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1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This service manual mainly contains the necessary technical information for operations performed in a service workshop.

For ease of understanding, the manual is divided into the following sections.

SECTION 1 GENERAL

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

SECTION 2 STRUCTURE AND FUNCTION

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

SECTION 3 HYDRAULIC SYSTEM

This section explains the hydraulic circuit, single and combined operation.

SECTION 4 ELECTRICAL SYSTEM

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

SECTION 5 MECHATRONICS SYSTEM

This section explains the computer aided power optimization system and each component.

SECTION 6 TROUBLESHOOTING

This section explains the troubleshooting charts correlating problems to causes.

SECTION 7 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

SECTION 8 DISASSEMBLY AND ASSEMBLY

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

SECTION 9 COMPONENT MOUNTING TORQUE

This section shows bolt specifications and standard torque values needed when mounting components to the machine.

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

2. HOW TO READ THE SERVICE MANUAL

Distribution and updating

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

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

Filing method

1. See the page number on the bottom of the page.
   File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1
   2 - 3
   - 2: Item number(2. Structure and Function)
   - 3: Consecutive page number for each item.
3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.
   10 - 4
   10 - 4 - 1 ┐
   10 - 4 - 2 ┘ Added pages
   10 - 5

Revised edition mark(①②③···)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

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

Example

1. **Method of using the Conversion Table to convert from millimeters to inches**
   Convert 55mm into inches.

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

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

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

2. Convert 550mm into inches.

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

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

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

Millimeters to inches

ⓑ

1mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

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

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

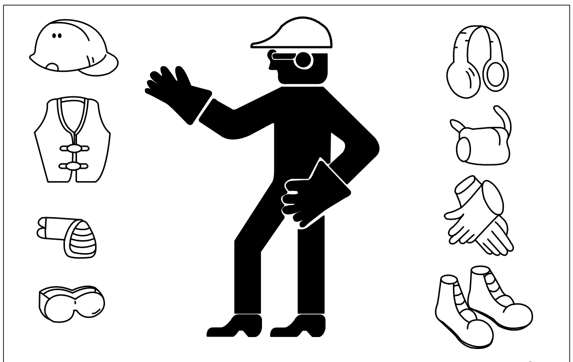
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

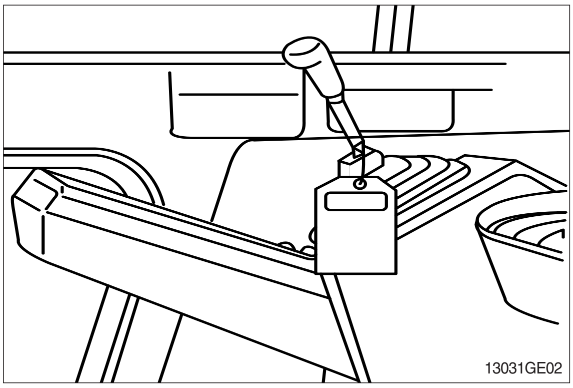
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

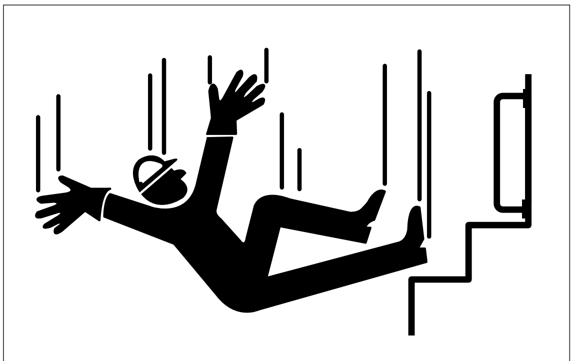
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a「**Do Not Operate**」tag on the right side control lever.



13031GE02

USE HANDHOLDS AND STEPS

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



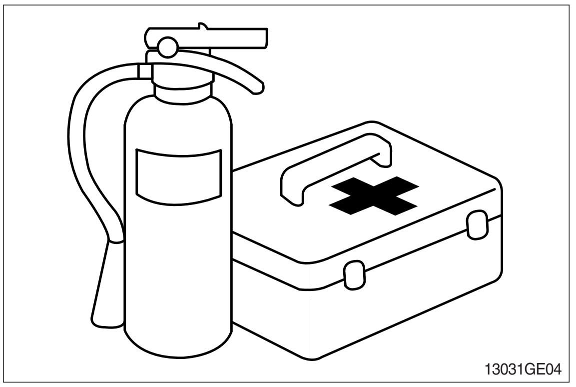
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

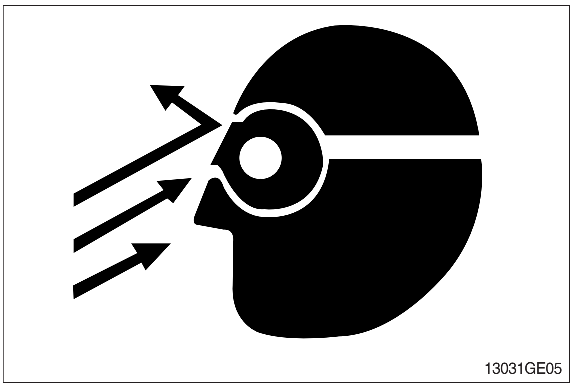
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

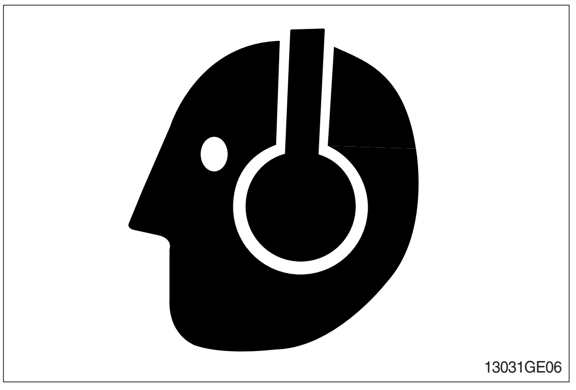
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

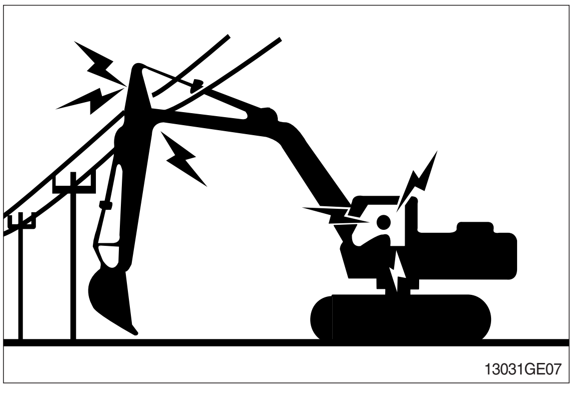
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



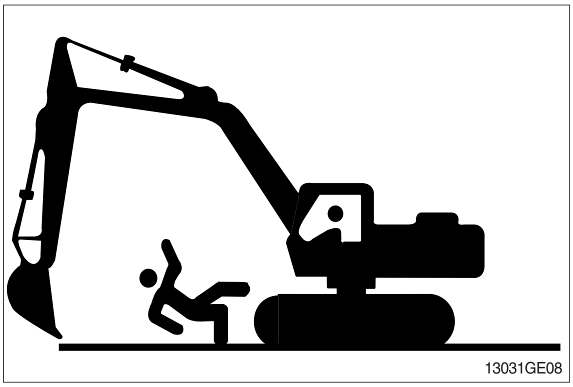
AVOID POWER LINES

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.



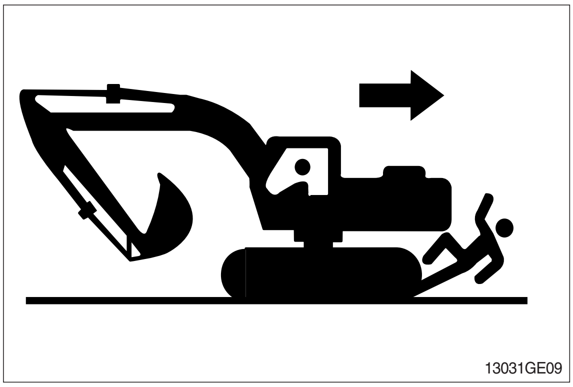
KEEP RIDERS OFF EXCAVATOR



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.

MOVE AND OPERATE MACHINE SAFELY

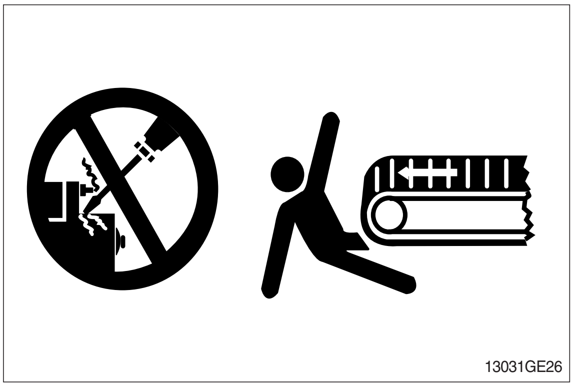


Bystanders can be run over. Know the location of bystanders before moving, swinging, or operating the machine.

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.

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.

PARK MACHINE SAFELY

Before working on the machine:

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

SUPPORT MACHINE PROPERLY

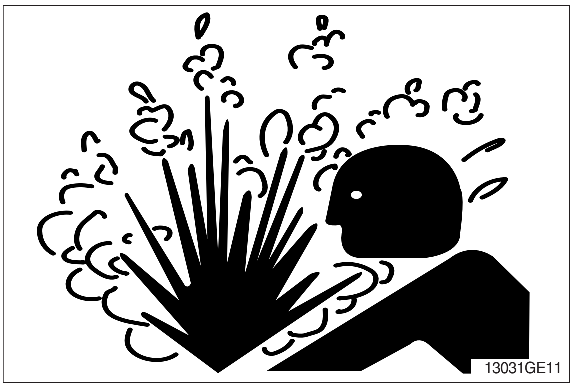
Always lower the attachment or implement to the ground before you work on the machine. If you must work on a lifted machine or attachment, securely support the machine or attachment.

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

SERVICE COOLING SYSTEM SAFELY

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

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



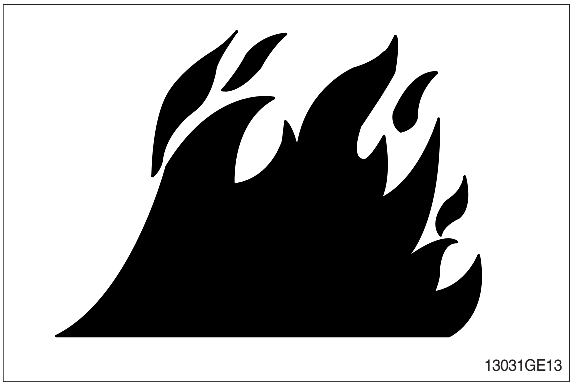
HANDLE FLUIDS SAFELY-AVOID FIRES

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

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

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

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



BEWARE OF EXHAUST FUMES

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

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

REMOVE PAINT BEFORE WELDING OR HEATING

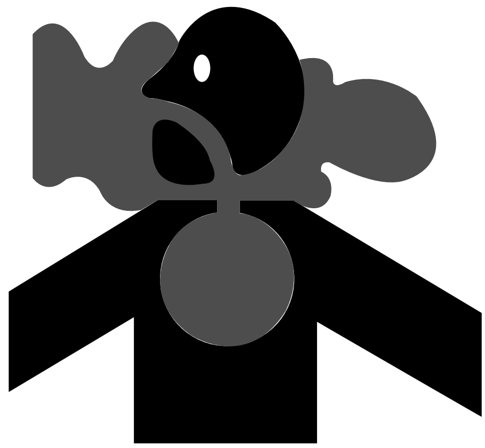
Avoid potentially toxic fumes and dust.

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

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

Remove paint before welding or heating:

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



13031GE14

ILLUMINATE WORK AREA SAFELY

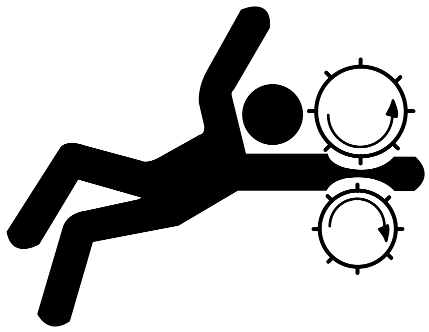
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

13031GE15

SERVICE MACHINE SAFELY

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

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

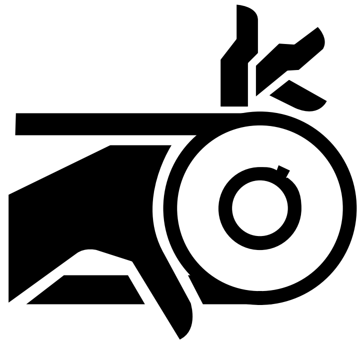


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



13031GE17

AVOID HIGH PRESSURE FLUIDS

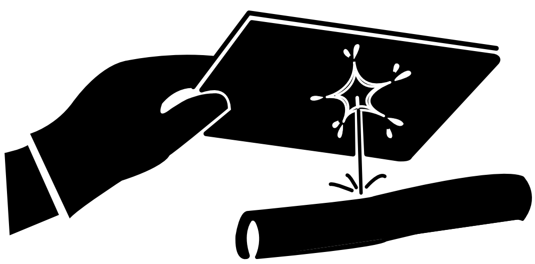
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES


13031GE20

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

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

PREVENT BATTERY EXPLOSIONS


13031GE21

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

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

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

PREVENT ACID BURNS

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

Avoid the hazard by:

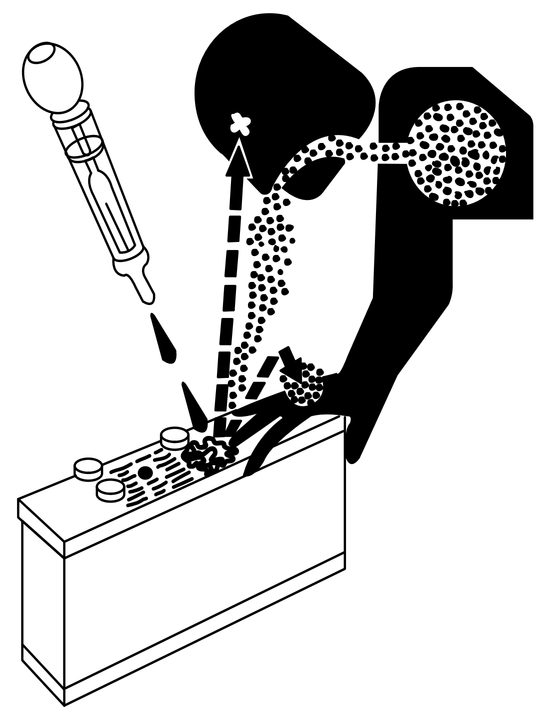
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



13031GE22

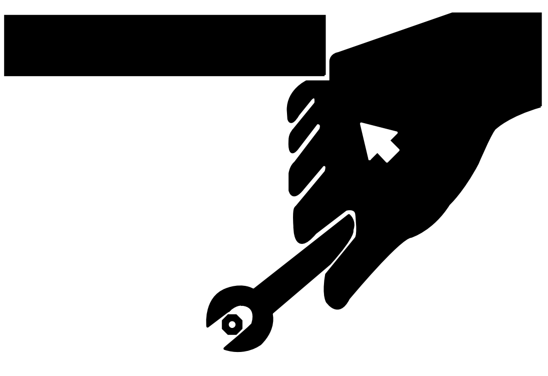
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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



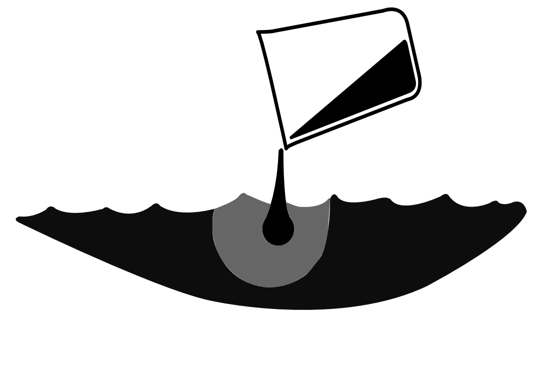
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

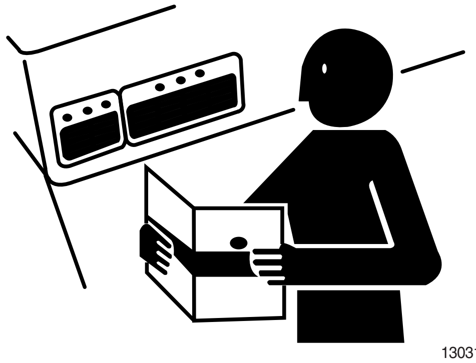
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY SIGNS

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



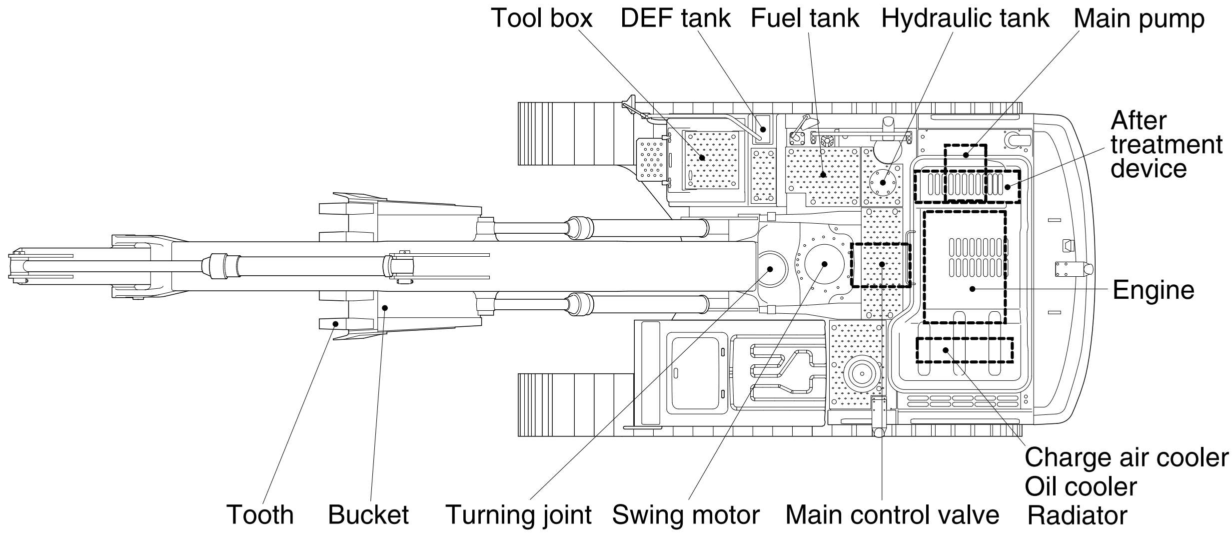
13031GE25

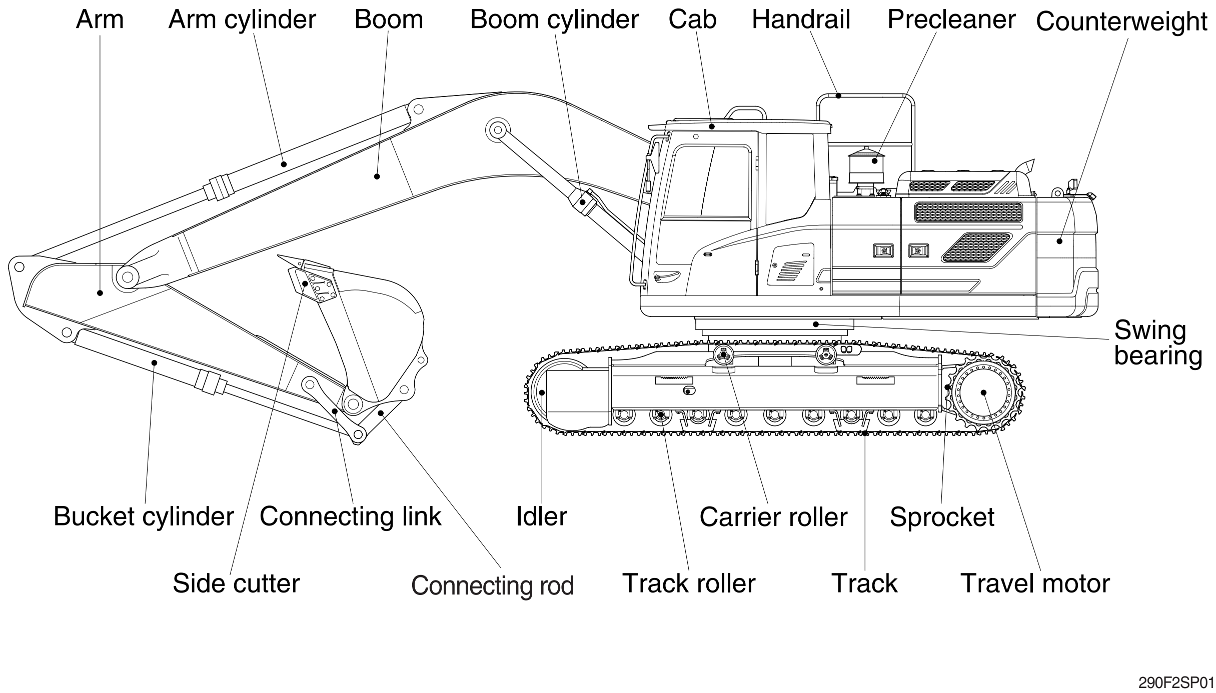
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

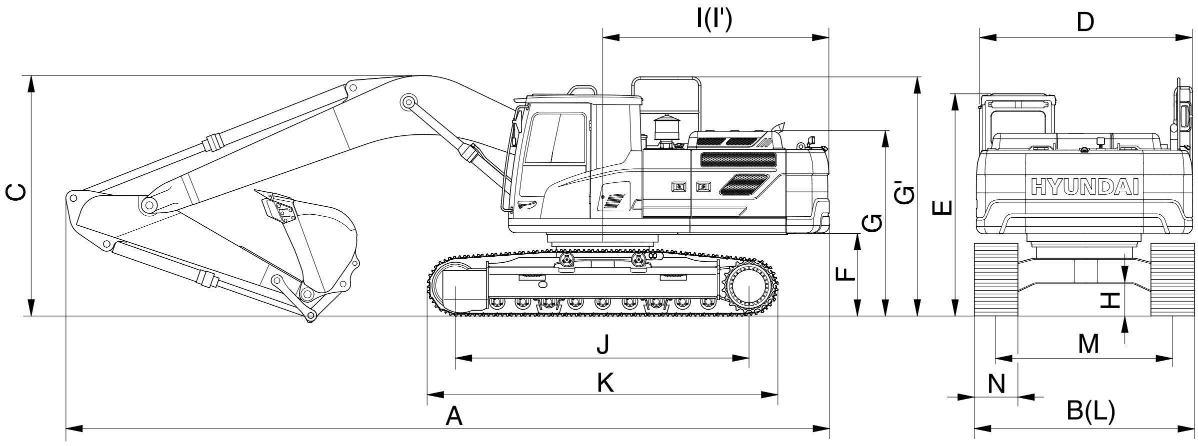




2. SPECIFICATIONS

1) HX300 L

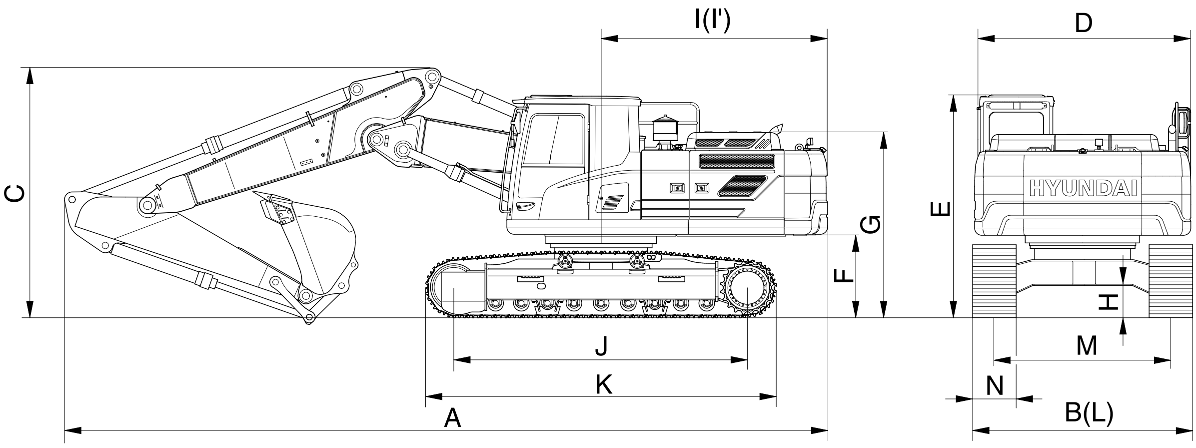
· 6.25 ㎜ (20' 6") BOOM and 3.05 ㎜ (10' 0") ARM



290F2SP02

Description		Unit	Specification
Operating weight		kg (lb)	30200 (66580)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	1.27 (1.66)
Overall length	A	mm (ft-in)	10560 (34' 8")
Overall width, with 600 mm shoe	B		3200 (10' 6")
Overall height of boom	C		3290 (10' 10")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3130 (10' 3")
Ground clearance of counterweight	F		1185 (3' 9")
Overall height of engine hood	G		2600 (8' 6")
Overall height of handrail	G'		3335 (10' 11")
Minimum ground clearance	H		500 (1' 8")
Rear-end distance	I		3120 (10' 3")
Rear-end swing radius	I'		3210 (10' 6")
Distance between tumblers	J		4030 (13' 3")
Undercarriage length	K		4885 (16' 0")
Undercarriage width	L		3200 (10' 6")
Track gauge	M		2600 (8' 6")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.9 (2.1/3.7)
Swing speed		rpm	10.2
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.58 (8.25)
Max traction force		kg (lb)	26500 (58420)

· 6.25 m (20' 6") 2-PIECE BOOM and 3.05 m (10' 0") ARM

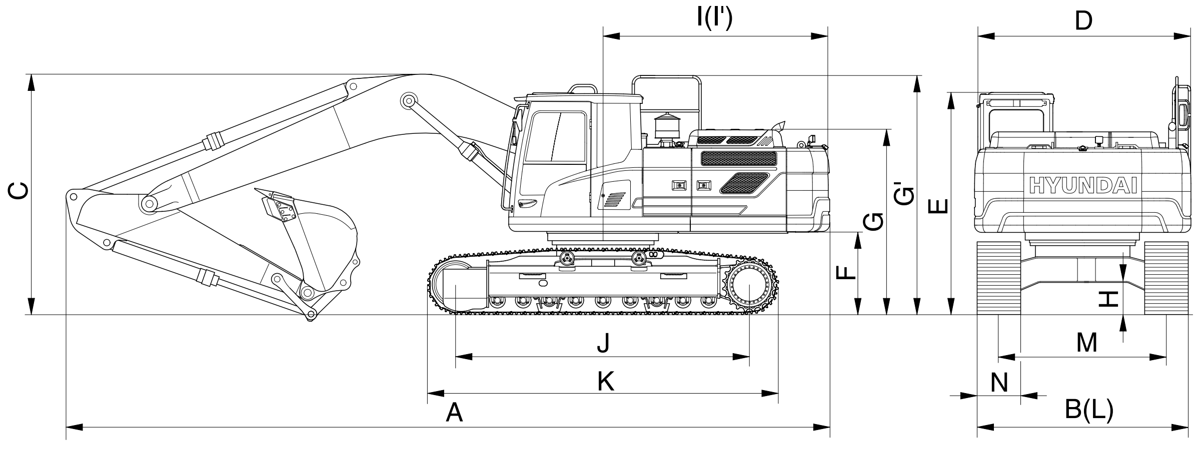


290F2SP02A

Description		Unit	Specification
Operating weight		kg (lb)	33210 (73220)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	1.27 (1.66)
Overall length	A	mm (ft-in)	10640 (34' 9")
Overall width, with 600 mm shoe	B		3200 (10' 6")
Overall height of boom	C		3270 (11' 0")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3130 (10' 3")
Ground clearance of counterweight	F		1185 (3' 9")
Overall height of engine hood	G		2600 (8' 6")
Overall height of handrail	G'		3335 (10' 11")
Minimum ground clearance	H		500 (1' 8")
Rear-end distance	I		3120 (10' 3")
Rear-end swing radius	I'		3210 (10' 6")
Distance between tumblers	J		4030 (13' 3")
Undercarriage length	K		4885 (16' 0")
Undercarriage width	L		3200 (10' 6")
Track gauge	M		2600 (8' 6")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.9 (2.1/3.7)
Swing speed		rpm	10.2
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.64 (9.10)
Max traction force		kg (lb)	26500 (58420)

2) HX300 NL

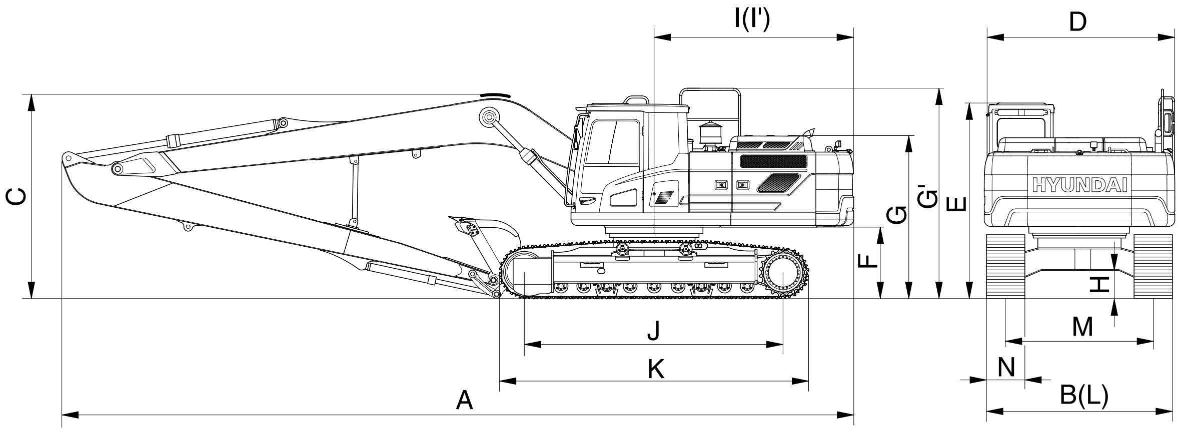
· 6.25 ㎜ (20' 6") BOOM and 3.05 ㎜ (10' 0") ARM



Description		Unit	Specification
Operating weight		kg (lb)	30000 (66140)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	1.27 (1.66)
Overall length	A	mm (ft-in)	10560 (34' 8")
Overall width, with 600 mm shoe	B		2990 (9' 10")
Overall height of boom	C		3290 (10' 10")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3130 (10' 3")
Ground clearance of counterweight	F		1185 (3' 9")
Overall height of engine hood	G		2600 (8' 6")
Overall height of handrail	G'		3335 (10' 11")
Minimum ground clearance	H		500 (1' 8")
Rear-end distance	I		3120 (10' 3")
Rear-end swing radius	I'		3210 (10' 6")
Distance between tumblers	J		4030 (13' 3")
Undercarriage length	K		4885 (16' 0")
Undercarriage width	L		2990 (9' 10")
Track gauge	M		2390 (7' 10")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.9 (2.1/3.7)
Swing speed		rpm	10.2
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.58 (8.25)
Max traction force		kg (lb)	26500 (58420)

3) HX300 L LONG REACH

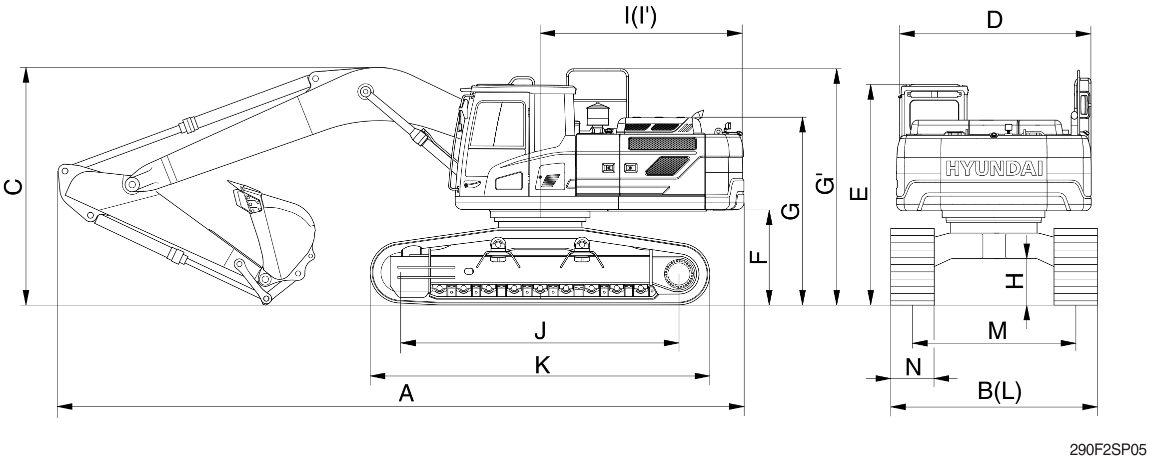
· 10.2 m (33' 6") BOOM and 7.85 m (25' 9") ARM



Description		Unit	Specification
Operating weight		kg (lb)	33070 (72910)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.52 (0.68)
Overall length	A	mm (ft-in)	14560 (47' 9")
Overall width, with 800 mm shoe	B		3400 (11' 2")
Overall height of boom	C		3560 (11' 8")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3130 (9' 11")
Ground clearance of counterweight	F		1185 (3' 9")
Overall height of engine hood	G		2600 (8' 6")
Overall height of handrail	G'		3335 (10' 11")
Minimum ground clearance	H		500 (1' 8")
Rear-end distance	I		3120 (10' 3")
Rear-end swing radius	I'		3210 (10' 6")
Distance between tumblers	J		4030 (13' 3")
Undercarriage length	K		4885 (16' 0")
Undercarriage width	L		3400 (11' 2")
Track gauge	M		2600 (8' 6")
Track shoe width, standard	N		800 (31' 5")
Travel speed (low/high)		km/hr (mph)	3.3/5.9 (2.1/3.7)
Swing speed		rpm	10.2
Gradeability		Degree (%)	35 (70)
Ground pressure (800 mm shoe)		kgf/cm^2 (psi)	0.48 (6.83)
Max traction force		kg (lb)	26500 (58420)

4) HX300 L HIGH WALKER

· 6.25 m (20' 6") BOOM and 3.05 m (10' 0") ARM

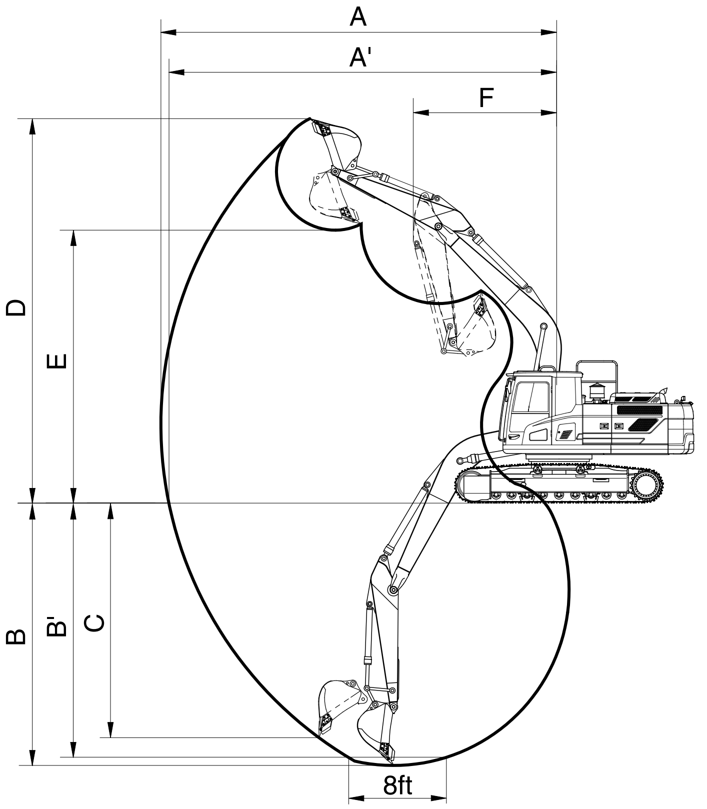


Description		Unit	Specification
Operating weight		kg (lb)	33040 (72840)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	1.27 (1.66)
Overall length	A	mm (ft-in)	10430 (34' 3")
Overall width, with 600 mm shoe	B		3470 (11' 5")
Overall height of boom	C		3350 (11' 0")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3400 (11' 2")
Ground clearance of counterweight	F		1500 (4' 11")
Overall height of engine hood	G		2910 (9' 7")
Overall height of handrail	G'		3650 (12' 0")
Minimum ground clearance	H		765 (2' 6")
Rear-end distance	I		3120 (10' 3")
Rear-end swing radius	I'		3200 (10' 6")
Distance between tumblers	J		4030 (13' 3")
Undercarriage length	K		4950 (16' 3")
Undercarriage width	L		3470 (11' 5")
Track gauge	M		2870 (9' 5")
Track shoe width, standard	N		600 (23' 6")
Travel speed (low/high)		km/hr (mph)	3.3/5.9 (2.1/3.7)
Swing speed		rpm	10.2
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.64 (9.10)
Max traction force		kg (lb)	26500 (58420)

3. WORKING RANGE

1) HX300 L/NL

· 6.25 m (20' 6") BOOM

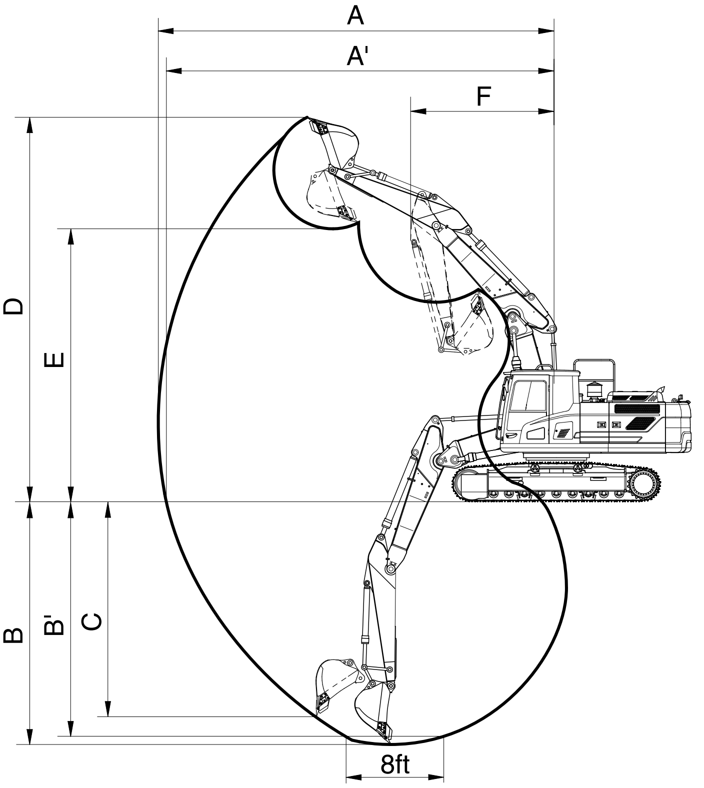


290F2SP06

Description		2.10m (6' 11") Arm	2.50 m (8' 2") Arm	3.05 m (10' 0") Arm	3.75 m (12' 4") Arm
Max digging reach	A	10020 mm (32' 10")	10280 mm (33' 9")	10820 mm (35' 6")	11400 mm (37' 5")
Max digging reach on ground	A'	9820 mm (32' 3")	10080 mm (33' 1")	10620 mm (34' 10")	11220 mm (36' 10")
Max digging depth	B	6440 mm (21' 2")	6840 mm (22' 5")	7390 mm (24' 3")	8090 mm (26' 7")
Max digging depth (8 ft level)	B'	6240 mm (20' 6")	6630 mm (21' 9")	7200 mm (23' 7")	7920 mm (26' 0")
Max vertical wall digging depth	C	6000 mm (19' 8")	5850 mm (19' 2")	6380 mm (20' 11")	7080 mm (23' 3")
Max digging height	D	10040 mm (32' 11")	10000 mm (32' 10")	10160 mm (33' 4")	10360 mm (34' 0")
Max dumping height	E	6940 mm (22' 9")	7030 mm (23' 1")	7110 mm (23' 4")	7310 mm (24' 0")
Min swing radius	F	4400 mm (14' 5")	4300 mm (14' 1")	4250 mm (13' 11")	4200 mm (13' 9")
Bucket digging force	SAE	168.7 [183.1] kN	168.7 [183.1] kN	168.7 [183.1] kN	168.7 [183.1] kN
		17200 [18670] kgf	17200 [18670] kgf	17200 [18670] kgf	17200 [18670] kgf
		37920 [41170] lbf	37920 [41170] lbf	37920 [41170] lbf	37920 [41170] lbf
	ISO	192.2 [208.7] kN	192.2 [208.7] kN	192.2 [208.7] kN	192.2 [208.7] kN
		19600 [21280] kgf	19600 [21280] kgf	19600 [21280] kgf	19600 [21280] kgf
		43210 [46910] lbf	43210 [46910] lbf	43210 [46910] lbf	43210 [46910] lbf
Arm digging force	SAE	180.4 [195.9] kN	156.9 [170.4] kN	131.4 [142.7] kN	114.7 [124.6] kN
		18400 [19980] kgf	16000 [17370] kgf	13400 [14550] kgf	11700 [12700] kgf
		40570 [44050] lbf	35270 [38290] lbf	29540 [32070] lbf	25790 [28000] lbf
	ISO	190.3 [206.6] kN	163.8 [177.8] kN	136.3 [148] kN	119.6 [129.9] kN
		19400 [21060] kgf	16700 [18130] kgf	13900 [15090] kgf	12200 [13250] kgf
		42770 [46440] lbf	36820 [39980] lbf	30640 [33270] lbf	26900 [29210] lbf

[ ] : Power boost

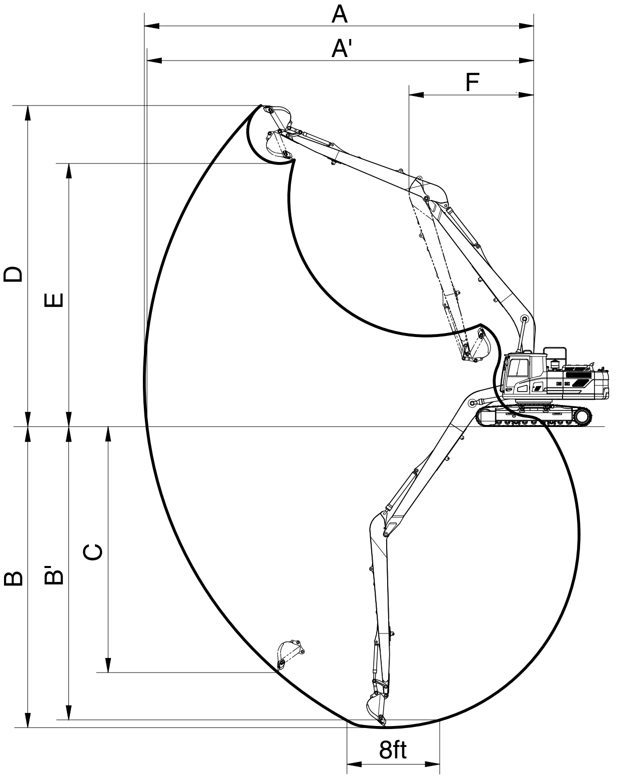
· 6.25 m (20' 6") 2-PIECE BOOM



Description		2.10m (6' 11") Arm	2.50 m (8' 2") Arm	3.05 m (10' 0") Arm	3.75 m (12' 4") Arm
Max digging reach	A	10060 mm (33' 0")	10340 mm (33' 9")	10860 mm (35' 6")	11480 mm (37' 7")
Max digging reach on ground	A'	9850 mm (32' 3")	10140 mm (33' 3")	10670 mm (35' 0")	11300 mm (37' 1")
Max digging depth	B	5930 mm (19' 5")	6280 mm (20' 6")	6820 mm (22' 4")	7490 mm (24' 6")
Max digging depth (8 ft level)	B'	5930 mm (19' 5")	6330 mm (20' 8")	6910 mm (22' 7")	7630 mm (25' 0")
Max vertical wall digging depth	C	5010 mm (16' 4")	5210 mm (17' 1")	5780 mm (19' 0")	6450 mm (21' 2")
Max digging height	D	11540 mm (37' 9")	11680 mm (38' 3")	12090 mm (40' 4")	12550 mm (41' 2")
Max dumping height	E	8310 mm (27' 3")	8440 mm (27' 7")	8850 mm (29' 0")	9320 mm (30' 6")
Min swing radius	F	3180 mm (10' 4")	2900 mm (9' 5")	2630 mm (8' 6")	2850 mm (9' 4")
Bucket digging force	SAE	168.7 [183.1] kN	168.7 [183.1] kN	168.7 [183.1] kN	168.7 [183.1] kN
		17200 [18670] kgf	17200 [18670] kgf	17200 [18670] kgf	17200 [18670] kgf
		37920 [41170] lbf	37920 [41170] lbf	37920 [41170] lbf	37920 [41170] lbf
	ISO	192.2 [208.7] kN	192.2 [208.7] kN	192.2 [208.7] kN	192.2 [208.7] kN
		19600 [21280] kgf	19600 [21280] kgf	19600 [21280] kgf	19600 [21280] kgf
		43210 [46910] lbf	43210 [46910] lbf	43210 [46910] lbf	43210 [46910] lbf
Arm digging force	SAE	180.4 [195.9] kN	156.9 [170.4] kN	131.4 [142.7] kN	114.7 [124.6] kN
		18400 [19980] kgf	16000 [17370] kgf	13400 [14550] kgf	11700 [12700] kgf
		40570 [44050] lbf	35270 [38290] lbf	29540 [32070] lbf	25790 [28000] lbf
	ISO	190.3 [206.6] kN	163.8 [177.8] kN	136.3 [148] kN	119.6 [129.9] kN
		19400 [21060] kgf	16700 [18130] kgf	13900 [15090] kgf	12200 [13250] kgf
		42770 [46440] lbf	36820 [39980] lbf	30640 [33270] lbf	26900 [29210] lbf

2) HX300 L LONG REACH

· 10.2 m (33' 6") BOOM

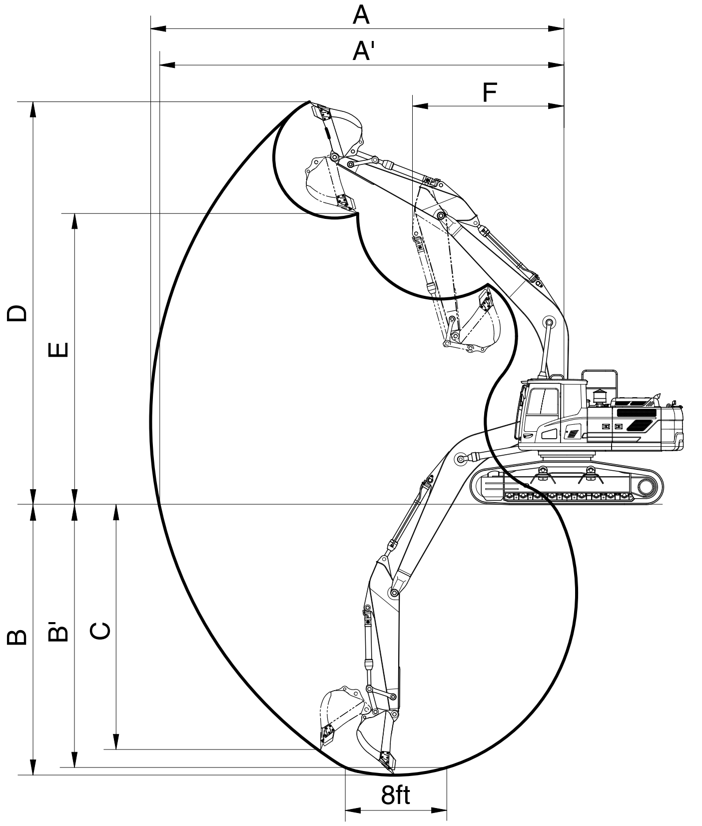


290F2SP07

Description		7.85 m (25' 9") Arm
Max digging reach	A	18510 (60' 9")
Max digging reach on ground	A'	18400 (60' 4")
Max digging depth	B	14820 (48' 7")
Max digging depth (8 ft level)	B'	14690 (48' 2")
Max vertical wall digging depth	C	12020 (39' 5")
Max digging height	D	14500 (47' 7")
Max dumping height	E	12190 (40' 0")
Min swing radius	F	6250 (20' 6")
Bucket digging force	SAE	70 kN
		7100 kgf
		15650 lbf
	ISO	80 kN
		8200 kgf
		18080 lbf
Arm crowd force	SAE	47.1 kN
		4800 kgf
		10580 lbf
	ISO	48.1 kN
		4900 kgf
		10800 lbf

3) HX300 L HIGH WALKER

· 6.25 m (20' 6") BOOM



290F2SP08

Description		2.10 m (6' 11") Arm	2.50 m (8' 2") Arm	3.05 m (10' 0") Arm	3.75 m (12' 4") Arm
Max digging reach	A	10020 mm (32' 10")	10280 mm (33 ' 9")	10790 mm (35' 5")	11400 mm (37' 5")
Max digging reach on ground	A'	9750 mm (32' 0")	10020 mm (32' 10")	10530 mm (34' 7")	11160 mm (36' 7")
Max digging depth	B	6140 mm (20' 2")	6540 mm (21' 5")	7090 mm (23' 3")	7790 mm (25' 7")
Max digging depth (8 ft level)	B'	5930 mm (19' 5")	6330 mm (20' 9")	6910 mm (22' 8")	7630 mm (25' 0")
Max vertical wall digging depth	C	5700 mm (18' 8")	5560 mm (18' 3")	6090 mm (20' 0")	6790 mm (22' 3")
Max digging height	D	10320 mm (33' 10")	10270 mm (33' 8")	10440 mm (34' 3")	10660 mm (35' 0")
Max dumping height	E	7240 mm (23' 9")	7170 mm (23' 6")	7400 mm (24' 3")	7610 mm (25' 0")
Min swing radius	F	4400 mm (14' 5")	4300 mm (14' 1")	4250 mm (13' 11")	4200 mm (13' 9")
Bucket digging force	SAE	168.7 [183.1] kN	168.7 [183.1] kN	168.7 [183.1] kN	168.7 [183.1] kN
		17200 [18670] kgf	17200 [18670] kgf	17200 [18670] kgf	17200 [18670] kgf
		37920 [41170] lbf	37920 [41170] lbf	37920 [41170] lbf	37920 [41170] lbf
	ISO	192.2 [208.7] kN	192.2 [208.7] kN	192.2 [208.7] kN	192.2 [208.7] kN
		19600 [21280] kgf	19600 [21280] kgf	19600 [21280] kgf	19600 [21280] kgf
		43210 [46910] lbf	43210 [46910] lbf	43210 [46910] lbf	43210 [46910] lbf
Arm digging force	SAE	180.4 [195.9] kN	156.9 [170.4] kN	131.4 [142.7] kN	114.7 [124.6] kN
		18400 [19980] kgf	16000 [17370] kgf	13400 [14550] kgf	11700 [12700] kgf
		40570 [44050] lbf	35270 [38290] lbf	29540 [32070] lbf	25790 [28000] lbf
	ISO	190.3 [206.6] kN	163.8 [177.8] kN	136.3 [148] kN	119.6 [129.9] kN
		19400 [21060] kgf	16700 [18130] kgf	13900 [15090] kgf	12200 [13250] kgf
		42770 [46440] lbf	36820 [39980] lbf	30640 [33270] lbf	26900 [29210] lbf

[ ] : Power boost

4. WEIGHT

1) HX300 L, HX300 NL

Item	HX300 L		HX300 NL	
	kg	lb	kg	lb
Upperstructure assembly				
· Main frame weld assembly	2720	6000	←	←
· Engine assembly	520	1150	←	←
· Aftertreatment assy	94	210	←	←
· Main pump assembly	140	310	←	←
· Main control valve assembly	220	490	←	←
· Swing motor assembly	350	770	←	←
· Hydraulic oil tank assembly	270	600	←	←
· Fuel tank assembly	235	520	←	←
· Counterweight	5200	11460	←	←
· Cab assembly	490	1080	←	←
Lower chassis assembly				
· Track frame weld assembly	3750	8270	3550	7830
· Swing bearing	435	960	←	←
· Travel motor assembly	360	790	←	←
· Turning joint	54	120	←	←
· Sprocket	83	180	←	←
· Track recoil spring	225	500	←	←
· Idler	260	570	←	←
· Carrier roller	35	80	←	←
· Track roller	56	120	←	←
· Track-chain assembly (600 mm standard triple grouser shoe)	1880	4150	←	←
Front attachment assembly				
· 6.25 m boom assembly	2280	5030	←	←
· 3.05 m arm assembly	1040	2290	←	←
· 1.27 m^3 SAE heaped bucket	1100	2430	←	←
· Boom cylinder assembly	270	600	←	←
· Arm cylinder assembly	360	790	←	←
· Bucket cylinder assembly	220	490	←	←
· Bucket control linkage total	110	240	←	←

※ 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.

2) HX300 L LONG REACH

Item	HX300 L LONG REACH	
	kg	lb
Upperstructure assembly		
· Main frame weld assembly	2720	6000
· Engine assembly	520	1150
· Aftertreatment assy	94	210
· Main pump assembly	140	310
· Main control valve assembly	220	490
· Swing motor assembly	350	770
· Hydraulic oil tank assembly	270	600
· Fuel tank assembly	235	520
· Counterweight	7000	15450
· Cab assembly	490	1080
Lower chassis assembly		
· Track frame weld assembly	3750	8270
· Swing bearing	435	960
· Travel motor assembly	360	790
· Turning joint	54	120
· Sprocket	83	180
· Track recoil spring	225	500
· Idler	260	570
· Carrier roller	35	80
· Track roller	56	120
· Track-chain assembly (800 mm standard triple grouser shoe)	2350	5180
Front attachment assembly		
· 10.2 m boom assembly	2980	6570
· 7.85 m arm assembly	1340	2960
· 0.52 m^3 SAE heaped bucket	460	1010
· Boom cylinder assembly	270	600
· Arm cylinder assembly	360	790
· Bucket cylinder assembly	140	310
· Bucket control linkage total	110	240

※ 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.

3) HX300 L HIGH WALKER

Item	HX300 L HIGH WALKER	
	kg	lb
Upperstructure assembly		
· Main frame weld assembly	2720	6000
· Engine assembly	520	1150
· Aftertreatment assy	94	210
· Main pump assembly	140	310
· Main control valve assembly	220	490
· Swing motor assembly	350	770
· Hydraulic oil tank assembly	270	600
· Fuel tank assembly	235	520
· Counterweight	5200	11460
· Cab assembly	490	1080
Lower chassis assembly		
· Track frame weld assembly	5825	12840
· Swing bearing	435	960
· Travel motor assembly	360	790
· Turning joint	54	120
· Sprocket	83	180
· Track recoil spring	225	500
· Idler	260	570
· Carrier roller	35	80
· Track roller	56	120
· Track-chain assembly (600 mm standard triple grouser shoe)	1880	4150
Front attachment assembly		
· 6.25 m boom assembly	2280	5030
· 3.05 m arm assembly	1040	2290
· 1.27 m^3 SAE heaped bucket	1100	2430
· Boom cylinder assembly	270	600
· Arm cylinder assembly	360	790
· Bucket cylinder assembly	220	490
· Bucket control linkage total	110	240

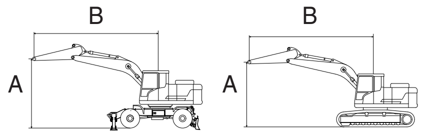
※ This information is different with operating and transportation weight because it is not including harness, pipe, oil, fuel so on.

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

5. LIFTING CAPACITIES

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3050	5200	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	kg													*4410	*4410	7.38
(24.6 ft)	lb													*9720	*9720	(24.2)
6.0 m	kg									*6490	5820			*4220	*4220	8.30
(19.7 ft)	lb									*14310	12830			*9300	*9300	(27.2)
4.5 m	kg					*9450	*9450	*7760	*7760	*6980	5650			*4210	*4210	8.86
(14.8 ft)	lb					*20830	*20830	*17110	*17110	*15390	12460			*9280	*9280	(29.1)
3.0 m	kg					*12510	11510	*9210	7550	*7720	5430	*5490	4080	*4350	3980	9.14
(9.8 ft)	lb					*27580	25380	*20300	16640	*17020	11970	*12100	8990	*9590	8770	(30.0)
1.5 m	kg					*14900	10740	*10550	7150	8220	5210	*6190	3990	*4640	3870	9.17
(4.9 ft)	lb					*32850	23680	*23260	15760	18120	11490	*13650	8800	*10230	8530	(30.1)
Ground	kg					*15940	10420	11290	6890	8050	5060			*5160	3960	8.94
Line	lb					*35140	22970	24890	15190	17750	11160			*11380	8730	(29.3)
-1.5 m	kg	*7650	*7650	*11100	*11100	*15950	10360	11170	6790	7980	4990			*6050	4270	8.44
(-4.9 ft)	lb	*16870	*16870	*24470	*24470	*35160	22840	24630	14970	17590	11000			*13340	9410	(27.7)
-3.0 m	kg	*13100	*13100	*17910	*17910	*15100	10470	11230	6830	8060	5060			*7770	4970	7.61
(-9.8 ft)	lb	*28880	*28880	*39480	*39480	*33290	23080	24760	15060	17770	11160			*17130	10960	(25.0)
-4.5 m	kg			*18100	*18100	*13040	10770	*9550	7070					*8810	6620	6.32
(-14.8 ft)	lb			*39900	*39900	*28750	23740	*21050	15590					*19420	14590	(20.7)

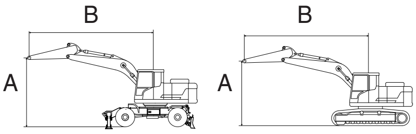
Note 1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates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

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

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

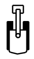
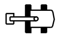
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2100	5200	600	-	-	-	-	-

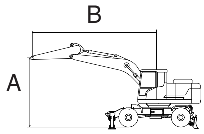
· : Rating over-front · : Rating over-side or 360 degree

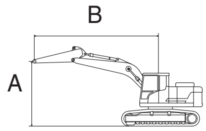


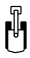
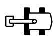
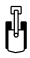
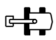
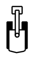
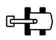
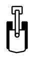
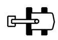
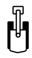
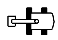
Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg					*7670	*7670			*7890	7410	6.40
(24.6 ft)	lb					*16910	*16910			*17390	16340	(21.0)
6.0 m	kg					*7900	*7900			*7790	5740	7.44
(19.7 ft)	lb					*17420	*17420			*17170	12650	(24.4)
4.5 m	kg					*8950	7830	*7930	5580	7640	4950	8.06
(14.8 ft)	lb					*19730	17260	*17480	12300	16840	10910	(26.5)
3.0 m	kg					*10270	7420	8420	5400	7100	4570	8.37
(9.8 ft)	lb					*22640	16360	18560	11900	15650	10080	(27.5)
1.5 m	kg					*11350	7110	8240	5230	6970	4470	8.40
(4.9 ft)	lb					*25020	15670	18170	11530	15370	9850	(27.6)
Ground	kg					11340	6950	8130	5140	7230	4610	8.16
Line	lb					25000	15320	17920	11330	15940	10160	(26.8)
-1.5 m	kg			*15530	10610	11330	6940	8170	5170	8030	5100	7.60
(-4.9 ft)	lb			*34240	23390	24980	15300	18010	11400	17700	11240	(24.9)
-3.0 m	kg	*18440	*18440	*14030	10810	*10600	7090			*9060	6220	6.66
(-9.8 ft)	lb	*40650	*40650	*30930	23830	*23370	15630			*19970	13710	(21.9)
-4.5 m	kg			*10580	*10580					*8760	*8760	5.12
(-14.8 ft)	lb			*23320	*23320					*19310	*19310	(16.8)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2500	5200	600	-	-	-	-	-

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

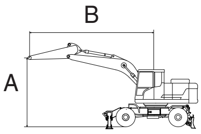


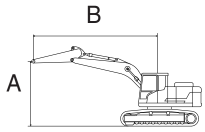


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg					*6980	*6980			*6760	*6760	6.74
(24.6 ft)	lb					*15390	*15390			*14900	*14900	(22.1)
6.0 m	kg					*7380	*7380	*7170	5740	*6440	5430	7.74
(19.7 ft)	lb					*16270	*16270	*15810	12650	*14200	11970	(25.4)
4.5 m	kg			*10660	*10660	*8470	7900	*7530	5610	*6420	4710	8.34
(14.8 ft)	lb			*23500	*23500	*18670	17420	*16600	12370	*14150	10380	(27.4)
3.0 m	kg			*13720	11240	*9850	7470	*8180	5410	*6640	4360	8.64
(9.8 ft)	lb			*30250	24780	*21720	16470	*18030	11930	*14640	9610	(28.3)
1.5 m	kg					*11040	7120	8230	5220	6640	4250	8.67
(4.9 ft)	lb					*24340	15700	18140	11510	14640	9370	(28.4)
Ground	kg			*16170	10470	11310	6920	8100	5100	6850	4360	8.43
Line	lb			*35650	23080	24930	15260	17860	11240	15100	9610	(27.7)
-1.5 m	kg	*11150	*11150	*15780	10490	11260	6870	8080	5090	7530	4770	7.89
(-4.9 ft)	lb	*24580	*24580	*34790	23130	24820	15150	17810	11220	16600	10520	(25.9)
-3.0 m	kg	*19830	*19830	*14550	10660	*10980	6980			*9000	5700	6.99
(-9.8 ft)	lb	*43720	*43720	*32080	23500	*24210	15390			*19840	12570	(22.9)
-4.5 m	kg	*15970	*15970	*11820	11040					*9210	8150	5.55
(-14.8 ft)	lb	*35210	*35210	*26060	24340					*20300	17970	(18.2)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3750	5200	600	-	-	-	-	-

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

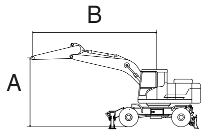


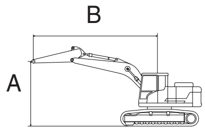


Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
7.5 m	kg									*5120	*5120			*3490	*3490	8.14
(24.6 ft)	lb									*11290	*11290			*7690	*7690	(26.7)
6.0 m	kg									*5700	*5700			*3370	*3370	8.97
(19.7 ft)	lb									*12570	*12570			*7430	*7430	(29.4)
4.5 m	kg							*6830	*6830	*6290	5730	*5230	4220	*3380	*3380	9.50
(14.8 ft)	lb							*15060	*15060	*13870	12630	*11530	9300	*7450	*7450	(31.2)
3.0 m	kg					*10960	*10960	*8340	7690	*7110	5480	6380	4100	*3490	*3490	9.76
(9.8 ft)	lb					*24160	*24160	*18390	16950	*15670	12080	14070	9040	*7690	*7690	(32.0)
1.5 m	kg					*13740	10950	*9850	7220	*7970	5220	6240	3970	*3720	3480	9.79
(4.9 ft)	lb					*30290	24140	*21720	15920	*17570	11510	13760	8750	*8200	7670	(32.1)
Ground	kg			*6810	*6810	*15380	10430	*10980	6890	8030	5030	6120	3860	*4110	3530	9.58
Line	lb			*15010	*15010	*33910	22990	*24210	15190	17700	11090	13490	8510	*9060	7780	(31.4)
-1.5 m	kg	*7070	*7070	*10570	*10570	*15920	10250	11100	6720	7900	4910	*5710	3820	*4750	3760	9.11
(-4.9 ft)	lb	*15590	*15590	*23300	*23300	*35100	22600	24470	14820	17420	10820	*12590	8420	*10470	8290	(29.9)
-3.0 m	kg	*11090	*11090	*15460	*15460	*15540	10270	11080	6690	7900	4910			*5900	4270	8.35
(-9.8 ft)	lb	*24450	*24450	*34080	*34080	*34260	22640	24430	14750	17420	10820			*13010	9410	(27.4)
-4.5 m	kg	*15990	*15990	*20280	*20280	*14140	10480	*10510	6830					*8250	5350	7.19
(-14.8 ft)	lb	*35250	*35250	*44710	*44710	*31170	23100	*23170	15060					*18190	11790	(23.6)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	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

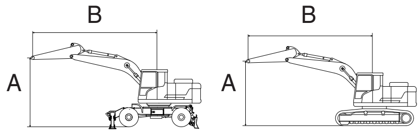




Lift-point height (A)		Lift-point radius (B) -0.5 m (-1.6 ft)		1.0 m (3.3 ft)		2.5m (8.2ft)		4.0m (13.1ft)		5.5m (18.0ft)		7.0m (23.0ft)		8.5m (27.9ft)		10.0m (32.8ft)		11.5m (37.7ft)		13.0m (42.7ft)		14.5m (47.6ft)		16.0m (52.5ft)		At max. reach Capacity		Reach
																												m (ft)
12.4 m	kg																									*780	*780	13.80
40.7 ft	lb																									*1720	*1720	(45.3)
10.9 m	kg																					*940	*940			*750	*750	14.82
35.8 ft	lb																					*2070	*2070			*1650	*1650	(48.6)
9.4 m	kg																					*1270	*1270			*730	*730	15.63
30.8 ft	lb																					*2800	*2800			*1610	*1610	(51.3)
7.9 m	kg																			*1740	*1740	*1500	*1500	*900	*900	*720	*720	16.25
25.9 ft	lb																			*3840	*3840	*3310	*3310	*1980	*1980	*1590	*1590	(53.3)
6.4 m	kg																			*1940	*1940	*1700	*1700	*1190	*1190	*730	*730	16.72
21.0 ft	lb																			*4280	*4280	*3750	*3750	*2620	*2620	*1610	*1610	(54.9)
4.9 m	kg																	*2390	*2390	*2200	*2200	*1910	*1910	*1400	*1400	*750	*750	17.04
16.1 ft	lb																	*5270	*5270	*4850	*4850	*4210	*4210	*3090	*3090	*1650	*1650	(55.9)
3.4 m	kg													*3960	*3960	*3400	*3400	*2950	*2950	*2570	*2570	*2160	*2160	*1590	*1590	*770	*770	17.23
11.2 ft	lb													*8730	*8730	*7500	*7500	*6500	*6500	*5670	*5670	*4760	*4760	*3510	*3510	*1700	*1700	(56.5)
1.9 m	kg							*3290	*3290	*7670	*7670	*5730	*5730	*4660	*4660	*3990	*3990	*3550	3270	*3070	2680	*2440	2220	*1740	*1740	*820	*820	17.28
6.2 ft	lb							*7250	*7250	*16910	*16910	*12630	*12630	*10270	*10270	*8800	*8800	*7830	7210	*6770	5910	*5380	4890	*3840	*3840	*1810	*1810	(56.7)
0.4 m	kg							*2340	*2340	*5890	*5890	*6680	6100	*5310	4730	*4450	3780	*3890	3080	*3490	2550	*2760	2120	*1850	1780	*870	*870	17.20
1.3 ft	lb							*5160	*5160	*12990	*12990	*14730	13450	*11710	10430	*9810	8330	*8580	6790	*7690	5620	*6080	4670	*4080	3920	*1920	*1920	(56.4)
-1.1 m	kg			*1200	*1200	*1430	*1430	*2500	*2500	*4840	*4840	*7420	5680	*5860	4420	*4870	3550	*4200	2920	*3720	2430	*3050	2040	*1880	1720	*950	*950	16.98
-3.6 ft	lb			*2650	*2650	*3150	*3150	*5510	*5510	*10670	*10670	*16360	12520	*12920	9740	*10740	7830	*9260	6440	*8200	5360	*6720	4500	*4140	3790	*2090	*2090	(55.7)
-2.6 m	kg			*1780	*1780	*2070	*2070	*2980	*2980	*4860	*4860	*7950	5400	*6290	4190	*5210	3380	*4460	2790	3810	2330	*3240	1970	*1750	1680	*1050	*1050	16.63
-8.5 ft	lb			*3920	*3920	*4560	*4560	*6570	*6570	*10710	*10710	*17530	11900	*13870	9240	*11490	7450	*9830	6150	8400	5140	*7140	4340	*3860	3700	*2310	*2310	(54.6)
-4.1 m	kg	*2400	*2400	*2390	*2390	*2750	*2750	*3620	*3620	*5330	*5330	*8260	5250	*6590	4060	5370	3260	4430	2690	3740	2260	3210	1930	*1350	*1350	*1180	*1180	16.12
-13.5 ft	lb	*5290	*5290	*5270	*5270	*6060	*6060	*7980	*7980	*11750	*11750	*18210	11570	*14530	8950	11840	7190	9770	5930	8250	4980	7080	4250	*2980	*2980	*2600	*2600	(52.9)
-5.6 m	kg	*2930	*2930	*3040	*3040	*3470	*3470	*4380	*4380	*6070	*6070	*8390	5190	6640	3990	5300	3200	4380	2640	3700	2230	*2790	1910			*1360	*1360	15.46
-18.4 ft	lb	*6460	*6460	*6700	*6700	*7650	*7650	*9660	*9660	*13380	*13380	*18500	11440	14640	8800	11680	7050	9660	5820	8160	4920	*6150	4210			*3000	*3000	(50.7)
-7.1 m	kg	*3510	*3510	*3740	*3740	*4270	*4270	*5260	*5260	*7080	*7080	*8340	5210	6640	3980	5290	3190	4370	2640	3710	2230	*1810	*1810			*1620	*1620	14.61
-23.3 ft	lb	*7740	*7740	*8250	*8250	*9410	*9410	*11600	*11600	*15610	*15610	*18390	11490	14640	8770	11660	7030	9630	5820	8180	4920	*3990	*3990			*3570	*3570	(47.9)
-8.6 m	kg			*4500	*4500	*5160	*5160	*6320	*6320	*8410	7540	*8090	5300	*6590	4040	5330	3230	4410	2680	*3260	2290					*2030	*2030	13.53
-28.2 ft	lb			*9920	*9920	*11380	*11380	*13930	*13930	*18540	16620	*17840	11680	*14530	8910	11750	7120	9720	5910	*7190	5050					*4480	*4480	(44.4)
-10.1 m	kg			*5360	*5360	*6190	*6190	*7620	*7620	*9570	7770	*7590	5460	*6220	4160	*5180	3330	*4330	2780							*2750	2600	12.18
-33.1 ft	lb			*11820	*11820	*13650	*13650	*16800	*16800	*21100	17130	*16730	12040	*13710	9170	*11420	7340	*9550	6130							*6060	5730	(40.0)
-11.6 m	kg					*7430	*7430	*9330	*9330	*8440	8110	*6740	5700	*5510	4360	*4480	3520									*4200	3350	10.44
-38.1 ft	lb					*16380	*16380	*20570	*20570	*18610	17880	*14860	12570	*12150	9610	*9880	7760									*9260	7390	(34.2)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2100	7500	600	-	-	-	-	-

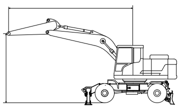
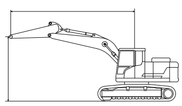
· : Rating over-front · : Rating over-side or 360 degree



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)
9.0 m	kg			*12270	*12270							*11940	*11940	4.58
(29.5 ft)	lb			*27050	*27050							*26320	*26320	(15.0)
7.5 m	kg			*11390	*11390	*9440	*9440					*9270	8880	6.35
(24.6 ft)	lb			*25110	*25110	*20810	*20810					*20440	19580	(20.8)
6.0 m	kg			*12450	*12450	*9540	*9540					*8140	6890	7.41
(19.7 ft)	lb			*27450	*27450	*21030	*21030					*17950	15190	(24.3)
4.5 m	kg					*10460	9350	*8100	6690			*7640	5960	8.05
(14.8 ft)	lb					*23060	20610	*17860	14750			*16840	13140	(26.4)
3.0 m	kg					*12000	8910	*8540	6510			*7520	5520	8.38
(9.8 ft)	lb					*26460	19640	*18830	14350			*16580	12170	(27.5)
1.5 m	kg					13540	8580	*9090	6340			*7690	5410	8.42
(4.9 ft)	lb					29850	18920	*20040	13980			*16950	11930	(27.6)
Ground	kg					13360	8410	*9510	6240			*8200	5580	8.19
Line	lb					29450	18540	*20970	13760			*18080	12300	(26.9)
-1.5 m	kg			*14820	12810	*11970	8410	*8830	6280			*8300	6140	7.66
(-4.9 ft)	lb			*32670	28240	*26390	18540	*19470	13850			*18300	13540	(25.1)
-3.0 m	kg					*9040	8590							
(-9.8 ft)	lb					*19930	18940							

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2500	7500	600	-	-	-	-	-

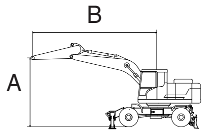
· : Rating over-front · : Rating over-side or 360 degree

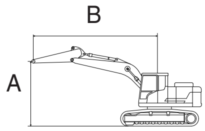
B
A

B
A


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
		front	side	front	side	front	side	front	side	front	side	front	side	m (ft)
9.0 m	kg			*9800	*9800							*9000	*9000	5.09
(29.5 ft)	lb			*21610	*21610							*19840	*19840	(16.7)
7.5 m	kg			*9870	*9870	*8870	*8870					*7750	*7750	6.73
(24.6 ft)	lb			*21760	*21760	*19550	*19550					*17090	*17090	(22.1)
6.0 m	kg	*11920	*11920	*11130	*11130	*9100	*9100	*7570	6860			*7290	6500	7.73
(19.7 ft)	lb	*26280	*26280	*24540	*24540	*20060	*20060	*16690	15120			*16070	14330	(25.4)
4.5 m	kg			*14530	*14530	*9990	9430	*7780	6730			*7040	5670	8.35
(14.8 ft)	lb			*32030	*32030	*22020	20790	*17150	14840			*15520	12500	(27.4)
3.0 m	kg					*11470	8970	*8260	6520			*6960	5260	8.67
(9.8 ft)	lb					*25290	19780	*18210	14370			*15340	11600	(28.4)
1.5 m	kg					*13240	8590	*8850	6330			*7140	5140	8.71
(4.9 ft)	lb					*29190	18940	*19510	13960			*15740	11330	(28.6)
Ground	kg			*17730	12640	13330	8380	*9350	6200			*7460	5270	8.48
Line	lb			*39090	27870	29390	18470	*20610	13670			*16450	11620	(27.8)
-1.5 m	kg			*15730	12680	*12400	8340	*9480	6190			*8400	5750	7.97
(-4.9 ft)	lb			*34680	27950	*27340	18390	*20900	13650			*18520	12680	(26.1)
-3.0 m	kg			*12570	*12570	*9980	8460					*7450	6810	7.10
(-9.8 ft)	lb			*27710	*27710	*22000	18650					*16420	15010	(23.3)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3050	7500	600	-	-	-	-	-

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

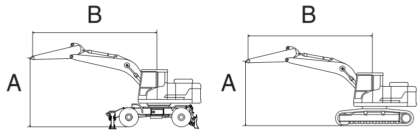




Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m	kg			*8820	*8820	*5960	*5960					*5620	*5620	6.06
(29.5 ft)	lb			*19440	*19440	*13140	*13140					*12390	*12390	(19.9)
7.5 m	kg			*8660	*8660	*8280	*8280					*4990	*4990	7.46
(24.6 ft)	lb			*19090	*19090	*18250	*18250					*11000	*11000	(24.5)
6.0 m	kg			*9630	*9630	*8600	*8600	*7100	6940			*4740	*4740	8.37
(19.7 ft)	lb			*21230	*21230	*18960	*18960	*15650	15300			*10450	*10450	(27.5)
4.5 m	kg			*13240	*13240	*9450	*9450	*7410	6770			*4690	*4690	8.93
(14.8 ft)	lb			*29190	*29190	*20830	*20830	*16340	14930			*10340	*10340	(29.3)
3.0 m	kg			*17310	13700	*10880	9020	*7930	6530	*6360	4950	*4810	4770	9.21
(9.8 ft)	lb			*38160	30200	*23990	19890	*17480	14400	*14020	10910	*10600	10520	(30.2)
1.5 m	kg			*18670	12890	*12670	8590	*8570	6300	*6580	4850	*5090	4670	9.24
(4.9 ft)	lb			*41160	28420	*27930	18940	*18890	13890	*14510	10690	*11220	10300	(30.3)
Ground	kg			*18290	12560	13280	8330	*9140	6140	*5760	4800	*5590	4790	9.01
Line	lb			*40320	27690	29280	18360	*20150	13540	*12700	10580	*12320	10560	(29.6)
-1.5 m	kg	*12160	*12160	*16670	12520	*12820	8230	9440	6080			*6450	5170	8.51
(-4.9 ft)	lb	*26810	*26810	*36750	27600	*28260	18140	20810	13400			*14220	11400	(27.9)
-3.0 m	kg			*13870	12670	*10860	8300	*7840	6180			*7310	6000	7.69
(-9.8 ft)	lb			*30580	27930	*23940	18300	*17280	13620			*16120	13230	(25.2)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2100	5200	600	-	-	-	-	-

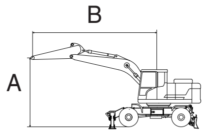
· : Rating over-front · : Rating over-side or 360 degree

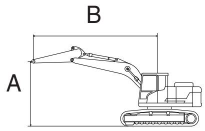


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg					*7690	7600			*7920	6780	6.40
(24.6 ft)	lb					*16950	16760			*17460	14950	(21.0)
6.0 m	kg					*7930	7480			*7810	5250	7.44
(19.7 ft)	lb					*17480	16490			*17220	11570	(24.4)
4.5 m	kg					*8980	7140	*7950	5100	7610	4520	8.06
(14.8 ft)	lb					*19800	15740	*17530	11240	16780	9960	(26.5)
3.0 m	kg					*10300	6750	8380	4930	7070	4170	8.37
(9.8 ft)	lb					*22710	14880	18470	10870	15590	9190	(27.5)
1.5 m	kg					*11390	6450	8200	4770	6940	4070	8.40
(4.9 ft)	lb					*25110	14220	18080	10520	15300	8970	(27.6)
Ground	kg					11290	6300	8100	4680	7200	4200	8.16
Line	lb					24890	13890	17860	10320	15870	9260	(26.8)
-1.5 m	kg			*15560	9510	11280	6290	8130	4710	7990	4640	7.60
(-4.9 ft)	lb			*34300	20970	24870	13870	17920	10380	17610	10230	(24.9)
-3.0 m	kg	*18480	*18480	*14060	9700	*10630	6430			*9090	5650	6.66
(-9.8 ft)	lb	*40740	*40740	*31000	21380	*23440	14180			*20040	12460	(21.9)
-4.5 m	kg			*10610	10150					*8790	8490	5.12
(-14.8 ft)	lb			*23390	22380					*19380	18720	(16.8)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2500	5200	600	-	-	-	-	-

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

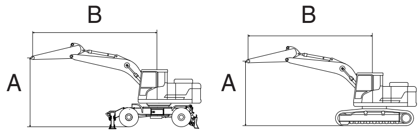




Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg					*7020	*7020			*6800	6430	6.67
(24.6 ft)	lb					*15480	*15480			*14990	14180	(21.9)
6.0 m	kg					*7360	*7360	*7200	5260	*6460	5040	7.68
(19.7 ft)	lb					*16230	*16230	*15870	11600	*14240	11110	(25.2)
4.5 m	kg			*10530	*10530	*8420	7240	*7520	5150	*6430	4350	8.30
(14.8 ft)	lb			*23210	*23210	*18560	15960	*16580	11350	*14180	9590	(27.2)
3.0 m	kg			*13560	10180	*9790	6830	*8170	4950	*6650	4010	8.61
(9.8 ft)	lb			*29890	22440	*21580	15060	*18010	10910	*14660	8840	(28.3)
1.5 m	kg					*10990	6480	8210	4770	6640	3890	8.65
(4.9 ft)	lb					*24230	14290	18100	10520	14640	8580	(28.4)
Ground	kg			*16130	9400	11280	6280	8080	4650	6840	3980	8.42
Line	lb			*35560	20720	24870	13850	17810	10250	15080	8770	(27.6)
-1.5 m	kg	*10890	*10890	*15780	9410	11220	6230	8050	4630	7490	4340	7.90
(-4.9 ft)	lb	*24010	*24010	*34790	20750	24740	13730	17750	10210	16510	9570	(25.9)
-3.0 m	kg	*19890	18990	*14600	9570	*11030	6320			8990	5170	7.02
(-9.8 ft)	lb	*43850	41870	*32190	21100	*24320	13930			19820	11400	(23.0)
-4.5 m	kg	*16160	*16160	*11970	9920					*9240	7290	5.60
(-14.8 ft)	lb	*35630	*35630	*26390	21870					*20370	16070	(18.4)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3050	5200	600	-	-	-	-	-

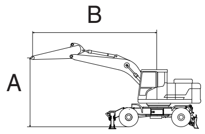
· : Rating over-front · : Rating over-side or 360 degree

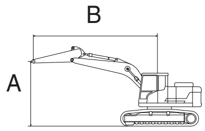


Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m (ft)
7.5 m	kg													*4420	*4420	7.38
(24.6 ft)	lb													*9740	*9740	(24.2)
6.0 m	kg									*6510	5330			*4230	*4230	8.30
(19.7 ft)	lb									*14350	11750			*9330	*9330	(27.2)
4.5 m	kg					*9480	*9480	*7790	7320	*7010	5170			*4220	3910	8.86
(14.8 ft)	lb					*20900	*20900	*17170	16140	*15450	11400			*9300	8620	(29.1)
3.0 m	kg					*12540	10370	*9240	6870	*7750	4950	*5510	3720	*4360	3620	9.14
(9.8 ft)	lb					*27650	22860	*20370	15150	*17090	10910	*12150	8200	*9610	7980	(30.0)
1.5 m	kg					*14940	9640	*10580	6480	8190	4740	*6210	3630	*4660	3520	9.17
(4.9 ft)	lb					*32940	21250	*23320	14290	18060	10450	*13690	8000	*10270	7760	(30.1)
Ground	kg					*15980	9320	11240	6230	8020	4590			*5180	3600	8.94
Line	lb					*35230	20550	24780	13730	17680	10120			*11420	7940	(29.3)
-1.5 m	kg	*7670	*7670	*11120	*11120	*15990	9270	11120	6130	7950	4530			*6070	3880	8.44
(-4.9 ft)	lb	*16910	*16910	*24520	*24520	*35250	20440	24520	13510	17530	9990			*13380	8550	(27.7)
-3.0 m	kg	*13120	*13120	*17920	*17920	*15130	9370	11170	6180	8030	4600			*7790	4520	7.61
(-9.8 ft)	lb	*28920	*28920	*39510	*39510	*33360	20660	24630	13620	17700	10140			*17170	9960	(25.0)
-4.5 m	kg			*18140	*18140	*13070	9660	*9580	6410					*8830	6000	6.32
(-14.8 ft)	lb			*39990	*39990	*28810	21300	*21120	14130					*19470	13230	(20.7)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3750	5200	600	-	-	-	-	-

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

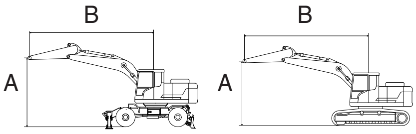




Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
7.5 m	kg									*5040	*5040			*3520	*3520	8.08
(24.6 ft)	lb									*11110	*11110			*7760	*7760	(26.5)
6.0 m	kg									*5710	5450			*3390	*3390	8.93
(19.7 ft)	lb									*12590	12020			*7470	*7470	(29.3)
4.5 m	kg							*6790	*6790	*6280	5270	*5140	3870	*3390	*3390	9.46
(14.8 ft)	lb							*14970	*14970	*13850	11620	*11330	8530	*7470	*7470	(31.0)
3.0 m	kg					*10810	10800	*8290	7040	*7090	5020	6370	3750	*3500	3270	9.74
(9.8 ft)	lb					*23830	23810	*18280	15520	*15630	11070	14040	8270	*7720	7210	(31.9)
1.5 m	kg					*13610	9890	*9790	6580	*7940	4770	6230	3620	*3730	3180	9.77
(4.9 ft)	lb					*30000	21800	*21580	14510	*17500	10520	13730	7980	*8220	7010	(32.1)
Ground	kg			*6790	*6790	*15290	9370	*10930	6250	8010	4580	6110	3520	*4110	3210	9.57
Line	lb			*14970	*14970	*33710	20660	*24100	13780	17660	10100	13470	7760	*9060	7080	(31.4)
-1.5 m	kg	*6950	*6950	*10490	*10490	*15870	9180	11070	6080	7880	4460	*5730	3470	*4740	3420	9.11
(-4.9 ft)	lb	*15320	*15320	*23130	*23130	*34990	20240	24410	13400	17370	9830	*12630	7650	*10450	7540	(29.9)
-3.0 m	kg	*10970	*10970	*15340	*15340	*15540	9190	11040	6050	7870	4450			*5860	3870	8.36
(-9.8 ft)	lb	*24180	*24180	*33820	*33820	*34260	20260	24340	13340	17350	9810			*12920	8530	(27.4)
-4.5 m	kg	*15830	*15830	*20350	18580	*14200	9380	*10570	6170					*8250	4830	7.22
(-14.8 ft)	lb	*34900	*34900	*44860	40960	*31310	20680	*23300	13600					*18190	10650	(23.7)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2100	7500	600	-	-	-	-	-

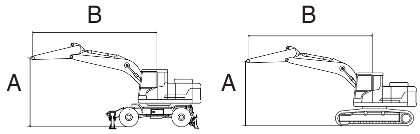
· : Rating over-front · : Rating over-side or 360 degree



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)
9.0 m	kg			*12270	*12270							*11940	*11940	4.58
(29.5 ft)	lb			*27050	*27050							*26320	*26320	(15.0)
7.5 m	kg			*11390	*11390	*9440	9020					*9270	8160	6.35
(24.6 ft)	lb			*25110	*25110	*20810	19890					*20440	17990	(20.8)
6.0 m	kg			*12450	*12450	*9540	8920					*8140	6330	7.41
(19.7 ft)	lb			*27450	*27450	*21030	19670					*17950	13960	(24.3)
4.5 m	kg					*10460	8560	*8100	6140			*7640	5470	8.05
(14.8 ft)	lb					*23060	18870	*17860	13540			*16840	12060	(26.4)
3.0 m	kg					*12000	8130	*8540	5960			*7520	5060	8.38
(9.8 ft)	lb					*26460	17920	*18830	13140			*16580	11160	(27.5)
1.5 m	kg					13470	7810	*9090	5790			*7690	4940	8.42
(4.9 ft)	lb					29700	17220	*20040	12760			*16950	10890	(27.6)
Ground	kg					13280	7650	*9510	5700			*8200	5100	8.19
Line	lb					29280	16870	*20970	12570			*18080	11240	(26.9)
-1.5 m	kg			*14820	11540	*11970	7650	*8830	5740			*8300	5610	7.66
(-4.9 ft)	lb			*32670	25440	*26390	16870	*19470	12650			*18300	12370	(25.1)
-3.0 m	kg					*9040	7820							
(-9.8 ft)	lb					*19930	17240							

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2500	7500	600	-	-	-	-	-

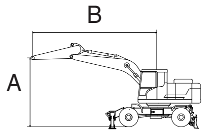
· : Rating over-front · : Rating over-side or 360 degree

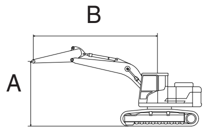


Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg lb			*9800 *21610	*9800 *21610							*9000 *19840	*9000 *19840	5.09 (16.7)
7.5 m (24.6 ft)	kg lb			*9870 *21760	*9870 *21760	*8870 *19550	*8870 *19550					*7750 *17090	7540 16620	6.73 (22.1)
6.0 m (19.7 ft)	kg lb	*11920 *26280	*11920 *26280	*11130 *24540	*11130 *24540	*9100 *20060	9010 19860	*7570 *16690	6300 13890			*7290 *16070	5970 13160	7.73 (25.4)
4.5 m (14.8 ft)	kg lb			*14530 *32030	13250 29210	*9990 *22020	8640 19050	*7780 *17150	6180 13620			*7040 *15520	5200 11460	8.35 (27.4)
3.0 m (9.8 ft)	kg lb					*11470 *25290	8190 18060	*8260 *18210	5970 13160			*6960 *15340	4810 10600	8.67 (28.4)
1.5 m (4.9 ft)	kg lb					*13240 *29190	7820 17240	*8850 *19510	5780 12740			*7140 *15740	4690 10340	8.71 (28.6)
Ground Line	kg lb			*17730 *39090	11370 25070	13250 29210	7610 16780	*9350 *20610	5660 12480			*7460 *16450	4820 10630	8.48 (27.8)
-1.5 m (-4.9 ft)	kg lb			*15730 *34680	11410 25150	*12400 *27340	7570 16690	*9480 *20900	5650 12460			*8400 *18520	5250 11570	7.97 (26.1)
-3.0 m (-9.8 ft)	kg lb			*12570 *27710	11610 25600	*9980 *22000	7690 16950					*7450 *16420	6220 13710	7.10 (23.3)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3050	7500	600	-	-	-	-	-

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

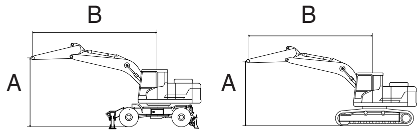




Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m	kg			*8820	*8820	*5960	*5960					*5620	*5620	6.06
(29.5 ft)	lb			*19440	*19440	*13140	*13140					*12390	*12390	(19.9)
7.5 m	kg			*8660	*8660	*8280	*8280					*4990	*4990	7.46
(24.6 ft)	lb			*19090	*19090	*18250	*18250					*11000	*11000	(24.5)
6.0 m	kg			*9630	*9630	*8600	*8600	*7100	6380			*4740	*4740	8.37
(19.7 ft)	lb			*21230	*21230	*18960	*18960	*15650	14070			*10450	*10450	(27.5)
4.5 m	kg			*13240	*13240	*9450	8720	*7410	6210			*4690	4670	8.93
(14.8 ft)	lb			*29190	*29190	*20830	19220	*16340	13690			*10340	10300	(29.3)
3.0 m	kg			*17310	12390	*10880	8240	*7930	5970	*6360	4530	*4810	4360	9.21
(9.8 ft)	lb			*38160	27320	*23990	18170	*17480	13160	*14020	9990	*10600	9610	(30.2)
1.5 m	kg			*18670	11600	*12670	7820	*8570	5750	*6580	4430	*5090	4270	9.24
(4.9 ft)	lb			*41160	25570	*27930	17240	*18890	12680	*14510	9770	*11220	9410	(30.3)
Ground	kg			*18290	11290	13200	7560	*9140	5590	*5760	4370	*5590	4370	9.01
Line	lb			*40320	24890	29100	16670	*20150	12320	*12700	9630	*12320	9630	(29.6)
-1.5 m	kg	*12160	*12160	*16670	11250	*12820	7470	9380	5540			*6450	4710	8.51
(-4.9 ft)	lb	*26810	*26810	*36750	24800	*28260	16470	20680	12210			*14220	10380	(27.9)
-3.0 m	kg			*13870	11400	*10860	7540	*7840	5630			*7310	5470	7.69
(-9.8 ft)	lb			*30580	25130	*23940	16620	*17280	12410			*16120	12060	(25.2)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	High walker	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2100	5200	600	-	-	-	-	-

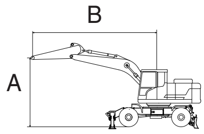
· : Rating over-front · : Rating over-side or 360 degree

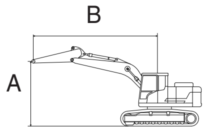


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg lb					*7620 *16800	*7620 *16800			*7860 *17330	*7860 *17330	6.56 (21.5)
6.0 m (19.7 ft)	kg lb					*8010 *17660	*8010 *17660	*7770 *17130	6890 15190	*7790 *17170	6850 15100	7.53 (24.7)
4.5 m (14.8 ft)	kg lb					*9110 *20080	*9110 *20080	*7990 *17610	6790 14970	*7880 *17370	6010 13250	8.11 (26.6)
3.0 m (9.8 ft)	kg lb					*10410 *22950	9090 20040	*8570 *18890	6610 14570	7930 17480	5620 12390	8.38 (27.5)
1.5 m (4.9 ft)	kg lb					*11420 *25180	8790 19380	*9110 *20080	6450 14220	7860 17330	5550 12240	8.37 (27.4)
Ground Line	kg lb					*11860 *26150	8650 19070	9120 20110	6370 14040	8230 18140	5790 12760	8.08 (26.5)
-1.5 m (-4.9 ft)	kg lb			*15320 *33770	13370 29480	*11600 *25570	8660 19090			*8890 *19600	6470 14260	7.47 (24.5)
-3.0 m (-9.8 ft)	kg lb	*17960 *39590	*17960 *39590	*13650 *30090	13610 30000	*10240 *22580	8850 19510			*9070 *20000	8030 17700	6.47 (21.2)
-4.5 m (-14.8 ft)	kg lb			*9580 *21120	*9580 *21120							

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	High walker	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	2500	5200	600	-	-	-	-	-

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

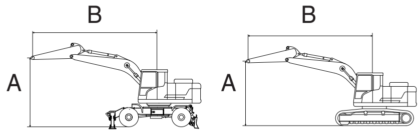




Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg					*6980	*6980			*6690	*6690	6.89
(24.6 ft)	lb					*15390	*15390			*14750	*14750	(22.6)
6.0 m	kg					*7490	*7490	*7190	6970	*6420	*6420	7.82
(19.7 ft)	lb					*16510	*16510	*15850	15370	*14150	*14150	(25.7)
4.5 m	kg			*11050	*11050	*8640	*8640	*7600	6830	*6440	5730	8.38
(14.8 ft)	lb			*24360	*24360	*19050	*19050	*16760	15060	*14200	12630	(27.5)
3.0 m	kg					*10000	9140	*8270	6620	*6700	5360	8.64
(9.8 ft)	lb					*22050	20150	*18230	14590	*14770	11820	(28.3)
1.5 m	kg			*13480	13350	*11140	8800	*8890	6440	*7230	5290	8.63
(4.9 ft)	lb			*29720	29430	*24560	19400	*19600	14200	*15940	11660	(28.3)
Ground	kg			*16080	13200	*11730	8620	9070	6330	7800	5480	8.35
Line	lb			*35450	29100	*25860	19000	20000	13960	17200	12080	(27.4)
-1.5 m	kg	*12560	*12560	*15600	13250	*11680	8590	9080	6330	8650	6060	7.77
(-4.9 ft)	lb	*27690	*27690	*34390	29210	*25750	18940	20020	13960	19070	13360	(25.5)
-3.0 m	kg	*19340	*19340	*14230	13450	*10720	8720			*9050	7360	6.81
(-9.8 ft)	lb	*42640	*42640	*31370	29650	*23630	19220			*19950	16230	(22.3)
-4.5 m	kg	*15100	*15100	*11130	*11130					*9180	*9180	5.26
(-14.8 ft)	lb	*33290	*33290	*24540	*24540					*20240	*20240	(17.2)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	High walker	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3050	5200	600	-	-	-	-	-

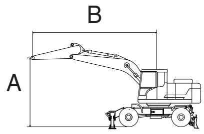
· : Rating over-front · : Rating over-side or 360 degree

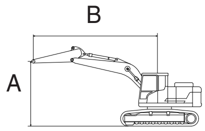


Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
7.5 m	kg									*4470	*4470			*4360	*4360	7.52
(24.6 ft)	lb									*9850	*9850			*9610	*9610	(24.7)
6.0 m	kg									*6530	*6530			*4210	*4210	8.38
(19.7 ft)	lb									*14400	*14400			*9280	*9280	(27.5)
4.5 m	kg					*9830	*9830	*7940	*7940	*7070	6870			*4220	*4220	8.90
(14.8 ft)	lb					*21670	*21670	*17500	*17500	*15590	15150			*9300	*9300	(29.2)
3.0 m	kg					*12850	*12850	*9390	9210	*7820	6640	*5540	5040	*4380	*4380	9.14
(9.8 ft)	lb					*28330	*28330	*20700	20300	*17240	14640	*12210	11110	*9660	*9660	(30.0)
1.5 m	kg					*15040	13430	*10670	8820	*8550	6420	*5980	4940	*4700	*4700	9.13
(4.9 ft)	lb					*33160	29610	*23520	19440	*18850	14150	*13180	10890	*10360	*10360	(30.0)
Ground	kg					*15910	13140	*11480	8580	9020	6280			*5260	4980	8.87
Line	lb					*35080	28970	*25310	18920	19890	13850			*11600	10980	(29.1)
-1.5 m	kg	*8460	*8460	*12060	*12060	*15810	13110	*11680	8500	8970	6230			*6230	5430	8.33
(-4.9 ft)	lb	*18650	*18650	*26590	*26590	*34860	28900	*25750	18740	19780	13730			*13730	11970	(27.3)
-3.0 m	kg	*13970	*13970	*19190	*19190	*14830	13250	*11120	8560					*8140	6400	7.44
(-9.8 ft)	lb	*30800	*30800	*42310	*42310	*32690	29210	*24520	18870					*17950	14110	(24.4)
-4.5 m	kg			*17350	*17350	*12530	*12530	*8990	8860					*8840	8750	6.06
(-14.8 ft)	lb			*38250	*38250	*27620	*27620	*19820	19530					*19490	19290	(19.9)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX300 L	High walker	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6250	3750	5200	600	-	-	-	-	-

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

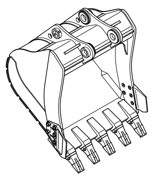
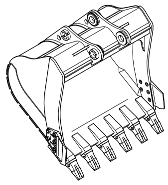
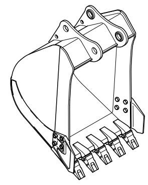




Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
7.5 m	kg									*5310	*5310			*3470	*3470	8.26
(24.6 ft)	lb									*11710	*11710			*7650	*7650	(27.1)
6.0 m	kg									*5760	*5760	*3580	*3580	*3360	*3360	9.05
(19.7 ft)	lb									*12700	*12700	*7890	*7890	*7410	*7410	(29.7)
4.5 m	kg							*7020	*7020	*6390	*6390	*5370	5180	*3380	*3380	9.53
(14.8 ft)	lb							*15480	*15480	*14090	*14090	*11840	11420	*7450	*7450	(31.3)
3.0 m	kg					*11350	*11350	*8550	*8550	*7220	6690	*6530	5050	*3510	*3510	9.76
(9.8 ft)	lb					*25020	*25020	*18850	*18850	*15920	14750	*14400	11130	*7740	*7740	(32.0)
1.5 m	kg					*13980	13630	*10000	8890	*8060	6430	*6990	4920	*3760	*3760	9.75
(4.9 ft)	lb					*30820	30050	*22050	19600	*17770	14180	*15410	10850	*8290	*8290	(32.0)
Ground	kg			*7380	*7380	*15440	13140	*11060	8570	*8730	6240	6890	4820	*4180	*4180	9.51
Line	lb			*16270	*16270	*34040	28970	*24380	18890	*19250	13760	15190	10630	*9220	*9220	(31.2)
-1.5 m	kg	*7640	*7640	*11270	*11270	*15840	12980	*11550	8410	8880	6140	*4870	4790	*4870	4790	9.00
(-4.9 ft)	lb	*16840	*16840	*24850	*24850	*34920	28620	*25460	18540	19580	13540	*10740	10560	*10740	10560	(29.5)
-3.0 m	kg	*11750	*11750	*16400	*16400	*15340	13030	*11380	8410	*8830	6150			*6140	5490	8.19
(-9.8 ft)	lb	*25900	*25900	*36160	*36160	*33820	28730	*25090	18540	*19470	13560			*13540	12100	(26.9)
-4.5 m	kg	*16870	*16870	*19650	*19650	*13760	13280	*10210	8580					*8320	7000	6.96
(-14.8 ft)	lb	*37190	*37190	*43320	*43320	*30340	29280	*22510	18920					*18340	15430	(22.8)

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET

		
1.27, 1.50 m^3 SAE heaped bucket	1.73, 1.85 m^3 SAE heaped bucket	★0.52 m^3 SAE heaped bucket

Capacity		Width		Weight	Recommendation				
					6.25 m (20' 6") boom				10.2 m (33' 6") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		2.1 m arm (6' 11")	2.5 m arm (8' 2")	3.05 m arm (10' 0")	3.75 m arm (12' 4")	7.85 m arm (25' 9")
1.27 m^3 (1.66 yd^3)	1.11 m^3 (1.45 yd^3)	1325 mm (52.2")	1410 mm (55.5")	1100 kg (2430 lb)	○	○	○	⊙	
1.50 m^3 (1.96 yd^3)	1.30 m^3 (1.70 yd^3)	1515 mm (59.6")	1600 mm (63.0")	1180 kg (2600 lb)	○	○	⊙	●	
1.73 m^3 (2.26 yd^3)	1.51 m^3 (1.98 yd^3)	1605 mm (63.2")	1690 mm (66.5")	1280 kg (2820 lb)	⊙	⊙	●	●	
1.85 m^3 (2.42 yd^3)	1.61 m^3 (2.11 yd^3)	1700 mm (66.9")	1780 mm (70.1")	1330 kg (2930 lb)	⊙	●	●	●	
★0.52 m^3 (0.68 yd^3)	0.45 m^3 (0.59 yd^3)	945 mm (37.2")	1020 mm (40.2")	460 kg (1010 lb)					⊙

★ : Long reach bucket

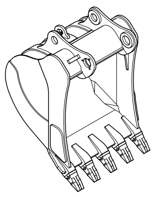
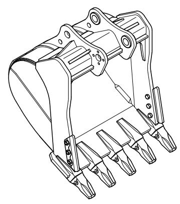
○ Applicable for materials with density of 2000 kgf/m^3 (3370 lbf/yd^3) or less

⊙ Applicable for materials with density of 1600 kgf/m^3 (2700 lbf/yd^3) or less

● Applicable for materials with density of 1100 kgf/m^3 (1850 lbf/yd^3) or less

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

2) HEAVY DUTY AND ROCK-HEAVY DUTY BUCKET

	
◈1.27 m^3 SAE ◈1.46 m^3 SAE heaped bucket	◆1.33 m^3 SAE ◆1.50 m^3 SAE heaped bucket

Capacity		Width		Weight	Recommendation			
					6.25 m (20' 6") boom			
SAE heaped	CECE heaped	Without side cutter	With side cutter		2.1 m arm (6' 11")	2.5 m arm (8' 2")	3.05 m arm (10' 0")	3.75 m arm (12' 4")
◈1.27 m^3 (1.66 yd^3)	1.11 m^3 (1.45 yd^3)	1380 mm (54.3")	-	1290 kg (2840 lb)	○	○	⊙	⊙
◈1.46 m^3 (1.91 yd^3)	1.28 m^3 (1.67 yd^3)	1535 mm (60.4")	-	1380 kg (3040 lb)	⊙	⊙	⊙	●
◆1.33 m^3 (1.74 yd^3)	1.16 m^3 (1.52 yd^3)	1420 mm (55.9")	-	1470 kg (3240 lb)	⊙	⊙	⊙	●
◆1.50 m^3 (1.96 yd^3)	1.30 m (1.70 yd^3)	1550 mm (61.0")	-	1550 kg (3420 lb)	⊙	⊙	●	●

◈ : Heavy duty bucket
◆ : Rock-Heavy duty bucket

○ Applicable for materials with density of 2000 kgf/m^3 (3370 lbf/yd^3) or less

⊙ Applicable for materials with density of 1600 kgf/m^3 (2700 lbf/yd^3) or less

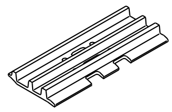
● Applicable for materials with density of 1100 kgf/m^3 (1850 lbf/yd^3) or less

7. UNDERCARRIAGE

1) TRACKS

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

2) TYPES OF SHOES

Model	Shapes		Triple grouser			
						
HX300 L	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)	900 (36)
	Operating weight	kg (lb)	30200 (66580)	30770 (67840)	31150 (68670)	31530 (69510)
	Ground pressure	kgf/cm^2 (psi)	0.58 (8.25)	0.51 (7.25)	0.45 (6.40)	0.41 (5.83)
	Overall width	mm (ft-in)	3200 (10' 6")	3300 (10' 10")	3400 (11' 1")	3500 (11' 5")
HX300 NL	Shoe width	mm (in)	600 (24)	-	-	-
	Operating weight	kg (lb)	30000 (66140)	-	-	-
	Ground pressure	kgf/cm^2 (psi)	0.58 (8.25)	-	-	-
	Overall width	mm (ft-in)	2990 (9'10")	-	-	-
HX300 L LONG REACH	Shoe width	mm (in)	-	-	800 (32)	-
	Operating weight	kg (lb)	-	-	33070 (72910)	-
	Ground pressure	kgf/cm^2 (psi)	-	-	0.48 (6.83)	-
	Overall width	mm (ft-in)	-	-	3400 (11' 2")	-
HX300 L HIGH WALKER	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)	★710 (28)
	Operating weight	kg (lb)	33040 (72840)	33610 (74100)	33990 (74930)	34520 (76100)
	Ground pressure	kgf/cm^2 (psi)	0.64 (9.10)	0.56 (7.96)	0.49 (6.97)	0.56 (7.96)
	Overall width	mm (ft-in)	3470 (11' 5")	3570 (11' 9")	3670 (12' 0")	3580 (11' 9")

★ : Double grouser

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

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

4) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

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

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

※ Table 1

Track shoe	Specification	Category
600 mm triple grouser	Standard	A
700 mm triple grouser	Option	B
710 mm double grouser	Option	B
800 mm triple grouser	Option	C
900 mm triple grouser	Option	C
800 mm triple grouser (long reach)	Standard	C

※ Table 2

Category	Applications	Precautions
A	Rocky ground, river beds, normal soil	· Travel at low speed on rough ground with large obstacles such as boulders or fallen trees
B	Normal soil, soft ground	· These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees · Travel at high speed only on flat ground · Travel slowly at low speed if it is impossible to avoid going over obstacles
C	Extremely soft 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
Model	Cummins QSB6.7
Type	4-cycle turbocharged, charge air cooled diesel engine
Cooling method	Water cooling
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	107 × 124 mm (4.21" × 4.88")
Piston displacement	6700 cc (409 cu in)
Compression ratio	17.3 : 1
Rated net horse power (SAE J1349)	230 Hp at 1950 rpm (171 kW at 1950 rpm)
Rated gross horse power (SAE J1995)	242 Hp at 1950 rpm (180 kW at 1950 rpm)
Maximum torque	100.9 kgf · m (729.8 lbf · ft) at 1500 rpm
Engine oil quantity	23.1 ℓ (6.1 U.S. gal)
Wet weight	520 kg (1146 lb)
High idling speed	1950 ± 50 rpm
Low idling speed	800 ± 100 rpm
Rated fuel consumption	152.1 g/Hp · hr at 1950 rpm
Starting motor	Denso 24 V-4.8 kW
Alternator	Denso 24 V-95 A
Battery	2 × 12 V × 160 Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 140 cc/rev
Maximum pressure	350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]
Rated oil flow	2 × 273 ℓ/min (72.1 U.S. gpm / 60.1 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	29.25 l/min (7.7 U.S. gpm/6.4 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	36.5 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	ø 140 × 1465 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Stroke	ø 150 × 1765 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Stroke	ø 135 × 1185 mm
	Cushion	Extend only
Bucket cylinder (long reach)	Bore dia × Stoke	ø 100 × 870 mm
	Cushion	Extend and retract

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

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

8) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
HX300 L	Standard	600 mm (24")	0.58 kgf/cm^2 (8.25 psi)	48	3200 mm (10' 6")
	Option	700 mm (28")	0.51 kgf/cm^2 (7.25 psi)	48	3300 mm (10' 10")
		800 mm (32")	0.45 kgf/cm^2 (6.40 psi)	48	3400 mm (11' 1")
		900 mm (36")	0.41 kgf/cm^2 (5.83 psi)	48	3500 mm (11' 5")
HX300 NL	Standard	600 mm (24")	0.58 kgf/cm^2 (8.25 psi)	48	2990 mm (9' 10")
HX300 L LONG REACH	Standard	800 mm (32")	0.48 kgf/cm^2 (6.83 psi)	48	3400 mm (11' 2")
HX300 L HIGH WALKER	Standard	600 mm (24")	0.64 kgf/cm^2 (9.10 psi)	48	3470 mm (11' 5")
	Option	700 mm (28")	0.56 kgf/cm^2 (7.96 psi)	48	3570 mm (11' 9")
		800 mm (32")	0.49 kgf/cm^2 (6.97 psi)	48	3670 mm (12' 0")
		★710 mm (28")	0.56 kgf/cm^2 (7.96 psi)	48	3580 mm (11' 9")

★ : Double grouser

9) BUCKET

Item	Capacity		Tooth quantity	Width	
	SAE heaped	CECE heaped		Without side cutter	With side cutter
HX300 L HX300 NL H/WALKER	1.27 m^3 (1.66 yd^3)	1.11 m^3 (1.45 yd^3)	5	1325 mm (52.2")	1410 mm (55.5")
	◈1.27 m^3 (1.66 yd^3)	1.11 m^3 (1.45 yd^3)	5	1380 mm (54.3")	-
	◈1.46 m^3 (1.91 yd^3)	1.28 m^3 (1.67 yd^3)	5	1535 mm (60.4")	-
	◆1.33 m^3 (1.74 yd^3)	1.16 m^3 (1.52 yd^3)	5	1420 mm (55.9")	-
	◆1.50 m^3 (1.96 yd^3)	1.30 m^3 (1.70 yd^3)	5	1550 mm (61.0")	-
	1.50 m^3 (1.96 yd^3)	1.30 m^3 (1.70 yd^3)	5	1515 mm (59.6")	1600 mm (63.0")
	1.73 m^3 (2.26 yd^3)	1.51 m^3 (1.98 yd^3)	6	1605 mm (63.2")	1690 mm (66.5")
	1.85 m^3 (2.42 yd^3)	1.61 m^3 (2.11 yd^3)	6	1700 mm (66.9")	1780 mm (70.1")
LONG REACH	0.52 m^3 (0.68 yd^3)	0.45 m^3 (0.59 yd^3)	5	945 mm (37.2")	1020 mm (40.2")

◈ : Heavy duty bucket

◆ : Rock-Heavy duty bucket

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 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
DEF/ AdBlue® tank	Mixture of urea and deionized water	42.5 (11.2)	ISO 22241, High-purity urea + deionized water (32.5:67.5)
Swing drive	Gear oil	11 (2.91)	★SAE 75W-90
Final drive	Gear oil	7.8×2 (2.1×2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank : 190 (50) System : 330 (87)	★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
UTTO : Universal Tractor Transmission Oil
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).

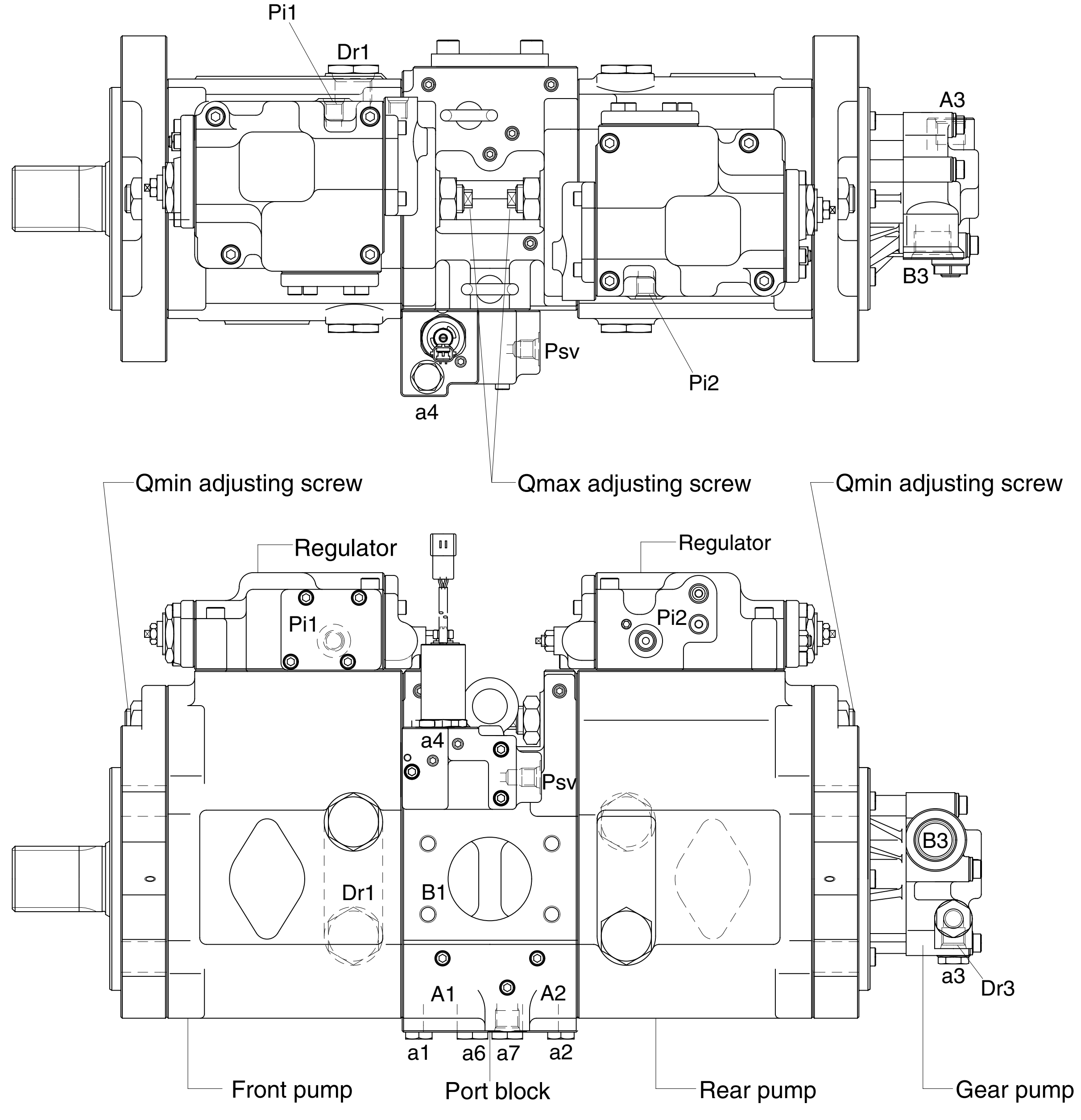
※ For HD Hyundai Construction Equipment genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact HD Hyundai Construction Equipment dealers.

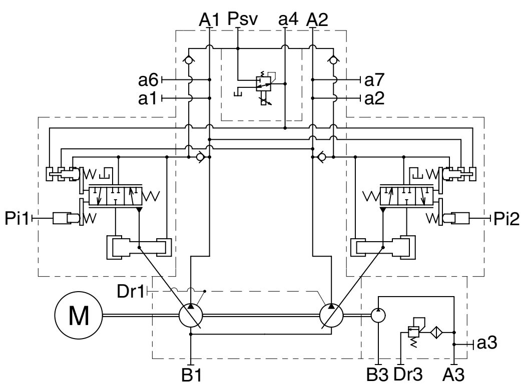
SECTION 2 STRUCTURE AND FUNCTION

GROUP 1 PUMP DEVICE

1. STRUCTURE

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



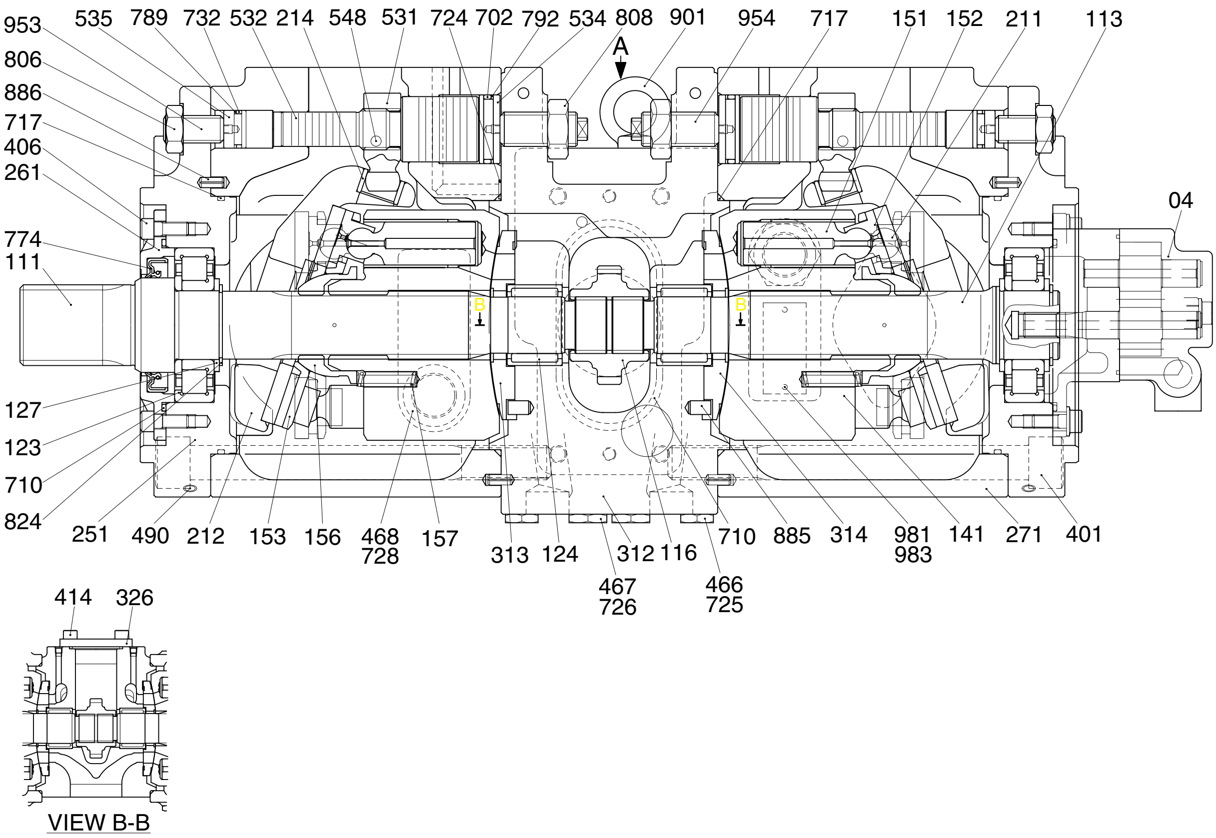


300L2MP01

Port	Port name	Port size
A1, 2	Delivery port	SAE6000 psi 1"
B1	Suction port	SAE2500 psi 2 1/2"
Dr1	Drain port	PF 3/4 - 20
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
a6, a7	Gauge port	PF 3/8 - 17
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

1) MAIN PUMP (1/2)

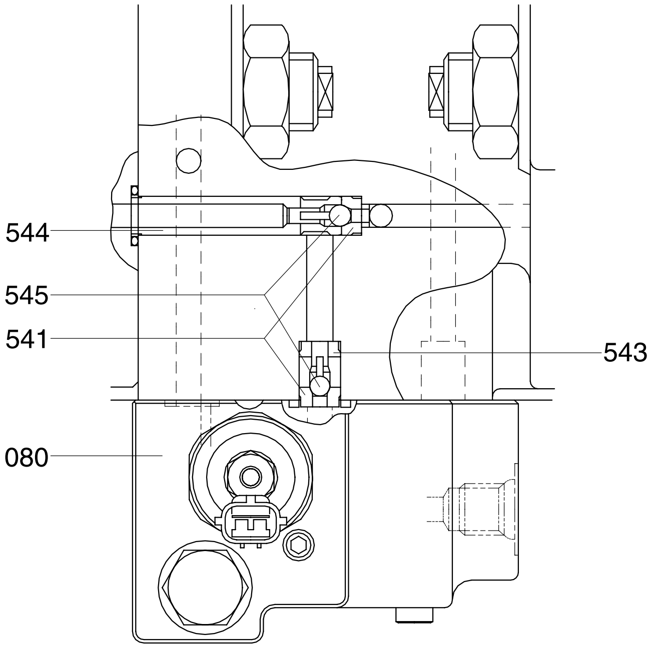
The main pump consists of two piston pumps (front & rear) and valve block.



29092MP02

04	Gear pump	271	Pump casing	710	O-ring
111	Drive shaft (F)	312	Valve block	717	O-ring
113	Drive shaft (R)	313	Valve plate (R)	724	O-ring
116	Gear	314	Valve plate (L)	725	O-ring
123	Roller bearing	326	Cover	728	O-ring
124	Needle bearing	401	Hexagon socket bolt	732	O-ring
127	Bearing spacer	406	Hexagon socket bolt	774	Oil seal
141	Cylinder block	414	Hexagon socket bolt	789	Back up ring
151	Piston	466	VP plug	792	Back up ring
152	Shoe	467	VP plug	806	Hexagon head nut
153	Set plate	468	VP plug	808	Hexagon head nut
156	Spherical bushing	490	VP plug	824	Snap ring
157	Cylinder spring	531	Tilting pin	885	Pin
211	Shoe plate	532	Servo piston	886	Spring pin
212	Swash plate	534	Stopper (L)	901	Eye bolt
214	Bushing	535	Stopper (S)	953	Set screw
251	Swash plate support	548	Feedback pin	954	Set screw
261	Seal cover (F)	702	O-ring		

MAIN PUMP (2/2)

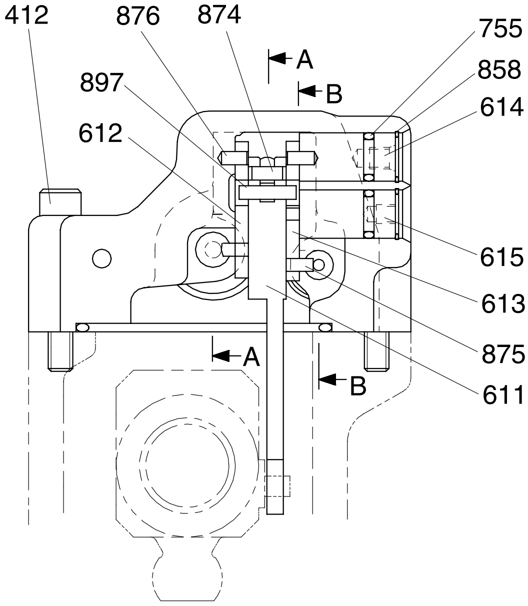


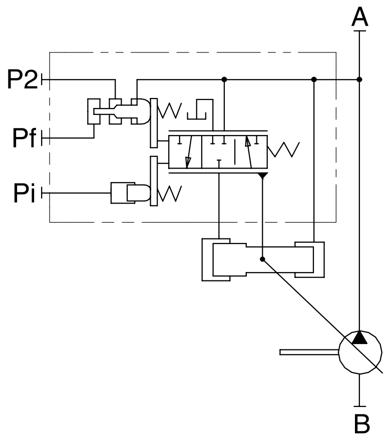
VIEW A

3009SH2MP02

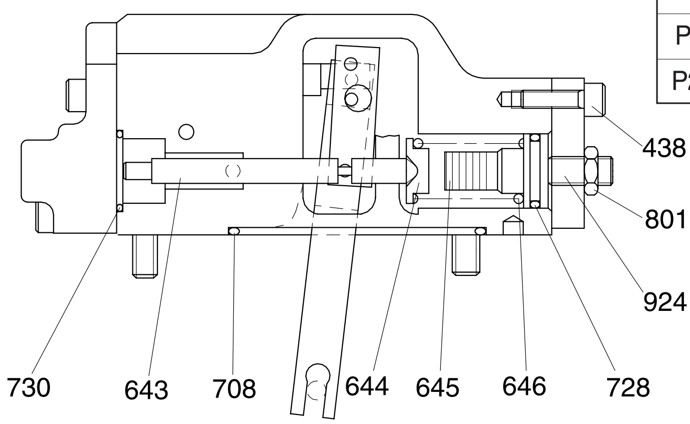
080	Proportional reducing valve	543	Stopper 1	545	Steel ball
541	Seat	544	Stopper 2		

2) REGULATOR (1/2)

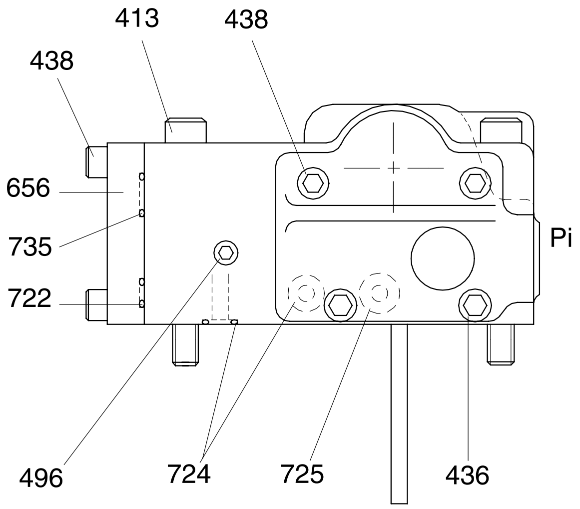




Port	Port name	Port size
A	Delivery port	1"
B	Suction port	2 1/2"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



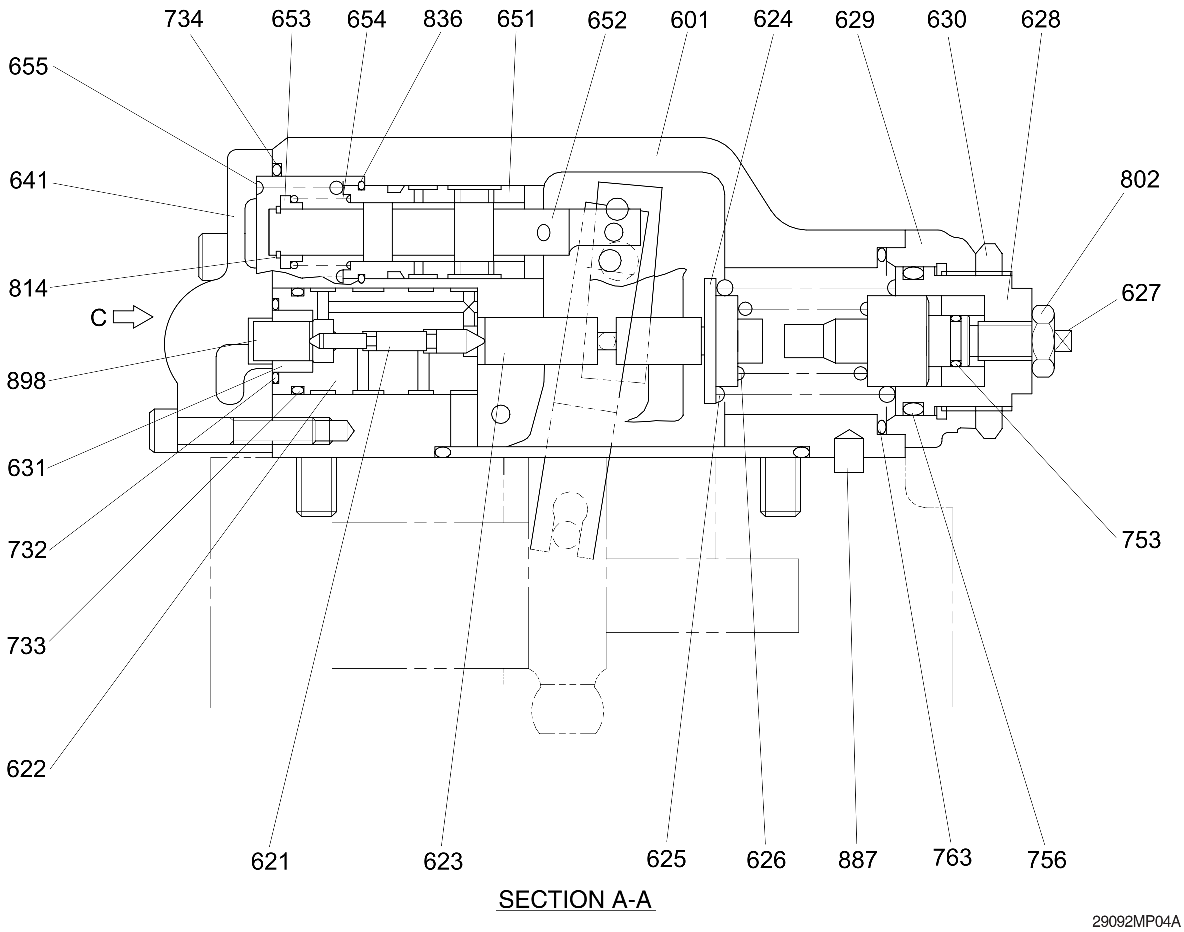
SECTION B-B



VIEW C

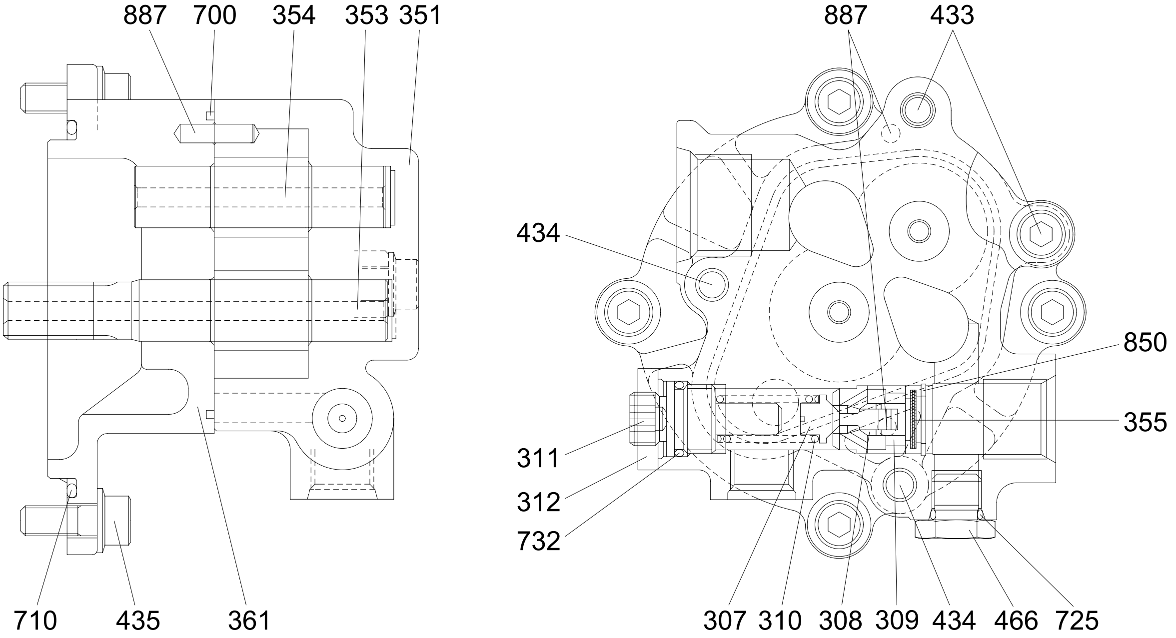
29092MP03

REGULATOR (2/2)



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

3) GEAR PUMP



3009SH2MP03

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	Nut	434	Flange socket	850	Snap ring
351	Gear case	435	Flange socket	887	Pin

2. FUNCTION

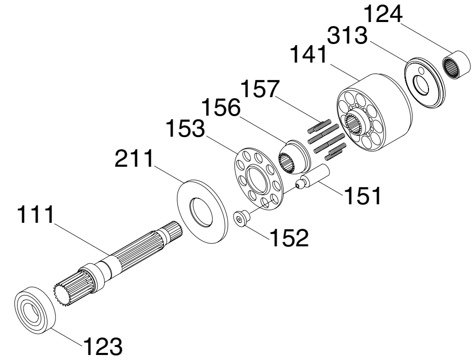
1) MAIN PUMP

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.



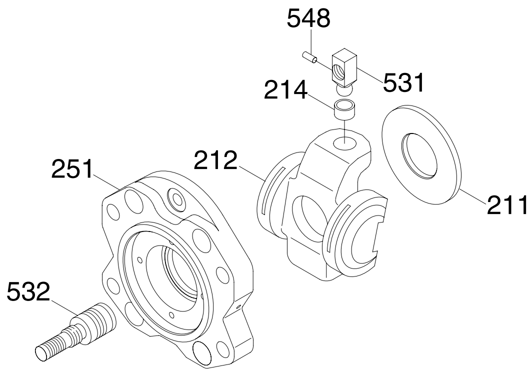
29092MP06

(2) Swash plate group

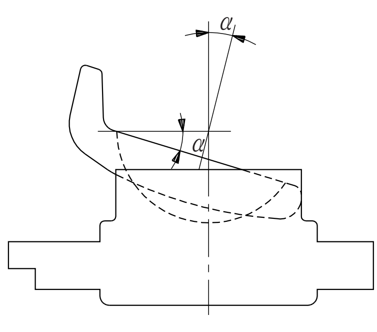
The swash plate group consists of swash plate (212), shoe plate (211), swash plate support (251), tilting bush (214), tilting pin (531) and servo piston (532).

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

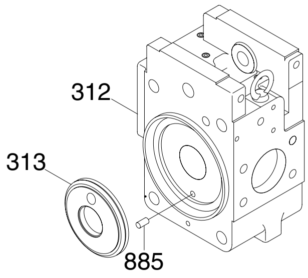
The valve block group consists of valve block (312), valve plate (313) and valve plate pin (885).

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

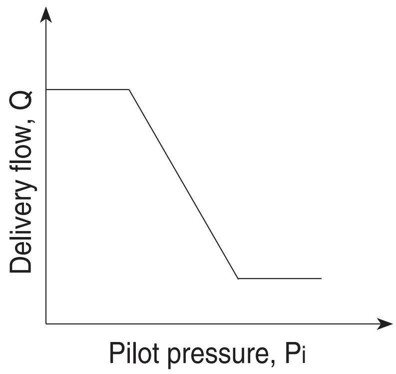
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

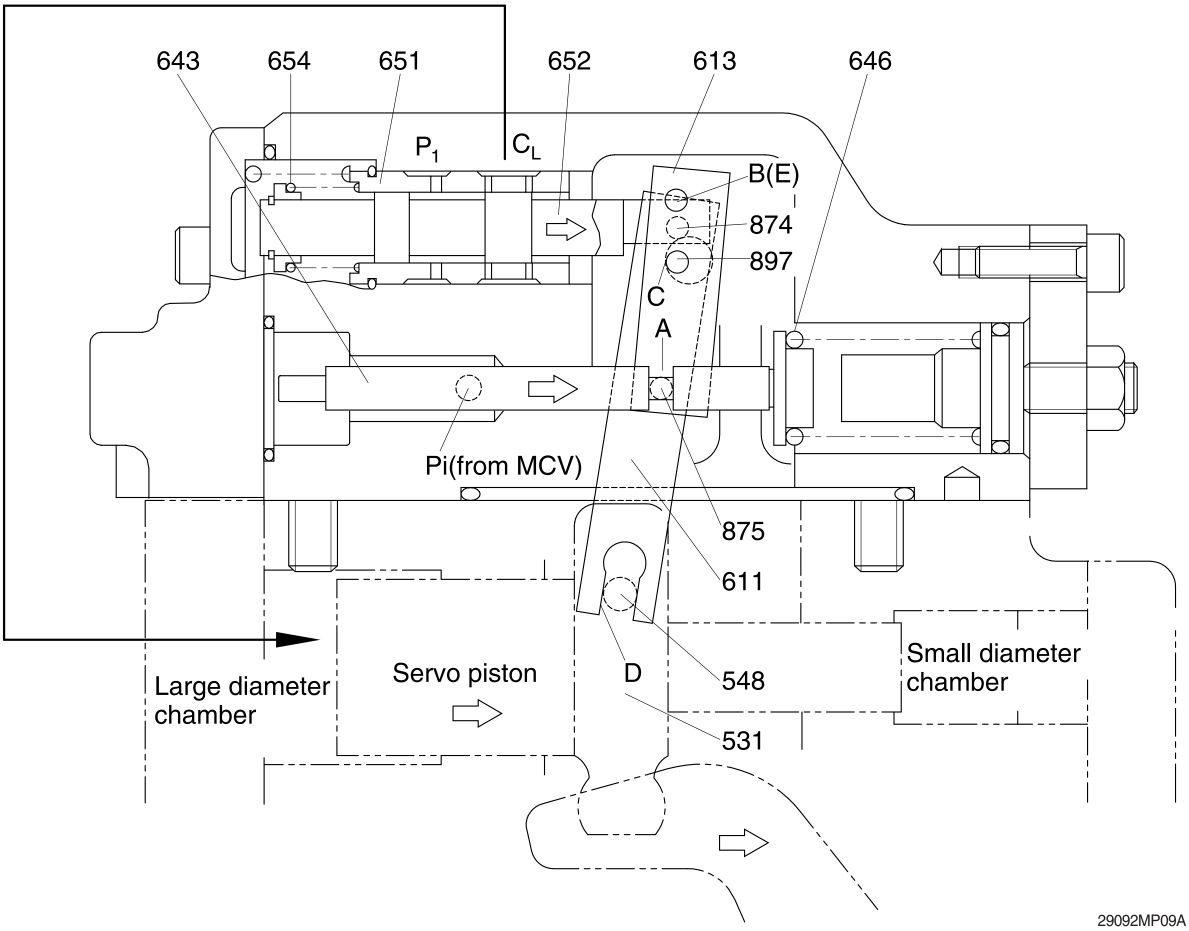
By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

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.

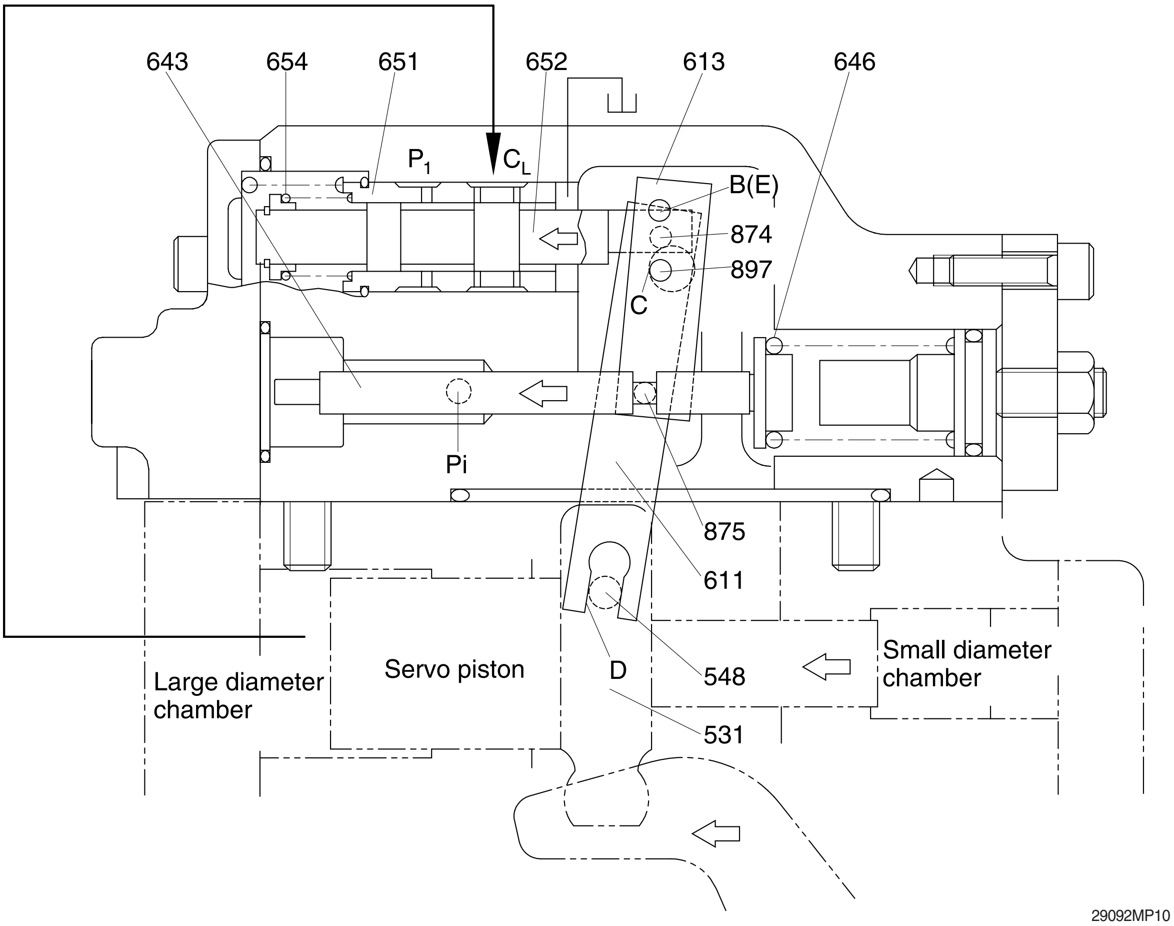
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.

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**

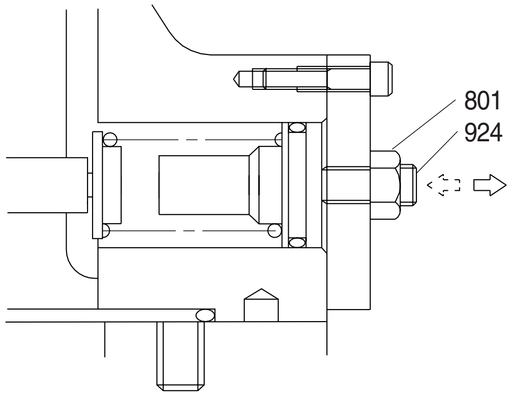
The flow control characteristic can be adjusted with the adjusting screw.

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

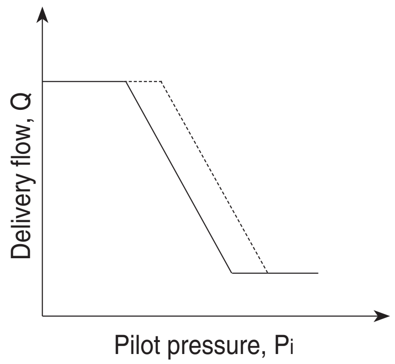
Tightening the screw shifts the control chart to the right as shown in the figure.

※ **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/cm2)	(ℓ /min)
1800	+1/4	+0.7	+14.6



2-12



(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.

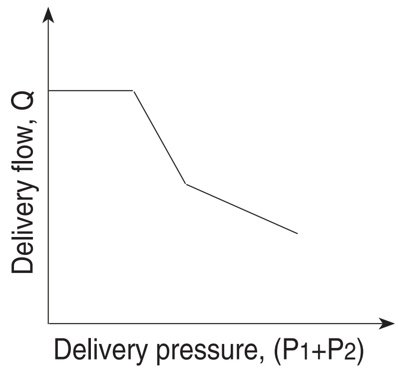
(The input horsepower is constant when the speed is constant.)

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.

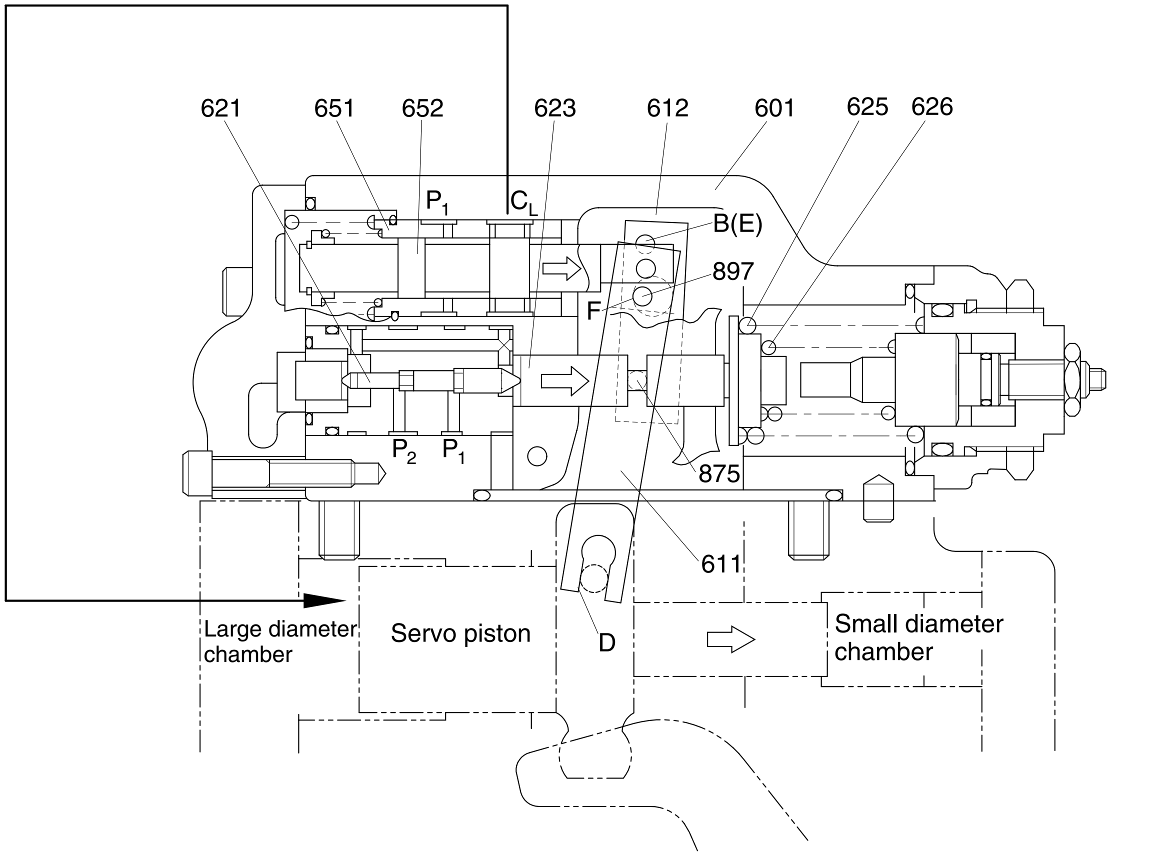
Since this regulator is of the simultaneous total horsepower type, it controls the tilting angles (displacement volumes) of the two pumps to the same value as represented by the following equation :

$$\begin{aligned} Tin &= P1 \times q / 2\pi + P2 \times q / 2\pi \\ &= (P1+P2) \times q / 2\pi \end{aligned}$$

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



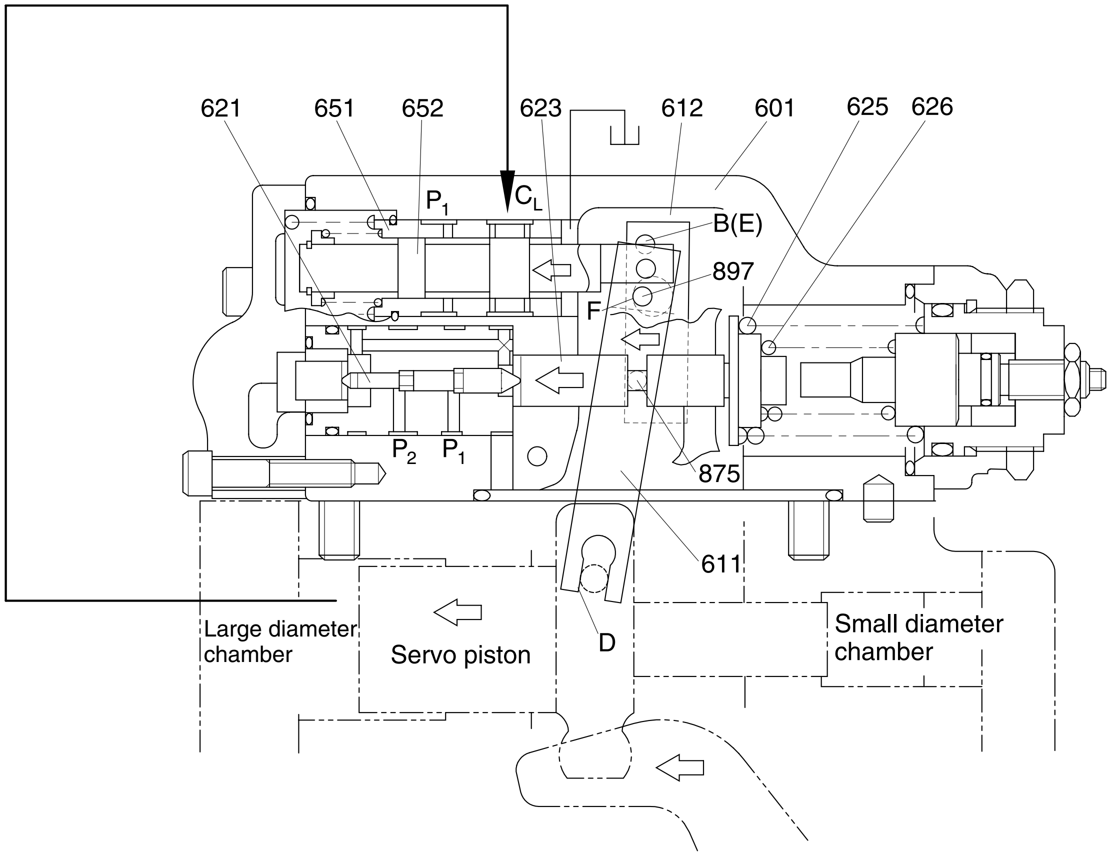
29092MP11

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



29092MP12

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

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

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

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

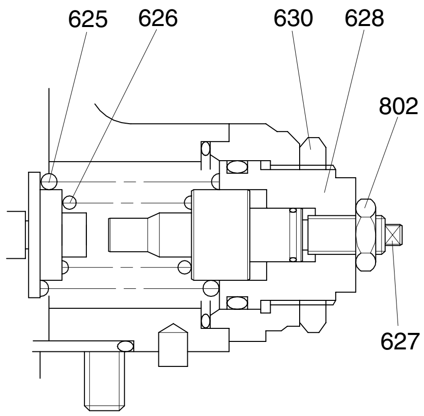
As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections (C & F) of levers 1 and 2. However, since sections C and F have the pins (Ø4) protruding from the large hole (Ø8), only the lever lessening the tilting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

④ **Adjustment of input horsepower**

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

a. **Adjustment of outer spring**

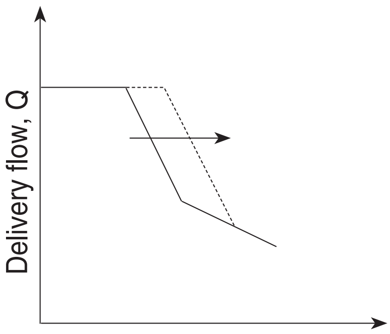
Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628). Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C by N turns changes the setting of the inner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



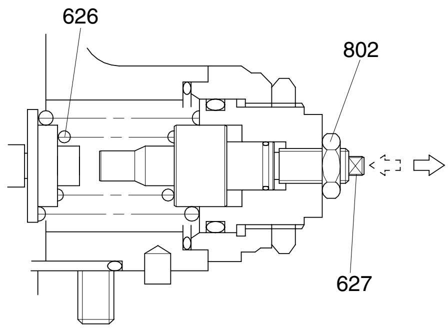
b. Adjustment of inner spring

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

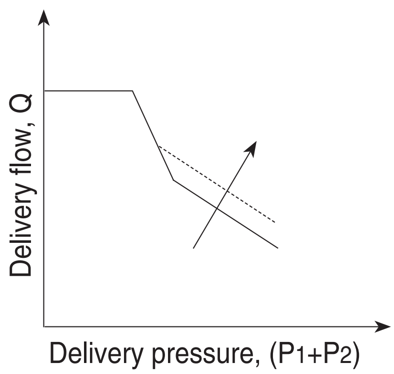
Tightening the screw increases the flow and then the input horsepower as shown in the figure.

※ Adjusting valves are shown in table.

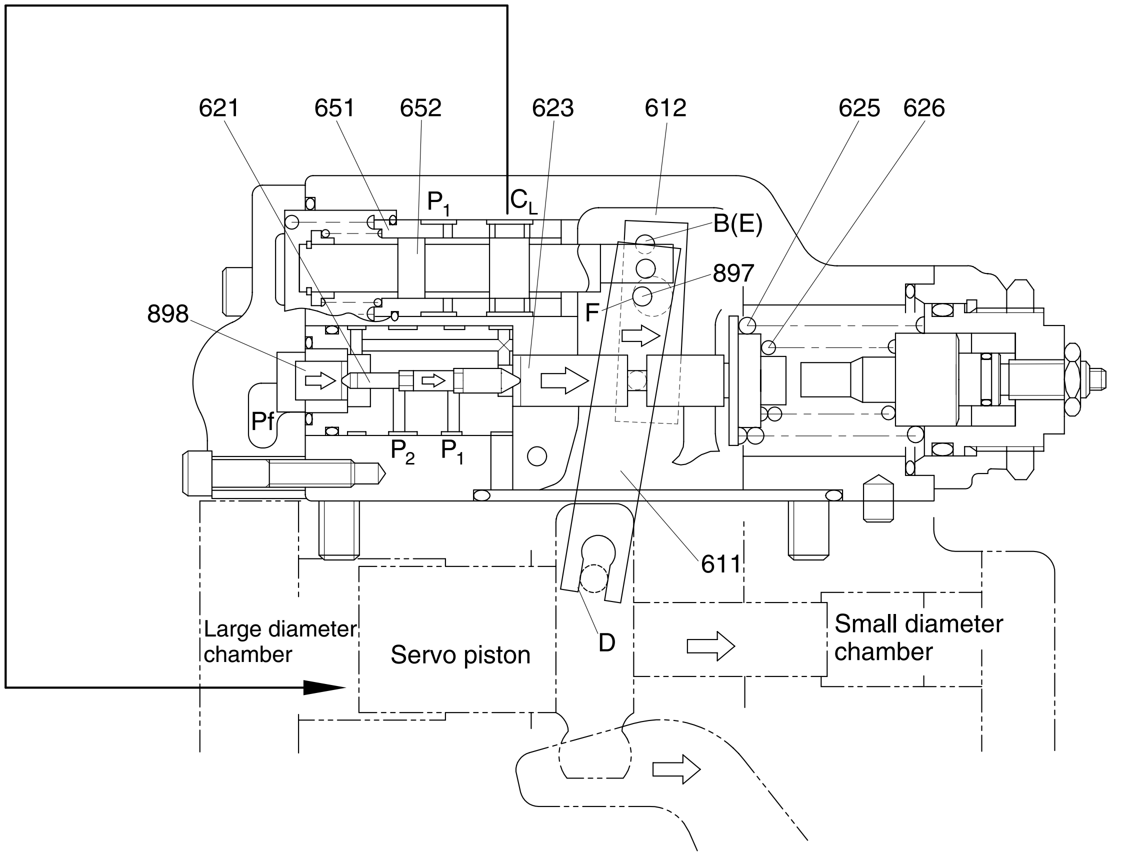
Speed	Adjustment of inner spring		
	Tightening amount of adjusting screw (QI) (627)	Flow change amount	Input torque change amount
(min^{-1})	(Turn)	(kgf/cm^2)	(kgf · m)
1800	+1/4	+12.6	+5.7



8007A2MP04



(3) Power shift control

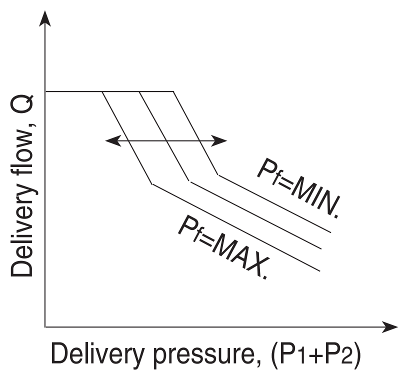


29092MP13

The set horsepower valve is shifted by varying the command current level of the proportional pressure reducing valve attached to the pump.

Only one proportional pressure reducing valve is provided.

However, the secondary pressure Pf (power shift pressure) is admitted to the horsepower control section of each pump regulator through the pump's internal path to shift it to the same set horsepower level.



This function permits arbitrary setting of the pump output power, thereby providing the optimum power level according to the operating condition.

The power shift pressure Pf controls the set horsepower of the pump to a desired level, as shown in the figure.

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

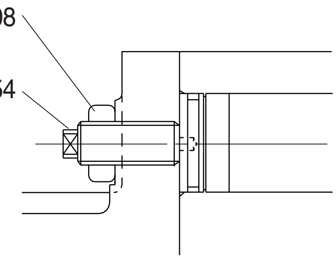
This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure Pf falls.

(4) Adjustment of maximum and minimum flows

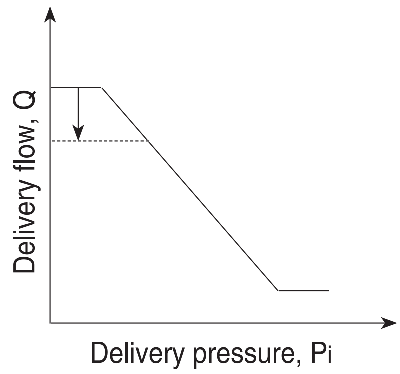
① **Adjustment of maximum flow**

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

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



2-19(1)

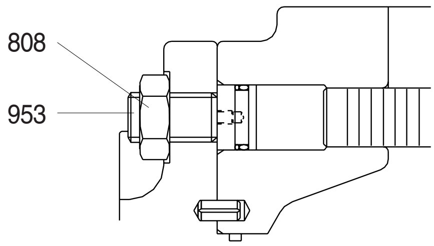


Speed	Adjustment of max flow	
	Tightening amount of adjusting screw (954)	Flow change amount
(min^{-1})	(Turn)	(ℓ /min)
1800	+1/4	-5.6

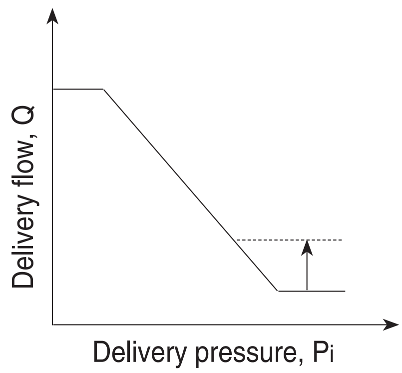
② **Adjustment of minimum flow**

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.

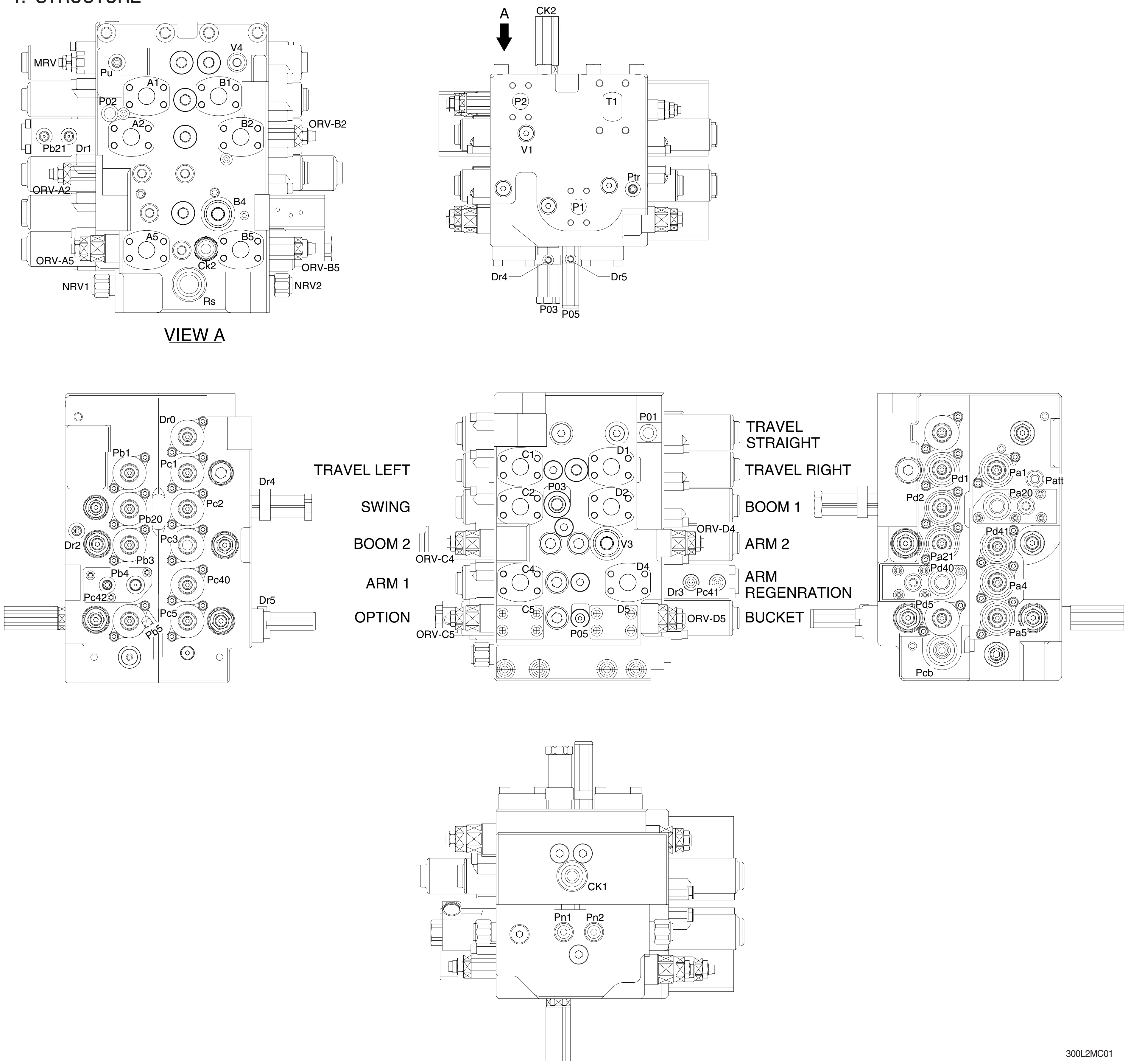


2-19(2)



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

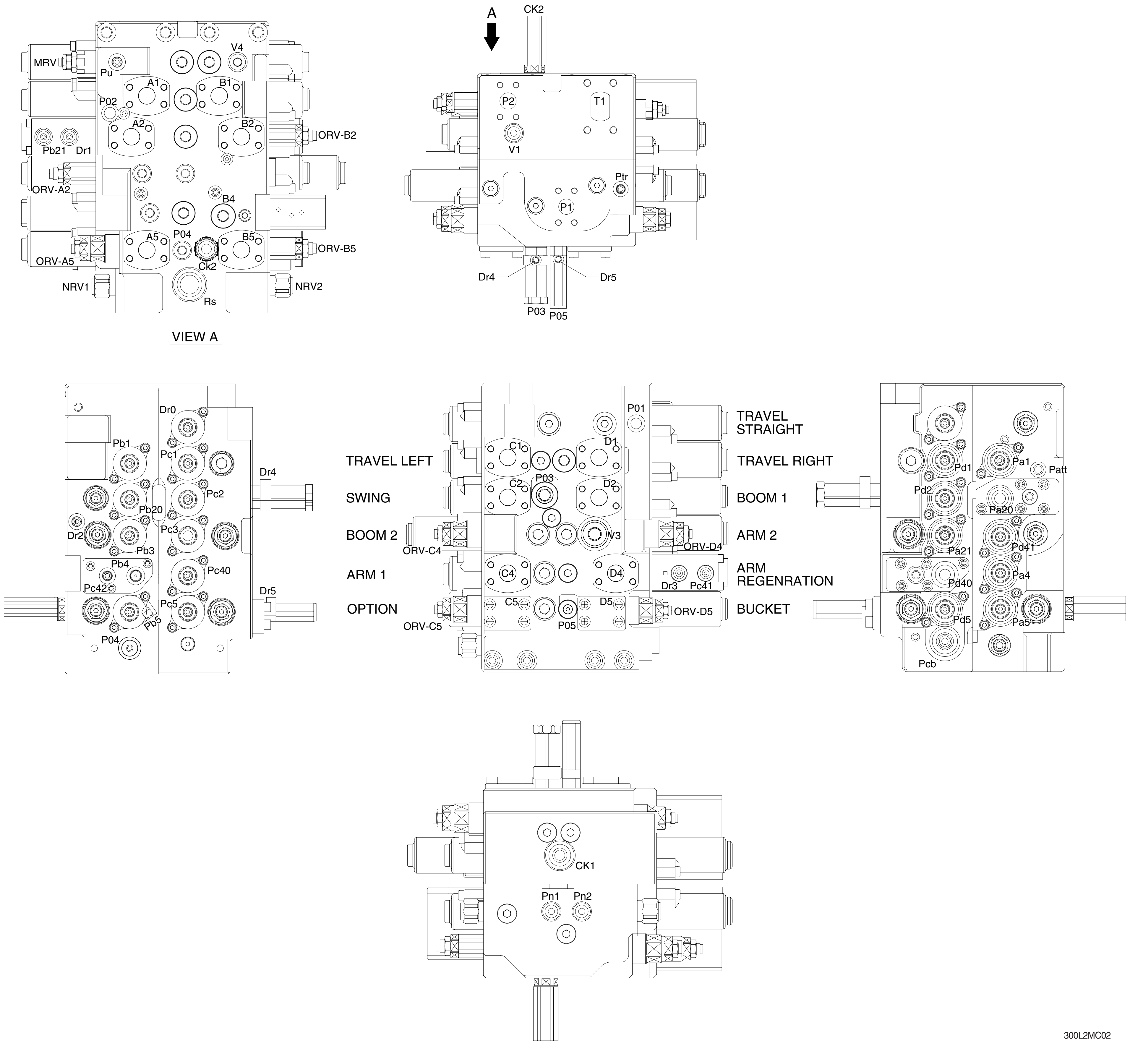
1. STRUCTURE



Mark	Port name	Port size	Tightening torque
Rs V3 B4	Make up for swing motor Carry-over P port Option A port (breaker)	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt Pb21 Pcb P01 P02 P03 P04 P05 Pc41 Pc42 Ptr Pu Dr1 Dr2 Dr3	Auto idle signal-attachment Lock valve pilot port (boom) Bucket in confluence pilot port Pilot signal port Pilot signal port Swing logic pilot port Bucket parallel orifice pilot port Option B confluence pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Auto idle signal-travel Power boost Drain port Drain port Drain port	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Ck1 Ck2	Bucket confluence Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Dr0 Pn1 Pn2 V1 V4	Travel pilot port-LH (FW) Travel pilot port-LH (BW) Travel pilot port-RH (BW) Travel pilot port-RH (FW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Swing pilot port (LH) Swing pilot port (RH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Drain port Negative control signal port (A2 port side) Negative control signal port (A1 port side) Carry-over port Carry-over port	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 A2 B2 C2 D2 C4 D4 A5 B5 C5 D5 P1 P2	Travel motor port-LH (FW) Travel motor port-LH (BW) Travel motor port-RH (BW) Travel motor port-RH (FW) Boom up port Boom down port Swing motor port (LH) Swing motor port (RH) Arm in port Arm out port Bucket in port Bucket out port Option B port Option B port Pump port (A2 side) Pump port (A1 side)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
Dr4 Dr5	Drain port Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

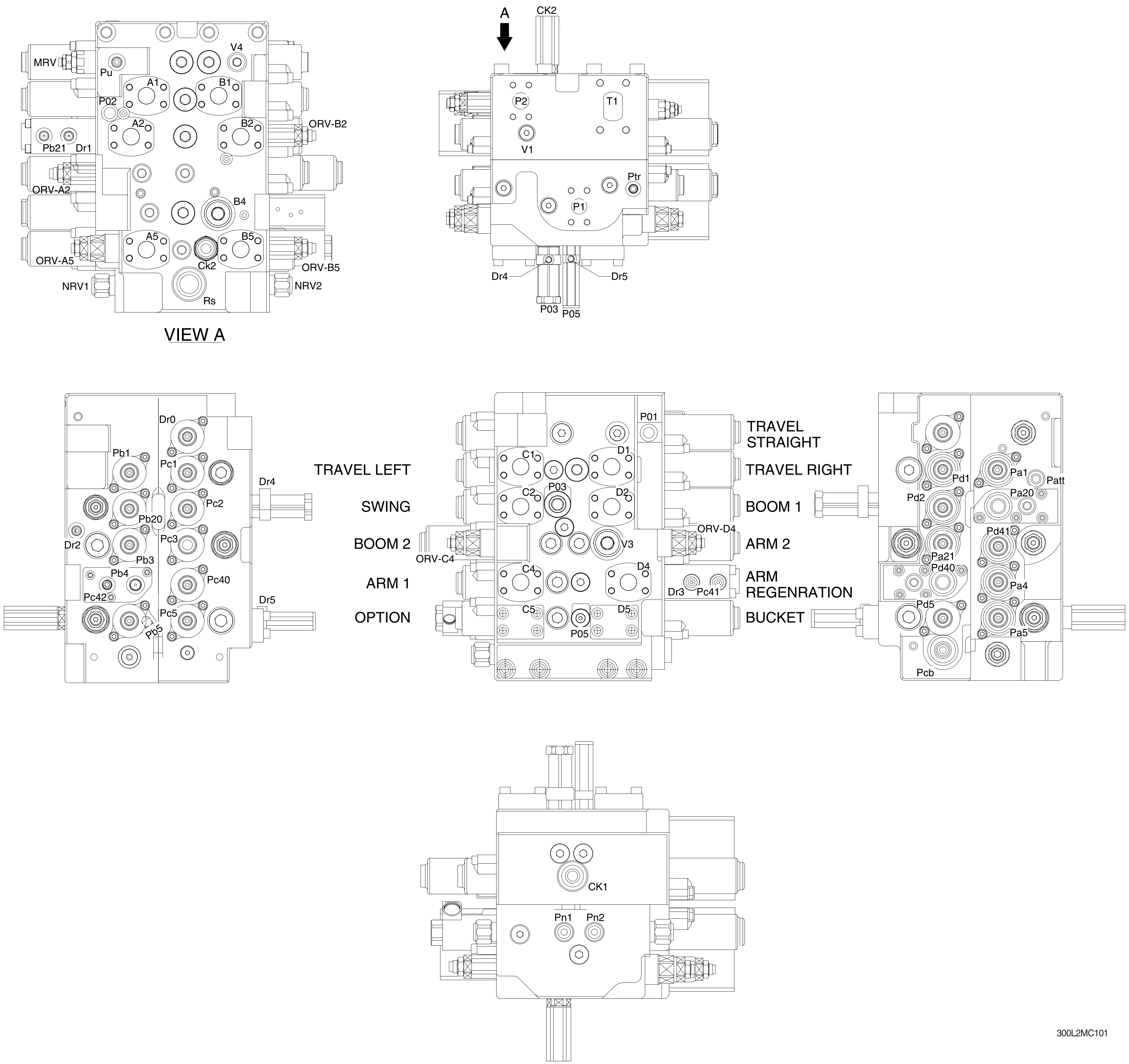
MAIN CONTROL VALVE (TYPE 2)

1. STRUCTURE



Mark	Port name	Port size	Tightening torque
Rs V3 B4	Make up for swing motor Carry-over P port Option A port (breaker)	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt Pb21 Pcb P01 P02 P03 P04 P05 Pc41 Pc42 Ptr Pu Dr1 Dr2 Dr3	Auto idle signal-attachment Lock valve pilot port (boom) Bucket in confluence pilot port Pilot signal port Pilot signal port Swing logic pilot port Bucket parallel orifice pilot port Option B confluence pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Auto idle signal-travel Power boost Drain port Drain port Drain port	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Ck1 Ck2	Bucket confluence Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Dr0 Pn1 Pn2 V1 V4	Travel pilot port-LH (FW) Travel pilot port-LH (BW) Travel pilot port-RH (BW) Travel pilot port-RH (FW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Swing pilot port (LH) Swing pilot port (RH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Drain port Negative control signal port (A2 port side) Negative control signal port (A1 port side) Carry-over port Carry-over port	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 A2 B2 C2 D2 C4 D4 A5 B5 C5 D5 P1 P2	Travel motor port-LH (FW) Travel motor port-LH (BW) Travel motor port-RH (BW) Travel motor port-RH (FW) Boom up port Boom down port Swing motor port (LH) Swing motor port (RH) Arm in port Arm out port Bucket in port Bucket out port Option B port Option B port Pump port (A2 side) Pump port (A1 side)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
Dr4 Dr5	Drain port Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

1. STRUCTURE

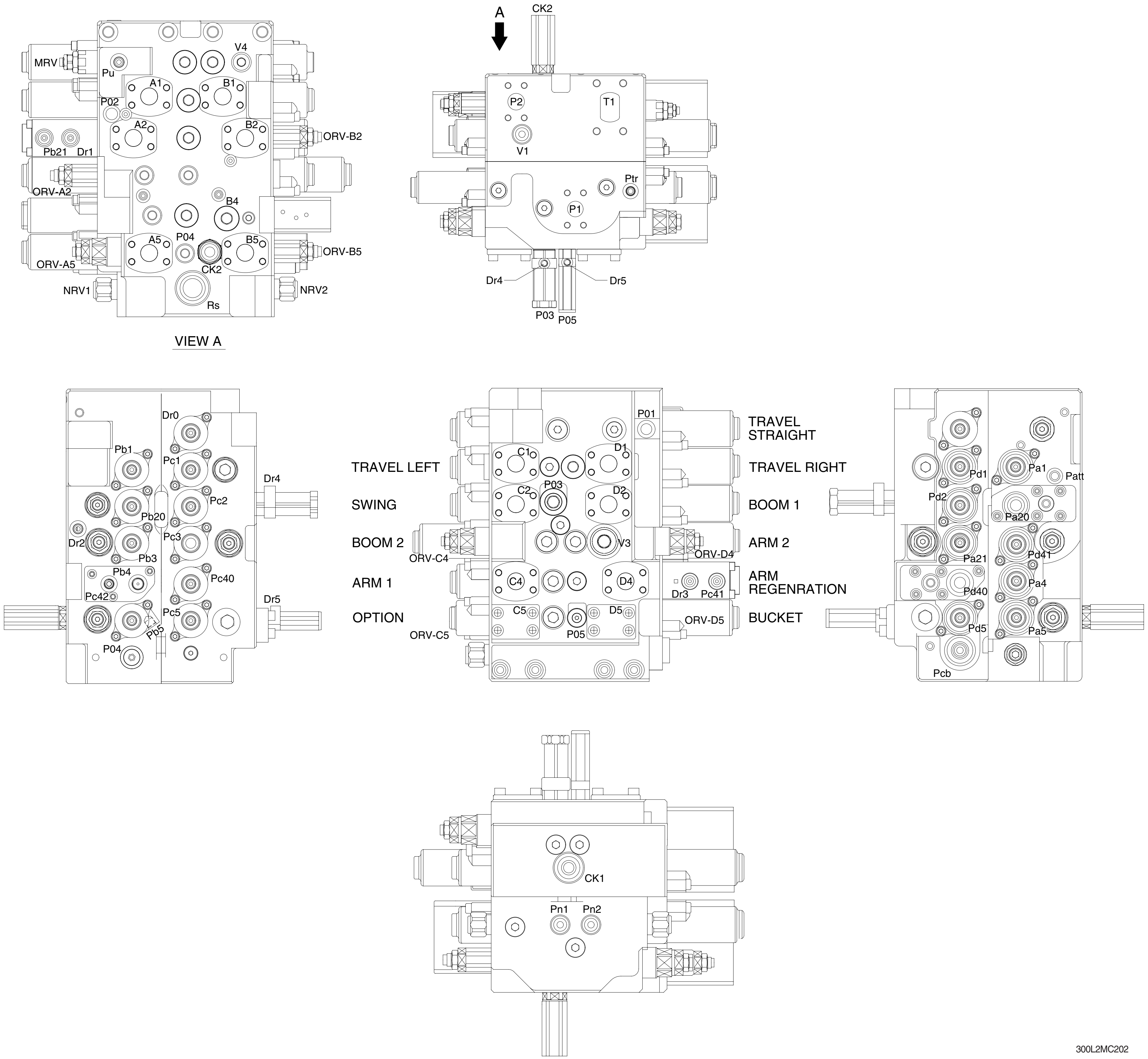


300L2MC101

Mark	Port name	Port size	Tightening torque
Rs V3 B4	Make up for swing motor Carry-over P port Option A port (breaker)	PF1	20~25 kgf · m (145~180 lbf · ft)
Patt Pb21 Pcb P01 P02 P03 P04 P05 Pc41 Pc42 Ptr Pu Dr1 Dr2 Dr3	Auto idle signal-attachment Lock valve pilot port (boom) Bucket in confluence pilot port Pilot signal port Pilot signal port Swing logic pilot port Bucket parallel orifice pilot port Option B confluence pilot port Lock valve pilot port (arm) Arm in regen-cut signal selector port Auto idle signal-travel Power boost Drain port Drain port Drain port	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
CK1 CK2	Bucket confluence Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
Pa1 Pb1 Pc1 Pd1 Pa20 Pa21 Pb20 Pc2 Pd2 Pb3 Pc3 Pa4 Pb4 Pc40 Pd40 Pd41 Pa5 Pb5 Pc5 Pd5 Dr0 Pn1 Pn2 V1 V4	Travel pilot port-LH (FW) Travel pilot port-LH (BW) Travel pilot port-RH (BW) Travel pilot port-RH (FW) Boom up pilot port Boom up confluence pilot port Boom down pilot port Swing pilot port (LH) Swing pilot port (RH) Arm in confluence pilot port Swing priority pilot port Option A pilot port (breaker) Arm in regeneration cut port Arm in pilot port Arm out pilot port Arm out confluence pilot port Bucket in pilot port Bucket out pilot port Option B pilot port Option B pilot port Drain port Negative control signal port (A2 port side) Negative control signal port (A1 port side) Carry-over port Carry-over port	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
A1 B1 C1 D1 A2 B2 C2 D2 C4 D4 A5 B5 C5 D5 P1 P2	Travel motor port-LH (FW) Travel motor port-LH (BW) Travel motor port-RH (BW) Travel motor port-RH (FW) Boom up port Boom down port Swing motor port (LH) Swing motor port (RH) Arm in port Arm out port Bucket in port Bucket out port Option B port Option B port Pump port (A2 side) Pump port (A1 side)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
Dr4 Dr5	Drain port Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

MAIN CONTROL VALVE (TYPE 4)

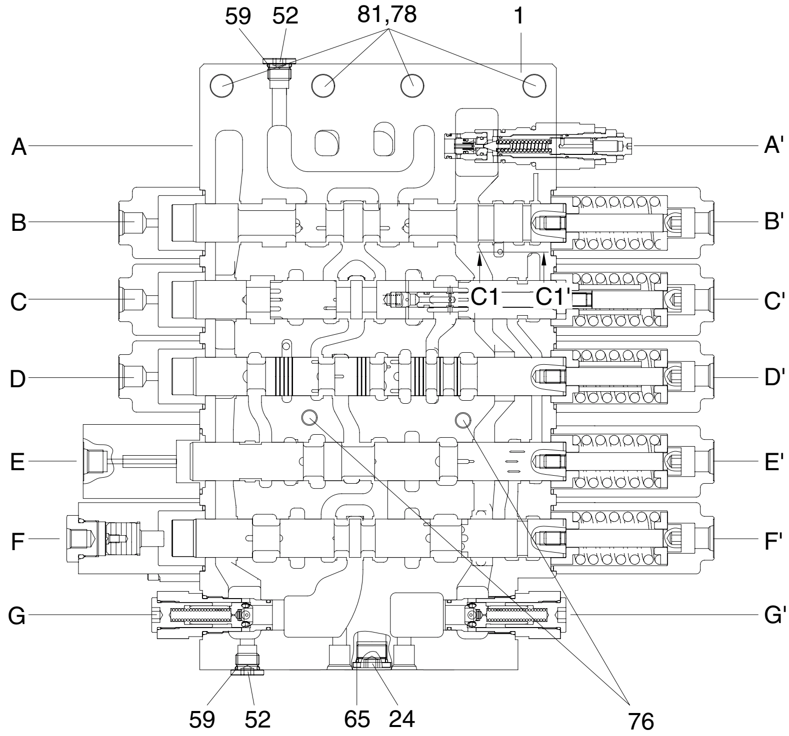
1. STRUCTURE



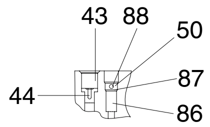
300L2MC202

Mark	Port name	Port size	Tightening torque
Rs	Make up for swing motor	PF1	20~25 kgf · m (145~180 lbf · ft)
V3	Carry-over P port		
B4	Option A port (breaker)		
Patt	Auto idle signal-attachment	PF1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Pb21	Lock valve pilot port (boom)		
Pcb	Bucket in 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		
Pc41	Lock valve pilot port (arm)		
Pc42	Arm in regen-cut signal selector port		
Ptr	Auto idle signal-travel		
Pu	Power boost		
Dr1	Drain port		
Dr2	Drain port		
Dr3	Drain port		
CK1	Bucket confluence	PF3/4	17~19 kgf · m (123~137.4 lbf · ft)
CK2	Bucket confluence		
Pa1	Travel pilot port-LH (FW)	PF3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
Pb1	Travel pilot port-LH (BW)		
Pc1	Travel pilot port-RH (BW)		
Pd1	Travel pilot port-RH (FW)		
Pa20	Boom up pilot port		
Pa21	Boom up confluence pilot port		
Pb20	Boom down pilot port		
Pc2	Swing pilot port (LH)		
Pd2	Swing pilot port (RH)		
Pb3	Arm in confluence pilot port		
Pc3	Swing priority pilot port		
Pa4	Option A pilot port (breaker)		
Pb4	Arm in regeneration cut port		
Pc40	Arm in pilot port		
Pd40	Arm out pilot port		
Pd41	Arm out confluence pilot port		
Pa5	Bucket in pilot port		
Pb5	Bucket out pilot port		
Pc5	Option B pilot port		
Pd5	Option B pilot port		
Dr0	Drain port		
Pn1	Negative control signal port (A2 port side)		
Pn2	Negative control signal port (A1 port side)		
V1	Carry-over port		
V4	Carry-over port		
A1	Travel motor port-LH (FW)	SAE 5000 psi 1"	7.5~9.2 kgf · m (54.2~66.5 lbf · ft)
B1	Travel motor port-LH (BW)		
C1	Travel motor port-RH (BW)		
D1	Travel motor port-RH (FW)		
A2	Boom up port		
B2	Boom down port		
C2	Swing motor port (LH)		
D2	Swing motor port (RH)		
C4	Arm in port		
D4	Arm out port		
A5	Bucket in port		
B5	Bucket out port		
C5	Option B port		
D5	Option B port		
P1	Pump port (A2 side)		
P2	Pump port (A1 side)		
Dr4	Drain port	PF1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
Dr5	Drain port		
T1	Return port	SAE 3000 psi 2" (M12)	6.4~8.6 kgf · m (46.2~62.2 lbf · ft)

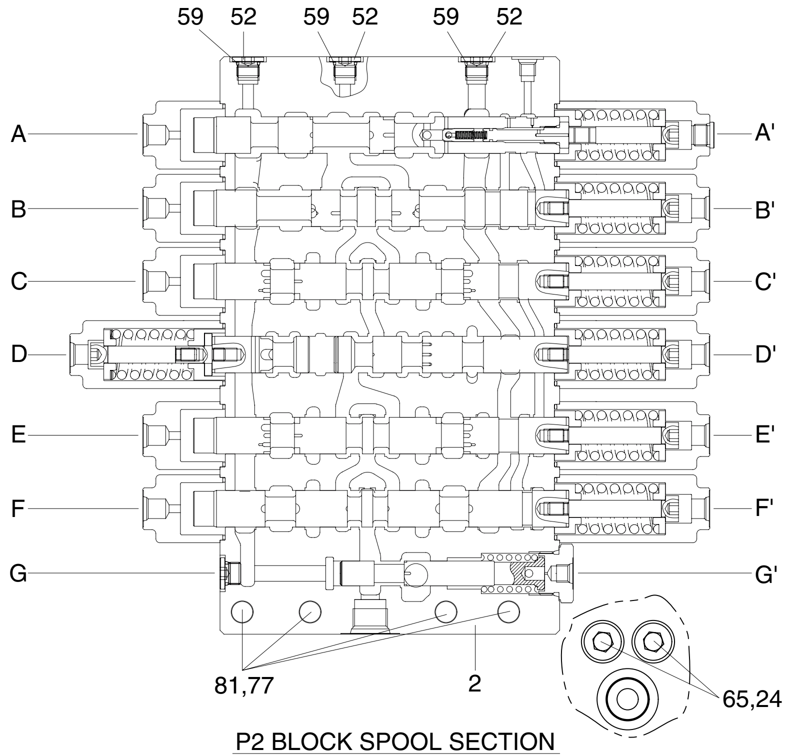
· MCV TYPE 1



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

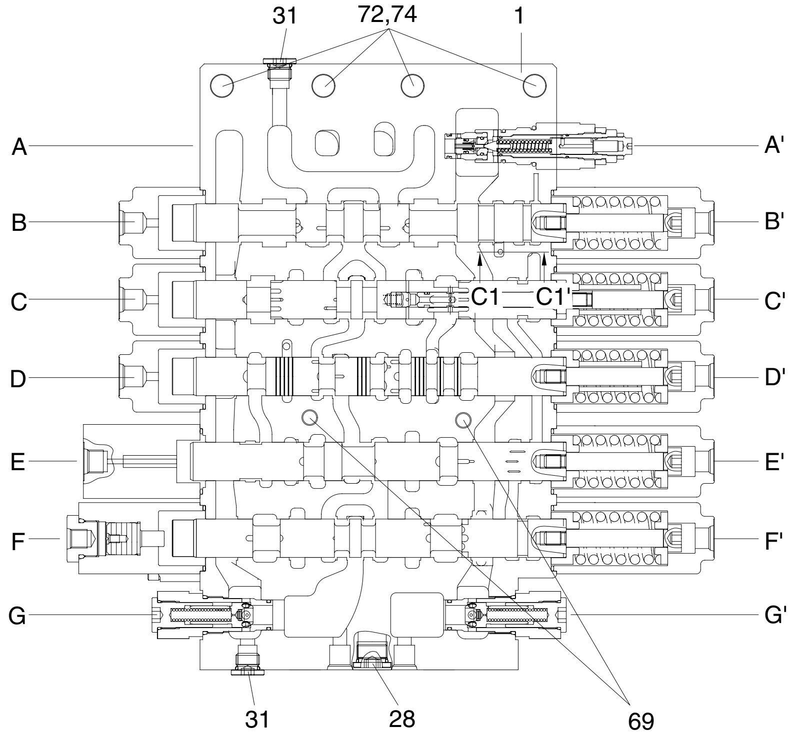


P2 BLOCK SPOOL SECTION

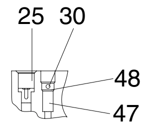
1	Housing (P1)
2	Housing (P2)
24	Plug
43	Orifice-signal
44	Coin type filter
50	O-ring
52	Plug
59	O-ring
65	O-ring
76	Hex socket head bolt
77	Hex socket head bolt
78	Hex socket head bolt
81	Spring washer
86	Poppet
87	Check spring
88	Plug

300L2MC10

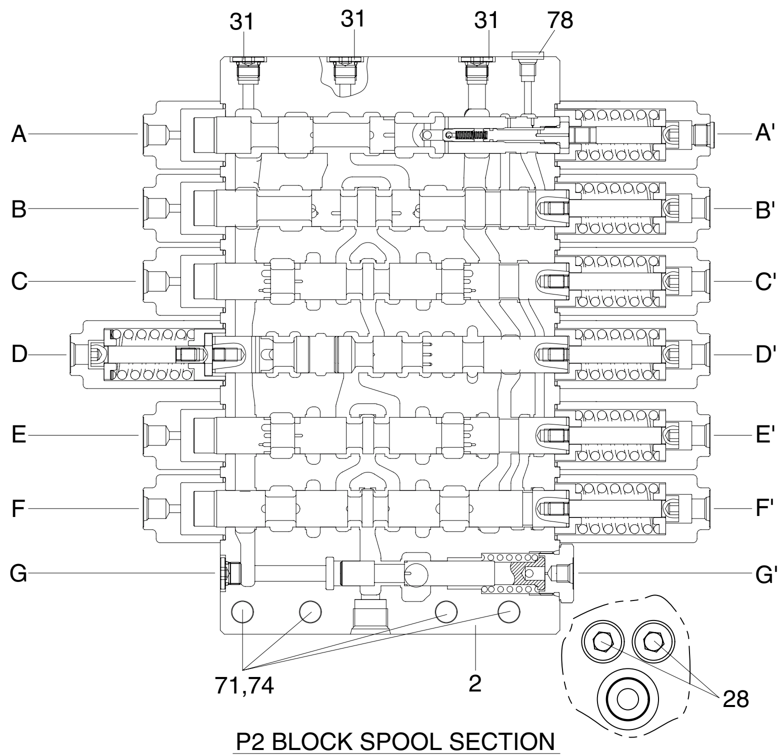
· MCV TYPE 2



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

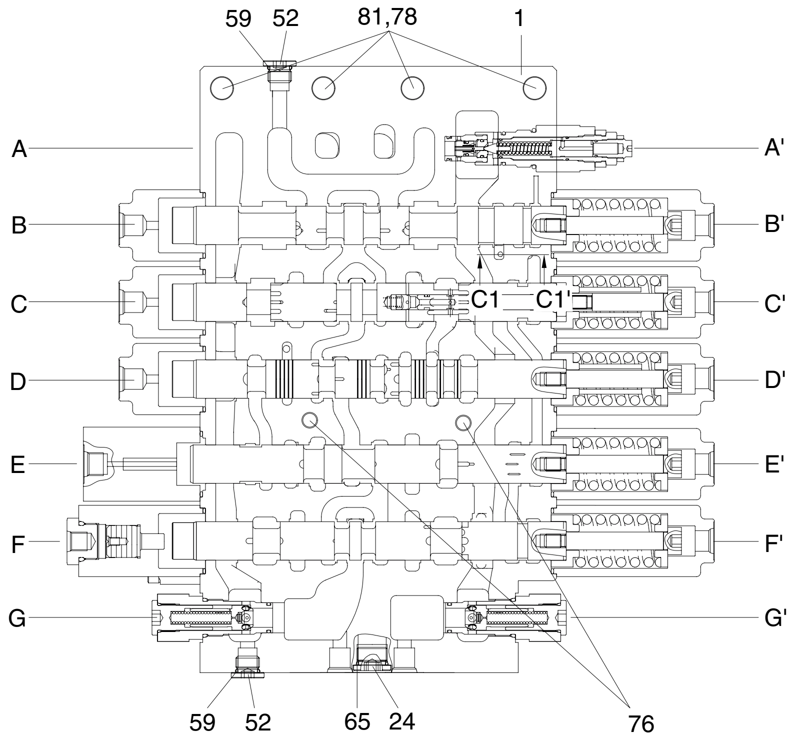


P2 BLOCK SPOOL SECTION

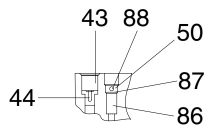
300L2MC15

1	Housing (P1)
2	Housing (P2)
25	Orifice-signal
28	Plug
30	Plug
31	Plug
47	Poppet
48	Spring
69	Hex socket head bolt
71	Hex socket head bolt
72	Hex socket head bolt
74	Spring washer
78	Dust cap

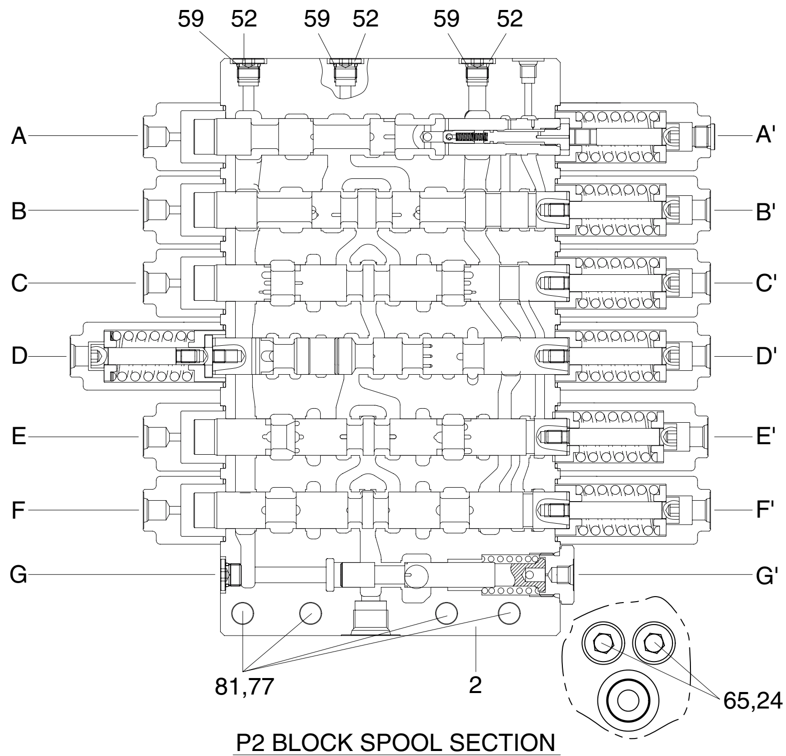
· MCV TYPE 3



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

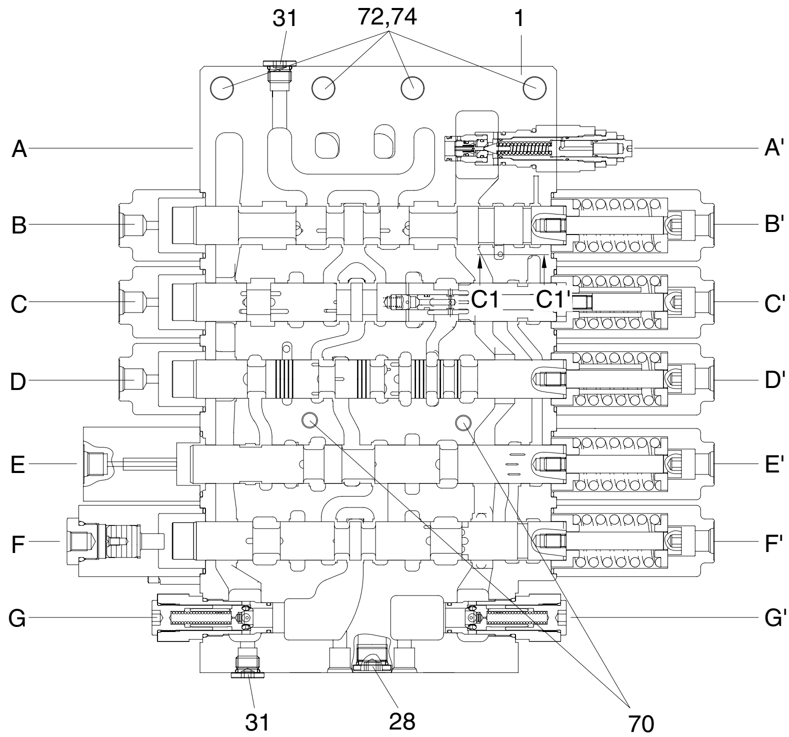


P2 BLOCK SPOOL SECTION

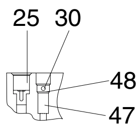
1	Housing (P1)
2	Housing (P2)
24	Plug
43	Orifice-signal
44	Coin type filter
50	O-ring
52	Plug
59	O-ring
65	O-ring
76	Hex socket head bolt
77	Hex socket head bolt
78	Hex socket head bolt
81	Spring washer
86	Poppet
87	Check spring
88	Plug

300L2MC110

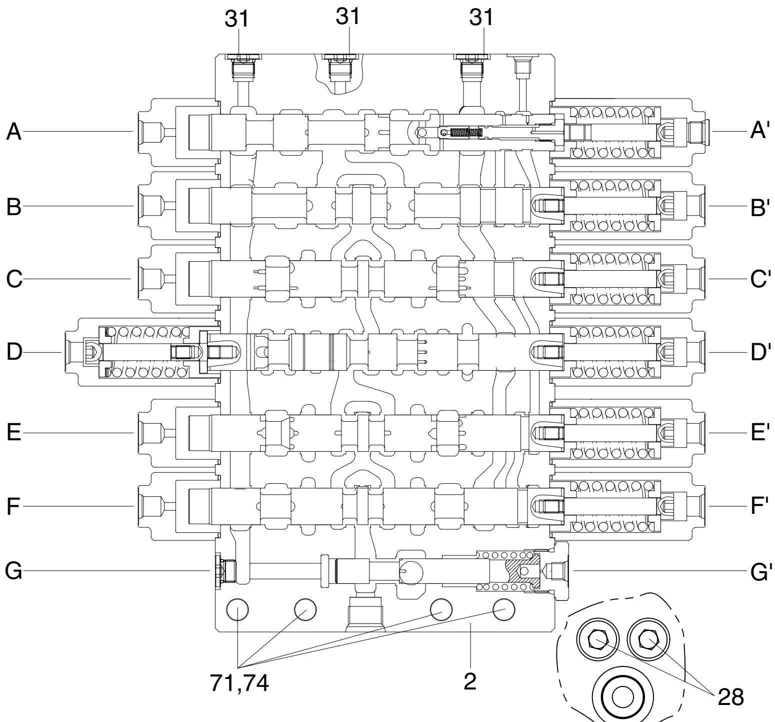
· MCV TYPE 4



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

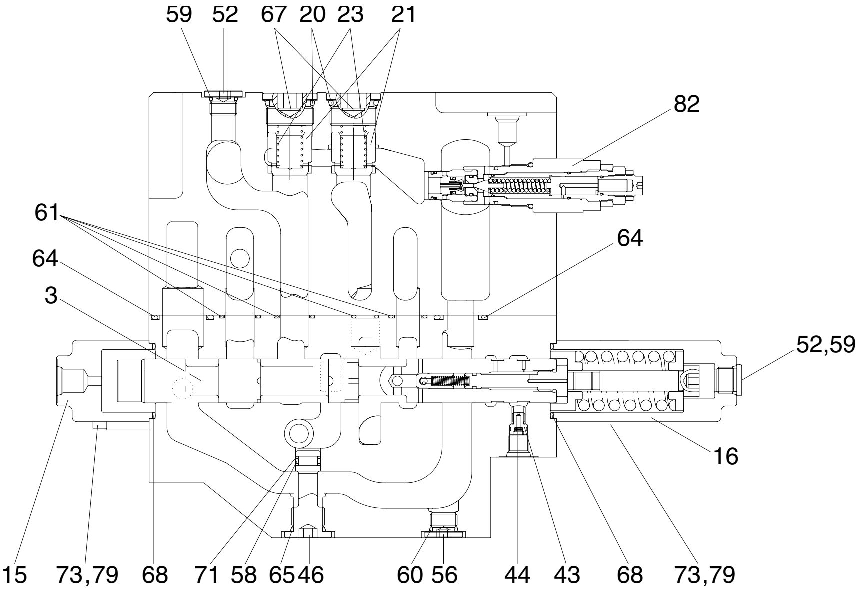


P2 BLOCK SPOOL SECTION

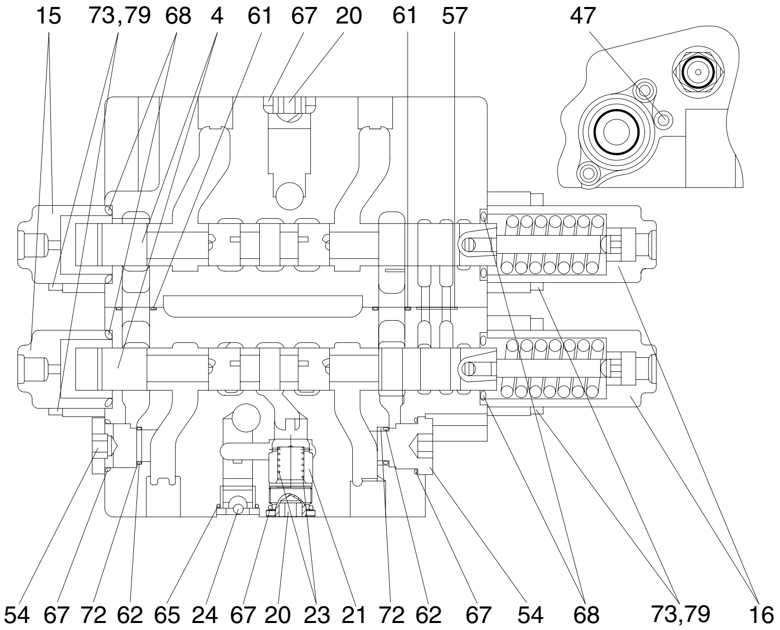
1	Housing (P1)
2	Housing (P2)
25	Orifice-signal
28	Plug
30	Plug
31	Plug
47	Poppet-signal
48	Spring-signal
70	Hex socket head bolt
71	Hex socket head bolt
72	Hex socket head bolt
74	Spring washer

300L2MC215

· MCV TYPE 1



A-A' (STRAIGHT-TRAVEL & SUPPLY)

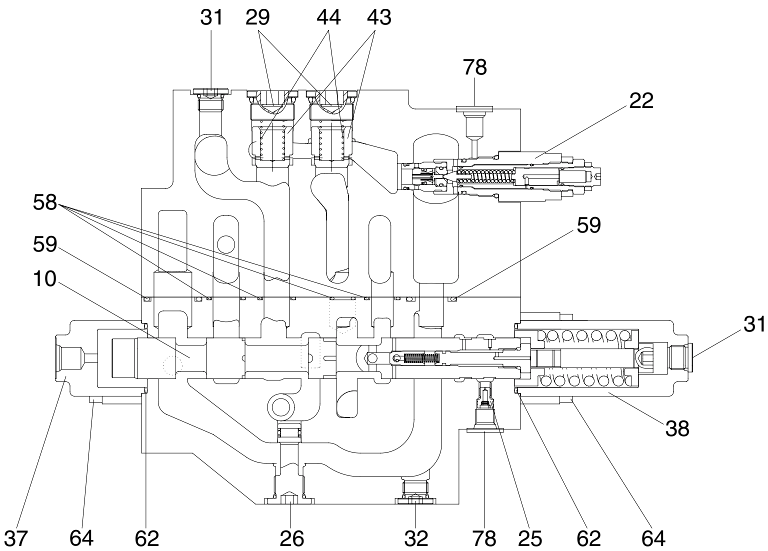


B-B' (TRAVEL RIGHT & LEFT)

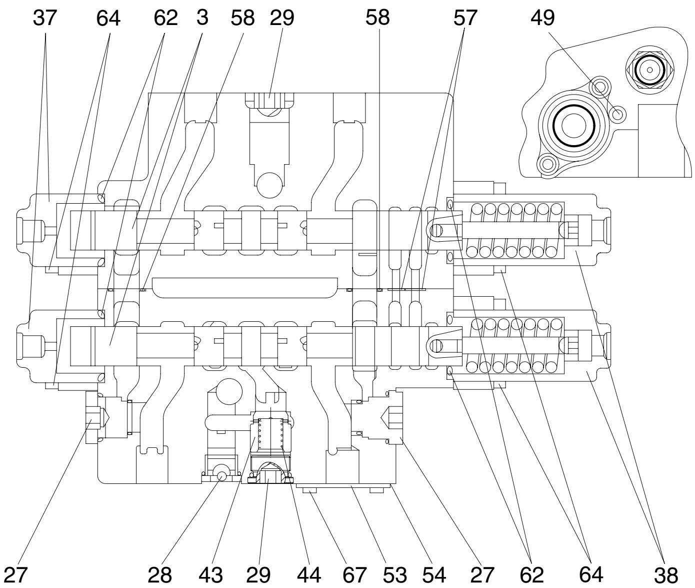
300L2MC111

3	Spool-straight
4	Spool-travel
15	Cover A-pilot
16	Cover B1-pilot
20	Plug
21	Poppet 1-check valve
23	Spring 1-check valve
24	Plug
43	Orifice-signal
44	Coin type filter
46	Plug
47	Plug
52	Plug
54	Plug
56	Plug
57	O-ring
58	O-ring
59	O-ring
60	O-ring
61	O-ring
62	O-ring
64	O-ring
65	O-ring
67	O-ring
68	O-ring
71	Back-up ring
72	Back-up ring
73	Hex socket head bolt
79	Washer
82	Main relief valve

· MCV TYPE 2



A-A' (STRAIGHT-TRAVEL & SUPPLY)

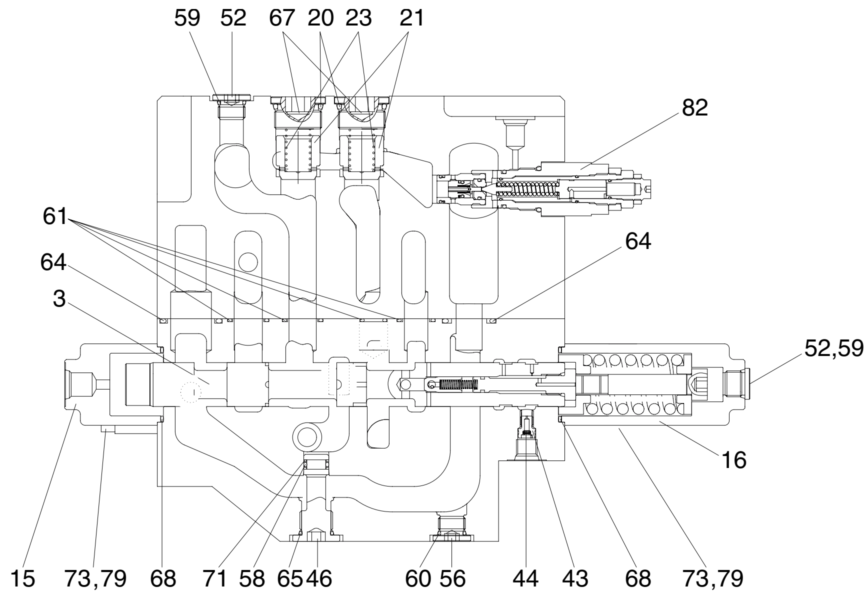


B-B' (TRAVEL RIGHT & LEFT)

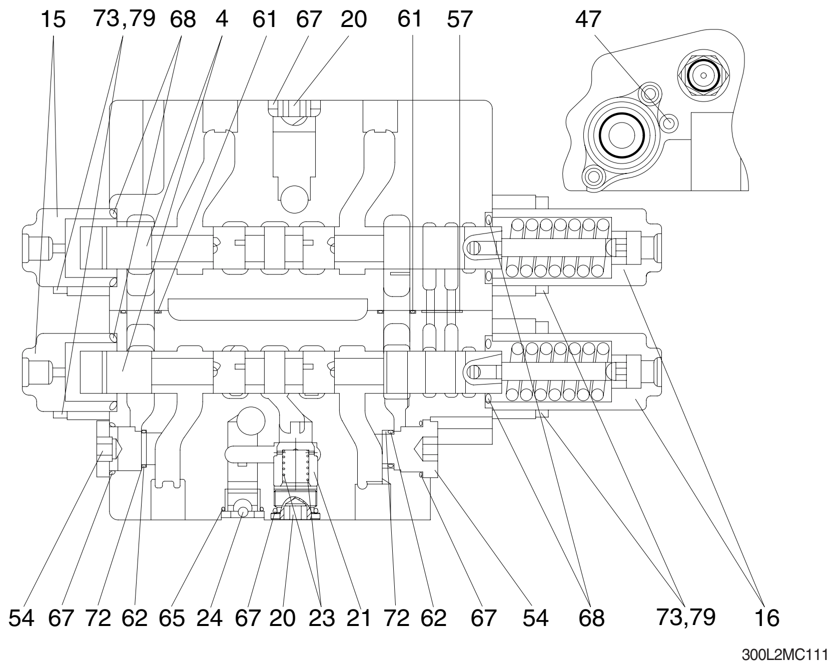
300L2MC116

3	Spool-travel
10	Spool-straight
22	Main relief valve
25	Orifice-signal
26	Parallel block plug
27	Plug
28	Plug
29	Plug
31	Plug
32	Plug
37	Cover A-pilot
38	Cover B1-pilot
43	Poppet 1-check valve
44	Spring 1-check valve
49	Plug
53	Cover 1
54	Gasket 1
57	O-ring
58	O-ring
59	O-ring
62	O-ring
64	Hex socket head bolt
67	Hex socket head bolt
78	Dust cap

· MCV TYPE 3



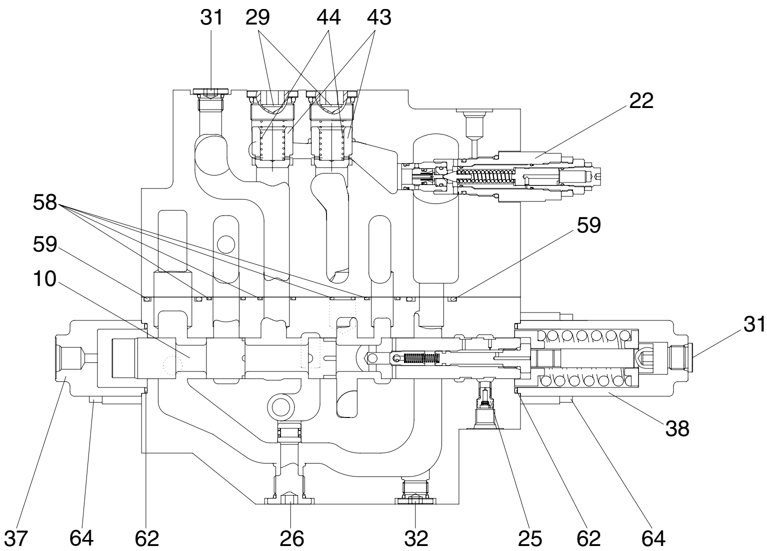
A-A' (STRAIGHT-TRAVEL & SUPPLY)



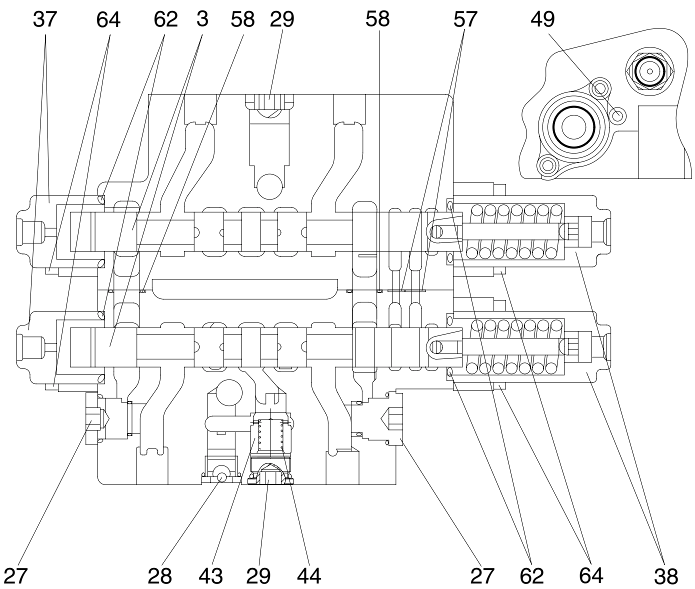
B-B' (TRAVEL RIGHT & LEFT)

3	Spool-straight
4	Spool-travel
15	Cover A-pilot
16	Cover B1-pilot
20	Plug
21	Poppet 1-check valve
23	Spring 1-check valve
24	Plug
43	Orifice-signal
44	Coin type filter
46	Plug
47	Plug
52	Plug
54	Plug
56	Plug
57	O-ring
58	O-ring
59	O-ring
60	O-ring
61	O-ring
62	O-ring
64	O-ring
65	O-ring
67	O-ring
68	O-ring
71	Back-up ring
72	Back-up ring
73	Hex socket head bolt
79	Washer
82	Main relief valve

· MCV TYPE 4



A-A' (STRAIGHT-TRAVEL & SUPPLY)

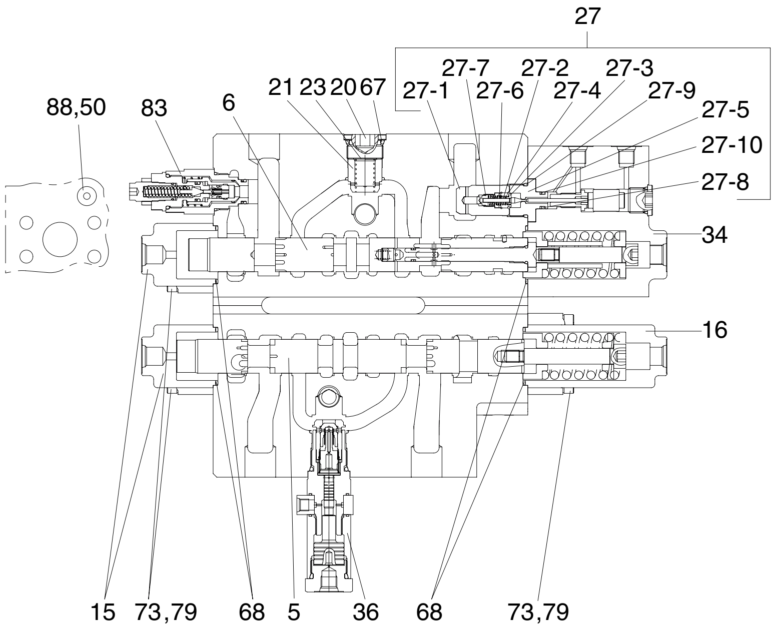


B-B' (TRAVEL RIGHT & LEFT)

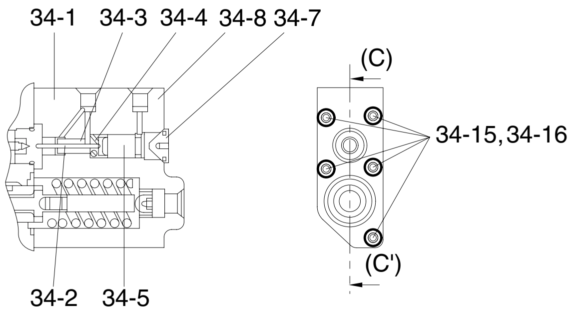
300L2MC216

3	Spool-travel
10	Spool-straight travel
22	Main relief valve
25	Orifice-signal
26	Parallel block plug
27	ORV Plug
28	Plug
29	Plug
31	Plug
32	Plug
37	Cover A-pilot
38	Cover B1-pilot
43	Poppet 1-check valve
44	Spring 1-check valve
49	Plug
57	O-ring
58	O-ring
59	O-ring
62	O-ring
64	Hex socket head bolt

· MCV TYPE 1



C-C' (SWING & BOOM 1)

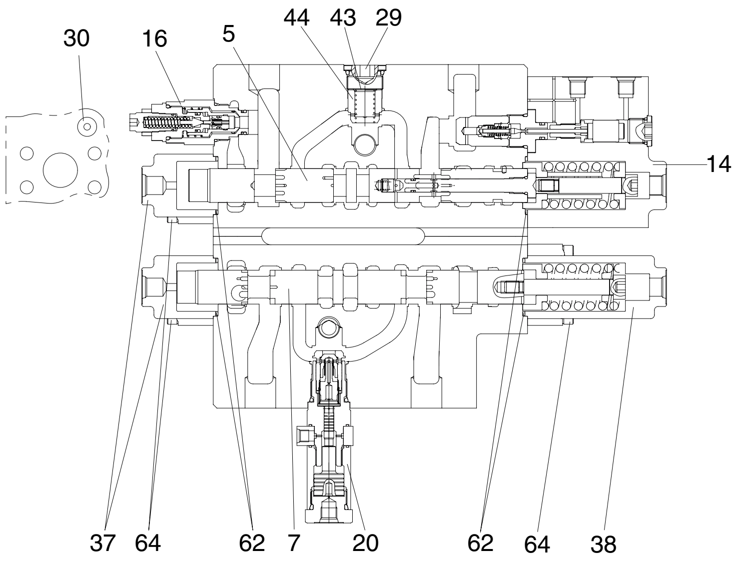


34 DETAIL (HOLDING ASSY)

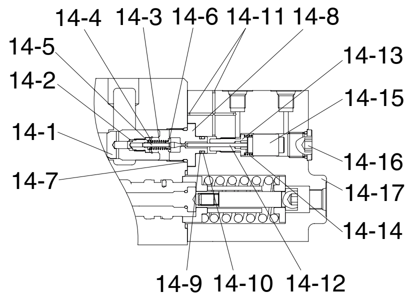
300L2MC12

5	Spool-swing	27-5	Poppet seat	34-7	Plug
6	Spool-boom	27-6	C-ring	34-8	Plug
15	Cover A-pilot	27-7	Restrictor-lock valve	34-15	Socket bolt
16	Cover B1-pilot	27-8	O-ring	34-16	Spring washer
20	Plug	27-9	O-ring	36	Logic valve
21	Poppet 1-check valve	27-10	Back up ring	50	O-ring
23	Spring 1-check valve	34	Holding kit A1	67	O-ring
27	Holding kit B	34-1	Block-holding P1	68	O-ring
27-1	Poppet	34-2	Piston 1-holding	73	Hex socket head bolt
27-2	Spring	34-3	Guide piston-holding	79	Washer
27-3	Poppet guide	34-4	Spring 1-lock valve	83	Overload relief valve
27-4	Pilot poppet	34-5	Piston 2-holding	88	Plug

· MCV TYPE 2



C-C' (SWING & BOOM 1)

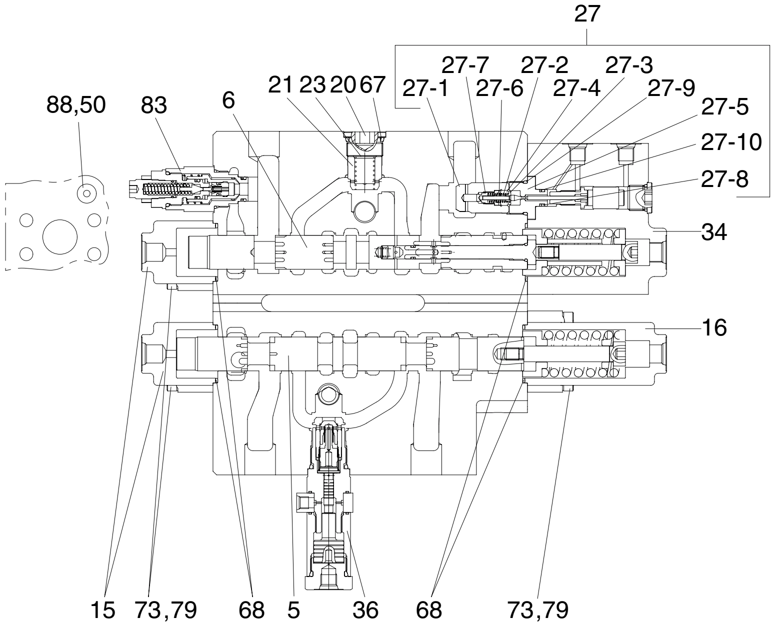


14 DETAIL (HOLDING VALVE ASSY)

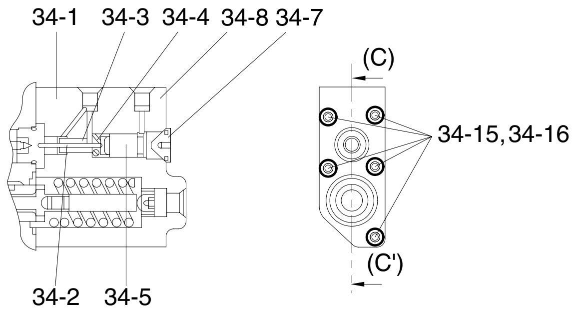
300L2MC17

5	Spool-boom 1	14-8	Poppet seat	16	Overload relief valve
7	Spool-swing	14-9	Back up ring	20	Logic valve
14	Holding valve assy	14-10	O-ring	29	Plug
14-1	Poppet	14-11	Plug	30	Plug
14-2	Restrictor	14-12	Pilot piston	37	Cover A-pilot
14-3	Spring	14-13	Piston guide	38	Cover B1-pilot
14-4	C-ring	14-14	Spring	43	Spring 1-check valve
14-5	Pilot poppet	14-15	Main piston	44	Poppet 1-check valve
14-6	Poppet guide	14-16	Plug	62	O-ring
14-7	O-ring	14-17	Block	64	Hex socket head bolt

· MCV TYPE 3



C-C' (SWING & BOOM 1)

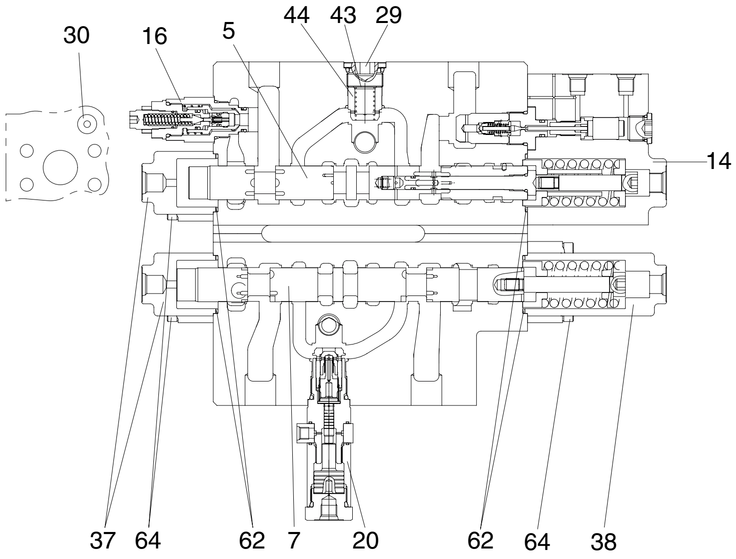


34 DETAIL (HOLDING ASSY)

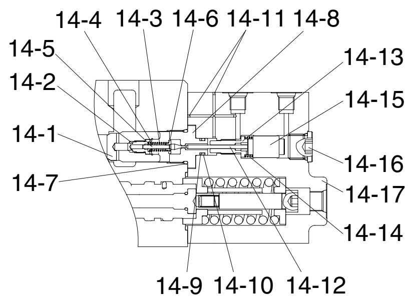
300L2MC112

5	Spool-swing	27-5	Poppet seat	34-7	Plug
6	Spool-boom	27-6	C-ring	34-8	Plug
15	Cover A-pilot	27-7	Restrictor-lock valve	34-15	Socket bolt
16	Cover B1-pilot	27-8	O-ring	34-16	Spring washer
20	Plug	27-9	O-ring	36	Logic valve
21	Poppet 1-check valve	27-10	Back up ring	50	O-ring
23	Spring 1-check valve	34	Holding kit A1	67	O-ring
27	Holding kit B	34-1	Block-holding P1	68	O-ring
27-1	Poppet	34-2	Piston 1-holding	73	Hex socket head bolt
27-2	Spring	34-3	Guide piston-holding	79	Washer
27-3	Poppet guide	34-4	Spring 1-lock valve	83	Overload relief valve
27-4	Pilot poppet	34-5	Piston 2-holding	88	Plug

· MCV TYPE 4



C-C' (SWING & BOOM 1)

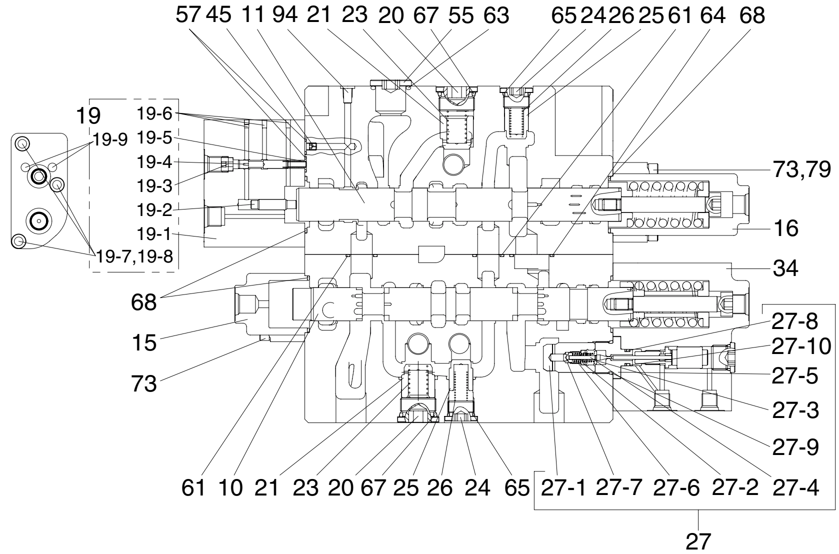


14 DETAIL (HOLDING VALVE ASSY)

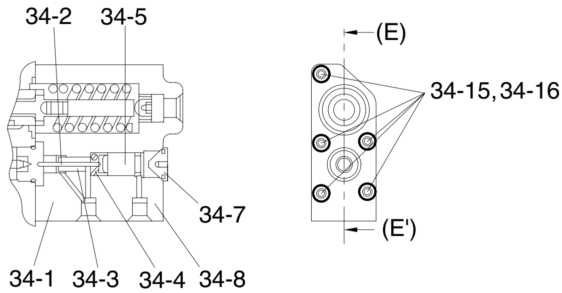
300L2MC217

5	Spool-boom 1	14-8	Poppet seat	16	Overload relief valve
7	Spool-swing	14-9	Back up ring	20	Logic valve-swing
14	Holding valve assy	14-10	O-ring	29	Plug
14-1	Poppet-main	14-11	Plug	30	Plug
14-2	Restrictor	14-12	Pilot piston	37	Cover A-pilot
14-3	Spring-pilot	14-13	Piston guide	38	Cover B1-pilot
14-4	C-ring	14-14	Spring	43	Spring 1-check valve
14-5	Pilot poppet	14-15	Main piston	44	Poppet 1-check valve
14-6	Poppet guide	14-16	Plug	62	O-ring
14-7	O-ring	14-17	Block	64	Hex socket head bolt

· MCV TYPE 1



E-E' (ARM & ARM REGENRATION)

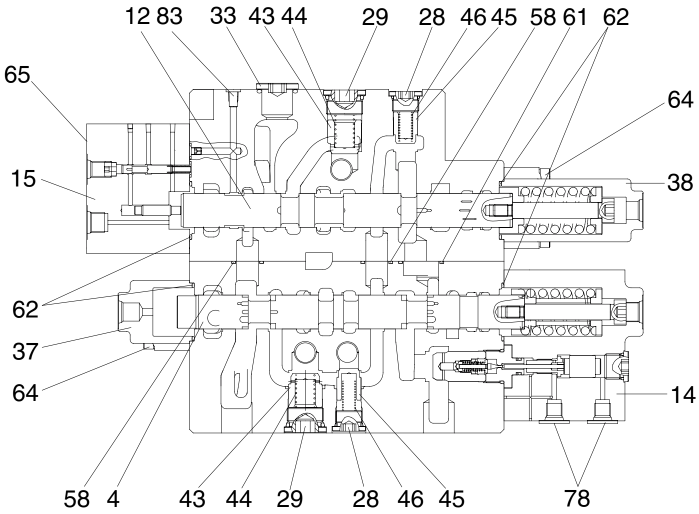


34 DETAIL (HOLDING ASSY)

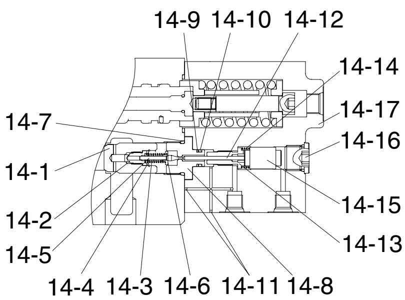
300L2MC13

10	Spool-arm 1	25	Poppet 2-check valve	34-5	Piston 2-holding
11	Spool-arm regeneration	26	Spring 2-check valve	34-7	Plug
15	Cover A-pilot	27	Poppet-lock valve	34-8	Plug
16	Cover B1-pilot	27-1	Poppet	34-15	Socket bolt
19	Arm-regeneration	27-2	Spring	34-16	Spring washer
19-1	Block-regeneration	27-3	Poppet guide	45	Orifice-plug
19-2	Piston-cut off	27-4	Pilot poppet	55	Plug
19-3	Stopper-regeneration	27-5	Poppet seat	57	O-ring
19-4	Spool-regeneration	27-6	C-ring	61	O-ring
19-5	Spring-regeneration	27-7	Restrictor-lock valve	63	O-ring
19-6	Plug	27-8	O-ring	64	O-ring
19-7	Socket bolt	27-9	O-ring	65	O-ring
19-8	Spring wahser	27-10	Back up ring	67	O-ring
19-9	Pin-regeneration	34	Holding kit A1	68	O-ring
20	Plug	34-1	Block-holding P1	73	Hex socket head bolt
21	Poppet 1-check valve	34-2	Piston 1-holding	79	Washer
23	Spring 1-check valve	34-3	Guide piston-holding	94	Plug
24	Plug	34-4	Spring 1-lock valve		

· MCV TYPE 2



E-E' (ARM & ARM REGENRATION)

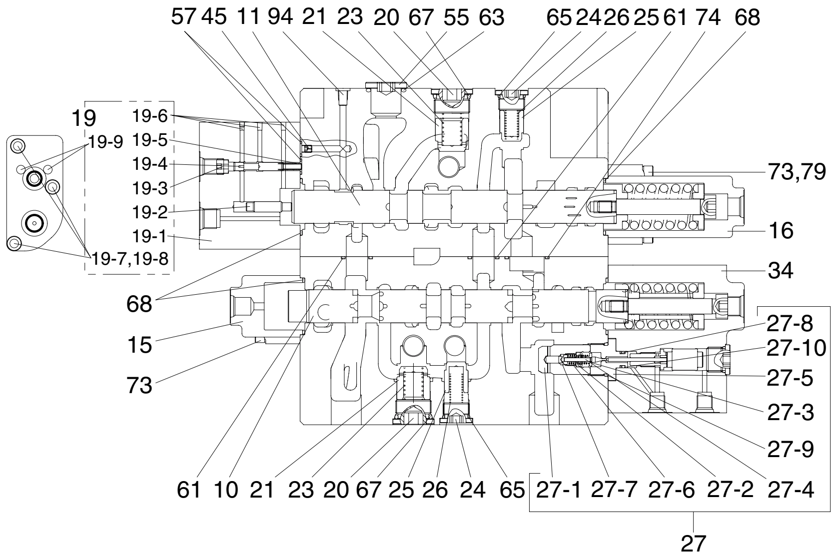


14 DETAIL (HOLDING VALVE ASSY)

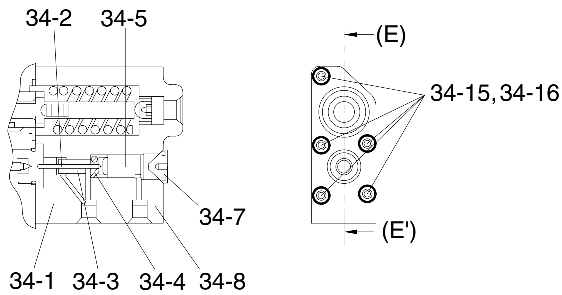
300L2MC18

4	Spool-arm 1
12	Spool-arm regeneration
14	Holding valve assy
14-1	Poppet
14-2	Restrictor
14-3	Spring
14-4	C-ring
14-5	Pilot poppet
14-6	Poppet guide
14-7	O-ring
14-8	Poppet seat
14-9	Back up ring
14-10	O-ring
14-11	Plug
14-12	Pilot piston
14-13	Piston guide
14-14	Spring
14-15	Main piston
14-16	Plug
14-17	Block
15	Arm regeneration valve
28	Plug
29	Plug
33	Plug
37	Cover A-pilot
38	Cover B1-pilot
43	Poppet 1-check valve
44	Spring 1-check valve
45	Poppet 2-check valve
46	Spring 2-check valve
58	O-ring
61	O-ring
62	O-ring
64	Hex socket head bolt
65	Hex socket head bolt
78	Dust cap
83	Plug

· MCV TYPE 3



E-E' (ARM & ARM REGENRATION)

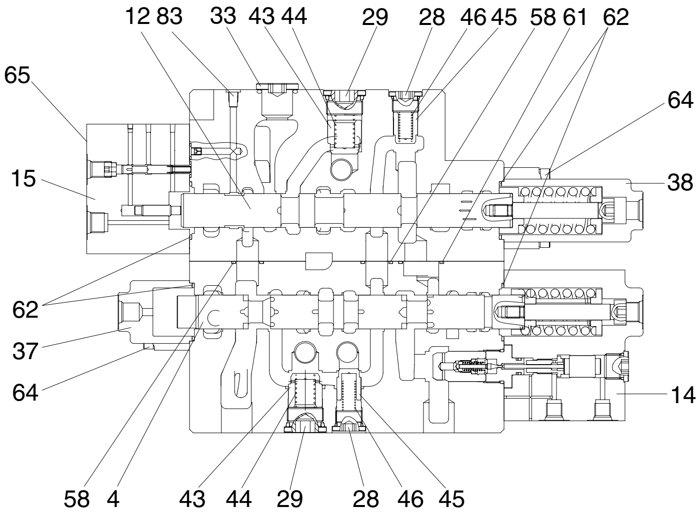


34 DETAIL (HOLDING ASSY)

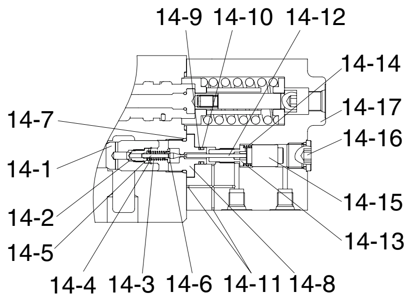
300L2MC113

10	Spool-arm 1	25	Poppet 2-check valve	34-5	Piston 2-holding
11	Spool-arm regeneration	26	Spring 2-check valve	34-7	Plug
15	Cover A-pilot	27	Holding kit B	34-8	Plug
16	Cover B1-pilot	27-1	Poppet	34-15	Socket bolt
19	Arm-regeneration	27-2	Spring	34-16	Spring washer
19-1	Block-regeneration	27-3	Poppet guide	45	Orifice-plug
19-2	Piston-cut off	27-4	Pilot poppet	55	Plug
19-3	Stopper-regeneration	27-5	Poppet seat	57	O-ring
19-4	Spool-regeneration	27-6	C-ring	61	O-ring
19-5	Spring-regeneration	27-7	Restrictor-lock valve	63	O-ring
19-6	Plug	27-8	O-ring	65	O-ring
19-7	Socket bolt	27-9	O-ring	67	O-ring
19-8	Spring wahser	27-10	Back up ring	68	O-ring
19-9	Pin-regeneration	34	Holding kit A1	73	Hex socket head bolt
20	Plug	34-1	Block-holding P1	74	O-ring
21	Poppet 1-check valve	34-2	Piston 1-holding	79	Washer
23	Spring 1-check valve	34-3	Guide piston-holding	94	Plug
24	Plug	34-4	Spring 1-lock valve		

· MCV TYPE 4



E-E' (ARM & ARM REGENRATION)

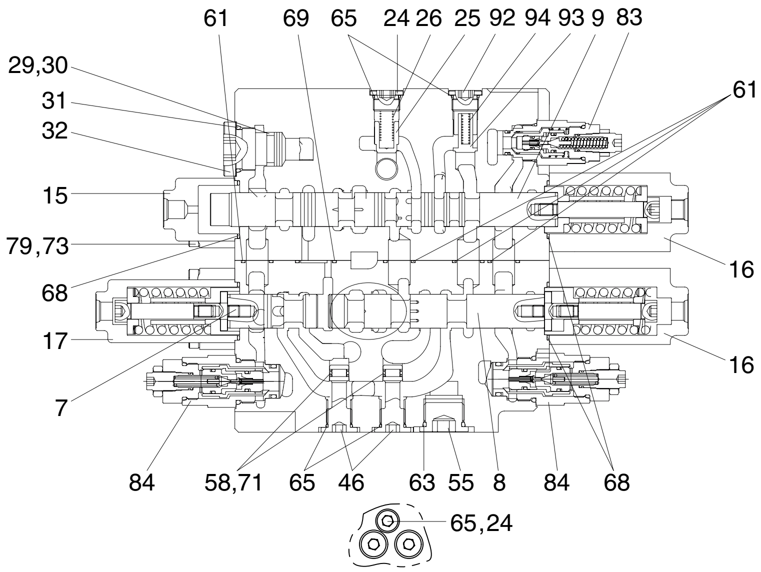


14 DETAIL (HOLDING VALVE ASSY)

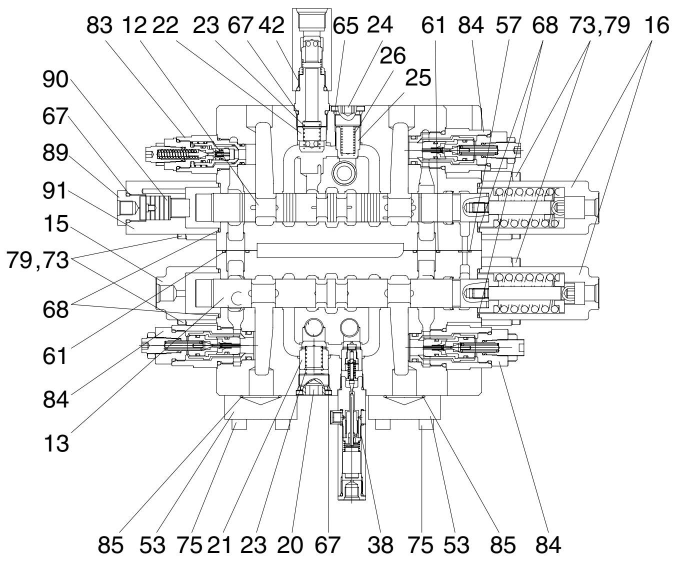
300L2MC218

4	Spool-arm 1	14-11	Plug	43	Poppet 1-check valve
12	Spool-arm regeneration	14-12	Pilot piston	44	Spring 1-check valve
14	Holding valve assy	14-13	Piston guide	45	Poppet 2-check valve
14-1	Poppet-main	14-14	Spring	46	Spring 2-check valve
14-2	Restrictor	14-15	Main piston	58	O-ring
14-3	Spring-pilot	14-16	Plug	61	O-ring
14-4	C-ring	14-17	Block	62	O-ring
14-5	Pilot poppet	15	Arm regeneration valve	64	Hex socket head bolt
14-6	Poppet guide	28	Plug	65	Hex socket head bolt
14-7	O-ring	29	Plug	83	Plug
14-8	Poppet seat	33	Plug		
14-9	Back up ring	37	Cover A-pilot		
14-10	O-ring	38	Cover B1-pilot		

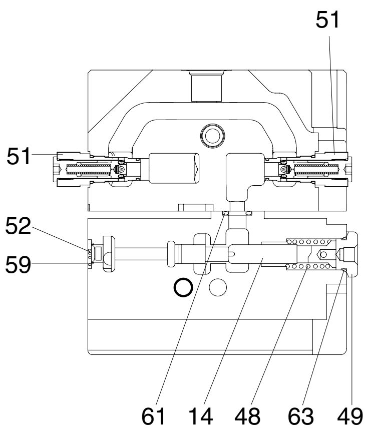
· MCV TYPE 1



D-D' (SWING PRIORITY-BOOM2 & ARM2)



F-F' (OPTION & BUCKET)

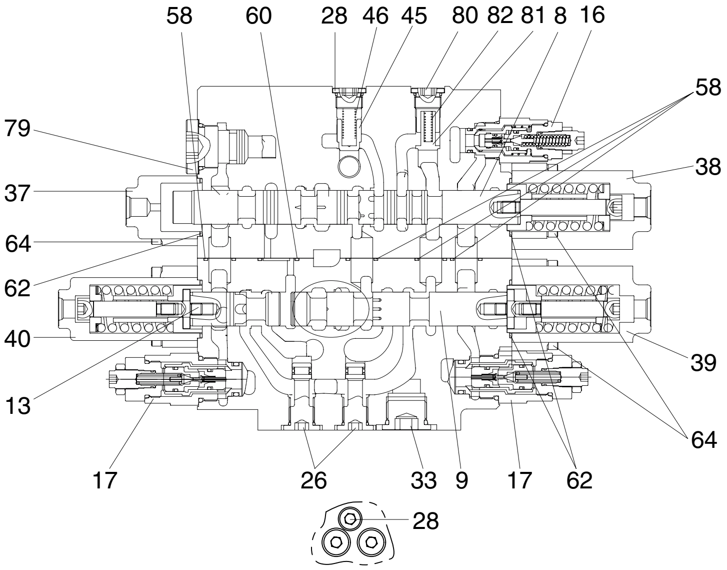


G-G' (CENTER BYPASS CUT-OFF
& NEGATIVE CONTROL)

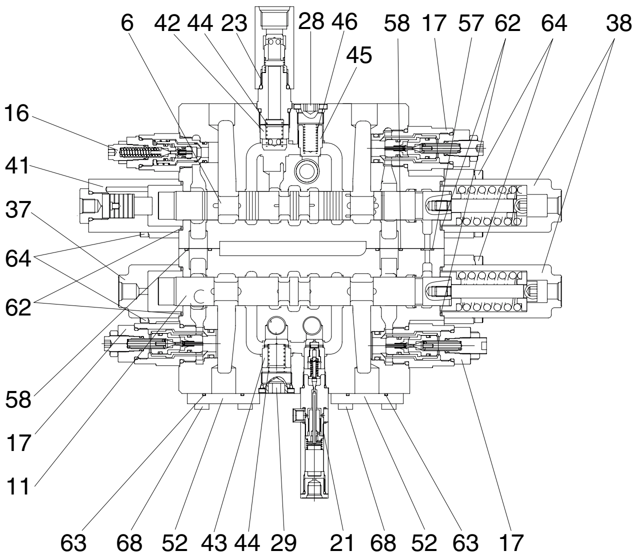
300L2MC14

7	Spool-swing priority
8	Spool-boom 2
9	Spool-arm 2
12	Spool-bucket
13	Spool-option
14	Spool-bypass cut
15	Cover A-pilot
16	Cover B1-pilot
17	Cover B2-pilot
20	Plug
21	Poppet 1-check valve
22	Poppet-L/C bucket
23	Spring 1-check valve
24	Plug
25	Poppet 2-check valve
26	Spring 2-check valve
29	Back up ring
30	O-ring
31	O-ring
32	Plug
38	Load check valve assy
42	Check valve
46	Plug
48	Spring-bypass cut spool
49	Plug-bypass cut spool
51	Negative control valve
52	Plug
53	Flange
55	Plug
57	O-ring
58	O-ring
59	O-ring
61	O-ring
63	O-ring
65	O-ring
67	O-ring
68	O-ring
69	O-ring
71	Back-up ring
73	Hex socket head bolt
75	Socket bolt
79	Washer
83	Overload relief valve
84	Overload relief valve
85	O-ring
89	Plug
90	Piston
91	Pilot cover C1
92	Plug
93	Poppet
94	Spring

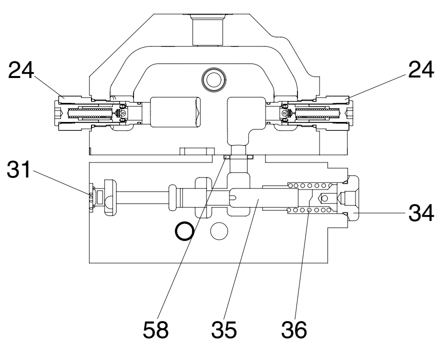
· MCV TYPE 2



D-D' (SWING PRIORITY-BOOM 2 & ARM 2)



F-F' (OPTION & BUCKET)

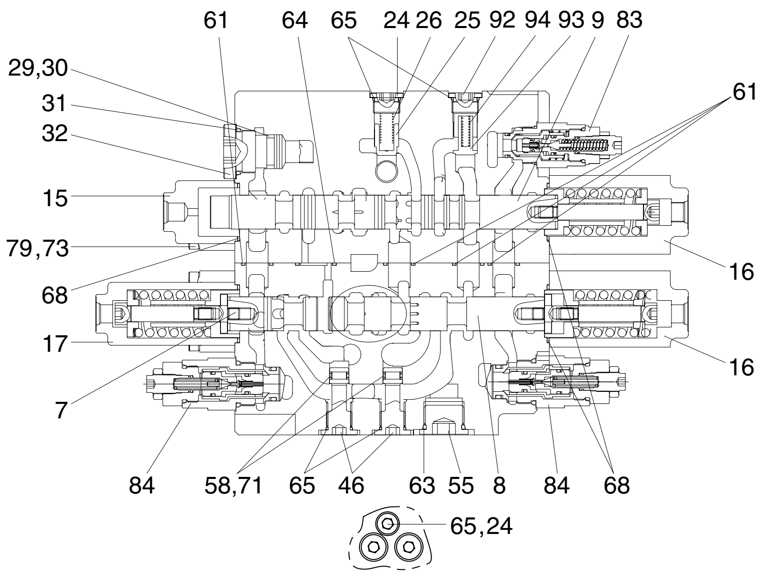


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

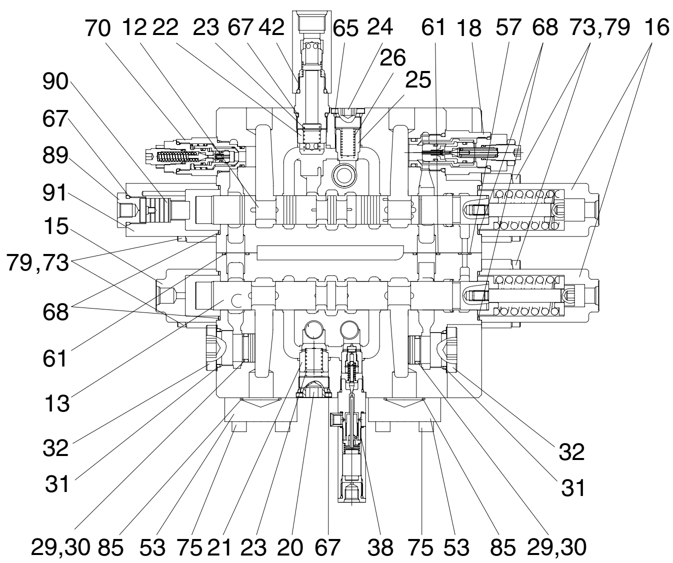
300L2MC19

6	Spool-bucket
8	Spool-arm 2
9	Spool-boom 2
11	Spool-option
13	Spool-swing priority
16	Overload relief valve
17	Overload relief valve
21	Option logic valve assy
23	Spool-bypass cut
24	Negative control valve
26	Plug
28	Plug
29	Plug
31	Plug
33	Plug
34	Plug-bypass cut spool
35	Spool-bypass cut
36	Spring-bypass cut spool
37	Cover A-pilot
38	Cover B1-pilot
39	Cover B2-pilot
40	Cover B3-pilot
41	Pilot cover C1
42	Poppet L/C-bucket
43	Poppet 1-check valve
44	Spring 1-check valve
45	Poppet 2-check valve
46	Spring 2-check valve
52	Flange
57	O-ring
58	O-ring
60	O-ring
62	O-ring
63	O-ring
64	Hex socket head bolt
67	Hex socket head bolt
68	Hex socket head bolt
79	Plug
80	Plug
81	Poppet 3-check valve
82	Spring 3-check valve

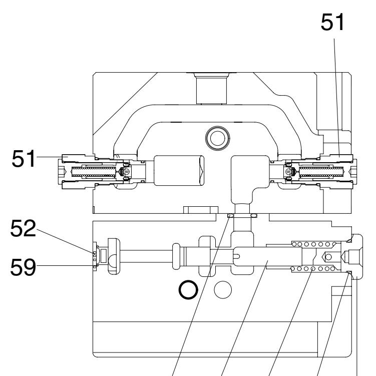
· MCV TYPE 3



D-D' (SWING PRIORITY-BOOM2 & ARM2)



F-F' (OPTION & BUCKET)

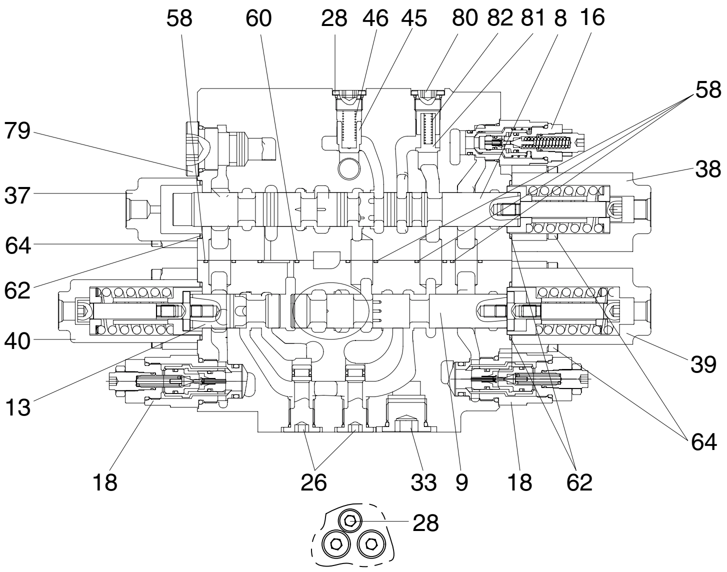


G-G' (CENTER BYPASS CUT-OFF
& NEGATIVE CONTROL)

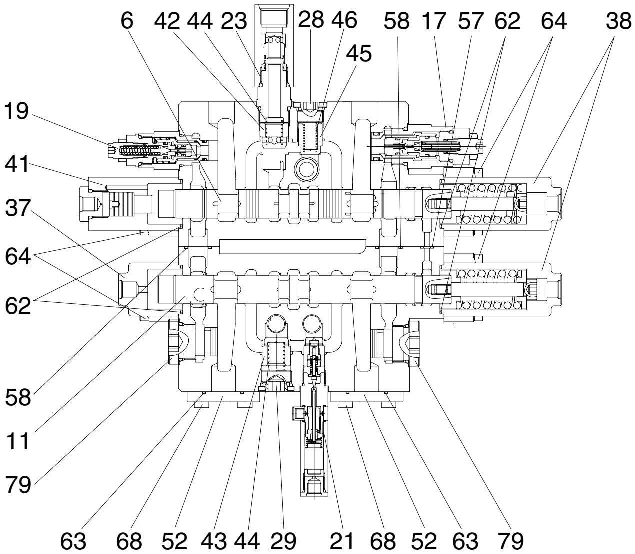
300L2MC114

7	Spool-swing priority
8	Spool-boom 2
9	Spool-arm 2
12	Spool-bucket
13	Spool-option
14	Spool-bypass cut
15	Cover A-pilot
16	Cover B1-pilot
17	Cover B3-pilot
18	Overload relief valve
20	Plug
21	Poppet 1-check valve
22	Poppet-L/C bucket
23	Spring 1-check valve
24	Plug
25	Poppet 2-check valve
26	Spring 2-check valve
29	O-ring
30	Back-up ring
31	O-ring
32	Plug
38	Load check valve assy
42	Check valve
46	Plug
48	Spring-bypass cut spool
49	Plug-bypass cut spool
51	Negative control valve
52	Plug
53	Flange
55	Plug
57	O-ring
58	O-ring
59	O-ring
61	O-ring
63	O-ring
65	O-ring
67	O-ring
68	O-ring
70	Overload relief valve
71	Back-up ring
73	Hex socket head bolt
75	Socket bolt
79	Washer
83	Overload relief valve
84	Overload relief valve
85	O-ring
89	Plug
90	Piston
91	Pilot cover C1
92	Plug
93	Poppet
94	Spring

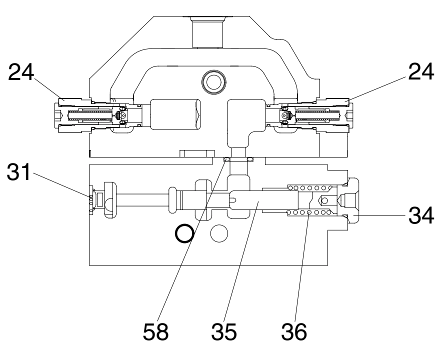
· MCV TYPE 4



D-D' (SWING PRIORITY-BOOM 2 & ARM 2)



F-F' (OPTION & BUCKET)

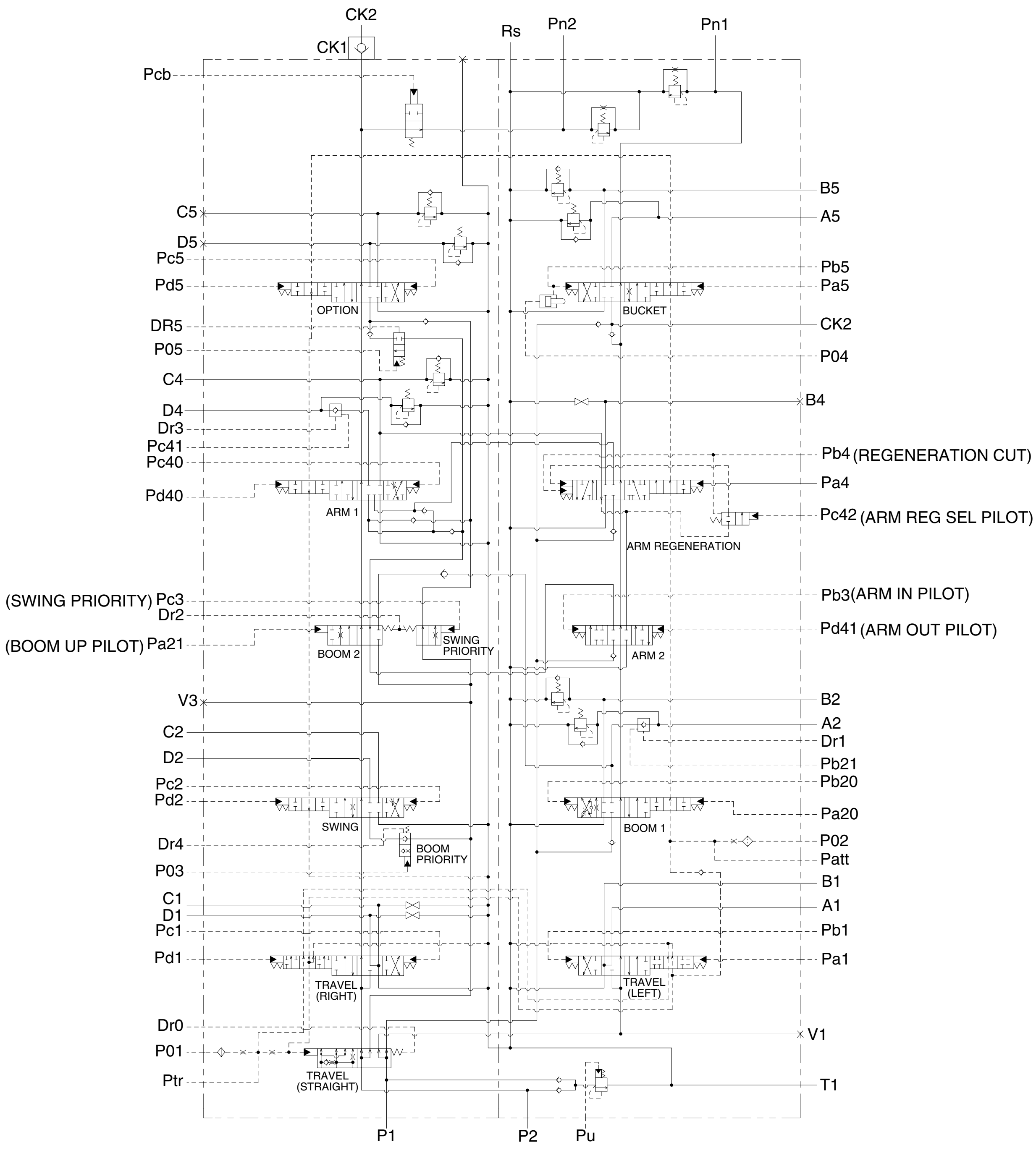


G-G' (CENTER BYPASS CUT-OFF
& NEGATIVE CONTROL)

300L2MC219

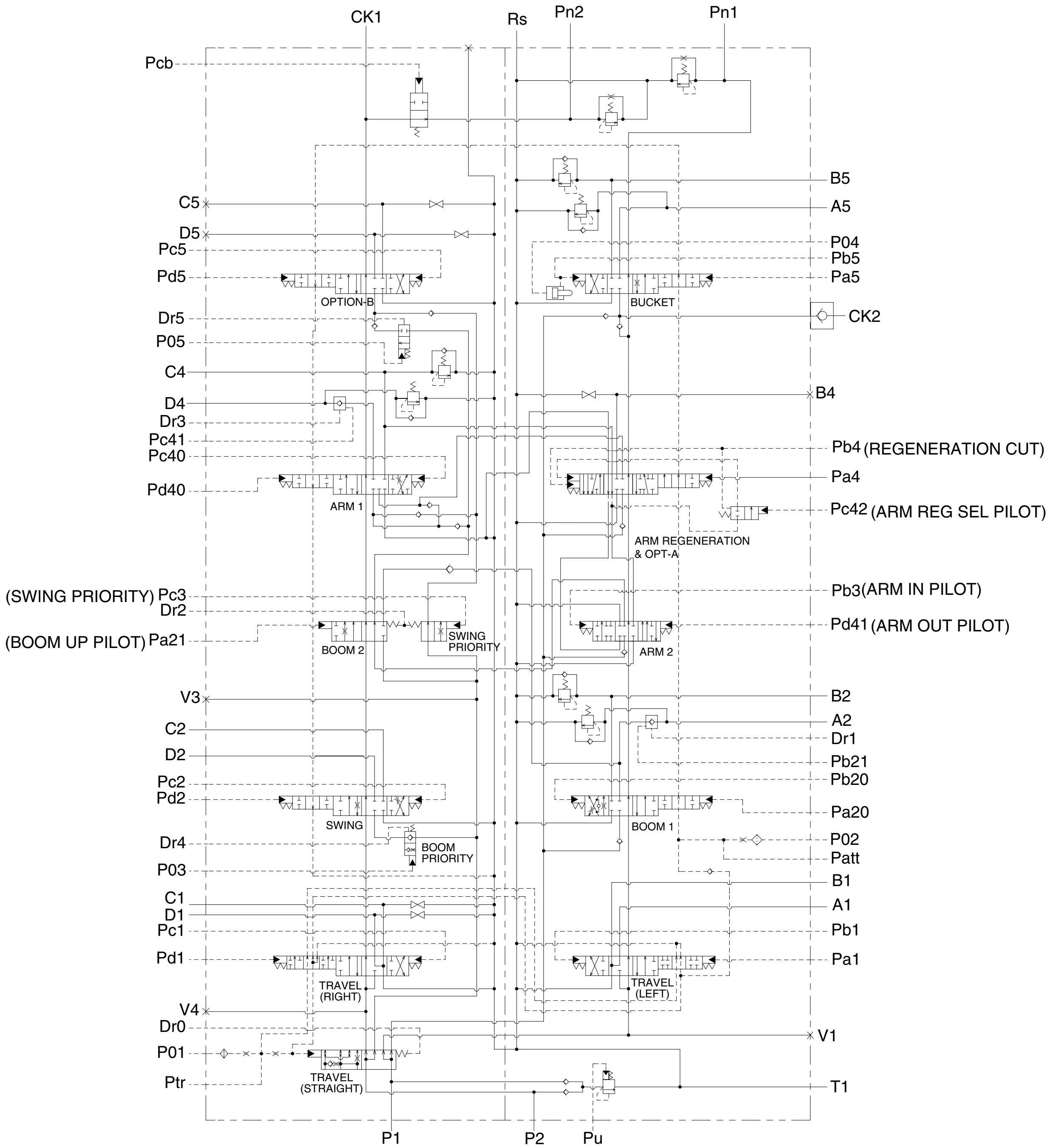
6	Spool-bucket
8	Spool-arm 2
9	Spool-boom 2
11	Spool-option
13	Spool-swing priority
18	Overload relief valve
19	Overload relief valve
21	Option logic valve
23	Spool-bypass cut
24	Negative control valve
26	Plug
28	Plug
29	Plug
31	Plug
33	Plug
34	Plug-bypass cut spool
35	Spool-bypass cut
36	Spring-bypass cut spool
37	Cover A-pilot
38	Cover B1-pilot
39	Cover B2-pilot
40	Cover B3-pilot
41	Pilot cover C1
42	Poppet L/C-bucket
43	Poppet 1-check valve
44	Spring 1-check valve
45	Poppet 2-check valve
46	Spring 2-check valve
52	Flange
57	O-ring
58	O-ring
60	O-ring
62	O-ring
63	O-ring
64	Hex socket head bolt
68	Hex socket head bolt
79	Plug
80	Plug
81	Poppet 3-check valve
82	Spring 3-check valve

2. HYDRAULIC CIRCUIT (TYPE 1 & 2)



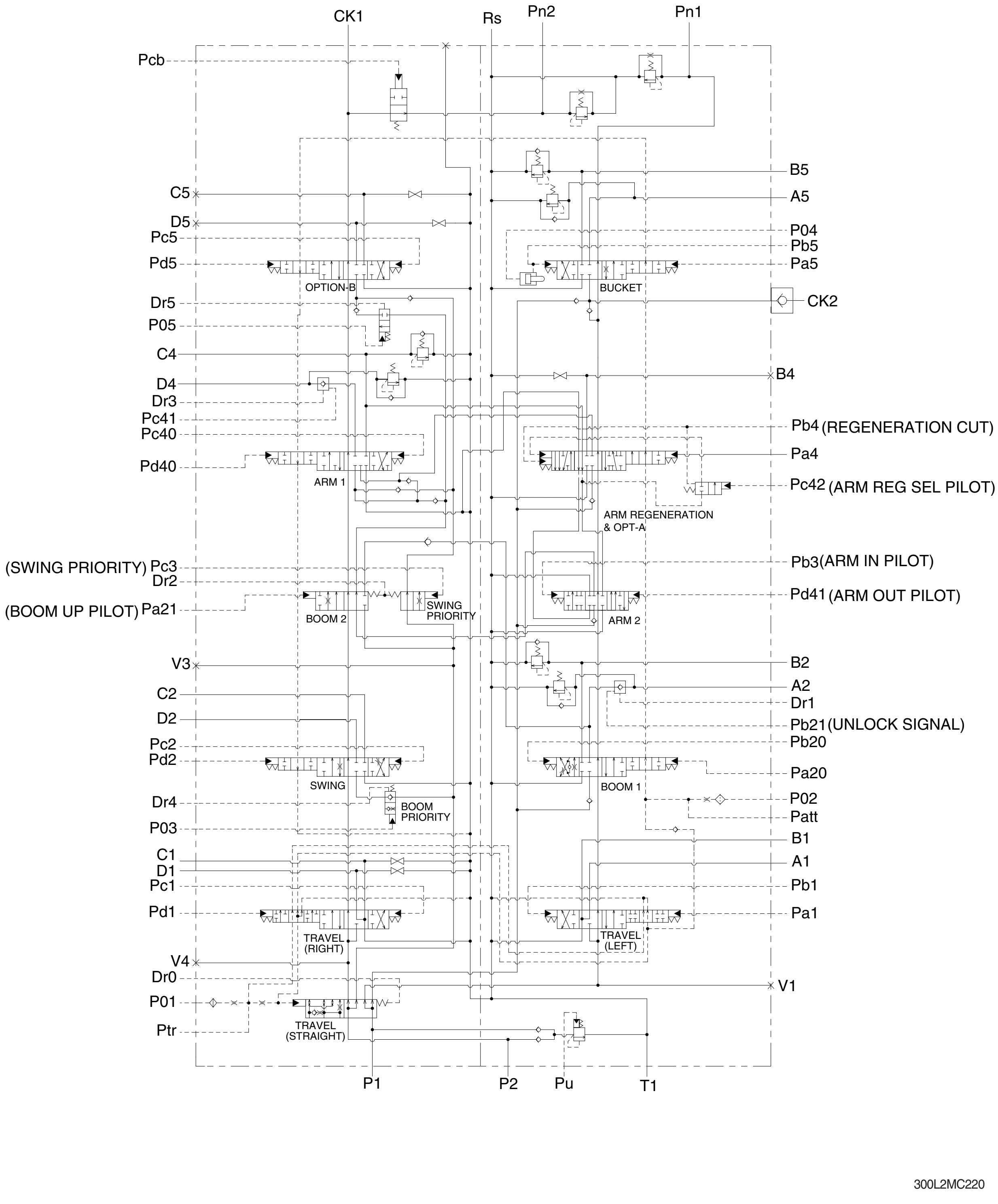
300L2MC20

HYDRAULIC CIRCUIT (TYPE 3)



300L2MC120

HYDRAULIC CIRCUIT (TYPE 4)



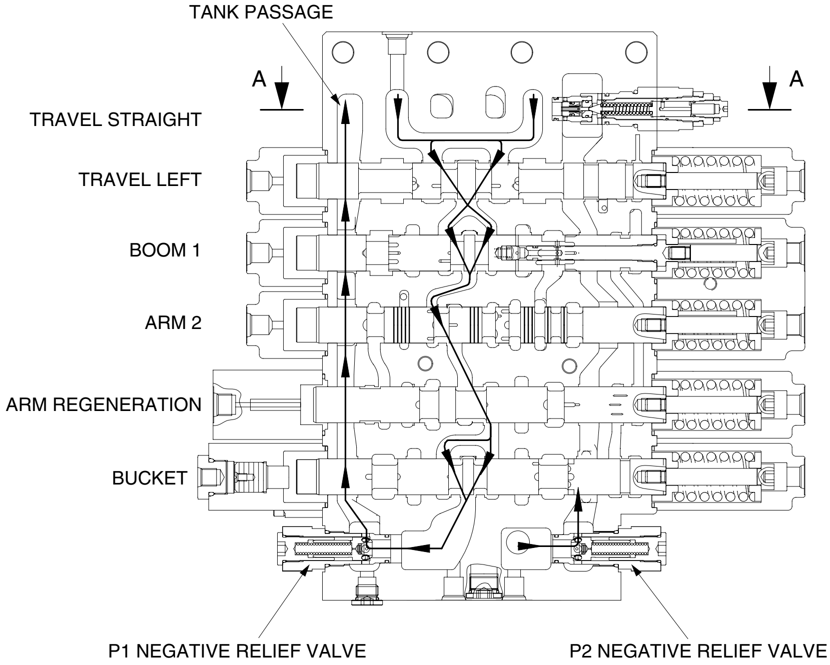
3. FUNCTION

1) CONTROL IN NEUTRAL

(1) P1 SIDE

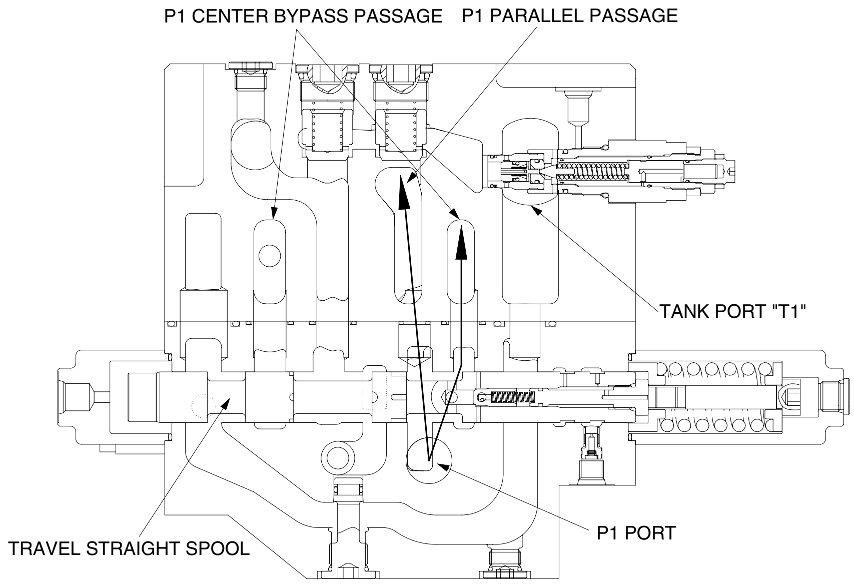
The hydraulic fluid from pump flows into the main control valve through the inlet port "P1", pass the land of the travel straight spool, into the P1 bypass passage and P1parallel passage.

When the straight travel spool is in neutral position, the bypass passage is not shut off. Then the hydraulic fluid from the pump P1 is directed to the tank through the bypass passage of spools : travel left, boom 1, arm 2, arm regeneration & option A and bucket, the negative relief valve of P1, tank passage, and the tank port "T1"



P1 SPOOL SECTION

3009A2MC03



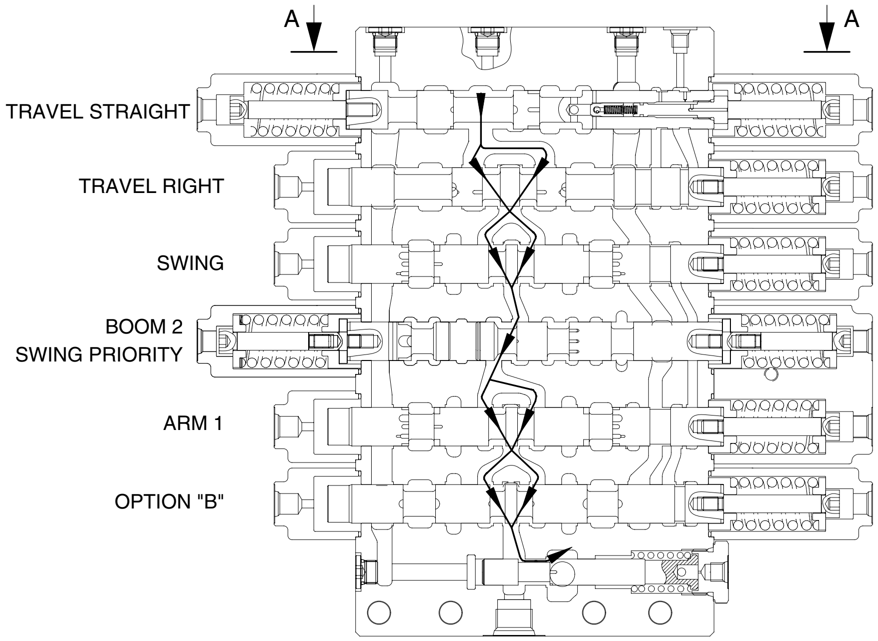
SECTION A - A

3009A2MC04

(2) P2 SIDE

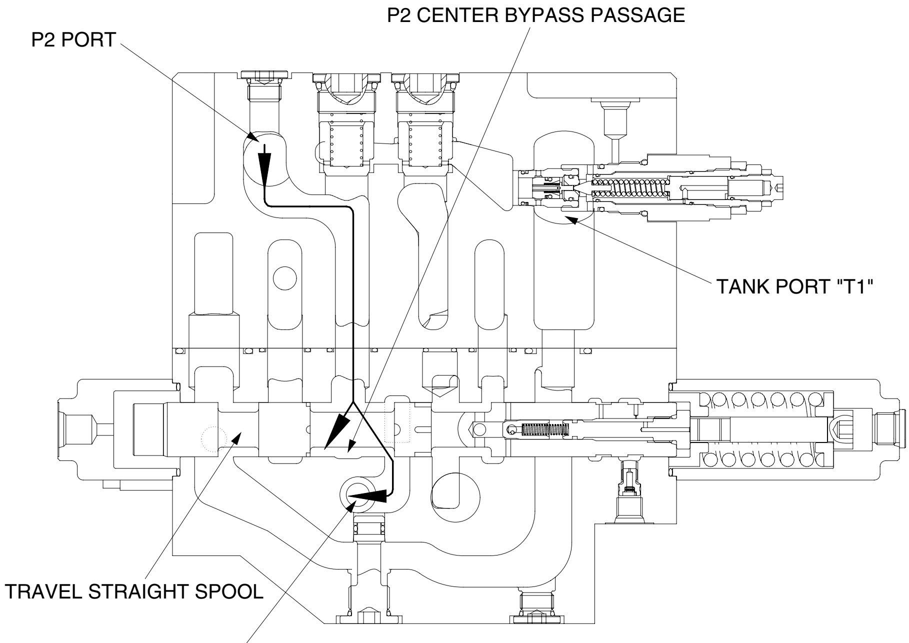
The hydraulic fluid from pump flows into the main control valve through the inlet port "P2", pass the land of the straight travel spool, into the P2 bypass passage and P2 parallel passage.

When the straight travel spool is in neutral position, the bypass passage is not shut off. Then the hydraulic fluid from the pump P2 is directed to the tank through the bypass passage of spools : travel right, swing, boom 2 & swing priority, arm 1, option "B" and option "C" of bypass passage summation, and the negative relief valve of P2, the tank passage and the tank port "T1".



P2 SPOOL SECTION

300L2MC03



SECTION A - A

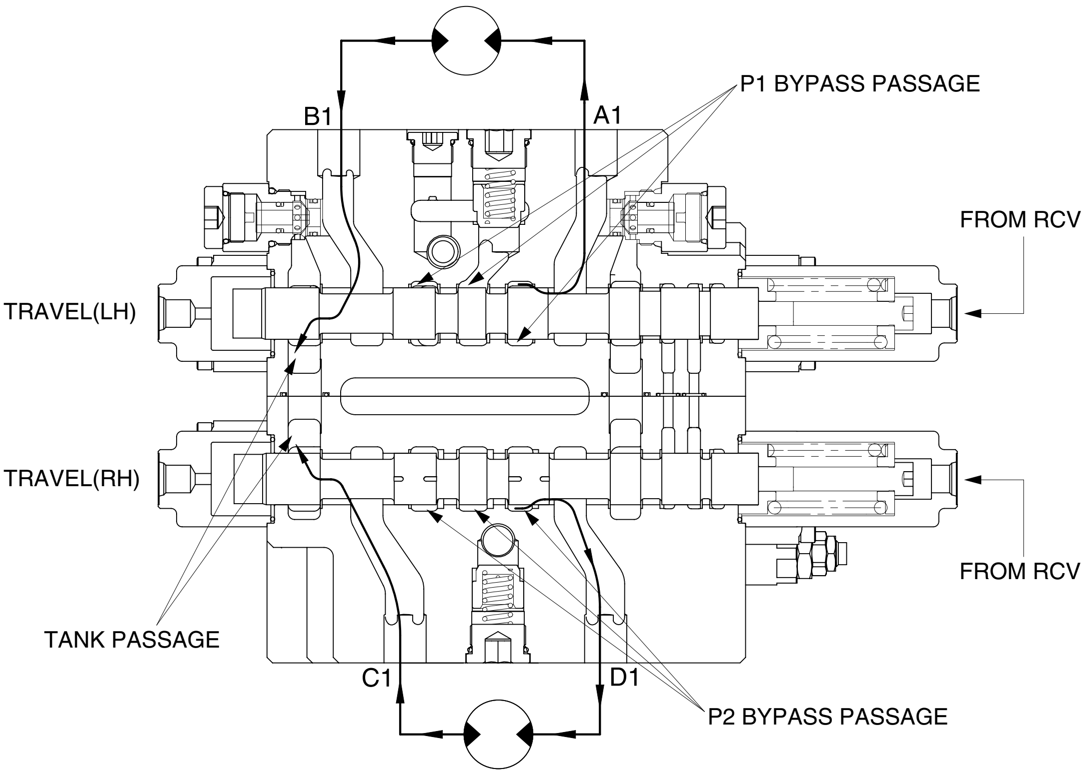
3009A2MC05

2) TRAVEL OPERATION

(1) TRAVEL FORWARD OPERATION

During the travel forward operation, the pilot pressure of RCV is supplied to the port of the spring side, and it shifts travel right and left spools in the left direction against springs. Hydraulic fluid from the pump flows into the bypass passage of travel spool through the land of the straight travel spool.

Then the bypass passage is shut off by the movement of the spool, they are directed to the each travel motor through port B1 and D1. At the same time, the hydraulic fluid from the each travel motor through port A1 and C1 returns to the tank passage through the travel spools.

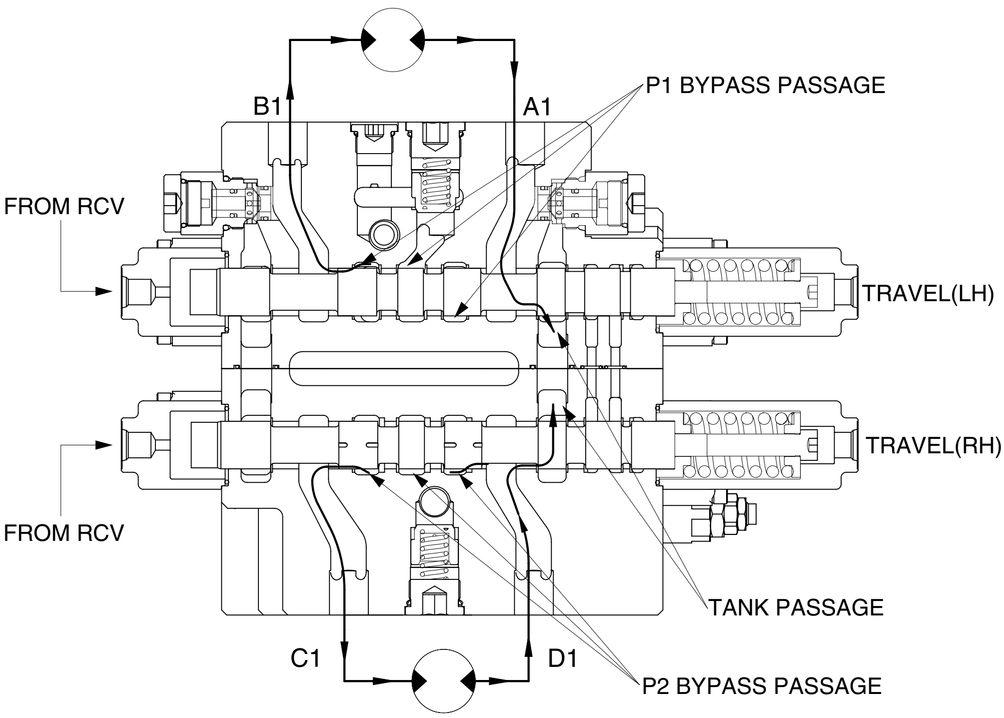


29092MC07

(2) TRAVEL REVERSE OPERATION

During the travel reverse operation, the pilot pressure of RCV is supplied to the port of the spring opposite side, and it shifts travel right and left spools in the right direction against springs. Hydraulic fluid from the pump flows into the bypass passage of travel spool through the land of the straight travel spool.

Then the bypass passage is shut off by the movement of the spool, they are directed to the each travel motor through port A1 and C1. At the same time, the hydraulic fluid from the each travel motor through port B1 and D1 returns to the tank passage through the travel spools.



29092MC08

(3) TRAVEL STRAIGHT FUNCTION

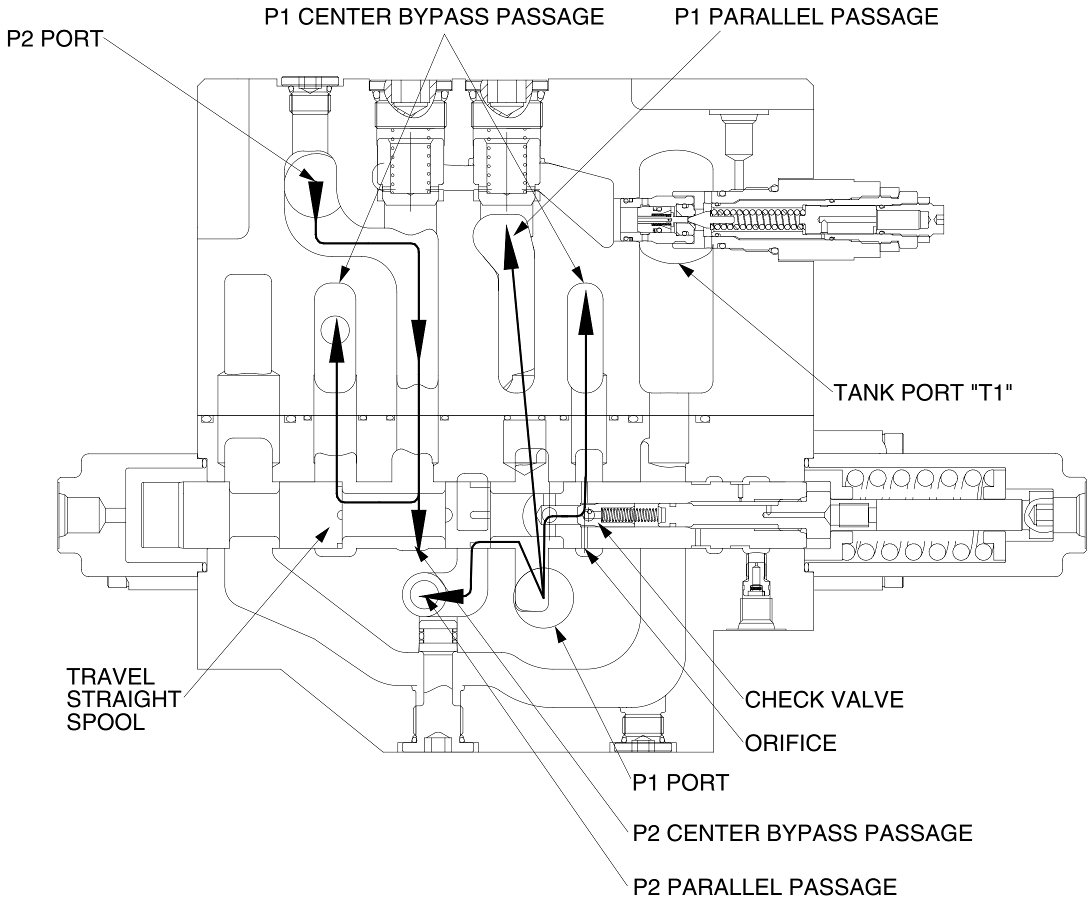
Straight travel valve is the valve for keeping traveling straight when boom, arm, bucket or swing is operated at the time of traveling. Therefore the oil from the P1 and P2 pump flows into the control valve through the each passage in neutral condition.

When the both travels and any of attachment is switched, the pilot pressure is applied the port of spring chamber and the travel straight spool is shifted.

When the straight travel spool is switched, the oil pressure from P1 is led to the each attachment switching section through the P1 and P2 parallel passage. Also some of oil id combined with bypass of P1 side by opening of check valve of spool inside through the orifice of the straight travel spool.

On the other hand, the oil from P2 is supplied to the both travel section through P1 and P2 bypass passage.

Therefore, when attachment is switched at the time of both travels, since the oil of P2 mainly flows to both travels, and the oil of P1 mainly flows to attachments, it can keep traveling straight.



29092MC09

3) BOOM OPERATION

(1) BOOM UP OPERATION

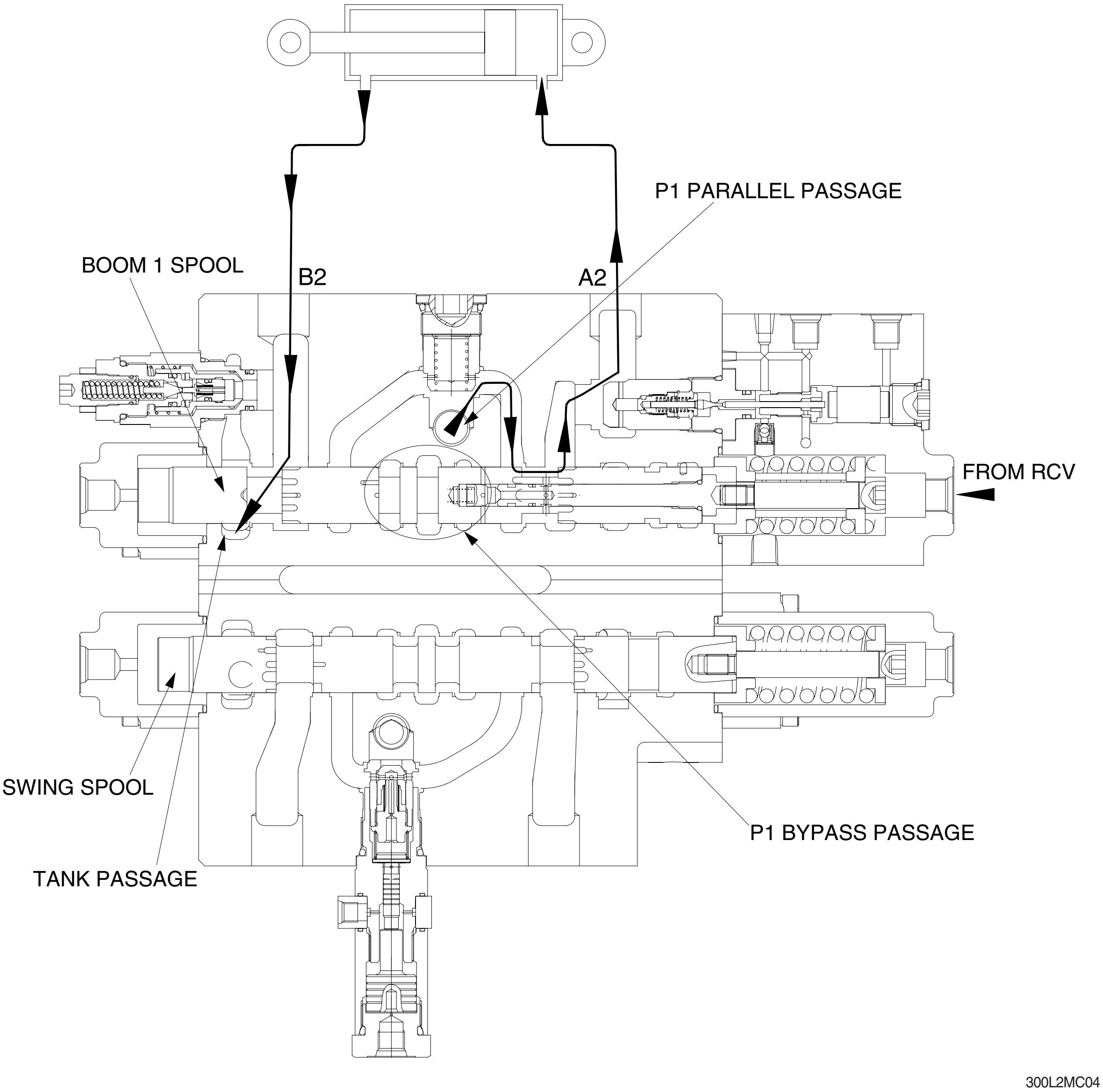
During boom up operation, the pilot secondary pressure from RCV is supplied to the port of the spring side and shifts the boom 1 spool in the left direction. The bypass passage is shut off by the movement of the spool and the hydraulic oil fluid from pump P1 is entered P1 parallel passage and then passes through the load check valve, bridge passage and boom holding valve then flows into the port A2.

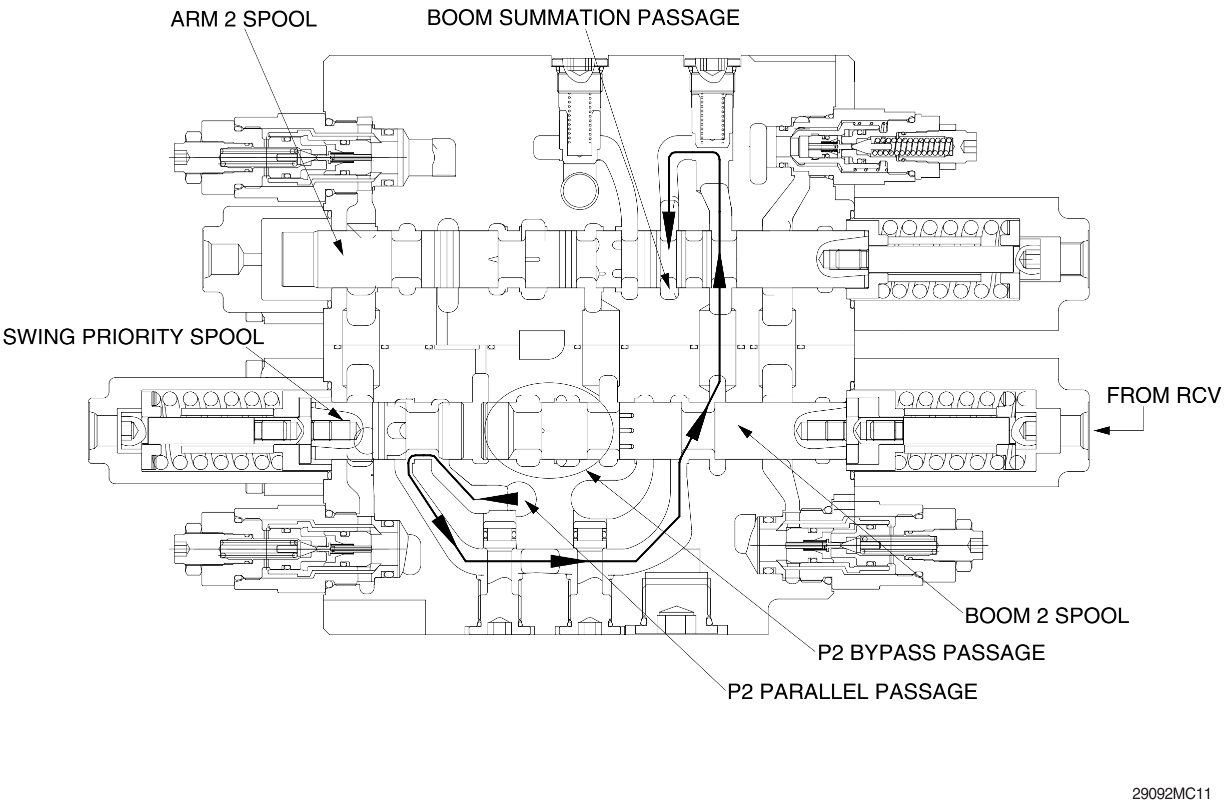
Following this it flows into the head side of the boom cylinder.

(In this case, the boom holding valve is free flow condition)

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

At the same time, the flow from rod side of the boom cylinder return to the boom 1 spool through




ARM 2 SPOOL
BOOM SUMMATION PASSAGE
SWING PRIORITY SPOOL
FROM RCV
BOOM 2 SPOOL
P2 BYPASS PASSAGE
P2 PARALLEL PASSAGE
29092MC11

(2) BOOM DOWN OPERATION

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

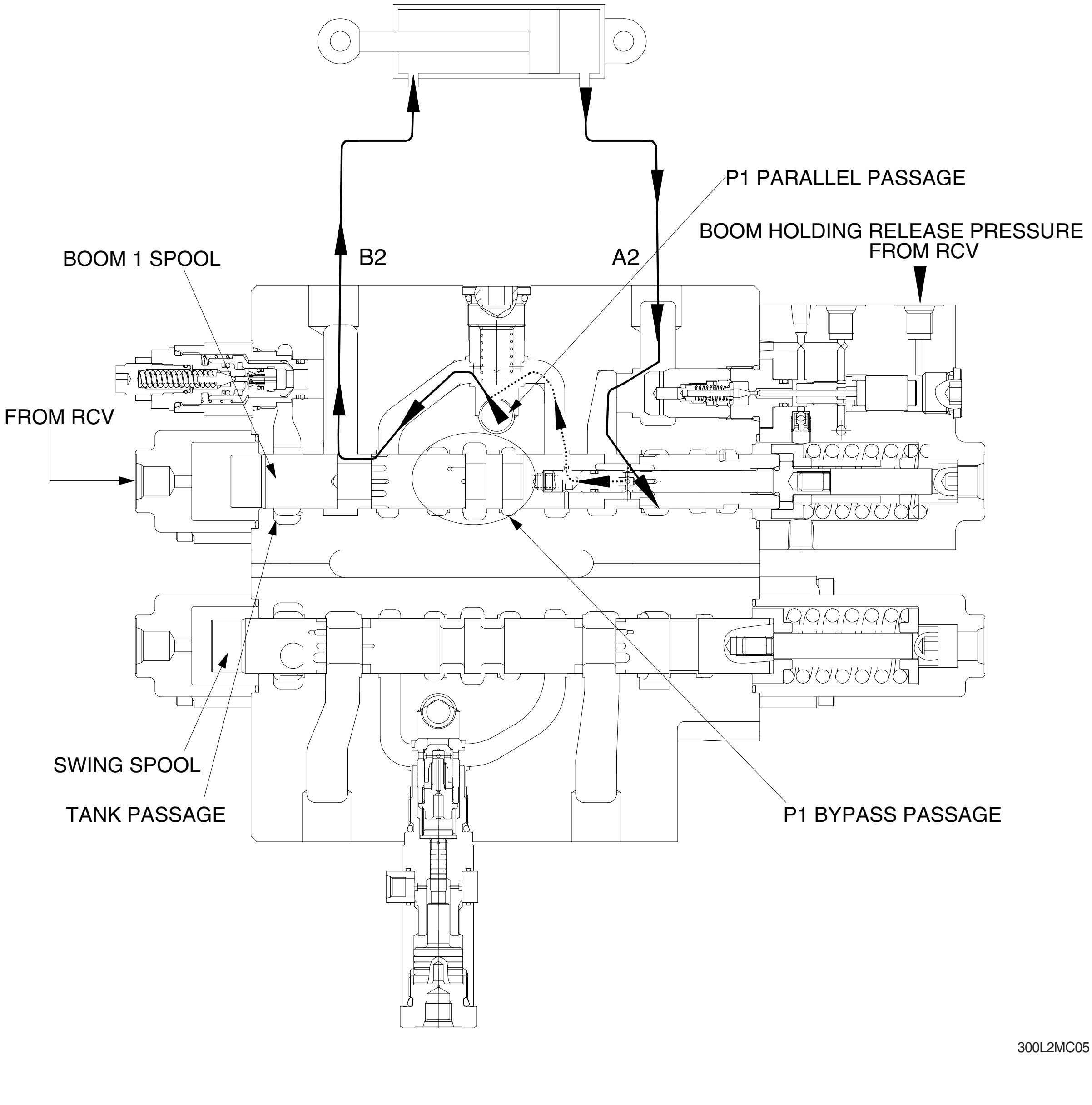
The bypass passage is shut off by the movement of the spool and the hydraulic fluid from the pump P1 enters the parallel passage and is directed to the port B2 through the load check valve. Following this, it flows into the rod side of the boom cylinder.

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

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

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

During the boom lowering operation, the fluid from P2 pump is not summation.

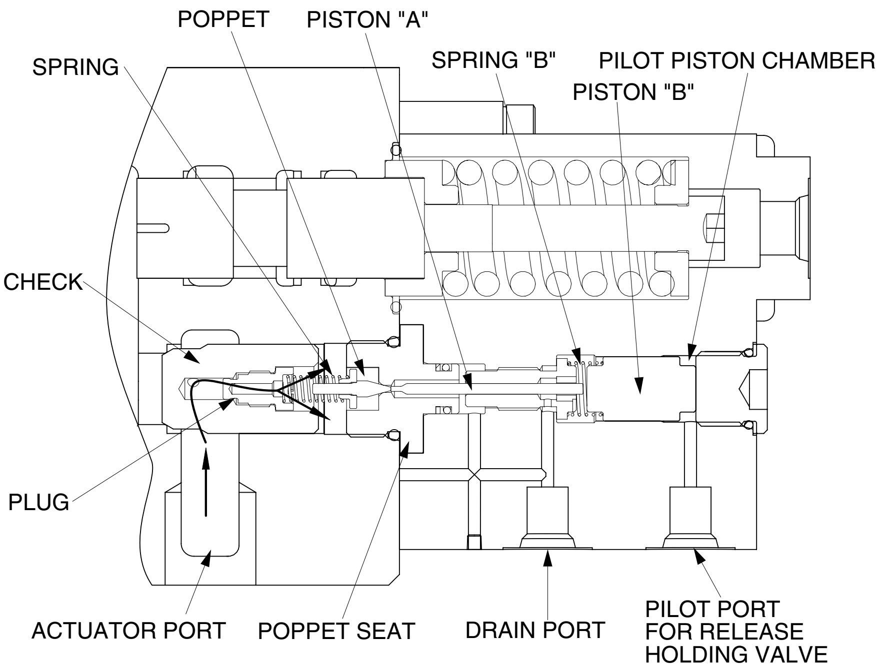


300L2MC05

4) HOLDING VALVE OPERATION

(1) HOLDING OPERATION

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



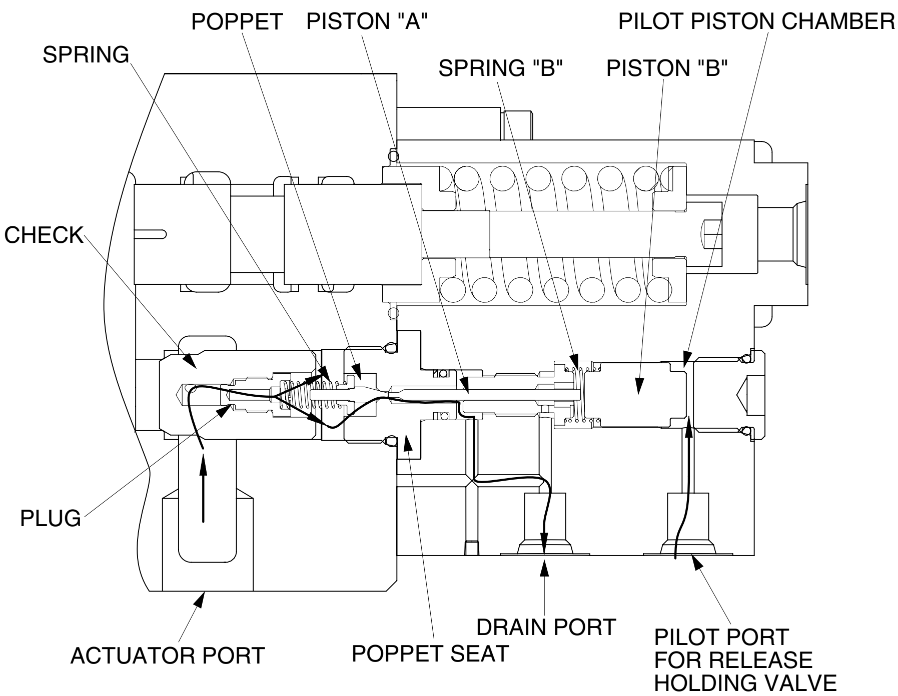
29092MC13

(2) RELEASE HOLDING OPERATION

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

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

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



29092MC14

5) BUCKET OPERATION

(1) BUCKET IN OPERATION (TYPE 1 & 2)

① Bucket operation only

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

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port A5 through the check2.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check1.

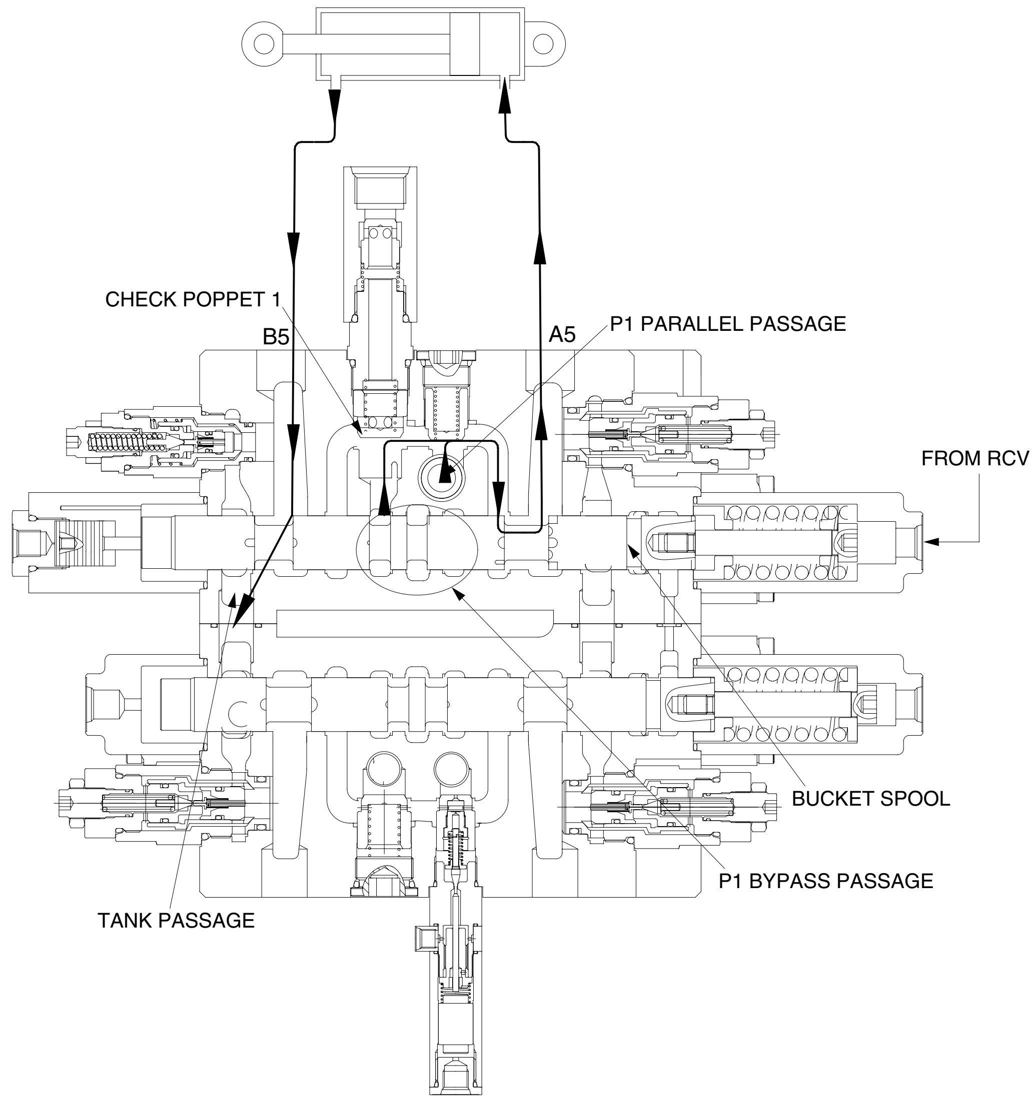
Following this it flows into the head side of the bucket cylinder.

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

② Bucket operation with arm or boom operation

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

So only the fluid from parallel passage is supplied to the bucket cylinder. Also, parallel passage is installed the orifice for supplying the fluid from pump to the boom or the arm operation prior to the bucket operation.



300L2MC21

(1) BUCKET IN OPERATION (TYPE 3 & 4)

① **Bucket operation only**

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

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port A5 through the check2.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check1.

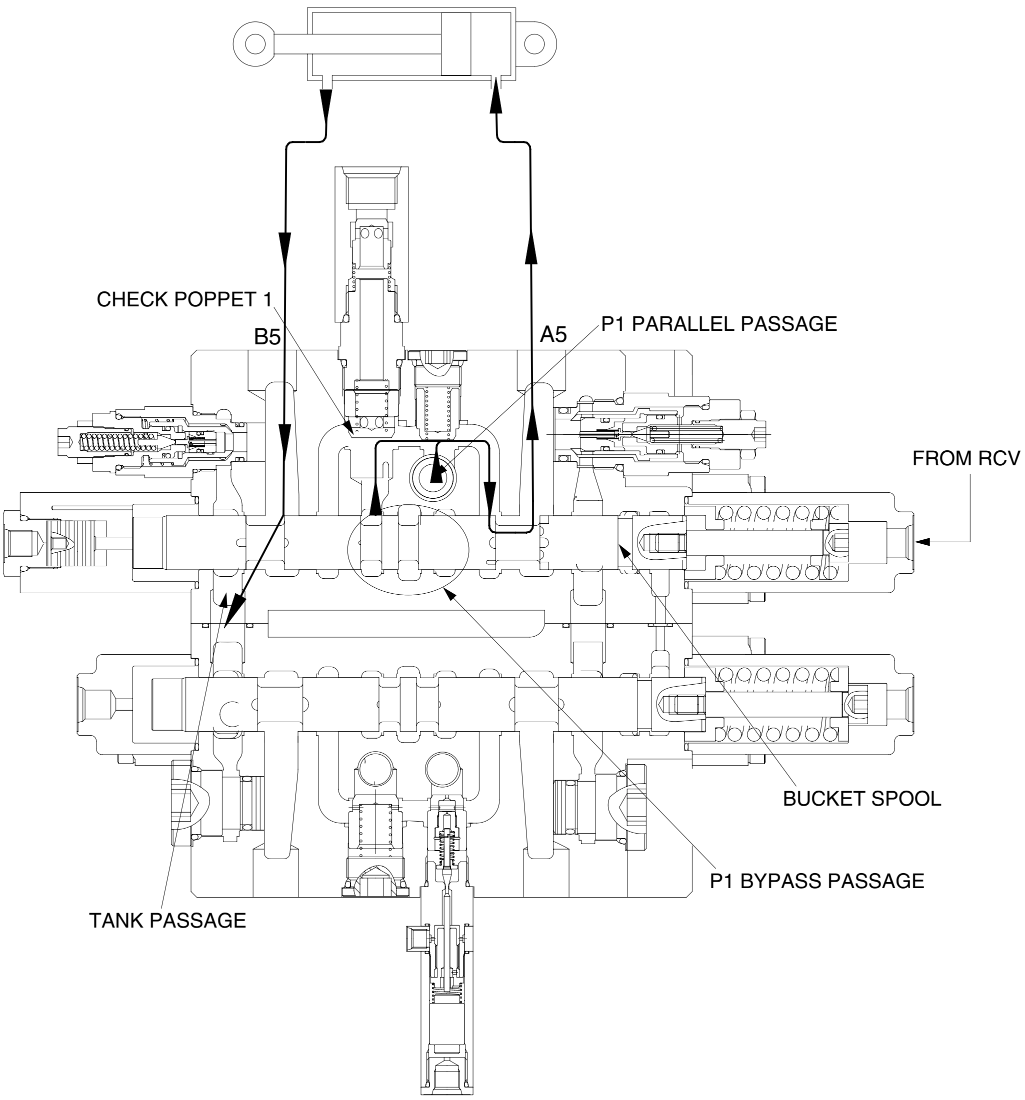
Following this it flows into the head side of the bucket cylinder.

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

② **Bucket operation with arm or boom operation**

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

So only the fluid from parallel passage is supplied to the bucket cylinder. Also, parallel passage is installed the orifice for supplying the fluid from pump to the boom or the arm operation prior to the bucket operation.



300L2MC121

(2) BUCKET OUT OPERATION (TYPE 1 & 2)

① **Bucket operation only**

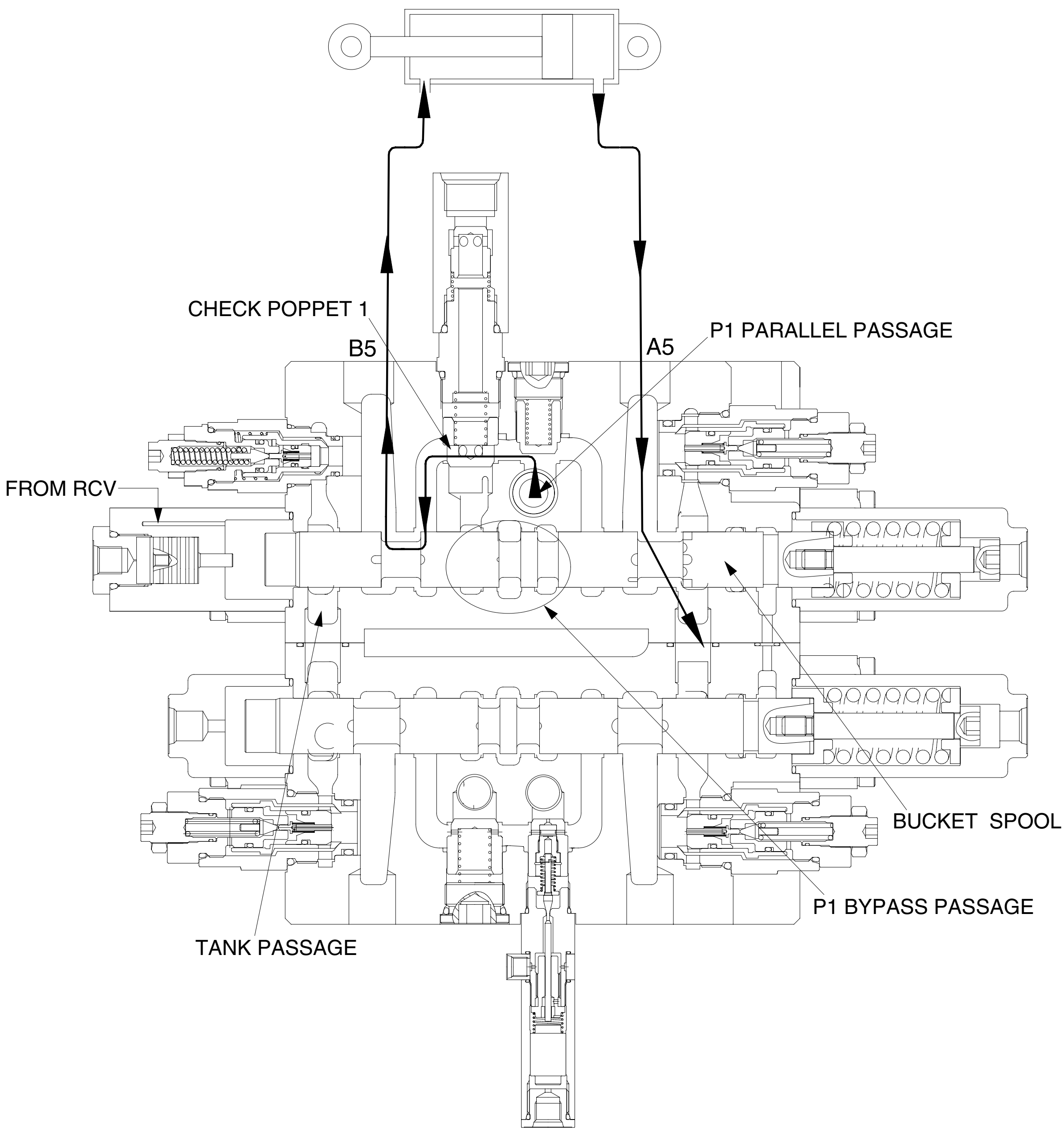
During the bucket out operation, the pilot secondary pressure from RCV is supplied to port of the spring opposite side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B5 through the check1.

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

② **Bucket operation with arm or boom operation**

When combined operation, the same as above.



300L2MC23

(2) BUCKET OUT OPERATION (TYPE 3 & 4)

① Bucket operation only

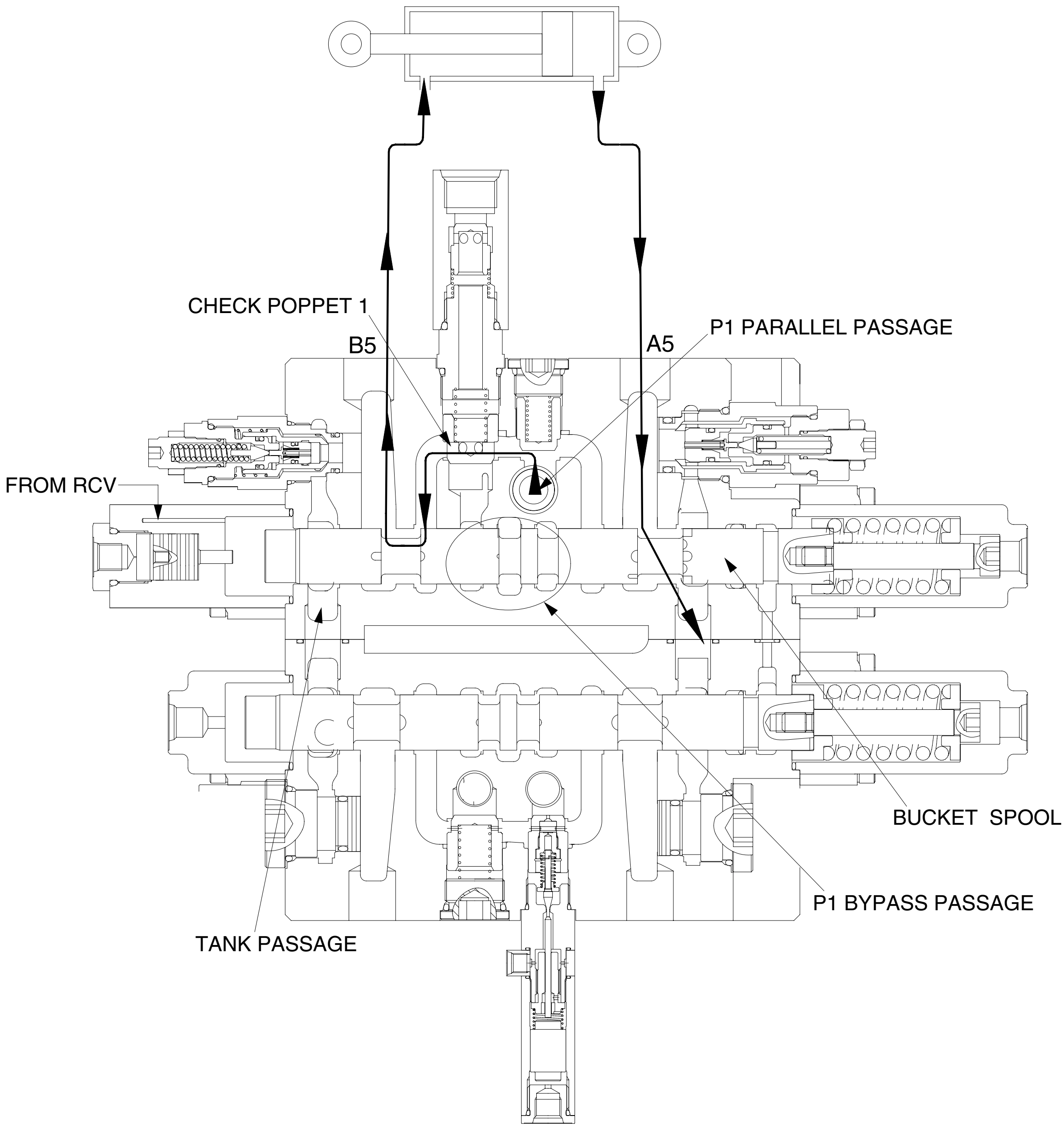
During the bucket out operation, the pilot secondary pressure from RCV is supplied to port of the spring opposite side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B5 through the check1.

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

② Bucket operation with arm or boom operation

When combined operation, the same as above.



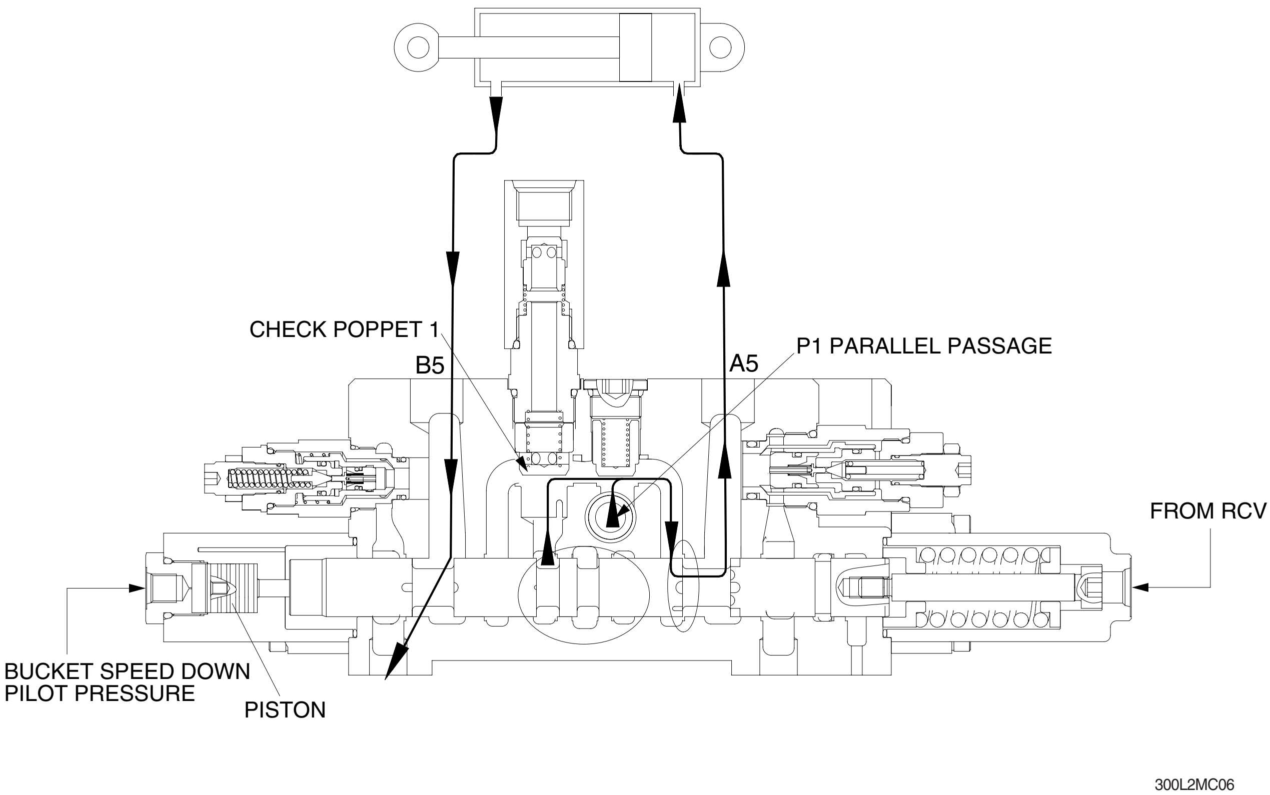
300L2MC123

(3) BUCKET SLOW OPERATION

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

When the boom up operation, the boom up pilot pressure is supplied the pilot port of bucket spool stroke limit and the piston is shifted to the right and then the bucket spool stroke is limited and the open of the bucket spool is reduced.

Accordingly, the oil of the bucket spool is reduced and the boom speed up.



6) SWING OPERATION

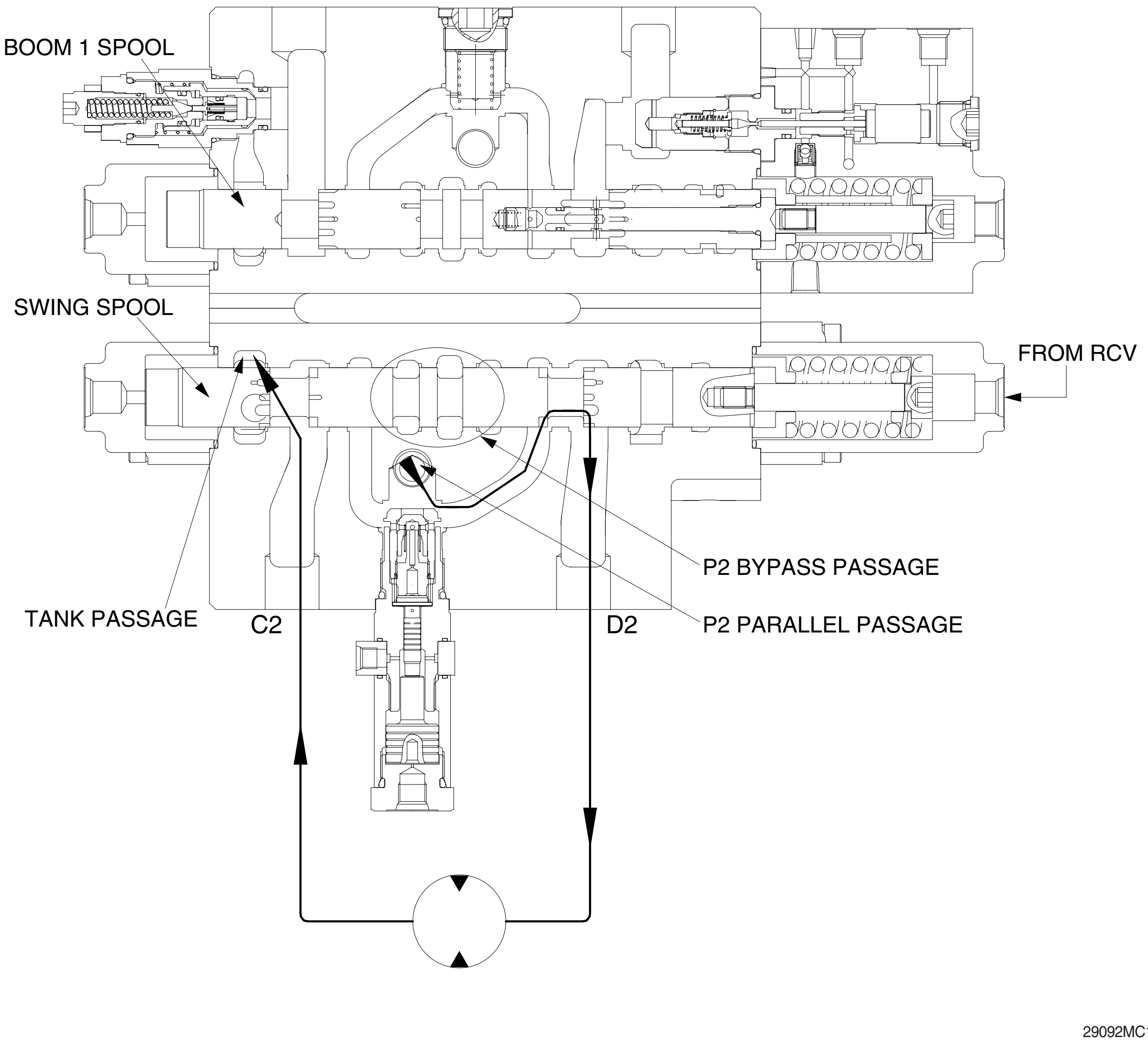
(1) SWING LEFT & RIGHT OPERATION

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

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

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

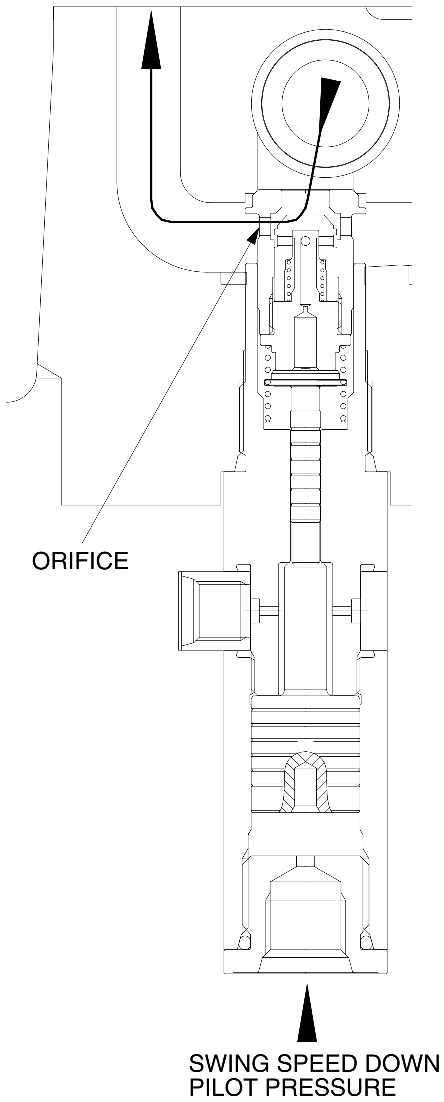
Accordingly, the hydraulic fluid from pump P2 flows into swing motor through the port C2 and returns to the hydraulic oil tank through the port D2 and the tank passage.



(2) SWING SLOW DOWN OPERATION

This operation is used to speed up the boom or arm by reducing the swing speed when swing operation with boom or arm operation.

The poppet of swing logic valve is closed by the pilot pressure of swing speed down is supplied to the port, the fluid from the port P2 is drained through orifice. Accordingly, the fluid from the port P2 is reduced and swing speed is slow down.



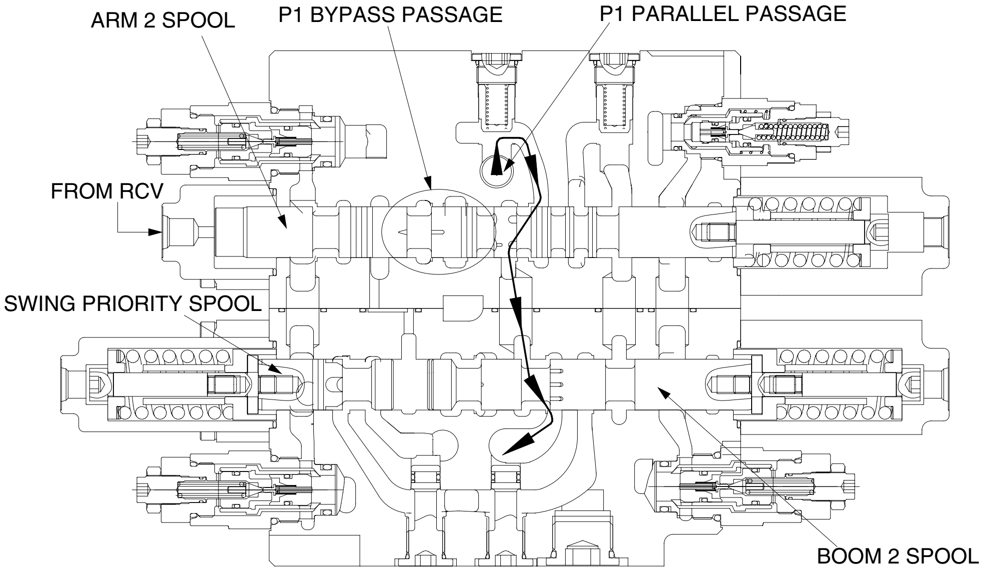
7) ARM OPERATION

(1) ARM IN OPERATION

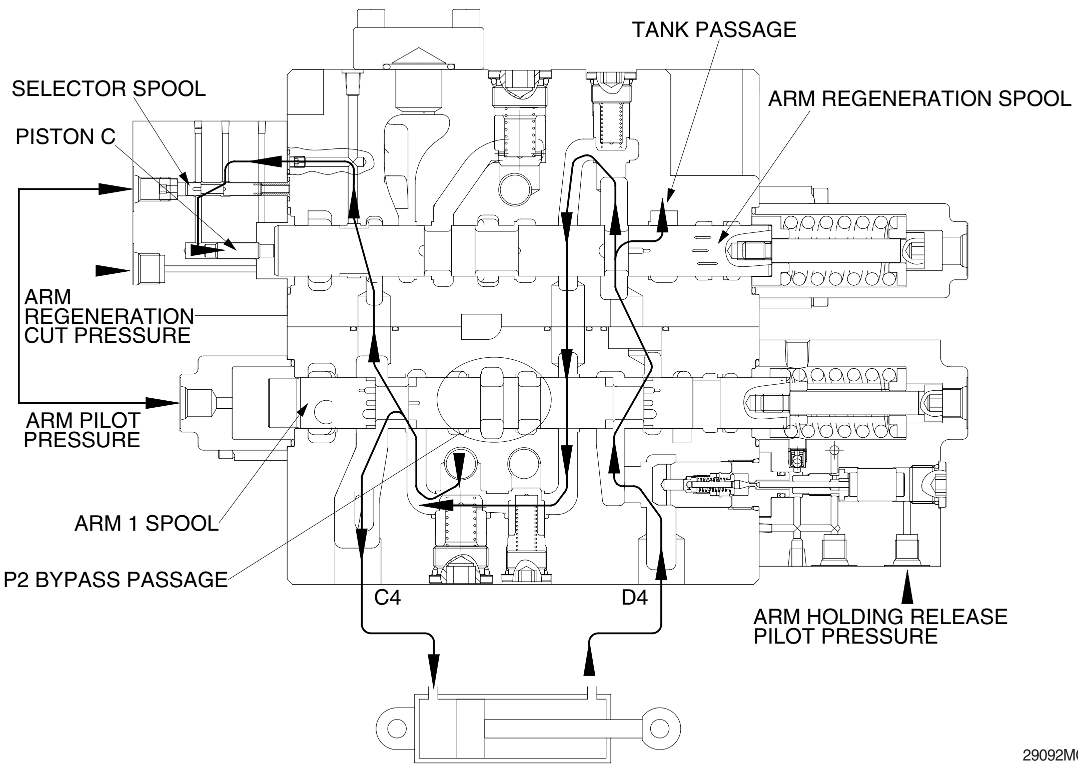
During arm in operation, the pilot secondary pressure from the RCV is supplied to the port of spring opposite side and shifts arm 1 spool in the right direction.

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

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



29092MC20



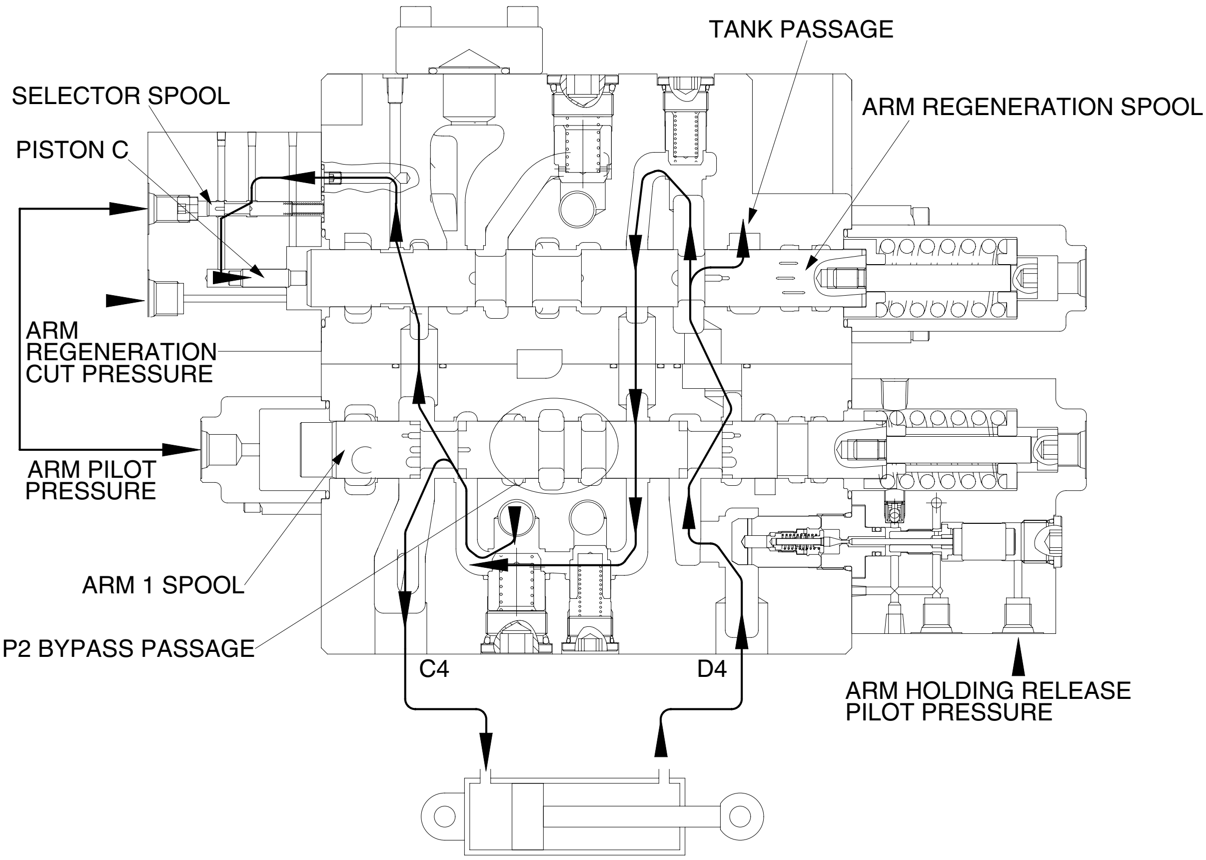
29092MC21

ARM REGENERATION

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

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

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



29092MC21

(2) ARM OUT OPERATION

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

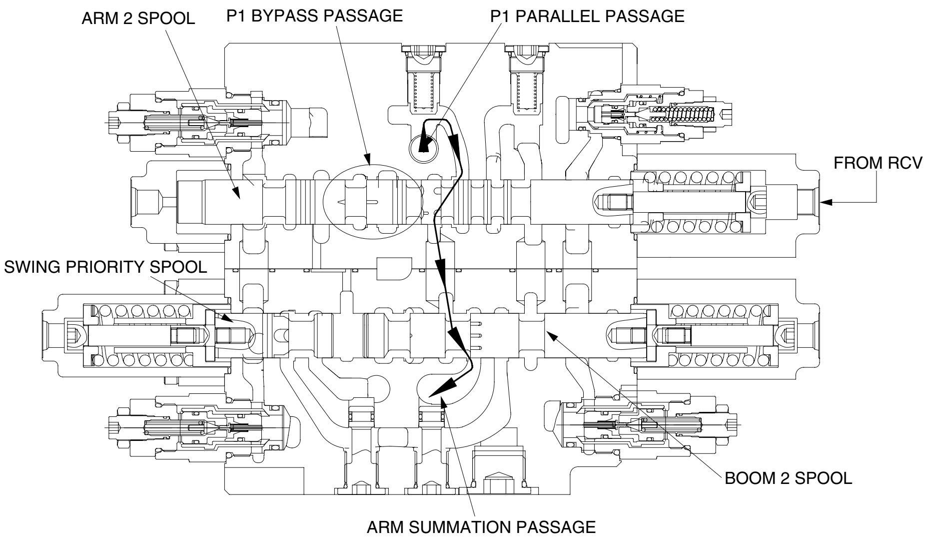
The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P2 flows into arm 1 spool through the parallel passage. Then it enters into the arm cylinder rod side through the load check valve, bridge passage, arm holding valve and the port D4.

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

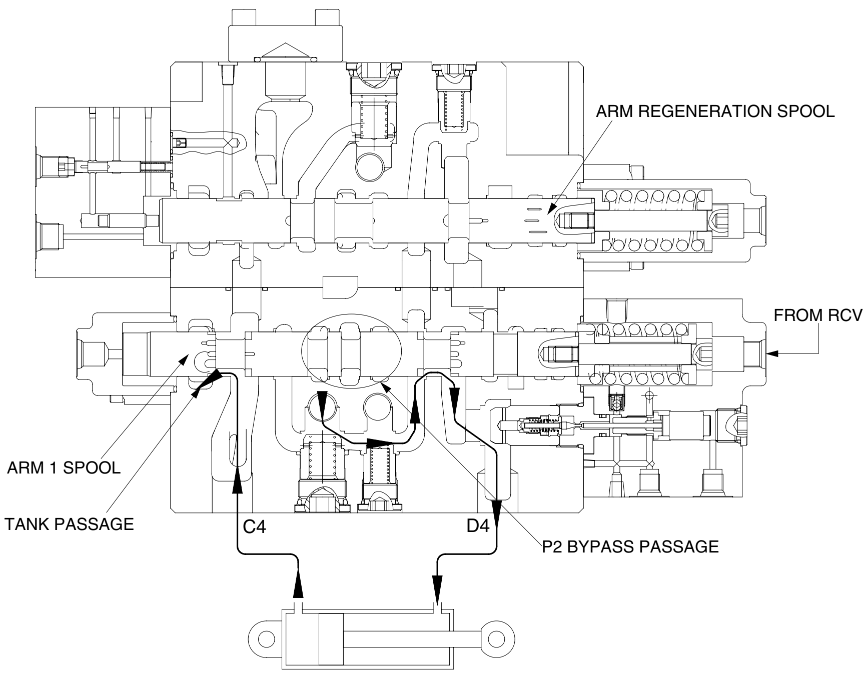
The bypass passage is shut off by the movement of the spool and some of the hydraulic fluid from pump P2 bypassed through bypass notch. The rest of hydraulic fluid from pump P2 flows into the arm summation passage through P1 parallel passage the check valve arm 2 spool and boom 2 spool.

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

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



29092MC22



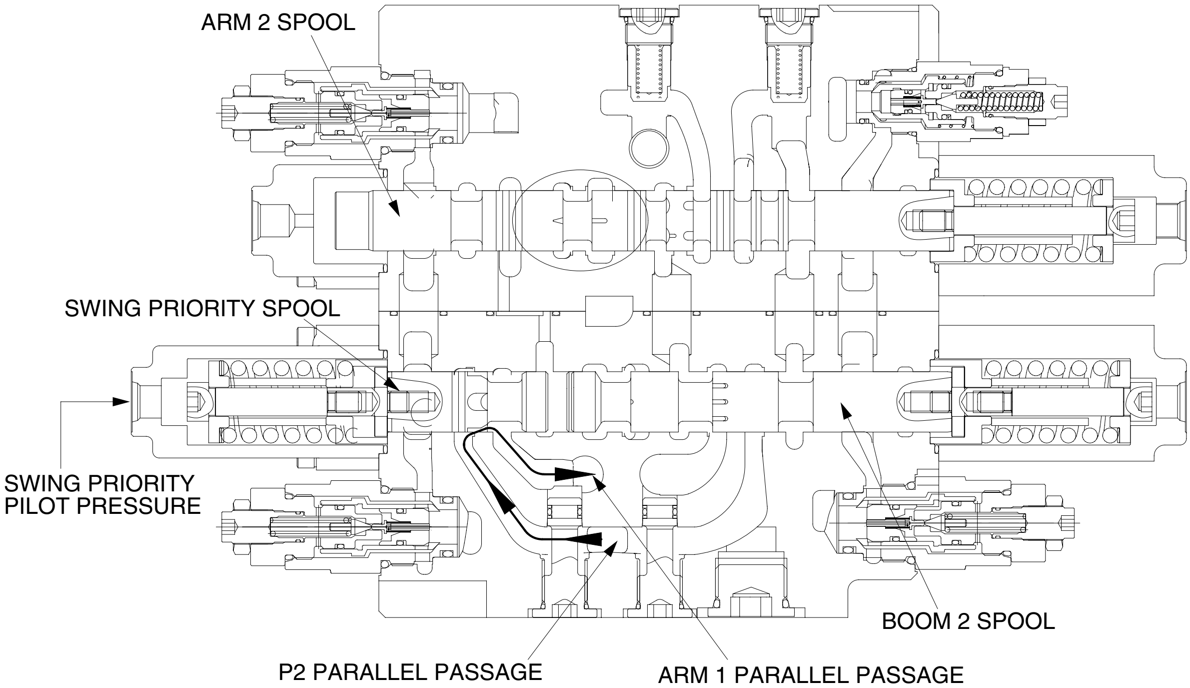
29092MC23

8) SWING PRIORITY FUNCTION

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 in the right direction.

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

When the swing priority spool is neutral condition, the passage is same as normal condition. But due to shifting of the swing priority spool, the fluid from pump P2 flows to swing side more then the boom 2, arm 1, option B and bucket summation spools to make the swing operation most preferential.



29092MC24

9) OPERATION OF OPTION

(1) OPERATION BY PUMP P2

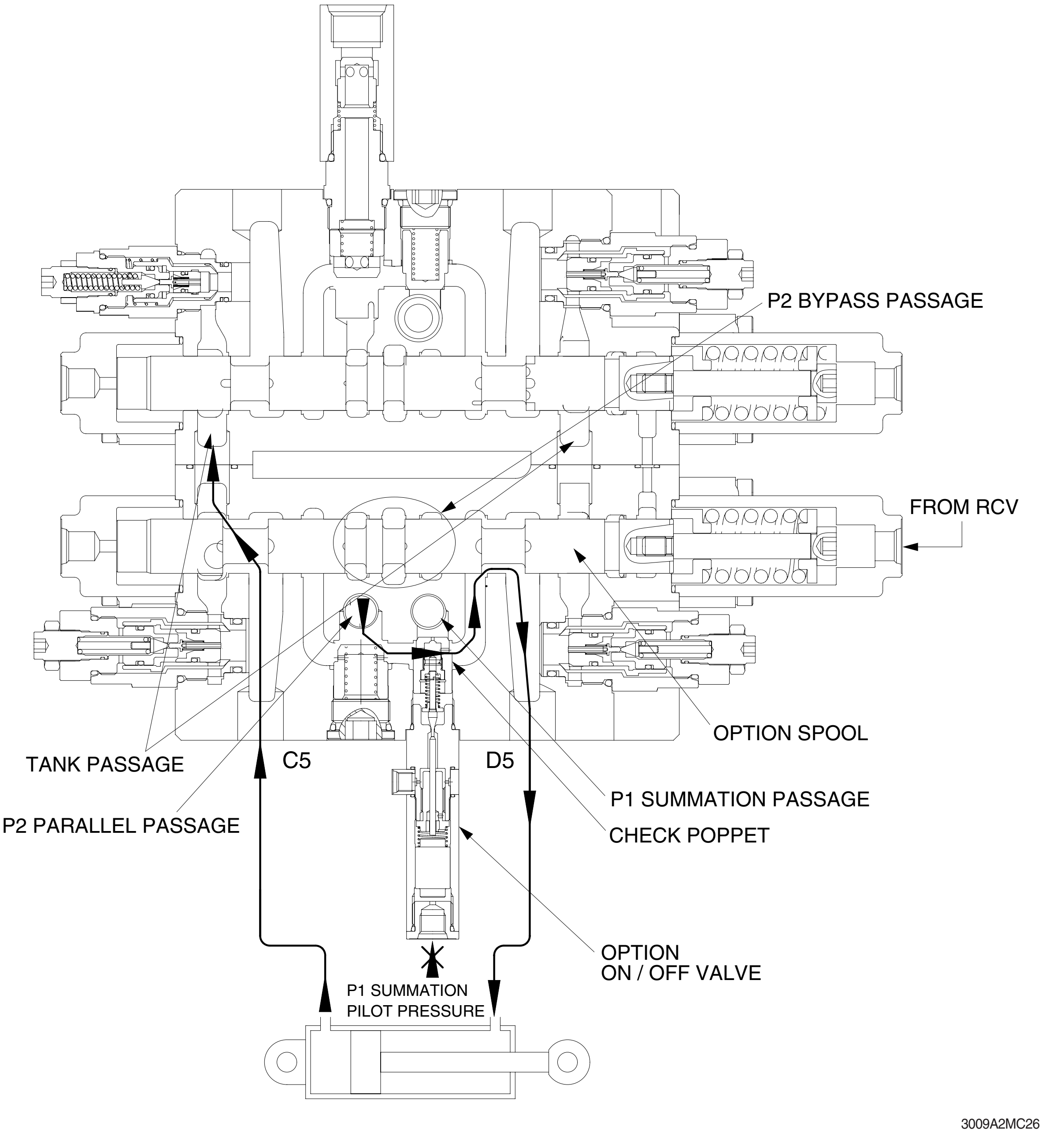
The pilot secondary pressure from RCV is supplied to the port of spring side and shifts option spool as the figure.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P2 flows into actuator through the load check valve, bridge passage and port D5.

If the pilot pressure is not supplied to P1 summation pilot port and is not shifts arm 2 spool. Accordingly, the pump P1 fluid connected the parallel passage is not flowing the check poppet of option ON/OFF valve and the fluid from pump is not joined the fluid from P2.

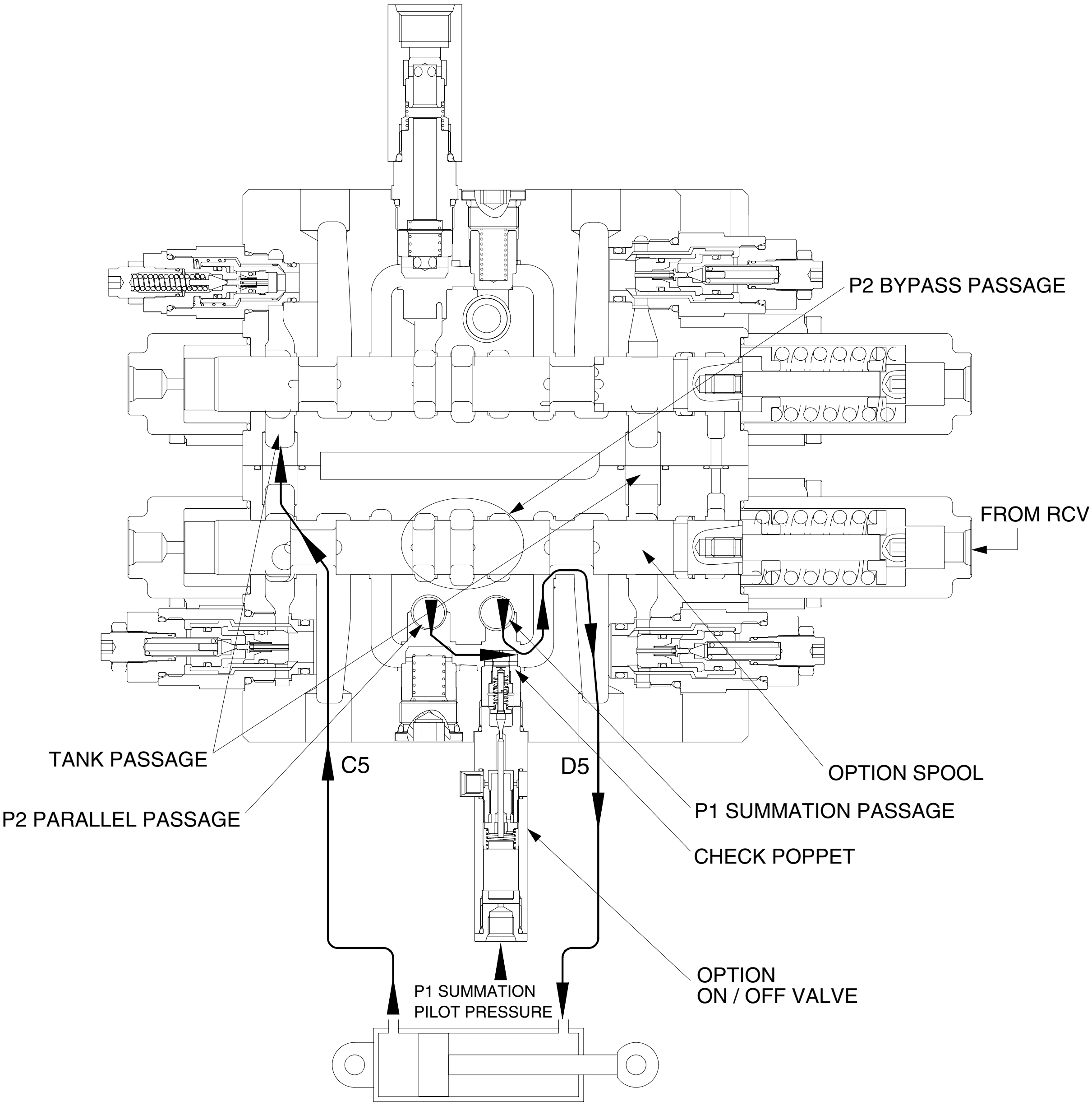
At the same time, the fluid from actuator returns to the tank passage through port C5 and notch of the option spool.

In case of reverse operation, the operating principle is same as above.



10) SUMMATION OPERATION WITH PUMP P1

The pilot pressure from RCV is supplied to option pilot port and one of arm 2 pilot port at the same time, the fluid for the arm summation is build up. This fluid flows into the arm 1 spool priority but the arm is not operated, the fluid flows into P1 summation passage. Now the pilot pressure of RCV is supplied to the P1 summation pilot port of option ON/OFF valve, the fluid from pump P1 opens the load check valve and flows into port D5 with the fluid of pump P2.



3009A2MC27

11) NEGATIVE RELIEF VALVE OPERATION

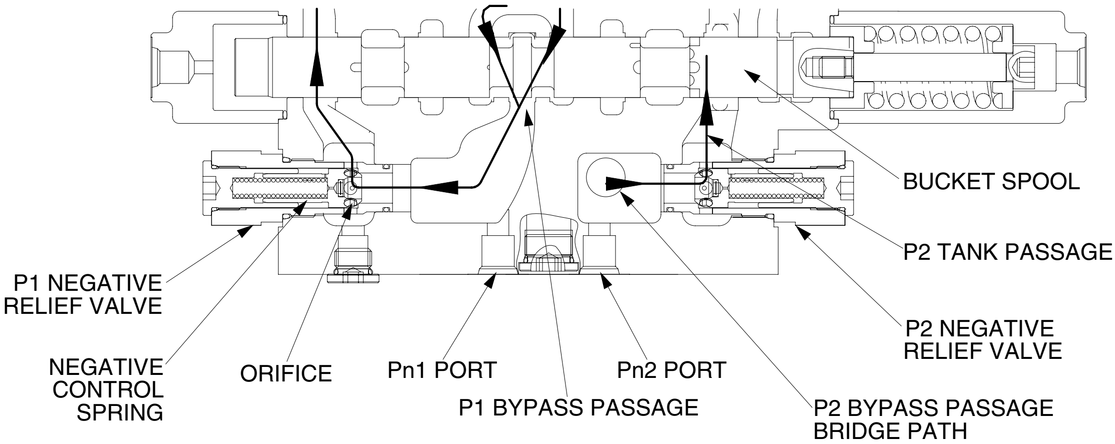
When no function is being actuated on P1 side, the hydraulic fluid from the pump P1, flows into the tank passage through the bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump P1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

It controls the pump regulator so as to minimize the discharge of the pump P1.

The bypass passage is shut off when the shifting of one or more spools and the flow through bypass passage became zero. The pressure of negative control signal becomes zero and the discharge of the pump P1 becomes maximum.

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

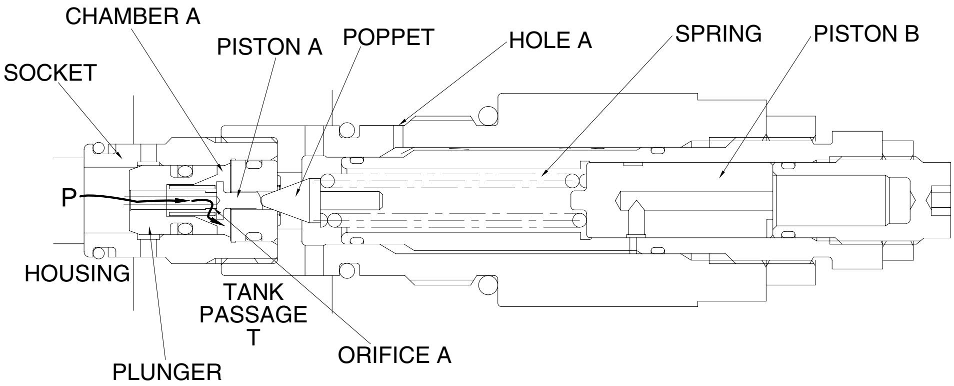
For the pump P2 the same negative control principle.



29092MC28

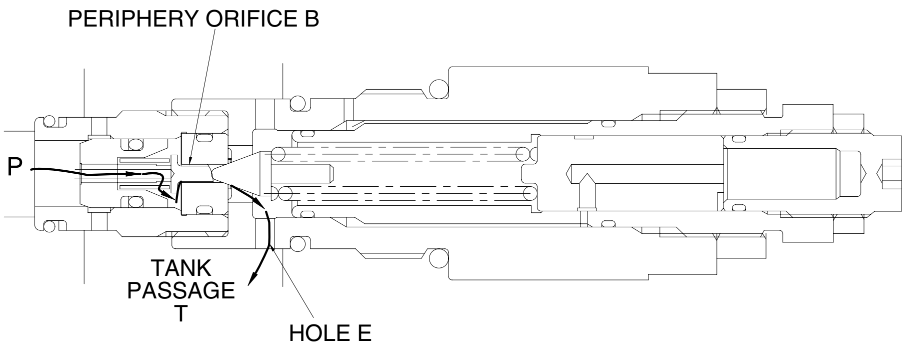
12) OPERATION OF MAIN RELIEF VALVE

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



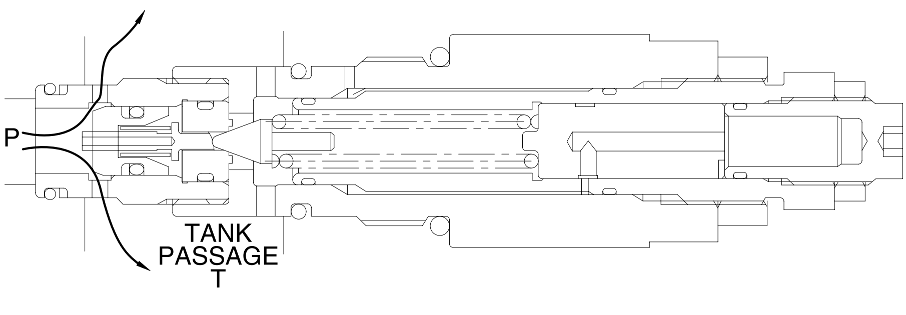
29092MC29

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



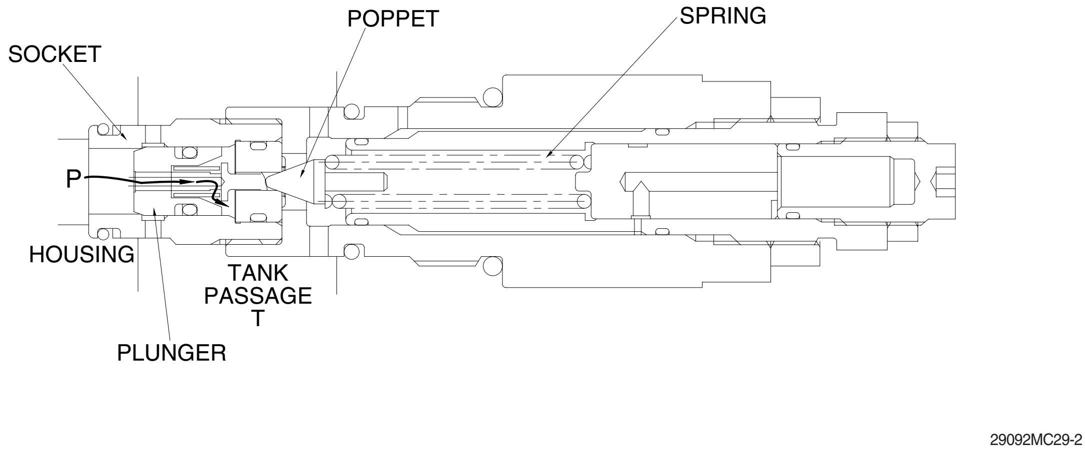
29092MC30

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

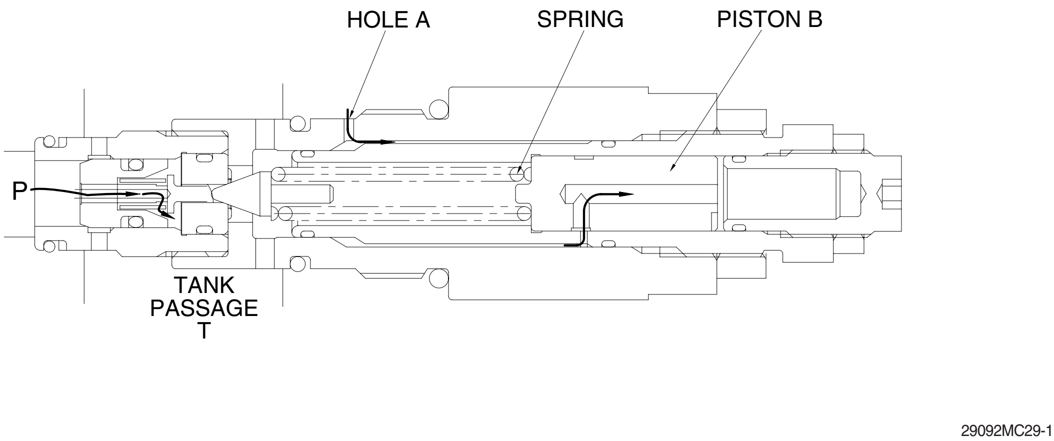


29092MC31

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



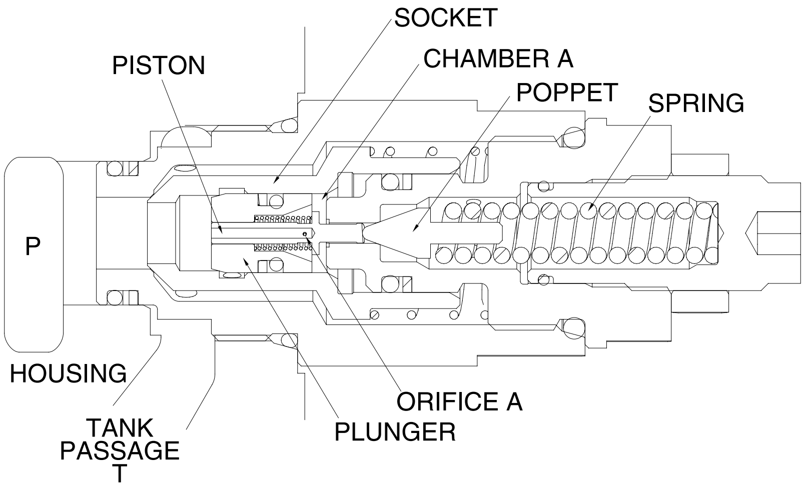
(5) When the power boost switch is ON, the pilot pressure enters through hole A.
It pushes the piston (B) in the left direction to increase the force of the spring and change the relief set pressure to the high pressure.



13) OPERATION OF OVERLOAD RELIEF VALVE

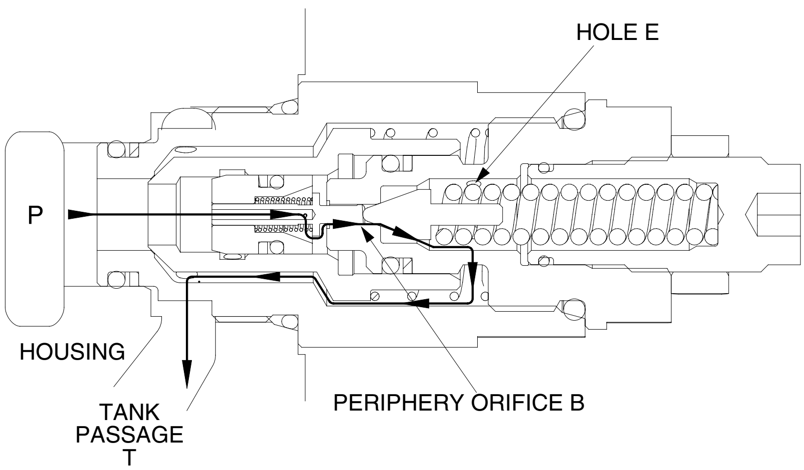
FUNCTION AS RELIEF VALVE

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



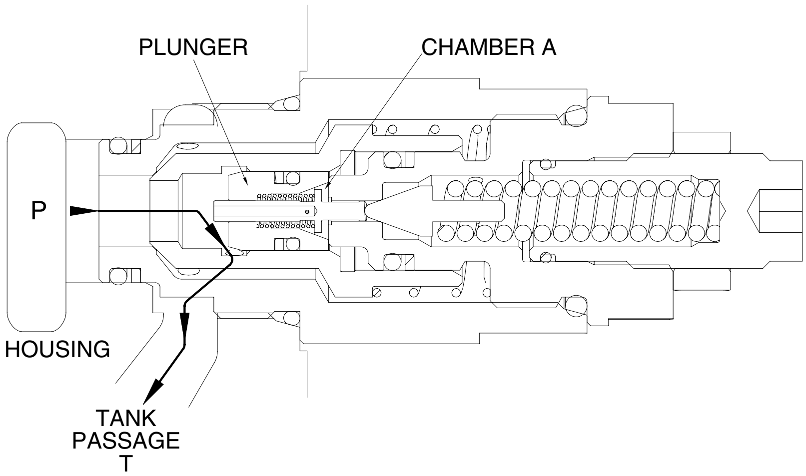
29092MC32

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



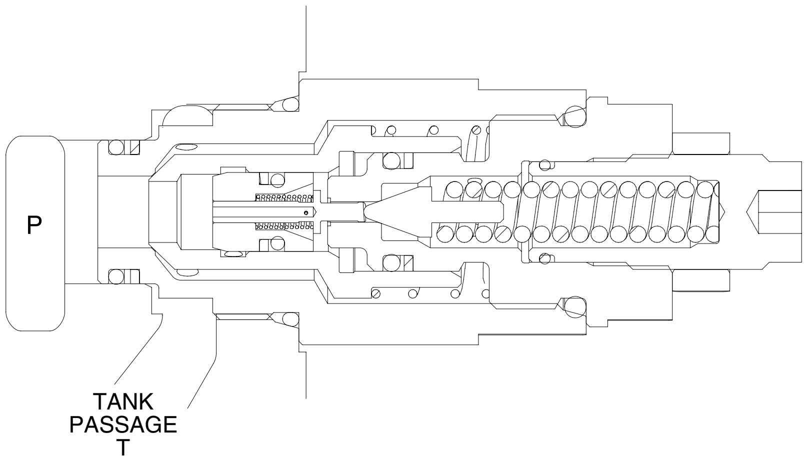
29092MC33

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



29092MC34A

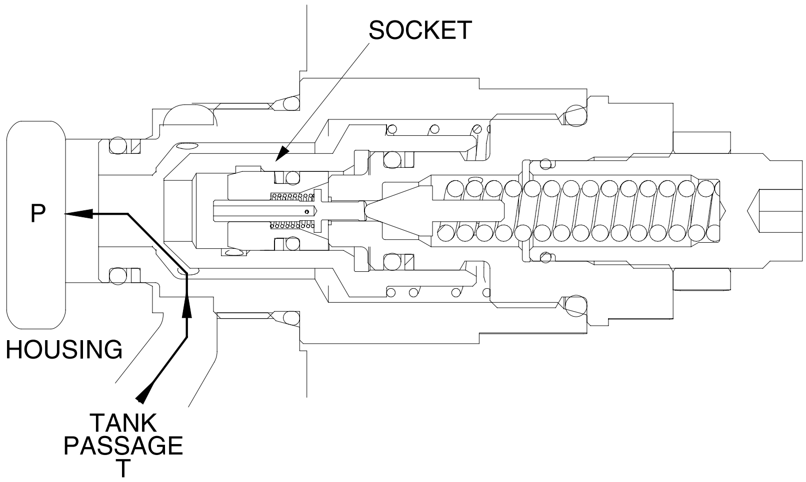
(4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



29092MC32-1

MAKE-UP FUNCTION

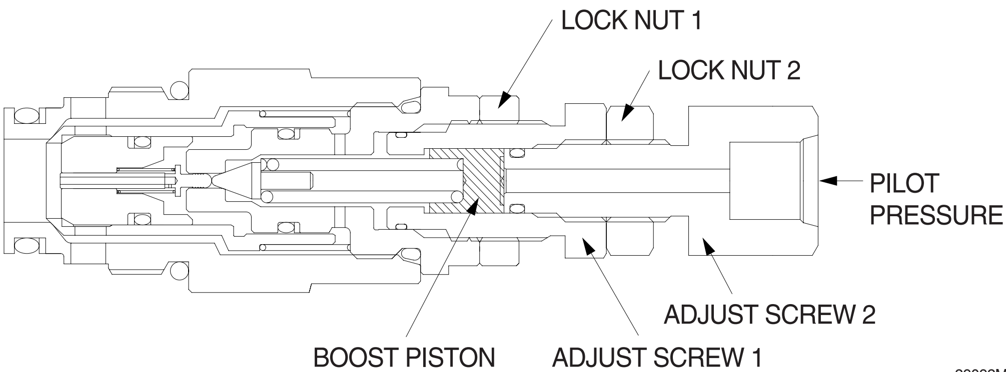
(5) When negative pressure exists at port P, the oil is supplied through tank passage (T). When the pressure at tank passage (T) becomes higher than that of at port P, the socket moves in the right direction. Then, sufficient oil passes around the socket from tank passage (T) to port P and fills up the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



29092MC35

14) BREAKER OVERLOAD RELIEF VALVE FUNCTION

(1) The structure and function of 2 stage relief valve is similar with the overload relief but it can set the higher pressure by pilot pressure.



29092MC46

Boost function

(1) When the pilot pressure is supplied, the spring is a little compressure by moving of the boost piston and the set pressure is higher as length of spring compressed.

Pressure set method

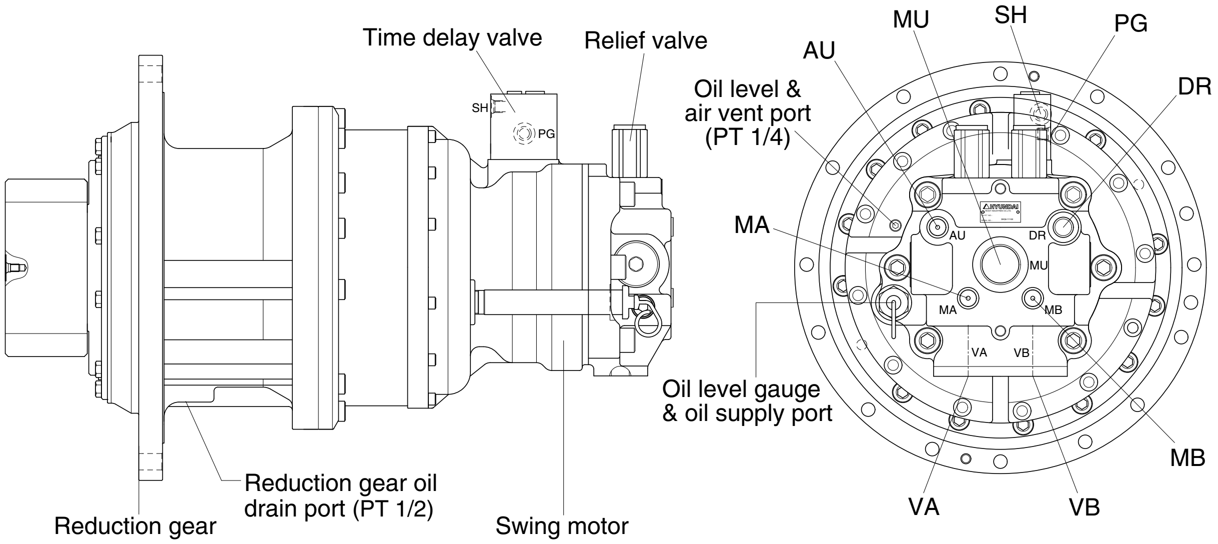
(2) Loosen lock nut 1 and 2 and then full tighten adjust screw 2.
(3) Set the high pressure by adjusting the adjust screw 1 and 2 and then fix it by the lock nut 1. Keep the adjust screw 1 do not move when fixing the lock nut 1.
(4) Set the low pressure by adjusting the adjust screw 2 and then fix it by the lock nut 2. Keep the adjust screw 2 do not move when fixing the lock nut 2.

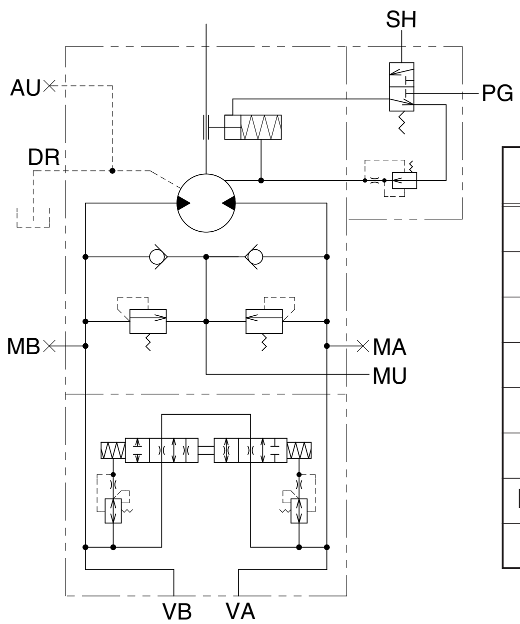
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

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



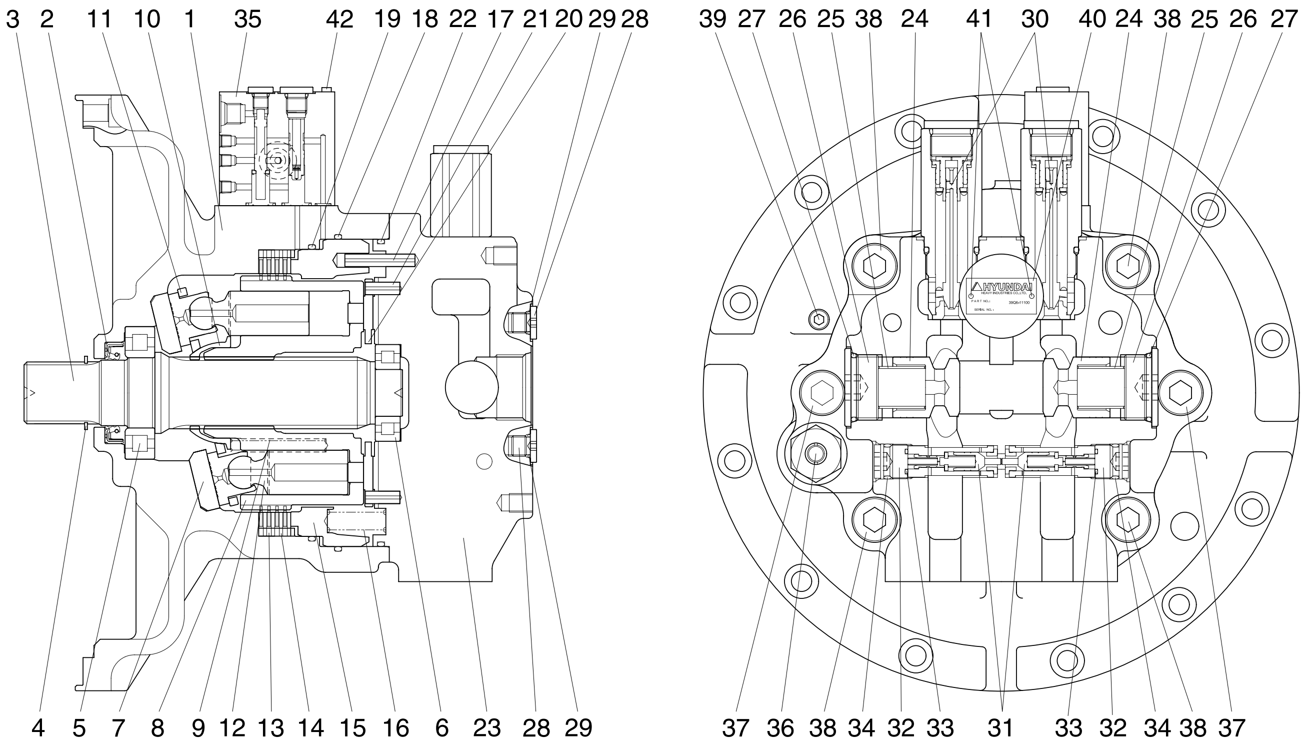


Hydraulic circuit

Port	Port name	Port size
VA	Main port	ø 20
VB	Main port	ø 20
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 port	PF 1/4
MA, MB	Gauge port	PF 1/4
AU	Air vent port	PF 1/4

300L2SM01

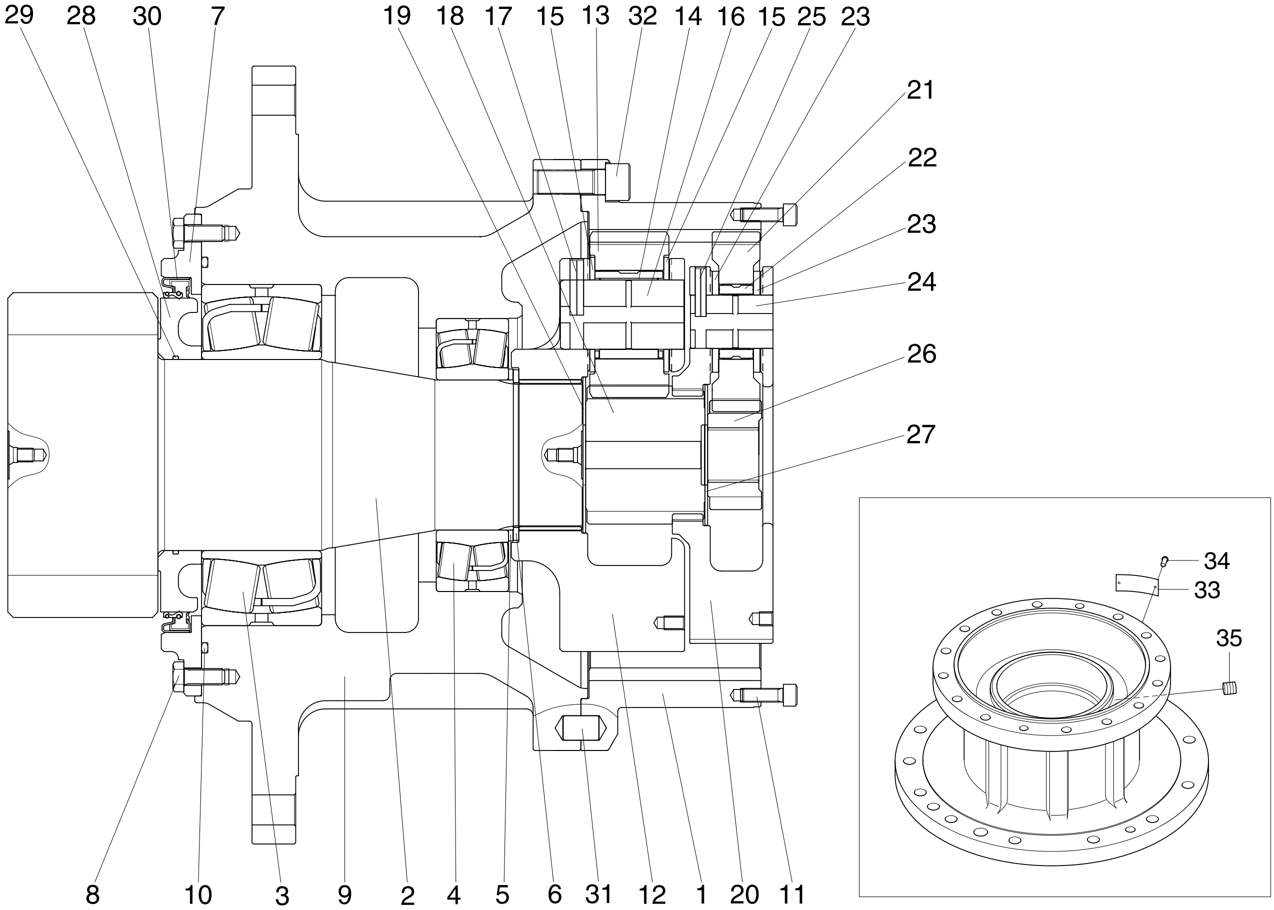
1) SWING MOTOR



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).

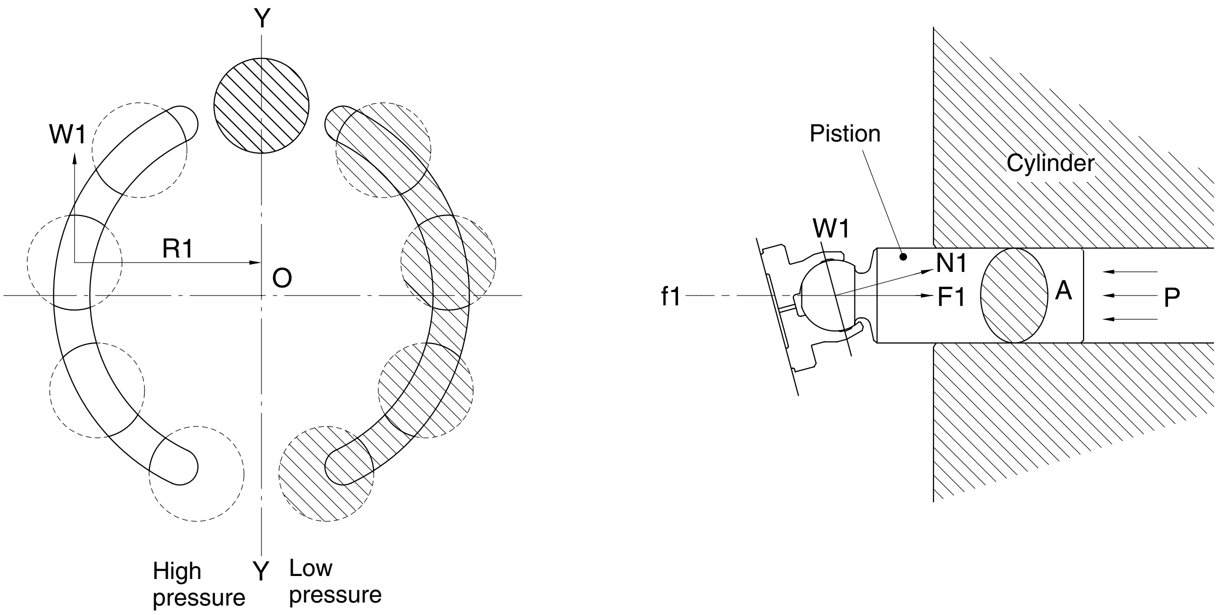
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

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

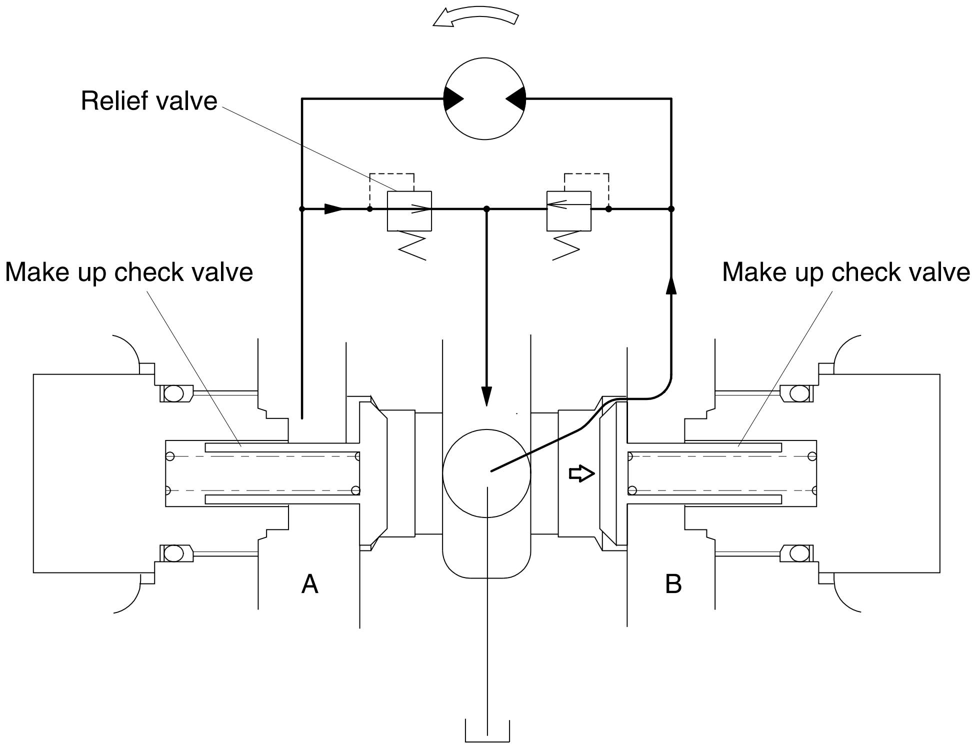
2) MAKE UP VALVE

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.

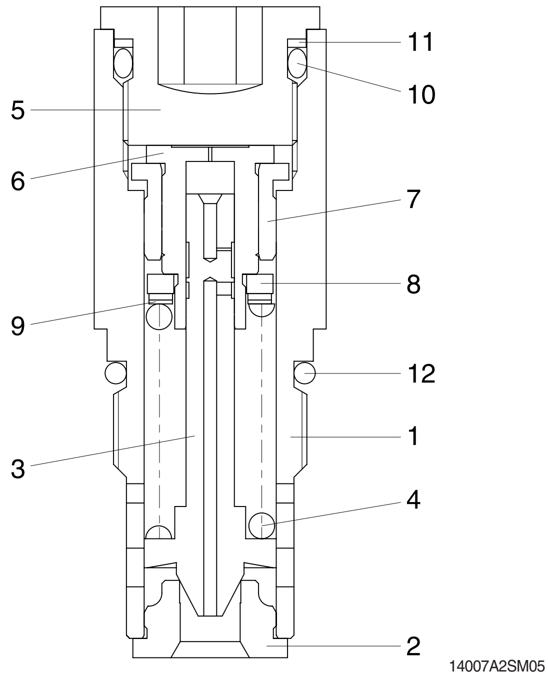
Pressurized oil into the port B, the motor rotate counterclockwise.

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



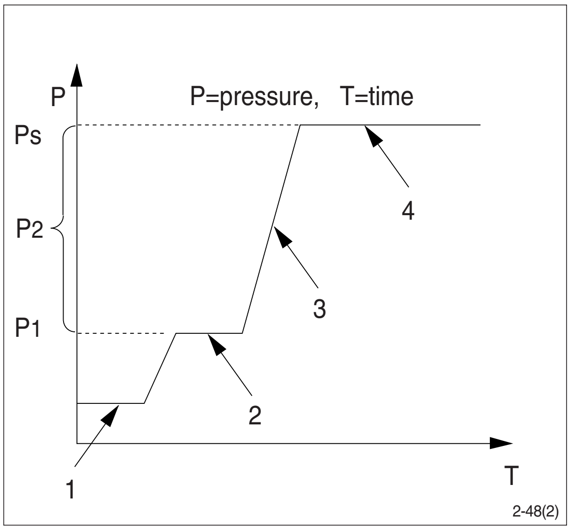
1	Body
2	Seat
3	Plunger
4	Spring
5	Adjusting screw
6	Piston
7	Bushing
8	Spring seat
9	Shim
10	O-ring
11	Back up ring
12	O-ring

(1) Construction of relief valve

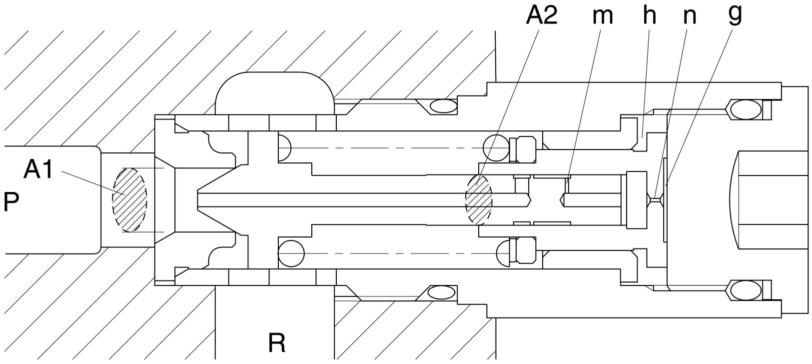
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(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.

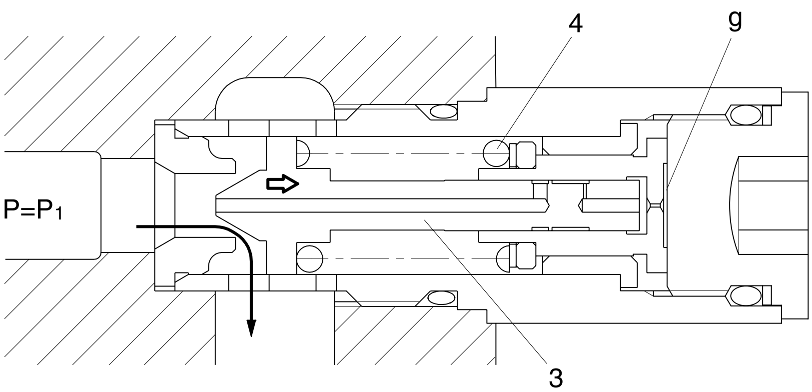


14007A2SM06

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.

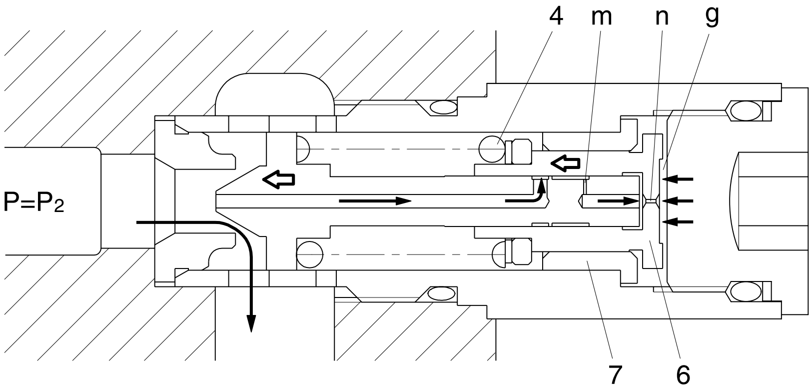
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



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).

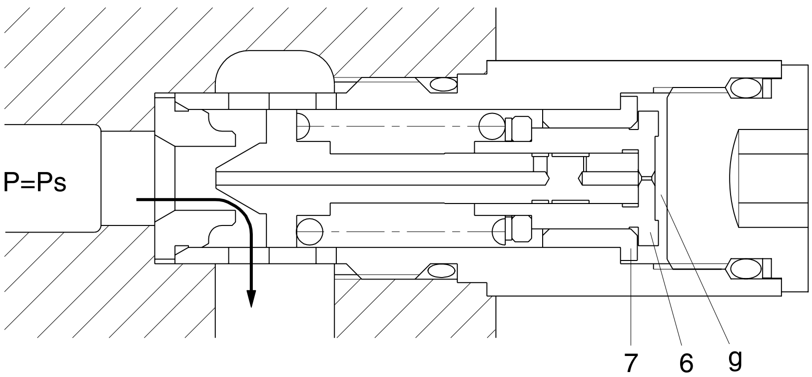


14007A2SM08

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).

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

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



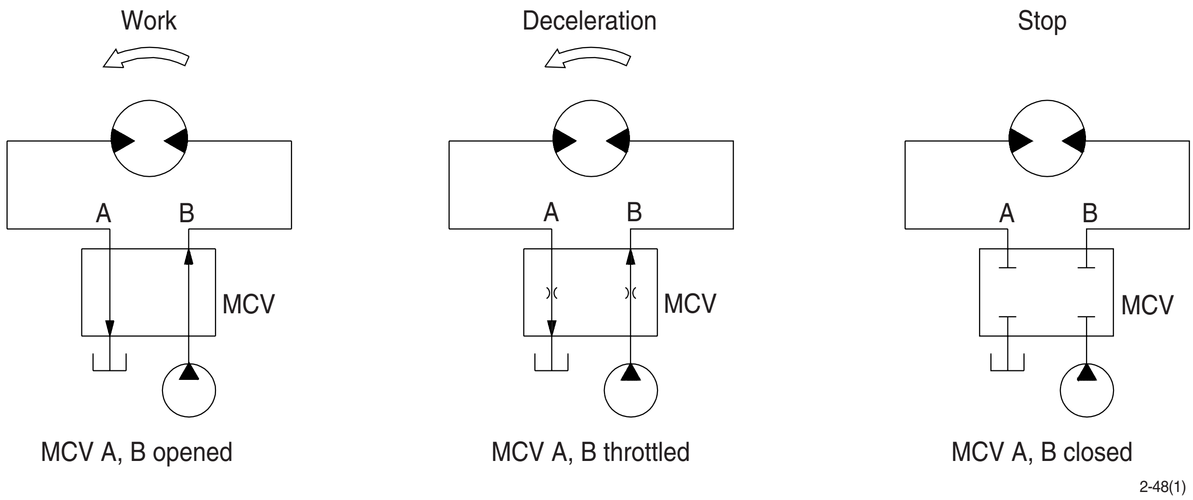
14007A2SM09

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.



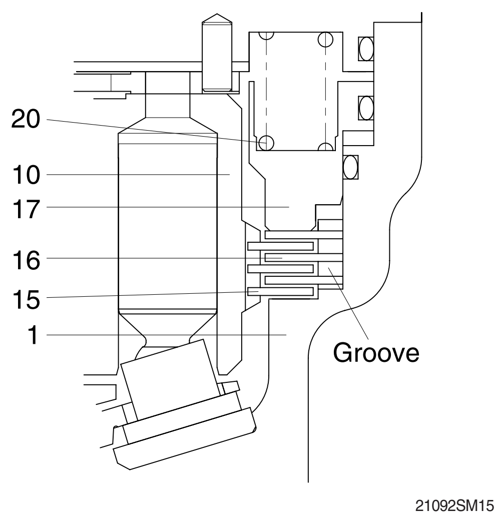
(2) Mechanical swing parking brake system

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.



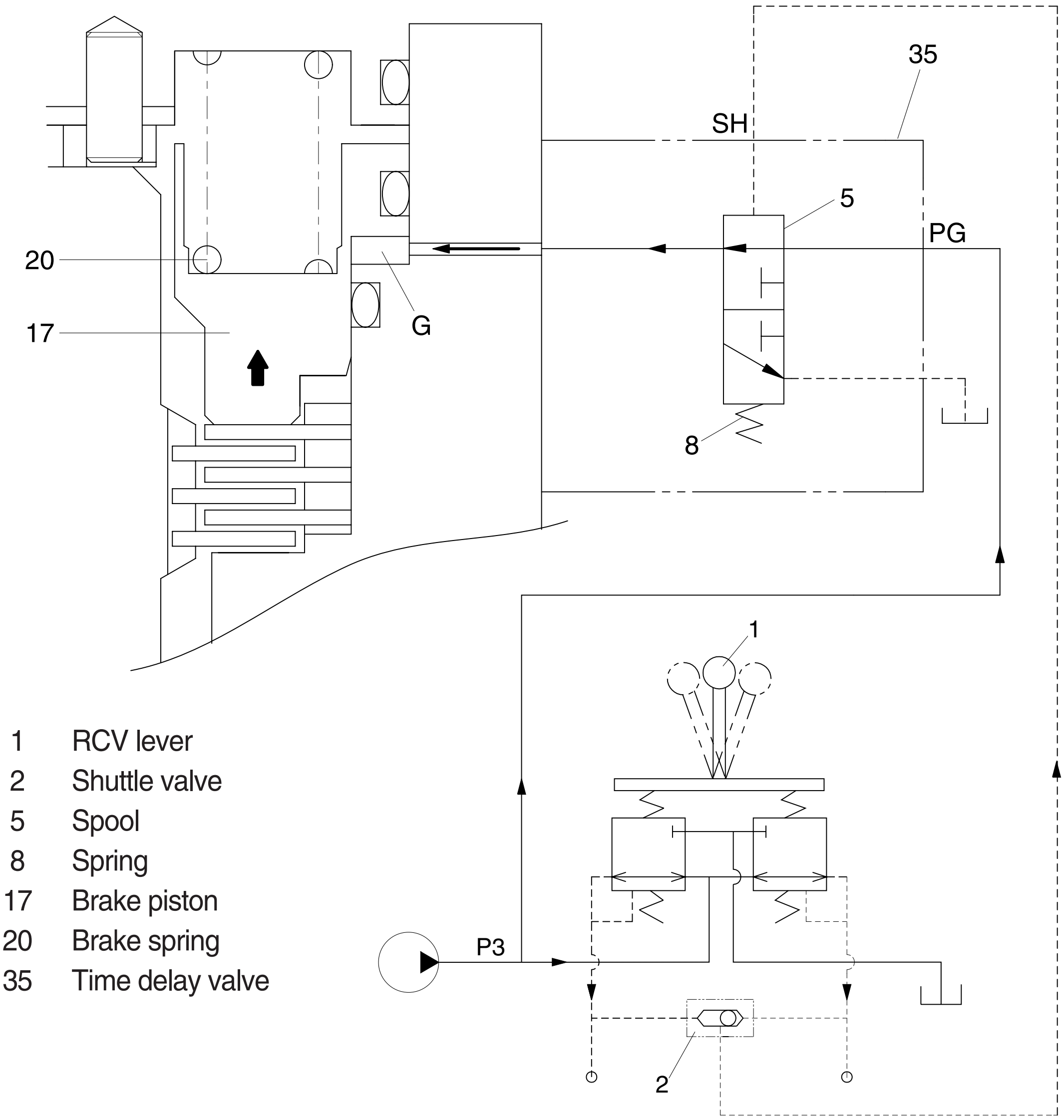
1	Housing	16	Separate plate
10	Cylinder block	17	Brake piston
15	Friction plate	20	Spring

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.

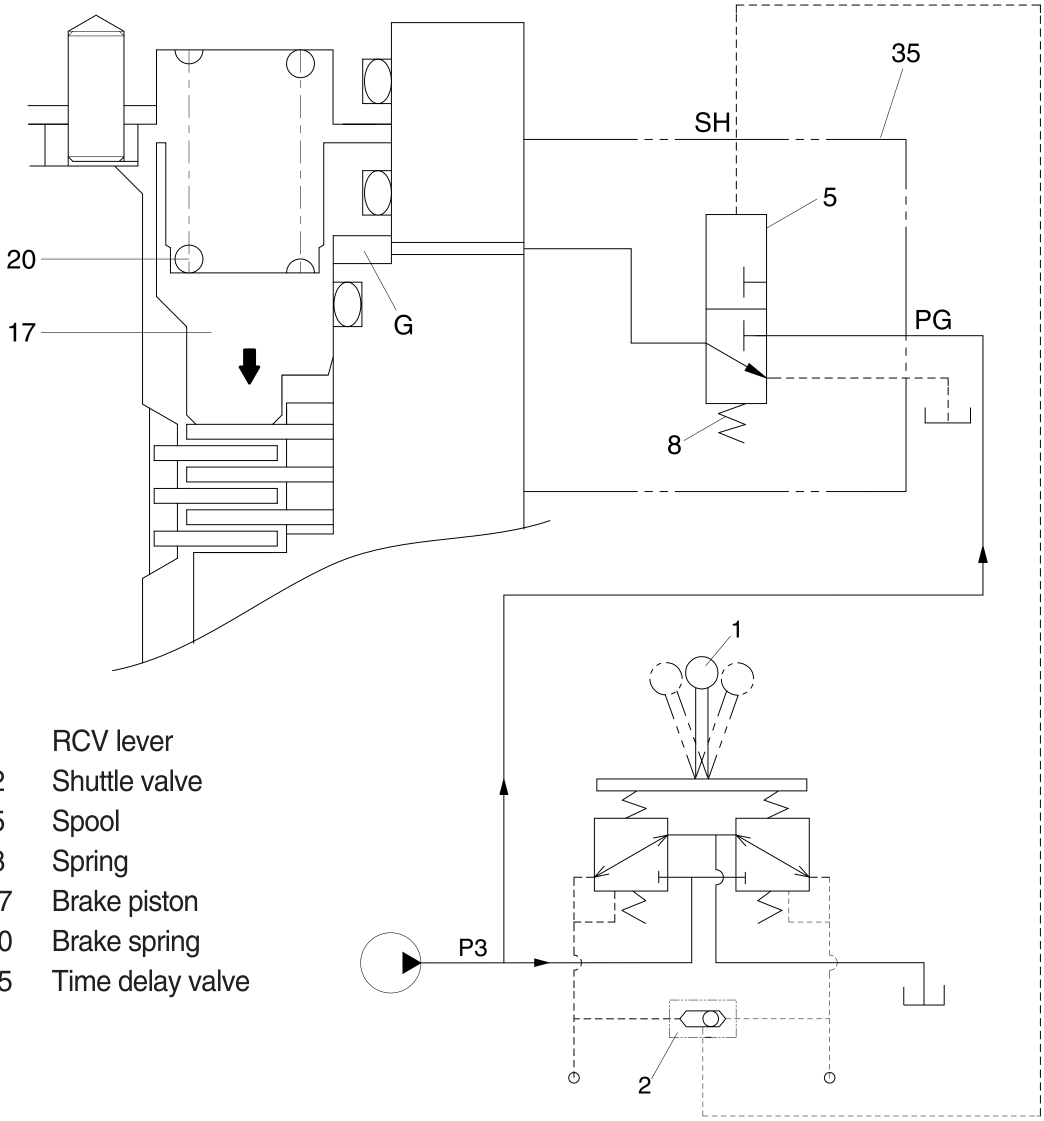
This pressure is applied to move the piston (17) to the upward against the force of the spring (20). Thus, it releases the brake force.



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

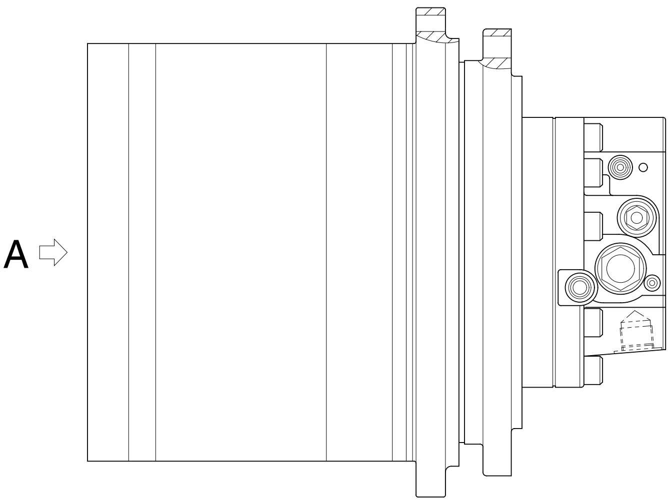
300L2SM05

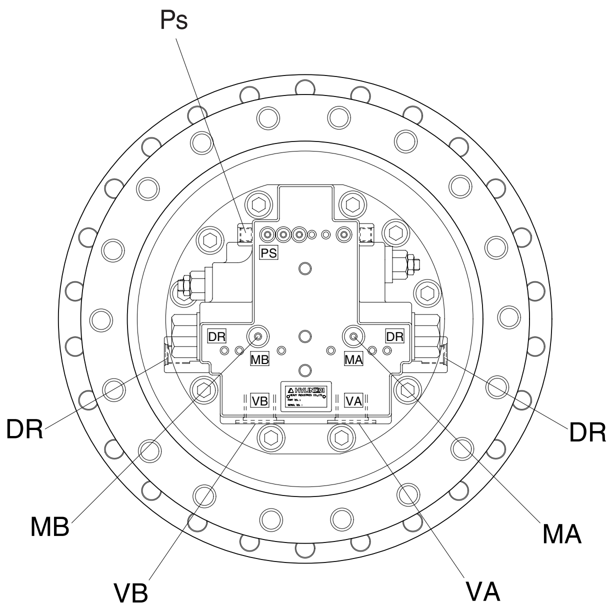
GROUP 4 TRAVEL DEVICE (TYPE 1 & 3)

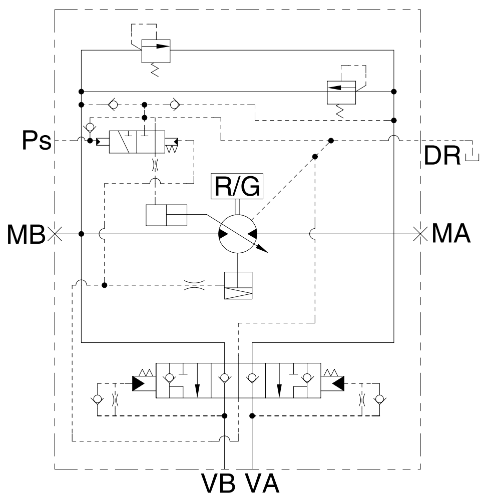
1. CONSTRUCTION

Travel device consists travel motor and gear box.

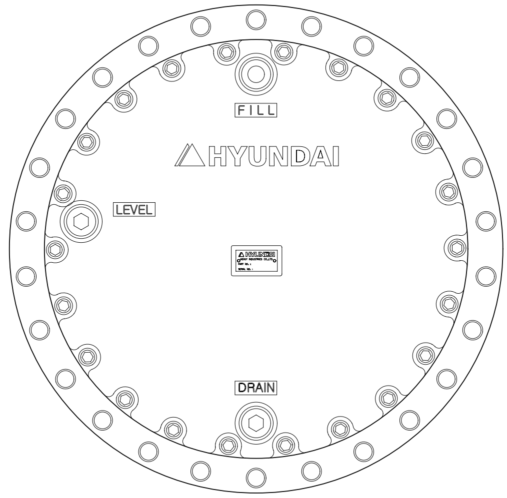
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.







HYDRAULIC CIRCUIT



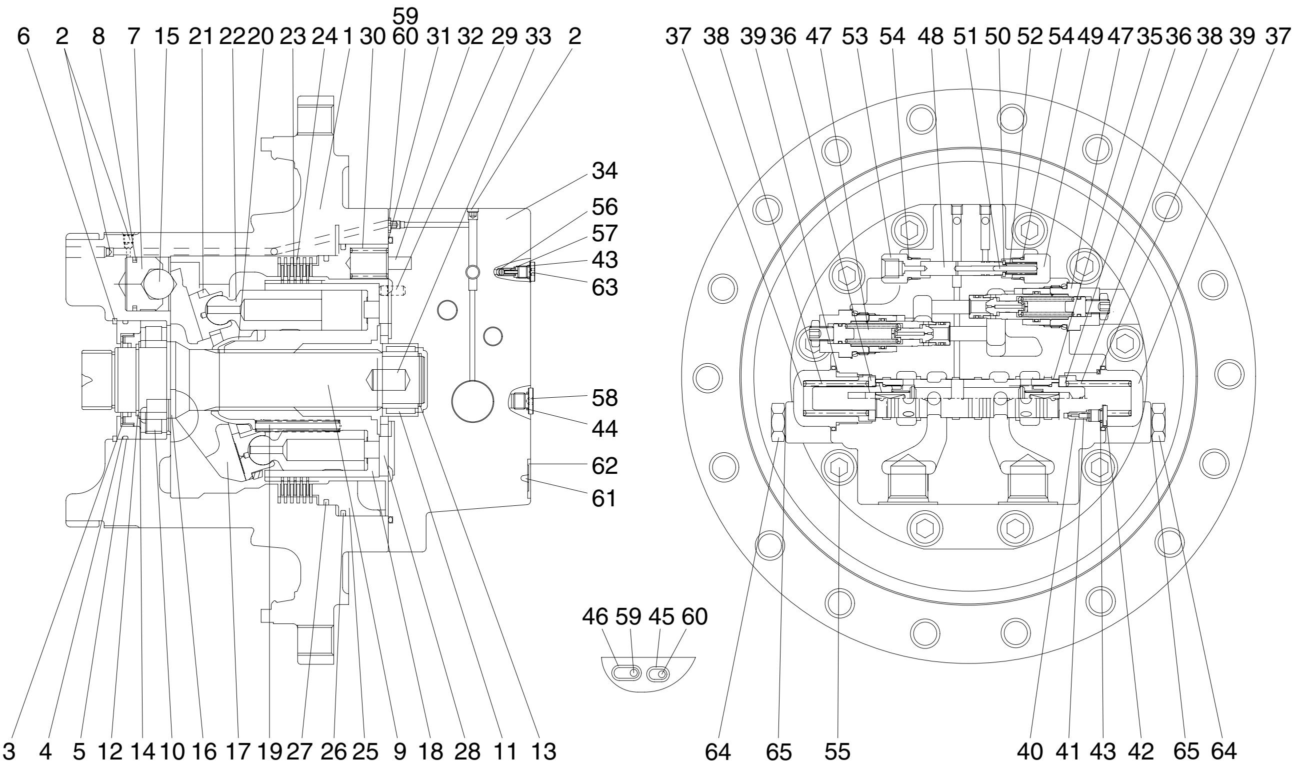
VIEW A

300L2TM01

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

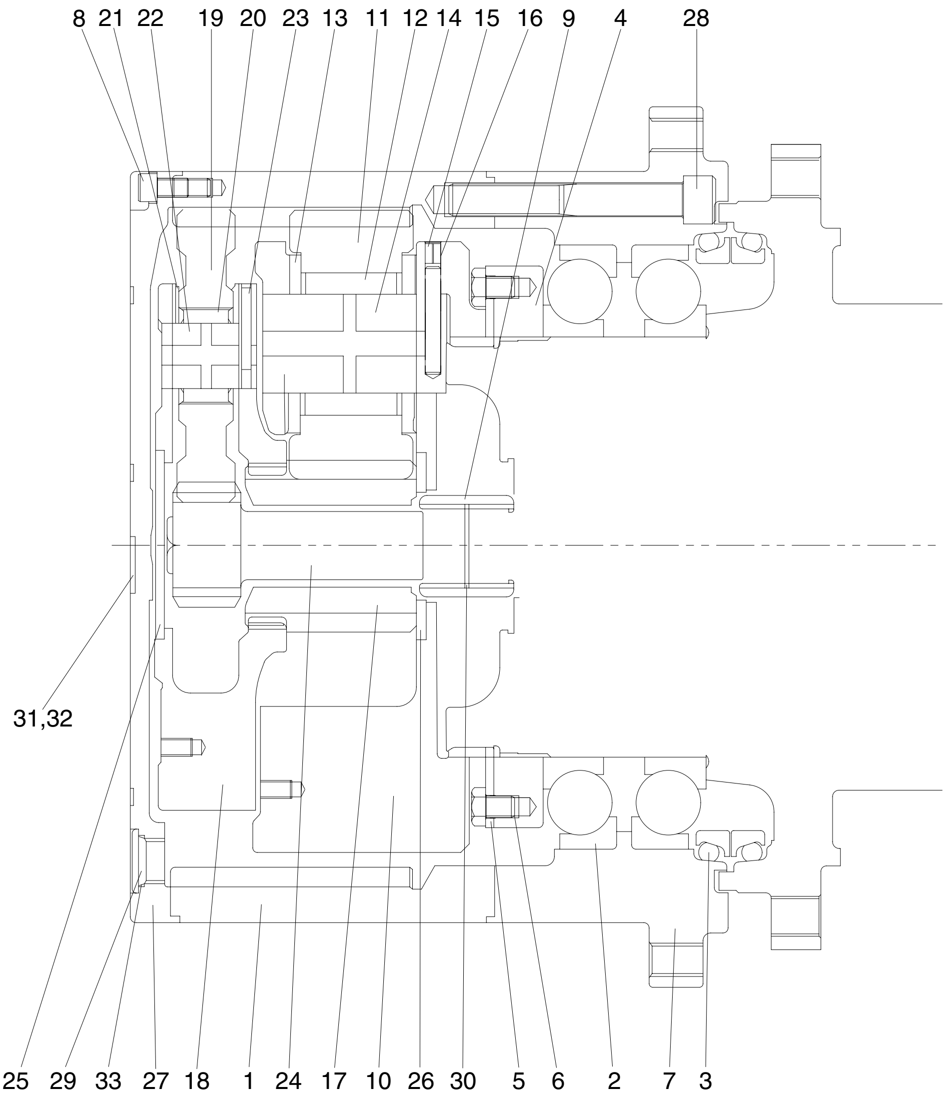
1) TRAVEL MOTOR



300L2TM02

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

2) TRAVEL REDUCTION GEAR

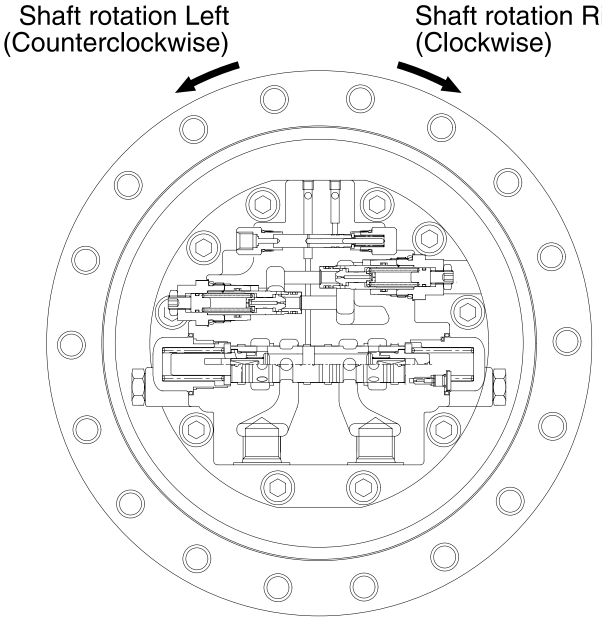


1	Gear ring	12	Needle bearing 2	23	Spring pin 1
2	Ball bearing	13	Thrust washer 2	24	Sun gear 1
3	Floating seal assy	14	Carrier pin 2	25	Thrust plate
4	Nut ring	15	Spring pin 2	26	Thrust plate
5	Lock plate	16	Solid pin 2	27	Cover
6	Hexagon socket head bolt	17	Sun gear 2	28	Hexagon socket head bolt
7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

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

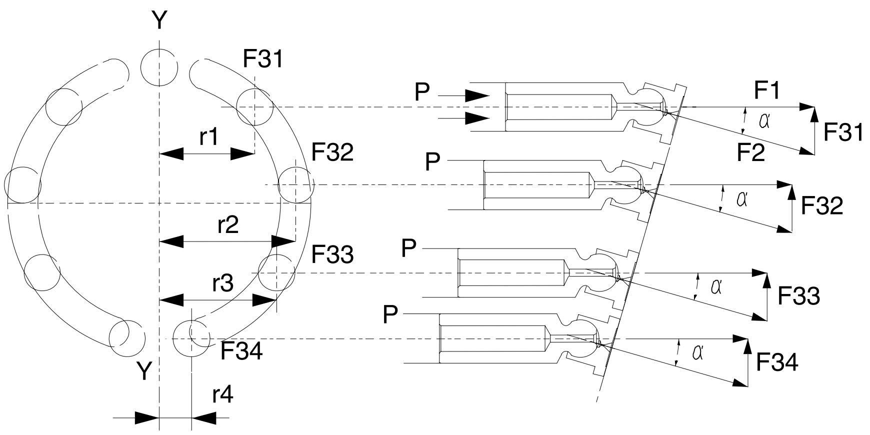
As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

F1 = P $\times$ 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).

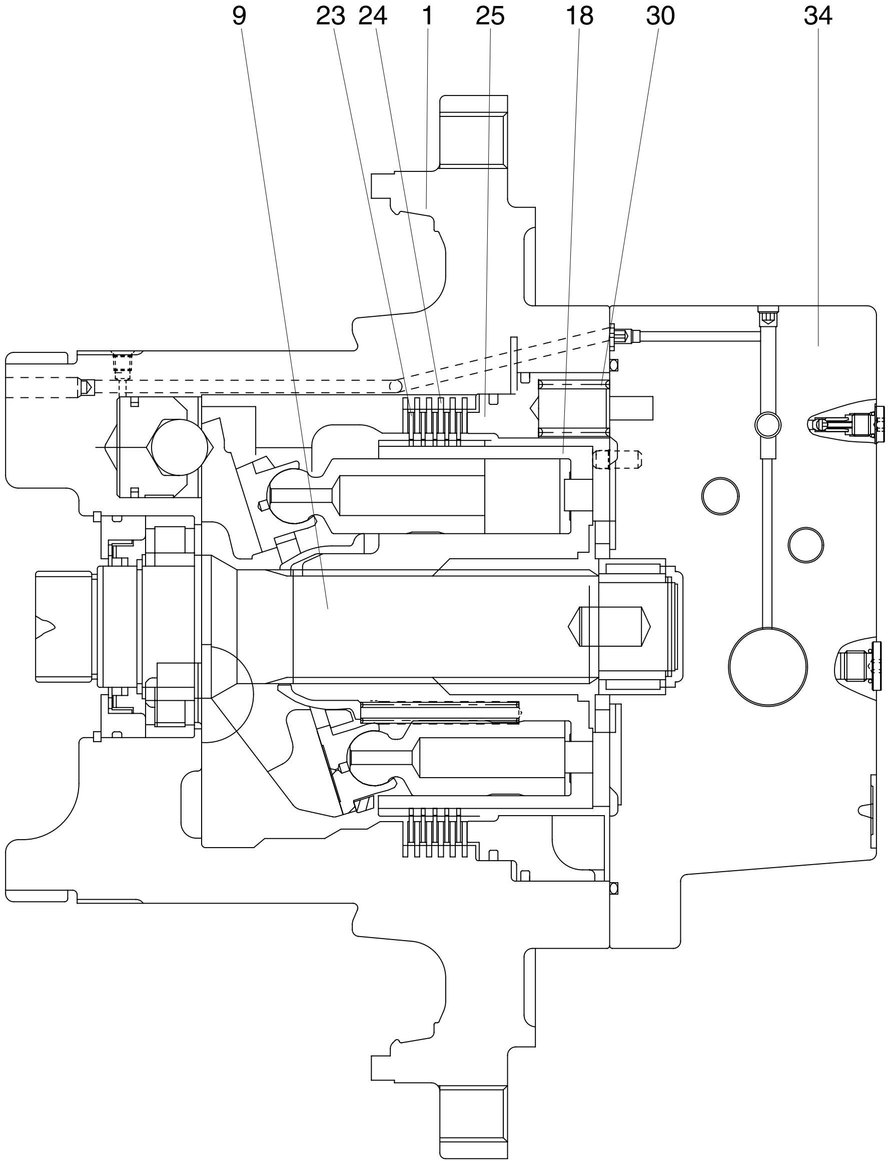


29092TM07

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).



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3) CAPACITY CONTROL MECHANISM

Figure typically shows the capacity control mechanism.

When high speed pilot line is charged with the pressure P_A that overcome the spring (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.

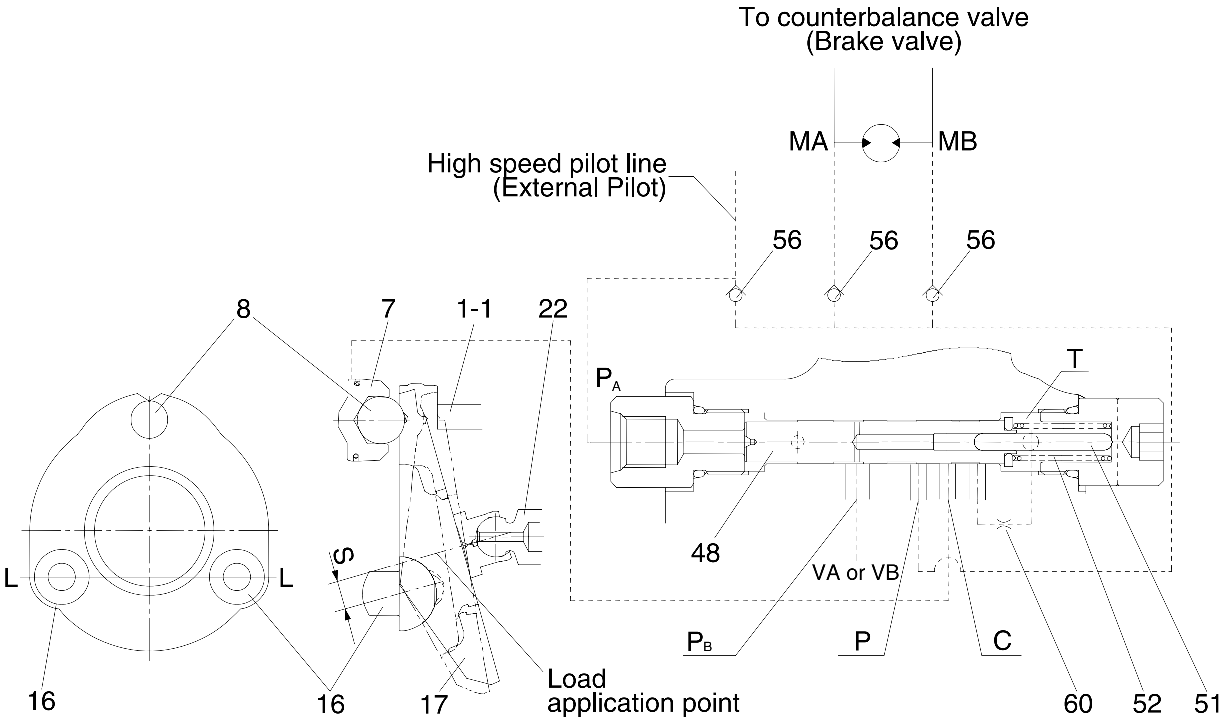
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

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.

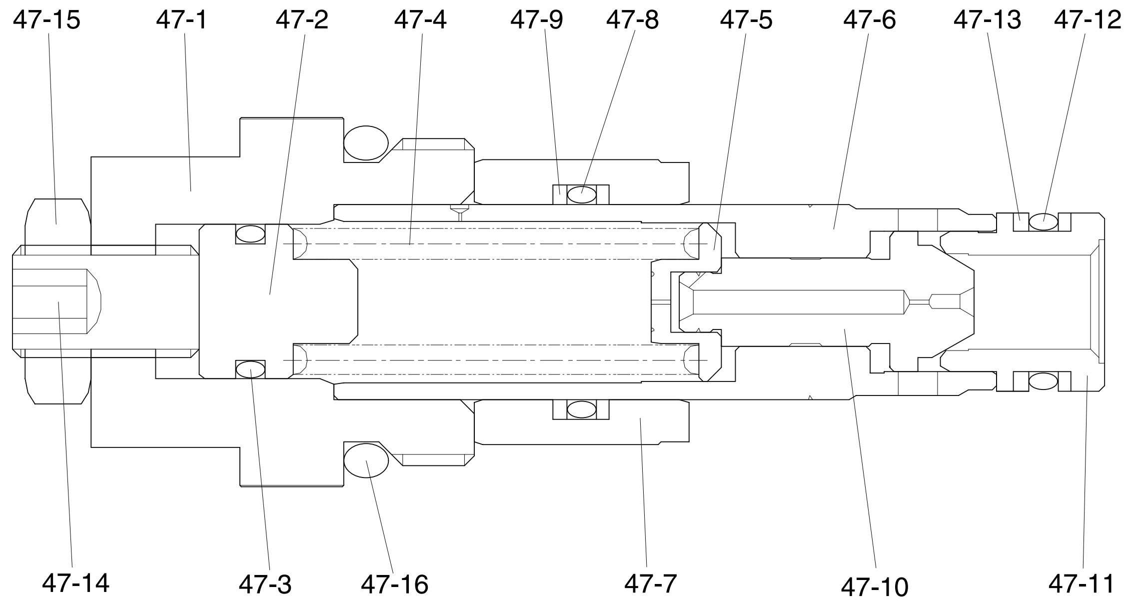


2609A2TM06

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.



2609A2TM07

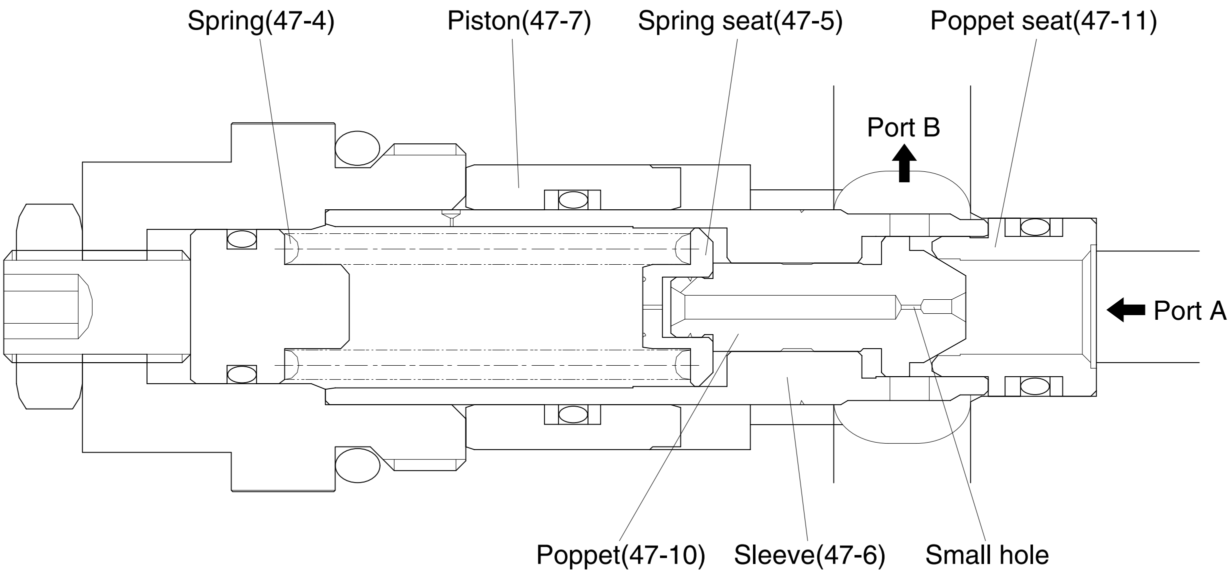
47-1	Plug	47-7	Piston	47-12	O-ring
47-2	Guide	47-8	O-ring	47-13	Back-up ring
47-3	O-ring	47-9	Back-up ring	47-14	Socket screw
47-4	Spring	47-10	Poppet	47-15	Hexagon nut
47-5	Spring seat	47-11	Poppet seat	47-16	O-ring
47-6	Sleeve				

(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:

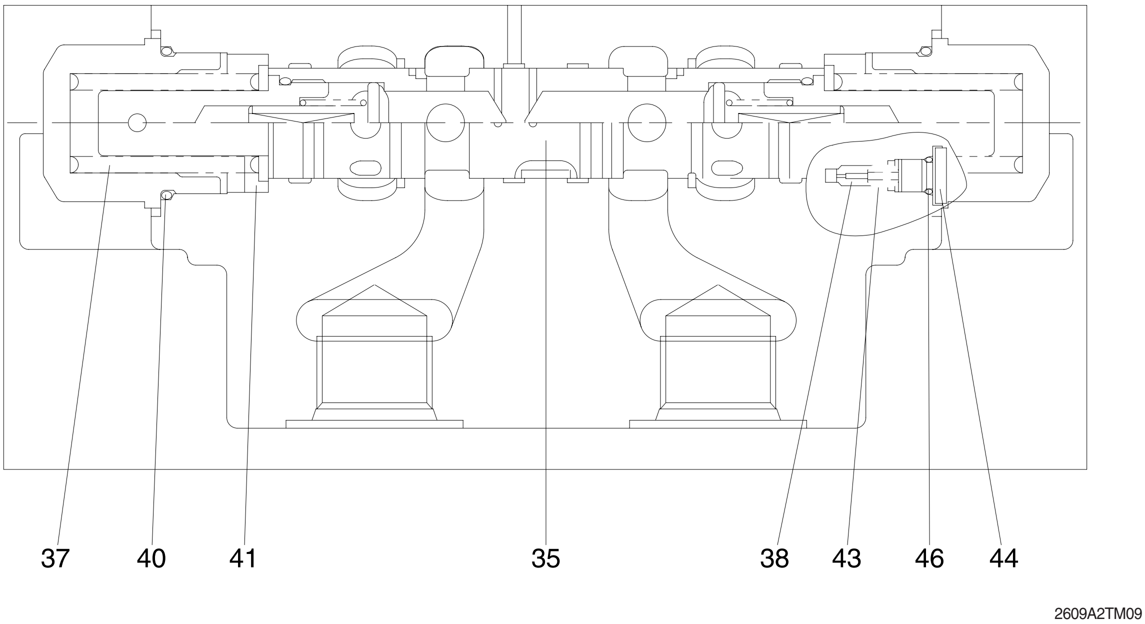
① Spool

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.



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

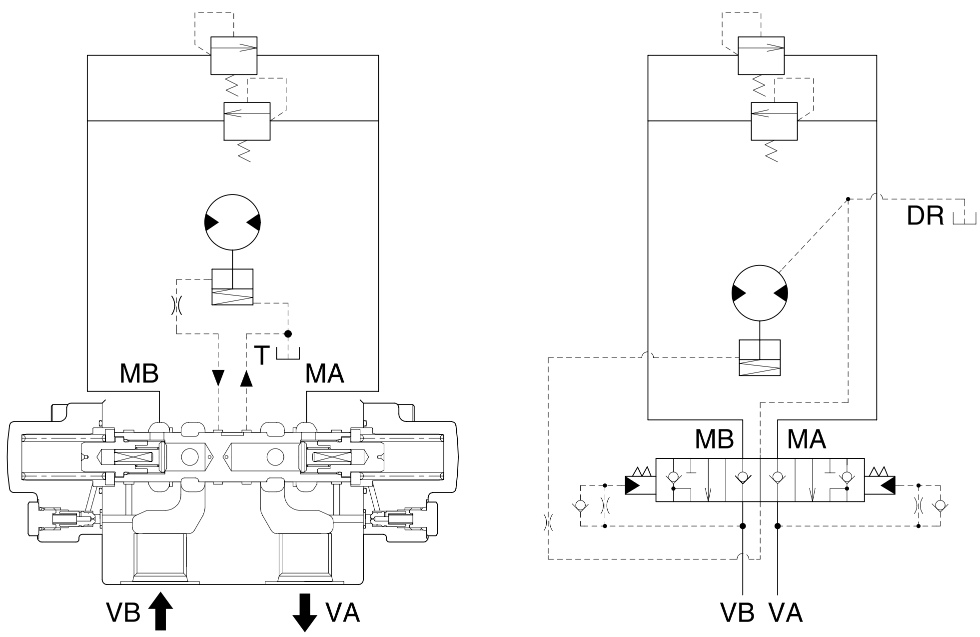
(2) Operation

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.



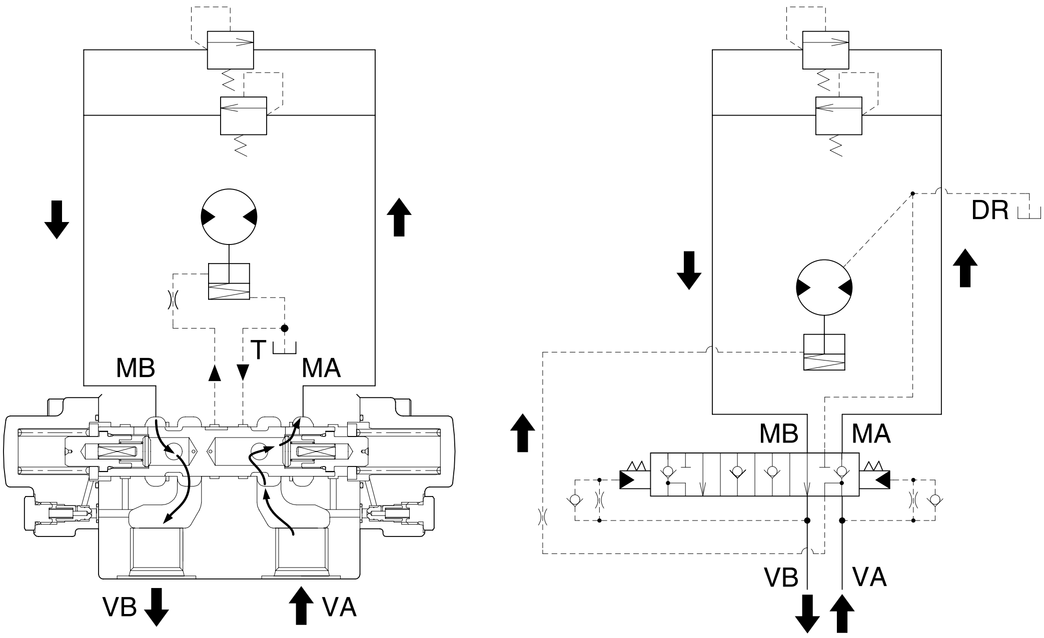
25092TM29

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.



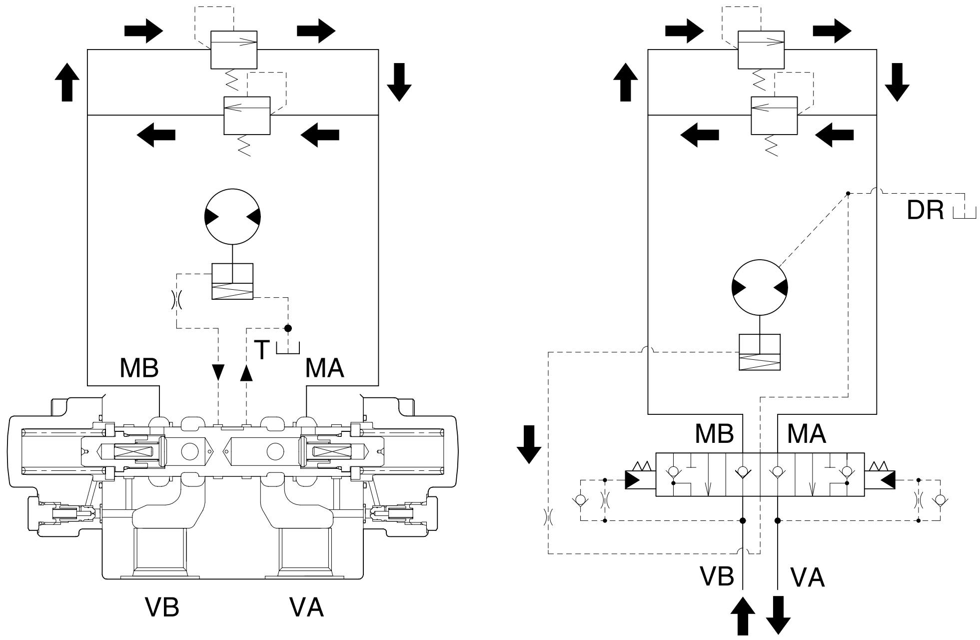
25092TM30

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.



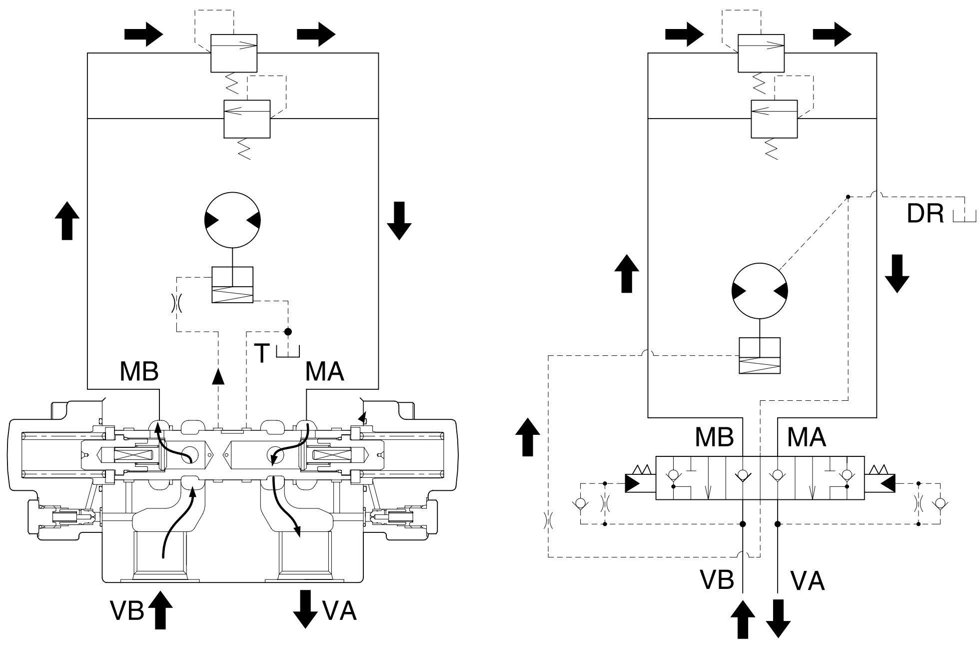
25092TM31

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.

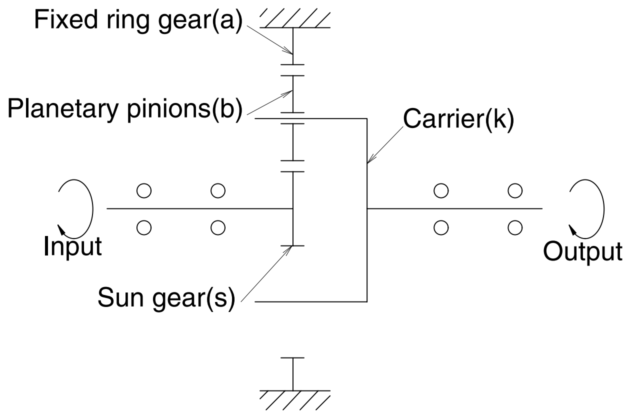
If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and spool (35) moves rightwards to enlarge the area of passage from MA to VA. Therefore the braking effect becomes smaller and the rotational speed of motor is controlled to correspond 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).



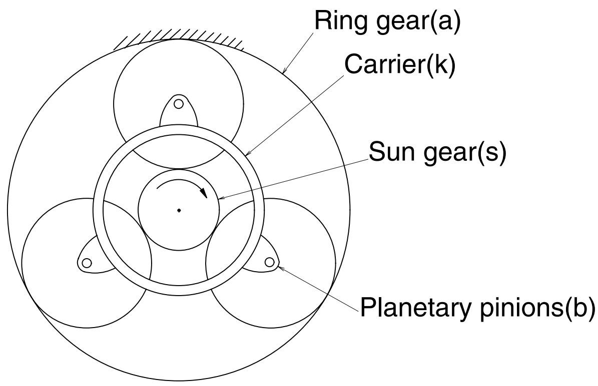
25092TM32

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.

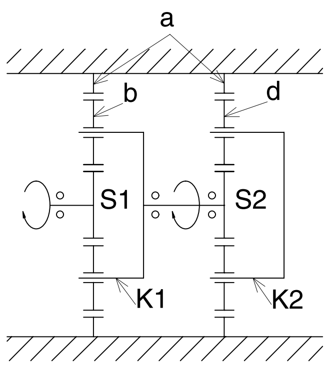


29072TM10



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.



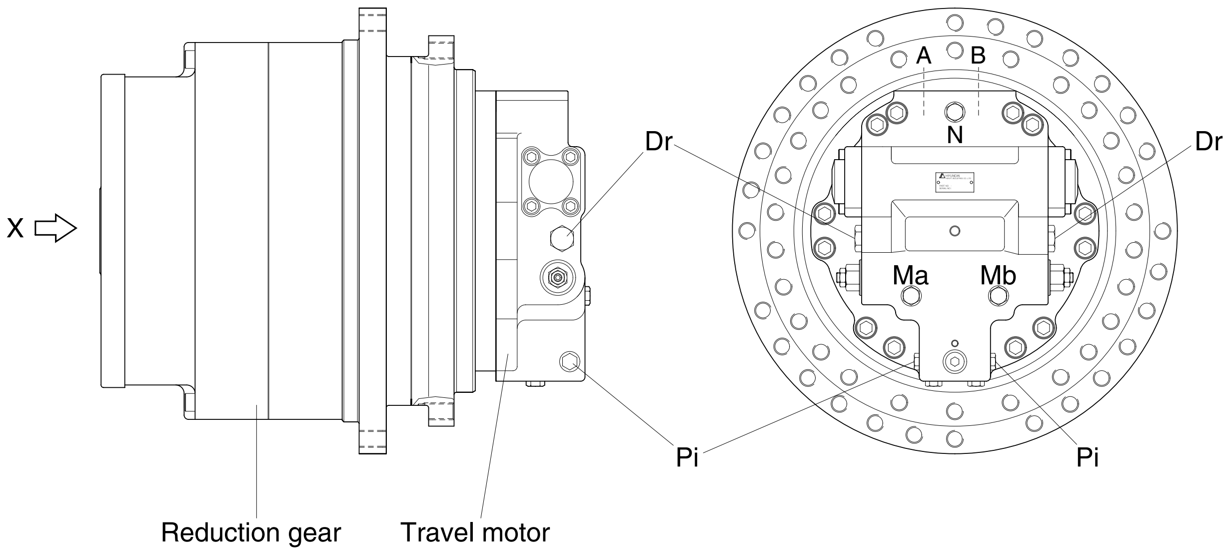
29072TM12

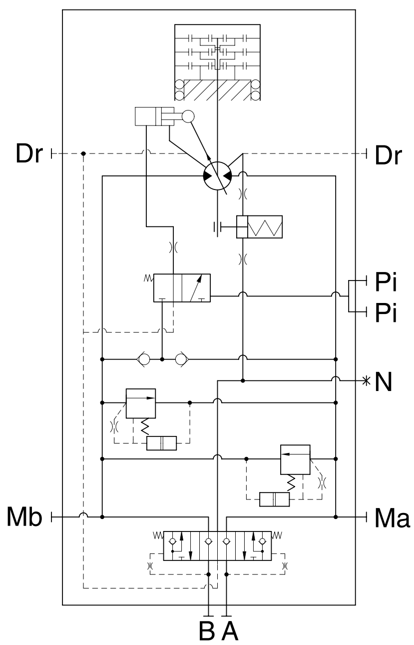
■ TRAVEL MOTOR (TYPE 2)

1. CONSTRUCTION

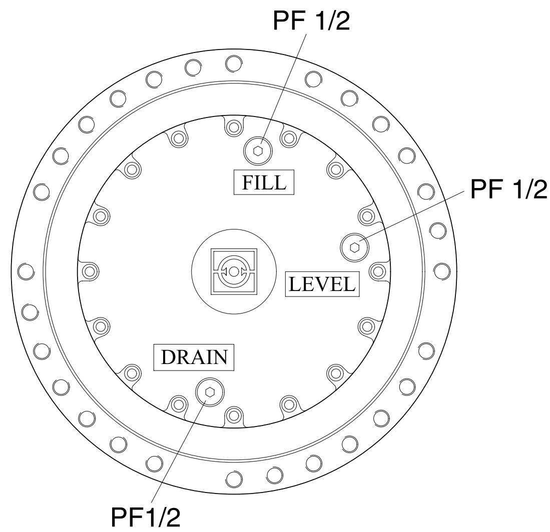
Travel device consists travel motor and gear box.

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





Hydraulic circuit



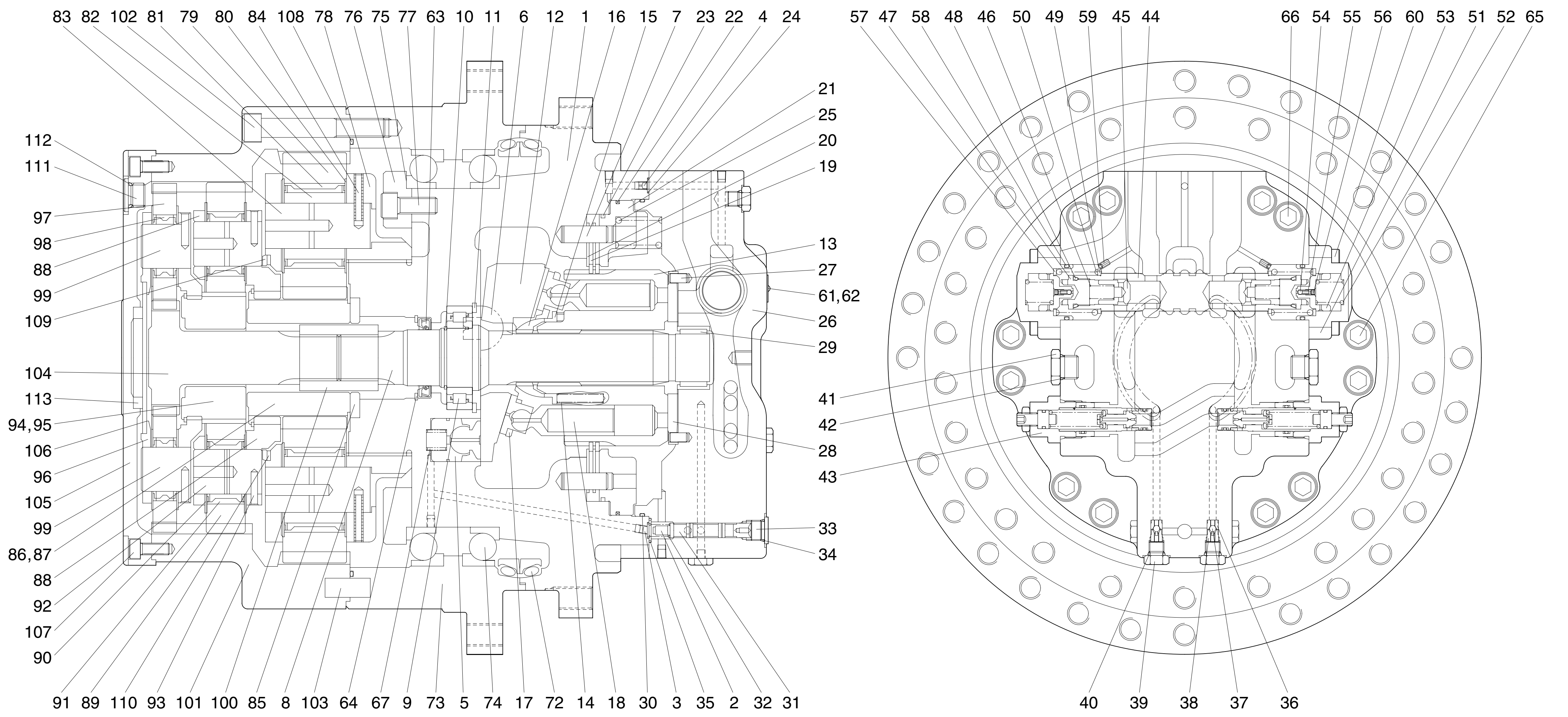
VIEW X

3809A2TM21

Port	Port name	Port size
A, B	Main port	SAE 6000 psi Ø25
Pi	Two speed control port	PF 1/4
Dr	Drain port	PF 1/2
Ma, Mb	Gage port	PF 1/4
N	Brake release port	PF 1/4

2. SPECIFICATION

1) TRAVEL MOTOR



3809A2TM22

1 Shaft casing
2 Plug
3 Orifice
4 Orifice screw
5 Swash piston
6 Swash ball
7 Brake pin
8 Shaft
9 Roller bearing
10 Stop ring
11 Lock ring
12 Swash plate
13 Cylinder block
14 Cylinder spring
15 Spacer
16 Ball guide
17 Set plate
18 Piston & Shoe assy
19 Friction plate
20 Separator plate
21 Brake piston
22 Piston ring
23 Piston ring
24 O-ring
25 Brake spring
26 Valve casing
27 Valve plate pin
28 Valve plate
29 Needle bearing
30 O-ring
31 Swash spool
32 Swash spring
33 Plug
34 O-ring
35 O-ring
36 Seat
37 Steel ball
38 Stopper
39 Plug
40 O-ring
41 Plug
42 O-ring
43 Relief valve assy
44 Main spool
45 Check
46 Spring
47 Plug
48 O-ring
49 Spring seat
50 Spring
51 Cover
52 Spring
53 Spool
54 Steel ball
55 Spring
56 Plug
57 Spring seat
58 O-ring
59 Orifice
60 Wrench bolt
61 Name plate
62 Rivet
63 Oil seal
64 Snap ring
65 Wrench bolt
66 Wrench bolt
67 Spring pin
72 Floating seal
73 Hub
74 Bearing
75 Shim
76 Bearing guide
77 Wrench bolt
78 Carrier
79 Planetary gear
80 Plate
81 Needle bearing
82 Bearing bushing
83 Pin
84 Spring pin
85 Thrust plate
86 Sun gear
87 Snap ring
88 Carrier
89 Planetary gear
90 Plate
91 Needle bearing
92 Pin
93 Spring pin
94 Sun gear
95 Snap ring
96 Carrier
97 Planetary gear
98 Needle bearing
99 Pin
100 Coupling
101 Ring gear
102 Wrench bolt
103 Planetary pin
104 Drive gear
105 End cover
106 Plate
107 Wrench bolt
108 O-ring
109 Ring
110 Ring
111 Plug
112 O-ring
113 Bushing

3. PRINCIPLE OF DRIVING

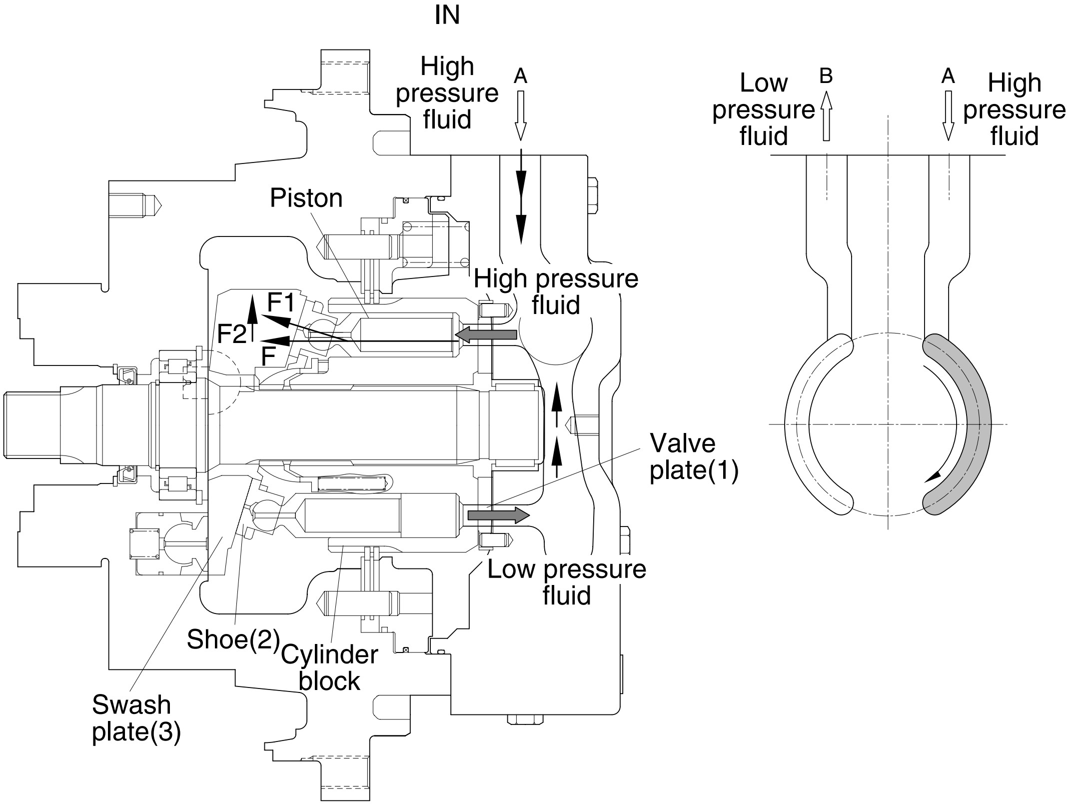
Travel motor comprises with rotary, relief valve, parking brake, counterbalance valve and 2-speed control.

1) WORKING OF ROTARY PART

In the figure below, axis direction power F occurs, when the high pressure oil flows in the cylinder block through to the valve plate (1) port, and the piston moves to the left hand side.

This power F, which takes shoe (2) as a medium, split into F1 power vertical to swash plate (3), and F2 power perpendicular from an axis. Through F2 power, cylinder block rotate with piston and shoe, while shoe (2) moves on the swash plate with piston. There are 9 pistons inserted into the cylinder block and they rotate with the cylinder block by taking high pressure gas in order at the entrance.

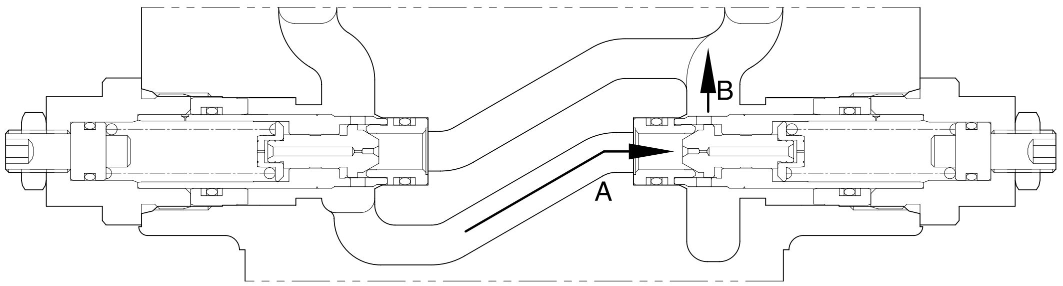
When you reverse the flow of the high pressure oil, piston and cylinder block rotate in the opposite direction above the shoe plate.



3809A2TM23

2) WORKING OF RELIEF VALVE

When the port from control valve to motor is closed, traveling movement stops.
However, motor continues rotating because of the traveling inertia of the machine's upper body.
By doing so, motor is damaged by the gradual rising of the pressure at the exit.
To prevent this damage, relief valve discharge the gradual rising pressure from the exit to the entrance which has lower pressure.



3809A2TM24

- Setting pressure : 360 kgf/cm^2
- Back pressure : 5 kgf/cm^2
- Cracking pressure : 330 kgf/cm^2 over

- AT THE BEGINNING OF TRAVELING

RELIEF VALVE A

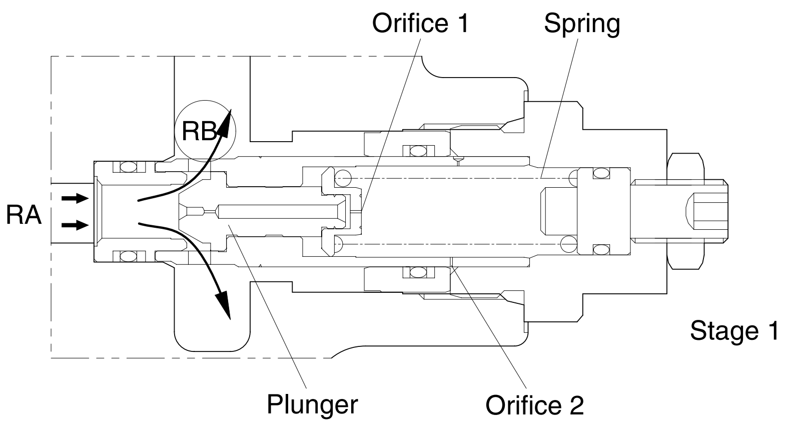
Traveling manipulation lever works to rise the pressure of RA port up. When this pressure oil press plunger to the right, and then sustain the power of the spring, the plunger moves to the right and release the pressure oil of RA port to RB port (stage 1).

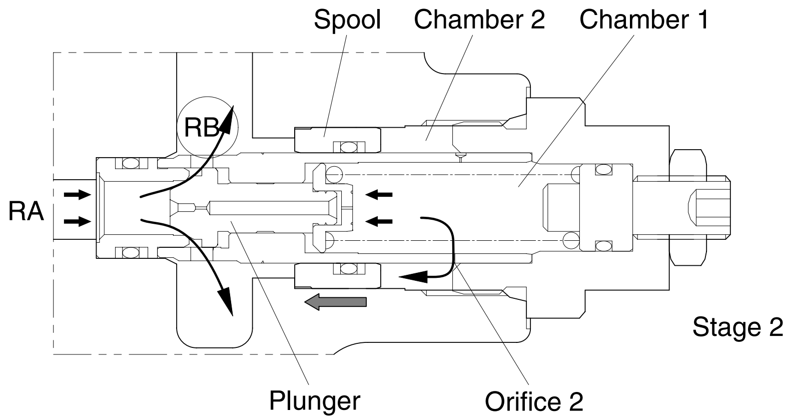
The plunger moves slowly by the pressure oil which flows into chamber 1 through orifice 1.

The pressure oil flowed into chamber 1 flows into chamber 2 through orifice 2, and at this point, the plunger moves to the left again, when the spring is compressed by the flowed pressure oil which press the spool to the left. (stage 2).

When the RA port pressure goes up much more and the set pressure overcome the power of the compressed spring again, the plunger moves to the right and the pressure has of RA port is released to RB port.

Thus, at the early stage of the relief-valve operation, it works primarily at lower pressure, after then, shock is reduced during rotating at the set pressure as the secondary operation.





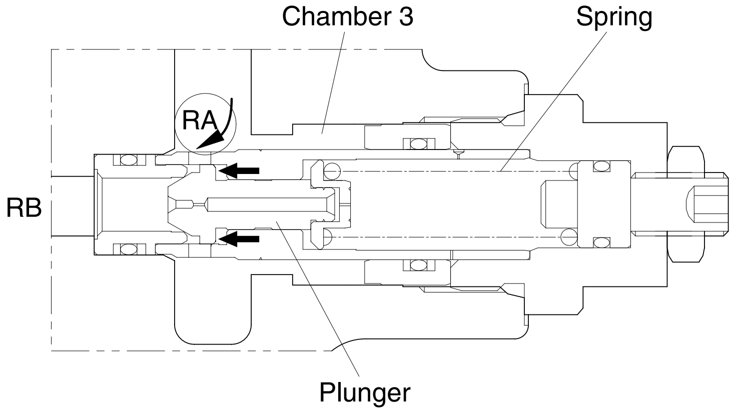
RELIEF VALVE A

3809A2TM25

- DURING TRAVELING OPERATION

RELIEF VALVE B

During traveling operation, RA port pressure goes up and RB port pressure goes down. Thus RA port pressure oil flows into chamber 3, and pushes plunger to the left with a high pressure and the power of the spring.



RELIEF VALVE B

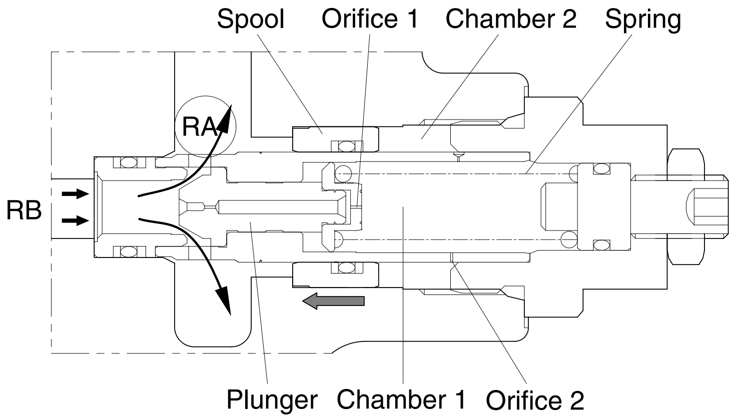
3809A2TM26

- WHEN IT STOP

RELIEF VALVE B

When it stops or operates reversely, RA port pressure is extremely lowered and RB port pressure gradually goes up because of the swing inertia from the upper swing part of machine.

Consequently, relief valve B operates as the same order as relief valve A, and maintains the set pressure by releasing the high pressure of RB port to RA port.



RELIEF VALVE B

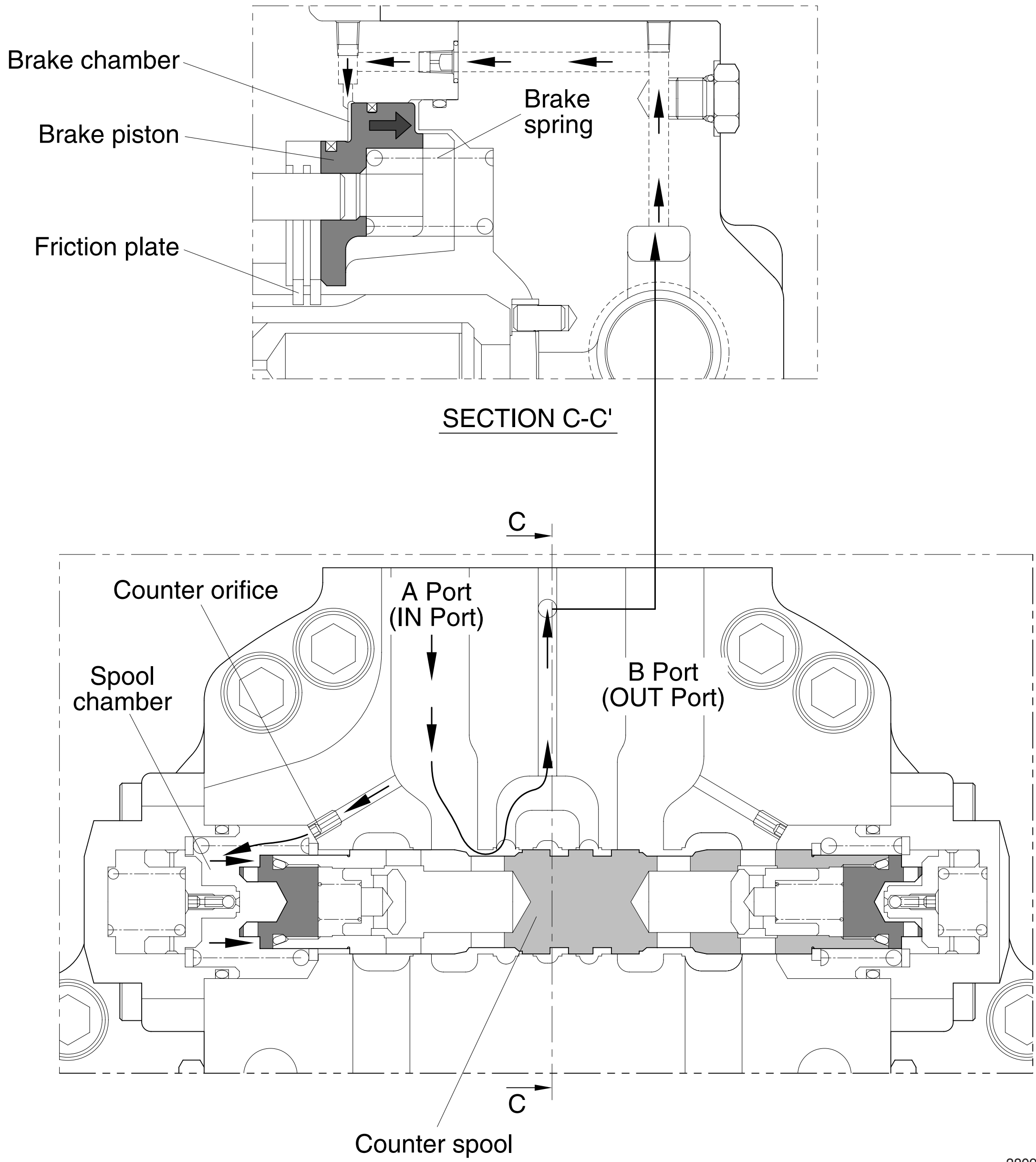
3809A2TM27

3) WORKING OF PARKING BRAKE

Parking brake consists of many wet friction plate. The brake is usually held with the power of spring, and it only removed by traveling pressure of motor.

- Parking brake OFF

  If worker operates the traveling control lever, traveling working pressurized oil into IN PORT flows from spool chamber through counter orifice.
  Pressurized oil pushes counter balance spool to right.
  Then notch of spool opens the brake line. At the same time, pressurized oil flow to brake chamber of motor from brake line. Brake piston to force of brake spring moves to right and brake lift.



3809A2TM28

- **Parking brake ON**

  If worker leave lever in neutral, pressurized oil supply to in port of motor stop.

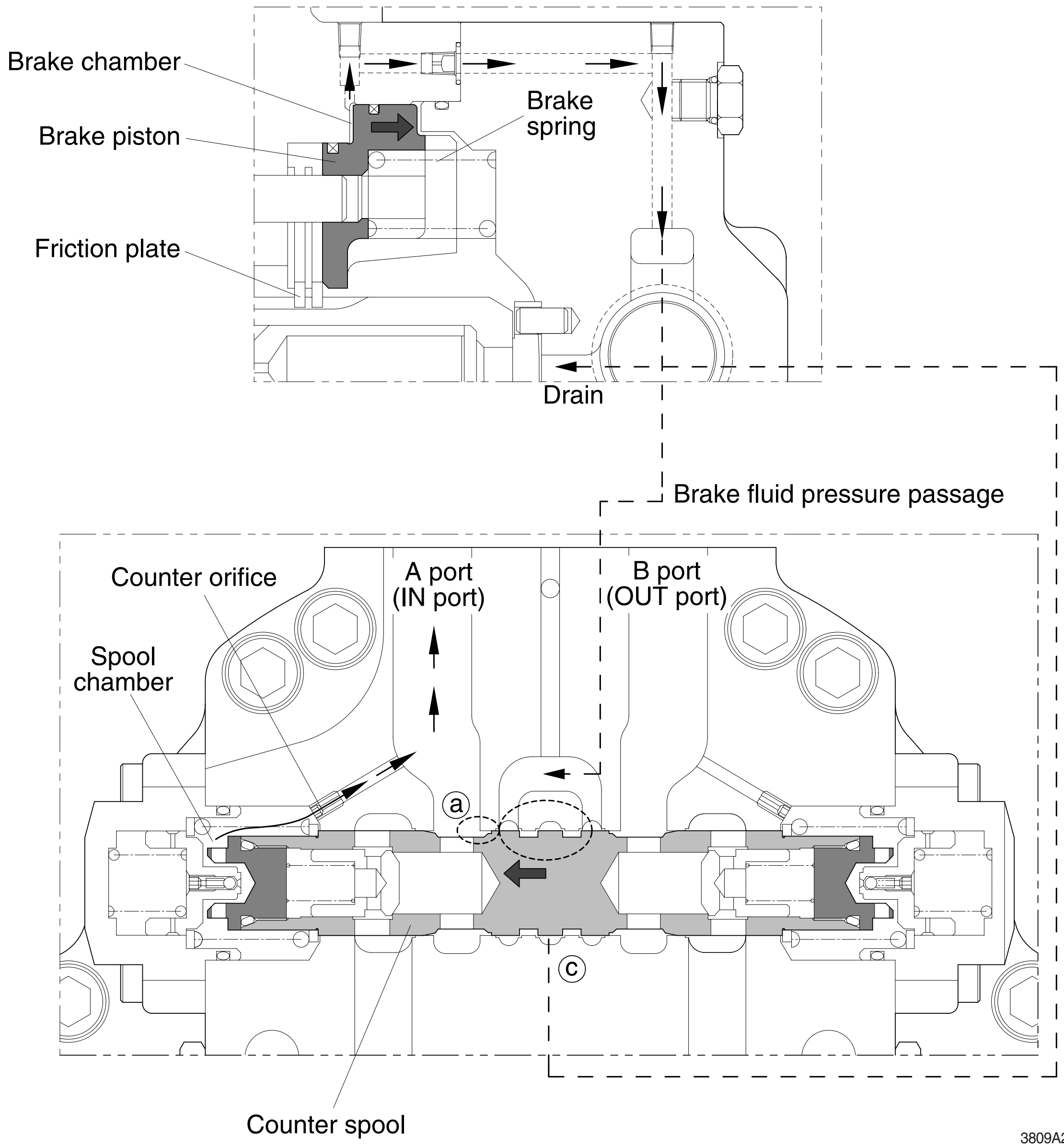
  If pressurized oil supply stop, in port pressure decline and pressurized oil of spool chamber moves to oil tank through counter orifice. Therefore counter balance spool return in neutral.

  If spool leave in neutral, notch ⓐ part of spool obstructed and brake pressurized oil obstructed.

  Brake pressurized oil line obstructed. So pressurized oil supply to brake chamber obstructed.

  Therefore if pressure of brake chamber decline, brake piston to force of brake spring moves to left and push friction plate.

  If brake force happens, brake stop. And pressurized oil to brake chamber drain to motor casing internal through line ⓒ to counter spool center.



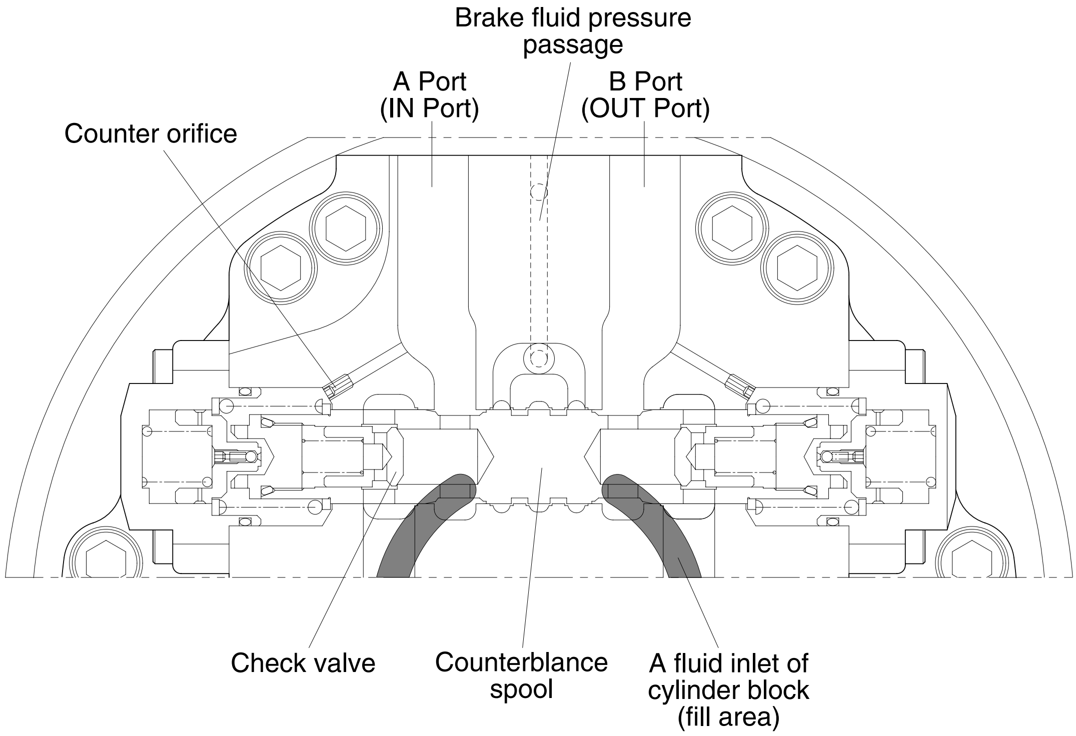
3809A2TM29

4) COUNTERBALANCE VALVE

- **Function of counterbalance valve**

(1) Parking brake off and operation of motor
(2) When motor descend in slope, traveling velocity control.
(3) After motor stop in slope, slip prevention.
(4) When motor stop, supplement the flow.

- NEUTRAL



3809A2TM30

5) HOW TO WORK

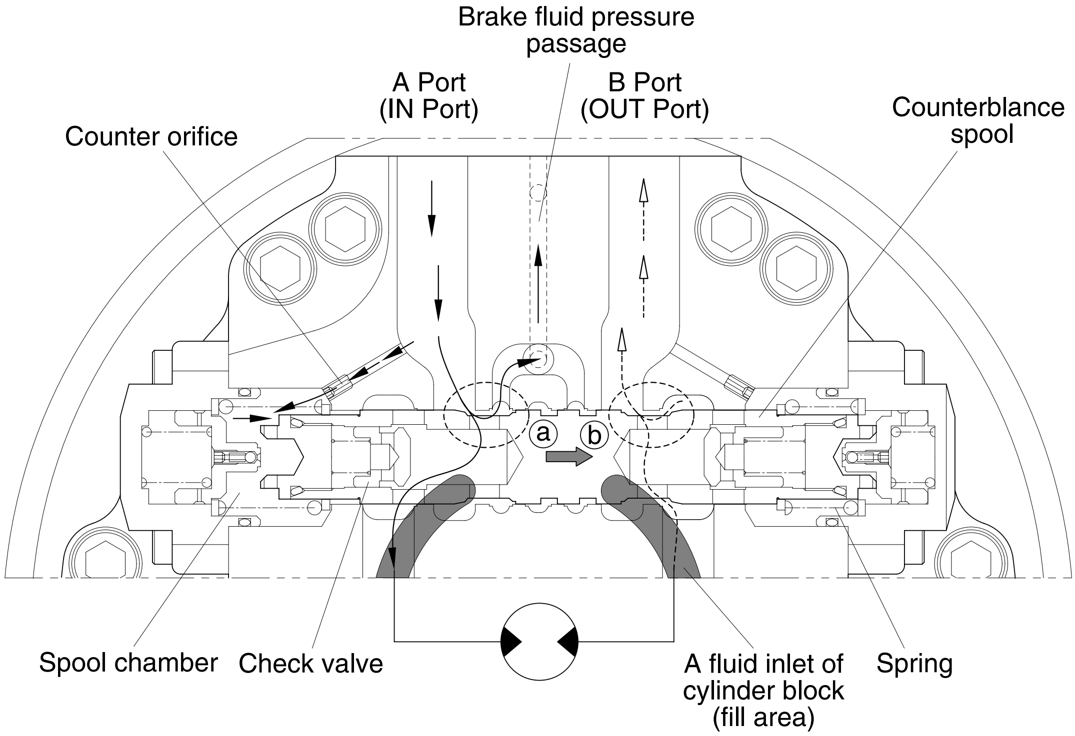
(1) When motor travel

If worker operates the traveling control lever, traveling working pressurized oil into IN PORT flows from spool chamber through counter orifice.

If spool moves to right, notch of spool open line ⓐ of brake pressurized oil.

Then pressurized oil lift the brake. At the same time, notch of counterbalance spool opens the line ⓑ.

Flowed pressurized oil to A port opens check valve and cylinder block of motor rotate.



3809A2TM31

(2) When motor stop

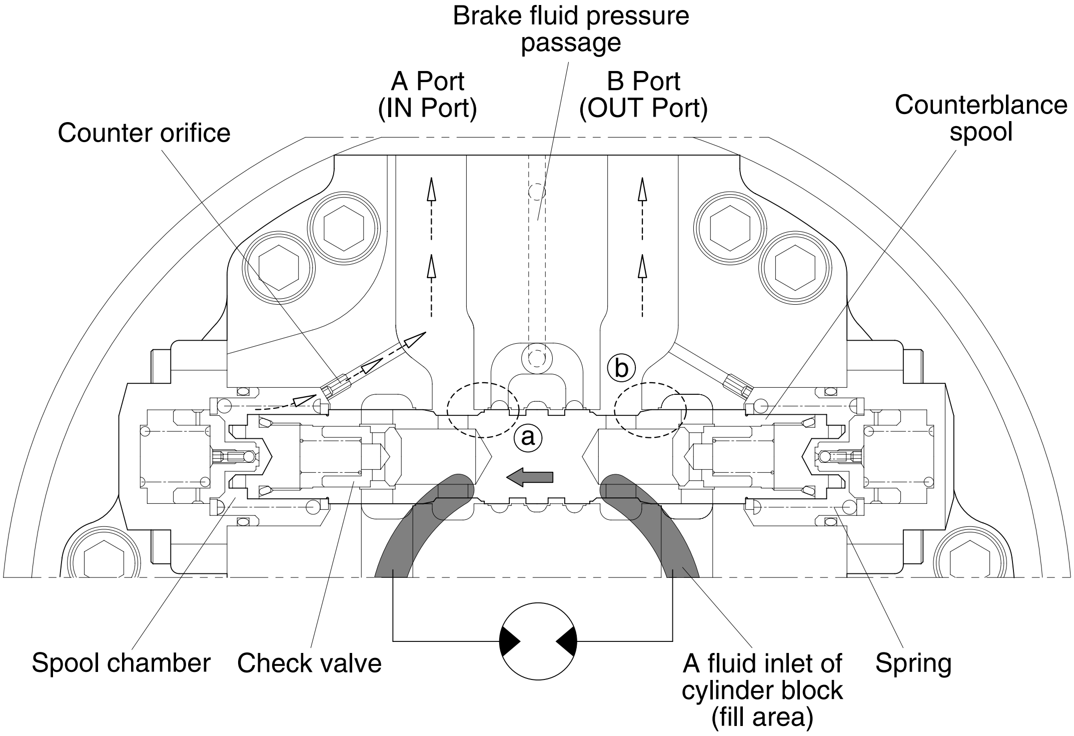
If worker leave lever in neutral, pressurized oil supply to in port of motor stop.

If pressurized oil supply stop, A port pressure decline and pressurized oil of spool chamber moves to oil tank through counter orifice. Therefore counterbalance spool return in neutral.

If counterbalance spool moves to left, line ⓑ by notch of counterbalance spool obstructed and brake pressurized oil obstructed.

At the same time, line ⓐ by notch of counterbalance valve obstructed. Therefore brake obstructed.

If brake force happens, brake stop.

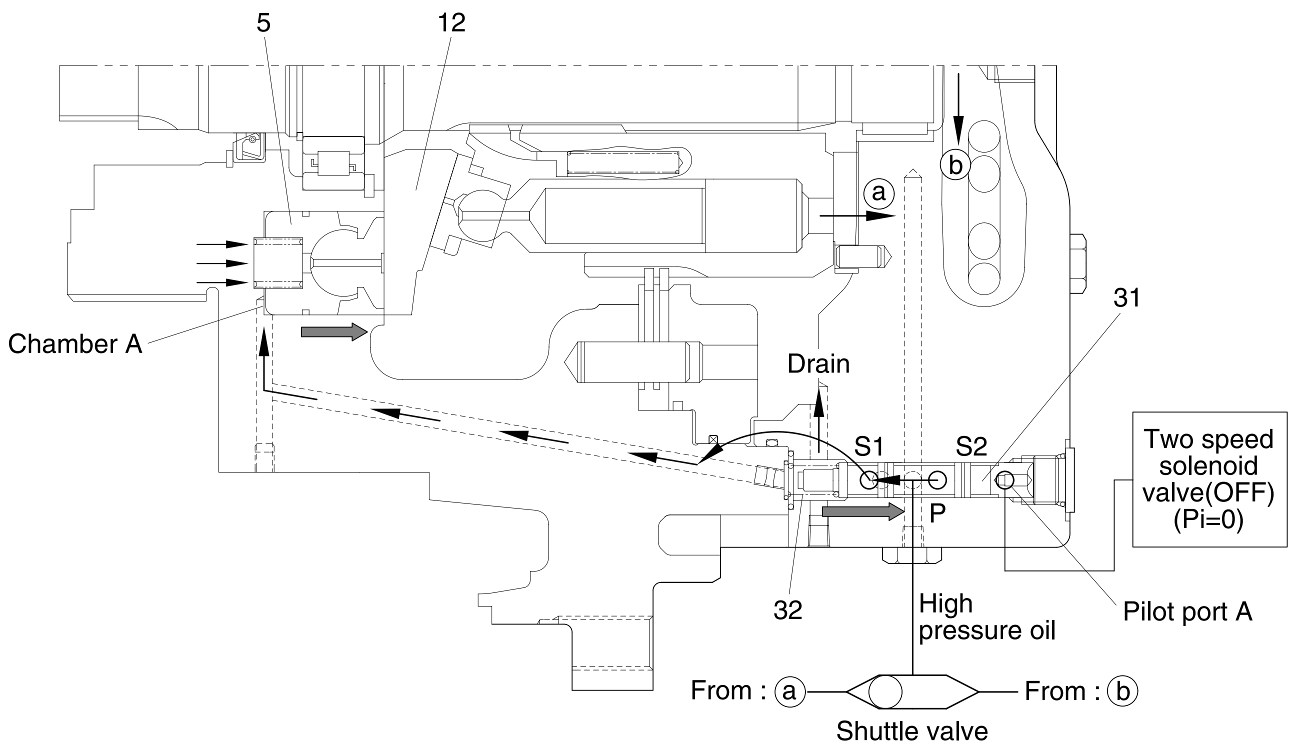


3809A2TM32

6) TWO SPEED (LOW SPEED - HIGH SPEED) CHANGEOVER EQUIPMENT

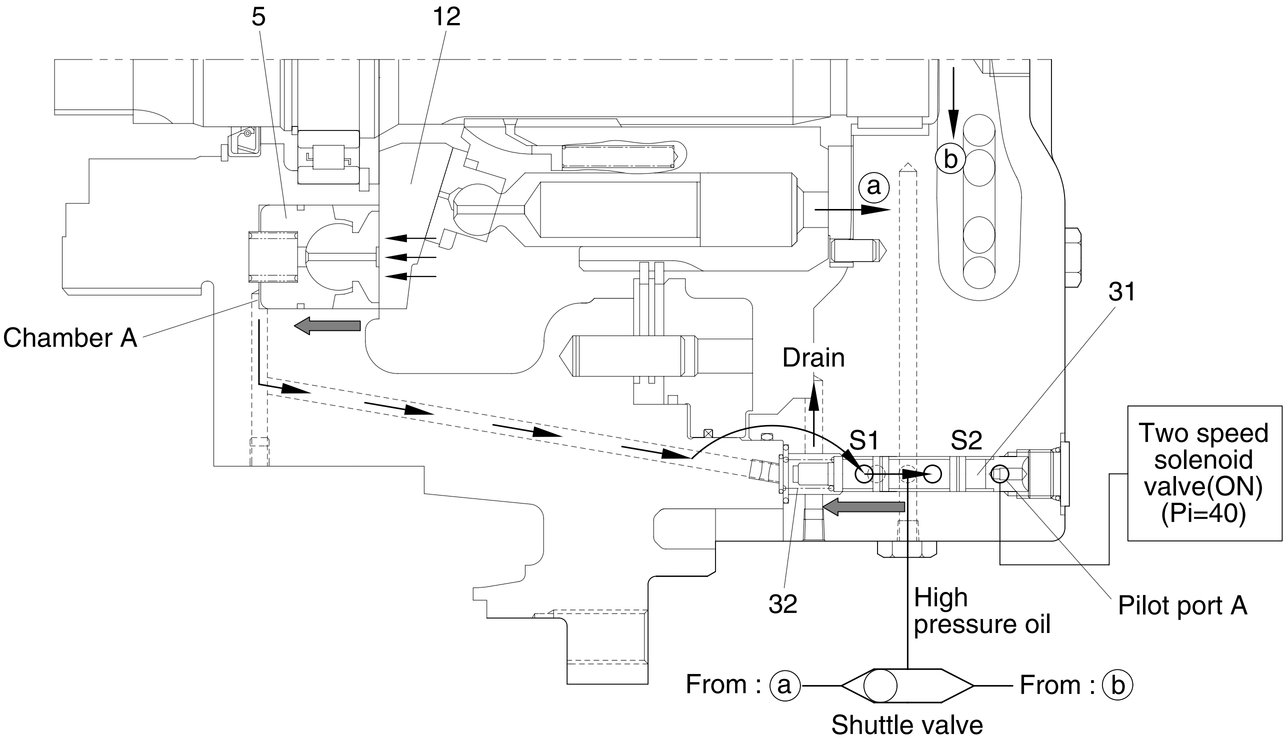
Rotation speed of track motor is depended on slope angle of swash plate (12).
When swash plate angle is Max, the motor rotates at low speed.
When swash plate angle is Min, the motor rotates at high speed.

- Low speed
  - When the pilot pressure on spool (31) is disconnected, pilot pressure does not pass to pilot port A. Two speed changeover spool (31) moves right by the spring (32) force.
  - High pressure oil of ⓐ port (or ⓑ port) of cylinder block flow to P port of two speed changeover spool (31) through shuttle valve.
    Pressurized oil of two speed changeover spool flow to chamber A of swash piston (5) through S2 port.
  - Swash plate moves to increase swash angle, so the motor rotates at low speed.



3809A2TM33

- **High speed**
  - The pilot pressure on spool (31) of the displacement changeover valve overcomes the force of spring (32), and the spool moves left.
  - High pressure oil of ⓐ port (or ⓑ port) of cylinder block flow to P port of two speed changeover spool (31) through shuttle valve.
  - Swash plate moves to decrease swash angle, so the motor rotates at high speed.



3809A2TM34

4. REDUCTION GEAR

1) PLANETARY GEAR MECHANISM

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

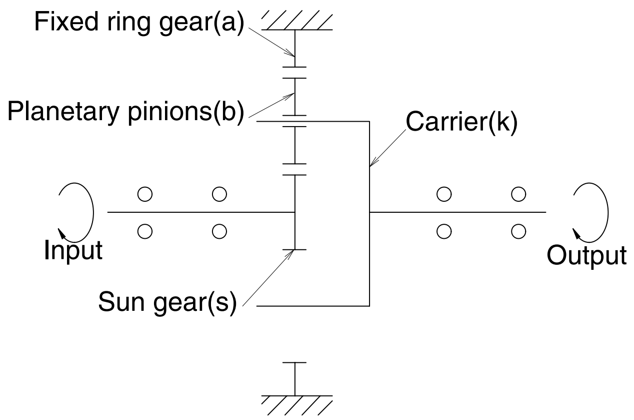
This reduction unit utilizes two stages, planetary reduction system.

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

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

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

This mechanism is called planetary gear mechanism.



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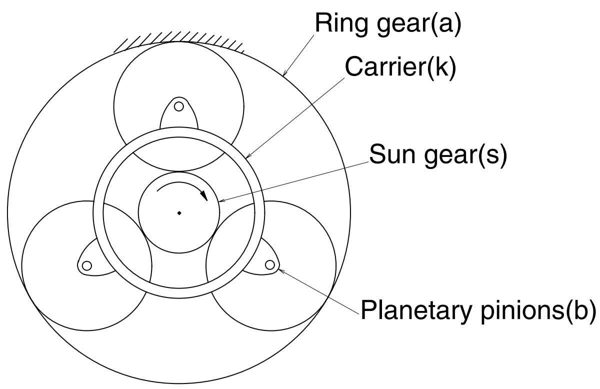
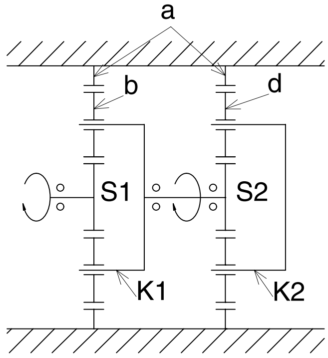


29072TM11

2) TWO STAGES REDUCTION GEAR

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

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



29072TM12

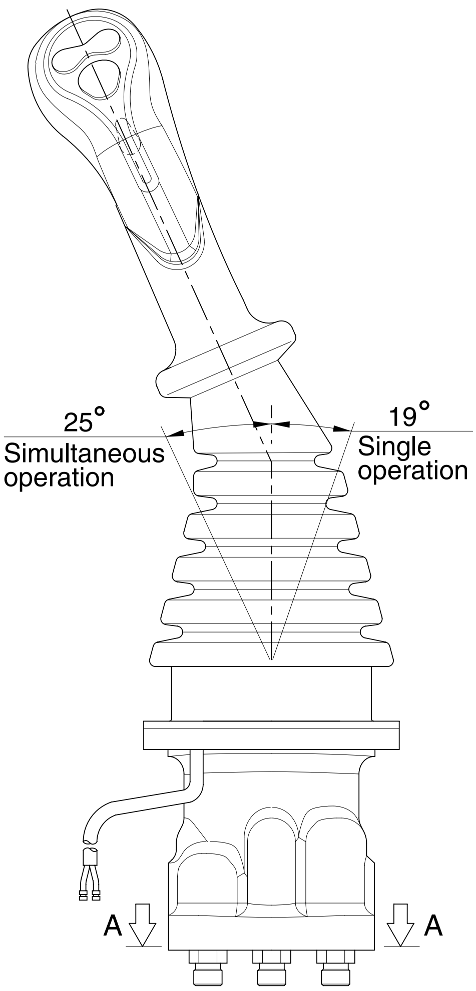
GROUP 5 RCV LEVER

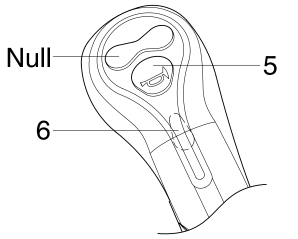
1. STRUCTURE

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

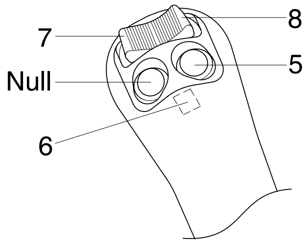
※ **Refer to the parts manual for the types of the RCV lever.**

1) TYPE L1, L3, L5, L10





TYPE L1, L3, L10

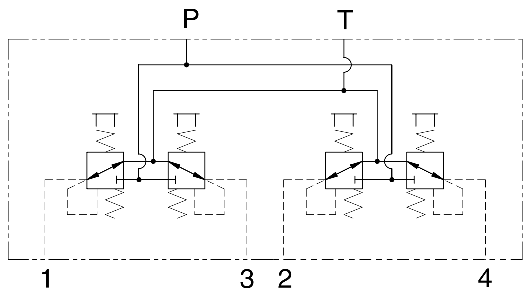


TYPE L5

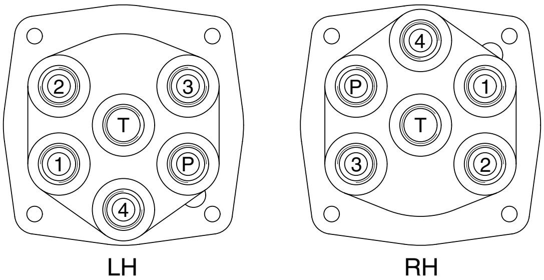
Switches

Type	No.	LH	RH
L1, L3, L10	5	One touch decel	Horn
	6	Power boost	Breaker
L5	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



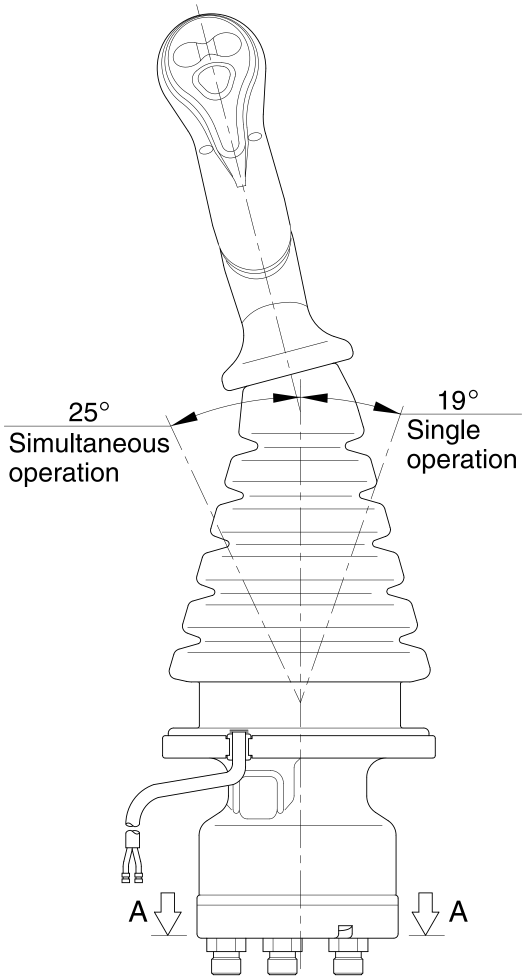
VIEW A-A

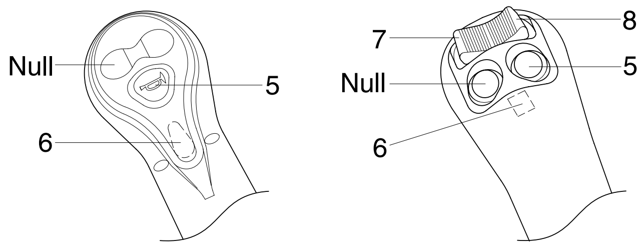
Pilot ports

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	

300L2RL101

2) TYPE L2, L4, L6, L9



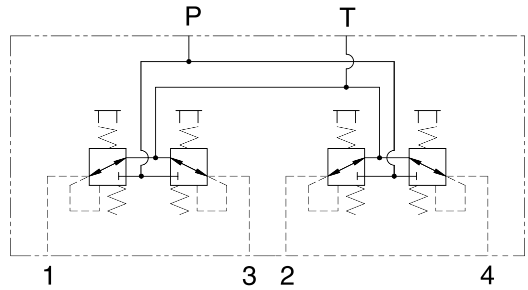


TYPE L2, L4, L9 TYPE L6

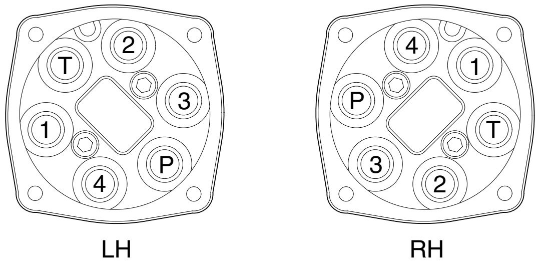
Switches

Type	No.	LH	RH
L2, L4, L9	5	One touch decel	Horn
	6	Power boost	Breaker
L6	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



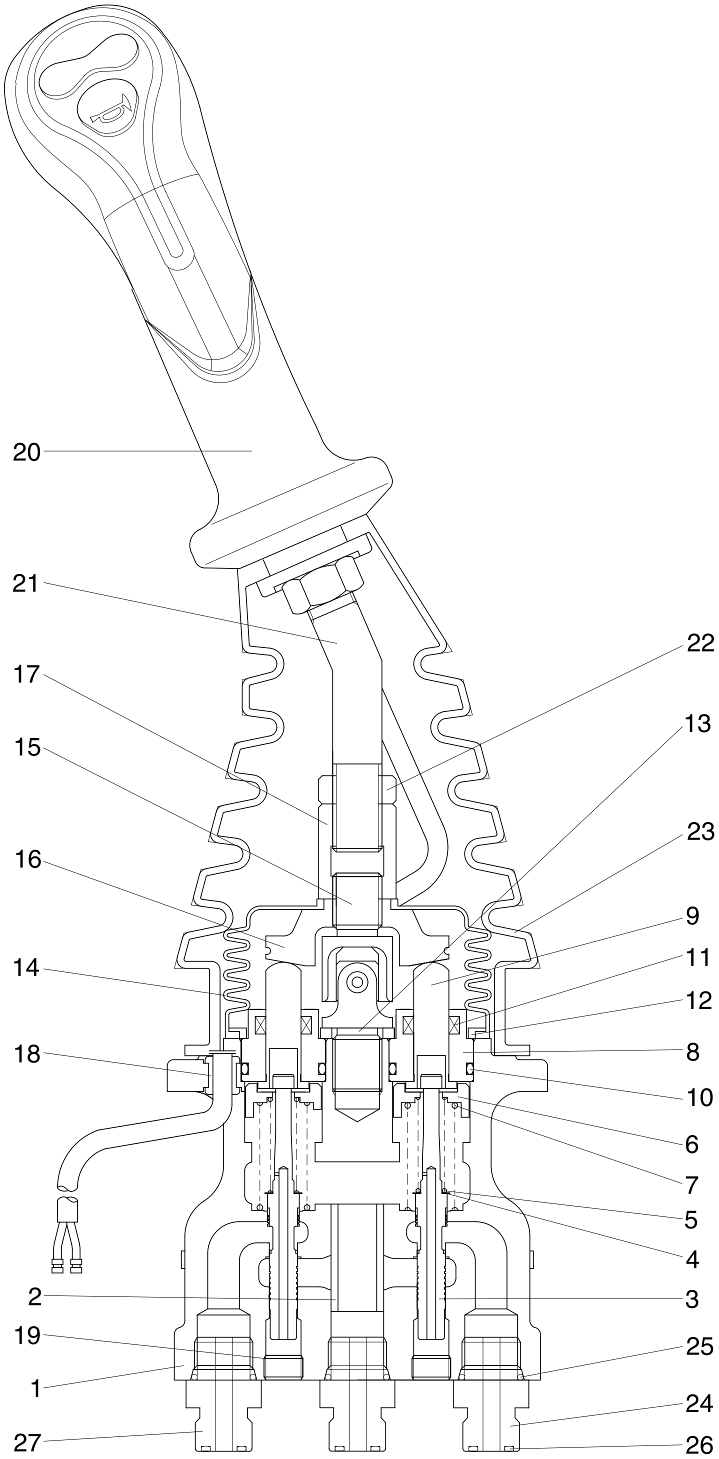
VIEW A-A

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	

300L2RL105

3) CROSS SECTION



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

300L2RL06

Item numbers are based on the type L1.

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 L1.

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

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

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

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

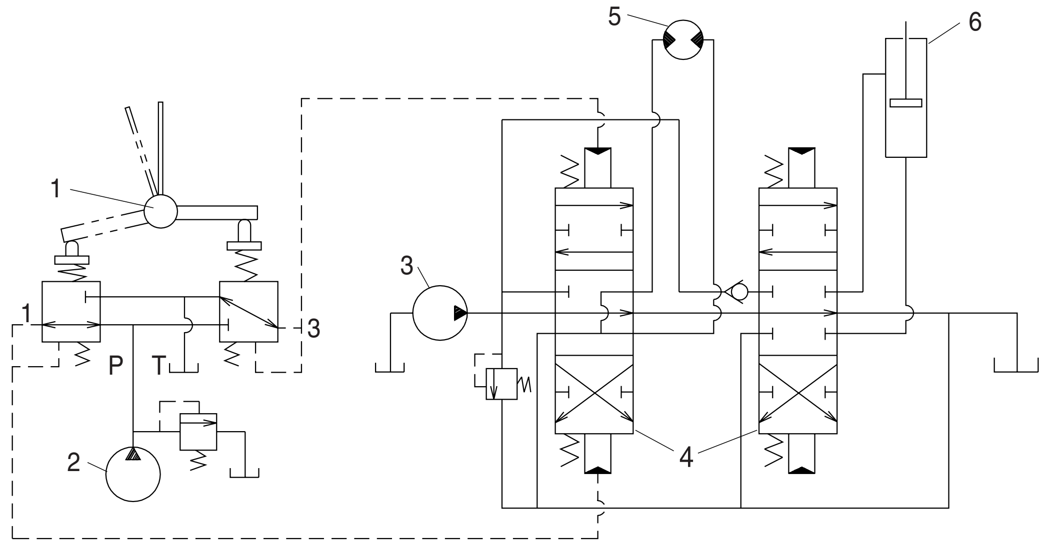
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

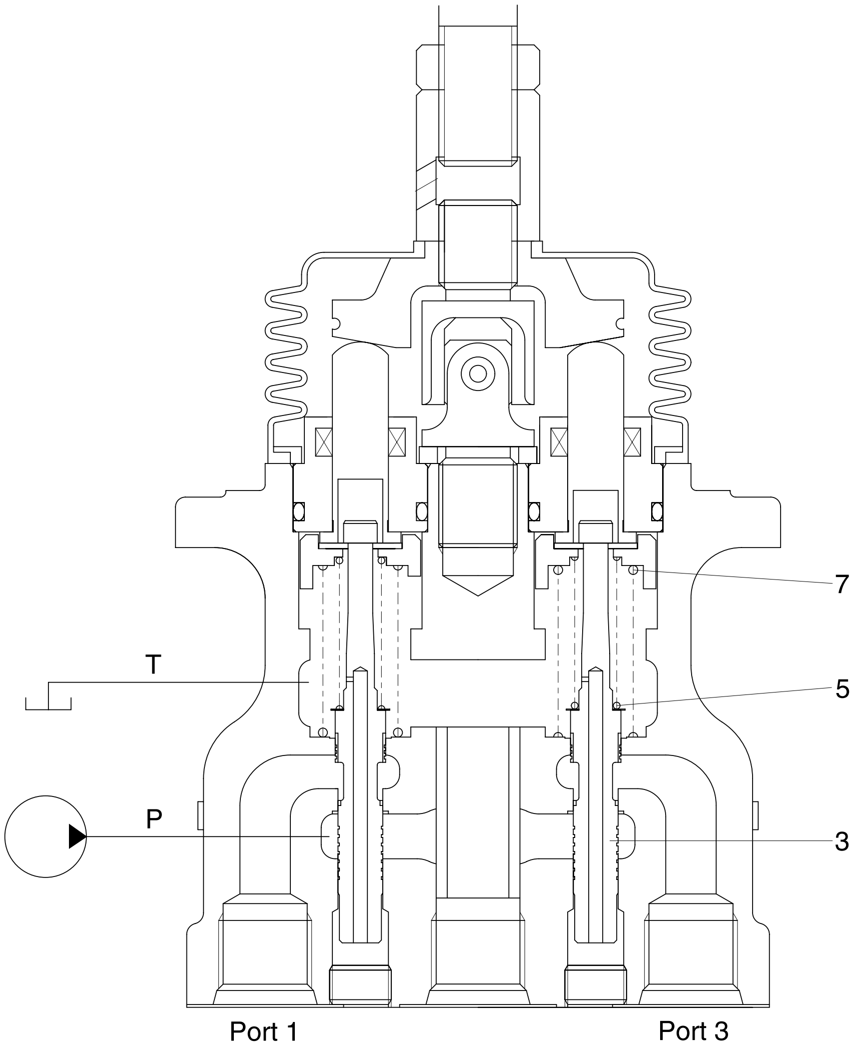
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

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



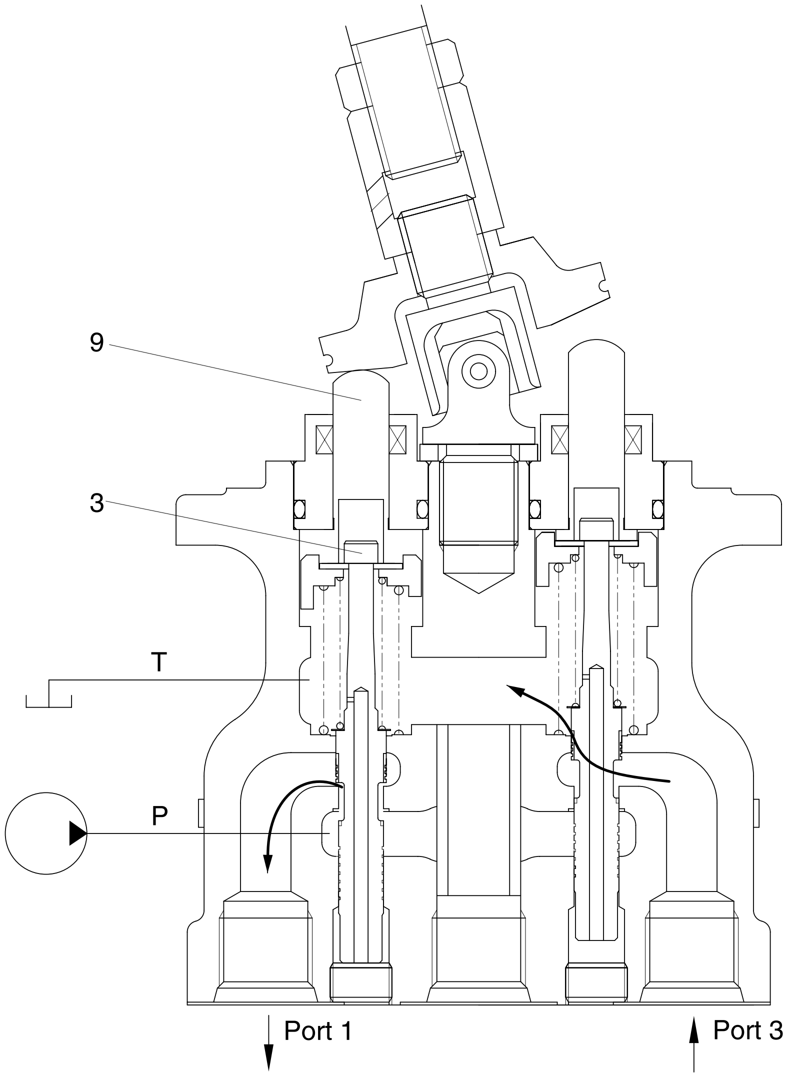
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where handle is in neutral position



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



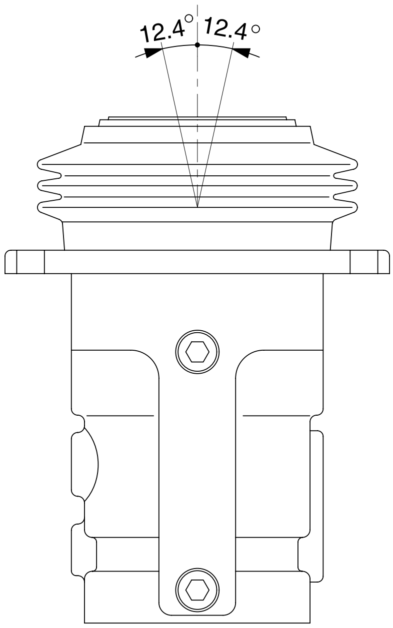
300L2RL04

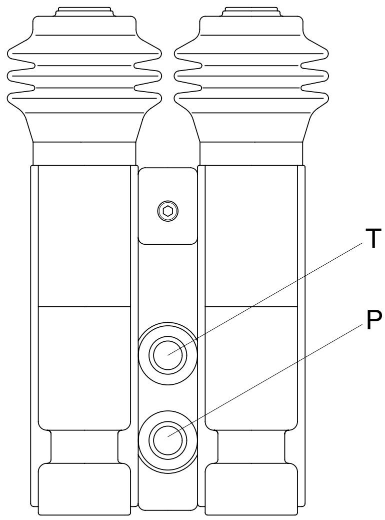
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle,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

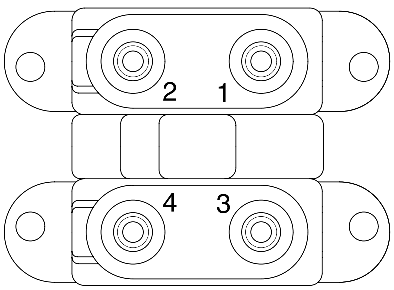
GROUP 6 RCV PEDAL (-#0473)

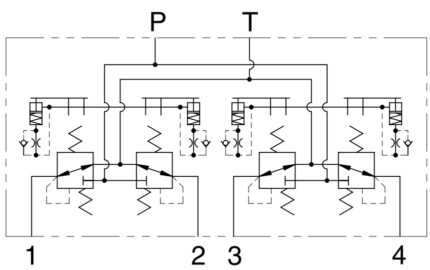
1. STRUCTURE

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)	

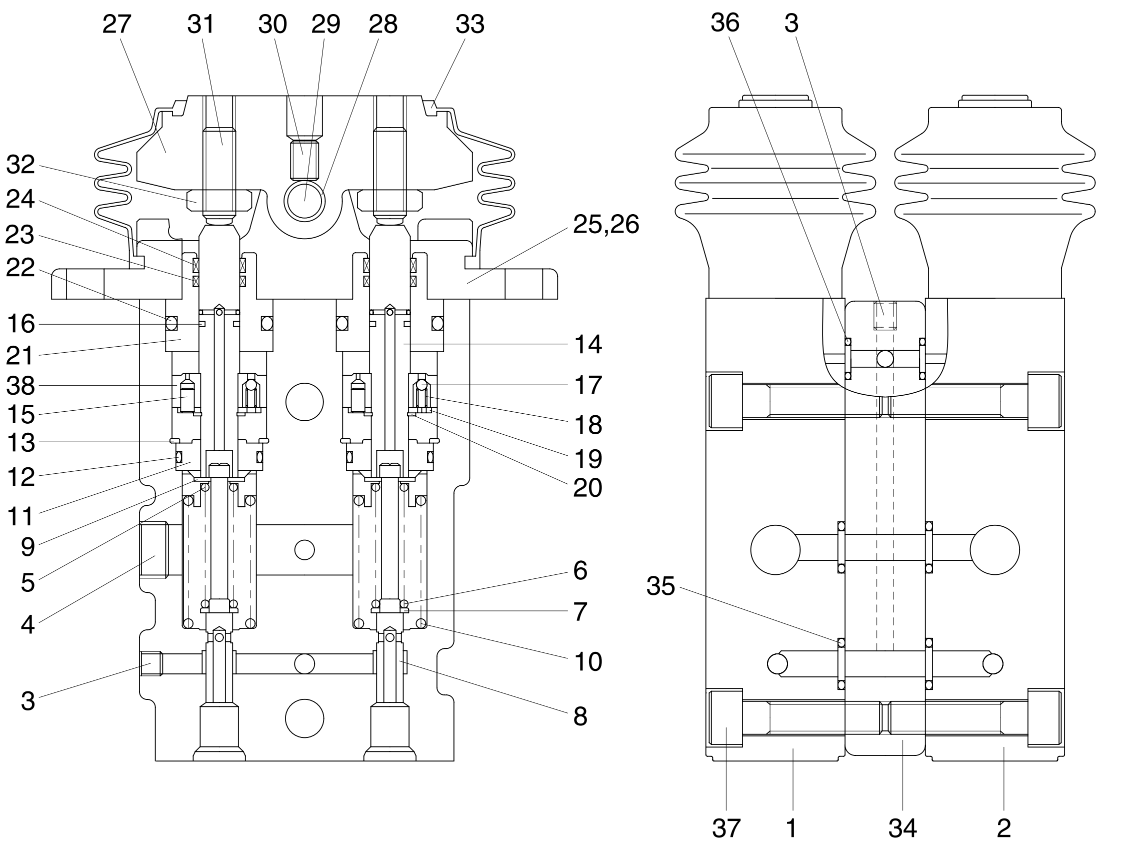
21092RP01

CROSS SECTION

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

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

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



21092RP02

1	Body(1)	14	Push rod	27	Cam
2	Body(2)	15	Spring pin	28	Bushing
3	Plug	16	Seal	29	Cam shaft
4	Plug	17	Steel ball	30	Set screw
5	Spring seat	18	Spring	31	Set screw
6	Spring	19	Plate	32	Nut
7	Spring seat	20	Snap ring	33	Bellows
8	Spool	21	Plug	34	Space
9	Stopper	22	O-ring	35	O-ring
10	Spring	23	Rod seal	36	O-ring
11	Rod guide	24	Dust seal	37	Socket bolt
12	O-ring	25	Cover	38	Piston
13	Snap ring	26	Socket bolt		

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

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

The change the deflection of this spring, the push rod (14) is inserted and can slide in the plug (21).

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

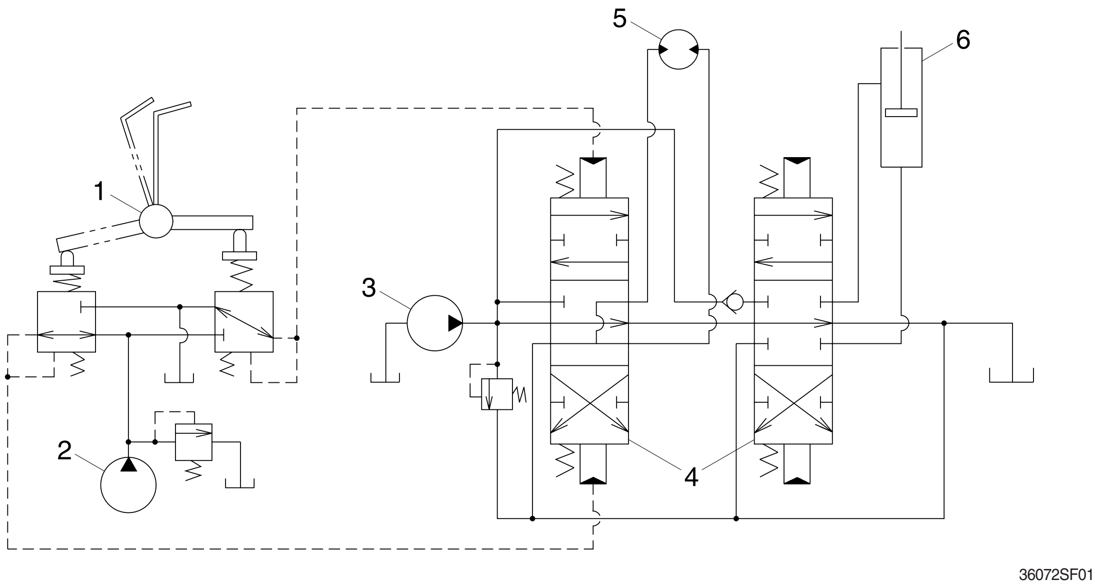
The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

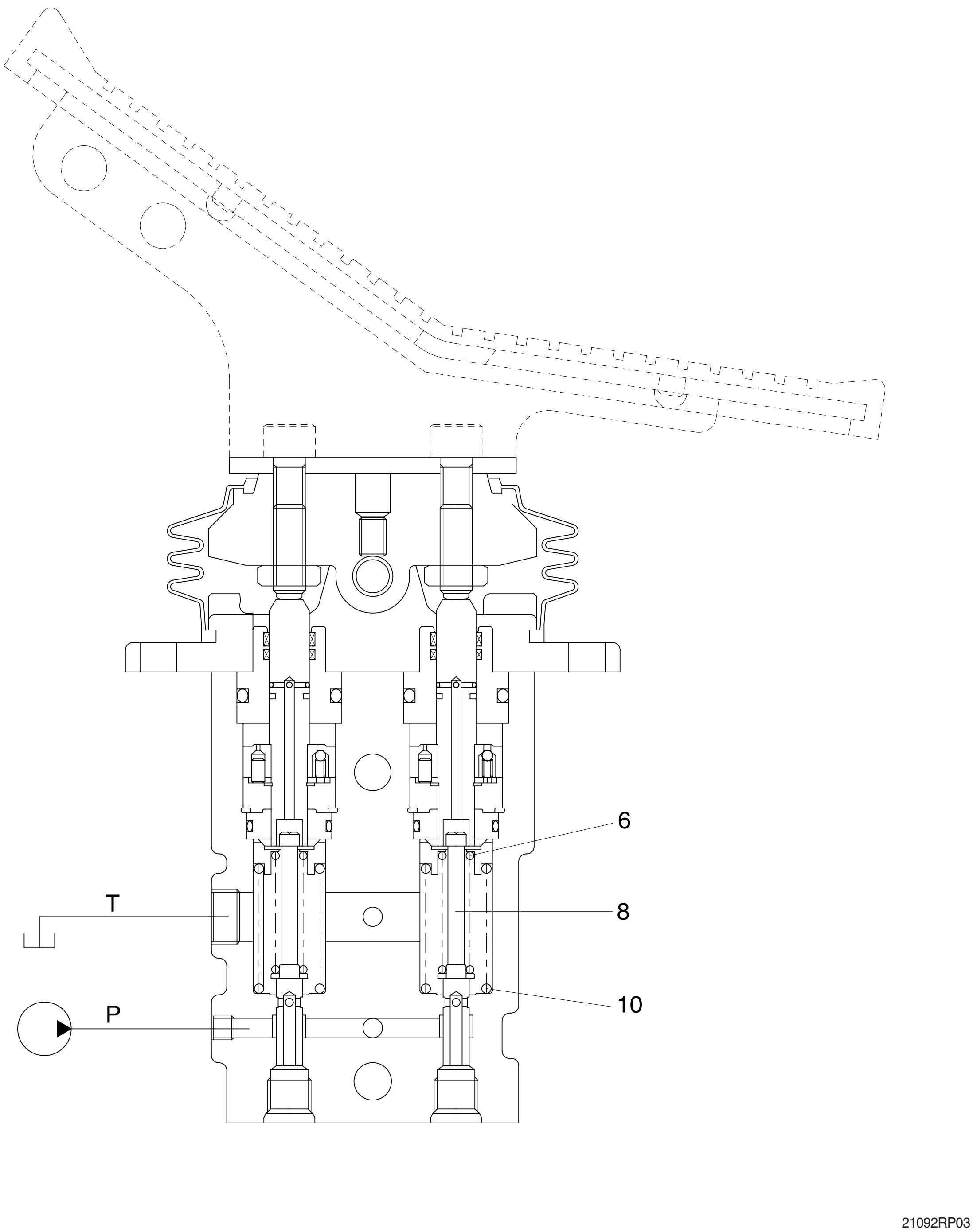
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below ant the attached operation explanation drawing.

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



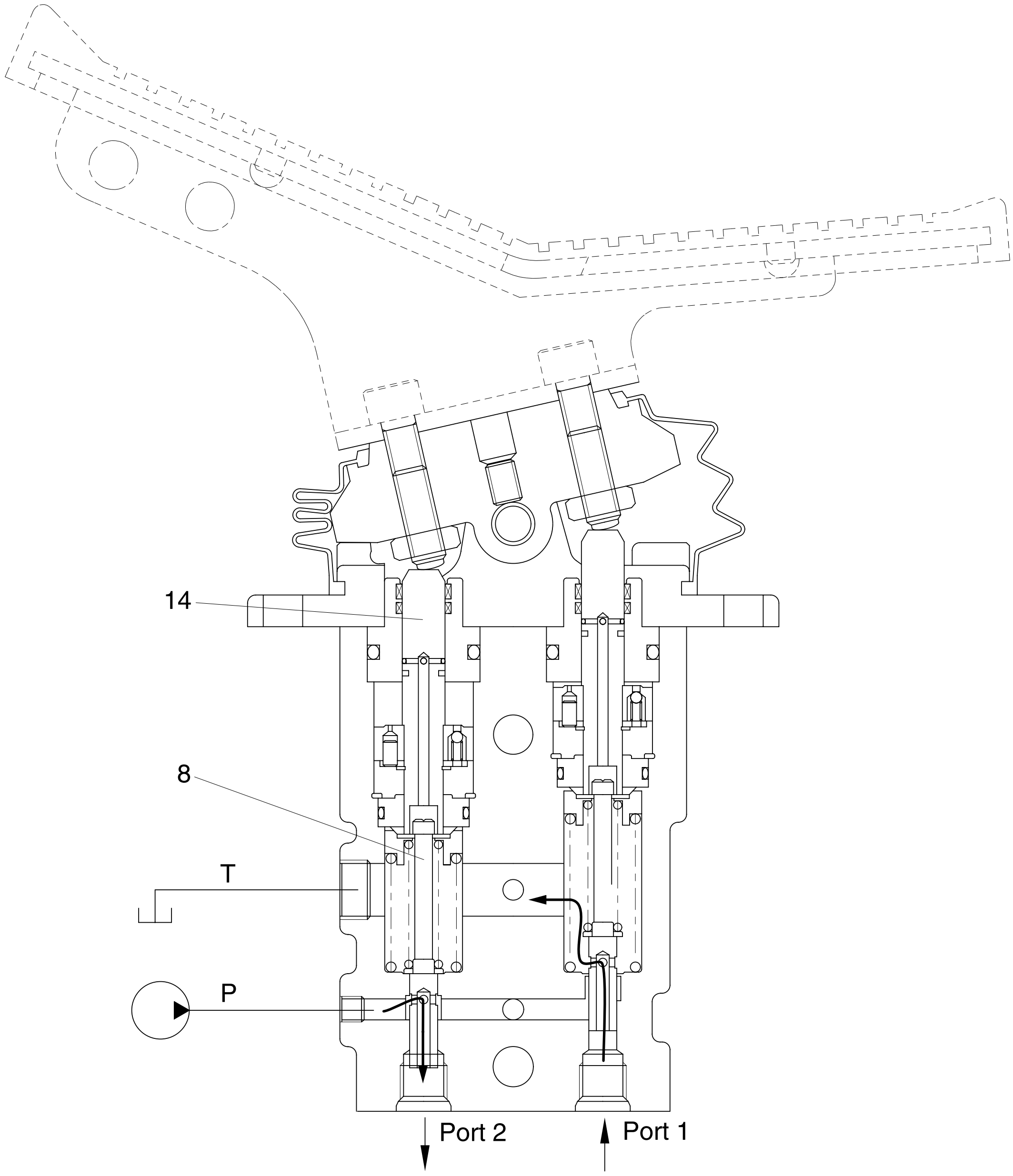
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where pedal is in neutral position



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

(2) Case where pedal is tilted



300L2RL08

When the push rod (14) is stroked, the spool (8) moves downwards.

Then port P is connected with port (2), and the oil supplied from the pilot pump flows through port 1 to generate the pressure.

When the pressure at port (2) increases to the value corresponding to the spring force set by tilting the pedal, 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 (2). If it decreases lower than the set pressure, port P is connected with port (2) and port T is disconnected from port (2).

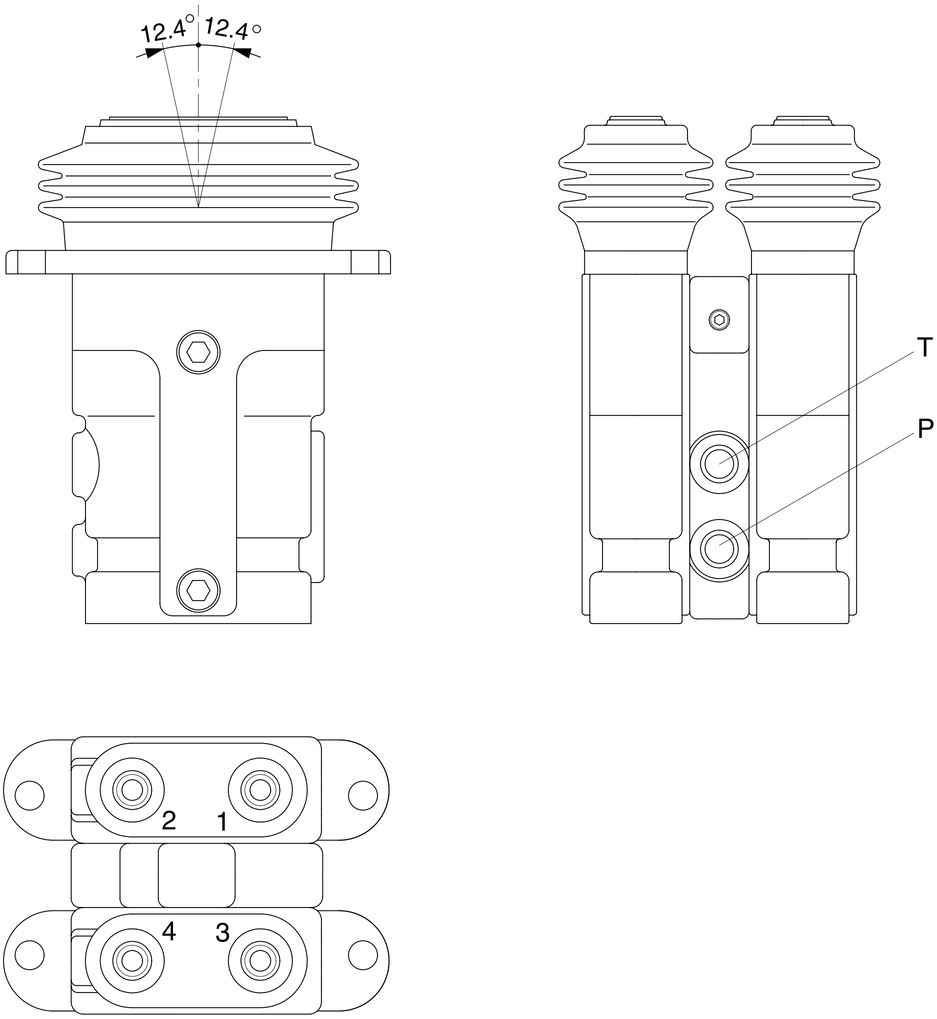
In this manner the secondary pressure is kept at the constant value.

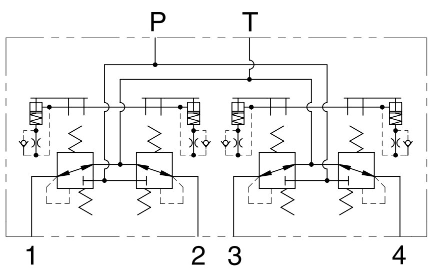
Besides, in some type, when the pedal is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.

GROUP 6 RCV PEDAL (#0474-)

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)	

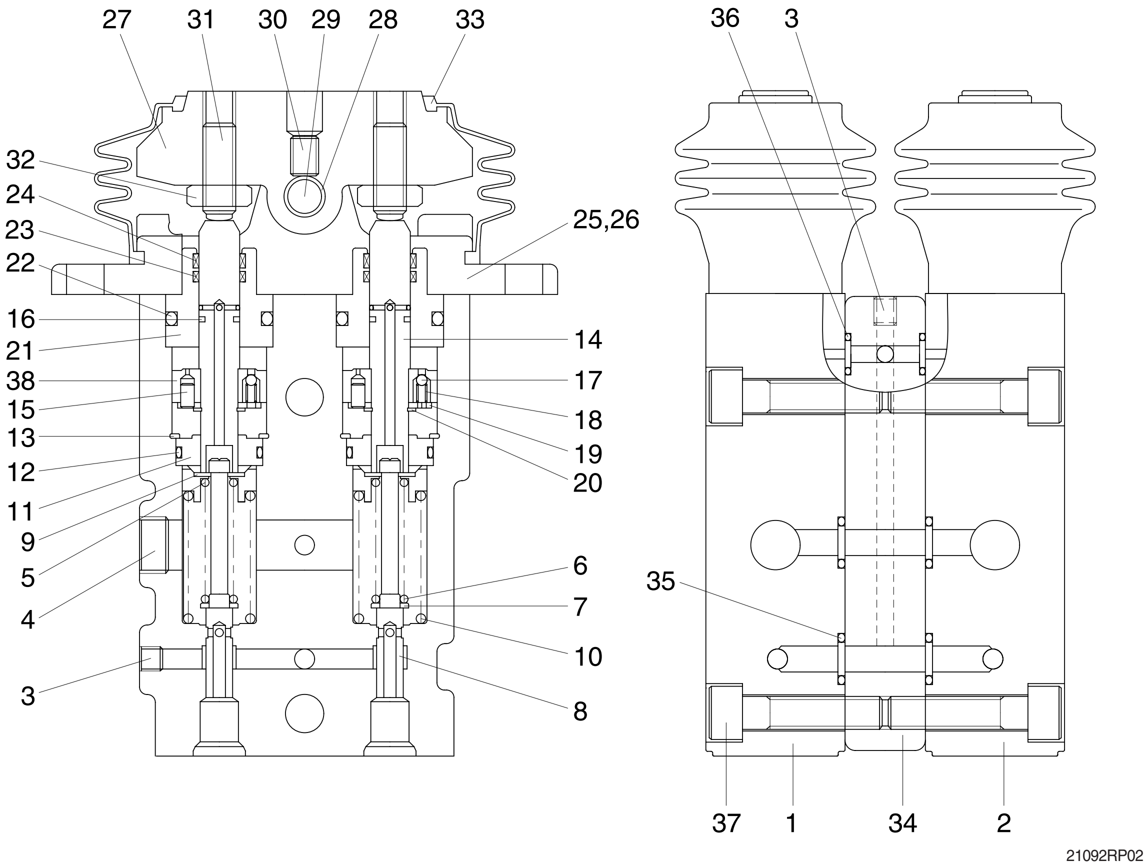
21092RP01

CROSS SECTION

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

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

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



1	Body(1)	14	Push rod	27	Cam
2	Body(2)	15	Spring pin	28	Bushing
3	Plug	16	Seal	29	Cam shaft
4	Plug	17	Steel ball	30	Set screw
5	Spring seat	18	Spring	31	Set screw
6	Spring	19	Plate	32	Nut
7	Spring seat	20	Snap ring	33	Bellows
8	Spool	21	Plug	34	Space
9	Stopper	22	O-ring	35	O-ring
10	Spring	23	Rod seal	36	O-ring
11	Rod guide	24	Dust seal	37	Socket bolt
12	O-ring	25	Cover	38	Piston
13	Snap ring	26	Socket bolt		

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

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

The change the deflection of this spring, the push rod (14) is inserted and can slide in the plug (21).

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

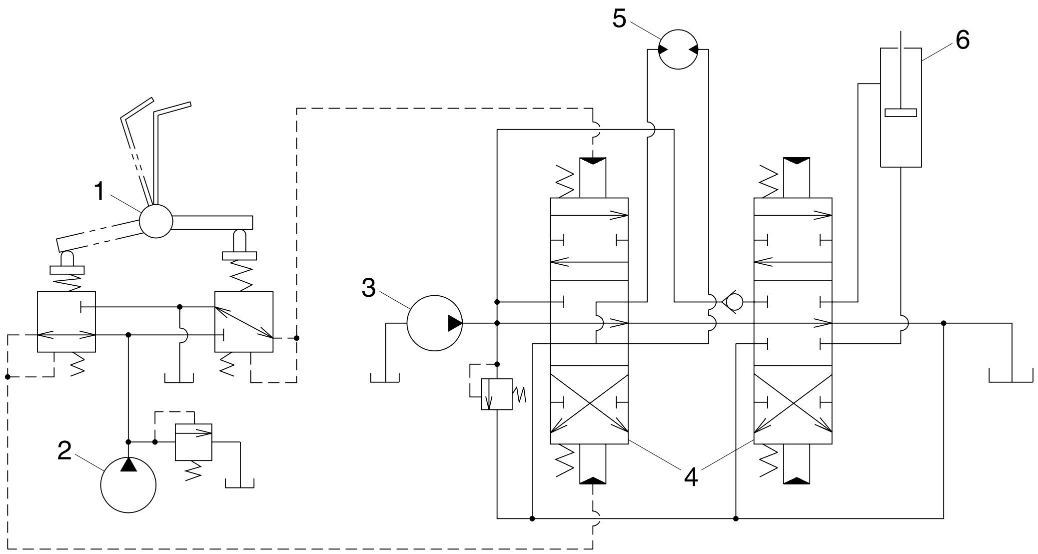
The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

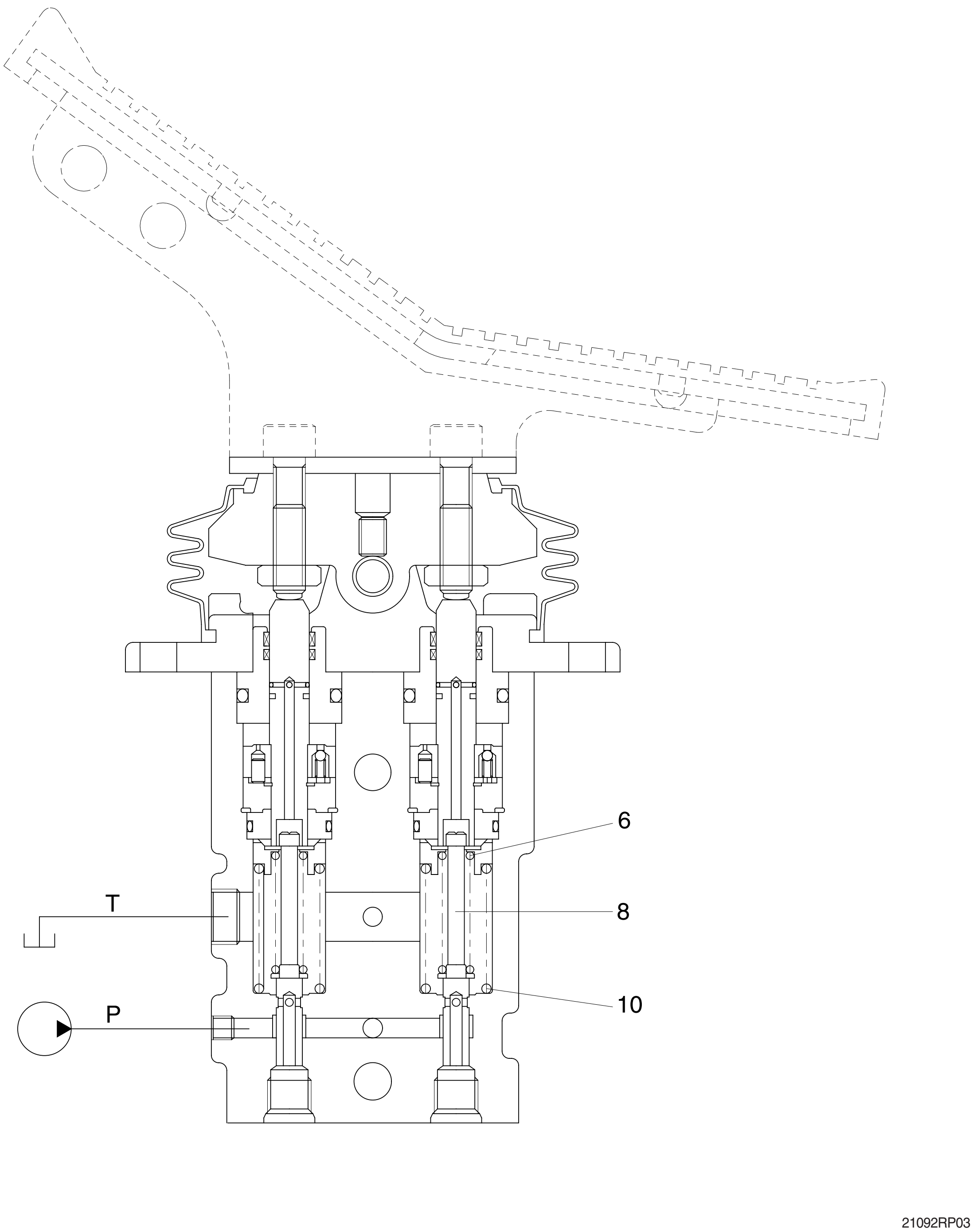
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below ant the attached operation explanation drawing.

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



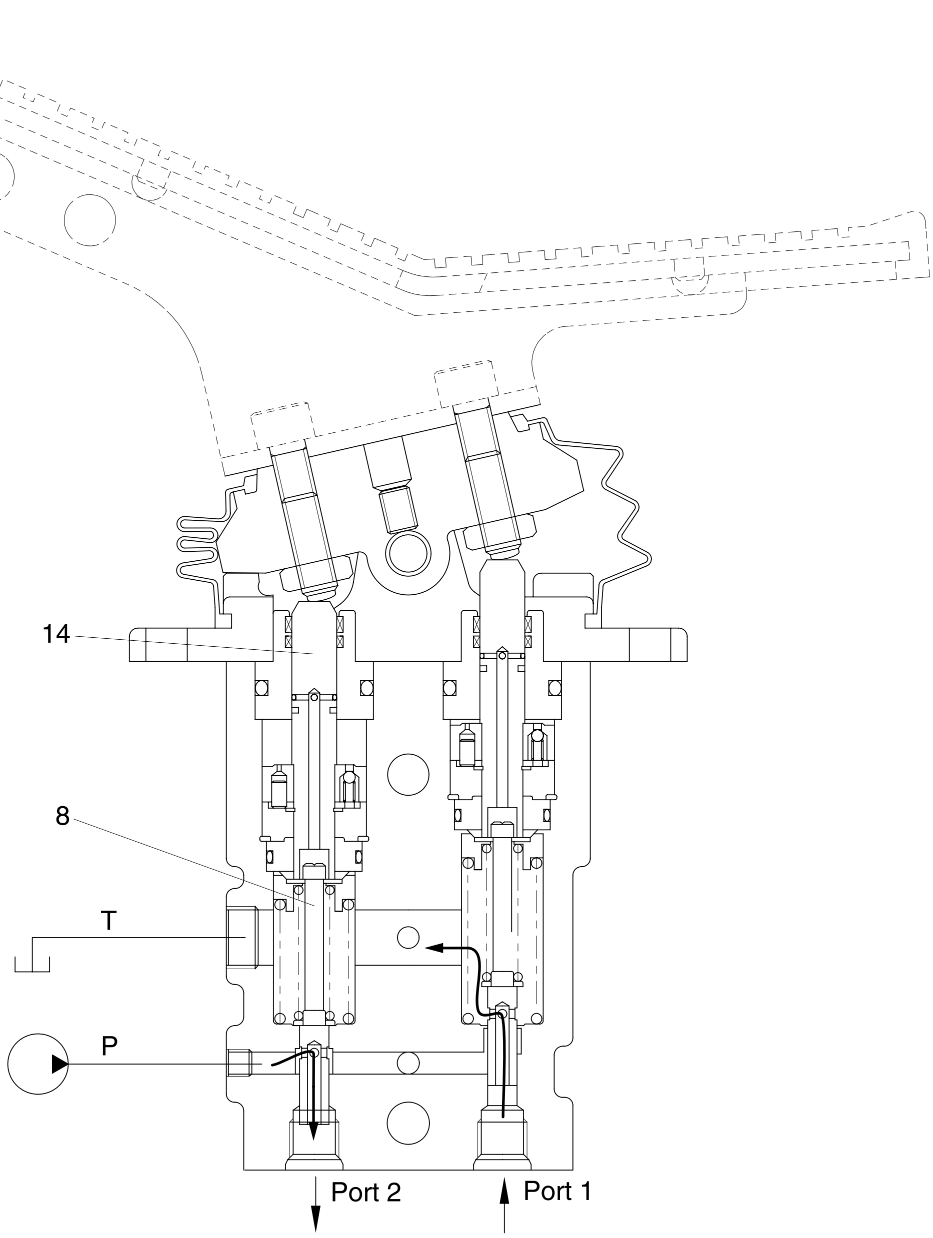
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where pedal is in neutral position



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

(2) Case where pedal is tilted

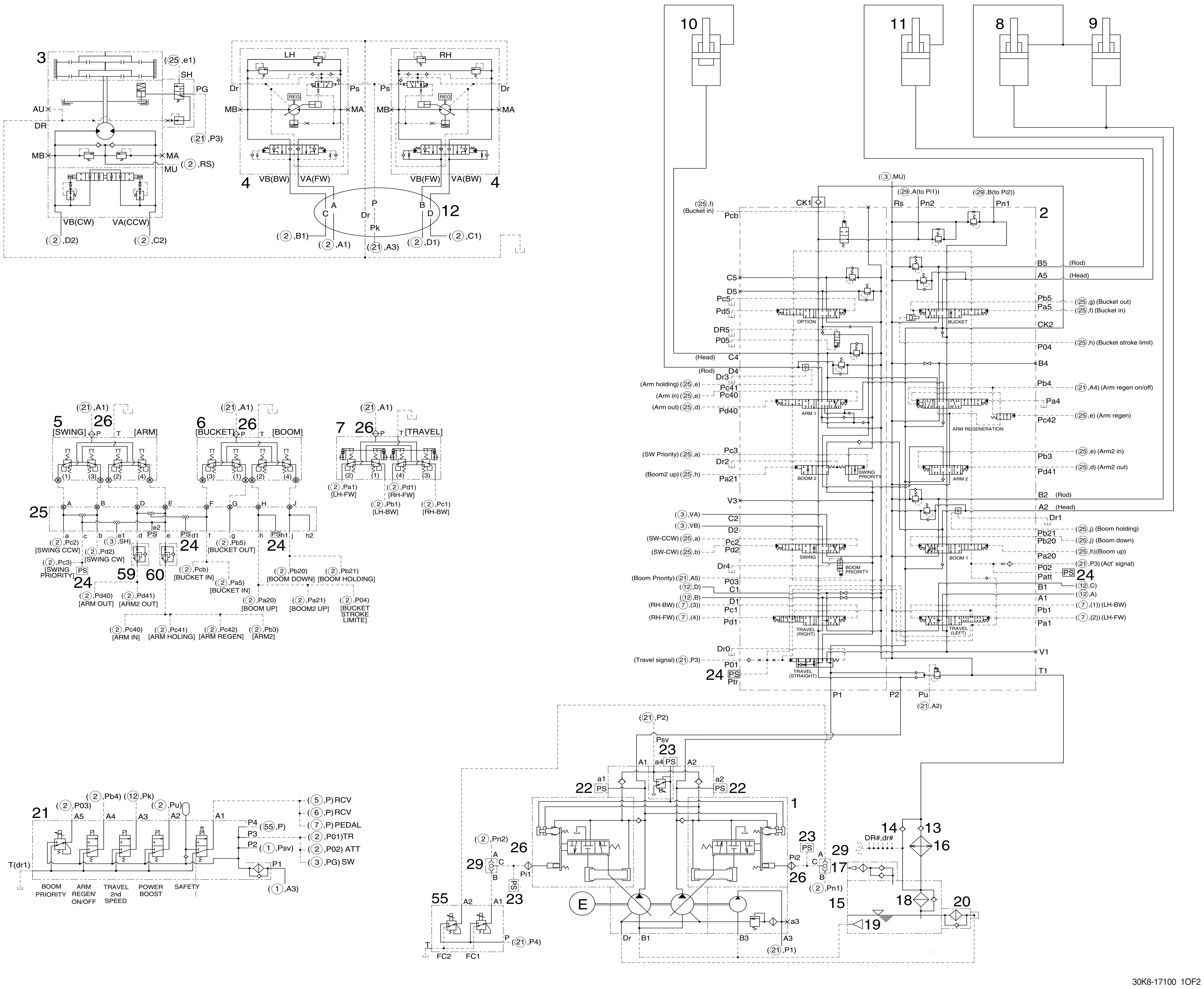


300L2RL08

When the push rod (14) is stroked, the spool (8) moves downwards.
Then port P is connected with port (2), and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port (2) increases to the value corresponding to the spring force set by tilting the pedal, 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 (2).   If it decreases lower than the set pressure, port P is connected with port (2) and port T is disconnected from port (2).
In this manner the secondary pressure is kept at the constant value.
Besides, in some type, when the pedal is tilted more than a certain angle, the upper end of the spool contacts with inside bottom of the push rod and the output pressure is left to be connected with port P.

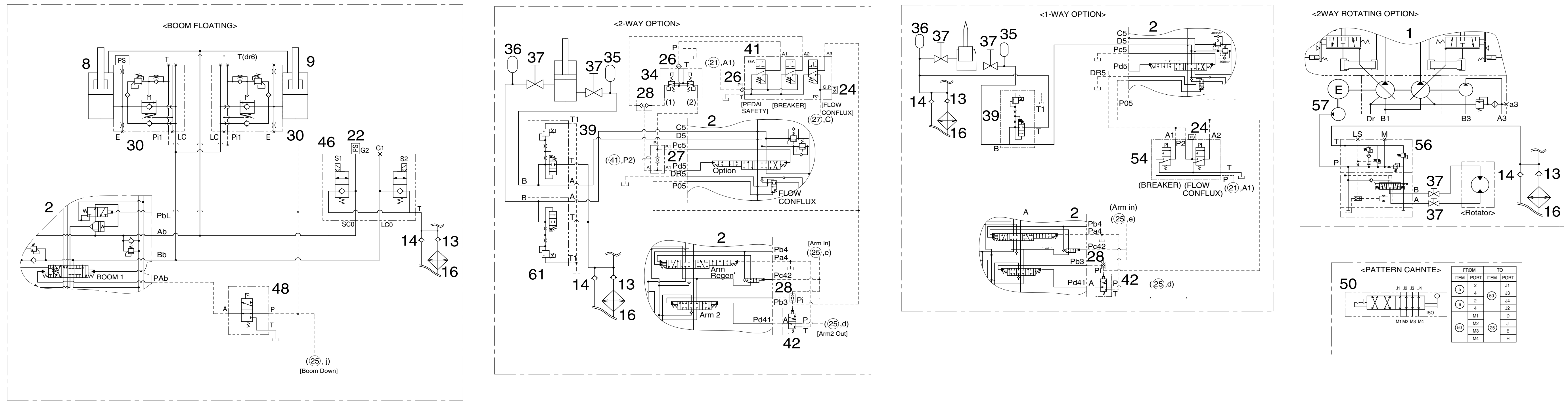
SECTION 3 HYDRAULIC SYSTEM

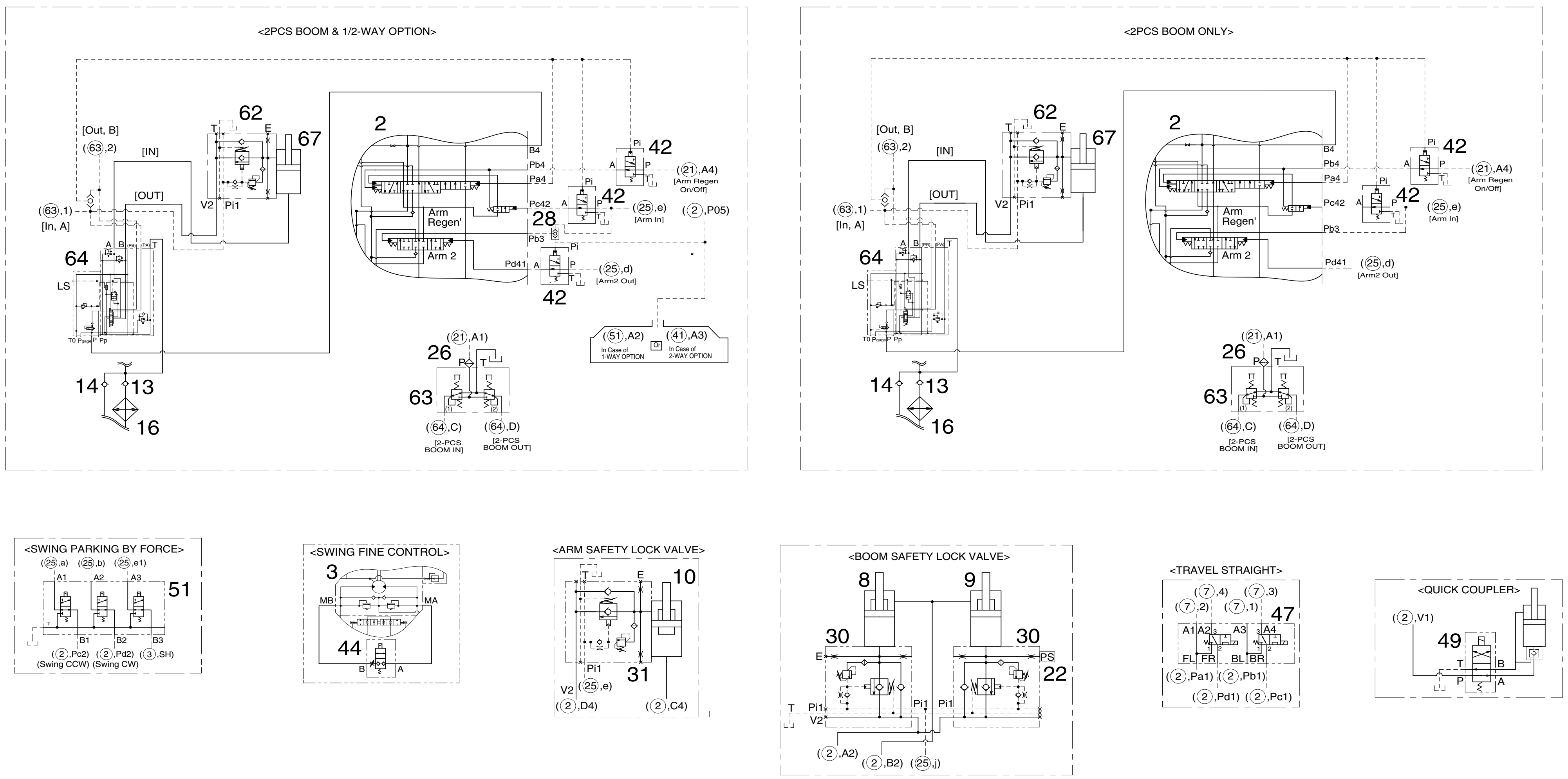
GROUP 1 HYDRAULIC CIRCUIT (1/2)



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 Bypass valve
19 Strainer
20 Drain valve
21 Solenoid valve
22 Pressure sensor
23 Pressure sensor
24 Pressure sensor
25 Shuttle block
26 Last guard filter
29 Tee shuttle
55 2-EPPR cartridge valve
59 Shockless valve
60 Shockless valve

HYDRAULIC CIRCUIT (2/2)





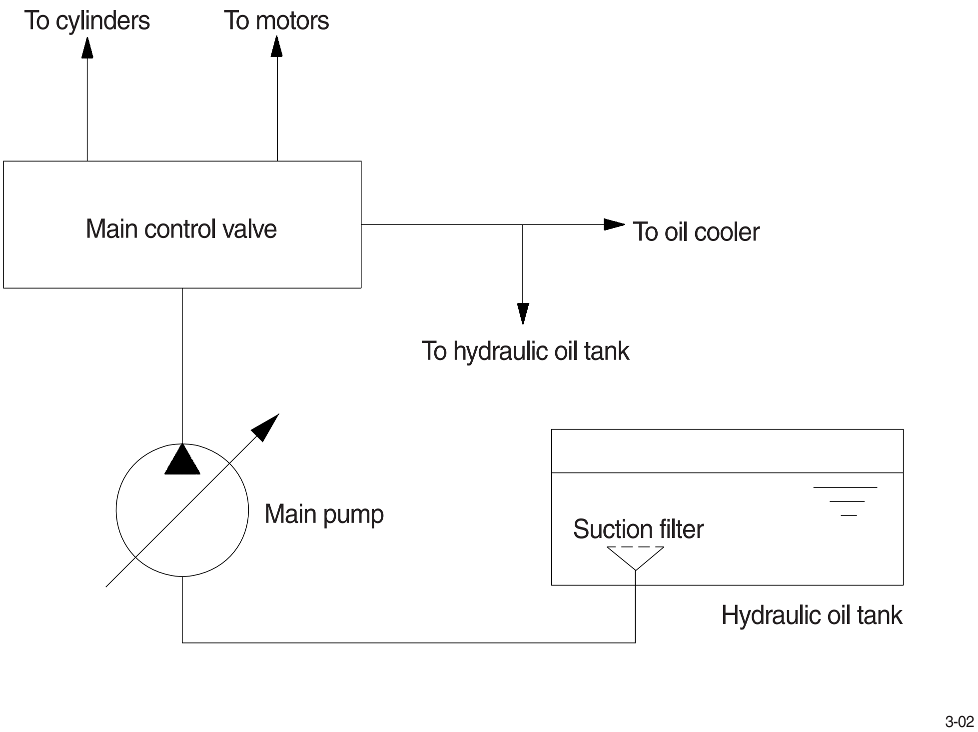
1 Main pump
2 Main control valve
3 Swing motor
8 Boom cylinder (LH)
9 Boom cylinder (RH)
10 Arm cylinder
13 Check valve
14 Check valve
16 Oil cooler
22 Pressure switch
24 Pressure switch
26 Last guard switch
27 5-shuttle valve (option)
28 Tee shuttle (option)
30 Boom safety valve (option)
31 Arm safety valve (option)
35 Accumulator (option)
36 Accumulator (option)
37 Stop valve (option)
39 Pro. relief valve (option)
41 3-sol cartridge valve (option)
42 Pilot selector valve (option)
44 Solenoid valve (option)
46 Boom floating 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)
61 Pro. relief valve (option)
62 Cylinder safety valve (option)
63 2-way pedal (option)
64 Control valve (option)
67 2pcs boom cylinder (option)

30K8-17100 2OF2

GROUP 2 MAIN CIRCUIT

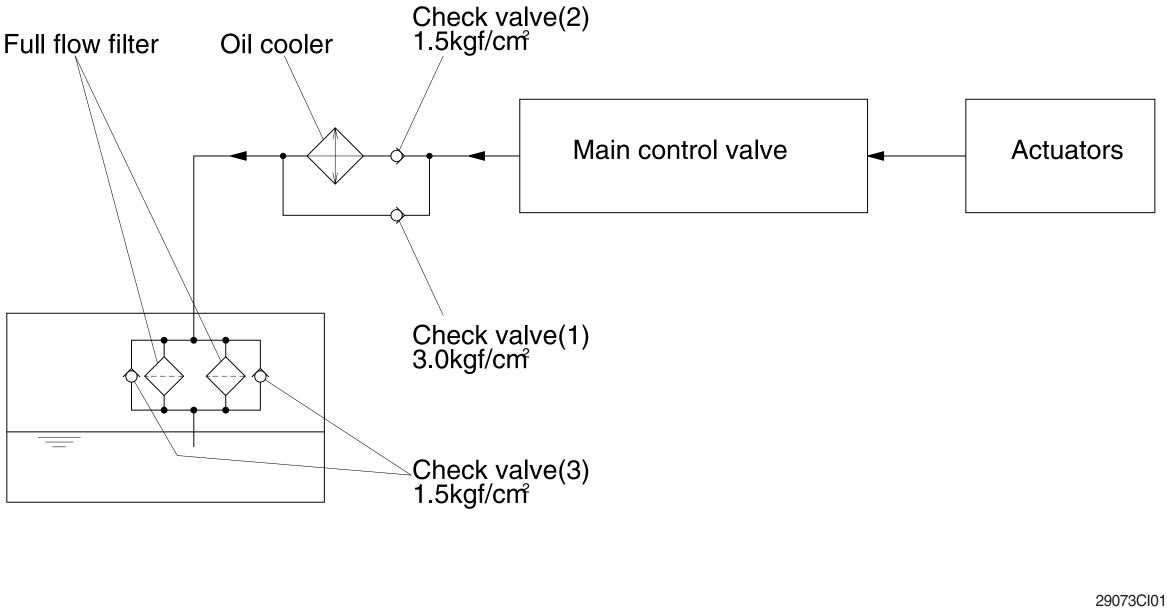
The main hydraulic circuit consists of suction circuit, delivery circuit, return circuit and drain circuit.
The hydraulic system consists of one main pump, one control valve, one swing motor, four cylinders and two travel motors.
The swash plate type variable displacement tandem axial piston pump is used as the main pump and is driven by the engine at ratio 1.0 of engine speed.

1. SUCTION AND DELIVERY CIRCUIT



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

2. RETURN CIRCUIT



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/cm^2 (21 psi) and 3.0 kgf/cm^2 (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. The oil pressure exceeds 3.0 kgf/cm^2 (43 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

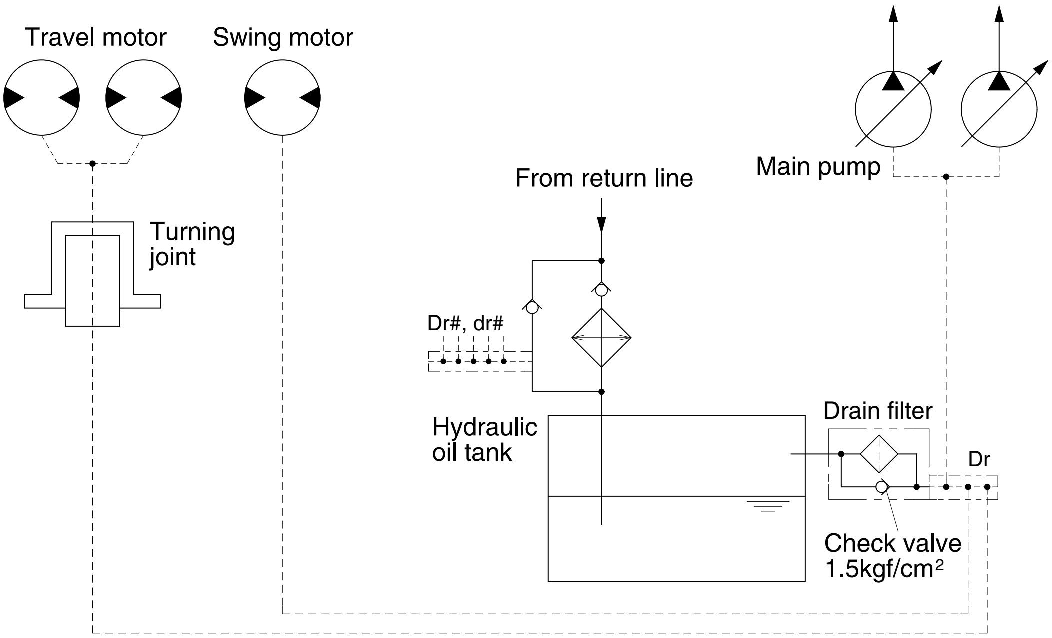
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).

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

The oil 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/cm^2 (21 psi) differential pressure.

3. DRAIN CIRCUIT



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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 full flow filter in the hydraulic tank. When the drain oil pressure exceed 1.5 kgf/cm^2 (21 psi), the oil returns to the hydraulic tank directly.

1) TRAVEL MOTOR DRAIN CIRCUIT

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

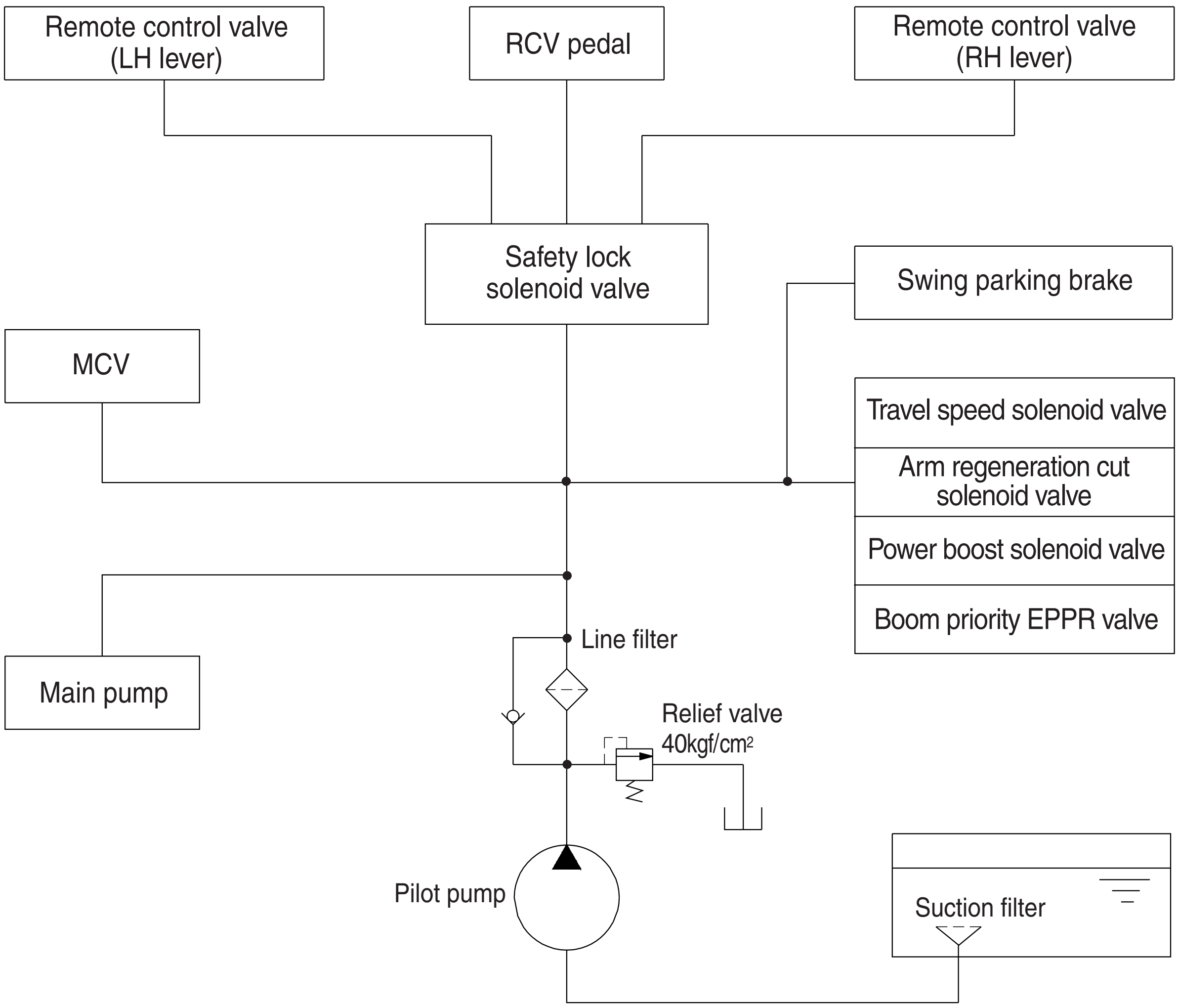
2) SWING MOTOR DRAIN CIRCUIT

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

3) MAIN PUMP DRAIN CIRCUIT

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

GROUP 3 PILOT CIRCUIT



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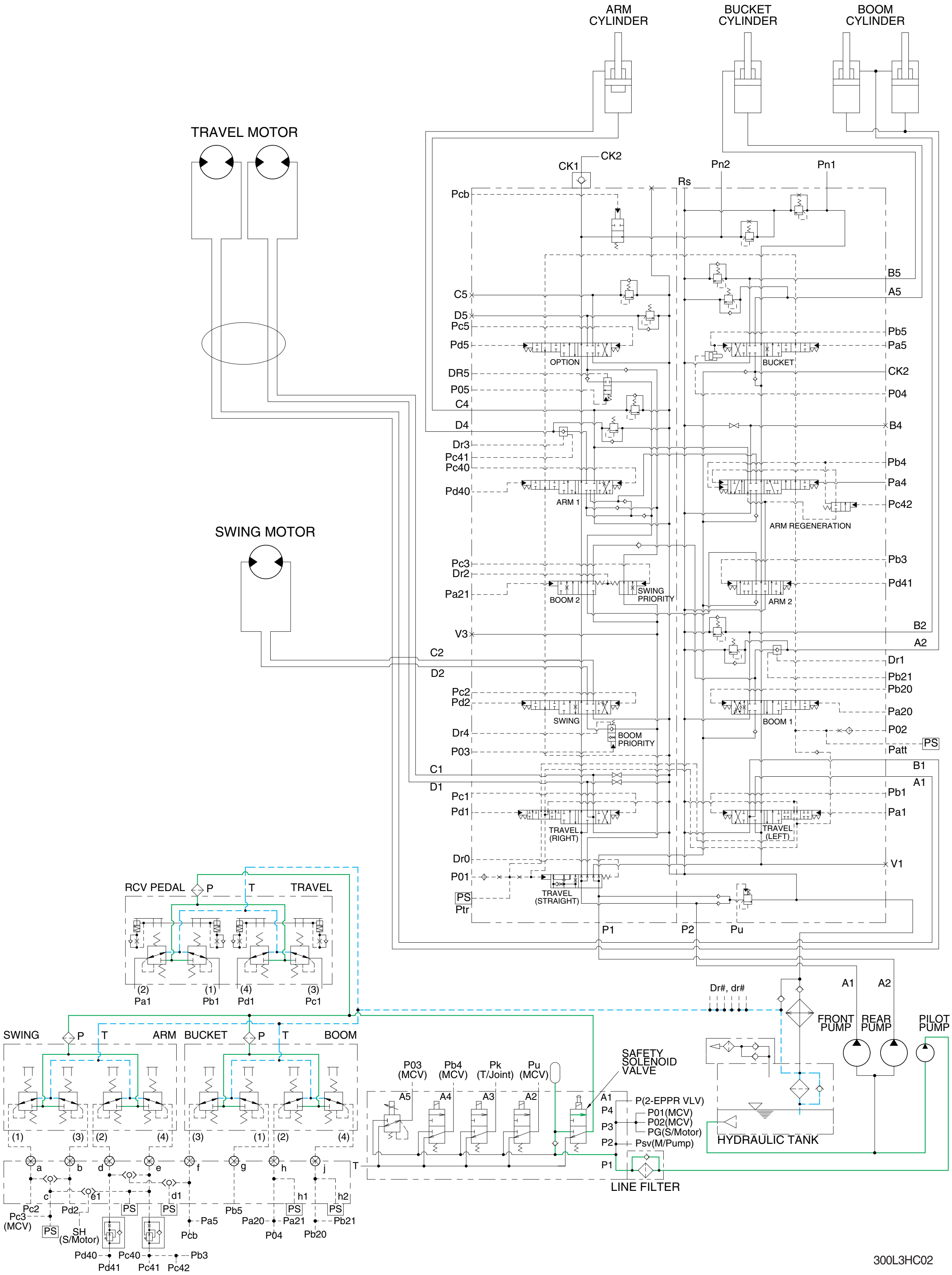
The pilot circuit consists of suction circuit, delivery circuit and return circuit.
The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction filter.
The discharged oil from the pilot pump flows to the remote control valve through line filter, EPPR valve,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

1. SUCTION, DELIVERY AND RETURN CIRCUIT

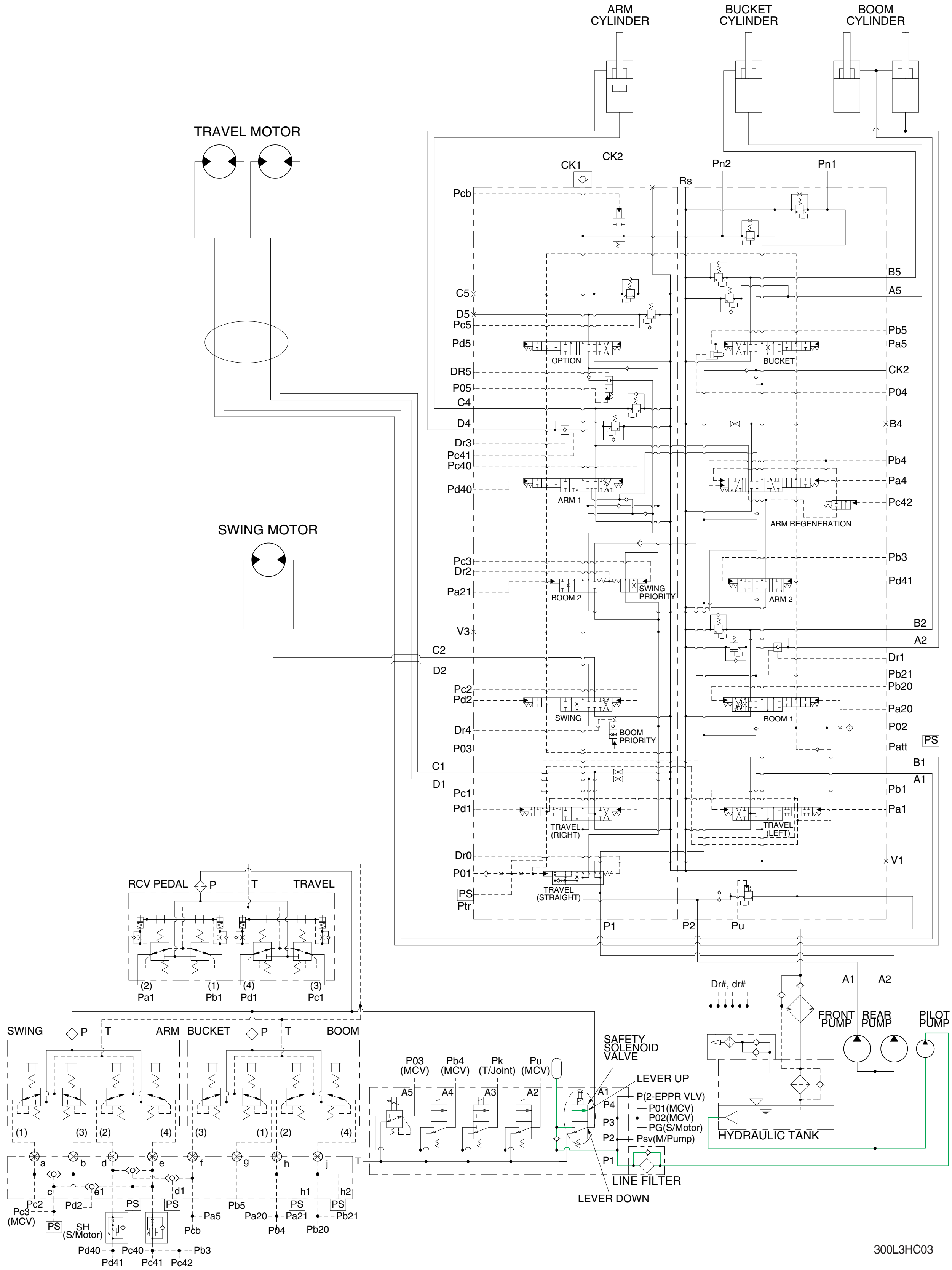


The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

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

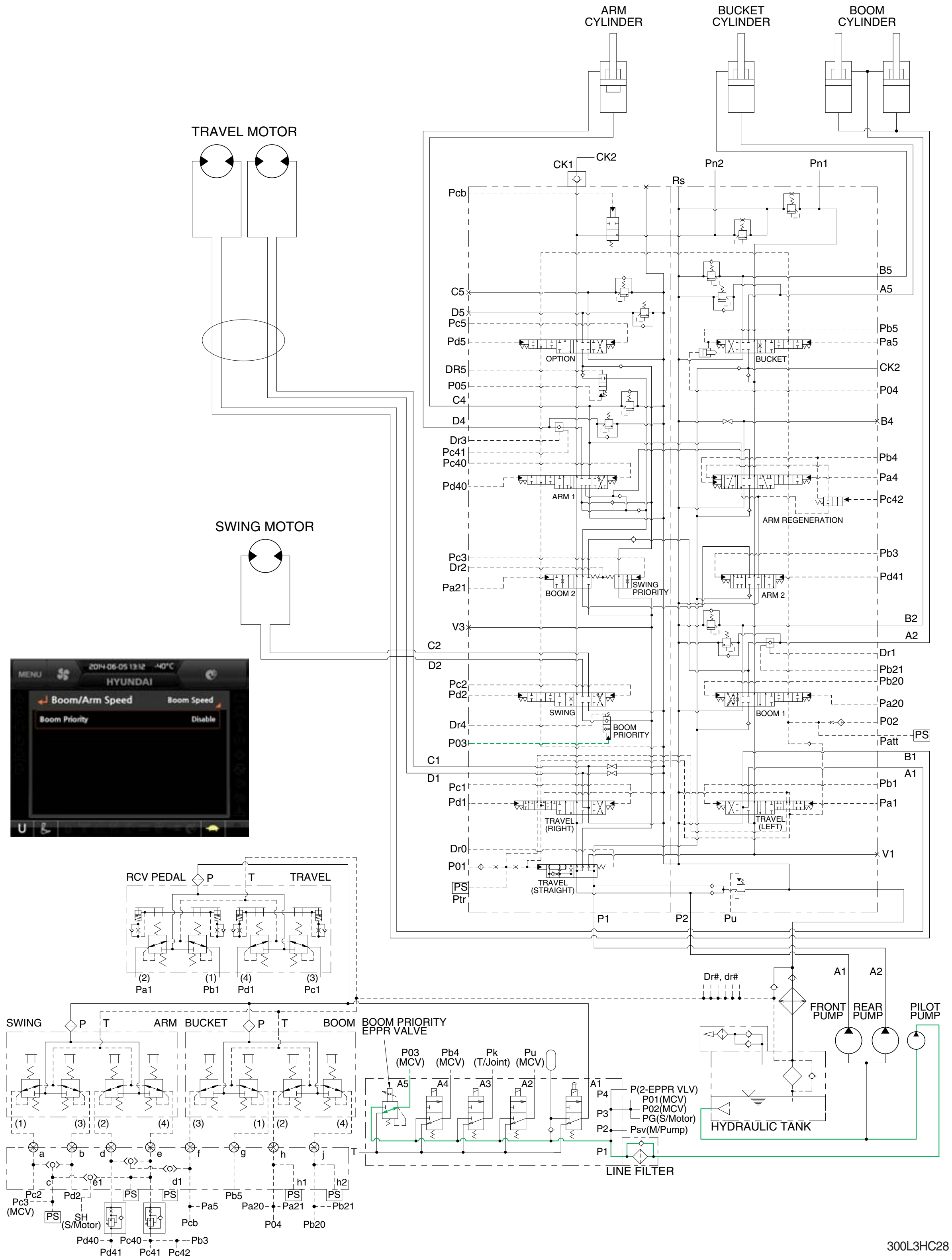
2. SAFETY SOLENOID VALVE (SAFETY LEVER)



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

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

3. BOOM PRIORITY SYSTEM



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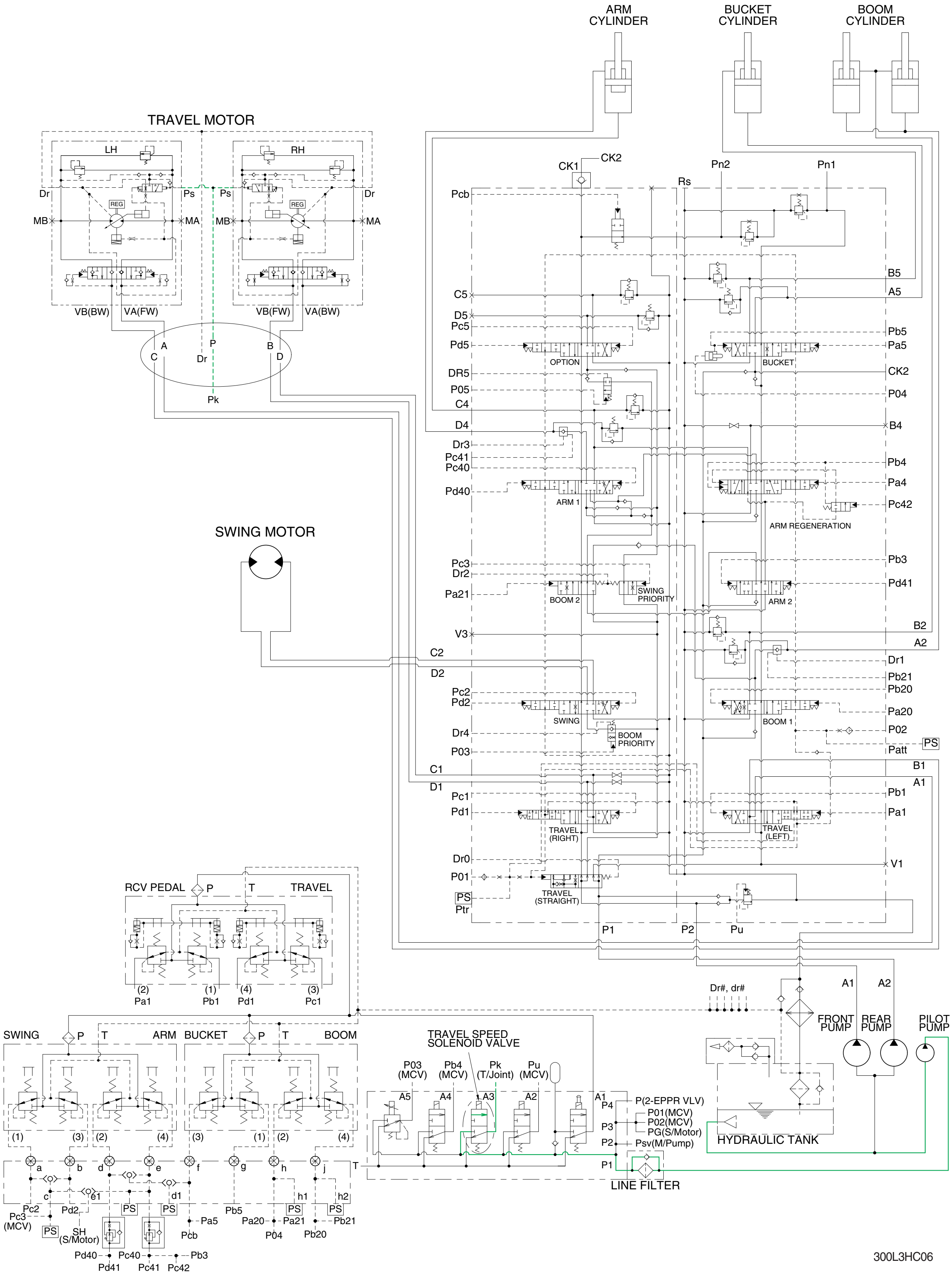
When carrying out the combined operation of swing and boom up, the boom up operating speed is lowered then normal operation.

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 EPPR valve. P03 oil pressure moves swing reducing spool to upper position and oil flow rate to the swing motor decreased.

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

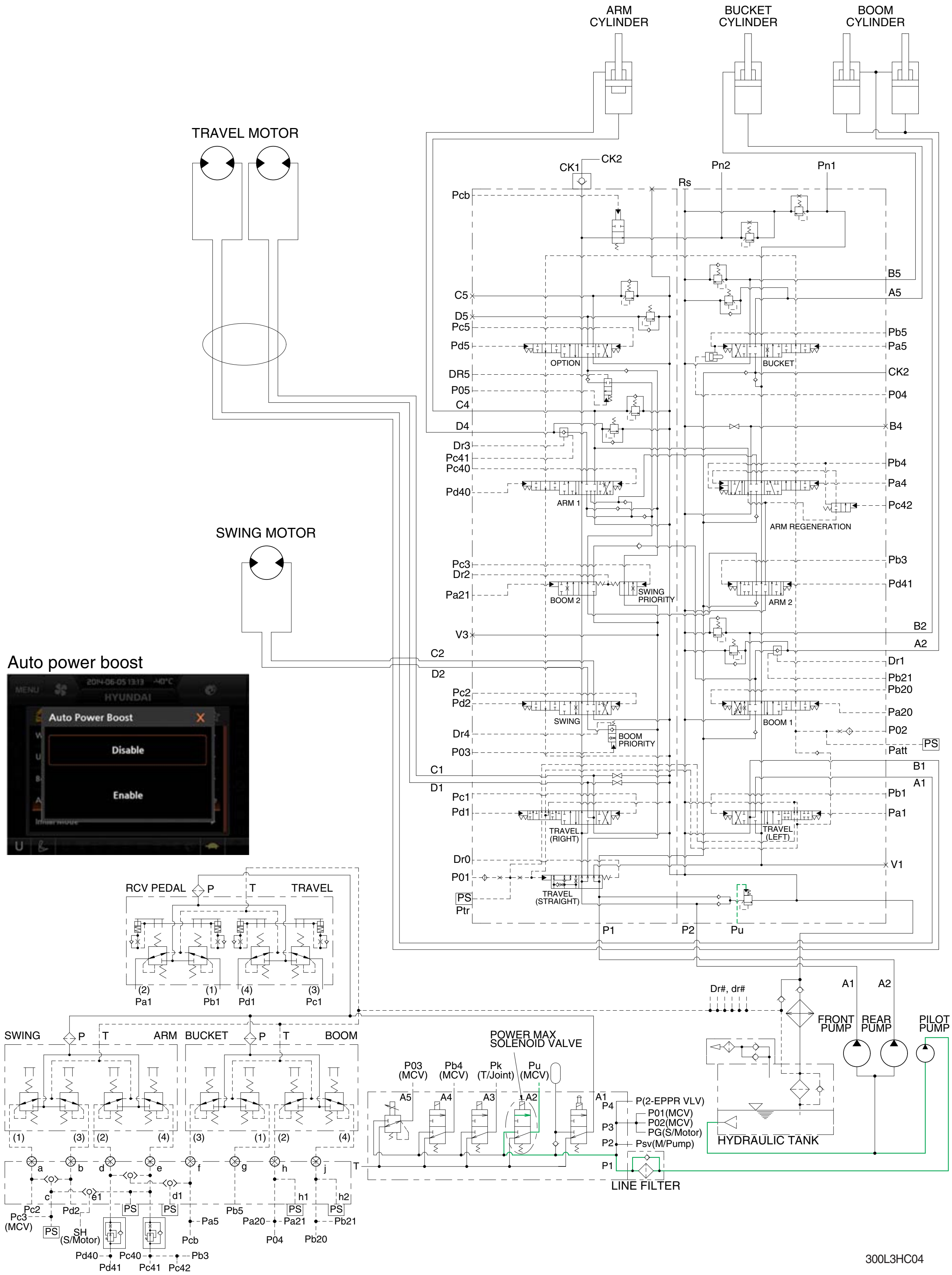
4. TRAVEL SPEED CONTROL SYSTEM



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

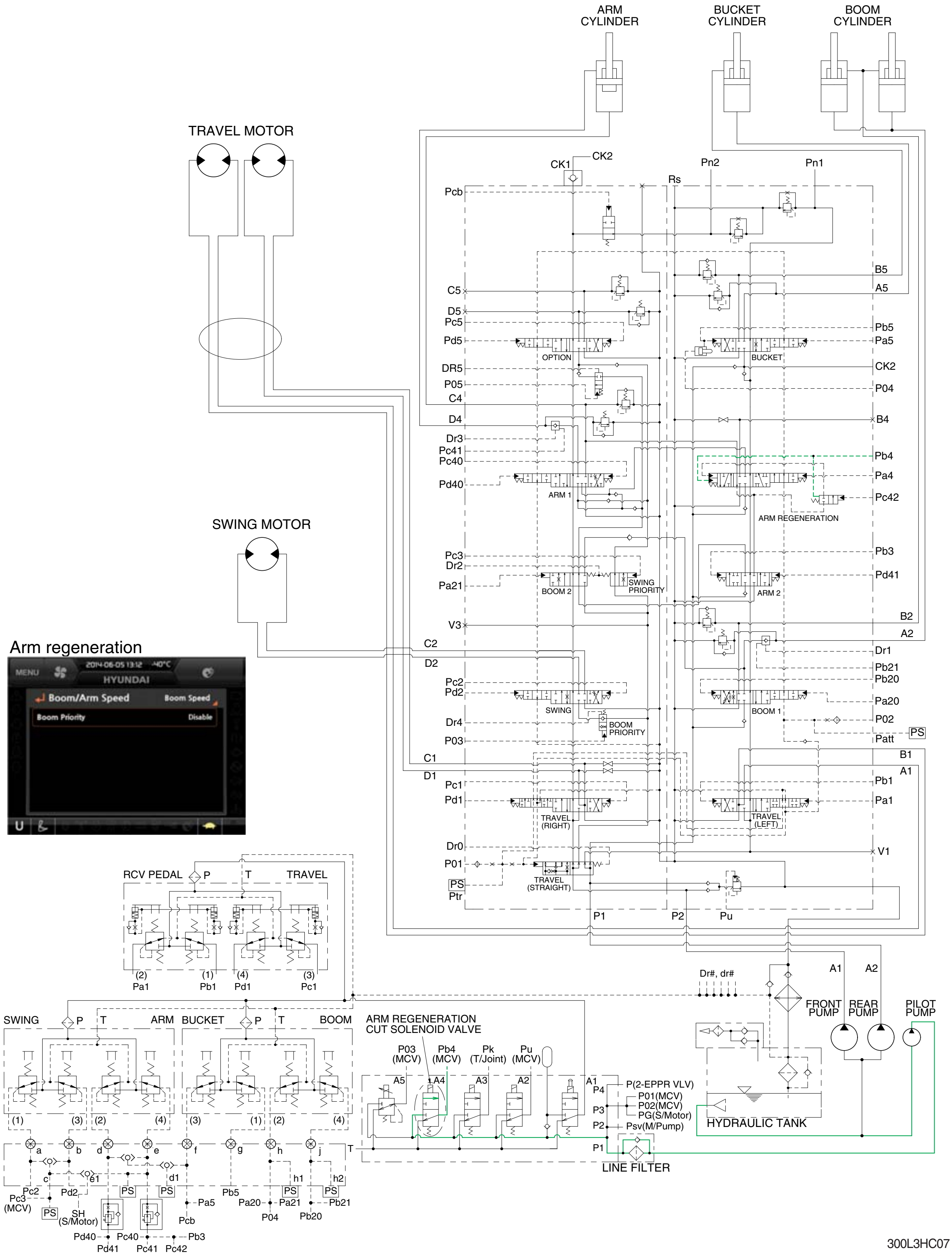
When the travel speed solenoid valve was placed in the Lo position, the oil of **Ps** port return to the tank and the control piston is returned, thus maximizing the displacement.

5. MAIN RELIEF PRESSURE CHANGE CIRCUIT



When the power max switch on the left control lever is pushed ON, the power max solenoid valve is actuated, the discharged oil from the pilot pump into Pu port of the main relief valve of main control valve ; Then the setting pressure of the main control valve is raises from 350 kgf/cm^2 to 380 kgf/cm^2 for increasing the digging power. And even when press continuously, it is canceled after 8 seconds.

6. ARM REGENERATION CUT SYSTEM



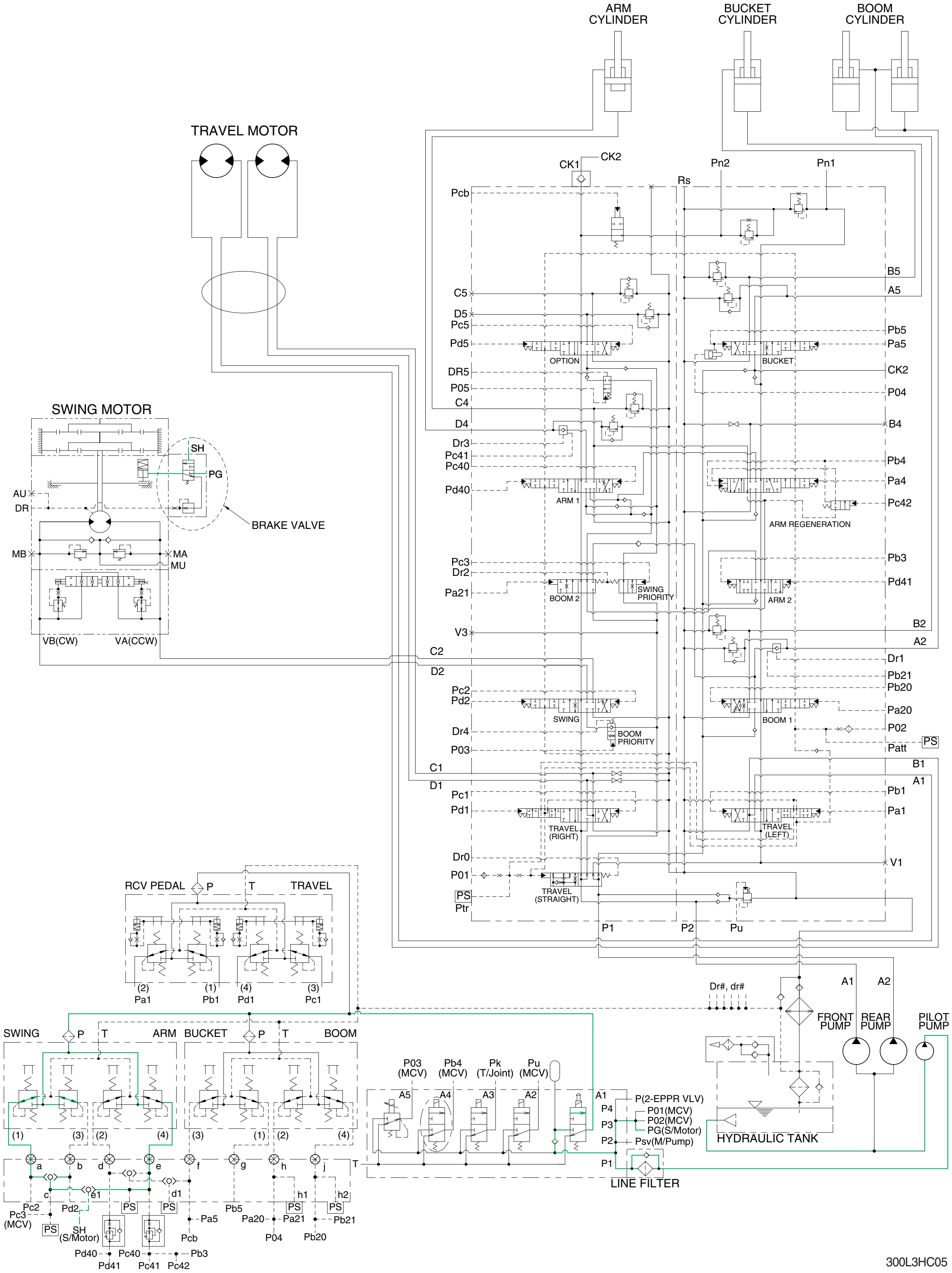
When the arm regeneration is selected to disable on the cluster, the arm regeneration solenoid valve is activated. The pilot oil from pilot pump flow into **Pb4** port in main control valve through solenoid valve and the arm regeneration spool is shifted to right.

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 2-49 for the arm regeneration function.

7. SWING PARKING BRAKE RELEASE



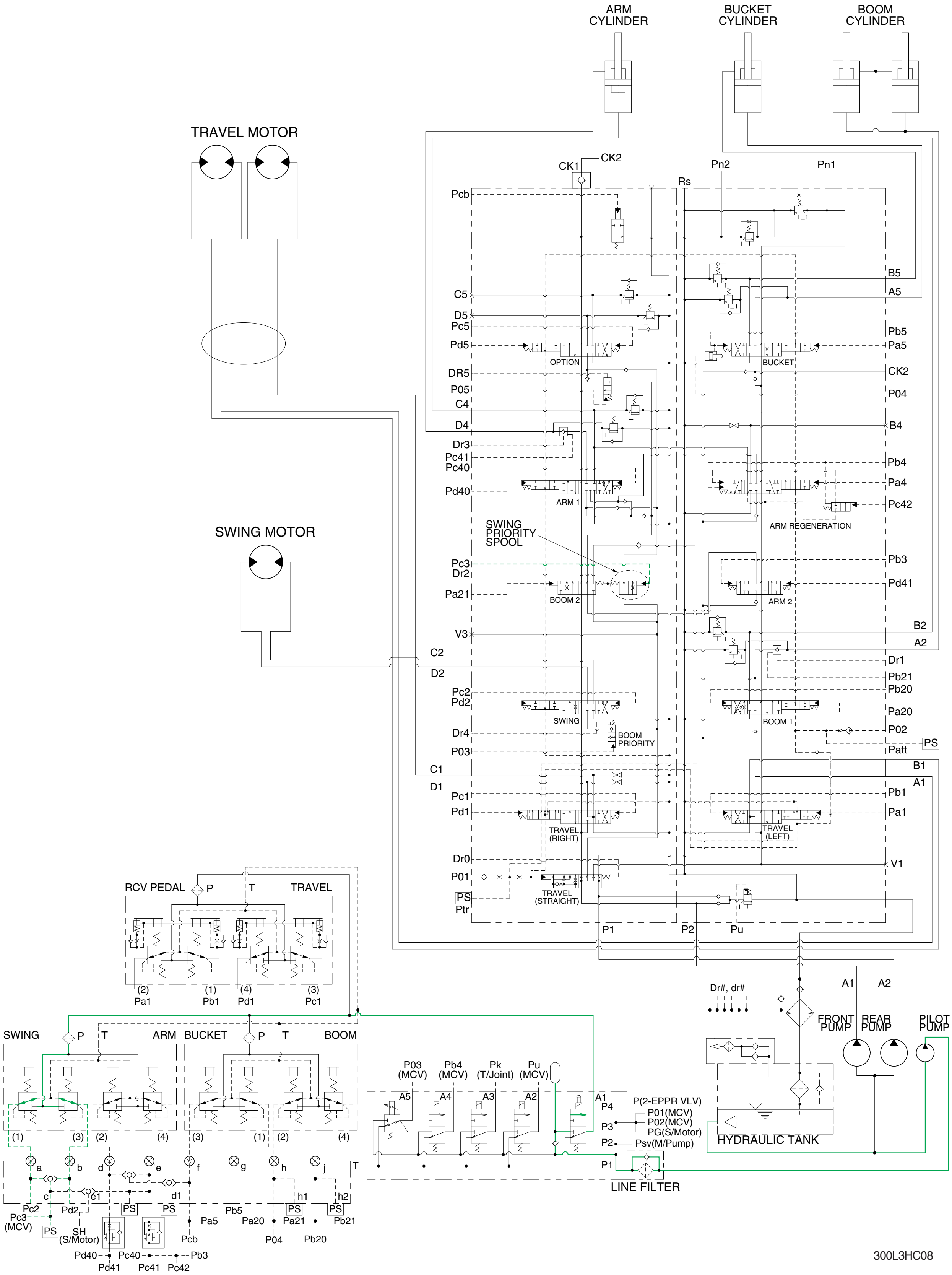
When the RCV lever (swing or arm in) is tilted, the pilot oil flows into SH port through shuttle valve.

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 all of the RCV lever are set in the neutral position, oil in the swing motor disc cylinder is drained, thus the brake is applied.

8. SWING PRIORITY SYSTEM

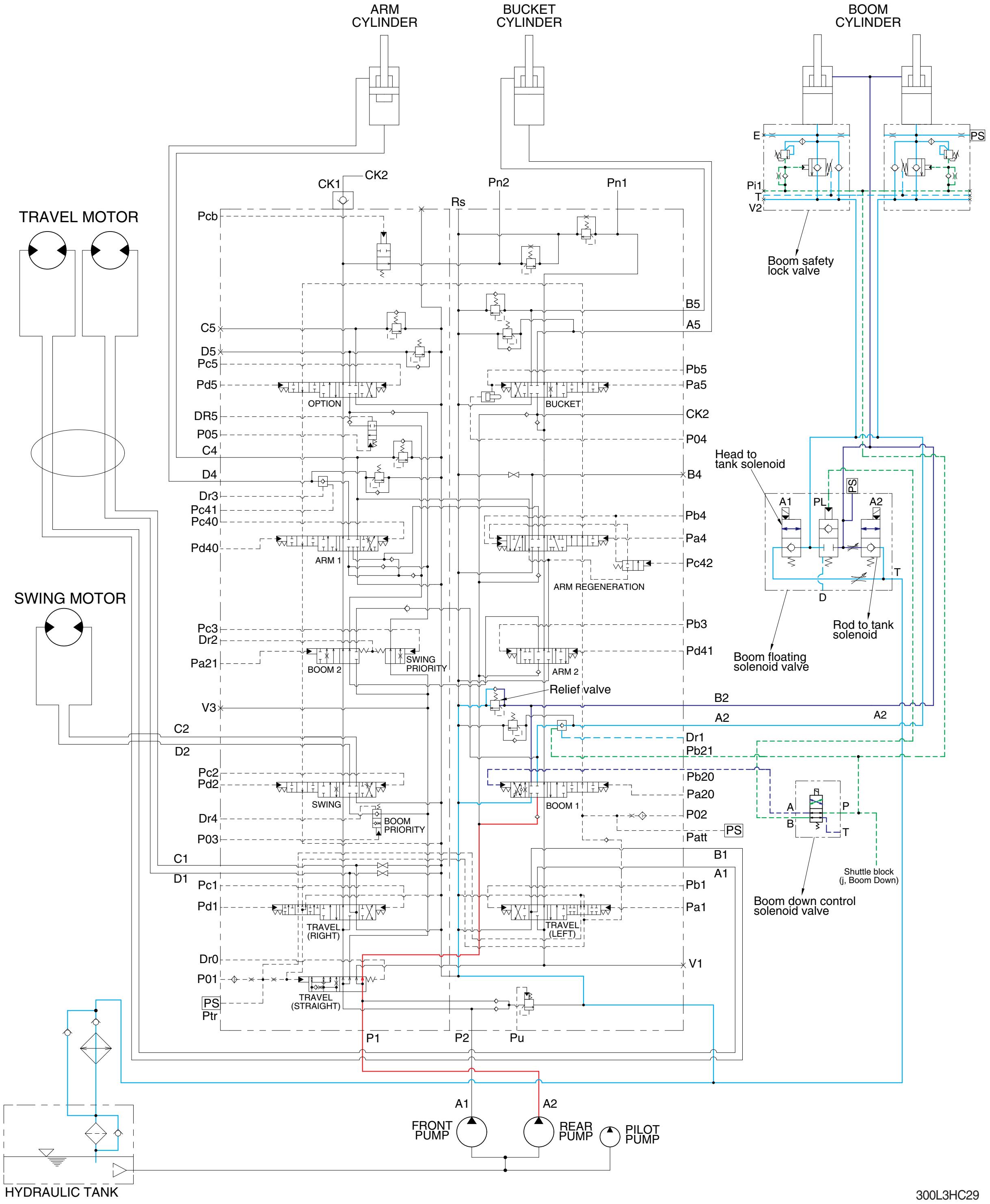


When carrying out the combined operation of swing and arm of the left control valve, the swing speed can be lowered than operating speed of arm.

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

This is called the swing priority system. For details, refer to page 2-45.

9. BOOM FLOATING SYSTEM



Smooth and convenient boom movement is accomplished by only arm control lever operation.

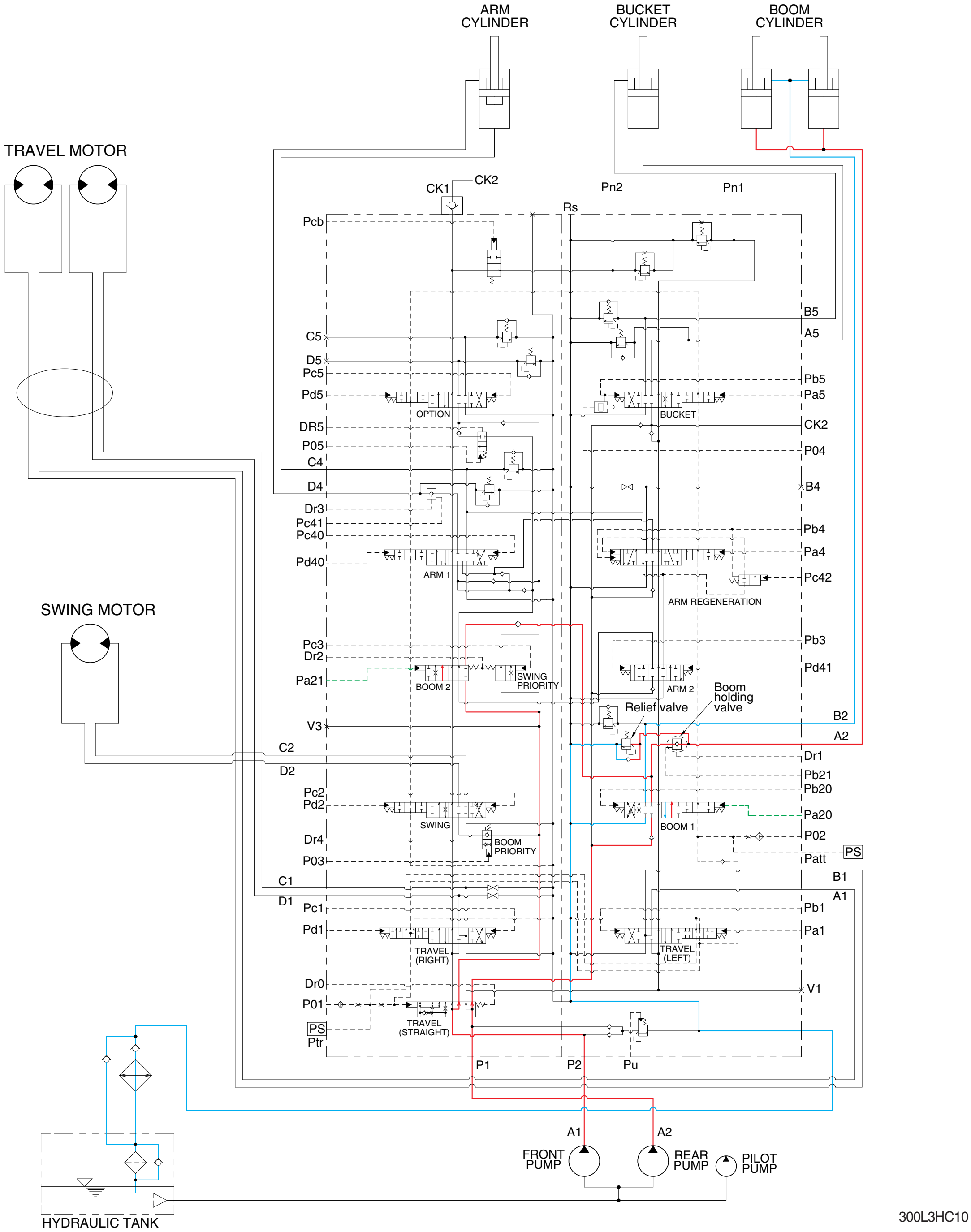
The boom floating solenoid values are equipped in the rod and head of boom cylinder that are controlled to act as floating mode.

"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.

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION



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

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

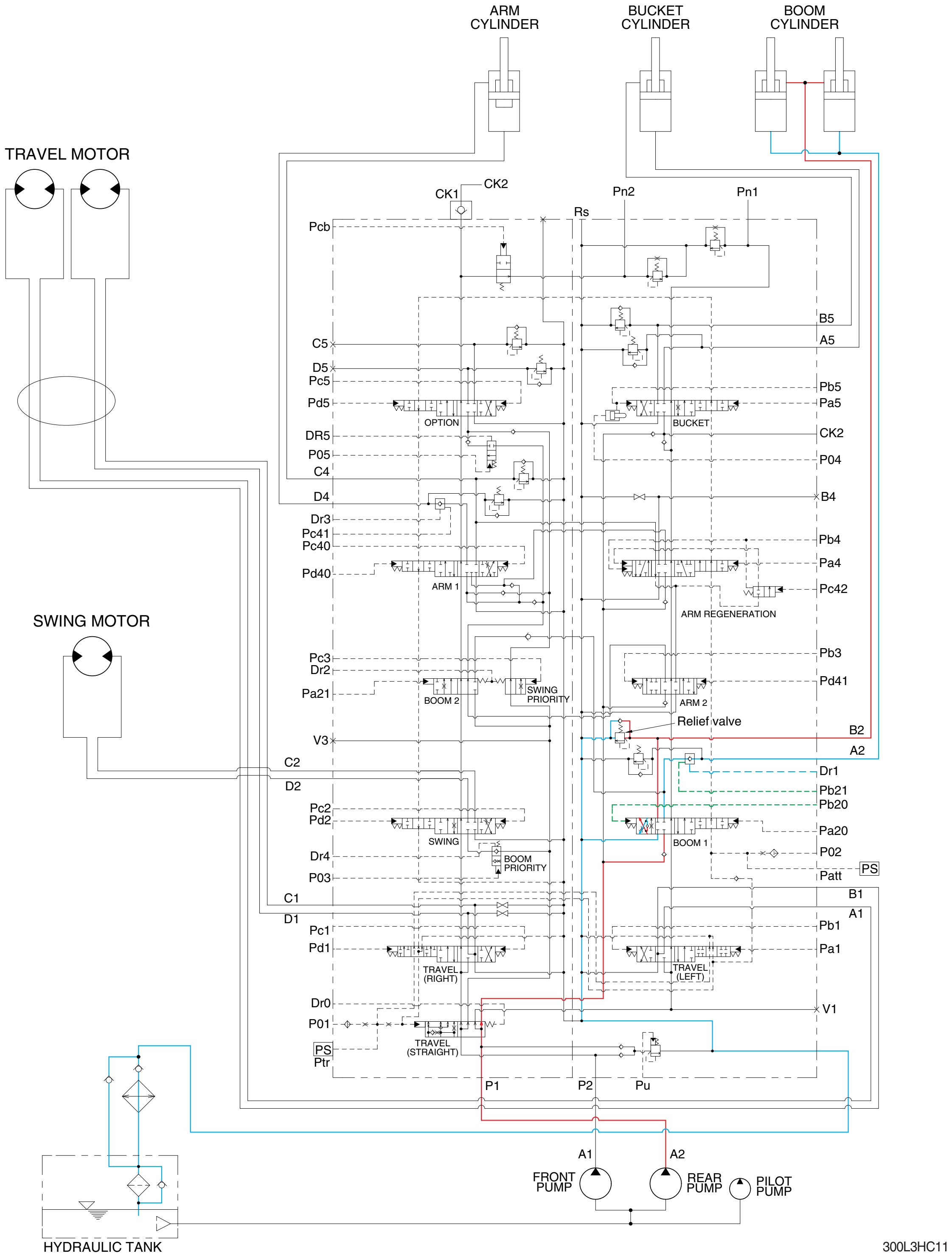
At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up.

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

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

This prevents the hydraulic drift of boom cylinder.

2. BOOM DOWN OPERATION



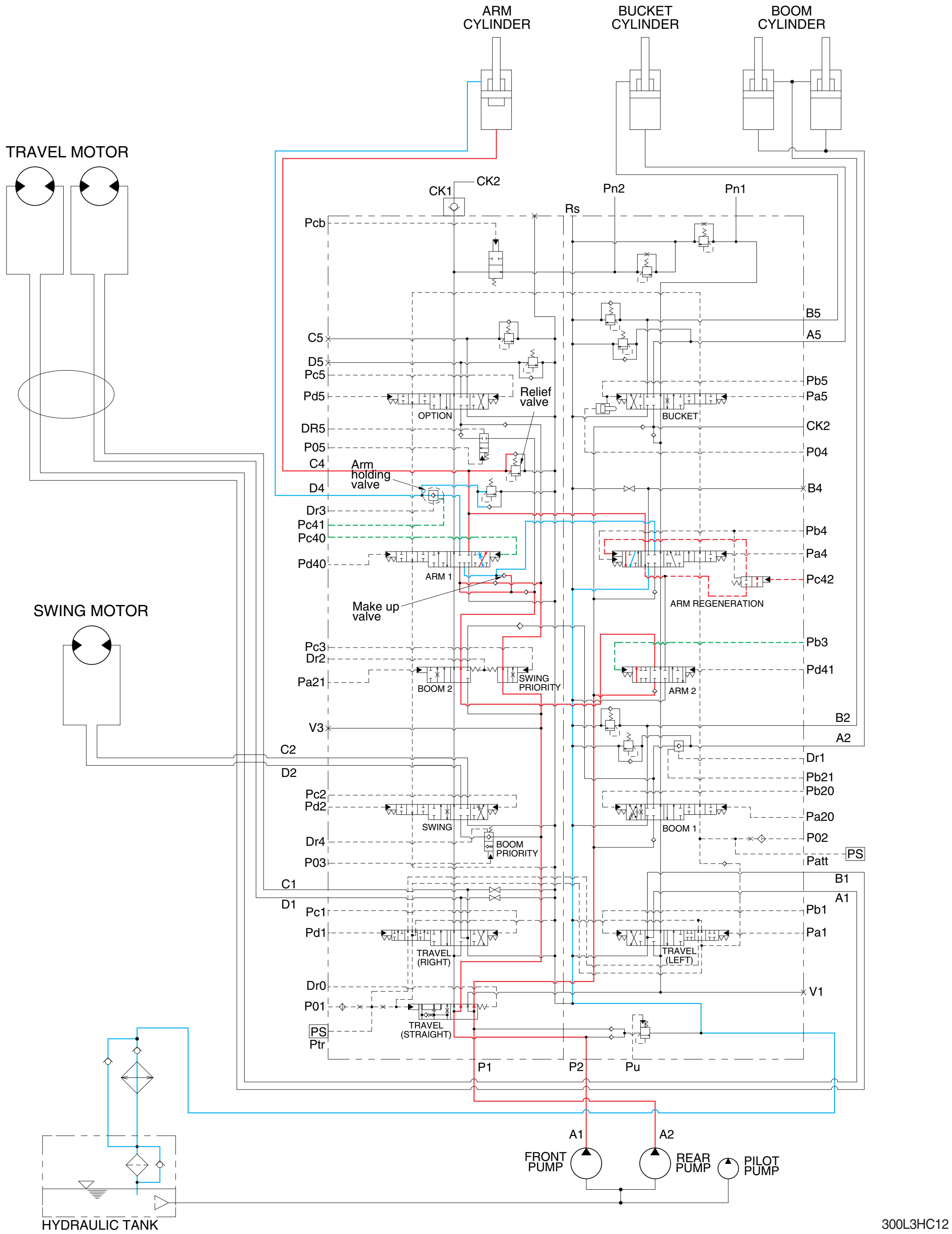
When the RH control lever is pushed forward, the boom spools in the main control valve are moved to the down position by the pilot oil pressure from the remote control valve.

The oil from the 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 spool in the main control valve.

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

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

3. ARM IN OPERATION



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

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

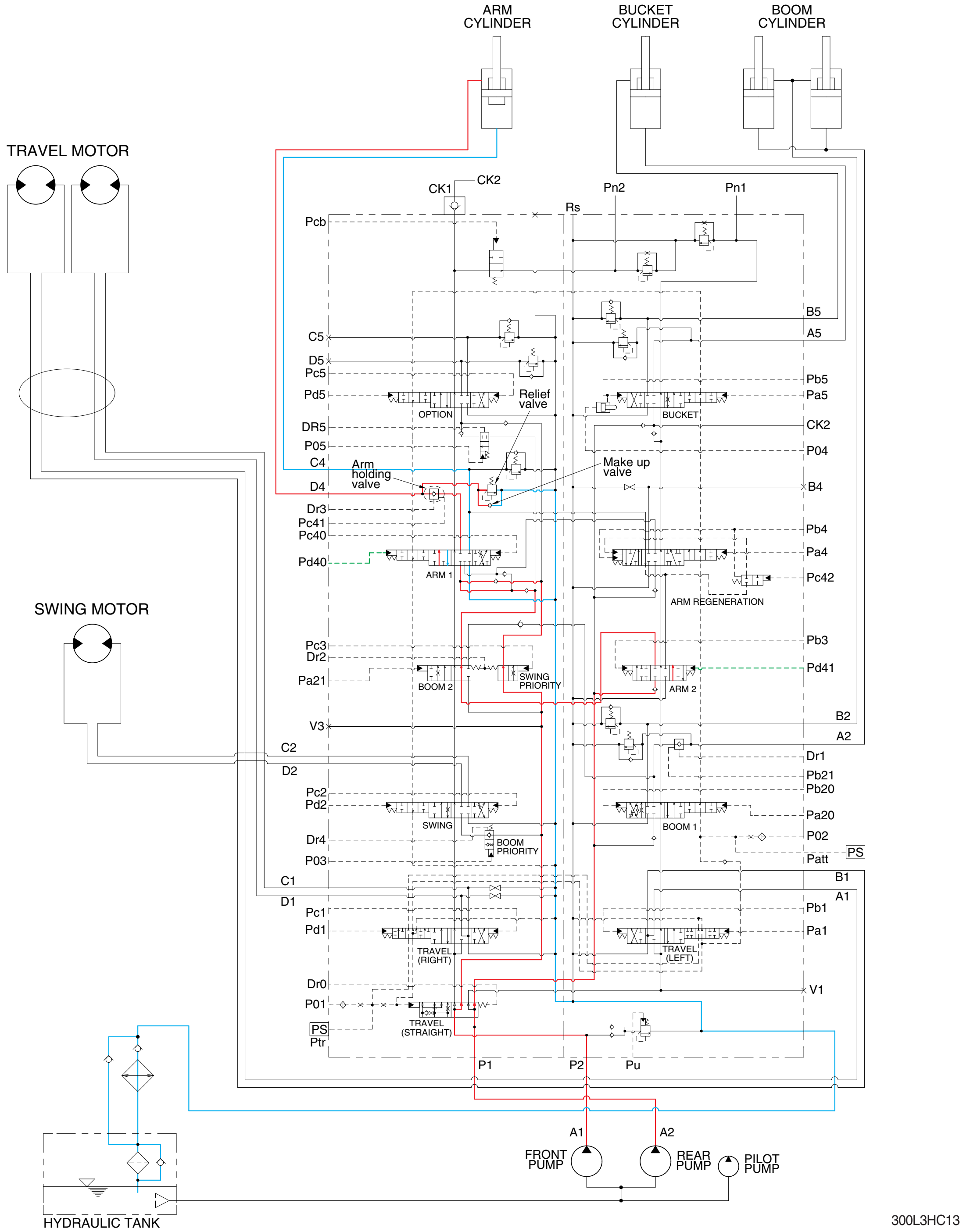
At the same time, the oil from the small chamber of arm cylinder returns to the hydraulic oil tank through the arm spool in the main control valve. When this happens, the arm rolls in.

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

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

Refer to page 3-11 for the arm regeneration.

4. ARM OUT OPERATION



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

The oil from the 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 spool in the main control valve.

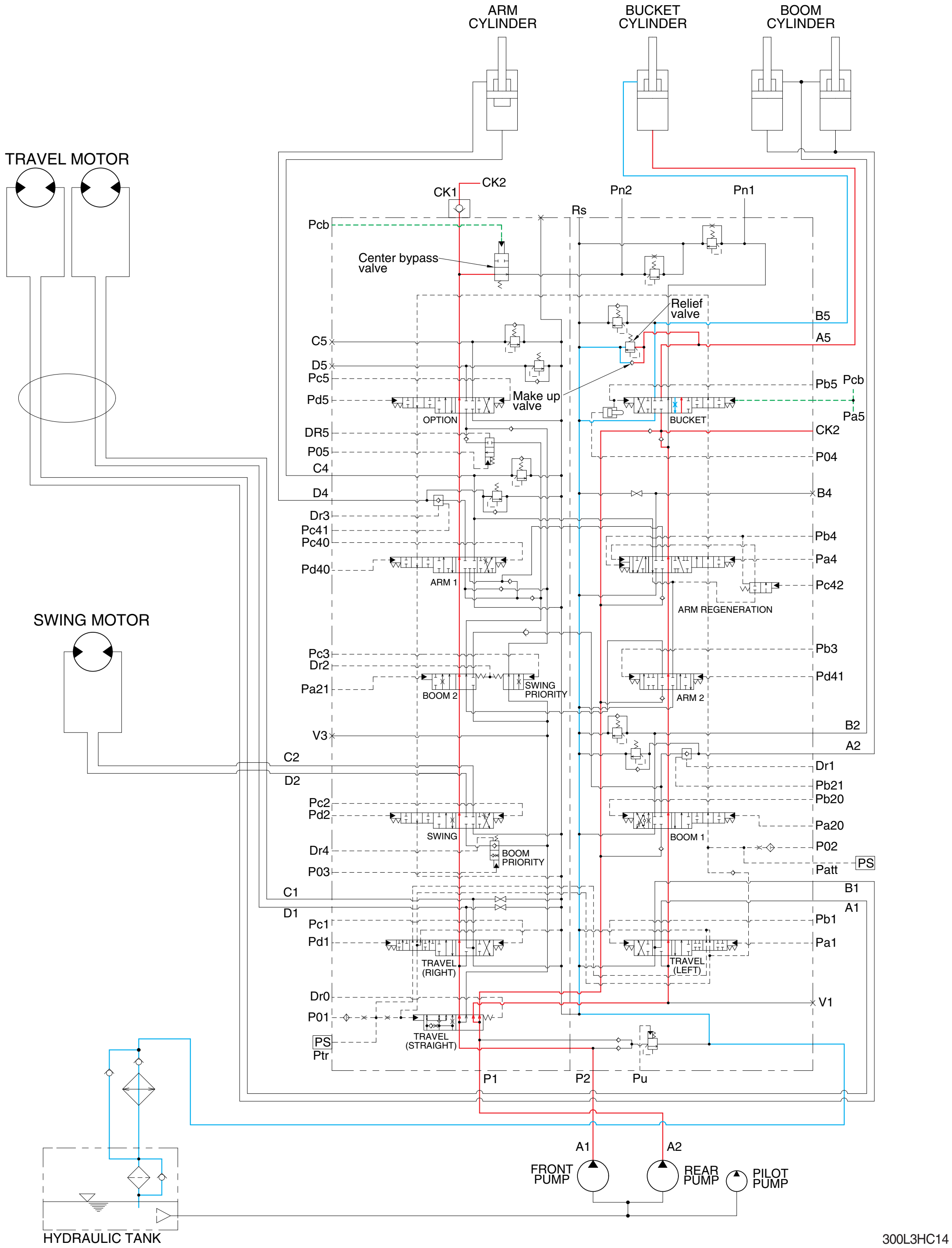
When this happens, the arm roll out. When the roll out speed of arm is faster, the oil returned from the large chamber of arm cylinder combines with the oil from both pump, and flows into the small chamber of the arm cylinder by a make up valve.

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

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

This prevents the hydraulic drift of arm cylinder.

5. BUCKET IN OPERATION



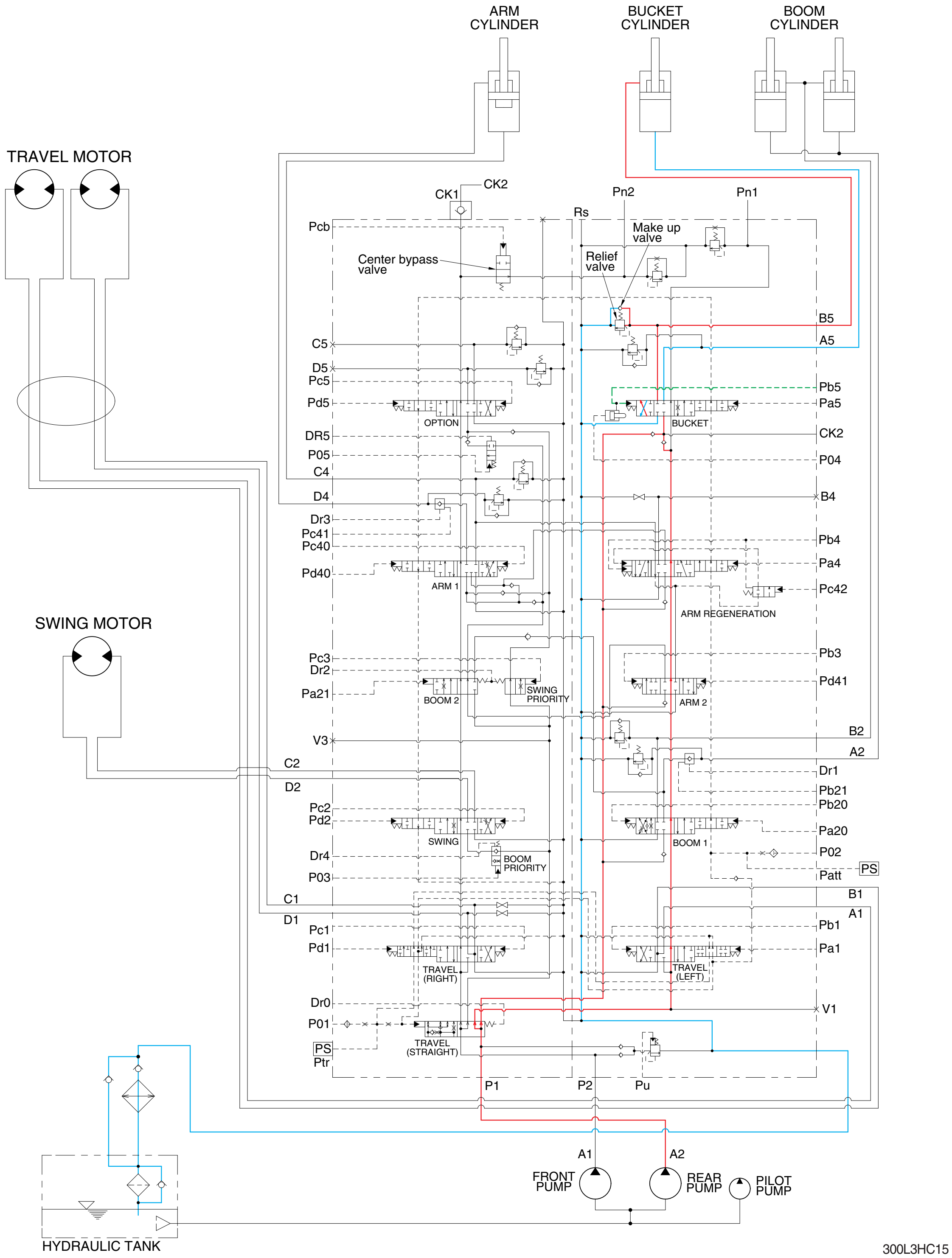
When the RH control lever is manually placed in the bucket roll in position. Then the oil flows from pilot pump through the pilot valve to bucket section of the main control valve. Here the spool position is moved to bucket roll in position.

The center bypass valve is change over by the pilot pressure (Pcb) and then the oil from A2 pump is joint to the flow of A1 pump via check 1 and external piping.

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

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

6. BUCKET OUT OPERATION



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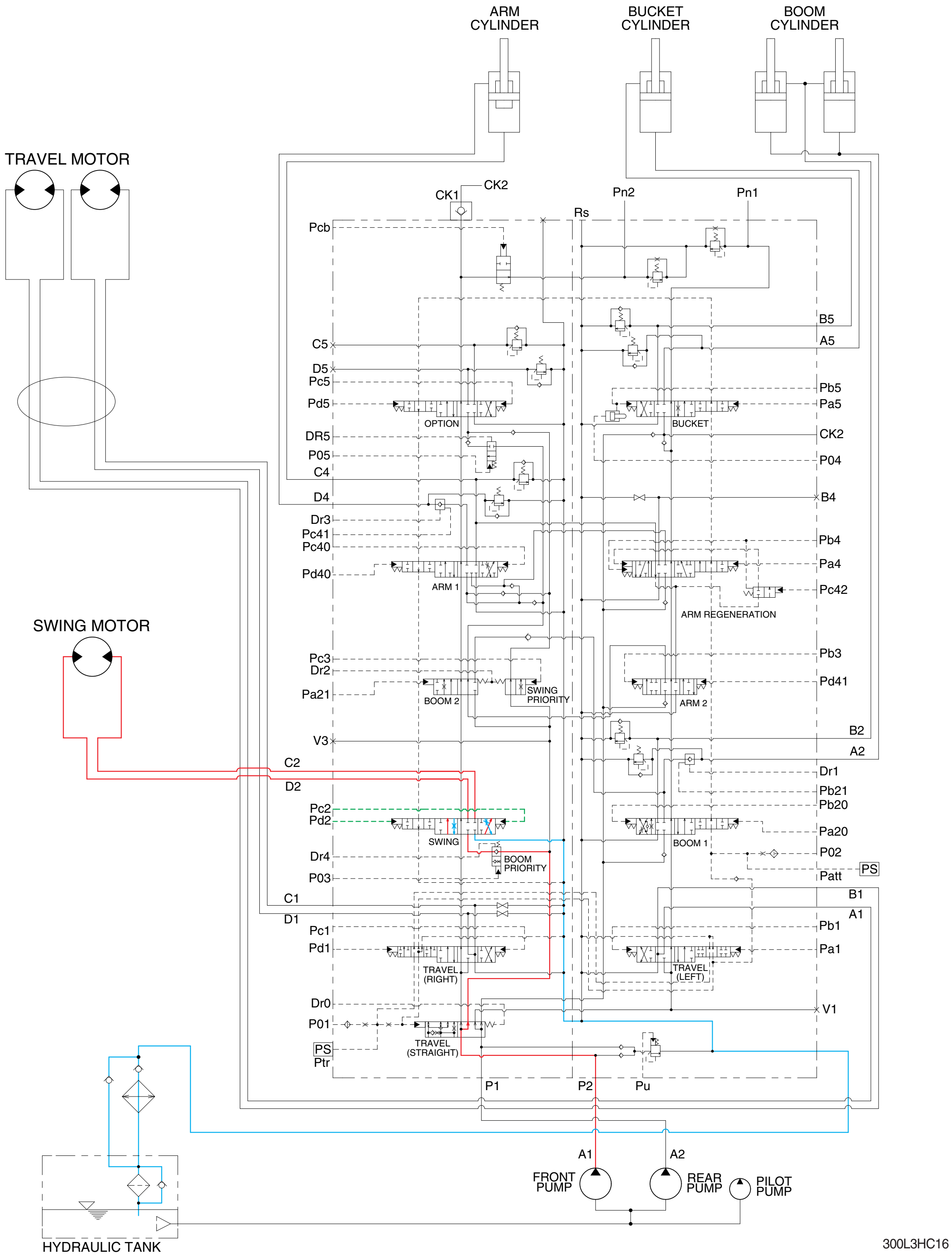
When the RH control lever is manually placed in the bucket roll out position. Then the oil flows from pilot pump through the pilot valve to bucket section of the main control valve. Here the spool position is moved to bucket roll out position.

The oil flows from A2 pump through bucket section of main control valve to the rod end of the bucket cylinder, and to roll out bucket.

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

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

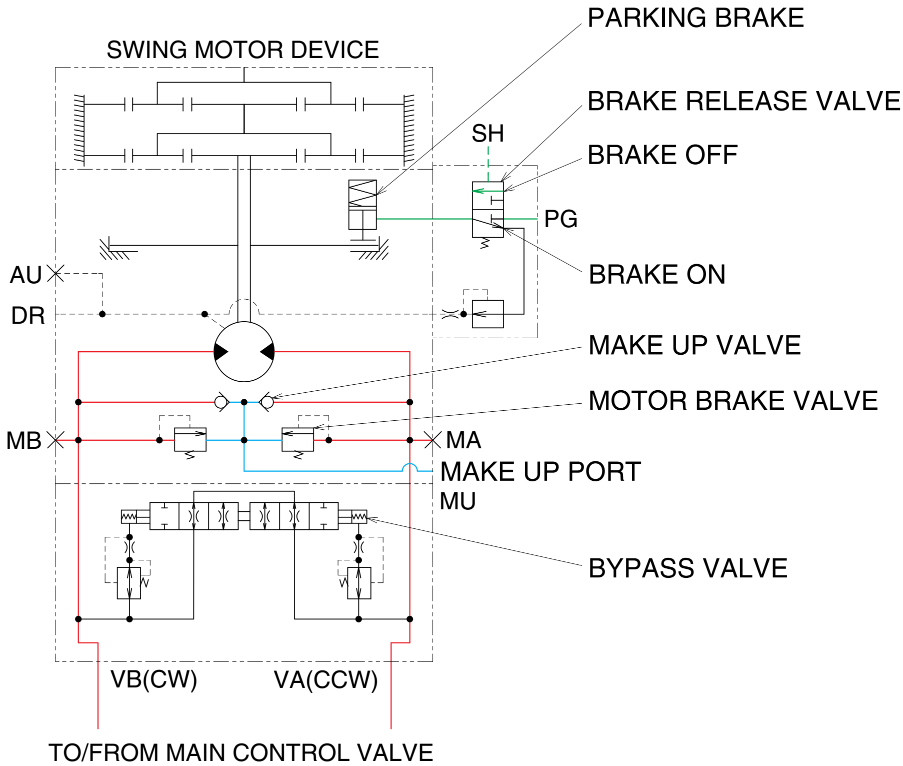
7. SWING OPERATION



When the LH control lever is manually placed in the left (right) swing position. Then the oil flows from A1 pump through the swing section of the main control valve to swing motor to left (right) swing the superstructure. The return oil flows from swing motor through the swing section of the main control valve returned to the tank.

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

SWING CIRCUIT OPERATION



300L3HC17

1) MOTOR BRAKE VALVE

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

2) MAKE UP VALVE

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

3) PARKING BRAKE

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

PARKING BRAKE "OFF" OPERATION

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

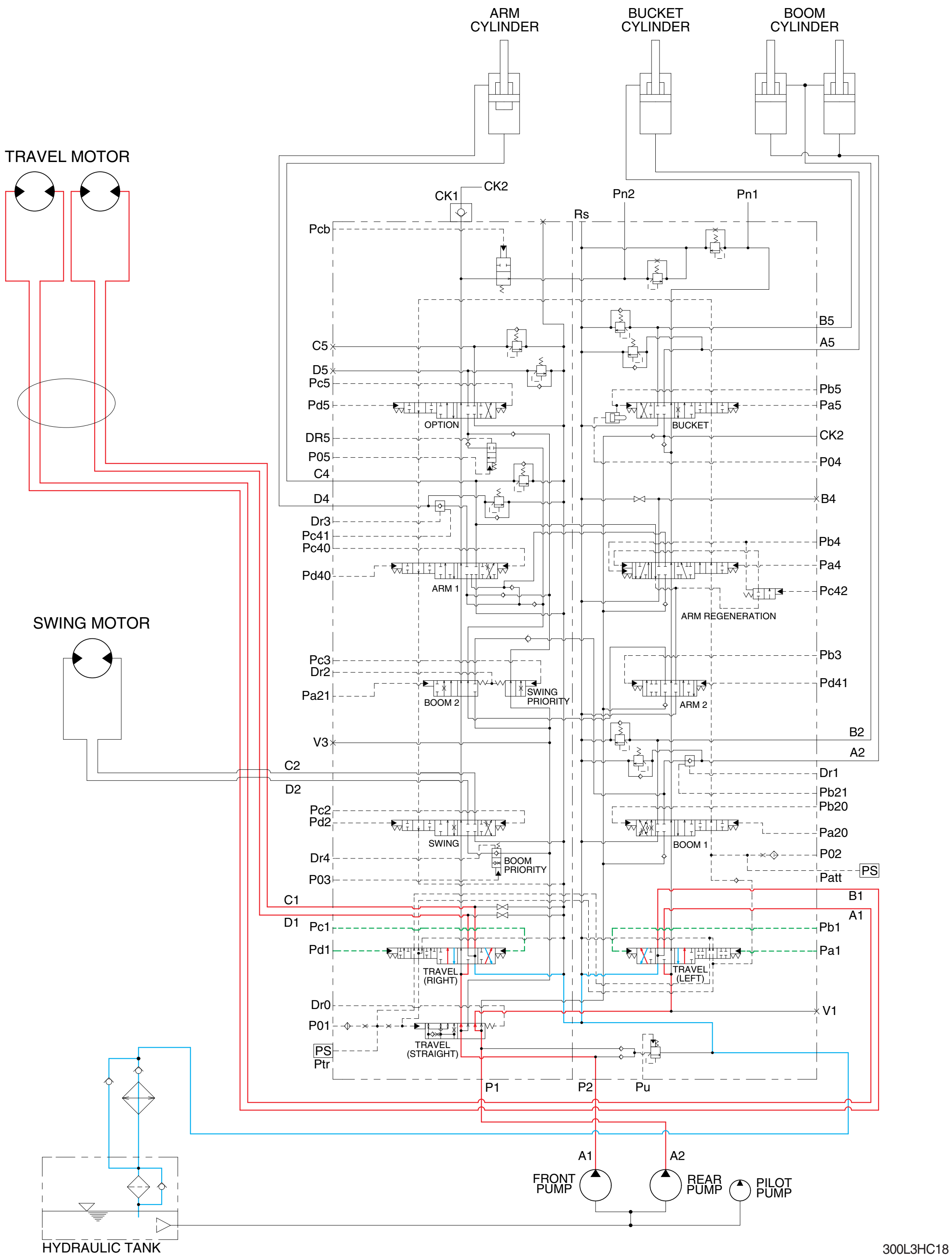
PARKING BRAKE "ON" OPERATION

When the control lever placed in the neutral position, the pressure of the pilot oil passage down.
Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the tank. And the brake is set to 'ON".

4) BYPASS VALVE

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

8. TRAVEL FORWARD AND REVERSE OPERATION

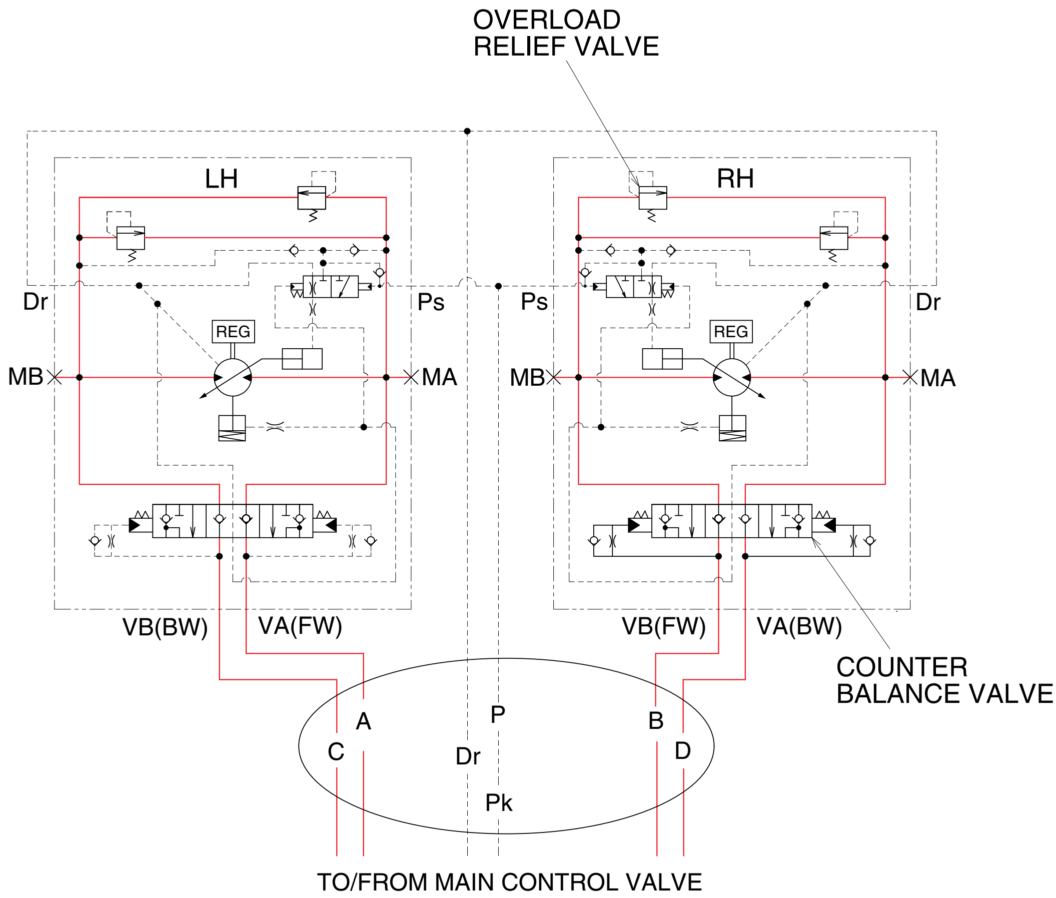


When the right and left travel levers are manually placed to the forward or reverse position, the oil flows from pilot pump through the pilot valve to travel sections of the main control valve.

Here, spool position is moved to forward and reverse position. The oil flows from A2 pump through the travel (RH) section of the main control valve and turning joint to the right travel motor and oil flows from A1 pump through the travel (LH) section of the main control valve and turning joint to the left travel motor and move the machine forward or reverse.

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

TRAVEL CIRCUIT OPERATION



300L3HC19

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

1) COUNTER BALANCE VALVE

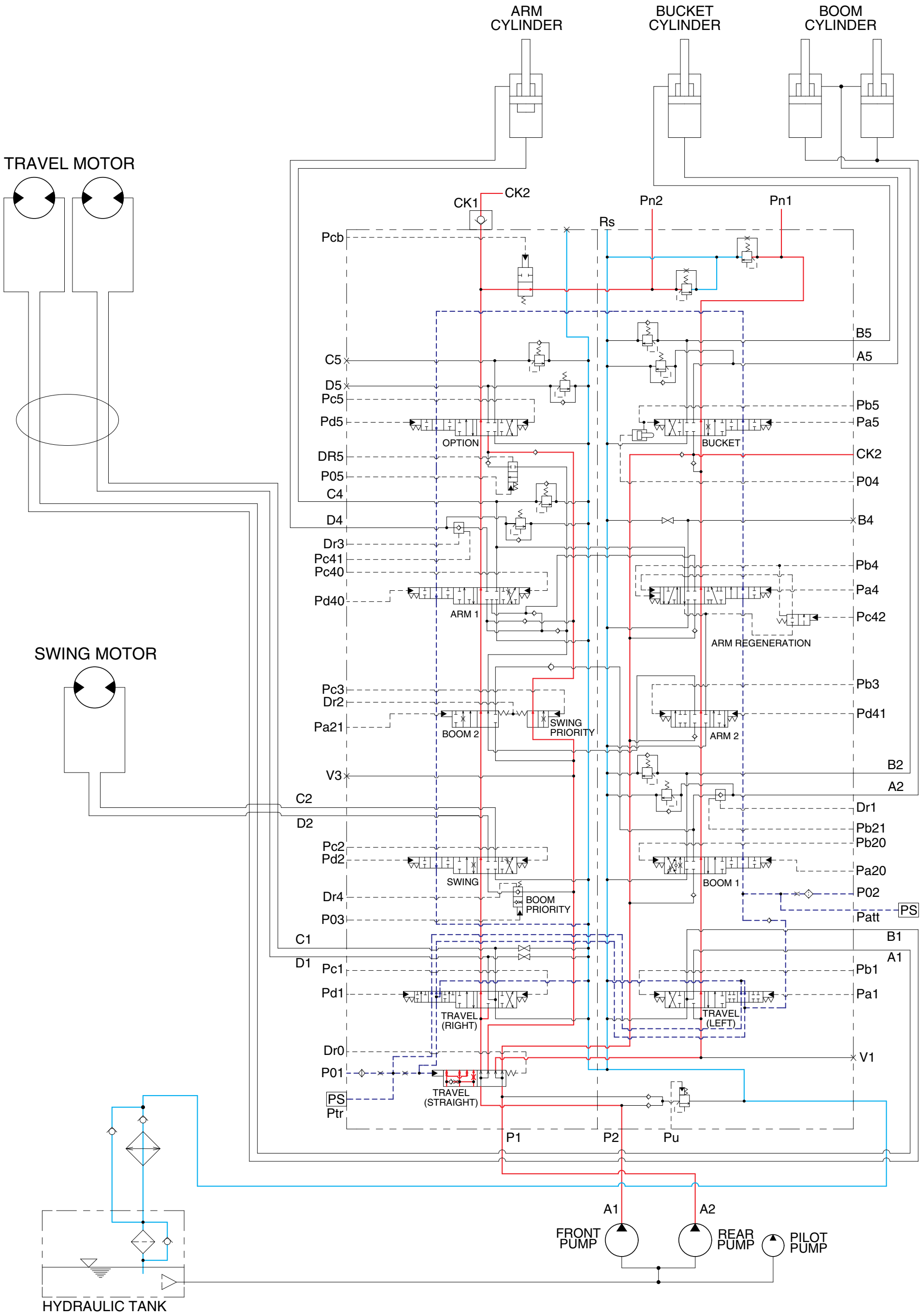
When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 380 kgf/cm^2 to prevent high pressure generated at a time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

GROUP 5 COMBINED OPERATION

1. OUTLINE



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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.

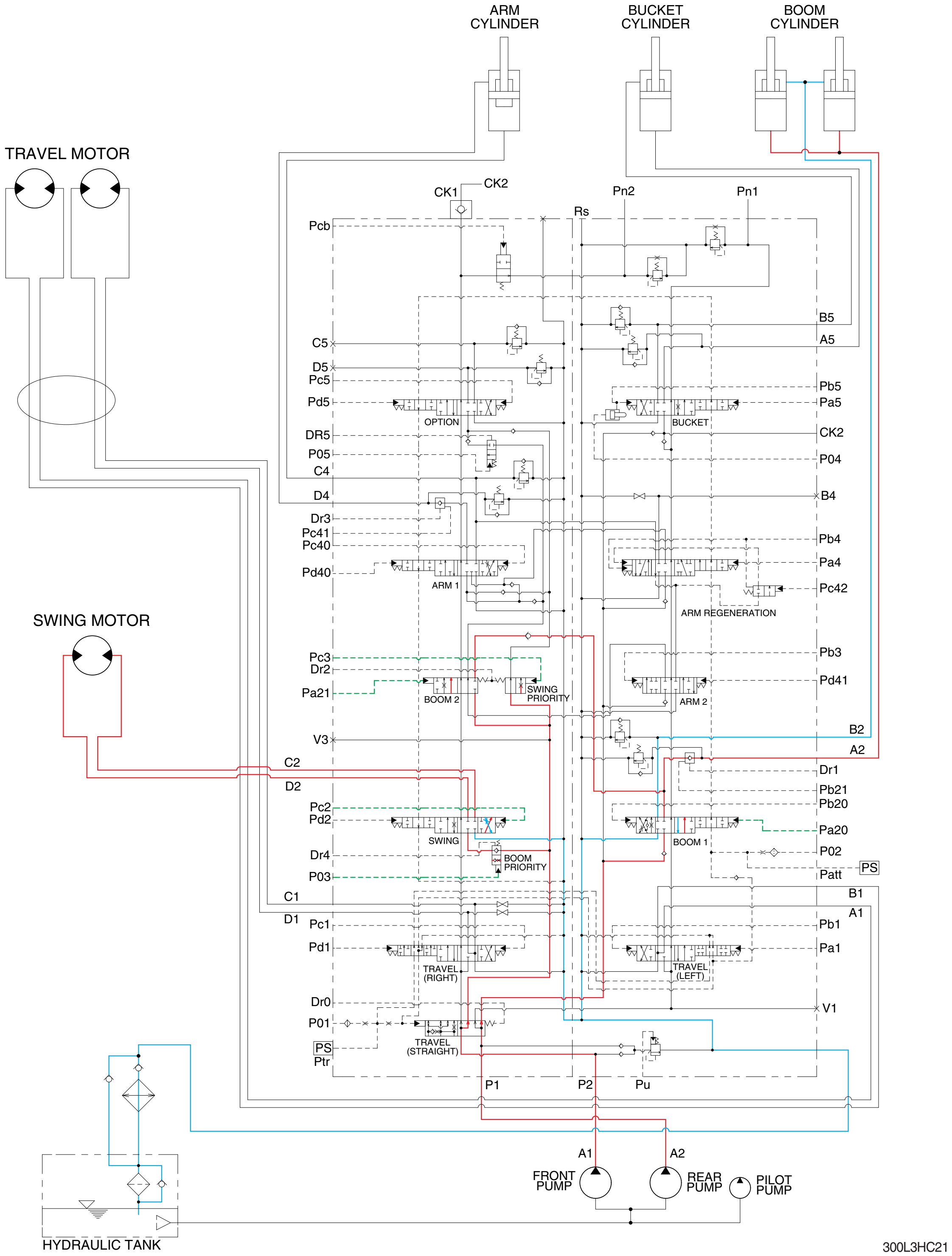
STRAIGHT TRAVEL SPOOL

This straight travel spool 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 from the pilot pump.

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

2. COMBINED SWING AND BOOM UP OPERATION



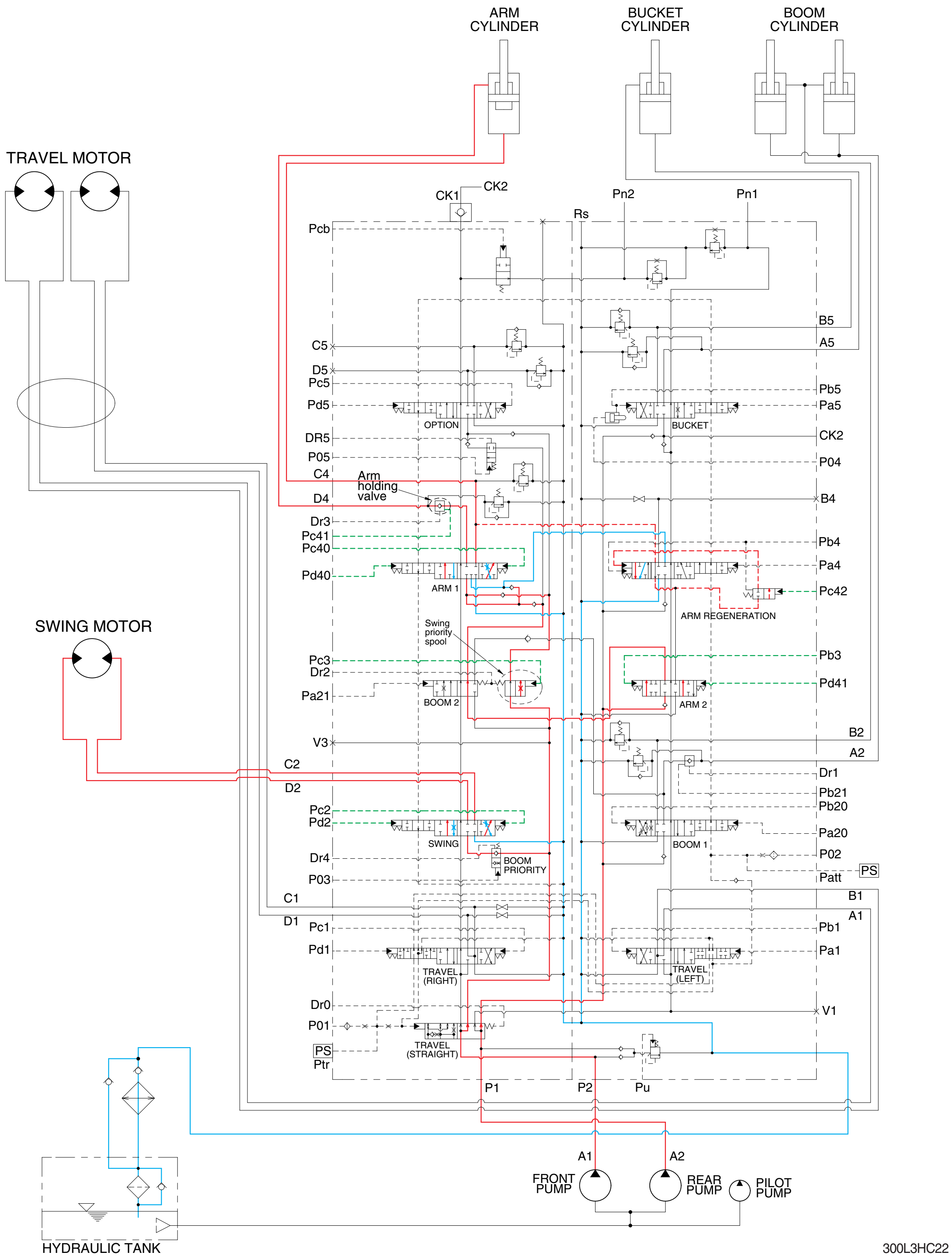
When the swing and boom up functions are operated, simultaneously the swing spool and boom spools changed. The oil flows from the A2 pump through boom 1 section of the main control valve to boom cylinders and the boom functions.

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

The upper structure swing and the boom is up.

Refer to page 3-8 for the boom priority system.

3. COMBINED SWING AND ARM OPERATION

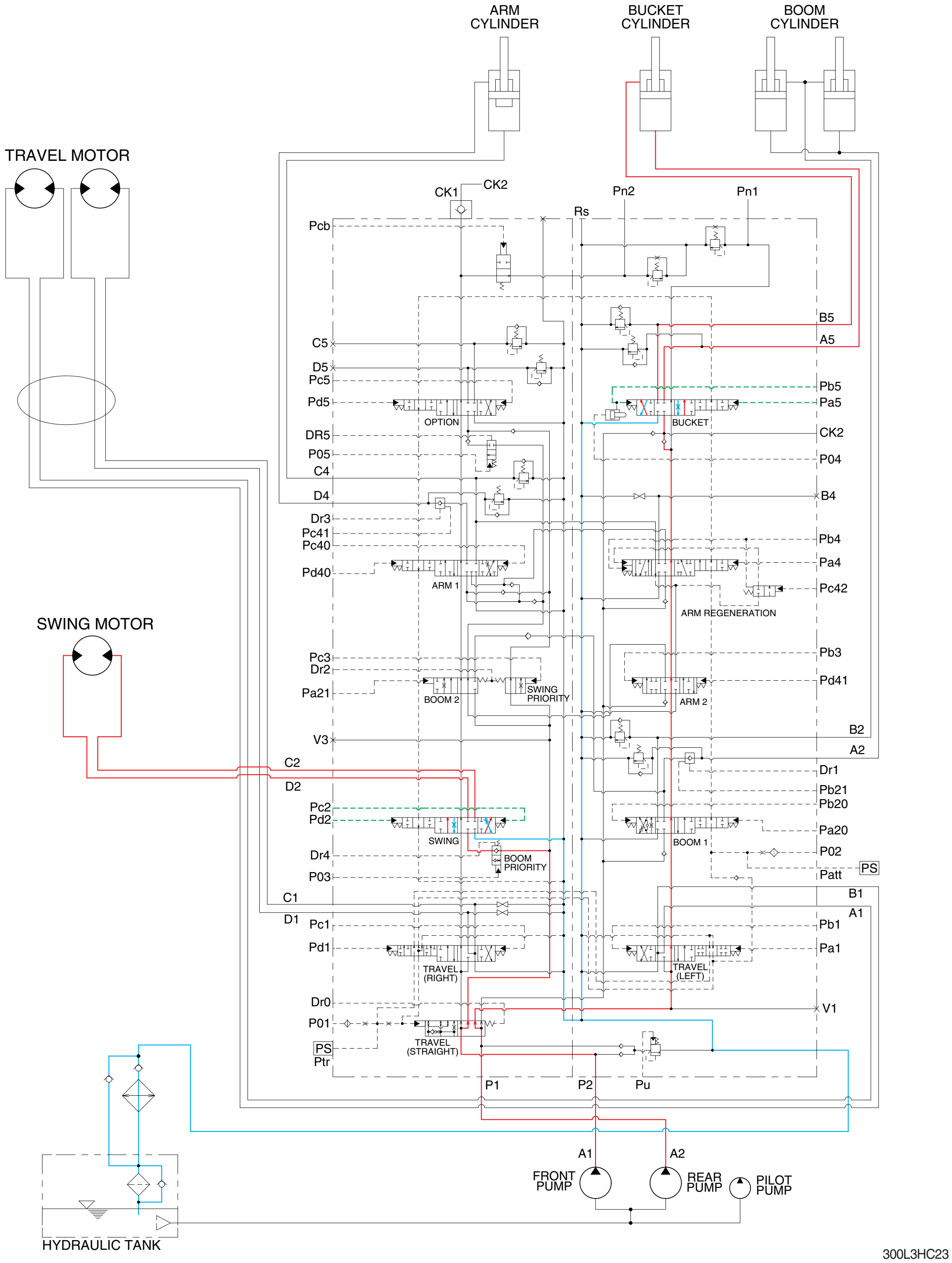


When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

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

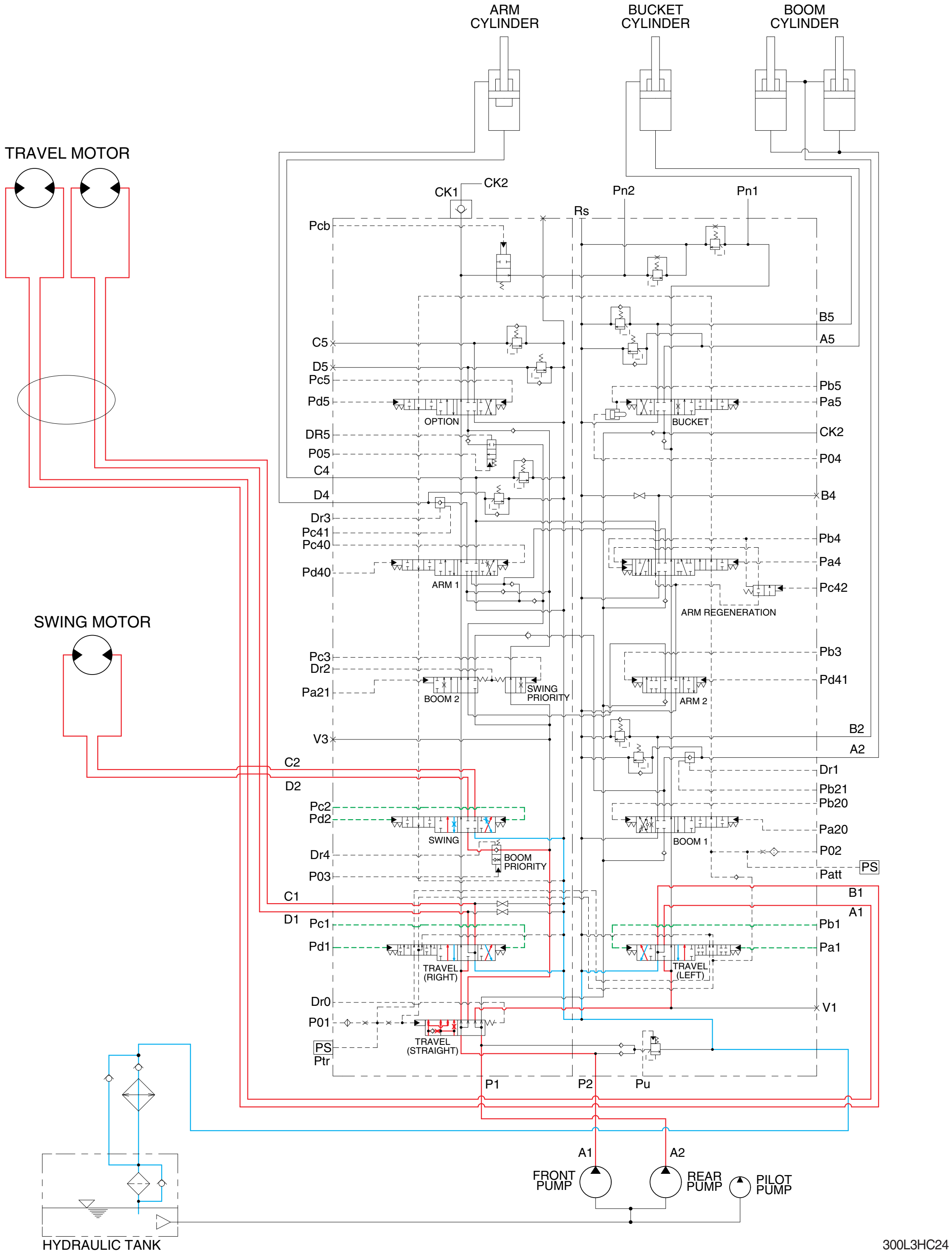
The oil from the A2 pump flows into the arm cylinder through the arm 2 spool of the right control valve. The upper structure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



When the swing and bucket functions are operated, the swing and bucket spools changed. The oil flows from the A2 pump through the bucket section of the main control valve to the bucket cylinder and the bucket functions. The oil flows from A1 pump through swing section of the main control valve to the swing motor and swing the superstructure.

5. COMBINED SWING AND TRAVEL OPERATION



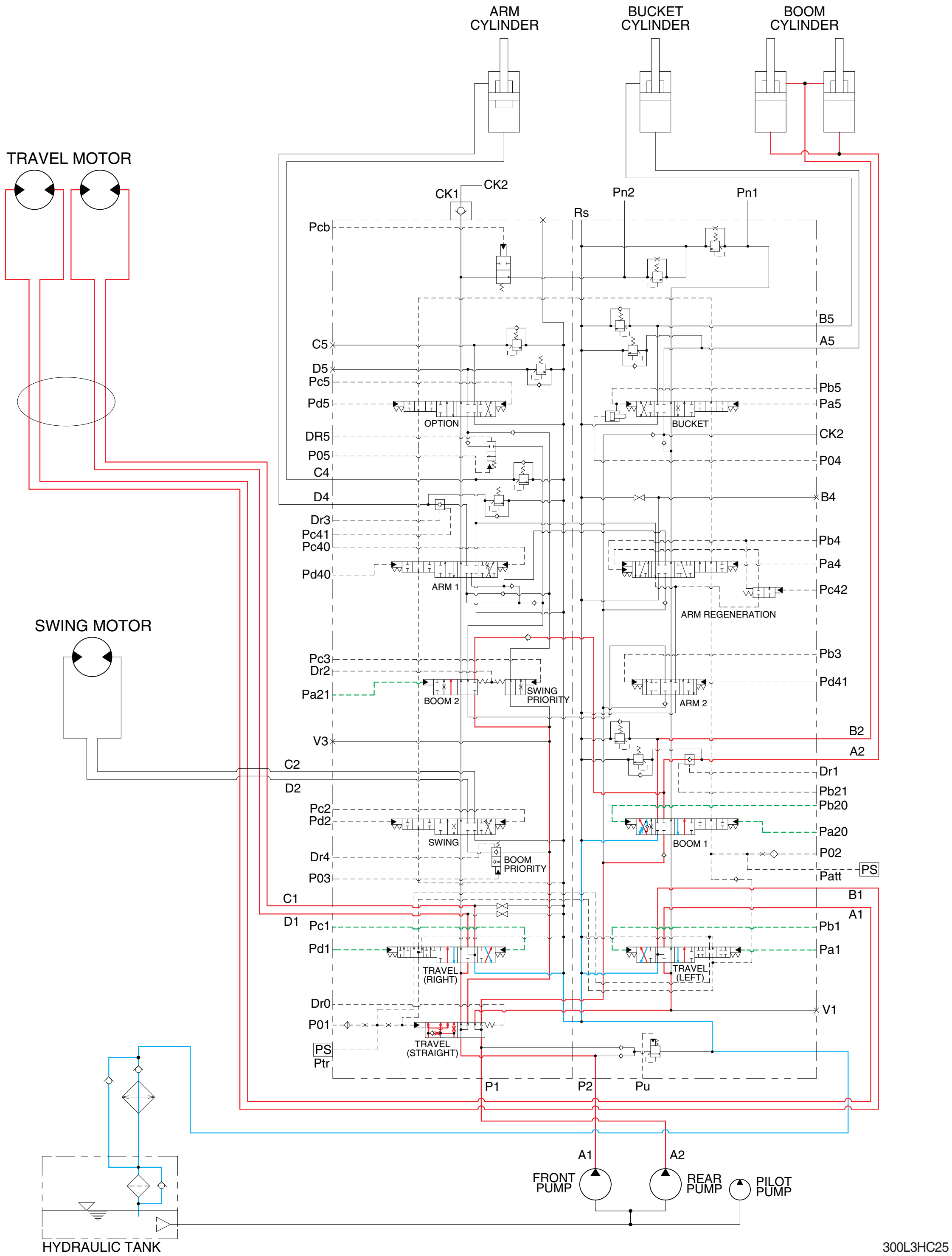
When the swing and travel functions are operated, simultaneously the swing spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve. At the same time, the straight travel spool is pushed to the right by the pilot oil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

The oil from the A2 pump flows into the swing motor through the swing spool. The oil from the A1 pump flows into the travel motor through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool.

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 superstructure swings and the machine travels straight.

6. COMBINED BOOM AND TRAVEL OPERATION

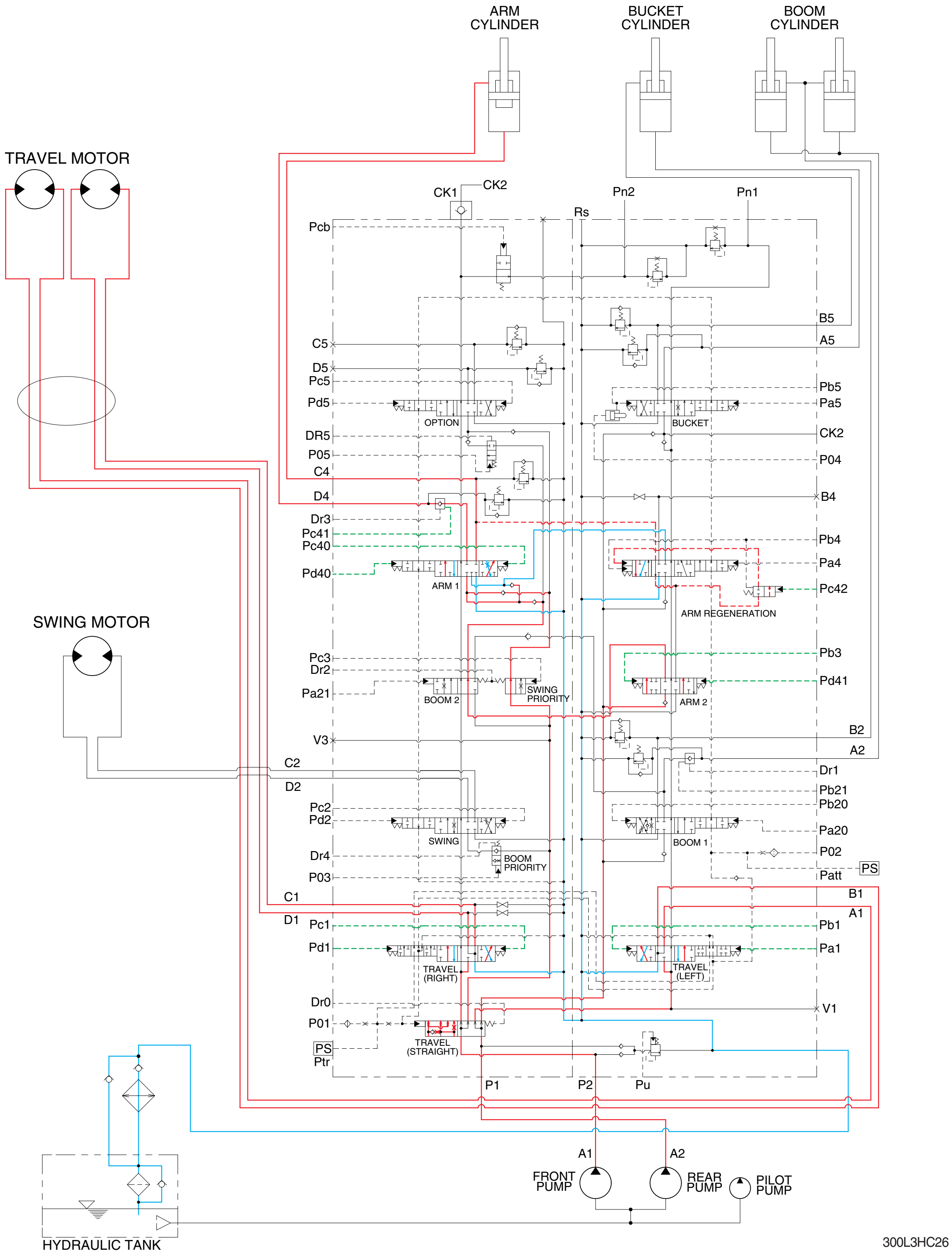


When the boom and travel functions are operated, simultaneously the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve. At the same time, the straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump. 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 passage in case boom up operation. The oil from the A1 pump flows into the travel motors through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool.

When the 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 boom is operated and the machine travels straight.

7. COMBINED ARM AND TRAVEL OPERATION

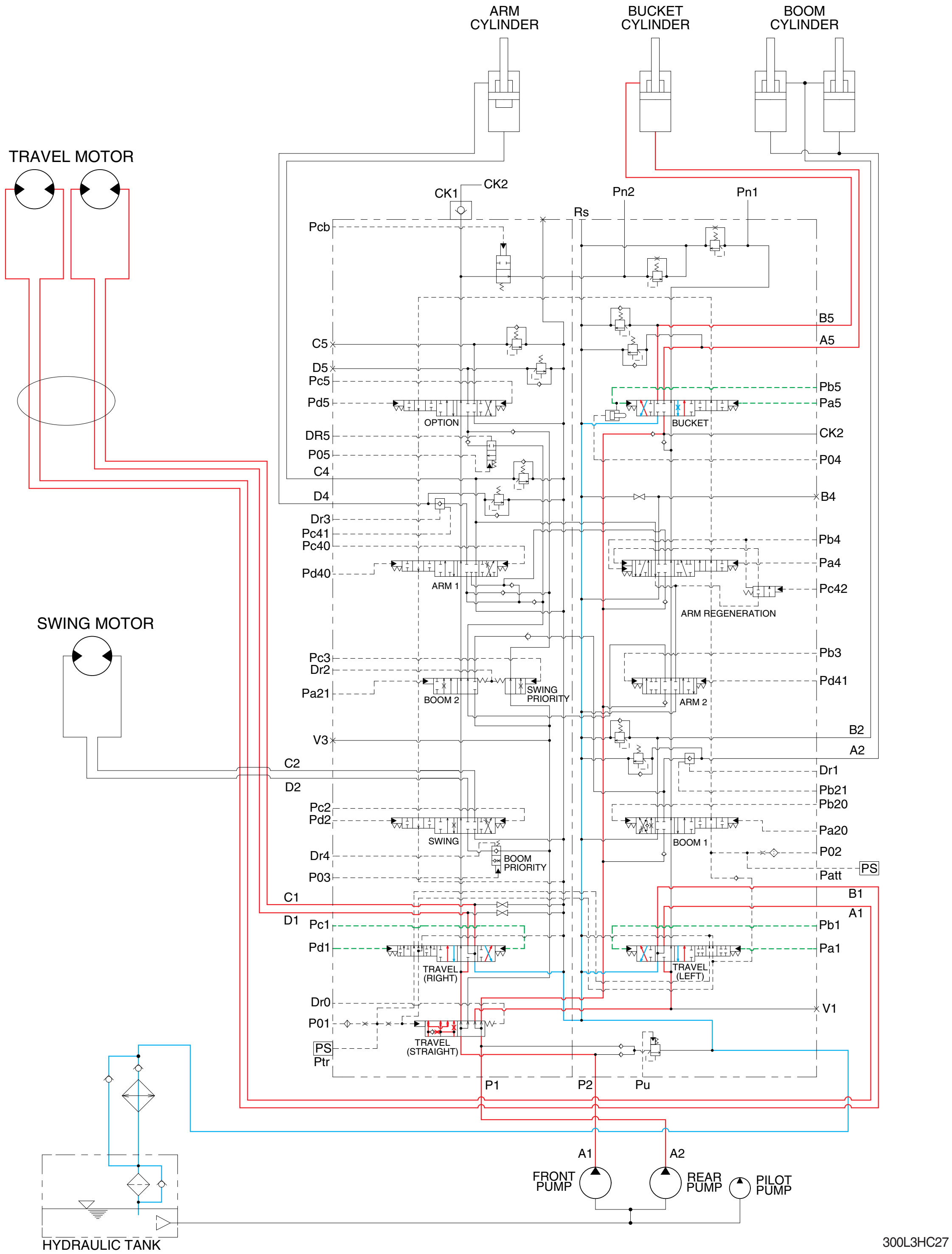


When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve. At the same time, the straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump. 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. The oil from the A1 pump flows into the travel motors through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool.

When the 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 arm is operated and the machine travels straight.

8. COMBINED BUCKET AND TRAVEL OPERATION



When the bucket and travel functions are operated, simultaneously the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve. At the same time, the straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump. The oil from the A2 pump flows into the bucket cylinder through the bucket spool via the confluence oil passage. The oil from the A1 pump flows into the travel motors through the RH travel spool of the right control valve and the LH travel spool of the left control valve via the straight travel spool of the control valve.

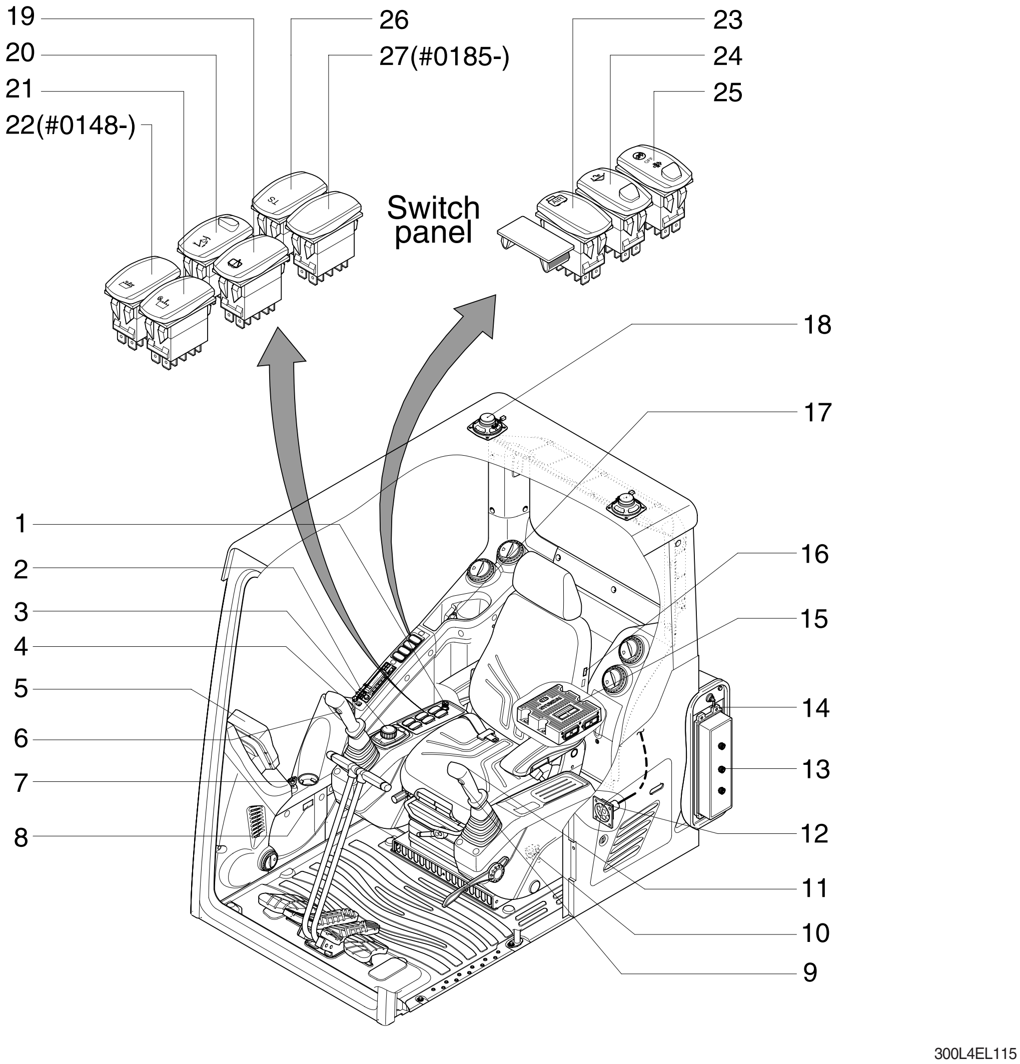
When the pressure of the travel motors is lower than the pressure of the bucket cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel.

The bucket is operated and the machine travels straight.

SECTION 4 ELECTRICAL SYSTEM

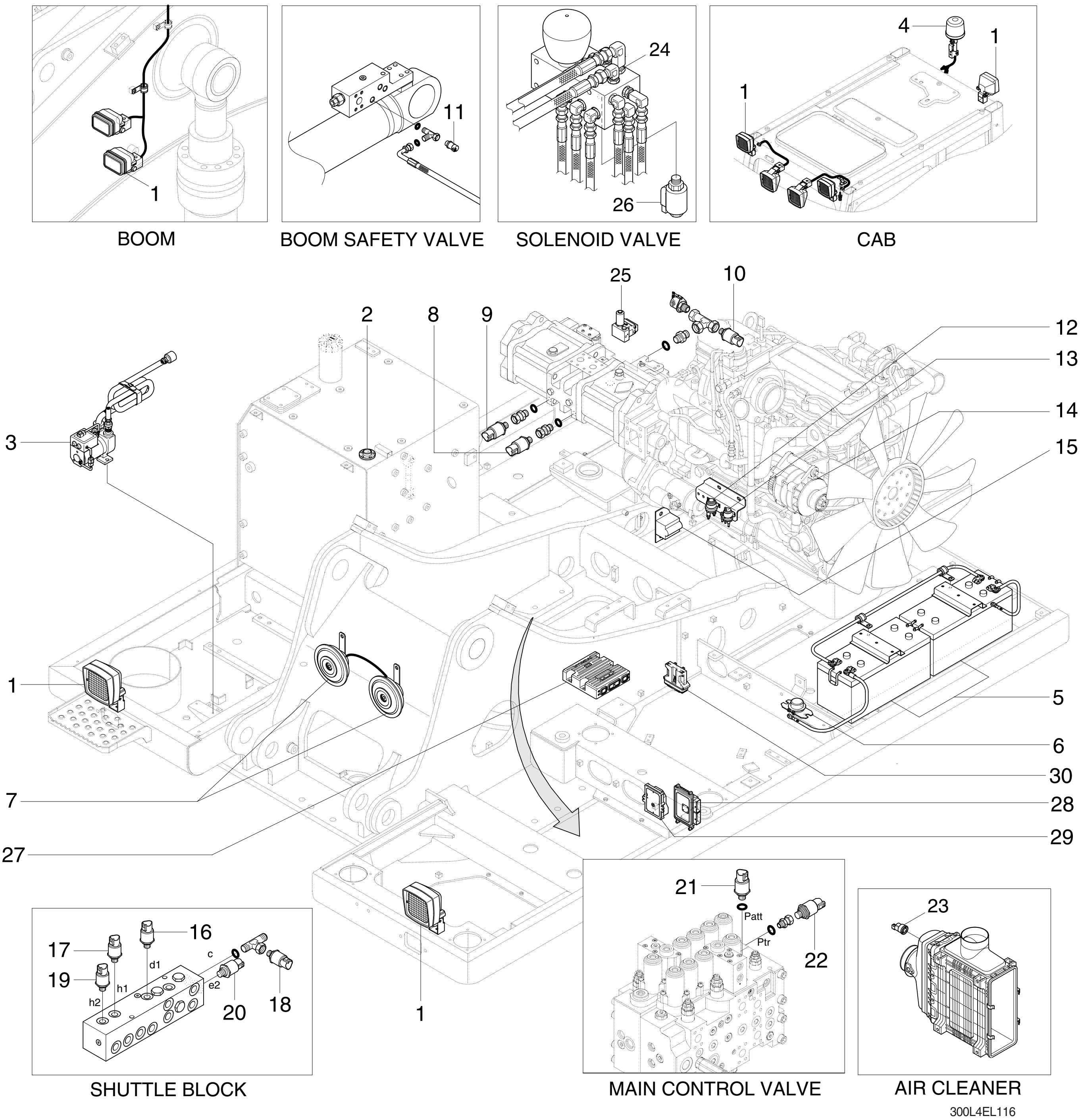
GROUP 1 COMPONENT LOCATION

1. LOCATION 1



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	Haptic controller	12	RS232 & J1939 service socket	21	Swing lock switch
4	Horn switch	13	Fuse & relay box	22	Swing fine switch
5	Cluster	14	Master switch	23	Air compressor switch
6	Breaker operation switch	15	Machine control unit	24	Quick clamp switch
7	Starting switch	16	Seat heater switch	25	SCR system cleaning switch
8	Service meter	17	Service socket	26	Travel straight switch
9	Power max switch	18	Speaker	27	Option attach switch

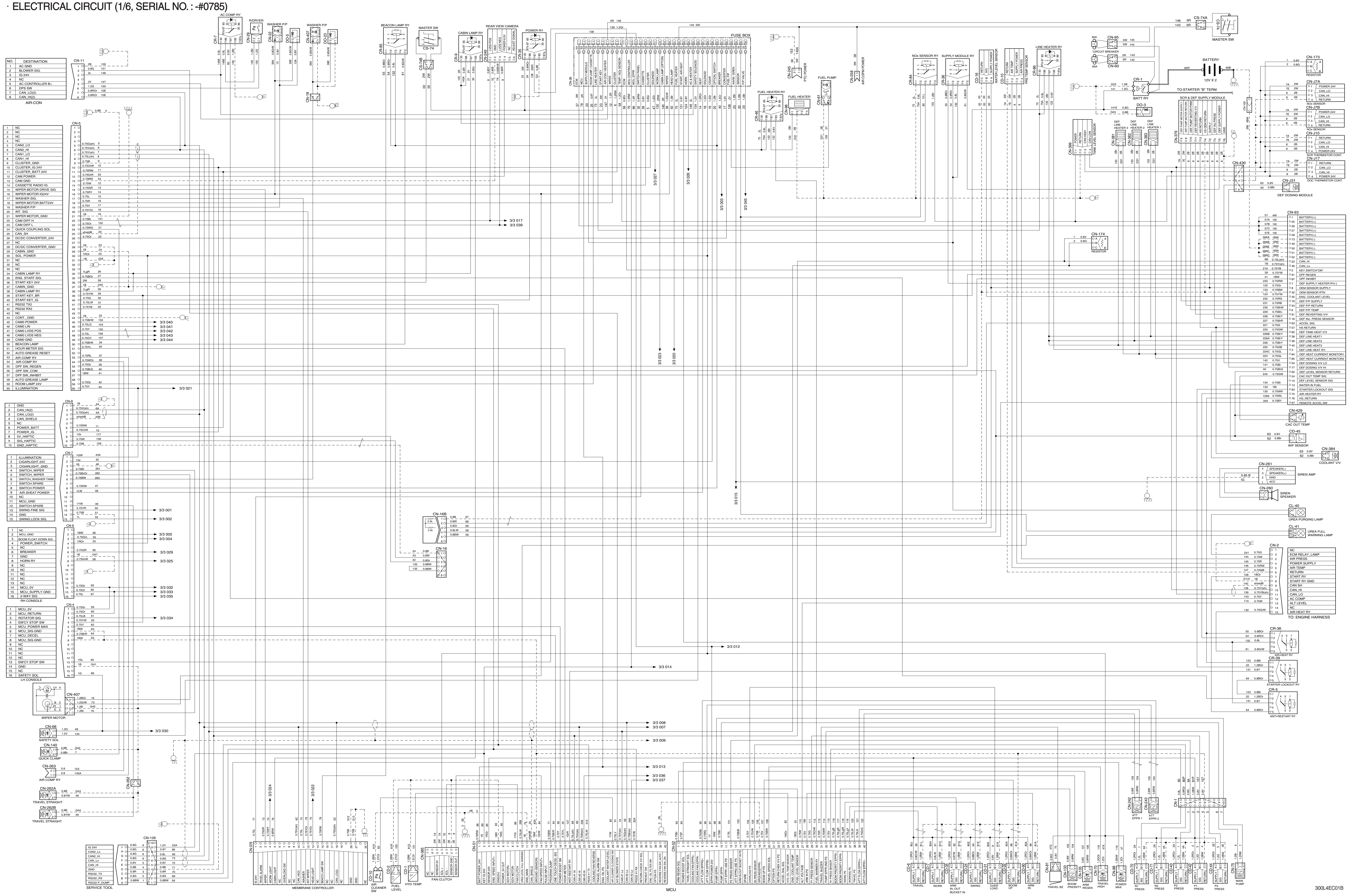
2. LOCATION 2



1	Lamp	11	Overload pressure sensor	21	Attach pressure sensor
2	Fuel sender	12	Start relay	22	Travel pressure sensor
3	Fuel filler pump	13	Heater relay	23	Air cleaner sensor
4	Beacon lamp	14	Alternator	24	Solenoid valve
5	Battery	15	Travel alarm buzzer	25	Pump EPPR valve
6	Battery relay	16	Arm/Bucket in pressure sensor	26	Boom priority EPPR valve
7	Horn	17	Boom up pressure sensor	27	MCU
8	P1 pressure sensor	18	Swing pressure sensor	28	AAVM controller
9	P2 pressure sensor	19	Boom down pressure sensor	29	DRU
10	EPPR pressure sensor	20	Arm in/swing pressure sensor	30	PVG32 controller

GROUP 2 ELECTRICAL CIRCUIT

· ELECTRICAL CIRCUIT (1/6, SERIAL NO. : -#0785)



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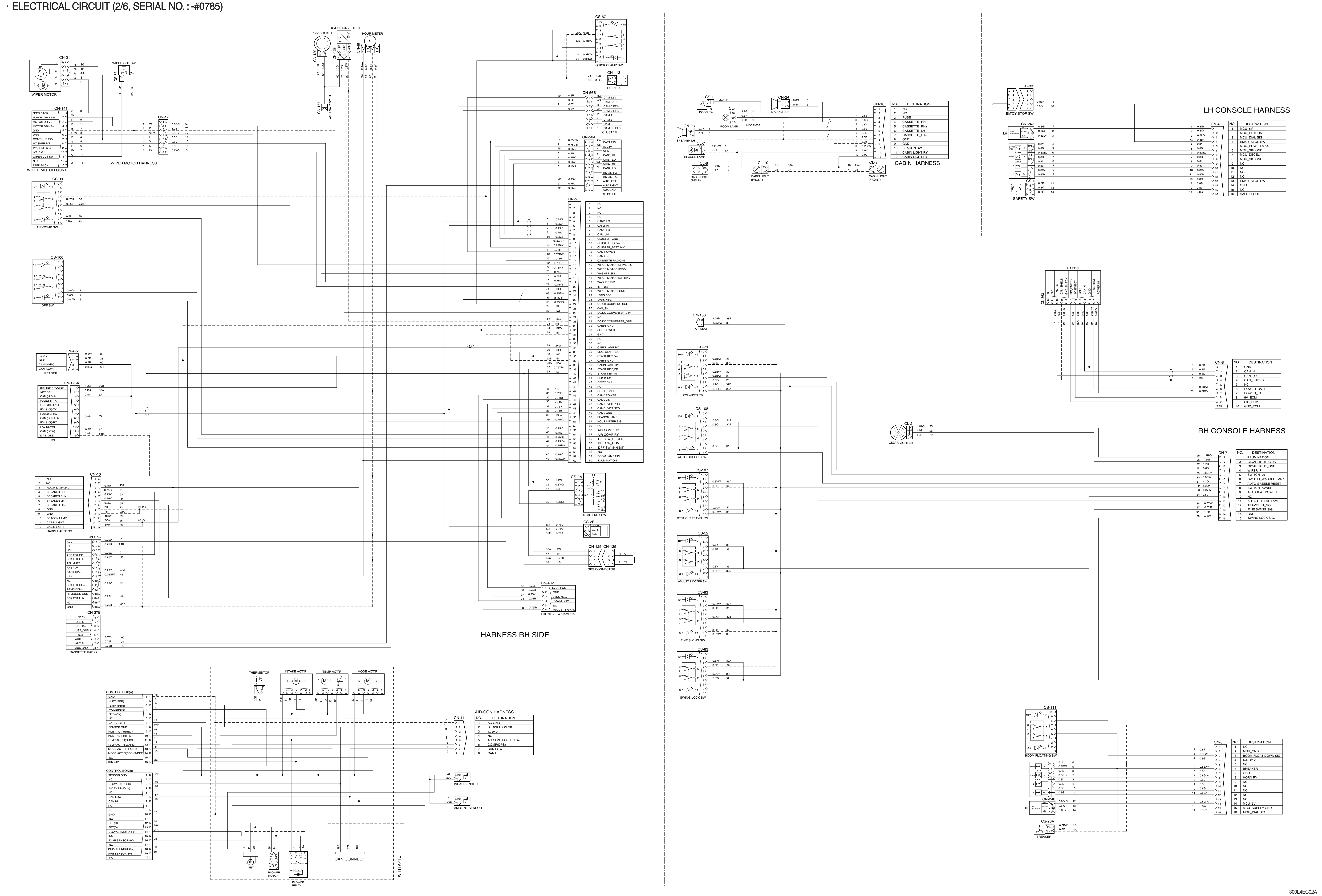
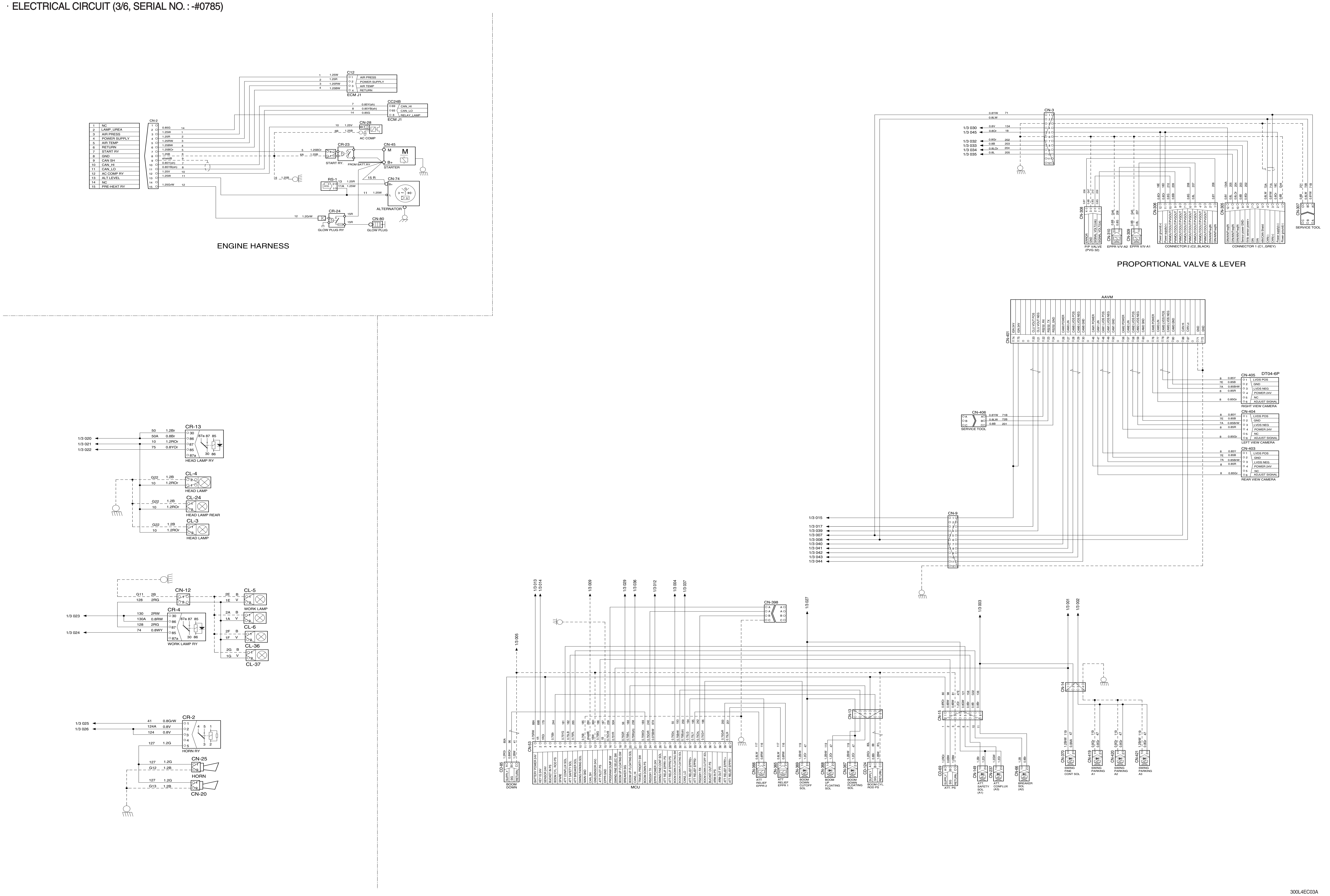
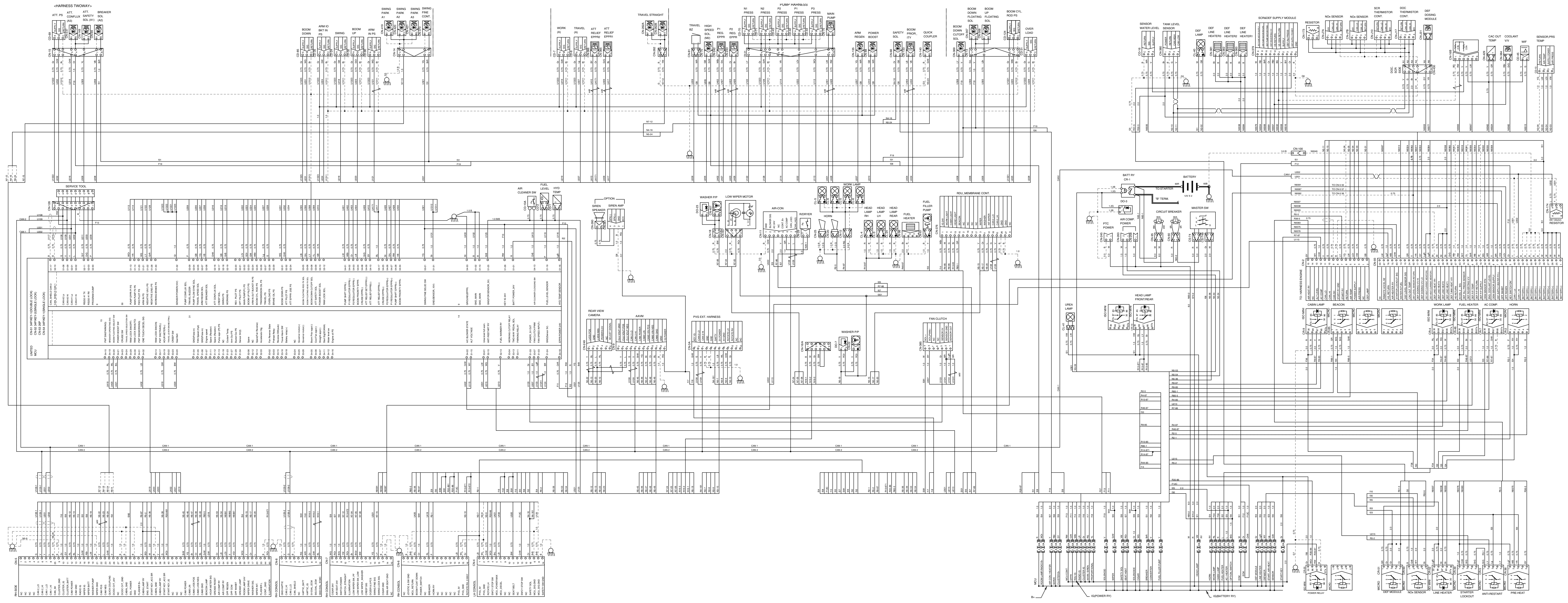
· ELECTRICAL CIRCUIT (2/6, SERIAL NO. : -#0785)



· ELECTRICAL CIRCUIT (3/6, SERIAL NO. : -#0785)

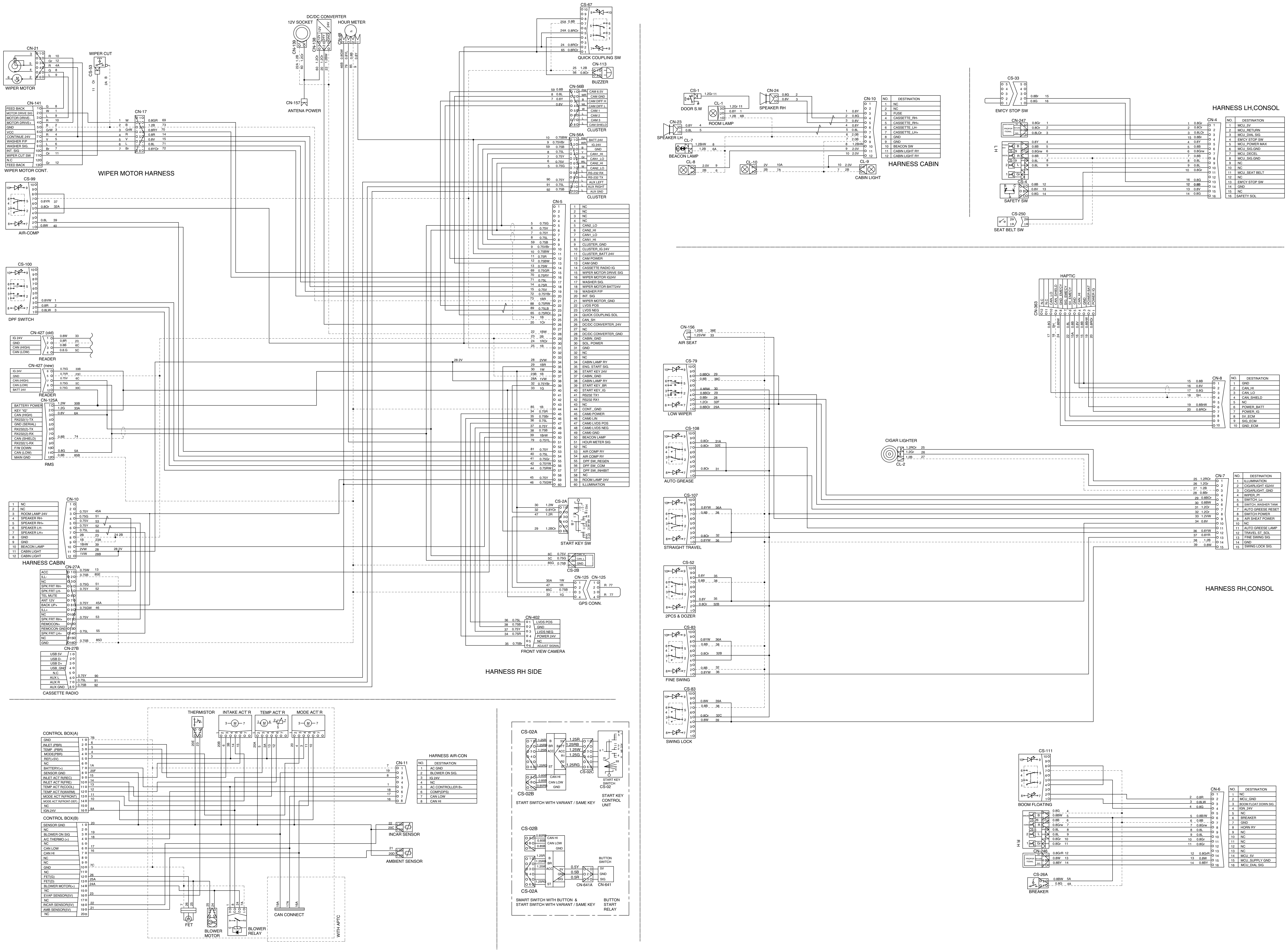


· ELECTRICAL CIRCUIT (4/6, SERIAL NO. : #0786-)



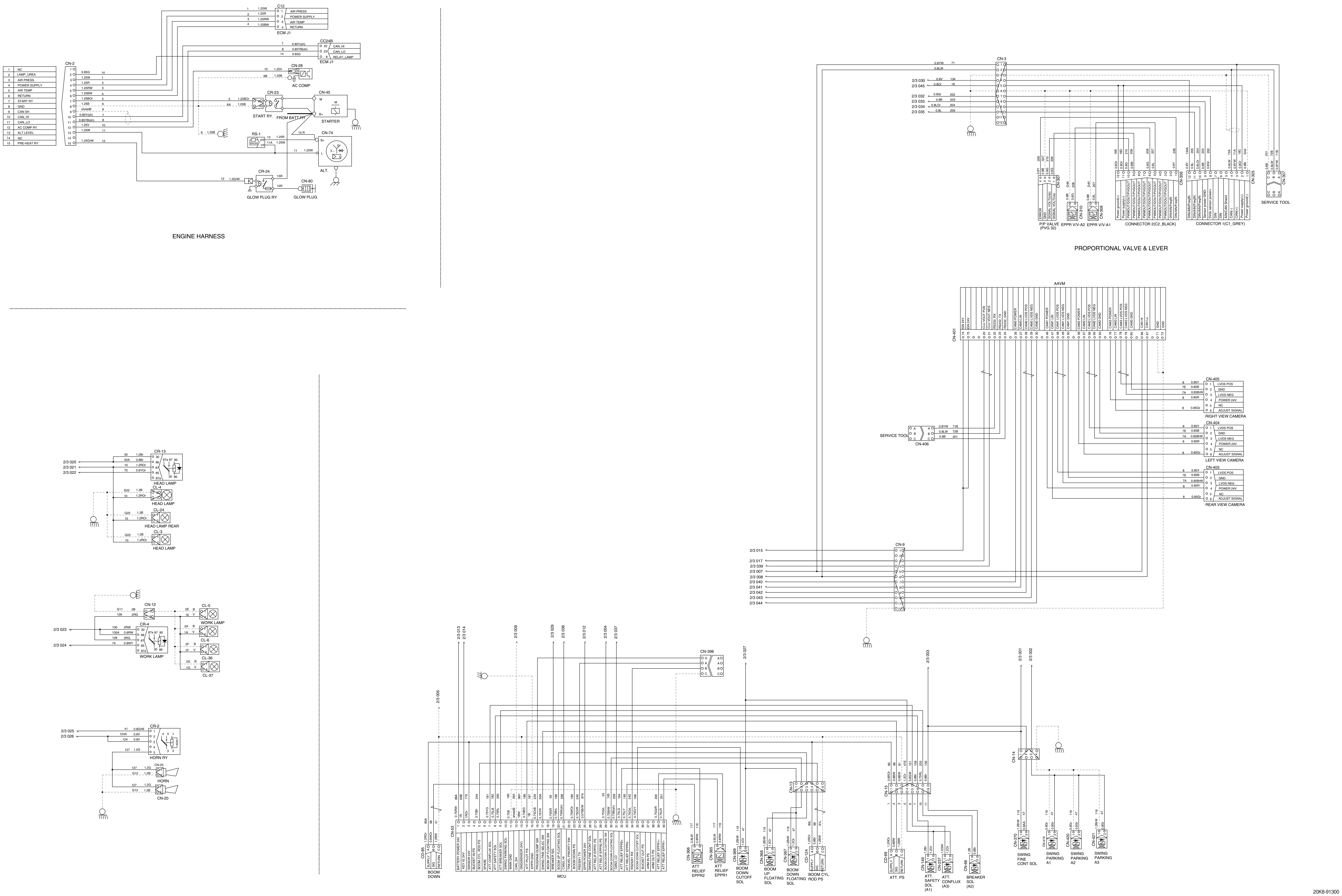
20K8-91202A

· ELECTRICAL CIRCUIT (5/6, SERIAL NO. : #0786-)



20K8-91103-00

· ELECTRICAL CIRCUIT (6/6, SERIAL NO. : #0786-)



MEMORANDUM

1. POWER CIRCUIT

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

1) OPERATING FLOW

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

- → Fuse box [No.1] → Engine ECM [CN-93 (1, 25, 26, 27, 28)]
  - → Urea purging lamp [CL-40 (1)]
- → Fuse box [No.2] → United MCU [CN-51 (01)]
- → Fuse box [No.3] → DEF module [CR-51 (2, 3)]
- → Fuse box [No.4] → I/conn [CN-5 (59)] → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
  - → Door switch [CS-1]
  - → Radio & USB player [CN-27A (8)]
- → Fuse box [No.5] → Line heater [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)]
- → Fuse box [No.10] → NOx sensor [CR-50 (3)]
- → Fuse box [No.11] → United MCU [CN-54 (8)]

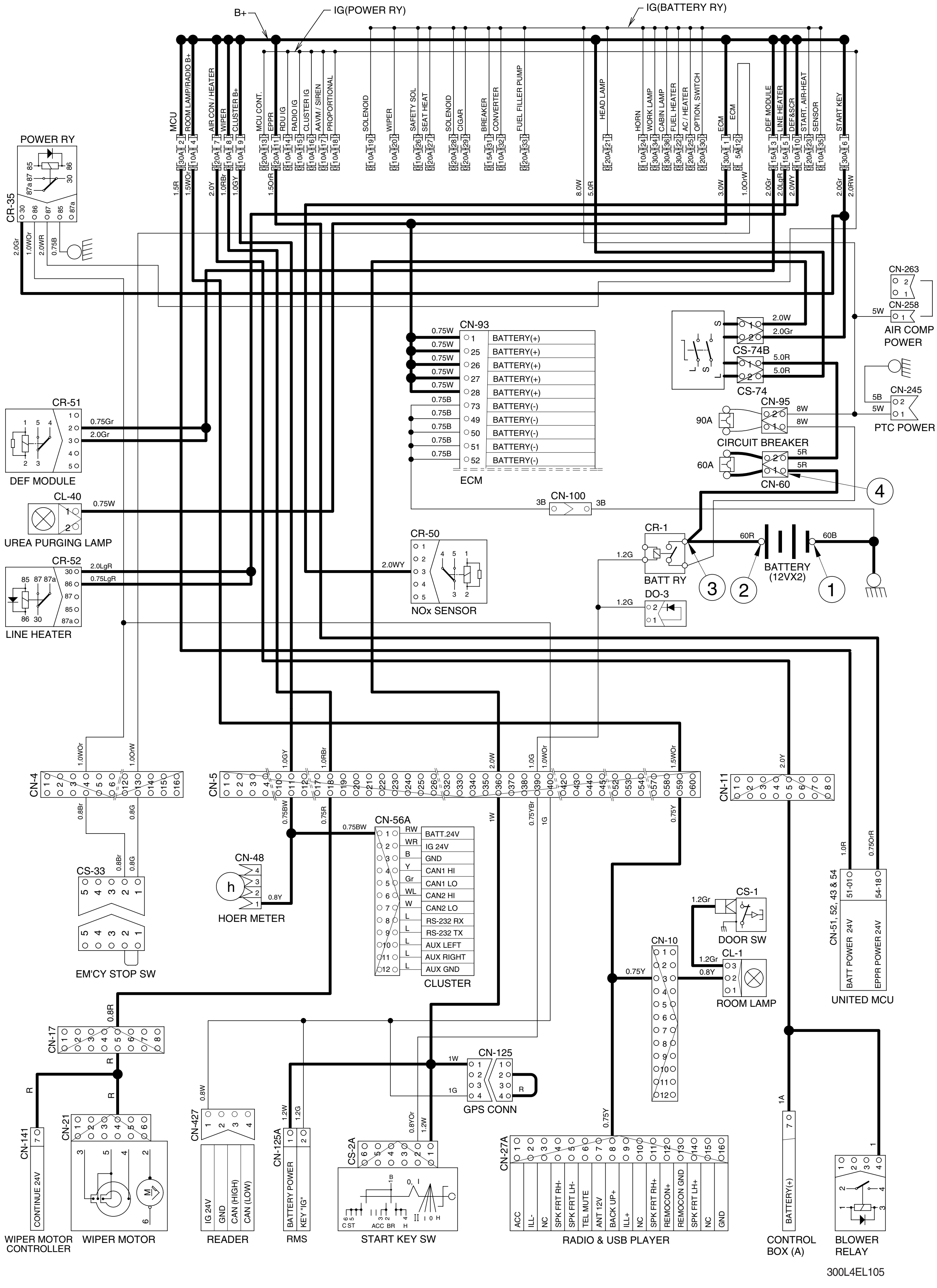
※ I/conn : Intermediate connector

2) CHECK POINT

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

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.5] ┌→ 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-2 (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-2 (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
→ Reader [CN-427 (1)]
└→ RMS [CN-125A (2)]

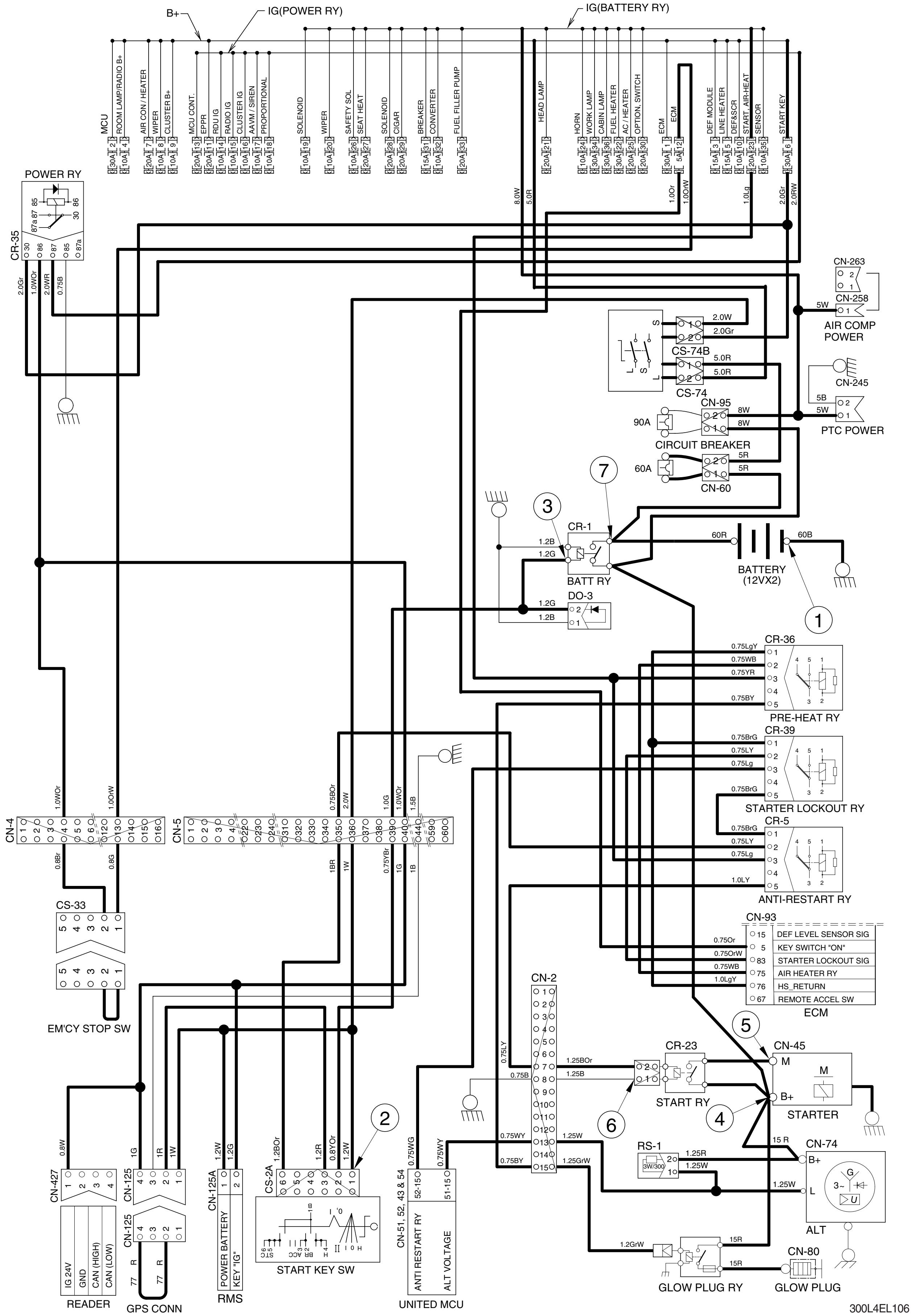
(2) When start key switch is in START position

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

2) CHECK POINT

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

STARTING CIRCUIT



3. CHARGING CIRCUIT

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

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

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

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-2 (13)] → United MCU alternator level [CN-51 (15)]
→ Cluster charging warning lamp (Via serial interface)

(2) Charging flow

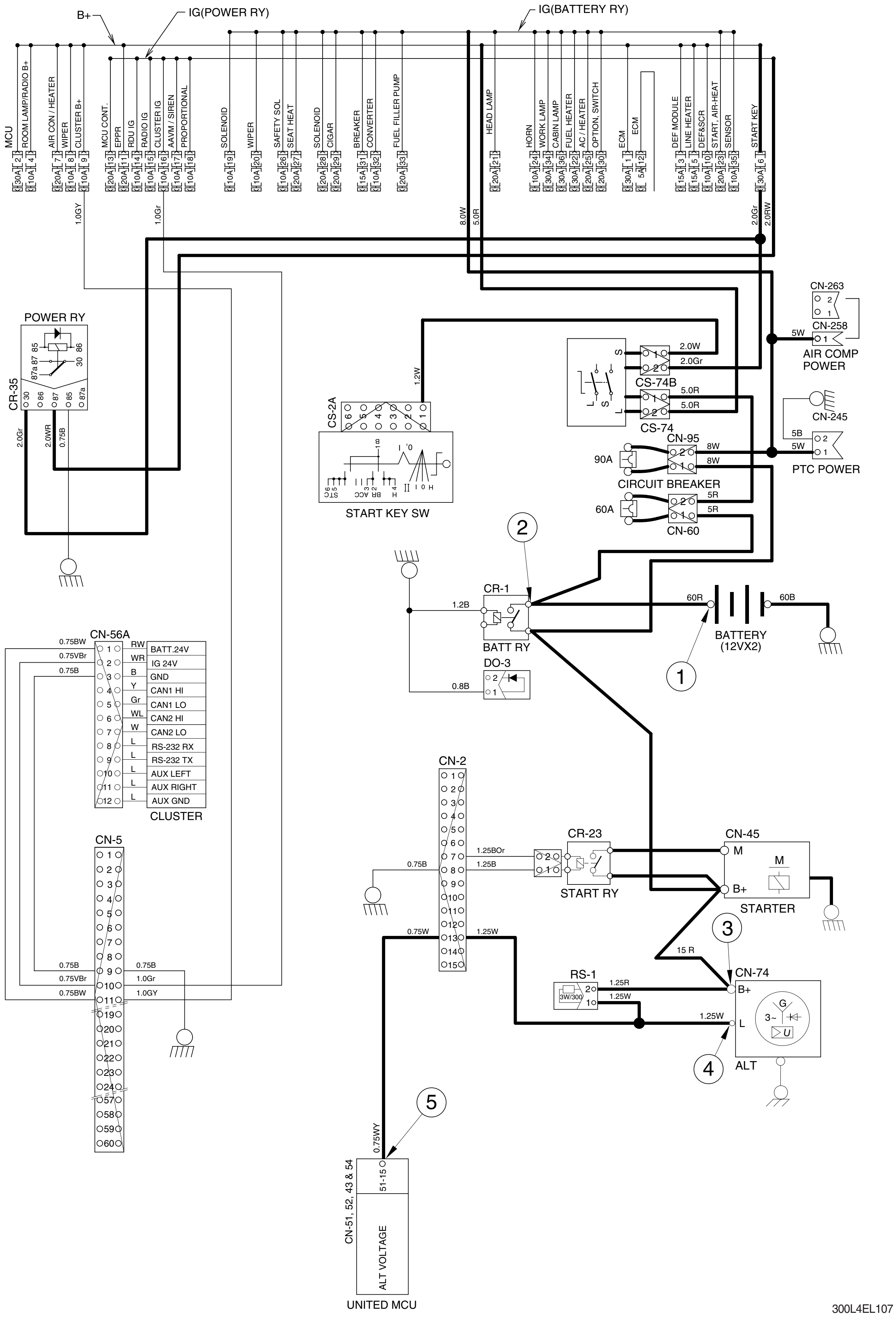
Alternator "B^+" terminal → Starter [CN-45 (B^+)] → Battery relay(M8)
→ Battery (+) terminal
→ Circuit breaker [CN-60] → Master switch [CS-74] → Fuse box [B^+]
→ Circuit breaker [CN-95] → Fuse box

2) CHECK POINT

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

※ GND : Ground

CHARGING CIRCUIT



4. HEAD AND WORK LIGHT CIRCUIT

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 [CR-376 (1)]

(1) Head light switch ON

Head light switch ON [CN-376 (13)] → Head light relay [CR-13 (85) → (87)]
→ Head light ON [CL-3 (2), CL-4 (1), CL-24 (2)]
→ I/conn [CN-7 (1)] → Cigar lighter [CL-2]
→ I/conn [CN-5 (60)] → Radio & USB player illumination ON [CN-27A (9)]
→ Hour meter illumination ON [CN-48 (4)]

(2) Work light switch ON

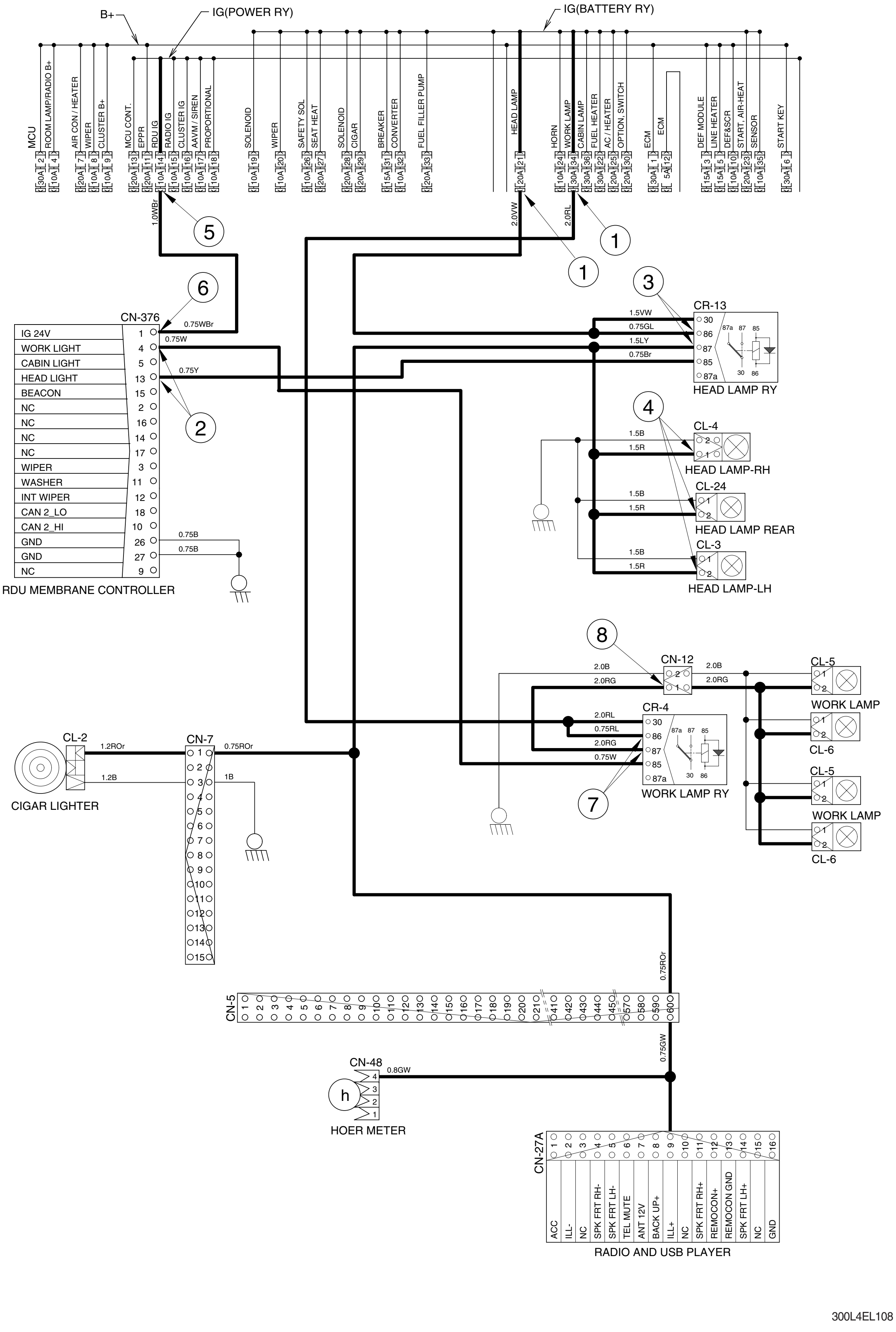
Work light switch ON [CN-376 (4)] → Work light relay [CR-4 (85) → (87)]
→ I/conn [CN-12 (1)] → Work light ON [CL-5 (2), CL-6 (2)]

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

HEAD AND WORK LIGHT CIRCUIT



5. BEACON LAMP AND CAB LIGHT CIRCUIT

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

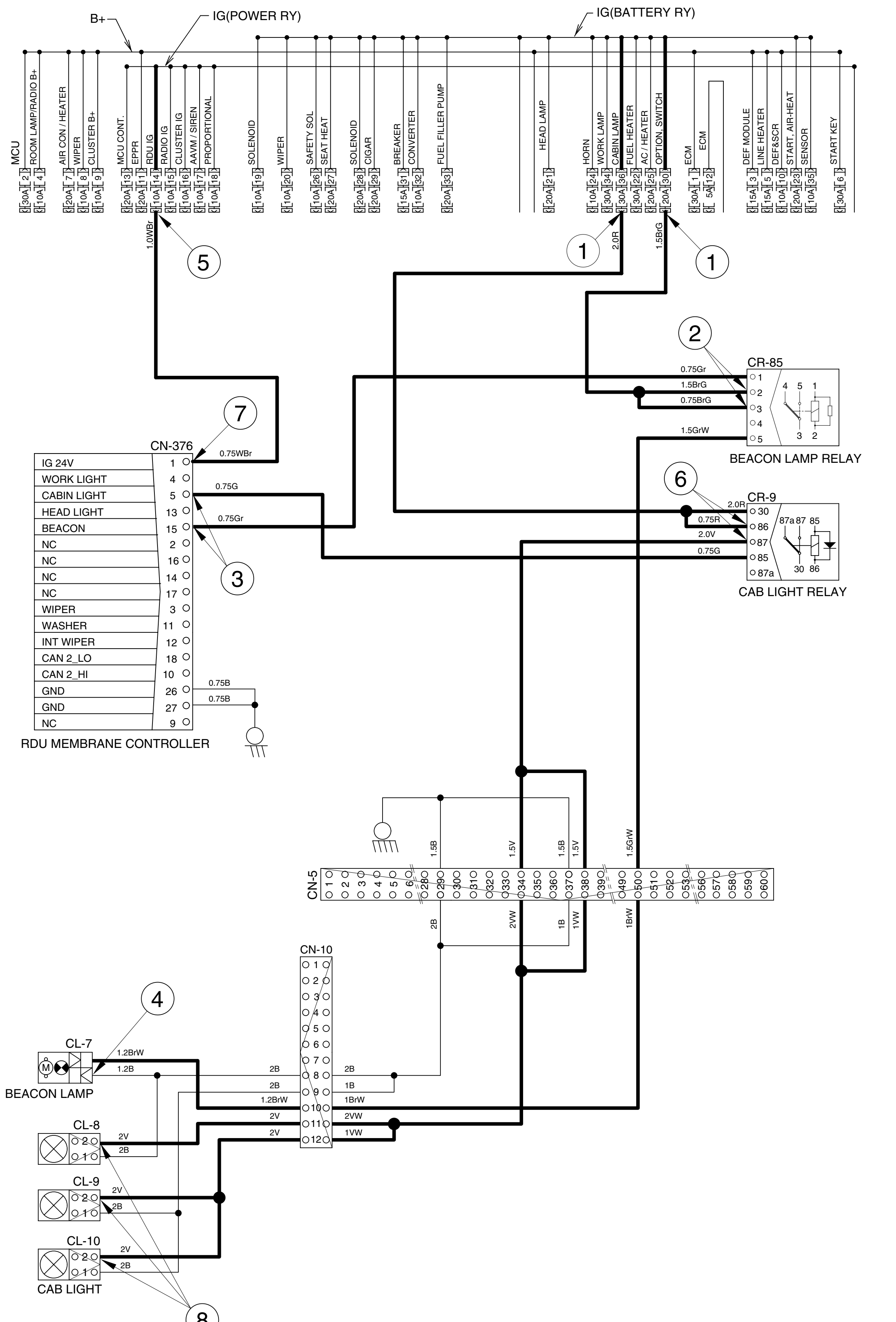
Cab light switch ON [CN-376 (8)] → Cab lamp relay [CR-9 (85)→(87)]
→ I/conn [CN-5 (34, 38)] → I/conn [CN-10 (11)] → Cab light ON [CL-8 (2)]
→ I/conn [CN-10 (12)] → Cab light ON [CL-9 (2), CL-10 (2)]

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

BEACON LAMP AND CAB LIGHT CIRCUIT



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6. WIPER AND WASHER CIRCUIT

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)]
→ 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)

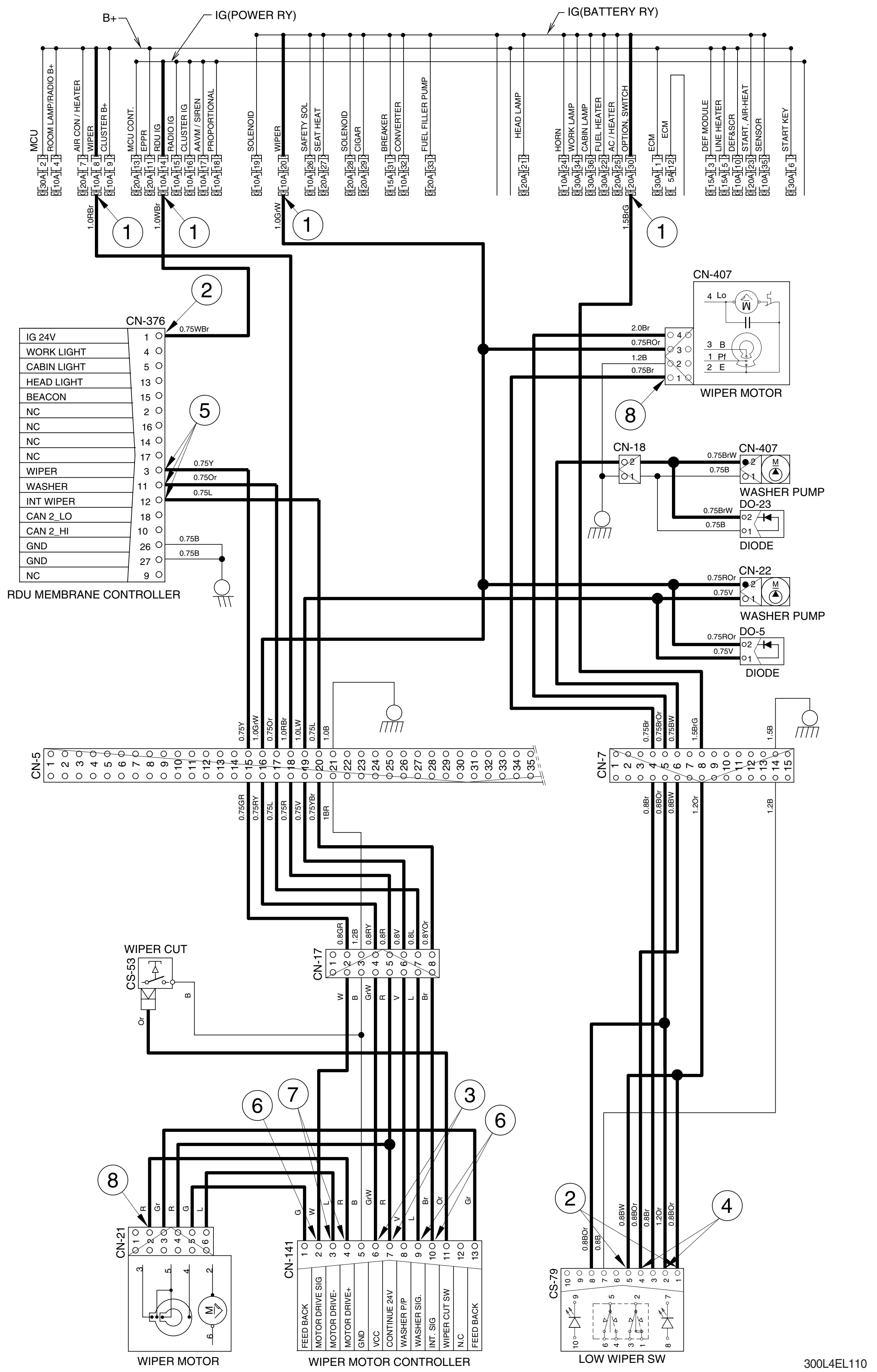
Wiper switch ON [CS-79 (5 → 4)] → I/conn [CN-7 (6)] → I/conn [NC-18 (2)] → Washer pump [CN-407 (2)]
→ Washer operating

3) CHECK POINT

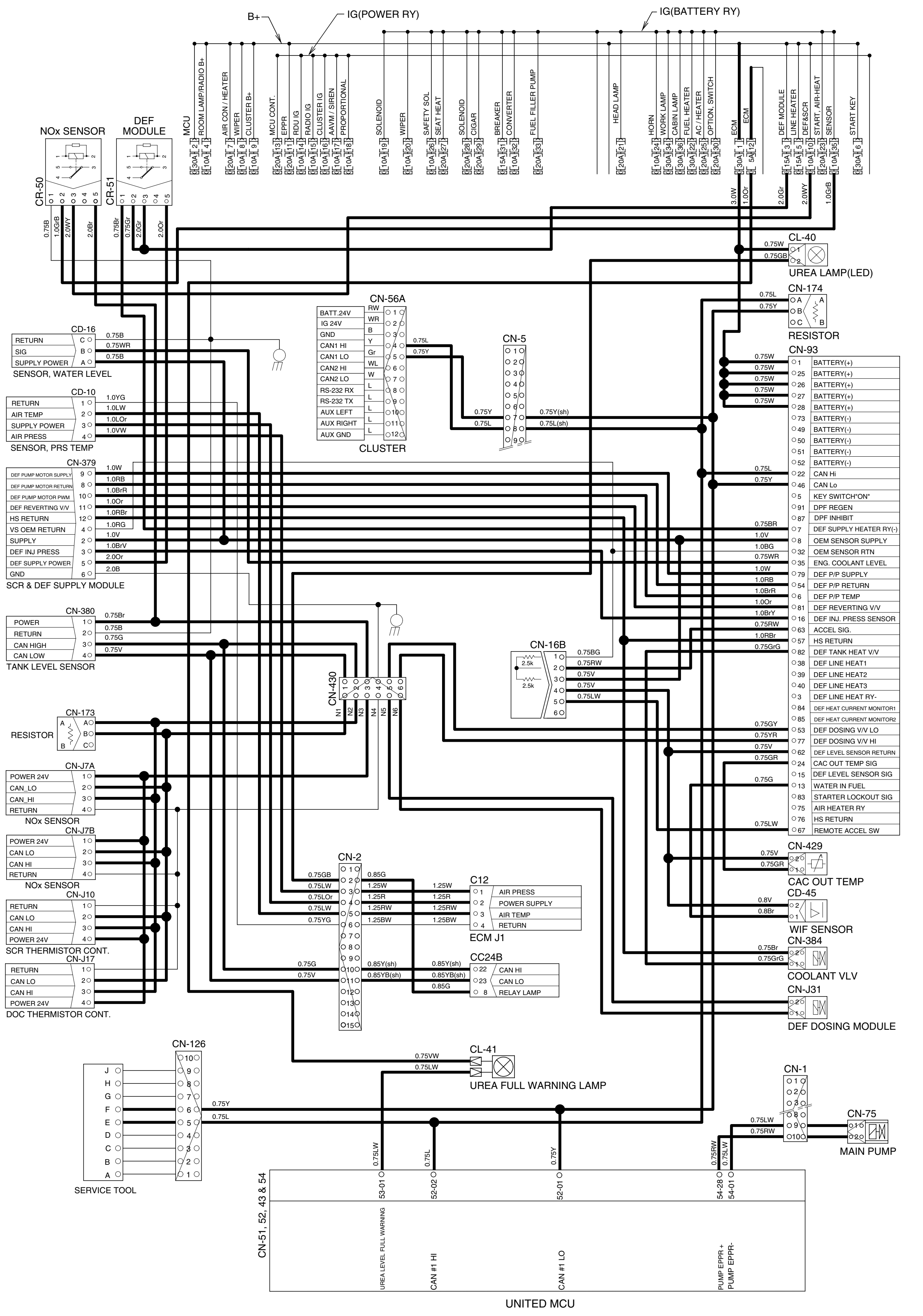
Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (wiper power input) ④ - GND (switch power output)	20~25V
		⑤ - GND (switch power output) ⑥ - GND (wiper switch power input)	0 ~ 5V
		⑦ - GND (wiper power output)	24V
		⑧ - GND (wiper motor)	0 or 24V

※ GND : Ground

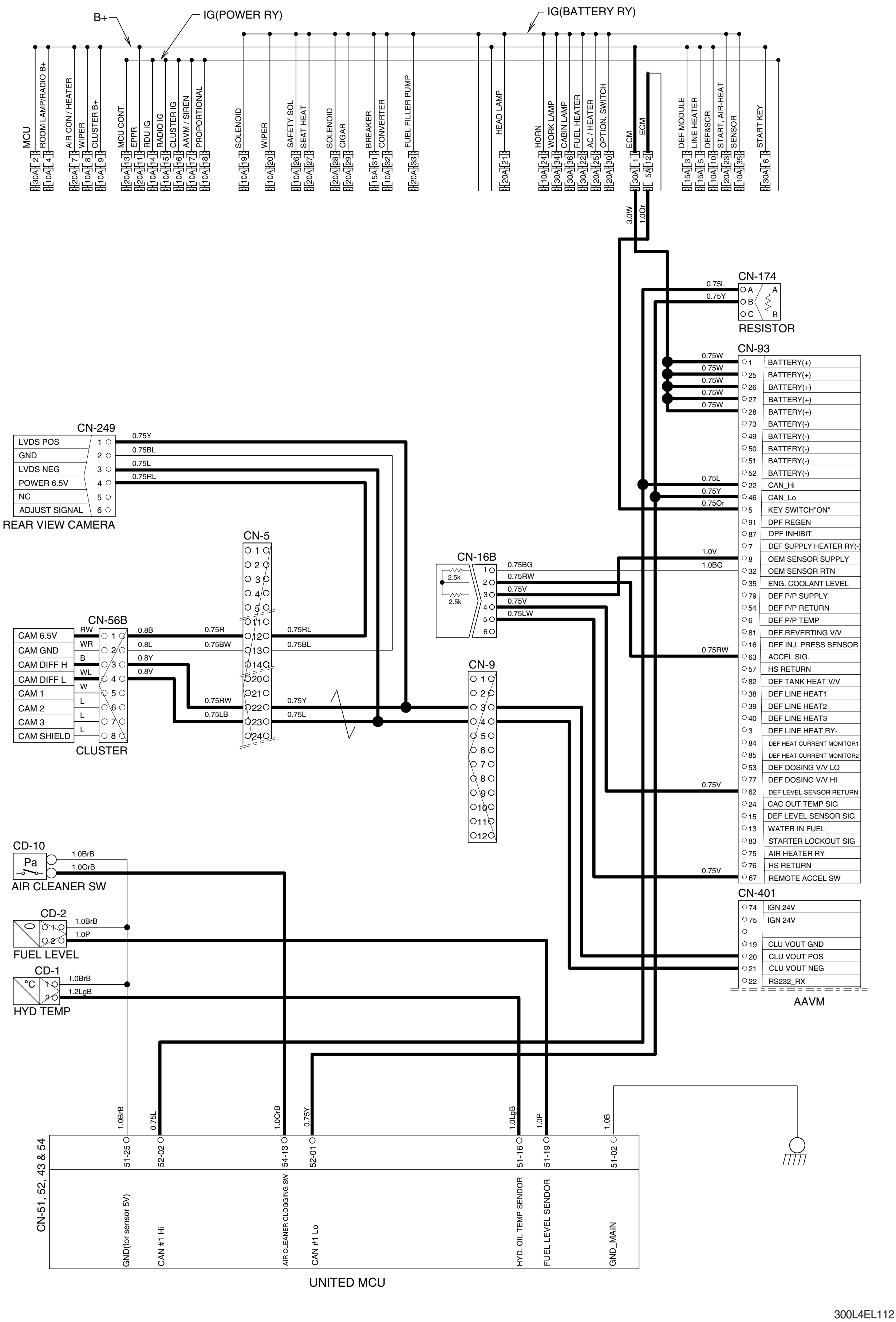
WIPER AND WASHER CIRCUIT



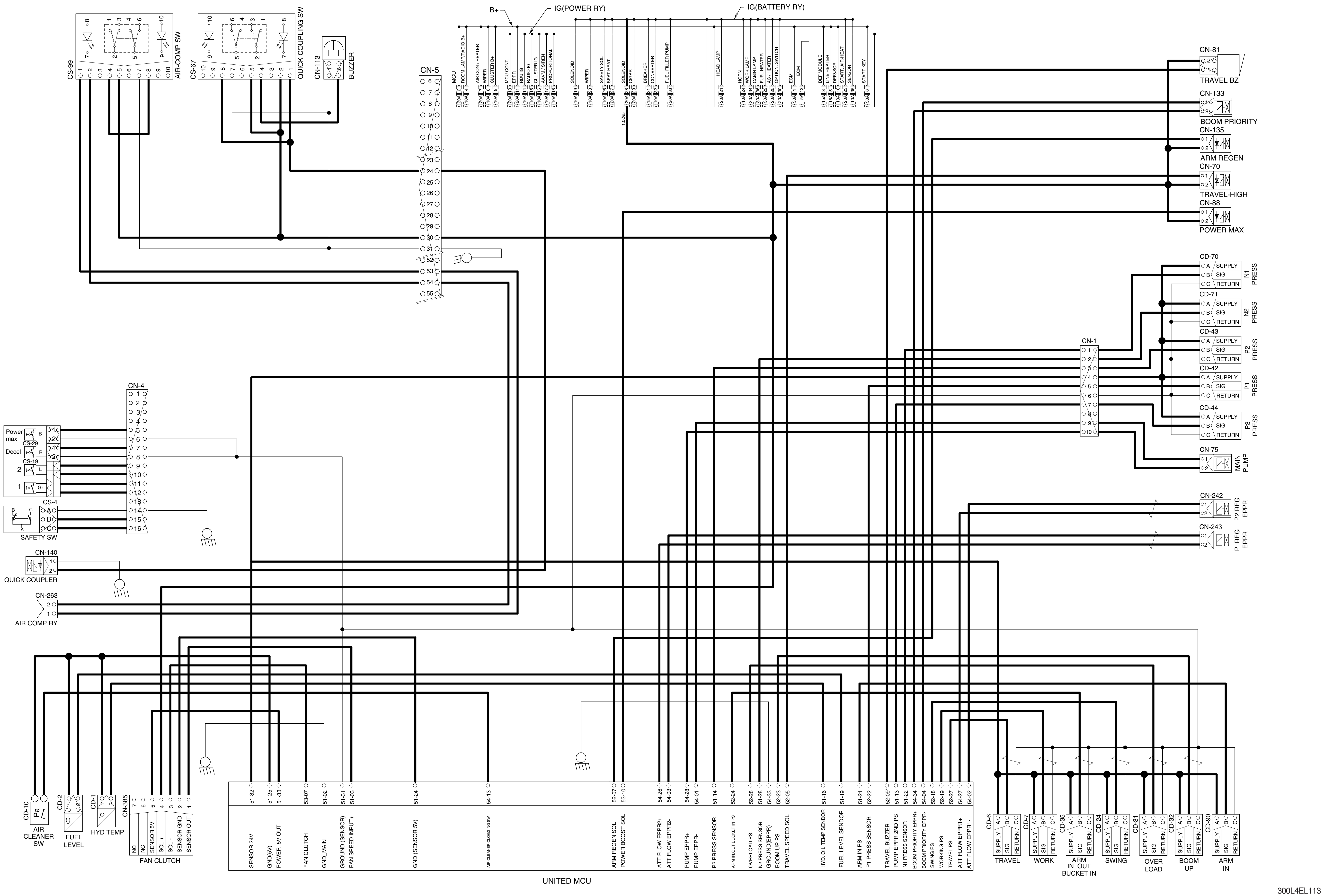
CONTROLLER CIRCUIT



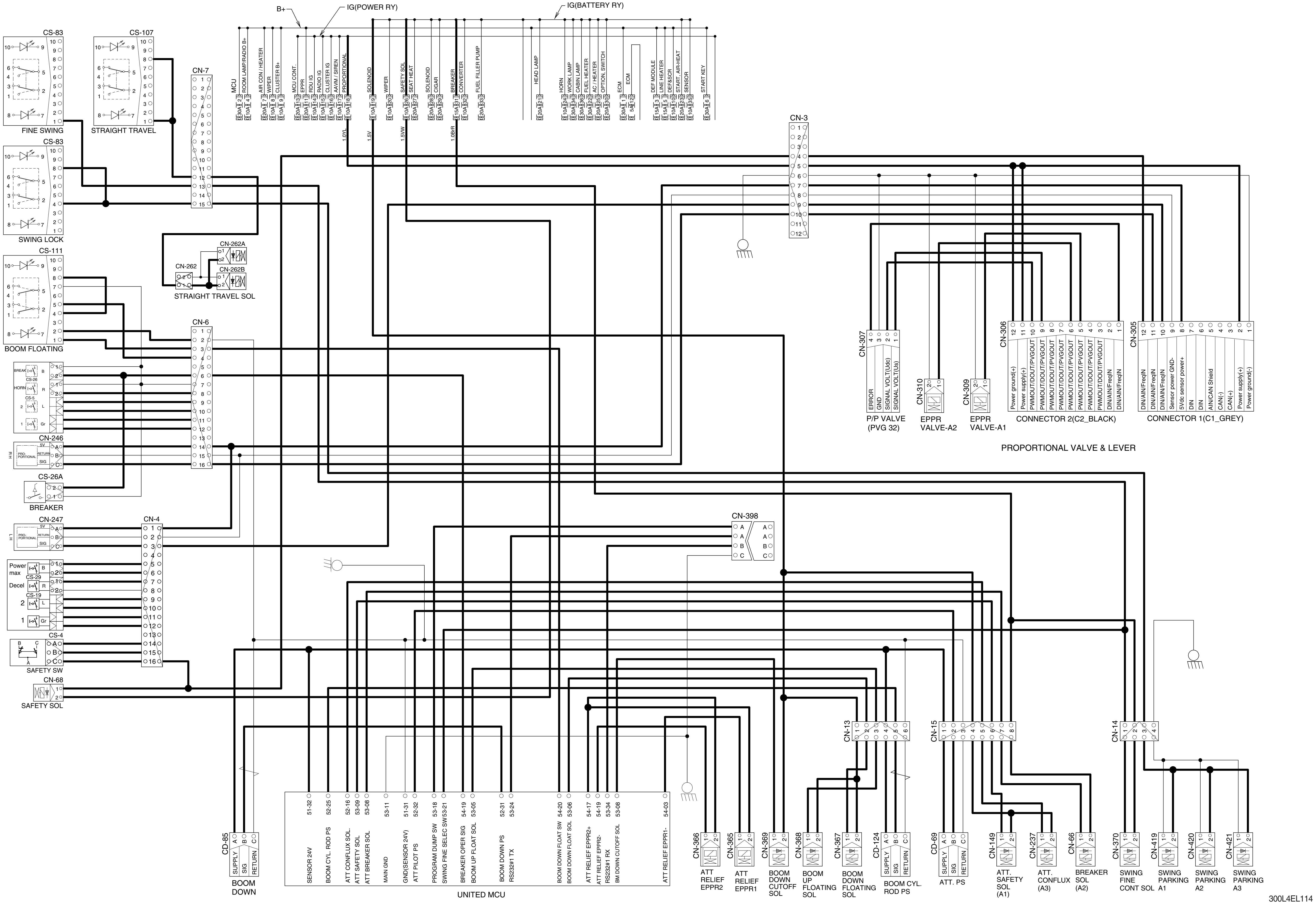
MONITORING CIRCUIT



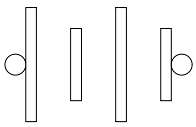
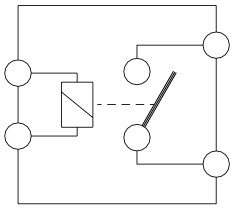
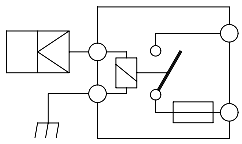
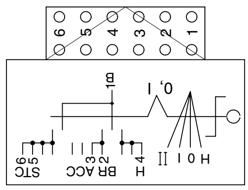
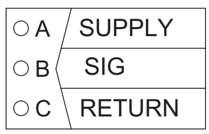
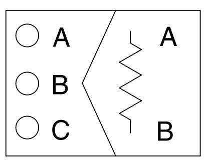
ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)

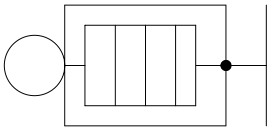
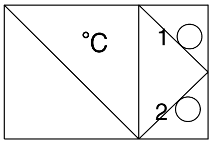
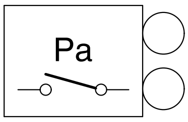
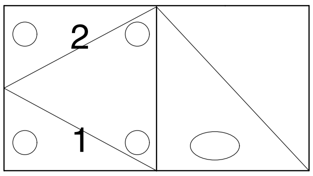
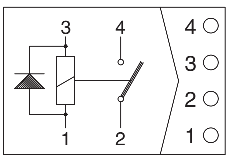
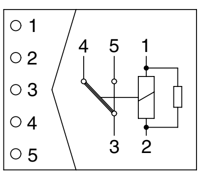


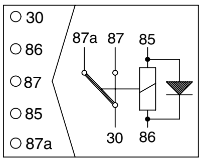
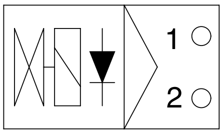
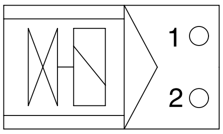
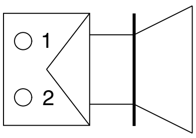
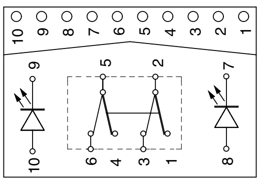
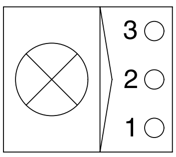
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

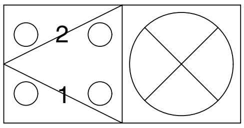
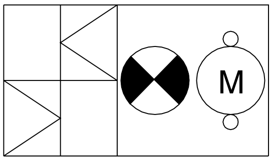
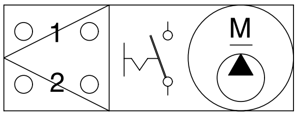
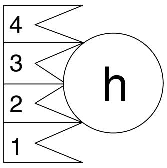
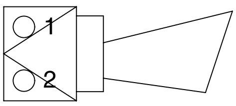
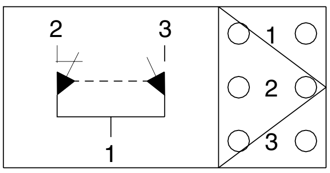


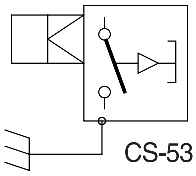
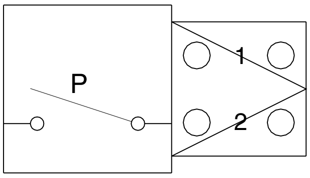
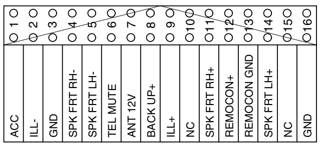
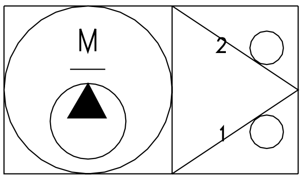
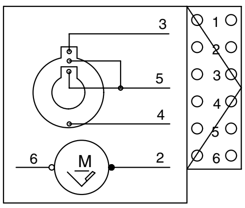
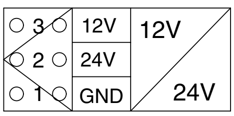
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

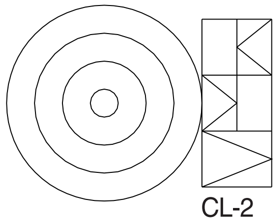
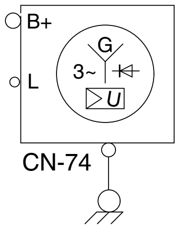
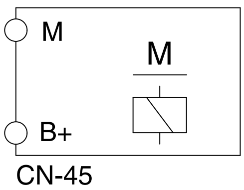
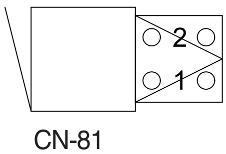
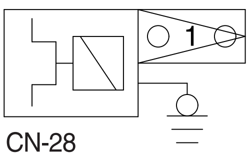
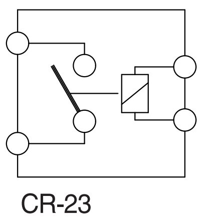
Part name	Symbol	Specifications	Check
Battery		12V × 160Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Glow plug relay	 CR-24	24V 200A	※ Check contact Normal : 0.942Ω (For terminal 1-GND)
Start key	 CS-2	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 1-5)
Pressure sensor	 CD-6 CD-7 CD-16 CD-24 CD-31 CD-32 CD-33 CD-35 CD-42 CD-43 CD-44 CD-69 CD-70 CD-71 CD-85 CD-90 CD-108 CD-109 CD-124	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 CN-173 CN-174	4W	※ Check resistance A-B : 120Ω

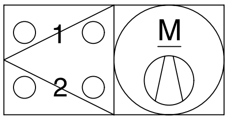
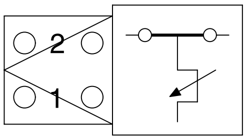
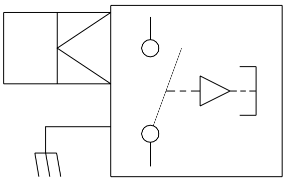
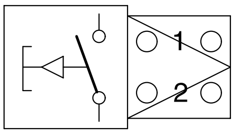
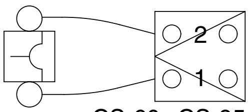
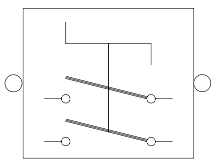
Part name	Symbol	Specifications	Check
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner pressure switch	 CD-10	(N.O TYPE)	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel sender	 CD-2	-	※ 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-45 CR-51	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0Ω (for terminal 3-4) ∞Ω (for terminal 3-5)

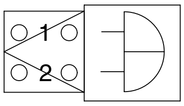
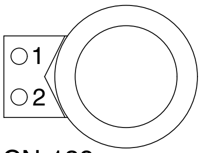
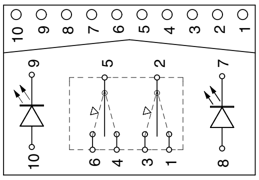
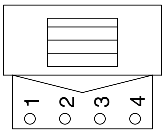
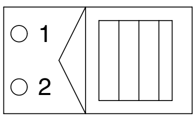
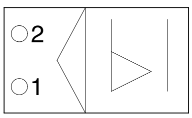
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-7 CR-9 CR-13 CR-35 CR-46 CR-50 CR-52	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω(for terminal 30-87a) ∞Ω(for terminal 30-87)
Solenoid valve	 CN-66 CN-70 CN-88 CN-135 CN-140 CN-149 CN-237 CN-262 CN-367 CN-368 CN-369 CN-370 CN-384 CN-419 CN-420 CN-421 CN-J31	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-133 CN-242 CN-309 CN-310 CN-365 CN-366 CN-378	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	20W	※ Check resistance Normal : A fewΩ
Switch (locking type)	 CS-50 CS-67 CS-83 CS-99 CS-107 CS-108 CS-111	24V 1.5A	※ Check contact Normal ON : 0 Ω(for terminal 3-7, 4-8) ∞Ω(for terminal 7-9, 8-10) OFF : ∞Ω(for terminal 3-7, 4-8) 0 Ω(for terminal 7-9, 8-10)
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)

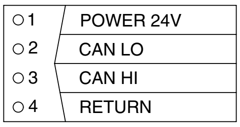
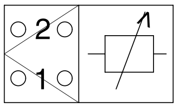
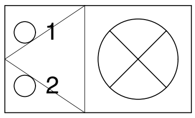
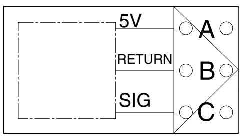
Part name	Symbol	Specifications	Check
Head lamp, Work lamp, Cab lamp	 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10 CL-24 CL-36 CL-37	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	 CL-7	21V 70W (H1 Type)	※ Check disconnection Normal : A fewΩ
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Hour meter		16~32V	※ Check operation Supply power(24V) to terminal No.2 and connect terminal No.1 and ground
Horn	 CN-20 CN-25	DC22~28V 2A	※ Check operation Supply power(24V) to each terminal and connect ground.
Safety switch	 CS-4	24V 15A (N.C TYPE)	※ Check contact Normal : 0Ω(for terminal 1-2) ∞Ω(for terminal 1-3) Operating : ∞Ω(for terminal 1-2) 0Ω(for terminal 1-3)

Part name	Symbol	Specifications	Check
Wiper cut switch	 CS-53	24V (N.O TYPE)	※ Check contact Normal : 0Ω (one pin to ground)
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22 CN-408	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)
Duct sensor (switch)		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω (for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch	 CS-1	24V 2W	※ Check resistance Normal : About 5MΩ
Switch (power max, one touch decel, horn, breaker)	 CS-5 CS-19 CS-26 CS-29	24V 6A	※ Check resistance Normal : ∞Ω
Circuit breaker	 CS-60 CS-95	60A	※ Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Master switch	 CS-74A, CS-74B	6-36V	※ Check disconnection Normal : 0.1Ω

Part name	Symbol	Specifications	Check
Quick clamp buzzer	 CN-113	24V 200mA 107±4dB	
Socket	 CN-139	12V 10A	
Switch	 CS-73 CS-79 CS-100	24V 8A	※ Check contact Normal ON : 0Ω(for terminal 3-7, 4-8) ∞Ω(for terminal 7-9, 8-10) OFF : ∞Ω(for terminal 3-7, 4-8) 0Ω(for terminal 7-9, 8-10)
Fuel heater	 CN-96	-	
DEF/AdBlue® line heater	 CN-381 CN-382 CN-383	-	
WIF sensor	 CD-45	-	

Part name	Symbol	Specifications	Check
DEF/AdBlue® sensor	 CN-399 CN-J7A CN-J7B CN-J10 CN-J17	-	
CAC out temperature sensor	 CN-429	-	
DEF/AdBlue® fill up warning lamp (LED)	 CL-40	-	
Proportional valve sensor	 CN-246 CN-247	-	

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION (SERIAL NO. : -#1094)

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	TYCO	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	DRB12-60P-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	S816-110002
CN-9	DEUTSCH	12	I/conn (AAVM harness-Frame harness)	DT06-12SA-P021	DT04-12PA-P021
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E004
CN-15	AMP	12	I/conn (Frame harness-Breaker sol)	S816-012002	S816-112002
CN-16	AMP	6	Emergency engine start & speed control	S816-006002	S816-106002
CN-17	AMP	8	I/conn (Wiper harness-Side harness RH)	S816-008002	S816-108002
CN-20	MOLEX	2	Horn	36825-0211	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer pump	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	KUM	1	Aircon compressor	NMWP01F-B	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse & relay box	21Q7-10910	-
CN-45	RING-TERM	-	Starter motor B^+	S820-108000	-
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	DEUTSCH	40	MCU	DRC26-40SA	-
CN-52	DEUTSCH	40	MCU	DRC26-40SB	-
CN-53	DEUTSCH	40	MCU	DRC26-40SC	-
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	YAZAKI	4	Circuit breaker	4-1416390-1	-
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	-

(SERIAL NO. : -#1094)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid	DT06-2S-EP06	-
CN-74	RING-TERM	1	Alternator "L" terminal	S820-108000	-
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	DT06-2S-EP06	-
CN-93	DELPHI	60	ECM	13964577	-
CN-95	YAZAKI	2	Circuit breaker	-	7222-4220-30
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	RMS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	RMS	DT06-12S-P021	DT04-12PA-P021
CN-126	TYCO	10	Service tool	2-1418390-1	S816-110002
CN-133	DEUTSCH	2	Boom priority solenoid	DT06-2S-EP06	-
CN-135	DEUTSCH	2	Arm regeneration solenoid	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-147	AMP	4	Fuel heater	2-967325-3	-
CN-149	DEUTSCH	2	Attach safety solenoid	DT06-2S-EP06	-
CN-156	DEUTSCH	2	Air seat	DT06-2S-EP06	DT04-2P-E005
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	Attach EPPR 1	DT06-2S-EP06	-
CN-245	FCI	4	PTC power	180900-0	-
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	4	Rear view camera	DT06-4S-EP06	DT04-4P-E005
CN-258	KET	1	Air compressor power	MG640944-5	MG650943-5
CN-259	AMP	6	Camera	S816-006002	S816-106002
CN-262A CN-262B	DEUTSCH	2	Straight travel solenoid	DT06-2S-EP06	DT04-2P-E005
CN-263	DEUTSCH	2	Air compressor relay	DT06-2S-EP06	DT04-2P-E005

(SERIAL NO. : -#1094)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
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-A1	DT06-2S-EP06	-
CN-310	DEUTSCH	2	Proportional-EPPR valve-A2	DT06-2S-EP06	-
CN-363	AMP	12	Haptic controller	174045-2	-
CN-365	DEUTSCH	2	Attach EPPR valve-LH	DT06-2S-EP06	DT04-2P-E005
CN-366	DEUTSCH	2	Attach EPPR valve-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	2	SCR & DEF/AdBlue® supply module	2-1703639-1	-
CN-381	DELPHI	2	Line heater 1	12162194	-
CN-382	DELPHI	2	Line heater 2	12162194	-
CN-383	DELPHI	2	Line heater 3	12162194	-
CN-384	DEUTSCH	2	Coolant valve	DT06-2S-EP06	-
CN-385	-	7	Fan clutch	965570	-
CN-398	DEUTSCH	4	RS232	DT04-4S-E005	DT06-4P-E005
CN-399	TYCO	4	DEF/AdBlue® tank level sensor	1-967325-1	-
CN-402	DEUTSCH	6	Front view camera	DT06-6S-EP06	DT04-6P-EP14
CN-403	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP14
CN-404	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-407	FCI	4	Low wiper motor	180900-0	-
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
CN-429	DELPHI	4	CAC Out temp	12162197	-
CN-J7A	TYCO	4	DOC Nox sensor	2-1418390-1	-
CN-J7B	TYCO	4	SCR Nox sensor	1-1418390-1	-
CN-J10	TYCO	4	SCR Thermistor	3-1418390-1	-
CN-J17	TYCO	4	DOC Thermistor	4-1418390-1	-
CN-J31	BOSCH	2	DEF/AdBlue® dosing module	1-928-403-874	-

(SERIAL NO. : -#1094)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
· 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-45	-	5	Beacon lamp relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-50	-	5	NO_x sensor relay	-	-
CR-51	-	5	DEF/AdBlue® module relay	-	-
CR-52	-	5	Line heater relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2	WP	6	Start key switch	S814-006100	-
CS-4	DEUTSCH	3	Safety switch	DT06-3S-EP06	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P-E005
CS-19	DEUTSCH	2	One touch decel switch	-	DT04-2P-E005
CS-26	DEUTSCH	2	Breaker switch	DT06-2S-EP06	-
CS-26A	AMP	2	Breaker pedal switch	S816-002002	S816-102002
CS-29	DEUTSCH	2	Power max switch	DT06-2S-EP06	-
CS-33	AMP	6	Emergency engine stop switch	S816-006002	S816-106002
CS-50	CARLING	10	Travel priority switch	VC2-01	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-67	CARLING	10	Quick clamp switch	VC2-01	-
CS-73	CARLING	10	Swing lock & fine switch	VC2-01	-
CS-74A	AMP	2	Master switch	S813-030201	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-79	CARLING	10	Lower wiper switch	VC2-01	-
CS-83	CARLING	10	Spare switch	VC2-01	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-

(SERIAL NO. : -#1094)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-100	CARLING	10	SCR 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 light	S822-014002	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	DT06-2S-EP06	DT04-2P
CL-24	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-36	DEUTSCH	2	Work lamp	DT06-2S-EP06	DT04-2P
CL-37	DEUTSCH	2	Work lamp	DT06-2S-EP06	DT04-2P
CL-40	DEUTSCH	2	DEF/AdBlue® lamp	DT06-2S-EP06	DT04-2P
· Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-6	DEUTSCH	3	Travel pressure switch	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Working pressure switch	DT06-3S-EP06	-
CD-10	RING TERM	-	Air cleaner switch	ST730135-2	-
CD-16	AMP	3	Water level sensor	12110293	-
CD-24	DEUTSCH	3	Swing sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload sensor	DT06-3S-EP06	-
CD-32	DEUTSCH	3	Boom up sensor	DT06-3S-EP06	-
CD-35	DEUTSCH	3	Arm & bucket in sensor	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	2	WIF sensor	DT06-2S-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 sensor	DT06-3S-EP06	DT06-3P-E005
CD-90	DEUTSCH	3	Arm in sensor	DT06-3S-EP06	-
CD-124	DEUTSCH	3	Boom cylinder rod pressure snensor	DT06-3S-EP06	-

CONNECTOR DESTINATION (SERIAL NO. : #1095-)

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	DRB12-60P-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-P021
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E004
CN-13	TYCO	6	Boom floating	S816-006002	S816-106002
CN-14	AMP/DEUTSCH	4	S/parking & fine control	174257-2	DT04-4P-E005
CN-15	-	8	I/conn (Frame harness-Breaker sol)	174962-2	S816-112002
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 (Washer pump-Frame harness)	174352-2	174354-2
CN-20	MOLEX	2	Horn	36825-0211	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer pump	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	MOLEX	2	Horn	36825-0211	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	Radio & USB player	-	174984-2
CN-28	KUM	1	Aircon compressor	NMWP01F-B	-
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
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

(SERIAL NO. : #1095-)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	-
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid	DT06-2S-EP06	-
CN-74	RING-TERM	1	Alternator "L" terminal	S820-108000	-
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	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	TYCO	10	Service tool	2-1418390-1	S816-110002
CN-133	DEUTSCH	2	Boom priority solenoid	DT06-2S-EP06	-
CN-135	DEUTSCH	2	Arm regeneration solenoid	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-147	AMP	2	Fuel heater	85202-1	-
CN-149	DEUTSCH	2	Attach safety 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	Attach EPPR 1	DT06-2S-EP06	-
CN-243	DEUTSCH	2	Attach EPPR 2	DT06-2S-EP06	-
CN-245	KET	2	PTC power	MG620558	-
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	4	Rear view camera	DT06-4S-EP06	DT04-4P-E005
CN-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

(SERIAL NO. : #1095-)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-261	-	4	Siren AMP	-	-
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-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	Haptic controller	174045-2	-
CN-365	DEUTSCH	2	Attach relief EPPR valve1	DT06-2S-EP06	DT04-2P-E005
CN-366	DEUTSCH	2	Attach relief EPPR valve2	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	-	4	DEF/AdBlue® tank level sensor	1-967325-1	-
CN-381	BOSCH	2	DEF line heater 1	1 926 403 674	-
CN-382	BOSCH	2	DEF line heater 2	1 926 403 674	-
CN-383	BOSCH	2	DEF line heater 3	1 926 403 674	-
CN-384	DEUTSCH	2	Coolant valve	DT06-2S-EP06	-
CN-385	-	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-PO21	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
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-A3	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking-A1	DT06-2S-EP06	-
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
		12		5557-12R	5559-12P

(SERIAL NO. : #1095-)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-430	DEUTSCH	6	Aftertreatment harness	DT06-6S-EP06	-
CN-J7A	TYCO	4	DOC Nox sensor	2-1418390-1	-
CN-J7B	TYCO	4	SCR Nox sensor	1-1418390-1	-
CN-J10	TYCO	4	SCR Thermistor	3-1418390-1	-
CN-J17	TYCO	4	DOC Thermistor	4-1418390-1	-
CN-J31	BOSCH	2	DEF/AdBlue® dosing module	1-928-403-874	-
· 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-45	-	5	Beacon lamp relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-50	-	5	NOx sensor relay	-	-
CR-51	-	5	DEF/AdBlue® module relay	-	-
CR-52	-	5	Line heater relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2	WP	6	Start key switch	S814-006100	-
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	6	Emergency engine stop switch	S816-006002	S816-106002
CS-50	CARLING	10	Travel priority switch	VC2-01	-
CS-52	CARLING	10	2 Piece switch	VC2-01	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-67	CARLING	10	Quick clamp switch	VC2-01	-

(SERIAL NO. : #1095-)

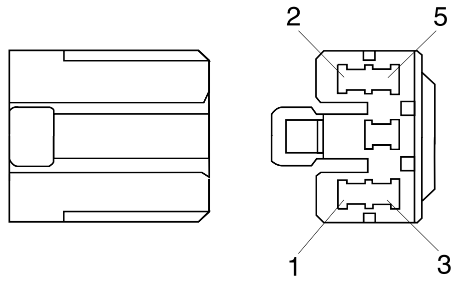
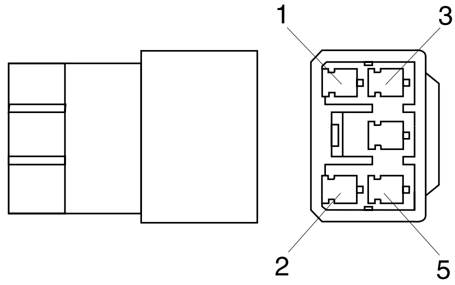
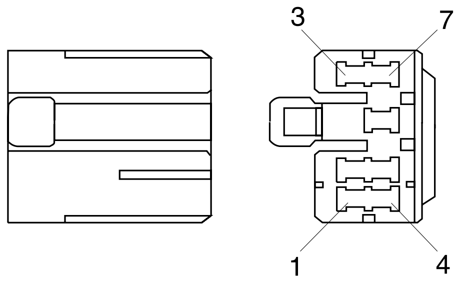
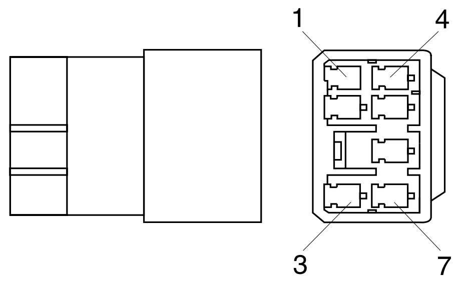
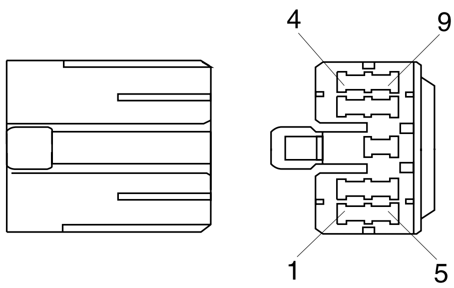
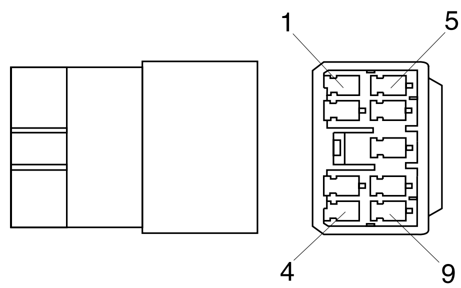
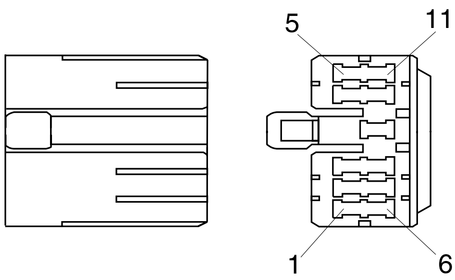
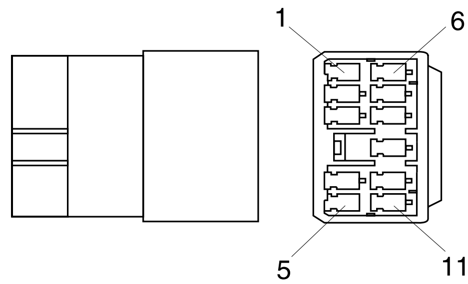
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-73	CARLING	10	Swing lock switch	VC2-01	-
CS-73A	CARLING	10	Swing fine switch	VC2-01	-
CS-74A	KET	2	Master switch	MG620558	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-79	CARLING	10	Lower wiper switch	VC2-01	-
CS-83	CARLING	10	Spare switch	VC2-01	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-
CS-100	CARLING	10	SCR 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 S810-001002	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-36	DEUTSCH	2	Work lamp	DT06-2S-EP06	DT04-2P
CL-37	DEUTSCH	2	Work lamp	DT06-2S-EP06	DT04-2P
CL-40	DEUTSCH	2	DEF/AdBlue® lamp	DT06-2S-EP06	DT04-2P
CL-41	-	1	DEF/AdBlue® lamp full warning	S822-014000	S822-114000
Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-6	DEUTSCH	3	Travel pressure switch	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Working pressure switch	DT06-3S-EP06	-
CD-10	SUMITOMO	4	Air cleaner switch	6098-0144	-
CD-10A	AMP	2	Air cleaner switch	85202-1	-
CD-16	AMP	3	Water level sensor	12110293	-
CD-24	DEUTSCH	3	Swing sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload sensor	DT06-3S-EP06	DT04-3P-E005
CD-32	DEUTSCH	3	Boom up sensor	DT06-3S-EP06	-

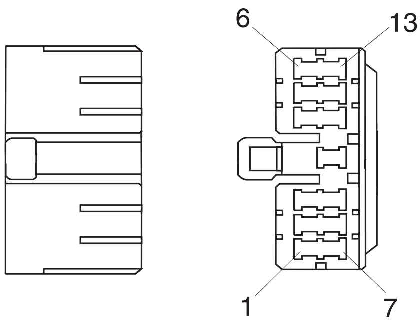
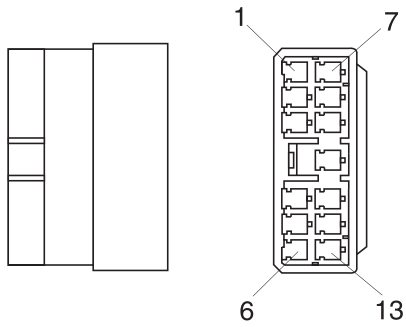
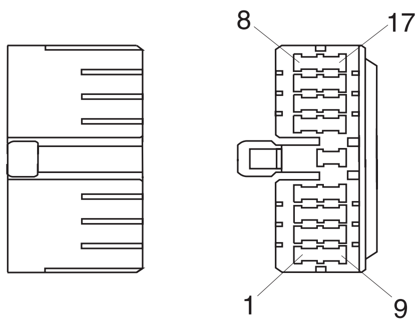
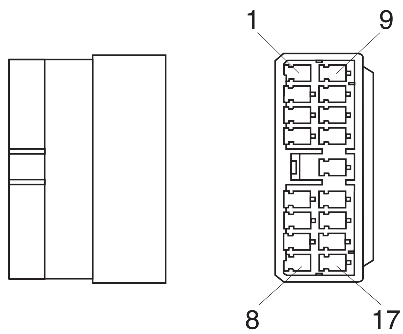
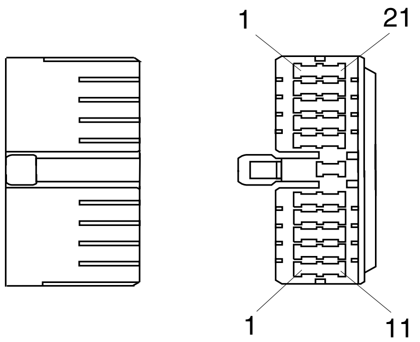
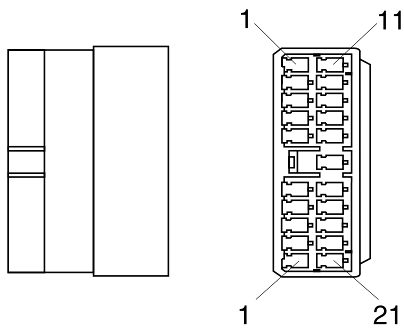
(SERIAL NO. : #1095-)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CD-35	DEUTSCH	3	Arm in/out & bucket in sensor	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	AMP	2	WIF sensor	-	-
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	-
CD-70	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 pressure sensor	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down sensor	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in sensor	DT06-3S-EP06	-
CD-124	DEUTSCH	3	Boom cylinder rod pressure snensor	DT06-3S-EP06	-

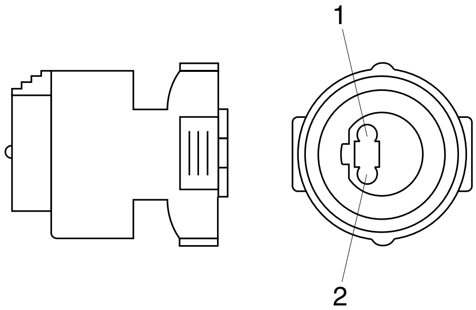
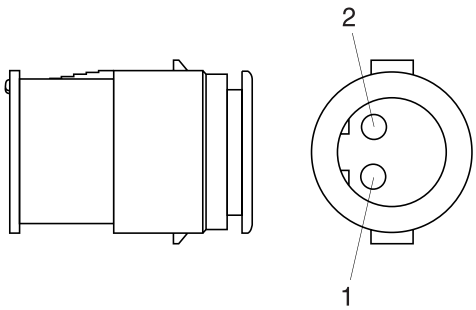
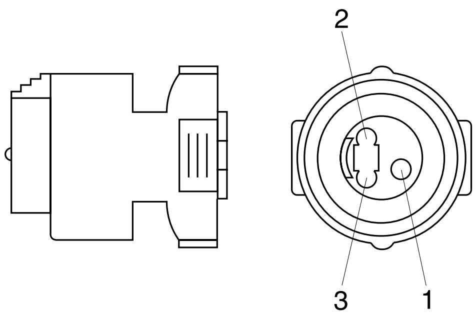
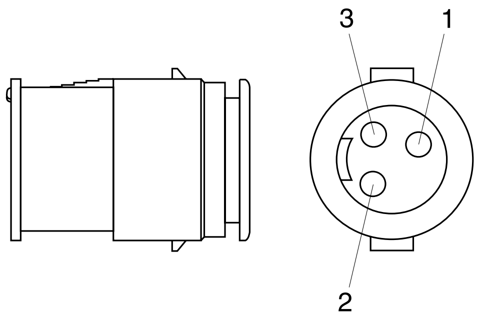
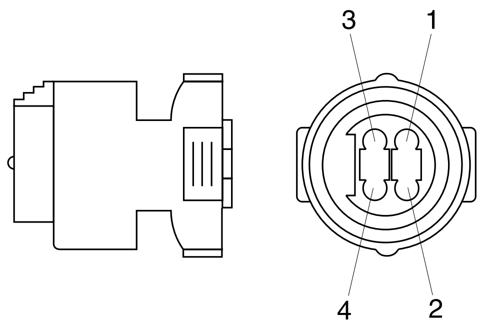
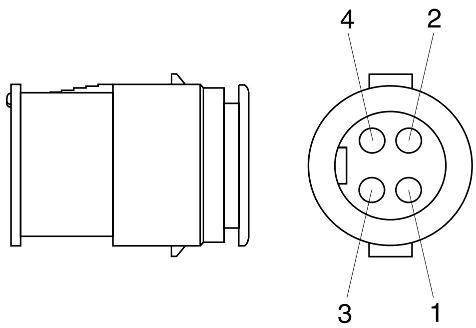
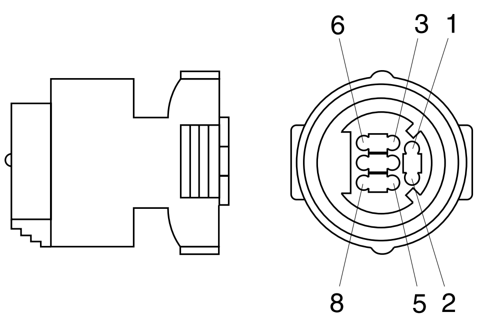
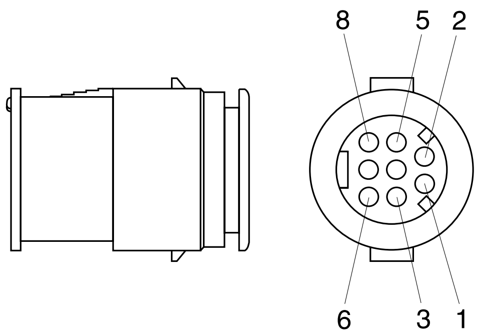
2. CONNECTION TABLE FOR CONNECTORS

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

<table>
<tr><th>No. of pin</th><th>Receptacle connector (female)</th><th>Plug connector (male)</th></tr>
<tr><td>2</td><td>S816-002001</td><td>S816-102001</td></tr>
<tr><td>3</td><td>S816-003001</td><td>S816-103001</td></tr>
<tr><td>4</td><td>S816-004001</td><td>S816-104001</td></tr>
<tr><td>8</td><td>S816-008001</td><td>S816-108001</td></tr>
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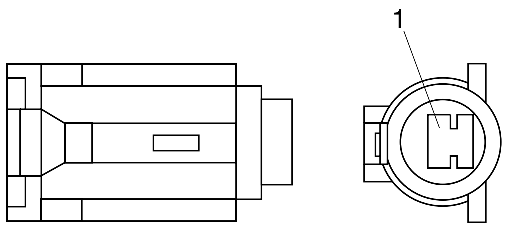
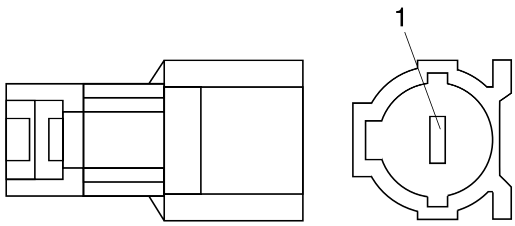
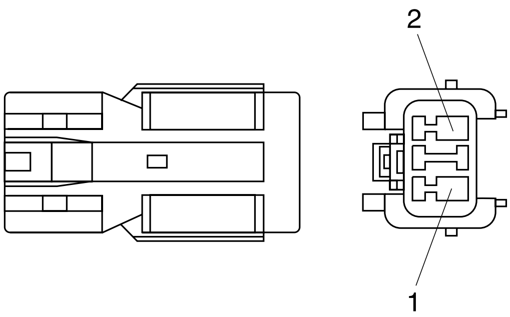
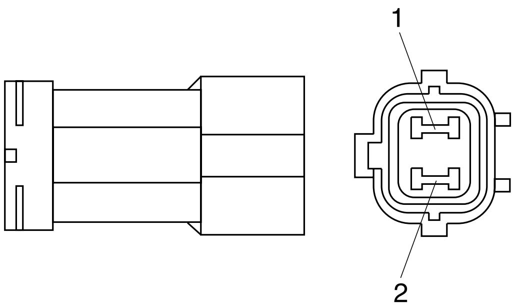
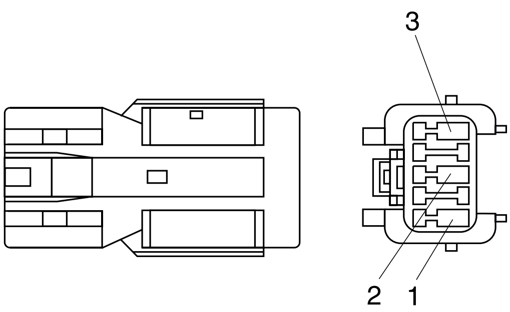
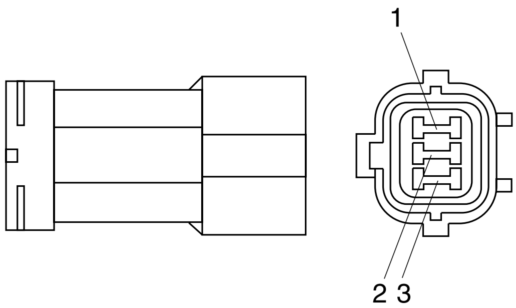
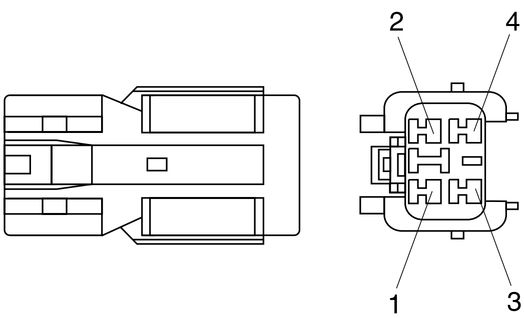
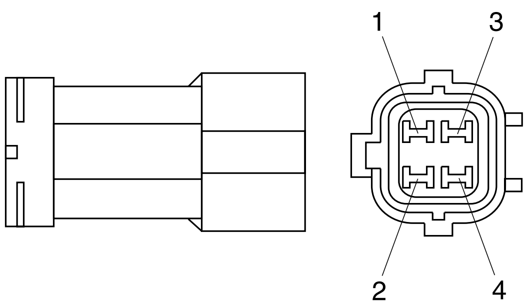
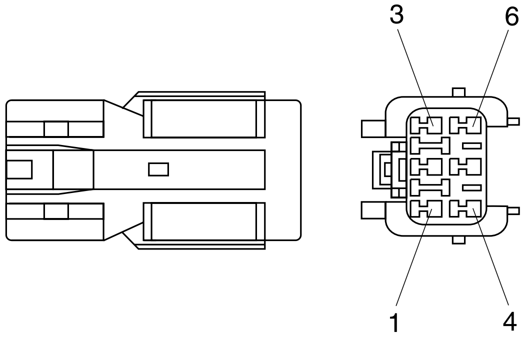
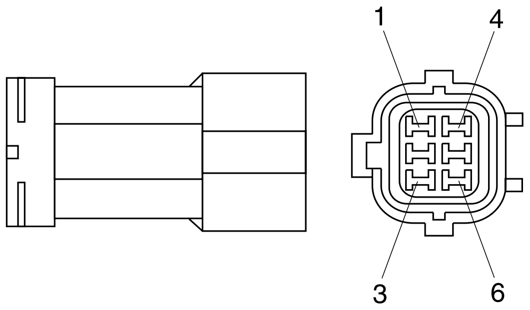
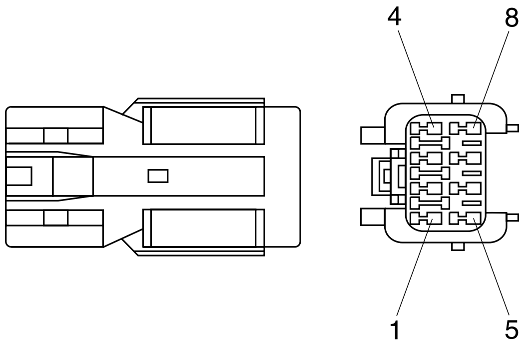
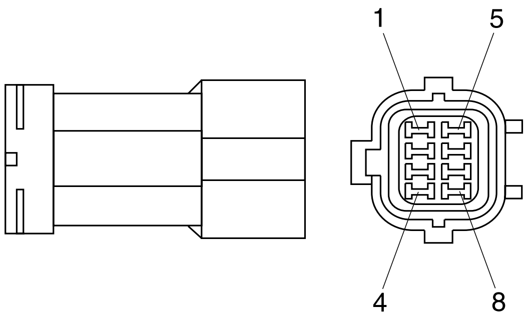
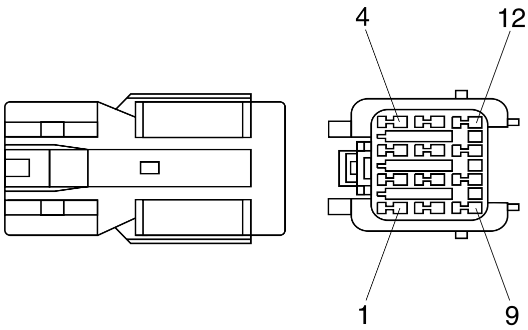
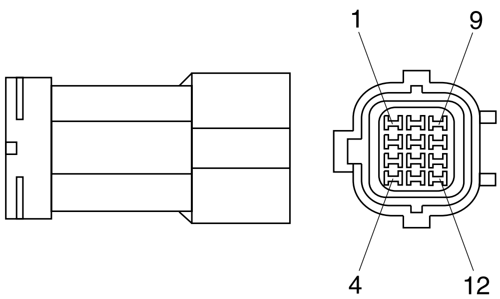
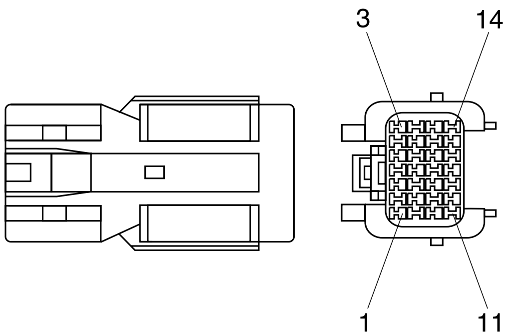
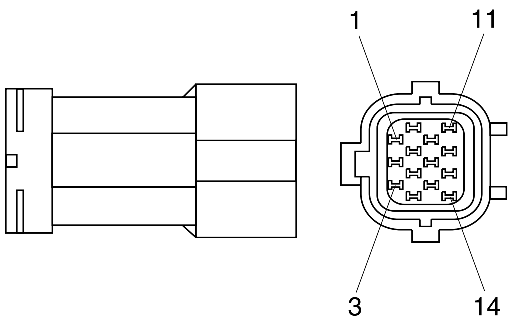
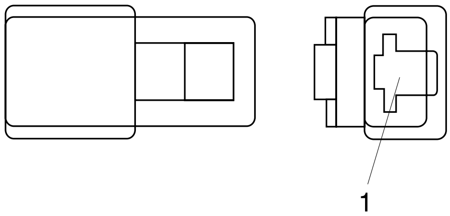
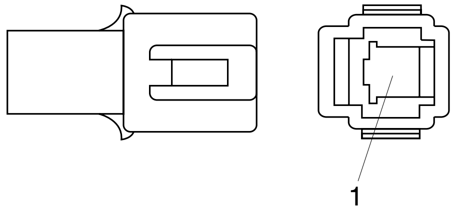
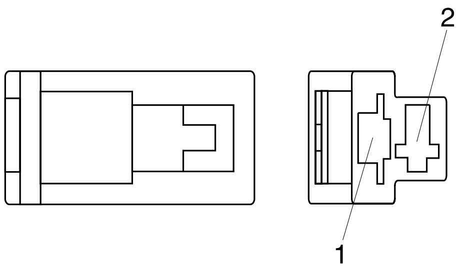
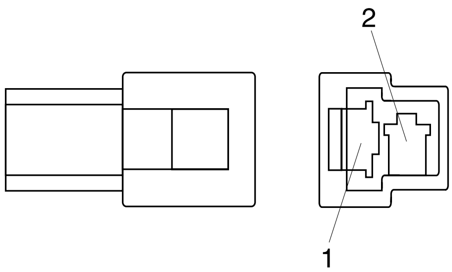
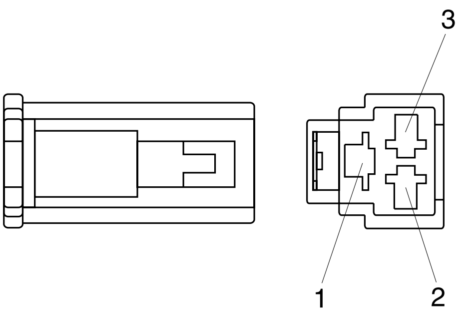
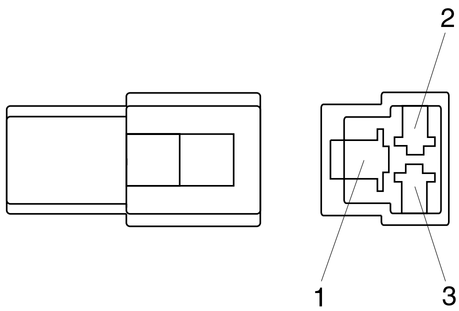
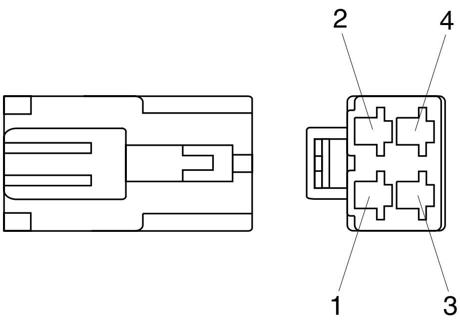
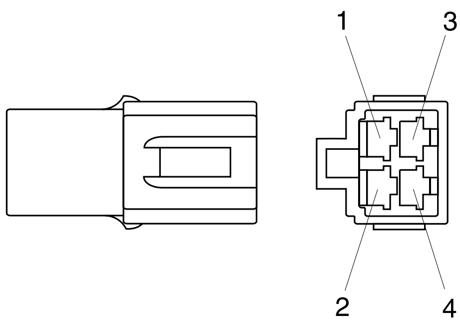
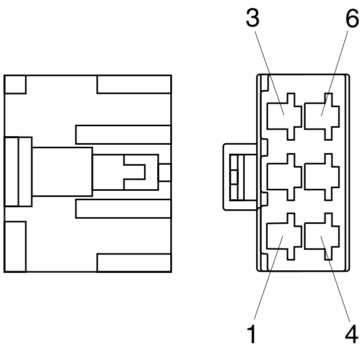
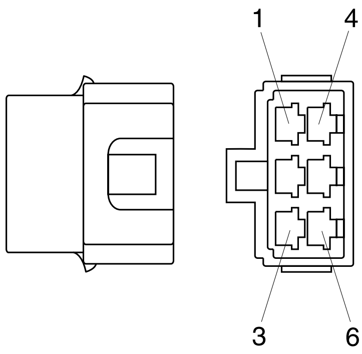
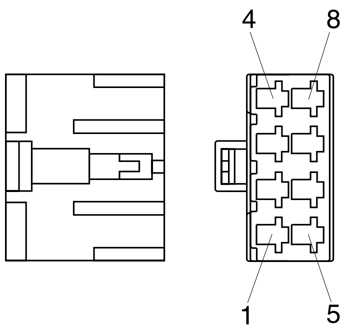
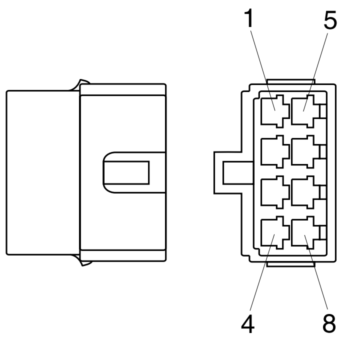
3) SWP TYPE CONNECTOR

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

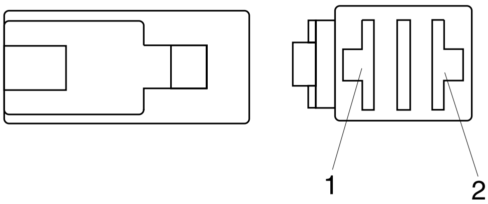
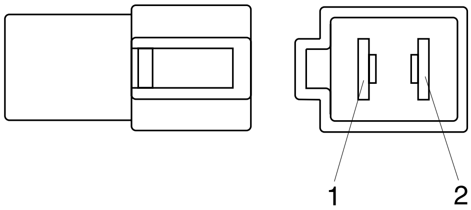
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

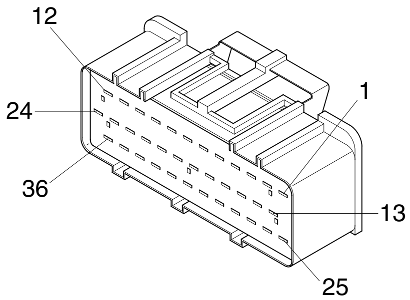
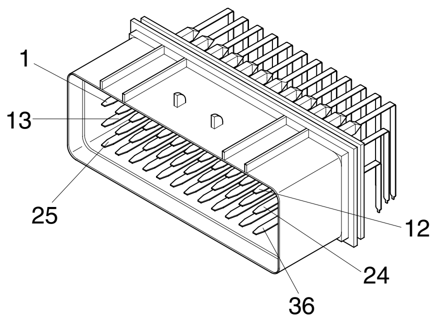
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

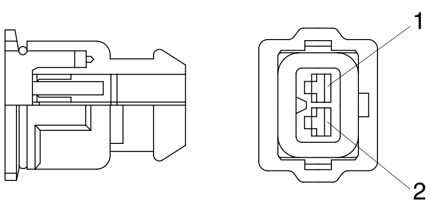
5) 375 FASTEN TYPE CONNECTOR

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

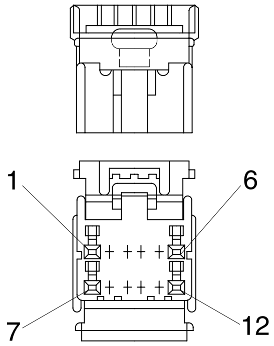
6) AMP ECONOSEAL CONNECTOR

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

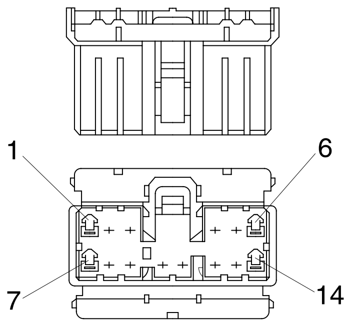
7) AMP TIMER CONNECTOR

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

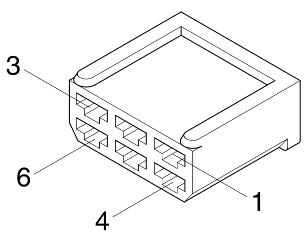
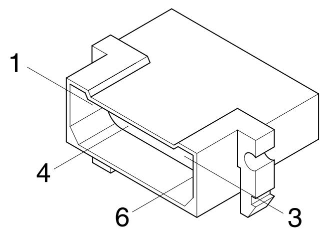
8) AMP 040 MULTILOCK CONNECTOR

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

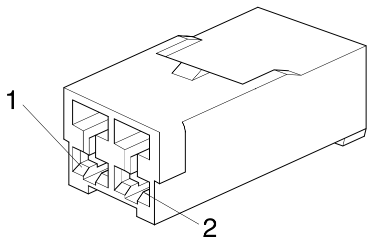
9) AMP 070 MULTILOCK CONNECTOR

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

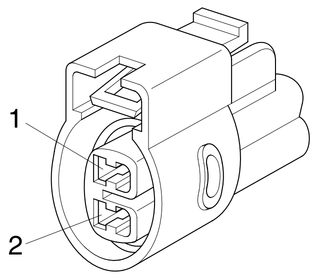
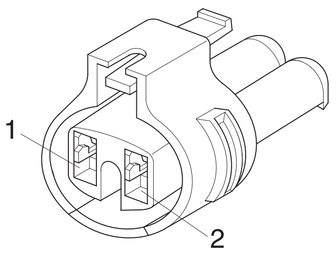
10) AMP FASTIN - FASTON CONNECTOR

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

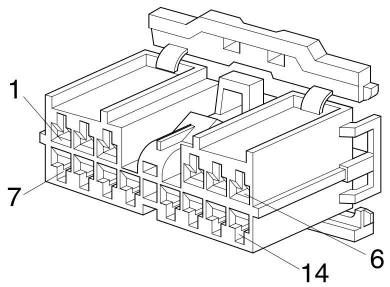
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

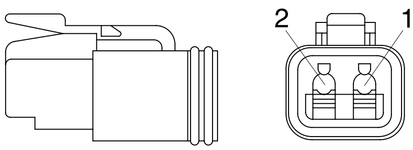
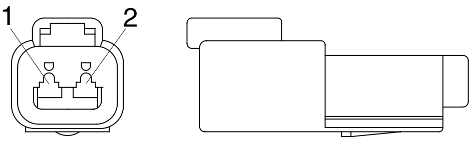
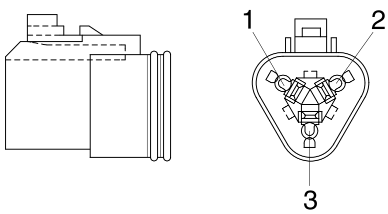
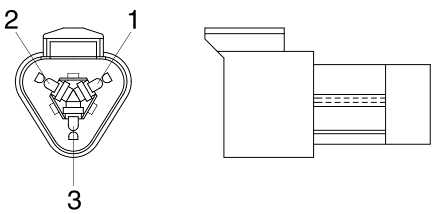
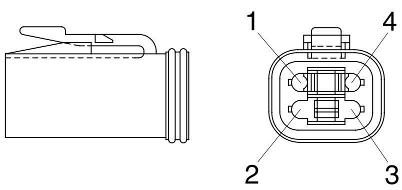
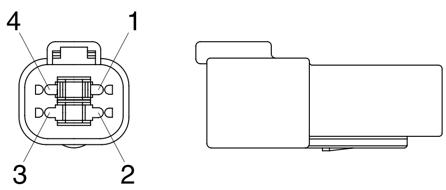
14) DEUTSCH DT CONNECTORS

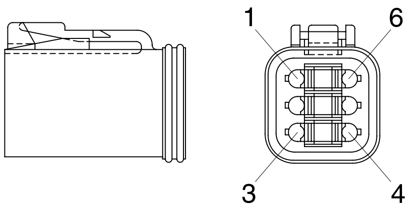
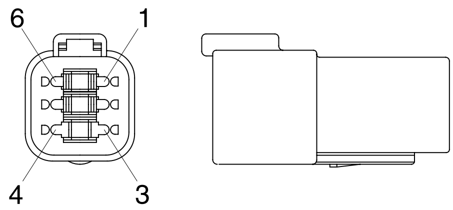
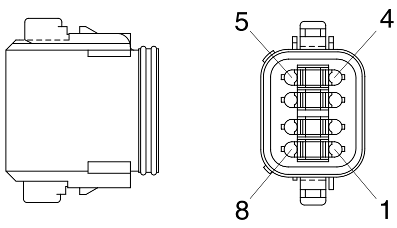
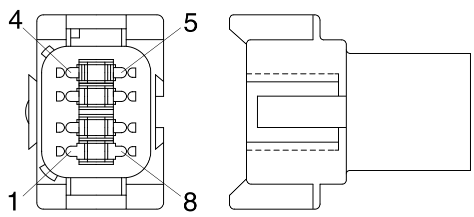
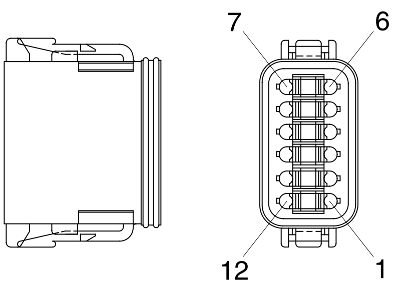
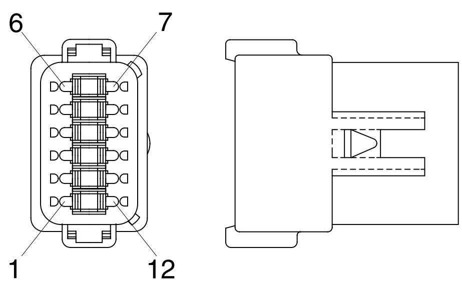
DT 06 - 3S - ★★★★

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

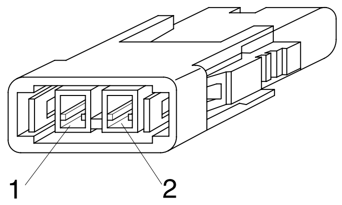
※ Modification

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

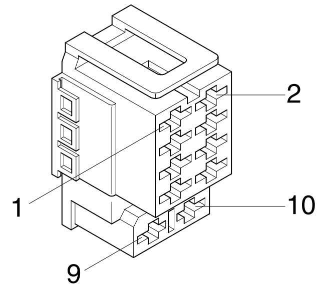
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

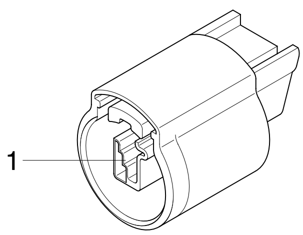
15) MOLEX 2CKTS CONNECTOR

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

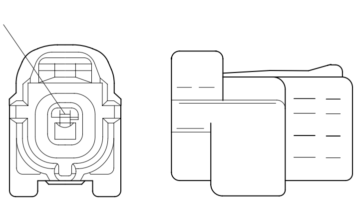
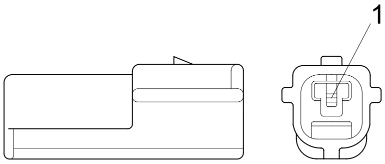
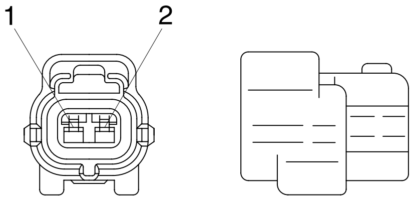
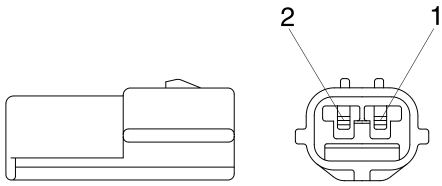
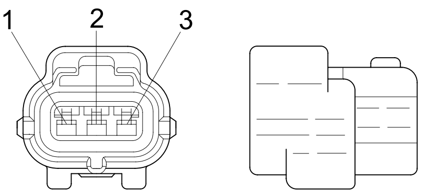
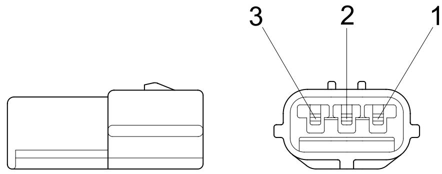
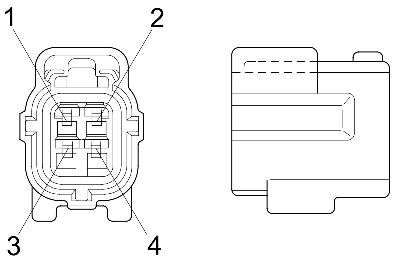
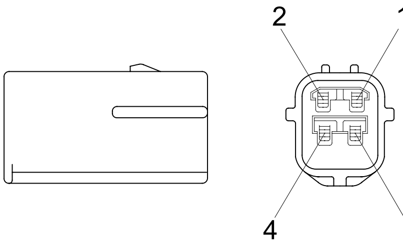
16) ITT SWF CONNECTOR

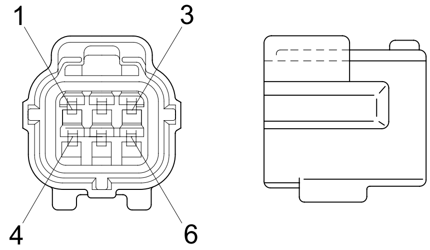
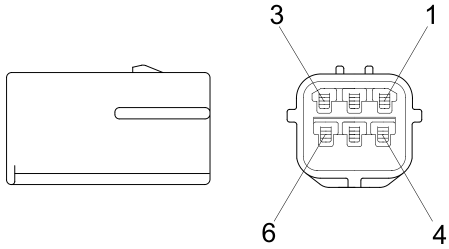
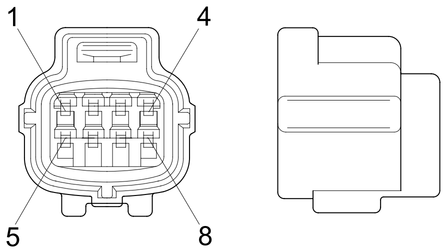
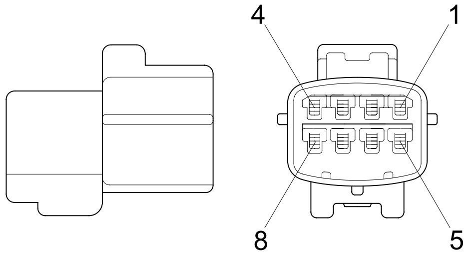
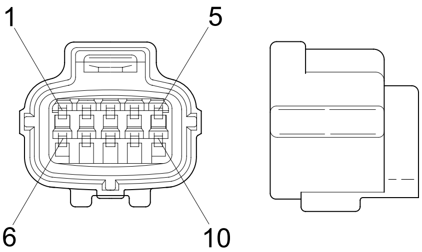
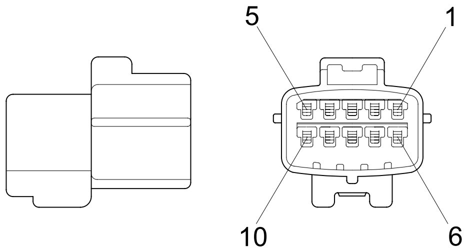
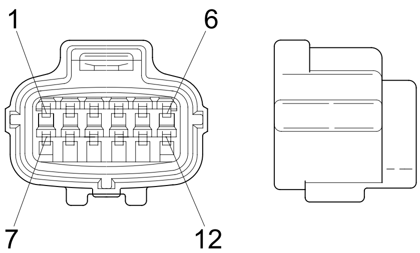
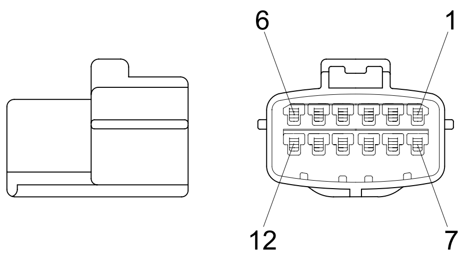
No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

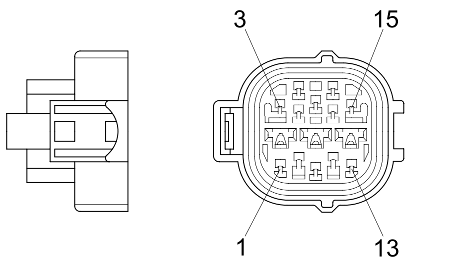
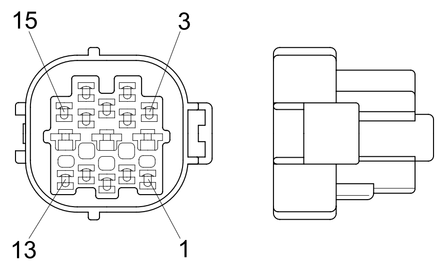
17) MWP NMWP CONNECTOR

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

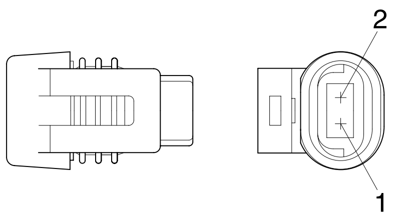
18) ECONOSEAL J TYPE CONNECTORS

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

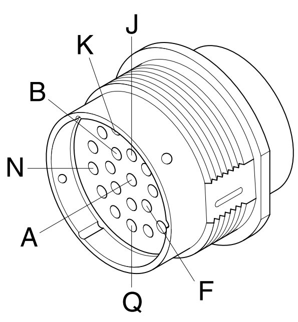
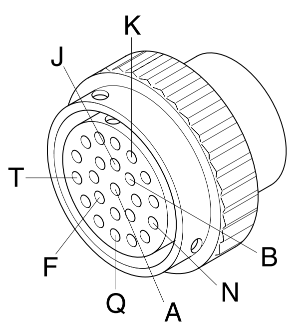
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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

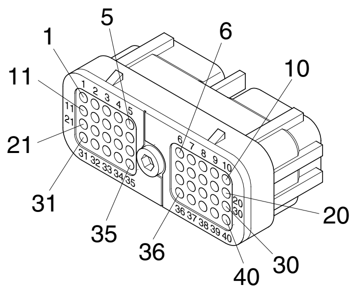
19) METRI-PACK TYPE CONNECTOR

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

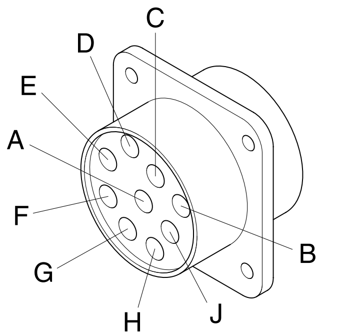
20) DEUTSCH HD30 CONNECTOR

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

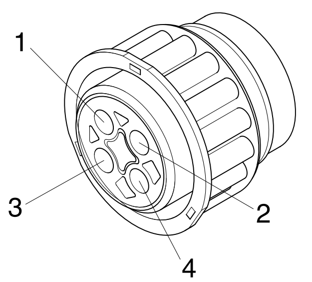
21) DEUTSCH MCU CONNECTOR (SERIAL NO. : -#1094)

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

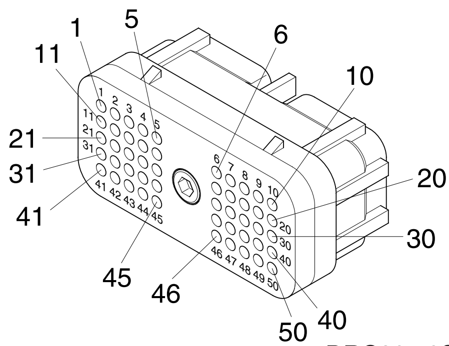
22) DEUTSCH SERVICE TOOL CONNECTOR

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

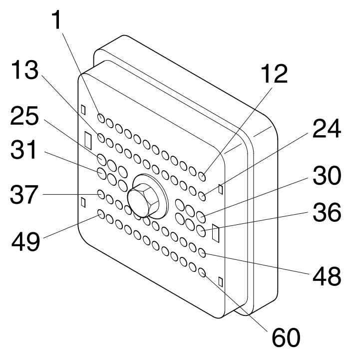
23) AMP FUEL WARMER CONNECTOR

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

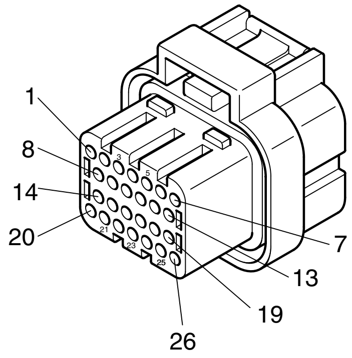
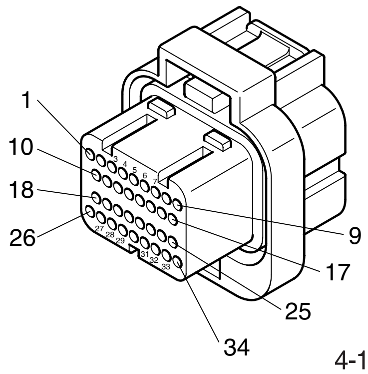
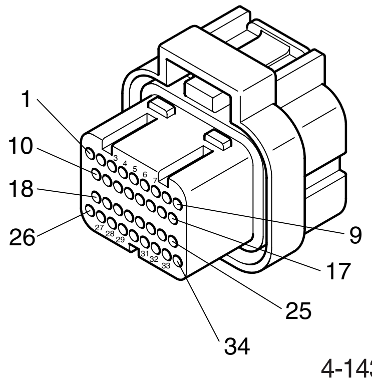
24) DEUTSCH ENGINE ECM CONNECTOR

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

25) DEUTSCH INTERMEDIATE CONNECTOR

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

26) TE MCU CONNECTOR (SERIAL NO. : #1095-)

No. of pin	Receptacle connector (female)	Plug connector (male)
26	 1473416-1	
34	 4-1437290-0	
34	 4-1437290-1	

SECTION 5 MECHATRONICS SYSTEM

SECTION 5 MECHATRONICS SYSTEM

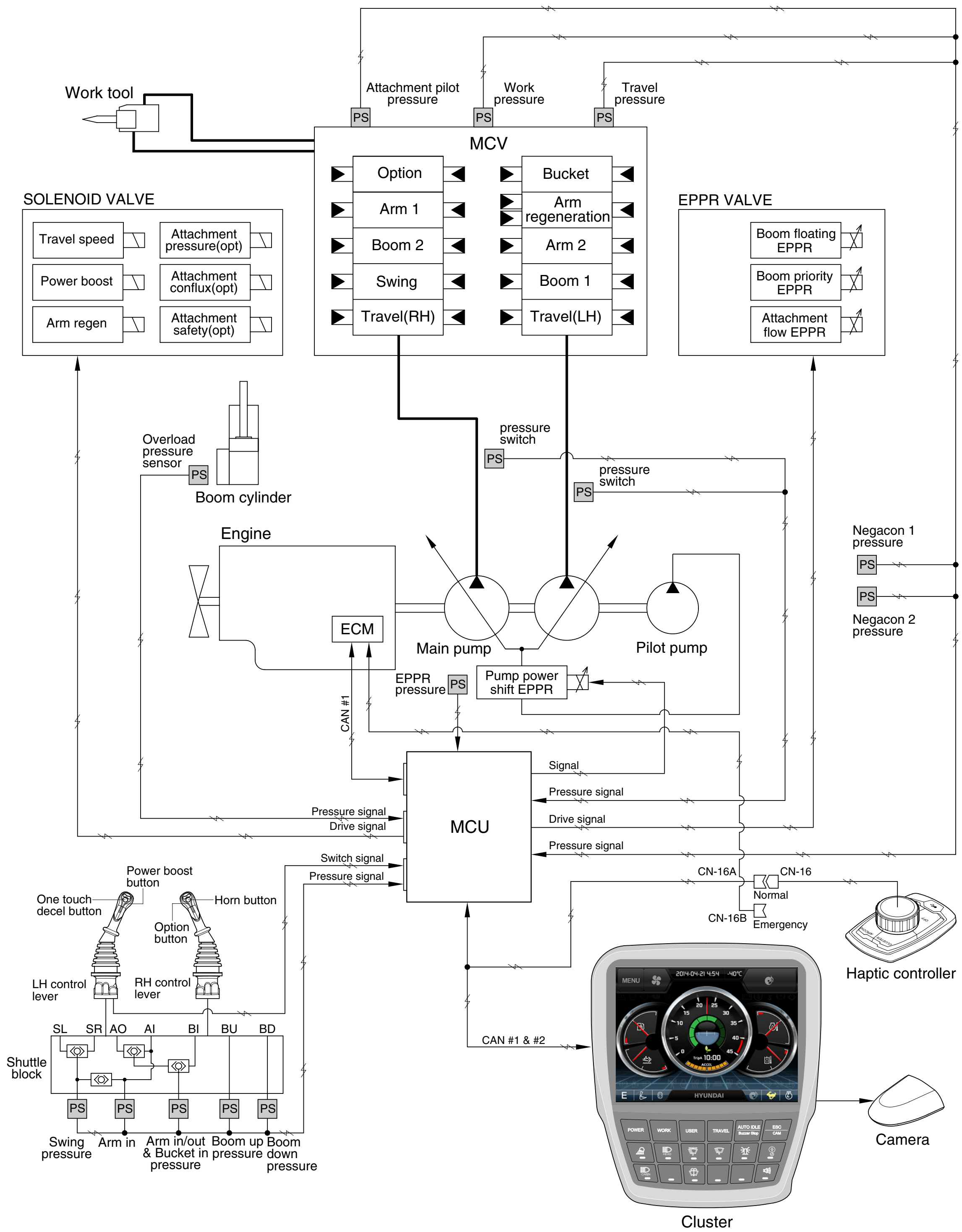
GROUP 1 OUTLINE

The ADVANCED CAPO (Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc.

It consists of a MCU, a cluster, an ECM, EPPR valves, and other components. The MCU and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.

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

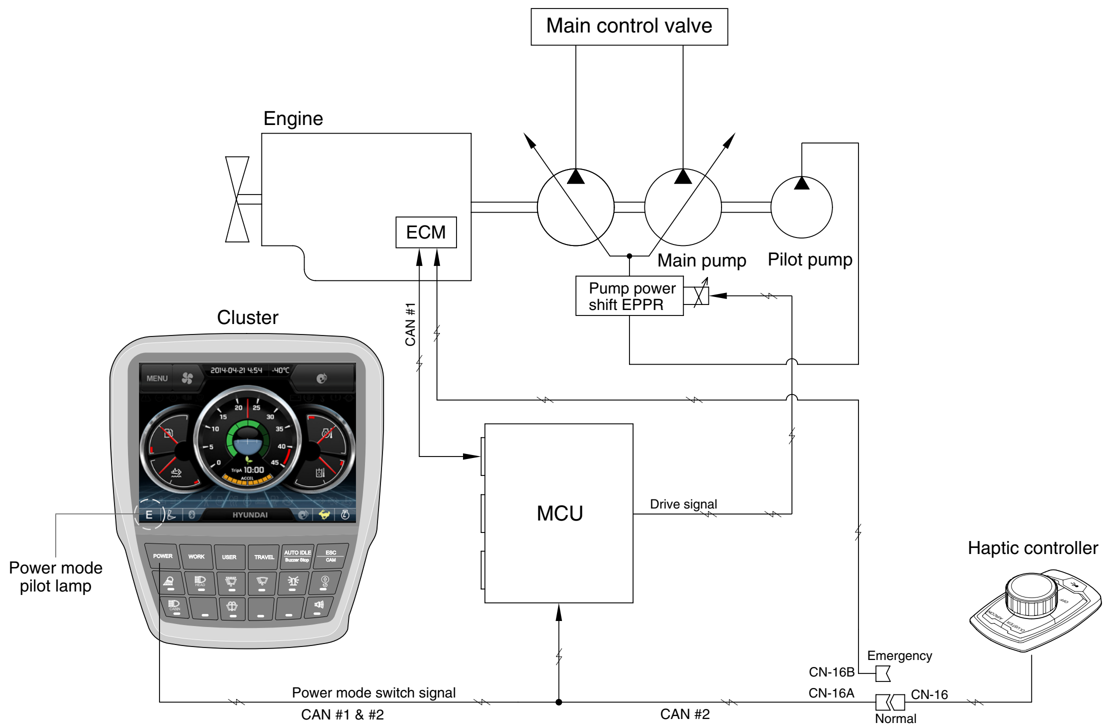
SYSTEM DIAGRAM



300L5MS101

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



300L5MS102

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.

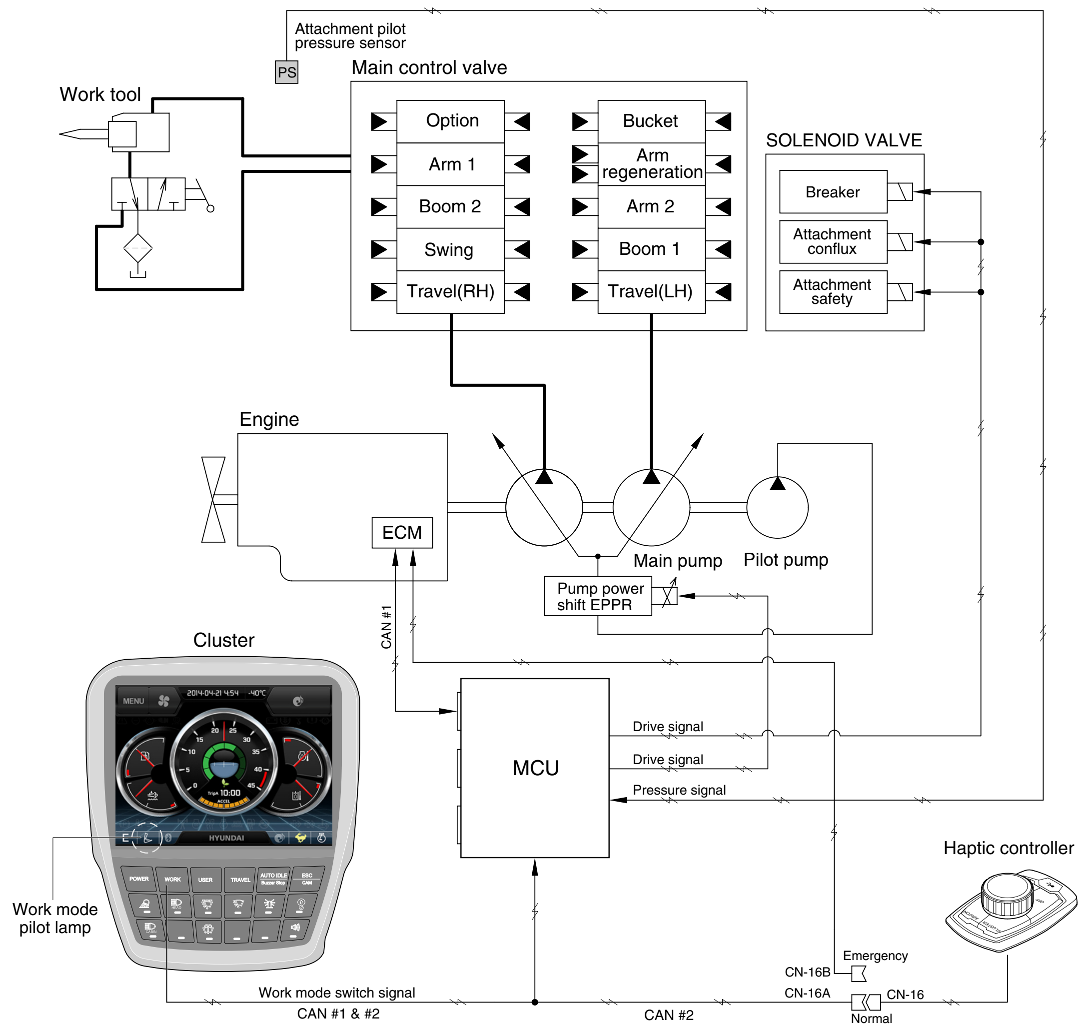
Power mode	Application	Engine rpm				Power shift by EPPR valve			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm2)	Current (mA)	Pressure (kgf/cm2)
P	Heavy duty power	1800±50	1950±50	1800±50	1900±50	290±30	8 (~5)	290±30	8 (~5)
S	Standard power	1700±50	1850±50	1700±50	1800±50	330±30	10 (~5)±3	330±30	10 (~5)±3
E	Economy operation	1600±50	1750±50	1600±50	1700±50	360±30	12 (~7)±3	360±30	12 (~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).



300L5MS103

1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

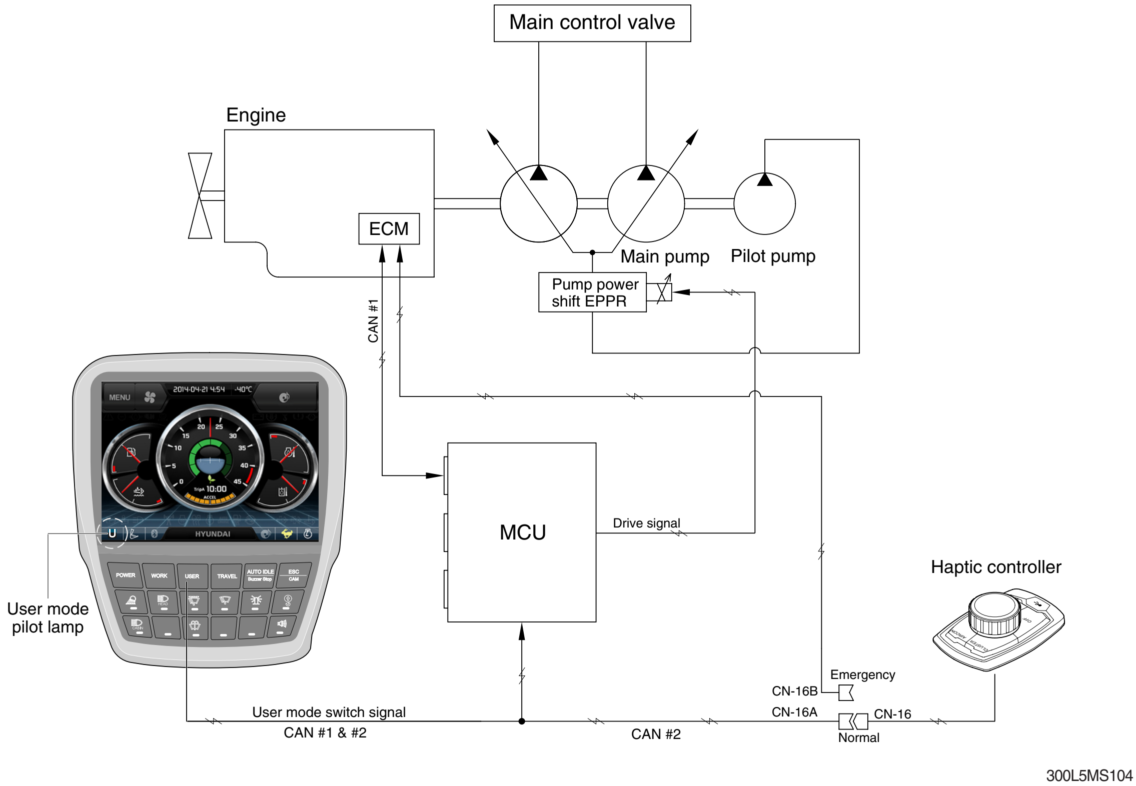
2) ATT WORK MODE (breaker, crusher)

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

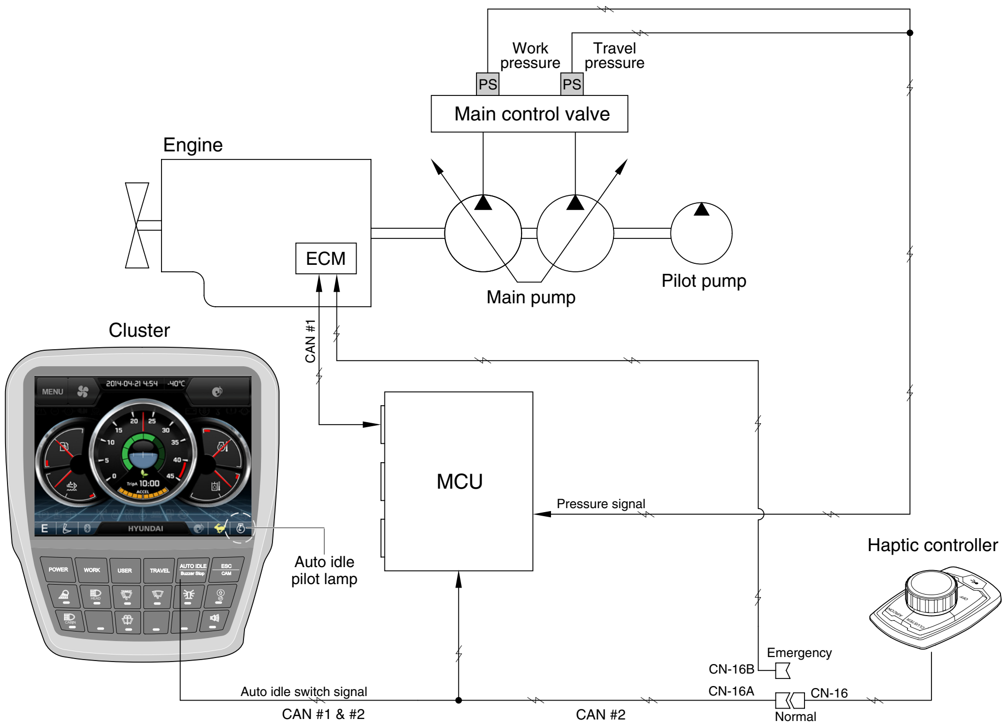


1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	700	0
2	1400	750	3
3	1500	800	6
4	1600	850	9
5	1700	900	12
6	1800	950	16
7	1850	1000	20
8	1900	1050	26
9	1950	1100 (auto decel)	32
10	2000	1150	38

GROUP 3 AUTOMATIC DECELERATION SYSTEM

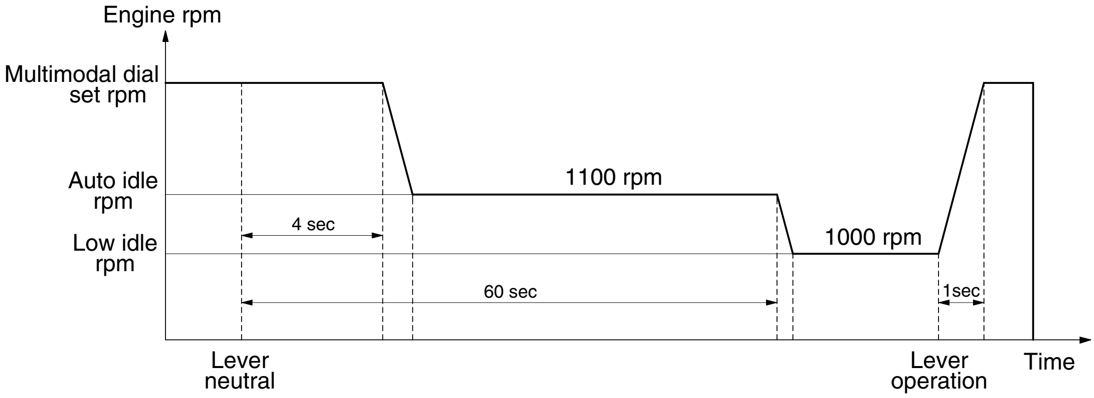


300L5MS105

1. WHEN AUTO IDLE PILOT LAMP ON

When all of the work equipment control levers including swing and travel levers are at neutral for 4 seconds, MCU sends throttle command to ECM to reduce the engine speed to 1100 rpm. If the control levers are at neutral for 1 minute, MCU reduces the engine speed to 1000 rpm. As the result of reducing the engine speed, fuel consumption and noise are effectively cut down during non-operation of the control levers.

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



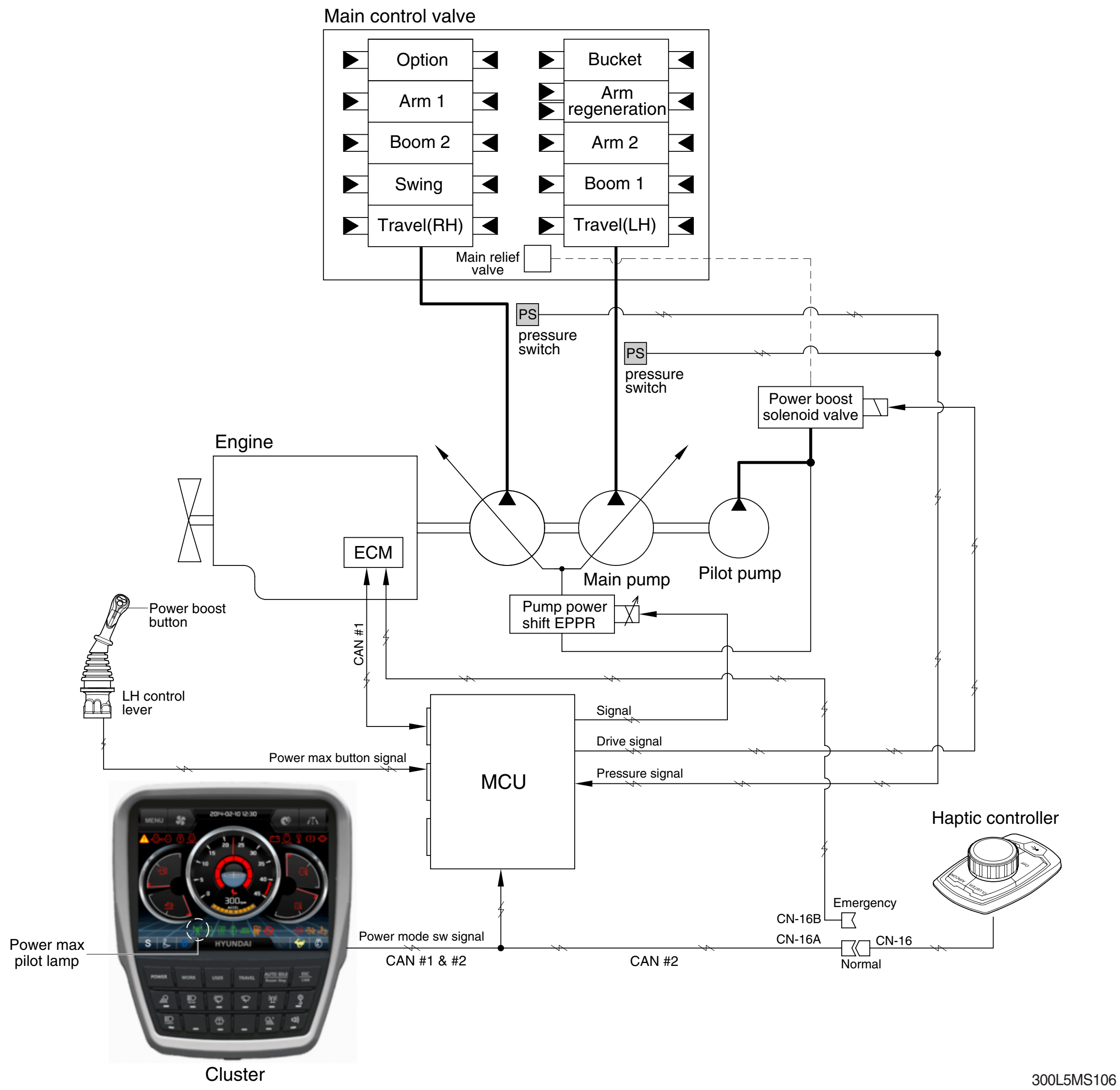
300L5MS135

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



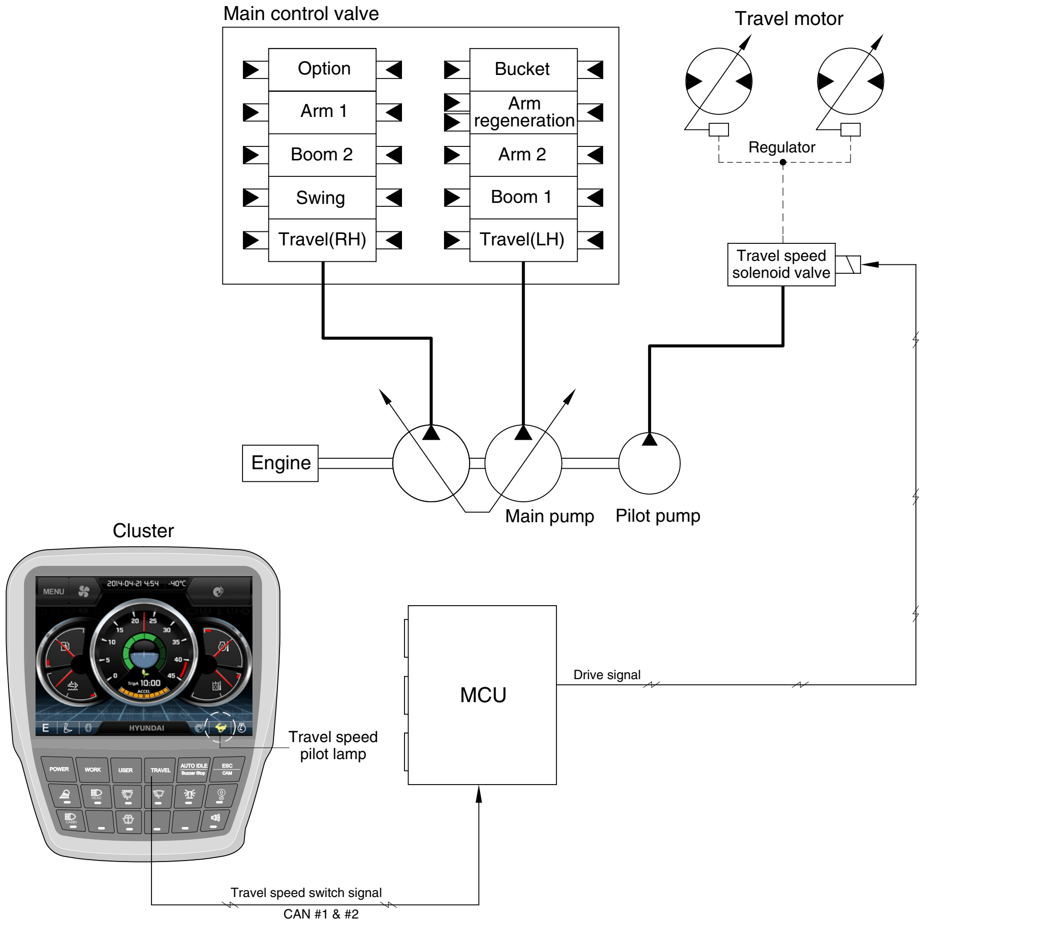
· When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· 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

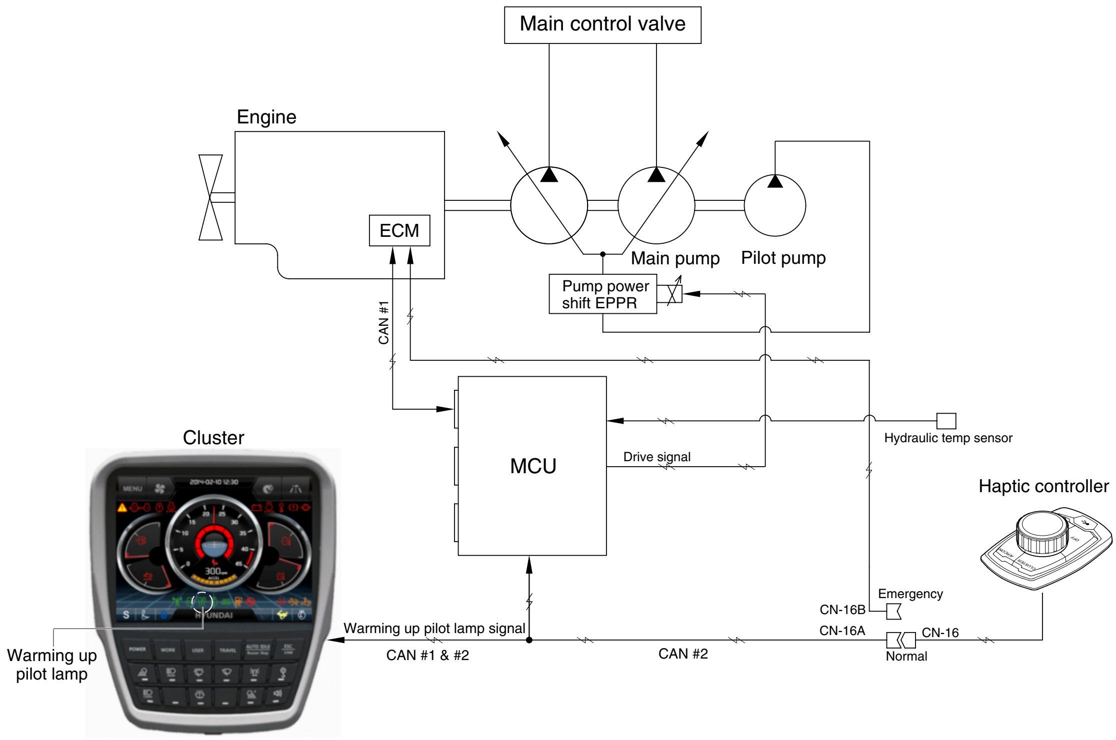


Travel speed can be switched manually by pressing the travel speed switch on the cluster.

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



300L5MS108

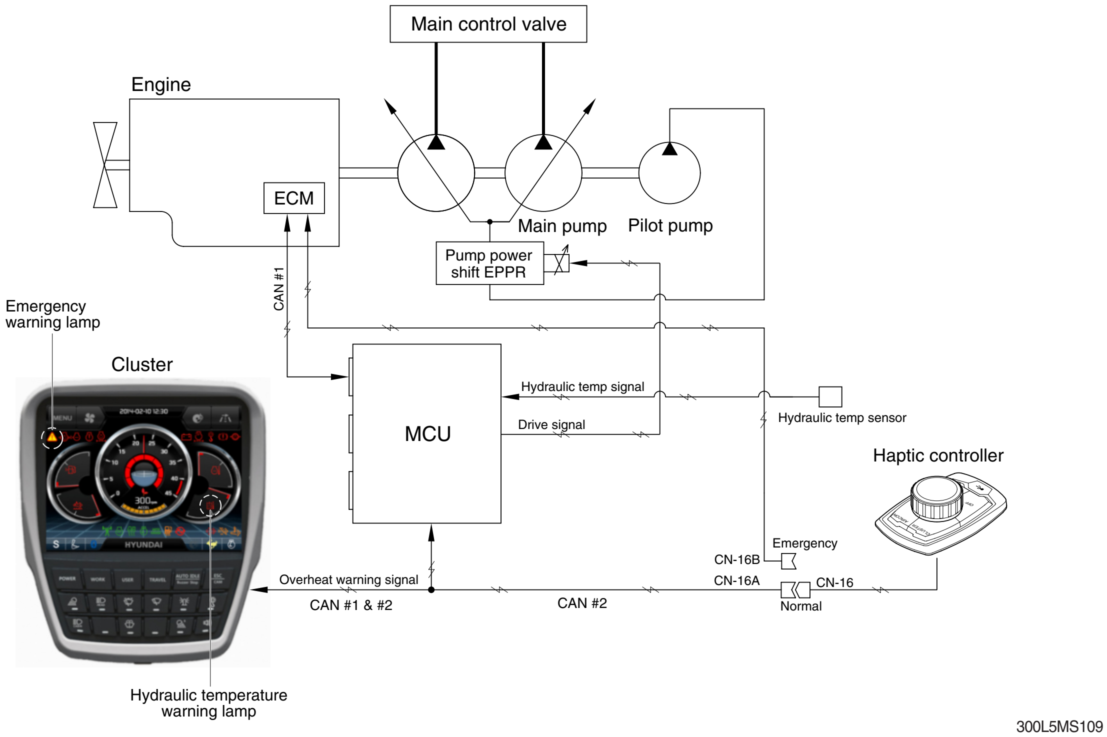
1. The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1100 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

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 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



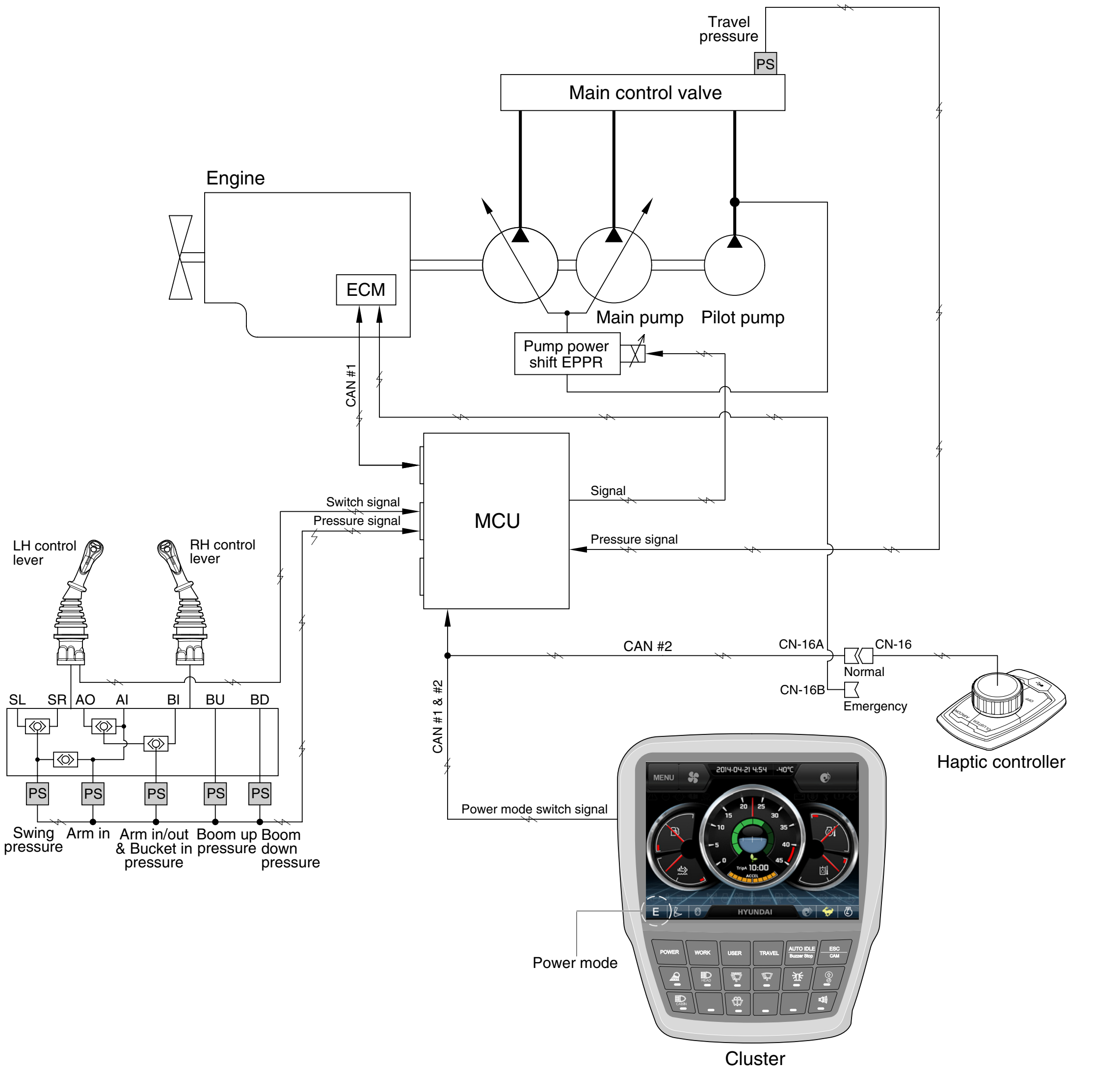
300L5MS109

1. If the engine coolant temperature 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



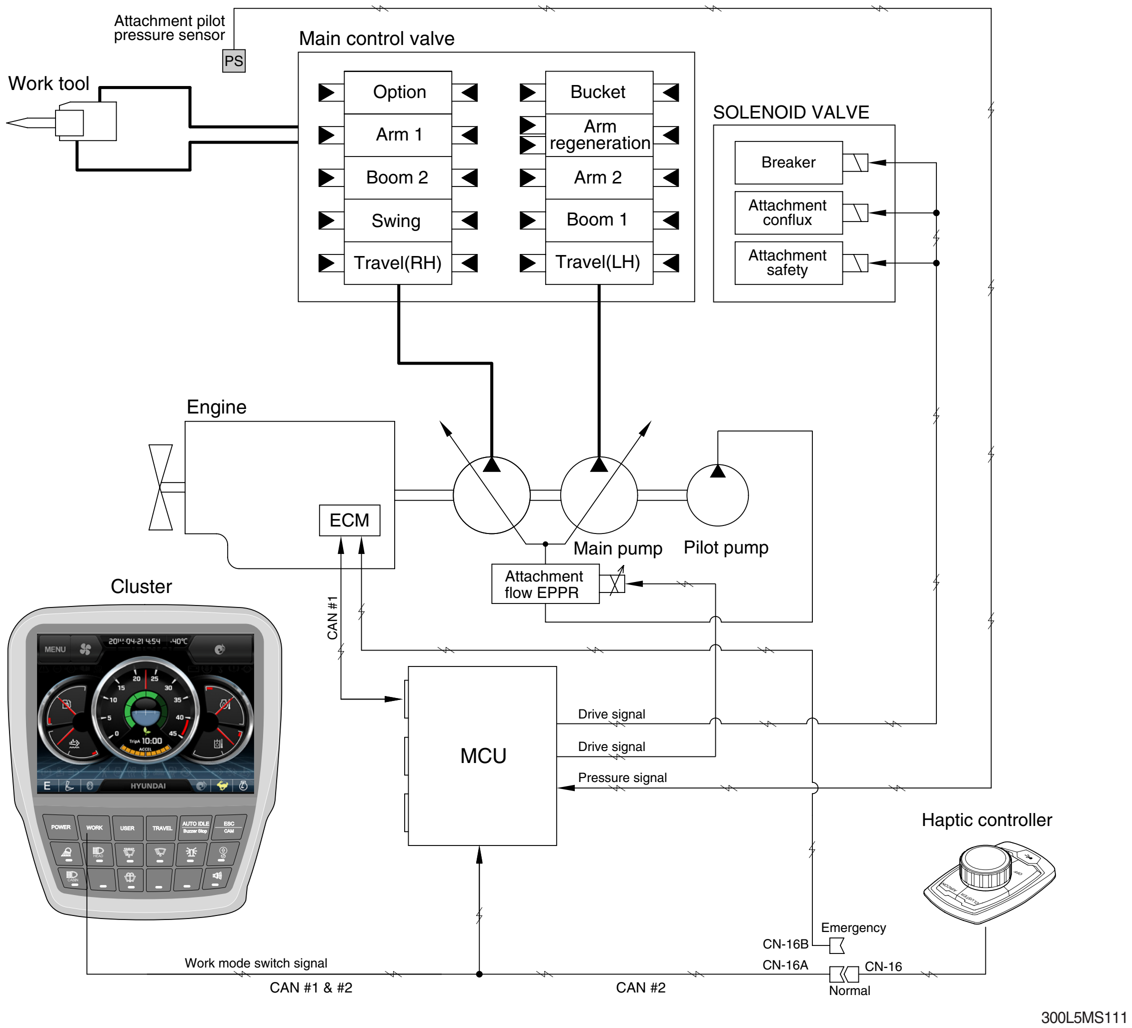
300L5MS110

· 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



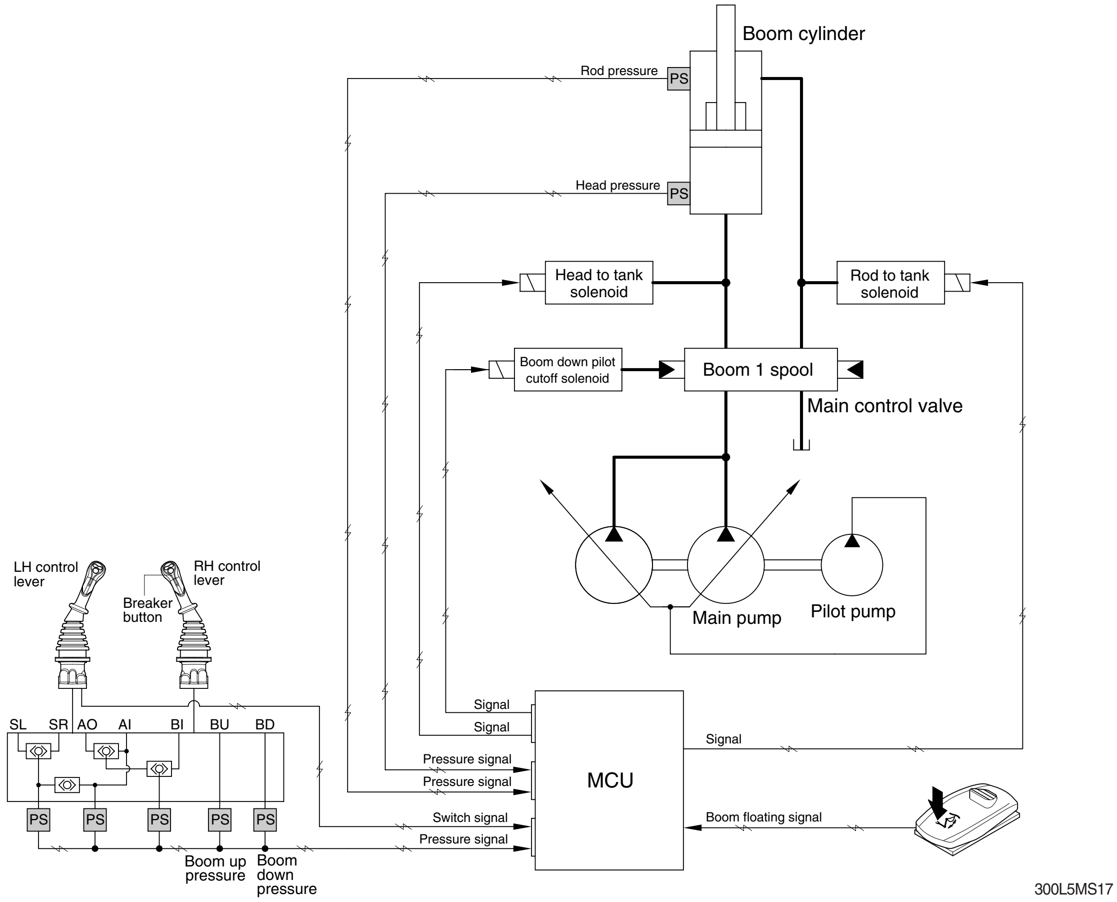
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

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 5-79 for the attachment kinds and max flow.

★ When breaker operating button is pushed.

GROUP 10 BOOM FLOATING CONTROL SYSTEM



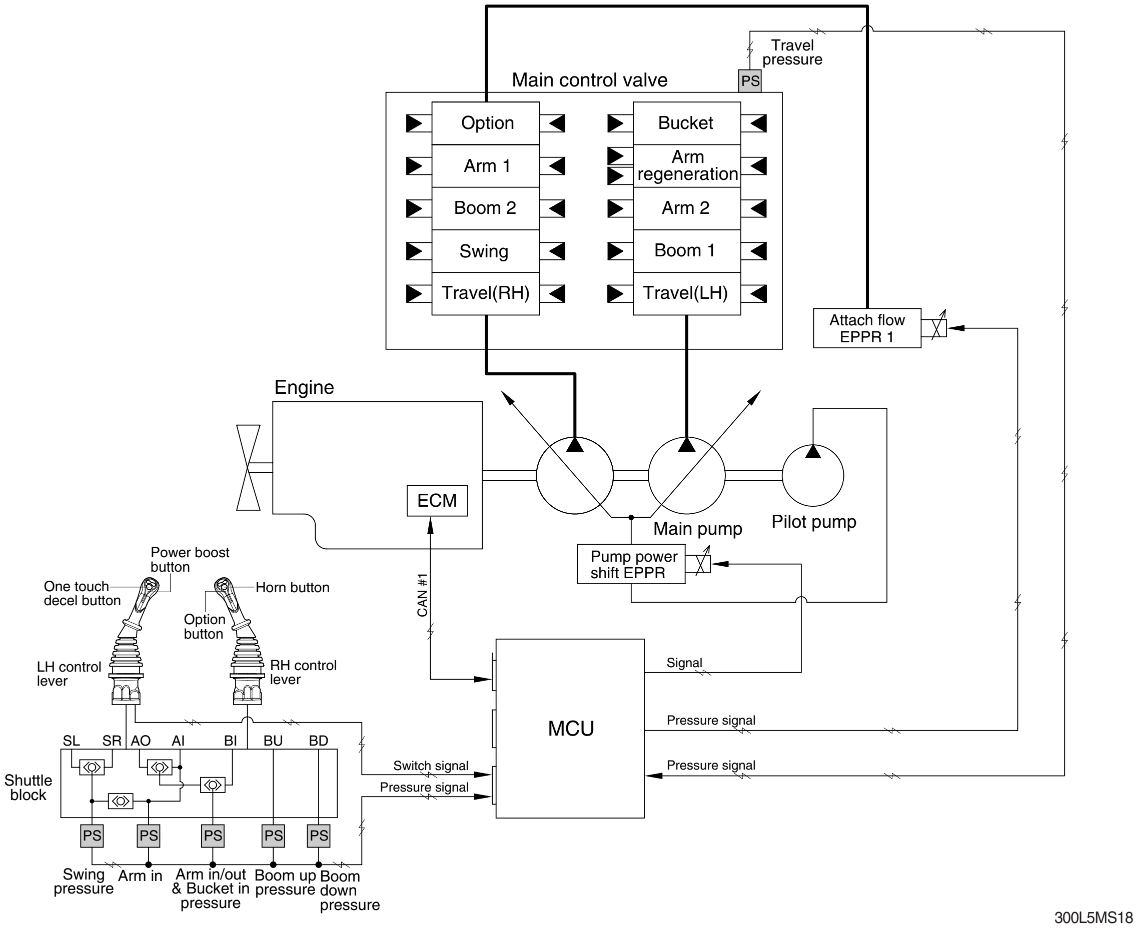
· Boom floating automatically controls boom cylinder along the ground by operating arm cylinder only.

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.

GROUP 11 INTELLIGENT POWER CONTROL SYSTEM



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

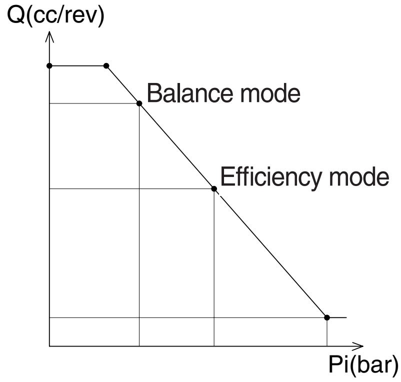
Condition★1	Function
IPC mode : ON★2 Boom up Arm in Not travel motion Not swing motion	Limitation of pump flow rate : Activated
None of upper condition	Limitation of pump flow rate : Canceled

★1 AND condition

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

2. IPC MODE SELECTION

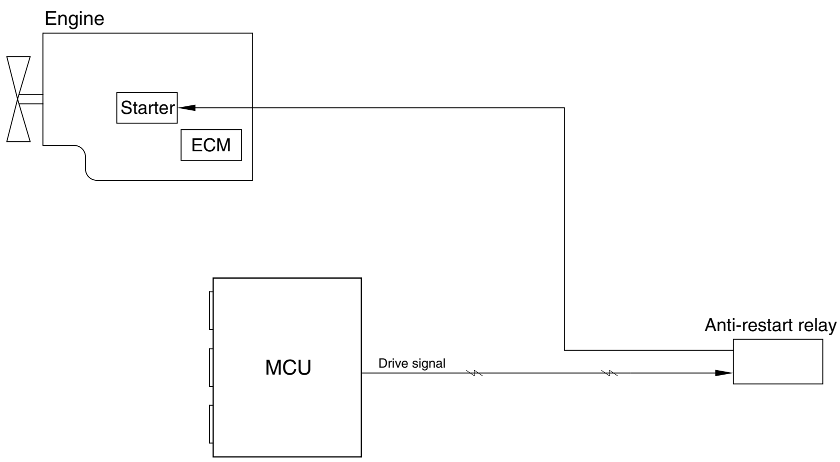
IPC mode ON/OFF and the levels of flow rate limit can be selected at "Mode setup > IPC mode"



290F3CD311

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

GROUP 12 ANTI-RESTART SYSTEM



140L5MS12

1. ANTI-RESTART FUNCTION

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

1. OUTLINE

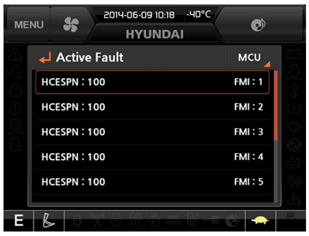
When any abnormality occurs in the ADVANCED CAPO system caused by electric parts malfunction and by open or short circuit, the MCU diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

2. MONITORING

1) Active fault

290F3CD120

290F3CD121

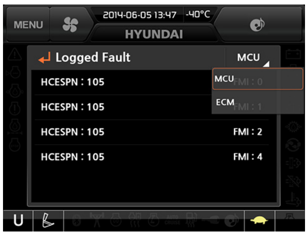


290F3CD125

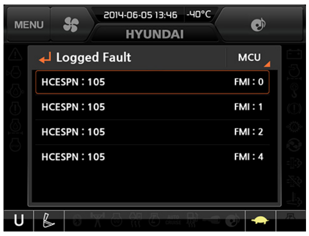
· The active faults of the MCU, engine ECM or air conditioner can be checked by this menu.

2) Logged fault

290F3CD128



290F3CD123

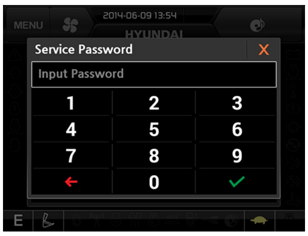


290F3CD124

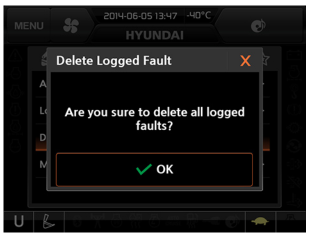
· The logged faults of the MCU, engine ECM or air conditioner can be checked by this menu.

3) Delete logged fault

290F3CD134



290F3CD126



290F3CD127

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

3. MACHINE ERROR CODES TABLE (SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">101</td><td>3</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Hydraulic oil temperature display failure
2. Control Function – Fan revolutions control failure
(Checking list)
1. CD-1 (#2) - CN-52 (#24) Checking Open/Short
2. CD-1 (#1) - CN-51 (#5) Checking Open/Short</td></tr>
<tr><td rowspan="4">105</td><td>0</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Working Press. display failure
2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure
(Checking list)
1. CD-7 (#B) – CN-52 (#37) Checking Open/Short
2. CD-7 (#A) – CN-51 (#3) Checking Open/Short
3. CD-7 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">108</td><td>0</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V</td><td></td><td>●</td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Travel Oil Press. display failure
2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure
(Checking list)
1. CD-6 (#B) – CN-52 (#38) Checking Open/Short
2. CD-6 (#A) – CN-51 (#3) Checking Open/Short
3. CD-6 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
120	0	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Main Pump 1 (P1) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-42 (#B) – CN-52 (#29) Checking Open/Short 2. CD-42 (#A) – CN-51 (#3) Checking Open/Short 3. CD-42 (#C) – CN-51 (#13) Checking Open/Short			
121	0	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Main Pump 2 (P2) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-52 (#12) Checking Open/Short 2. CD-43 (#A) – CN-51 (#3) Checking Open/Short 3. CD-43 (#C) – CN-51 (#13) Checking Open/Short			
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#16) Checking Open/Short 2. CD-31 (#A) – CN-51 (#3) Checking Open/Short 3. CD-31 (#C) – CN-51 (#13) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

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-52 (#33) Checking Open/Short 2. CD-70 (#A) – CN-51 (#3) Checking Open/Short 3. CD-70 (#C) – CN-51 (#13) Checking Open/Short			
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-52 (#17) Checking Open/Short 2. CD-71 (#A) – CN-51 (#3) Checking Open/Short 3. CD-71 (#C) – CN-51 (#13) Checking Open/Short			
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 (#19) Checking Open/Short 2. CD-32 (#A) – CN-51 (#3) Checking Open/Short 3. CD-32 (#C) – CN-5 1(#13) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">128</td><td>0</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Boom Down Pilot Press. display failure
2. Control Function – Boom floating operation failure
(Checking list)
1. CD-85 (#B) – CN-53 (#23) Checking Open/Short
2. CD-85 (#A) – CN-53 (#3) Checking Open/Short
3. CD-85 (#C) – CN-53 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">129</td><td>0</td><td>10 seconds continuous, Arm In Pilot Press. Sensor
Measurement Voltage > 4.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Arm In Pilot Press. Sensor
Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Arm In Pilot Press. display failure
2. Control Function – IPC operation failure
(Checking list)
1. CD-90 (#B) – CN-52 (#28) Checking Open/Short
2. CD-90 (#A) – CN-51 (#3) Checking Open/Short
3. CD-90 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">133</td><td>0</td><td>10 seconds continuous,
Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous,
0.3V≤ Arm In/Out & Bucket In Pilot Press. Sensor
Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous,
Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Arm In/Out & Bucket In Pilot Press. display failure
2. Control Function – Engine variable horse power control operation failure
(Checking list)
1. CD-35 (#B) – CN-52 (#14) Checking Open/Short
2. CD-35 (#A) – CN-51 (#3) Checking Open/Short
3. CD-35 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

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 (#36) Checking Open/Short 2. CD-24 (#A) – CN-51 (#3) Checking Open/Short 3. CD-24 (#C) – CN-51 (#13) 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-53 (#14) Checking Open/Short 2. CD-69 (#A) – CN-53 (#3) Checking Open/Short 3. CD-69 (#C) – CN-53 (#13) Checking Open/Short				
139	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

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">140</td><td>5</td><td>(Detection)
(When Pump EPPR Current is more than 10 mA)
10 seconds continuous, Pump EPPR drive current < 0 mA
(Cancellation)
(When Pump EPPR Current is more than 10 mA)
3 seconds continuous, Pump EPPR drive current ≥10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Pump EPPR drive current > 1.0A
(Cancellation)
3 seconds continuous, Pump EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Pump horse power setting specification difference
(Fuel efficiency/speed specification failure)
(Checking list)
1. CN-75 (#2) – CN-52 (#9) Checking Open/Short
2. CN-75 (#1) – CN-52 (#10) Checking Open/Short</td></tr>
<tr><td rowspan="3">141</td><td>5</td><td>(Model Parameter) mounting Boom Priority EPPR
(Detection)
(When Boom Priority EPPR Current is more than 10 mA)
10 seconds continuous, Boom Priority EPPR drive current < 0 mA
(Cancellation)
(When Boom Priority EPPR Current is more than 10 mA)
3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Boom Priority EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom first control operation failure
(Checking list)
1. CN-133 (#2) – CN-52 (#34) Checking Open/Short
2. CN-133 (#1) – CN-52 (#35) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">143</td><td>5</td><td>(Detection)
(When Travel EPPR Current is more than 10 mA)
10 seconds continuous, Travel EPPR drive current = 0 mA
(Cancellation)
(When Travel EPPR Current is more than 100 mA)
3 seconds continuous, Travel EPPR drive current ≥ 10 mA</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Travel EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Travel EPPR drive current ≤ 1.0 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – cruise control operation failure
(Checking list)
1. CN-246 (#2) – CN-54 (#39) Checking Open/Short
2. CN-246 (#1) – CN-51 (#40) Checking Open/Short</td></tr>
<tr><td rowspan="3">145</td><td>5</td><td>(Model Parameter) mounting Remote Cooling Fan EPPR
(Detection)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA
(Cancellation)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Remote fan control operation failure
(Checking list)
1. CD-385 (#3) – CN-51 (#9) Checking Open/Short
2. CD-385 (#1) – CN-51 (#14) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">164</td><td>4</td><td>(Detection)
(When Working Cutoff Relay is Off)
10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Working Cutoff Relay is Off)
3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Working Cutoff Relay is On)
10 seconds continuous, Working Cutoff Relay drive current > 6.5 A
(Cancellation)
(When Working Cutoff Relay is On)
3 seconds continuous, Working Cutoff Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure
(Checking list)
1. CR-47 (#85) – CN-54 (#9) Checking Open/Short
2. CR-47 (#30, #86) – Fuse box (#28) Checking Open/Short</td></tr>
<tr><td rowspan="3">166</td><td>4</td><td>(Detection)
(When Power Max Solenoid is Off)
10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Power Max Solenoid is Off)
3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Power Max Solenoid is On)
5 seconds continuous, Power Max Solenoid drive current > 4.5 A
(Cancellation)
(When Power Max Solenoid is On)
3 seconds continuous, Power Max Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Voltage increase operation failure
(Checking list)
1. CN-88 (#1) – CN-52 (#2) Checking Open/Short
2. CN-88 (#2) – Fuse box (#28) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
167	4	(Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V		●	
		(When Parking mode is not) (Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Travel Speed Solenoid is On) 10 seconds continuous, Travel Speed Solenoid drive current > 4.5 A (Cancellation) (When Travel Speed Solenoid is On) 3 seconds continuous, Travel Speed Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – driving in 1/2 transmission operation failure (Checking list) 1. CN-70 (#1) – CN-52(#20) Checking Open/Short 2. CN-70 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

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-53 (#7) Checking Open/Short 2. CN-237 (#2) – Fuse box (#17) 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 (#1) 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

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">171</td><td>4</td><td>Monitor – Selecting attachment(crusher)
(Detection)
(When Attachment Safety Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Attachment Safety Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Attachment Safety Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Attachment Safety Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Option spool pilot pressure cut off failure (crusher mode)
(Checking list)
1. CN-149 (#1) – CN-53 (#8) Checking Open/Short
2. CN-149 (#2) – Fuse box (#17) Checking Open/Short</td></tr>
<tr><td rowspan="3">179</td><td>4</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When Breaker Operating Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Breaker Operating Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Breaker Operating Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Breaker Operating Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode)
(Checking list)
1. CN-66 (#1) – CN-53 (#9) Checking Open/Short
2. CN-66 (#2) – Fuse box (#31) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General　　C : Crawler Type　　W : Wheel Type

(SERIAL NO. : -#0785)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
181	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 Attachment Flow EPPR 1 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CN-242 (#2) – CN-52 (#39) Checking Open/Short 2. CN-242 (#1) – CN-52 (#40) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

DTC HCESPN	DTC FMI	Diagnostic Criteria	Application G	Application C	Application W
189	5	(Detection) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA	●		
189	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A	●		
189		(Results / Symptoms) 1. Control Function – Option attachment flow control operation failure (Checking list) 1. CN-243 (#2) – CN-52 (#6) Checking Open/Short 2. CN-243 (#1) – CN-52 (#7) Checking Open/Short			
196	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
196	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
196	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
196		(Results / Symptoms) 1. Control Function – Driving second pump joining function operation failure (Checking list) 1. CD-93 (#B) – CN-52 (#11) Checking Open/Short 2. CD-93 (#A) – CN-51 (#3) Checking Open/Short 3. CD-93 (#C) – CN-51 (#13) Checking Open/Short			
200	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V	●		
200	1	10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V	●		
200	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V	●		
200		(Results / Symptoms) 1. Monitor – Pump EPPR Press. display failure 2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Fuel efficiency/speed performance failure) (Checking list) 1. CD-44 (#B) – CN-52 (#32) Checking Open/Short 2. CD-44 (#A) – CN-51 (#3) Checking Open/Short 3. CD-44 (#C) – CN-51 (#13) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">205</td><td>0</td><td>(Mounting pressure sensor)
10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>(Mounting pressure sensor)
10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(Mounting pressure sensor)
10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Boom Cylinder Rod Press. display failure
2. Control Function – Boom floating control operation failure
(Checking list)
1. CD-124 (#B) – CN-53 (#5) Checking Open/Short
2. CD-124 (#A) – CN-53 (#3) Checking Open/Short
3. CD-124 (#C) – CN-53 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="3">218</td><td>4</td><td>Mounting pressure sensor (HCESPN128 or HCESPN 205)
(Detection)
(When Boom Up Floating Solenoid is Off)
10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Boom Up Floating Solenoid is Off)
3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Boom Up Floating Solenoid is On)
10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A
(Cancellation)
(When Boom Up Floating Solenoid is On)
3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom floating control operation failure
(Checking list)
1. CN-368 (#1) – CN-53 (#20) Checking Open/Short
2. CN-368 (#2) – Fuse box (#17) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General　　C : Crawler Type　　W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">220</td><td>4</td><td>Mounting pressure sensor (HCESPN 128 or 205)
(Detection)
(When Boom Down Pilot Pressure Cutoff Solenoid is Off)
10 seconds continuous,
Boom Down Pilot Pressure Cutoff Solenoid drive unit
Measurement Voltage ≤ 3.0V
(Cancellation)
(When Boom Down Pilot Pressure Cutoff Solenoid is Off)
3 seconds continuous,
Boom Down Pilot Pressure Cutoff Solenoid drive unit
Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Boom Down Pilot Pressure Cutoff Solenoid is On)
10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current > 6.5 A
(Cancellation)
(When Boom Down Pilot Pressure Cutoff Solenoid is On)
3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom floating control operation failure
(Checking list)
1. CN-369 (#1) – CN-53 (#35) Checking Open/Short
2. CN-369 (#2) – Fuse box (#17) Checking Open/Short</td></tr>
<tr><td rowspan="3">221</td><td>5</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA)
10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA
(Cancellation)
ATT Relief Setting EPPR 1 Current is equal or more than 10 mA)
3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, ATT Relief Setting EPPR 1 drive current > 1.0 A
(Cancellation)
3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – P1 relief pressure setting failure
(Checking list)
1. CN-365 (#2) – CN-53 (#39) Checking Open/Short
2. CN-365 (#1) – CN-53 (#40) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

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-53 (#32) Checking Open/Short 2. CN-366 (#1) – CN-53 (#33) Checking Open/Short				
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-52 (#26) Checking Open/Short 2. CD-2 (#1) – CN-51 (#5) 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 (#30) 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

(SERIAL NO. : -#0785)

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">514</td><td>4</td><td>(Detection)
(When Parking Relay is Off)
10 seconds continuous, Parking Relay drive unit
Measurement Voltage ≤ 3.0V
(Cancellation)
(When Parking Relay is Off)
3 seconds continuous, Parking Relay drive unit
Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Parking Relay is On)
10 seconds continuous, Parking Relay drive current > 6.5 A
(Cancellation)
(When Parking Relay is On)
3 seconds continuous, Parking Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Parking Relay operation failure
(Checking list)
1. CR-66 (#1) – CN-54 (#20) Checking Open/Short
2. CR-66 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
<tr><td rowspan="3">517</td><td>4</td><td>(Detection)
(When Traveling Cutoff Relay is Off)
10 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Traveling Cutoff Relay is Off)
3 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Traveling Cutoff Relay is On)
10 seconds continuous, Traveling Cutoff Relay drive current > 6.5 A
(Cancellation)
(When Traveling Cutoff Relay is On)
3 seconds continuous, Traveling Cutoff Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Traveling Cutoff Relay operation failure
(Checking list)
1. CR-47 (#85) – CN-54 (#9) Checking Open/Short
2. CR-47 (#86) – Fuse box (#28) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">525</td><td>4</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Ram lock control operation failure
(Checking list)
1. CN-69 (#1) – CN-54 (#8) Checking Open/Short
2. CN-69 (#2) – Fuse box (#33) Checking Open/Short</td></tr>
<tr><td rowspan="3">527</td><td>4</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Creep mode operation failure
(Checking list)
1. CN-206 (#1) – CN-54 (#7) Checking Open/Short
2. CN-206 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">714</td><td>3</td><td>(Model Parameter) Mounting Acc. Dial
10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(Model Parameter) Mounting Acc. Dial
10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Acc. Dial Voltage display failure
2. Control Function – Engine rpm control failure
(Checking list)
1. CN-7 (#15) – CN-52 (#23) Checking Open/Short</td></tr>
<tr><td rowspan="3">722</td><td>4</td><td>(Detection)
(When Travel Alarm (Buzzer) Sound is Off)
10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Travel Alarm (Buzzer) Sound Relay is Off)
3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Travel Alarm (Buzzer) Sound is On)
10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A
(Cancellation)
(When Travel Alarm (Buzzer) Sound is On)
3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Driving alarm operation failure
(Checking list)
1. CN-81 (#1) – CN-52 (#31) Checking Open/Short
2. CN-81 (#2) – Fuse box (#28) Checking Open/Short</td></tr>
<tr><td rowspan="2">831</td><td>2</td><td>(When mounting the A/C Controller)
60 seconds continuous, A/C Controller Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – A/C Controller operation failure
(Checking list)
1. CN-11 (#8) – CN-51 (#22) Checking Open/Short
2. CN-11 (#7) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">840</td><td>2</td><td>60 seconds continuous, Cluster Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Cluster operation failure
(Checking list)
1. CN-56A (#7) – CN-51 (#22) Checking Open/Short
2. CN-56A (#6) – CN-51 (#32) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : -#0785)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
	(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-401 (#86) – CN-51 (#22) Checking Open/Short 2. CN-401 (#87) – CN-51 (#32) Checking Open/Short				
867	2	60 seconds continuous, RDU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#22) Checking Open/Short 2. CN-376 (#18) – CN-51 (#32) Checking Open/Short				
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#22) Checking Open/Short 2. CN-56A (#6) – CN-51 (#32) Checking Open/Short				
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#22) Checking Open/Short 2. CS-2B (#B) – CN-51 (#32) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

MACHINE ERROR CODES TABLE (SERIAL NO. : #0786-)

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-19 (#19) Checking Open/Short 2. CD-7 (#A) – CN-32 (#32) Checking Open/Short 3. CD-7 (#C) – CN-31 (#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-27 (#27) Checking Open/Short 2. CD-6 (#A) – CN-32 (#32) Checking Open/Short 3. CD-6 (#C) – CN-31 (#31) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">120</td><td>0</td><td>10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Main Pump 1 (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</td></tr>
<tr><td rowspan="4">121</td><td>0</td><td>10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Main Pump 2 (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</td></tr>
<tr><td rowspan="3">122</td><td>1</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Overload Press. display failure
2. Control Function – Overload warning alarm failure
(Checking list)
1. CD-31 (#B) – CN-52 (#28) Checking Open/Short
2. CD-31 (#A) – CN-51 (#32) Checking Open/Short
3. CD-31 (#C) – CN-51 (#31) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General　　C : Crawler Type　　W : Wheel Type

(SERIAL NO. : #0786-)

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

(SERIAL NO. : #0786-)

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, Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In/Out & Bucket In Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-52 (#24) 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

(SERIAL NO. : #0786-)

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	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

(SERIAL NO. : -#0785)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">140</td><td>5</td><td>(Detection)
(When Pump EPPR Current is more than 10 mA)
10 seconds continuous, Pump EPPR drive current < 0 mA
(Cancellation)
(When Pump EPPR Current is more than 10 mA)
3 seconds continuous, Pump EPPR drive current ≥10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Pump EPPR drive current > 1.0A
(Cancellation)
3 seconds continuous, Pump EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Pump horse power setting specification difference
(Fuel efficiency/speed specification failure)
(Checking list)
1. CN-75 (#2) – CN-54 (#28) Checking Open/Short
2. CN-75 (#1) – CN-54 (#01) Checking Open/Short</td></tr>
<tr><td rowspan="3">141</td><td>5</td><td>(Model Parameter) mounting Boom Priority EPPR
(Detection)
(When Boom Priority EPPR Current is more than 10 mA)
10 seconds continuous, Boom Priority EPPR drive current < 0 mA
(Cancellation)
(When Boom Priority EPPR Current is more than 10 mA)
3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Boom Priority EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom first control operation failure
(Checking list)
1. CN-133 (#2) – CN-54 (#34) Checking Open/Short
2. CN-133 (#1) – CN-54 (#04) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
143	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

(SERIAL NO. : #0786-)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">164</td><td>4</td><td>(Detection)
(When Working Cutoff Relay is Off)
10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Working Cutoff Relay is Off)
3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Working Cutoff Relay is On)
10 seconds continuous, Working Cutoff Relay drive current > 6.5 A
(Cancellation)
(When Working Cutoff Relay is On)
3 seconds continuous, Working Cutoff Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure
(Checking list)
1. CR-47 (#85) – CN-54 (#9) Checking Open/Short
2. CR-47 (#30, #86) – Fuse box (#28) Checking Open/Short</td></tr>
<tr><td rowspan="3">166</td><td>4</td><td>(Detection)
(When Power Max Solenoid is Off)
10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Power Max Solenoid is Off)
3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Power Max Solenoid is On)
5 seconds continuous, Power Max Solenoid drive current > 4.5 A
(Cancellation)
(When Power Max Solenoid is On)
3 seconds continuous, Power Max Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Voltage increase operation failure
(Checking list)
1. CN-88 (#1) – CN-53 (#10) Checking Open/Short
2. CN-88 (#2) – Fuse box (#28) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">167</td><td rowspan="2">4</td><td>(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</td><td></td><td>●</td><td></td></tr>
<tr><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
</table>

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(SERIAL NO. : #0786-)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">169</td><td>4</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When Attachment Conflux Solenoid is Off)
10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage $\leq$ 3.0V
(Cancellation)
(When Attachment Conflux Solenoid is Off)
3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage $>$ 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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 $\leq$ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="3">170</td><td>4</td><td>(Model Parameter) mounting Arm Regenerating Solenoid
(Detection)
(When Arm Regeneration Solenoid is Off)
10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage $\leq$ 3.0V
(Cancellation)
(When Arm Regeneration Solenoid is Off)
3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage $>$ 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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 $\leq$ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(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</td></tr>
</table>

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(SERIAL NO. : #0786-)

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">171</td><td>4</td><td>Monitor – Selecting attachment(crusher)
(Detection)
(When Attachment Safety Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Attachment Safety Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Attachment Safety Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Attachment Safety Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Option spool pilot pressure cut off failure (crusher mode)
(Checking list)
1. CN-149 (#1) – CN-53 (#09) Checking Open/Short
2. CN-149 (#2) – Fuse box (#19) Checking Open/Short</td></tr>
<tr><td rowspan="3">179</td><td>4</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When Breaker Operating Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Breaker Operating Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Breaker Operating Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Breaker Operating Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode)
(Checking list)
1. CN-66 (#1) – CN-52 (#08) Checking Open/Short
2. CN-66 (#2) – Fuse box (#31) Checking Open/Short</td></tr>
</table>

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G : General C : Crawler Type W : Wheel Type

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<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">181</td><td>4</td><td>(Model Parameter) mounting Reverse Cooling Fan Solenoid
(Detection)
(When Reverse Cooling Fan Solenoid is Off)
10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Reverse Cooling Fan Solenoid is Off)
3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Reverse Cooling Fan Solenoid is On)
10 seconds continuous, Reverse Cooling Fan Solenoid drive current > 4.5 A
(Cancellation)
(When Reverse Cooling Fan Solenoid is On)
3 seconds continuous, Reverse Cooling Fan Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Cooling Fan reverse control operation failure (not applicable)</td></tr>
<tr><td rowspan="3">188</td><td>5</td><td>(Detection)
(When 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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – IPC operation failure, Option attachment flow control operation failure
(Checking list)
1. CN-242 (#2) – CN-54 (#27) Checking Open/Short
2. CN-242 (#1) – CN-54 (#02) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

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	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			

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G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

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				

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G : General C : Crawler Type W : Wheel Type

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<table>
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<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">220</td><td>4</td><td>Mounting pressure sensor (HCESPN 128 or 205)
(Detection)
(When Boom Down Pilot Pressure Cutoff Solenoid is Off)
10 seconds continuous,
Boom Down Pilot Pressure Cutoff Solenoid drive unit
Measurement Voltage ≤ 3.0V
(Cancellation)
(When Boom Down Pilot Pressure Cutoff Solenoid is Off)
3 seconds continuous,
Boom Down Pilot Pressure Cutoff Solenoid drive unit
Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Boom Down Pilot Pressure Cutoff Solenoid is On)
10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current > 6.5 A
(Cancellation)
(When Boom Down Pilot Pressure Cutoff Solenoid is On)
3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom floating control operation failure
(Checking list)
1. CN-369 (#1) – CN-53 (#08) Checking Open/Short
2. CN-369 (#2) – Fuse box (#19) Checking Open/Short</td></tr>
<tr><td rowspan="3">221</td><td>5</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA)
10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA
(Cancellation)
ATT Relief Setting EPPR 1 Current is equal or more than 10 mA)
3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, ATT Relief Setting EPPR 1 drive current > 1.0 A
(Cancellation)
3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – P1 relief pressure setting failure
(Checking list)
1. CN-365 (#2) – CN-54 (#17) Checking Open/Short
2. CN-365 (#1) – CN-54 (#09) Checking Open/Short</td></tr>
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<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">222</td><td>5</td><td>Monitor – Selecting attachment(crusher)
(Detection)
(When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA)
10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA
(Cancellation)
(When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA)
3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A
(Cancellation)
3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – P2 relief pressure setting failure
(Checking list)
1. CN-366 (#2) – CN-54 (#17) Checking Open/Short
2. CN-366 (#1) – CN-54 (#10) Checking Open/Short</td></tr>
<tr><td rowspan="3">301</td><td>3</td><td>10 seconds continuous, Fuel Level Measurement Voltage > 3.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Fuel Level Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Fuel remaining display failure
(Checking list)
1. CD-2 (#2) – CN-51 (#19) Checking Open/Short
2. CD-2 (#1) – CN-51 (#25) Checking Open/Short</td></tr>
<tr><td rowspan="3">325</td><td>4</td><td>(Model Parameter) mounting Fuel Warmer Relay
(Detection)
(When Fuel Warmer Relay is Off)
10 seconds continuous, Fuel Warmer Relay drive unit
Measurement Voltage ≤ 3.0V
(Cancellation)
(When Fuel Warmer Relay is Off)
3 seconds continuous, Fuel Warmer Relay drive unit
Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Fuel Warmer Relay is On)
10 seconds continuous, Fuel Warmer Relay drive current > 4.5 A
(Cancellation)
(When Fuel Warmer Relay is On)
3 seconds continuous, Fuel Warmer Relay drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Fuel warmer operation failure
(Checking list)
1. CR-46 (#85) – CN-52 (#13) Checking Open/Short
2. CR-46 (#86) – Fuse box (#22) Checking Open/Short</td></tr>
</table>

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G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
501	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	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	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			

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G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
514	4	(Detection) (When Parking Relay is Off) 10 seconds continuous, Parking Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Parking Relay is Off) 3 seconds continuous, Parking Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Parking Relay is On) 10 seconds continuous, Parking Relay drive current > 6.5 A (Cancellation) (When Parking Relay is On) 3 seconds continuous, Parking Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Parking Relay operation failure (Checking list) 1. CR-66 (#1) – CN-53 (#11) Checking Open/Short 2. CR-66 (#2) – Fuse box (#30) Checking Open/Short				
517	4	(Detection) (When Traveling Cutoff Relay is Off) 10 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Traveling Cutoff Relay is Off) 3 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Traveling Cutoff Relay is On) 10 seconds continuous, Traveling Cutoff Relay drive current > 6.5 A (Cancellation) (When Traveling Cutoff Relay is On) 3 seconds continuous, Traveling Cutoff Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Traveling Cutoff Relay operation failure (Checking list) 1. CR-47 (#85) – CN-53 (#04) Checking Open/Short 2. CR-47 (#86) – Fuse box (#28) Checking Open/Short				

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G : General C : Crawler Type W : Wheel Type

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<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">525</td><td>4</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(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</td></tr>
<tr><td rowspan="3">527</td><td>4</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(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</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(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</td></tr>
</table>

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G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
530	0	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			●
		(Results / Symptoms) 1. Monitor – Travel Forward Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-73 (#B) – CN-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	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-74A (#1) – CN-51 (#01) Checking Open/Short			
707	1	(When Engine is equal or more than 400 rpm) 10 seconds continuous, Alternator Node L Measurement Voltage < 18V (In case 12v goods, Alternator Node I Measurement Voltage < 9V)	●		
		(Results / Symptoms) 1. Control Function – Battery charging circuit failure (Checking list) 1. CS-74A (#1) – CN-51 (#26) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

(SERIAL NO. : #0786-)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
714	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

(SERIAL NO. : #0786-)

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
841	2	10 seconds continuous, ECM Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – ECM operation failure (Checking list) 1. CN-93 (#22) – CN-52 (#02) Checking Open/Short 2. CN-93 (#46) – CN-52 (#01) Checking Open/Short				
848	2	(When mounting the Haptic Controller) 60 seconds continuous, Haptic Controller Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Haptic Controller operation failure (Checking list) 1. CN-8 (#2) – CN-51 (#09) Checking Open/Short 2. CN-8 (#3) – 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

(SERIAL NO. : #0786-)

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 (#7) – CN-51 (#08) Checking Open/Short 2. CN-56A (#6) – 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	Reason	Effect (only when fault code is active)
111 629 12	Engine control module critical internal failure - Bad intelligent device or component. Error internal to the ECM related to memory hardware failures or internal ECM voltage supply circuits.	Possible no noticeable performance effects, engine dying, or hard starting.
115 612 2	Engine magnetic crankshaft speed/position lost both of two signals - Data erratic, intermittent, or incorrect. The ECM has detected the primary and backup speed sensor signals are connected backwards.	The engine will shut down or will not start.
122 102 3	Intake manifold 1 pressure sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the intake manifold pressure circuit.	Engine power derate.
123 102 4	Intake manifold 1 pressure sensor circuit - Voltage below normal, or shorted to low Source. Low signal voltage or open circuit detected at the intake manifold pressure circuit.	Engine power derate.
124 102 16	Intake manifold 1 pressure - Data valid but above normal operational range - Moderately severe level. Intake manifold pressure is above the maximum operating limit.	Engine power derate.
125 102 18	Intake Manifold 1 Pressure - Data valid but below normal operating range - Moderately severe level. Intake manifold pressure is below the minimum operating limit.	Engine power derate.
131 91 3	Accelerator pedal or lever position sensor 1 circuit - Voltage above normal, or shorted to high source. High voltage detected at accelerator pedal position number 1 circuit.	The engine will operate in limp home mode.
132 91 4	Accelerator pedal or lever position sensor 1 circuit - Voltage below normal, or shorted to low source. Low voltage detected at accelerator pedal position number 1 signal circuit.	The engine will operate in limp home mode.
133 974 3	Remote accelerator pedal or lever position sensor 1 circuit - Voltage above normal, or shorted to high source. High voltage detected at remote accelerator pedal position signal circuit.	Remote accelerator will not operate.
134 974 4	Remote accelerator pedal or lever position sensor 1 circuit - Voltage below normal, or shorted to low source. Low voltage detected at remote accelerator pedal position signal circuit.	Remote accelerator will not operate.
143 100 18	Engine oil rifle pressure - Data valid but below normal operational range - Moderately severe level. Engine oil pressure signal indicates engine oil pressure is below the engine protection warning limit.	Engine power derate.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
144 110 3	Engine coolant temperature 1 sensor circuit - Voltage above normal, or shorted to high source. High signal voltage or open circuit detected at engine coolant temperature circuit.	Fan will stay ON if controlled by ECM.
145 110 4	Engine coolant temperature 1 sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at engine coolant temperature circuit.	Fan will stay ON if controlled by ECM.
146 110 16	Engine coolant temperature - Data valid but above normal operational range - Moderately severe level. Engine coolant temperature is above engine protection warning limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red stop lamp starts flashing.
151 110 0	Engine coolant temperature - Data valid but above normal operational range - Most severe level. Engine coolant temperature signal indicates engine coolant temperature above engine protection critical limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red stop lamp starts flashing.
153 105 3	Intake manifold 1 temperature sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at intake manifold air temperature circuit.	Fan will stay ON if controlled by ECM.
154 105 4	Intake manifold 1 temperature sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at intake manifold air temperature circuit.	Fan will stay ON if controlled by ECM.
155 105 0	Intake manifold 1 temperature - Data valid but above normal operational range - Most severe level. Intake manifold air temperature signal indicates intake manifold air temperature above engine protection critical limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red stop lamp starts flashing.
175 3464 3	Electronic throttle control actuator driver circuit - Voltage above normal, or shorted to high source. A short circuit to battery or open circuit has been detected in the engine intake air throttle actuator signal circuit.	Possible reduced engine performance.
176 3464 4	Electronic throttle control actuator driver circuit - Voltage below normal, or shorted to low source. A short circuit to ground has been detected in the engine intake air throttle actuator signal circuit.	Possible reduced engine performance.
177 3464 7	Electronic throttle control actuator - Mechanical system not responding or out of adjustment. The engine intake air throttle actuator has failed the auto zero span check.	Possible reduced engine performance.
187 3510 4	Sensor supply 2 circuit - Voltage below normal, or shorted to low source. Low voltage detected at the sensor supply number 2 circuit.	Engine power derate.
195 111 3	Coolant level sensor 1 circuit - Voltage above normal, or shorted to high source. High signal voltage detected at engine coolant level circuit.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
196 111 4	Coolant level sensor 1 circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at engine coolant level circuit.	None on performance.
197 111 18	Coolant level - Data valid but below normal operational range - Moderately severe level. Low coolant level has been detected.	Engine power derate.
221 108 3	Barometric pressure sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at barometric pressure circuit.	Engine power derate.
222 108 4	Barometric pressure sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at barometric pressure circuit.	Engine power derate.
227 3510 3	Sensor supply 2 circuit - Voltage above normal, or shorted to high source. High voltage detected at sensor supply number 2 circuit.	Engine power derate.
234 190 0	Engine crankshaft speed/position - Data valid but above normal operational range - Most severe level. Engine speed signal indicates engine speed above engine protection limit.	Engine power derate.
238 3511 4	Sensor supply 3 circuit - Voltage below normal, or shorted to low source. Low voltage detected on the +5 volt sensor supply circuit to the engine speed sensor.	Engine may run rough, may stop running, may not start, or may be difficult to start.
239 3511 3	Sensor supply 3 circuit - Voltage above normal or shorted to high source. High voltage detected on the 5 volt sensor supply circuit to the engine speed sensor.	Engine may run rough, may stop running, may not start, or may be difficult to start.
241 84 2	Wheel-based vehicle speed - Data erratic, intermittent, or incorrect. The ECM lost the vehicle speed signal or is reading an erratic value.	Engine speed limited to ,maximum engine speed without VSS parameter value. Cruise control, gear-down protection, and road speed governor will not work.
245 647 4	Fan control circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the fan control circuit when commanded on.	The fan may stay on continuously or not run at all.
249 171 3	Ambient air temperature sensor 1 circuit - Voltage above normal or shorted to high source. High signal voltage detected at ambient air temperature circuit.	Possible reduced engine performance.
256 171 4	Ambient air temperature sensor 1 circuit - Voltage below normal or shorted to low source. Low voltage detected at ambient air temperature circuit.	Possible reduced engine performance.
271 1347 4	Fuel pump pressurizing assembly 1 circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the fuel pump actuator circuit.	Engine power derate.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
272 1347 3	Fuel pump pressurizing assembly 1 circuit - Voltage above normal, or shorted to high source. High signal voltage or open circuit detected at the fuel pump actuator circuit.	Engine may run rough, may stop running, may not start, or may be difficult to start.
285 639 9	SAE J1939 multiplexing PGN timeout error - Abnormal update rate. The ECM expected information from a multiplexed device but did not receive it soon enough or did not receive it at all.	At least one multiplexed device will not operate properly.
286 639 13	SAE J1939 multiplexing configuration error - Out of calibration. The ECM expected information from a multiplexed device but only received a portion of the necessary information.	At least one multiplexed device will not operate properly.
288 974 19	Sae J1939 multiplexing remote accelerator pedal or lever position sensor circuit - Received network data in error. The oem vehicle electronic control unit (VECM) detected a fault with the remote accelerator.	Remote accelerator will not operate.
295 108 2	Barometric pressure - Data erratic, intermittent, or incorrect. An error in the barometric pressure sensor signal was detected by the ECM.	Engine power derate.
322 651 5	Injector solenoid driver cylinder 1 circuit - Current below normal, or open circuit. Current detected at injector 1 when voltage is turned OFF.	Engine power derate.
323 655 5	Injector solenoid driver cylinder 5 circuit - Current below normal, or open circuit. Current detected at injector 5 when voltage is turned OFF.	The current to the injector is shut OFF. Engine power derate.
324 653 5	Injector solenoid driver cylinder 3 circuit - Current below normal, or open circuit. Current detected at injector 3 when voltage is turned OFF.	The current to the injector is shut OFF. Engine power derate.
325 656 5	Injector solenoid driver cylinder 6 circuit - Current below normal, or open circuit. Current detected at injector 6 when voltage is turned OFF.	The current to the injector is shut OFF. Engine power derate.
331 652 5	Injector solenoid driver cylinder 2 circuit - Current below normal, or open circuit. Current detected at injector 2 when voltage is turned OFF.	The current to the injector is shut OFF. Engine power derate.
332 654 5	Injector solenoid driver cylinder 4 circuit - Current below normal, or open circuit. Current detected at injector 4 when voltage is turned OFF.	The current to the injector is shut OFF. Engine power derate.
334 110 2	Engine coolant temperature - Data erratic, intermittent, or incorrect. The engine coolant temperature sensor is reading an erratic value at initial key ON.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
338 1267 3	Idle shutdown vehicle accessories relay driver circuit - Voltage above normal, or shorted to high source. Open circuit or short to voltage source detected at the idle shutdown vehicle accessory/ignition bus relay circuit.	Vehicle accessories or ignition bus loads controlled by the idle shutdown relay will not power up.
339 1267 4	Idle shutdown vehicle accessories relay driver circuit - Voltage below normal, or shorted to low source. Low voltage detected at the idle shutdown vehicle accessory or ignition bus relay circuit when commanded ON.	Vehicle accessories or ignition bus loads controlled by the idle shutdown relay will not power up.
343 629 12	Engine control module warning internal hardware failure - Bad intelligent device or component. ECM power supply errors have been detected.	Engine power derate.
346 630 12	Engine control module calibration memory software - Bad intelligent device or component. Invalid switch configuration adjustable parameter setting have been detected by the engine control module (ECM).	Various optional switch inputs to the ECM may not operate correctly.
351 627 12	Injector power supply - Bad intelligent device or component. The ECM measured injector boost voltage is low.	Engine power derate.
352 3509 4	Sensor supply 1 circuit - Voltage below normal, or shorted to low source. Low voltage detected at sensor supply number 1 circuit.	Engine power derate.
383 729 5	Engine intake air heater 1 circuit - Current below normal or open circuit. A malfunctioning engine intake air heater circuit has been detected.	Engine may not start or may be difficult to start.
386 3509 3	Sensor supply 1 circuit - Voltage above normal, or shorted to high source. High voltage detected at sensor supply number 1 circuit.	Engine power derate.
415 100 1	Engine oil rifle pressure - Data valid but below normal operational range - Most severe level. Oil pressure signal indicates oil pressure below the engine protection critical limit.	Progressive power and/or speed derate increasing in severity from time of alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red stop lamp starts flashing.
418 97 15	Water in fuel indicator - Data valid but above normal operational range - Least severe level. water has been detected in the fuel filter.	None on performance.
427 639 9	J1939 data link - Abnormal update rate. Communication between the engine control module (ECM) and another device on the SAE J1939 data link has been lost.	Engine will only idle.
428 97 3	Water in fuel indicator sensor circuit - Voltage above normal, or shorted to high source. High voltage detected at the water in fuel circuit.	None on performance. No water in fuel warning available.
435 100 2	Engine oil rifle pressure - Data erratic, intermittent, or incorrect. The engine oil pressure sensor is reading an erratic value.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
436 105 2	Intake manifold 1 temperature - Data erratic, intermittent, or incorrect. The intake manifold temperature sensor is reading an erratic value at initial key on or while the engine is running.	Possible reduced engine performance.
441 168 18	Battery 1 voltage - Data valid but below normal operational range - Moderately severe level. ECM supply voltage is below the minimum system voltage level.	Engine may run rough, may stop running, may not start, or may be difficult to start.
442 168 16	Battery 1 Voltage - Data valid but above normal operational range - Moderately severe level. ECM supply voltage is above the maximum system voltage level.	None on performance.
451 157 3	Injector metering rail 1 pressure sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the rail fuel pressure sensor circuit.	Power and/or speed derate.
452 157 4	Injector metering rail 1 pressure sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the rail fuel pressure sensor circuit.	Power and/or speed derate.
483 1349 3	Injector metering rail 2 pressure sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at the fuel rail 2 pressure sensor circuit.	Possible reduced engine performance.
484 1349 4	Injector metering rail 2 pressure sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the fuel rail 2 pressure sensor circuit.	Possible reduced engine performance.
515 3514 3	Sensor supply 6 circuit - Voltage above normal or shorted to high source. High voltage detected on the +5 volt sensor supply circuit to the fuel rail pressure sensor.	Engine power derate.
516 3514 4	Sensor supply 6 circuit - Voltage below normal or shorted to low source. Low voltage detected on the +5 volt sensor supply circuit to the fuel rail pressure sensor.	Engine power derate.
553 157 16	Injector metering rail 1 pressure - Data valid but above normal operational range - Moderately severe level. The ECM has detected that fuel pressure is higher than commanded pressure.	Possible reduced engine performance.
555 101 16	Crankcase pressure - Data valid but above normal operational range - Moderately severe level. The crankcase breather filter requires maintenance.	None on performance.
556 101 0	Crankcase pressure - Data valid but above normal operational range - Most severe level. The crankcase breather filter requires maintenance.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
559 157 18	Injector metering rail 1 pressure - Data valid but below normal operational range - Moderately severe level. The ECM has detected that fuel pressure is lower than commanded pressure.	Possibly hard to start or low power. Engine could possibly **not** start.
584 677 3	Starter relay driver circuit - Voltage above normal, or shorted to high source. Open circuit or high voltage detected at starter lockout circuit.	Either the engine will not start or the engine will not have starter lockout protection.
585 677 4	Starter relay driver circuit - Voltage below normal, or shorted to low source. Low voltage detected at starter lockout circuit.	Either the engine will not start or the engine will not have starter lockout protection.
595 103 16	Turbocharger 1 speed - Data valid but above normal operating range - Moderately severe level. High turbocharger speed has been detected by the ecm.	Engine power derate.
596 167 16	Electrical charging system voltage - Data valid but above normal operational range - Moderately severe level. High battery voltage detected by the battery voltage monitor feature.	None on performance.
597 167 18	Electrical charging system voltage - Data valid but below normal operational range - Moderately severe level. Low battery voltage detected by the battery voltage monitor feature.	None on performance.
649 1378 31	Engine oil change interval - Condition exists. Change engine oil and filter.	None on performance.
687 103 18	Turbocharger 1 speed - Data valid but below normal operational range - Moderately severe level. Low turbocharger speed detected by the ECM.	Engine power derate. The ECM uses an estimated turbocharger speed.
689 190 2	Engine crankshaft speed/position - Data erratic, intermittent, or incorrect. The ECM has detected an error in the engine speed signal.	Possible reduced engine performance.
691 1172 3	Turbocharger 1 compressor inlet temperature sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at turbocharger compressor inlet air temperature circuit.	Engine power derate.
692 1172 4	Turbocharger 1 compressor inlet temperature circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at turbocharger compressor inlet air temperature circuit.	Engine power derate.
693 1172 2	Turbocharger 1 compressor intake temperature - Data erratic, intermittent, or incorrect. A temperature too high or low for the operating conditions has been detected by the turbocharger compressor intake temperature sensor.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
731 723 7	Engine speed / position camshaft and crankshaft misalignment - Mechanical system not responding properly or out of adjustment. Engine position signal from the crankshaft position sensor and camshaft position sensor do not match.	Engine power derate.
755 157 7	Injector metering rail 1 pressure - Mechanical system not responding or out of adjustment. The ECM has detected a difference in the 2 fuel rail pressure signals.	Possible reduced engine performance.
778 723 2	Engine camshaft speed / position sensor - Data erratic, intermittent, or incorrect. The ECM has detected an error in the camshaft position sensor signal.	Possible reduced engine performance.
784 1590 2	Adaptive cruise control mode - Data erratic, intermittent, or incorrect. Loss of communication with adaptive cruise control.	Adaptive cruise control will not operate. Standard cruise control may not operate.
1117 627 2	Power supply lost with ignition on - Data erratic, intermittent, or incorrect. Supply voltage to the ECM fell below 6.2 volts momentarily, or the ECM was not allowed to power down correctly (retain battery voltage for 30 seconds after key OFF).	Possible no noticeable performance.
1139 651 7	Injector solenoid driver cylinder 1 - Mechanical system not responding or out of adjustment. The ECM has detected an error with the injection timing or quantity.	Possible reduced engine performance.
1141 652 7	Injector solenoid driver cylinder 2 - Mechanical system not responding or out of adjustment. The ECM has detected an error with the injection timing or quantity.	Possible reduced engine performance.
1142 653 7	Injector solenoid driver cylinder 3 - Mechanical system not responding or out of adjustment. The ECM has detected an error with the injection timing or quantity.	Possible reduced engine performance.
1143 654 7	Injector solenoid driver cylinder 4 - Mechanical system not responding or out of adjustment. The ECM has detected an error with the injection timing or quantity.	Possible reduced engine performance.
1144 655 7	Injector solenoid driver cylinder 5 - Mechanical system not responding or out of adjustment. The ECM has detected an error with the injection timing or quantity.	Possible reduced engine performance.
1145 656 7	Injector solenoid driver cylinder 6 - Mechanical system not responding or out of adjustment. The ECM has detected an error with the injection timing or quantity.	Possible reduced engine performance.
1228 27 2	Egr valve position - Data erratic, intermittent, or Incorrect. The EGR valve is unable to meet commanded position.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
1239 2623 3	Accelerator pedal or lever position sensor 2 circuit - Voltage above normal or shorted to high source. High voltage detected at accelerator pedal position number 2 signal circuit.	The engine will operate in limp home mode.
1241 2623 4	Accelerator pedal or lever position sensor 2 circuit - Voltage below normal or shorted to low source. Low voltage detected at accelerator pedal position number 2 signal circuit.	The engine will operate in limp home mode.
1242 91 2	Accelerator pedal or lever position sensor 1 and 2 - Data erratic, intermittent, or incorrect. Accelerator position sensor number 1 and number 2 are reading different values.	The engine will only idle.
1515 91 19	Sae J1939 multiplexed accelerator pedal or lever sensor system - Received network data in error. The J1939 multiplexing controller has indicated a malfunction of the multiplexed accelerator pedal.	The engine will only idle.
1654 1323 31	Engine misfire cylinder 1- Condition exists. Engine misfire has been detected in cylinder number 1.	Possible reduced engine performance.
1655 1324 31	Engine misfire cylinder 2 - Condition exists. Engine misfire has been detected in cylinder number 2.	Possible reduced engine performance.
1656 1325 31	Engine misfire cylinder 3 - Condition exists. Engine misfire has been detected in cylinder number 3.	Possible reduced engine performance.
1657 1326 31	Engine misfire cylinder 4 - Condition exists. Engine misfire has been detected in cylinder number 4.	Possible reduced engine performance.
1658 1327 31	Engine misfire cylinder 5 - Condition exists. Engine misfire has been detected in cylinder number 5.	Possible reduced engine performance.
1659 1328 31	Engine misfire cylinder 6 - Condition exists. Engine misfire has been detected in cylinder number 6.	Possible reduced engine performance.
1668 1761 4	Aftertreatment diesel exhaust fluid tank level sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the aftertreatment diesel exhaust fluid tank level sensor circuit.	Possible reduced engine performance.
1669 1761 3	Aftertreatment diesel exhaust fluid tank level sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at the catalyst tank level sensor circuit.	Possible reduced engine performance.
1673 1761 1	Aftertreatment diesel exhaust fluid tank level - Data valid but below normal operating range - Most severe level. The aftertreatment diesel exhaust fluid tank level has fallen below the critical warning level.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
1677 3031 4	Aftertreatment diesel exhaust fluid tank temperature sensor - Voltage below normal or shorted to low source. Low signal voltage detected at the diesel exhaust fluid tank temperature sensor circuit.	Possible reduced engine performance.
1678 3031 3	Aftertreatment diesel exhaust fluid tank temperature sensor - Voltage above normal or shorted to high source. High signal voltage or open circuit detected at the diesel exhaust fluid tank temperature sensor circuit.	Possible reduced engine performance.
1679 3031 2	Aftertreatment diesel exhaust fluid tank temperature - Data erratic, intermittent, or incorrect. The diesel exhaust fluid tank temperature sensor has indicated a tank temperature too high or too low for the ambient conditions.	Possible reduced engine performance.
1682 3362 31	Aftertreatment diesel exhaust fluid dosing unit input lines - Condition exists. The aftertreatment diesel exhaust fluid dosing unit is unable to prime.	Possible reduced engine performance.
1683 3363 3	Aftertreatment diesel exhaust fluid tank heater - Voltage above normal or shorted to high source. High signal voltage detected at the aftertreatment diesel exhaust fluid tank heater circuit.	Possible reduced engine performance.
1684 3363 4	Aftertreatment diesel exhaust fluid tank heater - Voltage below normal, or shorted to low source. Low signal voltage detected at the aftertreatment diesel exhaust fluid tank heater circuit.	Possible reduced engine performance.
1691 100 18	Aftertreatment diesel oxidation catalyst conversion efficiency - Data valid but below normal operating range - Moderately severe level. The temperature increase across the aftertreatment catalyst is lower than expected.	Possible frequent need for aftertreatment regeneration.
1695 3513 3	Sensor supply 5 - Voltage above normal or shorted to high source. High voltage detected at sensor supply 5 circuit in the oem harness.	the engine will operate in limp home mode.
1696 3513 4	Sensor supply 5 - Voltage below normal or shorted to low source. Low voltage detected at sensor supply number 5 circuit in the oem harness.	the engine will operate in limp home mode.
1712 3363 18	Aftertreatment diesel exhaust fluid tank heater - Data valid but below normal operating range - Moderately severe level. The aftertreatment diesel exhaust fluid tank heater is unable to thaw the frozen diesel exhaust fluid.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
1713 3363 16	Aftertreatment diesel exhaust fluid tank heater - Data valid but above normal operating range - Moderately severe level. The diesel exhaust fluid tank heater is continuously in the on position.	None on performance.
1718 1322 31	Engine misfire for multiple cylinders - Condition exists. Engine misfire has been detected in multiple cylinder numbers.	Possible reduced engine performance.
1776 2634 3	Power relay driver circuit - Voltage above normal or shorted to high source. High voltage detected at power relay driver circuit.	Possible reduced engine performance.
1777 2634 4	Power relay driver circuit - Voltage below normal or shorted to low source. An open circuit or low voltage has been detected at the power relay circuit.	Possible reduced engine performance.
1843 101 3	Crankcase pressure circuit - Voltage above normal or shorted to high source. High signal voltage detected at the crankcase pressure circuit.	None on performance.
1844 101 4	Crankcase pressure circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the crankcase pressure circuit.	None on performance.
1866 411 2	Exhaust gas recirculation valve delta pressure - Data erratic, intermittent, or incorrect. An error in the EGR delta pressure signal was detected at initial key on or the sensor failed the autozero test.	possible reduced engine performance.
1867 412 2	Engine gas recircuilation temperature - Data erratic, intermittent, or incorrect. Engine misfire has been detected in multiple cylinder numbers.	Possible reduced engine performance.
1879 3251 3	Aftertreatment diesel particulate filter differential pressure sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at the aftertreatment differential pressure sensor circuit.	possible reduced engine performance.
1881 3251 4	Aftertreatment diesel particulate filter differential pressure sensor circuit - Voltage below normal or shorted to low source. Low signal voltage or open circuit detected at the aftertreatment differential pressure sensor circuit.	possible reduced engine performance.
1883 3251 2	Aftertreatment diesel particulate filter differential pressure sensor - Data erratic, intermittent, or incorrect. The aftertreatment diesel particulate filter differential pressure sensor is reading an erratic value at initial key on or during engine operation.	possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
1885 3216 4	Aftertreatment intake NOx sensor circuit - Voltage below normal or shorted to low source. An internal circuit error has been detected by the aftertreatment intake NOx sensor.	Possible reduced engine performance.
1887 3226 4	Aftertreatment outlet NOx sensor circuit - Voltage below normal or shorted to low source. An internal circuit error has been detected by the aftertreatment outlet NOx sensor.	Possible reduced engine performance.
1896 2791 13	EGR valve controller - Out of calibration. The EGR valve has failed the automatic calibration procedure at initial key ON.	Possible reduced engine performance.
1921 3251 0	Aftertreatment diesel particulate filter differential pressure - Data valid but above normal operating range - Moderately severe level. The soot load of the aftertreatment diesel particulate filter has exceeded the recommended limits.	Possible reduced engine performance.
1922 3251 0	Aftertreatment diesel particulate filter differential pressure - Data valid but above normal operating range - Most severe level. The soot load of the aftertreatment diesel particulate filter has exceeded the recommended limits. Engine protection derate is enabled.	Possible reduced engine performance.
1938 3597 1	Ecu power output supply voltage 1 - Data valid but below normal operational range - Moderately severe level. Low battery voltage detected by the VGT actuator.	Possible reduced engine performance.
1942 101 2	Crankcase pressure - Data erratic, intermittent, or incorrect. The ECM has detected that the crankcase pressure signal is reading an erratic value at initial key ON or during engine operation.	None on performance.
1961 2791 0	EGR valve control circuit calculated over temperature - Data valid but above normal operational range - Least severe level. High EGR valve driver temperature has been detected.	Possible reduced engine performance.
1962 641 0	VGT Actuator driver over temperature (calculated) - Data valid but above normal operating range - Least severe level. High internal VGT actuator temperature has been detected.	None on performance.
1974 101 16	Crankcase pressure - Data valid but above normal operating range - Moderately severe level. The crankcase breather filter requires maintenance.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
1993 4795 31	Aftertreatment diesel particulate filter missing - Condition exists. The aftertreatment diesel particulate filter in the exhaust system is not present.	Active aftertreatment diesel particulate filter regeneration will be disabled.
2185 3512 3	Sensor supply 4 circuit - Voltage above normal, or shorted to high source. High voltage detected at 5 VDC sensor supply circuit to the accelerator pedal position sensor.	Engine will only idle.
2186 3512 4	Sensor supply 4 circuit - Voltage below normal, or shorted to low source. Low voltage detected at 5 VDC sensor supply circuit to the accelerator pedal position sensor.	Engine will only idle.
2198 641 11	VGT Actuator driver circuit - Root cause not known. Intermittent communication between the smart VGT controller and the ECM has been detected. The VGT controller is not interpreting the J1939 message from the ECM correctly.	Possible reduced engine performance.
2272 27 4	EGR Valve position circuit - Voltage below normal or shorted to low source. Low signal voltage has been detected at the EGR valve position sensor circuit	Possible reduced engine performance.
2273 411 3	Exhaust gas recirculation valve delta pressure sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at the EGR differential pressure sensor circuit.	Possible reduced engine performance.
2274 411 4	Exhaust gas recirculation valve delta pressure sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the EGR differential pressure sensor circuit.	Possible reduced engine performance.
2288 103 15	Turbocharger 1 speed - Data valid but above normal operating range - Least severe level. High turbocharger speed has been detected by the ECM.	Possible reduced engine performance.
2311 633 31	Electronic fuel injection control valve circuit - Condition exists. Fuel pump actuator circuit resistance too high or too low, or an intermittent connection has been detected.	Possible reduced engine performance.
2322 723 2	Engine camshaft speed / position sensor - Data erratic, intermittent, or incorrect. Camshaft engine speed sensor intermittent synchronization.	None on performance.
2349 2791 5	EGR Valve control circuit - Current below normal or open circuit. Motor terminal or motor coil open circuit has been detected by the ECM.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
2353 2791 6	EGR Valve control circuit - Current above normal or grounded circuit. A short circuit to ground has been detected in the EGR valve motor circuit.	Possible reduced engine performance.
2372 95 16	Fuel filter differential pressure - Data valid but above normal operational range - Moderately severe level. Excessive fuel flow restriction to the high pressure fuel pump has been detected.	Possible reduced engine performance.
2373 1209 3	Exhaust gas pressure sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at the exhaust gas pressure circuit.	Possible reduced engine performance.
2374 1209 4	Exhaust gas pressure sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the exhaust gas pressure circuit.	Possible reduced engine performance.
2375 412 3	Exhaust gas recirculation temperature sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at EGR temperature circuit.	Possible reduced engine performance.
2376 412 4	Exhaust gas recirculation temperature sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at EGR temperature circuit.	Possible reduced engine performance.
2377 647 3	Fan control circuit - Voltage above normal, or shorted to high source. Open circuit or high voltage detected at the fan control circuit.	The fan can stay on continuously or **not** run at all.
2387 641 7	VGT Actuator driver circuit (motor) - Mechanical system not responding or out of adjustment. The smart VGT controller has detected incorrect stop limits, or the VGT is unable to move to the closed position.	Possible reduced engine performance.
2398 171 2	Ambient air temperature - Data erratic, intermittent, or incorrect. The ambient air temperature sensor is reading an erratic value.	Possible reduced engine performance.
2448 111 17	Coolant level - Data valid but below normal operational range - Least severe level. Low engine coolant level detected.	none on performance.
2449 641 13	Vgt actuator controller - Out of calibration. The VGT actuator has been installed incorrectly.	Possible reduced engine performance.
2468 102 3	Engine crankshaft speed/position - Data valid but above normal operating range - Moderately severe level. The engine speed has exceeded a critical limit.	Engine will be shut down.
2554 1209 2	Exhaust gas pressure - Data erratic, intermittent or incorrect. The exhaust gas pressure sensor is reading an erratic value.	possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
2555 729 3	Intake air heater 1 circuit - Voltage above normal, or shorted to high source. High voltage detected at the intake air heater signal circuit.	The intake air heaters may be ON or OFF all the time.
2556 729 4	Intake air heater 1 circuit - Voltage below normal, or shorted to low source. Low voltage detected at the intake air heater signal circuit.	The intake air heaters may be ON or OFF all the time.
2634 641 12	VGT Actuator controller - Bad intelligent device or component. An internal error has been detected by the smart VGT controller.	Possible reduced engine performance.
2636 641 9	VGT Actuator driver circuit - abnormal update rate. No communications on the J1939 data link between the engine ECM and the smart VGT controller.	Possible reduced engine performance.
2638 5298 17	Aftertreatment diesel oxidation catalyst conversion efficiency - Data valid but below normal operating range - Least severe level. The temperature increase across the aftertreatment diesel oxidation catalyst is lower than expected.	Possible frequent need for aftertreatment regeneration.
2639 3251 15	Aftertreatment diesel particulate filter differential pressure - Data valid but above normal operating range - Least severe level. The soot load of the aftertreatment diesel particulate filter has exceeded the recommended limits.	Possible reduced engine performance.
2646 110 32	Engine coolant temperature - Condition exists. The EGR valve was closed to reduce engine coolant temperature.	Possible reduced engine performance.
2718 520325 31	Brake switch and accelerator pedal position incompatible - Condition exists. The ECM has detected the brake pedal and accelerator pedal were depressed simultaneously.	The engine will operate in limp home mode.
2771 3226 9	Aftertreatment outlet NOx sensor - Abnormal update rate. No communications or an invalid data transfer rate detected on the J1939 data link between the ECM and the aftertreatment outlet NOx sensor.	Possible reduced engine performance.
2777 3703 31	Particulate trap active regeneration inhibited due to inhibit switch - Condition exists. Regeneration of the diesel particulate filter has been prevented due to the permit switch being disabled.	Possible frequent need for aftertreatment regeneration.
2961 412 15	Exhaust gas recirculation temperature - Data valid but above normal operational range - Least severe level. EGR temperature has exceeded the engine protection limit.	Possible reduced engine performance.
2962 412 16	Exhaust gas recirculation temperature - Data valid but above normal operational range - Moderately severe level. EGR temperature has exceeded the engine protection limit.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
2963 110 15	Engine coolant temperature - Data valid but above normal operational range - Least severe level. Engine coolant temperature is above the engine protection warning limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the Engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
2964 105 15	Intake manifold 1 temperature - Data valid but above normal operational range - Least severe level. Intake manifold air temperature signal indicates intake manifold air temperature is above engine protection warning limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the Engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
2973 102 2	Intake manifold 1 pressure - Data erratic, intermittent, or incorrect. The intake manifold pressure sensor is reading an erratic value.	Possible reduced engine performance.
2976 3361 2	Aftertreatment diesel exhaust fluid dosing unit temperature - Data erratic, intermittent, or incorrect. An internal error has been detected in the aftertreatment diesel exhaust fluid dosing unit.	Possible reduced engine performance.
3133 3610 3	Aftertreatment diesel particulate filter outlet pressure sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the aftertreatment diesel particulate filter outlet pressure sensor circuit.	Possible reduced engine performance.
3134 3610 4	Aftertreatment diesel particulate filter outlet pressure sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the aftertreatment diesel particulate filter outlet pressure sensor circuit.	Possible reduced engine performance.
3135 3610 2	Aftertreatment diesel particulate filter outlet pressure - Data erratic, intermittent or incorrect. The aftertreatment diesel particulate filter outlet pressure sensor is reading an erratic value at initial key ON or during engine operation.	Possible reduced engine performance.
3146 4363 3	Aftertreatment SCR outlet temperature sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at the SCR outlet temperature sensor circuit.	Possible reduced engine performance.
3147 4363 4	Aftertreatment SCR outlet temperature sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the SCR outlet temperature sensor circuit.	Possible reduced engine performance.
3148 4363 2	Aftertreatment SCR outlet temperature sensor - Data erratic, intermittent, or incorrect. The SCR outlet temperature sensor is not changing with engine operating conditions.	Possible reduced engine performance.
3151 4794 31	Aftertreatment SCR catalyst system missing - Condition exists. The aftertreatment SCR catalyst in the exhaust system is not present.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3165 4363 0	Aftertreatment SCR outlet temperature - Data valid but above normal operational range - Most severe level. The SCR outlet temperature sensor reading has exceeded the maximum engine protection temperature limit.	Possible reduced engine performance.
3168 3936 16	Aftertreatment diesel particulate filter system - Data valid but above normal operating range - Moderately severe level. The system has detected a malfunction in the filtering capability of the aftertreatment diesel particulate filter.	None on performance.
3186 1623 9	Tachograph output shaft speed - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the tachograph output shaft speed sensor.	None on performance.
3213 1623 19	Tachograph output shaft speed - Received network data in error. The J1939 multiplexing controller has indicated a malfunction of the tachograph output shaft speed sensor.	None on performance.
3228 3216 2	Aftertreatment Intake NOx sensor - Data erratic, intermittent, or incorrect. An incorrect NOx sensor reading has been detected by the aftertreatment intake NOx sensor.	Possible reduced engine performance.
3232 3216 9	Aftertreatment Intake NOx sensor - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the aftertreatment intake NOx sensor.	Possible reduced engine performance.
3235 4363 16	Aftertreatment SCR outlet temperature - Data valid but above normal operating range - Moderately severe level. The SCR outlet temperature sensor reading has exceeded the maximum temperature limit.	Possible reduced engine performance.
3237 4340 3	Aftertreatment diesel exhaust fluid line heater 1 circuit - Voltage above normal or shorted to high source. High signal voltage detected at the diesel exhaust fluid line heater 1 circuit.	Possible reduced engine performance.
3238 4340 4	Aftertreatment diesel exhaust fluid line heater 1 circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the diesel exhaust fluid line heater 1 circuit.	Possible reduced engine performance.
3239 4342 3	Aftertreatment diesel exhaust fluid line heater 2 circuit - Voltage above normal or shorted to high source. High signal voltage detected at the diesel exhaust fluid line heater 2 circuit.	Possible reduced engine performance.
3241 4342 4	Aftertreatment diesel exhaust fluid line heater 2 circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the diesel exhaust fluid line heater 2 circuit.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3242 3363 7	Aftertreatment diesel exhaust fluid tank heater - Mechanical system not responding or out of adjustment. The aftertreatment diesel exhaust fluid temperature did not increase when the aftertreatment diesel exhaust fluid tank heater was commanded ON.	Possible reduced engine performance.
3243 3060 18	Engine cooling system monitor - Data valid but below normal operating range - Moderately severe level. The engine is not warming up as expected.	None on performance.
3251 4765 16	Aftertreatment diesel oxidation catalyst intake temperature - Data valid but above normal operating range - Moderately severe level. The diesel oxidation catalyst intake temperature sensor reading has exceeded the maximum temperature limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the Engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
3253 3242 16	Aftertreatment diesel particulate filter intake temperature - Data valid but above normal operating range - Moderately severe level. The aftertreatment diesel particulate filter intake temperature sensor reading has exceeded the maximum engine protection temperature limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the Engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
3254 3242 15	Aftertreatment diesel particulate filter intake temperature - Data valid but above normal operating range - Least severe level. The aftertreatment diesel particulate filter intake temperature sensor reading has exceeded the maximum engine protection temperature limit.	Possible reduced engine performance.
3255 3246 16	Aftertreatment diesel particulate filter outlet temperature - Data valid but above normal operating range - Moderately severe level. The aftertreatment diesel particulate filter outlet temperature sensor reading has exceeded the maximum engine protection temperature limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
3256 3246 15	Aftertreatment diesel particulate filter outlet temperature - Data valid but above normal operating range - Least severe level. The aftertreatment diesel particulate filter outlet temperature sensor reading has exceeded the maximum engine protection temperature limit.	Possible reduced engine performance.
3258 4340 5	Aftertreatment diesel exhaust fluid line heater 1 circuit - Current below normal or open circuit. Open circuit detected in the diesel exhaust fluid line heater 1.	Possible reduced engine performance.
3261 4342 5	Aftertreatment diesel exhaust fluid line heater 2 circuit - Current below normal or open circuit. Open circuit detected in the diesel exhaust fluid line heater 2.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3311 3242 0	Aftertreatment diesel particulate filter intake temperature - Data valid but above normal operating range - Most severe level. The aftertreatment diesel particulate filter intake temperature sensor reading has exceeded the maximum engine protection temperature limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
3312 3246 0	Aftertreatment diesel particulate filter outlet temperature - Data valid but above normal operating range - Most severe level. The aftertreatment diesel particulate filter outlet temperature sensor reading has exceeded the maximum engine protection temperature limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
3313 4765 4	Aftertreatment diesel oxidation catalyst intake temperature sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the catalyst intake sensor circuit.	Possible reduced engine performance.
3314 4765 3	Aftertreatment diesel oxidation catalyst intake temperature sensor circuit - Voltage above normal or shorted to high source. High signal voltage detected at the catalyst intake temperature sensor circuit.	Possible reduced engine performance.
3315 4765 2	Aftertreatment diesel oxidation catalyst intake temperature - Data erratic, intermittent, or incorrect. The aftertreatment diesel oxidation catalyst intake temperature sensor is not changing with engine operating conditions.	Possible reduced engine performance.
3316 3242 4	Aftertreatment diesel particulate filter intake temperature sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the aftertreatment diesel particulate filter intake temperature sensor circuit.	Possible reduced engine performance.
3317 3242 3	Aftertreatment diesel particulate filter intake temperature sensor circuit - Voltage above normal or shorted to high source. High signal voltage or open circuit detected at the aftertreatment diesel particulate filter intake temperature sensor circuit.	Possible reduced engine performance.
3318 3242 2	Aftertreatment diesel particulate filter intake temperature - Data erratic, intermittent, or incorrect. The aftertreatment diesel particulate filter intake temperature is not changing with engine operating conditions.	Possible reduced engine performance.
3319 3246 3	Aftertreatment diesel particulate filter outlet temperature sensor circuit - Voltage above normal or shorted to high source. High signal voltage or open circuit detected at the aftertreatment diesel particulate filter outlet temperature sensor circuit.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3321 3246 4	Aftertreatment diesel particulate filter outlet temperature sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the aftertreatment diesel particulate filter outlet temperature sensor circuit.	Possible reduced engine performance.
3322 3246 2	Aftertreatment diesel particulate filter outlet temperature - Data erratic, intermittent, or incorrect. The aftertreatment diesel particulate filter outlet temperature is not changing with engine operating conditions.	Possible reduced engine performance.
3326 91 9	SAE J1939 Multiplexed accelerator pedal or lever sensor system - Abnormal update rate. The ECM expected information from a multiplexed accelerator pedal or lever sensor but did not receive it soon enough or did not receive it at all.	Engine will only idle.
3328 191 9	Transmission output shaft speed - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the transmission output shaft speed sensor.	None on performance.
3342 4752 18	Engine exhaust gas recirculation cooler efficiency - Data valid but below normal operating range - Moderately severe level. The EGR cooler is not cooling the recirculated exhaust gas sufficiently.	None on performance.
3343 5285 18	Engine charge-air cooler efficiency - Data valid but below normal operating range - Moderately severe level. The engine charge air cooler is not cooling the intake air flow sufficiently.	None on performance.
3361 102 10	Intake manifold 1 pressure - Abnormal rate of change. The VGT position reading is stuck.	Possible reduced engine performance.
3366 111 18	Coolant level - Data valid but below normal operating range - Moderately severe level. Very low engine coolant level detected.	None on performance.
3374 1818 31	Roll over protection brake control active - Condition exists. The ECM received a message from the anti-lock braking (ABS) controller, inhibiting cruise control operation.	Cruise control could possibly not operate.
3375 5397 31	Aftertreatment diesel particulate filter regeneration too frequent - Condition exists. The system has detected the need for an active regeneration has occurred too soon following the last active regeneration.	None on performance.
3376 5319 31	Aftertreatment diesel particulate filter incomplete regeneration - Condition exists. The system has detected that the aftertreatment diesel particulate filter differential pressure is too high following an active regeneration.	Possible frequent need for aftertreatment regeneration.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3382 3058 18	Engine exhaust gas recirculation (EGR) system - Data valid but below normal operating range - Moderately severe level. Measured egr flow is lower than commanded.	Possible reduced engine performance.
3383 3058 16	Engine exhaust gas recirculation (EGR) system - Data valid but above normal operating range - Moderately severe Level. Measured EGR flow is higher than commanded.	Possible reduced engine performance.
3394 4766 18	Aftertreatment 1 diesel oxidation catalyst outlet gas temperature - Data valid but below normal operating range - Moderately severe level. The diesel oxidation catalyst outlet Temperature is below the operating limit	Possible frequent need for aftertreatment regeneration.
3396 3750 31	Diesel particulate filter 1 conditions not met for active regeneration - Condition exists. The aftertreatment temperatures are not warm enough for aftertreatment injection.	Possible frequent need for aftertreatment regeneration.
3418 191 19	Transmission output shaft speed - Received network data in error. The J1939 multiplexing controller has indicated a malfunction of the transmission output shaft speed sensor.	None on performance.
3422 4344 3	Aftertreatment diesel exhaust fluid line heater 3 circuit - Voltage above normal or shorted to high source. High signal voltage detected at the diesel exhaust fluid line heater 3 circuit.	Possible reduced engine performance.
3423 4344 4	Aftertreatment diesel exhaust fluid line heater 3 circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the diesel exhaust fluid line heater 3 circuit.	Possible reduced engine performance.
3425 4344 5	Aftertreatment diesel exhaust fluid line heater 3 circuit - Current below normal or open circuit. Open circuit detected in the diesel exhaust fluid line heater 3.	Possible reduced engine performance.
3488 563 9	Anti-lock braking (ABS) controller - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the anti-lock braking (ABS) controller.	None on performance.
3492 251 10	Real time clock - Abnormal rate of change. The real time clock indicates a stuck engine off timer.	None on performance.
3494 1081 7	Engine wait to start lamp - Mechanical system not responding or out of adjustment. Wait to Start lamp has malfunction.	None on performance.
3497 1761 17	Aftertreatment diesel exhaust fluid tank level - Data valid but below normal operating range - Least severe level. The aftertreatment diesel exhaust fluid tank level is low.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3498 1761 18	Aftertreatment diesel exhaust fluid tank level - Data valid but below normal operating range - Moderately severe level. The aftertreatment diesel exhaust fluid tank level is very low.	None on performance.
3525 84 19	Wheel-based vehicle speed - Received network data in error. The J1939 multiplexing controller has indicated a malfunction of the wheel-based vehicle speed sensor.	Engine speed limited to maximum engine speed without VSS parameter value. Cruise control, gear-down protection, and road speed governor will not work.
3526 84 9	Wheel-Based vehicle speed - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the wheel-based vehicle speed sensor.	Engine speed limited to maximum engine speed without VSS parameter value. Cruise control, gear-down protection, and road speed governor will not work.
3527 558 19	Accelerator pedal or lever idle validation switch - Received network data in error. The J1939 multiplexing controller has indicated a malfunction of the accelerator pedal or lever idle validation switch.	The engine will only idle.
3528 558 9	Accelerator pedal or lever idle validation switch - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the accelerator pedal or lever idle validation switch.	Engine will only idle.
3531 171 9	Ambient air temperature - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the ambient air temperature sensor.	Possible reduced engine performance.
3532 171 19	Ambient air temperature - Received network data in error. The J1939 multiplexing controller has indicated a malfunction of the ambient air temperature sensor.	Possible reduced engine performance.
3539 51 3	Engine intake throttle actuator position sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the engine intake air throttle position sensor circuit.	Possible reduced engine performance.
3541 51 4	Engine intake throttle actuator position sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the engine intake air throttle position sensor circuit.	Possible reduced engine performance.
3542 51 2	Engine intake throttle actuator position sensor - Data erratic, intermittent or incorrect. The engine intake air throttle posistion feedback is erratic or incorrect.	Possible reduced engine performance.
3545 3226 10	Aftertreatment outlet NOx sensor circuit - Abnormal rate of change. The aftertreatment outlet NOx sensor reading is not valid.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3547 4096 31	Aftertreatment diesel exhaust fluid tank empty - Condition exists. The diesel exhaust fluid tank is empty.	Possible reduced engine performance.
3555 1081 9	Engine wait to start lamp - Abnormal update rate. A loss of communication has been detected.	None on performance.
3556 1081 19	Engine wait to start lamp - Received network data in error. The ECM received an invalid signal on the SAE J1939 datalink.	None on performance.
3558 3361 3	Aftertreatment diesel exhaust fluid dosing unit - Voltage above normal or shorted to high source. High signal voltage detected at the aftertreatment diesel exhaust fluid dosing unit.	Possible reduced engine performance.
3559 3361 4	Aftertreatment diesel exhaust fluid dosing unit - Voltage below normal or shorted to low source. Low signal voltage detected at the aftertreatment diesel exhaust fluid dosing unit.	Possible reduced engine performance.
3562 5491 3	Aftertreatment diesel exhaust fluid line heater relay - Voltage above normal or shorted to high source. High signal voltage detected at the diesel exhaust fluid line heater relay.	Possible reduced engine performance.
3563 5491 4	Aftertreatment diesel exhaust fluid line heater relay - Voltage below normal or shorted to low source. Low signal voltage detected at the diesel exhaust fluid line heater relay.	Possible reduced engine performance.
3567 5394 5	Aftertreatment diesel exhaust fluid dosing valve - Current below normal or open circuit. A circuit error has been detected in the aftertreatment diesel exhaust fluid dosing valve circuit.	Possible reduced engine performance.
3568 5394 7	Aftertreatment diesel exhaust fluid (DEF) Dosing valve - Mechanical system not responding or out of adjustment. A mechanical malfunction has been detected in the DEF dosing valve.	Possible reduced engine performance.
3571 4334 3	Aftertreatment diesel exhaust fluid pressure sensor - Voltage above normal or shorted to high source. High signal voltage detected at the aftertreatment diesel exhaust fluid pressure sensor circuit.	Possible reduced engine performance.
3572 4334 4	Aftertreatment diesel exhaust fluid pressure sensor - Voltage below normal or shorted to low source. Low signal voltage detected at the diesel exhaust fluid pressure sensor circuit.	Possible reduced engine performance.
3574 4334 18	Aftertreatment diesel exhaust fluid pressure sensor - Data valid but below normal operating range - Moderately severe level. Low diesel exhaust fluid pressure has been detected in the dosing unit.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3575 4334 16	Aftertreatment diesel exhaust fluid pressure sensor - Data valid but above normal operating range - Moderately severe level. The diesel exhaust fluid dosing unit has detected a blockage in the diesel exhaust fluid return flow.	Possible reduced engine performance.
3577 4376 3	Aftertreatment diesel exhaust fluid return valve - Voltage above normal or shorted to high source. High signal voltage detected at the aftertreatment diesel exhaust fluid return valve.	Possible reduced engine performance.
3578 4376 4	Aftertreatment diesel exhaust fluid return valve - Voltage below normal, or shorted to low source. Low signal voltage detected at the diesel exhaust fluid return valve.	Possible reduced engine performance.
3582 4364 18	Aftertreatment SCR catalyst conversion efficiency - Data valid but below normal operating range - Moderately severe level. NOx conversion across the SCR catalyst is too low.	Possible reduced engine performance.
3583 5031 10	Aftertreatment outlet NOx sensor heater - Abnormal rate of change. The aftertreatment outlet NOx sensor heater is unable to maintain its normal operating temperature.	None on performance.
3596 4334 2	Aftertreatment diesel exhaust fluid pressure sensor - Data erratic, intermittent, or incorrect. The diesel exhaust fluid pressure sensor has reported a reading too high or low for the operating conditions.	Possible reduced engine performance.
3649 5024 10	Aftertreatment Intake NOx sensor heater - Abnormal rate of change. The aftertreatment intake NOx sensor heater is unable to maintain its normal operating temperature.	None on performance.
3681 3228 2	Aftertreatment outlet NOx sensor power supply - Data erratic, intermittent, or incorrect. The aftertreatment outlet NOx sensor indicates that the power supply to the sensor is incorrect.	None on performance.
3682 3218 2	Aftertreatment Intake NOx sensor power supply - Data erratic, entermittent or encorrect. The aftertreatment intake NOx sensor indicates that the power supply to the sensor is incorrect.	None on performance.
3697 630 12	Engine control module calibration memory - Bad intelligent device or component. Error internal to the ECM related to engine software failures.	Engine may not start or may be difficult to start.
3712 5246 0	Aftertreatment SCR operator inducement - Data valid but above normal operational range - Most severe level. Critical SCR related fault codes have been active for an extended period of time and require immediate attention.	Vehicle speed will be limited to 8 ㎞ [5 miles] per hour.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3714 1569 31	Engine protection torque derate - Condition exists. Critical fault codes related to engine operation are active.	Possible reduced engine performance.
3715 188 16	Engine speed at idle - Data valid but below normal operating range - Moderately severe level. The engine speed at idle has exceeded the governed idle speed.	Possible reduced engine performance.
3716 188 18	Engine speed at idle - Data valid but below normal operational range - Moderately severe level. Engine is not maintaining the governed idle speed.	None on performance.
3717 3226 13	Aftertreatment outlet NOx sensor - Out of calibration. A calibration mismatch between the aftertreatment outlet NOx sensor and the ECM has been detected.	None on performance.
3718 3216 13	Aftertreatment intake NOx - Out of calibration. A calibration mismatch between the aftertreatment intake NOx sensor and the ECM has been detected.	None on performance.
3724 168 17	Battery 1 voltage - Data valid but below normal operating range - Least severe level. Low voltage to the EGR valve device driver has been detected.	Possible reduced engine performance.
3725 3216 10	Aftertreatment Intake NOx sensor - Abnormal rate of change. The aftertreatment intake NOx sensor reading is not valid.	None on performance.
3727 5571 7	High pressure common rail fuel pressure relief valve - Mechanical system not responding or out of adjustment. The fuel rail high-pressure relief valve has opened at a lower than expected pressure.	Possible reduced engine performance.
3737 1675 31	Engine starter mode overcrank protection - Condition exists. The starter motor has been temporarily disabled in order to prevent starter damage.	Starter operation is prohibited until the starter motor has adequately cooled.
3741 5571 0	High pressure common rail fuel pressure relief valve - Data valid but above normal operational range - Most severe level. The fuel rail pressure relief valve has opened due to high fuel rail pressure.	Engine may run rough, may stop running, may not start, or may be difficult to start.
3749 3226 20	Aftertreatment outlet NOx sensor - Data not rational - Drifted high. An offset in the outlet NOx sensor reading has been detected.	None on performance.
3838 2978 9	Estimated engine parasitic losses - Percent torque - Abnormal update rate. A loss of communication has been detected.	None on performance.
3843 5603 9	Cruise control disable command - Abnormal update rate. No communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the cruise control.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
3844 5605 31	Cruise control pause command - Condition exists. The adaptive cruise control has dropped out and must be manually engaged.	Cruise control could possibly not operate.
3845 5603 31	Cruise control disable command - Condition exists. The adaptive cruise control has dropped out and must be manually engaged.	Cruise control could possibly not operate.
3899 5848 4	Aftertreatment 1 SCR Intermediate NH3 sensor - Voltage below normal, or shorted to low source. A circuit error has been detected in the NH3 sensor.	None on performance.
3911 5848 9	Aftertreatment SCR Intermediate NH3 sensor - Abnormal update rate. Loss of communication with the aftertreatment SCR intermediate NH3 sensor.	Possible reduced engine performance.
3912 5853 10	Aftertreatment SCR Intermediate NH3 sensor heater - Abnormal rate of change. A malfunction of the aftertreatment SCR intermediate NH3 sensor heater has been detected.	Possible reduced engine performance.
3932 5851 16	Aftertreatment SCR Intermediate NH3 gas sensor power supply - Data valid but above normal operating range - Moderately severe level. High battery voltage supply detected at the aftertreatment SCR intermediate NH3 sensor.	Possible reduced engine performance.
3933 5851 18	Aftertreatment SCR Intermediate NH3 gas sensor power supply - Data valid but below normal operating range - Moderately severe level. Low battery voltage supply detected at the aftertreatment SCR intermediate NH3 sensor.	Possible reduced engine performance.
3934 5851 2	Aftertreatment SCR Intermediate NH3 gas sensor power supply - Data erratic, intermittent or incorrect. Intermittent battery voltage supply detected at the aftertreatment SCR intermediate NH3 sensor.	Possible reduced engine performance.
3935 5848 13	Aftertreatment SCR Intermediate NH3 sensor - Out of calibration. Incorrect trim resistance has been detected in the aftertreatment SCR intermediate NH3 sensor.	Possible reduced engine performance.
3936 5848 12	Aftertreatment SCR Intermediate NH3 sensor - Bad intelligent device or component. An internal error of the aftertreatment SCR intermediate NH3 sensor has been detected.	Possible reduced engine performance.
3937 5848 10	Aftertreatment 1 SCR Intermediate NH3 sensor - Abnormal rate of change. The aftertreatment SCR intermediate NH3 sensor reading is NOT valid.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
4149 2623 8	Accelerator pedal or lever position sensor 2 circuit frequency - Abnormal frequency or pulse width or period. The accelerator pedal position sensor reading is out of range.	The engine will operate in Limp Home mode.
4151 5742 9	Aftertreatment diesel particulate filter temperature sensor module - Abnormal update rate. No communications on the J1939 data link between the ECM and the aftertreatment diesel particulate filter temperature sensor module.	Possible reduced engine performance.
4152 5743 9	Aftertreatment selective catalytic reduction temperature sensor module - Abnormal update rate. No communications on the J1939 data link between the ECM and the aftertreatment SCR temperature sensor module.	Possible reduced engine performance.
4155 5746 3	Aftertreatment 1 diesel exhaust fluid dosing unit heater relay - Voltage above normal, or shorted to high source. High signal voltage detected at the aftertreatment diesel exhaust fluid dosing unit heater relay circuit.	Possible reduced engine performance.
4156 5746 4	Aftertreatment 1 diesel exhaust fluid dosing unit heater relay - Voltage below normal, or shorted to low source. Low signal voltage detected at the aftertreatment diesel exhaust fluid dosing unit heater relay circuit.	Possible reduced engine performance.
4157 4376 7	Aftertreatment diesel exhaust fluid return valve - Mechanical system not responding or out of adjustment. A stuck aftertreatment diesel exhaust fluid return valve has been detected.	None on performance.
4158 5742 12	Aftertreatment diesel particulate filter temperature sensor module - Bad intelligent device or component. An internal error has been detected in the aftertreatment diesel particulate filter temperature sensor module.	Possible reduced engine performance.
4159 5743 12	Aftertreatment selective catalytic reduction temperature sensor module - Bad intelligent device or component. An internal error has been detected in the aftertreatment SCR temperature sensor module.	Possible reduced engine performance.
4161 5742 3	Aftertreatment diesel particulate filter temperature sensor module - Voltage above normal, or shorted to high source. High battery supply voltage detected at the aftertreatment diesel particulate filter temperature sensor module.	Possible reduced engine performance.
4162 5742 4	Aftertreatment diesel particulate filter temperature sensor module - Voltage below normal, or shorted to low source. Low battery supply voltage detected at the aftertreatment diesel particulate filter temperature sensor module.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
4163 5742 16	Aftertreatment diesel particulate filter temperature sensor module- Data valid but above normal operating range - Moderately severe level. High internal temperature detected in the aftertreatment diesel particulate filter temperature sensor module.	Possible reduced engine performance.
4164 5743 3	Aftertreatment selective catalytic reduction temperature sensor module - Voltage above normal, or shorted to high source. High battery supply voltage detected at the aftertreatment SCR temperature sensor module.	Possible reduced engine performance.
4165 5743 4	Aftertreatment selective catalytic reduction temperature sensor module - Voltage below normal, or shorted to low source. Low battery supply voltage detected at the aftertreatment SCR temperature sensor module.	Possible reduced engine performance.
4166 5743 16	Aftertreatment selective catalytic reduction temperature sensor module - Data valid but above normal operating range - Moderately severe level. High internal temperature detected in the aftertreatment SCR temperature sensor module.	Possible reduced engine performance.
4168 5745 3	Aftertreatment diesel exhaust fluid dosing unit heater - Voltage above normal, or shorted to high source. The aftertreatment diesel exhasut fluid dosing unit heater is detected to be stuck on.	None on performance.
4169 5745 5	Aftertreatment diesel exhaust fluid dosing unit heater - Voltage below normal, or shorted to low source. The aftertreatment diesel exhasut fluid dosing unit heater is detected to be stuck off.	Possible reduced engine performance.
4171 5745 18	Aftertreatment diesel exhaust fluid dosing unit heater - Data valid but below normal operating range - Moderately severe level. The aftertreatment diesel exhaust fluid dosing unit failed to thaw.	Possible reduced engine performance.
4213 3695 2	Aftertreatment diesel particulate filter regeneration inhibit switch - Data erratic, intermittent or incorrect. The diesel particulate filter regeneration permit switch is stuck in the OFF or INHIBIT position.	Possible frequent need for aftertreatment regeneration.
4215 563 31	Anti-lock braking (ABS) Active - Condition exists. Cruise control was paused due to an anti-wheel slip message from teh ABS controller.	Adaptive cruise control will not operate. Standard cruise control may not operate.
4244 4337 2	Aftertreatment diesel exhaust fluid dosing temperature - Data erratic, intermittent or incorrect. The aftertreatment diesel exhaust fluid dosing temperature is irrational.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
4245 5798 2	Aftertreatment diesel exhaust fluid dosing unit heater temperature - Data erratic, intermittent or incorrect. The aftertreatment diesel exhaust fluid dosing unit heater temperature is irrational.	None on performance.
4249 4337 10	Aftertreatment diesel exhaust fluid dosing temperature - Abnormal rate of change. The aftertreatment diesel exhaust fluid dosing unit temperature is stuck.	None on performance.
4251 5798 10	Aftertreatment 1 diesel exhaust fluid dosing unit heater temperature - Abnormal rate of change. The aftertreatment diesel exhaust fluid dosing unit heater temperature sensor reading is stuck.	None on performance.
4252 1081 31	Engine wait to start lamp - Condition exists. The received signal does not match the commanded signal.	None on performance.
4259 5742 11	Aftertreatment diesel particulate filter temperature sensor module - Root cause not known. Intermittent battery voltage supply detected at the aftertreatment diesel particulate filter temperature sensor module.	Possible reduced engine performance.
4261 5743 11	Aftertreatment selective catalytic reduction temperature sensor module - Root cause not known. Intermittent battery voltage supply detected at the aftertreatment SCR temperature sensor module.	Possible reduced engine performance.
4279 5848 21	Aftertreatment 1 SCR Intermediate NH3 - Data not rational - Drifted low. An in range low failure has been detected.	Possible reduced engine performance.
4281 5848 2	Aftertreatment SCR Intermediate NH3 - Data erratic, intermittent or incorrect. The aftertreatment SCR intermediate NH3 sensor reading is stuck.	None on performance.
4284 5793 9	Desired engine fueling state - Abnormal update rate. A valid message from the transmission ECU has NOT been received.	Engine may not start or may be difficult to start.
4289 91 8	Accelerator pedal or lever position sensor 1 circuit frequency - Abnormal frequency or pulse width or period. The accelerator pedal position sensor reading is out of range.	The engine will operate in limp home mode.
4452 520668 31	Aftertreatment outlet NOx sensor closed loop operation - Condition exists. The maximum dosing adjustment has been reached.	Possible reduced engine performance.
4453 520669 31	Aftertreatment intermediate NH3 sensor closed loop operation - Condition exists. The maximum dosing adjustment has been reached.	None on performance.
4517 237 13	Vehicle Identification number - Out of calibration. The vehicle identification number has not been programmed into the ECM.	None on performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
4518 5862 3	Aftertreatment SCR Intermediate gas temperature sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the aftreatment SCR intermediate temperature sensor circuit.	Possible reduced engine performance.
4519 5862 4	Aftertreatment SCR Intermediate gas temperature sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the aftertreatment SCR intermediate temperature sensor circuit.	Possible reduced engine performance.
4521 5862 2	Aftertreatment SCR Intermediate gas temperature sensor - Data erratic, intermittent or incorrect. The aftertreatment SCR intermediate temperature sensor reading is irrational.	Possible reduced engine performance.
4524 5862 0	Aftertreatment SCR intermediate gas temperature - Data valid but above normal operational range - Most severe level. The aftertreatment SCR intermediate temperature sensor reading is above the engine protection limit.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
4525 5862 16	Aftertreatment 1 SCR intermediate gas temperature - Data valid but above normal operating range - Moderately severe level. High SCR Intermediate temperature detected.	Progressive power and/or speed derate increasing in severity from time of alert. If the engine protection shutdown feature is enabled, the engine will shut down 30 seconds after the red STOP lamps starts flashing.
4526 521 2	Brake pedal position - Data erratic, intermittent or incorrect. The values of the 2 brake switch signals do not match.	None on performance.
4572 3031 9	Aftertreatment diesel exhaust fluid tank temperature - Abnormal update rate. The ECM lost communication with the aftertreatment diesel exhaust fluid tank temperature sensor.	Possible reduced engine performance.
4584 3936 14	Aftertreatment diesel particulate filter system - Special instructions. The incorrect aftertreatment diesel particulate filter system has been installed with the engine.	Engine will be shut down.
4585 4792 14	Aftertreatment 1 SCR catalyst system - Special instructions. The incorrect SCR system has been Installed.	Engine will be shut down.
4612 520701 31	Engine intake manifold pressure system monitor - Condition exists. The engine is unable to meet the air handling system commands.	Possible reduced engine performance.
4658 4331 18	Aftertreatment SCR actual dosing reagent quantity - Data valid but below normal operating range - Moderately severe level. Low aftertreatment diesel exhaust fluid flow detected.	Possible reduced engine performance.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
4691 5585 18	Engine injector metering rail 1 cranking pressure - Data valid but below normal operating range - Moderately severe level. The fuel rail pressure during cranking is too low for the engine to start.	Engine may not start or may be difficult to start.
4713 5357 31	Engine fuel injection quantity error for multiple cylinders - Condition exists. A malfunction of all fuel injectors has been detected.	Engine may run rough, may stop running, may not start, or may be difficult to start.
4726 1239 16	Engine fuel leakage - Data valid but above normal operating range - Moderately severe level. Fuel rail pressure decay has been detected.	Engine may run rough, may stop running, may not start, or may be difficult to start.
4727 157 15	Injector metering rail 1 pressure - Data valid but above normal operating range - Least severe level. A self pumping condition has been detected in the fuel system.	Possible reduced engine performance.
4731 3031 13	Aftertreatment diesel exhaust fluid tank temperature sensor - Out of calibration. The received datalink message was not valid.	Possible reduced engine performance.
4732 1761 13	Aftertreatment diesel exhaust fluid tank level sensor - Out of calibration. The received datalink message was not valid.	None on performance.
4739 1761 11	Aftertreatment 1 diesel exhaust fluid tank level sensor - Root cause not known. An unknown error has been detected with the aftertreatment diesel exhaust fluid tank level sensor.	Possible reduced engine performance.
4769 1761 10	Aftertreatment 1 diesel exhaust fluid tank level sensor - Abnormal rate of change. A valid diesel exhaust fluid tank level reading has NOT been received.	Possible reduced engine performance.
4865 6303 3	Engine coolant level 2 sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the engine coolant level 2 circuit.	None on performance.
4866 6303 4	Engine coolant level 2 sensor circuit - Voltage below normal, or shorted to low source. Low signal voltage detected at the engine coolant level 2 circuit.	None on performance.
4956 520750 13	Engine variable geometry turbo (VGT) software - Out of calibration. VGT software does not match application.	Possible reduced engine performance.
4957 520750 31	Engine variable geometry turbo (VGT) software - Condition exists. The VGT actuator and ECM software is not compatible.	Possible reduced engine performance.

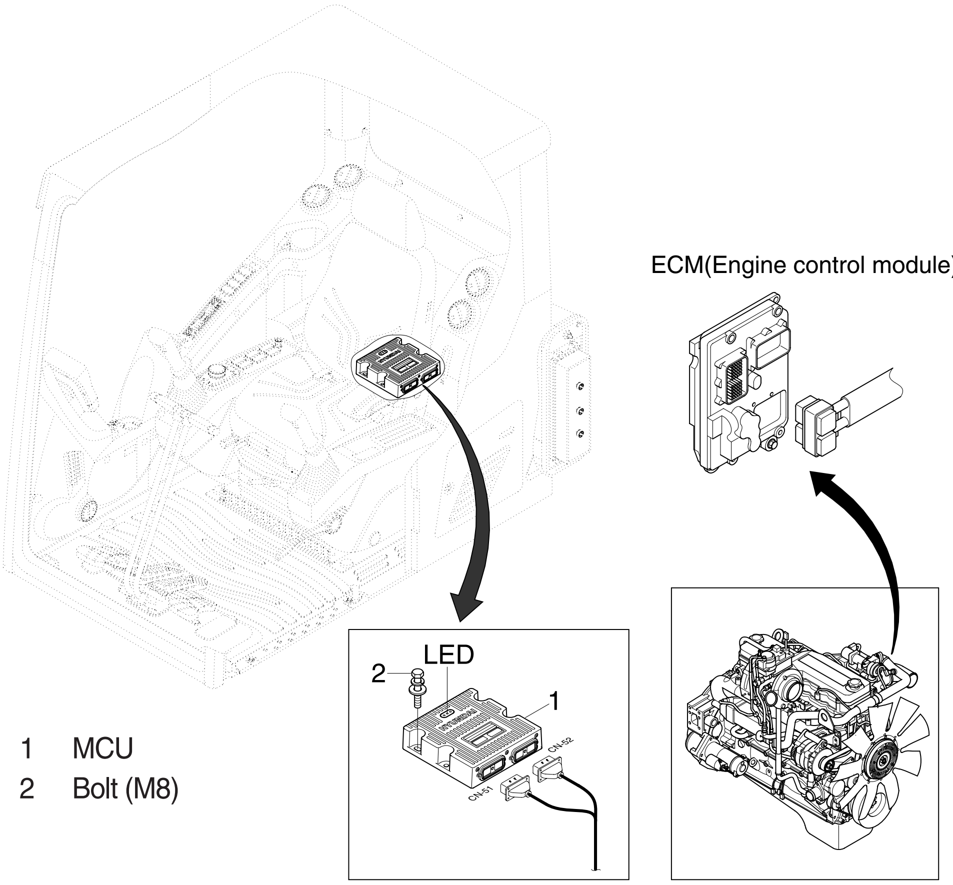
※ Some fault codes are not applied to this machine.

5. AAVM FAULT CODE

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

GROUP 14 ENGINE CONTROL SYSTEM

(SERIAL NO. : -#1094)
1. MCU AND ENGINE ECM



300L5MS13

2. MCU ASSEMBLY

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

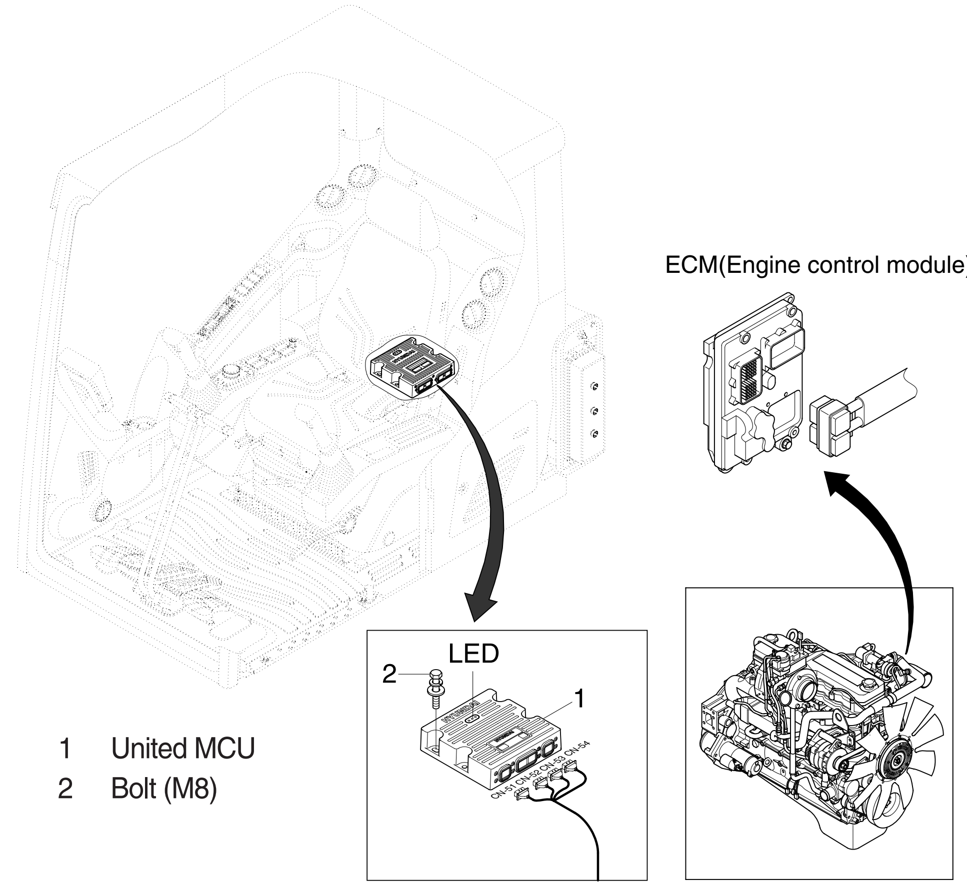
2) Three LED lamps on the MCU display as below.

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

G : green, R : red, Y : yellow

(SERIAL NO. : #1095-)

1. UNITED MCU AND ENGINE ECM



1 United MCU
2 Bolt (M8)

300L5MS113

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 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

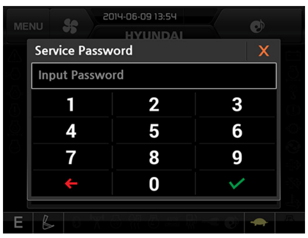
Mode		Pressure		Electric current (mA)	Engine rpm (at multimodal dial 10)	
		kgf/cm^2	psi		No load	load
Standard	P	8	114	290 ± 30	1800 ± 50	1950 ± 50
	S	10 ± 3	142 ± 40	330 ± 30	1700 ± 50	1850 ± 50
	E	12 ± 3	171 ± 40	360 ± 30	1600 ± 50	1750 ± 50
Option	P	8	114	290 ± 30	1800 ± 50	1900 ± 50
	S	10 ± 3	142 ± 40	330 ± 30	1700 ± 50	1800 ± 50
	E	12 ± 3	171 ± 40	360 ± 30	1600 ± 50	1700 ± 50

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

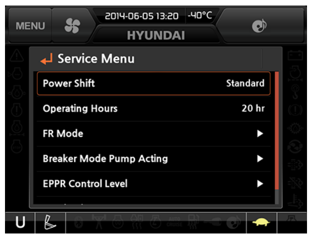
You can switch the EPPR valve pressure set by selecting the power shift (standard ↔ option).

- Management
  · Service menu

290F3CD149



Enter the password 290F3CD126



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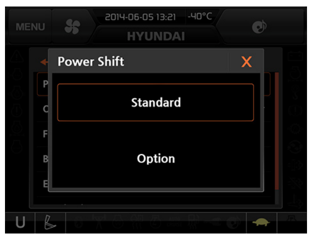

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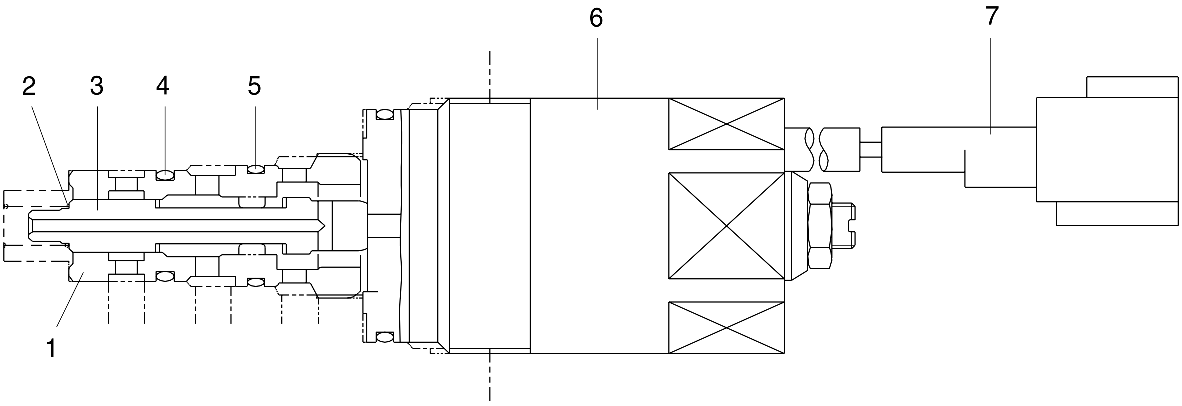
· Power shift (standard/option) : Power shift pressure can be set by option menu.

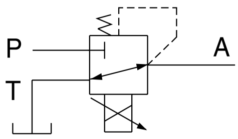
3) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



5-22(1)

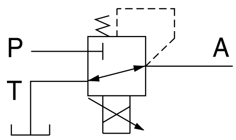
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

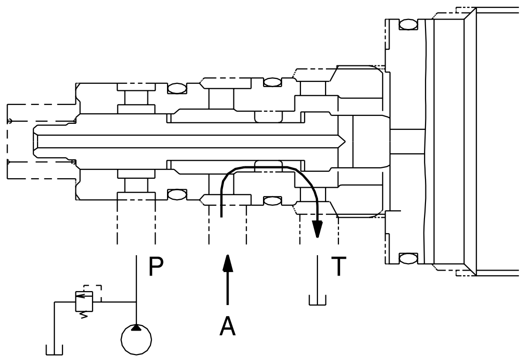


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

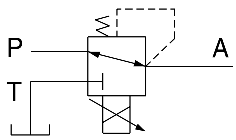
Pressure line is blocked and A oil returns to tank.

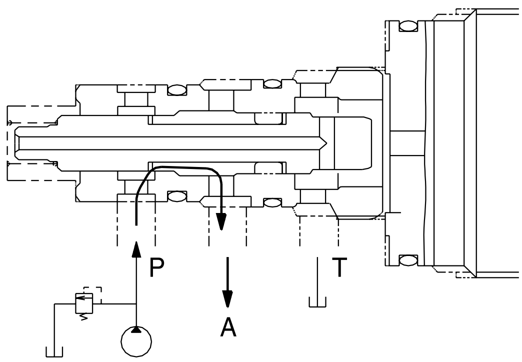




(3) Operating

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.

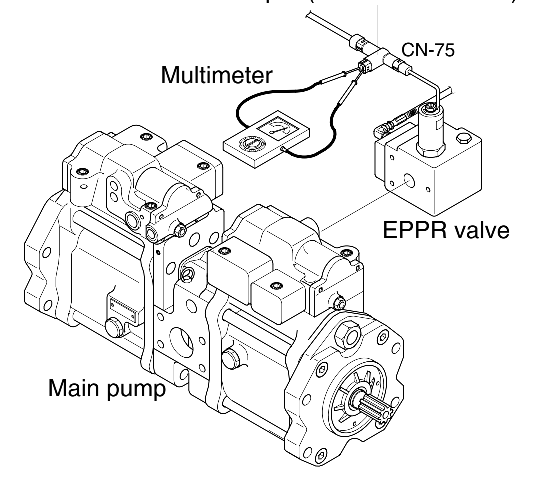
③ Start engine.

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/cm^2 (0 to 725 psi)

② Start engine.

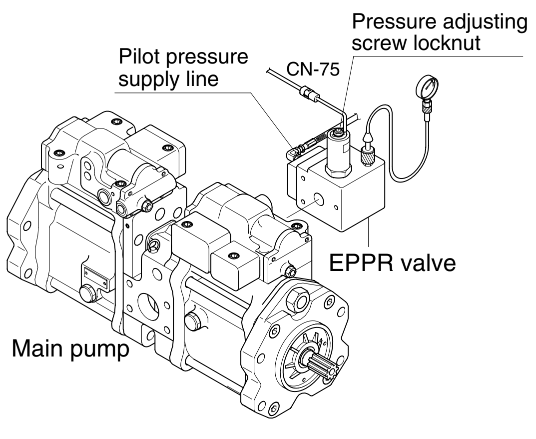
③ Set S-mode and cancel auto decel mode.

④ Position the multimodal dial at 10.

⑤ If tachometer show approx 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.



CLUSTER CONNECTOR (SERIAL NO. : #1095-)

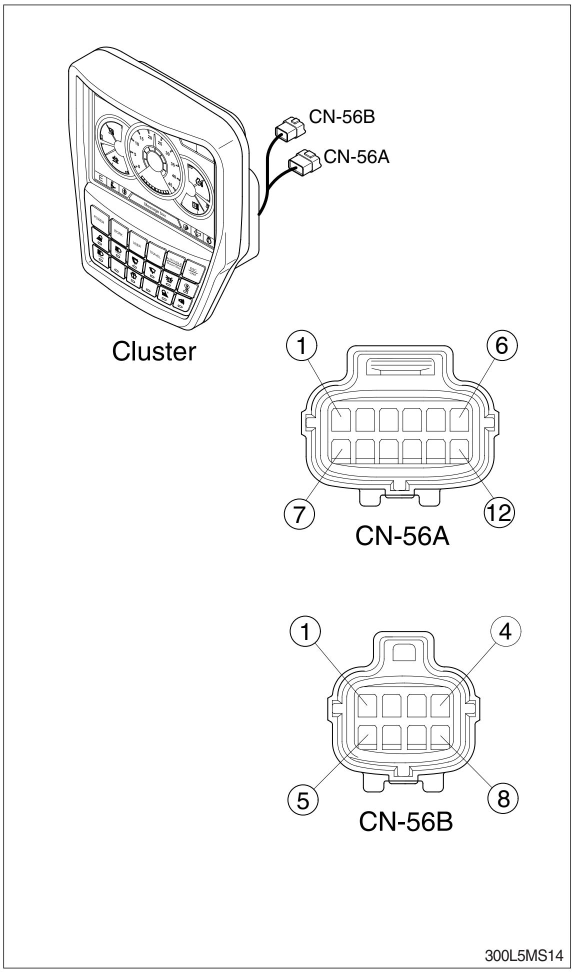
1) CN-56A

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	0~5V

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



2. BOOM PRIORITY EPPR VALVE

1) COMPOSITION

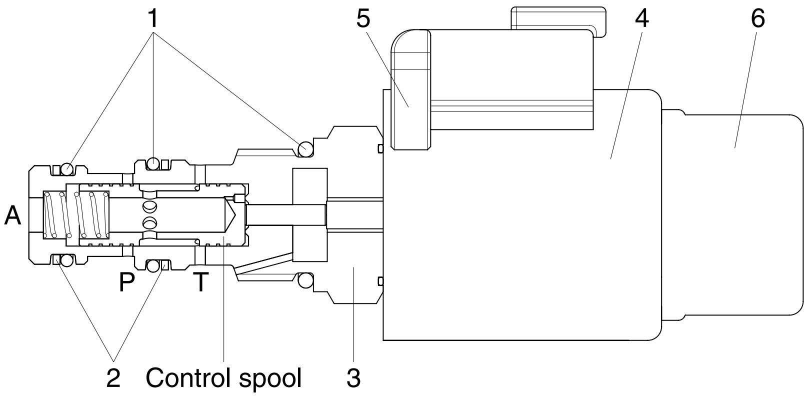
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

2) CONTROL

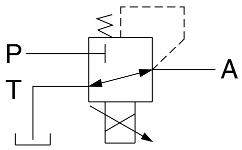
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at 30Ω and 24 V.

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.

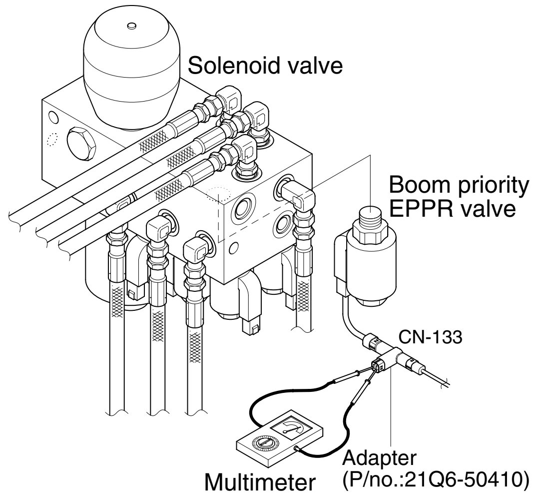
③ Start engine.

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)



21095MS15

(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.

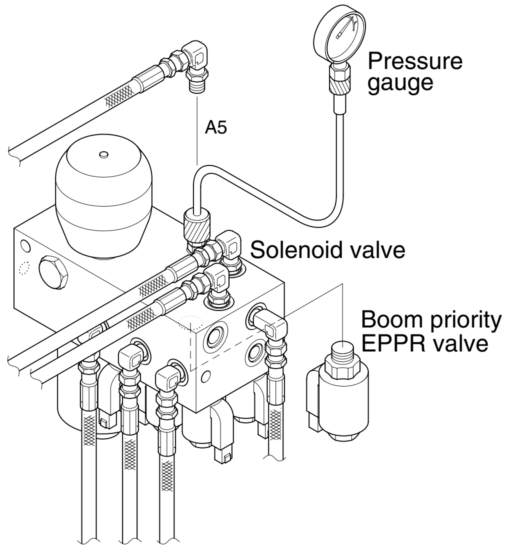
③ Set S-mode and cancel auto decel mode.

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)



21095MS16

GROUP 16 MONITORING SYSTEM

1. OUTLINE

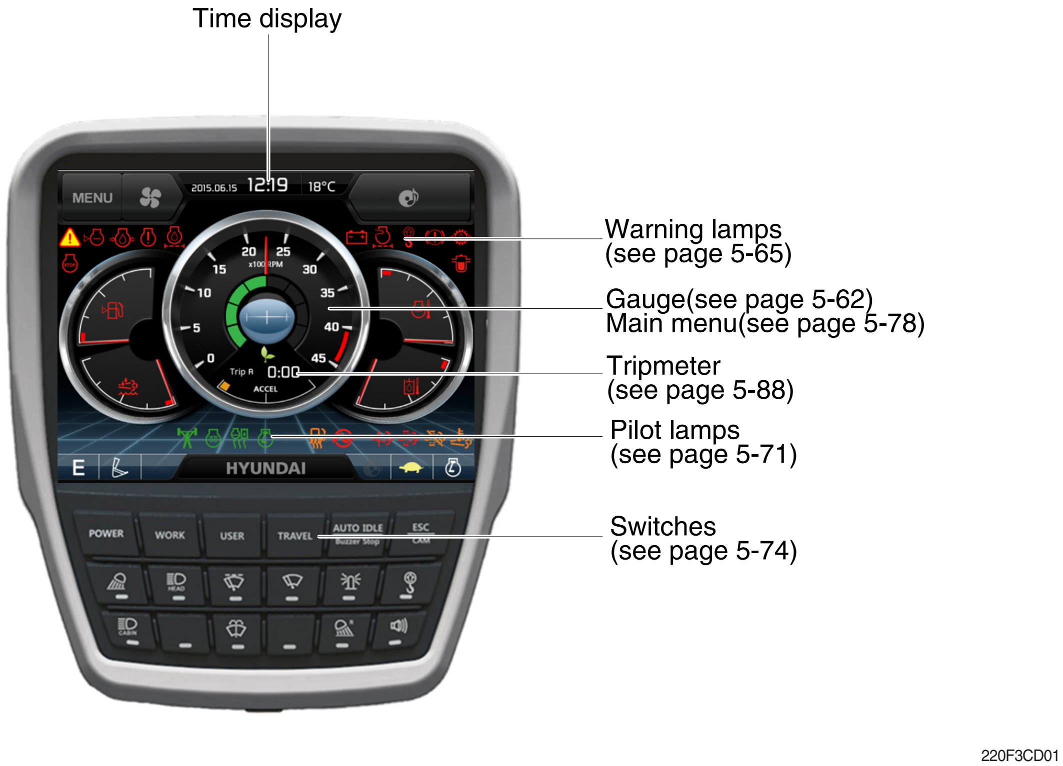
Monitoring system consists of the monitor part and switch part.

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.

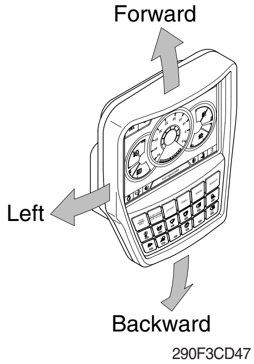
2. CLUSTER

1) MONITOR PANEL



※ 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 5-65 for details.

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



2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor

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

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

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

a. Engine rpm display : 0 rpm

b. Engine coolant temperature gauge : White range

c. Hydraulic oil temperature gauge : White range

d. Fuel level gauge : White range

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 (SERIAL NO. : -#1094)

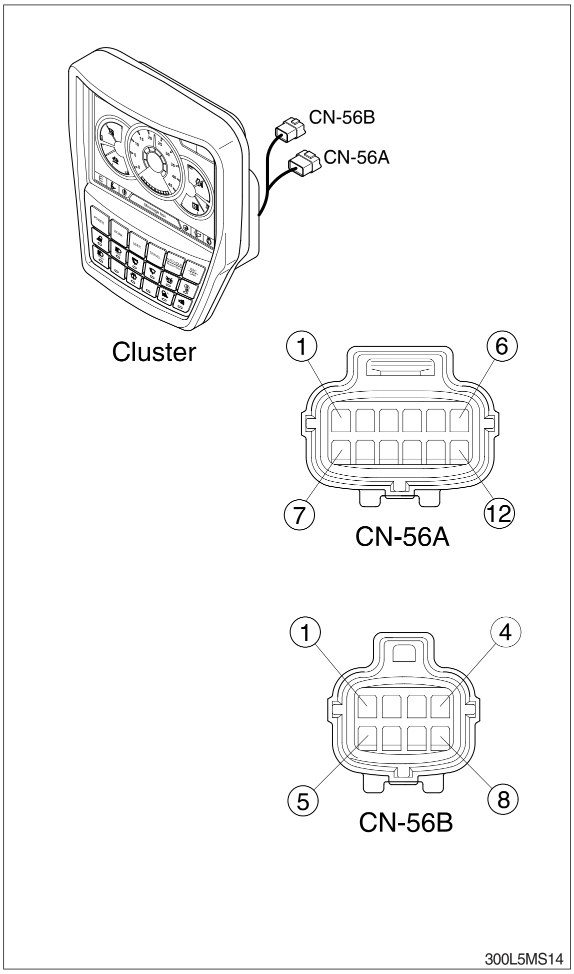
1) CN-56A

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)	20~32V
7	CAN 2 (L)	20~32V
8	RS-232 (RX)	±15V
9	RS-232 (TX)	±15V
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	-

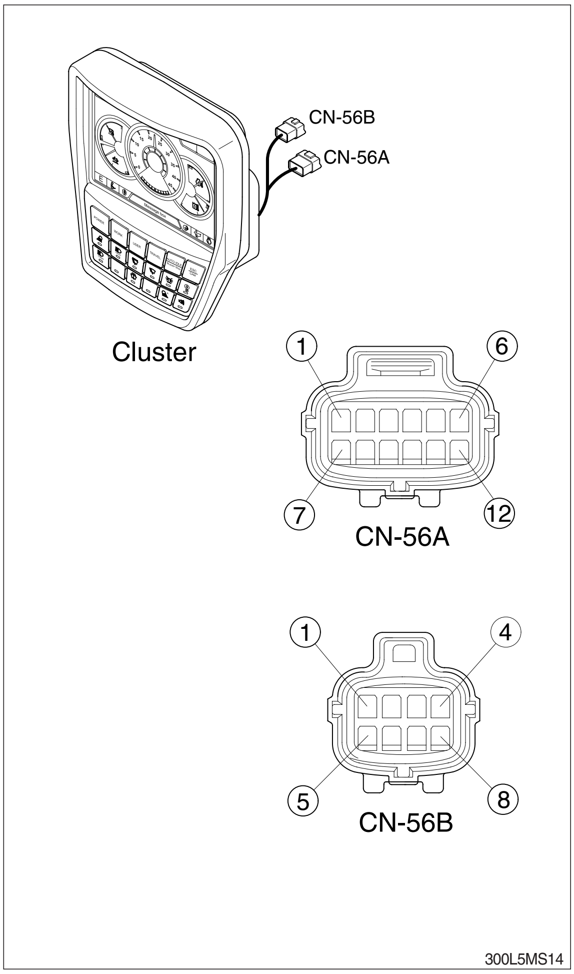
NTSC : National Television System Committee



CLUSTER CONNECTOR (SERIAL NO. : #1095-)

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	RS-232 (RX)	-
9	RS-232 (TX)	-
10	Aux left	0~5V
11	Aux right	0~5V
12	Aux GND	0~5V



2) CN-56B

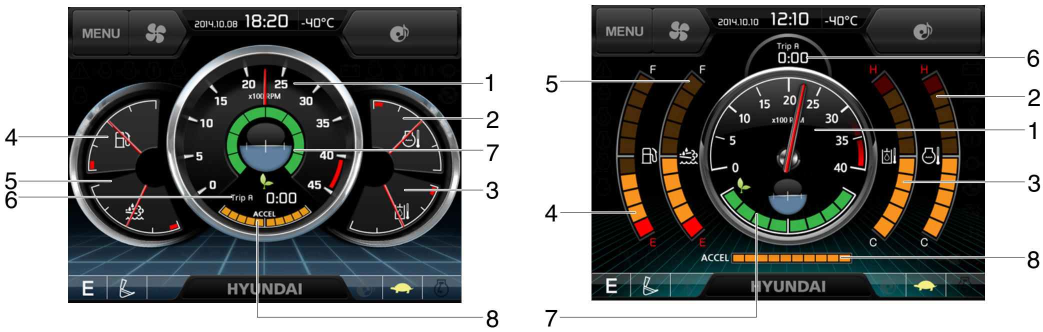
No.	Name	Signal
1	CAM 6.5V	6.3~6.7V
2	CAM GND	-
3	CAM DIFF (H)	0~5V
4	CAM DIFF (L)	0~5V
5	CAM 1	NTSC signal
6	CAM 2	NTSC signal
7	CAM 3	NTSC signal
8	CAM shield	0~5V

NTSC : National Television System Committee

2) GAUGE

(1) Operation screen

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



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

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

(2) RPM / Speed gauge

290F3CD49

① This display the engine speed.

(3) Engine coolant temperature gauge

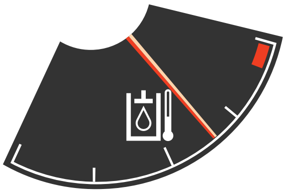

290F3CD53

① This gauge indicates the temperature of coolant.
· White range : 40-107˚C (104-225˚F)
· Red range : Above 107˚C (225˚F)

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

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

(4) Hydraulic oil temperature gauge



290F3CD54

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

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

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

(5) Fuel level gauge

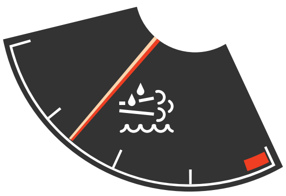
290F3CD55

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

② Fill the fuel when the red range, or lamp pops up and the buzzer sounds.

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

(6) DEF/AdBlue® Level gauge



290F3CD57

① This gauge indicates the amount of liquid in the DEF/AdBlue® tank.

② Fill the DEF/AdBlue® when the red range, or lamp pops up and the buzzer sounds.

③ Do not pour DEF/AdBlue® any more when the DEF/AdBlue® fill up warning lamp lights ON.

※ Refer to page 5-70.

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

(7) Tripmeter display

290F3CD56

① This displays the engine the tripmeter.

※ Refer to page 5-88 for details.

(8) Eco gauge

290F3CD58

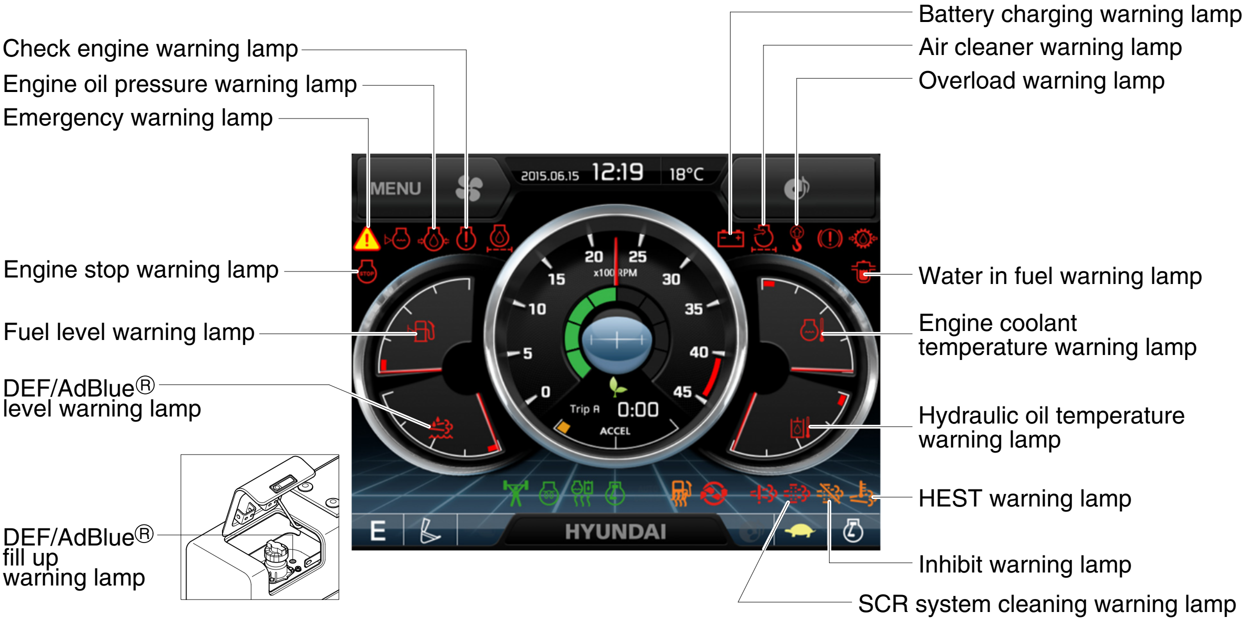
① This gauge indicates the fuel consumption rate and machine load status. So that operators can be careful with fuel economy.
② The fuel consumption rate or machine load is higher, the number of segment is increased.
③ The color of Eco gauge indicates operation status.
 · White : Idle operation
 · Green : Economy operation
 · Yellow : Non-economy operation at a medium level.
 · Red : Non-economy operation at a high level.

(9) Accel dial gauge

290F3CD59

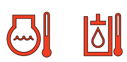
① This gauge indicates the level of multimodal dial.

3) WARNING LAMPS



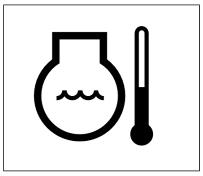
290F3CD60

※ Warning lamps and buzzer

Warnings	When error happened	Lamps and buzzer
All warning lamps except below	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position and blinks, and the buzzer stops when ; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the knob of the haptic controller is pushed - the lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position and light ON or blinks, and the buzzer stops when ; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the knob of the haptic controller is pushed - the lamp of the LCD is touched **※ Refer to page 5-70 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 and lights ON, and the buzzer stops when 2 seconds elapsed.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position and blinks, and the buzzer stops when 2 seconds elapsed.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	**※ Refer to page 5-66 for details.**

※ Refer to page 5-75 for the buzzer stop switch AUTO IDLE Buzzer Stop and operator's manual page 3-57 for the haptic controller.

(1) Engine coolant temperature warning lamp



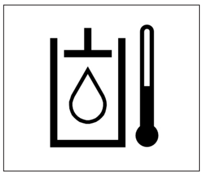
290F3CD61

① Engine coolant temperature warning is indicated two steps.
- 103˚C over : The lamp pops up and the buzzer sounds.
- 107˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch is pushed. And the buzzer stops and , lamps keep blink.

③ Check the cooling system when the lamps keep blink.

(2) Hydraulic oil temperature warning lamp



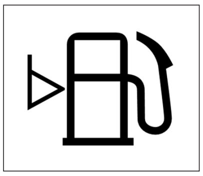
290F3CD62

① Hydraulic oil temperature warning is indicated two steps.
- 100˚C over : The lamp pops up and the buzzer sounds.
- 105˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch is pushed. And the buzzer stops and , lamps keep blink.

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

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the level of fuel is below 55 ℓ (14.5 U.S. gal).

② Fill the fuel immediately when the lamp blinks.

(4) Emergency warning lamp

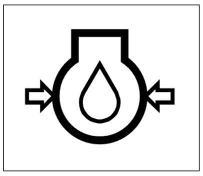
290F3CD64

① This warning lamp pops up and the buzzer sounds when each of the below warnings is happened.
- Engine coolant overheating (over 107˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Cluster communication data error
- Engine ECM communication data error

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

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

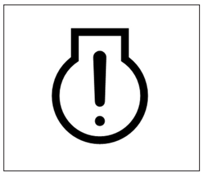
(5) Engine oil pressure warning lamp



290F3CD65

① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.
② If the lamp blinks, shut OFF the engine immediately. Check oil level.

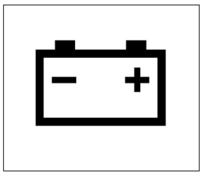
(6) Check engine warning lamp



290F3CD66

① This warning lamp pops up and the buzzer sounds when the communication between MCU and engine ECM on the engine is abnormal, or if the cluster received specific fault code from engine ECM.
② Check the communication line between them.
If the communication line is OK, then check the fault codes on the cluster.

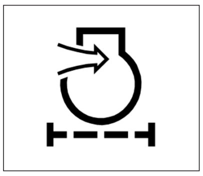
(7) Battery charging warning lamp



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.

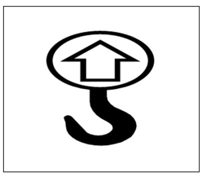
(8) Air cleaner warning lamp



290F3CD68

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

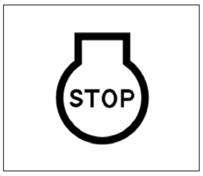
(9) Overload warning lamp (opt)



290F3CD69

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

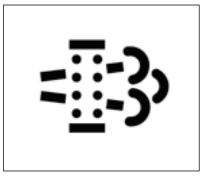
(10) Engine stop warning lamp



290F3CD252

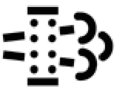
① This warning lamp pops up and the buzzer sounds when 30 minutes elapsed with empty condition of the DEF/AdBlue® tank, stop the engine immediately and check the DEF/AdBlue® tank.
② Fill the DEF/AdBlue® immediately in the DEF/AdBlue® tank.
※ Refer to page 5-70.
③ This lamp pops up and the buzzer sounds when the stationary SCR system cleaning is not performed.
※ Refer to page 5-68.
※ Please contact your HD Hyundai Construction Equipment service center or local dealer.

(11) SCR (selective catalytic reduction) system cleaning warning lamp

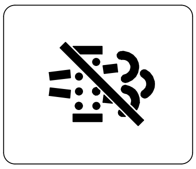


290F3CD70

① This warning lamp lights ON or blinks when the SCR system cleaning is needed as table below.

Warning lamp			Description
SCR 	Check engine 	Stop engine 	
Off	Off	Off	· Automatic SCR system cleaning
Blink	Off	Off	· The status of a manual (stationary) SCR system cleaning when the SCR system cleaning switch has been activated. ※ Refer to page 5-69.
On	On	Off	· The aftertreatment SCR system needs to be cleaned immediately. · Engine power will be reduced automatically if action is not taken. ※ The SCR system cleaning can be accomplished by : - Changing to more challengine duty cycle. - Performing a manual SCR system cleaning.
On	On	On	· These lamps will be ON when a stationary (manual) SCR system cleaning is not performed. · Stop the engine immediately. · Please contact your HD Hyundai Construction Equipment service center or local dealer.

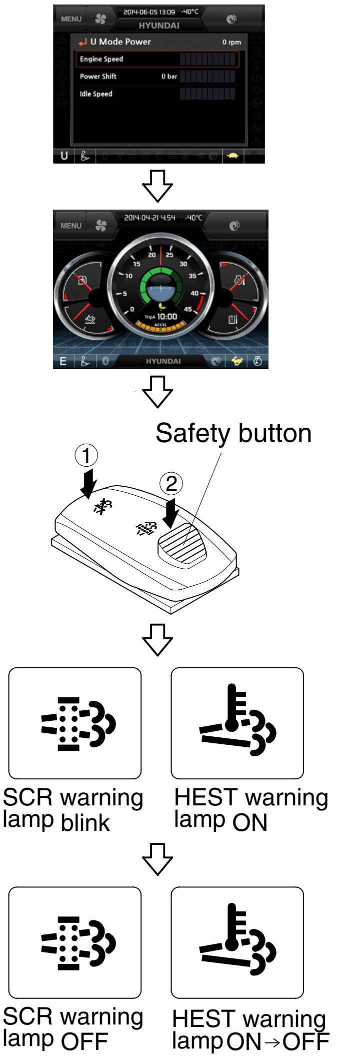
(12) SCR system cleaning inhibit warning lamp



2609A3CD20

① This warning lamp indicates, when illuminated, the SCR system cleaning switch is pushed inhibit position, therefore automatic and manual SCR system cleaning can not occur.
※ Refer to the operator's manual page 3-36 for the SCR system cleaning switch.

※ Manual SCR system cleaning



290F3CD73

※ Manual SCR system cleaning applies if the machine is in a fireproof area.

※ To stop a manual SCR system cleaning before it has completed, set to the SCR 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 SCR system cleaning.

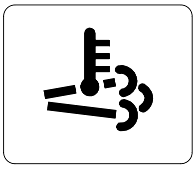
※ Refer to the operator's manual page 3-36 for the SCR system cleaning switch operation.

※ The engine speed may increase to 950~1050 rpm and SCR system cleaning begins and it will take approximately 20~60 minutes.

③ The SCR system cleaning warning lamp will blink and HEST warning lamp will light ON during the SCR system cleaning is operating.

④ The SCR system cleaning and/or HEST warning lamp will light OFF when the SCR 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 SCR system cleaning.

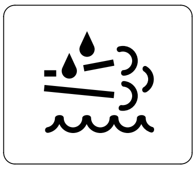
② The lamp will also illuminate during a manual SCR system cleaning.

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 will be common for the lamp to illuminate on and off during normal equipment operation as the engine completes SCR system cleaning.

(14) DEF/AdBlue® level warning lamp



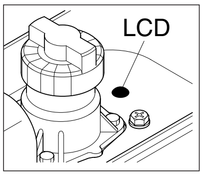
290F3CD257

① This warning lamp indicates when ON or blinking, that the DEF/AdBlue® level is low as 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
DEF/AdBlue® level 	Check engine 	Stop engine 	
On	Off	Off	· The DEF/AdBlue® level has fallen below the initial warning level (10%).
Blink	Off	Off	· The DEF/AdBlue® level has fallen below the critical warning level (5%).
Blink	On	Off	· The DEF/AdBlue® level has fallen below the initial derate level (2.5%). · The engine power will be limited automatically.
Blink	On	On	· This is happened when 30 minutes 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 persent gauge reading.

(15) DEF/AdBlue® fill up warning lamp



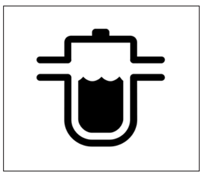
290F3CD272

① This lamp lights ON when the DEF/AdBlue® tank is completely filled with DEF/AdBlue®.

※ **Fill the tank with the DEF/AdBlue® after start switch ON and then turn OFF the start switch.**

※ **Do not pour DEF/AdBlue® any more when this lamp lights ON. Otherwise DEF/AdBlue® tank may freeze and burst in winter season.**

(16) Water in fuel warning lamp



210WF3CD02

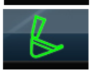
① This warning lamp pops up and the buzzer sounds when the water separator is full of water or malfunctioning.

※ **When this lamp blinks, stop the machine and spill water out of the separator.**

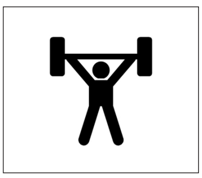
4) PILOT LAMPS

290F3CD74

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode	P S E	Heavy duty power work mode Standard power mode Economy power mode
2	User mode	U	User preferable power mode
3	Work tool mode	    	General operation - IPC speed mode General operation - IPC balance mode General operation - IPC efficiency mode Breaker operation mode Crusher operation mode
4	Travel mode	 	Low speed traveling High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp



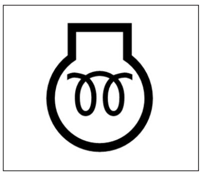
290F3CD78

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

② The power max function is operated maximum 8 seconds.

※ Refer to the operator's manual page 3-38 for power max function.

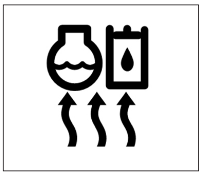
(3) Preheat pilot lamp



290F3CD79

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

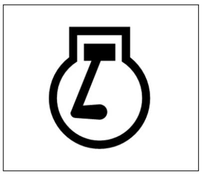
(4) Warming up pilot lamp



290F3CD80

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

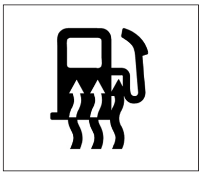
(5) Decel pilot lamp



290F3CD81

① Operating one touch decel switch on the RCV lever makes the lamp ON.
② Also, the lamp will be ON and engine speed will be lowered automatically to save fuel consumption when all levers and pedals are at neutral position, and the auto idle function is selected.
※ **One touch decel is not available when the auto idle pilot lamp is turned ON.**
※ **Refer to the operator's manual page 3-38.**

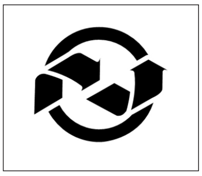
(6) Fuel warmer pilot lamp



290F3CD82

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

(7) Maintenance pilot lamp



290F3CD83

① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.
② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.
※ **Refer to the page 5-82.**

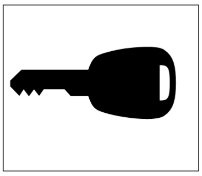
(8) Entertainment pilot lamp

290F3CD84

① This lamp is on when audio or video files are playing.

※ Refer to the page 5-87.

(9) Smart key pilot lamp (opt)



290F3CD214

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

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

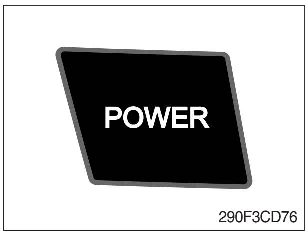
※ Refer to the page 5-83

5) SWITCHES

290F3CD86

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-71 for details.

(1) Power mode switch



290F3CD76

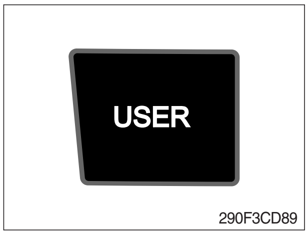
① This switch is to select the machine power mode and selected power mode pilot lamp is displayed on the pilot lamp position.
· P : Heavy duty power work.
· S : Standard power work.
· E : Economy power work.
② The pilot lamp changes E → S → P → E in order.

(2) Work mode switch

290F3CD88

① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
· : General operation mode
· : Breaker operation mode (if equipped)
· : Crusher operation mode (if equipped)
· Not installed : Breaker or crusher is not installed.
※ Refer to the operator's manual page 4-7 for details.

(3) User mode switch



290F3CD89

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

② Refer to the page 5-79 for another set of user mode.

(4) Travel speed switch

290F3CD91

① This switch is used to select the travel speed alternatively.
· : Low speed
· : High speed

※ Do not change the setting of the travel speed switch. Machine stability may be adversely affected.

⚠ Personal injury can result from sudden changes in machine stability.

(5) Auto idle/ buzzer stop switch

290F3CD90

① This switch is used to activate or cancel the auto idle function.
· Pilot lamp ON : Auto idle function is activated.
· Pilot lamp OFF : Auto idle function is cancelled.

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

(6) Escape/Camera switch

290F3CD92

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

② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 5-88 for the camera.

③ If the camera is not installed, this switch is used only ESC function.

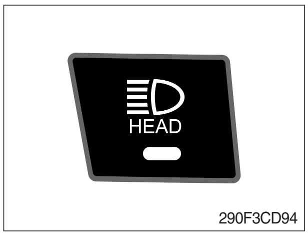
(7) Work light switch

290F3CD93

① This switch is used to operate the work light.

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

(8) Head light switch



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

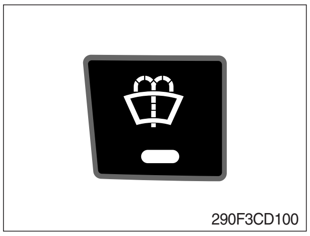
(9) Intermittent wiper switch

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

(10) Wiper switch

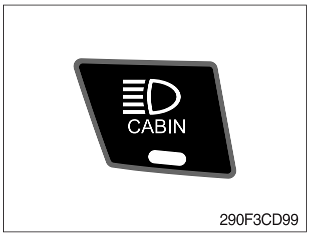
① This switch is used to operate the window wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp is turned ON when operating the switch.
※ **If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause. If the switch remains ON, motor failure can result.**

(11) Washer switch



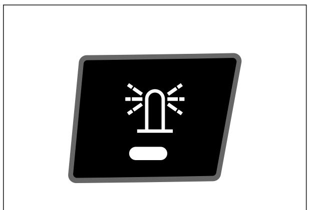
① The washer liquid is sprayed and the wiper is operated only while pressing this switch.
② The pilot lamp is turned ON when operating the switch.

(12) Cab light switch



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

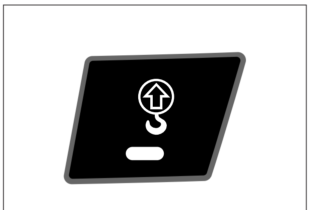
(13) Beacon switch



290F3CD97

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

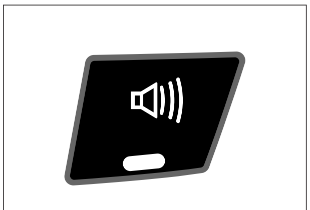
(14) Overload switch



290F3CD98

① When this switch turned ON, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.
② When it turned OFF, buzzer stops and warning lamp goes out.
⚠ Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.

(15) Travel alarm switch



290F3CD101

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

(16) Air conditioner quick touch switch

290F3CD216

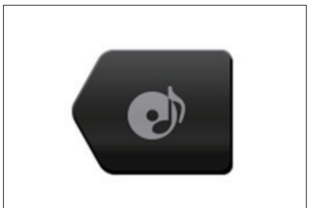
① This switch used to select air conditioner control mode.
※ Refer to the page 5-90.

(17) Main menu quick touch switch

290F3CD217

① This switch is to activate the main menu in the cluster.
※ Refer to the page 5-78.

(18) Entertainment quick touch switch



290F3CD218

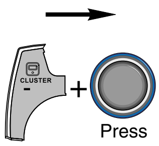
① This switch is to activate the entertainment control menu in the cluster.
※ Refer to the page 5-87.

6) MAIN MENU

※ You can select or set the menu by the haptic controller 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

Tap
MENU



Main menu screen

Sub menu screen

290F3CD102

※ Please refer to the haptic controller, operator's manual page 3-57 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 (option) Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed, Arm speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode, Accel initial mode / step Switch function
2	 Monitoring 290F3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, Engine ECM MCU, Engine ECM All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 290F3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor, Haptic / switch controller, RMCU, Relay drive unit, FATC, AAVM (opt) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure Clinometer setting Cluster, ETC device
4	 Display 290F3CD106	Display item Clock Brightness Unit setup Language selection Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, Chinese, ETC A type, B type
5	 Utilities 290F3CD107	Entertainment Tripmeter Camera	Play Video, Audio, Smart terminal. 3 kinds (A, B, C) Number of active, Display order, AAVM (opt)

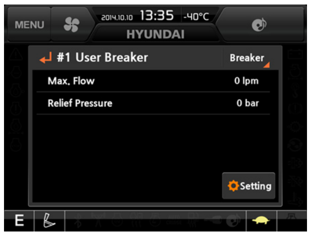
(2) Mode setup

① Work tool

210WF3CD108

290F3CD253

A



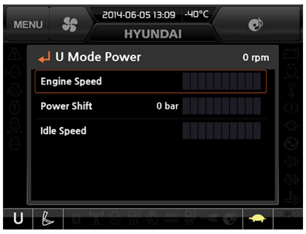
290F3CD254

B

· Select on installed optional attachment
  - A : It can set the user's attachment.
    It is available in setting #1~#10.
  - B : Max flow - Set the maximum flow for the attachment.
    Relief pressure - Set the relief pressure.

② U mode power

210WF3CD111



290F3CD112

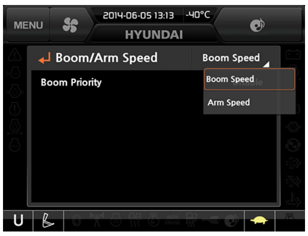
Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	700	0
2	1400	750	3
3	1500	800	6
4	1600	850	9
5	1700	900	12
6	1800	950	16
7	1850	1000	20
8	1900	1050	26
9	1950	1100 (auto decel)	32
10	2000	1150	38

※One touch decel & low idle : 1000 rpm

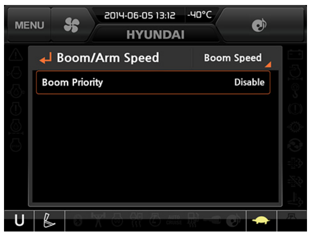
· Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
· U-mode can be activated by user mode switch.

③ Boom/Arm speed

210WF3CD113



290F3CD114



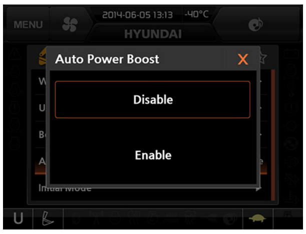
290F3CD115

· Boom speed
  - Boom priority function can be activated or cancelled
    Enable - Boom up speed is automatically adjusted as working conditions by the MCU.
    Disable - Normal operation

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

④ Auto power boost

210WF3CD118



290F3CD117

· The power boost function can be activated or cancelled.
Enable - The digging power is automatically increased as working conditions by the MCU.
It is operated max 8 seconds.
Disable - Not operated.

⑤ IPC mode

290F3CD310

290F3CD311

290F3CD304

290F3CD312

290F3CD305

290F3CD313

290F3CD306

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

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

※ Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to the operator's manual page 3-25-1.

⑥ Automatic engine shutdown (option)

210WF3CD11

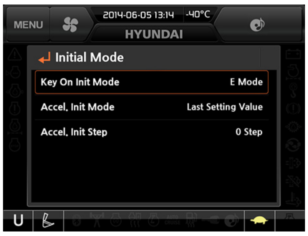
210WF3CD12

210WF3CD13

· The automatic engine shutdown function can be set by this menu.
  - One time
  - Always
  - Disable
  - Wait time setting : Max 40 minutes, min 2 minutes

⑦ Initial mode

290F3CD122



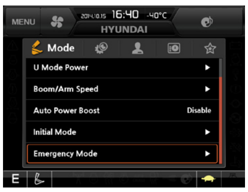
290F3CD119

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

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

· Accel initial step
  - 0~9 step

⑧ Emergency mode



290F3CD248

290F3CD249

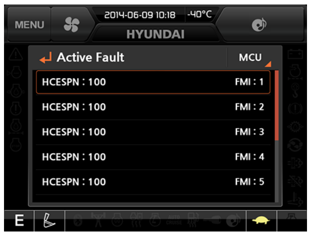
· This mode can be use when the switches are abnormal on the cluster.
· The cluster switches will be selected by touched each icon.

(3) Monitoring

① Active fault

290F3CD120

290F3CD121

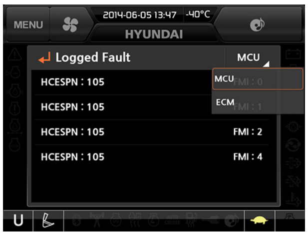


290F3CD125

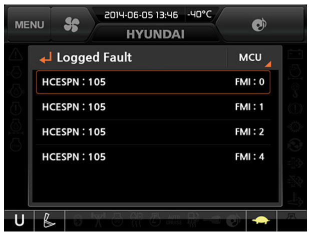
· The active faults of the MCU, engine ECM or air conditioner can be checked by this menu.

② Logged fault

290F3CD128



290F3CD123

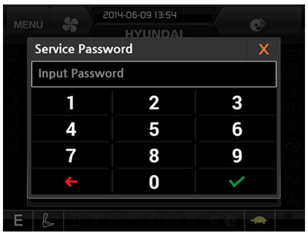


290F3CD124

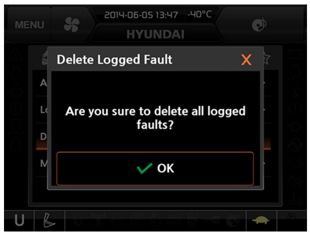
· The logged faults of the MCU, engine ECM or air conditioner can be checked by this menu.

③ Delete logged fault

290F3CD134



290F3CD126

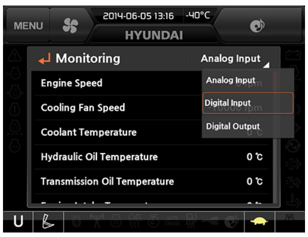


290F3CD127

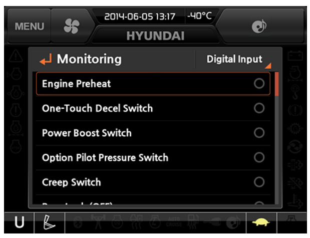
· The logged faults of the MCU, engine ECM or air conditioner can be deleted by this menu.

④ Monitoring

290F3CD172



290F3CD188



290F3CD189

· The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).
· The switch status or output status can be confirmed by this menu (Digital input & Digital output).
· The activated switch or output pilot lamps ● are light ON.

(4) Management

① Fuel rate information

210WF3CD14

210WF3CD15

A

· General record (A)
  - Average fuel rate (left) (from "Reset" to now)
    Fuel consumption devided by engine run time (service meter time).
  - A days fuel used (right)
    Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).

B

· Hourly record (B)
  - Hourly fuel rates for past 12 hours (service meter time).
  - No record during key-off time.
  - One step shift to the right for every one hour.
  - Automatic deletion for 12 hours earlier data.
  - All hourly records deletion by "Reset".

C

· Daily record (C)
  - Daily fuel consumption for past seven days (MCU real time).
  - No record during key-off time.
  - One step shift to the right at 24:00 for every day.
  - Automatic deletion for 7 days earlier data.
  - All daily records deletion by "Reset".

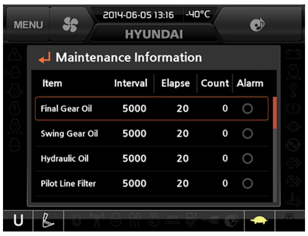
D

210WF3CD16

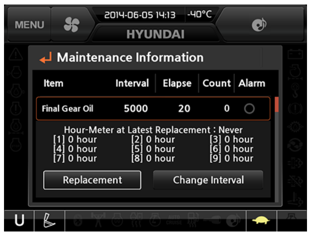
· Mode record (D)
  - Average fuel rate for each power mode/multimodal dial (at least 7) from "Reset" to now.
  - No record during idle.
  - All mode records deletion by "Reset".

② Maintenance information

210WF3CD131



290F3CD132



290F3CD133

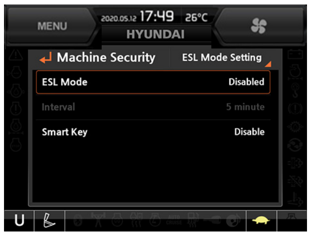
· Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
· Replacement : The elapsed time will be reset to zero (0).
· Change interval : The change or replace interval can be changed in the unit of 50 hours.
· Change or relpace interval

No	Item	Interval
1	Engine oil	500
2	Final gear oil	1000
3	Swing gear oil	1000
4	Hydraulic oil	5000
5	Pilot line filter	1000
6	Drain filter	1000
7	Hydraulic oil return filter	1000
8	Engine oil filter	500
9	Fuel filter	500
10	Pre-filter	500
11	Hydraulic tank breather	1000
12	Air cleaner (inner & outer)	4000
13	Radiator coolant	2000
14	Swing gear pinion grease	1000
15	DEF/AdBlue® supply module filter	4500
16	Crankcase Breather Filter	2000
17	DEF/AdBlue® Tank Filter	4000

③ Machine security

210WF3CD190B

290F3CD135B



290F3CD136A

290F3CD137A

290F3CD138A

· ESL mode setting
- ESL : Engine Starting Limit
- ESL mode is desingned to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- Machine security

  Disable : ESL function is disabled and password is not required to start engine.

  Enable (always) : The password is required whenever the operator starts engine.
- Interval : The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set to a maximum 4 hours.

  ※Default password : 00000 + ✅

  ※Password length : (5~10 digits) + ✅
- Smart key (option) : Refer to next page.

· Password change
- The password is 5~10 digits.

210WF3CD190A

290F3CD140B

290F3CD135C

Enter the current password

290F3CD143B

Enter the new password again

290F3CD142B

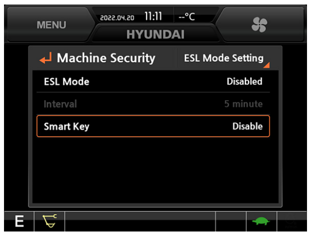
Enter the new password

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

- Smart key

210WF3CD190A

290F3CD135C

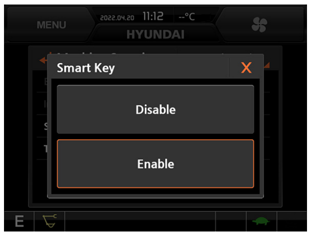


290F3CD001

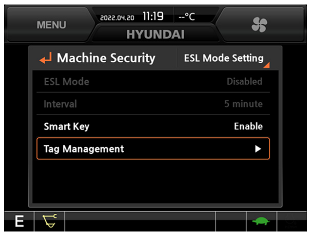
- Smart key is registered when equipped with optional smart key. If smart key is not inside of the cabin, authentication process fails and the password is needed.
- Tag management menu is activated when the Smart key menu is Enabled.
  You can register and delete the tags.

- Tag management

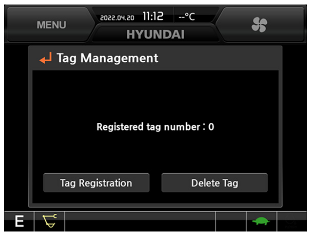
- When registering a tag : Only the tag you want to register must be in the cabin.
- When deleting a tag : All registered tags are deleted.



290F3CD002

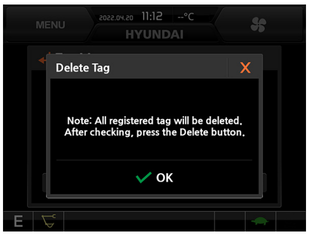


290F3CD003



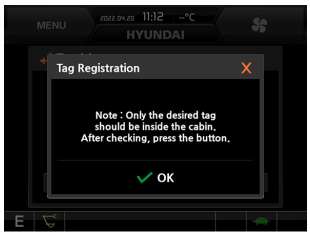
290F3CD004

Deleting



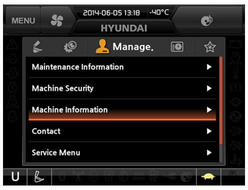
290F3CD006

Registering

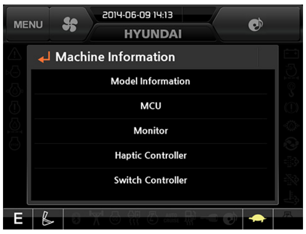


290F3CD005

④ Machine Information



290F3CD144

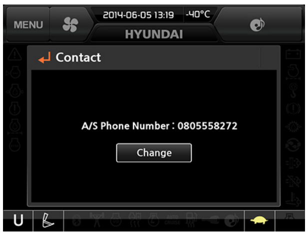


290F3CD145

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

⑤ Contact (A/S phone number)

290F3CD146



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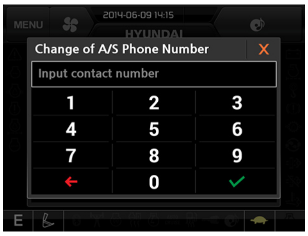
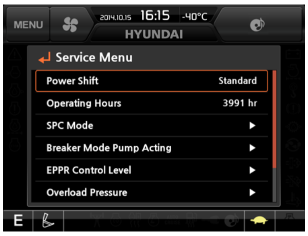


290F3CD148

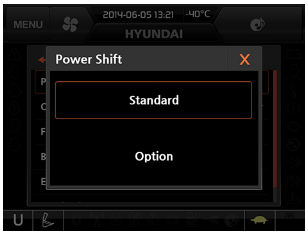
Enter the new A/S phone number

⑥ Service menu

290F3CD149



290F3CD250



290F3CD151

· Power shift (standard/option) : Power shift pressure can be set by option menu.
· Operating hours : Operating hours since the machine line out can be checked by this menu.
· Breaker mode pump acting (1 pump/2 pump)
· EPPR current level (attach flow EPPR 1 & 2, boom priority EPPR, attach relief pressure EPPR 1& 2)
· Overload pressure : 100 ~ 350 bar

⑦ Clinometer

290F3CD152

290F3CD153

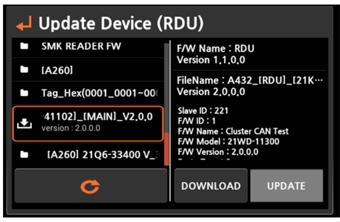
· When the machine is on the flatland, if tap the "initialization", the values of X, Y reset "0".
· You can confirm tilt of machine in cluster's operating screen.

⑧ Update (cluster & ETC devices)

210WF3CD17

210WF3CD18

210WF3CD19



380F3CD06

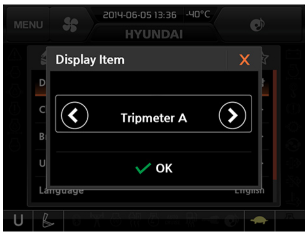
380F3CD04

· ETC devices and cluster can be updated through CAN 2 network.
· Insert USB memory stick which includes program files, start download.

(5) Display

① Display item

290F3CD154



290F3CD155

290F3CD156

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

② Clock

290F3CD157

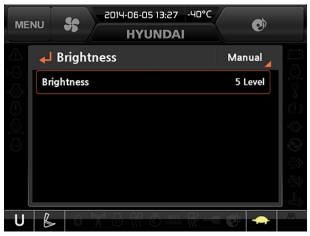
290F3CD158

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

③ Brightness

290F3CD159

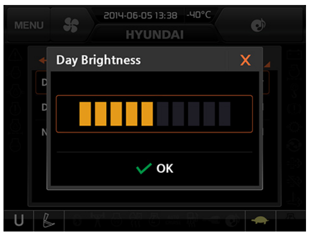
290F3CD160



290F3CD139

290F3CD141

290F3CD191



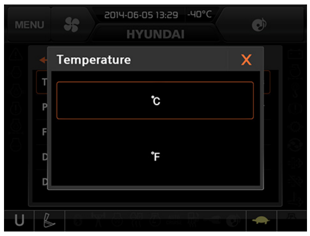
290F3CD192

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

④ Unit

290F3CD161

210WF3CD162



290F3CD193

- Temperature : ˚C ↔ ˚F
- Pressure : bar ↔ MPa ↔ kgf/cm^2
- Volume : ℓ ↔ gal
- Flow : lpm ↔ gpm
- Distance : km ↔ mile
- Date format : yy/mm/dd ↔ mm/dd/yy ↔ dd-mm-yy

⑤ Language

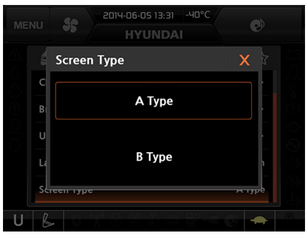
290F3CD163

290F3CD164

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

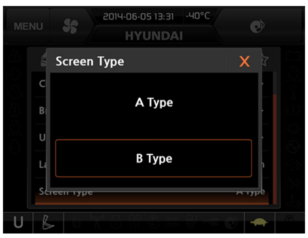
⑥ Screen type

290F3CD165



A Type (Default) 290F3CD166

290F3CD156A

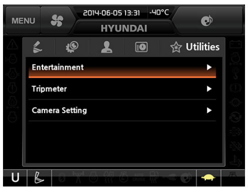


B Type (Option) 290F3CD194

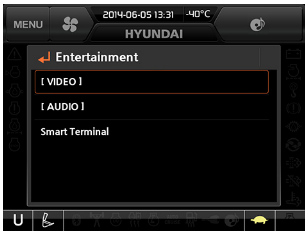
290F3CD167A

(6) Utilities

① Entertainment



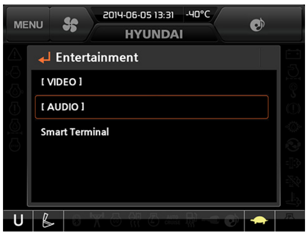
290F3CD195



A

290F3CD196

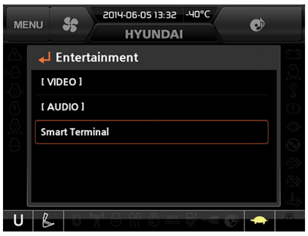
210WF3CD219



B

290F3CD197

210WF3CD220



C

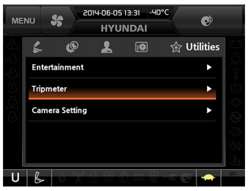
290F3CD198

210WF3CD199

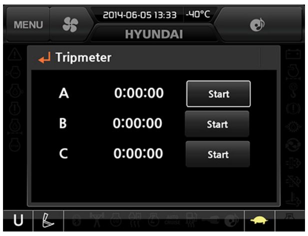
210WF3CD22

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

② Tripmeter



290F3CD168

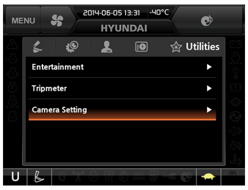


290F3CD169

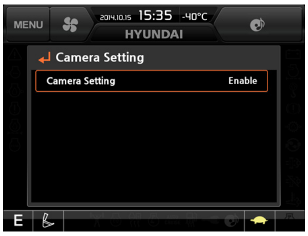
· Maximum 3 kinds of tripmeters can be used at the same time.
· Each tripmeter can be turned on by choosing "Start" while it also can be turned off by choosing "Stop".
· If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

③ Camera setting

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



290F3CD200



290F3CD255

290F3CD256

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

290F3CD156

290F3CD221

④ **AAVM** (All Around View Monitoring, option)

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

290F3CD244

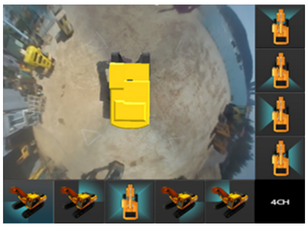
- **Escape button**

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

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

290F3CD156

The beginning screen



AAVM mode 290F3CD222

- **Buzzer stop button**

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

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

290F3CD246

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

290F3CD247

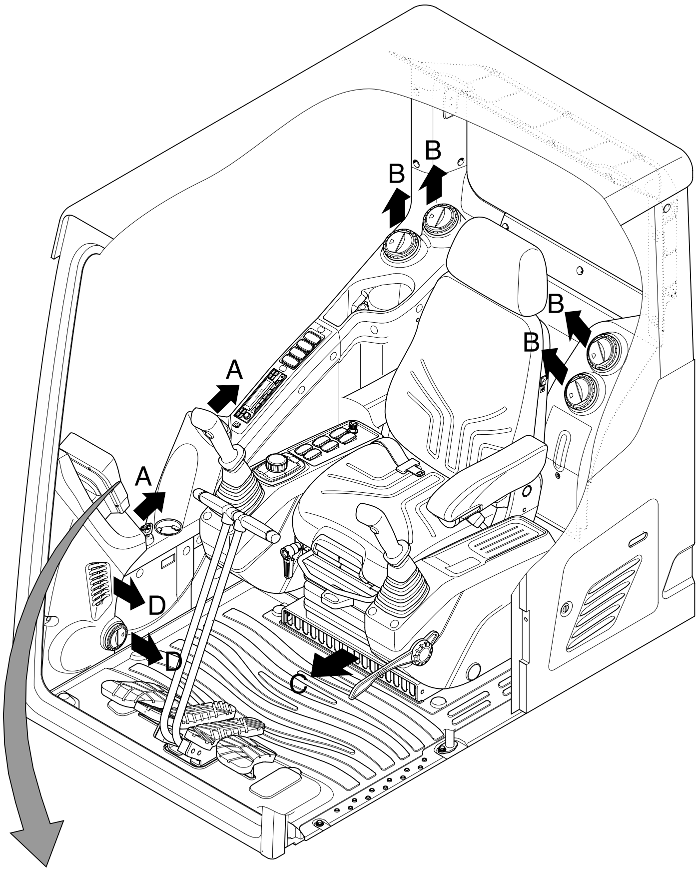
· When the worker or pedestrian go inside of red line (radius 3 m), an internal danger area of equipping on the cluster screen, the warning buzzer sounds and it displays the red rectangular box for the recognition of the worker and pedestrian.
At this time, the operator should stop work immediately,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

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

7) AIR CONDITIONER AND HEATER

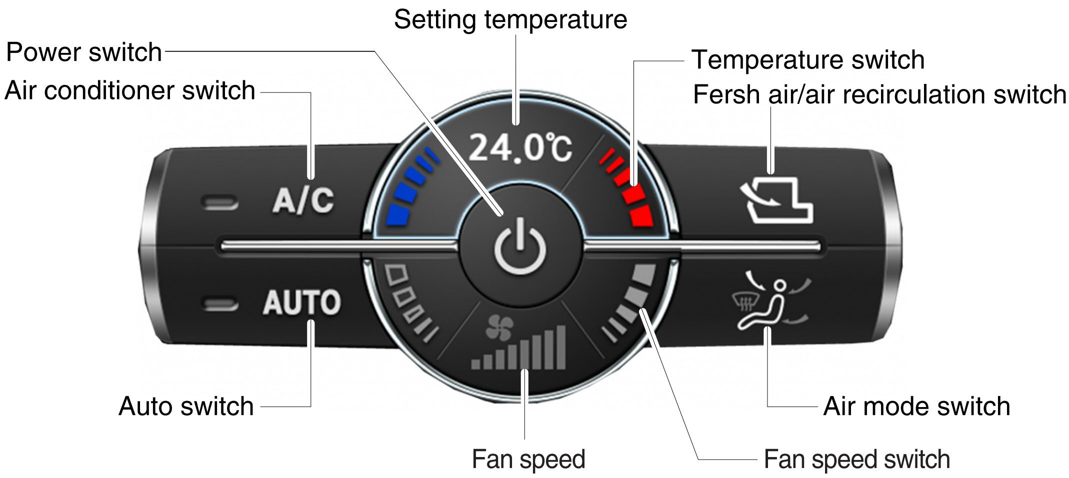
Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

· Location of air flow ducts



Cluster LCD

Cluster : [icon] or
Haptic controller : SET



290F3CD201

※ Haptic controller : Refer to the operator's manual page 3-57.

(1) Power switch


290F3CD251

① This switch makes the system ON/OFF.
Just before the power OFF, set values are stored.
② Default setting values

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

(2) Air conditioner switch

290F3CD203

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

290F3CD223

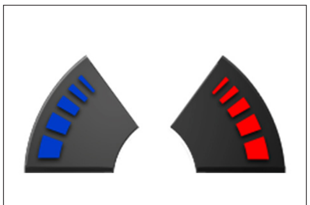
① Auto air conditiner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

(4) Setting temperature

290F3CD224

① Display the temperature setting out.

(5) Temperature switch

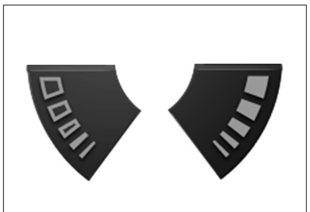

290F3CD225

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 as 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. Push Up/Down temperature switch simultaneously more than 5 second displayed temperature unit change (˚C → ˚F)

(6) Fan speed switch



290F3CD226

① Fan speed is controlled automatically by setted temperature.

② This switch controls fan speed manually.

- There are 8 up/down steps to control fan speed.
- The maximum step or the minimum step beeps 5 times.

(7) Fan speed

290F3CD227

① Steps 1 through 8 to display the amount of wind.

(8) Fresh air/air recirculation switch

290F3CD228

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 time.**

※ **Check out the fresh air filter and the recirculation filter periodically to keep a good efficiency.**

(9) Air mode switch

290F3CD229

① Operating this switch, it beeps and displays symbol of each mode in 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 defroster mode operating, FRESH AIR/AIR RECIRCULATION switch turns to FRESH AIR mode and air conditioner switch turns ON.

8) 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

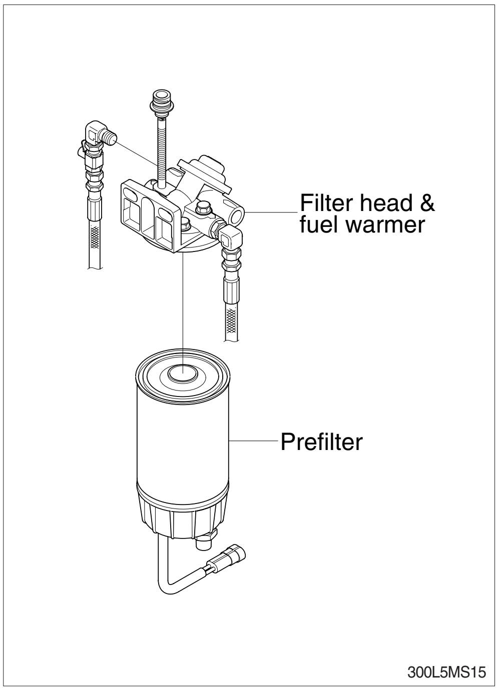
(SERIAL NO. : -#1094)

1. SPECIFICATION

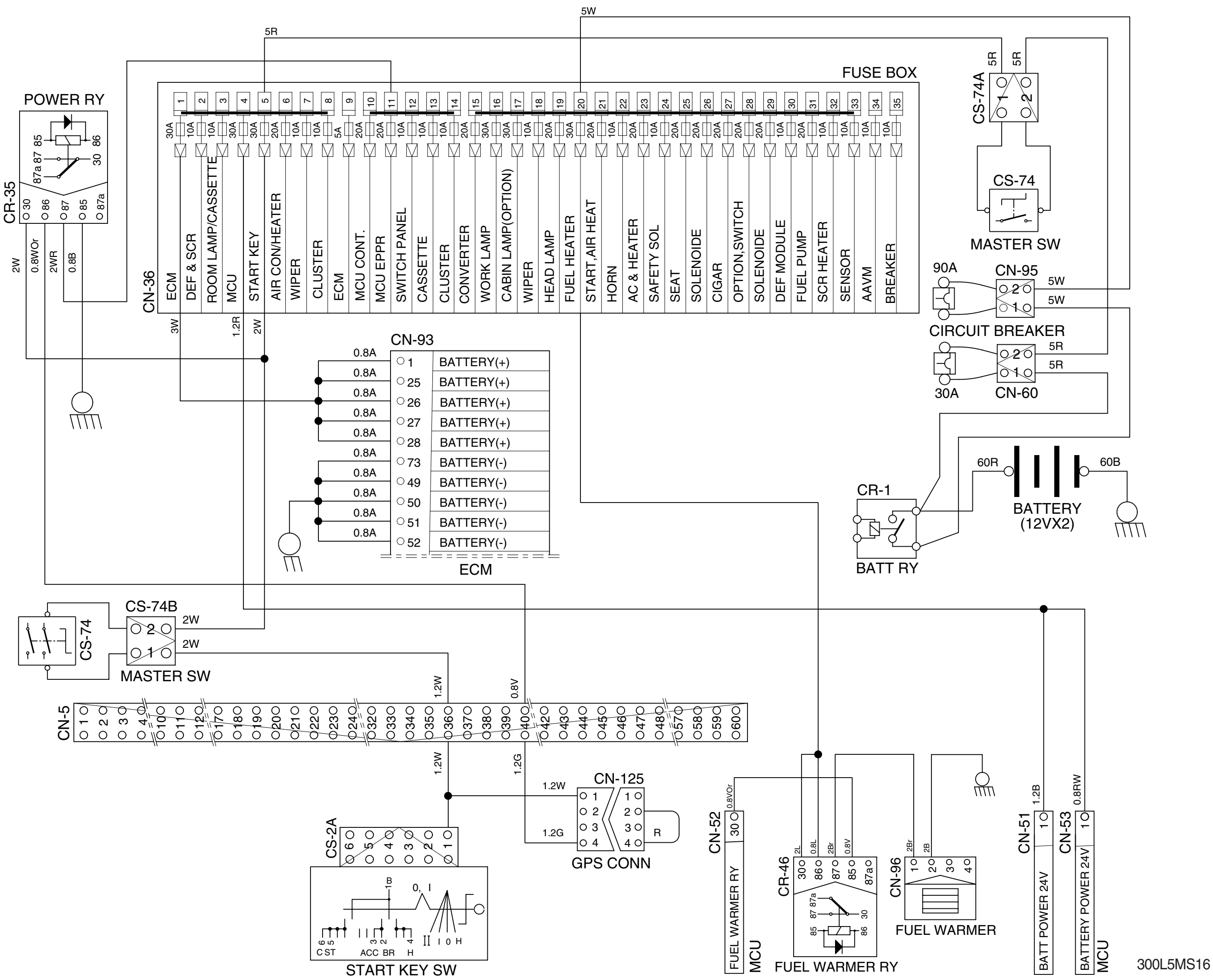
1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A

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



(SERIAL NO. : #1095-)

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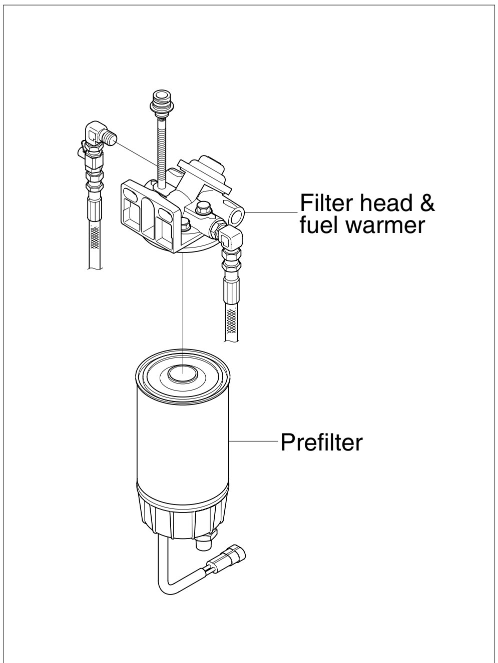
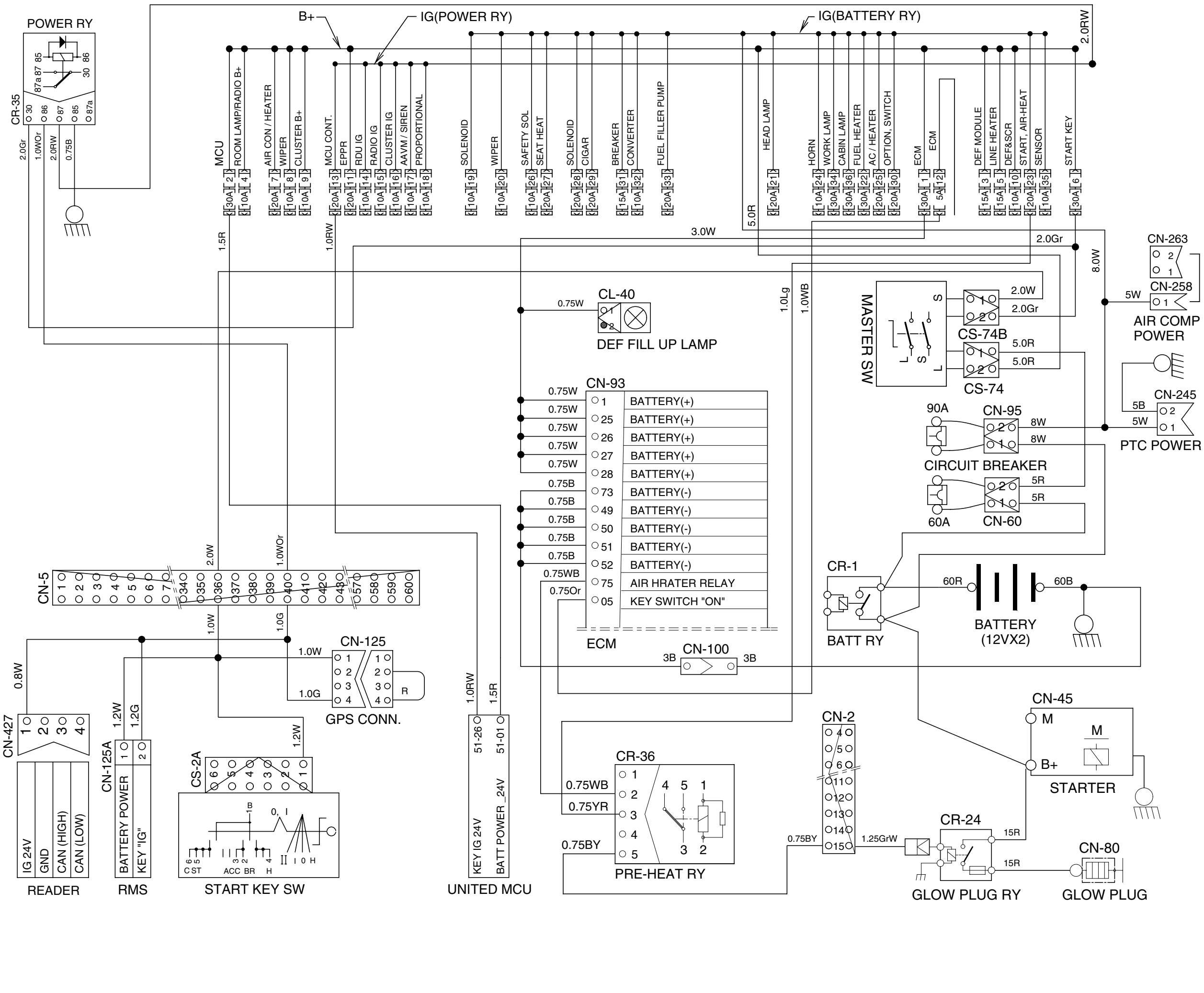


300L5MS15

3. ELECTRIC CIRCUIT



300L5MS16

SECTION 6 TROUBLESHOOTING

SECTION 6 TROUBLESHOOTING

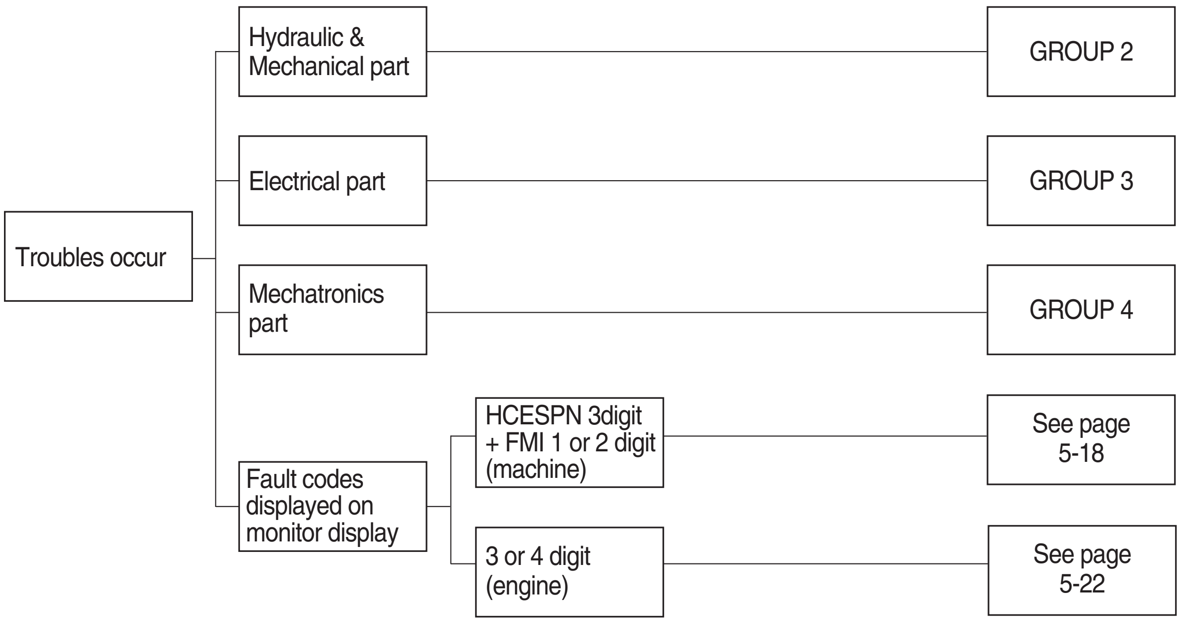
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

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

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

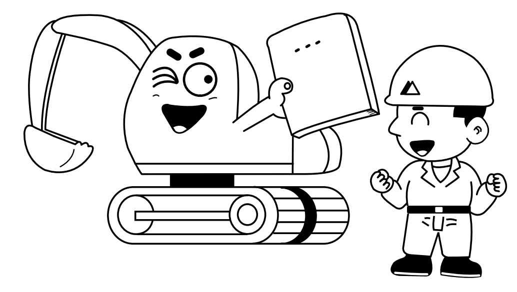


2. DIAGNOSING PROCEDURE

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.

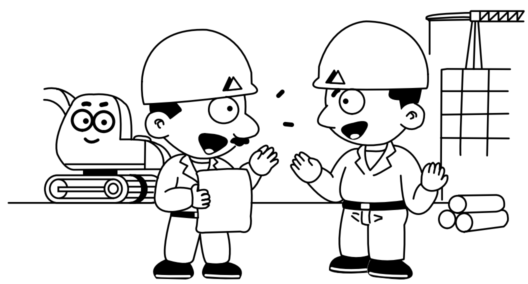


13031SH02

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.

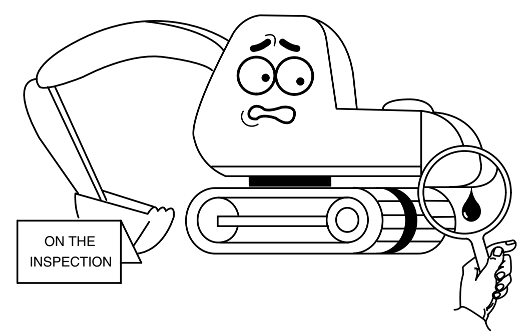


13031SH03

STEP 3. Inspect the machine

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

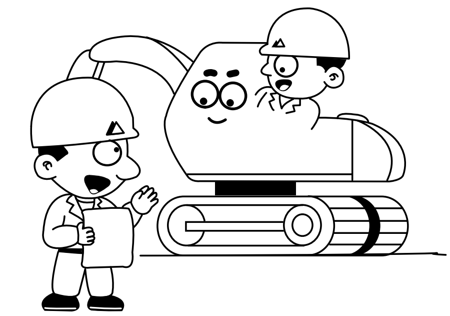
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

STEP 4. Inspect the trouble actually on the machine

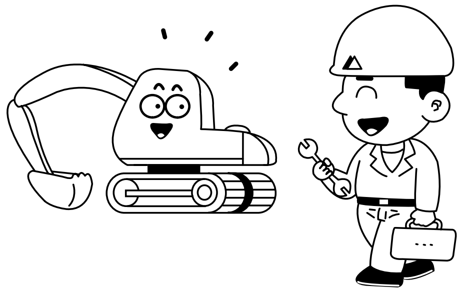
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



(210-7) 6-3(1)

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.

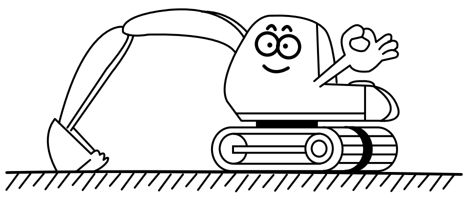


13031SH05

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.

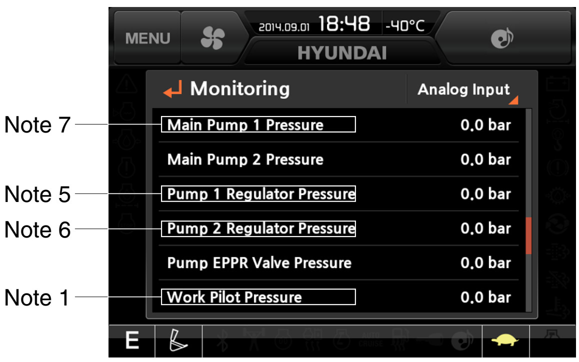
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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?

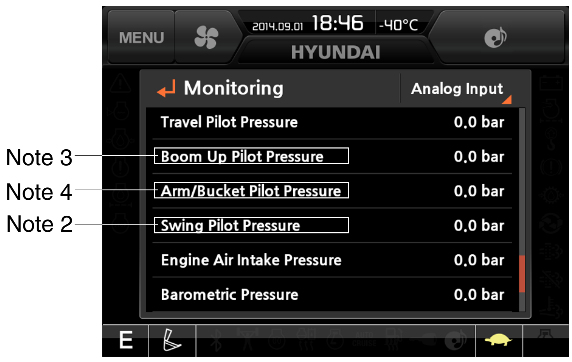
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

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

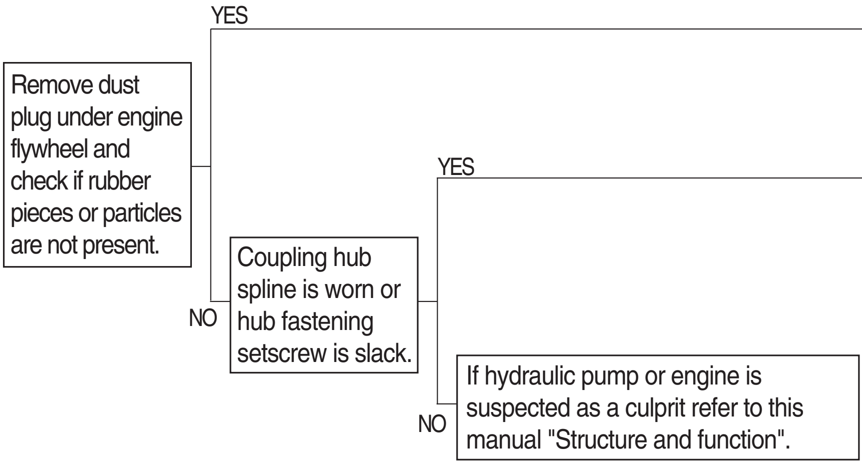
300L6HS01

(2) Specification

No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar

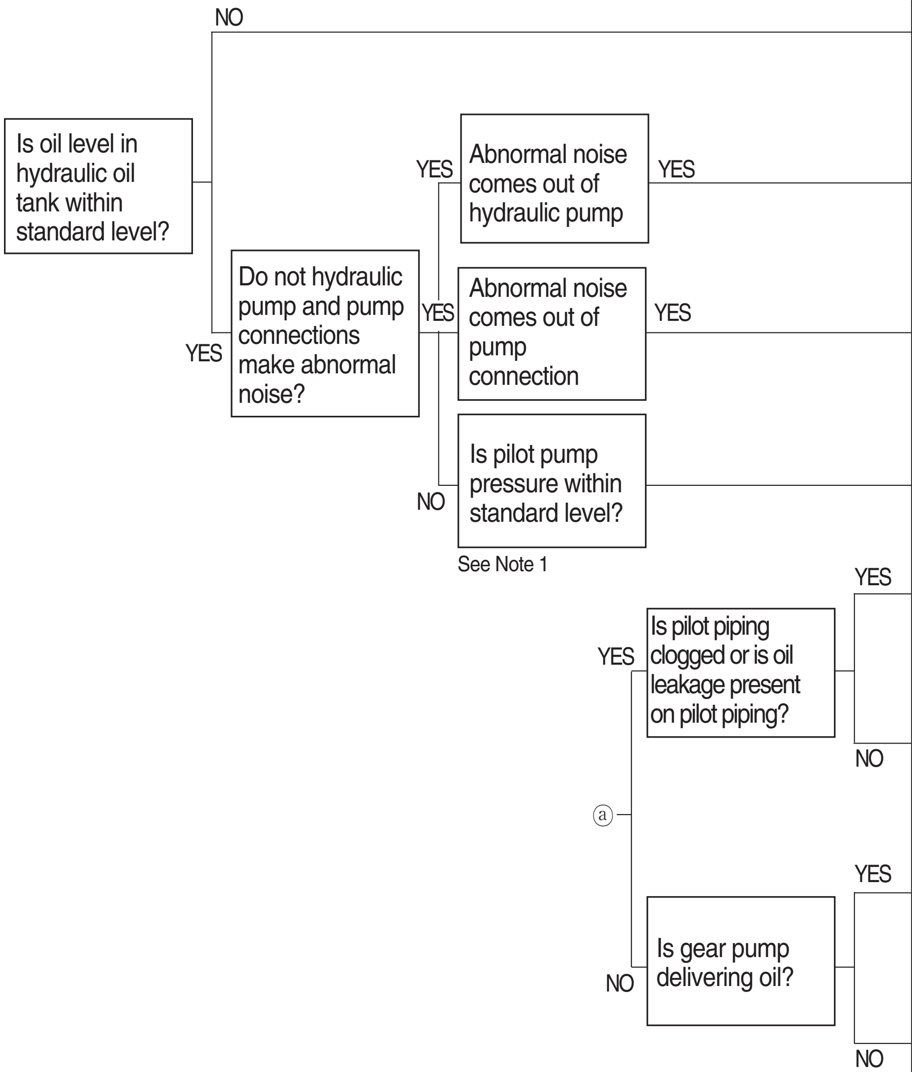
2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



Cause	Remedy
Coupling element is broken.	Disassemble and repair.
	Replace hub or retighten setscrew.

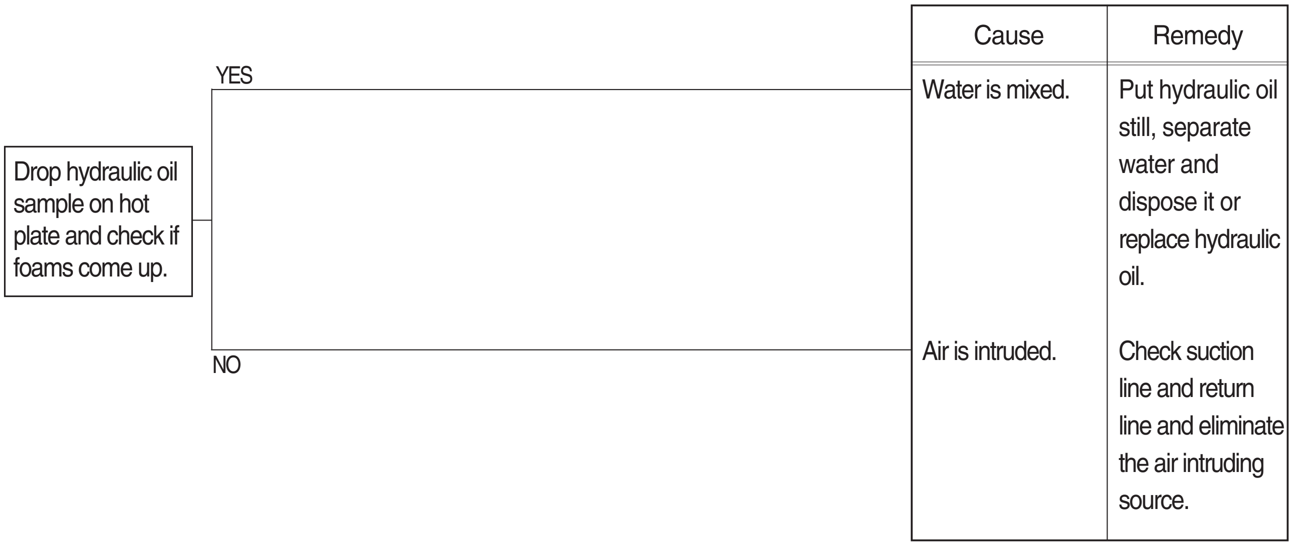
2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



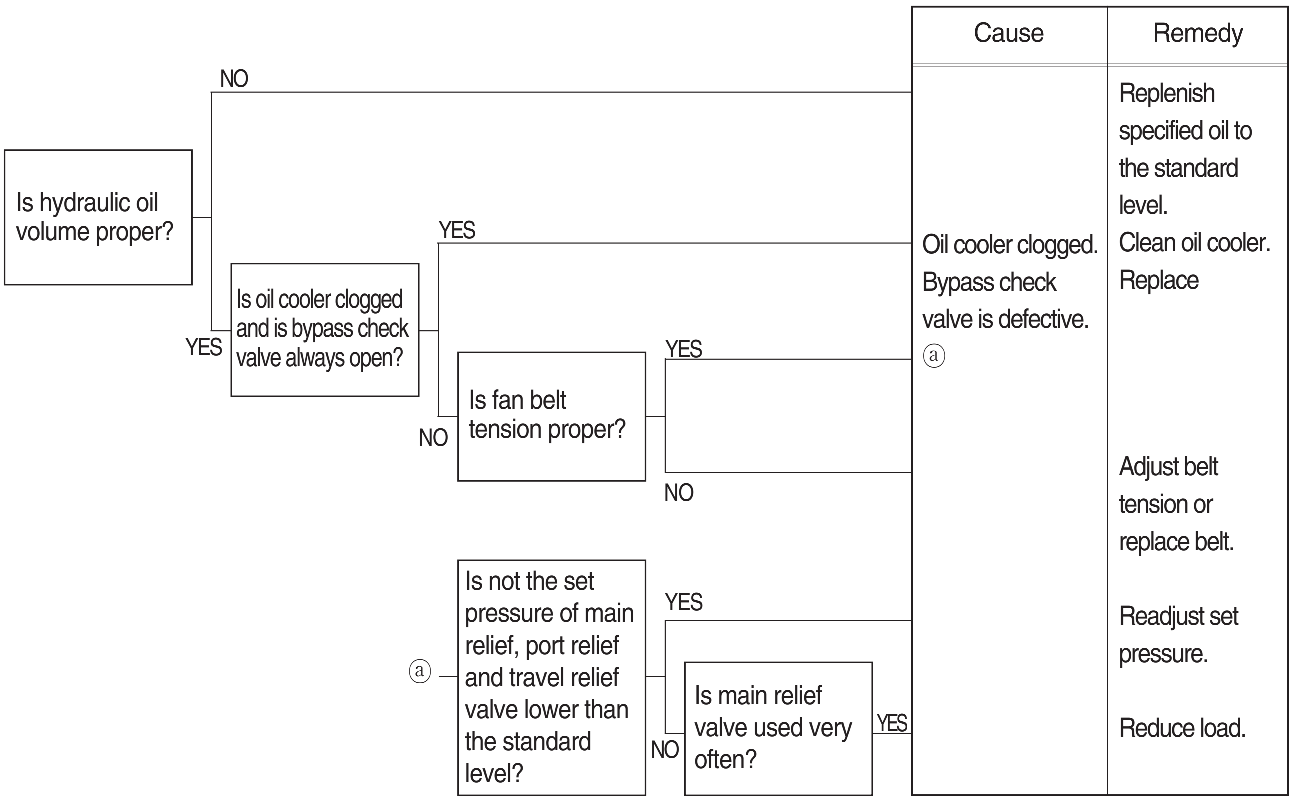
Cause	Remedy
	Replenish specified oil to the standard level.
Hydraulic pump is broken.	Disassemble and repair.
	See item 1). at page 6-5
ⓐ	
	Clean pilot piping interior or repair piping.
RCV and safety solenoid valve is faulty.	Disassemble and repair.
Pilot relief valve in gear pump is faulty.	Repair or replace.
Gear pump is broken.	Disassemble and repair.

3. HYDRAULIC SYSTEM

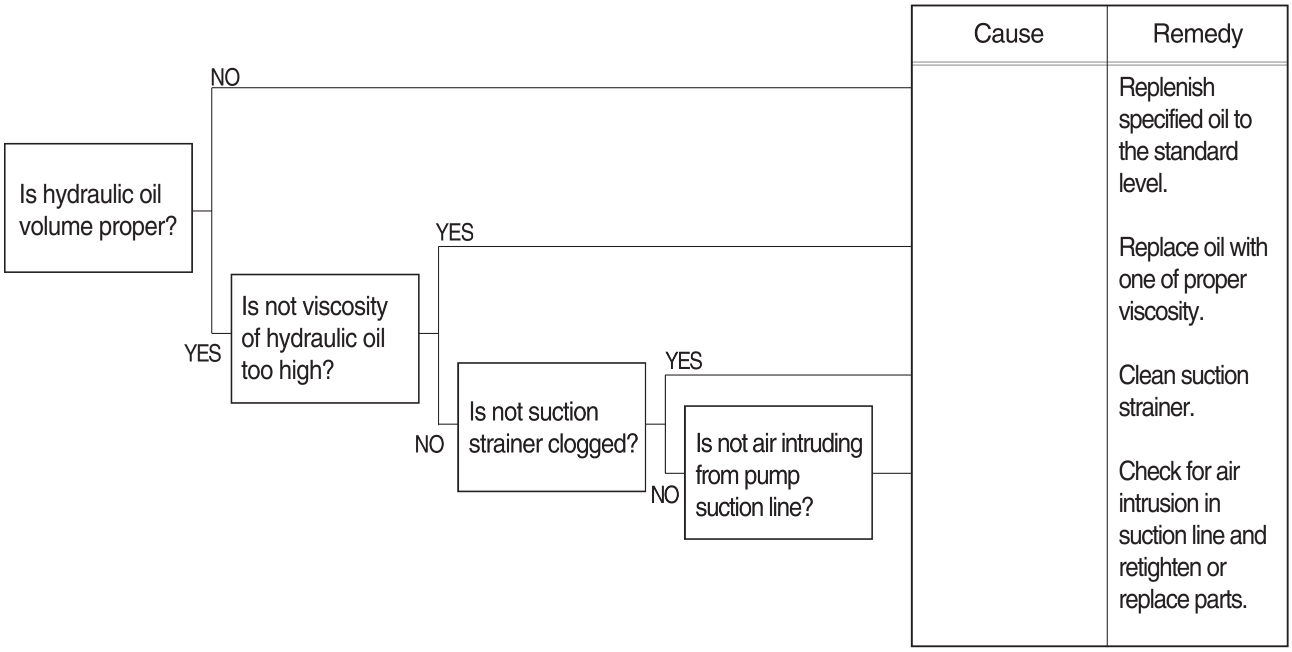
1) HYDRAULIC OIL IS CLOUDY



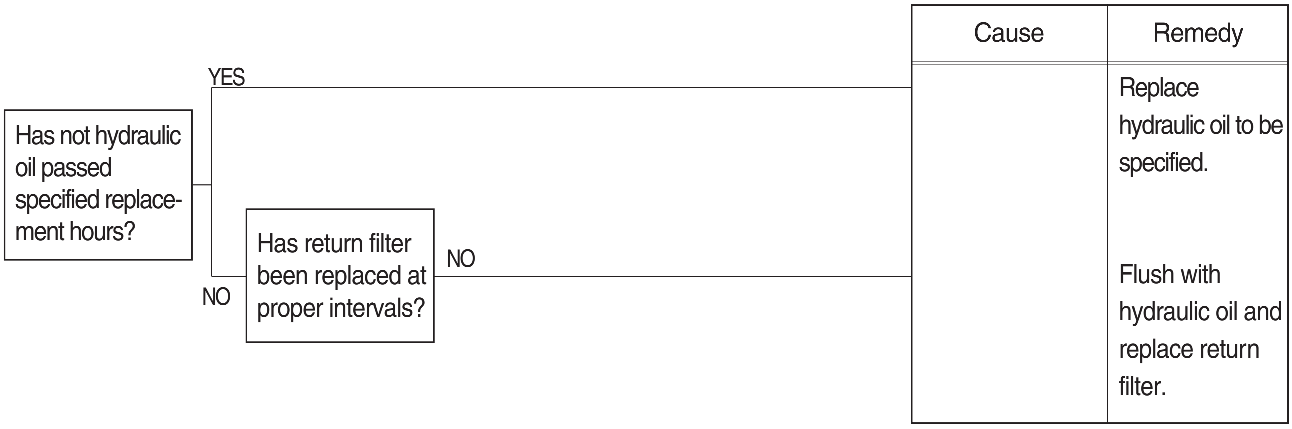
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

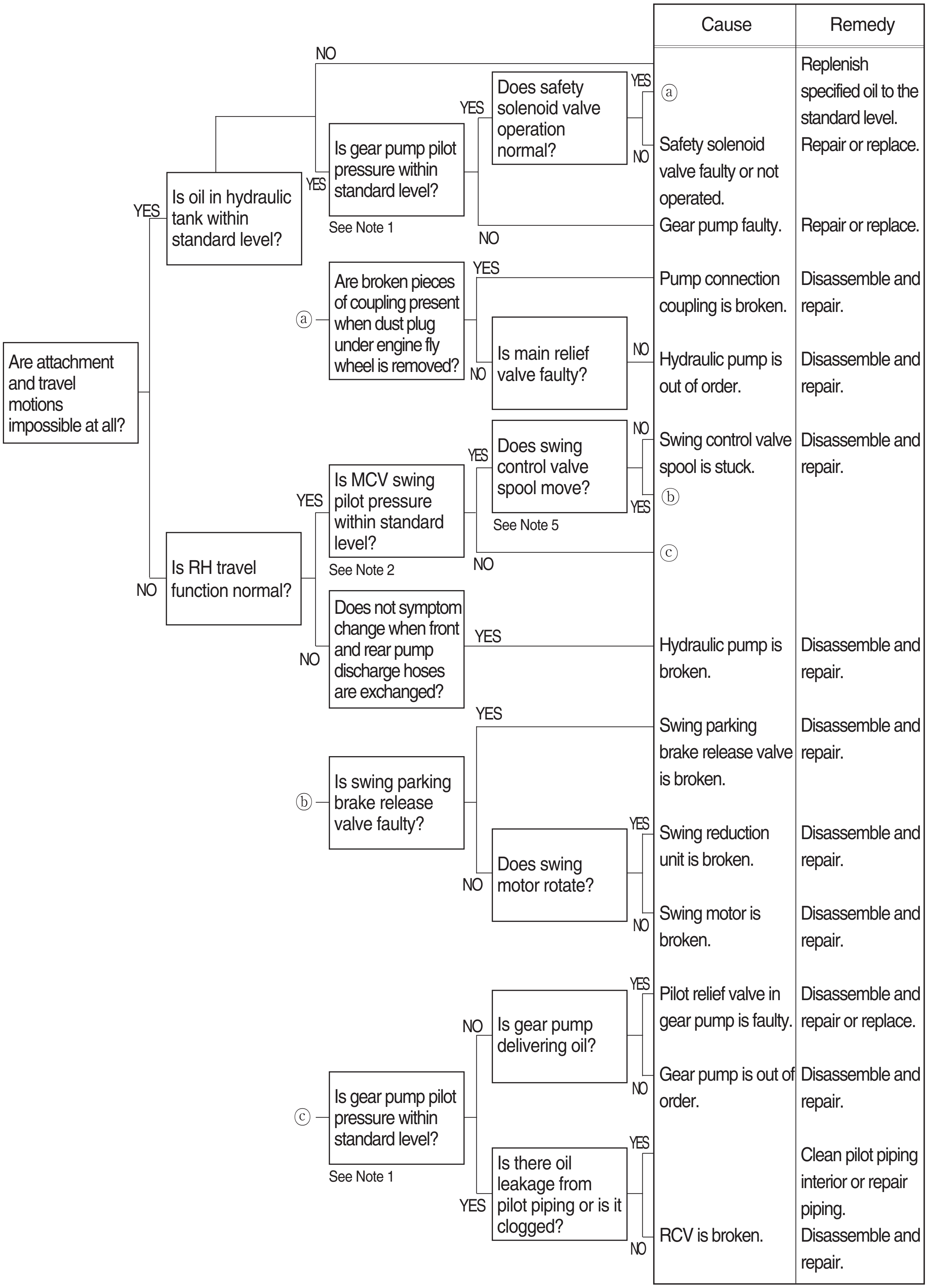


4) HYDRAULIC OIL IS CONTAMINATED

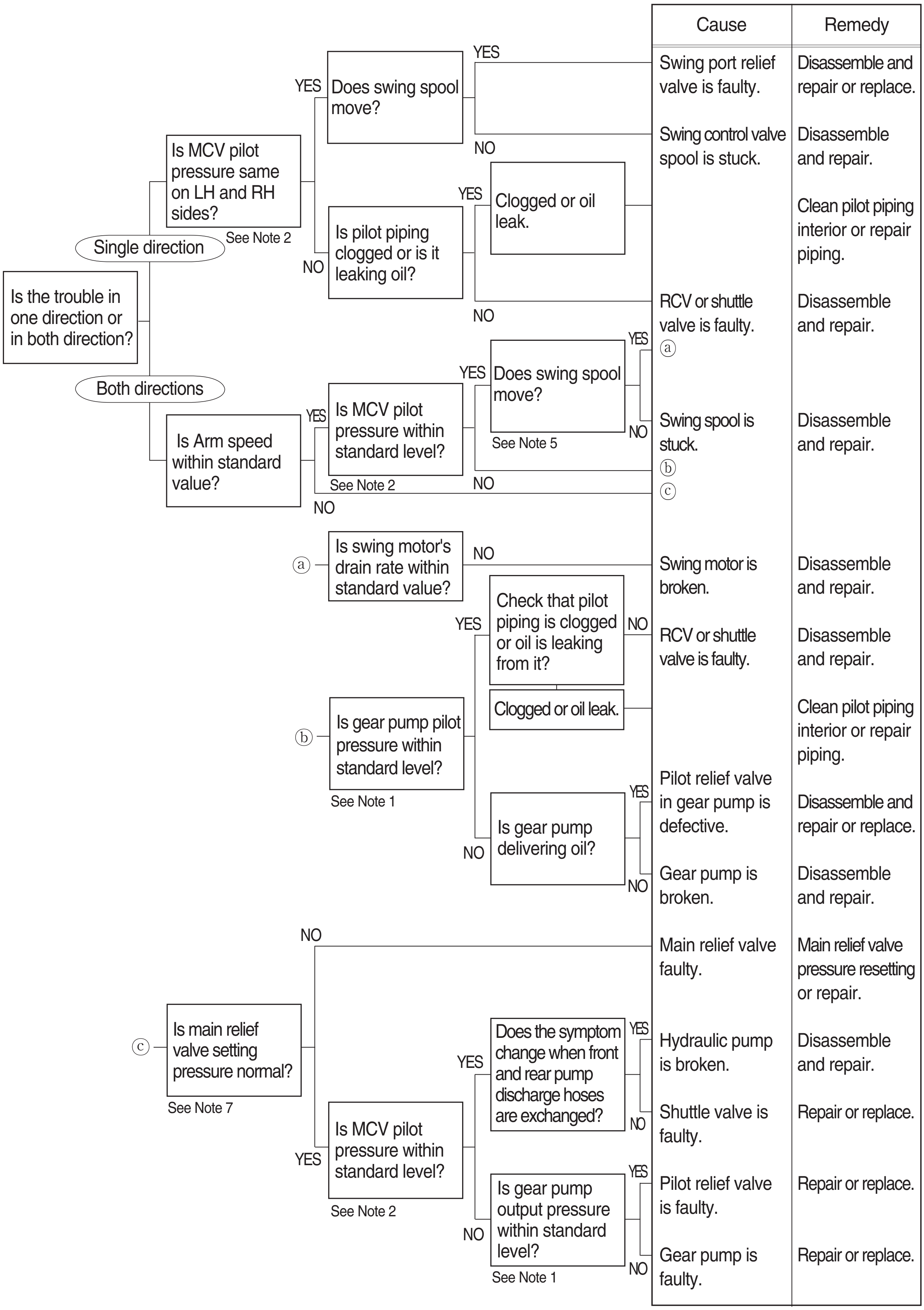


4. SWING SYSTEM

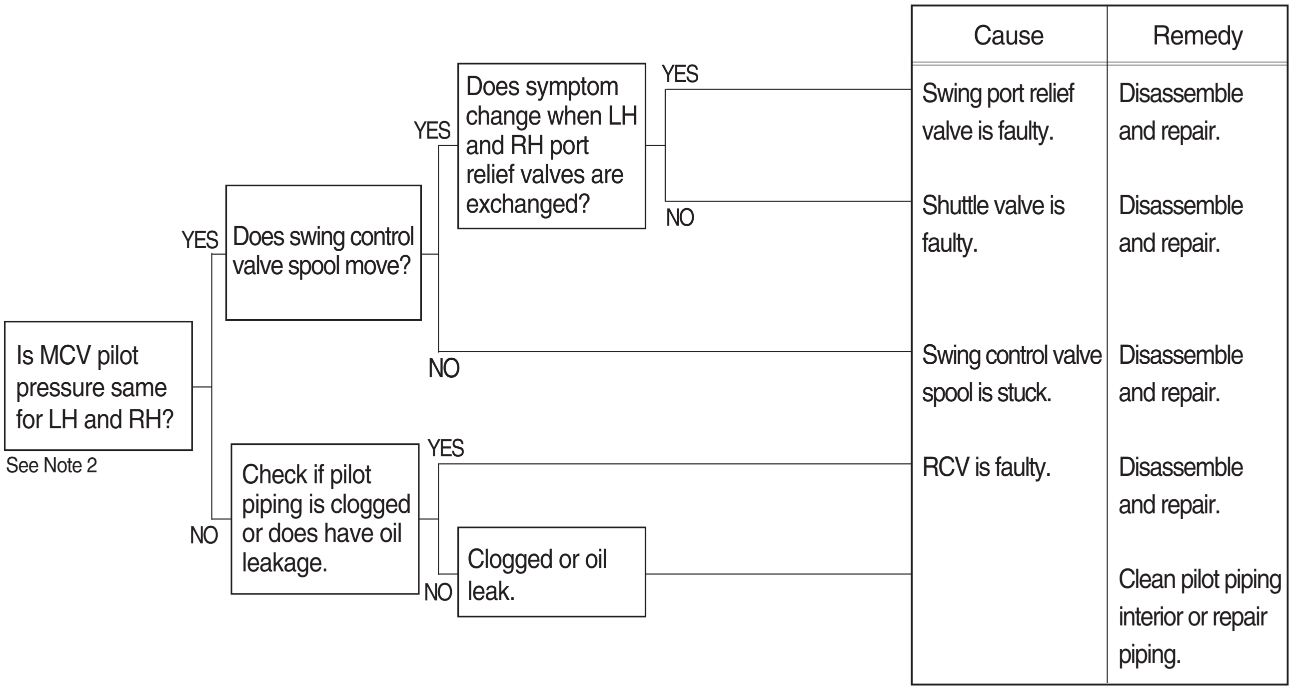
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



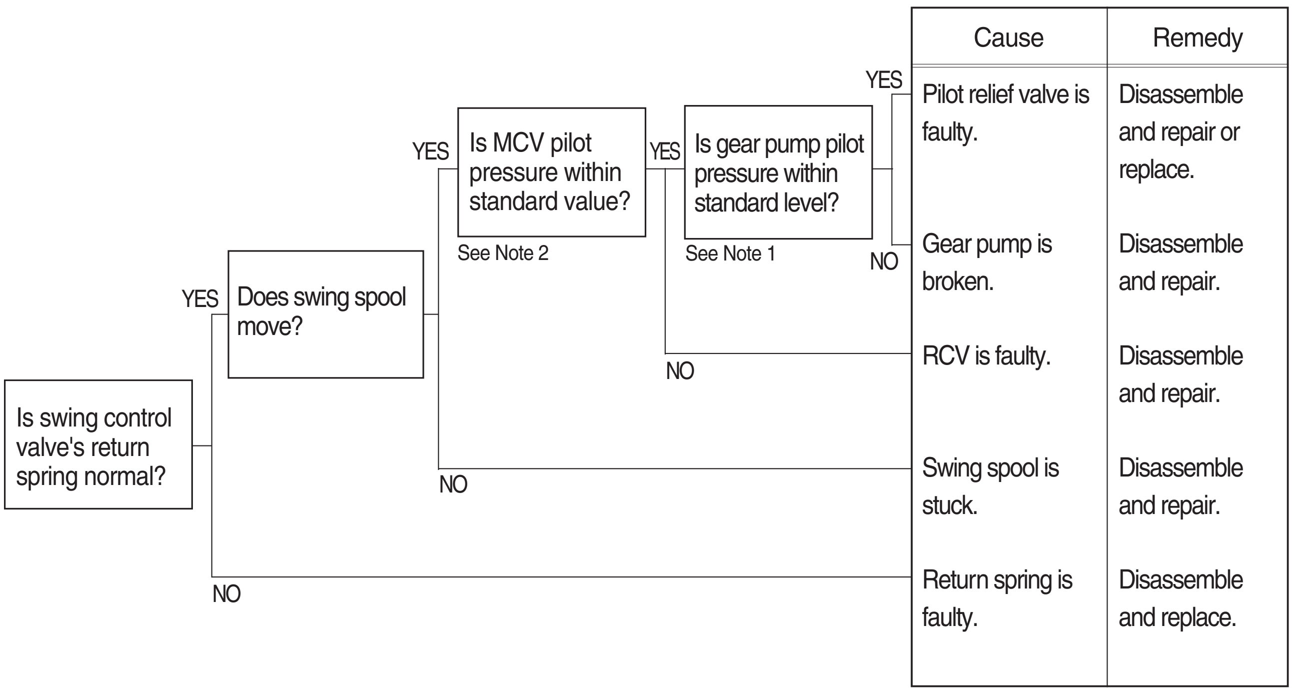
2) SWING SPEED IS LOW



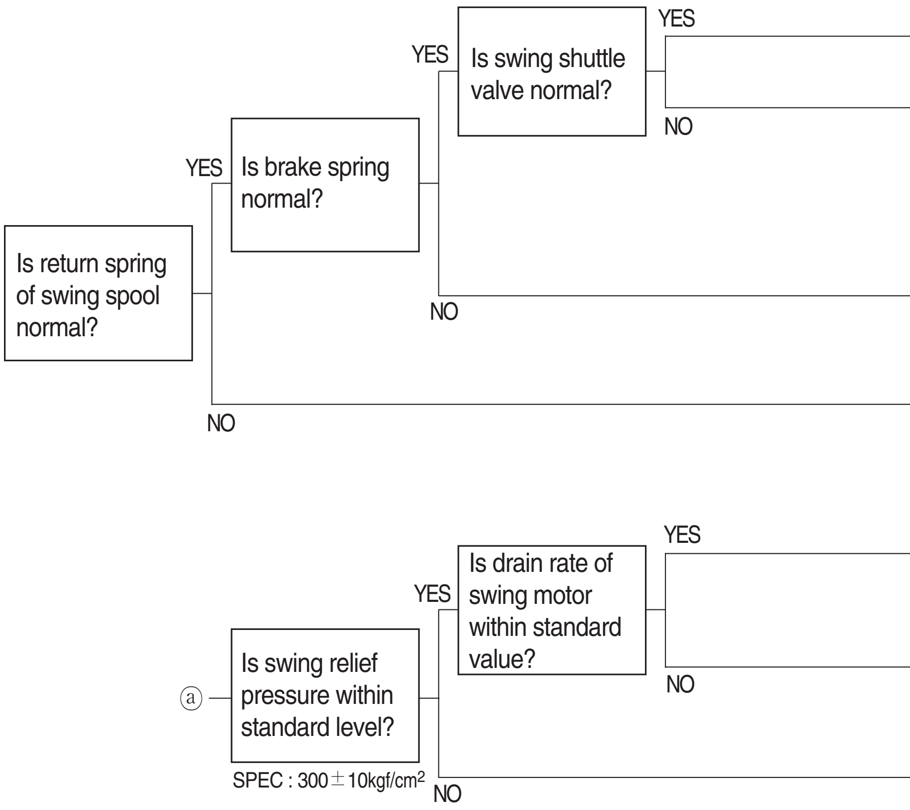
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP



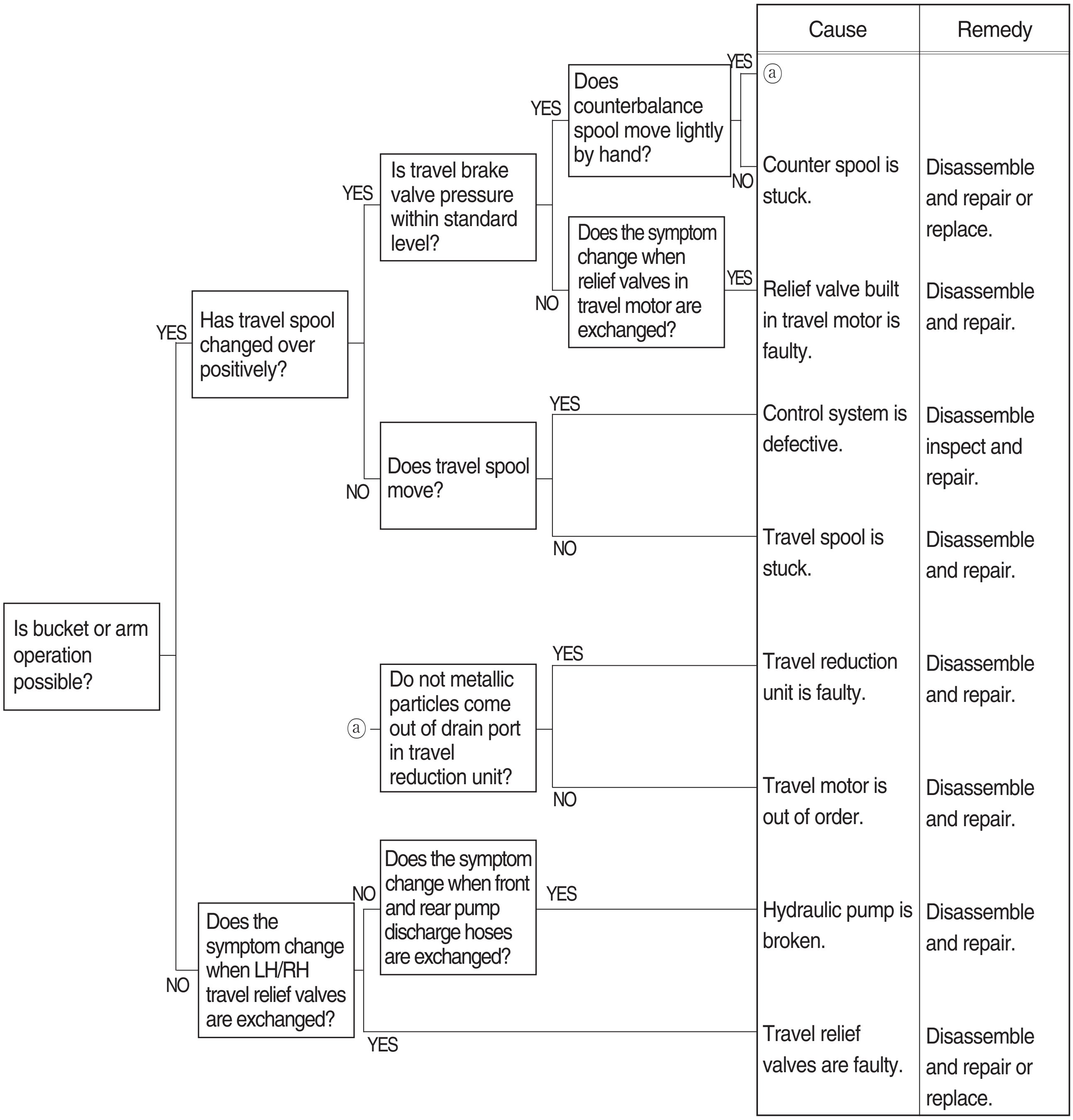
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



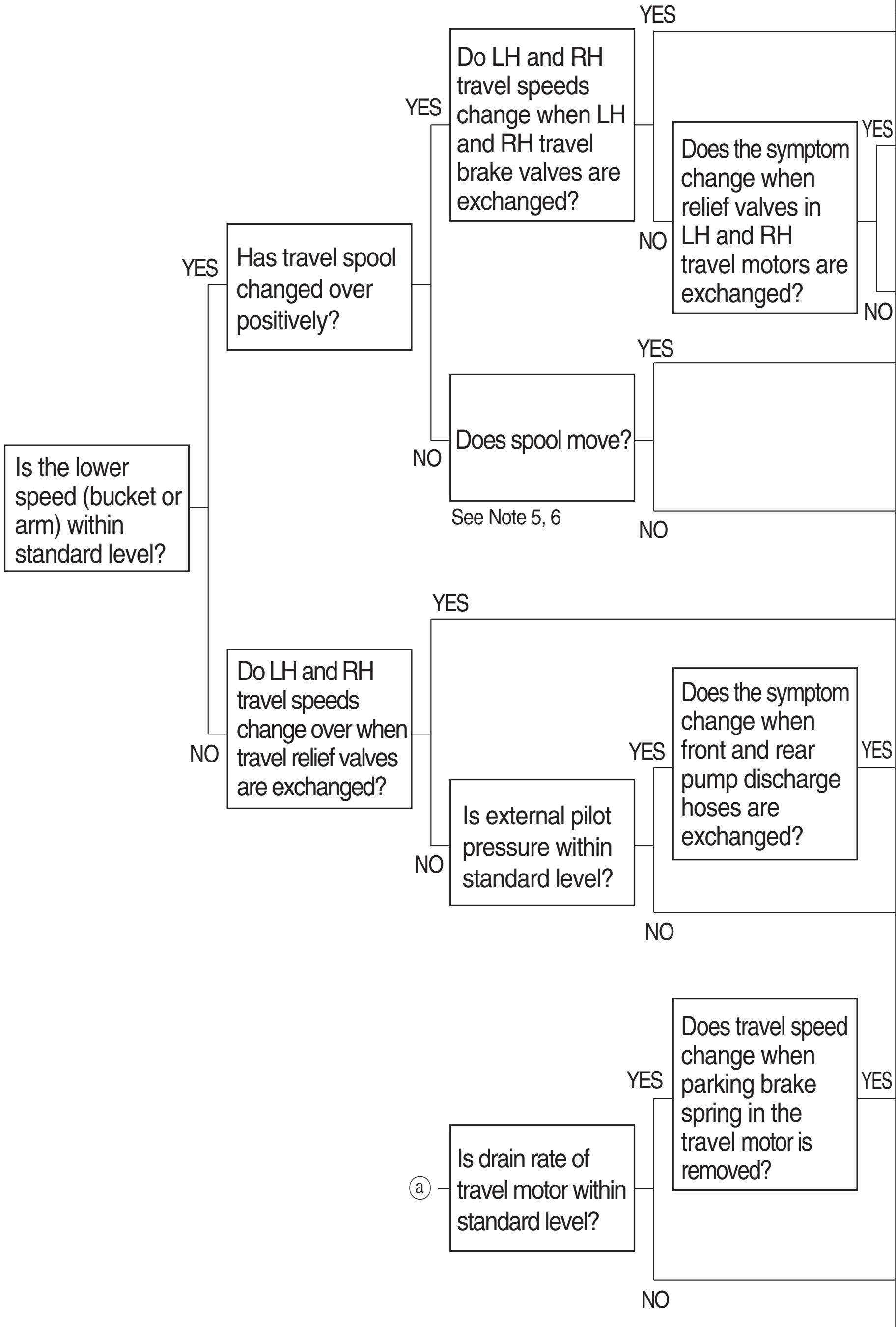
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing port relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.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

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



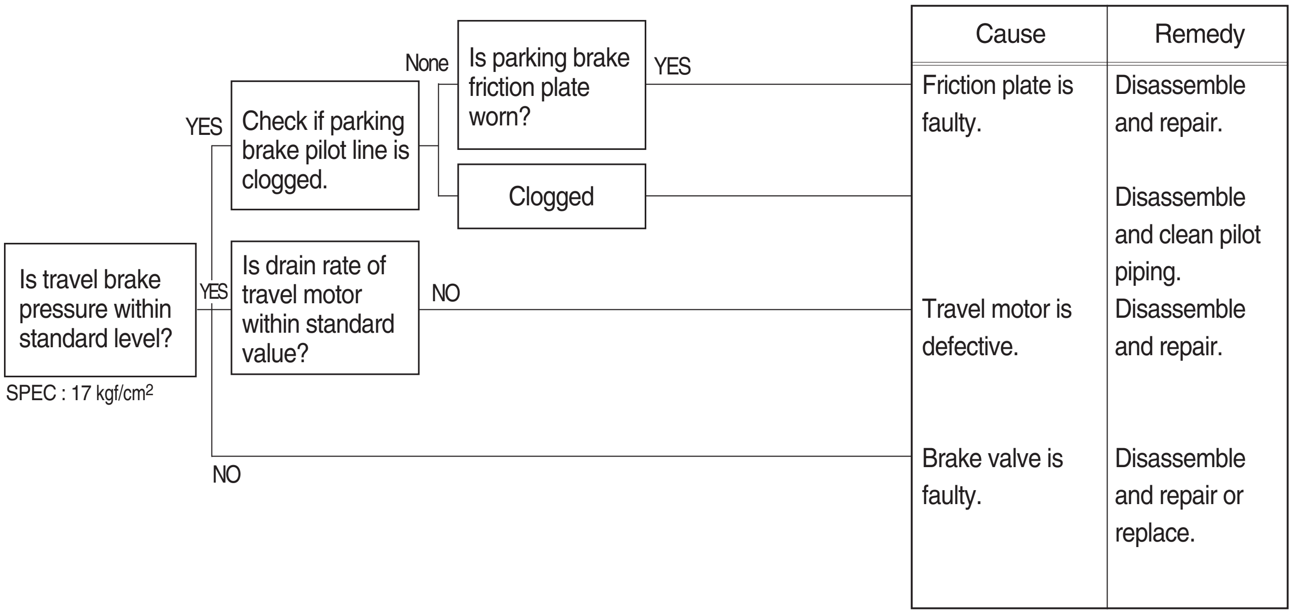
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



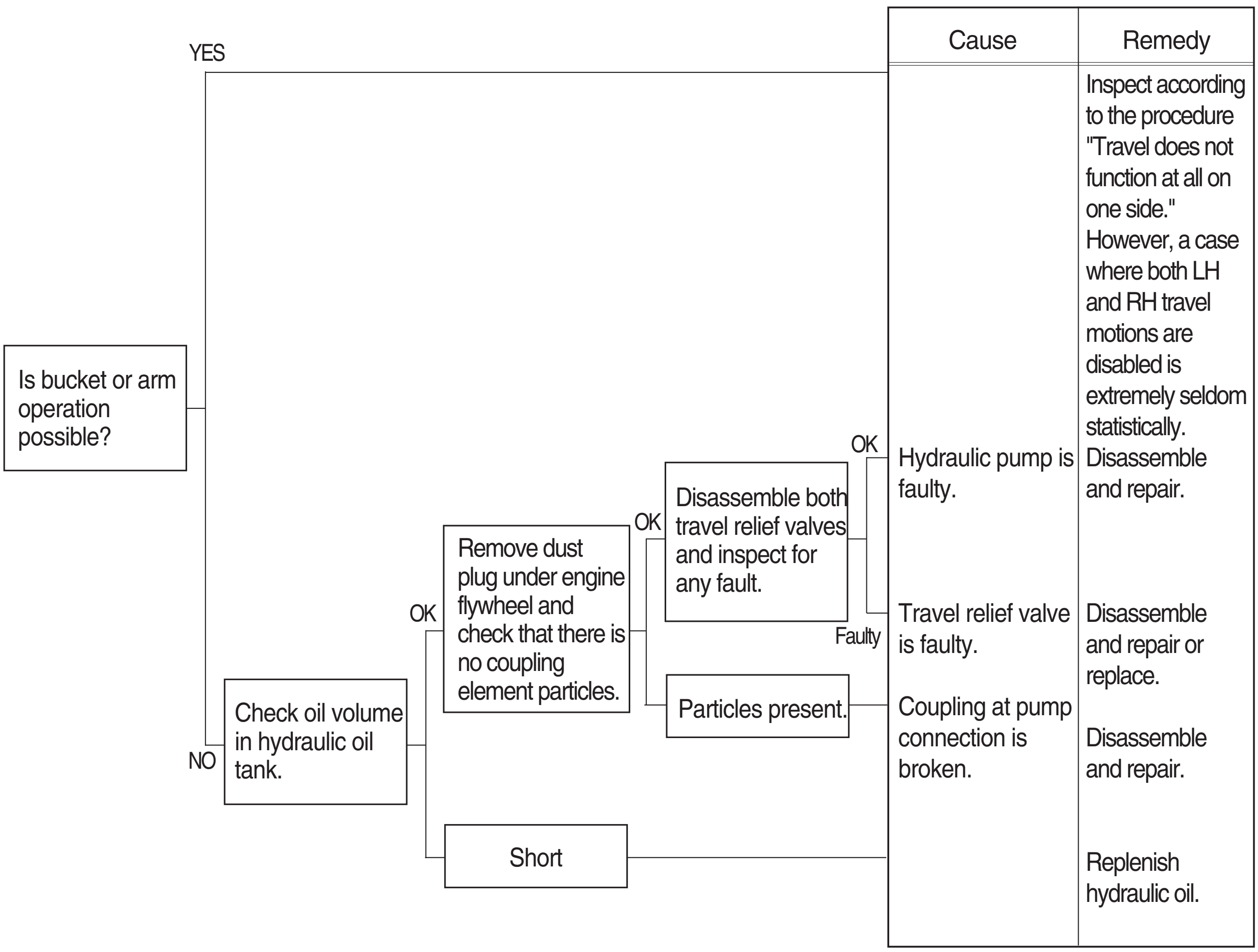
Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
ⓐ	
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic pump is broken.	Disassemble and repair.
External pilot piping is clogged or oil is leaking from it.	Disassemble and clean.
Travel motor's parking brake is not released properly.	Disassemble and clean pilot piping.
Travel motor is faulty.	Disassemble and repair.

3) MACHINE DOES NOT STOP ON A SLOPE

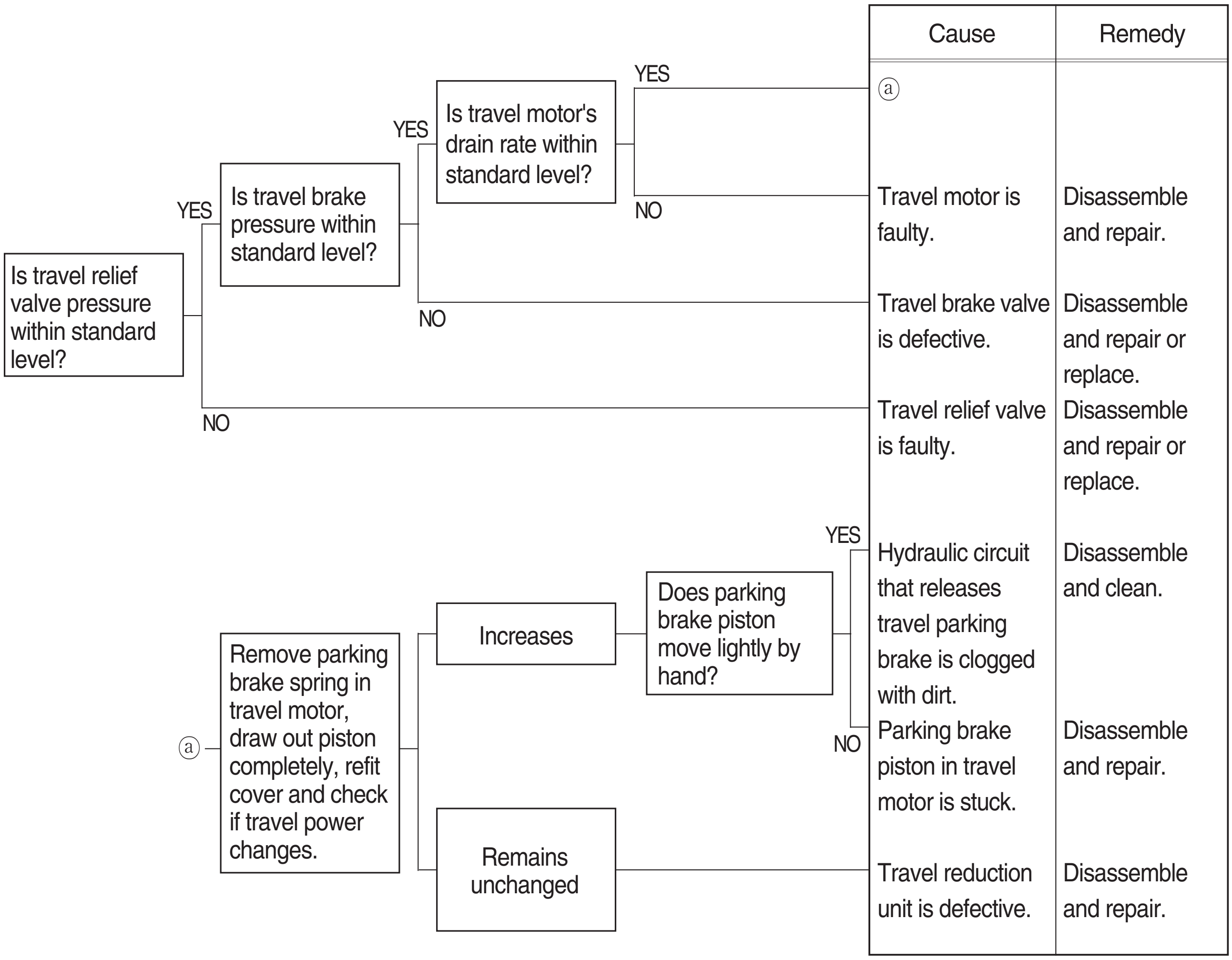
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

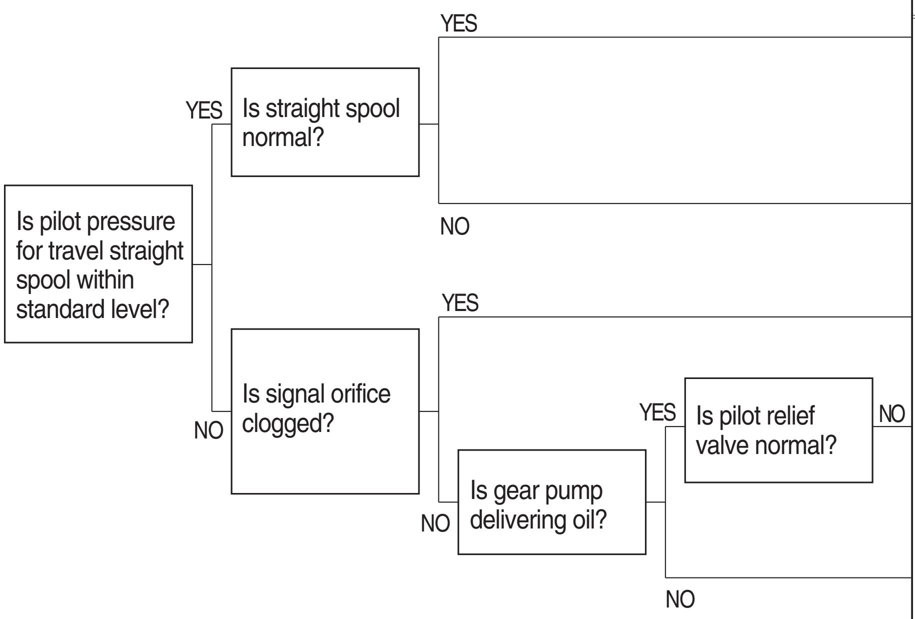


5) TRAVEL ACTION IS POWERLESS (travel only)



6) MACHINE RUNS RECKLESSLY ON A SLOPE

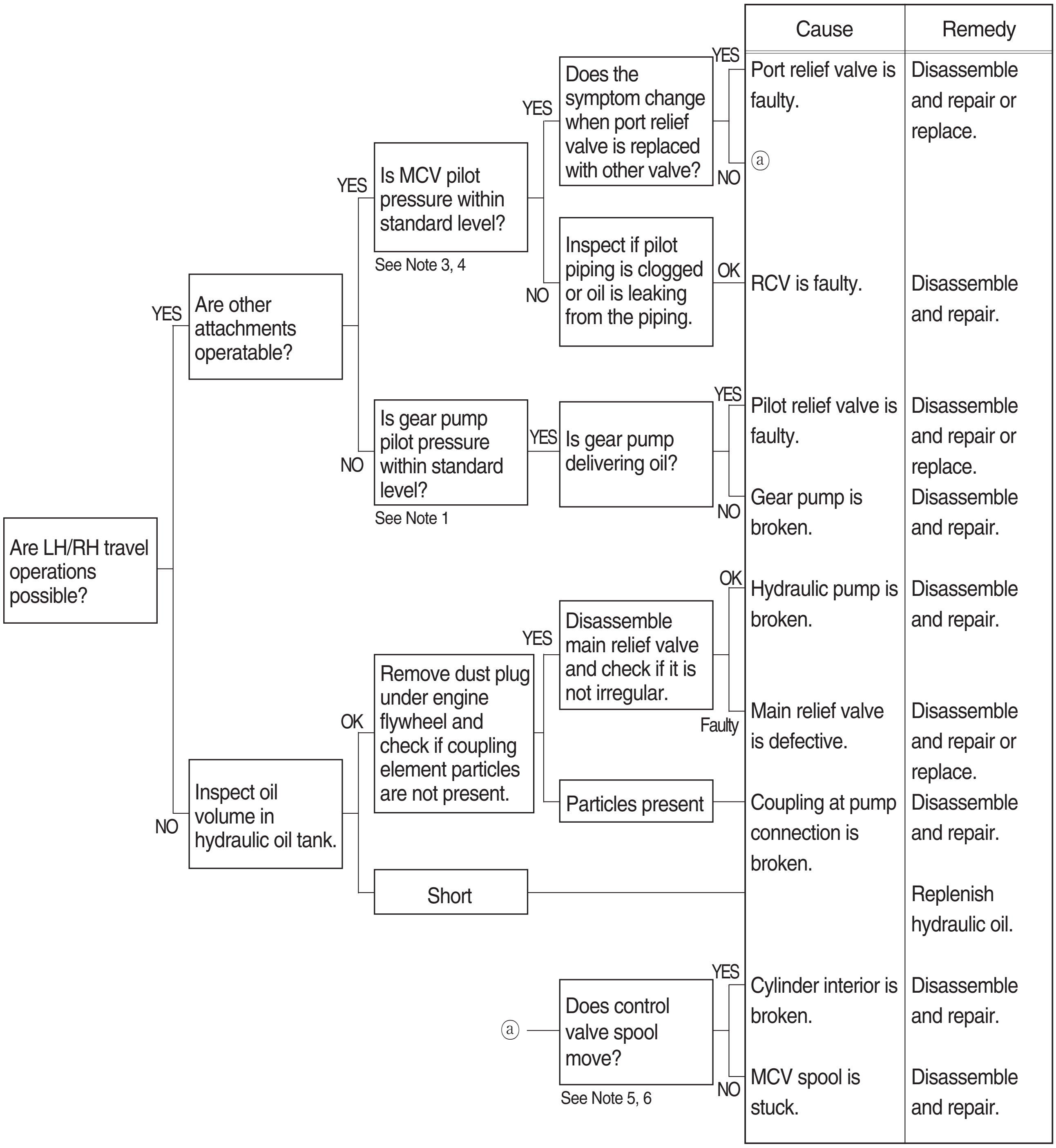
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



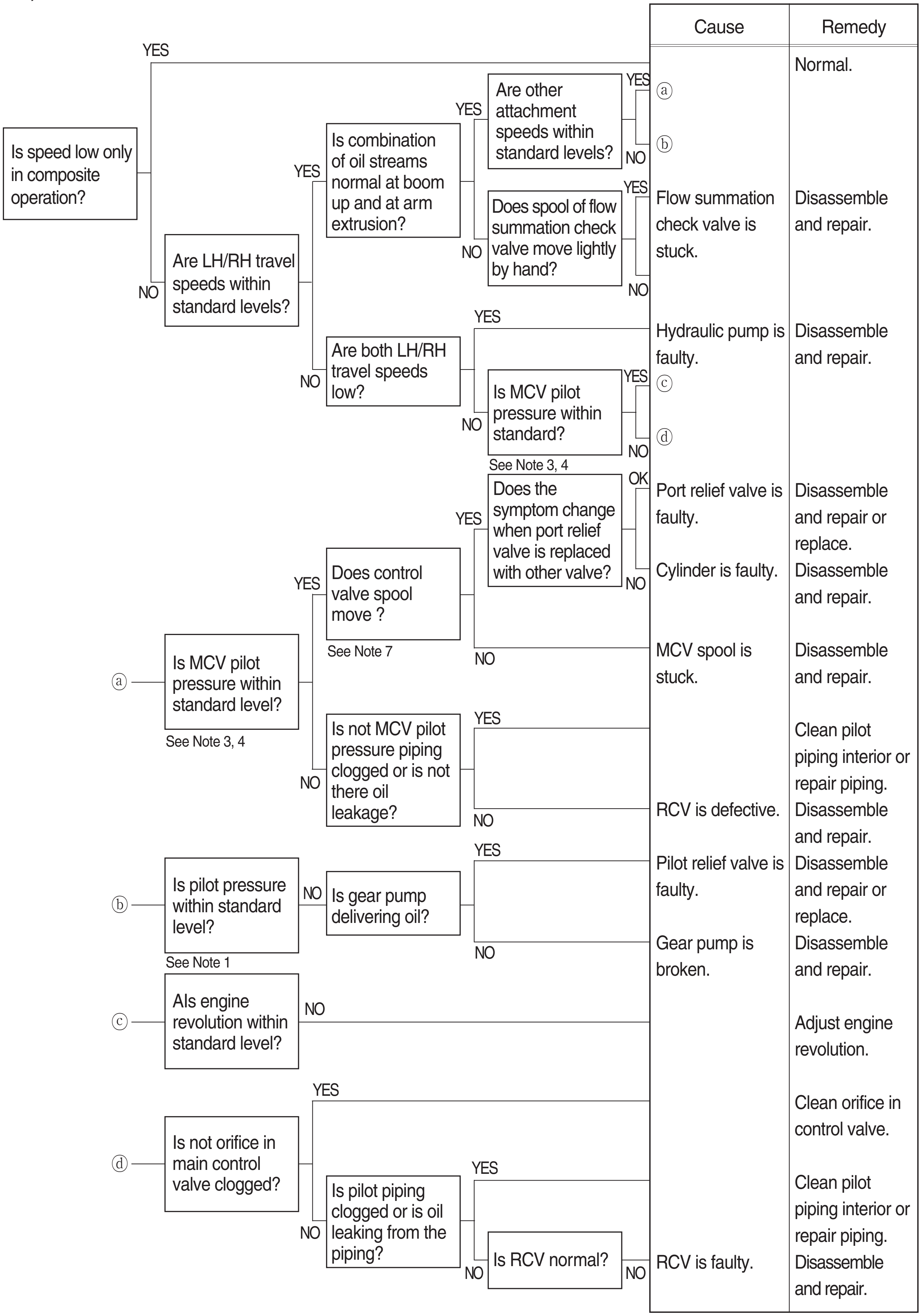
Cause	Remedy
	Normal.
Straight spool is faulty.	Repair or replace.
	Remove dirt on signal orifice.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

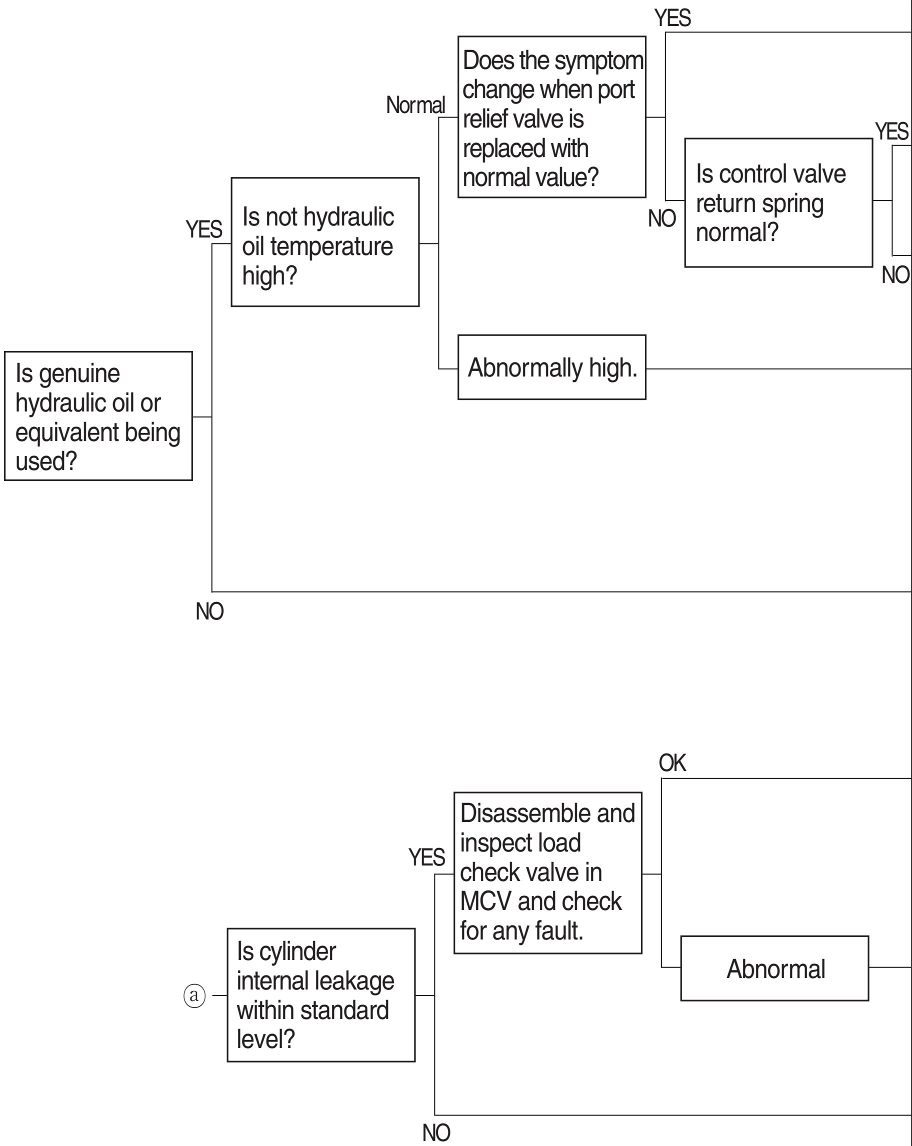
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

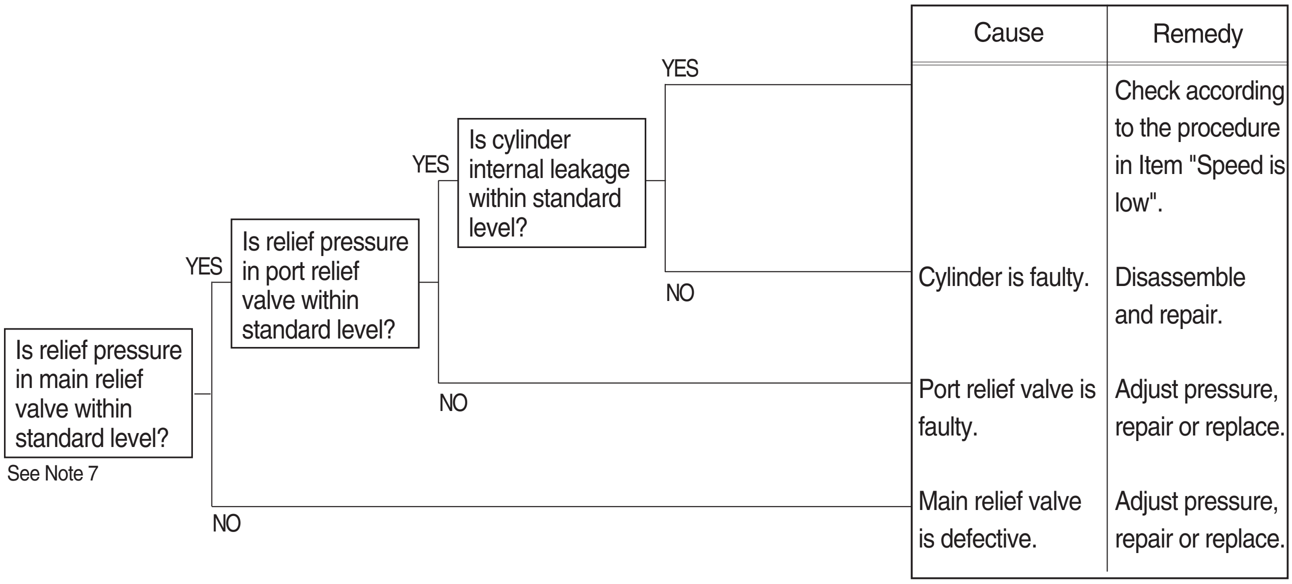


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS

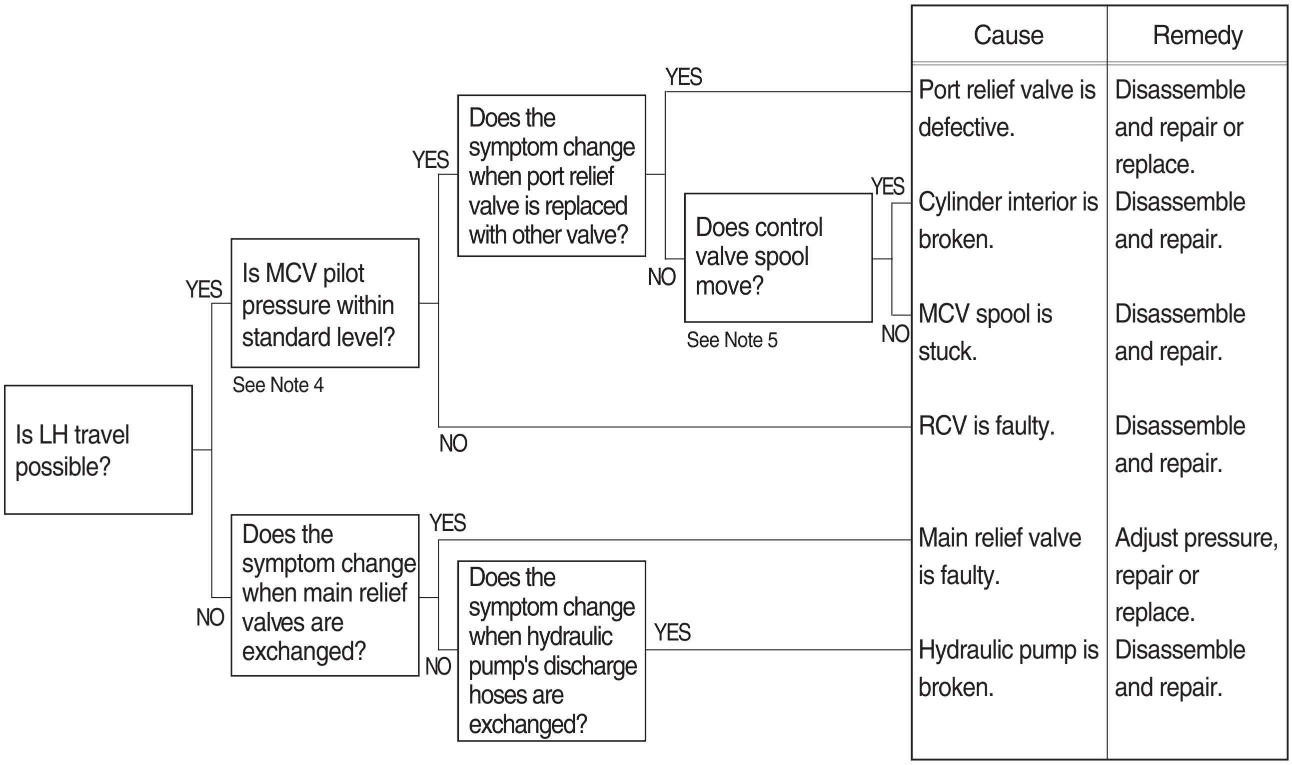


Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
ⓐ	
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE

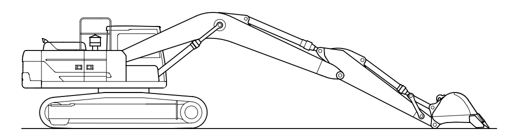


6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

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

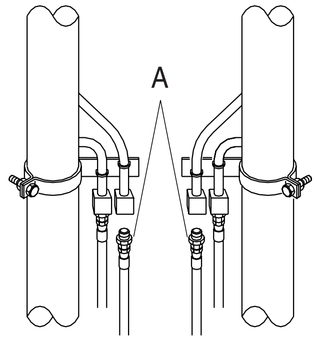
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



300L6TS01

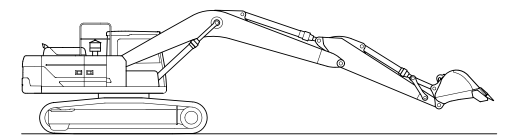
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



(210-7) 6-20(2)

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

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



300L6TS02

GROUP 3 ELECTRICAL SYSTEM

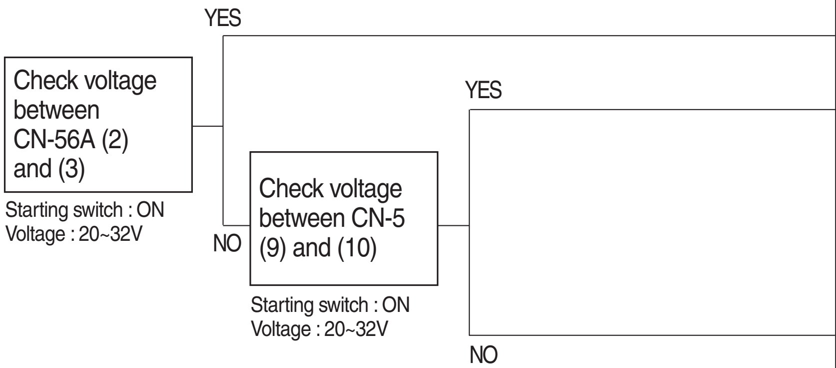
(SERIAL NO. : -#0785)

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.

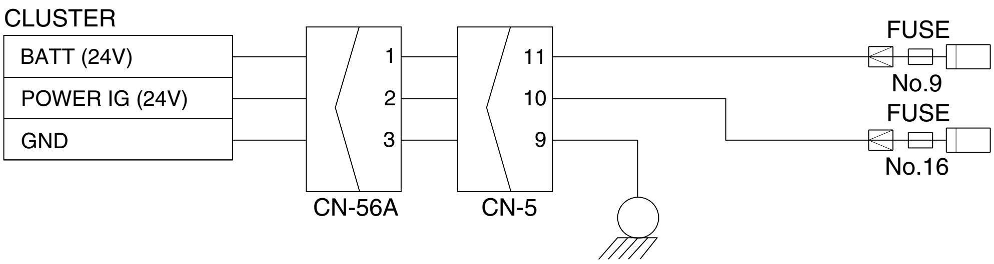
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



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

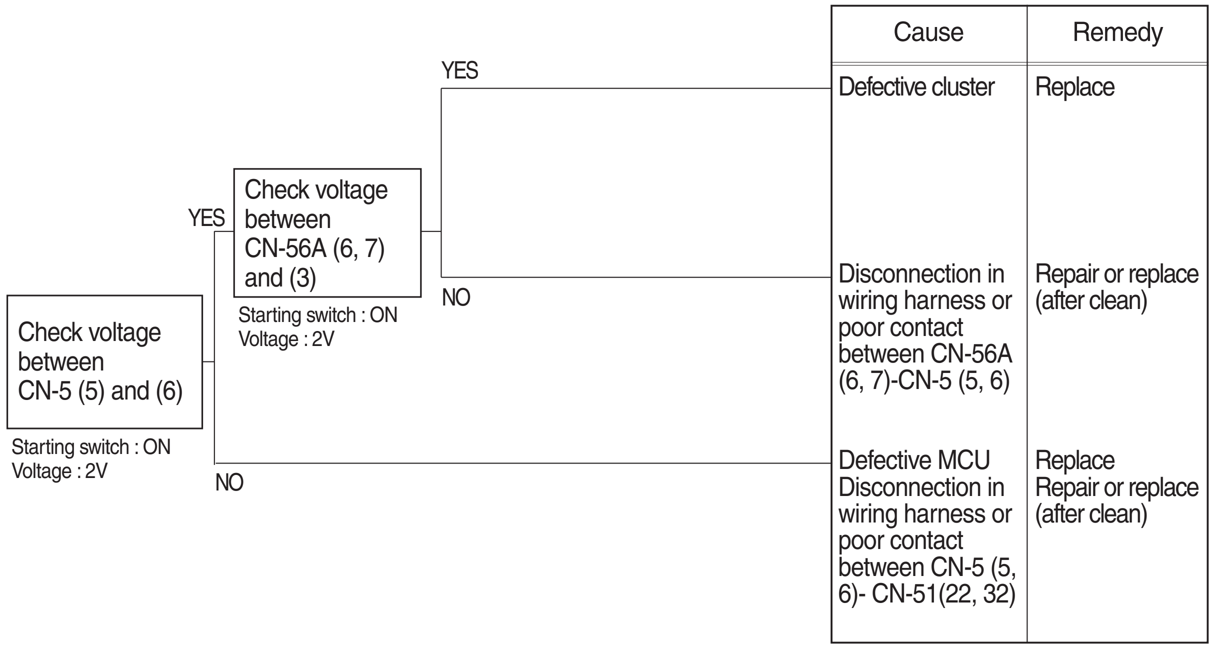


300L6ES51

(SERIAL NO. : -#0785)

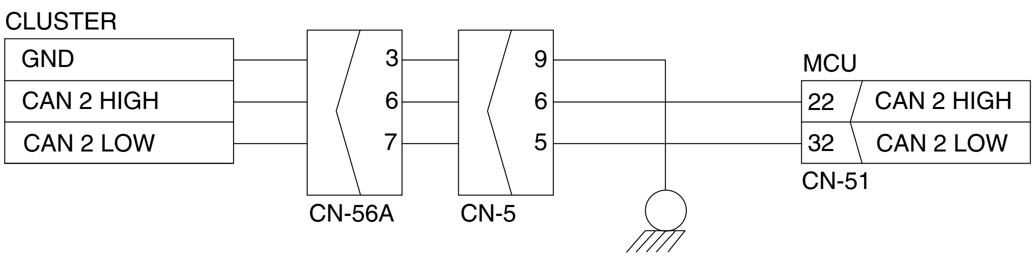
2. ⚠ COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

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



Check voltage

YES	2V
NO	0V

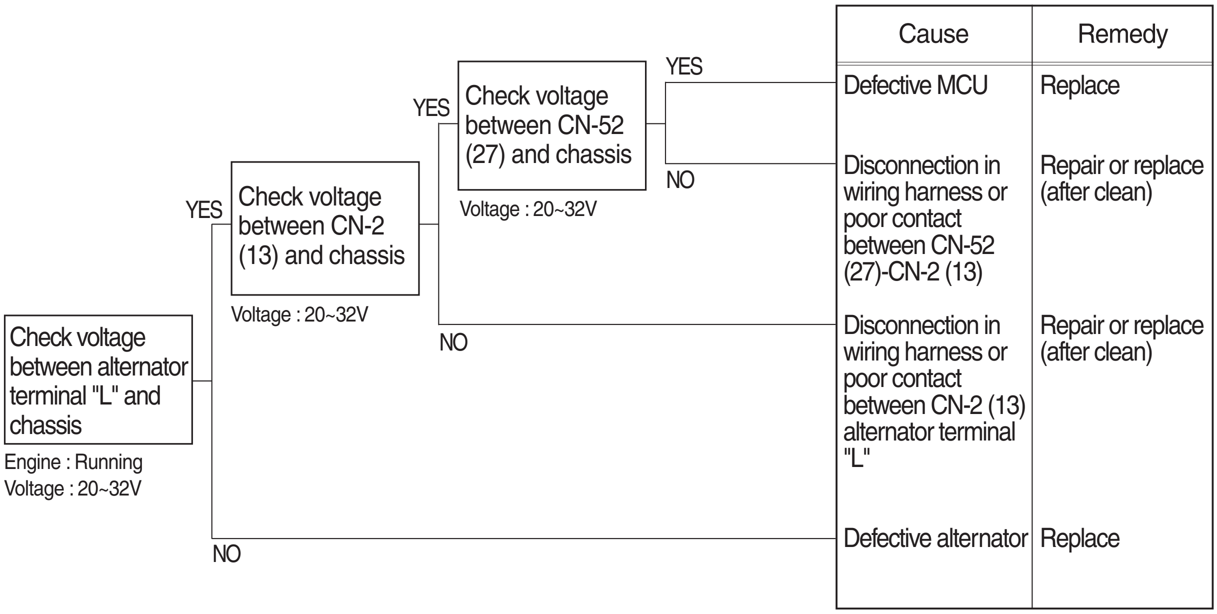


300L6ES02

(SERIAL NO. : -#0785)

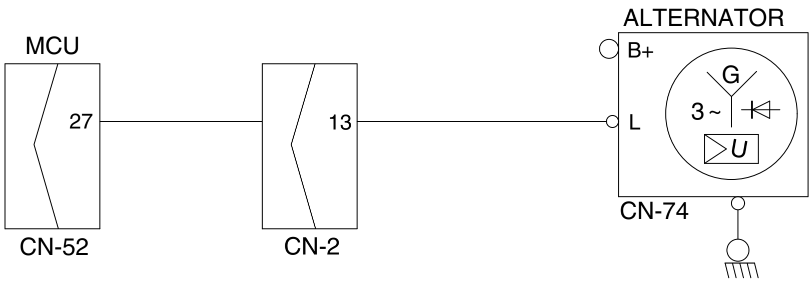
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

· 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

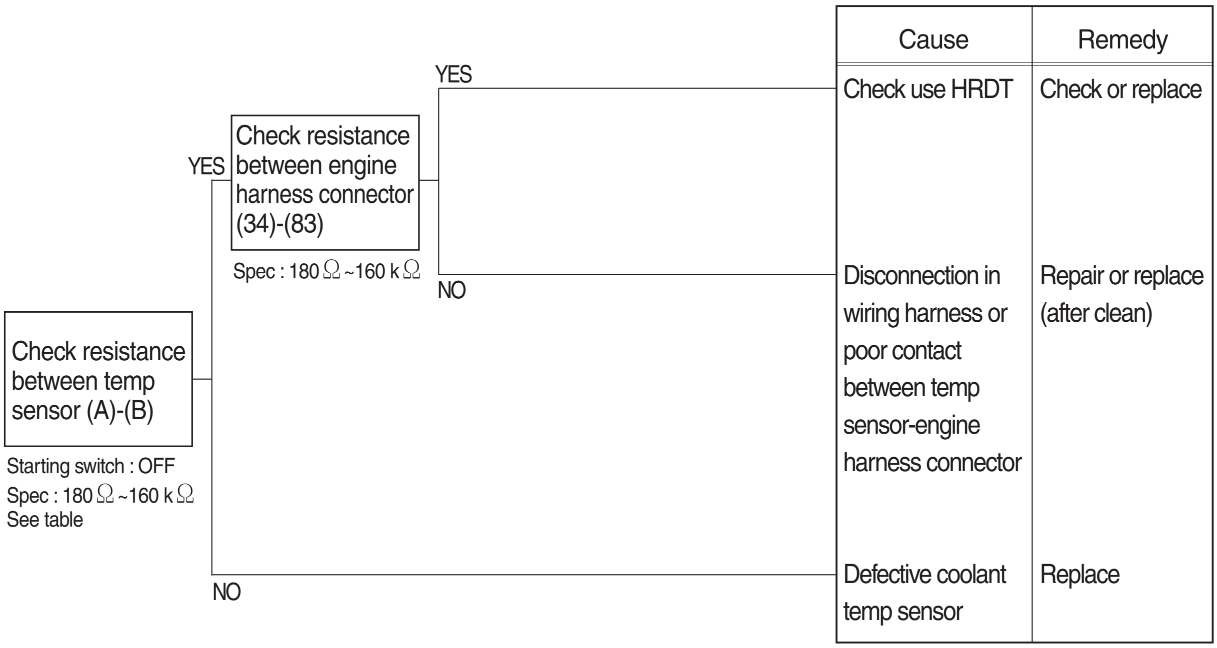


300L6ES03

(SERIAL NO. : -#0785)

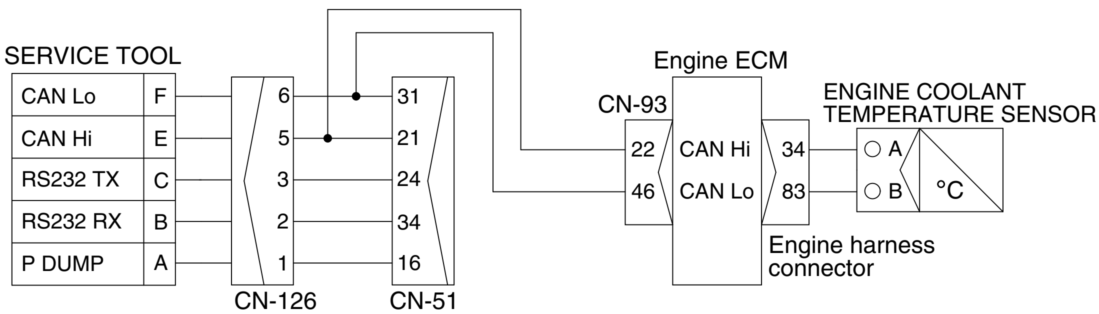
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

· 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

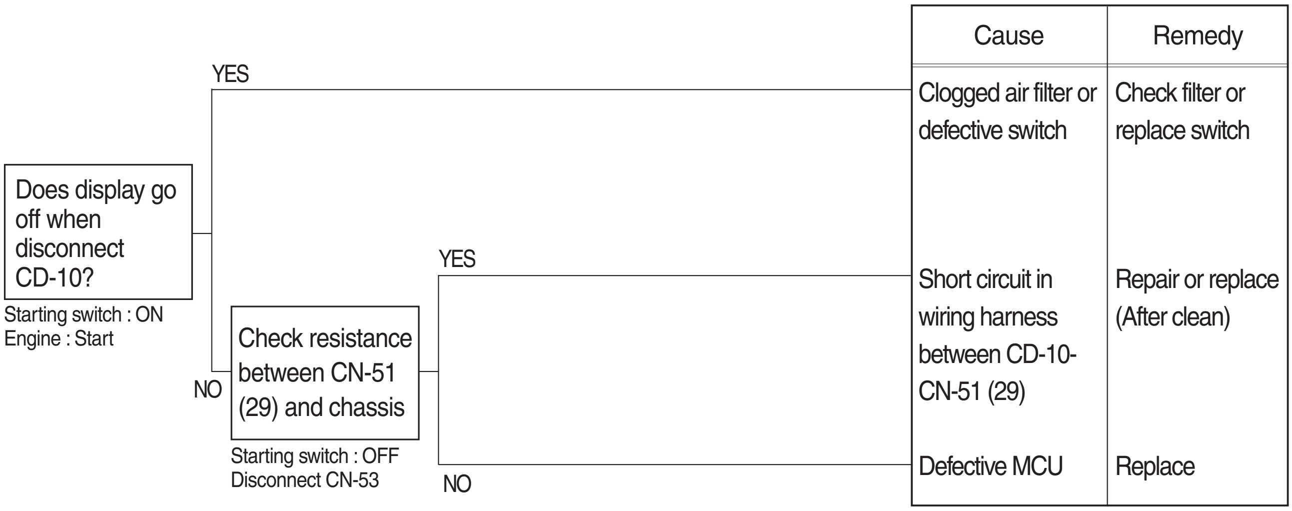


300L6ES04

(SERIAL NO. : -#0785)

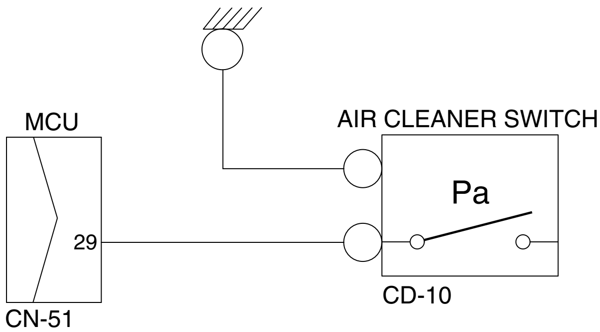
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

YES	MAX 1Ω
NO	MIN 1MΩ

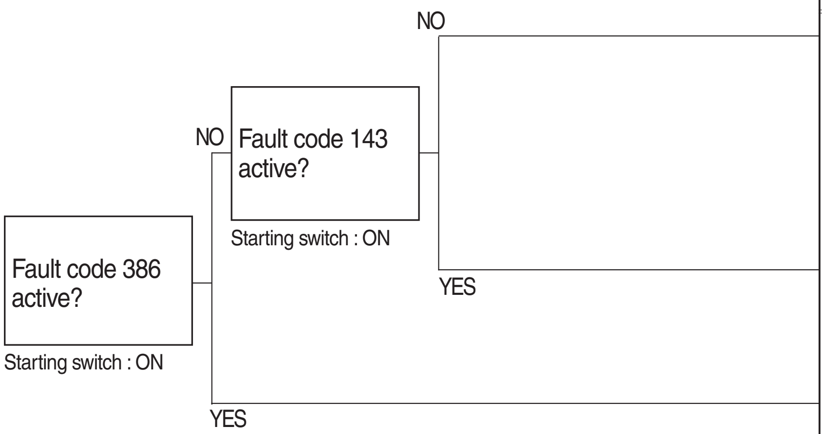


300L6ES06

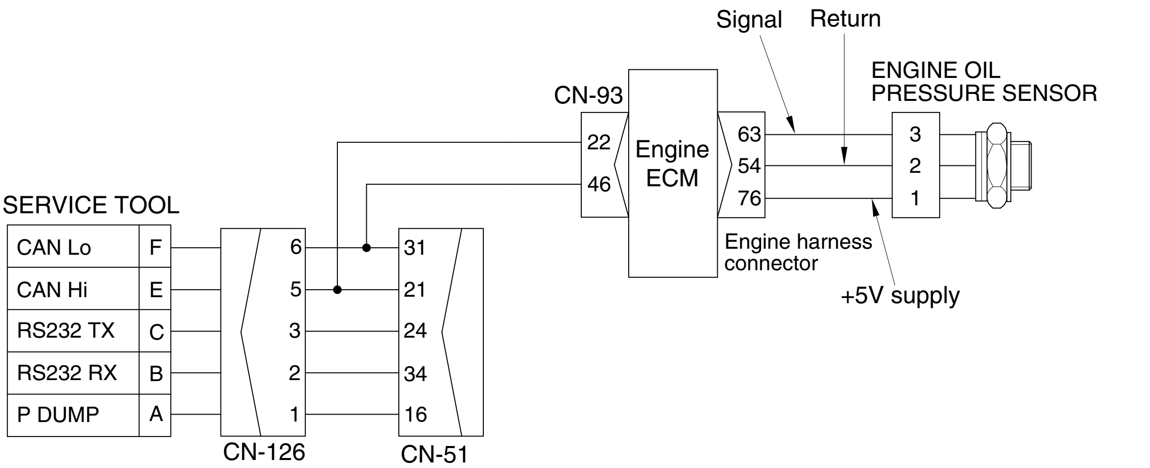
(SERIAL NO. : -#0785)

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 ECM.	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

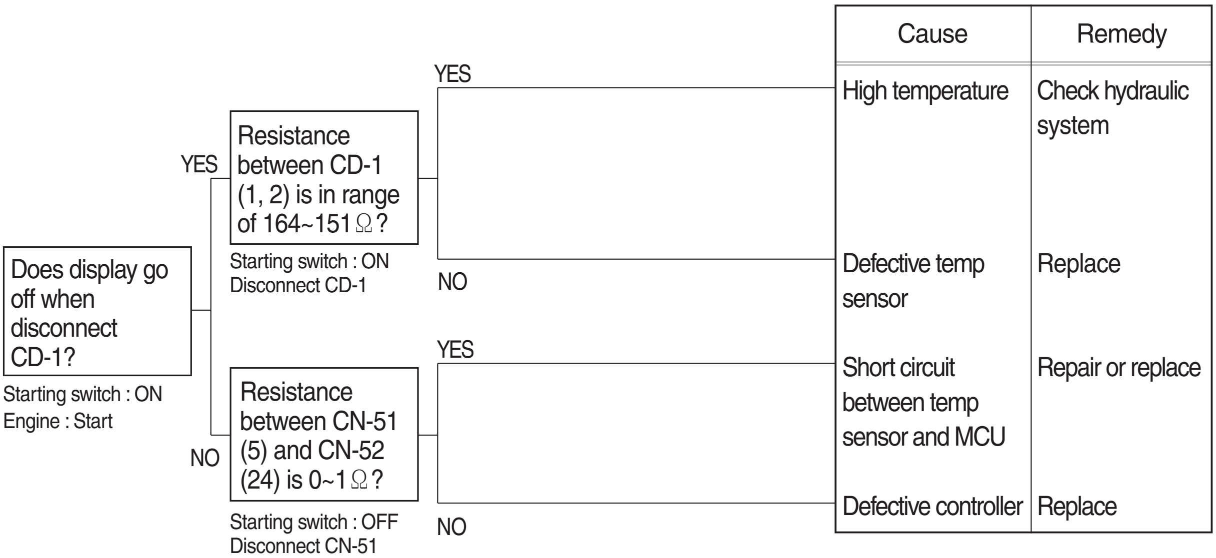


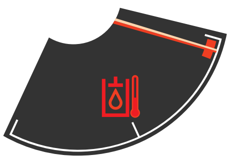
300L6ES07

(SERIAL NO. : -#0785)

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

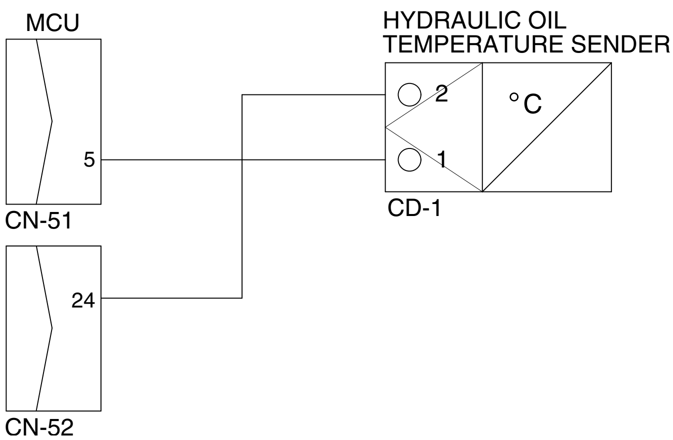
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

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

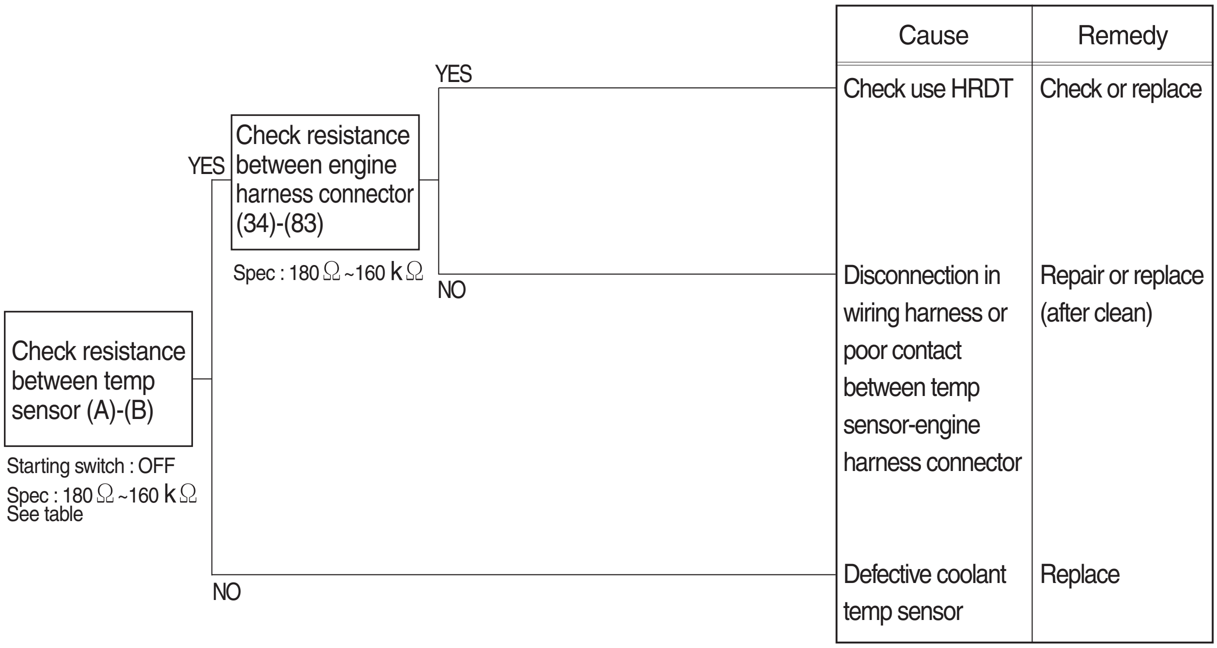


300L6ES08

(SERIAL NO. : -#0785)

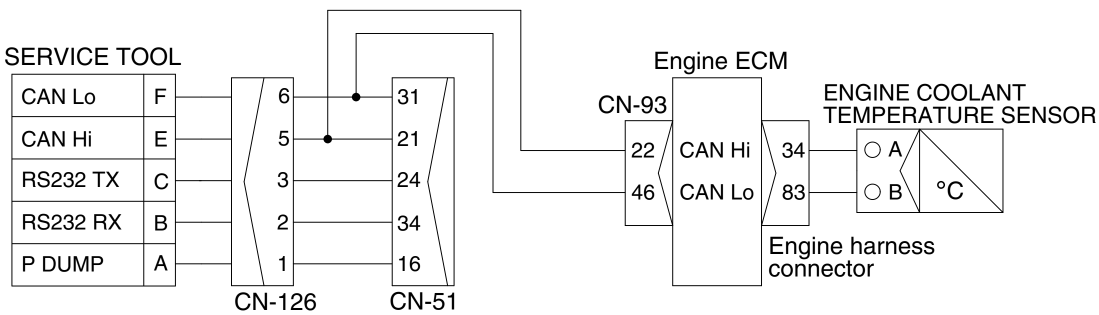
8. WHE RE GAUGE DOES NOT OPERATE

· 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

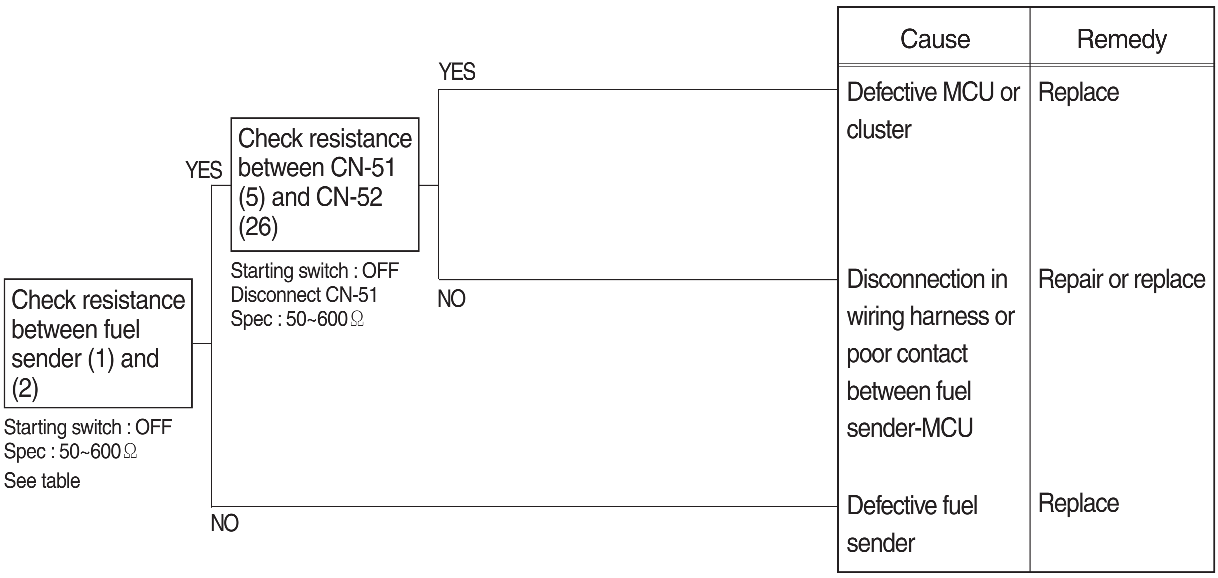


300L6ES04

(SERIAL NO. : -#0785)

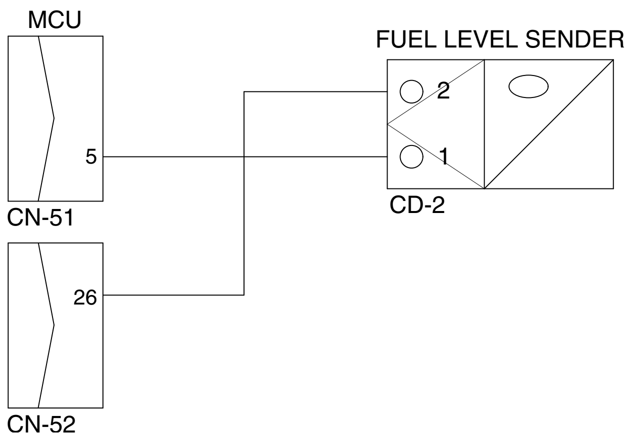
9. WHEN FUEL GAUGE DOES NOT OPERATE (HCESPN 301, FMI 3 or 4)

· 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	-	-



300L6ES10

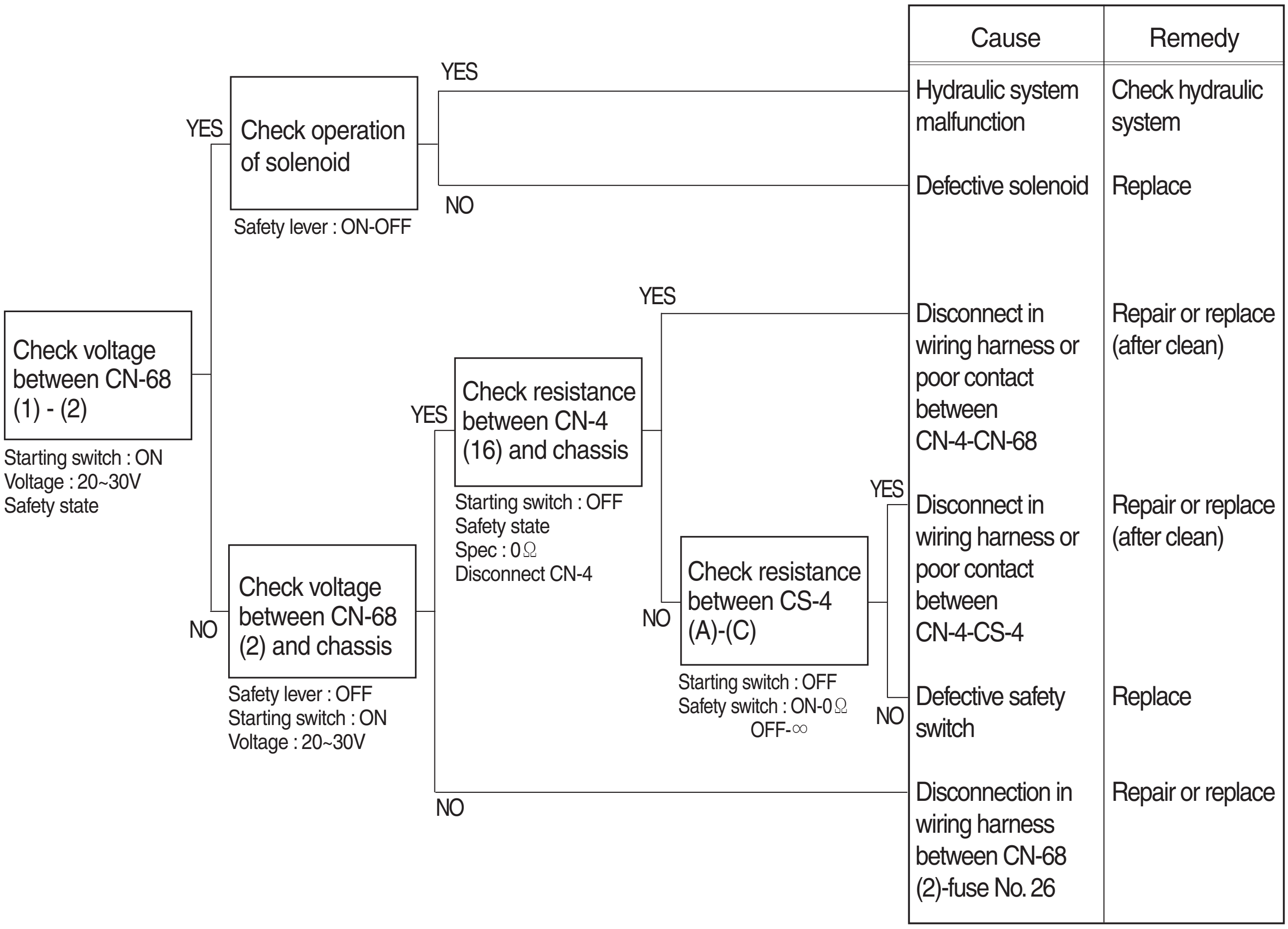
(SERIAL NO. : -#0785)

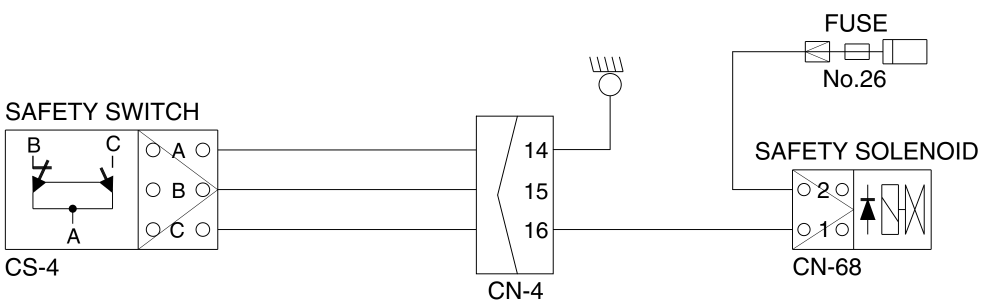
10. WHEN SAFETY SOLENOID DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.

· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 26.

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



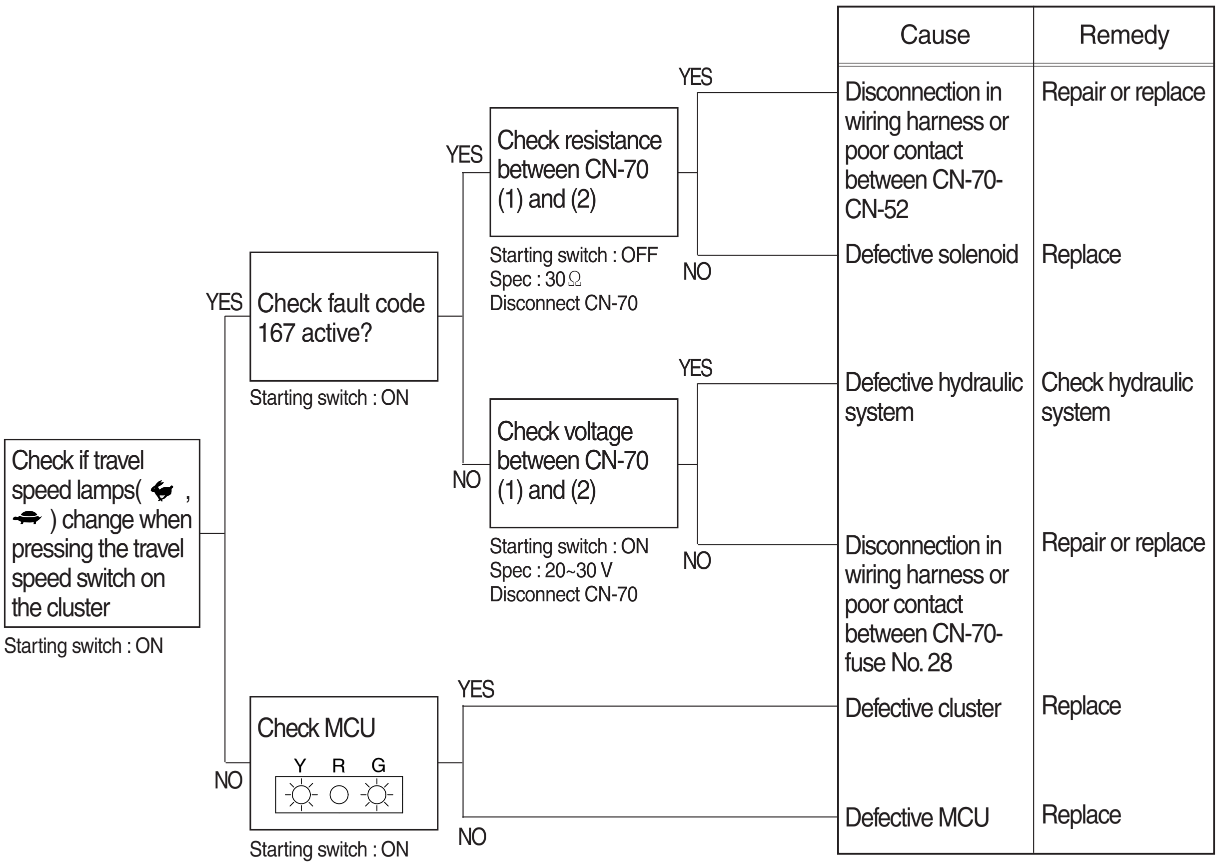


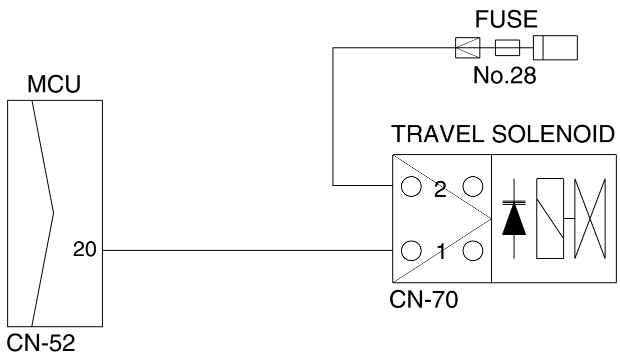
300L6ES52

(SERIAL NO. : -#0785)

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.



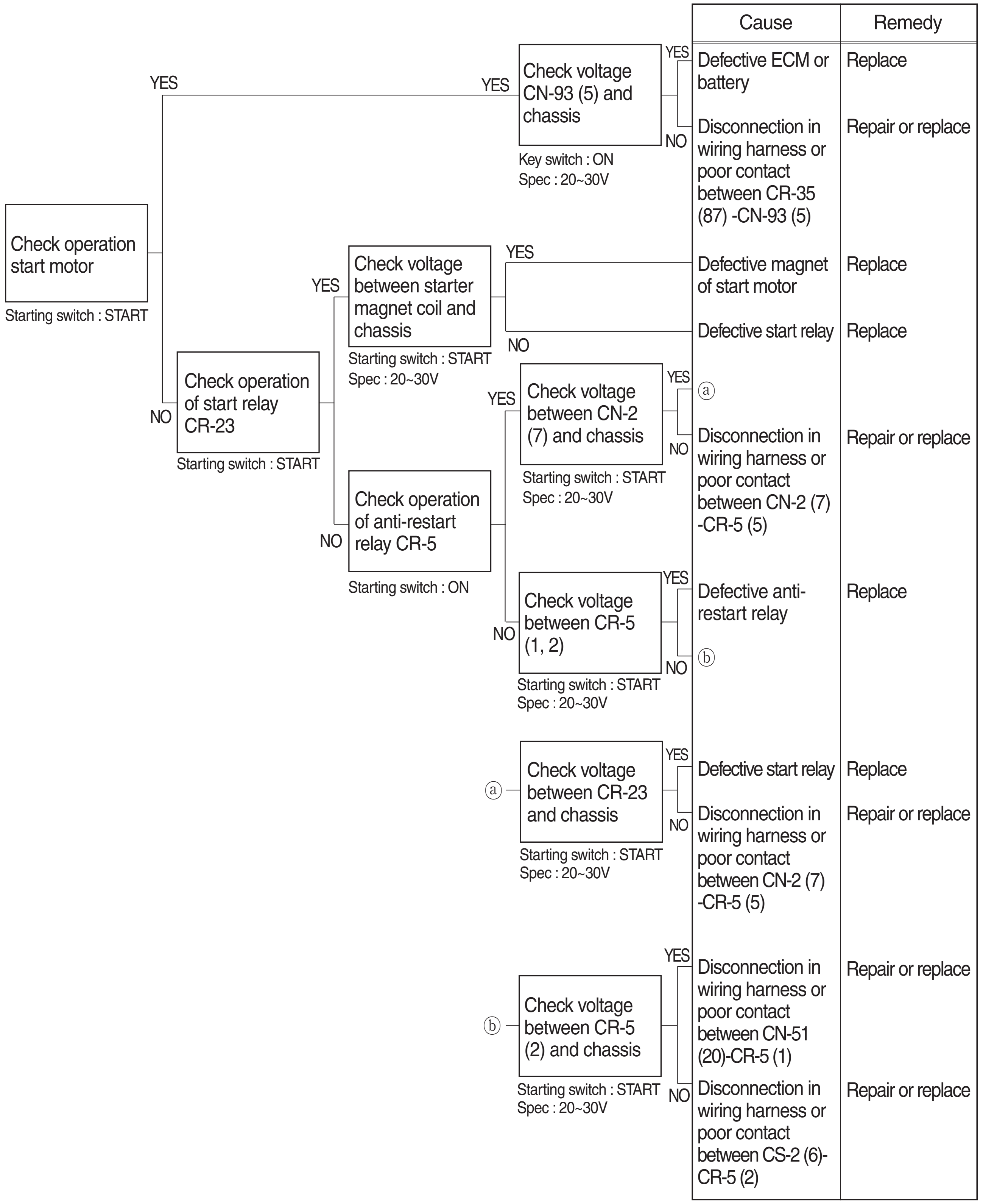


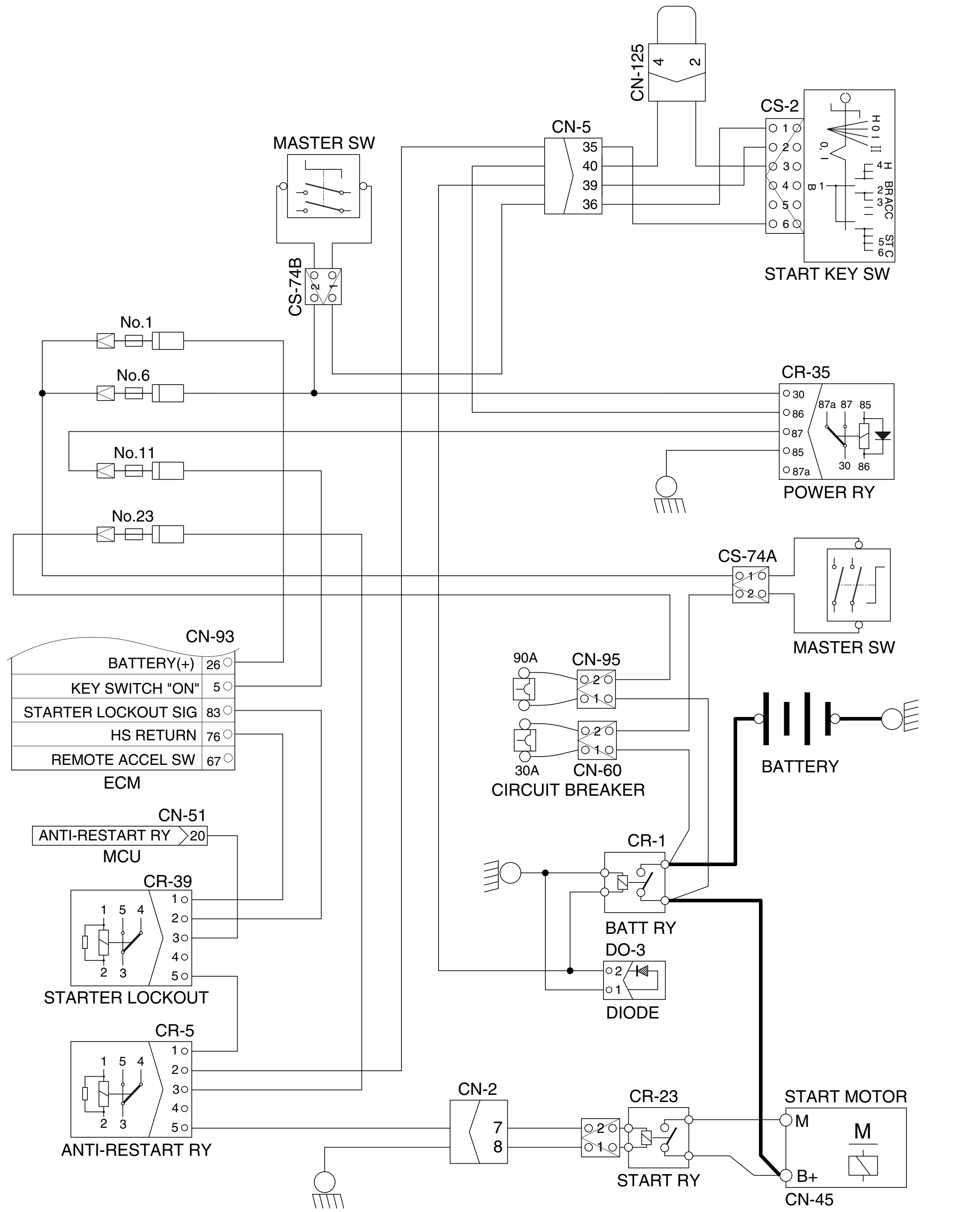
300L6ES53

(SERIAL NO. : -#0785)

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 1, 6, 11, 23.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





300L6ES54

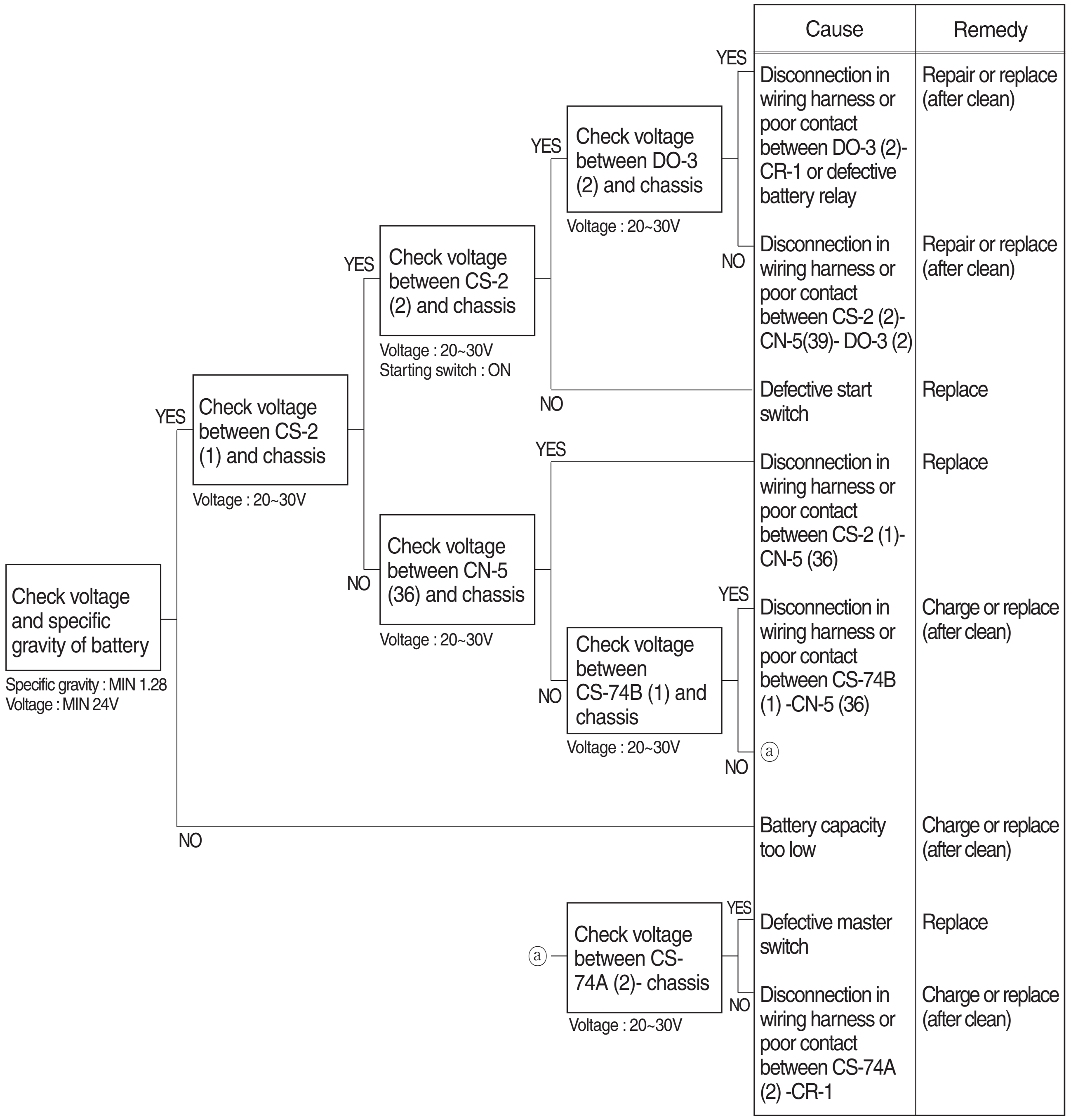
(SERIAL NO. : -#0785)

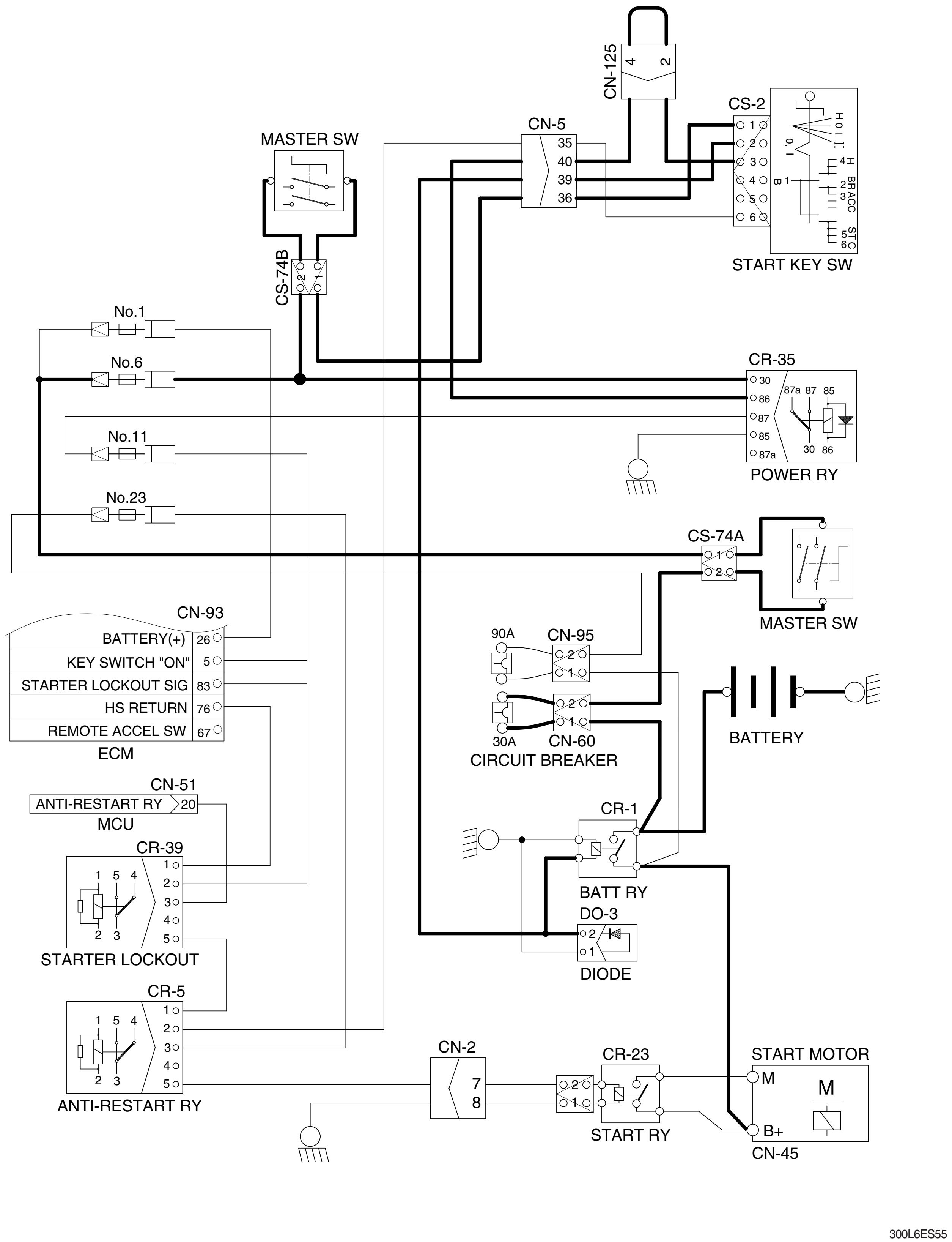
13. WHEN STARTING SWITCH ON DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.

· Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of fusible link (CN-60).

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

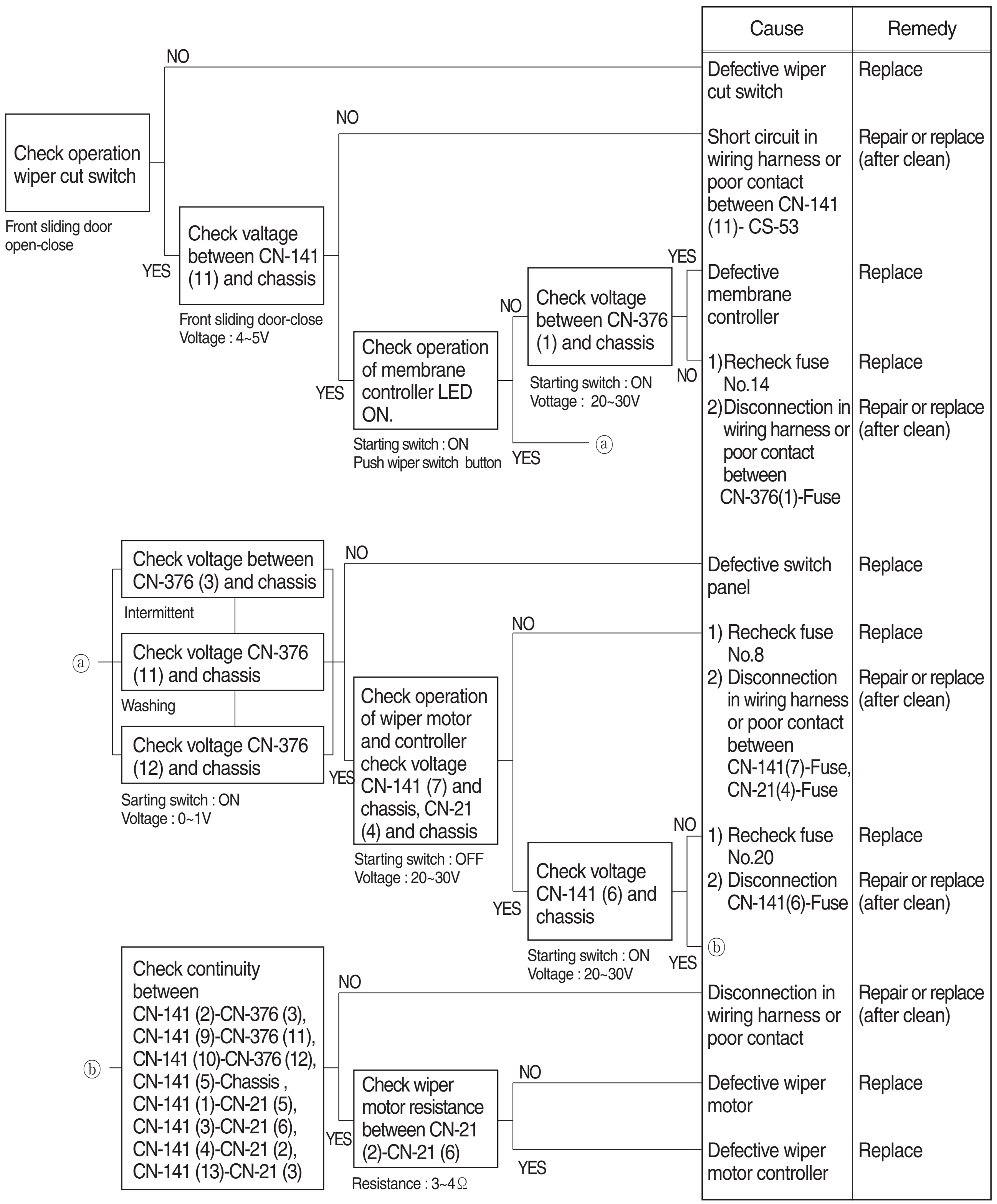


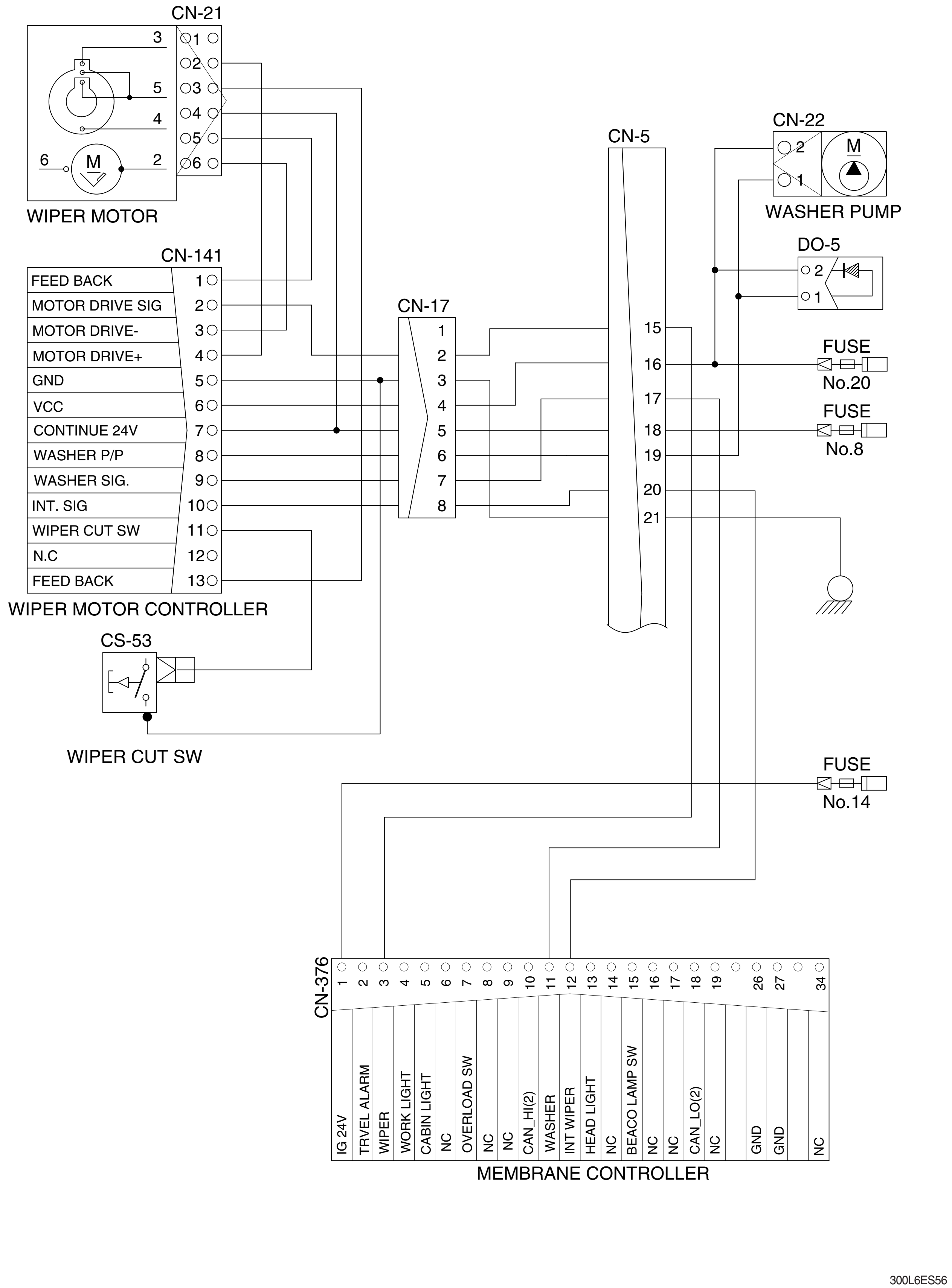


(SERIAL NO. : -#0785)

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No. 8, 14 and 20 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

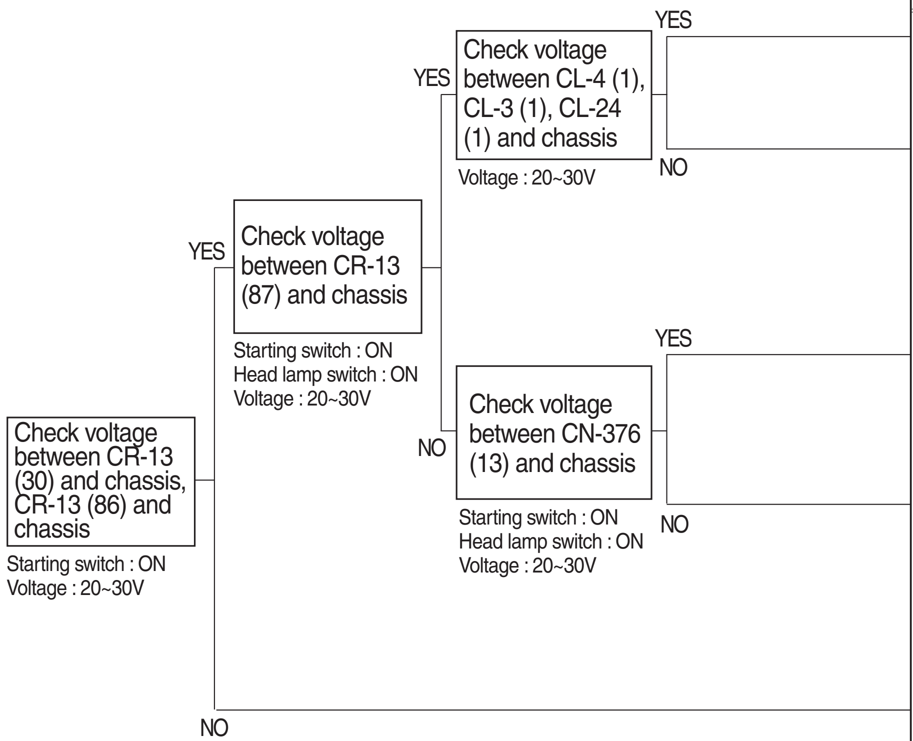




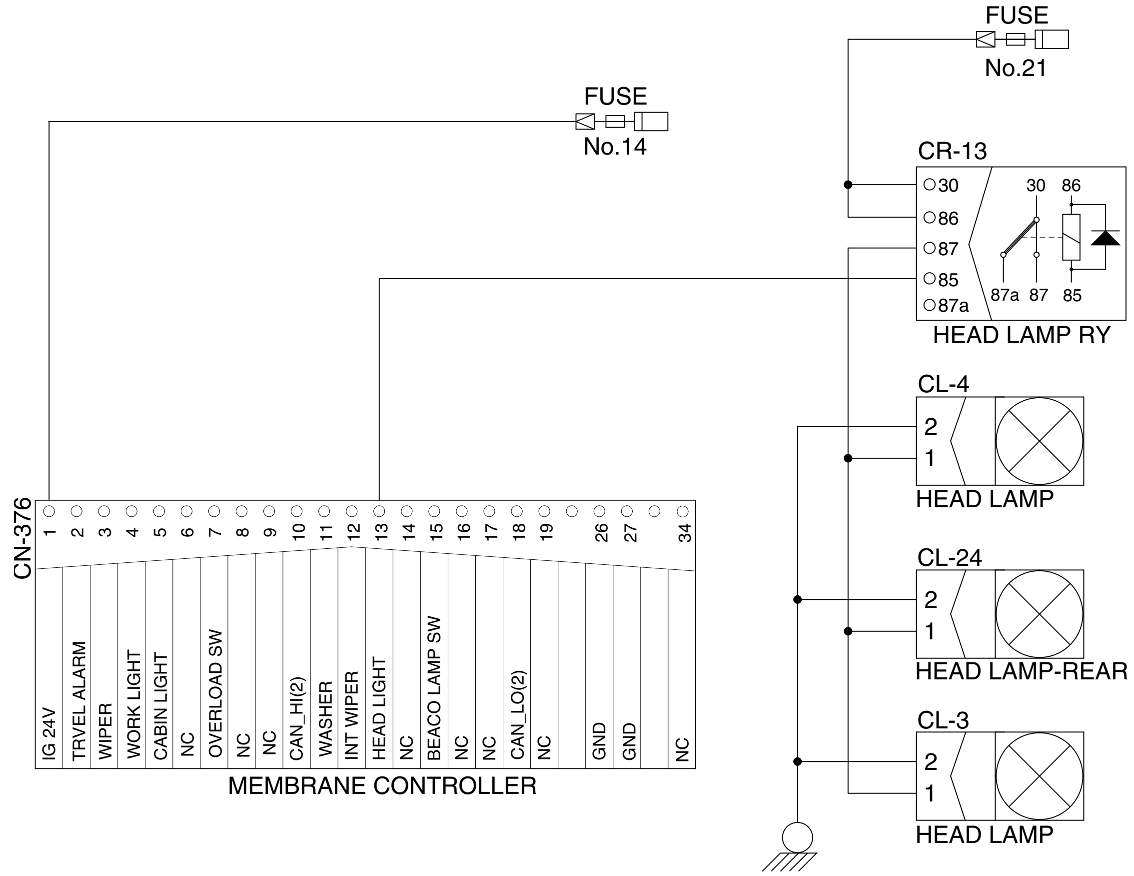
(SERIAL NO. : -#0785)

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.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)	Repair or replace (after clean)
Defective switch panel	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

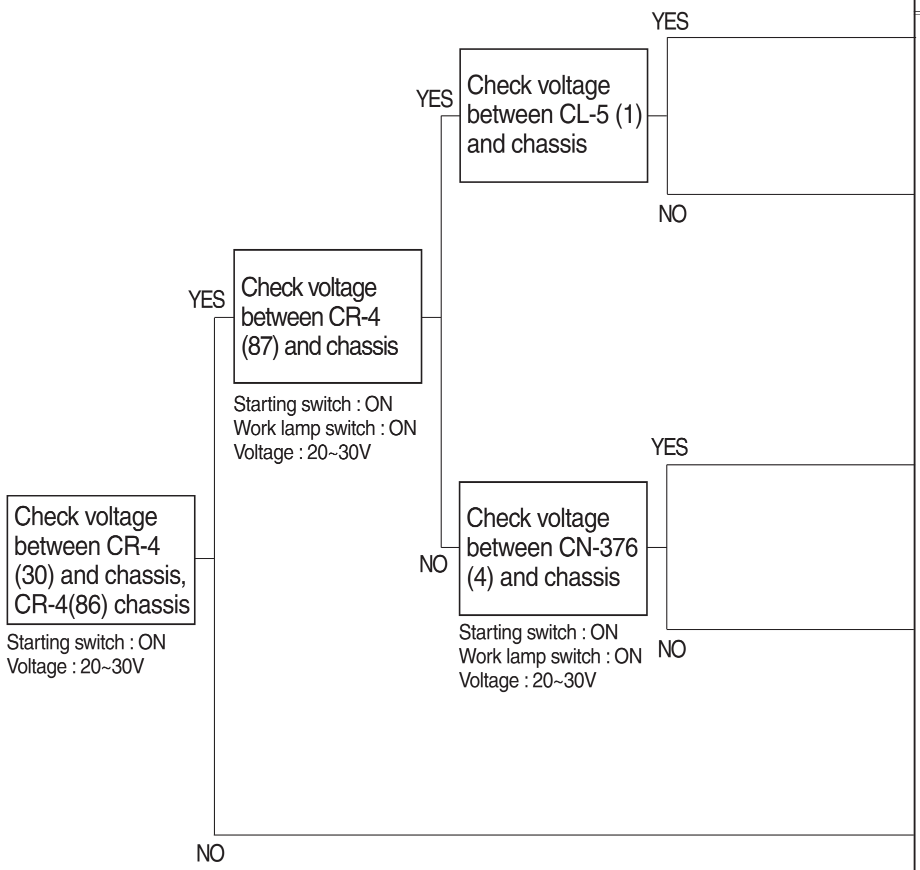


300L6ES17

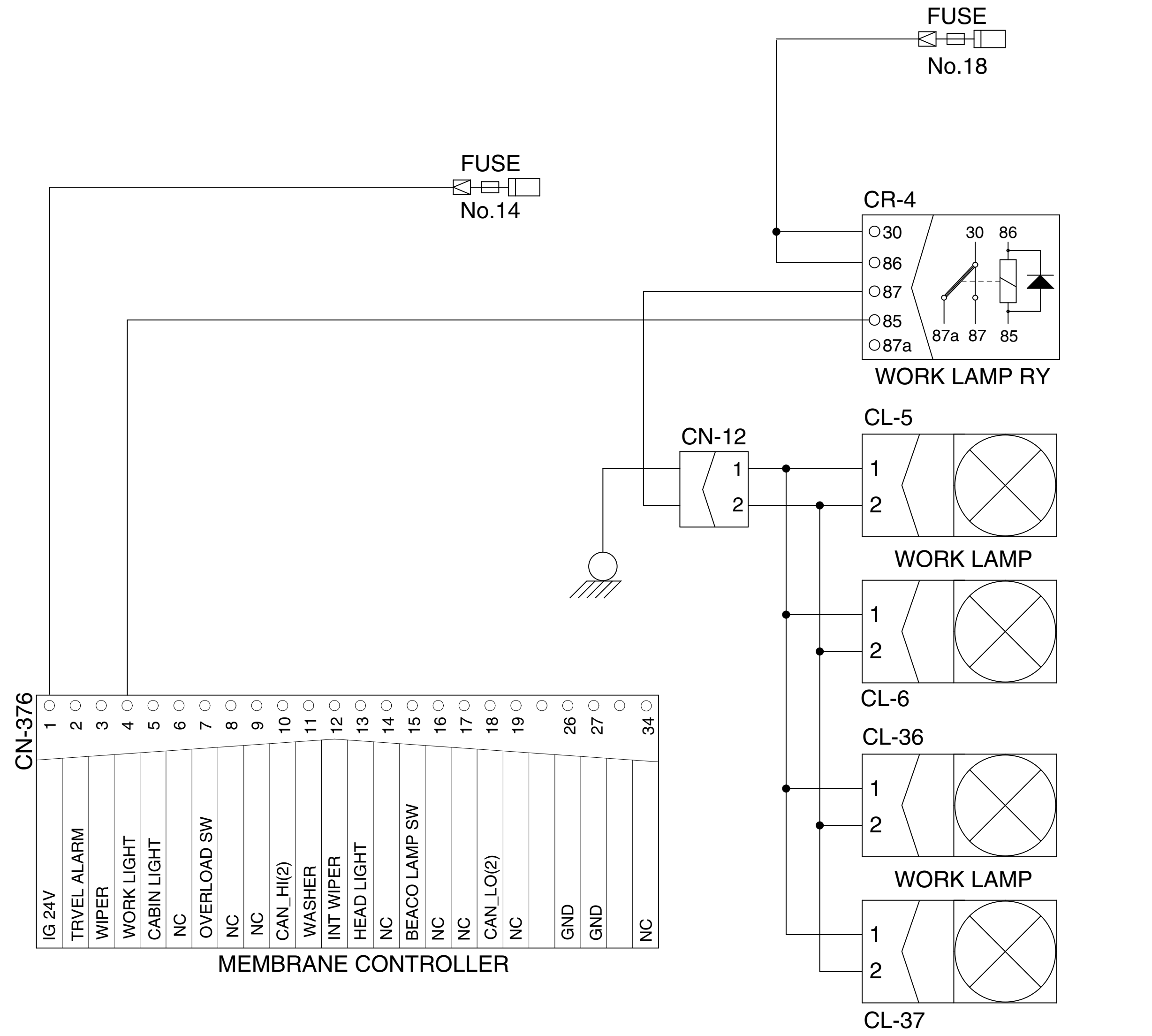
(SERIAL NO. : -#0785)

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.18.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CL-5 (2)	Repair or replace (after clean)
Defective switch panel	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.18	Replace

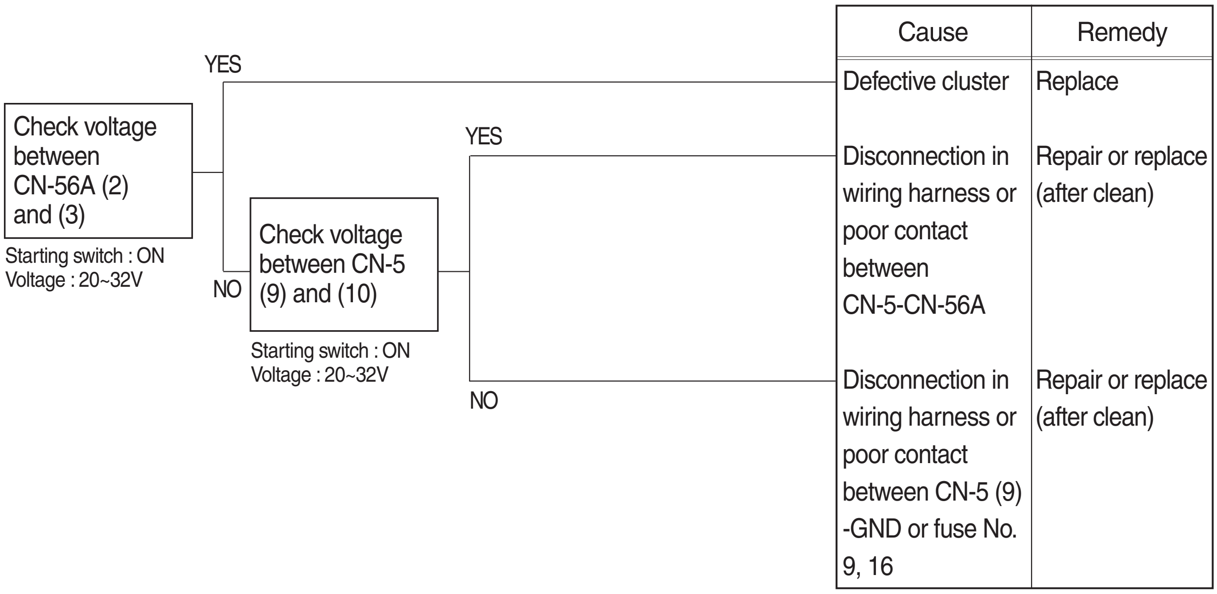


300L6ES58

(SERIAL NO. : #0786-)

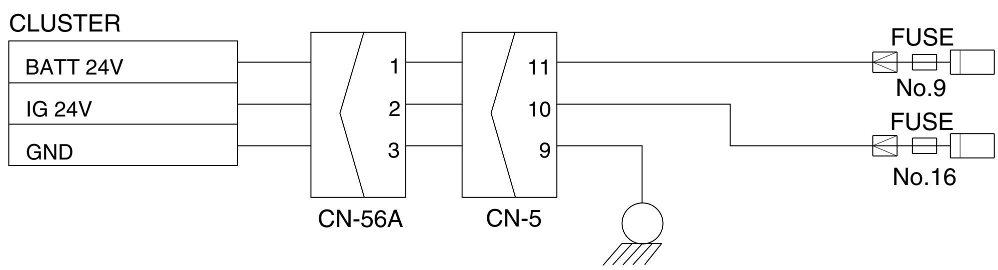
1. WHEN STARTING SWITCH IS TURNED ON, CLUSTER DISPLAY DOES NOT APPEAR

· 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.



Check voltage

YES	20~32V
NO	0V

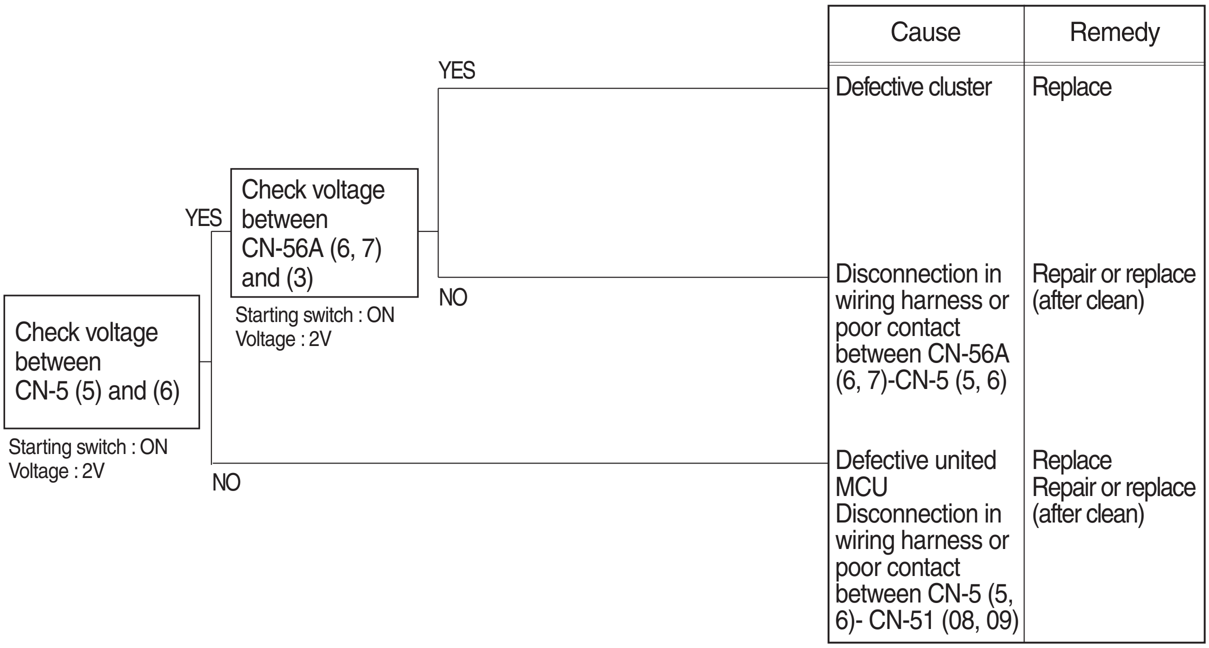


300L6ES101

(SERIAL NO. : #0786-)

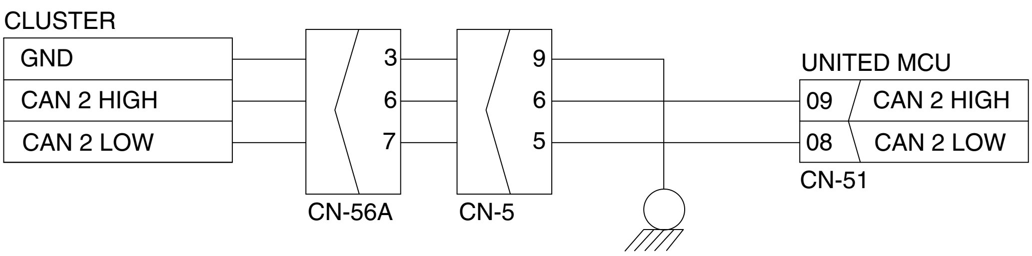
2. COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

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



Check voltage

YES	2V
NO	0V

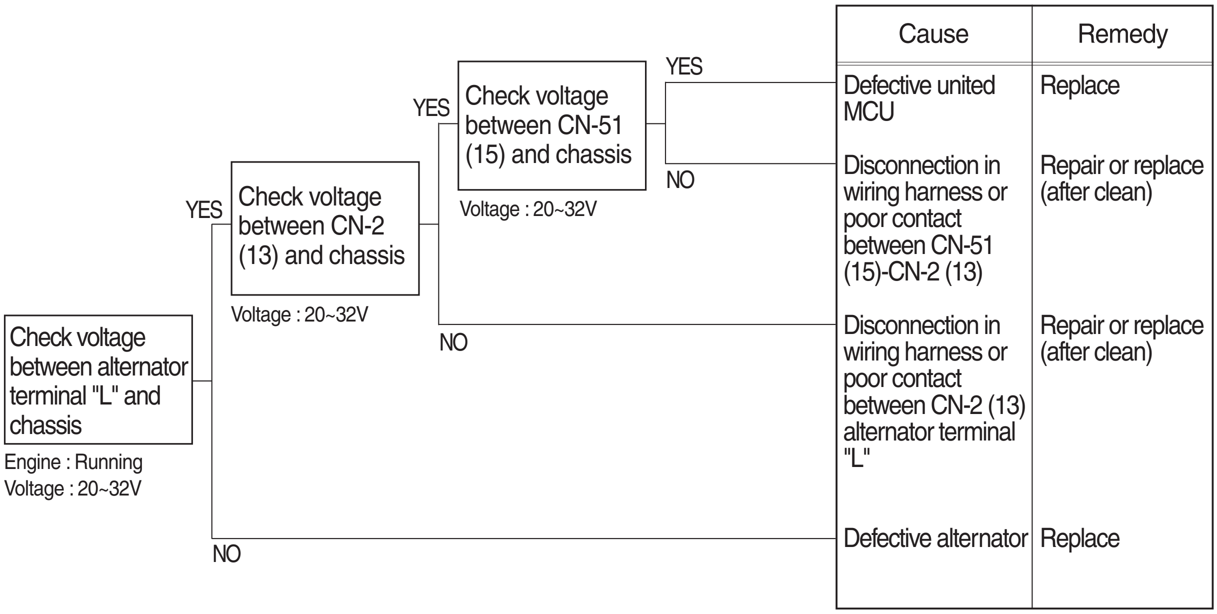


300L6ES102

(SERIAL NO. : #0786-)

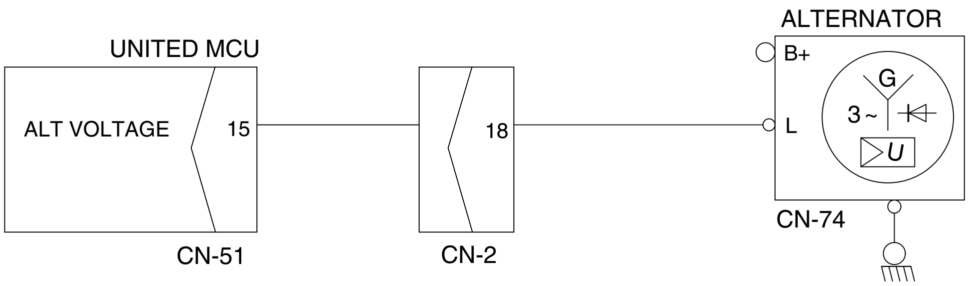
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

· 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

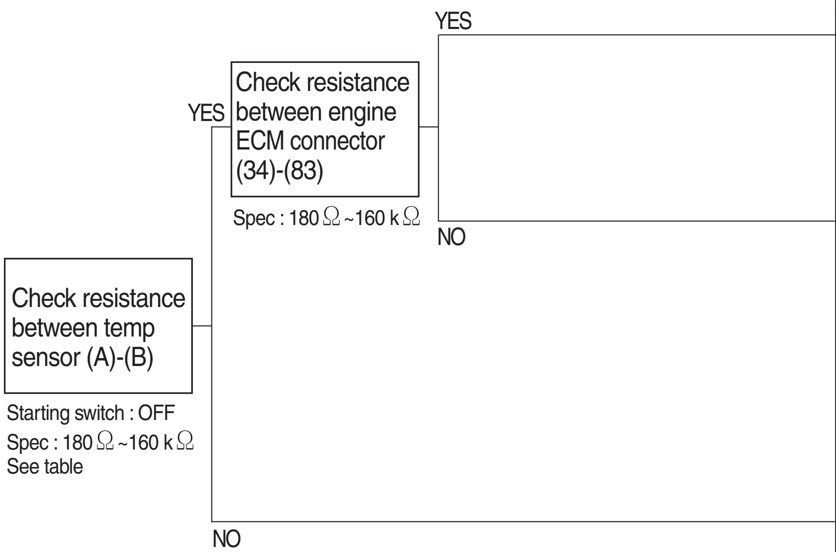


300L6ES103

(SERIAL NO. : #0786-)

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

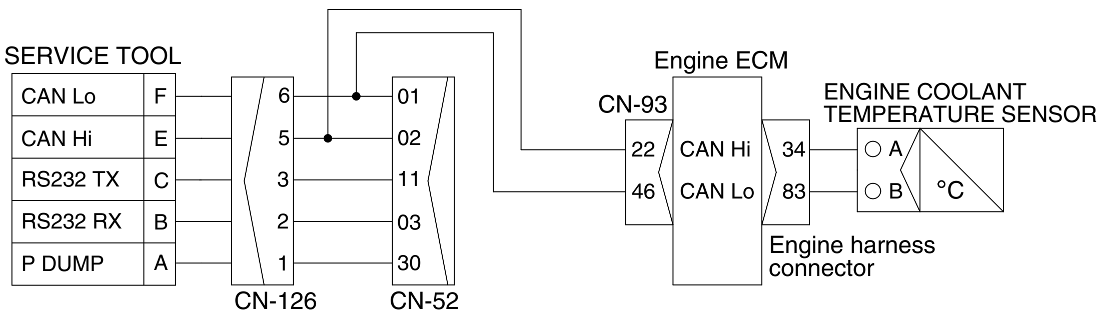
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Check use HRDT	Check or replace
Disconnection in wiring harness or poor contact between temp sensor-engine ECM connector	Repair or replace (after clean)
Defective coolant temp sensor	Replace

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

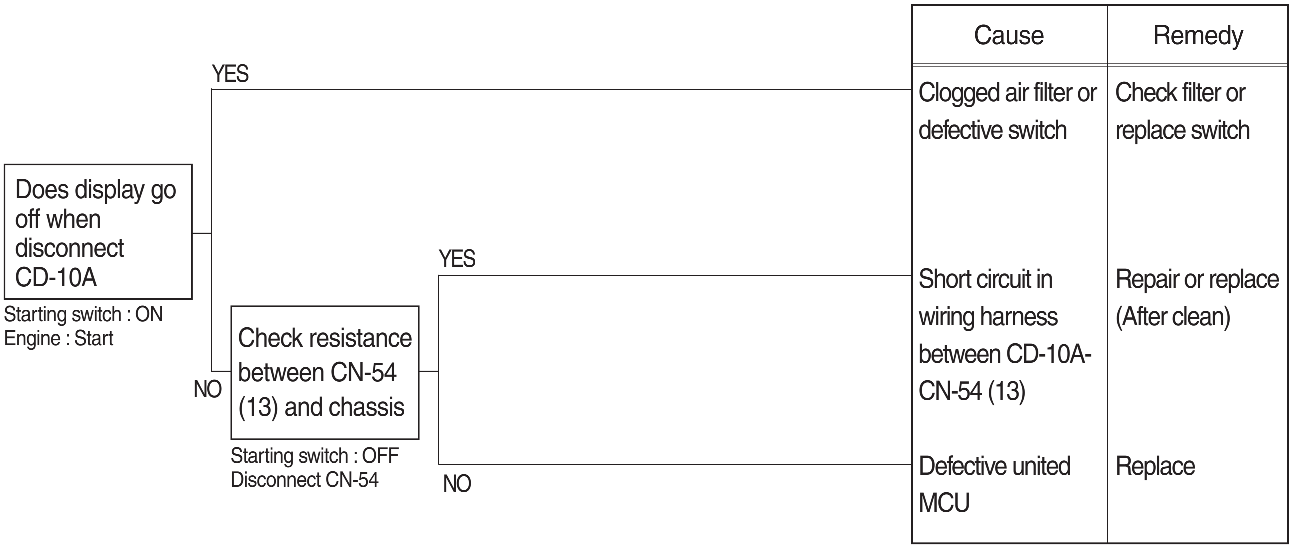


300L6ES104

(SERIAL NO. : #0786-)

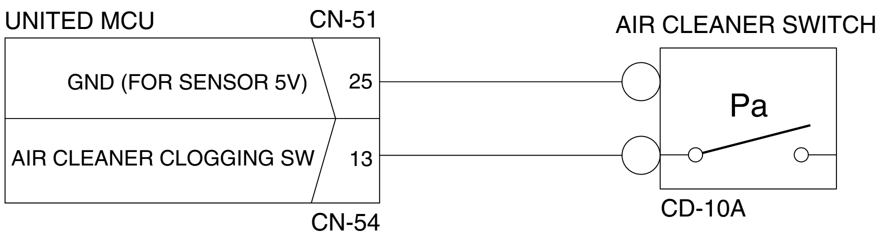
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

YES	MAX 1Ω
NO	MIN 1MΩ

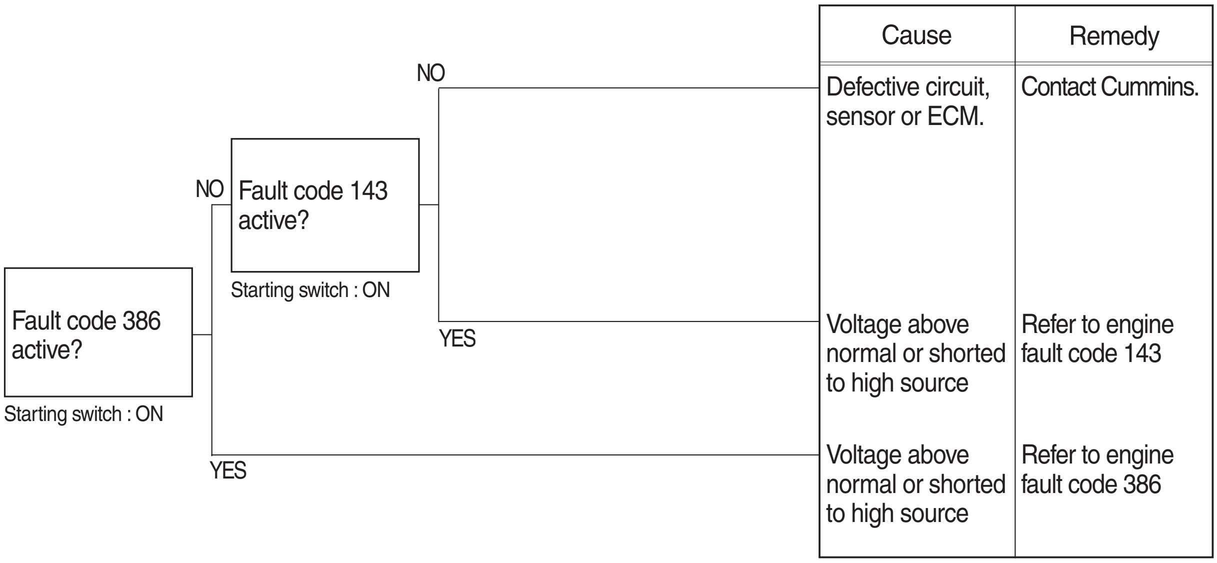


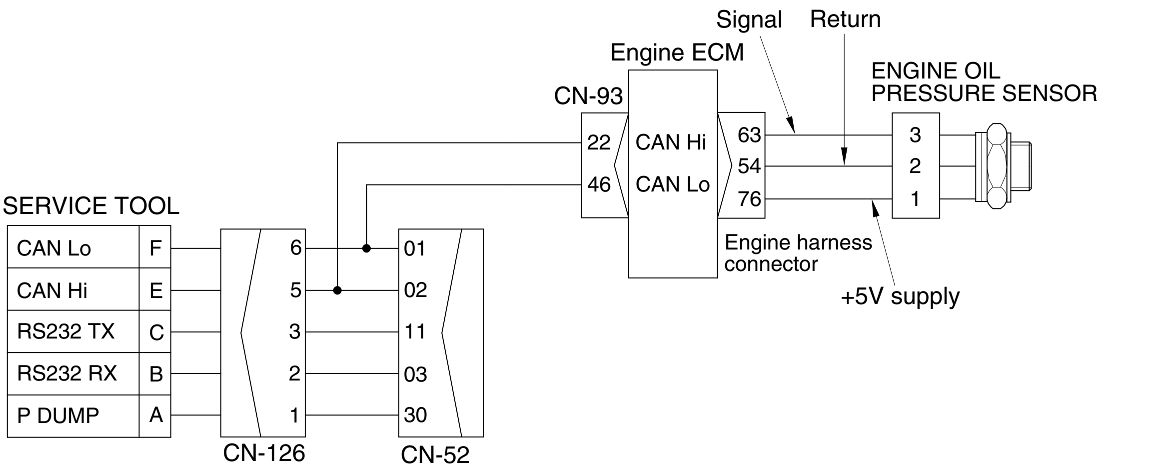
300L6ES106

(SERIAL NO. : #0786-)

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.



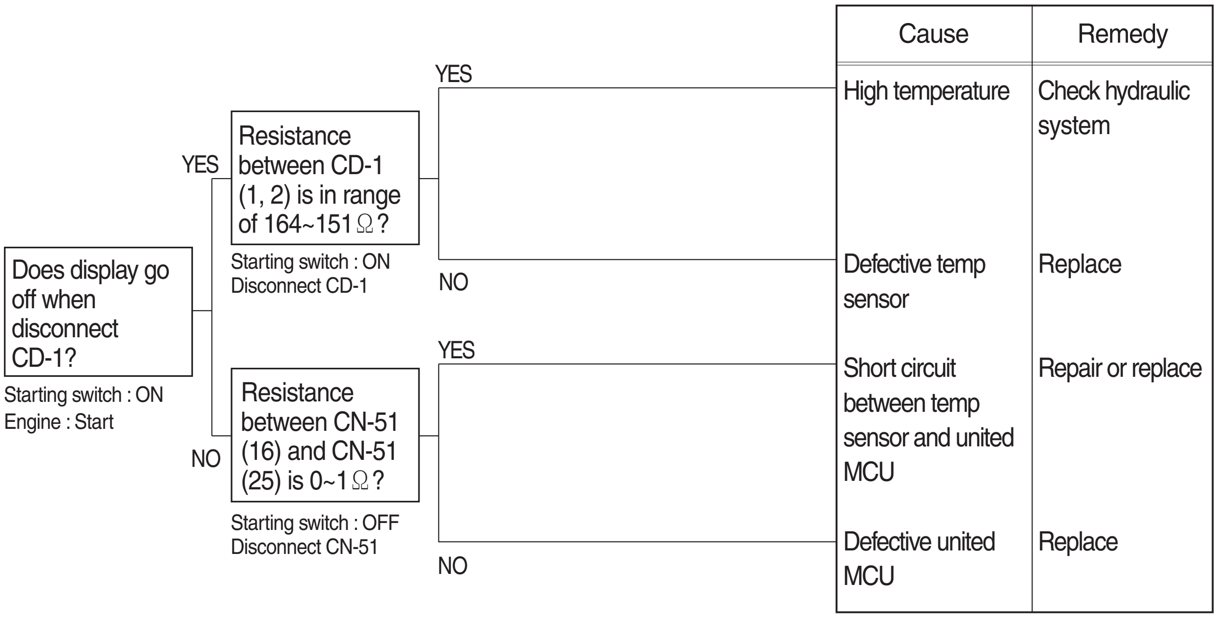


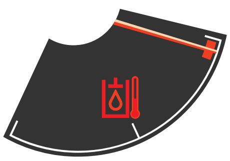
300L6ES107

(SERIAL NO. : #0786-)

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

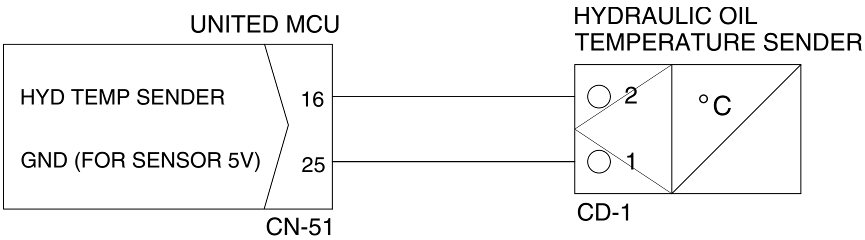
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





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

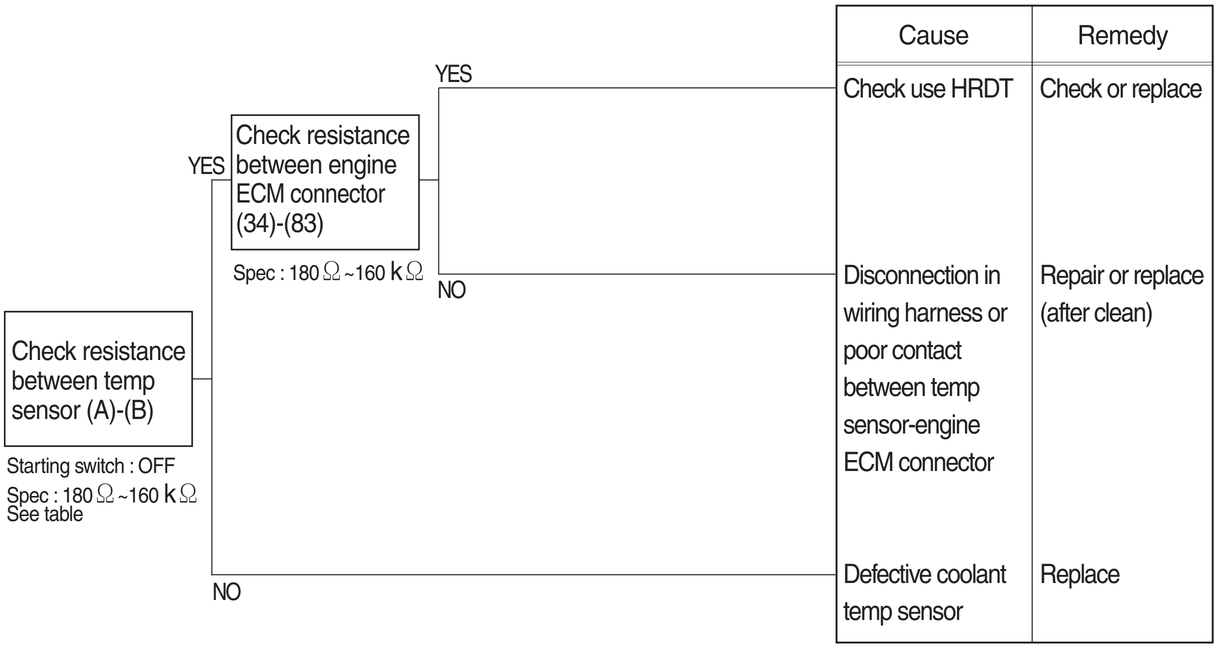


140L6ES108

(SERIAL NO. : #0786-)

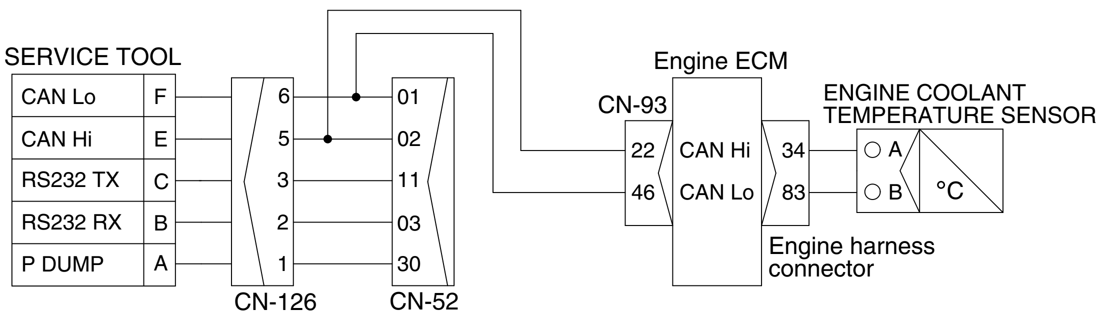
8. WHE RE GAUGE DOES NOT OPERATE

· 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

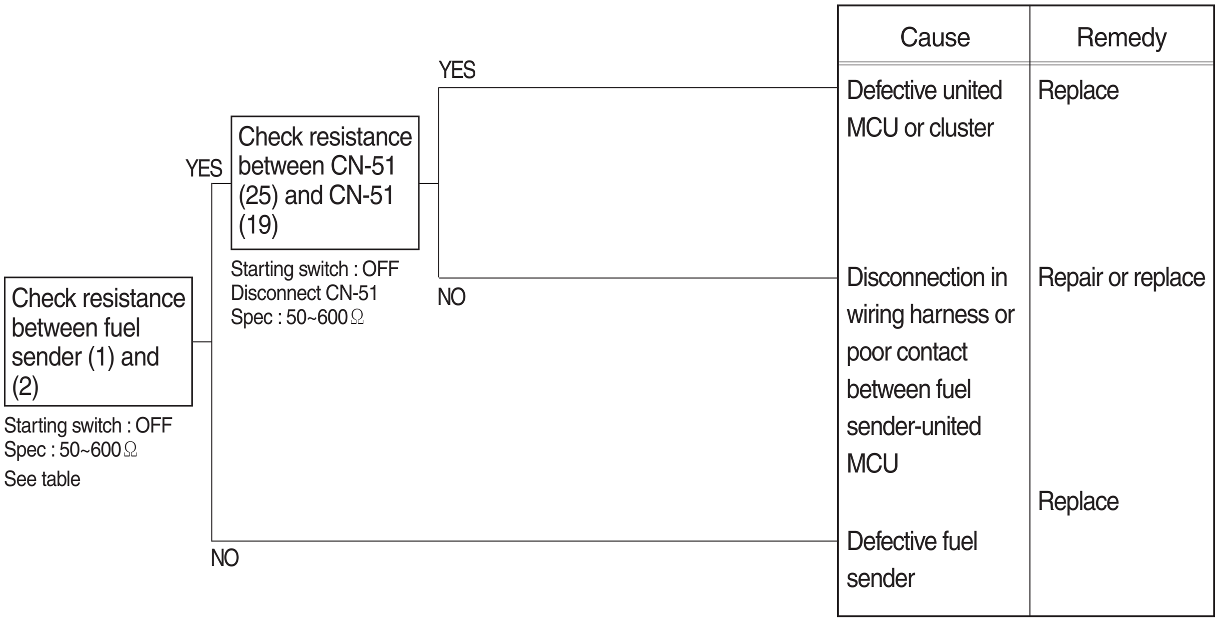


300L6ES104

(SERIAL NO. : #0786-)

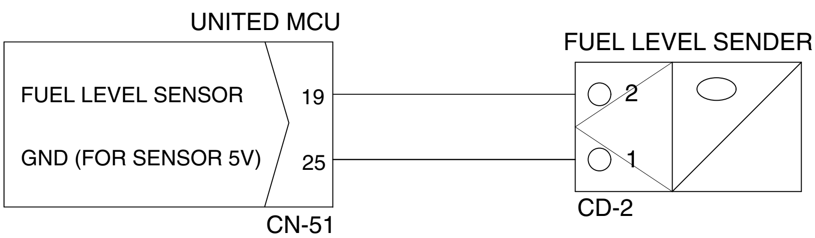
9. WHEN FUEL GAUGE DOES NOT OPERATE (HCESPN 301, FMI 3 or 4)

· 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	-	-

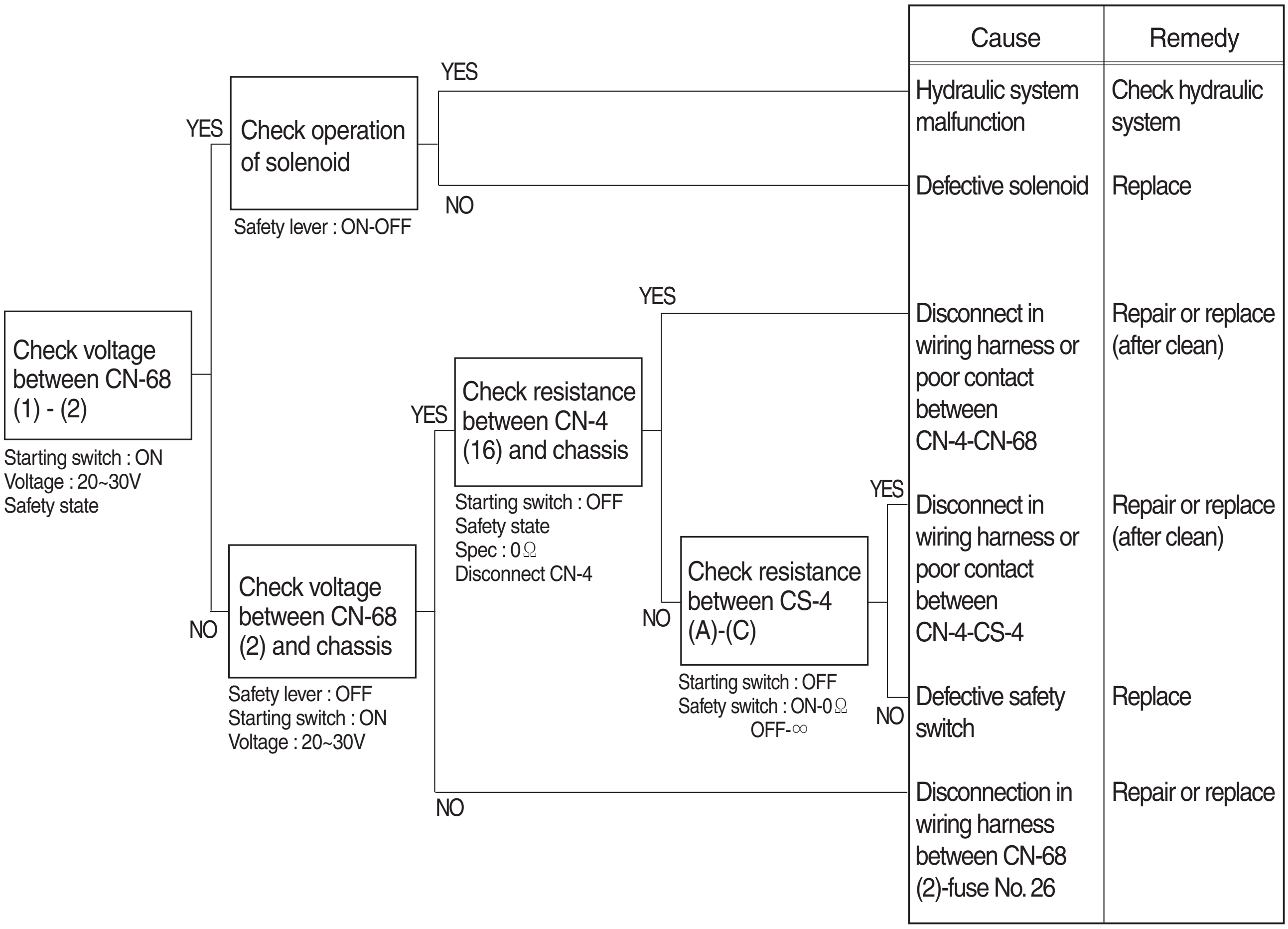


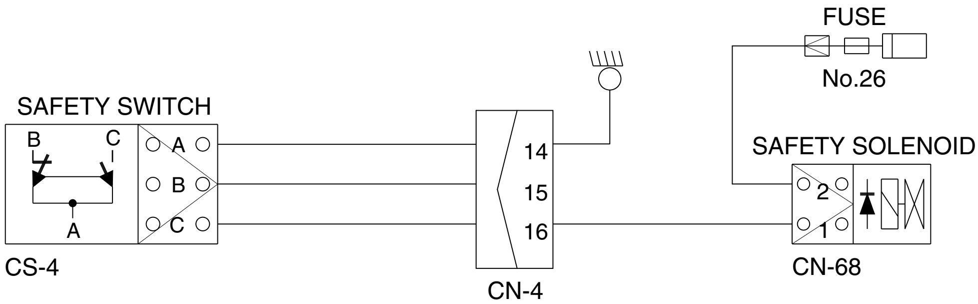
140L6ES110

(SERIAL NO. : #0786-)

10. WHEN SAFETY SOLENOID DOES NOT OPERATE

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



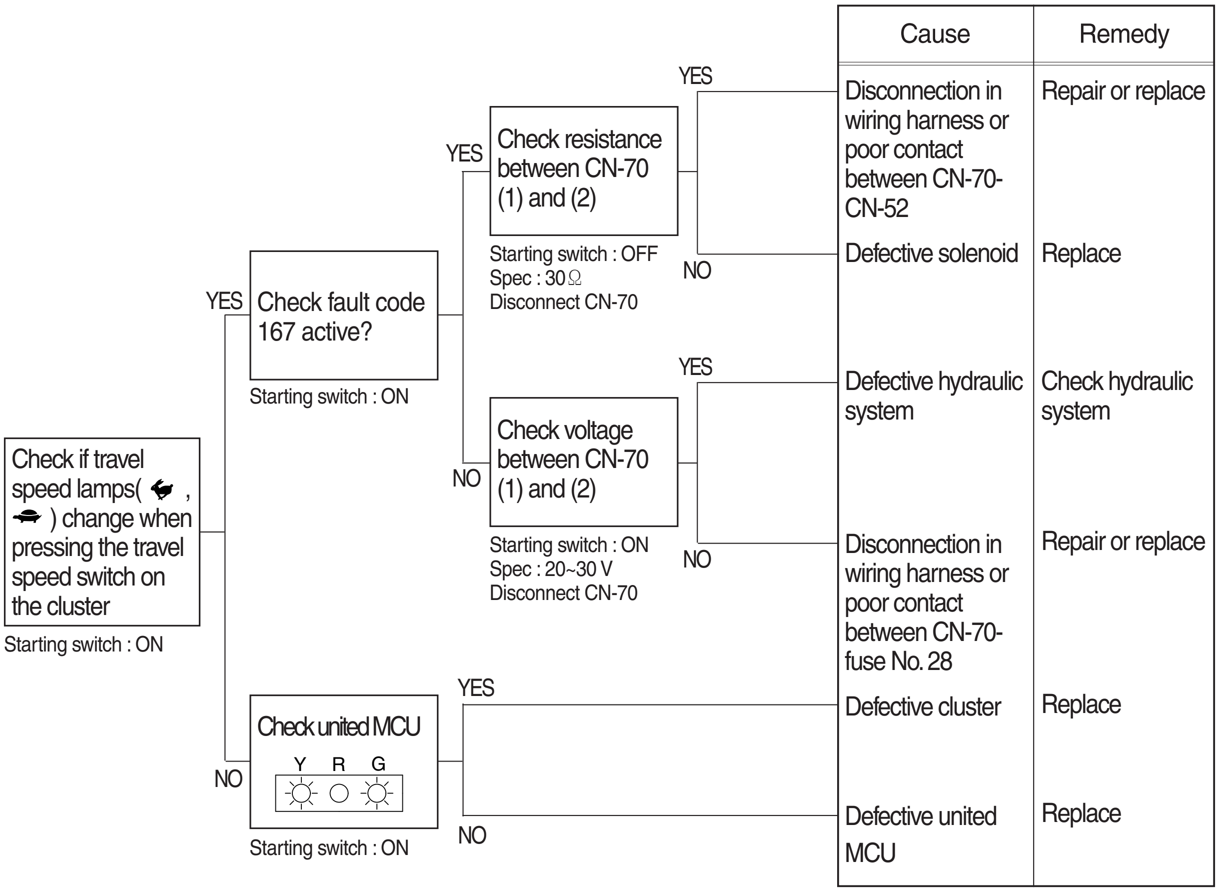


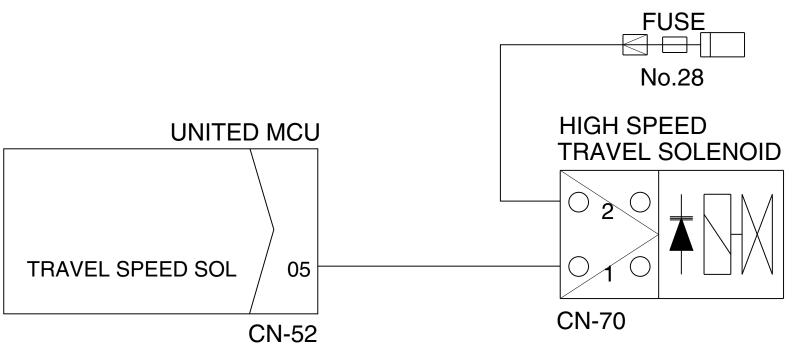
140L6ES109

(SERIAL NO. : #0786-)

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.



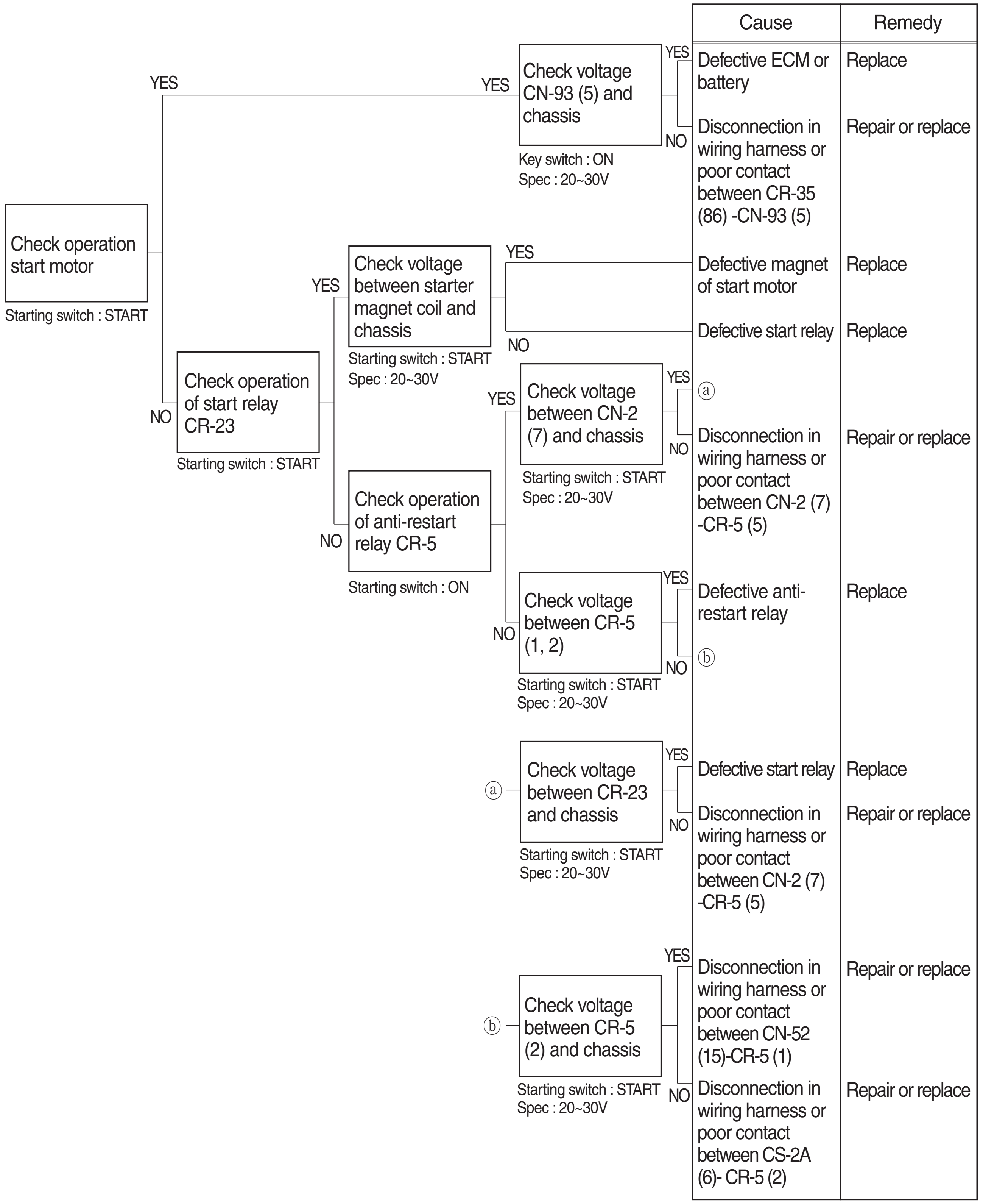


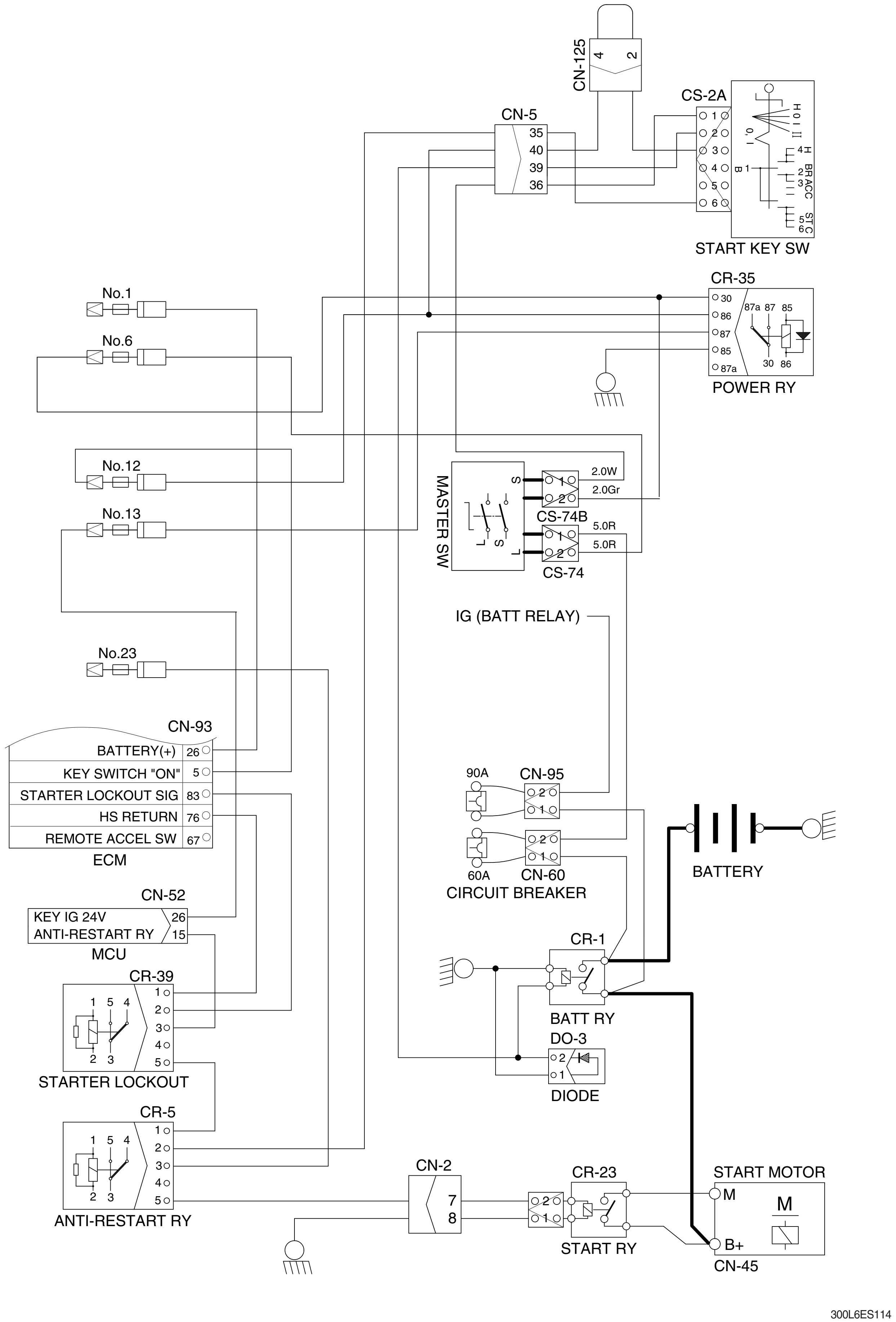
140L6ES107

(SERIAL NO. : #0786-)

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 1, 6, 12, 13, 23.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

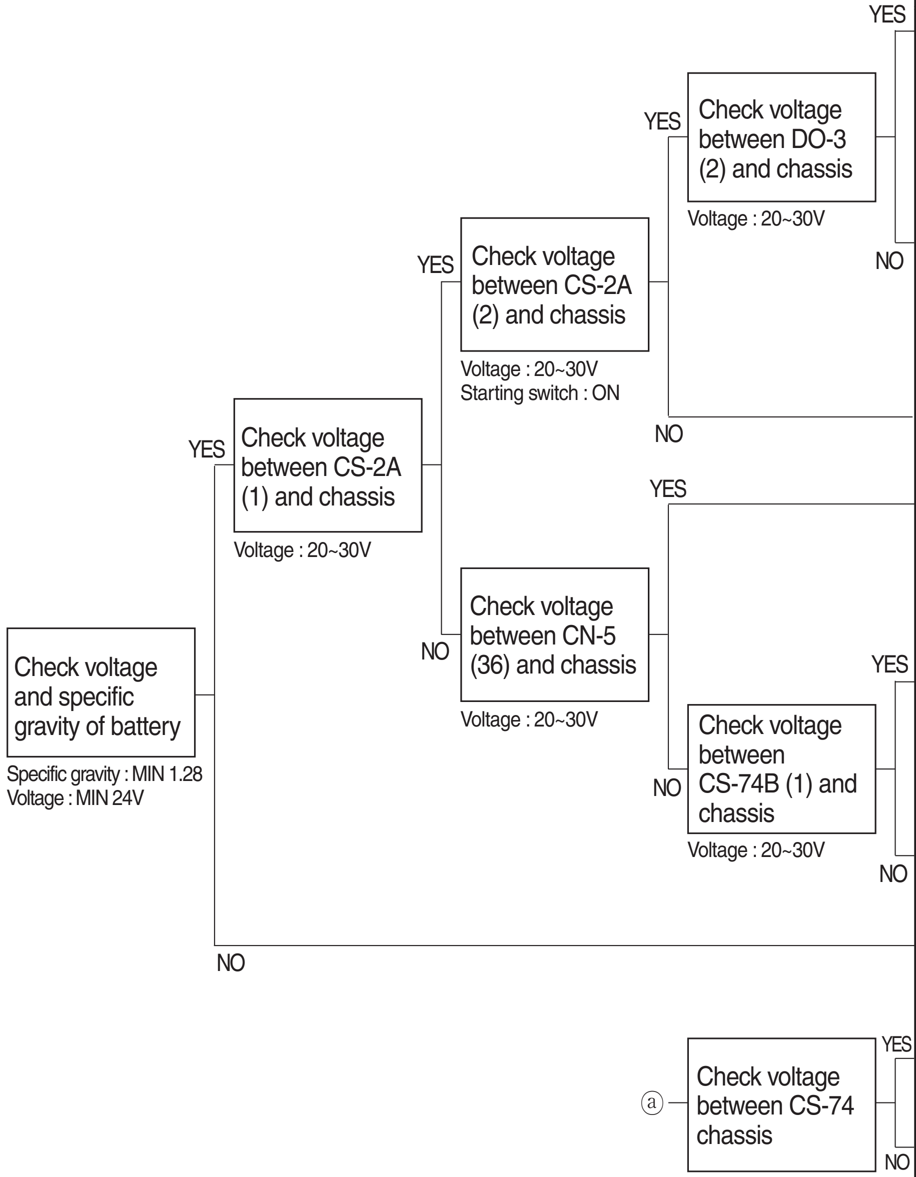




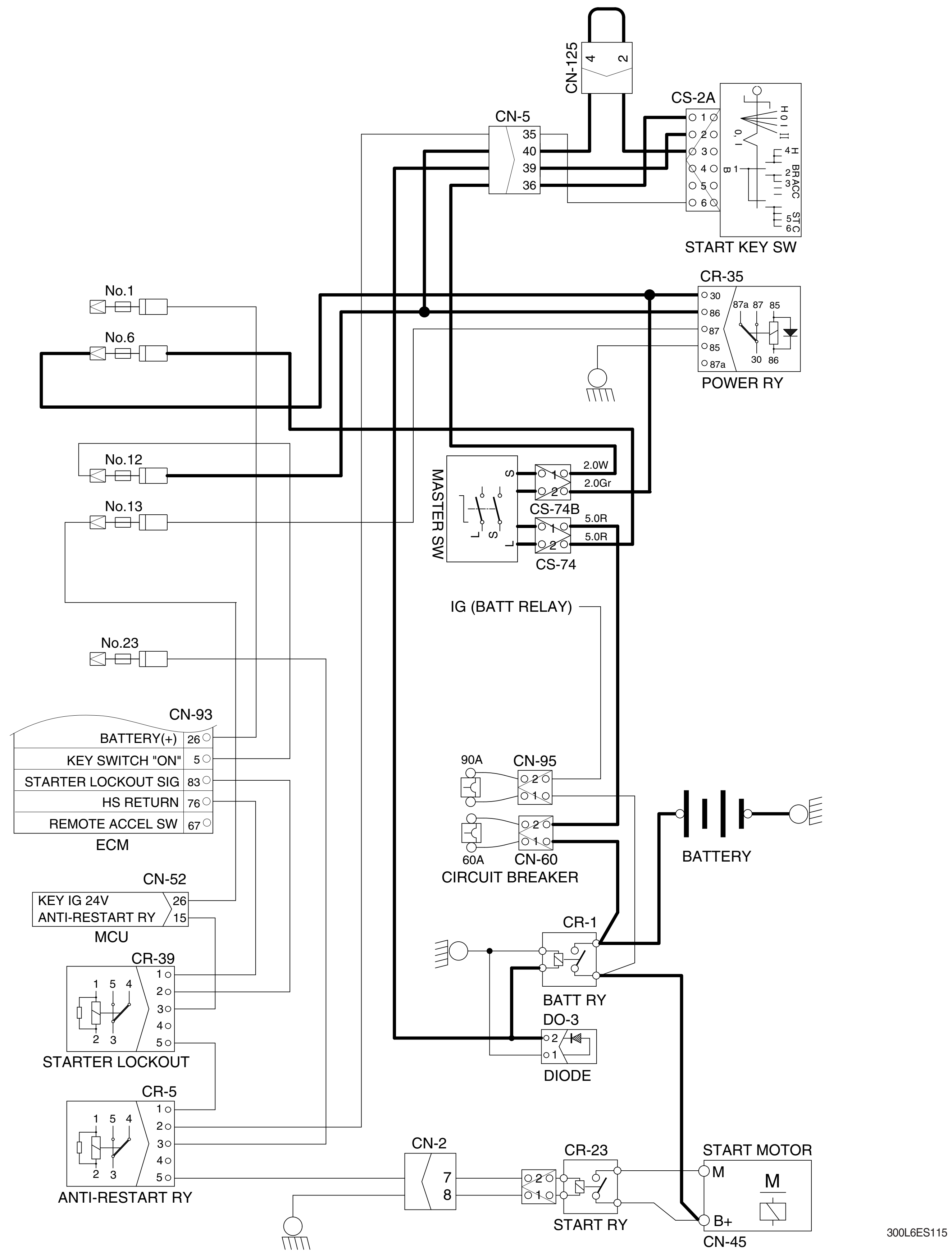
(SERIAL NO. : #0786-)

13. WHEN STARTING SWITCH ON DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of circuit breaker (CN-60).
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



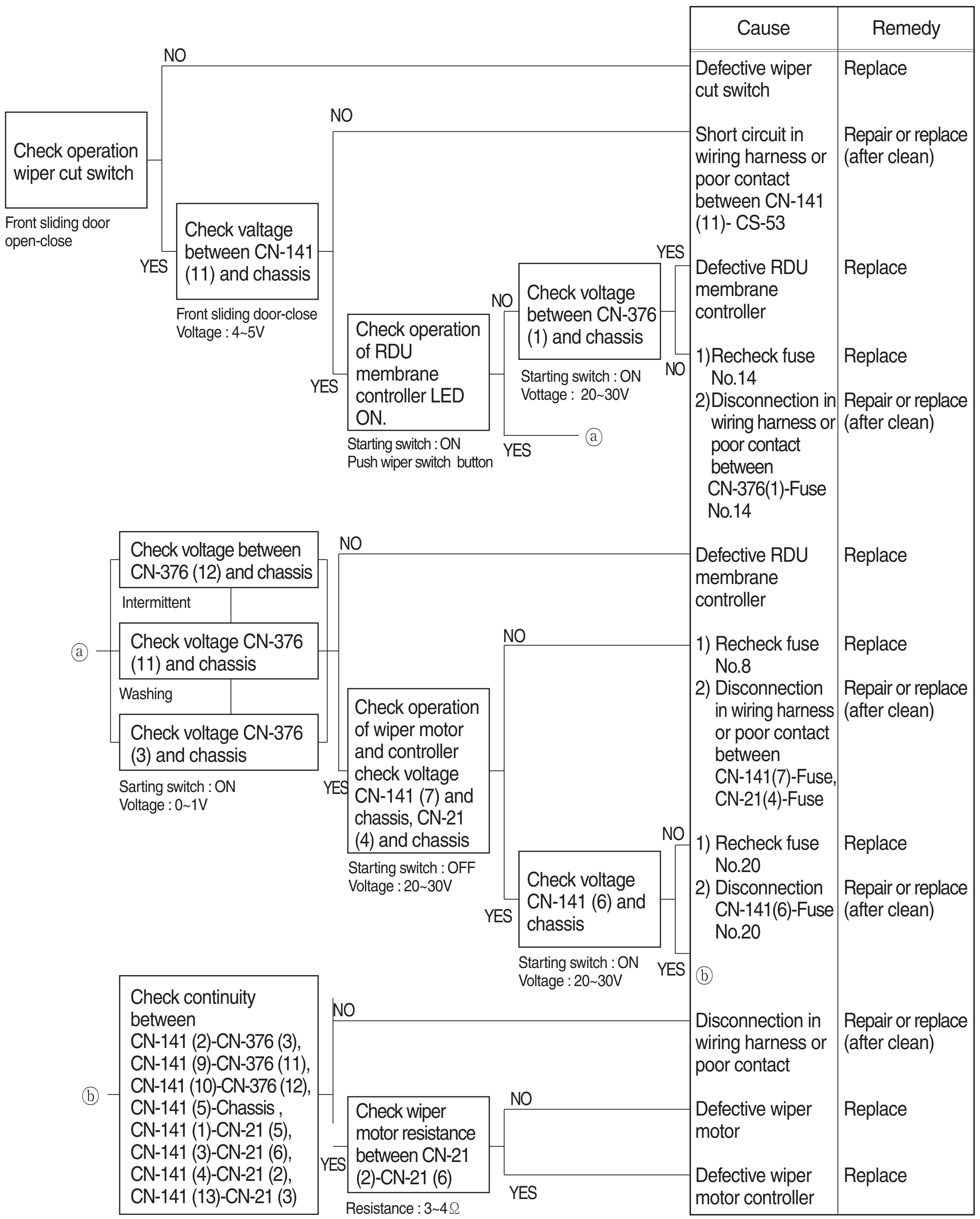
Cause	Remedy
Disconnection in wiring harness or poor contact between DO-3 (2)-CR-1 or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2A (2)-CN-5(39)- DO-3 (2)	Repair or replace (after clean)
Defective start switch	Replace
Disconnection 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)

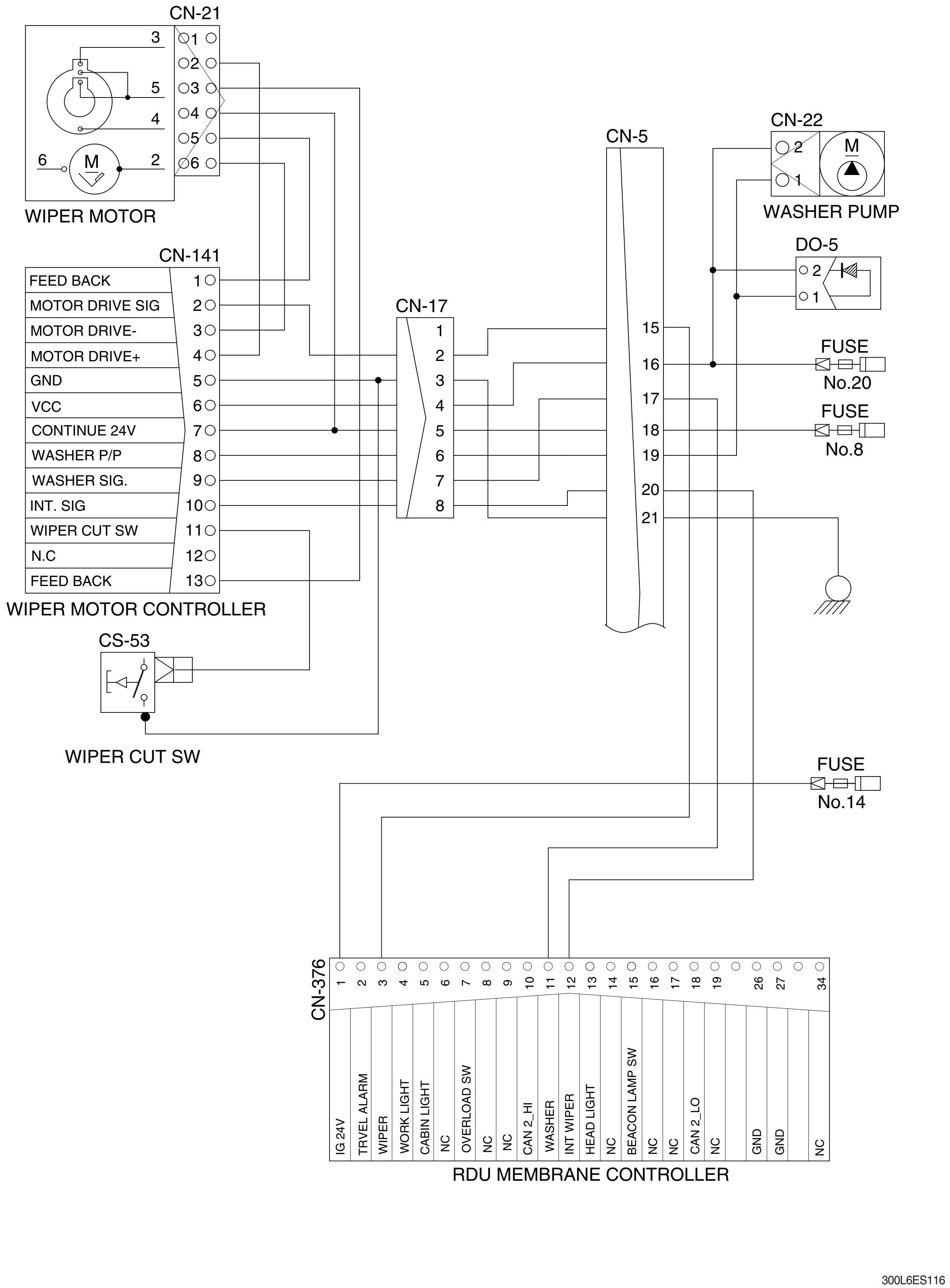


(SERIAL NO. : #0786-)

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No. 8, 14 and 20 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

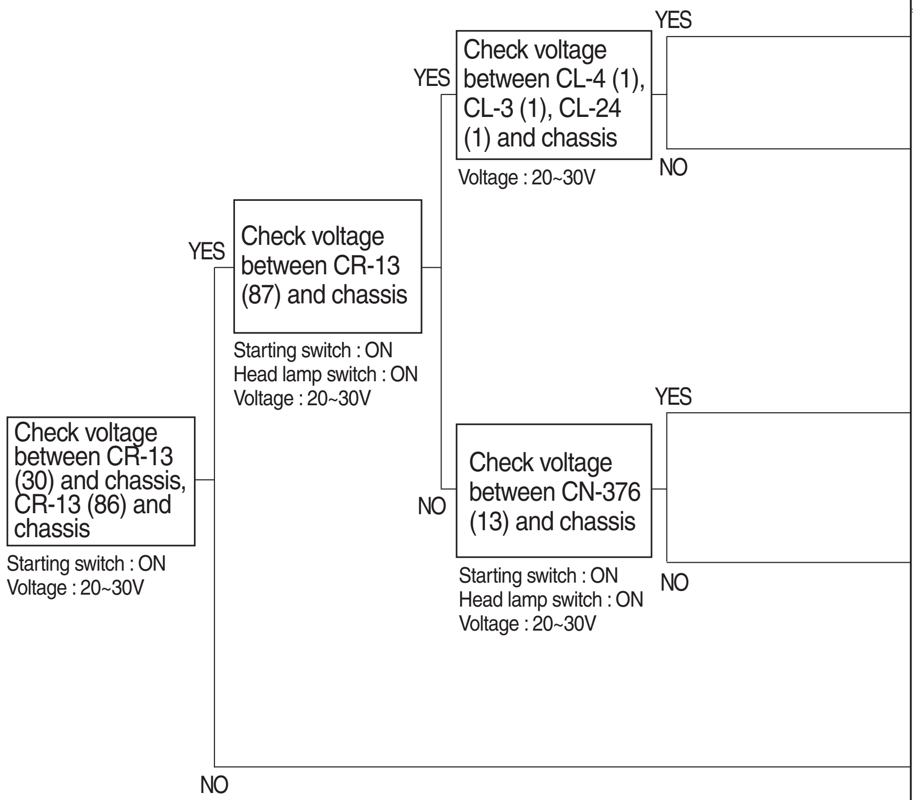




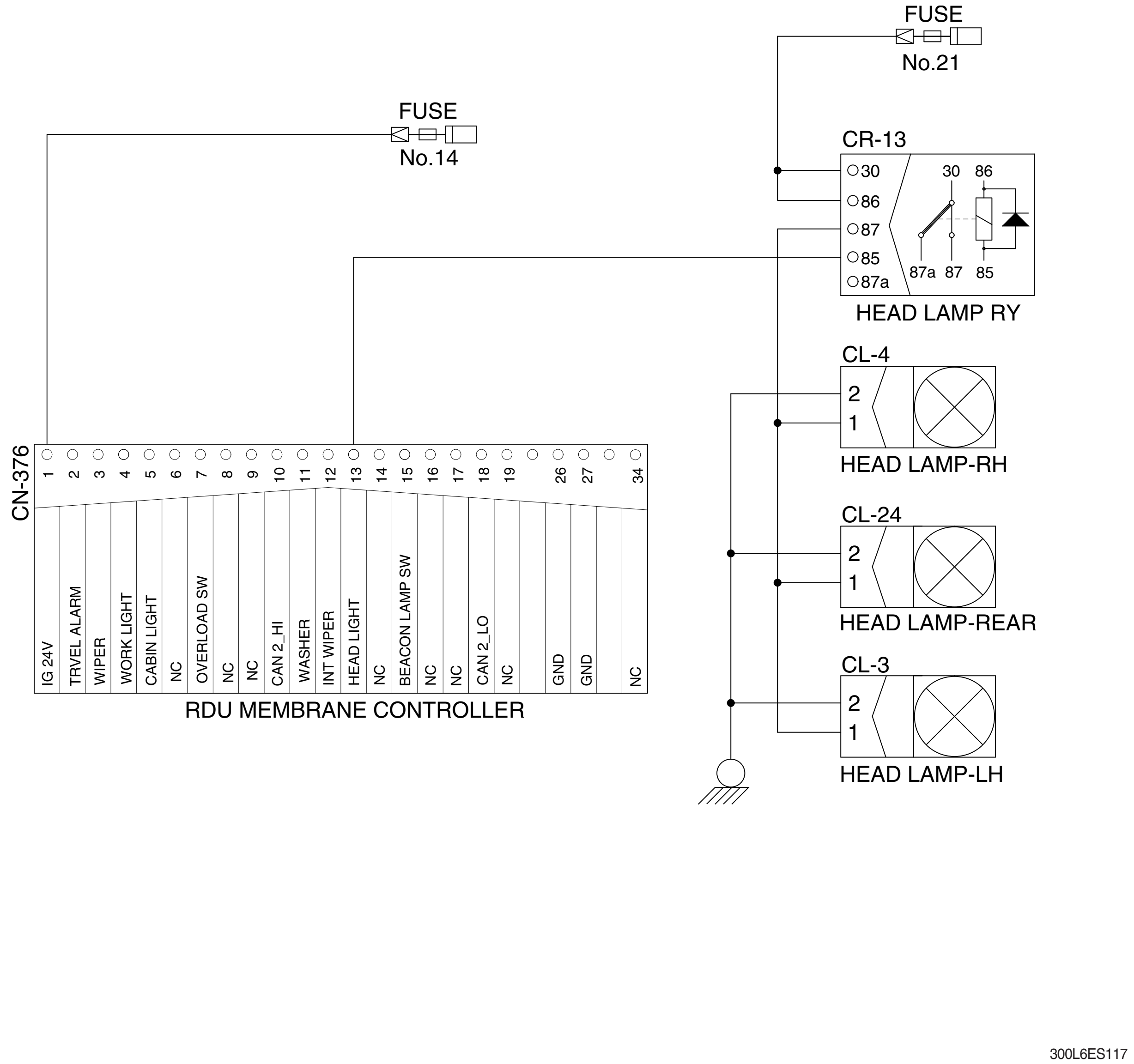
(SERIAL NO. : #0786-)

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

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.14 & 21.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



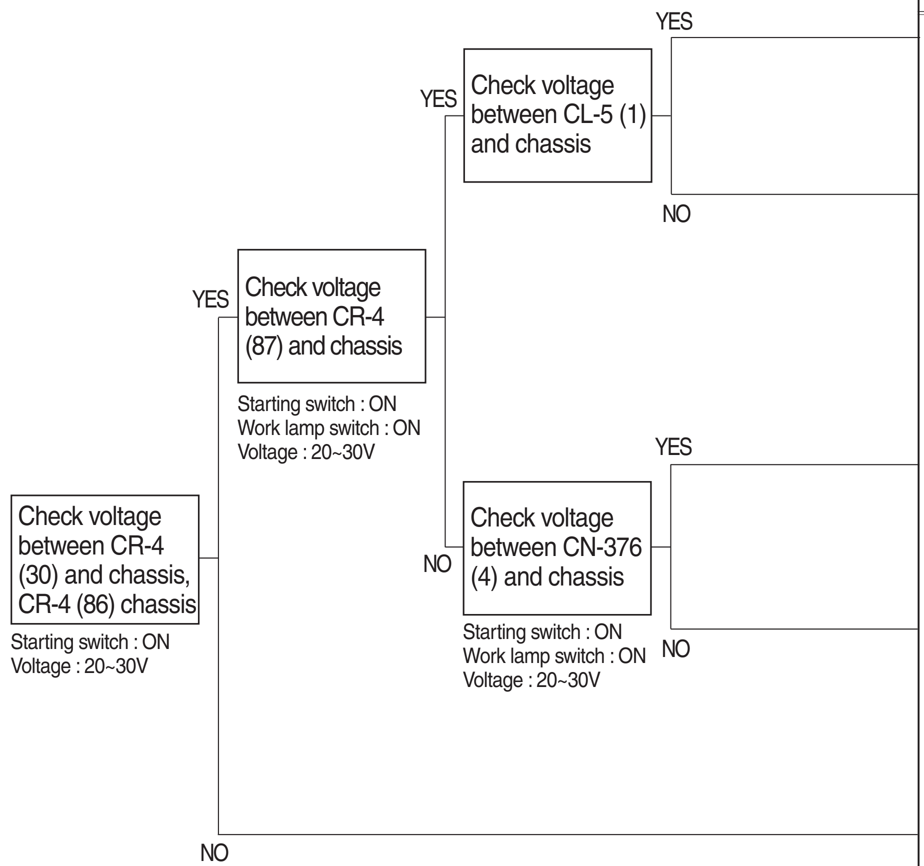
Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-13 (87)-CL-4 (1) or CR-13 (87)-CL-3 (1) or CR-13 (87)-CL-24 (1)	Repair or replace (after clean)
Defective RDU membrane controller	Replace
Disconnection in wiring harness or poor contact between CN-376 (13)-CR-13 (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



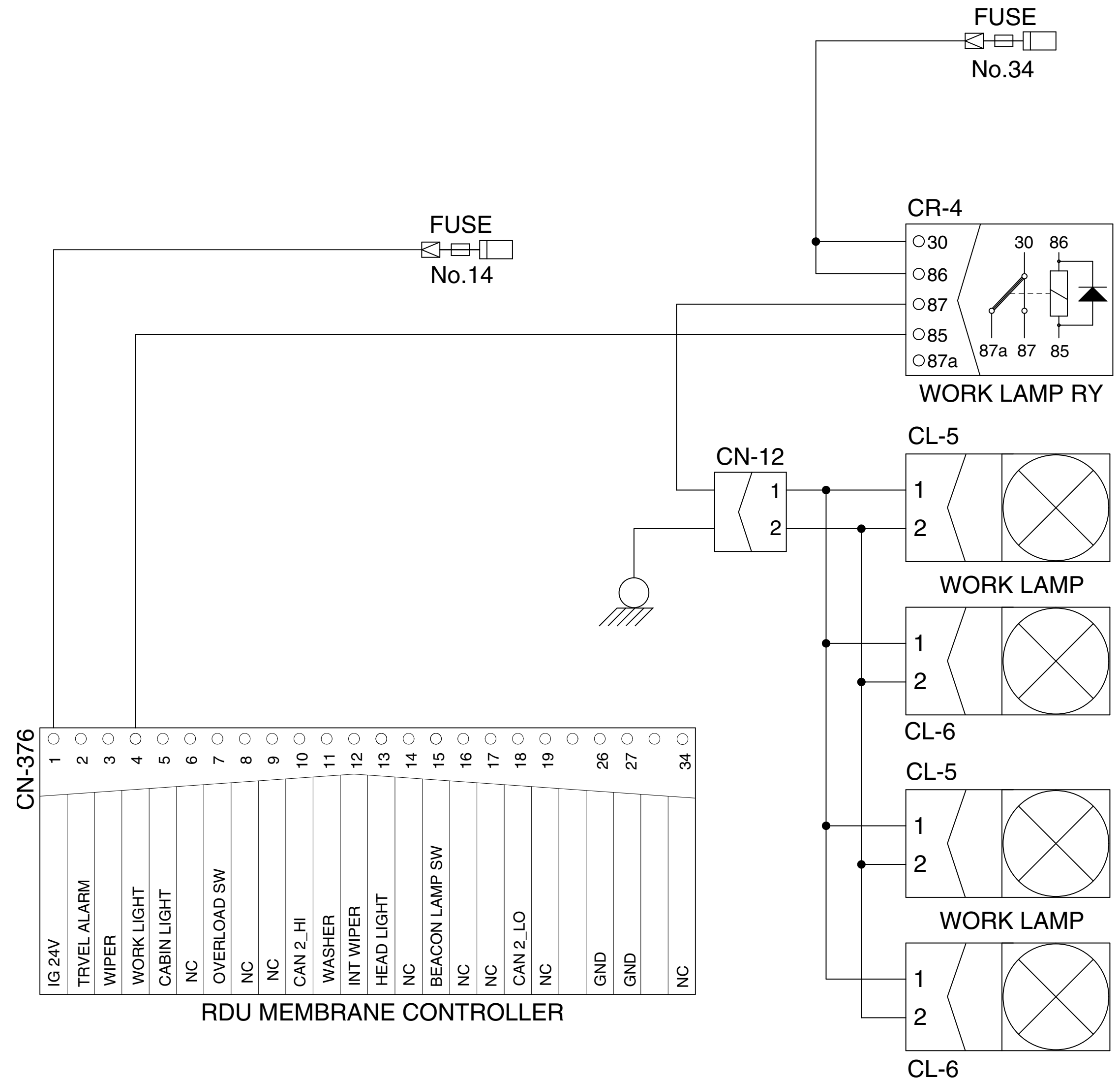
(SERIAL NO. : #0786-)

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

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.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

GROUP 4 MECHATRONICS SYSTEM

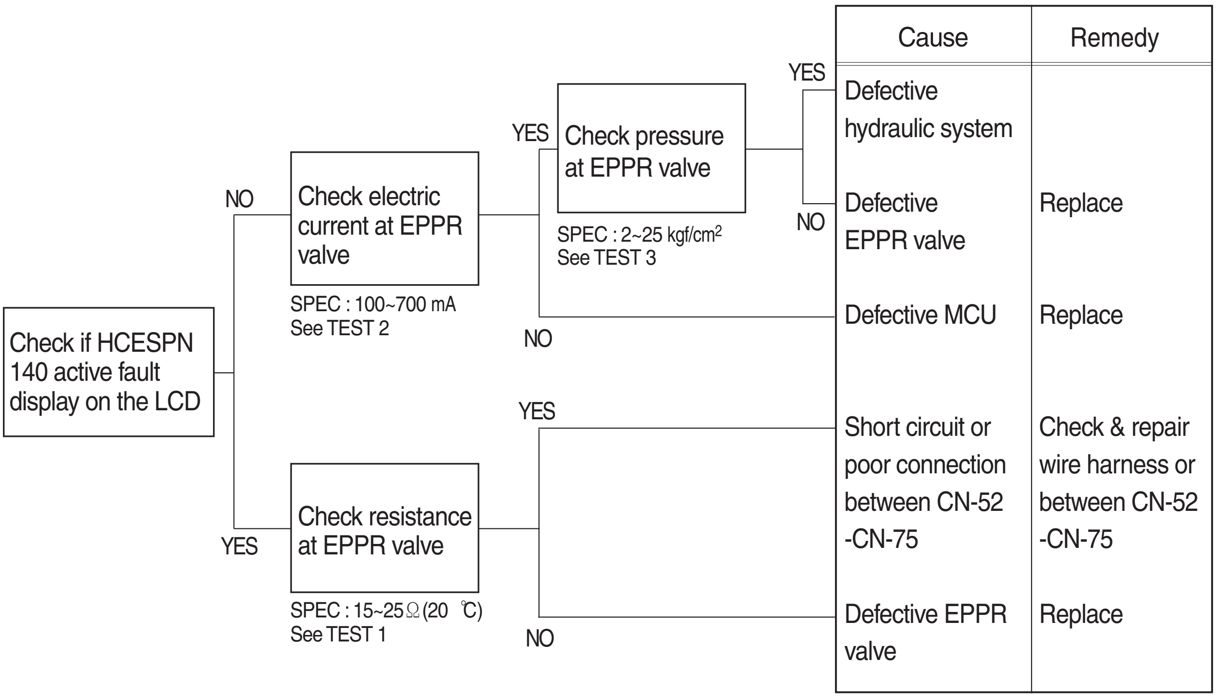
1. ALL ACTUATORS SPEED ARE SLOW (SERIAL NO. : -#0785)

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

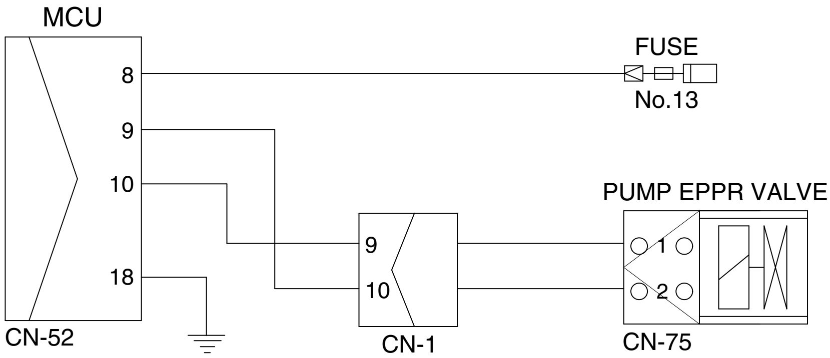
※ Spec : P-mode 1800 ± 50 rpm S -mode 1700 ± 50 rpm E-mode 1600 ± 50 rpm

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

1) INSPECTION PROCEDURE



Wiring diagram



300L6MS51

(SERIAL NO. : -#0785)

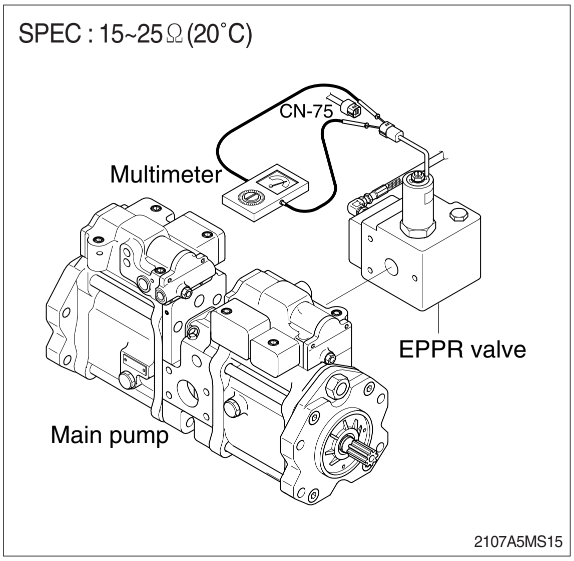
2) TEST PROCEDURE

(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.

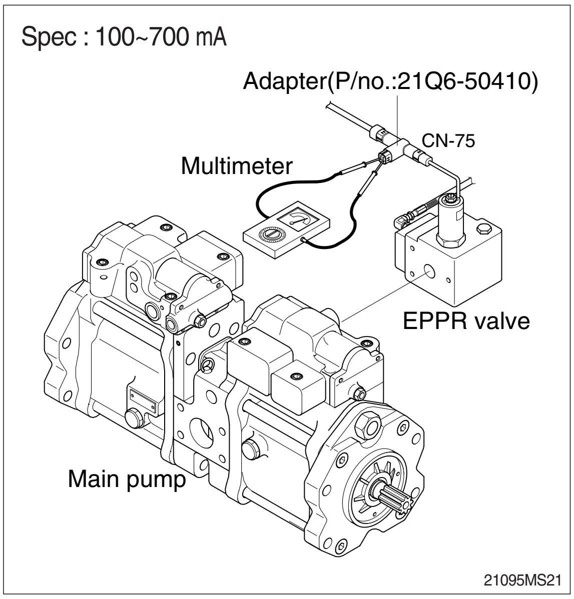
③ Start engine.

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/cm^2 (0 to 725 psi)

② Start engine.

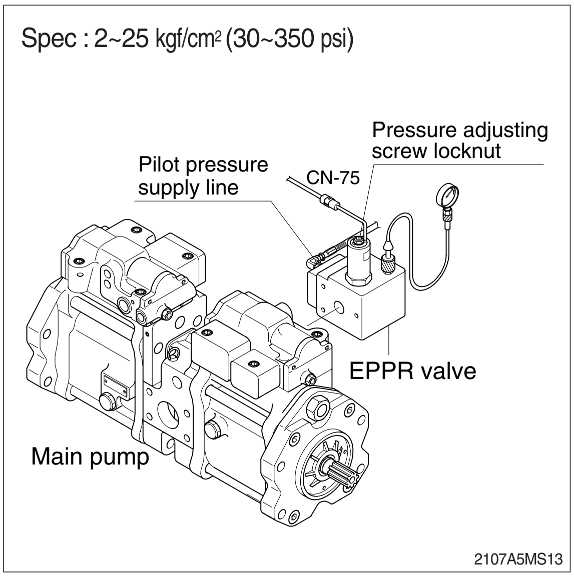
③ Set S-mode and cancel auto decel mode.

④ Position the multimodal dial at 10.

⑤ If tachometer show approx 1700±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

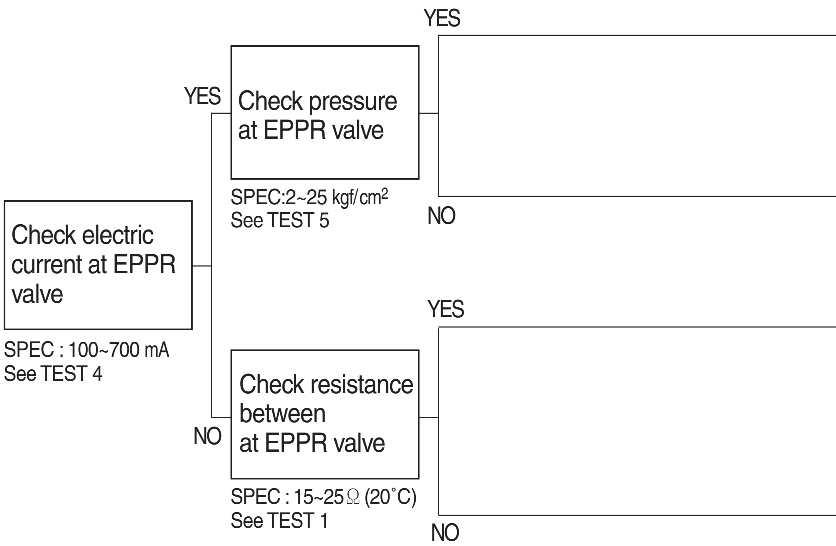
⑦ After adjust, test the machine.



2. ENGINE STALL (SERIAL NO. : -#0785)

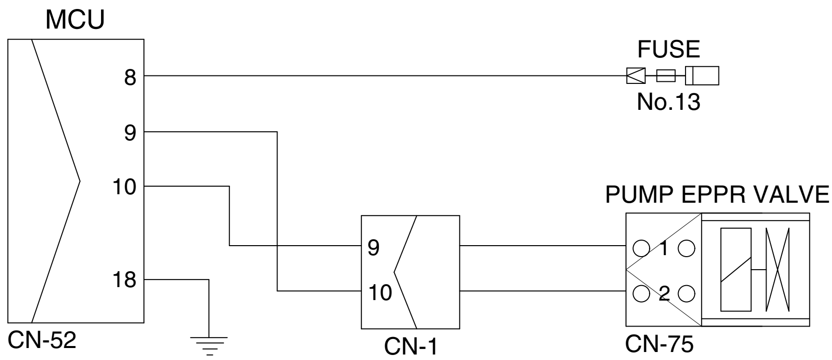
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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

Wiring diagram



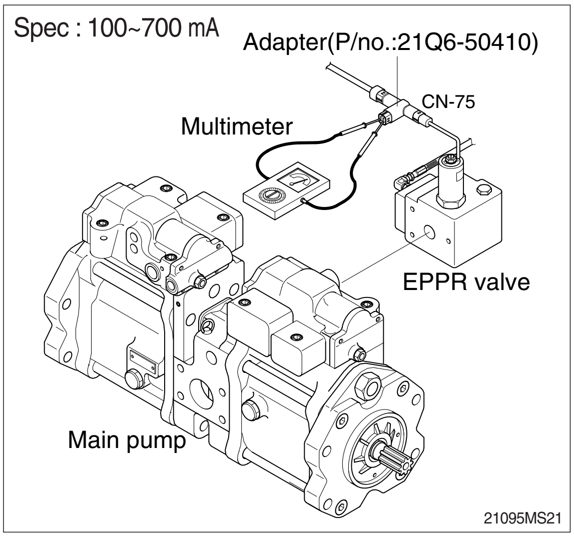
300L6MS51

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

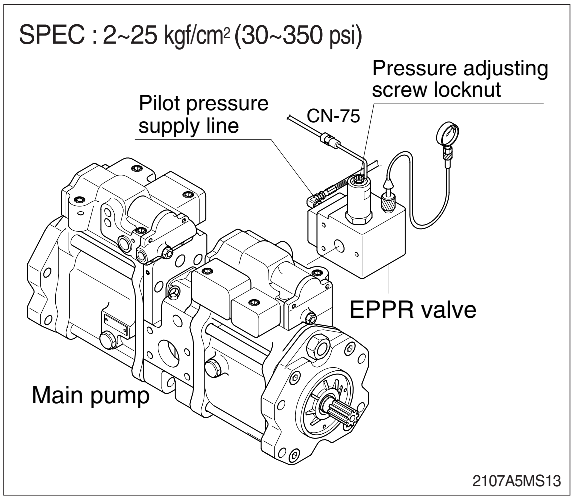
(1) Test 4 : Check electric current at EPPR valve.

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.

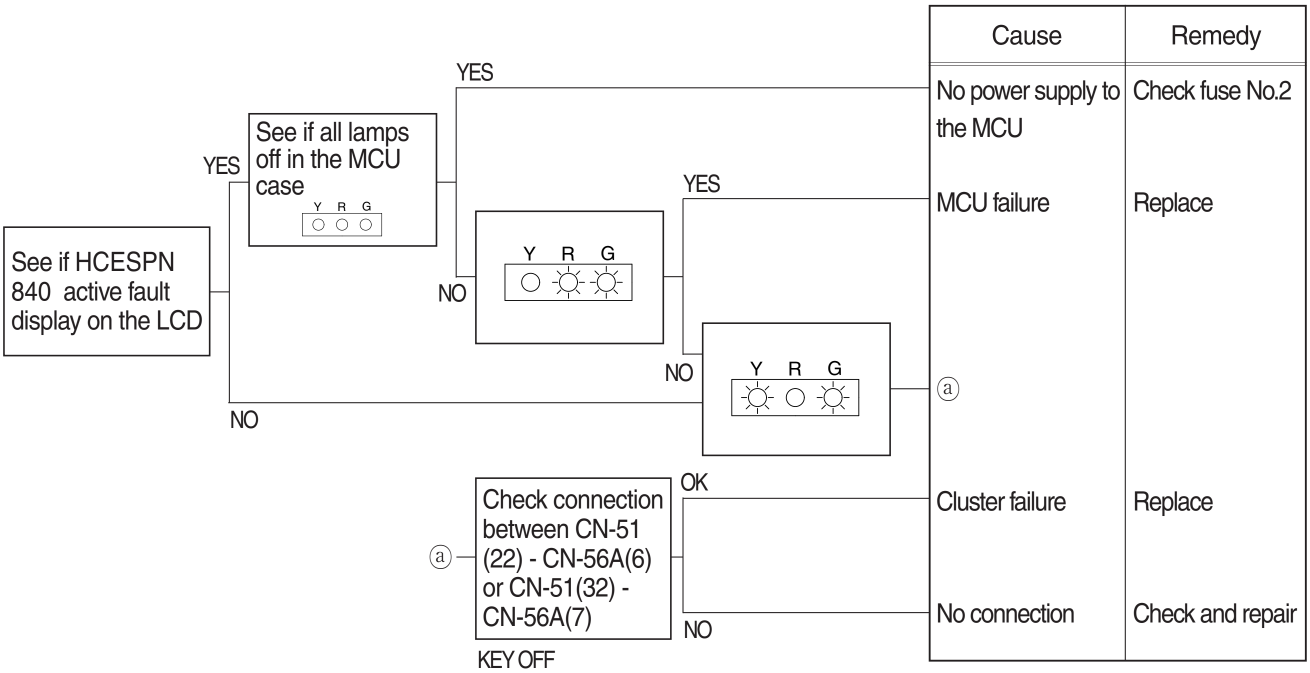
① Remove plug and connect pressure gauge as figure.
· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)
② Start engine.
③ Set S-mode and cancel auto decel mode.
④ Position the multimodal dial at 10.
⑤ If rpm show approx 1700±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.



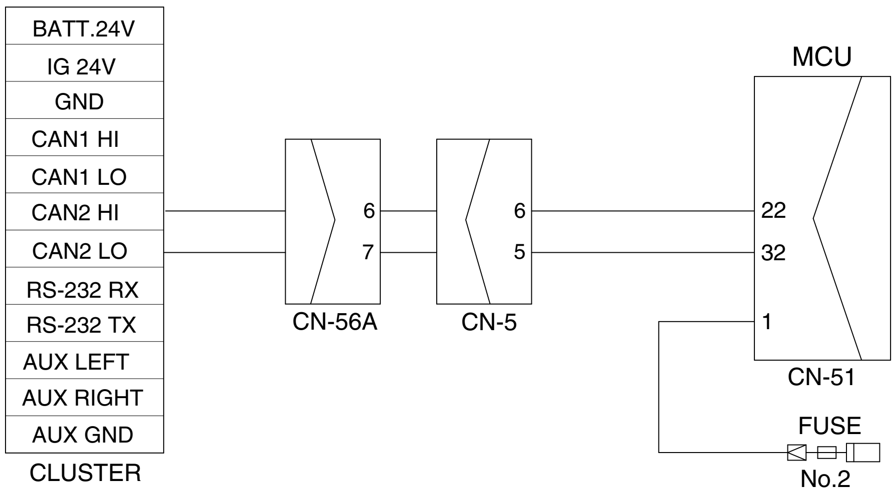
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM (SERIAL NO. : -#0785)

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

1) INSPECTION PROCEDURE



Wiring diagram



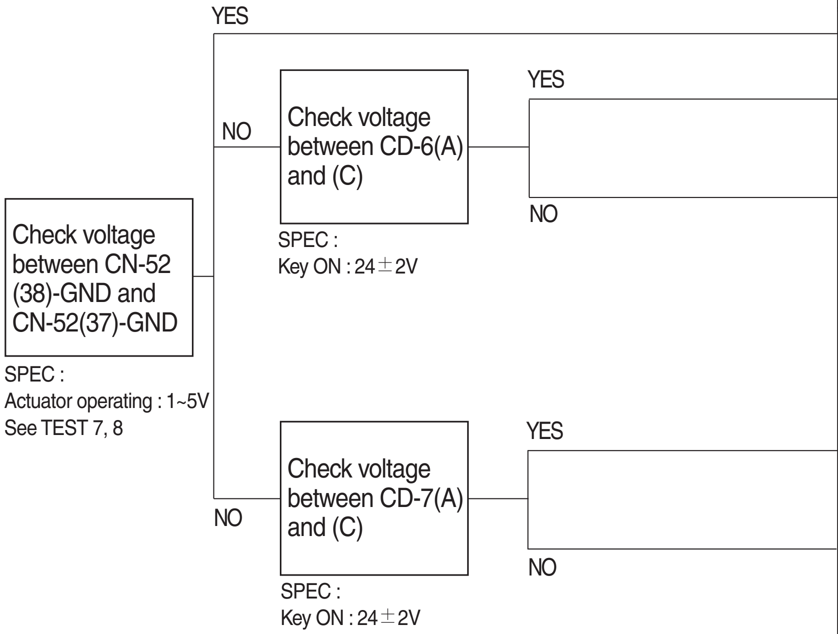
300L6MS52

4. AUTO DECEL SYSTEM DOES NOT WORK (SERIAL NO. : -#0785)

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

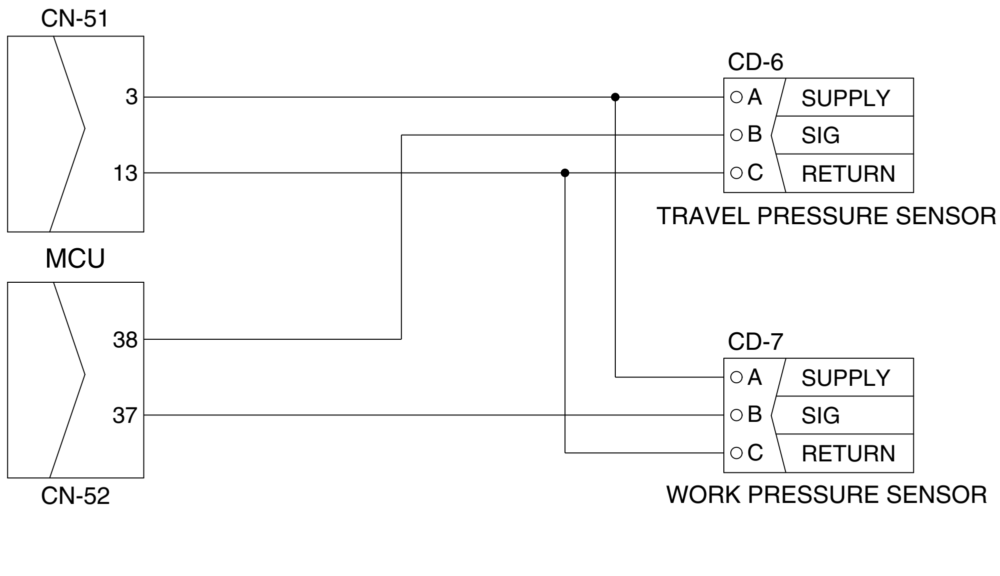
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Defective travel pressure switch	Replace
Short circuit or poor connection between CN-51(3)-CD-6(A) and / or CN-51(13)-CD-6 (C) (fault code 108 displayed)	Replace or repair
Defective work pressure sensor	Replace
Short circuit or poor connection between CN-51(3)-CD-7(A) and / or CN-51(13)-CD-7 (C) (fault code 105 displayed)	Replace or repair

Wiring diagram



(SERIAL NO. : -#0785)

2) TEST PROCEDURE

(1) Test 7 : Check voltage at CN-52 (38) and ground.

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

② Insert prepared pin to rear side of connectors : One pin to (38) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

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

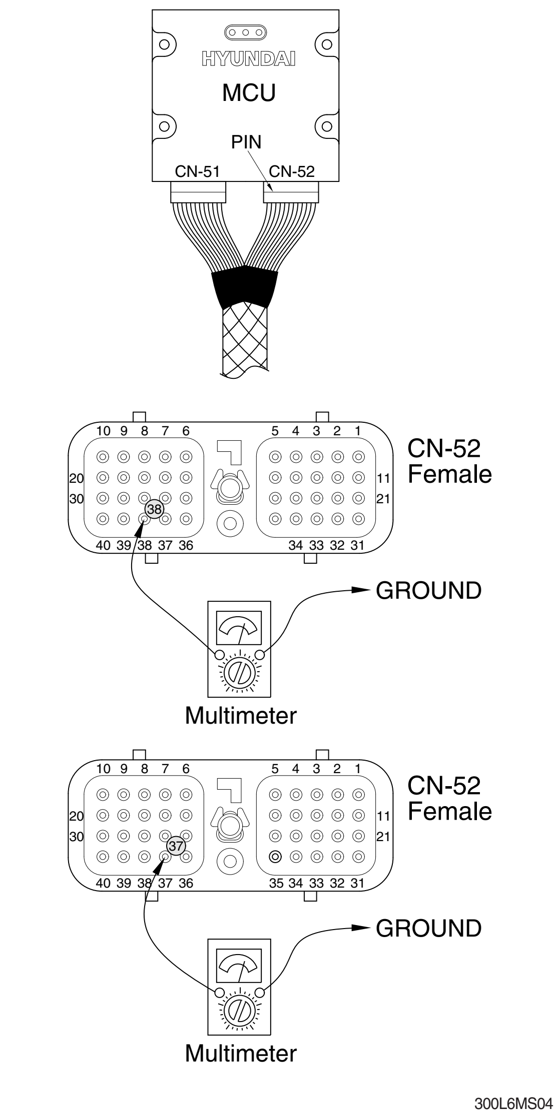
① Prepare 1 piece of thin sharp pin, steel or copper

② Insert prepared pin to rear side of connectors : One pin to (37) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

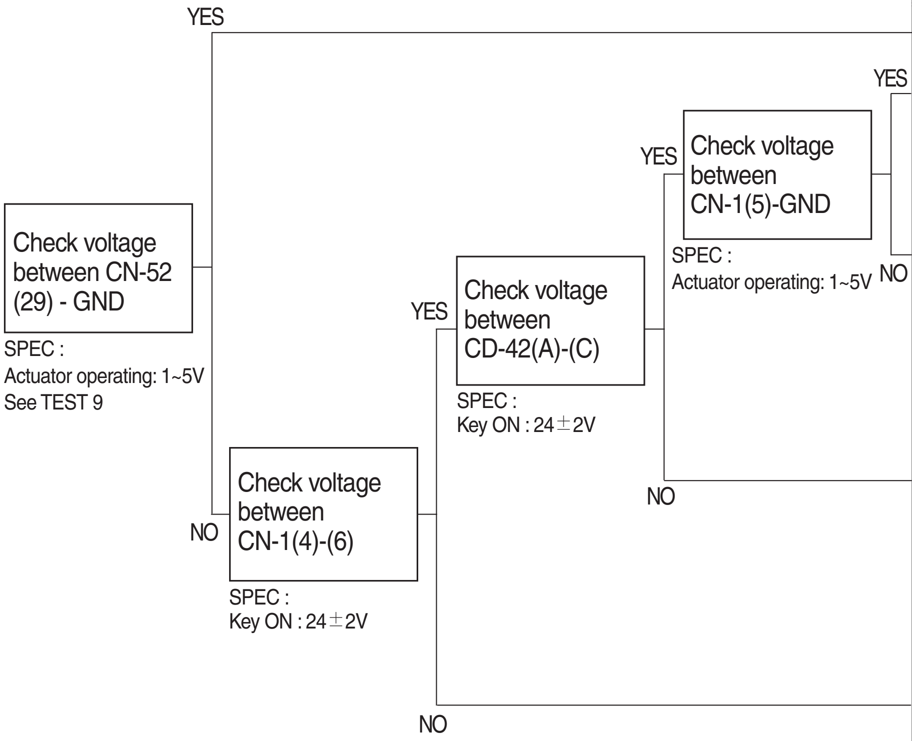


5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR (SERIAL NO. : -#0785)

· Fault code : HCESPN 120, FMI 0~4

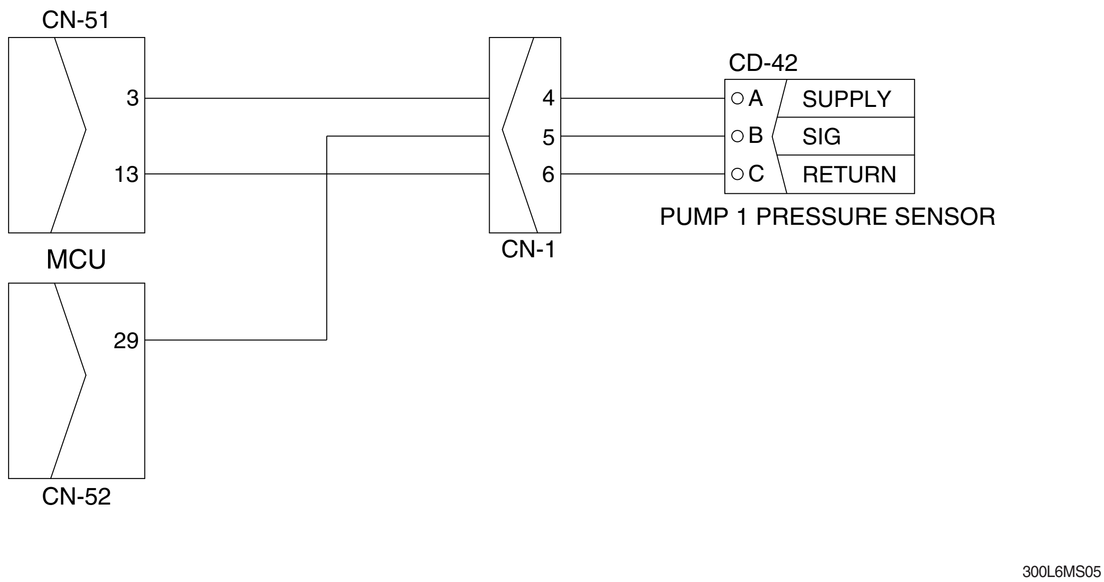
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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

Wiring diagram



(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

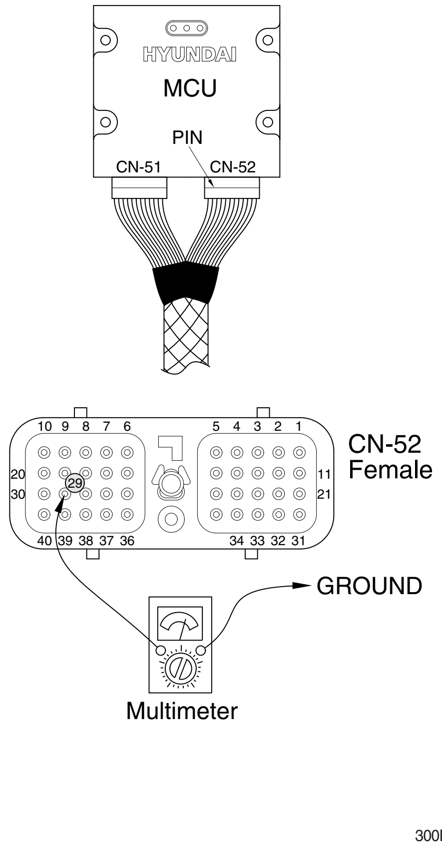
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (29) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

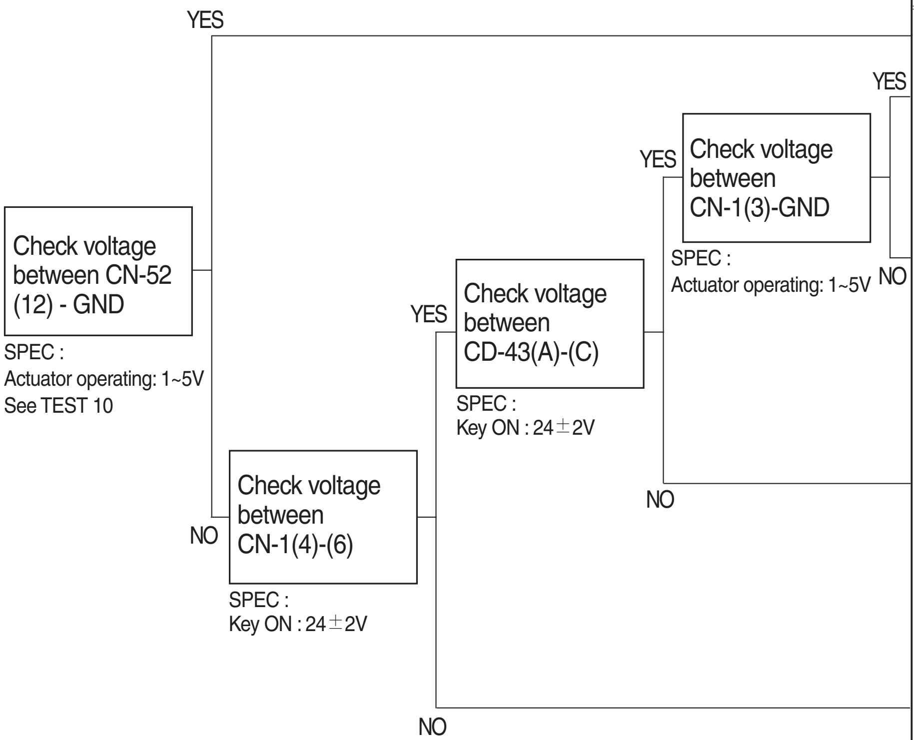


6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR (SERIAL NO. : -#0785)

· Fault code : HCESPN 121, FMI 0~4

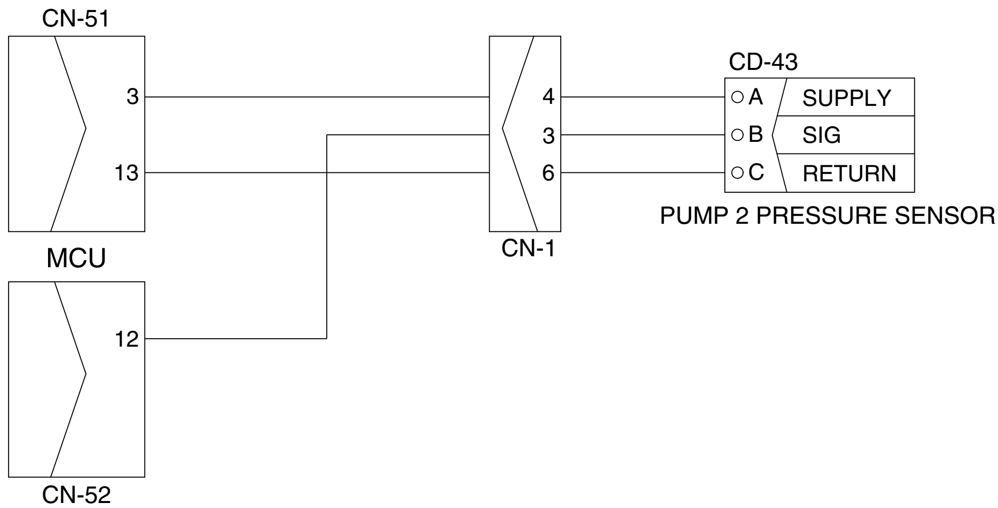
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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

Wiring diagram



300L6MS07

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

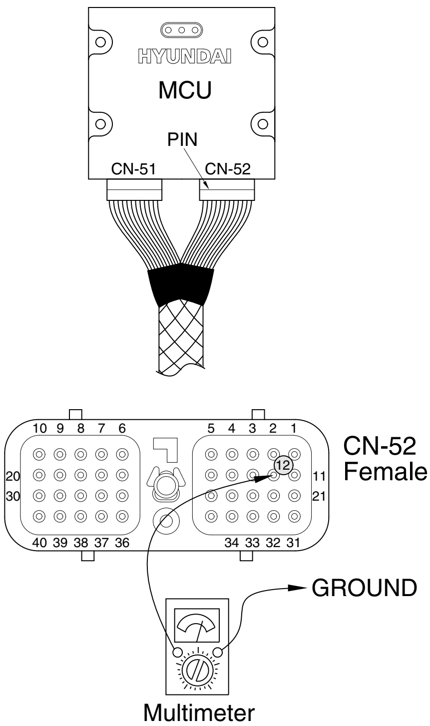
① Prepare 1 piece of thin sharp pin, steel or copper.

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

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

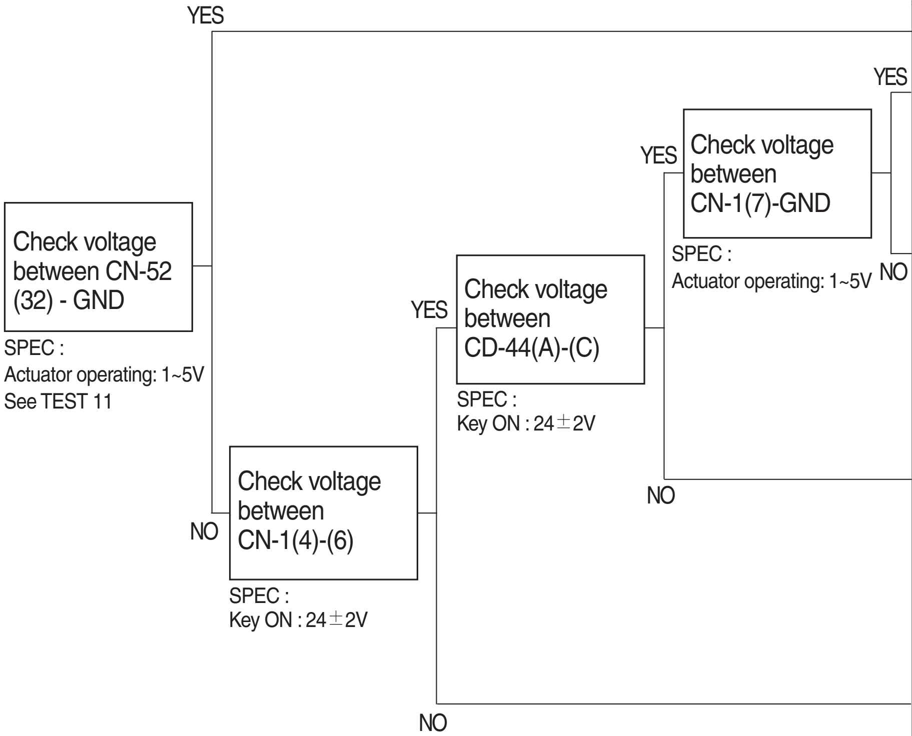


300L6MS08

7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR (SERIAL NO. : -#0785)

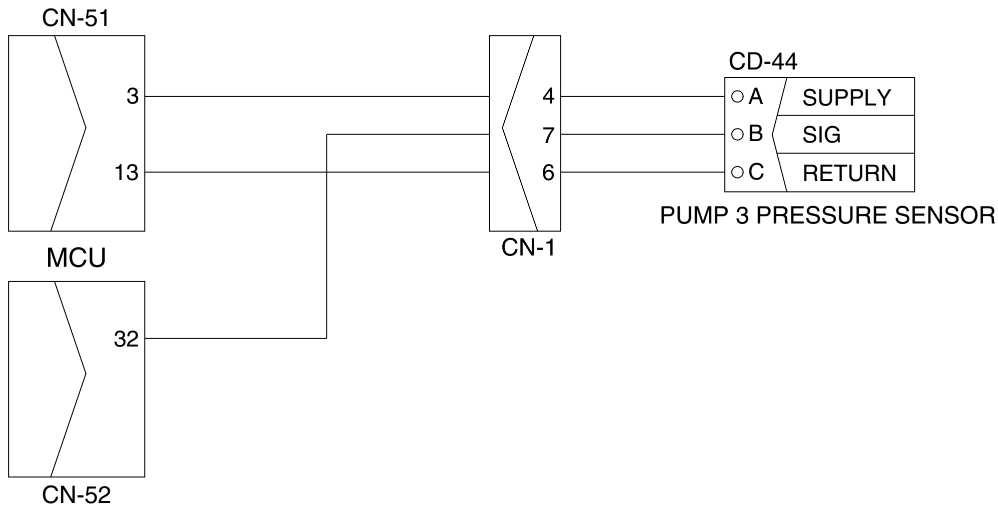
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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

Wiring diagram



300L6MS09

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

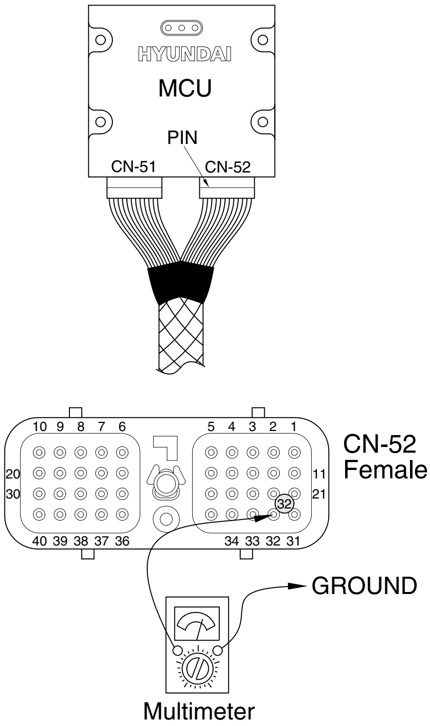
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (32) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



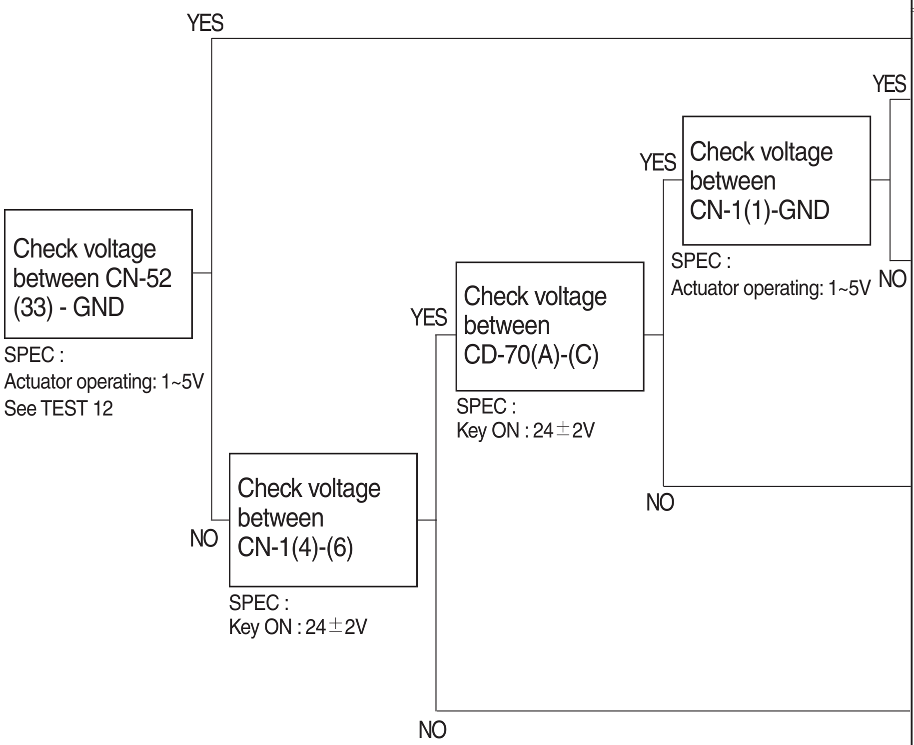
300L6MS10

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR (SERIAL NO. : -#0785)

· Fault code : HCESPN 123, FMI 0~4

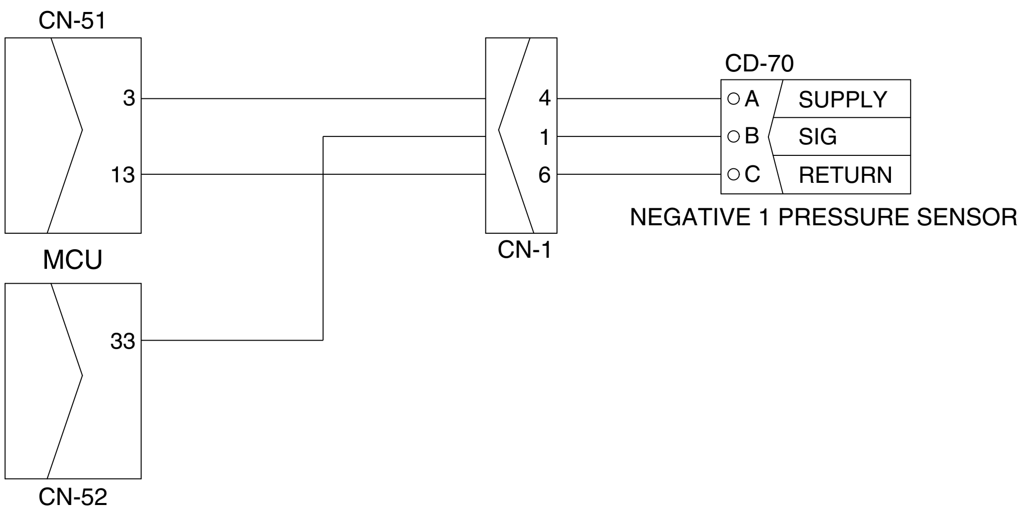
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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

Wiring diagram



300L6MS11

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-52 (33) and ground.

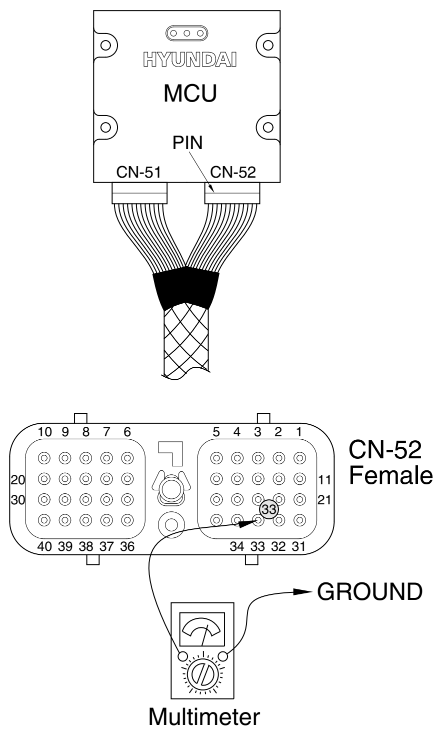
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (33) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



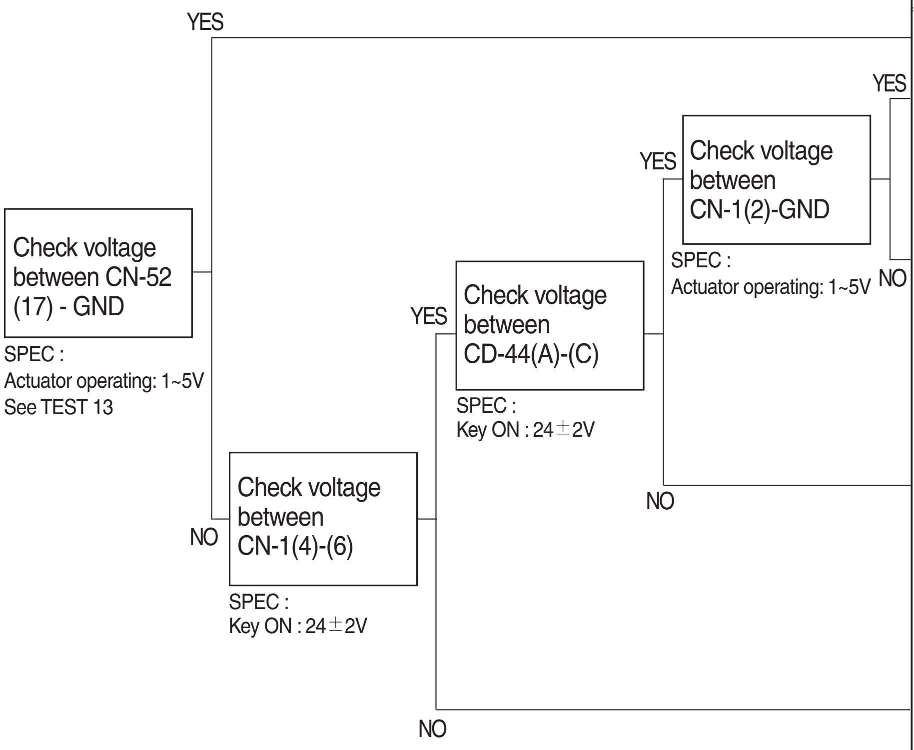
300L6MS12

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR (SERIAL NO. : -#0785)

· Fault code : HCESPN 124, FMI 0~4

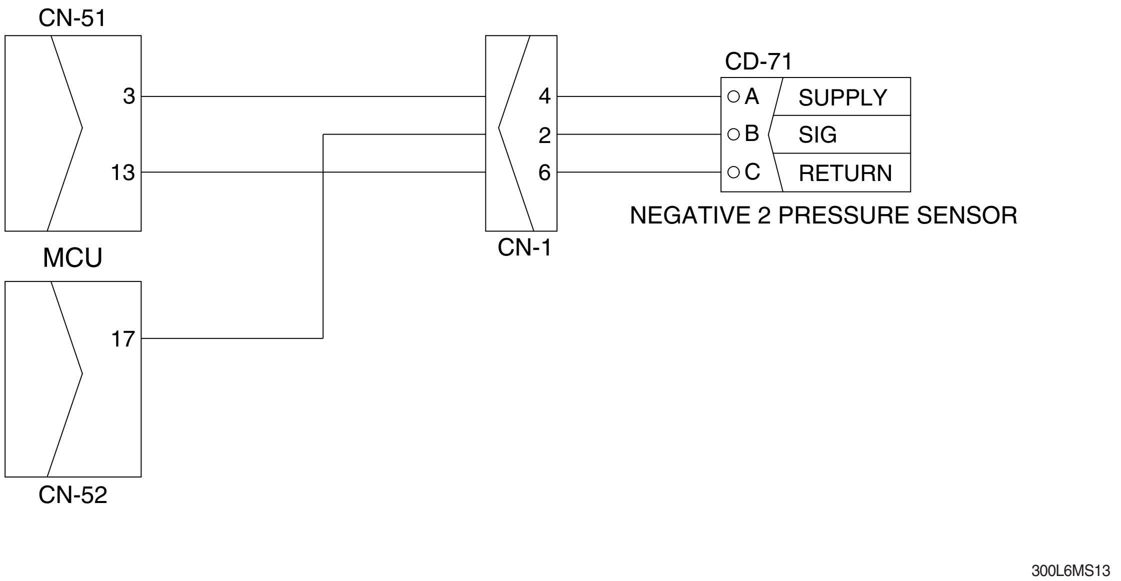
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(17)-CN-1(2)	Replace or repair
Detective N2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1(2)-CD-44(B)	Replace or repair
Short circuit or poor connection between CD-44(A)-CN-1(4) or CD-44(C)-CN-1(6)	Replace or repair
Short circuit or poor connection between CN-1(4)-CN-51(3) or CN-1 (6) - CN-51(13)	Replace or repair

Wiring diagram



(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

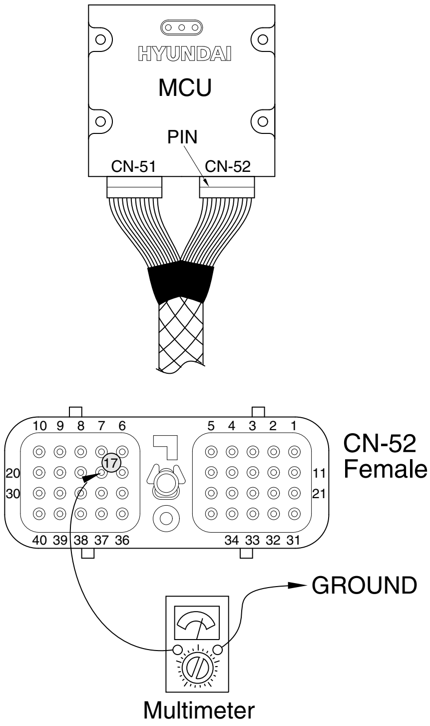
① Prepare 1 piece of thin sharp pin, steel or copper.

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

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



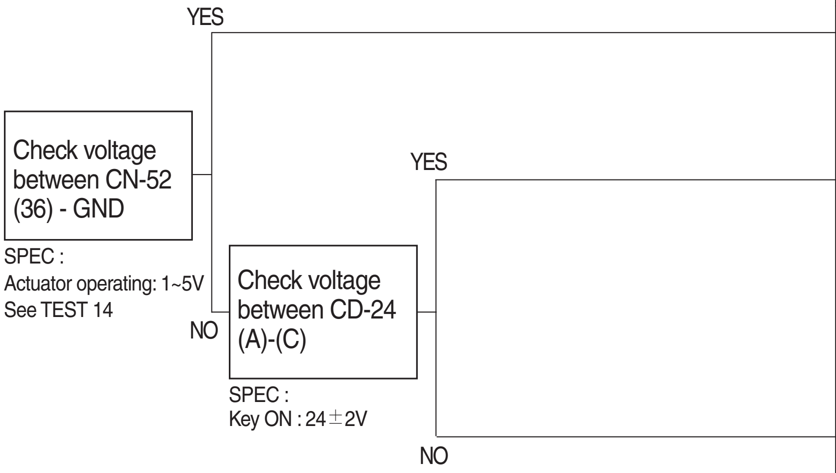
300L6MS14

10. MALFUNCTION OF SWING PRESSURE SENSOR (SERIAL NO. : -#0785)

· Fault code : HCESPN 135, FMI 0~4

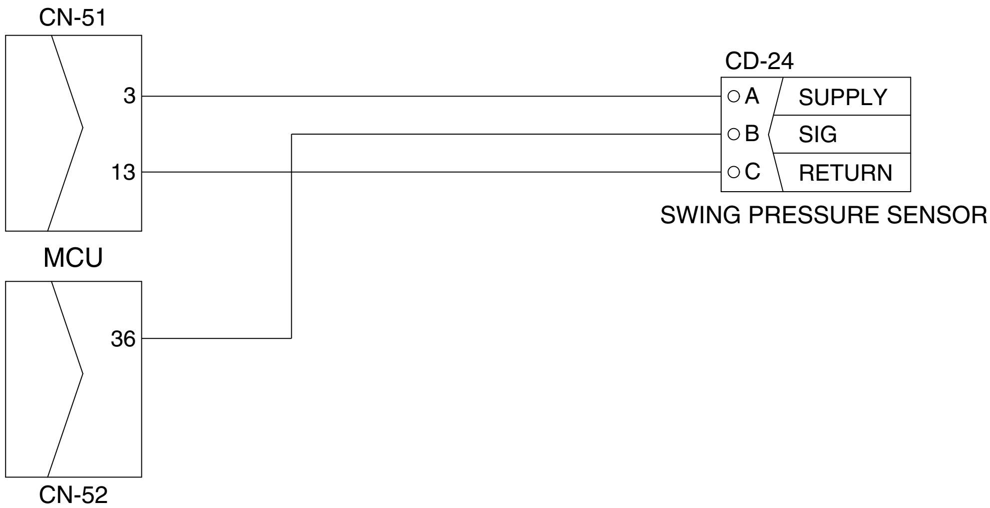
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Detective swing pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (36)-CD-24 (B)	Replace or repair
Short circuit or poor connection between CD-24 (A)-CN-51(3) or CD-24(C)- CN-51 (13)	Replace or repair

Wiring diagram



300L6MS15

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

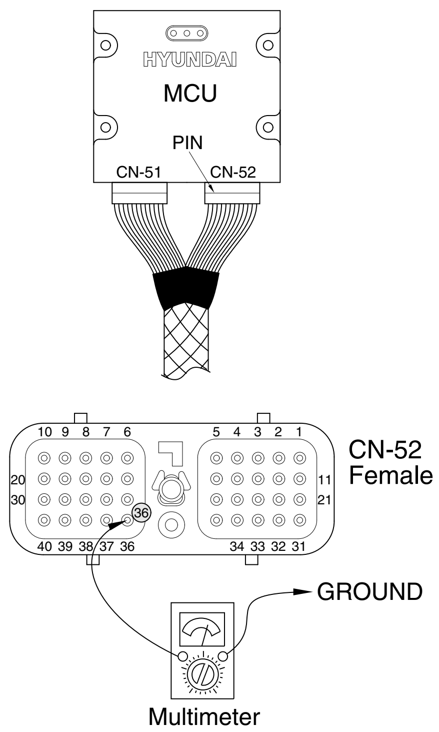
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (36) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



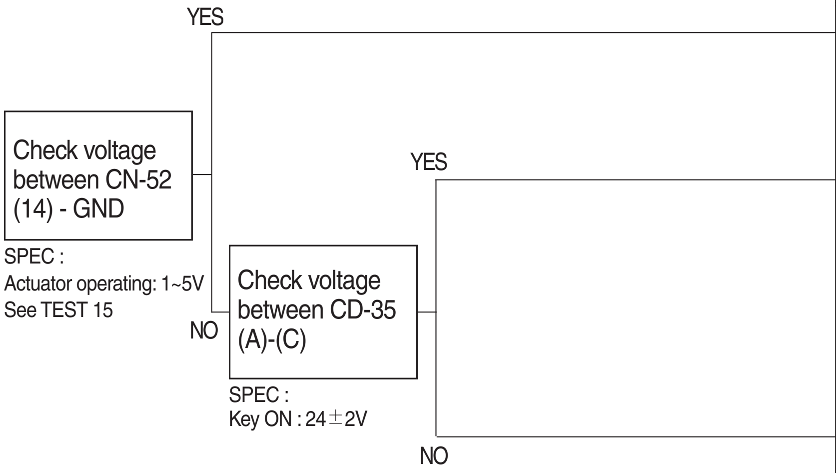
300L6MS16

11. MALFUNCTION OF ARM IN/OUT & BUCKET IN PRESSURE SENSOR (SERIAL NO. : -#0785)

· Fault code : HCESPN 133, FMI 0~4

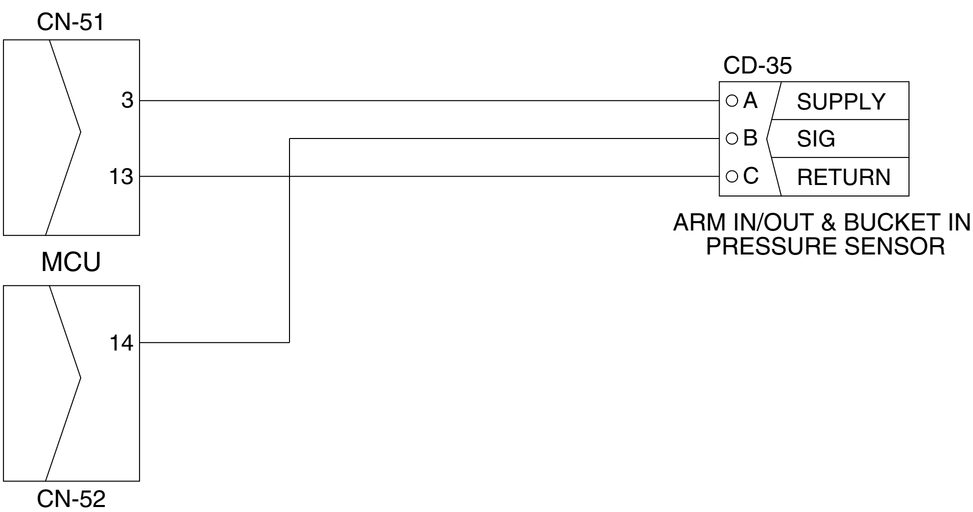
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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

Wiring diagram



300L6MS17

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

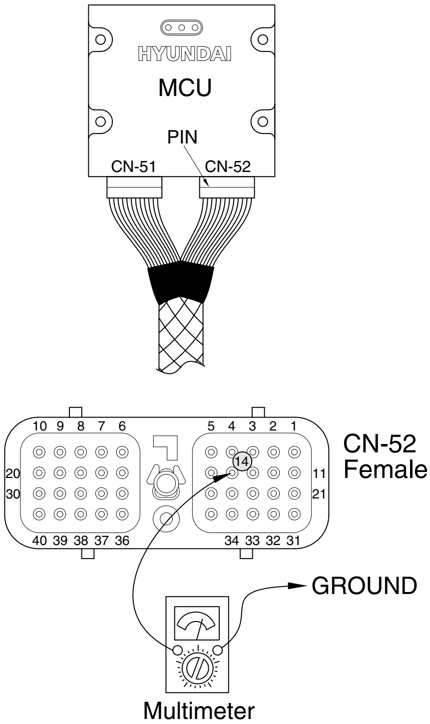
① Prepare 1 piece of thin sharp pin, steel or copper.

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

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



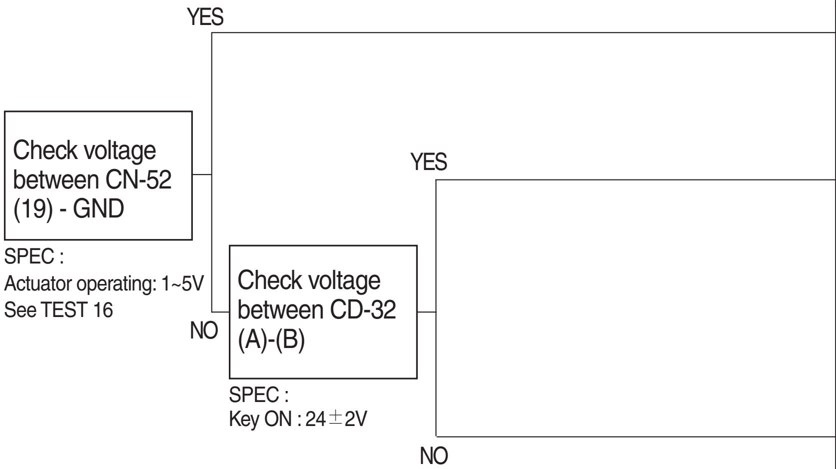
300L6MS18

12. MALFUNCTION OF BOOM UP PRESSURE SENSOR (SERIAL NO. : -#0785)

· Fault code : HCESPN 127, FMI 0~4

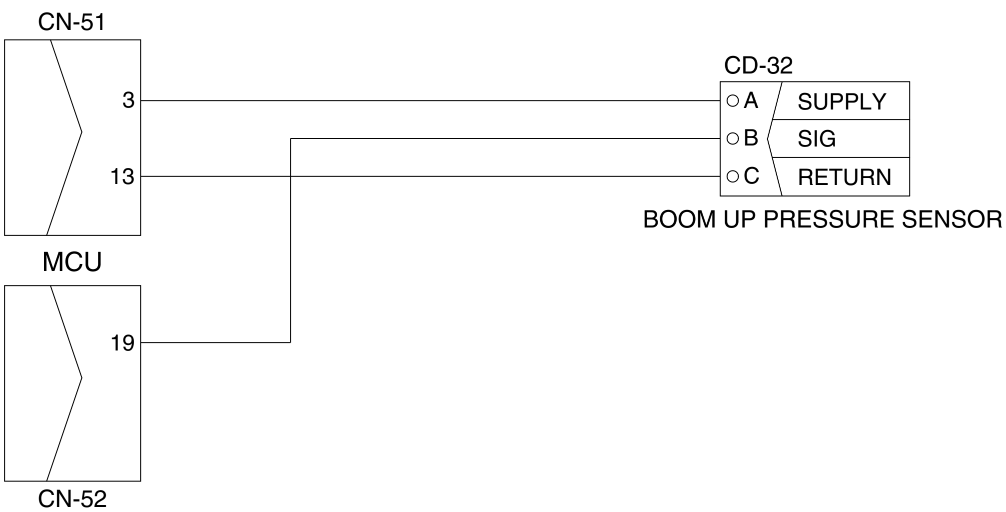
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (19)-CD-32 (B)	Replace or repair
Short circuit or poor connection between CD-32 (A)-CN-51(3) or CD-32(C)- CN-51 (13)	Replace or repair

Wiring diagram



300L6MS19

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

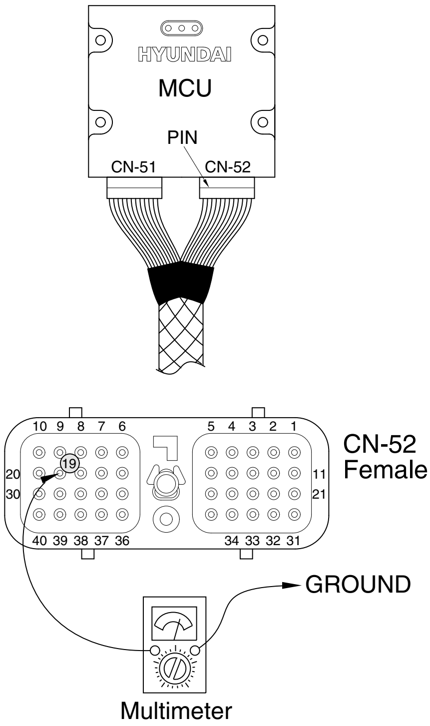
① Prepare 1 piece of thin sharp pin, steel or copper.

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

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



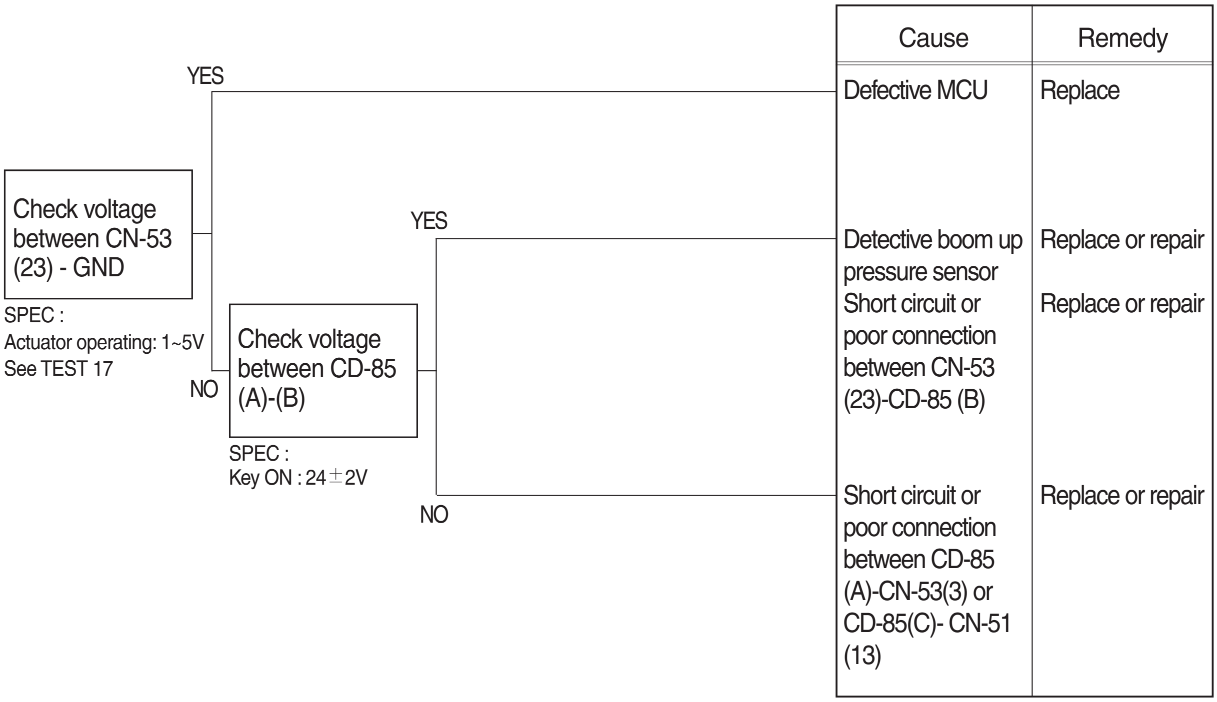
300L6MS20

13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR (SERIAL NO. : -#0785)

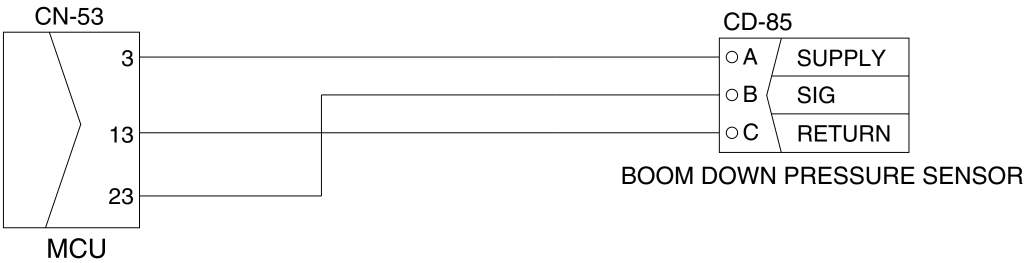
· Fault code : HCESPN 128, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



300L6MS25

(SERIAL NO. : -#0785)

2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-53 (23) and ground.

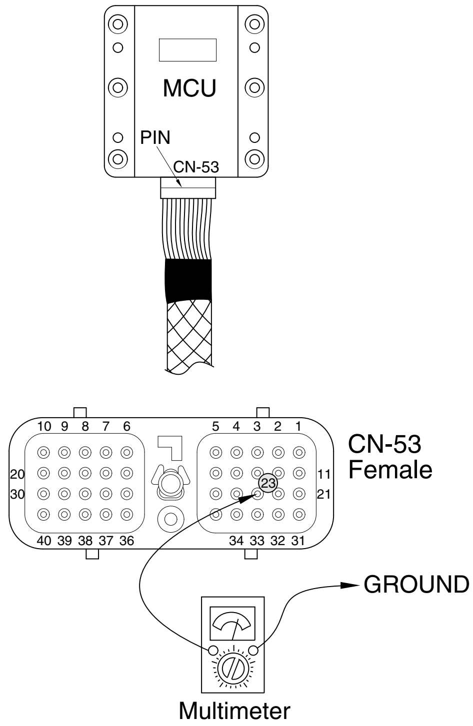
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (23) of CN-53.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



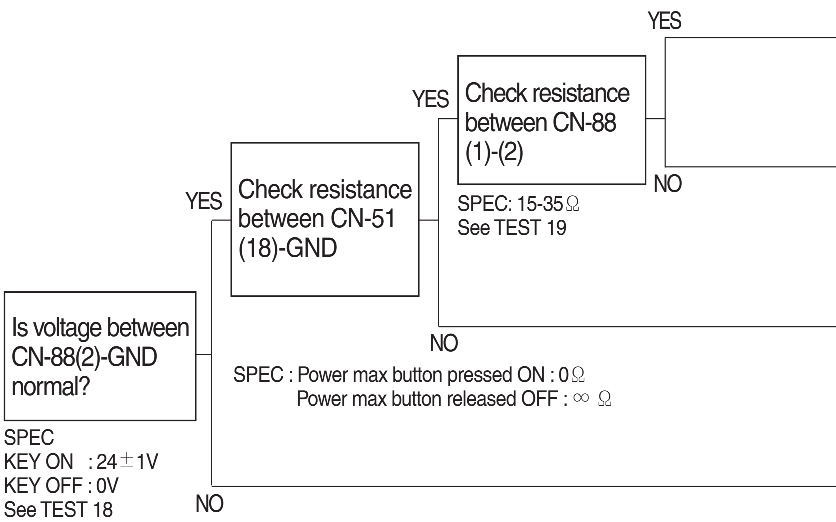
300L6MS26

14. MALFUNCTION OF POWER MAX (SERIAL NO. : -#0785)

· Fault code : HCESPN 166, FMI 4 or 6

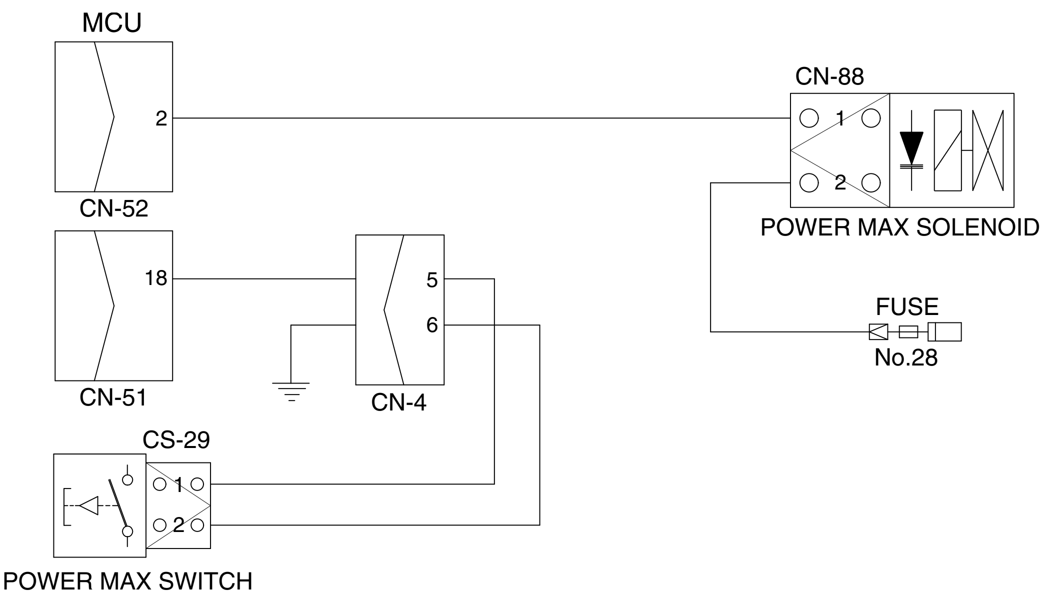
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Short circuit or poor connection between CN-88(1)-CN-52 (2)	Repair or replace
Defective power max. solenoid valve Check hydraulic system	Repair or replace
Short circuit or poor connection between CN-51(18)-CS-29	Repair or replace
Short circuit or poor connection between CN-88(2)- Fuse No. 28	Repair or replace

Wiring diagram



300L6MS61

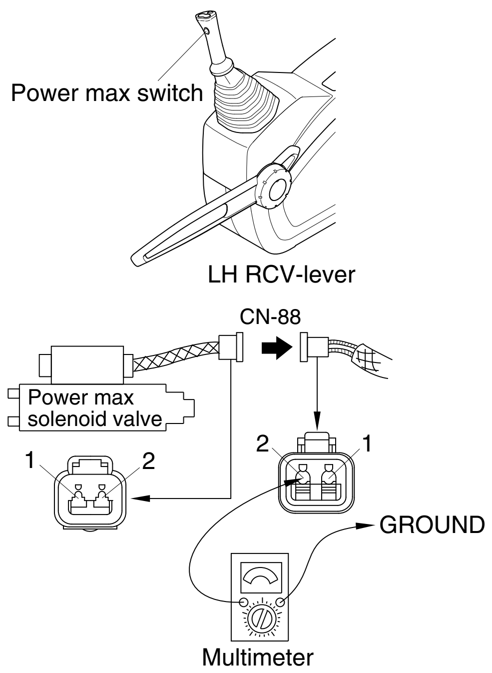
(SERIAL NO. : -#0785)

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 key ON.
③ Check voltage as figure.

SPEC : Key ON : 24±1V
Key OFF : 0V

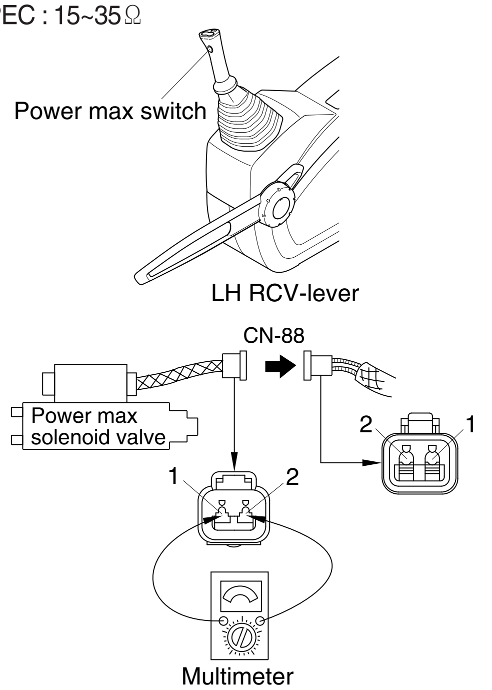


21096MS14A

(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting key OFF.
② Disconnect connector CN-88 from power max solenoid valve.
③ Check resistance as figure.

SPEC : 15~35Ω



21096MS14B

15. MALFUNCTION OF BOOM PRIORITY EPPR VALVE (SERIAL NO. : -#0785)

· Fault code : HCESPN 141, FMI 5 or 6

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

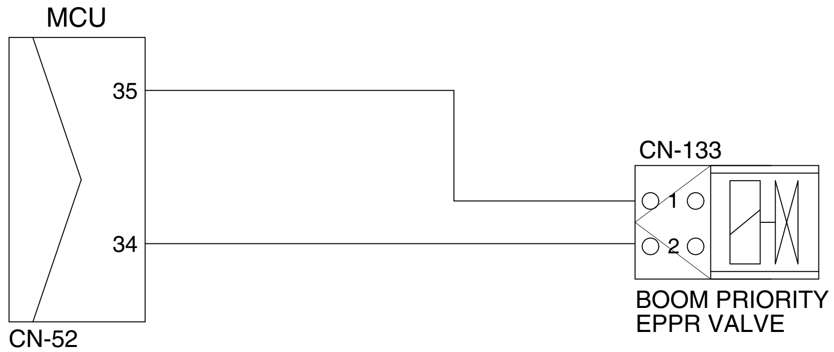
1) INSPECTION PROCEDURE

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

SPEC : 20~30V
KEY : ON

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

Wiring diagram



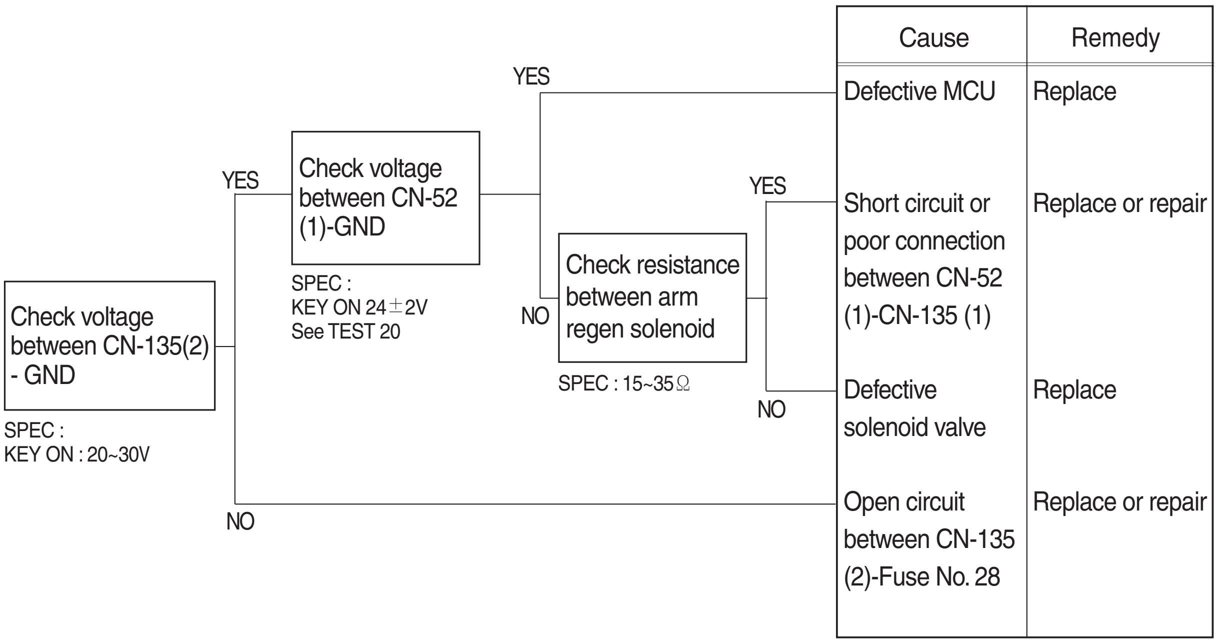
300L6MS23

16. MALFUNCTION OF ARM REGENERATION SOLENOID (SERIAL NO. : -#0785)

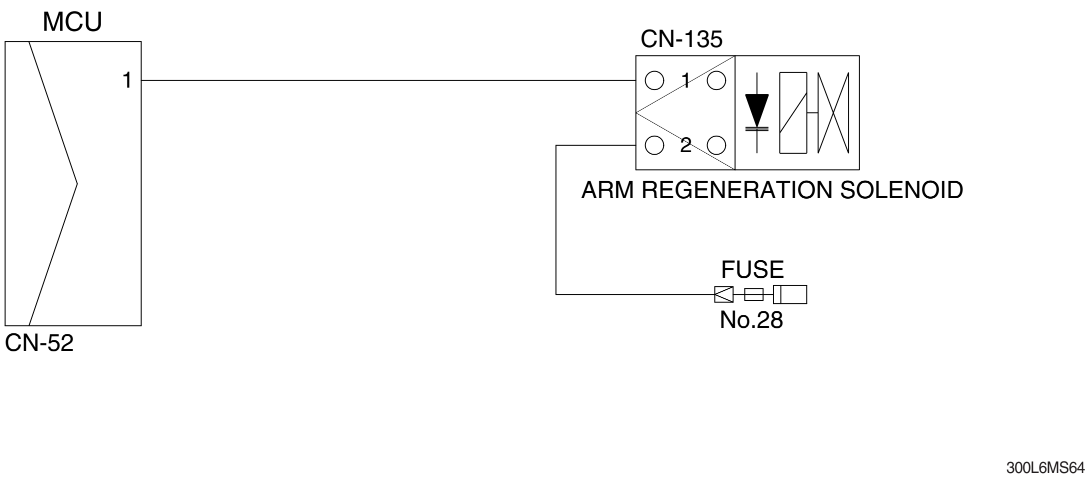
· Fault code : HCESPN 170, FMI 4 or 6

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

1) INSPECTION PROCEDURE



Wiring diagram



(SERIAL NO. : -#0785)

2) TEST PROCEDURE

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

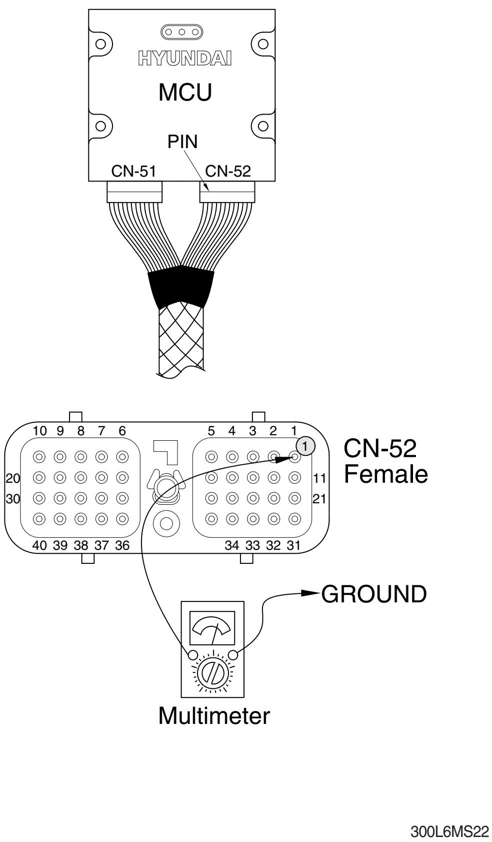
① Prepare 1 piece of thin sharp pin, steel or copper.

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

③ Starting key ON.

④ Check voltage as figure.

SPEC : Key ON : 24±2 V



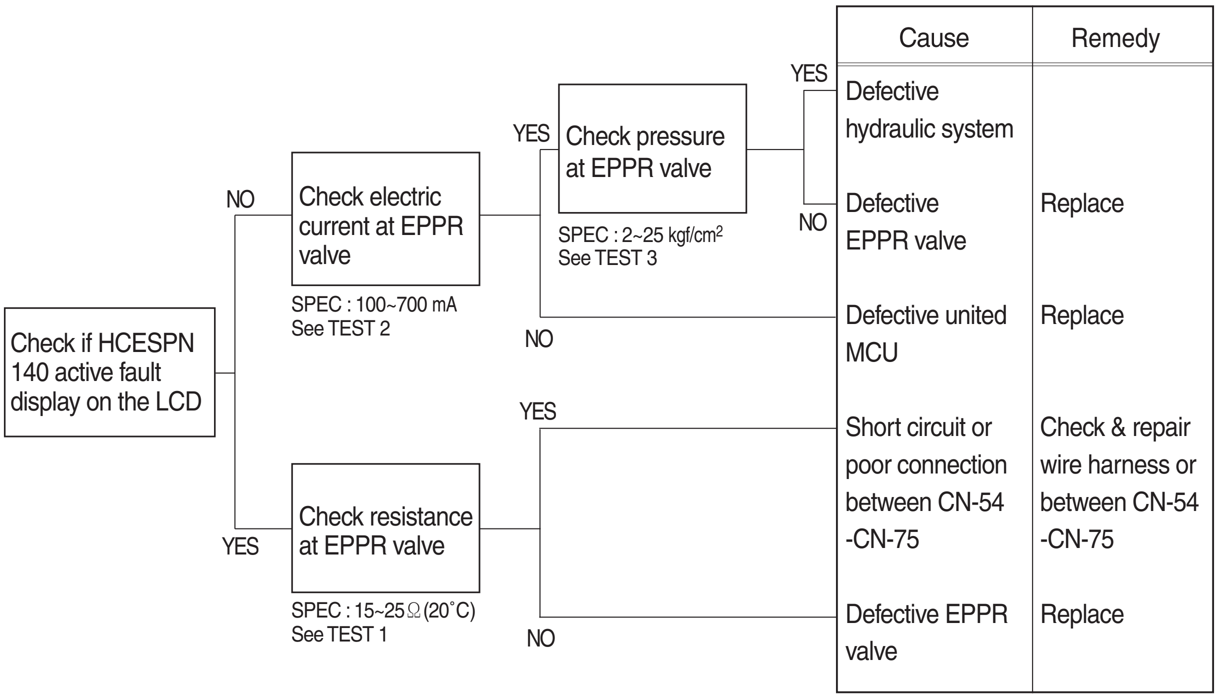
1. ALL ACTUATORS SPEED ARE SLOW (SERIAL NO. : #0786-)

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

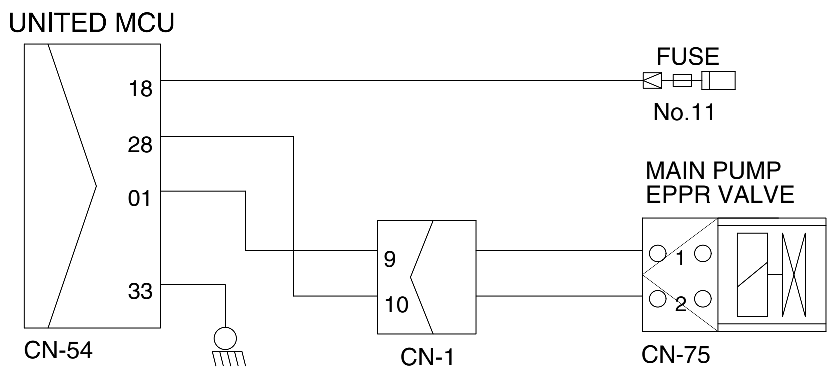
※ Spec : P-mode 1800 ± 50 rpm S -mode 1700 ± 50 rpm E-mode 1600 ± 50 rpm

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

1) INSPECTION PROCEDURE



Wiring diagram



140L6MS101

(SERIAL NO. : #0786-)

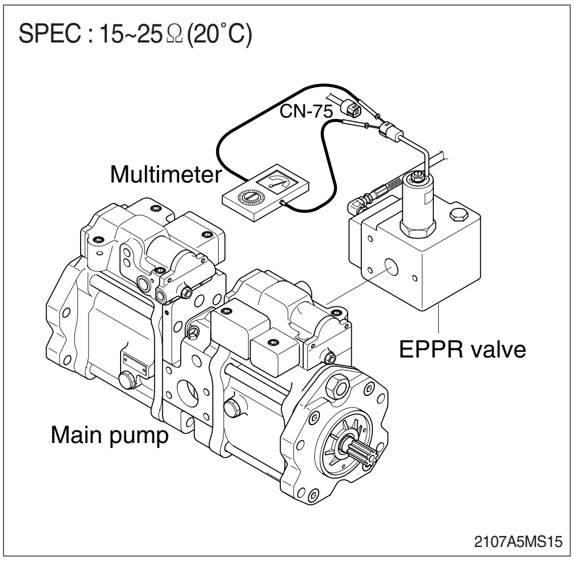
2) TEST PROCEDURE

(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.

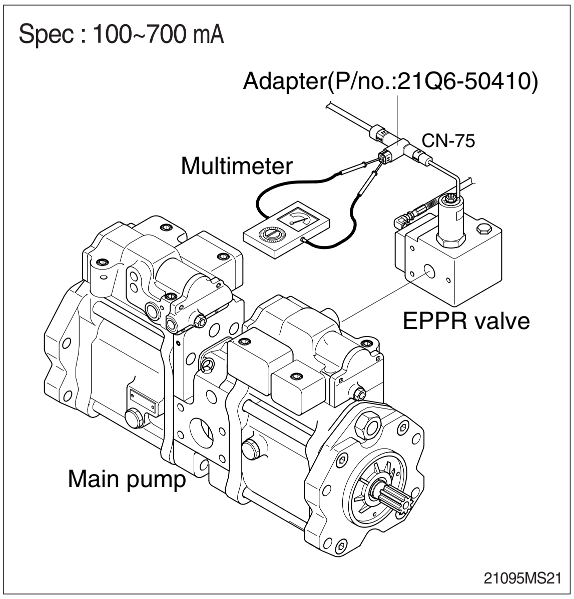
③ Start engine.

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/cm^2 (0 to 725 psi)

② Start engine.

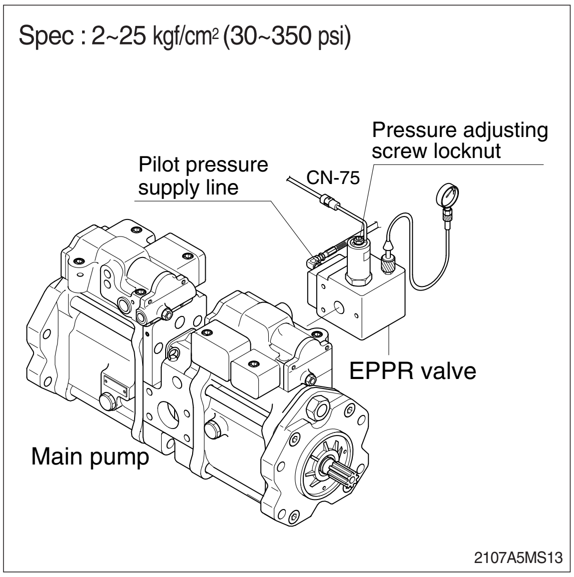
Set ③ S-mode and cancel auto decel mode. Position the multimodal dial at 10.

④ If tachometer show approx 1700±50 rpm

⑤ check pressure at relief position of bucket circuit by operating bucket control lever. If pressure is not correct, adjust it.

⑥ After adjust, test the machine.

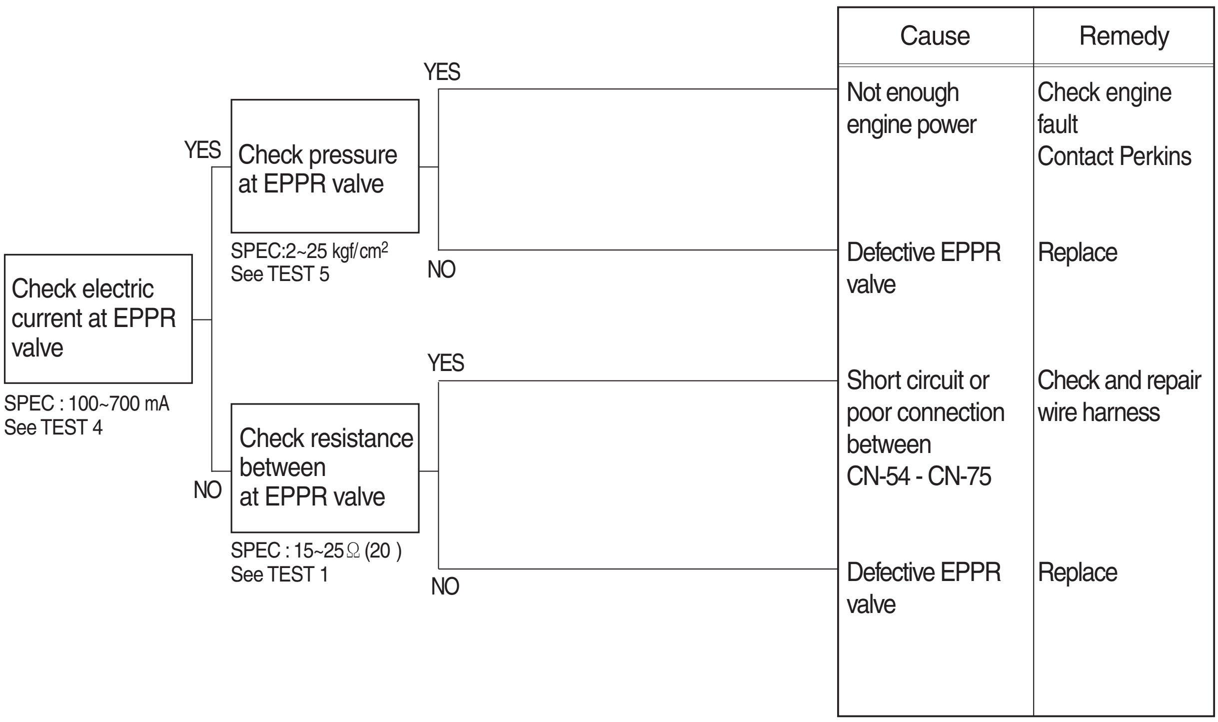
⑦



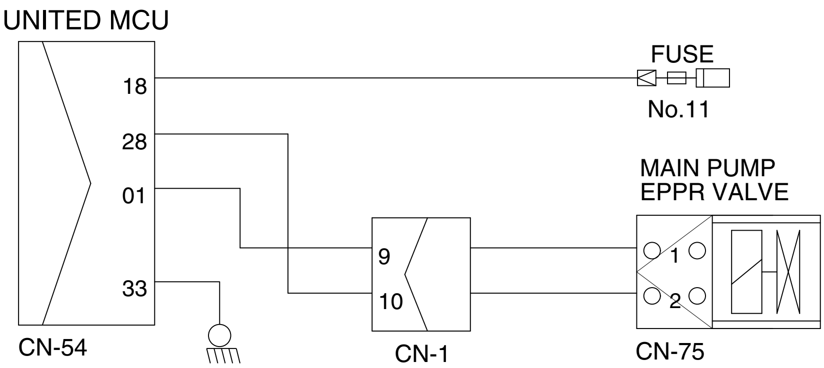
2. ENGINE STALL (SERIAL NO. : #0786-)

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

1) INSPECTION PROCEDURE



Wiring diagram



140L6MS101

(SERIAL NO. : #0786-)

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.

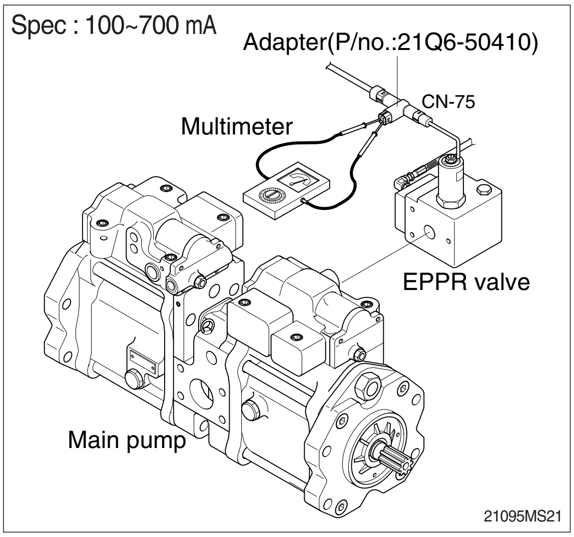
③ Start engine.

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/cm^2 (0 to 725 psi)

② Start engine.

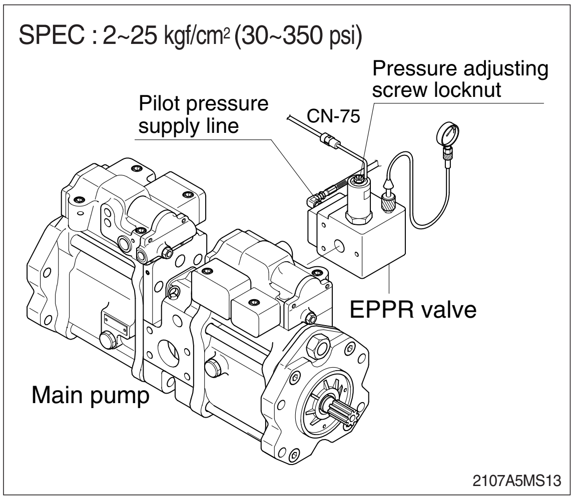
③ Set S-mode and cancel auto decel mode.

④ Position the multimodal dial at 10.

⑤ If rpm show approx 1700±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

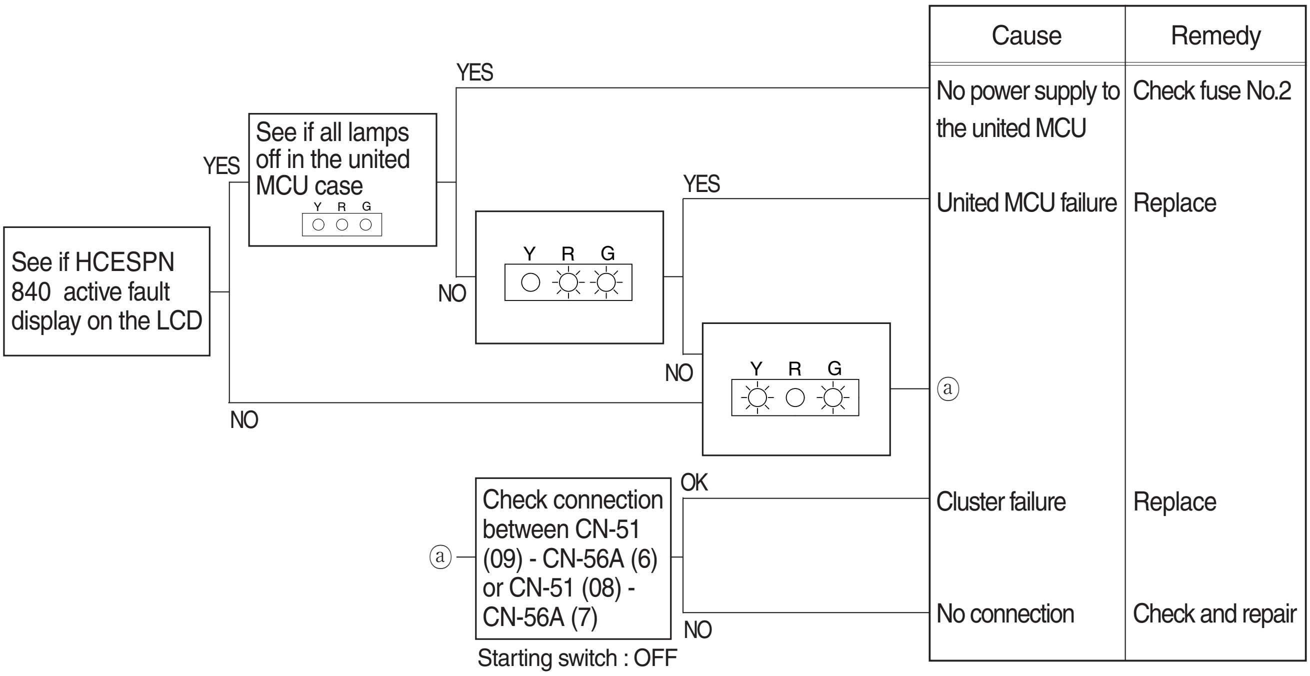
⑦ After adjust, test the machine.



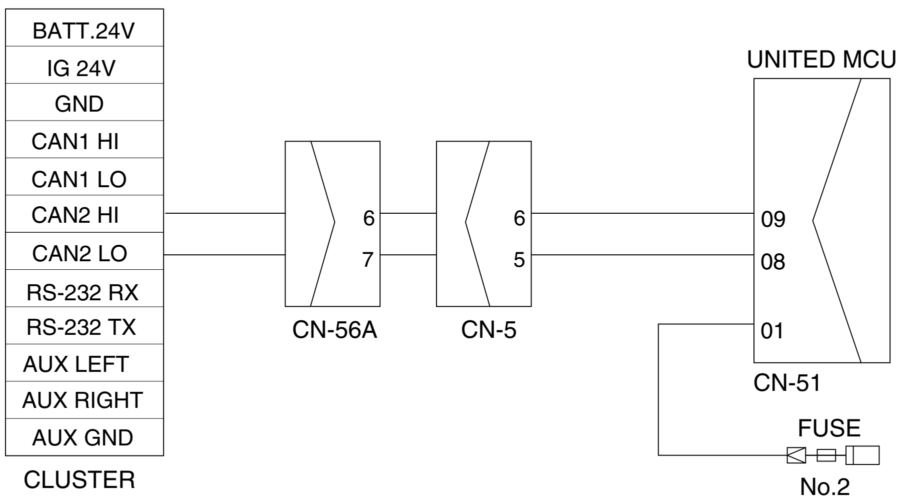
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM (SERIAL NO. : #0786-)

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

1) INSPECTION PROCEDURE



Wiring diagram



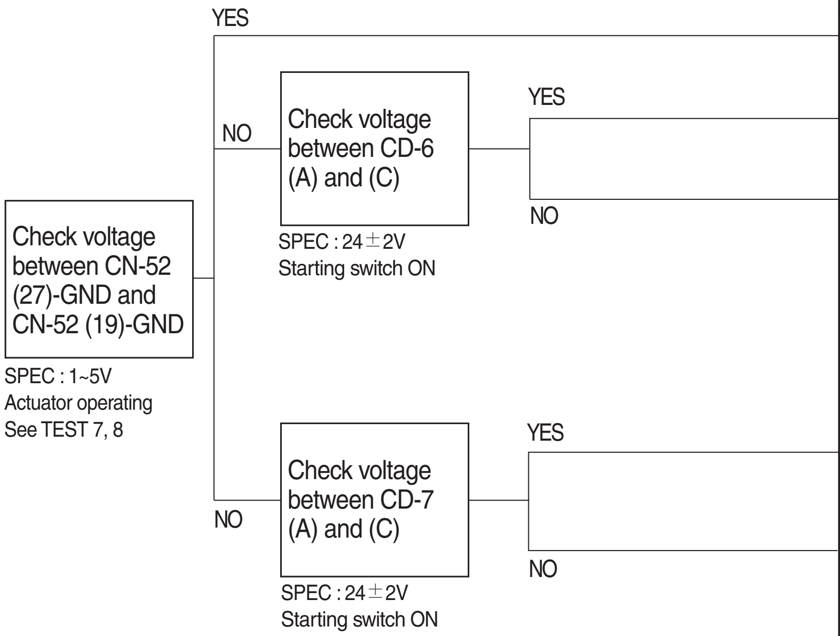
140L6MS102

4. AUTO DECEL SYSTEM DOES NOT WORK (SERIAL NO. : #0786-)

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

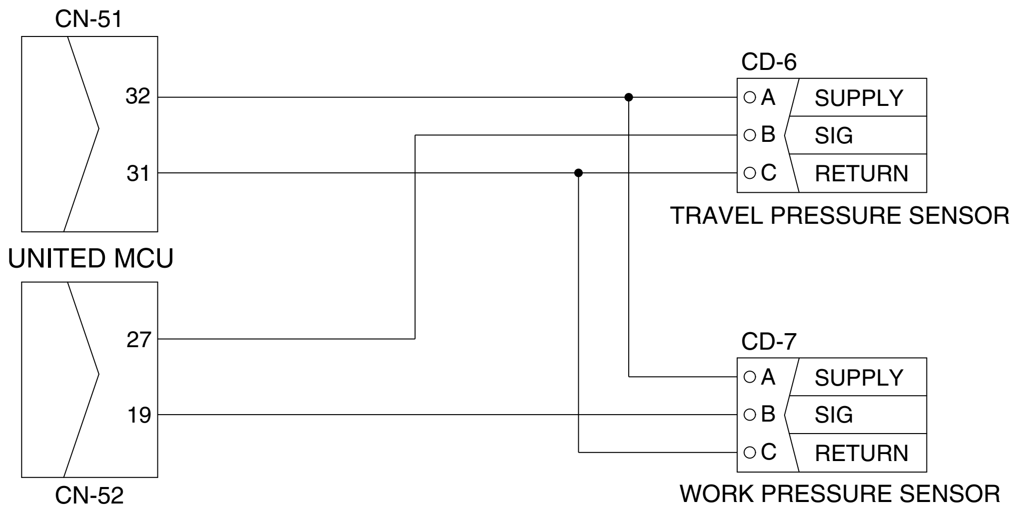
※ Before carrying out below procedure, check all the related connectors are properly inserted.

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



140L6MS103

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

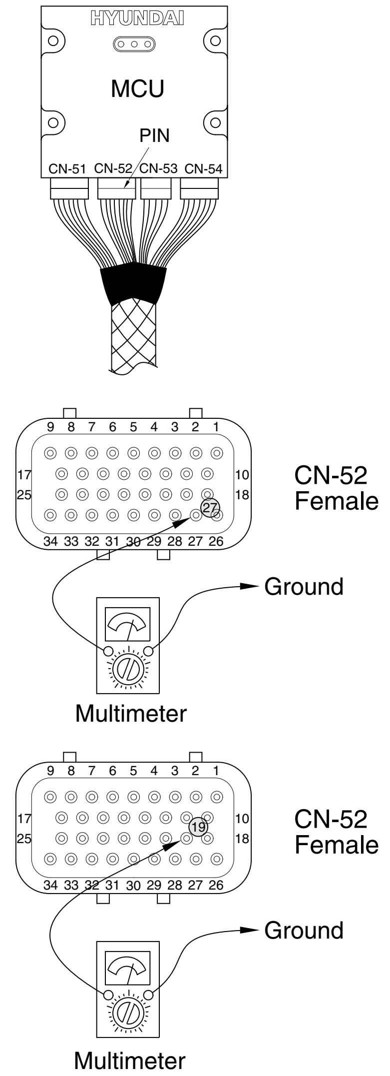
(1) Test 7 : Check voltage at CN-52 (27) and ground.

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



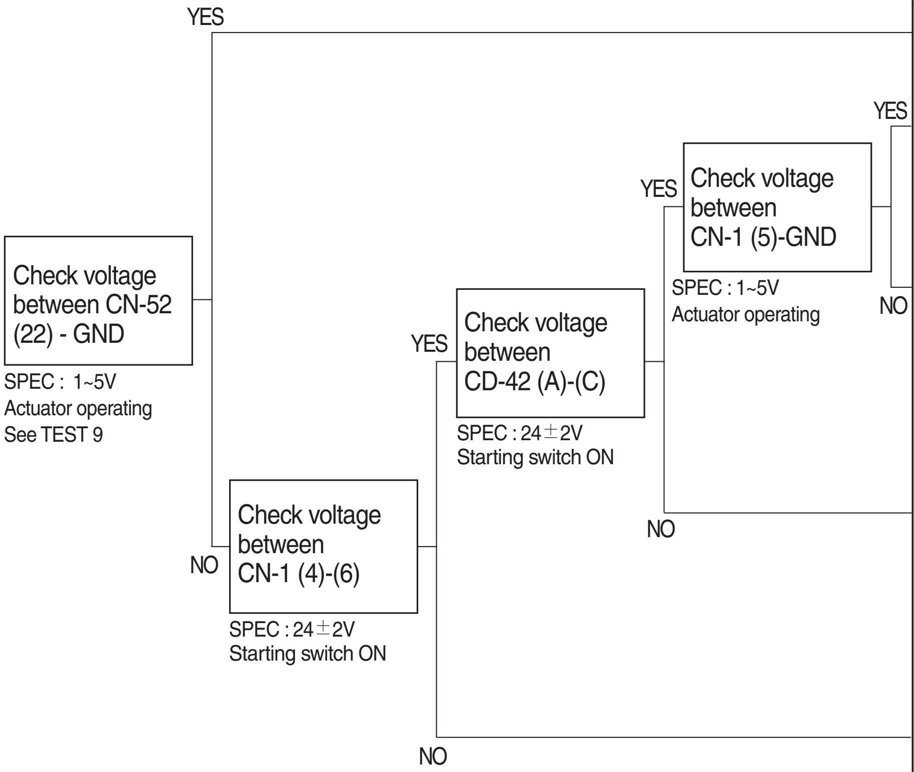
140L6MS104

5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 120, FMI 0~4

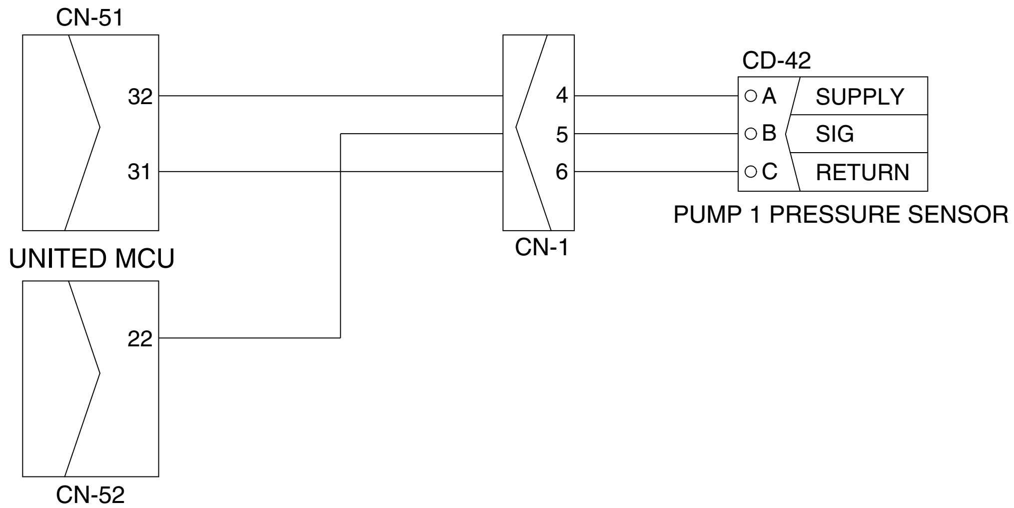
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Short circuit or poor connection between CN-52-(22)-CN-1 (5)	Replace or repair
Detective P1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1 (5)-CD-42 (B)	Replace or repair
Short circuit or poor connection between CD-42 (A)-CN-1 (4) or CD-42 (C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1 (4)-CN-51 (32) or CN-1 (6) - CN-51 (31)	Replace or repair

Wiring diagram



140L6MS105

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (22) and ground.

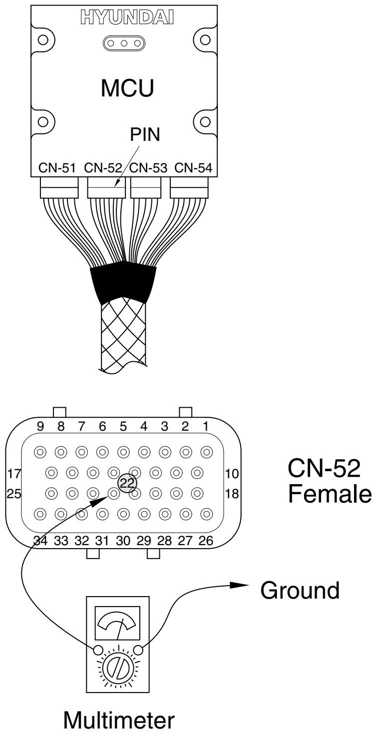
① Prepare 1 piece of thin sharp pin, steel or copper.

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



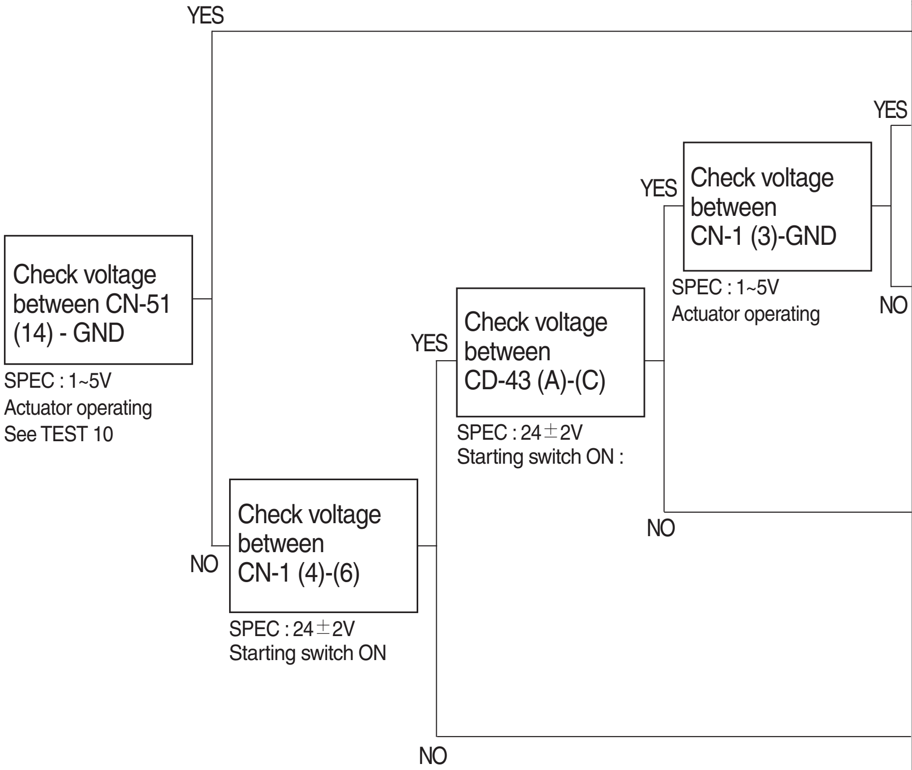
140L6MS106

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 121, FMI 0~4

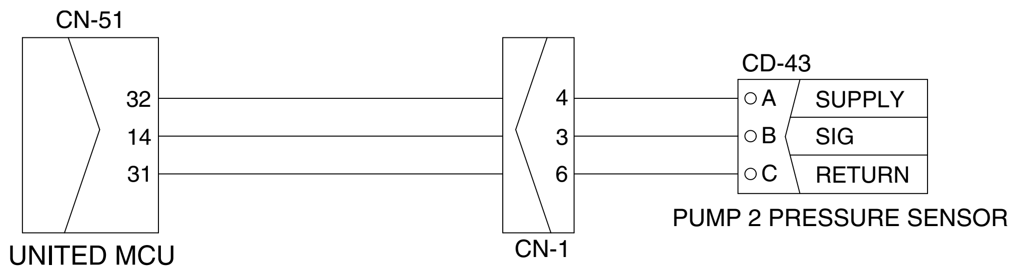
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Short circuit or poor connection between CN-51-(14)-CN-1 (3)	Replace or repair
Detective P2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1 (3)-CD-43 (B)	Replace or repair
Short circuit or poor connection between CD-43 (A)-CN-1 (4) or CD-43 (C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1 (4)-CN-51 (32) or CN-1 (6) - CN-51(31)	Replace or repair

Wiring diagram



140L6MS107

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-51 (14) and ground.

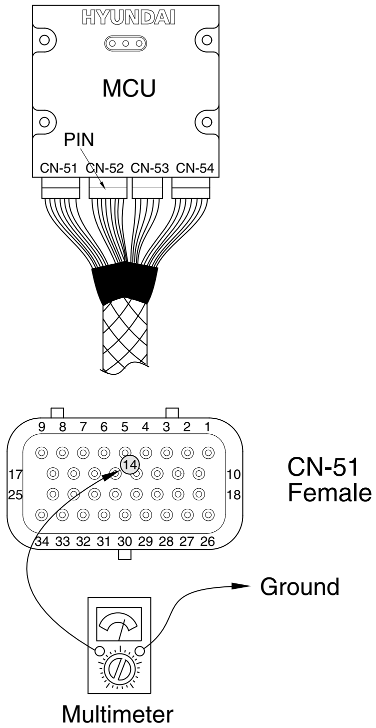
① Prepare 1 piece of thin sharp pin, steel or copper.

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

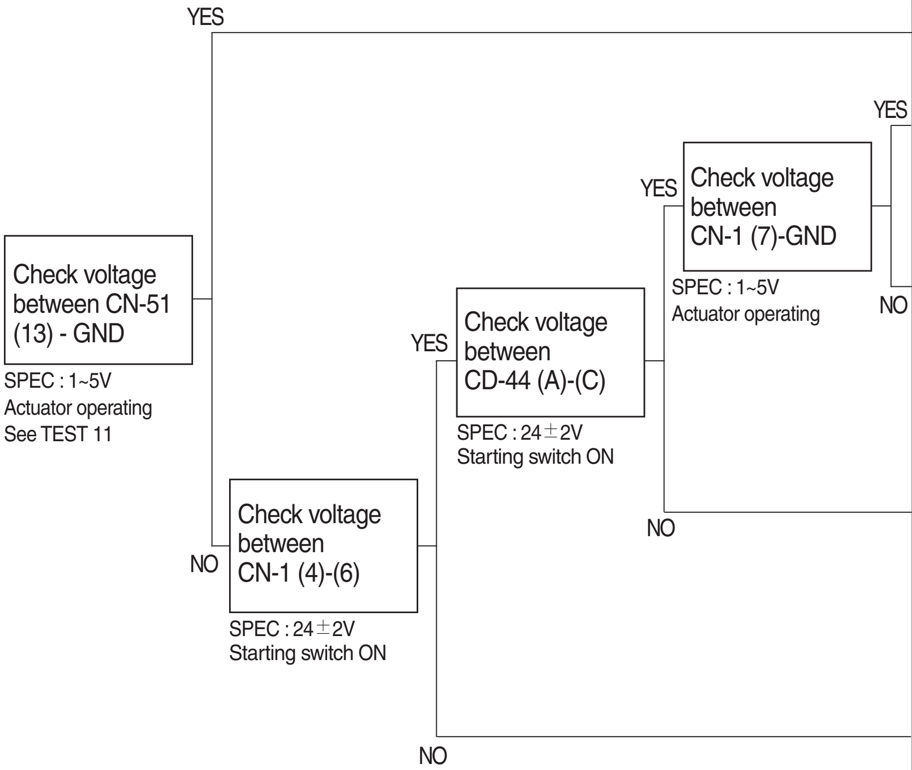


140L6MS108

7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR (SERIAL NO. : #0786-)

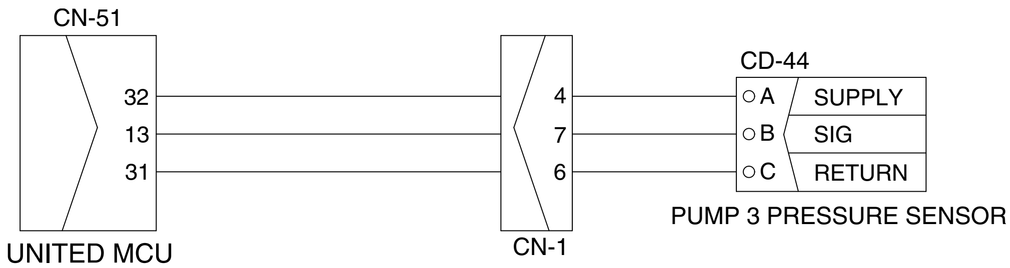
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Short circuit or poor connection between CN-51-(13)-CN-1 (7)	Replace or repair
Detective P3 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1 (7)-CD-44 (B)	Replace or repair
Short circuit or poor connection between CD-44 (A)-CN-1 (4) or CD-44 (C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1 (4)-CN-51 (32) or CN-1 (6) - CN-51 (31)	Replace or repair

Wiring diagram



140L6MS109

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 11 : Check voltage at CN-51 (13) and ground.

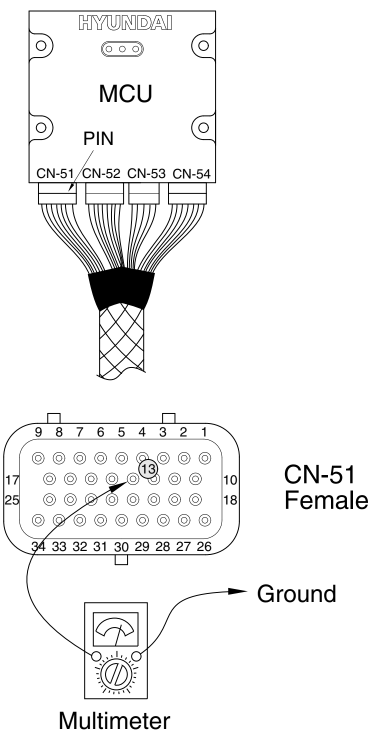
① Prepare 1 piece of thin sharp pin, steel or copper.

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



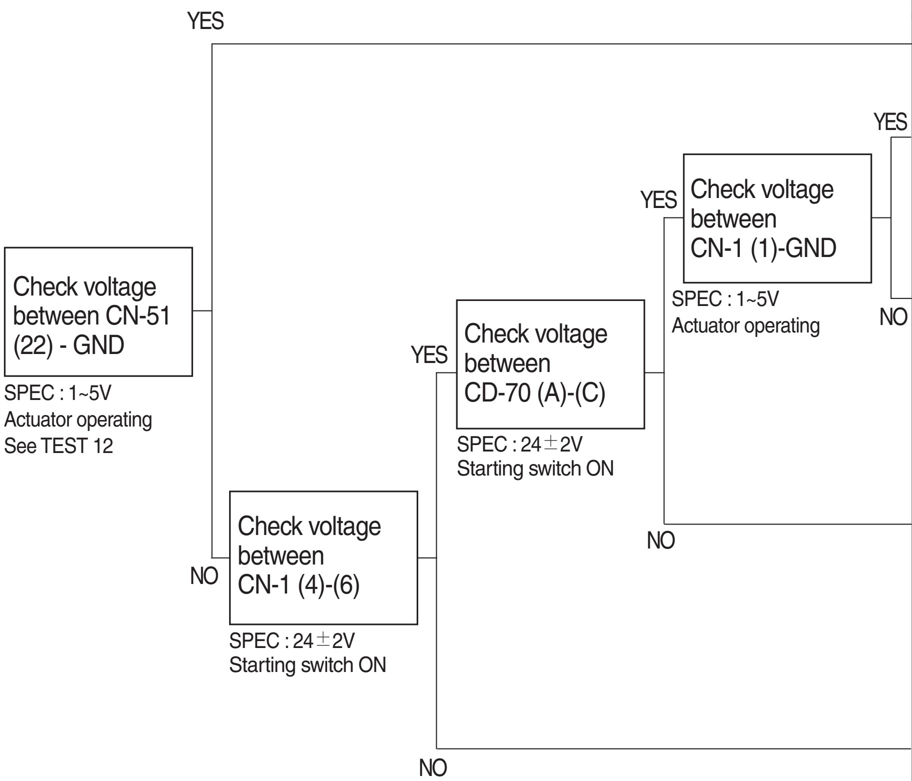
140L6MS110

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 123, FMI 0~4

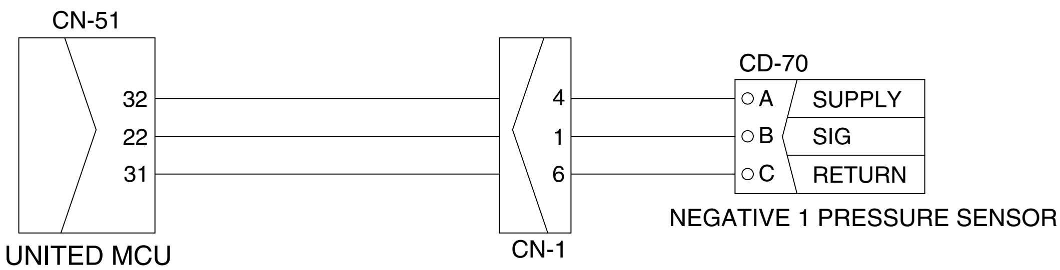
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Short circuit or poor connection between CN-51-(22)-CN-1 (1)	Replace or repair
Detective N1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1 (1)-CD-70 (B)	Replace or repair
Short circuit or poor connection between CD-70 (A)-CN-1 (4) or CD-70 (C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1 (4)-CN-51 (32) or CN-1 (6) - CN-51 (31)	Replace or repair

Wiring diagram



140L6MS111

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-51 (22) and ground.

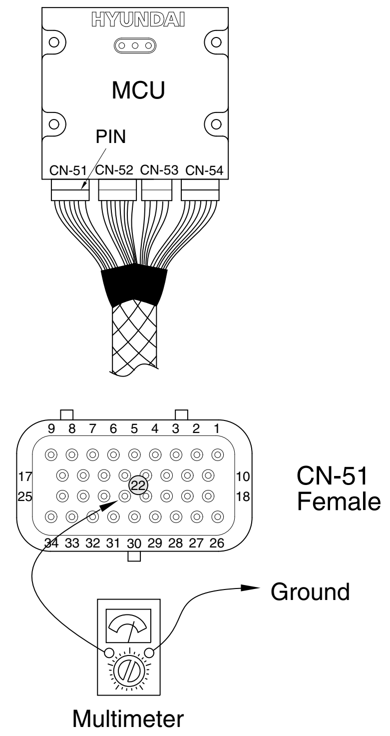
① Prepare 1 piece of thin sharp pin, steel or copper.

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



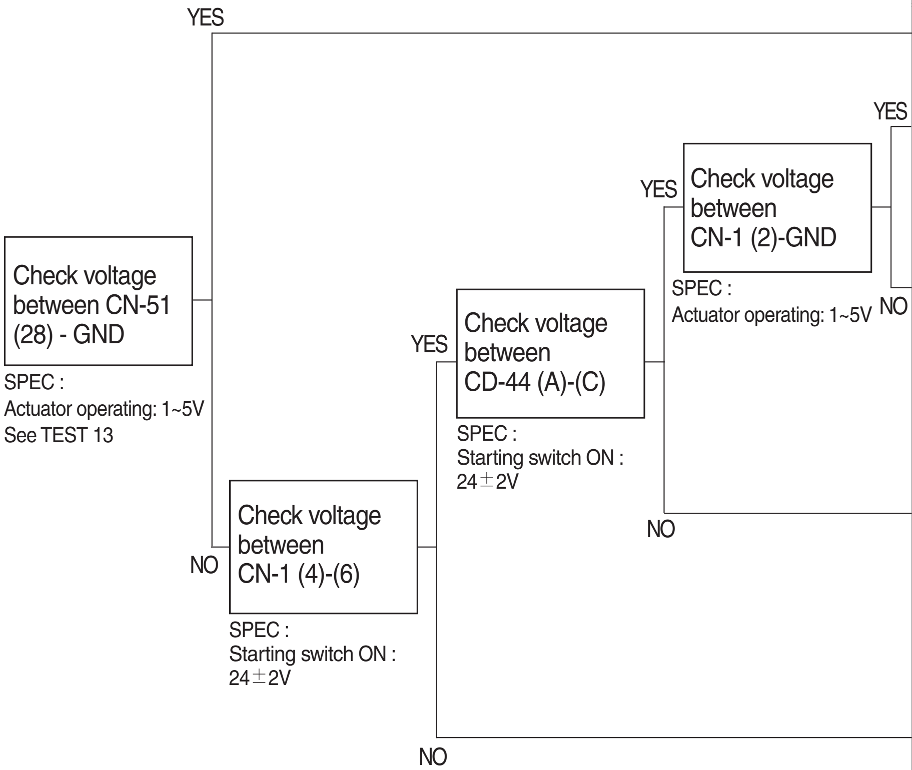
140L6MS112

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 124, FMI 0~4

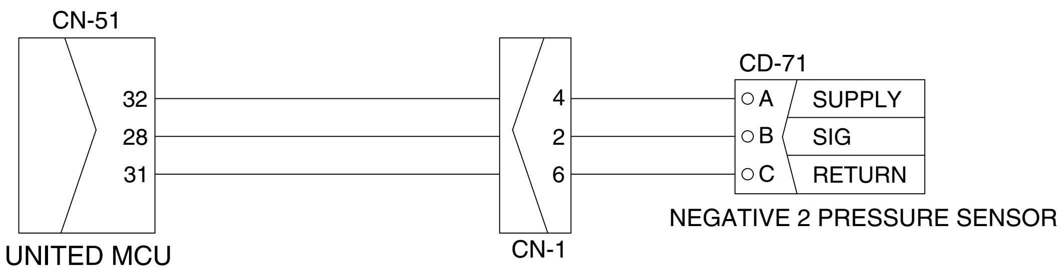
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Short circuit or poor connection between CN-51-(28)-CN-1(2)	Replace or repair
Detective N2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-1 (2)-CD-71 (B)	Replace or repair
Short circuit or poor connection between CD-71 (A)-CN-1 (4) or CD-71 (C)-CN-1 (6)	Replace or repair
Short circuit or poor connection between CN-1 (4)-CN-51 (32) or CN-1 (6) - CN-51 (31)	Replace or repair

Wiring diagram



140L6MS113

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-51 (28) and ground.

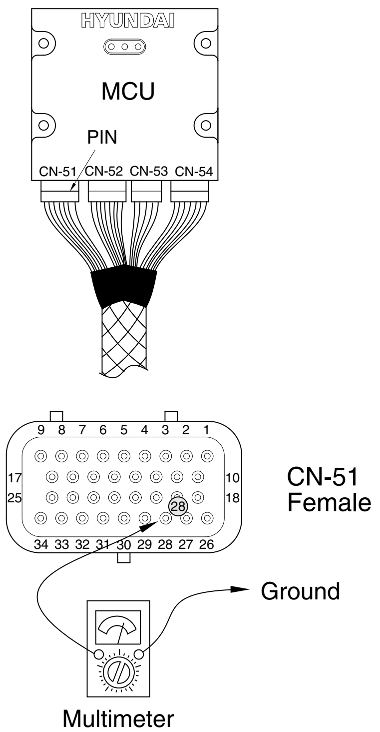
① Prepare 1 piece of thin sharp pin, steel or copper.

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



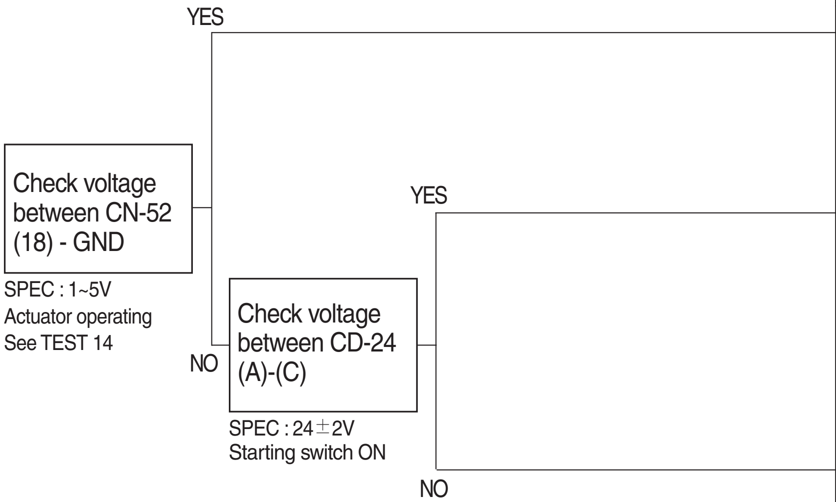
140L6MS114

10. MALFUNCTION OF SWING PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 135, FMI 0~4

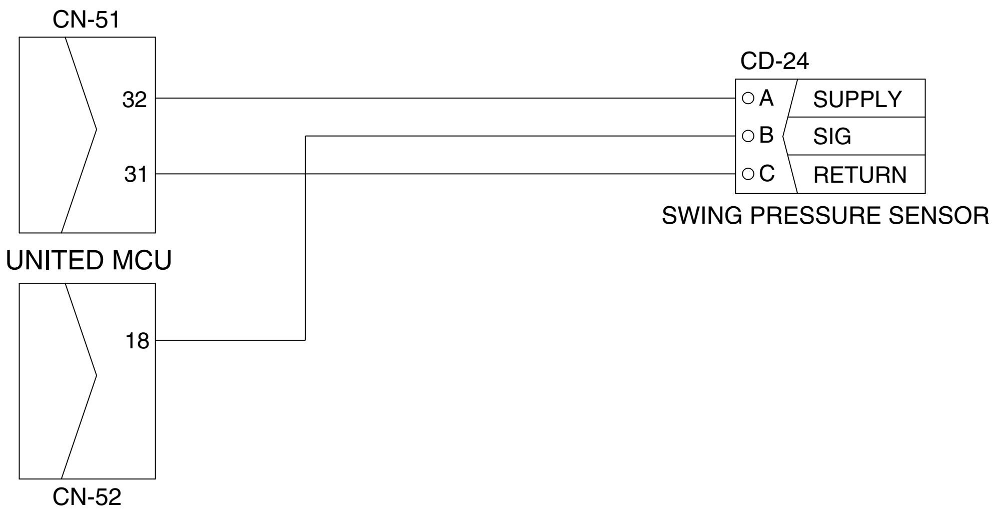
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective swing pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (18)-CD-24 (B)	Replace or repair
Short circuit or poor connection between CD-24 (A)-CN-51 (32) or CD-24 (C)- CN-51 (31)	Replace or repair

Wiring diagram



140L6MS115

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (18) and ground.

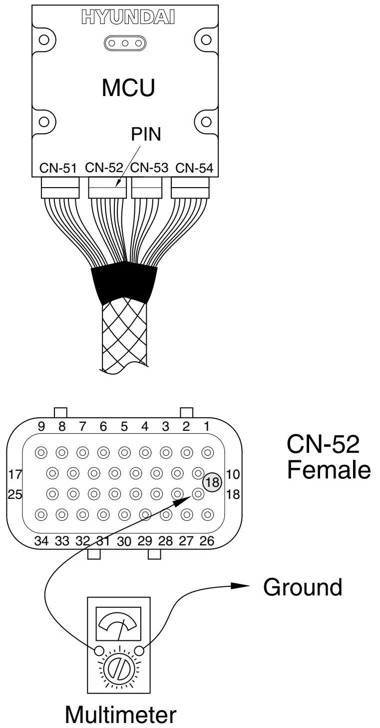
① Prepare 1 piece of thin sharp pin, steel or copper.

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



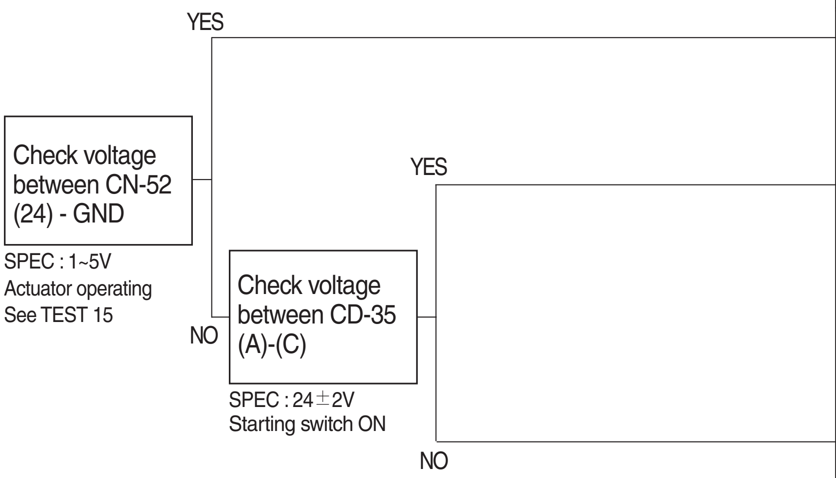
140L6MS116

11. MALFUNCTION OF ARM IN/OUT & BUCKET IN PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 133, FMI 0~4

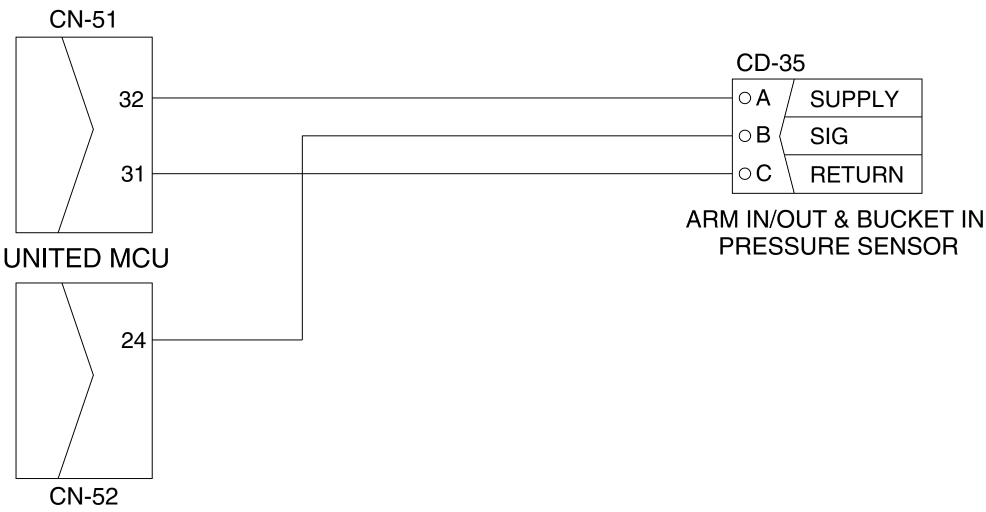
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective arm in/out & bucket in pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (24)-CD-35 (B)	Replace or repair
Short circuit or poor connection between CD-35 (A)-CN-51 (32) or CD-35 (C)- CN-51 (31)	Replace or repair

Wiring diagram



140L6MS117

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-52 (24) and ground.

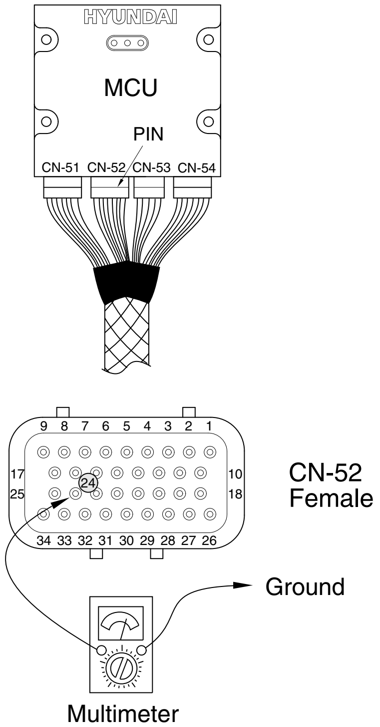
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (24) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



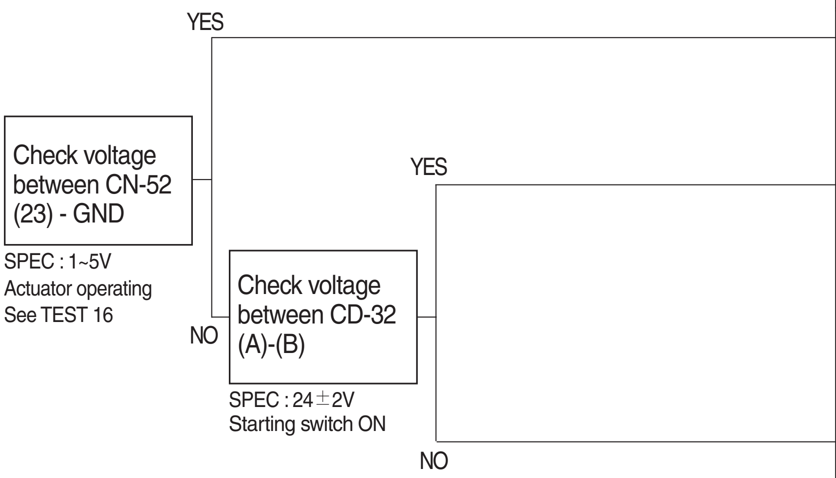
140L6MS118

12. MALFUNCTION OF BOOM UP PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 127, FMI 0~4

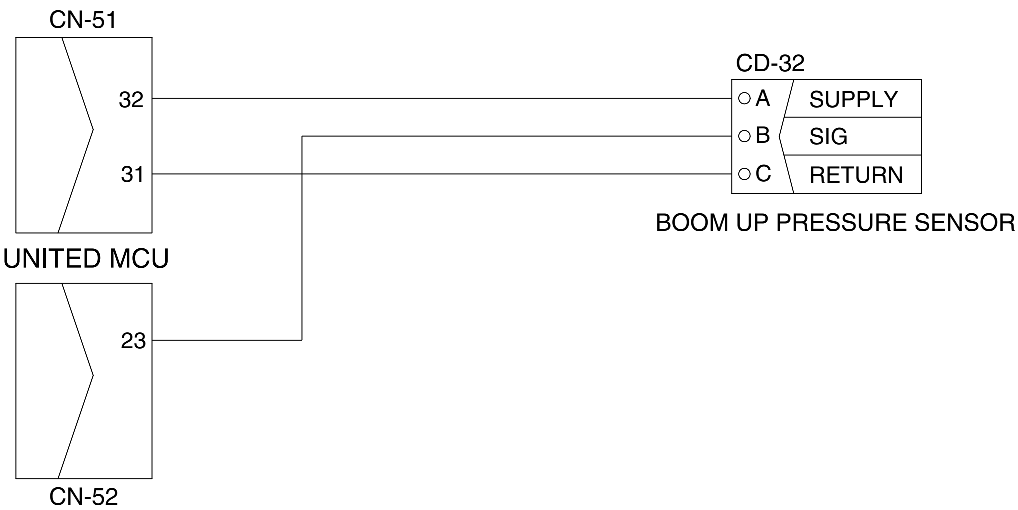
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (23)-CD-32 (B)	Replace or repair
Short circuit or poor connection between CD-32 (A)-CN-51 (32) or CD-32 (C)- CN-51 (31)	Replace or repair

Wiring diagram



140L6MS119

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 16 : Check voltage at CN-52 (23) and ground.

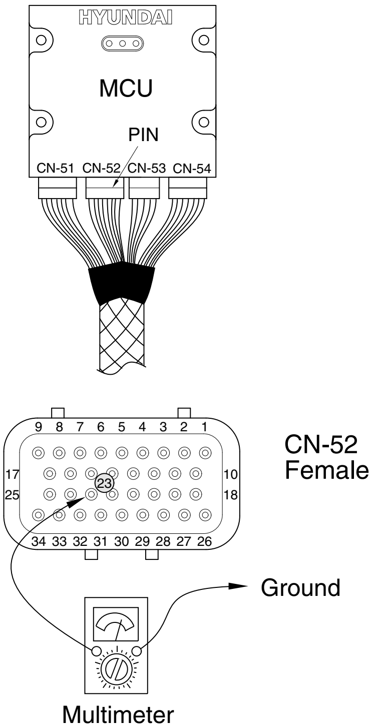
① Prepare 1 piece of thin sharp pin, steel or copper.

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



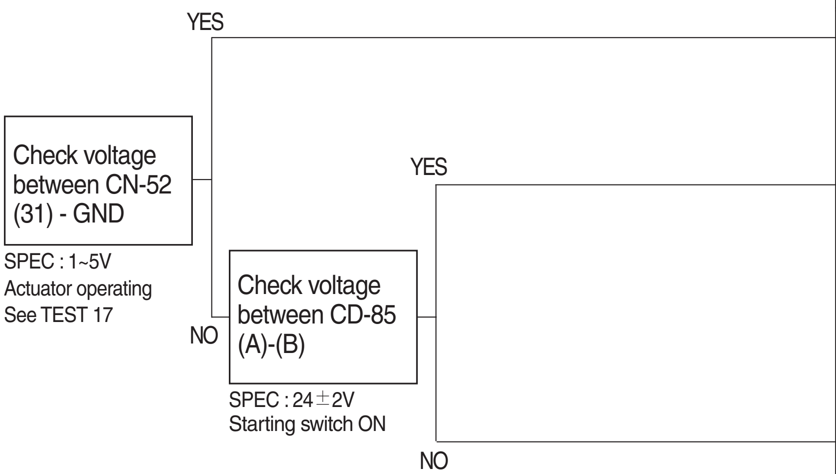
140L6MS120

13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR (SERIAL NO. : #0786-)

· Fault code : HCESPN 128, FMI 0~4

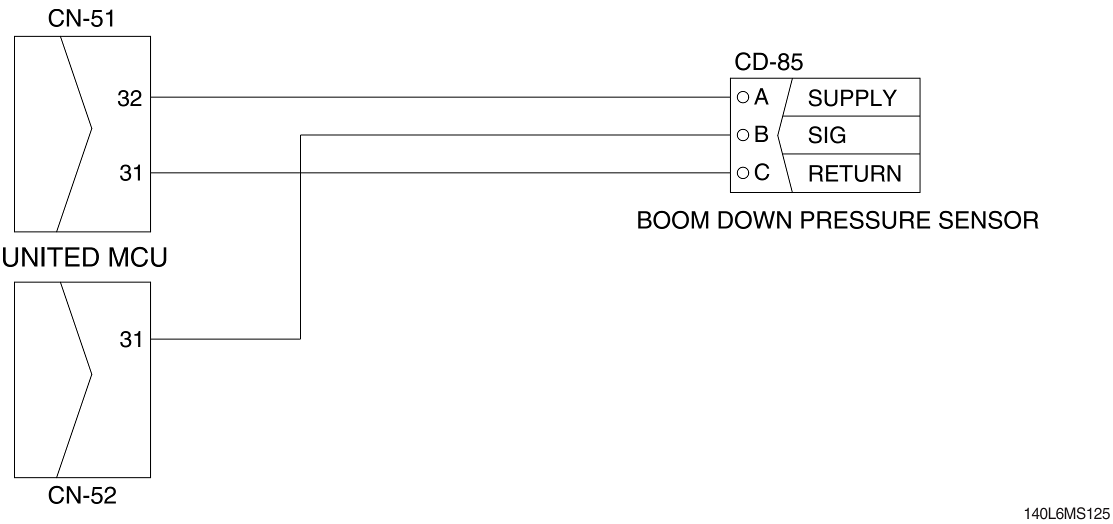
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (31)-CD-85 (B)	Replace or repair
Short circuit or poor connection between CD-85 (A)-CN-51 (32) or CD-85(C) - CN-51 (31)	Replace or repair

Wiring diagram



(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-52 (31) and ground.

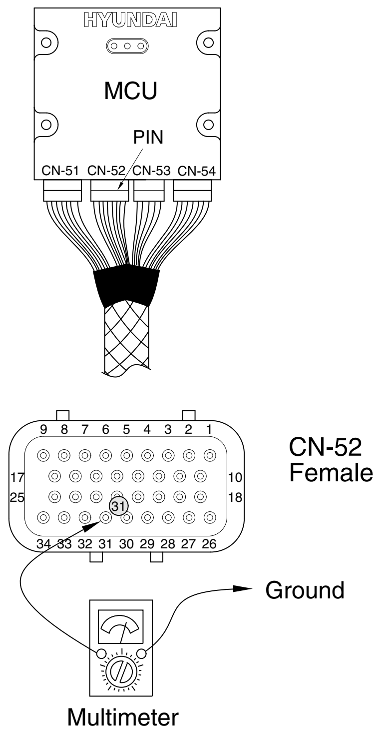
① Prepare 1 piece of thin sharp pin, steel or copper.

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



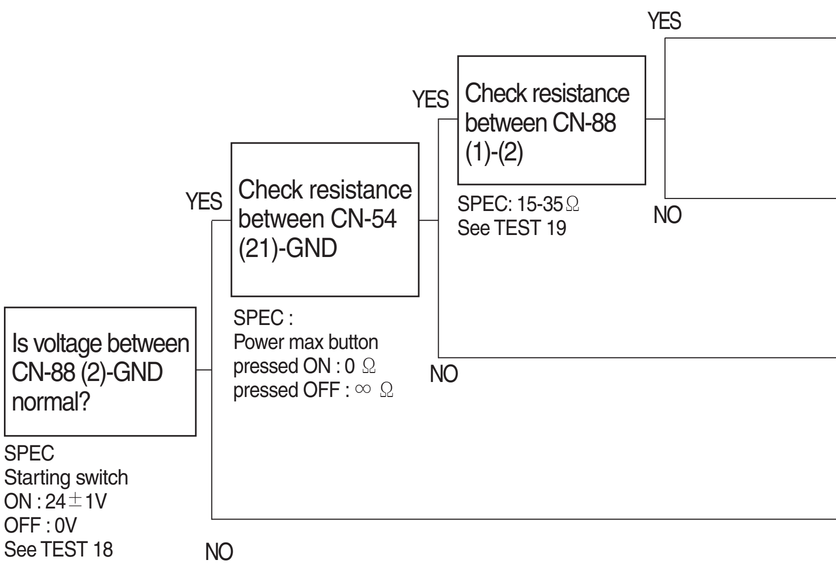
140L6MS126

14. MALFUNCTION OF POWER MAX (SERIAL NO. : #0786-)

· Fault code : HCESPN 166, FMI 4 or 6

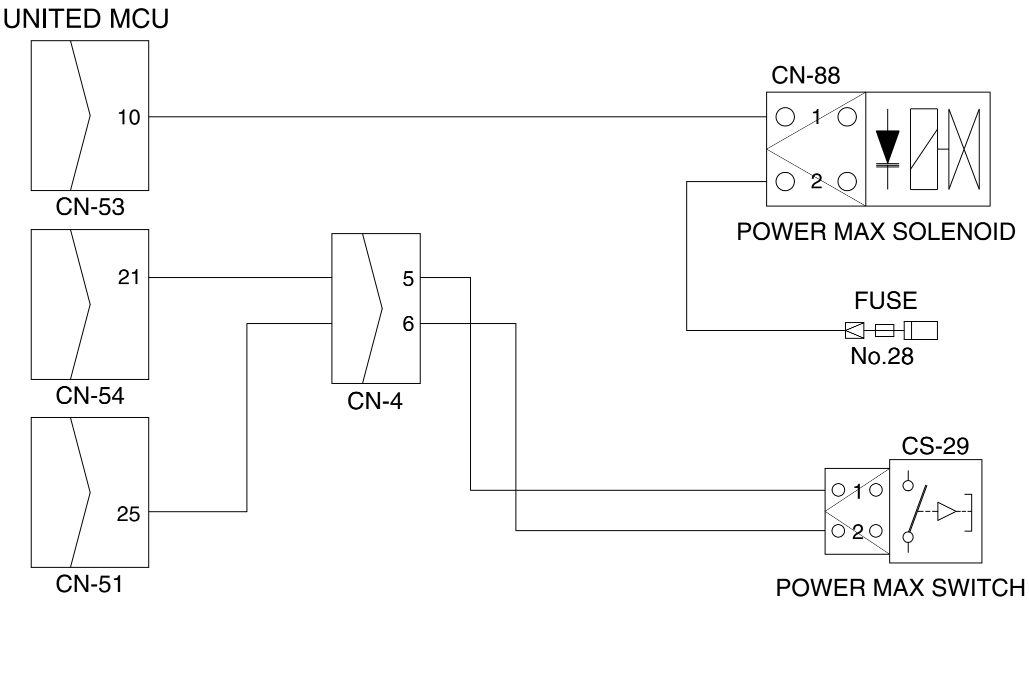
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Short circuit or poor connection between CN-88 (1)-CN-53 (10)	Repair or replace
Defective power max. solenoid valve Check hydraulic system	Repair or replace
Short circuit or poor connection between CN-54 (21)-CS-29 (1)	Repair or replace
Short circuit or poor connection between CN-88 (2)- Fuse No. 28	Repair or replace

Wiring diagram



(SERIAL NO. : #0786-)

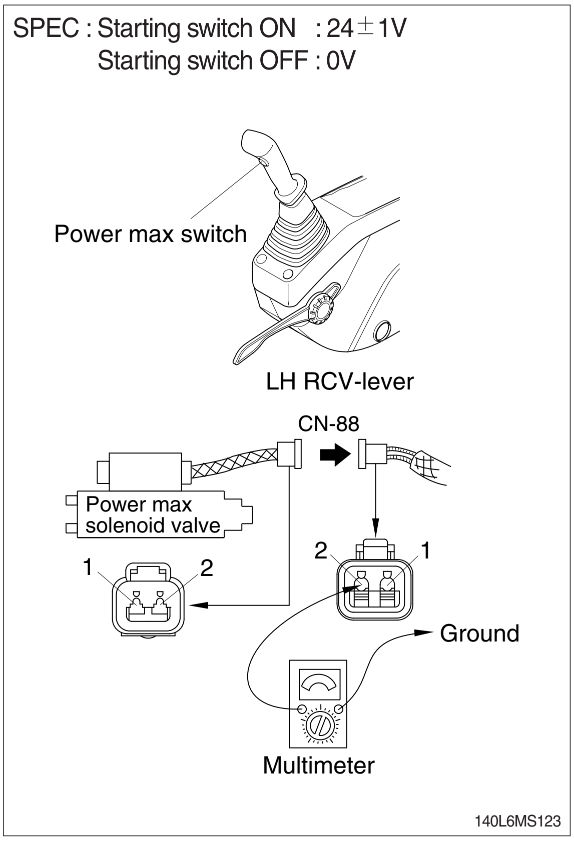
2) TEST PROCEDURE

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

① Disconnect connector CN-88 from power max solenoid valve.

② Start switch ON.

③ Check voltage as figure.

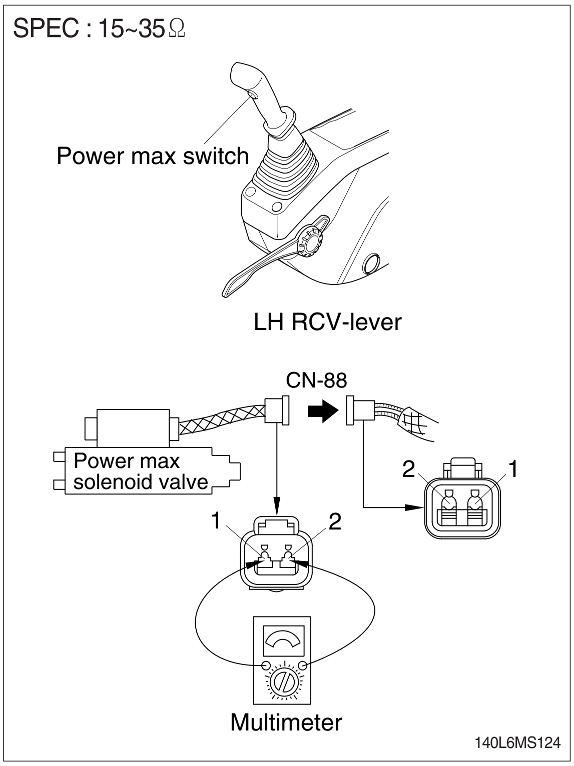


(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting switch OFF.

② Disconnect connector CN-88 from power max solenoid valve.

③ Check resistance as figure.

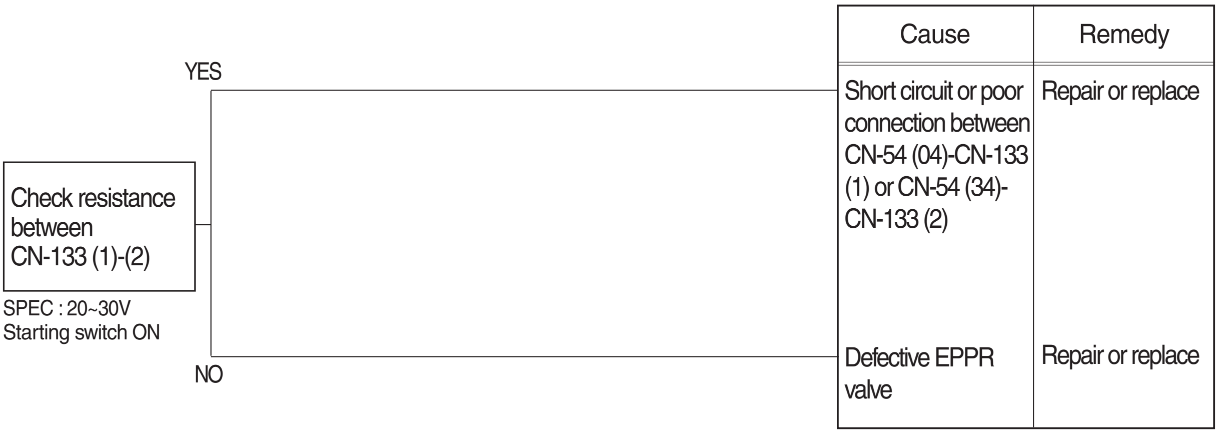


15. MALFUNCTION OF BOOM PRIORITY EPPR VALVE (SERIAL NO. : #0786-)

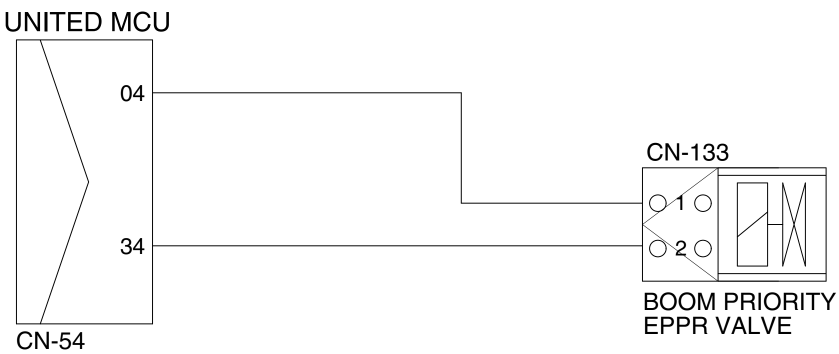
· Fault code : HCESPN 141, FMI 5 or 6

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

1) INSPECTION PROCEDURE



Wiring diagram



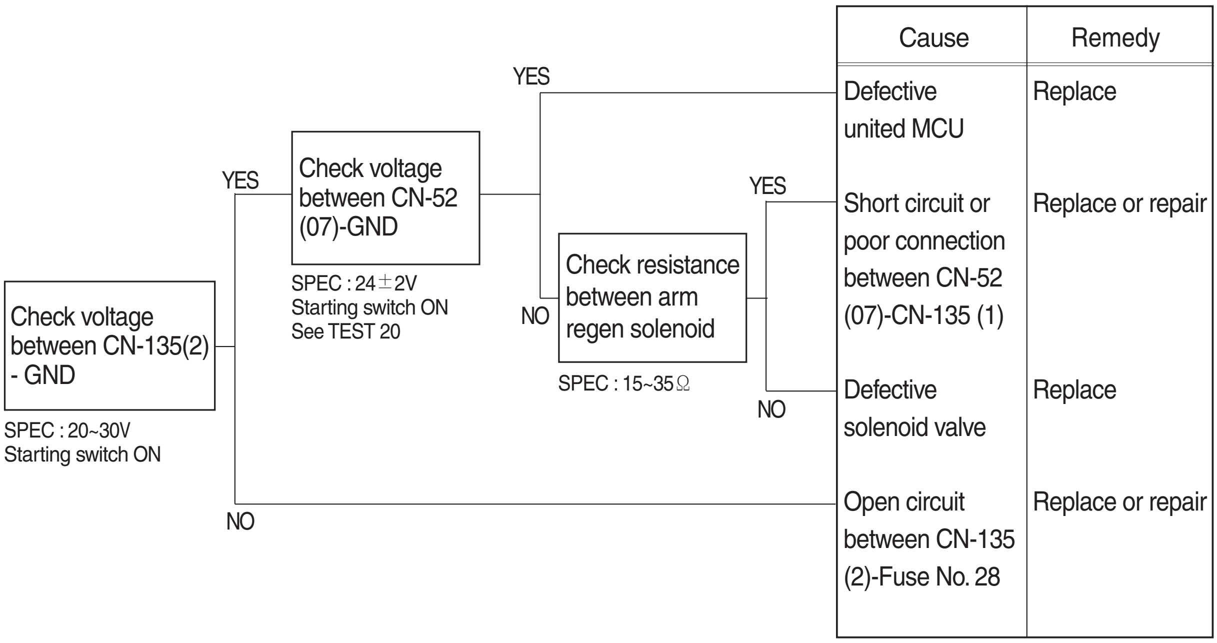
140L6MS122

16. MALFUNCTION OF ARM REGENERATION SOLENOID (SERIAL NO. : #0786-)

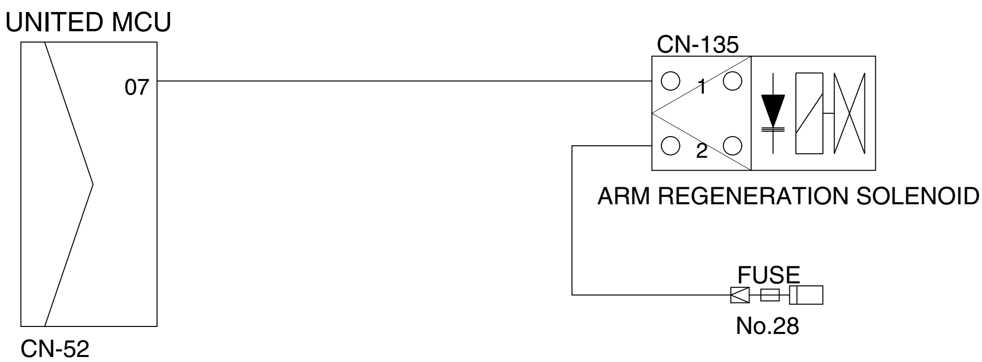
· Fault code : HCESPN 170, FMI 4 or 6

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

1) INSPECTION PROCEDURE



Wiring diagram



140L6MS127

(SERIAL NO. : #0786-)

2) TEST PROCEDURE

(1) Test 20 : Check voltage at CN-52 (07) and ground.

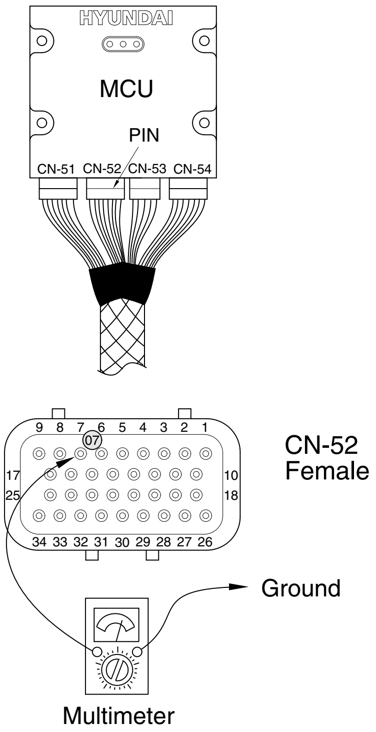
① Prepare 1 piece of thin sharp pin, steel or copper.

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

SECTION 7 MAINTENANCE STANDARD

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check :

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets HD Hyundai Construction Equipment spec.

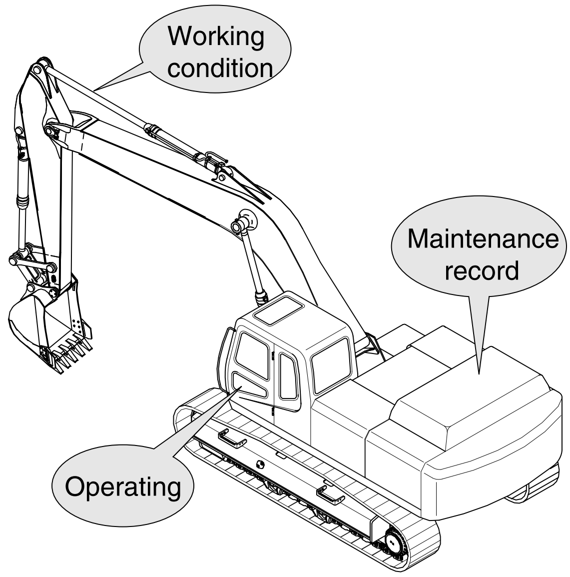
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done(by referring to the "Service Limits" in this manual).

3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.

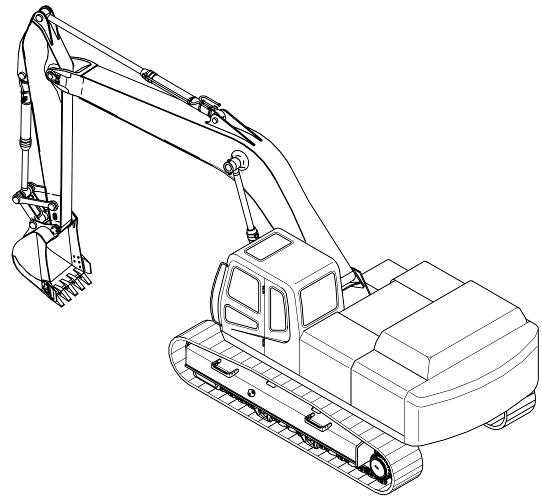


21077MS01

2. TERMINOLOGY

1) STANDARD

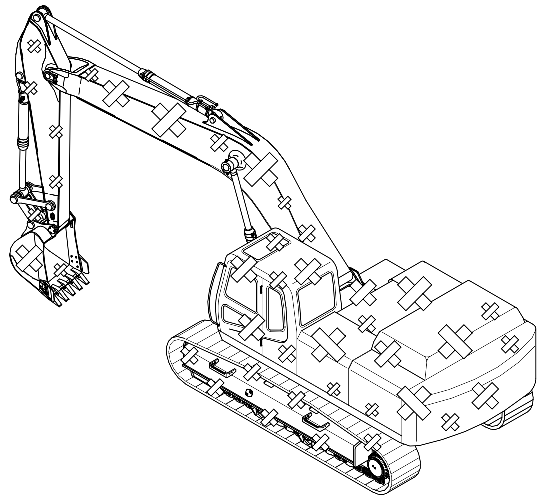
Specifications applied to the brand-new machine, components and parts.



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

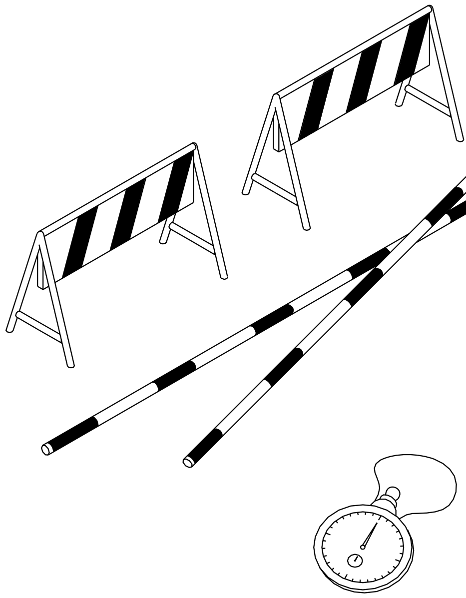
Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(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.



(210-7) 7-3

(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.

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

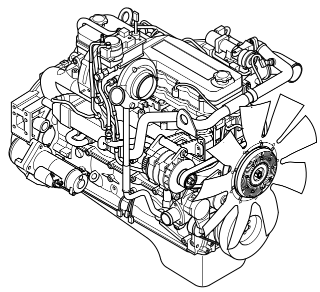
① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.

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.



300L7MS01

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX300 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 ㎧ test track.

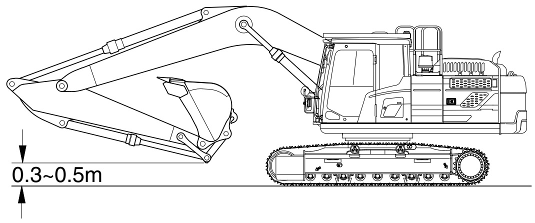
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Prepare a flat and solid test track 20㎧ in length, with extra length of 3 to 5 ㎧ on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 ㎧ 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.

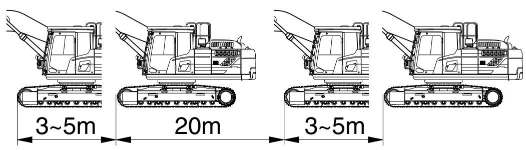
· Power mode switch : P mode

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 ㎧

Model	Travel speed	Standard	Maximum allowable	Remarks
HX300 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.

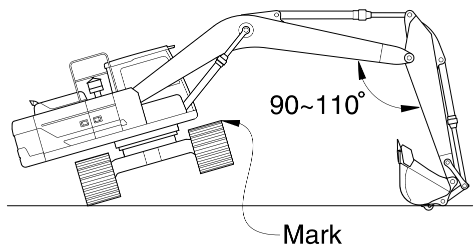
(2) Preparation

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
HX300 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.

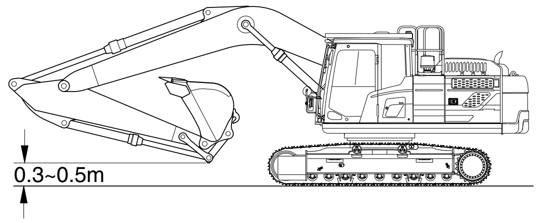
(2) Preparation

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.

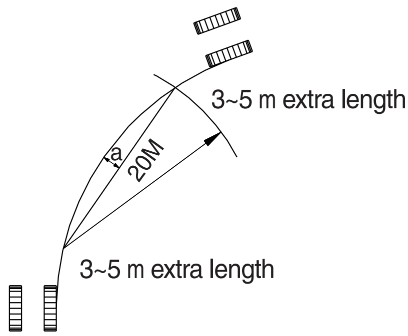
· Power mode switch : P mode

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
HX300 L	200 below	240	-

6) SWING SPEED

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

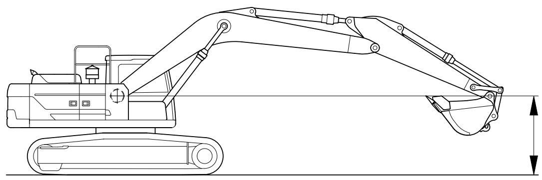
(2) Preparation

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
HX300 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.

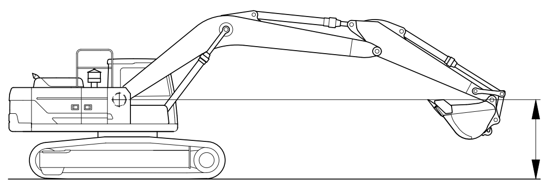
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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.

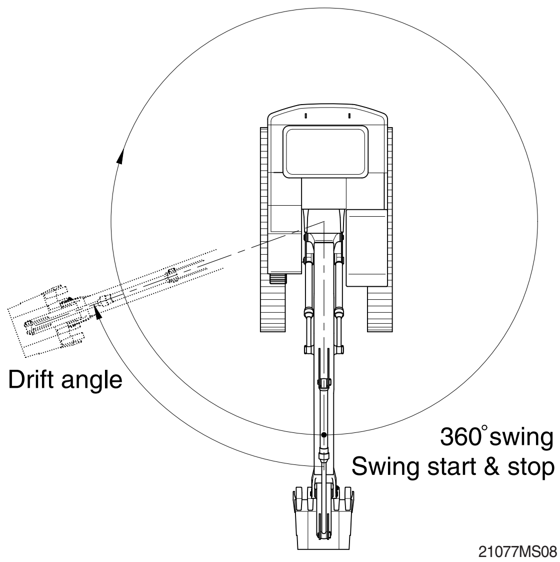
· Power mode switch : P mode

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

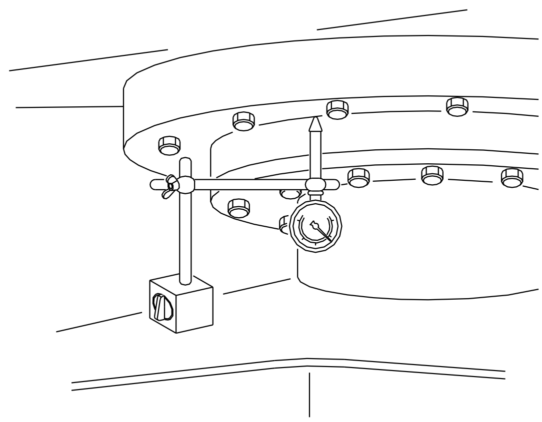
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX300 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.

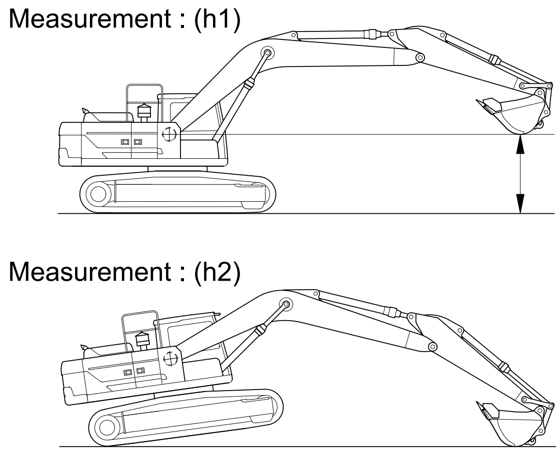
⑥ Bucket should be empty.

(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 cm.
Record the dial gauge reading (h2).

③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1



300L7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX300 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.

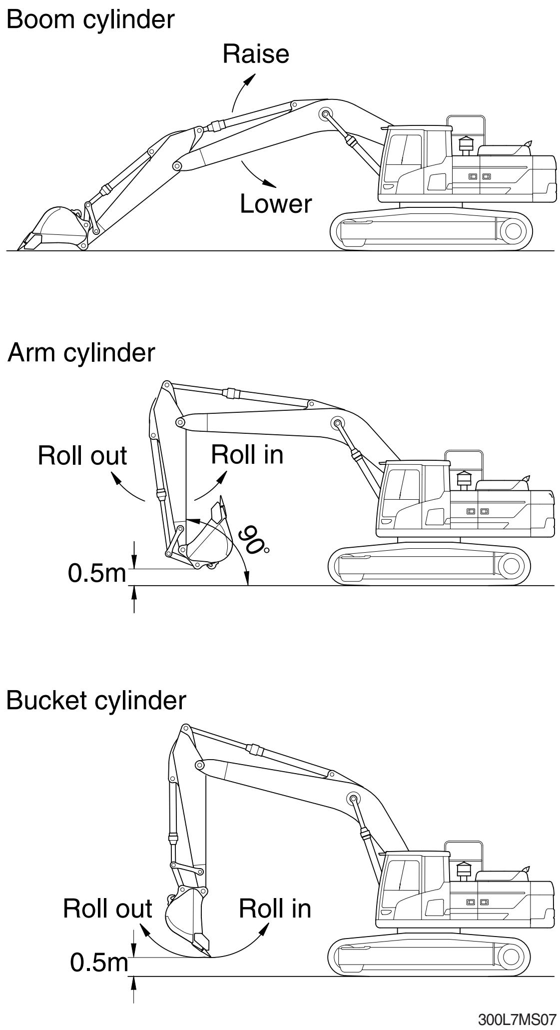
(2) Preparation

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.

- 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
HX300 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	
HX300 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)

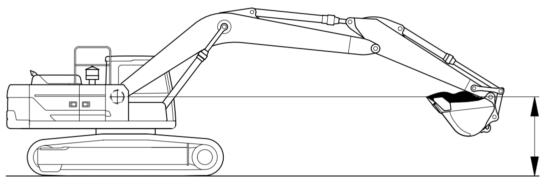
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30 mm extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30 mm retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

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



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
HX300 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
HX300 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
HX300 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.

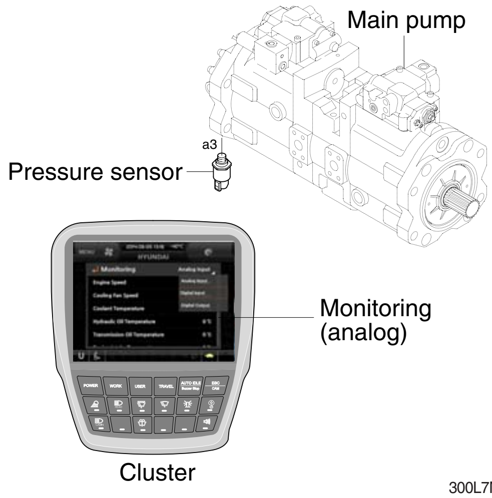
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Auto decel switch : OFF

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



300L7MS09

(3) Evaluation

The average measured pressure should meet the following specifications:

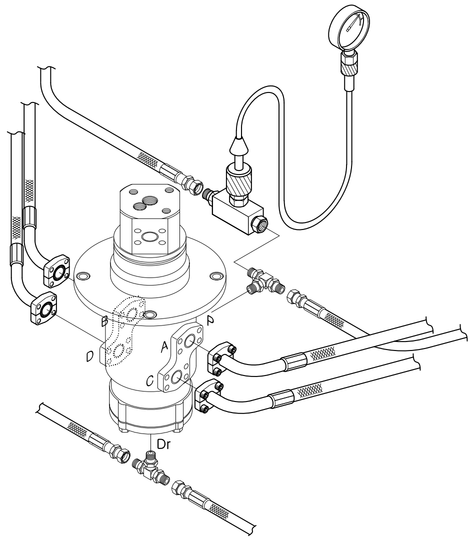
Unit : kgf / cm2

Model	Engine speed	Standard	Allowable limits	Remarks
HX300 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 assembly to turning joint P port as shown.
④ Start the engine and check for on leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



21077MS13

(2) Measurement

① Select the following switch positions.
· 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.

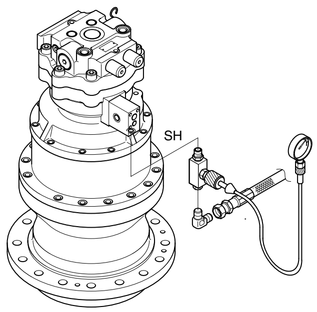
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX300 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 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.



300L7MS10

(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.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Description	Standard	Allowable limits	Remarks
HX300 L	Brake disengaged	40	31~42	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

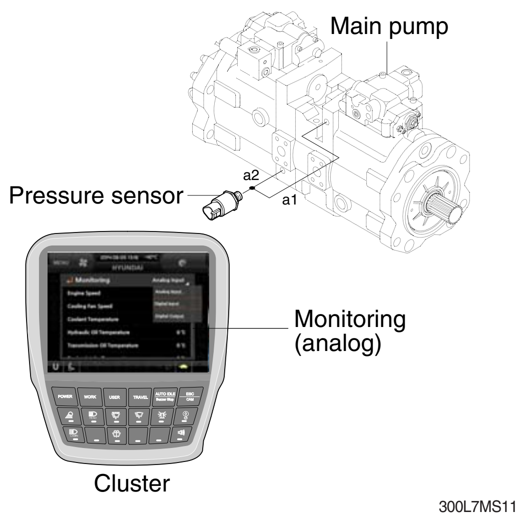
① Keep the hydraulic oil temperature at 50±5˚C.

(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).



(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX300 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

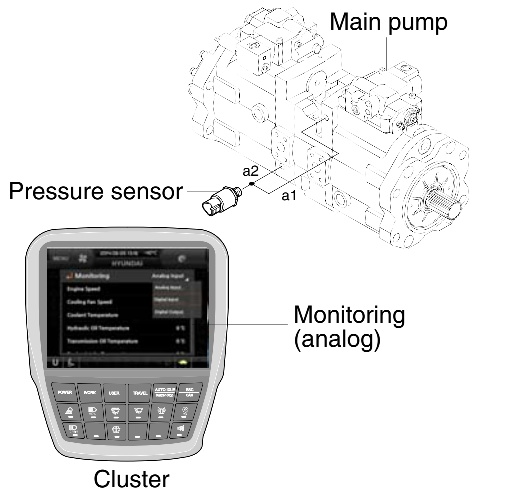
① Select the following switch positions.

· 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.



300L7MS11

(3) Evaluation

The average measured pressure should be within the following specifications.

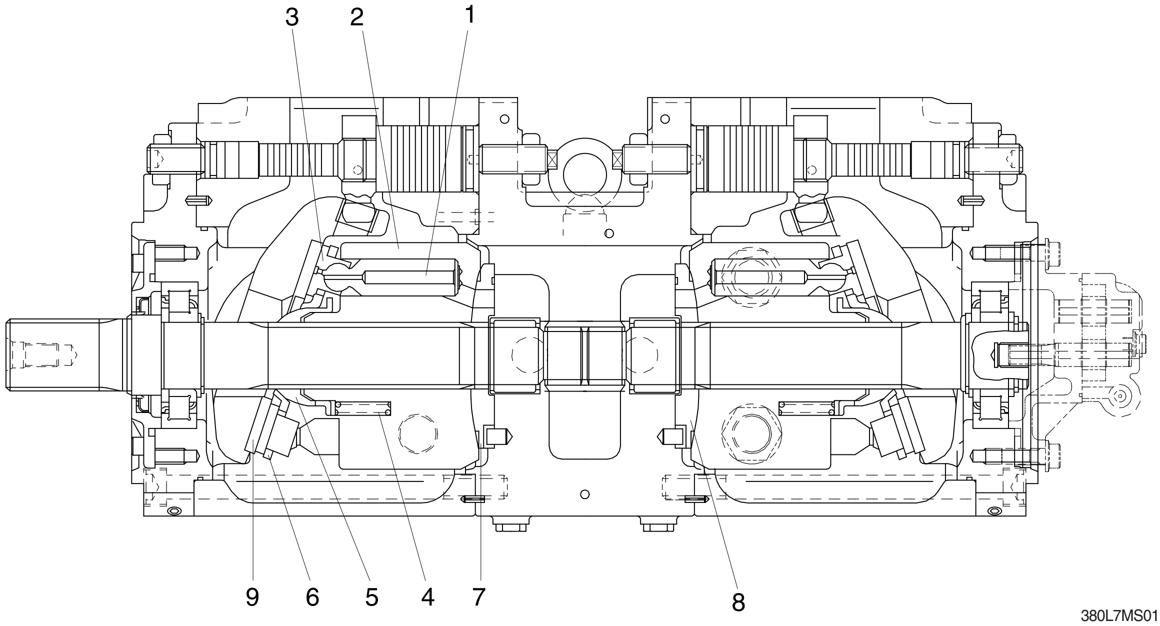
Unit : kgf / cm²

Model	Function to be tested	Standard	Port relief setting
HX300 L	Boom, Arm, Bucket	350 (380)±10	400±10
	Travel	350±10	-
	Swing	300±10	-

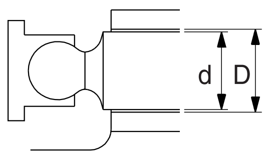
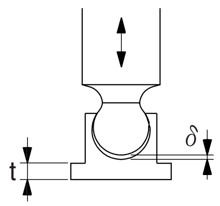
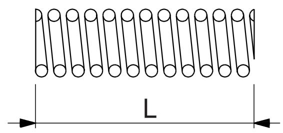
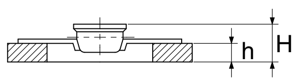
( ) : Power boost

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP



380L7MS01

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		

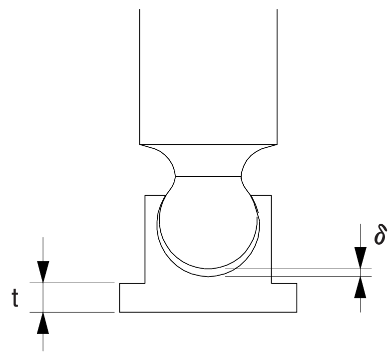
2. MAIN CONTROL VALVE

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. · O-ring seal sections at both ends. · Insert spool into casing hole, rotate and reciprocate it.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of spring · Damage of poppet · Insert poppet into casing and function it.	· Replacement. · Correction or replacement when sealing is incomplete. · 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. · Rusting, corrosion or deformation of seal plate.	· Correction or replacement. · Correction or replacement.
Main relief valve, port relief valve & negative control valve	· External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · O-rings and back up rings.	· Replacement. · Replacement when damaged. · Replacement when damaged. · 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



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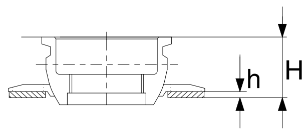


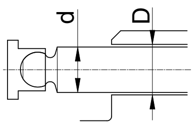
2609A7MS01

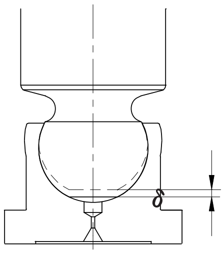
2) SLIDING PARTS

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)	

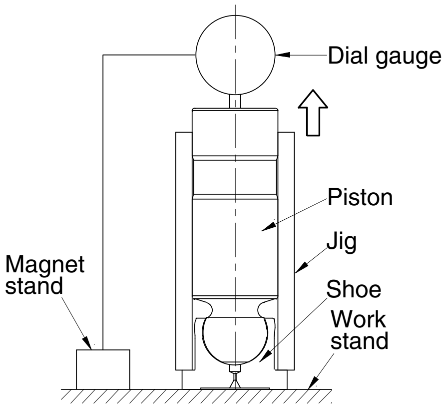
4. TRAVEL MOTOR

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..

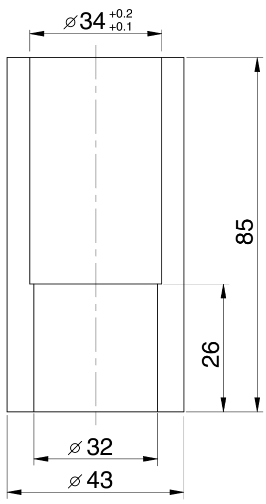
Check item		Measuring method	Criteria	Allowable	Remedy
Sliding surface of cylinder block, valve plate and swash plate	Surface roughness of cylinder block, valve plate and swas plate	Measure the surface roughness by rough-ness tester	Below 0.4 Zμ	Below 3.0 Zμ	Replace or repair ※ Lap together the surfaces 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 tes-ter	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 microme-ter 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 pis-tons 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 pis-ton 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



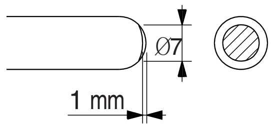
Jig for measuring play

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.

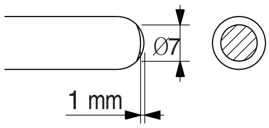
Check item	Measuring method	Judging criteria and remedy
Shaft	Measure the wear at contacting surface of oil seal (3) with the surface roughness tester	If the depth of shaft wear is less than 0.05 mm, the shaft is reusable. ※ In case of replacing the shaft (9), replace oil seal (3) at the same time.
Bearings	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.

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.	

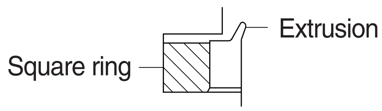
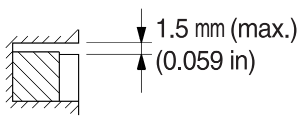
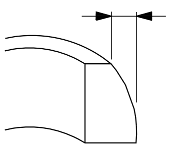
Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.
2. When loosening the hexagon socket head cap screw (125), replace the seal washers (121) without fail.

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

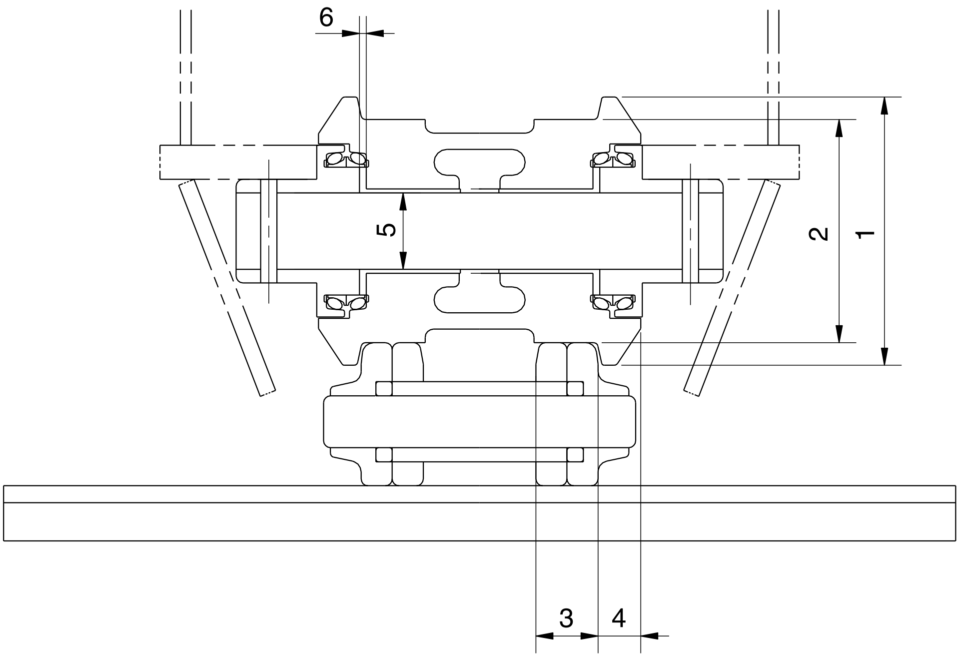
8. CYLINDER

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

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK

1) TRACK ROLLER

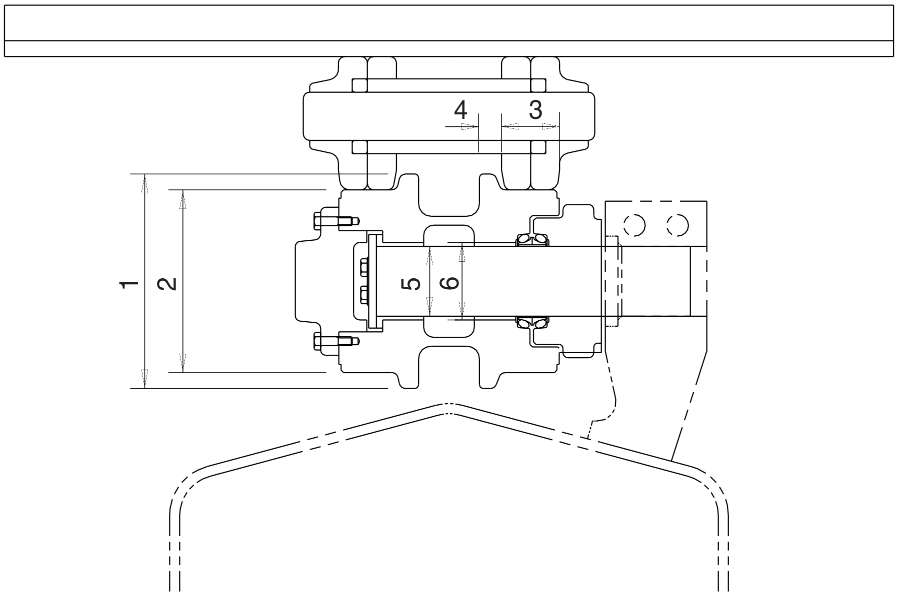


21037MS01

Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="2">ø 216</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">ø 180</td><td colspan="2">ø 168</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">50</td><td colspan="2">56</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">57</td><td colspan="2">21</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 75 $^{0}_{-0.03}$</td><td>ø 75.35 $^{+0.05}_{0}$</td><td>0.35 to 0.40</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Side clearance of roller (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="2">0.16~1.24</td><td colspan="2">2.0</td></tr>
</table>

2) CARRIER ROLLER

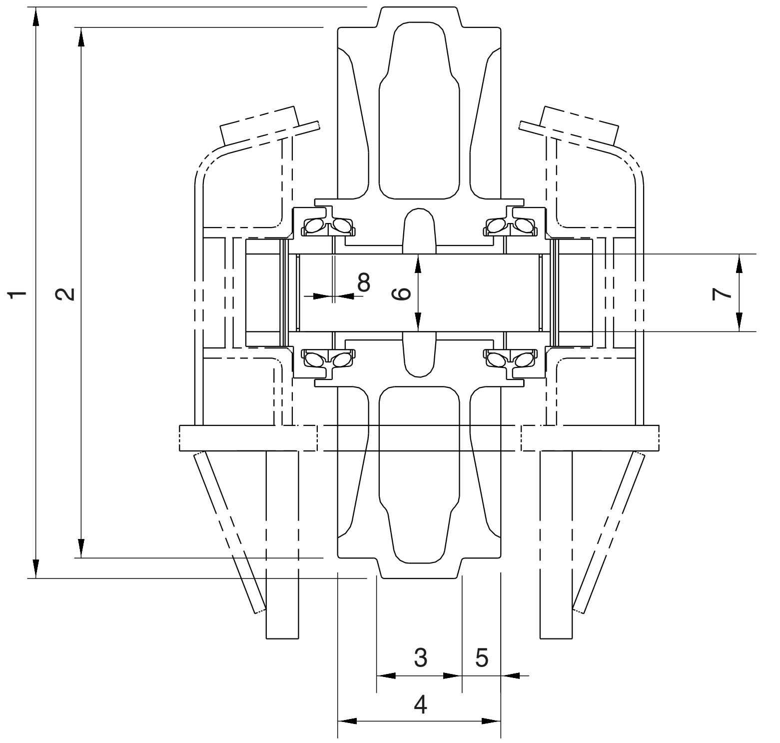


32037MA37

Unit : ㎜

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		ø 200		–		
2	Outside diameter of tread	ø 168		ø 158		
3	Width of tread	54		59		
4	Width of flange	19		–		
5	Clearance between shaft and bushing	Standard size & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		ø 55 $^{+0.085}_{+0.066}$	ø 55 $^{+0.37}_{+0.33}$	0.245 to 0.304	2.0	
6	Clearance between shaft and support	ø 58 $^{0}_{-0.1}$	ø 58 $^{+0.5}_{+0.3}$	0.3 to 0.6	1.2	Replace

3) IDLER

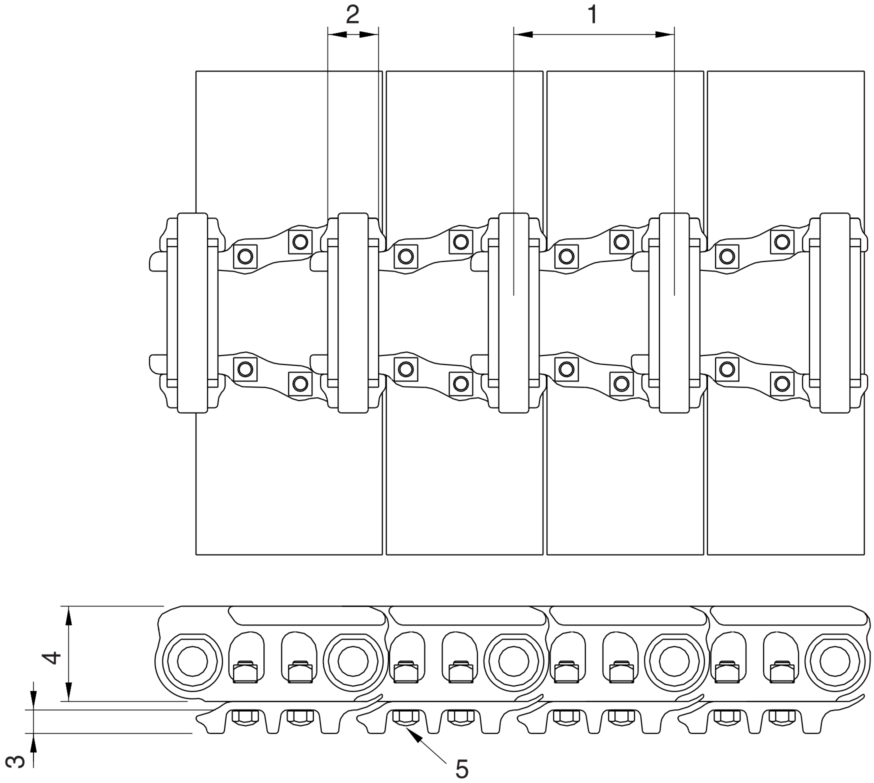


21037MS03

Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of protrusion</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="6">Rebuild or replace</td></tr>
<tr><td colspan="2">ø 646</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">ø 594</td><td colspan="2">ø 588</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="2">102</td><td colspan="2">–</td></tr>
<tr><td>4</td><td>Total width</td><td colspan="2">203</td><td colspan="2">–</td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="2">50.5</td><td colspan="2">56.5</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 90 $^{0}_{-0.035}$</td><td>ø 90.35 $^{+0.05}_{0}$</td><td>0.35 to 0.435</td><td>2.0</td></tr>
<tr><td>7</td><td>Clearance between shaft and support</td><td>ø 90 $^{0}_{-0.035}$</td><td>ø 90 $^{+0.09}_{+0.036}$</td><td>0.036 to 0.125</td><td>1.2</td><td>Replace</td></tr>
<tr><td>8</td><td>Side clearance of idler (both side)</td><td colspan="2">Standard clearance
0.4 to 1.2</td><td colspan="2">Clearance limit
2.0</td><td>Replace</td></tr>
</table>

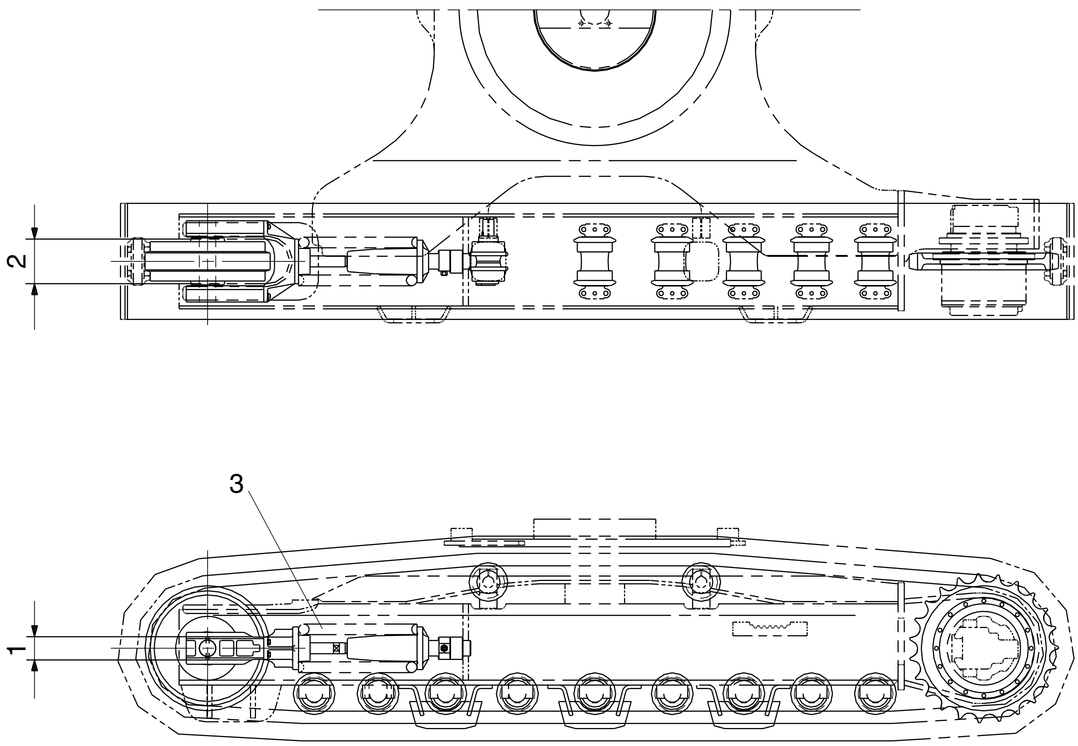
4) TRACK



Unit : mm

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		216	221	
2	Outside diameter of bushing	ø 66.5	ø 60.9	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

5) TRACK FRAME AND RECOIL SPRING

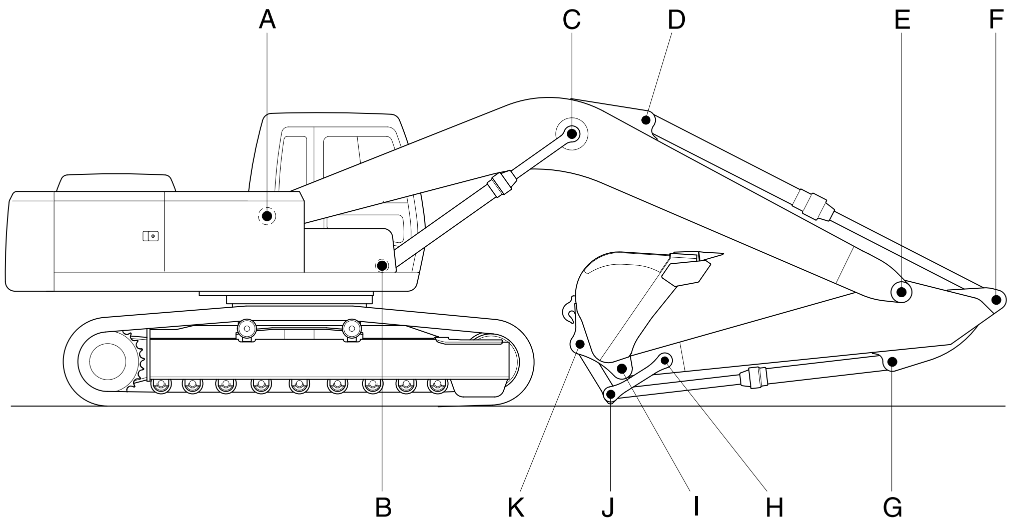


21037MS05

Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="20">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Vertical width of idler guide</td><td colspan="5"></td><td colspan="5">Standard size</td><td colspan="5">Tolerance</td><td colspan="5">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="5">Track frame</td><td colspan="5">132</td><td colspan="5">+2
0</td><td colspan="5">136</td></tr>
<tr><td colspan="5">Idler support</td><td colspan="5">130</td><td colspan="5">0
- 1.5</td><td colspan="5">126</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Horizontal width of idler guide</td><td colspan="5">Track frame</td><td colspan="5">292</td><td colspan="5">+2
0</td><td colspan="5">297</td></tr>
<tr><td colspan="5">Idler support</td><td colspan="5">290</td><td colspan="5">-</td><td colspan="5">288</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Recoil spring</td><td colspan="12">Standard size</td><td colspan="8">Repair limit</td><td rowspan="3">Replace</td></tr>
<tr><td colspan="4">Free length</td><td colspan="4">Installation length</td><td colspan="4">Installation load</td><td colspan="4">Free length</td><td colspan="4">Installation load</td></tr>
<tr><td colspan="4">Ø 253×710</td><td colspan="4">580</td><td colspan="4">19012 kg</td><td colspan="4">–</td><td colspan="4">15210 kg</td></tr>
</table>

2. WORK EQUIPMENT



21077MS20

Unit : ㎜

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	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

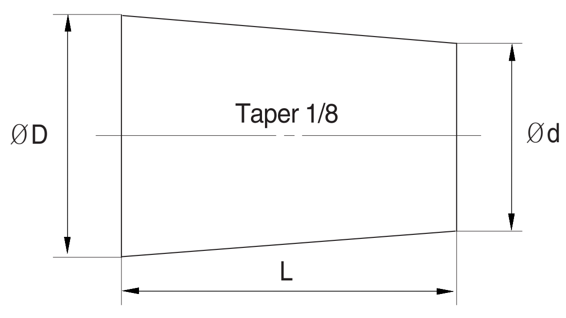
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to
※ the work equipment.
Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

3. COMPLETING WORK

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

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

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

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket)	M12 × 1.75	11.5 ± 1.0	83.2 ± 7.2
2		Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	52.1 ± 5.0	377 ± 36.2
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	46 ± 5.1	333 ± 36.9
7	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	4.8 ± 0.3	34.7 ± 2.2
8		Main pump mounting socket bolt	M20 × 2.5	52.1 ± 5.0	377 ± 36.2
9		Main control valve mounting nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
10		Hydraulic oil tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
11		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
12	Power train system	Swing motor mounting bolt	M20 × 2.5	58.4 ± 6.4	422 ± 46.3
13		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M24 × 3.0	84 ± 8.0	608 ± 57.8
16		Sprocket mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Track roller mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
19		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
20		Track shoe mounting bolt, nut	M22 × 1.5	123 ± 6.0	831 ± 36
21		Track guard mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
22	Others	Counterweight mounting bolt	M36 × 3.0	337 ± 33	2440 ± 72.3
23		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
24		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10×1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12×1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14×2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16×2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18×2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20×2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22×2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24×3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30×3.5	120 ~161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8×1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10×1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12×1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14×1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16×1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18×1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20×1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22×1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24×2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30×2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

2) PIPE AND HOSE (FLARE TYPE)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

3) PIPE AND HOSE (ORFS TYPE)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

(4) 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

(6) Remove bolts (13) and disconnect pipe (1,2).

(7) Disconnect pilot line hoses (4, 5, 6, 7, 8, 9, 10).

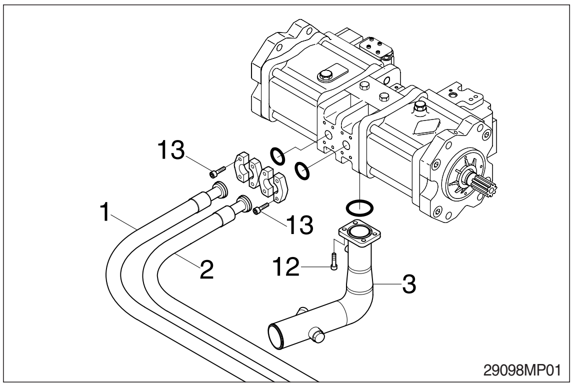
(8) Remove bolts(12) and disconnect pump suction tube (3).

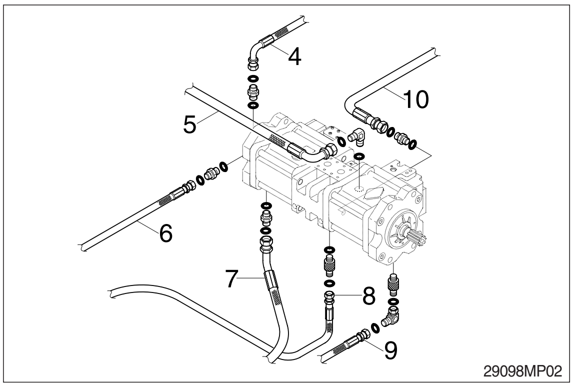
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(9) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 140 kg (310 lb)

※ 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.

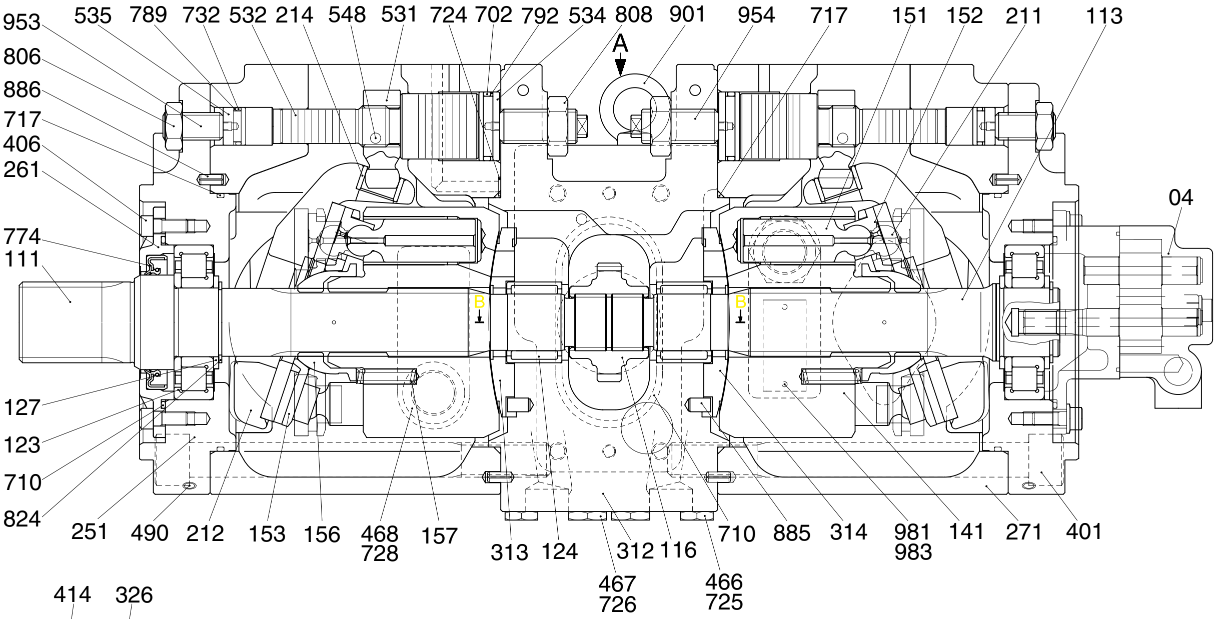
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA)
② Tighten plug lightly
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

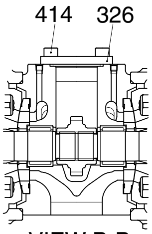
(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

(8) Confirmed the hydraulic oil level and check the hydraulic oil leaks or not.

2. MAIN PUMP (1/2)

1) STRUCTURE



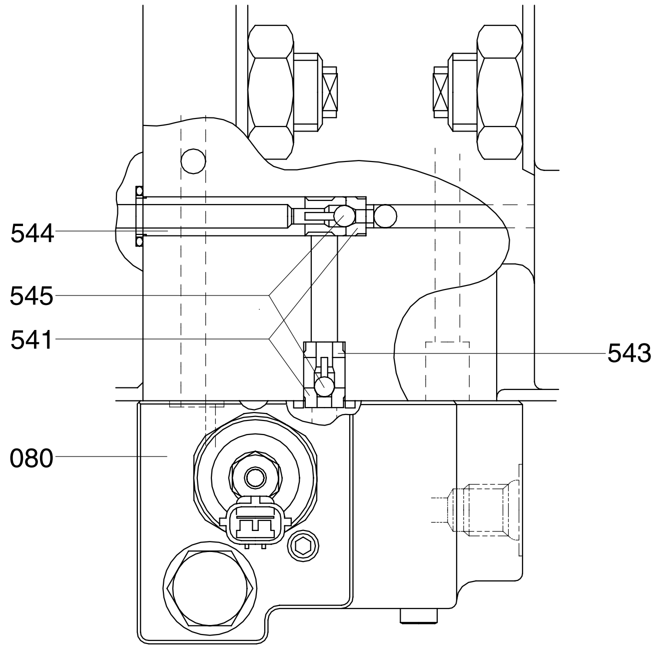


VIEW B-B

29092MP02

04	Gear pump	271	Pump casing	710	O-ring
111	Drive shaft (F)	312	Valve block	717	O-ring
113	Drive shaft (R)	313	Valve plate (R)	724	O-ring
116	Gear	314	Valve plate (L)	725	O-ring
123	Roller bearing	326	Cover	728	O-ring
124	Needle bearing	401	Hexagon socket bolt	732	O-ring
127	Bearing spacer	406	Hexagon socket bolt	774	Oil seal
141	Cylinder block	414	Hexagon socket bol	789	Back up ring
151	Piston	466	VP plug	792	Back up ring
152	Shoe	467	VP plug	806	Hexagon head nut
153	Set plate	468	VP plug	808	Hexagon head nut
156	Spherical bushing	490	VP plug	824	Snap ring
157	Cylinder spring	531	Tilting pin	885	Pin
211	Shoe plate	532	Servo piston	886	Spring pin
212	Swash plate	534	Stopper (L)	901	Eye bolt
214	Bushing	535	Stopper (S)	953	Set screw
251	Swash plate support	548	Feedback pin	954	Set screw
261	Seal cover (F)	702	O-ring		

MAIN PUMP (2/2)



VIEW A

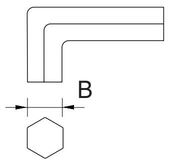
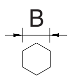
3009SH2MP02

080	Proportional reducing valve	543	Stopper 1	545	Steel ball
541	Seat	544	Stopper 2		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="12">Part name</th></tr>
<tr><td rowspan="6">Allen wrench
</td><td>B</td><td colspan="3">Hexagon socket head bolt</td><td colspan="3">PT plug (PT thread)</td><td colspan="3">PO plug (PF thread)</td><td colspan="3">Hexagon socket head setscrew</td></tr>
<tr><td>4</td><td colspan="3">M 5</td><td colspan="3">BP-1/16</td><td colspan="3">-</td><td colspan="3">M 8</td></tr>
<tr><td>5</td><td colspan="3">M 6</td><td colspan="3">BP1/ 8</td><td colspan="3">-</td><td colspan="3">M10</td></tr>
<tr><td>6</td><td colspan="3">M 8</td><td colspan="3">BP-1/ 4</td><td colspan="3">PO-1/4</td><td colspan="3">M12, M14</td></tr>
<tr><td>8</td><td colspan="3">M10</td><td colspan="3">BP-3/ 8</td><td colspan="3">PO-3/8</td><td colspan="3">M16, M18</td></tr>
<tr><td>17</td><td colspan="3">M20, M22</td><td colspan="3">BP-1</td><td colspan="3">PO-1, 1 1/4, 1 1/2</td><td colspan="3">-</td></tr>
<tr><td rowspan="6">Double ring spanner, socket wrench, double (single) open end spanner
</td><td>-</td><td colspan="4">Hexagon head bolt</td><td colspan="4">Hexagon head bolt</td><td colspan="4">VP plug (PF thread)</td></tr>
<tr><td>19</td><td colspan="4">M12</td><td colspan="4">M12</td><td colspan="4">VP-1/4</td></tr>
<tr><td>24</td><td colspan="4">M16</td><td colspan="4">M16</td><td colspan="4">-</td></tr>
<tr><td>27</td><td colspan="4">M18</td><td colspan="4">M18</td><td colspan="4">VP-1/2</td></tr>
<tr><td>30</td><td colspan="4">M20</td><td colspan="4">M20</td><td colspan="4">-</td></tr>
<tr><td>36</td><td colspan="4">-</td><td colspan="4">-</td><td colspan="4">VP-3/4</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="12">Medium size, 1 set</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="12">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="12">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="12">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="12">Steel bar of key material approx. 10×8×200</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="12">Capable of tightening with the specified torques</td></tr>
</table>

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	115.7	0.47	12
	M16	24.0	173.6	0.55	14
	M18	34.0	245.9	0.55	14
	M20	44.0	318.3	0.67	17
PT plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/16	0.7	5.1	0.16	4
	PT 1/ 8	1.05	7.59	0.20	5
	PT 1/ 4	1.75	12.66	0.24	6
	PT 3/ 8	3.5	25.3	0.31	8
	PT 1/ 2	5.0	36.2	0.39	10
PF plug (material : S45C)	PF 1/ 4	3.0	21.7	0.24	6
	PF 1/ 2	10.0	72.3	0.39	10
	PF 3/ 4	15.0	108.5	0.55	14
	PF 1	19.0	137.4	0.67	17
	PF 1 1/4	27.0	195.3	0.67	17
	PF 1 1/2	28.0	202.5	0.67	17

3) DISASSEMBLY

(1) Select place suitable to disassembling.

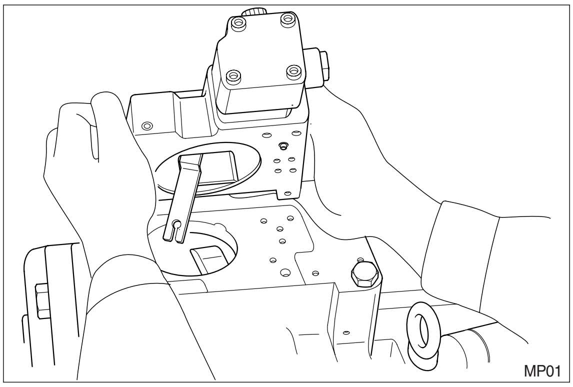
※ Select clean place.

※ Spread rubber sheet, cloth or so on, on overhaul workbench top to prevent parts from being damaged.

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

(3) Remove drain port plug (468) and let oil out of pump casing. (front and rear pump).

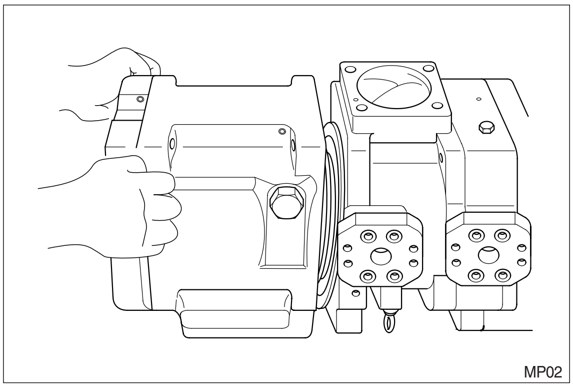
(4) Remove hexagon socket head bolts (412, 413) and remove regulator.
Remove hexagon socket head bolts (416) and remove gear pump.



(5) Loosen hexagon socket head bolts (401) fixing swash plate support (251), pump casing (271) and valve block (312).

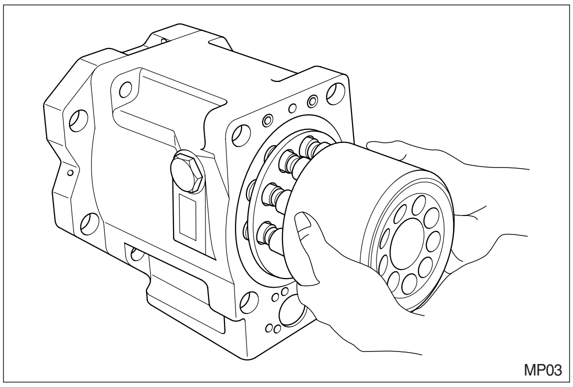
(6) Place pump horizontally on workbench with its regulator-fitting surface down, and separate pump casing (271) from valve block (312).

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



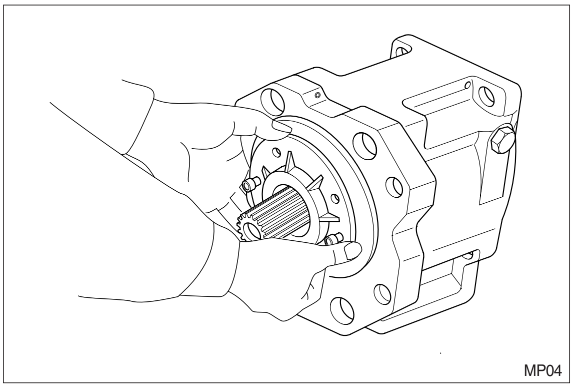
(7) Pull cylinder (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.



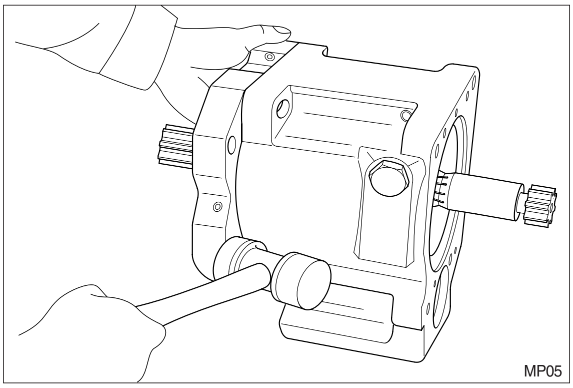
(8) Remove hexagon socket head bolts (406) and then seal cover (F) (261).
Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

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

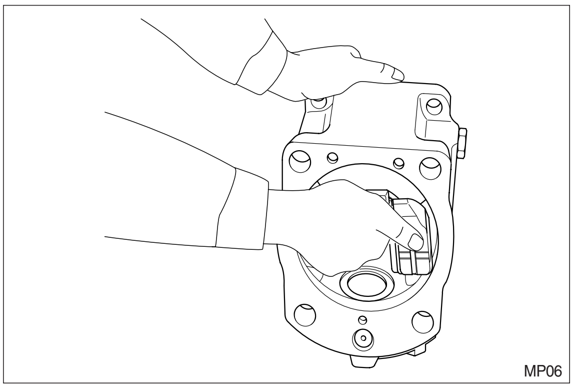


(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).
In case of fitting a gear pump, first, remove gear pump.

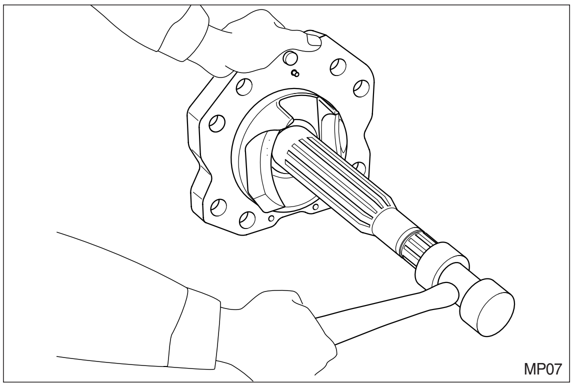
(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



(11) Remove shoe plate (211)and swash plate (212) from pump casing (271).

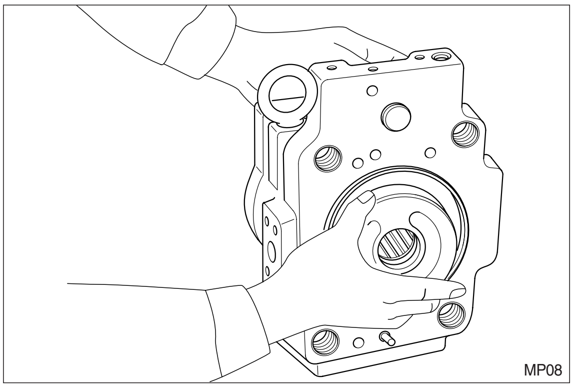


(12) Tapping lightly shaft's end of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



(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 (116) 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.

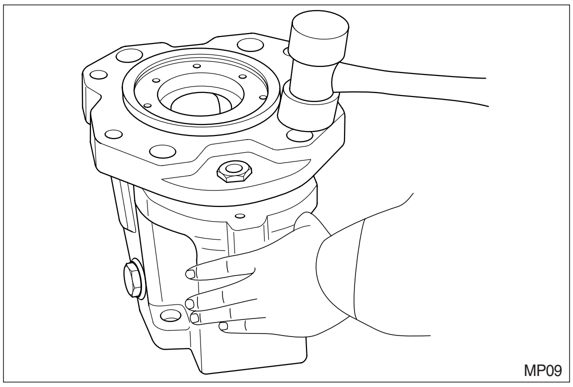
⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in Section 2-3.

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.

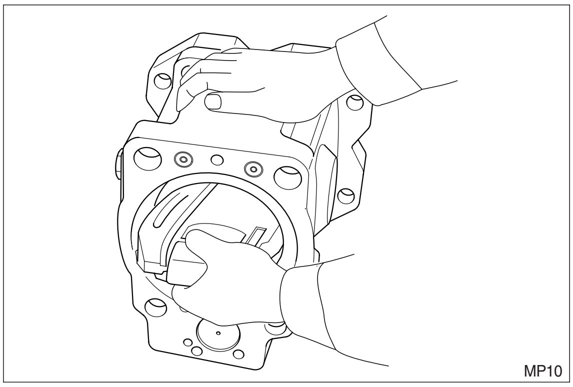
※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply lock-tight (medium strength) to their threaded sections.



(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.



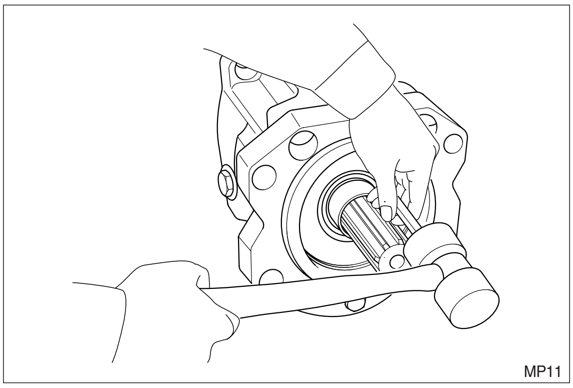
MP10

(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.



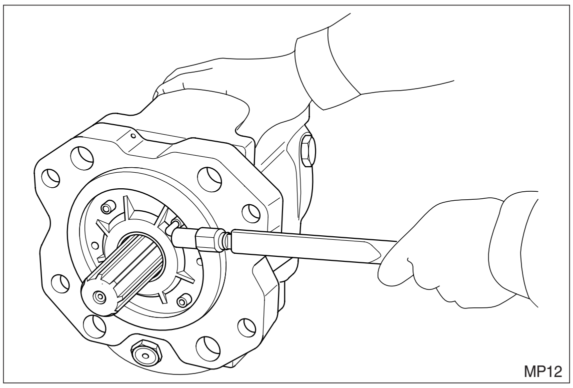
MP11

(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.

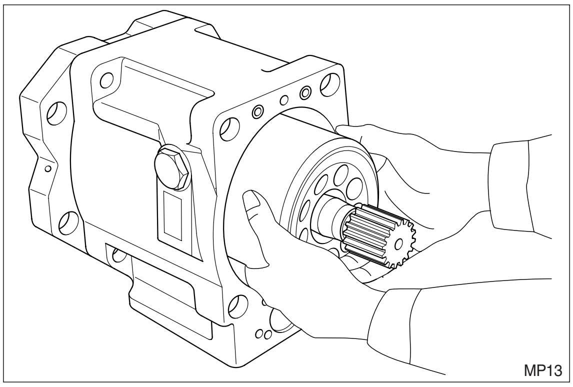
※ For tandem type pump, fit rear cover (263) and seal cover (262).



MP12

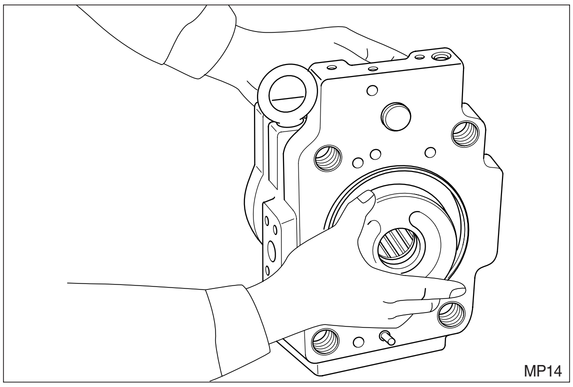
(6) Assemble piston cylinder subassembly 〔Cylinder (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157).〕

Fit spline phases of retainer and cylinder. Then, insert piston cylinder subassembly into pump casing.

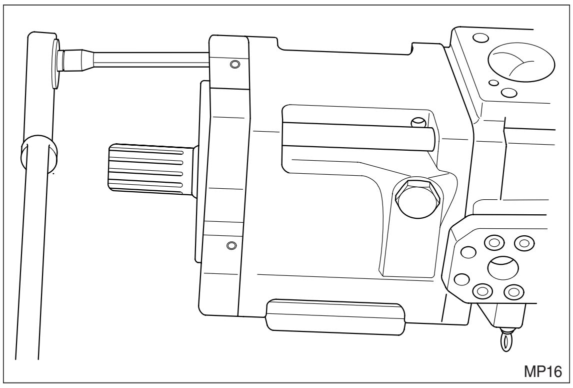


MP13

(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.

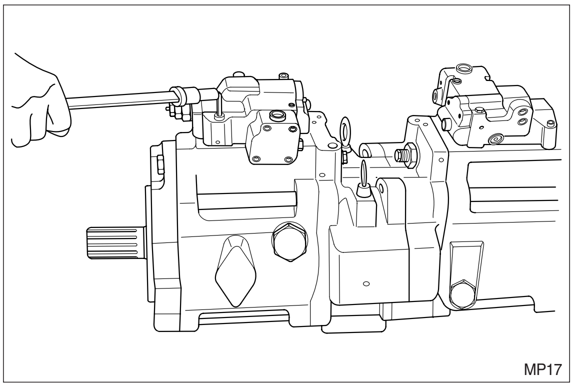


(8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).
※ At first assemble this at rear pump side, and this work will be easy.
※ Take care not to mistake direction of valve block.



※ Clockwise rotation (viewed from input shaft side)
※ Fit block with regulator up and with delivery flange left, viewed from front side.

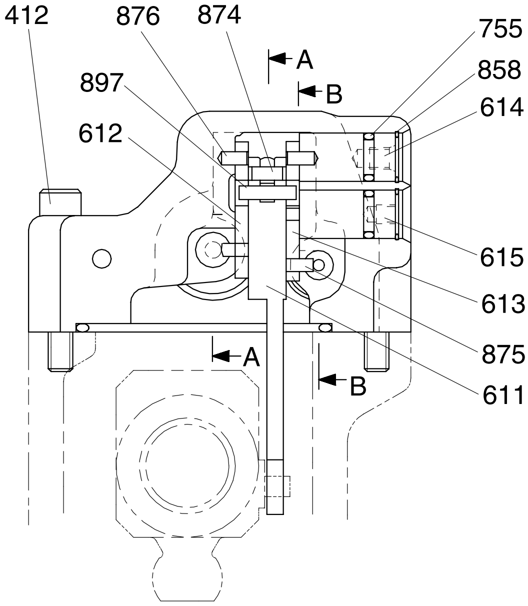
(9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
※ Take care not to mistake regulator of front pump for that of rear pump.

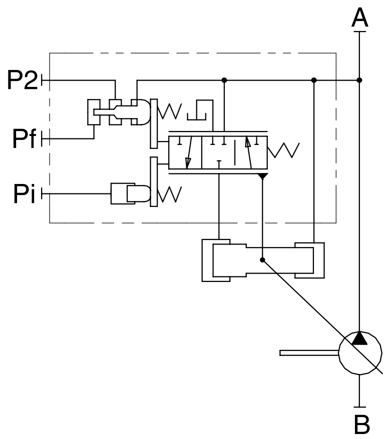


(10) Fit drain port plug (468).
This is the end of reassembling procedures.

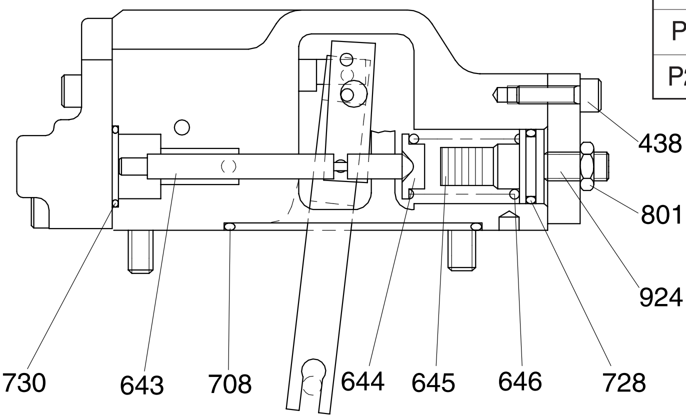
3. REGULATOR

1) STRUCTURE(1/2)

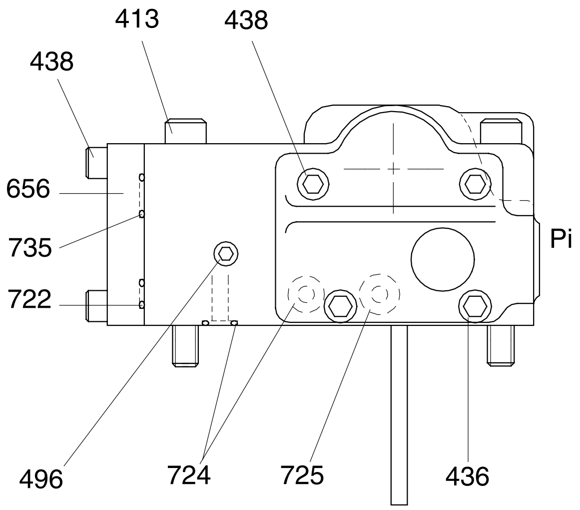




Port	Port name	Port size
A	Delivery port	1"
B	Suction port	2 1/2"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



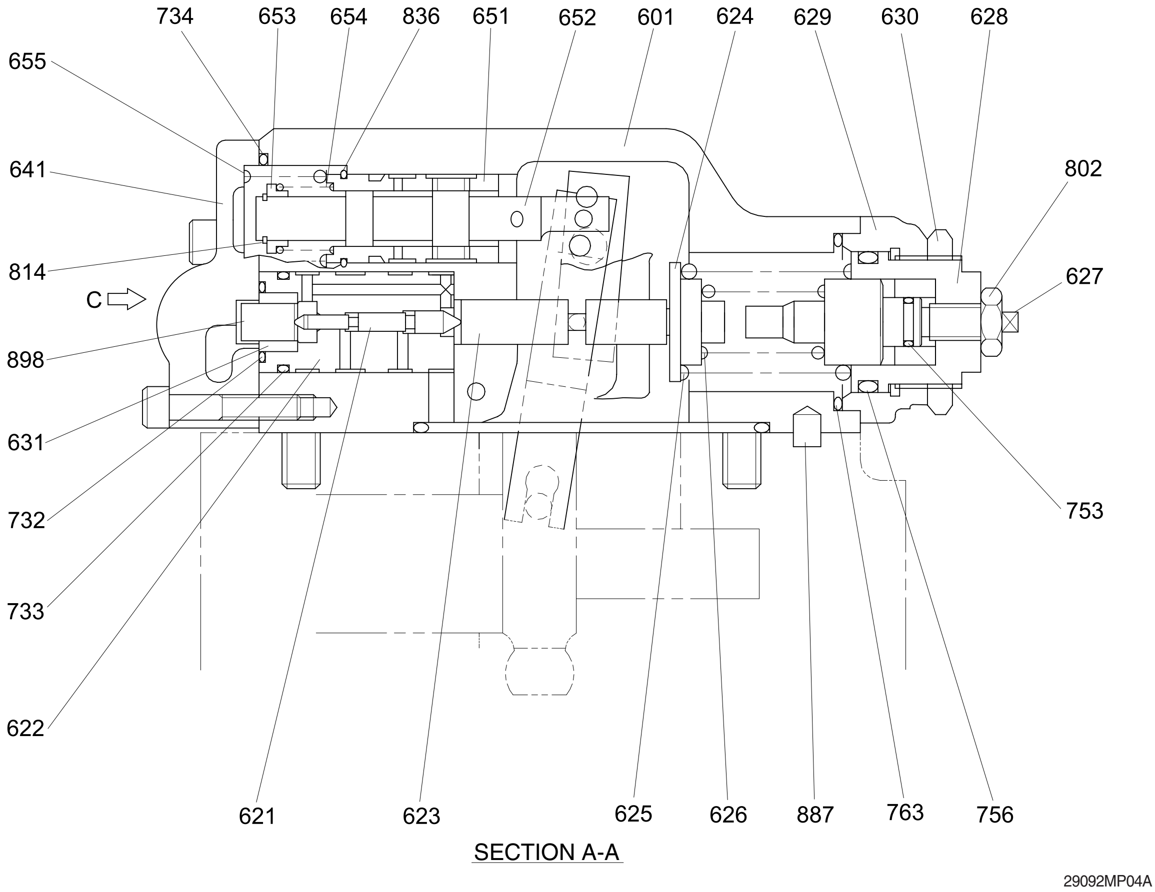
SECTION B-B



VIEW C

29092MP03

REGULATOR (2/2)

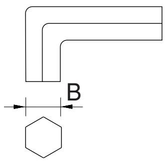
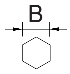


412	Hexagon socket screw	630	Lock nut	733	O-ring
413	Hexagon socket screw	631	Sleeve, pf	734	O-ring
436	Hexagon socket screw	641	Pilot cover	735	O-ring
438	Hexagon socket screw	643	Pilot piston	753	O-ring
496	Plug	644	Spring seat (Q)	755	O-ring
601	Casing	645	Adjust stem (Q)	756	O-ring
611	Feed back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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

Tool name & size		Part name			
Allen wrench 	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
	4	M 5	BP-1/16	-	M 8
	5	M 6	BP1/ 8	-	M10
	6	M 8	BP-1/ 4	PO-1/4	M12, M14
Socket wrench, double (single) open end 	-	Hexagon head bolt	Hexagon nut	VP plug (PF thread)	
	6	M 8	M 8	-	
Adjustable angle wrench	Small size, Max 36 mm				
Screw driver	Minus type screw driver, Medium size, 2 sets				
Hammer	Plastic hammer, 1 set				
Pliers	For snap ring, TSR-160				
Steel bar	Steel bar of key material approx. 10×8×200				
Torque wrench	Capable of tightening with the specified torques.				
Pincers	-				
Bolt	M4, Length : 50 mm				

(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.

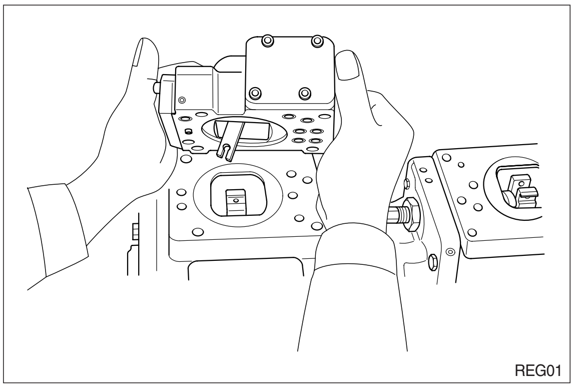
※ Choose a clean place.

※ 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.



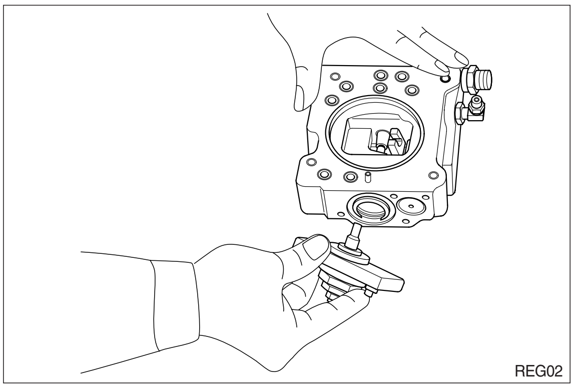
REG01

(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).

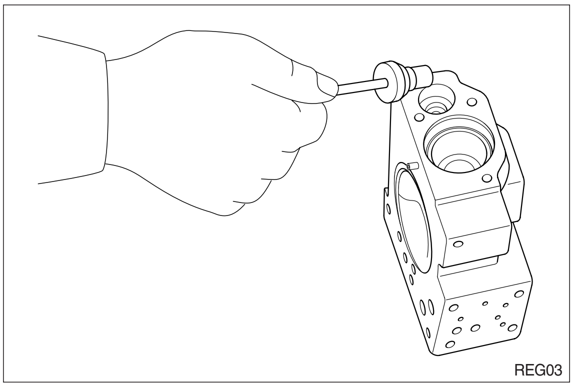
Do not loosen these screws and nuts.

If they are loosened, adjusted pressure-flow setting will vary.

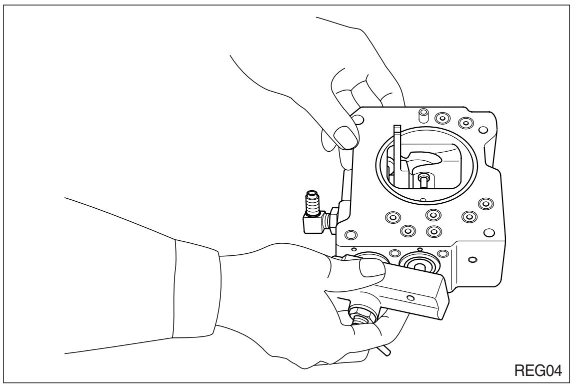


REG02

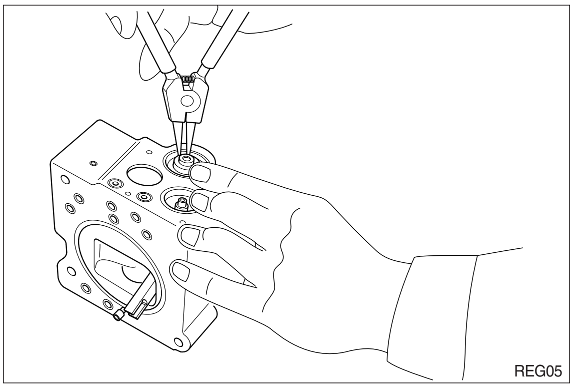
(5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.
Then draw out adjusting stem (Q, 645), pilot spring (646) and spring seat (644) from pilot section.
※ Adjusting stem (Q, 645) can easily be drawn out with M4 bolt.


REG03

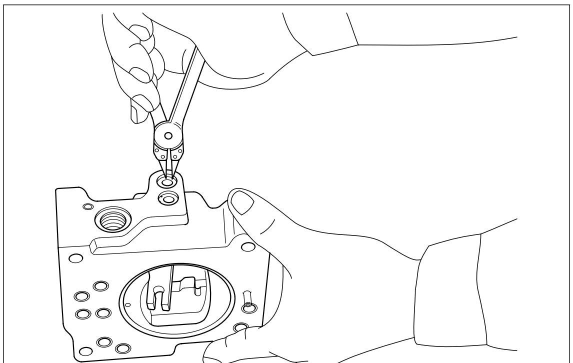
(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.

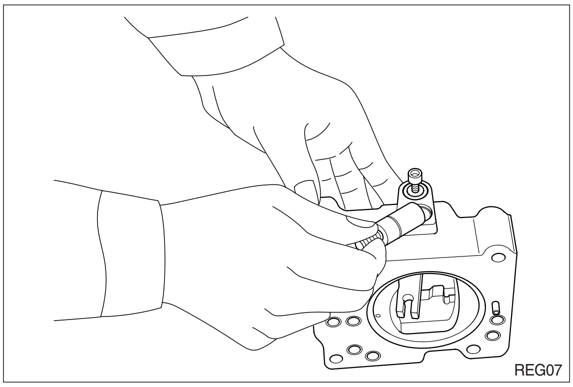

REG04

(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.

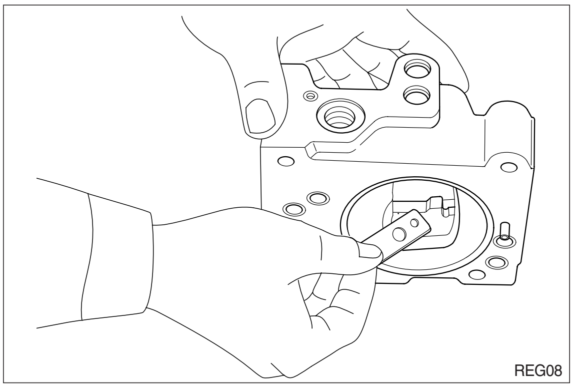

REG06



REG07

(9) Remove lever (2, 613). Do not draw out pin (875).

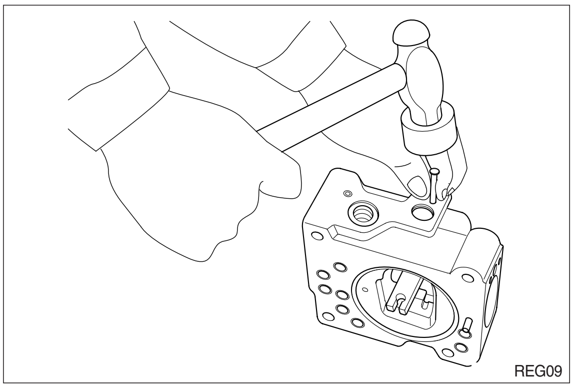
※ Work will be promoted by using pincers or so on.



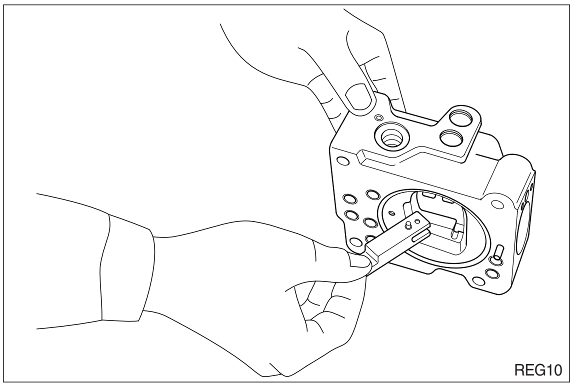
REG08

(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.

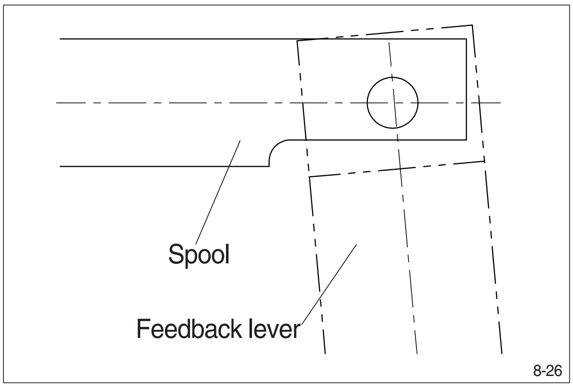
(2) Put compensating rod (623) into compensating hole of casing (601).

(3) Put pin force-fitted in lever (1, 612) into groove of compensating rod and fit lever (1) to pin force-fitted in casing.

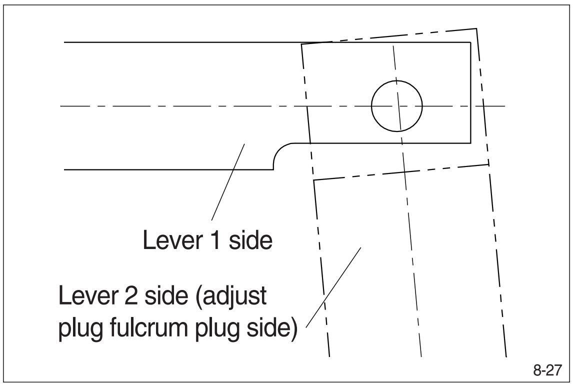
(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

※ Confirm that spool and sleeve slide smoothly in casing without binding.

※ Pay attention to orientation of spool.

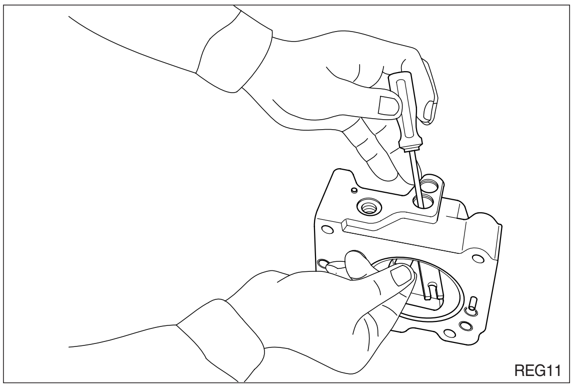


(5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).
※ Insert pin in feedback lever a little to ease operation.
※ Take care not to mistake direction of feedback lever.



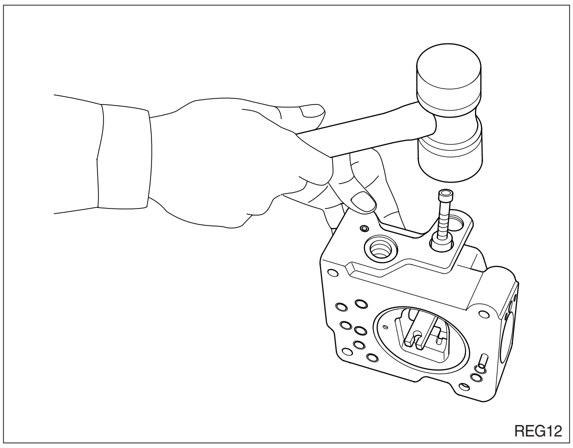
(6) Put pilot piston (643) into pilot hole of casing.
※ Confirm that pilot piston slides smoothly without binding.

(7) Put pin force-fitted in lever (2, 613) into groove of pilot piston.
Then fix lever (2).

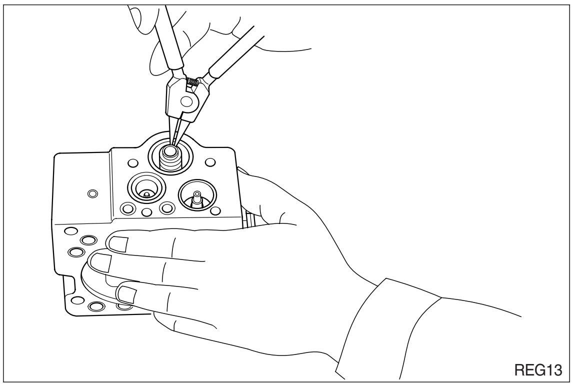


(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug(614) can be put into pin hole of lever (2).
Then fix locking ring (858).

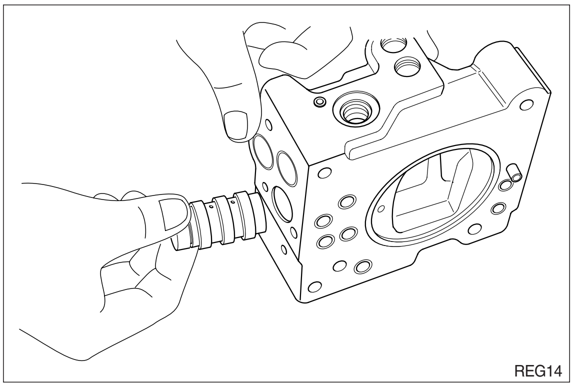
(9) Insert adjusting plug (615) and fit locking ring.
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.



(10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).

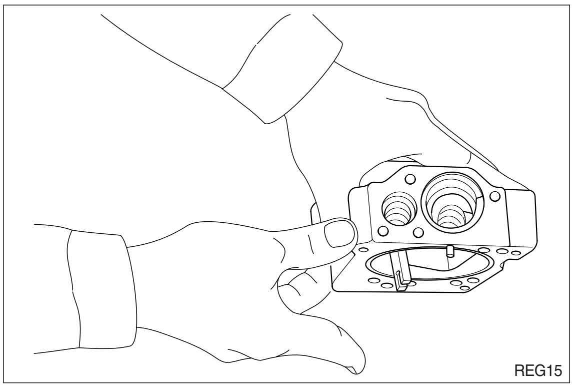


(11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).

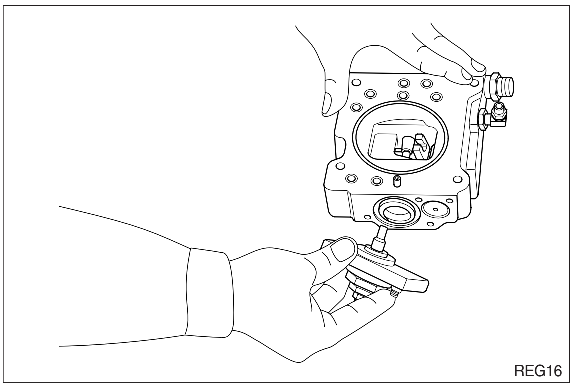


(12) Put spring seat (644), pilot spring (646) and adjusting stem (Q, 645) into pilot hole. Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

※ When fitting spring seat, take care not to mistake direction of spring seat.



(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.



GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

(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.

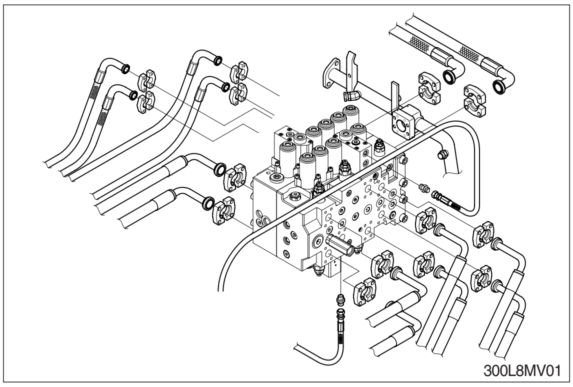
13031GE18

⚠ **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.



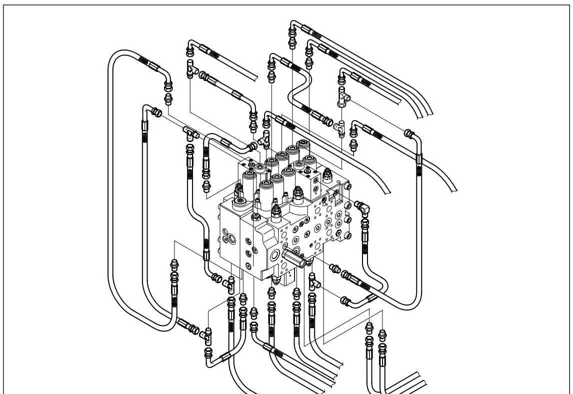
300L8MV01

(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt.
· Weight : 200 kg (441lb)

(9) Remove the control valve assembly. When removing the control valve assembly, check that all the piping have been disconnected.



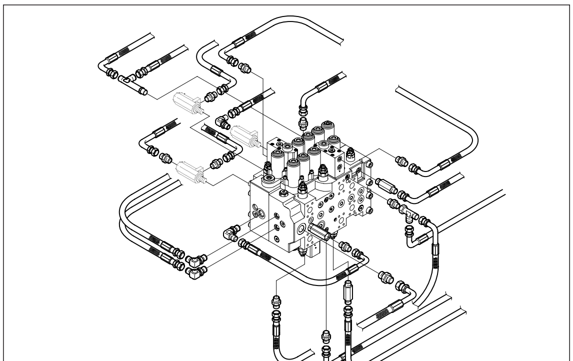
300L8MV02

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.

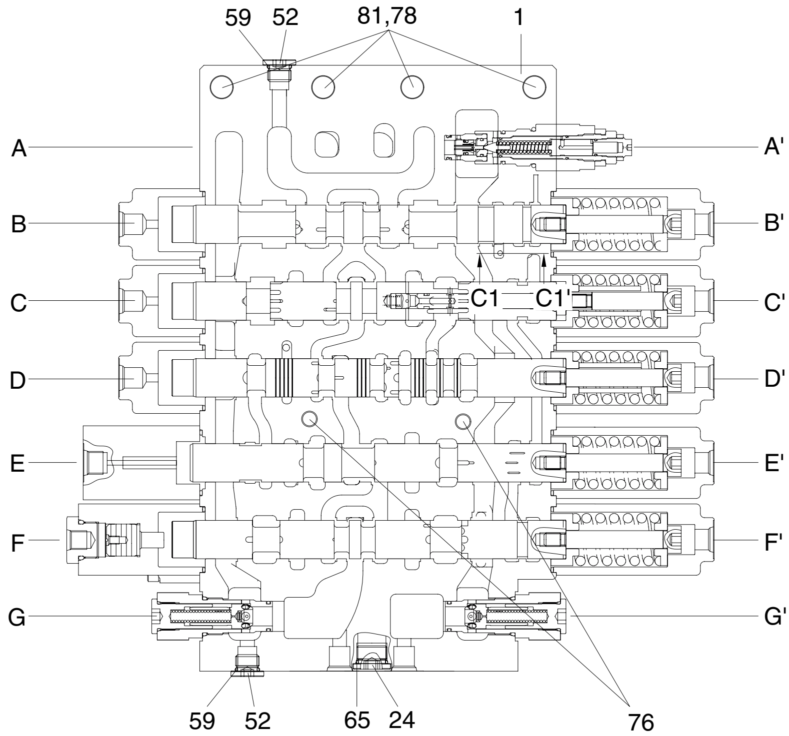
(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



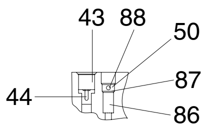
300L8MV03

2. STRUCTURE

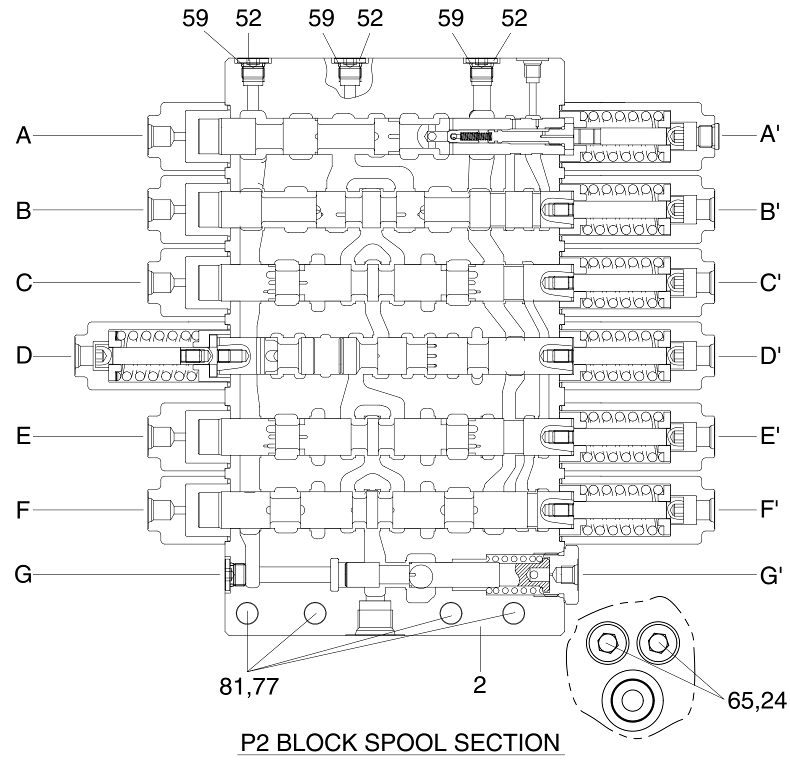
· MCV TYPE 1



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

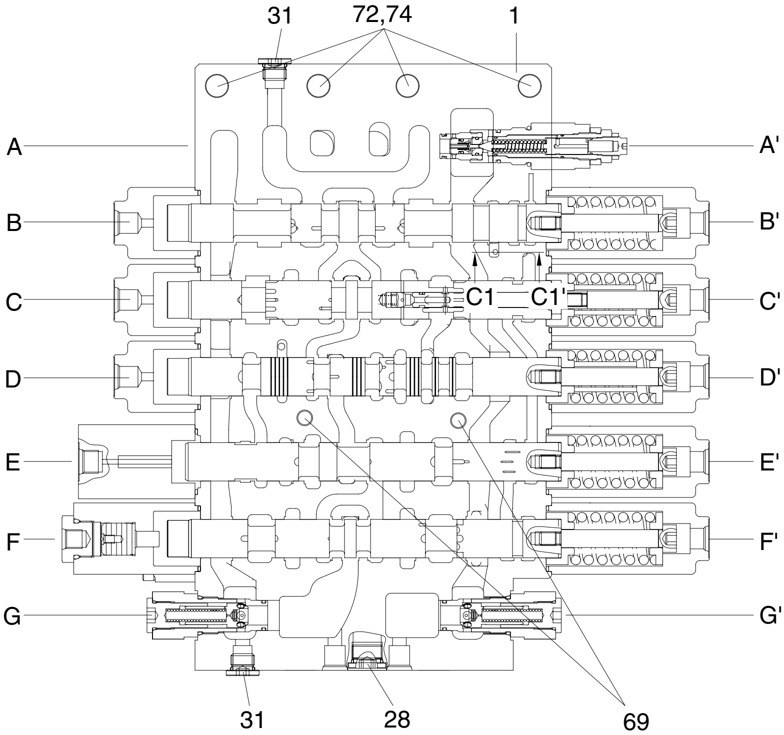


P2 BLOCK SPOOL SECTION

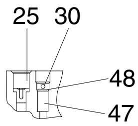
300L2MC10

1	Housing (P1)
2	Housing (P2)
24	Plug
43	Orifice-signal
44	Coin type filter
50	O-ring
52	Plug
59	O-ring
65	O-ring
76	Hex socket head bolt
77	Hex socket head bolt
78	Hex socket head bolt
81	Spring washer
86	Poppet
87	Check spring
88	Plug

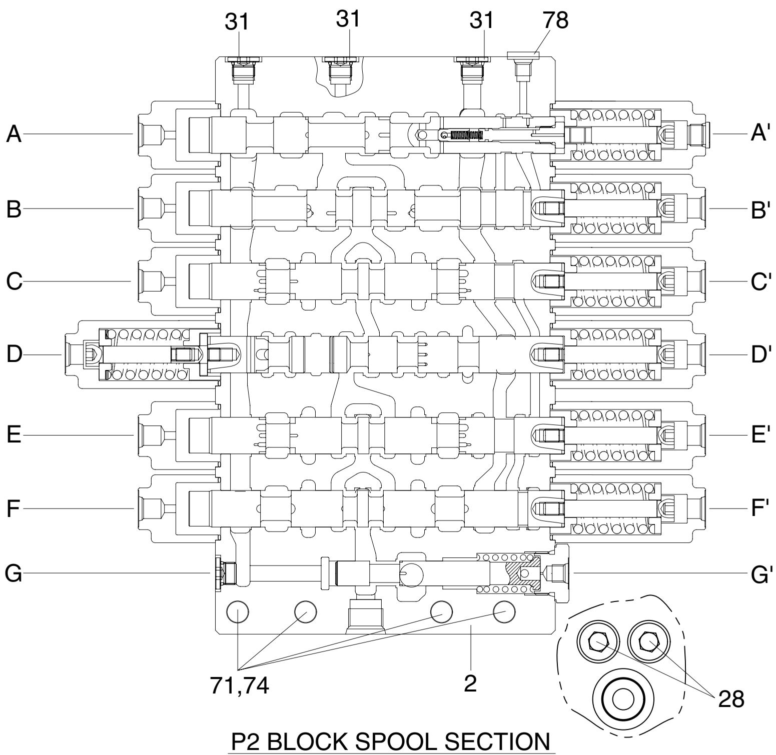
· MCV TYPE 2



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

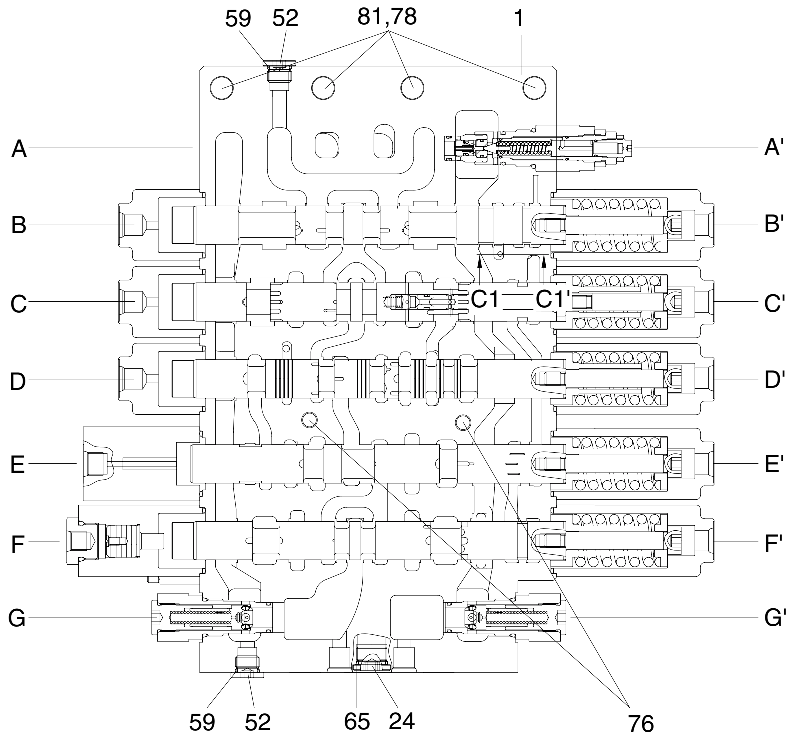


P2 BLOCK SPOOL SECTION

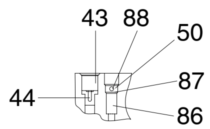
1	Housing (P1)
2	Housing (P2)
25	Orifice-signal
28	Plug
30	Plug
31	Plug
47	Poppet
48	Spring
69	Hex socket head bolt
71	Hex socket head bolt
72	Hex socket head bolt
74	Spring washer
78	Dust cap

300L2MC15

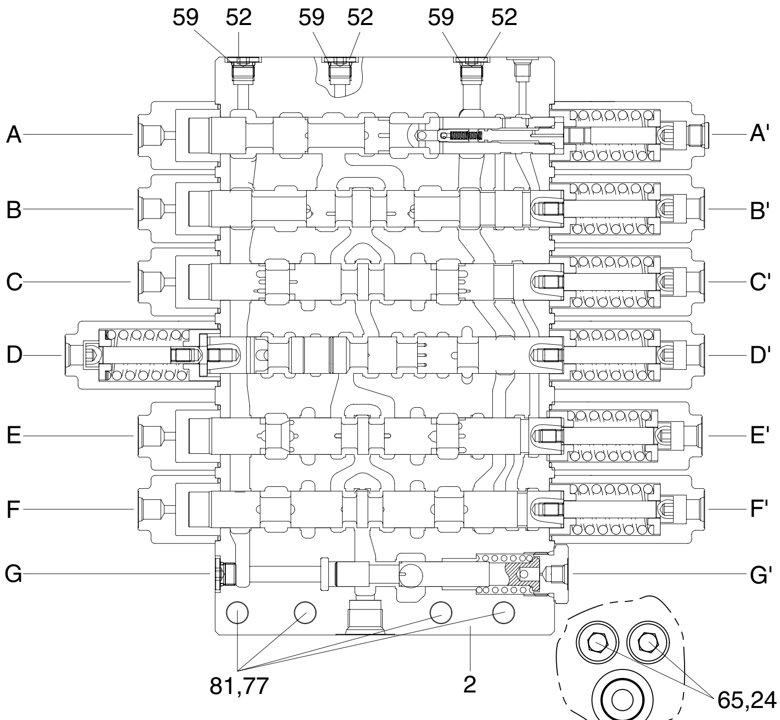
· MCV TYPE 3



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

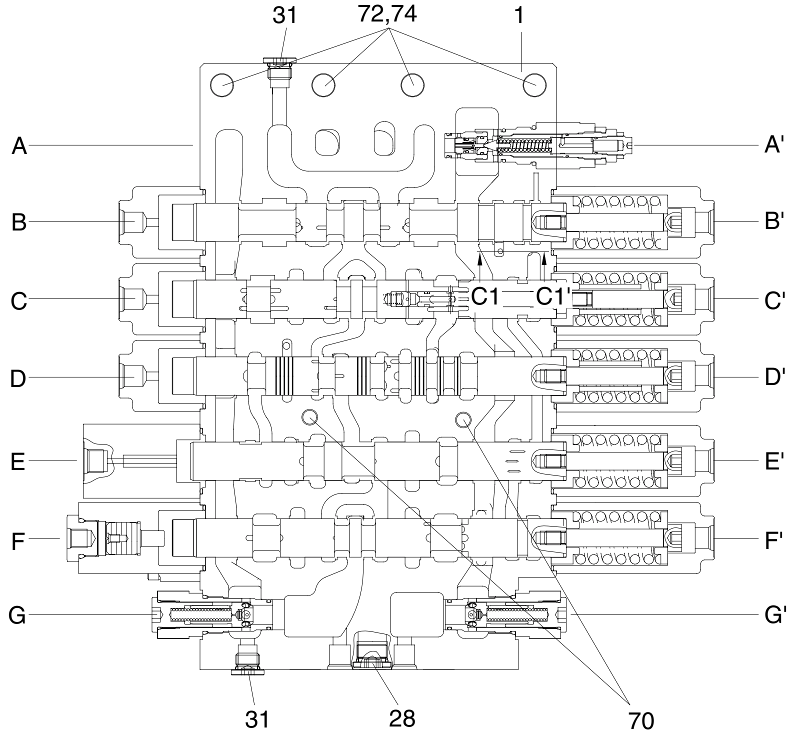


P2 BLOCK SPOOL SECTION

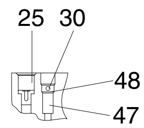
1	Housing (P1)
2	Housing (P2)
24	Plug
43	Orifice-signal
44	Coin type filter
50	O-ring
52	Plug
59	O-ring
65	O-ring
76	Hex socket head bolt
77	Hex socket head bolt
78	Hex socket head bolt
81	Spring washer
86	Poppet
87	Check spring
88	Plug

300L2MC110

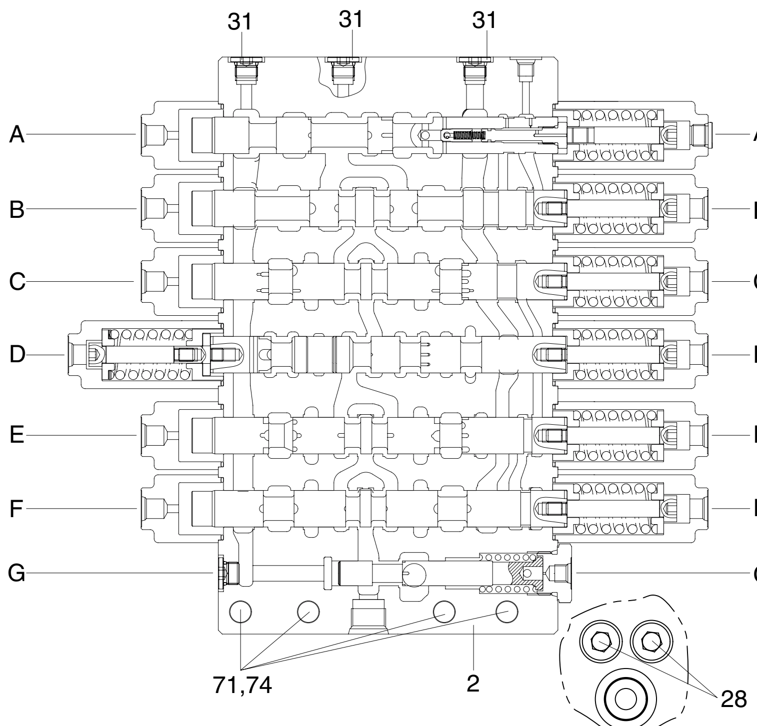
· MCV TYPE 4



P1 BLOCK SPOOL SECTION



SECTION C1-C1'

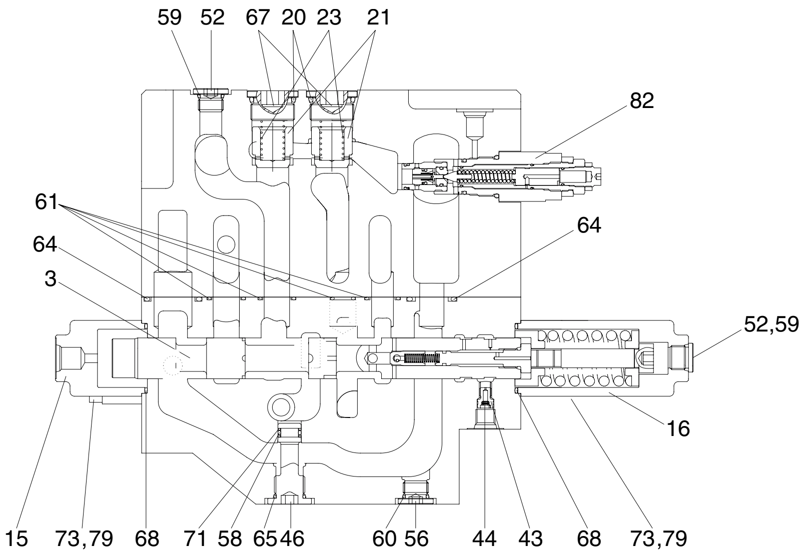


P2 BLOCK SPOOL SECTION

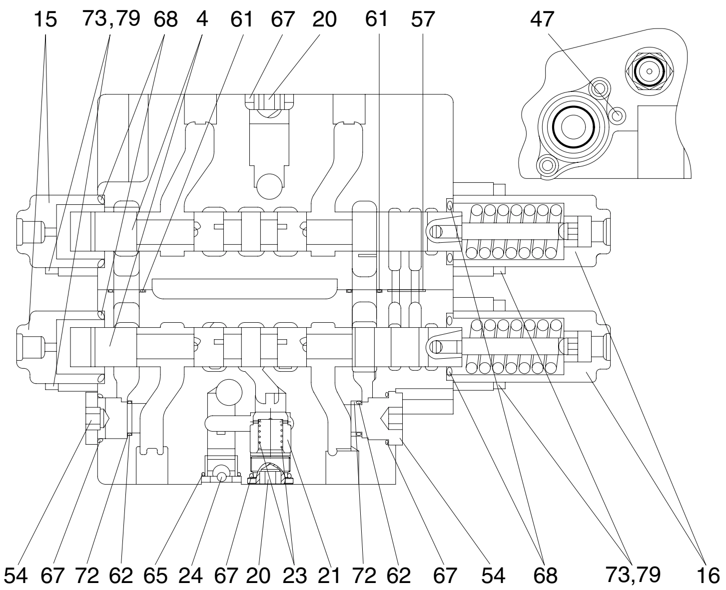
1	Housing (P1)
2	Housing (P2)
25	Orifice-signal
28	Plug
30	Plug
31	Plug
47	Poppet-signal
48	Spring-signal
70	Hex socket head bolt
71	Hex socket head bolt
72	Hex socket head bolt
74	Spring washer

300L2MC215

· MCV TYPE 1



A-A' (STRAIGHT-TRAVEL & SUPPLY)

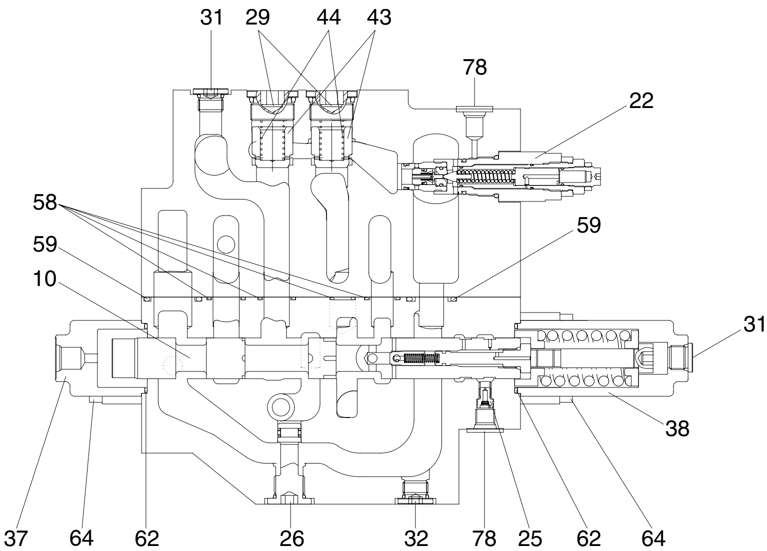


B-B' (TRAVEL RIGHT & LEFT)

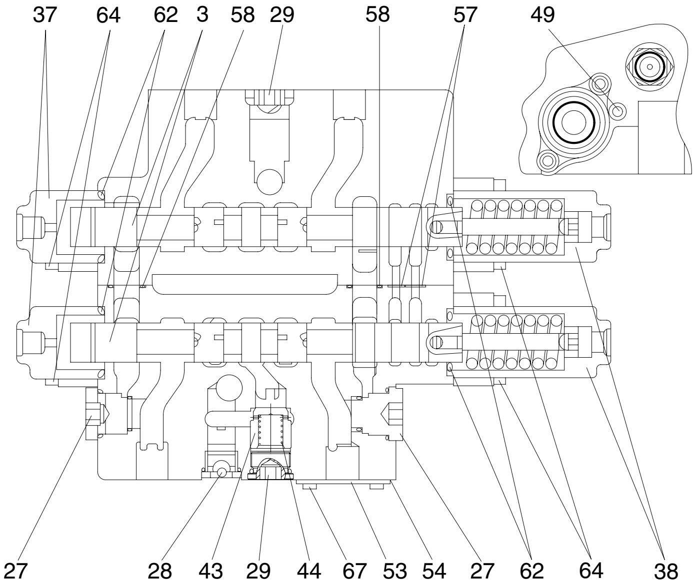
300L2MC111

3	Spool-straight
4	Spool-travel
15	Cover A-pilot
16	Cover B1-pilot
20	Plug
21	Poppet 1-check valve
23	Spring 1-check valve
24	Plug
43	Orifice-signal
44	Coin type filter
46	Plug
47	Plug
52	Plug
54	Plug
56	Plug
57	O-ring
58	O-ring
59	O-ring
60	O-ring
61	O-ring
62	O-ring
64	O-ring
65	O-ring
67	O-ring
68	O-ring
71	Back-up ring
72	Back-up ring
73	Hex socket head bolt
79	Washer
82	Main relief valve

· MCV TYPE 2



A-A' (STRAIGHT-TRAVEL & SUPPLY)

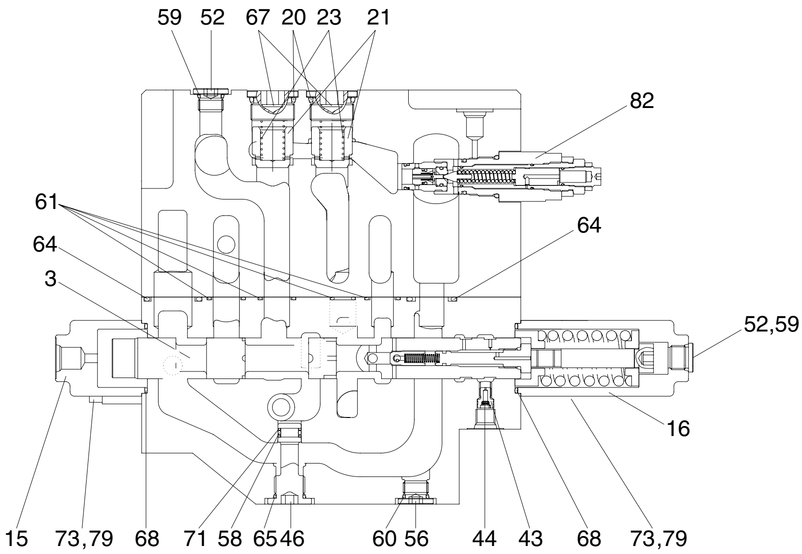


B-B' (TRAVEL RIGHT & LEFT)

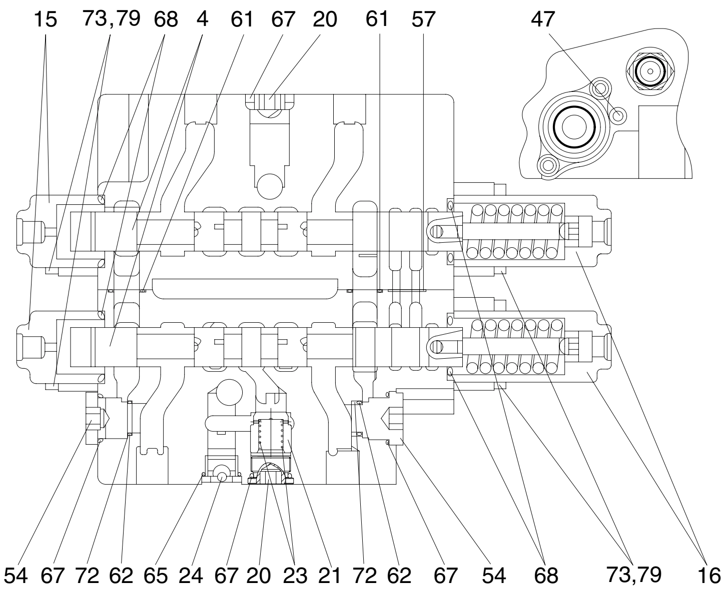
300L2MC116

3	Spool-travel
10	Spool-straight
22	Main relief valve
25	Orifice-signal
26	Parallel block plug
27	Plug
28	Plug
29	Plug
31	Plug
32	Plug
37	Cover A-pilot
38	Cover B1-pilot
43	Poppet 1-check valve
44	Spring 1-check valve
49	Plug
53	Cover 1
54	Gasket 1
57	O-ring
58	O-ring
59	O-ring
62	O-ring
64	Hex socket head bolt
67	Hex socket head bolt
78	Dust cap

· MCV TYPE 3



A-A' (STRAIGHT-TRAVEL & SUPPLY)

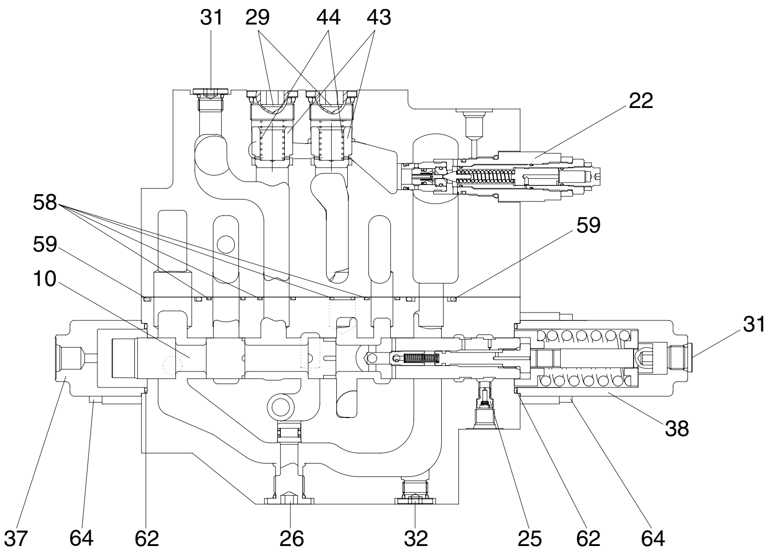


B-B' (TRAVEL RIGHT & LEFT)

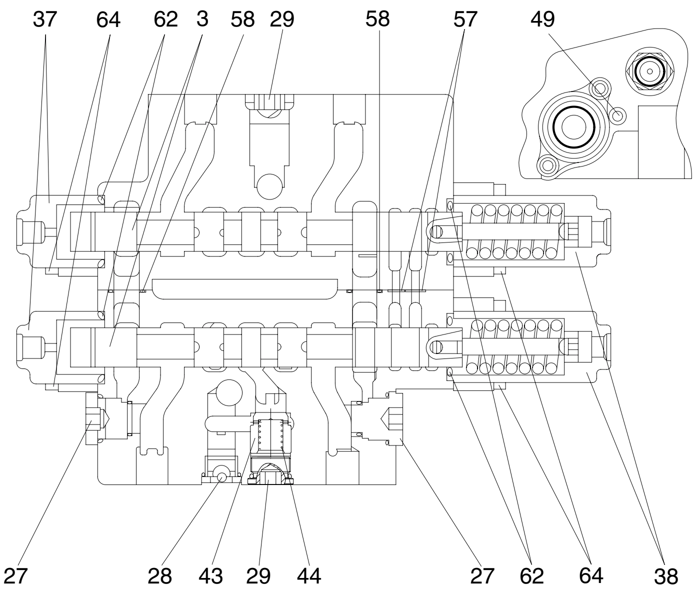
300L2MC111

3	Spool-straight
3	Spool-travel
15	Cover A-pilot
16	Cover B1-pilot
20	Plug
21	Poppet 1-check valve
23	Spring 1-check valve
24	Plug
43	Orifice-signal
44	Coin type filter
46	Plug
47	Plug
52	Plug
54	Plug
56	Plug
57	O-ring
58	O-ring
59	O-ring
60	O-ring
61	O-ring
62	O-ring
64	O-ring
65	O-ring
67	O-ring
68	O-ring
71	Back-up ring
72	Back-up ring
73	Hex socket head bolt
79	Washer
82	Main relief valve

· MCV TYPE 4



A-A' (STRAIGHT-TRAVEL & SUPPLY)

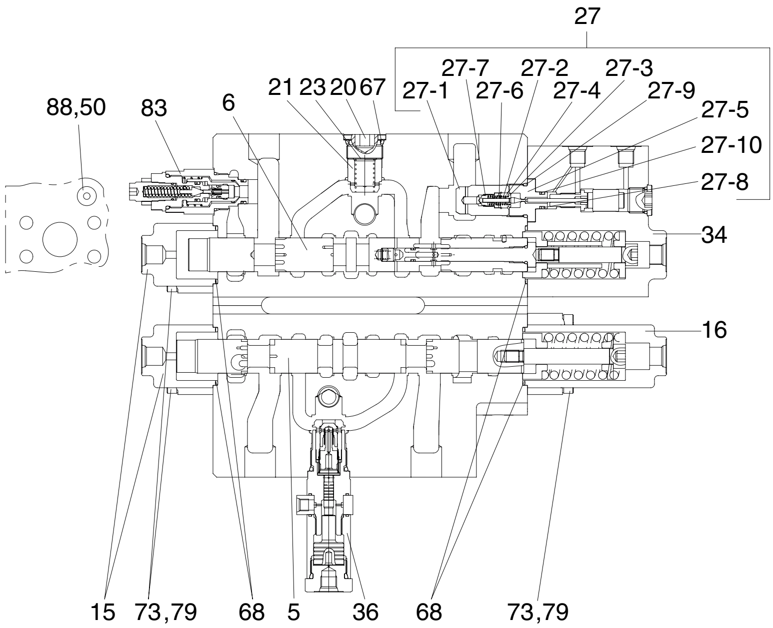


B-B' (TRAVEL RIGHT & LEFT)

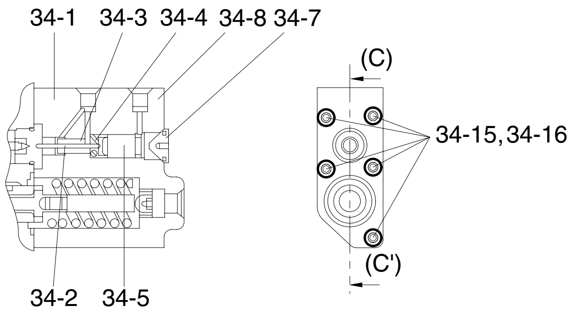
300L2MC216

3	Spool-travel
10	Spool-straight travel
22	Main relief valve
25	Orifice-signal
26	Parallel block plug
27	ORV Plug
28	Plug
29	Plug
31	Plug
32	Plug
37	Cover A-pilot
38	Cover B1-pilot
43	Poppet 1-check valve
44	Spring 1-check valve
49	Plug
57	O-ring
58	O-ring
59	O-ring
62	O-ring
64	Hex socket head bolt

· MCV TYPE 1



C-C' (SWING & BOOM 1)

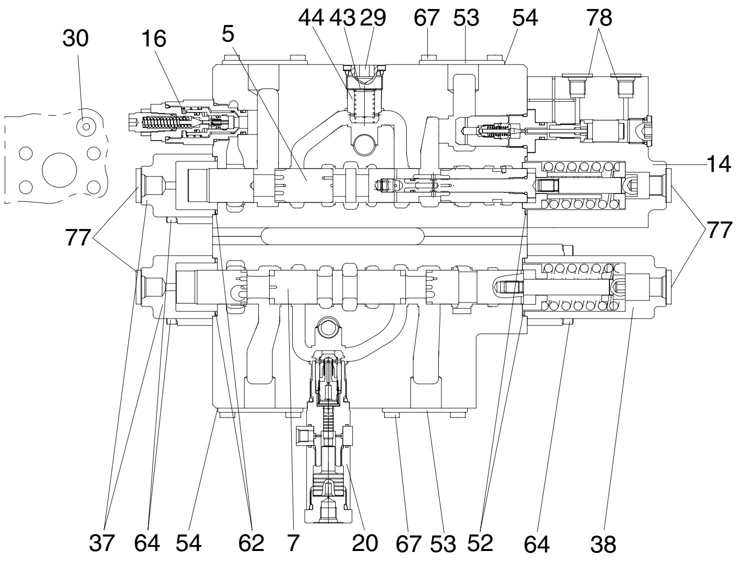


34 DETAIL (HOLDING ASSY)

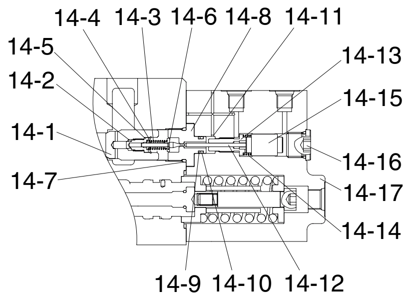
300L2MC12

5	Spool-swing	27-5	Poppet seat	34-7	Plug
6	Spool-boom	27-6	C-ring	34-8	Plug
15	Cover A-pilot	27-7	Restrictor-lock valve	34-15	Socket bolt
16	Cover B1-pilot	27-8	O-ring	34-16	Spring washer
20	Plug	27-9	O-ring	36	Logic valve
21	Poppet 1-check valve	27-10	Back up ring	50	O-ring
23	Spring 1-check valve	34	Holding kit A1	67	O-ring
27	Holding kit B	34-1	Block-holding P1	68	O-ring
27-1	Poppet	34-2	Piston 1-holding	73	Hex socket head bolt
27-2	Spring	34-3	Guide piston-holding	79	Washer
27-3	Poppet guide	34-4	Spring 1-lock valve	83	Overload relief valve
27-4	Pilot poppet	34-5	Piston 2-holding	88	Plug

· MCV TYPE 2



C-C' (SWING & BOOM1)

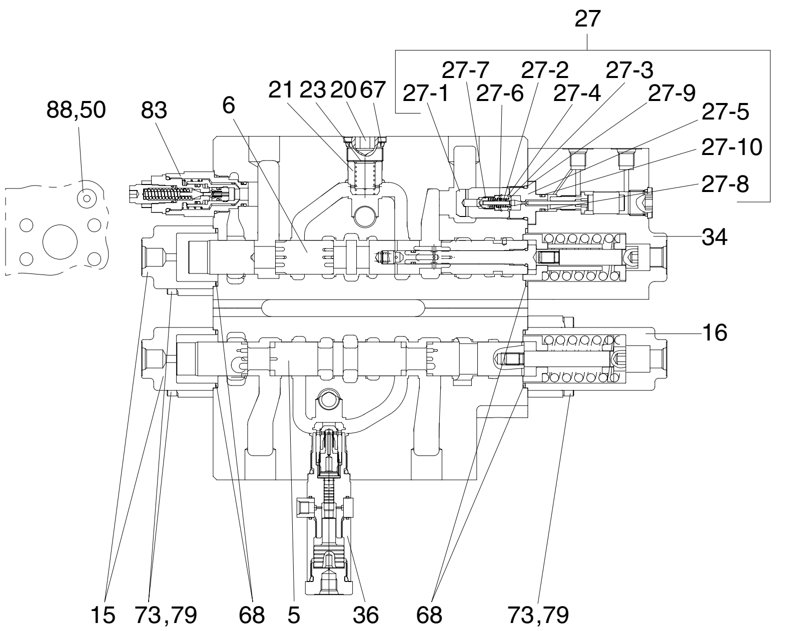


14 DETAIL (HOLDING VALVE ASSY)

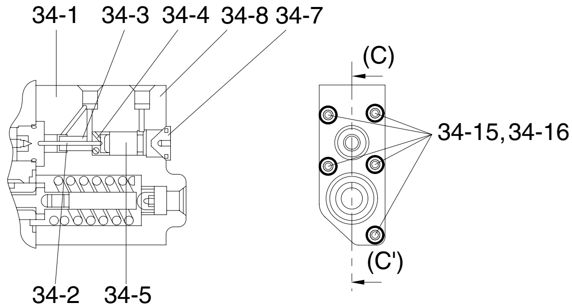
300L2MC17

5	Spool-boom 1	14-10	O-ring	37	Cover-pilot A
7	Spool-swing	14-11	Plug	38	Cover-pilot B1
14	Holding valve assy	14-12	Pilot spring	43	Spring 1-check valve
14-1	Poppet	14-13	Piston guide	44	Poppet 1-check valve
14-2	Restrictor	14-14	Spring	53	Cover 1
14-3	Spring	14-15	Main piston	54	Gasket 1
14-4	C-ring	14-16	Plug	62	O-ring
14-5	Pilot poppet	14-17	Block	64	Hex socket head bolt
14-6	Poppet guide	16	Overload relief valve	67	Hex socket head bolt
14-7	O-ring	20	Logic valve	77	Dust cap
14-8	Poppet seat	29	Plug	78	Dust cap
14-9	Back up ring	30	Plug		

· MCV TYPE 3



C-C' (SWING & BOOM 1)

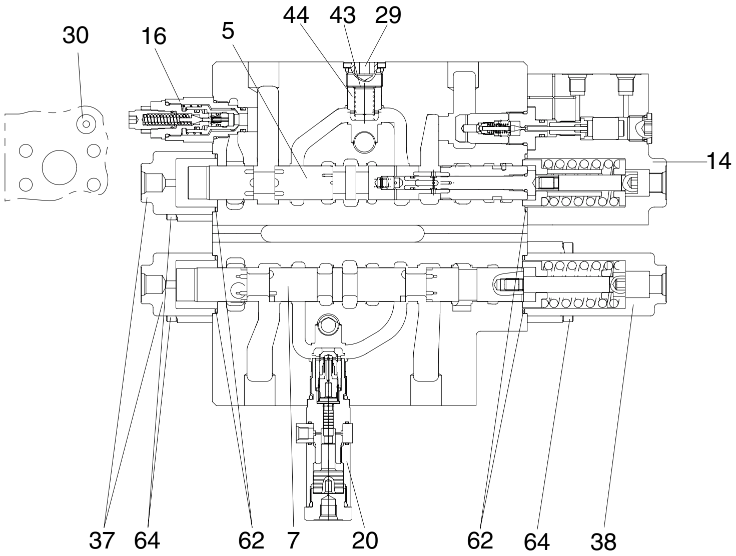


34 DETAIL (HOLDING ASSY)

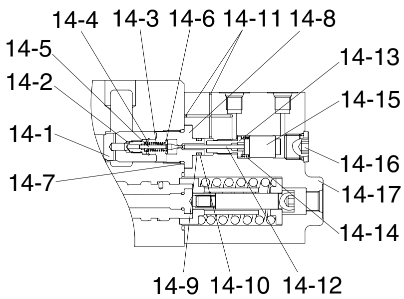
300L2MC112

5	Spool-swing	27-5	Poppet seat	34-7	Plug
6	Spool-boom	27-6	C-ring	34-8	Plug
15	Cover A-pilot	27-7	Restrictor-lock valve	34-15	Socket bolt
16	Cover B1-pilot	27-8	O-ring	34-16	Spring washer
20	Plug	27-9	O-ring	36	Logic valve
21	Poppet 1-check valve	27-10	Back up ring	50	O-ring
23	Spring 1-check valve	34	Holding kit A1	67	O-ring
27	Holding kit B	34-1	Block-holding P1	68	O-ring
27-1	Poppet	34-2	Piston 1-holding	73	Hex socket head bolt
27-2	Spring	34-3	Guide piston-holding	79	Washer
27-3	Poppet guide	34-4	Spring 1-lock valve	83	Overload relief valve
27-4	Pilot poppet	34-5	Piston 2-holding	88	Plug

· MCV TYPE 4



C-C' (SWING & BOOM 1)

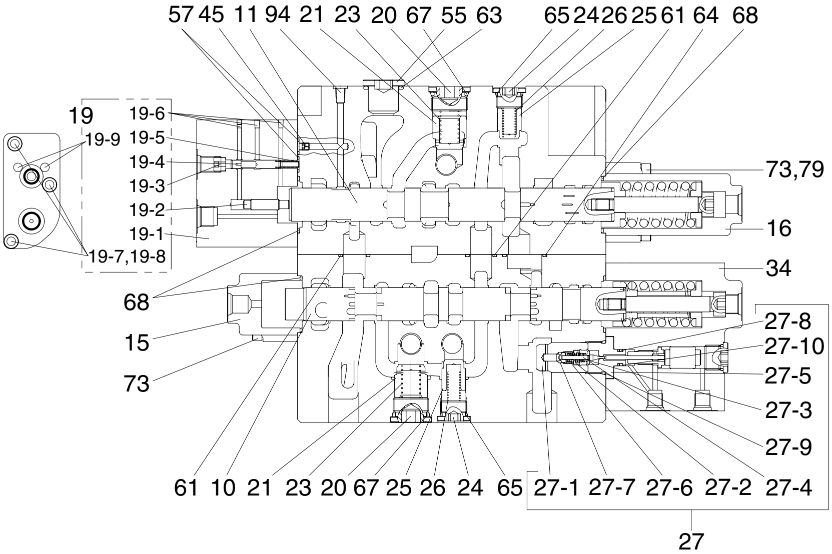


14 DETAIL (HOLDING VALVE ASSY)

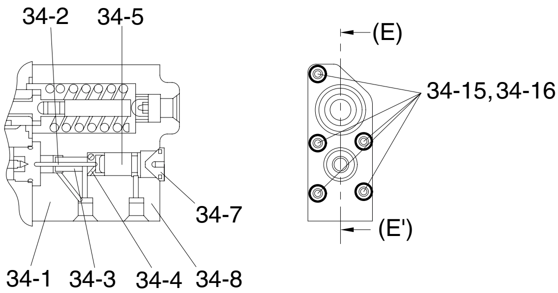
300L2MC217

5	Spool-boom 1	14-8	Poppet seat	16	Overload relief valve
7	Spool-swing	14-9	Back up ring	20	Logic valve-swing
14	Holding valve assy	14-10	O-ring	29	Plug
14-1	Poppet-main	14-11	Plug	30	Plug
14-2	Restrictor	14-12	Pilot piston	37	Cover A-pilot
14-3	Spring-pilot	14-13	Piston guide	38	Cover B1-pilot
14-4	C-ring	14-14	Spring	43	Spring 1-check valve
14-5	Pilot poppet	14-15	Main piston	44	Poppet 1-check valve
14-6	Poppet guide	14-16	Plug	62	O-ring
14-7	O-ring	14-17	Block	64	Hex socket head bolt

· MCV TYPE 1



E-E' (ARM & ARM REGENRATION)

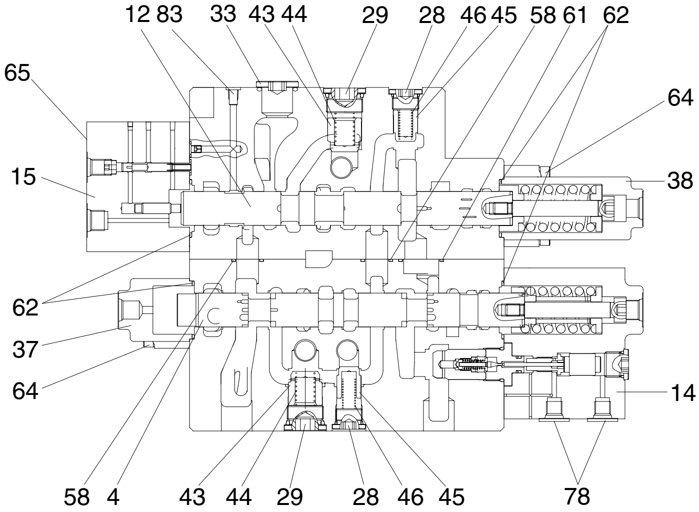


34 DETAIL (HOLDING ASSY)

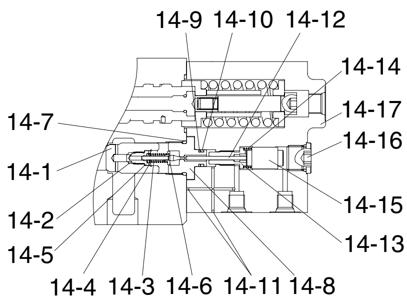
300L2MC13

10	Spool-arm 1
11	Spool-arm regeneration
15	Cover A-pilot
16	Cover B1-pilot
19	Arm-regeneration
19-1	Block-regeneration
19-2	Piston-cut off
19-3	Stopper-regeneration
19-4	Spool-regeneration
19-5	Spring-regeneration
19-6	Plug
19-7	Socket bolt
19-8	Spring wahser
19-9	Pin-regeneration
20	Plug
21	Poppet 1-check valve
23	Spring 1-check valve
24	Plug
25	Poppet 2-check valve
26	Spring 2-check valve
27	Poppet-lock valve
27-1	Poppet
27-2	Spring
27-3	Poppet guide
27-4	Pilot poppet
27-5	Poppet seat
27-6	C-ring
27-7	Restrictor-lock valve
27-8	O-ring
27-9	O-ring
27-10	Back up ring
34	Holding kit A1
34-1	Block-holding P1
34-2	Piston 1-holding
34-3	Guide piston-holding
34-4	Spring 1-lock valve
34-5	Piston 2-holding
34-7	Plug
34-8	Plug
34-15	Socket bolt
34-16	Spring washer
45	Orifice-plug
55	Plug
57	O-ring
61	O-ring
63	O-ring
64	O-ring
65	O-ring
67	O-ring
68	O-ring
73	Hex socket head bolt
79	Washer
94	Plug

· MCV TYPE 2



E-E' (ARM & ARM REGENRATION)

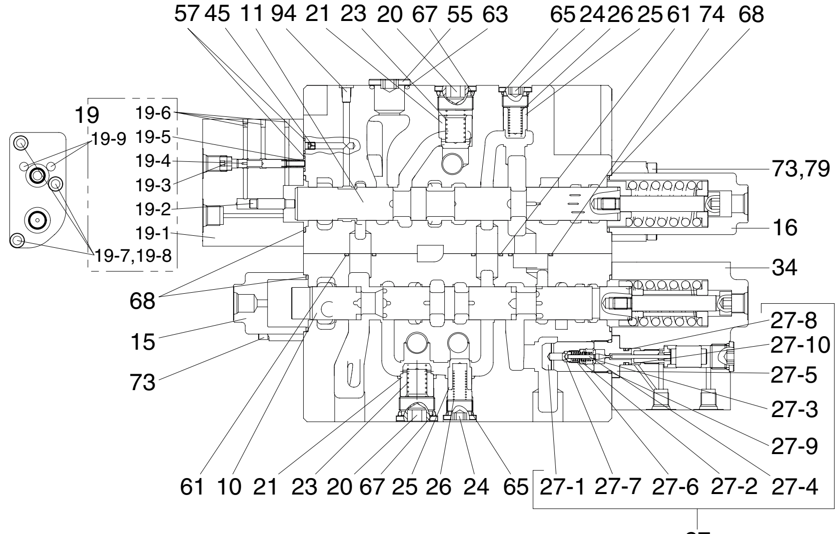


14 DETAIL (HOLDING VALVE ASSY)

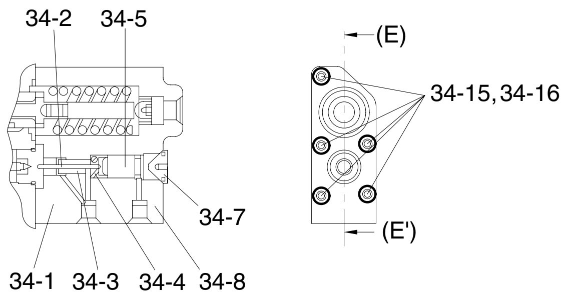
300L2MC18

4	Spool-arm 1	14-11	Plug	43	Poppet 1-check valve
12	Spool-arm regeneration	14-12	Pilot piston	44	Spring 1-check valve
14	Holding valve assy	14-13	Piston guide	45	Poppet 2-check valve
14-1	Poppet	14-14	Spring	46	Spring 2-check valve
14-2	Restrictor	14-15	Main piston	58	O-ring
14-3	Spring	14-16	Plug	61	O-ring
14-4	C-ring	14-17	Block	62	O-ring
14-5	Pilot poppet	15	Arm regeneration valve	64	Hex socket head bolt
14-6	Poppet guide	28	Plug	65	Hex socket head bolt
14-7	O-ring	29	Plug	78	Dust cap
14-8	Poppet seat	33	Plug	83	Plug
14-9	Back up ring	37	Cover A-pilot		
14-10	O-ring	38	Cover B1-pilot		

· MCV TYPE 3



E-E' (ARM & ARM REGENRATION)

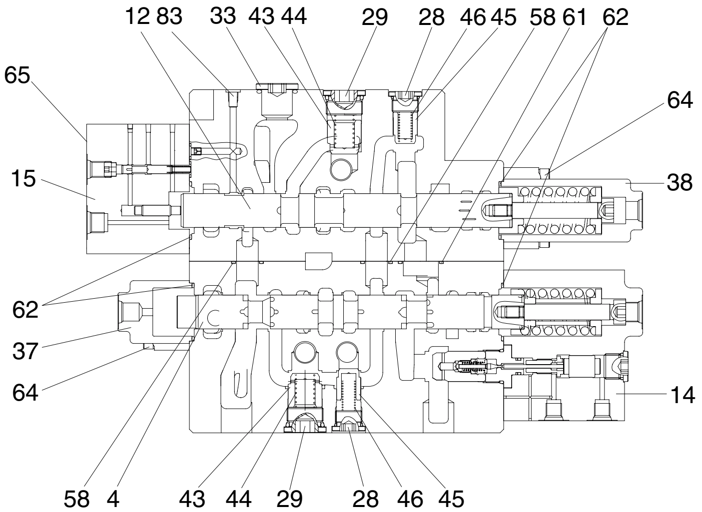


34 DETAIL (HOLDING ASSY)

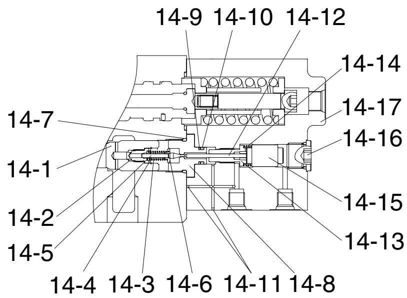
300L2MC113

10	Spool-arm 1	25	Poppet 2-check valve	34-5	Piston 2-holding
11	Spool-arm regeneration	26	Spring 2-check valve	34-7	Plug
15	Cover A-pilot	27	Holding kit B	34-8	Plug
16	Cover B1-pilot	27-1	Poppet	34-15	Socket bolt
19	Arm-regeneration	27-2	Spring	34-16	Spring washer
19-1	Block-regeneration	27-3	Poppet guide	45	Orifice-plug
19-2	Piston-cut off	27-4	Pilot poppet	55	Plug
19-3	Stopper-regeneration	27-5	Poppet seat	57	O-ring
19-4	Spool-regeneration	27-6	C-ring	61	O-ring
19-5	Spring-regeneration	27-7	Restrictor-lock valve	63	O-ring
19-6	Plug	27-8	O-ring	65	O-ring
19-7	Socket bolt	27-9	O-ring	67	O-ring
19-8	Spring wahser	27-10	Back up ring	68	O-ring
19-9	Pin-regeneration	34	Holding kit A1	73	Hex socket head bolt
20	Plug	34-1	Block-holding P1	74	O-ring
21	Poppet 1-check valve	34-2	Piston 1-holding	79	Washer
23	Spring 1-check valve	34-3	Guide piston-holding	94	Plug
24	Plug	34-4	Spring 1-lock valve		

· MCV TYPE 4



E-E' (ARM & ARM REGENRATION)

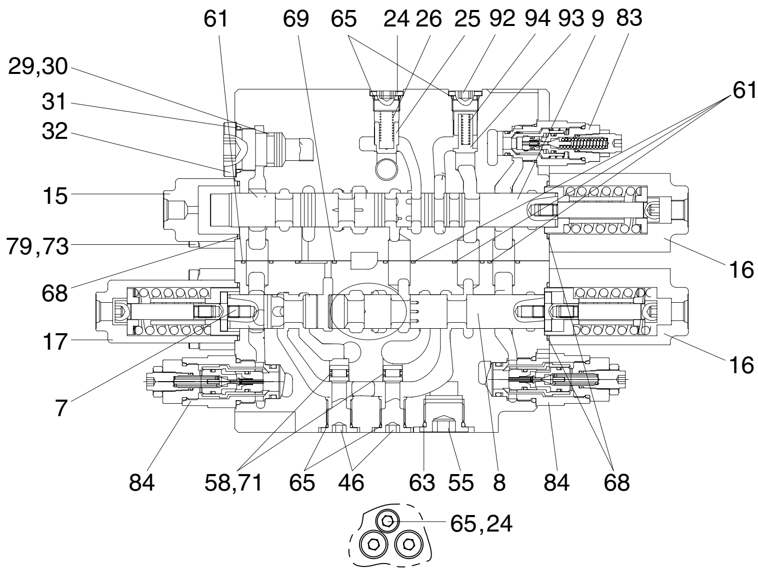


14 DETAIL (HOLDING VALVE ASSY)

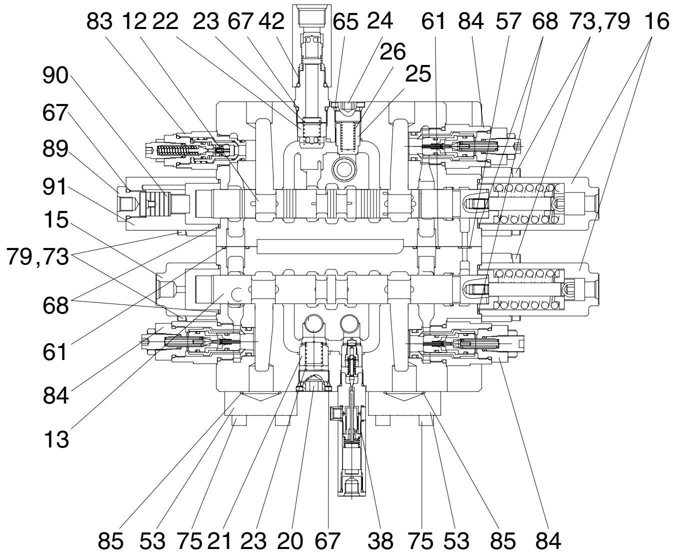
300L2MC218

4	Spool-arm 1	14-11	Plug	43	Poppet 1-check valve
12	Spool-arm regeneration	14-12	Pilot piston	44	Spring 1-check valve
14	Holding valve assy	14-13	Piston guide	45	Poppet 2-check valve
14-1	Poppet-main	14-14	Spring	46	Spring 2-check valve
14-2	Restrictor	14-15	Main piston	58	O-ring
14-3	Spring-pilot	14-16	Plug	61	O-ring
14-4	C-ring	14-17	Block	62	O-ring
14-5	Pilot poppet	15	Arm regeneration valve	64	Hex socket head bolt
14-6	Poppet guide	28	Plug	65	Hex socket head bolt
14-7	O-ring	29	Plug	83	Plug
14-8	Poppet seat	33	Plug		
14-9	Back up ring	37	Cover A-pilot		
14-10	O-ring	38	Cover B1-pilot		

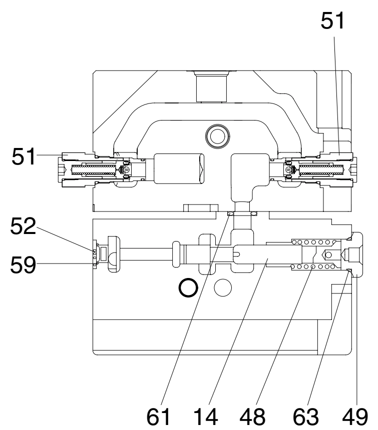
· MCV TYPE 1



D-D' (SWING PRIORITY-BOOM2 & ARM2)



F-F' (OPTION & BUCKET)

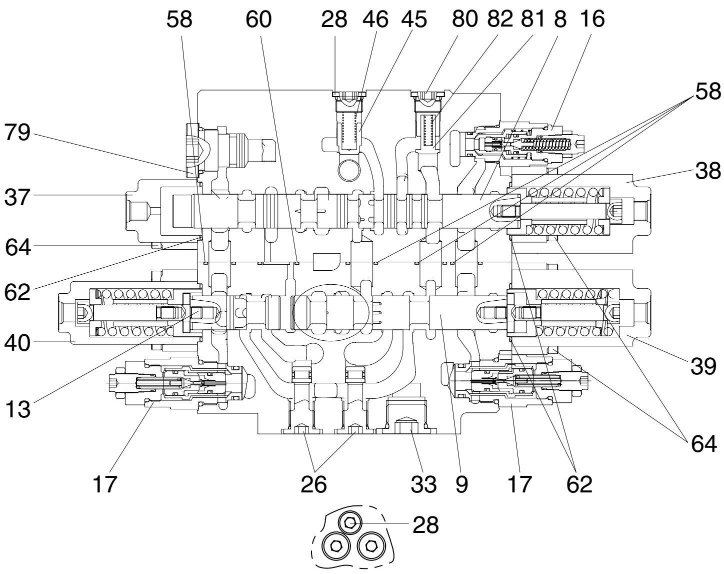


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

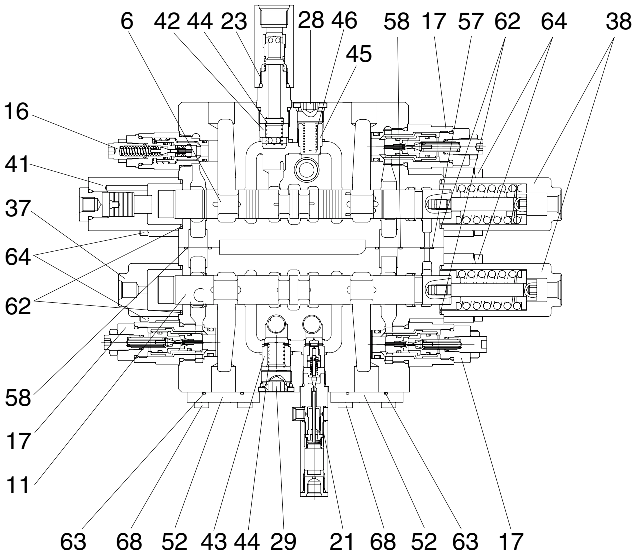
300L2MC14

7	Spool-swing priority
8	Spool-boom 2
9	Spool-arm 2
12	Spool-bucket
13	Spool-option
14	Spool-bypass cut
15	Cover A-pilot
16	Cover B1-pilot
17	Cover B2-pilot
20	Plug
21	Poppet 1-check valve
22	Poppet-L/C bucket
23	Spring 1-check valve
24	Plug
25	Poppet 2-check valve
26	Spring 2-check valve
29	Back up ring
30	O-ring
31	O-ring
32	Plug
38	Load check valve assy
42	Check valve
46	Plug
48	Spring-bypass cut spool
49	Plug-bypass cut spool
51	Negative control valve
52	Plug
53	Flange
55	Plug
57	O-ring
58	O-ring
59	O-ring
61	O-ring
63	O-ring
65	O-ring
67	O-ring
68	O-ring
69	O-ring
71	Back-up ring
73	Hex socket head bolt
75	Socket bolt
79	Washer
83	Overload relief valve
84	Overload relief valve
85	O-ring
89	Plug
90	Piston
91	Pilot cover C1
92	Plug
93	Poppet
94	Spring

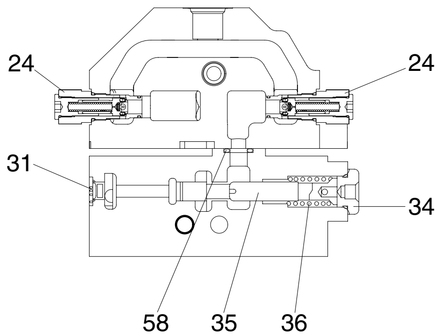
· MCV TYPE 2



D-D' (SWING PRIORITY-BOOM 2 & ARM 2)



F-F' (OPTION & BUCKET)

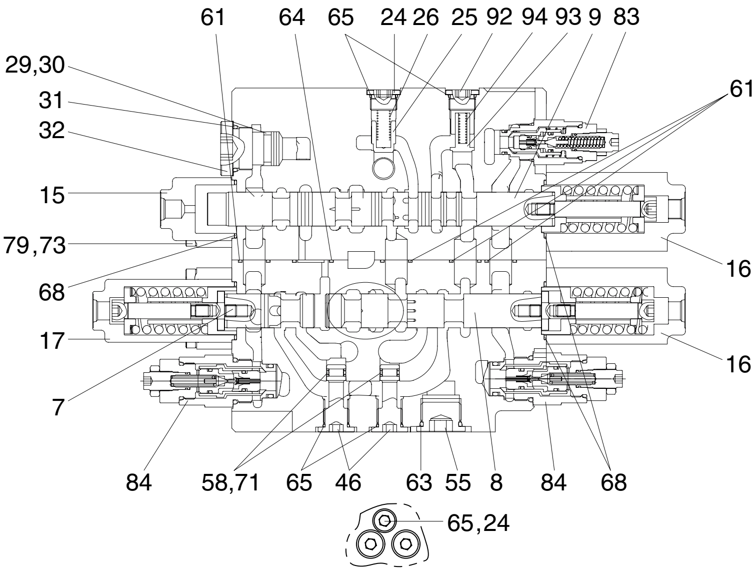


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

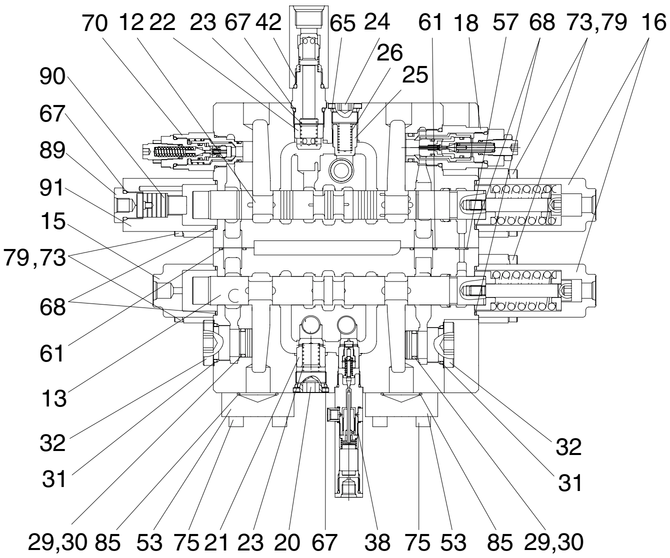
300L2MC19

6	Spool-bucket
8	Spool-arm 2
9	Spool-boom 2
11	Spool-option
13	Spool-swing priority
16	Overload relief valve
17	Overload relief valve
21	Option logic valve assy
23	Spool-bypass cut
24	Negative control valve
26	Plug
28	Plug
29	Plug
31	Plug
33	Plug
34	Plug-bypass cut spool
35	Spool-bypass cut
36	Spring-bypass cut spool
37	Cover A-pilot
38	Cover B1-pilot
39	Cover B2-pilot
40	Cover B3-pilot
41	Pilot cover C1
42	Poppet L/C-bucket
43	Poppet 1-check valve
44	Spring 1-check valve
45	Poppet 2-check valve
46	Spring 2-check valve
52	Flange
57	O-ring
58	O-ring
60	O-ring
62	O-ring
63	O-ring
64	Hex socket head bolt
67	Hex socket head bolt
68	Hex socket head bolt
79	Plug
80	Plug
81	Poppet 3-check valve
82	Spring 3-check valve

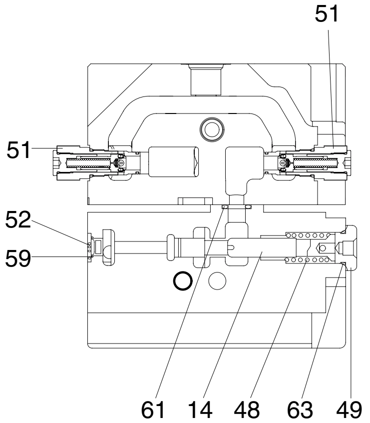
· MCV TYPE 3



D-D' (SWING PRIORITY-BOOM2 & ARM2)



F-F' (OPTION & BUCKET)

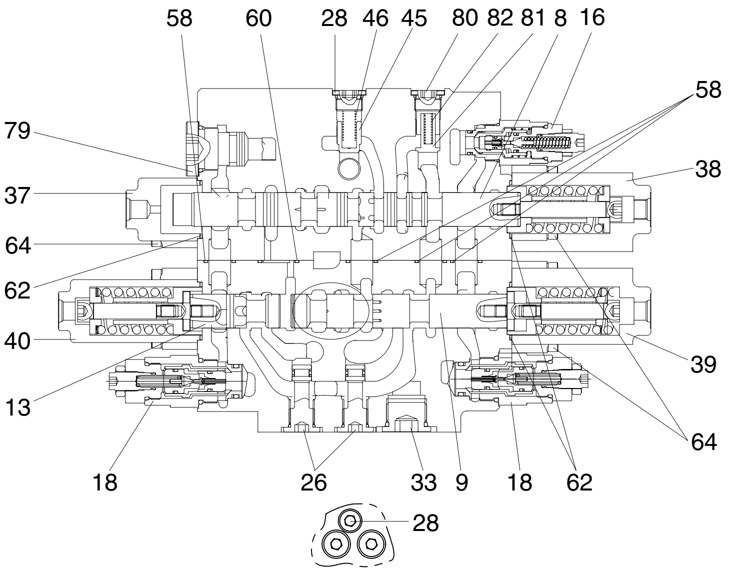


G-G' (CENTER BYPASS CUT-OFF & NEGATIVE CONTROL)

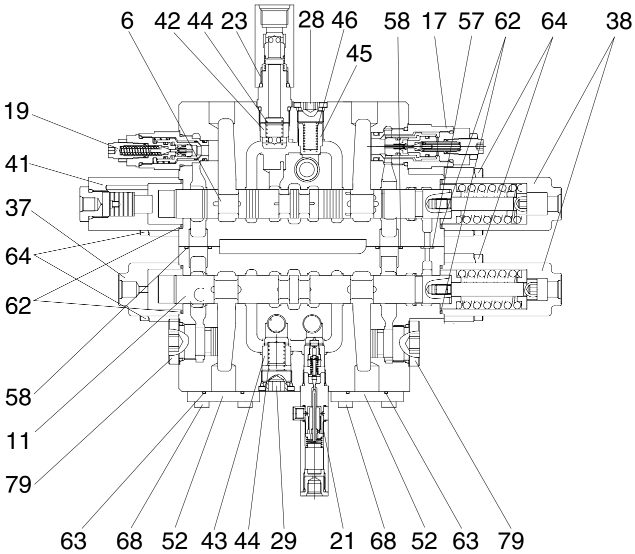
300L2MC114

7	Spool-swing priority
8	Spool-boom 2
9	Spool-arm 2
12	Spool-bucket
13	Spool-option
14	Spool-bypass cut
15	Cover A-pilot
16	Cover B1-pilot
17	Cover B3-pilot
18	Overload relief valve
20	Plug
21	Poppet 1-check valve
22	Poppet-L/C bucket
23	Spring 1-check valve
24	Plug
25	Poppet 2-check valve
26	Spring 2-check valve
29	O-ring
30	Back-up ring
31	O-ring
32	Plug
38	Load check valve assy
42	Check valve
46	Plug
48	Spring-bypass cut spool
49	Plug-bypass cut spool
51	Negative control valve
52	Plug
53	Flange
55	Plug
57	O-ring
58	O-ring
59	O-ring
61	O-ring
63	O-ring
65	O-ring
67	O-ring
68	O-ring
70	Overload relief valve
71	Back-up ring
73	Hex socket head bolt
75	Socket bolt
79	Washer
83	Overload relief valve
84	Overload relief valve
85	O-ring
89	Plug
90	Piston
91	Pilot cover C1
92	Plug
93	Poppet
94	Spring

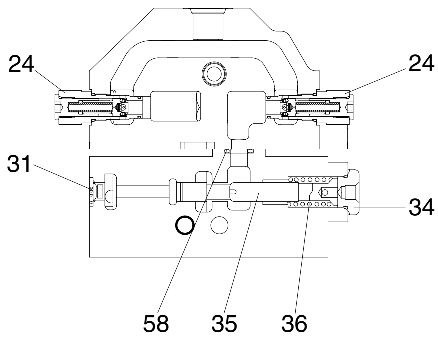
· MCV TYPE 4



D-D' (SWING PRIORITY-BOOM 2 & ARM 2)



F-F' (OPTION & BUCKET)



G-G' (CENTER BYPASS CUT-OFF
& NEGATIVE CONTROL)

300L2MC219

6	Spool-bucket
8	Spool-arm 2
9	Spool-boom 2
11	Spool-option
13	Spool-swing priority
18	Overload relief valve
19	Overload relief valve
21	Option logic valve
23	Spool-bypass cut
24	Negative control valve
26	Plug
28	Plug
29	Plug
31	Plug
33	Plug
34	Plug-bypass cut spool
35	Spool-bypass cut
36	Spring-bypass cut spool
37	Cover A-pilot
38	Cover B1-pilot
39	Cover B2-pilot
40	Cover B3-pilot
41	Pilot cover C1
42	Poppet L/C-bucket
43	Poppet 1-check valve
44	Spring 1-check valve
45	Poppet 2-check valve
46	Spring 2-check valve
52	Flange
57	O-ring
58	O-ring
60	O-ring
62	O-ring
63	O-ring
64	Hex socket head bolt
68	Hex socket head bolt
79	Plug
80	Plug
81	Poppet 3-check valve
82	Spring 3-check valve

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) As hydraulic equipments, not only this valve are constructed precisely with very small clearances, disassembling and assembling must be carefully done in a clean place with preventing dusts and contaminants from entering.

(2) Prepare the section drawing and study the structure of MCV and then start disassembly work.

(3) When removing the control valve from the machine, install caps on every ports, and wash the outside of the assembly with confirming the existence of caps before disassembling.
Prepare a suitable table and some clean papers or rubber mat on the table for disassembling.

(4) If the components are left disassembled, they may get rust. Make sure to measure the greasing and sealing.

(5) For carrying the control valve, never hold with pilot cover or relief valve and overload relief valve and carefully treat the valves.

(6) Do not tap the valve even if the spool movement is not smooth.

(7) Several tests for such as relief characteristics, leakage, overload relief valve setting and flow resistance are required after re-assembling, and the hydraulic test equipments for those tests are needed.
Therefore, do not disassemble what cannot perform test adjustment, even if it can disassemble.

※ Be sure to observe the mark (※) description in the disassembly and assembly procedures.

2) TOOLS

Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	27 and 32
Spanner	Each 1 piece	26 and 32 (main relief valve)

3) DISASSEMBLY

(1) Removing spool

① **The case of the section without holding valve**
Instruction for removing the travel spool (for instance) is follows :
Remove two hex socket bolts by 5 ㎜ allen key wrench, then remove pilot cover.

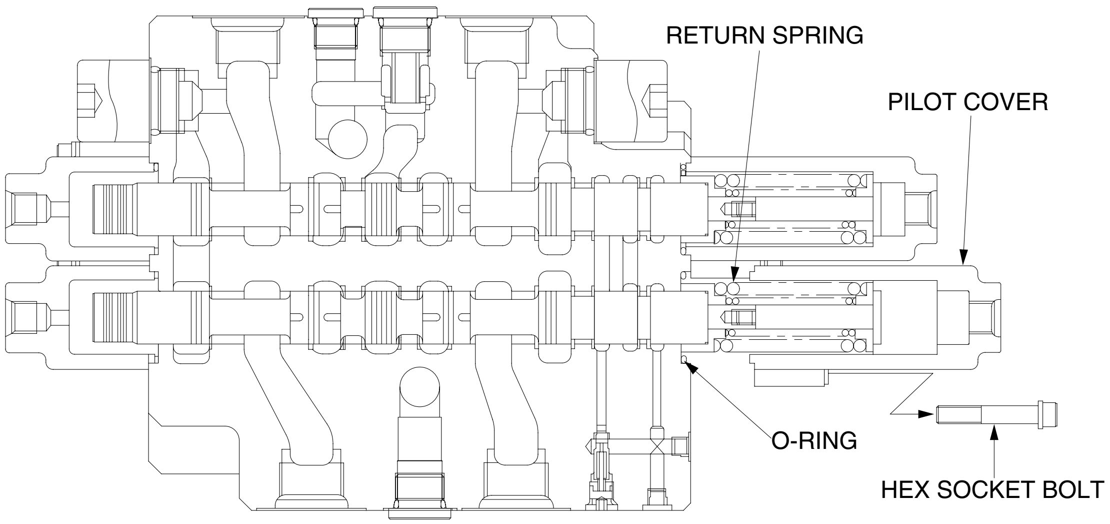
※ Pay attention not to lose the O-ring under the pilot cover.

As the return spring portion of travel spool comes out, pull the spring straight slowly, by which spool assembly is removed.

※ The spools have to remove from the spring side.

Other spools (no lock valve type) can be removed in the same manner but the swing priority spool is reversed.

※ When spool replace, do not disassemble of a spool by any cases. Please replace by spool assembly.
※ Please attach using a tag etc. in the case of two or more kinds of spool replace, and understand a position.



② **The case of the section with holding valve**

Instruction for removing the boom spool (for instance) is follows :

Remove five hex socket bolts with washer by 5 ㎜ allen key wrench. Then remove pilot cover with internal parts below figure.

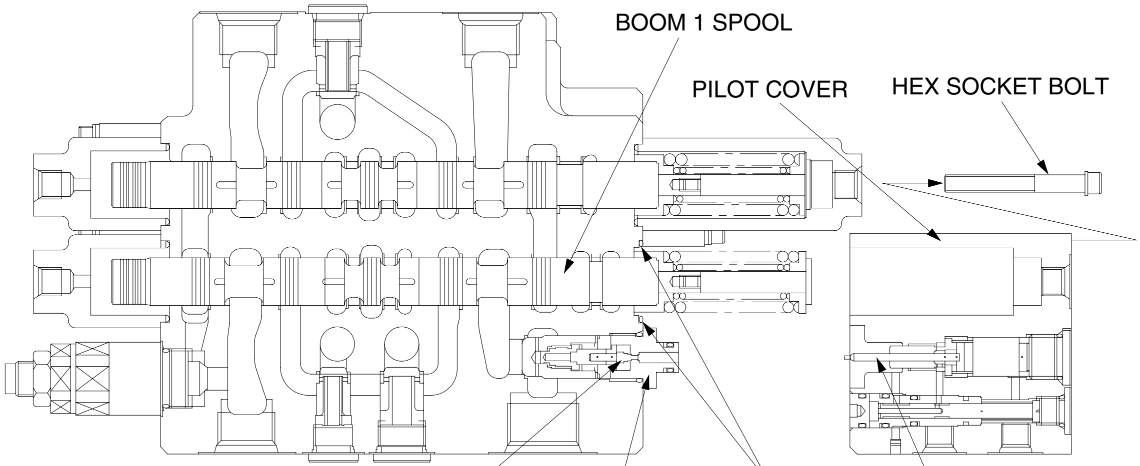
※ Be careful not to separate O-ring and poppet under pilot cover.

※ Pay attention not to damage the exposed piston A under pilot cover.

As the return spring portion of boom 1 spool comes out, pull the spring straight slowly, by which spool assembly is removed.

※ The spools have to remove form the spring side.

※ When spool replace, do not disassemble of a spool by any cases, please replace by spool assembly.



29098MC02

(2) Removing holding valve

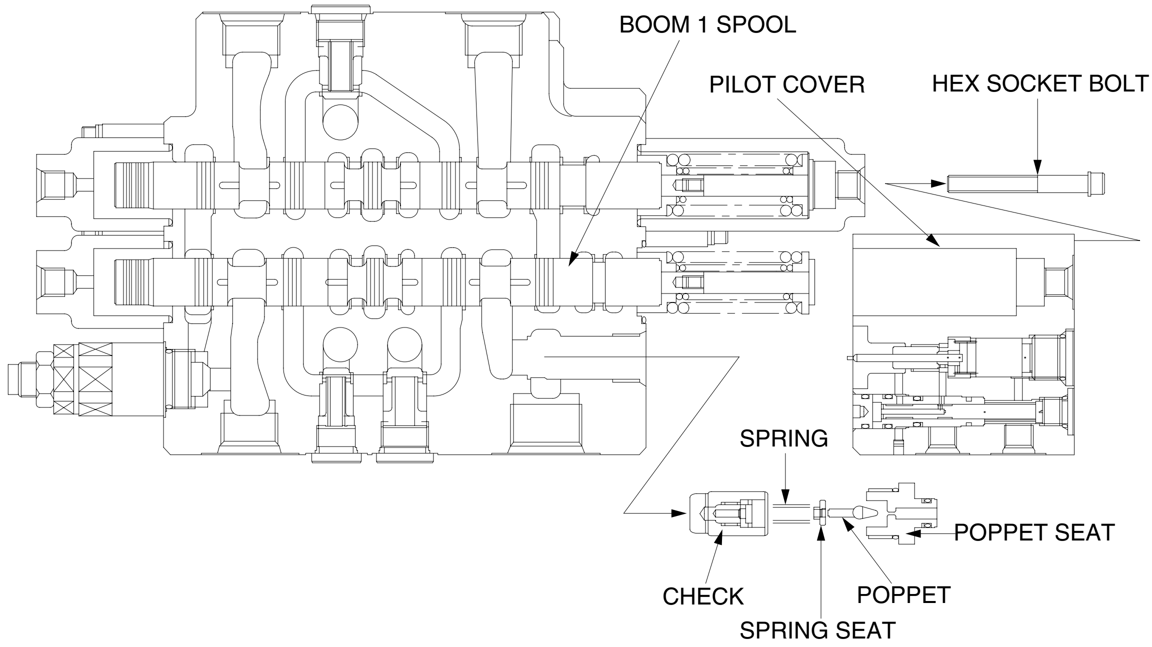
Remove the pilot cover with the holding valve as described on previous page.

※ Do not disassembled internal parts of the pilot cover.

Loosen the poppet seat by 26 mm spanner and remove the poppet, the spring seat, the spring and the check in order.

※ Pay attention not to lose the poppet.

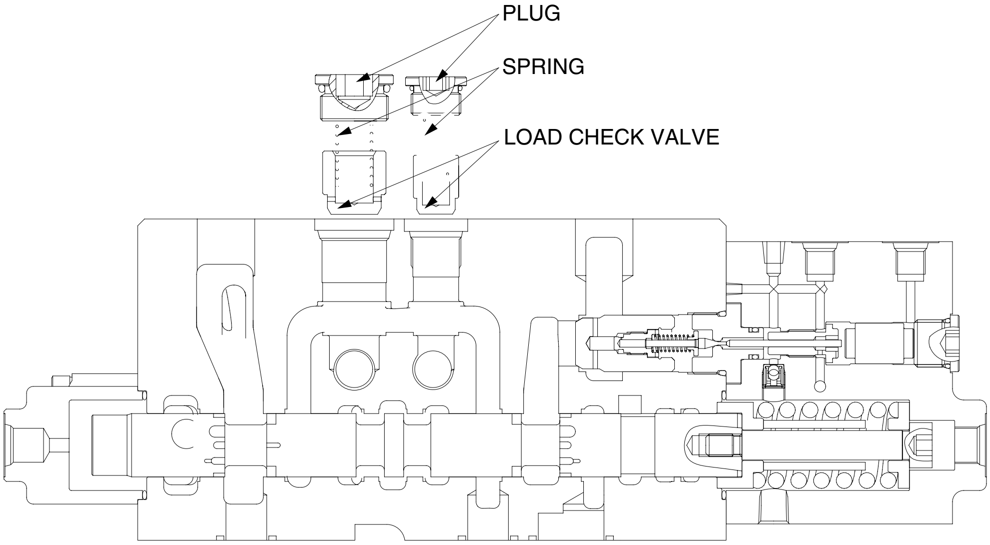
※ Do not disassembled internal parts of the check because the plug, functioning orifice, can damage easily.



(3) Removing load check valve and negative relief valve

① The load check valve

- Fix the body to suitable work bench. Loosen the plug by 10 ㎜ allen key wrench.
- Remove the spring and the load check valve with pincers or magnet.

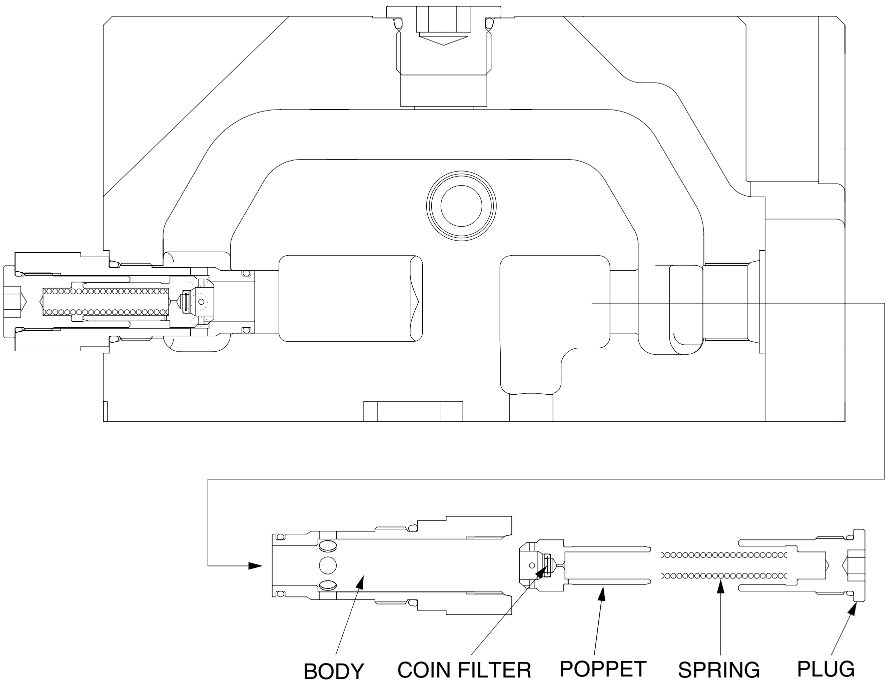


29098MC04

② The negative relief valve

Loosen the socket by 12 ㎜ allen key wrench.

Remove the spring, the spring holder, the piston and the negative control poppet.



29098MC05

※ Do not disassemble the coin filter inside the negative control poppet because of forced fit.

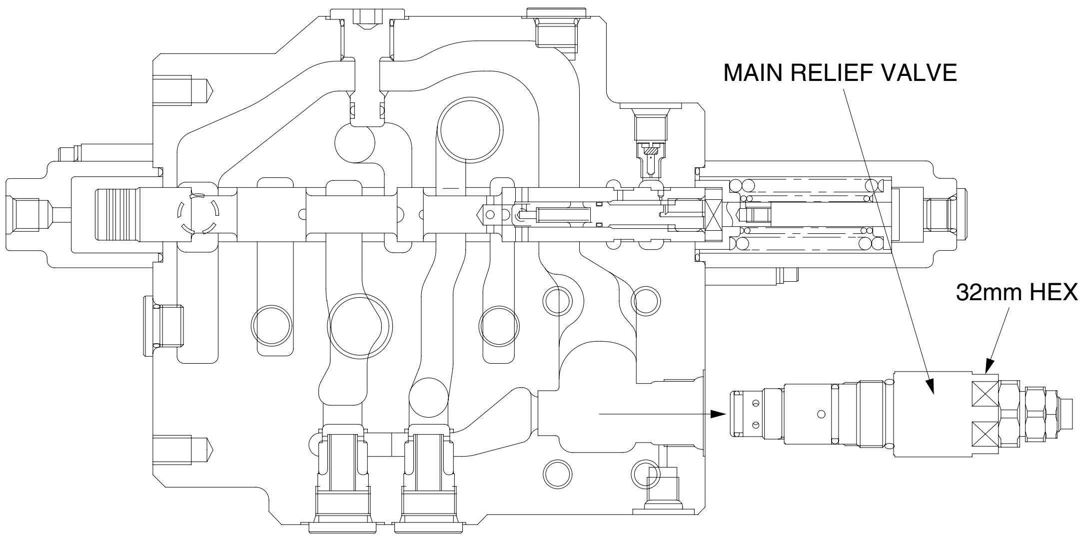
(4) Removing main relief valve and overload relief valve

Fix the valve body to suitable work bench. Remove the main relief valve by 32 mm spanner and remove the overload relief valve 32 mm spanner (standard) or 36 mm spanner (optional).

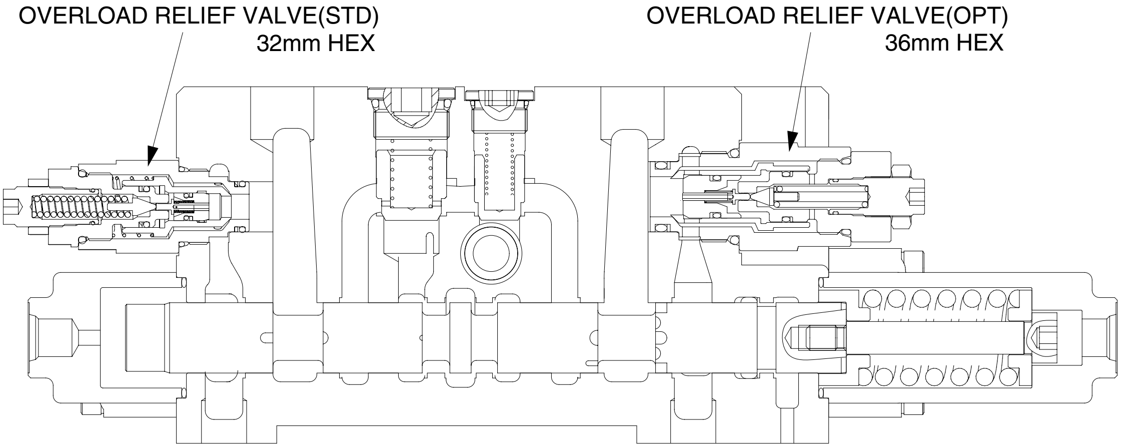
※ When disassembled, tag the relief valve for identification so that they can be reassembled correctly.

※ Pay attention not to damage seat face of disassembled main relief and overload relief valve.

※ Main relief and overload relief valve are very critical parts for performance and safety of the machine. Also, the pressure set is very difficult. Therefore, any abnormal parts are found, replace it with completely new relief valve assembly.



29098MC06



29098MC07

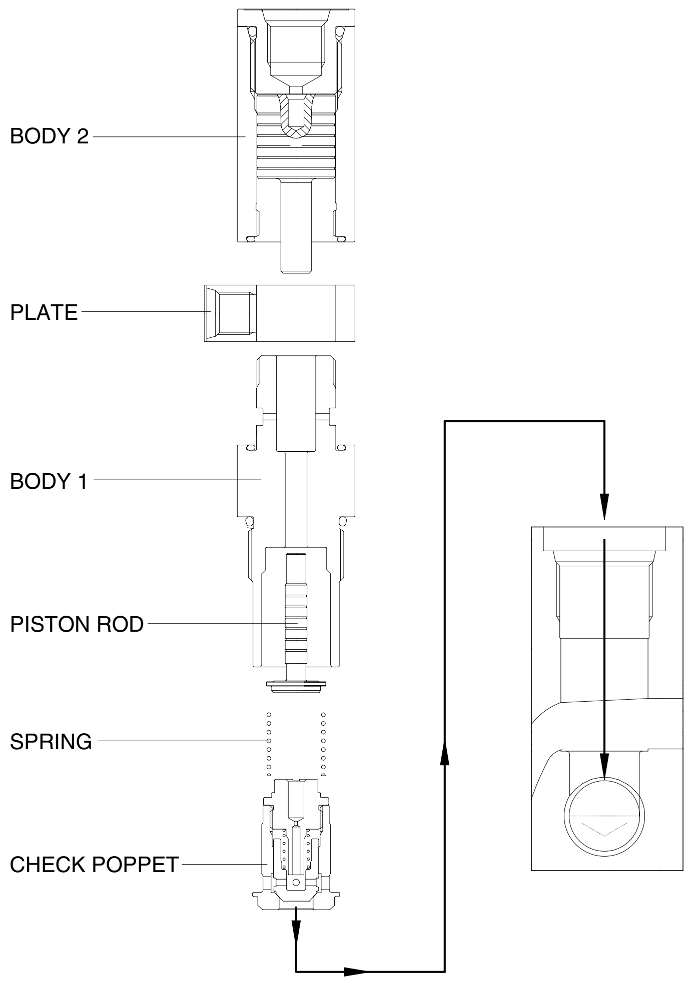
(5) Removing the swing logic valve and bucket logic valve

- Fix the valve body to suitable work bench.
- Loosen the body 2 by 32 ㎜ spanner (swing logic valve) or 24 ㎜ spanner (bucket logic valve) and remove it.
- Remove the banjo plate.
- Loosen the body 1 as the same spanner of body 2 and remove it.
- Remove the check poppet and spring.

※ Pay attention not to damage seat face of removed check poppet.

※ Do not disassemble the check poppet and replace it with a assembly in case any abnormal parts are found.

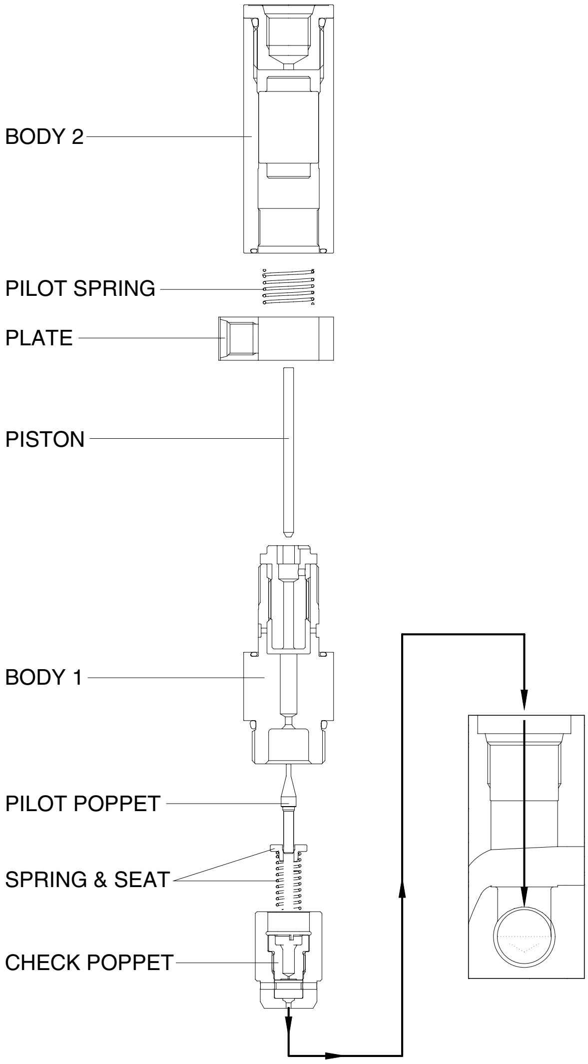
※ Pay attention not to lose and separation while disassembling and assembling.



29098MC08

(6) Removing the option ON/OFF valve

- Fix the valve body to suitable work bench.
- Loosen the body 2 by 24 mm spanner and remove it.
- Remove the banjo plate.
- Loosen the body 1 as the same spanner of body 2 and remove it.
- Remove the pilot poppet, spring and seat.
- Remove the check poppet.



29098MC09

4) ASSEMBLY

(1) Precaution

① When you assemble, please wash all parts by pure cleaning liquid.
② For re-assembling, basically use only bland new seals for all portions.
③ Apply grease or hydraulic oil to the seals and seal fitting section to make the sliding smooth, unless otherwise specified.
④ Pay attention not to roll the O-ring when fitting and it may cause oil leakage.
⑤ Do not tap the valve even if the spool movement is not smooth.
⑥ Prepare the section drawing and study the structure of MCV and then start disassembly work.
⑦ Tighten bolt and parts with thread for all section by torque wrench to the respective tightening torque.

(2) Assembly

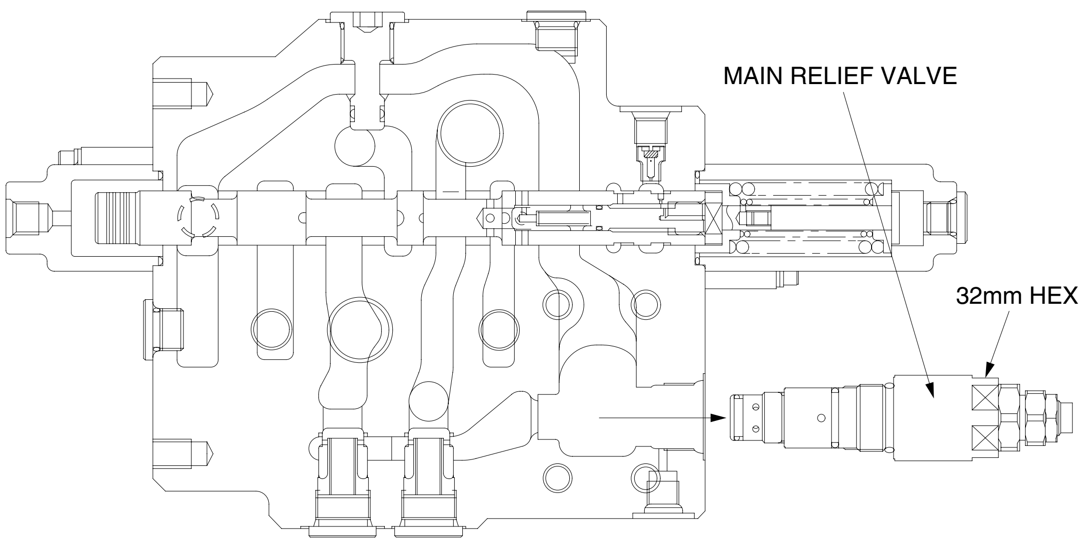
Explanation only is shown for the assembly, refer to the figures shown in the previous disassembly section.

① Main relief and overload relief valve

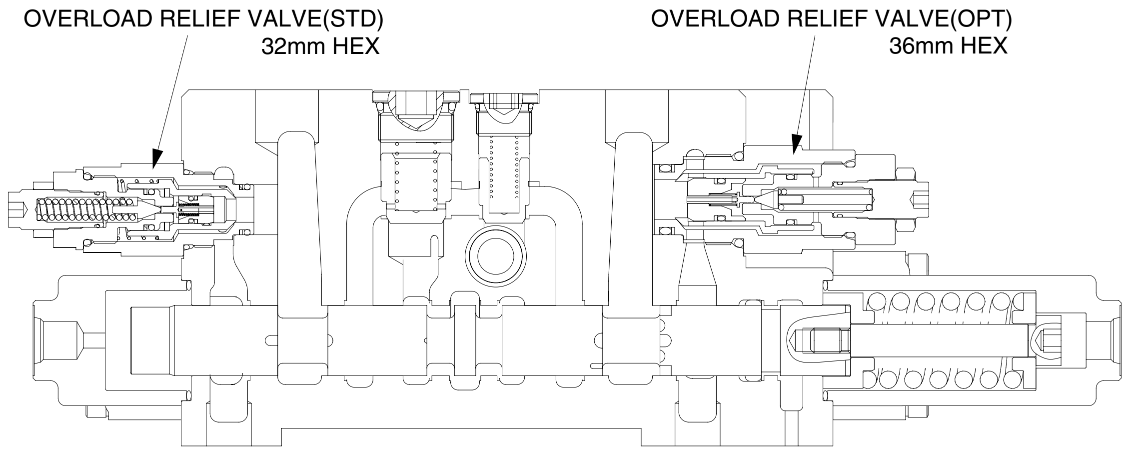
Fix the valve body to suitable work bench.

Install main relief valve and overload relief valve into the body and tighten to the specified torque by 32 mm torque wrench.

· Tightening torque : 8~9 kgf·m (57.8~65.1 lbf·ft)



29098MC06



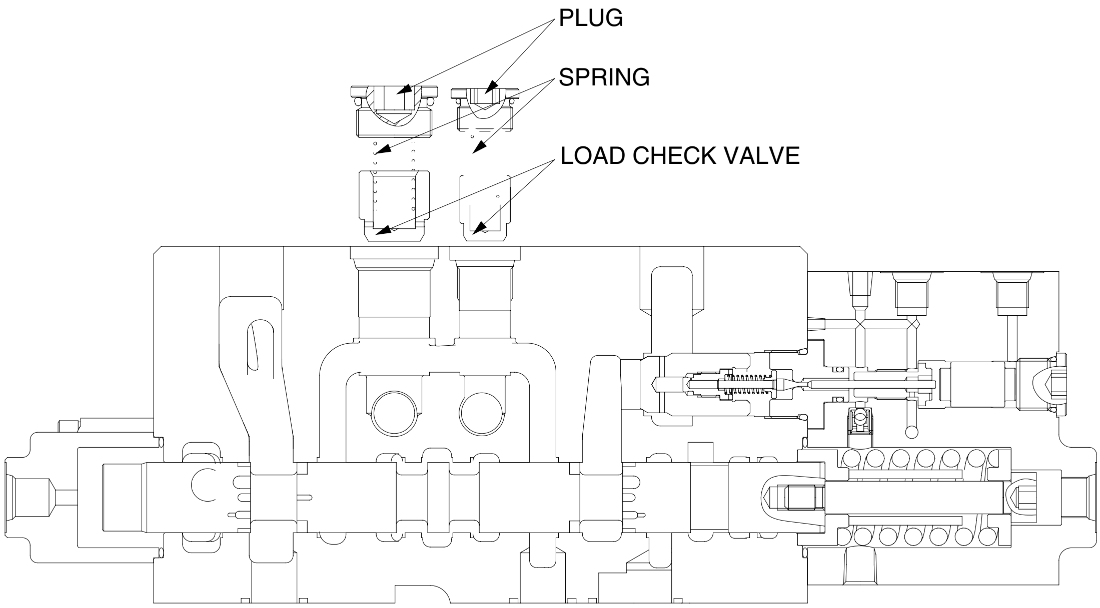
29098MC07

② Load check valve

Assemble the load check valve and spring.

Put O-rings on to plug and tighten plug to the specified torque by 10 ㎜ torque wrench.

· Tightening torque : 6~7 ㎏f·m (43.4~50.6 lbf·ft)

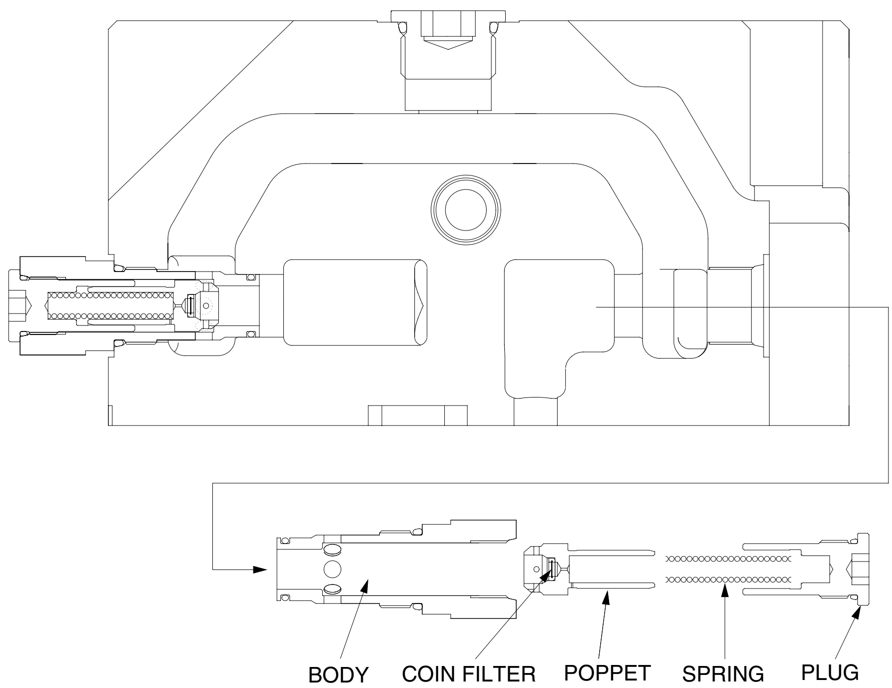


29098MC04

③ Negative control relief valve

Assemble the nega-con poppet, piston, spring holder and spring into body in order and tighten the socket to the specified torque by 12 mm torque wrench.

· Tightening torque : 8~9 ㎏f·m (57.8~65.1 lbf·ft)



29098MC05

④ Holding valves

Assemble the check, spring seat and poppet into the hole of valve body in order.

Tighten the poppet seat to the specified torque by 25 mm torque wrench.

· Tightening torque : 6~7 kgf·m (43.4~50.6 lbf·ft)

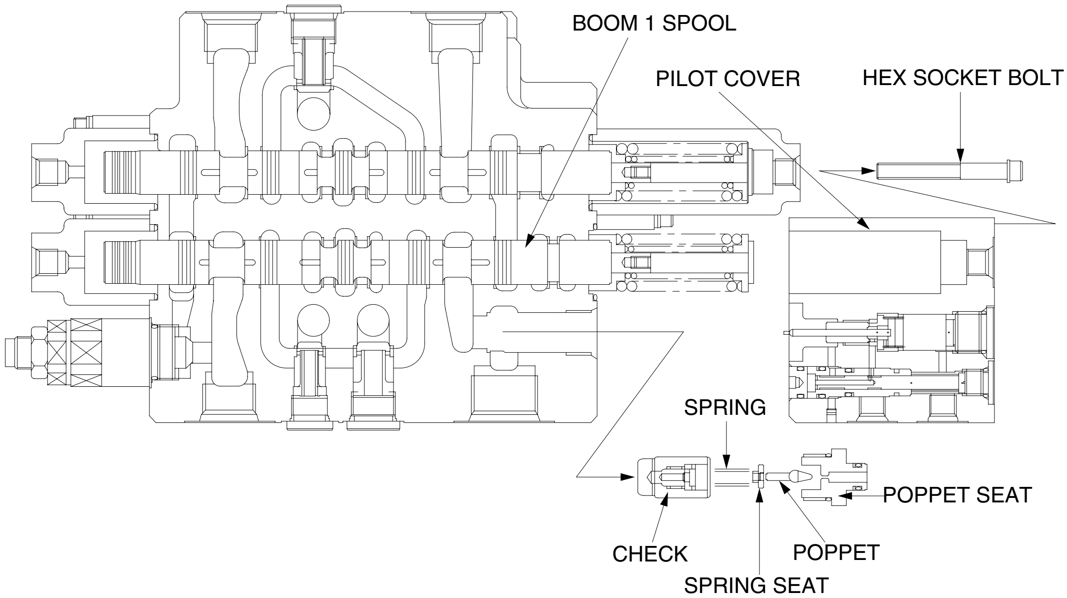
Fit the "piston A" under pilot cover with internal parts into hole on the poppet seat.

Tighten hexagon socket head bolt to specified torque by 5 mm torque wrench.

· Tightening torque : 1~1.1 kgf·m (7.23~7.96 lbf·ft)

※ Pay attention poppet not to separation.

※ Confirm that O-rings have been well fitted on the groove of body. (apply grease on O-ring)



29098MC03

⑤ Main spool

Put the spool position upward and fix it to the vise. Carefully insert the previously assembled spool assemblies into their respective bores within of body.

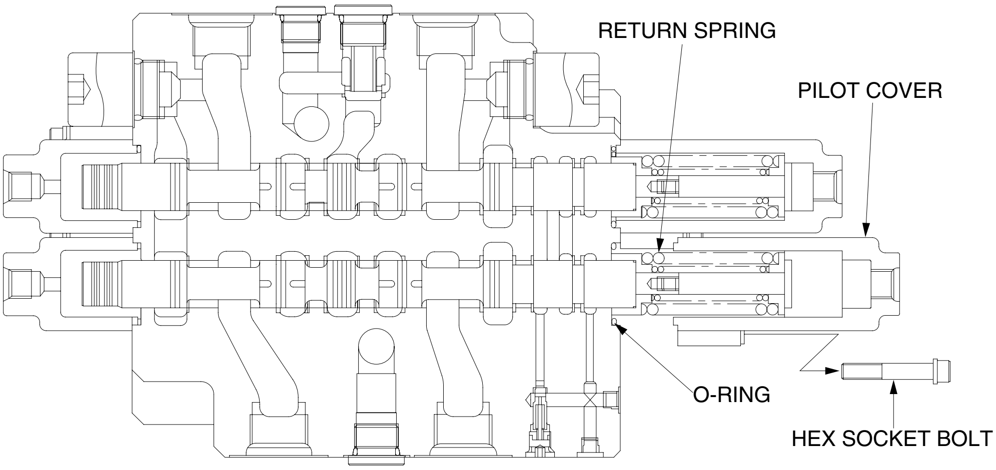
Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.

Fit the pilot cover to the groove of the valve body.

Confirm that O-rings have been fitted on the groove of body. (apply grease on O-ring)

Tighten the two socket bolt to the specified torque by 5 mm torque wrench.

· Tightening torque : 1~1.1 kgf·m (7.23~7.96 lbf·ft)



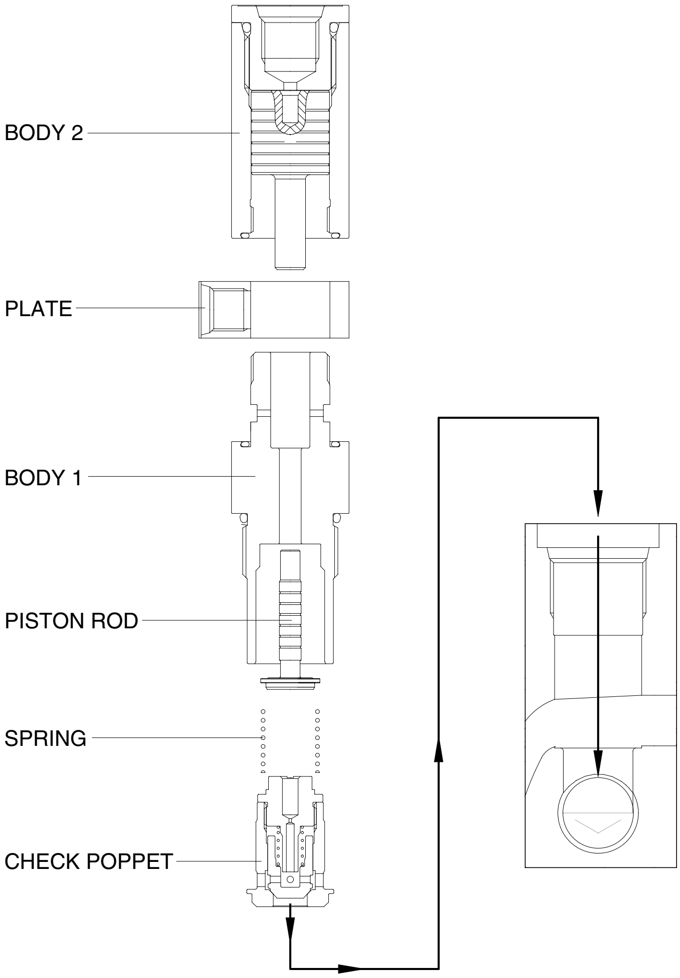
29098MC01

⑥ **The swing logic valve and bucket logic valve**

- Assemble the piston rod, spring and check poppet into the body 1 in order.
- Install the body 1 assembly into valve body and tighten to the specified torque.
  · Tightening torque : 2.9 kgf·m (21.0 lbf·ft)
- Assemble the banjo plate.

※ Confirm O-ring has been seated on the groove of banjo plate.

- Tighten the body 2 to the specified torque.
  · Tightening torque : 1.5 kgf·m (10.8 lbf·ft)



29098MC08

⑦ **Option ON/OFF valve**

- Assemble the check poppet into the valve body.

※ Push the check poppet about half of hole.

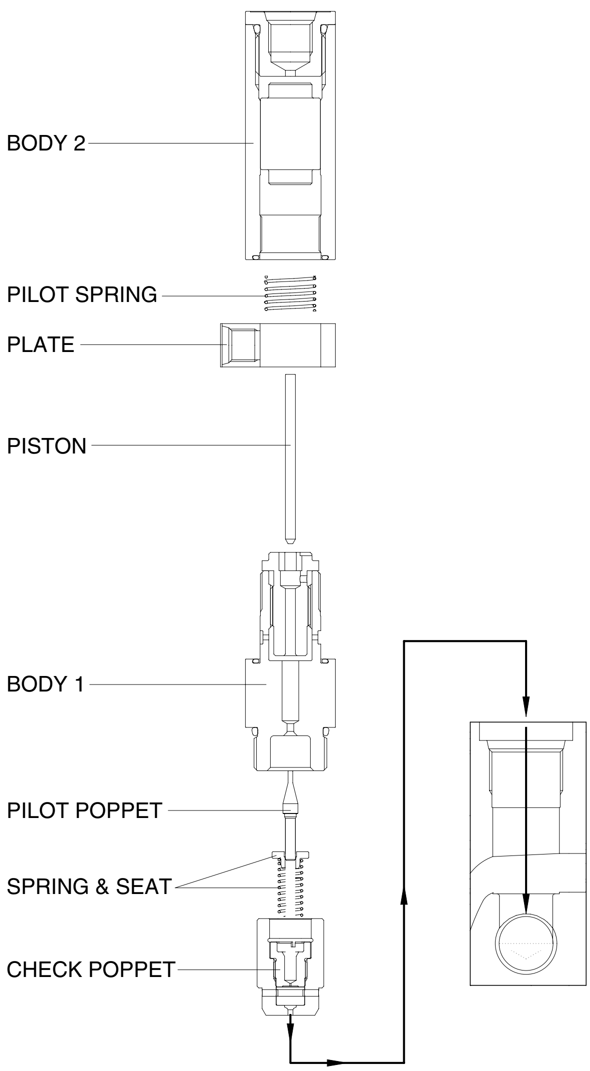
- Assemble the pilot poppet, spring and seat into check poppet.

※ As it can not be fixed, hang it diagonally.

- Insert the end of pilot poppet into the machined center hole of body 1 and push it complete
- slowly. Then tighten to the specified torque.
  · Tightening torque : 2.9 kgf·m (21.0 lbf·ft)

※ Tighten socket piston.

- When push the piston to the end, confirm the repulsive spring force.
- Assemble the banjo plate.
- Put the pilot spring into body 2 and assemble it into body 1 and then tighten to the specified torque.
  · Tightening torque : 1.5 kgf·m (10.8 lbf·ft)



29098MC09

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

13031GE18

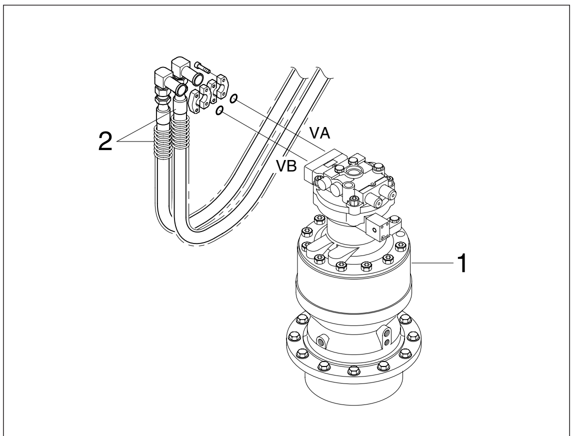
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Disconnect hose assembly (2).



2209A8SM21

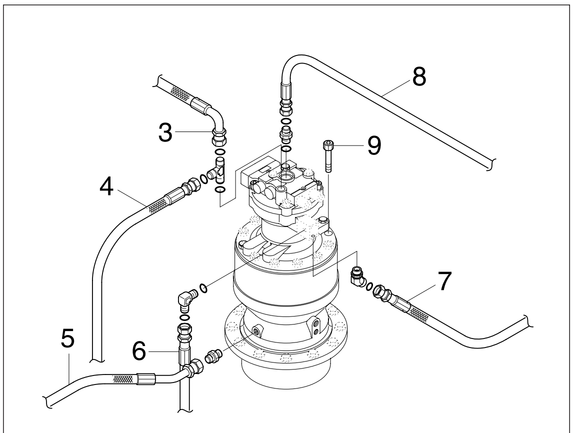
(5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).

· Motor device weight : 61 ㎏ (135 ℔)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.



2209A8SM22

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.

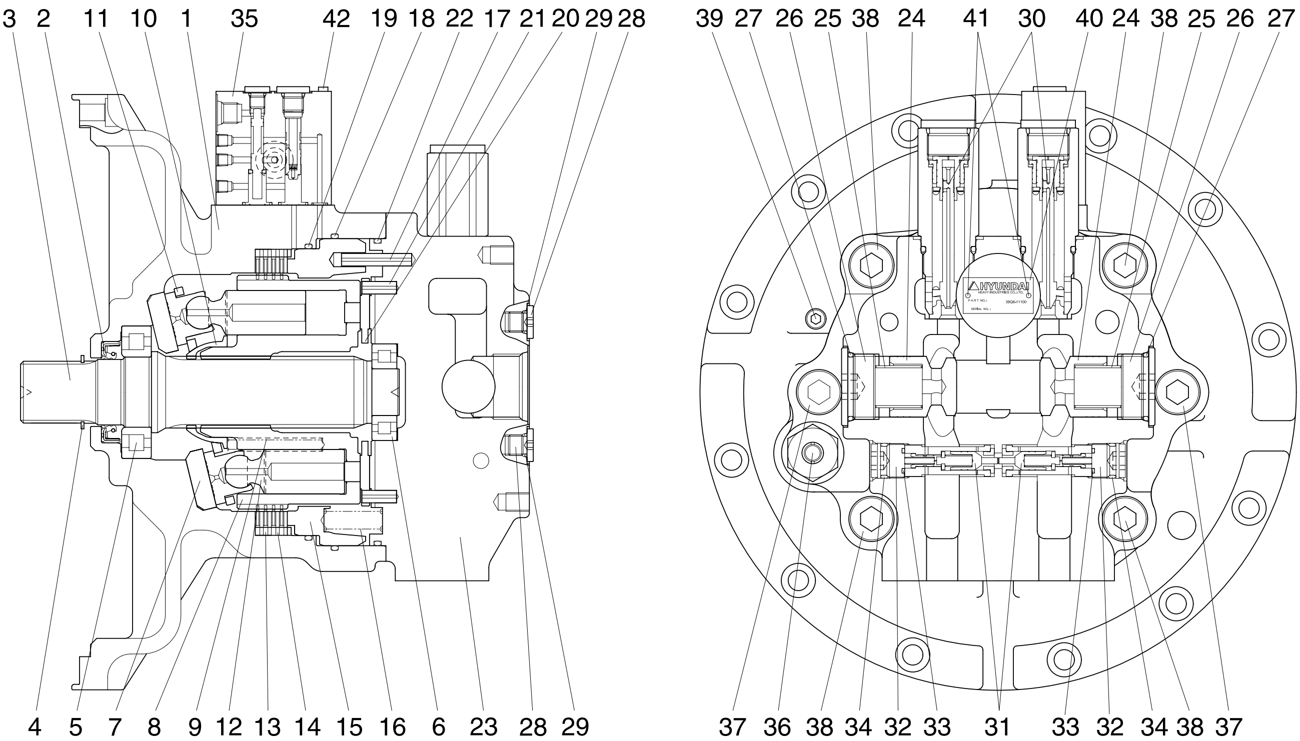
④ Start the engine, run at low idling and check oil come out from plug.

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



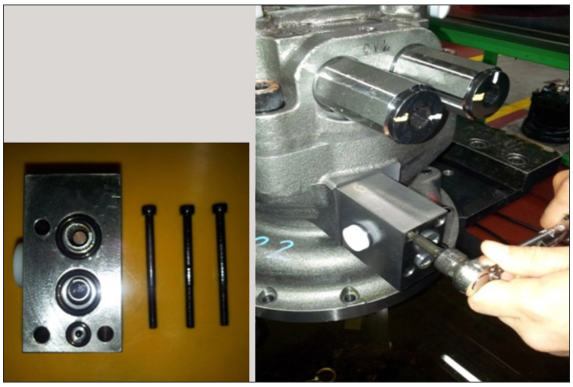
300L2SM02

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 (time delay valve, 42) and disassemble time delay valve assy (35) from casing (1).



2209A8SM51

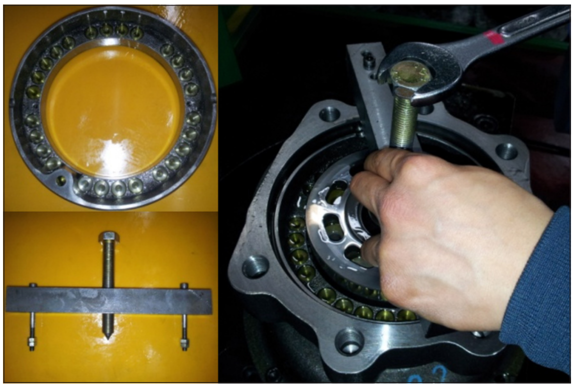
② Disassemble level gauge (36) from casing (1).

2209A8SM52

③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).

2209A8SM53

④ Disassemble spring (16) and using a jig, disassemble parking piston (15) from casing (1).



2209A8SM54

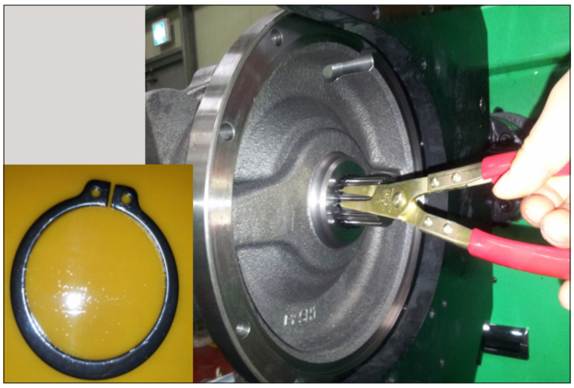
⑤ Disassemble respectively cylinder block sub (8), friction plate (13), separate plate (14) from casing (1).

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 (cylinder block, 9) from cylinder block (8).
- Ball guide × 1EA
- Spring × 9EA

2209A8SM60

(3) Disassemble valve casing sub

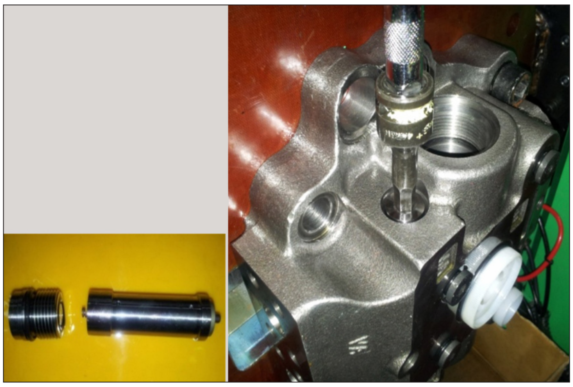
① Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).

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

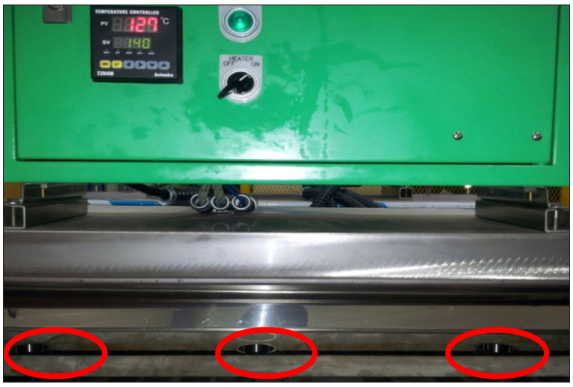
⑤ Disassemble plug (28), O-ring (29) from valve casing (23).

2209A8SM65

3) ASSEMBLING

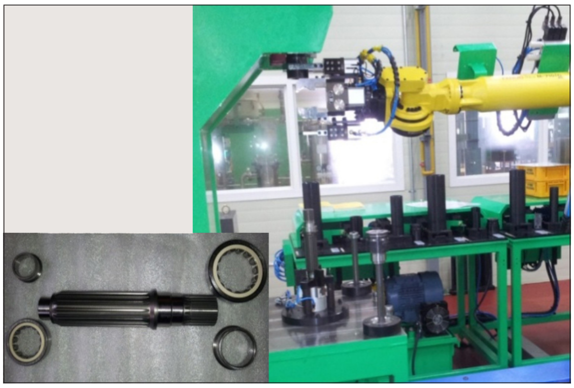
(1) Assemble shaft sub

① Put roller bearing (3) 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 (3) into shaft (5).

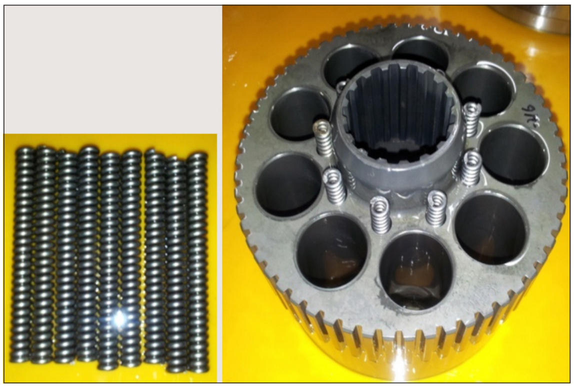


2209A8SM67

(2) Assemble cylinder block sub

① Assemble 9 springs (cylinder block, 9) into cylinder block (8).

· Spring × 9EA



2209A8SM68

② Assemble ball guide (10) into cylinder block (8).

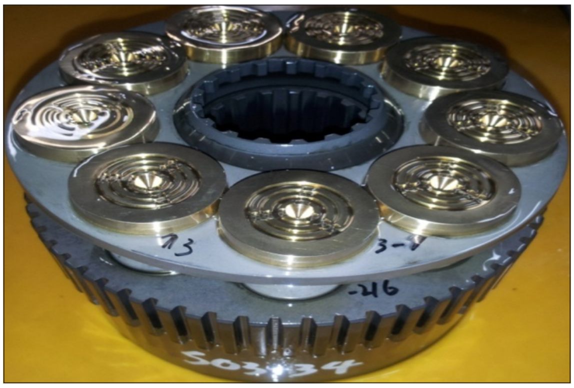
· Ball guide × 1EA

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.

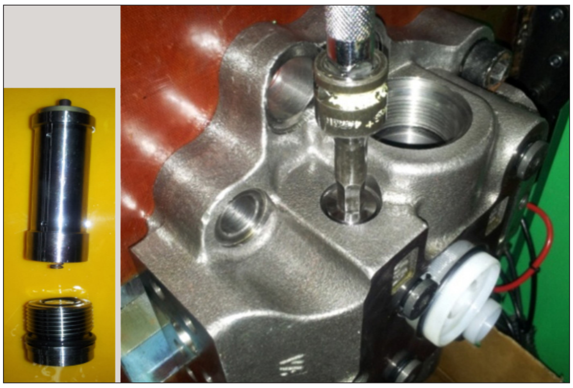

2209A8SM71

(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

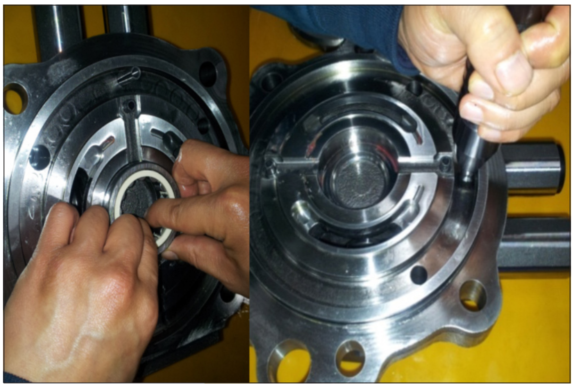
③ Using a torque wrench, assemble relief valve (30) 2 sets into valve casing (23).
- Relief valve (30) × 2EA
- Tightening torque : 18 ± 1.8 kgf · m (130 ± 13 lbf · ft)

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)

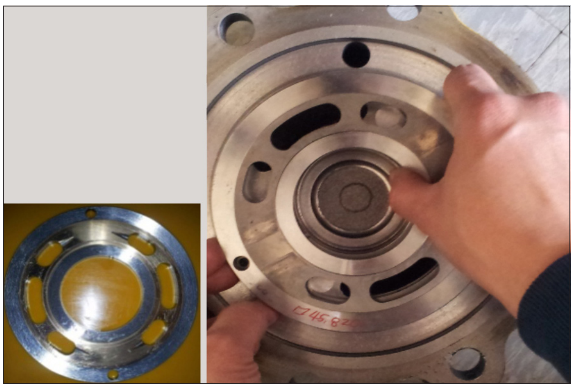
2209A8SM75

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).



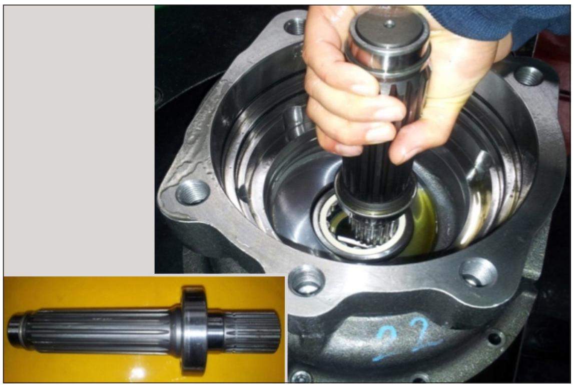
2209A8SM77

(4) Assemble drive shaft sub

① Using a jig, assemble oil sealing (2) into casing (1).

2209A8SM78

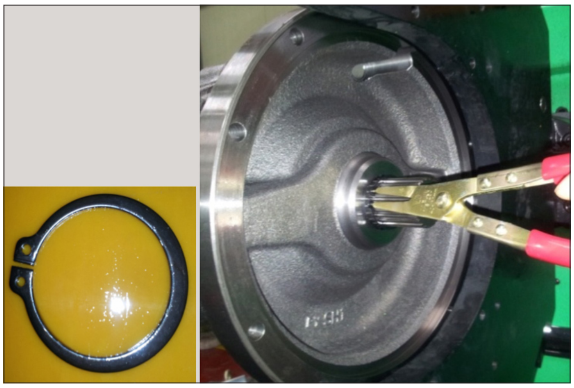
② Fit shaft sub (shaft+roller bearing) into casing (1).



2209A8SM79

③ Using a plier jig, assemble snap ring (4) to shaft (3).

· Snap ring × 1EA



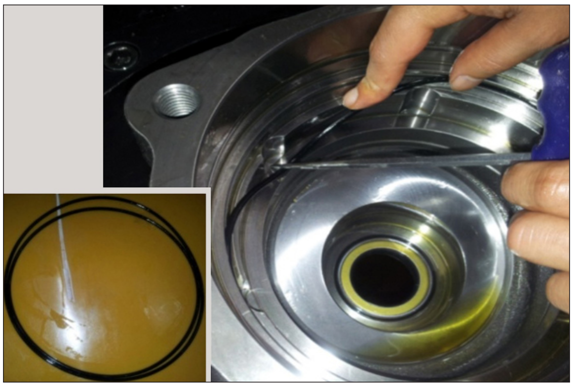
2209A8SM80

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

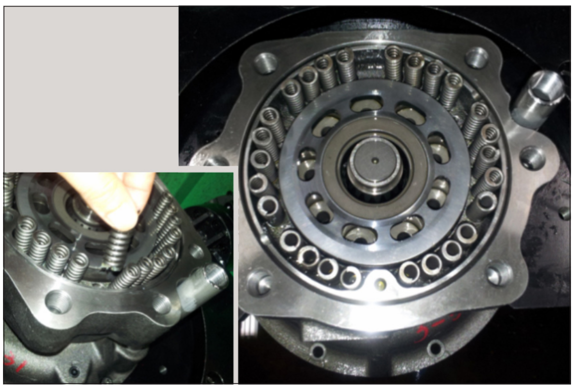
⑥ Assemble cylinder block (8) into casing (1).

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

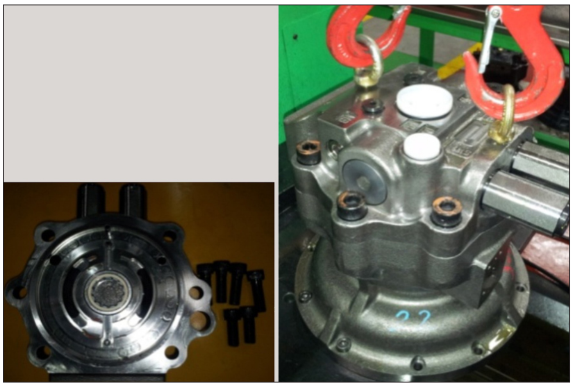
2209A8SM84

⑧ Assemble spring (parking piston, 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

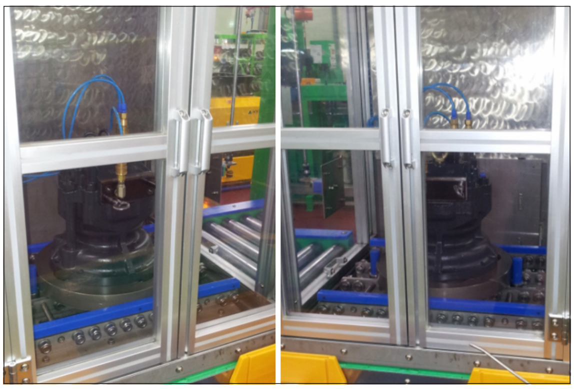
⑩ Assemble level gauge (36) and plug (39) into casing (1).
- Tightening torque (36) : 15±1.0 kgf · m
  (108.5±7.2 lbf · ft)
- Tightening torque (39) : 3±0.3 kgf · m
  (21.7±2.2 lbf · ft)

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

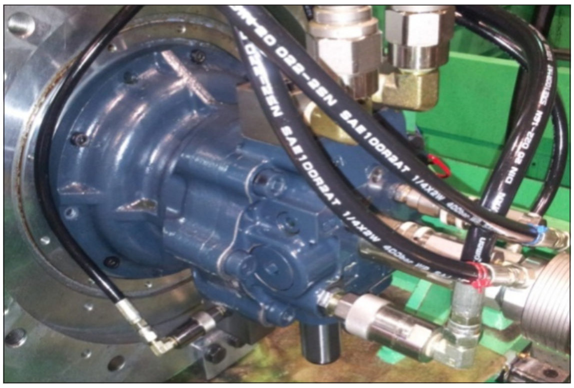
⑬ Leakage check

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

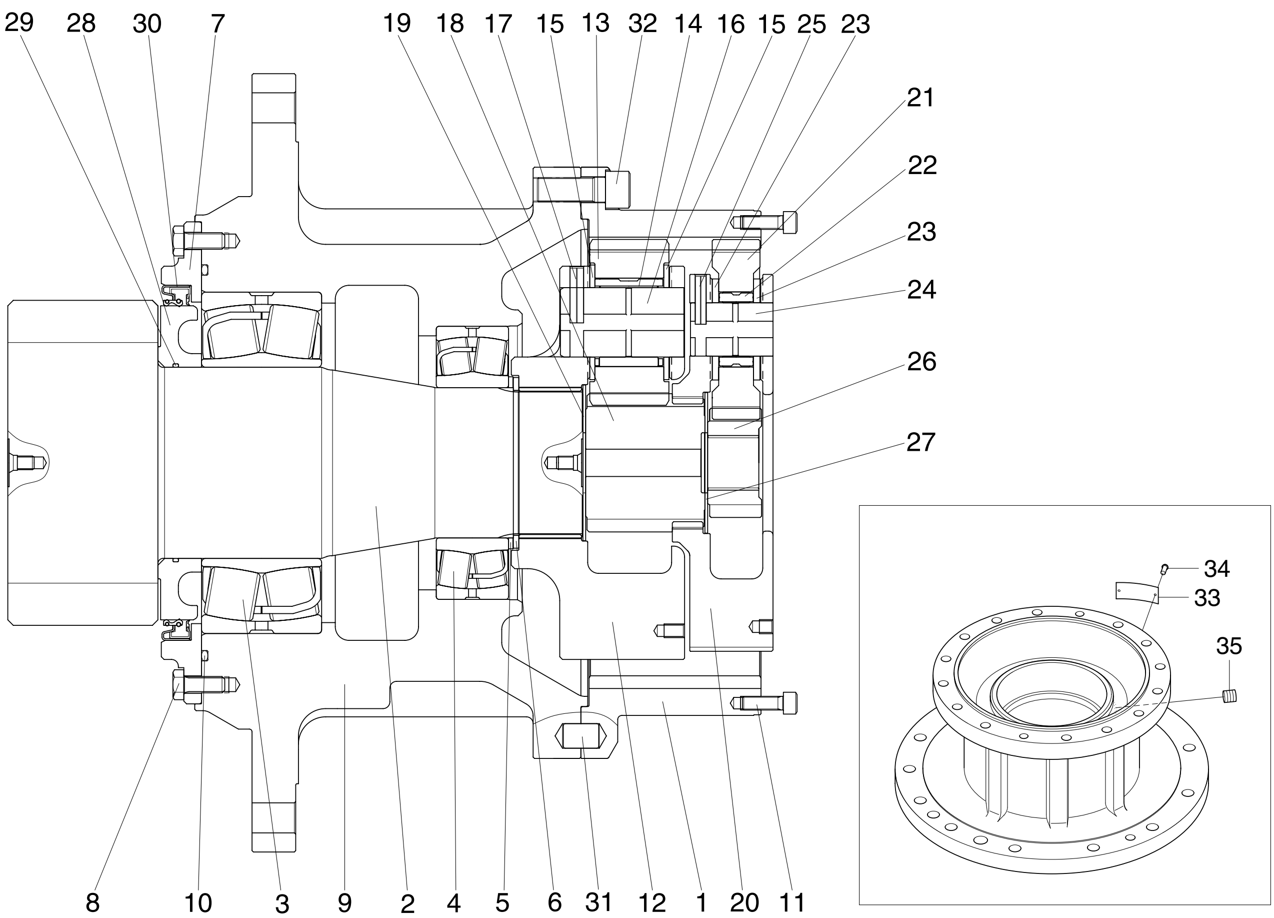
Mounting motor a test bench, test the availability of each part.



2209A8SM91

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.

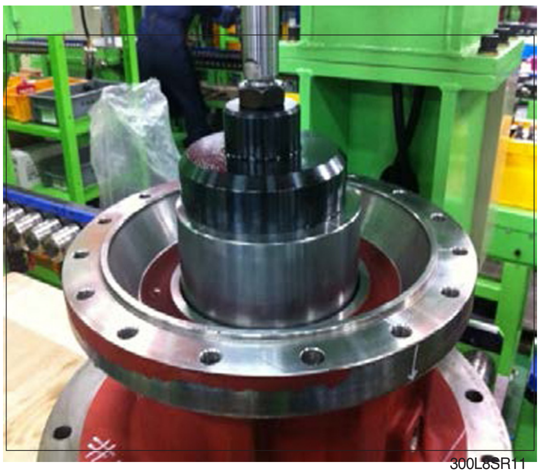
300L8SR09

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.

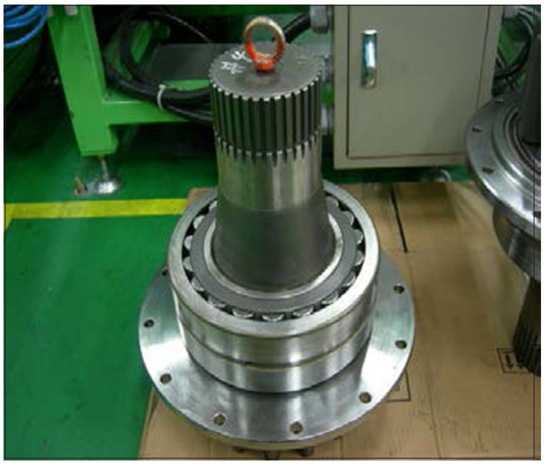
300L8SR13

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).

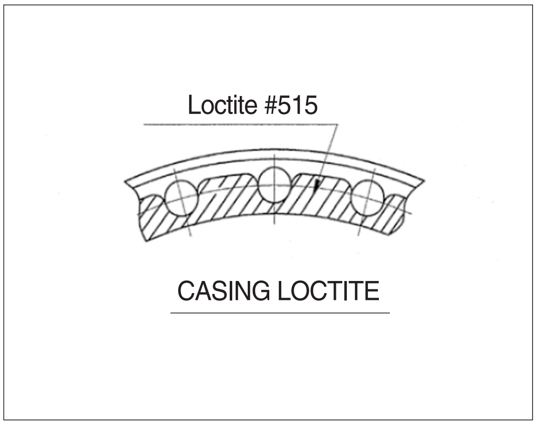
※ Assemble selected thrust plate (5) to make gap (0.1~0.3 mm) between snap ring (6) and sph. roller bearing (4).

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.

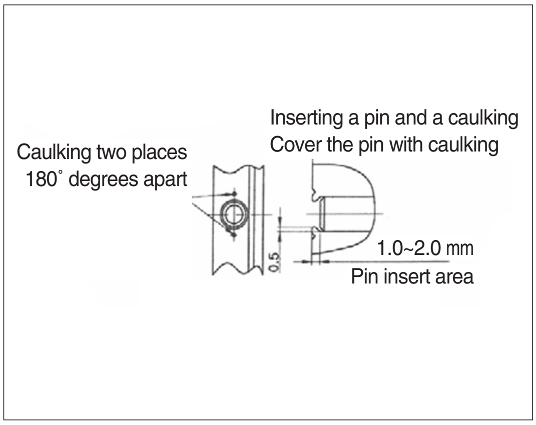
300L8SR22

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 liter.

300L8SR28

GROUP 6 TRAVEL DEVICE (TYPE 1 & 3)

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

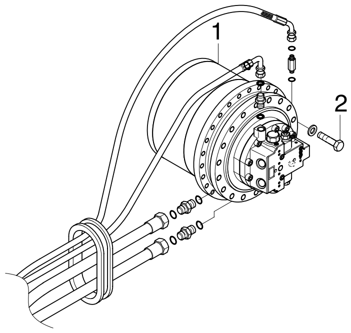
(1) Swing the work equipment 90° and lower it completely to the ground.

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



300L8TM01

(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 : 430 kg (950 lb)

2) INSTALL

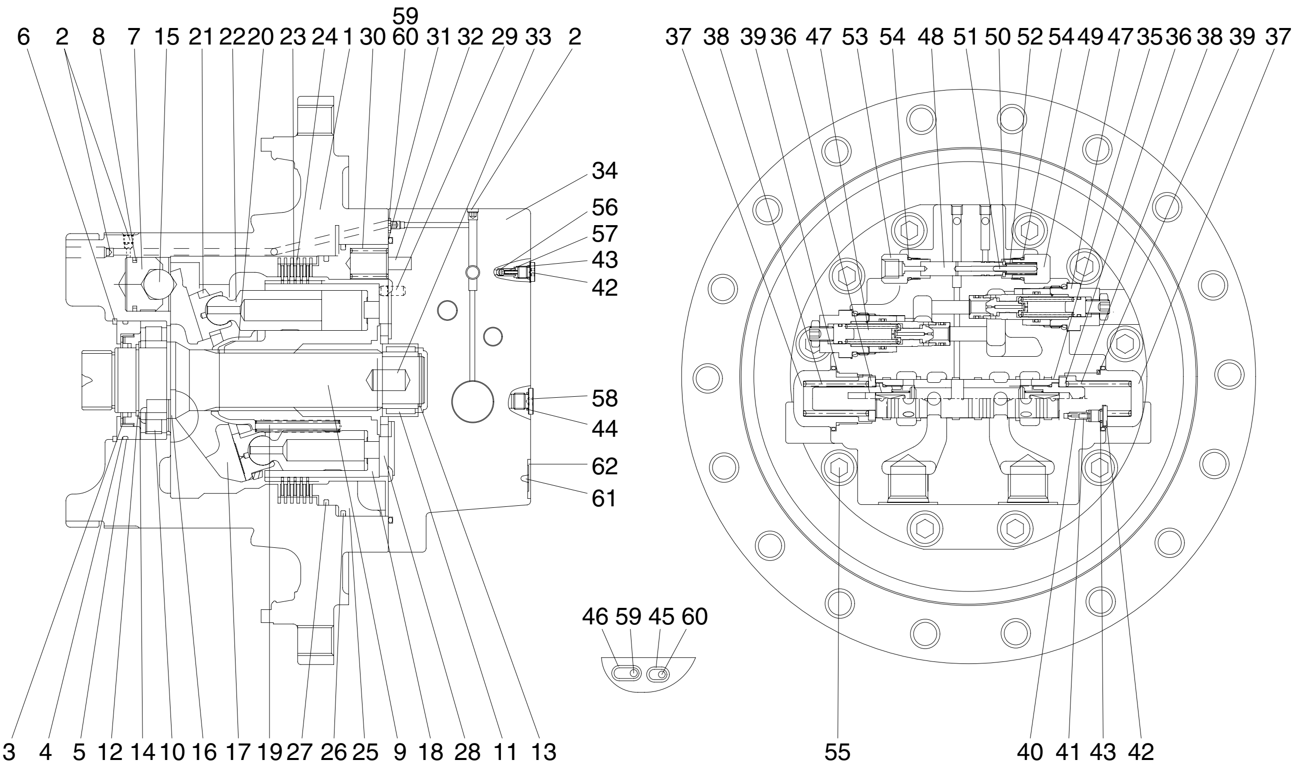
(1) Carry out installation in the reverse order to removal.

(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. SPECIFICATION

1) TRAVEL MOTOR



2609A2TM02

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

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±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

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.

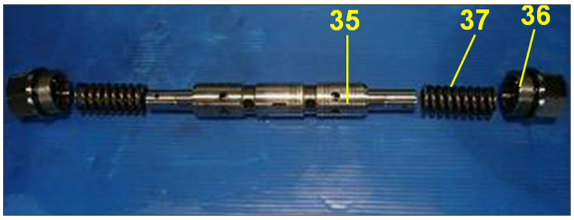
(3) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in advance.

(4) The piston can be inserted to whichever cylinder block for the initial assembling.
However, their combination should not be changed if they are once used. To reuse them, put the matching mark on both pistons and cylinder block before disassembling.

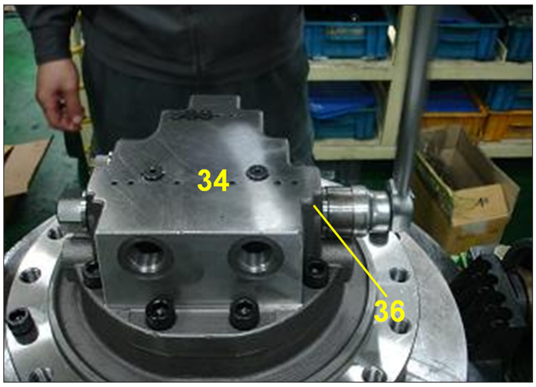
⚠ **Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

2) DISASSEMBLING TRAVEL MOTOR

(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

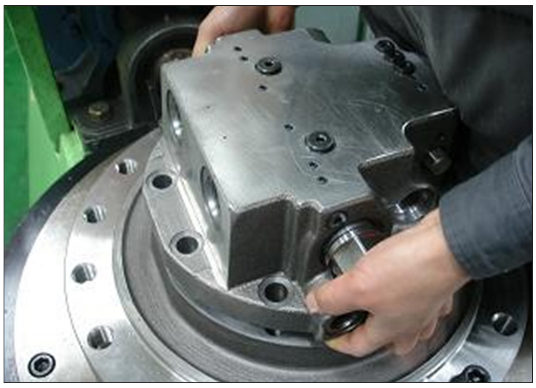


2609A8TM03

(2) Disassemble wrench bolt (54) using torque wrench.

2609A8TM04

(3) Take out rear cover (34) into casing (1).



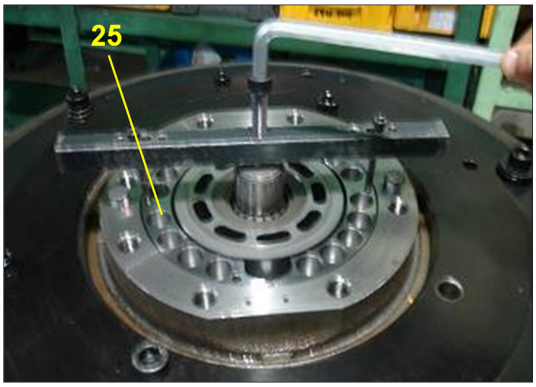
2609A8TM05

(4) Remove brake spring (30, 14EA)

2609A8TM06

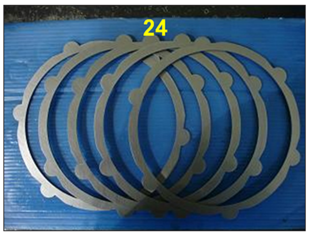
(5) Disassemble parking piston (25) using jig.

2609A8TM07



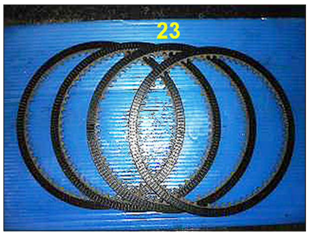
2609A8TM08

(6) Disassemble separate plate (24, 5EA) and friction plate (23, 4EA).

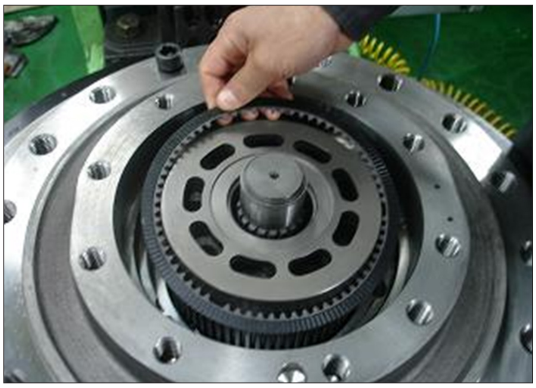


2609A8TM09

2609A8TM10

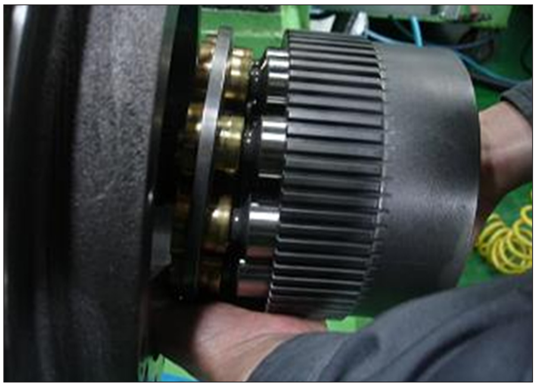


2609A8TM11



2609A8TM12

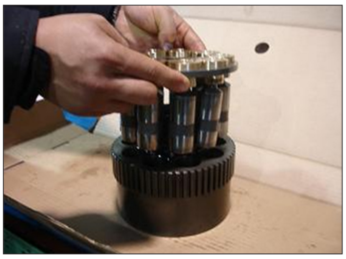
(7) Remove cylinder block kit.
It is easier to work by placing the casing (1) horizontal.

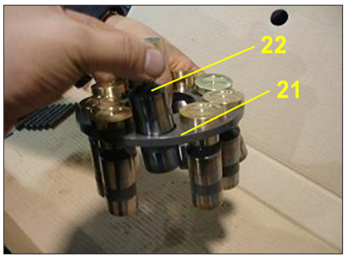


2609A8TM13

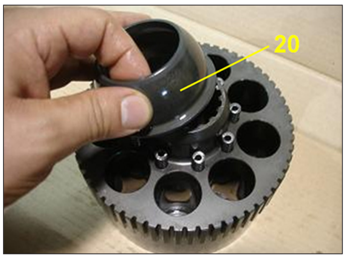
(8) Disassemble cylinder block (18), retainer plate (21), piston assy (22), ball guide (20) and spring (19) into cylinder block kit.


2609A8TM14

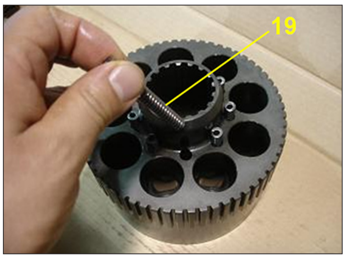

2609A8TM15



2609A8TM16



2609A8TM17



2609A8TM18

(9) Disassemble swash plate (17) into casing (1).

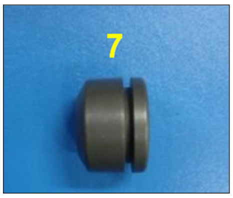
2609A8TM19


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.

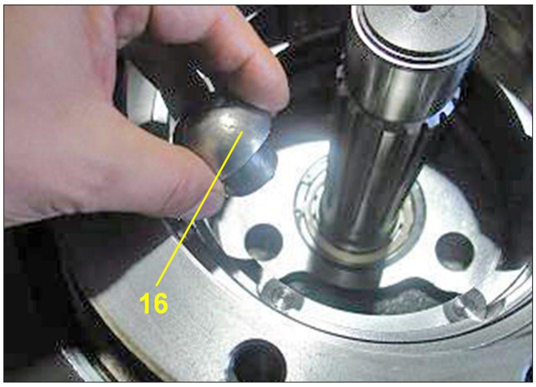
2609A8TM21



2609A8TM22


2609A8TM23

(11) Disassemble pivot (16, 2EA) into casing (1).

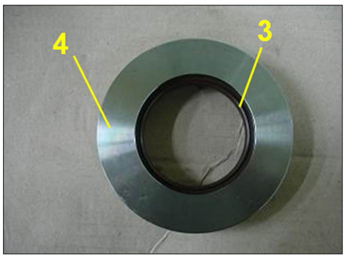


2609A8TM24

(12) Disassemble snap ring (6) using pliers.


2609A8TM25

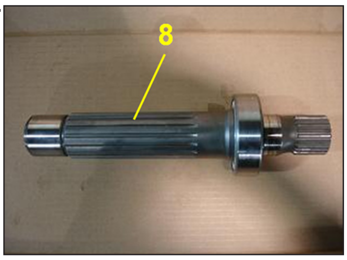
(13) Disassemble trust block (4) and oil-seal (3) into casing (1).



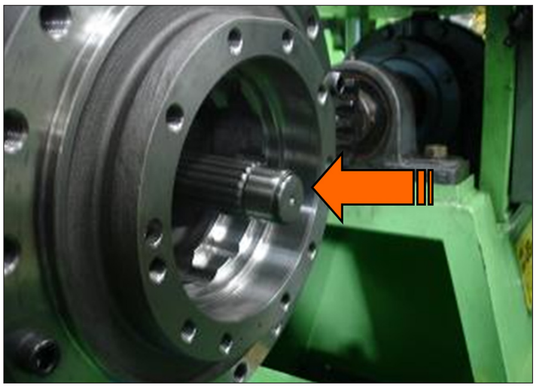
2609A8TM26


2609A8TM27

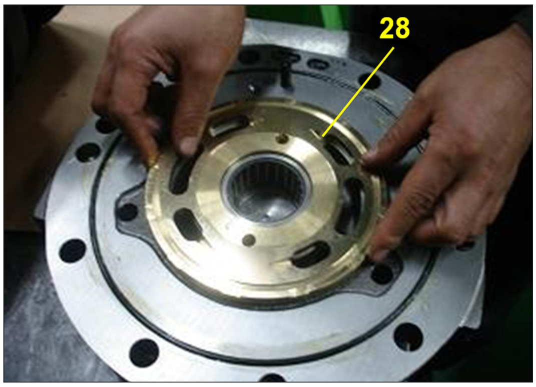
(14) In the casing (1), the arrow part of the shaft (8) using a rubber mallet taps and then disassemble the shaft (8) and bearing-roller (10) to the other side.



2609A8TM28


2609A8TM29

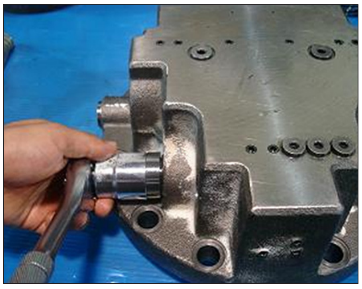
(15) Disassemble valve plate (28) into rear cover (34).

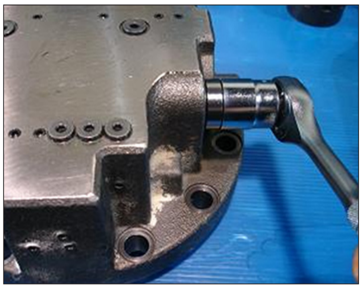


2609A8TM30

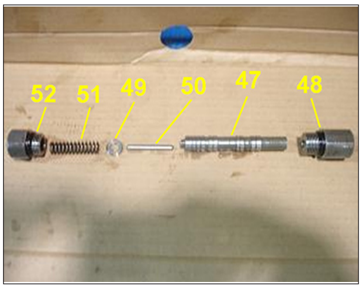
(16) Disassemble relief valve (46, 2EA) into rear cover (34) using the torque wrench.

2609A8TM31

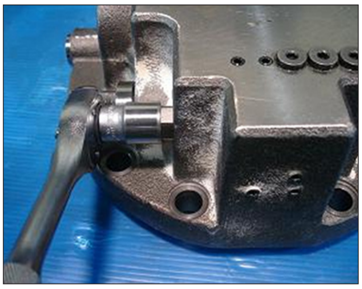

2609A8TM32

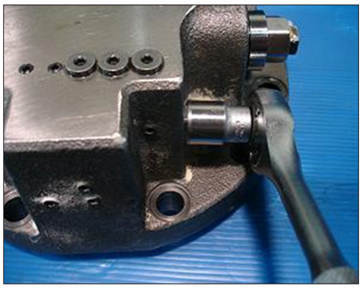

2609A8TM33

(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.

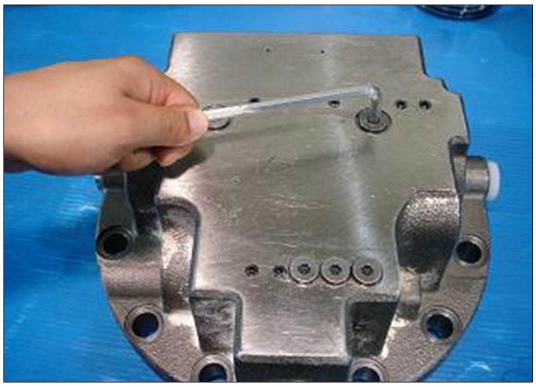


2609A8TM34


2609A8TM35

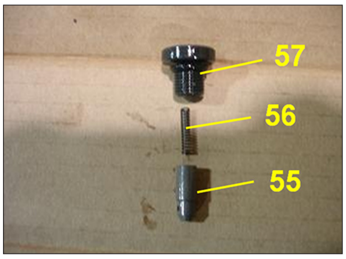

2609A8TM36

(18) Disassemble plug (57) into rear cover (34).

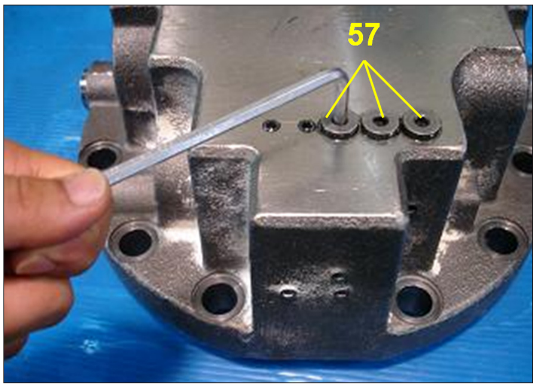


2609A8TM37

(19) Disassemble plug (57) into rear cover (34) and then disassemble spring (56), check valve (55) into rear cover (34) in regular sequence.



2609A8TM38



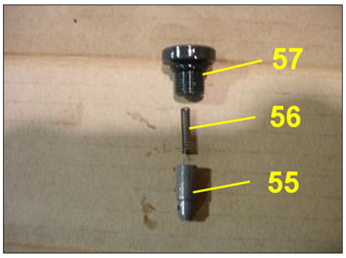
2609A8TM39

4. REASSEMBLING

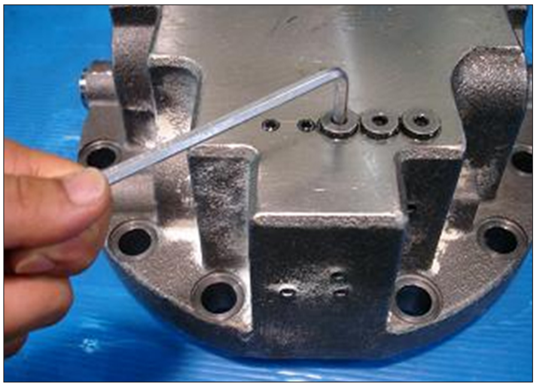
1) ASSEMBLING MOTOR

- REAR COVER ASSY

(1) Assemble check valve (55), spring (56) into rear cover (34) and then assemble plug (57) using L-wrench.



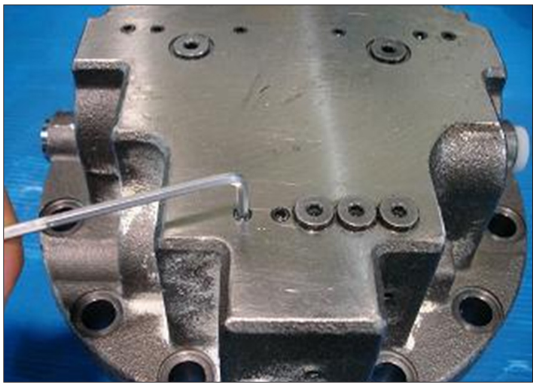
2609A8TM40



2609A8TM41

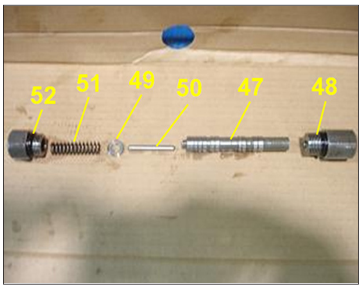
(2) Apply loctite #242 on the NPTF 1/16 plug (2) and then assemble 12-NPTF 1/16 Plug (2) into rear cover(34).

2609A8TM42

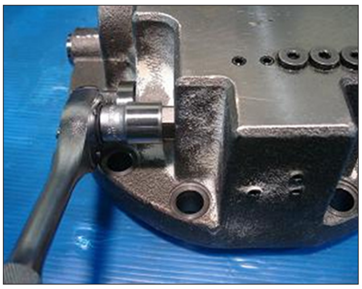


2609A8TM43

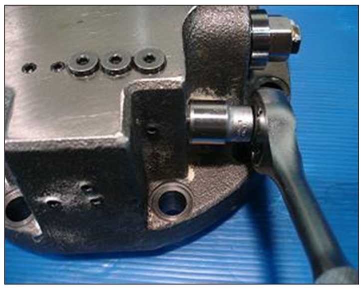
(3) Assemble spool (47), parallel pin (50), spring seat (49) and spring (51) into rear cover (34) in regular sequence and then assemble plug (48) and connector (52).



2609A8TM44



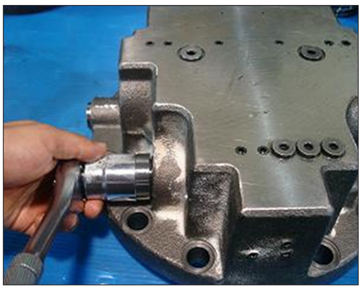
2609A8TM45



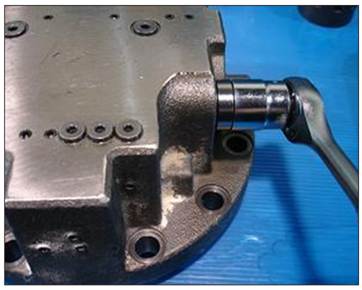
2609A8TM46

(4) Assemble relief valve (42, 2EA) into rear cover (34).

2609A8TM47



2609A8TM48



2609A8TM49

(5) Press needle bearing (11) into rear cover (34) using jig.

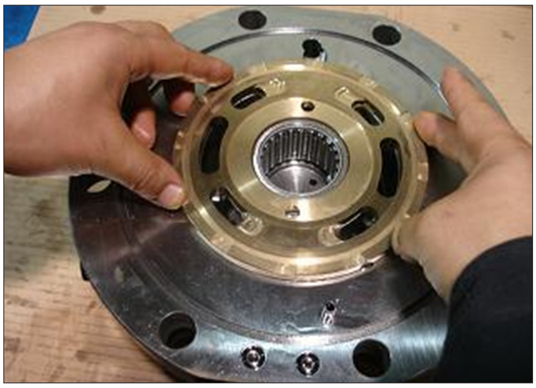
2609A8TM50

(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).

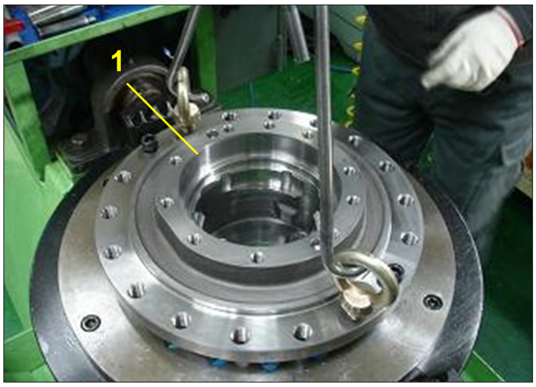


2609A8TM52

(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.

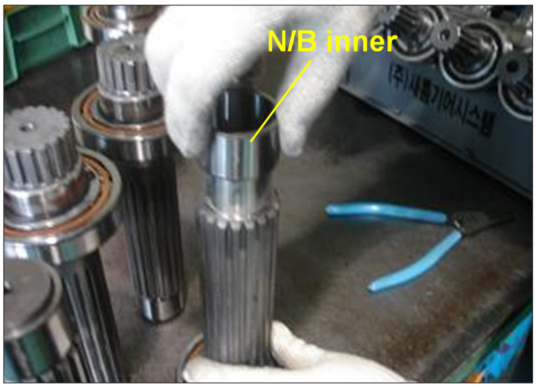
2609A8TM55

2609A8TM56

2609A8TM57

(11) Assemble the heated needle bearing inner ring on the shaft (8).

2609A8TM58

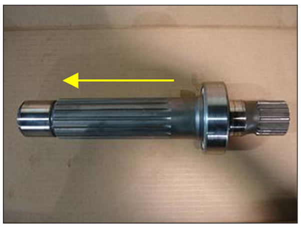


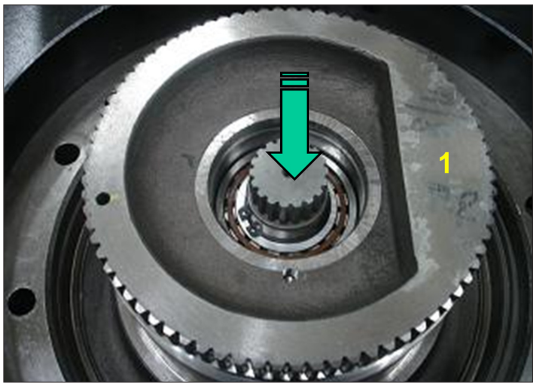
2609A8TM59

(12) Assemble snap ring (13) into Shaft (8) using pliers.

2609A8TM60

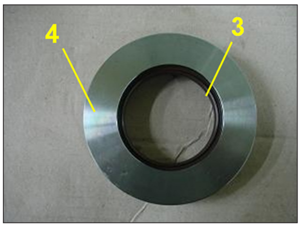
(13) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.


2609A8TM61

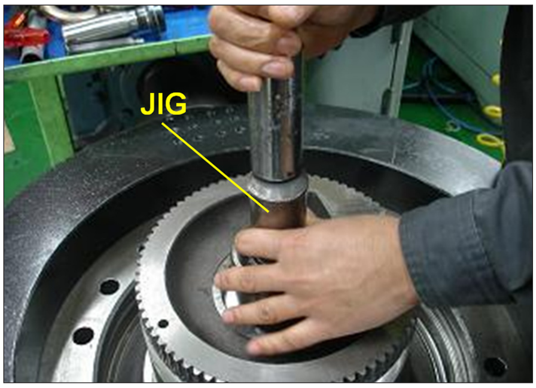


2609A8TM62

(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

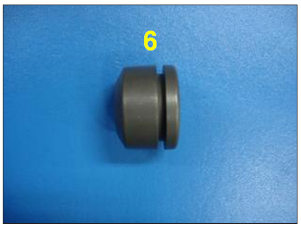
(15) Assemble snap ring(6) into casing(1) using pliers.


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).

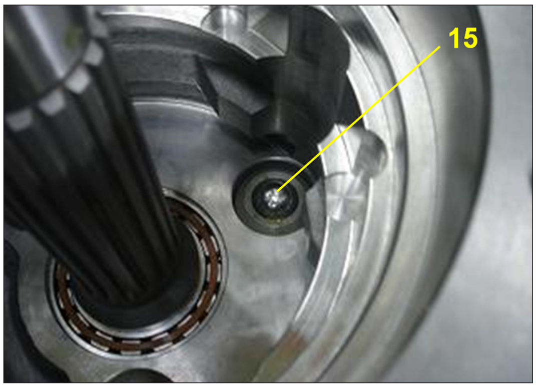


2609A8TM67


2609A8TM68

(18) Apply the grease to steel ball(15) and then assemble steel ball(15) into casing(1).

2609A8TM69



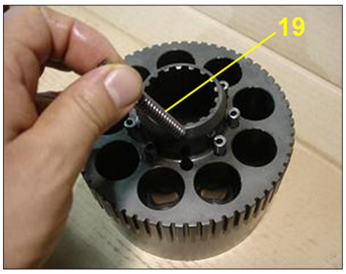
2609A8TM70

(19) Apply the grease to swash plate(17) and then assemble swash plate(17) into casing(1).

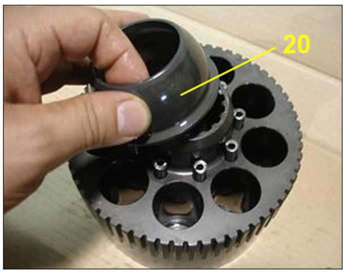
2609A8TM71


2609A8TM72

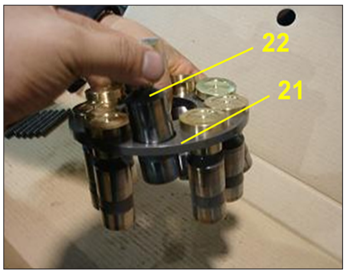
(20) Assemble spring (19), ball guide((20), retainer plate (21), piston assy (22) into cylinder block (18) in regular sequence.



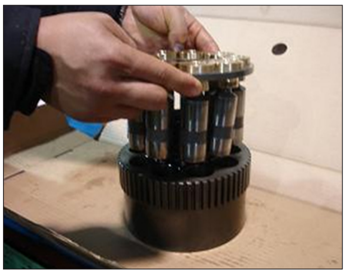
2609A8TM73



2609A8TM74



2609A8TM75

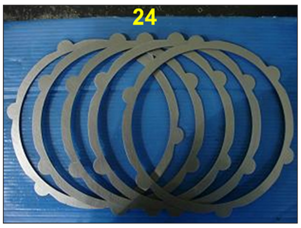

2609A8TM76


2609A8TM77

(21) Stant the casing (1) and then assemble cylinder block kit into casing (1).

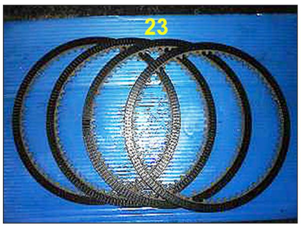

2609A8TM78

(22) Assemble separated plate (24), friction plate (23) into cylinder block in regular sequence.
Friction plate : 4EA
Separated plate : 5EA



2609A8TM79

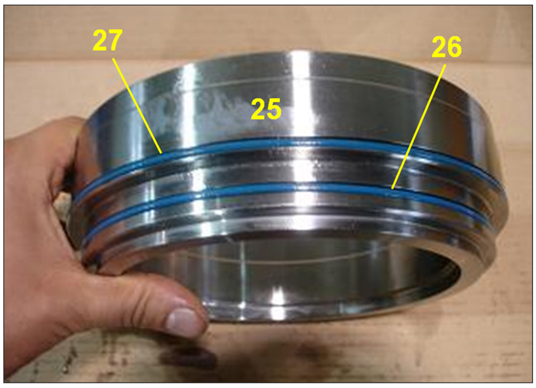

2609A8TM80



2609A8TM81

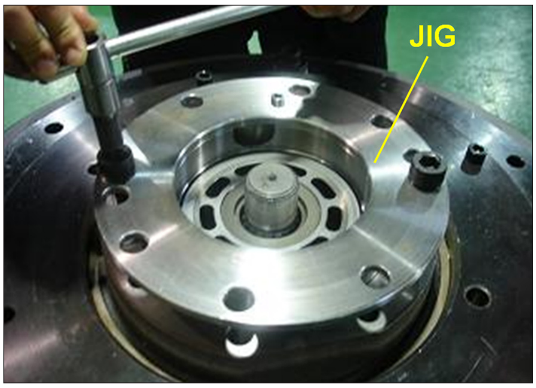

2609A8TM82

(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.

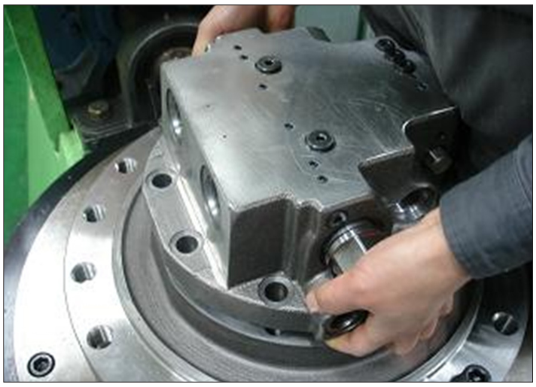


2609A8TM84

(25) Assemble brake spring (30, 18EA).

2609A8TM85

(26) Put on the rear cover (34) on the casing (1).



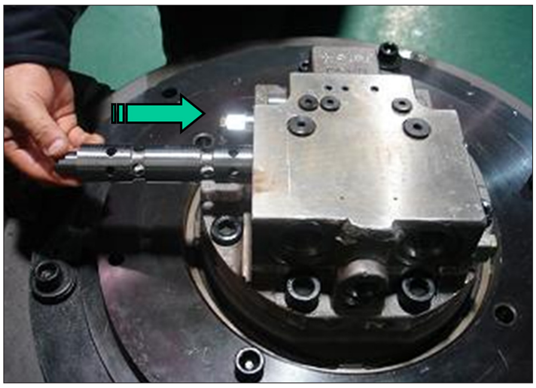
2609A8TM86

(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

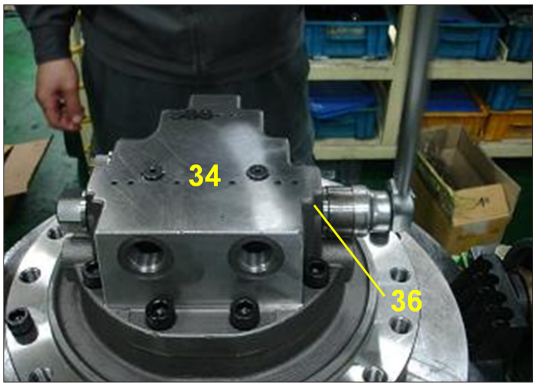


2609A8TM89

(29) Assemble spring (37), plug (36) into rear cover (34) in regular sequence and then plug (36) into rear cover (34) using torque wrench.

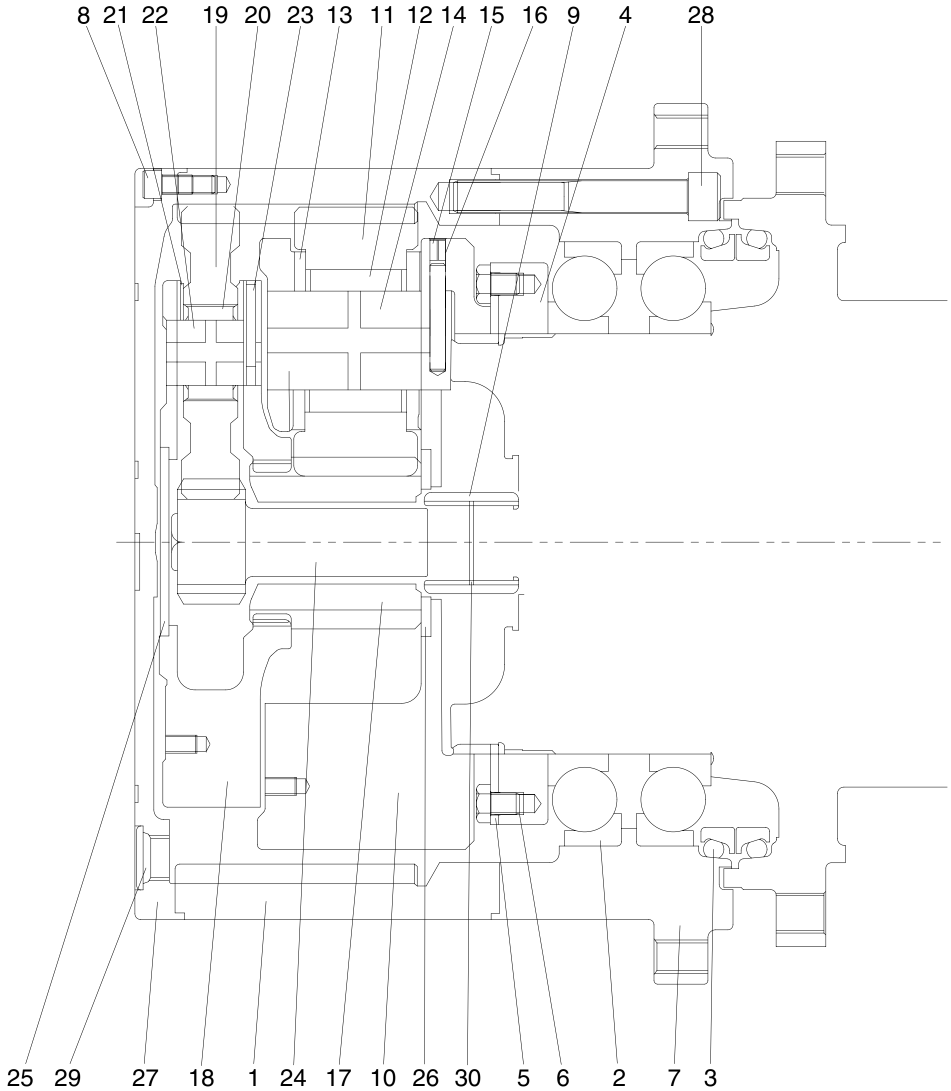
2609A8TM90

2609A8TM91



2609A8TM92

2) TRAVEL REDUCTION GEAR



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

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 TRAVEL REDUCTION GEAR

(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.

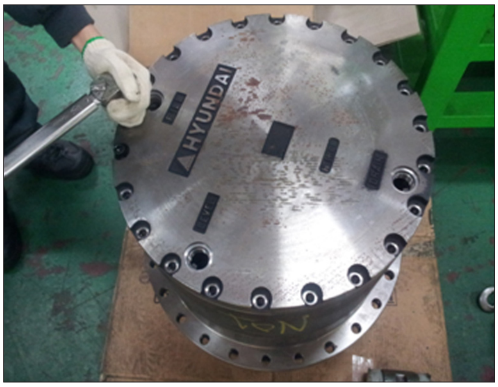
⚠ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

(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

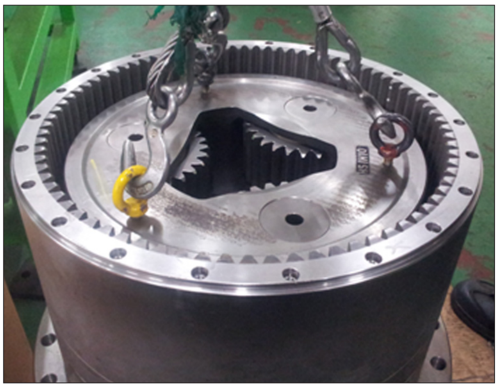
Pull away sun gear No.2 (17) for removing.

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

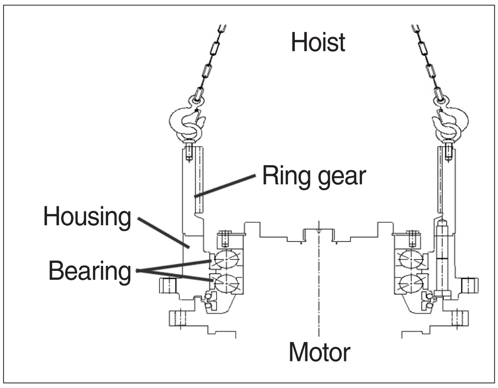
(10) Nut ring

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.



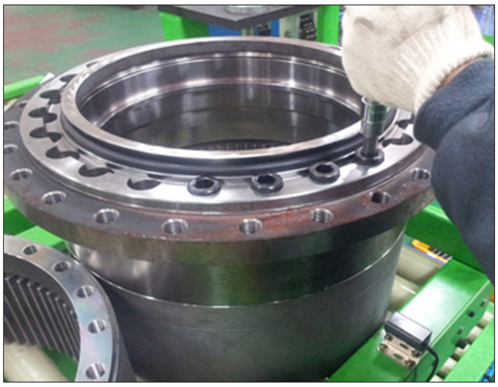
2609A8TM10

(12) Ring gear

① Reverse the housing sub-assembly part with machine, and remove floating seal (3) from the inside.

2609A8TM11

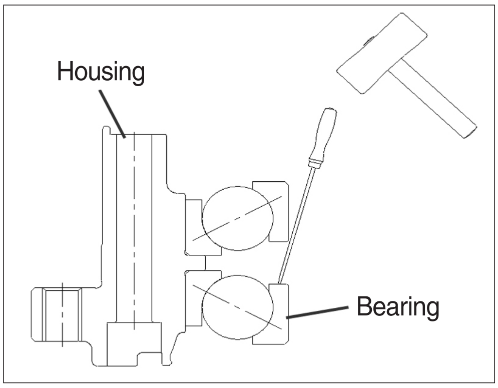
② Release 25 hex wrench bolts (28. M18) and remove ring gear (1) from housing (7).



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.

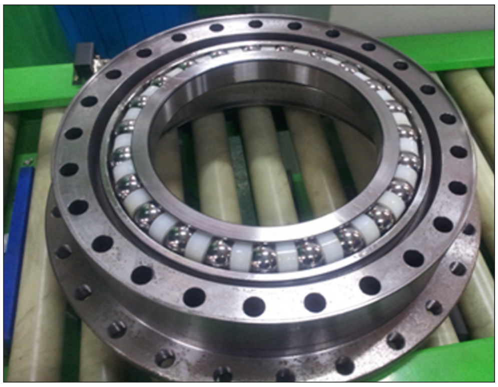
(5) Insert two more pins and spring pins on the same way.

2609A8TM23

4) ANGULAR BEARING

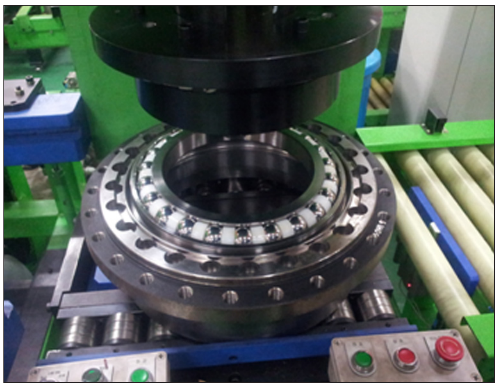
(1) Put the jig on housing (7) and insert angular bearing (2) into it with pressing machine, and turn down the upside of housing (7) by reversing machine.

※ **Check the direction of bearing when inserting it.**



2609A8TM24

(2) Insert angular bearing (2) into reversed housing (7) on the same way.



2609A8TM25

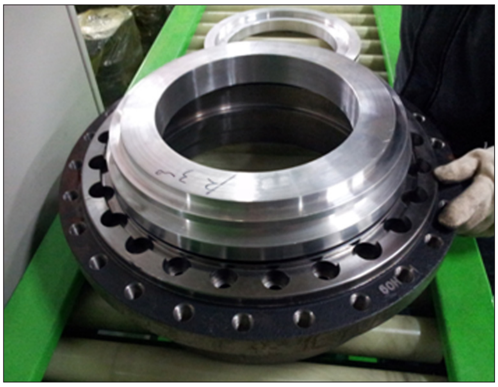
5) ASSEMBLING FLOATING SEAL

(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.

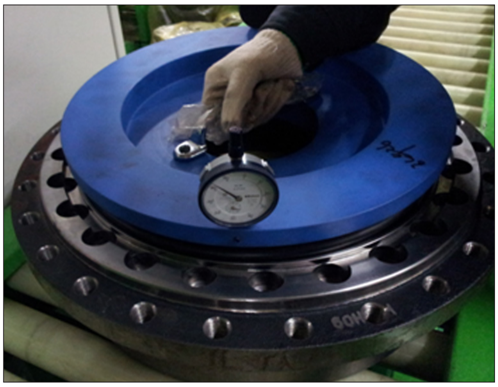
※ **Keep clean on surface of floating seal while assembling.**



2609A8TM27

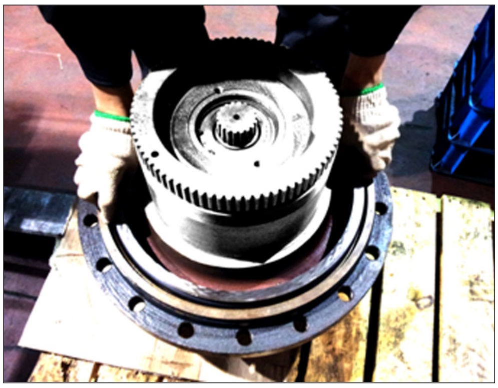
(3) Put the gauge for seal measurement on floating seal (3) and check the horizontal angle by gauge scale.

※ Two gauge scales should be same. (pass inspection)



2609A8TM28

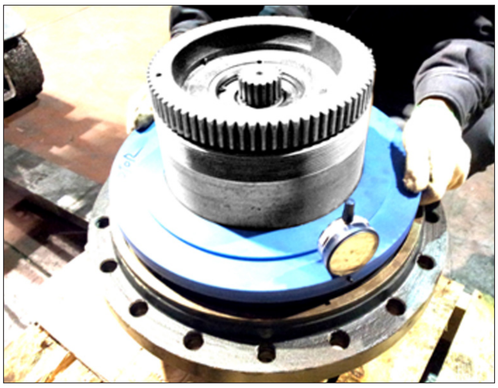
(4) Attach floating seal to motor that will be assembled with housing (on the same way to (1), (2))



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

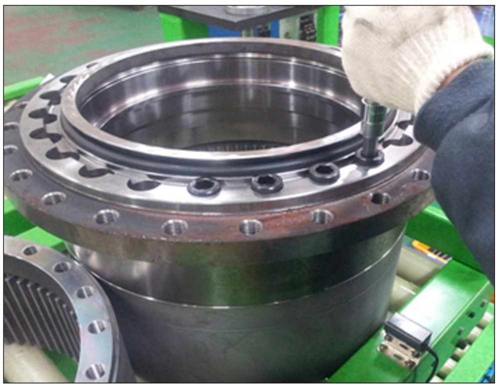
(1) Put ring gear (1) on contact surface (should be upside) of housing (7).

(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

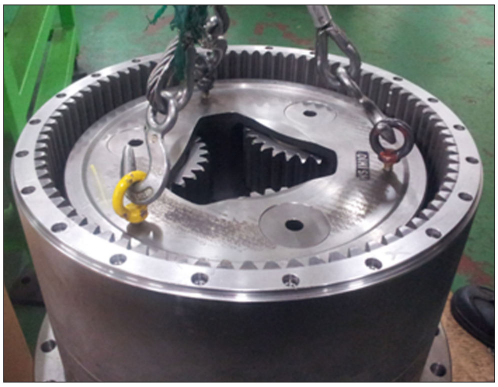
(2) Put coupling (9) on motor shaft to fit.

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).

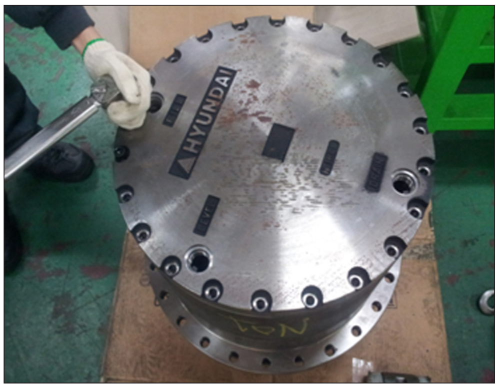
※ When assembling thrust washer, rounded edge-side should be facing casting side of carrier.

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 (10 ℓ) 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

■ TRAVEL MOTOR (TYPE 2)

1. REMOVAL AND INSTALL

1) REMOVAL

13031GE18

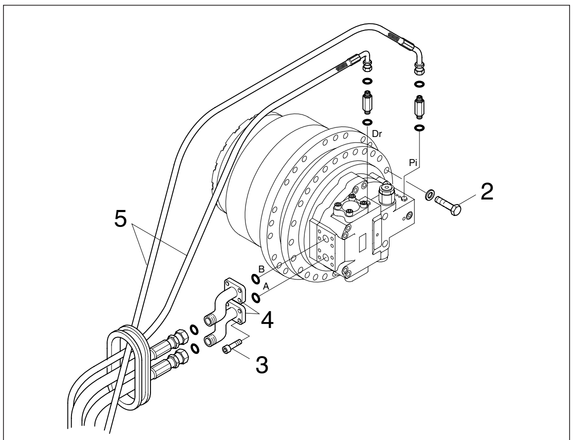
(1) Swing the work equipment 90˚ and lower it completely to the ground.

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



300L8TM101

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Loosen socket bolts (3) and remove the flange weld assy (4)

(7) Remove the hoses (5).

※ Fit blind plugs to the disconnected hoses.

(8) Remove the bolts and the sprocket.

(9) Sling travel device assembly (1).

(10) Remove the mounting bolts (2), then remove the travel device assembly.

· Weight : 425 ㎏ (940 ℔)

2) INSTALL

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

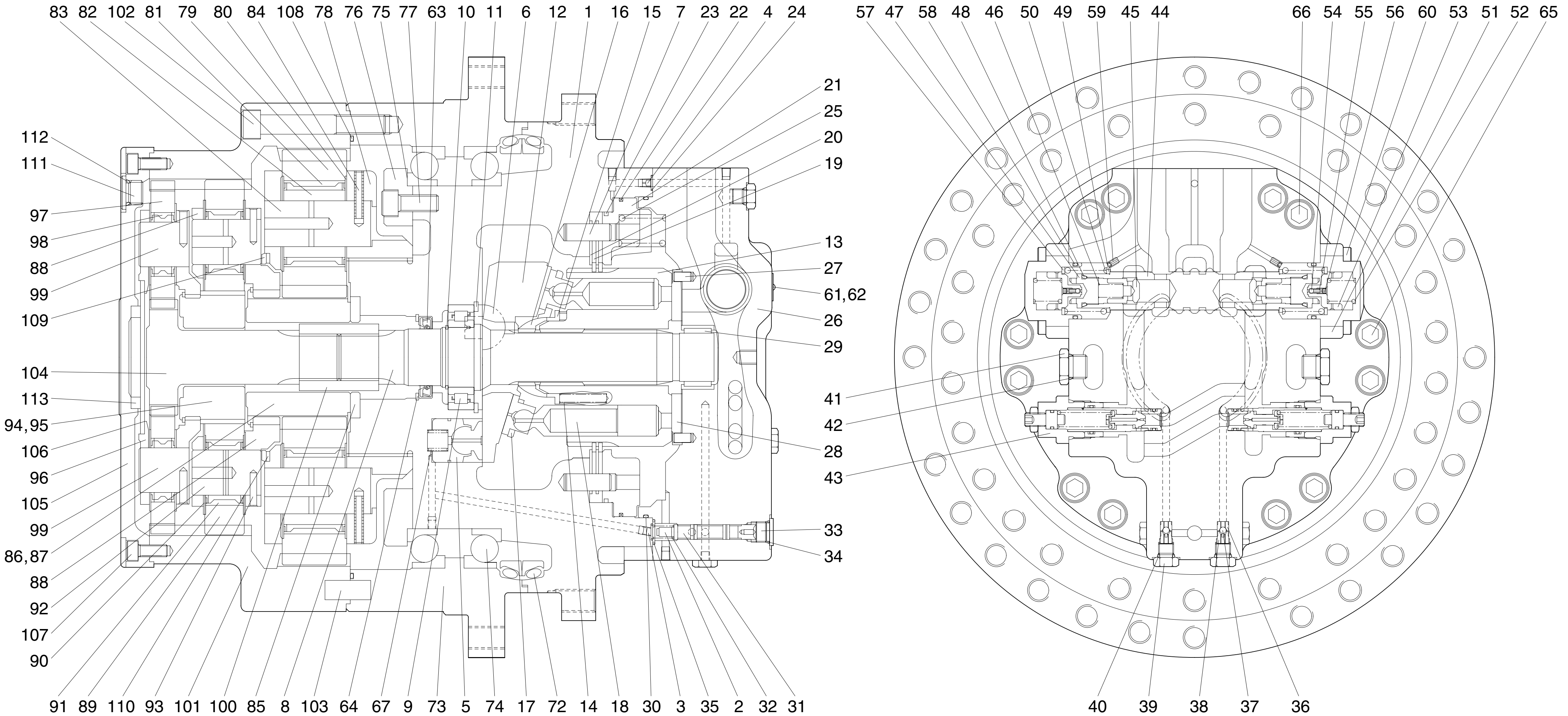
(2) Bleed the air from the travel motor.

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. SPECIFICATION

1) TRAVEL MOTOR



1	Shaft casing	15	Spacer	29	Needle bearing	43	Relief valve assy	57	Spring seat	75	Shim	89	Planetary gear	103	Parallel pin
2	Plug	16	Ball guide	30	O-ring	44	Main spool	58	O-ring	76	Bearing guide	90	Plate	104	Drive gear
3	Orifice	17	Set plate	31	Swash spool	45	Check	59	Orifice	77	Wrench bolt	91	Needle bearing	105	End cover
4	Orifice screw	18	Piston & Shoe assy	32	Swash spring	46	Spring	60	Wrench bolt	78	Carrier	92	Pin	106	Plate
5	Swash piston	19	Friction plate	33	Plug	47	Plug	61	Name plate	79	Planetary gear	93	Spring pin	107	Wrench bolt
6	Swash ball	20	Separator plate	34	O-ring	48	O-ring	62	Rivet	80	Plate	94	Sun gear	108	O-ring
7	Brake pin	21	Brake piston	35	O-ring	49	Spring seat	63	Oil seal	81	Needle bearing	95	Snap ring	109	Ring
8	Shaft	22	Piston ring	36	Seat	50	Spring	64	Snap ring	82	Bearing bushing	96	Carrier	110	Ring
9	Roller bearing	23	Piston ring	37	Steel ball	51	Cover	65	Wrench bolt	83	Pin	97	Planetary gear	111	Plug
10	Stop ring	24	O-ring	38	Stopper	52	Spring	66	Wrench bolt	84	Spring pin	98	Needle bearing	112	O-ring
11	Lock ring	25	Brake spring	39	Plug	53	Spool	67	Spring pin	85	Thrust plate	99	Pin	113	Bushing
12	Swash plate	26	Valve casing	40	O-ring	54	Steel ball	72	Floating seal	86	Sun gear	100	Coupling		
13	Cylinder block	27	Valve plate pin	41	Plug	55	Spring	73	Hub	87	Snap ring	101	Ring gear		
14	Cylinder spring	28	Valve plate	42	O-ring	56	Plug	74	Bearing	88	Carrier	102	Wrench bolt		

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)
	8	Plug (33)
	10	Wrench bolt (60)
	27	Hex (43)
Socket wrench/ spanner	19	Hp plug (39)
	27	Hp plug (41)
Snap-ring plier (for holes, axis)		Ring stop (10), Snap ring (64)
Hammer		Needle bearing (29), Pin (7, 27)
Torque wrench		Size : 500 kgf · m, 3000 kgf · m
Jig for oil seal assembling		Oil seal (63)
Heating tool for bearing		Roller bearing (11)

(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	Orifice screw	NPTF 1/16	4	0.7	5.06
33	Plug	PF 3/8	8	7.5	54.25
39	HP plug	PF 1/4	19	3.7	26.76
41	HP plug	PF 1/2	27	11	79.56
43	Relief valve	HEX 27	27	18±1.0	130±7.0
60	Wrench bolt	M12×35L	10	13	94.03
65	Wrench bolt	M16×50L	14	13	94.03
66	Wrench bolt	M16×100L	14	6.7	48.46

2. DISASSEMBLING

1) GENERAL INSTRUCTIONS

(1) Generally, hydraulic equipment is precisely manufactured and clearances between each parts are very narrow. Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather. Tools and kerosene to wash parts should also be clean and handled with great care.

(2) When motor is removed from the host machine, wash around the ports sufficiently and put the plugs so that no dust and/or water may invade. Take off these plugs just before the piping works when re-attach it to the host machine.

(3) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in advance.

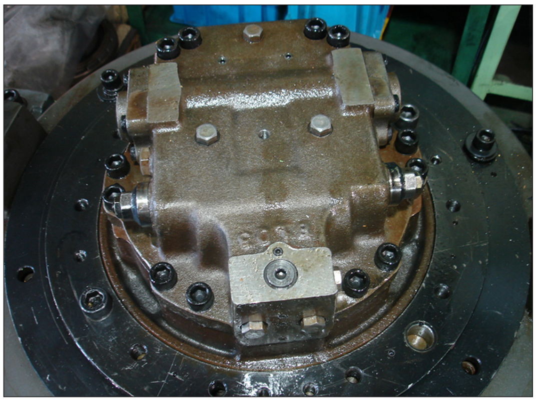
(4) The piston can be inserted to whichever cylinder block for the initial assembling.
However, their combination should not be changed if they are once used. To reuse them, put the matching mark on both pistons and cylinder block before disassembling.

⚠ **Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

2) DISASSEMBLEING

(1) Set up the motor assembly on the workbench for disassembly.

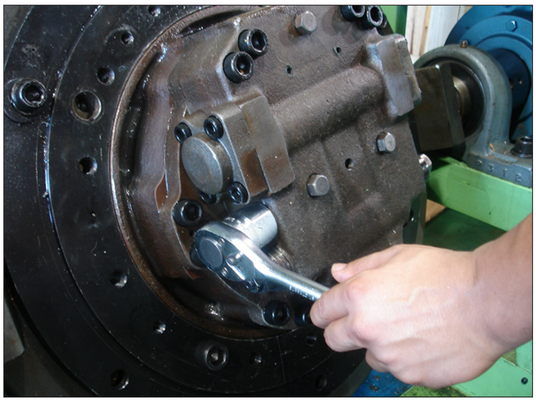
※ When you spin the disassembly-assembly jig at 90˚, please fix the motor drain plug (56) to the bottom.



3809A2TM040

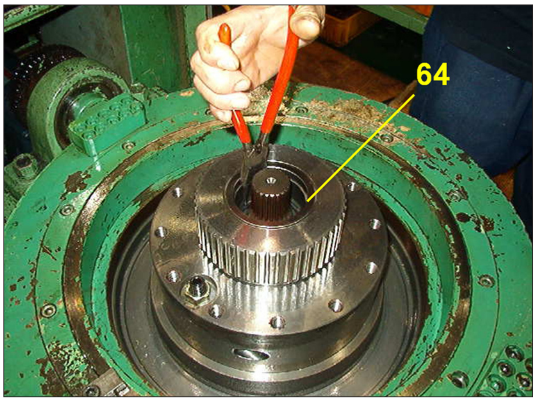
(2) Please emit the oil in the motor case with dismantlement for the drain plug (56).

※ Please inspect whether there are some kinds of foreign substance (metal powders, processed chips and others) during drain oil.



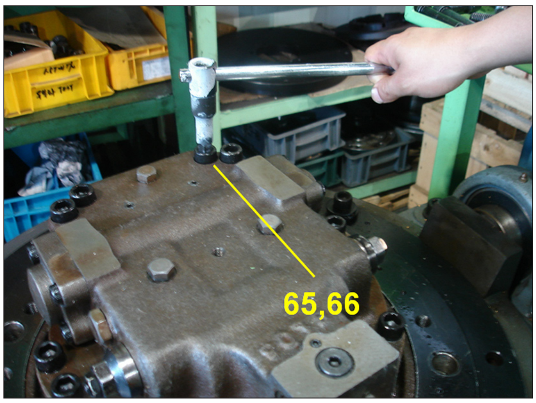
3809A2TM041

(3) Disassemble the snap-ring (64) using pliers.



3809A2TM042

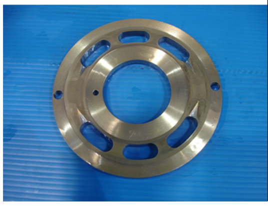
(4) Please disassemble the hexagonal socket bolt (65, 66) fixing the valve casing.



3809A2TM043

(5) Disassemble the valve plate (28) after the valve casing sub.

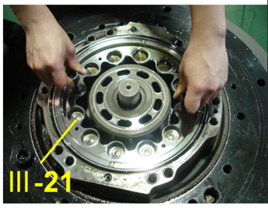
※ If abrasion on the valve plate, please change to new product.


3809A2TM044A

3809A2TM044

(6) Remove brake springs (25) and take the brake piston out by screwing a M16 screw into the brake piston.

※ Number of brake springs is 10.



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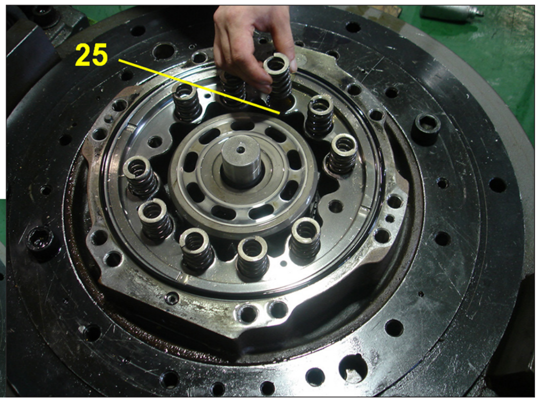
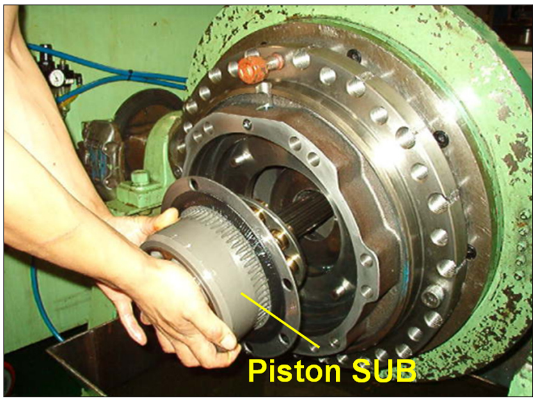


3809A2TM045

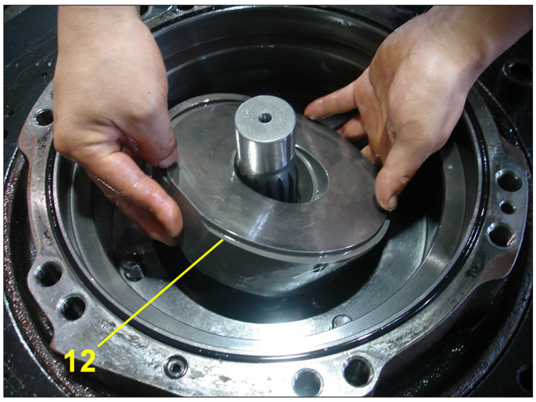
(7) Remove the cylinder and piston assembly.

※ It is easer to work by placing the motor shaft horizontal.



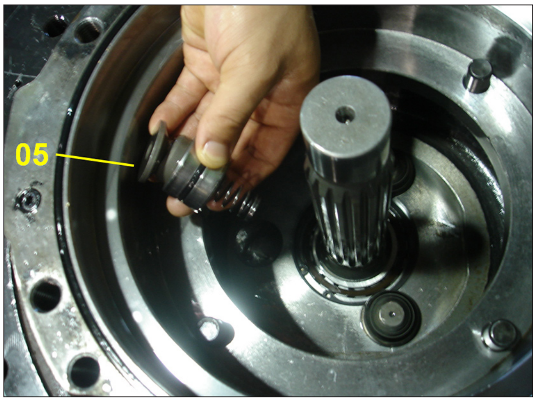
3809A2TM046

(8) Take swash plate (12) out.



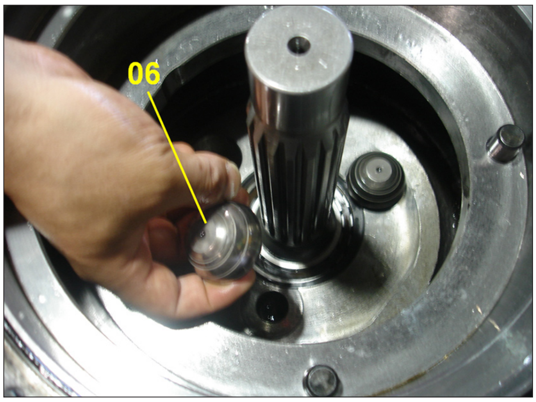
3809A2TM047

(9) Take swash piston kit out.



3809A2TM048

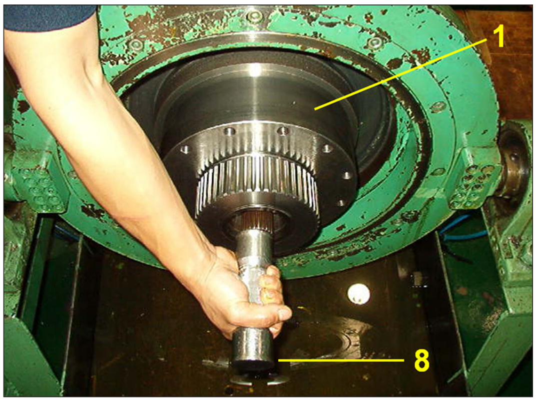
(10) Take swash ball (06) out.



3809A2TM049

(11) Take out shaft (8) from shaft casing (1) by striking the bottom part lightly with a hammer.

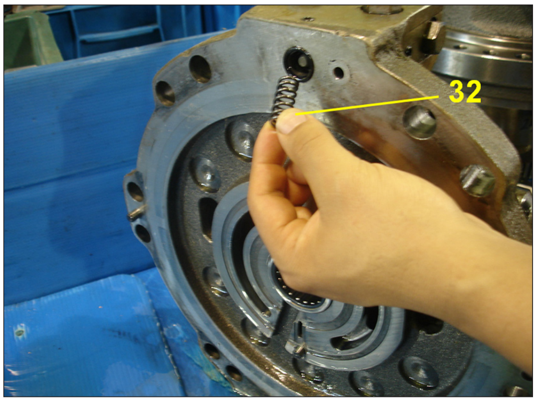
※ Be careful not to damage the roller bearing (9).



3809A2TM050

(12) Take valve casing sub out.
※ Be careful not to damage the needle bearing (29).

① Remove automatic control spring (32), automatic control spool (31).



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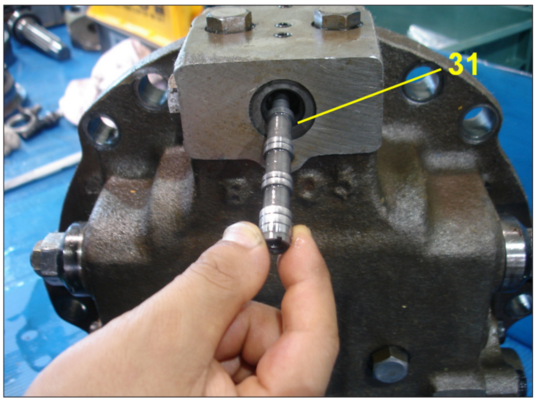
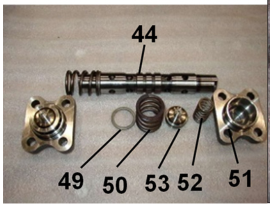


3809A2TM052

② Take out main spool cover (51) from valve casing (26). Remove spring (52), spool (53), spring seat (49), spring (50) and main spool (44) in sequence.



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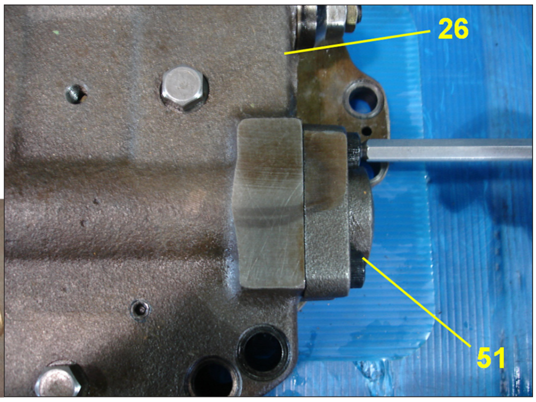
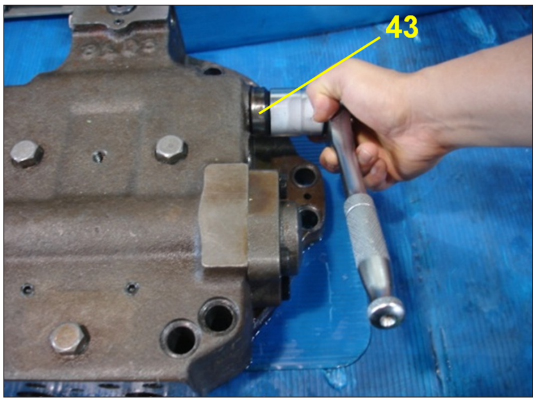


3809A2TM053

③ Remove relief valve assembly (43).



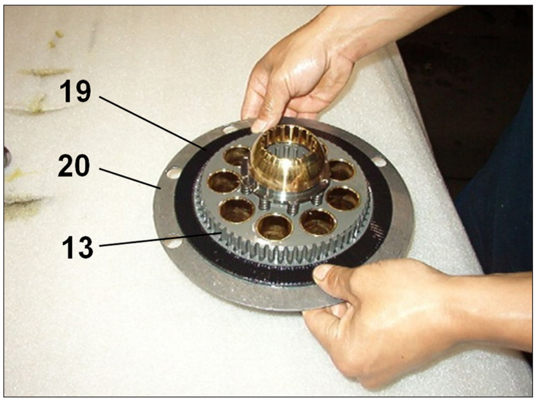
3809A2TM054

(13) Take cylinder sub out.

① Remove set plate (17) and piston (18) sub.

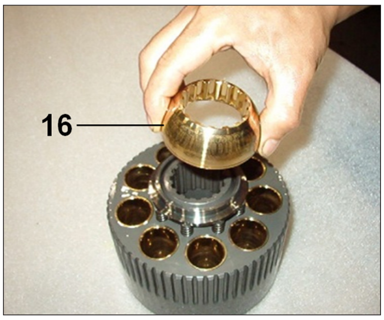
3809A2TM055

② Remove friction plates (19) and separate plates (20) from cylinder block (13).



3809A2TM056

③ Remove ball guide (16), spacer (15), cylinder spring (14).



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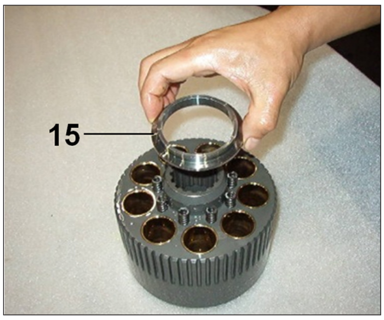

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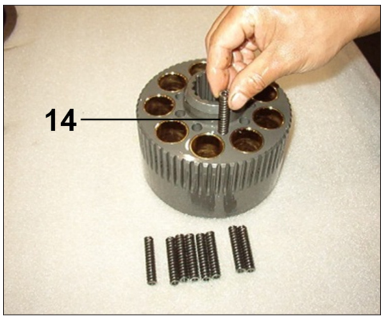


3809A2TM059

※ Disassembly has completed.
Check that the motor parts are broken or not.

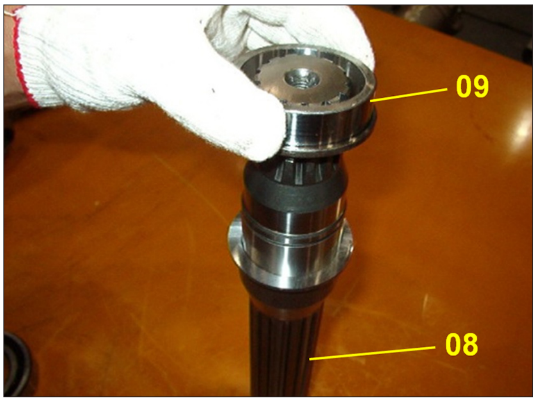
3) ASSEMBLING TRAVEL MOTOR

(1) Shaft sub assembly

① Fit bearing spacer to shaft (08) and press-fit roller bearing (09).

※ Press the roller bearing after preheating.

3809A2TM060



3809A2TM061

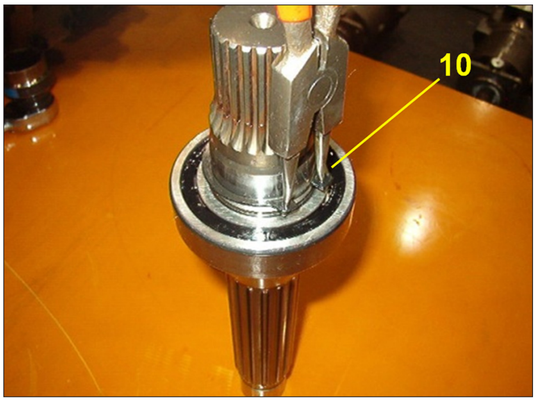
a. Induction heating apparatus temperature : 100˚C

b. Be careful not to damage the sliding surface for the seal on the shaft.

3809A2TM062

② Insert stop ring (10) with snap ring pliers.

※ Pay attention to the direction of the stop ring. (round direction is bearing direction.)



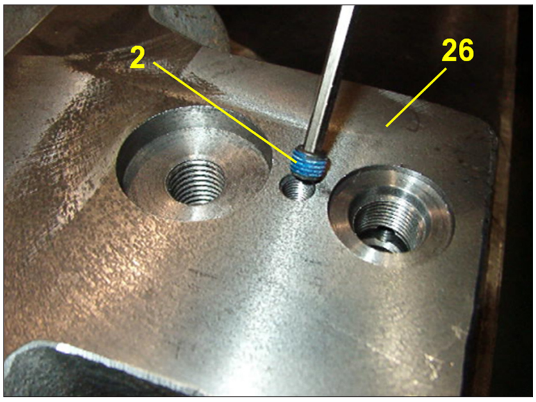
3809A2TM063

(2) Assemble valve casing sub assembly

① Tighten plugs (2) to valve casing (26) to the specified torque.

a. Apply loctite to the plug, and tighten them to the specified torque.

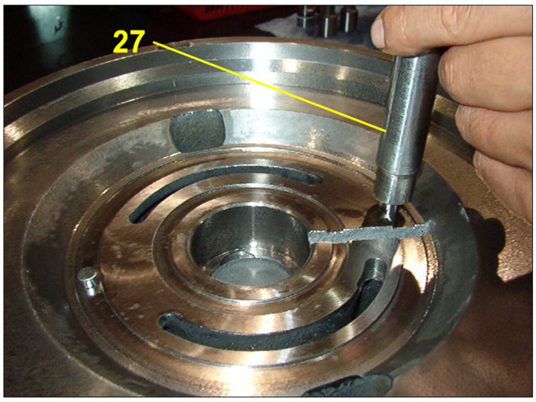
· Tightening torque : 70~110 kgf · cm



3809A2TM064

② Press-fit pin (27).

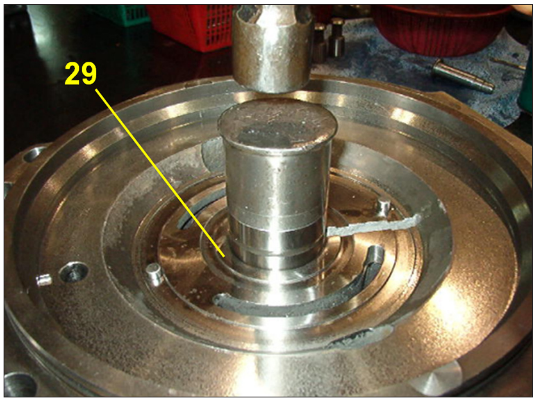
The pin's length will be 5 mm from valve plate with contacted area using a hammer.



3809A2TM065

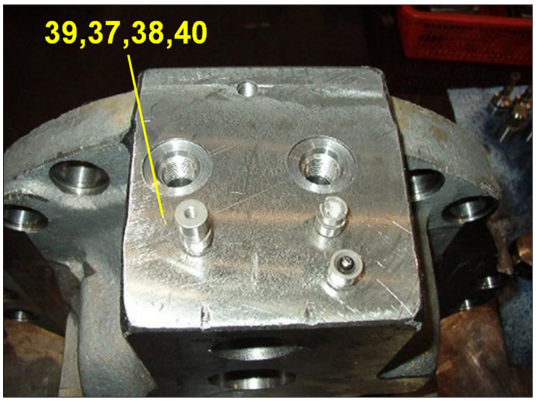
③ Assemble needle bearing (29).

- Tools : Press-fit jig and hammer.



3809A2TM066

④ Assemble seat (36), ball (37), stopper (38), O-ring (40) and HP plug (39) in sequence.



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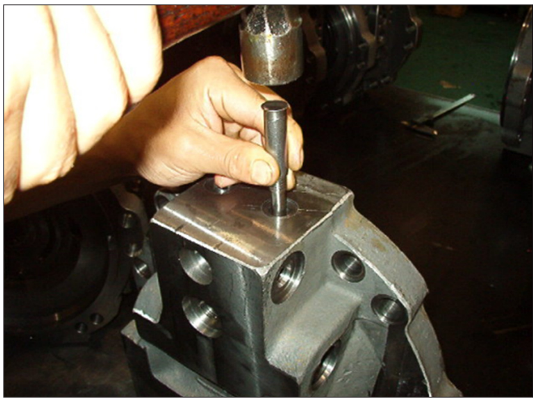


3809A2TM068

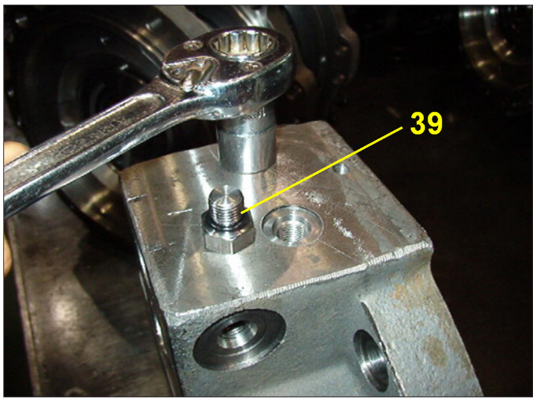
※ Pay attention to the direction of the seat and stopper.

· Tightening torque : 370 kgf · cm

⑤ Assemble HP plug (39) to the specified torque.

· 5 places

· Tightening torque : 370 kgf · cm

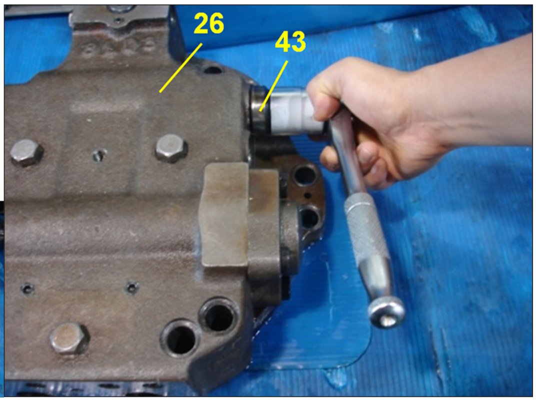


3809A2TM069

⑥ Mount relief valve (43) to the specified torque.

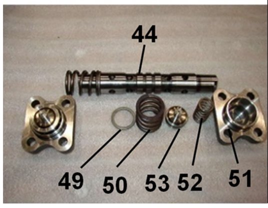
· Tightening torque : 2200 kgf · cm

3809A2TM070A

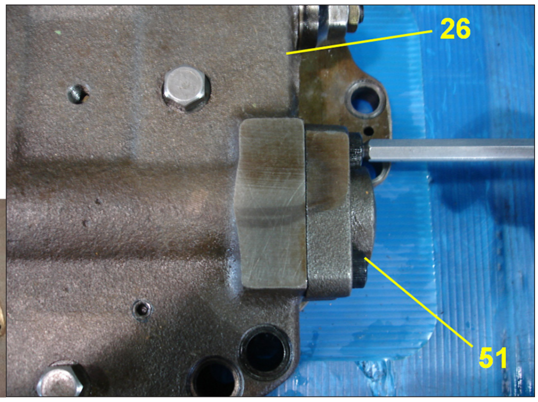


3809A2TM070

⑦ Assemble main spool cover (51), spring (52), spool (53), spring seat (49), spring (50), and main spool (44) in sequence.



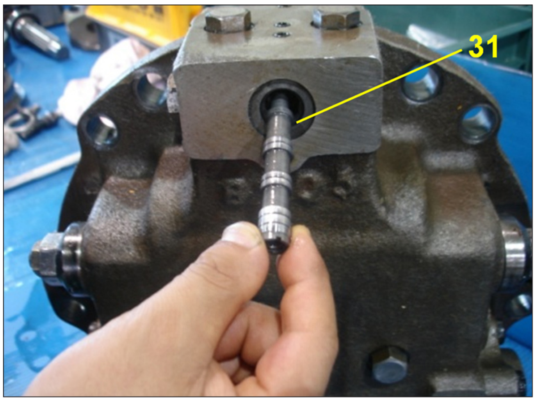
3809A2TM071A



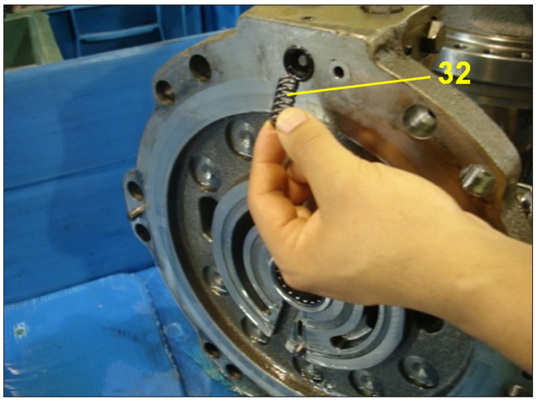
3809A2TM071

⑧ Assemble automatic control spool (31), spring (32), O-ring (35).

· Tightening torque : 750 kgf · cm

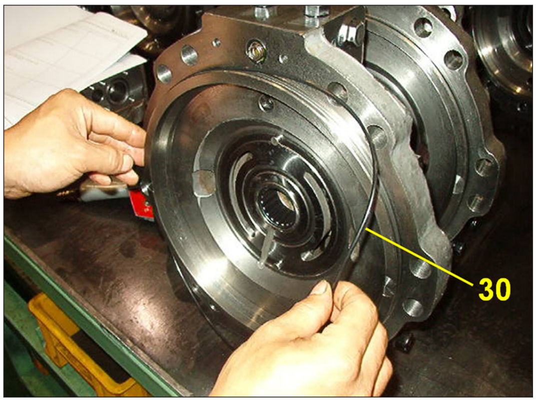


3809A2TM072



3809A2TM073

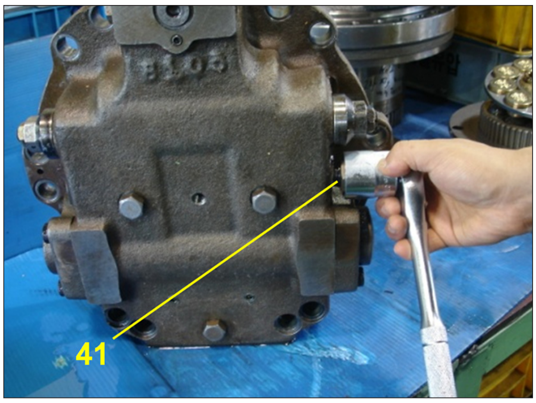
⑨ Insert O-ring (30) to valve casing. Apply grease to the O-ring.



3809A2TM074

⑩ Assemble drain plug (41) to the specified torque.

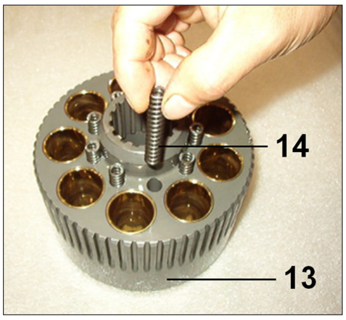
· Tightening torque : 1100 kgf · cm



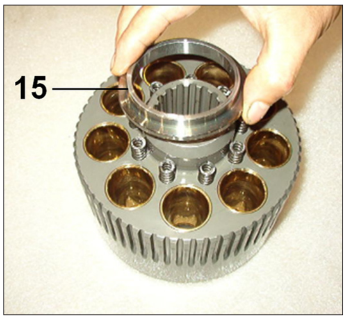
3809A2TM075

(3) Assemble cylinder sub assembly

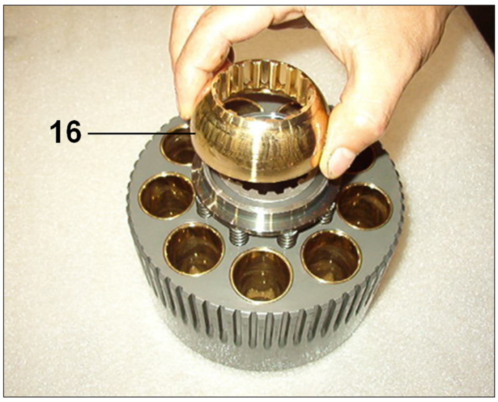
① Fit cylinder spring (14), spacer (15) and ball guide (16) to cylinder block (13).
Align the phase of the cylinder and the splineof the ball guide.



3809A2TM076A

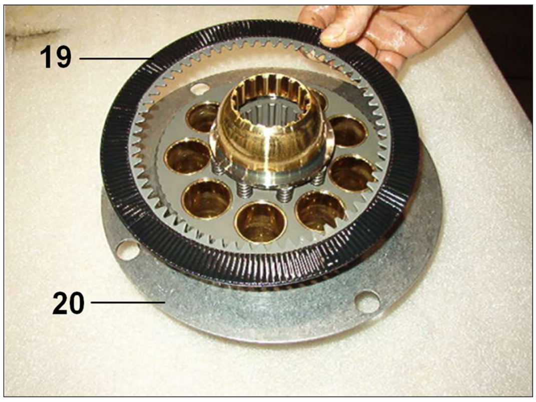


3809A2TM076B



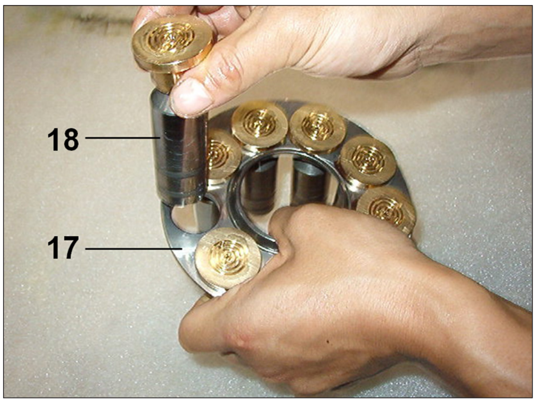
3809A2TM076

② Assemble friction plates (19) and separate plates (20).

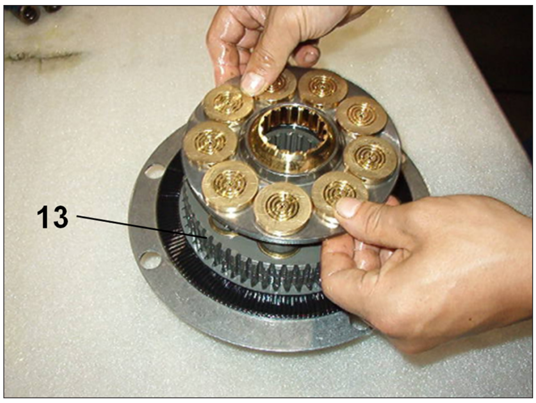


3809A2TM077

③ Insert the assembly of piston shoe (18) to retainer set plate (17) and fit it to the cylinder block (13).

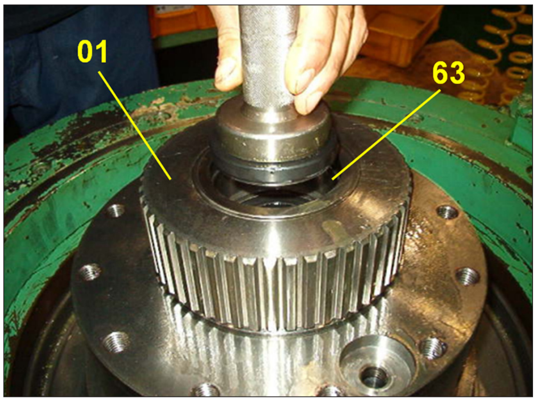


3809A2TM078



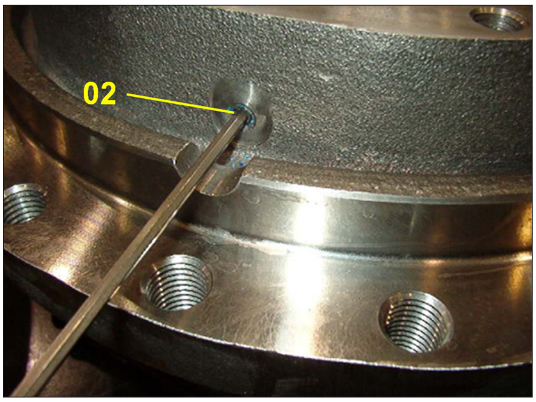
3809A2TM079

(4) Fit oil-seal (63).
※ Be careful not to damage the lip of the seal.

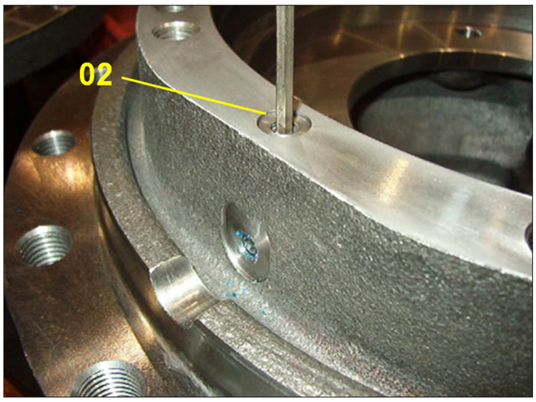


3809A2TM080

(5) Assemble plug (02) to the specified torque.



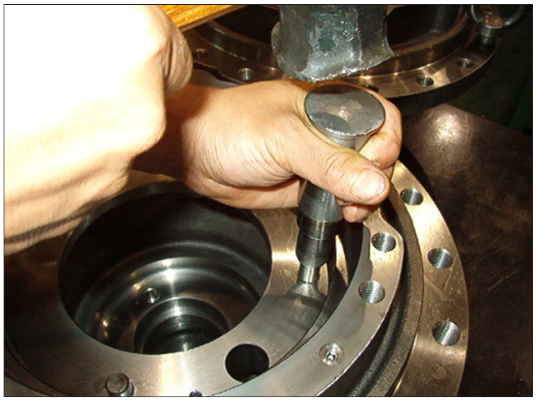
3809A2TM081



3809A2TM082

① Apply loctite to the plug and assemble.
② Tightening torque : 70~110 kgf · cm

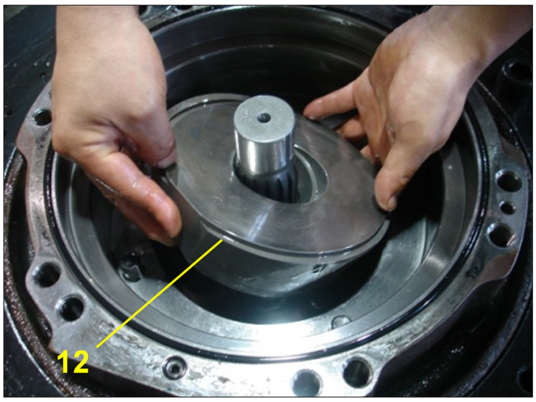
(6) Fit pins (7).
- Tools : Hammer
  Pin (7) : Please keep the length at 19 mm from surface of the shaft casing.
  Pin (7) numbers - 4 EA


3809A2TM083

(7) Assemble the shaft sub assembly.

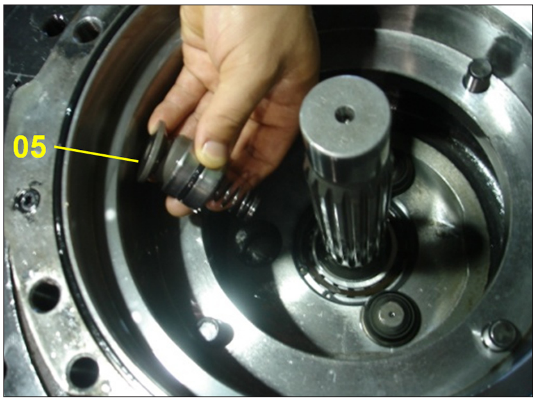
3809A2TM084

(8) Assemble swash plate (12).



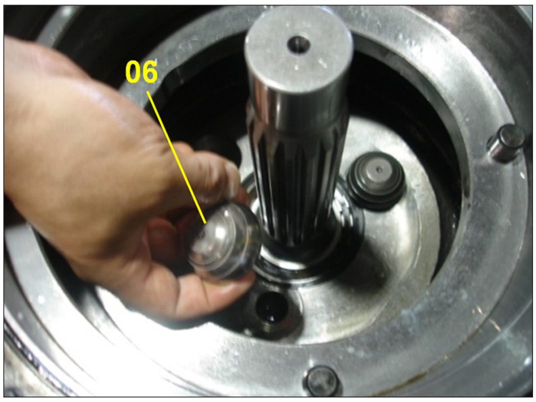
3809A2TM085

(9) Assemble swash piston kit assembly.



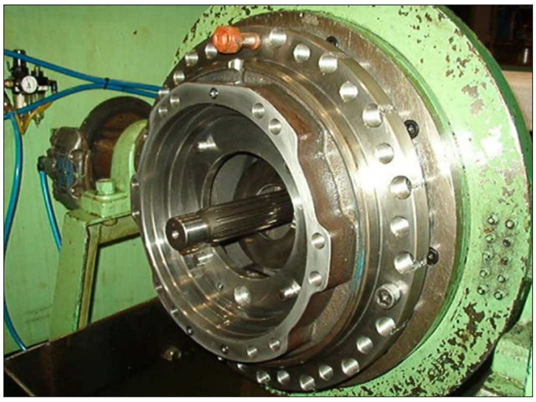
3809A2TM086

(10) Assemble swash ball (06).

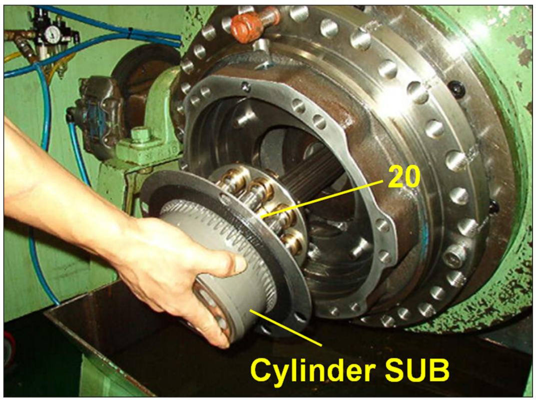


3809A2TM087

(11) Work when the shaft casing is at the vertical direction.
※ Be careful not to drop the swash plate.


3809A2TM088

(12) Fit the cylinder sub assembly.
※ Align the separate plates (20) to the pin.



3809A2TM089

(13) Place the motor vertical again.

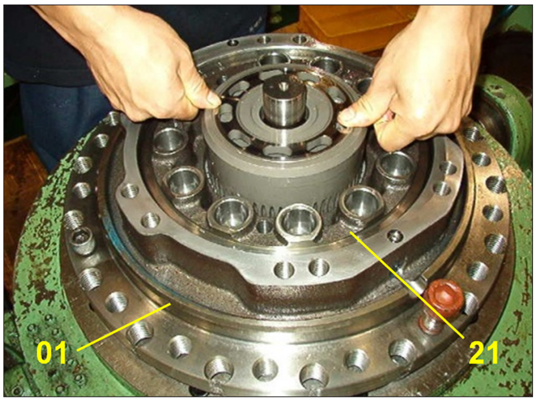

3809A2TM090

(14) Fit piston ring (22), piston ring (23) to brake piston (21).

3809A2TM091

(15) Fit the brake piston (21) to the shaft casing (01).

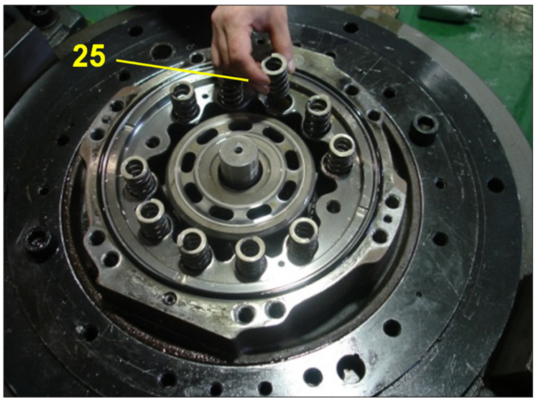
※ Pay attention to the direction of the brake piston.



3809A2TM092

(16) Mount brake springs (25).

① Numbers : Springs - 10EA , Holes - 10EA

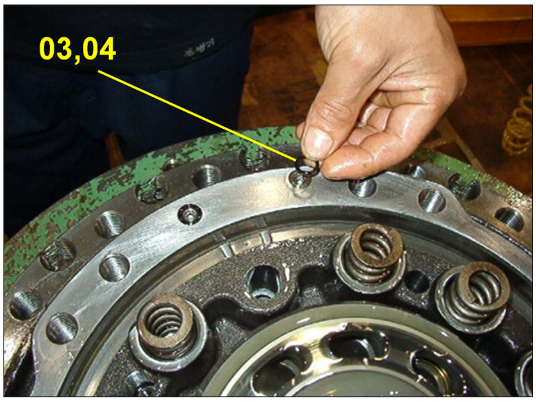


3809A2TM093

(17) Tighten orifice (03, 04) to the specified torque.

① Numbers and size : (03) 1 EA - Ø0.6
(04) 1 EA - Ø0.8

② Tightening torque : 70 kgf · cm

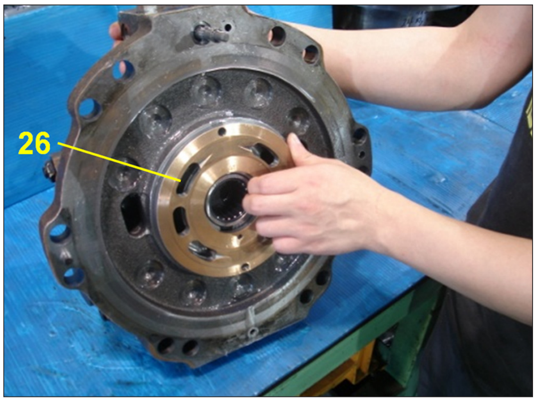


3809A2TM094

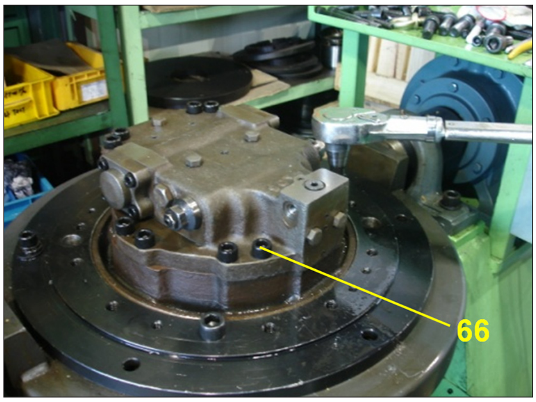
(18) Mount valve plate (26) to valve casing and tighten it with hexagonal socket bolt (66).

① Apply grease to the valve plate back and be careful not to drop the valve plate.
② When you assemble the valve casing to shaft casing, please use a crane.
③ The hole (Ø5) of valve plate will be located for inlet and outlet port of valve casing.
④ Coat grease to swash spool of swash spring.
 · Tightening torque : 2400 kgf · cm

- Bolt tightening torque : 1800±100 kgf · cm

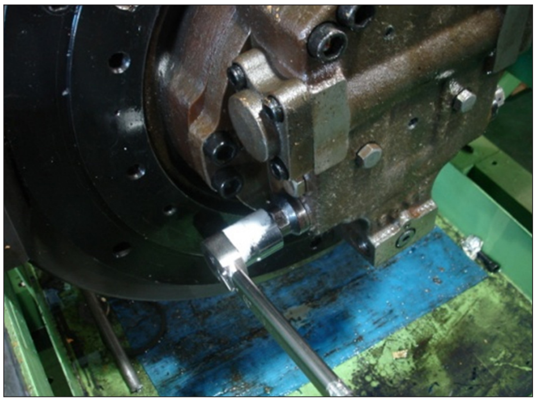


3809A2TM095



3809A2TM096

(19) Tighten relief valves (43) to the specified torque.



3809A2TM097

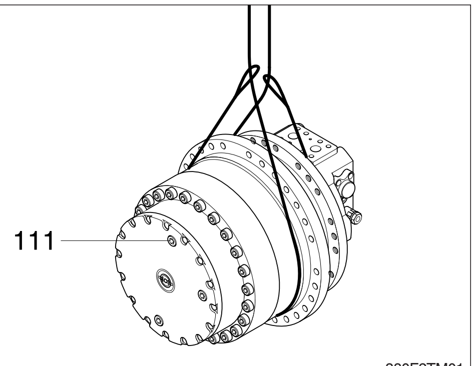
※ Assembly has completed.

3. DISASSEMBLING REDUCTION GEAR

1) DISASSEMBLY

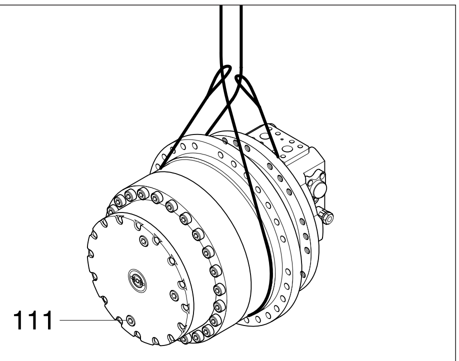
(1) Loosen drain plug (111).

- Do not remove drain plug (111) at once.
- Because gear oil was compressed, plug and oil protrude suddenly.



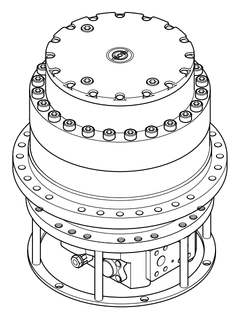
380F2TM01

(2) After loosening drain plug (111), drain gear oil.



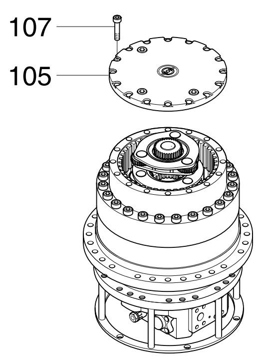
380F2TM02

(3) Overturn the traveling device.



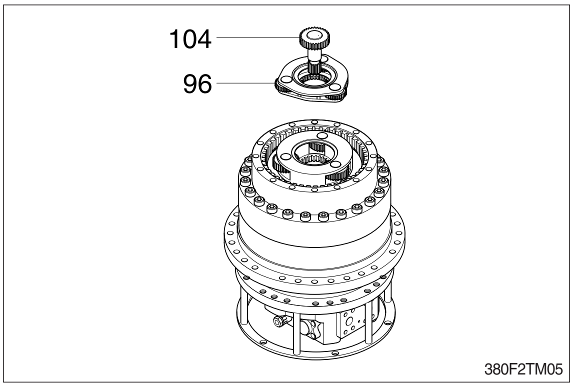
3809A2TM113

(4) After loosening bolt (107), take cover (105) off.

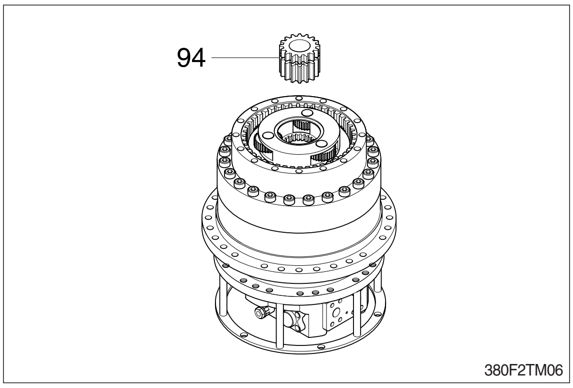


380F2TM04

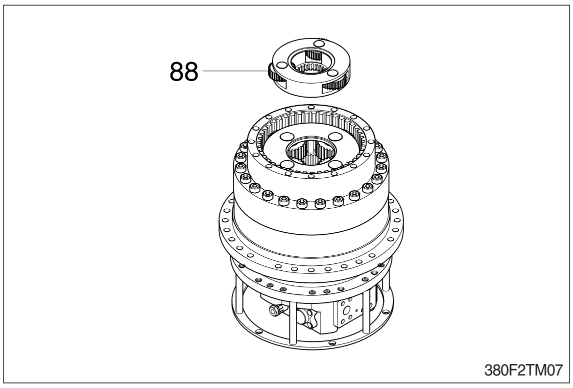
(5) Remove drive gear (104) and No.3 carrier (96).



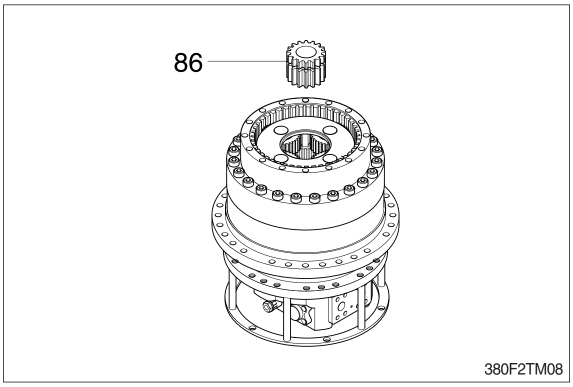
(6) Remove No.2 sun gear B (94).



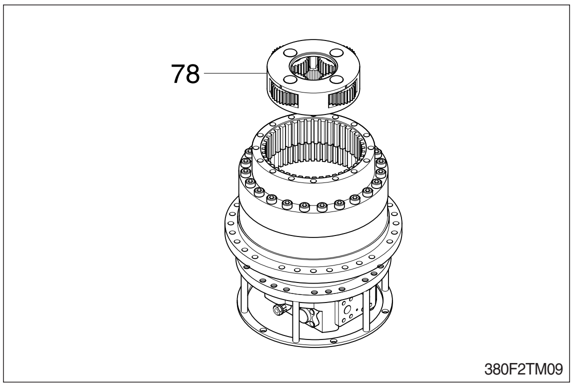
(7) Remove No.2 carrier B (88).



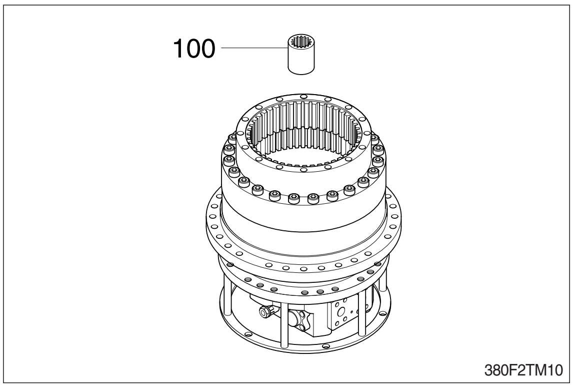
(8) Remove No.1 sun gear A (86).



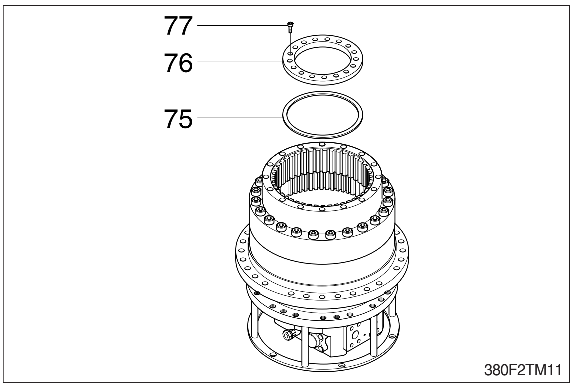
(9) Remove No.1 carrier A (78).



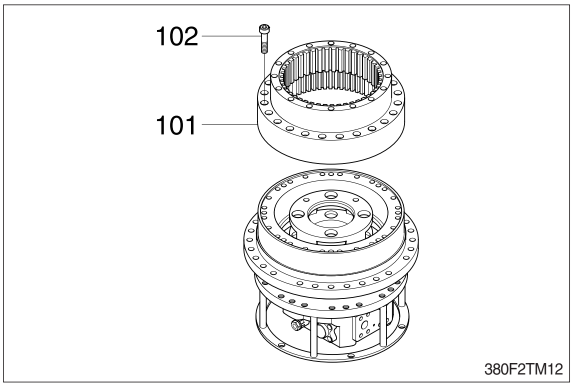
(10) Remove coupling (100).



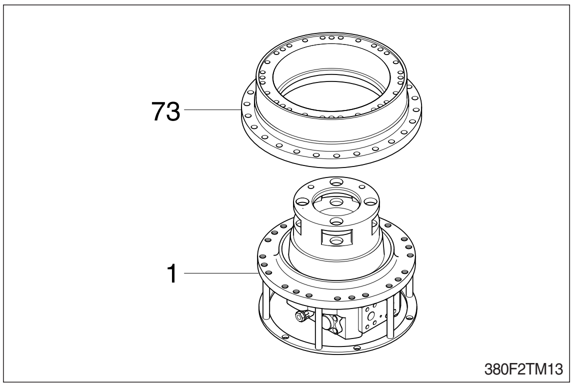
(11) After loosening bolt (77), remove bearing guide (76) and shim (75).



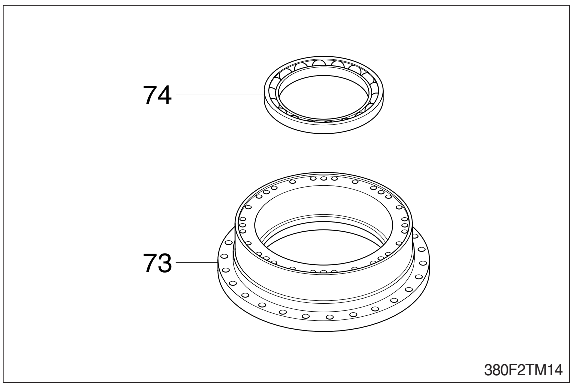
(12) After loosening bolt (102), remove ring gear (101).
- Tools : I-bolt, Hoist



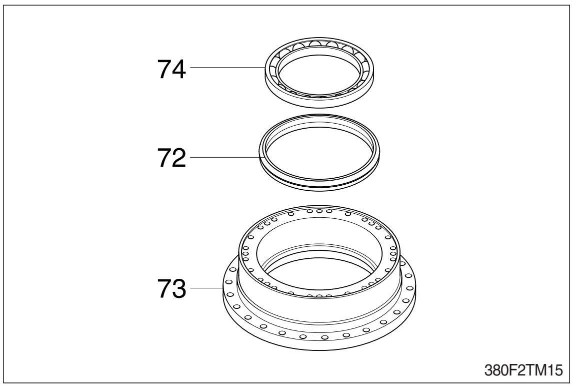
(13)Remove hub (73) from assembly (1).
- Tools : I-bolt, Hoist



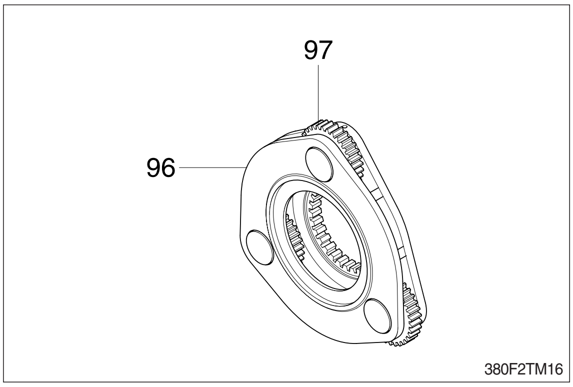
(14)Remove angular bearing (74) from hub (73).



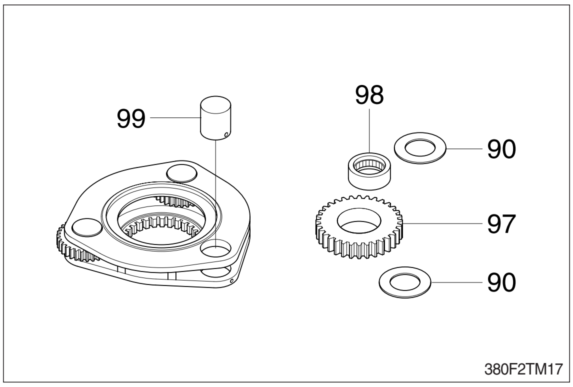
(15)Remove floating seal (72) and angular bearing (74) at opposite of hub (73).



(16)Remove planetary gear C (97) from No.3 carrier C (96).



(17)After removing pin (99), remove No.3 planetary gear C (97), needle bearing (81) and plate C (90).



(18)Remove No.2 carrier B (88) assy.

(19)Remove No.1 carrier A (78) assy.

※ Disassembly has completed.

4. ASSEMBLING REDUCTION GEAR

- General precautions

  Clean every part by kerosene and dry them by air blow.

  Surfaces to be applied by loctite must be decreased by solvent.

  Check every part for any abnormals.

  Each hexagon socket head bolt should be used with loctite No. 242 applied on its threads.

  Apply gear oil slightly on each part before assembling.

  Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

Inspection before reassembling

Thrust washer

· Check if there are seizure, abnormal wear or uneven wear.

· Check if wear is over the allowable limit.

Gears

· Check if there are pitting or seizure on the tooth surface.

· Check if there are cracks on the root of tooth by die check.

Bearings

· Rotate by hand to see if there are something unusual such as noise or uneven rotation.

Floating seal

· Check flaw or score on sliding surface or on O-rings.

1) Track gearbox, assembly

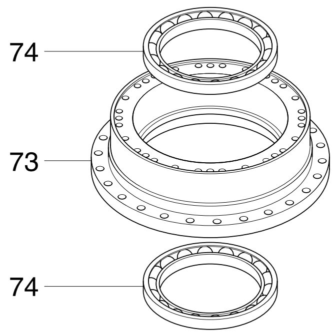
Before assembly track gearbox

Please observe following item.

- Wash all parts cleanly using solvent and dry all parts perfectly using compressed air.
- Check metal dust in casing and cleansing solution.
- Before application packing, please remove oil certainly.
- Before insert needle bearing, apply grease to bearing inlet enough.
- Apply lubricant to rotation part and sliding part.
- Damaged part or discolored part exchanges by new parts.

(1) Assemble hub

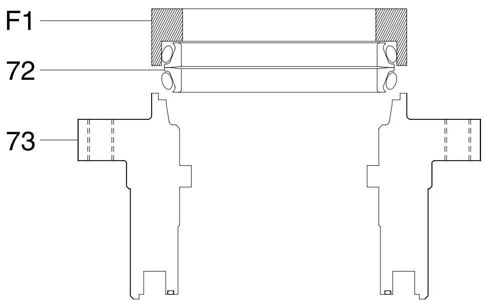
① Press fit angular bearing (74) to hub (73).



380F2TM18

② Assemble floating seal (72) to hub (73) using press jig (F1).

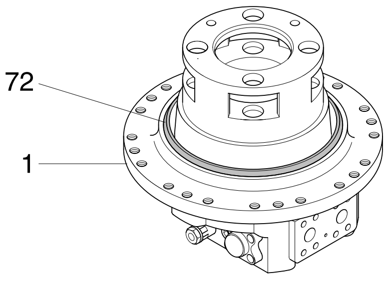
- Remove completely the oil of surface that O-ring and O-ring contact.
- Dry completely the floating seal.
- After assembling the floating seal, check floating seal angle (within 1 mm).
- After assembling the floating seal, coat lubricant to the sliding surface of the floating seal.



380F2TM19

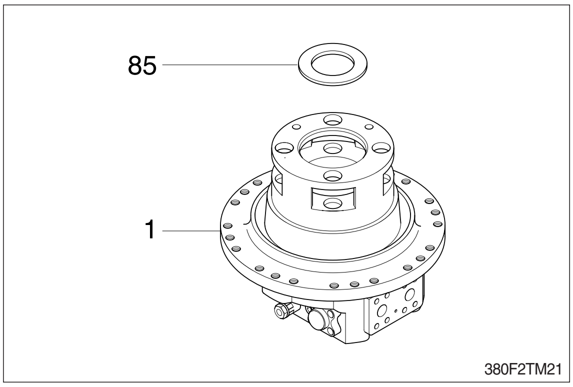
③ Assemble floating seal (72) to track motor (1) using press jig (F1).
Assembling sequence is same with sequence (②).

- Remove completely the oil of surface that O-ring and O-ring contact.
- Dry completely the floating seal.
- After assembling floating seal, coat lubricant to the sliding surface of the floating seal.

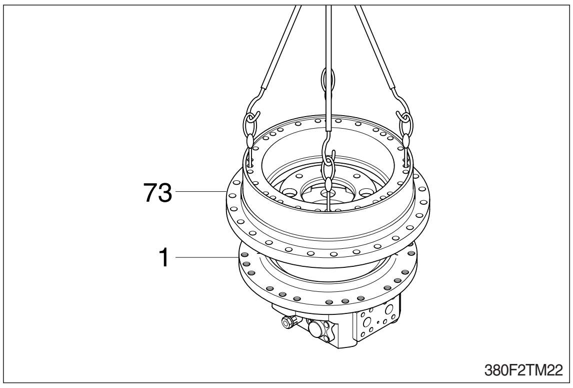


380F2TM20

(2) Assemble thrust plate (85) to spline surface of track motor (1).

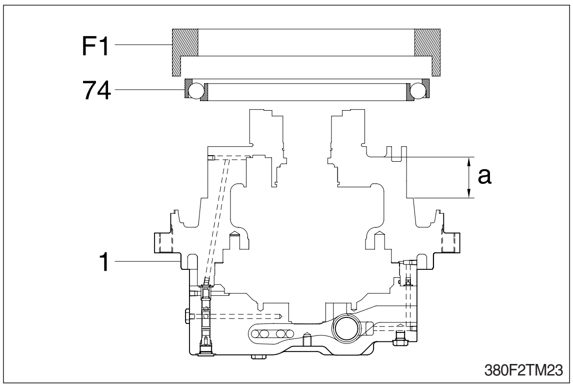


(3) Insert the assembly of hub (73) to track motor (1).



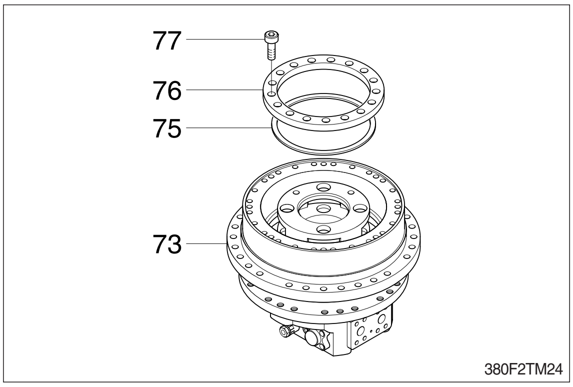
(4) Stick bearing (74) to track motor (1) using press jig (F1).

- Don't heat the bearing.
- Don't hit the bearing retainer.
- Spin the hub. (two times ~ three times)
- Measure "a" size of figure.

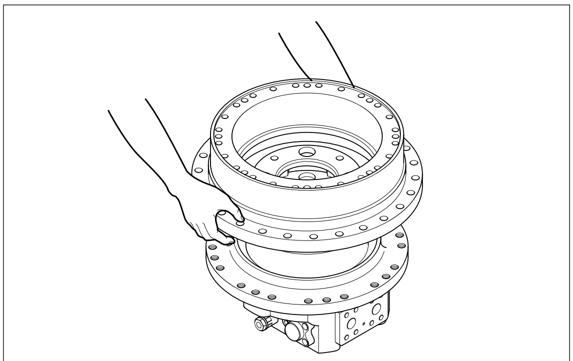


(5) After assembling shim (75), assemble bearing guide (76) using bolt (77).

- Select thickness of shim (75) and assembly.
- Apply loctite #262 to bolt (77).
  · Tightening torque : 1300 kgf · cm



(6) Assemble bearing guide.
According to the hub turn, we can check it goes on smoothly or not.



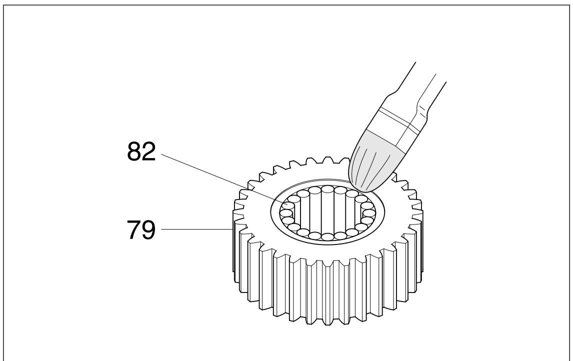
3809A2TM135

(7) Assemble No.1 carrier A (78) sub.

① Mount bearing bushing (82) to No.1 planetary gear A (79).

- Bearing bushing numbers : 18EA

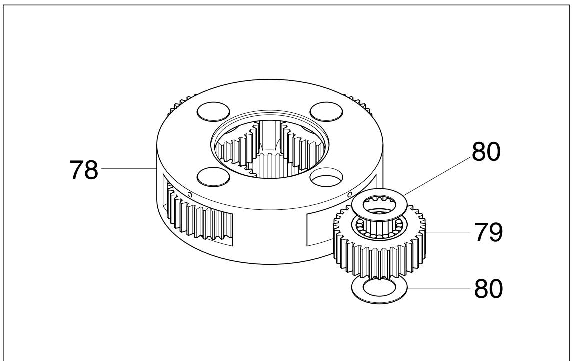
Insert needle and coat grease.



380F2TM26

② Mount No.1 planetary gear A (79) and plate A (80) to No.1 carrier A (78).

- Align the hole of carrier and needle inside diameter.

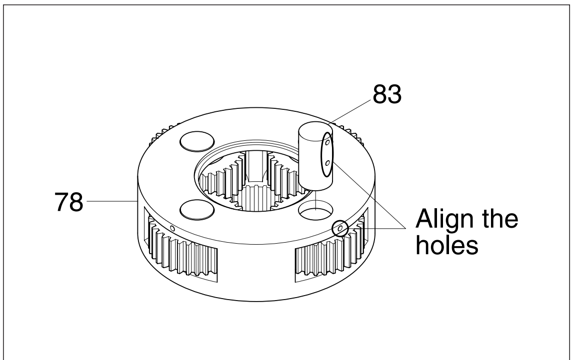


380F2TM27

③ Put pin (83) on holes of No.1 carrier A (78).

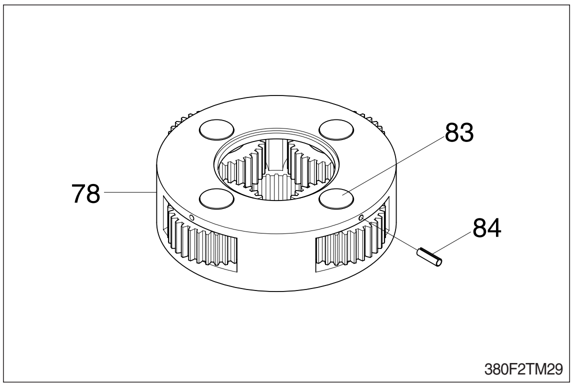
※ Align the holes of the carrier and pin holes.

※ Beat on it lightly with hammer and put in.

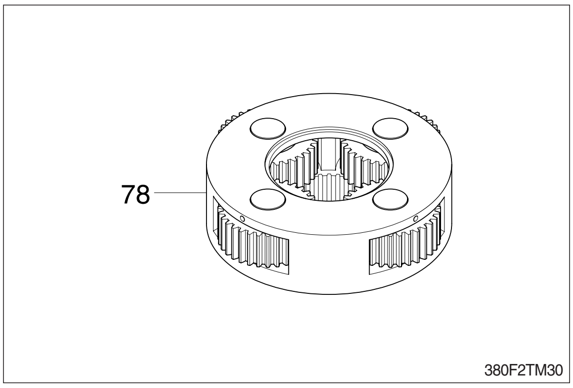


380F2TM28

④ Assemble carrier (78) and pin (83) striking pin (84) by hammer.
After assembly pin (84), caulking.



⑤ Complete remainder by equal method.

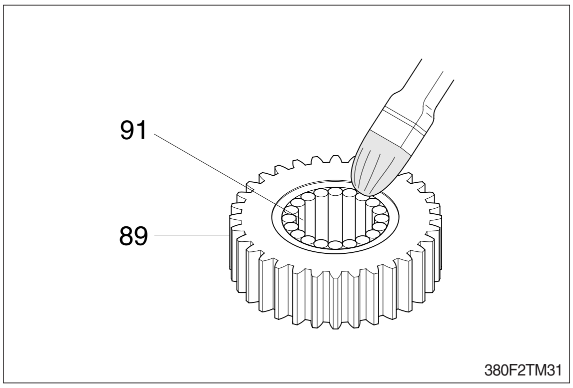


(8) Assemble No.2 carrier B (88) sub.

① Mount needle (91) to No.2 planetary gear B (89).

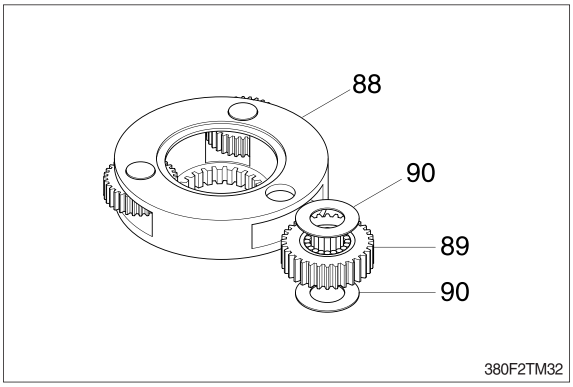
- Needle numbers : 15 EA

Insert needle and coat grease.



② Insert No.2 planetary gear B (89) and plate B (90) to No.2 carrier B (88).

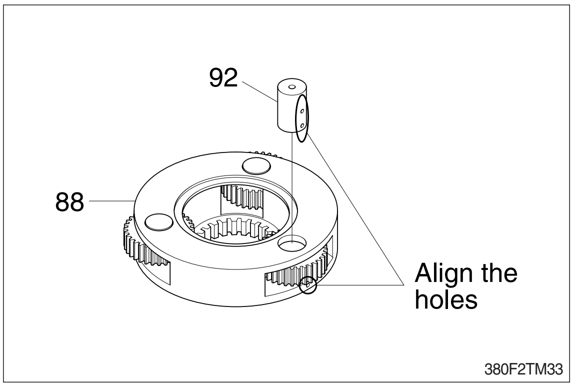
- Align the holes of the carrier and pin holes.



③ Put pin (92) on holes of No.2 carrier B (88).

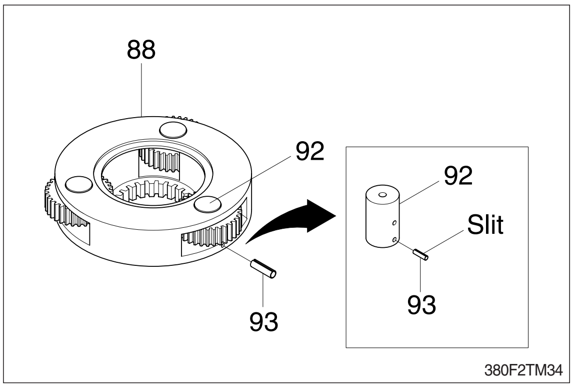
※ Align the holes of the carrier and pin holes.

※ Beat on it lightly with hammer and put in.

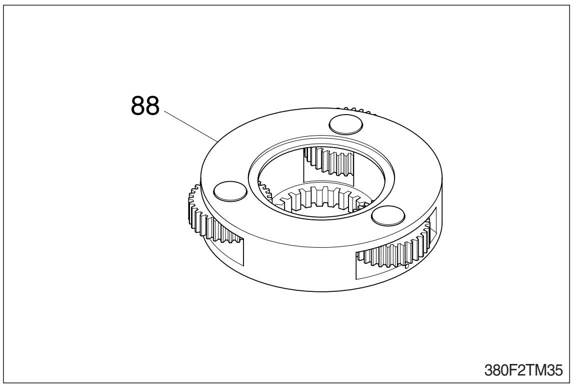


④ Assemble carrier (88) and pin (92), striking pin (93) by hammer.

- If the pin's divided side is not located in the above,it will be damaged during operation.
- After assembly pin, caulking.

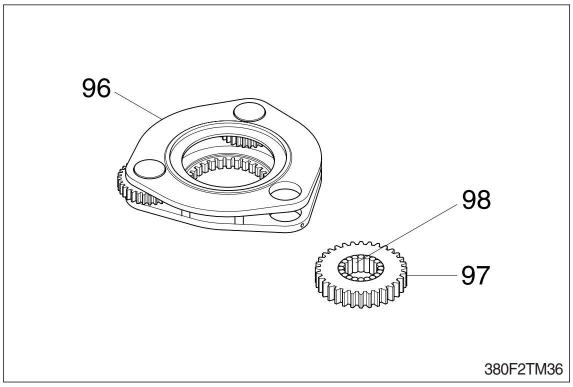


⑤ Complete remainder by equal method.



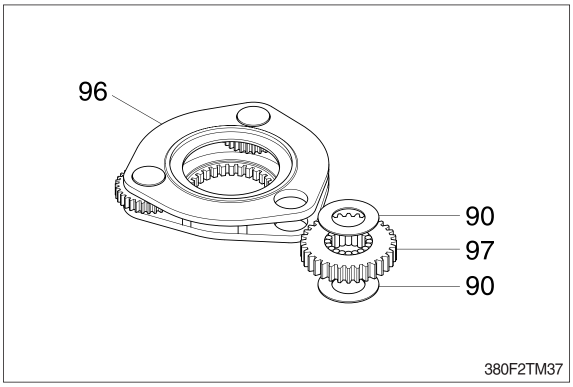
(9) Assemble No.3 carrier C (96) sub.

① Insert needle bearing (98) to No.3 planetary gear C (97).
Insert needle and coat grease.



② Insert No.3 planetary gear C (97) and plate C (90) to No.3 carrier C (96).

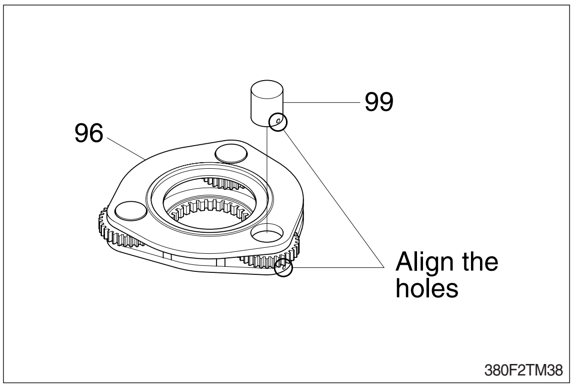
- Align the holes of the carrier and inside diameter of needle bearing.



③ Put pin (99) on holes of No.3 carrier C (96).

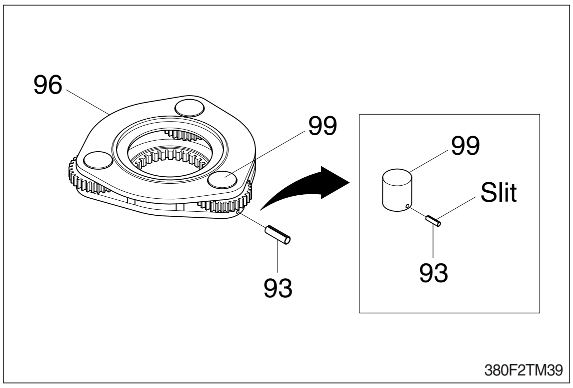
※ Align the holes of the carrier and pin holes.

※ Beat on it lightly with hammer and put in.

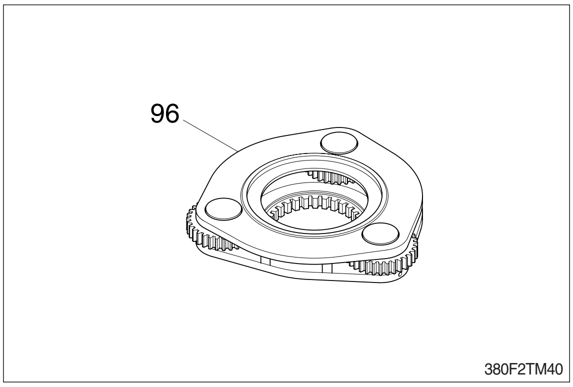


④ Assemble carrier (96) and pin (99) striking pin (93) by hammer.

- If the pin's divided side is not located in the above, it will be damaged during operation.
- After assembly pin, caulking.

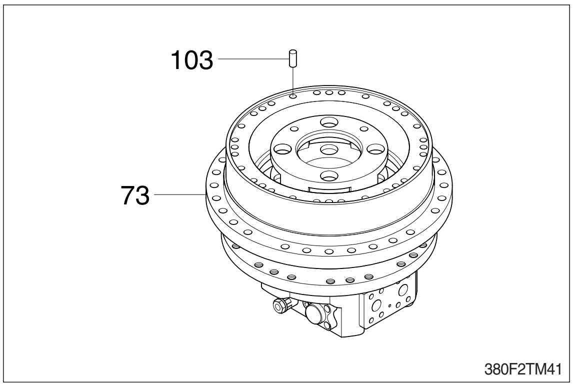


⑤ Complete remainder by equal method.

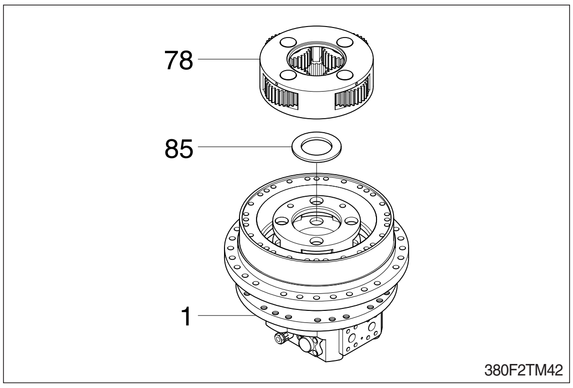


(10)Press-fit parallel pin (103) to the surface of hub (73).

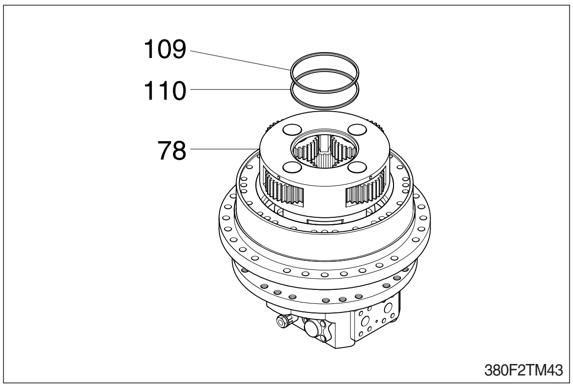
- Parallel pin numbers : 8EA



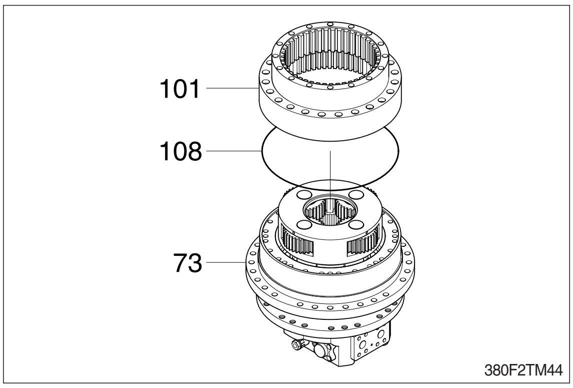
(11)Insert thrust plate (85) to shaft casing of track motor (1).
Press-fit No.1 carrier A (78) assy to shaft casing spline using hoist.



(12)Press-fit ring (109, 110) to the No.1 carrier A (78) assy.

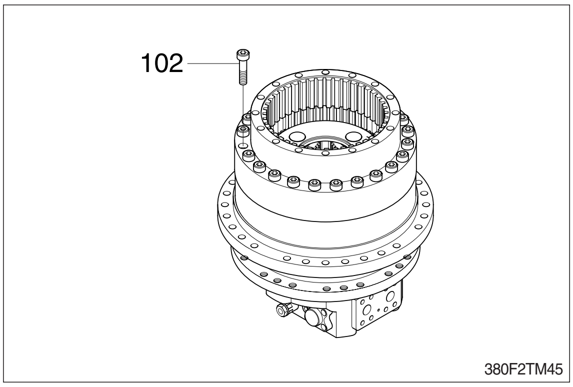


(13)Mounting O-ring (108) into hub (73), and assemble ring gear (101) to hub (73).

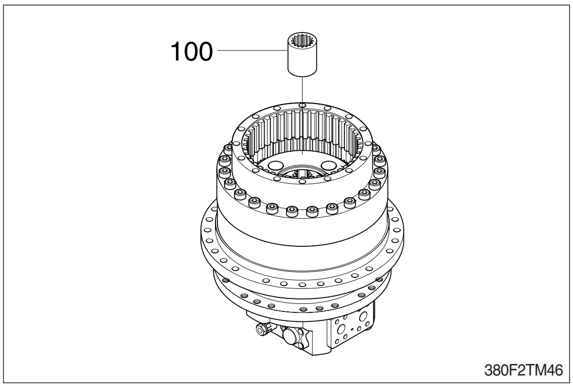


(14) Tighten hub and ring gear.

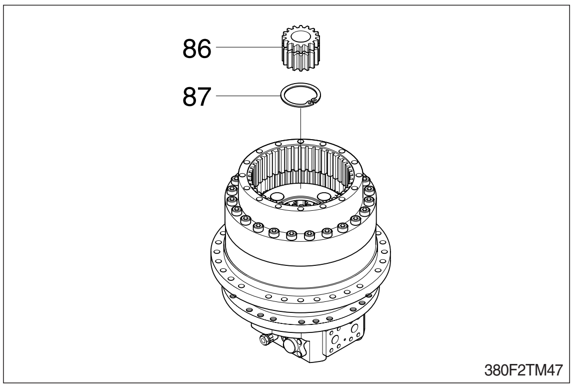
- Bolt numbers : 24 EA
- Tightening torque : 1800 kgf · cm



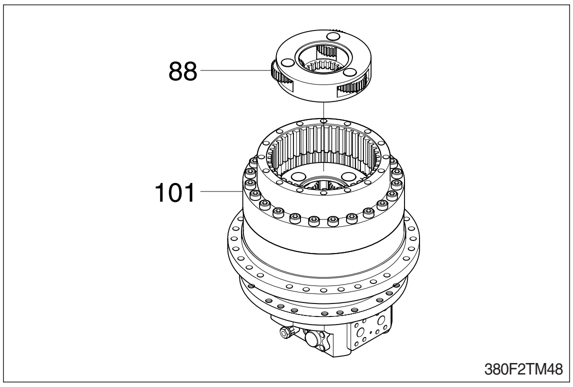
(15) Insert coupling (100) to spline of shaft.



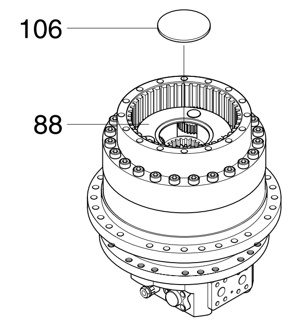
(16) Assemble snap ring (87) to sun gear A (86).
Insert sun gear A (86) to carrier A.



(17) Assemble carrier B (88) to ring gear (101).

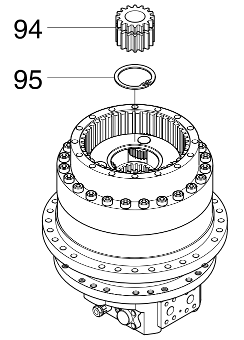


(18) Assemble plate (106) to carrier B (88).



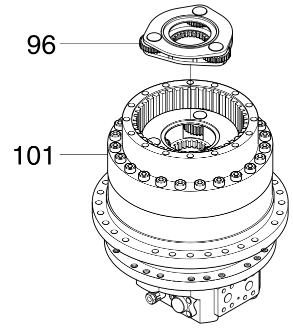
380F2TM25

(19) Assemble snap ring (95) to sun gear B (94).
Insert carrier B to sun gear B (94).



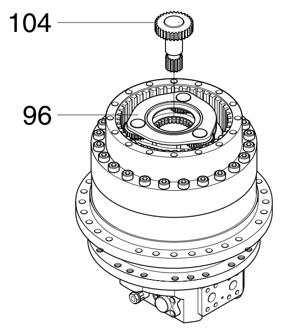
380F2TM49

(20) Assemble carrier C (96) assy to ring gear (101).
After assembling, check whether gear rotate or not.



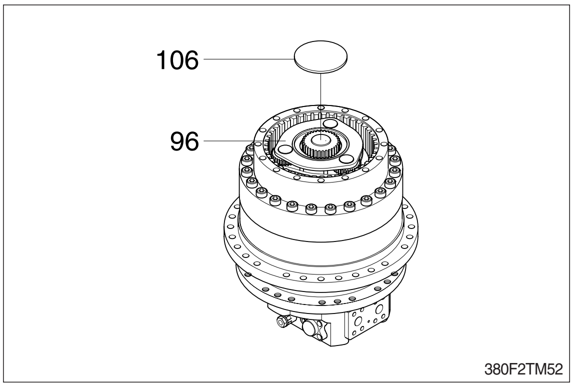
380F2TM50

(21) Assemble carrier C (96) to drive gear (104).

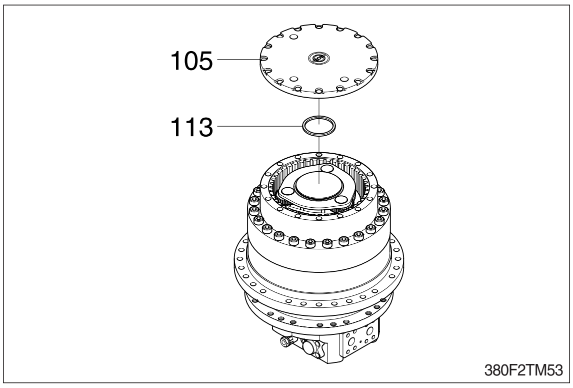


380F2TM51

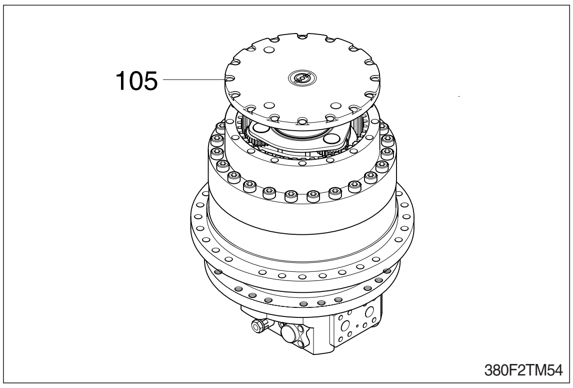
(22) Assemble plate (106) to carrier C (96).



(23) Press-fit bushing (113) to cover (105).

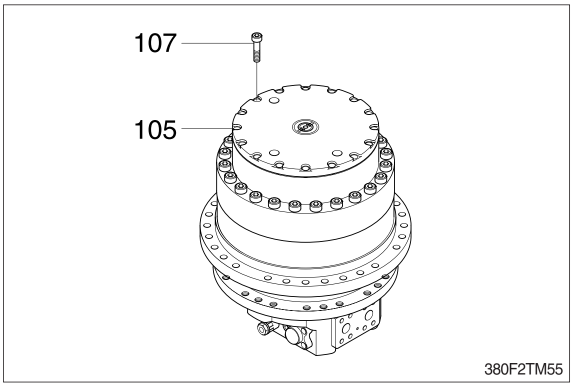


(24) Assemble cover (105).



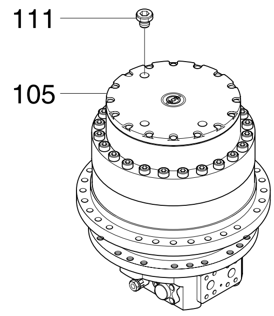
(25) Assemble cover (105) and tighten them to the specified torque.

· Tightening torque : 750 kgf · cm

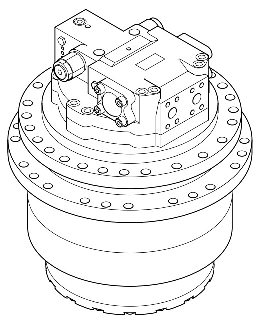


(26) Inject gear oil and assemble plug (111) of cover (105).

- Volume of gear oil : 4.5 liter



380F2TM56



※ Assembly has completed.

3809A2TM167

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

13031GE18

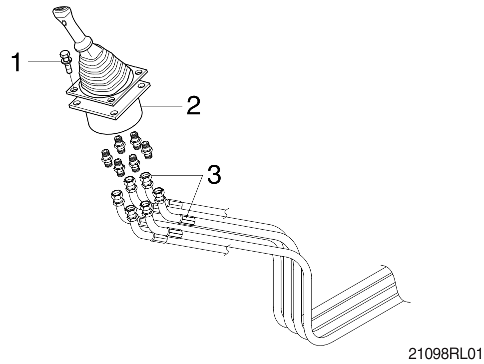
(4) Loosen the socket bolt (1).

(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.



21098RL01

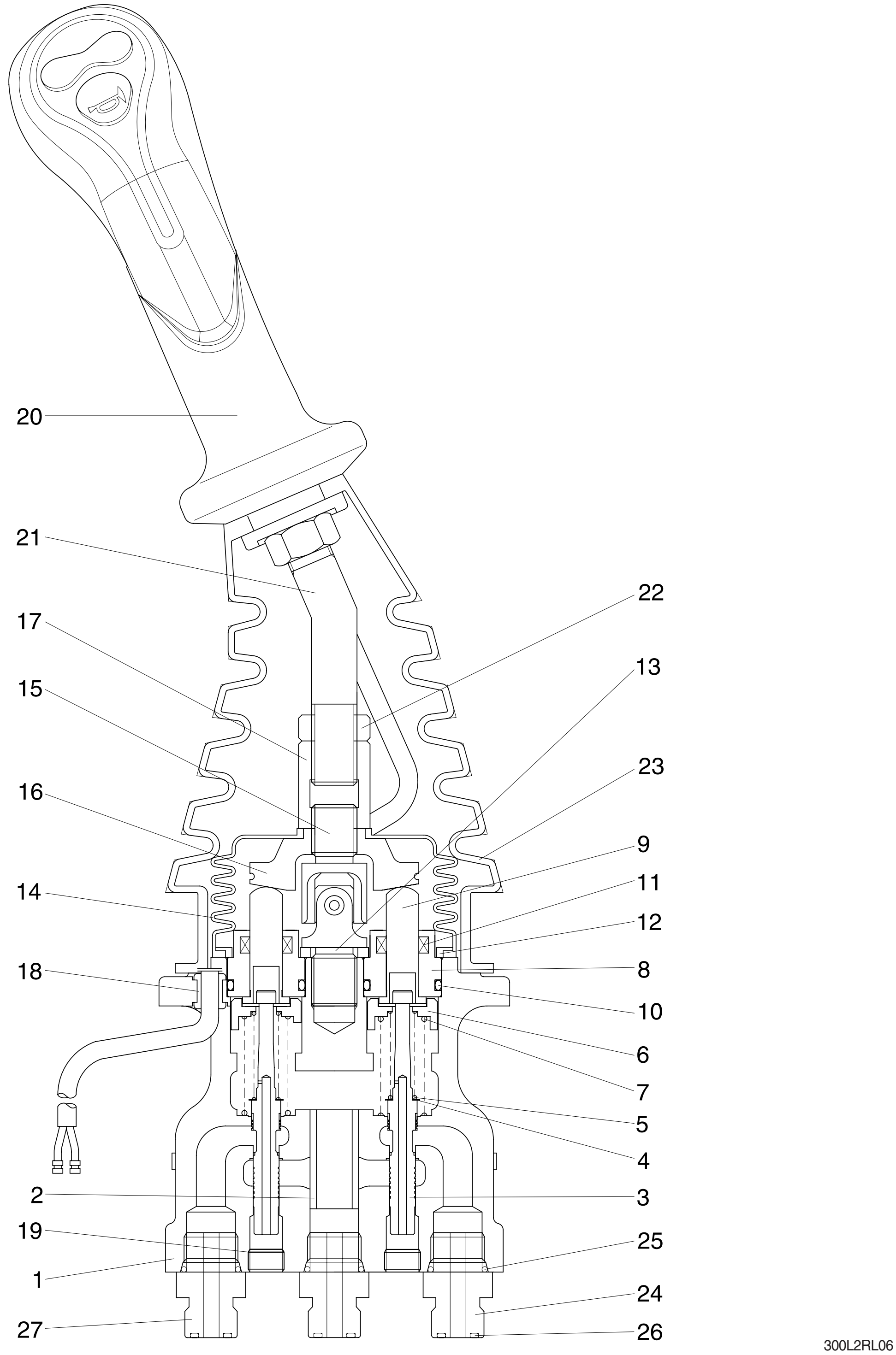
2) INSTALL

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

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

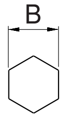
1) STRUCTURE



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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
Spanne	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	15	M14	3.5	25.3
Swash plate	16	M14	5.0±0.35	36.2±2.5
Adjusting nut	17	M14	5.0±0.35	36.2±2.5
Lock nut	22	M14	5.0±0.35	36.2±2.5

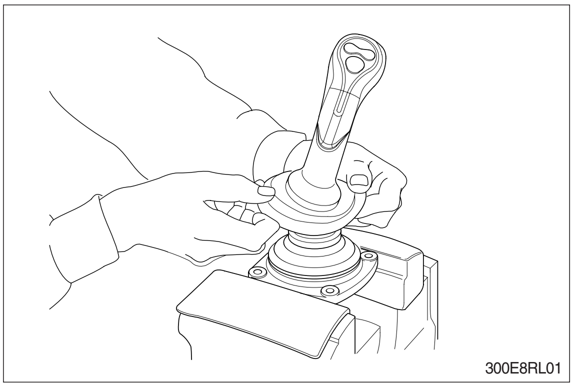
3) DISASSEMBLY

※ Procedures are based on the type L1.

(1) Clean pilot valve with kerosene.
※ Put blind plugs into all ports

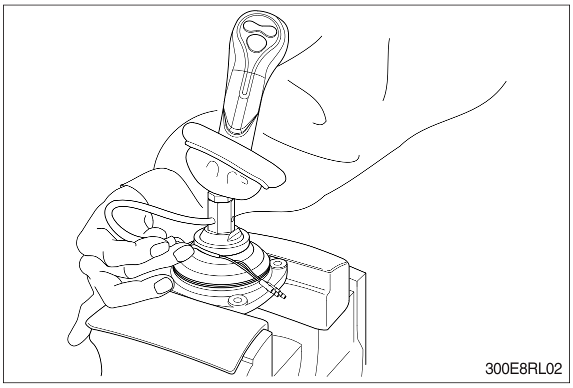
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (23) from case (1) and take it out upwards.



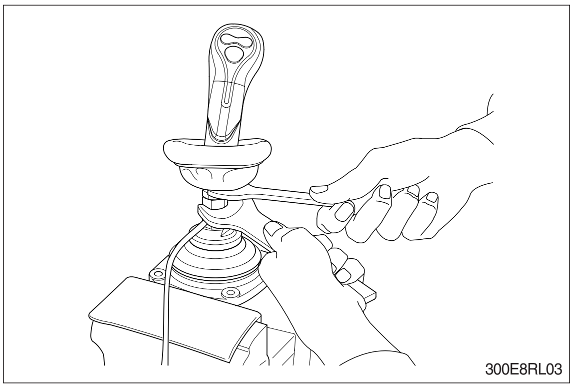
300E8RL01

※ For valve with switch, remove cord also through hole of casing.



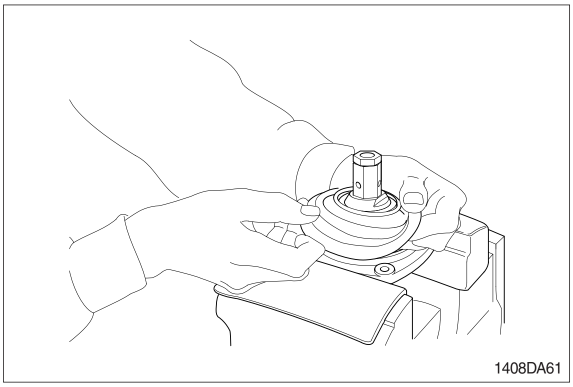
300E8RL02

(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



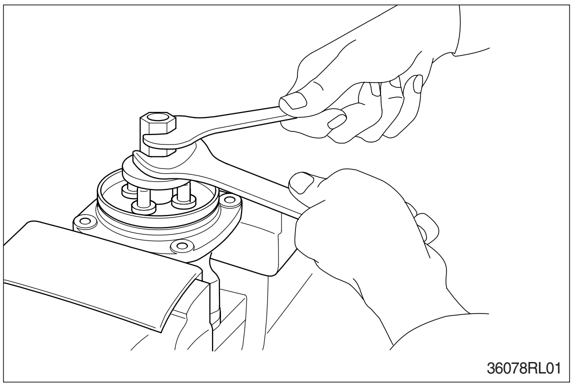
300E8RL03

(5) Remove the boot (14).

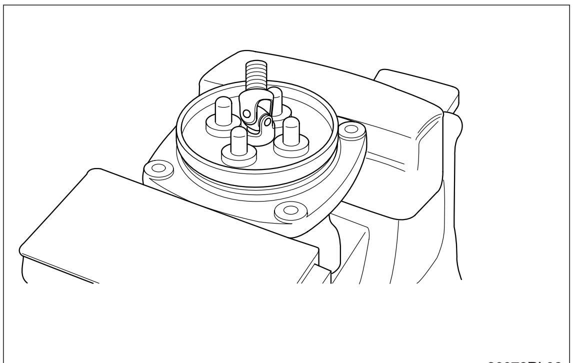


1408DA61

(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.



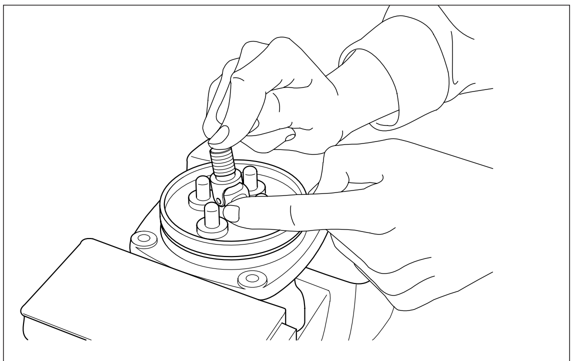
36078RL01



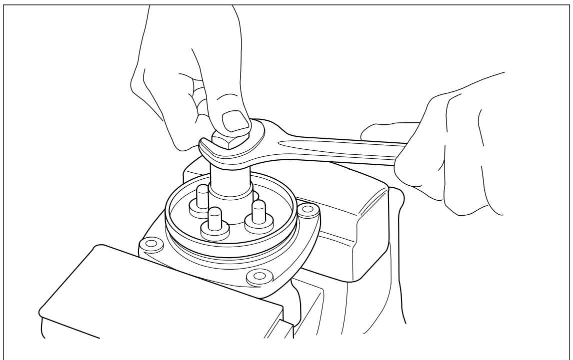
36078RL02

(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint.
Pay attention to this.

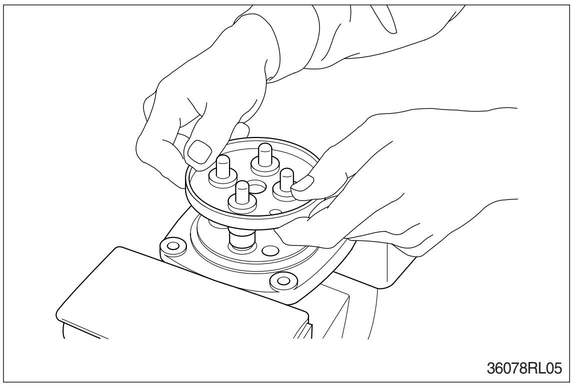


36078RL03



36078RL04

(8) Remove plate (12).

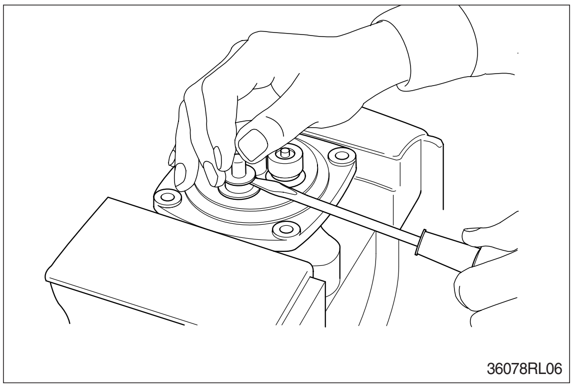


36078RL05

(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

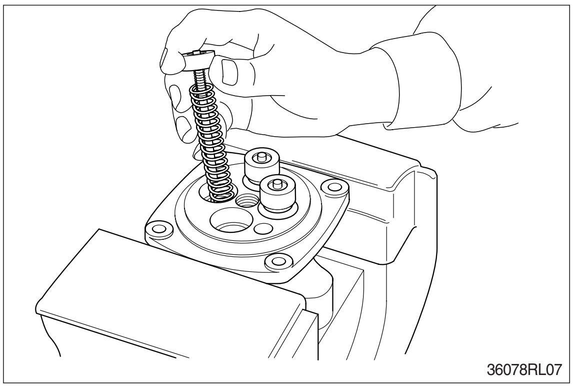
※ During taking out, plug may jump up due to return spring (7) force.
Pay attention to this.



36078RL06

(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



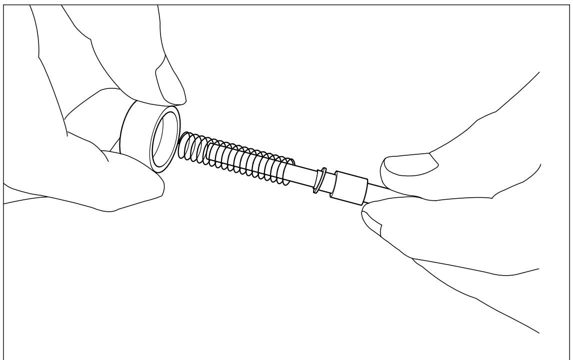
36078RL07

(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

※ Pay attention not to damage spool surface.

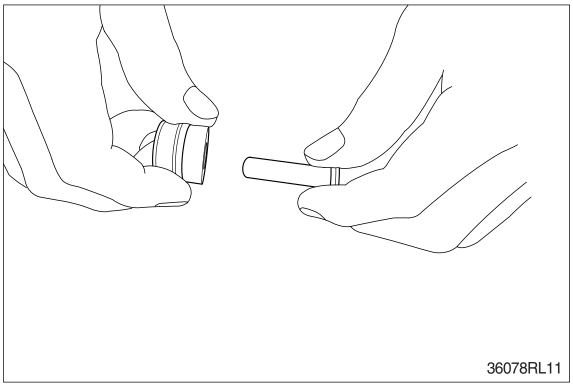
※ Record original position of spring seat (6).

※ Until being assembled, they should be handled as one subassembly group.



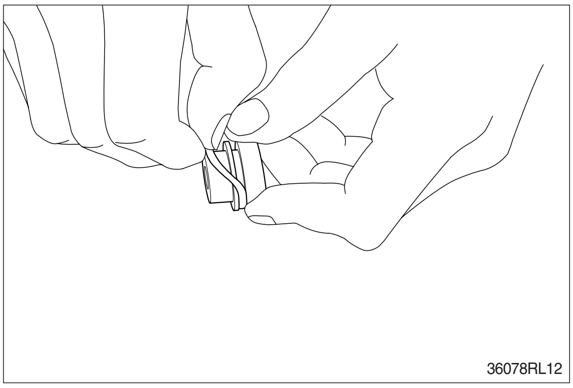
36078RL10

(12) Take push rod (9) out of plug (8).

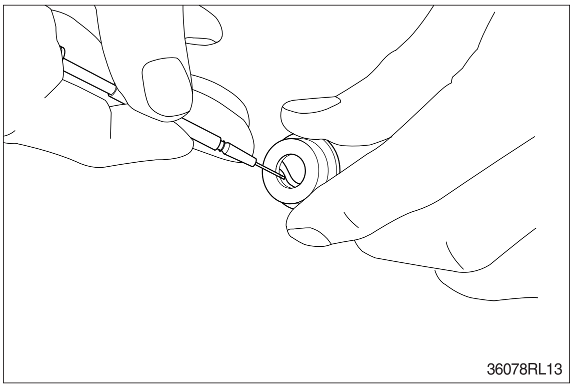


36078RL11

(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.

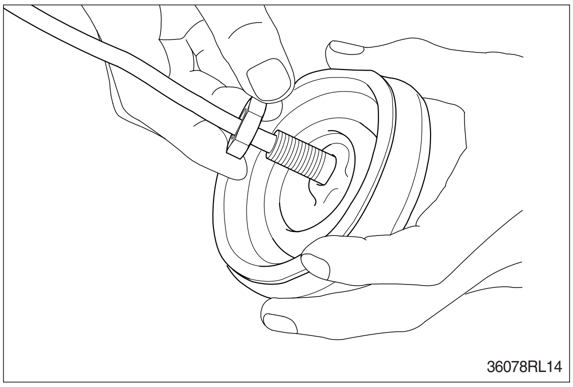


36078RL12

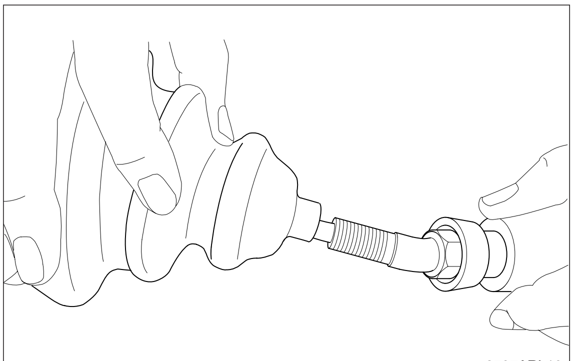


36078RL13

(14) Remove lock nut (22) and then boot (23).



36078RL14



2507ARL10

(15) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

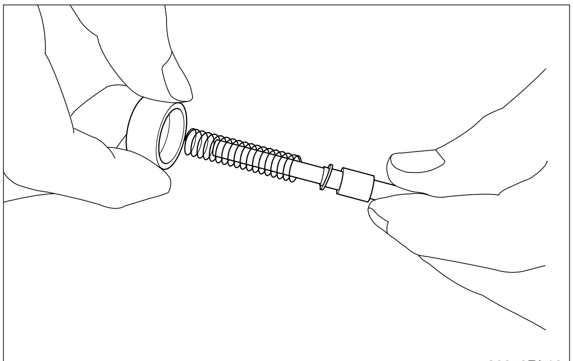
(16) Rust prevention of parts

Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

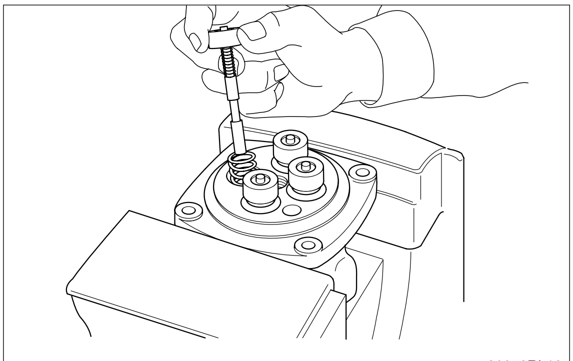
(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



36078RL16

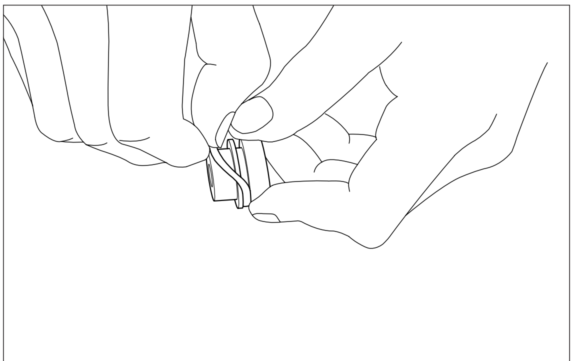
(2) Assemble spring (7) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



36078RL18

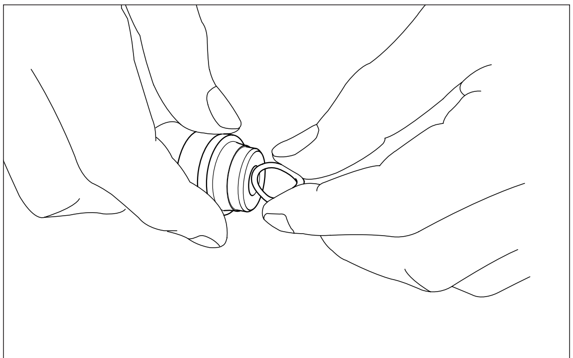
(3) Assemble O-ring (10) onto plug (8).



36078RL19

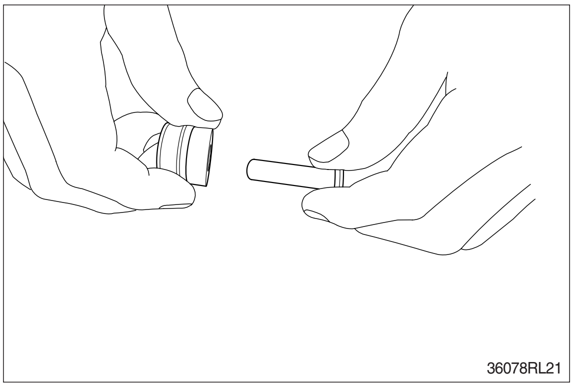
(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.

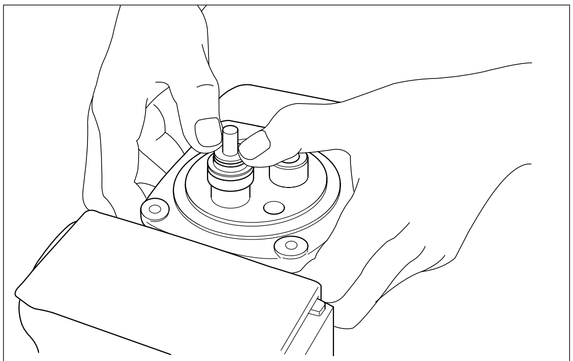


36078RL20

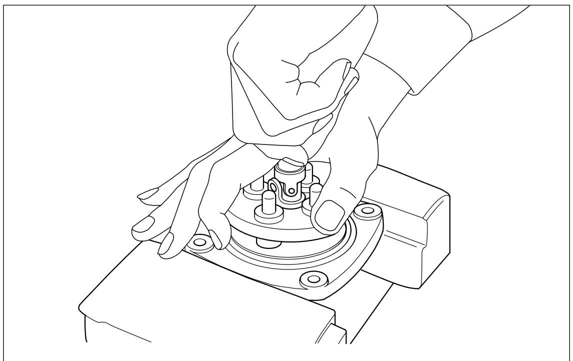
(5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.


36078RL21

(6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

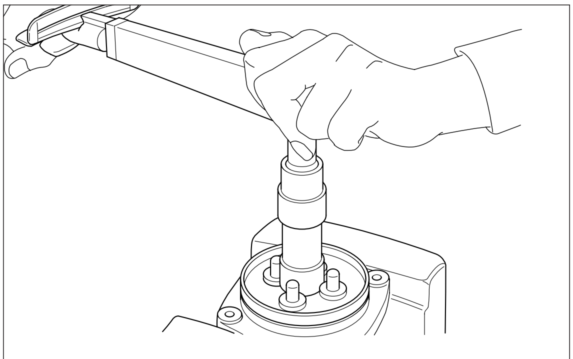

36078RL22

(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.


36078RL23

(8) Fit plate (12).

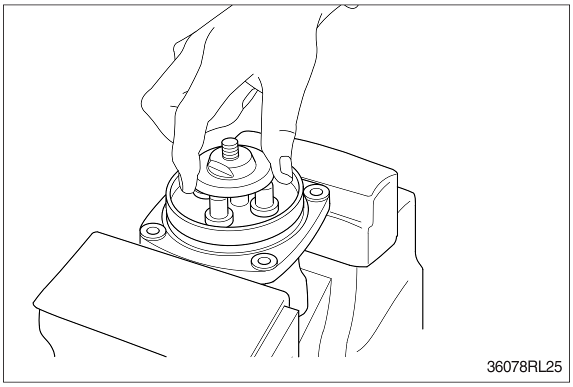
(9) Tighten joint (15) with the specified torque to casing, utilizing jig.


36078RL24

(10) Assemble swash plate (16) to joint (15).

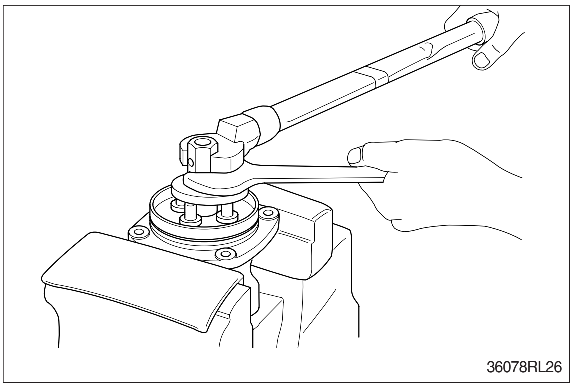
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

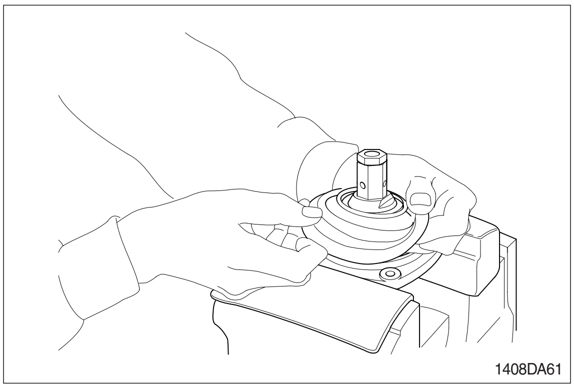


(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

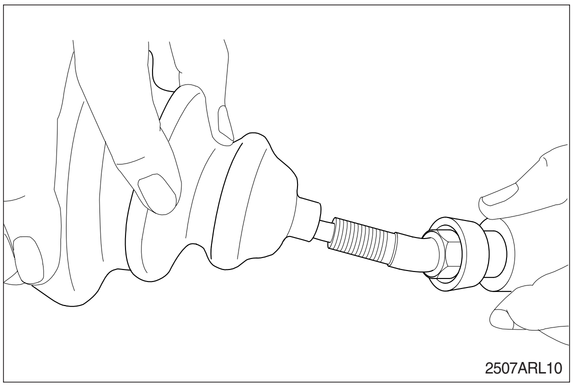
※ During tightening, do not change position of disk.

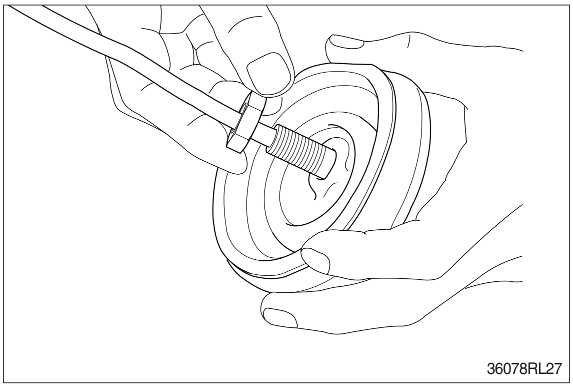


(12) Fit boot (14) to plate.

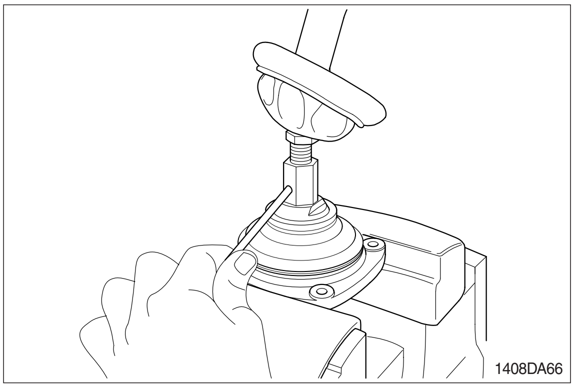


(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



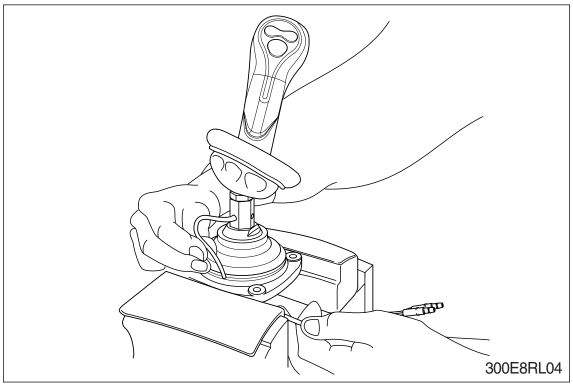


(14) Pull out cord and tube through adjusting nut hole provided in direction 60 °to 120 °from casing hole.

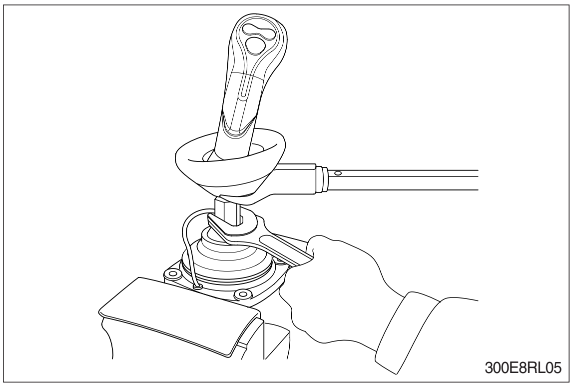


(15) Assemble bushing (18) to plate and pass cord and tube through it.

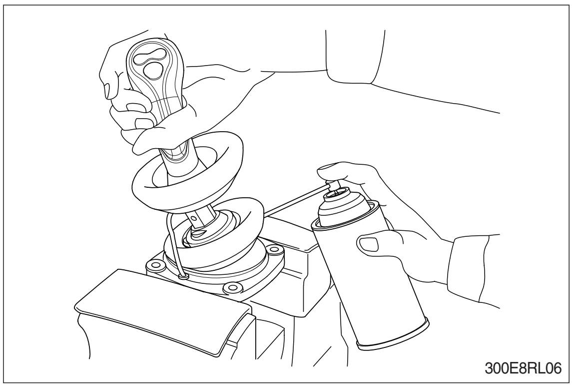
※ Provide margin necessary to operation.



(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

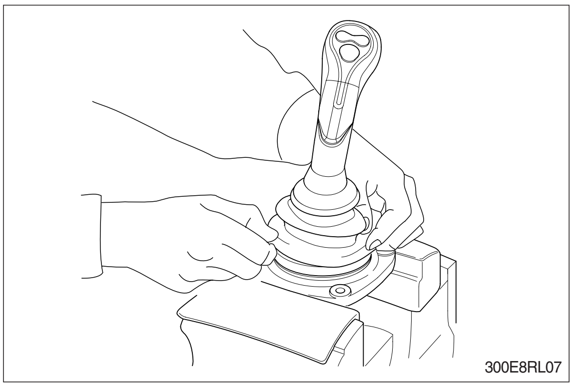


(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(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.

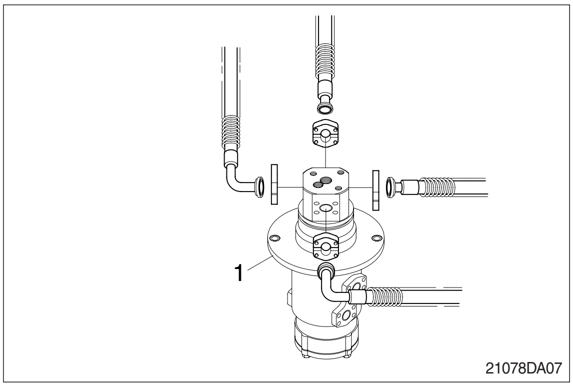
13031GE18

⚠ **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)



21078DA07

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

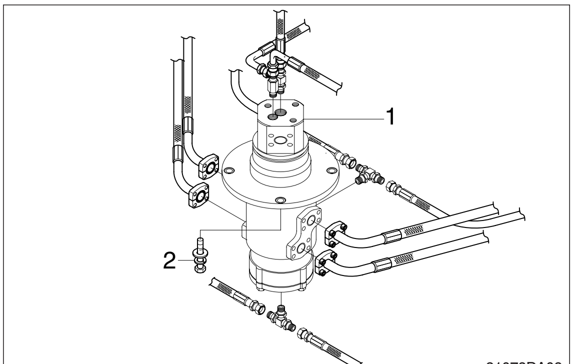
2) INSTALL

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

※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

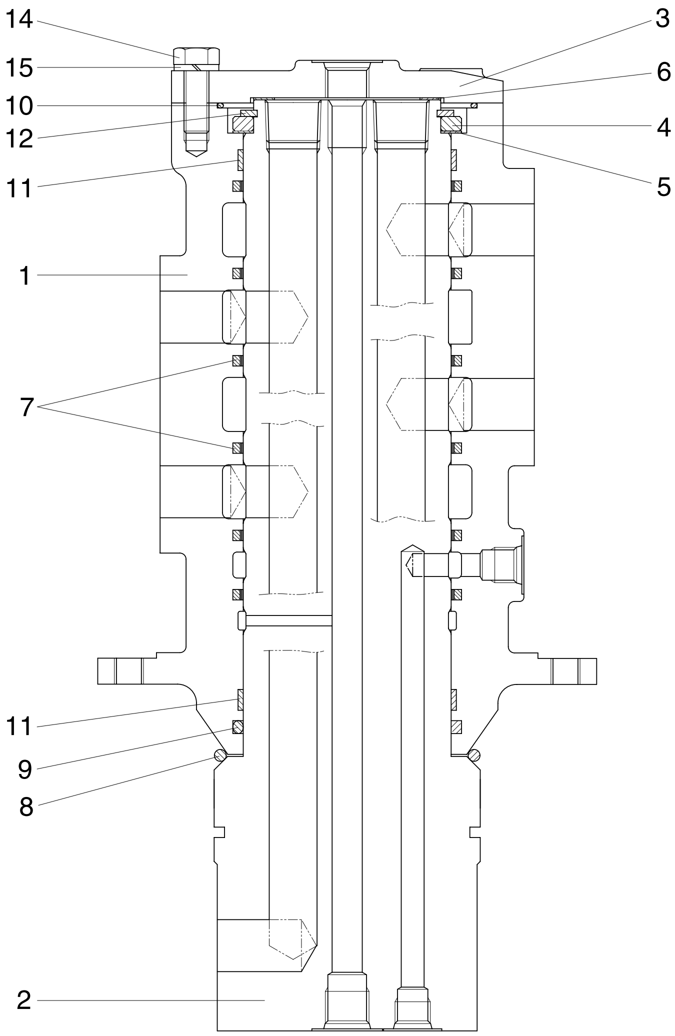
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



21078DA08

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



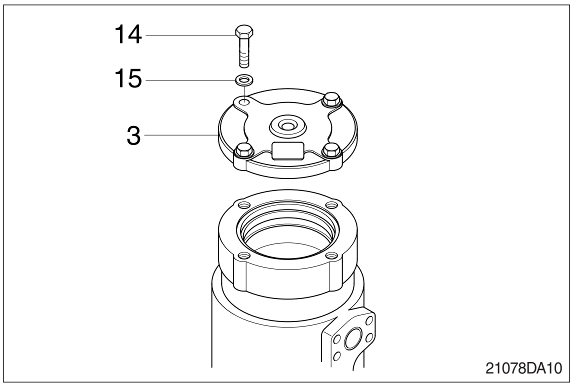
21098TJ01

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

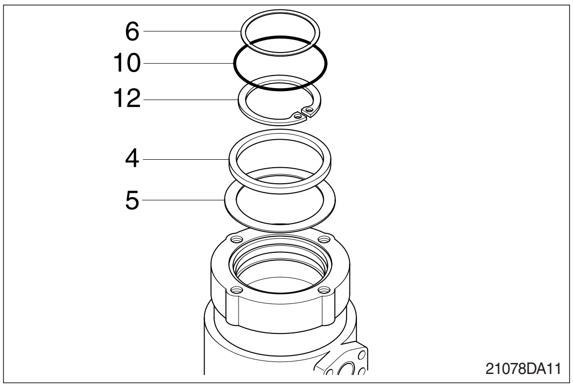
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (14), washer (15) and cover (3).



(2) Remove shim (6) and O-ring (10).

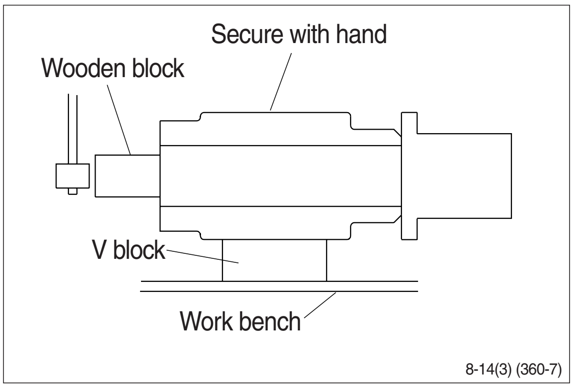
(3) Remove retainer ring (12), spacer (4) and shim (5).



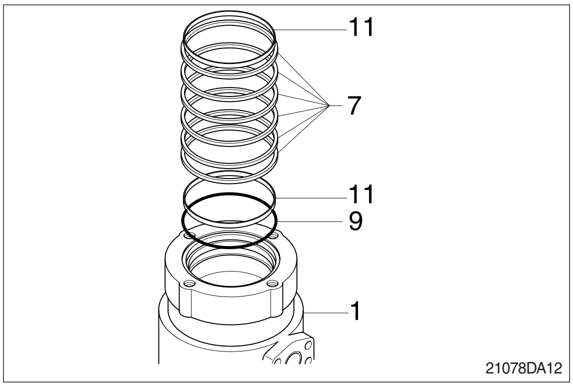
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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

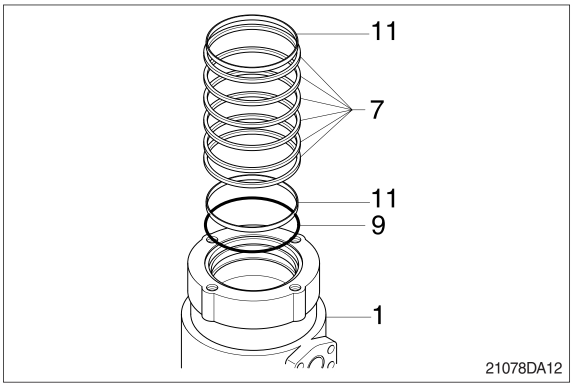
※ Clean all parts.

※ As a general rule, replace oil seals and O-ring.

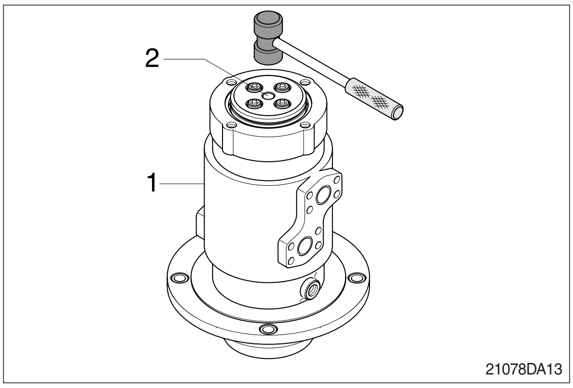
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(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).



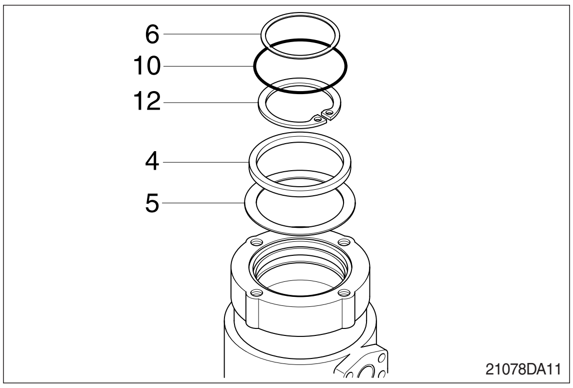
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



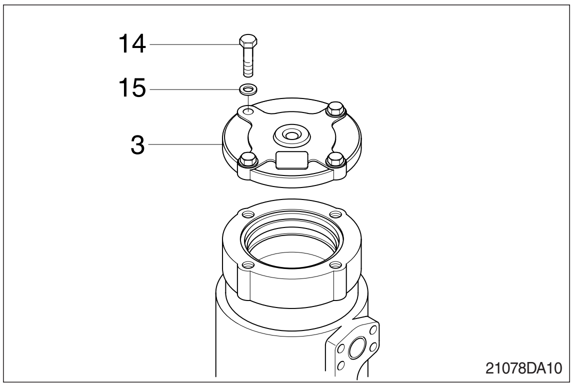
(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

(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.

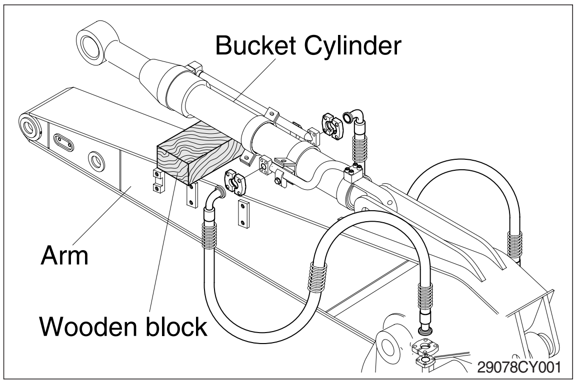
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **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.


13031GE18

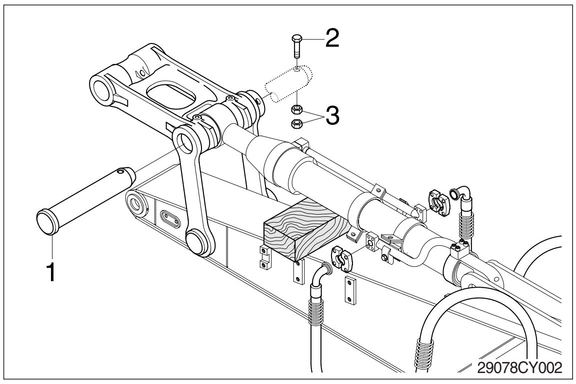
① Set block between bucket cylinder and arm.



29078CY001

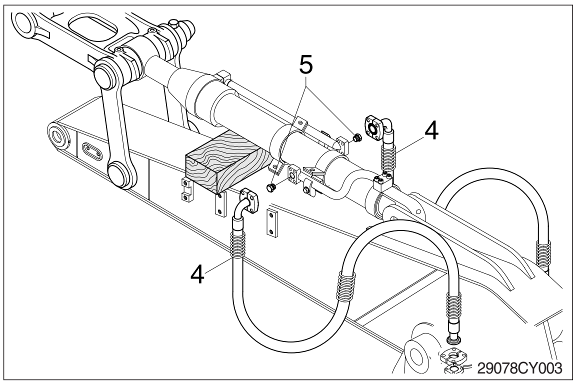
② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



29078CY002

③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.

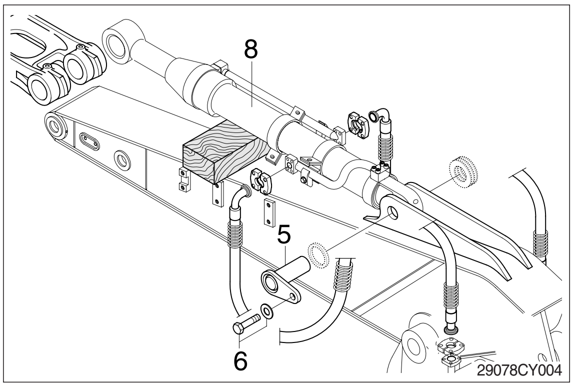


29078CY003

④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

  · Weight : 220 ㎏ (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.

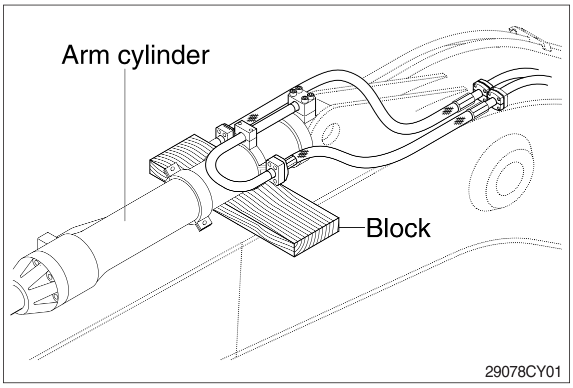
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **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.

13031GE18

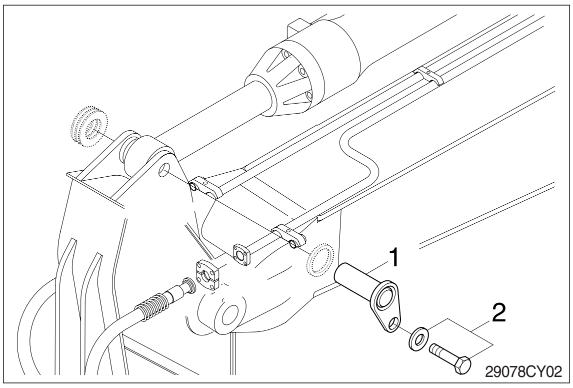
① Set block between arm cylinder and boom.



29078CY01

② Remove bolt (2) and pull out pin (1).

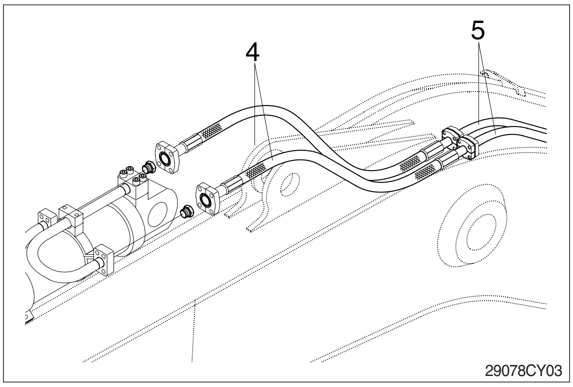
※ Tie the rod with wire to prevent it from coming out.



29078CY02

③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).

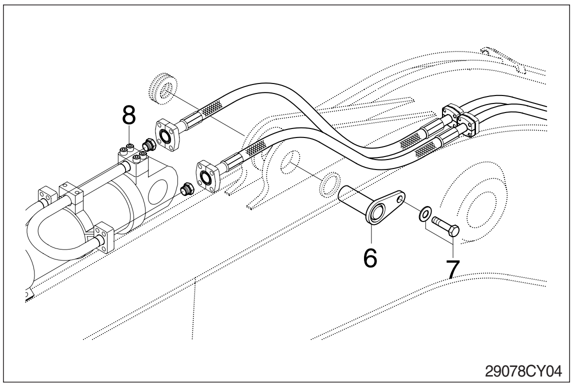


29078CY03

⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

· Weight : 360 ㎏ (790 ㏐)



(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.

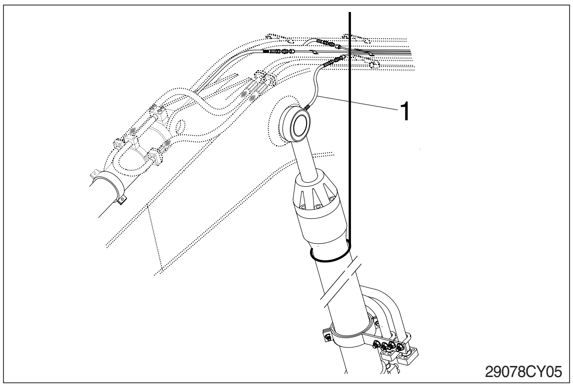
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **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.

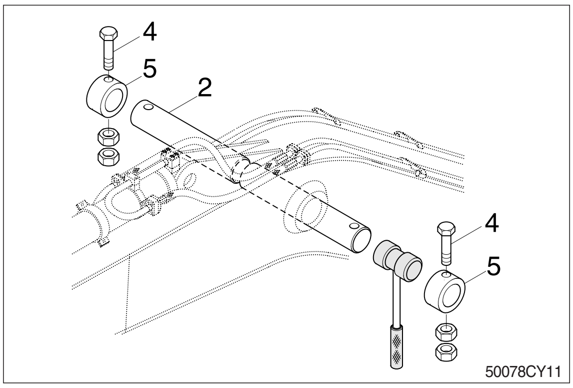
① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

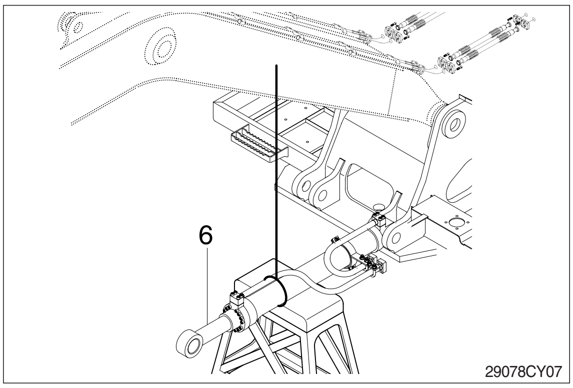


③ Remove bolt (4), pin stopper (5) and pull out pin (2).

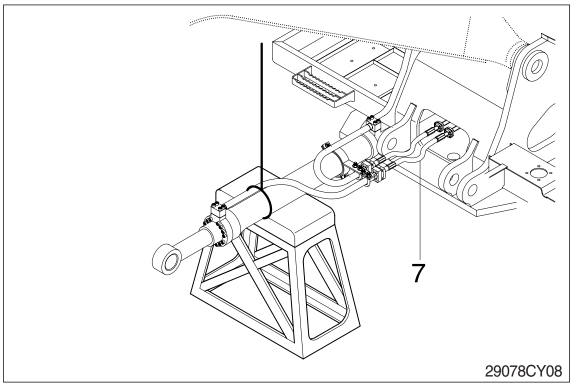
※ Tie the rod with wire to prevent it from coming out.



④ Lower the boom cylinder assembly (6) on a stand.



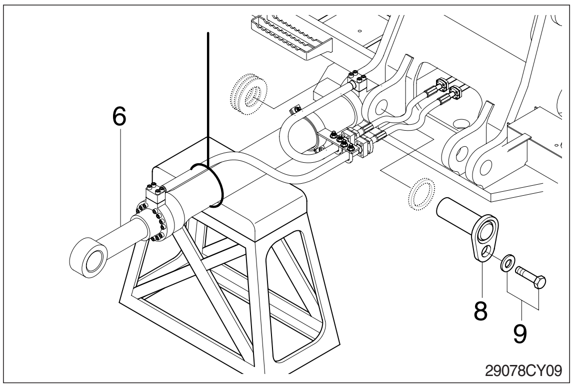
⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



⑥ Remove bolt (9) and pull out pin (8).

⑦ Remove boom cylinder assembly (6).

· Weight : 270 ㎏ (600 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

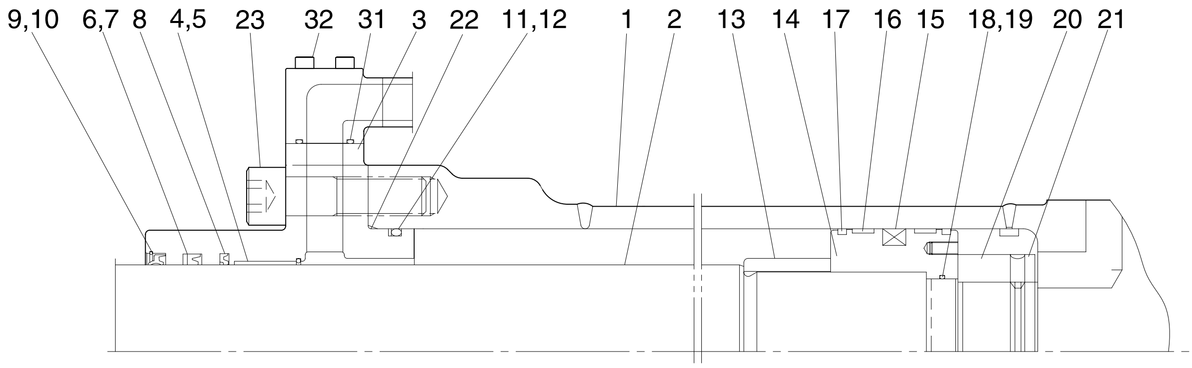
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

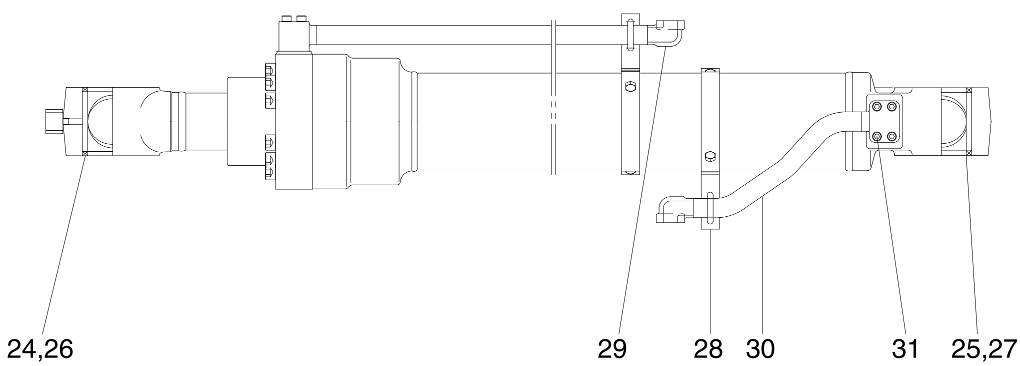
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder

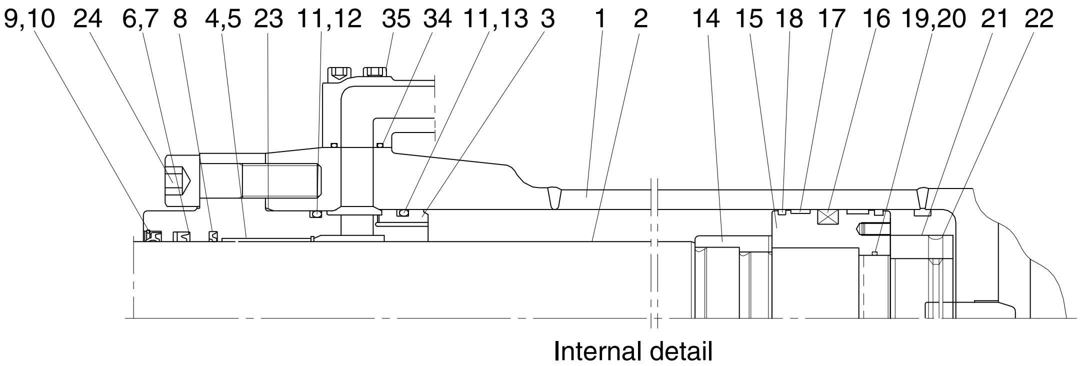


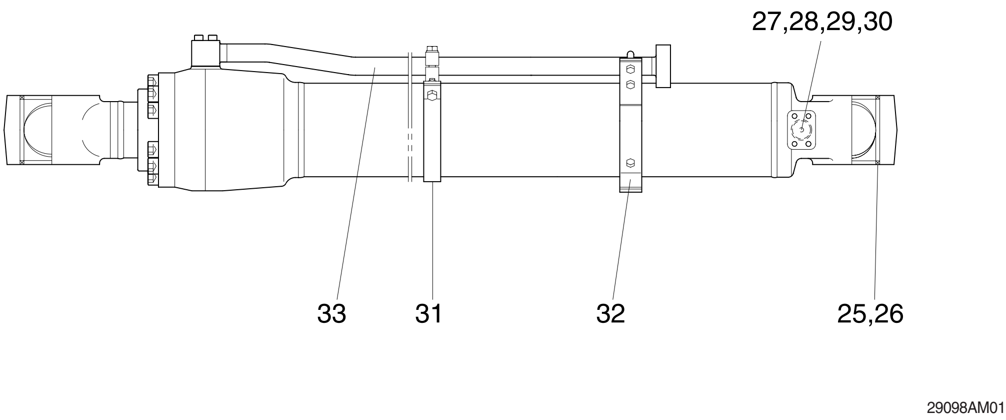
Internal detail



1	Tube assembly	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		

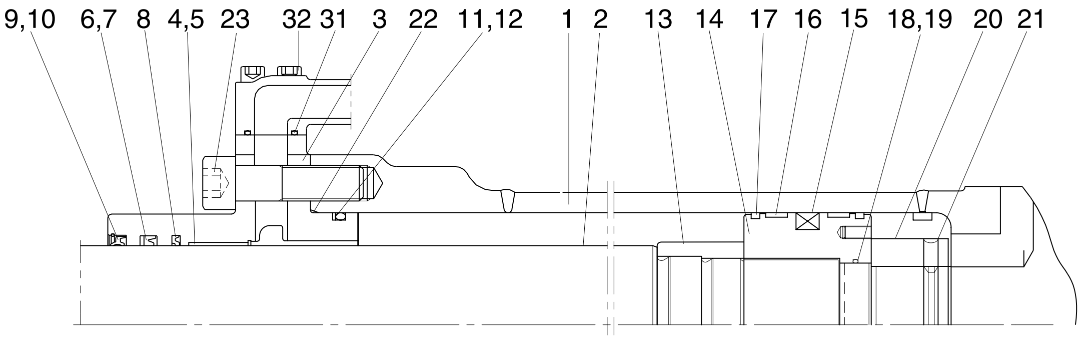
(2) Arm cylinder



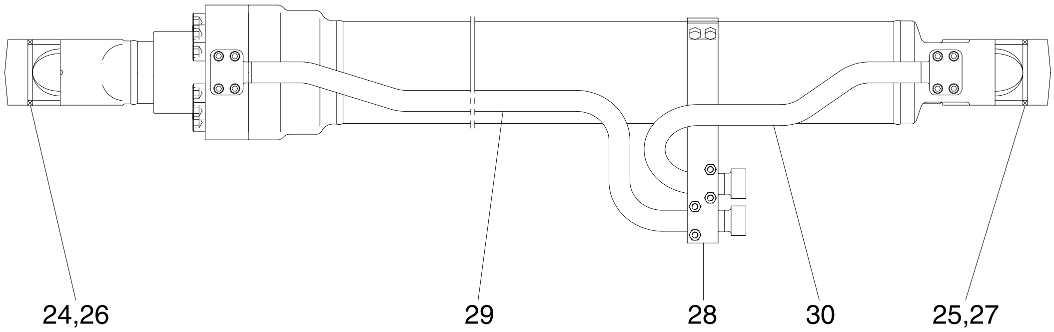


1	Tube assembly	13	Back up ring	25	Pin bushing
2	Rod assembly	14	Cushion ring	26	Dust seal
3	Gland	15	Piston	27	Check valve
4	DD2 bushing	16	Piston seal	28	Coil spring
5	Snap ring	17	Wear ring	29	O-ring
6	Rod seal	18	Dust ring	30	Plug
7	Back up ring	19	O-ring	31	Band assembly
8	Buffer ring	20	Back up ring	32	Band assembly
9	Dust wiper	21	Lock nut	33	Pipe assembly
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		

(3) Boom cylinder



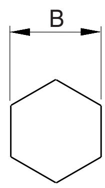
Internal detail



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		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools	Remark	
Allen wrench	6	
	8	
	14	
	17	
Spanner	7	
	8	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	23	M18	32.0±3.0	232±21.7
		32	M12	9.4±1.0	68.0±7.2
	Boom cylinder	23	M18	32.0±3.0	232±21.7
		32	M12	9.4±1.0	68.0±7.2
	Arm cylinder	24	M18	32.0±3.0	232±21.7
		35	M12	9.4±1.0	68.0±7.2
Lock nut	Bucket cylinder	20	-	100±10.0	723±72.3
	Boom cylinder	20	-	100±10.0	723±72.3
	Arm cylinder	21	-	150±15.0	1085±108
Piston	Bucket cylinder	14	-	150±15.0	1085±108
	Boom cylinder	14	-	150±15.0	1085±108
	Arm cylinder	15	-	200±20.0	1447±145

3) DISASSEMBLY

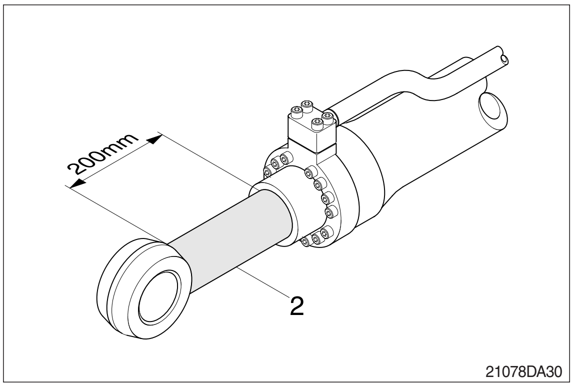
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

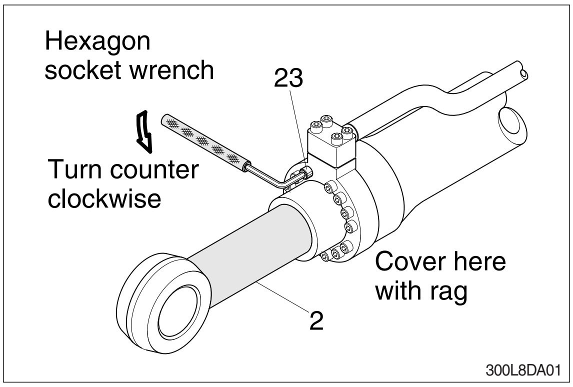
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



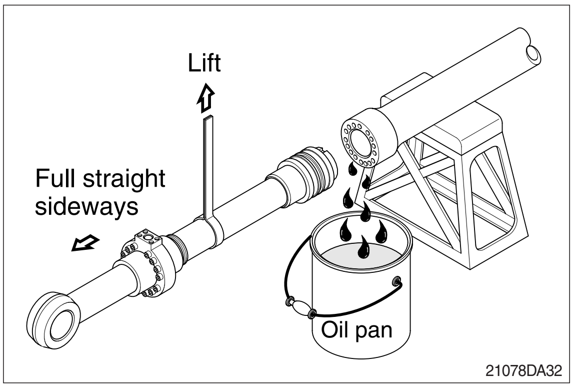
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



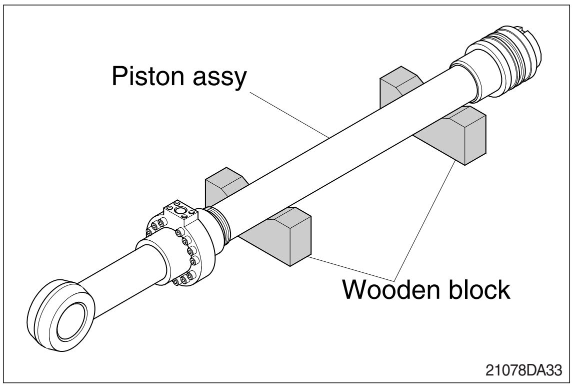
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ 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.

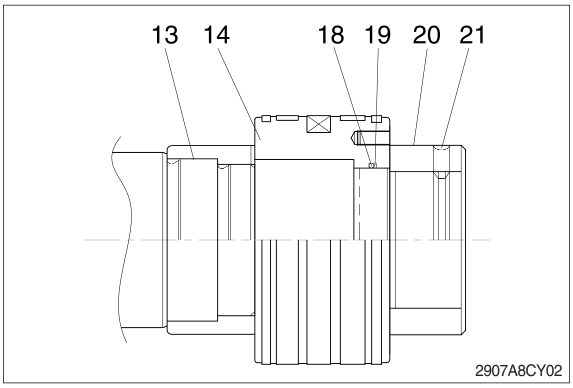


Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

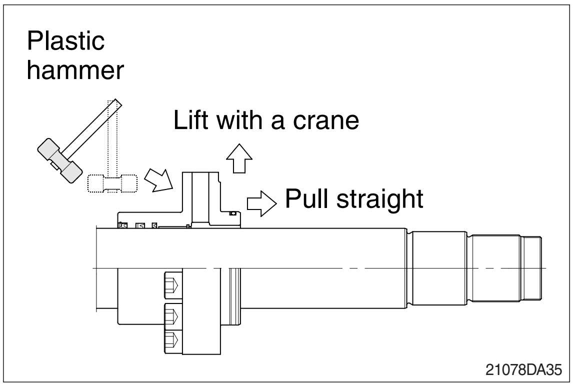
⑤ Place the removed rod assembly on a wooden V-block that is set level.
※ Cover a V-block with soft rag.



(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).

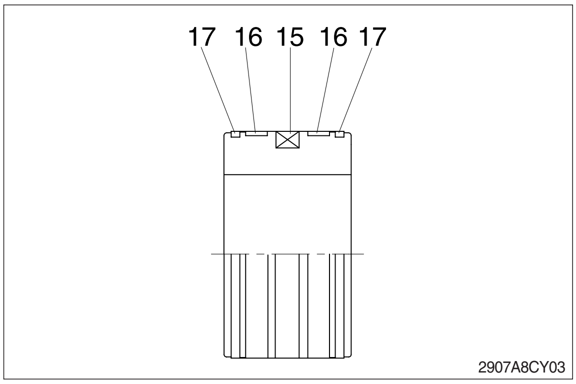


(3) Disassemble the piston assembly

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

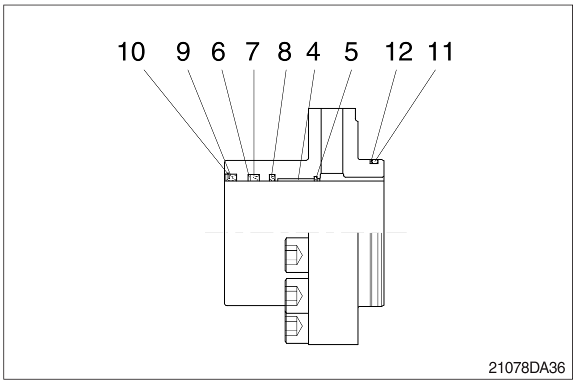
① Remove back up ring (12) and O-ring (11).

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.

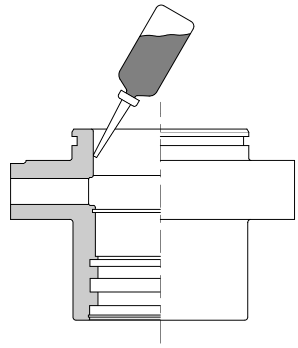


3) ASSEMBLY

(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.



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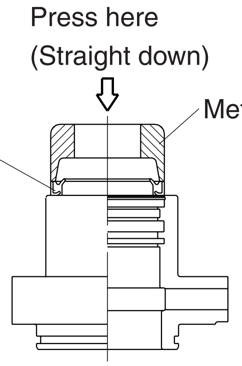
② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

③ Fit snap ring (10) to the stop face.

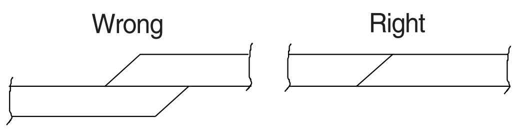


8-157(2)

④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

※ Coat each packing with hydraulic oil before fitting it.

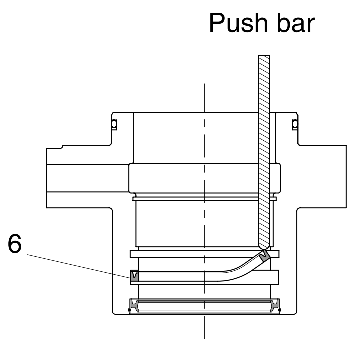
※ Insert the backup ring until one side of it is inserted into groove.



8-157(3)

※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



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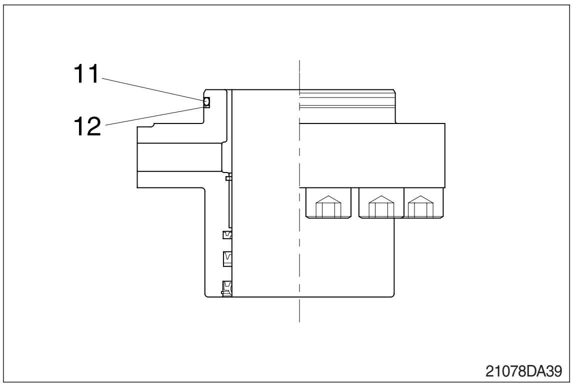
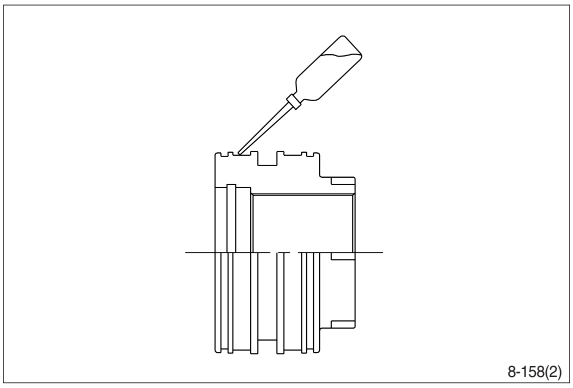
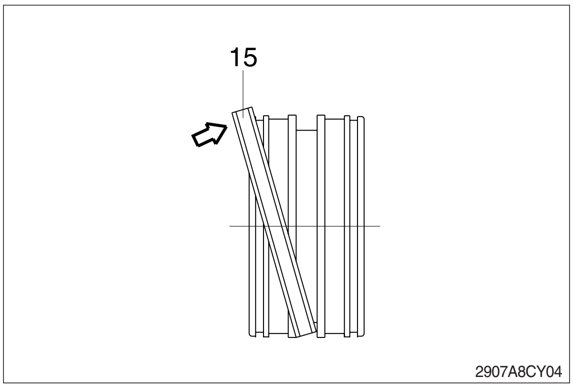
⑤ Fit back up ring (12) to gland (3).
※ Put the backup ring in the warm water of 30~50˚C.
⑥ Fit O-ring (11) to gland (3).



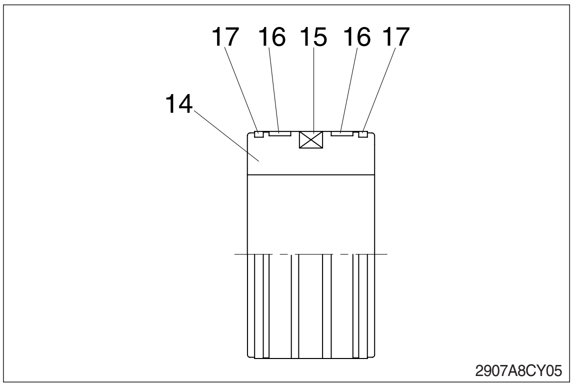
(2) Assemble piston assembly
※ Check for scratches or rough surfaces. If found smooth with an oil stone.
① Coat the outer face of piston (14) with hydraulic oil.



② Fit piston seal (15) to piston.
※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.
※ After assembling the piston seal, press its outer diameter to fit in.

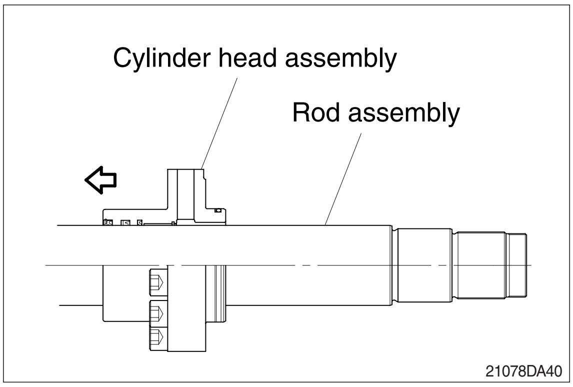


③ Fit wear ring (16) and dust ring (17) to piston (14).

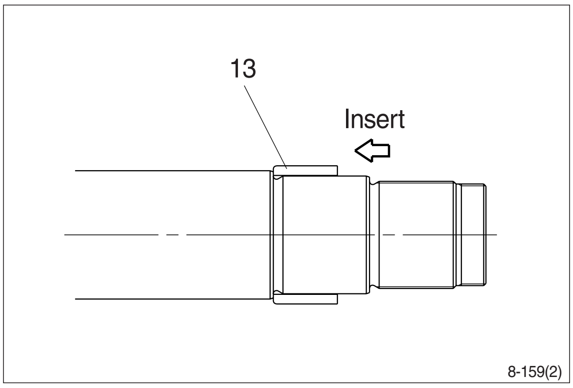


(3) Install piston and cylinder head

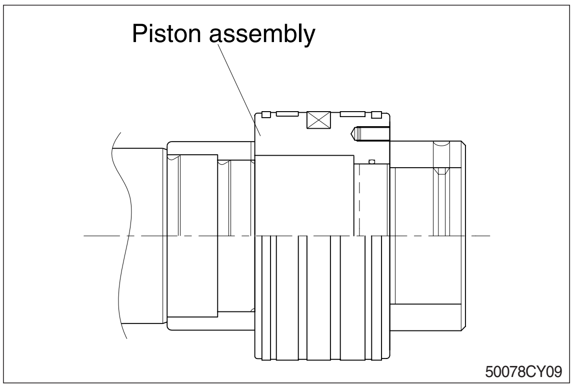
① Fix the rod assembly to the work bench.
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (13) to rod assembly.
※ Note that cushion ring (13) has a direction in which it should be fitted.

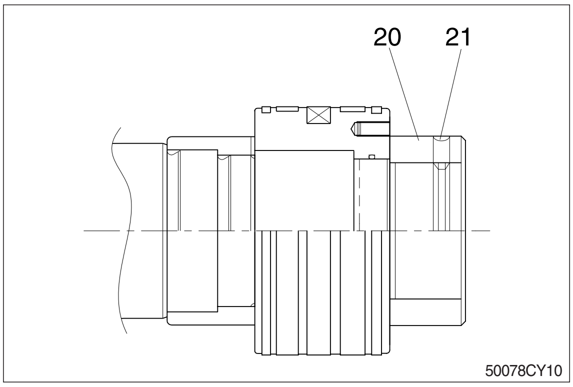


⑤ Fit piston assembly to rod assembly.
· Tightening torque : 100±10.0 kgf · m (723±72.3 lbf · ft)



⑥ Fit lock nut (20) and tighten the screw (21).
· Tightening torque :

Item		kgf · m	lbf · ft
Bucket Boom	20	100±10	723±72.3
	21	5.4±0.5	39.1±3.6
Arm	20	150±15	1085±108
	21	5.4±0.5	39.1±3.6



(3) Overall assemble

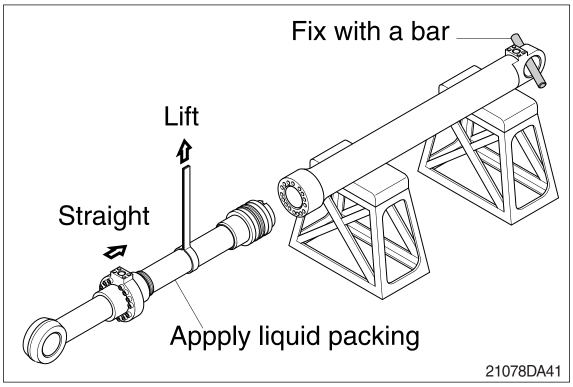
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

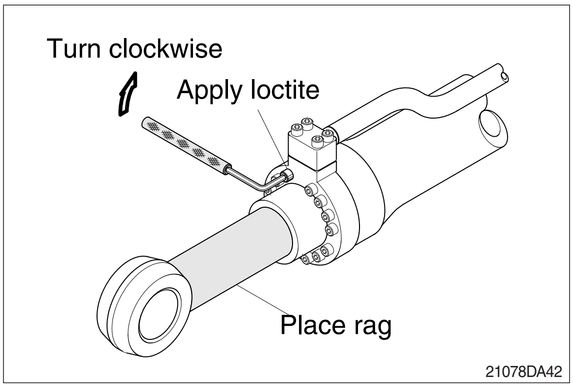
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ 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.





GROUP 10 UNDERCARRIAGE

1. TRACK LINK

1) REMOVAL

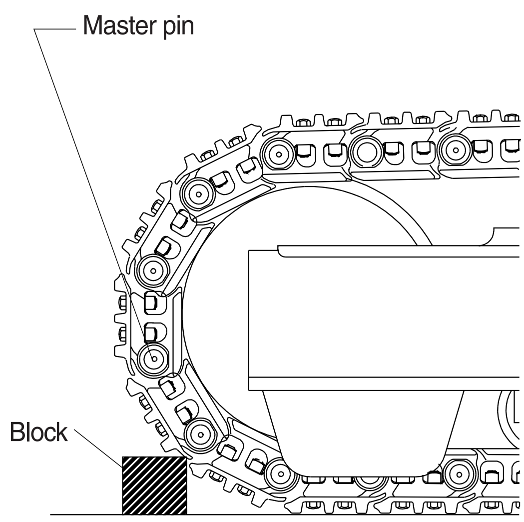
(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

(3) Push out master pin by using a suitable tool.

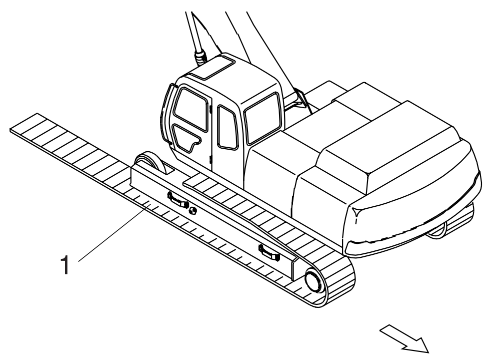


8-161(1)

(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

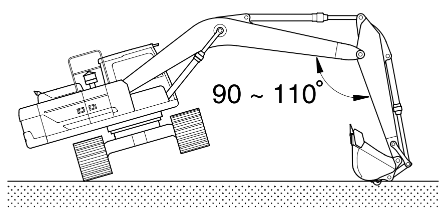
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



8-161(2)

2) INSTALL

(1) Carry out installation in the reverse order to removal.
Adjust the tension of the track link.



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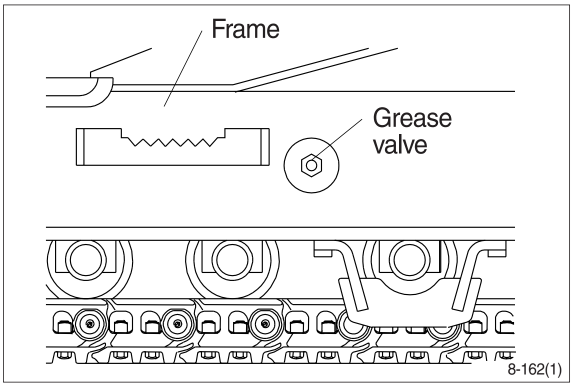
2. CARRIER ROLLER

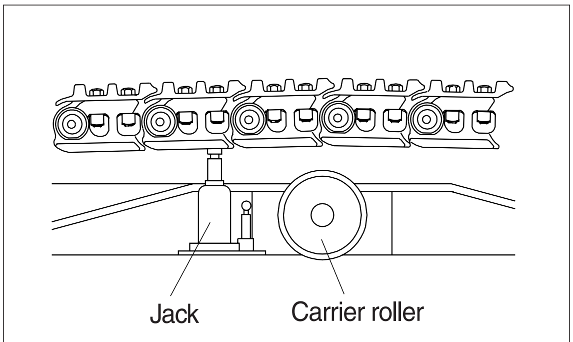
1) REMOVAL

(1) Loosen tension of the track link.



8-162(1)

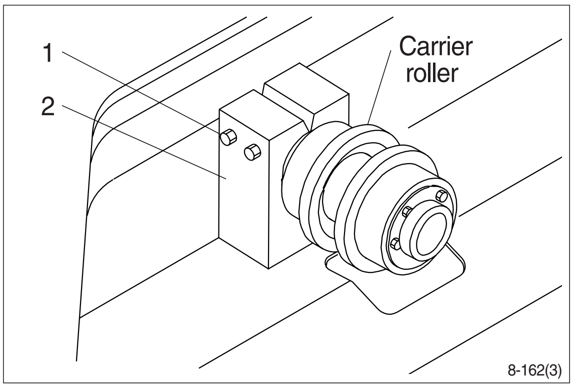
(2) Jack up the track link height enough to permit carrier roller removal.



8-162(2)

(3) Loosen the lock nut (1).

(4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.
- · Weight : 35 kg (80 lb)
- · Tightening torque : 29.7±4.5 kgf·m (215±32.5 lbf·ft)



8-162(3)

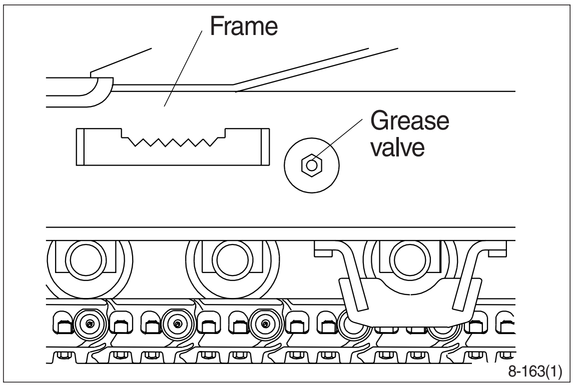
2) INSTALL

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

3. TRACK ROLLER

1) REMOVAL

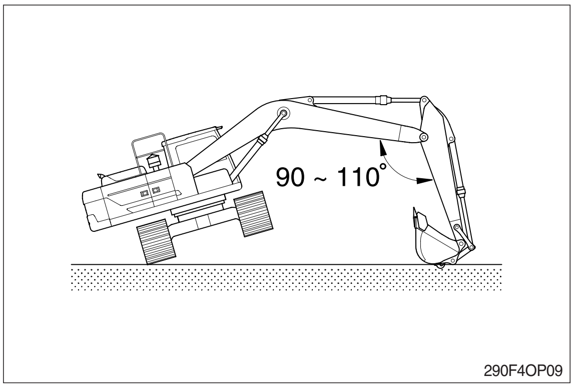
(1) Loosen tension of the track link.



8-163(1)

(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.

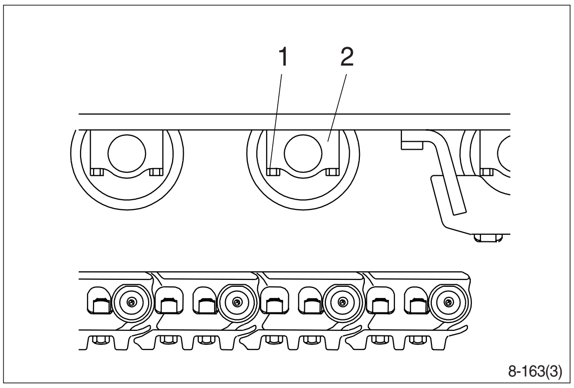


290F4OP09

(3) Remove the mounting bolt (1) and draw out the track roller (2).

· Weight : 56 kg (120 lb)

· Tightening torque : 57.9±8.7 kgf·m (419±62.9 lbf·ft)



8-163(3)

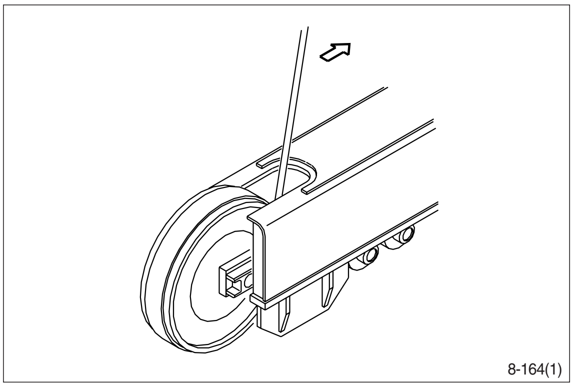
2) INSTALL

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

4. IDLER AND RECOIL SPRING

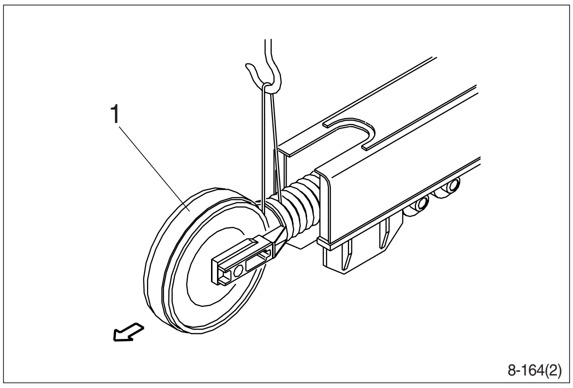
1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.



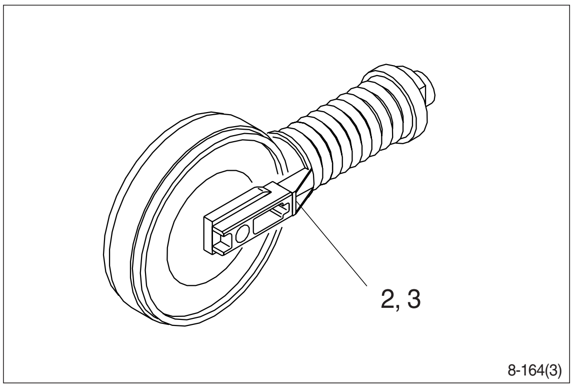
8-164(1)

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 457 kg (1010 lb)



8-164(2)

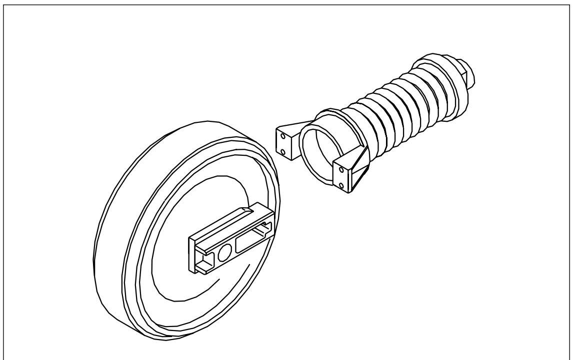
(3) Remove the bolts (2), washers (3) and separate idler from recoil spring.
· Tightening torque : 31.3±4.7 kgf·m
(226±34.0 lbf·ft)



8-164(3)

2) INSTALL

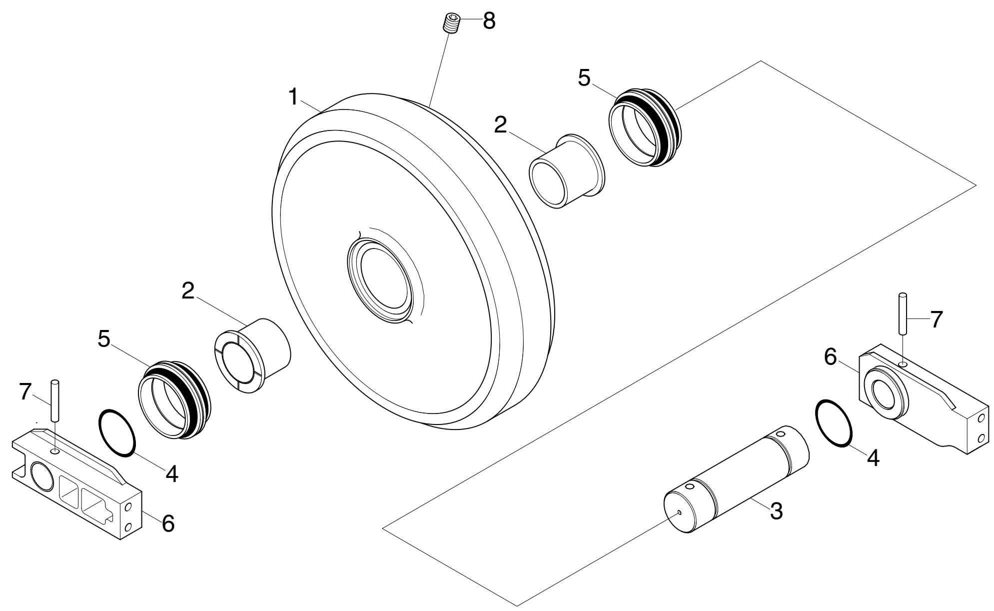
(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



8-164(4)

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



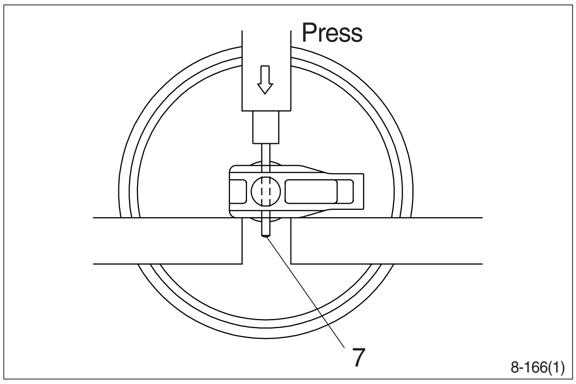
29078ID01

1	Shell	4	O-ring	7	Spring pin
2	Bushing	5	Seal assembly	8	Plug
3	Shaft	6	Bracket		

(2) Disassembly

① Remove plug and drain oil.

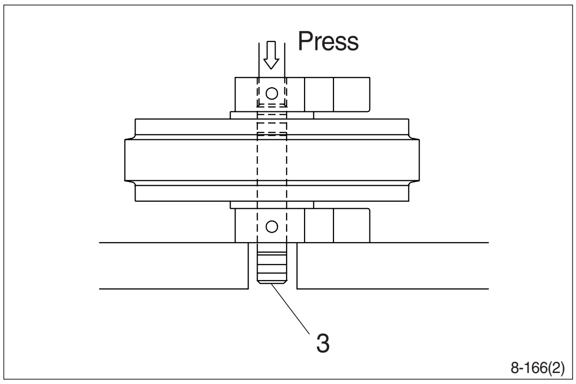
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

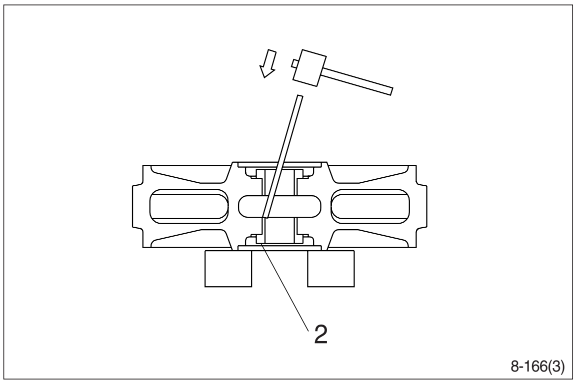
④ Remove seal (5) from shell (1) and bracket (6).

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.

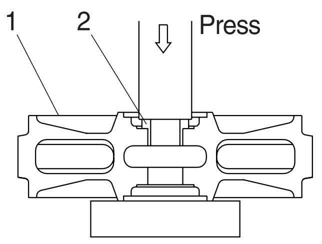


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

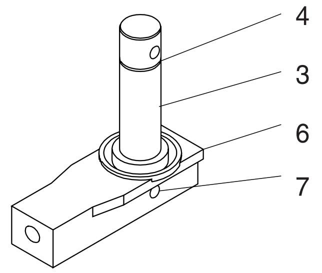
① Cool up bushing (2) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1)

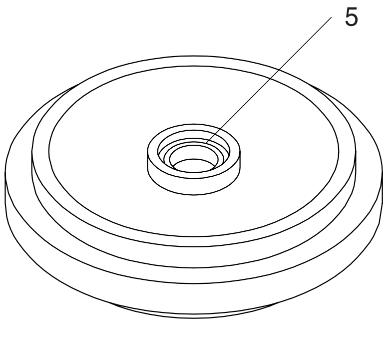
② Coat O-ring (4) with grease thinly, and install it to shaft (3).

③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



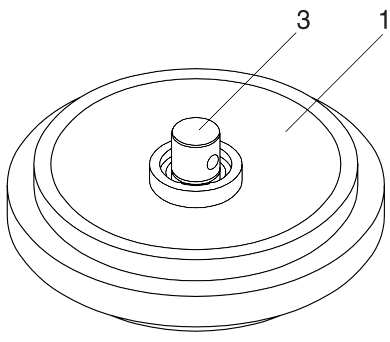
8-167(2)

④ Install seal (5) to shell (1) and bracket (6).



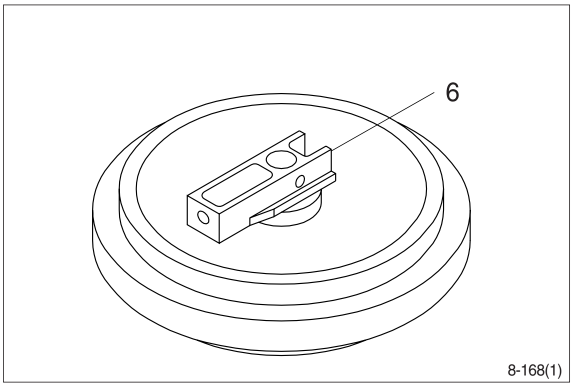
8-167(3)

⑤ Install shaft (3) to shell (1).



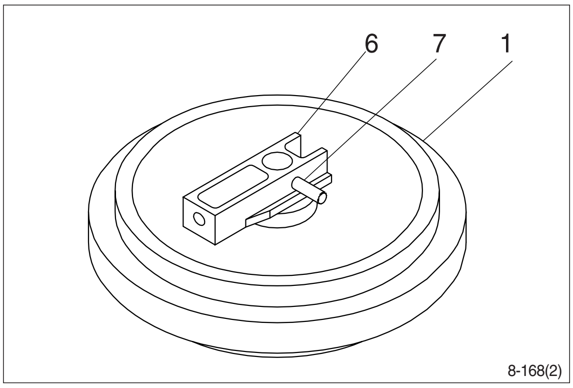
8-167(4)

⑥ Install bracket (6) attached with seal (5).



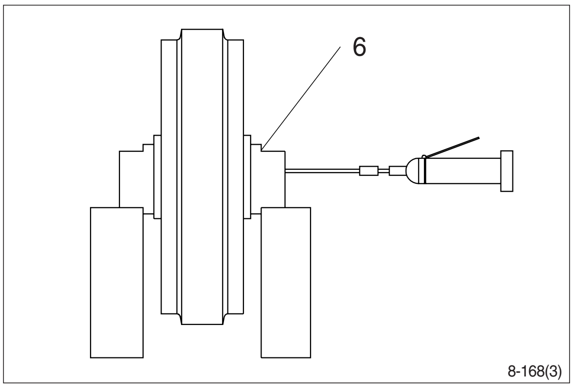
8-168(1)

⑦ Knock in the spring pin (7) with a hammer.



8-168(2)

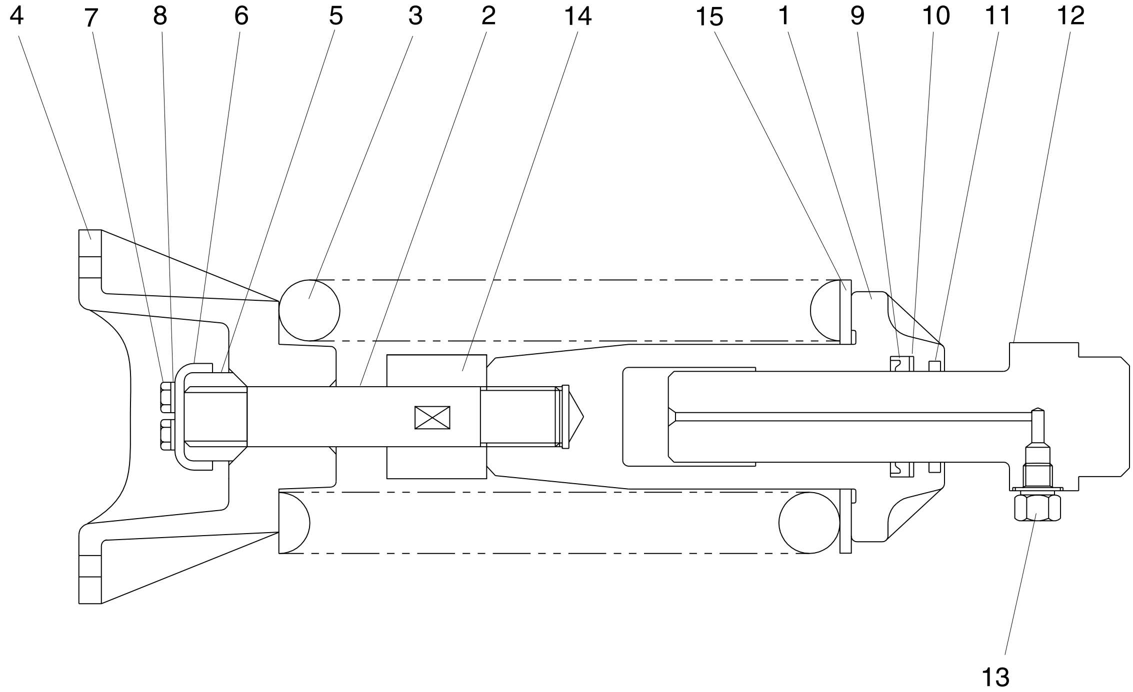
⑧ Lay bracket (6) on its side.
Supply engine oil to the specified level, and tighten plug.



8-168(3)

4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

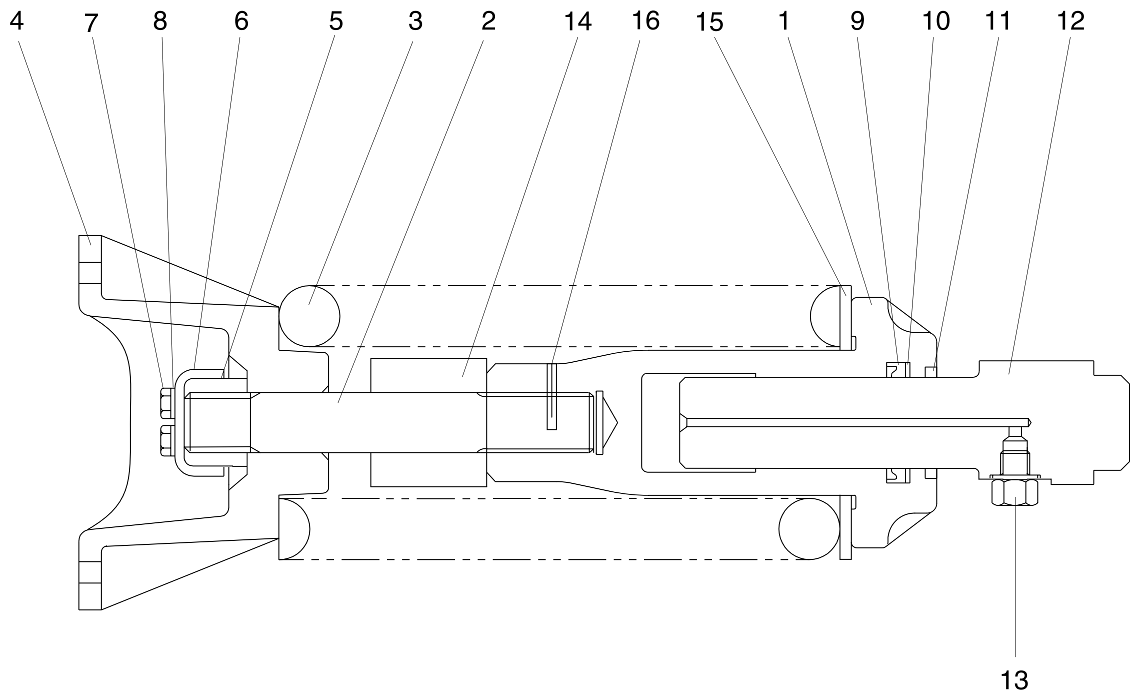
(1) Structure (type 1 & 3)



300L8UC01

1	Body	6	Lock plate	11	Dust seal
2	Tie bar	7	Bolt	12	Rod assembly
3	Spring	8	Spring washer	13	Grease valve
4	Bracket	9	Rod seal	14	Stopper tube
5	Lock nut	10	Back up ring	15	Spacer

Structure (type 2, high walker)



300L8UC101

1	Body	7	Bolt	13	Grease valve
2	Tie bar	8	Spring washer	14	Stopper tube
3	Spring	9	Rod packing	15	Spacer
4	Bracket	10	Back up ring	16	Spring pin
5	Lock nut	11	Dust seal		
6	Lock plate	12	Rod		

(2) Disassembly

※ The illustrations are base on the type 1.

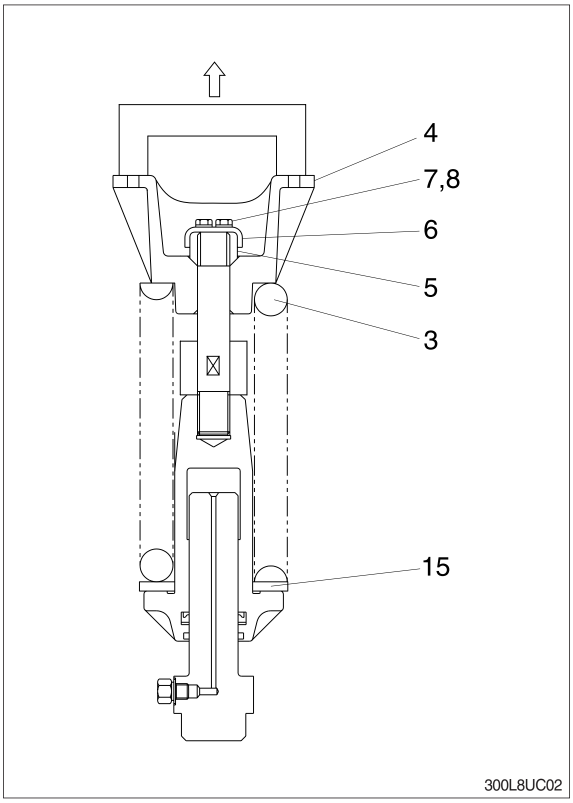
① Apply pressure on spring (3) with a press.

※ 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).

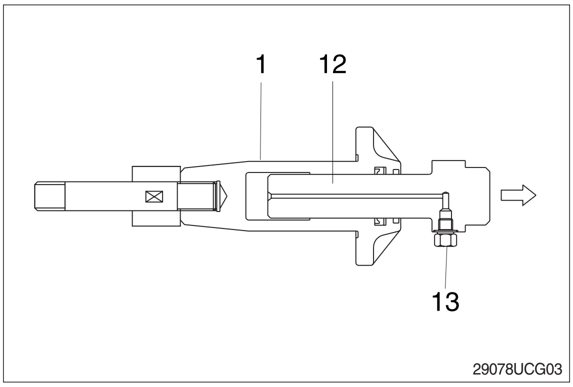
③ Remove lock nut (5).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove bracket (4), spring (3) and spacer (15).

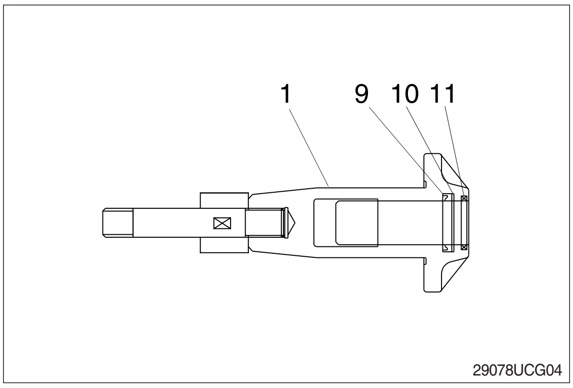


⑤ Remove rod (12) from body (1).

⑥ Remove grease valve (13) from rod (12).



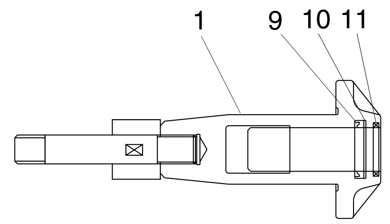
⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



(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.

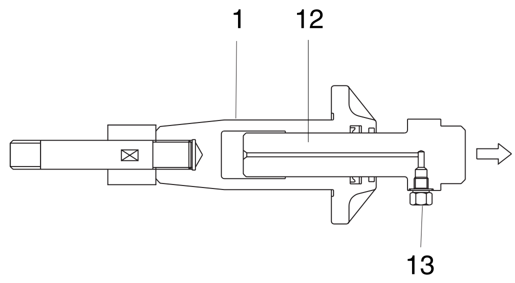


29078UCG05

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)



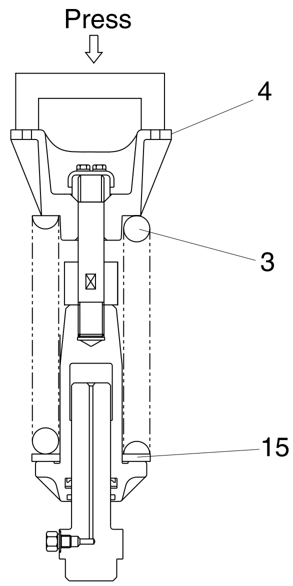
29078UCG06

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
- Type 1 : 19012 kg (41826 lb)
- Type 2 & 3 : 22285 kg (49130 lb)

※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.



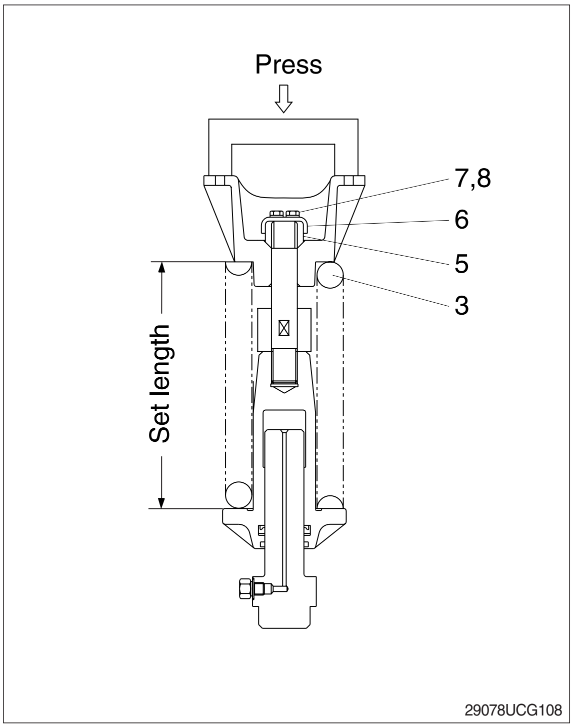
300L8UC03

⑥ Lighten the press load and confirm the set length of spring (3).

- Type 1 & 3 : 580 ± 1.5 mm
- Type 2 : 565 ± 1.5 mm

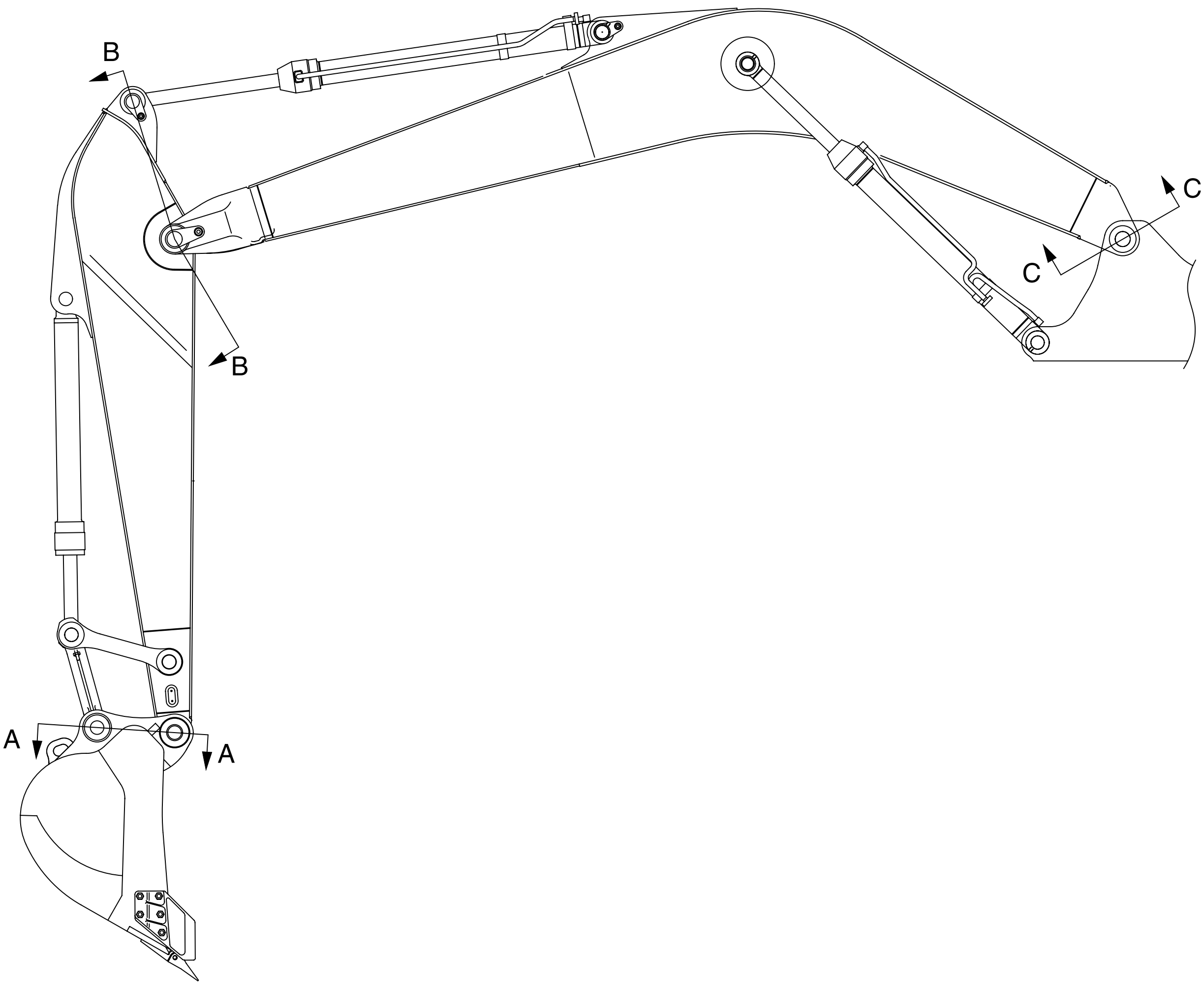
⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).

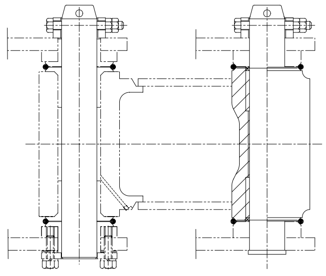
·Tightening torque : 15±0.5 kgf·m
(108±3.6 lbf·ft)



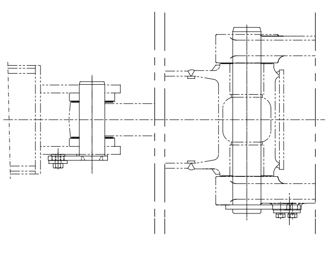
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

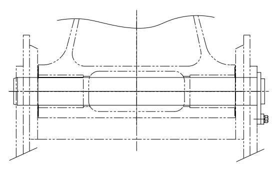




SECTION A



SECTION B



SECTION C

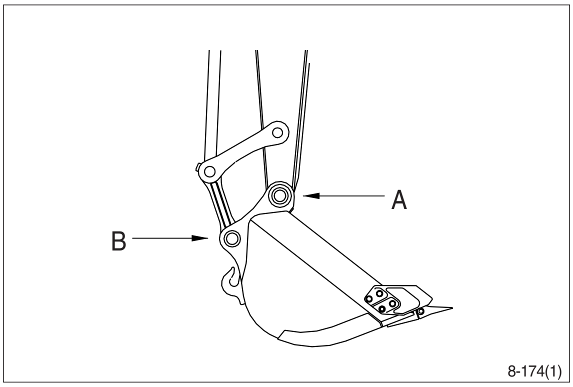
29078WE01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

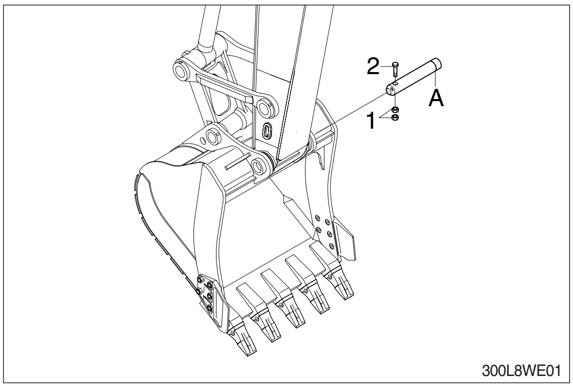
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



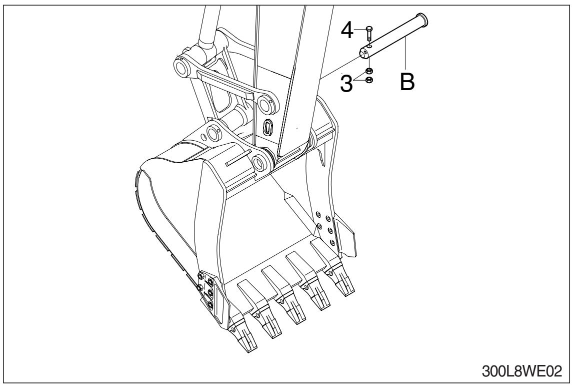
8-174(1)

② Remove nut (1), bolt (2) and draw out the pin (A).



300L8WE01

③ Remove nut (3), bolt (4) and draw out the pin (B).



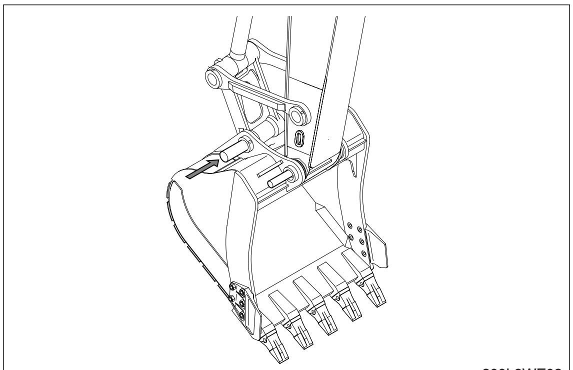
300L8WE02

(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.**



300L8WE03

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.**

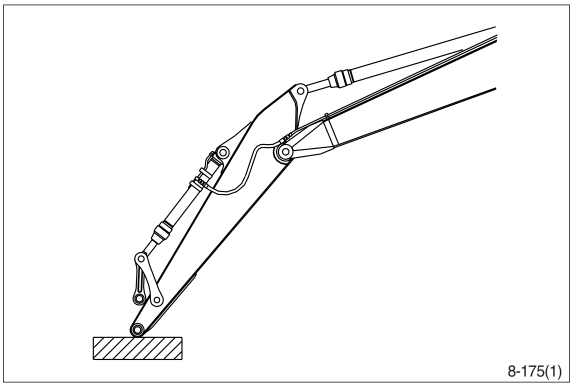
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

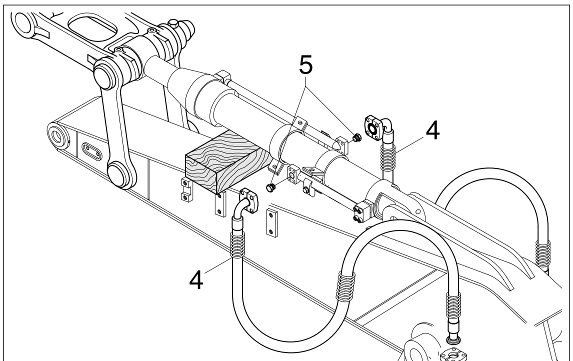
※ Tie the rod with wire to prevent it from coming out.

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 ㎏ (2260 ℔)

※ When lifting the arm assembly, always lift the center of gravity.


8-175(1)



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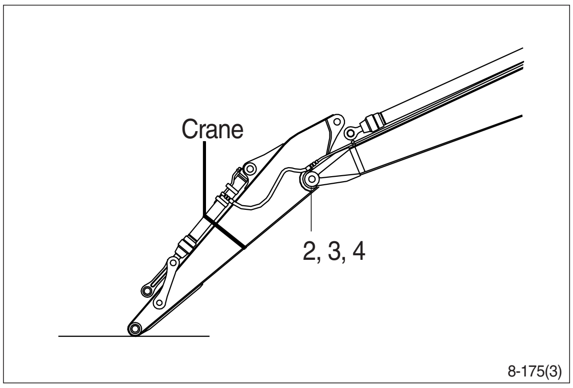


8-175(3)

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

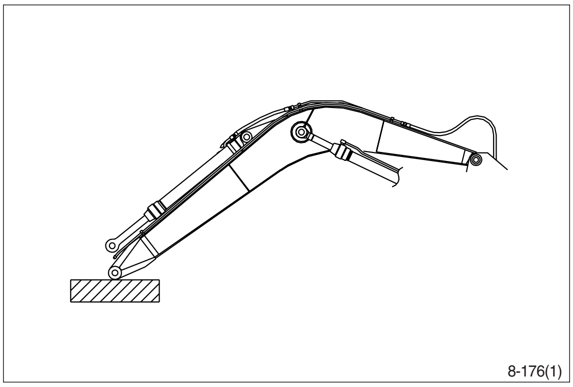
※ Bleed the air from the cylinder.

3) BOOM 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.**

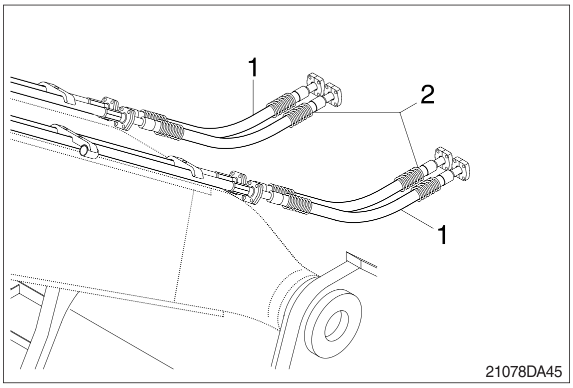


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

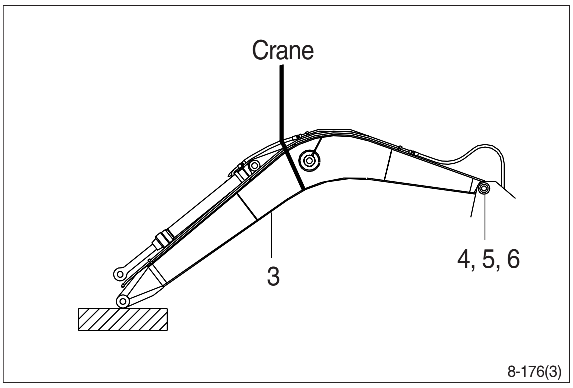
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· Weight : 2200 ㎏ (4860 ㏈)

※ When lifting the boom assembly always lift the center of gravity.

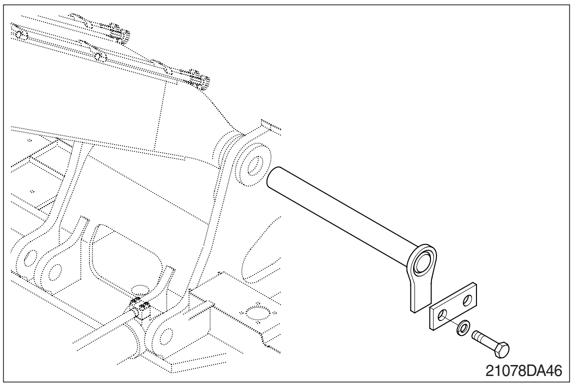


(2) Install

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.



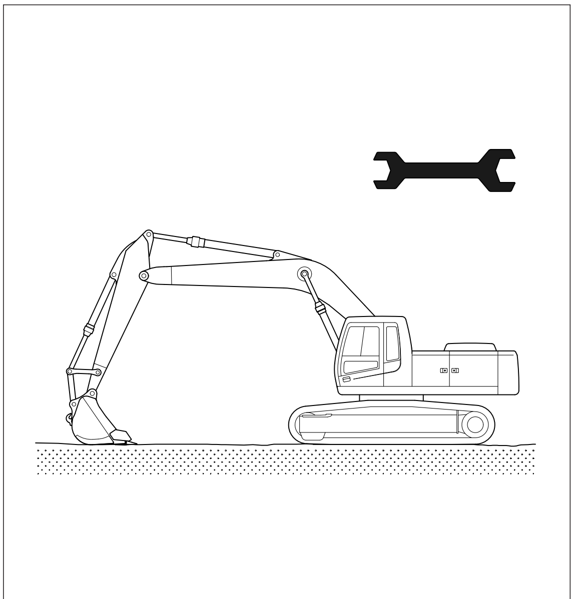
SECTION 9 COMPONENT MOUNTING TORQUE

SECTION 9 COMPONENT MOUNTING TORQUE

GROUP 1 INTRODUCTION GUIDE

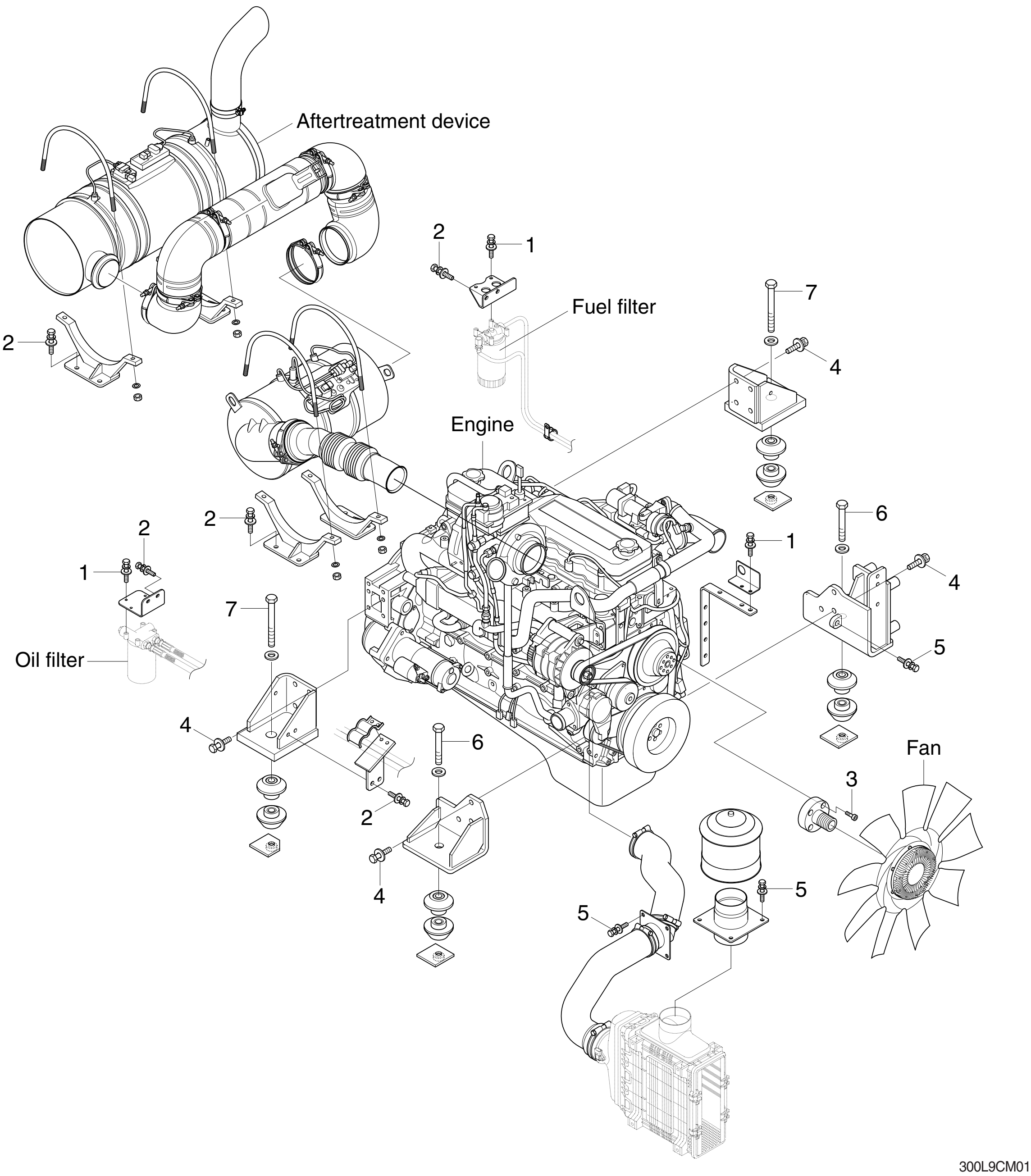
1. This section shows bolt specifications and standard torque values needed when mounting components to the machine.
2. Use genuine HD Hyundai Construction Equipment spare parts.
   We expressly point out that HD Hyundai Construction Equipment will not accept any responsibility for defects resulted from non-genuine parts.
   In such cases HD Hyundai Construction Equipment cannot assume liability for any damage.

※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.
※ Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.


29079CM00

GROUP 2 ENGINE SYSTEM

ENGINE AND ACCESSORIES MOUNTING

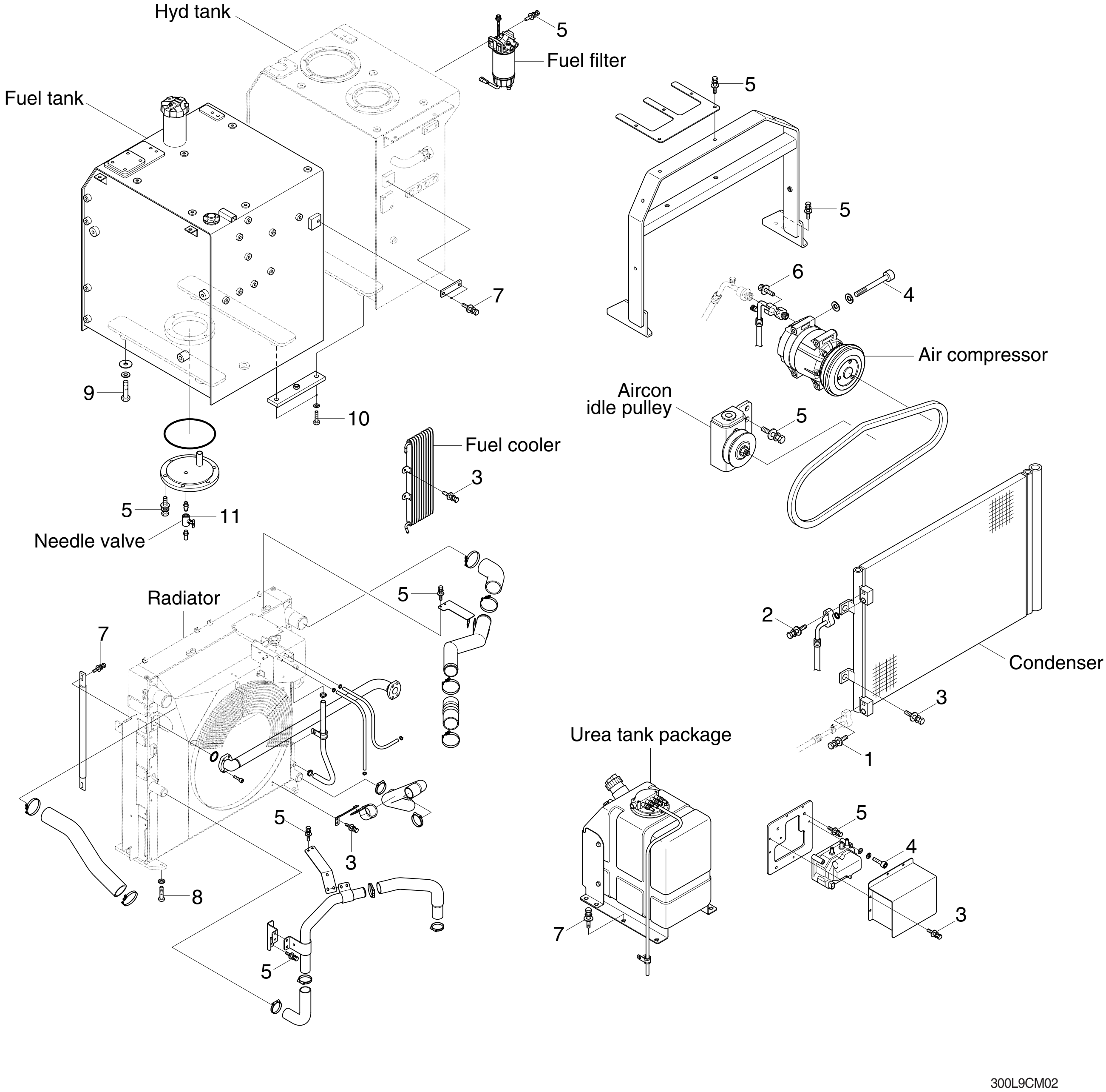


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1
3	M10×1.5	8.27±1.7	59.8±12.3
4	M12×1.75	11.5±1.0	83.2±7.2

Item	Size	kgf · m	lbf · ft
5	M14×2.0	9.8±0.9	70.8±6.5
6	M20×2.5	52.1±5.0	377±36.2
7	M24×3.0	90±9.0	651±65
-	-	-	-

COOLING SYSTEM AND FUEL TANK MOUNTING



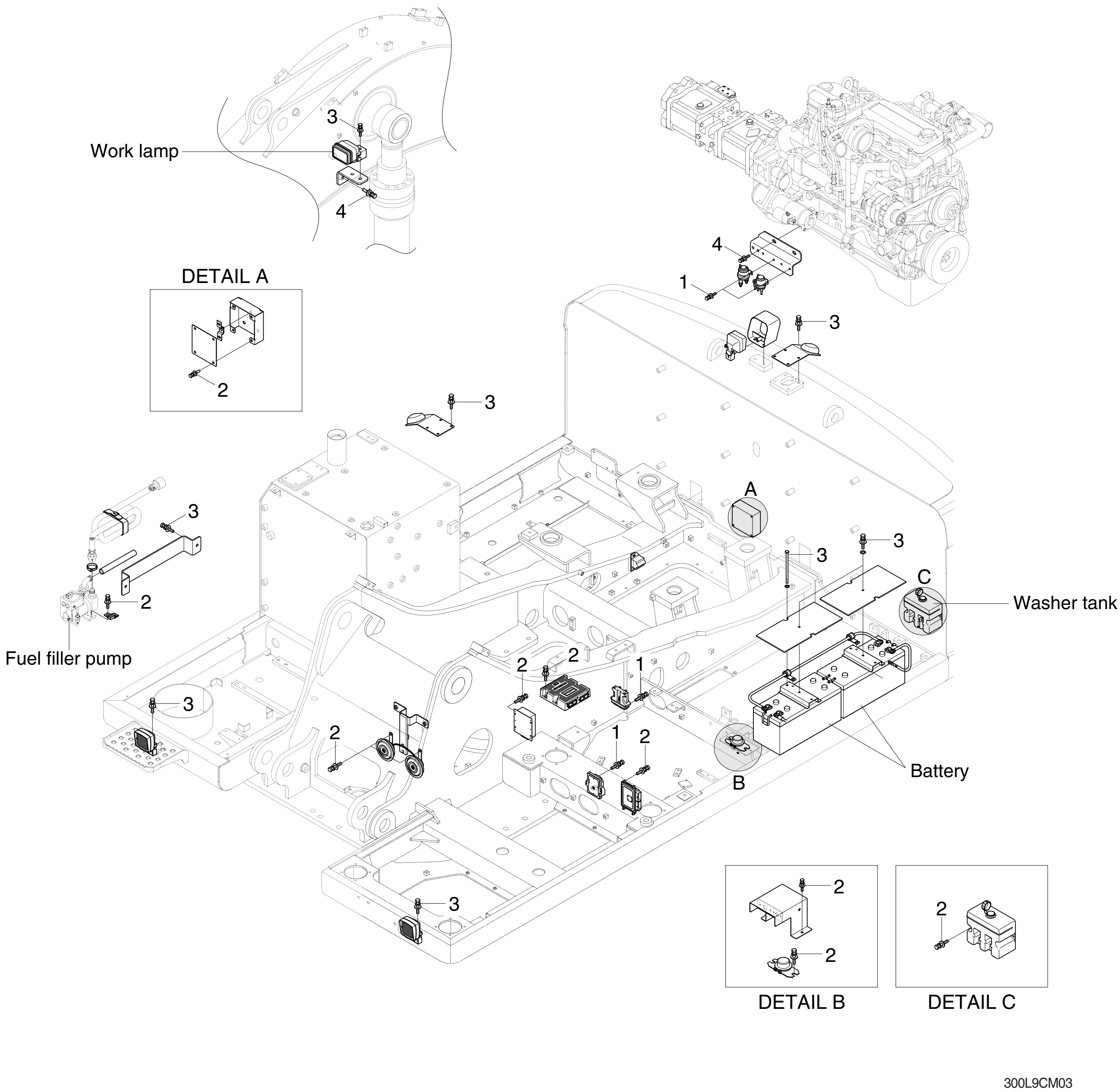
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	0.5±0.1	3.6±0.72
2	M 8×1.25	1.3±0.2	9.4±1.45
3	M 8×1.25	2.5±0.5	18.1±3.6
4	M 8×1.25	4.05±0.8	29.3±5.8
5	M10×1.5	6.9±1.4	49.9±10.1
6	M10×1.25	5.0±0.2	36.1±1.45

Item	Size	kgf · m	lbf · ft
7	M12×1.75	12.8±3.0	92.6±21.7
8	M16×2.0	29.7±4.5	215±32.5
9	M20×2.5	46±5.1	333±36.9
10	M20×2.5	57.9±8.7	419±62.9
11	-	2.3±0.6	16.6±4.3
-	-	-	-

GROUP 3 ELECTRIC SYSTEM

ELECTRIC COMPONENTS MOUNTING 1

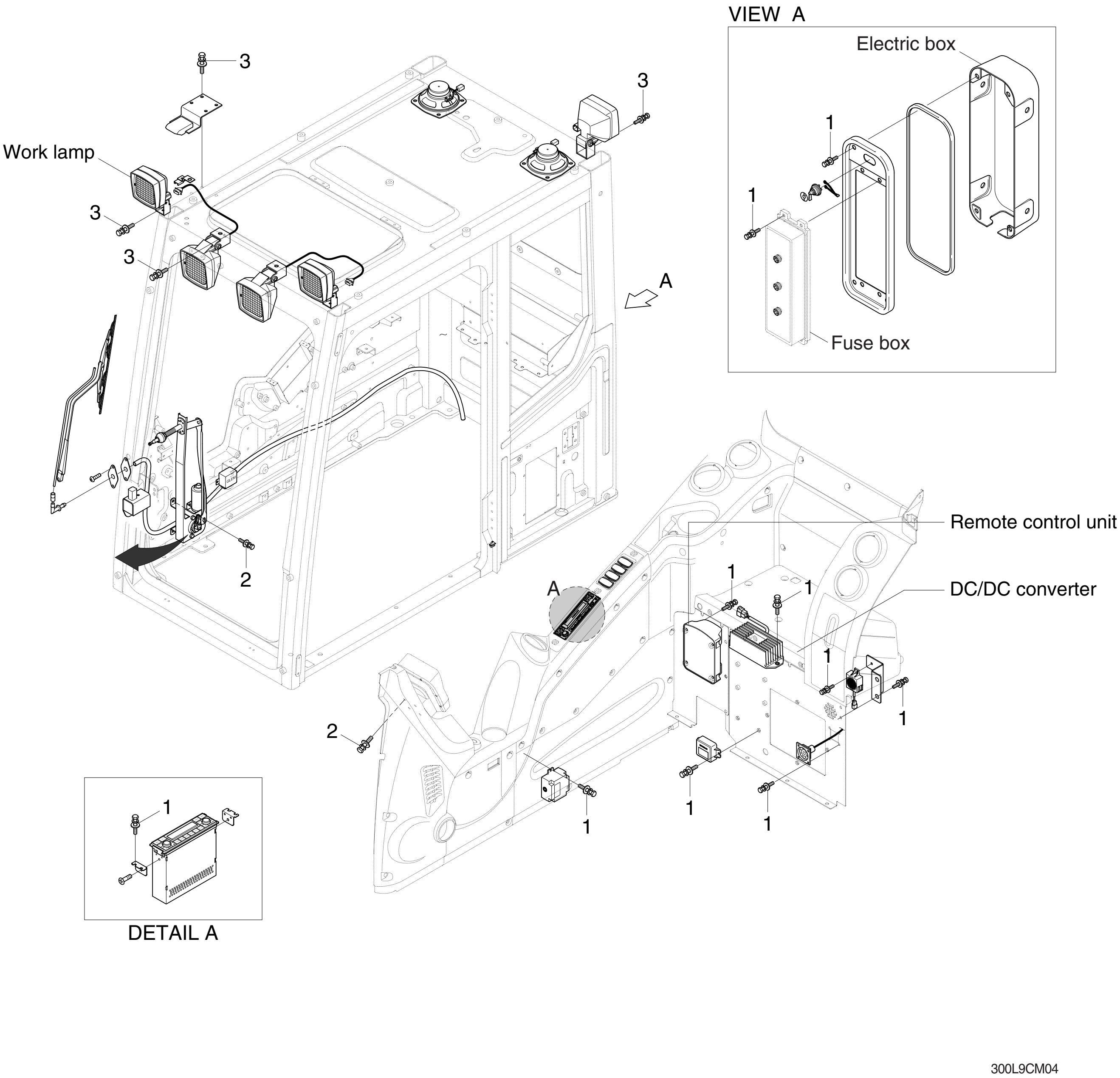


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1
4	M12×1.75	12.8±3.0	92.6±21.7

ELECTRIC COMPONENTS MOUNTING 2

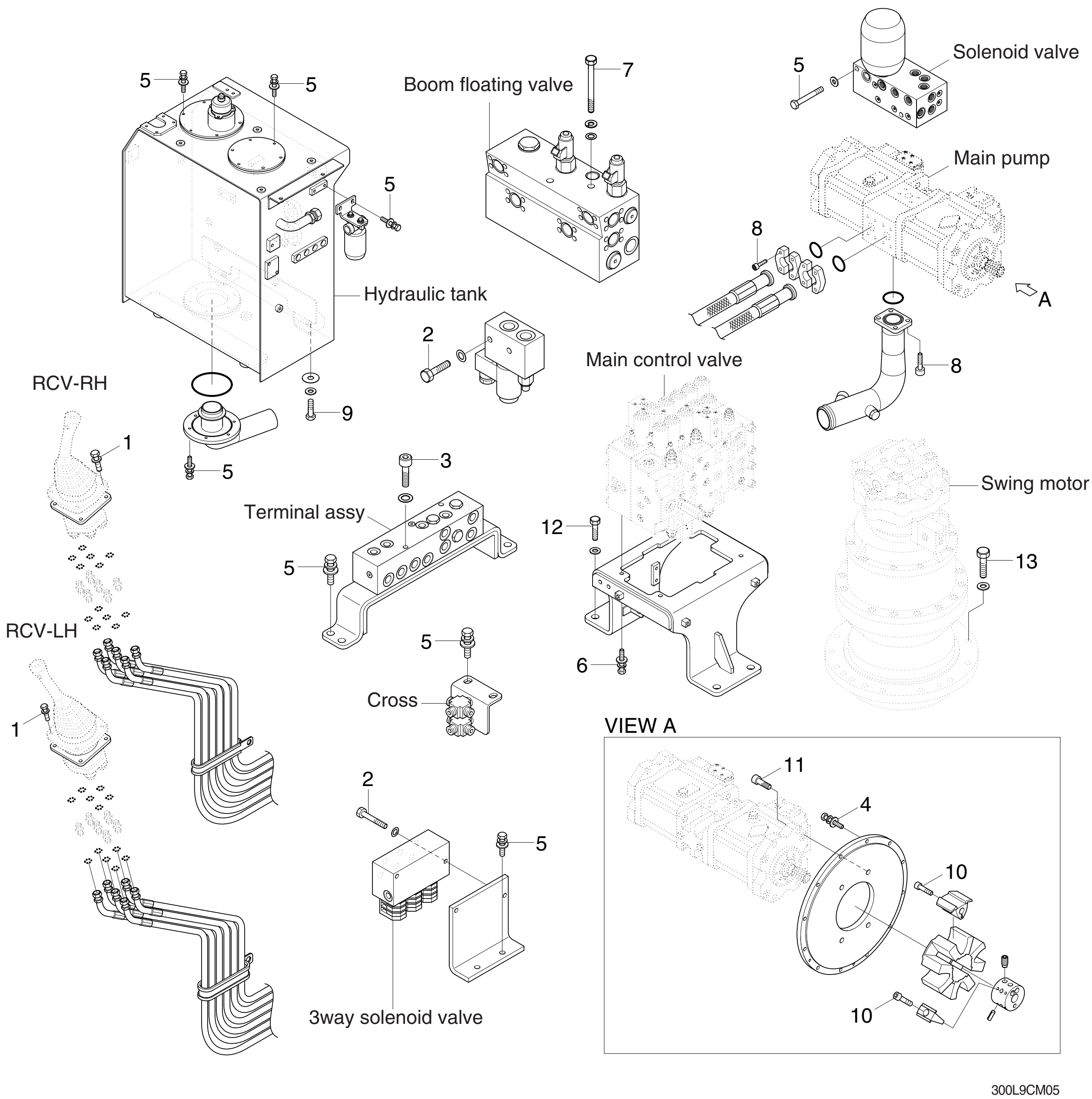


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1

HYDRAULIC COMPONENTS MOUNTING 1

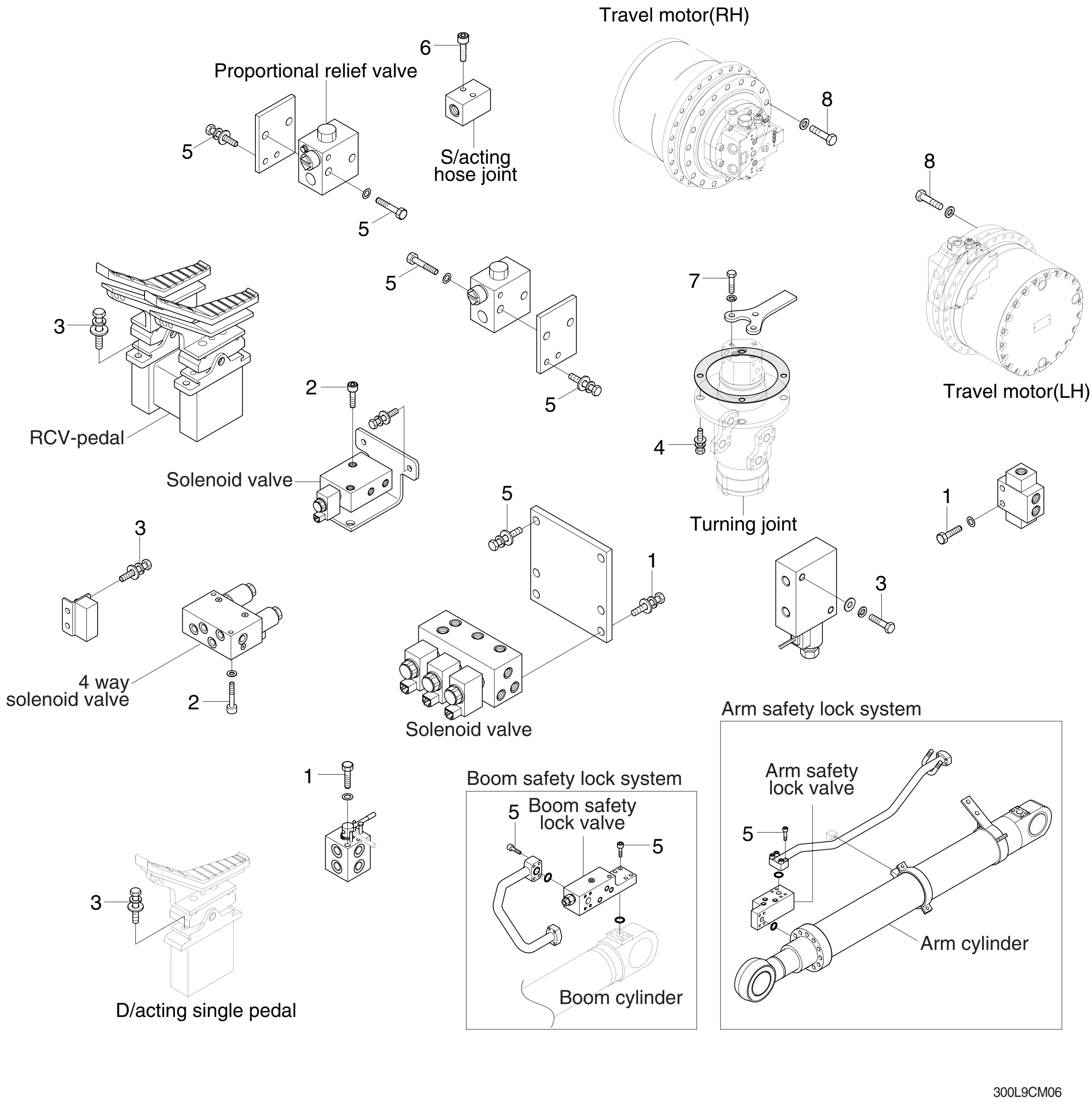


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M 8×1.25	4.05±0.8	29.3±5.8
4	M10×1.5	4.8±0.3	347±2.2
5	M10×1.5	6.9±1.4	49.9±10.1
6	M12×1.75	12.3±1.3	89.0±9.4
7	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
8	M12×1.75	14.7±2.2	106±15.9
9	M20×2.5	46±5.1	333±36.9
10	M20×2.5	46.5±2.5	336±18.1
11	M20×2.5	52.1±5.0	377±36.2
12	M20×2.5	57.9±8.7	419±62.9
13	M20×2.5	58.4±6.4	422±46.3
-	-	-	-

HYDRAULIC COMPONENTS MOUNTING 2

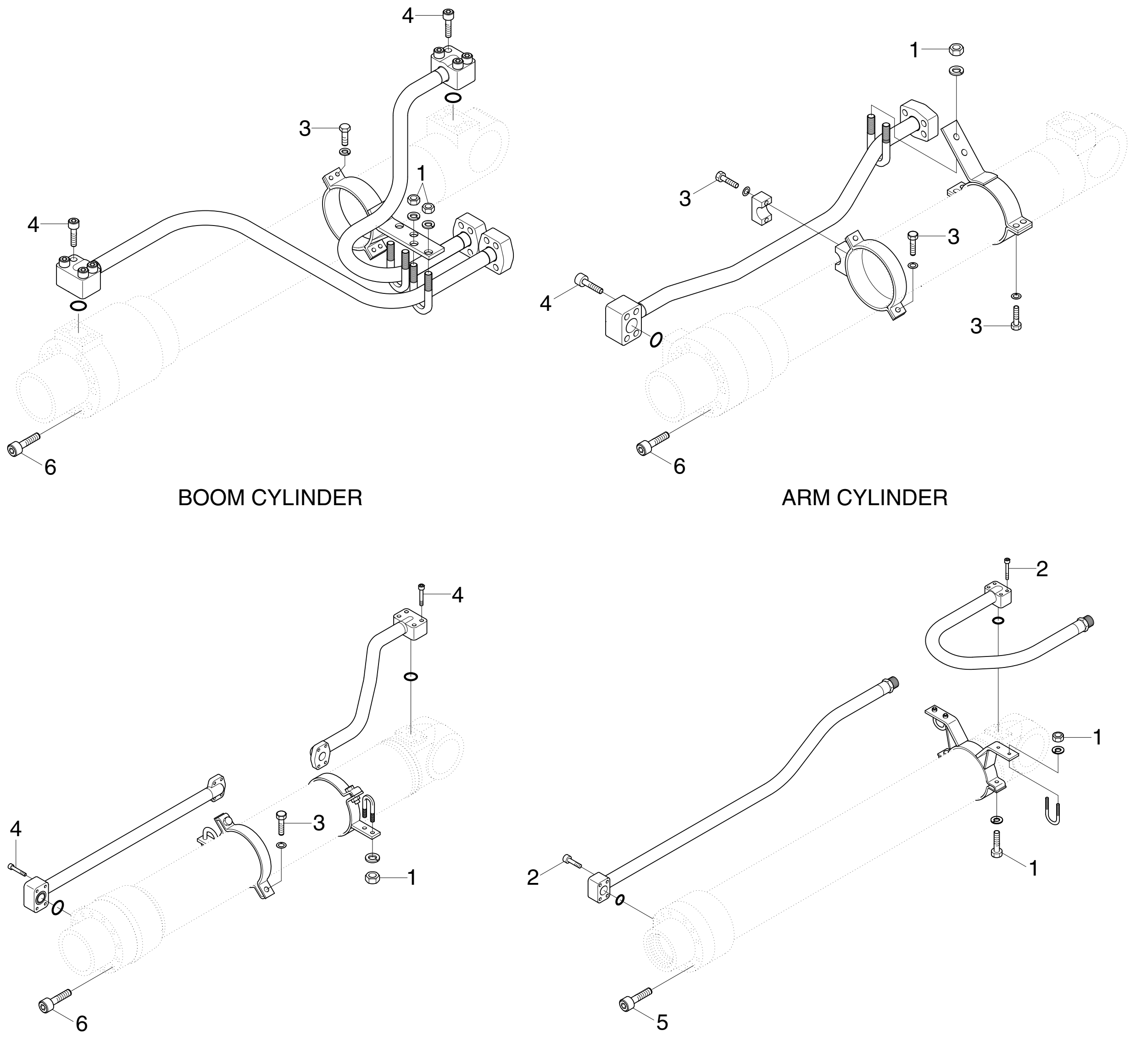


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M 8×1.25	4.05±0.8	29.3±5.8
3	M10×1.5	6.9±1.4	49.9±10.1
4	M12×1.75	12.3±1.3	89.0±9.4

Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.8±3.0	92.6±21.7
6	M12×1.75	14.7±2.2	106±15.9
7	M14×2.0	19.6±2.9	142±21.0
8	M24×3.0	84±8.0	608±57.8

HYDRAULIC COMPONENTS MOUNTING 3



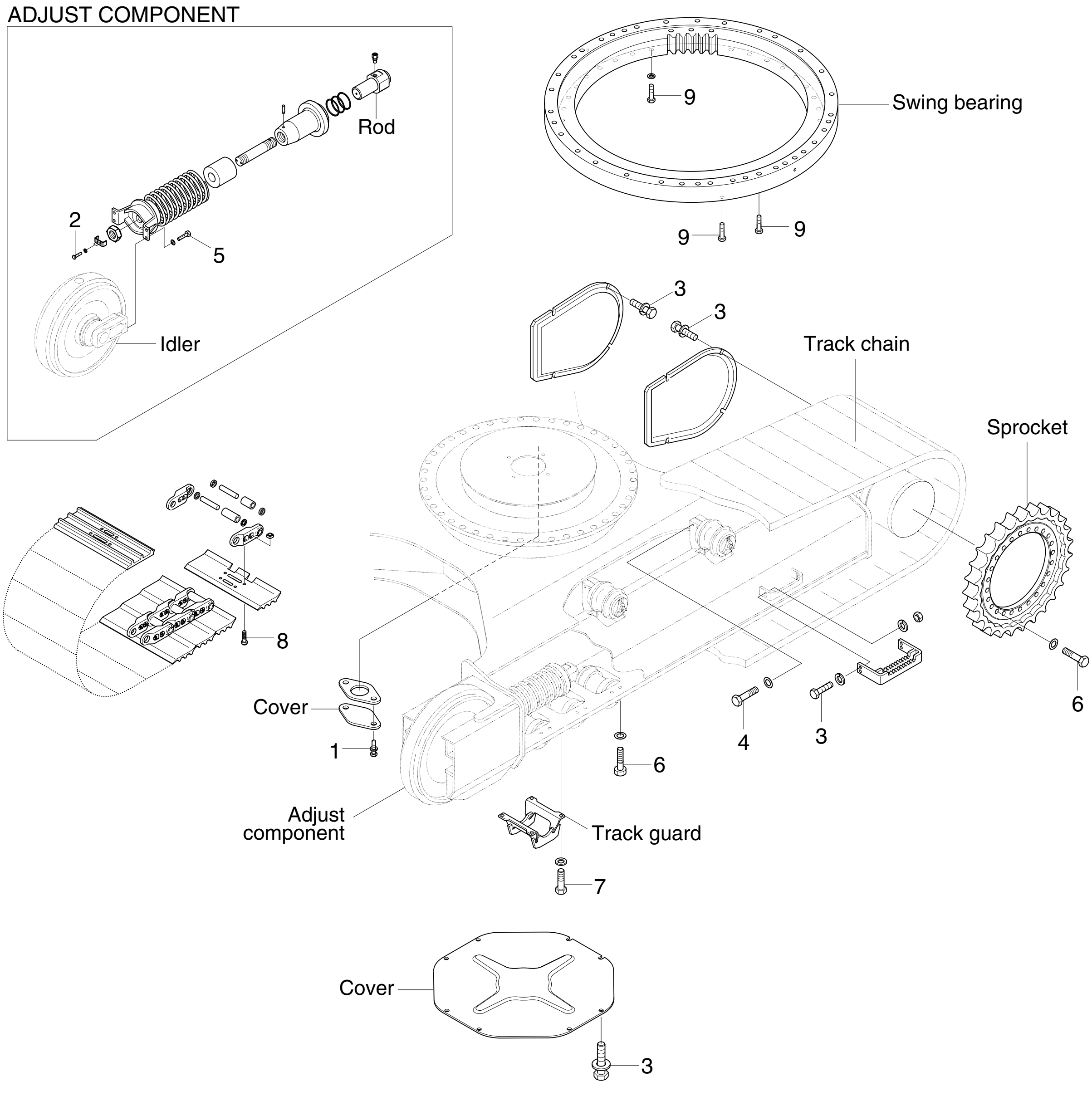
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	3.2±0.3	23.1±2.2
2	M 8×1.25	2.7±0.3	19.5±2.2
3	M12×1.75	5.5±0.6	39.8±4.3

Item	Size	kgf · m	lbf · ft
4	M12×1.75	9.4±1.0	68.0±7.2
5	M14×2.0	15±2.0	109±14.5
6	M18×2.5	32±3.0	232±21.7

GROUP 5 UNDERCARRIAGE

UNDERCARRIAGE MOUNTING

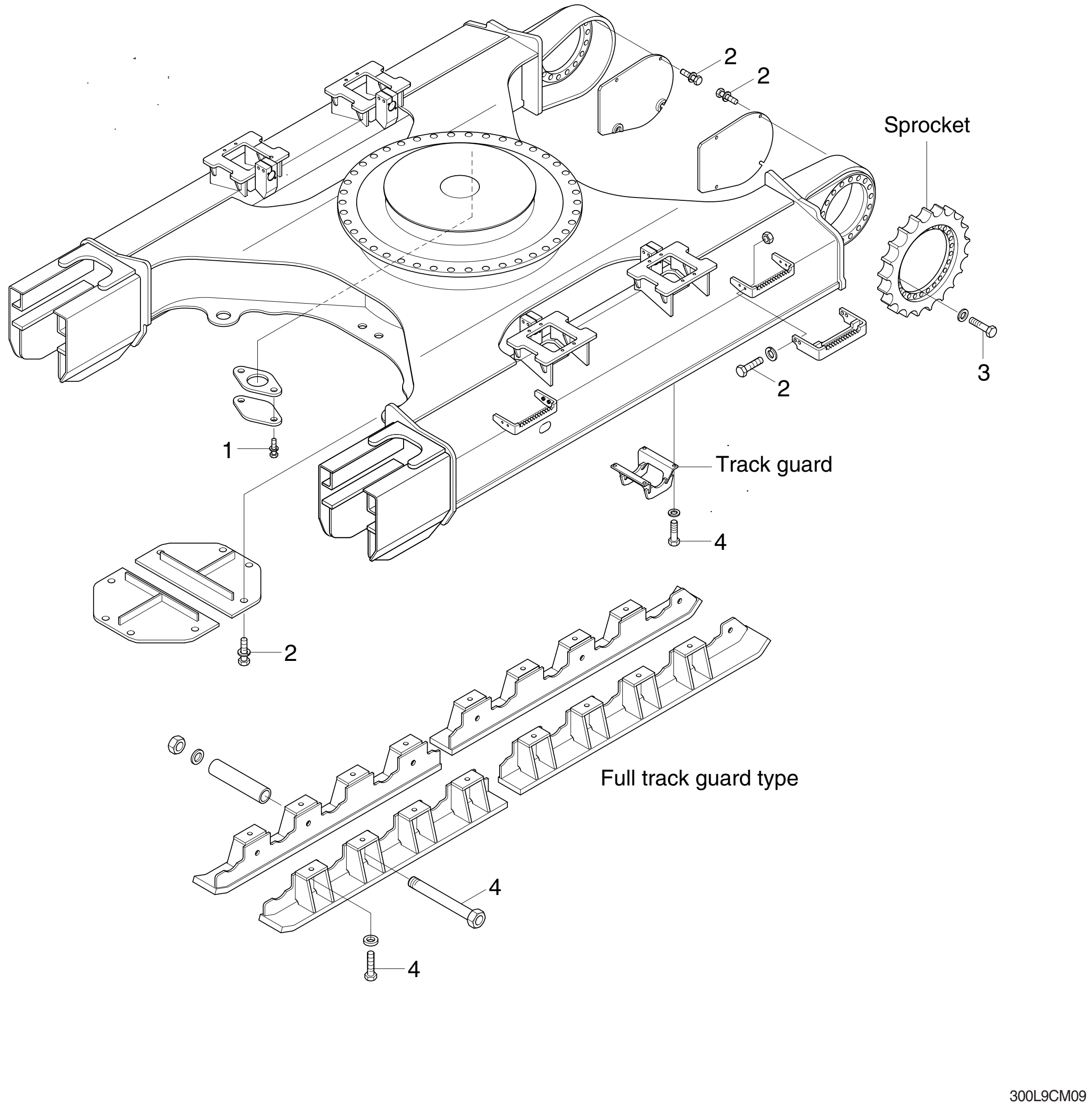


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.25	13.3±2.7	96.2±19.5
3	M12×1.75	12.8±3.0	92.6±21.7
4	M16×2.0	29.7±3.0	215±21.7
5	M16×2.0	29.7±4.5	215±32.5

Item	Size	kgf · m	lbf · ft
6	M20×2.5	57.9±6.0	419±43.4
7	M20×2.5	57.9±8.7	419±62.9
8	M22×1.5	123±6.0	831±36
9	M24×3.0	100±10	723±72.3
-	-	-	-

UNDERCARRIAGE MOUNTING (HIGH WALKER)



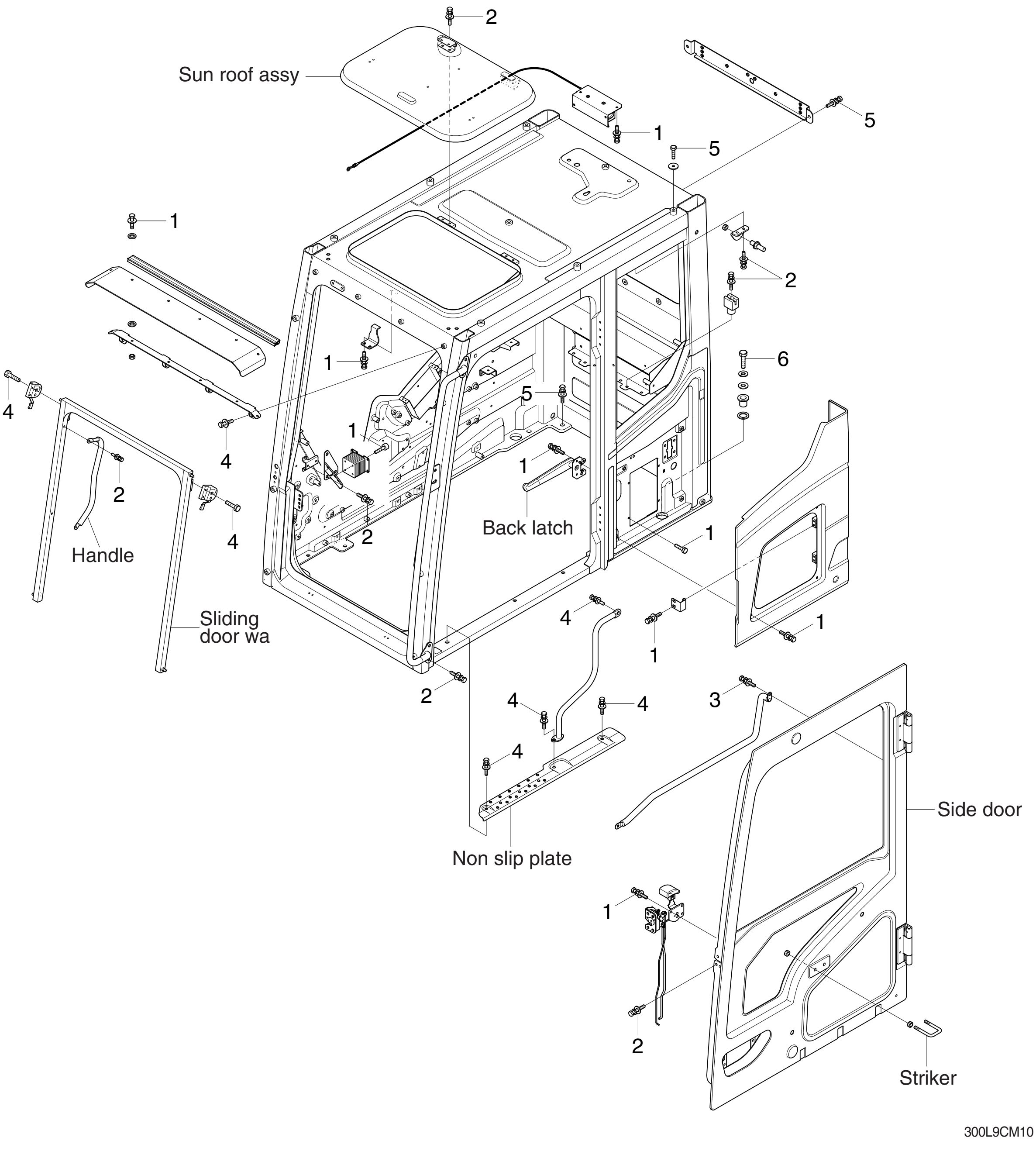
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
3	M20×2.5	57.9±6.0	419±43.4
4	M24×3.0	100±15	723±109

GROUP 6 STRUCTURE

CAB AND ACCESSORIES MOUNTING

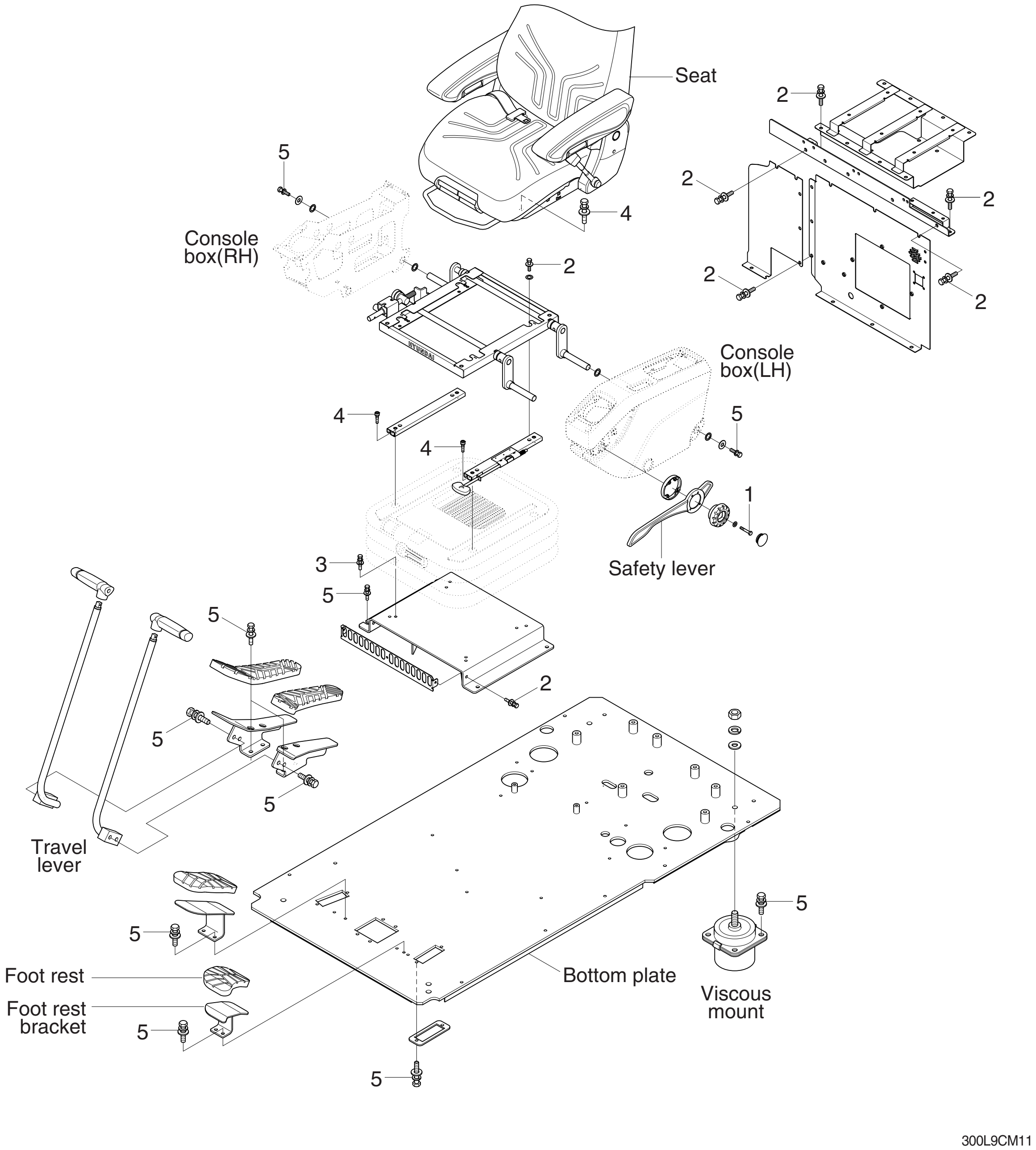


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.5	4.7±0.9	34±6.5

Item	Size	kgf · m	lbf · ft
4	M10×1.5	6.9±1.4	49.9±10.1
5	M12×1.75	12.8±3.0	92.6±21.7
6	M30×3.5	199±30	2025±217

CAB INTERIOR MOUNTING

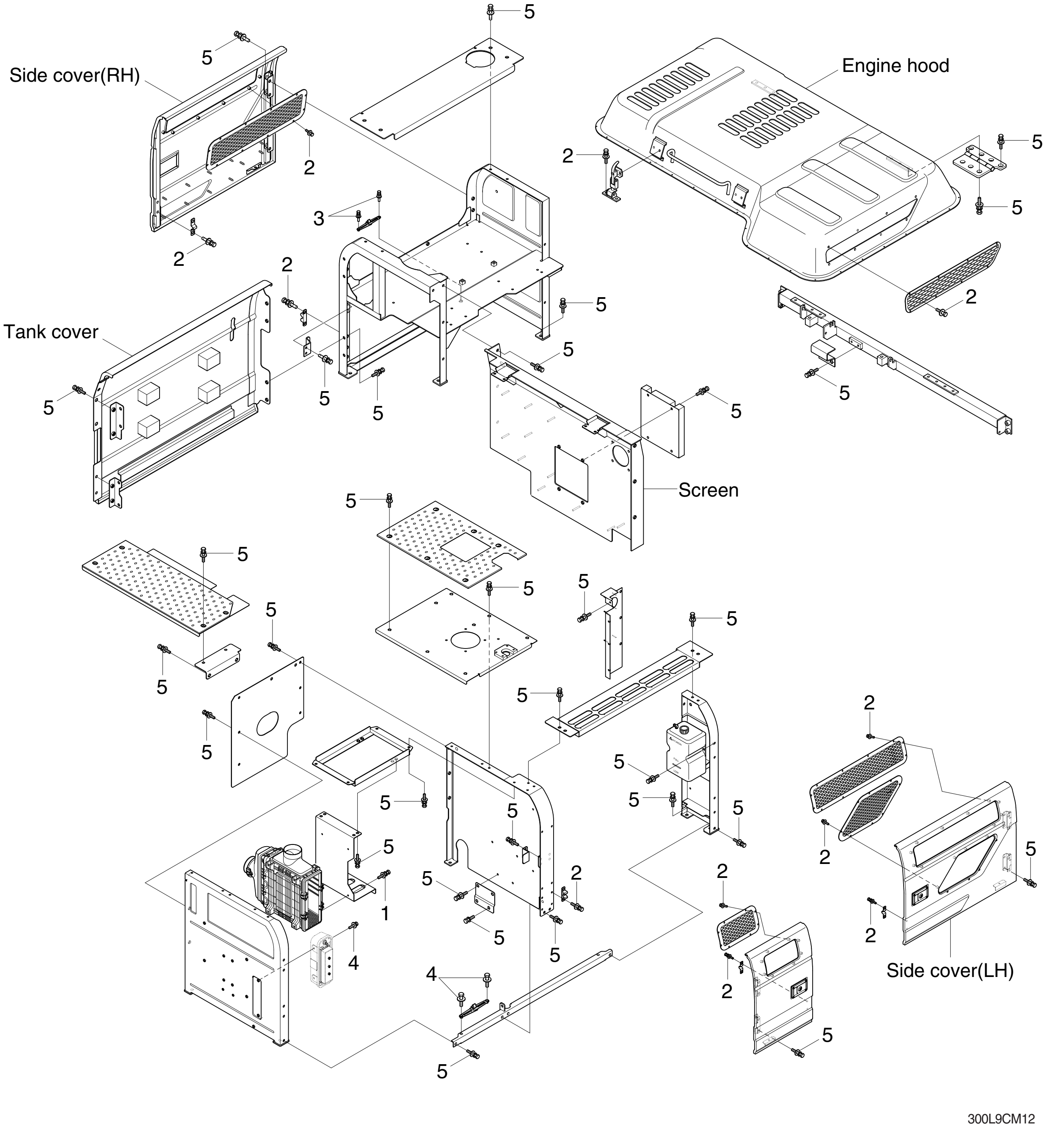


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.4
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M 8×1.25	3.43±0.7	24.8±5.1

Item	Size	kgf · m	lbf · ft
4	M 8×1.25	4.05±0.8	29.3±5.8
5	M10×1.5	6.9±1.4	49.9±10.1
-	-	-	-

COWLING MOUNTING

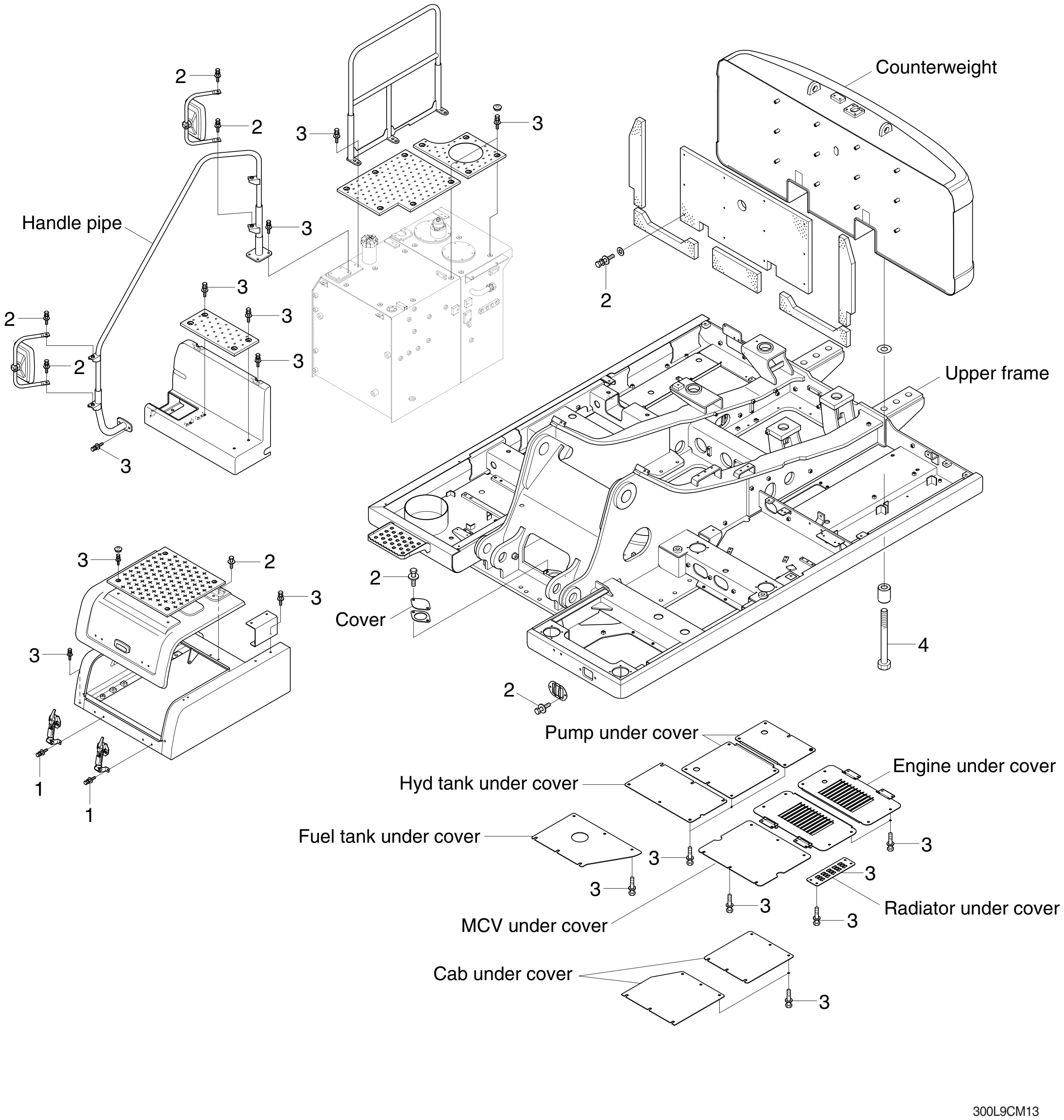


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.5	5.0±1.0	36.2±7.2

Item	Size	kgf · m	lbf · ft
4	M10×1.5	6.9±1.4	49.9±10.1
5	M12×1.75	12.8±3.0	92.6±21.7
-	-	-	-

COUNTERWEIGHT AND COVERS MOUNTING

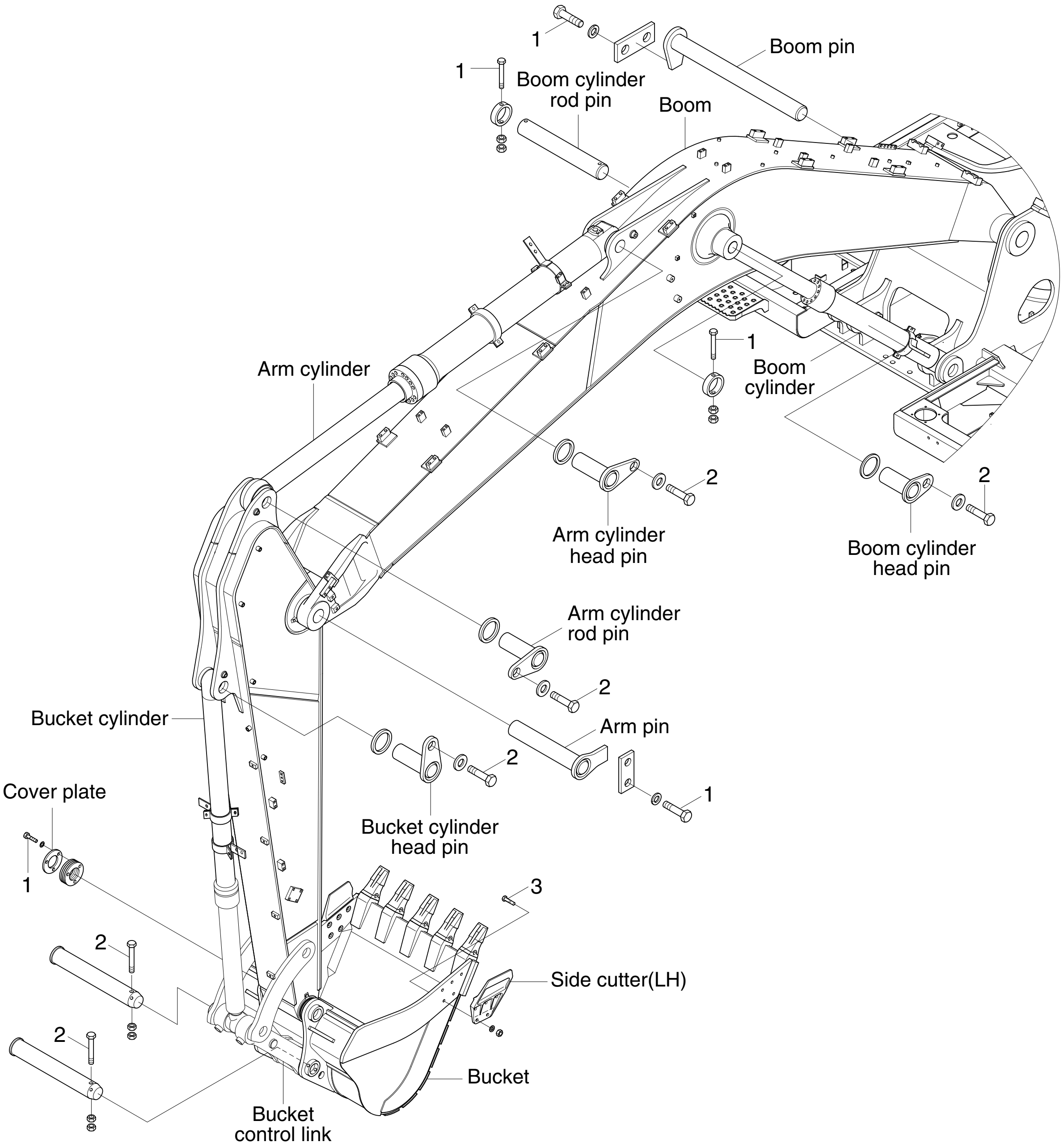


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M36×3.0	337±33	2440±239

GROUP 7 WORK EQUIPMENT



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M16×2.0	29.7±4.5	215±32.5
2	M20×2.5	57.9±8.7	419±62.9

Item	Size	kgf · m	lbf · ft
3	M22×2.5	81.9±16.1	592±116