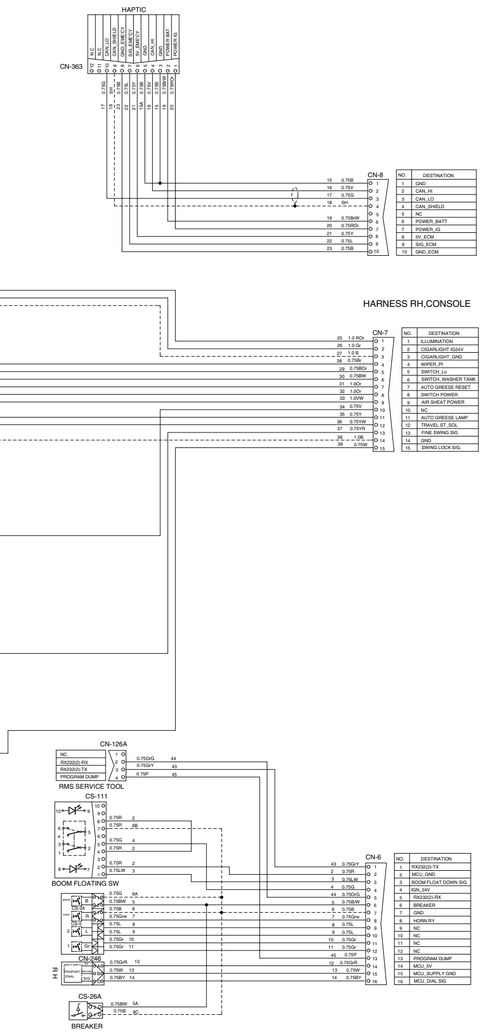

20KB-93102-00

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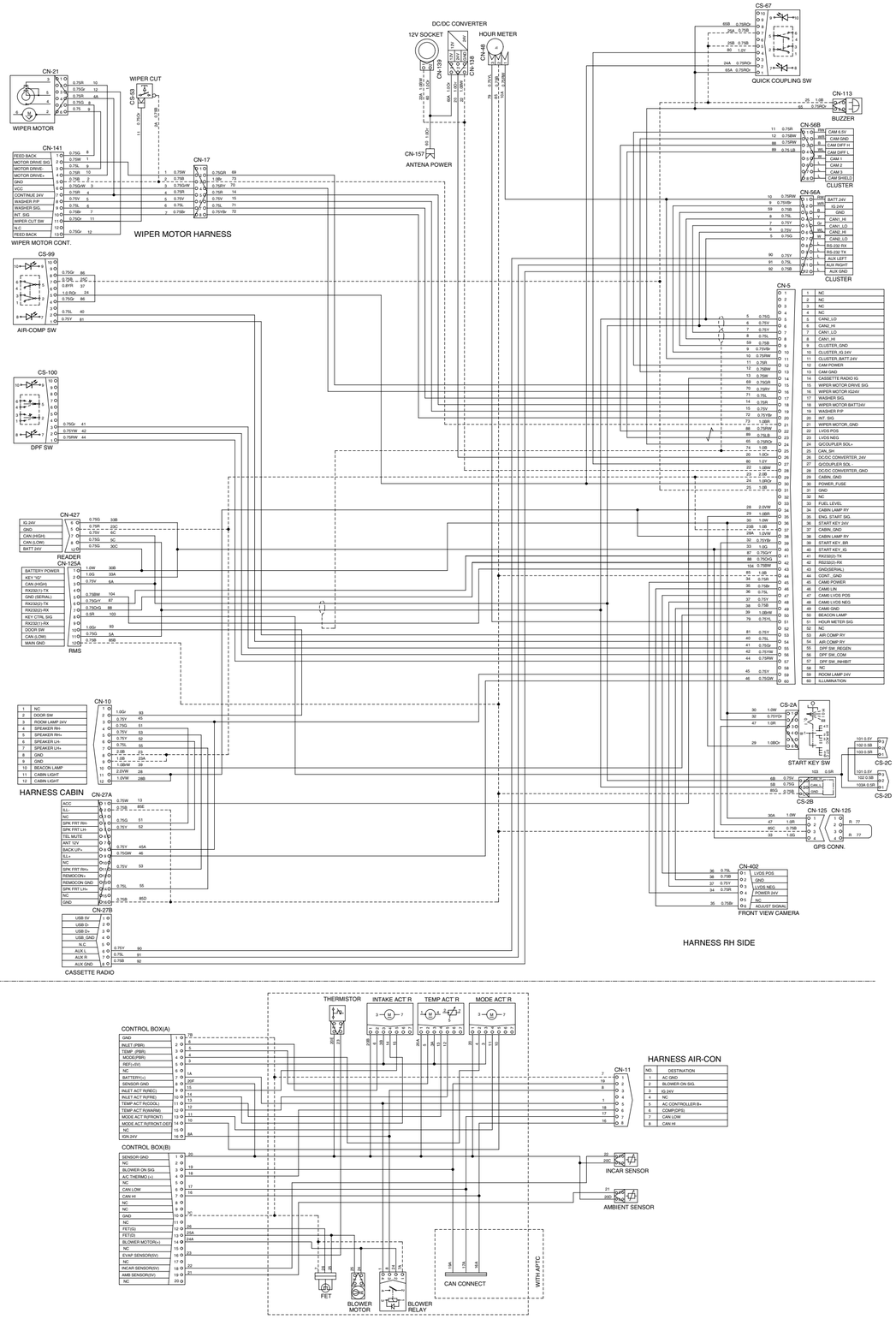


NO.	DESTINATION
1	NC
2	DOOR SW
3	FUSE
4	CASSETTE_RH+
5	CASSETTE_RH-
6	CASSETTE_LH-
7	CASSETTE_LH+
8	GND
9	GND
10	BEACON SW
11	CABIN LIGHT RY
12	CABIN LIGHT RY

HARNESS CABIN

NO.	DESTINATION
1	MCU_5V
2	MCU_RETURN
3	MCU_DIAL SIG
4	EMCY STOP SW
5	MCU_POWER MAX
6	MCU_SIG.GND
7	MCU_DECEL
8	MCU_SIG GND
9	G/COUPLER SOL +
10	G/COUPLER SOL -
11	MCU_SEAT BELT
12	NC
13	EMCY STOP SW
14	GND
15	IGNIV_FUSE
16	SAFETY SOL

HARNESS LH,CONSOLE

NO.	DESTINATION
1	GND
2	CAN_HI
3	CAN_LO
4	CAN_SHIELD
5	NC
6	POWER_BATT
7	POWER_IG
8	5V_ECM
9	SIG_ECM
10	GND_ECM

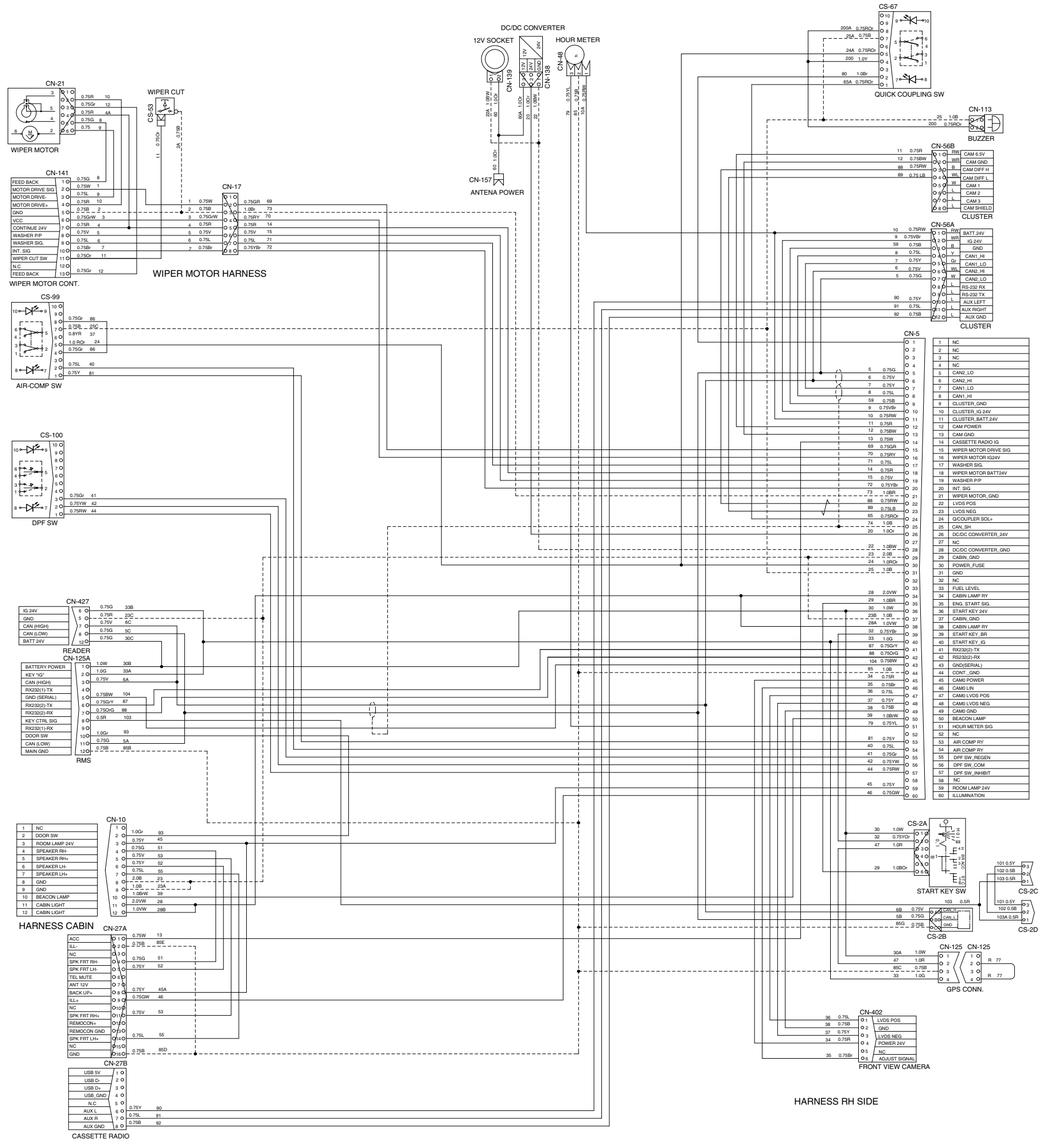
HARNESS RH,CONSOLE

NO.	DESTINATION
1	ILLUMINATION
2	CIGARLIGHT IGQ5V
3	CIGARLIGHT_GND
4	WIPER_R
5	SWITCH_Ls
6	SWITCH_WASHER TANK
7	AUTO GREESE RESET
8	SWITCH POWER
9	AIR SHEAT POWER
10	NC
11	AUTO GREESE LAMP
12	TRAVEL ST_SOL
13	FINE SWING SIG
14	GND
15	SWING LOCK SIG.

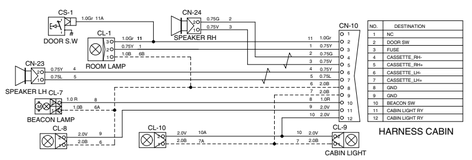
NO.	DESTINATION
1	RX232(2)-TX
2	MCU_GND
3	BOOM FLOAT DOWN SIG
4	IGN_24V
5	RX232(2)-RX
6	BREAKER
7	GND
8	HORN RY
9	NC
10	NC
11	NC
12	NC
13	GND(SERIAL)
14	MCU_5V
15	MCU_SUPPLY GND
16	MCU_DIAL SIG

20K8-93110-00

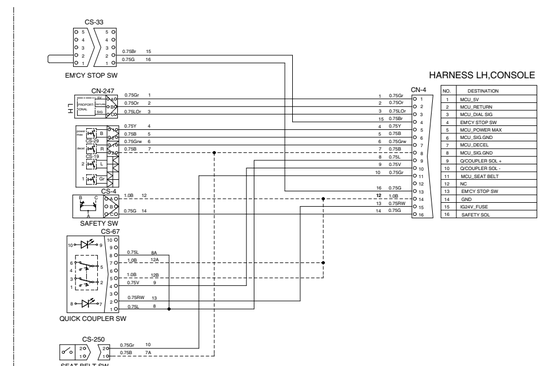
- MACHINE SERIAL NO. : #0945-



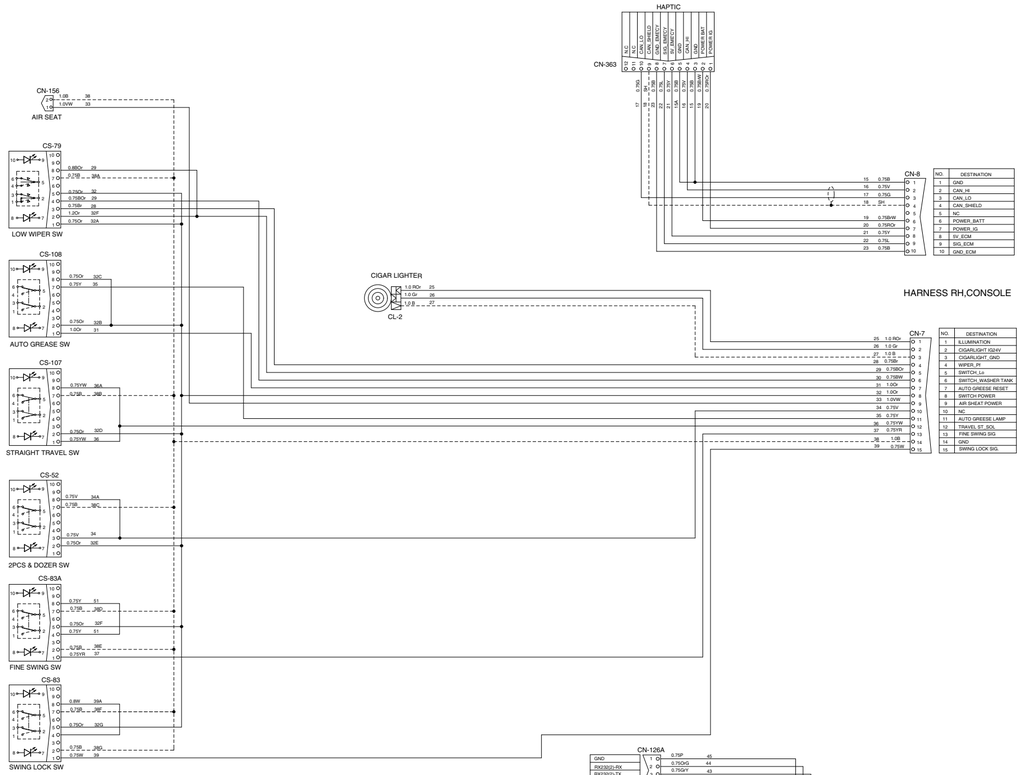
NO.	DESTINATION
1	NC
2	NC
3	NC
4	NC
5	CAN2_LO
6	CAN2_HI
7	CAN1_LO
8	CAN1_HI
9	CLUSTER_GND
10	CLUSTER_IG 24V
11	CLUSTER_BATT 24V
12	CAM POWER
13	CAM GND
14	CASSETTE RADIO IG
15	WIPER MOTOR DRIVE SIG
16	WIPER MOTOR IGQ9V
17	WASHER SIG.
18	WIPER MOTOR BATT24V
19	WASHER P/P
20	INT. SIG.
21	WIPER MOTOR, GND
22	LVDS POS
23	LVDS NEG
24	GICOUPLER SOL+
25	CAN_SH
26	DC/DC CONVERTER_24V
27	NC
28	DC/DC CONVERTER_GND
29	CABIN_GND
30	POWER_FUSE
31	GND
32	NC
33	FUEL LEVEL
34	CABIN LAMP RY
35	ENG. START SIG.
36	START KEY 24V
37	CABIN_GND
38	CABIN LAMP RY
39	START KEY_BR
40	START KEY_IG
41	RX(232)-TX
42	RS(232)-RX
43	GND(SERIAL)
44	CONT_GND
45	CAM0-POWER
46	CAM0-LIN
47	CAM0-LVDS POS
48	CAM0-LVDS NEG
49	CAM0 GND
50	BEACON LAMP
51	HOUR METER SIG.
52	NC
53	AIR COMP RY
54	AIR COMP RY
55	DPF SW_REGEN
56	DPF SW_COM
57	DPF SW_INHIBIT
58	NC
59	ROOM LAMP 24V
60	ILLUMINATION



NO.	DESTINATION
1	NC
2	DOOR SW
3	FUSE
4	CASSETTE_RH+
5	CASSETTE_RH-
6	CASSETTE_LH-
7	CASSETTE_LH+
8	GND
9	GND
10	BEACON SW
11	CABIN LIGHT RY
12	CABIN LIGHT RY



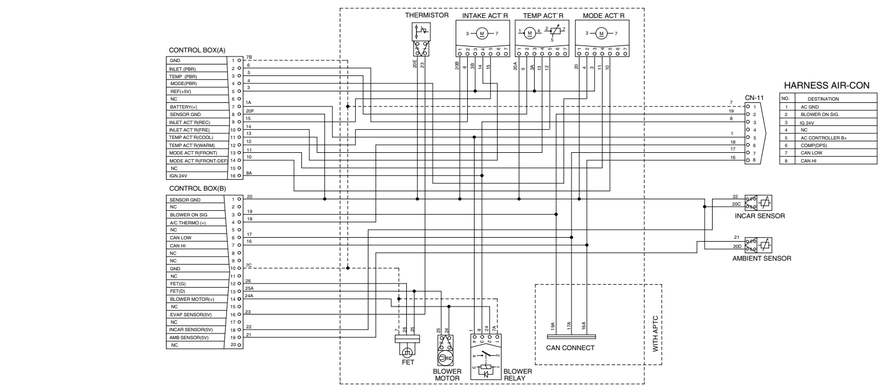
NO.	DESTINATION
1	MCU_5V
2	MCU_RETURN
3	MCU_DIAL SIG
4	EMCY STOP SW
5	MCU_POWER MAX
6	MCU_SIG.GND
7	MCU_DECEL
8	MCU_SIG GND
9	GICOUPLER SOL +
10	GICOUPLER SOL -
11	MCU_SEAT BELT
12	NC
13	EMCY STOP SW
14	GND
15	IGNIV_FUSE
16	SAFETY SOL



NO.	DESTINATION
1	GND
2	CAN_HI
3	CAN_LO
4	CAN_SHIELD
5	NC
6	POWER_BATT
7	POWER_IG
8	5V_ECM
9	SIG_ECM
10	GND_ECM

NO.	DESTINATION
1	ILLUMINATION
2	CIGARLIGHT IGQ5V
3	CIGARLIGHT_GND
4	WIPER_R
5	SWITCH_Ls
6	SWITCH_WASHER TANK
7	AUTO GREESE RESET
8	SWITCH POWER
9	AIR SHEAT POWER
10	NC
11	AUTO GREESE LAMP
12	TRAVEL ST_SOL
13	FINE SWING SIG
14	GND
15	SWING LOCK SIG.

NO.	DESTINATION
1	RX(232)-TX
2	MCU_GND
3	BOOM FLOAT DOWN SIG
4	IGN_24V
5	RX(232)-RX
6	BREAKER
7	GND
8	HORN RY
9	NC
10	NC
11	NC
12	NC
13	GND(SERIAL)
14	MCU_5V
15	MCU_SUPPLY GND
16	MCU_DIAL SIG

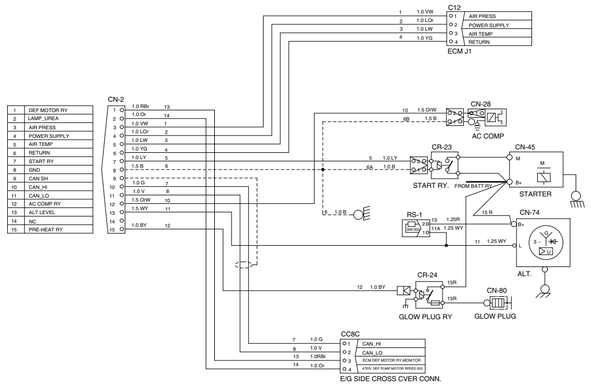


NO.	DESTINATION
1	AC GND
2	BLOWER ON SIG.
3	IG 24V
4	NC
5	AC CONTROLLER B+
6	COMP(DPS)
7	CAN LOW
8	CAN HI

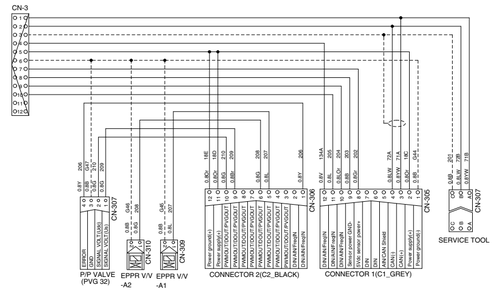
20K8-93111-00

· ELECTRICAL CIRCUIT (3/4)

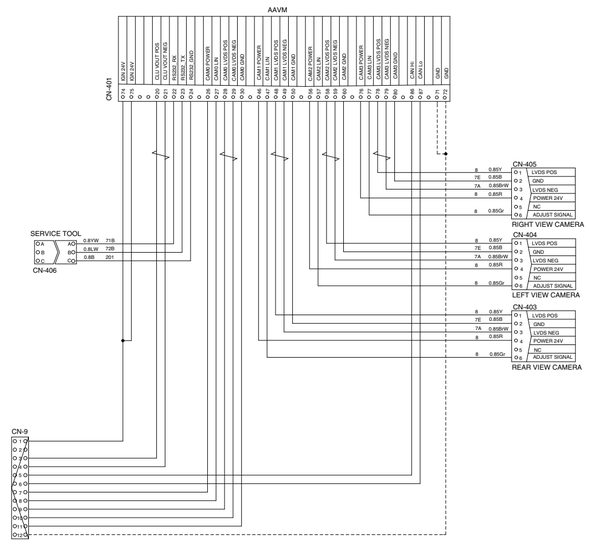
- MACHINE SERIAL NO. : -#0006



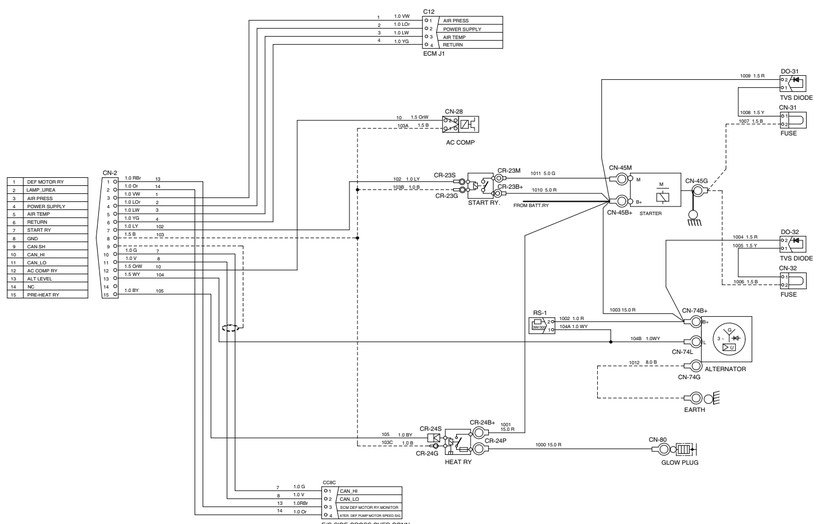
E/G HARNESS



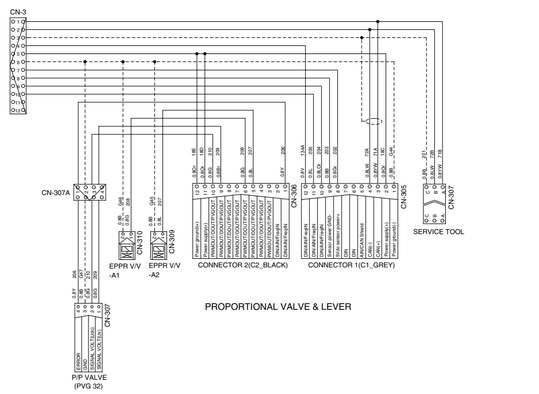
PROPORTIONAL VALVE & LEVER



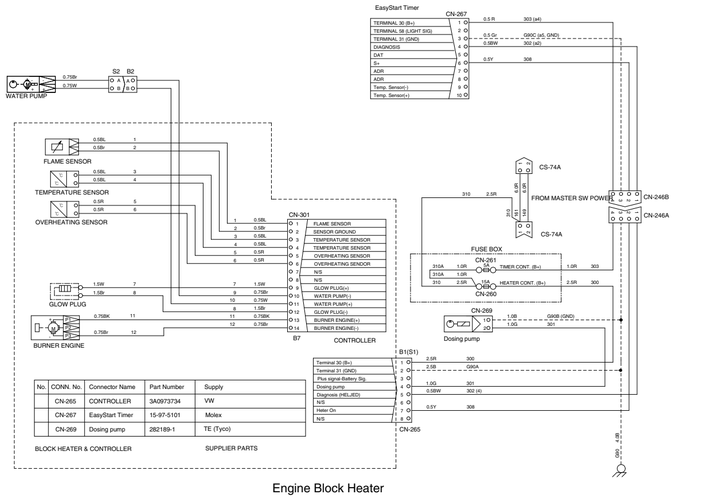
- MACHINE SERIAL NO. : #0007-#0182



E/G HARNESS



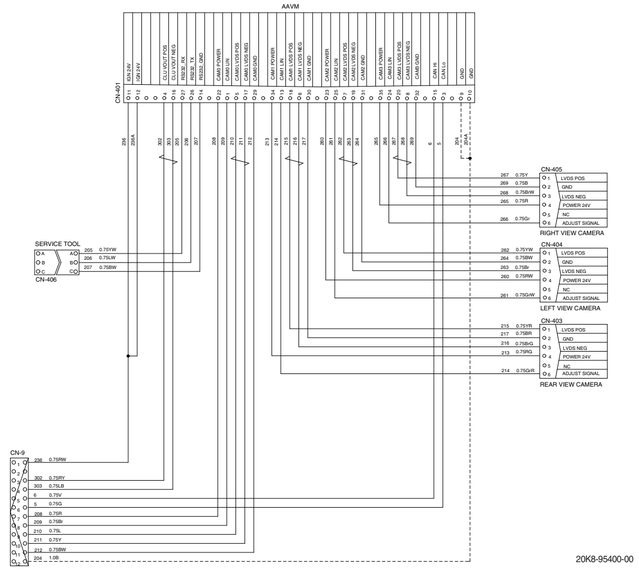
PROPORTIONAL VALVE & LEVER



No.	CONN. No.	Connector Name	Part Number	Supply
	CN-265	CONTROLLER	3A0973734	VW
	CN-267	EasyStart Timer	15-97-5101	Molex
	CN-269	Dosing pump	282189-1	TE (Tyco)

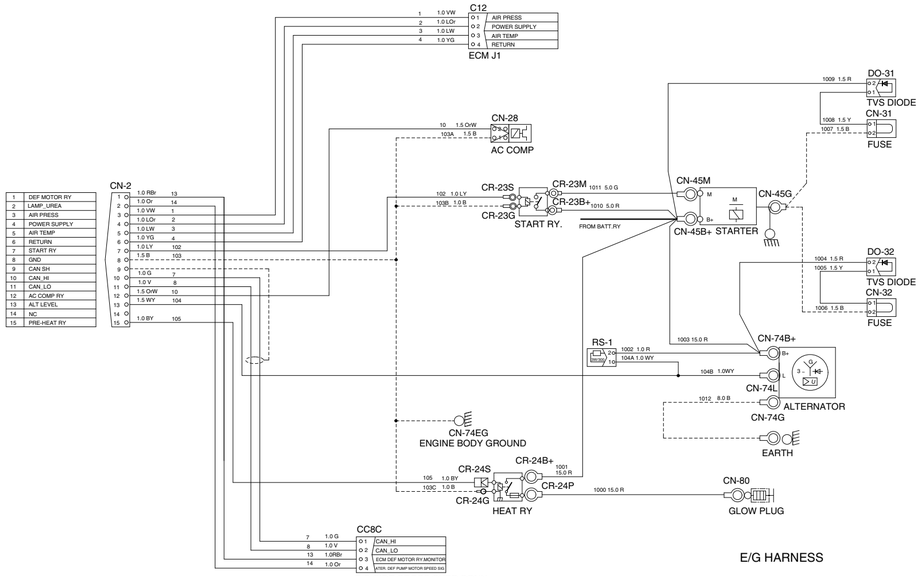
BLOCK HEATER & CONTROLLER SUPPLIER PARTS

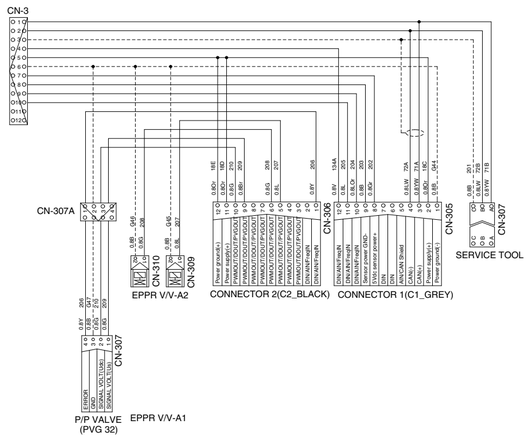
Engine Block Heater

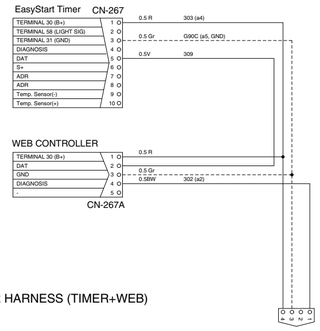


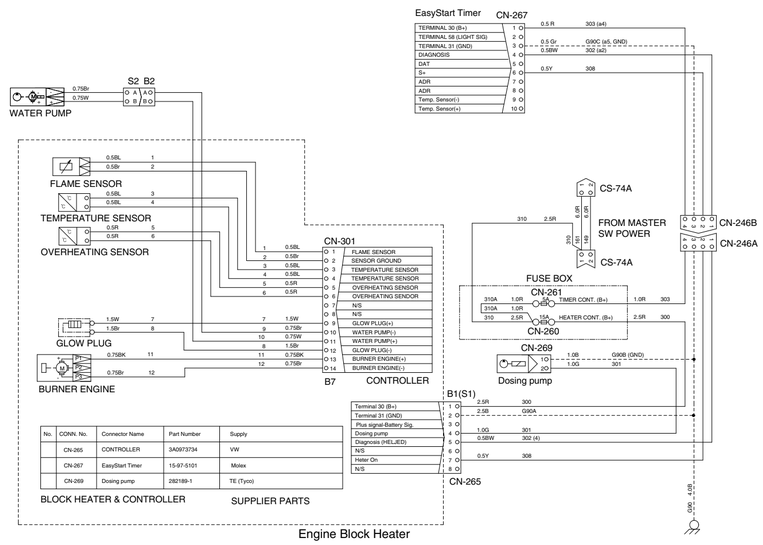
20K8-95400-00

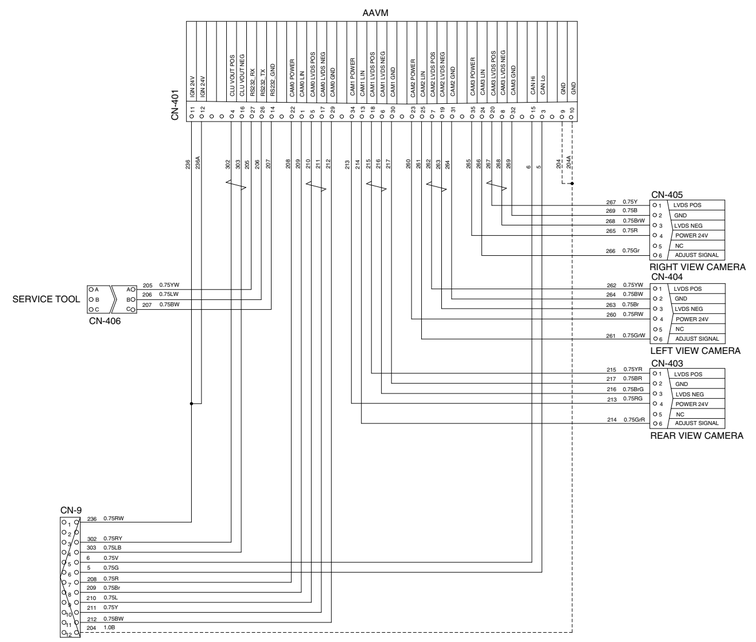
- MACHINE SERIAL NO. : #0183-#0655



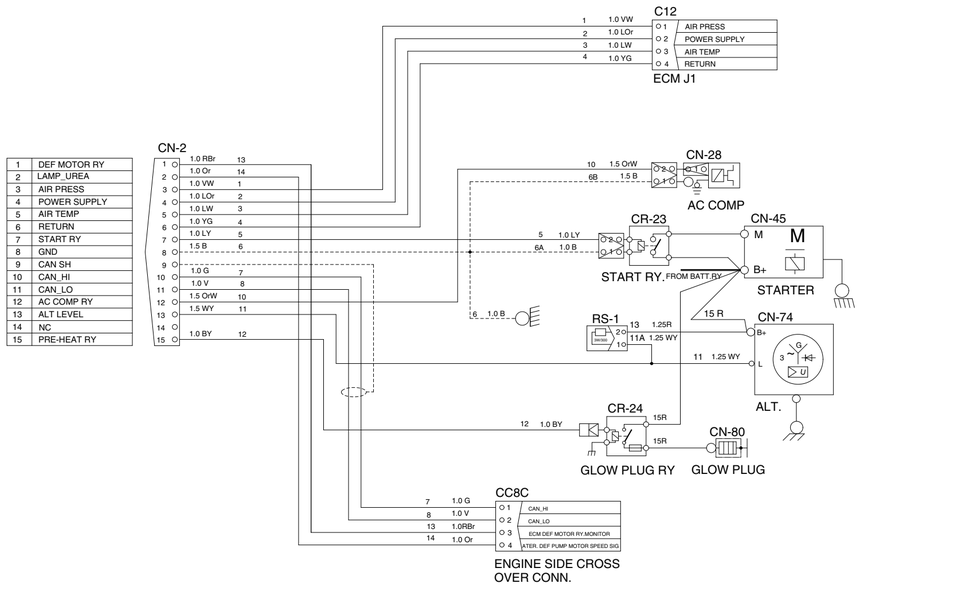




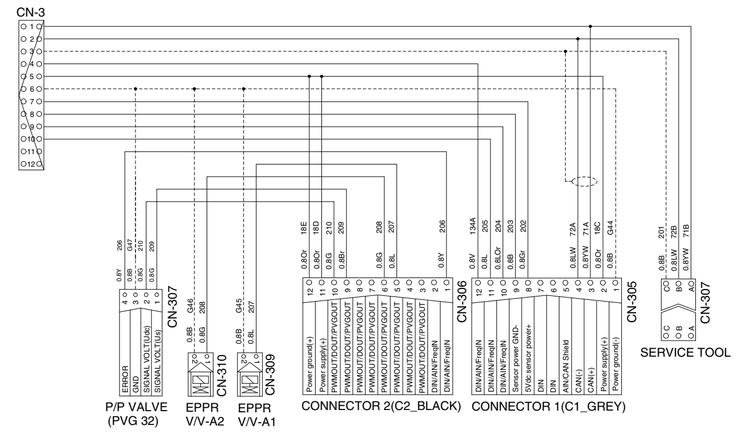




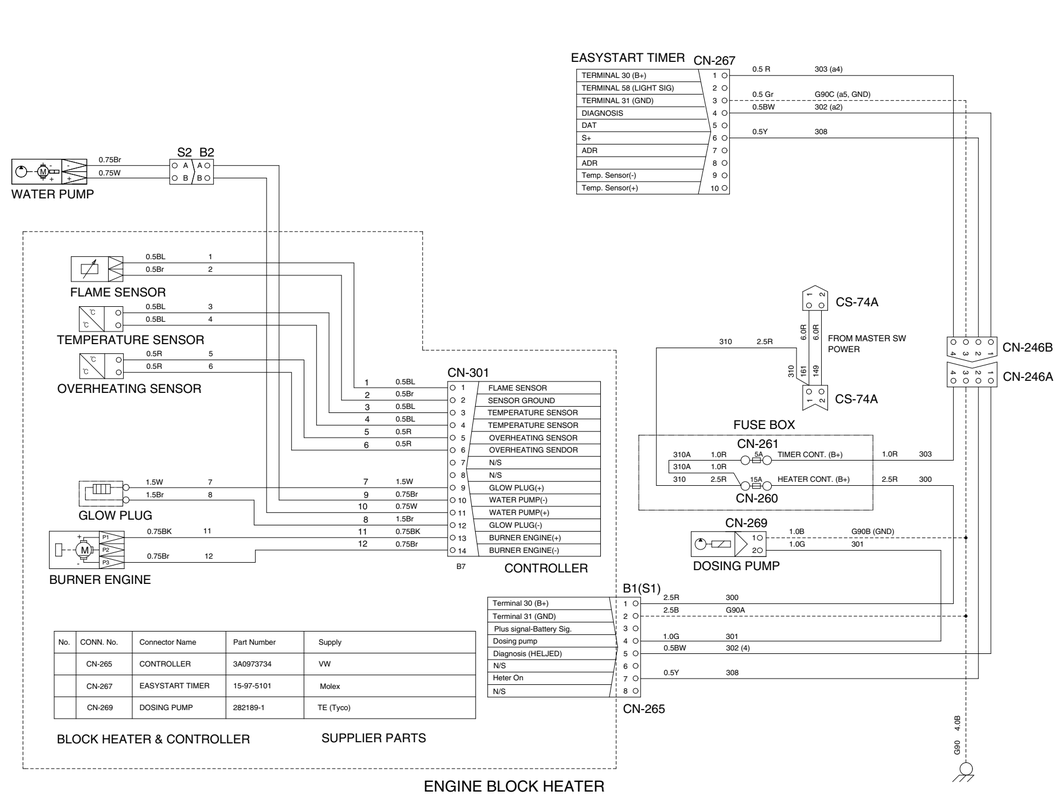
- MACHINE SERIAL NO. : #0656-#0758



ENGINE HARNESS

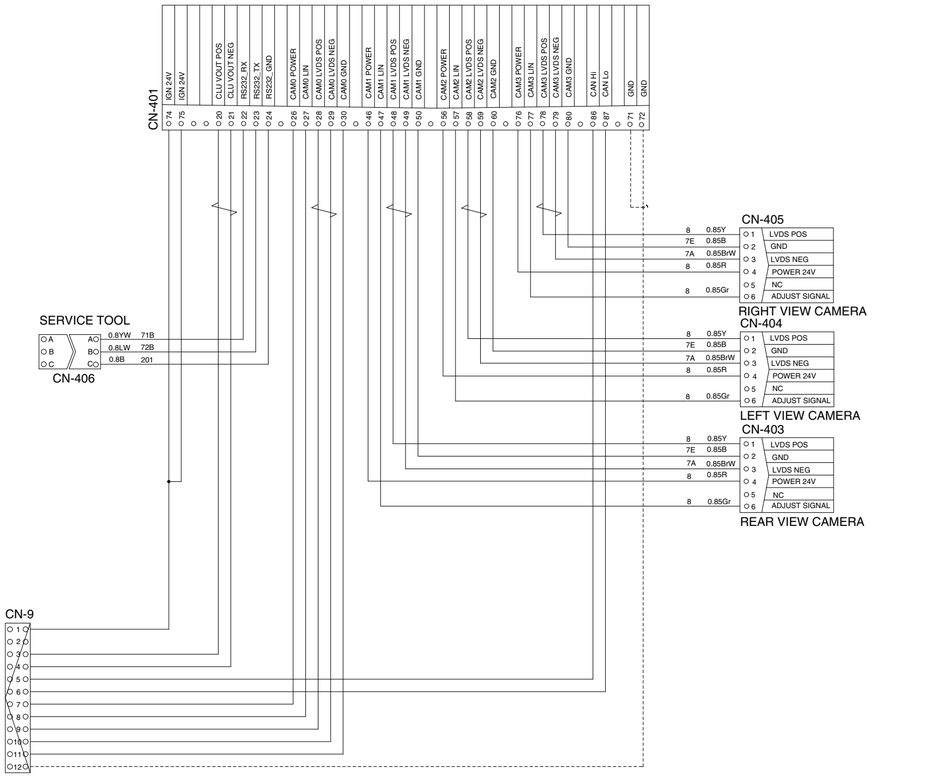


PROPORTIONAL VALVE & LEVER



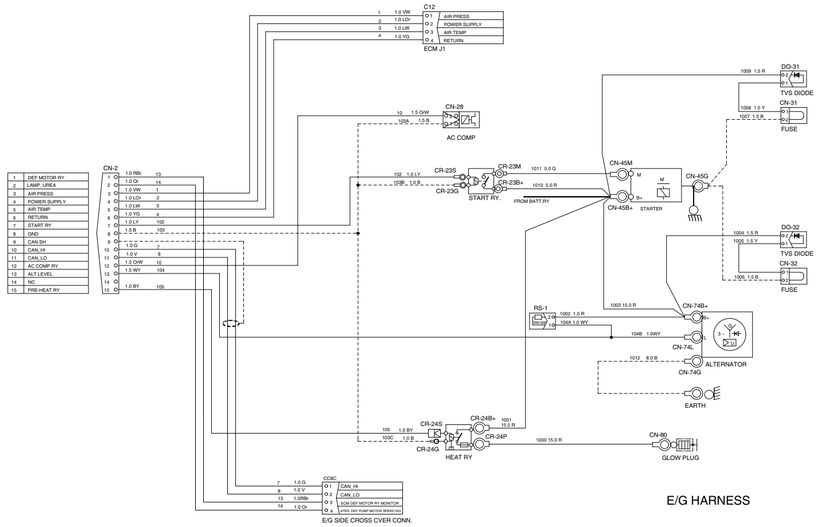
No.	CONN. No.	Connector Name	Part Number	Supply
	CN-265	CONTROLLER	3A0973734	VW
	CN-267	EASYSTART TIMER	15-97-5101	Molex
	CN-269	DOSING PUMP	282189-1	TE (Tyco)

BLOCK HEATER & CONTROLLER SUPPLIER PARTS

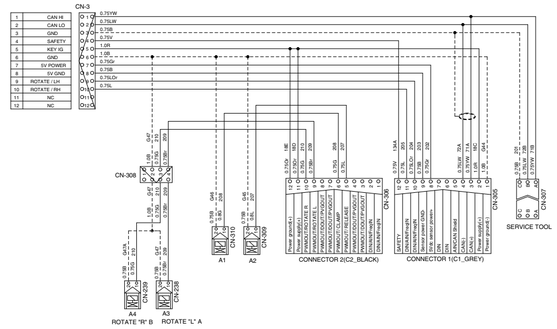


20K8-95310-00

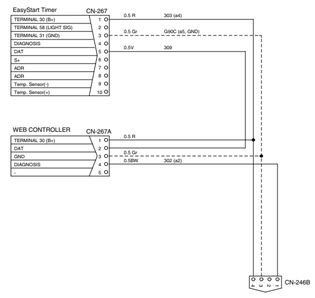
- MACHINE SERIAL NO. : #0759-



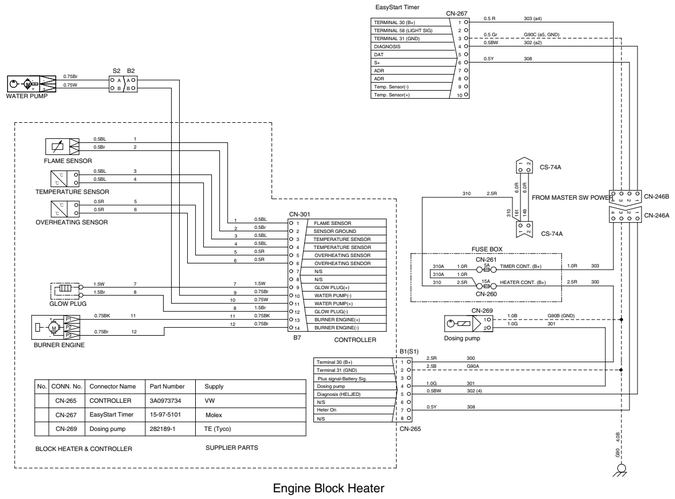
E/G HARNESS



PROPORTIONAL VALVE & LEVER

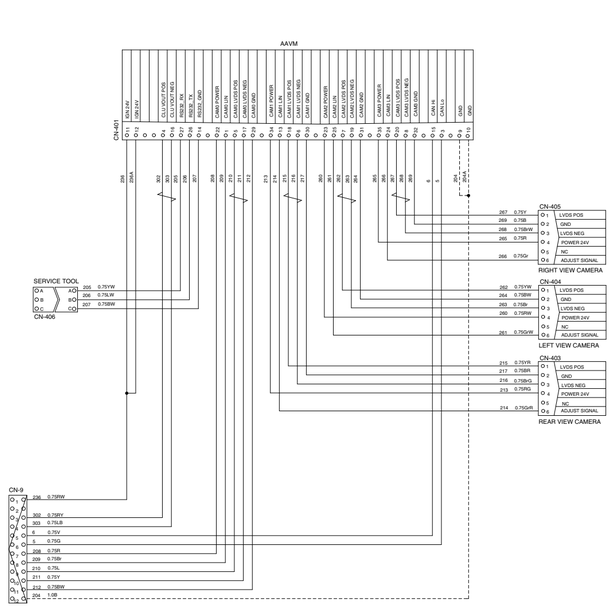


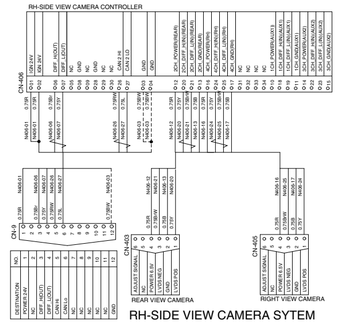
PREHEATER HARNESS (TIMER+WEB)



Engine Block Heater

PREHEATER HARNESS (ONLY TIMER)

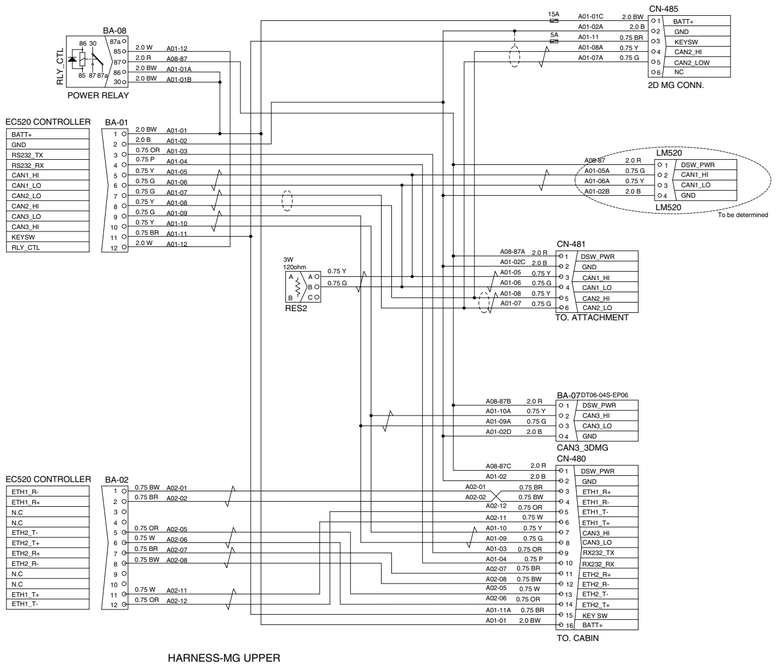


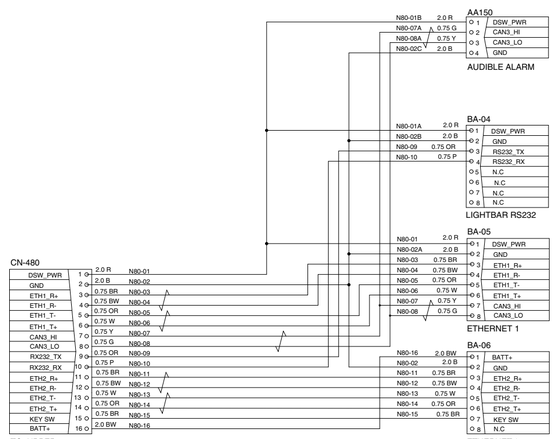


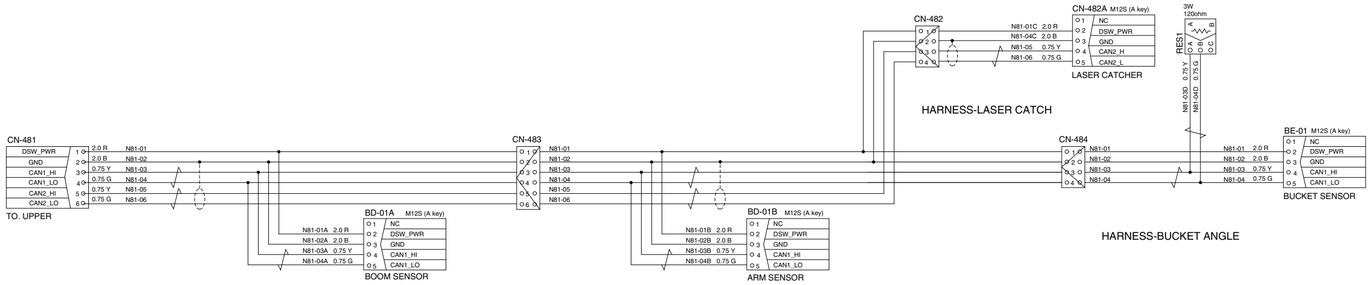
RH-SIDE VIEW CAMERA SYTEM

20K8-95311-00

· ELECTRICAL CIRCUIT (4/4, OPTION : 2D MG)







20K4-94310-00

MEMORANDUM

1. POWER CIRCUIT (MACHINE SERIAL NO. : -#0655)

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

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

1) OPERATING FLOW

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

- → Fuse box [No.1] → Engine ECM [CN-93 (1, 25, 26, 27, 28)]
- → Fuse box [No.2] → United MCU [CN-51 (01)]
- → Fuse box [No.3]
  - → DEF module relay [CR-51 (3)]
  - → Urea purging lamp [CL-40 (1)]
- → Fuse box [No.4] → I/conn [CN-5 (59)]
  - → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
    - → Door switch [CS-1]
    - → I/conn [CN-10 (2)] → RMS [CN-125B (6)]
  - → Radio & USB player [CN-27A (8)]
- → Fuse box [No.5] → Line heater relay [CR-52 (30, 86)]
- → Fuse box [No.6]
  - → Master switch [CS-74B] → I/conn [CN-5 (36)]
    - → Start switch [CS-2A (1)]
    - → RMS [CN-125A (1)]
    - → GPS connection [CN-125 (1)]
  - → Power relay [CR-35 (30)]
- → Fuse box [No.7] → I/conn [CN-11 (5)]
  - → AC & Heater controller box A (7)
  - → Blower relay (4)
- → Fuse box [No.8] → I/conn [CN-5 (18)] → I/conn [CN-17 (5)]
  - → Wiper motor controller [CN-141 (7)]
  - → Wiper motor [CN-21 (4)]
- → Fuse box [No.9]
  - → I/conn [CN-5 (11)]
    - → Cluster [CN -56A (1)]
    - → Hour meter [CN-48 (1)]
  - → I/conn [CN-8 (6)] → Jog dial module [CN-363 (2)]
- → Fuse box [No.10] → NOx sensor relay [CR-50 (3)]
- → Fuse box [No.11] → United MCU [CN-54 (18)]

※ I/conn : Intermediate connector

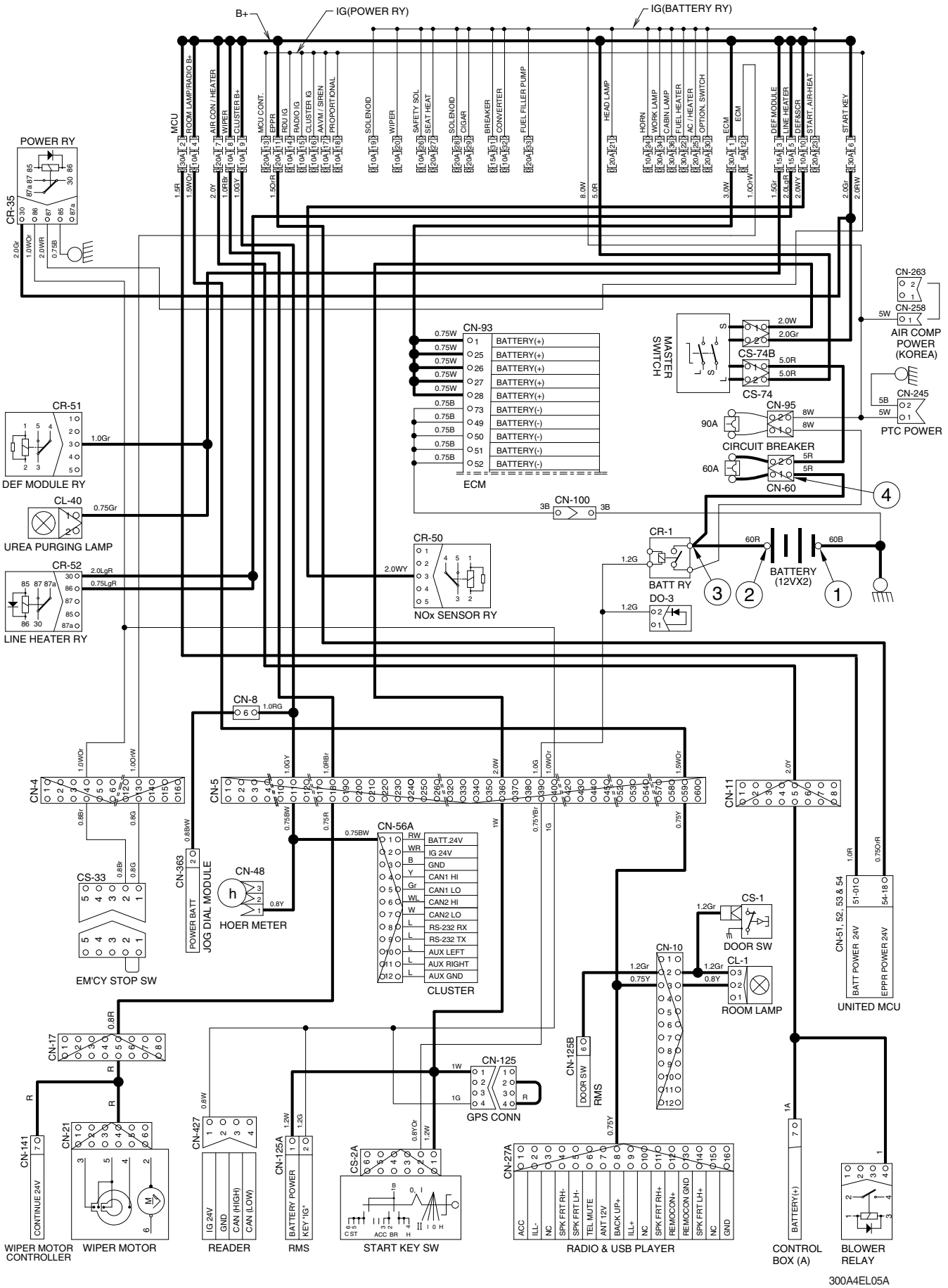
2) CHECK POINT

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

※ GND : Ground

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

POWER CIRCUIT (MACHINE SERIAL NO. : -#0655)



300A4EL05A

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

POWER CIRCUIT (MACHINE SERIAL NO. : #0656-)

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

1) OPERATING FLOW

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

- → Fuse box [No.1] → Engine ECM [CN-93 (1, 25, 26, 27, 28)]
- → Fuse box [No.2] → United MCU [CN-51 (01)]
- → Fuse box [No.3]
  - → DEF module relay [CR-51 (3)]
  - → Urea purging lamp [CL-40 (1)]
- → Fuse box [No.4] → I/conn [CN-5 (59)]
  - → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
    - → Door switch [CS-1]
    - → I/conn [CN-10 (2)] → RMS [CN-125A (10)]
  - → Radio & USB player [CN-27A (8)]
- → Fuse box [No.5] → Line heater relay [CR-52 (30, 86)]
- → Fuse box [No.6]
  - → Master switch [CS-74B] → I/conn [CN-5 (36)]
    - → Start switch [CS-2A (1)]
    - → RMS [CN-125A (1)]
    - → GPS connection [CN-125 (1)]
    - → Reader [CN-427 (12)]
  - → Power relay [CR-35 (30)]
- → Fuse box [No.7] → I/conn [CN-11 (5)]
  - → AC & Heater controller box A (7)
  - → Blower relay (4)
- → Fuse box [No.8] → I/conn [CN-5 (18)] → I/conn [CN-17 (5)]
  - → Wiper motor controller [CN-141 (7)]
  - → Wiper motor [CN-21 (4)]
- → Fuse box [No.9]
  - → I/conn [CN-5 (11)]
    - → Cluster [CN -56A (1)]
    - → Hour meter [CN-48 (1)]
  - → I/conn [CN-8 (6)] → Jog dial module [CN-363 (2)]
- → Fuse box [No.10] → NOx sensor relay [CR-50 (3)]
- → Fuse box [No.11] → United MCU [CN-54 (18)]

※ I/conn : Intermediate connector

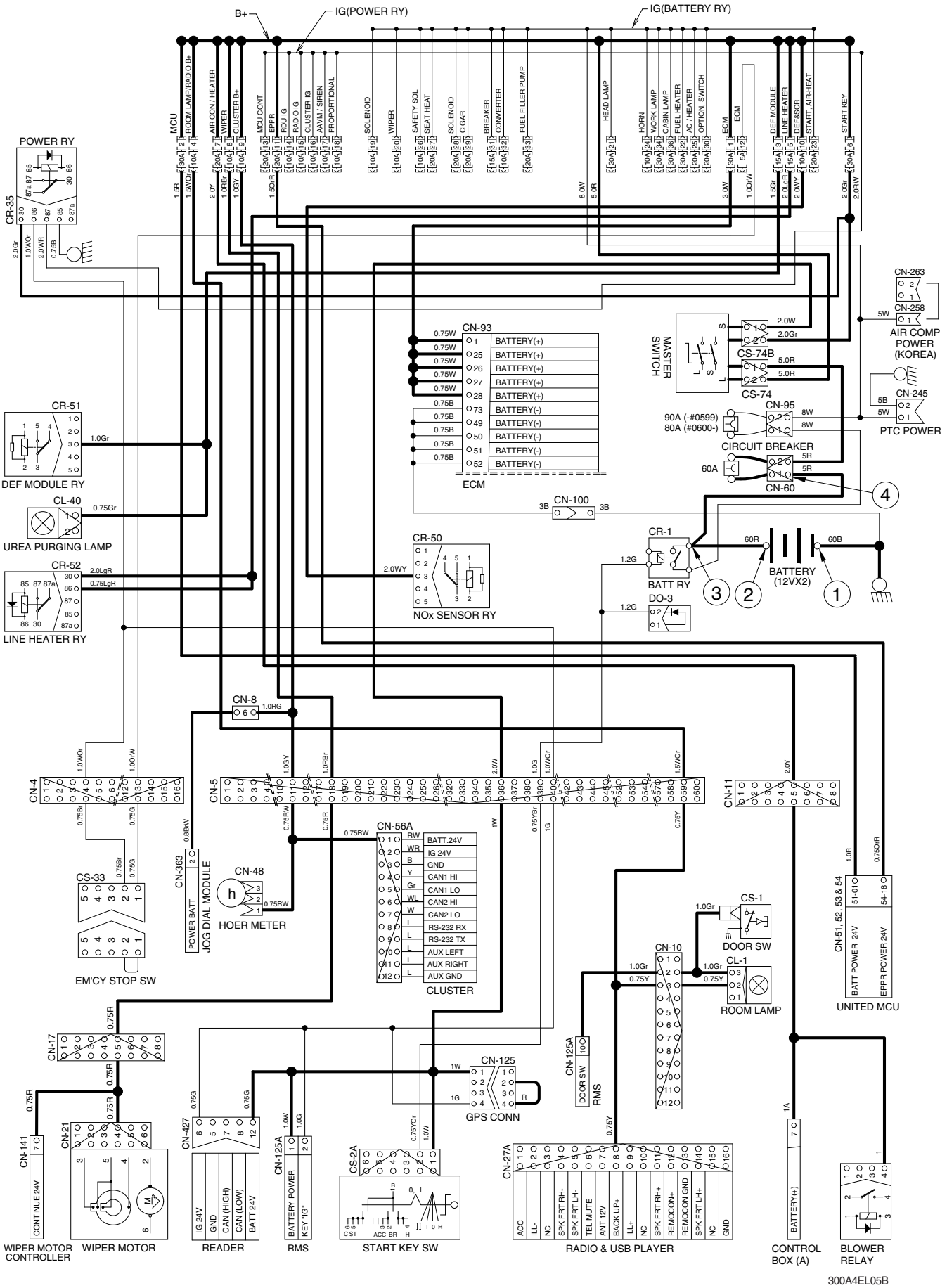
2) CHECK POINT

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

※ GND : Ground

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

POWER CIRCUIT (MACHINE SERIAL NO. : #0656-)



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

2. STARTING CIRCUIT (MACHINE SERIAL NO. : -#0047)

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.6] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
→ Power relay [CR-35 (30)]

(1) When start key switch is in ON position

→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
→ Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)
→ I/conn [CN-5 (40)] → Power relay [CR-35 (86) → (87)]
→ Fuse box [IG (power relay)]
→ I/conn [CN-4 (4)]
→ Emergency engine stop sw [CS-33 (2)→(1)]
→ I/conn [CN-4 (13)] → Fuse box [No. 12]
→ Engine ECM [CN-93 (5)]
→ Reader [CN-427 (1)]
→ RMS [CN-125A (2)]

(2) When start key switch is in START position

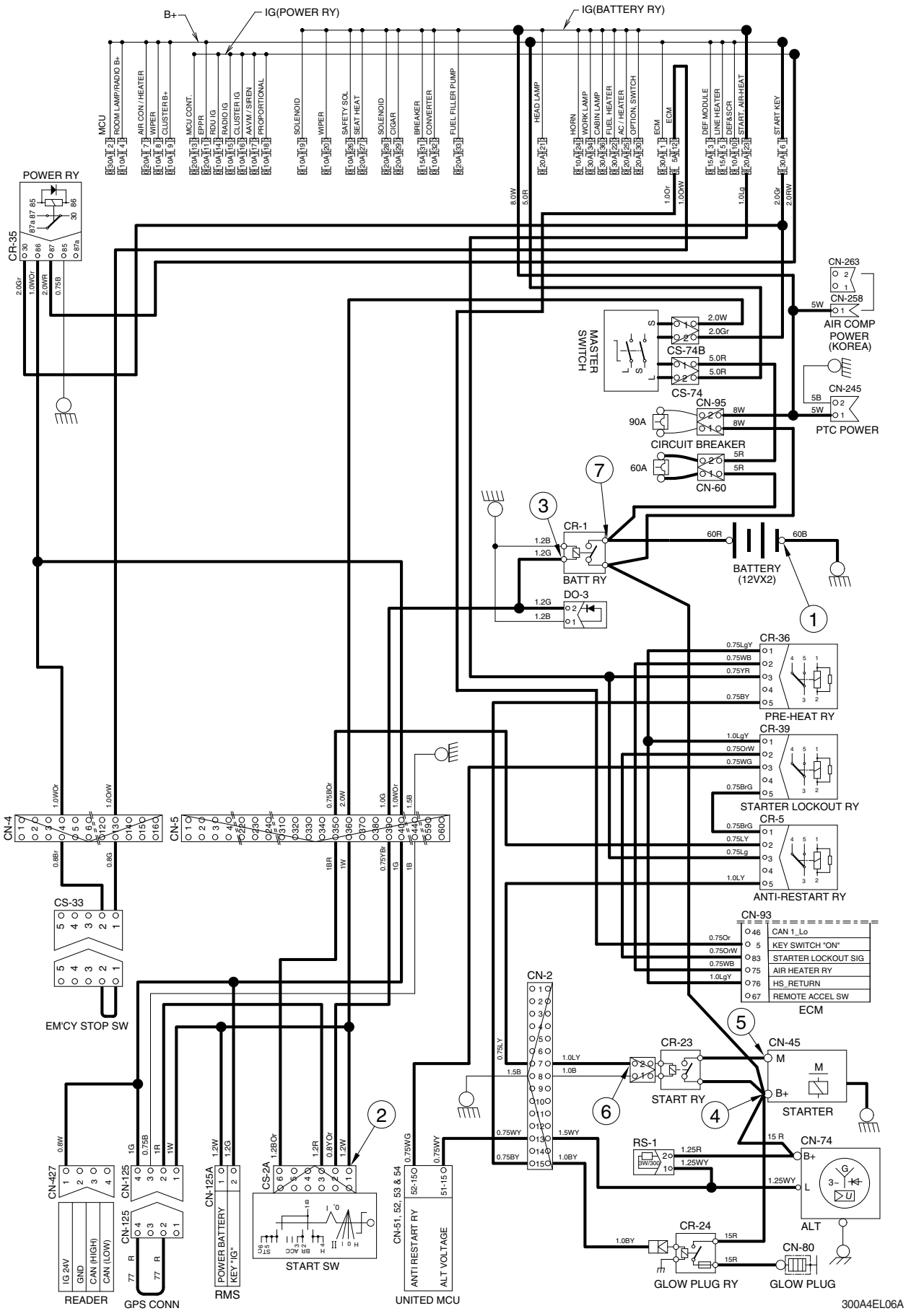
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn [CN-2 (7)] → Start relay [CR-23 (2)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT (MACHINE SERIAL NO. : -#0047)



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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0048-#0665)

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.6] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
→ Power relay [CR-35 (30)]

(1) When start key switch is in ON position

- Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
  → Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
- Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)
- I/conn [CN-5 (40)] → Power relay [CR-35 (86) → (87)]
  → Fuse box [IG (power relay)]
  → I/conn [CN-4 (4)]
  → Emergency engine stop sw [CS-33 (2)→(1)]
  → I/conn [CN-4 (13)] → Fuse box [No. 12]
  → Engine ECM [CN-93 (5)]
- Reader [CN-427 (1)]
- RMS [CN-125A (2)]

(2) When start key switch is in START position

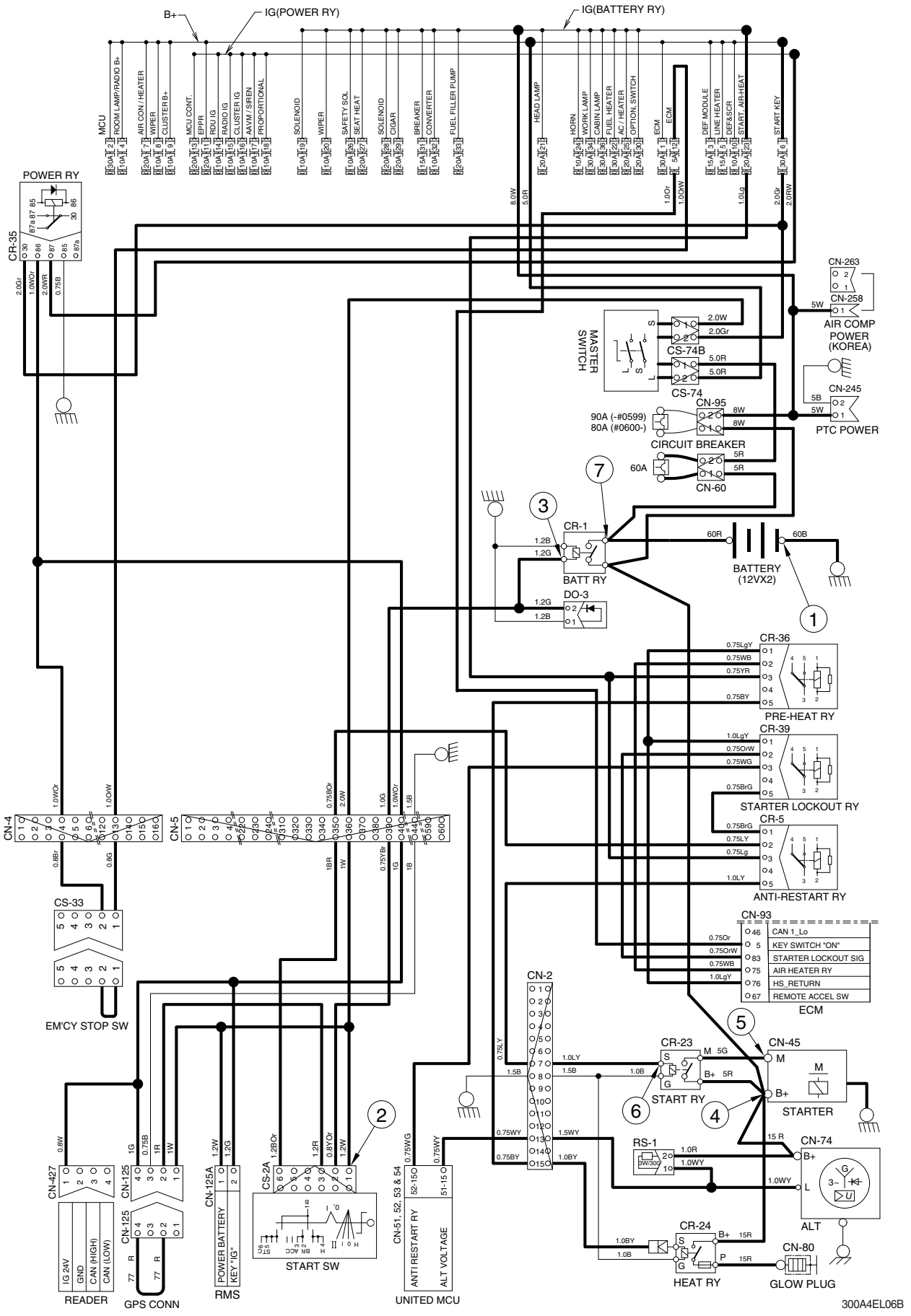
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn [CN-2 (7)] → Start relay [CR-23 (2)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0048-#0655)



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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0656-)

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.6] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
→ Power relay [CR-35 (30)]

(1) When start key switch is in ON position

- Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
  - → Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
- Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)
- I/conn [CN-5 (40)] → Power relay [CR-35 (86) → (87)]
  - → Fuse box [IG (power relay)]
  - I/conn [CN-4 (4)]
    - → Emergency engine stop sw [CS-33 (2)→(1)]
    - → I/conn [CN-4 (13)] → Fuse box [No. 12]
    - → Engine ECM [CN-93 (5)]
- Reader [CN-427 (6)]
- RMS [CN-125A (2)]

(2) When start key switch is in START position

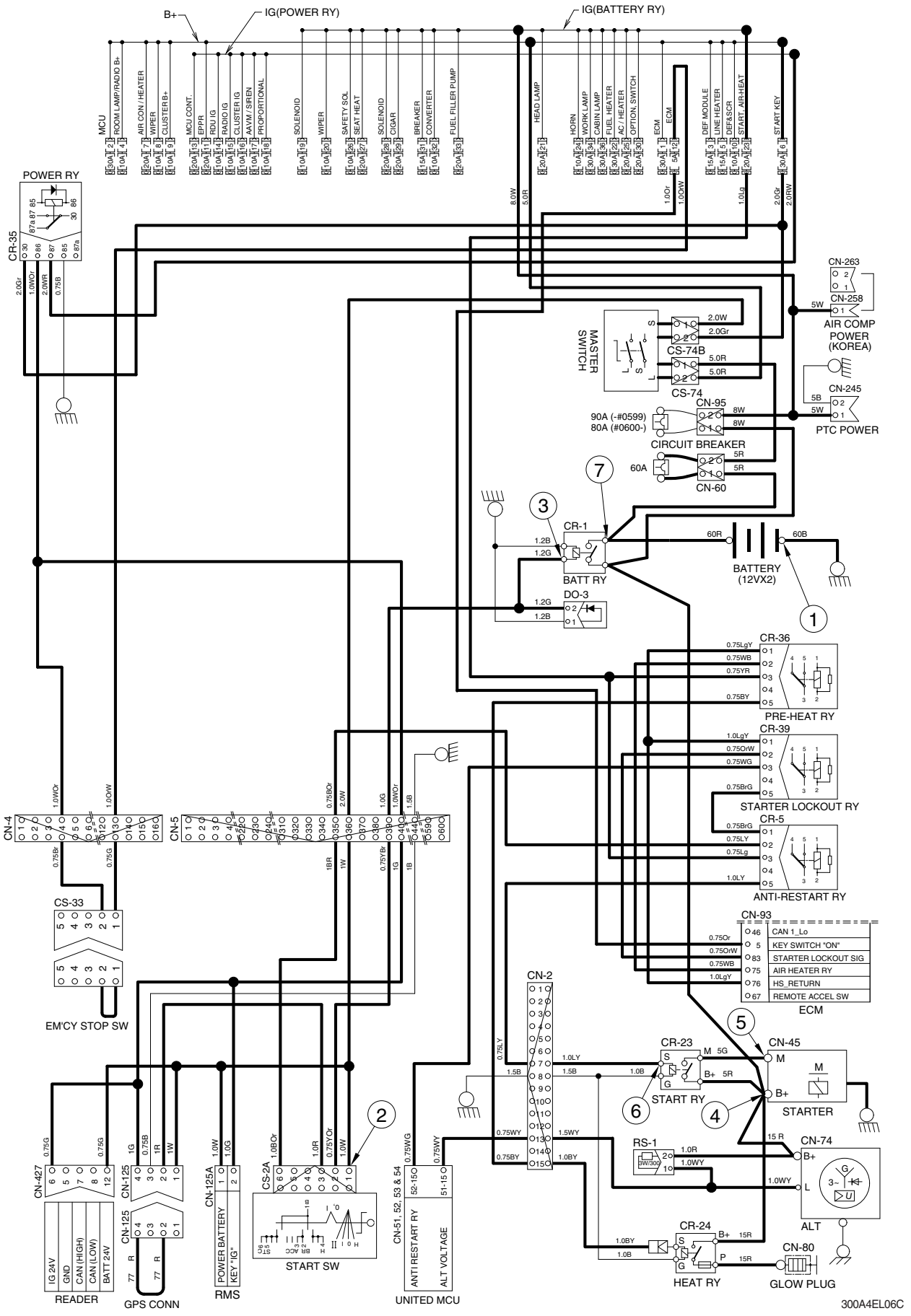
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn [CN-2 (7)] → Start relay [CR-23 (S)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0656-)



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

3. CHARGING CIRCUIT (MACHINE SERIAL NO. : -#0047)

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

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

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

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-2 (13)] → United MCU alternator voltage [CN-51 (15)] → Cluster charging warning lamp (Via CAN interface)

(2) Charging flow

Alternator "B^+" terminal → Starter [CN-45 (B^+)] → Battery relay (CR-1)

- → Battery (+) terminal
- → Circuit breaker [CN-60] → Master switch [CS-74] → Fuse box [B^+]
- → Circuit breaker [CN-95] → Fuse box [IG, battery] → Power relay [CR-35 (30)→(87)]
  - → Fuse box [IG, power]
  - → PTC power [CN-245 (1)]
  - → Air comp power [CN-258 (1)]

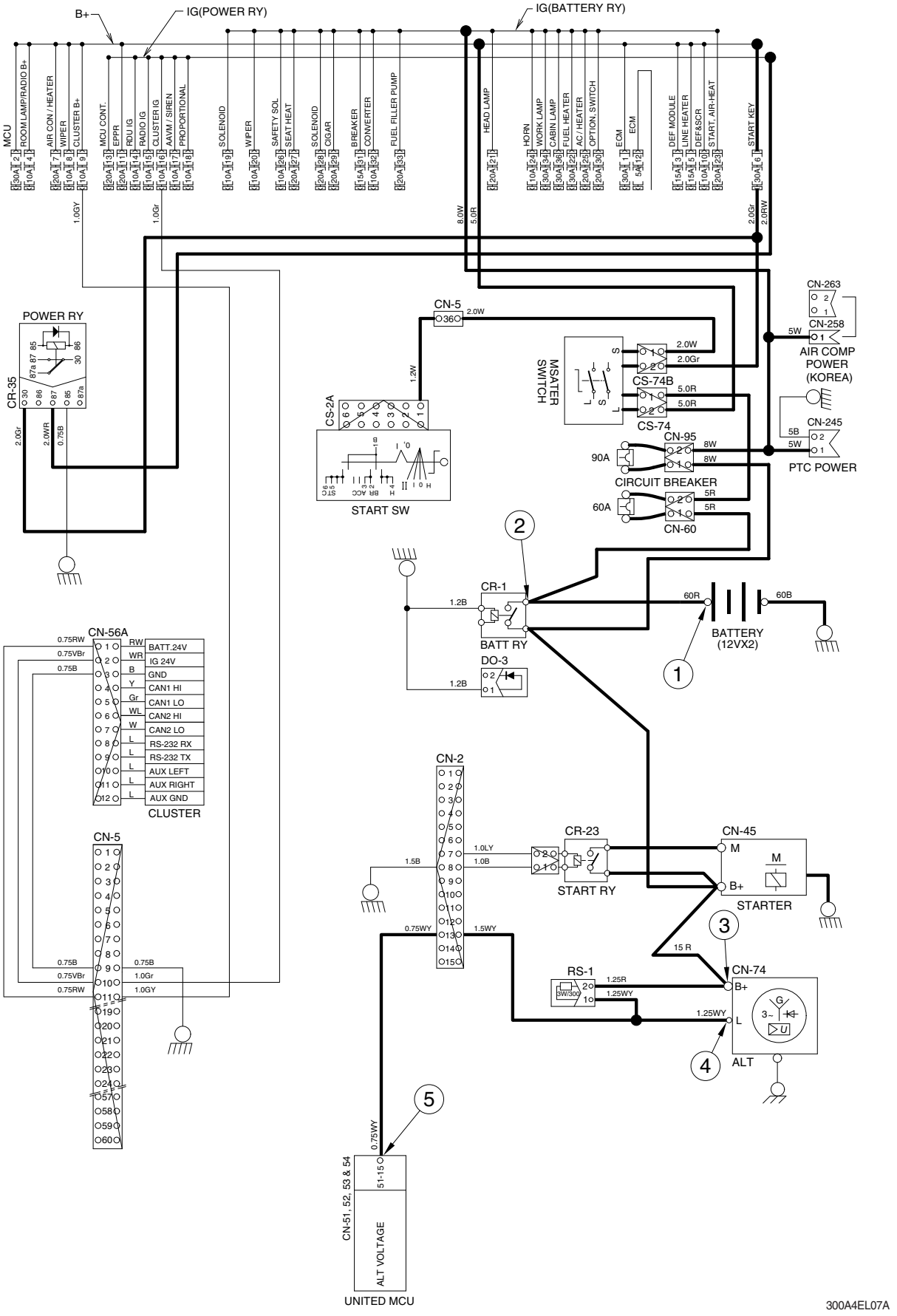
2) CHECK POINT

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

※ GND : Ground

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

CHARGING CIRCUIT (MACHINE SERIAL NO. : -#0047)



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

CHARGING CIRCUIT (MACHINE SERIAL NO. : #0048-)

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

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

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

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-2 (13)] → United MCU alternator voltage [CN-51 (15)]
→ Cluster charging warning lamp (Via CAN interface)

(2) Charging flow

Alternator "B^+" terminal → Starter [CN-45 (B^+)] → Battery relay (CR-1)
- → Battery (+) terminal
- → Circuit breaker [CN-60] → Master switch [CS-74] → Fuse box [B^+]
- → Circuit breaker [CN-95] → Fuse box [IG, battery] → Power relay [CR-35 (30)→(87)]
  - → Fuse box [IG, power]
  - → PTC power [CN-245 (1)]
  - → Air comp power [CN-258 (1)]

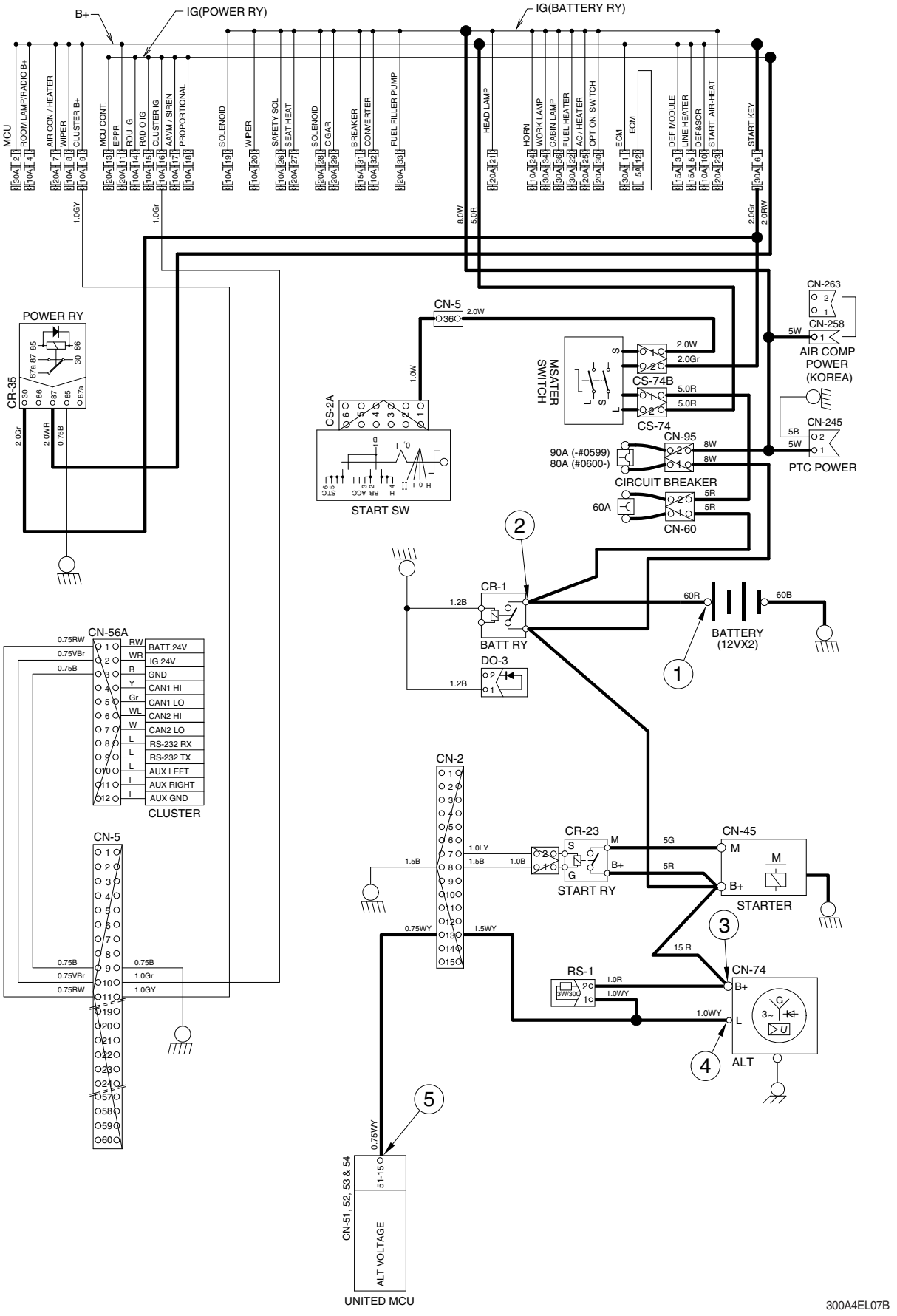
2) CHECK POINT

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

※ GND : Ground

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

CHARGING CIRCUIT (MACHINE SERIAL NO. : #0048-)



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

4. HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0655)

1) OPERATING FLOW

Fuse box (No.21) → Head light relay [CR-13 (30, 86)]
Fuse box (No.34) → Work light relay [CR-4 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Head light switch ON

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

(2) Work light switch ON

Work light switch ON [CN-376 (4)] → Work light relay [CR-4 (85) → (87)]
→ I/conn [CN-12 (1)] → Work light ON [CL-5 (1), CL-6 (1)]

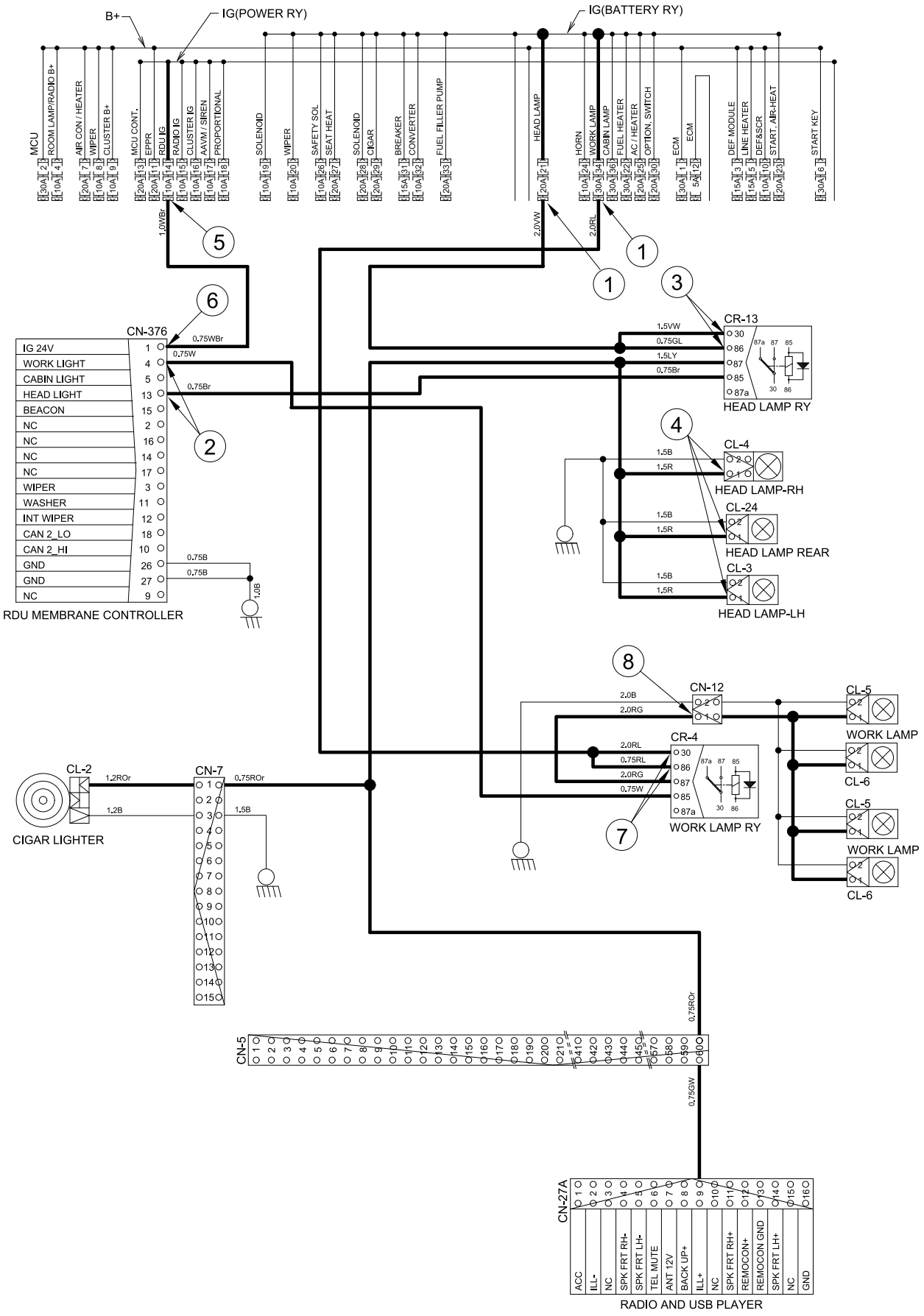
2) CHECK POINT

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

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0655)



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

4. HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : #0656-)

1) OPERATING FLOW

Fuse box (No.21) → Head light relay [CR-13 (30, 86)]
Fuse box (No.34) → Work light relay [CR-4 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Head light switch ON

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

(2) Work light switch ON

Work light switch ON [CN-376 (4)] → Work light relay [CR-4 (85) → (87)]
→ I/conn [CN-12 (1)] → Work light ON [CL-5 (1), CL-6 (1)]

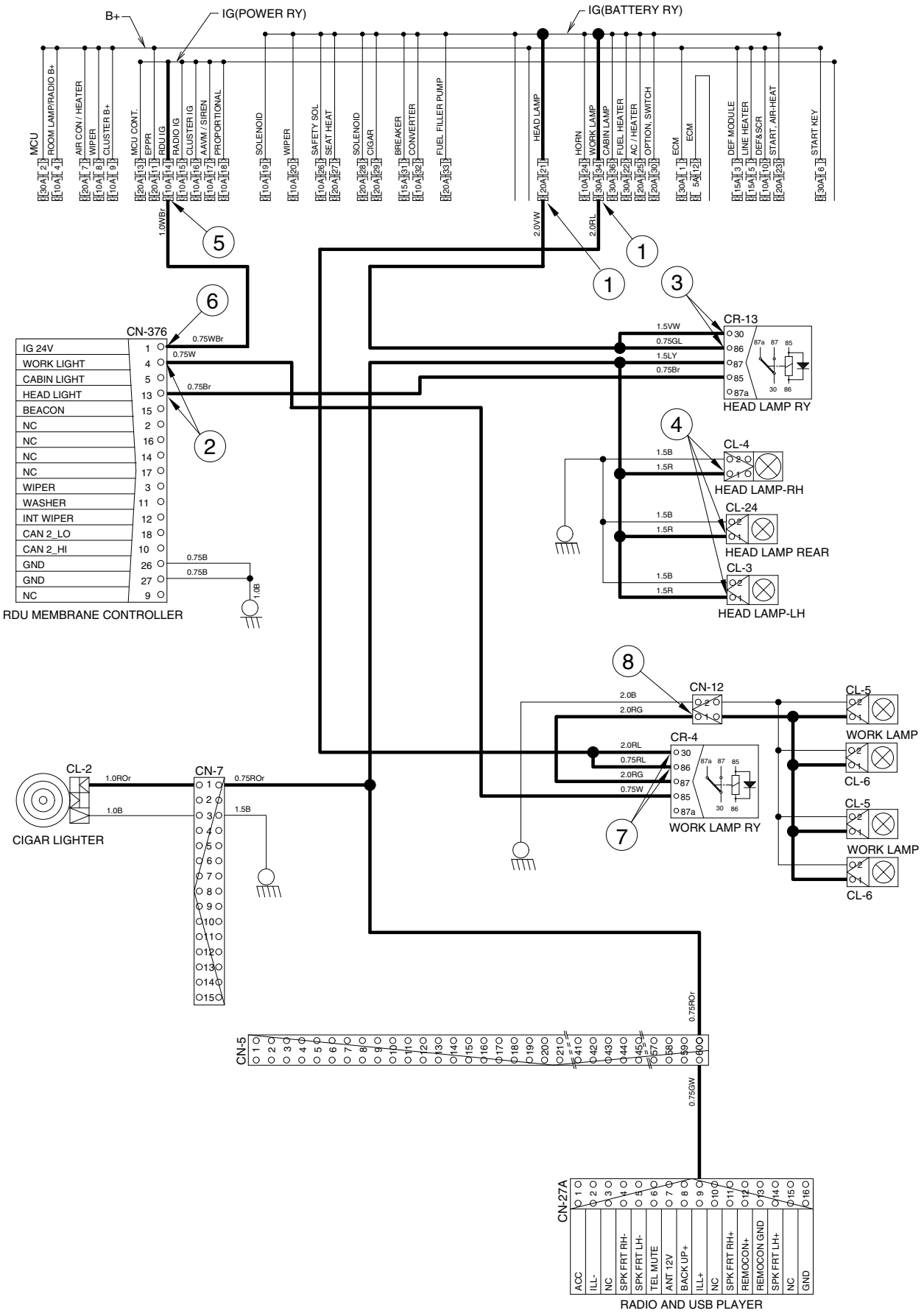
2) CHECK POINT

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

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : #0656-)



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

5. BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0655)

1) OPERATING FLOW

Fuse box (No.30) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.36) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

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

(2) Cab light switch ON

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

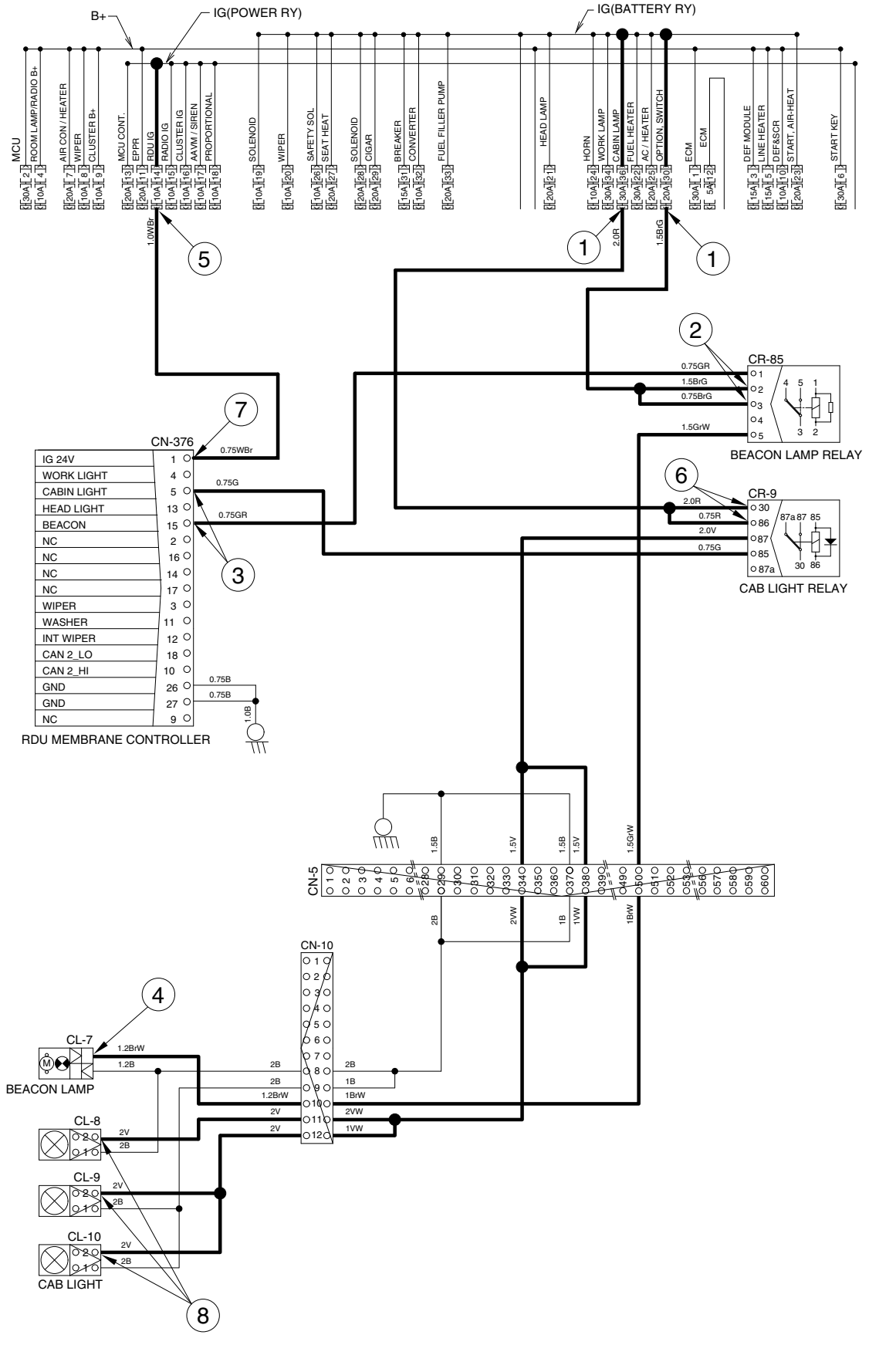
2) CHECK POINT

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

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0655)



300A4EL09A

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

BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : #0656-)

1) OPERATING FLOW

Fuse box (No.30) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.36) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-376 (15)] → Beacon lamp relay [CR-85 (1)→ (5)]
→ I/conn [CN-5 (50)] → I/conn [CN-10 (10)] → Beacon lamp ON [CL-7 (2)]

(2) Cab light switch ON

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

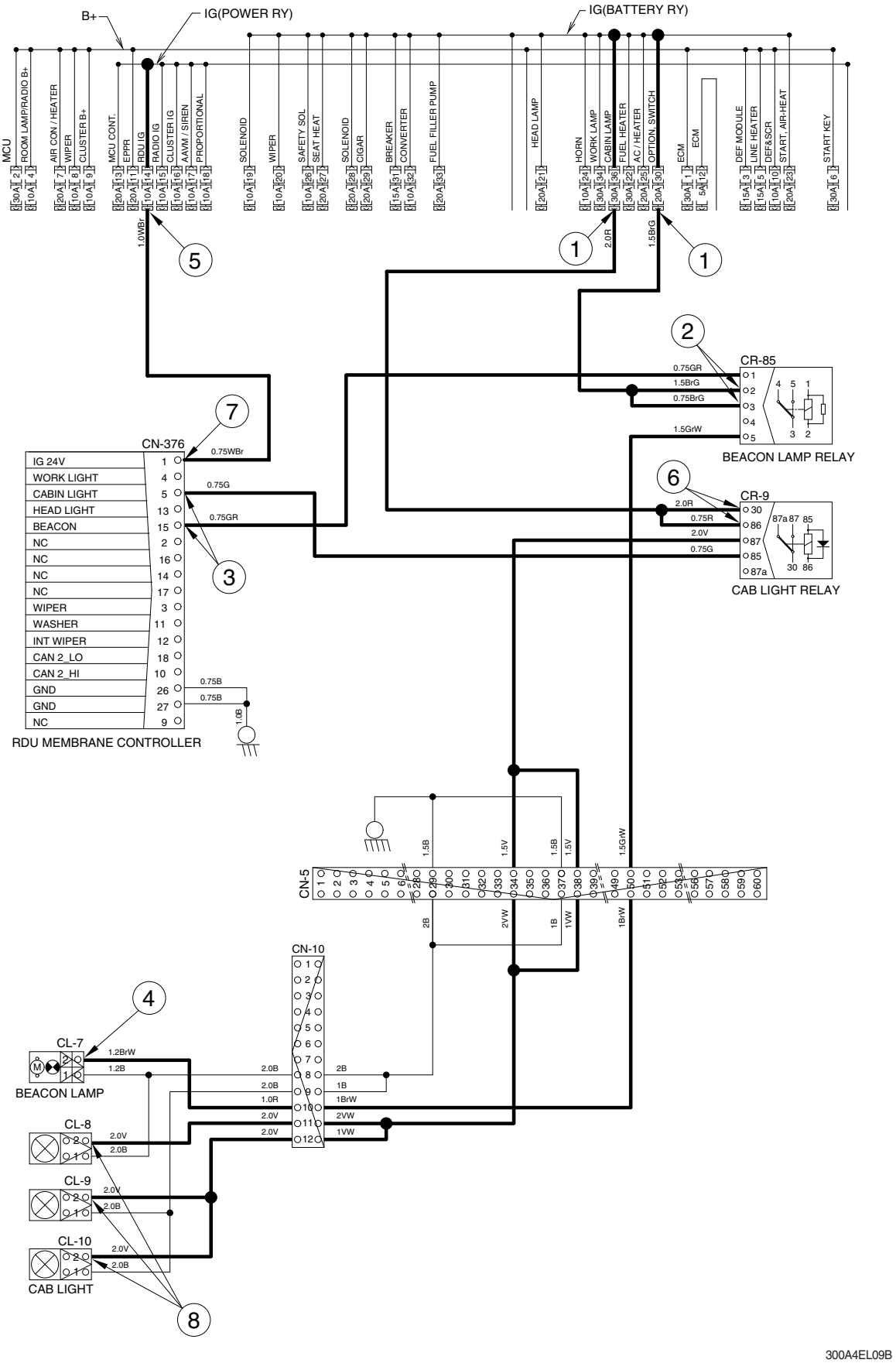
2) CHECK POINT

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

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : #0656-)



300A4EL09B

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

6. WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : -#0655)

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.14) → RDU membrance controller [CN-376 (1)]

Fuse box (No.8) → I/conn [CN-5 (18)] → I/conn [CN-17 (5)] → Wiper motor controller [CN-141 (7)]
→ Wiper motor [CN-21 (4)]

Fuse box (No.20) → I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
→ Low wiper motor [CN-407 (3)]
→ Washer pump [CN-22 (2)]

(2) Wiper switch ON (Intermittent)

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

(3) Wiper switch ON (continual)

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

(4) Washer switch ON

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

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

(5) Auto parking (when switch OFF)

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

2) OPERATING FLOW (LOW WIPER)

(1) Key switch ON

Fuse box (No. 30) → I/conn [CN-7 (8)] → Low wiper switch [CS-79 (1, 5)]

(2) Wiper switch ON (1st)

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

(3) Wiper switch ON (2nd)

Wiper switch ON [CS-79 (5 → 4)] → I/conn [CN-7 (6)] → I/conn [NC-18 (2)] → Washer pump [CN-407 (2)]
→ Washer operating

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

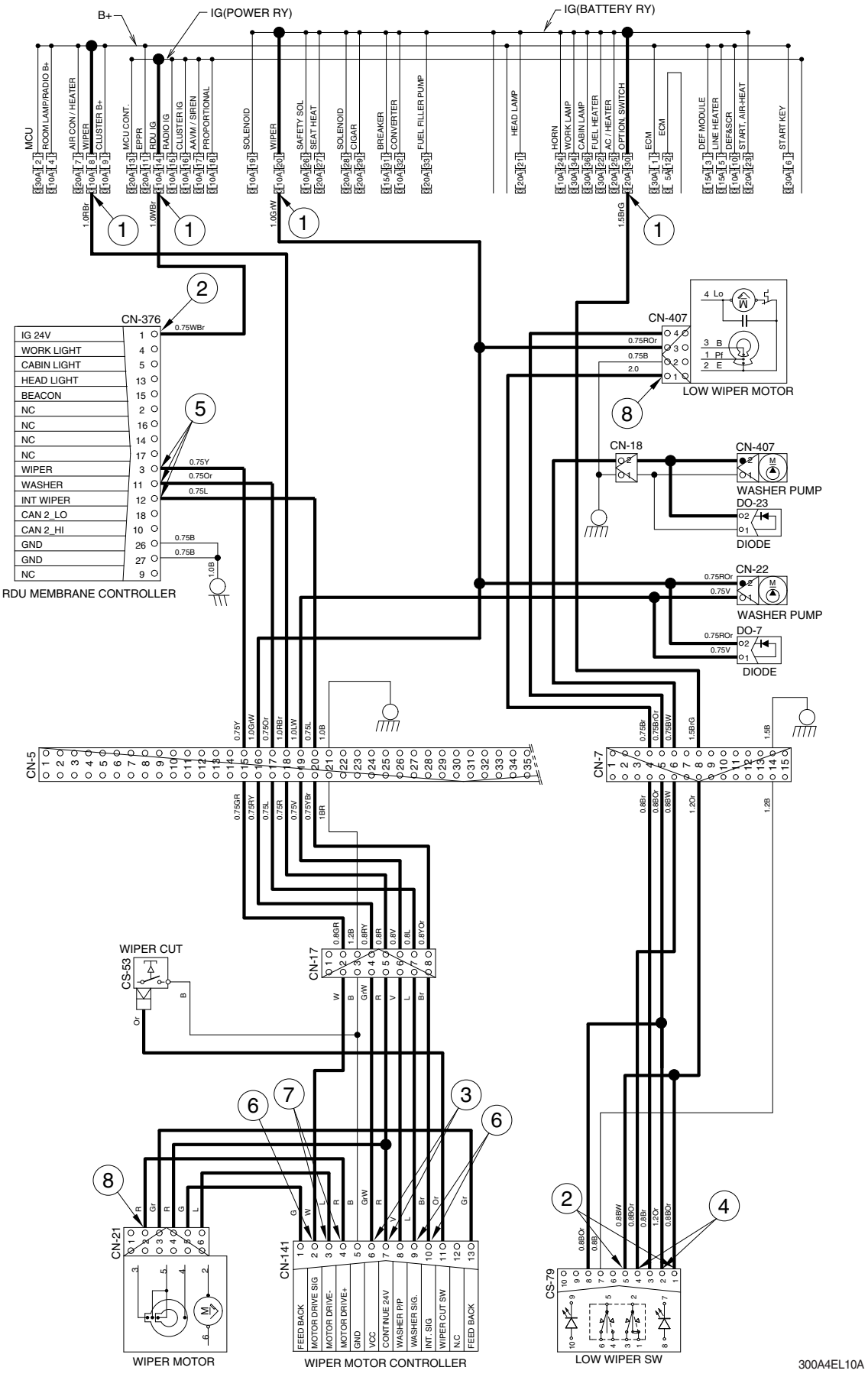
3) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (wiper power input) ④ - GND (switch power output)	20~25V
		⑤ - GND (switch power output) ⑥ - GND (wiper switch power input)	0 ~ 5V
		⑦ - GND (wiper power output)	24V
		⑧ - GND (wiper motor)	0 or 24V

※ GND : Ground

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

WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : -#0655)



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

WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : #0656-)

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.14) → RDU membrance controller [CN-376 (1)]

Fuse box (No.8) → I/conn [CN-5 (18)] → I/conn [CN-17 (5)] → Wiper motor controller [CN-141 (7)]
→ Wiper motor [CN-21 (4)]

Fuse box (No.20) → I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
→ Low wiper motor [CN-407 (3)]
→ Washer pump [CN-22 (2)]

(2) Wiper switch ON (Intermittent)

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

(3) Wiper switch ON (continual)

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

(4) Washer switch ON

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

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

(5) Auto parking (when switch OFF)

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

2) OPERATING FLOW (LOW WIPER)

(1) Key switch ON

Fuse box (No. 30) → I/conn [CN-7 (8)] → Low wiper switch [CS-79 (1, 5)]

(2) Wiper switch ON (1st)

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

(3) Wiper switch ON (2nd)

Wiper switch ON [CS-79 (5 → 4)] → I/conn [CN-7 (6)] → I/conn [NC-18 (2)] → Washer pump [CN-407 (2)]
→ Washer operating

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

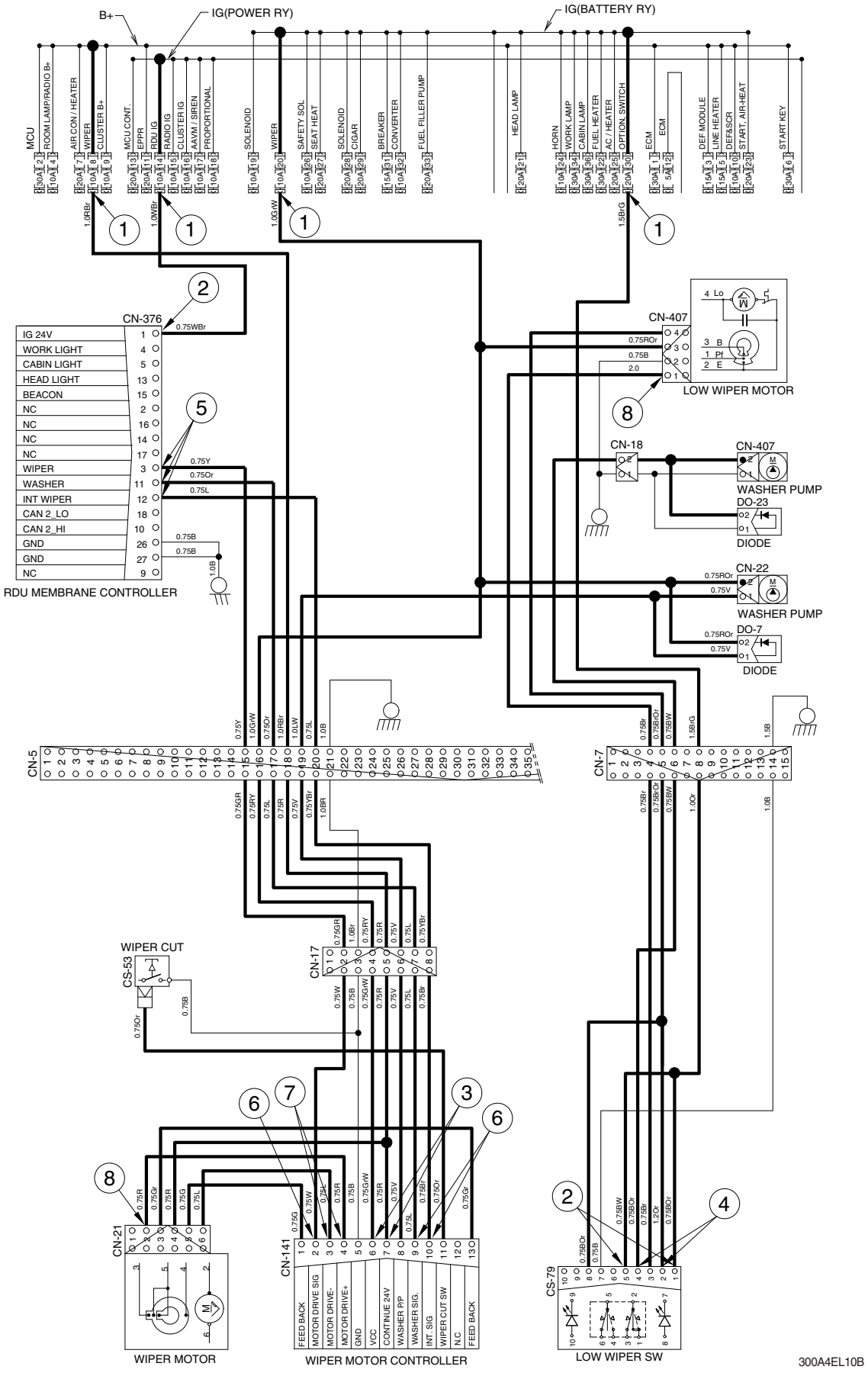
3) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (wiper power input) ④ - GND (switch power output)	20~25V
		⑤ - GND (switch power output) ⑥ - GND (wiper switch power input)	0 ~ 5V
		⑦ - GND (wiper power output)	24V
		⑧ - GND (wiper motor)	0 or 24V

※ GND : Ground

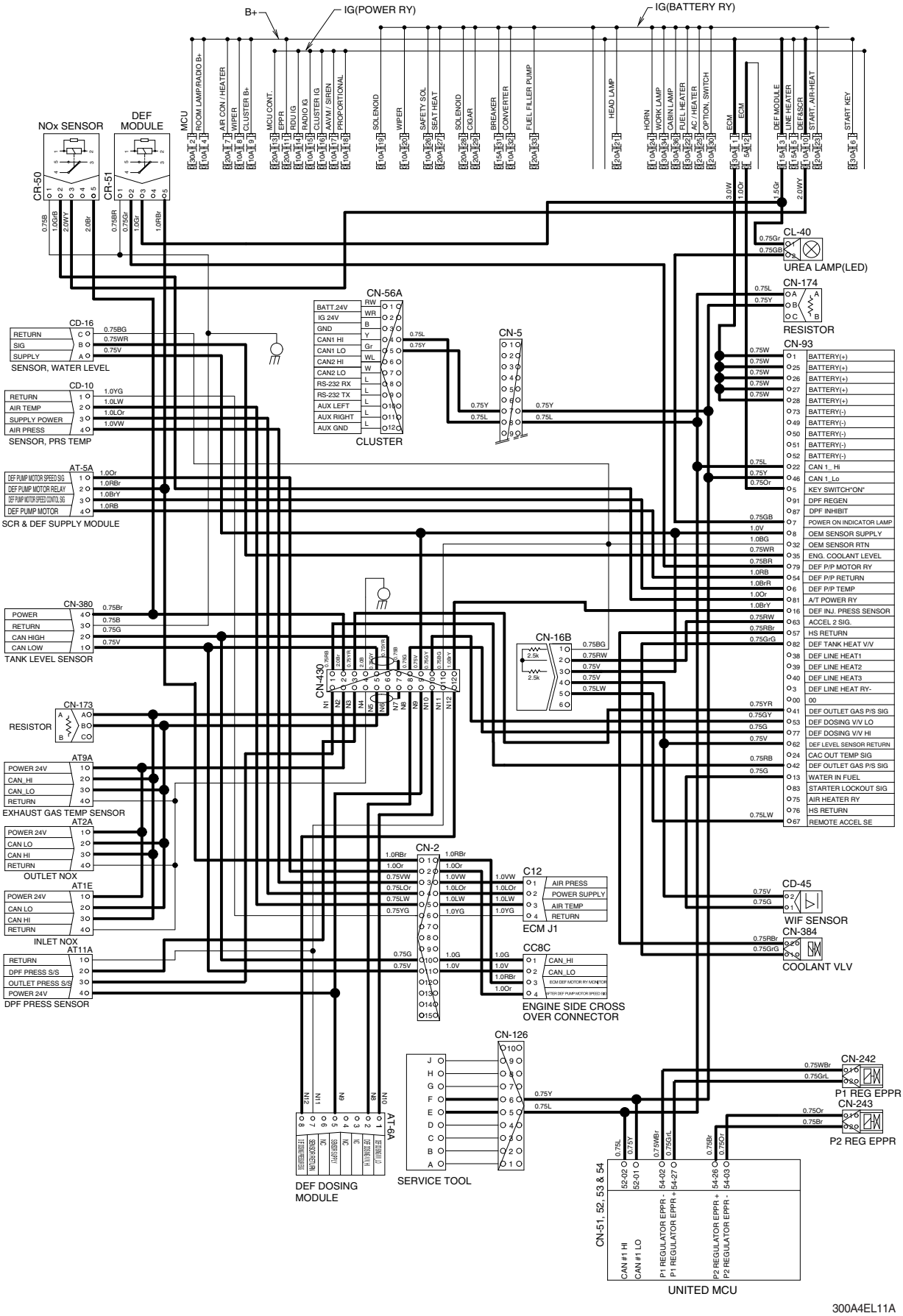
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : #0656-)



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

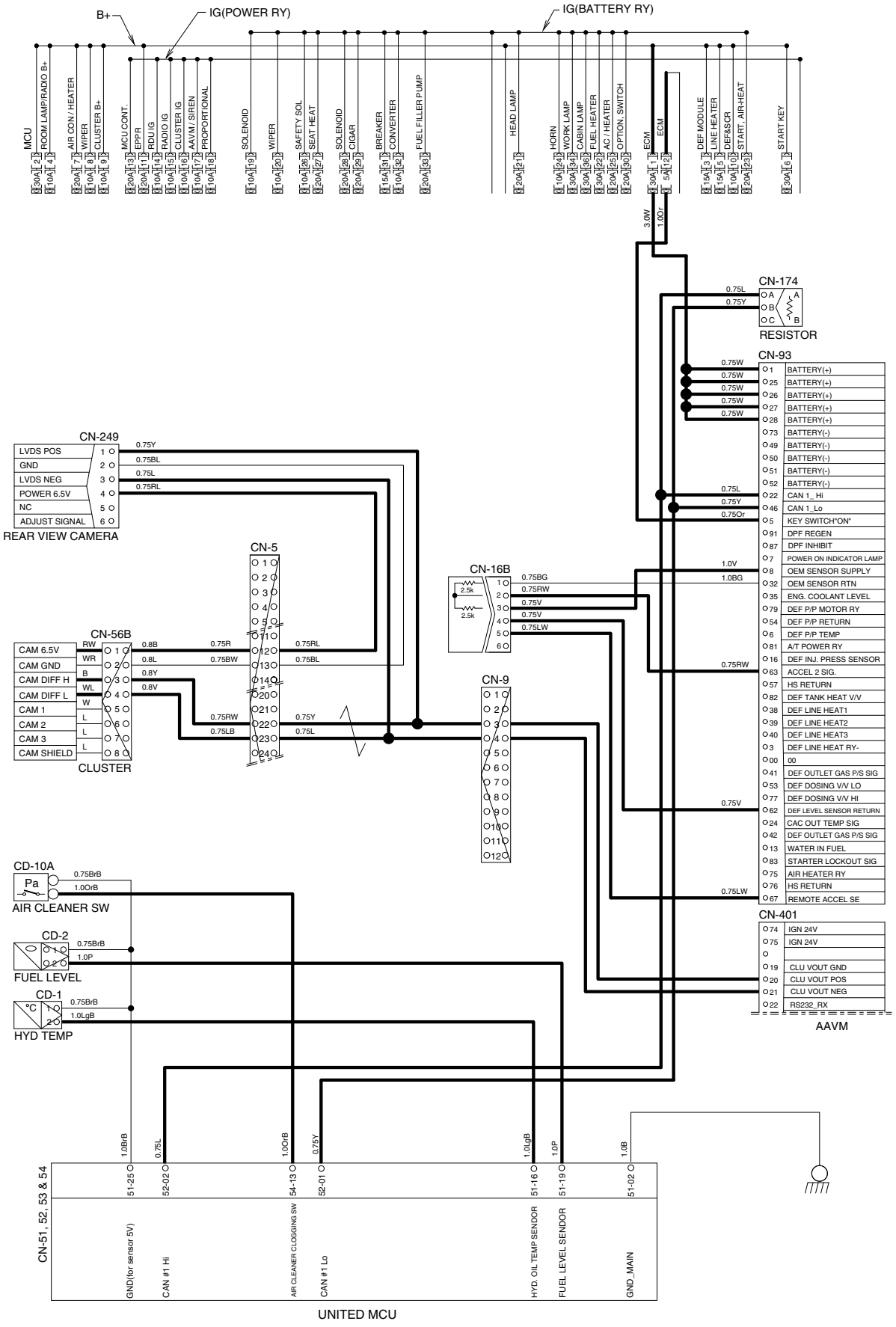
7. CONTROLLER CIRCUIT (MACHINE SERIAL NO. : #0001-)



300A4EL11A

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

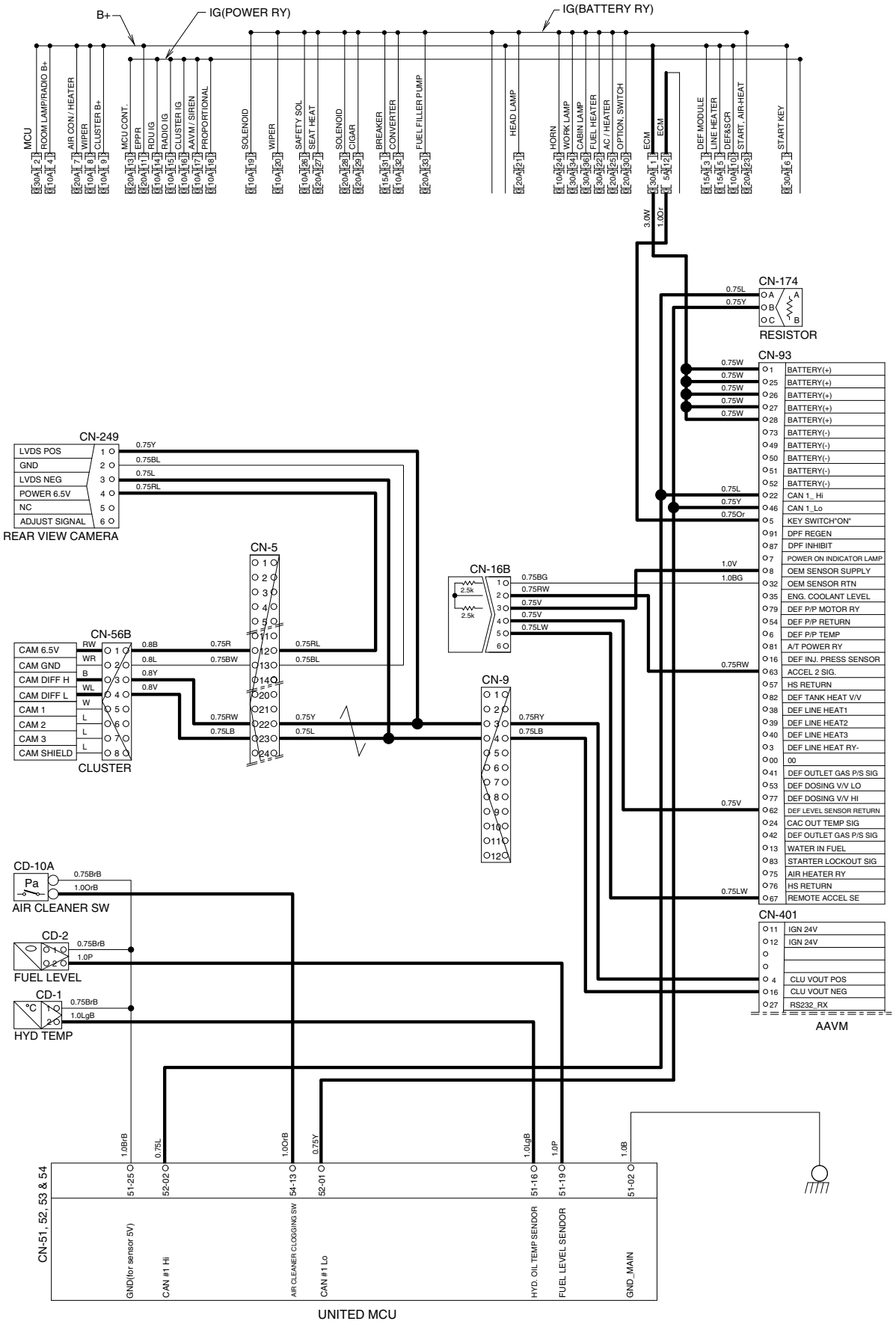
8. MONITORING CIRCUIT (MACHINE SERIAL NO. : -#0047)



300A4EL12

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

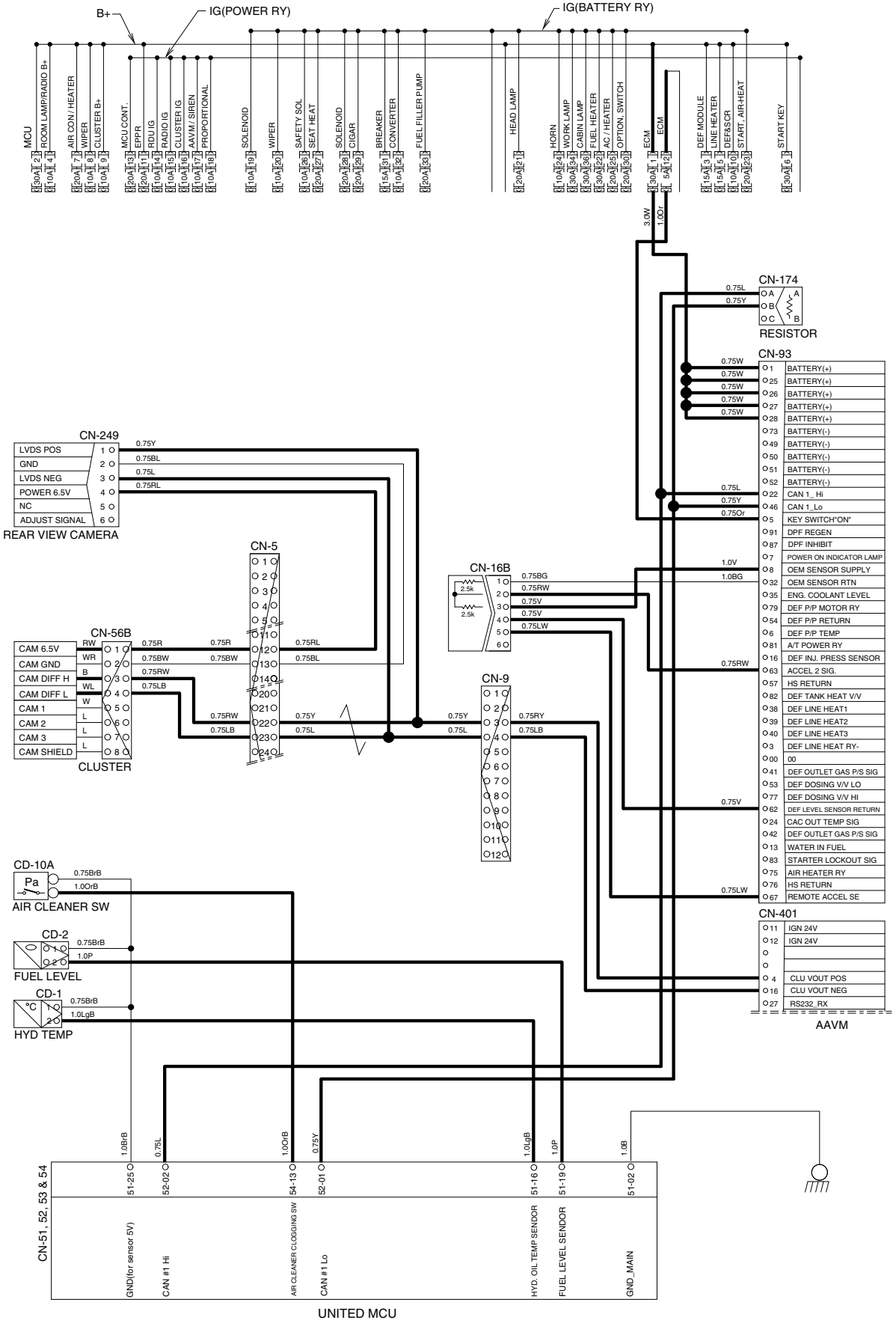
MONITORING CIRCUIT (MACHINE SERIAL NO. : #0048-#0655)



300A4EL12A

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

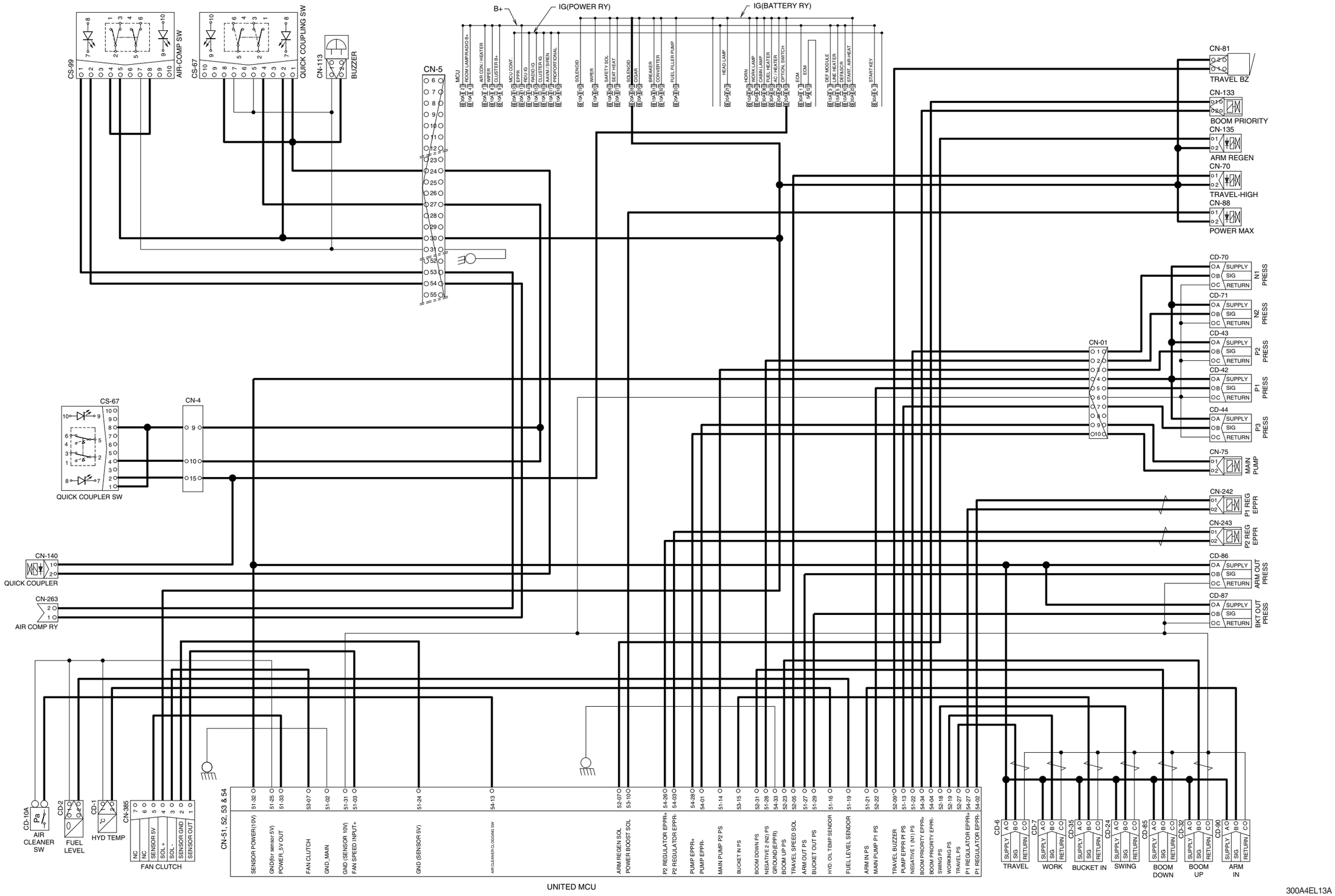
MONITORING CIRCUIT (MACHINE SERIAL NO. : #0656-)



300A4EL12B

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

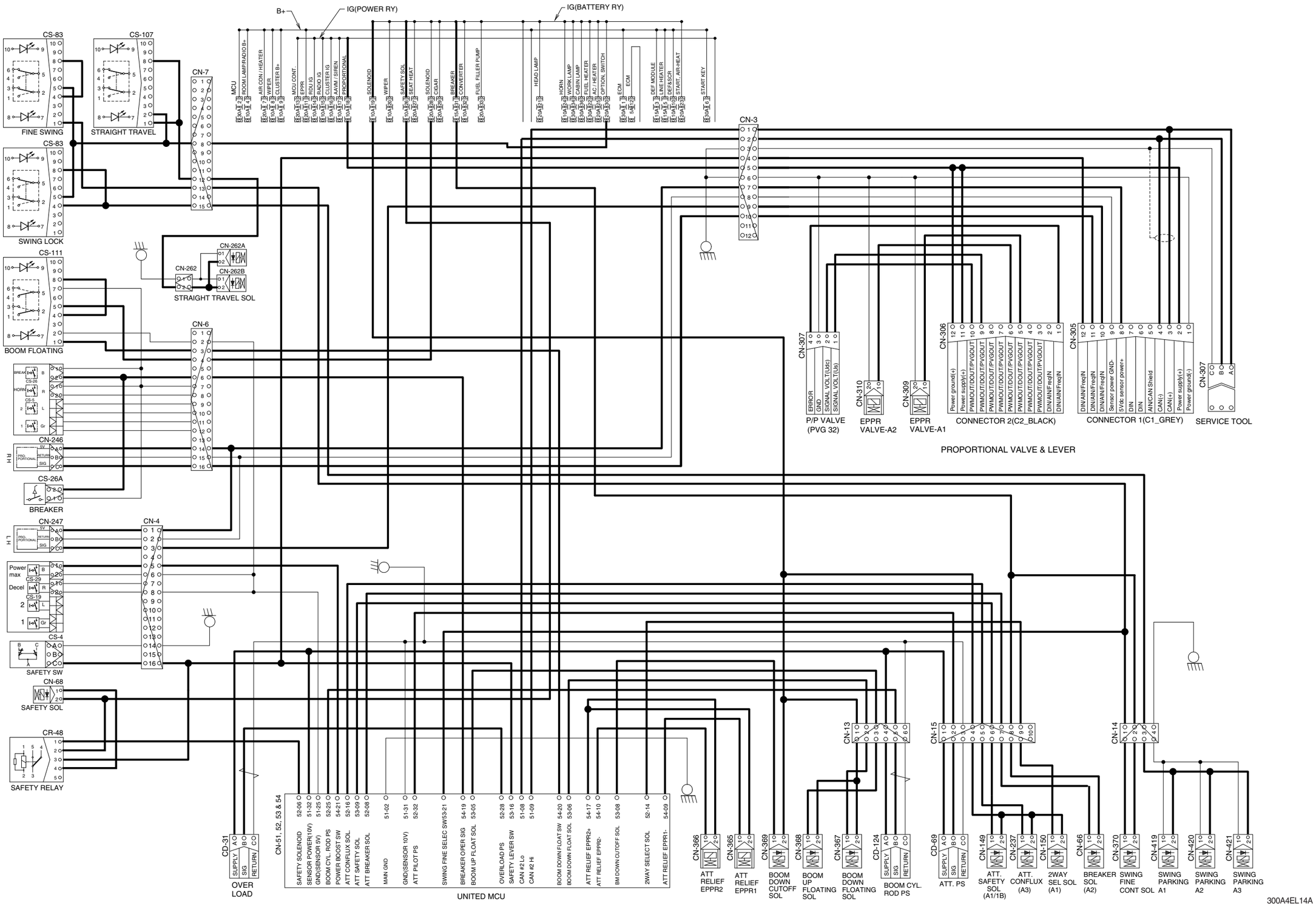
9. ELECTRIC CIRCUIT FOR HYDRAULIC (1/2, MACHINE SERIAL NO. : #0001-)



300A4EL13A

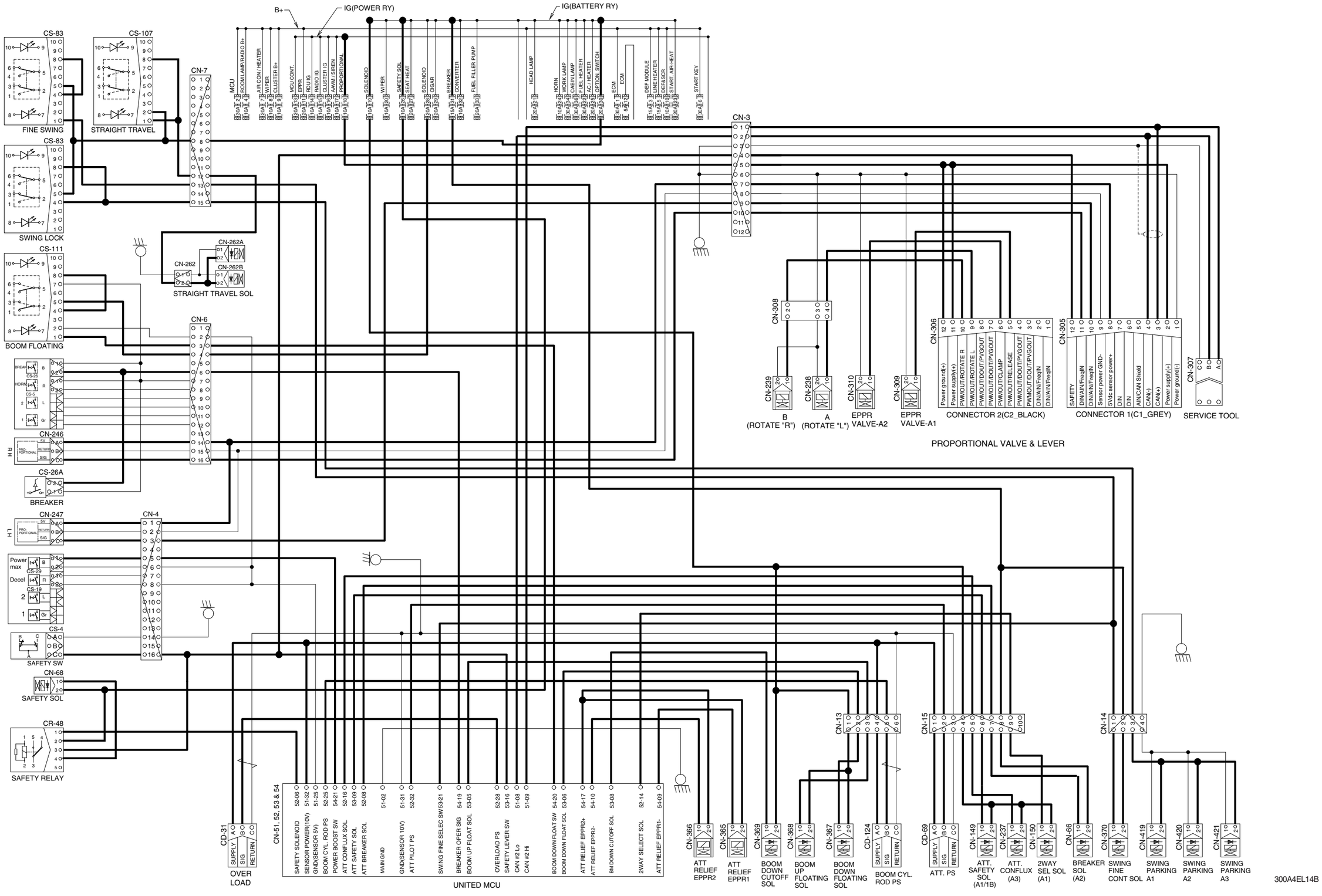
※ The circuit diagram may differ from the equipment, so please check before a repair.

10. ELECTRIC CIRCUIT FOR HYDRAULIC (2/2, MACHINE SERIAL NO. : -#0047)



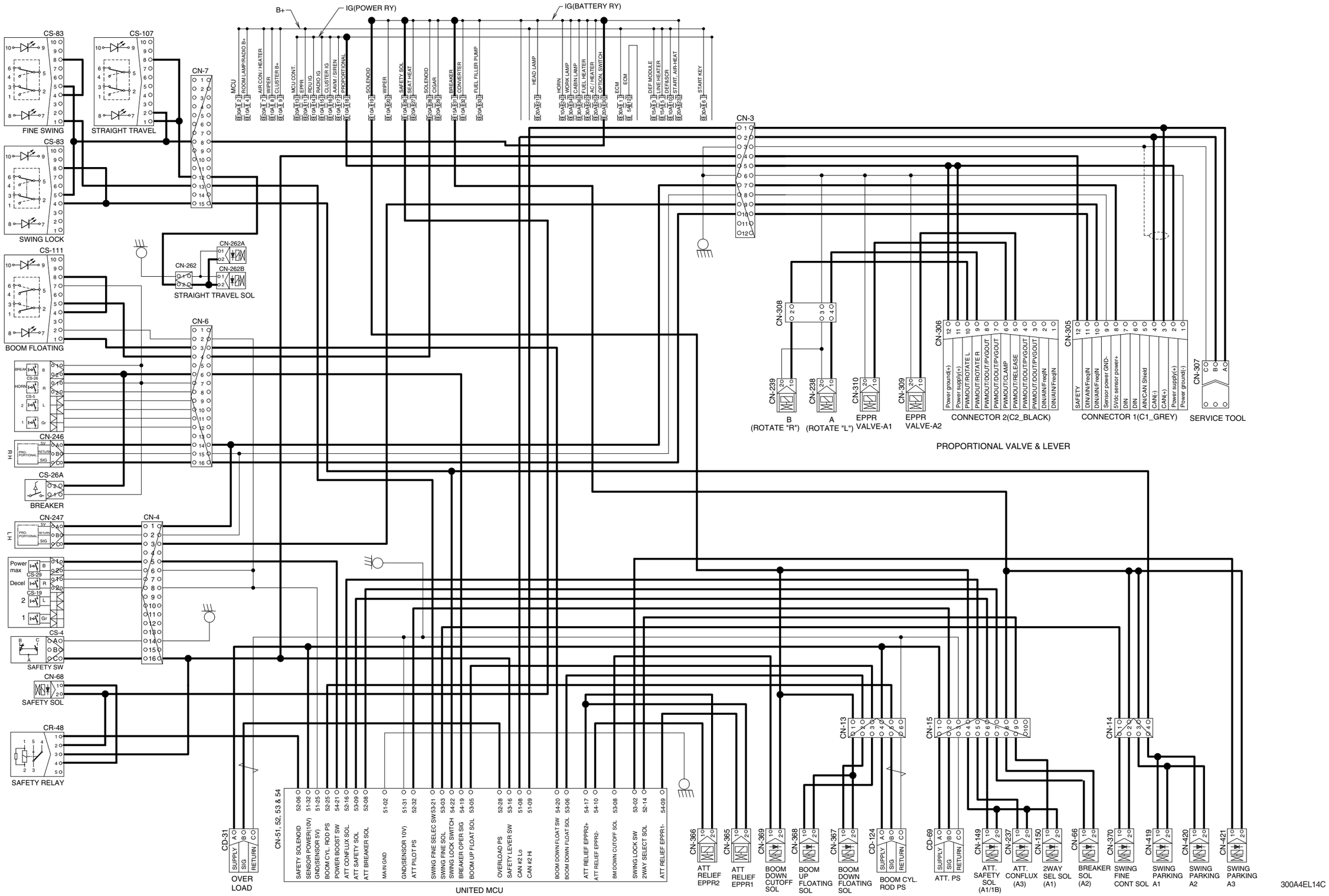
※ The circuit diagram may differ from the equipment, so please check before a repair.

ELECTRIC CIRCUIT FOR HYDRAULIC (2/2, MACHINE SERIAL NO. : #0048-#0599)



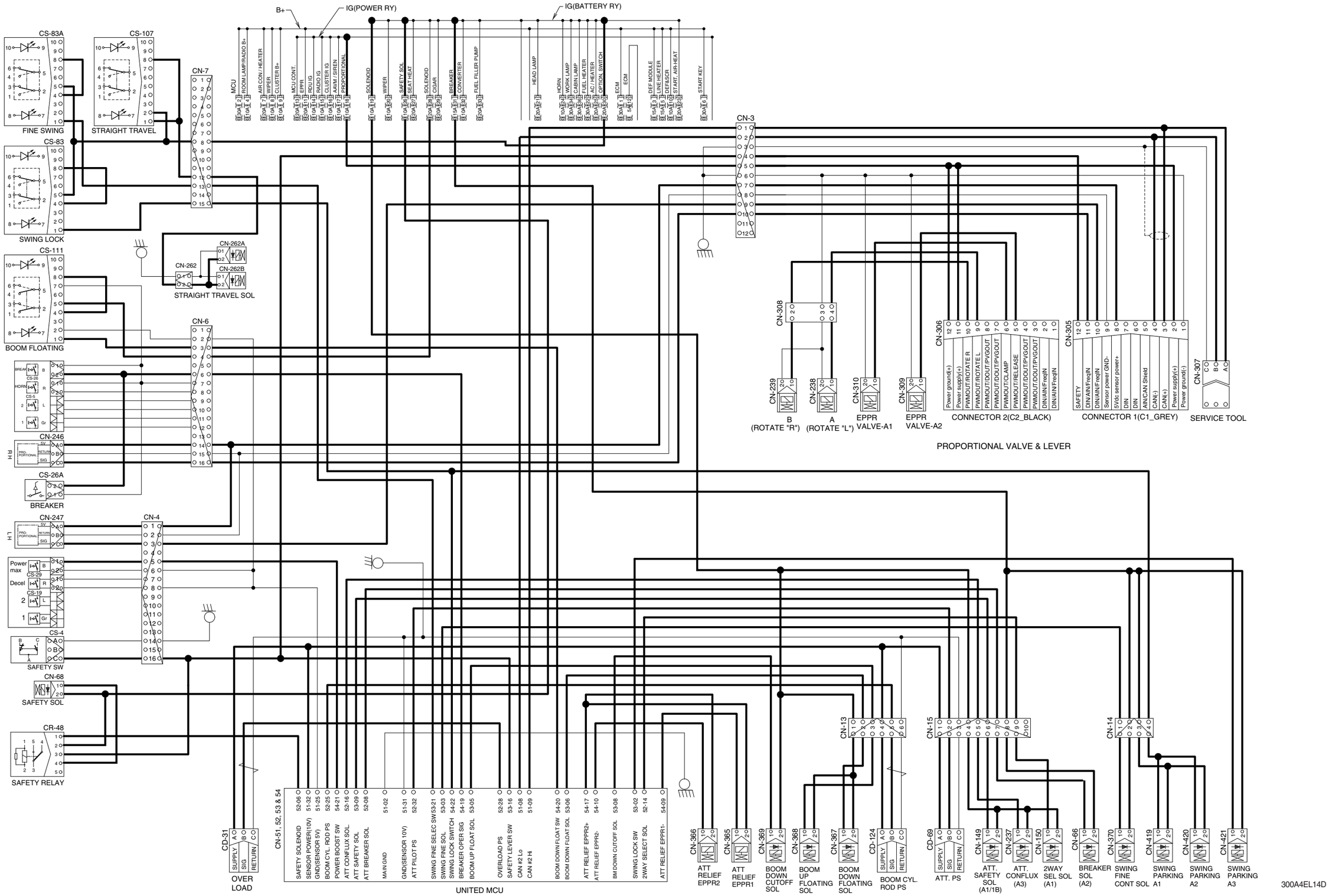
※ The circuit diagram may differ from the equipment, so please check before a repair.

ELECTRIC CIRCUIT FOR HYDRAULIC (2/2, MACHINE SERIAL NO. : #0600-#0655)



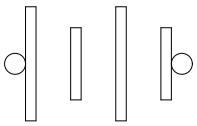
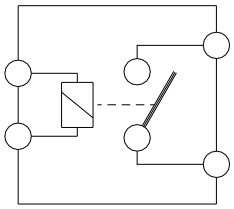
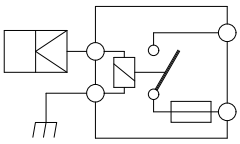
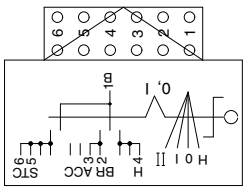
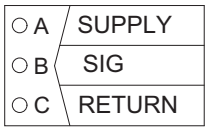
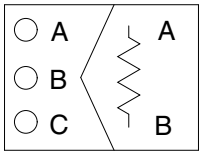
※ The circuit diagram may differ from the equipment, so please check before a repair.

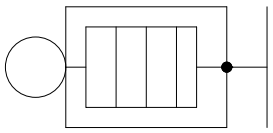
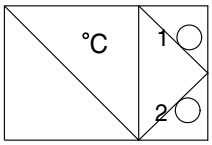
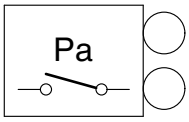
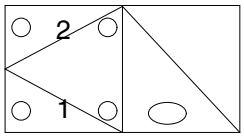
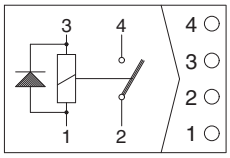
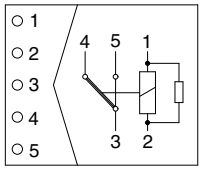
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2, MACHINE SERIAL NO. : #0656-)

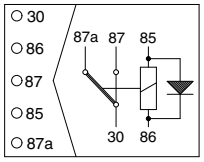
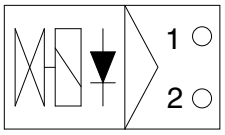
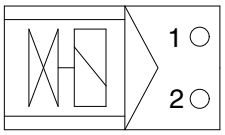
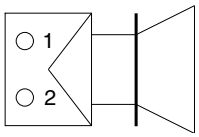
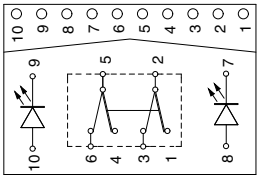
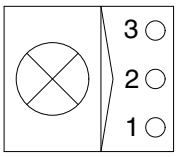


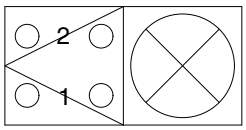
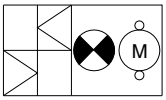
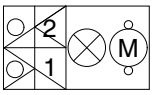
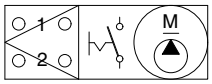
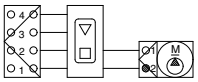
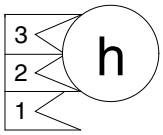
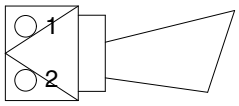
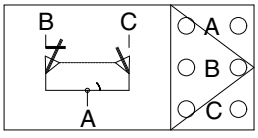
※ The circuit diagram may differ from the equipment, so please check before a repair.

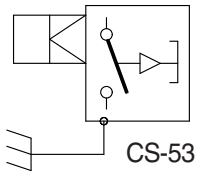
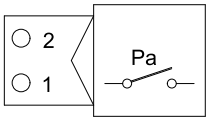
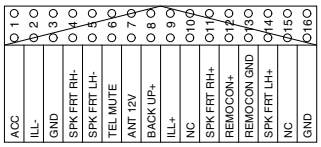
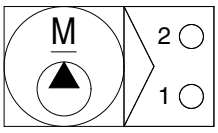
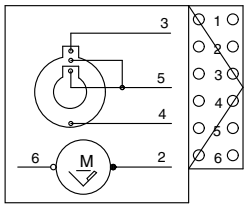
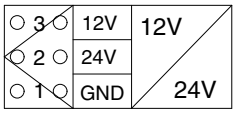
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

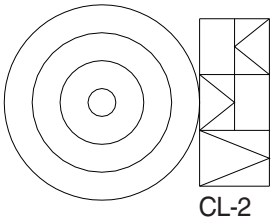
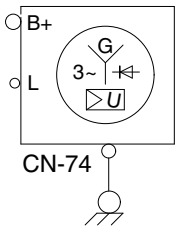
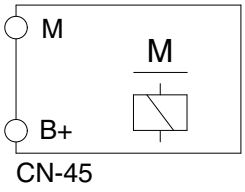
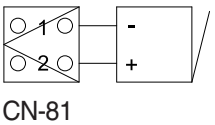
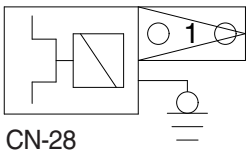
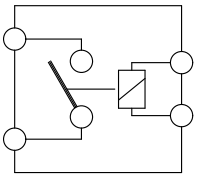
Part name	Symbol	Specifications	Check
Battery		12V × 160Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Glow plug relay	 CR-24	24V 200A	※ Check contact Normal : 0.942Ω (for terminal 1-GND)
Start key	 CS-2A	B-BR : 24V 1A B-ACC : 24V 10A B-ST : 24V 40A	※ Check contact OFF : ∞Ω (for each terminal) ON : 0Ω (for terminal 1-3 and 1-2) START : 0Ω (for terminal 1-6)
Pressure sensor	 CD-6 CD-7 CD-16 CD-24 CD-31 CD-32 CD-35 CD-42 CD-43 CD-44 CD-69 CD-70 CD-71 CD-85 CD-86 CD-87 CD-90 CD-124	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 CN-173 CN-174	3W	※ Check resistance A-B : 120Ω

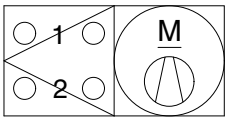
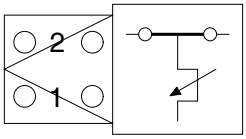
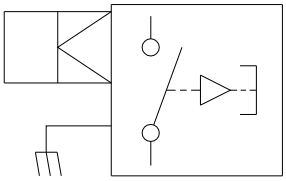
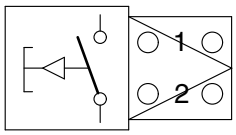
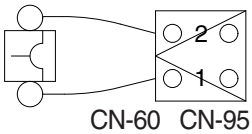
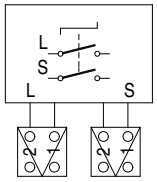
Part name	Symbol	Specifications	Check
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner pressure switch (-#00142)	 CD-10A	(N.O TYPE)	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 50Ω 6/12 : 350Ω 11/12 : 100Ω 5/12 : 400Ω 10/12 : 150Ω 4/12 : 450Ω 9/12 : 200Ω 3/12 : 500Ω 8/12 : 250Ω 2/12 : 550Ω 7/12 : 300Ω 1/12 : 600Ω Empty warning : 700Ω
Relay (air con blower)		24V 20A	※ Check resistance Normal : About 200Ω (for terminal 1-3) 0 Ω (for terminal 2-4)
Relay	 CR-2 CR-5 CR-36 CR-39 CR-48 CR-50 CR-51 CR-85	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0Ω (for terminal 3-4) ∞Ω (for terminal 3-5)

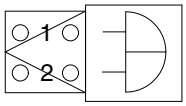
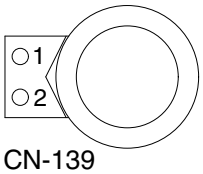
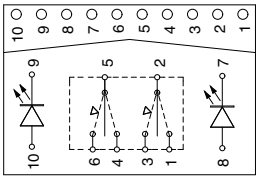
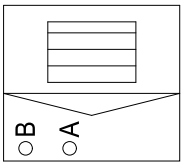
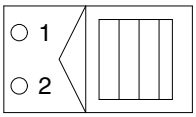
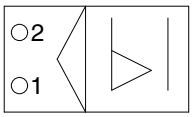
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-7 CR-9 CR-13 CR-35 CR-46 CR-52	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω(for terminal 30-87a) ∞Ω(for terminal 30-87)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-135 CN-140 CN-149 CN-150 CN-237 CN-262A CN-262B CN-367 CN-368 CN-369 CN-370 CN-419 CN-420 CN-421	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-133 CN-238 (#0048-) CN-239 (#0048-) CN-242 CN-243 CN-309 CN-310 CN-365 CN-366	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-260 CN-24(RH)	20W	※ Check resistance Normal : A few Ω
Switch (locking type)	 CS-52 CS-67 CS-83 CS-83A (#0656-) CS-99 CS-107 CS-108 CS-111	24V 1.5A	※ Check contact Normal ON : 0 Ω(for terminal 2-3, 5-6) ∞Ω(for terminal 2-1, 5-4) OFF : ∞Ω(for terminal 2-3, 5-6) 0 Ω(for terminal 2-1, 5-4)
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0Ω ON : 0Ω(For terminal 1-2) ∞Ω(For terminal 1-3) OFF : ∞Ω(For terminal 1-2) 0Ω(For terminal 1-3)

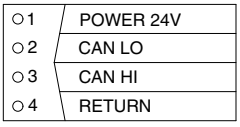
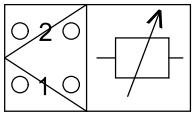
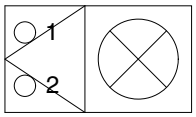
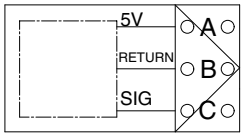
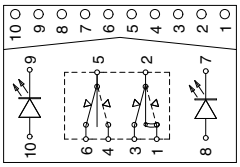
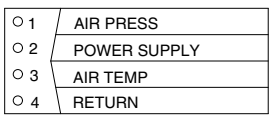
Part name	Symbol	Specifications	Check
Head lamp, Work lamp, Cab lamp	 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10 CL-24	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	-#0655  #0656-  CL-7	21V 70W (H1 Type)	※ Check disconnection Normal : A few Ω
Fuel filler pump	-#0599  #0600-  CN-61	24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Hour meter	 CN-48	16~32V	※ Check operation Supply power(24V) to terminal No.1 and connect terminal No.2 and ground
Horn	 CN-20 CN-25	DC22~28V 2A	※ Check operation Supply power(24V) to each terminal and connect ground.
Safety switch	 CS-4	24V 15A (N.C TYPE)	※ Check contact Normal : 0Ω (for terminal A-B) ∞Ω (for terminal A-C) Operating : ∞Ω (for terminal A-B) 0Ω (for terminal A-C)

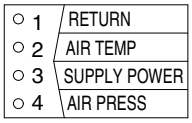
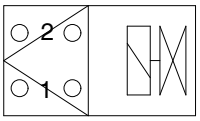
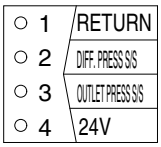
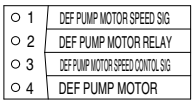
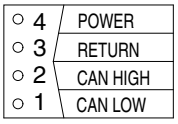
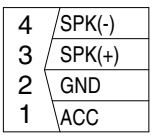
Part name	Symbol	Specifications	Check
Wiper cut switch		24V (N.O TYPE)	※ Check contact Normal : 0Ω(one pin to ground)
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27A	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22 CN-407	24V 3.8A	※ Check contact Normal : 10.7Ω(for terminal 1-2)
Wiper motor	 CN-21	24V 2A	※ Check disconnection Normal : 7Ω(for terminal 2-6)
DC/DC Converter	 CN-138	12V 3A	※ Check voltage 24V (for terminal 1-2) 12V (for terminal 1-3)

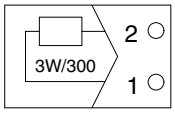
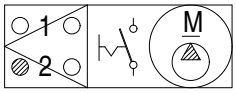
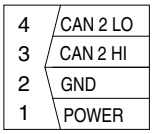
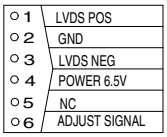
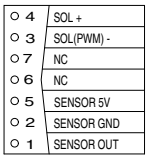
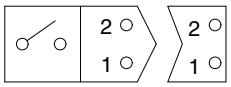
Part name	Symbol	Specifications	Check
Cigar lighter		24V 5A 1.4W	※ Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Alternator		Denso 24V 95A	※ Check contact Normal : 0Ω (for terminal B^+-L) Normal : 24~27.5V
Starter		Denso 24V 4.8kW	※ Check contact Normal : 0.1Ω
Travel alarm		24V 0.5A	※ Check contact Normal : 5.2Ω
Aircon compressor		24V 79W	※ Check contact Normal : 13.4Ω
Start relay		24V 300A	※ Check contact Normal : 0.94Ω (for terminal 1-2)

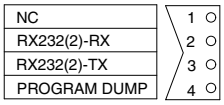
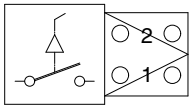
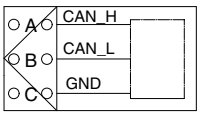
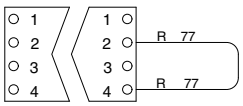
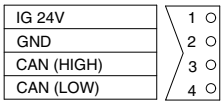
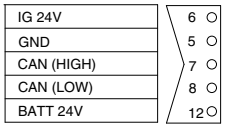
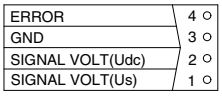
Part name	Symbol	Specifications	Check
Blower motor		24V 9.5A	※ Check resistance Normal : 2.5Ω(for terminal 1-2)
Thermistor (switch)		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω(for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch		24V 2W	※ Check resistance Normal : About 5MΩ
Switch (power max, one touch decel, horn, breaker)	 CS-5 CS-19 CS-26 CS-29	24V 6A	※ Check resistance Normal : ∞Ω
Circuit breaker	 CN-60 CN-95	CN-60 (60A) CN-95 90A (-#0599) 80A (#0600-)	※ Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Master switch	 CS-74, CS-74B	6-36V	※ Check disconnection Normal : 0.1Ω

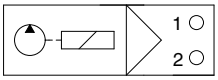
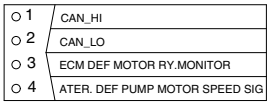
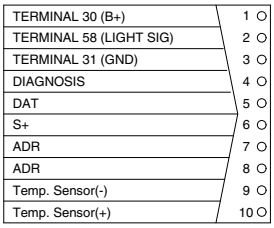
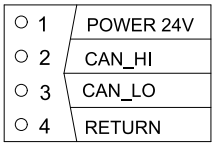
Part name	Symbol	Specifications	Check
Quick coupler buzzer	 CN-113	24V 200mA 107±4dB	
Socket	 CN-139	12V 10A	
Switch	 CS-100	24V 8A	※ Check contact Normal ON : 0Ω(for terminal 2-3, 5-6) ∞Ω(for terminal 2-1, 5-4) OFF : ∞Ω(for terminal 2-3, 5-6) 0Ω(for terminal 2-1, 5-4)
Fuel heater	 CN-96	-	
DEF/AdBlue® line heater	 CN-381 CN-382 CN-383	-	
WIF sensor	 CD-45	-	

Part name	Symbol	Specifications	Check
NOx sensor	 AT1E AT2A AT9A	-	
Temperature sensor (A/C)		-	
DEF/AdBlue® fill up warning lamp (LED)	 CL-40	-	
Proportional valve sensor	 CN-246 CN-247	-	
Switch	 CS-79	24V 8A	※ Check disconnection Normal ∞ Ω (for terminal 2-1, 5-4)
Sensor	 C12	-	

Part name	Symbol	Specifications	Check
Pressure temp sensor	 CD-10	-	
Coolant valve	 CN-384	-	
DPF pressure sensor	 AT11A	-	
SCR and DEF supply module	 AT-5A	-	
Tank level sensor	 CN-380	-	
Siren AMP	 CN-261	-	

Part name	Symbol	Specifications	Check
Resistor	 RS-1	3W	※ Check resistance Normal : 300Ω
Low wiper motor	 CN-407	-	
2D/3D MG	 CN-270	-	
Camera (front, rear, side)	 CN-249 CN-402 CN-403 CN-404 CN-405	-	
Fan clutch	 CN-385	-	
Seat belt sw	 CS-250	-	

Part name	Symbol	Specifications	Check
RMS service tool	 CN-126A	-	
Breaker switch	 CS-26A	-	
Start button	 CS-2B	-	
GPS connector	 CN-125	-	
Reader	-#0655  #0656-  CN-427	-	
Proportional valve	-#0047  CN-307	-	

Part name	Symbol	Specifications	Check
Dosing pump	 CN-269	-	
Engine side cross over connector	 CC8C	-	
Easystart timer	 CN-267	-	
Exhaust gas temp sensor	 AT9A	-	

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	10	I/conn (Frame harness-Pump PS harness)	S816-010002	S816-110002
CN-2	AMP	15	I/conn (Frame harness-Engine harness)	2-85262-1	368301-1
CN-3	AMP	12	I/conn (Frame harness-Pro vlv harness)	174661-2	368537-1
CN-4	AMP	16	I/conn (Console harness LH-Frame harness)	368047-1	368050-1
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	DRB12-60PAE-L018
CN-6	AMP	16	I/conn (Console harness RH-Frame harness)	368047-1	368050-1
CN-7	AMP	15	I/conn (Console harness RH-Frame harness)	2-85262-1	368301-1
CN-8	AMP	10	I/conn (Console harness RH-Frame harness)	S816-010002	174655-2
CN-9	DEUTSCH	12	I/conn (Frame harness-AAVM harness)	DT06-12SA-EP06	DT04-12PA
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E004
CN-13	TYCO	6	I/conn (Frame harness-Boom floating harness)	S816-006002	S816-106002
CN-14	AMP/DEUTSCH	4	I/conn (Frame harness-Swing p. & fine control harness)	174257-2	DT04-4P-E005
CN-15	TE	10	I/conn (Frame harness-2-way harness)	174655-2	174657-2
CN-16	TYCO	6	Emergency engine start & speed control	S816-006002	S816-106002
CN-16B	-	6	Resistor	S816-006002	21NB-10710
CN-17	AMP	8	I/conn (Wiper harness-Side harness RH)	S816-008002	S816-108002
CN-18	AMP	2	I/conn (Frame harness-Washer pump)	174352-2	174354-2
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer tank 1	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	Radio & USB player	-	174984-2
CN-28	KET	2	Aircon compressor	MS610320	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse & relay box	21Q7-10910	-
CN-45	RING-TERM	-	Starter motor B^+	S820-108000	-
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	TE	34	United MCU	2-1437285-3	3-6437285-0
CN-52	TE	34	United MCU	4-1437290-1	6473427-1
CN-53	TE	26	United MCU	1473416-1	6473427-1

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-54	TE	34	United MCU	4-1437290-0	6437288-1
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	Y-TYPE	2	Circuit breaker	-	7222-4220-30
CN-61	DEUTSCH	4	Fuel filler pump	DT06-4S-E005	DT04-4P-E005
CN-62	DEUTSCH	2	Auto grease	DT06-2S-EP06	DT04-2P-E005
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid (A1)	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid (A3)	DT06-2S-EP06	-
CN-74	RING-TERM	1	Alternator "I" terminal	S820-105000	-
CN-75	AMP	2	Pump EPPR	S816-002002	-
CN-80	RING-TERM	-	Glow plug	S820-306000	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	-
CN-88	DEUTSCH	2	Power max solenoid (A2)	DT06-2S-EP06	-
CN-93	DELPHI	96	ECM	13964577	-
CN-95	Y TYPE	2	Circuit breaker	-	7222-4220-30
CN-100	KET	1	ECM ground	MG640944-5	-
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	GPS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	GPS	DT06-12S-P021	DT04-12PA-P021
CN-126	-	10	Service tool	-	1-967325-1
CN-133	DEUTSCH	2	Boom priority solenoid (A5)	DT06-2S-EP06	-
CN-135	DEUTSCH	2	Arm regeneration solenoid (A4)	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick coupler solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-147	AMP	2	Fuel heater	18330027	-
CN-149	DEUTSCH	2	Attach safety solenoid	DT06-2S-EP06	-
CN-150	DEUTSCH	2	2 way select solenoid	DT06-2S-EP06	-
CN-156	DEUTSCH	2	Air seat	DT06-2S	DT04-2P
CN-157	AMP	1	Antena power	S822-014002	-
CN-173	DEUTSCH	3	Resistor	DT06-3S-EP06	DT04-3P-EP10
CN-174	DEUTSCH	3	Resistor	DT06-3S-EP06	DT04-3P-EP10
CN-237	DEUTSCH	2	Attach conflux solenoid	DT06-2S-EP06	-
CN-242	DEUTSCH	2	P1 regulator EPPR (A1)	DT06-2S-EP06	-
CN-243	DEUTSCH	2	P2 regulator EPPR (A2)	DT06-2S-EP06	-
CN-245	KET	2	PTC power	MG620558	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-E005
CN-258	KET	1	Air compressor power	MG640944-5	MG650943-5
CN-259	AMP	6	Camera	S816-006002	S816-106002
CN-260	AMP	2	Siren lamp	174352-2	174354-2
CN-261	TE-KET	4	Siren AMP	1473416-1	MG620046
CN-262	DEUTSCH	2	Straight travel solenoid	DT06-2S-EP06	DT04-2P-E005
CN-263	DEUTSCH	2	Air compressor relay	DT06-2S-EP06	DT04-2P-E005
CN-270	DEUTSCH	4	2D/3D MG	DT06-4S-E005	DT04-4P-E005
CN-305	DEUTSCH	12	Proportional-Connector-1	DTM06-12SA	-
CN-306	DEUTSCH	12	Proportional-Connector-2	DTM06-12SB	-
CN-307	DEUTSCH	3	Proportional-Service tool	DT06-3S-E005	DT06-3P-EP06
CN-308	AMP	4	Proportional-PVG32	2-967056-1	-
CN-309	DEUTSCH	2	Proportional-EPPR valve 1	DT06-2S-EP06	-
CN-310	DEUTSCH	2	Proportional-EPPR valve 2	DT06-2S-EP06	-
CN-363	AMP	12	Jog dial module	174045-2	-
CN-365	DEUTSCH	2	Attach relief EPPR valve 1-LH	DT06-2S-EP06	DT04-2P-E005
CN-366	DEUTSCH	2	Attach relief EPPR valve 2-RH	DT06-2S-EP06	DT04-2P-E005
CN-367	DEUTSCH	2	Boom down floating solenoid	DT06-2S-EP06	DT04-2P-E005
CN-368	DEUTSCH	2	Boom up floating solenoid	DT06-2S-EP06	DT04-2P-E005
CN-369	DEUTSCH	2	Boom down cut off solenoid	DT06-2S-EP06	DT04-2P-E005
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	DT04-2P-E005
CN-376	TYCO	34	Membrane controller	4-1437290-1	-
CN-378	DEUTSCH	2	Attach EPPR 2	DT06-2S-EP06	-
CN-379	TYCO	12	SCR & DEF/AdBlue® supply module	2-1703639-1	-
CN-380	DEUTSCH	4	DEF/AdBlue® tank level sensor	DT06-4S-E005	-
CN-381	DEUTSCH	2	DEF line heater 3	DT06-2S-EP06	-
CN-382	DEUTSCH	2	DEF line heater 2	DT06-2S-EP06	-
CN-383	DEUTSCH	2	DEF line heater 1	DT06-2S-EP06	-
CN-384	K2 MAYONET	2	Coolant valve	DIN72585	-
CN-385	PA46-GF30	7	Fan clutch	965570	-
CN-398	DEUTSCH	4	RS232	DT04-4S-E005	DT06-4P-E005
CN-401	FCI	90	AAVM controller	-	-
CN-402	DEUTSCH	6	Front view camera	DT06-6S-P021	DT04-6P-EP14
CN-403	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP14
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-406	DEUTSCH	3	Service tool	DT06-3S-EP06	DT04-3P-E005

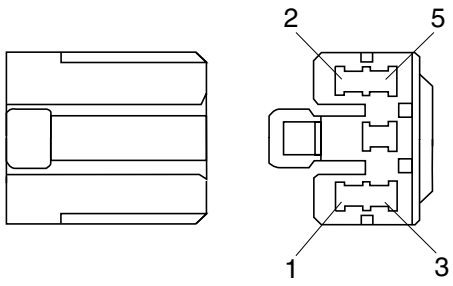
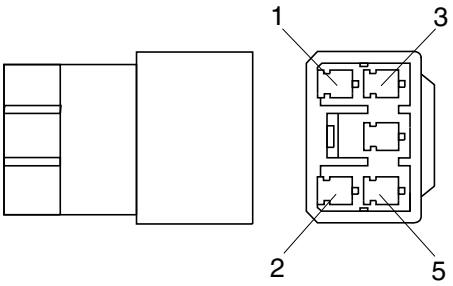
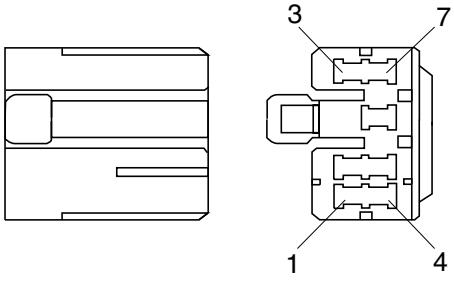
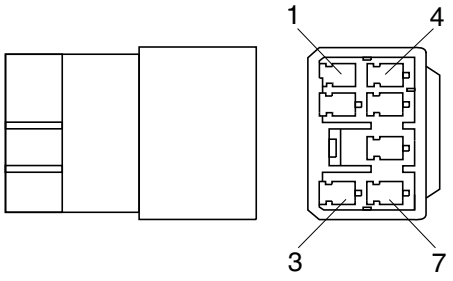
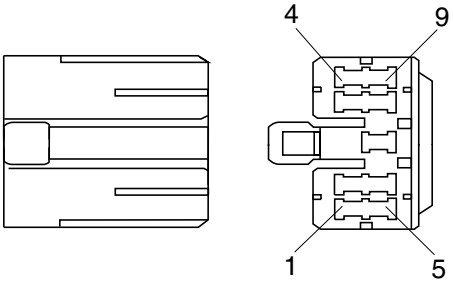
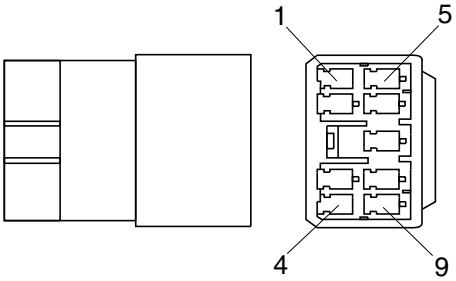
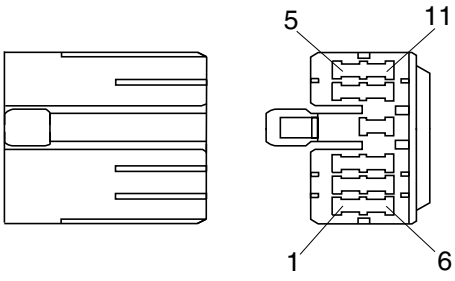
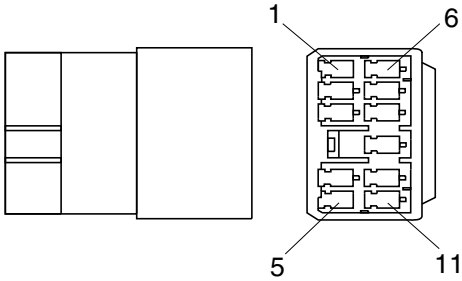
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-407	DEUTSCH	4	Low wiper motor	DT06-4S-EP06	DT04-4P-E005
CN-408	FCI	4	Washer tank	MG640795	-
CN-419	DEUTSCH	2	Swing parking-A1	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking-A3	DT06-2S-EP06	-
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
		12		5557-12R	5557-12P
CN-429	DELPHI	4	CAC Out temp	12162197	-
CN-430	AMP	12	Aftertreatment harness	S816-012002	-
AT1E	-	4	Inlet Nox sensor	-	-
AT2A	-	4	Outlet Nox sensor	-	-
AT-5A	TYCO	4	SCR supply module	2-1418390-1	-
AT-6A	-	8	DEF/AdBlue® dosing module	-	-
AT9A	-	4	Exhaust gas temp	-	-
AT11A	-	4	SCR perssure sensor	-	-
CCBC	DEUTSCH	4	Engine side cross over connector	DT06-4S-EP06	-
C-12	FCI	4	Air cleaner (ECM J1)	-	54200417
· Relay					
CR-1	RING-TERM	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	-	-
CR-13	-	5	Head lamp relay	-	-
CR-23	KET	2	Start relay	S814-002001	S814-102001
CR-24	RING TERM	1	Preheat relay	S822-014000	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-39	-	5	Starter lock out relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-48	-	5	Safety relay	-	-
CR-50	-	5	NOx sensor relay	-	-
CR-51	-	5	DEF/AdBlue® module relay	-	-
CR-52	-	5	Line heater relay	-	-
CR-85	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2A	WP	6	Start key switch	S814-006100	-

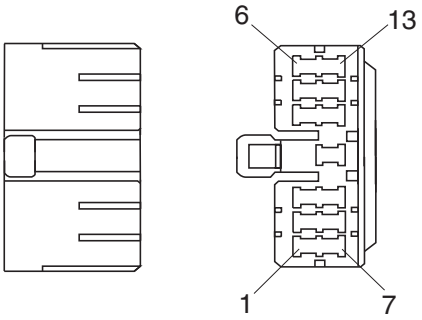
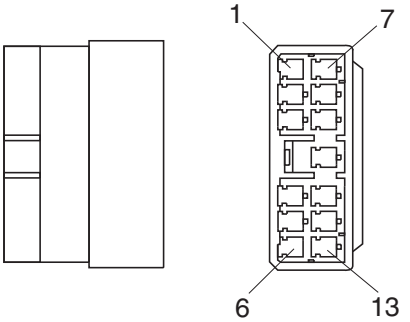
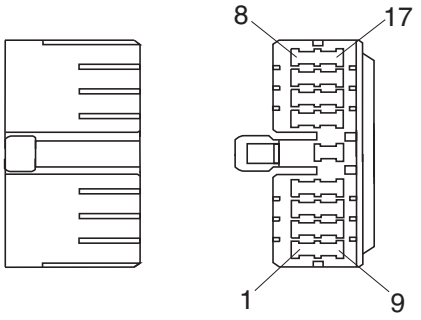
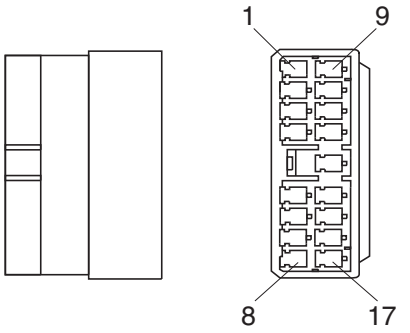
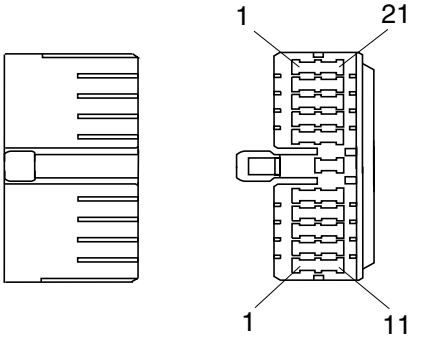
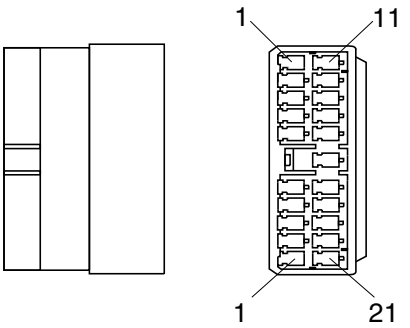
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-2B	DEUTSCH	3	Reader-start	DT06-3S-EP06	DT04-3P-E005
CS-4	DEUTSCH	3	Safety switch	DT06-3S-EP06	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P
CS-19	DEUTSCH	2	One touch decel switch	-	DT04-2P-E005
CS-26	DEUTSCH	2	Breaker switch	DT06-2S	-
CS-26A	AMP	2	Breaker pedal switch	S816-002002	S816-102002
CS-29	DEUTSCH	2	Power max switch	DT06-2S-EP06	-
CS-33	AMP	5	Emergency engine stop switch	S815-005002	S815-105002
CS-52	CARLING	10	2 Piece switch	VC2-01	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-61	AMP	2	Float swtich	174352-2	174354-2
CS-67	CARLING	10	Quick coupler switch	VC2-01	-
CS-73	CARLING	10	Swing lock switch	VC2-01	-
CS-73A	CARLING	10	Swing fine switch	VC2-01	-
CS-74	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-79	CARLING	10	Lower wiper switch	VC2-01	-
CS-83	CARLING	10	Swing lock switch	VC2-01	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-
CS-100	CARLING	10	Exhaust system cleaning switch	VC2-01	-
CS-107	CARLING	10	Travel straight switch	VC2-01	-
CS-108	CARLING	10	Auto grease switch	VC2-01	-
CS-111	CARLING	10	Boom floating switch	VC2-01	-
· Light					
CL-1	KET	3	Room lamp	MG651032	-
CL-2	AMP	1	Cigar lighter	S822-014002 S810-001202	S822-114002 -
CL-3	DEUTSCH	2	Head lamp-LH	DT06-2S-EP06	DT04-2P
CL-4	DEUTSCH	2	Head lamp-RH	DT06-2S-EP06	DT04-2P
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	DT04-2P
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	DT04-2P
CL-7	SHUR	1	Beacon lamp	S822-014002	S822-114002
CL-8	DEUTSCH	2	Cab light-LH	DT06-2S-EP06	DT04-2P
CL-9	DEUTSCH	2	Cab light-RH	DT06-2S-EP06	DT04-2P
CL-10	DEUTSCH	2	Cab light-RH	DT06-2S-EP06	DT04-2P
CL-24	DEUTSCH	2	Head lamp-rear	DT06-2S-EP06	DT04-2P-E005
CL-40	DEUTSCH	2	DEF/AdBlue® lamp	DT06-2S-EP06	DT04-2P
· Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-6	DEUTSCH	3	Travel pilot pressure switch	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Working pilot pressure switch	DT06-3S-EP06	-
CD-10	SUMITOMO	4	Air cleaner switch	6098-0144	-
CD-10A	AMP	2	Air cleaner switch (-#00142)	85202-1	-
CD-16	AMP	3	Water level sensor	1211 0293	-
CD-24	DEUTSCH	3	Swing pilot pressure sw	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload pressure sensor	DT06-3S-EP06	DT04-3P-E005
CD-32	DEUTSCH	3	Boom up pilot pressure sw	DT06-3S-EP06	-
CD-35	DEUTSCH	3	Bucket in pilot pressure sw	DT06-3S-EP06	-
CD-42	DEUTSCH	3	Pump pressure 1	DT06-3S-EP06	-
CD-43	DEUTSCH	3	Pump pressure 2	DT06-3S-EP06	-
CD-44	DEUTSCH	3	Pump pressure 3	DT06-3S-EP06	-
CD-45	DEUTSCH	3	WIF sensor	DT06-3S-EP06	-
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	-
CD-70	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 pressure sensor	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down pilot pressure sw	DT06-3S-EP06	-
CD-86	DEUTSCH	3	Arm out pilot pressure sw	DT06-3S-EP06	-
CD-87	DEUTSCH	3	Bucket out pilot pressure sw	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pilot pressure sw	DT06-3S-EP06	-
CD-124	DEUTSCH	3	Boom cylinder rod pressure snensor	DT06-3S-EP06	-

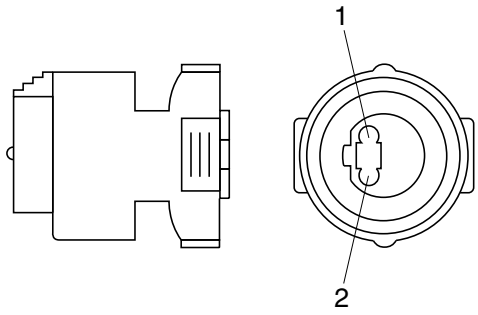
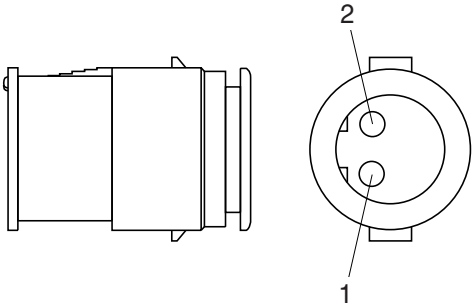
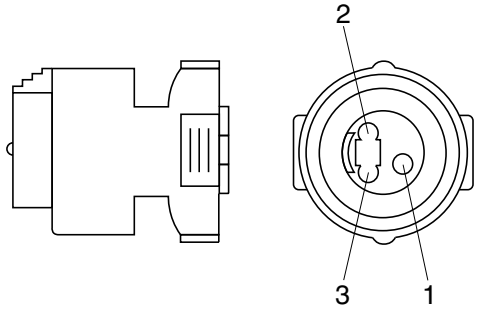
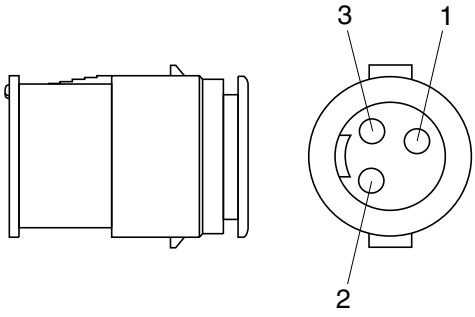
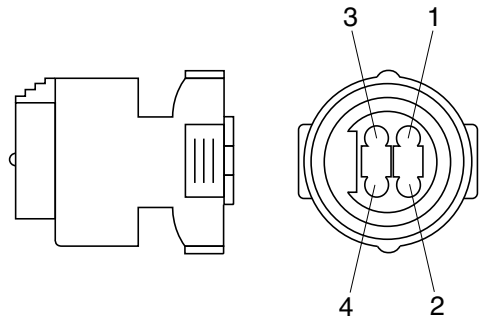
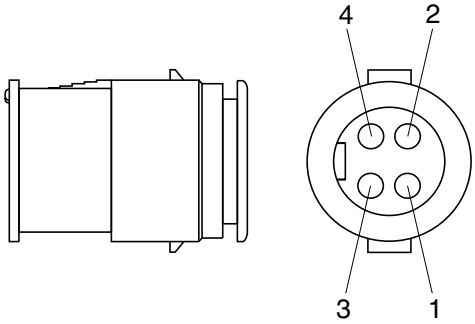
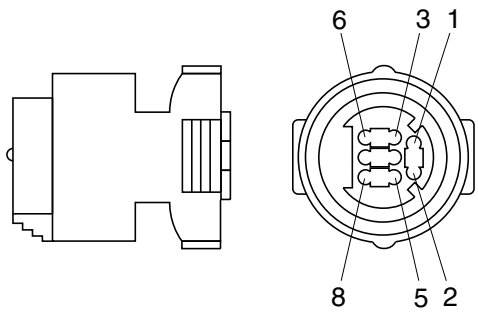
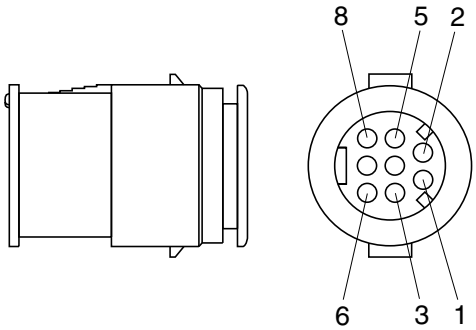
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

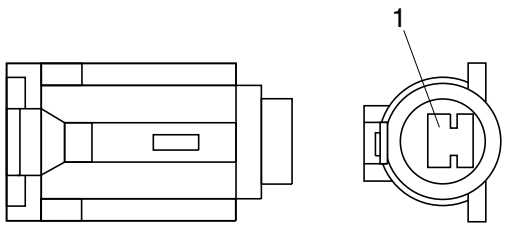
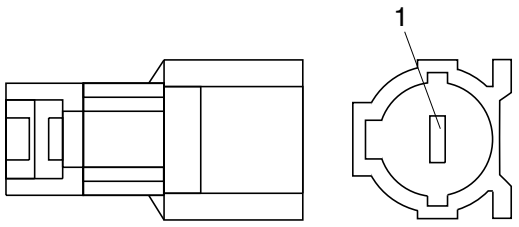
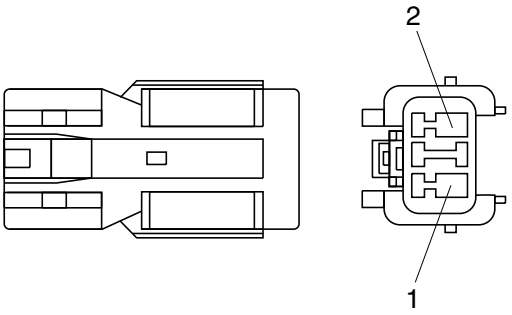
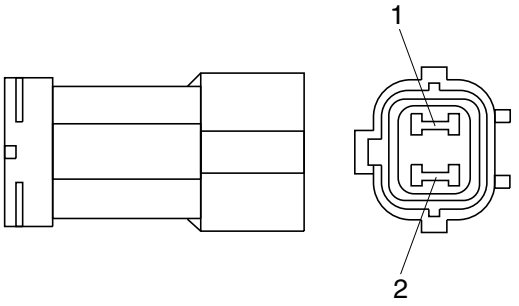
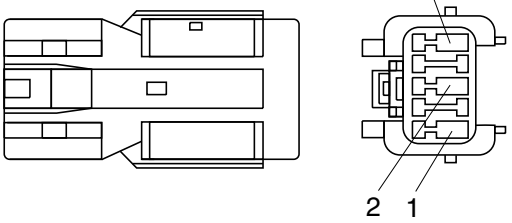
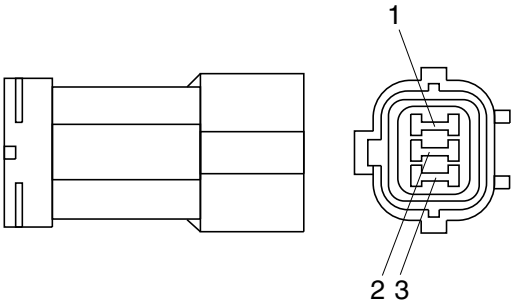
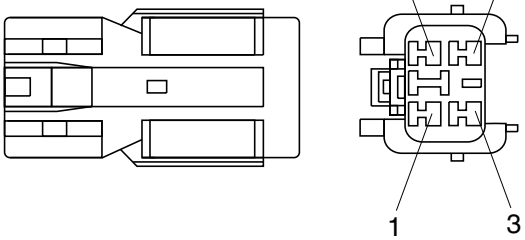
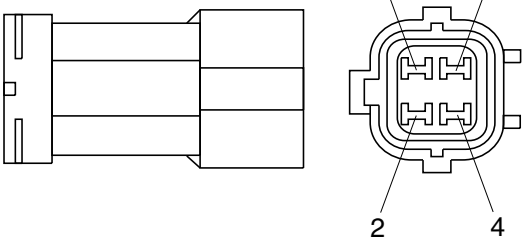
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

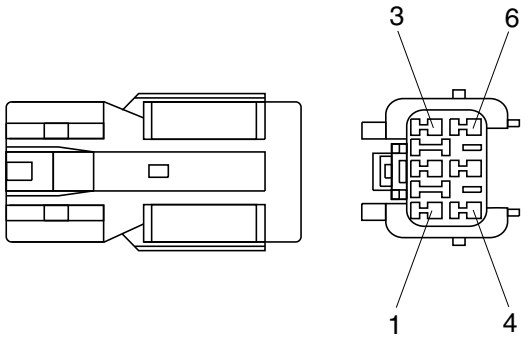
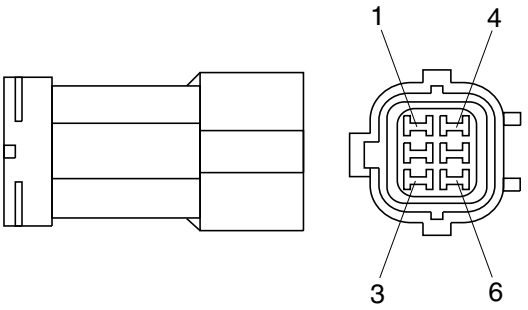
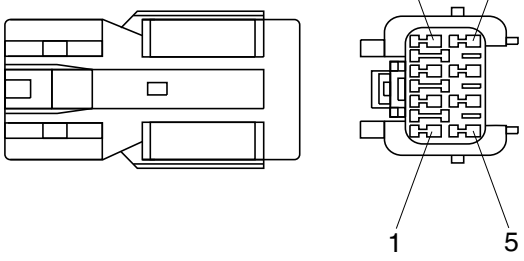
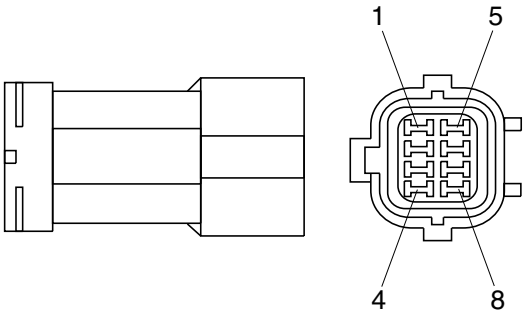
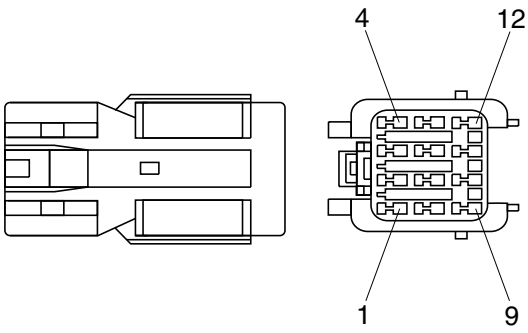
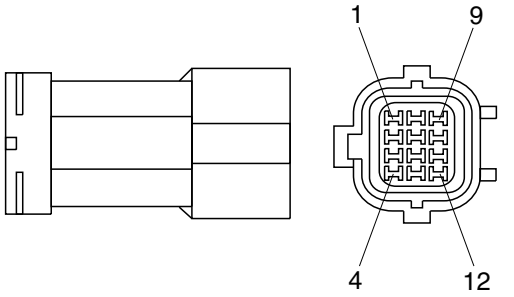
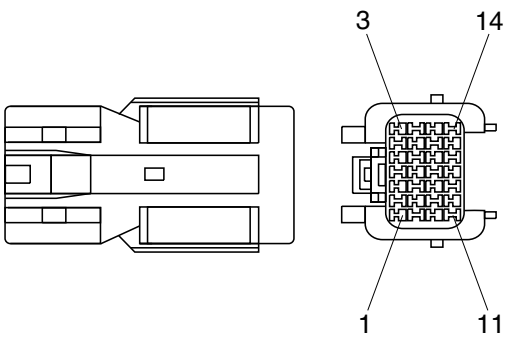
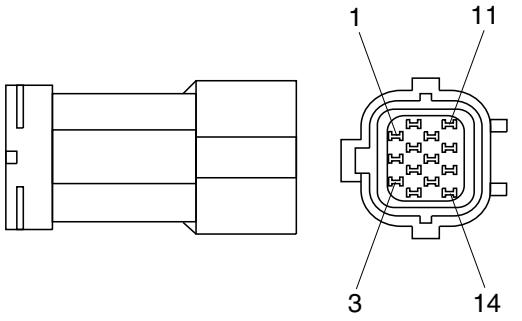
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

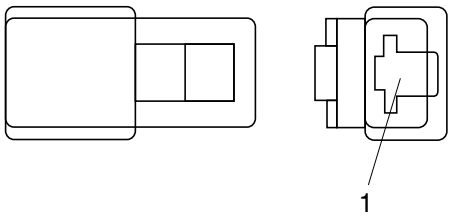
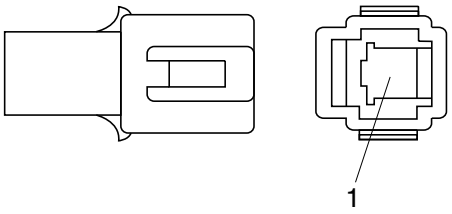
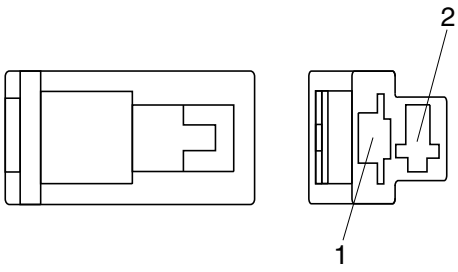
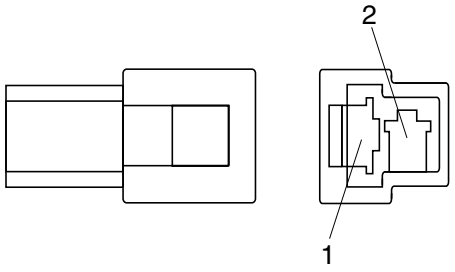
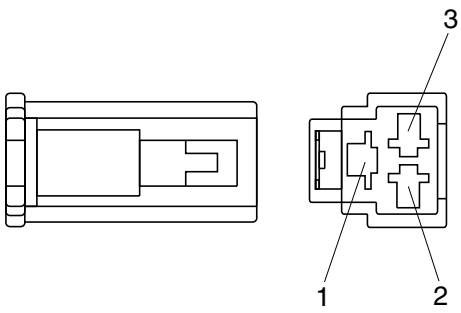
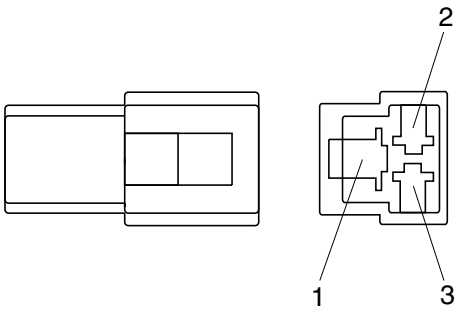
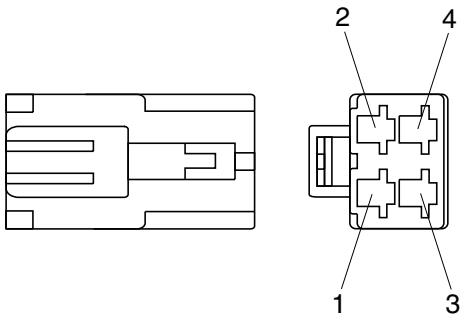
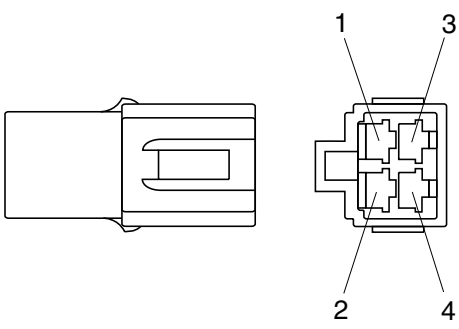
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

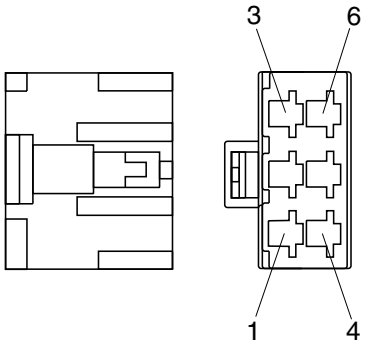
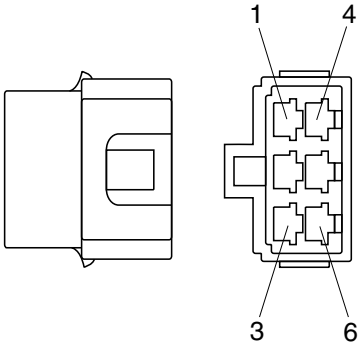
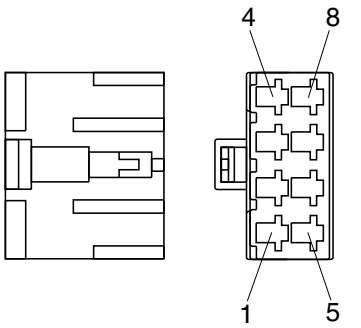
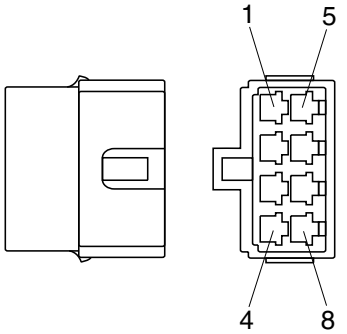
3) SWP TYPE CONNECTOR

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

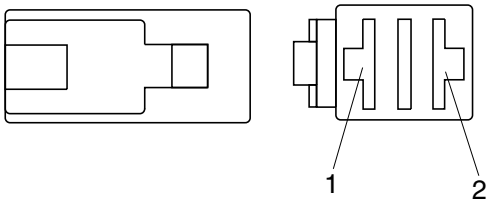
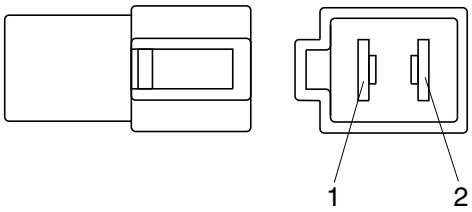
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

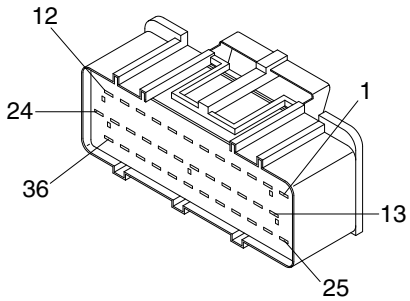
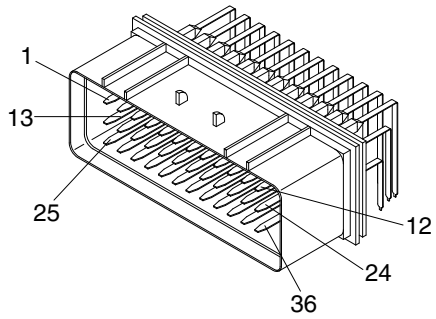
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

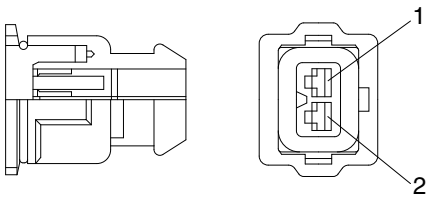
5) 375 FASTEN TYPE CONNECTOR

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

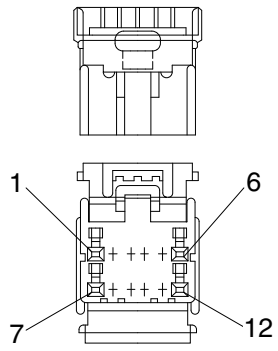
6) AMP ECONOSEAL CONNECTOR

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

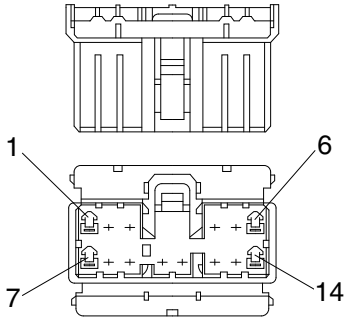
7) AMP TIMER CONNECTOR

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

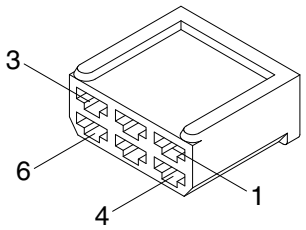
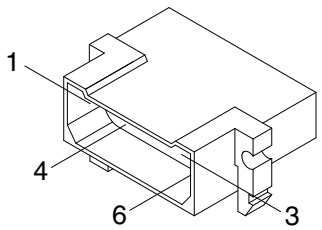
8) AMP 040 MULTILOCK CONNECTOR

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

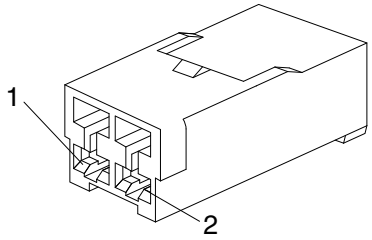
9) AMP 070 MULTILOCK CONNECTOR

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

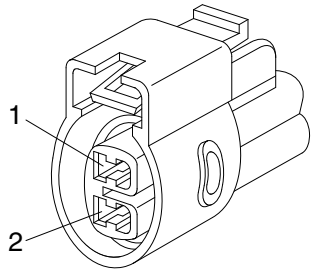
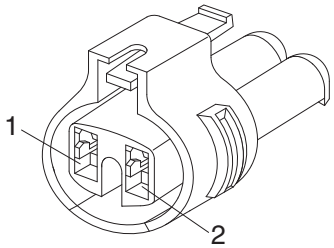
10) AMP FASTIN - FASTON CONNECTOR

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

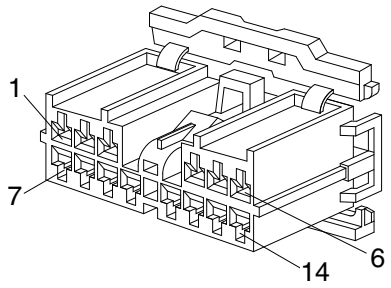
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

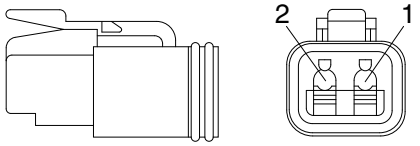
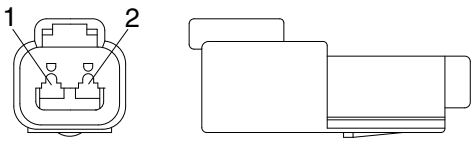
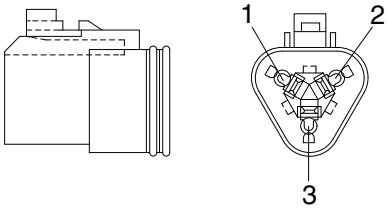
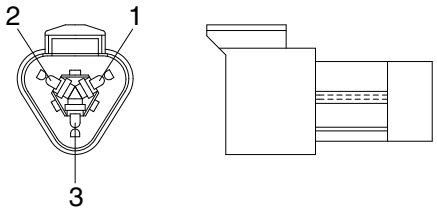
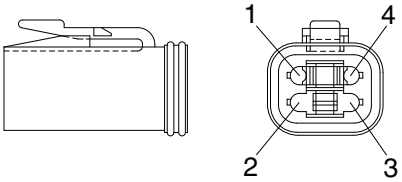
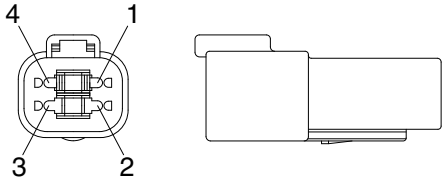
14) DEUTSCH DT CONNECTORS

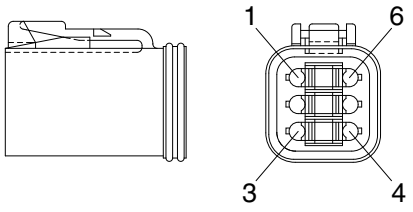
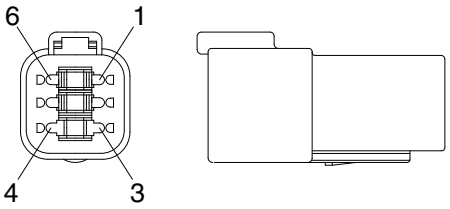
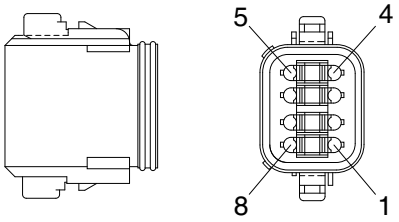
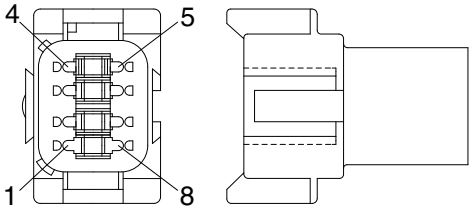
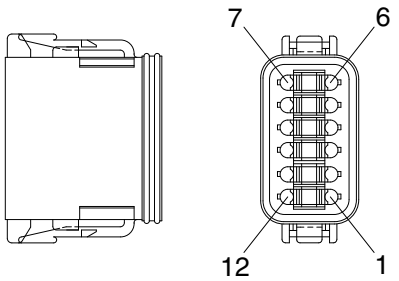
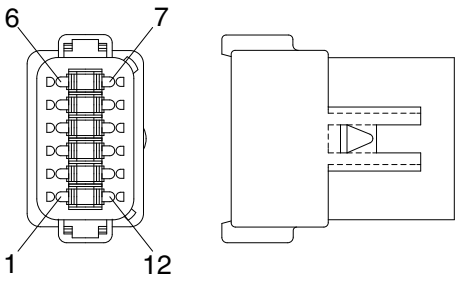
DT 06 - 3S - ★★★★

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

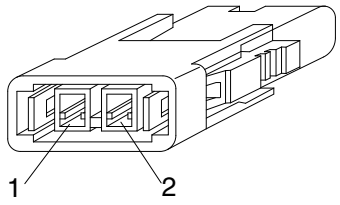
※ Modification

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

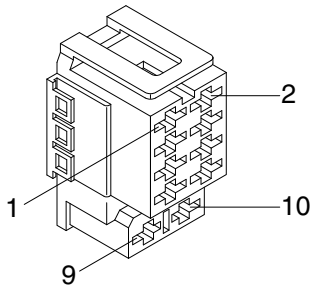
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

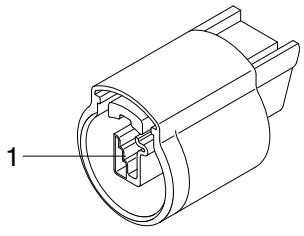
15) MOLEX 2CKTS CONNECTOR

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

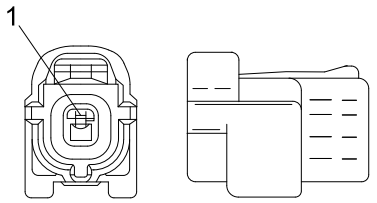
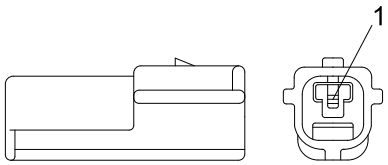
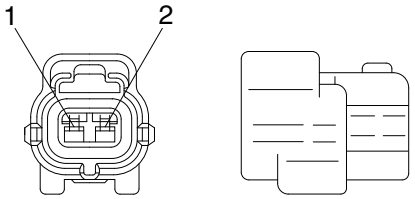
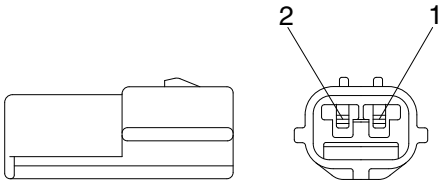
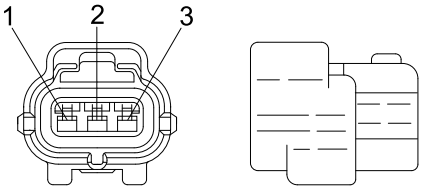
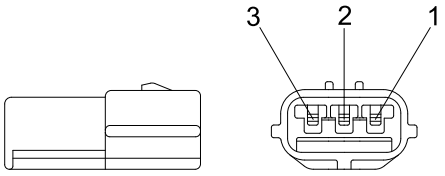
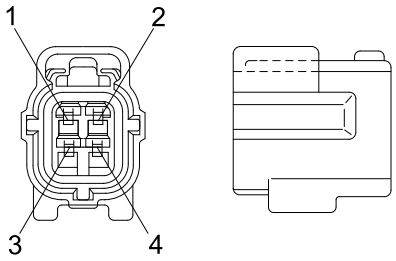
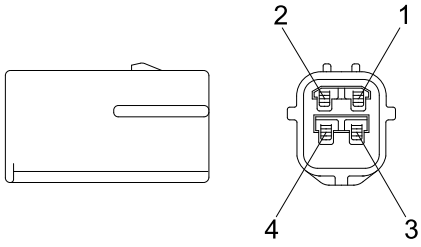
16) ITT SWF CONNECTOR

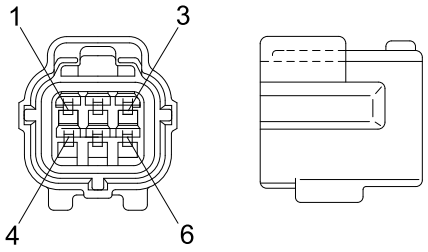
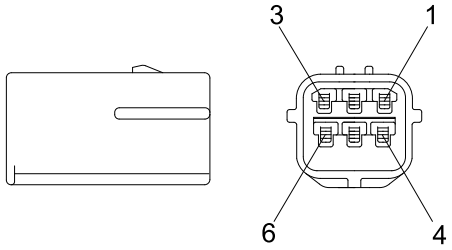
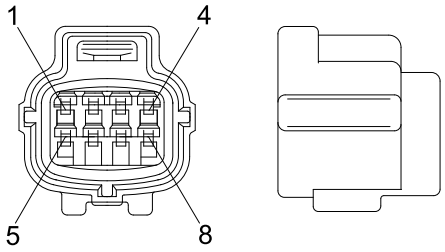
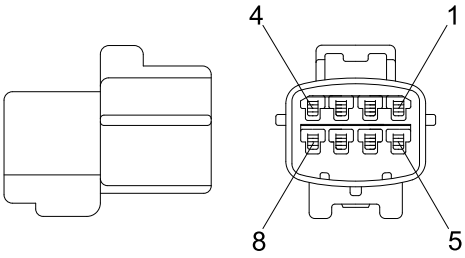
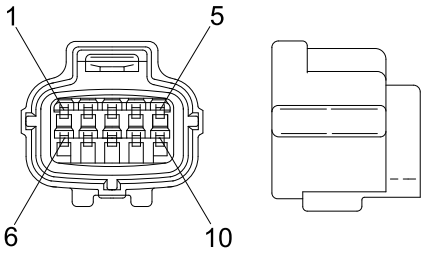
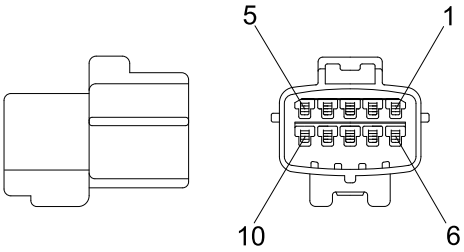
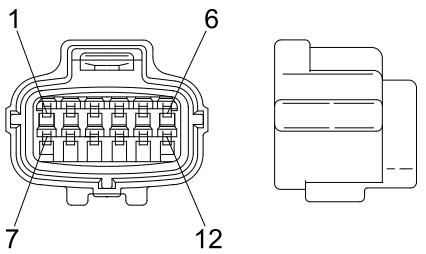
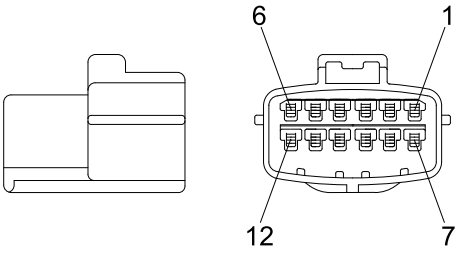
No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

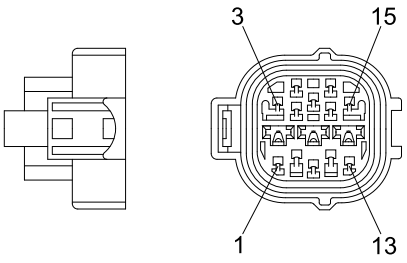
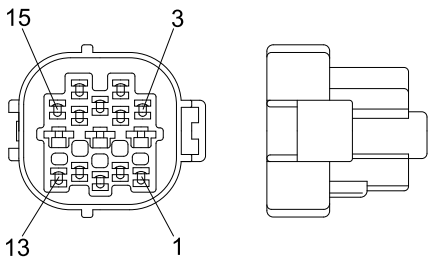
17) MWP NMWP CONNECTOR

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

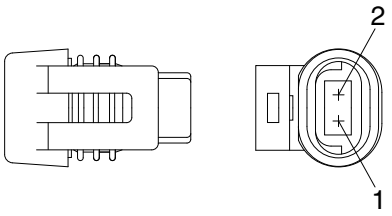
18) ECONOSEAL J TYPE CONNECTORS

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

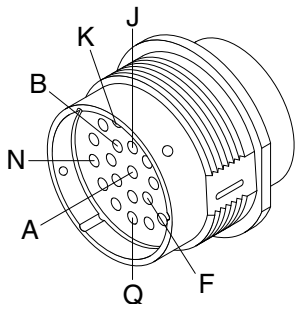
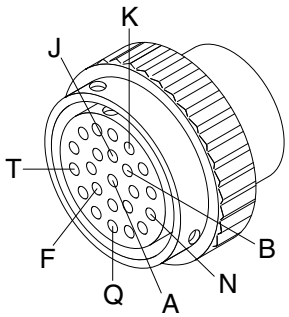
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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

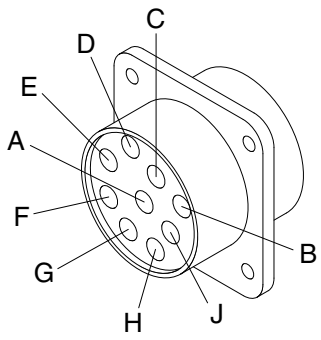
19) METRI-PACK TYPE CONNECTOR

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

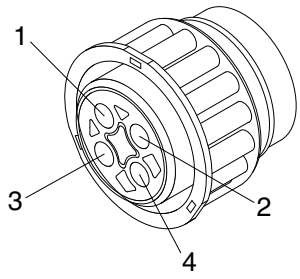
20) DEUTSCH HD30 CONNECTOR

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

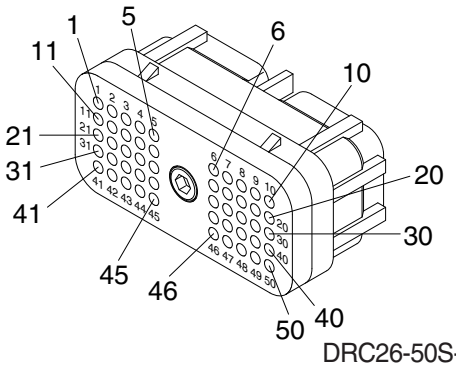
21) DEUTSCH SERVICE TOOL CONNECTOR

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

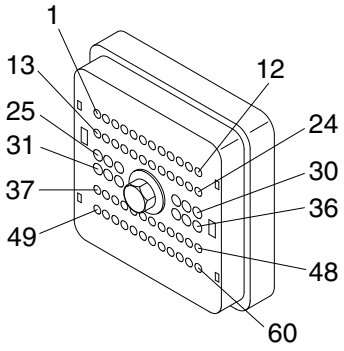
22) AMP FUEL WARMER CONNECTOR

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

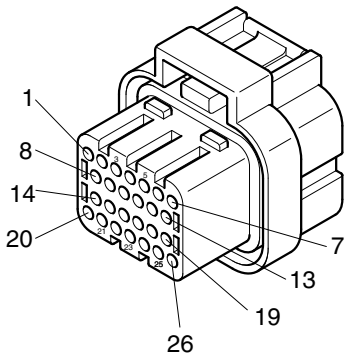
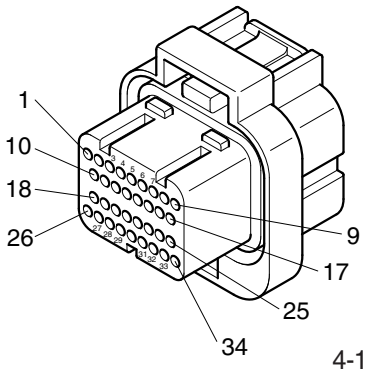
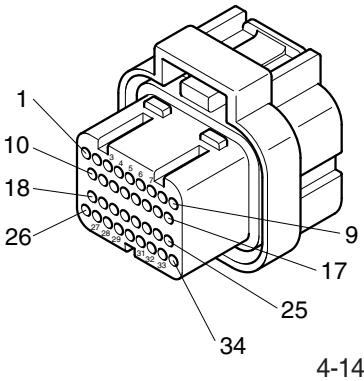
23) DEUTSCH ENGINE ECM CONNECTOR

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

24) DEUTSCH INTERMEDIATE CONNECTOR

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

25) TE MCU CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
26	 1473416-1	
34	 4-1437290-0	
34	 4-1437290-1	

SECTION 5 MECHATRONICS SYSTEM

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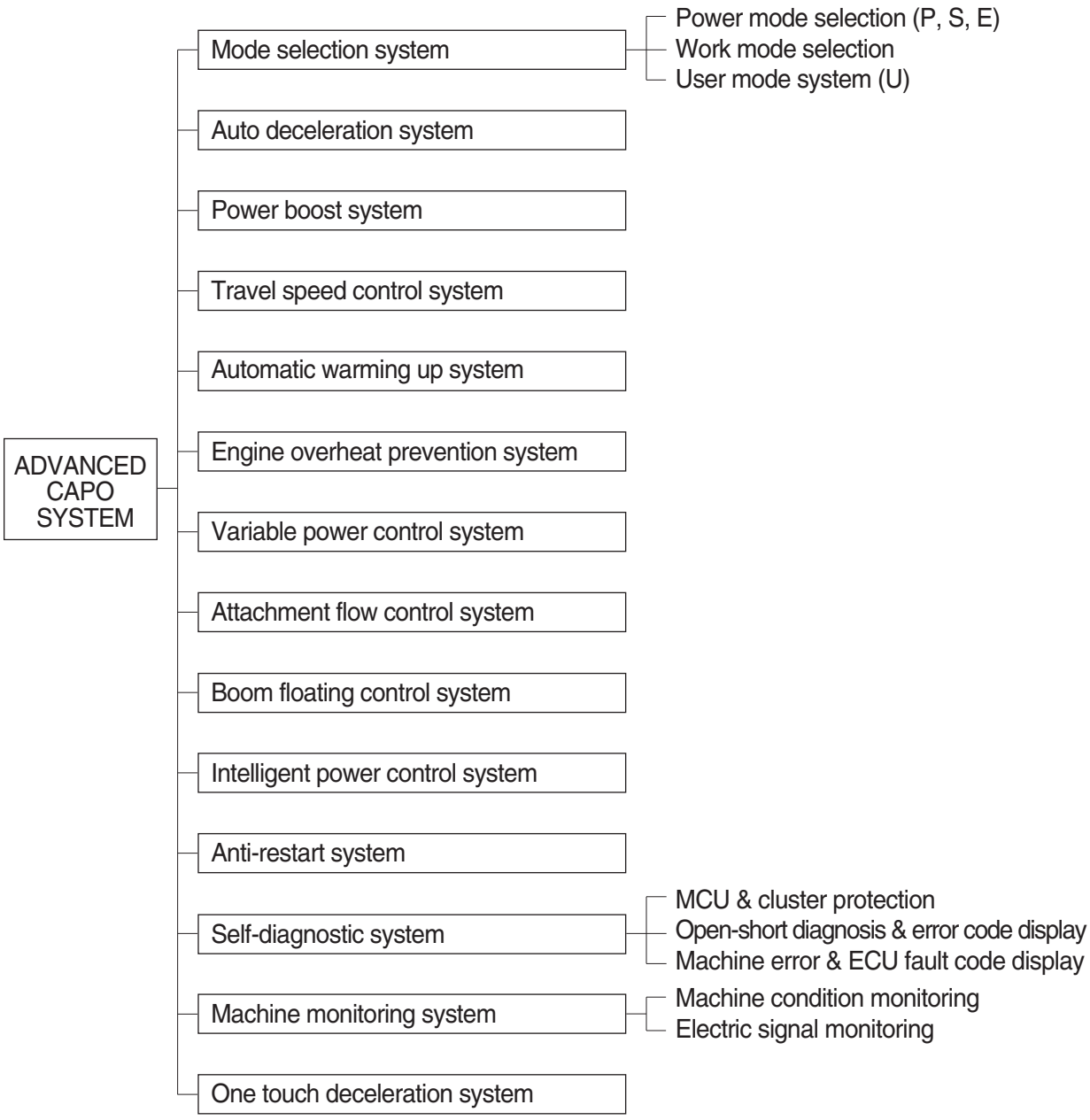
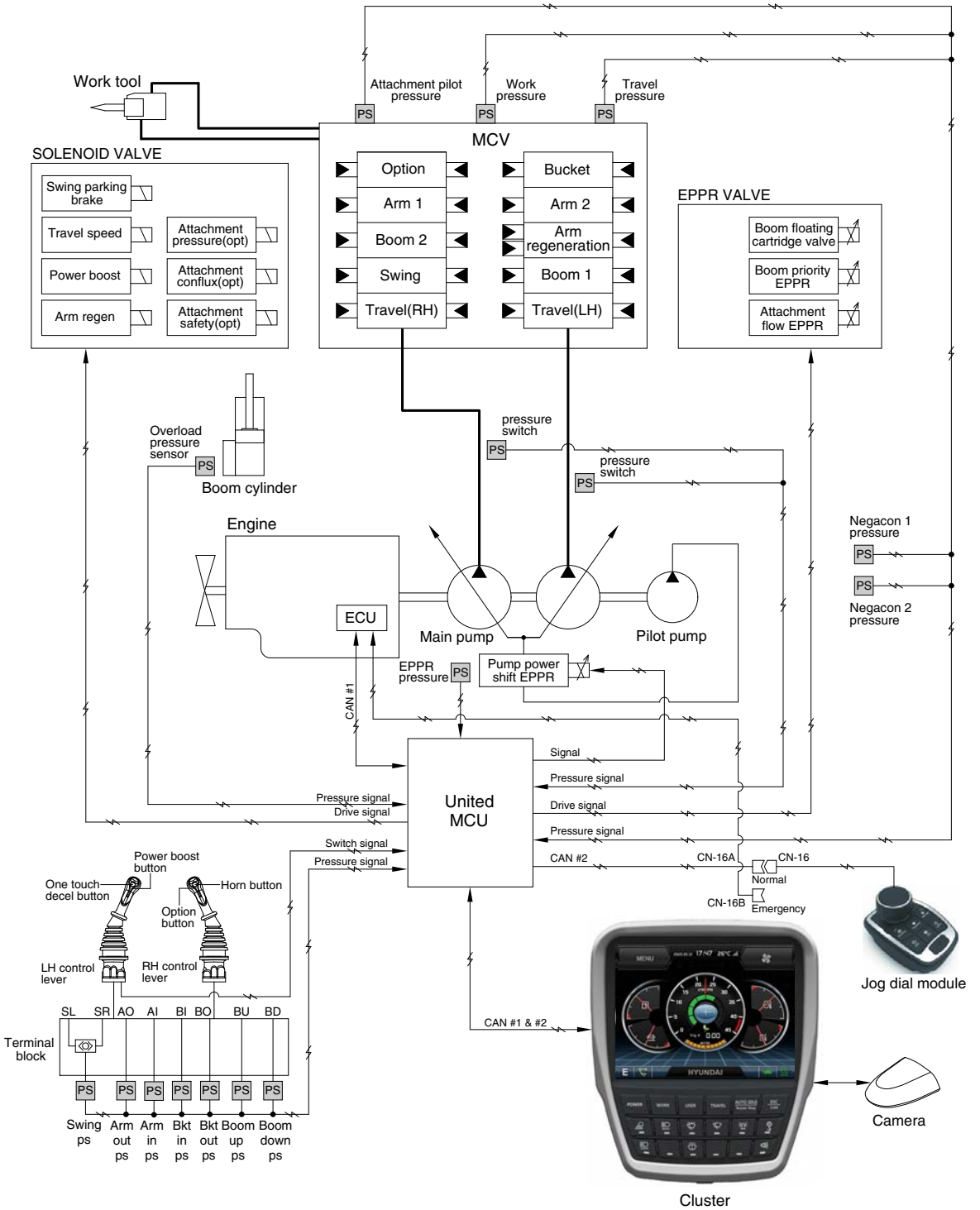
GROUP 1 OUTLINE

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

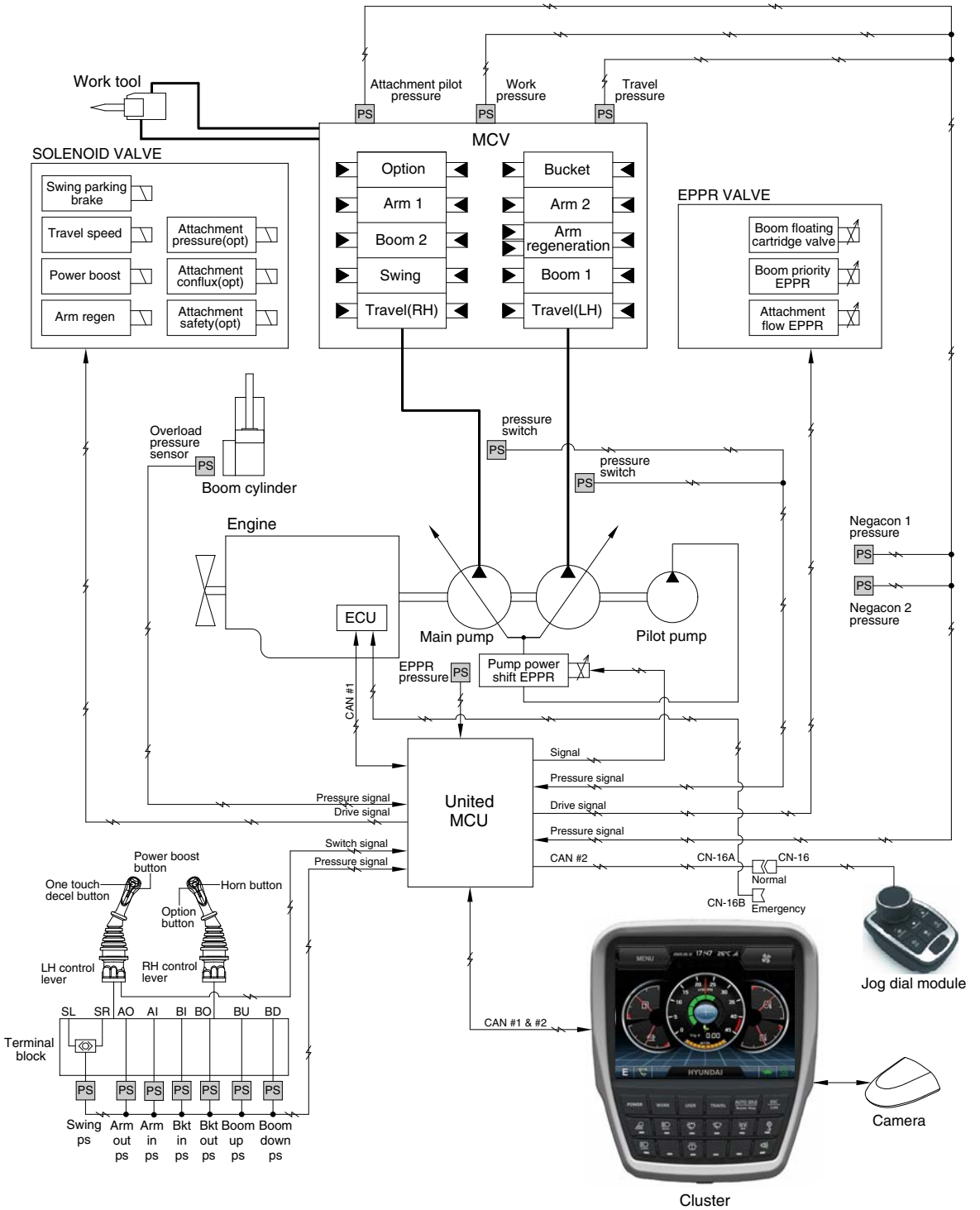


SYSTEM DIAGRAM (OLD VERSION)



320A5MS01

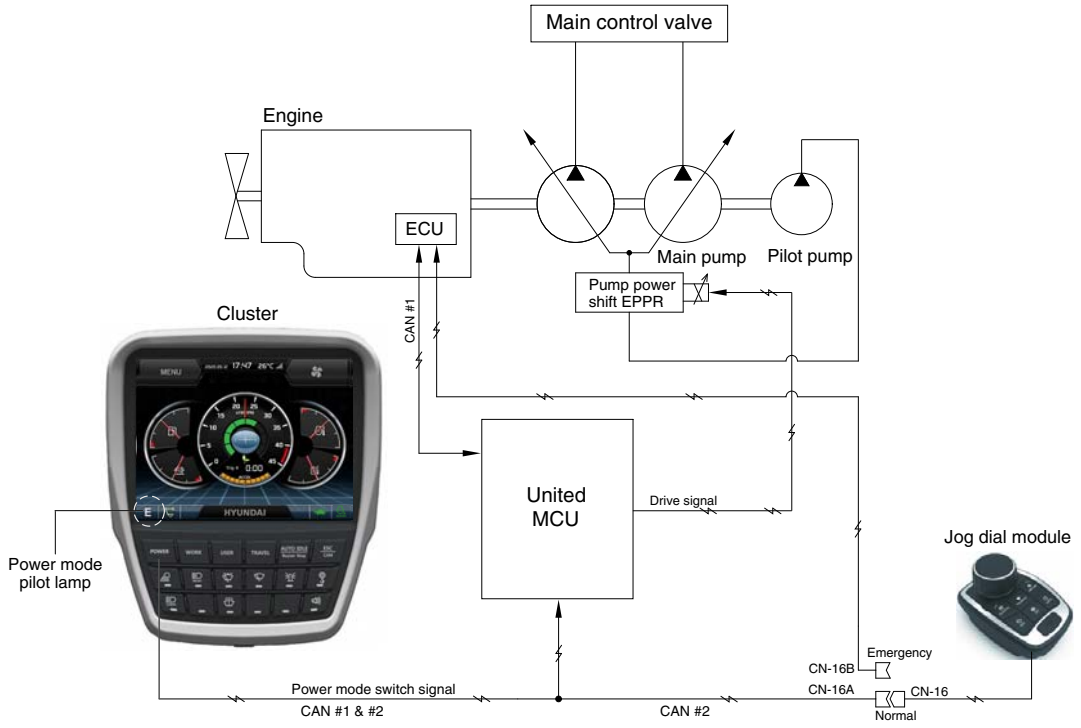
SYSTEM DIAGRAM (CURRENT VERSION)



320A5MS01

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



320A5MS02

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

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

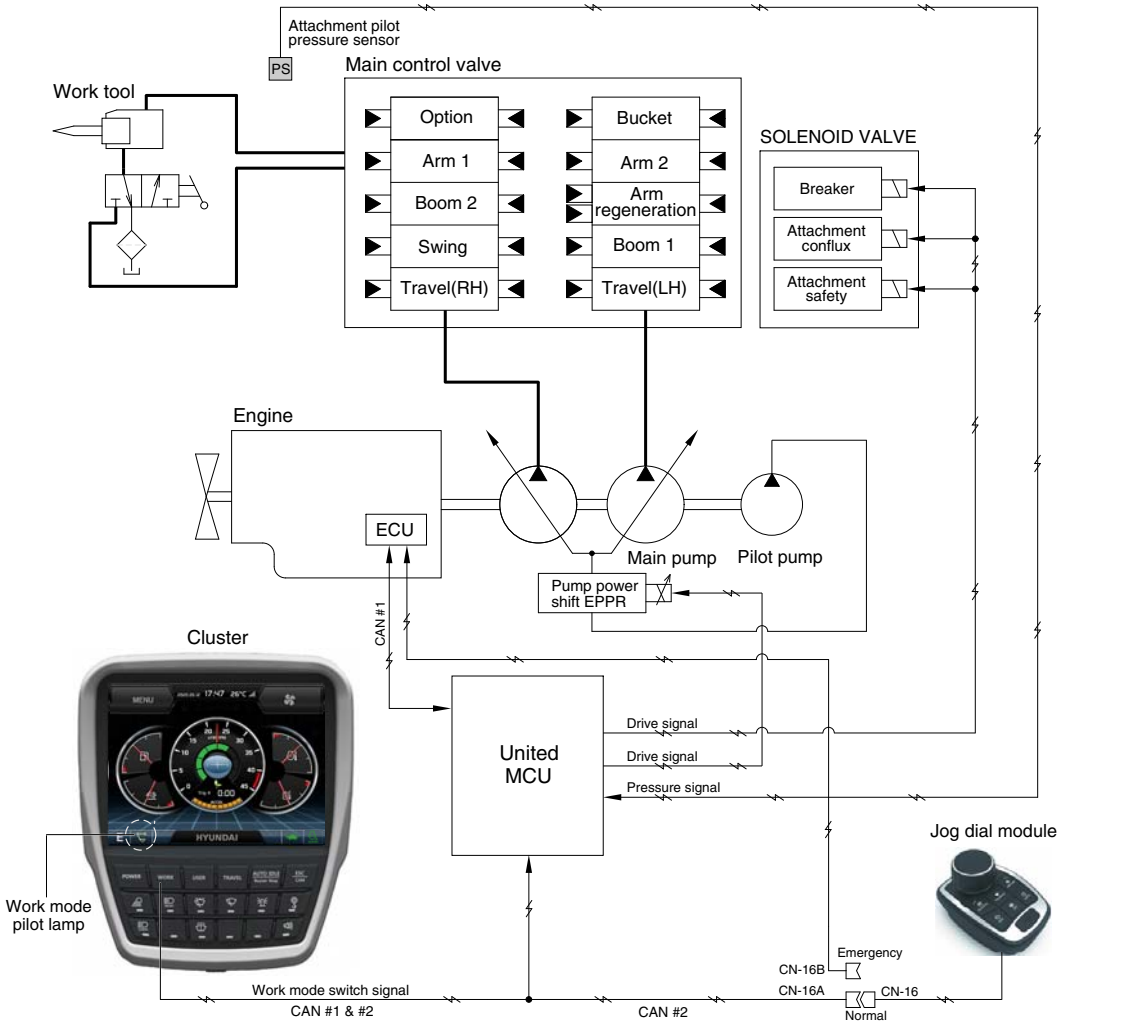
Power mode	Application	Engine rpm				Power shift by EPPR valve			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm²)	Current (mA)	Pressure (kgf/cm²)
P	Heavy duty power	1800±50	1900±50	1900±50	1900±50	290±30	8 (~3)	190±30	3 (~3)
S	Standard power	1700±50	1800±50	1800±50	1800±50	330±30	10 (~5)±3	250±30	5 (~5)±3
E	Economy operation	1600±50	1700±50	1700±50	1700±50	360±30	12 (~7)±3	280±30	7 (~7)±3
AUTO DECEL	Engine deceleration	1100±100	-	1100±100	-	700±30	38±3	700±30	38±3
One touch decel	Engine quick deceleration	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3
KEY START	Key switch start position	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3

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

※ (~*) : Load

2. WORK MODE SELECTION SYSTEM

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



320A5MS03

1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

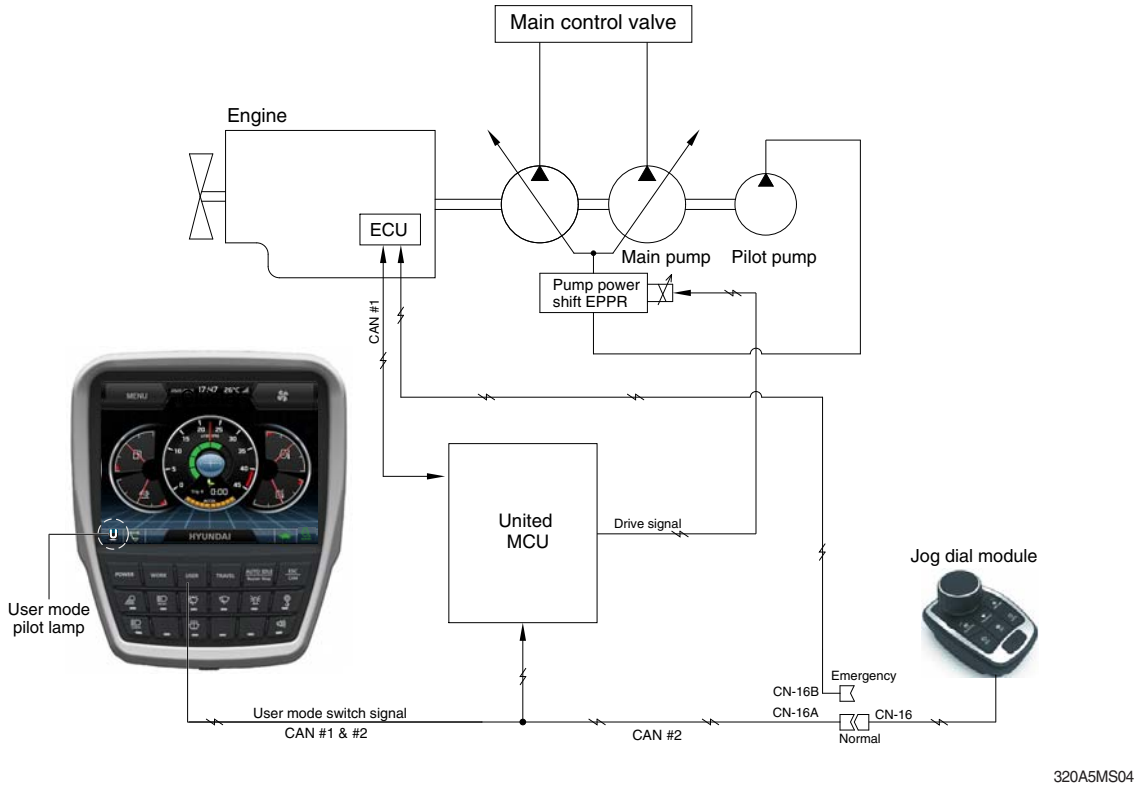
2) ATT WORK MODE (breaker, crusher)

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

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

★ When breaker operating button is pushed.

3. USER MODE SELECTION SYSTEM



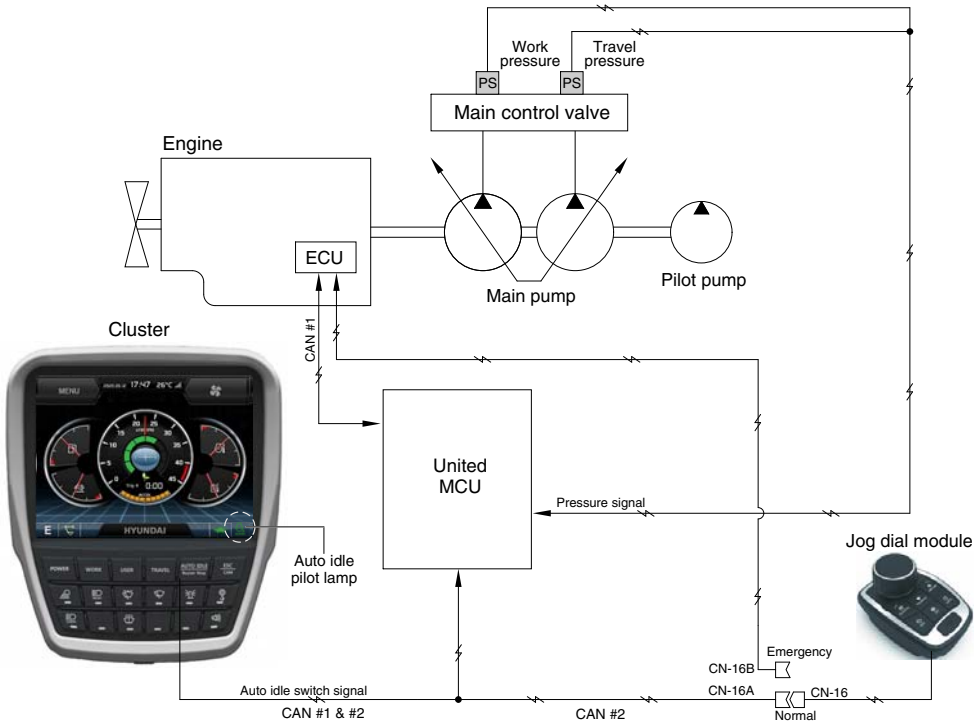
1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	800	0
2	1400	900	3
3	1500	950	6
4	1600	1000	9
5	1700	1050	12
6	1800	1100 (auto decel)	16
7	1850	1150	20
8	1900	1200	26
9	1950	1250	32
10	2000	1300	38

※ Refer to page 5-90.

GROUP 3 AUTOMATIC DECELERATION SYSTEM

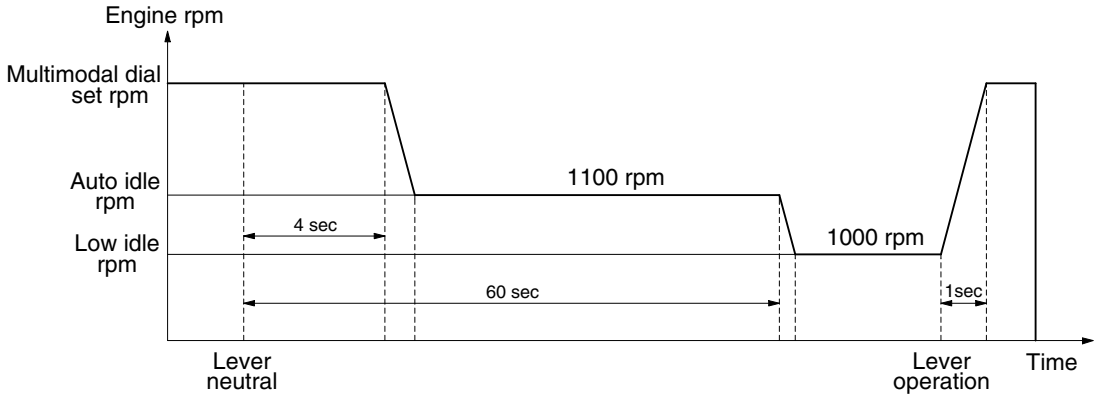


320A5MS05

1. WHEN AUTO IDLE PILOT LAMP ON

When all of the work equipment control levers including swing and travel levers are at neutral for 4 seconds, united MCU sends throttle command to ECU to reduce the engine speed to 1100 rpm. If the control levers are at neutral for 1 minute, united MCU reduces the engine speed to 1000 rpm. As the result of reducing the engine speed, fuel consumption and noise are effectively cut down during non-operation of the control levers.

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



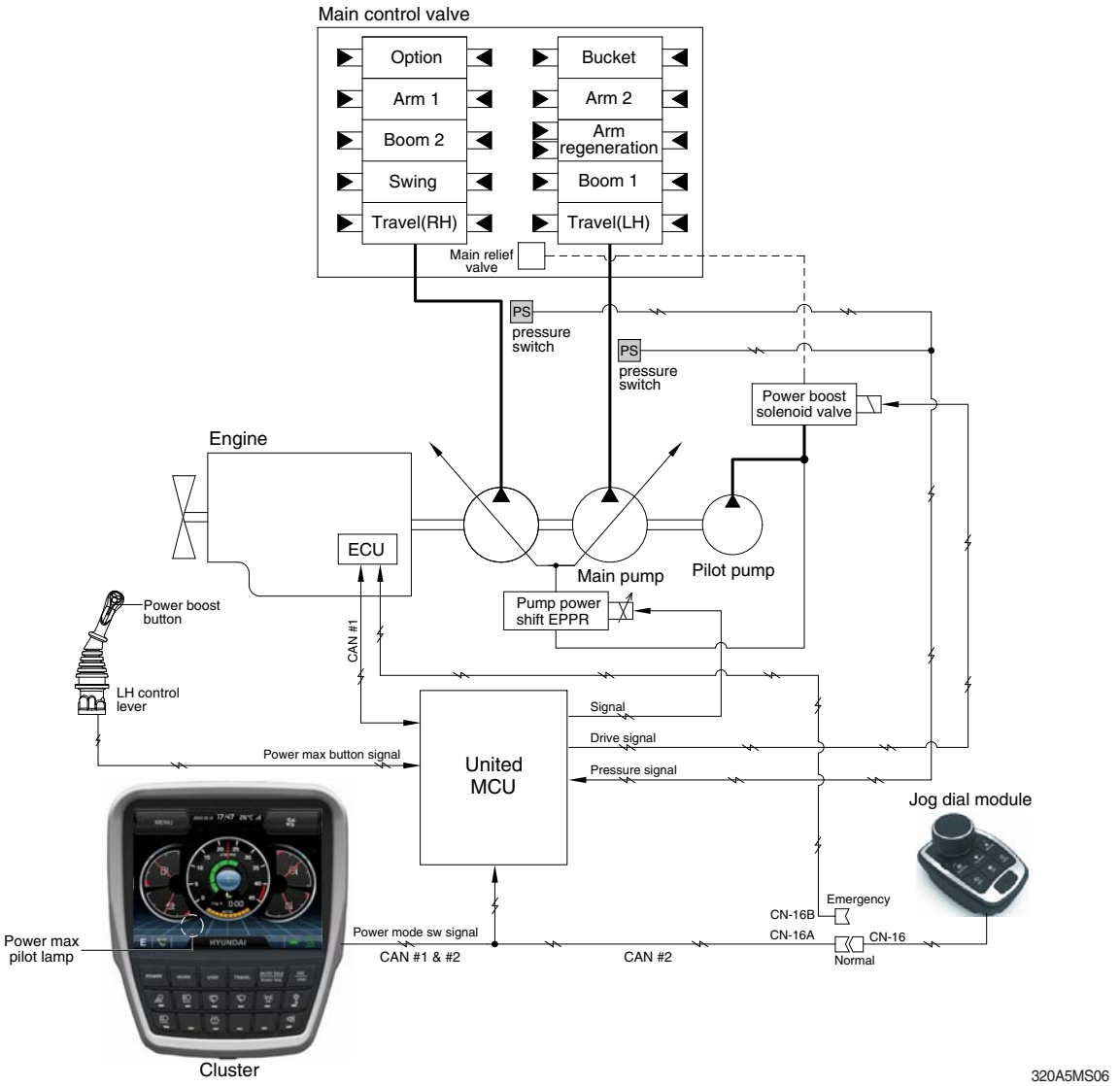
300L5MS135

2. WHEN AUTO IDLE PILOT LAMP OFF

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

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

GROUP 4 POWER BOOST SYSTEM



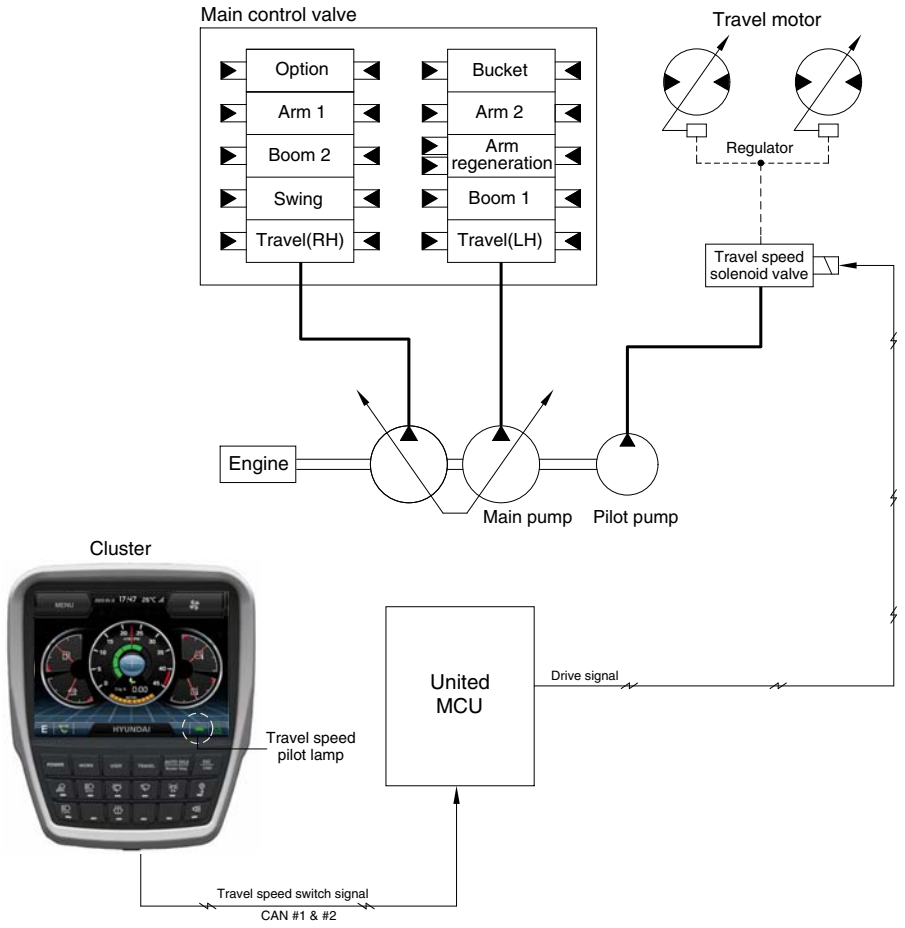
· When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

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

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

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

GROUP 5 TRAVEL SPEED CONTROL SYSTEM



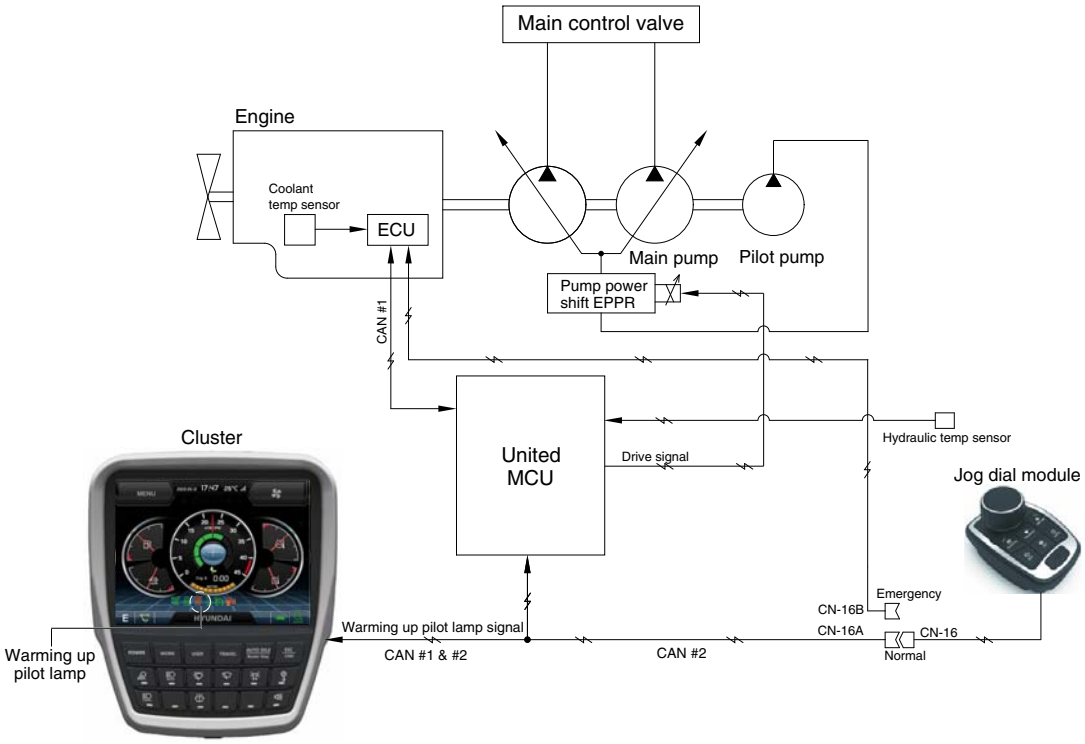
320A5MS07

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

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

※ Default : Turtle (Low)

GROUP 6 AUTOMATIC WARMING UP SYSTEM



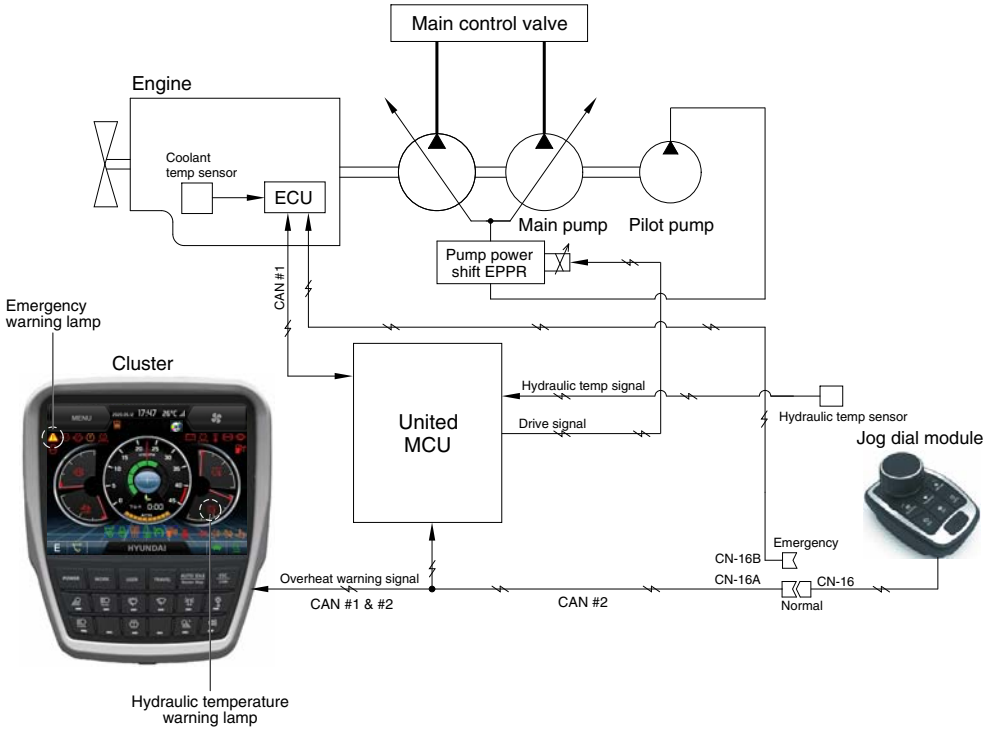
1. The united MCU receives the engine coolant temperature from the ECU, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1100 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

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

3. LOGIC TABLE

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

GROUP 7 ENGINE OVERHEAT PREVENTION SYSTEM

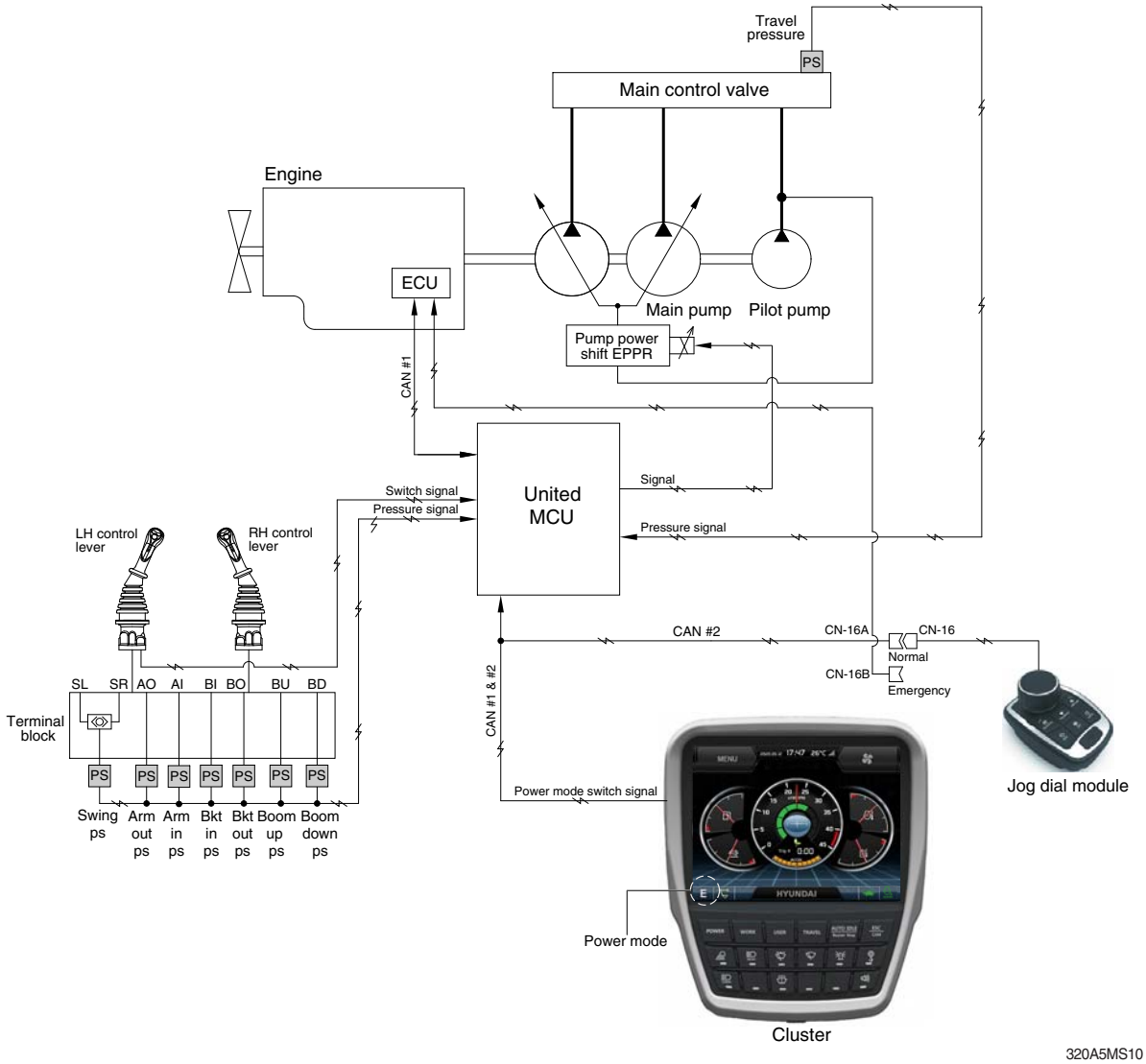


1. If the engine coolant temperature is overheated over 103˚C or the hydraulic oil temperature is overheated over 100˚C, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

2. LOGIC TABLE

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

GROUP 8 VARIABLE POWER CONTROL SYSTEM

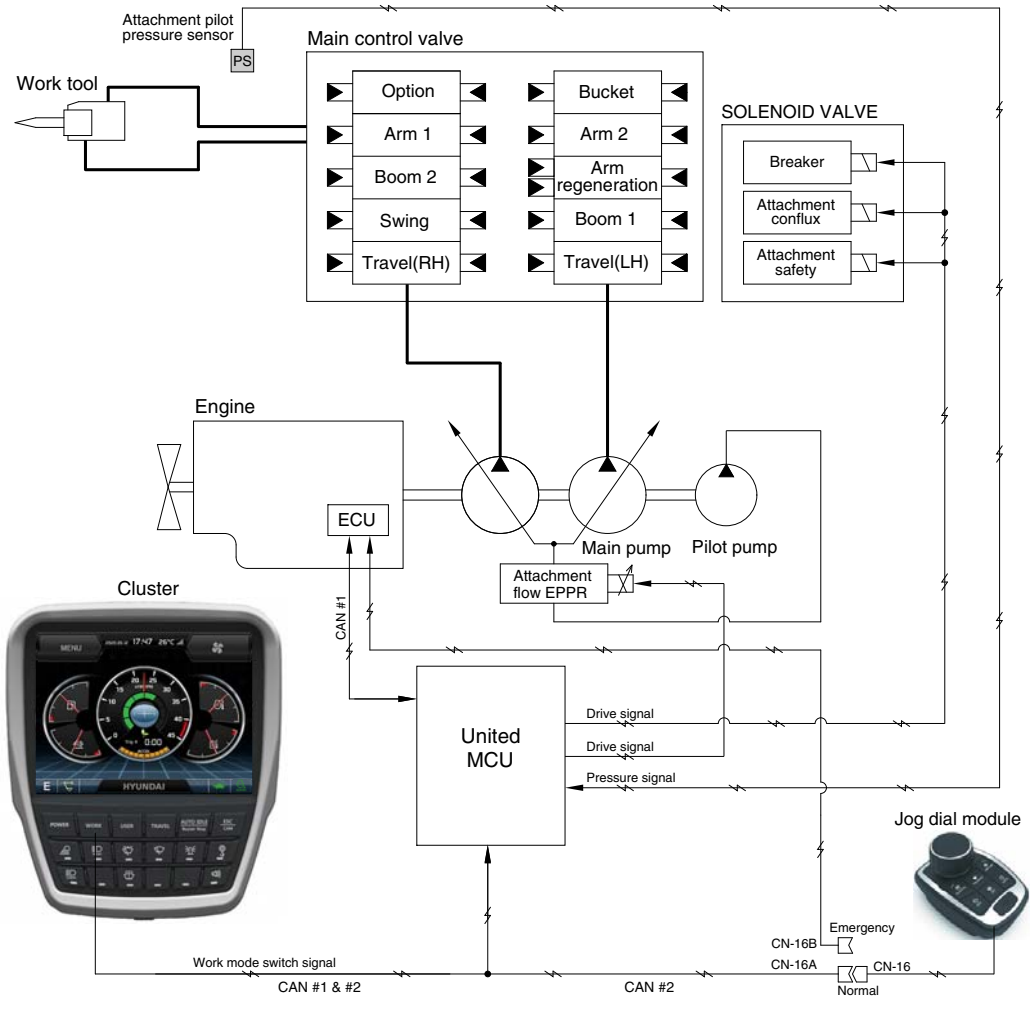


· The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.
It makes fuel saving and smooth control at precise work.

Description	Working condition
Power mode	P, S, E
Work mode	General (bucket)
Pressure sensor	Normal

※ The variable power control function can be activated when the power mode is set to all power mode.

GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM



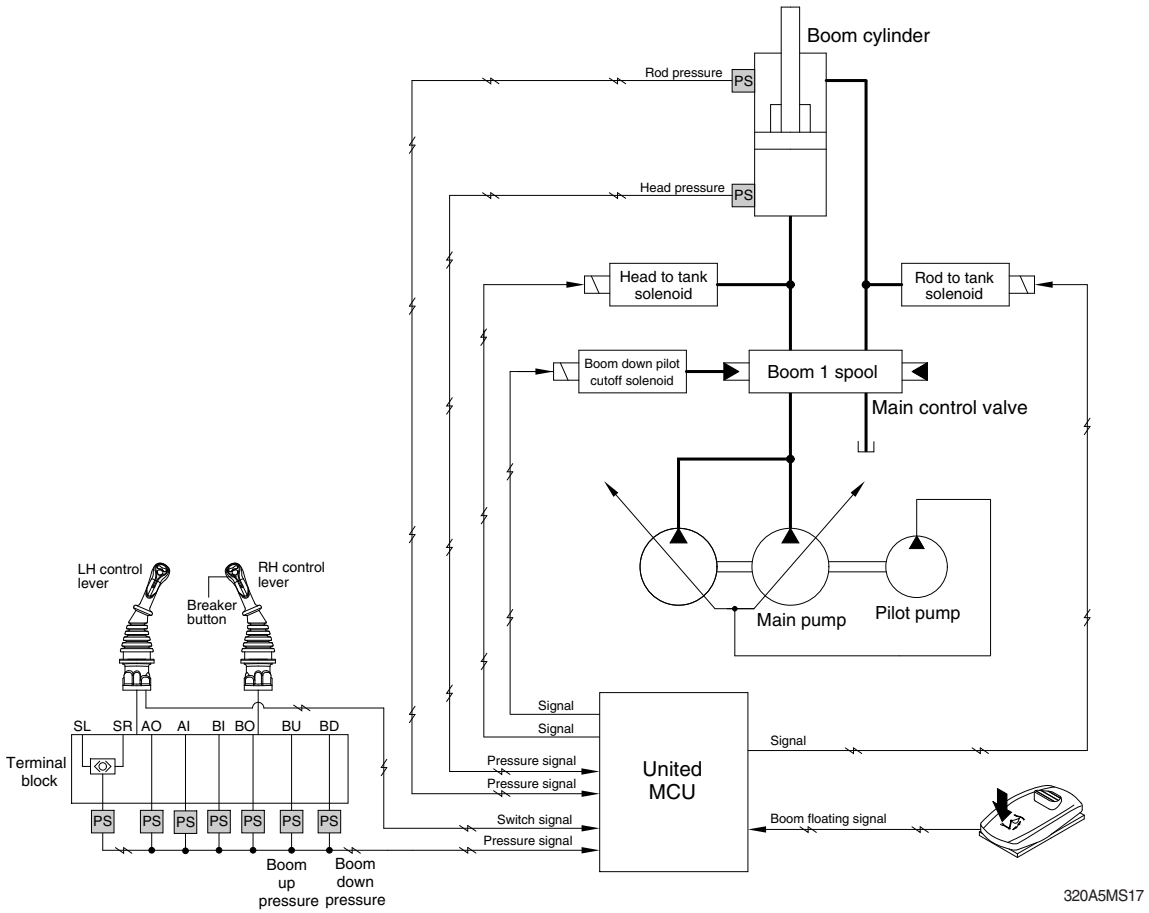
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool	
	Breaker	Crusher
Flow level	100 ~ 220 lpm	100 ~ 520 lpm
Attach safety solenoid	-	ON
Attach conflux solenoid	ON/OFF	ON/OFF
Breaker solenoid★	ON	-

※ Refer to the page 5-90 for the attachment kinds and max flow.

★ When breaker operating button is pushed.

GROUP 10 BOOM FLOATING CONTROL SYSTEM

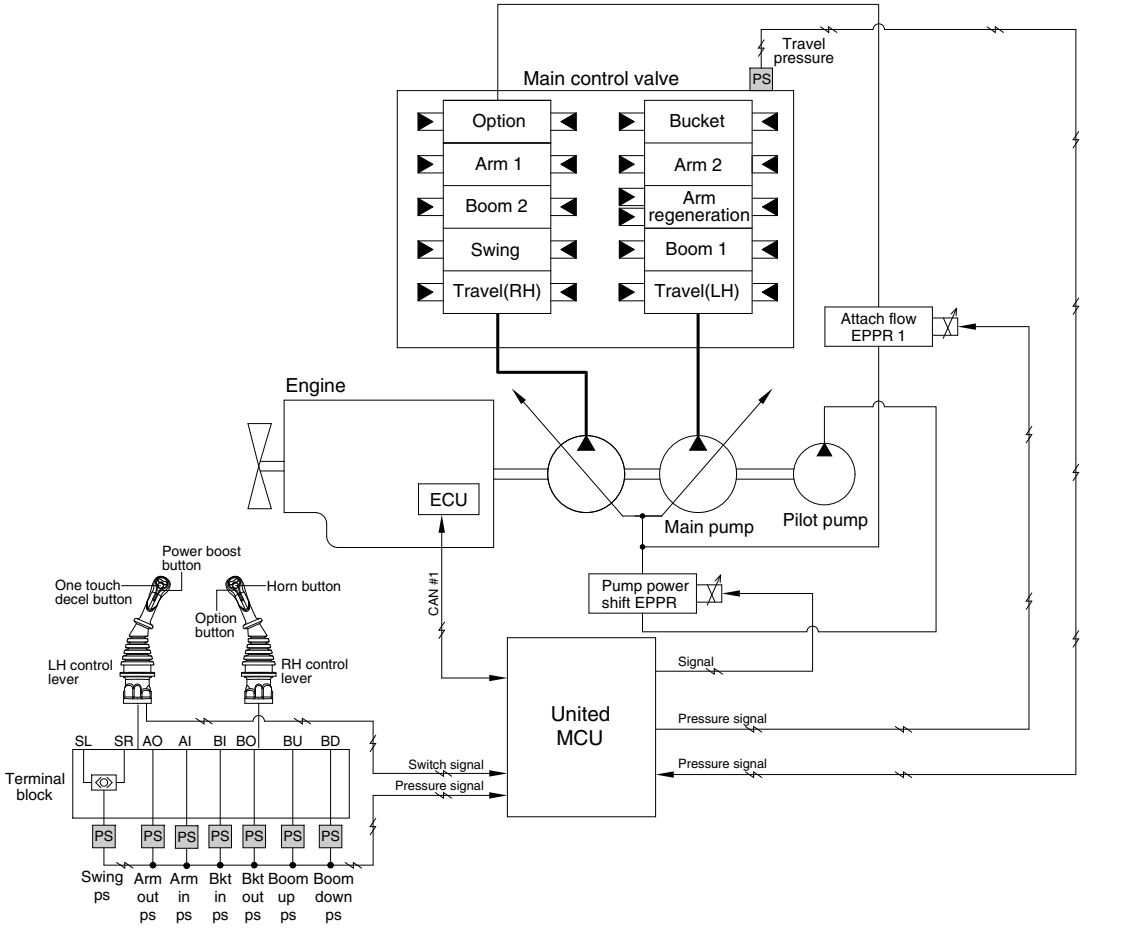


· Boom floating automatically controls boom cylinder along the ground by operating arm cylinder only.

Description		Condition	Function
Work mode★1	Floating mode		
General mode	Boom up floating★2	Floating mode sw : ON	Rod to tank solenoid : ON Head to tank solenoid : OFF Boom down cutoff solenoid : OFF
	Boom up/down floating★2	Floating mode sw : ON Breaker button : Pressed Boom down pilot pressure > 25 bar Boom up pilot pressure < 5 bar	Rod to tank solenoid : ON Head to tank solenoid : ON Boom down cutoff solenoid : ON
Breaker mode	Boom down floating	Floating mode sw : ON Breaker button : Pressed Boom down pilot pressure > 25 bar Boom up pilot pressure < 5 bar	Rod to tank solenoid : OFF Head to tank solenoid : ON Boom down cutoff solenoid : ON
Temporarily canceled		During operation of boom floating Boost sw : Pressed	Rod to tank solenoid : OFF Head to tank solenoid : OFF Boom down cutoff solenoid : OFF

★1 Boom floating is not activated when work mode is crusher mode.

★2 These functions are activated just in case the excavator is not in jack up status.



320A5MS18A

1. When the requirement of pump flow rate is low, IPC mode controls pump flow rate to improve fuel efficiency. The function works only in Balance or Efficiency mode.

Condition	Function
Arm in with boom up	Limitation of pump flow rate : Activated
Boom down with other actuator	
Starting point when swing operation	
Reduction for fuel when idle condition	
None of upper condition	Limitation of pump flow rate : Canceled

1) ARM IN WITH BOOM UP

A fuel efficiency is improved by maximizing arm regeneration by reducing pump flow rate during boom up and arm in combination operation.

2) BOOM DOWN WITH OTHER ACTUATOR

The flow for boom-down is replaced with regeneration-flow as much as possible, and fuel consumption is reduced by reducing the flow rate of the pump.

3) STARTING POINT WHEN SWING OPERATION

A technology reduces the amount of flow that is wasted to the swing relief due to the inertia at the beginning of the swing start.

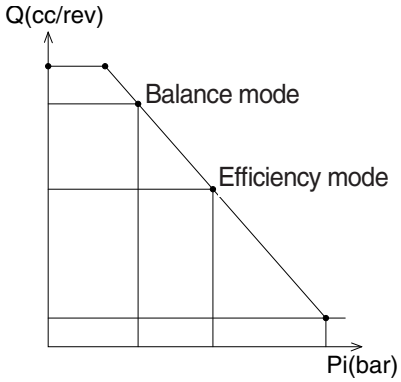
4) REDUCTION FOR FUEL WHEN IDLE CONDITION

A technology reduces energy loss due to unnecessary pump volume increase in idle state before the machine operation.

2. IPC MODE SELECTION

The levels of flow rate limit depends on at IPC mode.

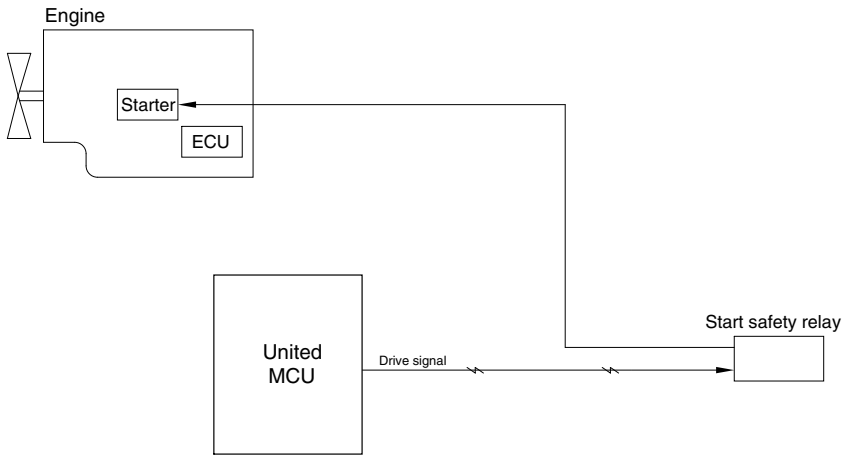
300A3CD52A



290F3CD311

IPC mode	Description
Balance mode	Fuel eifficiency ON, limit level 1
Efficiency mode	Fuel eifficiency ON, limit level 2
Speed mode	Fuel eifficiency OFF

GROUP 12 ANTI-RESTART SYSTEM



320A5MS12

1. ANTI-RESTART FUNCTION

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

GROUP 13 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

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

2. MONITORING

1) Active fault

300A3CD65A

300A3CD66A

300A3CD67A

· The active faults of the united MCU, FATC, AAVM (option) can be checked by this menu.

2) Logged fault

300A3CD68A

300A3CD69A

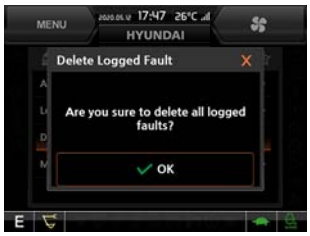
300A3CD70A

· The logged faults of the united MCU, FATC, AAVM (option) can be checked by this menu.

3) Delete logged fault

300A3CD71A

300A3CD72A



300A3CD73A

· The logged faults of the united MCU, FATC, AAVM (option) can be deleted by this menu.

3. MACHINE ERROR CODES TABLE

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
101	3	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Hydraulic oil temperature display failure 2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2) - CN-51 (#16) Checking Open/Short 2. CD-1 (#1) - CN-51 (#25) Checking Open/Short				
105	0	10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short				
108	0	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V		●	
	1	10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short 3. CD-6 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
120	0	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 1 (P1) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-42 (#B) – CN-52 (#22) Checking Open/Short 2. CD-42 (#A) – CN-51 (#32) Checking Open/Short 3. CD-42 (#C) – CN-51 (#31) Checking Open/Short				
121	0	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 2 (P2) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-51 (#14) Checking Open/Short 2. CD-43 (#A) – CN-51 (#32) Checking Open/Short 3. CD-43 (#C) – CN-51 (#31) Checking Open/Short				
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#28) Checking Open/Short 2. CD-31 (#A) – CN-51 (#32) Checking Open/Short 3. CD-31 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
123	0	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 1 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 1 Press. display failure 2. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CD-70 (#B) – CN-51 (#22) Checking Open/Short 2. CD-70 (#A) – CN-51 (#32) Checking Open/Short 3. CD-70 (#C) – CN-51 (#31) Checking Open/Short				
124	0	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 2 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 2 Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-71 (#B) – CN-51 (#28) Checking Open/Short 2. CD-71 (#A) – CN-51 (#32) Checking Open/Short 3. CD-71 (#C) – CN-51 (#31) Checking Open/Short				
127	0	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Boom Up Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Up Pilot Press. display failure 2. Control Function – Engine/Pump variable horse power control operation failure, IPC operation failure, Boom first operation failure (Checking list) 1. CD-32 (#B) – CN-52 (#23) Checking Open/Short 2. CD-32 (#A) – CN-51 (#32) Checking Open/Short 3. CD-32 (#C) – CN-5 1(#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
128	0	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Down Pilot Press. display failure 2. Control Function – Boom floating operation failure (Checking list) 1. CD-85 (#B) – CN-52 (#31) Checking Open/Short 2. CD-85 (#A) – CN-51 (#32) Checking Open/Short 3. CD-85 (#C) – CN-51 (#31) Checking Open/Short				
129	0	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V	●		
	1	10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In Pilot Press. display failure 2. Control Function – IPC operation failure (Checking list) 1. CD-90 (#B) – CN-51 (#21) Checking Open/Short 2. CD-90 (#A) – CN-51 (#32) Checking Open/Short 3. CD-90 (#C) – CN-51 (#31) Checking Open/Short				
133	0	10 seconds continuous, Bucket In Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Bucket In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Bucket In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Bucket In Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-53 (#15) Checking Open/Short 2. CD-35 (#A) – CN-51 (#32) Checking Open/Short 3. CD-35 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
135	0	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Swing Pilot Press. display failure 2. Control Function – IPC operation, Boom first operation failure (Checking list) 1. CD-24 (#B) – CN-52 (#18) Checking Open/Short 2. CD-24 (#A) – CN-51 (#32) Checking Open/Short 3. CD-24 (#C) – CN-51 (#31) Checking Open/Short				
138	0	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, 0.3V≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Attachment Pilot Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-69 (#B) – CN-52 (#32) Checking Open/Short 2. CD-69 (#A) – CN-51 (#32) Checking Open/Short 3. CD-69 (#C) – CN-51 (#31) Checking Open/Short				
139 (N.A)	1	10 seconds continuous, 0.3V≤ Option Pilot Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Option Pilot Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Option Pilot Press. display failure 2. Control Function – Auto Idle operation failure (Checking list) 1. CD-100 (#B) – CN-52 (#21) Checking Open/Short 2. CD-100 (#A) – CN-51 (#3) Checking Open/Short 3. CD-100 (#C) – CN-1 (#6) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
140	5	(Detection) (When Pump EPPR Current is more than 10 mA) 10 seconds continuous, Pump EPPR drive current < 0 mA (Cancellation) (When Pump EPPR Current is more than 10 mA) 3 seconds continuous, Pump EPPR drive current ≥10 mA	●		
	6	(Detection) 10 seconds continuous, Pump EPPR drive current > 1.0A (Cancellation) 3 seconds continuous, Pump EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Pump horse power setting specification difference (Fuel efficiency/speed specification failure) (Checking list) 1. CN-75 (#2) – CN-54 (#28) Checking Open/Short 2. CN-75 (#1) – CN-54 (#01) Checking Open/Short				
141	5	(Model Parameter) mounting Boom Priority EPPR (Detection) (When Boom Priority EPPR Current is more than 10 mA) 10 seconds continuous, Boom Priority EPPR drive current < 0 mA (Cancellation) (When Boom Priority EPPR Current is more than 10 mA) 3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Boom Priority EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Boom first control operation failure (Checking list) 1. CN-133 (#2) – CN-54 (#34) Checking Open/Short 2. CN-133 (#1) – CN-54 (#04) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
143 (N.A)	5	(Detection) (When Travel EPPR Current is more than 10 mA) 10 seconds continuous, Travel EPPR drive current = 0 mA (Cancellation) (When Travel EPPR Current is more than 100 mA) 3 seconds continuous, Travel EPPR drive current ≥ 10 mA			●
	6	(Detection) 10 seconds continuous, Travel EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Travel EPPR drive current ≤ 1.0 A			●
	(Results / Symptoms) 1. Control Function – cruise control operation failure (Checking list) 1. CN-246 (#2) – CN-54 (#39) Checking Open/Short 2. CN-246 (#1) – CN-51 (#40) Checking Open/Short				
145	5	(Model Parameter) mounting Remote Cooling Fan EPPR (Detection) (When Remote Cooling Fan EPPR Current is more than 10 mA) 10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA (Cancellation) (When Remote Cooling Fan EPPR Current is more than 10 mA) 3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Remote fan control operation failure (Checking list) 1. CN-385 (#3) – CN-53 (#07) Checking Open/Short 2. CN-385 (#1) – CN-51 (#03) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
164 (N.A)	4	(Detection) (When Working Cutoff Relay is Off) 10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Working Cutoff Relay is Off) 3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Working Cutoff Relay is On) 10 seconds continuous, Working Cutoff Relay drive current > 6.5 A (Cancellation) (When Working Cutoff Relay is On) 3 seconds continuous, Working Cutoff Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure (Checking list) 1. CR-47 (#85) – CN-54 (#9) Checking Open/Short 2. CR-47 (#30, #86) – Fuse box (#28) Checking Open/Short				
166	4	(Detection) (When Power Max Solenoid is Off) 10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Power Max Solenoid is Off) 3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Power Max Solenoid is On) 5 seconds continuous, Power Max Solenoid drive current > 4.5 A (Cancellation) (When Power Max Solenoid is On) 3 seconds continuous, Power Max Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Voltage increase operation failure (Checking list) 1. CN-88 (#1) – CN-53 (#10) Checking Open/Short 2. CN-88 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
167	4	(Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V		●	
		(When Parking mode is not) (Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Travel Speed Solenoid is On) 10 seconds continuous, Travel Speed Solenoid drive current > 4.5 A (Cancellation) (When Travel Speed Solenoid is On) 3 seconds continuous, Travel Speed Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – driving in 1/2 transmission operation failure (Checking list) 1. CN-70 (#1) – CN-52(#05) Checking Open/Short 2. CN-70 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
169	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Attachment Conflux Solenoid is Off) 10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Conflux Solenoid is Off) 3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Attachment Conflux Solenoid is On) 10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A (Cancellation) (When Attachment Conflux Solenoid is On) 3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A	●		
	(Results / symptoms) 1. Control Function – Option attachment flow control – Joining operation failure (Eco breaker mode, crusher mode) (Checking list) 1. CN-237 (#1) – CN-52 (#16) Checking Open/Short 2. CN-237 (#2) – Fuse box (#19) Checking Open/Short				
170	4	(Model Parameter) mounting Arm Regenerating Solenoid (Detection) (When Arm Regeneration Solenoid is Off) 10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Arm Regeneration Solenoid is Off) 3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Arm Regeneration Solenoid is On) 10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A (Cancellation) (When Arm Regeneration Solenoid is On) 3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A	●		
	(Results / symptoms) 1. Control Function – Arm regeneration operation failure (Checking list) 1. CN-135 (#1) – CN-52 (#07) Checking Open/Short 2. CN-135 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
171	4	Monitor – Selecting attachment(crusher) (Detection) (When Attachment Safety Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Safety Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Attachment Safety Solenoid is On) 10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A (Cancellation) (When Attachment Safety Solenoid is On) 3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – Option spool pilot pressure cut off failure (crusher mode) (Checking list) 1. CN-149 (#1) – CN-53 (#09) Checking Open/Short 2. CN-149 (#2) – Fuse box (#19) Checking Open/Short				
179	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Breaker Operating Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Breaker Operating Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Breaker Operating Solenoid is On) 10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A (Cancellation) (When Breaker Operating Solenoid is On) 3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode) (Checking list) 1. CN-66 (#1) – CN-52 (#08) Checking Open/Short 2. CN-66 (#2) – Fuse box (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
181 (N.A)	4	(Model Parameter) mounting Reverse Cooling Fan Solenoid (Detection) (When Reverse Cooling Fan Solenoid is Off) 10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Reverse Cooling Fan Solenoid is Off) 3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Reverse Cooling Fan Solenoid is On) 10 seconds continuous, Reverse Cooling Fan Solenoid drive current > 4.5 A (Cancellation) (When Reverse Cooling Fan Solenoid is On) 3 seconds continuous, Reverse Cooling Fan Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Cooling Fan reverse control operation failure (not applicable)				
188	5	(Detection) (When Pump P1 regulator EPPR current is equal or more than 300 mA) 10 seconds continuous, Pump P1 regulator EPPR drive current < 100 mA (Cancellation) (When Pump P1 regulator EPPR current is equal or more than 300 mA) 3 seconds continuous, Pump P1 regulator EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Pump P1 regulator EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Pump P1 regulator EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CN-242 (#2) – CN-54 (#27) Checking Open/Short 2. CN-242 (#1) – CN-54 (#02) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
189	5	(Detection) (When Pump P2 regulator EPPR current is equal or more than 300 mA) 10 seconds continuous, Pump P2 regulator EPPR drive current < 100 mA (Cancellation) (When Pump P2 regulator EPPR current is equal or more than 300 mA) 3 seconds continuous, Pump P2 regulator EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control operation failure (Checking list) 1. CN-243 (#2) – CN-54 (#26) Checking Open/Short 2. CN-243 (#1) – CN-54 (#03) Checking Open/Short				
196 (N.A)	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
	(Results / Symptoms) 1. Control Function – Driving second pump joining function operation failure (Checking list) 1. CD-93 (#B) – CN-52 (#34) Checking Open/Short 2. CD-93 (#A) – CN-51 (#32) Checking Open/Short 3. CD-93 (#C) – CN-51 (#31) Checking Open/Short				
200	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Pump EPPR Press. display failure 2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Fuel efficiency/speed performance failure) (Checking list) 1. CD-44 (#B) – CN-51 (#13) Checking Open/Short 2. CD-44 (#A) – CN-51 (#32) Checking Open/Short 3. CD-44 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205	0	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V	●		
	1	(Mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V	●		
	4	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Cylinder Rod Press. display failure 2. Control Function – Boom floating control operation failure (Checking list) 1. CD-124 (#B) – CN-52 (#25) Checking Open/Short 2. CD-124 (#A) – CN-51 (#32) Checking Open/Short 3. CD-124 (#C) – CN-51 (#31) Checking Open/Short				
218	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Up Floating Solenoid is On) 10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A (Cancellation) (When Boom Up Floating Solenoid is On) 3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-368 (#1) – CN-53 (#05) Checking Open/Short 2. CN-368 (#2) – Fuse box (#19) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
220	4	Mounting pressure sensor (HCESPN 128 or 205) (Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current > 6.5 A (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-369 (#1) – CN-53 (#08) Checking Open/Short 2. CN-369 (#2) – Fuse box (#19) Checking Open/Short				
221	5	Monitor – Selecting attachment(breaker / crusher) (Detection) (When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA (Cancellation) ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P1 relief pressure setting failure (Checking list) 1. CN-365 (#2) – CN-54 (#17) Checking Open/Short 2. CN-365 (#1) – CN-54 (#09) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
222	5	Monitor – Selecting attachment(crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P2 relief pressure setting failure (Checking list) 1. CN-366 (#2) – CN-54 (#17) Checking Open/Short 2. CN-366 (#1) – CN-54 (#10) Checking Open/Short				
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-51 (#19) Checking Open/Short 2. CD-2 (#1) – CN-51 (#25) Checking Open/Short				
325	4	(Model Parameter) mounting Fuel Warmer Relay (Detection) (When Fuel Warmer Relay is Off) 10 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Fuel Warmer Relay is Off) 3 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Fuel Warmer Relay is On) 10 seconds continuous, Fuel Warmer Relay drive current > 4.5 A (Cancellation) (When Fuel Warmer Relay is On) 3 seconds continuous, Fuel Warmer Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Fuel warmer operation failure (Checking list) 1. CR-46 (#85) – CN-52 (#13) Checking Open/Short 2. CR-46 (#86) – Fuse box (#22) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
501 (N.A)	0	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Transmission Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Transmission Oil Press. display failure, Transmission Oil low pressure warning failure (Checking list) 1. CD-5 (#B) – CN-52 (#26) Checking Open/Short 2. CD-5 (#A) – CN-51 (#32) Checking Open/Short 3. CD-5 (#C) – CN-51 (#31) Checking Open/Short				
503 (N.A)	0	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Brake Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Brake Oil Press. display failure, Brake Oil low pressure warning failure (Checking list) 1. CD-3 (#B) – CN-52 (#29) Checking Open/Short 2. CD-3 (#A) – CN-51 (#32) Checking Open/Short 3. CD-3 (#C) – CN-51 (#31) Checking Open/Short				
505 (N.A)	0	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Working Brake Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Working Brake Oil Press. display failure, Working Brake Oil low pressure warning failure (Checking list) 1. CD-38 (#B) – CN-51 (#30) Checking Open/Short 2. CD-38 (#A) – CN-51 (#32) Checking Open/Short 3. CD-38 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
514 (N.A)	4	(Detection) (When Parking Relay is Off) 10 seconds continuous, Parking Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Parking Relay is Off) 3 seconds continuous, Parking Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Parking Relay is On) 10 seconds continuous, Parking Relay drive current > 6.5 A (Cancellation) (When Parking Relay is On) 3 seconds continuous, Parking Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Parking Relay operation failure (Checking list) 1. CR-66 (#1) – CN-53 (#11) Checking Open/Short 2. CR-66 (#2) – Fuse box (#30) Checking Open/Short				
517 (N.A)	4	(Detection) (When Traveling Cutoff Relay is Off) 10 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Traveling Cutoff Relay is Off) 3 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Traveling Cutoff Relay is On) 10 seconds continuous, Traveling Cutoff Relay drive current > 6.5 A (Cancellation) (When Traveling Cutoff Relay is On) 3 seconds continuous, Traveling Cutoff Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Traveling Cutoff Relay operation failure (Checking list) 1. CR-47 (#85) – CN-53 (#04) Checking Open/Short 2. CR-47 (#86) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
525 (N.A)	4	(Detection) (When Ram Lock Solenoid is Off) 10 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Ram Lock Solenoid is Off) 3 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Ram Lock Solenoid is On) 10 seconds continuous, Ram Lock Solenoid drive current > 6.5 A (Cancellation) (When Ram Lock Solenoid is On) 3 seconds continuous, Ram Lock Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Ram lock control operation failure (Checking list) 1. CN-69 (#1) – CN-53 (#12) Checking Open/Short 2. CN-69 (#2) – Fuse box (#33) Checking Open/Short				
527 (N.A)	4	(Detection) (When Creep Solenoid is Off) 10 seconds continuous, Creep Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Creep Solenoid is Off) 3 seconds continuous, Creep Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Creep Solenoid is On) 10 seconds continuous, Creep Solenoid drive current > 6.5 A (Cancellation) (When Creep Solenoid is On) 3 seconds continuous, Creep Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Creep mode operation failure (Checking list) 1. CN-206 (#1) – CN-52 (#17) Checking Open/Short 2. CN-206 (#2) – Fuse box (#30) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
530 (N.A)	0	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Forward Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-73 (#B) – CN-51 (#20) Checking Open/Short 2. CD-73 (#A) – CN-51 (#32) Checking Open/Short 3. CD-73 (#C) – CN-51 (#31) Checking Open/Short				
531 (N.A)	1	10 seconds continuous, 0.3V≤ Travel Reverse Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Reverse Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Reverse Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-74 (#B) – CN-52 (#20) Checking Open/Short 2. CD-74 (#A) – CN-51 (#32) Checking Open/Short 3. CD-74 (#C) – CN-51 (#31) Checking Open/Short				
705	0	10 seconds continuous, Battery input Voltage > 35V	●		
	1	10 seconds continuous, Battery input Voltage < 18V	●		
	(Results / Symptoms) 1. Control Function – Startup impossibility (Checking list) 1. CS-74 (#1) – CN-51 (#01) Checking Open/Short				
707	1	(When Engine is equal or more than 400 rpm) 10 seconds continuous, Alternator Node I Measurement Voltage < 18V (In case 12v goods, Alternator Node I Measurement Voltage < 9V)	●		
	(Results / Symptoms) 1. Control Function – Battery charging circuit failure (Checking list) 1. CS-74 (#1) – CN-51 (#26) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
714 (N.A)	3	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V	●		
	4	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Acc. Dial Voltage display failure 2. Control Function – Engine rpm control failure (Checking list) 1. CN-7 (#15) – CN-52 (#33) Checking Open/Short				
722	4	(Detection) (When Travel Alarm (Buzzer) Sound is Off) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Alarm (Buzzer) Sound Relay is Off) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Travel Alarm (Buzzer) Sound is On) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A (Cancellation) (When Travel Alarm (Buzzer) Sound is On) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Driving alarm operation failure (Checking list) 1. CN-81 (#1) – CN-52 (#09) Checking Open/Short 2. CN-81 (#2) – Fuse box (#28) Checking Open/Short				
831	2	(When mounting the A/C Controller) 60 seconds continuous, A/C Controller Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – A/C Controller operation failure (Checking list) 1. CN-11 (#8) – CN-51 (#09) Checking Open/Short 2. CN-11 (#7) – CN-51 (#08) Checking Open/Short				
840	2	60 seconds continuous, Cluster Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Cluster operation failure (Checking list) 1. CN-56A (#5) – CN-52 (#01) Checking Open/Short 2. CN-56A (#4) – CN-52 (#02) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
841	2	10 seconds continuous, ECU Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – ECU operation failure (Checking list) 1. CN-93 (#22) – CN-52 (#02) Checking Open/Short 2. CN-93 (#46) – CN-52 (#01) Checking Open/Short				
848	2	(When mounting the Jog dial module) 60 seconds continuous, Jog dial module Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Jog dial module operation failure (Checking list) 1. CN-363 (#4) – CN-51 (#09) Checking Open/Short 2. CN-363 (#10) – CN-51 (#08) Checking Open/Short				
850	2	(When mounting the RMCU) 60 seconds continuous, RMCU communication Data Error	●		
	(Resuluts / Symptoms) 1. Control Function – RMCU operation failure (Checking list) 1. CN-125A (#3) – CN-51 (#09) Checking Open/Short 2. CN-125A (#11) – CN-51 (#08) Checking Open/Short				
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
	(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-9 (#5) – CN-51 (#09) Checking Open/Short 2. CN-9 (#6) – CN-51 (#08) Checking Open/Short				
867	2	60 seconds continuous, RDU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#09) Checking Open/Short 2. CN-376 (#18) – CN-51 (#08) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#6) – CN-51 (#08) Checking Open/Short 2. CN-56A (#7) – CN-51 (#09) Checking Open/Short				
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#08) Checking Open/Short 2. CS-2B (#B) – CN-51 (#09) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

Fault code J1939 SPN J1939 FMI	Item	Description
111 629 12	Engine control module critical internal failure	Bad intelligent device or component
122 102 3	Intake manifold 1 pressure sensor circuit	Voltage above normal, or shorted to high source
123 102 4	Intake manifold 1 pressure sensor circuit	Voltage below normal, or shorted to low source
133 974 3	Remote accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
134 974 4	Remote accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
135 100 3	Engine oil rifle pressure 1 sensor circuit	Voltage above normal, or shorted to high source
141 100 4	Engine oil rifle pressure 1 sensor circuit	Voltage below normal, or shorted to low source
143 100 18	Engine oil rifle pressure	Data valid but below normal operating range - moderately severe level
144 110 3	Engine coolant temperature 1 sensor circuit	Voltage above normal, or shorted to high source
145 110 4	Engine coolant temperature 1 sensor circuit	Voltage below normal, or shorted to low source
146 110 16	Engine coolant temperature	Data valid but above normal operating range - moderately severe level
147 91 1	Accelerator pedal or lever position 1 sensor circuit frequency	Data valid but below normal operating range
148 91 0	Accelerator pedal or lever position sensor 1	Data valid but above normal operational range - most severe level
151 110 0	Engine coolant temperature	Data valid but above normal operational range - most severe level
153 105 3	Intake manifold 1 temperature sensor circuit	Voltage above normal, or shorted to high source
154 105 4	Intake manifold 1 temperature sensor circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
187 3510 4	Sensor supply 2 circuit	Voltage below normal, or shorted to low source
197 111 18	Coolant level	Data valid but below normal operating range - moderately severe level
227 3510 3	Sensor supply 2 circuit	Voltage above normal, or shorted to high source
234 190 0	Engine crankshaft speed/position	Data valid but above normal operational range - most severe level
235 111 1	Coolant level	Data valid but below normal operational range - most severe level
237 644 2	External speed command input (Multiple unit synchronization)	Data erratic, intermittent or incorrect
238 3511 4	Sensor supply 3 circuit	Voltage below normal, or shorted to low source
239 3511 3	Sensor supply 3 circuit	Voltage above normal, or shorted to high source
241 84 2	Wheel-based vehicle speed	Data erratic, intermittent or incorrect
242 84 10	Wheel-based vehicle speed sensor circuit tampering has been detected	Abnormal rate of change
271 1347 4	Engine fuel pump pressurizing assembly 1 circuit	Voltage below normal, or shorted to low source
272 1347 3	Engine fuel pump pressurizing assembly 1 circuit	Voltage above normal, or shorted to high source
285 639 9	SAE J1939 multiplexing pgn timeout error	Abnormal update rate
286 639 13	SAE J1939 multiplexing configuration error	Out of calibration
288 974 19	SAE J1939 multiplexing remote accelerator pedal or lever position sensor system	Received network data in error
293 441 3	Auxiliary temperature sensor input 1 circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
294 441 4	Auxiliary temperature sensor input 1 circuit	Voltage below normal, or shorted to low source
297 1388 3	Auxiliary pressure sensor input 2 circuit	Voltage above normal, or shorted to high source
298 1388 4	Auxiliary pressure sensor input 2 circuit	Voltage below normal, or shorted to low source
322 651 5	Injector solenoid driver cylinder 1 circuit	Current below normal or open circuit
323 655 5	Injector solenoid driver cylinder 5 circuit	Current below normal or open circuit
324 653 5	Injector solenoid driver cylinder 3 circuit	Current below normal or open circuit
325 656 5	Injector solenoid driver cylinder 6 circuit	Current below normal or open circuit
331 652 5	Injector solenoid driver cylinder 2 circuit	Current below normal or open circuit
332 654 5	Injector solenoid driver cylinder 4 circuit	Current below normal or open circuit
334 110 2	Engine coolant temperature	Data erratic, intermittent or incorrect
343 629 12	Engine control module warning internal hardware failure	Bad intelligent device or component
349 191 16	Transmission output shaft speed	Data valid but above normal operating range - moderately severe level
351 3597 12	Injector power supply	Bad intelligent device or component
352 3509 4	Sensor supply 1 circuit	Voltage below normal, or shorted to low source
386 3509 3	Sensor supply 1 circuit	Voltage above normal, or shorted to high source
415 100 1	Engine oil rifle pressure	Data valid but below normal operational range - most severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
418 97 15	Water in fuel indicator	Data valid but above normal operating range - least severe level
428 97 3	Water in fuel indicator sensor circuit	Voltage above normal, or shorted to high source
429 97 4	Water in fuel indicator sensor circuit	Voltage below normal, or shorted to low source
431 558 2	Accelerator pedal or lever idle validation switch	Data erratic, intermittent or incorrect
432 558 13	Accelerator pedal or lever idle validation switch circuit	Out of calibration
435 100 2	Engine oil rifle pressure	Data erratic, intermittent or incorrect
451 157 3	Injector metering rail 1 pressure sensor circuit	Voltage above normal, or shorted to high source
452 157 4	Injector metering rail 1 pressure sensor circuit	Voltage below normal, or shorted to low source
483 1349 3	Injector metering rail 2 pressure sensor circuit	Voltage above normal, or shorted to high source
484 1349 4	Injector metering rail 2 pressure sensor circuit	Voltage below normal, or shorted to low source
488 105 16	Intake manifold 1 temperature	Data valid but above normal operating range - moderately severe level
489 191 18	Transmission output shaft speed	Data valid but below normal operating range - moderately severe level
497 1377 2	Multiple unit synchronization switch	Data erratic, intermittent or incorrect
515 3514 3	Sensor supply 6 circuit	Voltage above normal, or shorted to high source
516 3514 4	Sensor supply 6 circuit	Voltage below normal, or shorted to low source
527 702 3	Auxiliary input/output 2 circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
529 703 3	Auxiliary input/output 3 circuit	Voltage above normal, or shorted to high source
553 157 16	Injector metering rail 1 pressure	Data valid but above normal operating range - moderately severe level
555 101 16	Crankcase pressure	Data valid but above normal operating range - moderately severe level
556 101 0	Crankcase pressure	Data valid but above normal operational range - most severe level
559 157 18	Injector metering rail 1 pressure	Data valid but below normal operating range - moderately severe level
584 677 3	Starter relay driver circuit	Voltage above normal, or shorted to high source
585 677 4	Starter relay driver circuit	Voltage below normal, or shorted to low source
595 103 16	Turbocharger 1 speed	Data valid but above normal operating range - moderately severe level
599 640 14	Auxiliary commanded dual output shutdown	Special instructions
611 1383 31	Engine shut down hot	Condition exists
649 1378 31	Engine oil change interval	Condition exists
687 103 18	Turbocharger 1 speed	Data valid but below normal operating range - moderately severe level
689 190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect
691 1172 3	Turbocharger 1 compressor intake temperature circuit	Voltage above normal, or shorted to high source
692 1172 4	Turbocharger 1 compressor intake temperature circuit	Voltage below normal, or shorted to low source
693 1172 7	Turbocharger 1 compressor intake temperature	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
731 723 7	Engine speed / position camshaft and crankshaft misalignment	Mechanical system not responding or out of adjustment
741 1176 3	Turbocharger 1 compressor intake pressure circuit	Voltage above normal, or shorted to high source
742 1176 4	Turbocharger 1 compressor intake pressure circuit	Voltage below normal, or shorted to low source
743 1176 2	Turbocharger 1 compressor intake pressure	Data erratic, intermittent or incorrect
769 597 3	Brake switch circuit	Voltage above normal, or shorted to high source
771 597 4	Brake switch circuit	Voltage below normal, or shorted to low source
778 723 2	Engine camshaft speed / position sensor	Data erratic, intermittent or incorrect
1117 3597 2	Power supply lost with ignition on	Data erratic, intermittent or incorrect
1239 2623 3	Accelerator pedal or lever position sensor 2 circuit	Voltage above normal, or shorted to high source
1241 2623 4	Accelerator pedal or lever position sensor 2 circuit	Voltage below normal, or shorted to low source
1242 91 2	Accelerator pedal or lever position sensor 1	Data erratic, intermittent or incorrect
1358 91 3	Accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
1359 91 4	Accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
1515 91 19	SAE J1939 multiplexed accelerator pedal or lever sensor system	Received network data in error
1539 1387 3	Auxiliary pressure sensor input 1 circuit	Voltage above normal, or shorted to high source
1621 1387 4	Auxiliary pressure sensor input 1 circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
1668 1761 4	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage below normal, or shorted to low source
1669 1761 3	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage above normal, or shorted to high source
1673 1761 1	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operational range -most severe level
1677 3031 4	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage below normal, or shorted to low source
1678 3031 3	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage above normal, or shorted to high source
1679 3031 2	Aftertreatment 1 diesel exhaust fluid tank temperature	Data erratic, intermittent or incorrect
1682 3362 31	Aftertreatment 1 diesel exhaust fluid dosing unit input lines	Condition exists
1685 3364 4	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage below normal, or shorted to low source
1686 3364 3	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage above normal, or shorted to high source
1695 3513 3	Sensor supply 5	Voltage above normal, or shorted to high source
1696 3513 4	Sensor supply 5	Voltage below normal, or shorted to low source
1713 3363 16	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but above normal operating range - moderately severe level
1714 3364 13	Aftertreatment diesel exhaust fluid quality	Out of calibration
1715 3364 11	Aftertreatment diesel exhaust fluid quality	Root cause not known
1843 101 3	Crankcase pressure circuit	Voltage above normal, or shorted to high source
1844 101 4	Crankcase pressure circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
1852 97 16	Water in fuel indicator	Data valid but above normal operating range - moderately severe level
1879 3251 3	Aftertreatment diesel particulate filter differential pressure sensor circuit	Voltage above normal
1881 3251 4	Aftertreatment diesel particulate filter differential pressure sensor circuit	Voltage below normal
1883 3251 2	Aftertreatment diesel particulate filter differential pressure sensor	Data erratic, intermittent or incorrect
1885 3216 4	Aftertreatment 1 intake NOx sensor circuit	Voltage below normal, or shorted to low source
1887 3226 4	Aftertreatment 1 outlet NOx sensor circuit	Voltage below normal, or shorted to low source
1898 641 13	VGT actuator controller	Out of calibration
1921 3251 16	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
1922 3251 0	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
1976 641 15	VGT actuator driver over temperature (calculated)	Data valid but above normal operating range - least severe level
1993 4795 31	Aftertreatment 1 diesel particulate filter missing	Condition exists
2185 3512 3	Sensor supply 4 circuit	Voltage above normal, or shorted to high source
2186 3512 4	Sensor supply 4 circuit	Voltage below normal, or shorted to low source
2198 641 11	VGT actuator driver circuit	Root cause not known
2311 633 31	Electronic fuel injection control valve circuit	Condition exists
2321 190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
2322 723 2	Engine camshaft speed / position sensor	Data erratic, intermittent or incorrect
2373 1209 3	Exhaust gas pressure sensor 1 circuit	Voltage above normal, or shorted to high source
2374 1209 4	Exhaust gas pressure sensor 1 circuit	Voltage below normal, or shorted to low source
2387 641 7	VGT actuator driver circuit (motor)	Mechanical system not responding or out of adjustment
2448 111 17	Coolant level	Data valid but below normal operating range - least severe level
2468 190 16	Engine speed	Engine crankshaft speed/position - data valid but above normal operating range - moderately severe level
2554 1209 2	Exhaust gas pressure 1	Data erratic, intermittent or incorrect
2557 697 3	Auxiliary PWM driver 1 circuit	Voltage above normal, or shorted to high source
2558 697 4	AuxiliaryPWM driver 1 circuit	Voltage below normal, or shorted to low source
2571 2630 3	Engine charge air cooler outlet temperature	Voltage above normal, or shorted to high source
2572 2630 4	Engine charge air cooler outlet temperature	Voltage below normal, or shorted to low source
2634 641 12	VGT actuator controller	Bad intelligent device or component
2636 641 9	VGT actuator driver circuit	Abnormal update rate
2638 5298 17	Aftertreatment 1 diesel oxidation catalyst conversion efficiency	Data valid but below normal operating range - moderately severe level
2639 3251 15	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
2771 3226 9	Aftertreatment 1 outlet NOx sensor	Abnormal update rate

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
2778 3481 16	Aftertreatment fuel rate	Data valid but above normal operating range - moderately severe level
2973 102 2	Intake manifold 1 pressure	Data erratic, intermittent or incorrect
3133 3610 3	Aftertreatment 1 diesel particulate filter outlet pressure sensor circuit	Voltage above normal, or shorted to high source
3134 3610 4	Aftertreatment 1 diesel particulate filter outlet pressure sensor circuit	Voltage below normal, or shorted to low source
3135 3610 2	Aftertreatment 1 diesel particulate filter outlet pressure	Data erratic, intermittent or incorrect
3139 3667 3	Engine air shutoff circuit	Voltage above normal, or shorted to high source
3141 3667 4	Engine air shutoff circuit	Voltage below normal, or shorted to low source
3142 4360 3	Aftertreatment 1 SCR intake temperature sensor circuit	Voltage above normal, or shorted to high source
3144 4360 2	Aftertreatment 1 SCR intake temperature sensor	Data erratic, intermittent or incorrect
3146 4363 3	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage above normal, or shorted to high source
3147 4363 4	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage below normal, or shorted to low source
3148 4363 2	Aftertreatment 1 SCR outlet temperature sensor	Data erratic, intermittent or incorrect
3151 4974 31	Aftertreatment 1 SCR catalyst system missing	Condition exists
3165 4363 0	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operational range - most severe
3232 3216 9	Aftertreatment 1 intake NOx sensor	Abnormal update rate
3235 4363 16	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operating range - moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3251 4765 16	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data valid but above normal operating range
3253 3242 16	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operating range
3255 3246 16	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operating range
3311 3242 0	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operation
3312 3246 0	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operation
3313 4765 4	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage below normal, or shorted to low source
3314 4765 3	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage above normal, or shorted to high source
3315 4765 2	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data erratic, intermittent or incorrect
3316 3242 4	Aftertreatment 1 diesel particulate filter intake temperature sensor circuit	Voltage below normal, or shorted to low source
3317 3242 3	Aftertreatment 1 diesel particulate filter intake temperature sensor circuit	Voltage above normal, or shorted to high source
3318 3242 2	Aftertreatment 1 diesel particulate filter intake temperature	Data erratic, intermittent or incorrect
3319 3246 3	Aftertreatment 1 diesel particulate filter outlet temperature sensor circuit	Voltage above normal, or shorted to high source
3321 3246 4	Aftertreatment 1 diesel particulate filter outlet temperature sensor circuit	Voltage below normal, or shorted to low source
3322 3246 2	Aftertreatment 1 diesel particulate filter outlet temperature	Data erratic, intermittent or incorrect
3326 91 9	SAE J1939 multiplexed accelerator pedal or lever sensor system	Abnormal update rate
3341 107 16	Engine air filter differential pressure - data valid but above normal operating range	Moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3375 5397 31	Aftertreatment diesel particulate filter regeneration too frequent	Condition exists
3376 5319 31	Aftertreatment diesel particulate filter incomplete regeneration	Condition exists
3419 5125 3	Sensor supply 7 circuit	Voltage above normal, or shorted to high source
3421 5125 4	Sensor supply 7 circuit	Voltage below normal, or shorted to low source
3497 1761 17	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - least severe level
3498 1761 18	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - moderately severe level
3527 558 19	Accelerator pedal or lever idle validation switch	Received network data in error
3528 558 9	Accelerator pedal or lever idle validation switch	Abnormal update rate
3542 51 2	Engine intake throttle actuator position sensor	Data erratic, intermittent, or incorrect
3545 3226 31	Aftertreatment 1 outlet NOx sensor	Abnormal rate of change
3547 4096 31	Aftertreatment diesel exhaust fluid tank empty	Condition exists
3558 3361 3	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage above normal, or shorted to high source
3559 3361 4	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage below normal, or shorted to low source
3565 5394 3	Aftertreatment 1 diesel exhaust fluid dosing valve 1 circuit	Voltage above normal or shorted to high source
3567 5394 5	Aftertreatment diesel exhaust fluid dosing valve	Current below normal or open circuit
3568 5394 7	Aftertreatment diesel exhaust fluid dosing valve	Mechanical system not responding or out of adjustment

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3571 4334 3	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage above normal, or shorted to high source
3572 4334 4	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage below normal, or shorted to low source
3574 4334 18	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but below normal operating range
3575 4334 16	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but above normal operating range
3583 5031 10	Aftertreatment 1 outlet nox sensor heater	Abnormal rate of change
3596 4334 2	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data erratic, intermittent or incorrect
3641 748 9	Transmission output retarder	Abnormal update rate
3649 5024 10	Aftertreatment 1 intake NOx sensor heater	Abnormal rate of change
3681 3228 2	Aftertreatment 1 outlet NOx sensor power supply	Data erratic, intermittent or incorrect
3682 3218 2	Aftertreatment 1 intake NOx sensor power supply	Data erratic, intermittent or incorrect
3697 630 12	Engine control module calibration memory	Bad intelligent device or component
3712 5246 0	Aftertreatment SCR operator inducement	Data valid but above normal operational range - most severe level
3714 1569 31	Engine protection torque derate	Condition exists
3725 3216 10	Aftertreatment 1 intake NOx sensor	Abnormal rate of change
3727 5571 7	High pressure common rail fuel pressure relief valve	Mechanical system not responding or out of adjustment
3737 1675 31	Engine starter mode overcrank protection	Condition exists

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3741 5571 0	High pressure common rail fuel pressure relief valve	Data valid but above normal operational range
3748 3216 20	Aftertreatment 1 intake NOx sensor	Data not rational - drifted high
3765 442 3	Auxiliary temperature sensor input 2 circuit	Voltage above normal, or shorted to high source
3766 442 4	Auxiliary temperature sensor input 2 circuit	Voltage below normal, or shorted to low source
3838 2978 9	Estimated engine parasitic losses - percent torque	Abnormal update rate
3841 596 2	Cruise control enable switch	Data erratic, intermittent or incorrect
3843 5603 9	Cruise control disable command	Abnormal update rate
3845 5603 31	Cruise control disable command	Condition exists
3866 3364 1	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operational range - most severe level
3868 3364 9	Aftertreatment diesel exhaust fluid quality	Abnormal update rate
3878 3364 2	Aftertreatment diesel exhaust fluid quality	Data erratic, intermittent or incorrect
4151 5742 9	Aftertreatment diesel particulate filter temperature sensor module	Abnormal update rate
4152 5743 9	Aftertreatment selective catalytic reduction temperature sensor module	Abnormal update rate
4158 5742 12	Aftertreatment diesel particulate filter temperature sensor module	Bad intelligent device or component
4159 5743 12	Aftertreatment selective catalytic reduction temperature sensor module	Bad intelligent device or component
4161 5742 3	Aftertreatment diesel particulate filter temperature sensor module	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4162 5742 4	Aftertreatment diesel particulate filter temperature sensor module	Voltage below normal, or shorted to low source
4163 5742 16	Aftertreatment diesel particulate filter temperature sensor module	Data valid but above normal operating range
4164 5743 3	Aftertreatment selective catalytic reduction temperature sensor module	Voltage above normal, or shorted to high source
4165 5743 4	Aftertreatment selective catalytic reduction temperature sensor module	Voltage below normal, or shorted to low source
4166 5743 16	Aftertreatment selective catalytic reduction temperature sensor module	Data valid but above normal
4259 5742 11	Aftertreatment diesel particulate filter temperature sensor module	Root cause not known
4261 5743 11	Aftertreatment selective catalytic reduction temperature sensor module	Root cause not known
4262 5571 3	High pressure common rail fuel pressure relief valve	Voltage above normal, or shorted to high source
4263 5571 4	High pressure common rail fuel pressure relief valve	Voltage below normal, or shorted to low source
4265 5571 11	High pressure common rail fuel pressure relief valve	Root cause not known
4277 3364 10	Aftertreatment diesel exhaust fluid quality	Abnormal rate of change
4284 5793 9	Desired engine fueling state	Abnormal update rate
4452 3226 7	Aftertreatment 1 outlet NOx sensor closed loop operation	Condition exists
4484 3667 7	Engine air shutoff	Mechanical system not responding or out of Adjustment
4526 521 2	Brake pedal position	Data erratic, intermittent or incorrect
4572 3031 9	Aftertreatment 1 diesel exhaust fluid tank temperature	Abnormal update rate

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4584 3936 14	Aftertreatment diesel particulate filter system	Special instructions
4585 4792 14	Aftertreatment 1 SCR catalyst system	Special instructions
4677 1761 9	SAE J1939 multiplexing pgn timeout error	Abnormal update rate
4724 702 5	Auxiliary input/output 2 circuit	Current below normal or open circuit
4725 702 6	Auxiliary input/output 2 circuit	Current above normal or grounded circuit
4731 3031 13	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Out of calibration
4734 701 14	Auxiliary input/output 1	Special instructions
4737 3031 11	Aftertreatment 1 diesel exhaust fluid tank temperature	Root cause not known
4739 1761 11	Aftertreatment 1 diesel exhaust fluid tank level sensor	Root cause not known
4747 3217 20	Aftertreatment intake oxygen sensor	Data not rational - drifted high
4748 3217 21	Aftertreatment intake oxygen sensor	Data not rational - drifted low
4749 3227 20	Aftertreatment outlet oxygen	Data not rational - drifted high
4751 3227 21	Aftertreatment outlet oxygen	Data not rational - drifted low
4768 3521 11	Aftertreatment 1 diesel exhaust fluid property	Root cause not known
4769 1761 10	Aftertreatment 1 diesel exhaust fluid tank level sensor	Abnormal rate of change
4842 3364 15	Aftertreatment diesel exhaust fluid quality	Data valid but above normal operating range - Least severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4863 5245 31	Aftertreatment diesel exhaust fluid tank low level indicator	-
4953 3353 3	Alternator 1 status	Voltage above normal, or shorted to high source
4954 3353 4	Alternator 1 status	Voltage below normal, or shorted to low source
4956 6713 13	Variable geometry turbocharger actuator software	Out of calibration
4957 6713 31	Variable geometry turbocharger actuator software	Condition exists
5177 6713 9	VGT actuator driver circuit	Abnormal update rate
5248 1623 13	Tachograph output shaft speed	Out of calibration
5292 520809 31	Excessive time since last engine air shutoff maintenance test	Condition exists
5383 3720 15	Aftertreatment 1 diesel particulate filter ash load percent	Data valid but above normal operating range - least severe level
5576 107 15	Engine air filter differential pressure	Data valid but above normal operating range - least severe level
5632 6918 31	SCR system cleaning inhibited due to inhibit switch	Condition exists
5652 1209 15	Exhaust pressure 1	Data valid but above normal operating range - least severe level
5653 6881 9	SCR operator inducement override switch	Abnormal update rate
5654 6881 13	SCR operator inducement override switch	Out of calibration
5655 4364 31	Aftertreatment 1 scr conversion efficiency	Condition exists
5689 3226 11	Aftertreatment 1 outlet nox sensor	Root cause not known

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
5715 3521 10	Aftertreatment 1 diesel particulate filter differential pressure	Abnormal rate of change
5716 3610 10	Aftertreatment 1 diesel particulate filter outlet pressure	Abnormal rate of change
5864 4375 3	Aftertreatment 1 diesel exhaust fluid pump command circuit	Voltage above normal or shorted to high source
5865 4375 4	Aftertreatment 1 diesel exhaust fluid pump command circuit	Voltage below normal or shorted to low source
5866 520953 3	Aftertreatment diesel exhaust fluid dosing unit relay feedback	Voltage above normal or shorted to high source
5867 520953 4	Aftertreatment diesel exhaust fluid dosing unit relay feedback	Voltage below normal or shorted to low source.
5868 4339 7	Aftertreatment 1 scr feedback control status	Mechanical system not responding or out of adjustment
5879 3464 3	Electronic throttle control actuator driver circuit	Voltage above normal or shorted to high source
5881 3464 4	Electronic throttle control actuator driver circuit	Voltage below normal or shorted to low source
5935 4334 7	Aftertreatment 1 diesel exhaust fluid pressure	Mechanical system not responding or out of adjustment
5936 4334 15	Aftertreatment 1 diesel exhaust fluid pressure	Data valid but above normal operating range - least severe level
5938 3750 14	Aftertreatment 1 diesel particulate filter conditions not met for active regeneration	Special instructions
5939 520968 9	Machine constrained operation	Abnormal update rate. No communication or an Invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine
5941 520968 19	Machine constrained operation	Received network data in error. The received J1939 datalink message was not valid.
6256 168 15	Battery 1 voltage	Data valid but below normal operating range - moderately severe level
6257 168 17	Battery 1 voltage	Data valid but below normal operating range - moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6263 647 3	Fan control circuit	Voltage above normal, or shorted to high source
6264 647 4	Fan control circuit	Voltage below normal, or shorted to low source
6456 5484 3	Engine fan clutch 2 control circuit	Voltage above normal, or shorted to high source
6457 5484 4	Engine fan clutch 2 control circuit	Voltage below normal, or shorted to low source
6467 1639 15	Fan speed	Data valid but above normal operational range - most severe level
6468 1639 17	Fan speed	Data valid but below normal operational range - most severe level
6471 6799 3	Fan blade pitch position sensor circuit	Voltage above normal, or shorted to high source
6472 6799 4	Fan blade pitch position sensor circuit	Voltage below normal, or shorted to low source
6475 3363 7	Aftertreatment 1 diesel exhaust fluid tank heater	Mechanical system not responding or out of adjustment
6476 3363 18	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but below normal operating range - moderately severe level
6477 5491 3	Aftertreatment diesel exhaust fluid line heater relay	Voltage above normal, or shorted to high source
6478 5491 4	Aftertreatment diesel exhaust fluid line heater relay	Voltage below normal, or shorted to low source
6479 3363 3	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage above normal, or shorted to high source
6481 3363 4	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage below normal, or shorted to low source
6497 51 3	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to high source
6498 51 4	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6499 3597 17	ECU power output supply voltage 1	Data valid but below normal operating range - moderately severe level
6511 6655 3	Maintain ECM power lamp	Voltage above normal, or shorted to high source
6512 6655 4	Maintain ECM power lamp	Voltage below normal, or shorted to low source
6513 5745 17	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Data valid but below normal operating range
6522 111 3	Coolant level sensor 1 circuit	Voltage above normal, or shorted to high source
6523 111 4	Coolant level sensor 1 circuit	Voltage below normal, or shorted to low source
6526 1761 13	Aftertreatment 1 diesel exhaust fluid tank level sensor	Out of calibration
6531 4340 3	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage above normal, or shorted to high source
6532 4340 4	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage below normal, or shorted to low source
6533 4342 3	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage above normal, or shorted to high source
6534 4342 4	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage below normal, or shorted to low source
6535 4344 3	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage above normal, or shorted to high source
6536 4344 4	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage below normal, or shorted to low source
6556 729 3	Engine intake air heater 1 circuit	Voltage above normal, or shorted to high source
6557 729 4	Engine intake air heater 1 circuit	Voltage below normal, or shorted to low source
6563 976 2	Auxiliary intermediate (PTO) speed switch validation	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

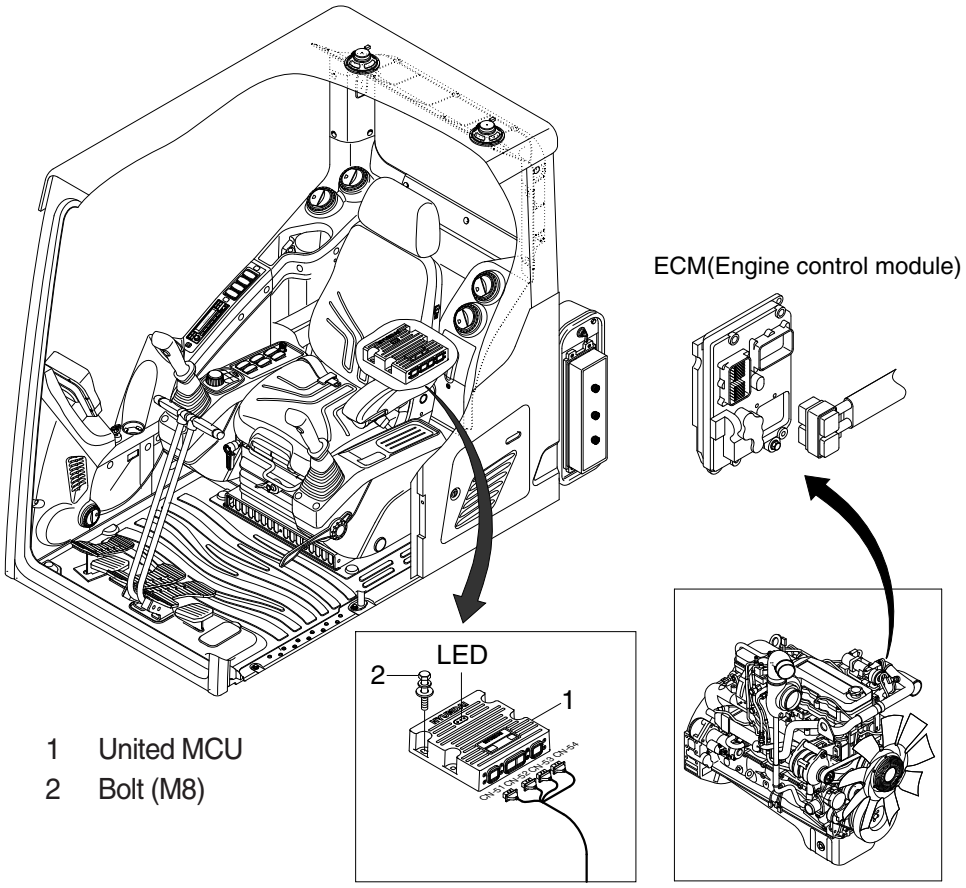
Fault code J1939 SPN J1939 FMI	Item	Description
6568 3695 2	Aftertreatment regeneration inhibit switch	Data erratic, intermittent or incorrect
6583 441 14	Auxiliary temperature sensor input 1	Special instructions
6584 1388 14	Auxiliary pressure sensor input 2	Special instructions
6595 190 11	Engine speed	Root cause not known
6596 3713 31	Diesel particulate filter active regeneration inhibited due to system timeout	Condition exists
6599 521002 31	Engine cranks slowly	Condition exists
6611 6385 3	Engine starter motor relay control circuit	Voltage above normal or shorted to high source
6612 6385 4	Engine starter motor relay control circuit	Voltage below normal or shorted to low source
6613 5842 14	SCR monitoring system malfunction	Special instructions
6618 70 2	Parking brake switch	Data erratic, intermittent, or incorrect
6619 3515 10	Aftertreatment 1 diesel exhaust fluid temperature 2	Abnormal rate of change
6726 4796 31	Aftertreatment 1 diesel oxidation catalyst missing	Condition exists
6752 3364 18	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operating range - moderately severe level
6771 521032 14	Aftertreatment system assembly	Special instructions
6938 5793 9	Desired engine fueling state	Abnormal update rate
6939 7745 9	Engine start request	Abnormal update rate

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
7133 7745 13	Engine start request	Out of calibration
7134 7746 13	Engine start consent	Out of calibration
7135 103 15	Engine turbocharger speed	Data valid but above normal operating range - least severe level
7745 1569 14	Engine protection torque derate	Special instructions
7393 7745 9	Engine start request	Abnormal update rate
7453 3242 15	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operating range - least severe level
7454 3246 15	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operating range - least severe level

※ Some fault codes are not applied to this machine.

1. UNITED MCU AND ENGINE ECM



300A5MS13

2. UNITED MCU ASSEMBLY

1) To match the pump absorption torque with the engine torque, united 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 united united MCU display as below.

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

G : green, R : red, Y : yellow

GROUP 15 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

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

(1) Electro magnet valve

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

(2) Spool valve

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

(3) Pressure and electric current value for each mode

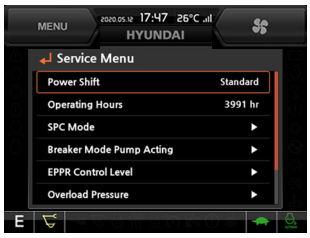
Mode		Pressure		Electric current (mA)	Engine rpm (at multimodal dial 10)	
		kgf/cm²	psi		No load	load
Standard	P	3	43	290 ± 30	1800 ± 50	1900 ± 50
	S	10 ± 3	142 ± 43	330 ± 30	1700 ± 50	1800 ± 50
	E	12 ± 3	171 ± 43	360 ± 30	1600 ± 50	1700 ± 50
Option	P	3	43	190 ± 30	1900 ± 50	1900 ± 50
	S	5 ± 3	71 ± 43	250 ± 30	1800 ± 50	1800 ± 50
	E	7 ± 3	100 ± 43	280 ± 30	1700 ± 50	1700 ± 50

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

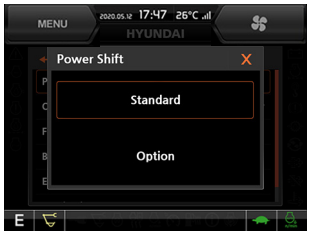
You can switch the EPPR valve pressure set by selecting the power shift (standard ↔ option).

- Management
  · Service menu

300A3CD105A



300A3CD106A

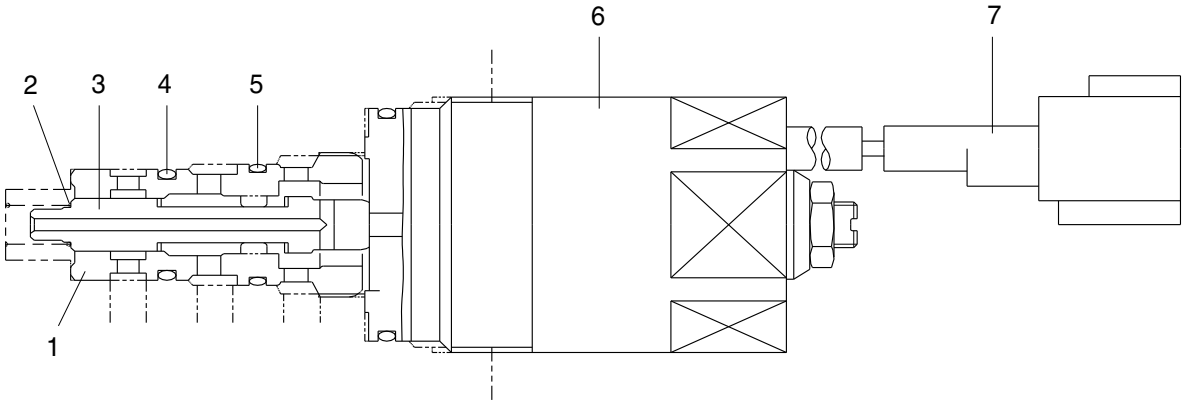


300A3CD107A

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

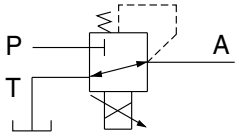
3) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



5-22(1)

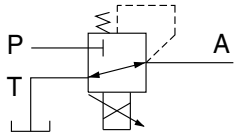
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

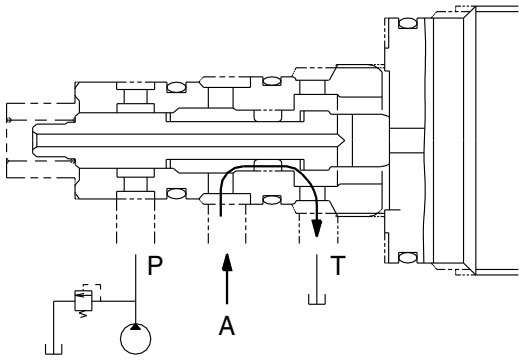


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

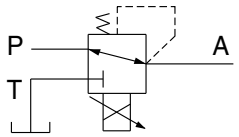
Pressure line is blocked and A oil returns to tank.

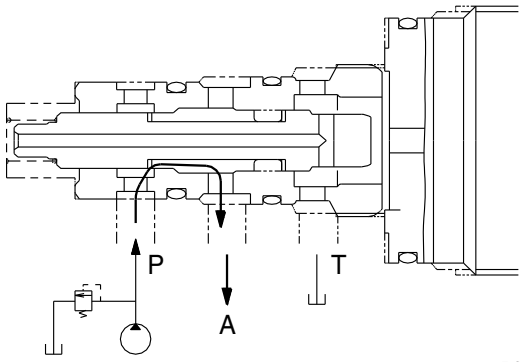




(3) Operating

Secondary pressure enters into A.





5-22(2)

4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-75 from EPPR valve.

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

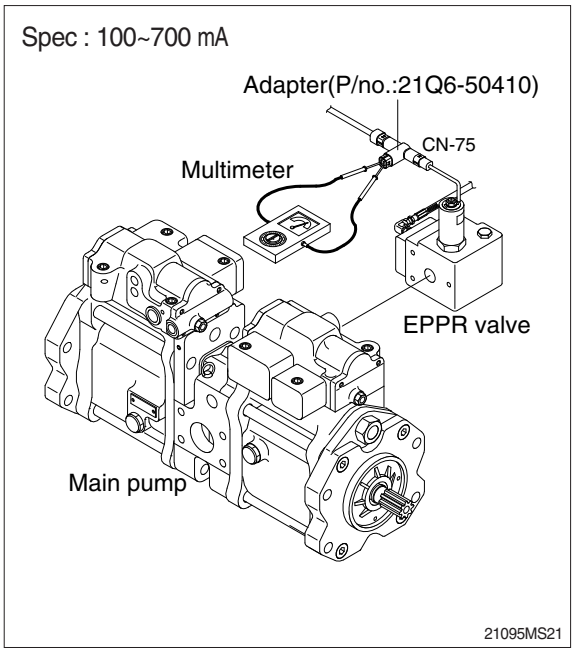
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If rpm display show approx 1700±50 rpm check electric current at bucket circuit relief position.

⑦ Check electric current at bucket circuit relief position.



(2) Check pressure at EPPR valve

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

② Start engine.

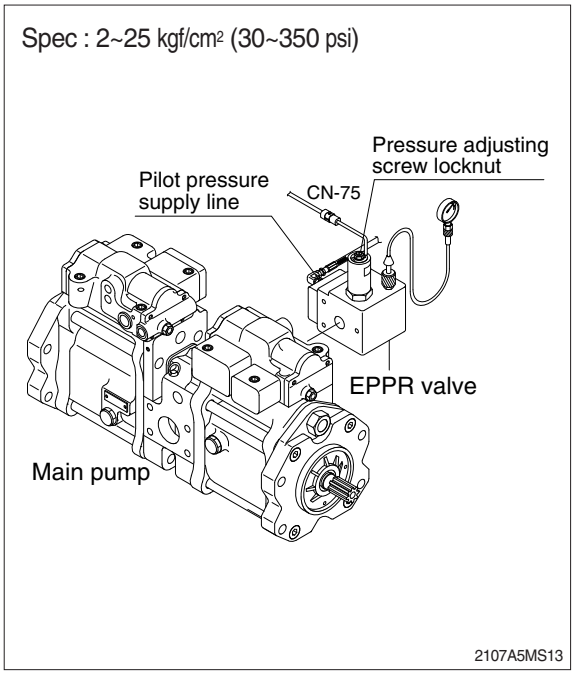
③ Set S-mode and cancel auto decel mode.

④ Position the multimodal dial at 10.

⑤ If tachometer show approx 1700±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

⑦ After adjust, test the machine.



2. BOOM PRIORITY EPPR VALVE

1) COMPOSITION

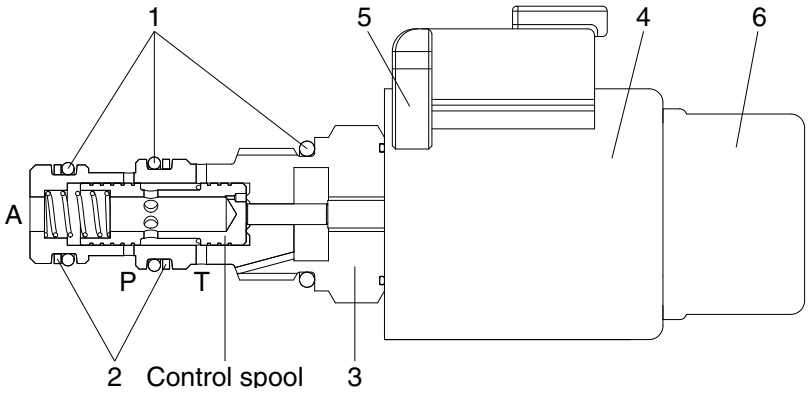
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

2) CONTROL

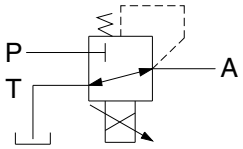
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at 30Ω and 24 V.

3) OPERATING PRINCIPLE

(1) Structure



21095MS14



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

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

(2) Operation

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

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

(3) Maximum pressure relief

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

2) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-133 from EPPR valve.

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

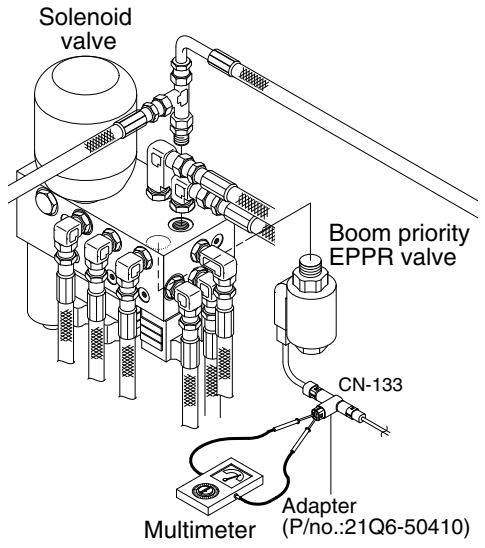
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ If rpm display approx 1700±50 rpm disconnect one wire harness from EPPR valve.

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

Spec : 400~600 mA
(combined boom up and swing operation)



300A5MS15

(2) Check pressure at EPPR valve

① Remove hose from A5 port and connect pressure gauge as figure.
· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)

② Start engine.

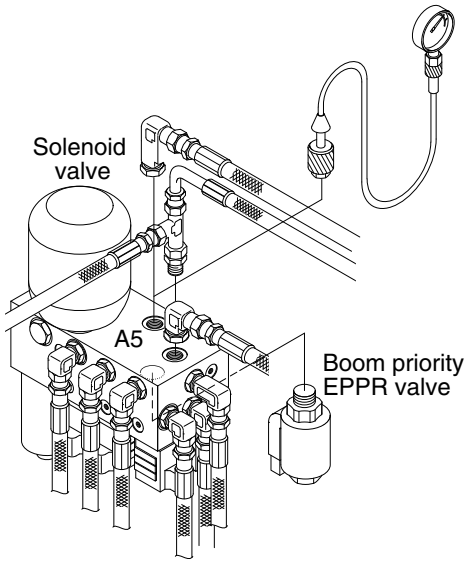
③ Set S-mode and cancel auto decel mode.

④ If rpm display approx 1700±50 rpm check pressure (In case of combined boom up and swing operation).

⑤ If pressure is not correct, adjust it.

⑥ After adjust, test the machine.

Spec : 12~37 kgf/cm² (170~530 psi)
(combined boom up and swing operation)



300A5MS25

GROUP 16 MONITORING SYSTEM

1. OUTLINE

Monitoring system consists of the monitor part and switch part.

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

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

2. CLUSTER

1) MONITOR PANEL

300A5CD20A

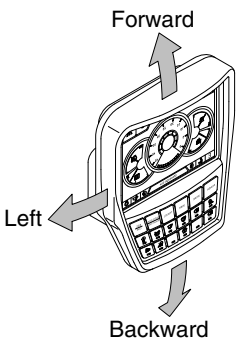
※ **The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem.**

The warning lamp blinks until the problem is cleared. Refer to page 5-75 for details.

※ **This cluster is adjustable.**

· Vertical (forward/backward) : each 15°

· Horizontal (left only) : 8°



290F3CD47

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor

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

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

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

a. Engine rpm display : 0 rpm
b. Engine coolant temperature gauge : White range
c. Hydraulic oil temperature gauge : White range
d. Fuel level gauge : White range

③ Indicating lamp state

a. Power mode pilot lamp : E mode or U mode
b. Work mode pilot lamp : General operation mode (bucket)
c. Travel speed pilot lamp : Low (turtle)

(2) Start of engine

① Check machine condition

a. RPM display indicates at present rpm
b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF

c. Work mode selection : General work
d. Power mode selection : E mode or U mode
e. Travel speed pilot lamp : Low (turtle)

② When warming up operation

a. Warming up pilot lamp : ON
b. After engine started, engine speed increases 1100 rpm.

※ Others same as above.

③ When abnormal condition

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

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

3) CLUSTER CONNECTOR

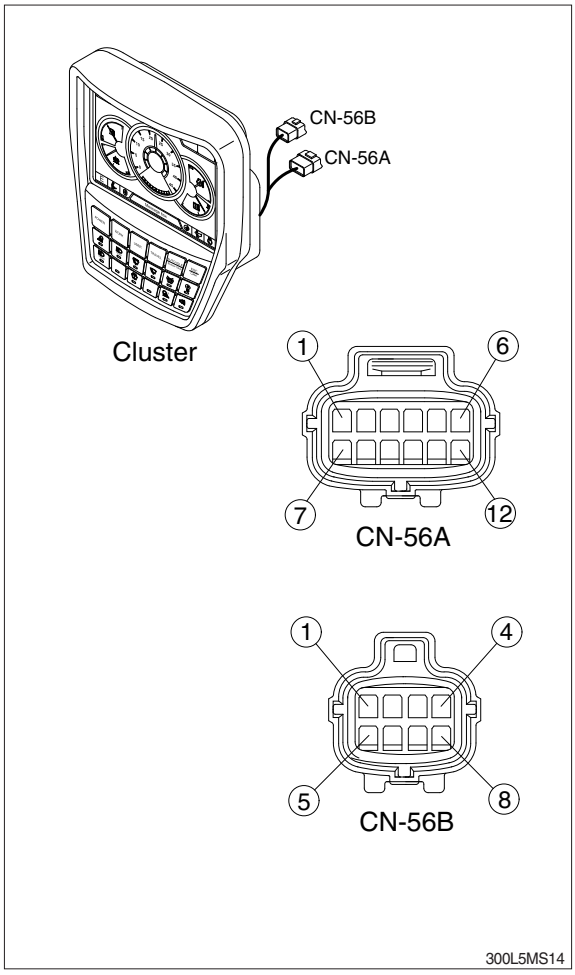
(1) CN-56A

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

(2) CN-56B

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

NTSC : National Television System Committee



4) GAUGE

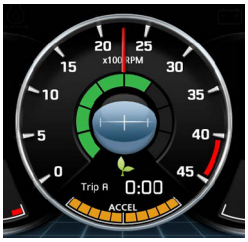
(1) Operation screen

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

300A3CD21A

1	RPM / Speed gauge	5	DEF/AdBlue® level gauge
2	Engine coolant temperature gauge	6	Tripmeter display
3	Hydraulic oil temperature gauge	7	Eco guage
4	Fuel level gauge	8	Accel dial gauge

(2) RPM / Speed gauge



300A3CD22

① This displays the engine speed.

(3) Engine coolant temperature gauge

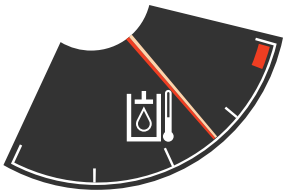
290F3CD53

① This gauge indicates the temperature of coolant.
- White range : 40-107˚C (104-225˚F)
- Red range : Above 107˚C (225˚F)

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

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

(4) Hydraulic oil temperature gauge



290F3CD54

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

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

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

(5) Fuel level gauge

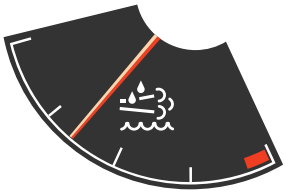
290F3CD55

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

② Fill the fuel when in the red range, or lamp pops up and the buzzer sounds.

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

(6) DEF/AdBlue® Level gauge



290F3CD57

① This gauge indicates the amount of liquid in the DEF/AdBlue® tank.

② Fill the DEF/AdBlue® when in the red range, or lamp pops up and the buzzer sounds.

③ Do not overfull DEF/AdBlue®.

※ **Refer to page 5-80.**

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

(7) Tripmeter display

290F3CD56

① This displays the engine the tripmeter.

※ **Refer to page 5-103 for details.**

(8) Eco gauge

290F3CD58

① This gauge indicates the fuel consumption rate and machine load status so that the operators can operate the machine efficient in regards to fuel consumption.

② Fuel consumption rate or machine load is higher if the number of segments are increased.

③ The color of Eco gauge indicates operation status.

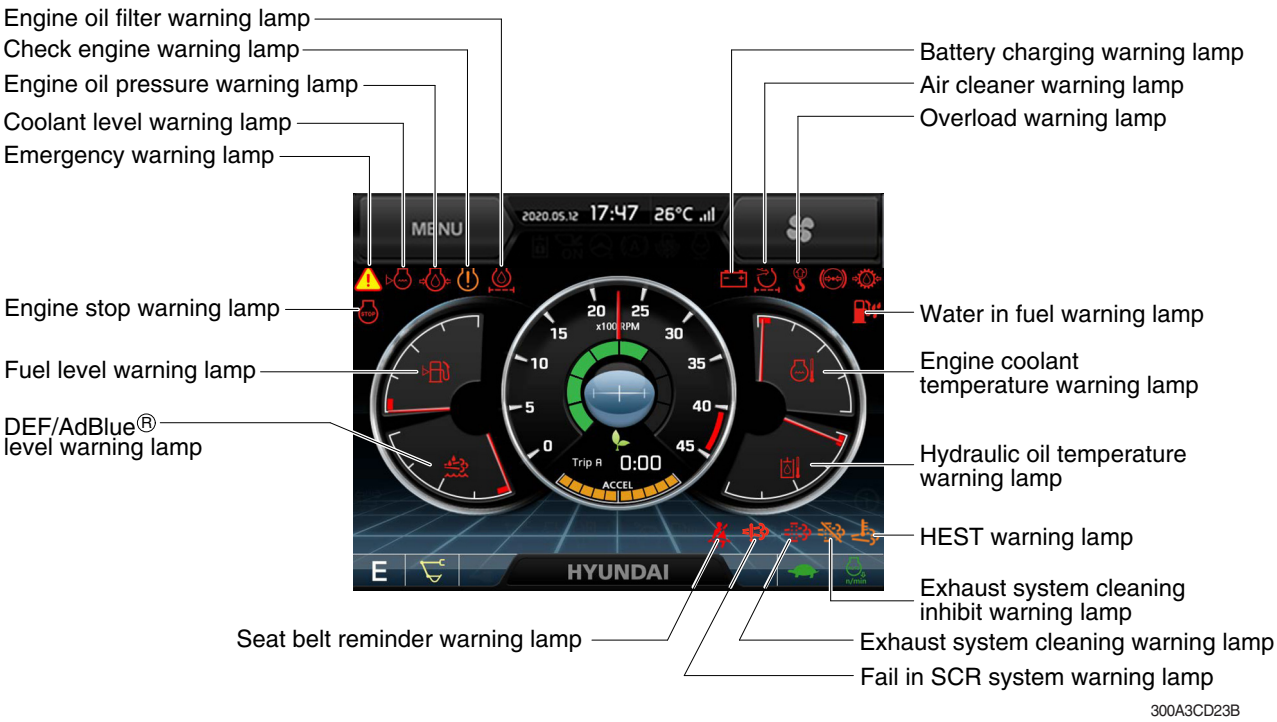
- White : Idle operation
- Green : Economy operation
- Yellow : Non-economy operation at a medium level.
- Red : Non-economy operation at a high level.

(9) Accel dial gauge

290F3CD59

① This gauge indicates the level of accel dial.

5) WARNING LAMPS

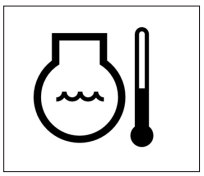


※ **Warning lamps and buzzer**

Warnings	When error happened	Lamps and buzzer
All warning lamps except below	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, blinks and the buzzer stops when; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, lights up or blinks and the buzzer stops when; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched **※ Refer to page 5-80 for details.**
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, lights up and the buzzer stops after 2 seconds elapses.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, blinks and the buzzer stops after 2 seconds elapses.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· Cluster displays this pop-up when it has communication error with MCU. · If communication with MCU become normal state, it will disappear automatically.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	**※ Refer to page 5-76 for details.**
	Warning lamp lights up and the buzzer sounds	**※ Refer to page 5-80 for details.**

※ Refer to page 5-86 for the buzzer stop switch AUTO IDLE Buzzer Stop and the operator's manual page 3-65 for the jog dial module.

(1) Engine coolant temperature warning lamp



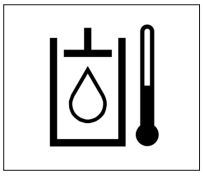
290F3CD61

① Engine coolant temperature warning is indicated in 2 steps.
- 103˚C over : The lamp pops up and the buzzer sounds.
- 107˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch AUTO IDLE Buzzer Stop is pushed. The buzzer will stop and , lamps will blink.

③ Check the cooling system when the lamps keep blinking.

(2) Hydraulic oil temperature warning lamp



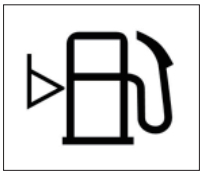
290F3CD62

① Hydraulic oil temperature warning is indicated in 2 steps.
- 100˚C over : The lamp pops up and the buzzer sounds.
- 105˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch AUTO IDLE Buzzer Stop is pushed. The buzzer will stop and , lamps will blink.

③ Check the hydraulic oil level and hydraulic cooling system.

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the fuel level is below 55 ℓ (14.5 U.S. gal).

② Fill the fuel immediately after the lamp blinks.

(4) Emergency warning lamp

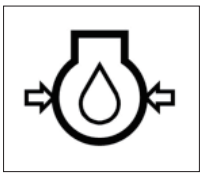
290F3CD64

① This warning lamp pops up and the buzzer sounds when each of the below warnings occurs.
- Engine coolant overheating (over 107˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Cluster communication data error
- Engine ECU communication data error

※ The pop-up warning lamp moves to the original position and blinks when the buzzer stop switch AUTO IDLE Buzzer Stop is pushed. The buzzer will stop.

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

(5) Engine oil pressure warning lamp



290F3CD65

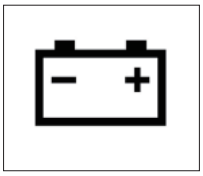
① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.
② If the lamp lights up, shut OFF the engine immediately. Check oil level.

(6) Check engine warning lamp

290F3CD66

① This warning lamp pops up and the buzzer sounds when the communication between MCU and engine ECU is abnormal, or if the cluster received specific fault code from the engine ECU.
② Check the communication line between the two.
If the communication line is OK, then check the fault codes on the cluster.

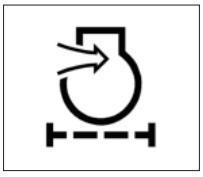
(7) Battery charging warning lamp



290F3CD67

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

(8) Air cleaner warning lamp



290F3CD68

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

(9) Overload warning lamp (opt)

290F3CD69

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

(10) Engine stop warning lamp

290F3CD252

① This warning lamp pops up and the buzzer sounds after 30 minutes of run time elapses, when the DEF/AdBlue® tank has reached it's minimum level. Stop engine immediately and check actual DEF/AdBlue® level.

② Fill the DEF/AdBlue® immediately.

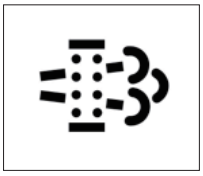
※ Refer to page 5-80.

③ This lamp pops up and the buzzer sounds when the maual (stationary) exhuast system cleaning is not performed.

※ Refer to page 5-78.

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

(11) Exhaust system cleaning warning lamp

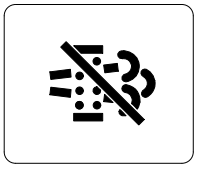


290F3CD70

① This warning lamp lights up or blinks when exhaust system cleaning is needed as seen in the table below.

Warning lamp			Description
Exhaust	Check engine	Stop engine	
Off	Off	Off	· Automatic exhaust system cleaning
Blink	Off	Off	· The status of a manual (stationary) exhaust system cleaning when the exhaust system cleaning switch has been activated. ※ Refer to page 5-79.
On	On	Off	· The aftertreatment exhaust system needs to be cleaned immediately. · Engine power will be reduced automatically if action is not taken. ※ The exhaust system cleaning can be accomplished by: - Changing to a more challenging duty cycle. - Performing a manual (stationary) exhaust system cleaning.
On	On	On	· These lamps will be ON when a manual (stationary) exhaust system cleaning is not performed. · Stop the engine immediately. · Please contact your HD Hyundai Construction Equipment service center or local dealer.

(12) Exhaust system cleaning inhibit warning lamp

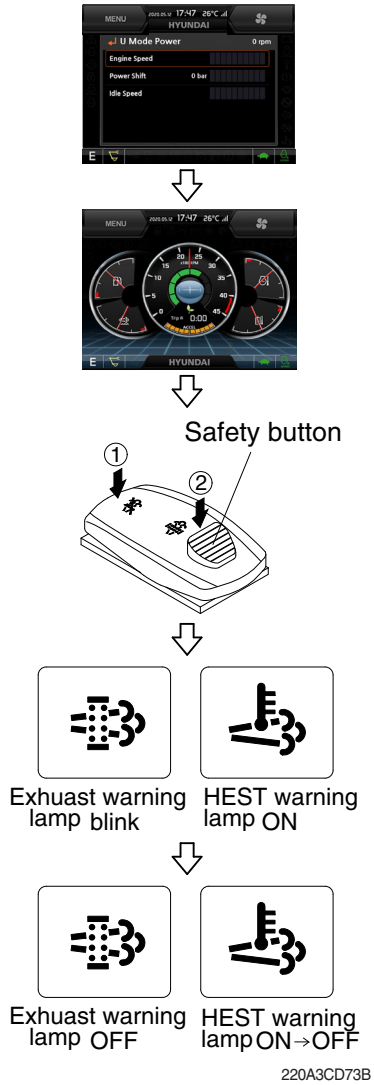


2609A3CD20

① This warning lamp indicates the exhaust system cleaning switch is pushed to the inhibit position, therefore automatic and manual exhaust system cleaning can not occur.

※ Refer to the operator's manual page 3-41 for the exhaust system cleaning switch.

※ Manual exhaust system cleaning



220A3CD73B

※ Manual exhaust system cleaning must be operated in a fireproof area.

※ To stop a manual exhaust system cleaning before it has completed, set to the exhaust system cleaning switch to the inhibit position or turn OFF the engine.

① Stop and park the machine.

② Pull the safety button and push the switch to position ② to initiate the manual exhaust system cleaning.

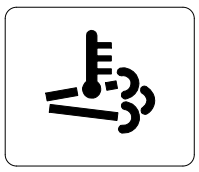
※ Refer to the operator's manual page page 3-41 for the exhaust system cleaning switch operation.

※ The engine speed may increase to 950~1050 rpm and exhaust system cleaning begins and it will take approximately 20~30 minutes.

③ The exhaust system cleaning warning lamp will blink and HEST warning lamp will light up during the exhaust system cleaning operation.

④ The exhaust system cleaning and/or HEST warning lamp light will go off when the exhaust system cleaning is completed.

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



2609A3CD21

① This warning lamp indicates, when illuminated, that exhaust temperatures are high due to exhaust system cleaning.

② The lamp will also illuminate during a manual exhaust system cleaning.

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

⚠ When this lamp is illuminated, the exhaust gas temperature could reach 800˚C [1500˚F], which is hot enough to ignite or melt common materials, and to burn people.

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

(14) DEF/AdBlue® level warning lamp

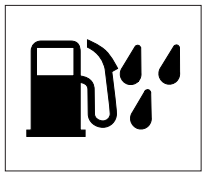
290F3CD257

① This warning lamp when ON or blinking, indicates that the DEF/AdBlue® level is low as per the table below.

※ **It is recommended that the DEF/AdBlue® tank be filled completely full of the DEF/AdBlue® in order to correct any fault conditions.**

Warning lamp				Description
Fail in SCR system	DEF/AdBlue® level	Check engine	Stop engine	
On	On	Off	Off	· The DEF/AdBlue® level has fallen below the initial warning level (10%).
On	On	On	Off	· The DEF/AdBlue® level has fallen below the initial derate level (2.5%). · The engine power will be limited automatically.
On	Blink	On	On	· This happens when 30 minutes has elapsed with empty conditions (0%) of the DEF/AdBlue® tank. · The engine will enter the final derate level which may include low idle lock or engine shutdown with restart limitations. · In order to remove the final derate, the DEF/AdBlue® tank must be filled to above 10% gauge reading.

(15) Water in fuel warning lamp



300A3CD24A

① This warning lamp lights up and the buzzer sounds when the water separator is full of water or malfunctioning.

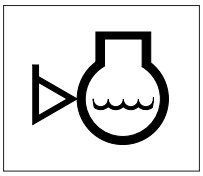
※ **When this lamp lights up, stop the machine and drain water from the separator.**

(16) Seat belt reminder warning lamp

300A3CD25

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

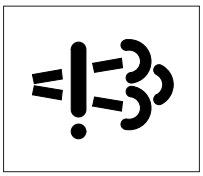
(17) Coolant level warning lamp



760F3CD58

① This warning lamp indicates lack of coolant.
② Check and refill coolant.

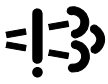
(18) Fail in SCR system warning lamp



300A3CD15

① This warning lamp indicates there are faults related to SCR system.
② The lamp lights up when each of the below warnings is happening.
   a. Low DEF/AdBlue® level
   b. Poor quality of DEF/AdBlue®
   c. Tempering or malfunction in the aftertreatment system
③ Once the lamp lights up, the engine will derate soon.

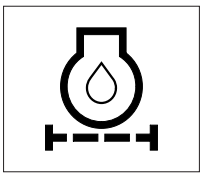
※ Please contact your HD Hyundai Construction Equipment service center or local dealer.

Warning lamp		Torque reduction
	Time	
On	Fault detected	-
On	After 2 h 30 min	· Torque is reduced to 75% of the highest torque.
Blink	After 3 h 45 min	· Torque is reduced to 50% of the highest torque.
Blink rapidly	After 4 hours	· Torque is reduced to 0% (low idling) of the hightest torque within 2~10 min.

※ If a new fault ocuurs within 40 hours of operation since the first fault, the warning lamp will light up. After 3 hours of operation, the warning lamp will blink rapidly and torque will be reduced to 0% (low idling) within 2~10 minutes.

※ Once the fault has been remedied and the engine control unit has received an indication that it is working, torque returns to the normal level.

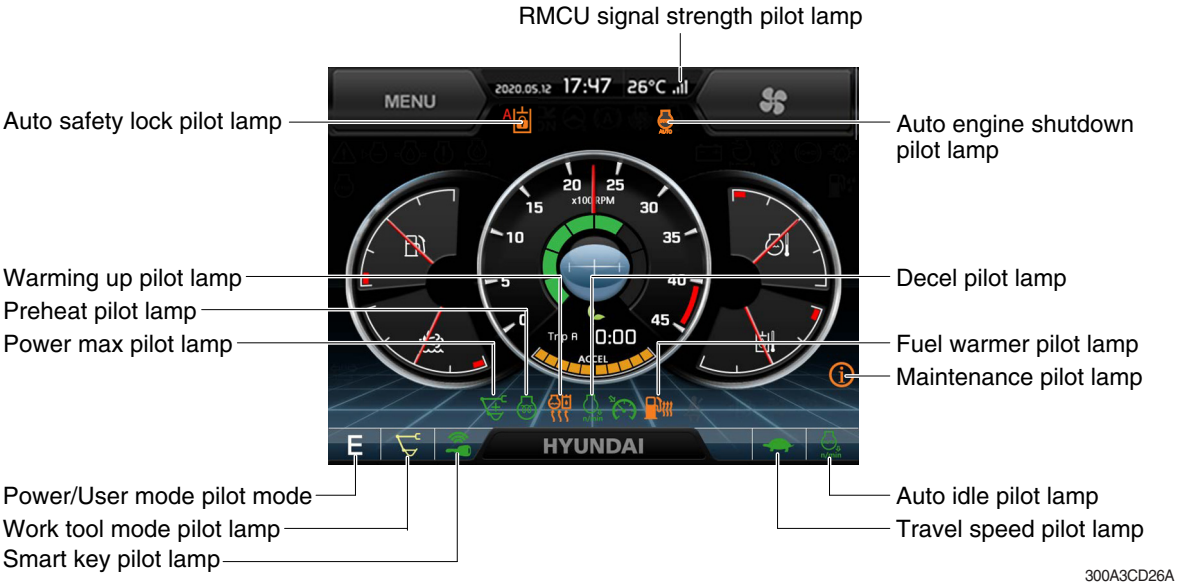
(19) Engine oil filter warning lamp



300A3CD306

① This warning lamp pops up and the buzzer sounds when the engine oil filter is clogged.
② Check, clean or replace filter.

6) PILOT LAMPS



300A3CD26A

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
		E	Economy power mode
2	User mode	U	User preferable power mode
3	Work tool mode		General operation - IPC speed mode
			General operation - IPC balance mode
			General operation - IPC efficiency mode
			Breaker operation mode
			Crusher operation mode
			Lifting mode
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp

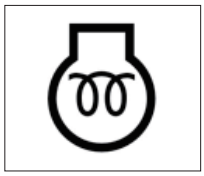
300A3CD32

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

② The power max function operates for a max period of 8 seconds.

※ **Refer to the operator's manual page page 3-43 for power max function.**

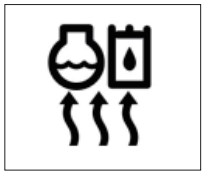
(3) Preheat pilot lamp



290F3CD79

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

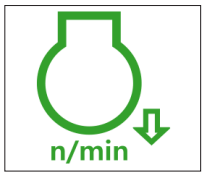
(4) Warming up pilot lamp



290F3CD80

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

(5) Decel pilot lamp



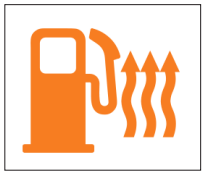
300A3CD33

① Operating one touch decel switch on the RCV lever makes the lamp light up.
② Also, the lamp will light up and engine speed will be reduced automatically to save fuel when all levers and pedals are in the neutral position, and the auto idle function is selected.

※ One touch decel is not available when the auto idle pilot lamp is turned ON.

※ Refer to the operator's manual page 3-44.

(6) Fuel warmer pilot lamp



300A3CD34

① This lamp lights up when the coolant temperature is below 10℃ (50°F) or the hydraulic oil temperature is 20℃ (68°F).
② The automatic fuel warming is cancelled when the engine coolant temperature is above 60℃ (140°F), and the hydraulic oil temperature is above 45℃ (113°F) since the start switch was ON position.

(7) Maintenance pilot lamp

300A3CD35

① This lamp lights up when consumable parts are in need of replacement. It means that the change or replacement interval of parts is 30 hours from the required change interval.
② Check the message in maintenance information of main menu. Also, this lamp lights up for 3 minutes when the start switch is switched to the ON position.

※ Refer to page 5-96.

(8) RMCU signal strength pilot lamp (mobile only)

220A3CD200

① This lamp indicates RMCU signal strength as below.

: Searching

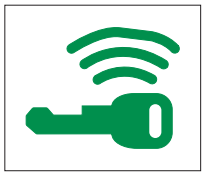
: Bad

: Normal

: Good

: Excellent

(9) Smart key pilot lamp (opt)



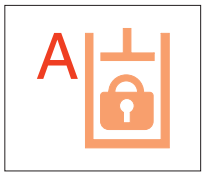
300A3CD36A

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

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

※ **Refer to page 5-97.**

(10) Auto safety lock pilot lamp



300A3CD37A

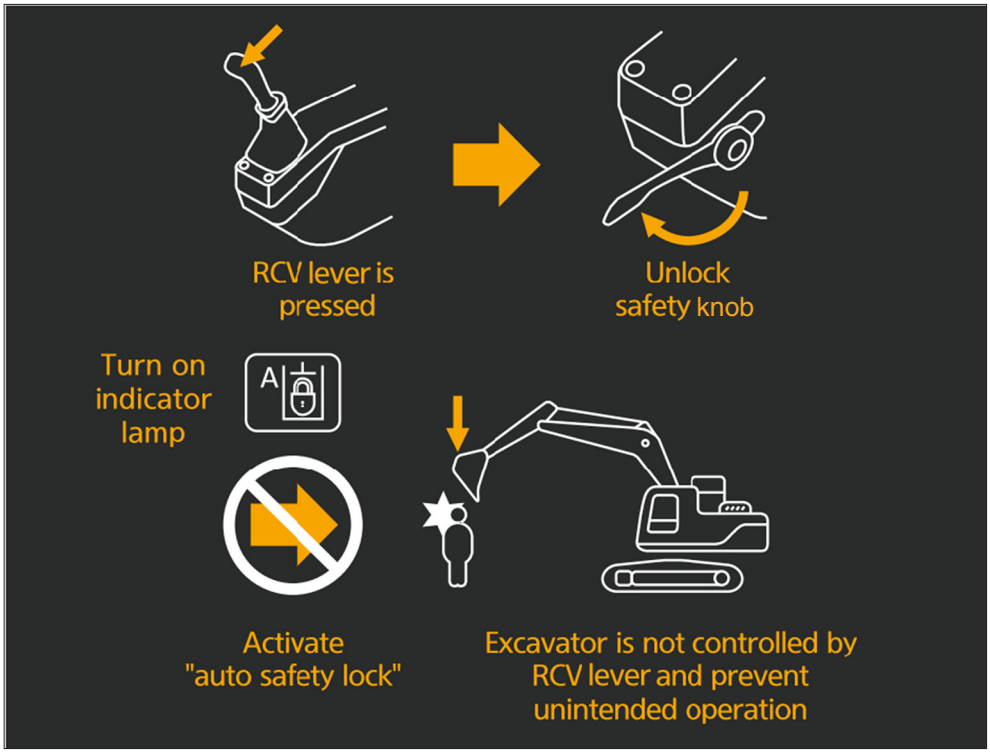
① Auto safety lock system prevents unintended operation of the machine in order to improve safety.

② Engine will only start if safety knob is locked.

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

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

④ The function is released only by turning the safety knob to the UNLOCK position and the LOCK position again.



300A3CD38A

(11) Auto engine shutdown pilot lamp

220A3CD202A

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

※ **Refer to page 5-92.**

(12) Engine rpm state

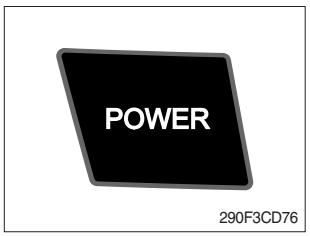
Function	Safety Knob	Auto Idle Mode	One Touch Decel	RPM State
State 1	Unlock	OFF	OFF	High rpm
State 2	Unlock	OFF	**ON**	Low rpm
State 3	Unlock	**ON**	OFF	Auto Idle rpm
State 4	Lock	**ON**	OFF	Low rpm
State 5	Lock	OFF	**ON**	Low rpm
State 6	Unlock	**ON**	**ON**	Low rpm
State 7	Lock → Unlock	**ON**	**ON**	Low → High → Low rpm (few seconds later)
State 8	Lock	**ON**	OFF	Low rpm
State 9	Lock	**ON**	**ON**	Low rpm

7) SWITCHES

300A3CD39A

※ **When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to page 5-82 for details.**

(1) Power mode switch

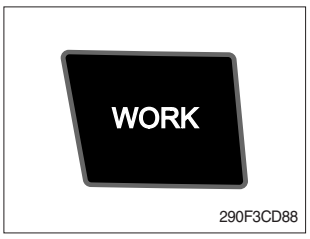


290F3CD76

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

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

(2) Work mode switch



290F3CD88

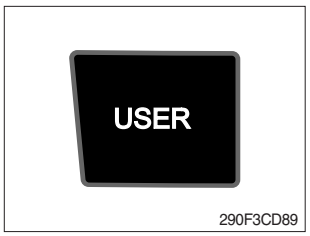
① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
- : General operation mode
- : Breaker operation mode (if equipped)
- : Crusher operation mode (if equipped)
- : Lifting mode
- Not installed : Breaker or crusher is not installed.

※ **Refer to the operator's manual page 2-7 for details.**

300A3CD168

② If you press this switch for a time (1 second), quick pop-up will appear. When you select an attachment from the popup, the operation mode will immediately switch to selected attachment.

(3) User mode switch



① This switch is used to select the user mode.
② Refer to page 5-90 for another set of the user mode.

(4) Travel speed switch

① This switch is used to select the travel speed alternatively.
- : Low speed
- : High speed

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

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

(5) Auto idle/ buzzer stop switch

① This switch is used to activate or cancel the auto idle function.
- Pilot lamp ON : Auto idle function is activated.
- Pilot lamp OFF : Auto idle function is cancelled.

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

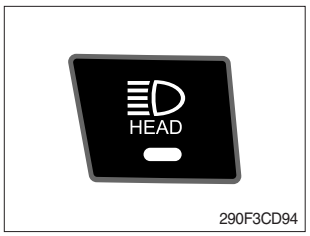
(6) Escape/Camera switch

① This switch is used to return to the previous menu or parent menu.
② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 5-103 for the camera.
③ If the camera is not installed, this switch is used only ESC function.

(7) Work light switch

① This switch is used to operate the work light.
② The pilot lamp lights up when this switch is pressed.

(8) Head light switch



① This switch is used to operate the head light.
② The pilot lamp lights up when this switch is pressed.

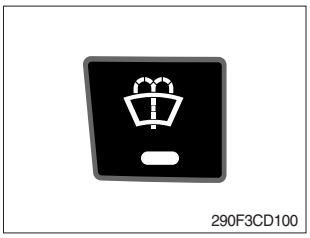
(9) Intermittent wiper switch

① When this switch is pressed, wipers operate intermittently.
② The pilot lamp lights up when this switch is pressed.

(10) Wiper switch

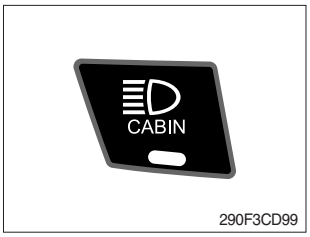
① This switch is used to operate the wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp lights up when this switch is pressed.
△ **If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause. If the switch remains ON, motor failure can result.**

(11) Washer switch



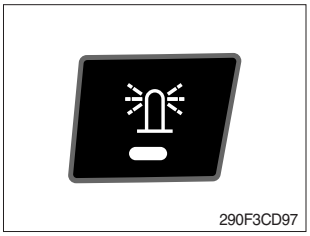
① Washer fluid is sprayed and the wiper is operated only when this switch is pressed.
② The pilot lamp lights up when this switch is pressed.

(12) Cab light switch



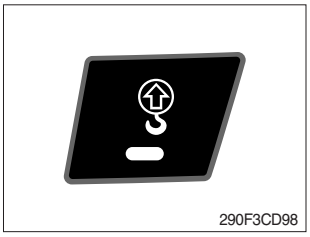
① This switch turns on the cab light.
② The pilot lamp lights up when this switch is pressed.

(13) Beacon switch (opt)



① This switch activates the rotary light on the cab.
② The pilot lamp lights up when this switch is pressed.

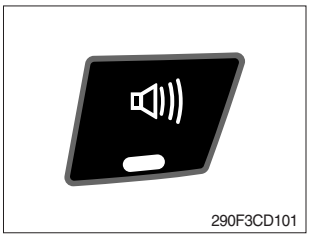
(14) Overload switch (opt)



① When this switch is activated, buzzer makes sound and overload warning lamp lights up in the event that the machine is or becomes in an overloaded situation.
② When the switch is inactivated, buzzer stops and warning lamp goes off.

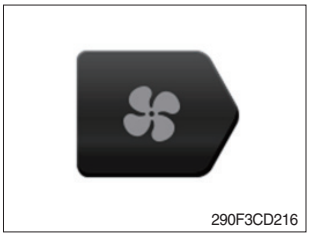
⚠ Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.

(15) Travel alarm switch



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

(16) Air conditioner quick touch switch



① This switch used to select air conditioner control mode.
※ Refer to page 5-105.

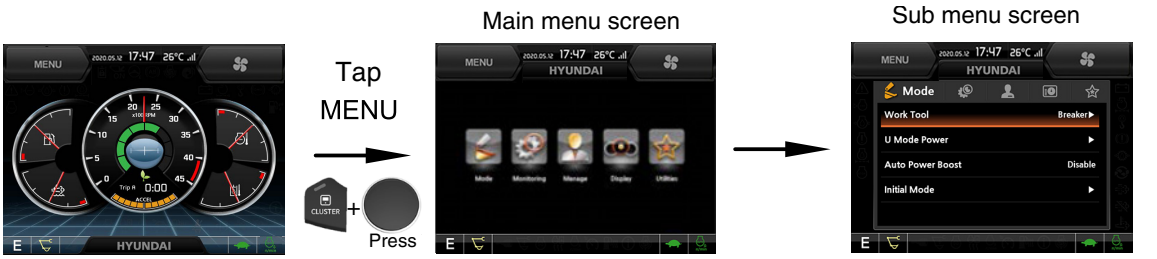
(17) Main menu quick touch switch

① This switch is to activate the main menu in the cluster.
※ Refer to page 5-89.

8) MAIN MENU

※ You can select or set the menu by the jog dial module or touch screen.
On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

· Operation screen



300A3CD40A

※ Please refer to the jog dial module, the operator's manual page 3-65 for selection and change of menu and input value.

(1) Structure

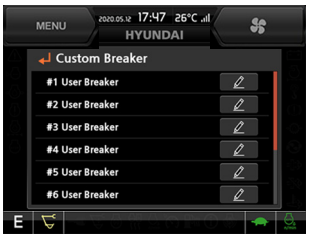
No	Main menu	Sub menu	Description
1	Mode 290F3CD103	Work tool U mode power Boom/Arm speed Auto power boost IPC mode Auto engine shutdown Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed, Arm speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode / initial work mode, Accel initial mode / step Switch function
2	Monitoring 290F3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, Engine ECM, FATC, AAVM (option) MCU, Engine ECM, FATC, AAVM (option) All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	Management 290F3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor, jog dial module, switch controller, RMCU, Relay drive unit, FATC, AAVM (option) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure, Optional piping pressure removal, Fine swing Clinometer setting Cluster, ETC device
4	Display 290F3CD106	Display item Clock Brightness Unit setup Language selection Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, ETC A type, B type
5	Utilities 290F3CD107	Tripmeter Camera Auto idle time setting	3 kinds (A, B, C) Camera setting, Auto mode (travel) Time setting

(2) Mode setup

① Work tool (Machine Serial No. : -#1429)

300A3CD41A

A



300A3CD42A

B

300A3CD43A

· Select installed optional attachment.
- A : It can set the user's attachment.
  It is available in setting #1~#10.
- B : Max flow - Set the maximum flow for the attachment.
  Relief pressure - Set the relief pressure.

(2) Mode setup

① Work tool (Machine Serial No. : #1430-)

300A3CD41A

A

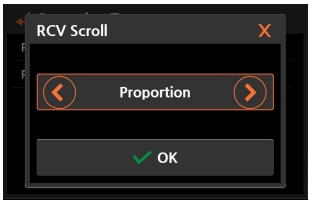
300A3CD42A

B

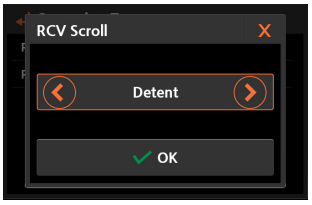
3003CD43B

· Select installed optional attachment
- A : It can set the user's attachment.
  It is available in setting #1~#10.
- B : Max flow - Set the maximum flow for the attachment.
  Relief pressure - Set the relief pressure.
  Operation type - Set the operation type for attachment.

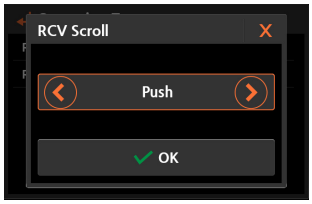
300A3CD651



140WA3CD652A



140WA3CD653A

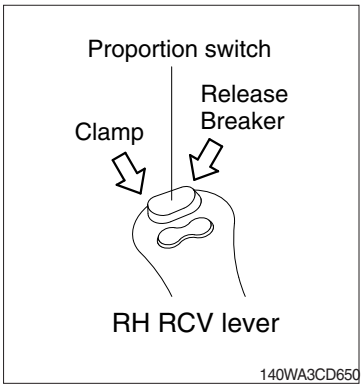


140WA3CD654A

■ Operation type

Operation type is used to set the operation of the proportion switch on the RCV lever if equipped proportional function.

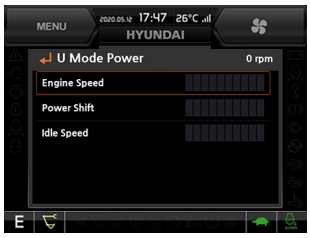
- Push : Switch actuation will be deactivated when the proportion switch is released.
- Detent : Switch actuation will remain even if the proportion switch is released.
  To deactivate, move the switch in the same direction again or to the opposite direction.
- Proportion : Switch actuation is proportional to the movement of the proportion switch.



140WA3CD650

② U mode power

300A3CD44A



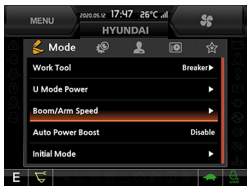
300A3CD45B

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

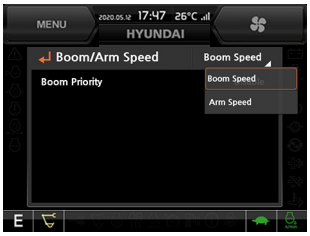
Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	800	0
2	1400	900	3
3	1500	950	6
4	1600	1000	9
5	1700	1050	12
6	1800	1100 (auto decel)	16
7	1850	1150	20
8	1900	1200	26
9	1950	1250	32
10	2000	1300	38

※One touch decel & low idle : 1000 rpm

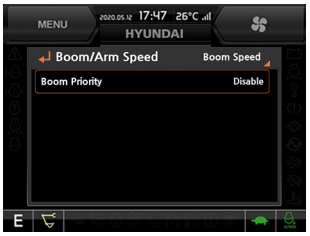
③ Boom/Arm speed



300A3CD46A



300A3CD47A



300A3CD48A

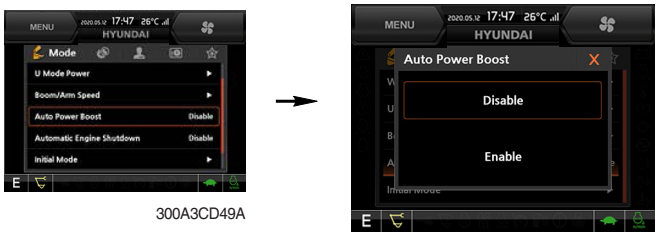
- **Boom speed**

  It adjusts the ratio of relative speed in the boom up and swing combination operation.
  - Boom priority enable is mainly used in work environments that require high boom up work at a short swing angle of about 45 degrees.
  - Boom priority disable is recommended for use in work environments that require high swing speed and acceleration, some slow boom up, and more than 45 degrees.

- **Arm speed**

  This provides ON and OFF of the regeneration function of the arm in operation.
  - Enable means that regeneration is ON, and an energy can be used efficiently through automatic regeneration according to the load.
  - Disable means that regeneration is always OFF, and it can be effective for heavy digging work.

④ Auto power boost



300A3CD49A

300A3CD50A

· The power boost function can be activated or cancelled.
  - Enable : The digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.
  - Disable : Not operated.

※ **The auto power boost function is activated in P mode. It does not work in S mode and E mode.**

⑤ IPC mode

300A3CD51A

300A3CD52A

300A3CD53A

300A3CD54A

300A3CD55A

300A3CD56A

300A3CD57A

· The operator can improve fuel consumption and working speed through IPC mode.
· IPC mode is working by using inertial energy in specific case.
· The IPC mode can be selected by this menu.
  - Speed mode / Balance mode / Efficiency mode
· The effect of IPC mode is different at power mode. The fuel efficiency is about 5% in P mode and about 3% in E mode based on Balance mode against Speed mode.
· The manufacturer recommends using the balance mode in IPC mode.

※ **The effect is the result of the standard operation. Depending on the operator's working conditions and machine options, the results could be different.**

※ **Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to page 5-99.**

⑥ Automatic engine shutdown

300A3CD58A

300A3CD59A

300A3CD60A

· The automatic engine shutdown function can be set by this menu.
  - One time
  - Always
  - Disable
  - Wait time setting : Max 40 minutes, min 2 minutes

⑦ Initial mode

300A3CD61A

300A3CD62B

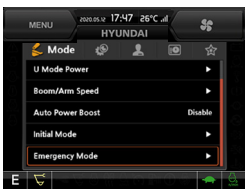
· **Key on initial mode**
  - Selected the power mode is activated when the engine is started.

· **Key on initial work mode**
  - Not installed
  - Last setting
  - Work mode

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

· **Accel initial step**
  - 0~9 step

⑧ Emergency mode



300A3CD63A

300A3CD64A

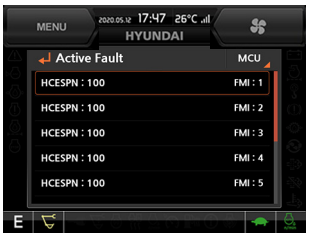
· This mode can be used when the switches are abnormal on the cluster.
· The cluster switches can be selected by touching each icon.

(3) Monitoring

① Active fault

300A3CD65A

300A3CD66A

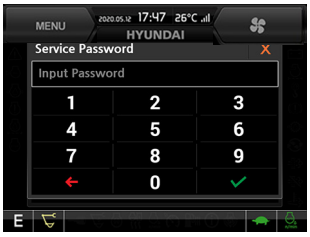


300A3CD67A

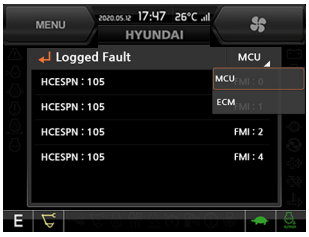
· The active faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

② Logged fault

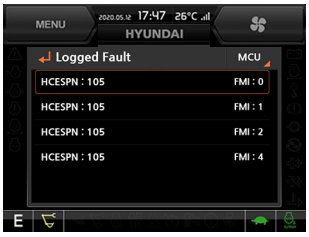
300A3CD68A



300A3CD72A



300A3CD69A

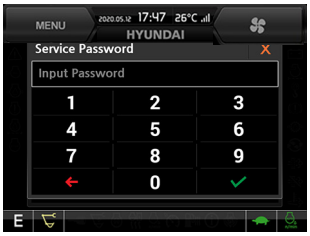


300A3CD70A

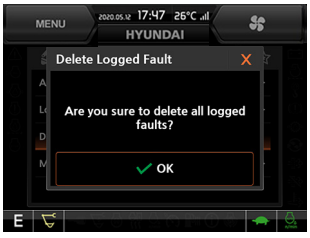
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

③ Delete logged fault

300A3CD71A



300A3CD72A

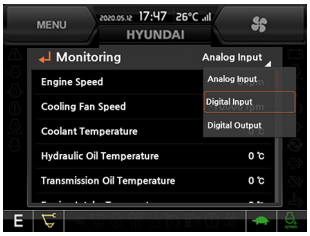


300A3CD73A

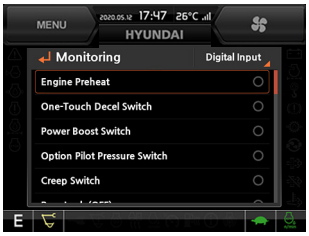
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be deleted by this menu.

④ Monitoring

300A3CD74A



300A3CD75A



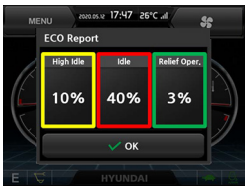
300A3CD76A

- The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).
- The switch status or output status can be confirmed by this menu (Digital input & Digital output).
- The activated switch or output pilot lamps ● will light up.

(4) Management

① ECO report

This reports the machine's inefficient operation status in order to improve operator's improper working habit.



300A3CD77A

High idle

300A3CD78A

- Shows a breakdown of high idle, idle and relief operation when monitor is on.
- Gives a daily usage breakdown record for a 7 day period and an overall accumulated record from the first operation.

Idle

300A3CD79A

Relief operation

300A3CD80A

② Fuel rate information

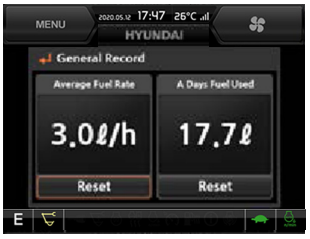
300A3CD81A

300A3CD82A

A

· **General record (A)**

- Average fuel rate (left) (from "Reset" to now)
  Fuel consumption divided by engine run time (service meter time).
- A days fuel used (right)
  Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).



300A3CD83A

B

· **Hourly record (B)**

- Hourly fuel rates for past 12 hours (service meter time).
- No record during key-off time.
- One step shift to the right for every one hour.
- Automatic deletion of data from 12 hours and earlier.
- "Reset" deletes all hourly records.

300A3CD84A

C

· **Daily record (C)**

- Daily fuel consumption for past seven days (MCU real time).
- No record during key-off time.
- One step shift to the right at 24:00 for every day.
- Automatically deletes data from 7 days and earlier.
- All daily records deletion by "Reset".

300A3CD85A

D

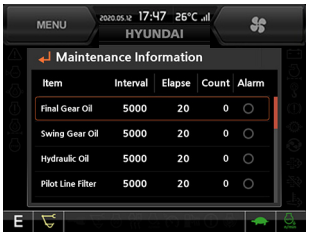
· **Mode record (D)**

- Average fuel rate for each power mode/jog dial module (at least 7) from "Reset" till present.
- No record during idle.
- All records can be deleted by "Reset".

300A3CD86A

③ Maintenance information

300A3CD87A



300A3CD88A

300A3CD89A

- Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
- Replacement : The elapsed time will be reset to zero (0).
- Change interval : The change intervals can be changed in hour increments of 50.

※ **Refer to section, Maintenance chart for further information of maintenance interval.**

④ Machine security

300A3CD90A

300A3CD91A

300A3CD92A

· **ESL mode setting**

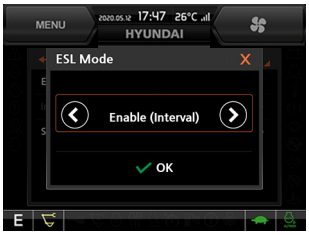
- ESL : Engine Starting Limit
- ESL mode is desingned to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- **Machine security**

  Disable : ESL function is disabled and password is not required to start engine.

  Enable (always) : The password is required whenever the operator starts engine.
- **Interval** : The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set to a maximum 4 hours.

  ※**Default password : 00000 +✔**

  ※**Password length : (5~10 digits) +✔**
- **Smart key** (option) : Refer to next page.



300A3CD93A

300A3CD94A

· **Password change**

- The password is 5~10 digits.

300A3CD95A

300A3CD96A

300A3CD91A

Enter the current password

300A3CD99A

Enter the new password

300A3CD98A

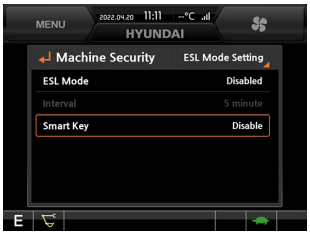
Enter the new password again

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

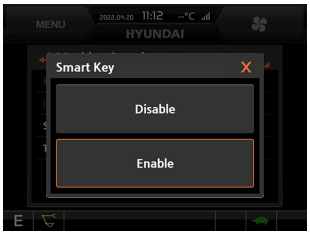
- Smart key

300A3CD90A

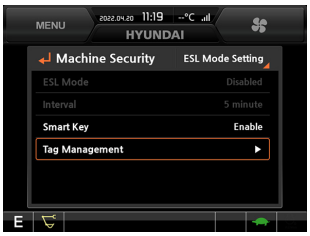
300A3CD91A



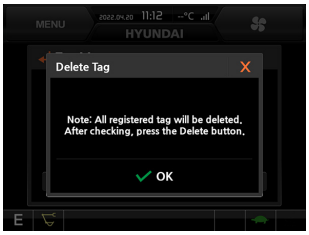
300A3CD001



300A3CD002

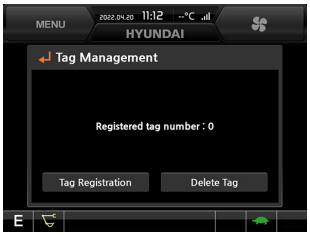


300A3CD003



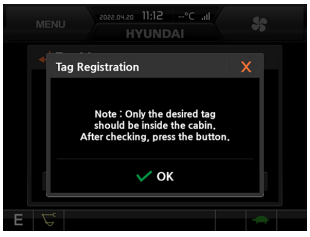
300A3CD006

Deleting



300A3CD004

Registering



300A3CD005

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

· Tag management menu is activated when the Smart key menu is Enabled.
You can register and delete the tags.

- Tag management

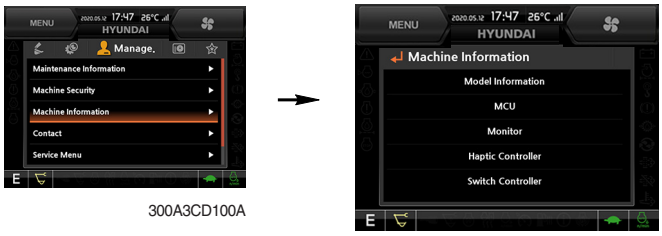
· When registering a tag : Only the tag you want to register must be in the cabin.

· When deleting a tag : All registered tags are deleted.

※ Engine Starting Condition

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

⑤ Machine Information



300A3CD100A

300A3CD101A

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

⑥ Contact (A/S phone number)

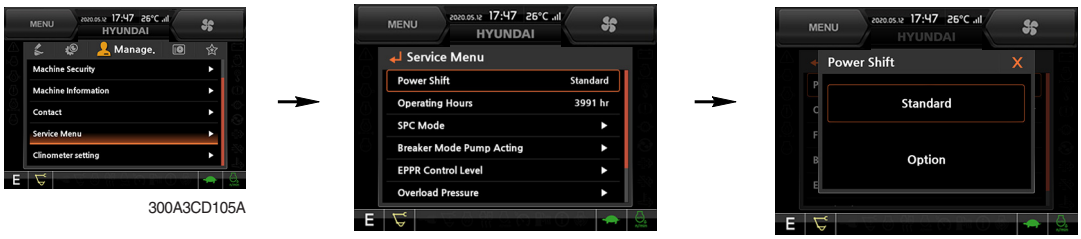
300A3CD102A

300A3CD103A

300A3CD104A

Enter the new A/S phone number

⑦ Service menu



300A3CD105A

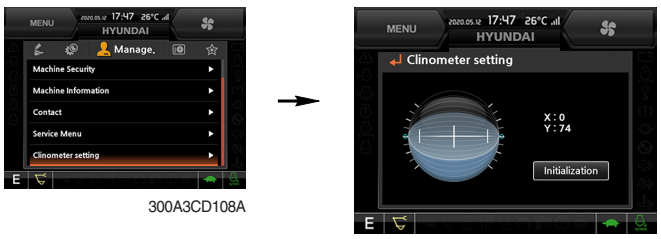
300A3CD106A

300A3CD107A

※ This menu can be used only HCE service man and can not be accessible by the owner and the operator.

· Power shift (standard / option) : Power shift pressure can be set by option menu.
· Operating hours : Operating hours since the machine line out can be checked by this menu.
· Breaker mode pump acting (1 pump / 2 pump)
· EPPR current level (attach flow EPPR 1 & 2, boom priority EPPR, attach relief pressure EPPR 1& 2)
· Overload pressure : 100 ~ 350 bar
· Opitonal piping pressure removal (Disable / Enable)
It is removing the residual pressure remaining in the option line when the quick coupler is operated.
· Fine swing (Disable / Enable)

⑧ Clinometer

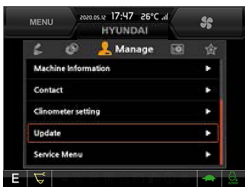


300A3CD108A

300A3CD109A

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

⑨ Update (cluster & ETC devices)

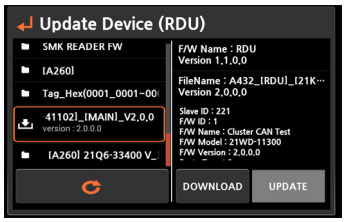


300A3CD110A

300A3CD111A

300A3CD112A

300A3CD114A



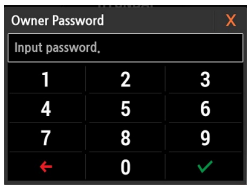
380F3CD06

- ETC devices and cluster can be updated through CAN 2 network.
- Insert USB memory stick which includes program files, start download.

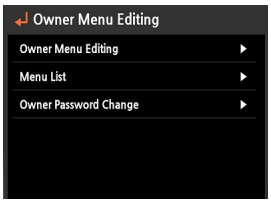
⑩ OME (owner menu editing)

The owner of machine can restrict operator access to set functions.

300A3CD115A



300A3CD115B



300A3CD115C

- **Owner can set the status of the function.**
  - Enable
  - Disable
- **In the menu, owner can set the list of functions in which they would like to lock or leave unlocked.**
- **Owner password (default password : 11111)**
  - Owner can manage and change the password.
  - Necessary to input the password to access function menu.

300A3CD116A

300A3CD117A

300A3CD118A

· **Password change**

- The password is 5~10 digits.

210WF3CD190A

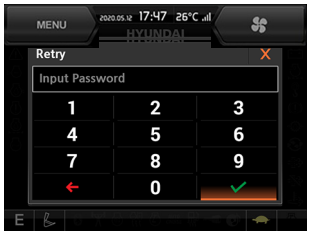
290F3CD140A

290F3CD135A

Enter the current password

290F3CD142A

Enter the new password



290F3CD143A

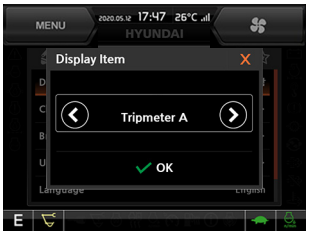
Enter the new password again

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

(5) Display

① Display item

300A3CD119A



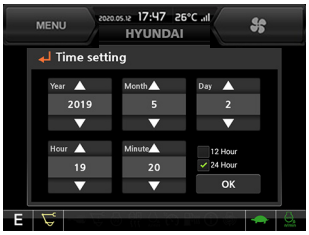
300A3CD120A

300A3CD121A

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

② Clock

300A3CD122A



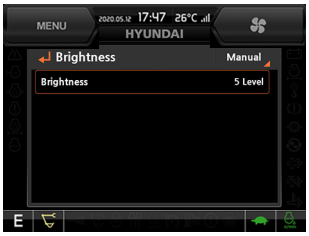
300A3CD123A

· The first row of boxes indicate Year/Month/Day.
· The second row shows the current time. (0:00~23:59)

③ Brightness

300A3CD124A

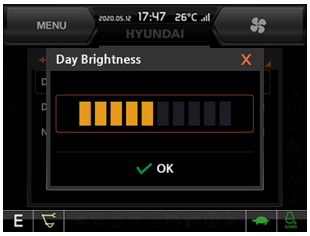
300A3CD125A



300A3CD126A

300A3CD127A

300A3CD128A

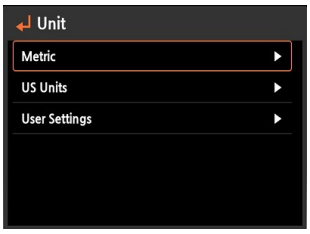


300A3CD129A

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

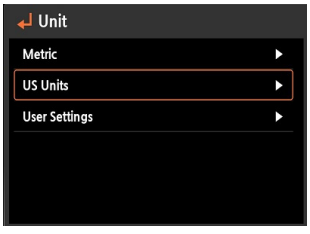
④ Unit

300A3CD130A

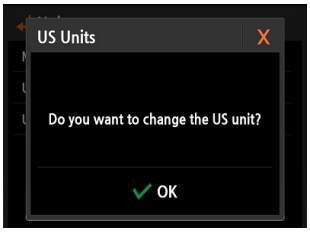


300A3CD130B

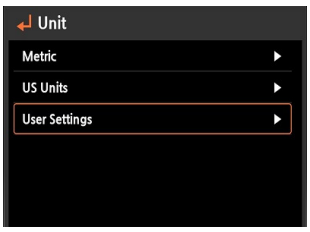
300A3CD130C



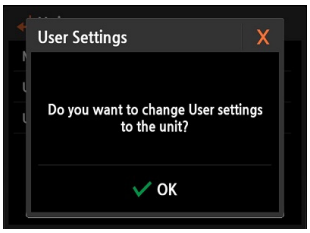
300A3CD130D



300A3CD130E

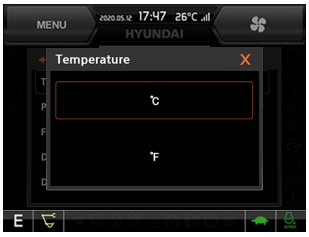


300A3CD130F



300A3CD130G

300A3CD131A



300A3CD132A

· Temperature : ˚C ↔ ˚F
· Pressure : bar ↔ MPa ↔ kgf/cm²
· Volume : ℓ ↔ gal
· Flow : lpm ↔ gpm
· Distance : km ↔ mile
· Date format : yy/mm/dd ↔ mm/dd/yy ↔ dd-mm-yy

⑤ Language

300A3CD133A

300A3CD134A

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

(6) Utilities

① Tripmeter

300A3CD143A

300A3CD144A

- A maximum of 3 types of tripmeters can be used at the same time.
- Each tripmeter can be turned on by choosing "Start". It can be turned off by choosing "Stop".
- If the tripmeter icon is activated in the operation screen, it can be controlled directly in this screen.

② Camera setting

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

300A3CD145A

300A3CD146B

300A3CD147A

- Auto Mode (Travel) : Enable
  The cluster will automatically show camera view while machine is traveling.
- In the operation screen, rear camera screen shows up when ESC/CAM switch is pushed.

300A3CD97A

290F3CD221

③ Auto idle time setting

300A3CD166

300A3CD167

- The auto idle time is can be set by this menu.
- Time : 3~30 seconds

④ **AAVM** (Advanced Around View Monitoring, option)

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

300A3CD149A

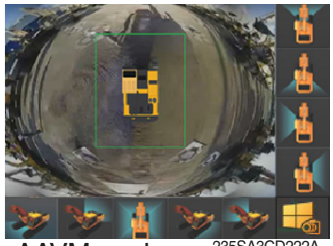
- **Escape switch**

· Activates AAVM mode from the beginning if AAVM is installed.

· While in the AAVM mode, select the ESC switch to return to the home screen.

300A3CD97A

Home screen

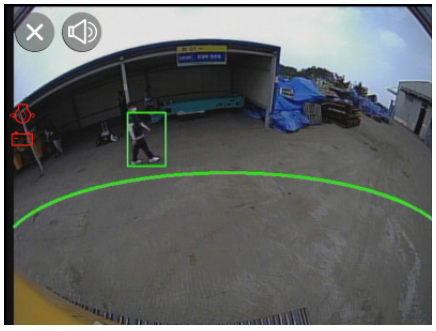


AAVM mode 235SA3CD222A

- **Buzzer stop switch**

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

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



220A3CD246

· When a worker/pedestrian reaches the green line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a blue rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

220A3CD247

· When a worker/pedestrian reaches the red line, which is an internal danger area equipped on the cluster, warning buzzer sounds and it displays a red rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

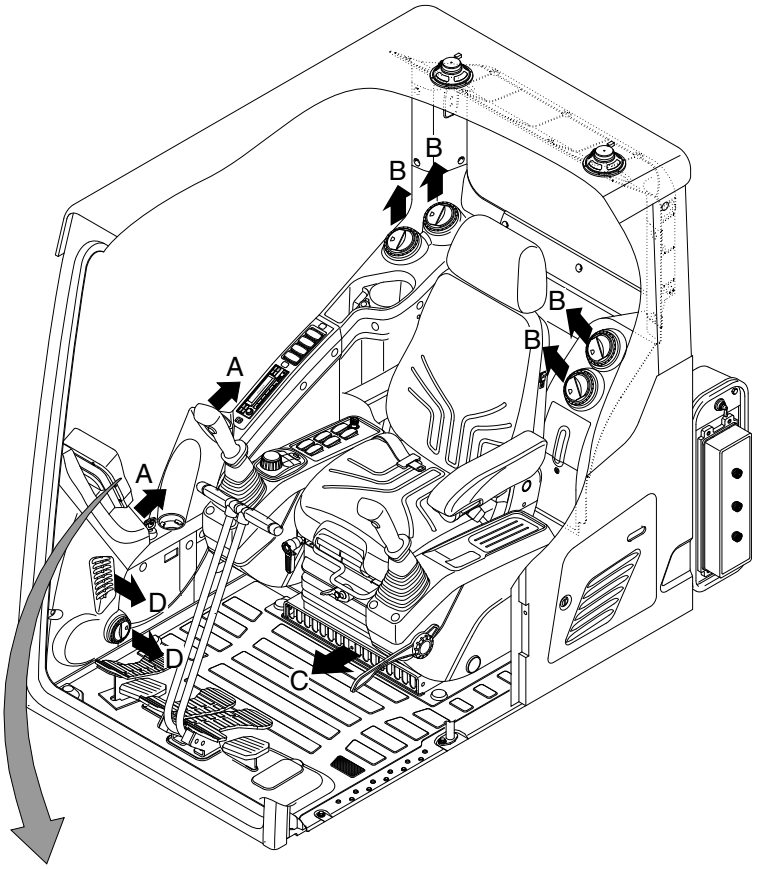
⚠ **Failure to comply may result in serious injury or death.**

※ **In AAVM mode, a touch screen of the LCD is available only. The multimodal dial of the jog dial module is not available.**

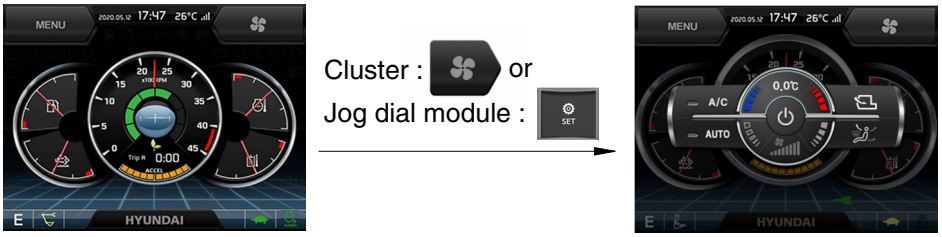
9) AIR CONDITIONER AND HEATER

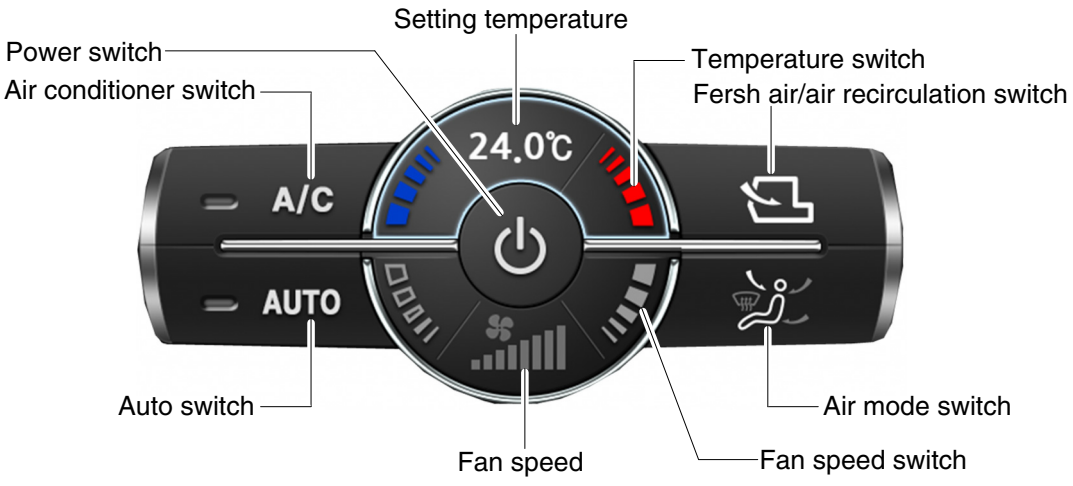
Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

· **Location of air flow ducts**



Cluster LCD

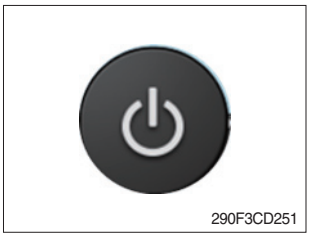




220A3CD21A

※ **Jog dial module : Refer to the operator's manual page 3-65.**

(1) Power switch



① This switch turns the system ON and OFF.
Just before powering OFF, set values are stored.
② Default setting values

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

(2) Air conditioner switch

① This switch turns the compressor ON/OFF.
※ Air conditioner operates to remove vapor and drains water through a drain hose. Water can be sprayed into the cab in case that the drain cock at the ending point of drain hose has a problem.
In this case, exchange the drain cock.

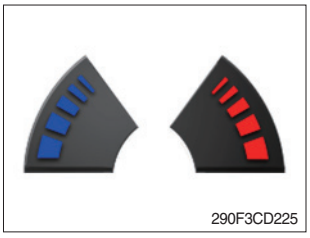
(3) Auto switch

① Auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

(4) Setting temperature

① Displays the temperature setting.

(5) Temperature switch

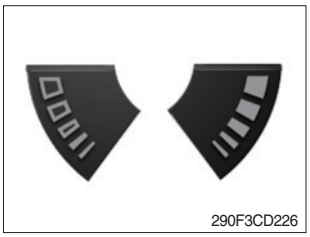


① Setting temperature indication
· Lo (17˚C), 17.5~31.5˚C, Hi (32˚C)
② Max cool and max warm beeps 5 times.
③ The max cool or the max warm position operates per the following table.

Temperature	Compressor	Fan speed	In/outlet	Mode
Max cool	ON	Hi (8 step)	Recirculation	Face
Max warm	OFF	Hi (7 step)	Fresh	Def/Foot

④ Temperature unit can be changed between celsius (˚C) and fahrenheit (˚F)
a. Default status (˚C)
b. The temperature unit can be changed (℃ ↔ ℉) by pressing temperature switchs (Up/Down) simultaneously for more than 5 seconds.

(6) Fan speed switch



① Fan speed is controlled automatically by set temperature.
② This switch controls fan speed manually.
- There are 8 up/down steps to control fan speed.
- The maximum step or the minimum step beeps 5 times.

(7) Fan speed

① Steps 1 through 8 to display the amount of air being circulated.

(8) Fresh air/air recirculation switch

① It is possible to change the air-inlet method.
a. **Fresh air ( )**
Inhaling air from the outside.
b. **Air recirculation ( )**
It recycles the heated or cooled air to increase the energy efficiency.
※ **Change air occasionally when using recirculation for a long periods of time.**
※ **Check condition of an outer filter and an inner filter periodically to maintain good efficiency of the system.**

(9) Air mode switch

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

Mode switch		Face	Face/Rear	Face/Rear/Foot	Foot	Def/Foot
Outlet	A	●	●	●		
	B		●	●		
	C			●	●	●
	D					●

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

(10) Self Diagnosis Function

① Diagnostic methods : Diagnostic information window, select

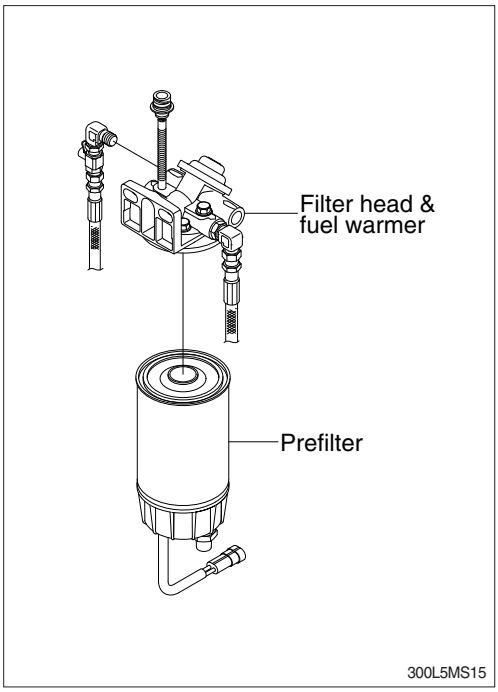
② Diagnostic indication (Displays fault)

Fault code	Description	Fail safe function
F01	Ambient temperature sensor open	20˚C alternate value control
F02	Ambient temperature sensor short	
F03	Cab inside temperature sensor open	25˚C alternate value control
F04	Cab inside temperature sensor short	
F05	Evaporate temperature sensor open	0˚C alternate value control
F06	Evaporate temperature sensor short	
F07	Null	-
F08	Null	-
F09	Mode 1 actuator open/short	The alternate value is face
F10	Mode 1 actuator drive circuit malfunction	If not, the alternate value is Def/Foot
F11	Intake actuator open/short	The alternate value is air recirculation
F12	Intake actuator drive circuit malfunction	The alternate fresh air
F13	Temperature actuator open/short	If opening amount is 0 %, the alternate value is 0 %
F14	Temperature actuator drive circuit malfunction	If not, the alternate value is 100 %
F15	Null	-
F16	Null	-

GROUP 17 FUEL WARMER SYSTEM (OLD VERSION)

1. SPECIFICATION

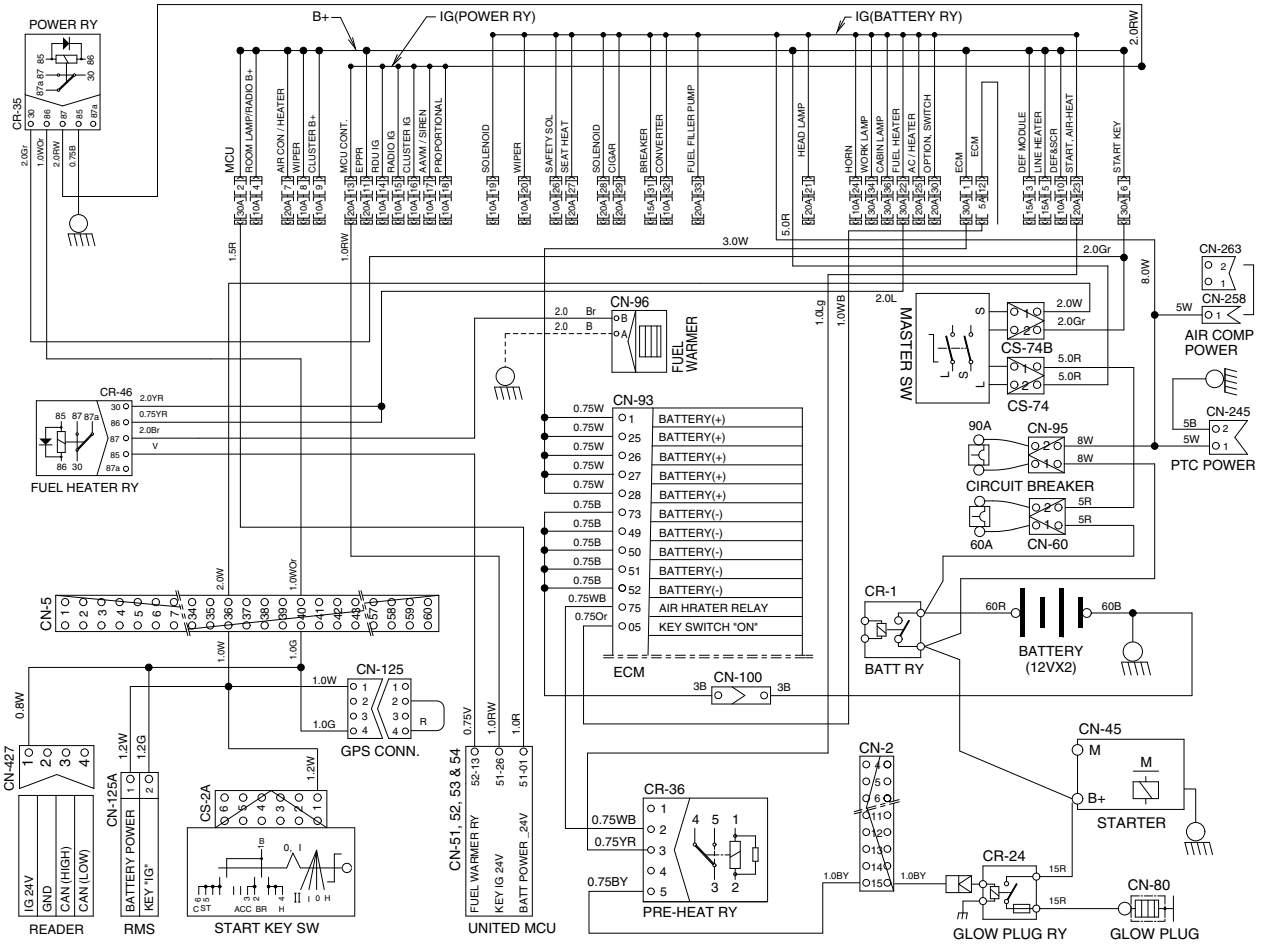
1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A



2. OPERATION

1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
   So, fuel is protected from overheating by this mechanism.

3. ELECTRIC CIRCUIT

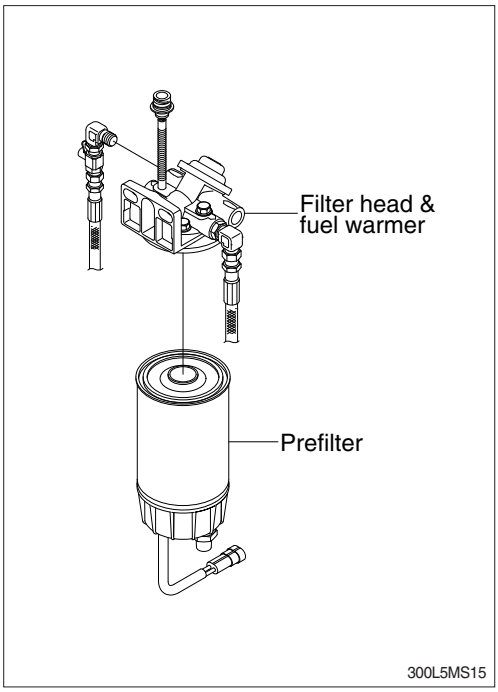


300A5MS16

FUEL WARMER SYSTEM (CURRENT VERSION)

1. SPECIFICATION

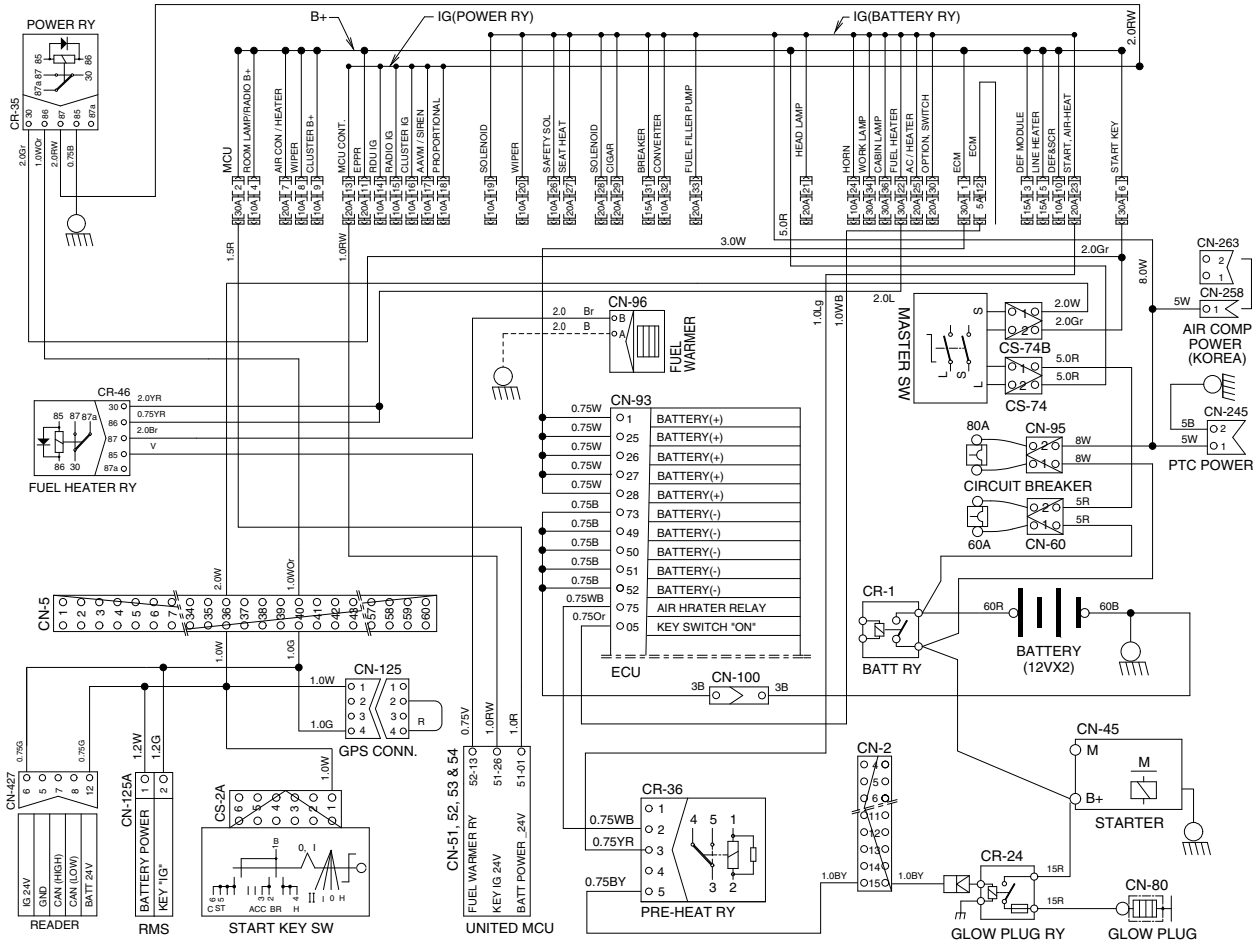
1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A



2. OPERATION

1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
   So, fuel is protected from overheating by this mechanism.

3. ELECTRIC CIRCUIT



320A5MS16

GROUP 18 1 or 2-WAY OPTIONAL PIPING PRESSURE REMOVAL SYSTEM

1. OUTLINE

This system can be removed the residual pressure of the optional attachment hydraulic piping when the quick coupler is operated by the switch of the RCV lever and then the oil quick function of the optional attachment is performed.

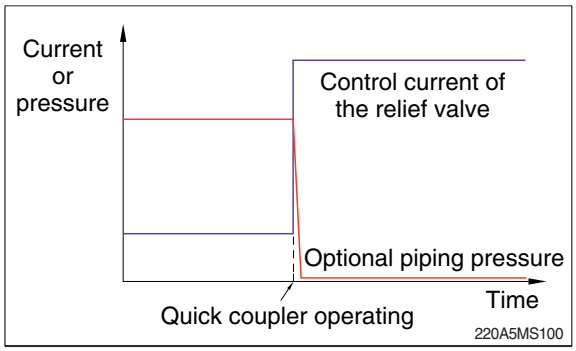
※ Oil quick function

In a convention work, the optional attachments such as breaker or grab are installed on the machine and needed to connect hydraulic piping additionally.

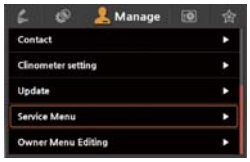
But currently, the hydraulic piping connection is not needed by the work man. The attachment is installed on the machine and the hydraulic pipings are connected by a coupler that is built in the quick coupler automatically and the attachment can be ready to operate immediately. This is called the oil quick function.

2. OPERATING PRINCIPLE

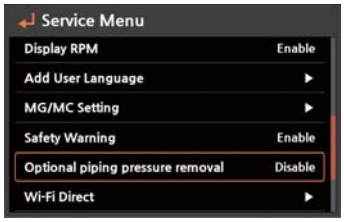
This is operated by controlling the setting pressure of the electric type relief valve when you operate the quick coupler with the switch of the RCV lever.



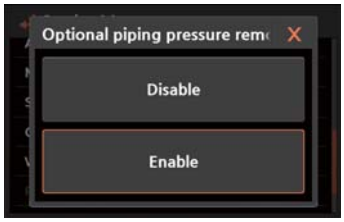
3. SETTING METHOD



220A5MS101



220A5MS102



220A5MS103

1) Optional piping pressure removal is set to Disable in the factory.
2) Optional piping pressure removal is set to Enable then the oil quick function is operated. Also, the caution letter is display on the lower side of the cluster.
3) The setting condition is saved even if shut the engine off.

220A5MS104

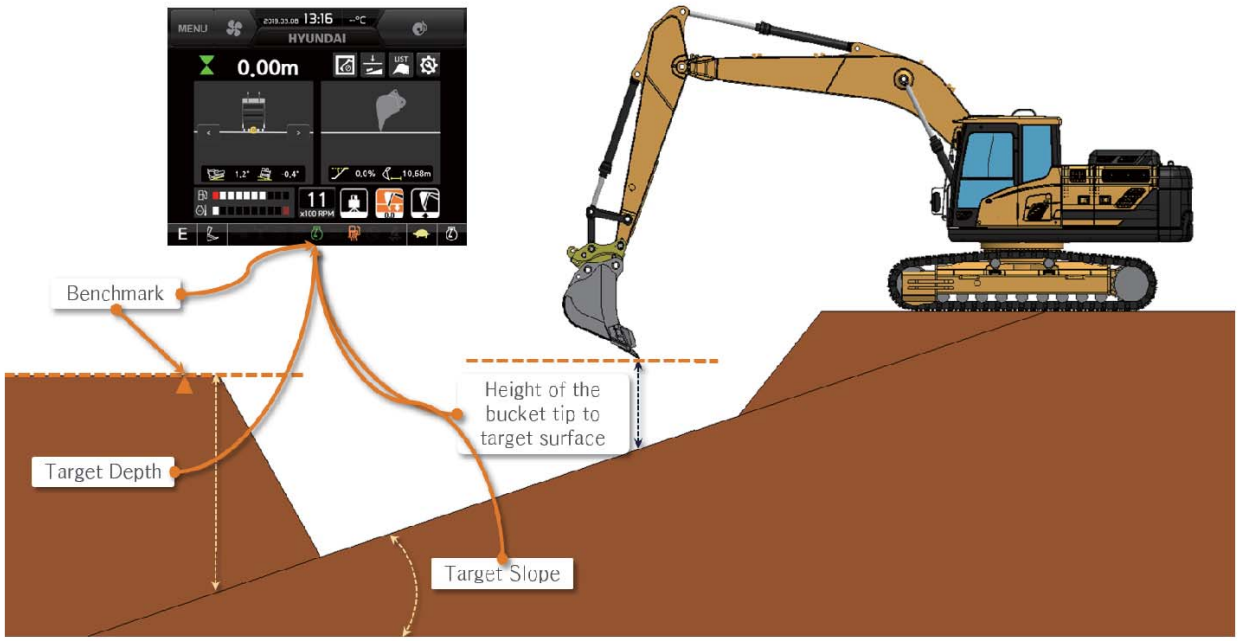
4. CAUTION

1) When the oil quick function is used, the hydraulic drift and etc can be occurred as the modified equipment specification.
2) The status of the cluster must be changed by a manager that is well-acquainted with the function and the operator must be well-informed of the oil quick function and safety work.

GROUP 19 2DMG+ SYSTEM

1. FUNCTION DEFINITION

HD Hyundai Construction Equipment 2DMG+ is a function that calculates the position of the tip of the bucket and transmits distance information to the target surface to the operator in the form of visual indicators and audible alarms through the cluster.

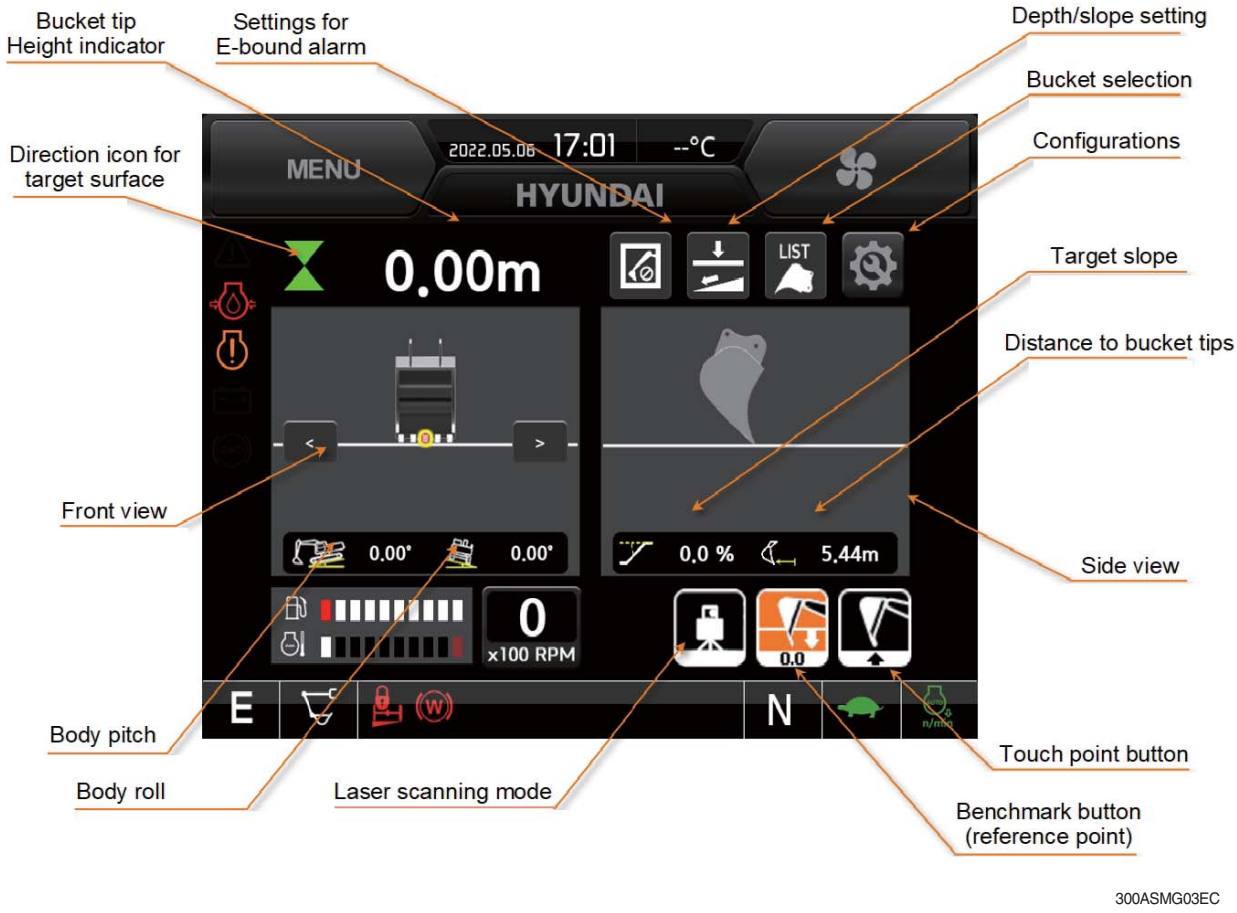


300ASMG01EC

2. SYSTEM LAYOUT

300ASMG02EC

3. 2DMG+ Main Screen



300ASMG03EC

4. 2DMG+ PROBLEM TYPE

No.	Problem	Cause and remedy	Remark
1	Action when the "Sensor failure" message is output	1. Check whether the angle sensor harness is damaged or loosened.	
		2. Check whether the angle sensor function abnormality	
		3. Check whether the CAN gateway function abnormality	
		4. Check whether the CAN termination resistor is damaged	
2	Action when the bucket end height measurement accuracy is abnormal	1. Data error due to internal damage of the angle sensor	
		2. Check current selected bucket	Corresponds to inexperience in user operation
		3. Check compliance with the vertical posture when entering bucket dimensions.	
		4. Check bucket dimensions	
		5. Check design surface (depth/slope) information	
		6. Check compliance with reference point movement procedures	
		7. Enter 2DMG+ setting value after replacing MCU	This needs to be checked in case of MCU or cluster replacement
3	Can not enter MG menu	1. 2DMG+ function not set after cluster replacement	

1) ACTION WHEN THE "SENSOR FAILURE" MESSAGE IS OUTPUT

(1) Check whether the angle sensor harness is damaged or loosened.

① Enter the cluster's 'Current Fault' menu.

a. From the cluster main menu, go through the following path.

b. Monitoring → Active fault

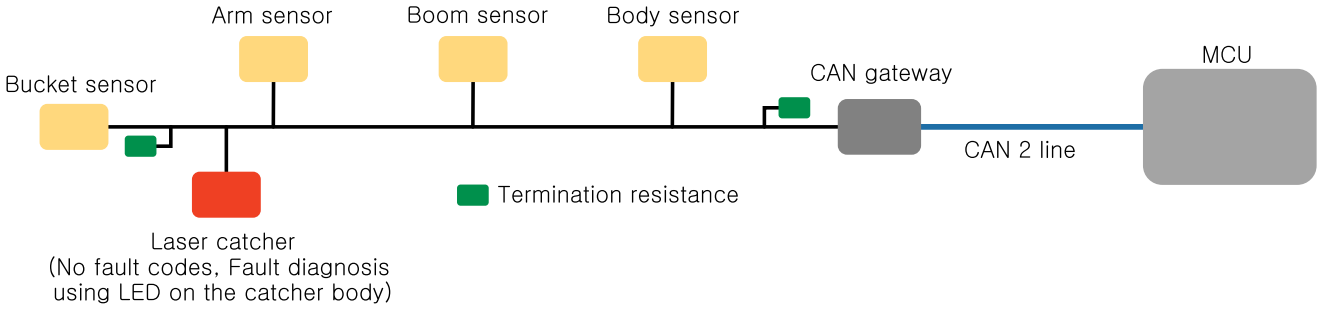
c. If all sensors are defective, refer to ⑤-b Short circuit test (page 5-117) or (3) CAN gateway function error (page 5-119).

300ASMG10EC

② Check faulty sensors.

No.	Fault code	Fault sensor
1	HCESPN 900	Bucket sensor
2	HCESPN 901	Arm sensor
3	HCESPN 902	Boom sensor
4	HCESPN 903	Body sensor

③ Sensor connection configuration



300ASMG11EC

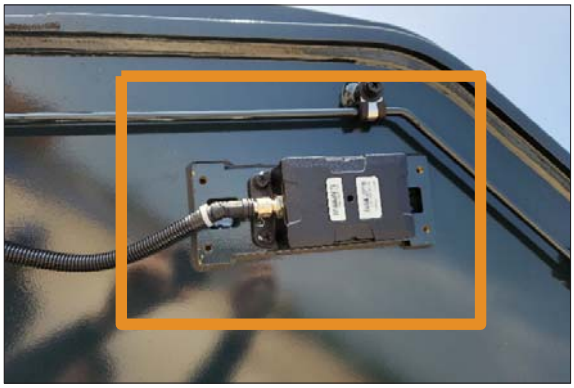
④ Check the connector of fault sensor is loosened.

※ When checking the loosened part, re-perform 2DMG+ after tightening

a. Bucket sensor

300ASMG12K

b. Arm sensor

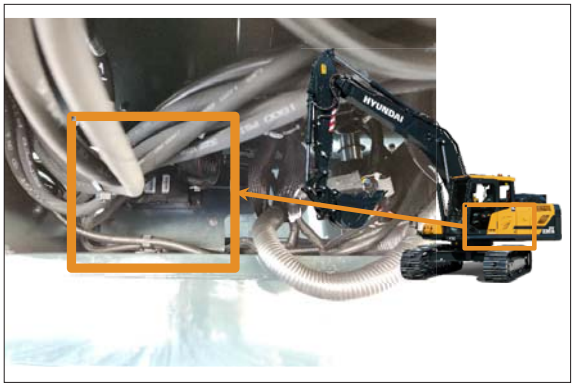


300ASMG13K

c. Boom sensor

300ASMG14K

d. Body sensor

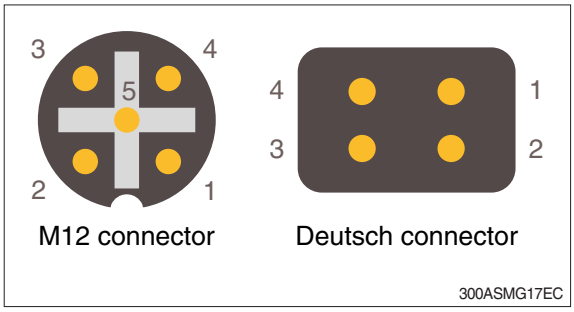


300ASMG15K

⑤ If the connector is not loosened, remove the harness and check for damage.

a. Harness connector pin map (required to check pin number)

Signal	Pin number	
	M12 connector	Deutsch connector
CAN shield	1	-
Vcc : 24V	2	1
GND	3	2
CAN High	4	3
CAN Low	5	4



b. Check for damage using a multimeter.

- Conduct an energization test for each pin between both ends of the harness connector.

- Perform a short circuit test between each pin of the connector.

※ In the case of short circuit, it may occur intermittently due to changes in the posture of the attachment, so short circuit tests are required for various postures.

※ If damage to the harness is confirmed, replace the harness.

(2) Check whether the angle sensor function abnormality.

① Test the operation of the angle sensor.

a. After disconnecting the connector of the laser catcher (other sensors such as boom, arm, bucket, etc. are also possible), install the angle sensor that occurred the fault code instead and check whether the signal is received.

b. If a signal is received, it can be judged to be a problem with the harness connected to the sensor.

c. If the signal is not received, it can be judged as a failure of the sensor itself.

※ After removing the laser catcher cable, perform a mounting test for the sensor that occurred the fault code.

(3) Check whether the can gateway function abnormality.

① Check CAN data of attachment sensor line.

a. Disconnect the Deutsch 4-pin connector near the laser catcher and connect a CAN data collector (PCAN, CANoe, etc.)

b. Check whether the CAN ID data in the table below is being output.

c. If it is output at a period of 20 ms, suspect a malfunction of the CAN gateway itself.

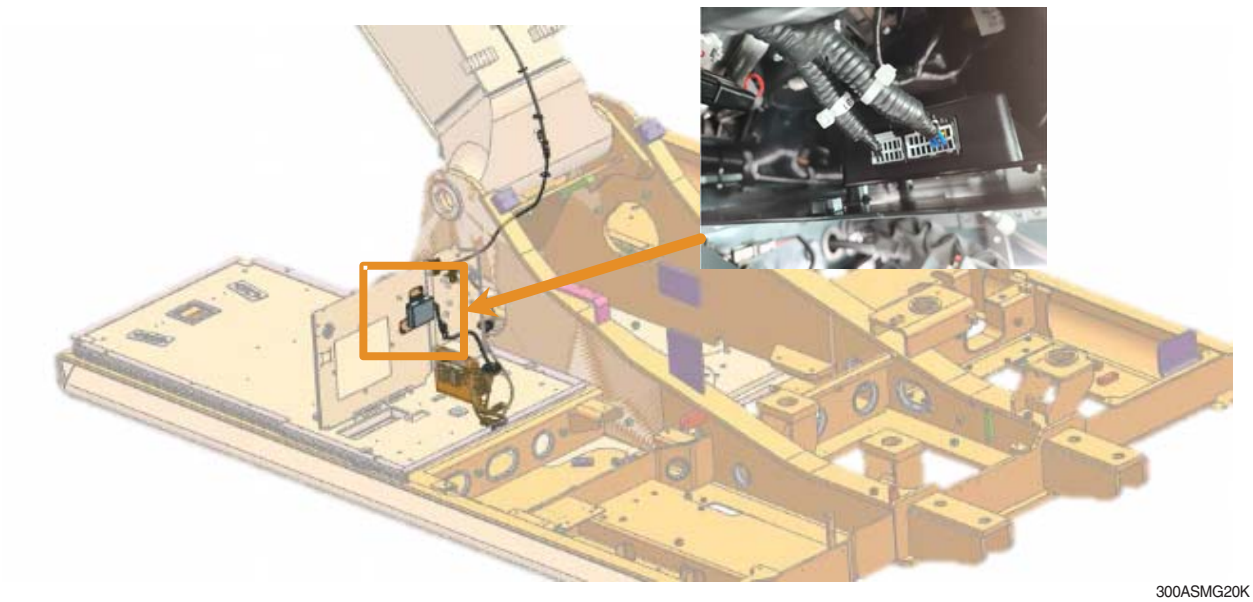
300ASMG19EC

※ CAN ID matching information for each sensor

Sensor	CAN ID
Boom sensor	0x18F029C1
Arm sensor	0x18F029C2
Bucket sensor	0x18F029C3
Body sensor	0x18F029C4

② Mounting location of CAN gateway

It is located near the RMCU at the bottom behind the seat in the cab.



300ASMG20K

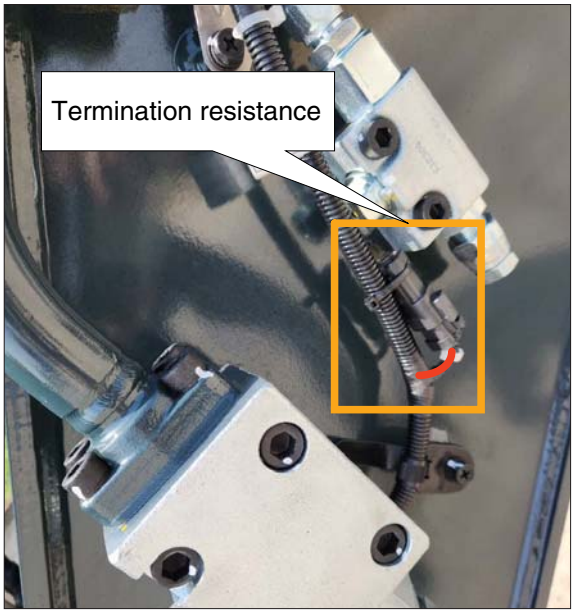
(4) Check whether the can termination resistor is damaged.

① Check whether the termination resistance of the attachment sensor line is normal.

a. If an error occurs in the termination resistance, the CAN line of the attachment will not function properly.

b. After disconnecting the termination resistor, measure the resistance at both ends of the internal pin and check whether a 60 Ω resistance value is output.

c. If the resistance value is normal, check whether the connector branch line indicated in red in the right picture is damaged.



300ASMG21EC

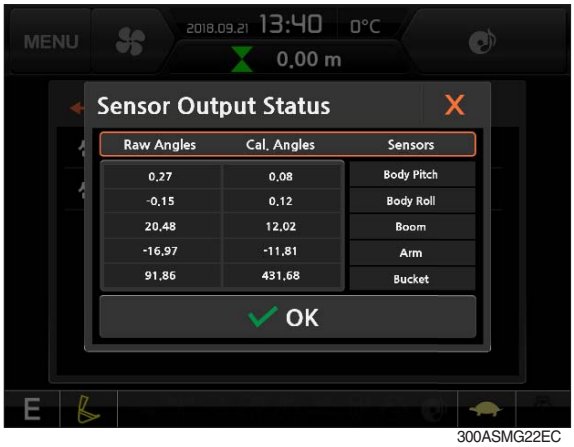
2) ACTION WHEN THE BUCKET END HEIGHT MEASUREMENT ACCURACY IS ABNORMAL

(1) Data error due to internal damage of the angle sensor

① Enter cluster 'Sensor Output Status' menu.

a. From the cluster main menu, go through the following path.

b. Management → Service menu → MG/MC Function set → MG/MC Default set → Monitoring → Sensor Output Status



300ASMG22EC

② Check operation of boom sensor.

a. After adjusting the boom so that the boom 'compensation angle' data is near 0 degrees, check whether the boom remains parallel to the ground as shown in the right picture.

b. Repeat boom up and down operation to check if the 'compensation angle' data of the boom, arm, and bucket changes. (The compensation angle value of the body may change due to vibration, but the change range is less than 1 degree.)

300ASMG23K

※ If abnormal operation is confirmed, replace the boom sensor.

③ Check operation of arm sensor.

a. After adjusting the arm so that the arm 'compensation angle' data is near -90 degrees, check whether the arm's posture remains vertical to the ground as shown in the right picture.

b. Repeat arm in and out operation to check if the 'compensation angle' data of the arm and bucket changes. (The compensation angle value of the body may change due to vibration, but the change range is less than 1 degree.)

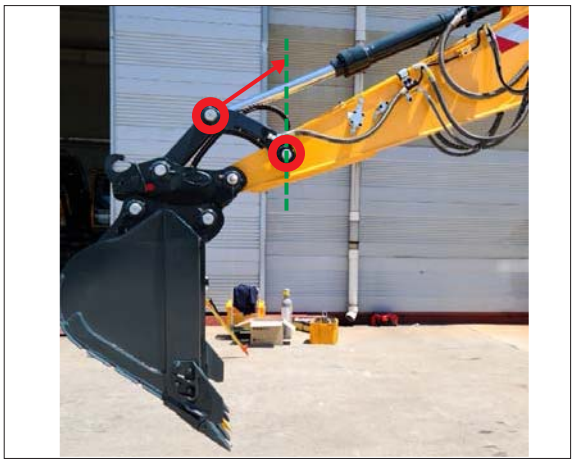
300ASMG24K

※ If abnormal operation is confirmed, replace the arm sensor.

④ Check operation of bucket sensor.

a. After adjusting the bucket so that the bucket 'compensation angle' data is near 90 degrees, check whether the link equipped with the bucket sensor is in a vertical position.

b. Repeat bucket in and out operation to check if the 'compensation angle' data of the bucket changes. (The compensation angle value of the body may change due to vibration, but the change range is less than 1 degree.)



300ASMG25K

※ If abnormal operation is confirmed, replace the bucket sensor.

(2) Check current selected bucket.

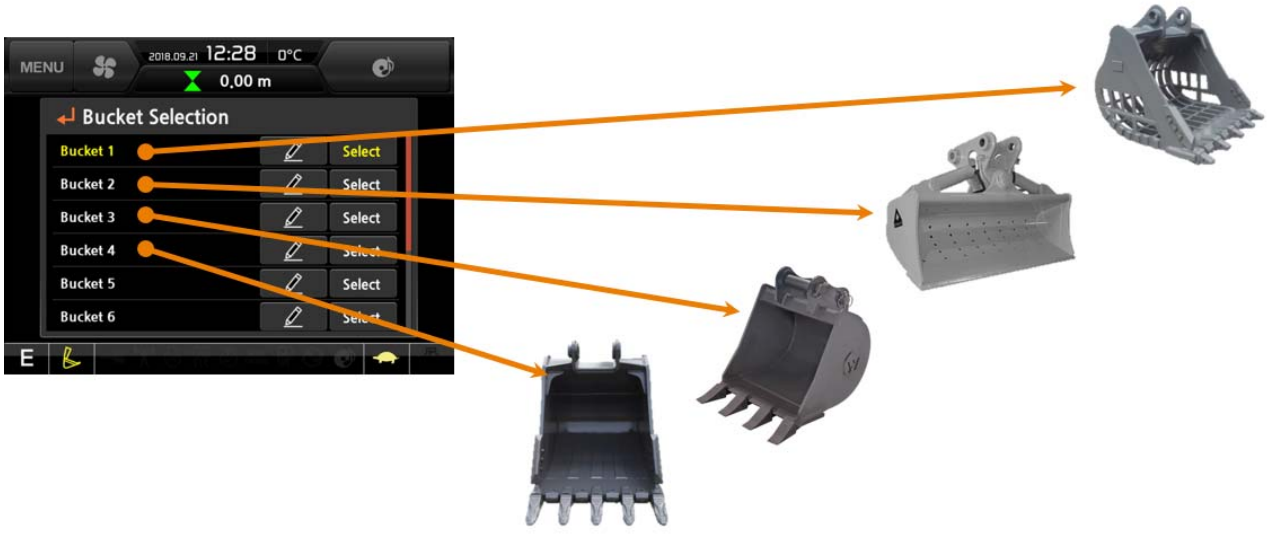
① Enter cluster 'Bucket Selection' menu.

a. From the cluster main menu, go through the following path.

b. MG Main Screen → ⚙ → Bucket selection

300ASMG26EC

② Check that the bucket selected on the menu (highlighted in yellow) matches the currently installed bucket.



300ASMG27EC

※ If a discrepancy is confirmed with the currently installed bucket, change the bucket selection information.

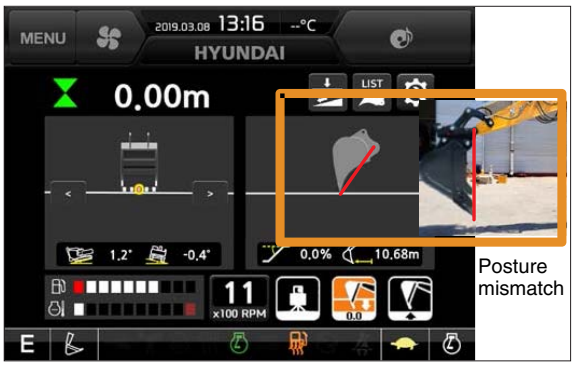
(3) Check compliance with the vertival posture when entering bucket dimensions.

① Adjust the bucket posture to a vertical position using the plumb bob.

300ASMG28K

② Check whether the bucket posture is vertical on the bucket side view screen on the right side of the 2DMG+ main screen.

※ **When a discrepancy in the vertical posture is confirmed, the dimension input procedure is performed again with the bucket in a vertical position.**



300ASMG29EC

(4) Check bucket dimensions.

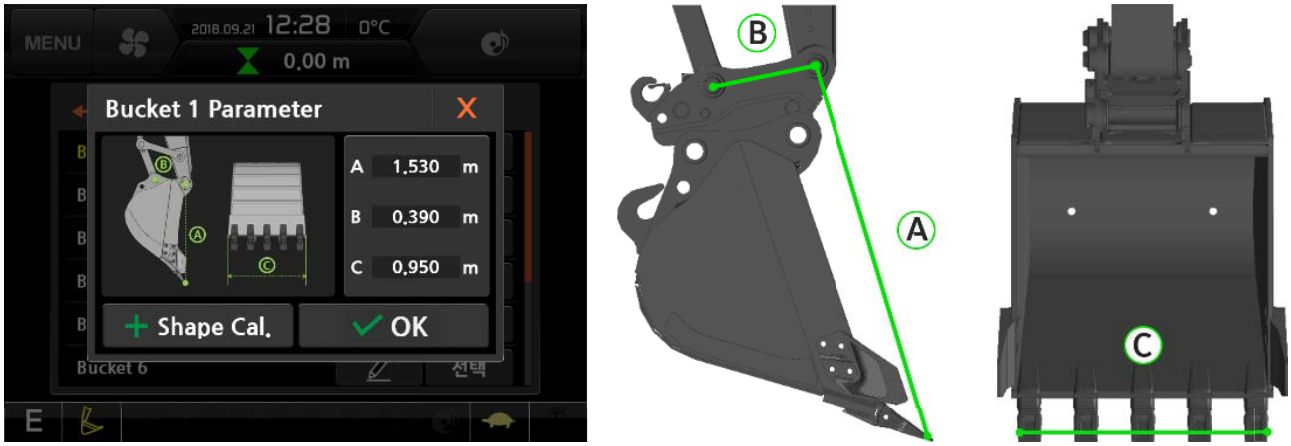
① Enter cluster 'Bucket Selection' menu.

a. From the cluster main menu, go through the following path.

b. MG Main Screen → ⚙ → Bucket selection

300ASMG30EC

② Click on the currently selected bucket to view the dimension information window, then measure and compare the dimensions of the installed bucket.



300ASMG31EC

※ **When discrepancy is confirmed, perform the bucket dimension input procedure.**

※ **If a quick coupler is installed, measure the dimensions based on the bucket rotation center pin at the top of the quick coupler as shown in the picture above.**

(5) Check design surface (depth/slope) information.

① When trenching work is in progress.

a. Enter the depth setting screen and check the set depth.

a) Enter the depth/slope setting screen on the cluster screen

b) MG Main Screen → →

300ASMG32EC

b. After checking the depth settings, check the gradient information on the 2DMG+ main screen.

a) Refer to the right picture and check whether the current slope is set.

b) If a gradient is set, enter the gradient settings screen and initialize the gradient value.
(→ → 초기화 → Confirm button)

300ASMG33EC

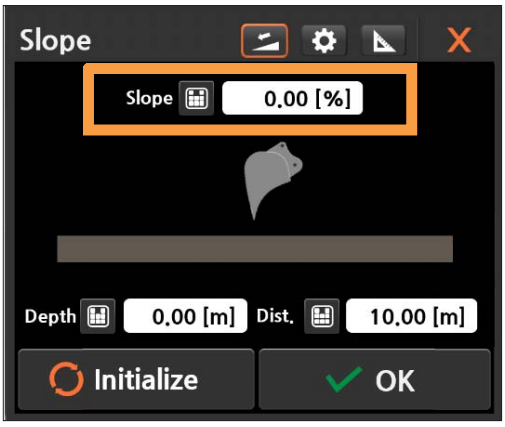
※ **If a slope is set during trenching work, the height measurement error increases as the bucket position moves away from the reference point.**

② When a slope work is in progress.

a. Enter the slope setting screen and check the set slope.

a) Enter the depth/slope setting screen on the cluster screen.

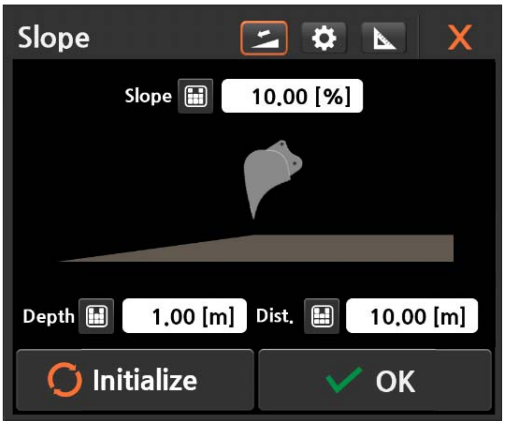
b) MG Main Screen → →



300ASMG34EC

b. Check the +/- mark according to the gradient setting value and gradient direction.

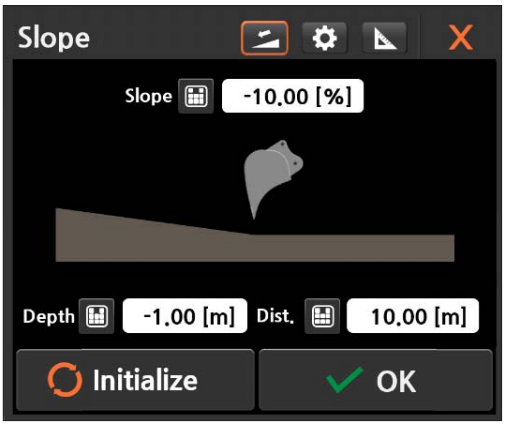
a) In case of (+) slope, slope downward in the direction of the attachment.



300ASMG35EC

b) In case of (-) slope, slope upward in the direction of the attachment.

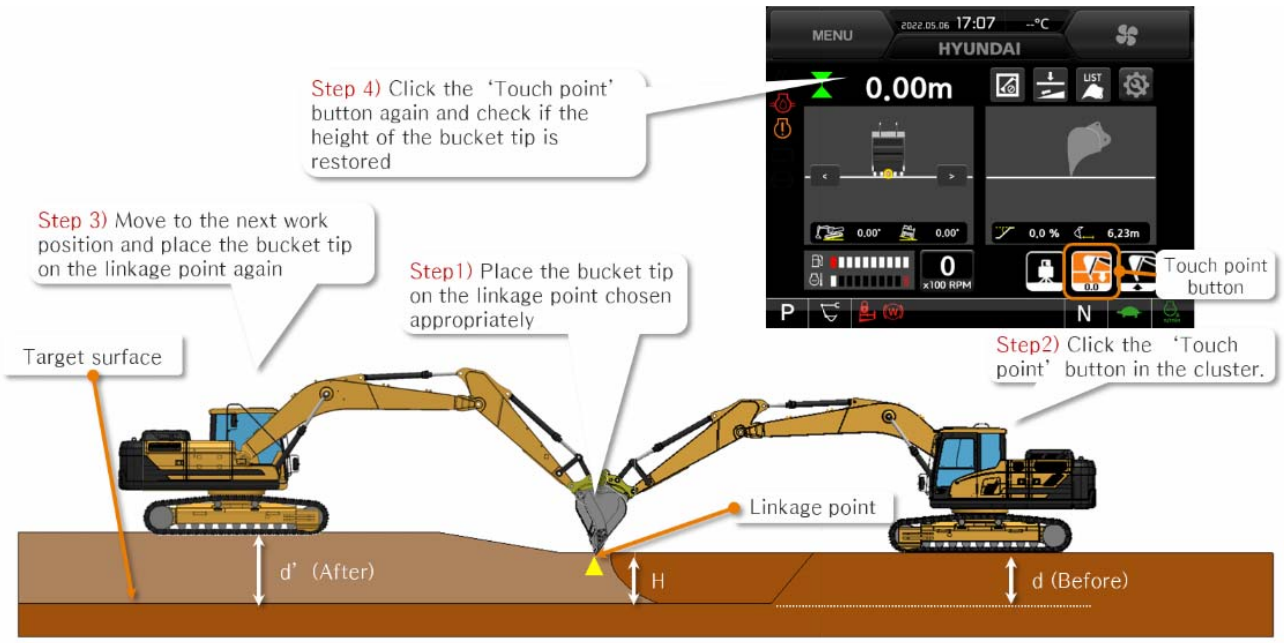
※ **It is necessary to check the value and direction of the currently set gradient by referring to the right picture.**



300ASMG36EC

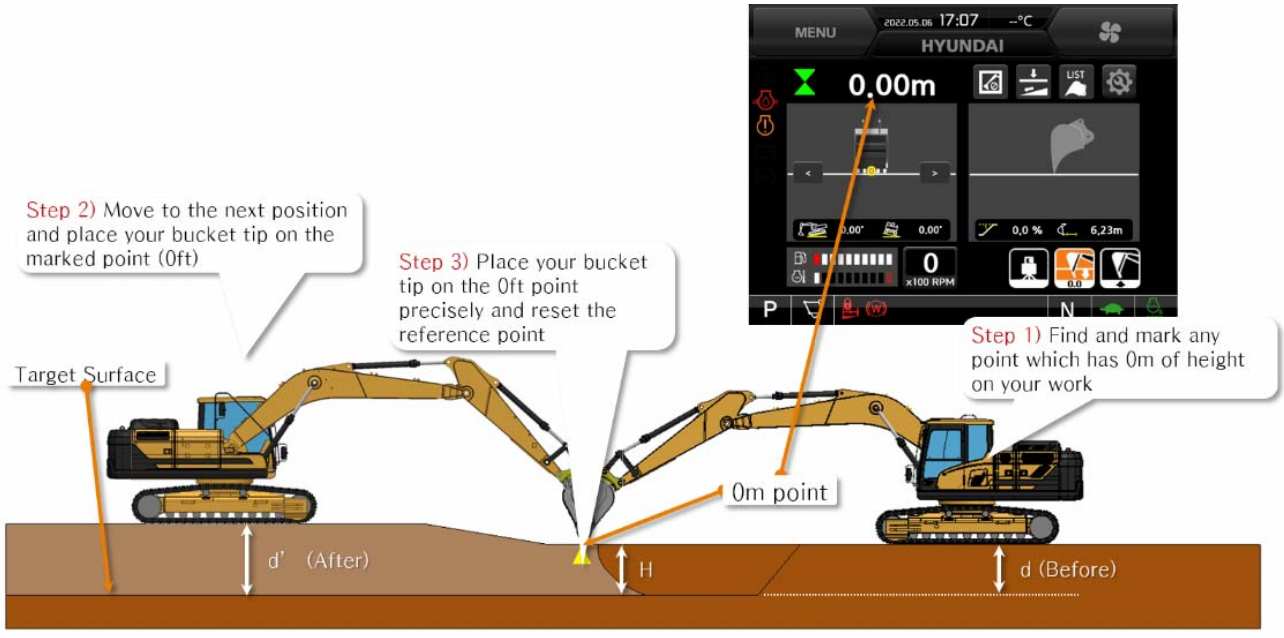
(4) Check compliance with reference point movement procedures.
When moving to a location, check whether the reference point movement function is used according to the procedure. (Refer to operator's manual)

① Touch point utilization



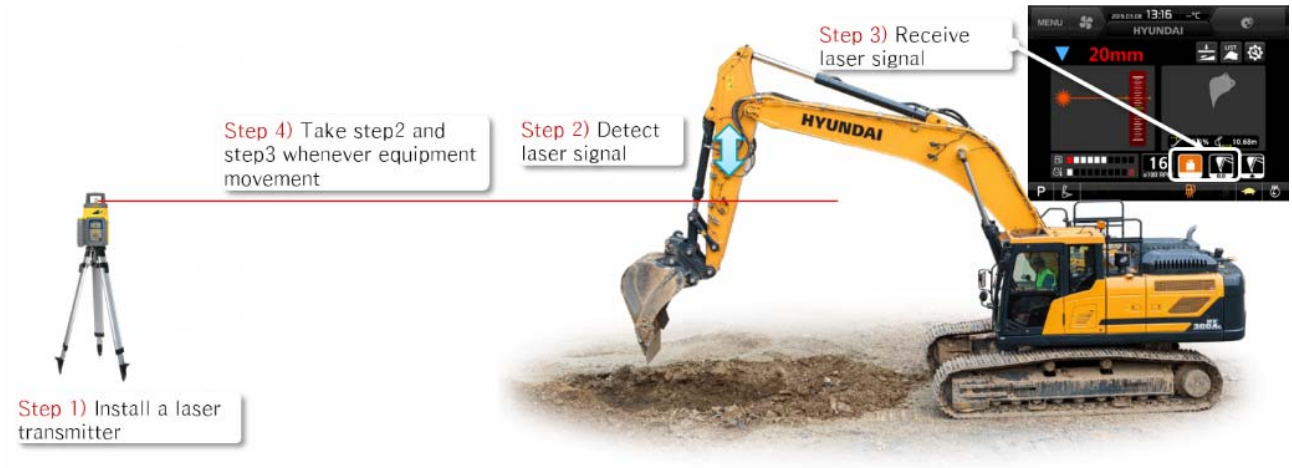
300ASMG38EC

② Reference height utilization



300ASMG39EC

③ Laser catcher utilization



300ASMG40EC

※ If the reference point movement procedures in ①, ②, ③ above are not followed and the work location is moved, measurement errors are likely higher to occur.

(5) Enter 2DMG+ setting value after replacing MCU.

① When replacing MCU, 2DMG+ related information needs to be re-entered.

a. During the 2DMG+ installation process, create a '2DMG+ Option Installation' check sheet that separately organizes 2DMG+ setting data for each machine.

b. After requesting the 2DMG+ person in charge of PS to deliver the check sheet along with the model and serial number, enter the setting information of the check sheet into the cluster.

Check Sheet for 2D MG Option Installation

Date	2020. 9. 18.	Site	■ Ulsan □ Dang-Jin □ etc	Draft	Review	Approval
Model	■ HX145SLCR □ HX260SLA □ HX220SLA □ HX300SLA □ HX235SLCR □ HX330SLA	#	0005			

1. Verification for Installation

① The brackets are properly touched-up after welding	Yes ■	No □
② The bucket-arm connecting harness is not interferred	Yes ■	No □
③ The arm-boom connecting harness is not overstreched	Yes ■	No □
④ The boom-body connecting harness is not overstreched	Yes ■	No □
⑤ The data from each sensor are normal	Yes ■	No □

2. Dimensions

Boom (A-B)	4.603 m	Bucket Pin to Link Pin (C-D)	0.340 m
		Bucket Link (D-E)	0.470 m
Arm (B-C)	2.495 m	Bucket Rod (E-F)	0.415 m

3. Calibration

			Check List		
Offset Angles	Pitch	-0.01			
	Roll	-0.08	① Are the measurement results for each bucket position the same?	Yes ■	No □
	Boom	10.09	② Are the measurement results the same with the real ones?	Yes ■	No □
	Arm	-9.93	③ Are the data for dimensions and calibration angles properly maintained after restarting?	Yes ■	No □
	Bucket	-0.37	④ Are there any problems on the machine?	Yes ■	No □

4. Laser Receiver (Yes □, No ■)

			Check List		
Data	Arm Pin	m			
	Bucket Pin	m	① Is it possible to receive the laser signal?	Yes □	No □
	Arm Width	m	② Is the measurement result using laser singal correct?	Yes □	No □
	Arm Edge	m	③ Is the reference height properly maintained after moving the machine?	Yes □	No □
	Mounting Angle	°	④ Are the data for dimensions and mounting angles properly maintained after restarting?	Yes □	No □

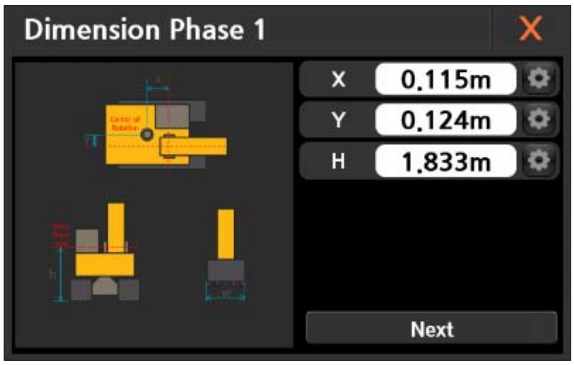
300ASMG41EC

② Input dimensions for 2DMG+ machine.

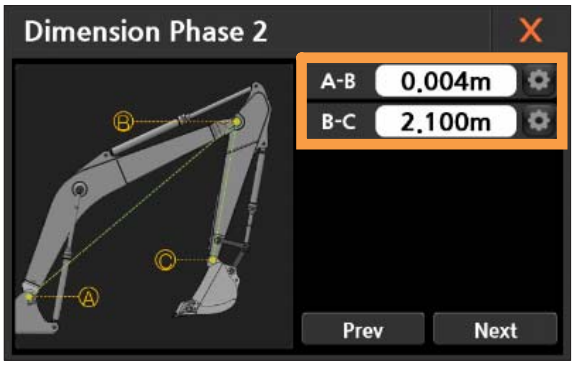
a. Enter the Dimension Phase 1 menu on the cluster menu.

b. Management → Service menu → MG/MC Function set → MG/MC Default set → Dimension set

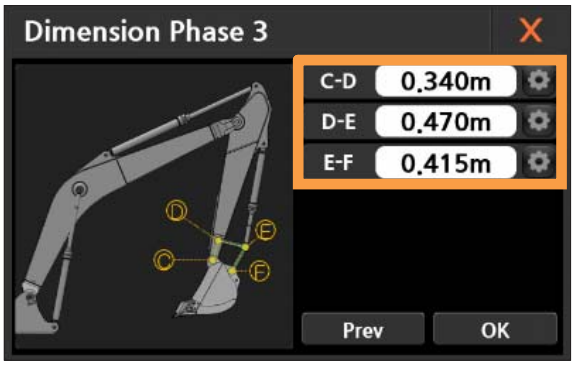
c. In step 1, 'Dimension Phase 1', be careful not to change the default values, and only enter the dimensions of the boom, arm, and bucket link in steps 2 and 3.



300ASMG42EC



300ASMG43EC



300ASMG44EC

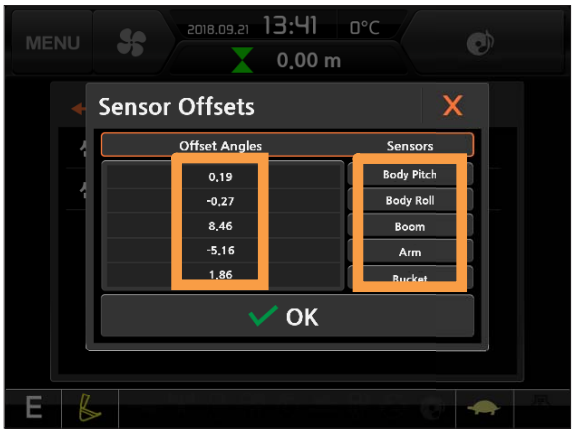
③ Input the angle sensor offset for 2DMG+.

a. Enter the sensor offset menu on the cluster menu.

b. Management → Service menu → MG/MC Function set → MG/MC Default set → Monitoring → Sensor Offsets

c. Refer to the check sheet and enter all offset values for the body roll, body pitch, boom, arm and bucket.

※ If dimension information and sensor offset are not entered after replacing the MCU, the accuracy of 2DMG+ measurement cannot be secured.



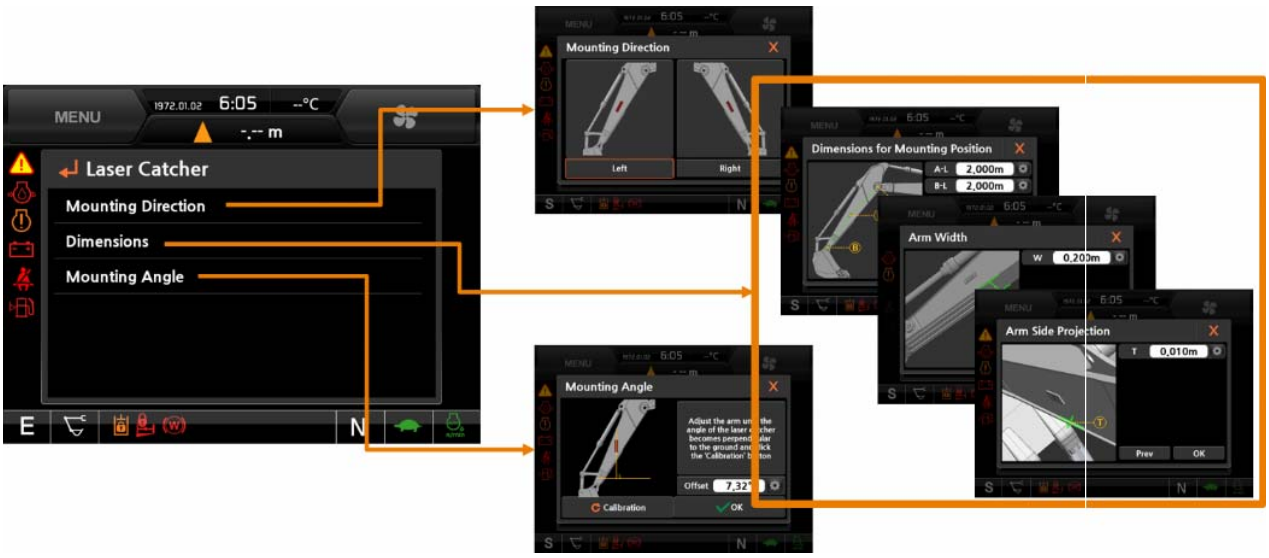
300ASMG45EC

④ Input laser catcher setup information. (If equipped with the laser catcher option.)

a. Enter the laser catcher menu on the cluster menu.

b. Management → Service menu → MG/MC Function set → Laser Catcher

c. Refer to the check sheet and enter the laser mounting location, laser catcher dimensions and laser catcher installation angle.



300ASMG46EC

⑤ Input bucket dimensions.

The bucket dimension input procedure is performed for all buckets owned by the user.

Bucket vertical posture adjustment

Keep vertical posture, input bucket dim (A,B,C)

300ASMG47EC

3) ACTION WHEN YOU CAN NOT ENTER THE CLUSTER'S 2DMG+ MENU

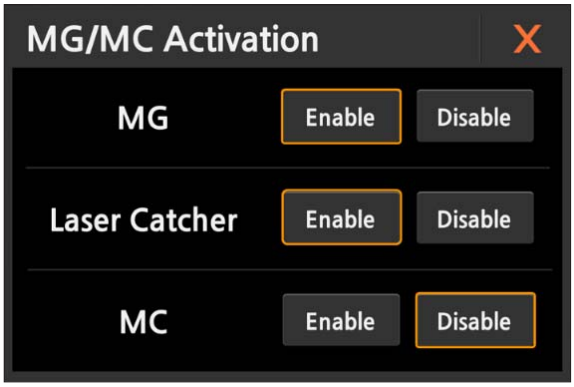
(1) 2DMG+ FUNCTION NOT SET AFTER CLUSTER REPLACEMENT

① Change cluster default settings.

a. From the cluster main menu, enter the function selection menu through the following path.

b. Management → Service menu → MG/MC Function set → MG/MC Activation select

c. Change MG function and laser catcher to "Enable".



300ASMG48EC

SECTION 6 TROUBLESHOOTING

Group 1 Before Troubleshooting ····· 6-1
Group 2 Hydraulic and Mechanical System ····· 6-4
Group 3 Electrical System ····· 6-24
Group 4 Mechatronics System ····· 6-40
Group 5 Air conditioner and Heater System ····· 6-70

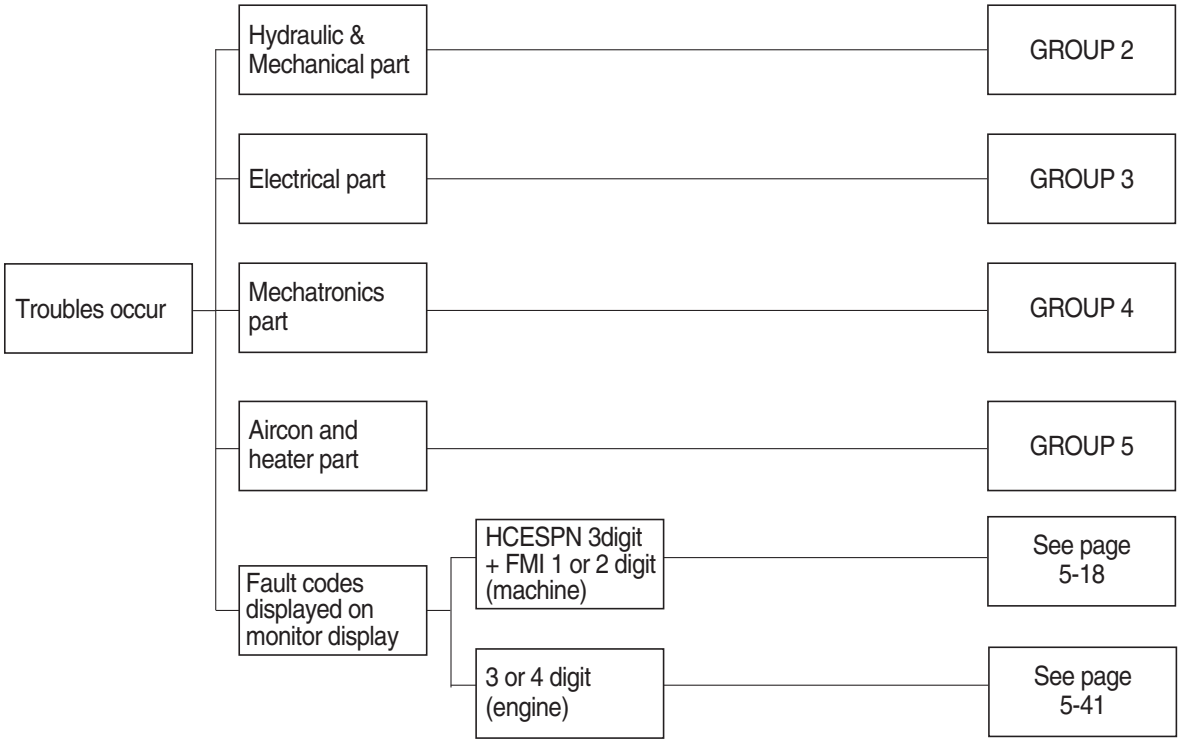
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

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

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

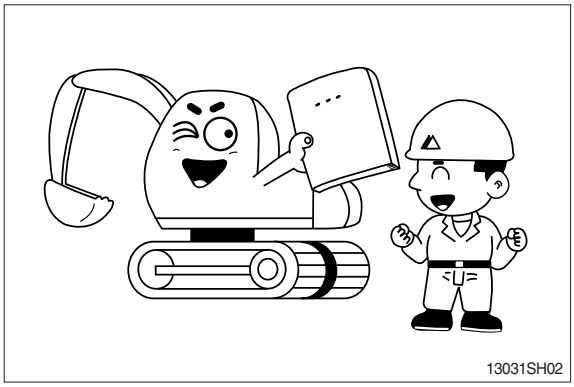


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

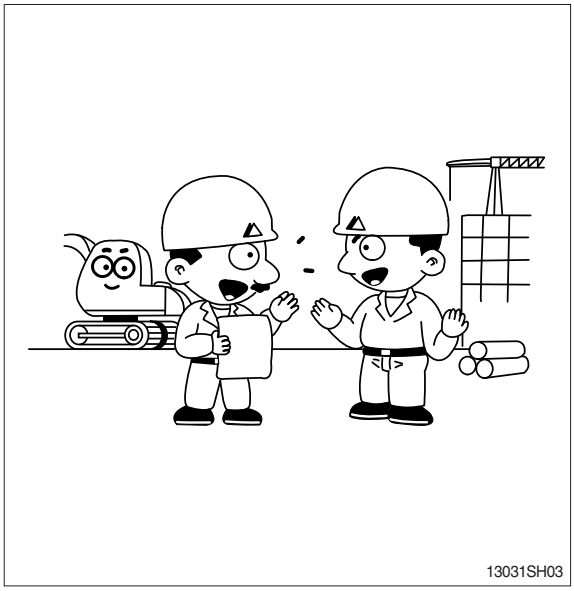
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.


13031SH02

STEP 2. Ask the operator

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

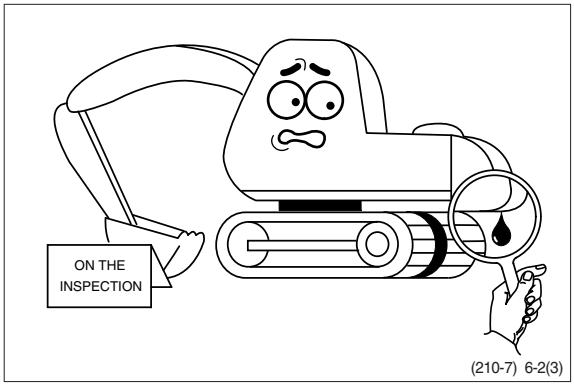
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously?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


13031SH03

STEP 3. Inspect the machine

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

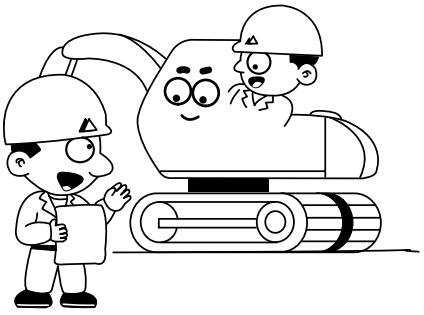
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

STEP 4. Inspect the trouble actually on the machine

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



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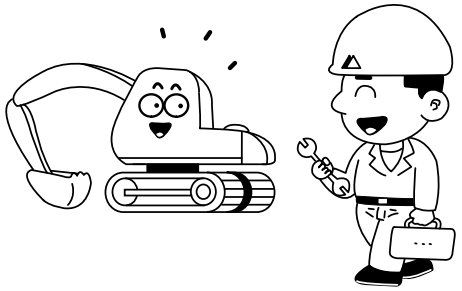
STEP 5. Perform troubleshooting

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

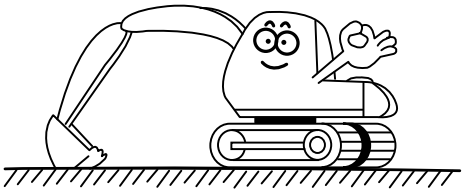


13031SH05

STEP 6. Trace a cause

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

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



(210-7) 6-3(3)

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

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

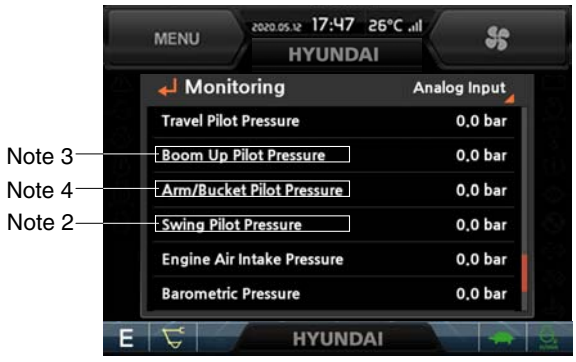
(4) Ask user or operator the following.
① Was there any strange thing about machine before failure occurred?
② Under what conditions did the failure occur?
③ Have any repairs been carried out before the failure?

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

2) MACHINE STATUS MONITORING ON THE CLUSTER

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

Analog 1



Analog 2

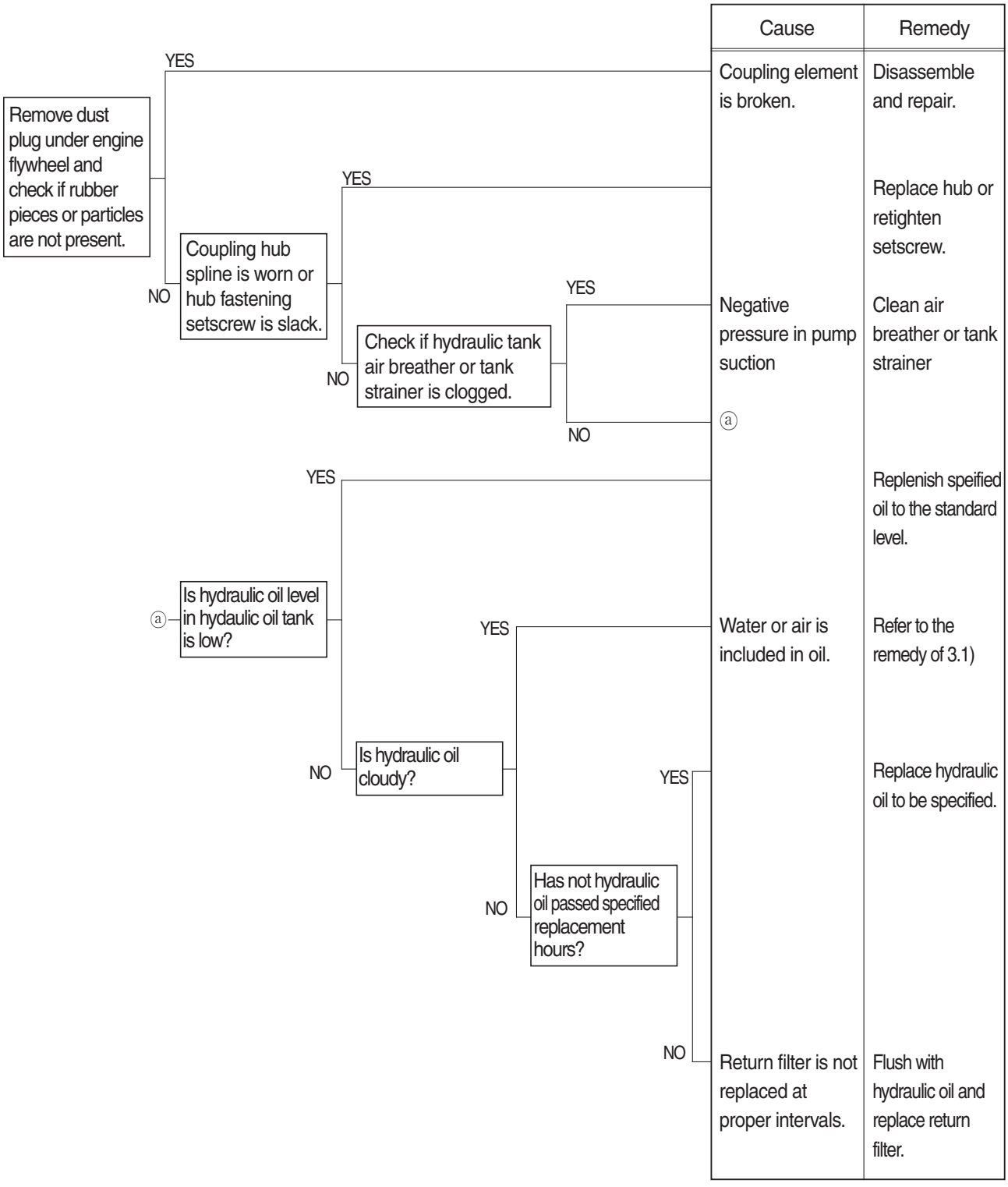
210A6HS01

(2) Specification

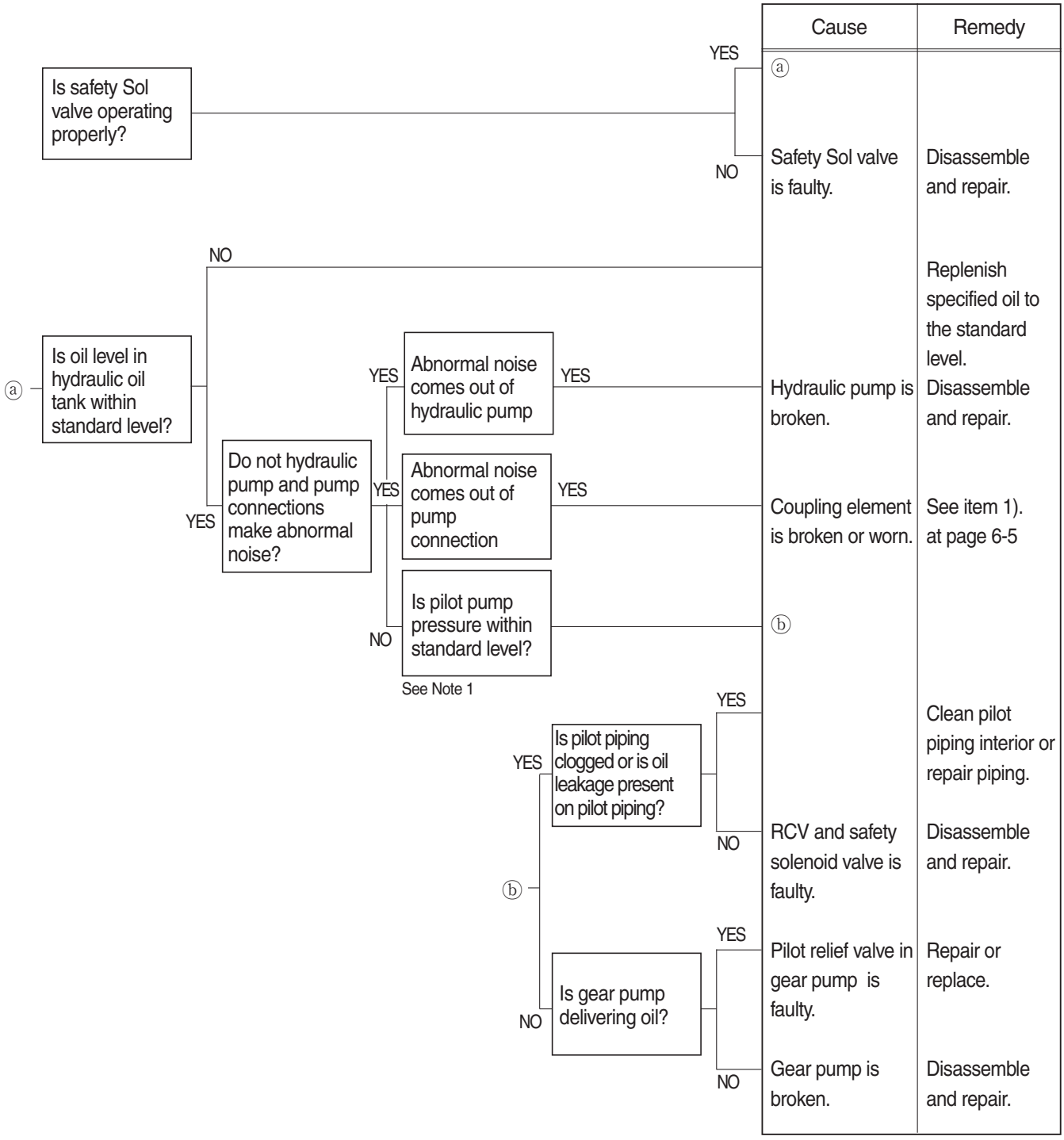
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

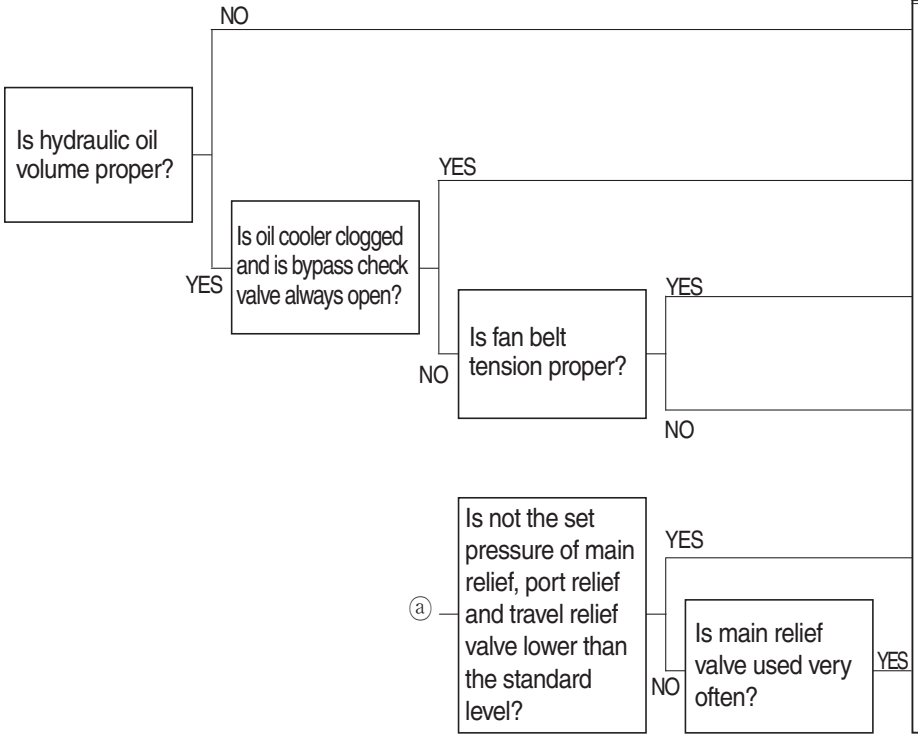


3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

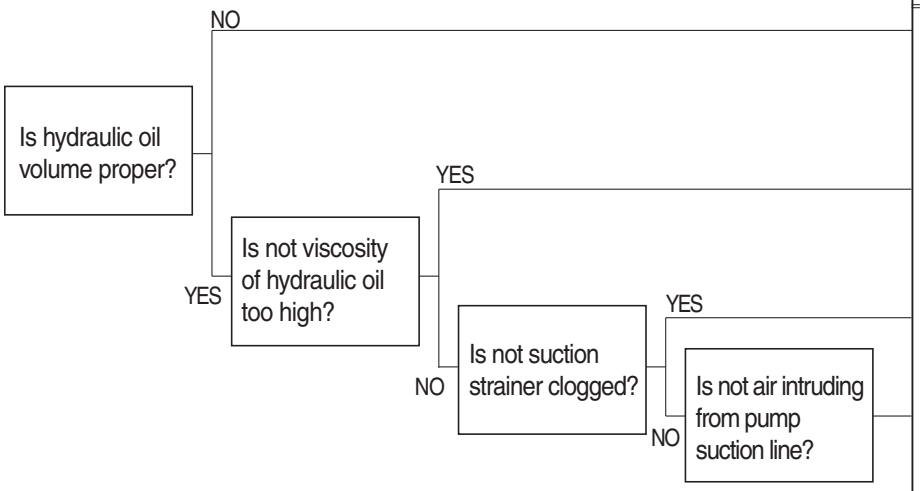
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



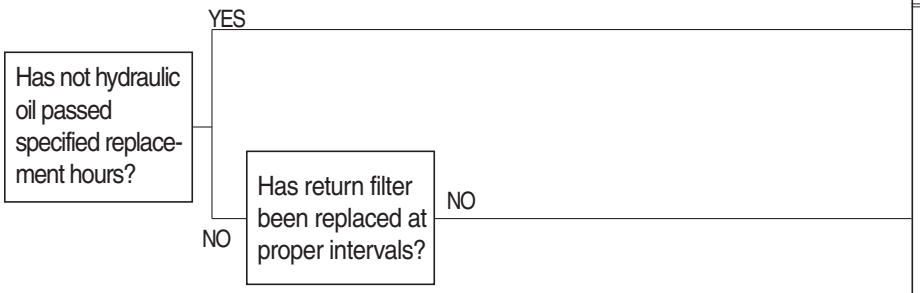
Cause	Remedy
Oil cooler clogged. Bypass check valve is defective. ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Replace
	Adjust belt tension or replace belt.
	Readjust set pressure.
	Reduce load.

3) CAVITATION OCCURS WITH PUMP



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

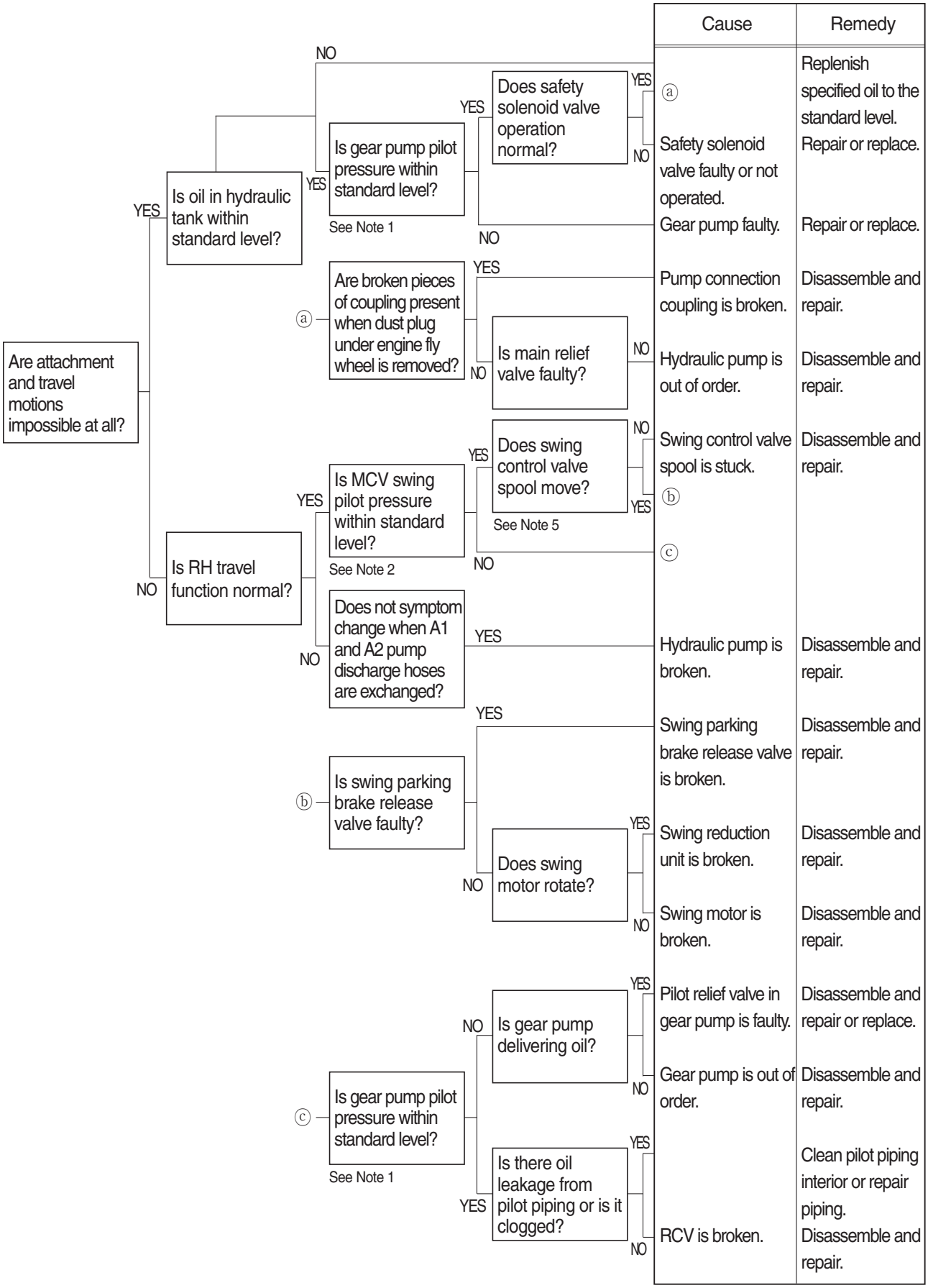
4) HYDRAULIC OIL IS CONTAMINATED



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

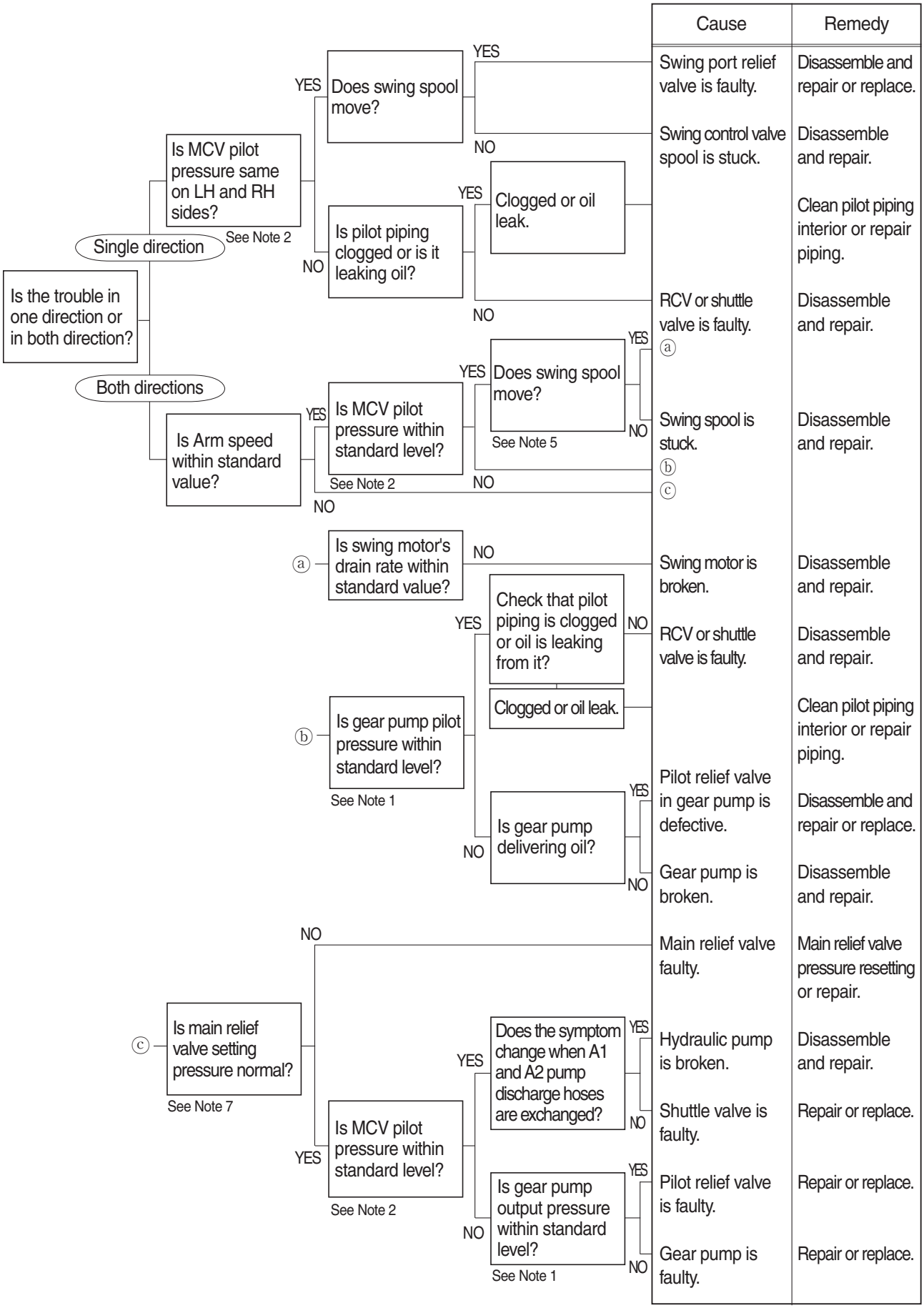
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

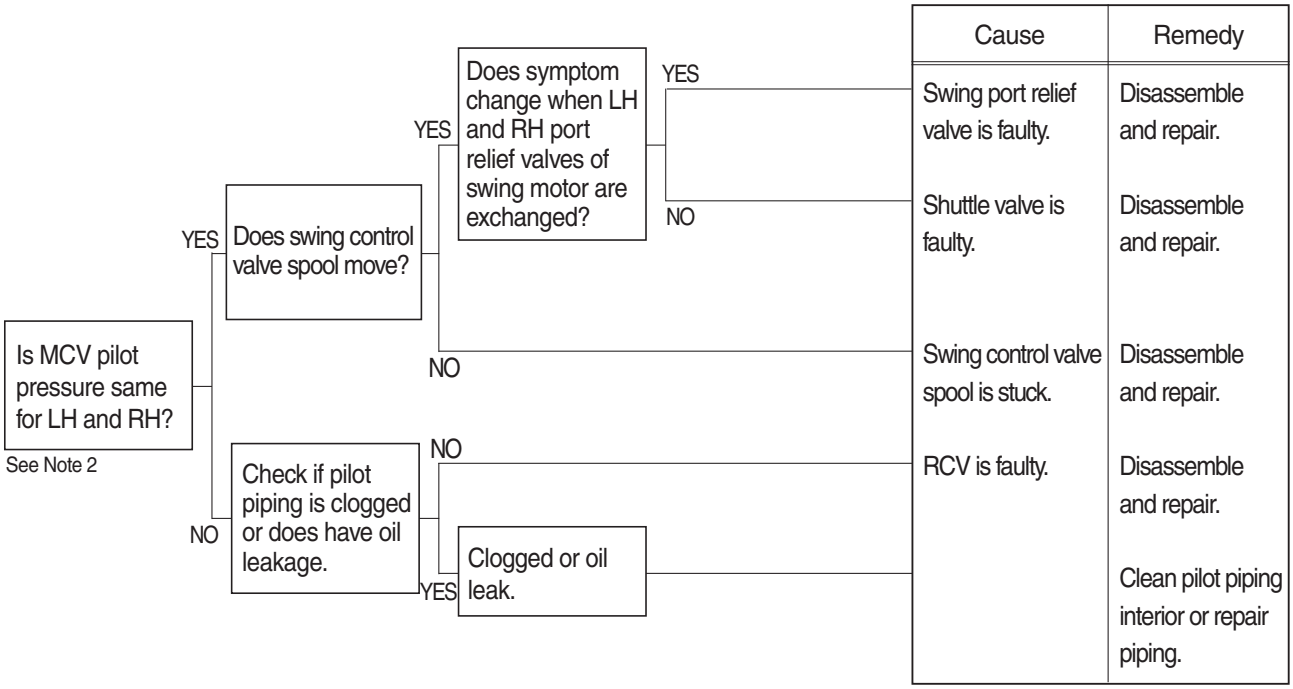


Cause	Remedy
ⓐ	Replenish specified oil to the standard level.
Safety solenoid valve faulty or not operated.	Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool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

2) SWING SPEED IS LOW

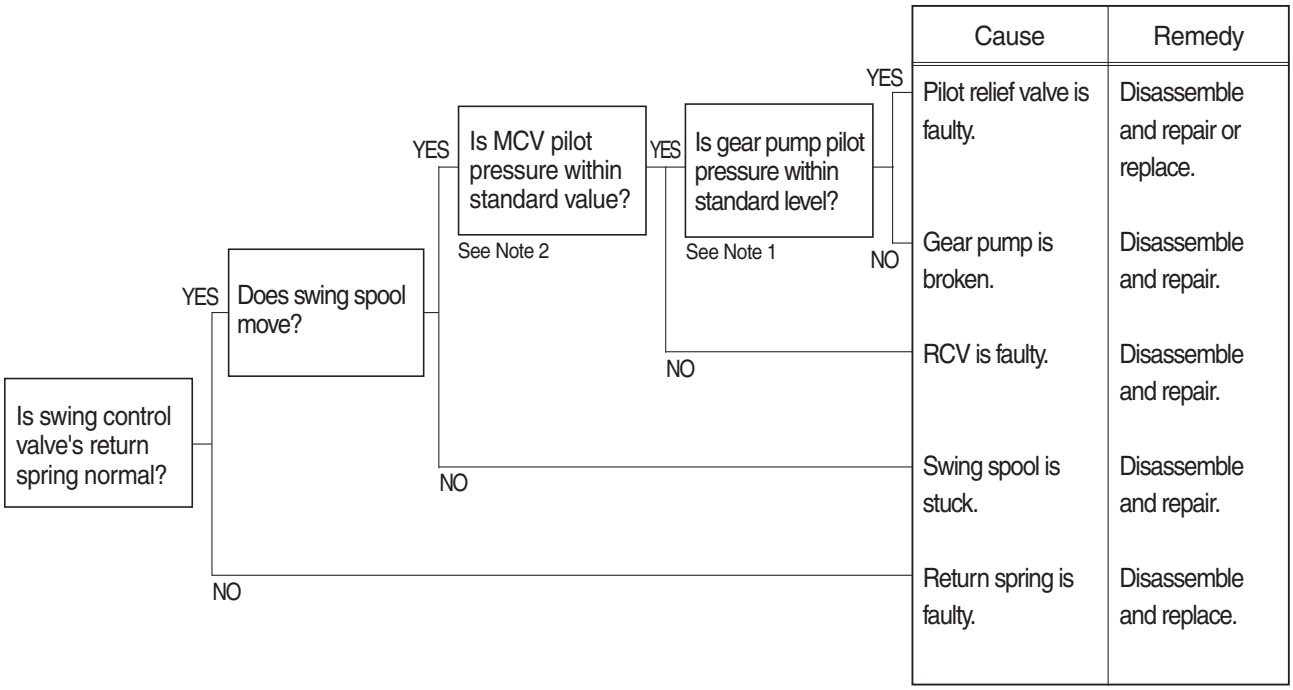


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



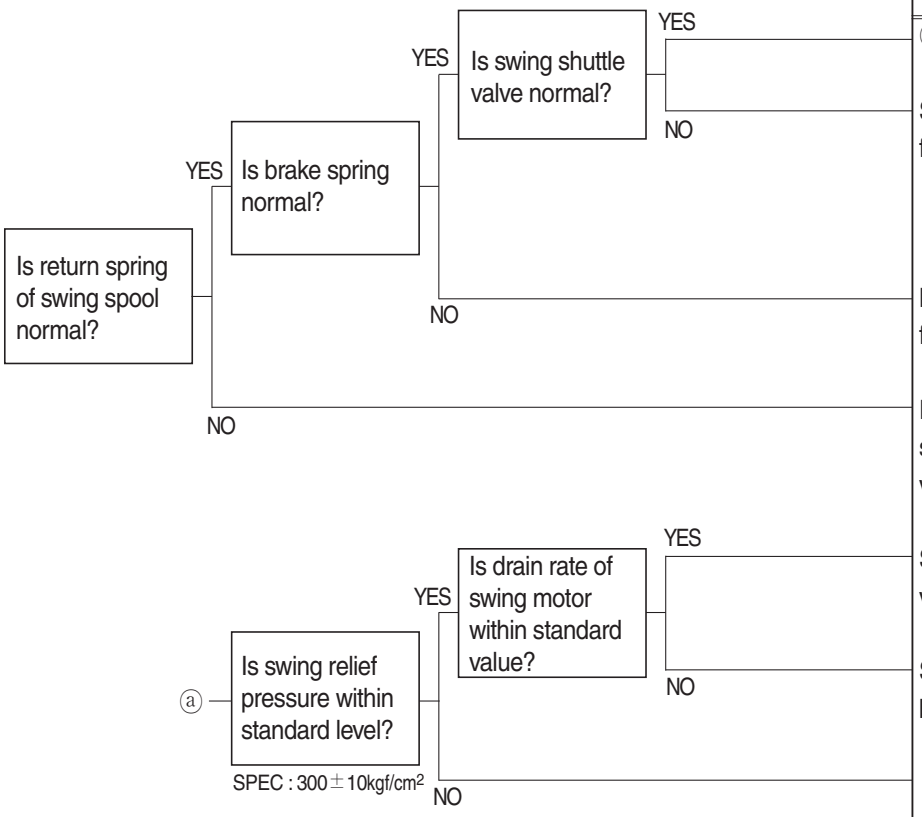
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



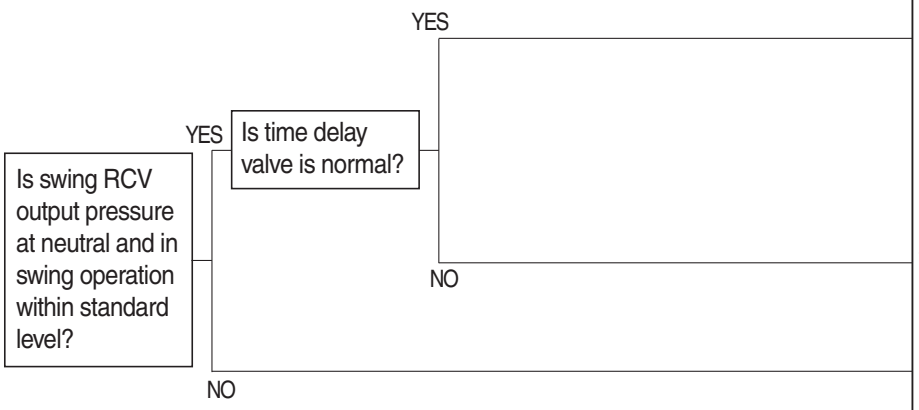
Cause	Remedy
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
Swing spool is stuck.	Disassemble and repair.
Return spring is faulty.	Disassemble and replace.

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



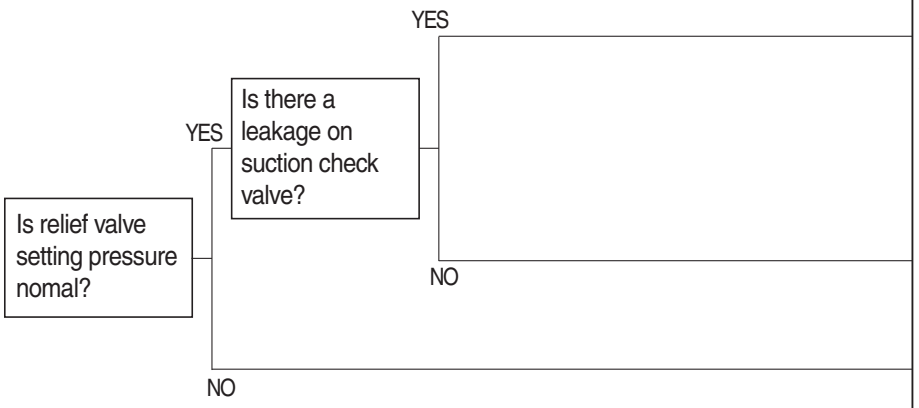
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing port relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.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

6) LARGE SHOCK OCCURS WHEN STOP SWINGING



Cause	Remedy
Swing motor is broken.	Disassemble and repair.
Time delay valve is faulty.	Disassemble and repair or replace.
Malfunction of swing RCV	Disassemble and repair.

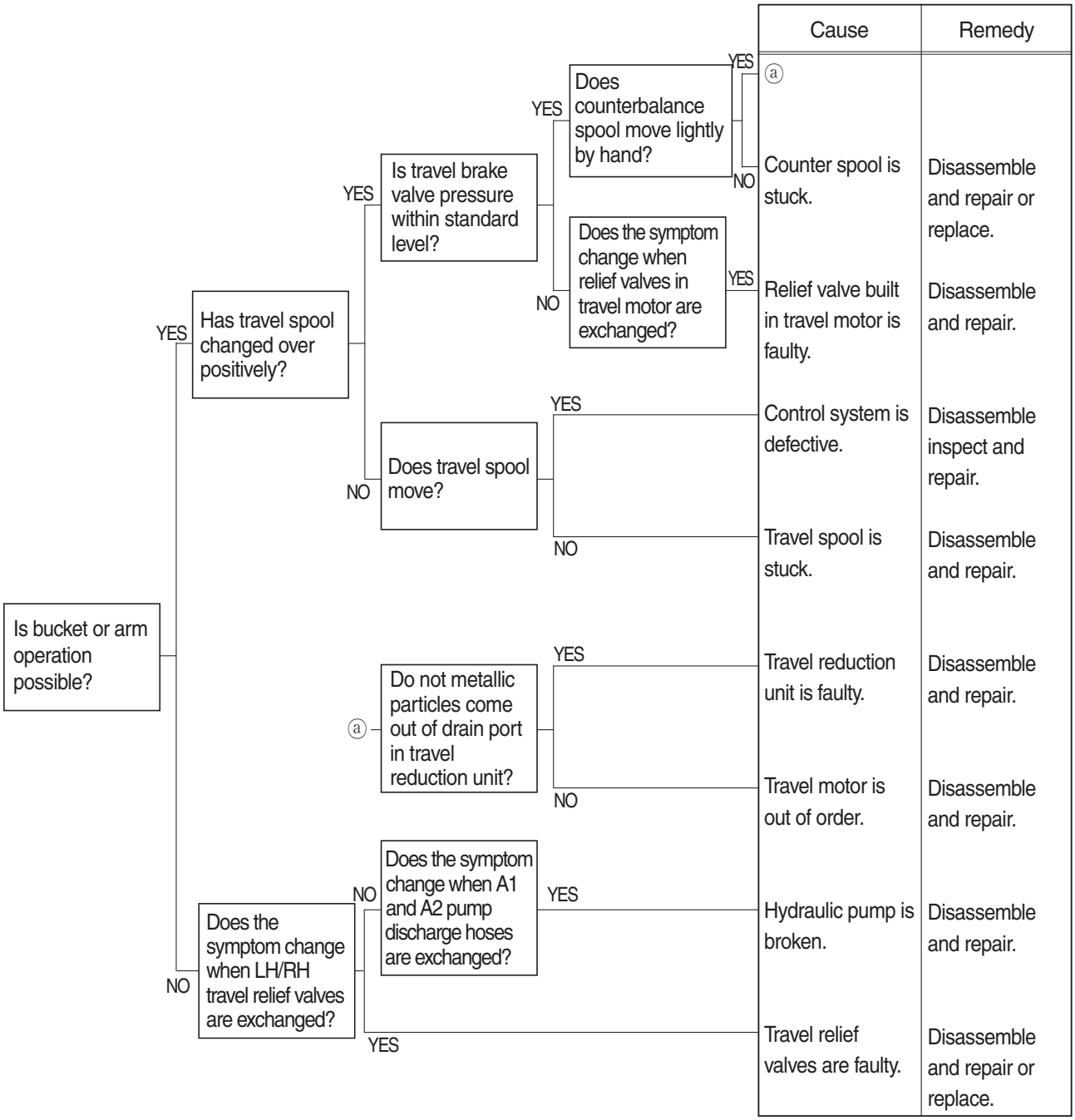
7) LARGE SOUND OCCURS WHEN STOP SWINGING



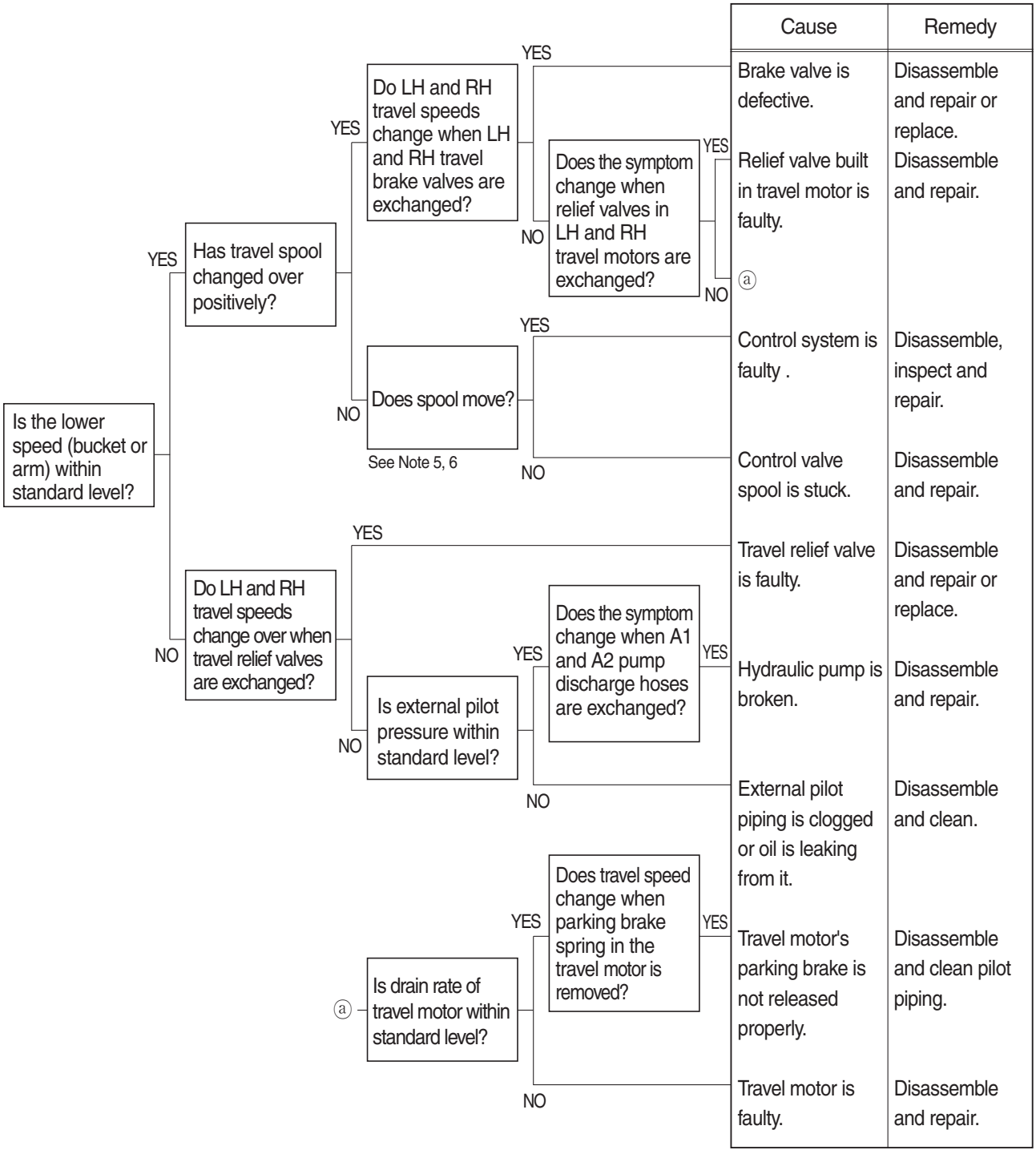
Cause	Remedy
Seal of suction valve is faulty.	Disassemble and repair.
Internal defect of swing motor.	Disassemble and repair.
Malfunction of relief valve.	Adjust swing relief valve pressure or replace swing relief valve.

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



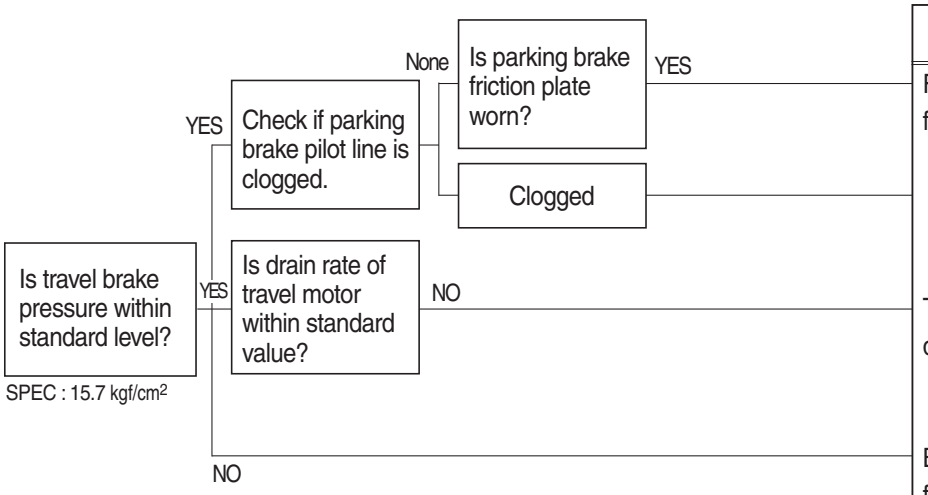
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



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.

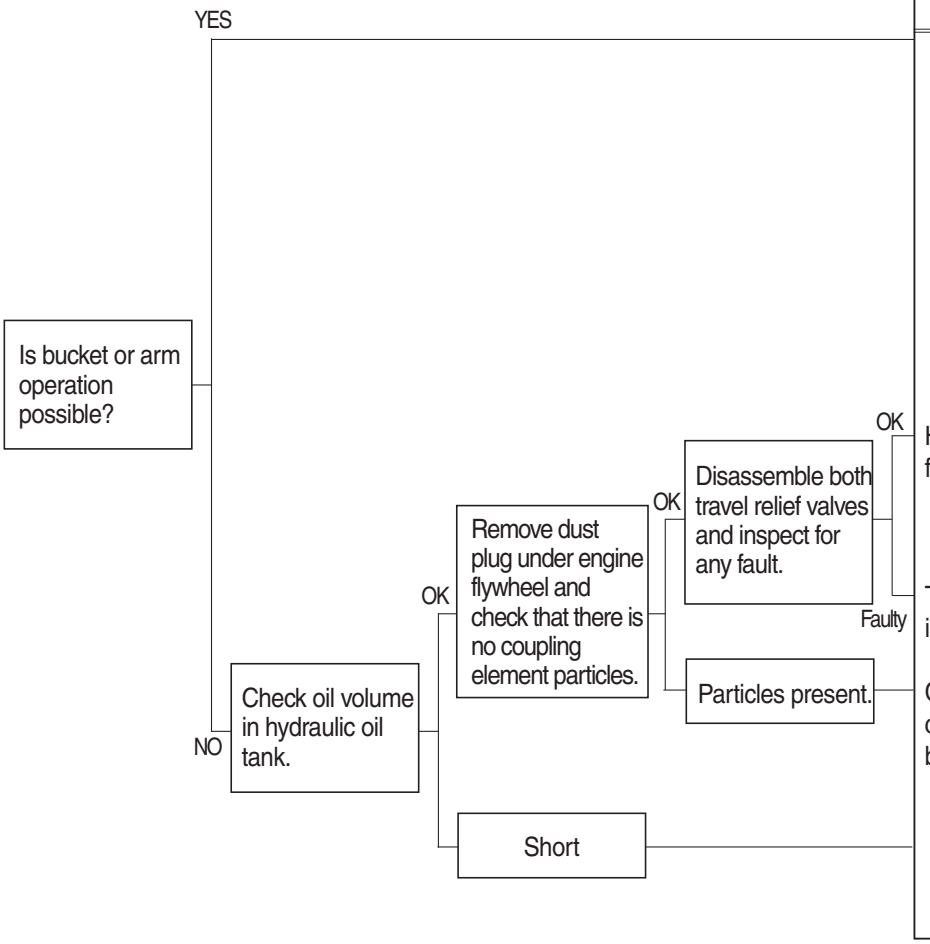
3) MACHINE DOES NOT STOP ON A SLOPE

Machine is pulled forward as sprocket rotates during digging operation.



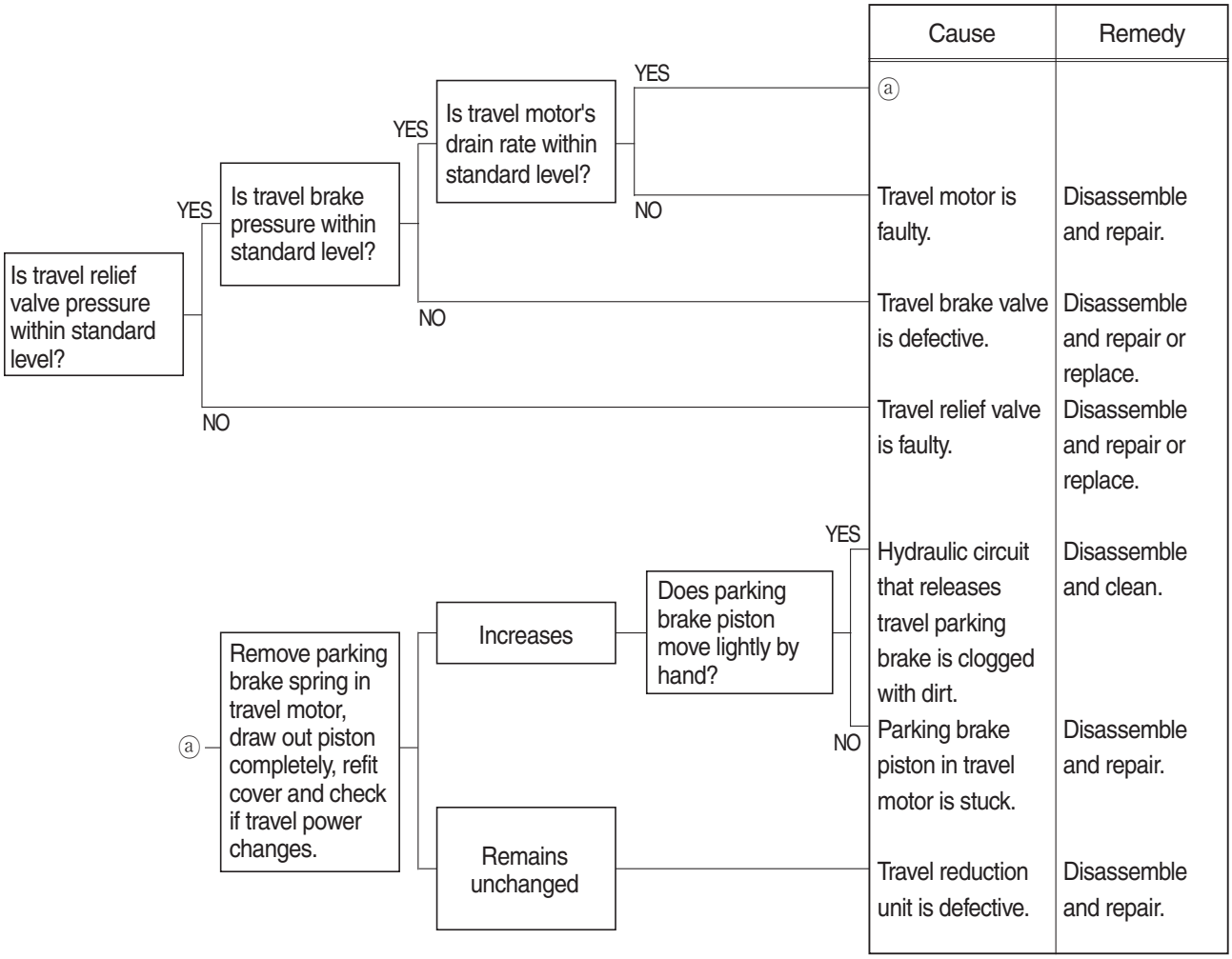
Cause	Remedy
Friction plate is faulty.	Disassemble and repair.
Clogged	Disassemble and clean pilot piping.
Travel motor is defective.	Disassemble and repair.
Brake valve is faulty.	Disassemble and repair or replace.

4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



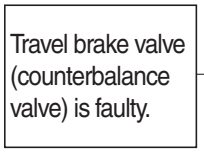
Cause	Remedy
	Inspect according to the procedure "Travel does not function at all on one side." However, a case where both LH and RH travel motions are disabled is extremely seldom statistically.
Hydraulic pump is faulty.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Coupling at pump connection is broken.	Disassemble and repair.
	Replenish hydraulic oil.

5) TRAVEL ACTION IS POWERLESS (travel only)



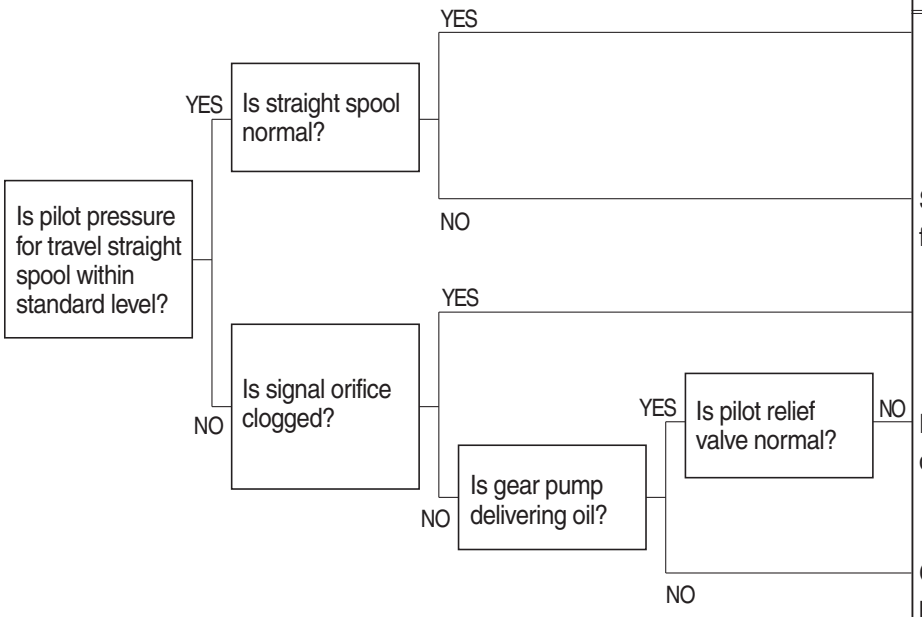
Cause	Remedy
ⓐ	
Travel motor is faulty.	Disassemble and repair.
Travel brake valve is defective.	Disassemble and repair or replace.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic circuit that releases travel parking brake is clogged with dirt.	Disassemble and clean.
Parking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

6) MACHINE RUNS RECKLESSLY ON A SLOPE



Cause	Remedy
	Disassemble and repair or replace.

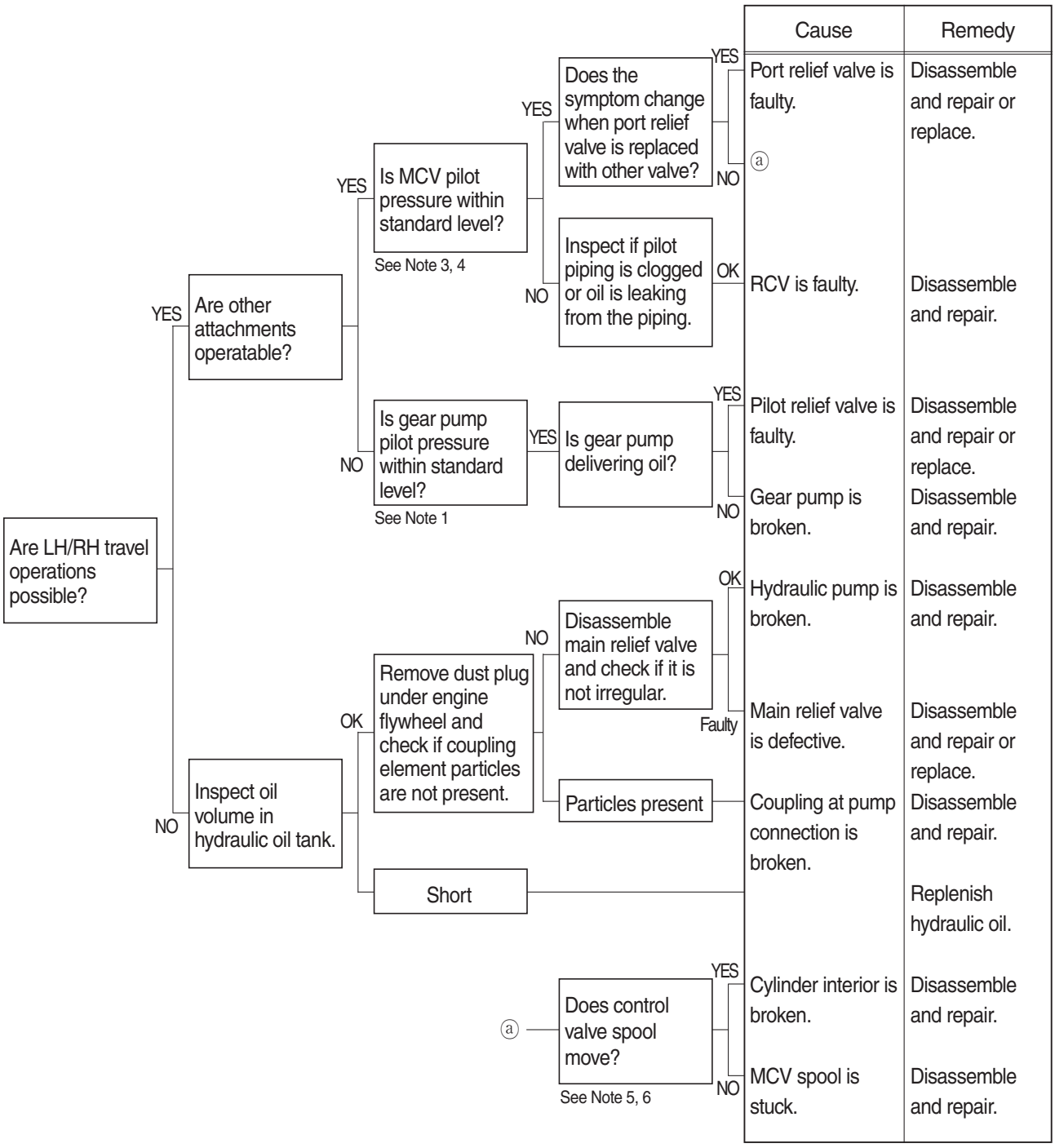
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



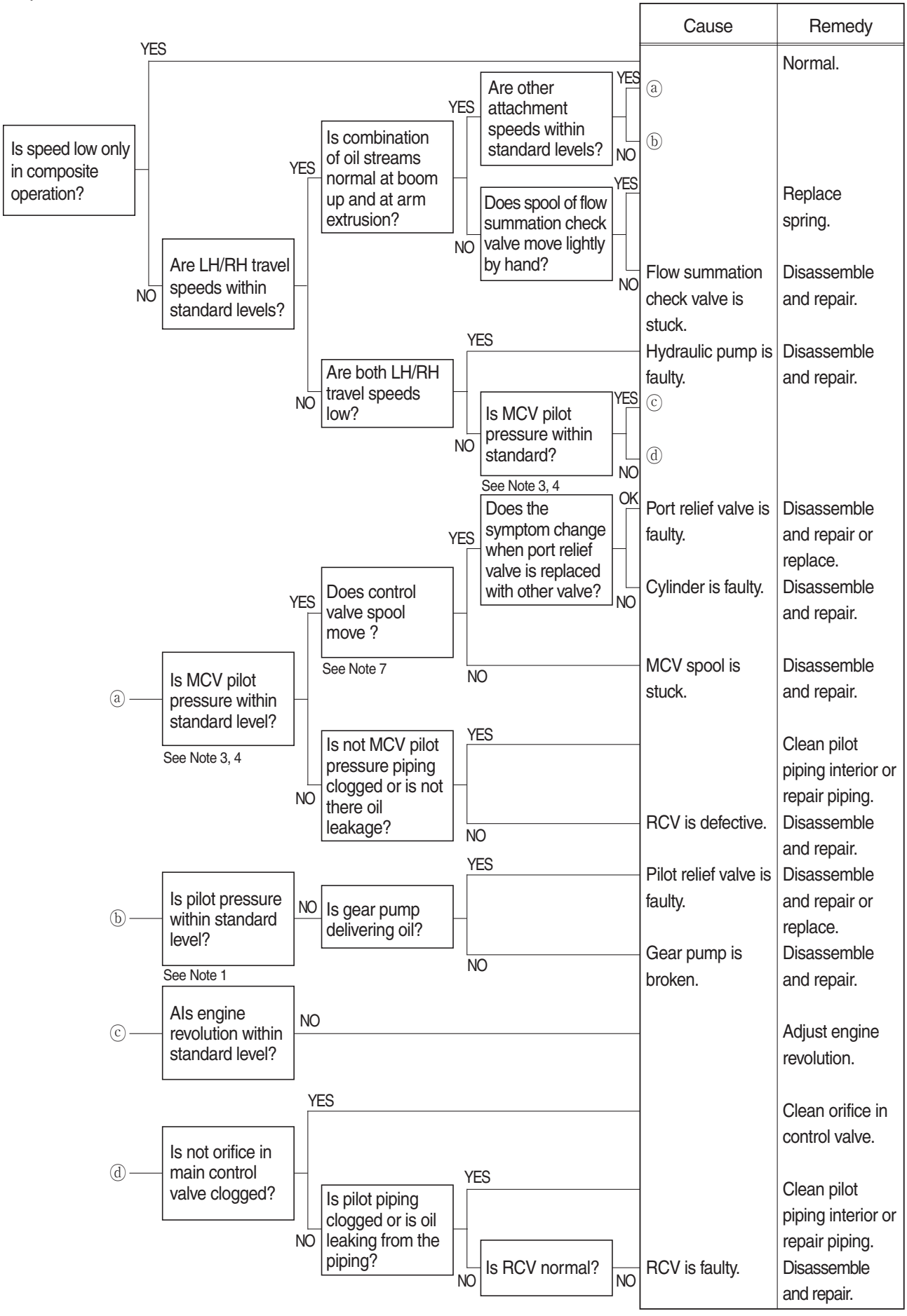
Cause	Remedy
	Normal.
Straight spool is faulty.	Repair or replace.
	Remove dirt on signal orifice.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL

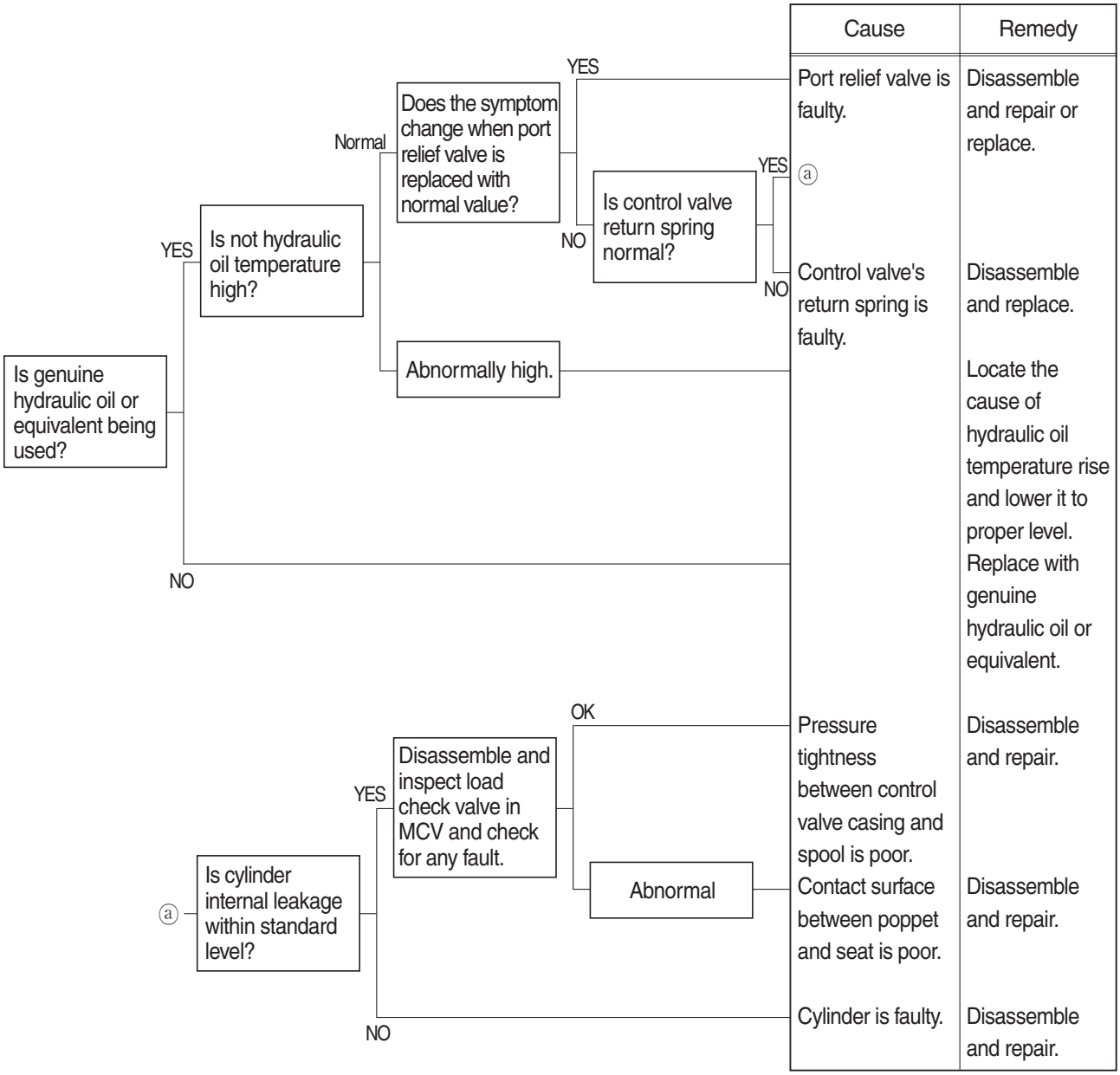


2) BOOM, ARM OR BUCKET SPEED IS LOW



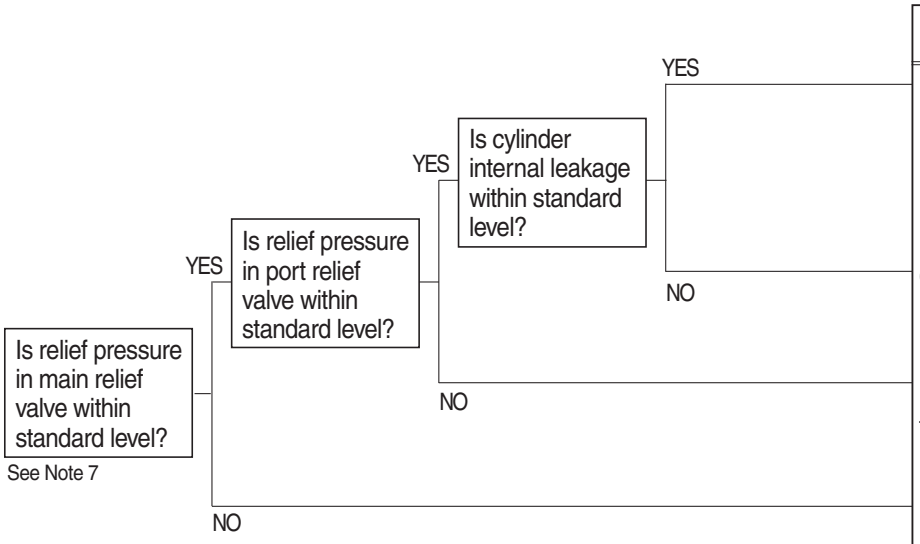
Cause	Remedy
	Normal.
	Replace spring.
Flow summation check valve is stuck.	Disassemble and repair.
Hydraulic pump is faulty.	Disassemble and repair.
Port relief valve is faulty.	Disassemble and repair or replace.
Cylinder is faulty.	Disassemble and repair.
MCV spool is stuck.	Disassemble and repair.
	Clean pilot piping interior or repair piping.
RCV is defective.	Disassemble and repair.
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
	Adjust engine revolution.
	Clean orifice in control valve.
	Clean pilot piping interior or repair piping.
RCV is faulty.	Disassemble and repair.

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



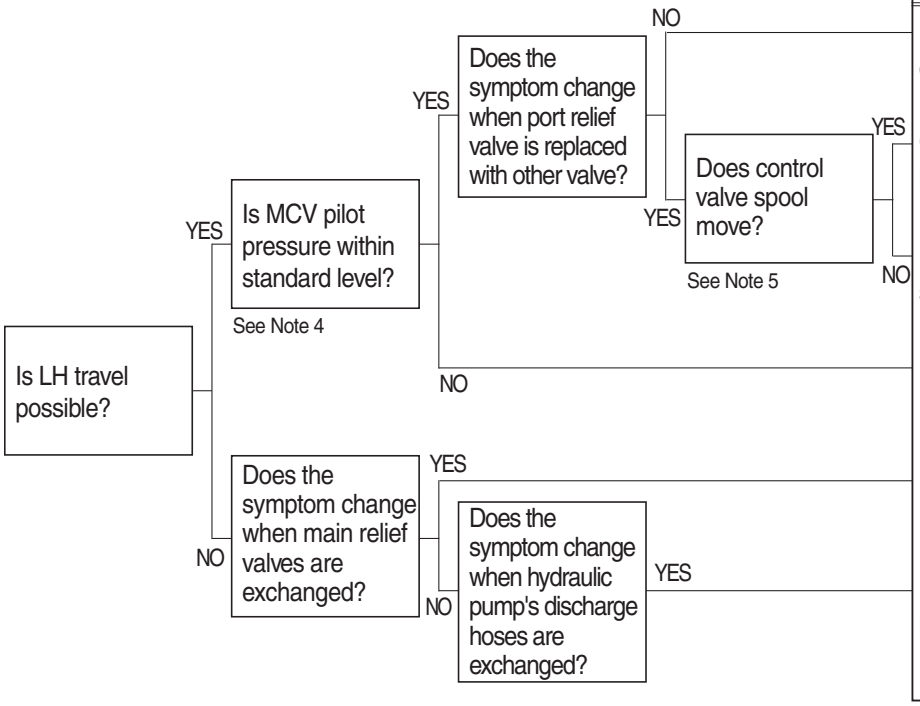
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level. Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



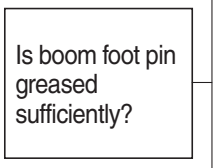
Cause	Remedy
Cylinder is faulty.	Check according to the procedure in Item "Speed is low".
Port relief valve is faulty.	Disassemble and repair.
Main relief valve is defective.	Adjust pressure, repair or replace.

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.
MCV spool is stuck.	Disassemble and repair.
RCV 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

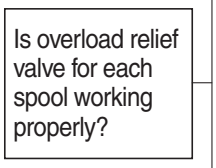


YES

NO

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

7) TIME LAG OF MACHINE WORKING IS LARGE.



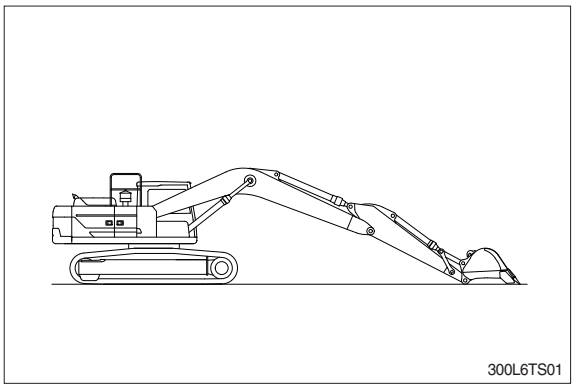
YES

NO

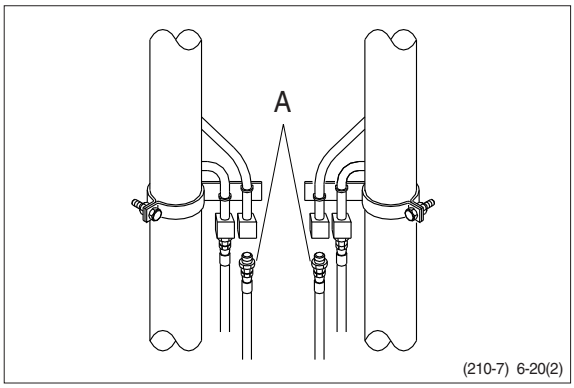
Cause	Remedy
	Refer to 2)
Overload relief valve is faulty.	Disassemble and repair.

※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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

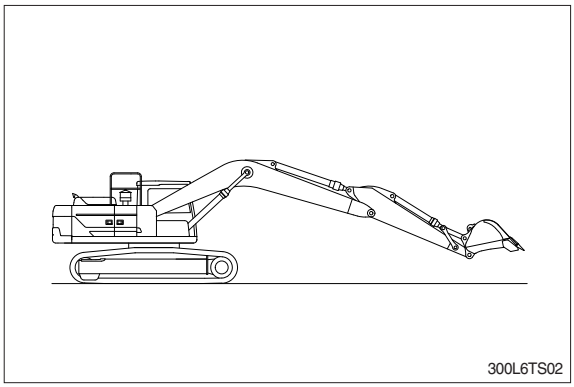


2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



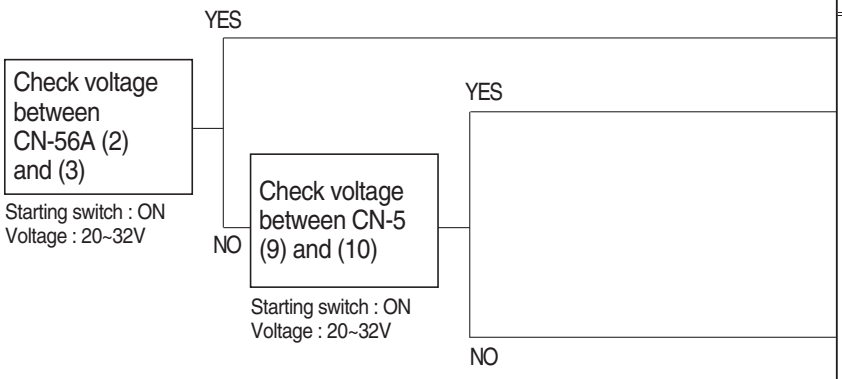
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

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



1. WHEN STARTING SWITCH IS TURNED ON, CLUSTER DISPLAY DOES NOT APPEAR

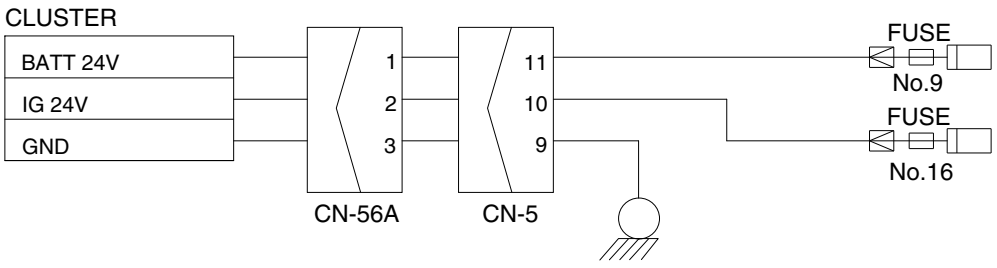
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 9, 16.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-5-CN-56A	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-5 (9) -GND or fuse No. 9, 16	Repair or replace (after clean)

Check voltage

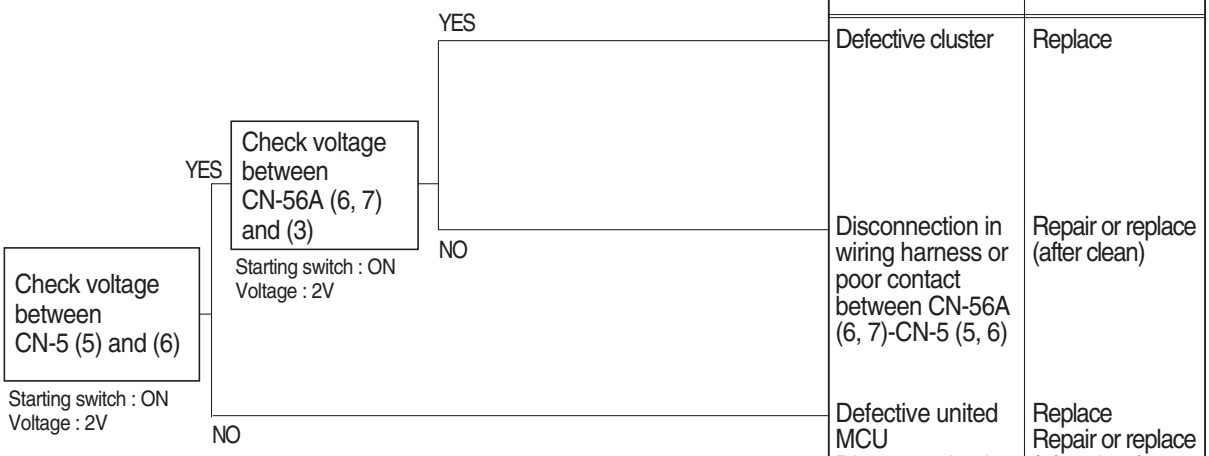
YES	20~32V
NO	0V



300L6ES101

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

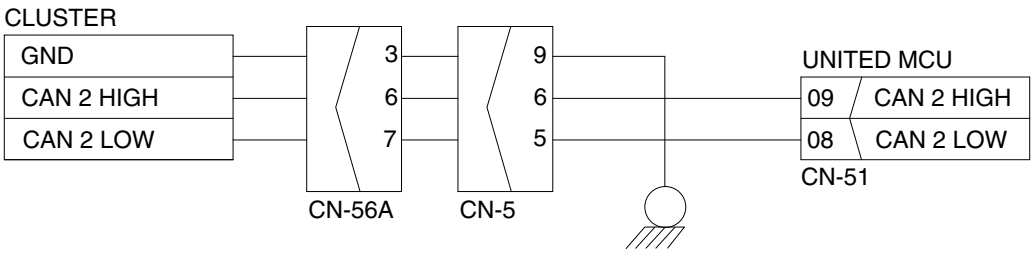
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56A (6, 7)-CN-5 (5, 6)	Repair or replace (after clean)
Defective united MCU Disconnection in wiring harness or poor contact between CN-5 (5, 6)- CN-51 (08, 09)	Replace Repair or replace (after clean)

Check voltage

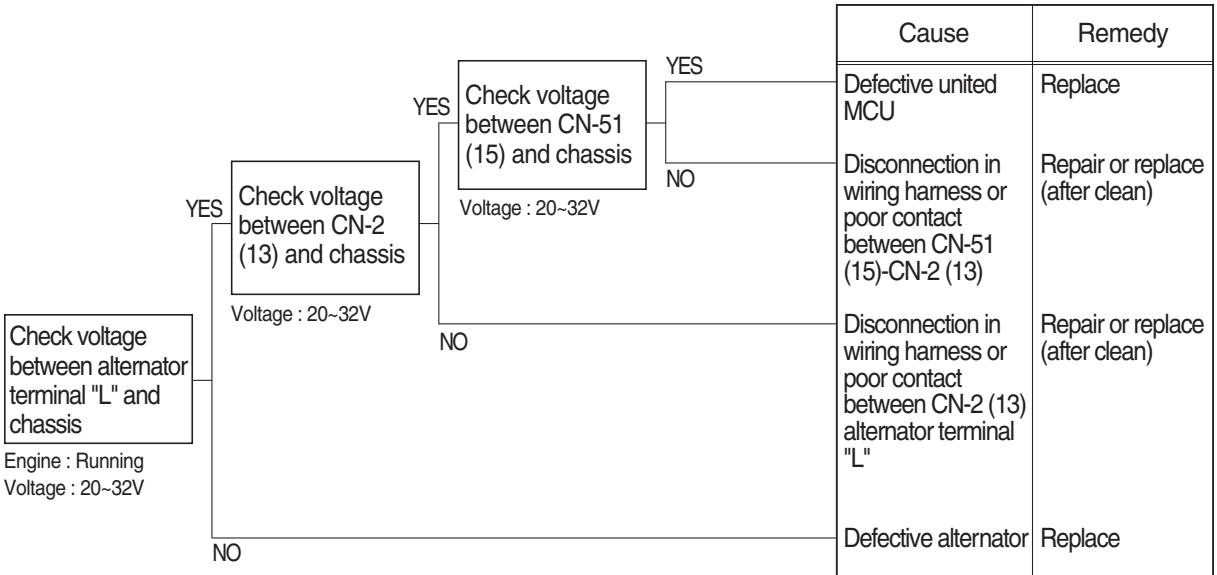
YES	2V
NO	0V



300L6ES102

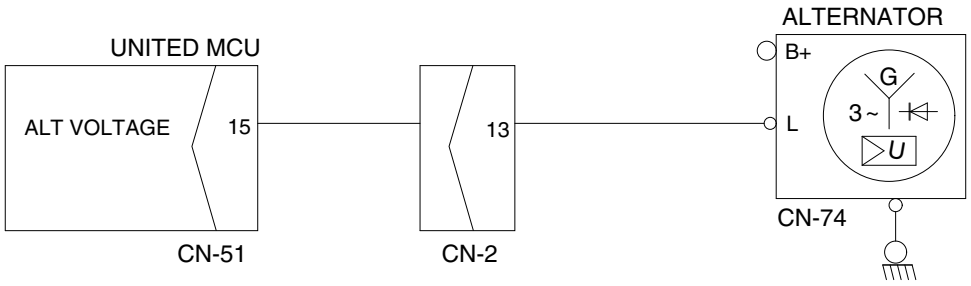
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

· 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

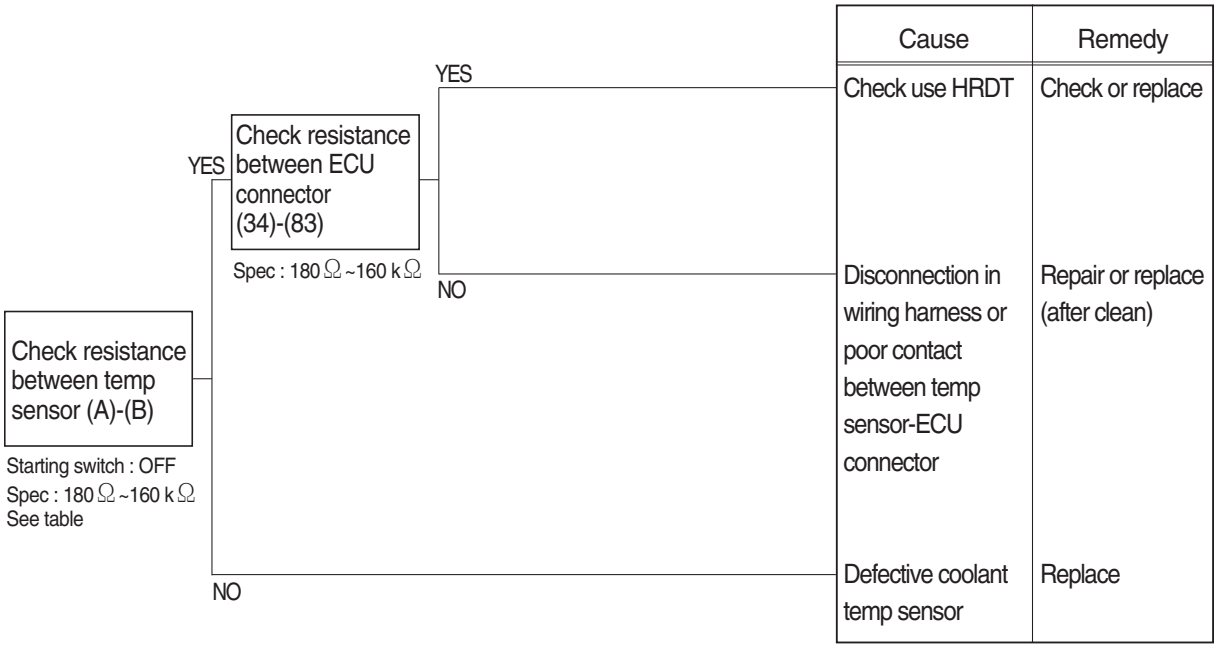
YES	20~32V
NO	0V



220F6ES103

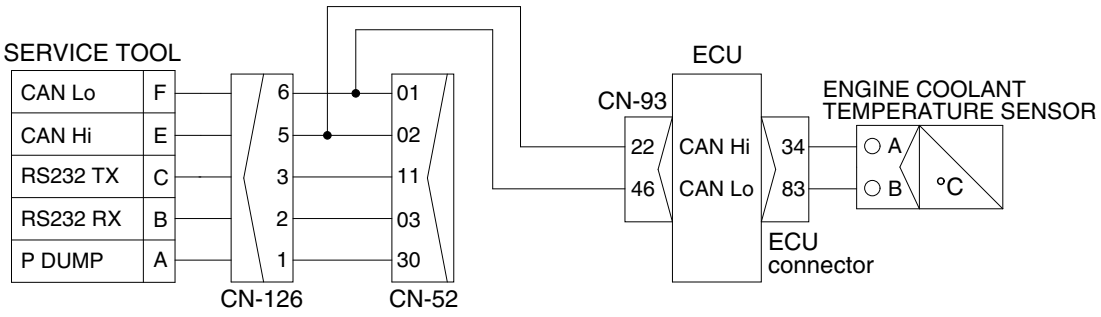
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

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



Check Table

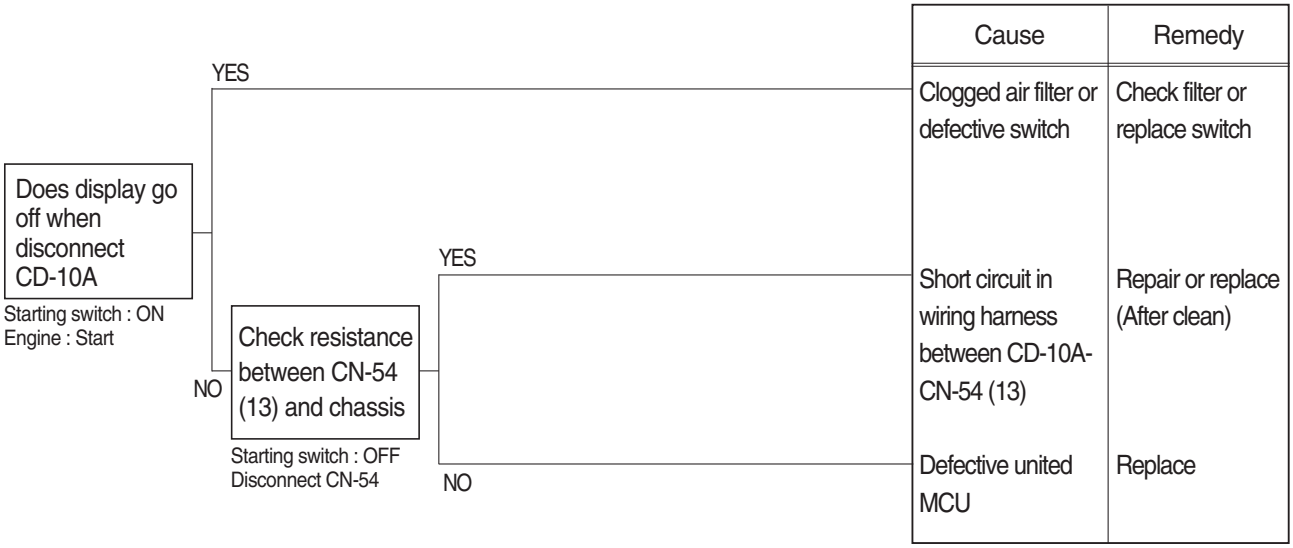
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



320A6ES104

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

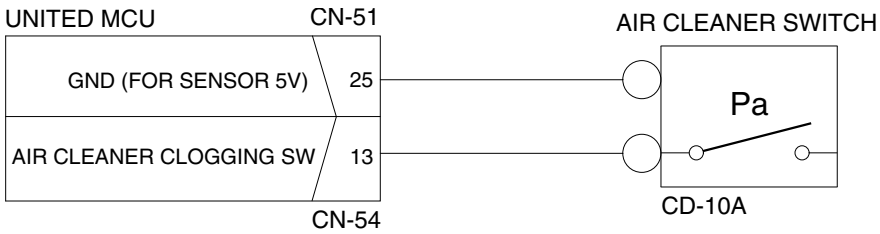
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Clogged air filter or defective switch	Check filter or replace switch
Short circuit in wiring harness between CD-10A-CN-54 (13)	Repair or replace (After clean)
Defective united MCU	Replace

Check resistance

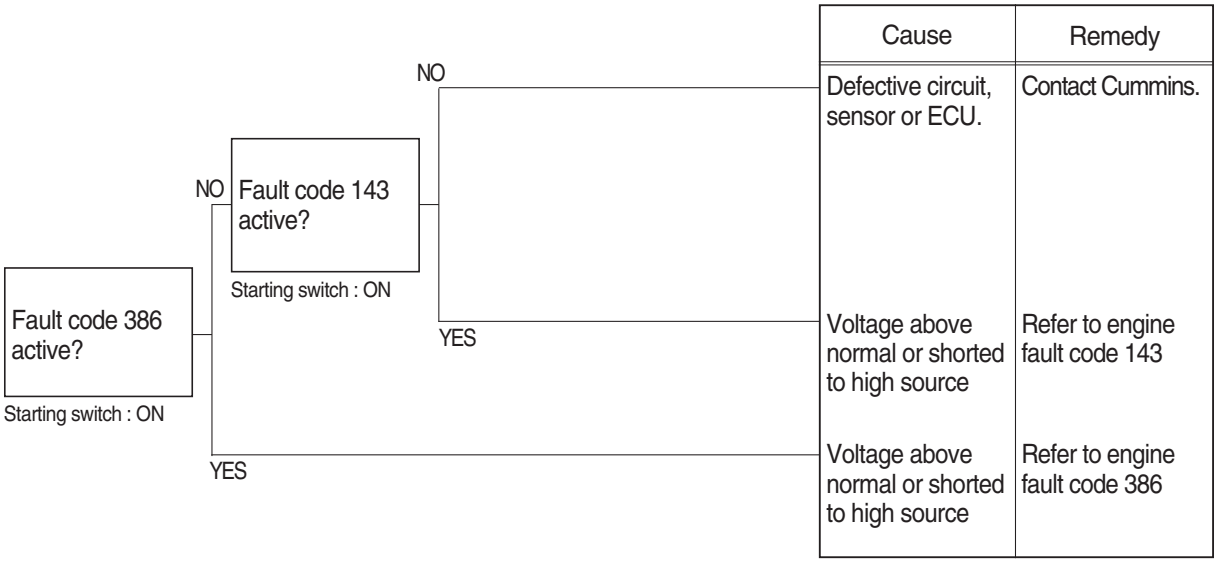
YES	MAX 1Ω
NO	MIN 1MΩ



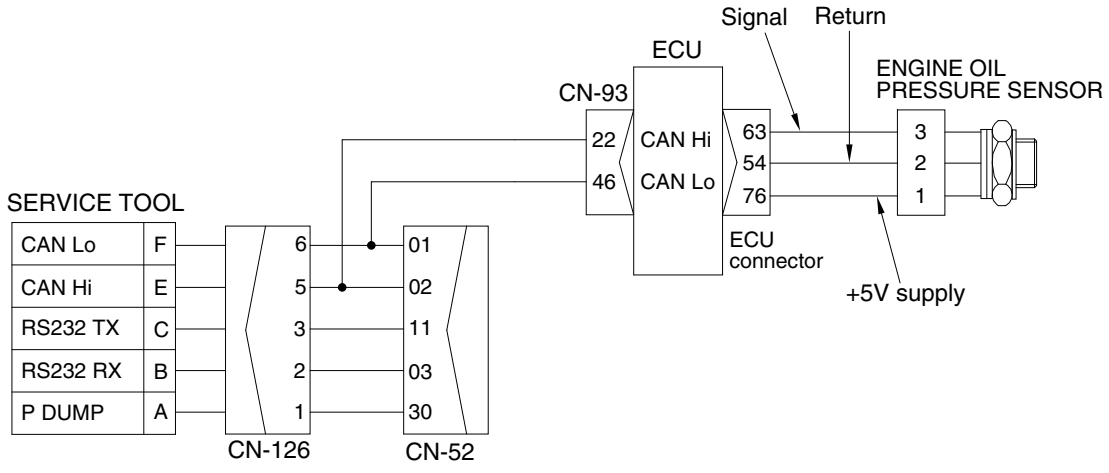
300L6ES106

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.



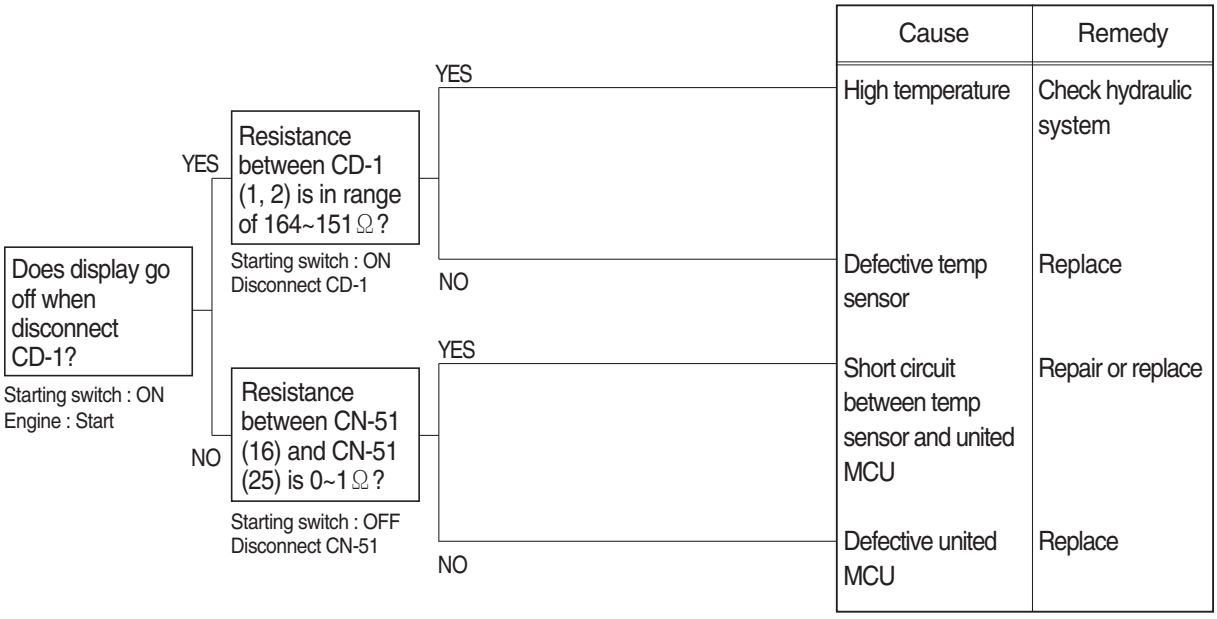
Cause	Remedy
Defective circuit, sensor or ECU.	Contact Cummins.
Voltage above normal or shorted to high source	Refer to engine fault code 143
Voltage above normal or shorted to high source	Refer to engine fault code 386



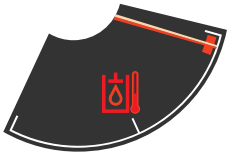
320A6ES107

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

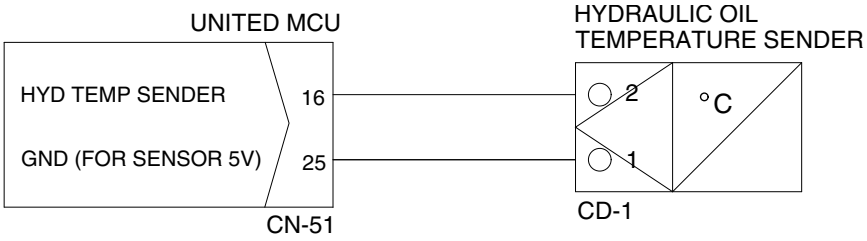
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check Table



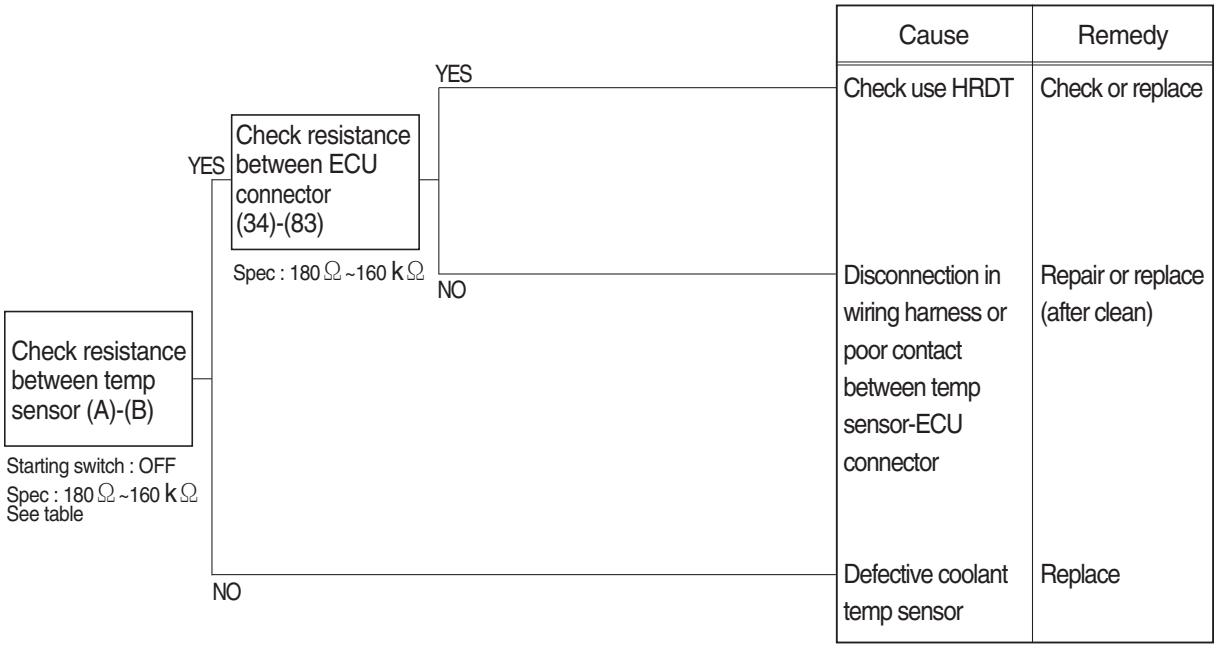
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 ~0.151



140L6ES108

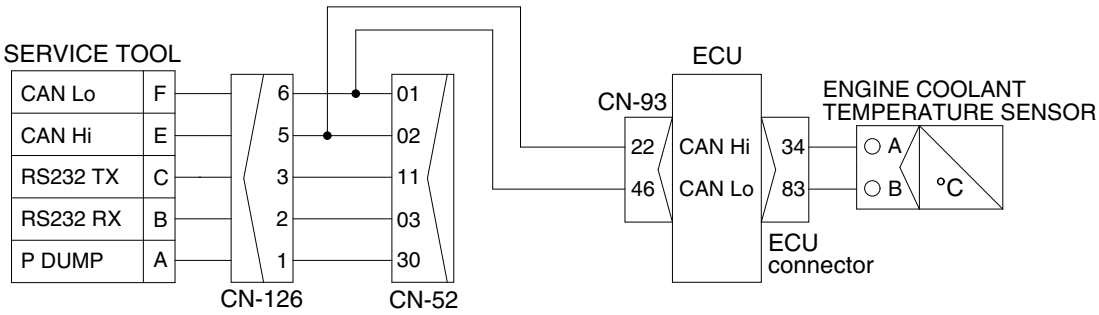
8. WHE RE GAUGE DOES NOT OPERATE

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



Check Table

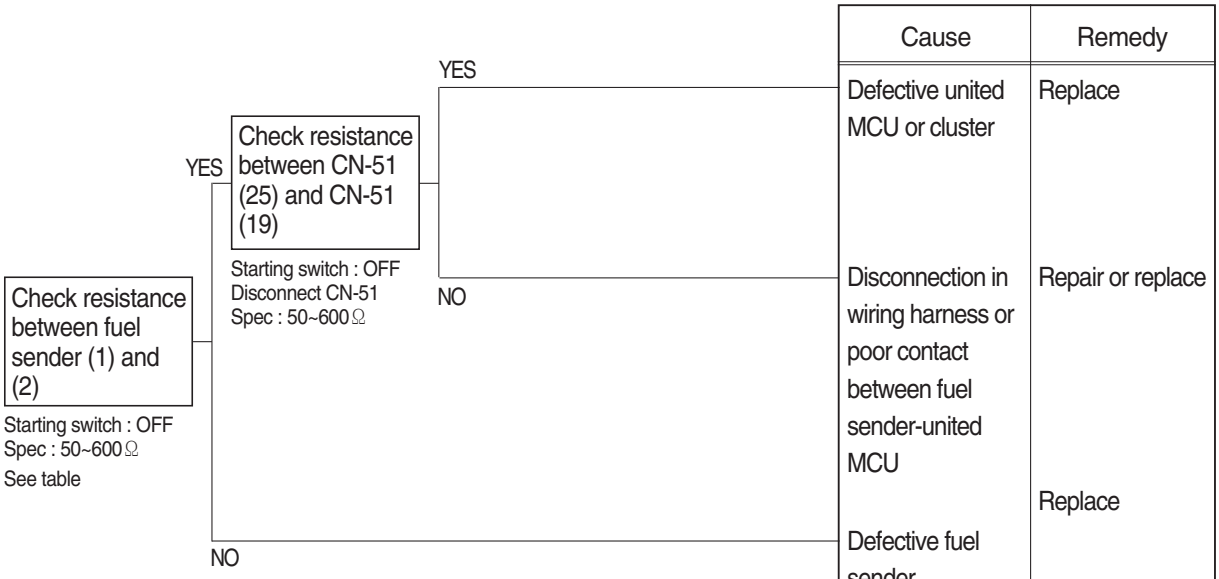
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8

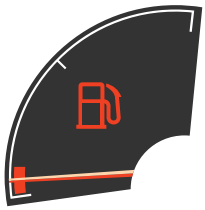


320A6ES104

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

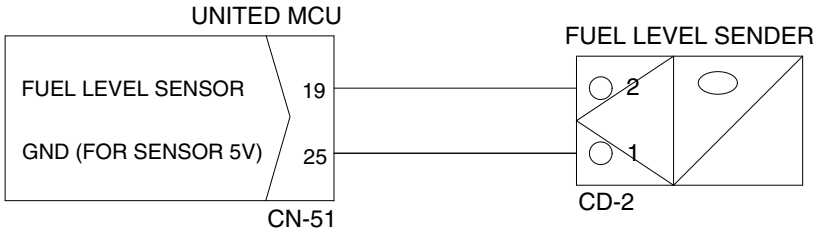
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

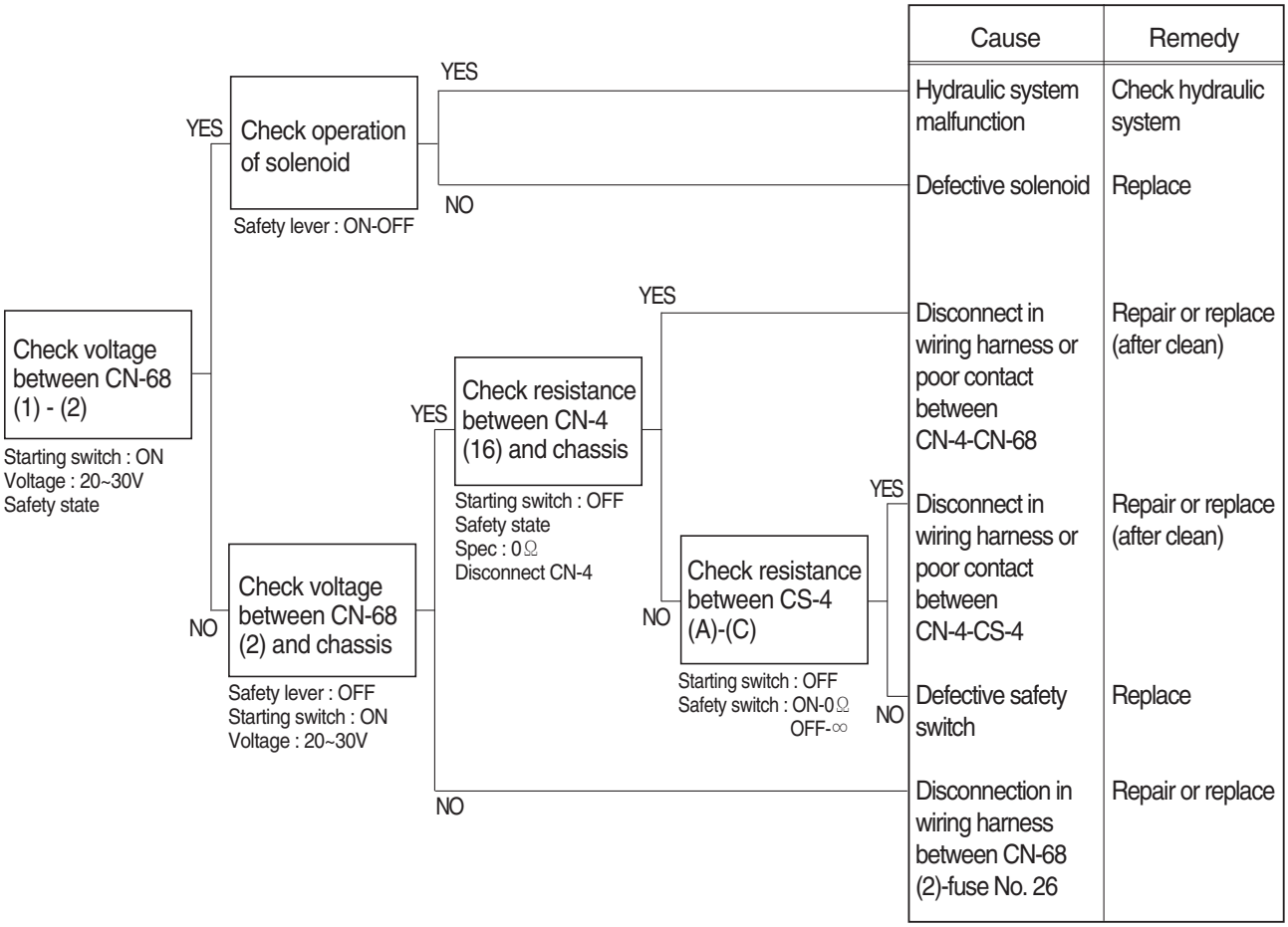
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-

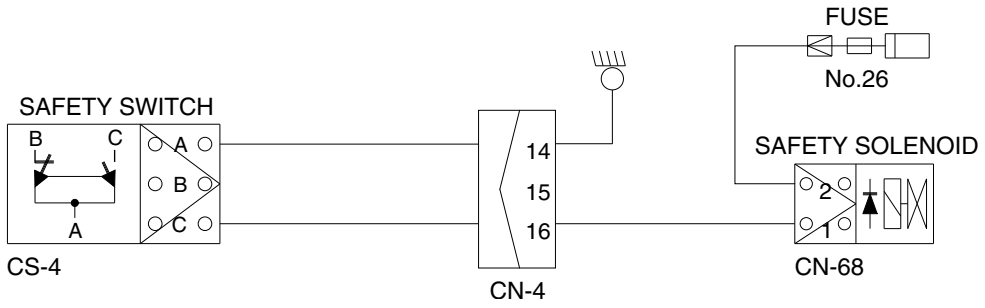


140L6ES110

10. WHEN SAFETY SOLENOID DOES NOT OPERATE (OLD VERSION)

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

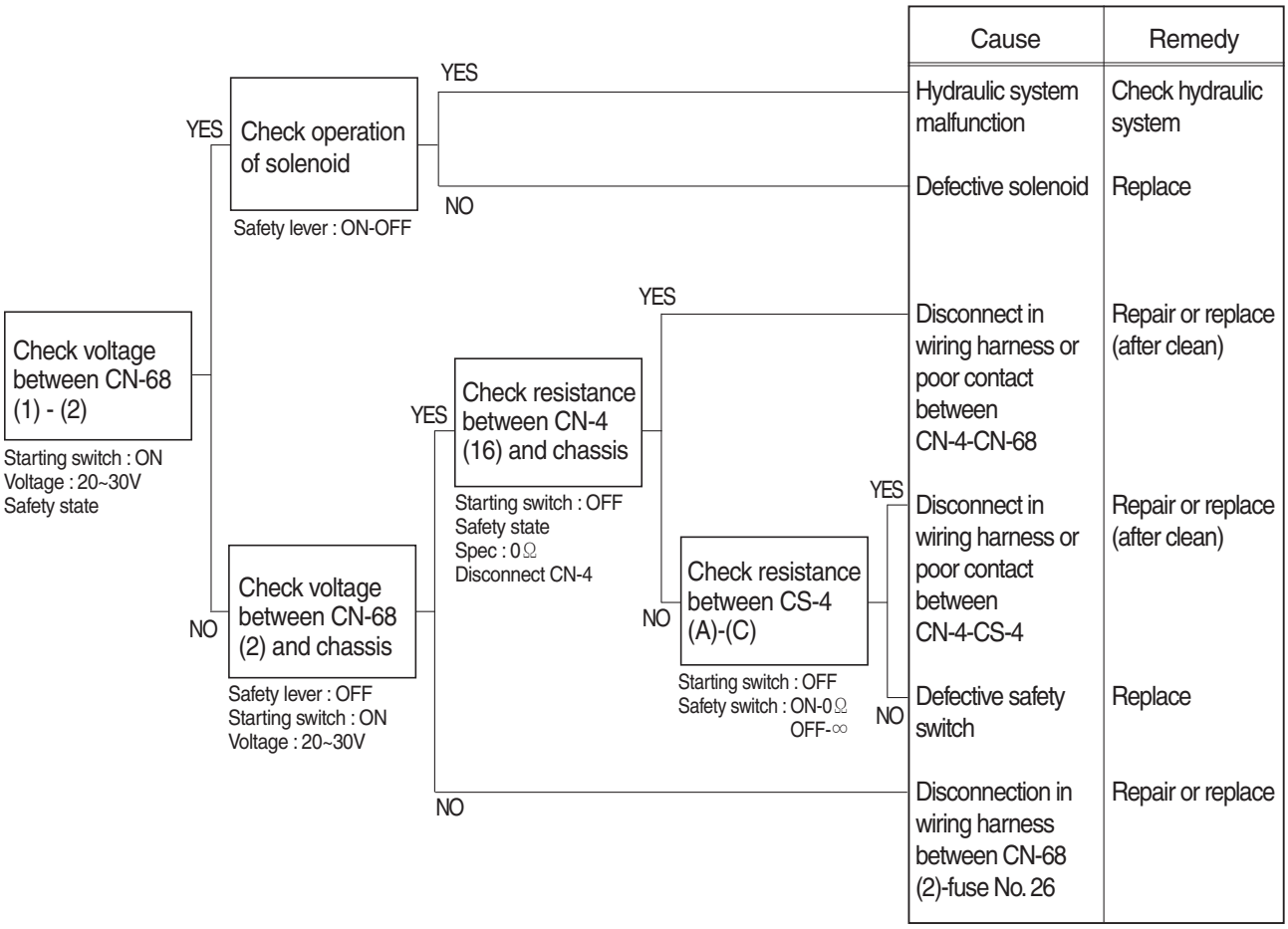


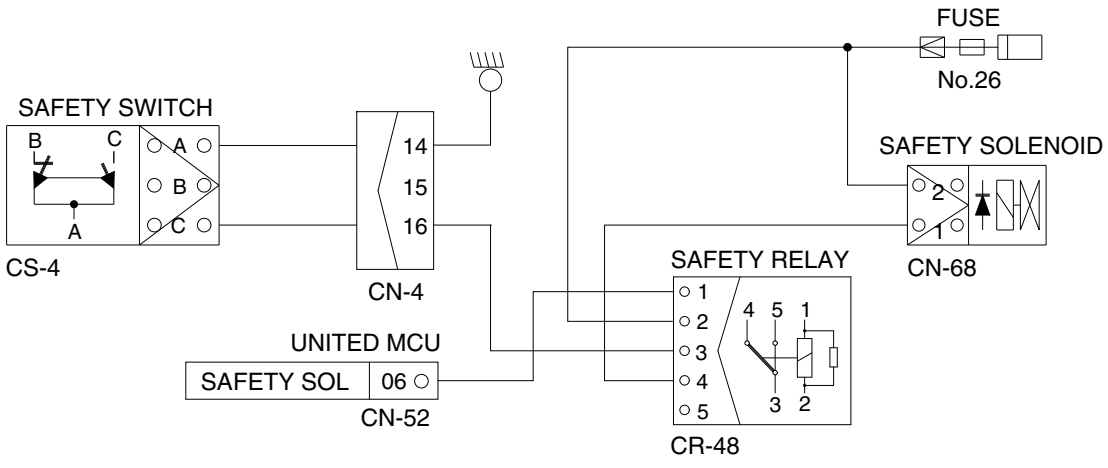


300A6ES109

10. WHEN SAFETY SOLENOID DOES NOT OPERATE (CURRENT VERSION)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 26.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.
· Auto safety lock function execution condition : When the RCV pilot pressure increases above certain pressure within the standard time after changing the safety knob LOCK → UNLOCK
· Under the above conditions, the electric current is turned off to the safety solenoid, and the function of RCV and pedal is disabled.

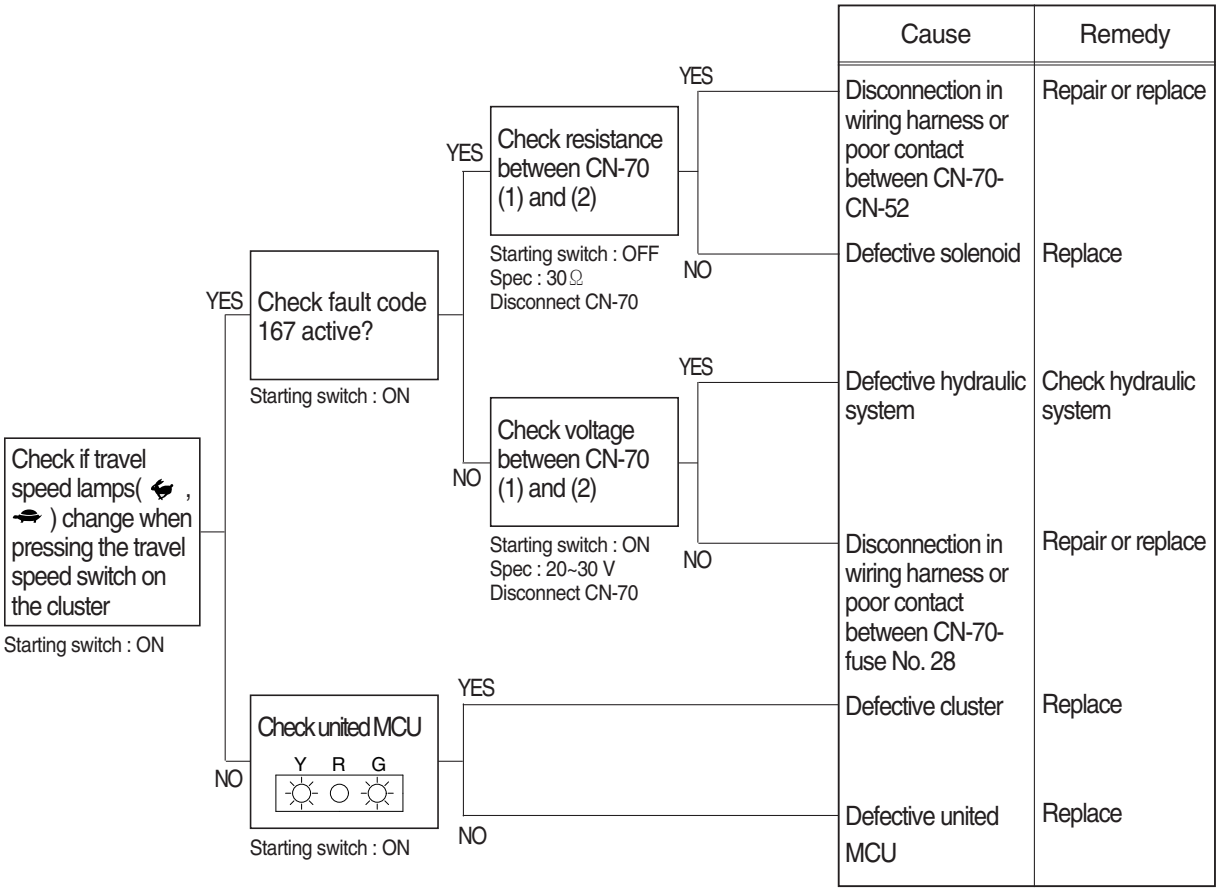


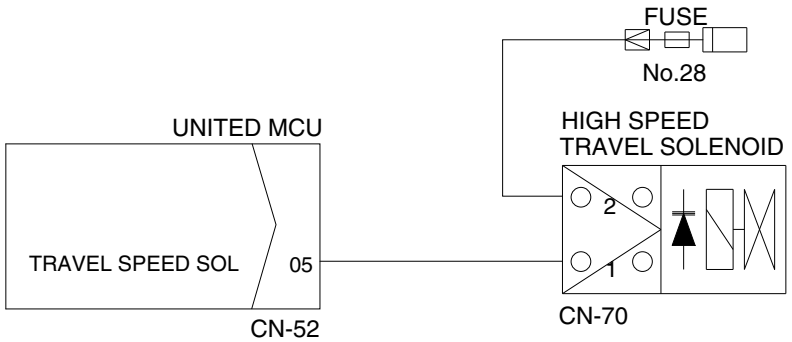


320A6ES109E

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

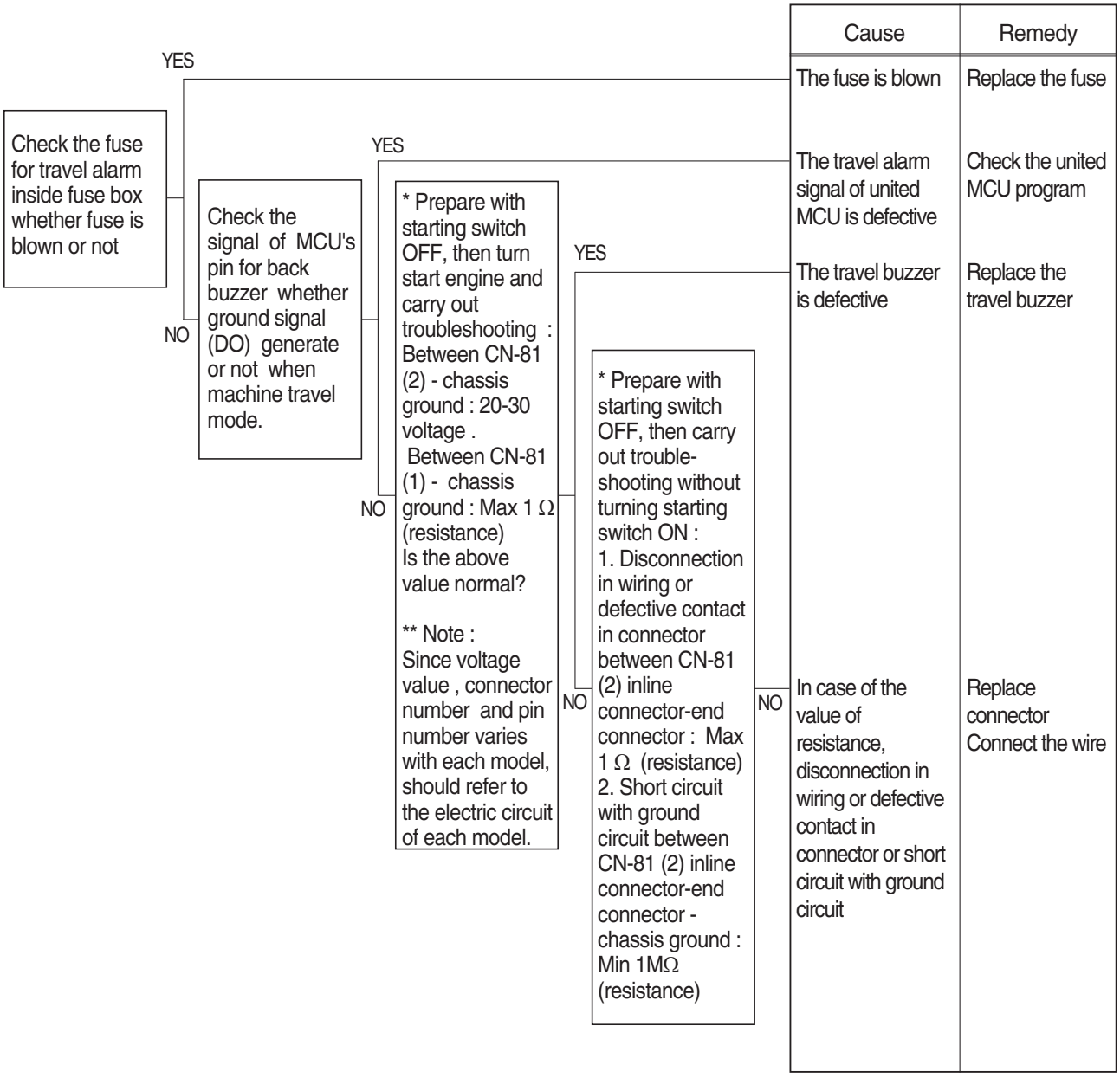
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 28.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

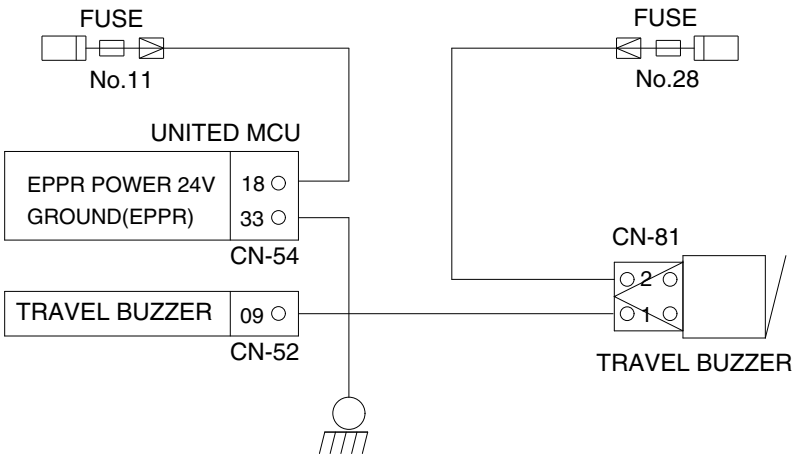




140L6ES107

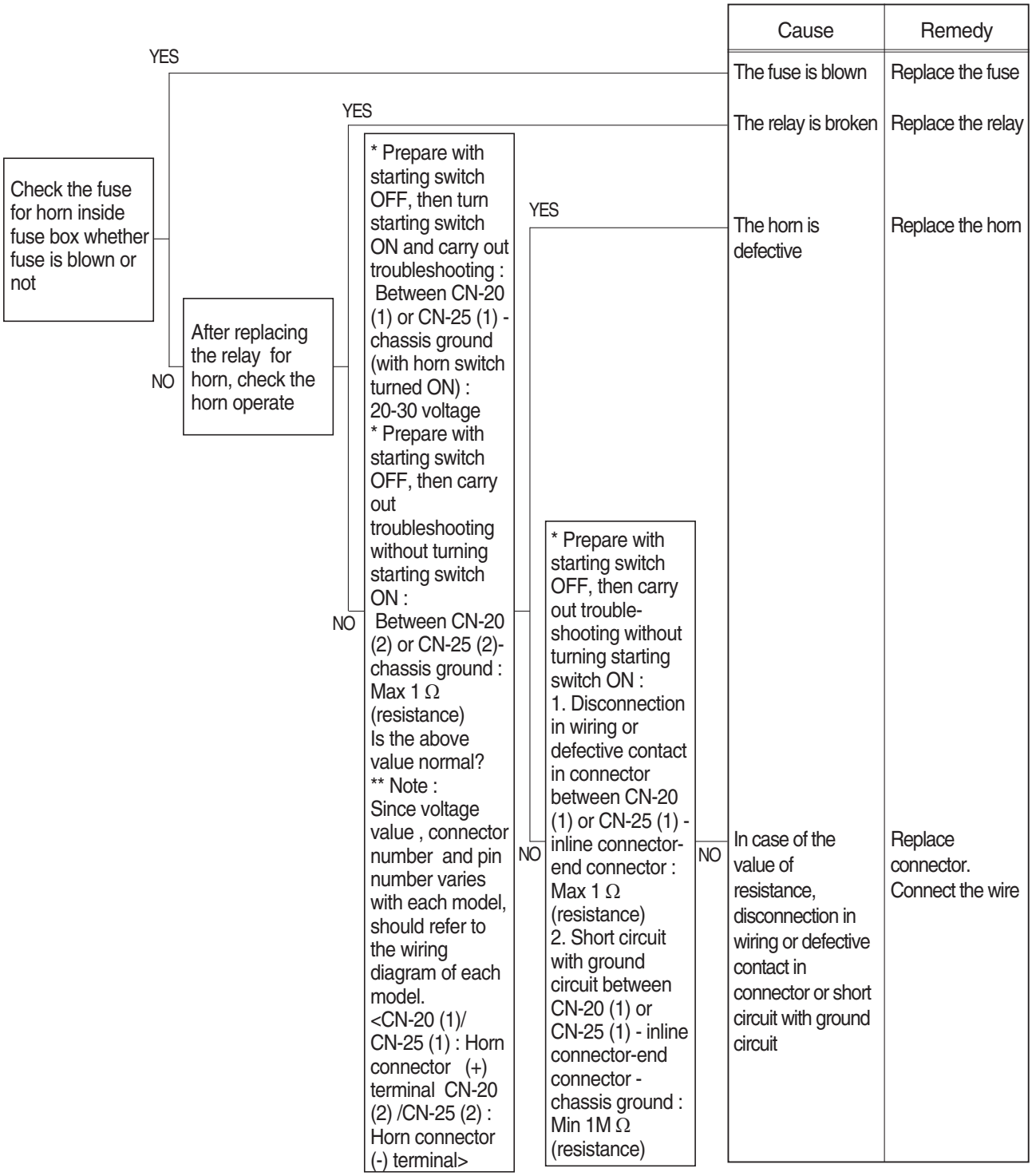
12. TRAVEL ALARM DOES NOT SOUND OR DOES NOT STOP SOUNDING





220A6ES150

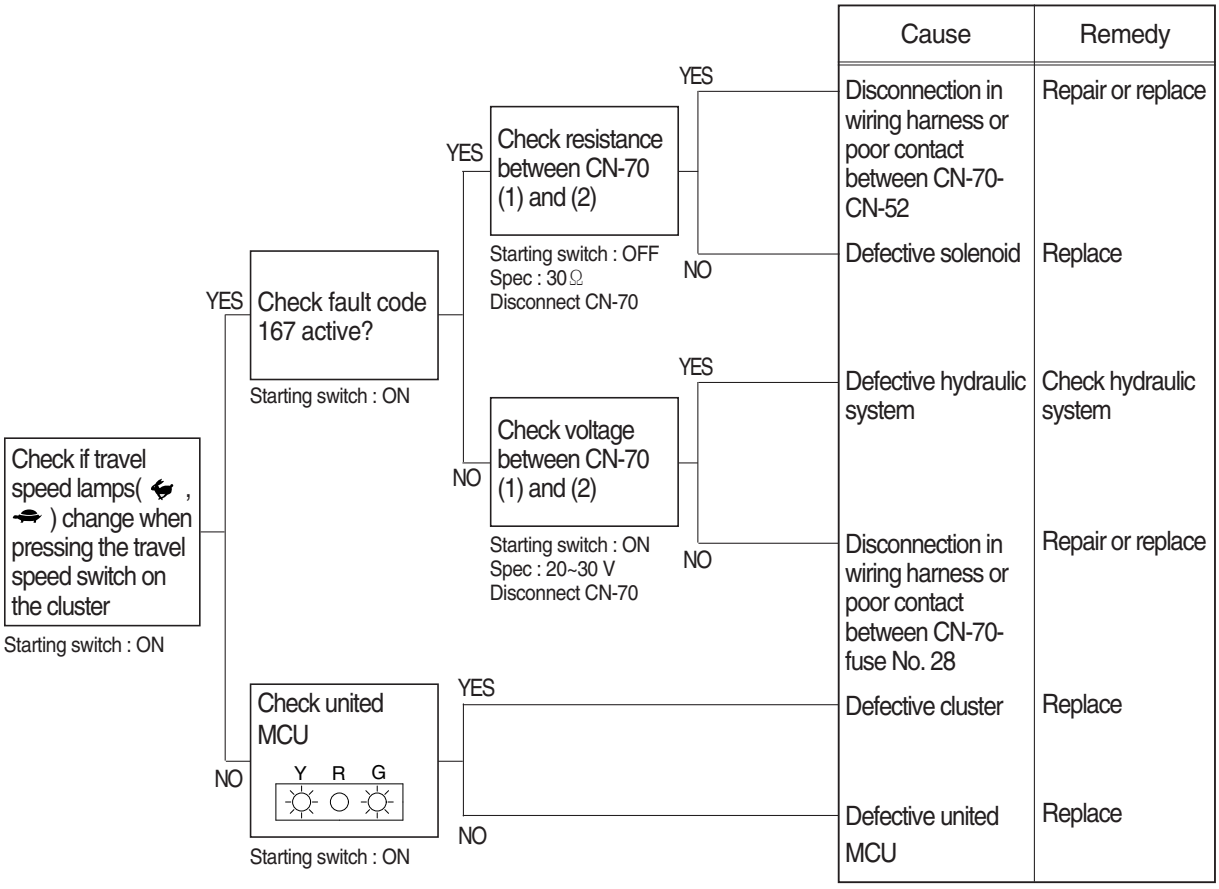
13. HORN DOES NOT SOUND

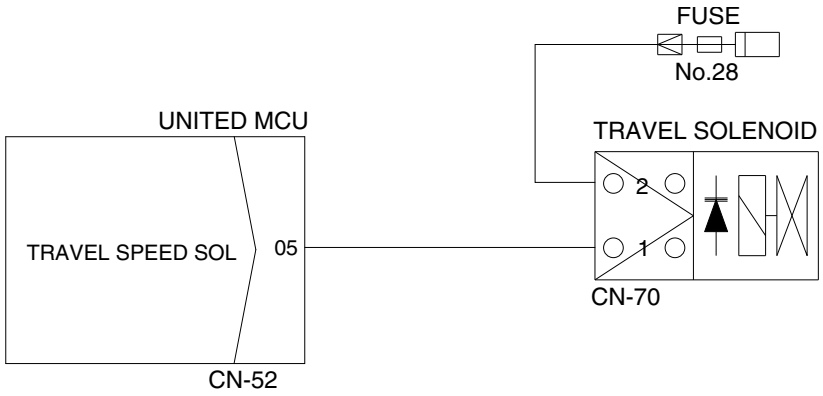


220A6ES151

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 28.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

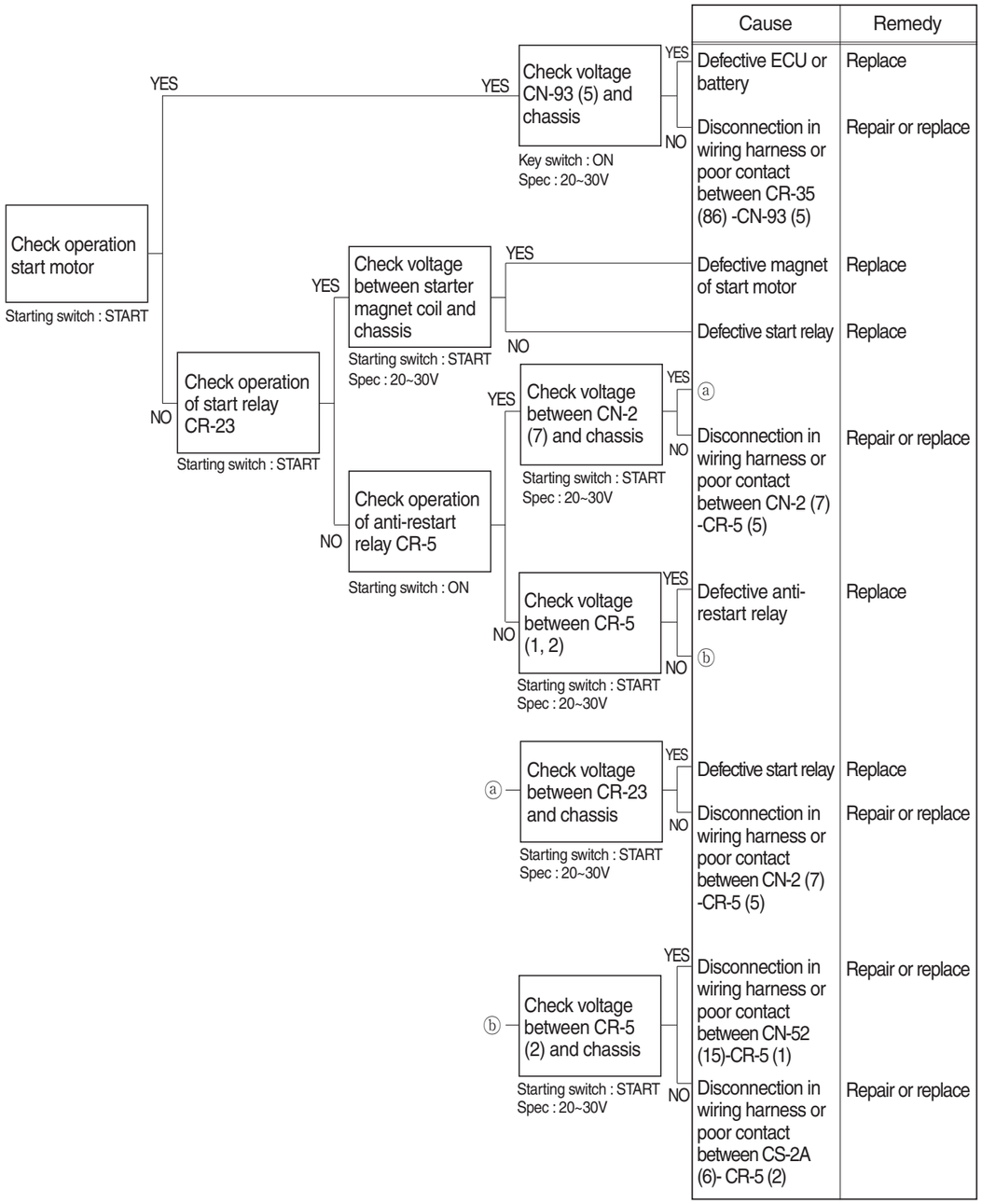




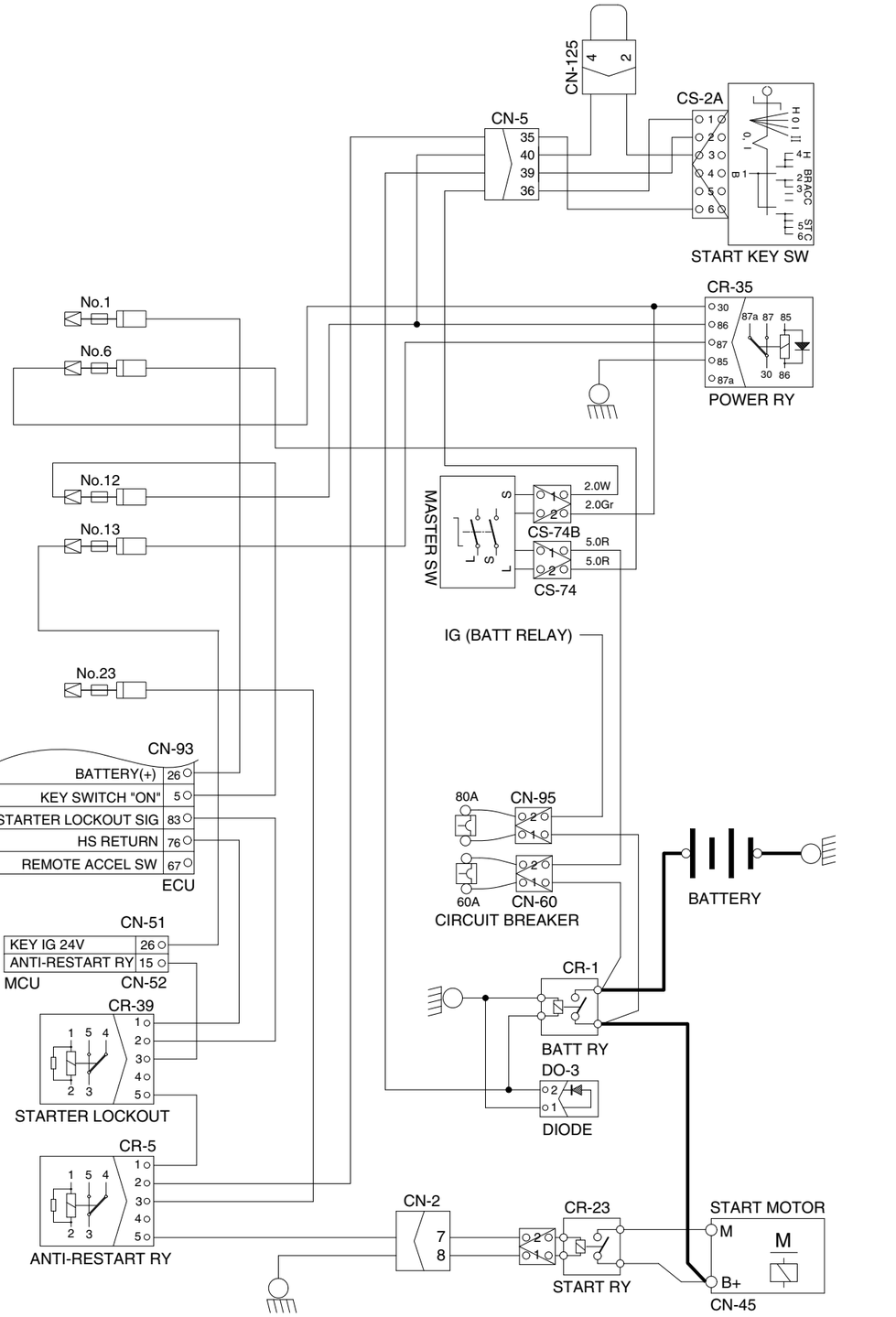
220A6ES03

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

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 1, 6, 12, 13, 23.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



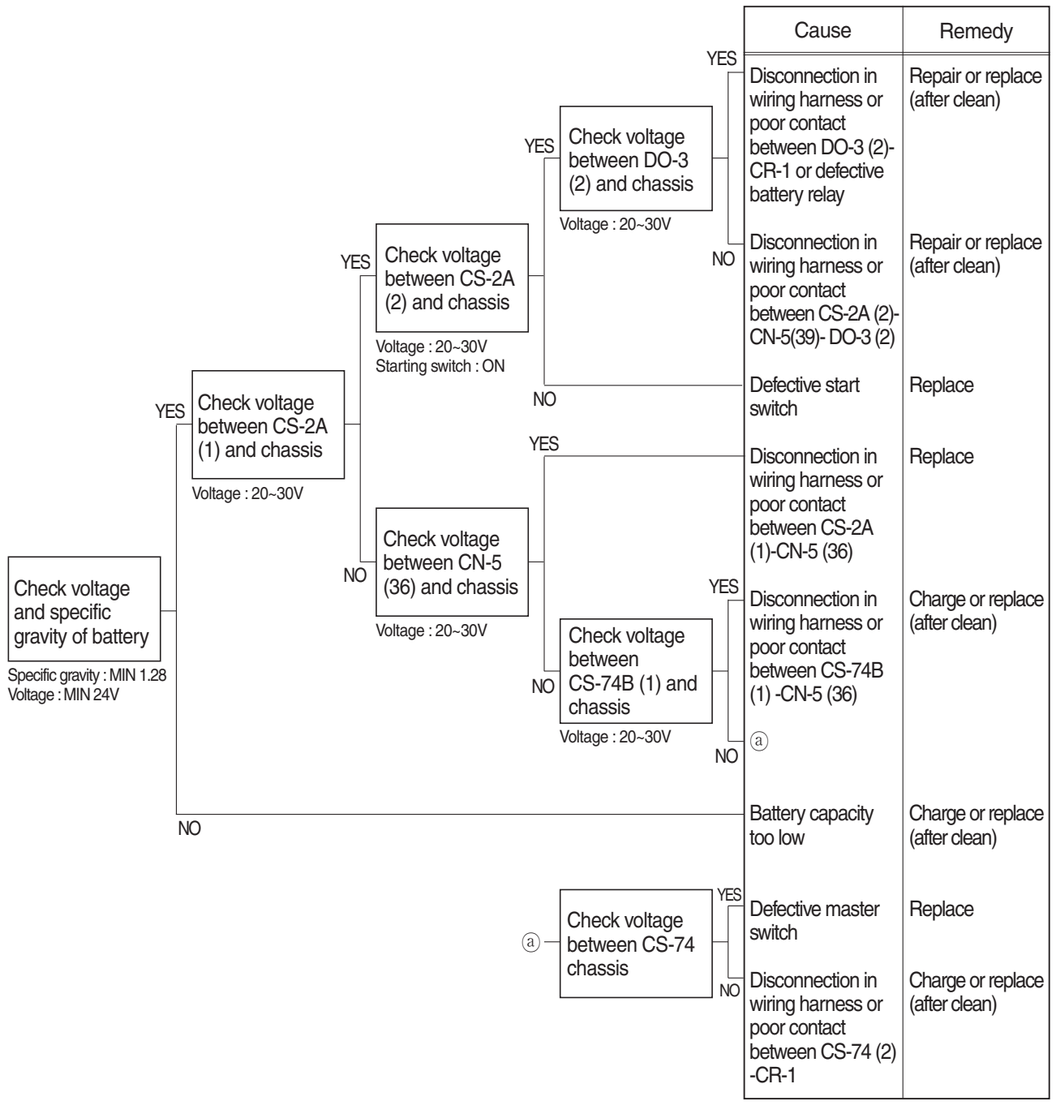
Cause	Remedy
Defective ECU or battery	Replace
Disconnection in wiring harness or poor contact between CR-35 (86) -CN-93 (5)	Repair or replace
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CN-2 (7) -CR-5 (5)	Repair or replace
Defective anti-restart relay	Replace
ⓑ	
Defective start relay	Replace
Disconnection in wiring harness or poor contact between CN-2 (7) -CR-5 (5)	Repair or replace
Disconnection in wiring harness or poor contact between CN-52 (15)-CR-5 (1)	Repair or replace
Disconnection in wiring harness or poor contact between CS-2A (6)- CR-5 (2)	Repair or replace



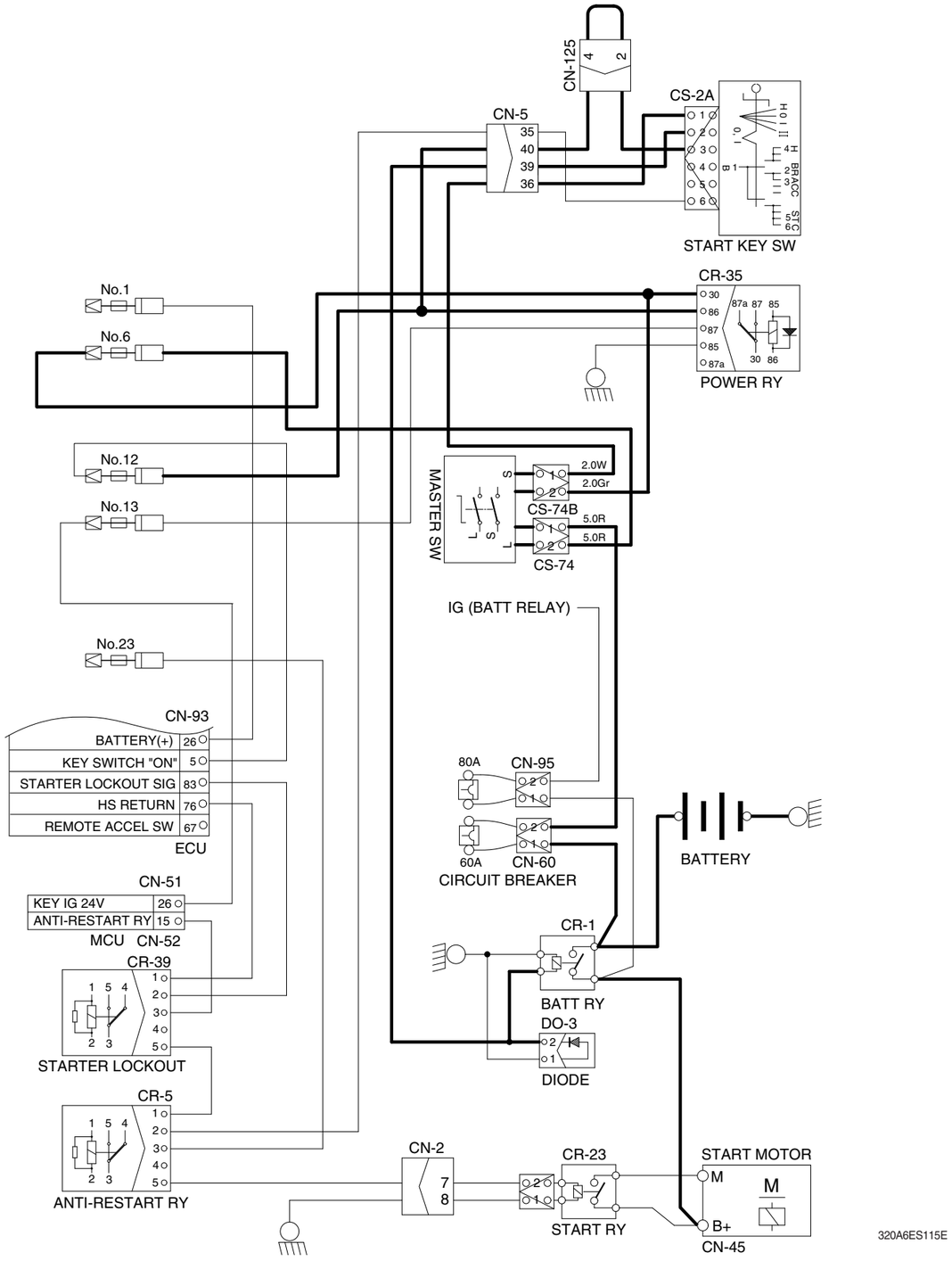
320A6ES114E

16. WHEN STARTING SWITCH ON DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of circuit breaker (CN-60).
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

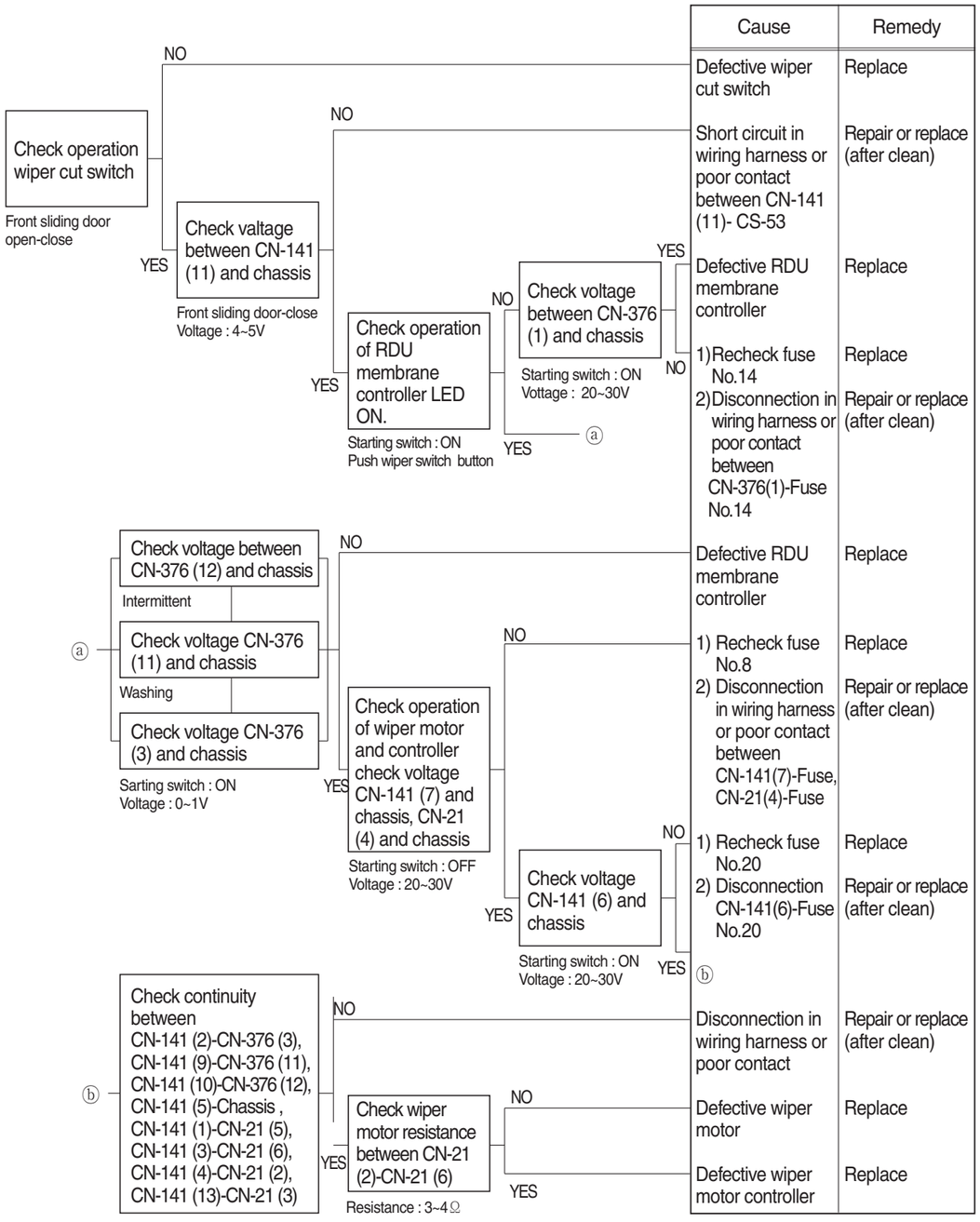


Cause	Remedy
Disconnection in wiring harness or poor contact between DO-3 (2)-CR-1 or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2A (2)-CN-5(39)- DO-3 (2)	Repair or replace (after clean)
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2A (1)-CN-5 (36)	Replace
Disconnection in wiring harness or poor contact between CS-74B (1) -CN-5 (36)	Charge or replace (after clean)
ⓐ	
Battery capacity too low	Charge or replace (after clean)
Defective master switch	Replace
Disconnection in wiring harness or poor contact between CS-74 (2) -CR-1	Charge or replace (after clean)

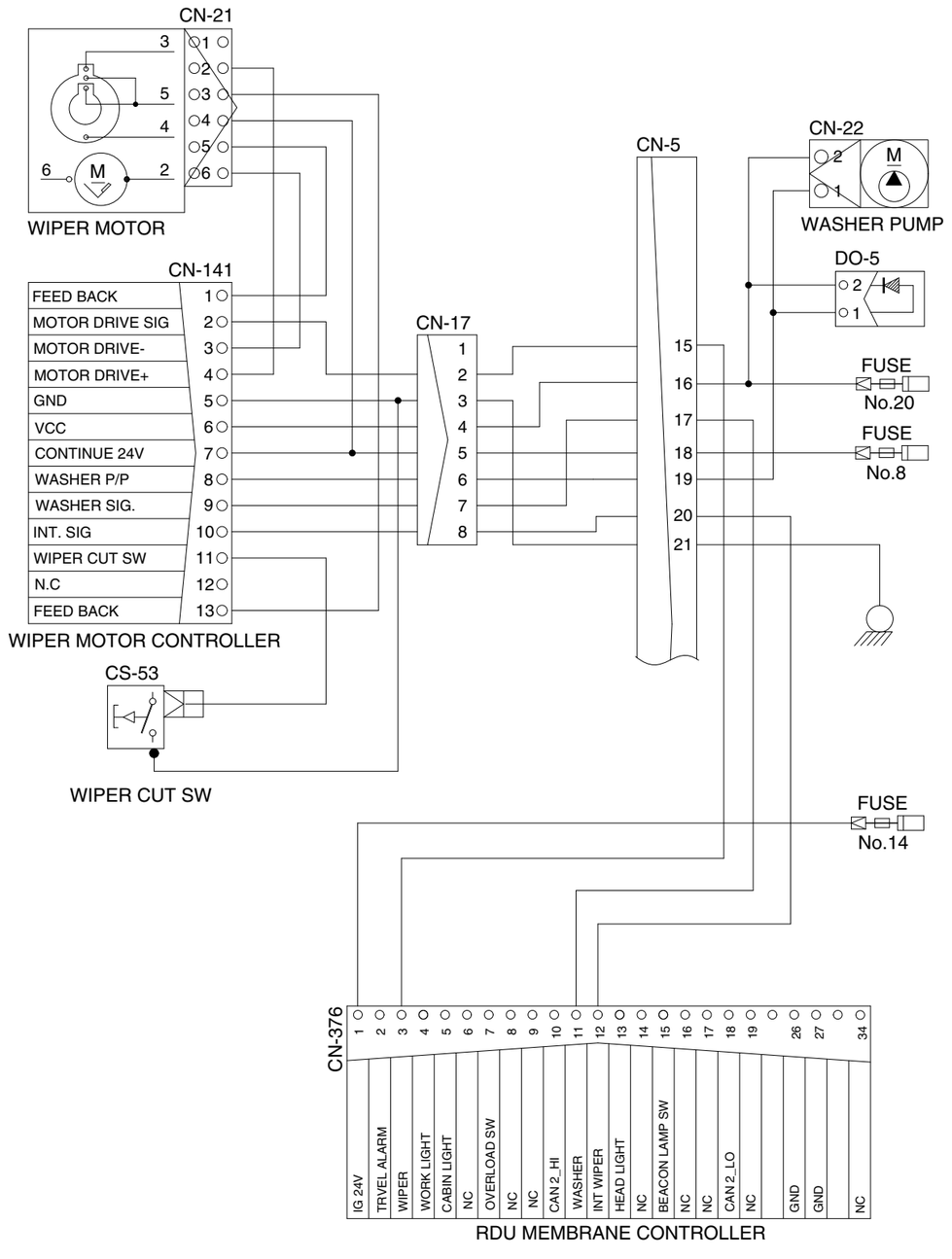


17. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

- 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. 8, 14 and 20 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



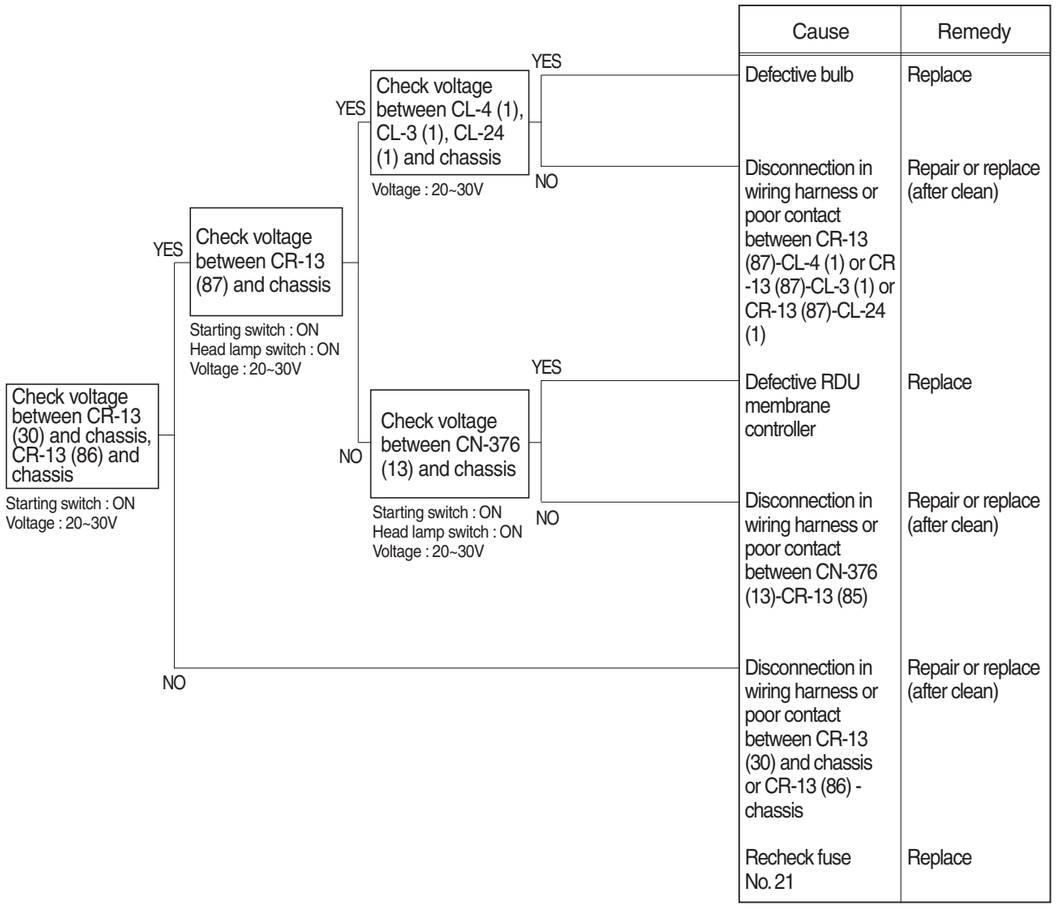
Cause	Remedy
Defective wiper cut switch	Replace
Short circuit in wiring harness or poor contact between CN-141 (11)- CS-53	Repair or replace (after clean)
Defective RDU membrane controller	Replace
1)Recheck fuse No.14	Replace
2)Disconnection in wiring harness or poor contact between CN-376(1)-Fuse No.14	Repair or replace (after clean)
Defective RDU membrane controller	Replace
1) Recheck fuse No.8	Replace
2) Disconnection in wiring harness or poor contact between CN-141(7)-Fuse, CN-21(4)-Fuse	Repair or replace (after clean)
1) Recheck fuse No.20	Replace
2) Disconnection CN-141(6)-Fuse No.20	Repair or replace (after clean)
ⓑ	
Disconnection in wiring harness or poor contact	Repair or replace (after clean)
Defective wiper motor	Replace
Defective wiper motor controller	Replace



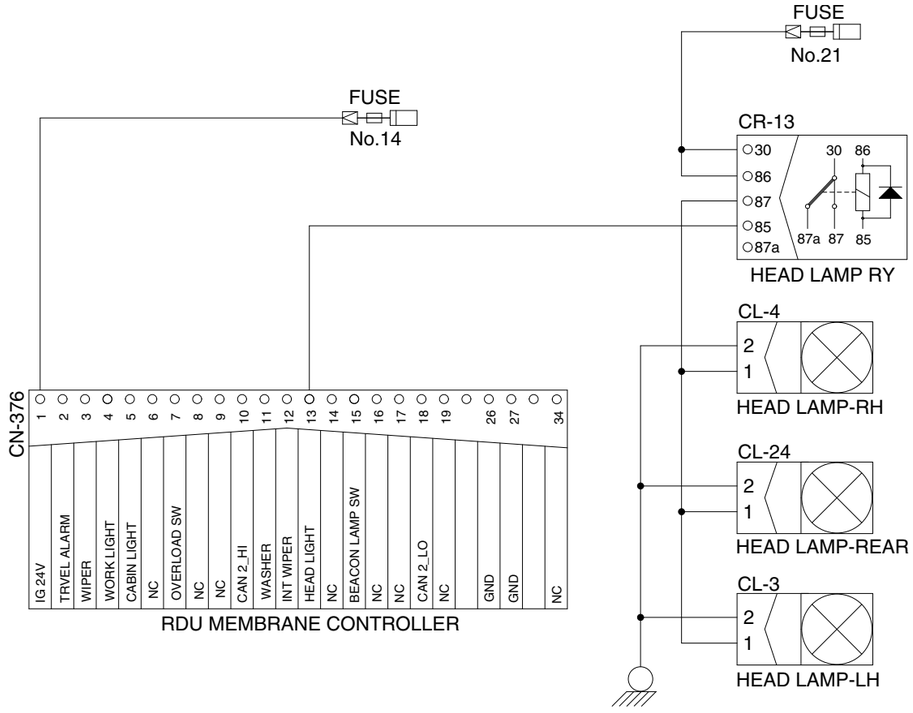
300A6ES115

18. 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 & 21.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



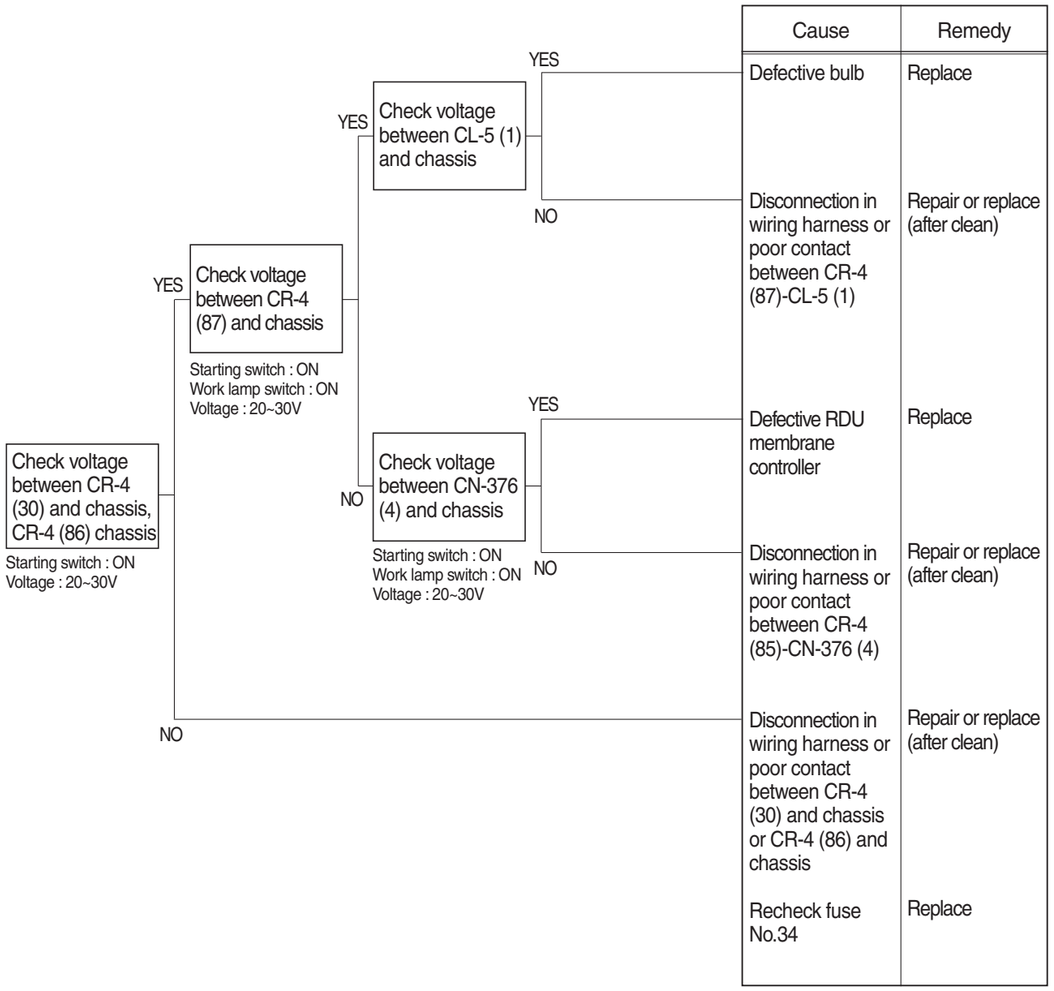
Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-13 (87)-CL-4 (1) or CR -13 (87)-CL-3 (1) or CR-13 (87)-CL-24 (1)	Repair or replace (after clean)
Defective RDU membrane controller	Replace
Disconnection in wiring harness or poor contact between CN-376 (13)-CR-13 (85)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-13 (30) and chassis or CR-13 (86) - chassis	Repair or replace (after clean)
Recheck fuse No. 21	Replace



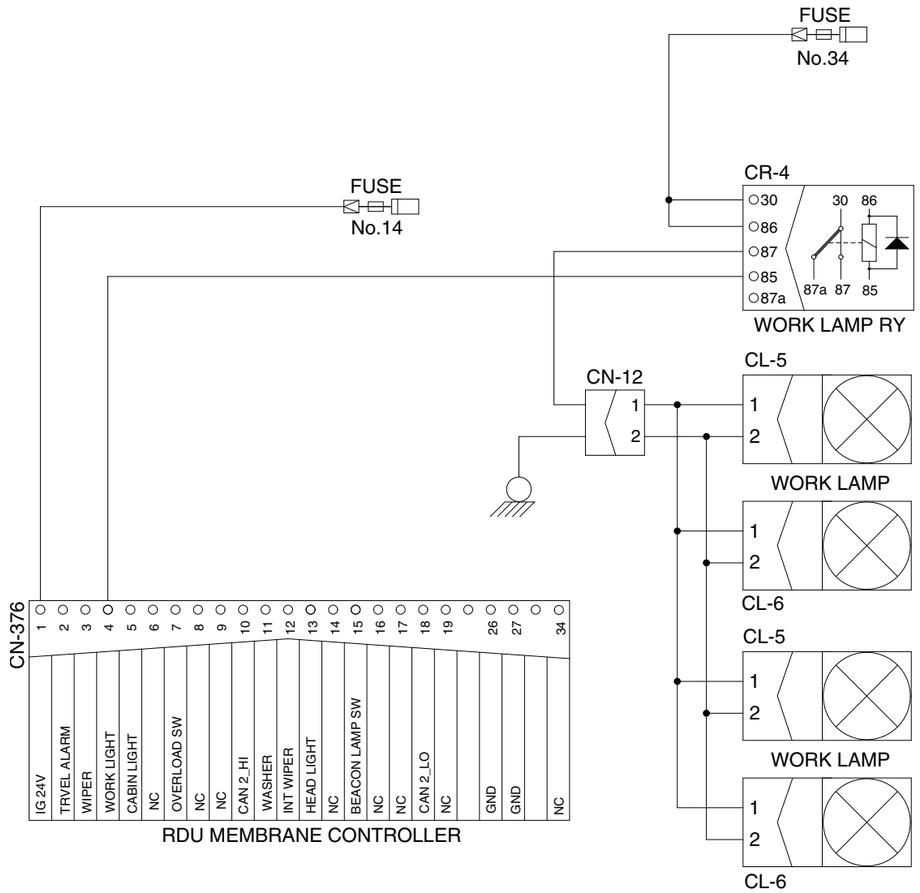
300L6ES117

19. 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.14 & 34.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CL-5 (1)	Repair or replace (after clean)
Defective RDU membrane controller	Replace
Disconnection in wiring harness or poor contact between CR-4 (85)-CN-376 (4)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-4 (30) and chassis or CR-4 (86) and chassis	Repair or replace (after clean)
Recheck fuse No.34	Replace

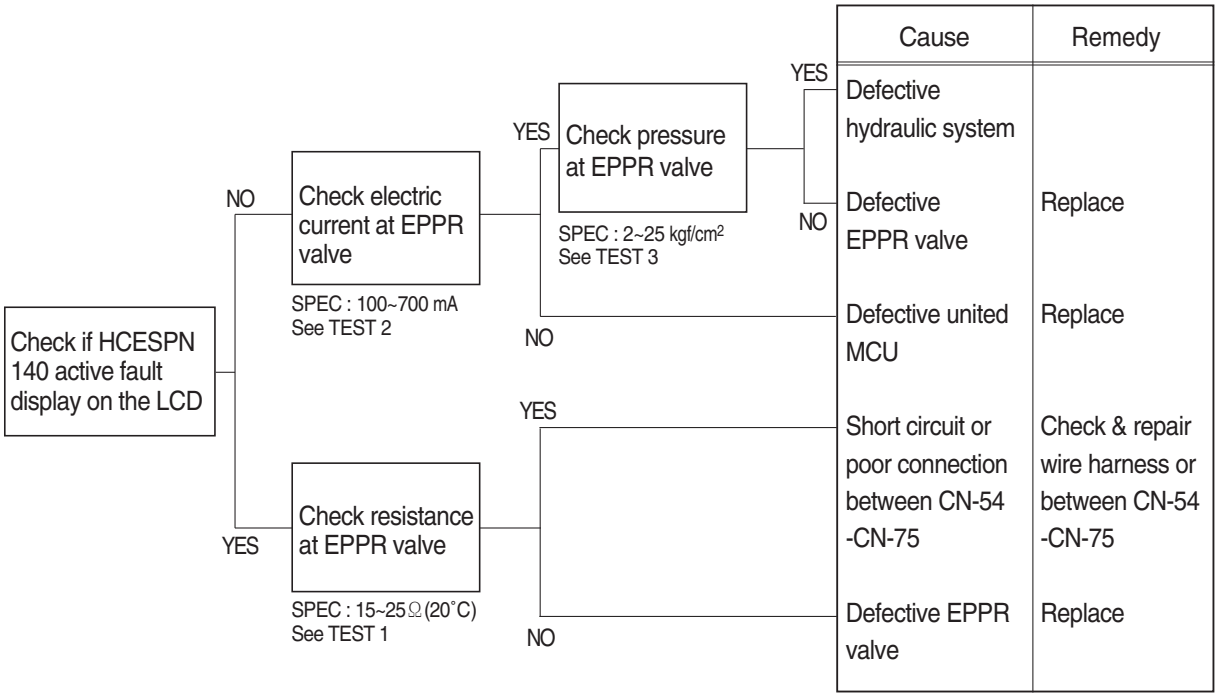


300L6ES118

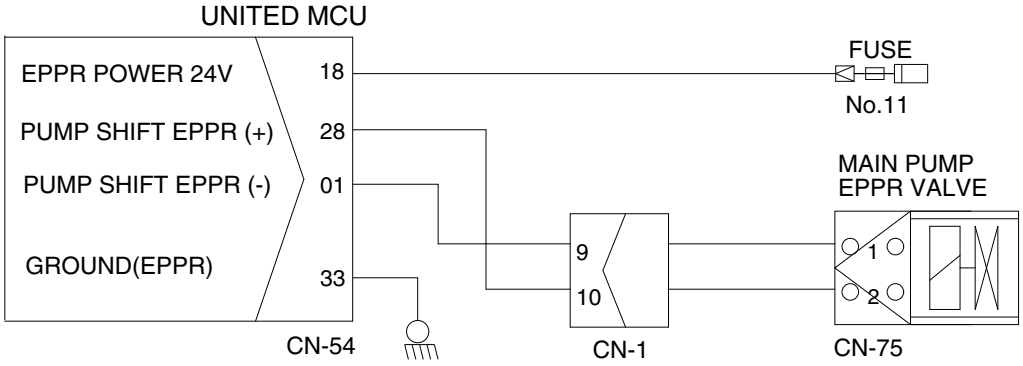
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.
※ Spec : P-mode 1800 ± 50 rpm S -mode 1700 ± 50 rpm E-mode 1600 ± 50 rpm
※ Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS01

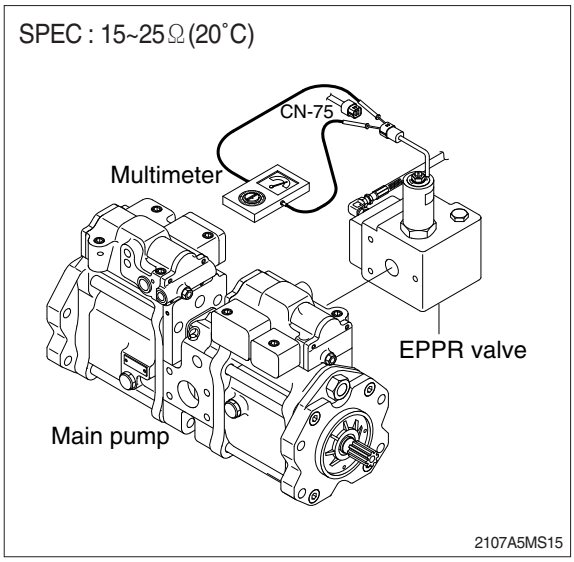
2) TEST PROCEDURE

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

① Starting key OFF.

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

③ Check resistance between 2 lines as figure.



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

① Disconnect connector CN-75 from EPPR valve.

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

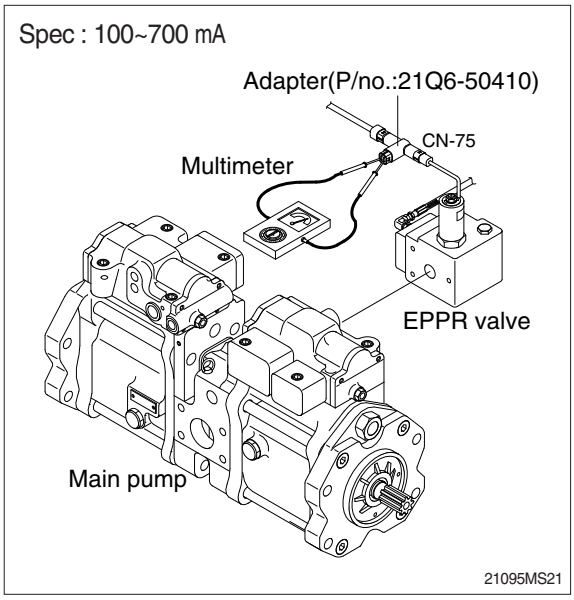
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If tachometer show approx 1700±50 rpm disconnect one wire harness from EPPR valve.

⑦ Check electric current at bucket circuit relief position.



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

① Remove plug and connect pressure gauge as figure.

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

② Start engine.

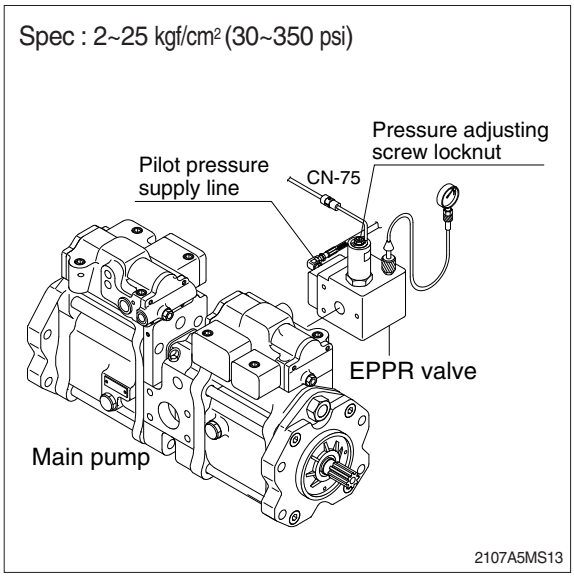
③ Set S-mode and cancel auto decel mode.
Position the multimodal dial at 10.

④ If tachometer show approx 1700±50 rpm

⑤ check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

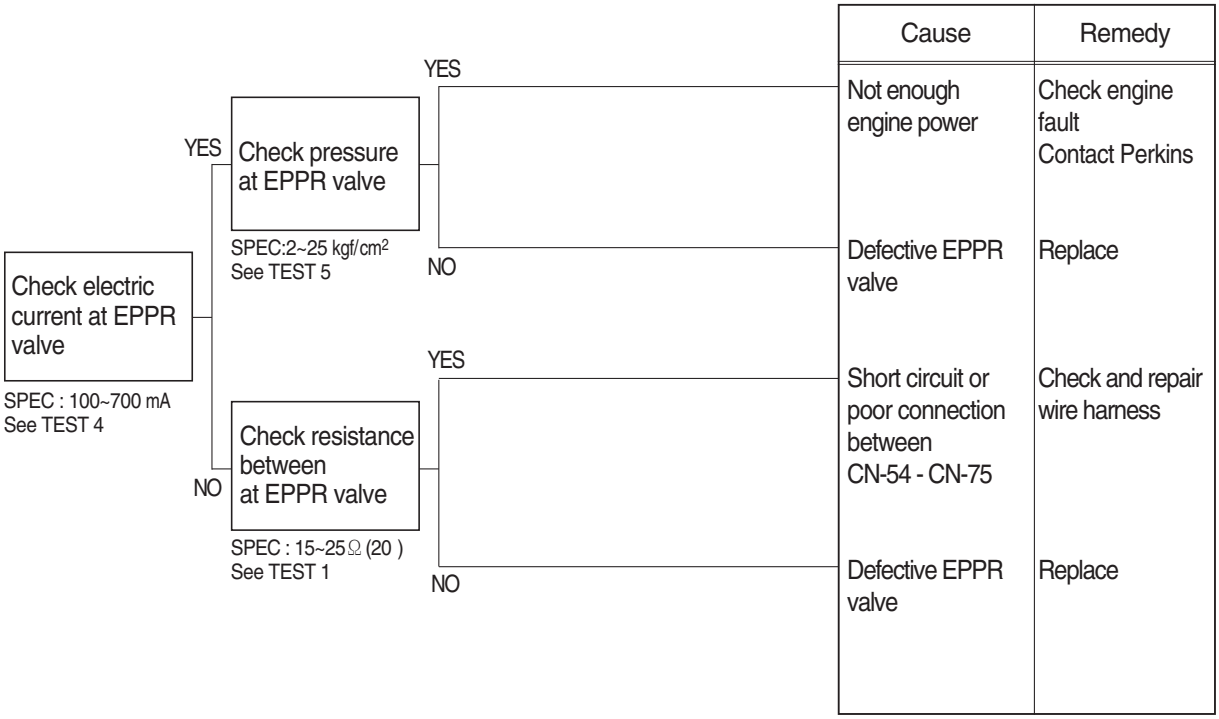
⑦ After adjust, test the machine.



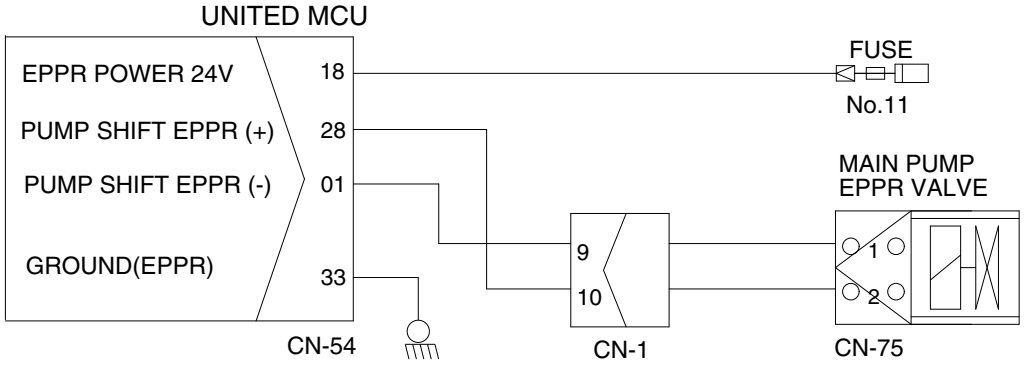
2. ENGINE STALL

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

1) INSPECTION PROCEDURE



Wiring diagram

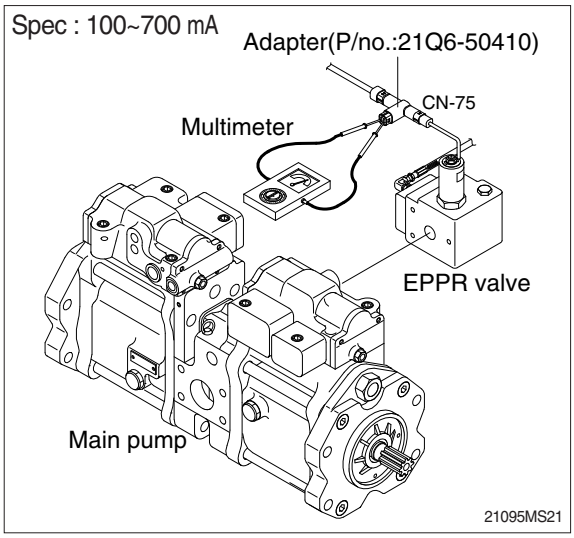


300A6MS01

2) TEST PROCEDURE

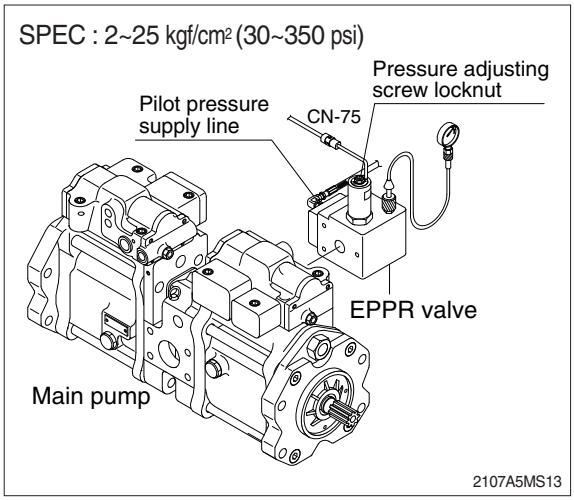
(1) Test 4 : Check electric current at EPPR valve.

① Disconnect connector CN-75 from EPPR valve.
② Insert the adapter to CN-75 and install multimeter as figure.
③ Start engine.
④ Set S-mode and cancel auto decel mode.
⑤ Position the multimodal dial at 10.
⑥ If rpm show approx 1700±50 rpm disconnect one wire harness from EPPR valve.
⑦ Check electric current at bucket circuit relief position.



(2) Test 5 : Check pressure at EPPR valve.

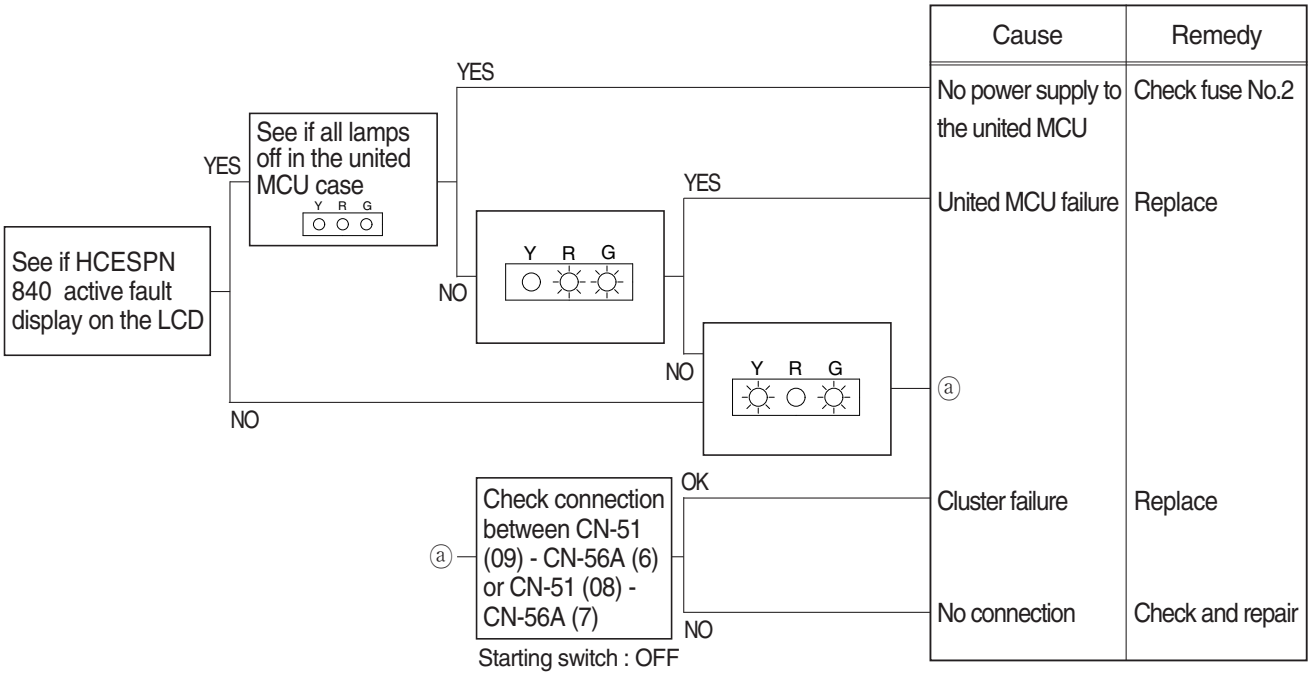
① Remove plug and connect pressure gauge as figure.
· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)
② Start engine.
③ Set S-mode and cancel auto decel mode.
④ Position the multimodal dial at 10.
⑤ If rpm show approx 1700±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.



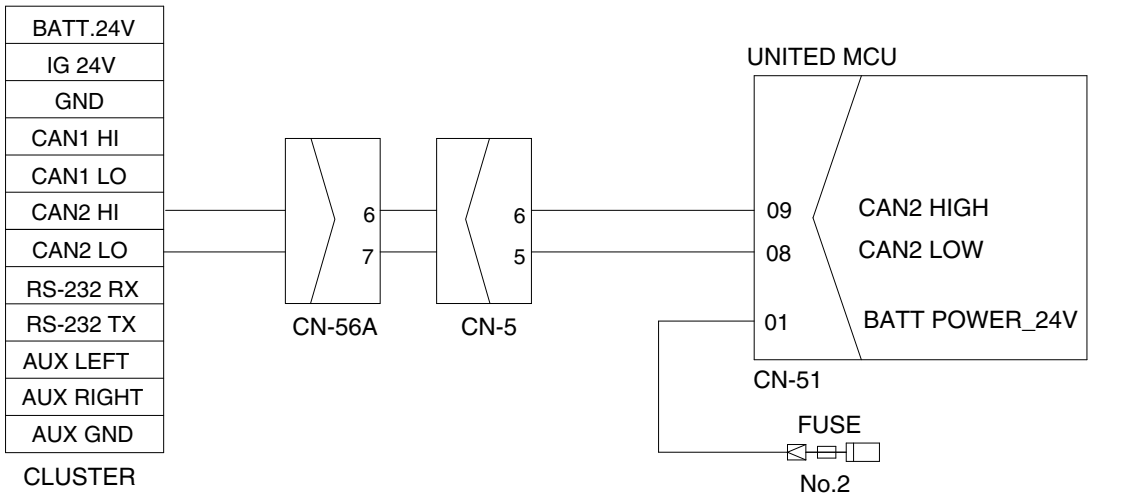
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

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

1) INSPECTION PROCEDURE



Wiring diagram



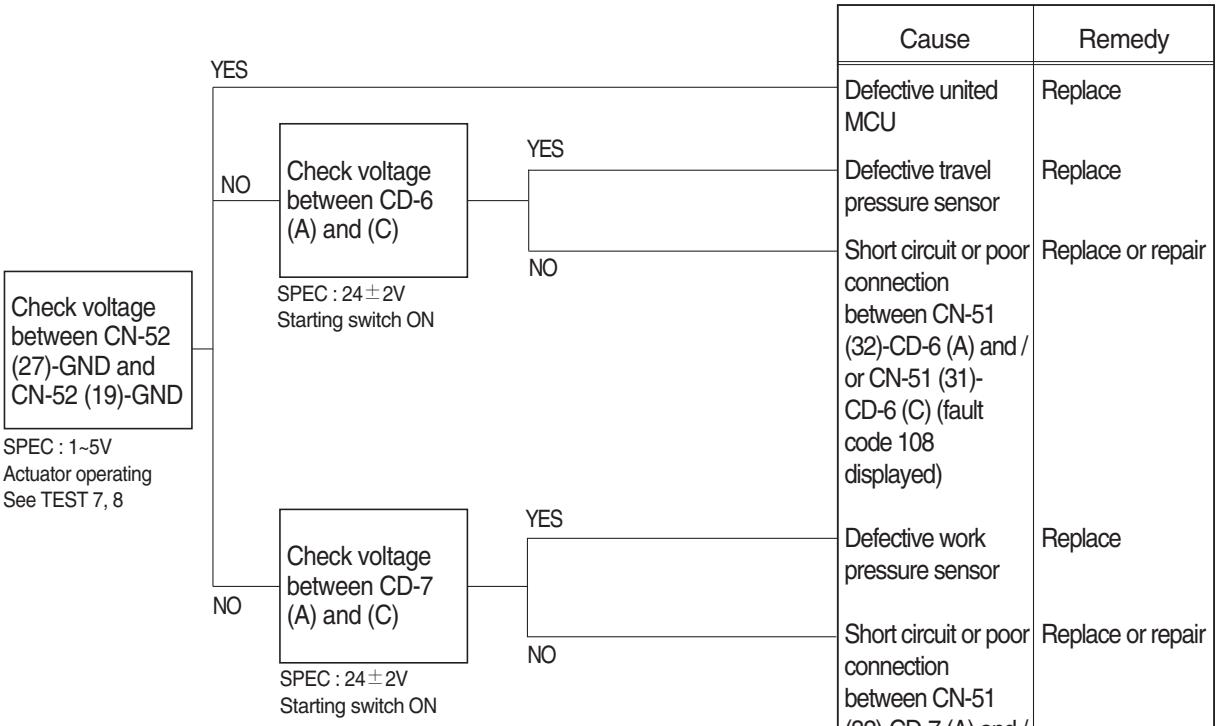
300A6MS02

4. AUTO DECEL SYSTEM DOES NOT WORK

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

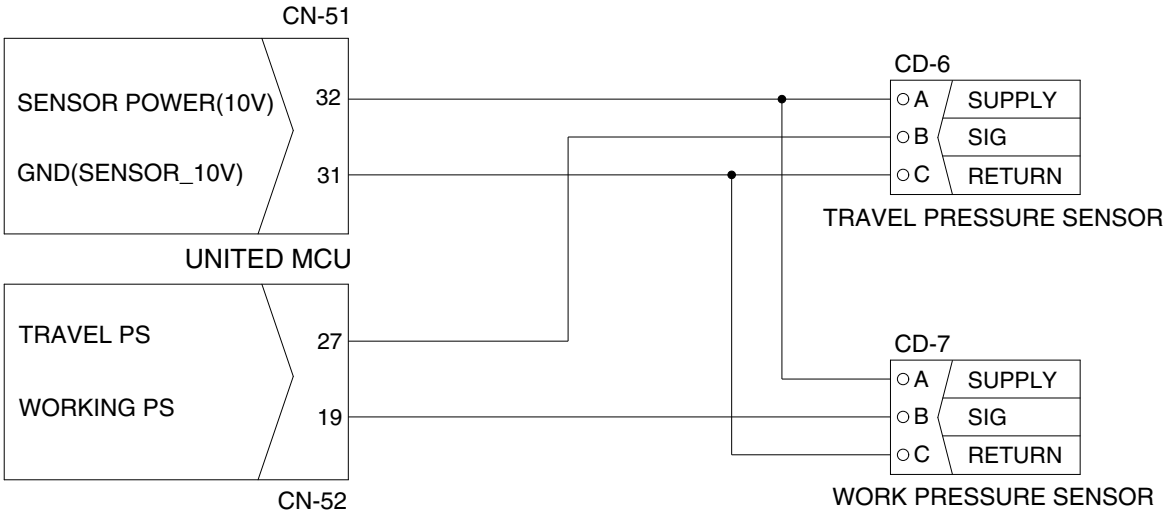
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Defective travel pressure sensor	Replace
Short circuit or poor connection between CN-51 (32)-CD-6 (A) and / or CN-51 (31)-CD-6 (C) (fault code 108 displayed)	Replace or repair
Defective work pressure sensor	Replace
Short circuit or poor connection between CN-51 (32)-CD-7 (A) and / or CN-51 (31)-CD-7 (C) (fault code 105 displayed)	Replace or repair

Wiring diagram



300A6MS03

2) TEST PROCEDURE

(1) Test 7 : Check voltage at CN-52 (27) and ground.

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

② Insert prepared pin to rear side of connectors : One pin to (27) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

(2) Test 8 : Check voltage at CN-52 (19) and ground.

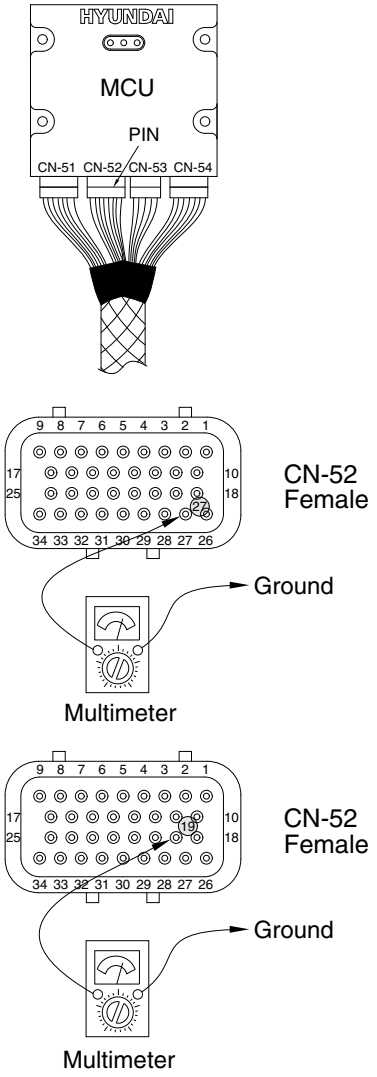
① Prepare 1 piece of thin sharp pin, steel or copper

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

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



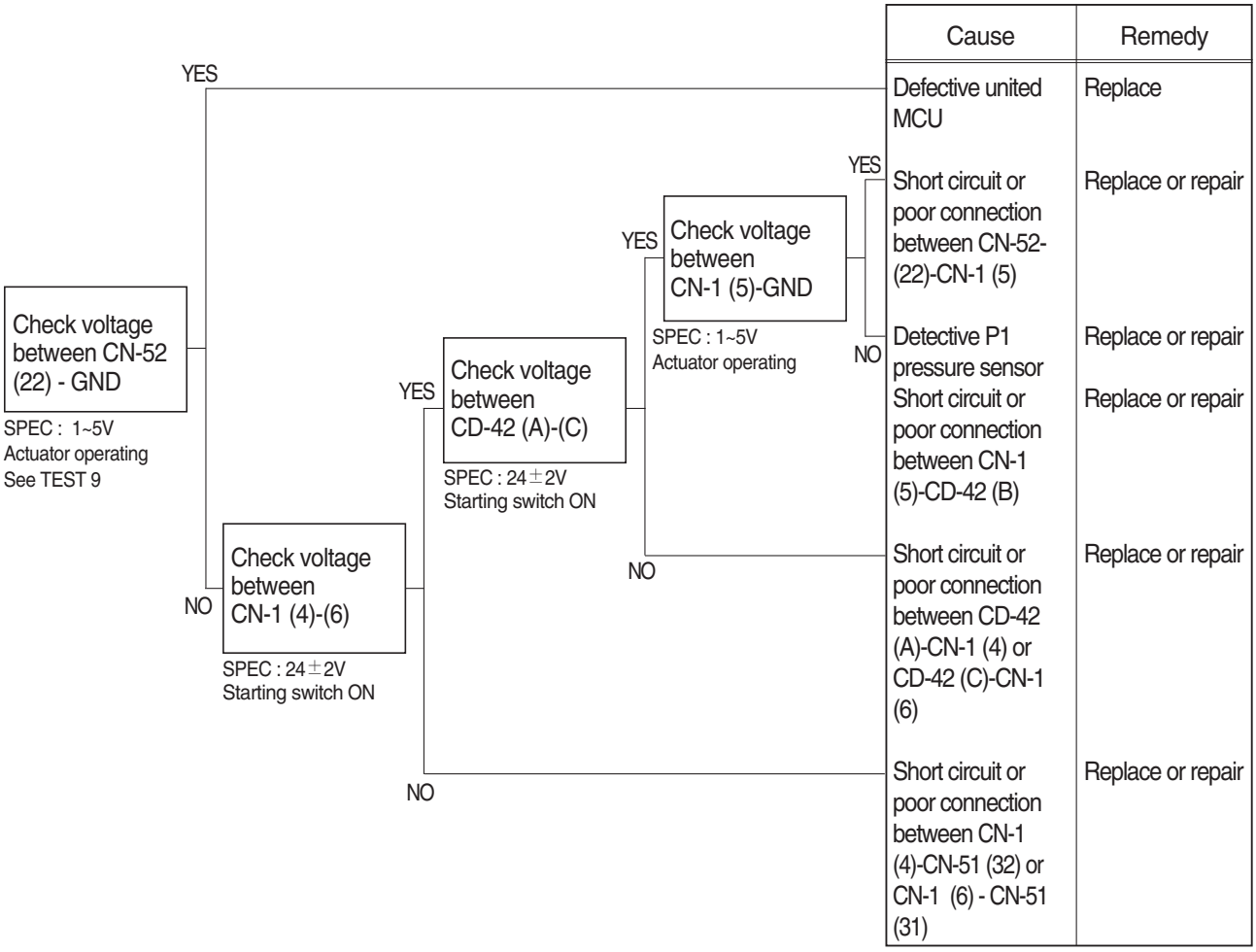
140L6MS104

5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

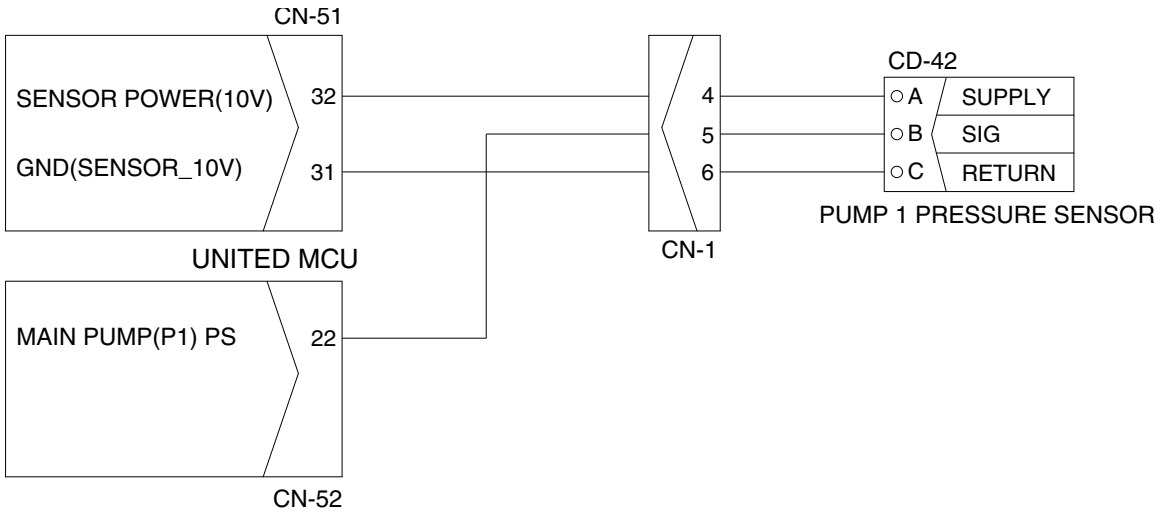
· Fault code : HCESPN 120, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS05

2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (22) and ground.

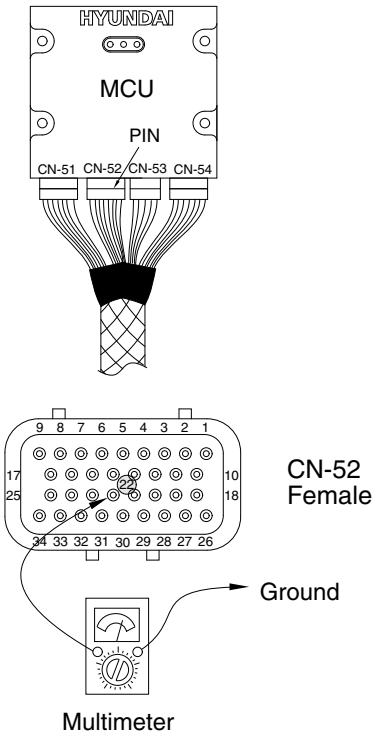
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (22) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



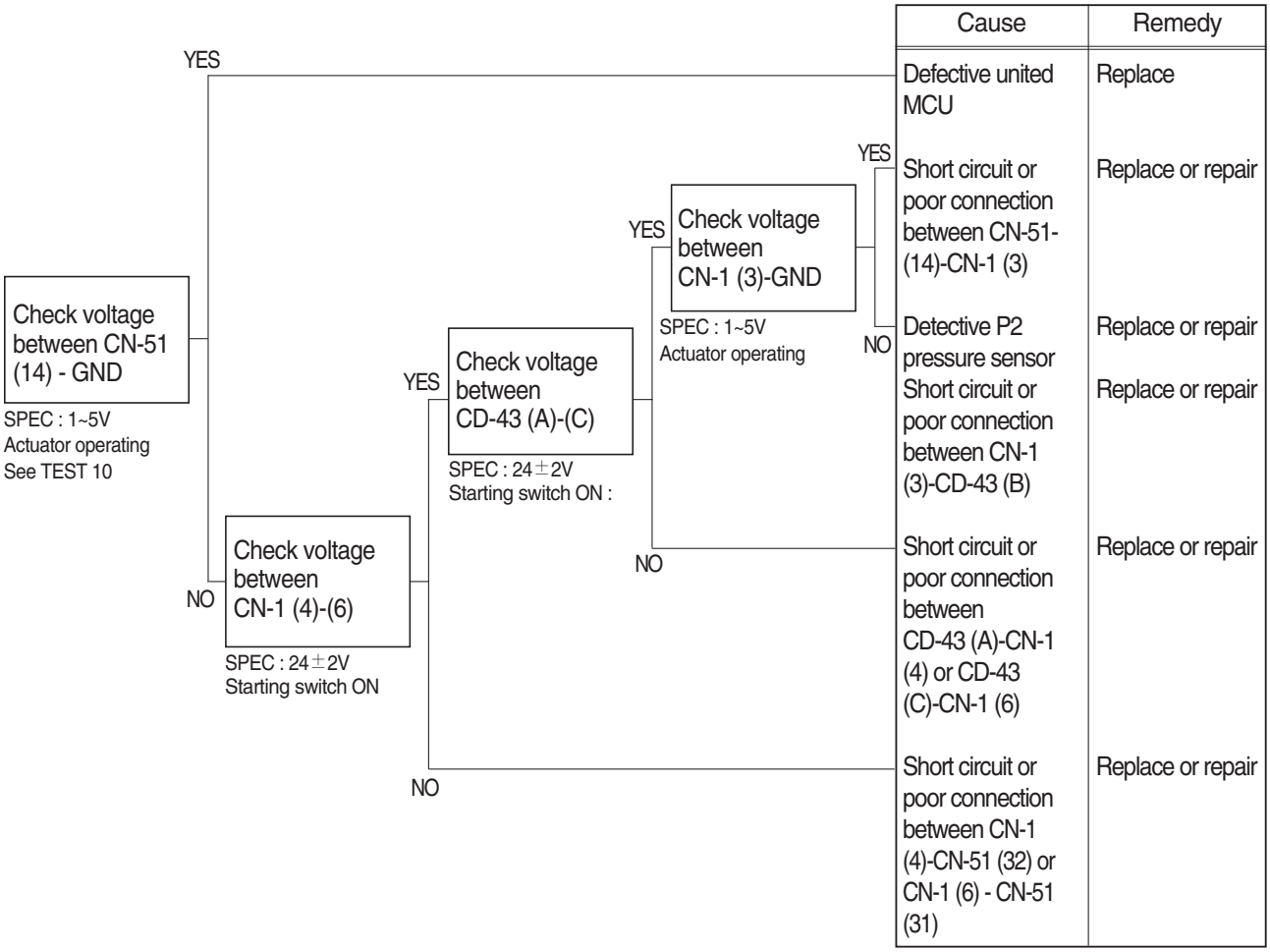
140L6MS106

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

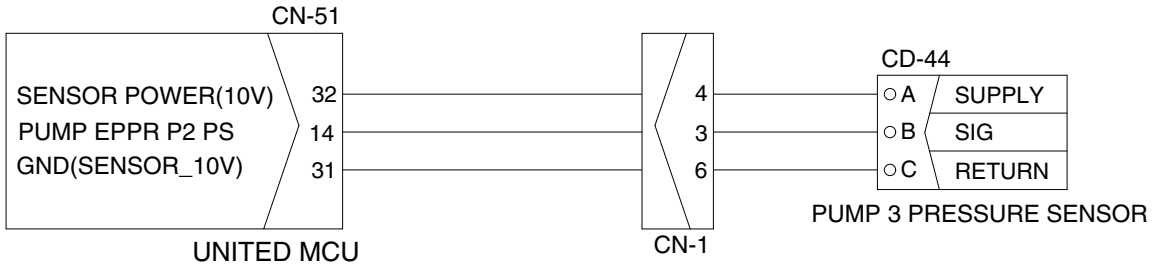
· Fault code : HCESPN 121, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS07

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-51 (14) and ground.

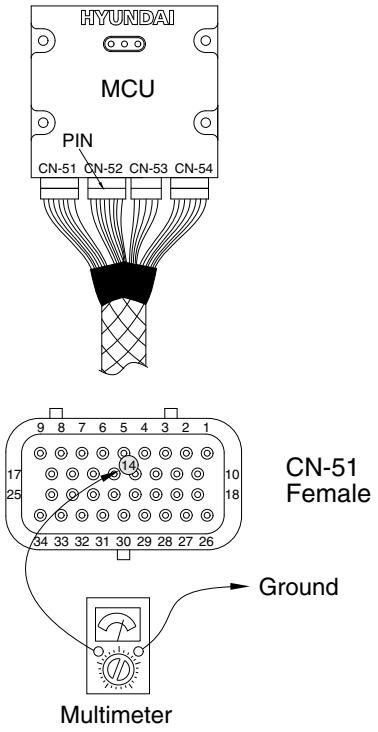
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (14) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

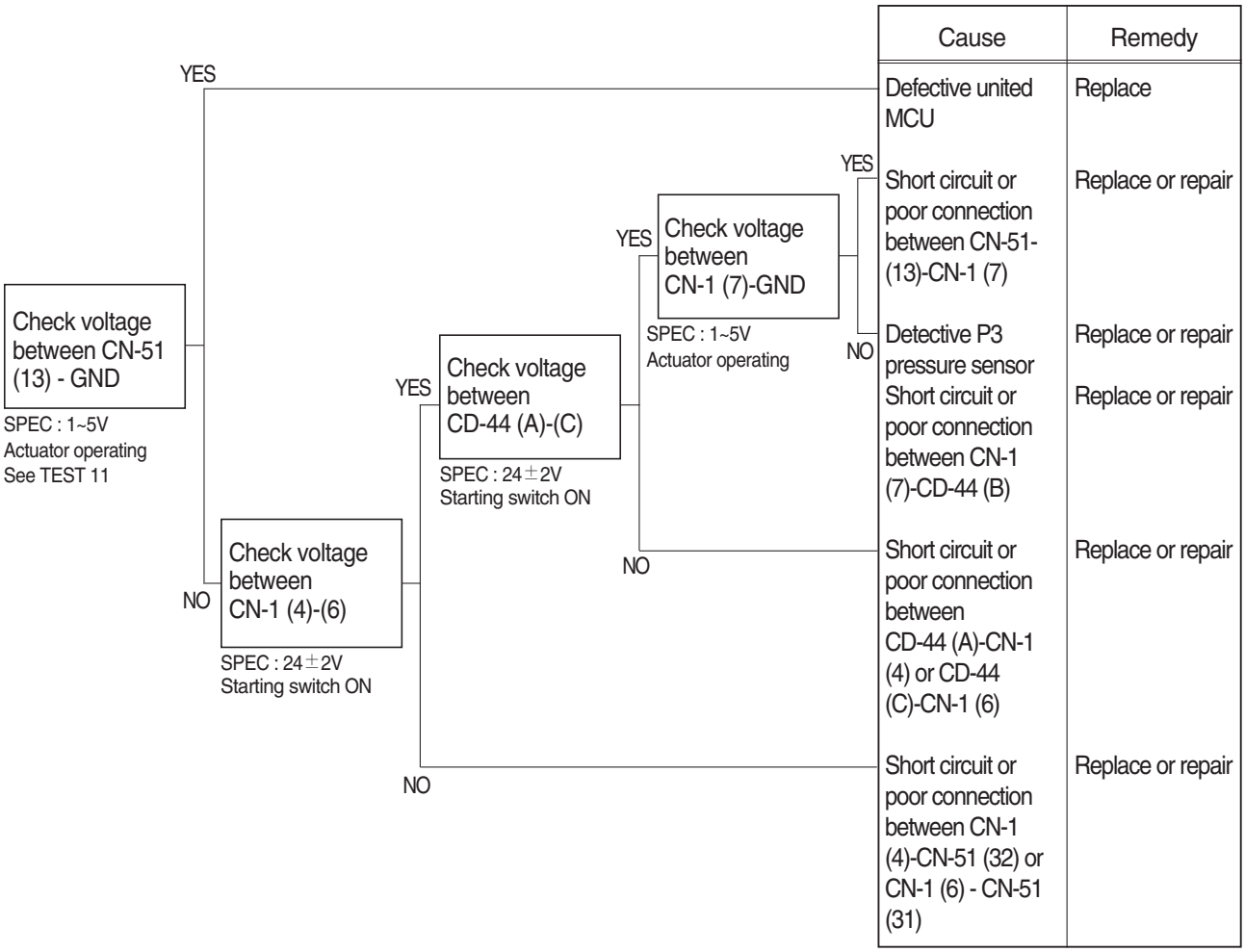


140L6MS108

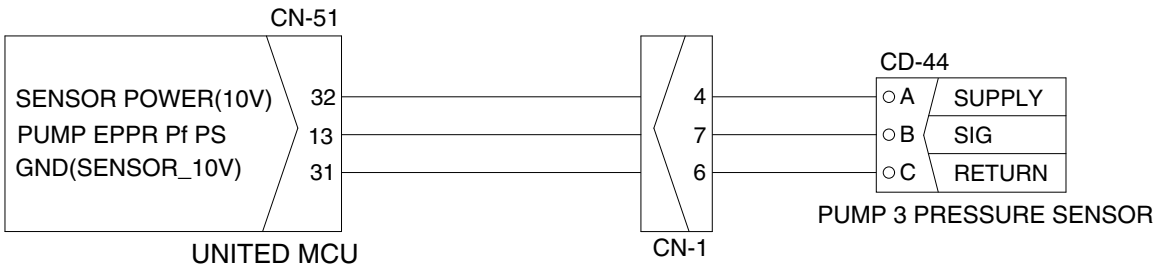
7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS09

2) TEST PROCEDURE

(1) Test 11 : Check voltage at CN-51 (13) and ground.

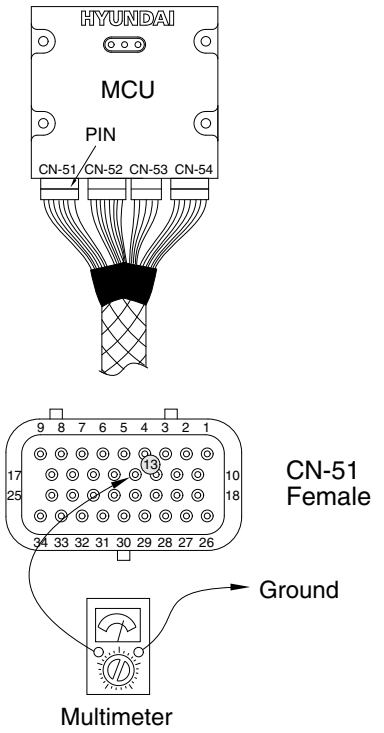
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (13) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



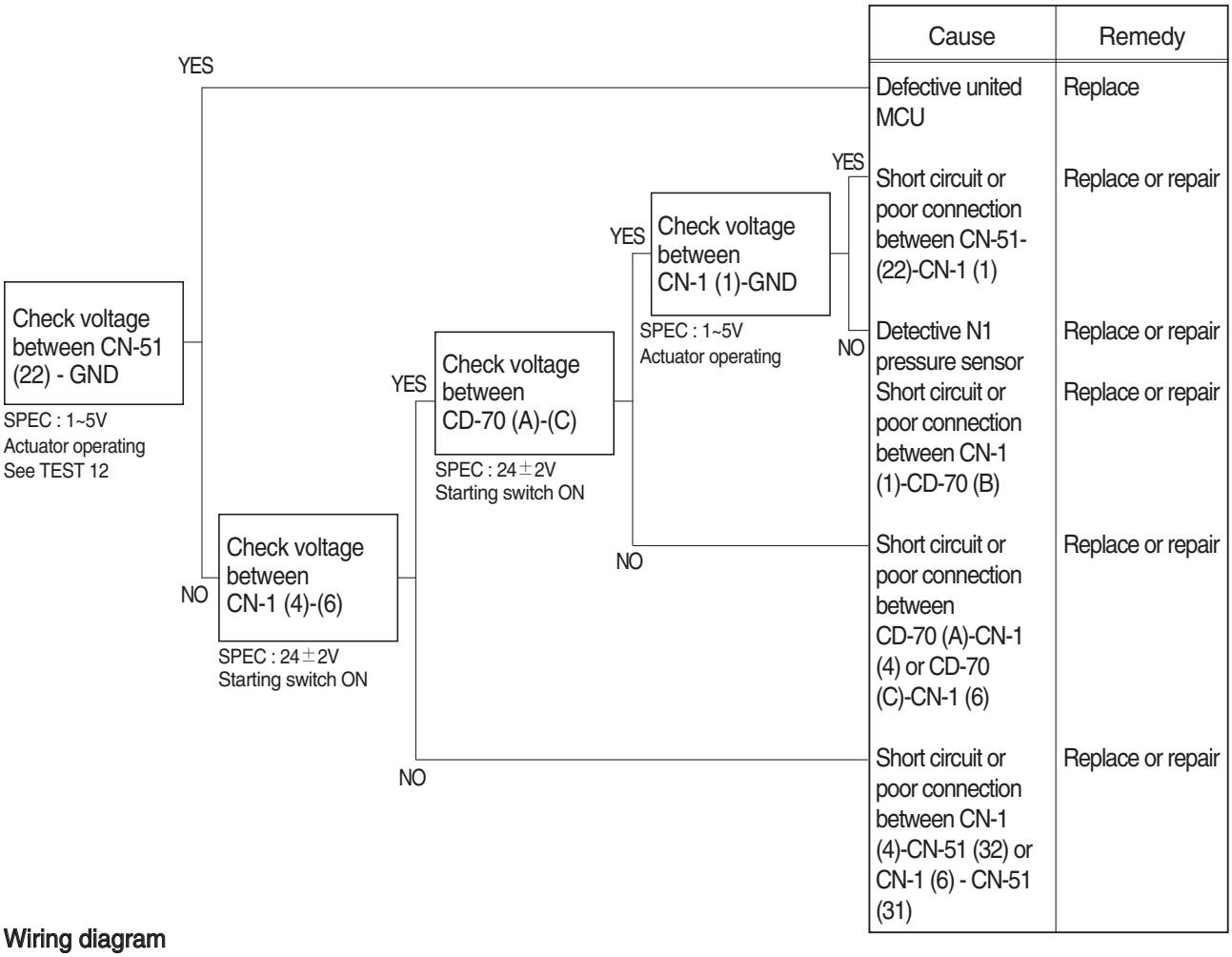
140L6MS110

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

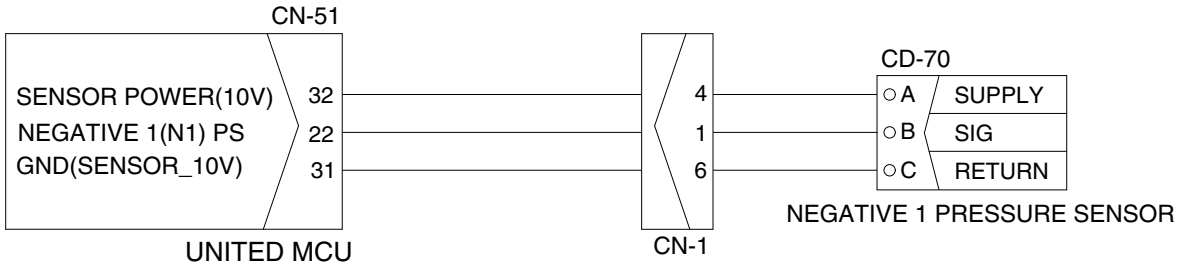
· Fault code : HCESPN 123, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS11

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-51 (22) and ground.

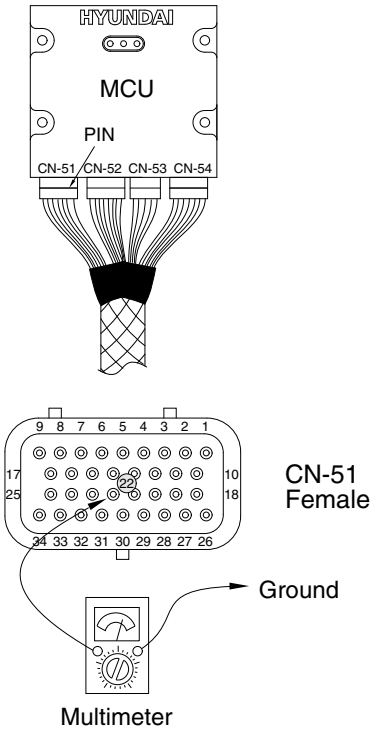
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (22) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



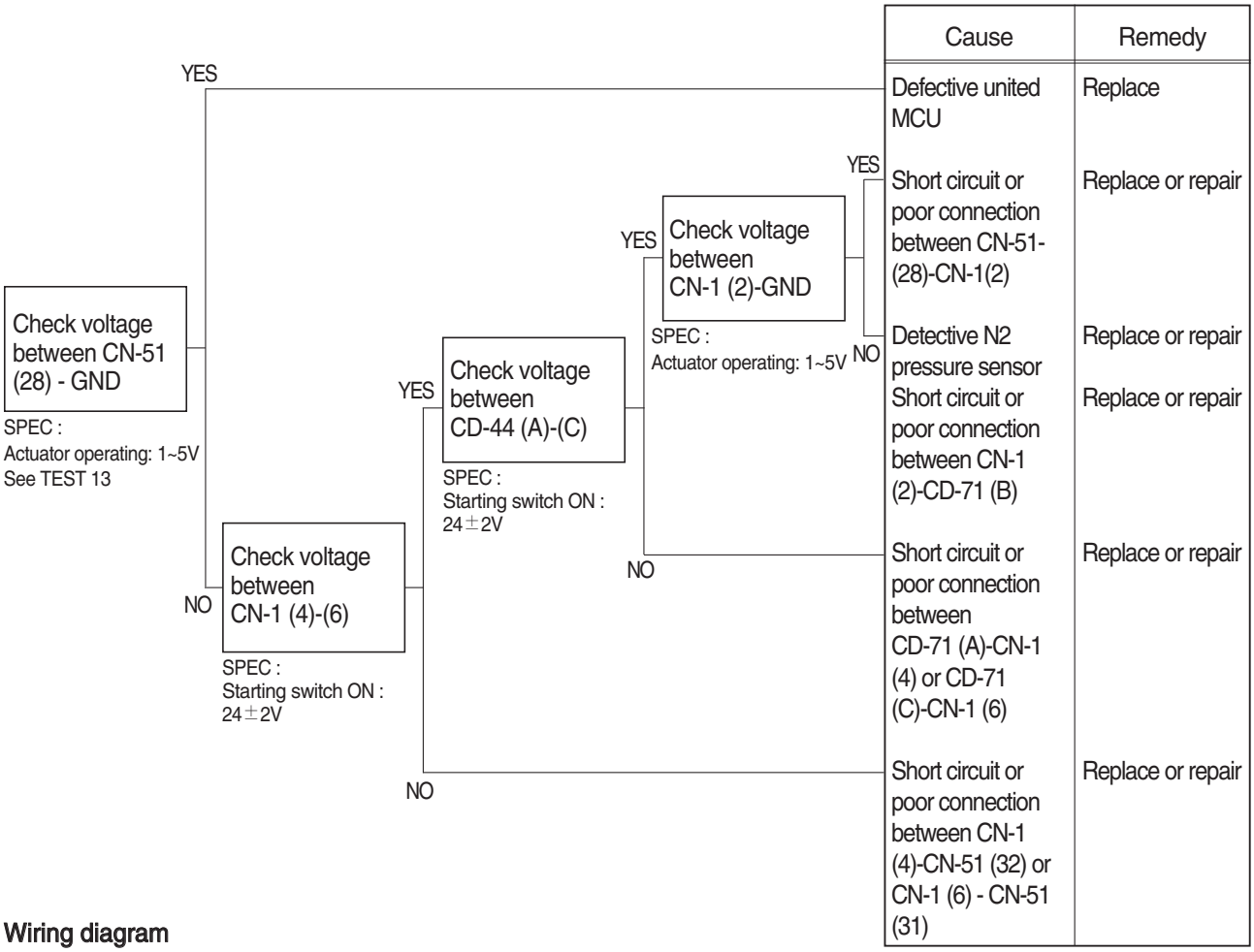
140L6MS112

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

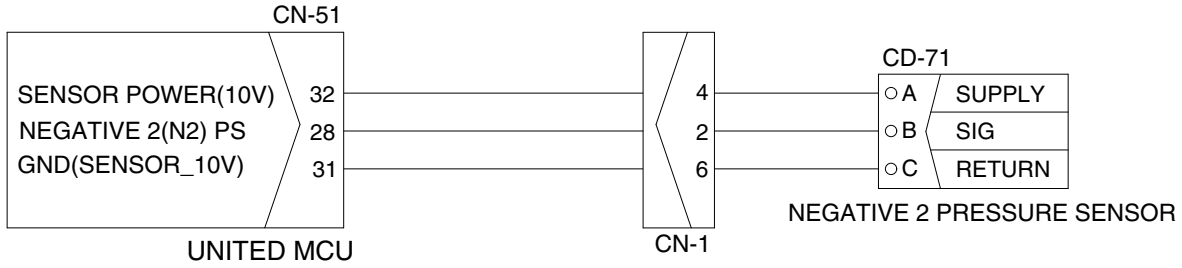
· Fault code : HCESPN 124, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS13

2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-51 (28) and ground.

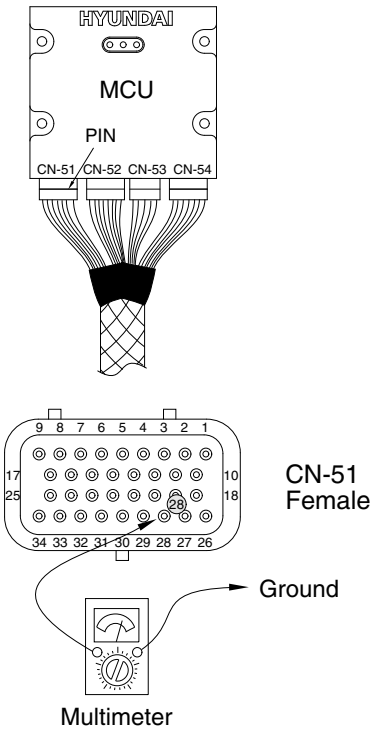
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (28) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



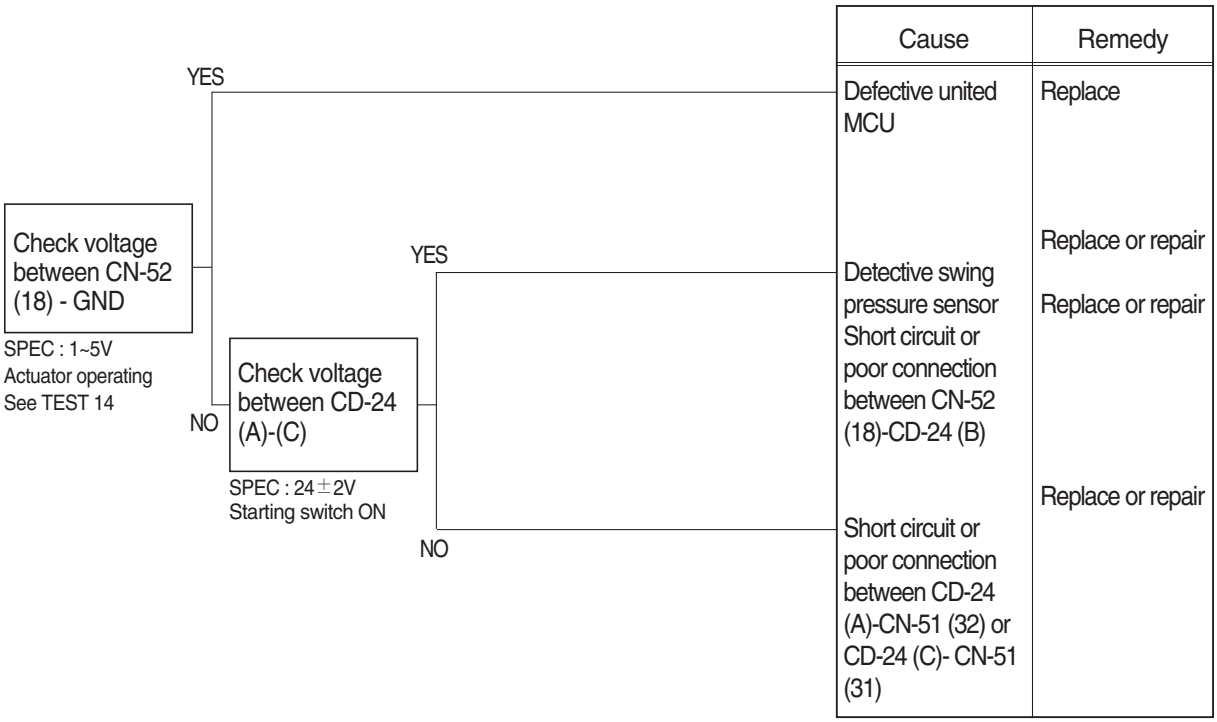
140L6MS114

10. MALFUNCTION OF SWING PRESSURE SENSOR

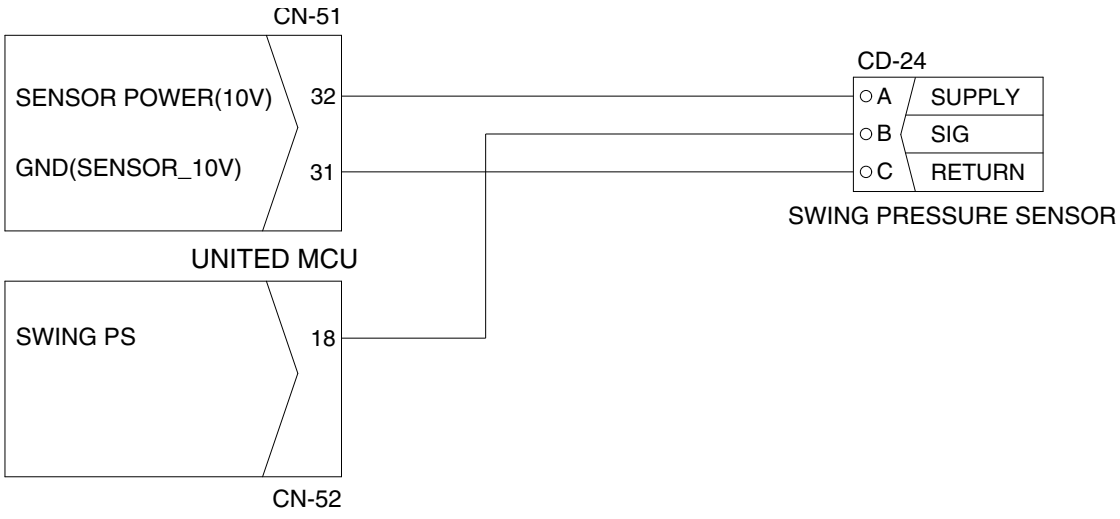
· Fault code : HCESPN 135, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS15

2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (18) and ground.

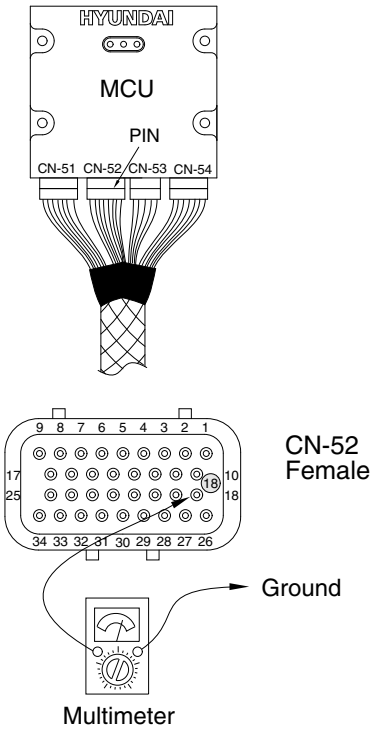
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (18) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



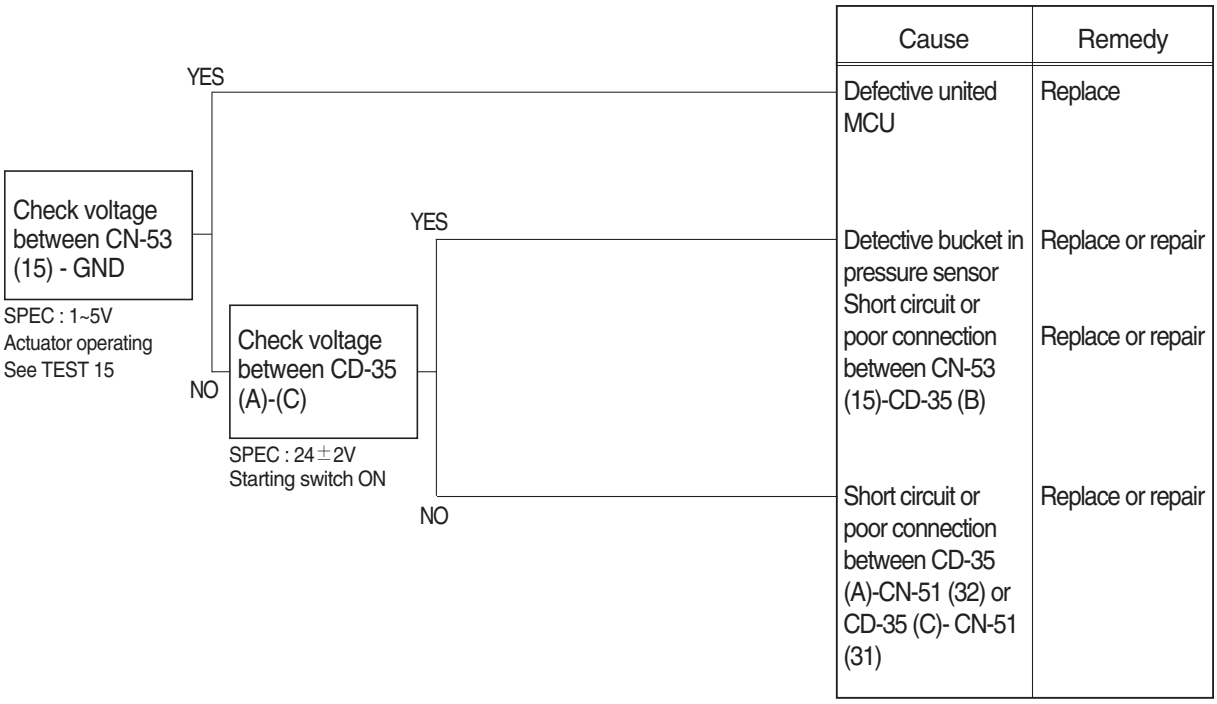
140L6MS116

11. MALFUNCTION OF BUCKET IN PRESSURE SENSOR

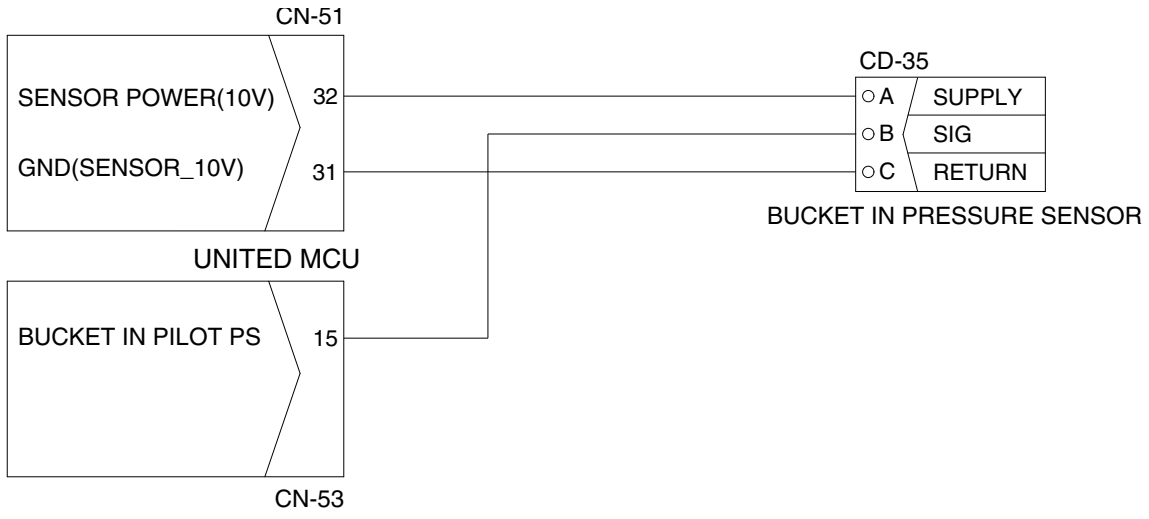
· Fault code : HCESPN 131, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS17

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-53 (15) and ground.

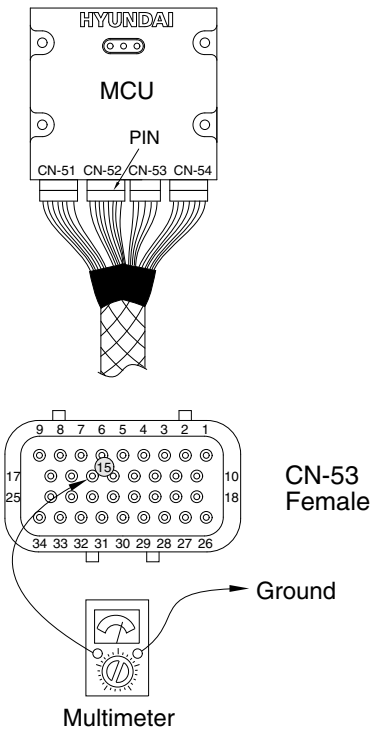
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (15) of CN-53.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



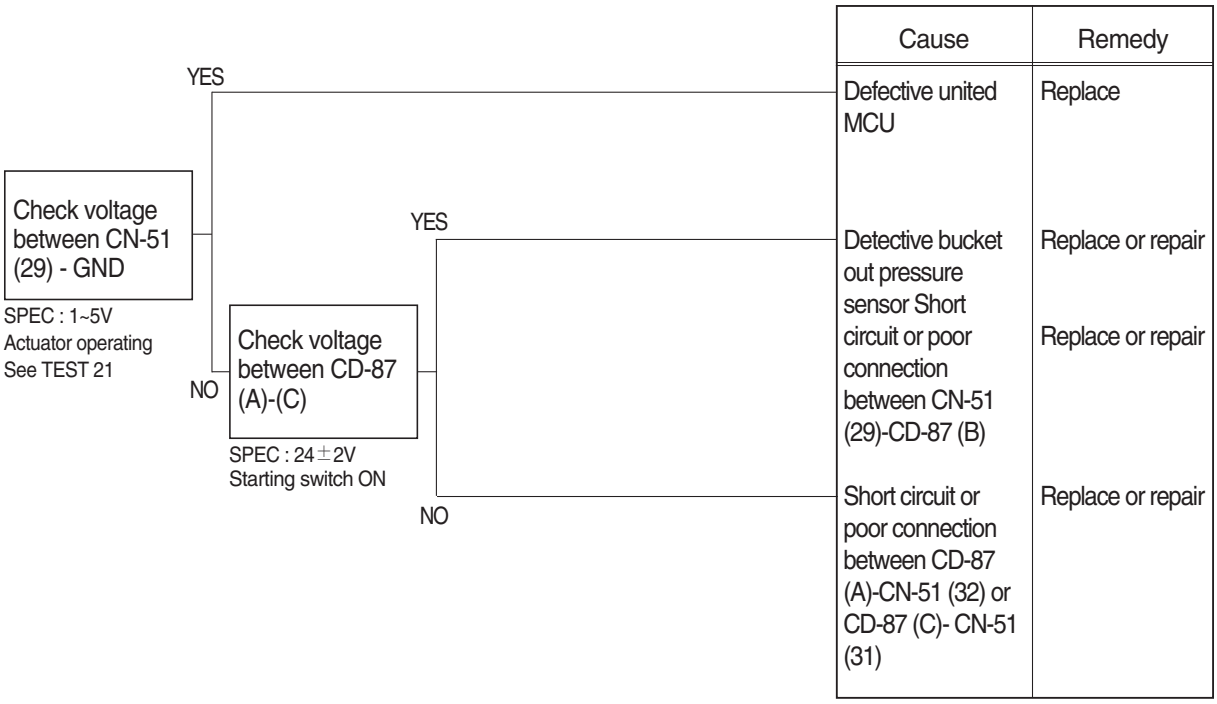
320A6MS120

12. MALFUNCTION OF BUCKET OUT PRESSURE SENSOR

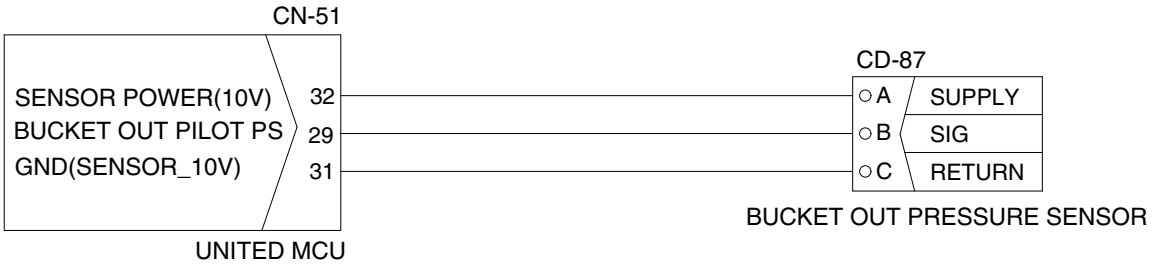
· Fault code : HCESPN 131, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



320A6MS19

2) TEST PROCEDURE

(1) Test 21 : Check voltage at CN-51 (29) and ground.

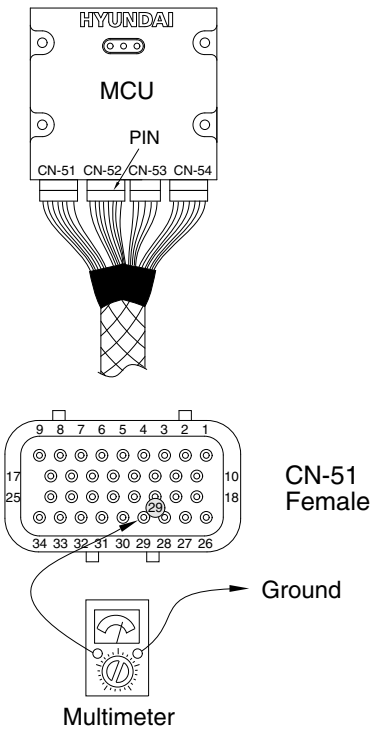
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (29) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



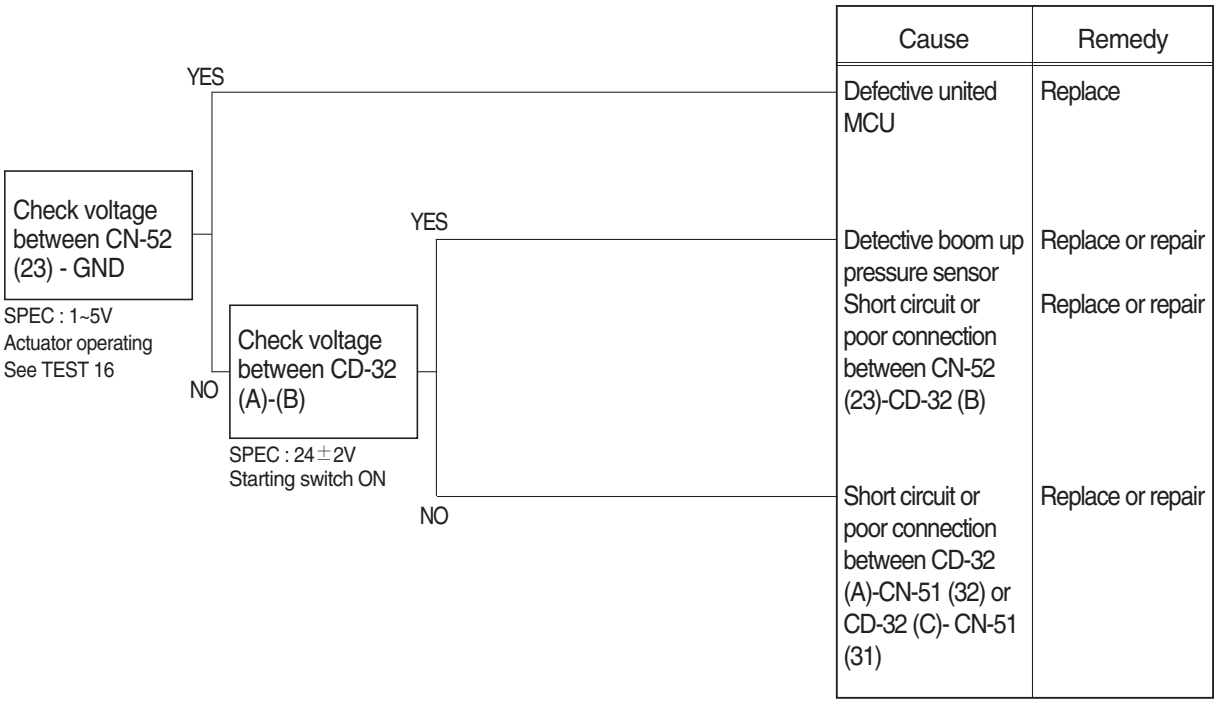
320A6MS121

13. MALFUNCTION OF BOOM UP PRESSURE SENSOR

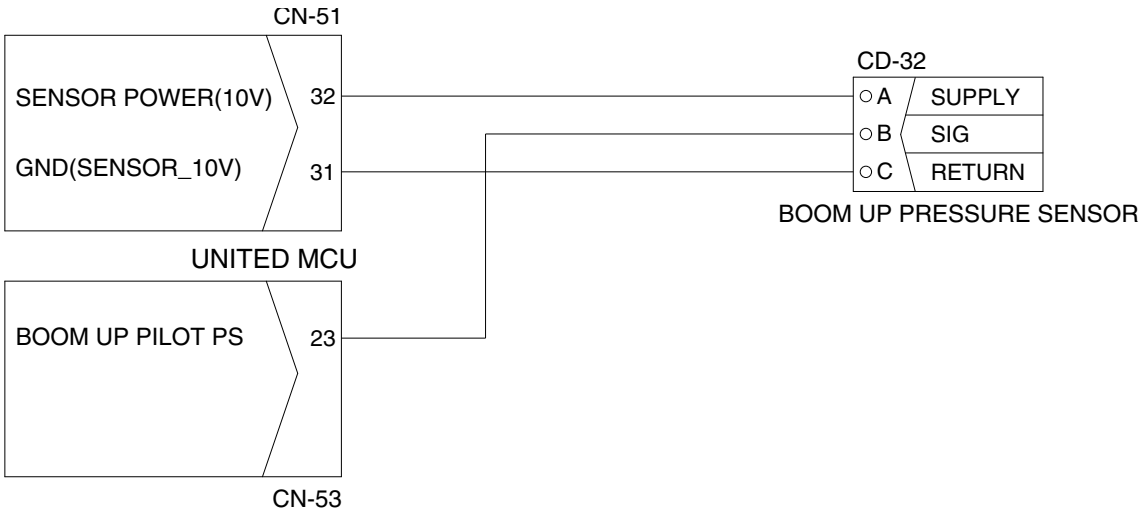
· Fault code : HCESPN 127, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS19

2) TEST PROCEDURE

(1) Test 16 : Check voltage at CN-52 (23) and ground.

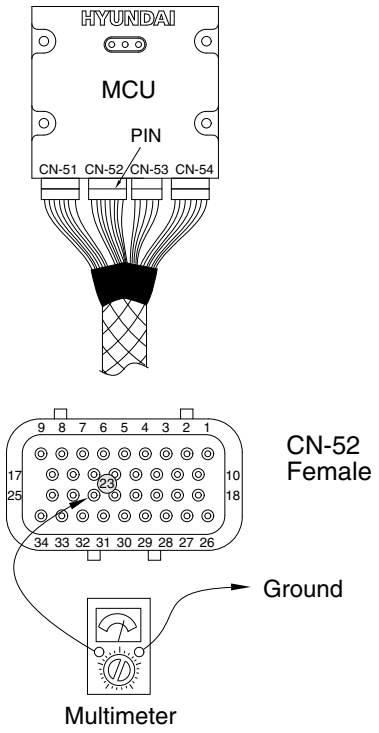
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (23) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



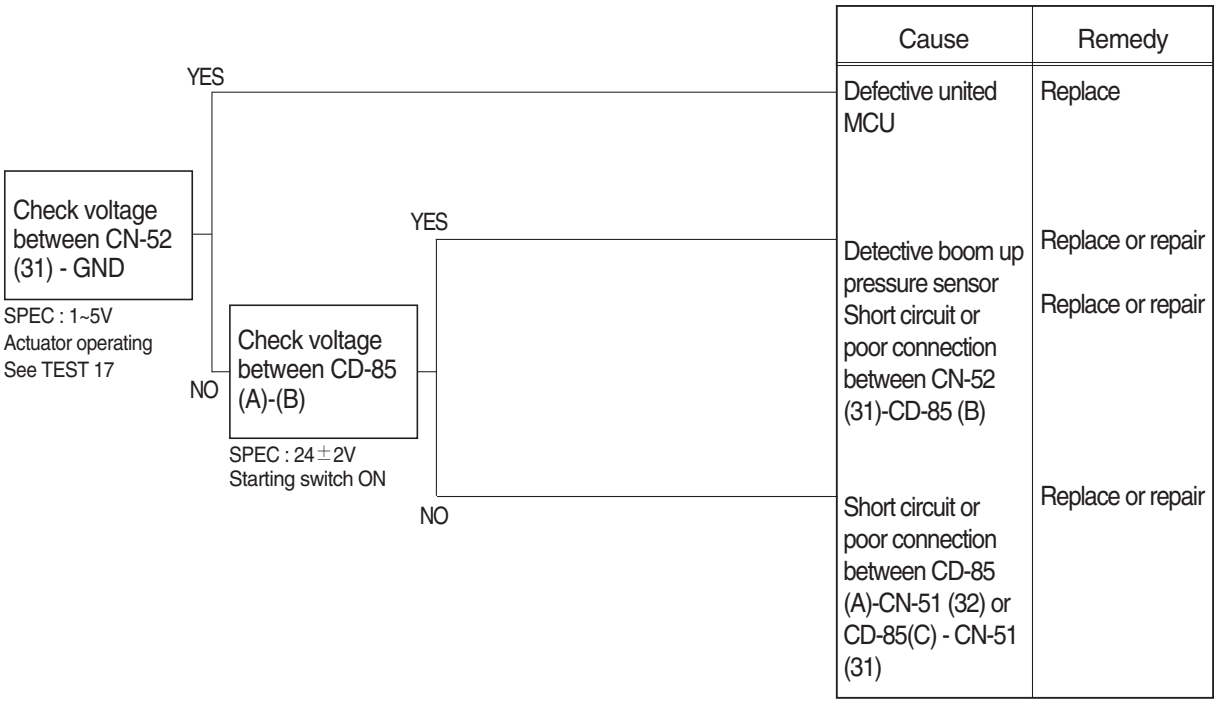
140L6MS120

14. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

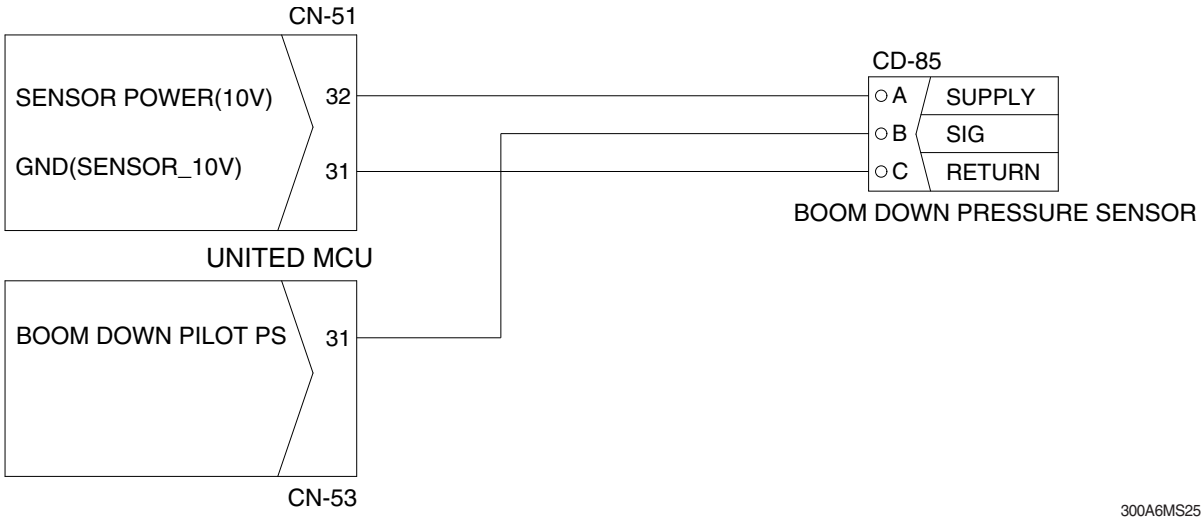
· Fault code : HCESPN 128, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-52 (31) and ground.

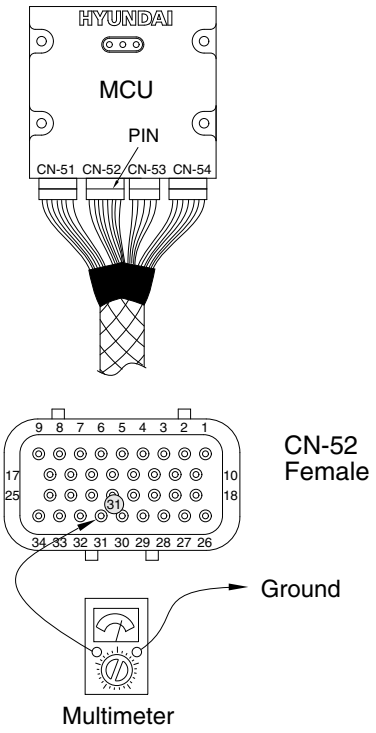
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (31) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



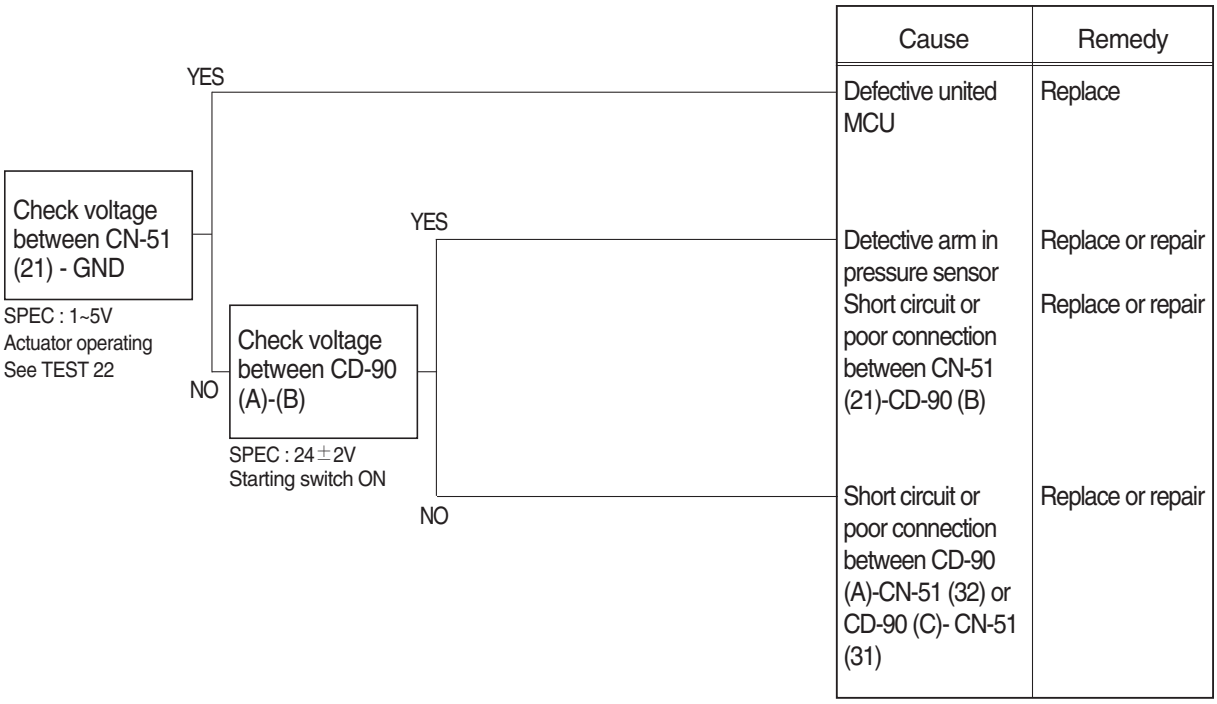
140L6MS126

15. MALFUNCTION OF ARM IN PRESSURE SENSOR

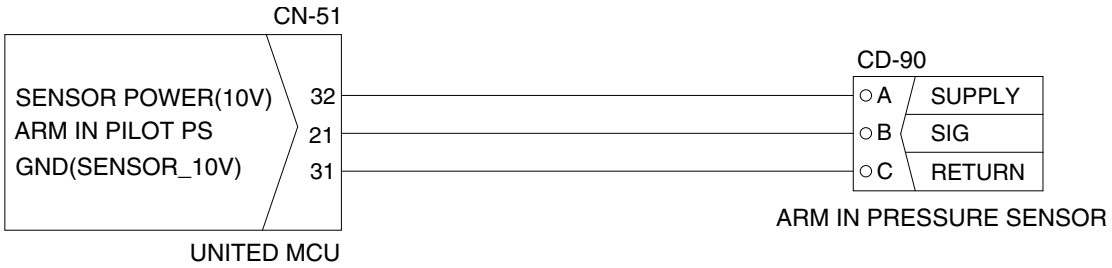
· Fault code : HCESPN 129, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



320A6MS17

2) TEST PROCEDURE

(1) Test 22 : Check voltage at CN-51 (21) and ground.

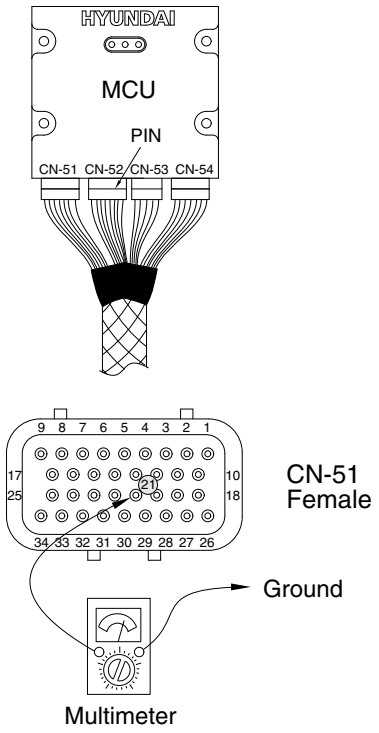
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (21) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



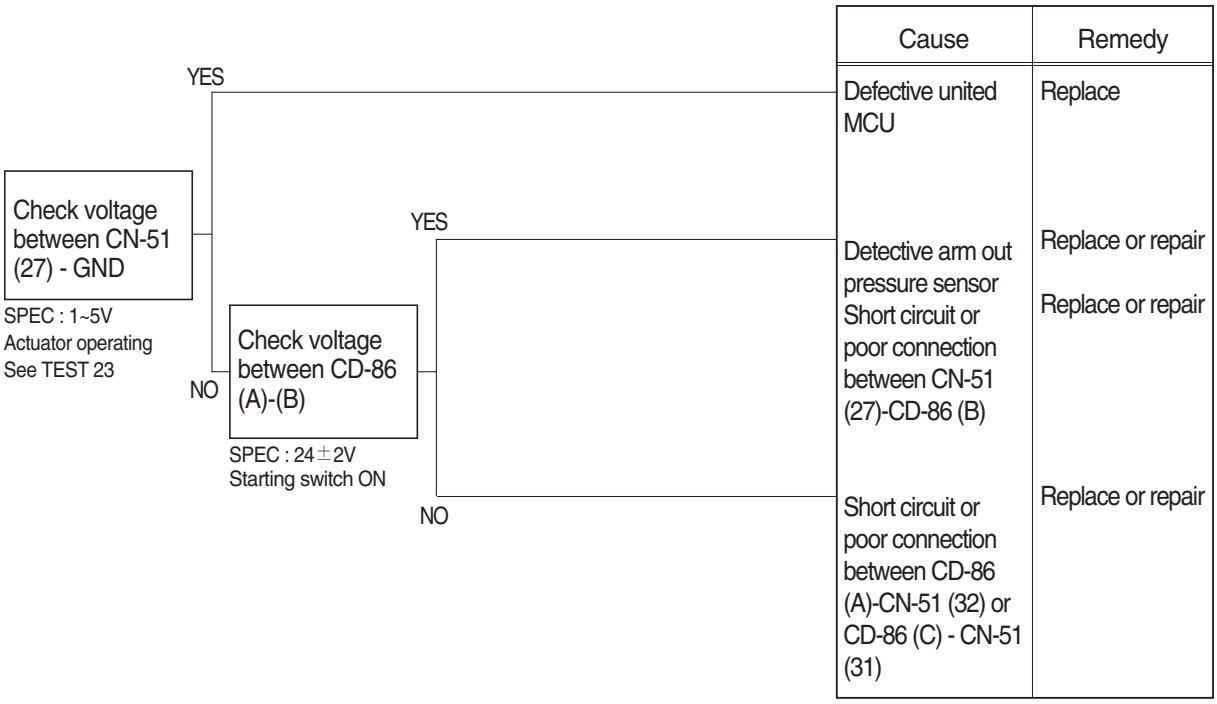
320A6MS118

16. MALFUNCTION OF ARM OUT PRESSURE SENSOR

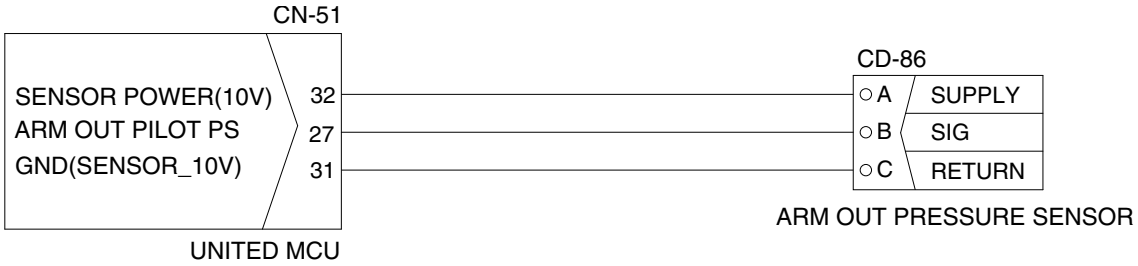
· Fault code : HCESPN 130, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



320A6MS18

2) TEST PROCEDURE

(1) Test 23 : Check voltage at CN-51 (27) and ground.

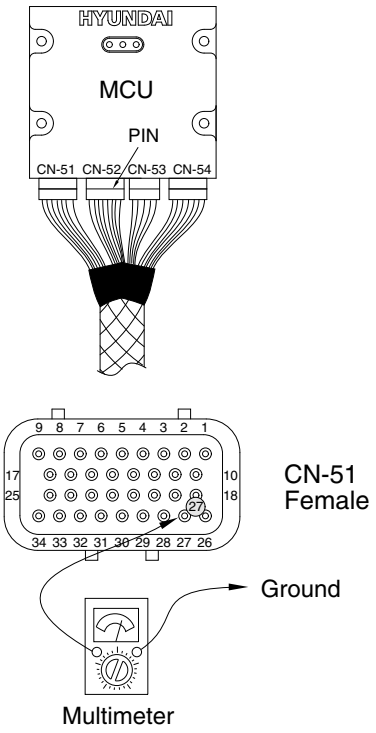
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (27) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



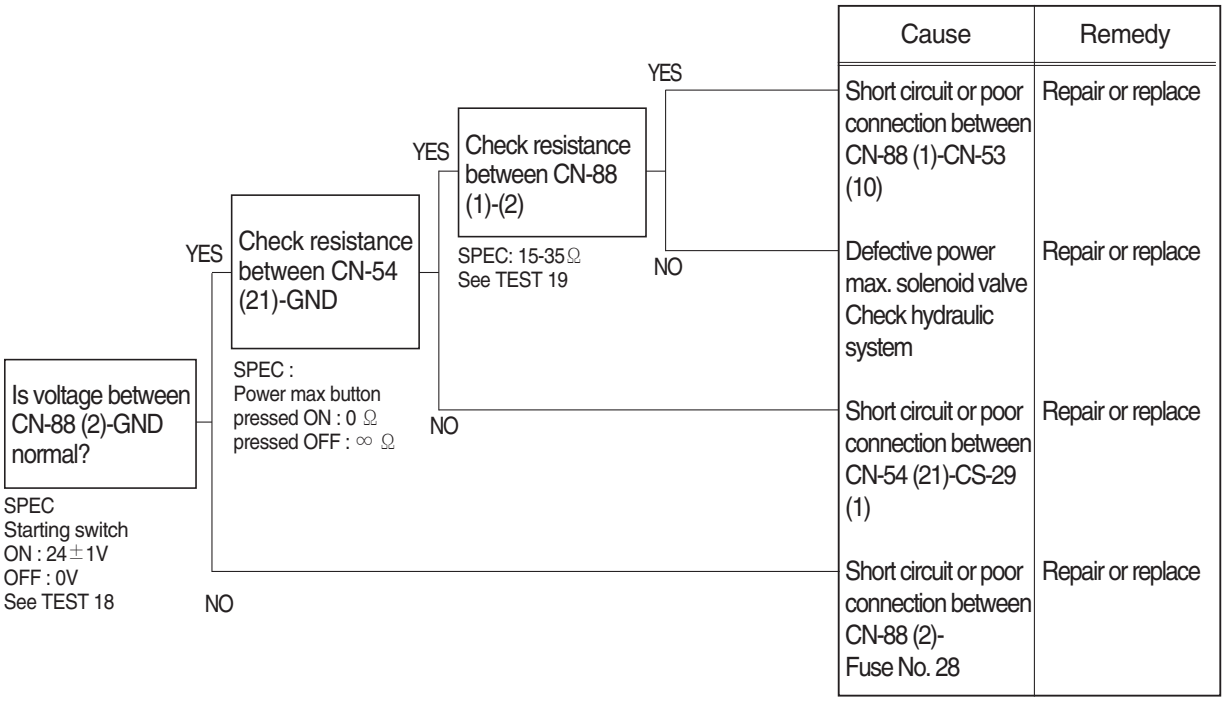
320A6MS119

17. MALFUNCTION OF POWER MAX

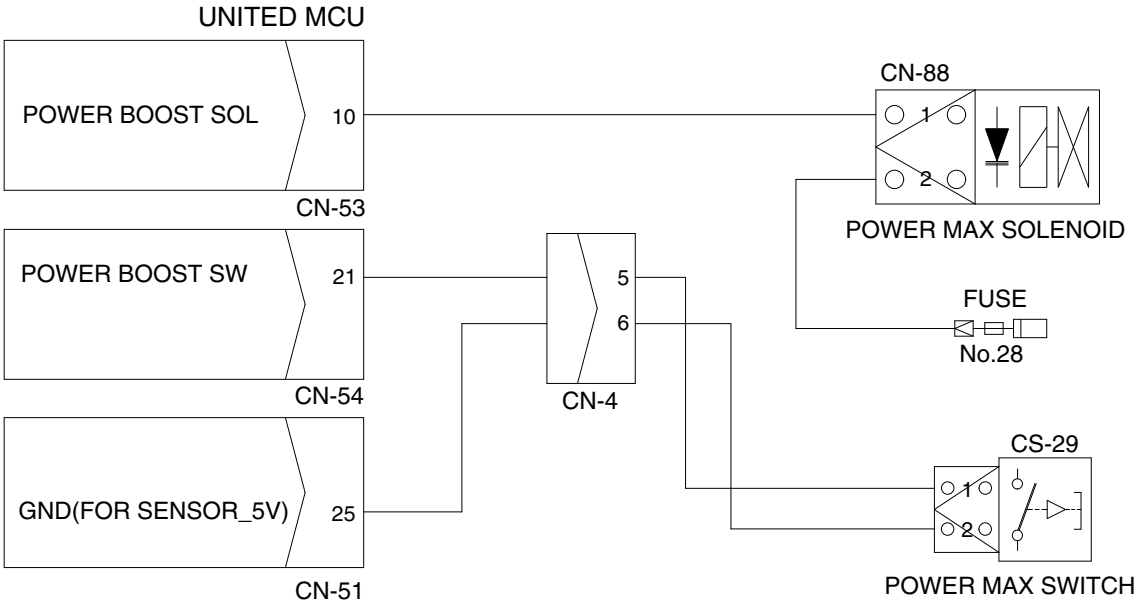
· Fault code : HCESPN 166, FMI 4 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS21

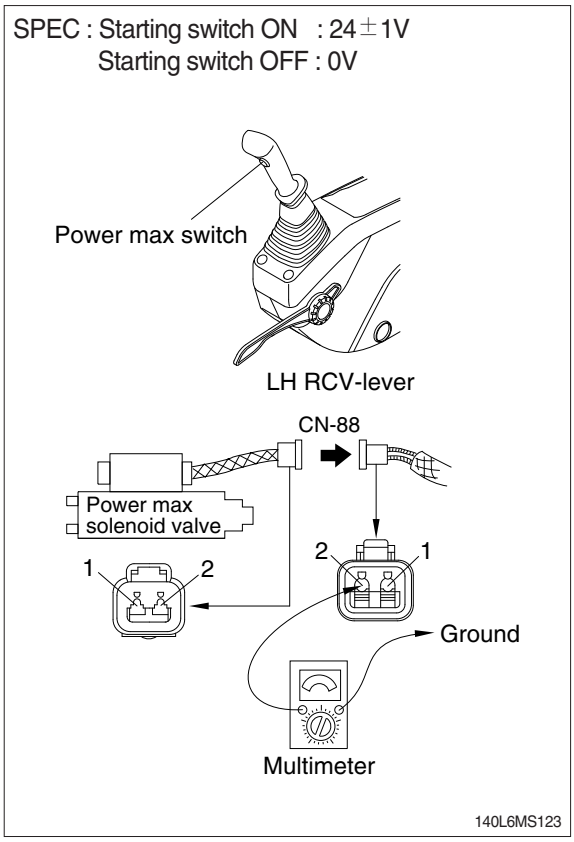
2) TEST PROCEDURE

(1) Test 18: Check voltage between connector CN-88 (2) - GND.

① Disconnect connector CN-88 from power max solenoid valve.

② Start switch ON.

③ Check voltage as figure.

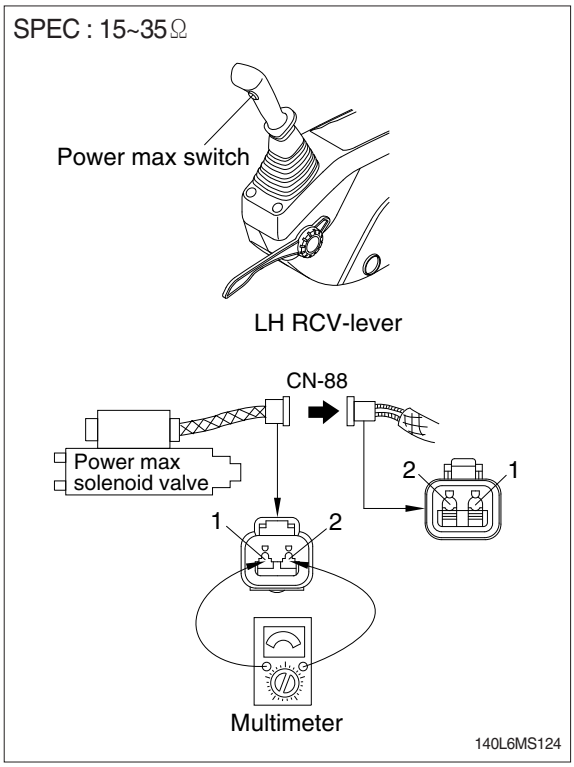


(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting switch OFF.

② Disconnect connector CN-88 from power max solenoid valve.

③ Check resistance as figure.



18. MALFUNCTION OF BOOM PRIORITY EPPR VALVE

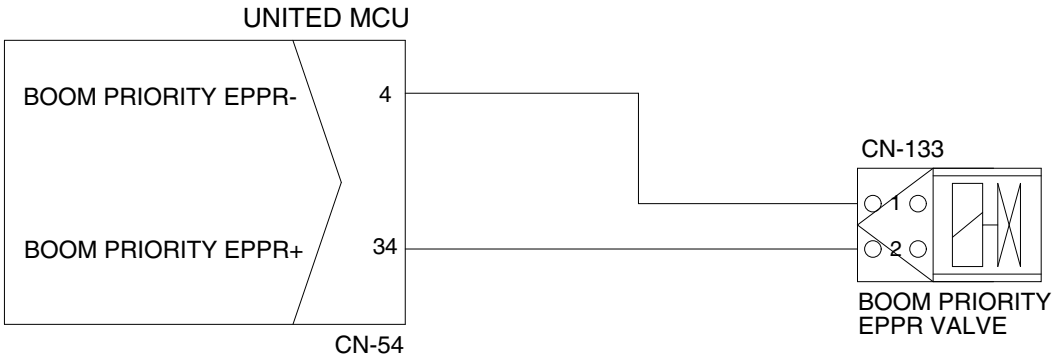
· Fault code : HCESPN 141, FMI 5 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE

Cause	Remedy
Short circuit or poor connection between CN-54 (04)-CN-133 (1) or CN-54 (34)-CN-133 (2)	Repair or replace
Defective EPPR valve	Repair or replace

Wiring diagram



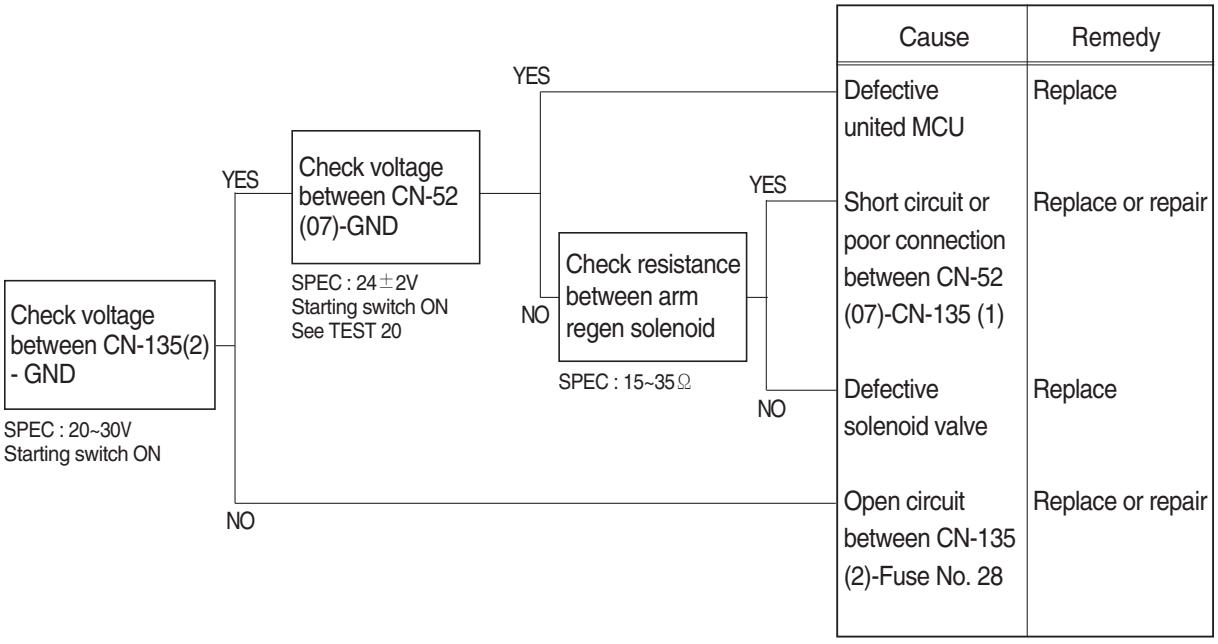
300A6MS22

19. MALFUNCTION OF ARM REGENERATION SOLENOID

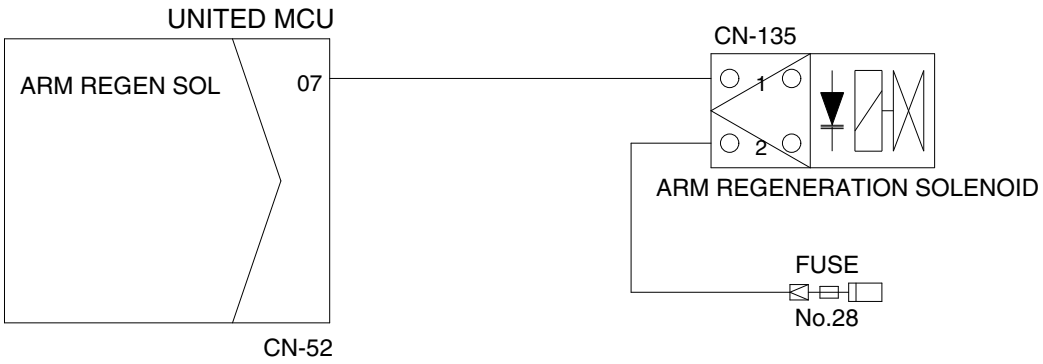
· Fault code : HCESPN 170, FMI 4 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS27

2) TEST PROCEDURE

(1) Test 20 : Check voltage at CN-52 (07) and ground.

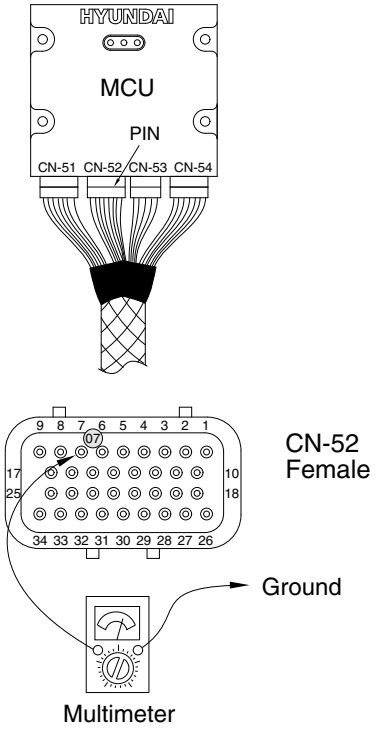
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (07) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

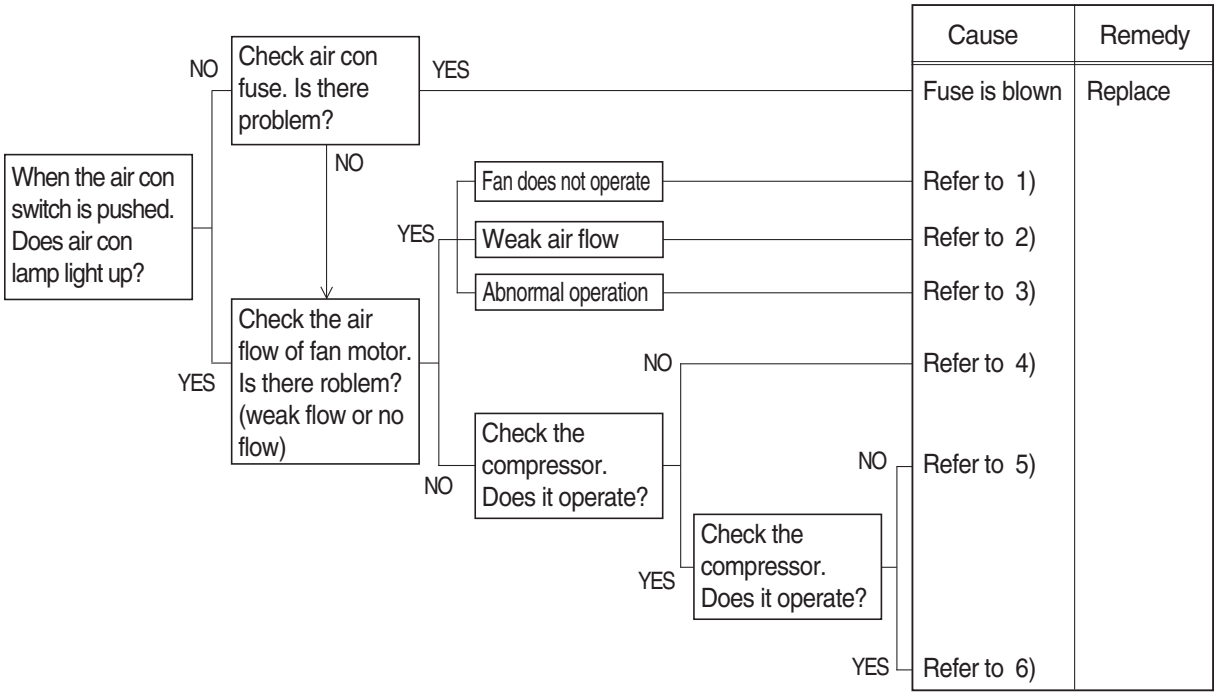
SPEC : Starting switch ON : 24±2 V



140L6MS128

GROUP 5 AIR CONDITIONER & HEATER SYSTEM

1. AIR CONDITIONER DOES NOT OPERATE



1) FAN DOES NOT OPERATE

Cause	Check	Remedy
Fuse is blown or abnormal relay operation	* Fuse * Does relay normally operate?	Replace
Harness short or poor contact	Check any harness short or abnormal contact of connnector	Repair shortage
Fan motor failure	Supply 24V to 2 lead wire from motor and check the operation	Replace
Resistor is broken	Check current flow of resistor with tester	Replace
Fan switch failure	Push fan switch by turn and check the operation	Replace

2) WEAK AIR FLOW FROM FAN MOTOR

Cause	Check	Remedy
Clogged evaporator or obstacles around air inlet	Check if evaporator is contaminated	Clean
Leakage of air flow	Check HVAC case assembly	Adjust
Duct sensor failure	Check if evaporator is frozen	Replace

3) ABNORMAL OPERATION OF FAN MOTOR

Cause	Check	Remedy
Abnormal operation of each step of control	4 step only operate	Replace resistor
	1 or 2 step does not operate	Replace control
	3 or 4 step does not operate	Replace relay

4) COMPRESSOR DOES NOT ROTATE OR HARDLY ROTATE

Cause	Check	Remedy
Loose belt	Belt shaking is severe	Adjust tension
Failure of compressor itself	Belt slip	Repair or Replace
Low voltage of battery	Slip when rotate	Charge battery
Fieldcoil short	Slip when rotate	Replace magnetic clutch
Oily clutch face	Contamination around clutch	Replace magnetic clutch, clean
Fieldcoil is broken	Magnetic clutch does not operate or "∞" resistance	Replace compressor
Leakage of refrigerant or oil inside	Check if wet with oil	Replace compressor Charge refrigerant

5) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Shortage of refrigerant	When air con operate during 5~10 min small temperature difference between high and low pressure pipes.	Repair leakage joint Charge refrigerant
Overcharge of refrigerant	*Magnetic clutch on/off rapidly *High pressure over specification *Lukewarm air from nozzle	Recharge refrigerant following specification
Lower pressure than normal condition at low side	Shortage of refrigerant	Make up refrigerant
	Clogged receive dryer	Replace receive dryer
	Clogged expansion valve	Replace expansion valve
	Clogged or crushed pipe	Replace pipe or clean
	Failure of duct sensor	Replace duct sensor

6) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Lower pressure than normal condition at low side	Failure of duct sensor Magnetic clutch off before air temperature sufficiently down	Replace duct sensor or adjust location
	Defective compressor gasket When compressor off, high and low pressure balance immediatly	Repair compressor or Replace
Higher pressure than normal condition at high side	Failure of condensing Contamination on condenser or insufficient air flow from fan	Clean the condenser Repair fan
	Overcharge of refrigerant	Adjust refrigerant
	Entrained air	Vacuum and recharge
Lower pressure than normal condition at high side	Shortage of refrigerant	Make up refrigerant

SECTION 7 MAINTENANCE STANDARD

Group 1 Operational Performance Test ····· 7-1
Group 2 Major Components ····· 7-21
Group 3 Track and Work Equipment ····· 7-33

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check :

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets HD Hyundai Construction Equipment spec.

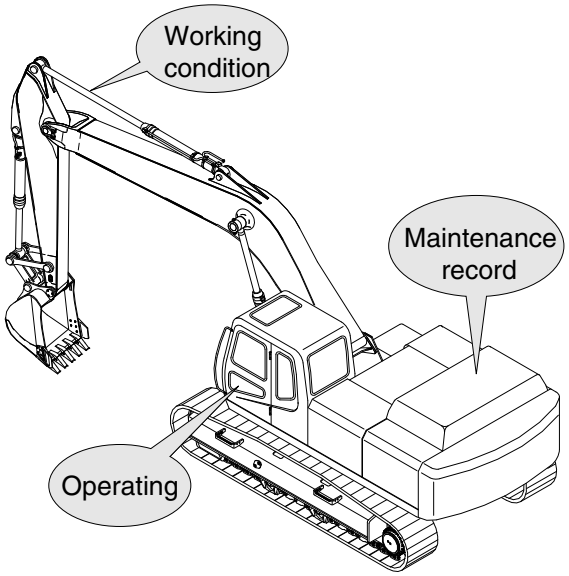
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done(by referring to the "Service Limits" in this manual).

3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.

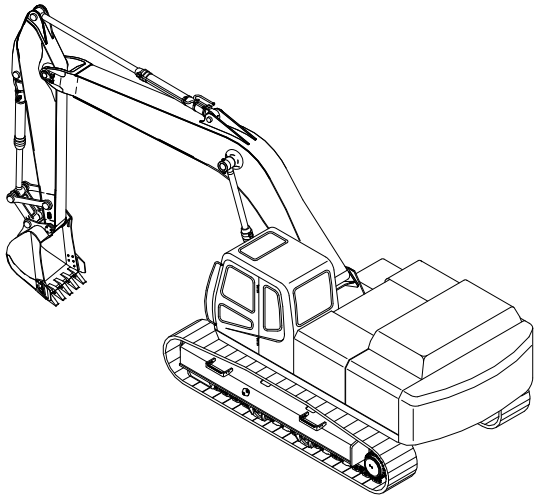


21077MS01

2. TERMINOLOGY

1) STANDARD

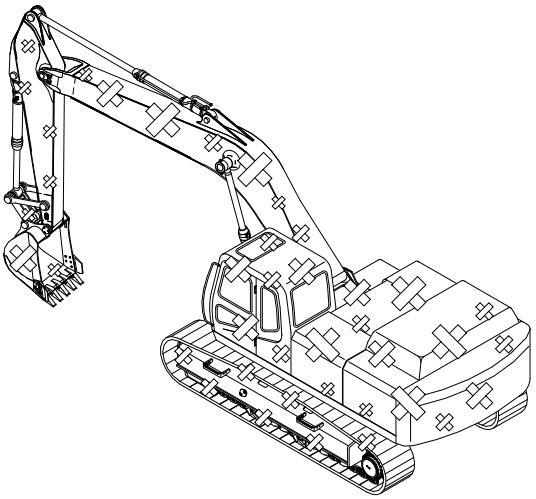
Specifications applied to the brand-new machine, components and parts.



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 20 m, 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.

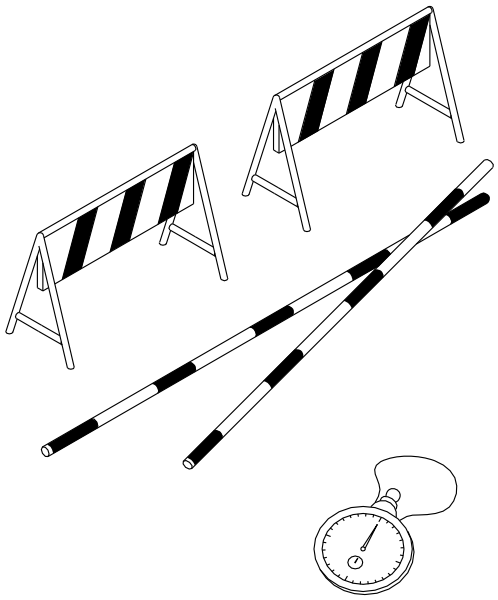
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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.



(210-7) 7-3

2) ENGINE SPEED

(1) Measure the engine speed at each power mode

※ The engine speed at each power mode must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.

(2) Preparation

① Warm up the machine, until the engine coolant temperature reaches 50˚C or more, and the hydraulic oil is 50±5˚C.

② Set the accel dial at 10 (Max) position.

③ Measure the engine RPM.

(3) Measurement

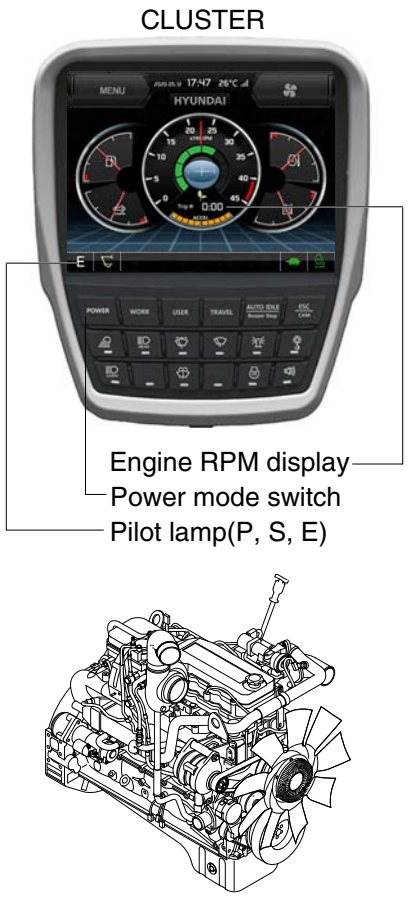
① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.

② Measure and record the engine speed at each mode (P, S, E).

③ Select the P-mode.

④ Lightly operate the bucket control lever a few times, then return the control lever to neutral; The engine will automatically enter the auto-idle speed after 4 seconds.

⑤ Measure and record the auto deceleration speed.



300A7MS01A

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX300A L	Start idle	1000±100	
	P mode	1800±50	
	S mode	1700±50	
	E mode	1600±50	
	Auto decel	1100±100	
	One touch decel	1000±100	

Condition : Set the accel dial at 10 (Max) position.

3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 20 m test track.

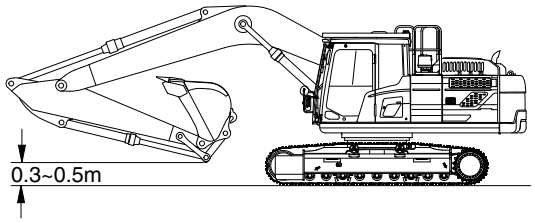
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Prepare a flat and solid test track 20m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



260A7MS02

(3) Measurement

① Measure both the low and high speeds of the machine.

② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested, then select the following switch positions.

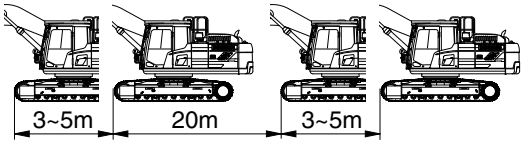
· Power mode switch : P mode

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the time required to travel 20 m.

⑤ After measuring the forward travel speed, turn the upperstructure 180˚ and measure the reverse travel speed.

⑥ Repeat steps ④ and ⑤ three times in each direction and calculate the average values.



260A7MS03

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 m

Model	Travel speed	Standard	Maximum allowable	Remarks
HX300A L	1 Speed	22.5±2.0	29.9	
	2 Speed	13.6±1.0	18.7	

4) TRACK REVOLUTION SPEED

(1) Measure the track revolution cycle time with the track raised off ground.

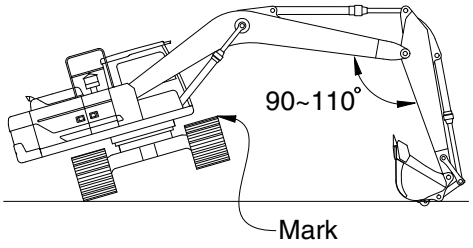
(2) Preparation

① Adjust the tension of both side tracks to be equal.

② On the track to be measured, mark one shoe with chalk.

③ Swing the upperstructure 90˚ and lower the bucket to raise the track off ground. Keep the boom-arm angle between 90 to 110˚ as shown. Place blocks under machine frame.

④ Keep the hydraulic oil temperature at 50±5˚C.



300L7MS04

(3) Measurement

① Select the following switch positions.

· Travel mode switch : 1 or 2 speed

· Power mode switch : P mode

· Auto idle switch : OFF

② Operate the travel control lever of the raised track in full forward and reverse.

③ Rotate 1 turn, then measure time taken for next 3 revolutions.

④ Raise the other side of machine and repeat the procedure.

⑤ Repeat steps ③ and ④ three times and calculate the average values.

(4) Evaluation

The revolution cycle time of each track should meet the following specifications.

Unit : Seconds / 3 revolutions

Model	Travel speed	Standard	Maximum allowable
HX300A L	1 Speed	36±2.0	45
	2 Speed	21±2.0	26.3

5) TRAVEL DEVIATION

(1) Measure the deviation by the tracks from a 20 m straight line.

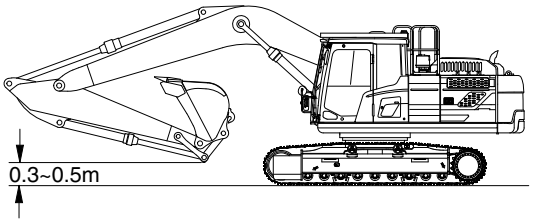
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 20 m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



260A7MS02

(3) Measurement

① Measure the amount of mistracking at high and low travel speeds.

② Before beginning each test, select the following switch positions.

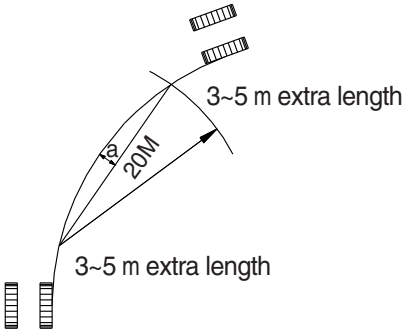
· Power mode switch : P mode

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the distance between a straight 20 m line and the track made by the machine. (Dimension a)

⑤ After measuring the tracking in forward travel, turn the upperstructure 180˚ and measure that in reverse travel.

⑥ Repeat steps ④ and ⑤ three times and calculate the average values.



(210-7) 7-7(2)

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20 m

Model	Standard	Maximum allowable	Remarks
HX300A L	200 below	240	-

6) SWING SPEED

(1) Measure the time required to swing three complete turns.

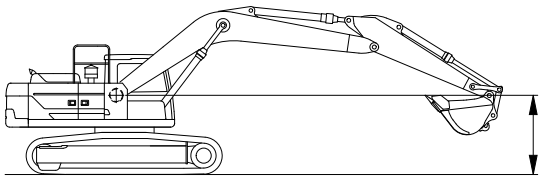
(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Keep the hydraulic oil temperature at 50±5˚C.



300L7MS05

(3) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Operate swing control lever fully.

③ Swing 1 turn and measure time taken to swing next 3 revolutions.

④ Repeat steps ② and ③ three time and calculate the average values.

(4) Evaluation

The time required for 3 swings should meet the following specifications.

Unit : Seconds / 3 revolutions

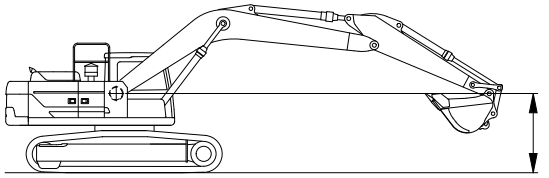
Model	Power mode switch	Standard	Maximum allowable
HX300A L	P mode	17.5±1.5	21.5

7) SWING FUNCTION DRIFT CHECK

(1) Measure the swing drift on the bearing outer circumference when stopping after a 360˚ full speed swing.

(2) Preparation

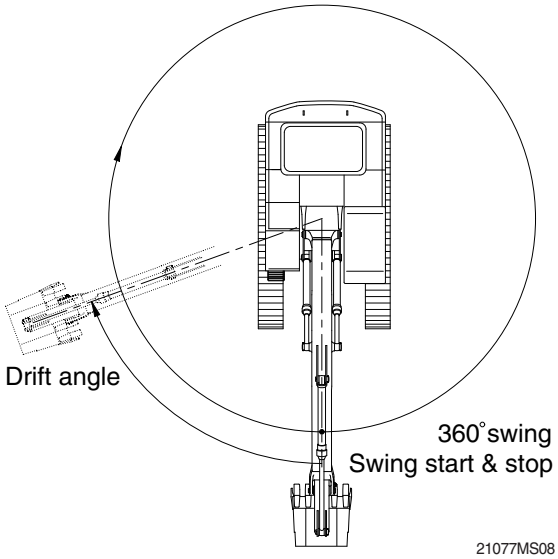
① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.
⑤ Swing the upperstructure 360˚.
⑥ Keep the hydraulic oil temperature at 50±5˚C.



300L7MS05

(3) Measurement

① Conduct this test in the M mode.
② Select the following switch positions.
· Power mode switch : P mode
③ Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360˚.
④ Measure the distance between the two marks.
⑤ Align the marks again, swing 360˚, then test the opposite direction.
⑥ Repeat steps ④ and ⑤ three times each and calculate the average values.



21077MS08

(4) Evaluation

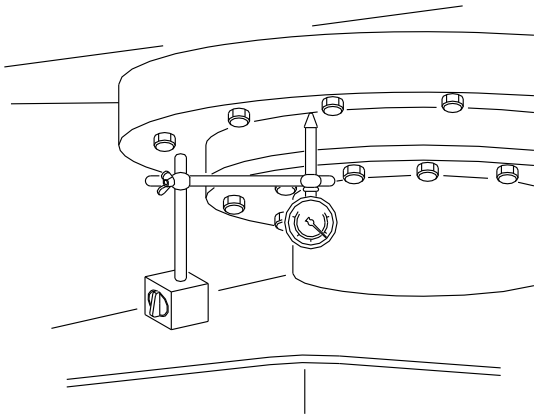
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX300A L	P mode	90 below	157.5	

8) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



(210-7) 7-10(1)

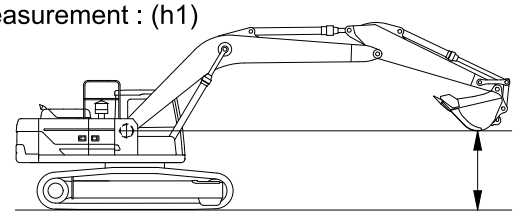
(2) Preparation

① Check swing bearing mounting cap screws for loosening.
② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.
③ Install a dial gauge on the track frame as shown, using a magnetic base.
④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.
⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
⑥ Bucket should be empty.

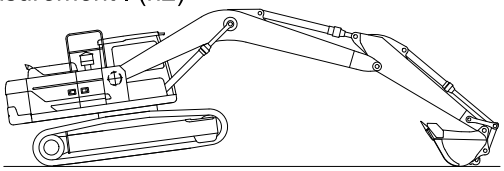
(3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).
③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1

Measurement : (h1)



Measurement : (h2)



300L7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX300A L	0.5 ~ 1.5	3.0	

9) HYDRAULIC CYLINDER CYCLE TIME

(1) Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

(2) Preparation

① To measure the cycle time of the boom cylinders:
With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.

② To measure the cycle time of the arm cylinder.
With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5 m above the ground.

③ To measure the cycle time of the bucket cylinder.
The empty bucket should be positioned at midstroke between roll-in and roll-out, so that the sideplate edges are vertical to the ground.

④ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

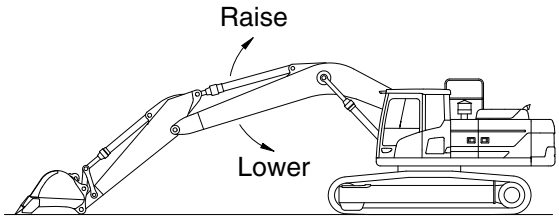
① Select the following switch positions.

· Power mode switch : P mode

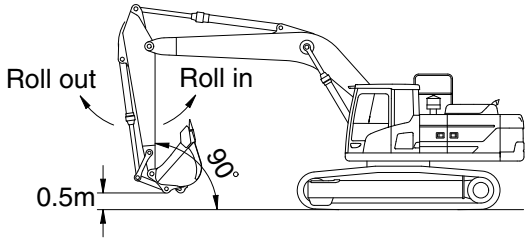
② To measure cylinder cycle times.

- Boom cylinders.
  Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.
- Arm cylinder.
  Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

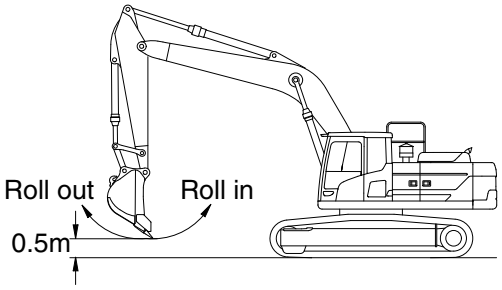
Boom cylinder



Arm cylinder



Bucket cylinder



300L7MS07

- 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
HX300A L	Boom raise	3.7±0.4	4.7	
	Boom lower	3.0±0.4	3.8	
	Arm in (Regen ON)	3.1±0.4	3.9	
	Arm out	3.1±0.3	3.9	
	Bucket load	2.5±0.4	3.2	
	Bucket dump	2.5±0.3	3.2	
HX300A L Long reach	Boom raise	4.0±0.4	5.0	
	Boom lower	3.0±0.4	3.8	
	Arm in	3.5±0.4	4.6	
	Arm out	4.1±0.3	4.8	
	Bucket load	1.4±0.4	2.2	
	Bucket dump	1.5±0.3	2.2	

10) DIG FUNCTION DRIFT CHECK

(1) Measure dig function drift, which can be caused by oil leakage in the control valve and boom, standard arm, and standard bucket cylinders, with the loaded bucket.
When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to purge air.

(2) Preparation

① Load bucket fully. Instead of loading the bucket, weight(W) of the following specification can be used.

· $W=M^3 \times 1.5$

Where :

M^3 = Bucket heaped capacity (m^3)

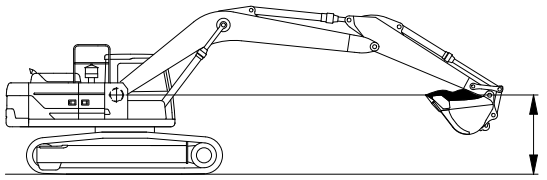
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30 ㎜ extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30 ㎜ retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



300L7MS08

(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
HX300A L	Boom cylinder	10 below	20	
	Arm cylinder	10 below	20	
	Bucket cylinder	40 below	50	

11) CONTROL LEVER OPERATING FORCE

(1) Use a spring scale to measure the maximum resistance of each control lever at the middle of the grip.

(2) Preparation

① Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Start the engine.
② Select the following switch positions.
· Power mode switch : P mode
③ Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.
④ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.
⑤ Repeat steps ③ and ④ three times and calculate the average values.

(4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
HX300A L	Boom lever	1.6 or below	2.0	
	Arm lever	1.6 or below	2.0	
	Bucket lever	1.3 or below	1.7	
	Swing lever	1.3 or below	1.7	
	Travel lever	2.1 or below	3.15	

12) CONTROL LEVER STROKE

(1) Measure each lever stroke at the lever top using a ruler.

※ When the lever has play, take a half of this value and add it to the measured stroke.

(2) Preparation

Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Stop the engine.

② Measure each lever stroke at the lever top from neutral to the stroke end using a ruler.

③ Repeat step ② three times and calculate the average values.

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

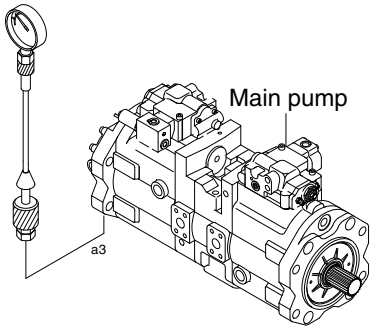
Model	Kind of lever	Standard	Maximum allowable	Remarks
HX300A L	Boom lever	101±10	125	
	Arm lever	101±10	125	
	Bucket lever	90±10	115	
	Swing lever	90±10	115	
	Travel lever	142±10	178	

13) PILOT PRIMARY PRESSURE

(1) Preparation

① Keep the hydraulic oil temperature at 50±5˚C.

② Loosen the hose on the a3 port of the pilot pump delivery port and connect pressure gauge.



320A7MS09

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Auto decel switch : OFF

② Measure the primary pilot pressure by the pressure gauge.

(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX300A L	P mode	40^{+2}_{0}	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation

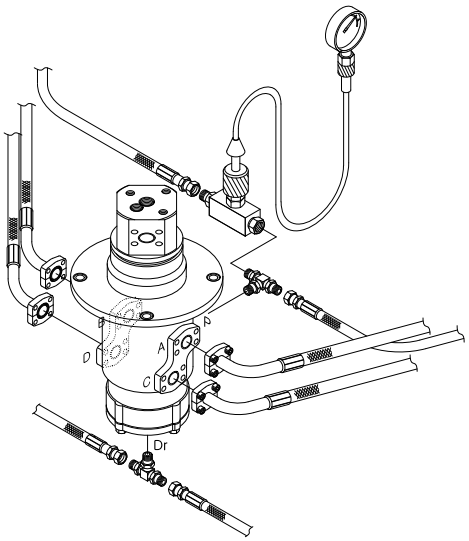
① Stop the engine.

② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

③ To measure the speed selecting pressure: Install a connector and pressure gauge

④ assembly to turning joint P port as shown. Start the engine and check for on leakage from the adapter.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



21077MS13

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Travel mode switch : 1 speed
2 speed

② Measure the travel speed selecting pressure in the Hi or Lo mode.

③ Lower the bucket to the ground to raise the track off the ground. Operate the travel lever at full stroke and measure the fast speed pressure.

④ Repeat steps ② and ③ three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX300A L	1 Speed	0	-	
	2 Speed	40±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

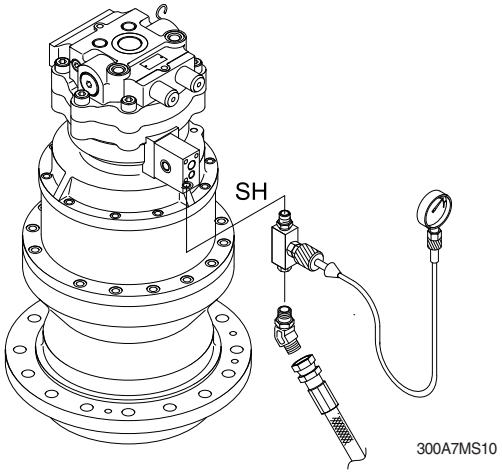
(1) Preparation

① Stop the engine.
② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
③ The pressure release L wrench to bleed air.
④ Install a connector and pressure gauge assembly to swing motor SH (or PG) 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.

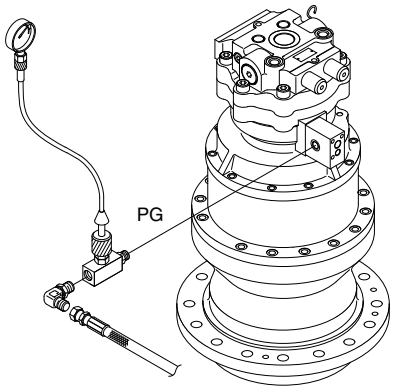
(2) Measurement

① Select the following switch positions.
· Power mode switch : P mode
② Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
Repeat step ② three times and calculate the average values.

Machine serial no. : -#0114



Machine serial no. : #0115-



(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Description	Standard	Allowable limits	Remarks
HX300A L	Brake disengaged	40	31~42	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

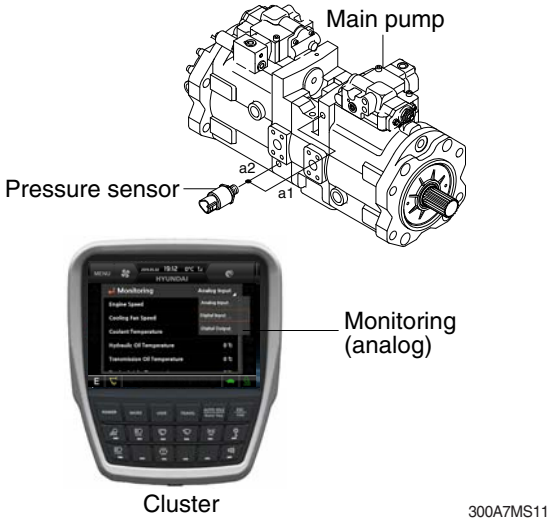
① Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Measure the main pump delivery pressure in the P mode (high idle).



300A7MS11

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX300A L	High idle	40±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

① Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

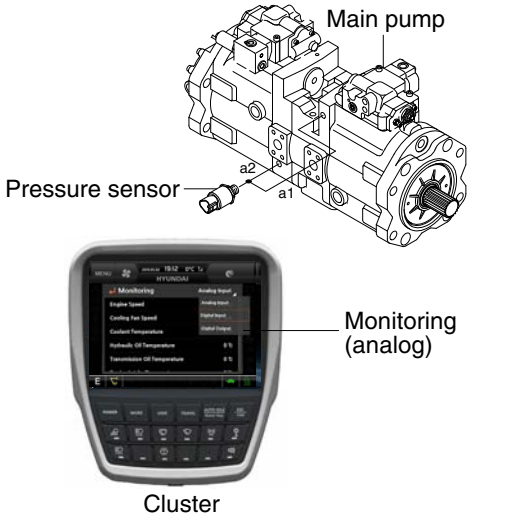
① Select the following switch positions.

· Power mode switch : P mode

② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

③ In the swing function, place bucket against an immovable object and measure the relief pressure.

④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.



300A7MS11

(3) Evaluation

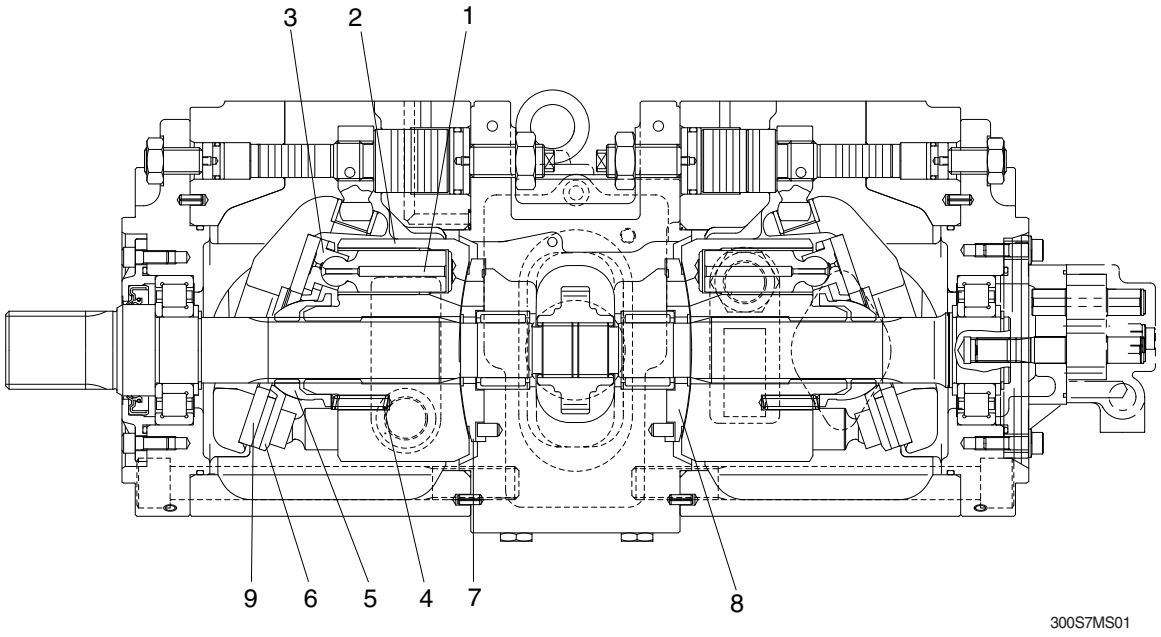
The average measured pressure should be within the following specifications.

Unit : kgf / cm²

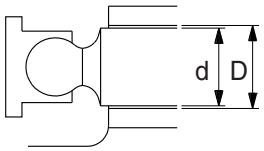
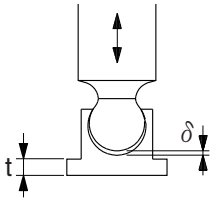
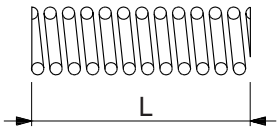
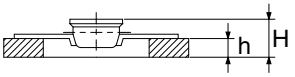
Model	Function to be tested	Standard	Port relief setting
HX300A L	Boom, Arm, Bucket	350 (380)±10	400±10
	Travel	350±10	-
	Swing	300±10	-

( ) : Power boost

1. MAIN PUMP



300S7MS01

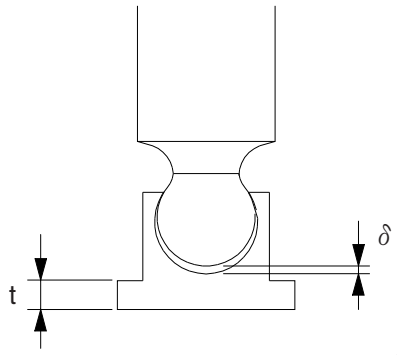
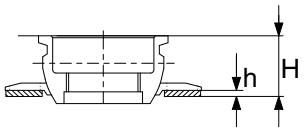
Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston(1) & cylinder bore(2) (D-d)		0.043	0.070	Replace piston or cylinder.
Play between piston(1) & shoe caulking section(3) (δ)		0-0.1	0.3	Replace assembly of piston & shoe.
Thickness of shoe (t)		5.4	5.0	
Free height of cylinder spring(4) (L)		47.9	47.1	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 scratches, rust or corrosion.	· In case of damage in following section, replace casing. - Sliding sections of casing hole and spool, especially land sections applied with held pressure. - Seal pocket section where spool is inserted. - Sealing section of port where O-ring contacts. - Sealing section of each relief valve for main and port. - Sealing section of plug. - Other damages that may damage normal function.
Spool	· Existence of scratch, gnawing, rusting or corrosion.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section).
	· O-ring seal sections at both ends.	· Replacement when its sliding section has scratch.
	· Insert spool into casing hole, rotate and reciprocate it.	· Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of spring	· Replacement.
	· Damage of poppet	· Correction or replacement when sealing is incomplete.
	· Insert poppet into casing and function it.	· Normal when it can function lightly and smoothly without sticking.
Spring and related parts	· Rusting, corrosion, deformation or breakage of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage.	· Correction or replacement.
	· Rusting, corrosion or deformation of seal plate.	· Correction or replacement.
Main relief valve, port relief valve & negative control valve	· External rusting or damage.	· Replacement.
	· Contacting face of valve seat.	· Replacement when damaged.
	· Contacting face of poppet.	· Replacement when damaged.
	· O-rings and back up rings.	· Replacement in principle.

3. SWING DEVICE

1) WEARING PARTS

Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.041	0.060	Replace piston or cylinder block
Thickness of valve plate	6	5.88	Replace
Play between piston and shoe caulking section (δ)	0.025	0.1	Replace assembly of piston and shoe
Thickness of shoe (t)	6.6	6.5	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H-h)	17.6	17.3	Replace set of retainer plate and sperical bushing
Thickness of friction plate	2.94	2.7	Replace
 140W77MS12		 2609A7MS01	

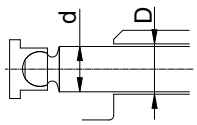
2) SLIDING PARTS

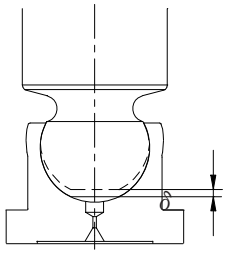
Part name	Standard roughness	Allowable roughness	Remark
Shoe	Rmax=1S (Ra=0.2a) (LAPPING)	4S (Ra=0.1a)	
Shoe plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Cylinder	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Valve plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	2S (Ra=0.5a)	

4. TRAVEL MOTOR

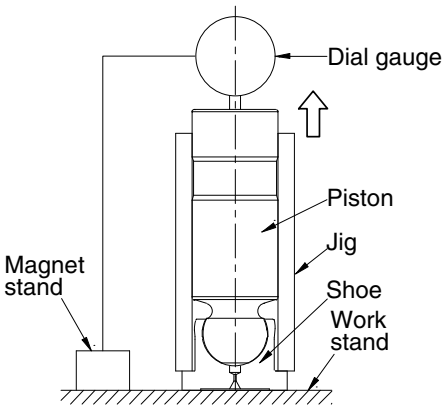
1) STANDARD (TYPE 1)

The followings are the general maintenance standards. However, it is the most important to determine which parts should be replaced, depending on the characteristics before disassembling, damages and discoloration of exterior view, the purpose of disassembling, the expected remaining service life. etc..

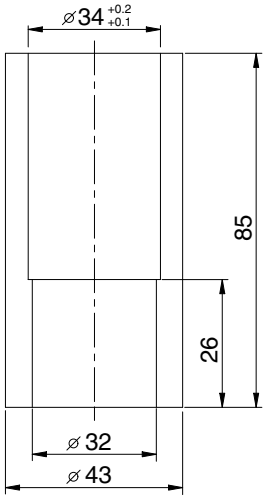
Check item		Measuring method	Criteria	Allowable	Remedy
Sliding surface of cylinder block, valve plate and swash plate	Surface roughness of cylinder block, valve plate and swas plate	Measure the surface roughness by roughness tester	Below 0.4 Z μ	Below 3.0 Z μ	Replace or repair ※ Lap together the surfaces of both cylinder block and valve plate to remedy their roughness (# 1200 power)
	Swash plate - hardness of sliding surface	Measure the surface hardness of swash plate by hardness tester	Over HS78	HS74	Replace
Clearance between piston and cylinder block  Measurement position	Outer dia of piston d max - d min	Measure outer dia of piston and bore of cylinder block at least 3 places in the longitudinal direction with micrometer and obtain : max outer dia = d max min outer dia = d min max inner dia = D max min inner dia = D min	0.01 mm	0.05 mm	Replace piston or cylinder block ※ In exchanging pistons, replace all of nine pistons at the same time
	Inner dia of cylinder bore D max - D min		0.01 mm	0.022 mm	
	Clearance D-d		0.037~ 0.047 mm	0.065 mm	
Play between piston and shoe	Play between calked piston and shoe (δ)	With the jig, hold down the shoe on work stand and pull up the piston vertical direction to measure the play between piston and shoe	0~0.1 mm	0.3 mm	Replace piston



Play



Method



Jig for measuring play

29097MS10

Check item	Measuring method	Criteria	Allowable	Remedy
Parking brake torque	After completion of assembly, set the torque wrench on the shaft end, and measure the braking torque generated when the shaft starts to rotate	92.6 kgf · m (670 lbf · ft)	82.8 kgf · m (599 lbf · ft)	Replace all of separator, friction plates and springs
Standard of replacing friction and separating plate. When measuring parking brake torque, it needs to disassemble traveling unit to motor and reduction gear portion, and it's so hard. The right allowable value is a standard of replacing friction and separating plate. If it is impossible to disassemble traveling unit, refer to the right value.	Measure the total thickness of 4 pieces of friction plate and 5 pieces of separating plate.	22.76 mm	Thickness : 21.3 mm	Replace all separating and friction plates and springs.

Check item	Measuring method	Judging criteria and remedy
Shaft	Measure the wear at contacting surface of oil seal (3) with the surface roughness tester	If the depth of shaft wear is less than 0.05 mm, the shaft is reusable. ※ In case of replacing the shaft (9), replace oil seal (3) at the same time.
Bearings	Replace bearings (10, 51) after decided hours	Replace bearings (10, 51) before hour meter of host machine indicates 10,000 hours. ※ In case replacing the bearings (10, 51), replace both inner and outer races at the same time. ※ Also the bearing shims (52) must be readjusted when replaced shaft (9) and/or bearings (10, 51). Contact dealers for jigs and tools required.
Splines	Replace if the wear of splines exceeds the allowable value	If the wear of splines is less than 0.3 mm, the spline is reusable.
Overload relief valve	Do not try to adjust the valve, since special hydraulic test bench is required for inspecting and adjusting the pressure	Replace relief valve part as an assembly each time the host machine works for 10,000 hours.

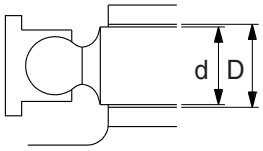
2) HIGH WALKER (TYPE 2)

Replace parts in accordance with the following standards. However, if a part is damaged significantly in terms of its appearance, replace it irrespective of the standards.

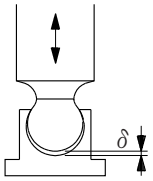
(1) Wearing parts

Part name & inspection item	Standard dimension	Recommended value for replacement	Remedy
Clearance between piston & cylinder bore (D-d)	0.052 mm	0.077 mm	Replacement
Clearance caulked part between piston and shoe (δ)	0.1 mm	0.3 mm	Replacement
Thickness of shoe	5.5 mm	5.3 mm	Replacement
Assembled height of spherical bush and set plate (H-h)	23.8 mm	23.3 mm	Replacement as a set
Free length of cylinder spring	40.9 mm	40.3 mm	Replacement
Shaft over pin dia. Output spline Cylinder spline	 43.91 ($\varnothing$5) 49.06 ($\varnothing$5)	 43.31 mm 48.46 mm	Replacement if either one reaches replacement value.
Spline over dia. Spline in cylinder Spline in spherical bushing	35.25 ($\varnothing$5)	35.75 mm	Replacement
Thickness of separation plate Thickness of friction plate	1.5 mm 3.9 mm	1.3 mm 3.7 mm	Replacement
Free length of brake spring	42.4 mm	41.4 mm	Replacement
Displacement over teeth Over pin dia. of friction plate internal teeth	50.02 (7teeth) 152.97 ($\varnothing$5)	49.42 mm 153.57 mm	Replacement Replacement
Roughness of sliding surfaces Swash plate/shoe Cylinder block/valve plate	 0.4 - z 0.4 - z	 3 - z 3 - z	 Each independent lapping Mutual lapping
Roller bearing Needle bearing	-	-	Replacement if flaking is found on rolling surface.
O-ring Oil seal	-	-	Replacement at every disassembly, in principle.

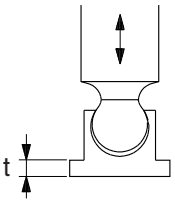
Part name & inspection item	Standard dimension	Recommended value for replacement	Remedy
Bolt	–	–	Replacement if elongation is found.



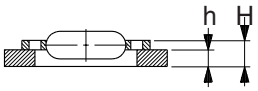
clearance between piston and cylinder bore : D-d



Play at caulking between piston and shoe : δ



Thickness of shoe : t

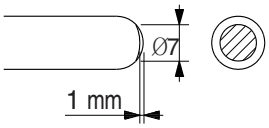


Assembled height of set plate and spherical bushing : H-h

(2) Reduction gear

Part name & inspection item		Standard dimension	Recommended value for replacement	Remedy
Pitting or crack of gear		-	Pitting area rate : 10%	Replacement pitting or crack is found
Motor driving gear external spline		Overpin 43.91 (Ø5)	43.31 mm	(Z=14)
No. 1 sun gar internal spline		Overpin 30.25 (Ø5)	30.85 mm	Replacement (Z=14)
Reduction ratio i = 70.145	No. 1 sun gear	Displacement 42.22 (4teeth)	41.92 mm	Do. (Z=23)
	No. 1 planetary gear	Displacement 43.98 (4teeth)	43.68 mm	Do. (Z=26)
No. 1 carrier internal spline		Overpin 81.562 (Ø5)	82.162 mm	Do. (Z=23)
No. 2 sun gear		Displacement 31.40 (3teeth)	31.10 mm	Do. (Z=23)
No. 2 planetary gear		Displacement 43.67 (4teeth)	43.37 mm	Do. (Z=26)
No. 2 carrier internal spline		Overpin 112.24 (Ø10)	112.84 mm	Do. (Z=25)
No. 3 sun gear		Displacement 54.92 (4teeth)	54.62 mm	Do. (Z=25)
No. 3 planetary gear		Displacement 54.93 (3teeth)	54.63 mm	Do. (Z=22)
Ring gear (3rd stages)		Overpin 348.74 (Ø8.5)	349.34 mm	Do. (Z=71)
Crack and flaking of bearing inner/outer races and rollers		-	-	Replacement if crack or flaking is found.
Crack and flaking of 1st/2nd/3rd planetary gears and pins		-	-	Replacement if crack or flaking is found.

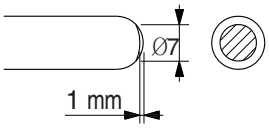
5. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000 cc/m at neutral handle position, or more than 2000 cc/m during operation.	Conditions : Primary pressure : 40 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6. Troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

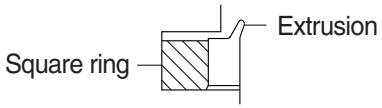
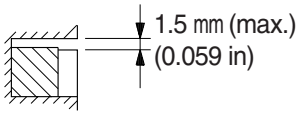
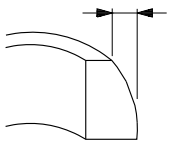
2. When loosening the hexagon socket head cap screw (125), replace the seal washers (121) without fail.

6. RCV PEDAL

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage effect to the system. For example, the primary pressure drop.	Conditions : Primary pressure : 40 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6. Troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

7. TURNING JOINT

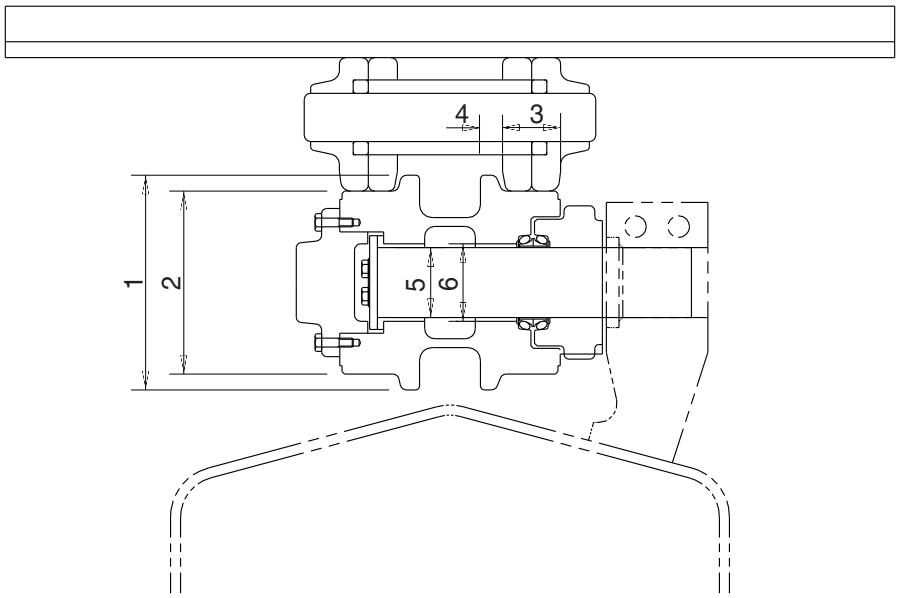
Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination.	Replace
		· Damaged more than 0.1 mm (0.0039 in) in depth.	Smooth with oilstone.
	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Smooth
Cover	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Replace
Seal set	-	· Extruded excessively from seal groove square ring. 	Replace
	-	· Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring. 	Replace
	-	· Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in) 	Replace

8. CYLINDER

Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal.	· Replace or replate
		· Rust is not present on plating.	· Replace or replate
		· Scratches are not present.	· Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating

1. TRACK

1) UPPER ROLLER



32037MA37

Unit : mm

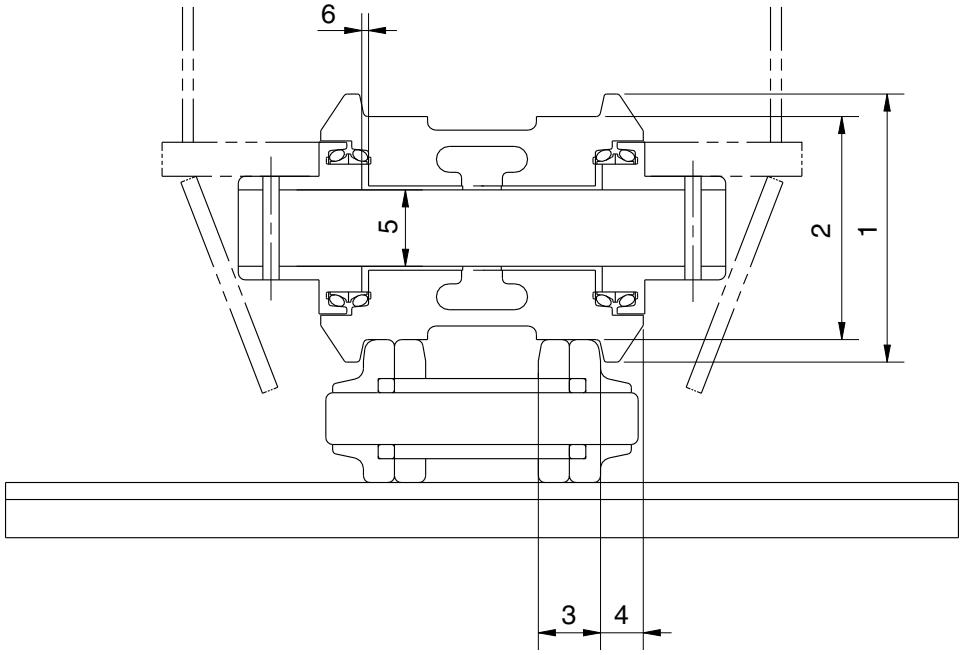
No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø200				–		
2	Outside diameter of tread	Ø168				Ø158		
3	Width of tread	54				59		
4	Width of flange	19				–		
5	Clearance between shaft and busing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø55	0.085 0.066	Ø55	0.37 0.33	0.245~0.304	2.0	
6	Clearance between shaft and support	Ø58	0 -0.1	Ø58	0.5 0.3	0.3~0.6	1.2	Replace

(Mahcine Serial No. #1619-)

Unit : mm

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø175				–		
2	Outside diameter of tread	Ø142				Ø132		
3	Width of tread	48.5				53.5		
4	Width of flange	20				3		
5	Clearance between shaft and busing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø55	0 -0.03	Ø55	0.35 0.3	0.3~0.38	2.0	
6	Clearance between shaft and support	Ø55	0 -0.1	Ø55.15	0.1 0	0.15~0.35	1.2	Replace

2) LOWER ROLLER

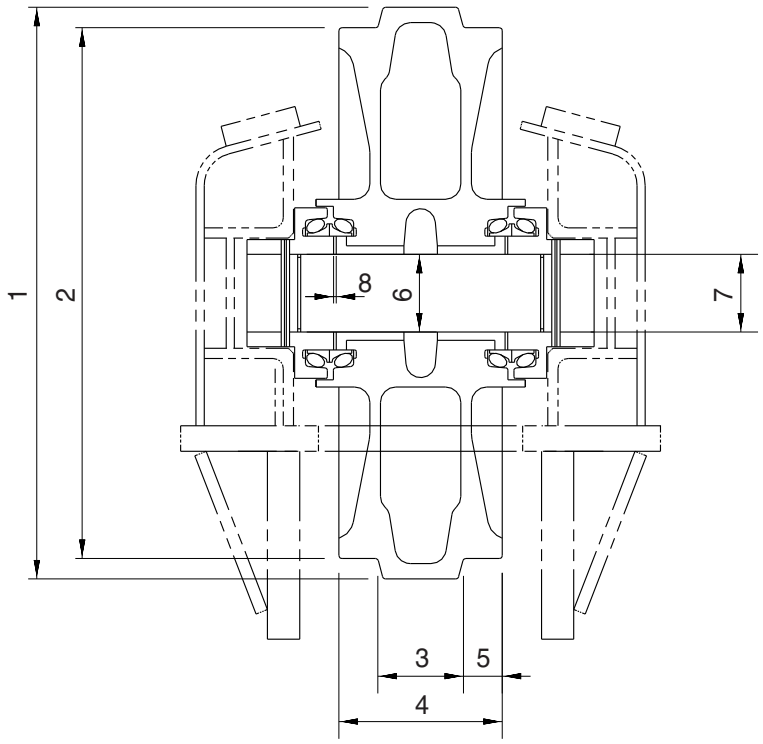


21037MS01

Unit : mm

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø216				–		
2	Outside diameter of tread	Ø180				Ø168		
3	Width of tread	50				56		
4	Width of flange	57				21		
5	Clearance between shaft and bushing	Standard size and tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø75	0 -0.03	Ø75.35	0.05 0	0.35~0.40	2.0	
6	Side clearance of roller (both side)	Standard clearance				Clearance limit		Replace
		0.16~1.24				2.0		

3) IDLER



21037MS03

Unit : mm

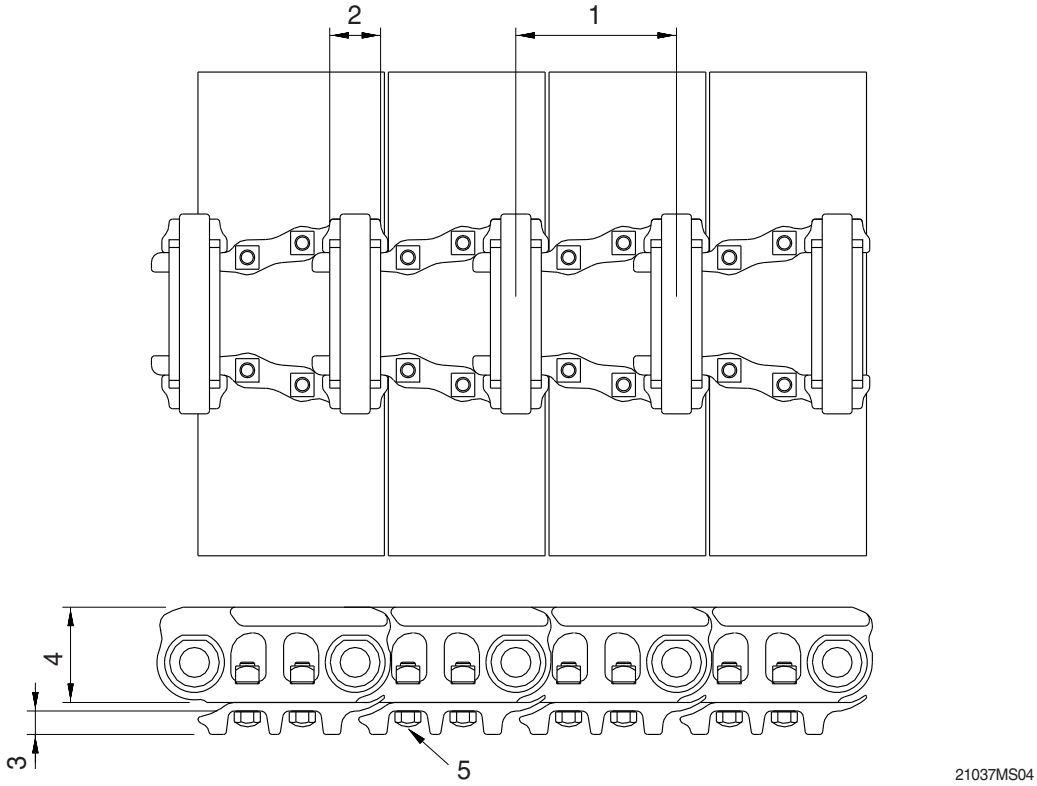
No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø646				–		
2	Outside diameter of tread	Ø594				Ø588		
3	Width of protrusion	102				–		
4	Total width	203				–		
5	Width of tread	50.5				56.5		
6	Clearance between shaft and bushing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø90	0 -0.035	Ø90.35	0.05 0	0.35~0.435	2.0	
7	Clearance between shaft and support	Ø90	0 -0.035	Ø90	0.09 0.036	0.036~0.125	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance				Clearance limit		Replace bushing
		0.4~1.2				2.0		

(Mahcine Serial No. #1619-)

Unit : mm

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø630				–		
2	Outside diameter of tread	Ø580				Ø570		
3	Width of protrusion	102				–		
4	Total width	190				–		
5	Width of tread	44				49		
6	Clearance between shaft and bushing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø90	0 -0.03	Ø90	0.34 0.3	0.3~0.37	2.0	
7	Clearance between shaft and support	Ø90	0 -0.03	Ø90	0.09 0.036	0.036~0.12	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance				Clearance limit		Replace bushing
		0.4~1.2				2.0		

4) TRACK



Unit : mm

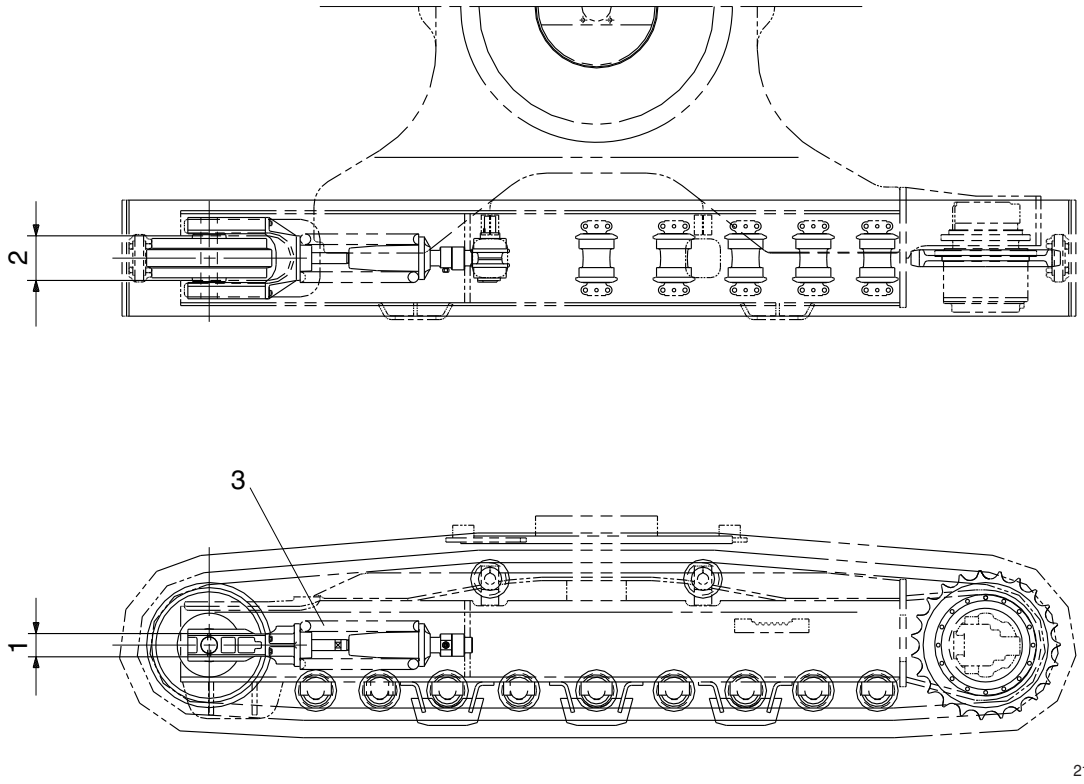
No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		216	221	
2	Outside diameter of bushing	Ø66.5	Ø60.9	Rebuild or replace
3	Height of grouser	30	23	
4	Height of link	116	111	
5	Tightening torque	Initial tightening torque : 115 ± 5 kgf · m		Retighten

(Mahcine Serial No. #1619-)

Unit : mm

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		216	221	
2	Outside diameter of bushing	Ø66.9	Ø61.3	Rebuild or replace
3	Height of grouser	30	23	
4	Height of link	116	111	
5	Tightening torque (Tightening angle method)	Initial tightening torque : 50 ± 5 kgf · m Additional tightening angle : 70 ± 6°		Retighten

5) TRACK FRAME AND RECOIL SPRING



21037MS05

Unit : mm

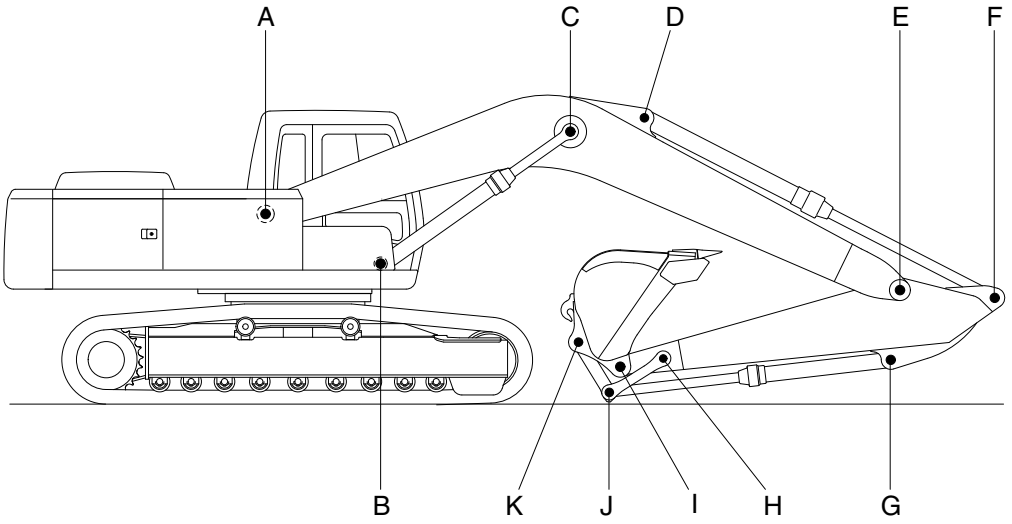
No.	Check item	Criteria					Remedy
1	Vertical width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		132	2.0 0	136	
		Idler support		130	0 -1.5	126	
2	Horizontal width of idler guide	Track frame		292	2.0 0	297	
		Idler support		290	–	288	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		710	580	19012 kg	–	15210 kg	

(Mahcine Serial No. #1619-)

Unit : mm

No.	Check item	Criteria					Remedy
1	Vertical width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		122	2.0 0	126	
		Idler support		120	0 -0.5	116	
2	Horizontal width of idler guide	Track frame		238	2.0 0	243	
		Idler support		235	–	233	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		603	522	19100 kg	–	15280 kg	

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	90	89	88.5	90.5	91	〃
C	Boom Cylinder Rod	100	99	98.5	100.5	101	〃
D	Arm Cylinder Head	90	89	88.5	90.5	91	〃
E	Boom Front	100	99	98.5	100.5	101	〃
F	Arm Cylinder Rod	90	89	88.5	90.5	91	〃
G	Bucket Cylinder Head	90	89	88.5	90.5	91	〃
H	Arm Link	80	79	78.5	80.5	81	〃
I	Bucket and Arm Link	90	89	88.5	90.5	91	〃
J	Bucket Cylinder Rod	80	79	78.5	80.5	81	〃
K	Bucket Link	90	89	88.5	90.5	91	〃

SECTION 8 DISASSEMBLY AND ASSEMBLY

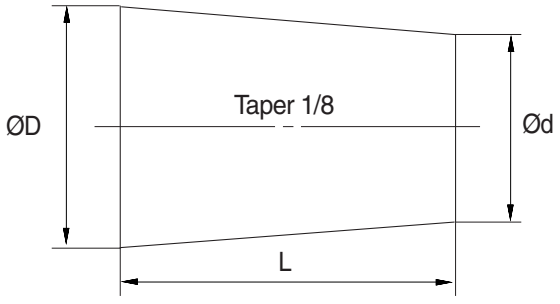
Group 1 Precaution ····· 8-1
Group 2 Tightening Torque ····· 8-4
Group 3 Pump Device ····· 8-7
Group 4 Main Control Valve ····· 8-30
Group 5 Swing Device (machine serial no. : -#0114) ····· 8-45
Swing Device (machine serial no. : #0115-) ····· 8-57-1
Group 6 Travel Device (type 1) ····· 8-69
Travel Device (type 2, machine serial no. : -#0900) ····· 8-102
Travel Device (type 2, machine serial no. : #0901-) ····· 8-133-1
Group 7 RCV Lever ····· 8-134
Group 8 Turning Joint ····· 8-148
Group 9 Boom, Arm and Bucket Cylinder ····· 8-153
Group 10 Undercarriage ····· 8-177
Group 11 Work Equipment ····· 8-189

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)	M12×1.75	11.5±1.0	83.2±7.2
2		Engine mounting bolt (bracket-frame, FR)	M20×2.5	57.9±8.7	419±62.9
3		Engine mounting bolt (bracket-frame, RR)	M24×3.0	90±9.0	651±65
4		Radiator mounting bolt	M16×2.0	29.7±4.5	215±32.5
5		Coupling mounting socket bolt	M20×2.5	46.5±2.5	336±18.1
6		Fuel tank mounting bolt	M20×2.5	57.8±5.8	418±42.0
7	Hydraulic system	Main pump housing mounting bolt	M10×1.5	6.5±0.7	47.0±5.1
8		Main pump mounting socket bolt (eng side)	M20×2.5	57.9±8.7	419±62.9
9		Main pump mtg bolt (rear side)	M20×2.5	57.9±8.7	419±62.9
10		Main control valve mounting nut	M12×1.75	12.3±1.3	89.0±9.4
11		Hydraulic oil tank mounting bolt	M20×2.5	57.8±5.8	418±42.0
12		Turning joint mounting bolt, nut	M12×1.75	12.3±1.3	89.0±9.4
13	Power train system	Swing motor mounting bolt	M20×2.5	58.4±6.4	422±46.3
14		Swing bearing upper part mounting bolt	M24×3.0	100±10	723±72.3
15		Swing bearing lower part mounting bolt	M24×3.0	100±10	723±72.3
16		Travel motor mounting bolt	M24×3.0	84±8.0	608±57.8
17		Sprocket mounting bolt	M20×2.5	57.9±6.0	419±43.4
18	Under carriage	Carrier roller mounting bolt, nut	M16×2.0 M20×2.5★	29.7±3.0 57.9±6.0★	215±21.7 419±43.4★
19		Track roller mounting bolt	M20×2.5	57.9±6.0	419±43.4
20		Track tension cylinder mounting bolt	M16×2.0	29.7±3.0	215±21.7
21		Track shoe mounting bolt, nut	M22×1.5	123±6.0 50.0±5.0 + 70°★	890±43.4 362±36.2 + 70°★
22		Track guard mounting bolt	M20×2.5	57.9±8.7	419±62.9
23	Others	Counterweight mounting bolt	M36×3.0	337±33	2440±239
24		Cab mounting bolt	M12×1.75	12.8±3.0	92.6±21.7
25		Operator's seat mounting bolt	M8×1.25	4.05±0.8	29.3±5.8
26		Under cover mounting bolt	M12×1.75	12.8±3.0	92.6±21.7

★ : Machine Serial No. #1619-

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10×1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12×1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14×2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16×2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18×2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20×2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22×2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24×3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30×3.5	120 ~161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8×1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10×1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12×1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14×1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16×1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18×1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20×1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22×1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24×2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30×2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

2) PIPE AND HOSE (FLARE TYPE)

Thread size (PF)	Width across flat (mm)	kgf·m	lbf·ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

3) PIPE AND HOSE (ORFS TYPE)

Thread size (UNF)	Width across flat (mm)	kgf·m	lbf·ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

4) FITTING

Thread size	Width across flat (mm)	kgf·m	lbf·ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

(4) Remove the wirings for the pressure sensors and so on.

(5) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

· Hydraulic tank quantity : 190 ℓ (50.2 U.S. gal)

(6) Remove bolts (13) and disconnect hoses (1,2).

(7) Disconnect pilot line hoses (4, 5, 6, 7, 8, 9, 10).

(8) Remove pressure switches and accessory items if necessary.

(9) 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.**

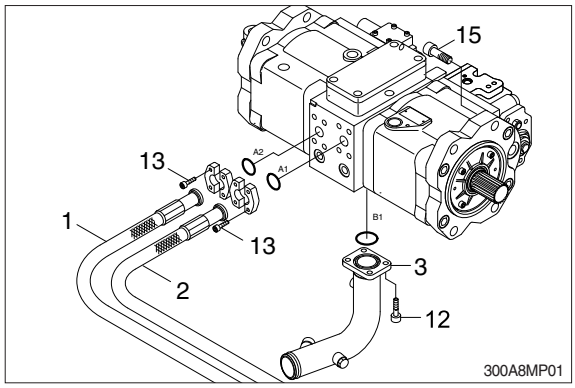
(10) Sling the pump assembly and remove the pump mounting bolts (15).

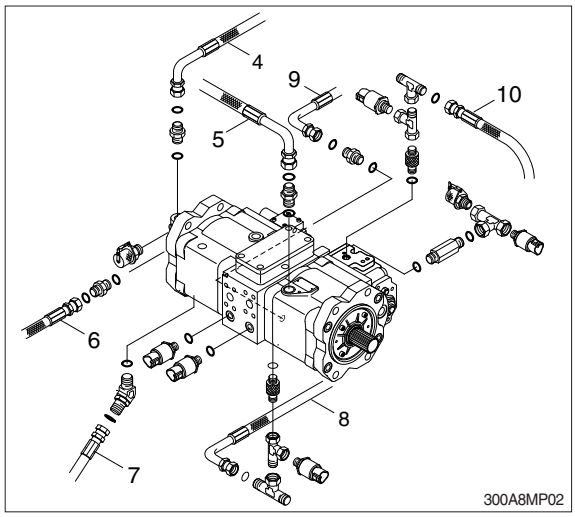
· Weight : 181 kg (399 lb)

· Tightening torque : 57.9±8.7 kgf·m (419±62.9 lbf·ft)

※ **Pull out the pump assembly from housing.**

When removing the pump assembly, check that all the hoses have been disconnected.





2) INSTALL

(1) Carry out installation in the reverse order to removal

(2) Remove the suction strainer and clean it.

(3) Replace 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.

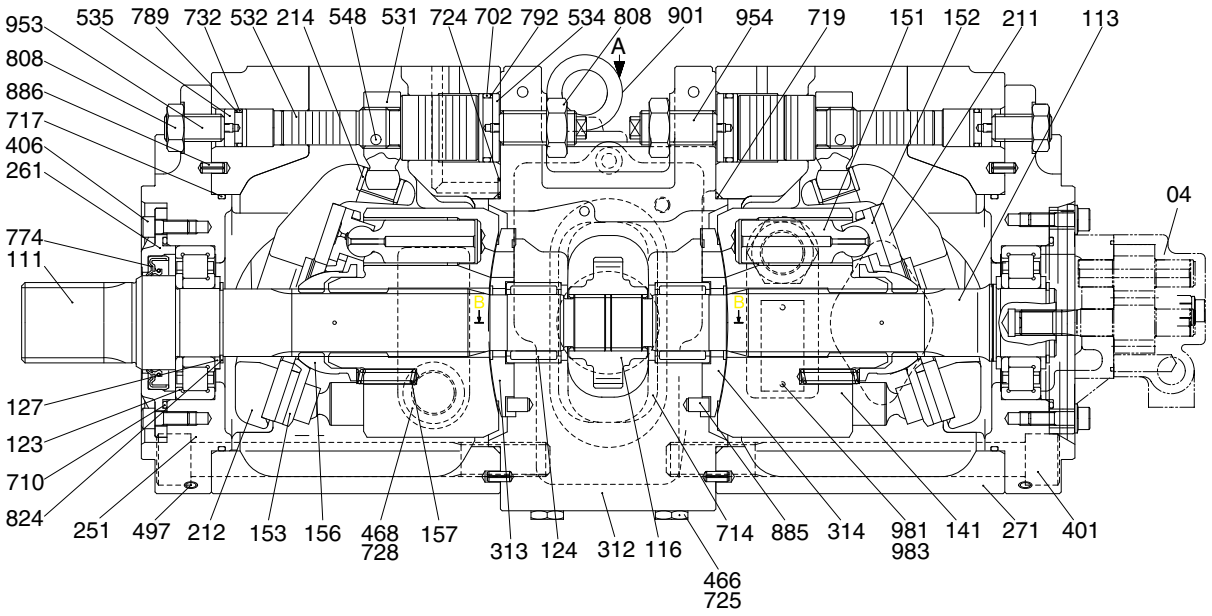
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA)
② Tighten plug lightly
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(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)

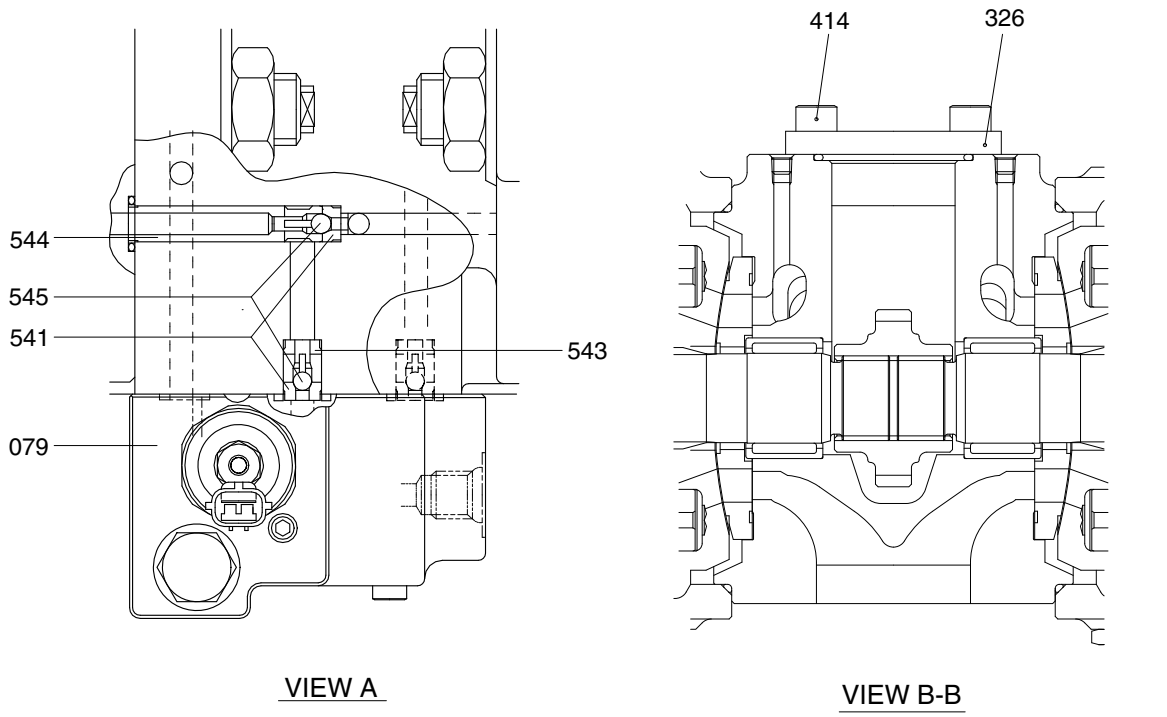
1) STRUCTURE



300S2MP03

04	Gear pump	313	Valve plate (R)	717	O-ring
111	Drive shaft (F)	314	Valve plate (L)	719	O-ring
113	Drive shaft (R)	401	Hexagon socket bolt	723	O-ring
114	1st gear	406	Hexagon socket bolt	724	Square ring
123	Roller bearing	465	ROH plug	725	O-ring
124	Needle bearing	466	VP plug	728	O-ring
127	Bearing spacer	468	VP plug	732	O-ring
141	Cylinder block	497	MH plug	774	Oil seal
151	Piston	531	Tilting pin	789	Back up ring
152	Shoe	532	Servo piston	792	Back up ring
153	Set plate	534	Stopper (L)	806	Hexagon head nut
156	Spherical bushing	535	Stopper (S)	808	Hexagon head nut
157	Cylinder spring	541	Seat	824	Snap ring
211	Shoe plate	543	Stopper 1	885	Valve plate pin
212	Swash plate	544	Stopper 2	886	Spring pin
214	Tilting bushing	545	Steel ball	901	Eye bolt
251	Swash plate support	548	Feedback pin	953	Set screw
261	Seal cover (F)	702	O-ring	954	Set screw
271	Pump casing	710	O-ring		
312	Valve block	714	O-ring		

MAIN PUMP (2/2)



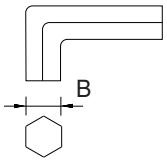
300S2MP04

079	Proportional reducing valve	541	Seat	544	Stopper 2
326	Cover	543	Stopper 1	545	Steel ball
414	Hexagon socket bolt				

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><td colspan="2">Tool name & size</td><td colspan="5">Part name</td></tr>
<tr><td rowspan="6">Allen wrench
 
</td><td>B</td><td>Hexagon socket head bolt</td><td colspan="2">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 colspan="2">BP-1/16</td><td>-</td><td>M 8</td></tr>
<tr><td>5</td><td>M 6</td><td colspan="2">BP1/ 8</td><td>-</td><td>M10</td></tr>
<tr><td>6</td><td>M 8</td><td colspan="2">BP-1/ 4</td><td>PO-1/4</td><td>M12, M14</td></tr>
<tr><td>8</td><td>M10</td><td colspan="2">BP-3/ 8</td><td>PO-3/8</td><td>M16, M18</td></tr>
<tr><td>17</td><td>M20, M22</td><td colspan="2">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 colspan="2">Hexagon head bolt</td><td colspan="2">Hexagon head bolt</td><td>VP plug (PF thread)</td></tr>
<tr><td>19</td><td colspan="2">M12</td><td colspan="2">M12</td><td>VP-1/4</td></tr>
<tr><td>24</td><td colspan="2">M16</td><td colspan="2">M16</td><td>-</td></tr>
<tr><td>27</td><td colspan="2">M18</td><td colspan="2">M18</td><td>VP-1/2</td></tr>
<tr><td>30</td><td colspan="2">M20</td><td colspan="2">M20</td><td>-</td></tr>
<tr><td>36</td><td colspan="2">-</td><td colspan="2">-</td><td>VP-3/4</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="5">Medium size, 1 set</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="5">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="5">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="5">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="5">Steel bar of key material approx. 10×8×200</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="5">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.

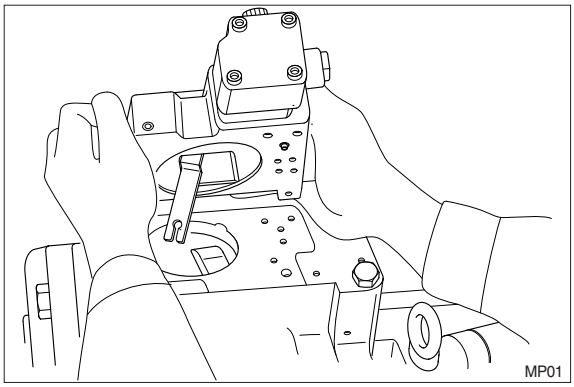
※ Select clean place.

※ 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).

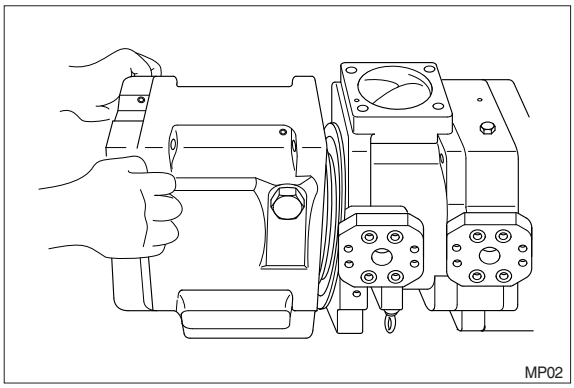
(4) Remove hexagon socket head bolts (412, 413) and remove regulator.
Remove flange socket bolts (435) and remove gear pump.


MP01

(5) Loosen hexagon socket head bolts (401) fixing swash plate support (251), pump casing (271) and valve block (312).

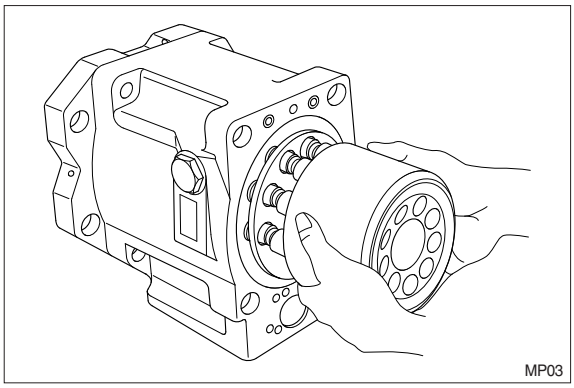
(6) Place pump horizontally on workbench with its regulator-fitting surface down, and separate pump casing (271) from valve block (312).

※ Before bringing this surface down, spread rubber sheet on workbench without failing to prevent this surface from being damaged.


MP02

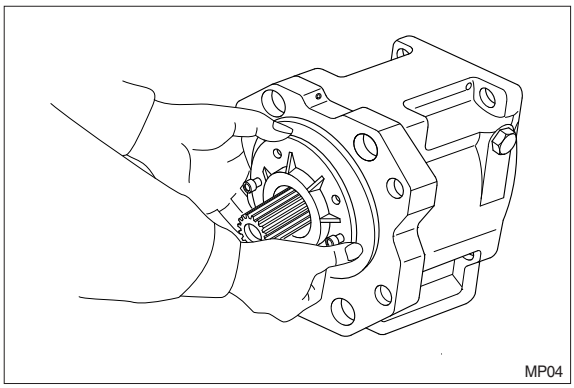
(7) Pull cylinder (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.


MP03

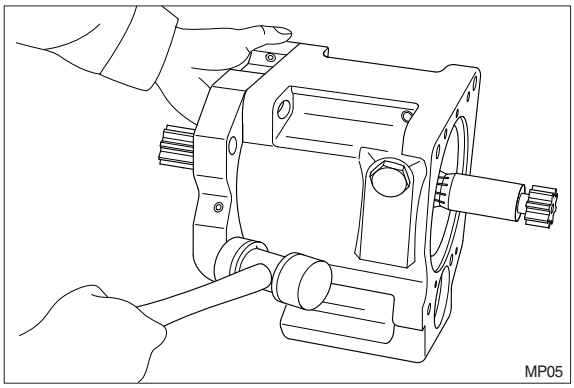
(8) Remove hexagon socket head bolts (406) and then seal cover (F) (261).
Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

※ Since oil seal is fitted on seal cover (F), take care not to damage it when removing cover.

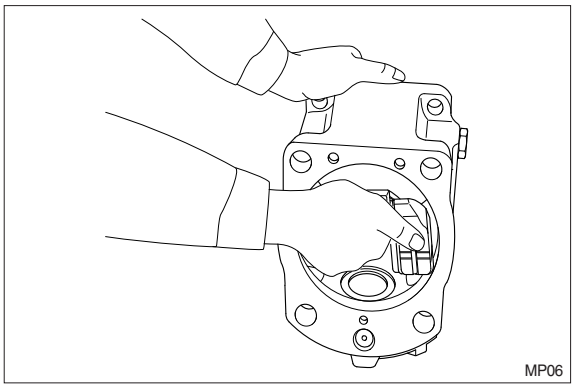

MP04

(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).
In case of fitting a gear pump, first, remove gear pump.

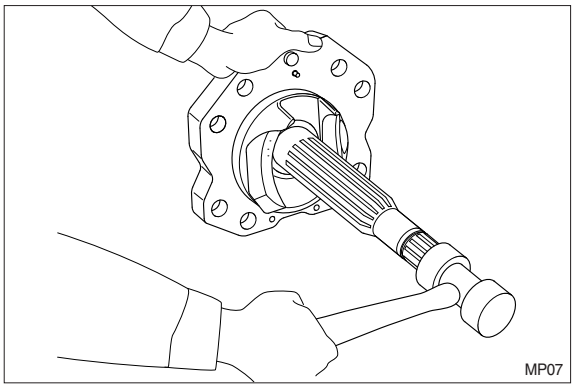
(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.


MP05

(11) Remove shoe plate (211)and swash plate (212) from pump casing (271).

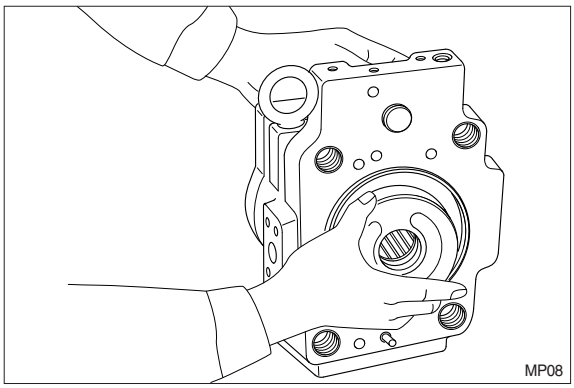

MP06

(12) Tapping lightly shaft's end of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



(13) Remove valve plates (313, 314) from valve block (312).

※ These may be removed in work 6.



(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 gear (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.

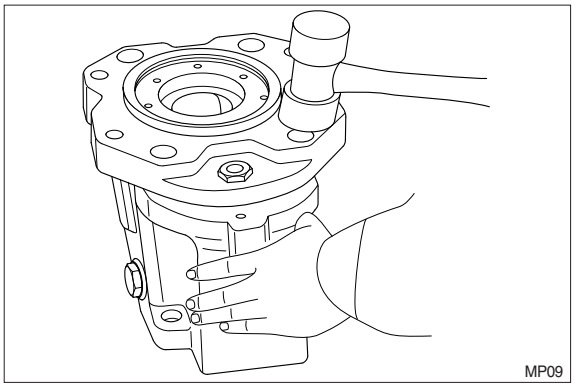
⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

(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.

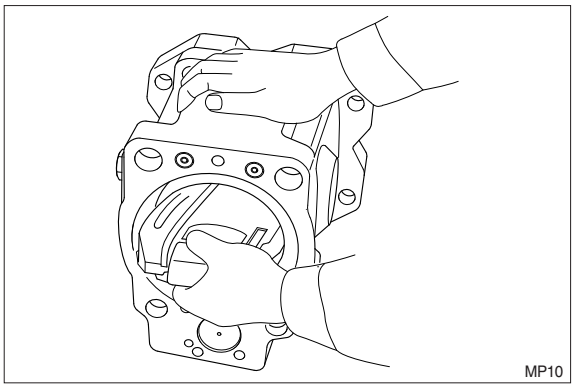


MP09

(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.

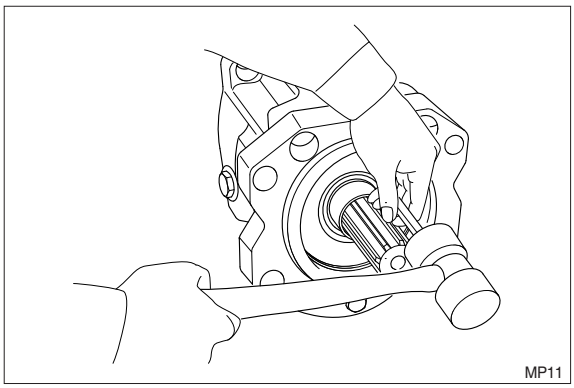

MP10

(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.

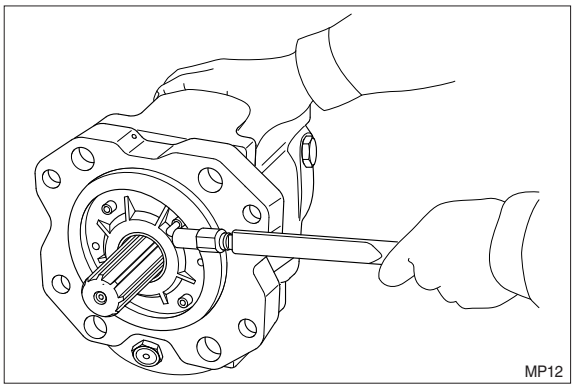

MP11

(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).

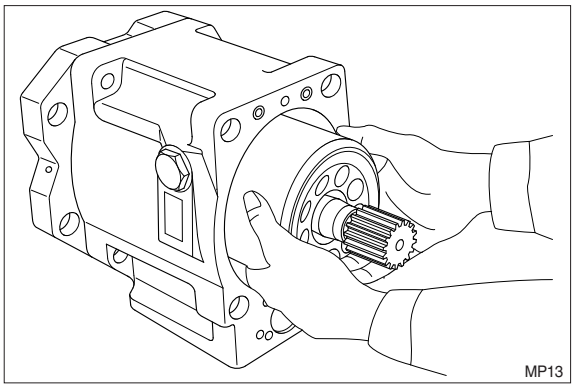
※ Assemble oil seal, taking full care not to damage it.

※ For tandem type pump, fit rear cover (263) and seal cover (262).


MP12

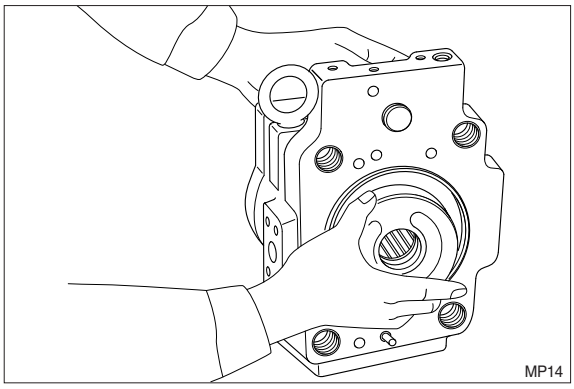
(6) Assemble piston cylinder subassembly [Cylinder (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157).]

Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.


MP13

(7) Fit valve plate (313) to valve block (312), entering pin into pin hole.

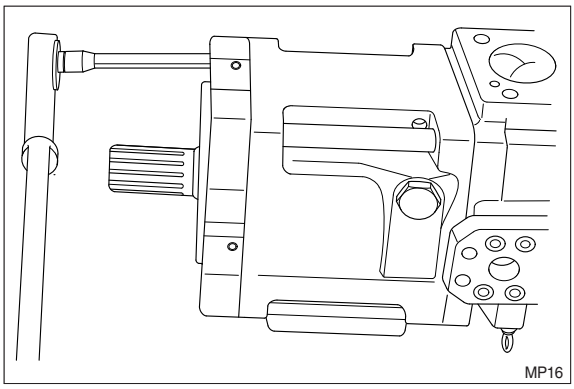
※ Take care not to mistake suction / delivery directions of valve plate.



(8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).

※ At first assemble this at rear pump side, and this work will be easy.

※ Take care not to mistake direction of valve block.

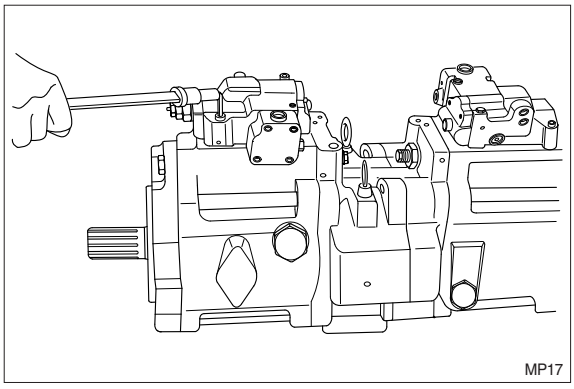


※ Clockwise rotation (viewed from input shaft side)

※ Fit block with regulator up and with delivery flange left, viewed from front side.

(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.

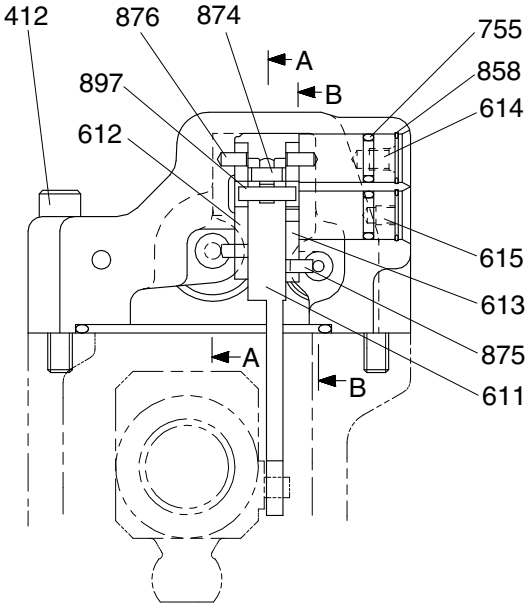


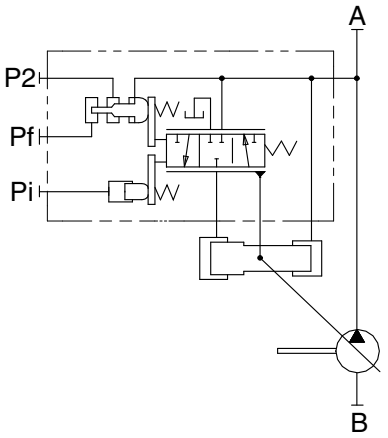
(10) Fit drain port plug (468).

This is the end of reassembling procedures.

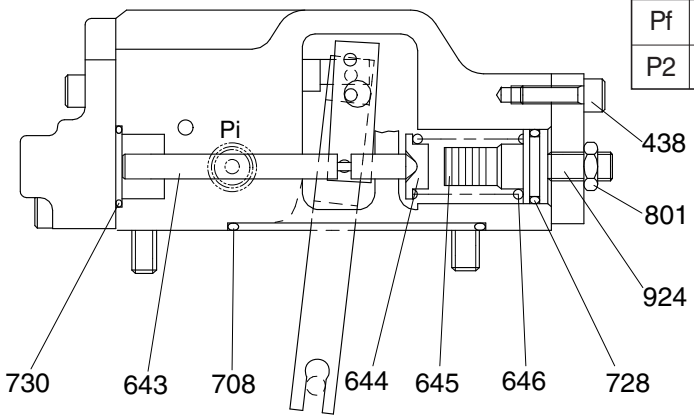
3. REGULATOR

1) STRUCTURE(1/2)

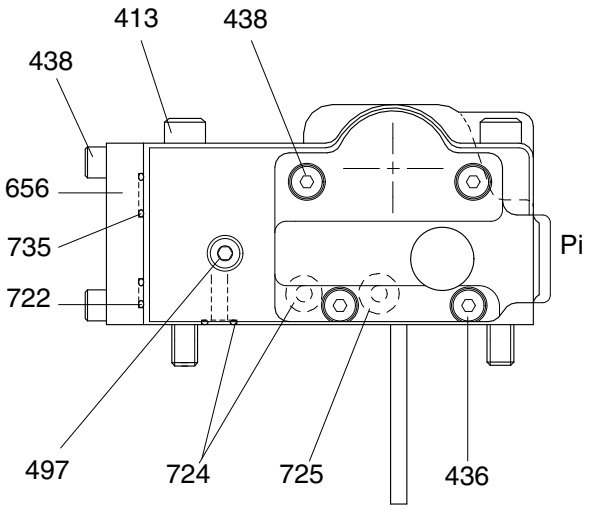




Port	Port name	Port size
A	Delivery port	SAE 6000 PSI 1"
B	Suction port	SAE 2500 PSI 3"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



SECTION B-B

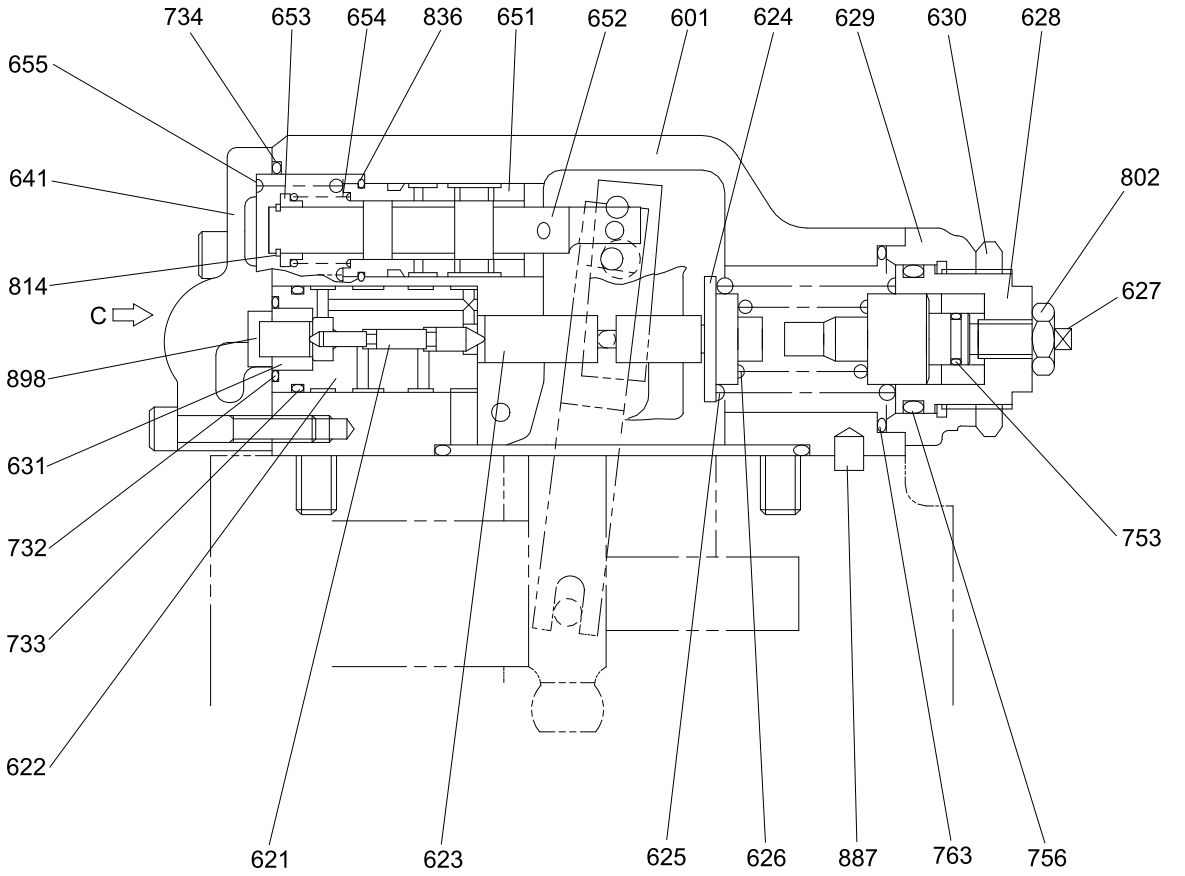


VIEW C

300S2MP06

412 Hexagon socket screw
413 Hexagon socket screw
436 Hexagon socket screw
438 Hexagon socket screw
497 Plug
611 Feed back lever
612 Lever (1)
613 Lever (2)
614 Fulcrum plug
615 Adjust plug
643 Pilot piston
644 Spring seat (Q)
645 Adjust stem (Q)
646 Pilot spring
656 Block cover
708 O-ring
722 O-ring
724 O-ring
725 O-ring
728 O-ring
730 O-ring
735 O-ring
755 O-ring
801 Nut
858 Snap ring
874 Pin
875 Pin
876 Pin
897 Pin
924 Set screw

REGULATOR (2/2)



SECTION A-A

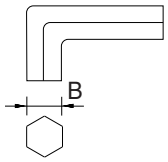
300S2MP07

601	Casing	630	Lock nut	734	O-ring
621	Compensator piston	631	Sleeve, pf	753	O-ring
622	Piston case	641	Pilot cover	756	O-ring
623	Compensator rod	651	Sleeve	763	O-ring
624	Spring seat (C)	652	Spool	802	Nut
625	Outer spring	653	Spring seat	814	Snap ring
626	Inner spring	654	Return spring	836	Snap ring
627	Adjust stem (C)	655	Set spring	887	Pin
628	Adjust screw (C)	732	O-ring	898	Pin
629	Cover (C)	733	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><td colspan="2">Tool name & size</td><td colspan="5">Part name</td></tr>
<tr><td rowspan="4">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 rowspan="2">Socket wrench, double (single) open end </td><td>-</td><td colspan="2">Hexagon head bolt</td><td>Hexagon nut</td><td>VP plug (PF thread)</td></tr>
<tr><td>6</td><td colspan="2">M 8</td><td>M 8</td><td>-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="5">Small size, Max 36 mm</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="5">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="5">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="5">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="5">Steel bar of key material approx. 10×8×200</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="5">Capable of tightening with the specified torques.</td></tr>
<tr><td colspan="2">Pincers</td><td colspan="5">-</td></tr>
<tr><td colspan="2">Bolt</td><td colspan="5">M4, Length : 50 mm</td></tr>
</table>

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	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.

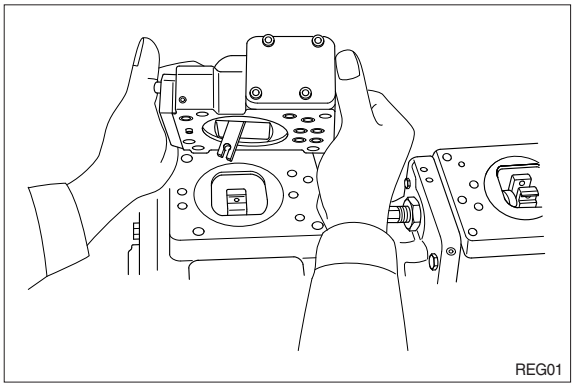
※ Choose a clean place.

※ 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.

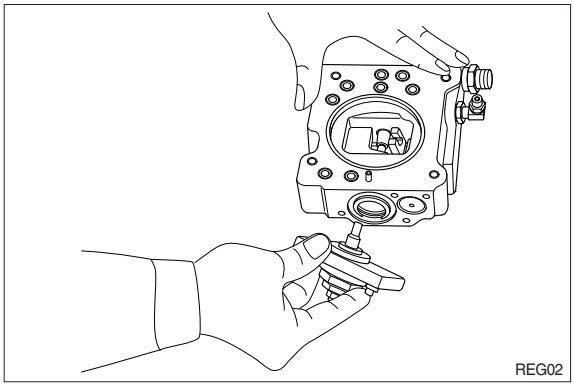

REG01

(4) Remove hexagon socket head screw (438) and remove cover (C, 629).

※ Cover (C) is fitted with adjusting screw (C, 628), adjusting stem (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

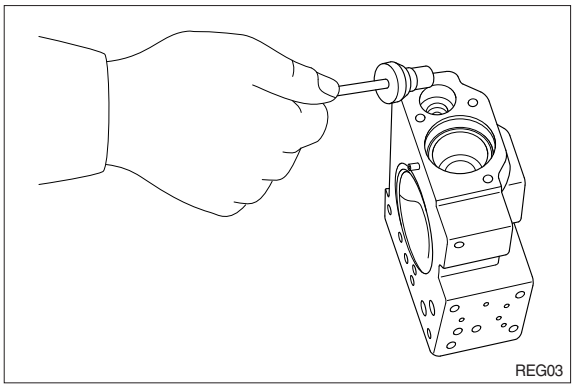
Do not loosen these screws and nuts.

If they are loosened, adjusted pressure-flow setting will vary.

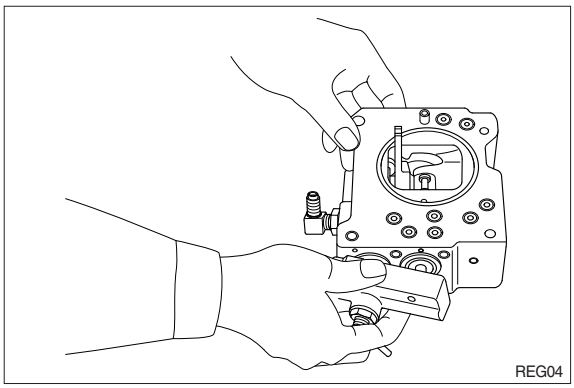

REG02

(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 stem (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

※ Adjusting stem (Q, 645) can easily be drawn out with M4 bolt.


REG03

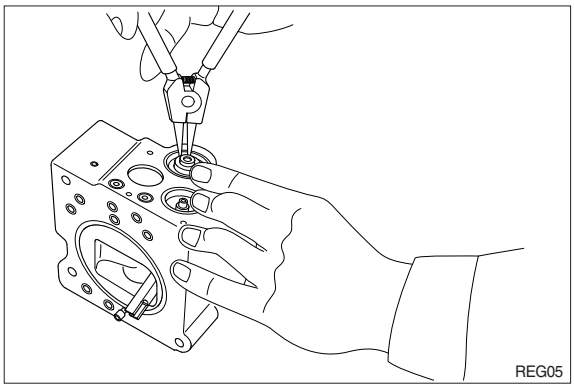
(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.


REG04

(7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).
Sleeve (651) is fitted with snap ring (836).

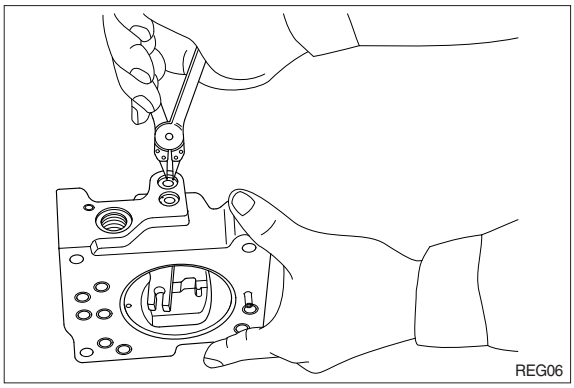
※ When removing snap ring (814), return spring (654) may pop out.

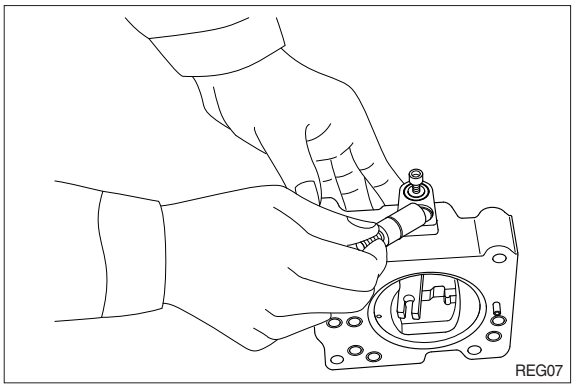
※ Take care not to lose it.


REG05

(8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

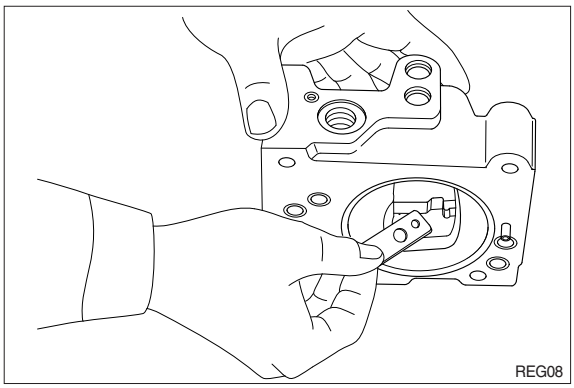
※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.


REG06


REG07

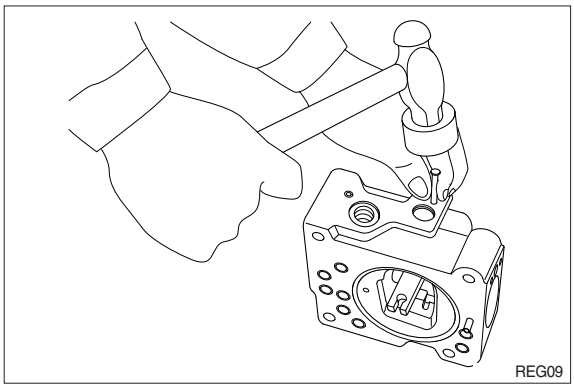
(9) Remove lever (2, 613). Do not draw out pin (875).

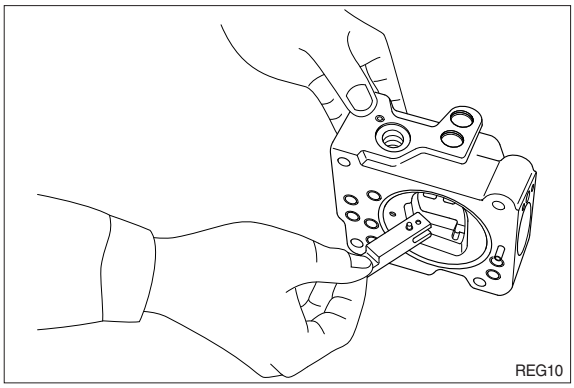
※ Work will be promoted by using pincers or so on.


REG08

(10) Draw out pin (874) and remove feedback lever (611).

※ Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever (1, 612).


REG09


REG10

(11) Remove lever (1, 612). Do not draw out pin (875).

(12) Draw out pilot piston (643) and spool (652).

(13) Draw out piston case (622), compensating piston (621) and compensating rod (623).

※ Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

This completes 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.

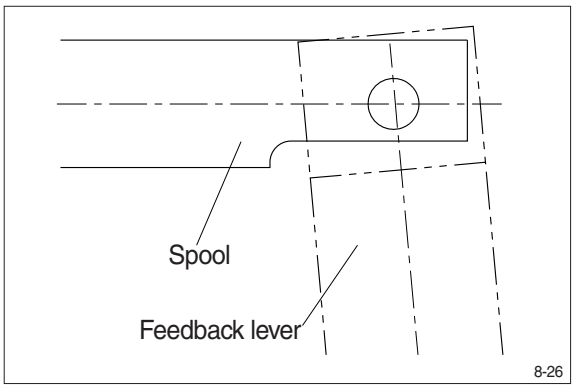
(2) Put compensating rod (623) into compensating hole of casing (601).

(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.

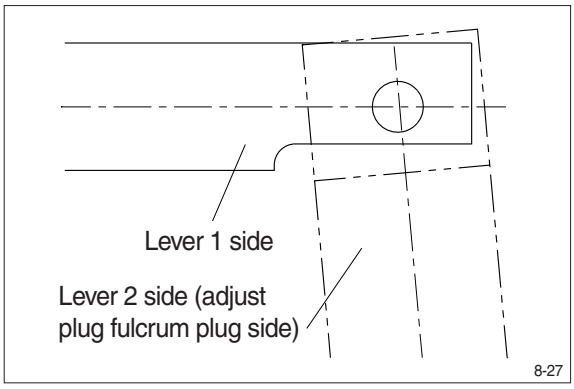
※ Pay attention to orientation of spool.



(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.

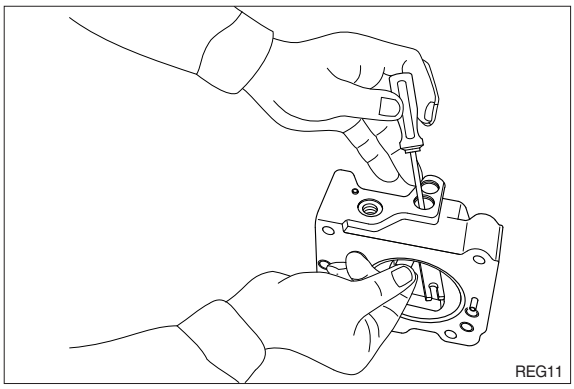
※ Take care not to mistake direction of feedback lever.



(6) Put pilot piston (643) into pilot hole of casing.

※ Confirm that pilot piston slides smoothly without binding.

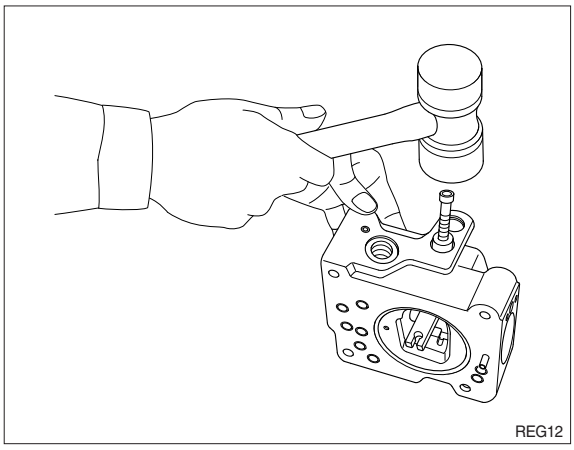
(7) Put pin force-fitted in lever (2, 613) into groove of pilot piston.
Then fix lever (2).



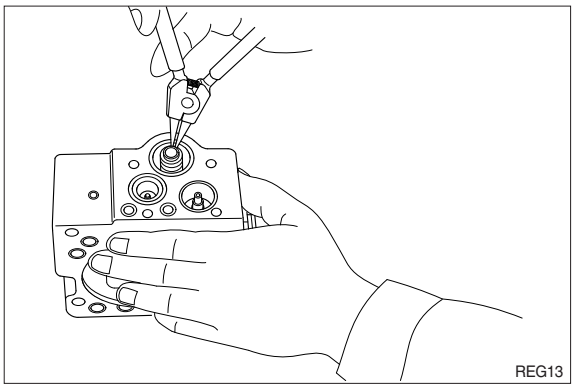
(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever (2).
Then fix locking ring (858).

(9) Insert adjusting plug (615) and fit locking ring.

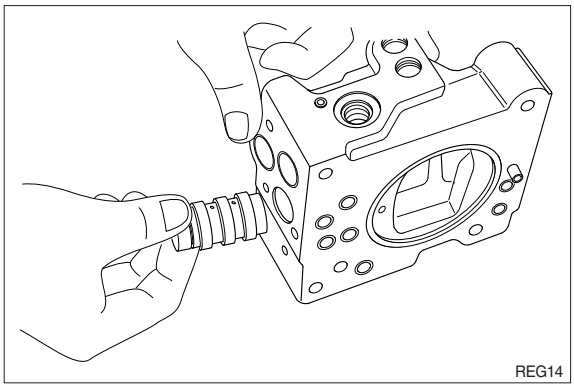
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.



(10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).

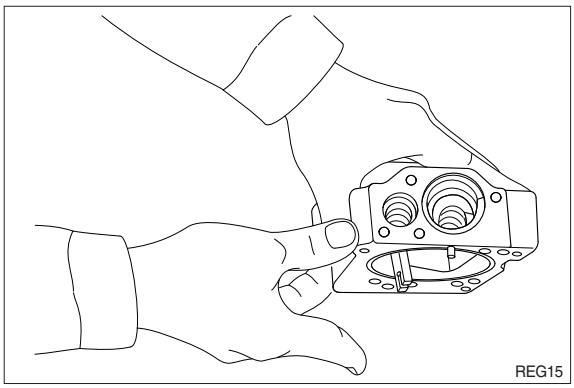


(11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).

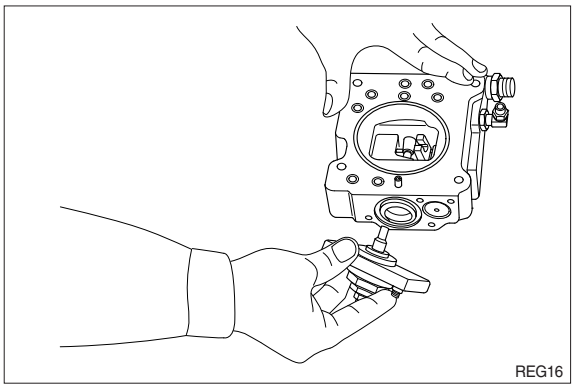

REG14

(12) Put spring seat (644), pilot spring (646) and adjusting stem (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

(13) Install cover (C, 629) fitted with adjusting screws (628), adjusting stem (C, 627), lock nut (630), hexagon nut (802) and adjusting screw (924).
Then tighten them with hexagonal socket head screws (438).
This completes assembly.


REG16

■ MACHINE SERIAL NO. : -#0559

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the wirings for the pressure sensor and so on.

(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.
- Weight : 220 kg (485 lb)
- Tightening torque : 12.3 ± 1.3 kgf·m (89.0 ± 9.4 lbf·ft)

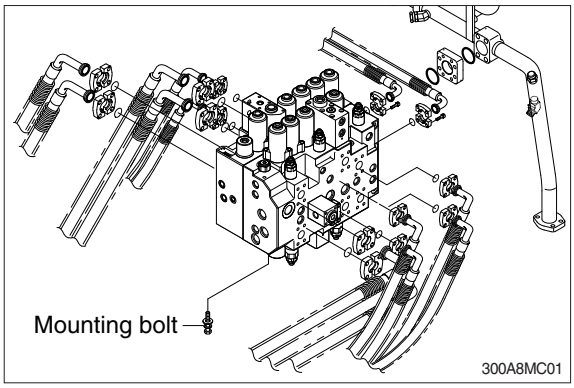
(9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

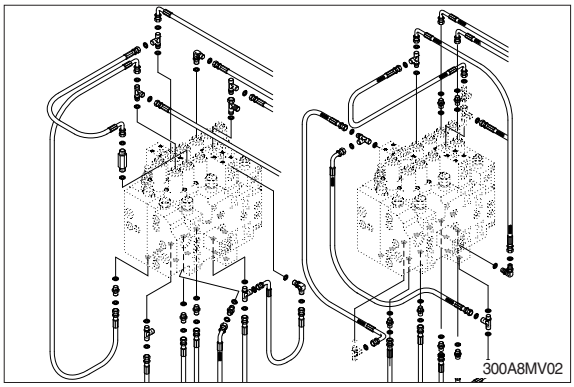
2) INSTALL

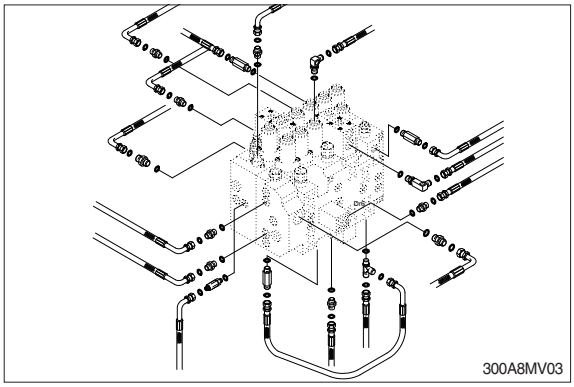
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from below items.
① Cylinder (boom, arm, bucket)
② Swing motor
③ Travel motor
※ See each item removal and install.

(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.







■ MACHINE SERIAL NO. : #0560-

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the wirings for the pressure sensor and so on.

(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.
- Weight : 220 kg (485 lb)
- Tightening torque : 12.3 ± 1.3 kgf·m (89.0 ± 9.4 lbf·ft)

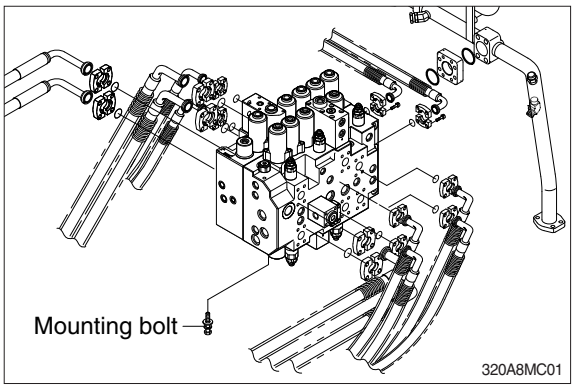
(9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

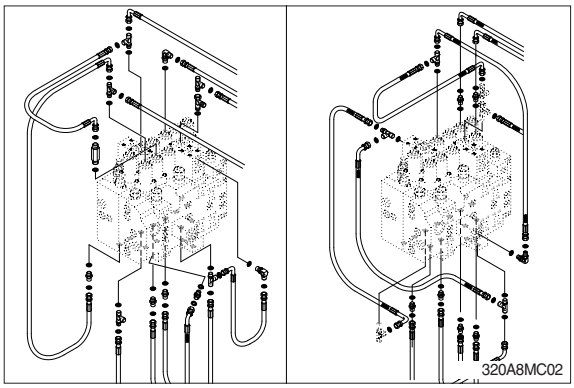
2) INSTALL

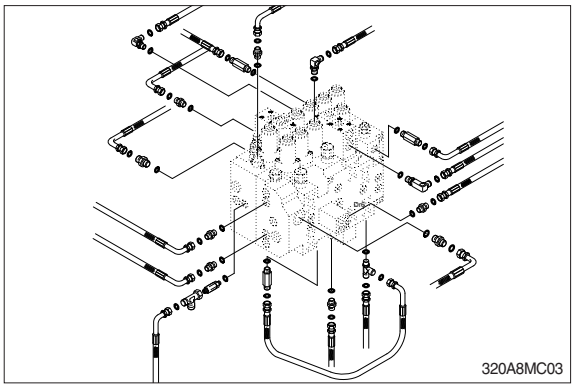
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from below items.
① Cylinder (boom, arm, bucket)
② Swing motor
③ Travel motor
※ See each item removal and install.

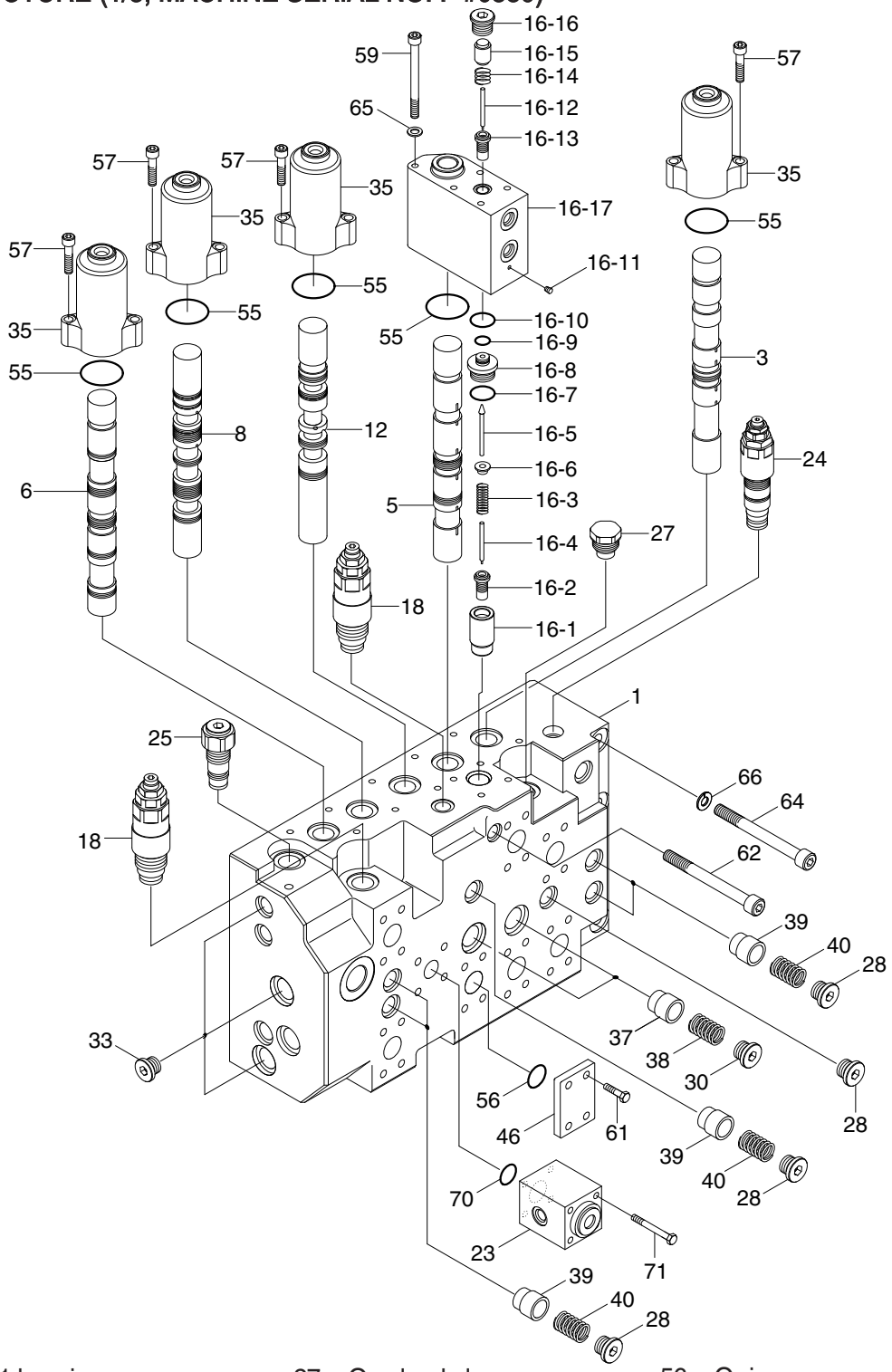
(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.







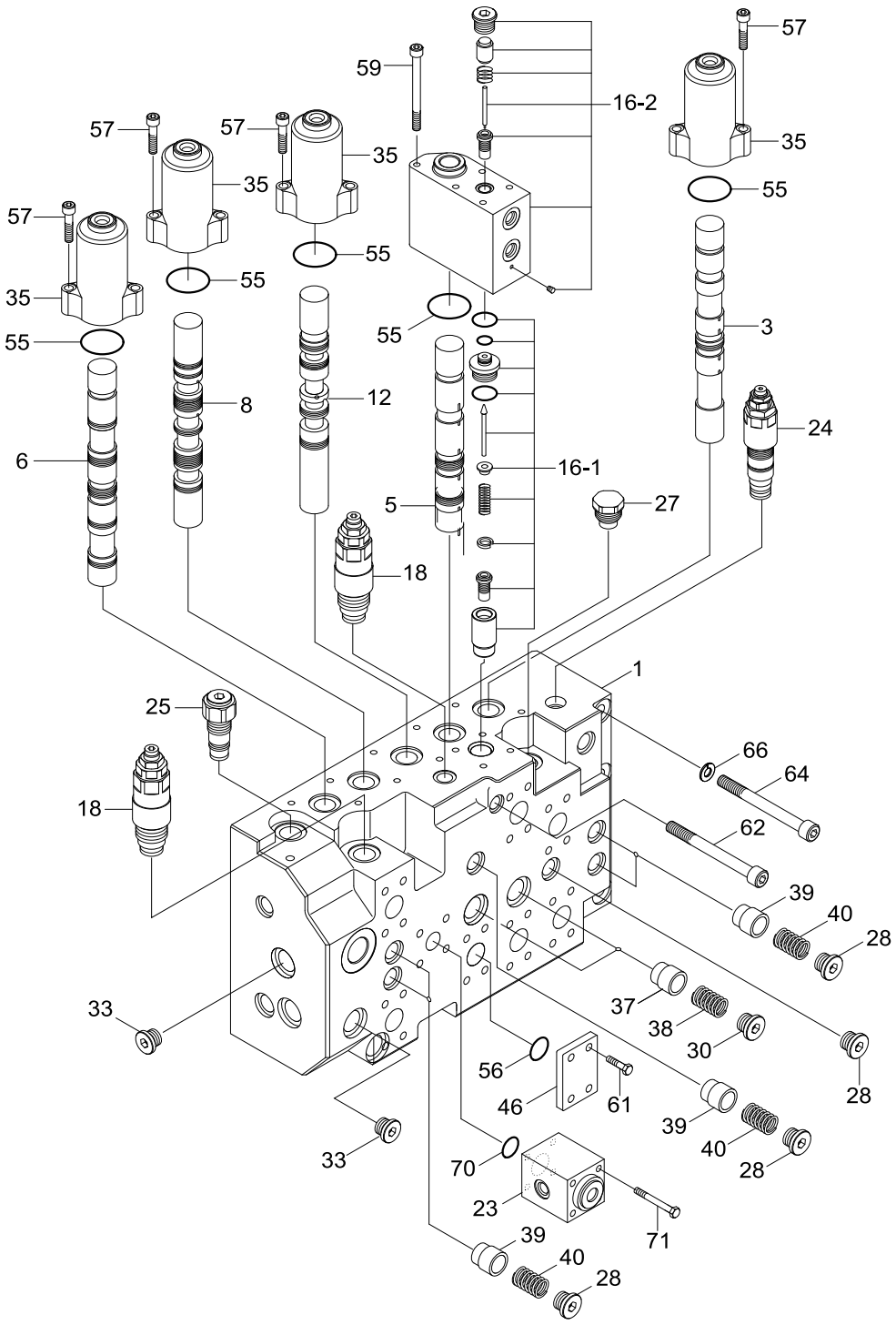
2. STRUCTURE (1/5, MACHINE SERIAL NO. : -#0559)



300S8MC04

1	P1 housing	27	Overload plug	56	O-ring
3	Travel spool kit	28	Plug	57	Socket bolt
5	Boom 1 spool kit	30	Load check plug	59	Socket bolt
6	Bucket spool kit	33	Plug	61	Socket bolt
8	Arm 2 spool kit	35	Spool cap	62	Socket bolt
12	Arm regen spool kit	37	L/C poppet 1	64	Socket bolt
16	Holding valve assy	38	L/C spring 1	66	Spring washer
18	Port relief valve assy	39	L/C poppet 2	70	O-ring
23	Arm 2 logic valve assy	40	L/C spring 2	71	Socket bolt
24	Main relief valve assy	46	Port plug flange		
25	Negacon relief valve	55	O-ring		

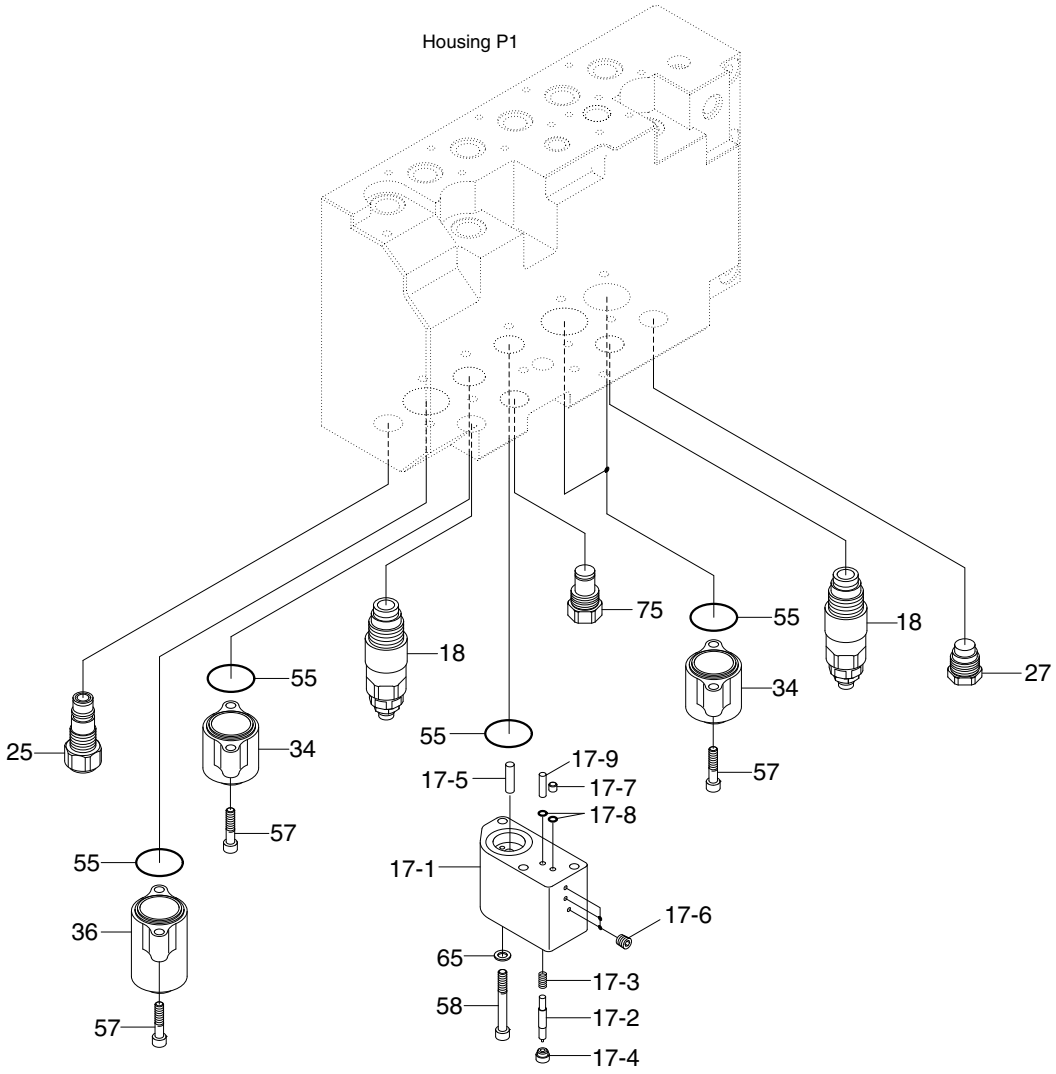
STRUCTURE (1/5, MACHINE SERIAL NO. : #0560-)



320A8MC04

1	P1 housing	24	Main relief valve assy	46	Port plug flange
3	Travel spool kit	25	Negacon relief valve	55	O-ring
5	Boom 1 spool kit	27	Overload plug	56	O-ring
6	Bucket spool kit	28	Plug	57	Socket bolt
8	Arm 2 spool kit	30	Load check plug	59	Socket bolt
12	Arm regen spool kit	33	Plug	61	Socket bolt
16	Holding valve assy	35	Spool cap	62	Socket bolt
16-1	Valve kit	37	L/C poppet 1	64	Socket bolt
16-2	Valve kit	38	L/C spring 1	66	Spring washer
18	Port relief valve assy	39	L/C poppet 2	70	O-ring
23	Arm 2 logic valve assy	40	L/C spring 2	71	Socket bolt

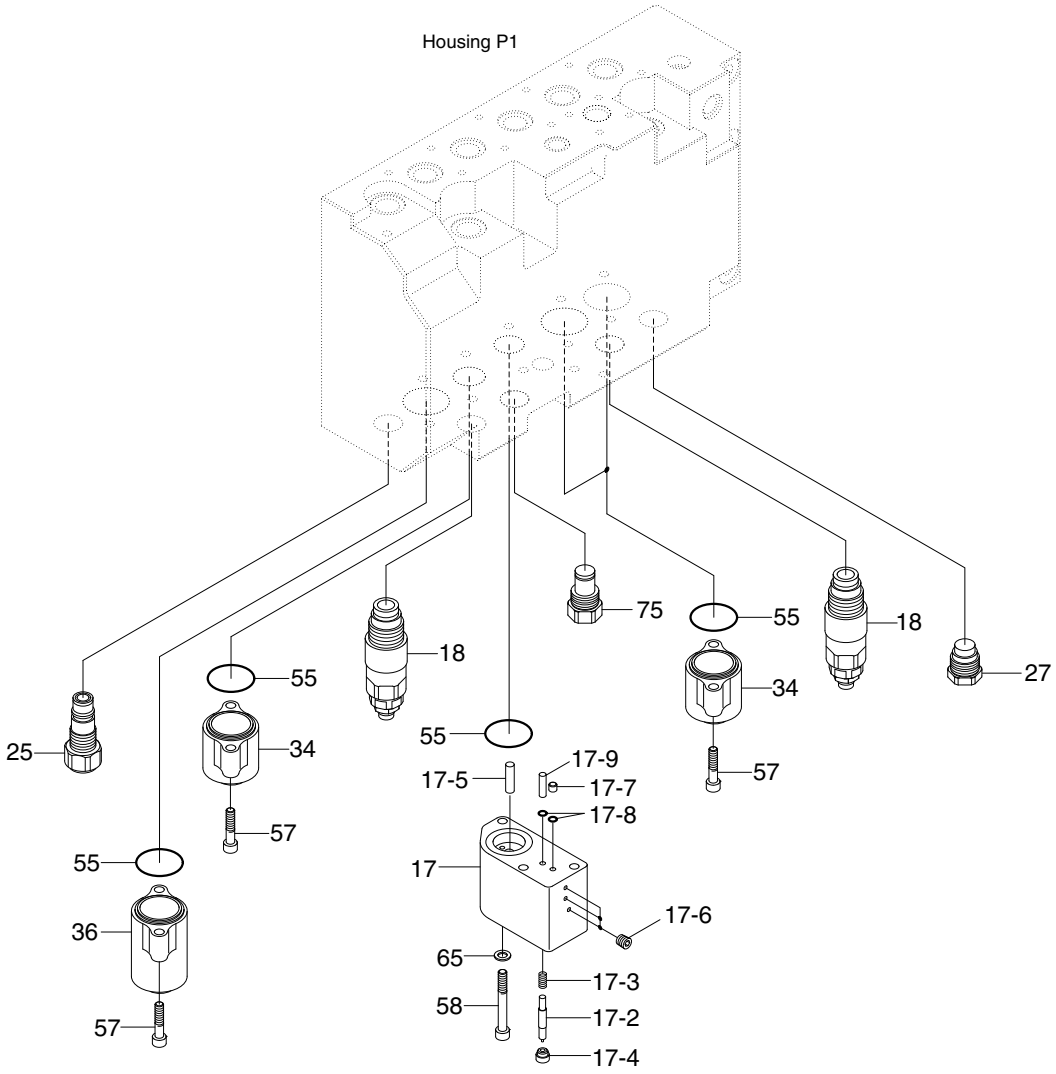
STRUCTURE (2/5, MACHINE SERIAL NO. : -#0559)



300S8MC05

17	Regen valve assy	34	Spool cap	58	Socket bolt
18	Port relief valve assy	36	Bucket stroke limit	75	Plug assy
25	Negacon relief valve	55	O-ring		
27	Overload plug	57	Socket bolt		

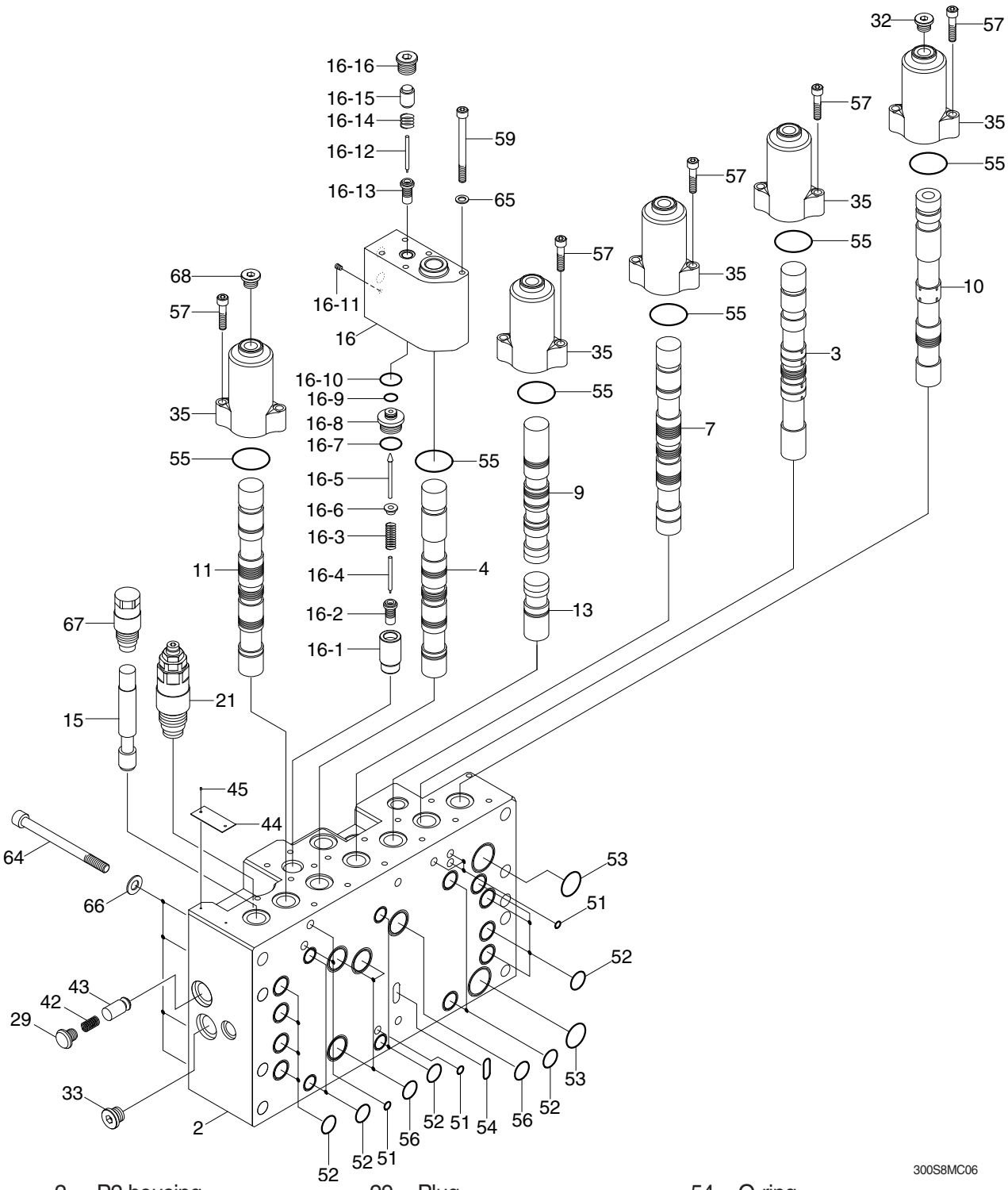
STRUCTURE (2/5, MACHINE SERIAL NO. : #0560-)



320A8MC05

17	Regen valve assy	17-7	Plug	34	Spool cap
17-2	Plunger	17-8	O-ring	36	Bucket stroke limit
17-3	Spring	17-9	Pin	55	O-ring
17-4	Stopper	18	Port relief valve assy	57	Socket bolt
17-5	Piston	25	Negacon relief valve	58	Socket bolt
17-6	Plug	27	Overload plug	75	Plug assy

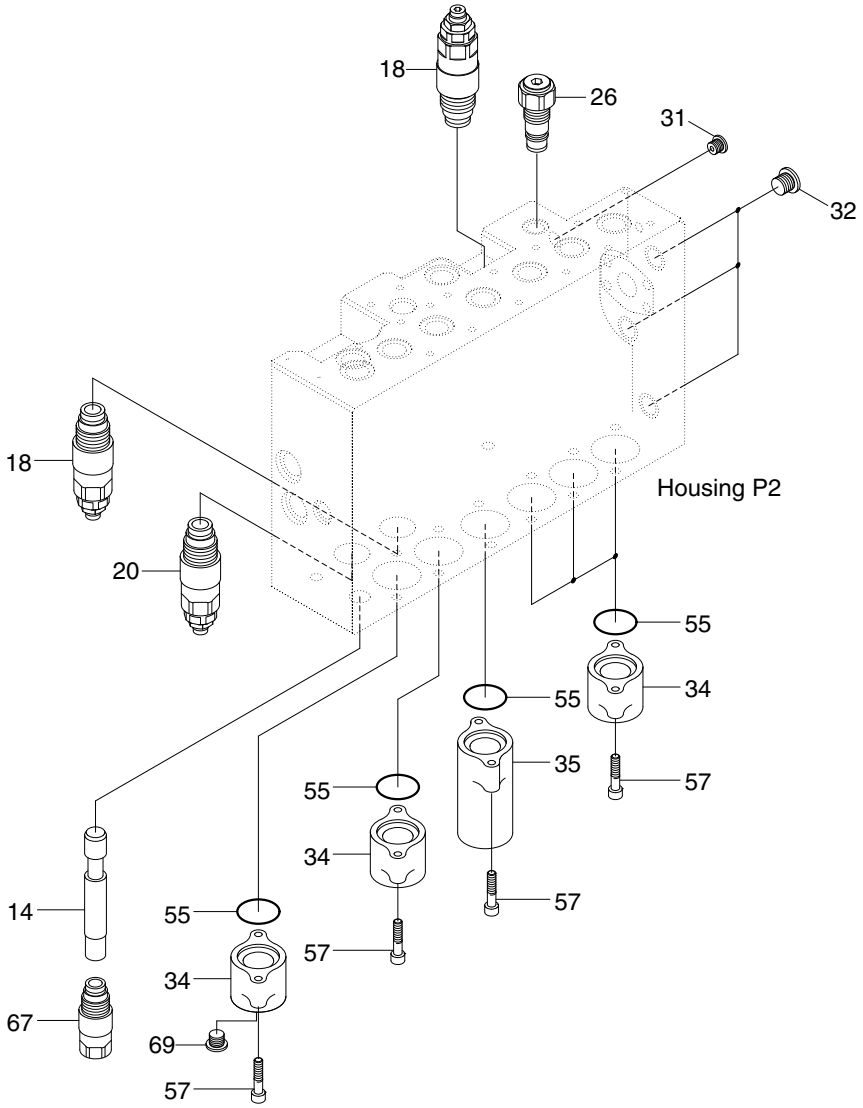
STRUCTURE (3/5)



300S8MC06

2	P2 housing	29	Plug	54	O-ring
3	Travel spool kit	32	Plug	55	O-ring
5	Arm 1 spool kit	33	Plug	56	O-ring
7	Swing spool kit	35	Cap spool	57	Socket bolt
9	Boom 2 spool kit	42	Spring	59	Socket bolt
10	Travel straight spool kit	43	Poppet	64	Socket bolt
11	Option spool kit	44	Name plate	66	Spring washer
13	Swing priority spool kit	45	Rivet	67	BC plug assy
15	BC2 spool kit	51	O-ring	68	Opt stroke limit plug kit 1
16	Holding valve assy	52	O-ring		
21	Port relief valve assy	53	O-ring		

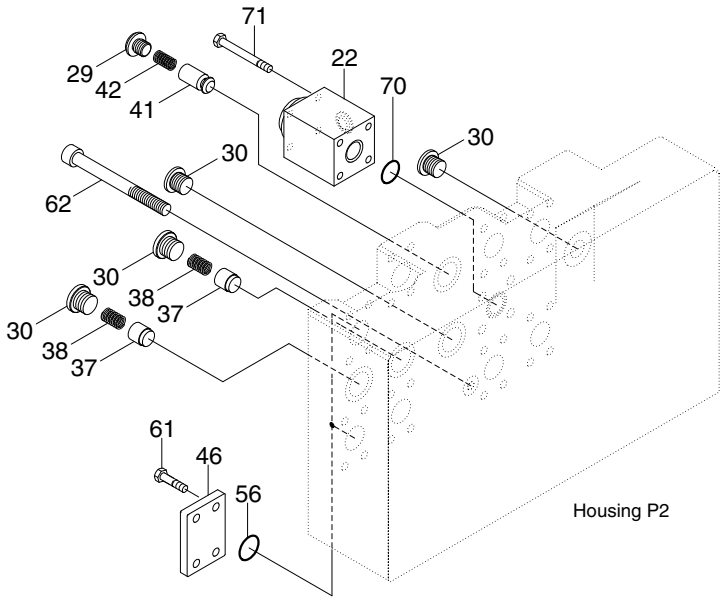
STRUCTURE (4/5)



300S8MC07

14	BC1 spool kit	31	Plug	55	O-ring
18	Port relief valve assy	32	Plug	57	Socket bolt
20	Port relief valve assy	34	Spool cap	67	BC plug assy
26	Orifice signal plug assy	35	Spool cap	69	Opt stroke limit plug kit 2

STRUCTURE (5/5)



220S8MC08

22	Swing logic valve assy	41	Poppet	62	Socket bolt
29	Plug	42	Spring	70	O-ring
30	Load check valve	46	Port plug flange	71	Socket bolt
37	L/C poppet 1	56	O-ring		
38	L/C spring 1	61	Socket bolt		

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.
In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(2) When a control valve is to be removed 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.

(3) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.

(4) 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)
Torque wrench	1	-
Extension bar	1	-
Hexagon bit socket	Each 1	6, 8, 10
Hex socket	1	36
Spanner	Each 1	32, 34, 38
Loctite #262	1	-

3) DISASSEMBLY

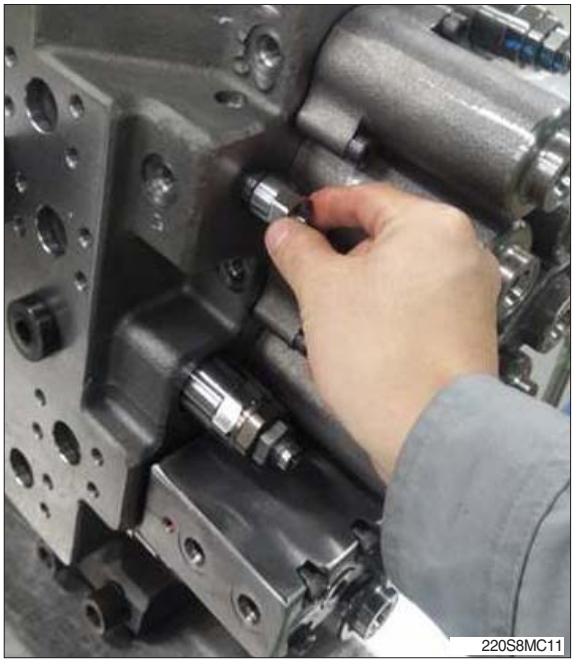
The figure in ( ) shown after the part name in explanation sentence shows its number in the construction figures (8-31)

(1) Place main control valve on working bench

※ Disassemble it in clean place and pay attention not to damage flange faces and plate faces.

(2) Disassembling of orifice signal plug

① Loosen and remove orifice signal plug (25).



(3) Disassembling of main spool assy 1 (Pilot cover B side) (Travel R/L (3), Swing (7), Boom 2 (9), Arm regen (12), Arm 2 (8), Bucket (6), Option (11))

① Loosen the hexagon socket head bolts (45) 2EA and remove the pilot cover B (33) and O-ring (43).
[Hexagon key wrench 6 mm]

② Pull out the main spool, spring, spring seat stopper and spacer bolt in the spool assembly condition from the housing P1 & P2.

(4) Disassembling of main spool assy 2 (Pilot cover B side) (Boom 1 (5), Arm 1 (4))

① Loosen the hexagon socket head bolts (47) 5EA and remove the O-ring (44) and holding valve block assy (16)
[Hexagon key wrench : 6 mm]

② Pull out the main spool, spring, spring seat stopper and spacer bolt in the spool assembly condition from the housing P1 & P2.

※ When you disassemble holding valve block assy, pay attention not to miss the pilot poppet.

(5) Disassembling of bypass cut spool (=BC) (Bucket BC (14), Option BC (15))

① Loosen bypass cut plug assy
[36mm socket wrench]

② Pull out the bypass cut spool

※ Option BC spool (14) and bucket BC spool (15) are different lengths. So when you reassemble, be careful of length. (length : option BC > bucket BC)

(6) Disassembling of pilot cover (Bucket stroke limiter)

① Loosen the hexagon socket head bolts (45) 2EA.
[Hexagon key wrench 6 mm]

② Remove the pilot cover (34) and O-ring (43).

(7) Disassembling of swing priority spool & pilot cover A
(Travel R/L (3), Swing (7), Boom1 (5), Arm 1 (4), Bucket (6), Option (11), Boom2 (9), Arm 2 (8))

① Loosen the hexagon socket head bolts (45) 2EA and remove the pilot cover A (32) and O-ring (43).

② Pull out the swing priority spool (13).

③ Remove the pilot cover A (32).

(8) Disassembling of regen valve block assy

① Loosen the hexagon socket head bolts (46) 3EA.
[Hexagon key wrench 6 mm]

② Remove plug (551) or (552) and take out poppet (511) or (515, 516) and spring (521) or (523).

③ When you disassemble regen valve block assy, pay attention not to miss the piston and O-ring (43).

(9) Disassembling of main relief valve

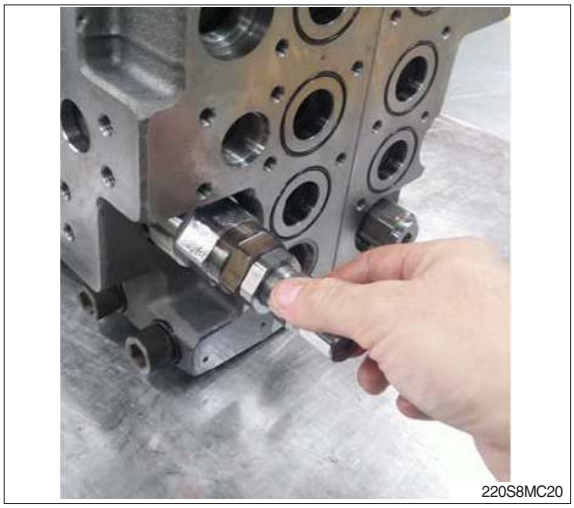
① Loosen and remove the main relief valve (23).
[Spanner 32 mm]

(10) Disassembling of port relief valve (Except the option side)

① Loosen and remove the port relief valve (18).
[Spanner 34 mm]

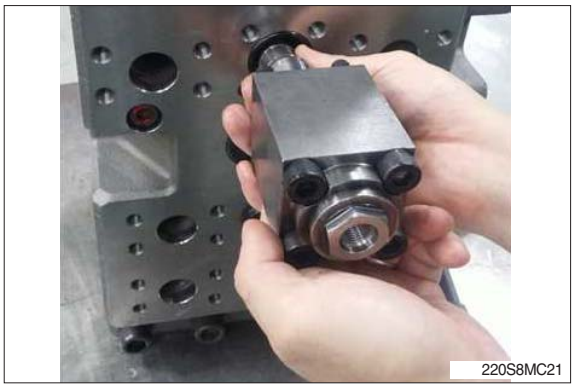
(11) Disassembling of port relief valve (Option side)
(1-stage (19), 2-stage (20))

① Loosen and remove the port relief valve.
[Spanner 38 mm]



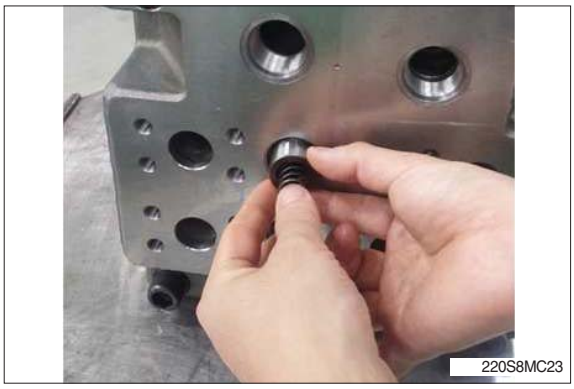
(12) Disassembling of logic valve (Arm logic valve (22), Swing logic valve (21))

① Loosen the hexagon socket head bolts (56) 4EA and remove the logic valve.
[Hexagon key wrench 8 mm]



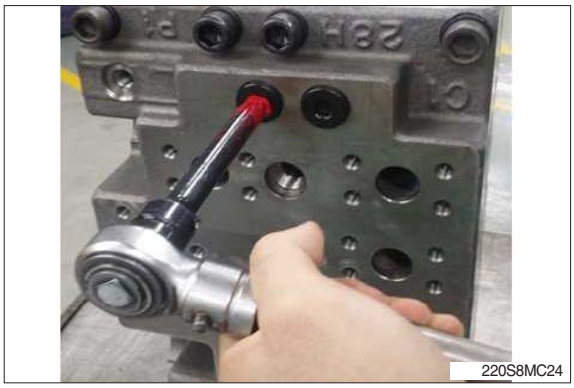
② Remove the swing logic poppet.

③ Remove the Arm logic poppet and spring by same method.



(13) Disassembling of check valve (Plug (27) 2EA)

① Loosen the plug (27) and remove the poppet (37), spring (38).
[Hexagon key wrench 10 mm]



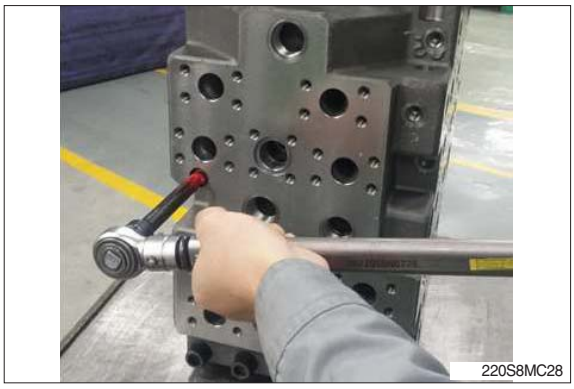
(14) Main spool disassembly

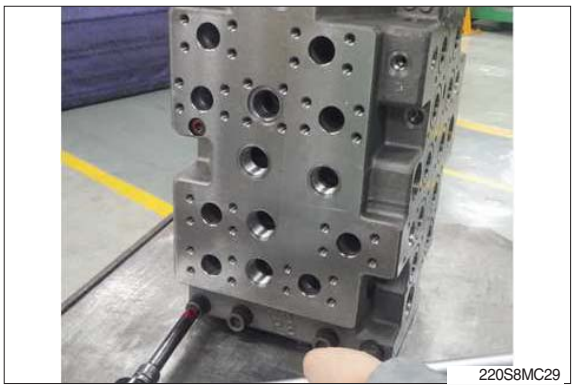
① Fix the spool to the dedicated jig and take it apart.
(Spacer bolt, spring, stopper, spring seat)
[Hexagon key wrench 8 mm]

(15) Disassembling of housing

① Loosen the hexagon socket head bolts (49, 50) each 2EA, 8EA

※ Except when required specially, do not disassemble housing P1&P2 for sanitation.


220S8MC28


220S8MC29

(16) 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 the seal groove faces of the housing and the covers are smooth and free of dust, dent, rust etc.
c. Correct dents and damages on check seat faces of housing, if any, by lapping.
※ Pay attention not to leave lapping agent in the housing.
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 its inspection procedures.
g. Replace all the 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 are uniform 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 orifices of the main poppet and seat section are not clogged with foreign matter.
e. Replace all O-rings with new ones.
f. When any light damage is found in above inspections, correct it by lapping.
g. When any abnormal part is found, replace it with a relief valve assembly.

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Disconnect hose assembly (2).

(5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).

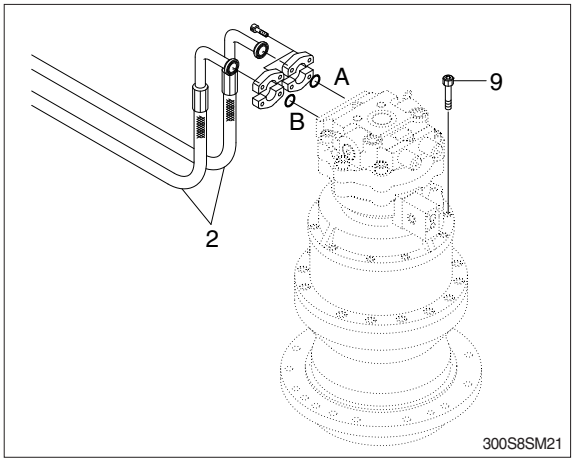
(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).

· Motor device weight : 61 kg (135 lb)

· Tightening torque : 57.9±5.8 kgf·m (419±42.0 lbf·ft)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.



2) INSTALL

(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

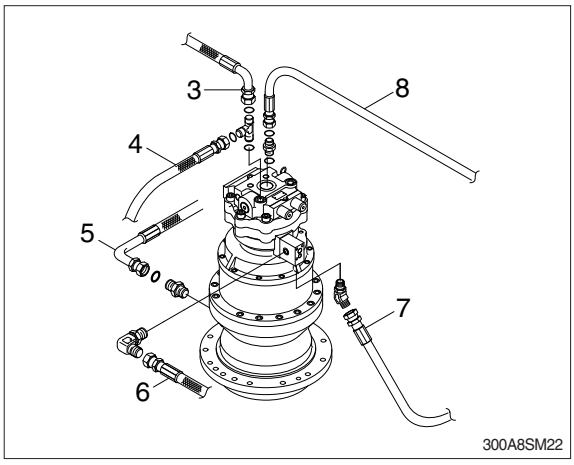
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

④ Start the engine, run at low idling and check oil come out from plug.

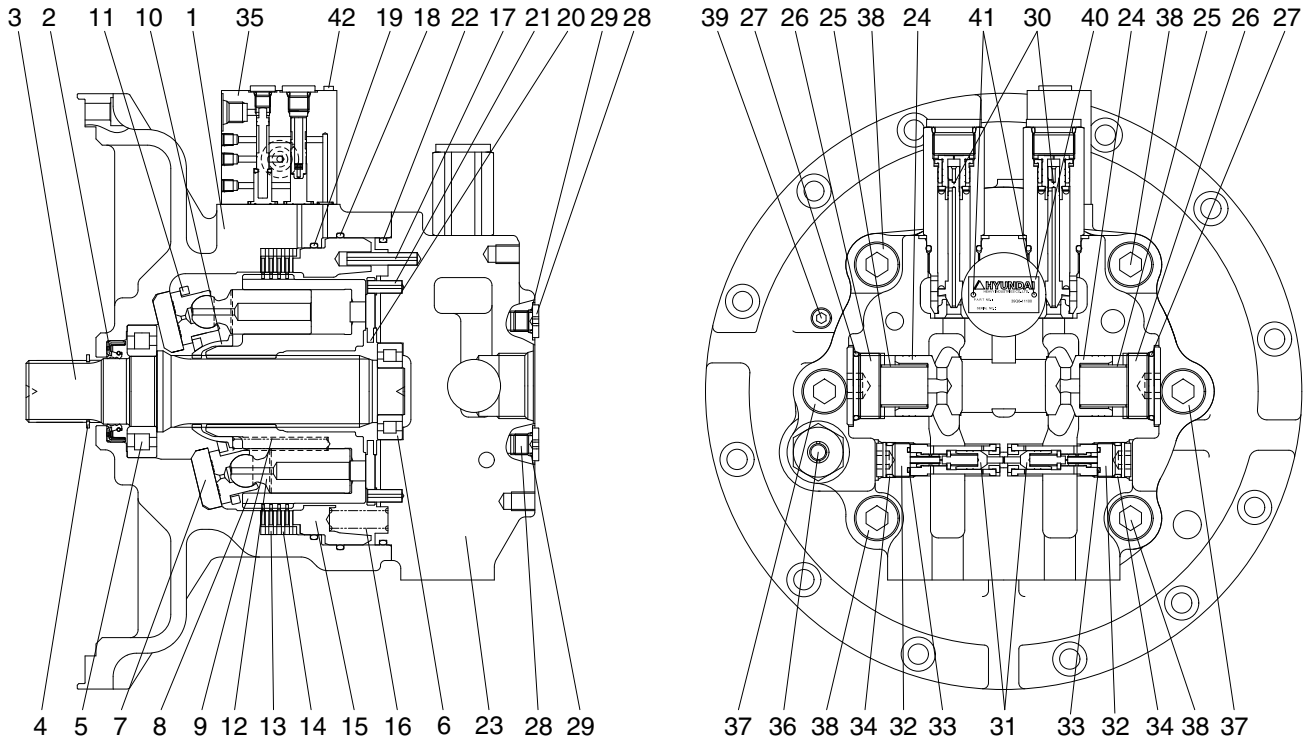
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



300L2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Needle bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Time delay valve assy
8	Cylinder block	22	O-ring	36	Level gauge
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) DISASSEMBLY

(1) Disassemble drive shaft

① Unloosing socket bolt (42) and disassemble time delay valve assy (35) from casing (1).

2209A8SM51

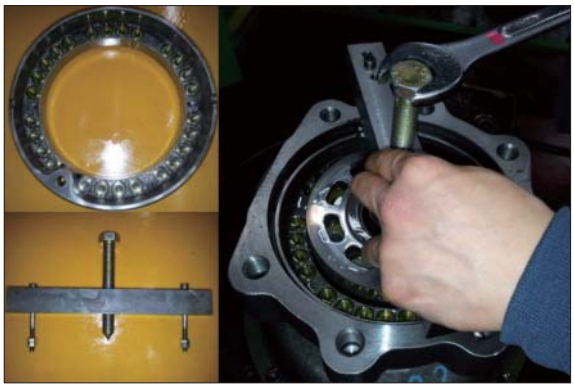
② Disassemble level gauge (36) from casing (1).

2209A8SM52

③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).

2209A8SM53

④ Disassemble brake spring (16) and using a jig, disassemble parking piston (15) from casing (1).



2209A8SM54

⑤ Disassemble respectively cylinder block sub (8), friction plate (13), separate plate (14) from casing (1).

2209A8SM55

⑥ Disassemble swash plate (7) from casing (1).

2209A8SM56

⑦ Using a plier jig, disassemble snap ring (4) from casing (1).

2209A8SM57

⑧ Disassemble shaft assy (3), oil seal (2) and O-ring (18, 22) from casing (1).

2209A8SM58

(2) Disassemble cylinder block sub

① Disassemble piston assy (12) from cylinder block (8).

2209A8SM59

② Disassemble ball guide (10) and spring (9) from cylinder block (8).

- Ball guide × 1EA
- Spring × 9EA

2209A8SM60

(3) Disassemble valve casing sub

① Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).

2209A8SM61

② Using a torque wrench, disassemble relief valve (30) from valve casing (23).

2209A8SM62

③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and reactionless valve assy (31).

2209A8SM63

④ Using a torque wrench, disassemble check valve (24) from valve casing (23).

2209A8SM64

⑤ Disassemble plug (28), O-ring (29) from valve casing (23).

2209A8SM65

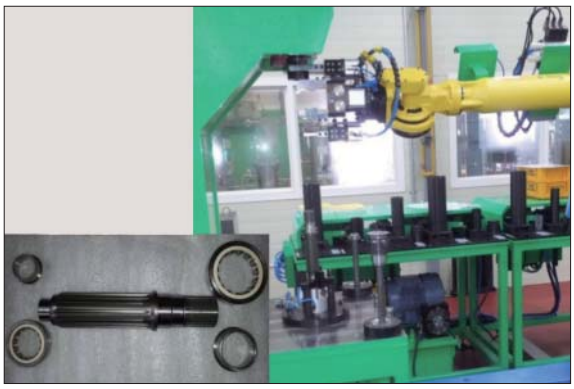
3) ASSEMBLING

(1) Assemble shaft sub

① Put roller bearing (5) on preheater and provide heat to inner race.
(Temperature in conveyor : 120°C for 3~5 minutes)

2209A8SM66

② Using a robot machine, assemble and press preheated roller bearing (5) into shaft (3).



2209A8SM67

(2) Assemble cylinder block sub

① Assemble 9 springs (9) into cylinder block (8).
- Spring × 9EA

2209A8SM68

② Assemble ball guide (10) into cylinder block (8).
- Ball guide × 1EA

2209A8SM69

③ Assemble 9 piston assy (12) into retainer plate (11).

- Piston assy × 9EA
- Retainer plate × 1EA

2209A8SM70

④ Assemble parts of procedure ② and ③.

2209A8SM71

(3) Assemble valve casing sub

① Assemble make up check valve sub

Assemble check valve (24), O-ring (27), plug (26) in that order and then screw it torque wrench.

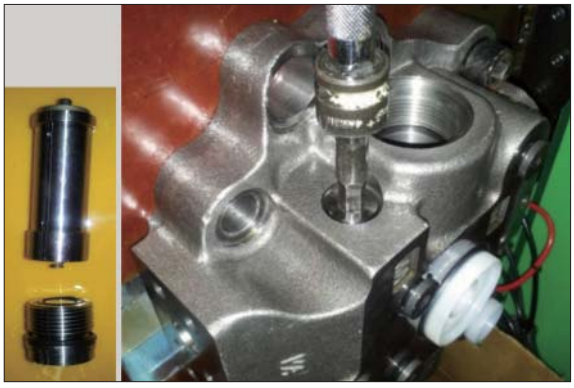
- Make up check valve × 2EA
- Spring × 2EA
- Plug × 2EA
- O-ring × 2EA
- Tightening torque : 38 ± 3.8 kgf · m (275 ± 27.5 lbf · ft)

2209A8SM72

② Assemble reactionless valve assy

Assemble reactionless valve assy (31), plug (32), O-ring (33, 34) in that order and then screw it a torque wrench.

- Reactionless valve assy (31) × 2EA
- Plug (32) × 2EA
- O-ring (33, 34) × 2EA
- Tightening torque : 22 ± 1.5 kgf · m (159 ± 11 lbf · ft)



2209A8SM73

③ Using a torque wrench, assemble relief valve (30) 2 sets into valve casing (23).

- Relief valve (30) × 2EA
- Tightening torque : 18 ± 1.8 kgf · m (130 ± 13 lbf · ft)

2209A8SM74

④ Assemble plug (28) and O-ring (27) into valve casing (23).

- Plug (28) × 3EA
- O-ring (27) × 3EA
- Tightening torque : 4.5 ± 0.4 kgf · m (32.5 ± 2.9 lbf · ft)

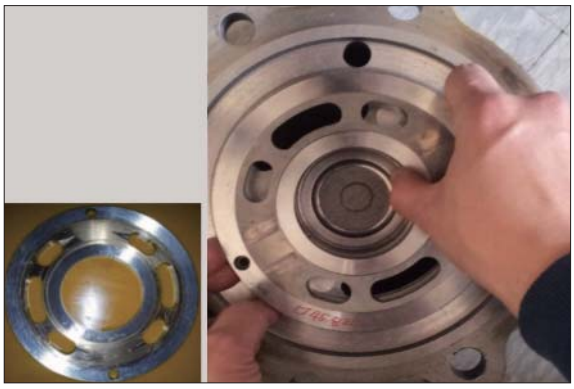
2209A8SM75

⑤ Assemble needle bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).

- Needle bearing (6) × 1EA
- Spring pin (17, 21) × 1EA

2209A8SM76

⑥ Apply some grease valve plate (20) and assemble it into valve casing (23).



2209A8SM77

(4) Assemble drive shaft sub

① Using a jig, assemble oil sealing (2) into casing (1).

2209A8SM78

② Fit shaft sub (shaft+roller bearing) into casing (1).

2209A8SM79

③ Using a plier jig, assemble snap ring (4) to shaft (3).

· Snap ring×1EA

2209A8SM80

④ Apply some grease swash plate (7) and assemble it into casing (1).

· Swash plate×1EA

2209A8SM81

⑤ Insert O-ring (18, 19) into casing (1).
- O-ring (18)×1EA
- O-ring (19)×1EA

2209A8SM82

⑥ Assemble cylinder block (8) into casing (1).

2209A8SM83

⑦ Assemble separate plate (14) and friction plate (13) 4 sets into casing (1) and fit parking piston (15) into casing (1) by a jig or a press.
- Separate plate×4EA
- Friction plate×4EA
- Parking piston×1EA

2209A8SM84

⑧ Assemble spring (16) into parking piston (15).
- Spring×26EA

2209A8SM85

⑨ Lift up valve casing (23) on casing (1) by a crane and assemble it with socket bolts (37, 38).

· Tightening torque : 33±3.3 kgf · m (239±23.9 lbf · ft)

2209A8SM86

⑩ Assemble level gauge (36) and plug (39) into casing (1).

· Tightening torque (36) : 15±1.0 kgf · m (108.5±7.2 lbf · ft)

· Tightening torque (39) : 3±0.3 kgf · m (21.7±2.2 lbf · ft)

2209A8SM87

⑪ Assemble time delay valve assy (35) into valve casing (23) with socket bolt (42).

· Time delay valve×1EA

· Socket bolt×3EA

· Tightening torque (42) : 1.3±0.1 kgf · m (9.4±0.72 lbf · ft)

2209A8SM88

⑫ **Air pressing test**

Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure : 2 kgf/cm²).

2209A8SM89

⑬ **Leakage check**

Place motor on a bench tester and after cleaning motor by color check No.1, paint No.3 and be sure of leakage.

2209A8SM90

⑭ **Mount test bench**

Mounting motor a test bench, test the availability of each part.

2209A8SM91

SWING DEVICE (MACHINE SERIAL NO. : #0115-)

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Disconnect hose assembly (2).

(5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).

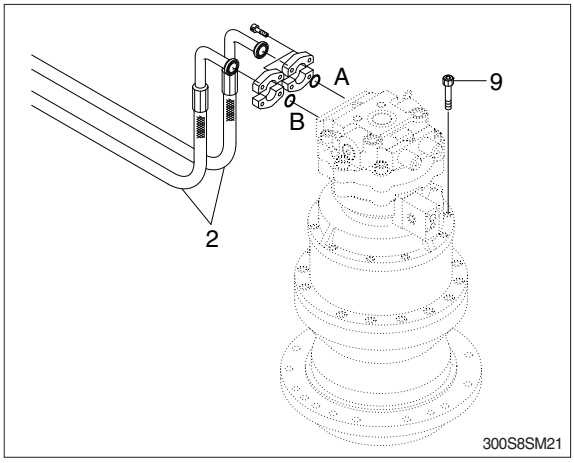
(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).

· Motor device weight : 61 kg (135 lb)

· Tightening torque : 57.9±5.8 kgf·m (419±42.0 lbf·ft)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.



2) INSTALL

(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

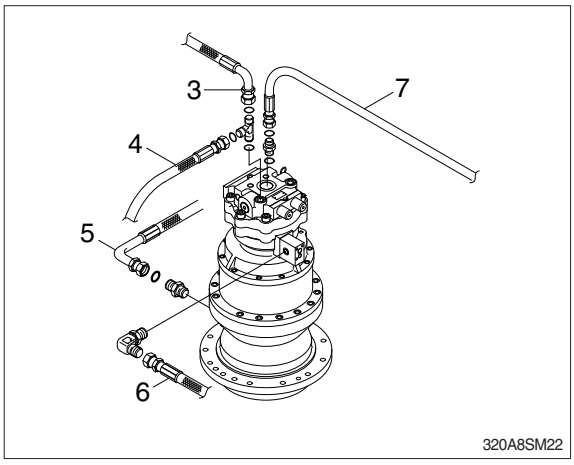
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

④ Start the engine, run at low idling and check oil come out from plug.

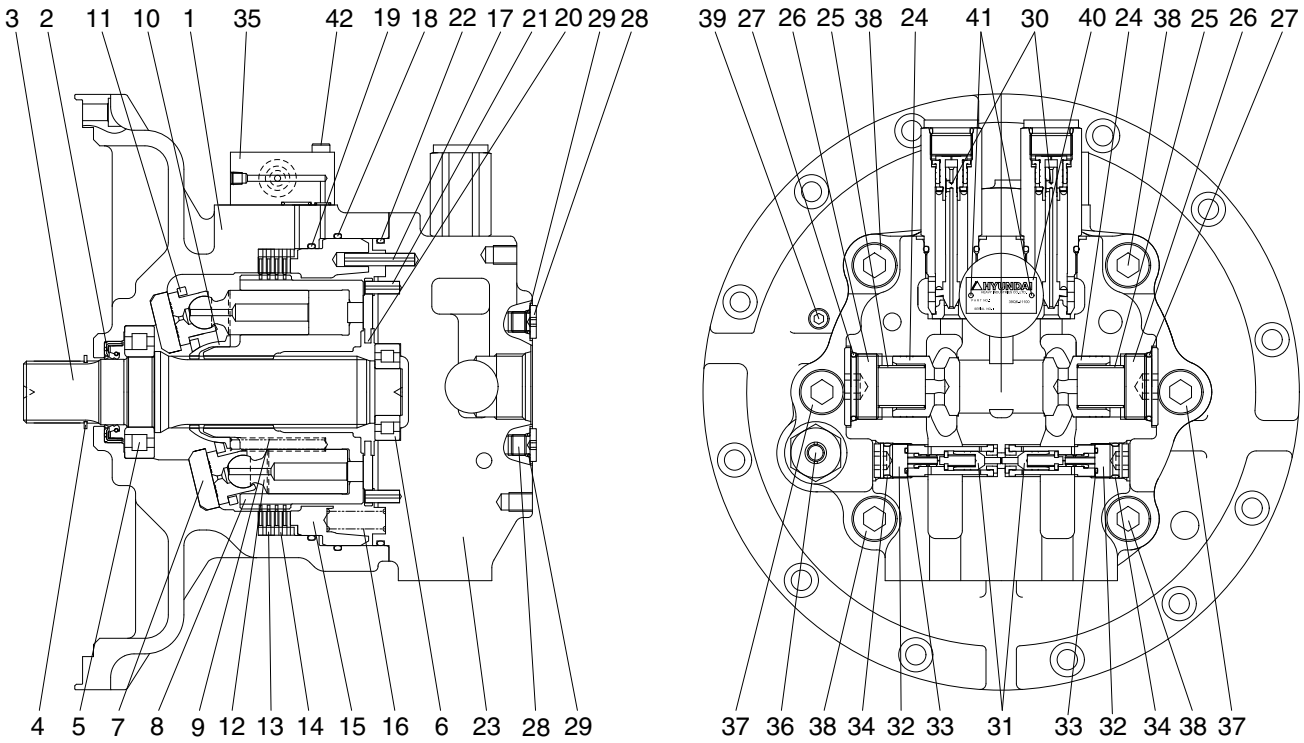
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



320A2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Roller bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Port block assy
8	Cylinder block	22	O-ring	36	Level gauge
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) DISASSEMBLY

(1) Disassemble drive shaft

① Unloosing socket bolt (42) and disassemble port block assy (35) from casing (1).

2209A8SM51

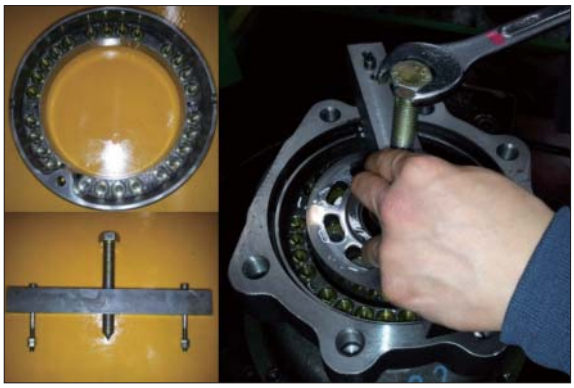
② Disassemble level gauge (36) from casing (1).

2209A8SM52

③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).

2209A8SM53

④ Disassemble brake spring (16) and using a jig, disassemble parking piston (15) from casing (1).



2209A8SM54

⑤ Disassemble respectively cylinder block sub (8), friction plate (13), separate plate (14) from casing (1).

2209A8SM55

⑥ Disassemble swash plate (7) from casing (1).

2209A8SM56

⑦ Using a plier jig, disassemble snap ring (4) from casing (1).

2209A8SM57

⑧ Disassemble shaft assy (3), oil seal (2) and O-ring (18, 22) from casing (1).

2209A8SM58

(2) Disassemble cylinder block sub

① Disassemble piston assy (12) from cylinder block (8).

2209A8SM59

② Disassemble ball guide (10) and spring (9) from cylinder block (8).

- Ball guide × 1EA
- Spring × 9EA

2209A8SM60

(3) Disassemble valve casing sub

① Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).

2209A8SM61

② Using a torque wrench, disassemble relief valve (30) from valve casing (23).

2209A8SM62

③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and reactionless valve assy (31).

2209A8SM63

④ Using a torque wrench, disassemble check valve (24) from valve casing (23).

2209A8SM64

⑤ Disassemble plug (28), O-ring (29) from valve casing (23).

2209A8SM65

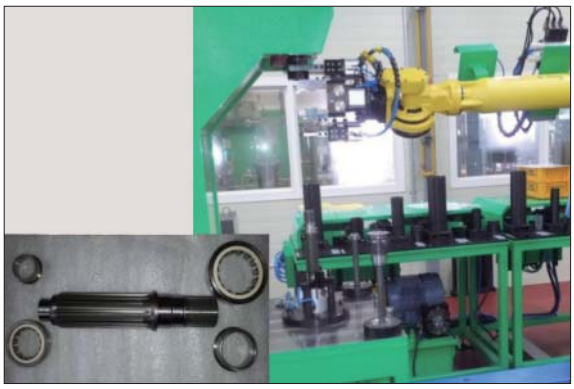
3) ASSEMBLING

(1) Assemble shaft sub

① Put roller bearing (5) on preheater and provide heat to inner race.
(Temperature in conveyor : 120°C for 3~5 minutes)

2209A8SM66

② Using a robot machine, assemble and press preheated roller bearing (5) into shaft (3).



2209A8SM67

(2) Assemble cylinder block sub

① Assemble 9 springs (9) into cylinder block (8).
- Spring × 9EA

2209A8SM68

② Assemble ball guide (10) into cylinder block (8).
- Ball guide × 1EA

2209A8SM69

③ Assemble 9 piston assy (12) into retainer plate (11).

- Piston assy × 9EA
- Retainer plate × 1EA

2209A8SM70

④ Assemble parts of procedure ② and ③.

2209A8SM71

(3) Assemble valve casing sub

① Assemble make up check valve sub

Assemble check valve (24), O-ring (27), plug (26) in that order and then screw it torque wrench.

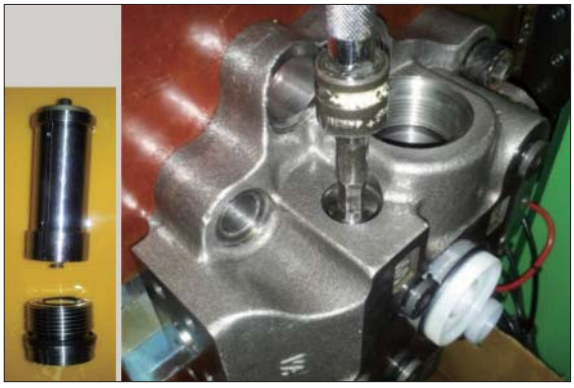
- Make up check valve × 2EA
- Spring × 2EA
- Plug × 2EA
- O-ring × 2EA
- Tightening torque : 38 ± 3.8 kgf · m (275 ± 27.5 lbf · ft)

2209A8SM72

② Assemble reactionless valve assy

Assemble reactionless valve assy (31), plug (32), O-ring (33, 34) in that order and then screw it a torque wrench.

- Reactionless valve assy (31) × 2EA
- Plug (32) × 2EA
- O-ring (33, 34) × 2EA
- Tightening torque : 22 ± 1.5 kgf · m (159 ± 11 lbf · ft)



2209A8SM73

③ Using a torque wrench, assemble relief valve (30) 2 sets into valve casing (23).

- Relief valve (30) × 2EA
- Tightening torque : 18 ± 1.8 kgf · m (130 ± 13 lbf · ft)

2209A8SM74

④ Assemble plug (28) and O-ring (27) into valve casing (23).

- Plug (28) × 3EA
- O-ring (27) × 3EA
- Tightening torque : 4.5 ± 0.4 kgf · m (32.5 ± 2.9 lbf · ft)

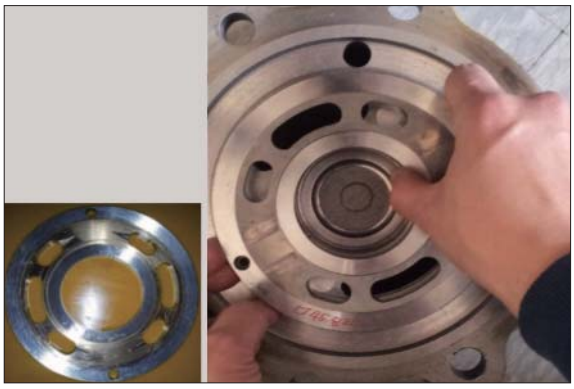
2209A8SM75

⑤ Assemble roller bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).

- Roller bearing (6) × 1EA
- Spring pin (17, 21) × 1EA

2209A8SM76

⑥ Apply some grease valve plate (20) and assemble it into valve casing (23).



2209A8SM77

(4) Assemble drive shaft sub

① Using a jig, assemble oil sealing (2) into casing (1).

2209A8SM78

② Fit shaft sub (shaft+roller bearing) into casing (1).

2209A8SM79

③ Using a plier jig, assemble snap ring (4) to shaft (3).

· Snap ring×1EA

2209A8SM80

④ Apply some grease swash plate (7) and assemble it into casing (1).

· Swash plate×1EA

2209A8SM81

⑤ Insert O-ring (18, 19) into casing (1).
- O-ring (18) × 1EA
- O-ring (19) × 1EA

2209A8SM82

⑥ Assemble cylinder block (8) into casing (1).

2209A8SM83

⑦ Assemble separate plate (14) and friction plate (13) 4 sets into casing (1) and fit parking piston (15) into casing (1) by a jig or a press.
- Separate plate × 4EA
- Friction plate × 4EA
- Parking piston × 1EA

2209A8SM84

⑧ Assemble spring (16) into parking piston (15).
- Spring × 26EA

2209A8SM85

⑨ Lift up valve casing (23) on casing (1) by a crane and assemble it with socket bolts (37, 38).

· Tightening torque : 33±3.3 kgf · m (239±23.9 lbf · ft)

2209A8SM86

⑩ Assemble level gauge (36) and plug (39) into casing (1).

· Tightening torque (36) : 15±1.0 kgf · m (108.5±7.2 lbf · ft)

· Tightening torque (39) : 3±0.3 kgf · m (21.7±2.2 lbf · ft)

2209A8SM87

⑪ Assemble port block assy (35) into valve casing (23) with socket bolt (42).

· Port block×1EA

· Socket bolt×3EA

· Tightening torque (42) : 1.3±0.1 kgf · m (9.4±0.72 lbf · ft)

2209A8SM88

⑫ **Air pressing test**

Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure : 2 kgf/cm²).

2209A8SM89

⑬ **Leakage check**

Place motor on a bench tester and after cleaning motor by color check No.1, paint No.3 and be sure of leakage.

2209A8SM90

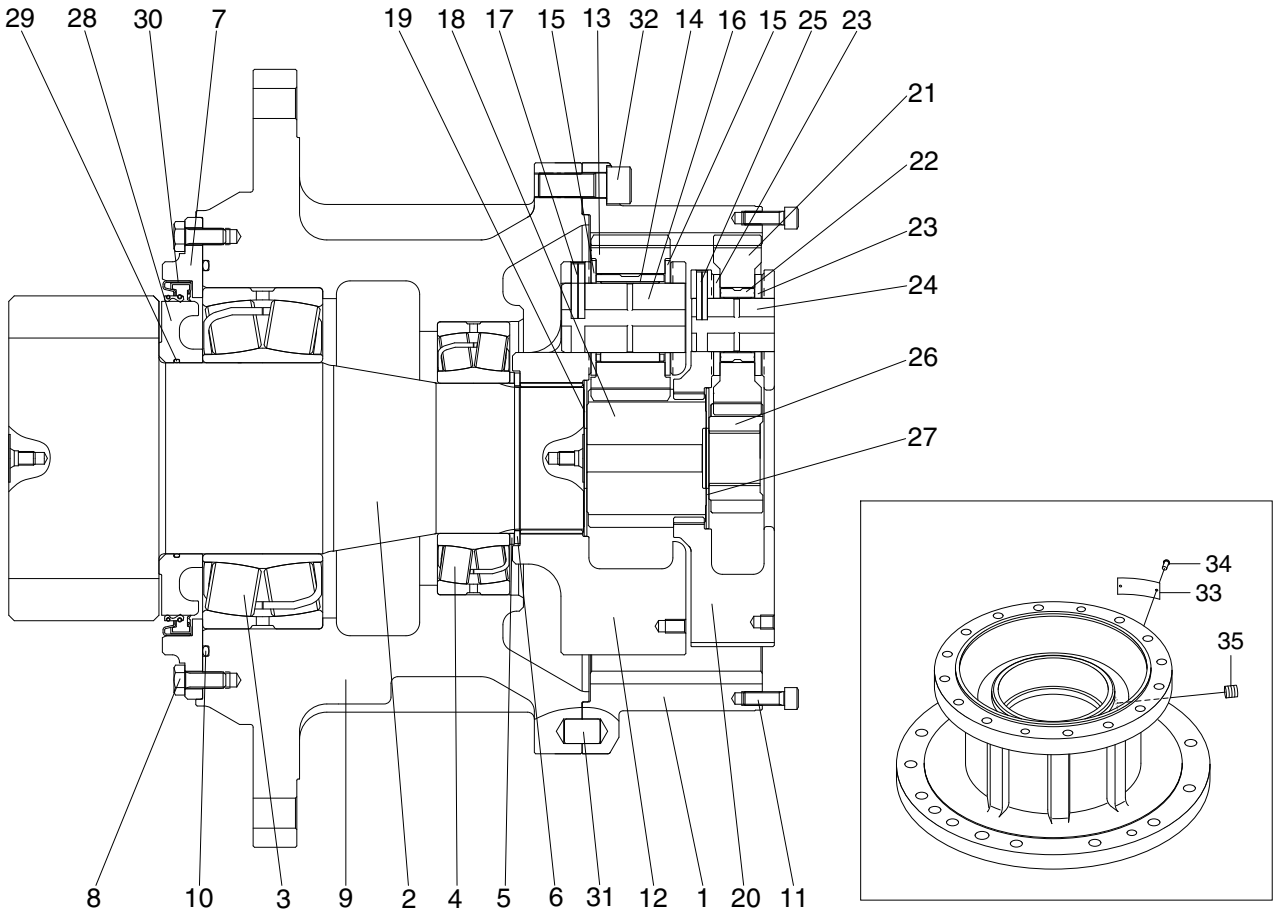
⑭ **Mount test bench**

Mounting motor a test bench, test the availability of each part.

2209A8SM91

3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



300L2SM03

1	Ring gear	13	Planetary gear 2	25	Spring pin 1
2	Drive shaft	14	Needle bearing 2	26	Sun gear 1
3	Bearing	15	Thrust washer 2	27	Thrust plate 1
4	Bearing	16	Carrier pin 2	28	Sleeve
5	Thrust plate	17	Spring pin 2	29	O-ring
6	Snap ring	18	Sun gear 2	30	Oil seal
7	Cover	19	Thrust plate 2	31	Parallel pin
8	Hex head bolt	20	Carrier 1	32	Hex socket head bolt
9	Casing	21	Planetary gear 1	33	Name plate
10	O-ring	22	Needle bearing 1	34	Rivet
11	Hex socket head bolt	23	Thrust washer 1	35	Plug
12	Carrier 2	24	Carrier pin 1		

2) DISASSEMBLY REDUCTION GEAR

(1) Preparation

① The reduction gear removed from machine is usually covered with mud.
Wash out side of reduction gear and dry it.

② Setting reduction gear on work stand for disassembling.

③ Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.

⚠ Take great care not to pinch your hand between parts while disassembling not let fall parts on your foot while lifting them.

(2) Disassemble the swing motor

① Loosen the hex wrench bolt (11, M10), and remove the swing motor.

300L8SR01

(3) Disassemble the carrier No.1 assy

① Disassemble gear-sun No.1 (26), tightening eye-bolt (M10) to screw holes for disassembly in carrier No.1 (20), then disassemble carrier No.1 assy.

300L8SR02

(4) Disassemble the carrier No.2 assy

① Disassemble gear-sun No.2 (18), tighten eye-bolt (M10) to screw holes for disassembly in carrier No.2 (12), then disassemble carrier No.2 assy.

300L8SR03

(5) Disassemble carrier No.1 assy

① Hold jig to spring pin No.1 (26), then tap jig with a hammer, so that place spring pin in the center of carrier pin No.1 (24).

※ Do not reuse spring pin.
※ Disassemble method of carrier No.2 assy is same.

300L8SR04

② Disassemble carrier pin No.1 (24), then disassemble planetary gear No.1 (21), thrust washer No.1 (23) from the carrier No.1 (20).

300L8SR05

(6) Disassemble the ring gear (1).

① Separate ring gear (1) from casing (9).

※ Separate casing (9) by using the groove area because loctite is spread on joining surface of ring gear (1) and casing (9) to prevent oil leakage.

300L8SR06

(7) Disassemble the drive shaft (2).

① Using the snapring plier, disassemble snap ring (6),then disassemble thrust plate (5).

300L8SR07

② Turn casing (9) over to face pinion gear upward. Then unscrew hex.head bolt (8) 12ea by using the tool.

300L8SR08

③ Disassemble drive shaft sub assy by using the press machine.

※ The drive shaft sub assy fall all together, so becareful when removing it.

300L8SR09

④ Disassemble sph. roller bearing (3), cover (7), oil seal (30), and sleeve (28) from the drive shaft (2).

※ Do not reuse oil seal (30).

300L8SR10

(8) Separate sph. roller bearing (4) from casing (9) by using the press machine.

300L8SR11

3) ASSEMBLY REDUCTION GEAR

(1) Even though assembly is accomplished by reversing disassembly steps, be careful of the following.

① Repair the damaged part when disassembling, prepare parts for the exchange in advance.

② All parts should be cleaned with cleaner, and dried with compressed air.

③ Sliding surface, O-ring, bearing and oil seal should be lubricated with clean hydraulic oil, prior to final assembly.

④ Replacement O-ring and oil seal with new parts is generally recommended.

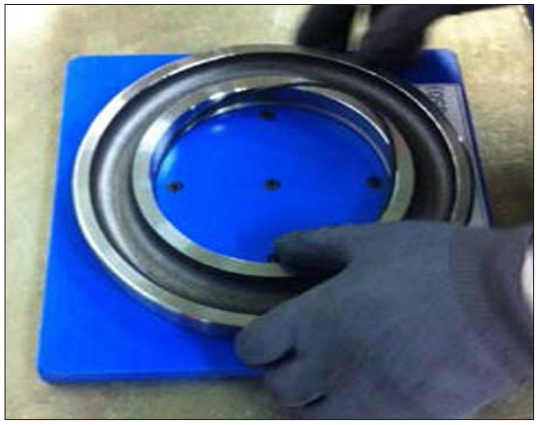
⑤ Use a torque wrench to make sure that assembly fasteners are tightened to specified values.

⑥ When assembling bolt, spread Loctite.

(2) Assemble drive shaft (2).

① After heating sleeve (28) for 5 minutes at 80 ~ 90˚C, assemble O-ring (29).

※ Apply grease to the O-ring (29) to prevent damage.



300L8SR12

② Apply grease to the oil seal (30), placed on the jig and then assemble it to cover (7) by using the press machine.

※ Apply grease to oil seal lip portion.
※ Be careful of damage of oil seal.

300L8SR13

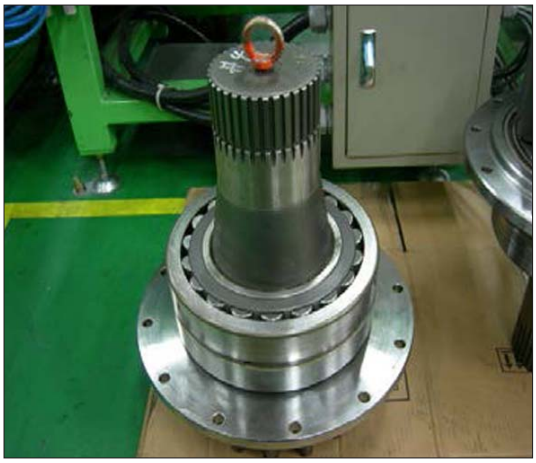
③ Assemble sleeve (28) and cover (7) to drive shaft (2).

※ Be careful of the direction of cover (7), sleeve (28).

※ Be careful of damage of oil seal.

300L8SR14

④ After heating sph. roller bearing (3) for 13 minutes at 80~90˚C and doing demagnetization, then assemble it to drive shaft (2).



300L8SR15

⑤ After assembling O-ring (10) on casing (9), assemble drive shaft sub assy by using a press machine.

300L8SR16

⑥ After spreading loctite #262 on hex.head bolt (8), screw them to fix casing (9) and cover (7).

※ Tightening torque : 8.8±0.9 kgf · m
(63.7±6.51 lbf · ft)

※ Screwing when rust inhibitor is not remove.

300L8SR17

(3) Assemble sph. roller bearing (4).

① Assemble sph. roller bearing (4) to casing (9) by using the press machine.

300L8SR18

② After assembling thrust plate (5), assemble snap ring (6) to assembly groove of drive shaft (2).

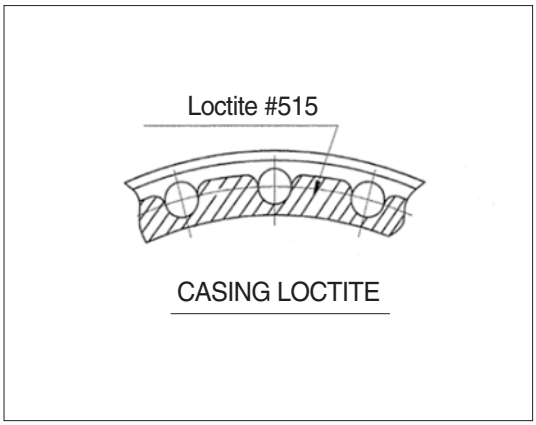
※ Assemble selected thrust plate (5) to make gap (0.1~0.3 mm) between snap ring (6) and sph. roller bearing (4).

300L8SR19

(4) Assemble ring gear (1).

① Spread the loctite #515 on the casing (9) with reference to the right detail view.

※ Loctite should not flow into casing (9).



300L8SR20

② After press-fitting parallel pin (31) with a hammer on the casing (9). Then spreading loctite #262 on hex.head bolt (32), screw them.

※ Tightening torque : 33±3.3 kgf · m
(239±23.9 lbf · ft)

※ Screwing when rust inhibitor is not removed.

300L8SR21

(5) Assemble carrier No.1 assy

① After assembling thrust plate No.1 (27) on carrier No.1 (20), assemble thrust washer No.1 (23), planetary gear No.1 (21), then assemble carrier pin No.1 (24) by using the hammer.

※ Assembly method of carrier No.2 assy is same.

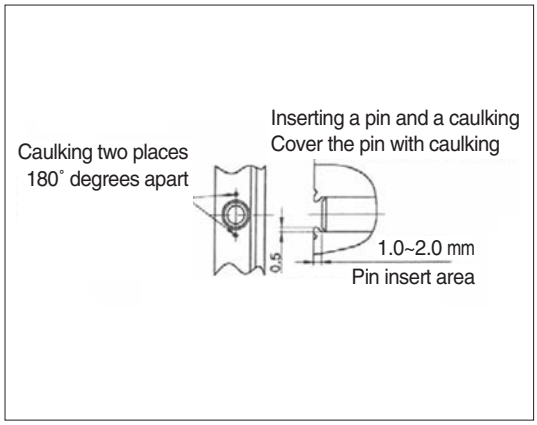
300L8SR22

② Assemble spring pin No.1 (25) to fix carrier No.1 (20) and spring pin No.1 (25) by using the jig.

300L8SR23

③ Caulking is performed on the assembled spring pin unit.

※ To cover pins, implement the caulking in two places that are located direction of 180 degrees around assembled spring pin No.1 (25).



300L8SR24

(6) Assemble carrier No.2 assy

① Lift pre-assembled carrier No.2 assy. Shaking it from side to side, assemble it to ring gear (1) to engage with ring gear (1). Then, press-fit it with polyurethane hammer.

※ Check caulking and rotating state before assembly.

300L8SR25

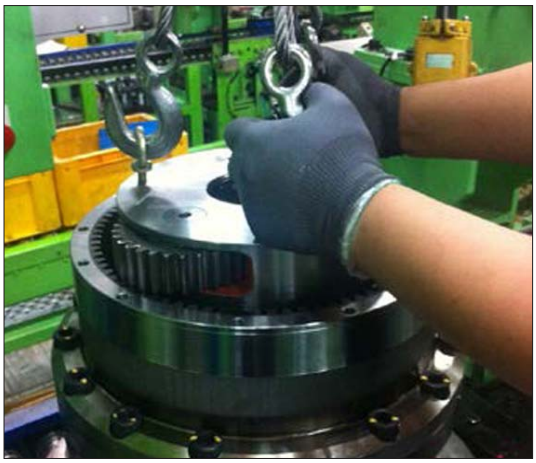
(7) Assemble sun gear No.2 (18).

① Shaking sun gear No.2 (18) from side to side, assemble it to carrier No.2 assy to engage with planetary gear No.2 (13).

300L8SR26

(8) Assemble carrier No.1 assy.
Lift carrier No.1 assy. Shaking it from side to side, assemble it to ring gear (1) to engage with ring gear (1).

※ Check rotating state before assembly.



300L8SR27

(9) Assemble sun gear No.1 (26).

① Shaking sun gear No.1 (26) from side to side, assembleit to engage planetary gear No.1 (21). Then fill with gear oil 11 ℓ (2.9 U.S. gal).

300L8SR28

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90 °and lower it completely to the ground.

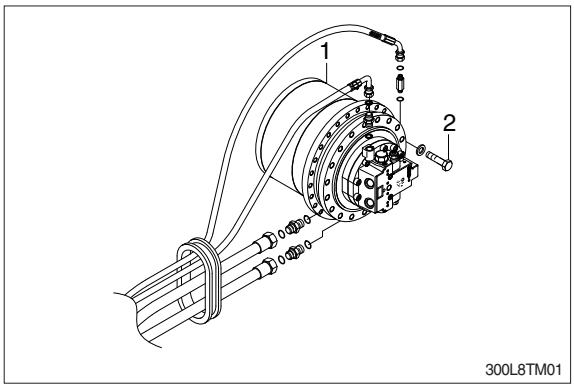
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly.**



(5) Remove the cover.

(6) Remove the hoses.
※ 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 : 443 kg (977 lb)
· Tightening torque : 84±8.0 kgf·m
(608±57.8 lbf·ft)

2) INSTALL

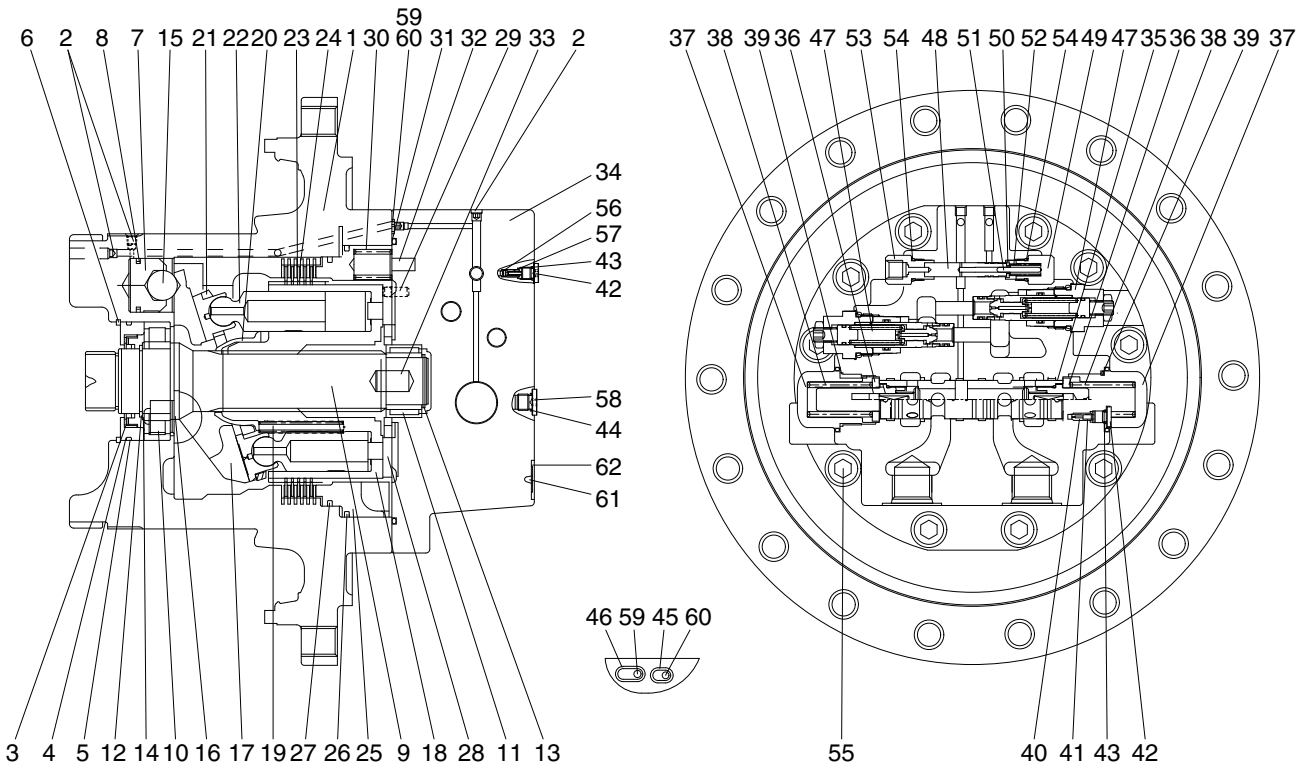
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

1) STRUCTURE



2609A2TM02

1	Casing	22	Piston assy	43	O-ring
2	Plug	23	Friction plate	44	O-ring
3	Oil seal	24	Separated plate	45	O-ring
4	Thrust block	25	Parking piston	46	O-ring
5	O-ring	26	D-ring	47	Relief valve
6	Snap ring	27	D-ring	48	Spool
7	Piston	28	Valve plate	49	Plug
8	Piston seal	29	Parallel pin	50	Spring seat
9	Shaft	30	Spring	51	Parallel pin
10	Cylinder roller bearing	31	O-ring	52	Spring
11	Needle bearing	32	Spring pin	53	Connector
12	Snap ring	33	Parallel pin	54	O-ring
13	Snap ring	34	Rear cover	55	Hexagon socket head bolt
14	Thrust plate	35	Main spool assy	56	Check valve
15	Steel ball	36	Spring seat	57	Spring
16	Pivot	37	Plug	58	Plug
17	Swash plate	38	Spring	59	Restrictor
18	Cylinder block	39	O-ring	60	Restrictor
19	Spring	40	Restrictor	61	Name plate
20	Ball guide	41	Spring	62	Rivet
21	Retainer plate	42	Plug		

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	0.9±0.2	6.51±1.45
3, 4, 38	Orifice screw	NPTF 1/16	4	0.7	5.06
49	Hex socket bolt	M12	10	10	72.33
50	Hex socket bolt	M10	8	6.7	48.46
54	Plug	PF 1/4	19	3.7	26.76
56	Plug	PF 1/2	27	11	79.56
57	Relief valve	HEX 27	1 5/16	34.4±3.4	246±24.6
63	Nut	M16	24	24	173.59
65	Plug	PF 3/8	8	7.5	54.25
70, 72	Hex socket bolt	M16	14	24	173.59
71	Hex socket bolt	M16	14	24	173.59

3. DISASSEMBLING TRAVEL MOTOR

1) GENERAL INSTRUCTIONS

⚠ Combustibles such as white kerosene are used for washing parts.
These combustibles are easily ignited, and could result in fire or injury.
Be very careful when using.

⚠ Internal parts are coated with hydraulic fluid during disassembling and are slippery.
If a part slips out of your hand and fails, it could result in bodily injury or could damage the park.
Be very careful when handling.

(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.

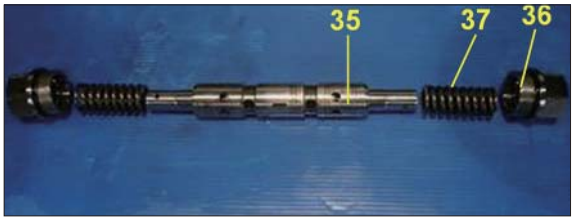
(3) Bofore disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in 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.

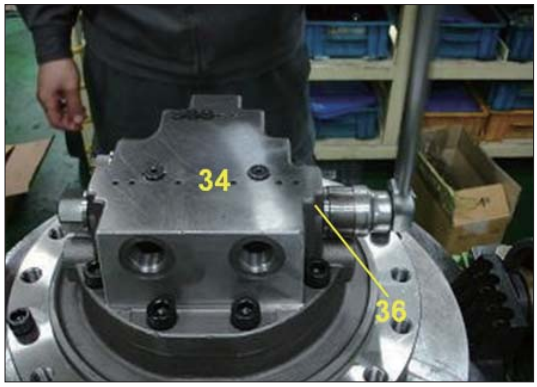
⚠ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

2) DISASSEMBLING

(1) Disassemble main spool cover (36) into rear cover (34) using spanner and torque wrench and then disassemble spring (37), main spool assy (35).



2609A8TM02



2609A8TM03

(2) Disassemble wrench bolt (54) using torque wrench.

2609A8TM04

(3) Take out rear cover (34) into casing (1).

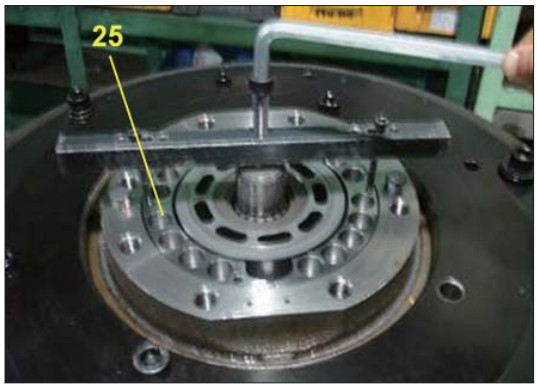
2609A8TM05

(4) Remove brake spring (30, 14EA)

2609A8TM06

(5) Disassemble parking piston (25) using jig.

2609A8TM07



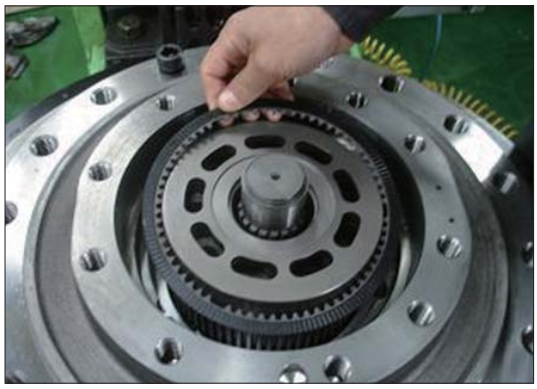
2609A8TM08

(6) Disassemble separate plate (24, 5EA) and friction plate (23, 4EA).

2609A8TM09

2609A8TM10

2609A8TM11



2609A8TM12

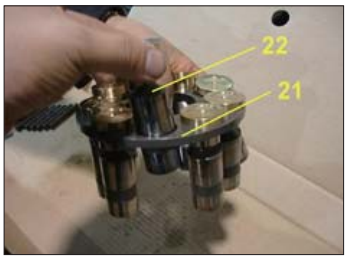
(7) Remove cylinder block kit.
It is easier to work by placing the casing (1) horizontal.

2609A8TM13

(8) Disassemble cylinder block (18), retainer plate (21), piston assy (22), ball guide (20) and spring (19) into cylinder block kit.

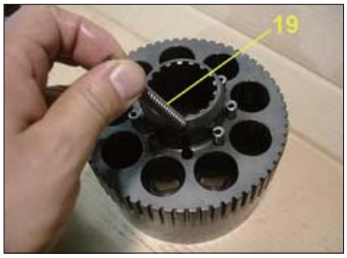
2609A8TM14

2609A8TM15



2609A8TM16

2609A8TM17



2609A8TM18

(9) Disassemble swash plate (17) into casing (1).

2609A8TM19

2609A8TM20

(10) Disassemble steel ball (15), swash piston (7) into casing (1).

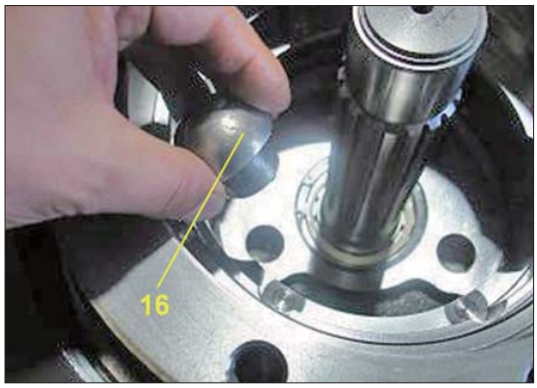
※ **Hole in the Casing(1) of two speed line is decomposed by injecting air.**

2609A8TM21

2609A8TM22

2609A8TM23

(11) Disassemble pivot (16, 2EA) into casing (1).



2609A8TM24

(12) Disassemble snap ring (6) using pliers.

2609A8TM25

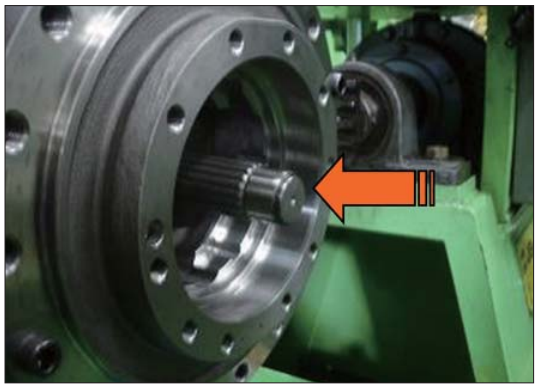
(13) Disassemble trust block (4) and oil-seal (3) into casing (1).

2609A8TM26

2609A8TM27

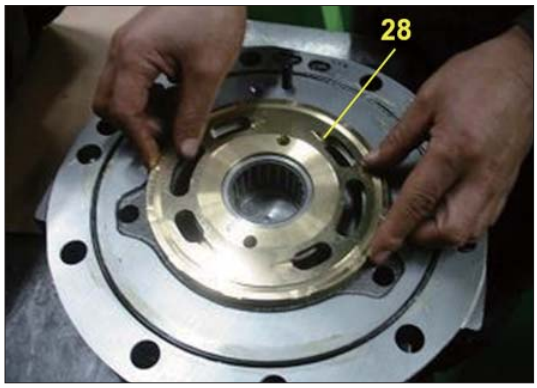
(14) In the casing (1), the arrow part of the shaft (8) using a rubber mallet taps and then disassemble the shaft (8) and bearing-roller (10) to the other side.

2609A8TM28



2609A8TM29

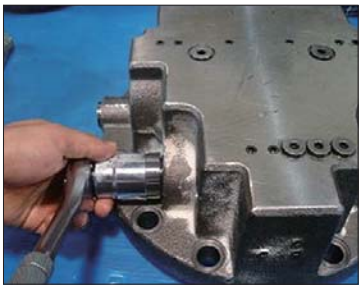
(15) Disassemble valve plate (28) into rear cover (34).

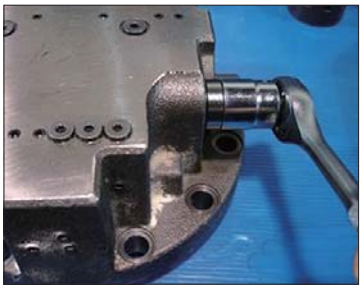


2609A8TM30

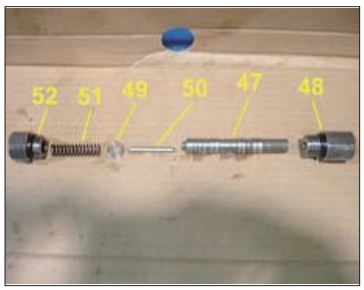
(16) Disassemble relief valve (46, 2EA) into rear cover (34) using the torque wrench.

2609A8TM31

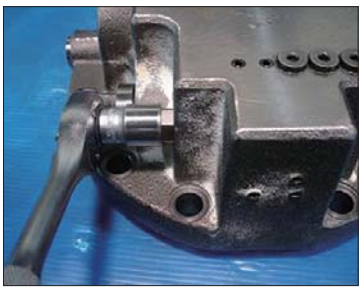

2609A8TM32


2609A8TM33

(17) Disassemble plug (48), connector (52) into rear cover (34) using the torque wrench and then disassemble spring (51), spring seat (49), parallel pin (50) and spool (47) in regular sequence.



2609A8TM34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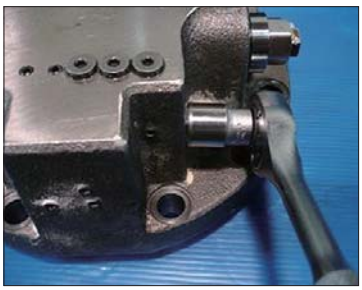
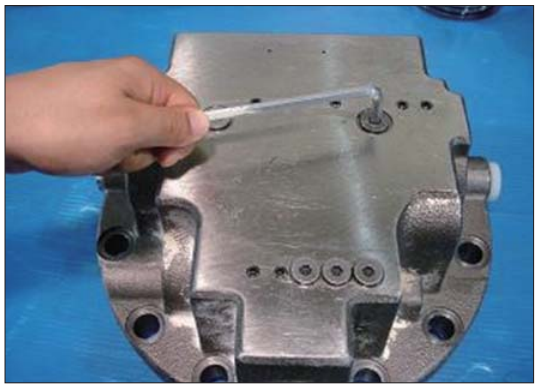
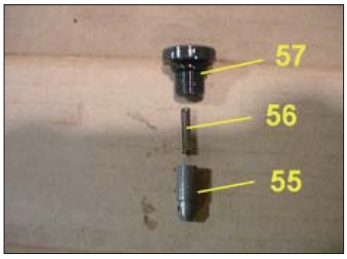

2609A8TM36

(18) Disassemble plug (57) into rear cover (34).

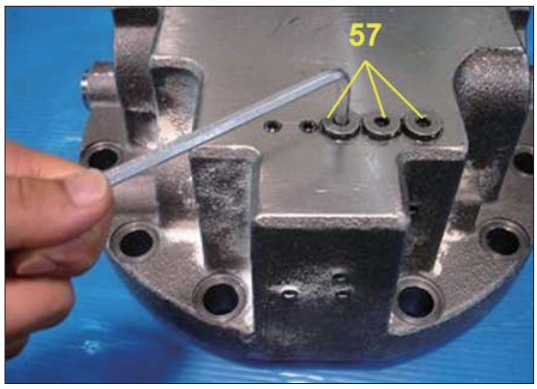


2609A8TM37

(19) Disassemble plug (57) into rear cover (34) and then disassemble spring (56), check valve (55) into rear cover (34) in regular sequence.



2609A8TM38



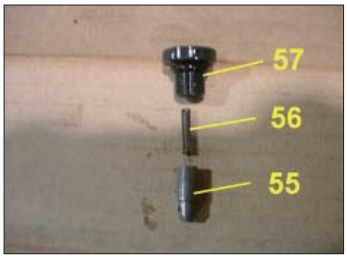
2609A8TM39

4. REASSEMBLING TRAVEL MOTOR

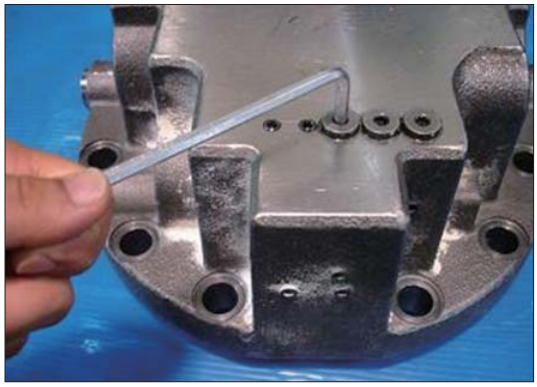
1) ASSEMBLING

- REAR COVER ASSY

(1) Assemble check valve (55), spring (56) into rear cover (34) and then assemble plug (57) using L-wrench.

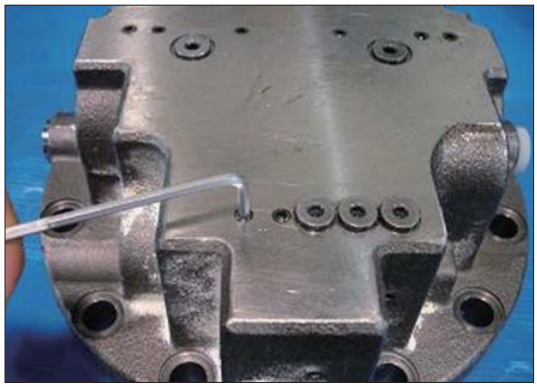


2609A8TM40

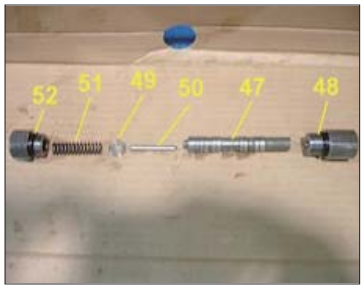

2609A8TM41

(2) Apply loctite #242 on the NPTF 1/16 plug (2) and then assemble 12-NPTF 1/16 Plug (2) into rear cover(34).

2609A8TM42


2609A8TM43

(3) Assemble spool (47), parallel pin (50), spring seat (49) and spring (51) into rear cover (34) in regular sequence and then assemble plug (48) and connector (52).



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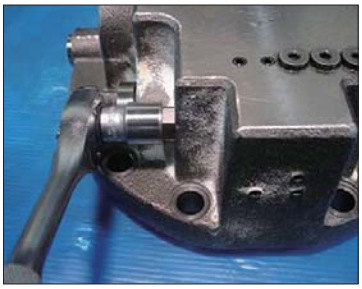
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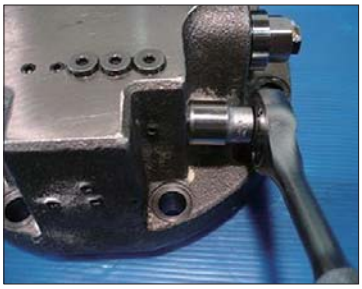
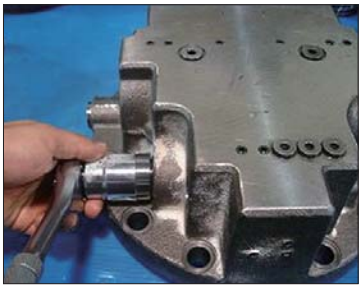

2609A8TM46

(4) Assemble relief valve (42, 2EA) into rear cover (34).

2609A8TM47


2609A8TM48

2609A8TM49

(5) Press needle bearing (11) into rear cover (34) using jig.

2609A8TM50

(6) Assemble spring pin (32) and parallel pin (29) using small hammer.

2609A8TM51

(7) Assemble valve plate (28) into rear cover (34).

※ **Apply grease to the valve plate contact and then assemble valve plate into rear cover (34).**

2609A8TM52

(8) Apply grease to the O-ring and then assemble O-ring into rear cover (34).

2609A8TM53

(9) Install casing (1) into assembling jig.

2609A8TM54

(10) Assemble the heated Roller Bearing(10) onto the Shaft(8).

① The temperature of the Roller Bearing : 100˚C.
Using tool : Heater.

※ **Be careful not to damage the sliding surface for the Oil seal on the shaft.**

2609A8TM55

2609A8TM56

2609A8TM57

(11) Assemble the heated needle bearing inner ring on the shaft (8).

2609A8TM58

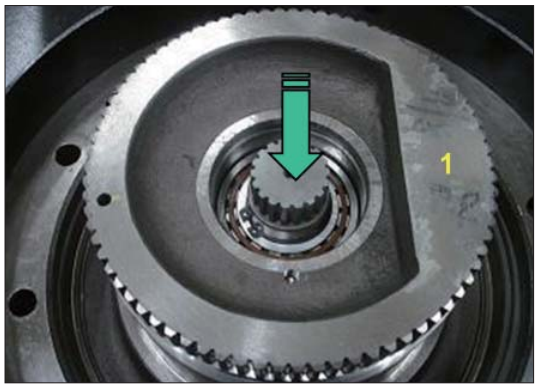
2609A8TM59

(12) Assemble snap ring (13) into Shaft (8) using pliers.

2609A8TM60

(13) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.

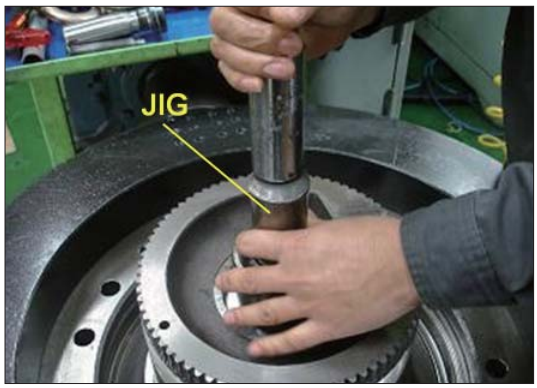
2609A8TM61



2609A8TM62

(14) Assemble oil seal(3) into trust block (4) with a assembling jig and press it into casing (1). Caution the direction of oil seal (3).

2609A8TM63



2609A8TM64

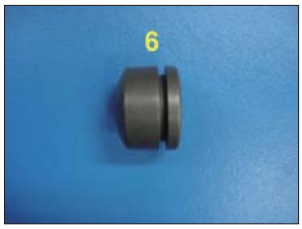
(15) Assemble snap ring(6) into casing(1) using pliers.

2609A8TM65

(16) Apply the grease to pivot (16, 2EA) and then assemble pivot (16) into casing(1).

2609A8TM66

(17) Warm piston seal (8) and assemble it on swash piston (7) and then bind the piston seal (8) with a bend for a minute.
Remove the bend and assemble it into casing (1).

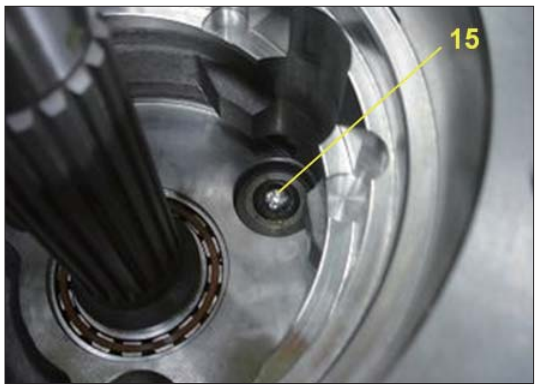


2609A8TM67

2609A8TM68

(18) Apply the grease to steel ball(15) and then assemble steel ball(15) into casing(1).

2609A8TM69



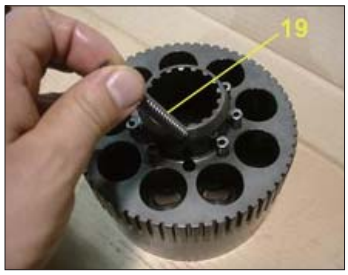
2609A8TM70

(19) Apply the grease to swash plate(17) and then assemble swash plate(17) into casing(1).

2609A8TM71

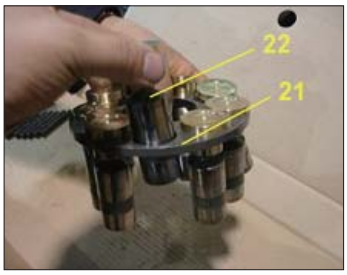
2609A8TM72

(20) Assemble spring (19), ball guide((20), retainer plate (21), piston assy (22) into cylinder block (18) in regular sequence.



2609A8TM73

2609A8TM74



2609A8TM75

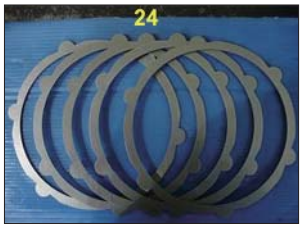
2609A8TM76

2609A8TM77

(21) Stant the casing (1) and then assemble cylinder block kit into casing (1).

2609A8TM78

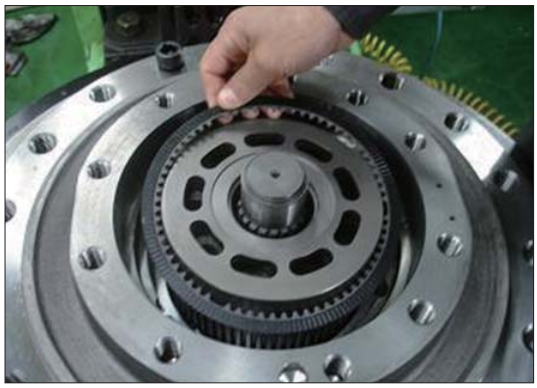
(22) Assemble separated plate (24), friction plate (23) into cylinder block in regular sequence.
Friction plate : 4EA
Separated plate : 5EA



2609A8TM79

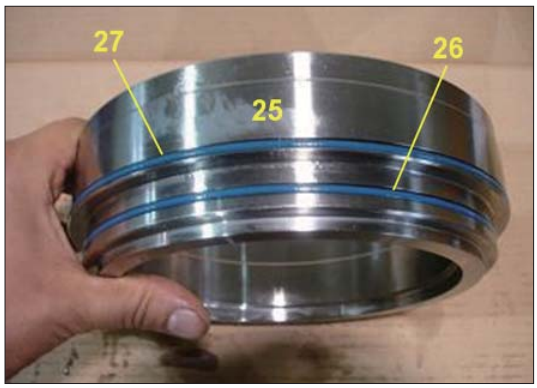
2609A8TM80

2609A8TM81



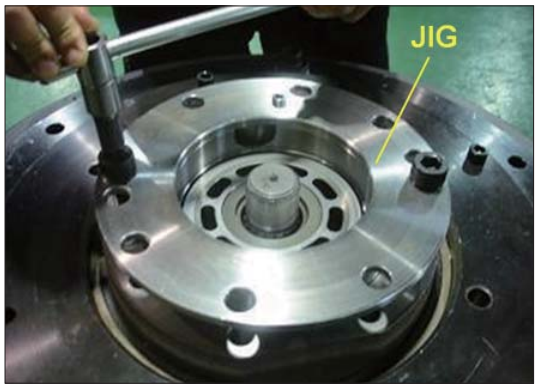
2609A8TM82

(23) Apply the grease to D-ring (26, 27) and then assemble D-ring (26, 27) into parking piston (25).



2609A8TM83

(24) Assemble parking piston into casing using jig.



2609A8TM84

(25) Assemble brake spring (30, 18EA).

2609A8TM85

(26) Put on the rear cover (34) on the casing (1).

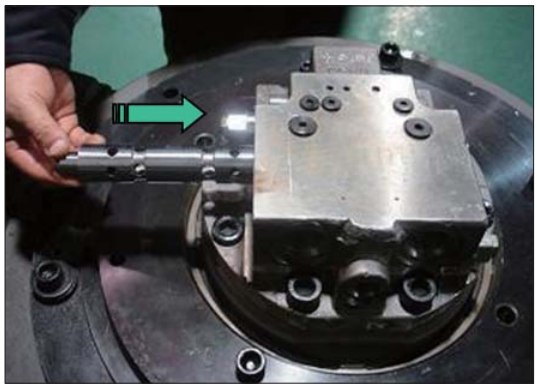
2609A8TM86

(27) Assemble rear cover (34) into casing (1) and then tighten the wrench bolt (54, 55) using torque wrench.

2609A8TM87

(28) Assemble main spool assy (35) into rear cover (34) after checking the direction to be correct.

2609A8TM88

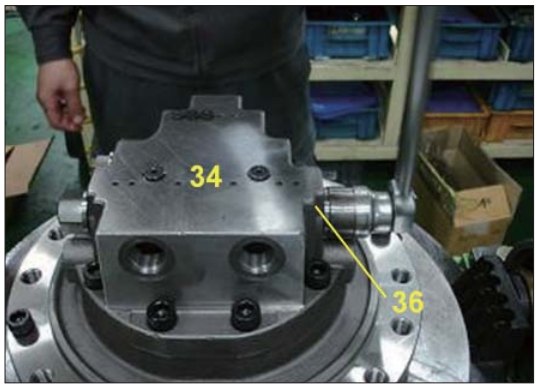


2609A8TM89

(29) Assemble spring (37), plug (36) into rear cover (34) in regular sequence and then plug (36) into rear cover (34) using torque wrench.

2609A8TM90

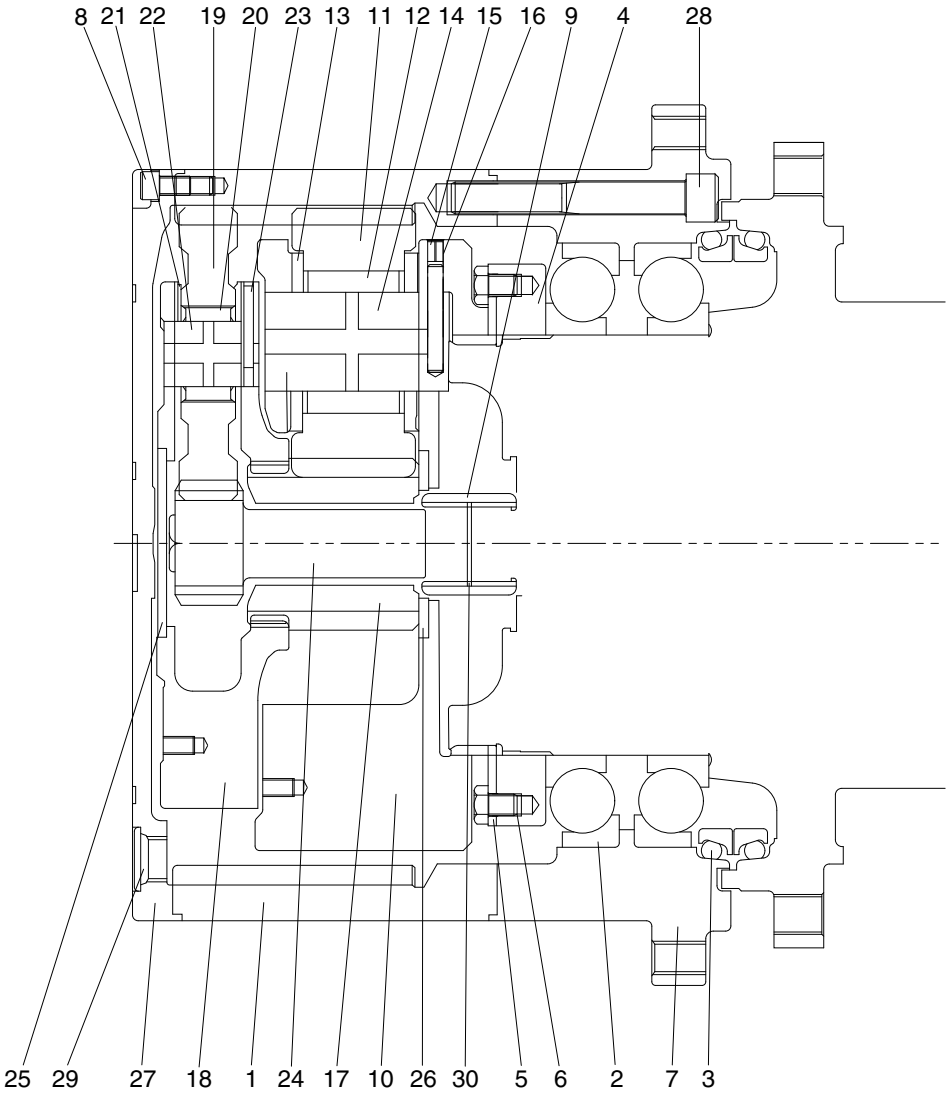
2609A8TM91



2609A8TM92

5. REDUCTION GEAR

1) STRUCTURE



2609A2TM03

1	Gear ring	11	Planetary gear 2	21	Thrust washer 1
2	Ball bearing	12	Needle bearing 2	22	Carrier pin 1
3	Floating seal assy	13	Thrust washer 2	23	Spring pin 1
4	Nut ring	14	Carrier pin 2	24	Sun gear 1
5	Lock plate	15	Spring pin 2	25	Thrust plate
6	Hexagon socket head bolt	16	Solid pin 2	26	Thrust plate
7	Housing	17	Sun gear 2	27	Cover
8	Hexagon socket head bolt	18	Carrier 1	28	Hexagon socket head bolt
9	Coupling	19	Planetary gear 1	29	Plug
10	Carrier 2	20	Needle bearing 1	30	Snap ring

6. DISASSEMBLING REDUCTION GEAR

1) GENERAL INSTRUCTIONS

⚠ Combustibles such as white kerosene are used for washing parts.
These combustibles are easily ignited, and could result in fire or injury.
Be very careful when using.

⚠ Internal parts are coated with gear oil during disassembling and are slippery.
If a part slips off from your hand and fails, it could result in bodily injury or could damage the park.
Be very careful when handling.

(1) 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) Bofore 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.

⚠ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

2) DISASSEMBLING

(1) Preparation for disassembling

① The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.

② Locate reducer in order for drain port to be at the lowest level loosen taper screw plug of drain port, and drain oil from reduction gear.

※ While oil is still hot, inside of the unit may be pressurized.

⚠ Take care of the hot oil gushing out of the unit when loosening the plug.

③ **Mark for mating**

Put marks on each mating parts when disassembling so as to reassemble correctly as before.

(2) Set the reduction unit on table

① Remove 7/16-14UNC hexagon socket head bolts at 3 places from cover almost equally apart each other, and then install 7/16-14UNC eye bolts.

⚠ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

(3) Removing cover

① Remove 22 socket bolts (7/16-14UNC) those are attached to ring gear.

② Cover is stuck (27) to ring gear (1).
So use sharp chisel for removing cover (27) from ring gear (1).

2609A8TM02

(4) Removing sun gear No.1

Pull sun gear No.1 (24) vertically slow after removing thrust plate (25).

2609A8TM03

(5) Removing carrier No.1 sub assembly

Pull away carrier No.1 (18) with attached eye-bolt (M10) that is assembled to hole on carrier sub-assembly.

2609A8TM04

(6) Removing sun gear No.2

Pull away sun gear No.2 (17) for removing.

2609A8TM05

(7) Deassembleing carrier No.2 sub-assembly

Attach eye-bolt (M10) to the hole of carrier No.2 (10), and remove the carrier No.2 sub-assembly to lift up slowly.

※ Keep horizontal to ground and make sure the eye-bolts to be safe operation.

2609A8TM06

(8) Take away coupling

Take away the coupling (9) from casing (1).

2609A8TM07

(9) Lock plate

Release four hex head bolts (6, M12) and remove lock plate (5).

2609A8TM08

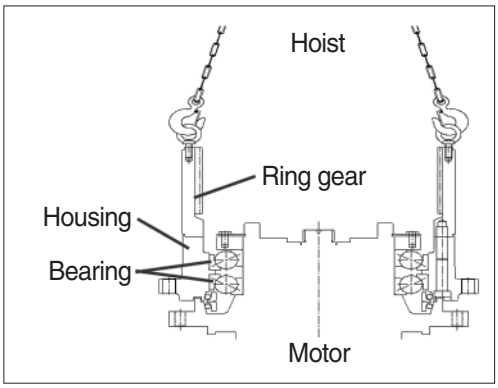
(10) Nut ring

Release nut ring with removing jig.

2609A8TM09

(11) Housing sub-assembly

Lift up housing part slowly with hoist after attaching eye-bolt (7/16-14UNC) on it If you hit softly the center of motor with hammer and particular jig, you can remove the device easily.



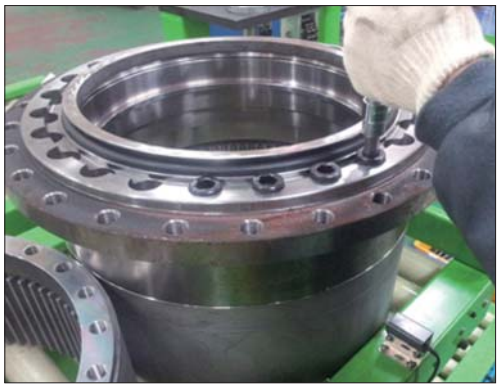
2609A8TM10

(12) Ring gear

① Reverse the housing sub-assembly part with machine, and remove floating seal (3) from the inside.

2609A8TM11

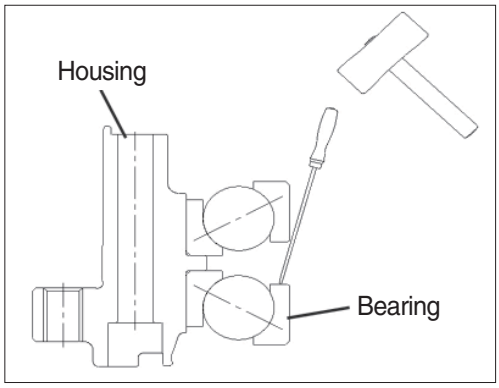
② Release 25 hex wrench bolts (28. M18) and remove ring gear (1) from housing (7).



2609A8TM12

(13) Angular Bearing

Put the housing sub-assembly (7) like this figure. And hit each opposite side of bearing with driver and hammer.



2609A8TM13

(14) Carrier No.1 sub-assembly

① Lay it on deassemblig jig. And remove pin No.1 (22) with press machine.

2609A8TM14

② Then remove planet gear No.1 (19) and thrust washer No.1 (21) from carrier No.1 (18).

2609A8TM15

(15) Carrier No.2 sub-assembly

Same as carrier No.1 (12) sub-asembly.

2609A8TM16

(16) Coupling

Remove snap ring (30) inside coupling (9) with nipper.

2609A8TM17

7. ASSEMBLY REDUTION UNIT

1) GENERAL NOTES

(1) Clean every part by kerosene and dry them by air blow.

(2) Surfaces to be applied by loctite must be decreased by solvent.

(3) Check every part for any abnormal.

(4) Each hexagon socket head bolt should be used with loctite No.242 applied on its threads.

(5) 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.

Gear
- Check if there are pitting or seizure on the tooth surface.
- Check if there are cracks on the root of tooth by die check.

Bearing
- Rotate by hand to see if there are something unusual such as noise or uneven rotation.

Floating seal
- Check flaw or score on sliding surfaces or O-ring.

2) ASSEMBLING CARRIER 1 SUB-ASSY

(1) Put carrier No.1 (18) on the flat table.

(2) Insert needle bearing No.1 (20) in planet gear No.1 (20), and attach 2 thrust washers No.1 (21) on the both side of planet gear No.1. then assemble them in carrier No.1 (18).

※ **When assembling thrust washer, rounded edge-side should be facing casting side of carrier.**

2609A8TM18

(3) Insert pin No.1 (22) into pinhole of carrier correctly.

※ **Insert careful the pin not to scratch thrust washer and needle bearing.**

2609A8TM19

(4) Press spring pin No.1 (23) with jig and strike round spring pinhole (2 symmetrical point) with tool.

※ **After striking, draw the line by marker pen.**
※ **Check swinging conditon of planet gears.**

(5) Press two more pins and spring pins on the same way.

2609A8TM20

3) ASSEMBLING CARRIER 2 SUB-ASSY

(1) Put thrust plate (26) inside of carrier No.2 (10).

2609A8TM21

(2) Insert needle bearing No.2 (12) in planet gear No.2 (11) and attach 2 thrust washers No.2 (13) on the both side of planet gear No.2. Then assemble them in carrier No.2 (10).

※ **When assembling thrust washer, rounded edge-side should be facing casting side of carrier.**

(3) Insert pin No.2 (14) into pinhole of carrier No.2 correctly.

※ **Insert careful pin No.2 not to scratch thrust washer and needle bearing.**

2609A8TM22

(4) Insert solid pin No.2 (16) with pressing jig and insert spring pin No.2 (15) in the same position. When insertion is done, strike inner circle of spring pin (2 symmetrical point) with tool.

※ **After striking, draw the line by marker pen.**
※ **Check the spining condition of planet gear.**

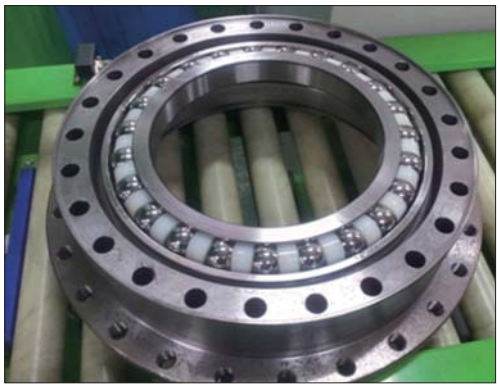
(5) Insert two more pins and spring pins on the same way.

2609A8TM23

4) ANGULAR BEARING

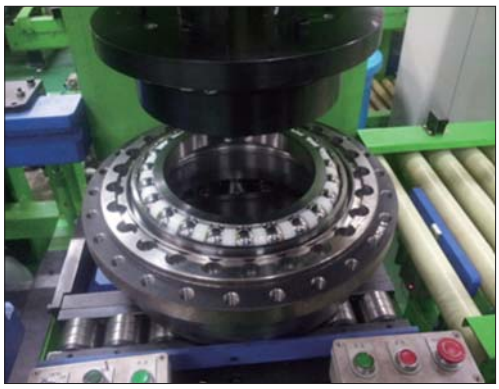
(1) Put the jig on housing (7) and insert angular bearing (2) into it with pressing machine, and turn down the upside of housing (7) by reversing machine.

※ **Check the direction of bearing when inserting it.**



2609A8TM24

(2) Insert angular bearing (2) into reversed housing (7) on the same way.



2609A8TM25

5) ASSEMBLING FLOATING SEAL

(1) Paint alchole on floating seal (3) and polish it.

2609A8TM26

(2) Put floating seal (3) on the right position of housing (3) and insert it by pressing jig.
After complete, check the condition by lifting with hand softly.

※ **Keep clean on surface of floating seal while assembling.**

2609A8TM27

(3) Put the gauge for seal measurement on floating seal (3) and check the horizontal angle by gauge scale.

※ **Two gauge scales should be same. (pass inspection)**

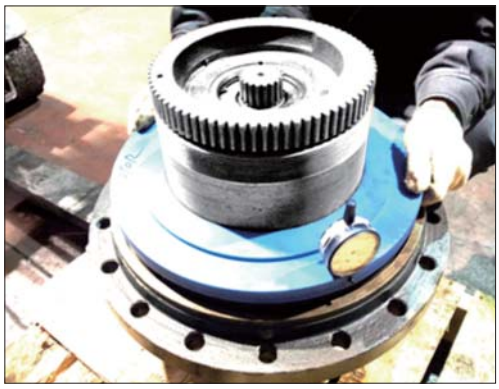
2609A8TM28

(4) Attach floating seal to motor that will be assembled with housing (on the same way to (1), (2))

2609A8TM29

(5) Put the measuring jig on floating seal (3) and check the horizontal angle condition with both gauge scale.

※ **Two gauge scales should be same. (pass inspection)**



2609A8TM30

6) ASSEMBLING RING GEAR

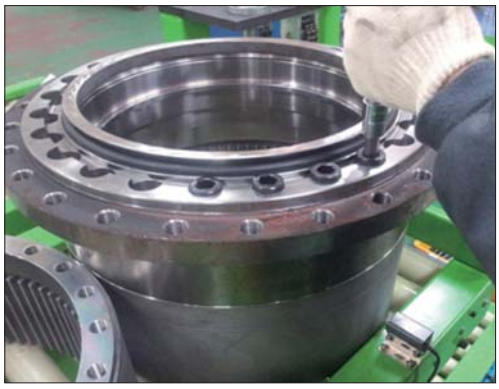
(1) Put ring gear (1) on contact surface (should be upside) of housing (7).

(2) Paint loctite #515 on ring gear (1) and put on housing (7). Then assemble 25 hexwrench bolts (28, M18)

※ **Paint loctite #262 on hex-wrench bolts (28) before assembling.**

※ **Tightening torque : 38.5±3.8 kgf · m (278.5±27.5 lbf · ft)**

※ **Bolts should be assembled with lust preventing oil.**



2609A8TM31

7) ASSEMBLING NUT RING

(1) Put housing (7) sub-assembly upside down (ring gear side is up), and attach it to motor by lifting with hoist. (shaking it lightly)

(2) When housing (7) sub-assembly is set, put nut ring (4) on it, and assemble with jig.

※ **Tightening torque for assembling nut ring : 66±6.0 kgf-m (477.3±43.3 lbf · ft)**

※ **Floating seal should not be damaged or separated while assembling.**

2609A8TM32

8) ASSEMBLING LOCK PLATE

(1) Put lock plate (5) on nut ring (4) to fit to M12 bolt hole. Then assemble 4 he head bolts (6, M12)

※ **Paint loctite #262 on hex-head bolts.**

※ **Tightening torque : 6.05±0.6 kgf · m (43.8±4.3 lbf · ft)**

※ **Bolts should be assembled with lust preventing oil.**

2609A8TM33

9) ASSEMBLING COUPLING

(1) Attach snap ring (3) into coupling (9) with nipper.

2609A8TM34

(2) Put coupling (9) on motor shaft to fit.

2609A8TM35

10) ASSEMBLING NO.2 CARRIER SUB-ASSY

(1) Lift carrier No.2 subassembly and put on ring gear (1), and fit it into internal side of ring gear (1). Then hit urethan hammer to fit.

※ **Check turning and cocking condition before assembling.**

2609A8TM36

11) ASSEMBLING NO.2 SUN GEAR

(1) Insert sun gear No.2 (17) in the middle of carrier No.2 sub assembly and make it fit in carrier No.2.

2609A8TM37

12) ASSEMBLING NO.1 CARRIER SUB-ASSY

(1) Lift carrier No.1 sub-assembly and put it into ring gear (1) and shake carrier No.1 to fit into ring gear.

※ **Check turning and cocking condition before assembling.**

2609A8TM38

13) SWINGING TORQUE INSPECTION

(1) Attach inspection jig before assembling sun gear No.1 (24).

2609A8TM39

(2) Attach torque wrench to the jig, check the torque when it swings.

※ **Swinging torque : below 3.0 kgf · m (21.7 lbf · ft)**

2609A8TM40

14) ASSEMBLING NO.1 SUN GEAR

(1) Remove the jig and wrench after torque inspection complete. And assemble sun gear No.1 (24) with pushing round to fix to the center of carrier No.1

2609A8TM41

15) ASSEMBLING THRUST PLATE

(1) Put thrust plate (25) on carrier No.1 sub assembly. And paint loctite #515 on flat side of ring gear (1).

※ **When assembling thrust washer, rounded edge-side should be facing casting side of carrier.**

2609A8TM42

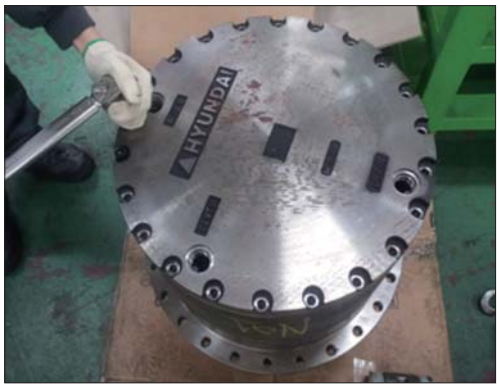
16) ASSEMBLING COVER

(1) Attach cover on ring gear (1) with assembling 22 hex-wrench bolts (8, 7/16-16UNC).

※ **Paint loctite #262 on screw of hex bolts.**

※ **Tightening torque : 8.1±0.8 kgf · m (58.6±5.8 lbf · ft)**

※ **Bolts should be assembled with lust preventing oil.**



2609A8TM43

17) ASSEMBLING OIL INJECTION

(1) Inject the oil (7.8 ℓ / 2.1 U.S. gal) through PF3/4 hole on cover (27).

2609A8TM44

18) ASSEMBLING PLUG

(1) Assemble 3 plugs (29, PF3/4) after oil injection complete.

※ **Tightening torque : 10±1.0 kgf · m (72.3±7.2 lbf · ft)**

2609A8TM45

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90° and lower it completely to the ground.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ Escaping fluid under pressure can penetrate the skin causing serious injury.

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

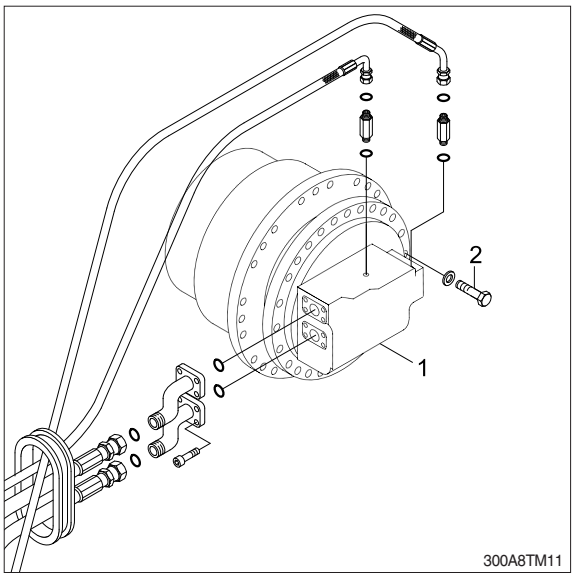
(6) Remove the hoses.

※ 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 : 380 kg (840 lb)
- Tightening torque : 58±6.0 kgf·m (420±43.4 lbf·ft)



2) INSTALL

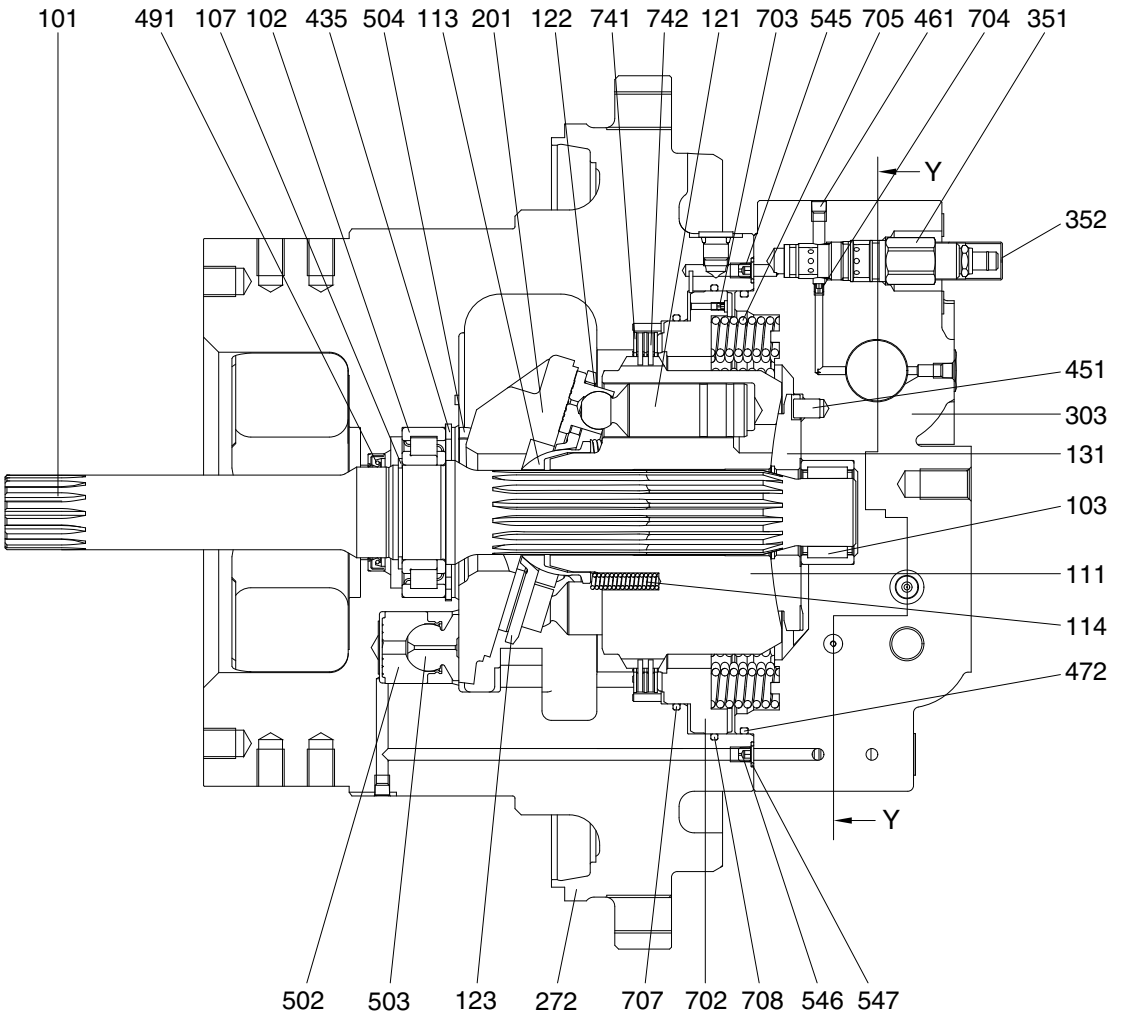
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

1) STRUCTURE (1/2)

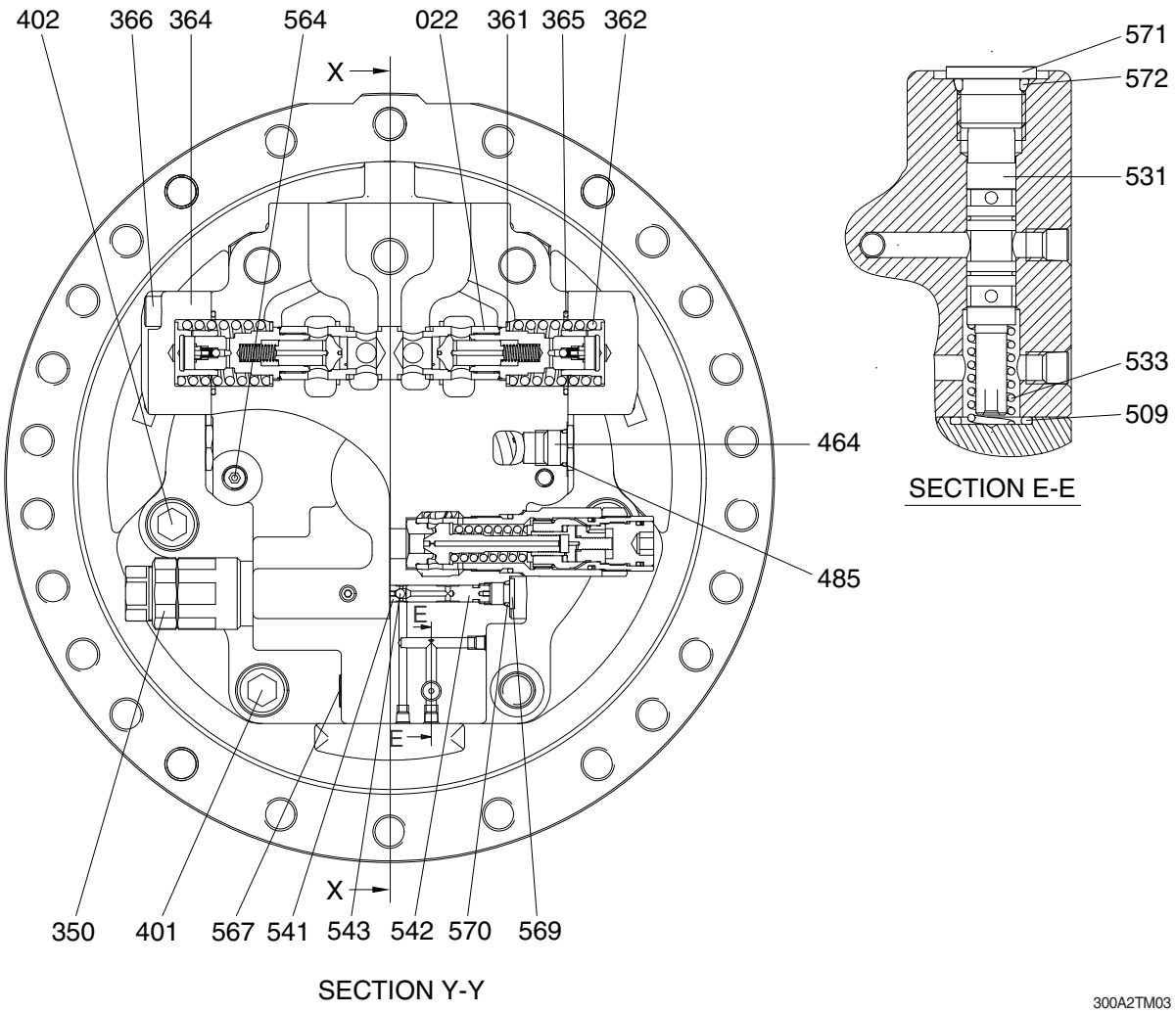


SECTION X-X

300A2TM02

101	Drive shaft	272	Shaft casing	545	Orifice
102	Roller bearing	303	Valve casing	546	Orifice
103	Needle bearing	351	Reducing valve	547	O-ring
107	Snap ring	352	Cover	702	Brake piston
111	Cylinder block	435	Snap ring	703	Orifice
113	Spherical bushing	451	Pin	704	Orifice
114	Cylinder spring	461	Plug	705	Brake spring
121	Piston	472	O-ring	707	O-ring
122	Shoe	491	Oil seal	708	O-ring
123	Set plate	502	Piston	741	Separation plate
131	Valve plate	503	Shoe	742	Friction plate
201	Swash plate	504	Pivot ball		

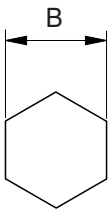
STRUCTURE (2/2)



022	Counterbalance spool	402	Hex socket bolt	543	Steel ball
350	Relief valve	464	VP plug	564	Plug
361	Washer	485	O-ring	567	VP plug
362	Counterbalance spring	509	O-ring	569	RO plug
364	Counterbalance cover	531	Tilting spool	570	O-ring
365	O-ring	533	Tilting spring	571	RO plug
366	Hex socket bolt	541	Seat	572	O-ring
401	Hex socket bolt	542	Stopper		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

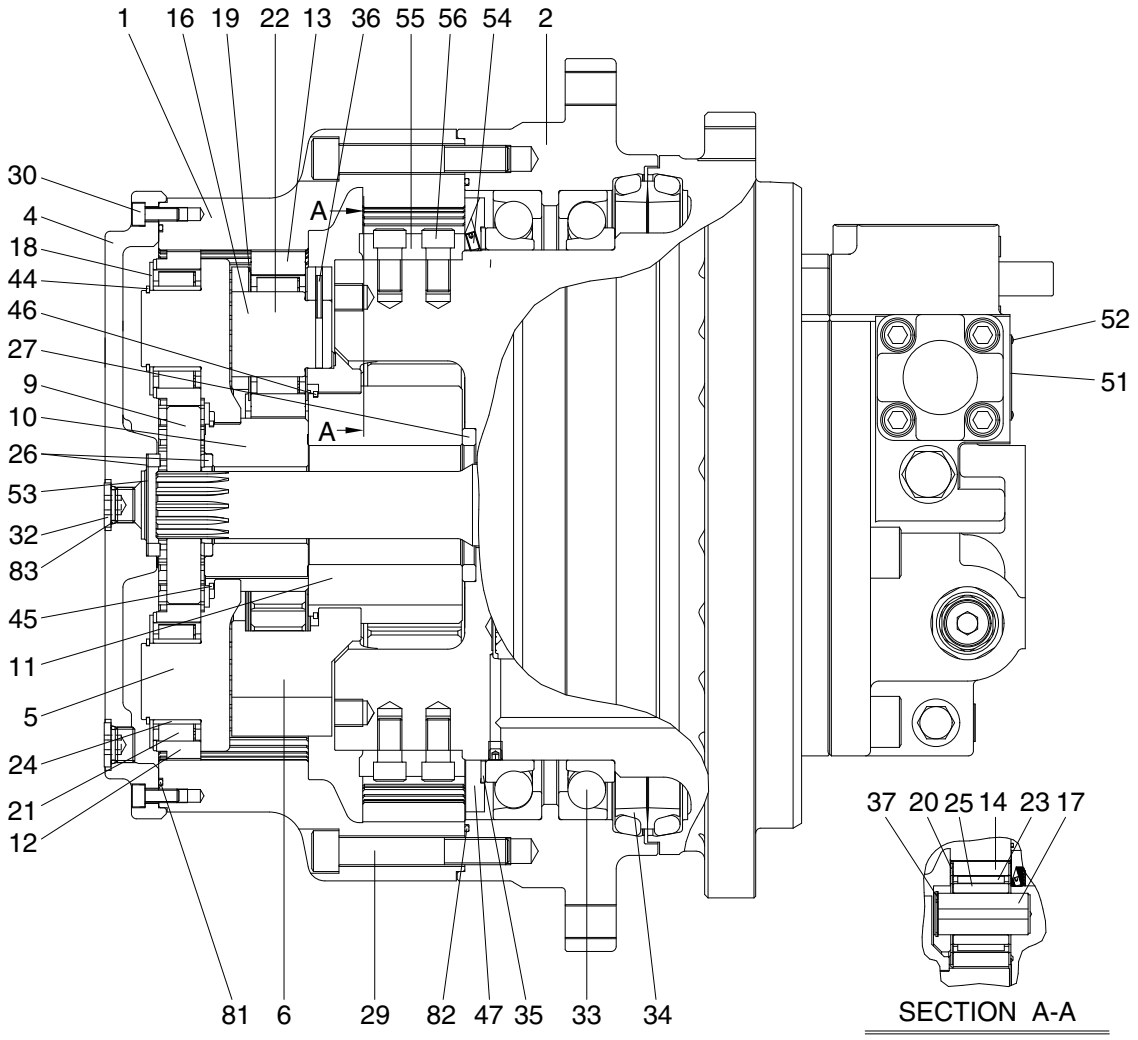
Tool name	Remark	
Allen wrench	2	
	2.5	
	4	
	6	
	8	
	10	
	17	
Socket for socket wrench, spanner	19	
	22.4	
	27	
	42	
Torque wrench	Capable of tightening with the specified torques.	
Plier (For hole, TPR-90)	For snap ring (435)	
Plier (For shaft)	For snap ring (107)	
(-) Driver	-	
Plastic hammer	Wooden hammer allowed. Nominal 1 or so	
Steel rod approx	7×7×200㎜, Bearing (102, 103)	
Monkey wrench	-	
Oil seal inserting jig	-	
Bearing plier	-	
Seal tape	-	

(2) Tightening torque

Part name	Item	Size	Torque		Wrench size	
			kgf · m	lbf · ft	in	mm
Socket bolt	366	M12×45	10	72.3	0.39	10
Socket bolt	401	M20×100	44	318	0.67	17
Socket bolt	402	M20×50	44	318	0.67	17
Plug	461	NPTF 1/16	0.9	6.5	0.16	4
VP Plug	464	PF 1/4	11	79.6	1.06	27
Orifice	545, 546	NPTF 1/16	0.7	5.1	0.16	4
Plug	564	PT 1/2	2.2	15.9	0.24	6
VP Plug	567	PF 1/4	3.7	26.8	0.75	19
Plug	569	PF 1/4	3.7	26.8	0.24	6
Plug	571	PF 3/8	7.5	54.2	0.31	8
Orifice	703	M4×0.7	0.35	2.5	0.08	2
Orifice	704	M5×0.8	0.7	5.1	0.1	2.5

3. TRAVEL REDUCTION GEAR

1) STRUCTURE

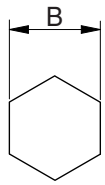


300A2TR01

1	Ring gear	20	Side plate	37	Snap ring
2	Housing	21	Needle cage	44	Snap ring
4	Side cover	22	Needle cage	45	Clip
5	Carrier 1	23	Needle cage	46	W clip
6	Carrier 2	24	Inner ring	47	Nutring
9	Sun gear 1	25	Floating bushing	51	Name plate
10	Sun gear 2	26	Thrust ring	52	Rivet
11	Sun gear 3	27	Thrust ring	53	Washer
12	Planetary gear 1	29	Socket bolt	54	Set screw
13	Planetary gear 2	30	Socket bolt	55	Nutring stopper
14	Planetary gear 3	32	RO plug	56	Hex socket bolt
16	Pin 2	33	Angular bearing	81	O-ring
17	Pin 3	34	Floating seal	82	O-ring
18	Side plate	35	Shim	83	O-ring
19	Side plate	36	Spring pin		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	4	
	8	
	10	
	14	
Spanner	27	
Torque wrench	Capable of tightening with the specified torques.	
Plier (for shaft)	Snap ring (037, 044)	
(-) Driver	For removing floating seal	
Plastic hammer	Wooden hammer allowed	
Eye bolt	M8, M10, M16, M20, For lifting-up	
Press (1 ton)	Angular bearing (033)	
Depth gauge straight edge	100㎜ depth, for adjusting shins (053)	
Tap M16	For removing screw lock in tapped holes	
Oil stone	For finishing mating faces	
Punch	For preventing spring pin from coming out	
Loctite (three bond 1373B)	Set screw (054)	
Loctite	Socket bolt (029)	
Nut ring inserting jig Nut ring (047)		

(2) Tightening torque

Part name	Item	Size	Torque		Wrench size	
			kgf · m	lbf · ft	in	mm
Socket bolt	29	M16×100	30	217	0.55	14
	30	M8×20	3.5	25.3	0.24	6
Plug	32	PF 1/2	11	79.6	0.39	10
Set screw	54	M8×16	1.0	7.2	0.24	6

4. DISASSEMBLING

1) GENERAL PRECAUTIONS

(1) Pay attention to not damaging contact surfaces for O-rings, oil seals, etc. and contact/sliding surfaces for gears, pins, bearings, etc.

(2) This motor can be disassembled even in a state on the reduction gear.
However, in that case, pay full attention to preventing mud, dust, etc. from entering in it.

(3) The numerical in parentheses following each part name indicates its part number shown in the attached **assembly drawings.**

(4) The piping side of the motor is referred to as the rear side, and the output side as the front side.

2) DISASSEMBLY OF REDUCTION GEAR

(1) Select a disassembling place.
※ Select a clean place.
※ Spread rubber sheet or cloth on work bench to prevent parts from being damaged.

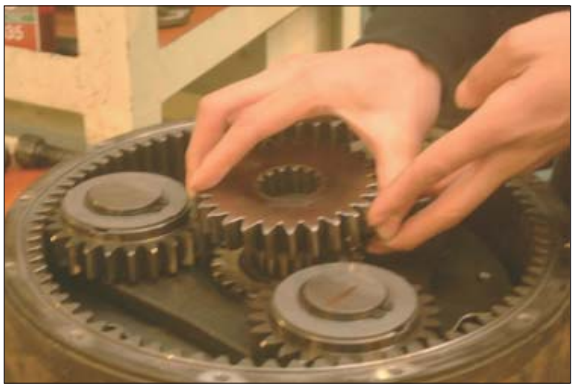
(2) Remove dust, mud, etc. from reduction gear surfaces with washing oil or so.

(3) Place reduction gear with its gear oil drain port or level gauge at the lowest position, and drain reduction gear oil.
※ Receive gear oil with clean vessel and check it for abnormalities.
Renew gear oil.

(4) Place reduction gear with its side cover (4) upward, and remove socket bolt (30), and remove side cover (4) and O-ring (81).

370078TM01

(5) Remove sun gear 1 (9).



370078TM02

(6) Remove carrier 1 (5), together with planetary gears 1 (12), sun gear 2 (10), etc. fitted.

370078TM03

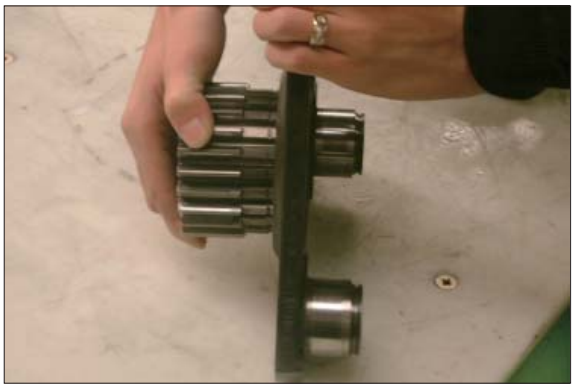
(7) Disassembling of carrier 1 sub-assembly

① Remove snap ring (44), and then remove side plate (18), planetary gear 1 (12), needle cage (21) and side plate (18).

※ If flaking is observed on the inner ring surface replace inner ring. In this case, replace planetary gear 1 and needle cage simultaneously.

370078TM04

② Remove circlip (45), and then remove carrier 1 (5) from sun gear 2 (10).



370078TM05

③ Remove thrust ring (26).

370078TM06

(8) Remove carrier 2 (6), with planetary gears 2 (13), sun gear 3 (11), etc. fitted.

※ Use M10 eyebolt. In this case, thrust ring (26) is removed simultaneously.

370078TM07

(9) Disassembling of carrier 2 sub-assembly

① Push in spring pin (36), and remove pin 2 (16), from carrier 2.

※ Carry out the following check in advance. If any abnormality should be found, carry out disassembling.

- Is there any crevice, crack or pitting on tooth surface of planetary gear?
- When turning planetary gear lightly, is there any abnormal noise or eccentric clearance? Carry out check similarly to the above for carrier 3.

370078TM08

② Remove side plate (20), planetary gear 2 (13), and needle bearing (22) from carrier 2.

③ Remove thrust ring (26).

370078TM09

④ Remove snap ring (46), and remove carrier 2 (6) from sun gear 3 (11).

⑤ Remove thrust ring (27) from sun gear 3 (11).

370078TM10

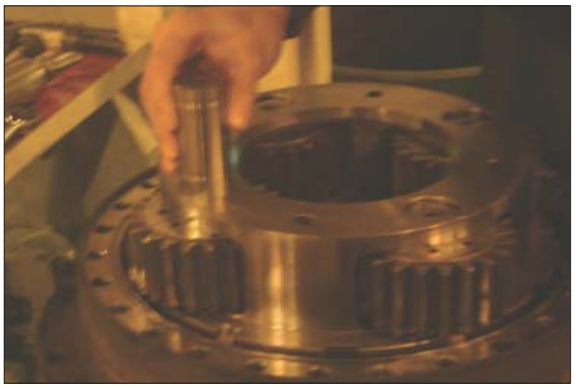
(10) Remove socket bolt (29), and then screw two M8 eyebolts on front side of ring gear (1), lift up ring gear with crane, and remove O-ring (82) from housing (2).

※ It is difficult to separate them, because it is assembled by LOCTITE.
In this case, if you can use wrench and pipe, it is easy to separate them.

370078TM11

(11) Remove snap ring (37) and then remove pin 3 (17) from shaft casing (272).

370078TM12


370078TM13

(12) Remove side plate (20), planetary gear 3 (14), needle cage (23), floating bushing (25) from shaft casing (272).

370078TM14

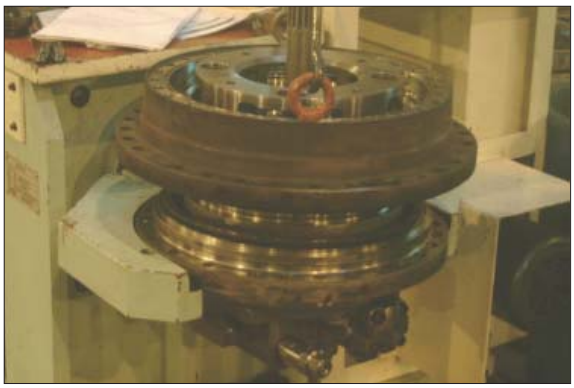
(13) Remove set screw (54) from nut ring (47), and then remove nut ring (47) from shaft casing (272).

※ When disassembling nut ring, remove dust, mud, etc. from set screw hole by blasting compressed air.
And remove the nut ring by using the special tool for removing the nut ring.

370078TM15

(14) Remove housing (2), angular bearing (33), floating seal (34) from shaft casing (272).

※ Screw two M16 eye bolts on front side of housing (2).
Lift up housing (2) with crane.



370078TM17

(15) Remove floating seal (34) from housing (2), paying attention to not damaging it.

※ Pay attention to O-ring and sheet faces.

370078TM18

(16) Remove floating seal (34) from casing (272), pay attention to not damaging it.

※ Pay attention to O-ring and sheet faces.

370078TM19

(17) Remove angular bearing (33) from housing (2).

※ Bearing should be renewed once it is removed.

370078TM20

3) DISASSEMBLY OF MOTOR

(1) Disassembling of motor main body

① Place hydraulic motor on bench with its output shaft down.

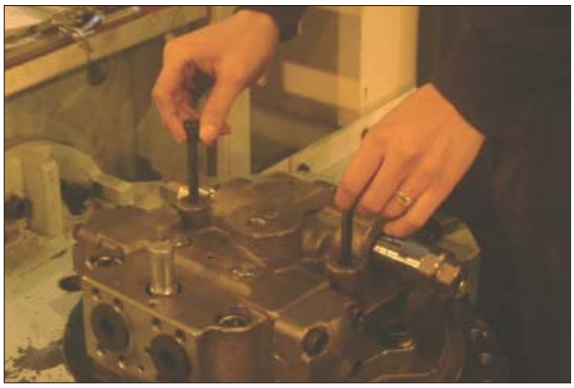
370078TM21

② Loosen relief valve (350), reducing valve (351), cover (352), plug, etc.
They are fitted to valve casing (303).

370078TM22

370078TM23

③ Remove plug (564) from valve casing (303). And then screw two M10×135 bolts on the holes of compelent brake release. Sub assembly (valve casing & brake piston)



370078TM24

④ Remove socket bolts (401, 402) that assemble valve casing (303).

370078TM25

⑤ Remove the above socket bolt, and then separate valve casing sub-assembly and remove valve plate (131).

370078TM26

⑥ Pull out friction plate (742) and separation plate (741) from cylinder block (111).

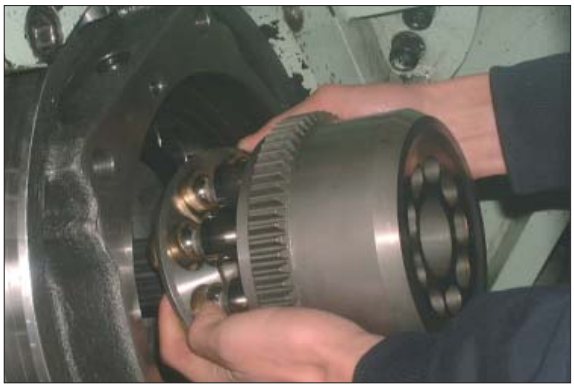
※ In this case, motor should be located in horizontally.

370078TM27

⑦ Pull out cylinder block and piston sub-assembly.

※ After placing the motor horizontally, take out cylinder block from casing.

※ Be careful not to damage the sliding parts of the cylinder block, spherical bushing and shoe.



370078TM28

⑧ Remove swash plate (201).

370078TM29

⑨ Remove pivot ball (504) and tilting piston sub assembly.

370078TM30

⑩ Take out snap ring (435), and then hit front side end face of shaft (101) lightly with plastic hammer or so to remove from casing (272).

※ Do not remove cylinderical roller bearing (102) as far as it remains normal.

370078TM31

⑪ Take out oil seal (491) from shaft casing (272).

※ Do not reuse the disassembling oil seal (491).

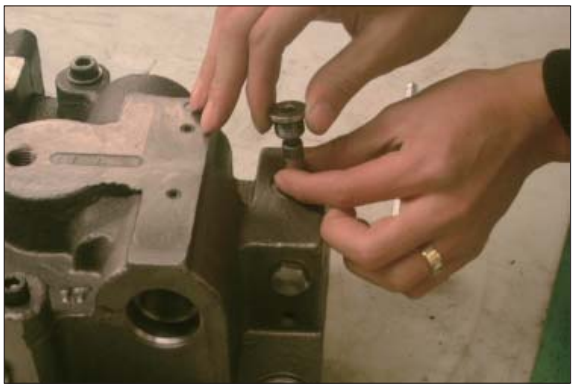
370078TM32

(2) Disassembling of valve casing sub-assembly

① Remove two M10×135 bolts for compelling brake release. Disassemble brake piston from valve casing.

370078TM33

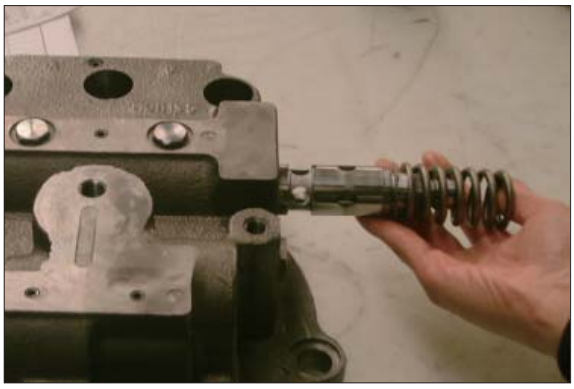
② Remove plug (571), tilting spring (533), and tilting spool (531) from valve casing.



370078TM34

③ Remove socket bolts (366), counterbalance cover (364), and counterbalance spool assembly.

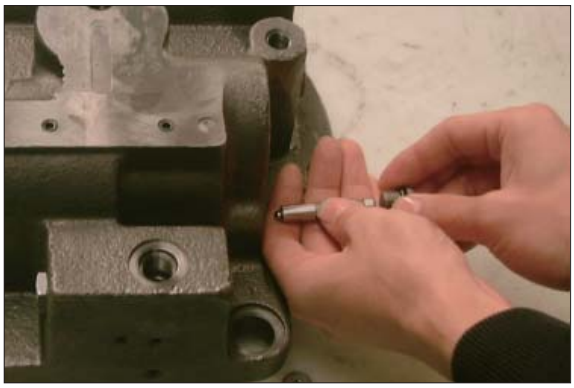
※ When any abnormality is found in counterbalance spool, counterbalance spring, etc. replace with the counter balance spool sub assembly as a set.



370078TM35

④ Remove plug (569), stopper (542), steel ball (543) and seat (541).

※ When no abnormality is found in displacement changeover, it is not necessary to overhaul it specifically.
And don't remove needle bearing (103) as far as it remains normal.



370078TM36

(3) Disassembling of cylinder sub-assembly

① Pull out set plate (123), piston (121), and shoe (122) sub-assembly.

370078TM37

② Remove spherical bush (113) and cylinder spring (114).
That is all of the disassembling work.
The pins (451) force-fitted to the valve casing cannot be removed.

370078TM38

5. ASSEMBLING

1) GENERAL CAUTIONS

(1) Clean each part fully with washing oil and dry it by blasting compressed air. It is better not to use waste cloths as much as possible.
However, if they are to be used, use clean ones, and pay attention to not leaving lint and so on.
Don't clean the friction plate with washing oil without fail.

(2) Use the torque wrench in tightening fitting screws and plugs to their respective torque shown in page 8-105, 8-107.

(3) When hammering is required, use the plastic hammer and try to hit parts lightly.

(4) Similarly to the disassembling procedures, the numeral in parentheses following each part name indicates its item number shown in the attached assembly drawings.

2) ASSEMBLY OF MOTOR

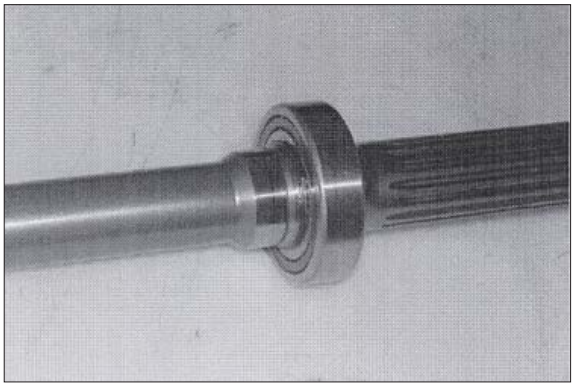
(1) Assembling driving shaft sub-assembly

① Put roller bearing (102) on drive shaft (101), and assemble snap ring (107) by using the plier.

※ Roller bearing is press fit by the heat to drive shaft.

※ Pay attention to not damaging oil seal sliding area of driving shaft.

※ Pay attention to not fitting snap ring the other way around.



370078TM39

(2) Assembling of valve casing sub-assembly

① Tighten plugs (461, 564) into valve casing (303) with specified torque.
- Plug(461) : 0.9 kgf · m (6.5 lbf · ft)
- Plug(564) : 2.2 kgf · m (15.9 lbf · ft)

370078TM40

② Interference-fit pin (451).

370078TM41

③ Interference-fit needle bearing (103).

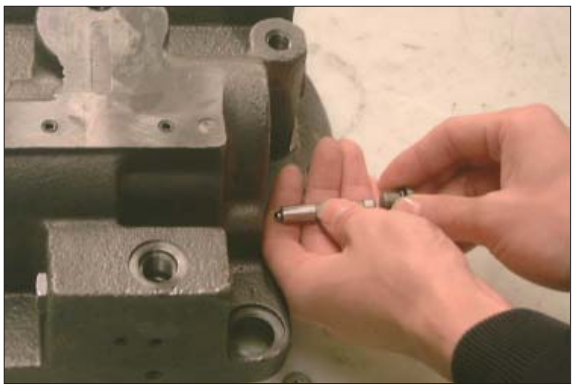
※ It is necessary when needle bearing was disassembled from the valve casing.

370078TM42

④ Assemble seat (541), steel ball (543), stopper (542) and RO plug (569) in the order named.

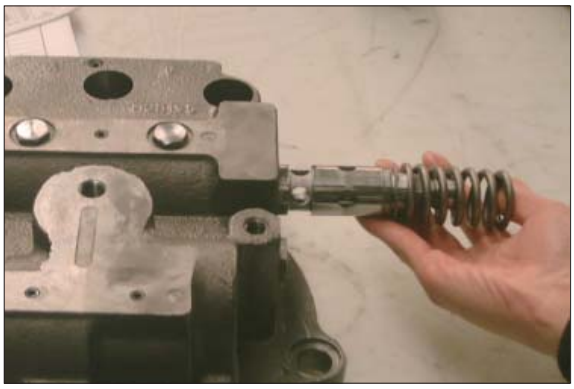
· Tightening torque : 3.7 kgf · m (26.8 lbf · ft)

※ Pay attention to not assembling seat and stopper the other way around.



370078TM43

⑤ Assemble counterbalance spool (360), washer (361), spring (362) in the order named.

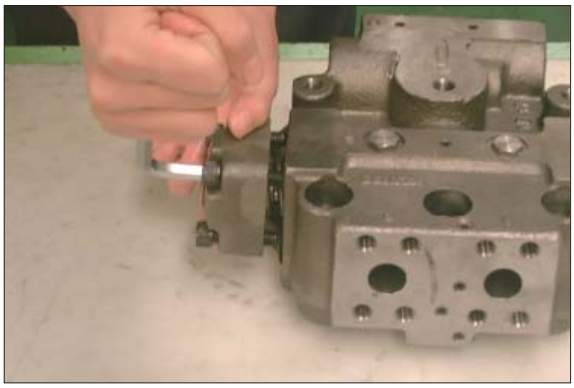


370078TM44

⑥ Fit counterbalance cover (364) by tightening socket bolt (366).

· Tightening torque : 10 kgf · m (72.3 lbf · ft)

※ Confirm that O-ring (365) has been inserted in cover.



370078TM45

⑦ Assemble tilting spool (531), tilting spring (533) and plug (571) in the order named.
· Tightening torque : 7.5 kgf · m (54.2 lbf · ft)

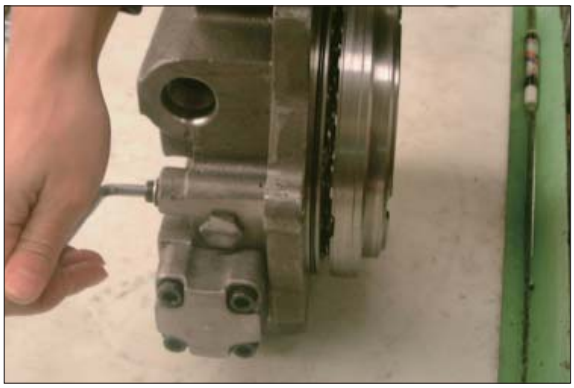
370078TM46

⑧ Assemble orifice (703) and tighten them into brake piston (702) to specified torque.
· Tightening torque : 0.35 kgf · m (2.5 lbf · ft)

370078TM47

⑨ Assemble brake spring (705) in brake piston (702). And then screw two M10×135 bolts on the holes for compelent brake release.
Sub-assembly (valve casing & brake piston)

※ After finishing assembly, two M10×135 bolts will be removed.



370078TM48

(3) Assembling of cylinder sub-assembly

① Fit cylinder spring (114) and spherical bush (113) to cylinder block (111).

※ Match spline phase of cylinder block (111) to that of spherical bush.

370078TM49

② Put piston (121), shoe (122) sub-assembly in set plate (123) and then assemble them to cylinder block (111).

370078TM50

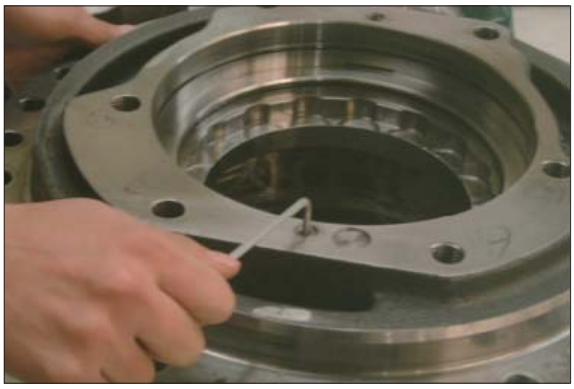
(4) Assembling of motor main body

① Tighten plug (461) and orifice (545, 546) into shaft casing (272) to specified torque.

· Plug (461) : 0.9 kgf · m (6.5 lbf · ft)

· Plug (545, 546) : 0.7 kgf · m (5.1 lbf · ft)

370078TM51



370078TM51A

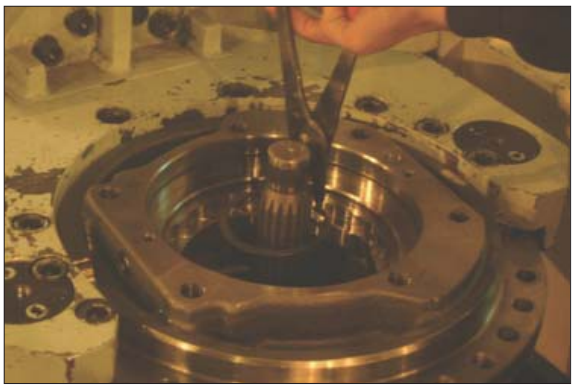
② Interference-fit oil seal (491) into shaft casing (272) by special tool.

370078TM52

③ Interference-fit the shaft sub-assembly. And then assemble snap ring (435).

※ Interference-fit outer race of cylindrical roller bearing (102) by hitting lightly with hammer, utilizing key.

370078TM53



370078TM54A

④ Assemble tilting piston sub-assembly and pivot ball (504) into shaft casing (272).

370078TM54

370078TM54A

⑤ Assemble swash plate (201) onto pivot ball (504).

※ Apply grease on sliding area of swash plate rear surface.

※ Confirm with finger tips of both hands if swash plate moves smoothly.

370078TM55

⑥ Change position of shaft casing (272) from vertical one to horizontal one.
And then mount cylinder block sub-assembly.

※ Pay attention to not dropping swash plate.

370078TM56

⑦ Change position of shaft casing (272) from horizontal one to vertical one.

370078TM57

⑧ Fit separation plate (741) and friction plate (742) into cylinder block (111).

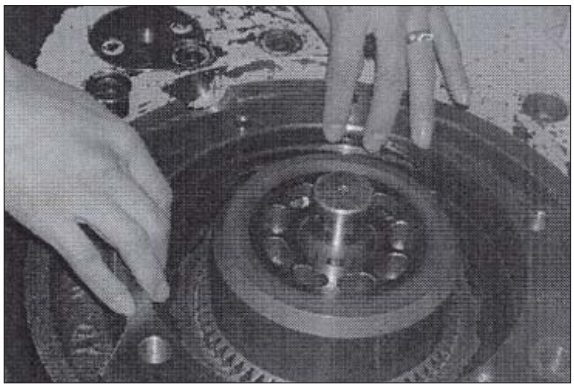
※ Mate hole of separation plate each other.

370078TM27

⑨ Assemble O-ring (707, 708) into shaft casing (272).

※ Do not reuse the disassembling O-ring (707, 708).

※ Coat the O-ring with grease.
(O-ring can be protected by grease)



370078TM59

⑩ Fit valve plate (131) to valve casing (303) sub-assembly. Assemble them to casing, and then tighten them with socket bolt (401, 402).

· Socket bolt (401, 402) Tightening torque : 44 kgf · m (318 lbf · ft)

※ Apply grease on valve plate rear surface and pay attention to not dropping valve plate.

※ Use guide bolt.

※ Apply grease on roller of needle bearing and pay attention to easy to assemble with driving shaft.

※ Use crane in assembling valve casing to shaft casing.

370078TM60

370078TM60A

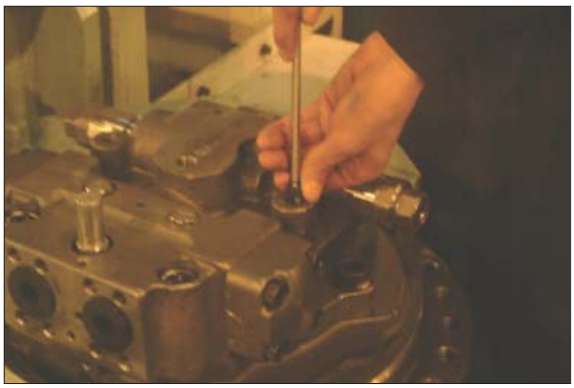
⑪ Tighten to specified torque plugs, relief valve (350), reducing valve (351), etc. fitted to valve casing sub-assembly.

· Tightening torque :
- Relief valve (350) : 18 kgf · m (130 lbf · ft)
- Reducing valve (351) : 4.5 kgf · m (32.5 lbf · ft)

370078TM61

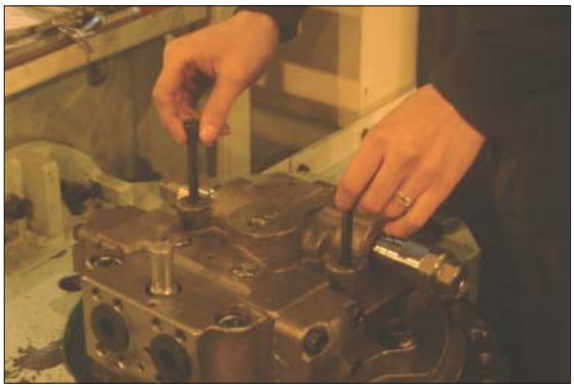
370078TM61A

⑫ Mount cover (352).



370078TM63

⑬ Disassemble two M10×135 bolts on the holes for compelent brake release.
And then assemble plug (564).
· Tightening torque : 2.2 kgf · m (15.9 lbf · ft)



370078TM24

3) ASSEMBLY OF REDUCTION GEAR

(1) Place housing (2) with its front side up, and fit angular bearings (33) with their back faces mated.

※ Fit angular bearings one by one with press or key hammer.

※ When housing is to be reused, remove screw lock of its tapped holes with M16 tap.

370078TM64

(2) Fit O-ring to floating seal (34) without twisting it, and then to housing (2).

※ Apply grease to O-ring thinly.

※ Do not reuse the disassembling O-ring.

370078TM65

(3) Similarly, fit floating seal to shaft casing (272) of hydraulic motor.

※ Do not reuse the disassembling O-ring.

370078TM66

(4) Lift up housing sub-assembly with its floating seal side down, and put inner diameter of angular bearing on outer diameter of shaft casing.

※ Pay attention to not damaging sliding faces of floating seal.

370078TM67

(5) Assemble shim (35) to nut ring (47).

※ Apply grease between shim and nut ring.

370078TM68

(6) Insert nut ring assembled shim to shaft casing, and then tighten it to specified torque, utilizing special tool.

※ After tighten it to maximum torque and then disassemble, and then tighten it to specified torque.

· Tightening torque : 60 kgf · m (434 lbf · ft)

370078TM70

(7) After assemble set screw (54) affixed LOCTITE, and punch at hole to lock it. Pay attention to not be lifted nut ring (47).

※ Screw the set screw, until upper side of set screw is lower than tilting side of nut ring.

· Loctite specifications : Three bond 1373B

· Tightening torque : 1 kgf · m (7.2 lbf · ft)

370078TM71

(8) Assemble thrust ring (27) into shaft casing (272).

※ Pay attention to not assembling thrust ring (27) the other way around. (Oil groove is located upside.)

370078TM72

(9) Put needle cage (23) into inside of planetary gears 3 (14), and insert them into shaft casing, holding them between side plates (20).

※ Mate pin hole of shaft casing with center of planetary gear.

370078TM73

(10) Insert pin 3 (17) into shaft casing, and then assemble snap ring (37).

370078TM74

370078TM74A

(11) Assemble O-ring (82) to housing (2), and then assemble ring gear (1).
Pay attention to its meshing planetary gear 3 (14) and ring gear (1), utilizing crane.

※ Applying grease to O-ring thinly.
※ Do not reuse the disassembling O-ring.

370078TM75

(12) Assemble ring gear (1) and housing (29).
(Screw socket bolt (29), and tighten it to specified torque, with torque wrench.)
· Tightening torque : 30 kgf · m (217 lbf · ft)
· Loctite specifications : #636

370078TM76

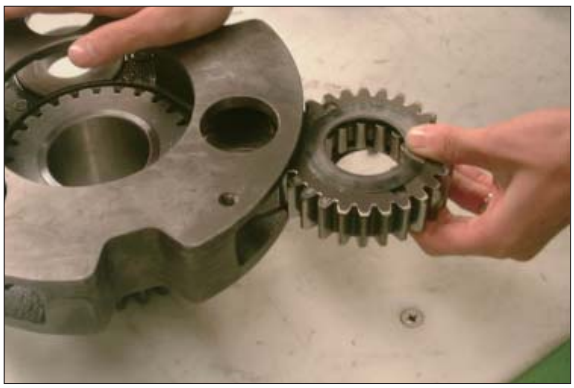
(13) Assembling carrier 2 sub-assembly

① Assemble carrier 2 (6) to sun gear 3 (11), and fit clip (46).

② Place carrier 2 with sun gear 3 up.

370078TM77

③ Put needle cage (22) into inside of planetary gear 2 (13), and insert them into carrier 2, holding them between side plates (19).



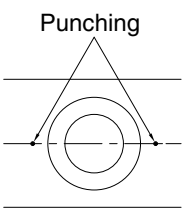
370078TM78

④ Insert pins 2 (16) into carrier 2.

370078TM78A

⑤ Insert spring pin (36) into pin holes of carrier 2 and pin 2, and punch at two points as figure to lock it.

※ Mate pin hole of carrier 2 with center of planetary gear.



370078TM79

(14) Screw two M10 eyebolts into carrier 2 sub-assembly, and assemble it with crane, paying attention to its meshing with planetary gear 2 and ring gear.

370078TM80

(15) Assembling of carrier 1 sub-assembly

① Interference-fit inner ring (24) to carrier 1 (5).

※ Inner ring is press-fit by the heat to carrier 1 (5).

370078TM81

② Assemble carrier 1 (5) to sun gear 2 (10), and fit clip (45).

370078TM82

③ Assemble thrust ring (26) to sun gear 2 (10).

※ Pay attention to not assembling thrust ring (26) the other way around.
(Oil groove is located upside.)

370078TM83

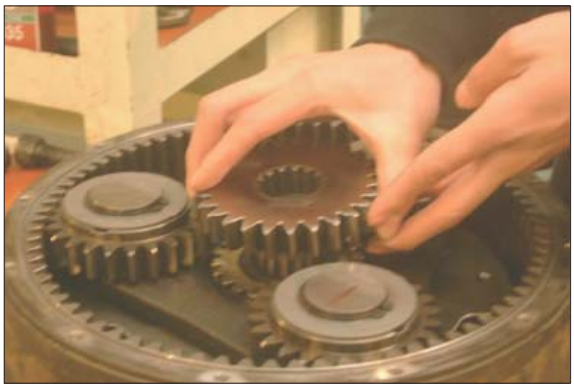
④ Put needle cage (21) into inside of planetary gear 1 (12), and assemble them, holding them between side plates (18). Then fit snap ring (44) on them.

370078TM84

(16) Assemble carrier 1 (5) sub-assembly to ring gear (1).
Paying attention to its meshing with carrier 1 sub-assembly and ring gear (1).

370078TM85

(17) Assemble sun gear 1 (9) to drive shaft (101) paying attention to its meshing with sungear and drive shaft (101).

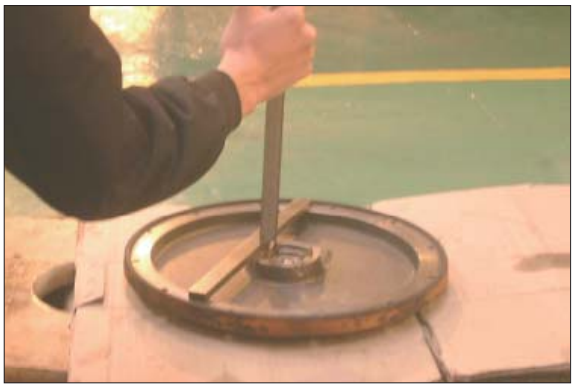


370078TM86

(18) Measure height "A" from sun gear 1 end face to ring gear (1) mating face with straight edge and depth gage.

370078TM87

(19) Measure height "B" from side cover (4) mating face to center hold bottom with straight edge and depth gage.



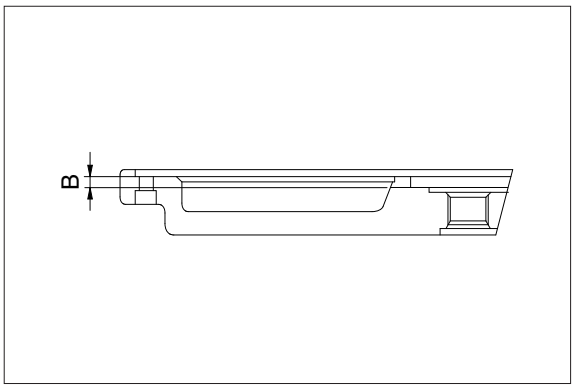
370078TM88

(20) Obtain optimum thickness with the following formula.

1.5~2.0 = (B+A)

- (Thickness of thrust ring + thickness of washer)

※ Keep axial clearance between sun gear and washer 1.5~2.0 ㎜.



370078TM89

(21) Place washer (53) of above-selected thickness and thrust ring (26) to center of side cover (4).

※ Pay attention to not assembling thrust ring (26) the other way around and punch it (Oil groove is located upside)

370078TM90

(22) Assemble O-ring (81) into ring gear.

And degrease and dry mating faces of side cover & ring gear. Then lift side cover(4) up, and place it on ring gear.

And tighten socket bolt (30) to specified torque to fix side cover.

· Tightening torque : 3.5 kgf · m (25.3 lbf · ft)

370078TM91

(23) Tighten plug (32) to specified torque at side cover (4).
· Tightening torque : 11.0 kgf · m (79.6 lbf · ft)

370078TM92

That is all of the assembling work. After fitting the motor this reduction gear, supply oil until overflows from the level gauge.

4) CHECKING FACTS AFTER ASSEMBLY

(1) Air test of reduction gear

Disassemble plug (32) of reduction gear part.

When compressed air(0.3 kgf/cm^2) is inserted that in water during the 2 minutes, it should be not happened air bubble.

· Gear oil : 7.8 ℓ / 2.1 U.S. gal (SAE 85W-140, API GL-5 or better)

(2) Air test of hydraulic motor

One port should be opened, the others port should be closed.

When compressed air (3 kgf/cm^2) is inserted opened port in water during the 2 minutes, it should be not happened air bubble.

· Working fluid : 1.5 ℓ (0.33 U.S. gal)

TRAVEL MOTOR (TYPE 2, HIGH WALKER, MACHINE SERIAL NO. : #0901-)

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90° and lower it completely to the ground.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ Escaping fluid under pressure can penetrate the skin causing serious injury.

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

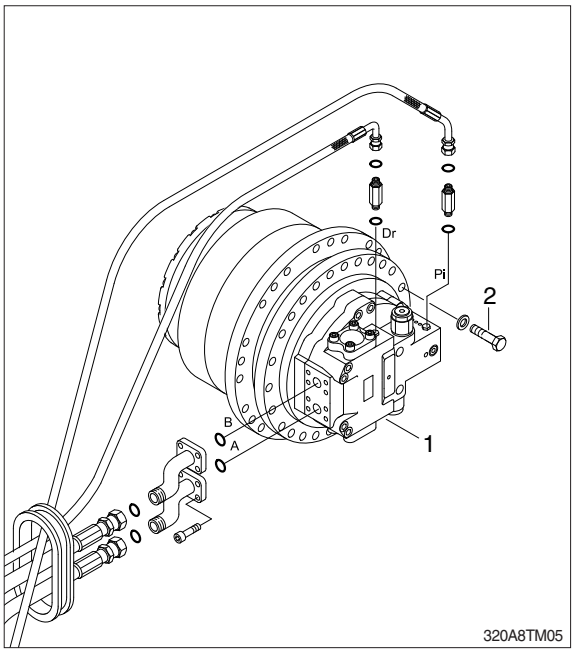
(6) Remove the hoses.

※ 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 : 380 kg (840 lb)
- Tightening torque : 58±6.0 kgf·m (420±43.4 lbf·ft)



2) INSTALL

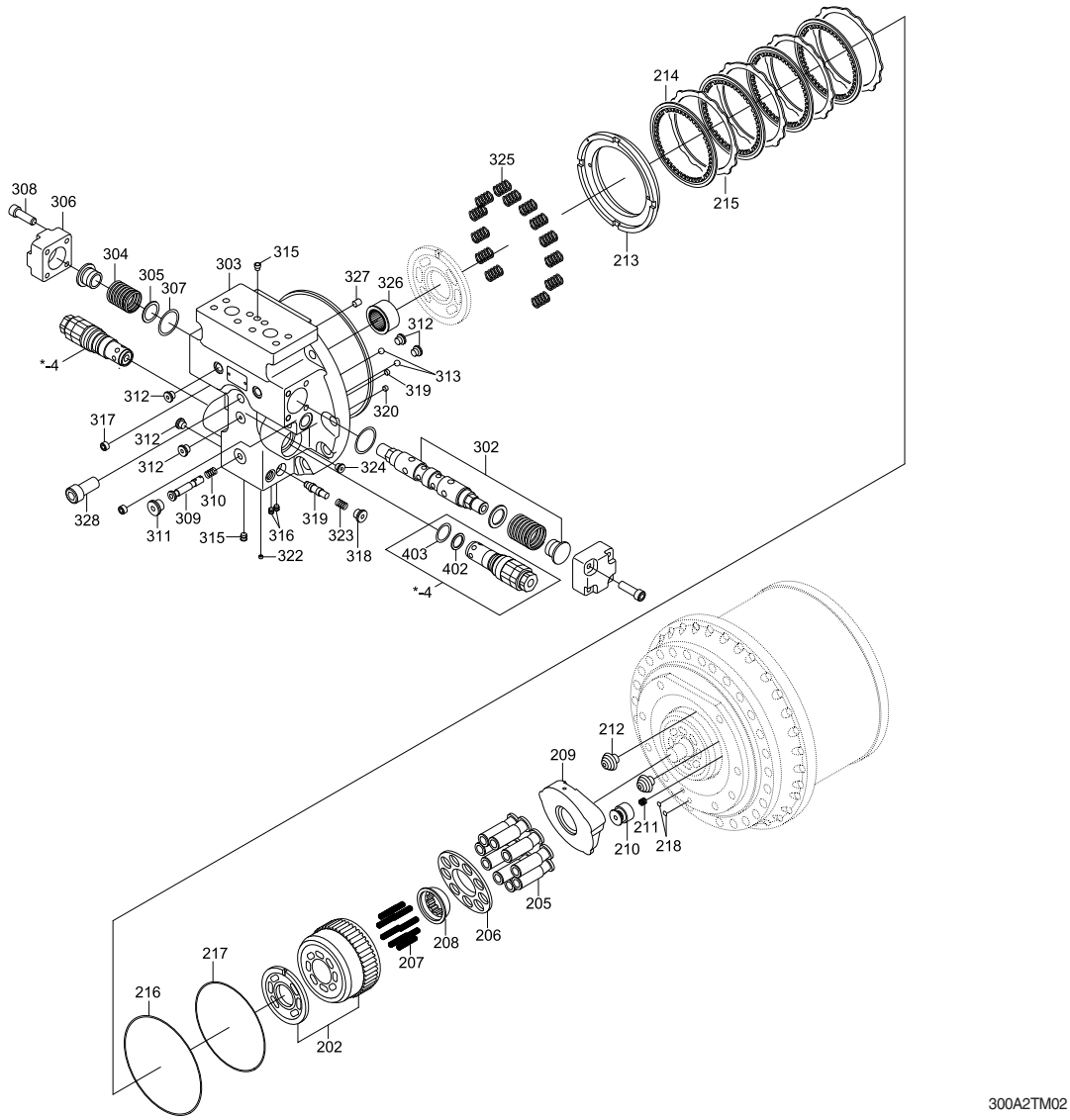
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

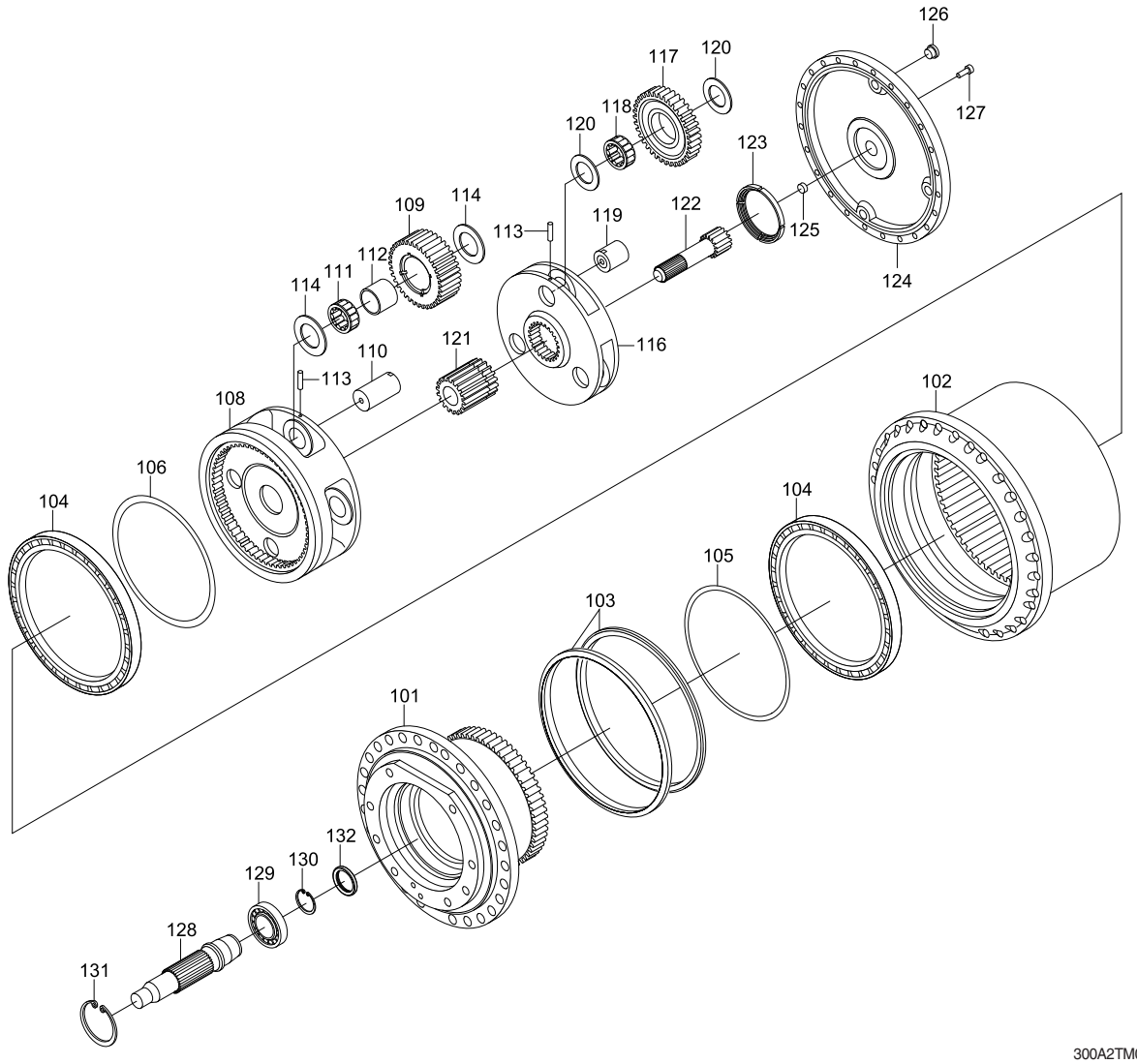
1) STRUCTURE (1/2)



300A2TM02

202	Rotary block	302	Spool	317	Plug
205	Rotary piston	303	Valve casing	318	Plug
206	Plate	304	Main spring	319	Control spool
207	Spring	305	Washer	320	Orifice
208	Steel ball	306	Cover	321	Orifice
209	Swash plate	307	O-ring	322	Screw
210	Piston	308	Socket bolt	323	Reducing spring
211	Spring	309	2 speed spool	324	Plug
212	Pivot	310	Spring	325	Spring
213	Brake piston	311	Plug	326	Needle bearing
214	Friction plate	312	Plug	327	Valve pin
215	Separate plate	313	Steel ball	328	Bolt
216	O-ring	314	O-ring	402	Backup ring
217	O-ring	315	Plug	403	O-ring
218	O-ring	316	Plug		

STRUCTURE (2/2)



300A2TM03

101	Casing	113	Spring pin	124	Cover
102	Hub	114	Thrust washer	125	Washer
103	Seal	116	Carrier no.1	126	Plug
104	Ball bearing	117	Planetary gear	127	Socket bolt
106	Shim plate	118	Needle bearing	128	Drive shaft
108	Carrier no.2	119	Shaft bearing	129	Roller bearing
109	Planetary gear	120	Thrust washer	130	Snap ring
110	Shaft bearing	121	Sun gear	131	Snap ring
111	Needle bearing	122	Drive gear	132	Shaft seal
112	Floating bushing	123	Thrust plate		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark
Hex bit	8, 10, 17 mm
Hex socket	41 mm
Eye bolt	M10x1.5
Guide pin	M20x2.5x45
Torque wrench	Capable of tightening with the specified torques.
Ball bearing assembly press-fit jig	-
Floating seal assembly jig	-
Plier	-
Plastic hammer	-
Air gun	-
Compressed air	-

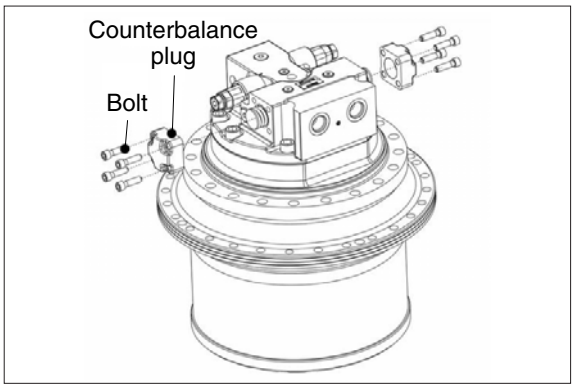
(2) Tightening torque

Item	Part name	Torque	
		kgf · m	lbf · ft
126	Plug	10±2.0	72.3±14.5
127	Socket bolt	5.9±1.0	42.7±7.2
308	Socket bolt	10.4±1.6	75.2±15.6
311	Plug	10.0±2.0	72.3±14.5
312	Plug	6.0±1.5	43.4±10.8
328	Socket bolt	50.3±8.0	364±57.9
401	Relief valve	18.0±3.6	130±26.0

3) DISASSEMBLY

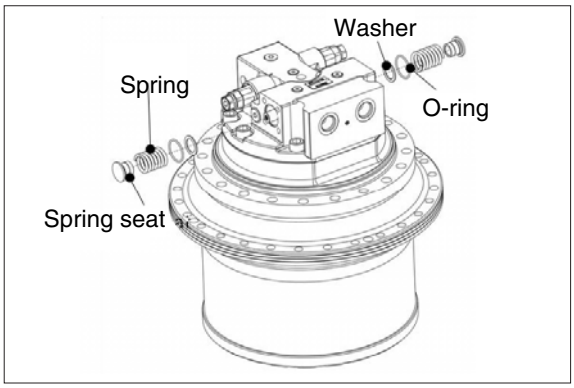
(1) Disassemble the counterbalance plug and bolt.

※ Required tools : torque wrench, hex bit 10 mm.



320A8TM10E

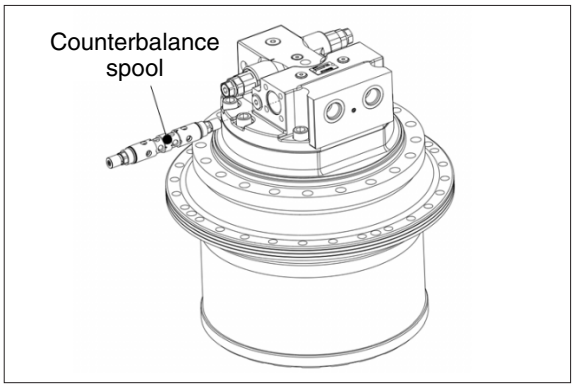
(2) Disassemble the spring, spring seat, O-ring, washer.



320A8TM11E

(3) Turn the counterbalance spool assy slowly to disassemble.

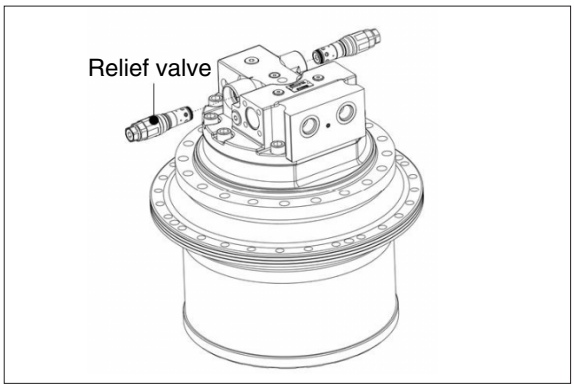
※ Damage caution of counterbalance spool surface



320A8TM12E

(4) Disassemble the relief valve.

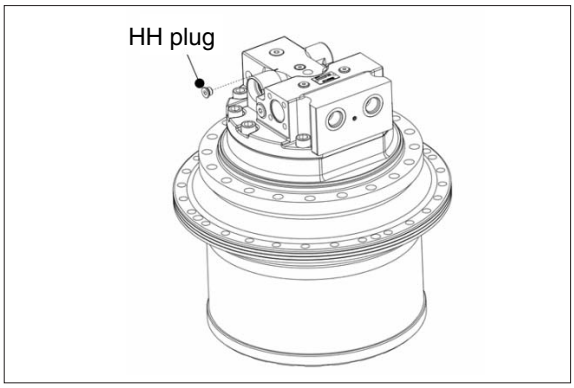
※ Required tools : torque wrench, hex socket 41 mm.



320A8TM13E

(5) Disassemble the HH plug from valve casing.

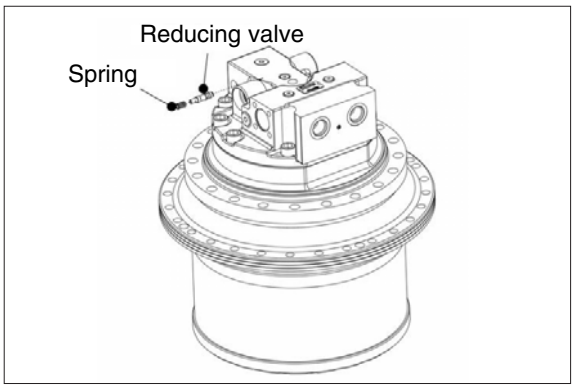
※ Required tools : torque wrench, hex bit 8 mm.



320A8TM14E

(6) Disassemble the reducing valve, spring.

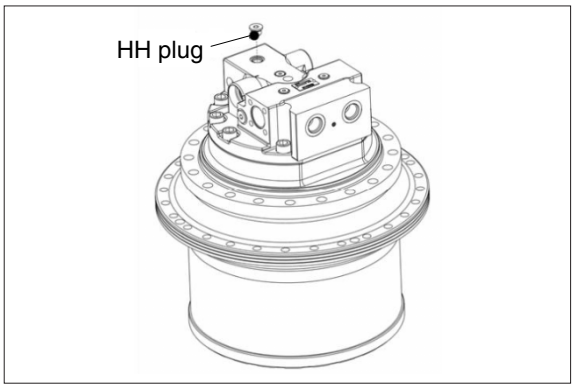
※ Damage caution of reducing valve surface.



320A8TM15E

(7) Disassemble the HH plug from valve casing.

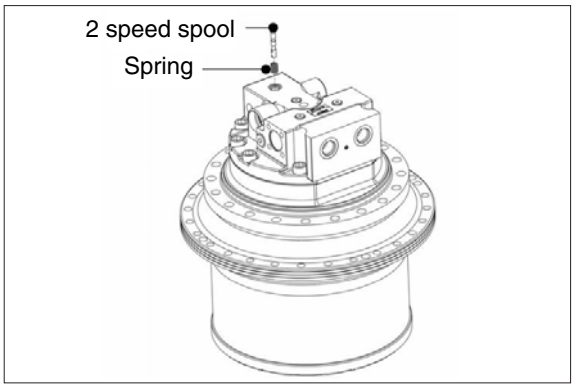
※ Required tools : torque wrench, hex bit 10 mm.



320A8TM16E

(8) Disassemble the 2 speed spool and spring.

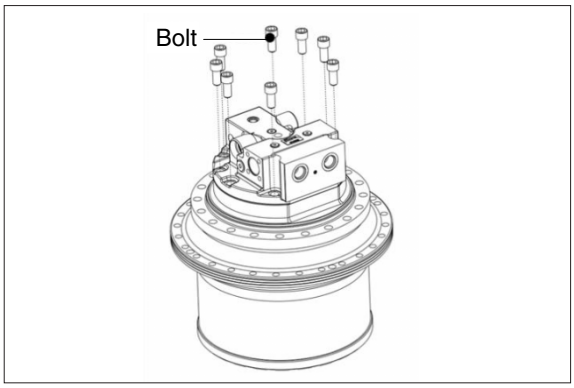
※ Damage caution of 2 speed spool surface.



320A8TM17E

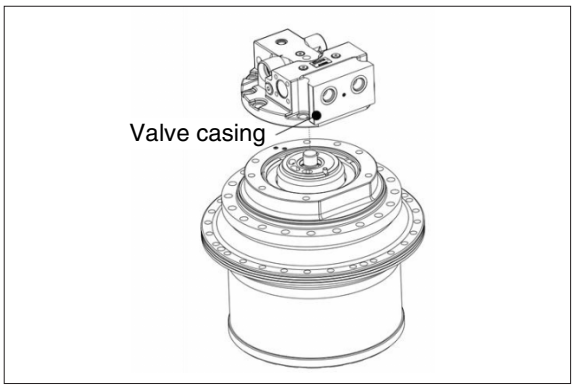
(9) Loosen each bolt evenly to disassemble.

※ Required tools : torque wrench, hex bit 17 mm.



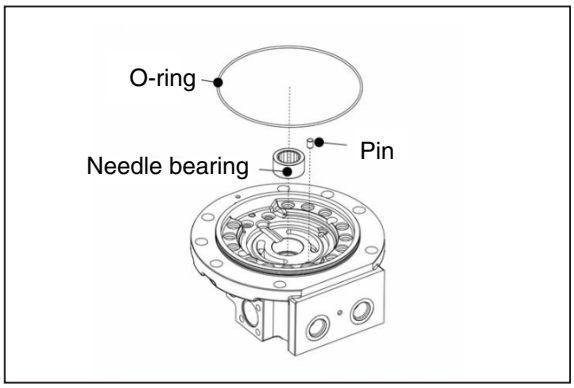
320A8TM18E

(10) Disassemble the valve casing.



320A8TM19E

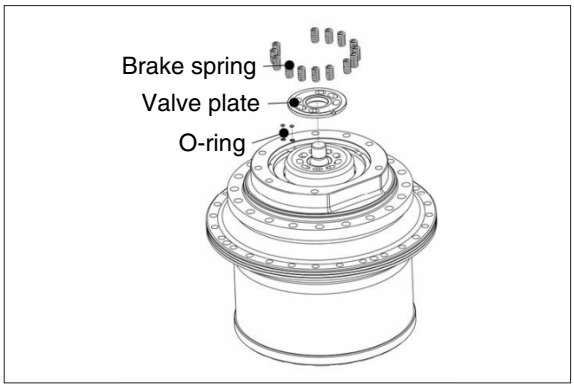
(11) Disassemble the needle bearing, O-ring, pin from the valve casing.



320A8TM20E

(12) Disassemble the brake spring.

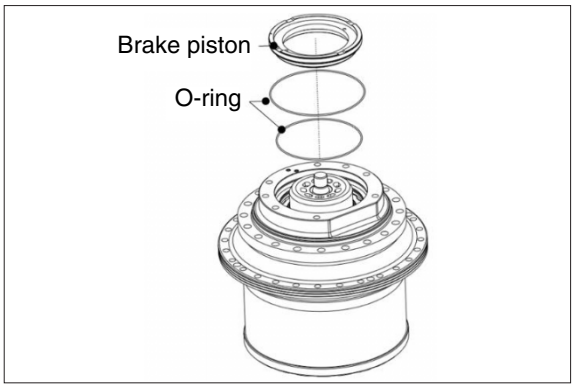
※ Quantity of the brake springs could be different of each model.
Disassemble the valve plate and O-ring.



320A8TM21E

(13) Cover the top of a motor with cloths and disassembly the brake piston by blowing compressed air into the brake releasing line of the motor casing.
Disassemble the O-ring.

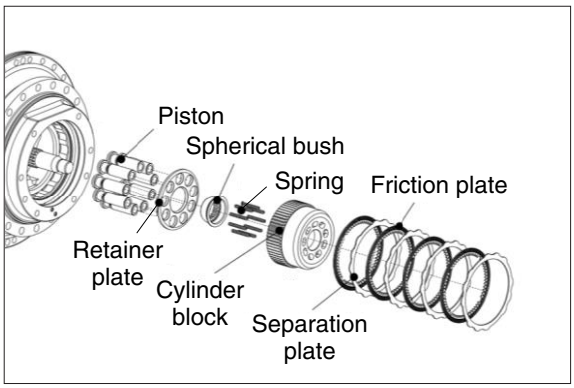
※ Required tools : compressed air, air gun.



320A8TM22E

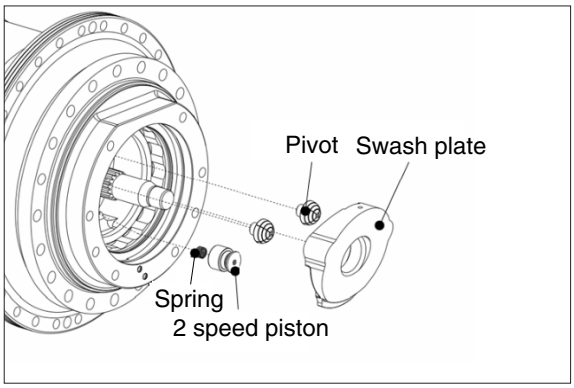
(14) Disassemble separation plate, friction plate, cylinder block assembly, spherical bush, spring, retaining plate and piston assembly.

※ Quantity of separation and friction plates could be different of each model.



320A8TM23E

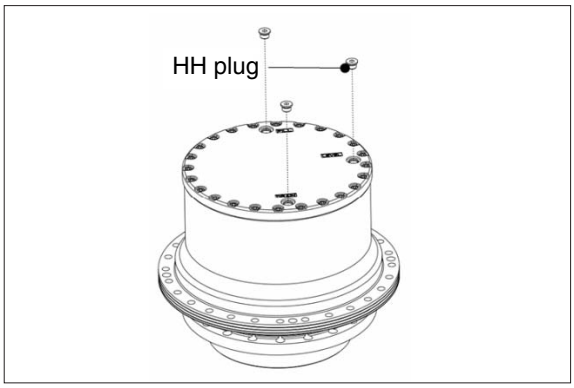
(15) Disassemble the swash plate, pivot, 2 speed piston and spring.



320A8TM24E

(16) Disassemble the HH plug and discharge the reduction gear oil.

※ Required tools : torque wrench, hex bit 10 mm.

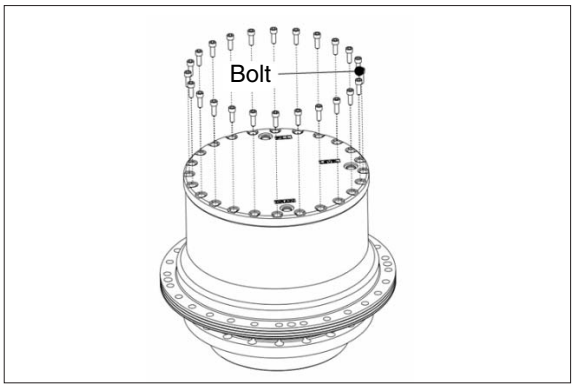


320A8TM25E

(17) Disassemble the bolt.

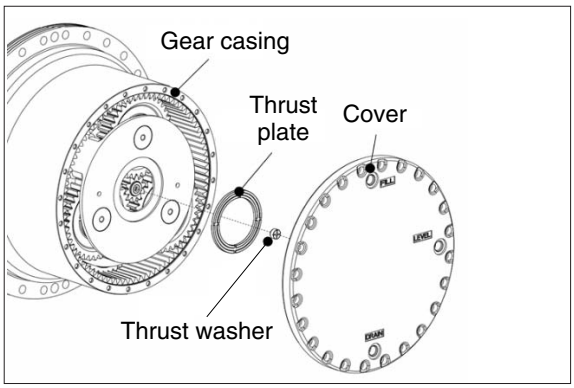
※ Do not re-use.

※ Required tools : torque wrench, hex bit 8 mm.



320A8TM26E

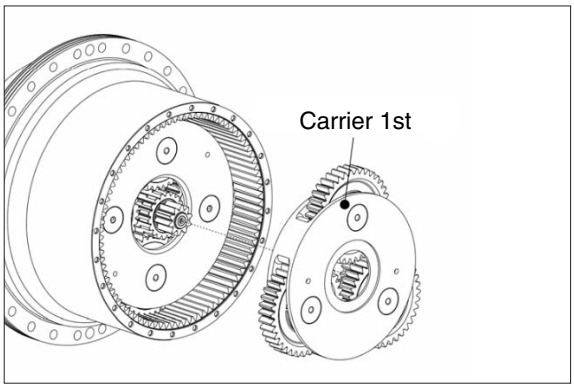
(18) Disassemble the cover, thrust plate and O-ring.



320A8TM27E

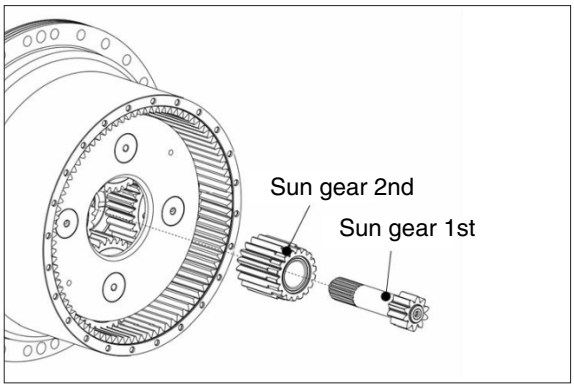
(19) Disassemble the carrier 1st assembly.

※ Required tools : eye bolt M10x1.5 (2ea)



320A8TM28E

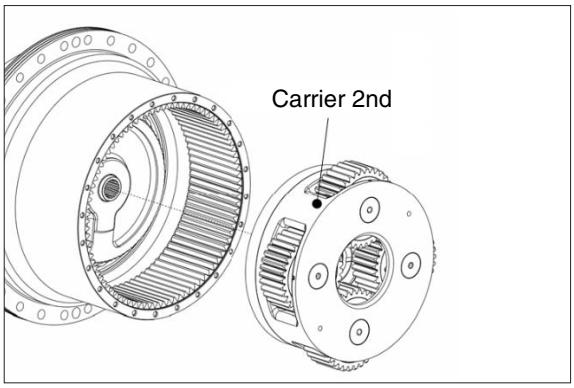
(20) Disassemble the sun gear 1st and sun gear 2nd.



320A8TM29E

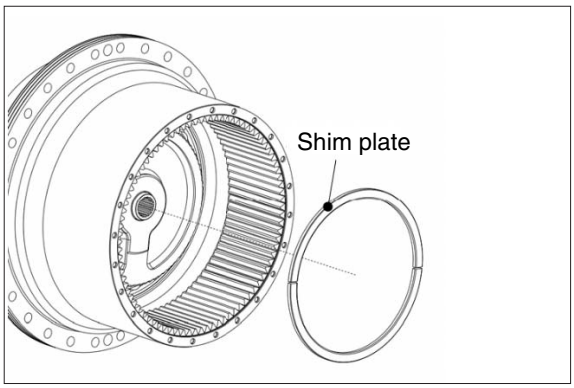
(21) Disassemble the carrier 2nd assembly.

※ Required tools : eye bolt M10x1.5 (2ea)



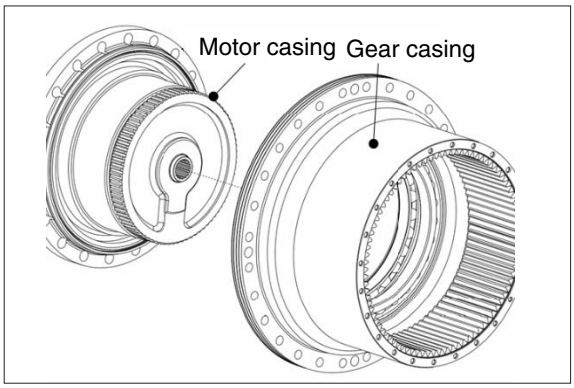
320A8TM30E

(22) Disassemble the shim plate.



320A8TM31E

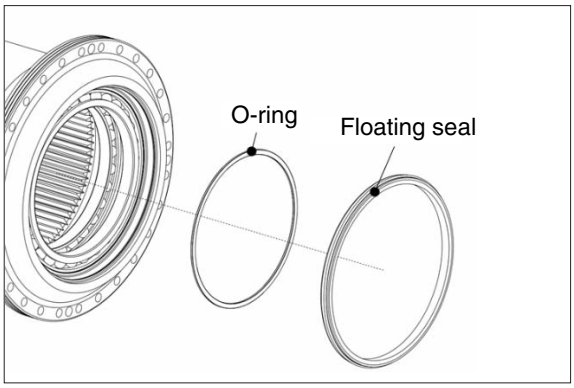
(23) Disassemble the gear casing from the motor casing.



320A8TM32E

(24) Disassemble the floating seals and O-ring.

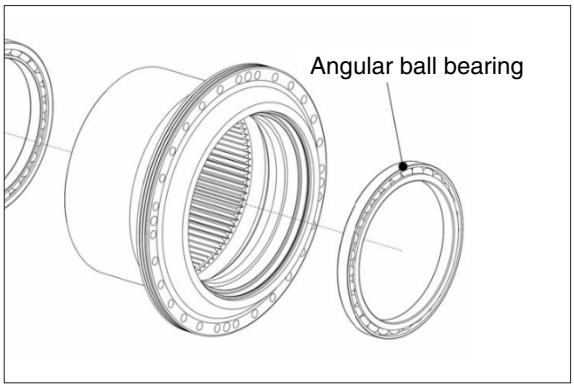
※ Damage caution of floating seal.



320A8TM33E

(25) Disassemble the angular ball bearing.

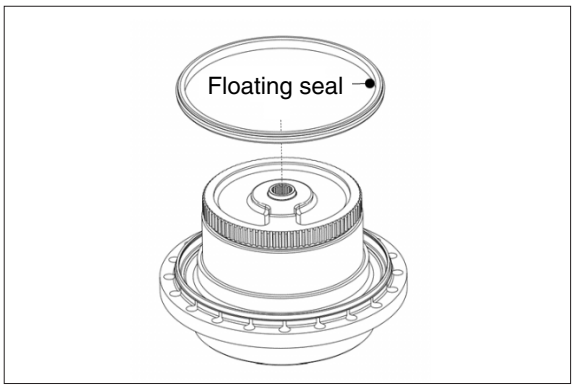
※ Do not disassemble if not necessary.



320A8TM34E

(26) Disassemble the floating seal.

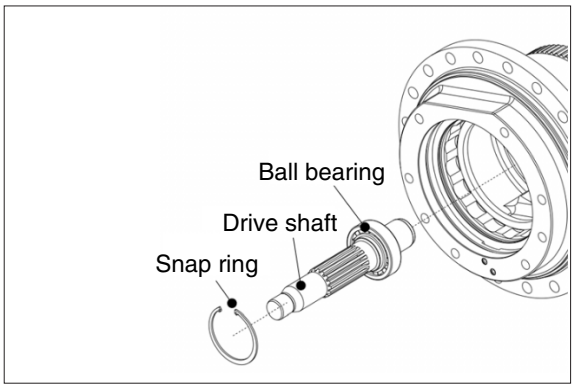
※ Damage caution of floating seal.



320A8TM35E

(27) Disassemble the drive shaft and ball bearing and snap ring.

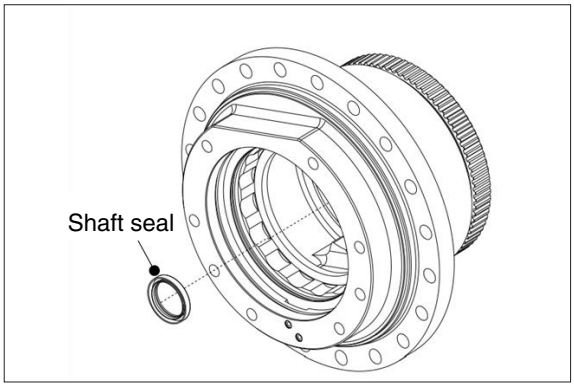
※ Required tools : plier



320A8TM36E

(28) Disassemble the shaft seal.

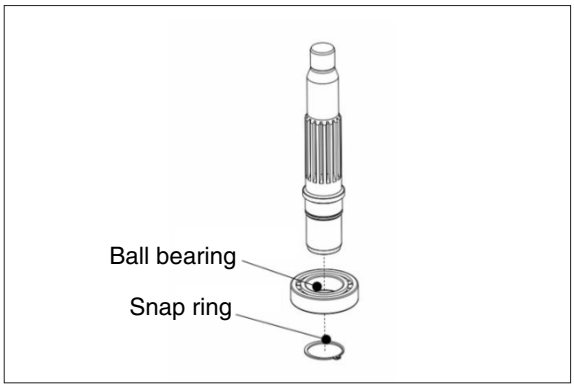
※ Do not re-use.



320A8TM37E

(29) Disassemble the ball bearing and snap ring.

※ Required tools : plier

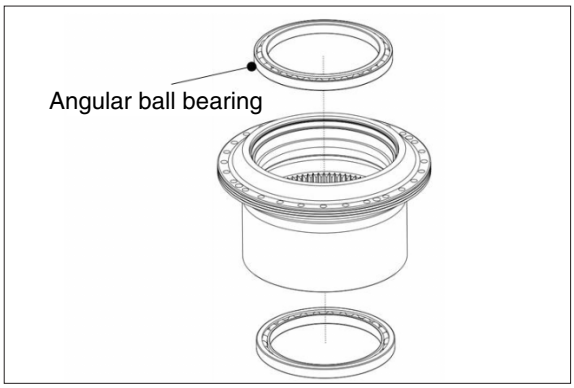


320A8TM38E

4) ASSEMBLY

(1) Assemble the angular ball bearing into the gear casing.

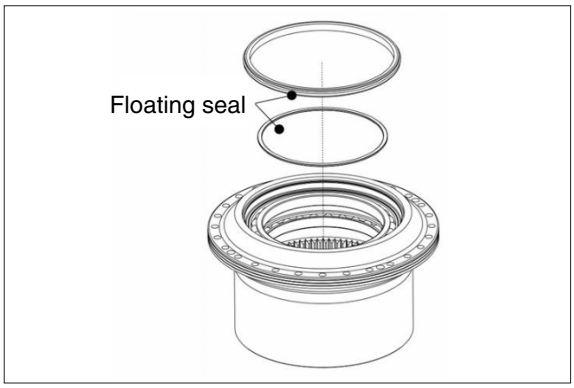
※ Required tools : angular ball bearing assembly press-fit jig.



320A8TM40E

(2) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the gear casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.

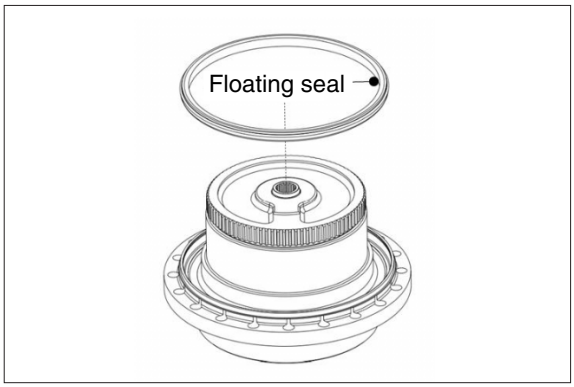
※ Required tools : floating seal assembly jig.



320A8TM41E

(3) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the gear casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.

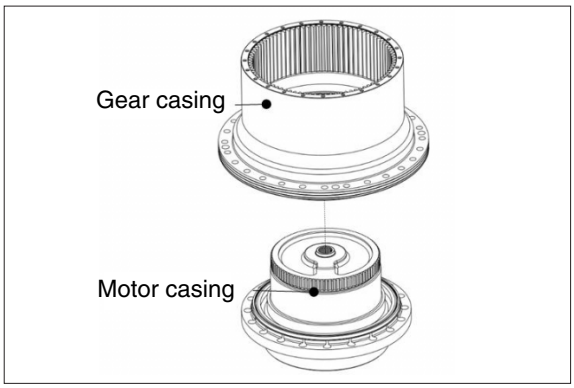
※ Required tools : floating seal assembly jig.



320A8TM42E

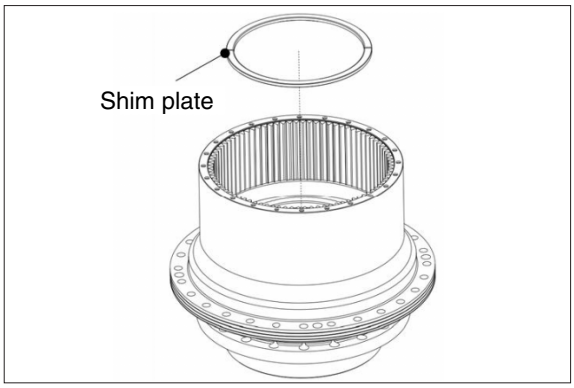
(4) Assemble the gear casing to motor casing.

※ Damage caution of floating seal.



320A8TM43E

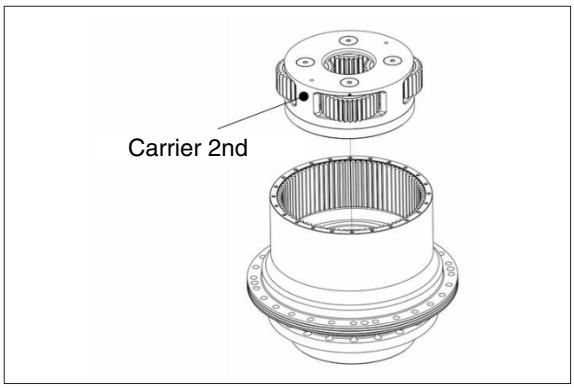
(5) Assemble the shim plate to motor casing.



320A8TM44E

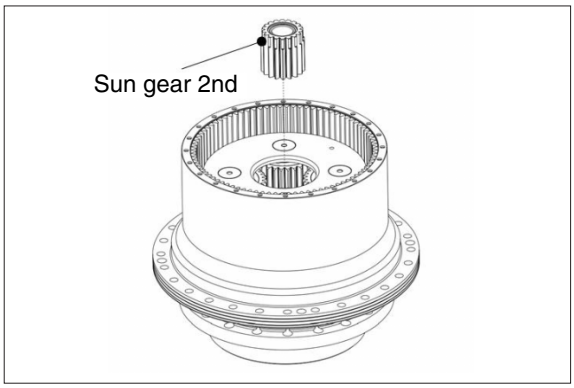
(6) Assemble the carrier 2nd assembly.

※ Required tools : eye bolt M10x1.5 (2ea)



320A8TM45E

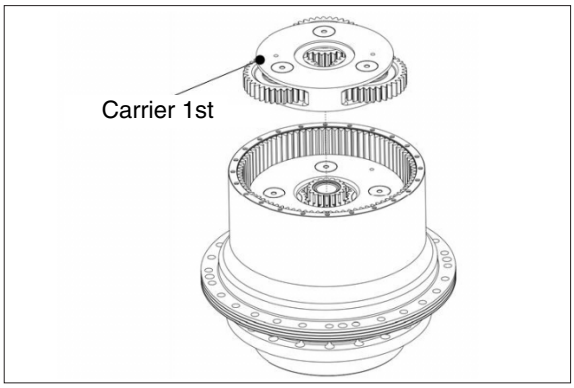
(7) Assemble the sun gear 2nd.



320A8TM46E

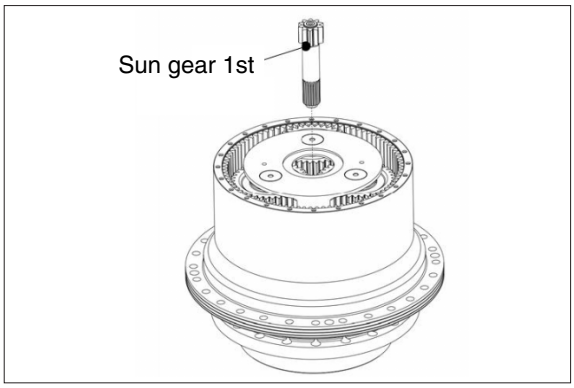
(8) Assemble the carrier 1st assembly

※ Required tools : eye bolt M10x1.5 (2ea)



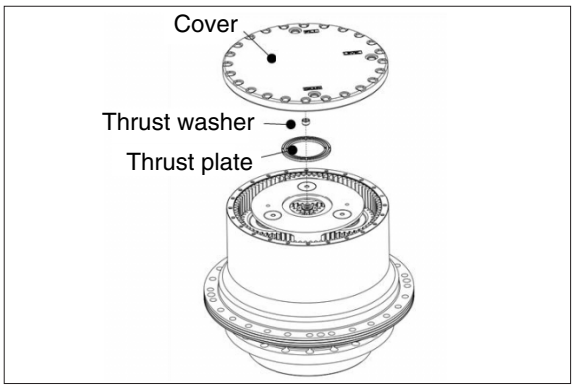
320A8TM47E

(9) Assemble the sun gear 1st.



320A8TM48E

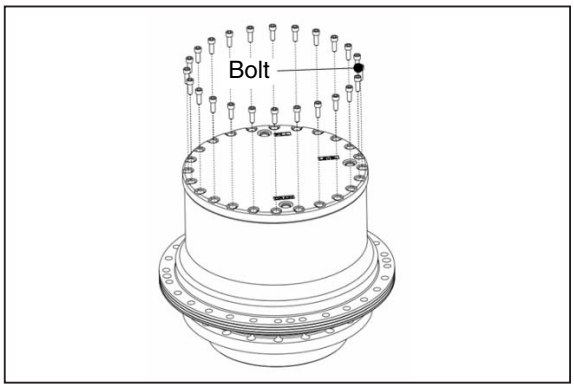
(10) Apply grease to thrust washer, thrust plate thinly and assemble them to cover.
Apply sealant to the contact face of the cover and assemble it to the gear casing.



320A8TM49E

(11) Tighten the bolt.

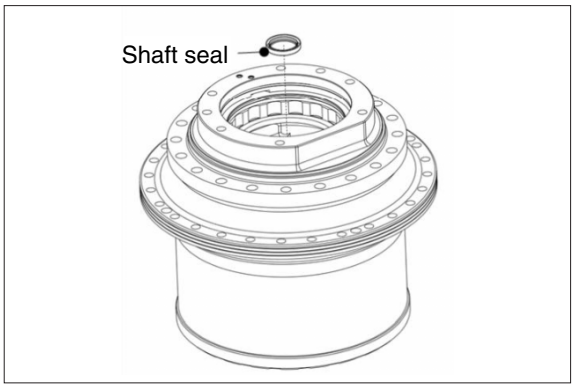
※ Required tools : torque wrench, hex bit 17 mm.
※ Bolt size : M10x1.5
※ Tightening torque : 5.9±1.0 kgf·m
(42.7±7.2 lbf·ft)



320A8TM26E

(12) Apply a small amount of hydraulic fluid to the outer diameter of the shaft seal and assemble it to the motor casing

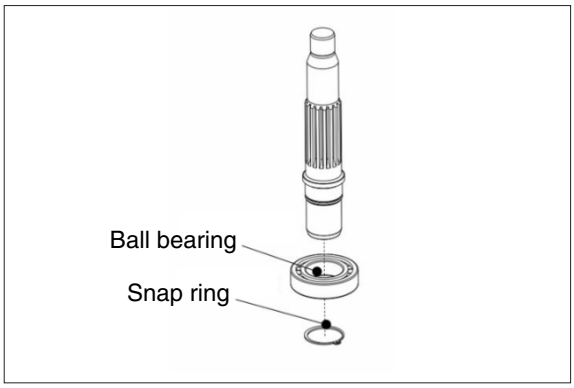
※ Required tools : shaft seal press-fit jig.



320A8TM50E

(13) Assemble the ball bearing and snap ring to the drive shaft.

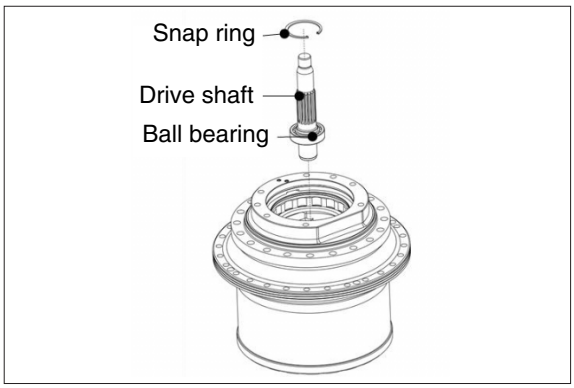
※ Required tools : ball bearing assembly press-fit jig, plier



320A8TM51E

(14) Assemble the drive shaft, ball bearing and snap ring to the motor casing.

※ Required tools : plier



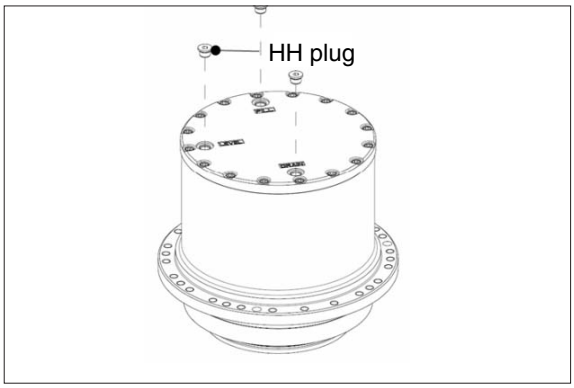
320A8TM52E

(15) Fill gear oil of 6.3 liter and assemble HH plug to cover.

※ Required tools : torque wrench, hex bit 10 mm.

※ HH plug size : PF 1/2

※ Tightening torque : 10.0±2.0 kgf·m (72.3±14.5 lbf·ft)



320A8TM53E

(16) Apply hydraulic fluid to the 2 speed piston outer diameter and swash plate polishing surface.

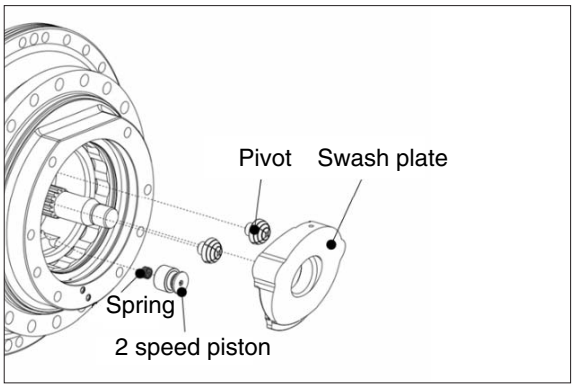
Apply grease to spring and assemble it to 2 speed piston. Assemble its to the motor casing.

Check whether assembled well by pushing 2 speed piston by hand.

Required tools : torque wrench, hex bit 10 mm.

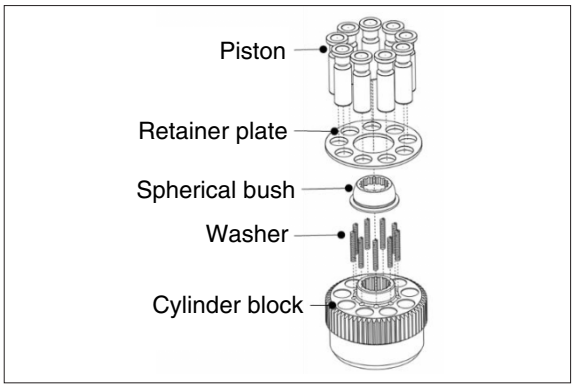
Assemble pivot and swash plate to motor casing.

Check whether low/high shift of swash plate well by pushing with hand.



320A8TM54E

(17) Assemble the cylinder spring, cylinder block, spherical bush, retainer plate and piston assembly.

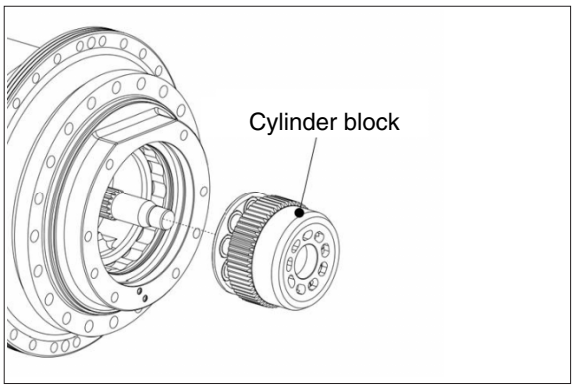


320A8TM55E

(18) Apply hydraulic fluid to the shoe.

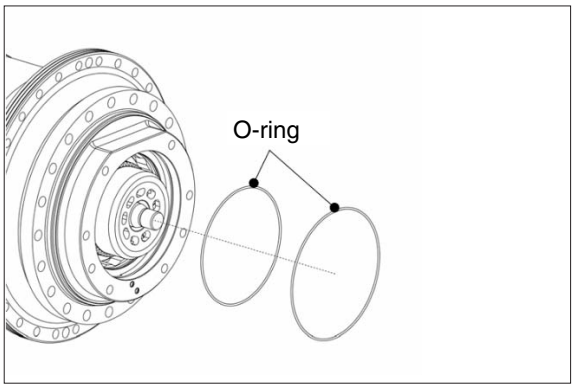
Assemble the cylinder block assembly to drive shaft.

Apply hydraulic fluid to the cylinder block polishing surface.



320A8TM56E

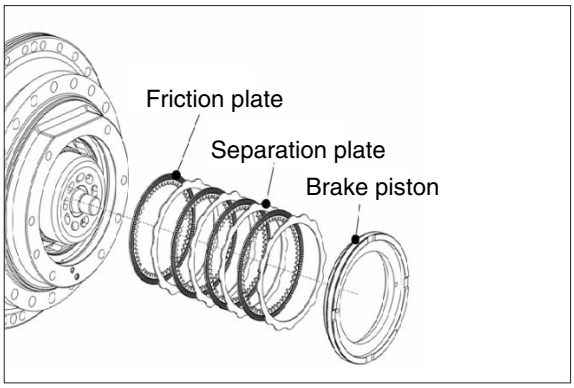
(19) Assemble the O-ring to the motor casing.



320A8TM57E

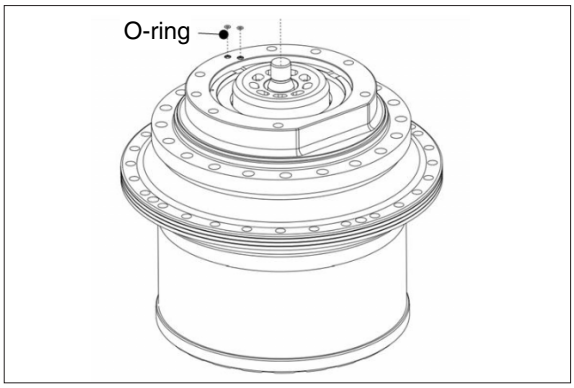
(20) Assemble the friction plate, separation plate to the motor casing in turn.
Be careful that the friction plate is in contact with the brake piston.
Assemble the brake piston to motor casing.
Check the brake piston is assembled completely to tap the the brake piston with a plastic hammer.

※ Quantity of friction plates and separation plates could be different of each model.



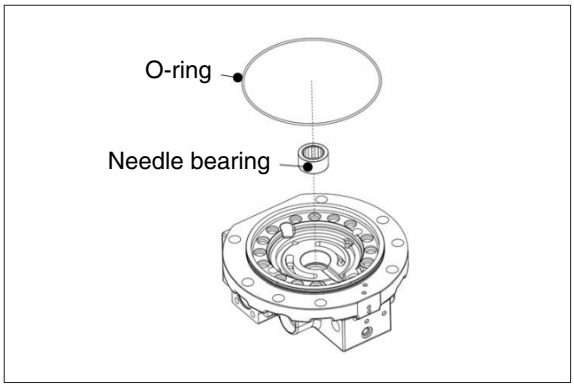
320A8TM58E

(21) Assemble the O-ring to the motor casing.



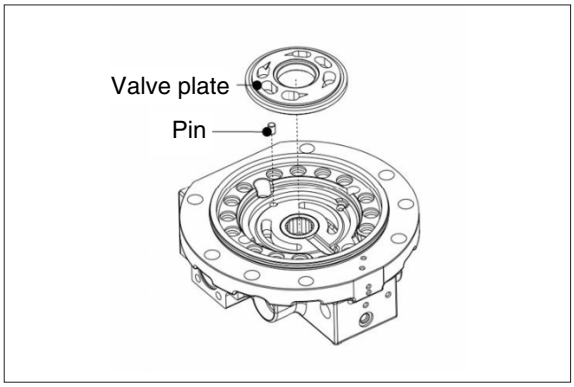
320A8TM59E

(22) Assemble the needle bearing to the valve casing.
Apply grease to the inner race of ball bearing.
Assemble the O-ring to the valve casing.



320A8TM60E

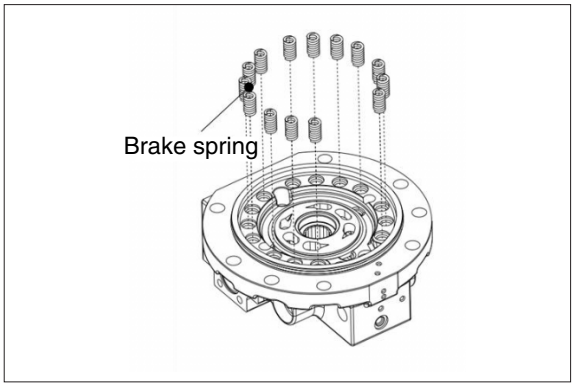
(23) Apply grease to the other side of the valve plate and assemble a valve plate and pin to valve casing.



320A8TM61E

(24) Apply grease to brake spring and assemble it to the valve casing.

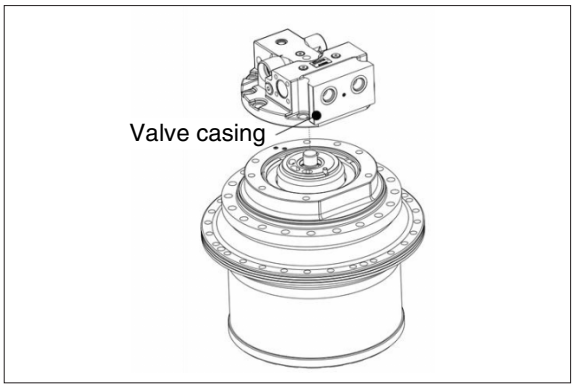
※ Quantity of brake springs could be different of each model.



320A8TM62E

(25) Assemble the valve casing to the motor casing.

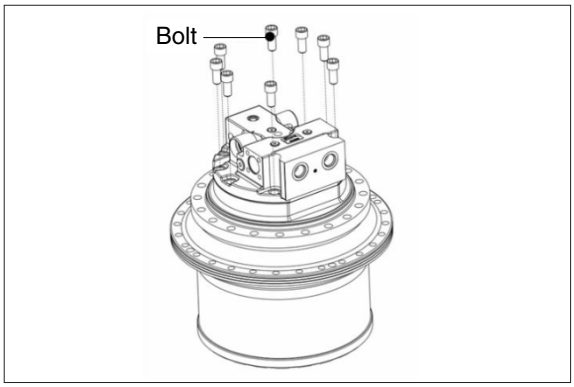
※ Required tools : guide pin
※ Guide pin size : M20x2.5x45
(total length 150 mm or more)



320A8TM19E

(26) Tighten each bolt evenly to assemble.

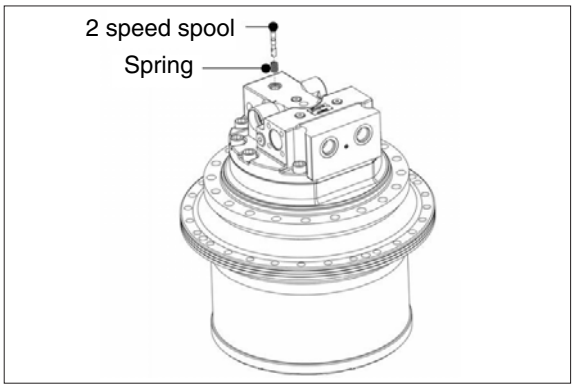
※ Required tools : torque wrench, hex bit 17 mm.
※ Bolt size : M20x2.5
※ Tightening torque : 50.3±8.0 kgf·m
(364±57.9 lbf·ft)



320A8TM18E

(27) Assemble the 2 speed spool, spring to valve casing.

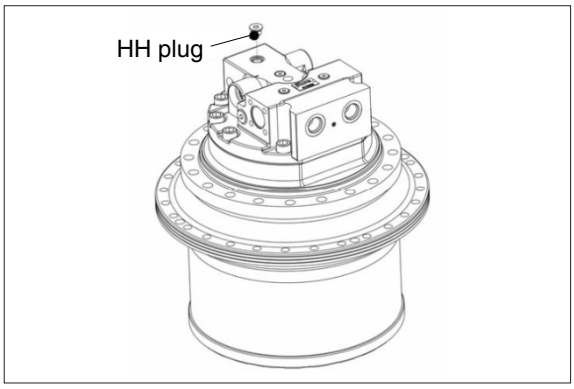
※ Damage caution of 2 speed spool surface.



320A8TM17E

(28) Assemble the HH plug to valve casing.

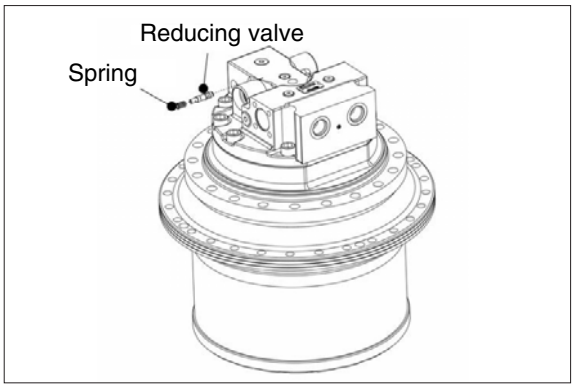
※ Required tools : torque wrench, hex bit 10 mm.
※ Bolt size : PF 1/2
※ Tightening torque : 10.0±2.0 kgf·m
(72.3±14.5 lbf·ft)



320A8TM16E

(29) Assemble the reducing valve and spring to valve casing.

※ Damage caution of reducing valve surface.



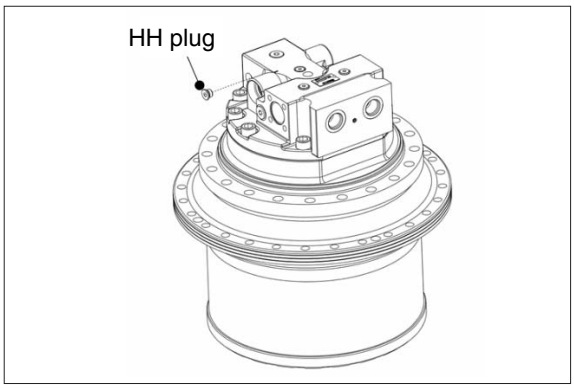
320A8TM15E

(30) Assemble the HH plug to valve casing.

※ Required tools : torque wrench, hex bit 8 mm.

※ Bolt size : PF 3/8

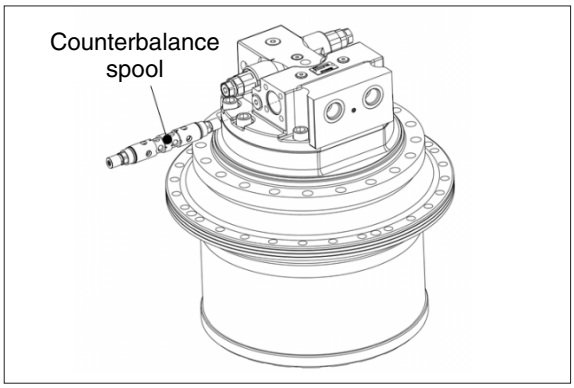
※ Tightening torque : 6.0±1.5 kgf·m
(43.4±10.8 lbf·ft)



320A8TM14E

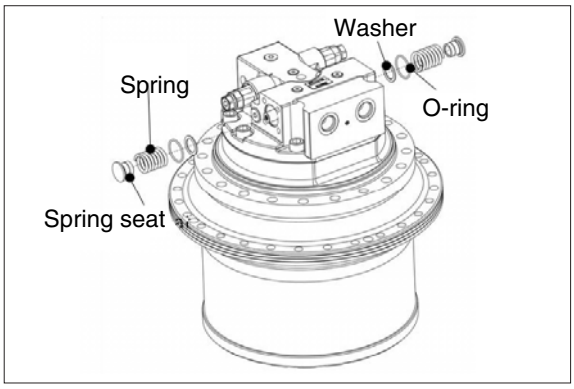
(31) Apply hydraulic fluid to counterbalance spool assy outer diameter and rotate the counterbalance spool assy slowly to assemble.

※ Damage caution of counterbalance spool surface.



320A8TM12E

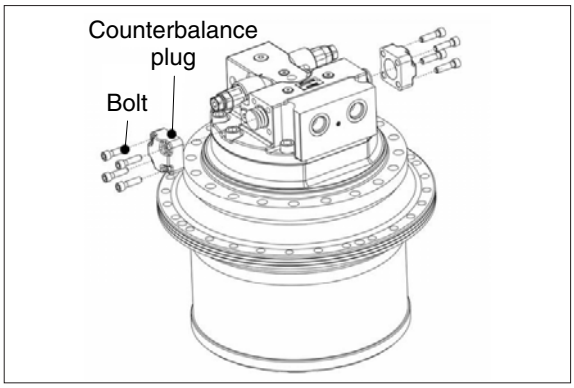
(32) Assemble the spring, spring seat, O-ring and washer to the valve casing.



320A8TM11E

(33) Assemble the counterbalance plug and bolt to valve casing.

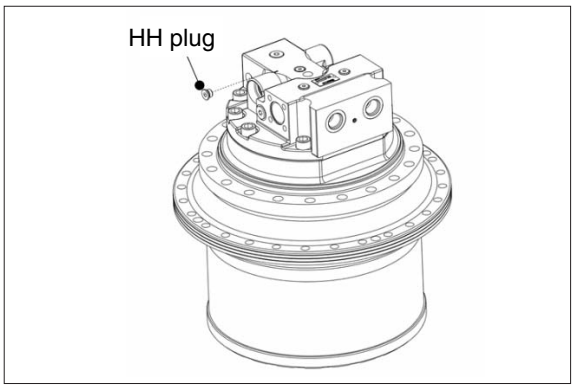
※ Required tools : torque wrench, hex bit 10 mm.
※ Bolt size : M12x1.75
※ Tightening torque : 10.4±1.6 kgf·m
(75.2±15.6 lbf·ft)



320A8TM10E

(34) Assemble the relief valve to relief valve block.

※ Required tools : torque wrench, hex socket 41 mm.
※ Bolt size : M33x1.5
※ Tightening torque : 18.0±3.6 kgf·m
(130±26.0 lbf·ft)



320A8TM14E

4) CHECKLIST AFTER ASSEMBLY

(1) Supply sufficient hydraulic fluid to the hydraulic motor part, fill the reduction gear with the appropriate amount of reduction gear oil and then perform a trial run.

(2) In a trial run, perform rotation test at low speed under no load and then a jack up test after mounted on equipment.

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ Escaping fluid under pressure can penetrate the skin causing serious injury.

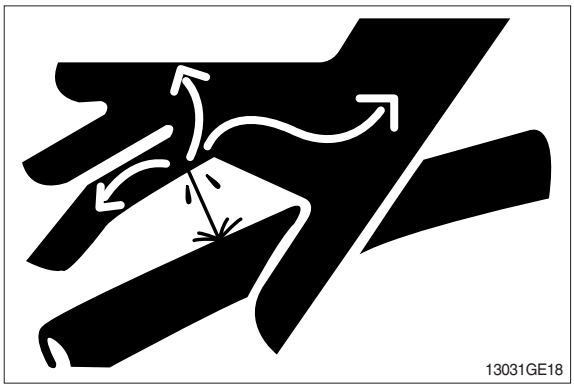
(4) Loosen the socket bolt (1).

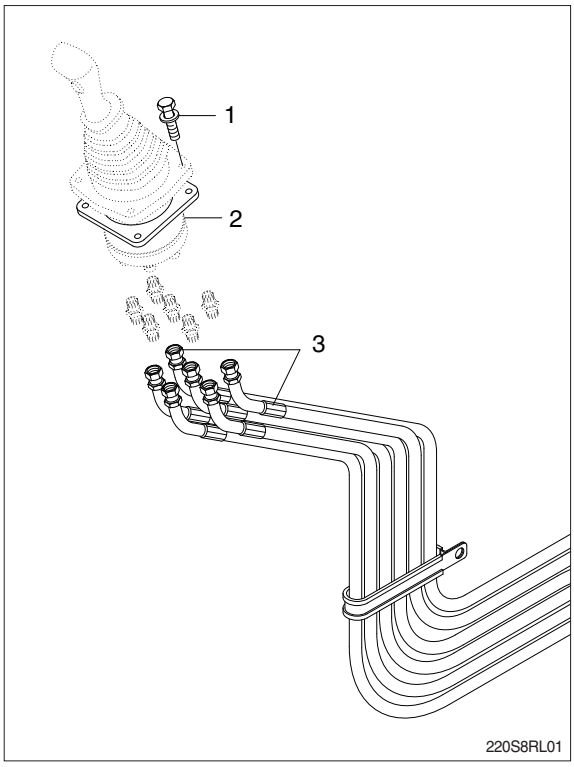
(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.





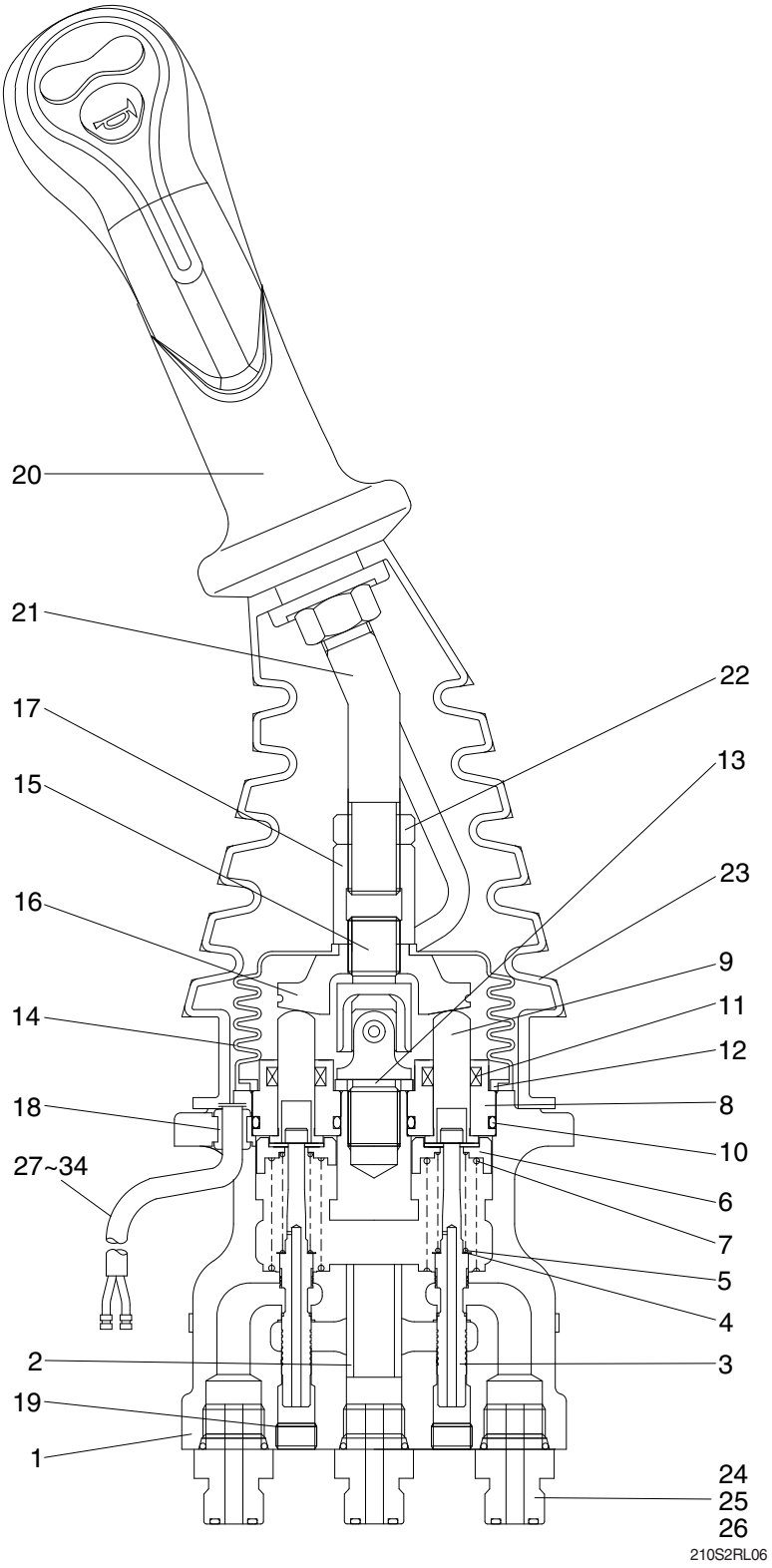
2) INSTALL

(1) Carry out installation in the reverse order to removal.

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

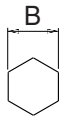
1) STRUCTURE



1 Case
2 Bushing
3 Spool
4 Shim
5 Spring
6 Spring seat
7 Spring
8 Plug
9 Push rod
10 O-ring
11 Rod seal
12 Plate
13 Spacer
14 Boot
15 Joint assembly
16 Swash plate
17 Adjusting nut
18 Bushing
19 Plug
20 Handle assembly
21 Handle bar
22 Nut
23 Boot
24 Last guard filter
25 Connector
26 Connector
27 Connector
28 Connector
27 Connector
29 Connector
30 Connector
31 Small guide
32 Connector
33 Big guide
34 Connector

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
Spanne	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	15	M14	3.8	27.5
Swash plate	16	M14	7.0	50.6±2.9
Adjusting nut	17	M14	7.0	50.6±2.9
Lock nut	22	M14	5.0±0.35	36.2±2.5

3) DISASSEMBLY

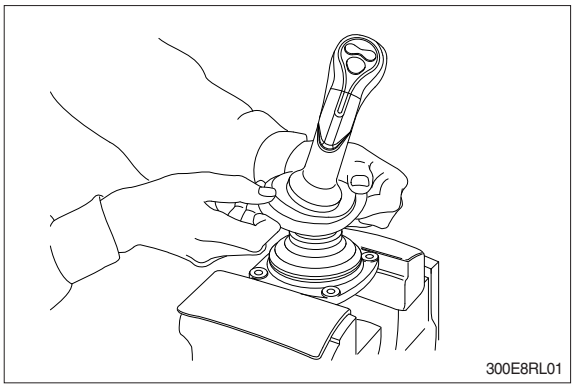
※ Procedures are based on the type M1.

(1) Clean pilot valve with kerosene.

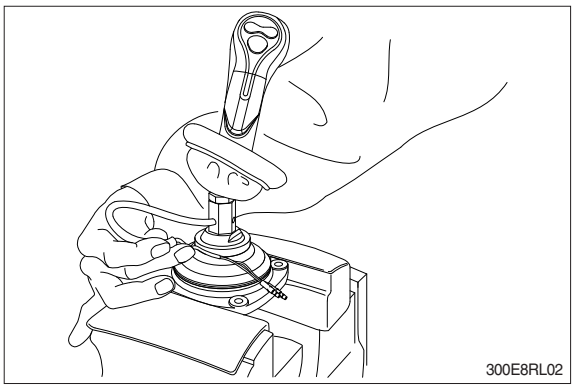
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

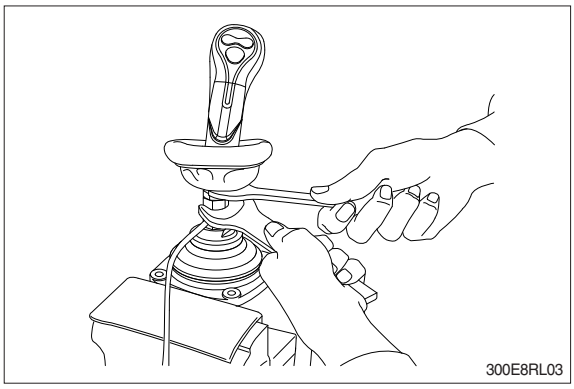
(3) Remove end of boot (23) from case (1) and take it out upwards.



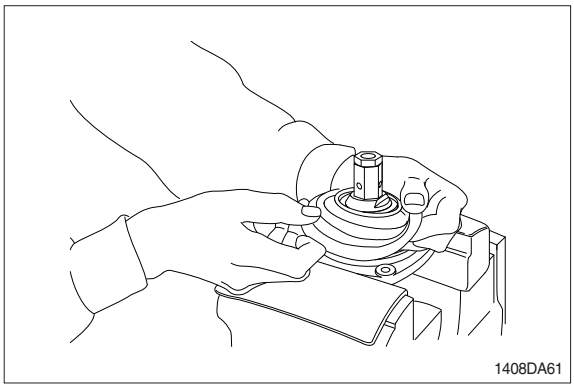
※ For valve with switch, remove cord also through hole of casing.



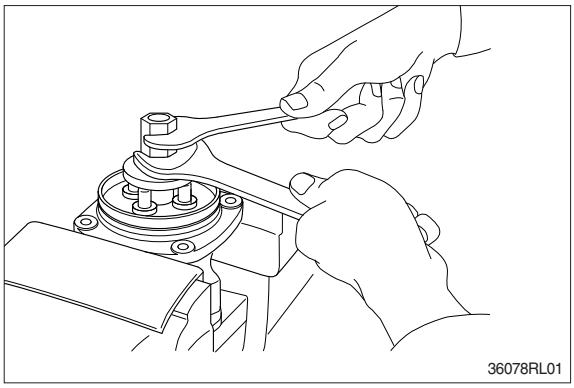
(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.

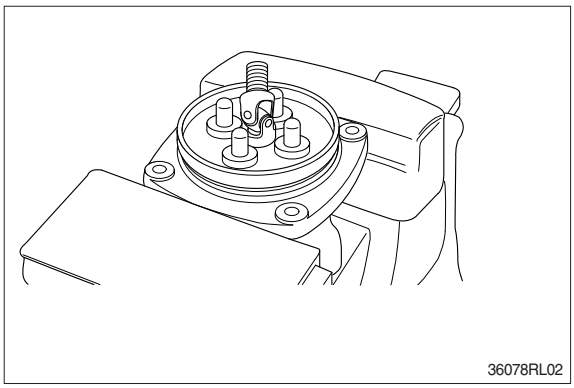


(5) Remove the boot (14).



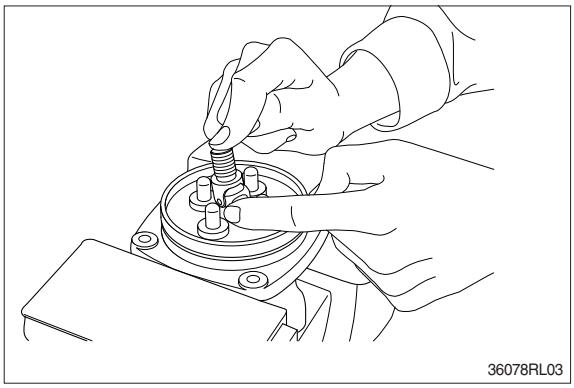
(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.

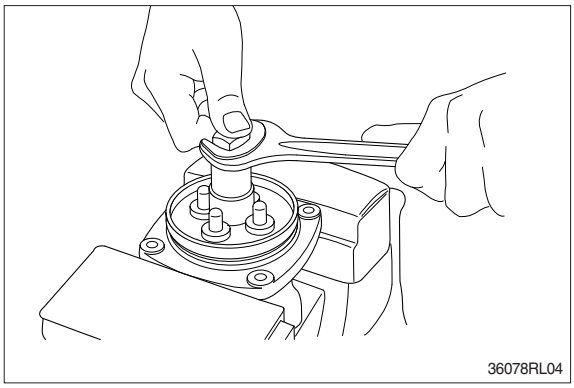




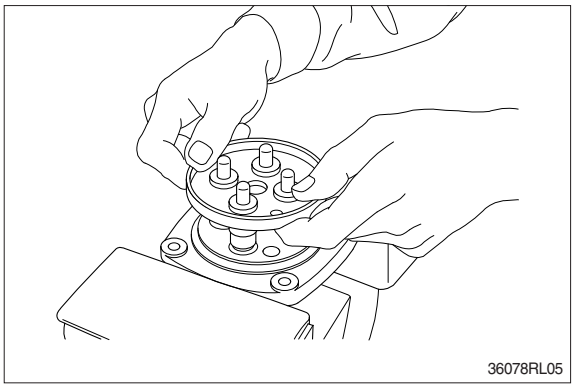
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint.
Pay attention to this.





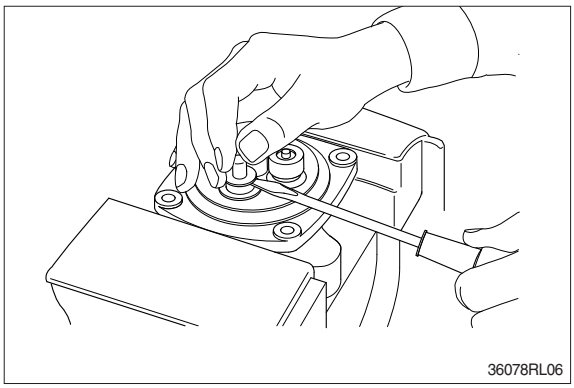
(8) Remove plate (12).



(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

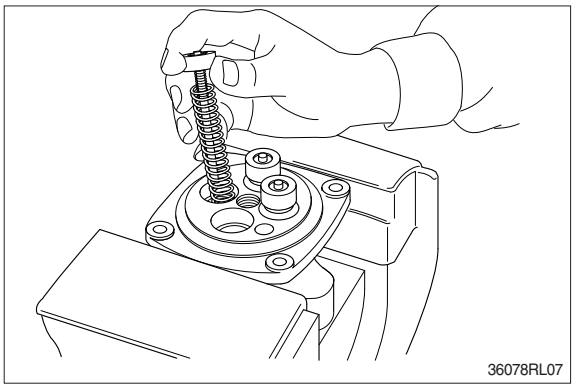
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (7) force.
Pay attention to this.



(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs.

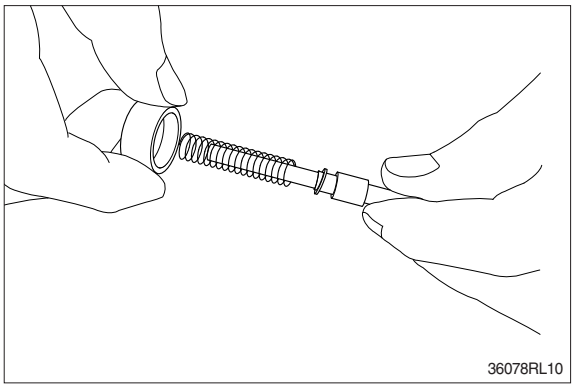


(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

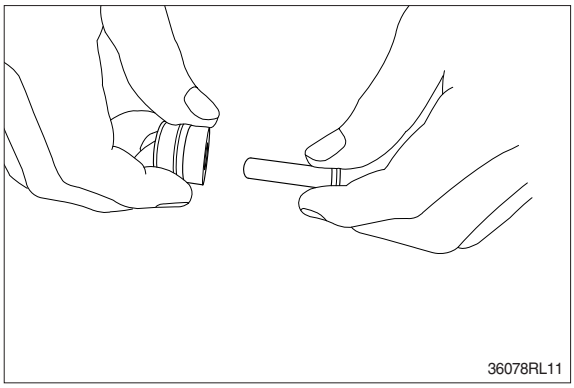
※ Pay attention not to damage spool surface.

※ Record original position of spring seat (6).

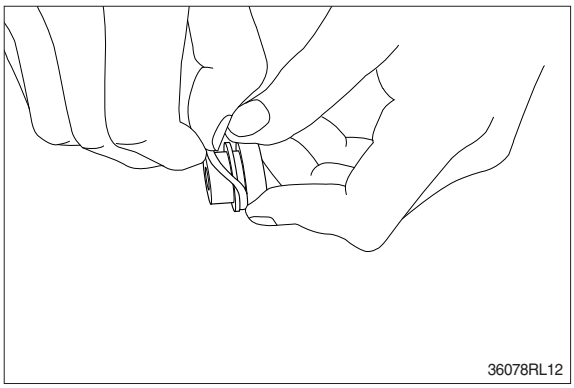
※ Until being assembled, they should be handled as one subassembly group.

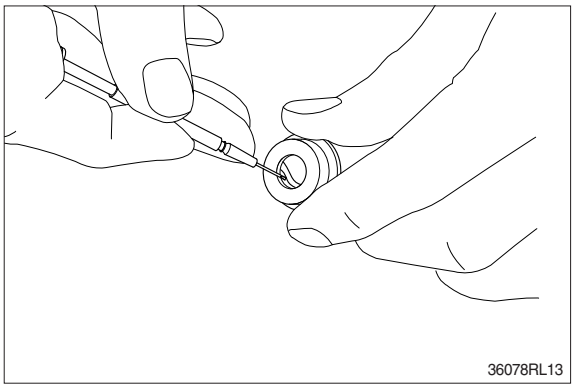


(12) Take push rod (9) out of plug (8).

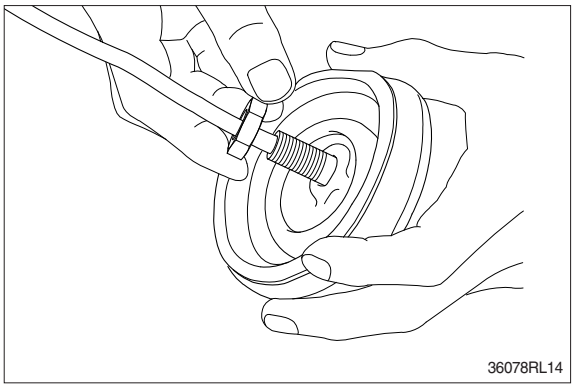


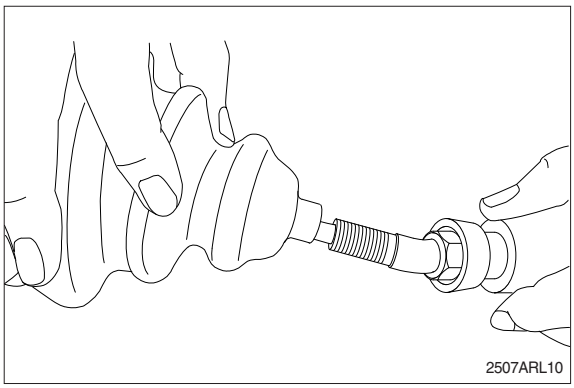
(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.





(14) Remove lock nut (22) and then boot (23).





(15) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

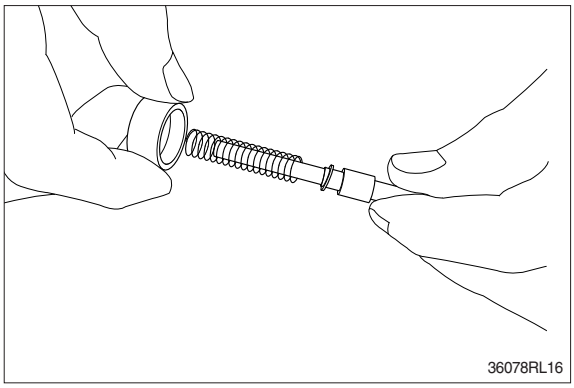
(16) Rust prevention of parts

Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

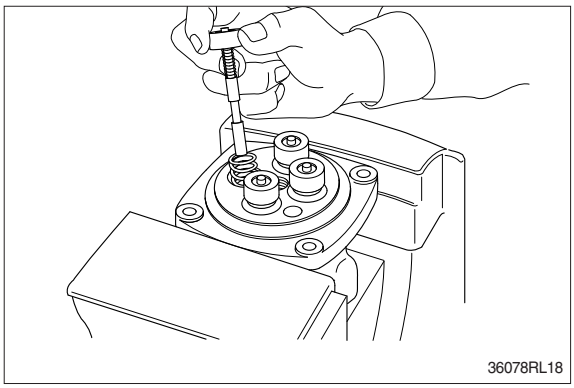
4) ASSEMBLY

(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.

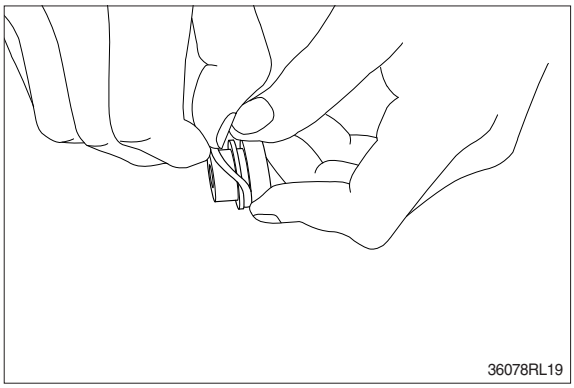


(2) Assemble spring (7) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

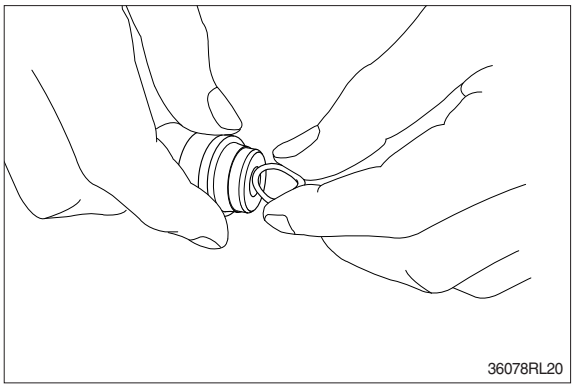


(3) Assemble O-ring (10) onto plug (8).



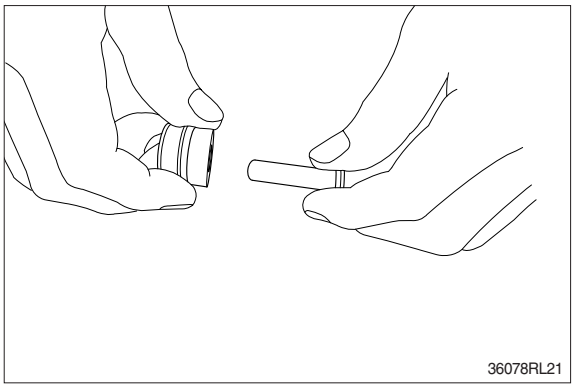
(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.



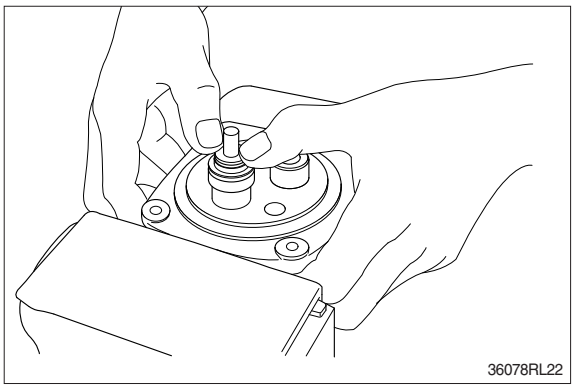
(5) Assemble push rod (9) to plug (8).

※ Apply working oil on push-rod surface.

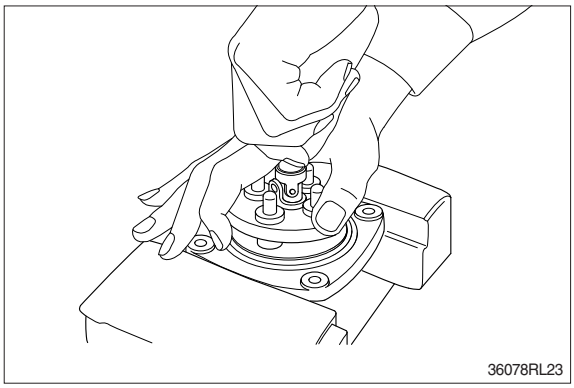


(6) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

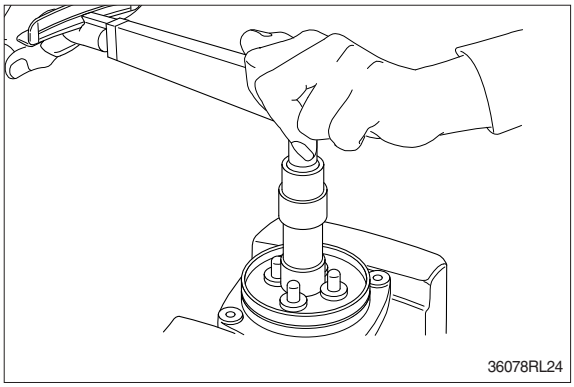


(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



(8) Fit plate (12).

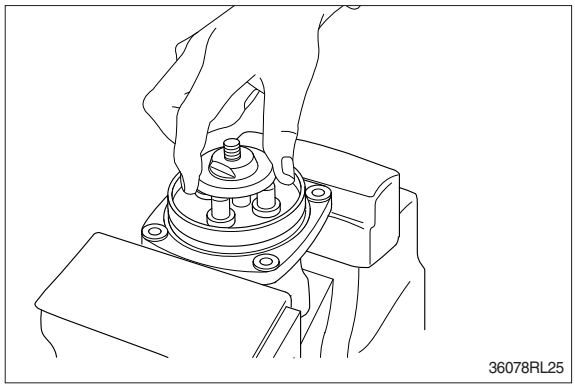
(9) Tighten joint (15) with the specified torque to casing, utilizing jig.



(10) Assemble swash plate (16) to joint (15).

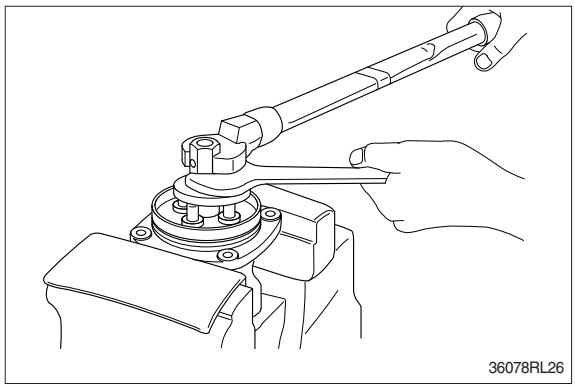
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

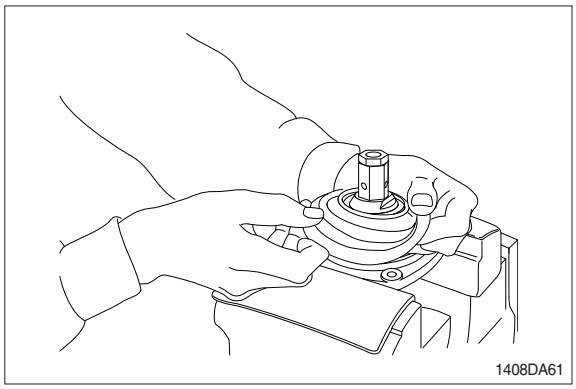


(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

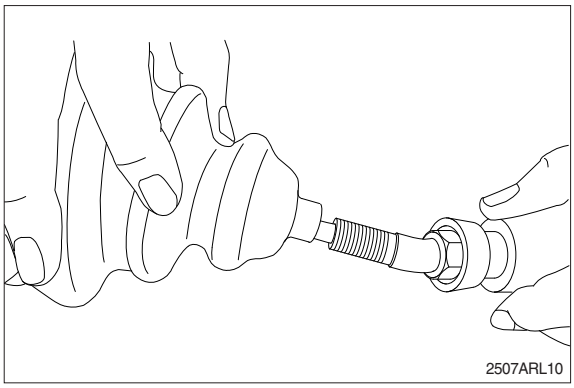
※ During tightening, do not change position of disk.

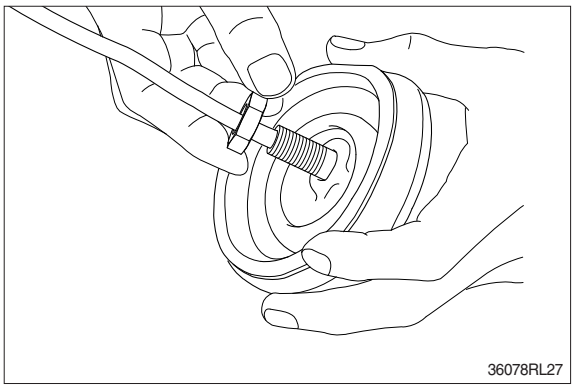


(12) Fit boot (14) to plate.

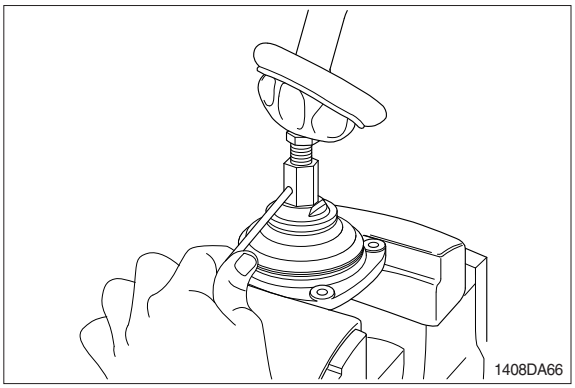


(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



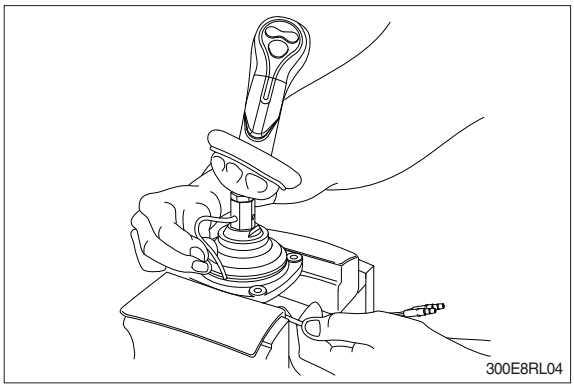


(14) Pull out cord and tube through adjusting nut hole provided in direction 60 ° to 120 ° from casing hole.

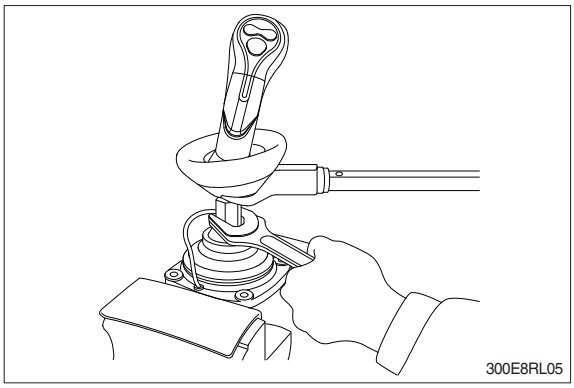


(15) Assemble bushing (18) to plate and pass cord and tube through it.

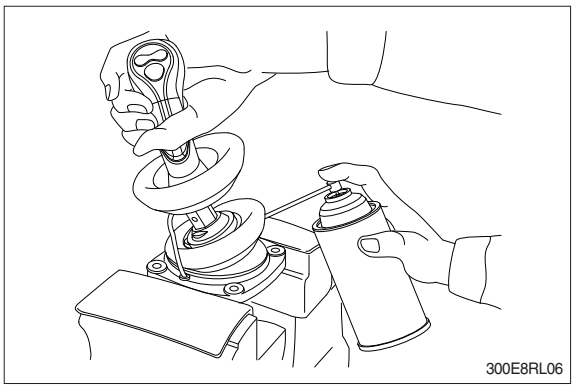
※ Provide margin necessary to operation.



(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

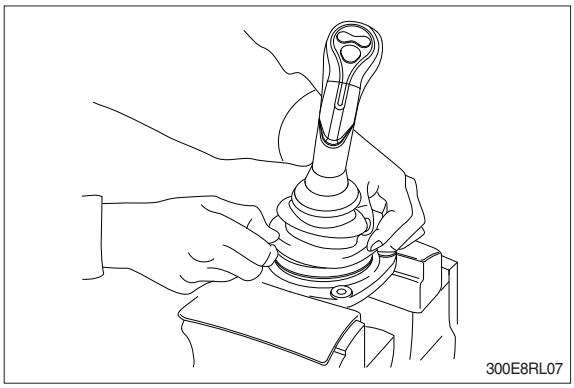


(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(18) Assemble lower end of bellows to casing.

(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

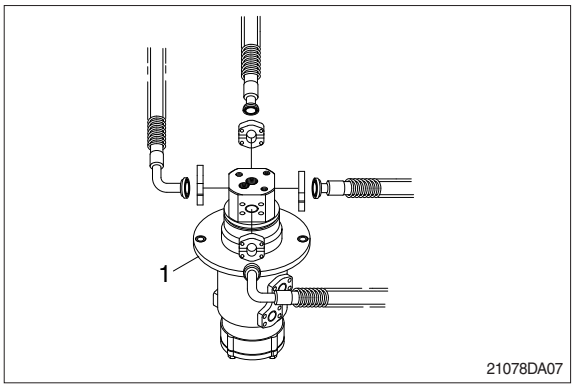
(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



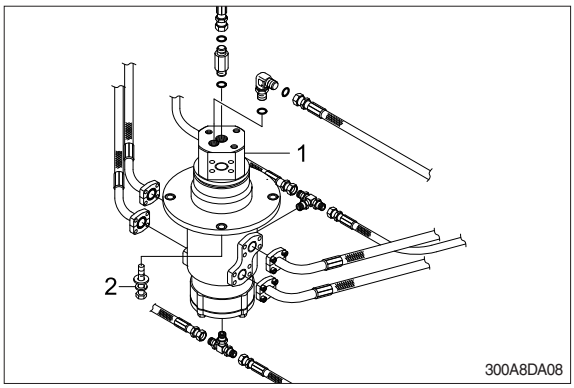
(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
- Weight : 55 kg (120 lb)
- Tightening torque : 12.3±1.3 kgf · m (89±9.4 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

2) INSTALL



(1) Carry out installation in the reverse order to removal.

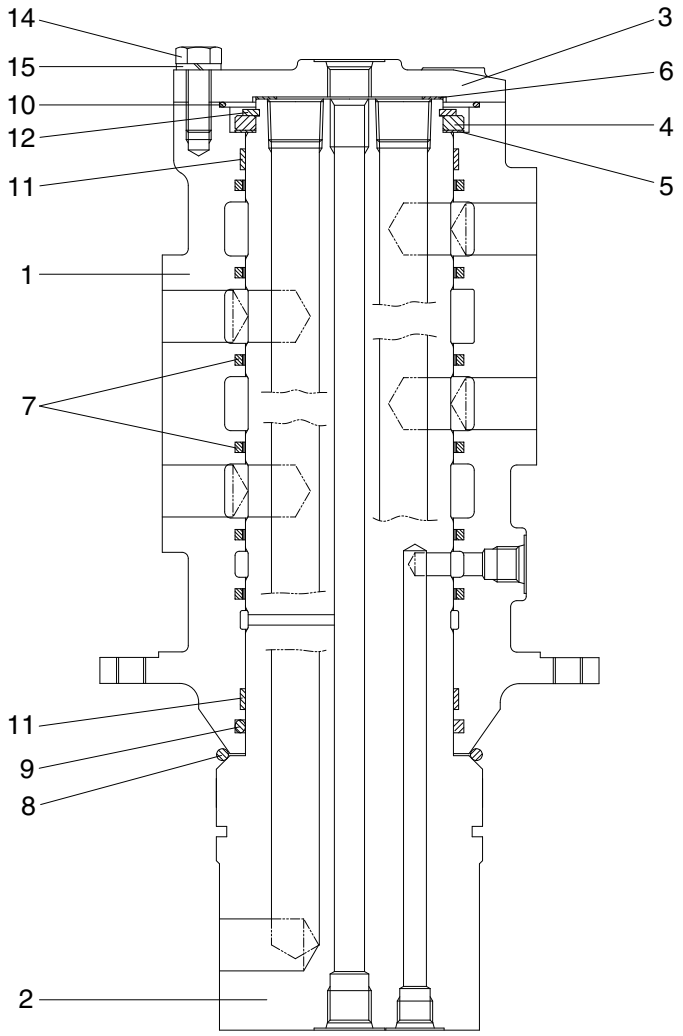
※ Take care of turning joint direction.

※ Assemble hoses to their original

※ positions.
Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



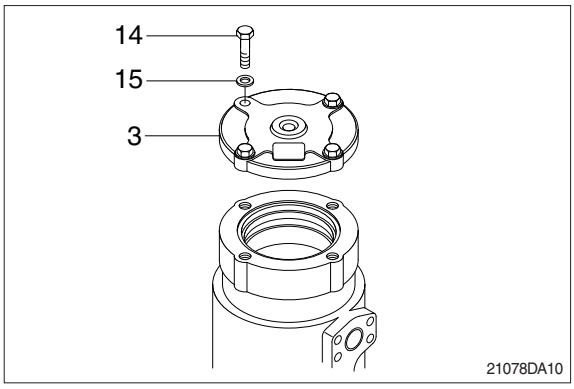
21098TJ01

1	Hub	6	Shim	11	Wear ring
2	Shaft	7	Slipper seal	12	Retainer ring
3	Cover	8	O-ring	13	Plug
4	Spacer	9	O-ring	14	Hexagon bolt
5	Shim	10	O-ring	15	Spring washer

2) DISASSEMBLY

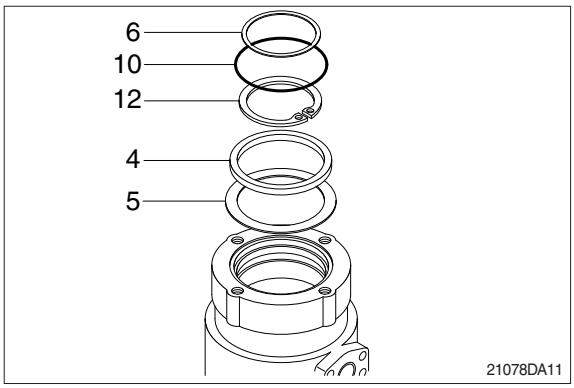
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (14), washer (15) and cover (3).



(2) Remove shim (6) and O-ring (10).

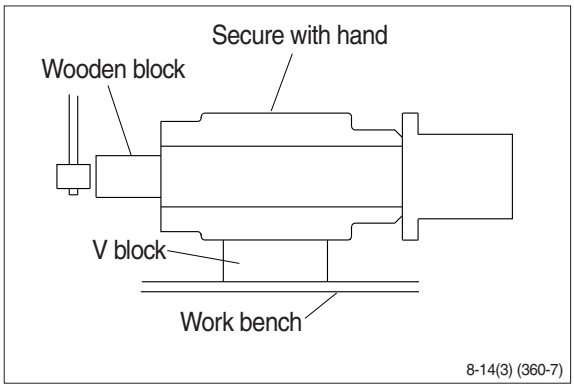
(3) Remove retainer ring (12), spacer (4) and shim (5).



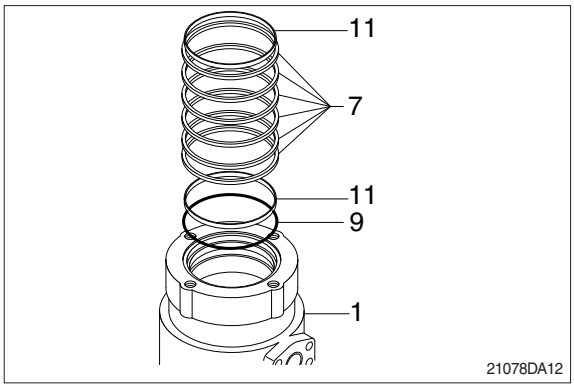
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



(5) Remove six slipper seals (7) and O-ring (9), two wear ring (11) from hub (1).

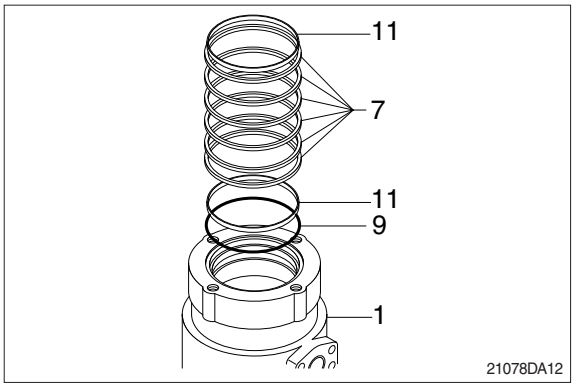


3) ASSEMBLY

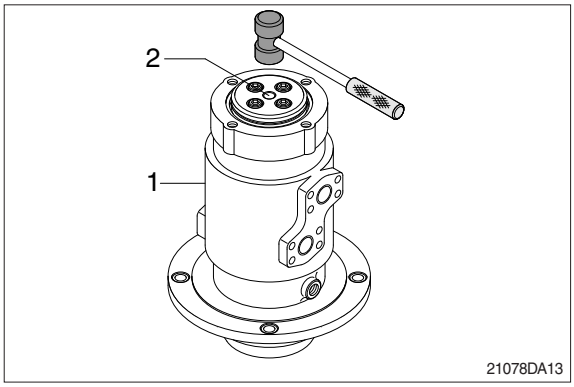
※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix seven slipper seal (7) and O-ring (9), two wear ring (11) to hub (1).

(2) Fit O-ring (8) to shaft (2).



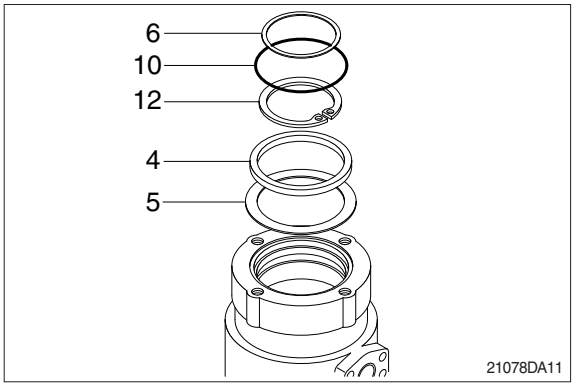
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



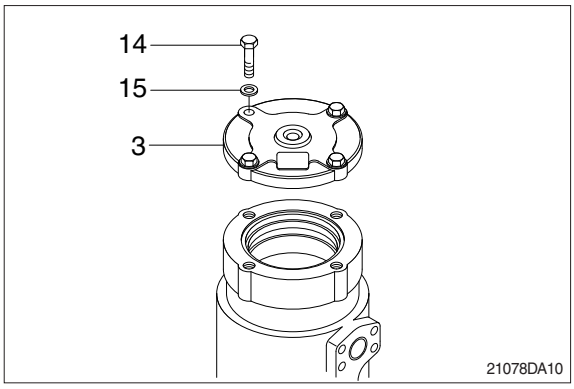
(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

(5) Fit O-ring (10) to hub (1).

(6) Fit shim (6) to shaft (2).



(7) Install cover (3) to body (1) and tighten bolts (14).
Torque : 10~12.5 kgf · m
(72.3~90.4 lbf · ft)



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

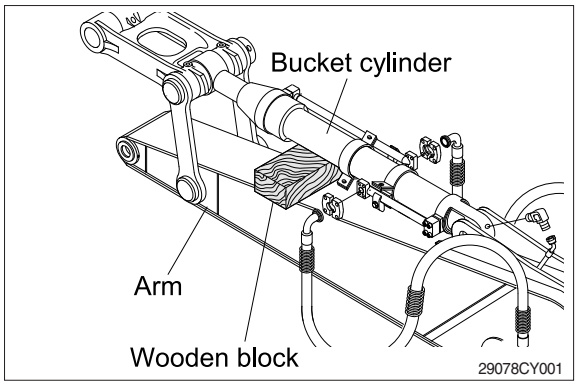
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

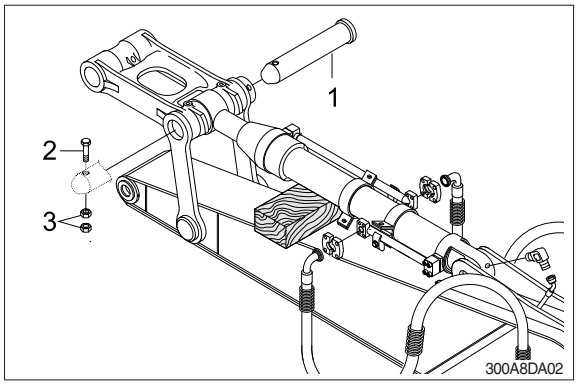
※ Escaping fluid under pressure can penetrate the skin causing serious injury.
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

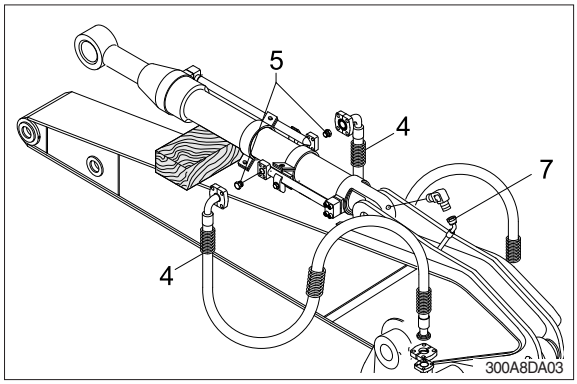


② Remove bolt (2), nut (3) and pull out pin (1).

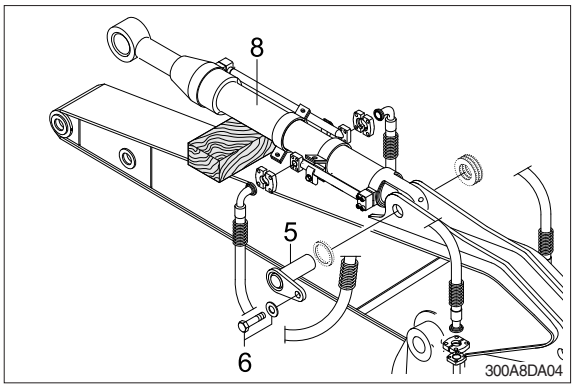
※ Tie the rod with wire to prevent it from coming out.



③ Disconnect bucket cylinder hoses (4), grease line hose (7) and put plugs (5) on cylinder pipe.



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
⑤ Remove bucket cylinder assembly (8).
· Weight : 220 kg (485 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the bucket cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) ARM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

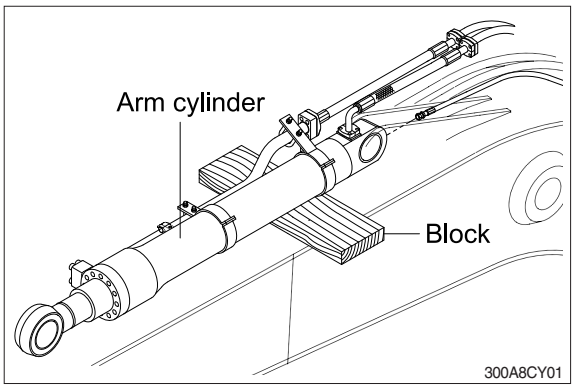
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

※ Escaping fluid under pressure can penetrate the skin causing serious injury.

Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

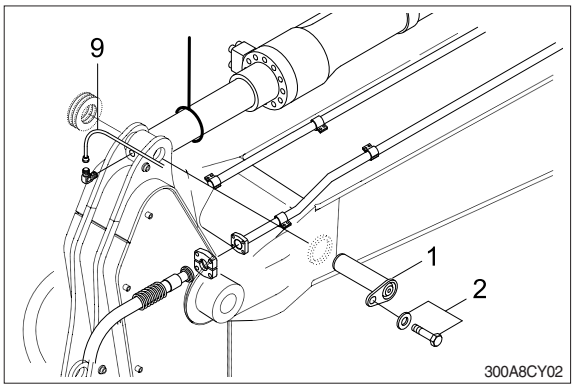
① Set block between arm cylinder and boom.



② Disconnect grease line hose (9).

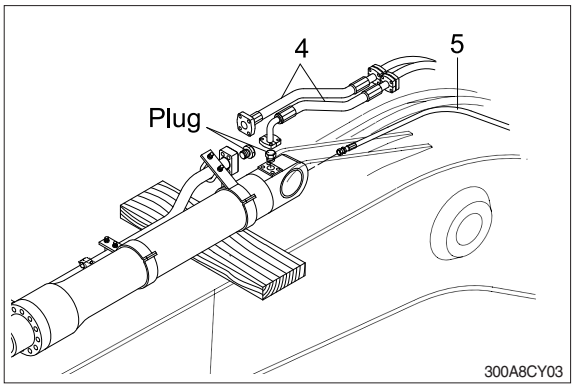
③ Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



④ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

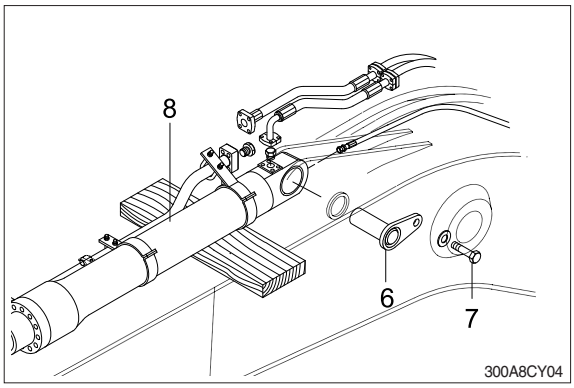
⑤ Disconnect greasing pipings (5).



⑥ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑦ Remove arm cylinder assembly (8).

· Weight : 360 kg (790 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

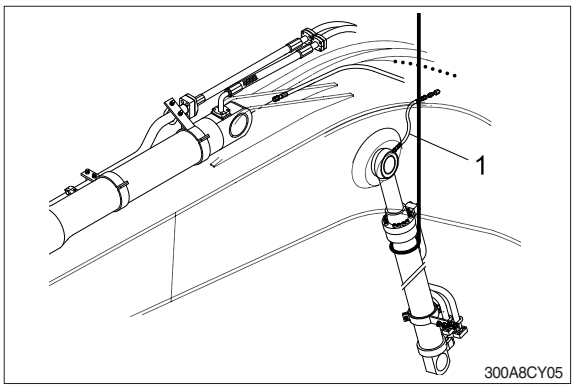
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

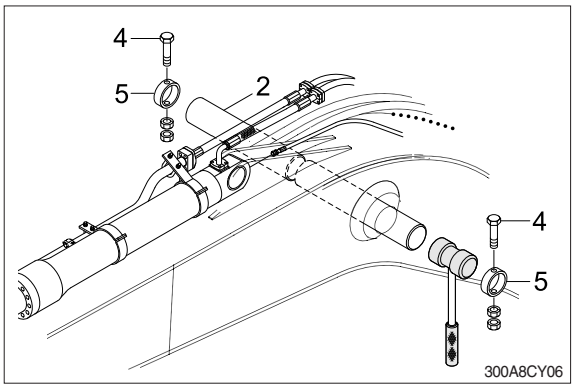
① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

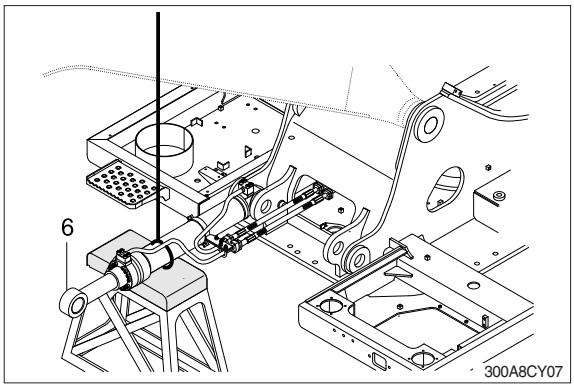


③ Remove bolt (4), pin stopper (5) and pull out pin (2).

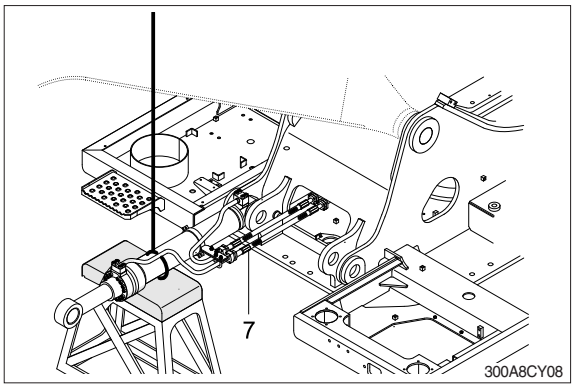
※ Tie the rod with wire to prevent it from coming out.



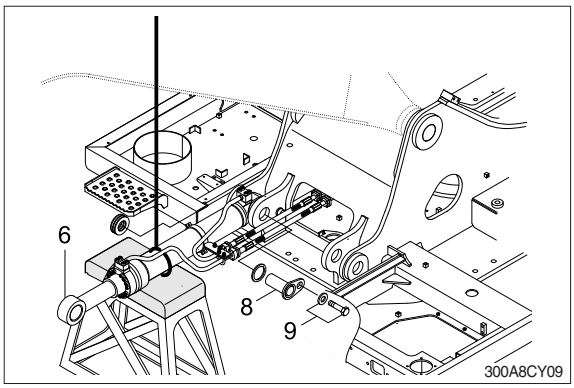
④ Lower the boom cylinder assembly (6) on a stand.



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 : 270 kg (600 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the boom cylinder.

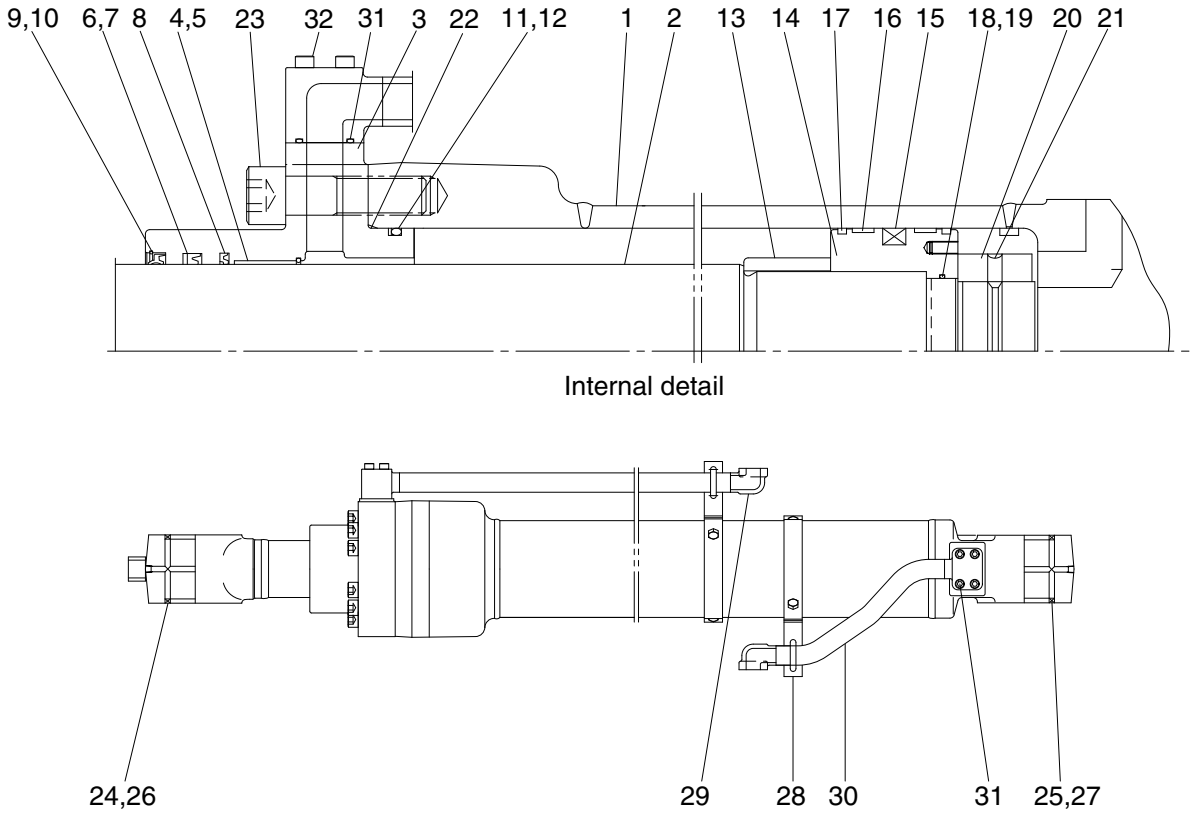
※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

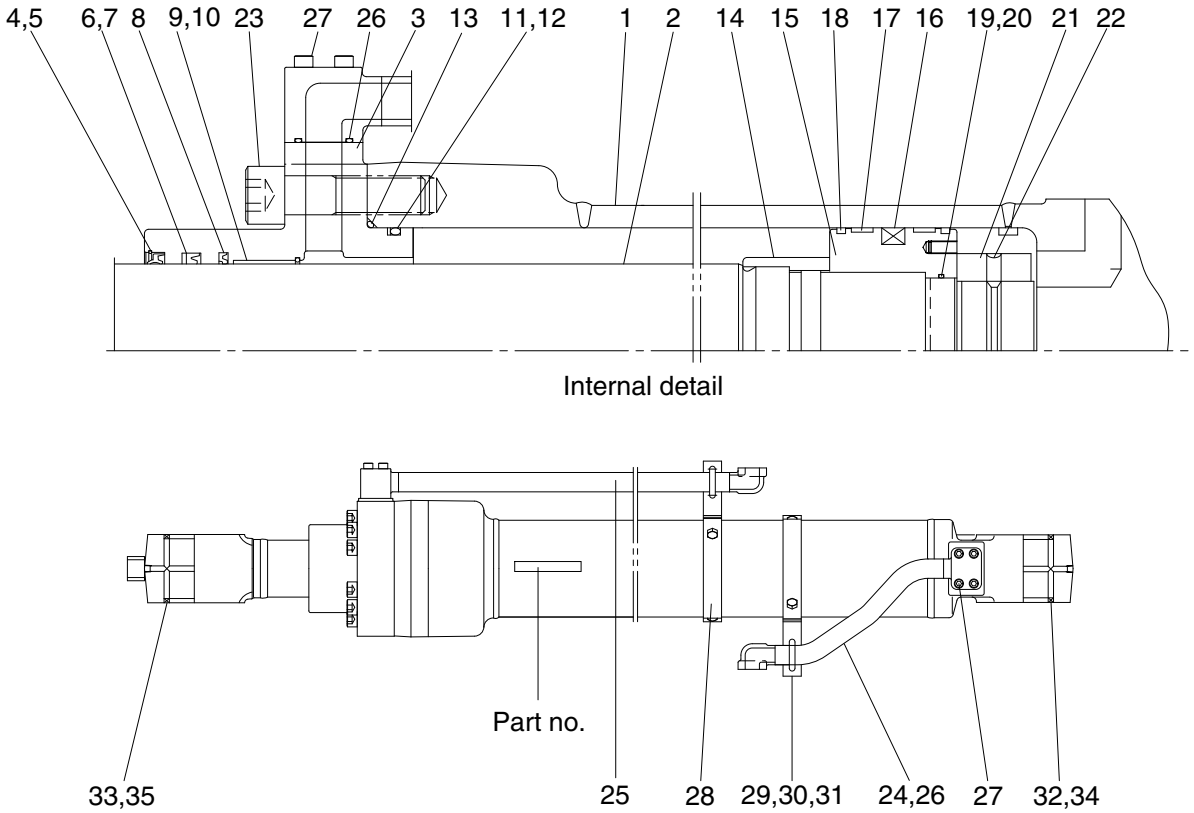
(1) Bucket cylinder

① Standard (CHANGZHOU)



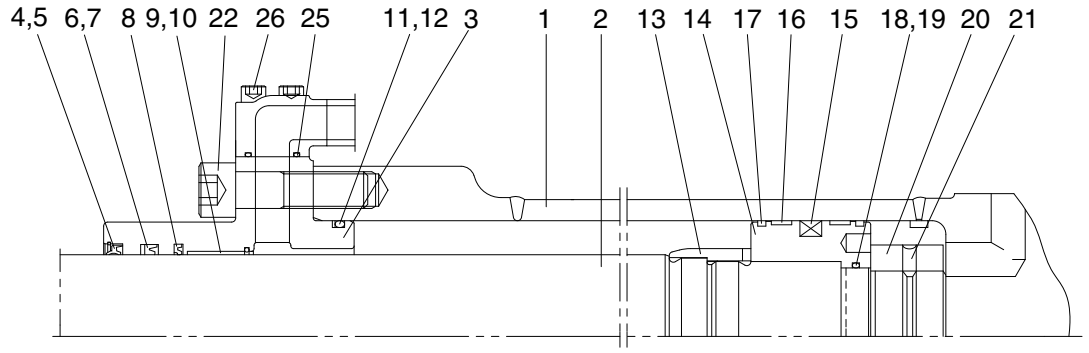
1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Dust seal
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	29	Pipe assembly
8	Buffer ring	19	Back up ring	30	Pipe assembly
9	Dust wiper	20	Lock nut	31	O-ring
10	Snap ring	21	Hexagon socket set screw	32	Hexagon socket head bolt
11	O-ring	22	O-ring		

Standard (SHPAC)

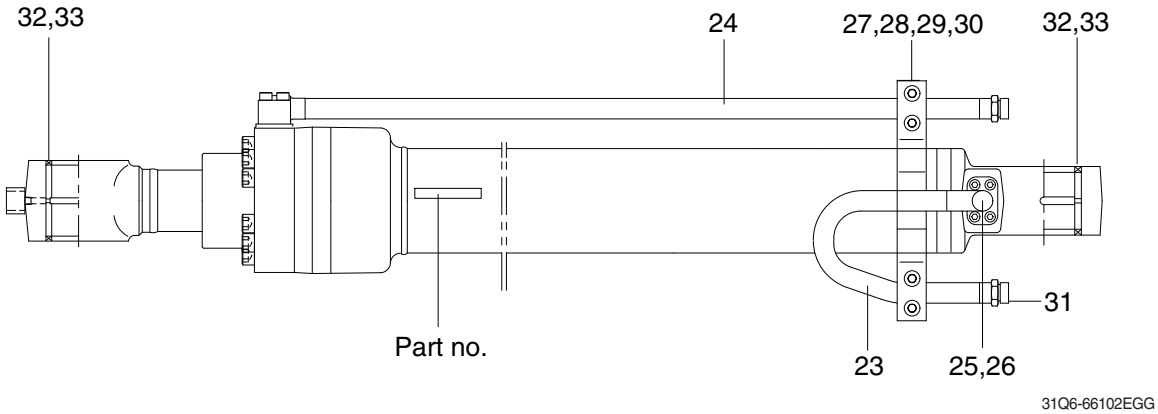


1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	Pin bushing
9	Dry bearing	21	Lock nut	33	Pin bushing
10	Retaining ring	22	Hexagon socket set screw	34	Dust seal
11	O-ring	23	Hexagon socket head bolt	35	Dust seal
12	Back up ring	24	Pipe assembly-B		

② Long reach (SHPAC)



Internal detail

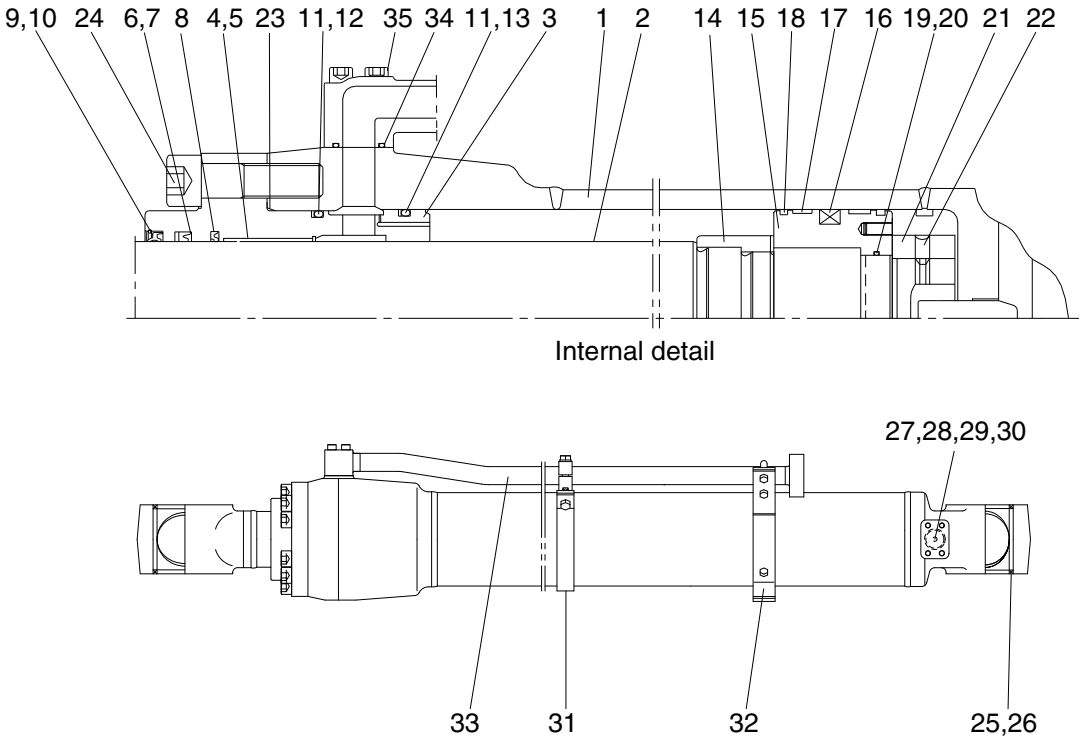


31Q6-66102EGG

1	Tube assembly	12	Back up ring	23	Pipe assembly-B
2	Rod assembly	13	Cushion ring	24	Pipe assembly-R
3	Gland	14	Piston	25	O-ring
4	Dust wiper	15	Piston seal	26	Hexagon socket head bolt
5	Retaining ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	U-bolt
7	Back up ring	18	O-ring	29	Hexagon nut
8	Buffer ring	19	Back up ring	30	Spring washer
9	Dry bearing	20	Lock nut	31	O-ring
10	Retaining ring	21	Hexagon socket set screw	32	Pin bushing
11	O-ring	22	Hexagon socket head bolt	33	Dust seal

(2) Arm cylinder

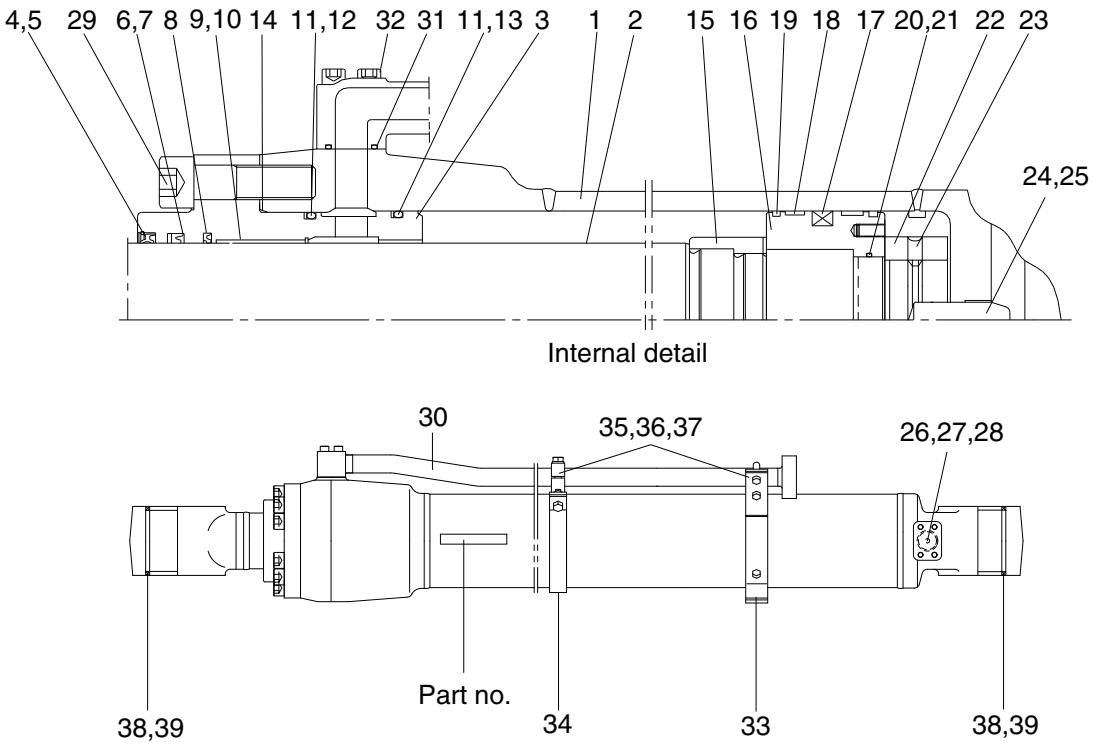
① Standard (CHANGZHOU)



31K8-50150C

1	Tube assembly	13	Back up ring	25	Pin bushing
2	Rod assembly	14	Cushion ring	26	Dust seal
3	Gland	15	Piston	27	Check valve
4	DD2 bushing	16	Piston seal	28	Coil spring
5	Snap ring	17	Wear ring	29	O-ring
6	Rod seal	18	Dust ring	30	Plug
7	Back up ring	19	O-ring	31	Band assembly-R
8	Buffer ring	20	Back up ring	32	Band assembly-B
9	Dust wiper	21	Lock nut	33	Pipe assembly-R
10	Snap ring	22	Hexagon socket set screw	34	O-ring
11	O-ring	23	O-ring	35	Hexagon socket head bolt
12	Back up ring	24	Hexagon socket head bolt		

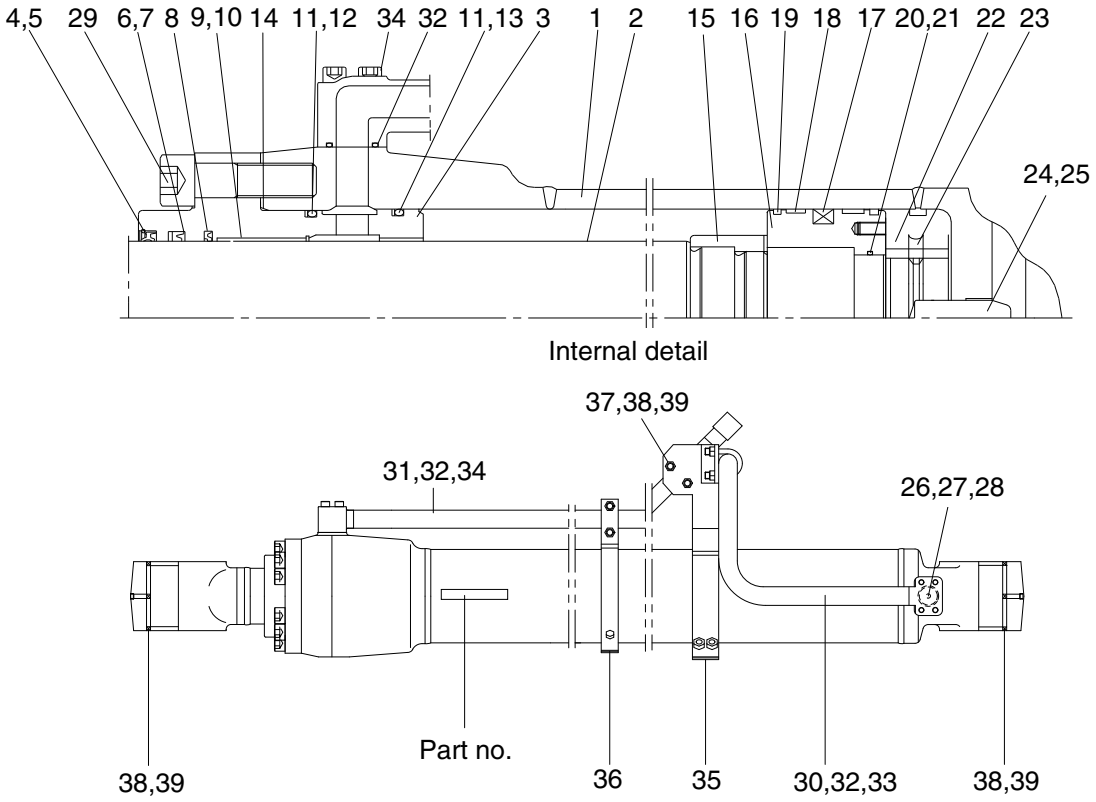
Standard (SHPAC)



31K8-50150E

1	Tube assembly	14	O-ring	27	Coil spring
2	Rod assembly	15	Cushion ring	28	Plug
3	Gland	16	Piston	29	Hexagon socket head bolt
4	Dust wiper	17	Piston seal	30	Pipe assembly-R
5	Retaining ring	18	Wear ring	31	O-ring
6	Rod seal	19	Dust ring	32	Hexagon socket head bolt
7	Back up ring	20	O-ring	33	Band assembly-B
8	Buffer ring	21	Back up ring	34	Band assembly-R
9	Dry bearing	22	Lock nut	35	U-bolt
10	Retaining ring	23	Hexagon socket set screw	36	Hexagon nut
11	O-ring	24	Cushion plunger	37	Spring washer
12	Back up ring	25	Stop ring	38	Pin bushing
13	Back up ring	26	Check valve	39	Dust seal

② 2-piece (SHPAC)

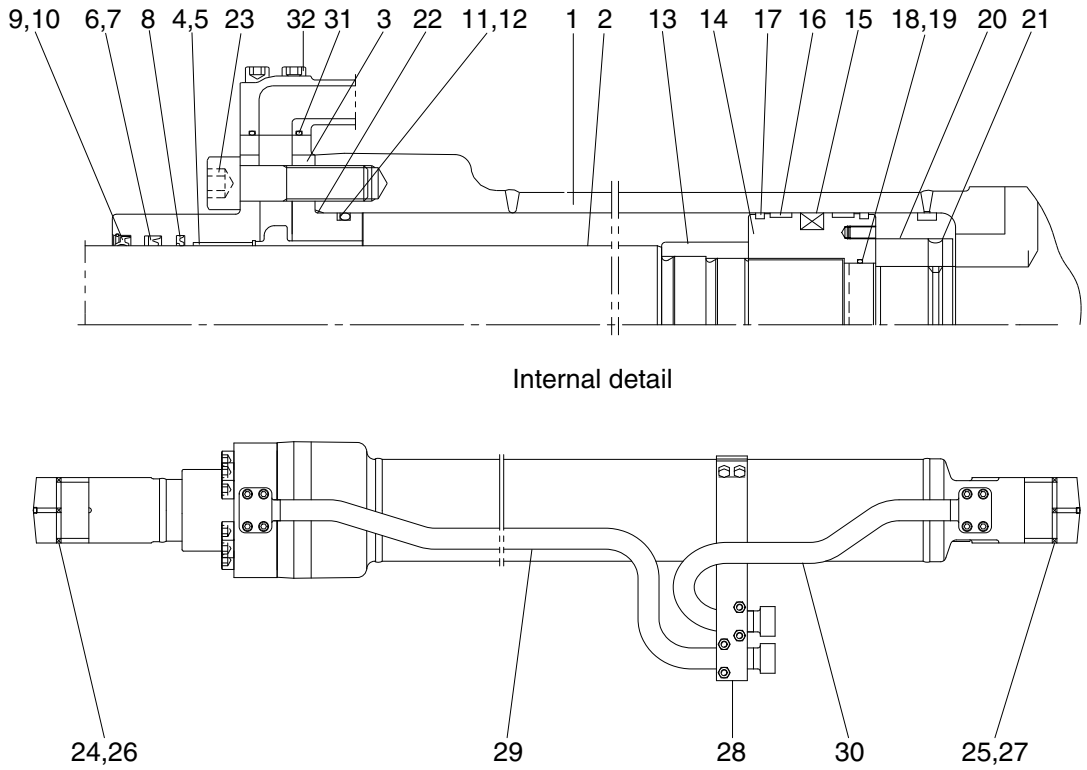


31K8-53210E

1	Tube assembly	15	Cushion ring	29	Hexagon socket head bolt
2	Rod assembly	16	Piston	30	Pipe assembly-B
3	Gland	17	Piston seal	31	Pipe assembly-R
4	Dust wiper	18	Wear ring	32	O-ring
5	Retaining ring	19	Dust ring	33	Hexagon socket head bolt
6	Rod seal	20	O-ring	34	Hexagon socket head bolt
7	Back up ring	21	Back up ring	35	Band assembly-B
8	Buffer ring	22	Lock nut	36	Band assembly-R
9	Dry bearing	23	Hexagon socket set screw	37	U-bolt
10	Retaining ring	24	Cushion plunger	38	Hexagon nut
11	O-ring	25	Stop ring	39	Spring washer
12	Back up ring	26	Check valve	40	O-ring
13	Back up ring	27	Coil spring	41	Pin bushing
14	O-ring	28	Plug	42	Dust seal

(3) Boom cylinder

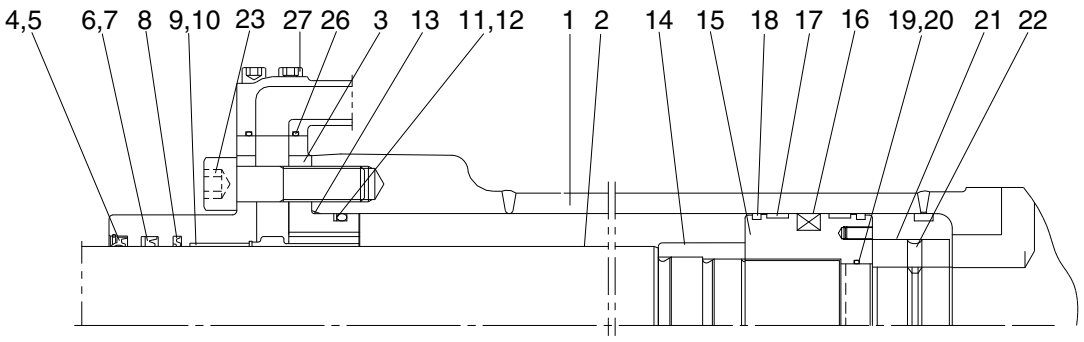
① Standard (CHANGZHOU)



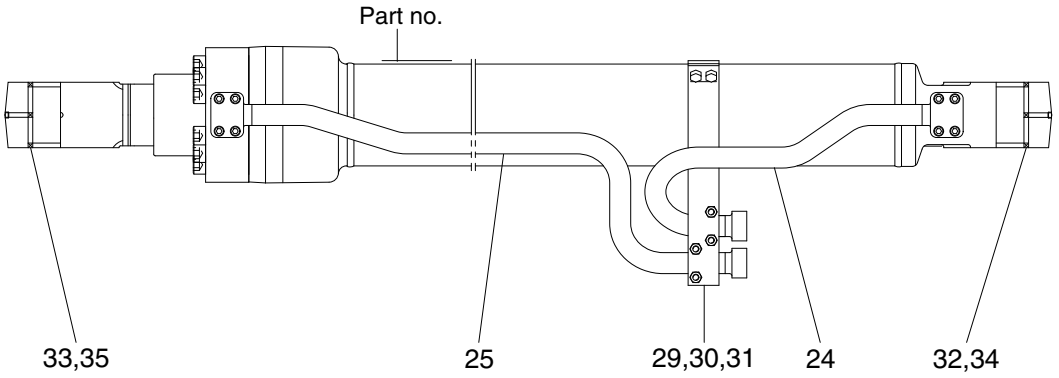
31Q8-50110CGG

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Dust seal
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	29	Pipe assembly-R
8	Buffer ring	19	Back up ring	30	Pipe assembly-B
9	Dust wiper	20	Lock nut	31	O-ring
10	Snap ring	21	Hexagon socket set screw	32	Hexagon socket head bolt
11	O-ring	22	O-ring		

Standard (SHPAC)



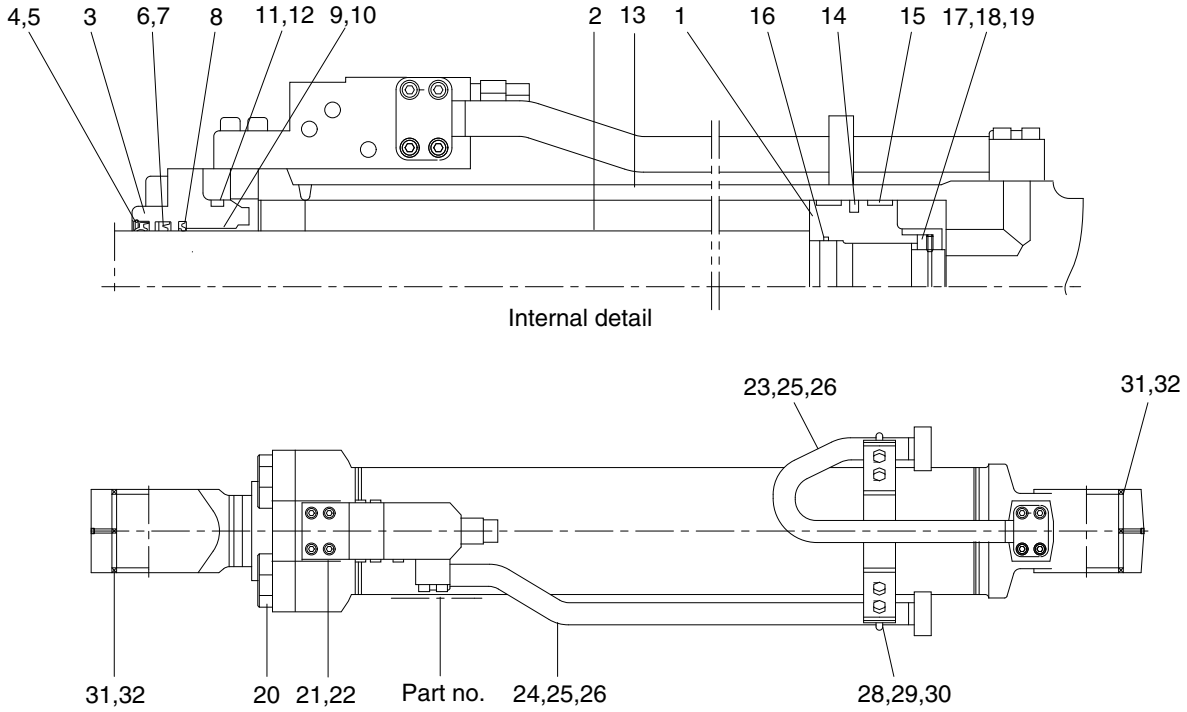
Internal detail



31Q8-50110EGG

1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	Pin bushing
9	Dry bearing	21	Lock nut	33	Pin bushing
10	Retaining ring	22	Hexagon socket set screw	34	Dust seal
11	O-ring	23	Hexagon socket head bolt	35	Dust seal
12	Back up ring	24	Pipe assembly-B		

(4) Adjustment cylinder

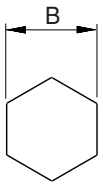


31K8-54130

1	Tube assembly	12	Back up ring	23	Pipe assembly-B
2	Rod assembly	13	Piston	24	Pipe assembly-R
3	Gland	14	Piston seal	25	Hexagon socket head bolt
4	Dust wiper	15	Wear ring	26	O-ring
5	Retaining ring	16	O-ring	27	Band assembly
6	Rod seal	17	Lock nut	28	U-bolt
7	Back up ring	18	Lock washer	29	Hexagon nut
8	Buffer ring	19	Hexagon socket set screw	30	Spring washer
9	Dry bearing	20	Hexagon socket head bolt	31	Pin bushing
10	Retaining ring	21	Safety valve	32	Dust seal
11	O-ring	22	Hexagon socket head bolt		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools		Remark
Allen wrench	6	
	8	
	10	
	12	
	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 (standard)	23★1★3	M18	32.0±3.0	232±21.7
		23★1★4	M18	38.0±3.8	275±27.5
		32★3	M12	9.4±1.0	68.0±7.2
		27★4	M12	11.3±1.1	81.7±8.0
	Bucket cylinder (long reach)	22★1★4	M14	17.9±1.8	130±13.0
		26★1★4	M8	3.3±0.3	23.9±2.2
	Boom cylinder	23★1★3	M18	32.0±3.0	232±21.7
		23★1★4	M18	38.0±3.8	275±27.5
		32★3	M12	9.4±1.0	68.0±7.2
		27★4	M12	11.3±1.1	81.7±8.0
	Arm cylinder	24★1★3	M18	32.0±3.0	232±21.7
		29★1★4	M18	38.0±3.8	275±27.5
		29★1★5	M18	38.0±3.8	275±27.5
		35★3	M12	9.4±1.0	68.0±7.2
		32★4	M12	11.3±1.1	81.7±8.0
		34★5	M12	11.3±1.1	81.7±8.0
	Adjustment cylinder	20★1★4	M22	69.4±6.9	502±49.9
		22★4	M12	11.3±1.1	81.7±8.0

★1 : Apply loctite #243 on the thread of bolt.
★2 : Apply loctite #277 on the thread of bolt.
★3 : CHANGZHOU
★4 : SHPAC
★5 : 2-piece boom

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Lock nut	Bucket cylinder (standard)	20★3 21★4	- M72	100±10.0 100±10.0	723±72.3 723±72.3
	Bucket cylinder (long reach)	20★4	M48	100±10.0	723±72.3
	Boom cylinder	20★3 21★4	- M70	100±10.0 100±10.0	723±72.3 723±72.3
	Arm cylinder	21★3 22★4 22★5	- M80 M80	150±15.0 150±15.0 150±15.0	1085±108 1085±108 1085±108
	Adjustment cylinder	17★4	M75	60±6	434±43.4
Piston	Bucket cylinder (standard)	14★3 15★4	- M85	150±15.0 150±15.0	1085±108 1085±108
	Bucket cylinder (long reach)	14★4	M60	150±15.0	1085±108
	Boom cylinder	14★3 15★4	- M90	150±15.0 150±15.0	1085±108 1085±108
	Arm cylinder	15★3 16★4 16★5	- M95 M95	200±20.0 200±20.0 200±20.0	1447±145 1447±145 1447±145
	Adjustment cylinder	13★4	M85	127.5±12	922±86.8
Set screw	Bucket cylinder (standard)	21★3 22★4	M10 M10	5.4±0.5 2.5±0.3	39.1±3.6 18.1±2.2
	Bucket cylinder (long reach)	21★4	M8	1.7±0.2	12.3±1.4
	Boom cylinder	21★3 22★4	M10 M10	5.4±0.5 2.5±0.3	39.1±3.6 18.1±2.2
	Arm cylinder	22★3 23★4 23★5	M10 M10 M10	5.4±0.5 2.5±0.3 2.5±0.3	39.1±3.6 18.1±2.2 18.1±2.2
	Adjustment cylinder	19★2★4	M8	1.7±0.2	12.3±1.4

★1 : Apply loctite #243 on the thread of bolt.
★2 : Apply loctite #277 on the thread of bolt.
★3 : CHANGZHOU
★4 : SHPAC
★5 : 2-piece boom

3) DISASSEMBLY

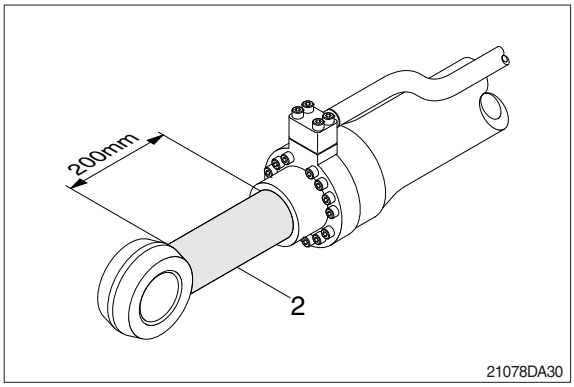
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder (CHANGZHOU type).

① Hold the clevis section of the tube in a vise.

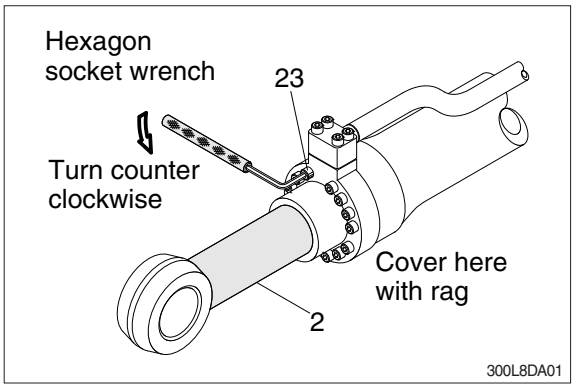
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200 ㎜ (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



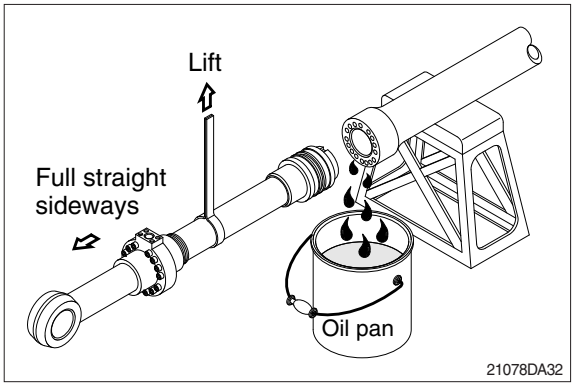
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly together from tube assembly (1).

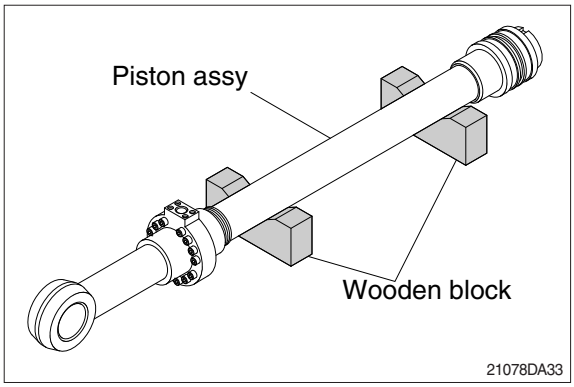
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.

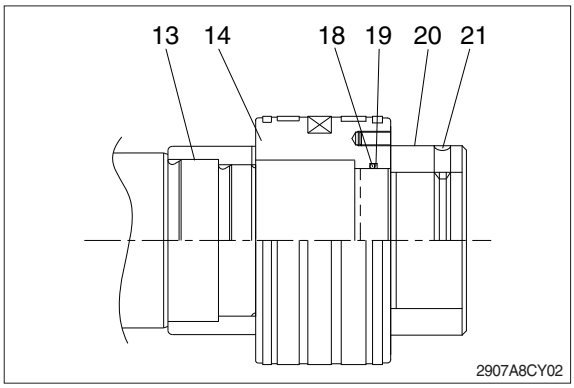


(2) Remove piston and cylinder head

① Remove set screw (21).

※ Since set screw (21) and lock nut (20) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the set screw (21) lock nut (20).

② Remove piston assembly (14), back up ring (19), and O-ring (18).

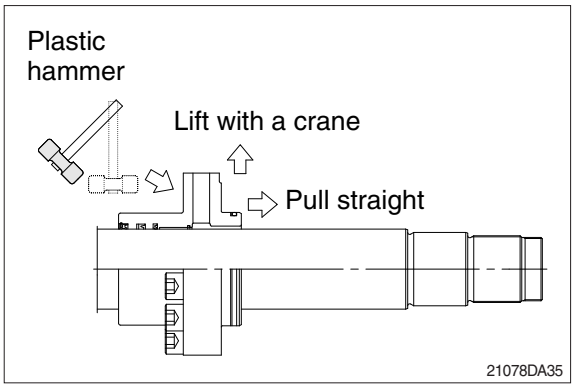


③ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.

Exercise care so as not to damage the lip of rod bushing (4) and packing (5,6,7,8,9,10) by the threads of rod assembly (2).

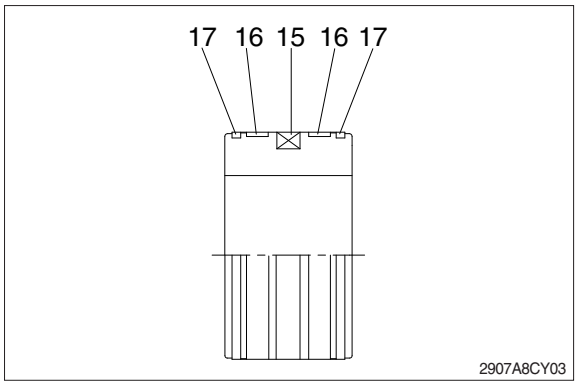


(3) Disassemble the piston assembly

① Remove wear ring (16).

② Remove dust ring (17) and piston seal (15).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

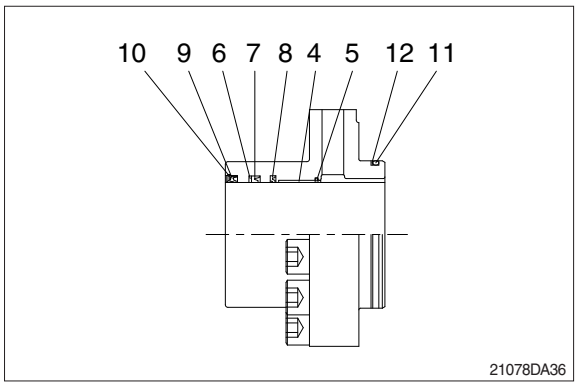
① Remove back up ring (12) and O-ring (11).

② Remove snap ring (10), dust wiper (9).

③ Remove back up ring (7), rod seal (6) and buffer ring (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

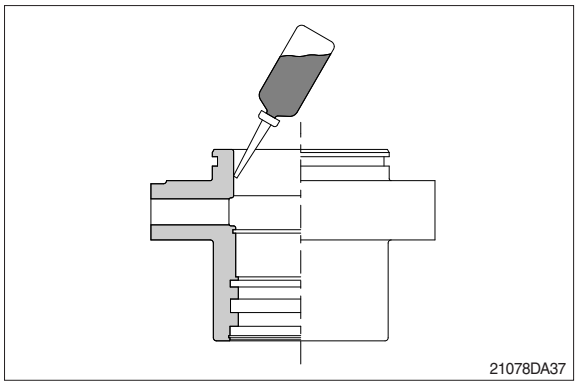


3) ASSEMBLY

(1) Assemble cylinder head assembly

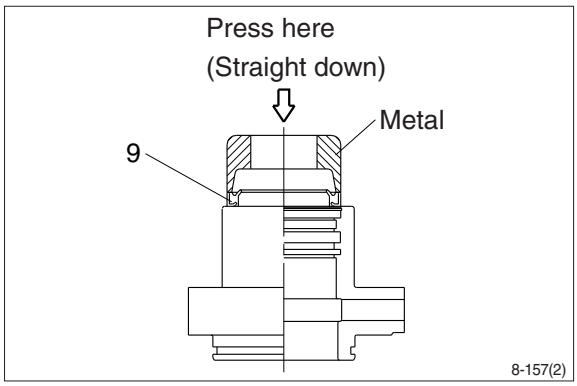
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland (3) with hydraulic oil.



② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

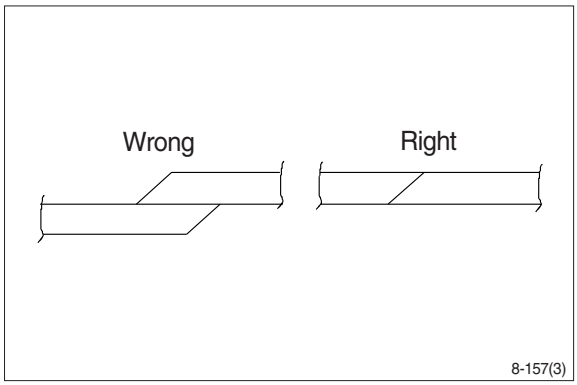
③ Fit snap ring (10) to the stop face.



④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

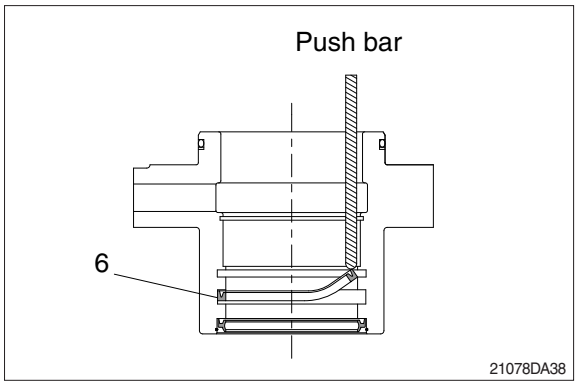
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until one side of it is inserted into groove.



※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

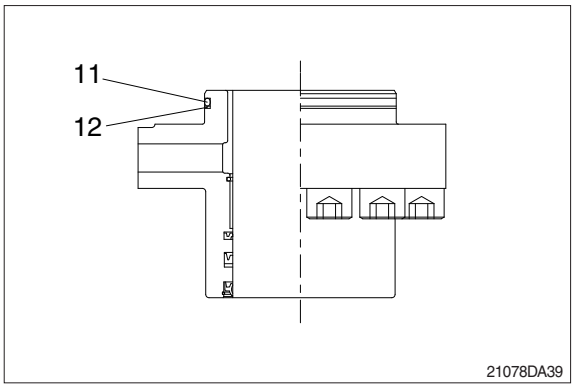
※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

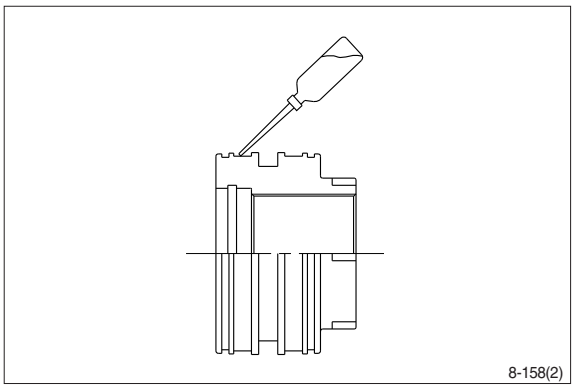
⑥ Fit O-ring (11) to gland (3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

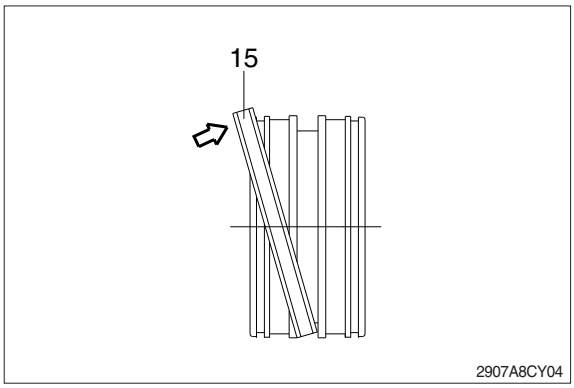
① Coat the outer face of piston (14) with hydraulic oil.



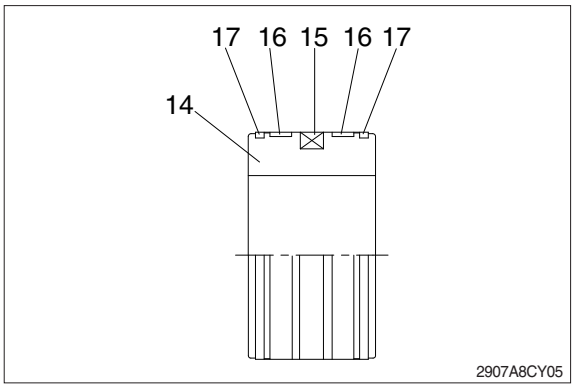
② Fit piston seal (15) to piston.

※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



③ Fit wear ring (16) and dust ring (17) to piston (14).

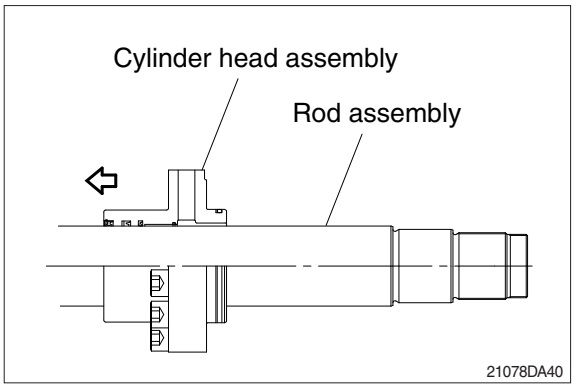


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

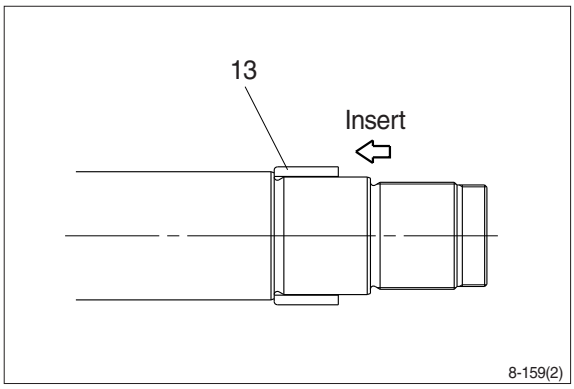
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (13) to rod assembly.

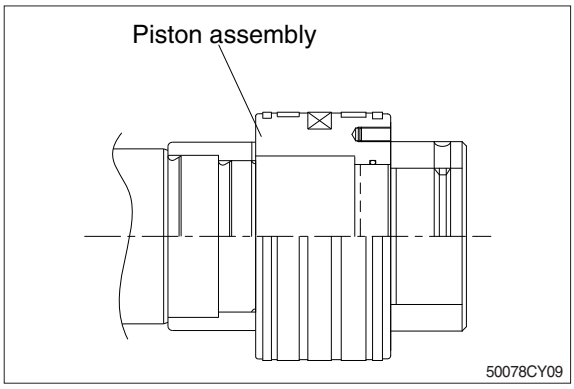
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque : 150±15.0 kgf · m (1085±108 lbf · ft)

※ Refer to page 8-169.



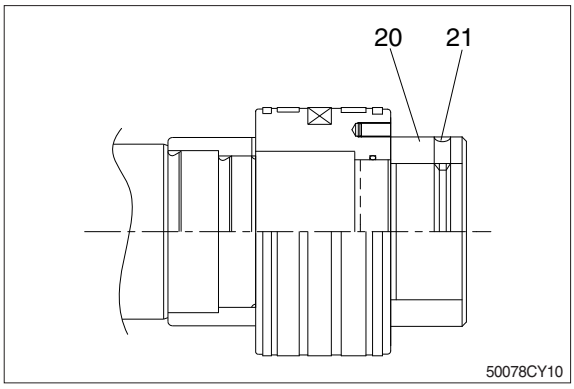
⑥ Fit lock nut (20) and tighten the screw (21).

· Tightening torque :

Item 20 : 100±10.0 kgf·m (723±72.3 lbf·ft)

Item 21 : 5.4±0.5 kgf·m (39.1±3.6 lbf·ft)

※ Refer to page 8-169.



(3) Overall assemble

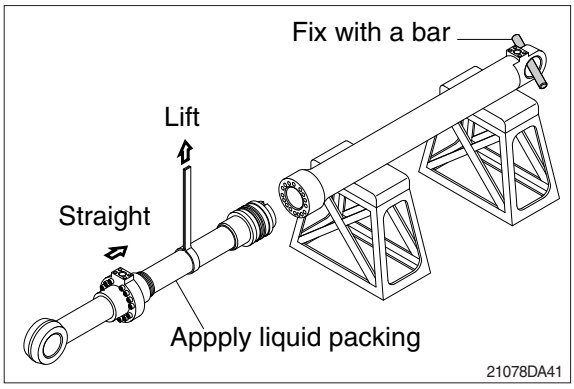
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

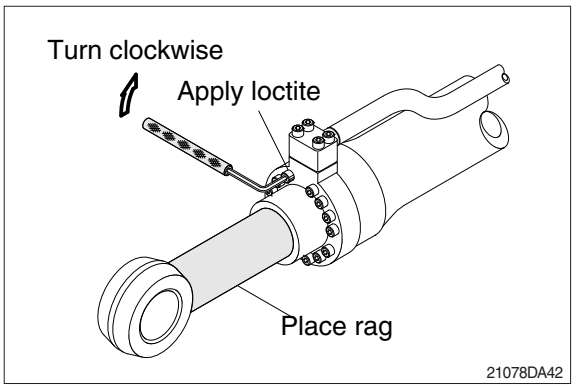
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

※ Refer to the table of tightening torque.





1. TRACK LINK

1) REMOVAL

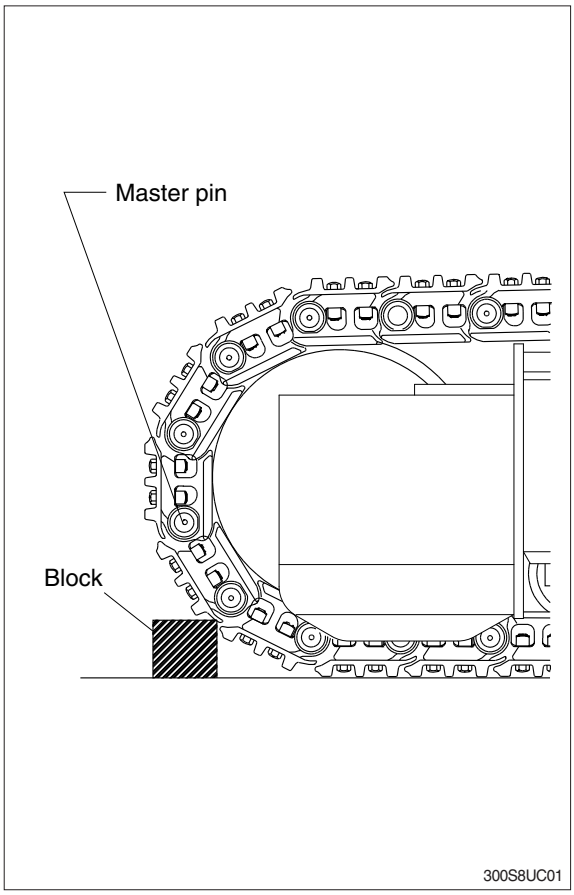
(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

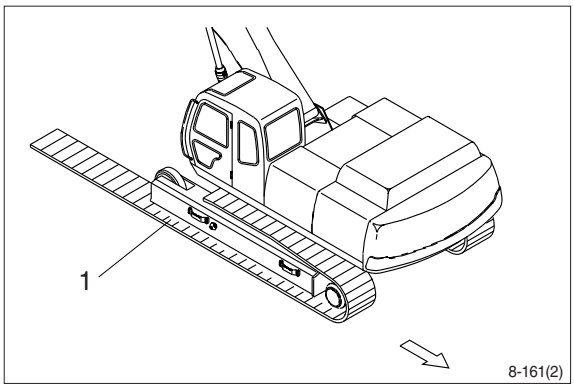
(3) Push out master pin by using a suitable tool.



(4) Move the machine slowly in reverse, and lay out track link assembly (1).

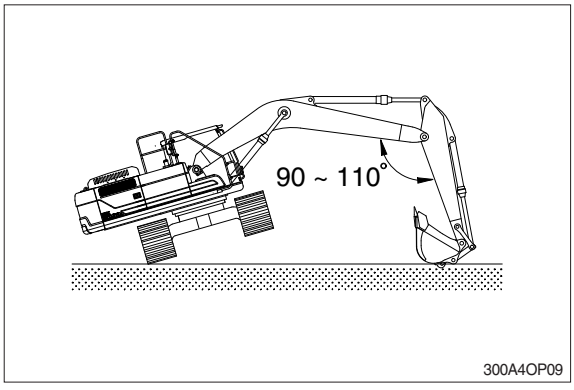
※ Jack up the machine and put wooden block under the machine.

※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

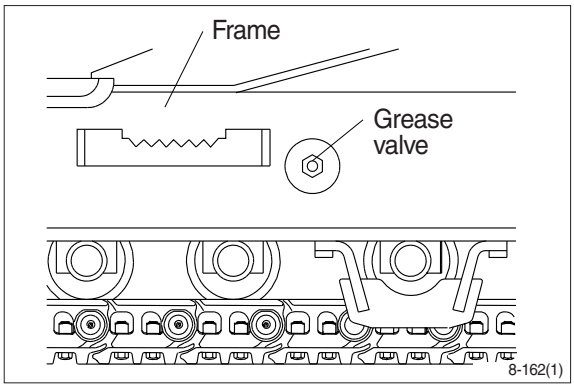
(1) Carry out installation in the reverse order to removal.
Adjust the tension of the track link.



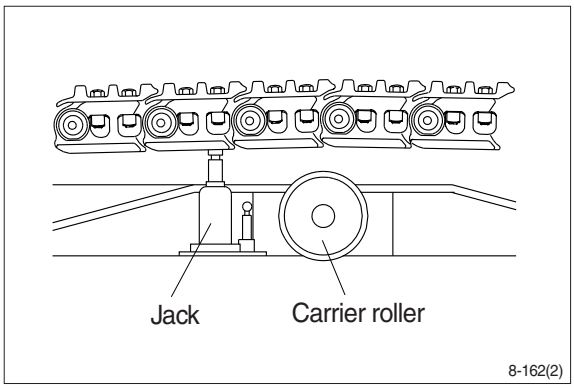
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



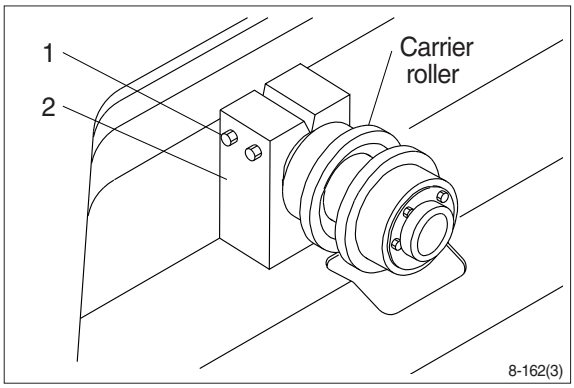
(2) Jack up the track link height enough to permit carrier roller removal.



(3) Loosen the lock nut (1).

(4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.

· Weight
  General : 70 kg (154 lb)
  High walker : 120 kg (265 lb)
· Tightening torque : 29.7±4.5 kgf·m
  (215±32.5 lbf·ft)



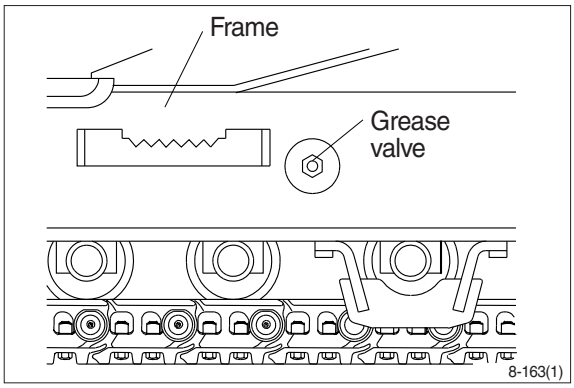
2) INSTALL

(1) Carry out installation in the reverse order to removal.

3. TRACK ROLLER

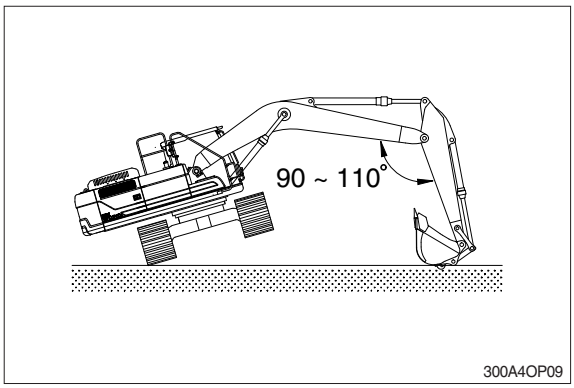
1) REMOVAL

(1) Loosen tension of the track link.



(2) Using the work equipment, push up track frame on side which is to be removed.

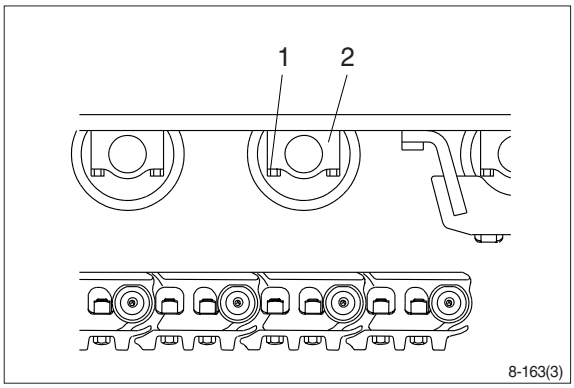
※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the track roller (2).

· Weight : 59.4 kg (131 lb)

· Tightening torque : 57.9±6.0 kgf·m (419±43.4 lbf·ft)



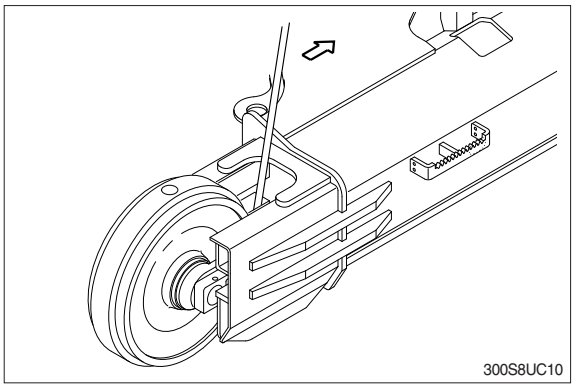
2) INSTALL

(1) Carry out installation in the reverse order to removal.

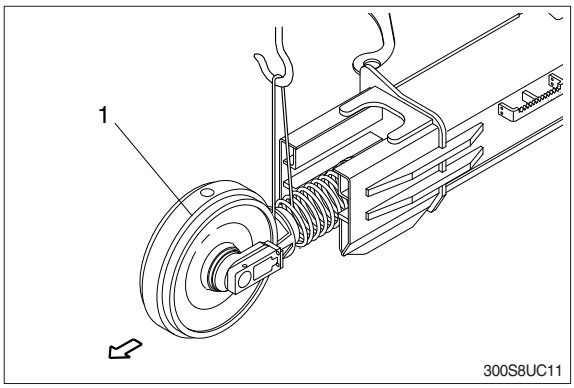
4. IDLER AND RECOIL SPRING

1) REMOVAL

(1) Remove the track link.
For detail, see **removal of track link.**

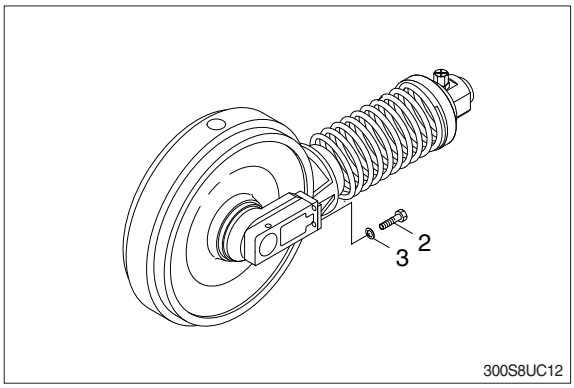

300S8UC10

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 475 kg (1047 lb)



300S8UC11

(3) Remove the bolts (2), washers (3) and separate idler from recoil spring.
· Tightening torque : 31.3±4.7 kgf·m
(226±34.0 lbf·ft)

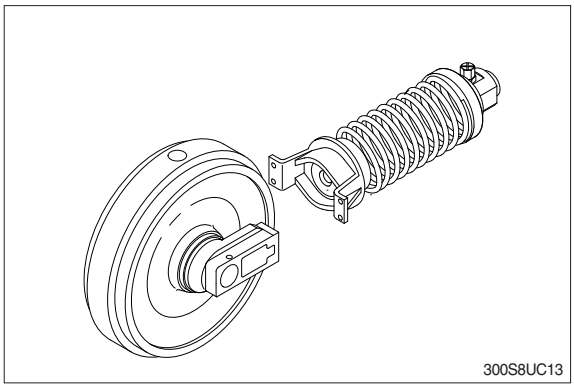


300S8UC12

2) INSTALL

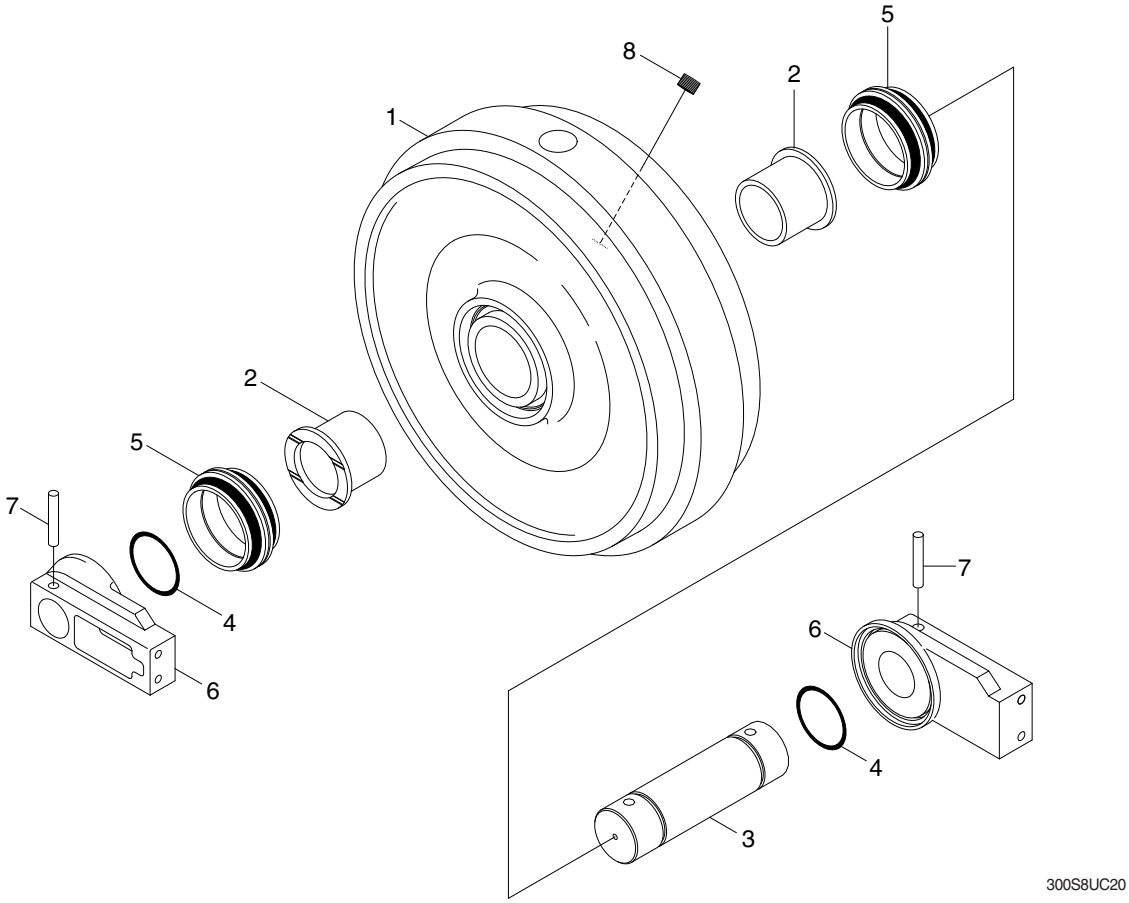
(1) Carry out installation in the reverse order to removal.

※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.


300S8UC13

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

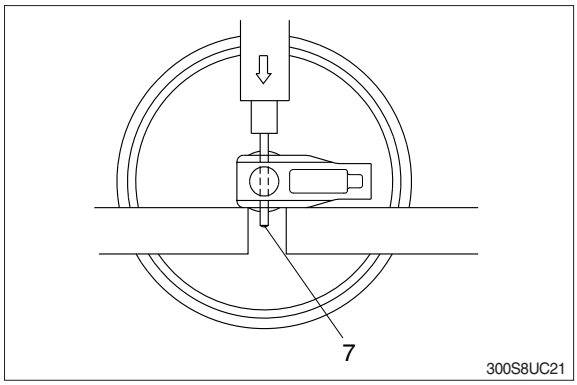


1	Shell	4	O-ring	7	Spring pin
2	Bushing	5	Seal assembly	8	Plug
3	Shaft	6	Bracket		

(2) Disassembly

① Remove plug and drain oil.

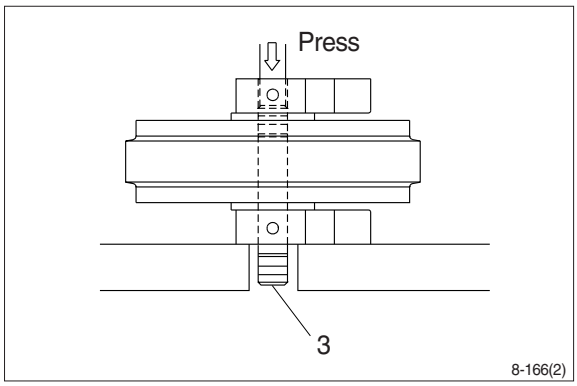
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

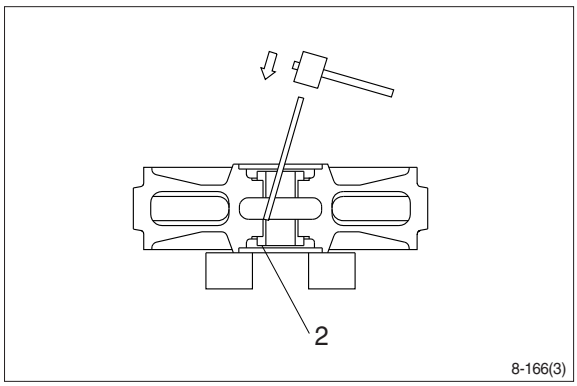
④ Remove seal (5) from shell (1) and bracket (6).

⑤ Remove O-ring (4) from shaft.



⑥ Remove the bushing (2) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

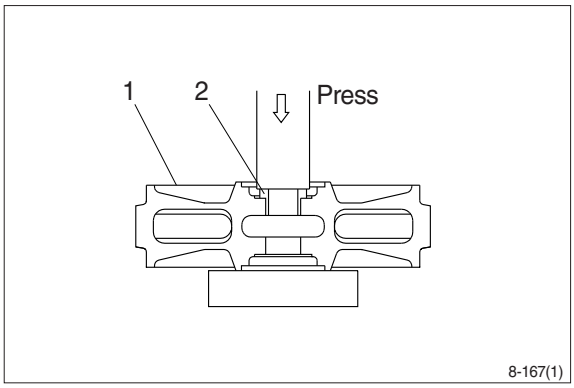


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

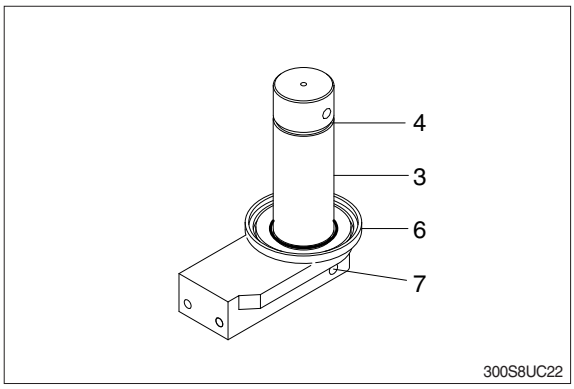
① Cool up bushing (2) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1)

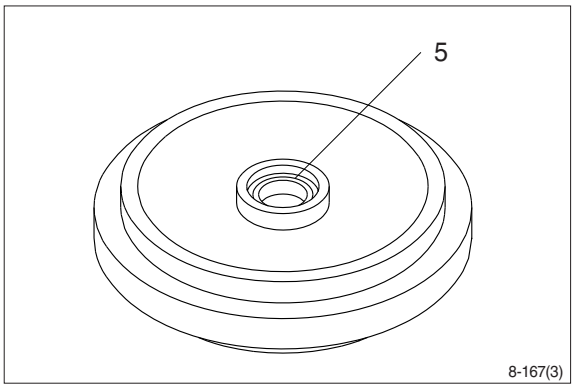
② Coat O-ring (4) with grease thinly, and install it to shaft (3).

③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



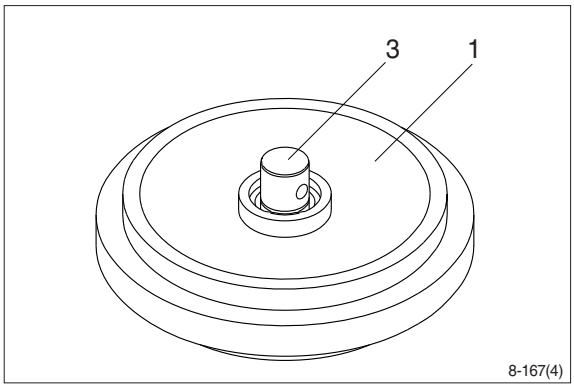
300S8UC22

④ Install seal (5) to shell (1) and bracket (6).



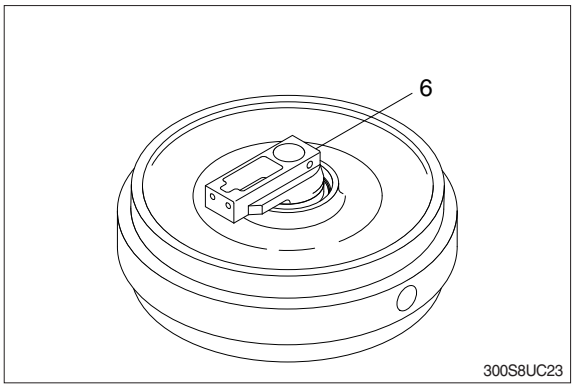
8-167(3)

⑤ Install shaft (3) to shell (1).

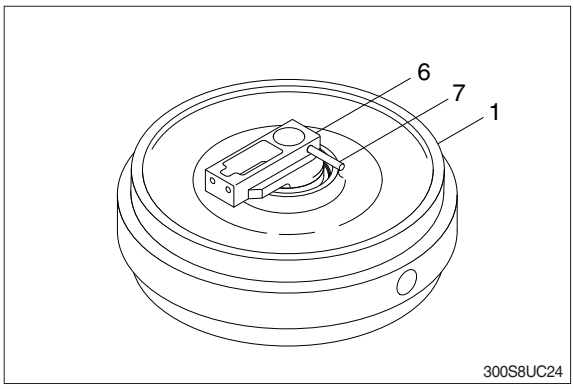


8-167(4)

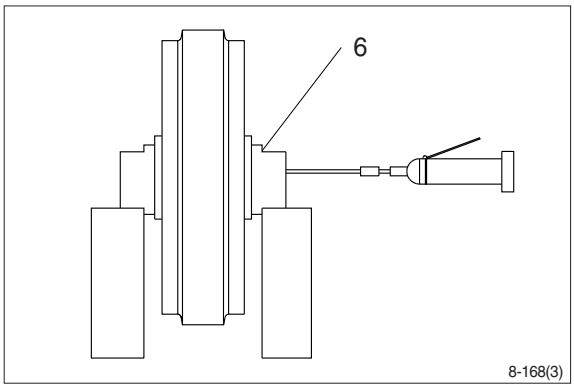
⑥ Install bracket (6) attached with seal (5).



⑦ Knock in the spring pin (7) with a hammer.

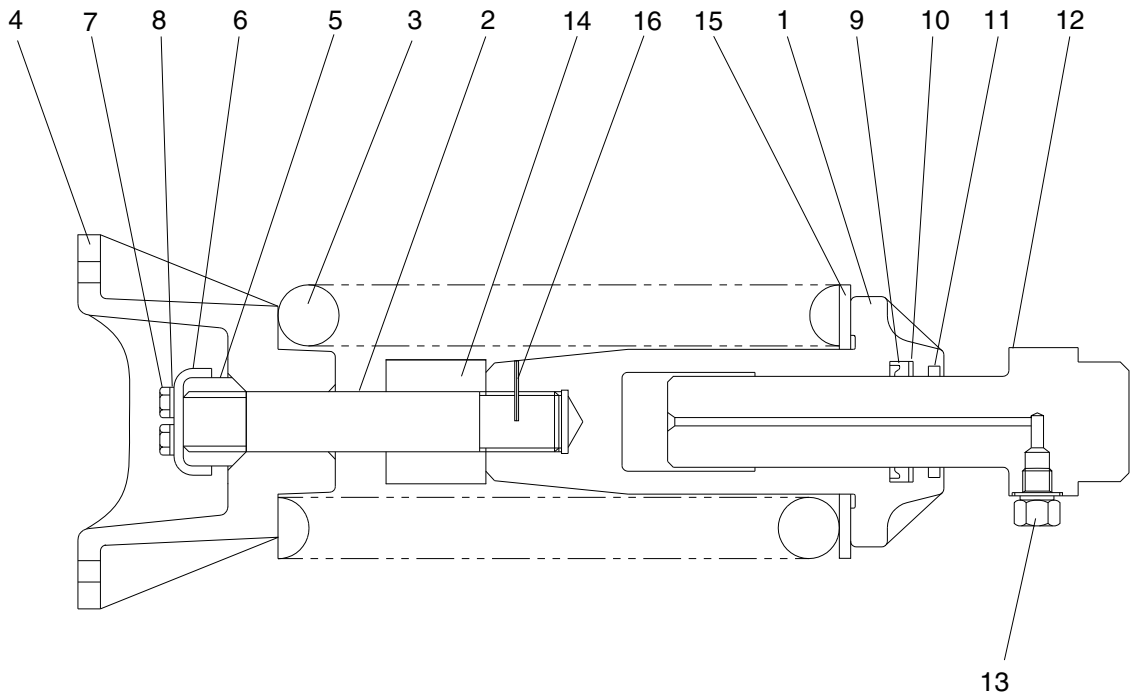


⑧ Lay bracket (6) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



300S8UC30

1	Body	6	Lock plate	11	Dust seal
2	Tie bar	7	Bolt	12	Adjust rod
3	Spring	8	Spring washer	13	Grease valve
4	Bracket	9	Rod seal	14	Stopper tube
5	Lock nut	10	Back up ring	15	Spacer
				16	Spring pin

(2) Disassembly

※ The illustrations are base on the type 1.

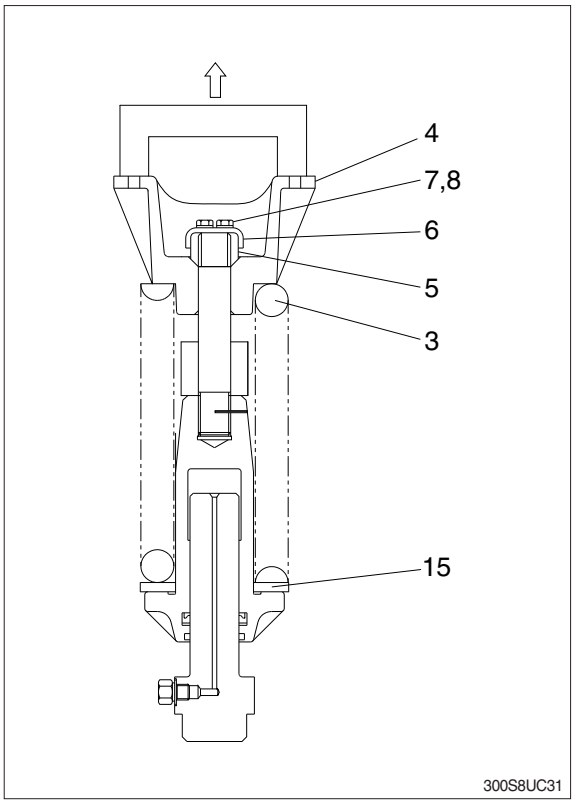
① Apply pressure on spring (3) with a press.

※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

② Remove bolt (7), spring washer (8) and lock plate (6).

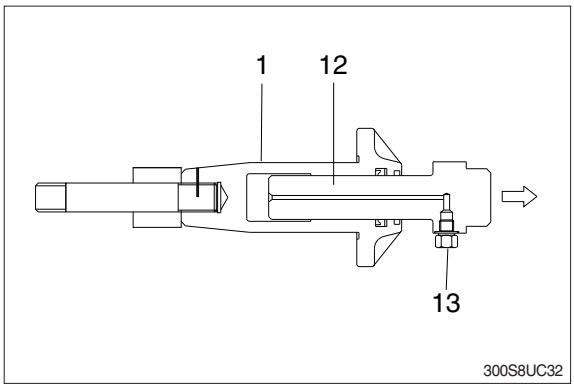
③ Remove lock nut (5).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove bracket (4), spring (3) and spacer (15).

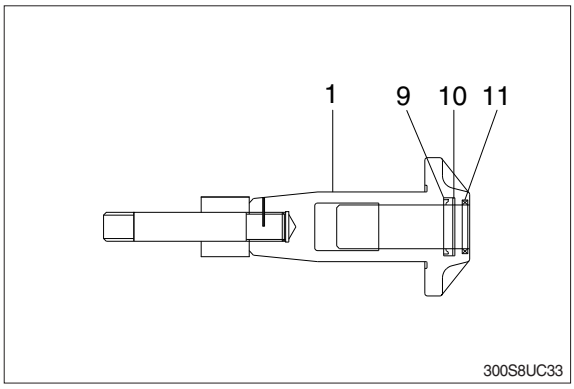


⑤ Remove rod (12) from body (1).

⑥ Remove grease valve (13) from rod (12).



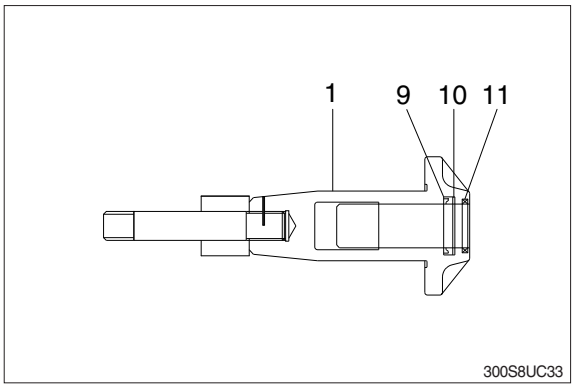
⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



(3) Assembly

① Install dust seal (11), back up ring (10) and rod seal (9) to body (1).

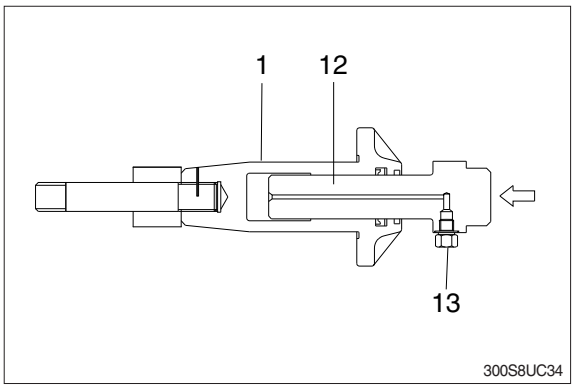
※ When installing dust seal (11) and rod seal (9), take full care so as not to damage the lip.



② Pour grease into body (1), then push in rod (12) by hand.
After take grease out of grease valve mounting hole, let air out.

※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve (13) to rod (12).
· Tightening torque : 13.0±1.0 kgf · m
(94±7.2 lbf · ft)

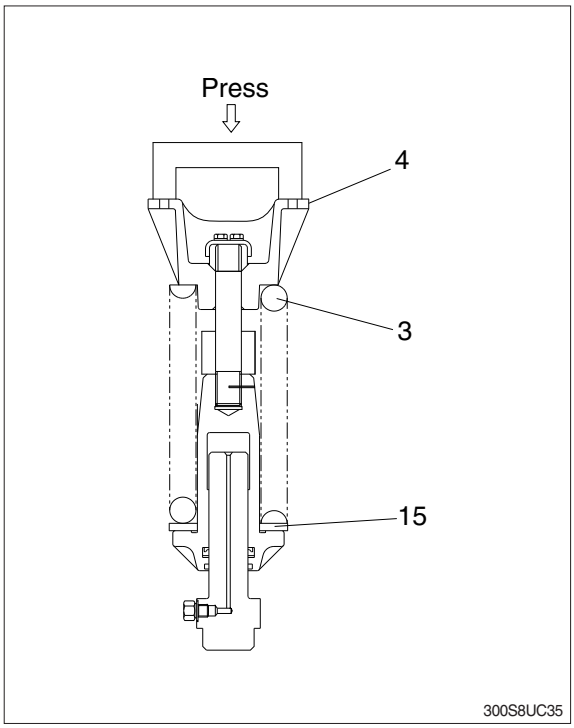


④ Install spacer (15), spring (3) and bracket (4) to body (1).

⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).
· Spring set load
22285 kg (49130 lb)

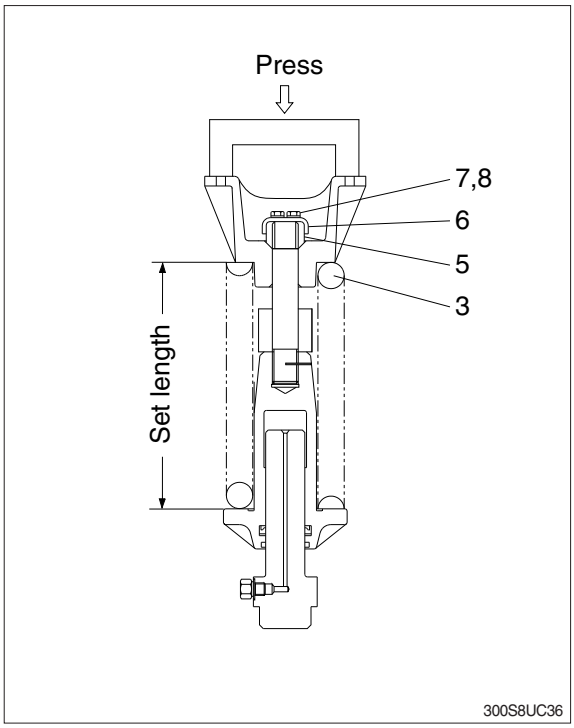
※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.

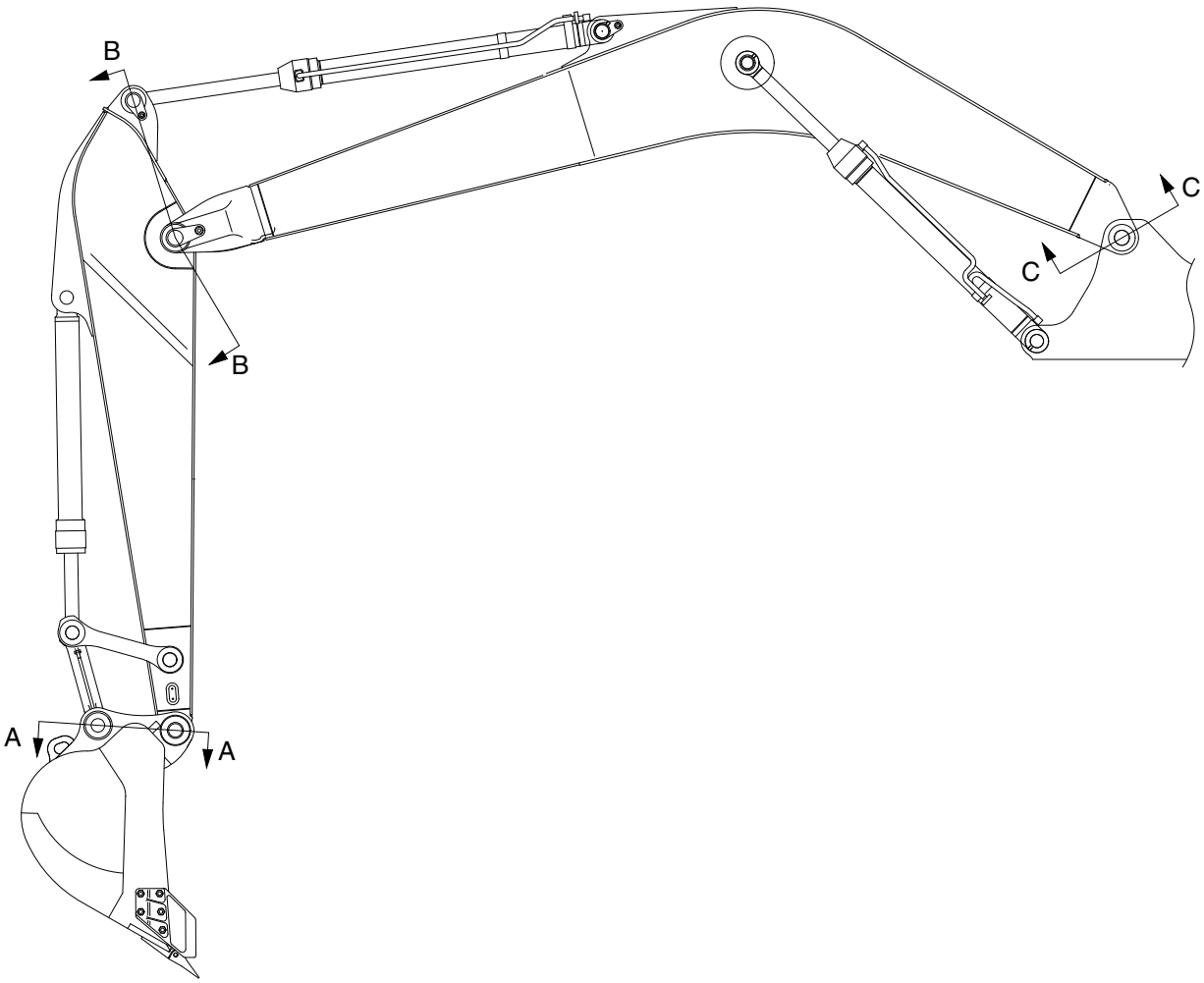


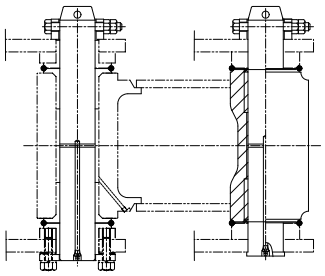
⑥ Lighten the press load and confirm the set length of spring (3).
·Set length : 565 ± 1.5 mm

⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).
·Tightening torque : 15±0.5 kgf·m
(108±3.6 lbf·ft)

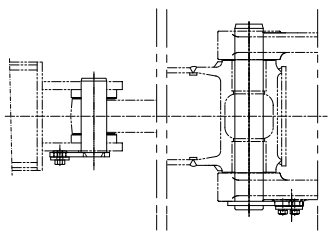


1. STRUCTURE

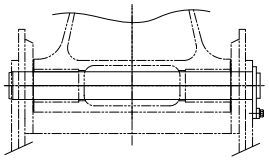




SECTION A



SECTION B



SECTION C

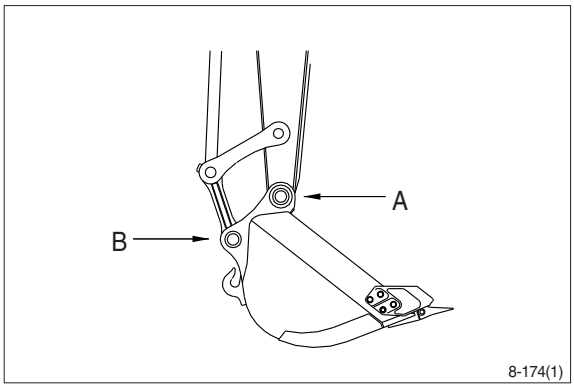
300S8WE01

2. REMOVAL AND INSTALL

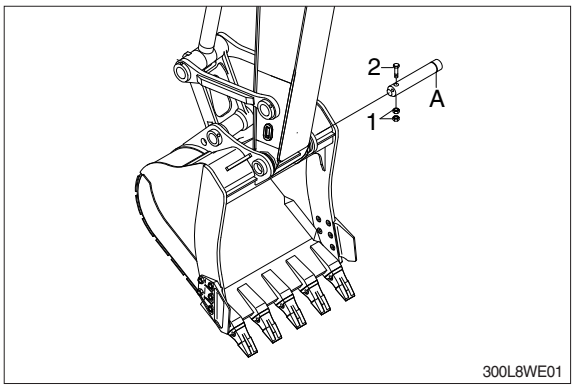
1) BUCKET ASSEMBLY

(1) Removal

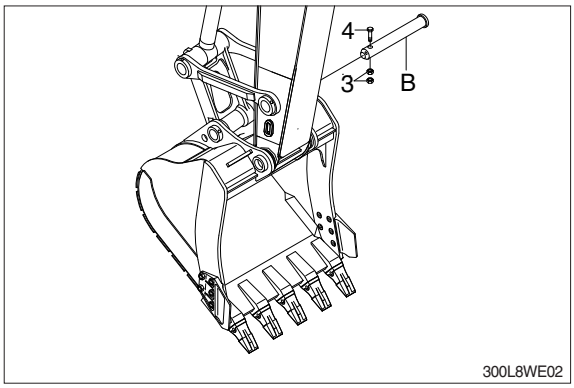
① Lower the work equipment completely to ground with back of bucket facing down.



② Remove nut (1), bolt (2) and draw out the pin (A).



③ Remove nut (3), bolt (4) and draw out the pin (B).

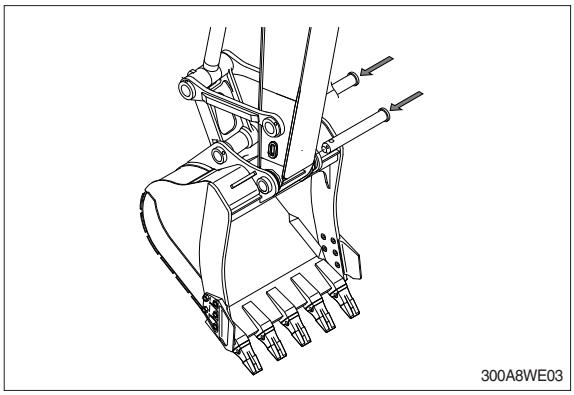


(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Adjust the bucket clearance.
For detail, see **operation manual.**



2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ Escaping fluid under pressure can penetrated the skin causing serious injury.

① Remove bucket assembly.
For details, see **removal of bucket assembly.**

② Disconnect bucket cylinder hose (1).

⚠ Fit blind plugs in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

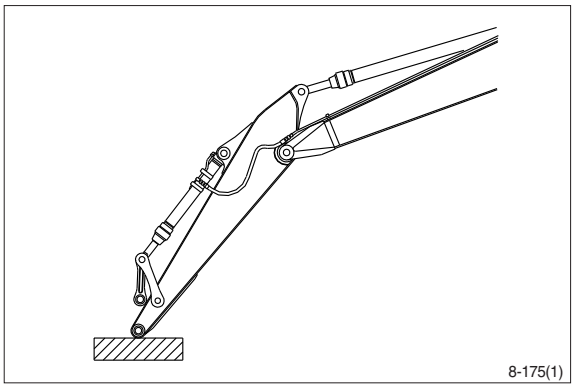
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

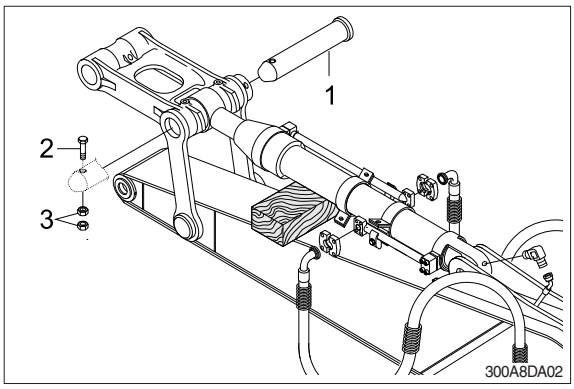
※ Tie the rod with wire to prevent it from coming out.

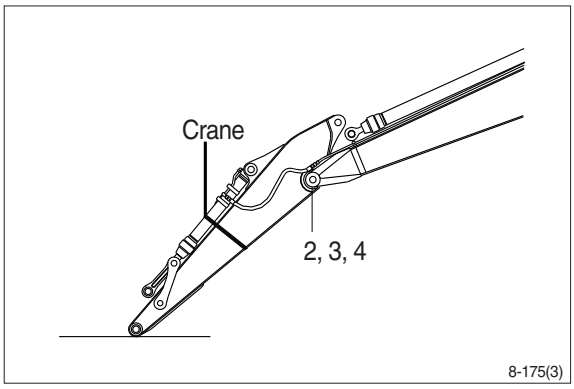
④ For details, see **removal of arm cylinder assembly.**
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.
- Weight : 1025 kg (2260 lb)
- Tightening torque (2) : 29.7±4.5 kgf·m (215±32.5 lbf·ft)

※ When lifting the arm assembly, always lift the center of gravity.







(2) Install

① Carry out installation in the reverse order to removal.
When lifting the arm assembly, always lift the center of gravity.

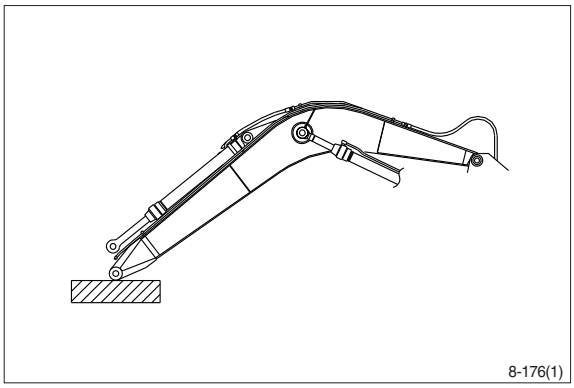
※ Bleed the air from the cylinder.

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.**

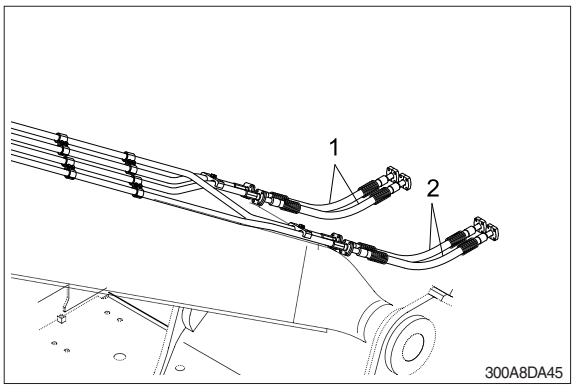


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

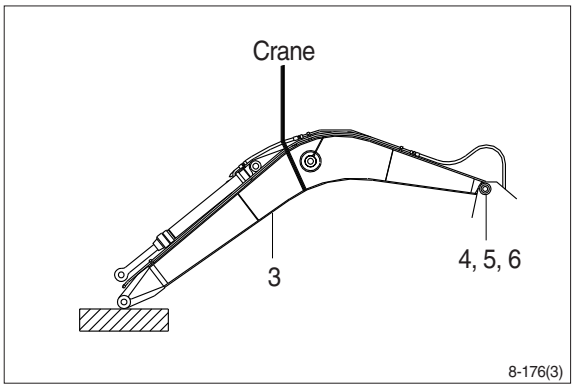
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· Weight : 2200 kg (4860 lb)

※ When lifting the boom assembly always lift the center of gravity.



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

※ Bleed the air from the cylinder.