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1. STRUCTURE

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

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

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

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

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

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

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

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

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

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

2. HOW TO READ THE SERVICE MANUAL

Distribution and updating

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

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

Filing method

1. See the page number on the bottom of the page.
   File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1
   2 - 3
   Item number (2. Structure and Function)
   Consecutive page number for each item.
3. Additional pages : Additional pages are indicated by a hyphen (-) and number after the page number. File as in the example.
   8 - 4
   8 - 4 - 1
   8 - 4 - 2] Added pages
   8 - 5

Revised edition mark (①②③⋯)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

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

Example

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

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

Millimeters to inches

1 mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

Kilogram to Pound

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 ℓ = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 ℓ = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

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

kgf/cm² to lbf/in²

1kgf / cm² = 14.2233lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

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

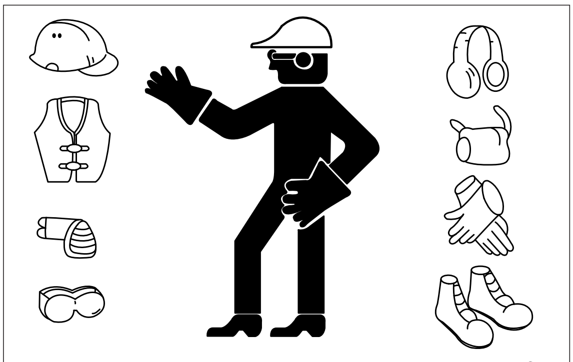
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

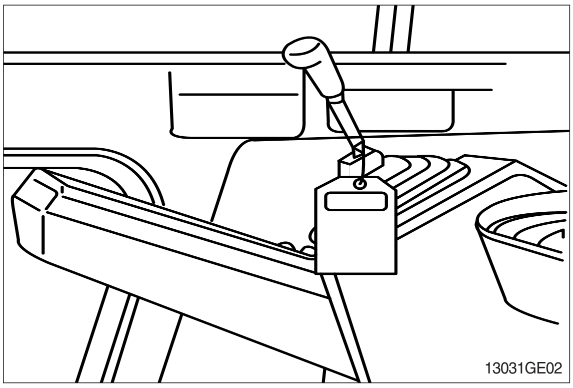
WEAR PROTECTIVE CLOTHING

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


13031GE01

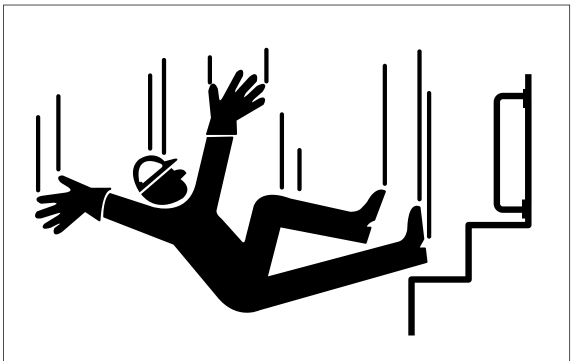
WARN OTHERS OF SERVICE WORK

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


13031GE02

USE HANDHOLDS AND STEPS

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

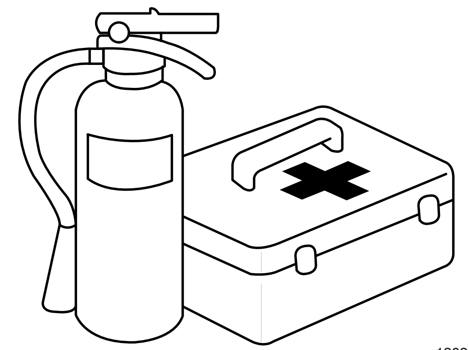

13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

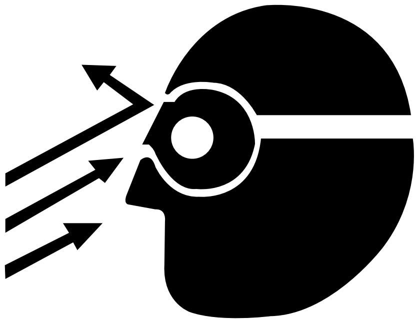
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

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



13031GE05

PROTECT AGAINST NOISE

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

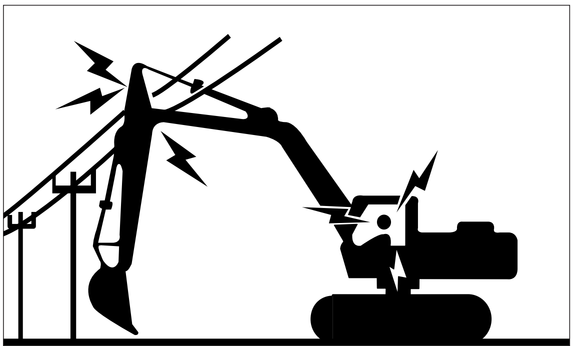
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

13031GE06

AVOID POWER LINES

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

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

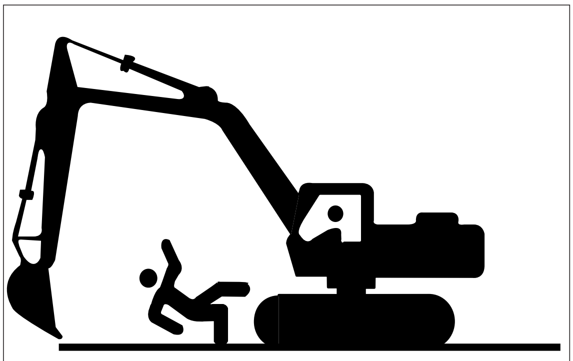


13031GE07

KEEP RIDERS OFF EXCAVATOR

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

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



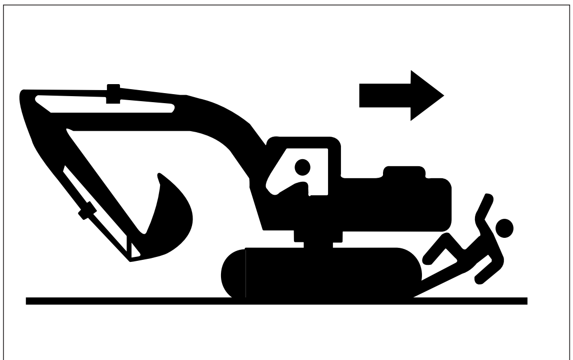
13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

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



13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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

13031GE26

PARK MACHINE SAFELY

Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

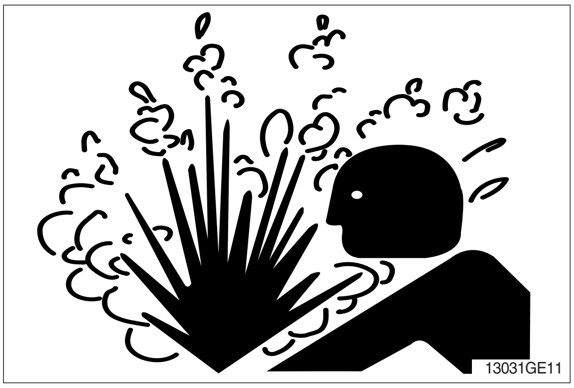
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

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


13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

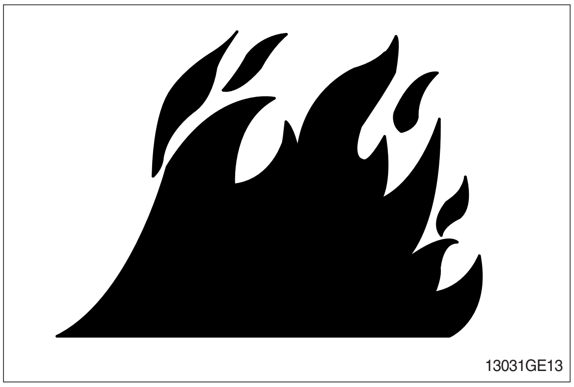
Handle fuel with care; It is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.
Fill fuel tank outdoors.


13031GE12

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

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

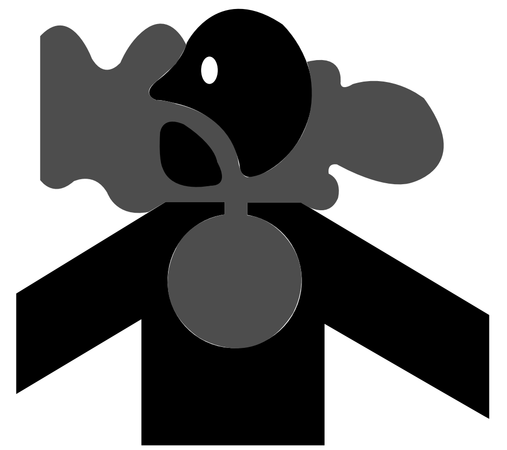
Do not store oily rags; They can ignite and burn spontaneously.


13031GE13

BEWARE OF EXHAUST FUMES

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

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



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

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

Remove paint before welding or heating:

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

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

ILLUMINATE WORK AREA SAFELY

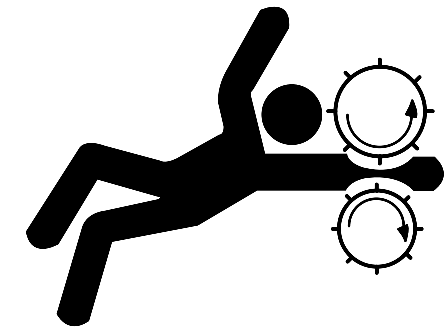
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

13031GE15

SERVICE MACHINE SAFELY

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

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

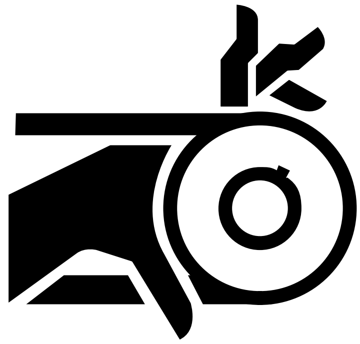


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



13031GE17

AVOID HIGH PRESSURE FLUIDS

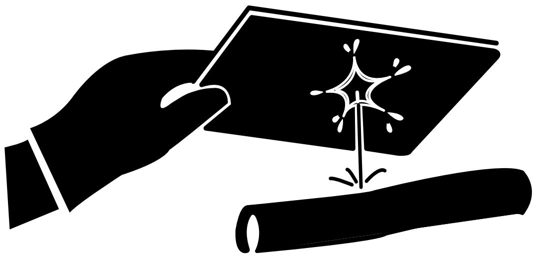
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES


13031GE20

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

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

PREVENT BATTERY EXPLOSIONS


13031GE21

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

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

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

PREVENT ACID BURNS

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

Avoid the hazard by:

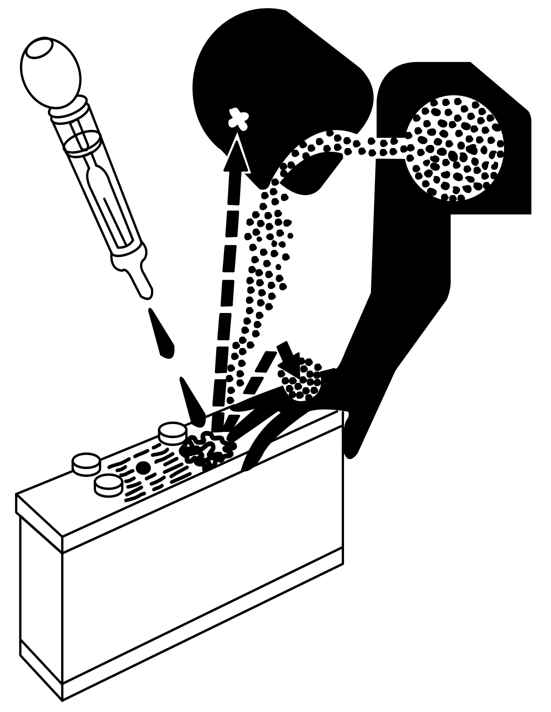
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



13031GE22

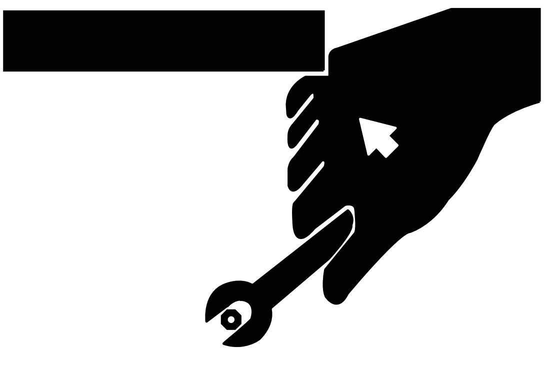
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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



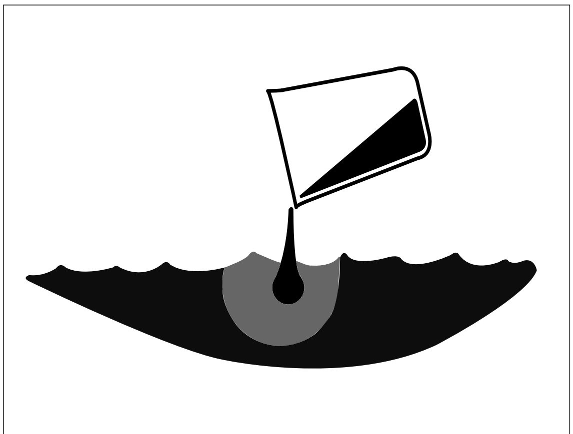
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

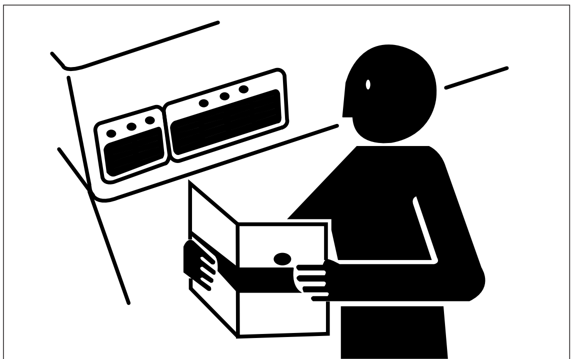
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY SIGNS

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



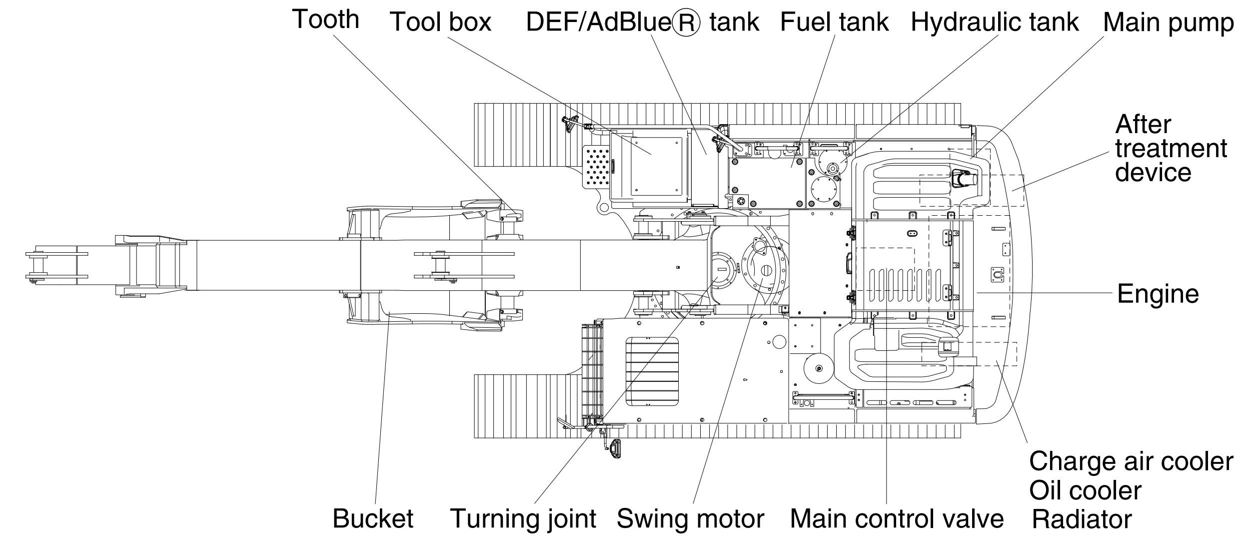
13031GE25

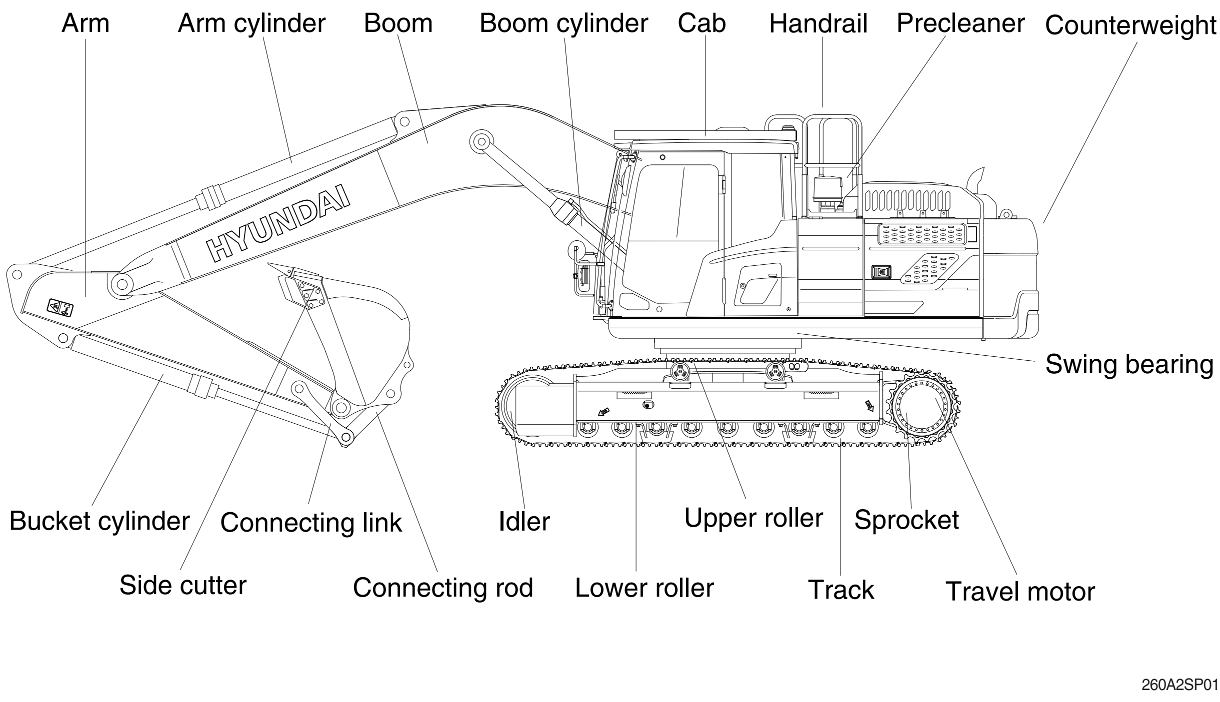
LIVE WITH SAFETY

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

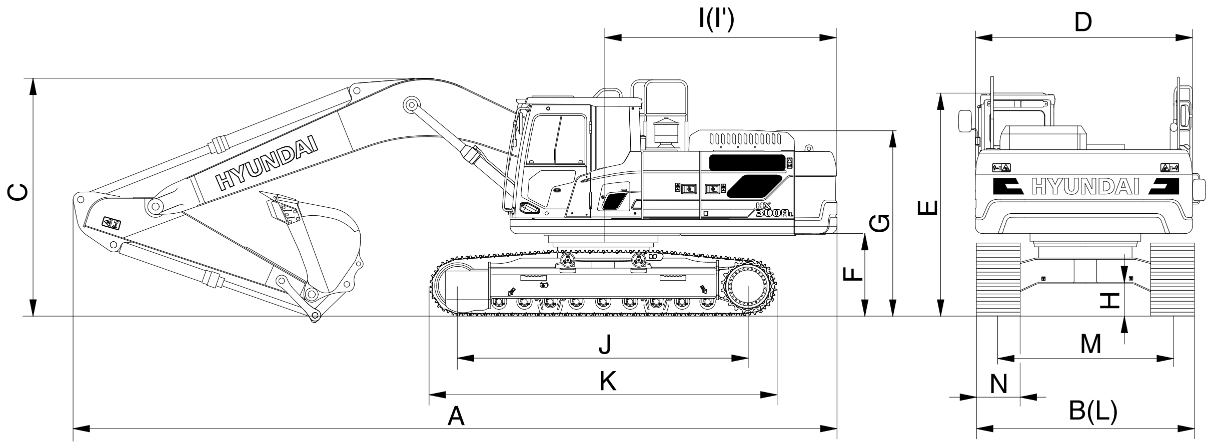




260A2SP01

2. SPECIFICATIONS

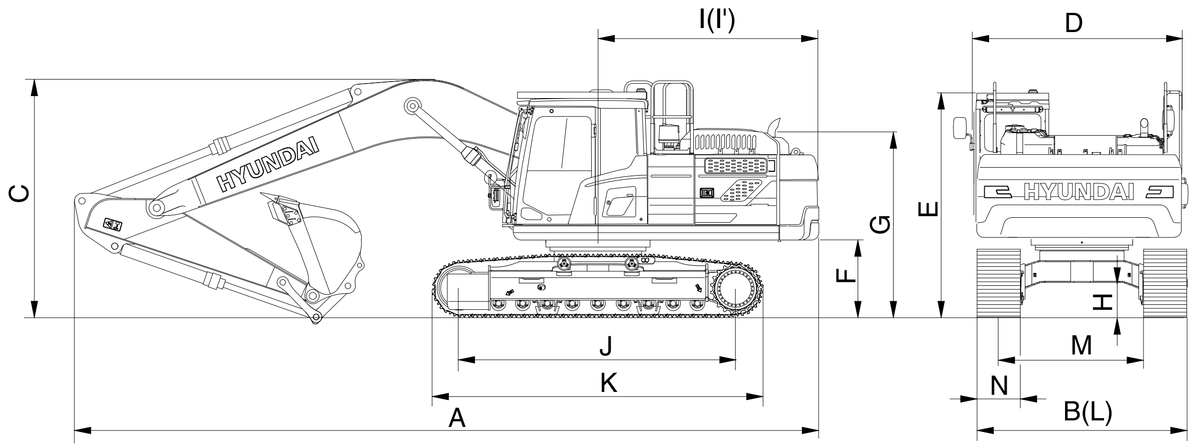
1) HX260A L, MONO BOOM



260A2SP02

Description		Unit		Specification			
		m (ft-in)	Boom	5.85 (19' 2")			
			Arm	3.05 (10' 0")	2.10 (6' 11")	2.50 (8' 2")	3.60 (11' 4")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		27000 (59520)	26830 (59150)	26800 (59080)	27130 (59810)
Bucket capacity (SAE heaped) standard		m^3 (yd^3)		1.08 (1.4)	1.08 (1.4)	1.08 (1.4)	1.08 (1.4)
Overall length	A	mm (ft-in)		10010 (32' 10")	10170 (33' 4")	10070 (33' 0")	10040 (32' 11")
Overall width	B			3180 (10' 5")	3180 (10' 5")	3180 (10' 5")	3180 (10' 5")
Overall height of boom	C			3230 (10' 7")	3480 (11' 5")	3360 (11' 0")	3360 (11' 0")
Superstructure width	D			2840 (9' 4")	2840 (9' 4")	2840 (9' 4")	2840 (9' 4")
Overall height of cab	E			3050 (10' 0")	3050 (10' 0")	3050 (10' 0")	3050 (10' 0")
Ground clearance of counterweight	F			1110 (3' 8")	1110 (3' 8")	1110 (3' 8")	1110 (3' 8")
Overall height of engine hood	G			2620 (8' 7")	2620 (8' 7")	2620 (8' 7")	2620 (8' 7")
Overall height of handrail	G'			3260 (10' 8")	3260 (10' 8")	3260 (10' 8")	3260 (10' 8")
Minimum ground clearance	H			480 (1' 7")	480 (1' 7")	480 (1' 7")	480 (1' 7")
Rear-end distance	I			2990 (9' 10")	2990 (9' 10")	2990 (9' 10")	2990 (9' 10")
Rear-end swing radius	I'			3085 (10' 1")	3085 (10' 1")	3085 (10' 1")	3085 (10' 1")
Distance between tumblers	J			3830 (12' 7")	3830 (12' 7")	3830 (12' 7")	3830 (12' 7")
Undercarriage length	K			4640 (15' 3")	4640 (15' 3")	4640 (15' 3")	4640 (15' 3")
Undercarriage width	L			3180 (10' 5")	3180 (10' 5")	3180 (10' 5")	3180 (10' 5")
Track gauge	M			2580 (8' 6")	2580 (8' 6")	2580 (8' 6")	2580 (8' 6")
Track shoe width standard	N			600 (24")	600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)
Swing speed		rpm		11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.55 (7.8)	0.54 (7.7)	0.54 (7.7)	0.55 (7.8)
Max traction force		kg (lb)		22194 (48929)	22194 (48929)	22194 (48929)	22194 (48929)

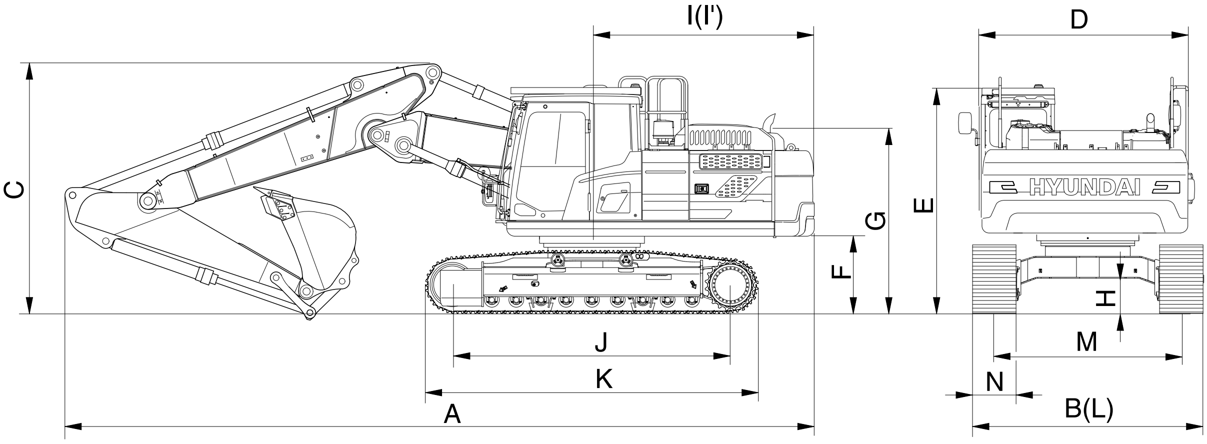
2) HX260A NL, MONO BOOM



260A2SP03

Description		Unit		Specification			
		m (ft-in)	Boom	5.85 (19' 2")			
			Arm	3.05 (10' 0")	2.10 (6' 11")	2.50 (8' 2")	3.60 (11' 10")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		26900 (59300)	26730 (58930)	26710 (58890)	27030 (59590)
Bucket capacity (SAE heaped) standard		m^3 (yd^3)		1.08 (1.4)	1.08 (1.4)	1.08 (1.4)	1.08 (1.4)
Overall length	A	mm (ft-in)		10010 (32' 10")	10170 (33' 4")	10070 (33' 0")	10040 (32' 10")
Overall width	B			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall height of boom	C			3230 (10' 7")	3480 (11' 5")	3360 (11' 0")	3360 (11' 0")
Superstructure width	D			2840 (9' 4")	2840 (9' 4")	2840 (9' 4")	2840 (9' 4")
Overall height of cab	E			3050 (10' 0")	3050 (10' 0")	3050 (10' 0")	3050 (10' 0")
Ground clearance of counterweight	F			1110 (3' 8")	1110 (3' 8")	1110 (3' 8")	1110 (3' 8")
Overall height of engine hood	G			2620 (8' 7")	2620 (8' 7")	2620 (8' 7")	2620 (8' 7")
Overall height of handrail	G'			3260 (10' 8")	3260 (10' 8")	3260 (10' 8")	3260 (10' 8")
Minimum ground clearance	H			480 (1' 7")	480 (1' 7")	480 (1' 7")	480 (1' 7")
Rear-end distance	I			2990 (9' 10")	2990 (9' 10")	2990 (9' 10")	2990 (9' 10")
Rear-end swing radius	I'			3085 (10' 1")	3085 (10' 1")	3085 (10' 1")	3085 (10' 1")
Distance between tumblers	J			3830 (12' 7")	3830 (12' 7")	3830 (12' 7")	3830 (12' 7")
Undercarriage length	K			4640 (15' 3")	4640 (15' 3")	4640 (15' 3")	4640 (15' 3")
Undercarriage width	L			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Track gauge	M			2380 (7' 10")	2380 (7' 10")	2380 (7' 10")	2380 (7' 10")
Track shoe width standard	N			600 (24")	600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)
Swing speed		rpm		11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm² (psi)		0.54 (7.8)	0.54 (7.7)	0.54 (7.7)	0.55 (7.8)
Max traction force		kg (lb)		22194 (48929)	22194 (48929)	22194 (48929)	22194 (48929)

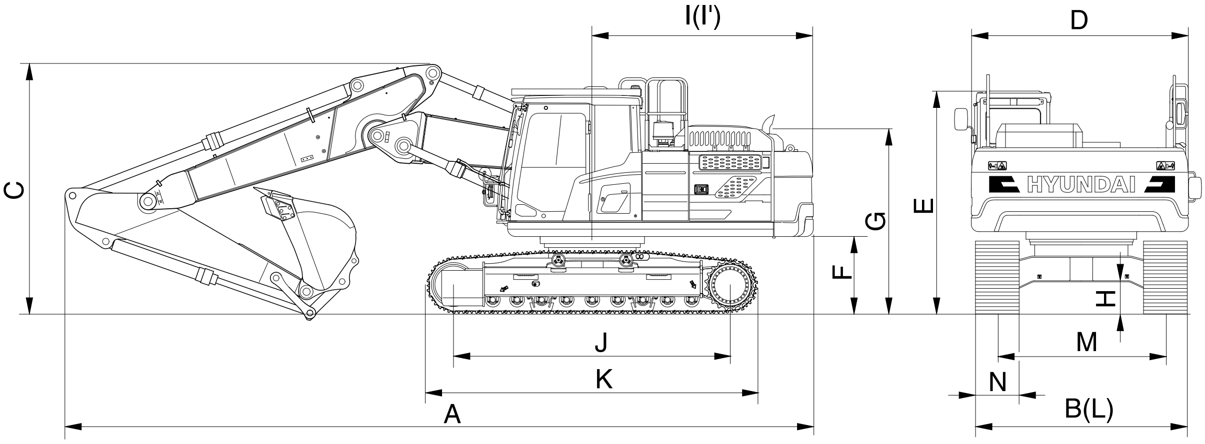
3) HX260A L, 2-PIECE BOOM



260A2SP06

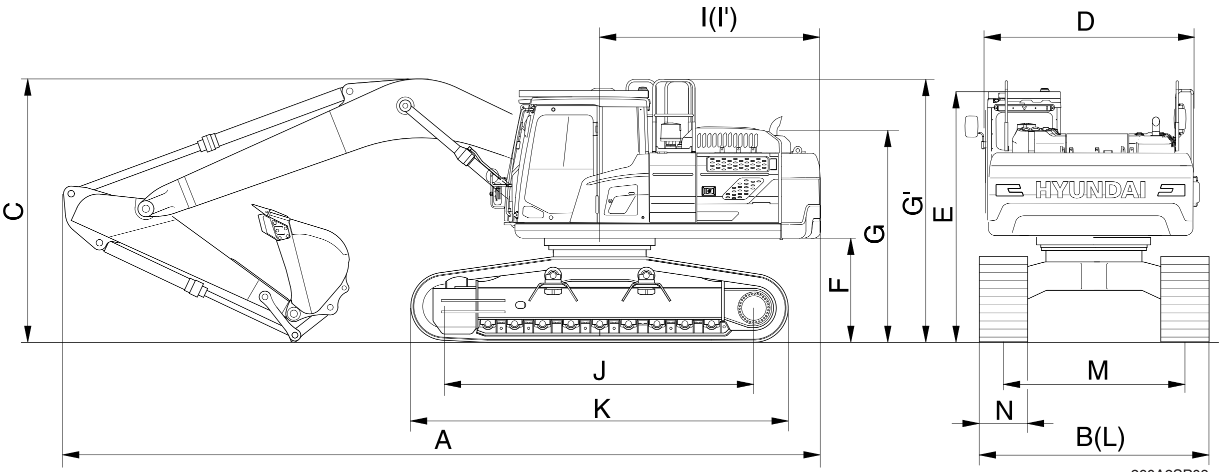
Description		Unit		Specification		
		m (ft-in)	Boom	5.90 (19' 4")		
			Arm	3.05 (10' 0")	2.1 (6' 11")	2.5 (8' 2")
		mm (in)	Shoe	600 (24)		
Operating weight		kg (lb)		29240 (64460)	29070 (64090)	28870 (63650)
Bucket capacity (SAE heaped) standard		m^3 (yd^3)		1.08 (1.4)	1.08 (1.4)	1.08 (1.4)
Overall length	A	mm (ft-in)		10090 (33' 1")	10210 (33' 6")	10110 (33' 2")
Overall width	B			3180 (10' 5")	3180 (10' 5")	3180 (10' 5")
Overall height of boom	C			3300 (10' 10")	3420 (11' 3")	3360 (11' 0")
Superstructure width	D			2840 (9' 4")	2840 (9' 4")	2840 (9' 4")
Overall height of cab	E			3050 (10' 0")	3050 (10' 0")	3050 (10' 0")
Ground clearance of counterweight	F			1110 (3' 8")	1110 (3' 8")	1110 (3' 8")
Overall height of engine hood	G			2620 (8' 7")	2620 (8' 7")	2620 (8' 7")
Overall height of handrail	G'			3260 (10' 8")	3260 (10' 8")	3260 (10' 8")
Minimum ground clearance	H			480 (1' 7")	480 (1' 7")	480 (1' 7")
Rear-end distance	I			2990 (9' 10")	2990 (9' 10")	2990 (9' 10")
Rear-end swing radius	I'			3085 (10' 1")	3085 (10' 1")	3085 (10' 1")
Distance between tumblers	J			3830 (12' 7")	3830 (12' 7")	3830 (12' 7")
Undercarriage length	K			4640 (15' 3")	4640 (15' 3")	4640 (15' 3")
Undercarriage width	L			3180 (10' 5")	3180 (10' 5")	3180 (10' 5")
Track gauge	M			2580 (8' 6")	2580 (8' 6")	2580 (8' 6")
Track shoe width standard	N			600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)
Swing speed		rpm		11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.59 (8.4)	0.59 (8.4)	0.58 (8.3)
Max traction force		kg (lb)		22194 (48929)	22194 (48929)	22194 (48929)

4) HX260A NL, 2-PIECE BOOM



Description		Unit		Specification		
		m (ft-in)	Boom	5.90 (19' 4")		
			Arm	3.05 (10' 0")	2.1 (6' 11")	2.5 (8' 2")
		mm (in)	Shoe	600 (24)		
Operating weight		kg (lb)		29150 (64260)	28970 (63870)	28770 (63430)
Bucket capacity (SAE heaped) standard		m^3 (yd^3)		1.08 (1.4)	1.08 (1.4)	1.08 (1.4)
Overall length	A	mm (ft-in)		10090 (33' 1")	10210 (33' 6")	10110 (33' 2")
Overall width	B			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall height of boom	C			3300 (10' 10")	3420 (11' 3")	3360 (11' 0")
Superstructure width	D			2840 (9' 4")	2840 (9' 4")	2840 (9' 4")
Overall height of cab	E			3050 (10' 0")	3050 (10' 0")	3050 (10' 0")
Ground clearance of counterweight	F			1110 (3' 8")	1110 (3' 8")	1110 (3' 8")
Overall height of engine hood	G			2620 (8' 7")	2620 (8' 7")	2620 (8' 7")
Overall height of handrail	G'			3260 (10' 8")	3260 (10' 8")	3260 (10' 8")
Minimum ground clearance	H			480 (1' 7")	480 (1' 7")	480 (1' 7")
Rear-end distance	I			2990 (9' 10")	2990 (9' 10")	2990 (9' 10")
Rear-end swing radius	I'			3085 (10' 1")	3085 (10' 1")	3085 (10' 1")
Distance between tumblers	J			3830 (12' 7")	3830 (12' 7")	3830 (12' 7")
Undercarriage length	K			4640 (15' 3")	4640 (15' 3")	4640 (15' 3")
Undercarriage width	L			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Track gauge	M			2380 (7' 10")	2380 (7' 10")	2380 (7' 10")
Track shoe width standard	N			600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)
Swing speed		rpm		11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.59 (8.4)	0.59 (8.4)	0.58 (8.3)
Max traction force		kg (lb)		22194 (48929)	22194 (48929)	22194 (48929)

5) HX260A HW, MONO BOOM

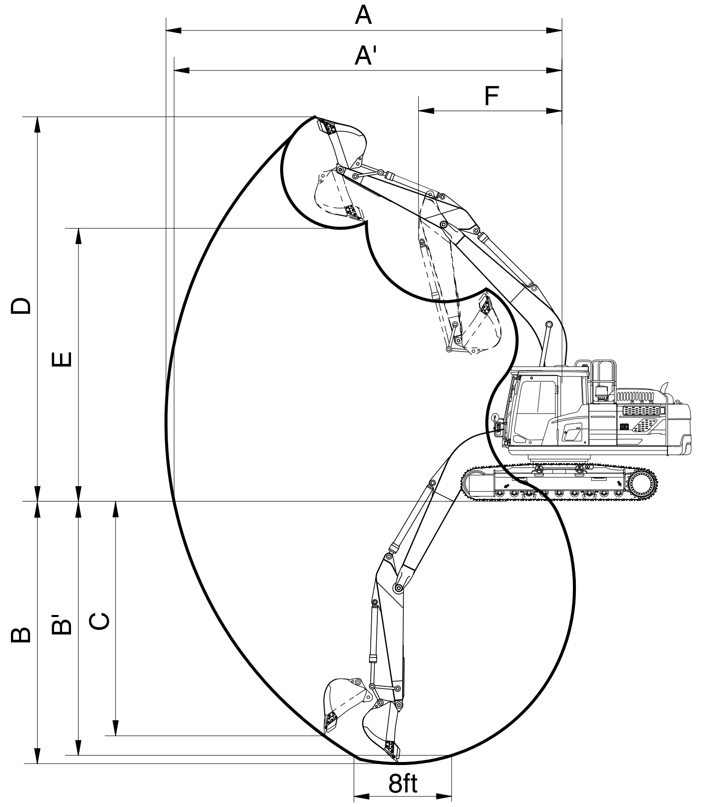


260A2SP08

Description		Unit		Specification			
		m (ft-in)	Boom	5.85 (19' 2")			
			Arm	2.10 (6' 11")	2.50 (8' 2")	3.05 (10' 0")	3.60 (11' 10")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		31040 (68430)	31100 (68560)	31210 (68810)	31340 (69090)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.08 (1.4)	1.08 (1.4)	1.08 (1.4)	1.08 (1.4)
Overall length	A	mm (ft-in)		10160 (33' 4")	10020 (32' 10")	9870 (32' 5")	10040 (32' 11")
Overall width	B			3470 (11' 5")	3470 (11' 5")	3470 (11' 5")	3470 (11' 5")
Overall width with additional footboard	B'			3590 (11' 9")	3590 (11' 9")	3590 (11' 9")	3590 (11' 9")
Overall height of boom	C			3630 (11' 11")	3460 (11' 4")	3220 (10' 7")	3610 (11' 10")
Superstructure width	D			2840 (9' 4")	2840 (9' 4")	2840 (9' 4")	2840 (9' 4")
Superstructure width with catwalk	D'			3170 (10' 5")	3170 (10' 5")	3170 (10' 5")	3170 (10' 5")
Overall height of cab	E			3405 (11' 2")	3405 (11' 2")	3405 (11' 2")	3405 (11' 2")
Ground clearance of counterweight	F			1475 (4' 10")	1475 (4' 10")	1475 (4' 10")	1475 (4' 10")
Overall height of engine hood	G			2990 (9' 10")	2990 (9' 10")	2990 (9' 10")	2990 (9' 10")
Overall height of handrail	G'			3625 (11' 11")	3625 (11' 11")	3625 (11' 11")	3625 (11' 11")
Minimum ground clearance	H			765 (2' 6")	765 (2' 6")	765 (2' 6")	765 (2' 6")
Rear-end distance	I			2990 (9' 10")	2990 (9' 10")	2990 (9' 10")	2990 (9' 10")
Rear-end swing radius	I'			3085 (10' 1")	3085 (10' 1")	3085 (10' 1")	3085 (10' 1")
Distance between tumblers	J			4030 (13' 3")	4030 (13' 3")	4030 (13' 3")	4030 (13' 3")
Undercarriage length	K			4940 (16' 2")	4940 (16' 2")	4940 (16' 2")	4940 (16' 2")
Undercarriage width	L			3470 (11' 5")	3470 (11' 5")	3470 (11' 5")	3470 (11' 5")
Undercarriage width with additional footboard	L'			3590 (11' 9")	3590 (11' 9")	3590 (11' 9")	3590 (11' 9")
Track gauge	M			2790 (9' 2")	2790 (9' 2")	2790 (9' 2")	2790 (9' 2")
Track shoe width, standard	N			600 (2' 0")	600 (2' 0")	600 (2' 0")	600 (2' 0")
Travel speed (low/high)		km/hr (mph)		3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)	3.25/5.62 (2.02/3.49)
Swing speed		rpm		11.2	11.2	11.2	11.2
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.60 (8.5)	0.60 (8.5)	0.60 (8.6)	0.60 (8.6)
Max traction force		kg (lb)		27404 (60415)	27404 (60415)	27404 (60415)	27404 (60415)

3. WORKING RANGE AND DIGGING FORCE

1) HX260A L/NL, MONO BOOM

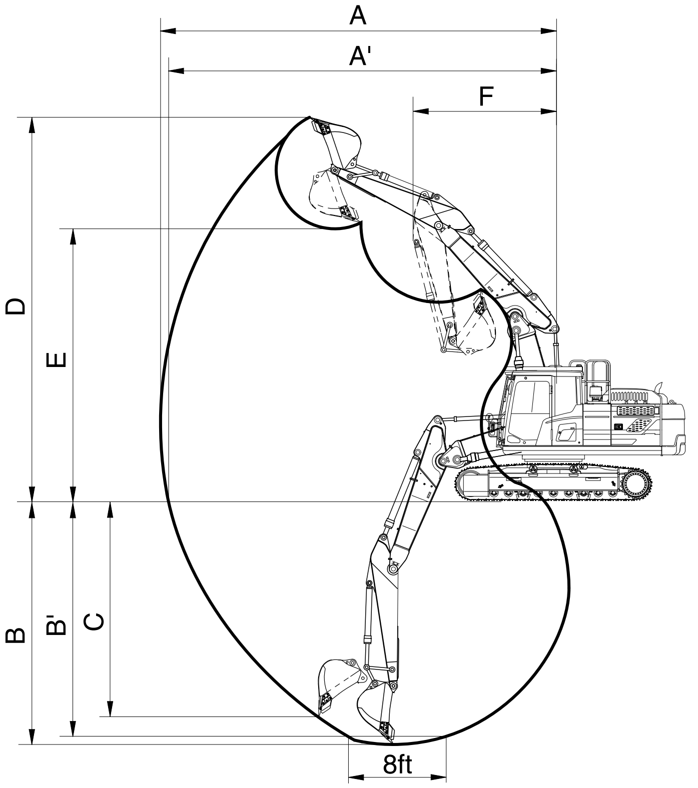


260A2SP10

Description	m (ft-in)	Boom	5.85 (19' 2")			
		Arm	2.10 (6' 11")	2.50 (8' 2")	3.05 (10' 0")	3.60 (11' 10")
Max digging reach	mm (ft-in)	A	9560 (31' 4")	9870 (32' 5")	10360 (34' 0")	10870 (35' 8")
Max digging reach on ground		A'	9370 (30' 9")	9690 (31' 9")	10190 (33' 5")	10710 (35' 2")
Max digging depth		B	6060 (19' 11")	6460 (21' 2")	7010 (23' 0")	7560 (24' 10")
Max digging depth (8 ft level)		B'	5850 (19' 2")	6280 (20' 7")	6850 (22' 6")	7420 (24' 4")
Max vertical wall digging depth		C	5520 (18' 1")	5680 (18' 8")	6170 (20' 3")	6860 (22' 6")
Max digging height		D	9950 (32' 8")	10020 (32' 10")	10290 (33' 9")	10560 (34' 8")
Max dumping height		E	6800 (22' 4")	6900 (22' 8")	7150 (23' 5")	7430 (24' 5")
Min swing radius		F	3840 (12' 7")	3190 (10' 6")	3450 (11' 4")	3150 (10' 4")
Bucket digging force	kN	SAE	156.9 [170.3]	156.9 [170.3]	156.9 [170.3]	156.9 [170.3]
	kgf		16000 [17370]	16000 [17370]	16000 [17370]	16000 [17370]
	lbf		35274 [38294]	35274 [38294]	35274 [38294]	35274 [38294]
	kN	ISO	178.5 [193.8]	178.5 [193.8]	178.5 [193.8]	178.5 [193.8]
	kgf		18200 [19760]	18200 [19760]	18200 [19760]	18200 [19760]
	lbf		40124 [43563]	40124 [43563]	40124 [43563]	40124 [43563]
Arm digging force	kN	SAE	134.4 [145.8]	130.4 [141.6]	114.7 [124.5]	104.0 [112.9]
	kgf		13700 [14870]	13300 [14440]	11700 [12700]	10600 [11510]
	lbf		30203 [32783]	29321 [31835]	25794 [27999]	23369 [25375]
	kN	ISO	139.3 [151.2]	134.4 [145.8]	118.7 [128.9]	107.9 [117.1]
	kgf		14200 [15420]	13700 [14870]	12100 [13140]	11000 [11940]
	lbf		31306 [33995]	30203 [32783]	26676 [28969]	24251 [26323]

[ ] : Power boost

2) HX260A L/NL, 2-PIECE BOOM

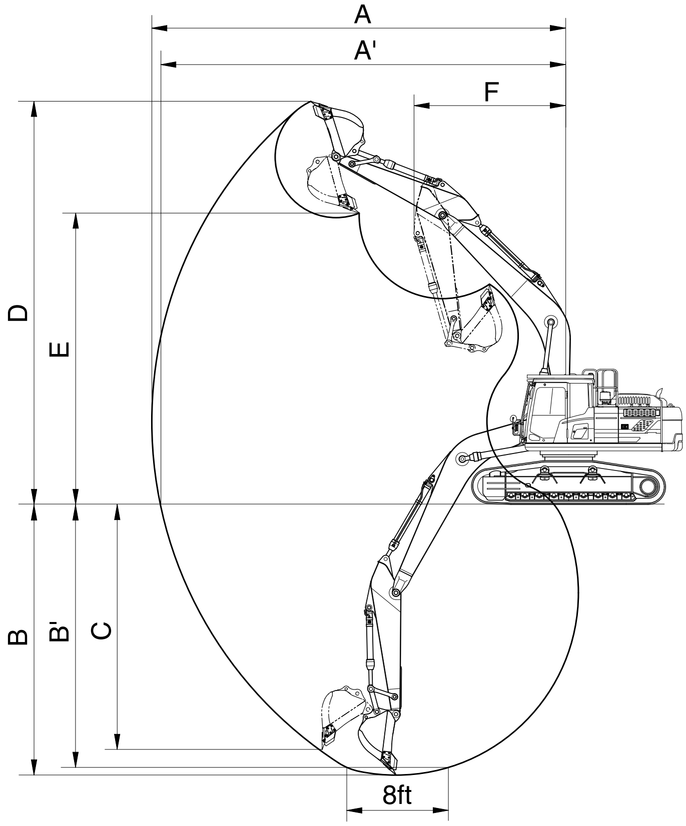


260A2SP11

Description	m (ft-in)	Boom	5.90 (19' 4")		
		Arm	2.10 (6' 11")	2.50 (8' 2")	3.05 (10' 0")
Max digging reach	mm (ft-in)	A	9660 (31' 8")	9990 (32' 9")	10500 (34' 5")
Max digging reach on ground		A'	9470 (31' 1")	9810 (32' 2")	10320 (33' 10")
Max digging depth		B	5750 (18' 10")	6120 (20' 1")	6660 (21' 10")
Max digging depth (8 ft level)		B'	5840 (19' 2")	6260 (20' 6")	6830 (22' 5")
Max vertical wall digging depth		C	4780 (15' 8")	5100 (16' 9")	5620 (18' 5")
Max digging height		D	10880 (35' 8")	11090 (36' 5")	11470 (37' 8")
Max dumping height		E	7660 (25' 2")	7870 (25' 10")	8250 (27' 1")
Min swing radius		F	3280 (10' 9")	2990 (9' 10")	2730 (8' 11")
Bucket digging force	kN	SAE	156.9 [170.3]	156.9 [170.3]	156.9 [170.3]
	kgf		16000 [17370]	16000 [17370]	16000 [17370]
	lbf		35274 [38294]	35274 [38294]	35274 [38294]
	kN	ISO	178.5 [193.8]	178.5 [193.8]	178.5 [193.8]
	kgf		18200 [19760]	18200 [19760]	18200 [19760]
	lbf		40124 [43563]	40124 [43563]	40124 [43563]
Arm digging force	kN	SAE	134.4 [145.8]	130.4 [141.6]	114.7 [124.5]
	kgf		13700 [14870]	13300 [14440]	11700 [12700]
	lbf		30203 [32783]	29321 [31835]	25794 [27999]
	kN	ISO	139.3 [151.2]	134.4 [145.8]	118.7 [128.9]
	kgf		14200 [15420]	13700 [14870]	12100 [13140]
	lbf		31306 [33995]	30203 [32783]	26676 [28969]

[ ] : Power boost

3) HX260A HW, MONO BOOM



260A2SP12

Description	m (ft-in)	Boom	5.85 (19' 2")			
		Arm	2.10 (6' 11")	2.50 (8' 2")	3.05 (10' 0")	3.60 (11' 10")
Max digging reach	mm (ft-in)	A	9560 (31' 4")	9870 (32' 5")	10360 (34' 0")	10870 (35' 8")
Max digging reach on ground		A'	9290 (30' 6")	9610 (31' 6")	10120 (33' 2")	10640 (34' 11")
Max digging depth		B	5700 (18' 8")	6100 (20' 0")	6650 (21' 10")	7200 (23' 7")
Max digging depth (8 ft level)		B'	5490 (18' 0")	5910 (19' 5")	6490 (21' 4")	7050 (23' 2")
Max vertical wall digging depth		C	5150 (16' 11")	5320 (17' 5")	5810 (19' 1")	6500 (21' 4")
Max digging height		D	10310 (33' 10")	10380 (34' 1")	10620 (34' 10")	10920 (35' 10")
Max dumping height		E	7160 (23' 6")	7260 (23' 10")	7510 (24' 8")	7790 (25' 7")
Min swing radius		F	3840 (12' 7")	3190 (10' 6")	3450 (11' 4")	3150 (10' 4")
Bucket digging force	kN	SAE	153.1 [166.1]	153.6 [167.2]	154.0 [167.2]	154.1 [167.2]
	kgf		15600 [16940]	15700 [17050]	15700 [17050]	15700 [17050]
	lbf		34403 [37346]	34522 [37589]	34603 [37589]	34638 [37589]
	kN	ISO	177.2 [192.7]	177.8 [192.7]	178.2 [193.8]	178.4 [193.8]
	kgf		18100 [19650]	18100 [19650]	18200 [19760]	18200 [19760]
	lbf		39819 [43321]	39957 [43321]	40051 [43563]	40092 [43563]
Arm digging force	kN	SAE	159.2 [172.5]	134.3 [145.8]	113.3 [122.5]	103.1 [111.8]
	kgf		16200 [17590]	13700 [14870]	11500 [12490]	10500 [11400]
	lbf		35777 [38779]	30188 [32783]	25461 [27536]	23170 [25133]
	kN	ISO	167.7 [182.1]	140.8 [153.3]	118.2 [127.8]	107.0 [116.0]
	kgf		17100 [18570]	14400 [15630]	12000 [13030]	10900 [11830]
	lbf		37698 [40940]	31651 [34458]	26553 [28726]	24056 [26081]

[ ] : Power boost

4. WEIGHT

Item	HX260A L		HX260A NL		HX260A HW	
	kg	lb	kg	lb	kg	lb
Upperstructure assembly						
· Main frame weld assembly	2426	5437	2426	5437	2443	5386
· Engine assembly	583	1285	583	1285	583	1285
· Aftertreatment assembly	74	162	74	162	74	162
· Main pump assembly	140	309	140	309	140	309
· Main control valve assembly	220	485	220	485	220	485
· Swing motor assembly	378	833	378	833	378	833
· Hydraulic oil tank WA	174	384	174	384	174	384
· Fuel tank WA	216	476	216	476	216	476
· Counterweight	4600	10141	6100	13448	4600	10141
· Cab assembly	495	1092	495	1092	495	1092
Lower chassis assembly						
· Track frame weld assembly	2927	6453	2829	6237	5134	11318
· Swing bearing	364	802	364	802	364	802
· Travel motor assembly (2EA)	617	1360	617	1360	886	1953
· Turning joint	53	117	53	117	53	117
· Sprocket (2EA)	103	227	103	227	166	367
· Track recoil spring (2EA)	326	720	326	720	450	992
· Idler (2EA)	301	664	301	664	499	1100
· Upper roller (4EA)	82	182	82	182	216	477
· Lower roller (18EA)	855	1885	855	1885	973	2144
· Track-chain assembly (600 mm triple grouser shoe) (2EA)	3000	6614	3000	6614	3759	8287
· Track-chain assembly (700 mm triple grouser shoe) (2EA)	3295	7264	3295	7264	-	-
· Track-chain assembly (800 mm triple grouser shoe) (2EA)	3590	7914	3590	7914	-	-
· Track-chain assembly (900 mm triple grouser shoe) (2EA)	3884	8564	-	-	-	-
· Track-chain assembly (700 mm double grouser shoe) (2EA)	3884	8564	-	-	5237	11546
Front attachment assembly						
· 5.85 m boom assembly	1940	4277	1940	4277	1940	4277
· 3.05 m arm assembly	1020	2249	1020	2249	1020	2249
· 1.08 m^3 SAE heaped bucket	1020	2249	1020	2249	1020	2249
· Boom cylinder assembly (2EA)	473	1044	473	1044	473	1044
· Arm cylinder assembly	334	736	334	736	334	736
· Bucket cylinder assembly	206	453	206	453	206	453
· Bucket control linkage total	280	617	280	617	280	617
· 5.90 m boom assembly (2-piece)	2295	5060	2295	5060	2295	5060
· Boom cylinder assembly (2EA, 2-piece)	473	1044	473	1044	473	1044
· Arm cylinder assembly (2-piece)	334	736	334	736	334	736
· Boom cylinder assembly (2-piece)	206	453	206	453	206	453
· Adjust boom cylinder assembly (2-piece)	295	651	295	651	295	651

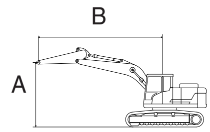
※ This information is different with operating and transportation weight because it is not including harness, pipe, oil, fuel so on.

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

5. LIFTING CAPACITIES

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
		Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
HX260A L	MONO BOOM	5850	3050	4600	600	-	-	-	-	-

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

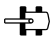


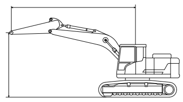
Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg							*5640	*5640			*4010	*4010	6.66
(24.6 ft)	lb							*12430	*12430			*8840	*8840	(21.8)
6.0 m	kg							*5760	*5760	*4710	*4710	*3770	*3770	7.70
(19.7 ft)	lb							*12700	*12700	*10380	*10380	*8310	*8310	(25.3)
4.5 m	kg					*7530	*7530	*6560	*6560	*6130	4690	*3730	*3730	8.34
(14.8 ft)	lb					*16600	*16600	*14460	*14460	*13510	10340	*8220	*8220	(27.4)
3.0 m	kg					*10040	9850	*7740	6380	*6690	4520	*3830	3570	8.67
(9.8 ft)	lb					*22130	21720	*17060	14070	*14750	9960	*8440	7870	(28.5)
1.5 m	kg					*12350	9120	*8940	6020	6660	4350	*4100	3440	8.74
(4.9 ft)	lb					*27230	20110	*19710	13270	14680	9590	*9040	7580	(28.7)
0.0 m	kg			*6350	*6350	*13640	8740	9130	5770	6510	4210	*4570	3500	8.53
(0.0 ft)	lb			*14000	*14000	*30070	19270	20130	12720	14350	9280	*10080	7720	(28.0)
-1.5 m	kg	*7170	*7170	*11190	*11190	*13910	8620	9000	5660	6450	4150	*5400	3780	8.04
(-4.9 ft)	lb	*15810	*15810	*24670	*24670	*30670	19000	19840	12480	14220	9150	*11900	8330	(26.4)
-3.0 m	kg	*12120	*12120	*17600	17480	*13260	8690	9030	5690			6900	4450	7.21
(-9.8 ft)	lb	*26720	*26720	*38800	38540	*29230	19160	19910	12540			15210	9810	(23.7)
-4.5 m	kg			*15990	*15990	*11320	8960					*8170	6090	5.88
(-14.8 ft)	lb			*35250	*35250	*24960	19750					*18010	13430	(19.3)

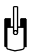
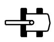
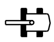
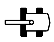
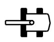
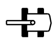
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult 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	
HX260A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	2100	4600	600	-	-	-	-	-

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

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)		Capacity		Reach
												m (ft)
7.5 m	kg									*7270	*7270	5.55
(24.6 ft)	lb									*16030	*16030	(18.2)
6.0 m	kg			*7460	*7460	*7010	6810			*7100	5540	6.77
(19.7 ft)	lb			*16450	*16450	*15450	15010			*15650	12210	(22.2)
4.5 m	kg			*9290	*9290	*7660	6580			6940	4610	7.49
(14.8 ft)	lb			*20480	*20480	*16890	14510			15300	10160	(24.6)
3.0 m	kg					*8710	6260	6810	4490	6320	4170	7.86
(9.8 ft)	lb					*19200	13800	15010	9900	13930	9190	(25.8)
1.5 m	kg					9330	5970	6670	4360	6140	4030	7.93
(4.9 ft)	lb					20570	13160	14700	9610	13540	8880	(26.0)
0.0 m	kg			*14080	8760	9150	5810	6590	4290	6340	4140	7.70
(0.0 ft)	lb			*31040	19310	20170	12810	14530	9460	13980	9130	(25.3)
-1.5 m	kg			*13680	8790	9120	5780			7070	4590	7.16
(-4.9 ft)	lb			*30160	19380	20110	12740			15590	10120	(23.5)
-3.0 m	kg	*16680	*16680	*12330	8960	*9030	5940			*8540	5700	6.20
(-9.8 ft)	lb	*36770	*36770	*27180	19750	*19910	13100			*18830	12570	(20.4)

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

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Lifting capacities will vary with different work tools ground conditions and attachments.
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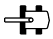
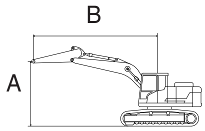
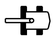
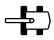
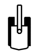
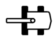
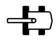
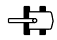
Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	2500	4600	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									*6080	*6080	6.00
(24.6 ft)	lb									*13400	*13400	(19.7)
6.0 m	kg					*6490	*6490			*5660	5130	7.14
(19.7 ft)	lb					*14310	*14310			*12480	11310	(23.4)
4.5 m	kg			*8570	*8570	*7220	6650	*6700	4650	*5580	4320	7.82
(14.8 ft)	lb			*18890	*18890	*15920	14660	*14770	10250	*12300	9520	(25.7)
3.0 m	kg			*11080	9640	*8340	6310	6840	4510	*5740	3930	8.18
(9.8 ft)	lb			*24430	21250	*18390	13910	15080	9940	*12650	8660	(26.8)
1.5 m	kg			*13120	9020	9370	6000	6670	4360	5780	3790	8.25
(4.9 ft)	lb			*28920	19890	20660	13230	14700	9610	12740	8360	(27.1)
0.0 m	kg			*13980	8760	9150	5800	6560	4260	5950	3880	8.03
(0.0 ft)	lb			*30820	19310	20170	12790	14460	9390	13120	8550	(26.3)
-1.5 m	kg	*11520	*11520	*13860	8730	9080	5740	6550	4260	6540	4250	7.51
(-4.9 ft)	lb	*25400	*25400	*30560	19250	20020	12650	14440	9390	14420	9370	(24.6)
-3.0 m	kg	*17870	17830	*12810	8860	9180	5830			7980	5140	6.61
(-9.8 ft)	lb	*39400	39310	*28240	19530	20240	12850			17590	11330	(21.7)
-4.5 m	kg			*10080	9220					*8510	7660	5.12
(-14.8 ft)	lb			*22220	20330					*18760	16890	(16.8)

Note 1. Lifting capacity are based on ISO 10567.
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4. *Indicates load limited by hydraulic capacity.

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Lifting capacities will vary with different work tools ground conditions and attachments.
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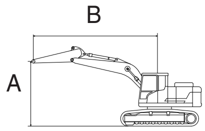
Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	3050	4600	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)		Capacity		Reach
														m (ft)
7.5 m	kg							*5640	*5640			*4010	*4010	6.66
(24.6 ft)	lb							*12430	*12430			*8840	*8840	(21.8)
6.0 m	kg							*5760	*5760	*4710	*4710	*3770	*3770	7.70
(19.7 ft)	lb							*12700	*12700	*10380	*10380	*8310	*8310	(25.3)
4.5 m	kg					*7530	*7530	*6560	*6560	*6130	4780	*3730	*3730	8.34
(14.8 ft)	lb					*16600	*16600	*14460	*14460	*13510	10540	*8220	*8220	(27.4)
3.0 m	kg					*10040	10020	*7740	6490	*6690	4610	*3830	3640	8.67
(9.8 ft)	lb					*22130	22090	*17060	14310	*14750	10160	*8440	8020	(28.5)
1.5 m	kg					*12350	9290	*8940	6140	6790	4430	*4100	3510	8.74
(4.9 ft)	lb					*27230	20480	*19710	13540	14970	9770	*9040	7740	(28.7)
0.0 m	kg			*6350	*6350	*13640	8910	9310	5890	6640	4300	*4570	3580	8.53
(0.0 ft)	lb			*14000	*14000	*30070	19640	20530	12990	14640	9480	*10080	7890	(28.0)
-1.5 m	kg	*7170	*7170	*11190	*11190	*13910	8790	9180	5780	6580	4240	*5400	3860	8.04
(-4.9 ft)	lb	*15810	*15810	*24670	*24670	*30670	19380	20240	12740	14510	9350	*11900	8510	(26.4)
-3.0 m	kg	*12120	*12120	*17600	*17600	*13260	8860	9220	5810			7040	4540	7.21
(-9.8 ft)	lb	*26720	*26720	*38800	*38800	*29230	19530	20330	12810			15520	10010	(23.7)
-4.5 m	kg			*15990	*15990	*11320	9130					*8170	6210	5.88
(-14.8 ft)	lb			*35250	*35250	*24960	20130					*18010	13690	(19.3)

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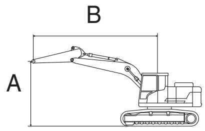
Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	3600	4600	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
9.0 m	kg													*3950	*3950	5.83
(29.5 ft)	lb													*8710	*8710	(19.1)
7.5 m	kg													*3470	*3470	7.32
(24.6 ft)	lb													*7650	*7650	(24.0)
6.0 m	kg									*5150	4860			*3280	*3280	8.27
(19.7 ft)	lb									*11350	10710			*7230	*7230	(27.1)
4.5 m	kg							*5870	*5870	*5580	4740			*3250	*3250	8.87
(14.8 ft)	lb							*12940	*12940	*12300	10450			*7170	*7170	(29.1)
3.0 m	kg					*8940	*8940	*7090	6450	*6210	4540	*4250	3350	*3340	3230	9.19
(9.8 ft)	lb					*19710	*19710	*15630	14220	*13690	10010	*9370	7390	*7360	7120	(30.1)
1.5 m	kg					*11450	9240	*8390	6050	6660	4340	*4880	3260	*3550	3110	9.25
(4.9 ft)	lb					*25240	20370	*18500	13340	14680	9570	*10760	7190	*7830	6860	(30.3)
0.0 m	kg			*7080	*7080	*13120	8720	9110	5750	6470	4160	*4310	3180	*3910	3150	9.05
(0.0 ft)	lb			*15610	*15610	*28920	19220	20080	12680	14260	9170	*9500	7010	*8620	6940	(29.7)
-1.5 m	kg	*6430	*6430	*10500	*10500	*13770	8510	8920	5580	6370	4070			*4550	3370	8.60
(-4.9 ft)	lb	*14180	*14180	*23150	*23150	*30360	18760	19670	12300	14040	8970			*10030	7430	(28.2)
-3.0 m	kg	*10430	*10430	*15470	*15470	*13500	8520	8900	5560	6380	4080			*5720	3870	7.82
(-9.8 ft)	lb	*22990	*22990	*34110	*34110	*29760	18780	19620	12260	14070	8990			*12610	8530	(25.7)
-4.5 m	kg	*15500	*15500	*17510	*17510	*12140	8710	*8850	5700					*7650	5000	6.62
(-14.8 ft)	lb	*34170	*34170	*38600	*38600	*26760	19200	*19510	12570					*16870	11020	(21.7)

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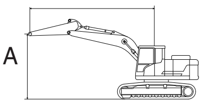
Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5906	2100	6100	600	-	-	-	-	-

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

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)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg lb									*11320 *24960	*11320 *24960	3.57 (11.7)
7.5 m (24.6 ft)	kg lb			*8710 *19200	*8710 *19200					*7630 *16820	*7630 *16820	5.70 (18.7)
6.0 m (19.7 ft)	kg lb			*9100 *20060	*9100 *20060	*7120 *15700	*7120 *15700			*6480 *14290	6130 13510	6.89 (22.6)
4.5 m (14.8 ft)	kg lb			*10840 *23900	*10840 *23900	*7580 *16710	7500 16530	*6040 *13320	5280 11640	*5990 *13210	5150 11350	7.60 (24.9)
3.0 m (9.8 ft)	kg lb					*8480 *18700	7140 15740	*6230 *13730	5150 11350	*5850 *12900	4690 10340	7.97 (26.1)
1.5 m (4.9 ft)	kg lb					*9570 *21100	6840 15080	*6560 *14460	5020 11070	*5970 *13160	4550 10030	8.04 (26.4)
0.0 m (0.0 ft)	kg lb					*9900 *21830	6670 14700	*6830 *15060	4940 10890	*6390 *14090	4690 10340	7.81 (25.6)
-1.5 m (-4.9 ft)	kg lb			*11140 *24560	10100 22270	*8730 *19250	6660 14680			*6370 *14040	5190 11440	7.28 (23.9)

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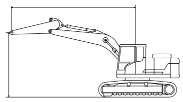
Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5906	2500	6100	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m	kg									*7520	*7520	4.28
(29.5 ft)	lb									*16580	*16580	(14.0)
7.5 m	kg			*8210	*8210	*6850	*6850			*6110	*6110	6.17
(24.6 ft)	lb			*18100	*18100	*15100	*15100			*13470	*13470	(20.2)
6.0 m	kg			*8600	*8600	*6780	*6780			*5630	*5630	7.28
(19.7 ft)	lb			*18960	*18960	*14950	*14950			*12410	*12410	(23.9)
4.5 m	kg			*10090	*10090	*7250	*7250	*5750	5330	*5480	4830	7.95
(14.8 ft)	lb			*22240	*22240	*15980	*15980	*12680	11750	*12080	10650	(26.1)
3.0 m	kg			*13070	10950	*8130	7210	*6010	5180	*5370	4420	8.30
(9.8 ft)	lb			*28810	24140	*17920	15900	*13250	11420	*11840	9740	(27.2)
1.5 m	kg			*13890	10290	*9240	6870	*6380	5020	*5490	4280	8.37
(4.9 ft)	lb			*30620	22690	*20370	15150	*14070	11070	*12100	9440	(27.5)
0.0 m	kg			*13360	10030	*10020	6670	*6700	4910	*5860	4390	8.16
(0.0 ft)	lb			*29450	22110	*22090	14700	*14770	10820	*12920	9680	(26.8)
-1.5 m	kg	*10210	*10210	*11810	10030	*9100	6610	*6640	4920	*6320	4810	7.64
(-4.9 ft)	lb	*22510	*22510	*26040	22110	*20060	14570	*14640	10850	*13930	10600	(25.1)
-3.0 m	kg			*9180	*9180	*6990	6730			*5430	*5430	6.76
(-9.8 ft)	lb			*20240	*20240	*15410	14840			*11970	*11970	(22.2)

Note 1. Lifting capacity are based on ISO 10567.
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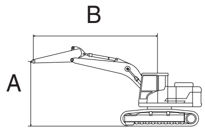
Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5906	3050	6100	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			*6440	*6440							*4710	*4710	5.21
(29.5 ft)	lb			*14200	*14200							*10380	*10380	(17.1)
7.5 m	kg					*6190	*6190					*4000	*4000	6.84
(24.6 ft)	lb					*13650	*13650					*8820	*8820	(22.4)
6.0 m	kg			*6880	*6880	*6340	*6340	*5290	*5290			*3720	*3720	7.85
(19.7 ft)	lb			*15170	*15170	*13980	*13980	*11660	*11660			*8200	*8200	(25.8)
4.5 m	kg	*12620	*12620	*9150	*9150	*6790	*6790	*5400	5380			*3650	*3650	8.48
(14.8 ft)	lb	*27820	*27820	*20170	*20170	*14970	*14970	*11900	11860			*8050	*8050	(27.8)
3.0 m	kg			*11860	11190	*7620	7280	*5700	5200			*3710	*3710	8.81
(9.8 ft)	lb			*26150	24670	*16800	16050	*12570	11460			*8180	*8180	(28.9)
1.5 m	kg			*13630	10410	*8720	6900	*6090	5000			*3920	3890	8.87
(4.9 ft)	lb			*30050	22950	*19220	15210	*13430	11020			*8640	8580	(29.1)
0.0 m	kg			*13620	10010	*9800	6640	*6470	4860			*4310	3970	8.67
(0.0 ft)	lb			*30030	22070	*21610	14640	*14260	10710			*9500	8750	(28.5)
-1.5 m	kg	*10150	*10150	*12500	9910	*9440	6530	*6710	4810			*4990	4290	8.19
(-4.9 ft)	lb	*22380	*22380	*27560	21850	*20810	14400	*14790	10600			*11000	9460	(26.9)
-3.0 m	kg			*10300	10010	*7860	6580					*5430	5010	7.38
(-9.8 ft)	lb			*22710	22070	*17330	14510					*11970	11050	(24.2)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	2100	6100	600	-	-	-	-	-

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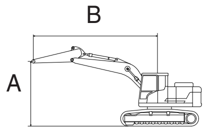

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg									*7280	*7280	5.50
(24.6 ft)	lb									*16050	*16050	(18.1)
6.0 m	kg			*7430	*7430	*7000	*7000			*7110	5930	6.74
(19.7 ft)	lb			*16380	*16380	*15430	*15430			*15670	13070	(22.1)
4.5 m	kg			*9220	*9220	*7630	6980			*7160	4950	7.47
(14.8 ft)	lb			*20330	*20330	*16820	15390			*15790	10910	(24.5)
3.0 m	kg					*8680	6660	*7450	4820	7180	4490	7.85
(9.8 ft)	lb					*19140	14680	*16420	10630	15830	9900	(25.8)
1.5 m	kg					*9680	6380	7570	4700	6980	4340	7.93
(4.9 ft)	lb					*21340	14070	16690	10360	15390	9570	(26.0)
0.0 m	kg			*14080	9260	*10260	6210	7490	4620	7200	4460	7.72
(0.0 ft)	lb			*31040	20410	*22620	13690	16510	10190	15870	9830	(25.3)
-1.5 m	kg			*13700	9280	*10220	6190			7990	4910	7.18
(-4.9 ft)	lb			*30200	20460	*22530	13650			17610	10820	(23.6)
-3.0 m	kg	*16760	*16760	*12390	9450	*9090	6330			*8530	6040	6.24
(-9.8 ft)	lb	*36950	*36950	*27320	20830	*20040	13960			*18810	13320	(20.5)

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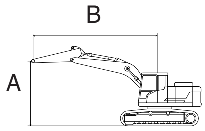
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	2500	6100	600	-	-	-	-	-

· : 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									*6100	*6100	5.96
(24.6 ft)	lb									*13450	*13450	(19.5)
6.0 m	kg					*6480	*6480			*5660	5500	7.11
(19.7 ft)	lb					*14290	*14290			*12480	12130	(23.3)
4.5 m	kg			*8510	*8510	*7190	7050	*6690	4980	*5580	4650	7.81
(14.8 ft)	lb			*18760	*18760	*15850	15540	*14750	10980	*12300	10250	(25.6)
3.0 m	kg			*11010	10130	*8300	6710	*7140	4840	*5730	4240	8.17
(9.8 ft)	lb			*24270	22330	*18300	14790	*15740	10670	*12630	9350	(26.8)
1.5 m	kg			*13080	9520	*9400	6410	7580	4700	*6130	4100	8.25
(4.9 ft)	lb			*28840	20990	*20720	14130	16710	10360	*13510	9040	(27.1)
0.0 m	kg			*13970	9260	*10120	6210	7460	4590	6760	4180	8.04
(0.0 ft)	lb			*30800	20410	*22310	13690	16450	10120	14900	9220	(26.4)
-1.5 m	kg	*11300	*11300	*13880	9220	*10260	6140	7460	4580	7420	4560	7.53
(-4.9 ft)	lb	*24910	*24910	*30600	20330	*22620	13540	16450	10100	16360	10050	(24.7)
-3.0 m	kg	*17940	*17940	*12860	9350	*9540	6230			*8300	5470	6.64
(-9.8 ft)	lb	*39550	*39550	*28350	20610	*21030	13730			*18300	12060	(21.8)
-4.5 m	kg	*14190	*14190	*10200	9690					*8510	7970	5.17
(-14.8 ft)	lb	*31280	*31280	*22490	21360					*18760	17570	(17.0)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	3050	6100	600	-	-	-	-	-

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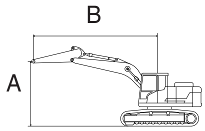

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg							*5640	*5640			*4020	*4020	6.62
(24.6 ft)	lb							*12430	*12430			*8860	*8860	(21.7)
6.0 m	kg							*5740	*5740	*4610	*4610	*3770	*3770	7.68
(19.7 ft)	lb							*12650	*12650	*10160	*10160	*8310	*8310	(25.2)
4.5 m	kg					*7450	*7450	*6520	*6520	*6110	5010	*3720	*3720	8.33
(14.8 ft)	lb					*16420	*16420	*14370	*14370	*13470	11050	*8200	*8200	(27.3)
3.0 m	kg					*9950	*9950	*7690	6760	*6670	4850	*3820	*3820	8.67
(9.8 ft)	lb					*21940	*21940	*16950	14900	*14700	10690	*8420	*8420	(28.4)
1.5 m	kg					*12280	9610	*8900	6420	*7300	4670	*4080	3720	8.74
(4.9 ft)	lb					*27070	21190	*19620	14150	*16090	10300	*8990	8200	(28.7)
0.0 m	kg			*6220	*6220	*13600	9220	*9800	6170	7410	4530	*4550	3780	8.54
(0.0 ft)	lb			*13710	*13710	*29980	20330	*21610	13600	16340	9990	*10030	8330	(28.0)
-1.5 m	kg	*7030	*7030	*11040	*11040	*13900	9110	*10170	6060	7340	4470	*5370	4070	8.06
(-4.9 ft)	lb	*15500	*15500	*24340	*24340	*30640	20080	*22420	13360	16180	9850	*11840	8970	(26.5)
-3.0 m	kg	*11970	*11970	*17380	*17380	*13280	9170	*9830	6080			*6990	4750	7.24
(-9.8 ft)	lb	*26390	*26390	*38320	*38320	*29280	20220	*21670	13400			*15410	10470	(23.8)
-4.5 m	kg			*16090	*16090	*11390	9420					*8150	6410	5.93
(-14.8 ft)	lb			*35470	*35470	*25110	20770					*17970	14130	(19.5)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	3600	6100	600	-	-	-	-	-

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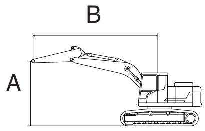

Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
9.0 m	kg													*3970	*3970	5.78
(29.5 ft)	lb													*8750	*8750	(19.0)
7.5 m	kg													*3480	*3480	7.28
(24.6 ft)	lb													*7670	*7670	(23.9)
6.0 m	kg									*5120	*5120			*3290	*3290	8.25
(19.7 ft)	lb									*11290	*11290			*7250	*7250	(27.1)
4.5 m	kg							*5840	*5840	*5570	5060			*3250	*3250	8.86
(14.8 ft)	lb							*12870	*12870	*12280	11160			*7170	*7170	(29.1)
3.0 m	kg					*8860	*8860	*7060	6840	*6190	4870	*4220	3630	*3330	*3330	9.18
(9.8 ft)	lb					*19530	*19530	*15560	15080	*13650	10740	*9300	8000	*7340	*7340	(30.1)
1.5 m	kg					*11390	9740	*8360	6450	*6910	4670	*4880	3530	*3540	3380	9.25
(4.9 ft)	lb					*25110	21470	*18430	14220	*15230	10300	*10760	7780	*7800	7450	(30.3)
0.0 m	kg			*7000	*7000	*13090	9220	*9420	6150	7380	4500	*4350	3460	*3900	3420	9.06
(0.0 ft)	lb			*15430	*15430	*28860	20330	*20770	13560	16270	9920	*9590	7630	*8600	7540	(29.7)
-1.5 m	kg	*6330	*6330	*10390	*10390	*13760	9010	*10000	5990	7270	4400			*4520	3650	8.61
(-4.9 ft)	lb	*13960	*13960	*22910	*22910	*30340	19860	*22050	13210	16030	9700			*9960	8050	(28.3)
-3.0 m	kg	*10310	*10310	*15300	*15300	*13520	9010	*9950	5960	7280	4410			*5670	4160	7.85
(-9.8 ft)	lb	*22730	*22730	*33730	*33730	*29810	19860	*21940	13140	16050	9720			*12500	9170	(25.8)
-4.5 m	kg	*15330	*15330	*17610	*17610	*12190	9190	*8910	6100					*7630	5320	6.66
(-14.8 ft)	lb	*33800	*33800	*38820	*38820	*26870	20260	*19640	13450					*16820	11730	(21.9)

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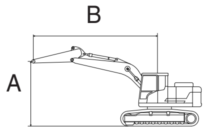
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5906	2100	6100	600	-	-	-	-	-



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Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m	kg									*11550	*11550	3.48
(29.5 ft)	lb									*25460	*25460	(11.4)
7.5 m	kg			*8710	*8710					*7680	*7680	5.66
(24.6 ft)	lb			*19200	*19200					*16930	*16930	(18.6)
6.0 m	kg			*9080	*9080	*7110	*7110			*6500	5680	6.87
(19.7 ft)	lb			*20020	*20020	*15670	*15670			*14330	12520	(22.5)
4.5 m	kg			*10770	10640	*7560	6890	*6040	4850	*6000	4750	7.59
(14.8 ft)	lb			*23740	23460	*16670	15190	*13320	10690	*13230	10470	(24.9)
3.0 m	kg					*8450	6550	*6230	4730	*5850	4310	7.96
(9.8 ft)	lb					*18630	14440	*13730	10430	*12900	9500	(26.1)
1.5 m	kg					*9540	6240	*6550	4600	*5970	4170	8.04
(4.9 ft)	lb					*21030	13760	*14440	10140	*13160	9190	(26.4)
0.0 m	kg					*9920	6080	*6830	4520	*6380	4280	7.83
(0.0 ft)	lb					*21870	13400	*15060	9960	*14070	9440	(25.7)
-1.5 m	kg			*11200	9120	*8770	6070			*6390	4730	7.30
(-4.9 ft)	lb			*24690	20110	*19330	13380			*14090	10430	(23.9)
-3.0 m	kg					*6170	*6170					
(-9.8 ft)	lb					*13600	*13600					

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5906	2500	6100	600	-	-	-	-	-

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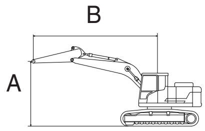

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m	kg									*7590	*7590	4.21
(29.5 ft)	lb									*16730	*16730	(13.8)
7.5 m	kg			*8210	*8210	*6870	*6870			*6130	*6130	6.13
(24.6 ft)	lb			*18100	*18100	*15150	*15150			*13510	*13510	(20.1)
6.0 m	kg			*8580	*8580	*6770	*6770			*5640	5250	7.25
(19.7 ft)	lb			*18920	*18920	*14930	*14930			*12430	11570	(23.8)
4.5 m	kg			*10030	*10030	*7230	6980	*5740	4910	*5480	4450	7.94
(14.8 ft)	lb			*22110	*22110	*15940	15390	*12650	10820	*12080	9810	(26.0)
3.0 m	kg			*13030	9970	*8100	6610	*6000	4760	*5370	4060	8.30
(9.8 ft)	lb			*28730	21980	*17860	14570	*13230	10490	*11840	8950	(27.2)
1.5 m	kg			*13890	9320	*9210	6280	*6370	4600	*5480	3920	8.37
(4.9 ft)	lb			*30620	20550	*20300	13850	*14040	10140	*12080	8640	(27.5)
0.0 m	kg			*13390	9060	*10030	6070	*6700	4490	*5840	4010	8.17
(0.0 ft)	lb			*29520	19970	*22110	13380	*14770	9900	*12870	8840	(26.8)
-1.5 m	kg	*9980	*9980	*11870	9050	*9140	6020	*6690	4490	*6330	4380	7.66
(-4.9 ft)	lb	*22000	*22000	*26170	19950	*20150	13270	*14750	9900	*13960	9660	(25.1)
-3.0 m	kg			*9270	9210	*7080	6120			*5470	5240	6.79
(-9.8 ft)	lb			*20440	20300	*15610	13490			*12060	11550	(22.3)

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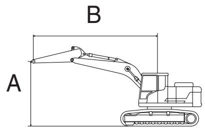
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited by hydraulic capacity.

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult your HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.
Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A NL	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5906	3050	6100	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
		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)
9.0 m	kg			*6390	*6390							*4740	*4740	5.15
(29.5 ft)	lb			*14090	*14090							*10450	*10450	(16.9)
7.5 m	kg					*6150	*6150					*4010	*4010	6.80
(24.6 ft)	lb					*13560	*13560					*8840	*8840	(22.3)
6.0 m	kg			*6850	*6850	*6330	*6330	*5240	5050			*3730	*3730	7.83
(19.7 ft)	lb			*15100	*15100	*13960	*13960	*11550	11130			*8220	*8220	(25.7)
4.5 m	kg	*11820	*11820	*9100	*9100	*6770	*6770	*5400	4950			*3650	*3650	8.47
(14.8 ft)	lb	*26060	*26060	*20060	*20060	*14930	*14930	*11900	10910			*8050	*8050	(27.8)
3.0 m	kg			*11750	10200	*7590	6680	*5690	4770			*3710	3680	8.81
(9.8 ft)	lb			*25900	22490	*16730	14730	*12540	10520			*8180	8110	(28.9)
1.5 m	kg			*13610	9430	*8690	6300	*6080	4580			*3910	3560	8.87
(4.9 ft)	lb			*30000	20790	*19160	13890	*13400	10100			*8620	7850	(29.1)
0.0 m	kg			*13640	9040	*9770	6040	*6470	4440			*4290	3620	8.68
(0.0 ft)	lb			*30070	19930	*21540	13320	*14260	9790			*9460	7980	(28.5)
-1.5 m	kg	*10000	*10000	*12540	8930	*9470	5940	*6710	4390			*4970	3900	8.21
(-4.9 ft)	lb	*22050	*22050	*27650	19690	*20880	13100	*14790	9680			*10960	8600	(26.9)
-3.0 m	kg			*10380	9030	*7920	5980					*5460	4550	7.41
(-9.8 ft)	lb			*22880	19910	*17460	13180					*12040	10030	(24.3)

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Lifting capacities will vary with different work tools ground conditions and attachments.
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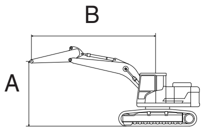
Failure to comply to the rated load can cause possible personal injury or property damage.
Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	2100	4600	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									*7190	*7190	5.91
(24.6 ft)	lb									*15850	*15850	(19.4)
6.0 m	kg			*7800	*7800	*7100	*7100			*7110	6640	6.98
(19.7 ft)	lb			*17200	*17200	*15650	*15650			*15670	14640	(22.9)
4.5 m	kg			*9880	*9880	*7900	*7900	*7200	5840	*7200	5700	7.61
(14.8 ft)	lb			*21780	*21780	*17420	*17420	*15870	12870	*15870	12570	(25.0)
3.0 m	kg					*8980	7900	*7580	5710	*7400	5280	7.90
(9.8 ft)	lb					*19800	17420	*16710	12590	*16310	11640	(25.9)
1.5 m	kg					*9890	7630	*8000	5590	7580	5200	7.90
(4.9 ft)	lb					*21800	16820	*17640	12320	16710	11460	(25.9)
0.0 m	kg			*14060	11430	*10320	7500	8120	5540	7970	5440	7.60
(0.0 ft)	lb			*31000	25200	*22750	16530	17900	12210	17570	11990	(24.9)
-1.5 m	kg	*13230	*13230	*13460	11500	*10060	7510			*8330	6160	6.97
(-4.9 ft)	lb	*29170	*29170	*29670	25350	*22180	16560			*18360	13580	(22.9)
-3.0 m	kg	*15910	*15910	*11770	11730					*8570	7940	5.89
(-9.8 ft)	lb	*35080	*35080	*25950	25860					*18890	17500	(19.3)

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4. *Indicates load limited by hydraulic capacity.

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Lifting capacities will vary with different work tools ground conditions and attachments.
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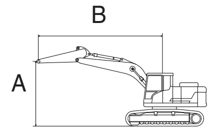
Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	2500	4600	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					*6460	*6460			*5930	*5930	6.33
(24.6 ft)	lb					*14240	*14240			*13070	*13070	(20.8)
6.0 m	kg					*6610	*6610			*5610	*5610	7.34
(19.7 ft)	lb					*14570	*14570			*12370	*12370	(24.1)
4.5 m	kg			*9150	*9150	*7470	*7470	*6790	5880	*5600	5360	7.94
(14.8 ft)	lb			*20170	*20170	*16470	*16470	*14970	12960	*12350	11820	(26.0)
3.0 m	kg			*11670	*11670	*8620	7950	*7290	5730	*5820	4990	8.22
(9.8 ft)	lb			*25730	*25730	*19000	17530	*16070	12630	*12830	11000	(27.0)
1.5 m	kg			*13440	11610	*9640	7650	*7800	5590	*6300	4900	8.22
(4.9 ft)	lb			*29630	25600	*21250	16870	*17200	12320	*13890	10800	(27.0)
0.0 m	kg			*14030	11410	*10220	7480	8080	5500	*7160	5100	7.93
(0.0 ft)	lb			*30930	25150	*22530	16490	17810	12130	*15790	11240	(26.0)
-1.5 m	kg	*13520	*13520	*13700	11420	*10170	7460			*8010	5690	7.33
(-4.9 ft)	lb	*29810	*29810	*30200	25180	*22420	16450			*17660	12540	(24.0)
-3.0 m	kg	*17170	*17170	*12370	11610	*9070	7600			*8390	7110	6.31
(-9.8 ft)	lb	*37850	*37850	*27270	25600	*20000	16760			*18500	15670	(20.7)

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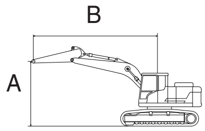
Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	3050	4600	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B) 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)		At max. reach Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m (ft)
9.0 m	kg											*4450	*4450	5.47
(29.5 ft)	lb											*9810	*9810	(18.0)
7.5 m	kg							*5580	*5580			*3920	*3920	6.96
(24.6 ft)	lb							*12300	*12300			*8640	*8640	(22.8)
6.0 m	kg							*5910	*5910	*5370	*5370	*3740	*3740	7.89
(19.7 ft)	lb							*13030	*13030	*11840	*11840	*8250	*8250	(25.9)
4.5 m	kg			*11340	*11340	*8090	*8090	*6830	*6830	*6250	5920	*3740	*3740	8.45
(14.8 ft)	lb			*25000	*25000	*17840	*17840	*15060	*15060	*13780	13050	*8250	*8250	(27.7)
3.0 m	kg					*10660	*10660	*8050	8010	*6850	5740	*3880	*3880	8.71
(9.8 ft)	lb					*23500	*23500	*17750	17660	*15100	12650	*8550	*8550	(28.6)
1.5 m	kg					*12770	11690	*9200	7670	*7470	5560	*4190	*4190	8.71
(4.9 ft)	lb					*28150	25770	*20280	16910	*16470	12260	*9240	*9240	(28.6)
0.0 m	kg			*7440	*7440	*13790	11370	*9970	7440	*7910	5440	*4730	4620	8.44
(0.0 ft)	lb			*16400	*16400	*30400	25070	*21980	16400	*17440	11990	*10430	10190	(27.7)
-1.5 m	kg	*8340	*8340	*12560	*12560	*13840	11300	*10180	7360	*7920	5410	*5700	5070	7.88
(-4.9 ft)	lb	*18390	*18390	*27690	*27690	*30510	24910	*22440	16230	*17460	11930	*12570	11180	(25.8)
-3.0 m	kg	*13470	*13470	*18550	*18550	*12940	11420	*9570	7430			*7730	6100	6.94
(-9.8 ft)	lb	*29700	*29700	*40900	*40900	*28530	25180	*21100	16380			*17040	13450	(22.8)
-4.5 m	kg			*14840	*14840	*10490	*10490					*8240	*8240	5.45
(-14.8 ft)	lb			*32720	*32720	*23130	*23130					*18170	*18170	(17.9)

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4. *Indicates load limited by hydraulic capacity.

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Lifting capacities will vary with different work tools ground conditions and attachments.
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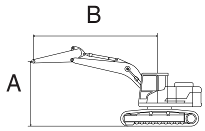
Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX260A HW	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5850	3600	4600	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
																m (ft)
9.0 m	kg							*4470	*4470					*3790	*3790	6.26
(29.5 ft)	lb							*9850	*9850					*8360	*8360	(20.5)
7.5 m	kg									*3730	*3730			*3410	*3410	7.59
(24.6 ft)	lb									*8220	*8220			*7520	*7520	(24.9)
6.0 m	kg							*5190	*5190	*5280	*5280			*3260	*3260	8.45
(19.7 ft)	lb							*11440	*11440	*11640	*11640			*7190	*7190	(27.7)
4.5 m	kg							*6140	*6140	*5720	*5720			*3260	*3260	8.97
(14.8 ft)	lb							*13540	*13540	*12610	*12610			*7190	*7190	(29.4)
3.0 m	kg					*9590	*9590	*7420	*7420	*6390	5750	*4480	4320	*3380	*3380	9.22
(9.8 ft)	lb					*21140	*21140	*16360	*16360	*14090	12680	*9880	9520	*7450	*7450	(30.3)
1.5 m	kg					*11960	11780	*8680	7680	*7090	5540	*4900	4220	*3620	*3620	9.22
(4.9 ft)	lb					*26370	25970	*19140	16930	*15630	12210	*10800	9300	*7980	*7980	(30.3)
0.0 m	kg			*7780	*7780	*13360	11330	*9630	7400	*7650	5390			*4040	*4040	8.97
(0.0 ft)	lb			*17150	*17150	*29450	24980	*21230	16310	*16870	11880			*8910	*8910	(29.4)
-1.5 m	kg	*7360	*7360	*11550	*11550	*13780	11170	*10060	7270	*7880	5310			*4770	4530	8.44
(-4.9 ft)	lb	*16230	*16230	*25460	*25460	*30380	24630	*22180	16030	*17370	11710			*10520	9990	(27.7)
-3.0 m	kg	*11530	*11530	*17020	*17020	*13290	11230	*9800	7280	*7090	5370			*6160	5300	7.58
(-9.8 ft)	lb	*25420	*25420	*37520	*37520	*29300	24760	*21610	16050	*15630	11840			*13580	11680	(24.9)
-4.5 m	kg			*16600	*16600	*11550	11480	*8270	7500					*7760	7110	6.24
(-14.8 ft)	lb			*36600	*36600	*25460	25310	*18230	16530					*17110	15670	(20.5)

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6. BUCKET SELECTION GUIDE

1) HX260A L, 4600 KG COUNTERWEIGHT

General bucket

Heavy duty
(without side cutter)

Heavy duty
(with side cutter)

Rock heavy duty

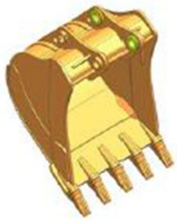
Type	Capacity		Width	Weight	Tooth	MONO				2-PIECE		
						Recommendation						
	SAE Heaped	CECE heaped				5.85 m (19' 2") Boom				5.90 m (19' 5") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.1 m (6' 11') Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm	3.60 m (11' 10") Arm	2.1 m (6' 11") Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm
General bucket	1.08 (1.41)	0.95 (1.24)	1170 (46.1")	1020 (2250)	5	●	●	●	◐	●	●	●
	1.27 (1.66)	1.11 (1.45)	1325 (52.2")	1100 (2430)	5	●	●	◐	■	●	◐	■
	1.50 (1.96)	1.30 (1.70)	1515 (59.6")	1180 (2600)	5	◐	◐	■	▲	◐	■	▲
Heavy duty	1.27 (1.66)	1.11 (1.45)	1380 (54.3")	1290 (2840)	5	●	◐	◐	■	●	◐	■
	1.46 (1.91)	1.28 (1.67)	1535 (60.4")	1380 (3040)	6	◐	■	■	▲	◐	■	▲
Rock heavy duty	1.16 (1.52)	1.00 (1.31)	1285 (50.6")	1380 (3040)	5	●	●	◐	X	●	◐	■

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

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

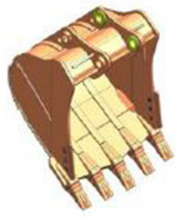
2) HX260A L, 5100 KG COUNTERWEIGHT

General bucket



Heavy duty
(without side cutter)

Heavy duty
(with side cutter)



Rock heavy duty

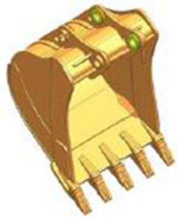
Type	Capacity		Width	Weight	Tooth	MONO				2-PIECE		
						Recommendation						
	SAE Heaped	CECE heaped				5.85 m (19' 2") Boom				5.90 m (19' 5") Boom		
	m³ (yd³)	m³ (yd³)	mm (in)	kg (lb)	EA	2.1 m (6' 11') Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm	3.60 m (11' 10") Arm	2.1 m (6' 11") Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm
General bucket	1.08 (1.41)	0.95 (1.24)	1170 (46.1")	1020 (2250)	5	●	●	●	●	●	●	●
	1.27 (1.66)	1.11 (1.45)	1325 (52.2")	1100 (2430)	5	●	●	◐	■	●	●	◐
	1.50 (1.96)	1.30 (1.70)	1515 (59.6")	1180 (2600)	5	◐	◐	■	▲	◐	◐	■
Heavy duty	1.27 (1.66)	1.11 (1.45)	1380 (54.3")	1290 (2840)	5	●	●	◐	■	●	◐	◐
	1.46 (1.91)	1.28 (1.67)	1535 (60.4")	1380 (3040)	6	◐	◐	■	▲	◐	■	■
Rock heavy duty	1.16 (1.52)	1.00 (1.31)	1285 (50.6")	1380 (3040)	5	●	●	◐	X	●	●	◐

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

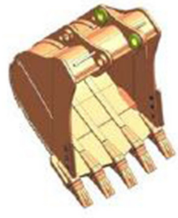
※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for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

3) HX260A L, 6100 KG COUNTERWEIGHT


General bucket


Heavy duty (without side cutter)


Heavy duty (with side cutter)


Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO				2-PIECE		
						Recommendation						
	SAE Heaped	CECE heaped				5.85 m (19' 2") Boom				5.90 m (19' 5") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.1 m (6' 11') Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm	3.60 m (11' 10") Arm	2.1 m (6' 11") Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm
General bucket	1.08 (1.41)	0.95 (1.24)	1170 (46.1")	1020 (2250)	5	●	●	●	●	●	●	●
	1.27 (1.66)	1.11 (1.45)	1325 (52.2")	1100 (2430)	5	●	●	●	◐	●	●	●
	1.50 (1.96)	1.30 (1.70)	1515 (59.6")	1180 (2600)	5	●	●	◐	■	●	◐	◐
Heavy duty	1.27 (1.66)	1.11 (1.45)	1380 (54.3")	1290 (2840)	5	●	●	●	◐	●	●	●
	1.46 (1.91)	1.28 (1.67)	1535 (60.4")	1380 (3040)	6	●	●	◐	■	●	◐	◐
Rock heavy duty	1.16 (1.52)	1.00 (1.31)	1285 (50.6")	1380 (3040)	5	●	●	●	X	●	●	●

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

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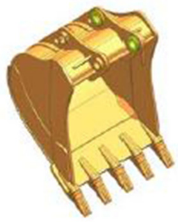
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom－arm－bucket combination.

4) HX260A NL, 6100 KG COUNTERWEIGHT

General bucket



Heavy duty
(without side cutter)

Heavy duty
(with side cutter)

Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO				2-PIECE		
						Recommendation						
	SAE Heaped	CECE heaped				5.85 m (19' 2") Boom				5.90 m (19' 5") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.1 m (6' 11') Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm	3.60 m (11' 10") Arm	2.1 m (6' 11") Arm	2.5 m (8' 2") Arm	3.05 m (10' 0") Arm
General bucket	1.08 (1.41)	0.95 (1.24)	1170 (46.1")	1020 (2250)	5	●	●	●	●	●	●	●
	1.27 (1.66)	1.11 (1.45)	1325 (52.2")	1100 (2430)	5	●	●	◐	◐	●	●	◐
	1.50 (1.96)	1.30 (1.70)	1515 (59.6")	1180 (2600)	5	●	◐	■	■	◐	◐	■
Heavy duty	1.27 (1.66)	1.11 (1.45)	1380 (54.3")	1290 (2840)	5	●	●	◐	■	●	●	◐
	1.46 (1.91)	1.28 (1.67)	1535 (60.4")	1380 (3040)	6	●	◐	■	▲	◐	◐	■
Rock heavy duty	1.16 (1.52)	1.00 (1.31)	1285 (50.6")	1380 (3040)	5	●	●	●	X	●	●	◐

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

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

7. UNDERCARRIAGE

1) TYPES OF SHOES

Model	Description	Unit		Triple grouser								Double grouser	
	width	mm	(in)	600	(24)	700	(28)	800	(32)	900	(36)	700	(28)
HX260A L	Operating weight	kg	(lb)	27000	59520	27310	60210	27600	60850	27910	61530	-	-
	Ground pressure	kgf/cm²	(psi)	0.55	7.81	0.48	6.77	0.42	5.99	0.38	5.39	-	-
	Link quantity	EA		51		51		51		51		-	
HX260A L 2-piece	Operating weight	kg	(lb)	29240	64460	29550	65150	29840	65790	30150	66470	-	-
	Ground pressure	kgf/cm²	(psi)	0.60	8.46	0.52	7.33	0.46	6.47	0.41	5.82	-	-
	Link quantity	EA		51		51		51		51		-	
HX260A NL	Operating weight	kg	(lb)	26900	59300	27210	59990	-	-	-	-	-	-
	Ground pressure	kgf/cm²	(psi)	0.55	7.78	0.48	6.76	-	-	-	-	-	-
	Link quantity	EA		51		51		-		-		-	
HX260A NL 2-piece	Operating weight	kg	(lb)	29150	64260	29460	64950	-	-	-	-	-	-
	Ground pressure	kgf/cm²	(psi)	0.59	8.40	0.51	7.28	-	-	-	-	-	-
	Link quantity	EA		51		51		-		-		-	
HX260A HW	Operating weight	kg	(lb)	31210	68810	-	-	-	-	-	-	33420	73680
	Ground pressure	kgf/cm²	(psi)	0.60	8.55	-	-	-	-	-	-	0.55	7.84
	Link quantity	EA		48		-		-		-		48	

2) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

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

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

Table 1

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

Table 2

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

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Maker / Model	Cummins / B6.7
Type	4-cycle turbocharged charge air cooled electronic controlled diesel engine
Cooling method	Water cooled
Number of cylinders and arrangement	6 cylinders in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	107 × 124 mm (4.21" × 4.88")
Displacement	6.7 ℓ (408 cu in)
Compression ratio	17.3 : 1
Gross power	232 Hp (173 kW) at 2000 rpm
Net power	227 Hp (169 kW) at 2000 rpm
Max. power	232 Hp (173 kW) at 2000 rpm
Peak Torque	949 N·m (700 lbf·ft) at 1500 rpm
Engine oil quantity	23.1 ℓ (6.1 U.S. gal)
Wet weight	583 kg (1285 lb)
Starter motor	24 V-4.8 kW
Alternator	24 V-95 A

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 130 cc/rev
Maximum pressure	350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]
Rated oil flow	2 × 221 ℓ/min (58.4 U.S. gpm / 48.6 U.K. gpm)
Rated speed	1700 rpm

[ ] : Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	10 cc/rev
Maximum pressure	44 kgf/cm^2 (626 psi)
Rated oil flow	17 ℓ/min (4.5 U.S. gpm/3.7 U.K. gpm)

4) MAIN CONTROL VALVE

Item		Specification
Type		9 spools, two block
Operating method		Hydraulic pilot system
Main relief valve pressure		350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]
Port relief valve pressure	Boom	400 kgf/cm^2 (5690 psi)
	Arm	400 kgf/cm^2 (5690 psi)
	Bucket	400 kgf/cm^2 (5690 psi)

[ ] : Power boost

5) SWING MOTOR

Item	Specification
Type	Axial piston motor
Capacity	142.8 cc/rev
Relief pressure	300 kgf/cm^2 (4267 psi)
Braking system	Automatic spring applied hydraulic released
Braking torque	63 kgf · m (456 lbf · ft) over
Brake release pressure	20.9~35.5 kgf/cm^2 (297~505 psi) below
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Capacity	182/105 cc/rev
Relief pressure	350 kgf/cm^2 (4980 psi)
Braking system	Automatic spring applied hydraulic released
Braking torque	73 kgf · m (528 lbf · ft)
Brake release pressure	14.2~16.8 kgf/cm^2 (202~239 psi)
Reduction gear type	2-stage planetary

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Stroke	Ø135 × 1395 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Stroke	Ø145 × 1620 mm
	Cushion	Extend and retract
Arm cylinder (2-piece boom)	Bore dia × Stroke	Ø145×1620 mm
	Cushion	Extend and retract
Adjust cylinder (2-piece boom)	Bore dia × Stroke	Ø160×1230 mm
	Cushion	X
Bucket cylinder	Bore dia × Stroke	Ø130 × 1185 mm
	Cushion	Extend only

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

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

9. RECOMMENDED OILS

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

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

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature °C(°F): -50 (-58), -30 (-22), -20 (-4), -10 (14), 0 (32), 10 (50), 20 (68), 30 (86), 40 (104)
Engine oil pan	Engine oil	23.1 (6.1)	★SAE 0W-40 SAE 5W-40 SAE 15W-40
DEF/ AdBlue® tank	Mixture of urea and deionized water	47.5 (12.5)	ISO 22241 High-purity urea + deionized water (32.5:67.5)
Swing drive	Gear oil	6.2 (1.2)	★SAE 75W-90
Final drive	Gear oil	4.5×2 (1.2×2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank 160 (42.3) System 275 (72.6)	★ISO VG 15 ISO VG 32 ISO VG 46 HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	450 (119)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (reservoir tank)	Mixture of antifreeze and soft water★2	40 (10.6)	Ethylene glycol base permanent type (50 : 50) ★Ethylene glycol base permanent type (60 : 40)

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

★ : Cold region (Russia CIS Mongolia)
★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm

★2 : Soft water
City water or distilled water

★3 : HD Hyundai Construction Equipment Bio Hydraulic Oil

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

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

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

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

SECTION 2 STRUCTURE AND FUNCTION

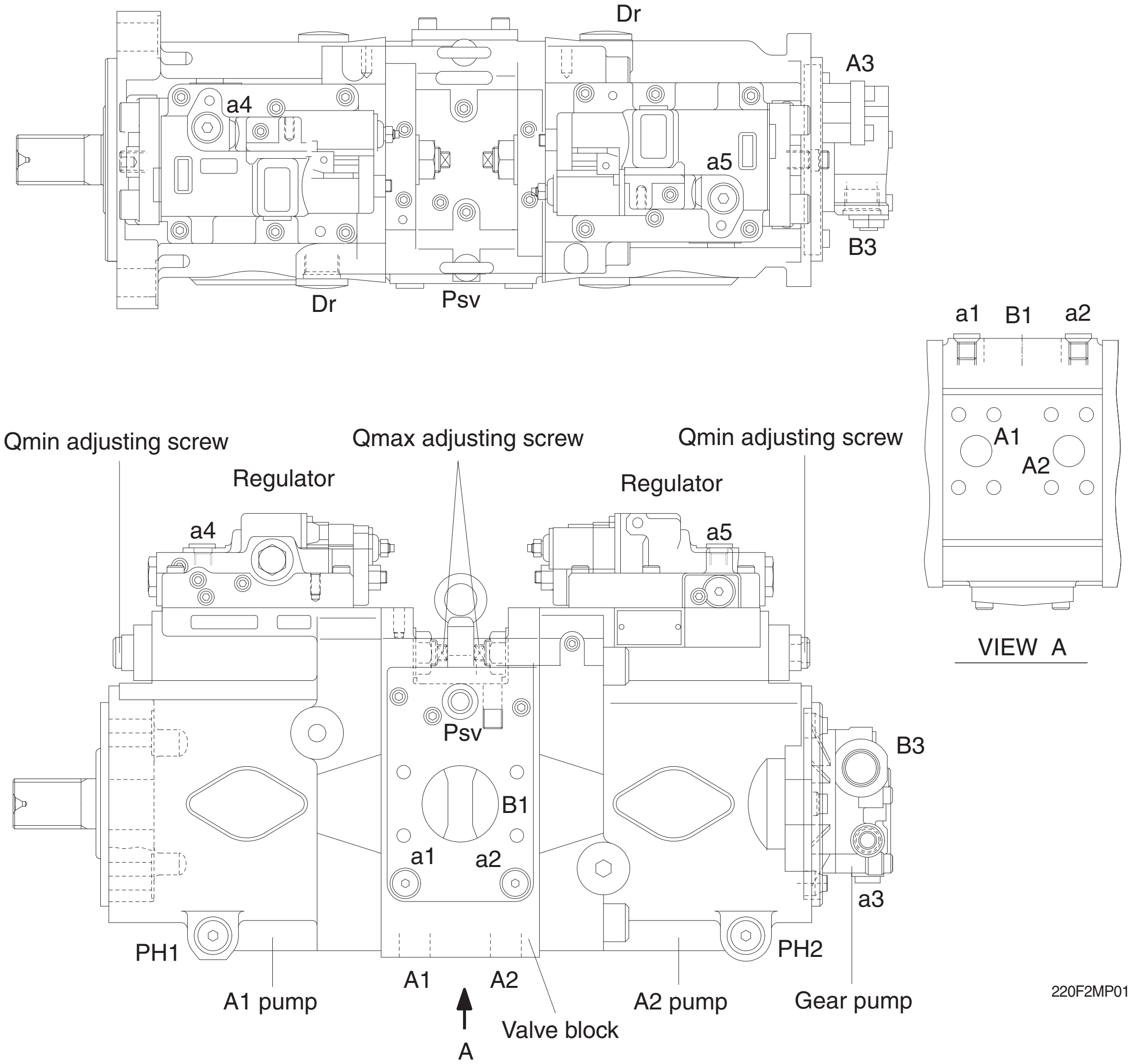
Group 1 Pump Device 2-1
Group 2 Main Control Valve 2-15
Group 3 Swing Device 2-49
Group 4 Travel Device 2-60
Group 5 RCV Lever 2-74
Group 6 RCV Pedal 2-81

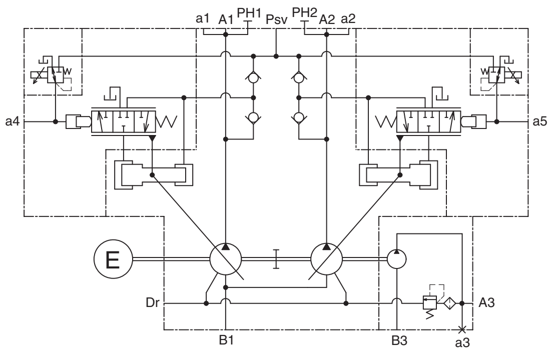
GROUP 1 PUMP DEVICE

1. STRUCTURE

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

· WITHOUT PTO TYPE

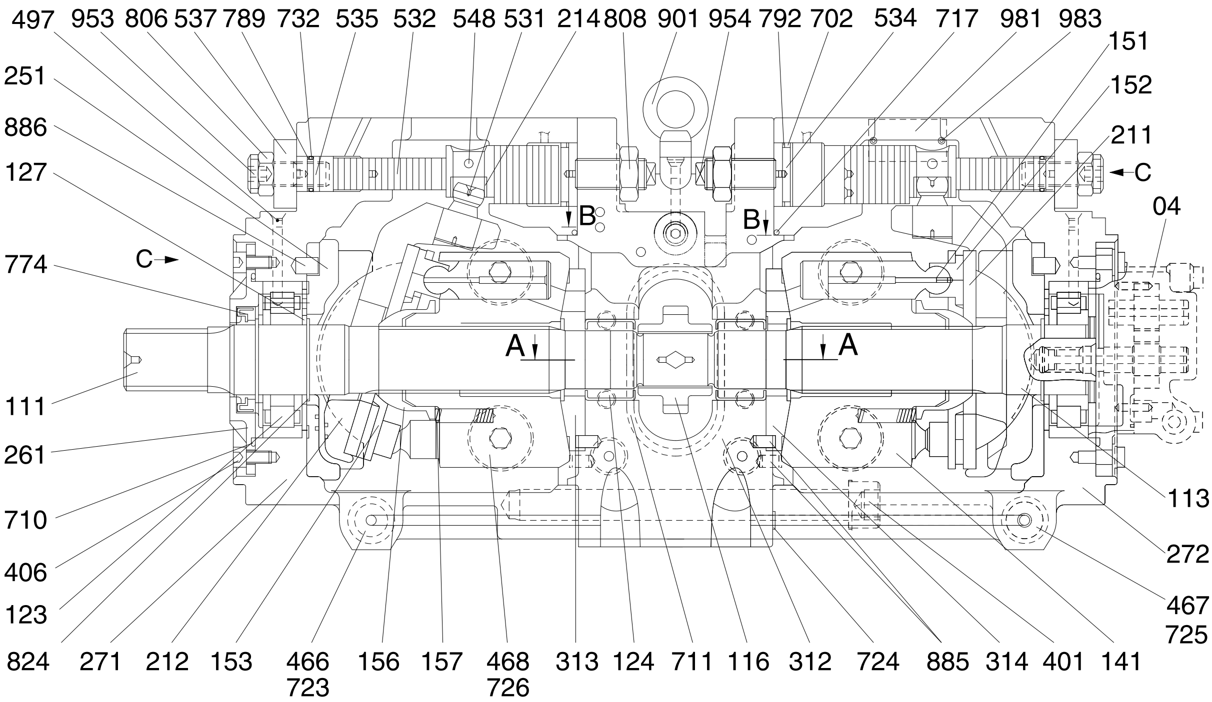




Port	Port name	Port size
A1,2	Delivery port	SAE6000psi 1"
B1	Suction port	SAE2500psi 2 1/2"
Dr	Drain port	PF 3/4 - 20
Psv	Servo assist port	PF 3/8 - 17
PH1,2	Pressure sensor port	PF 3/8-17
a1,2	Gauge port	PF 1/4 - 15
a3	Gauge port	PF 1/4-14
a4,5	Gauge port	PF 1/4 - 15
A3	Gear pump delivery port	PF 1/2 - 19
B3	Gear pump suction port	PF 3/4 - 20.5

1) MAIN PUMP (1/2)

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

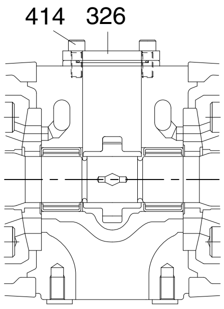


※ Section A-A, B-B, view C : see next page.

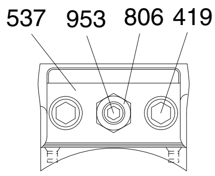
220F2MP05

04	Gear pump	272	Pump casing (R)	711	O-ring
111	Drive shaft (F)	312	Valve block B	717	O-ring
113	Drive shaft (R)	313	Valve plate (R)	723	O-ring
116	1st gear	314	Valve plate (L)	724	Square ring
123	Roller bearing	401	Hexagon socket bolt	725	O-ring
124	Needle bearing	406	Hexagon socket bolt	726	O-ring
127	Bearing spacer	466	Plug	732	O-ring
141	Cylinder block	467	Plug	774	Oil seal
151	Piston	468	Plug	789	Back up ring
152	Shoe	497	Plug	792	Back up ring
153	Set plate	531	Tilting pin	806	Hexagon head nut
156	Spherical bushing	532	Servo piston	808	Hexagon head nut
157	Cylinder spring	534	Stopper (L)	824	Snap ring
211	Shoe plate	535	Stopper (S)	885	Pin
212	Swash plate	537	Servo cover	886	Pin
214	Tilting bushing	548	Feedback pin	901	Eye bolt
251	Support	702	O-ring	953	Set screw
261	Seal cover (F)	710	O-ring	954	Set screw
271	Pump casing (F)				

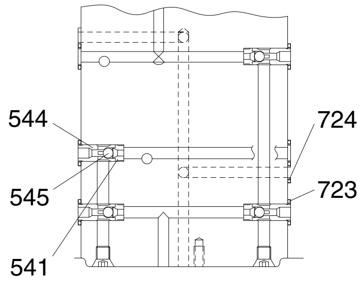
MAIN PUMP (2/2)



SECTION A-A



VIEW C

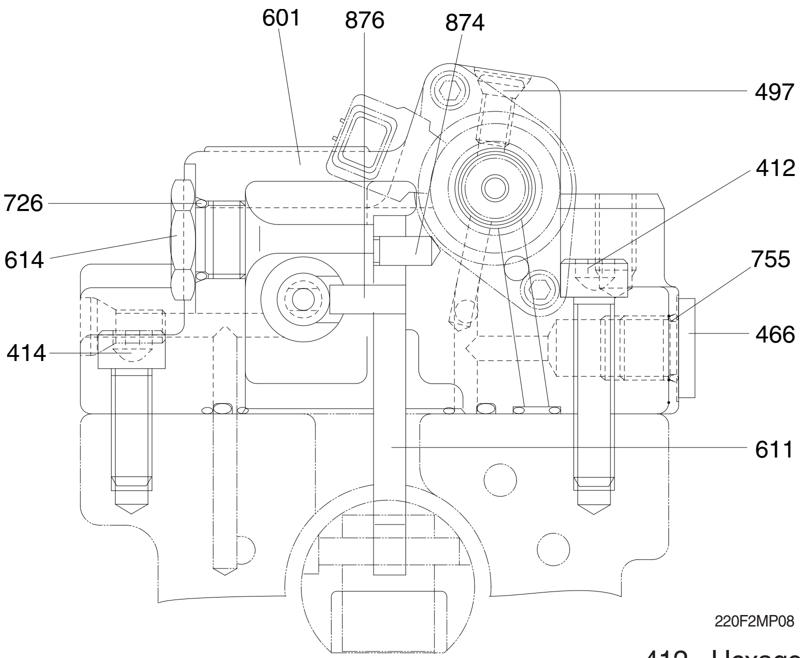


SECTION B-B

220F2MP06

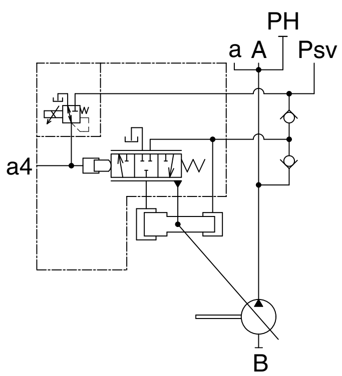
326	Cover	541	Seat	724	Square ring
414	Hexagon socket bolt	544	Stopper 1	806	Hexagon head nut
419	Hexagon socket bolt	545	Steel ball	953	Set screw
537	Servo cover	723	O-ring		

2) REGULATOR (1/2)



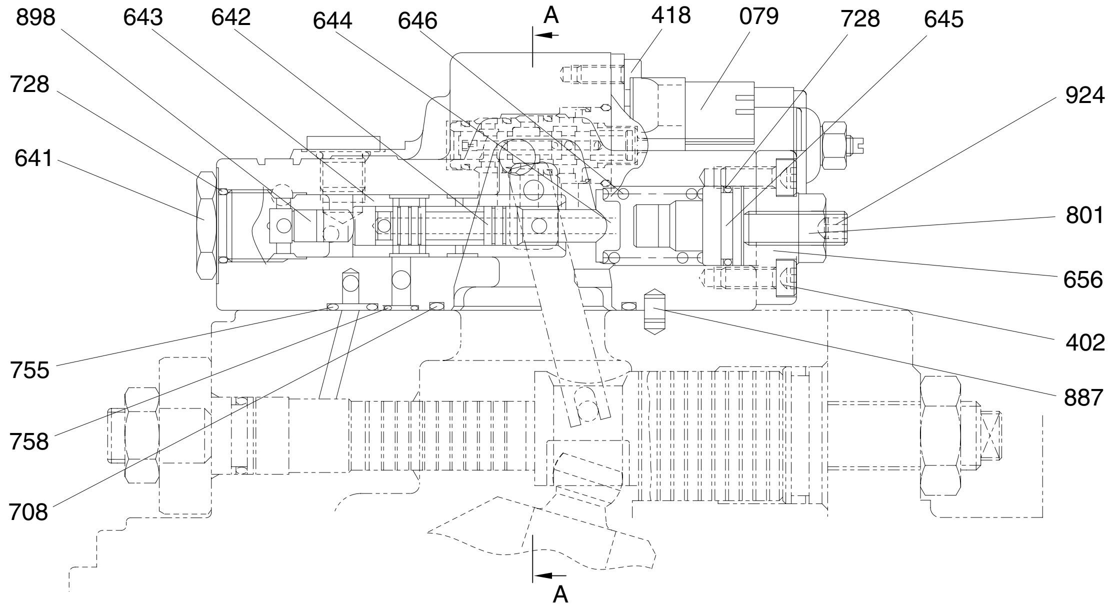
SECTION A-A

412 Hexagon socket screw
414 Hexagon socket screw
466 Plug
497 Plug
601 Casing
611 Feed back lever
614 Adjust plug
726 O-ring
755 O-ring
874 Pivot pin
876 Pin



Port	Port name	Port size
A	Delivery port	SAE 6000 psi 1"
B	Suction port	SAE 2500 psi 2 1/2"
Psv	Servo assist port	PF 3/8-17
a, a4	Gauge port	PF 1/4-15
PH	Pressure sensor port	PF 3/8-17

REGULATOR (2/2)

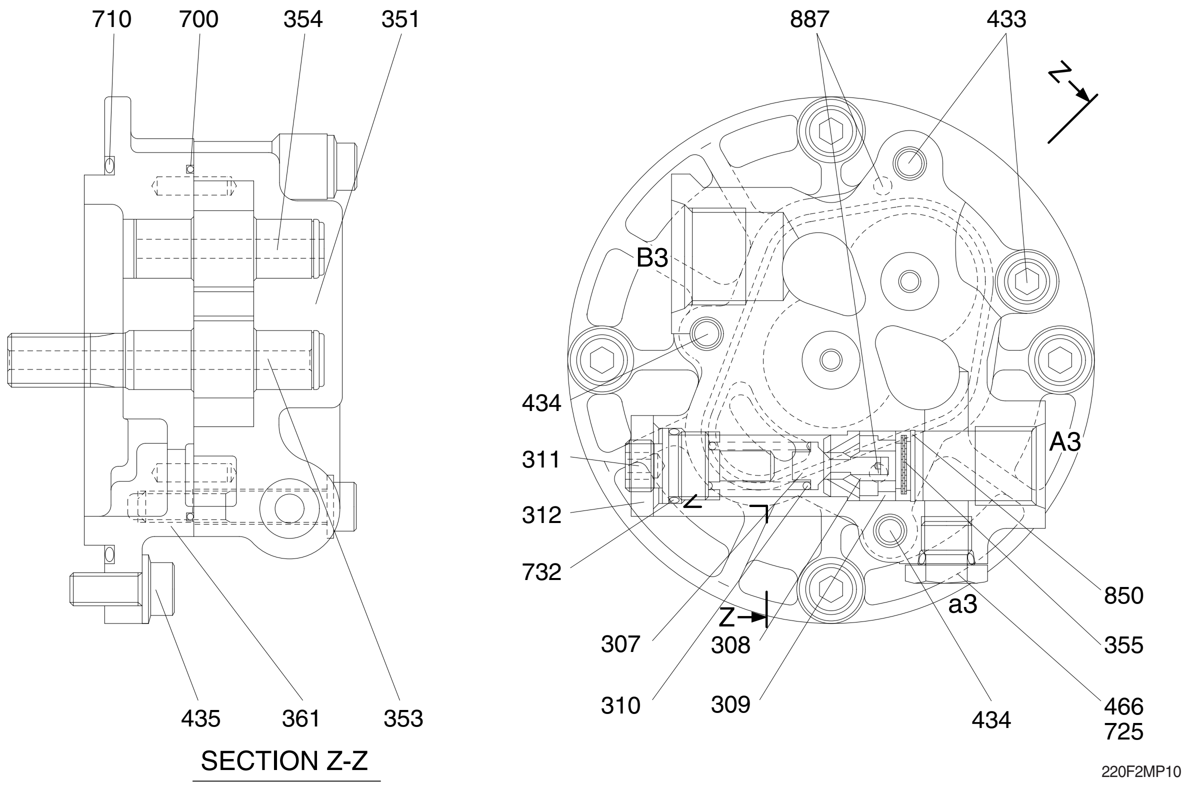


SECTION A-A

220F2MP09

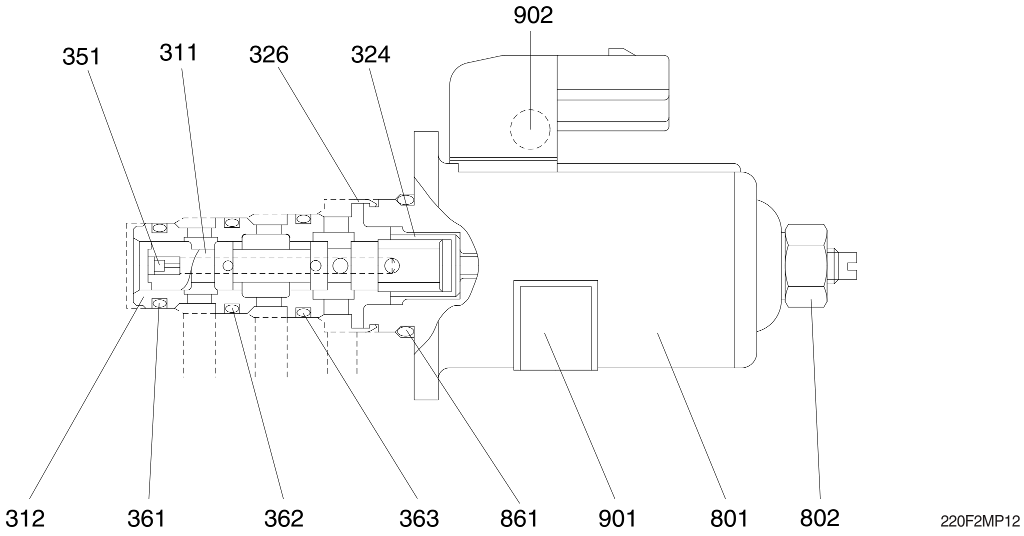
402	Hexagon socket screw	645	Adjust stem (Q)	758	Square ring
418	Hexagon socket screw	646	Pilot spring	801	Nut
641	Pilot plug	656	Cover	887	Pin
642	Pilot spool	708	O-ring	898	Piston piston
432	Pilot sleeve	728	O-ring	924	Set screw
644	Spring seat (Q)	755	O-ring		

3) GEAR PUMP



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

4) PROPORTIONAL REDUCING VALVE ASSY



311	Spool	361	O-ring	802	Seal nut
312	Sleeve	362	O-ring	861	O-ring
324	Spring	363	O-ring	901	Name plate
326	Retaining ring	801	Solenoid	902	Function name plate
351	Orifice				

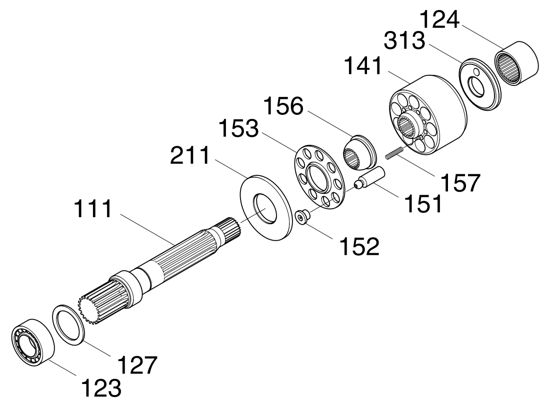
2. MAIN PUMP

The pumps may be classified roughly into the rotary group performing a rotary motion and working as the major part of the whole pump function: the swash plate group that varies the delivery flow: and the valve block group that changes over oil suction and discharge: and the PTO group to attach an auxiliary gear pump.

1) ROTARY GROUP

The rotary group consists of drive shaft (F) (111), bearing spacers (127), cylinder block (141), piston shoes (151,152), set plates (153), spherical bushings (156) and cylinder springs (157). The drive shaft is supported by bearings (123,124) at its both ends.

The shoe is caulked to the piston to form a spherical joint for lessening thrust force generated by load pressure and has grooves to slide on the shoe plate (211) smoothly and hydraulically balanced. The piston-shoe sub group is pushed onto the shoe plate by the cylinder springs through the set plate and spherical bushing for enabling smooth sliding on the shoe plate. Similarly, the cylinder block is pushed onto the valve plate (313, 314) by the cylinder springs.



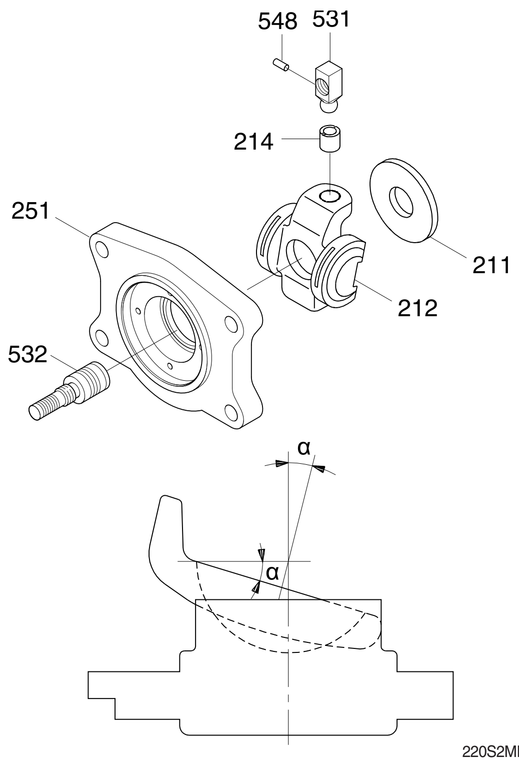
220S2MP13

2) SWASH PLATE GROUP

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

The swash plate is supported by the swash plate support at the cylindrical portion formed on the opposite side of the shoe sliding face.

When the servo piston is moved to the left or right by introducing the hydraulic force controlled by the regulator into the hydraulic chamber provided on both ends of the servo piston, the swash plate slides over the swash plate support through the spherical portion of the tilting pin and can vary the tilting angle (α).



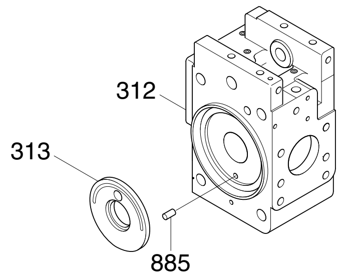
220S2MP14

3) VALVE BLOCK GROUP

The valve block group consists of the valve block (312), valve plate (313, 314) and valve plate pin (885).

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

The oil exchanged by the valve plate is connected to an external piping through the valve block.



220S2MP15

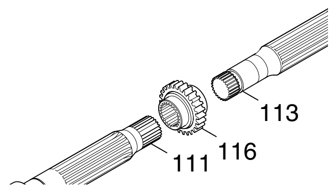
4) PTO GROUP

The PTO group is composed of the 1st gear (116), 2nd gear (111) and 3rd gear (113).

The 2nd gear (111) and 3rd gear (113) are supported by the bearings, respectively and attached to the valve block.

Now, suppose the drive shaft is rotated by the motor or engine, the cylinder block is also rotated through the spline conection. If the swash plate is tilted, the pistons arranged inside the cylinder reciprocate relatively to the cylinder, rotating with the cylinder block. Accordingly, if a piston is focused on, its motion is separating from the valve plate (oil suction process) for 180 degrees, and approaching the valve plate (oil delivery process) for the remaining 180 degrees. When the swash plate has a tilting angle of zero, the piston makes no stroke and discharges no oil.

In the meantime, the rotation of the drive shaft is picked up by the 1st gear (116), transmitted to the 3rd gear (113) through the 2nd gear (111), and drives the auxiliary pump connected to the 3rd gear (113).



220F2MP11

3. REGULATOR

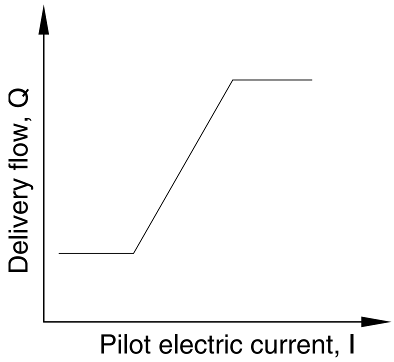
1) OUTLINE

The regulator for the K7V series axial piston pump has various models to satisfy various kinds of specifications required.

Electric flow control

By changing the pilot electric current I for proportional reducing valve, the pump tilting angle (delivery flow) is controlled arbitrarily, as shown in the figure.

This regulator has the positive flow control in which the delivery flow Q increases as the pilot electric current I increases. With this commanded, the pump discharges the required flow only, and so it does not consume the power uselessly.

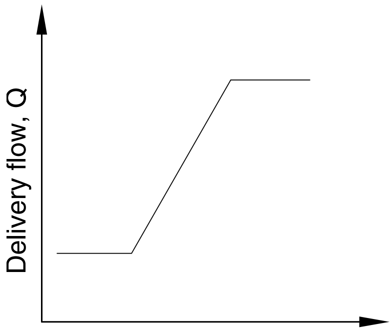


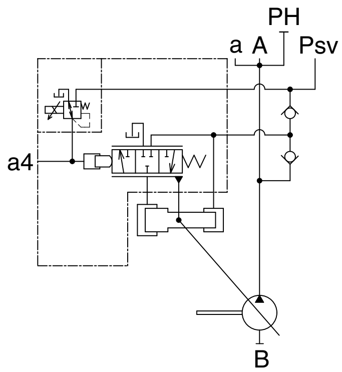
220F2MP16

2) FUNTION

(1) Flow control

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





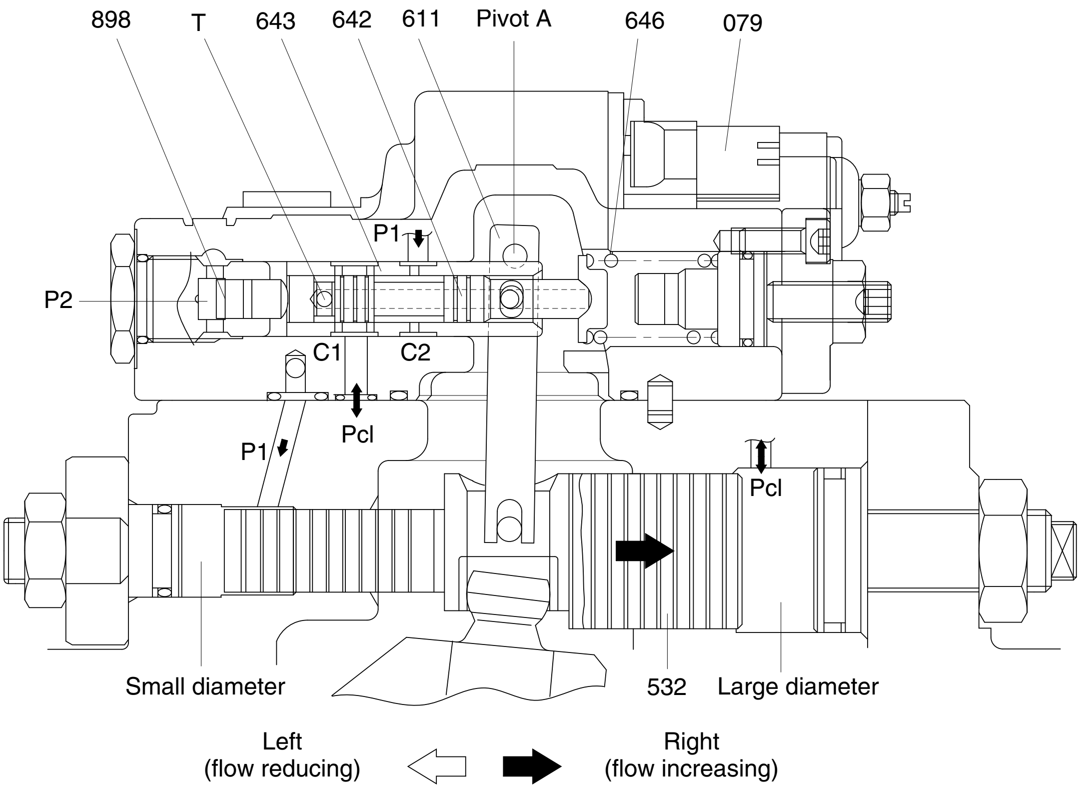
220F2MP17

① **Flow increasing funtion**

As the pilot electric current I increases, the secondary pressure of the proportional reducing valve (079) increases too. Then the pilot spool (642) through the pilot piston (898) moves to the right to position where the force of the pilot spring (646) balances with the hydraulic force.

The movement of the pilot spool (642) causes the port C1 connects to the tank port (T). This deprives the pressure of the large-diameter section of the servo piston (531) and moves the servo piston (532) to the right by the discharge pressure Pd1 in the small-diameter section, resulting in the flow rate increase.

The feedback lever (611) links both the servo piston (532) and the pilot sleeve (643). When the servo piston (532) moves, the feedback lever (611) rotates around the pivot A, and the pilot sleeve (643) moves to the left. This causes the opening between the pilot sleeve (643) and the pilot spool (642) to close slowly, and the servo piston (532) comes to being stop completely when the port C1 closes completely.



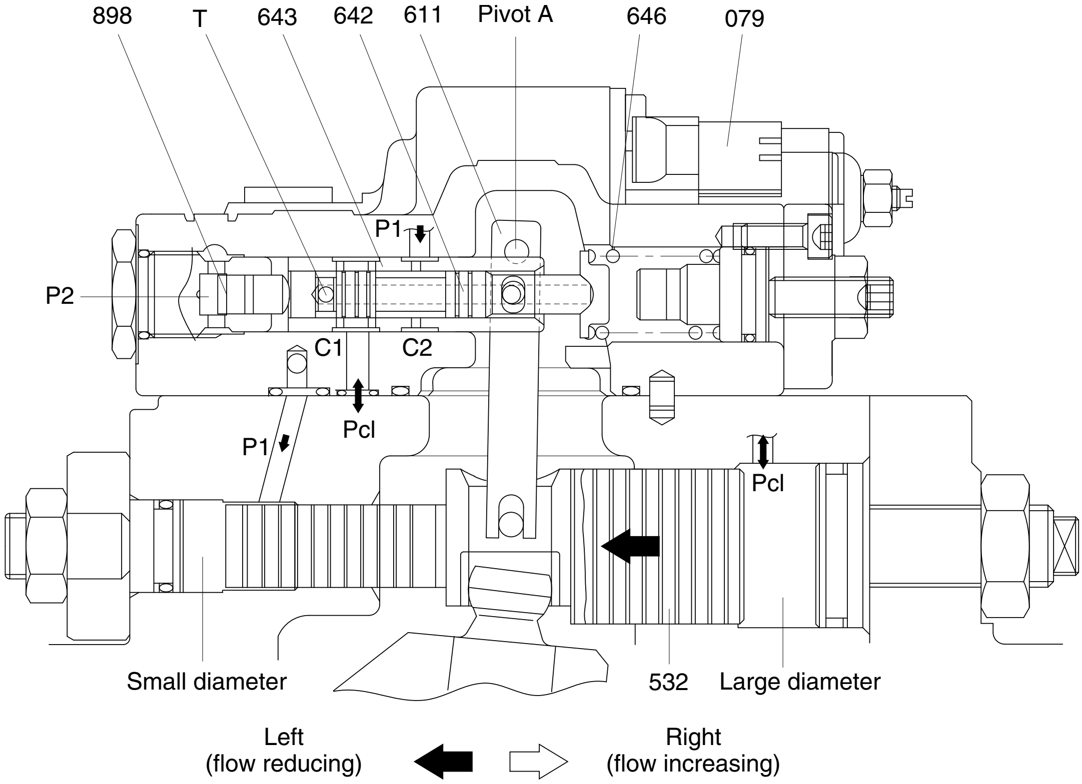
220F2MP25

② Flow reducing function

As the pilot electric current I decreases, the secondary pressure of the proportional reducing valve (079) decreases too, the pilot spool (642) moves to the left by action of the pilot spring (646).

The movement of the pilot spool (642) causes the delivery pressure Pd1 to connects to the port C2 through the pilot spool (642) and to be admitted to the large-diameter section of the servo piston (532). Although the delivery pressure Pd1 is constantly admitted to the small-diameter section of servo piston (532), the servo piston (532) moves to the left because of its difference of the area between large and small-diameter section. As a result, the tilting angle is decreased.

As the servo piston (532) moves, the feedback lever (611) rotates around the pivot A, and the pilot sleeve (643) moves to the right till the opening between the pilot spool (642) and pilot sleeve (643) being closed.



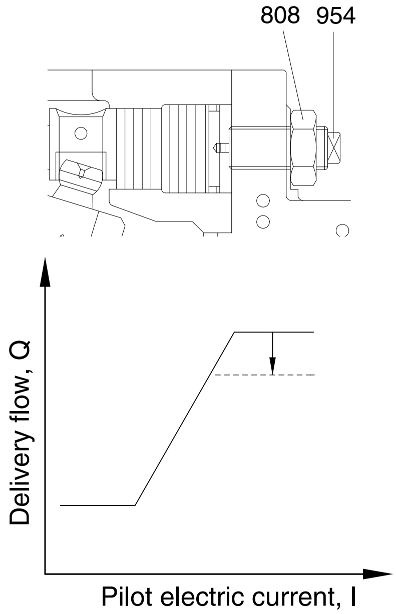
220F2MP26

4. ADJUSTMENT OF MAXIMUM AND MINIMUM FLOWS

The maximum flow and minimum flow can be adjusted with the adjusting screws (954, 953) of the pump. The flow control characteristics can be adjusted with the hexagon socket head cap (924). The horsepower control characteristics can be adjusted with the adjusting screw (C. 628) and adjusting stem (C, 627) of the regulator. The maximum flow and minimum flow can be adjusted with the adjusting screws of the pump.

1) ADJUSTMENT OF MAXIMUM FLOW (MAIN PUMP SIDE)

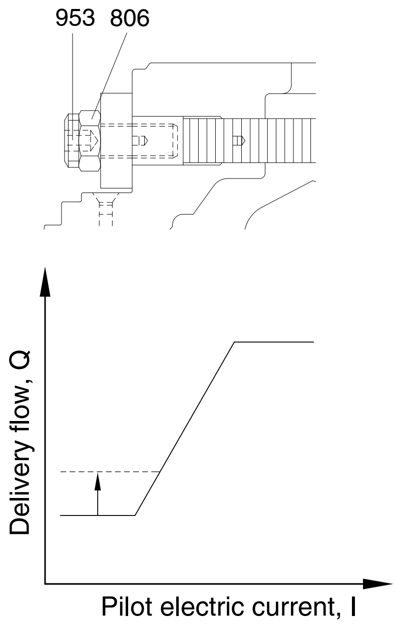
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the hexagonal socket head screw (954). Only the maxinum flow is adjusted without changing other control characteristics.



220F2MP18

2) ADJUSTMENT OF MINIMUM FLOW (MAIN PUMP SIDE)

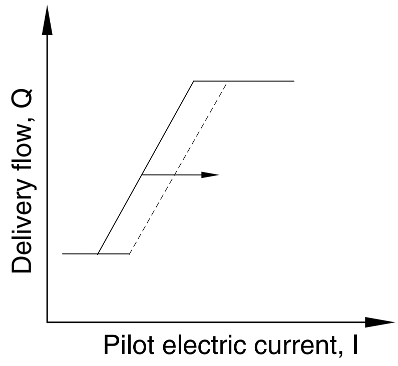
Adjust it by loosening the hexagon nut (806) and by tightening (or loosening) the hexagon socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed. However, remember that, if tightened too much, the required horsepower at the maximum delivery pressure (or during relieving) may increase.



220F2MP19

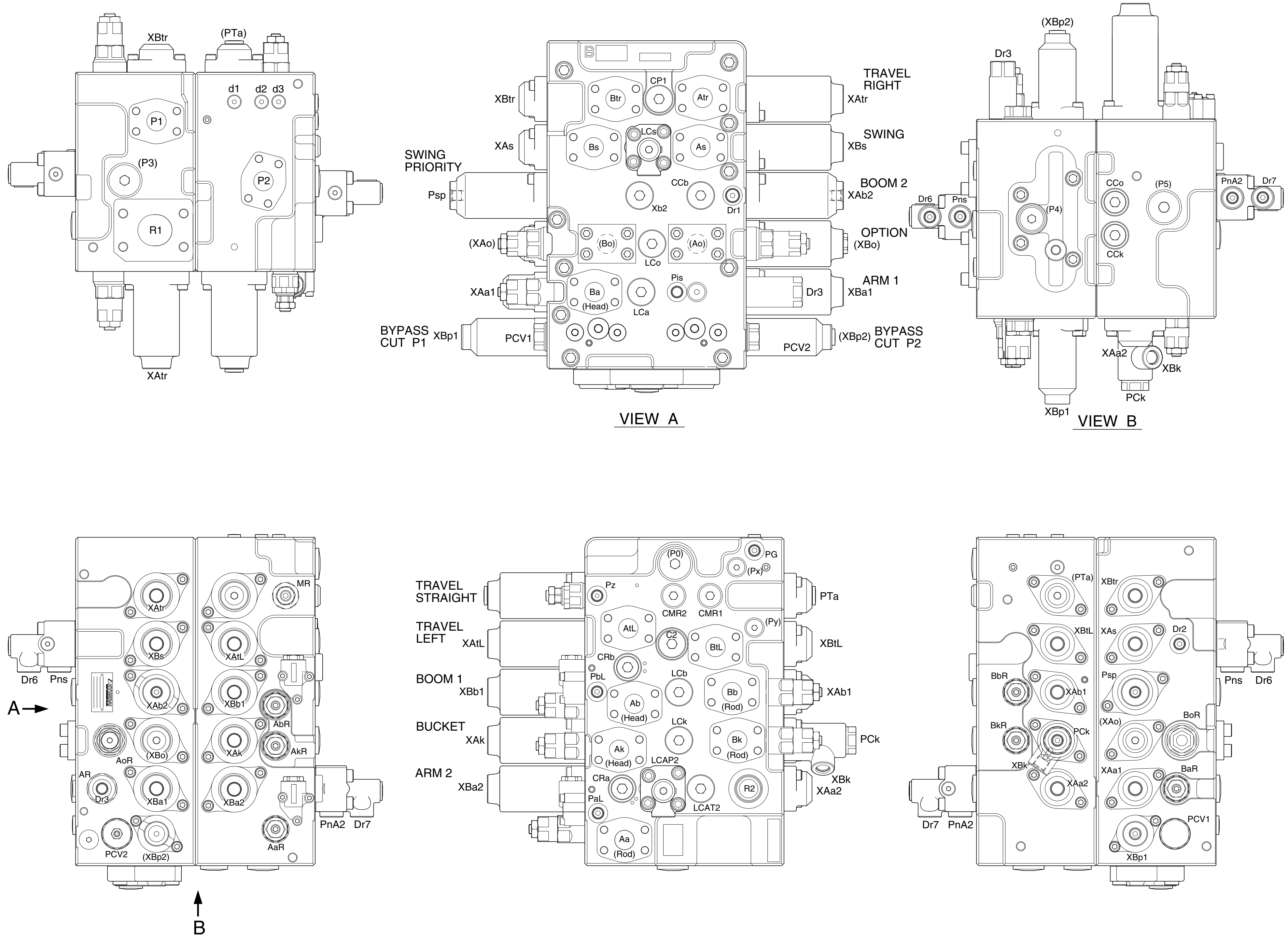
3) ADJUSTMENT OF LOW CONTROL CHARACHERISTIC.

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



220AL2MP20

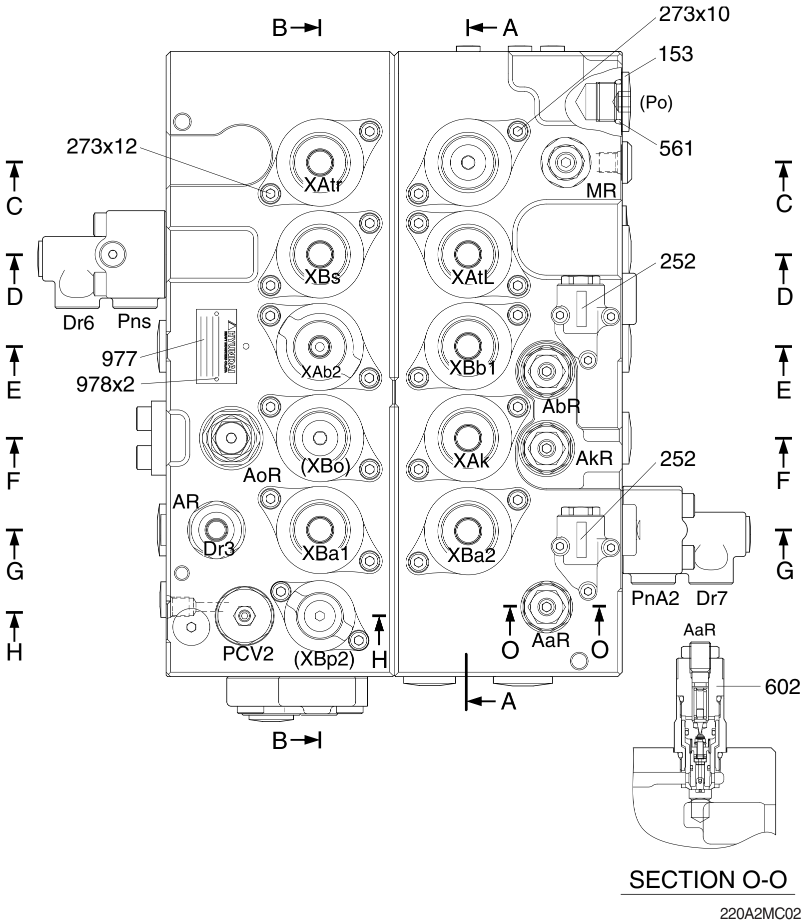
1. STRUCTURE



220A2MC01

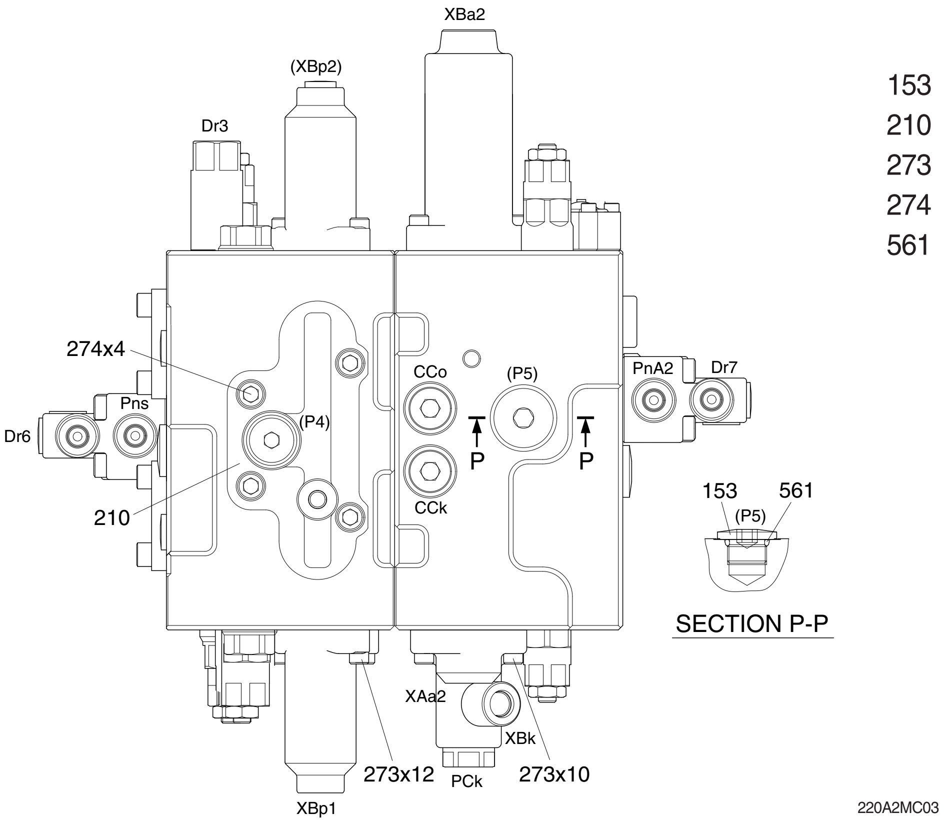
Mark	Port name	Port size	Tightening torque
R2	Make up port for swing	PF 1	20~25kgf · m (115~180lbf · ft)
XAtr	Travel right (reverse) pilot port	PF 3/8	7~8kgf · m (50.6~57.8lbf · ft)
XBtr	Travel right (forward) pilot port		
(XAo)	Optional pilot port		
(XBo)	Optional pilot port		
XAk	Bucket in pilot port		
XBk	Bucket out pilot port		
XAb1	Boom up pilot port		
XBb1	Boom down pilot port		
XAa2	Arm out confluence pilot port		
XBa2	Arm in confluence pilot port		
XAtL	Travel left (reverse) pilot port		
XBtL	Travel left (forward) pilot port		
XAs	Swing left pilot port		
XBs	Swing right pilot port		
XAa1	Arm out pilot port		
XBa1	Arm in pilot port		
Dr1	Drain port		
PTa	Travel straight pilot port		
(Px)	Pressure port for attachment	PF 1/4	3.5~3.9kgf · m (25.3~28.2lbf · ft)
(Py)	Pressure port for travel		
Pz	Main relief pilot pressure port		
PG	Pilot pressure port		
Dr2	Drain port		
Dr3	Drain port		
Dr6	Drain port		
Dr7	Drain port		
Pns	Swing logic valve pilot port		
PaL	Lock valve pilot port (arm rod side)		
PbL	Lock valve pilot port (boom head side)		
XAb2	Boom up confluence pilot port		
Psp	Swing priority pilot port		
XBp1	Bypass cut spool pilot port (A1 pump side)		
(XBp2)	Bypass cut spool pilot port (A2 pump side)		
PCk	Bucket in stroke limiter pilot port		
Pis	Arm regeneration cut pilot port		
PnA2	Arm2 logic valve pilot port		
Atr	Travel motor right side (reverse) port	M10	5~6.6kgf · m (36.1~47.7lbf · ft)
Btr	Travel motor right side (forward) port		
(Ao)	Optional port		
(Bo)	Optional port		
Ak	Bucket cylinder head side port		
Bk	Bucket cylinder rod side port		
Ab	Boom cylinder head side port		
Bb	Boom cylinder rod side port		
AtL	Travel motor left side (reverse) port		
BtL	Travel motor left side (forward) port		
As	Swing motor left port		
Bs	Swing motor right port		
Aa	Arm cylinder rod side port		
Ba	Arm cylinder head side port		
P1	Pump port (A1 pump side)		
P2	Pump port (A2 pump side)		
R1	Return port	M12	8.5~11.2kgf · m (61.5~81.1lbf · ft)

1) RELIEF VALVE SIDE VIEW



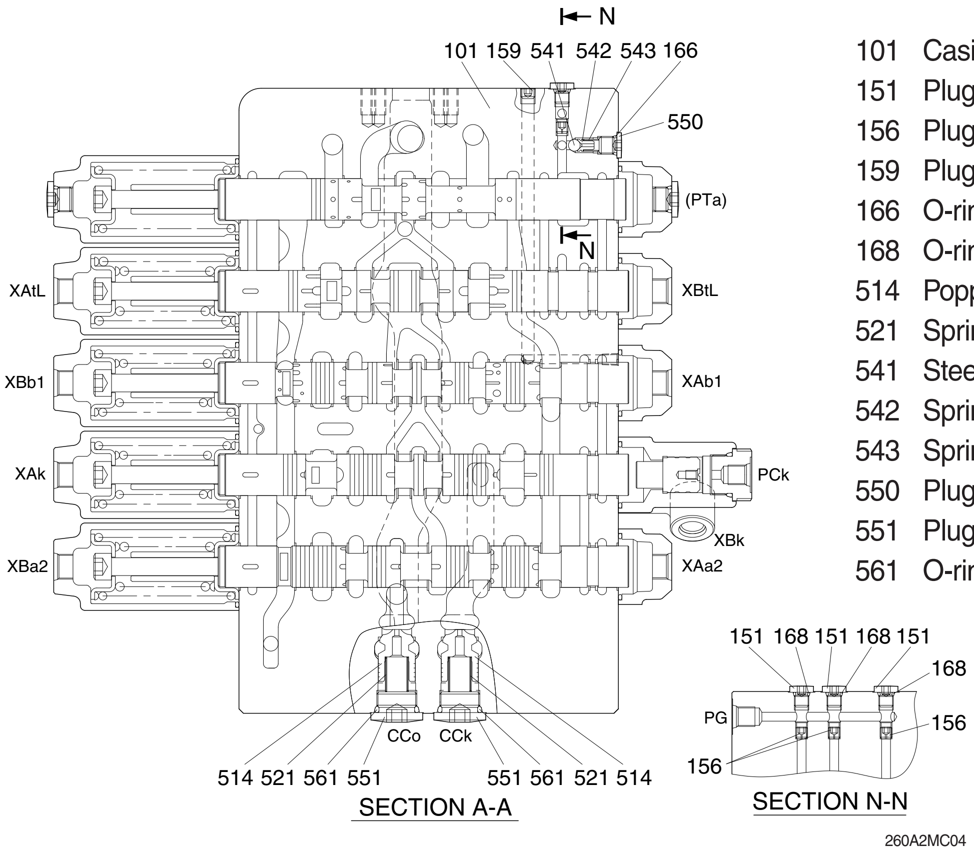
153 Plug
252 Lock valve selector sub assy
273 Socket screw
561 O-ring
602 Port relief valve assy
977 Name plate
978 Pin

2) TANK PORT SIDE BOTTOM VIEW



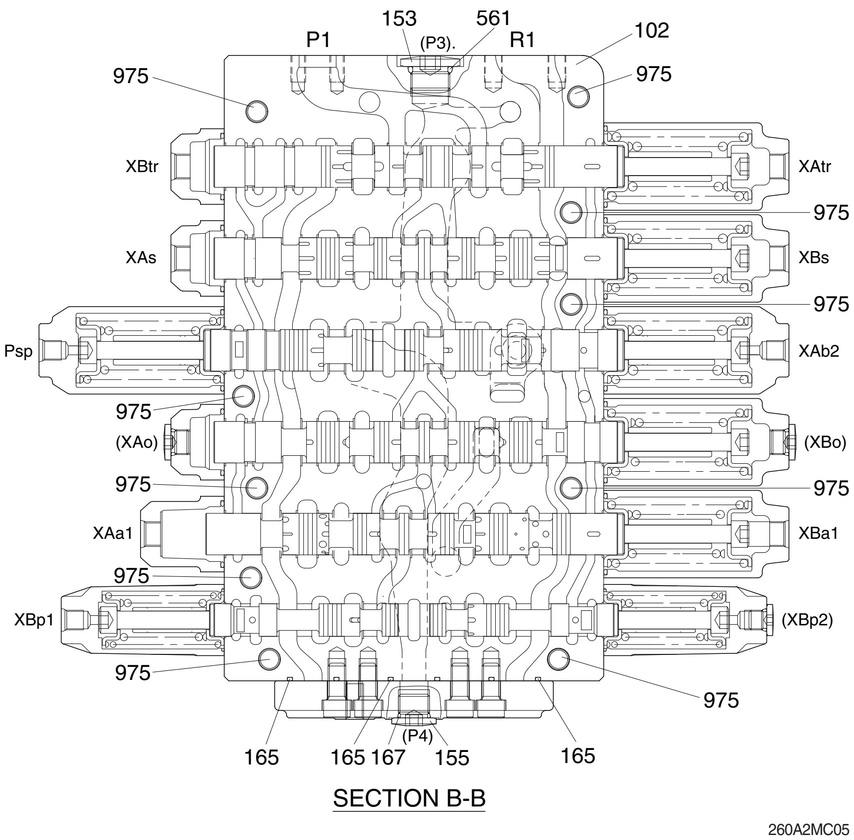
153 Plug
210 Plate
273 Socket screw
274 Socket screw
561 O-ring

3) CASING A SPOOL SECTION



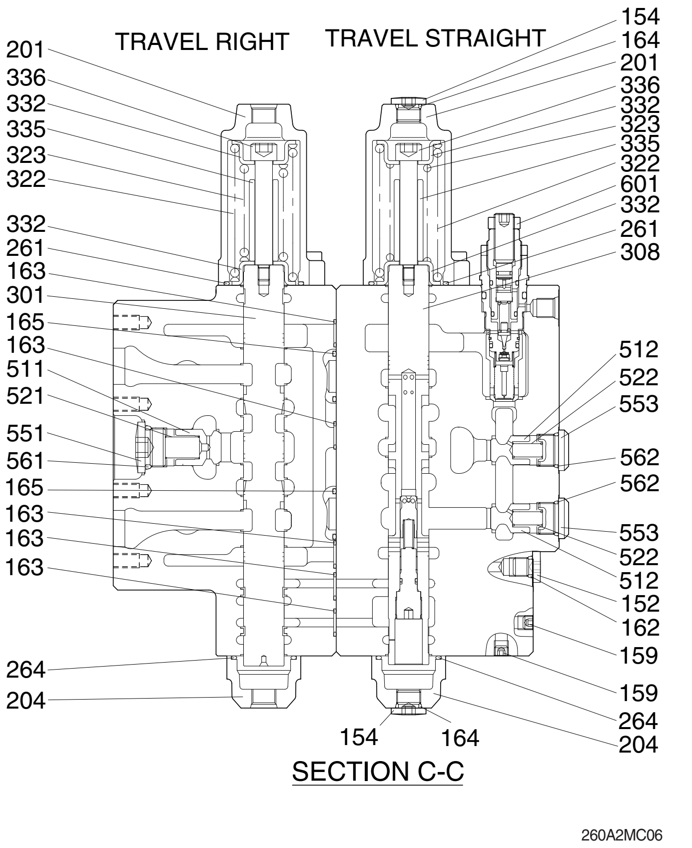
101 Casing A
151 Plug
156 Plug
159 Plug
166 O-ring
168 O-ring
514 Poppet
521 Spring
541 Steel ball
542 Spring seat
543 Spring
550 Plug
551 Plug
561 O-ring

4) CASING B SPOOL SECTION



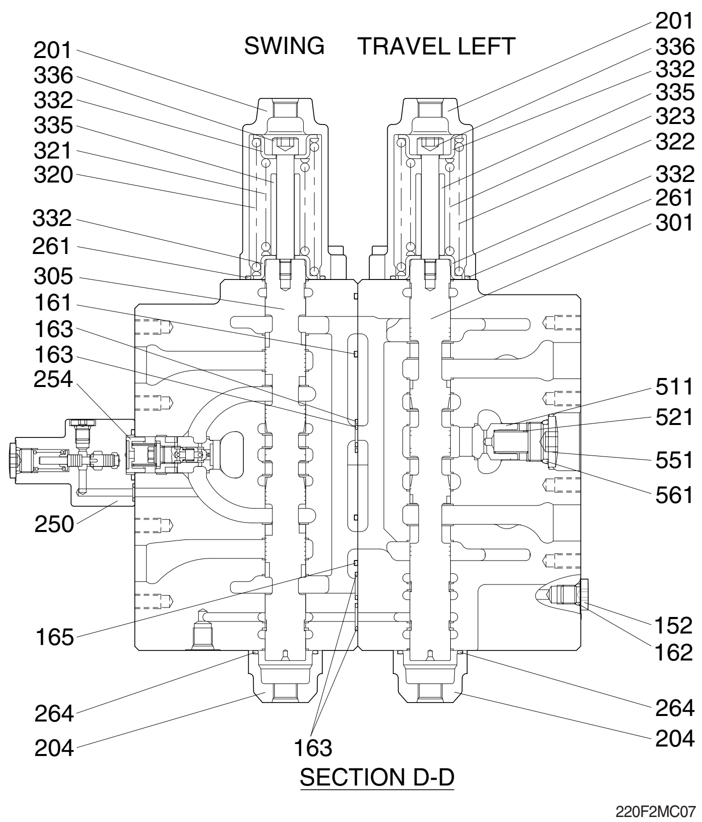
102 Casing B
153 Plug
155 Plug
165 O-ring
167 O-ring
561 O-ring
975 Socket screw

5) TRAVEL RIGHT AND TRAVEL STRAIGHT SECTION



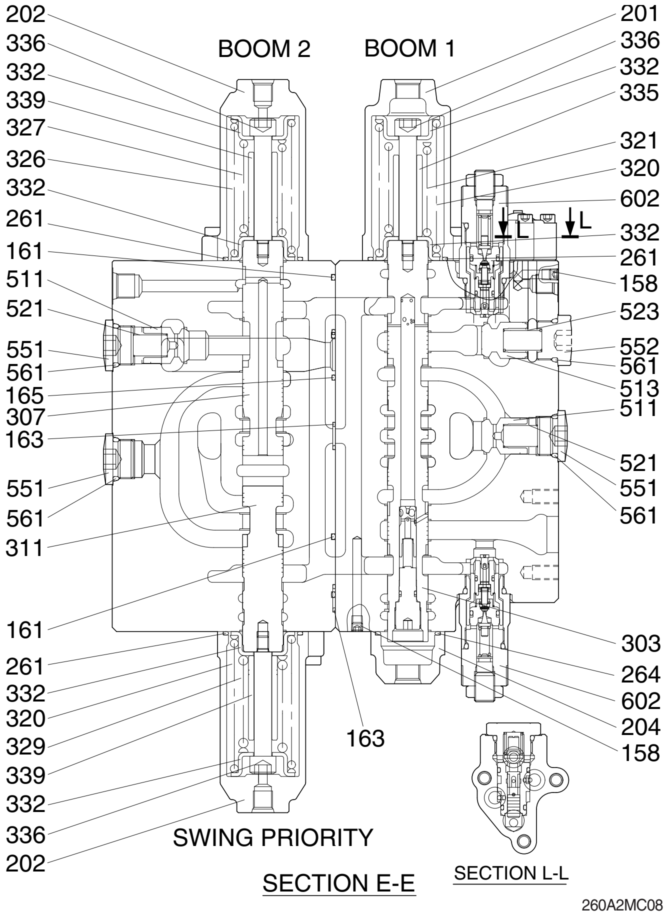
152 Plug
154 Plug
159 Plug
162 O-ring
163 O-ring
164 O-ring
165 O-ring
201 Spring cover
204 Spool cover
261 O-ring
264 Square ring
301 Travel spool
308 Straight travel spool sub assy
322 Spring
323 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
512 Poppet
521 Spring
522 Spring
551 Plug
553 Plug
561 O-ring
562 O-ring
601 Main relief valve assy

6) SWING AND TRAVEL LEFT SECTION



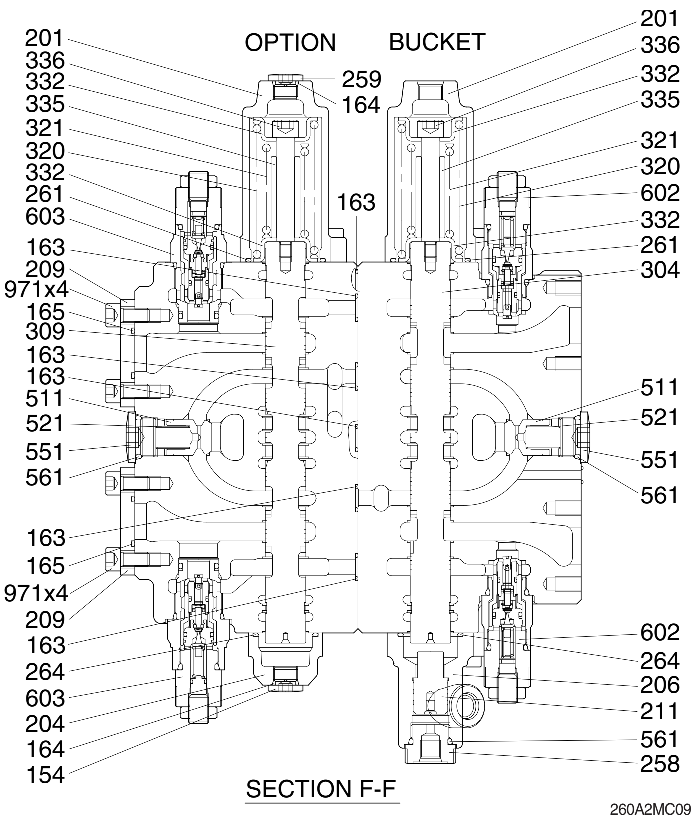
152 Plug
161 O-ring
162 O-ring
163 O-ring
165 O-ring
201 Spring cover
204 Spool cover
250 Logic control valve assy
254 Swing Logic poppet assy
261 O-ring
264 Square ring
301 Travel spool
305 Swing spool
320 Spring
321 Spring
322 Spring
323 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
521 Spring
551 Plug
561 O-ring

7) BOOM 1 AND 2 SECTION



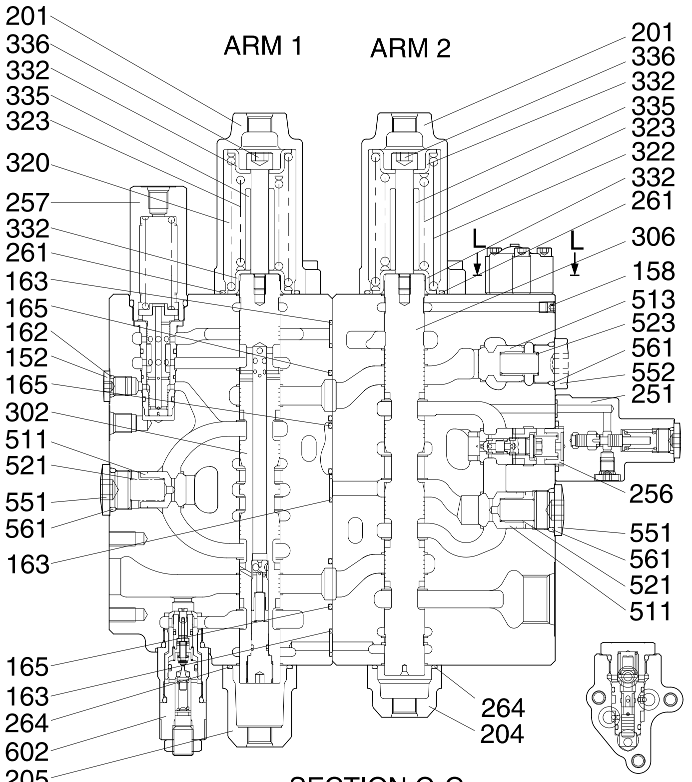
158	Plug
161	O-ring
163	O-ring
165	O-ring
201	Spring cover
202	Spring cover
204	Spool cover
261	O-ring
264	Square ring
303	Boom 1 spool sub assy
307	Boom 2 spool
311	Swing priority spool
320	Spring
321	Spring
326	Spring
327	Spring
329	Spring
332	Spring seat
335	Stopper
336	Spacer bolt
339	Stopper
511	Poppet
513	Poppet
521	Spring
523	Spring
551	Plug
552	Plug
561	O-ring
602	Port relief valve assy

8) BUCKET AND OPTION SECTION



154	Plug
163	O-ring
164	O-ring
165	O-ring
201	Spring cover
204	Spool cover
206	Spool cover
209	Flange
211	Piston
258	Plug
259	Plug
261	O-ring
264	Square ring
304	Bucket spool
309	Option spool
320	Spring
321	Spring
332	Spring seat
335	Stopper
336	Spacer bolt
511	Poppet
521	Spring
551	Plug
561	O-ring
602	Port relief valve assy
603	Port relief valve assy
971	Socket screw

9) ARM 1 AND 2 SECTION



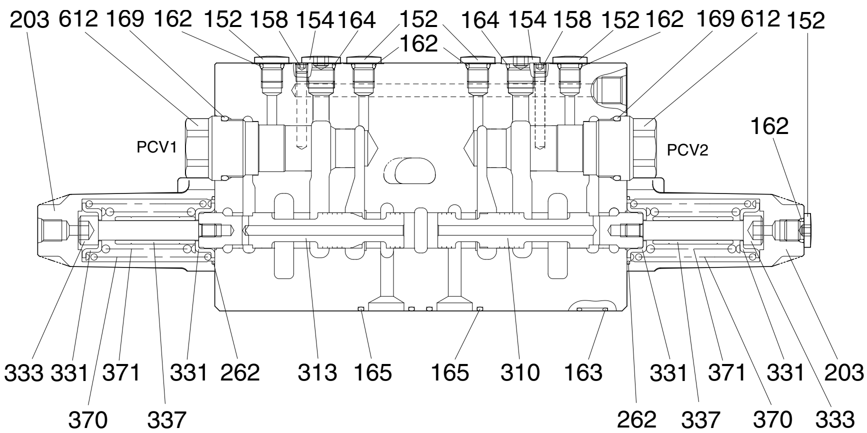
SECTION G-G

SECTION L-L

260A2MC10

152 Plug
158 Plug
162 O-ring
163 O-ring
165 O-ring
201 Spring cover
204 Spool cover
205 Spool cover
251 Logic control valve assy
256 Arm 2 Logic poppet assy
257 Arm regeneration cut sub assy
261 O-ring
264 Square ring
302 Arm 1 spool sub assy
306 Arm 2 spool
320 Spring
322 Spring
323 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
513 Poppet
521 Spring
523 Spring
551 Plug
552 Plug
561 O-ring
602 Port relief valve assy

10) BYPASS CUT SECTION

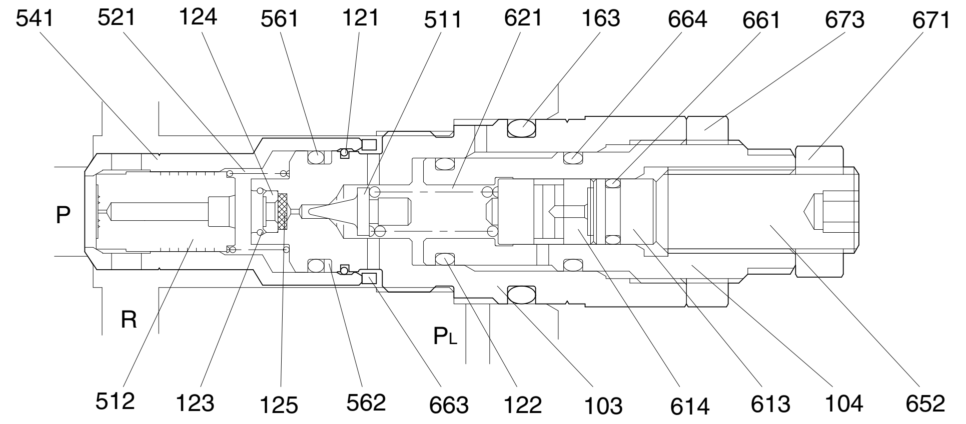


SECTION H-H

260A2MC11

152 Plug
154 Plug
158 Plug
162 O-ring
163 O-ring
164 O-ring
165 O-ring
169 O-ring
203 Spring cover
262 O-ring
310 Bypass cut spool
313 Bypass cut spool
331 Spring seat
333 Spring seat
337 Stopper
370 Spring
371 Spring
612 Plug

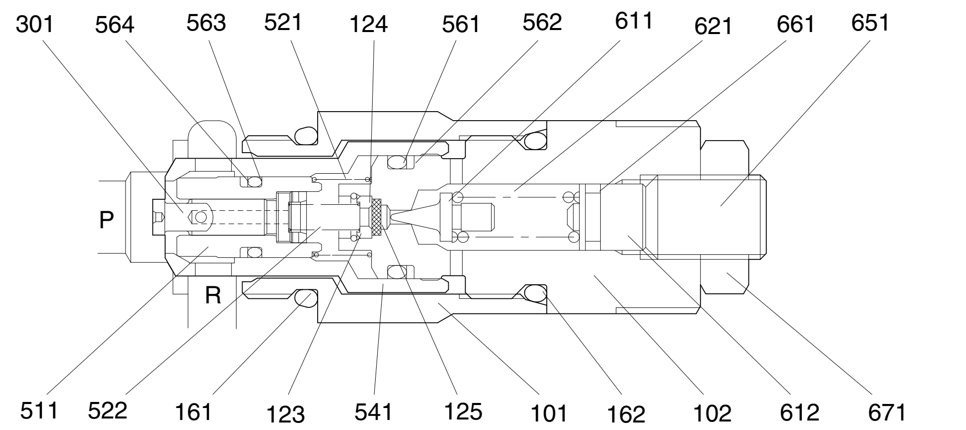
11) MAIN RELIEF VALVE (601)



220F2MC70

103	Plug	512	Plunger	621	Spring
104	Adjust plug	521	Spring	652	Adjust screw
121	C-ring	541	Seat	661	O-ring
122	Spacer	561	O-ring	663	O-ring
123	C-ring	562	Back-up ring	664	O-ring
124	Filler stopper	611	Poppet	671	Lock nut
125	Filler	613	Stopper	673	Lock nut
163	O-ring	614	Piston		

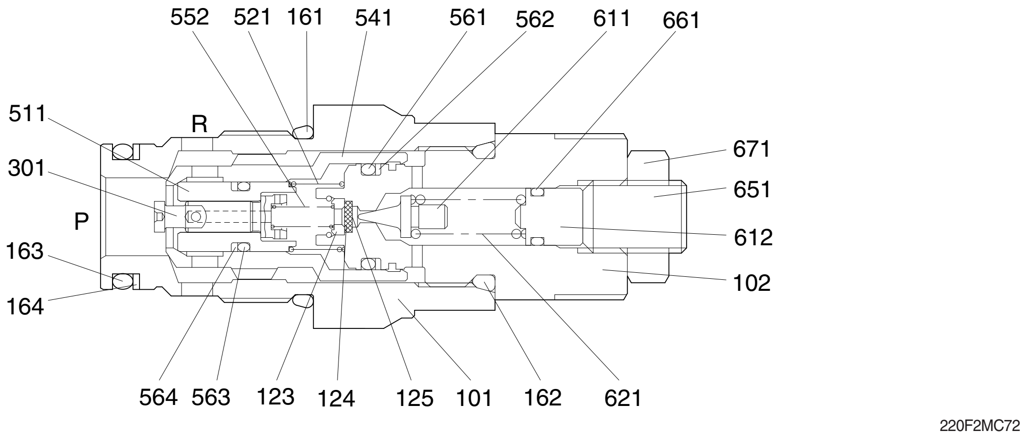
12) PORT RELIEF VALVE (602)



220F2MC71

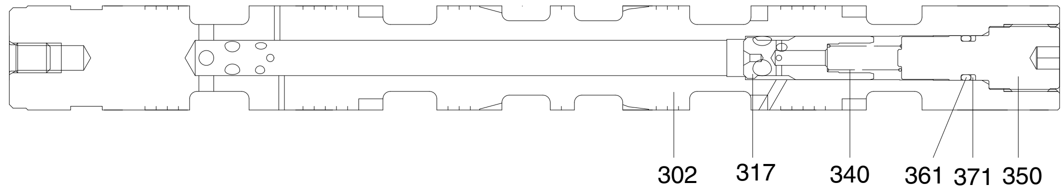
101	Body	511	Plunger	564	Back-up ring
102	Plug	521	Spring	611	Poppet
161	O-ring	522	Spring	612	Spring seat
162	O-ring	541	Seat	621	Spring
123	O-ring	561	O-ring	651	Adjust screw
124	Filler stopper	562	Back-up ring	661	O-ring
125	Filler	563	O-ring	671	Lock nut

13) PORT RELIEF VALVE (603)



101	Body	301	Piston	564	Back-up ring
102	Plug	511	Plunger	611	Poppet
123	C-ring	521	Spring	612	Spring seat
124	Filler stopper	522	Spring	621	Spring
125	Filler	541	Seat	651	Adjust screw
161	O-ring	561	O-ring	661	O-ring
162	O-ring	562	Back-up ring	671	Lock nut
163	O-ring	563	O-ring		

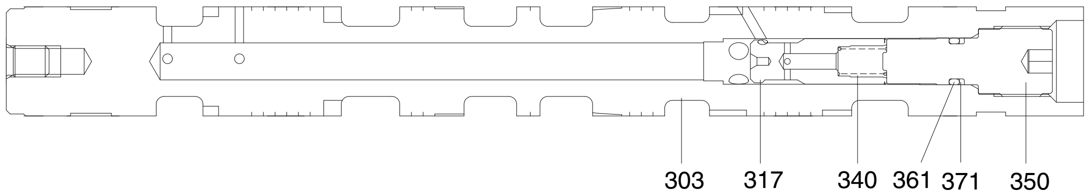
14) ARM 1 SPOOL ASSY (302)



220F2MC73

302 Spool	340 Spring	361 O-ring
317 Plunger	350 Plug	371 Back-up ring

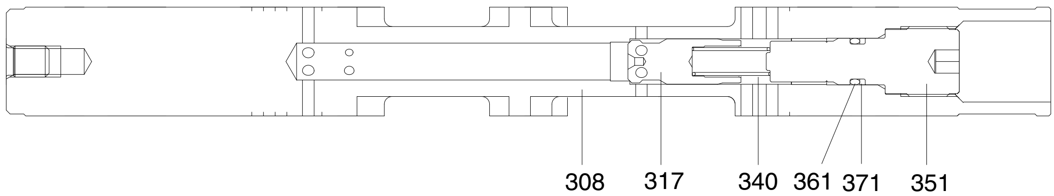
15) BOOM 1 SPOOL ASSY (303)



220F2MC74

303 Spool	340 Spring	361 O-ring
317 Plunger	350 Plug	371 Back-up ring

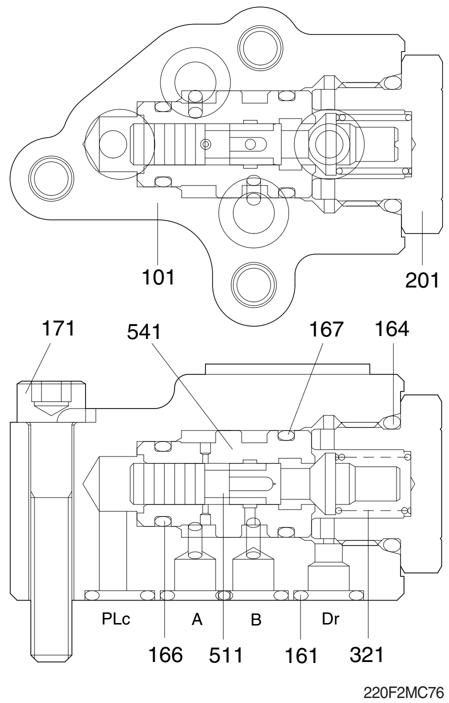
16) TRAVEL STRAIGHT SPOOL (308)



220F2MC75

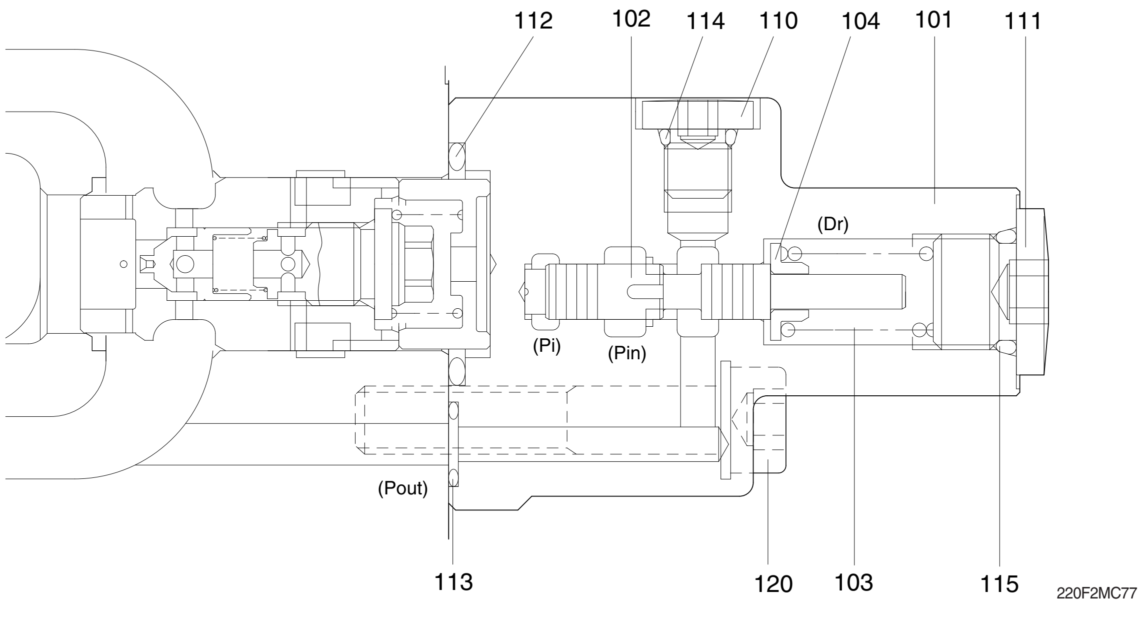
308 Spool	340 Spring	361 O-ring
317 Plunger	351 Plug	371 Back-up ring

17) LOCK VALVE SELECTOR (252)



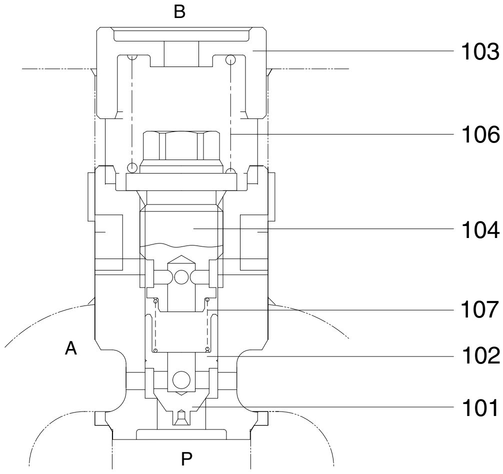
101 Casing
161 O-ring
164 O-ring
166 O-ring
167 O-ring
171 Hex socket head cap screw
201 Plug
321 Spring
511 Spool
541 Sleeve

18) LOGIC CONTROL VALVE ASSY (250, 251)



101 Casing
102 Spool
103 Spring
104 Spring seat
110 Plug
111 Plug
112 O-ring
113 O-ring
114 O-ring
115 O-ring
120 Hex socket head cap screw

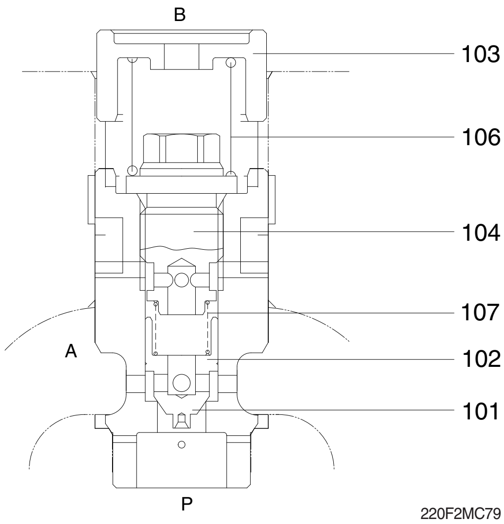
19) SWING LOGIC POPPET ASSY (254)



220F2MC78

101 Logic poppet
102 Poppet
103 Spring seat
104 Plug
106 Spring
107 Spring

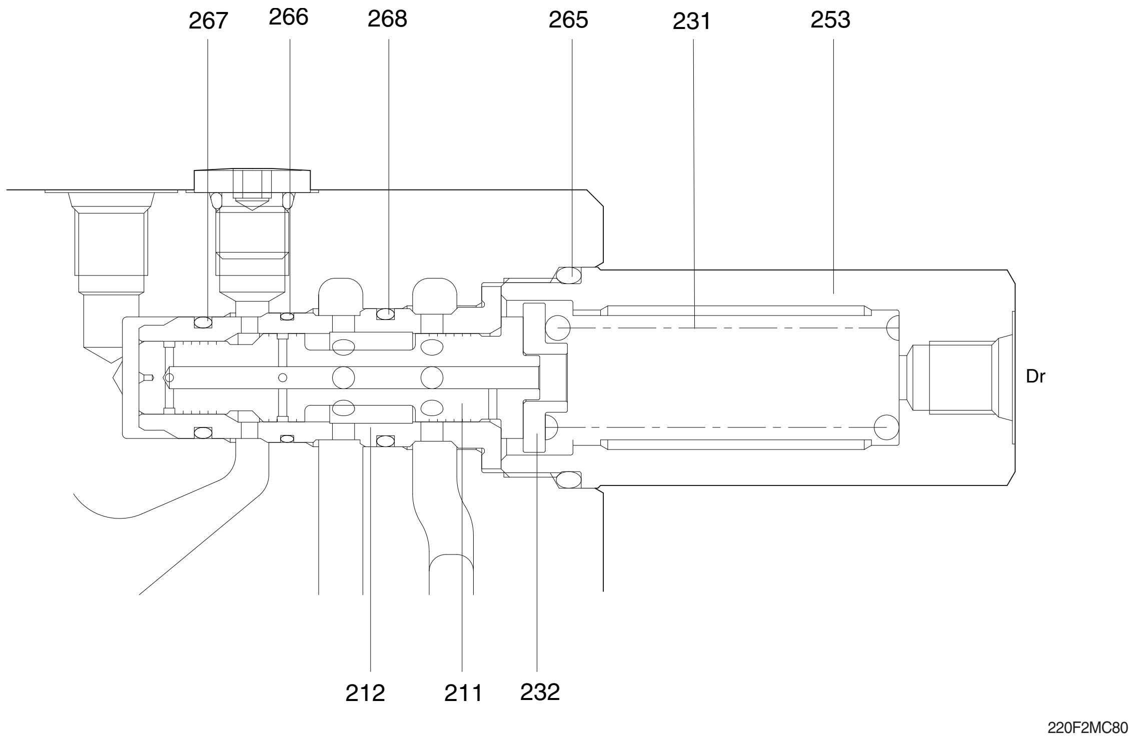
20) ARM 2 LOGIC POPPET ASSY (256)



220F2MC79

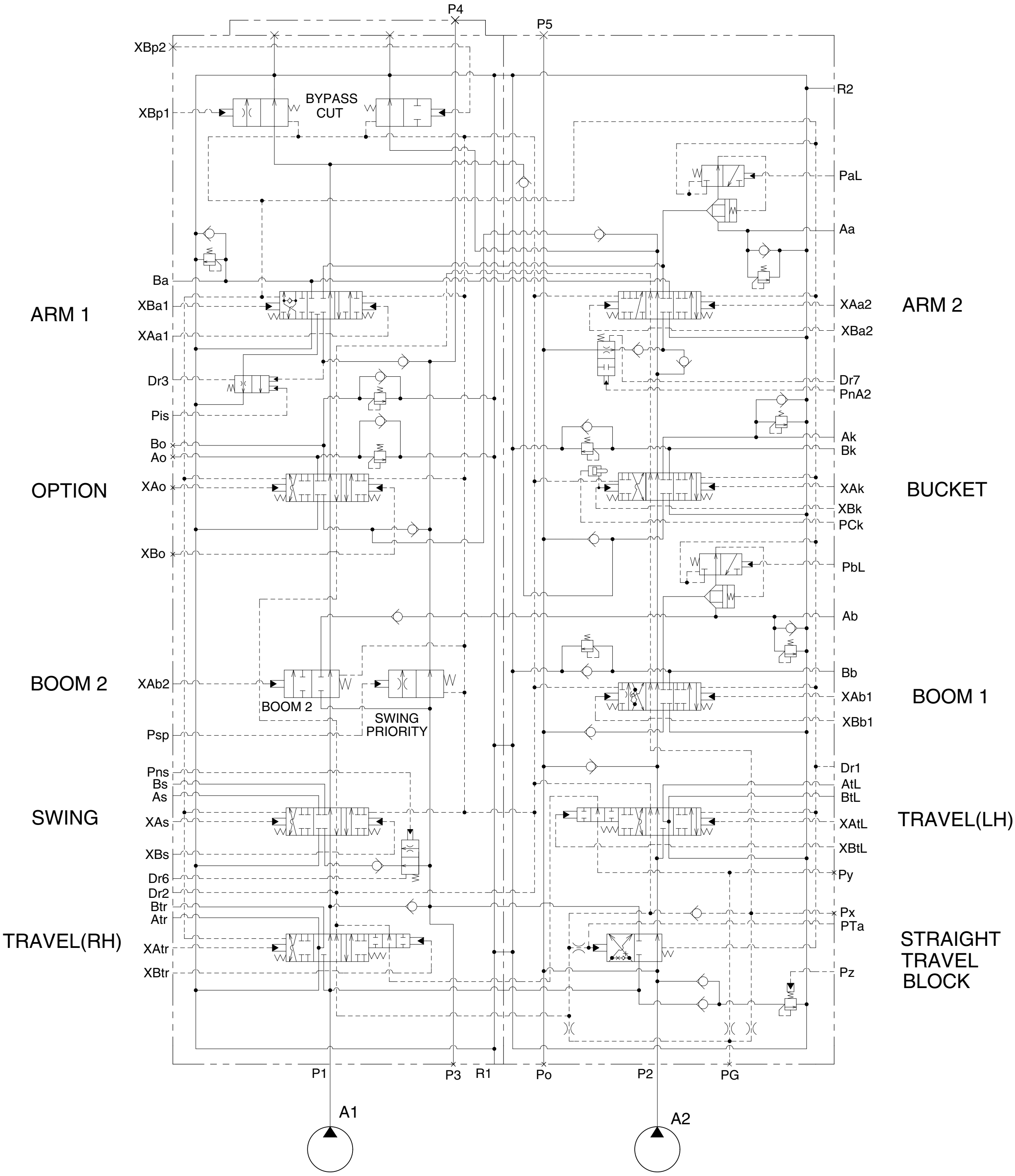
101 Logic poppet
102 Poppet
103 Spring seat
104 Plug
106 Spring
107 Spring

21) ARM REGENERATION CUT SUB ASSY (257)



211	Spool	232	Spring seat	266	O-ring
212	Sleeve	253	Plug	267	O-ring
231	Spring	265	O-ring	268	O-ring

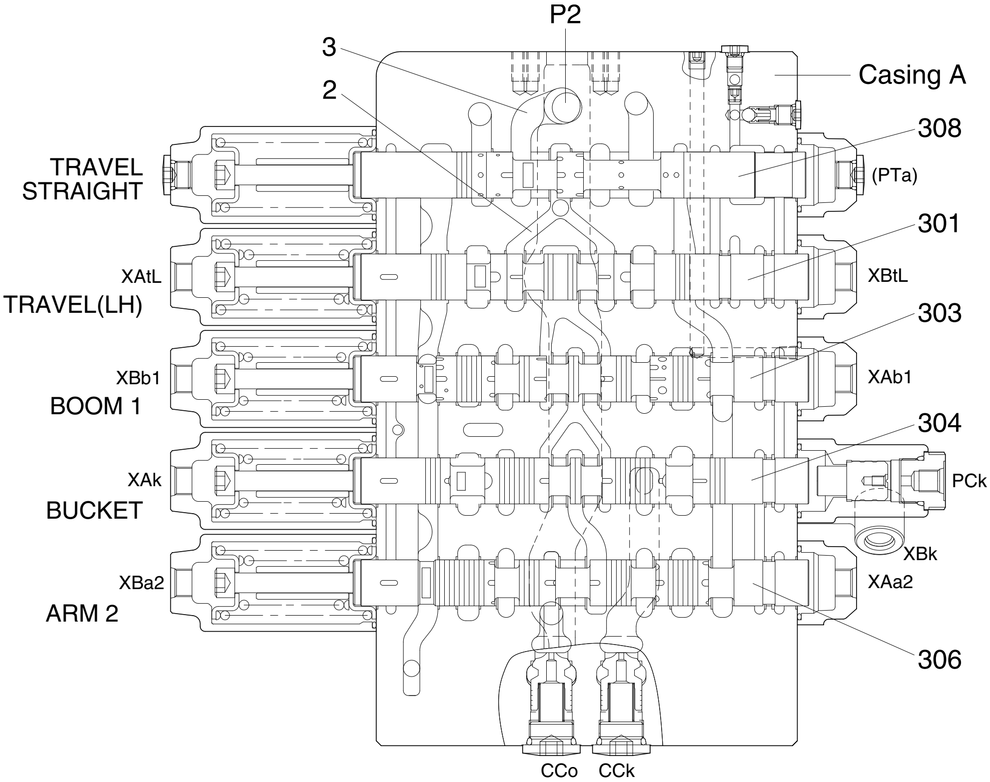
2. HYDRAULIC CIRCUIT



260A2MC12

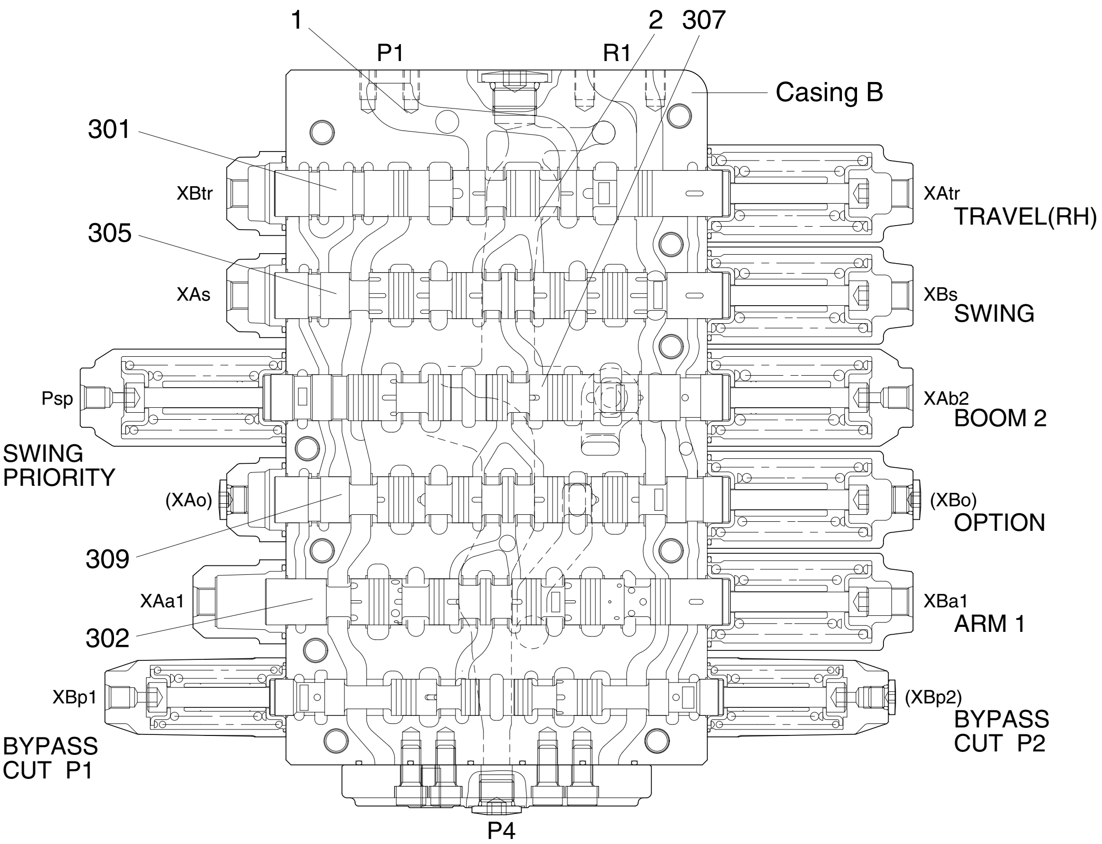
3. FUNCTION

1) CONTROL IN NEUTRAL POSITION



SPOOL SECTION (P2)

260A2MC15



SPOOL SECTION (P1)

260A2MC16

When all spools are in the neutral positions, the pressurized oil discharged from the hydraulic pump (A1) passes through Port P1, the main path (1), the bypass circuit (2) passing the spools for travel right (301), swing (305), boom confluence (boom 2; 307), option (309) and arm 1 (302), and returns to the hydraulic oil tank through the tank port (R1).

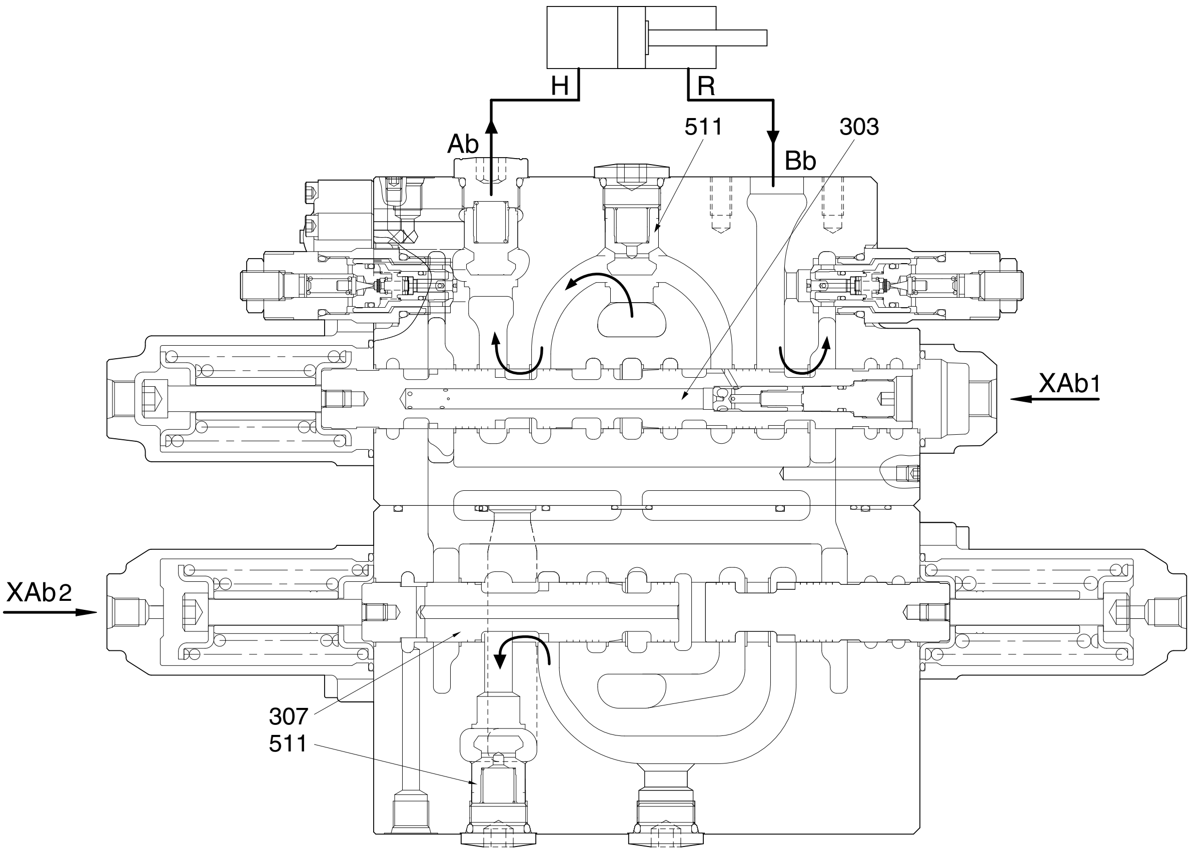
The oil discharged from the hydraulic pump (A2) passes through Port P2, the main path (3), the bypass circuit (2) passing the spools for travel left (301), boom 1 (303), bucket (304) and arm 2 (306), and returns to the hydraulic oil tank through the tank port (R1).

RCV secondary pressure in neutral position of spool is led to electrically controlled regulator and controls the pump discharge flow rate to its minimum value.

2) EACH SPOOL OPERATION

(1) Boom operation

① Boom up operation



Pilot circuit

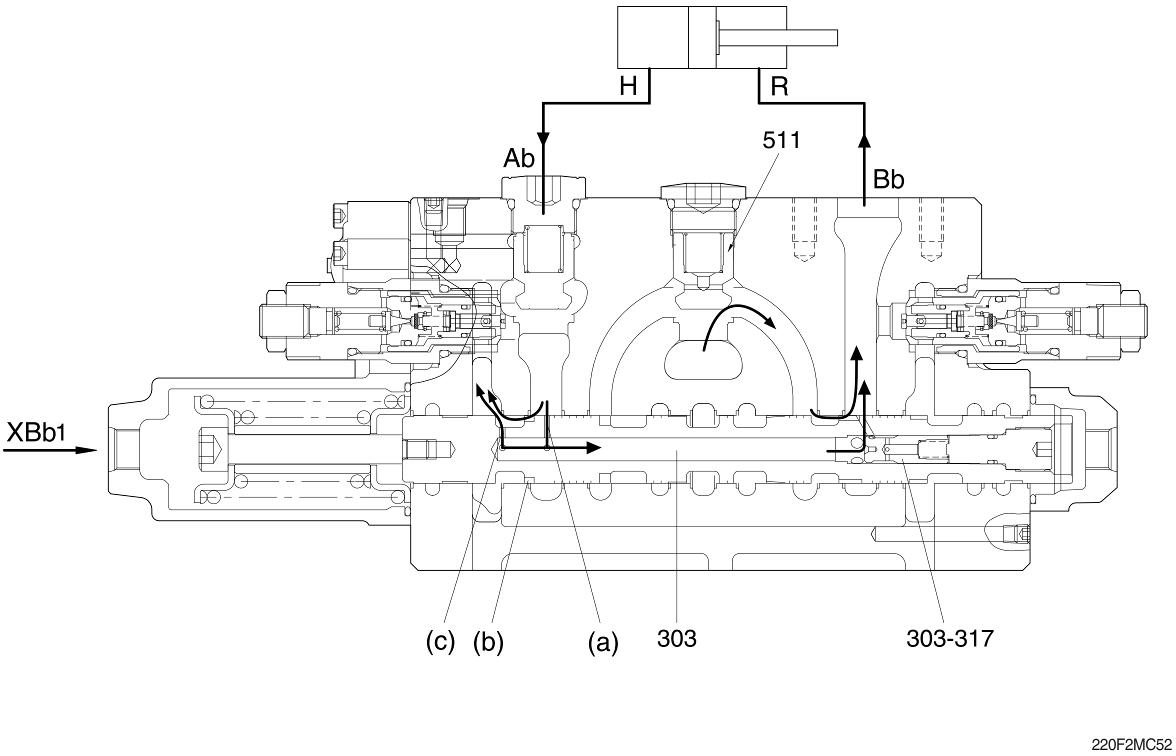
Since the boom 1 spool (303) transfers and shuts off the side-bypass path, the pressure at Port XAb1, XAb2 increases.

Main circuit

During the boom up operation, the pilot pressure enters through Port XAb1 and moves the boom 1 spool (303) in the left direction. The pressurized oil entering through Port P2 passes through the main path (3) and flows to the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the boom 1 spool (303).Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the boom 1 spool (303).
Then, it flows around the periphery of the boom 1 spool (303) to Port Ab, and is supplied to the boom cylinder head side (H).

At the same time, the pilot pressure enters also through Port XAb2 to transfer the boom 2 spool (307) in the right direction. Though the pressurized oil enters into Port P1, the bypass circuit (2) is shut off due to transfer of the boom 2 spool (307). Therefore, the hydraulic oil flows in the parallel circuit and flows through the U-shaped path to the boom 2 spool (307). Then, the hydraulic oil passes through the periphery of the boom 2 spool (307), pushes open the check valve (511), joins into Port Ab in the inside path, and is supplied to the boom cylinder head side. (Boom confluent flow)
On the other hand, the return oil from the boom cylinder rod side (R) enters through Port Bb and returns to the hydraulic oil tank through the tank port (R1).

② Boom down operation



Pilot circuit

Since the boom 1 spool (303) transfers and shuts off the side-bypass path, the pressure at Port XBb1 increases.Then, the pressure enters also through Port PbL and the release signal is sent to the lock valve (252).

Main circuit

During the boom down operation, the pilot pressure enters through Port XBb1 and transfers the boom 1 spool (303) in the right direction.The pressurized oil entering through Port P2 passes through the main path (3) and flows to the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the boom 1 spool (303).Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the boom 1 spool (303).Then, it flows around the periphery of the boom 1 spool (303) to Port Bb and is supplied to the boom cylinder rod side (R).

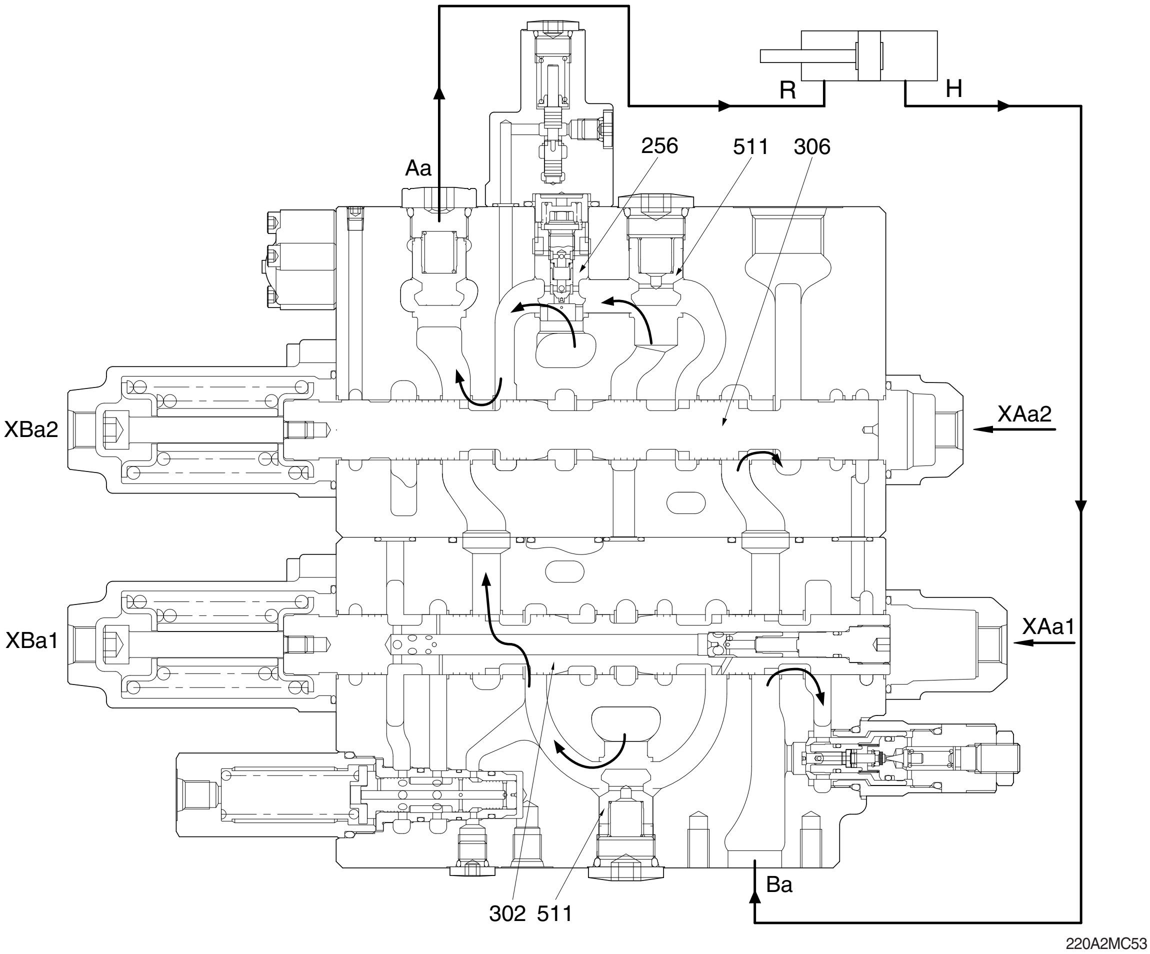
On the other hand, the return oil from the boom cylinder head side (H) passes to the holes (a) and the notches (b) of the boom 1 spool (303).

Since this return oil has a sufficient pressure caused by the weight of the boom, it passes through the path inside the spool, pushes the poppet (303-317) in the spool in the right direction, flows around the outside of the spool.Then, it is supplied again to the boom cylinder rod side as hydraulic oil to lower the boom. (Boom regeneration)

Besides, a part of the return oil from the boom cylinder flows from the hole (c) into the tank.

(2) Arm operation

① Arm out operation



Pilot circuit

Since the arm 2 spool (306) transfers and shuts off the side-bypass path, the pressure at Port XAa1, XAa2 increases.

Main circuit

During the arm out operation, the pilot pressure enters through Ports XAa1 and XAa2.When the pressure enters through Port XAa1 and XAa2, the spools transfer in the left direction.The hydraulic oil entering through Port P1 passes through the main path (1) and flows to the bypass circuit (2), but the bypass circuit is shut off due to transfer of the arm 1 spool (302).

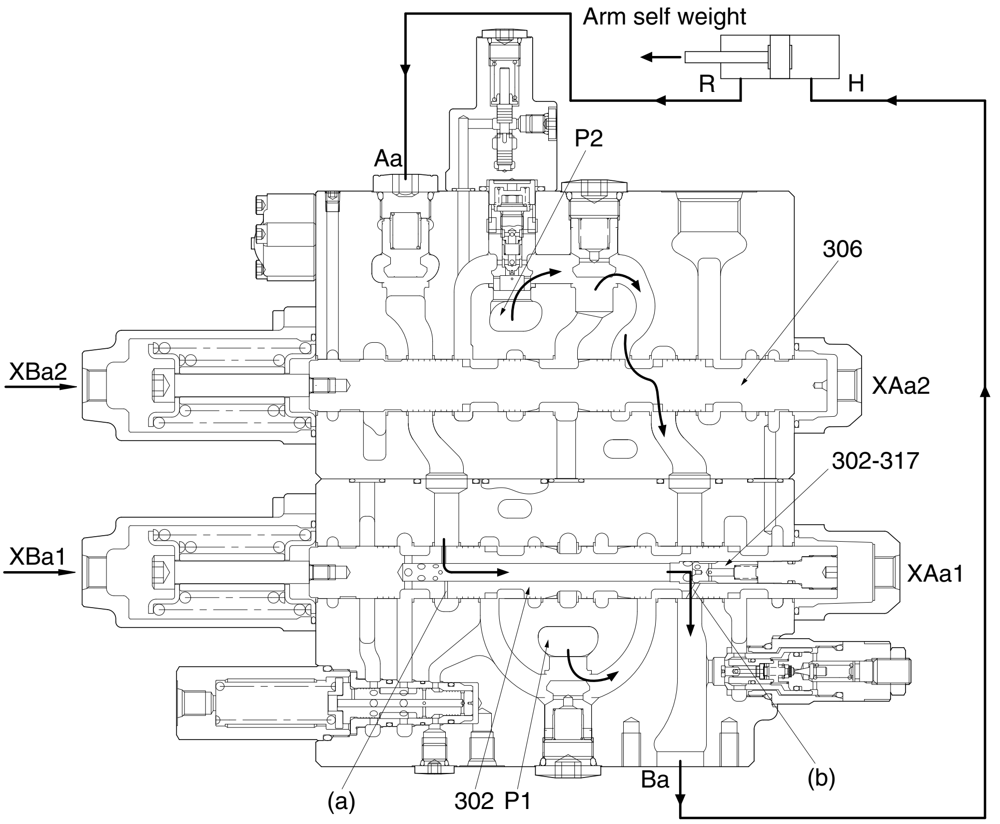
Therefore, the hydraulic oil from the parallel circuit pushes open the check valve (511) and flows through the U-shaped path to the arm 1 spool (302).Then, it flows around the periphery of the arm 1 spool (302) and the arm 2 spool (306) to Port Aa, and is supplied to the arm cylinder rod side (R).

On the other hand, the hydraulic oil entering through Port P2 passes in the main path (3), and flows into the bypass circuit (2), and the bypass circuit is shut off due to transfer of the arm 2 spool (306). The hydraulic oil from the parallel circuit pushes open the logic poppet (256) and the hydraulic oil from the bypass circuit (2) pushes open the check valve (511) and flows through the U-shaped path to the arm 2 spool (306).Then, it flows around the periphery of the arm 2 spool (306) in the inside path and joins into Port Aa.

Besides, the return oil from the arm cylinder head side passes (H) through Port Ba, flows into tank line in arm 1 side and in arm 2 side, and returns to the hydraulic oil tank through the tank port (R1).

② Arm in operation

· During light load only



220A2MC54

Pilot circuit

Since the arm 2 spool (306) transfers and shuts off the side-bypass path, the pressure at Port XBa1, XBa2 increases. Then, the pressure enters also through Port PaL and the release signal is sent to the lock valve (252).

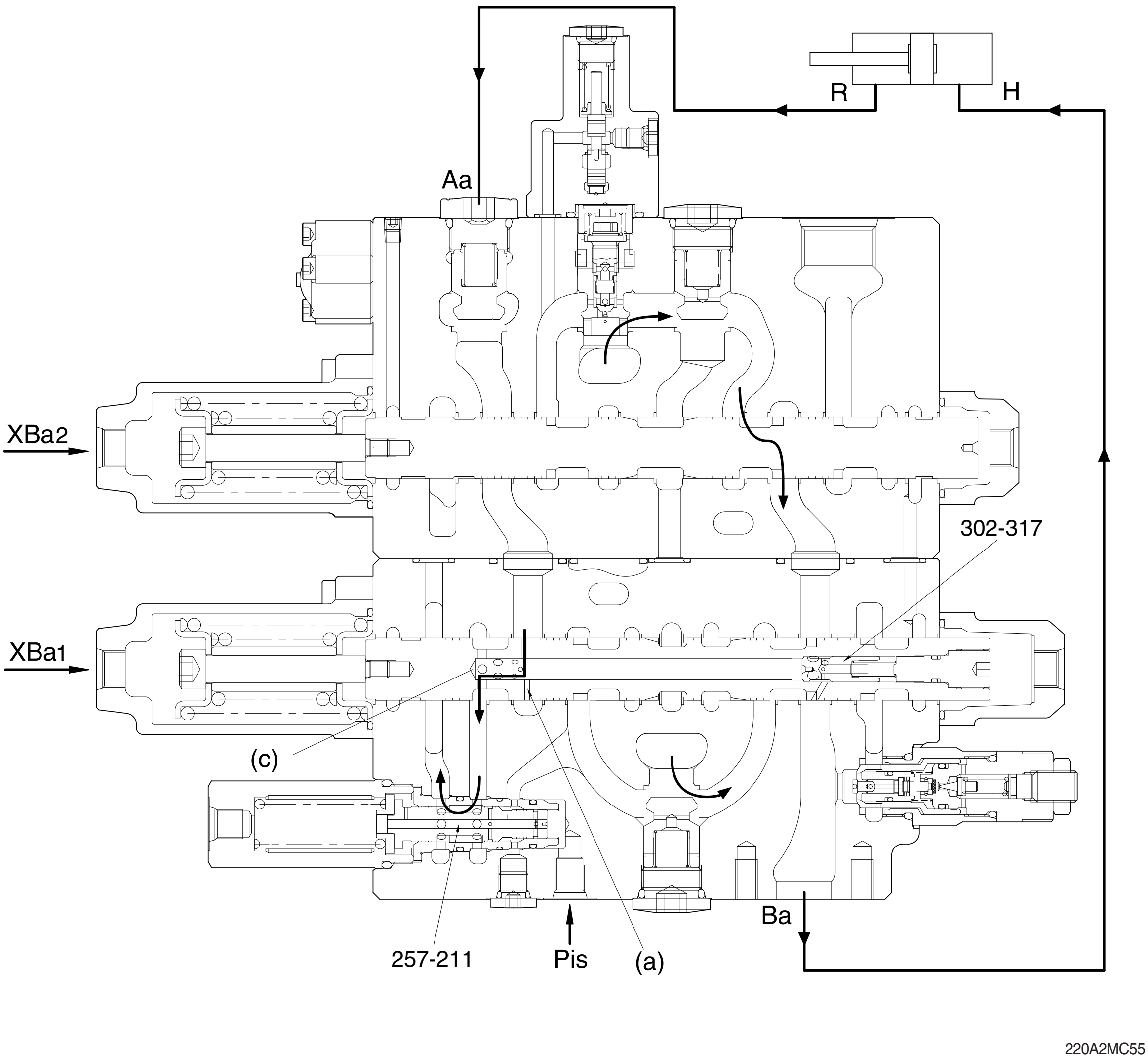
Main circuit

During the arm in operation, the pilot pressure enters through Ports XBa1 and XBa2. When the pressure enters through Port XBa1 and Port XBa2, the spools transfer in the right direction. The hydraulic oil entering through Port P1 passes through the main path (1) and flows to the bypass circuit (2), but the bypass circuit is shut off due to transfer of the arm 1 spool (302).Therefore, the hydraulic oil from the parallel circuit pushes open the check valve (511) and flows through the U-shaped path to the arm 1 spool (302). Then, it flows around the periphery of the arm 1 spool (302) to Port Ba, and is supplied to the arm cylinder head side (H).

On the other hand, the hydraulic oil entering through Port P2 passes in the main path (3), and flows into the bypass circuit (2), and the bypass circuit is shut off due to transfer of the arm 2 spool (306). The hydraulic oil from the parallel circuit pushes open the logic poppet (256) and the hydraulic oil from the bypass circuit (2) pushes open the check valve (511) and flows through the U-shaped path to the arm 2 spool (306). Then, it flows around the periphery of the arm 2 spool (306) and the arm 1 spool (302) in the inside path and joins into Port Ba.

Besides, the return oil from the arm cylinder rod side (R) is pressurized by self-weight of the arms and so on, and returns to Port Aa. The pressurized oil returning to Port Aa enters into the spool through the periphery hole (a) of the arm 1 spool (302).During a light load only, it pushes open the check valve (302-317) and joins into Port Ba from the spool hole (b).The rest of oil returns to the hydraulic oil tank through the tank port (R1).This is called the arm regeneration function.

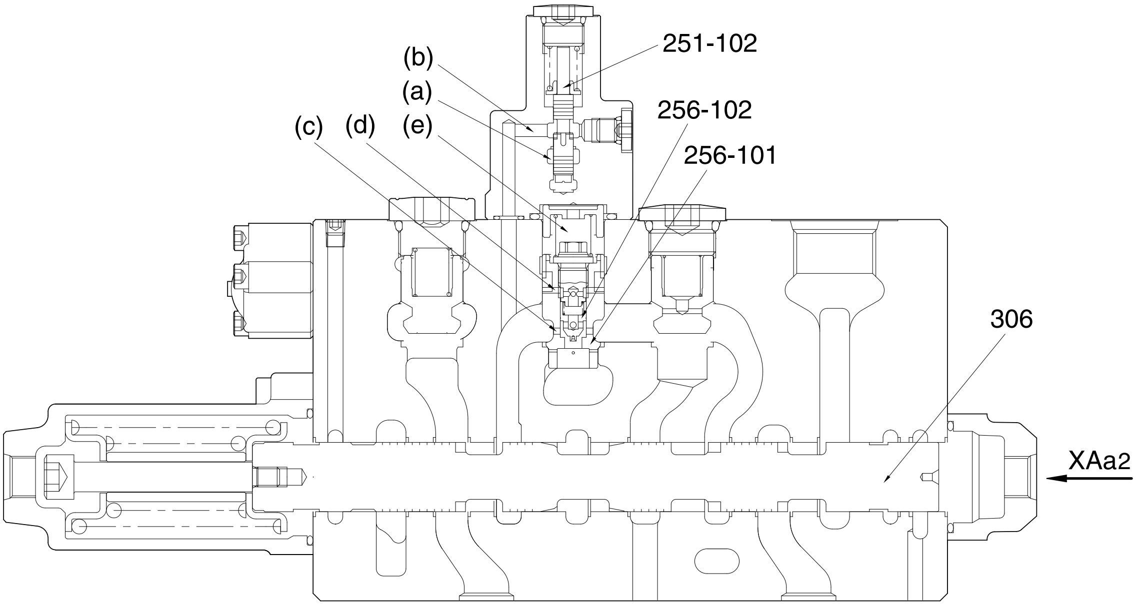
· The pressure in the arm cylinder head side (H) increases



When the pressure in the arm cylinder head side (H) and the U-shaped path increases, the arm regeneration cut spool (257-211) is transferred in the left direction, and at the same time the check valve (302-317) is closed by its backpressure. This shuts off the arm regeneration function, and the return oil from the arm cylinder rod side (R) enters from Port Aa through the periphery hole (a) of the arm 1 spool (302) into the spool, flows to the arm regeneration cut valve (257) through the periphery hole (c) of the arm 1 spool (302), and returns through the tank port (R1) to the hydraulic oil tank.

When the Pilot Port Pis of the arm regeneration cut spool (257-211) is pressurized, a part of the return oil from the arm cylinder rod side flows to the arm regeneration cut valve (257) and returns through the tank port (R1) to the hydraulic oil tank. (Variable arm regeneration)

③ Arm 2 logic control valve operation



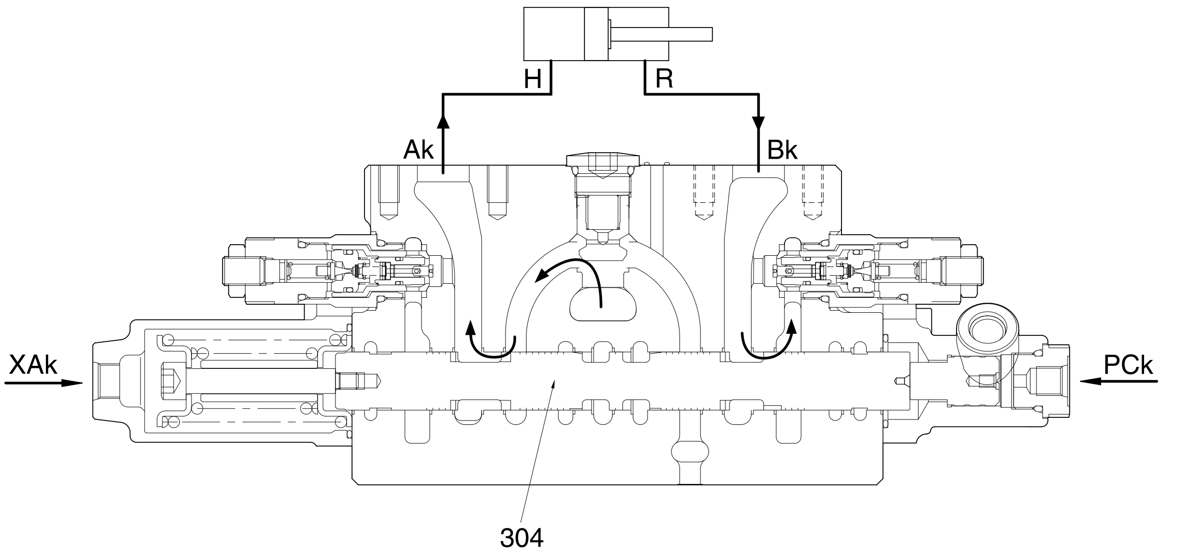
220A2MC116

During both the arm in operation and the boom up operation, the pilot pressure enters through Ports XBa1, XBa2, XAb1, XAb2, PaL and electrically controlled pilot pressure enters to PnA2. The pressure PnA2 transfers the spool (251-102) in the arm 2 logic control valve to the top direction, and the path from (a) to (b) is closed. Hereby, the pressurized oil pushes open the poppet (256-102), passes in the path (c) and (d), enters into the chamber (e), and the poppet (256-101) is pushed to the casing seat. Therefore, the most of pressurized oil entering through Port P2 flows to the boom 1 spool (303) than the arm 2 spool (306) to make the boom hoisting operation most preferential.

On the other hand, in the independent arm in operation, the pilot pressure does not enter through Ports PnA2, and the path from (a) to (b) is not closed, and the hydraulic oil of the chamber (e) flows to the path (a) and (b). The pressurized oil entering through Port P2 pushes open the poppet (256-101) and flows to the arm 2 spool (306).

(3) Bucket operation

① Bucket in operation



Pilot circuit

Since the bucket spool (304) transfers and shuts off the side-bypass path, the pressure at Port XAk increases. Then, the pressure enters also through Port XBp1.

Main circuit

During the bucket in operation, the pilot pressure enters through Port XAk and transfers the bucket spool (304) in the right direction.The pressurized oil entering through Port P2 passes through the main path (3) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the bucket spool (304).Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the bucket spool (304). Then, it flows through the periphery of the spool to Port Ak and is supplied to the bucket cylinder head side (H).

On the other hand, the return oil from the bucket cylinder rod side (R) enters through Port Bk, passes around the periphery of the spool, and returns to the hydraulic oil tank through the tank port (R1).

During both the boom up operation and bucket in operation, the pilot pressure enters through Port PCk and the bucket spool transfers in the half stroke not full stroke. Therefore, the most of pressurized oil entering through Port P2 flows to the boom 1 spool (303) than the bucket spool (304) to make the boom up operation most preferential.

② Bucket out operation

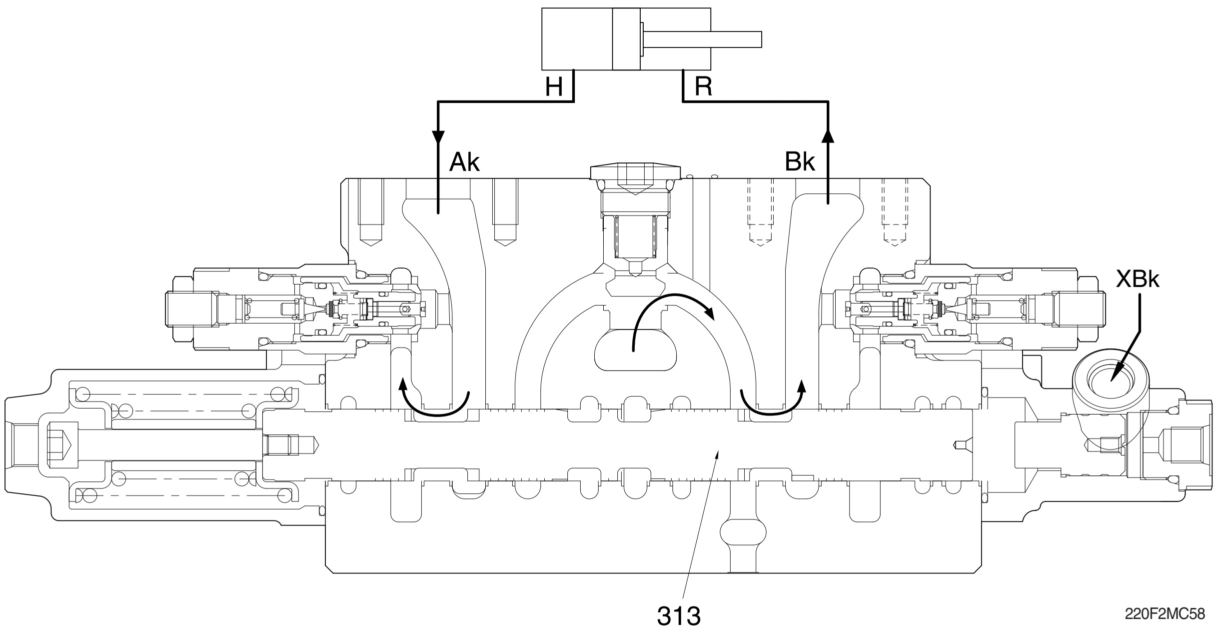
Pilot circuit

Since the bucket spool (304) transfers and shuts off the side-bypass path, the pressure at Port XBk increases. Then, the pressure enters also through Port XBp1.

Main circuit

During the bucket out operation, the pilot pressure enters through Port XBk and transfers the bucket spool (304) in the left direction.The pressurized oil entering through Port P2 passes through the main path (3) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the bucket spool (304). Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the bucket spool (304).Then, it flows through the periphery of the spool to Port Bk and is supplied to the bucket cylinder rod side (R).

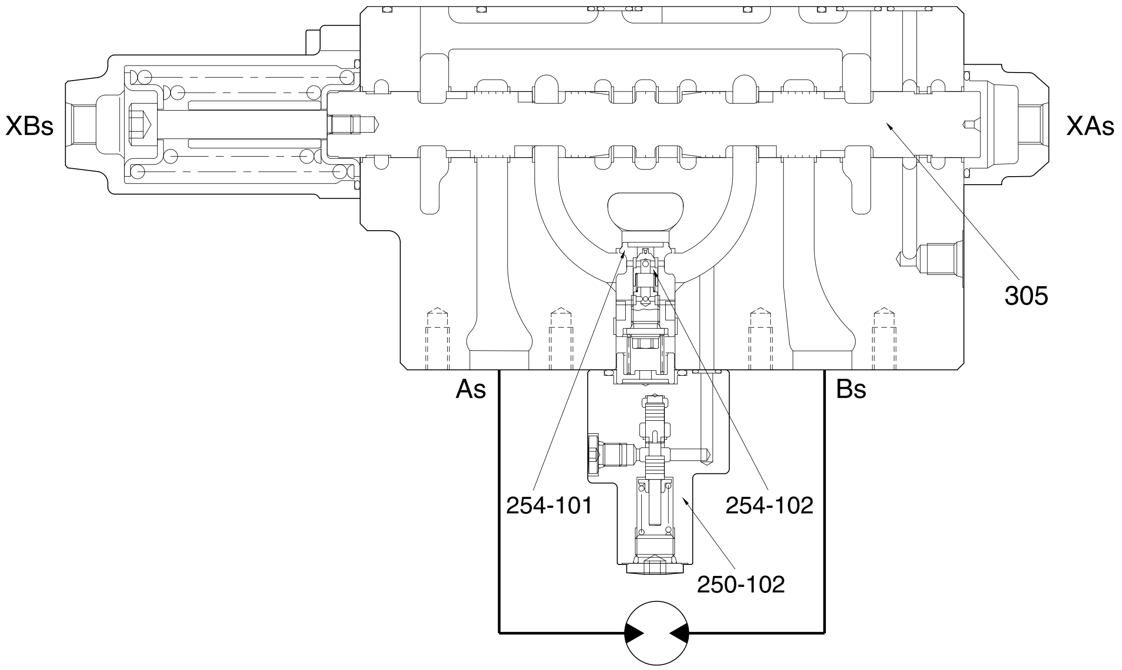
On the other hand, the return oil from the bucket cylinder head side (H) enters through Port Ak, passes around the periphery of the spool, and returns to the hydraulic oil tank through the tank port (R1).



③ Bucket in/out confluence

During the bucket in/out operation, the pilot pressure enters also through Port XBp1 and transfers the bypass-cut spool (313). The pressurized oil entering through Port P1 passes through the main path (1) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the bypass-cut spool (313). Therefore, the pressurized oil pushes open the check valve CCk (514), and flows through inside path and the U-shaped path to the bucket spool (304).

(4) Swing operation



① Swing operation

Pilot circuit

Since the swing spool (305) transfers and shuts off the side-bypass path, the pressure at Port XAs (or Xbs) increases.

Main circuit

During the swing operation, the pilot pressure enters through Port XAs (or XBs) and transfers the swing spool (305). The pressurized oil entering through Port P1 passes through the main path (1) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the swing spool (305). Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the swing spool (305). Then, it flows through the periphery of the spool to Port As (or Bs) and is supplied to the swing motor.

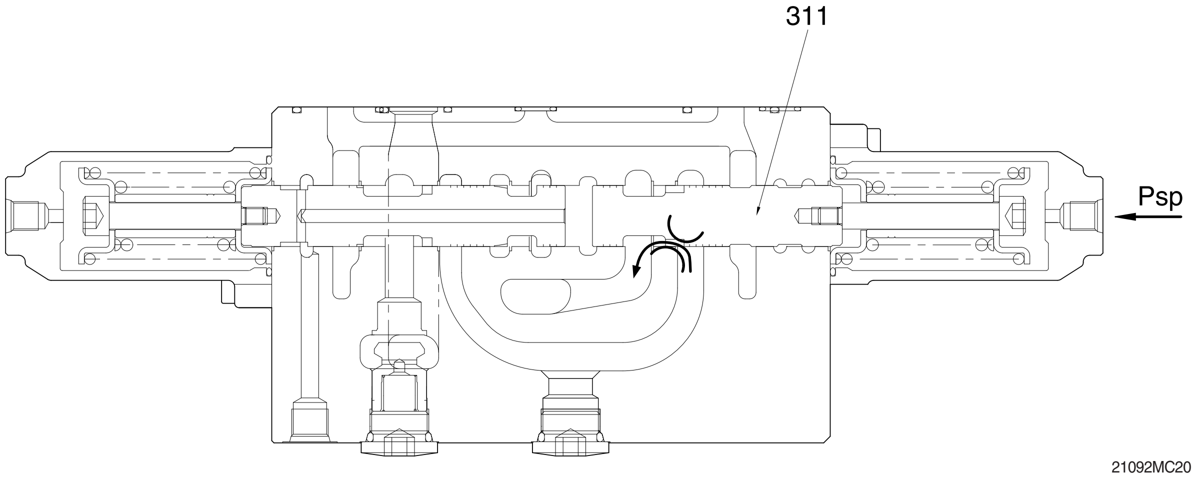
On the other hand, the return oil from the swing motor enters Port Bs (or As) and returns to the hydraulic oil tank through the tank port (R1).

② Swing logic control valve operation

During both the swing operation and the boom up operation, the pilot pressure enters through Ports XBs (or XAs), XAb1, XAb2 and electrically controlled pilot pressure enters to PnA2. The pressure Pns transfers the spool (250-102) in swing logic control valve. Hereby, the pressurized oil pushes open the poppet (254-102), and the poppet (254-101) is pushed to the casing seat. Therefore, the most of pressurized oil entering through Port P1 flows to the boom 2 spool (307) than the swing spool (305) to make the boom up operation most preferential.

On the other hand, in the independent swing operation, the pilot pressure does not enter through Ports Pns. The pressurized oil entering through Port P1 pushes open the poppet (254-101) and flows to the swing spool (305).

③ Swing operation preference function



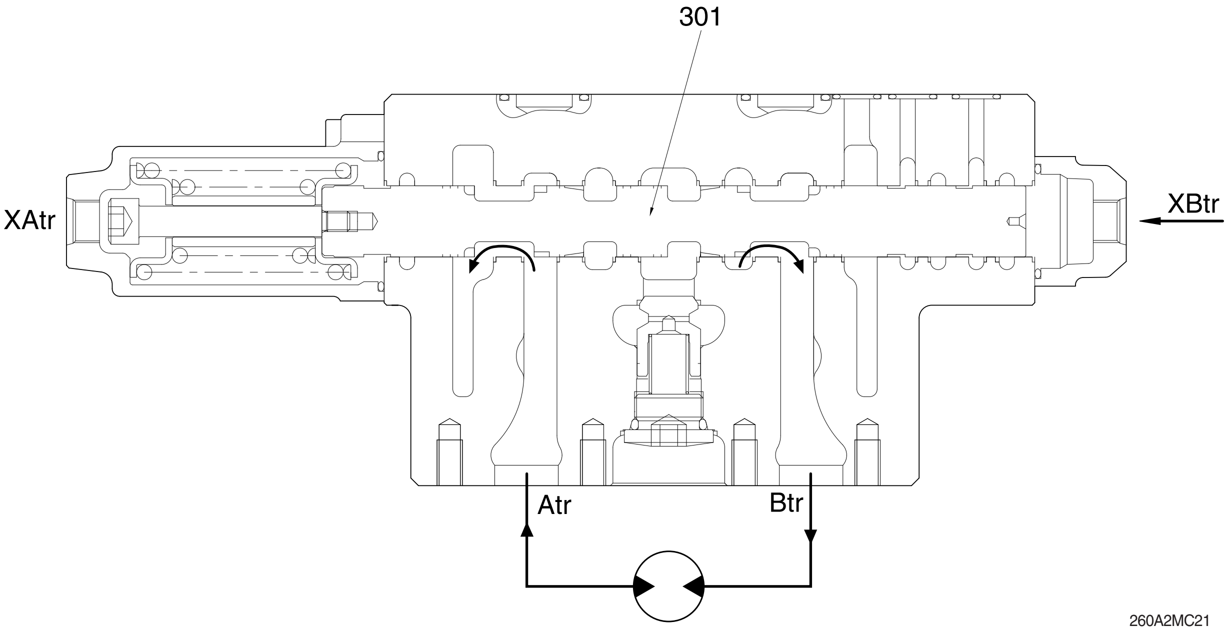
Pilot circuit

The pilot pressure enters through Port Psp to transfer the swing priority spool (311).

Main circuit

Due to transfer of the swing priority spool (311), the open area of the swing priority spool decreases, and the most of the pressurized oil entering through Port P1 flows to the swing side to make the swing operation most preferential.

(5) Travel operation



Pilot circuit

Since any of the travel spools (301) on the left or right transfers and shuts off the side-bypass path, the pressure at Port XBtr (or XAtr) increases.

Main circuit

When Pilot Port XBtr of the travel right spool (301) is pressurized, the bypass circuit (2) in the arm 1 side is shut off and the working fluid discharged from the hydraulic pump (A1) through Port Btr and flows to the travel right motor.

When Pilot Port XBtL of the travel left spool (301) is pressurized, the bypass circuit (2) in the boom 1 side is shut off and the working fluid discharged from the hydraulic pump (A2), similarly to that from the hydraulic pump (A1), through Port BtL and flows to the travel left motor.

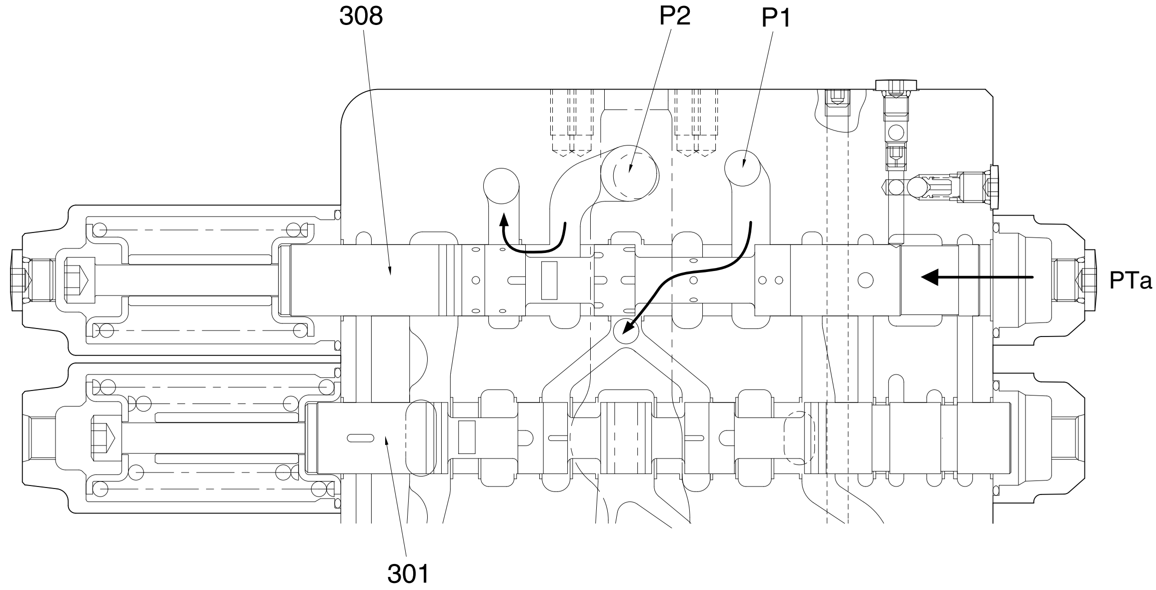
On the other hand, the return oil from the right and left travel motor passes flows from Port Atr (AtL) to the travel right (left) spools (301) and returns to the hydraulic oil tank through the tank port (R1). In the case of the opposite operation (when the pilot pressure is applied to Ports XAtr and XAtL of the control valve), the operation is similar.

(6) Travel straight operation

Simultaneous operating of both travel spools (301) and other spool.

The following the case that both travel spools (301) and swing spool (305) are changed over.

(When the pilot Ports XAtL, XAtr and XAs are pressurized.)



Pilot circuit

Since the side bypass sections of both travel spools (301) close and the side bypass section of the downstream-side swing closes, the pilot pressure from the port PG enters through the port PTa to transfer the travel straight spool (308).

Main circuit

After changeover of the travel straight spool (308), the port P1 and both travel spools (301) are connected preferentially and the port P2 and the parallel paths of swing, boom 2, option and arm 1 / boom 1, bucket and arm 2 are connected preferentially. Therefore, the pressurized oil entering through Port P1 passes through mainly ports AtL and Atr, and flows to both travel motors separately.

On the other hand, the pressurized oil entering through Port P2 flows to Port As and is supplied to the swing motor.

When the pressure of Port P1 is lower than the pressure of Port P2, the part of oil entering through Port P2 flows into Port P1 side. Therefore, it prevents the travel velocity from slowing rapidly.

3) FUNCTION OF LOCK VALVE

The lock valve (252) is fitted between the arm cylinder rod side (R) and the arm 2 spool (306). It decreases the leakage by the pressure of the cylinder.

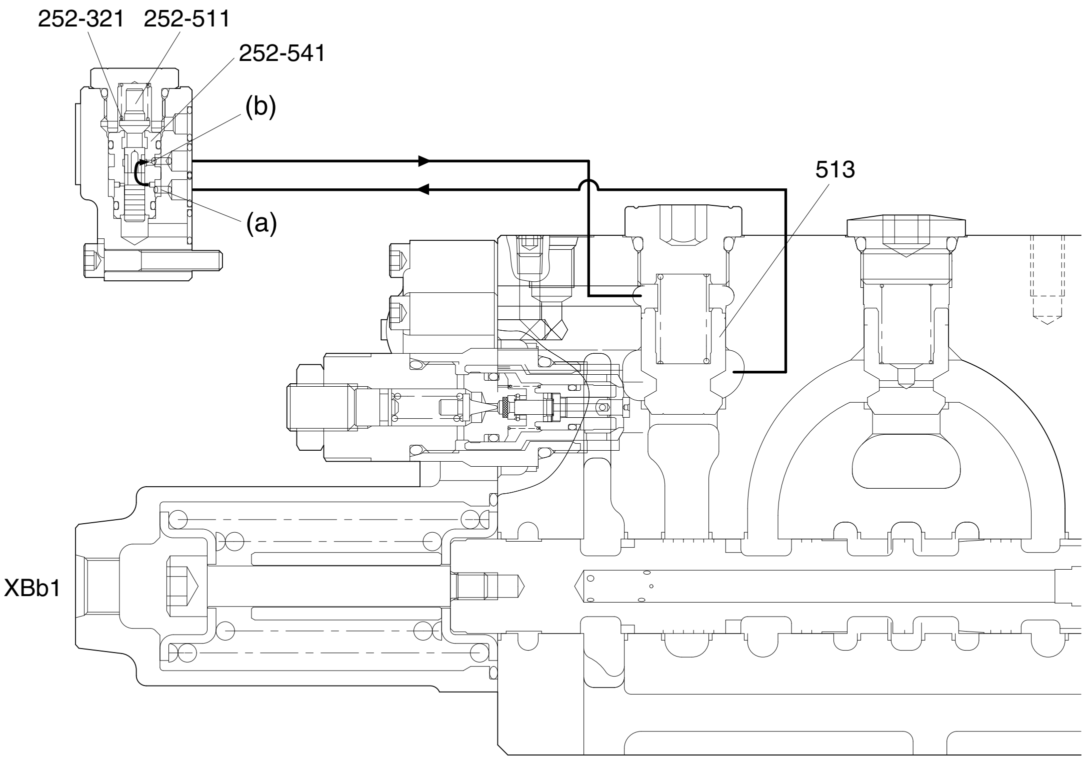
Another lock valve (252) is similarly fitted between the boom cylinder head side (H) and the boom 1 spool (303). It decreases the leakage by the pressure of the cylinder.

(1) Neutral positions of spools

The following is the case of the boom 1 spool (303).(The case of the arm 2 spool (306) is in the same way.)

During the boom 1 spool (303) is in the neutral position, the lock valve (252) is kept in the position shown in figure.The spool (252-511) in the lock valve is pushed to the seat of the sleeve (252-541) by the force of the spring (252-321).

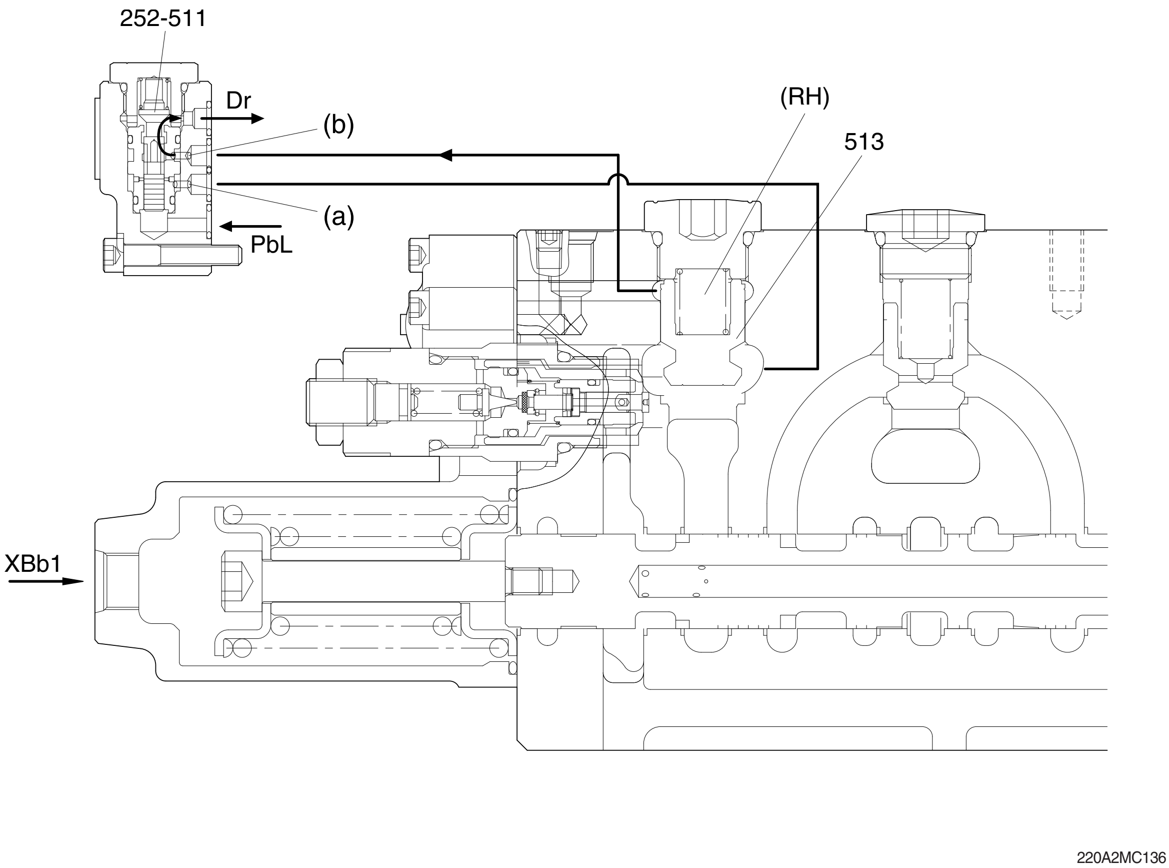
In this position, the pressurized oil from the boom cylinder head side (H) enters through the hole (a), the periphery of the spool (252-511) in the lock valve and the hole (b), and it pushes the poppet (513) to the casing seat, and the leakage is decreased.



220A2MC135

(2) Boom down operation

During the boom down operation, the pilot pressure enters through Port PbL and XBb1. The pilot pressure transfers the spool (252-511) in the lock valve assy in the top direction. By the transfer of the spool (252-511), firstly the hole (a) is blocked and the flow of oil from the boom cylinder head side (H) to the spring chamber (RH) stops. Secondly, the oil in the spring chamber (RH) enters through the hole (b) and flows to drain circuit. Therefore, the poppet (513) is lifted by the pressure of the boom cylinder head side (H) and the function of the lock valve (252) is released.



(3) Boom up operation

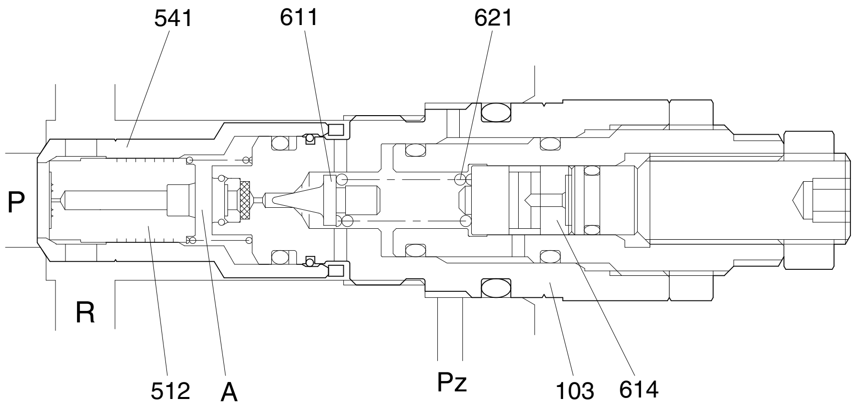
During the boom up operation, the pilot pressure enters through Port XAb1. The oil flowing from the boom 1 spool pushes open the poppet (513) and flows to Port Ab.

4) CIRCUIT PRESSURE PROTECTION

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

(1) Main relief valve

The main relief valve is fitted in the P2 housing and functions as follows.



21092MC25

① The hydraulic oil is filled up in the inside space chamber (A) from the path (P) through a hole of the seat (541) and a restriction of the plunger (512), and seats the plunger (512) against the seat (541) securely.

② When the pressure in the path (P) becomes equal to the set load of the spring (621), the poppet (611) opens to make the hydraulic oil flow through a hole of the plug (103), around the poppet (611) and the hydraulic oil flow into the low pressure path (R).

③ Opening of the poppet (611) causes the pressure in the chamber (A) to fall and the plunger (512) to open. As the result the pressurized oil in the path (P) runs into the low pressure path (R) directly.

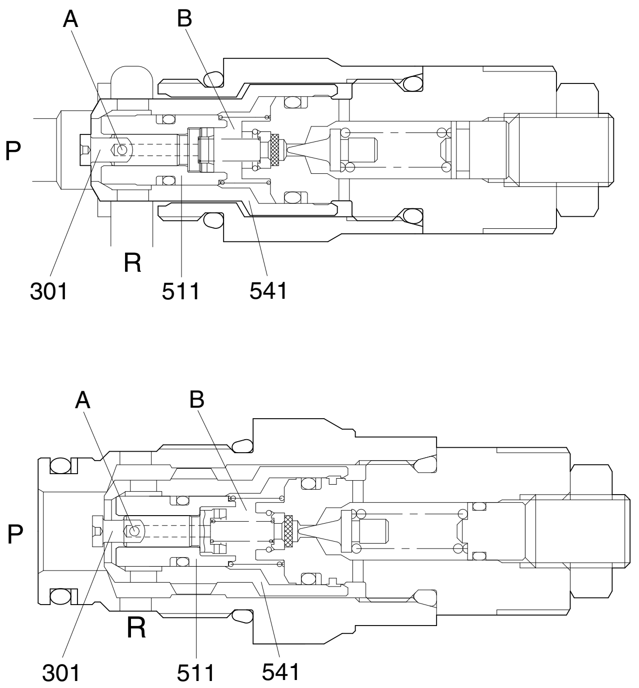
④ When the pressurized oil over 30 kgf/cm^2 enters through the port Pz, it pushes the piston (614), changes the relief set pressure of the spring (621) to the high pressure.

(2) Port relief valve

The port relief valve is fitted between the cylinder port and low-pressure path. In addition to the relief valve, it has the function of an anti-cavitation check valve, and functions as follows:

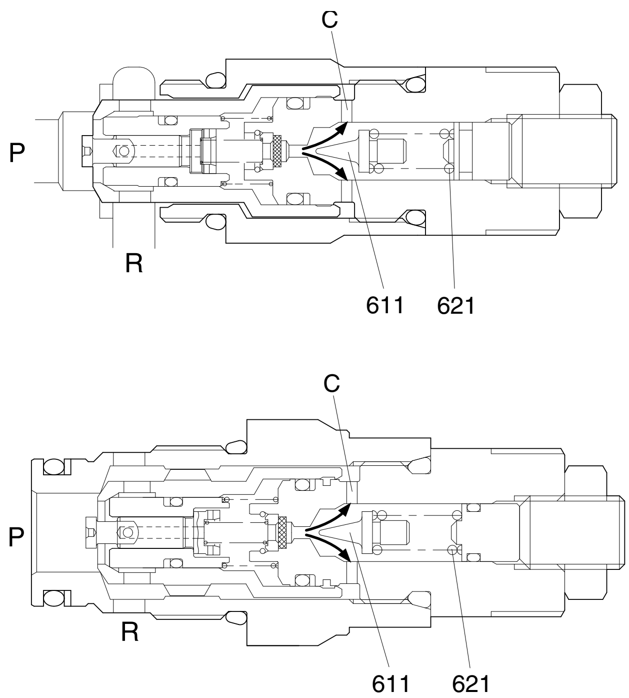
① Function as relief valve

a. The pressurized oil passes through Hole A of the piston (301), fills Chamber B, and seat the plunger (511) against the seat (541) securely.



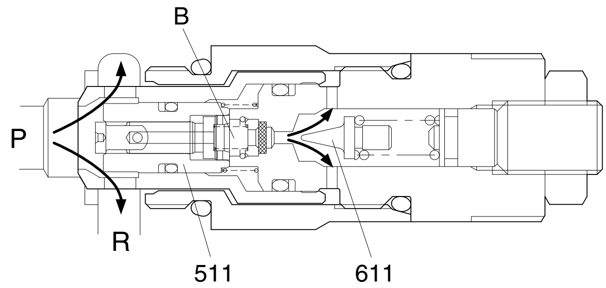
220F2MC66

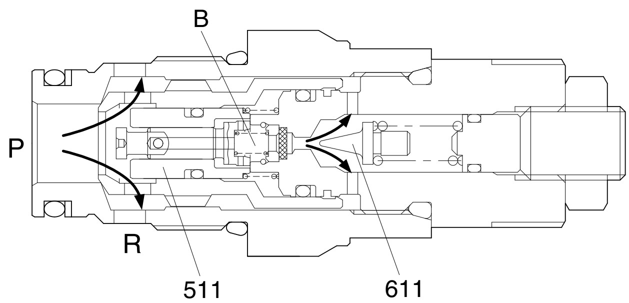
b. When the pressure in the path (P) exceeds the set pressure of the spring (621 or 622), the pressurized oil pushes open the poppet (611), flows around it, and flows to the low pressure path (R) through hole C.



220F2MC67

c. Opening of the poppet (611) causes the pressure in Chamber B to fall and the plunger (511) to open.As the result the pressurized oil in the path (P) runs into the low pressure path (R) directly.

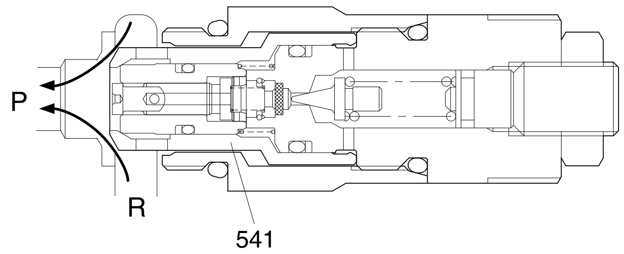


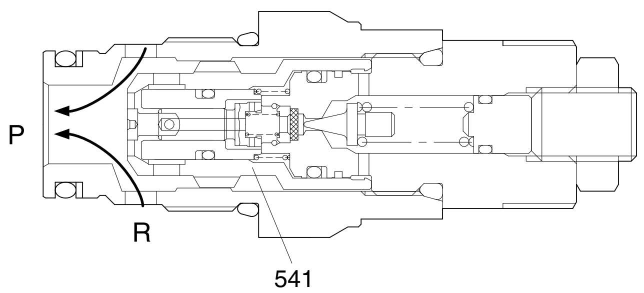


220F2MC68

② Function as Anti-Cavitation Check Valve

When any negative pressure exists in the path (P), the oil is supplied through the path (R). When the pressure at the path (R) exceeds it in the path (P), the seat (541) moves in the right direction. Then, sufficient oil passes from the path (R) to the path (P) around the seat (541) and prevents cavitation.





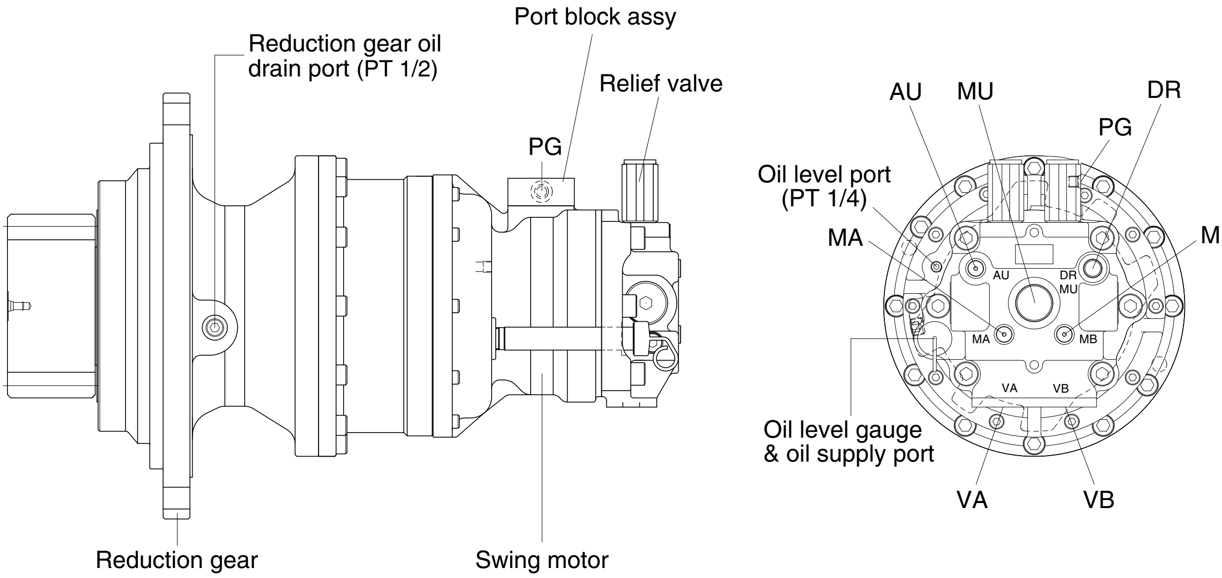
220F2MC69

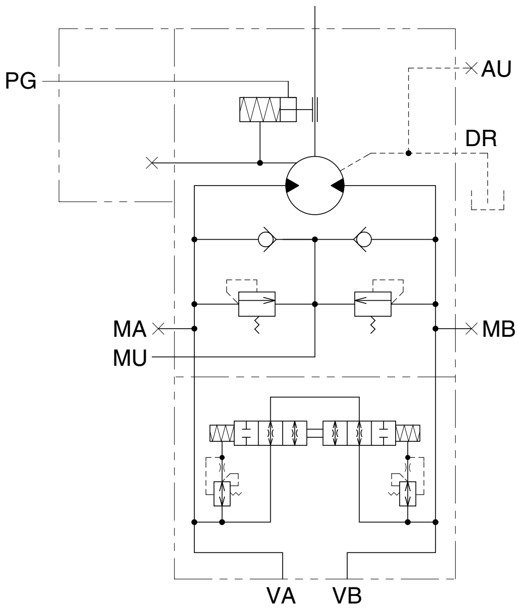
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

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



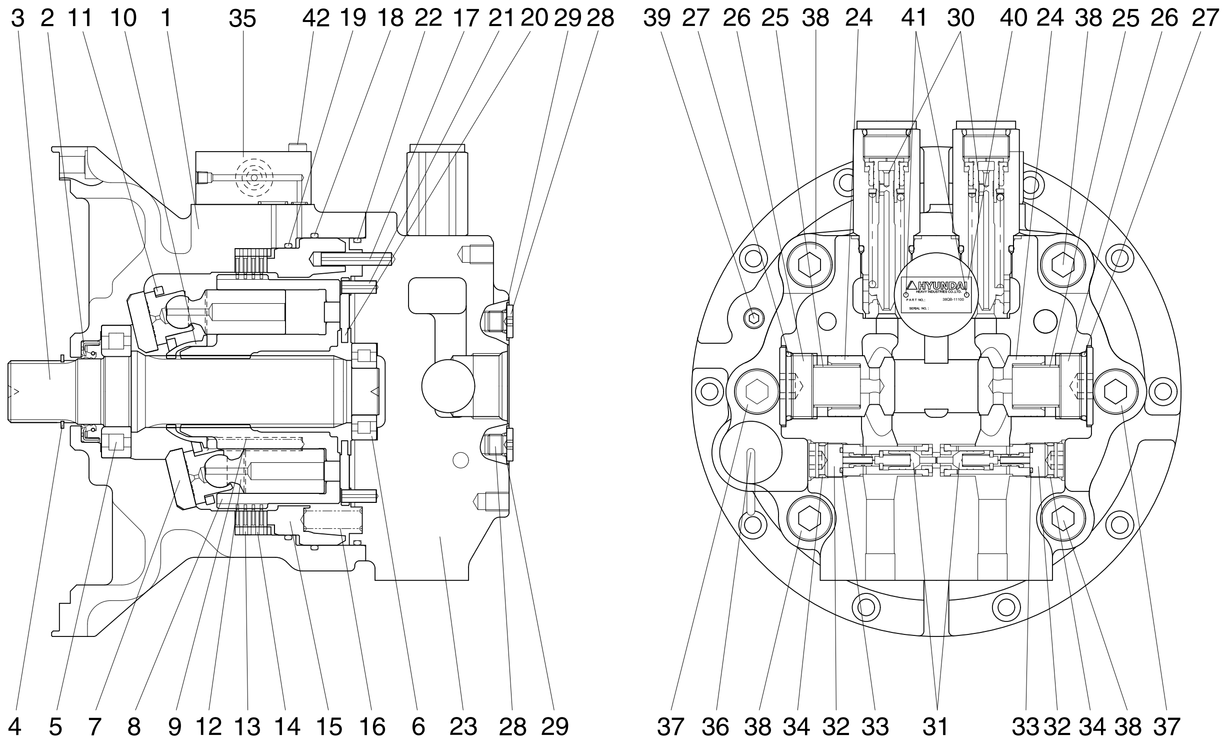


Hydraulic circuit

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

260A2SM01

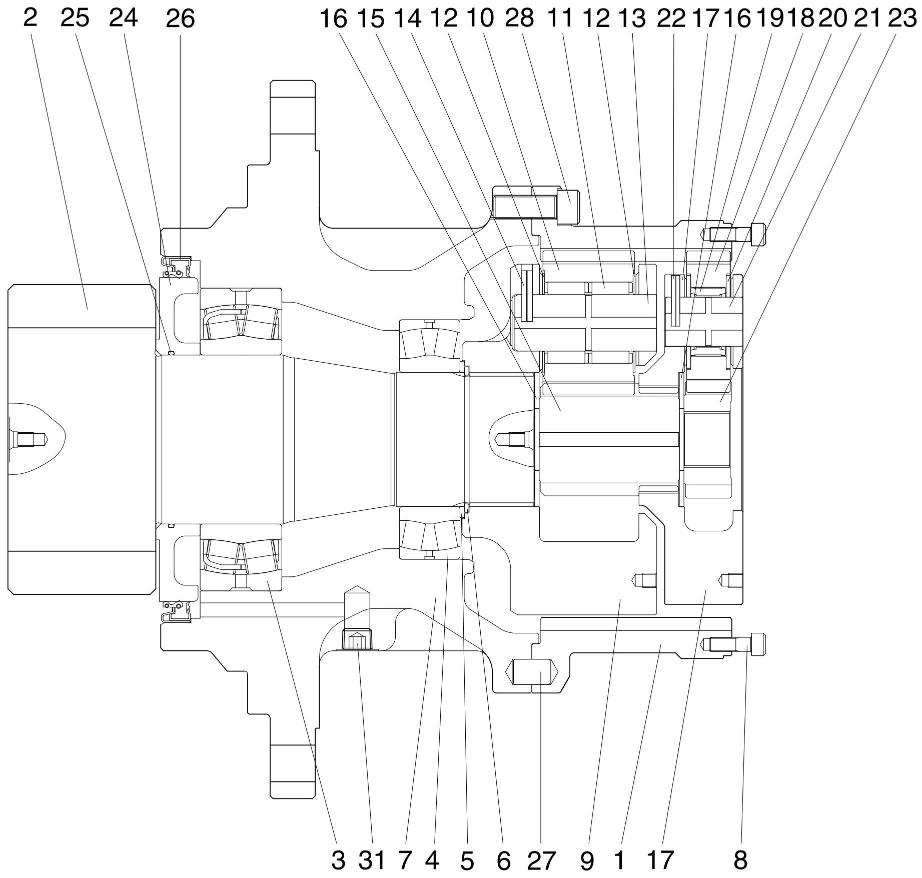
1) SWING MOTOR



260A2SM02

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

2) REDUCTION GEAR



260L2SM03

1	Ring gear	11	Needle bearing 2	21	Carrier pin 1
2	Drive shaft	12	Thrust washer 2	22	Spring pin 1
3	Roller bearing	13	Carrier pin 2	23	Sun gear 1
4	Roller bearing	14	Spring pin	24	Sleeve
5	Thrust plate	15	Sun gear 2	25	O-ring
6	Retainer ring	16	Thrust plate	26	Oil seal
7	Casing	17	Carrier 1	27	Parallel pin
8	Socket bolt	18	Planetary gear 1	28	Socket bolt
9	Carrier 2	19	Needle bearing 1	31	Socket plug
10	Planetary gear 2	20	Thrust washer 1		

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (8) through valve casing of motor (23), 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).

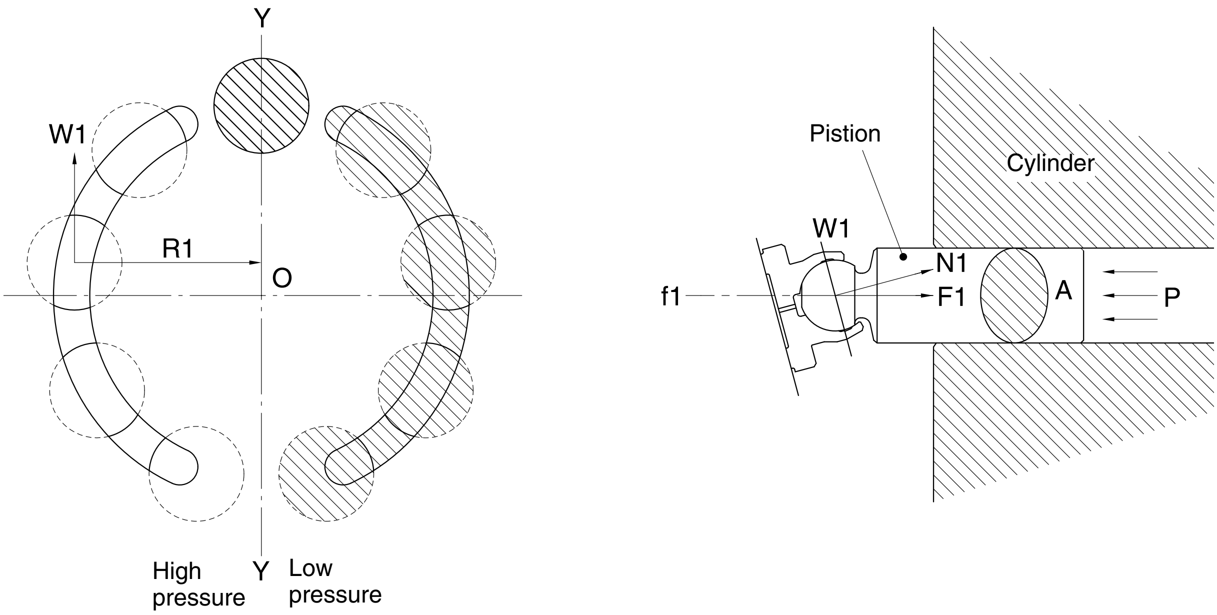
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

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

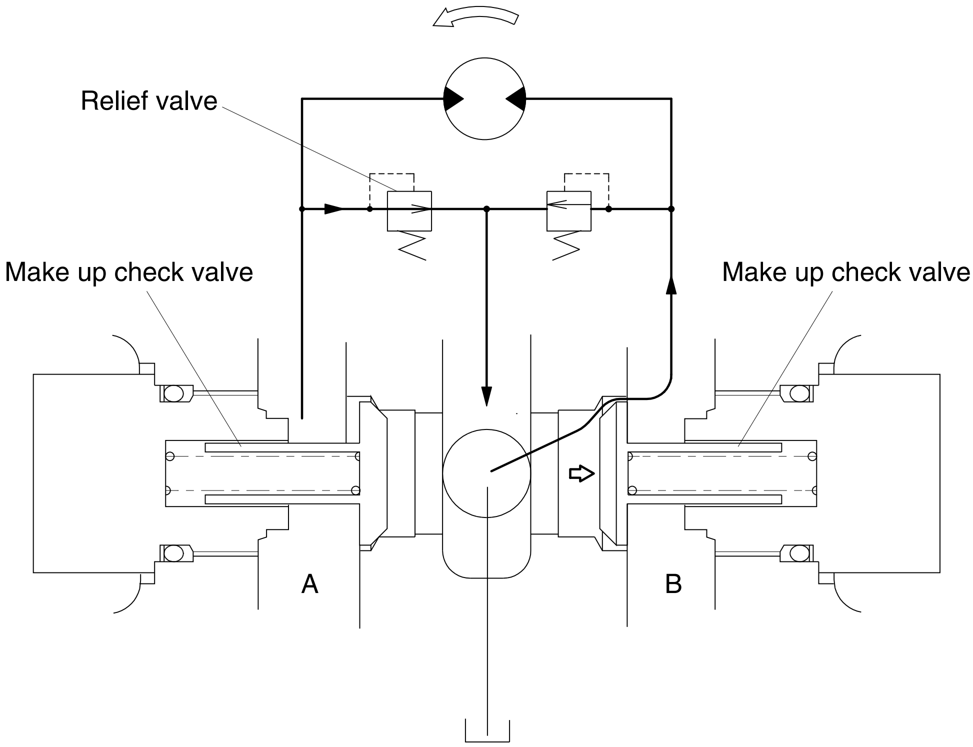
2) MAKE UP VALVE

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.

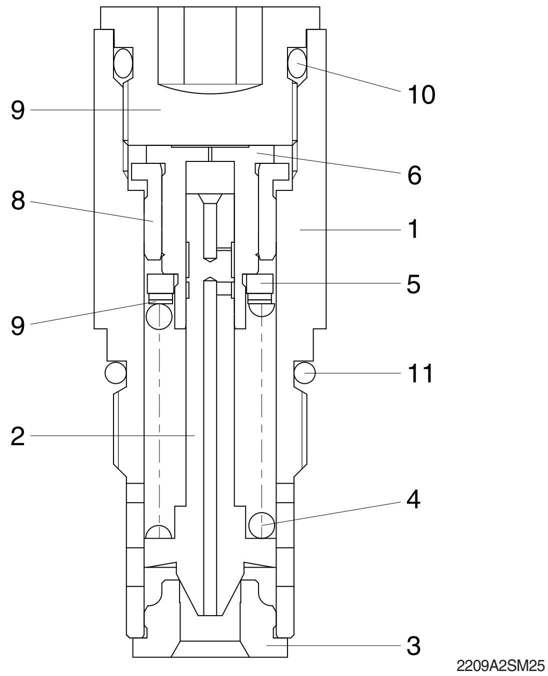
Pressurized oil into the port B, the motor rotate counterclockwise.

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



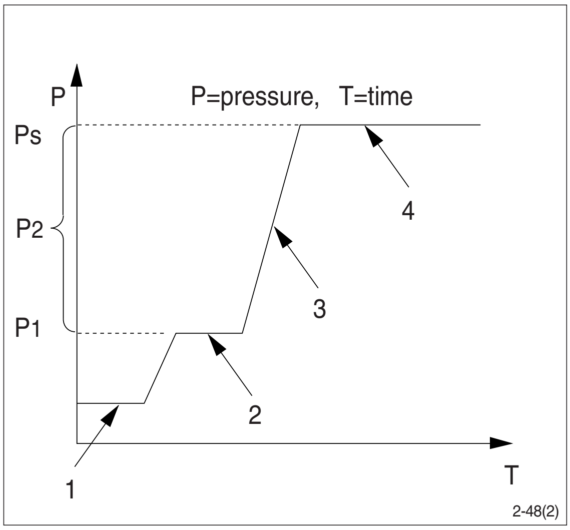
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(1) Construction of relief valve

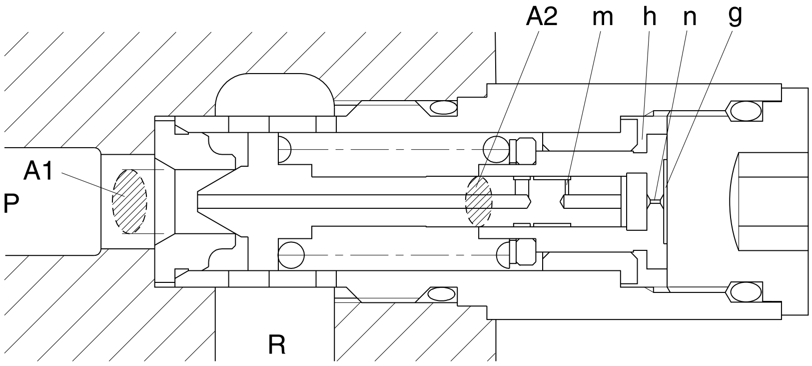
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(2) Function of relief valve

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



① Ports (P,R) at tank pressure.

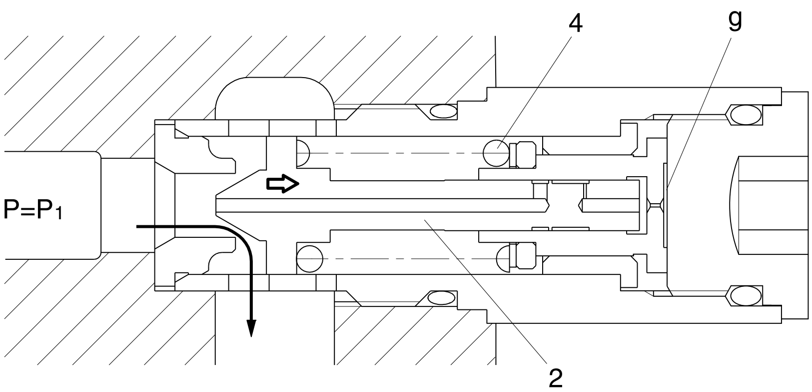


2209A2SM26

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

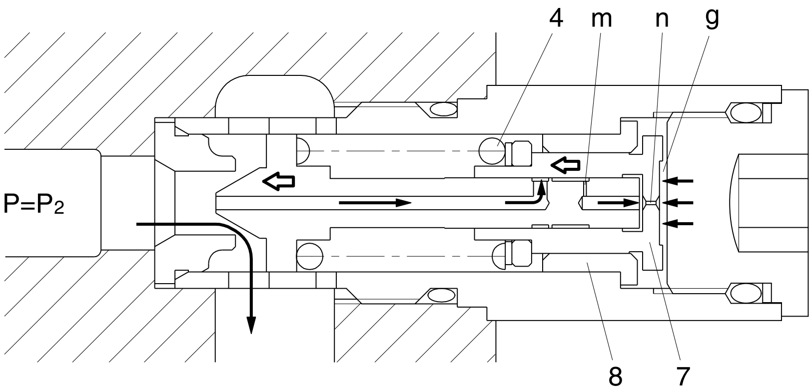
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



2209A2SM27

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 (7) moves left and stop the piston (7) hits the bottom of bushing (8).

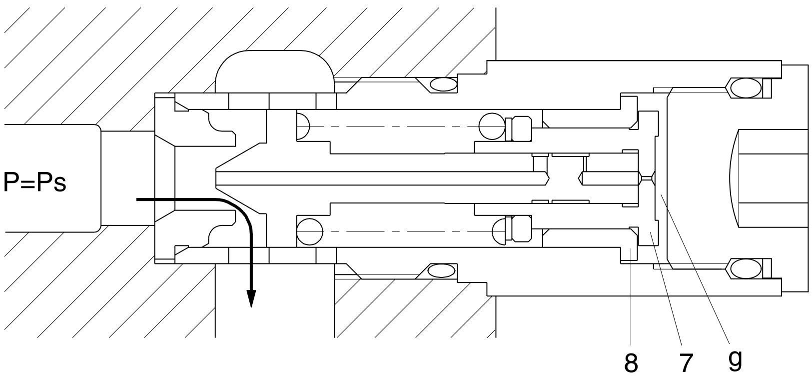


2209A2SM28

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

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

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



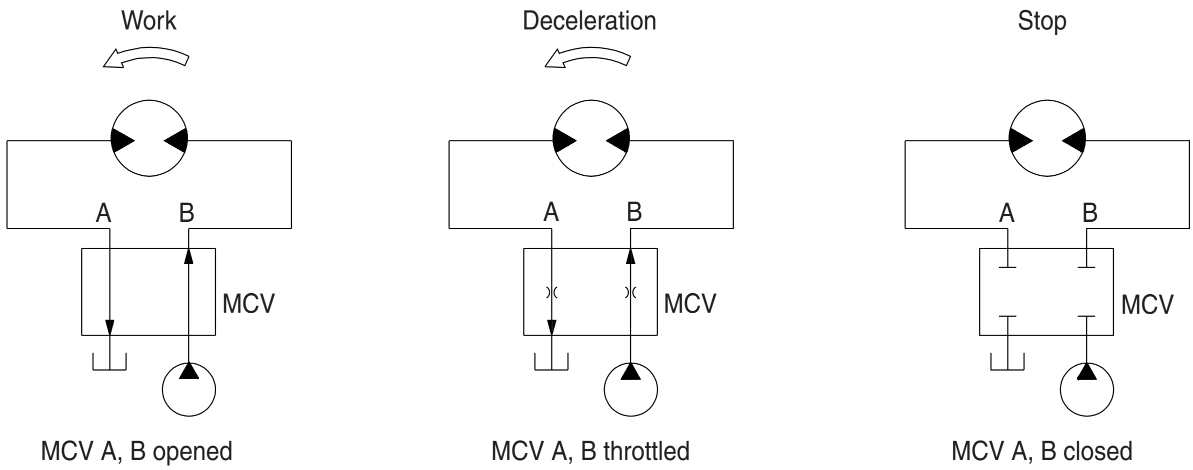
2209A2SM29

4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



2-48(1)

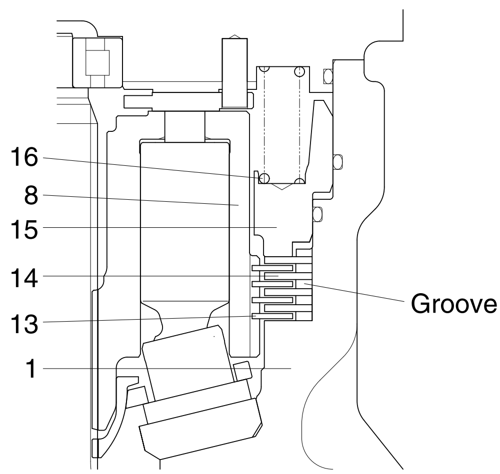
(2) Mechanical swing parking brake system

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

① Brake assembly

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

Cylinder block (8) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



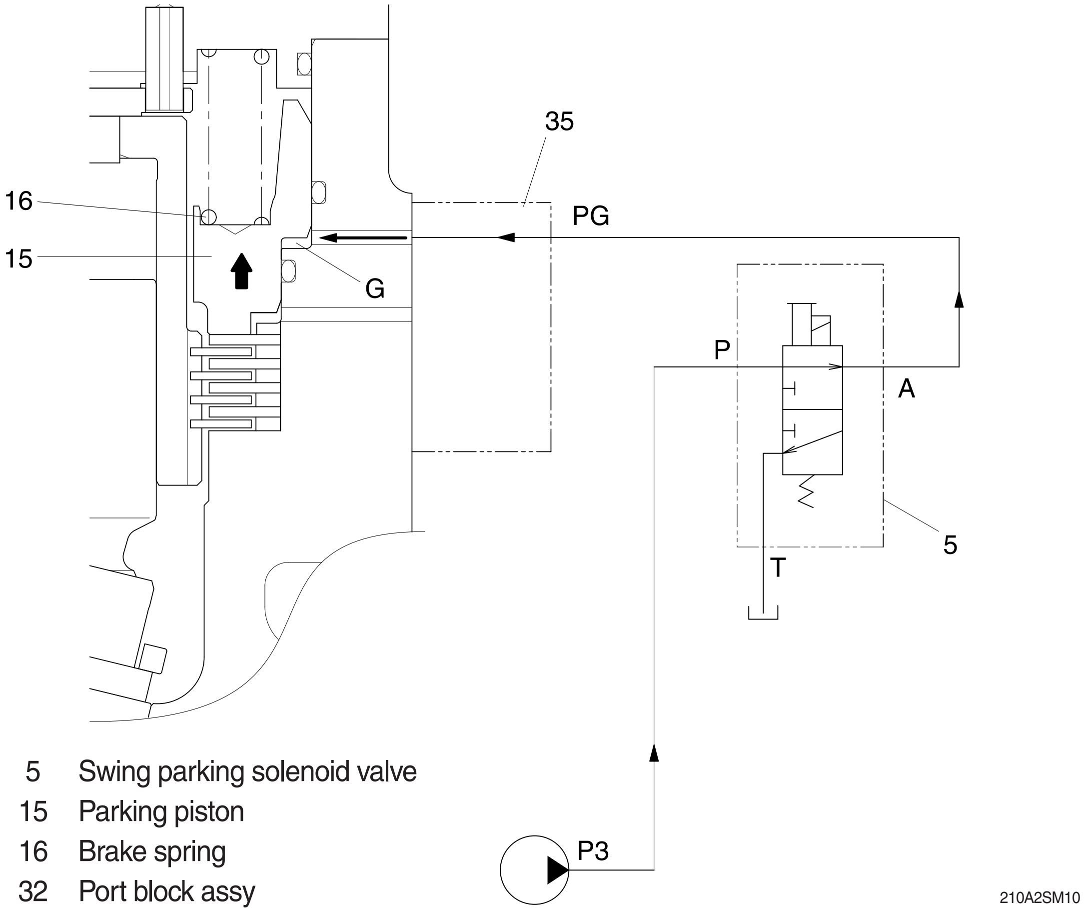
260A2SM35

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

② Operating principle

a. When any of the swing, arm in, travel and boom up function is operated, the swing parking solenoid valve (5) is shifted to the swing position, so pilot pump charged oil (P3) goes to the chamber G through port PG.
This pressure is applied to move the parking piston (15) to the upward against the force of the brake spring (16). Thus, it releases the brake force.

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



5 Swing parking solenoid valve
15 Parking piston
16 Brake spring
32 Port block assy

③ Electric control swing prarking system

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

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

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

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

④ Manual override function

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

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

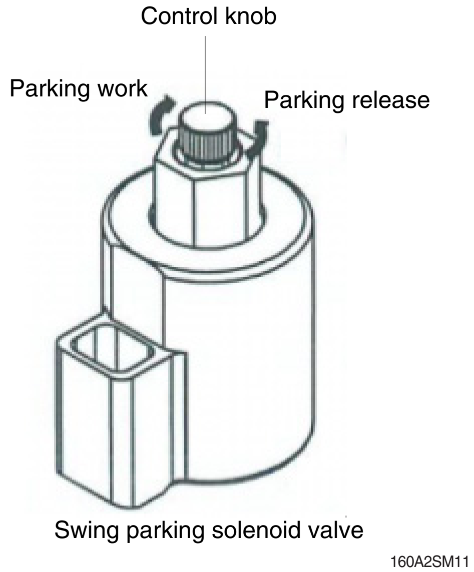
※ Manual override solenoid valve

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

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

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

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

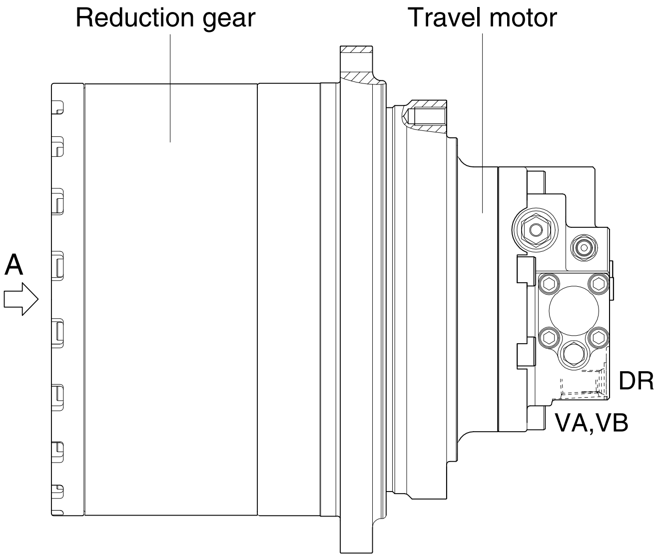


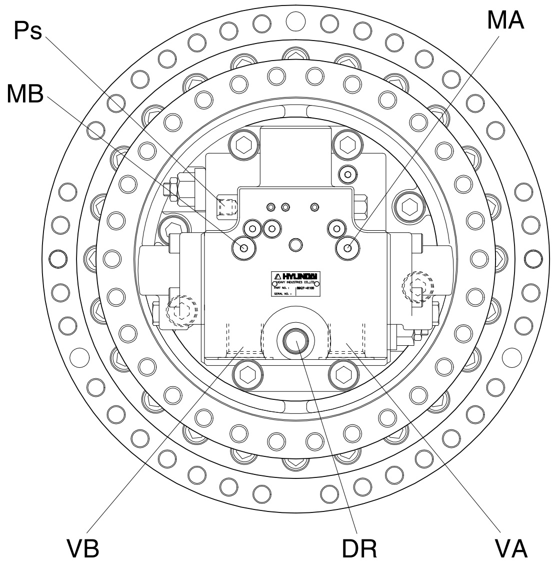
GROUP 4 TRAVEL DEVICE (TYPE 1)

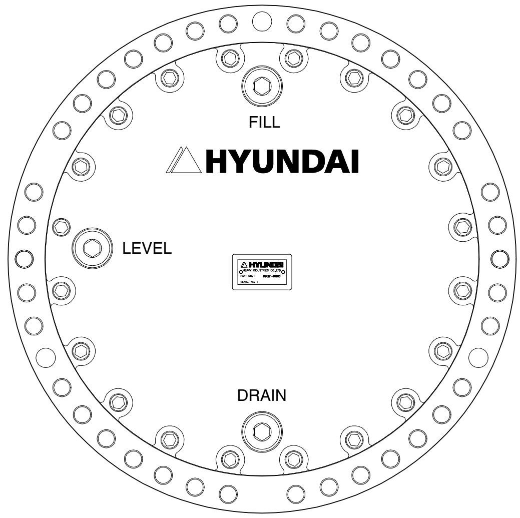
1. CONSTRUCTION

Travel device consists travel motor and gear box.

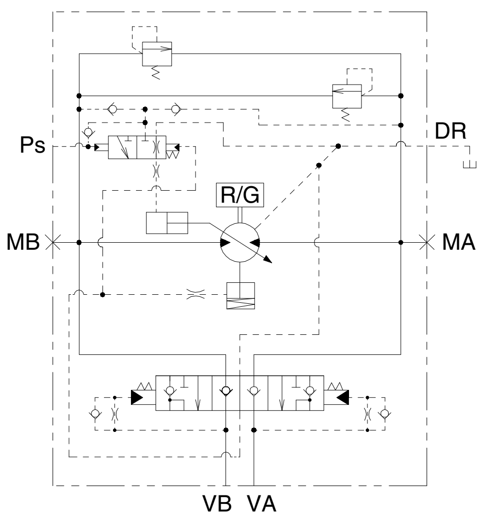
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.







VIEW A



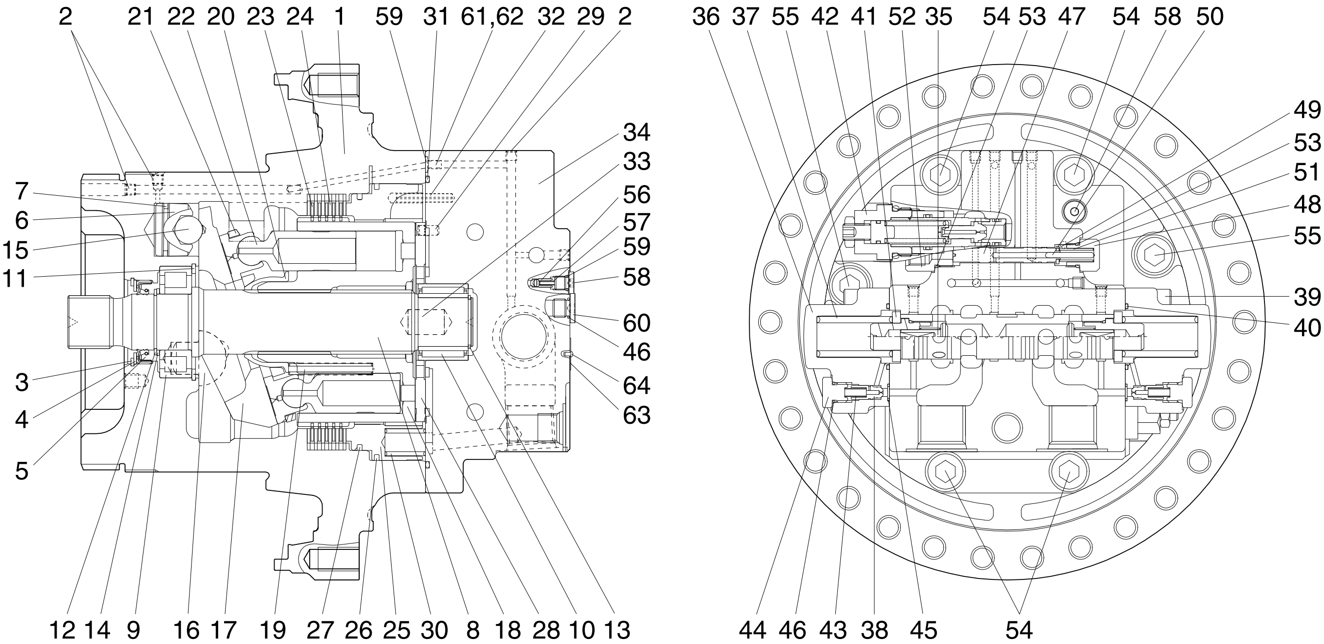
Hydraulic circuit

260L2TM01

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

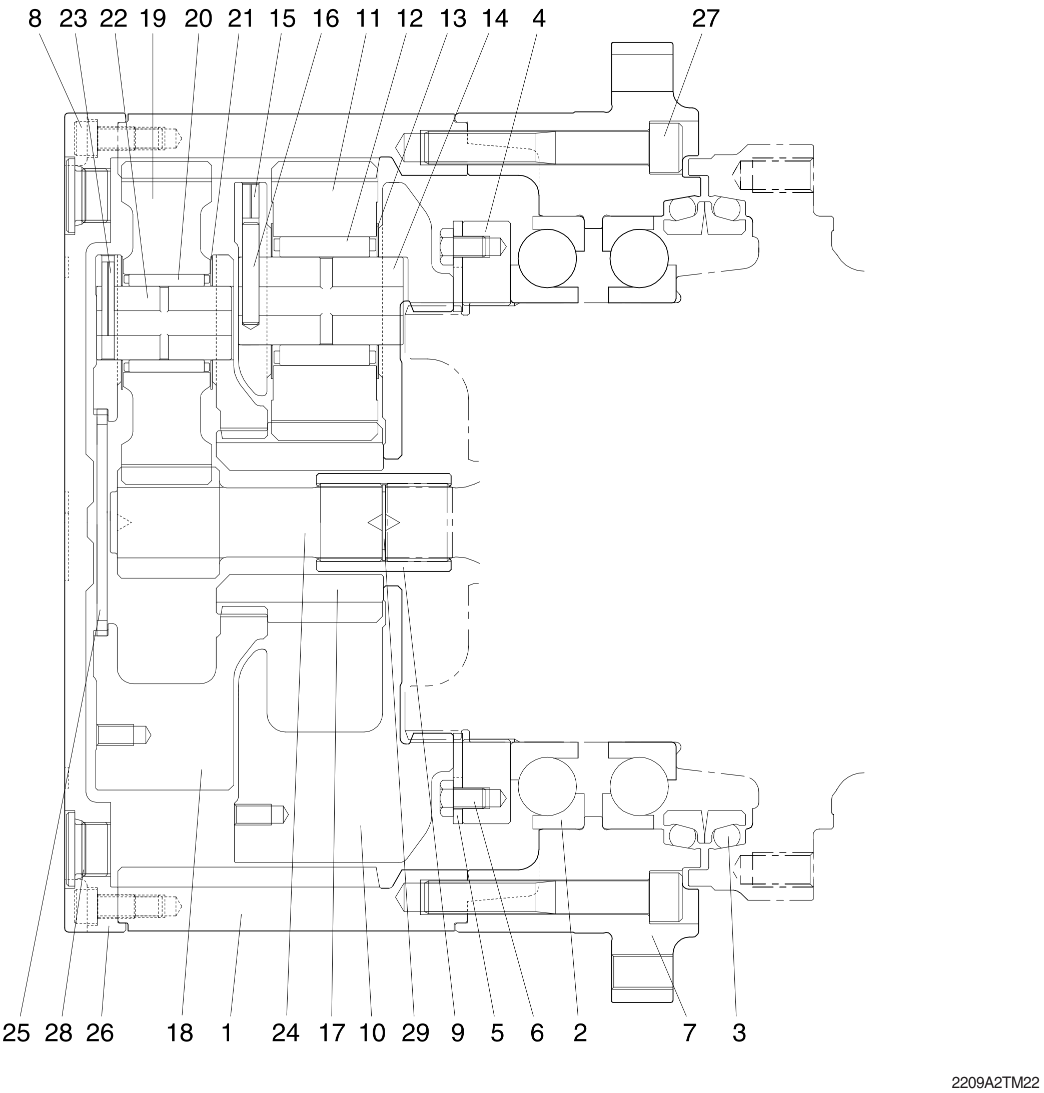
1) TRAVEL MOTOR



260L2TM02

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

2) TRAVEL REDUCTION GEAR



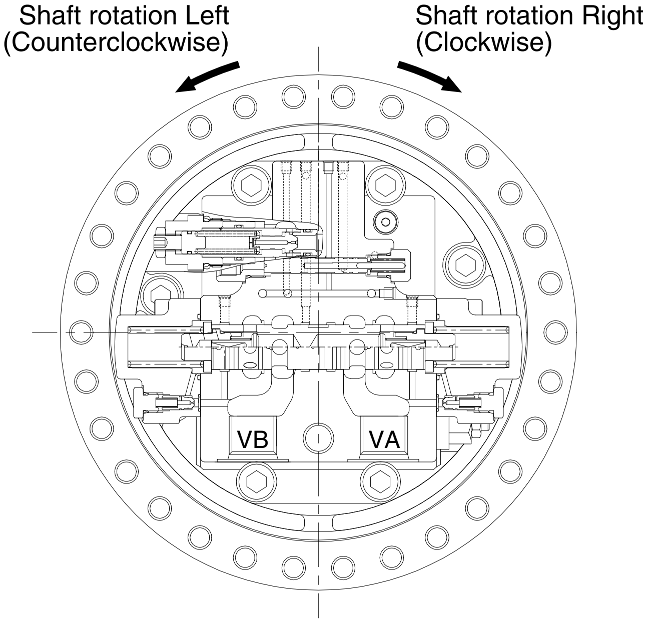
1	Gear ring	12	Needle bearing 2	22	Carrier pin 1
2	Ball bearing	13	Thrust washer 2	23	Spring pin 1
3	Floating seal assy	14	Carrier pin 2	24	Sun gear 1
4	Nut ring	15	Spring pin 2	25	Thrust plate
5	Lock plate	16	Solid pin 2	26	Cover
6	Hexagon bolt	17	Sun gear 2	27	Hexagon socket head bolt
7	Housing	18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

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)

25092TM23

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.

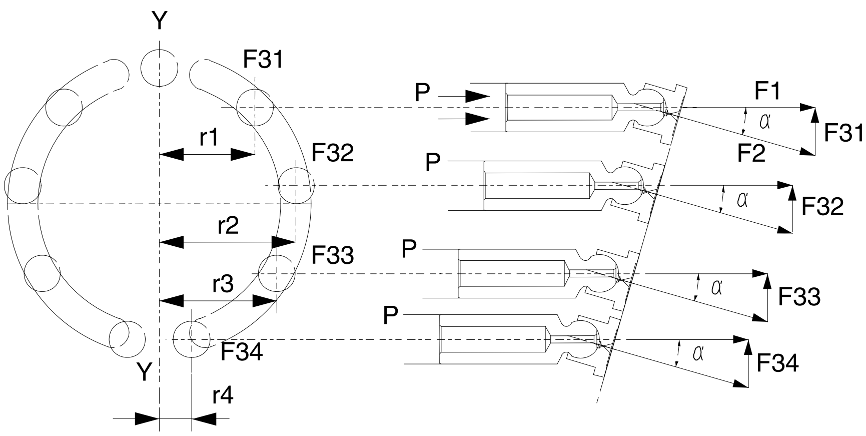
F1 = P $\times$ A (P : pressure, A : area of piston section)

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 (8).

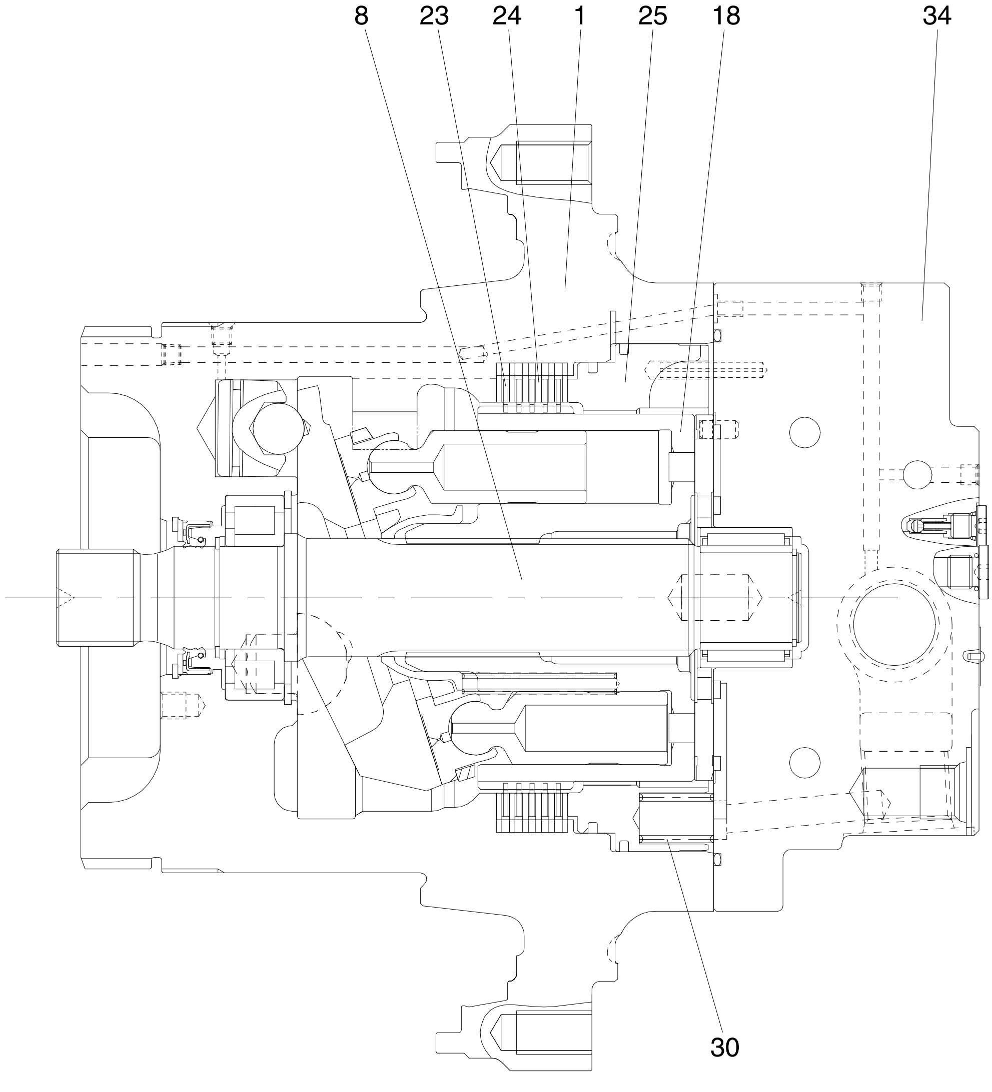


29092TM07

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 (8).



25092TM24

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 (51), the spring (51) is compressed and spool (47) 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 (6). 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.

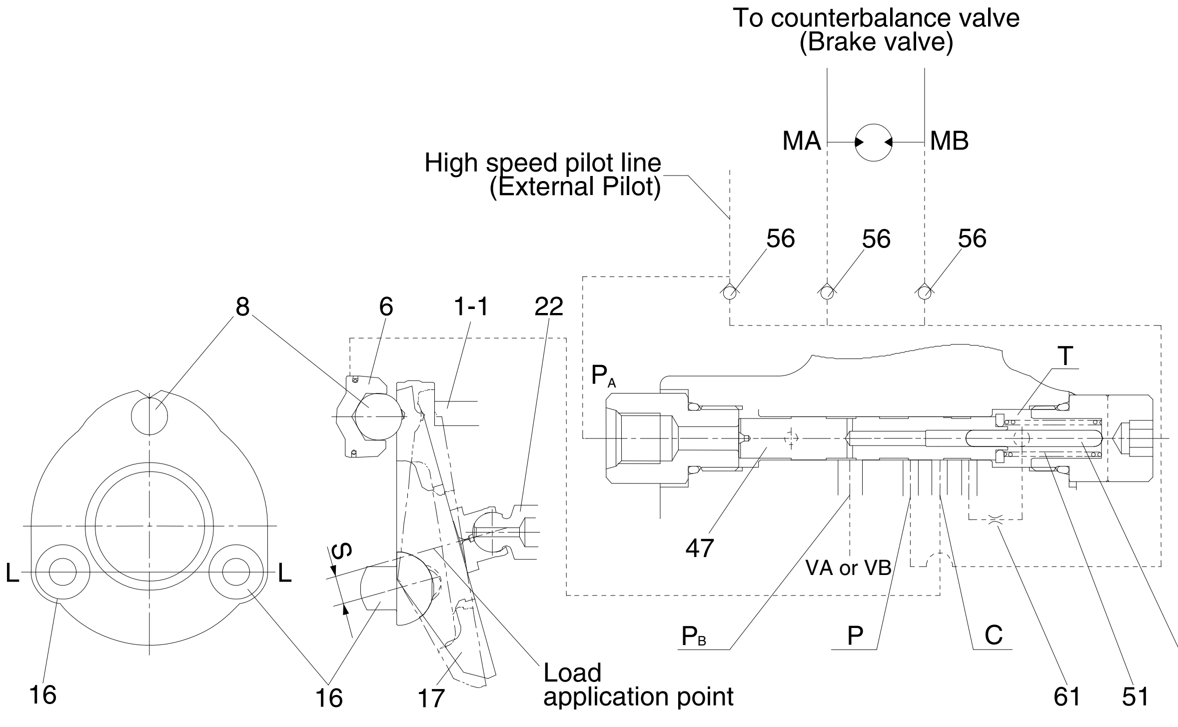
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

When no pressure is in the high speed pilot line P_A, spool (35) is pushed back by the spring (51) and pressure that pressed the shifter piston (6) is released to the hydraulic tank through restrictor (61).

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 (50). When the pressure at P_B exceeds predetermined value, spool (47) returns to the left by the counter-pressure against pin (50) and the pressure on the shifter piston (6) through port C is released to the tank and the motor comes to low speed.

When P_B goes down, the spool (47) moves to the right and the speed become high.

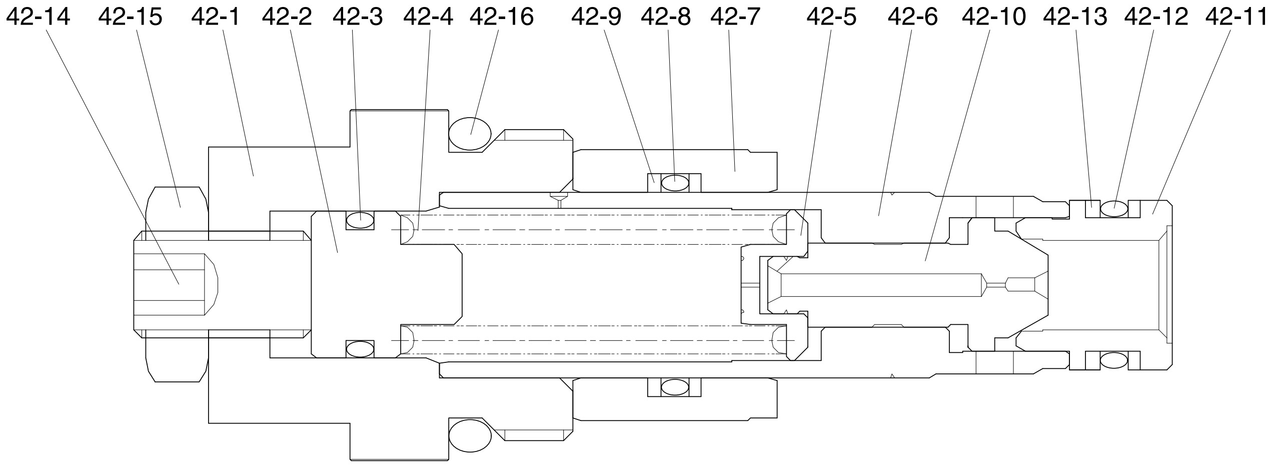


25092TM19

4) OVERLOAD RELIEF VALVE

(1) Structure

This valve is screwed in the motor rear cover (34) and consists of : plug (42-1) that is screwed and fixed in the rear cover (34), poppet (42-10) and supports the poppet seat (42-11), spring (42-4) that is operating relief valve setting pressure and supports the spring seat (42-5), that is inserted in the sleeve (42-6), screw (42-14) that is adjust the spring force, nut (42-15) that fix screw (42-14), piston (42-7) that reduce the shock.



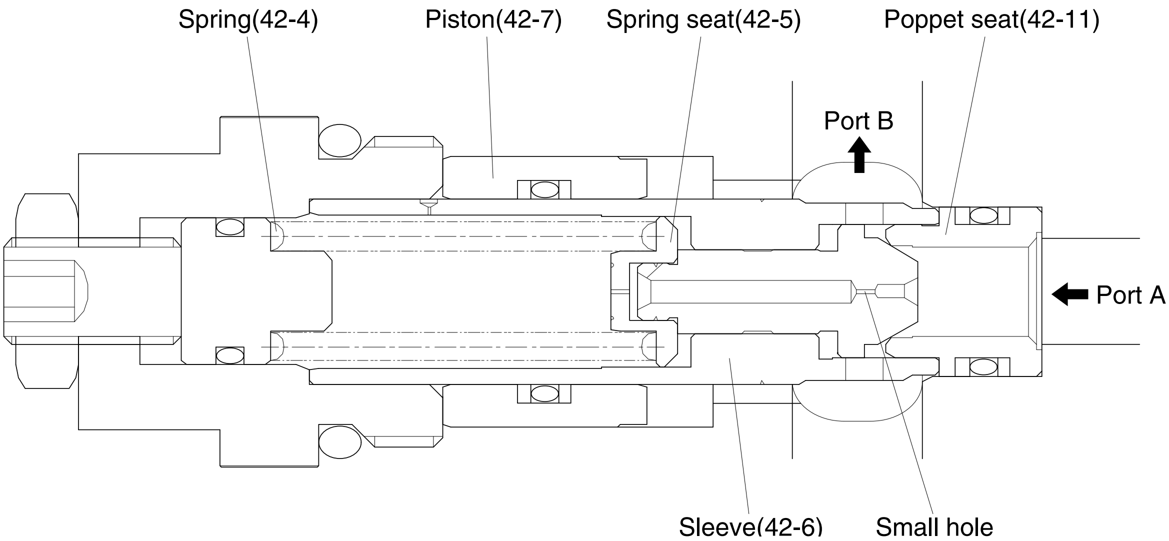
42-1	Plug	42-7	Piston	42-12	O-ring
42-2	Guide	42-8	O-ring	42-13	Back-up ring
42-3	O-ring	42-9	Back-up ring	42-14	Socket screw
42-4	Spring	42-10	Poppet	42-15	Hexagon nut
42-5	Spring seat	42-11	Poppet seat	42-16	O-ring
42-6	Sleeve				

(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 (42-10) which seats on the poppet seat (42-11) and, at the same time, is delivered, via small hole, to the spring seat (42-5) located inside the sleeve (42-6) and the seat bore pressure increases up to "A" port pressure. The poppet (42-10) opposes to spring (42-4) 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 (42-7) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (42-7) through the small hole in the poppet (42-10) and piston (42-7) moves rightward until it touches the stopper in rear cover. In this while, the poppet (42-10) maintains "A" port pressure at comparatively low against the spring (42-4) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.



25092TM27

5) BRAKE VALVE

(1) Structure

The brake valve portion mainly consists of the following parts:

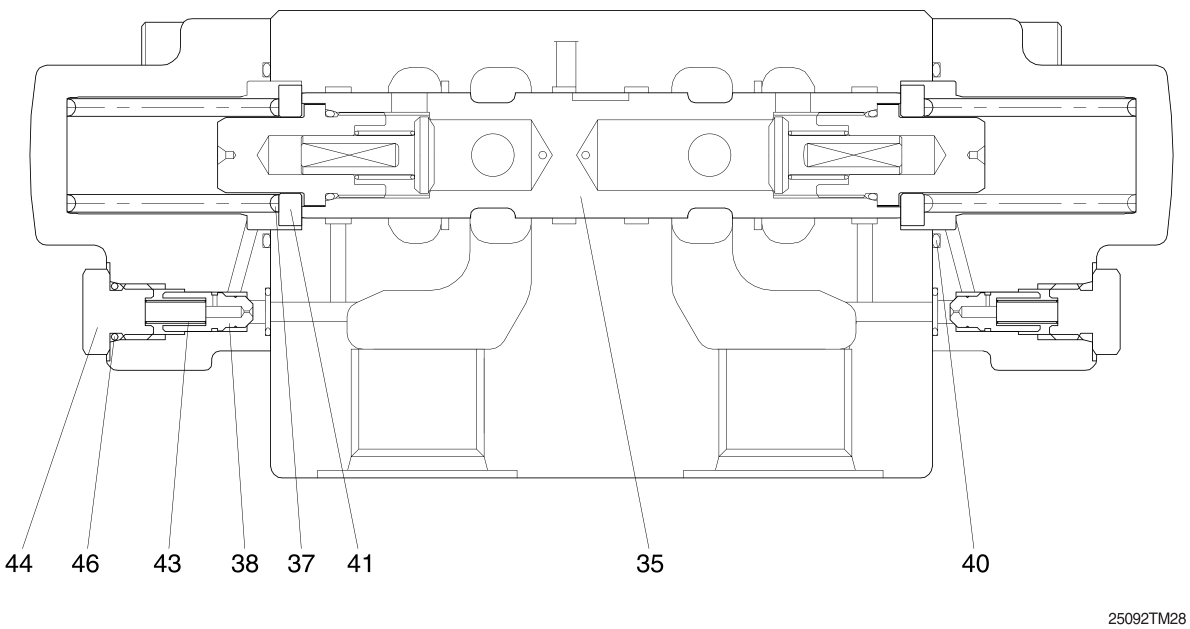
① Spool

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 2-96, (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	Plug
37	Spring	41	Spring seat	46	O-ring
38	Restrictor	43	Restrictor spring		

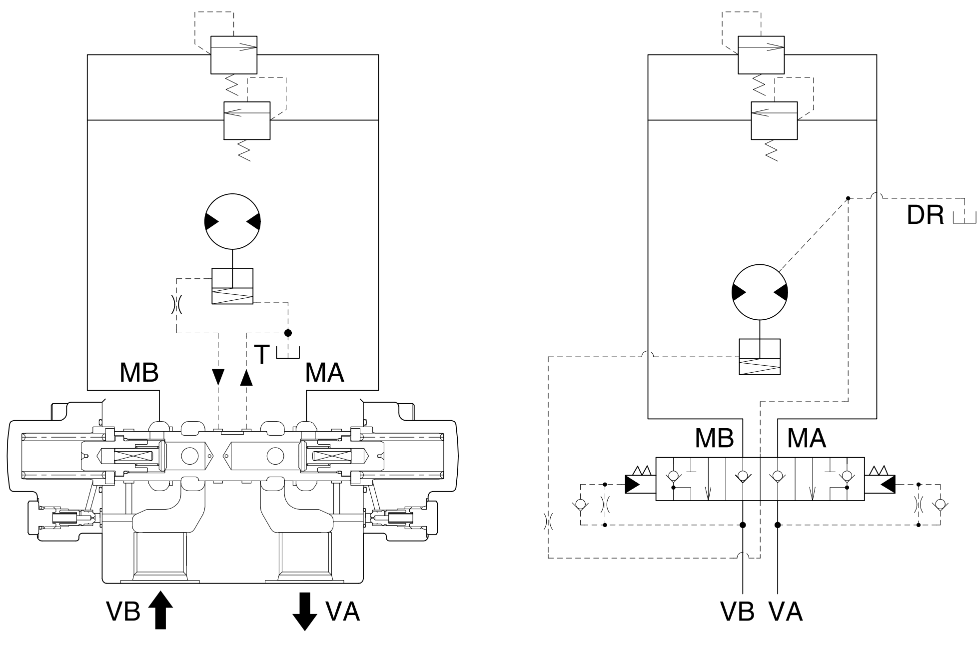
(2) Operation

① Holding operation

When the control valve is at neutral position, VA and VB ports are connected to the tank, and the spring (37) 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.



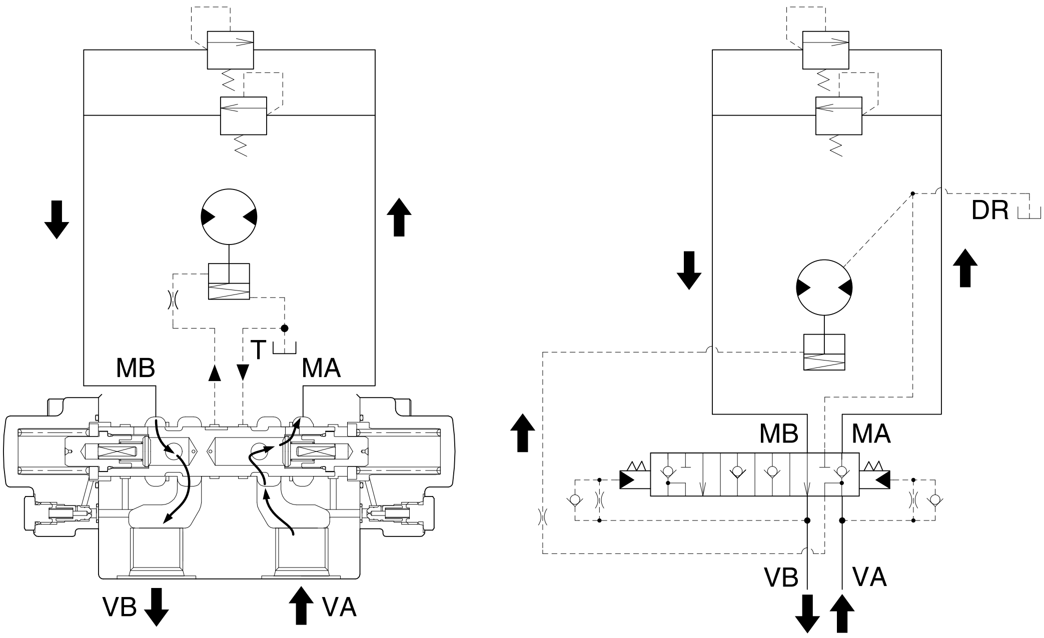
25092TM29

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 (37) 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.



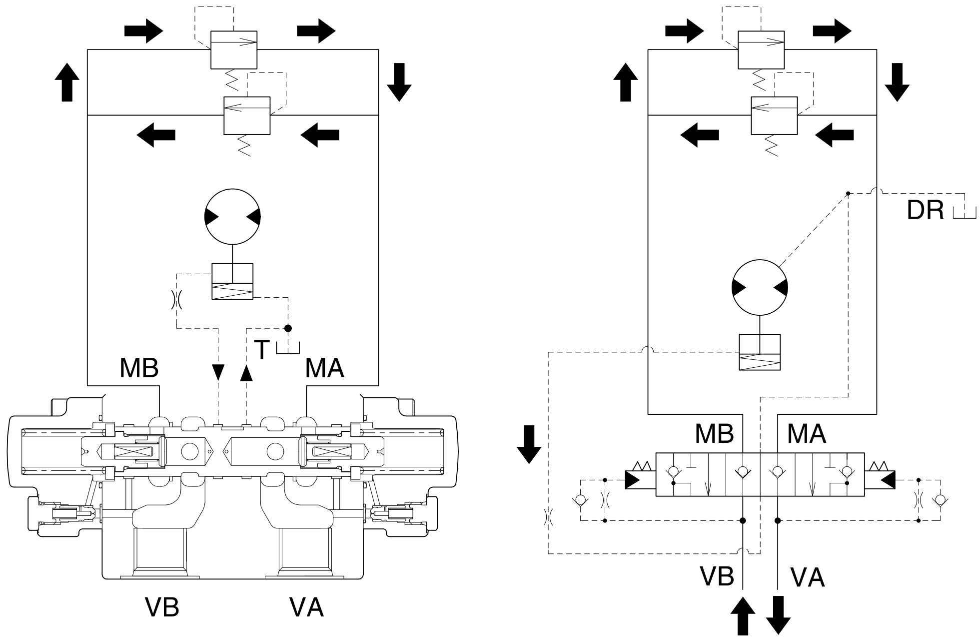
25092TM30

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 (37) 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.



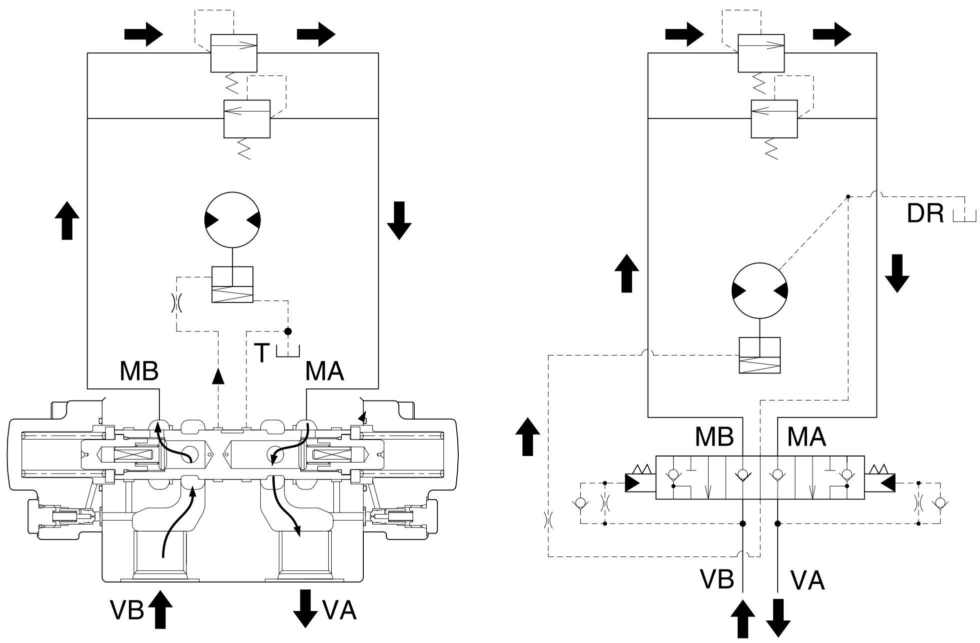
25092TM31

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 (37) 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 (38) 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.

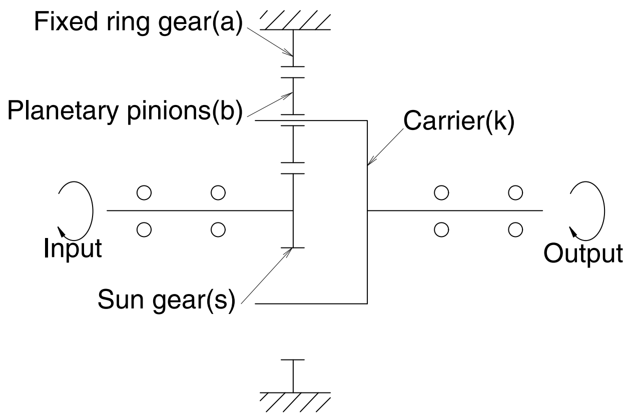
This reduction unit utilizes two stages, planetary reduction system.

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

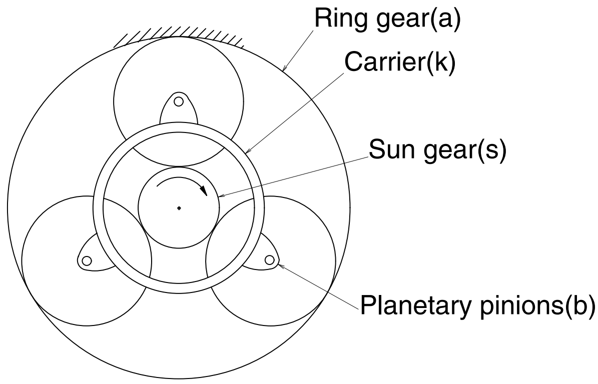
When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).

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

This mechanism is called planetary gear mechanism.



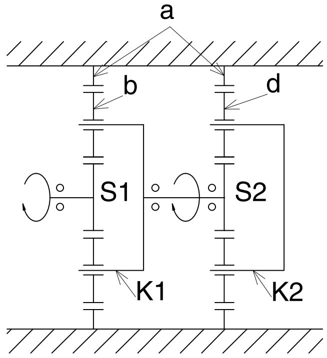
29072TM10



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.



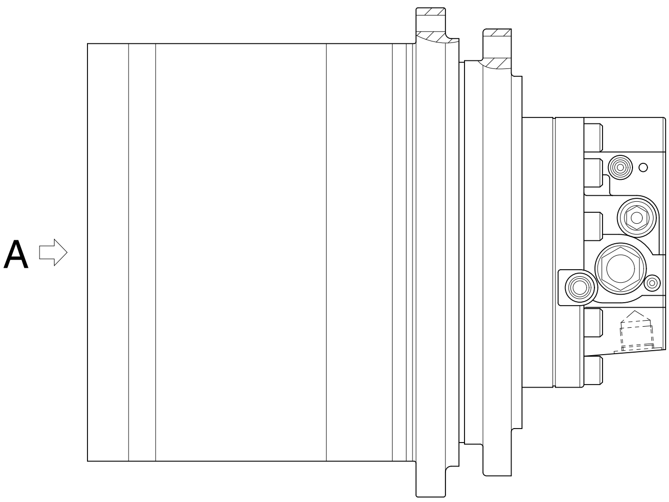
29072TM12

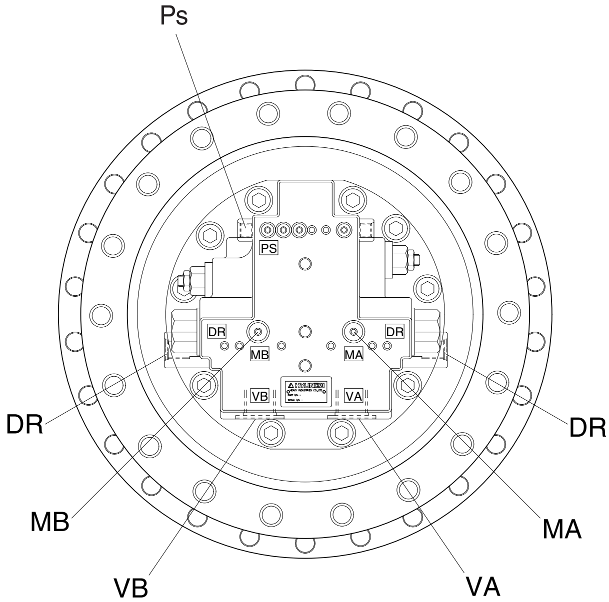
GROUP 4 TRAVEL DEVICE (TYPE 2, HIGH WALKER)

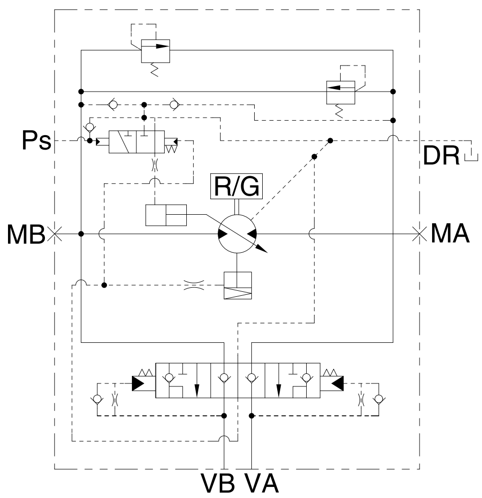
1. CONSTRUCTION

Travel device consists travel motor and gear box.

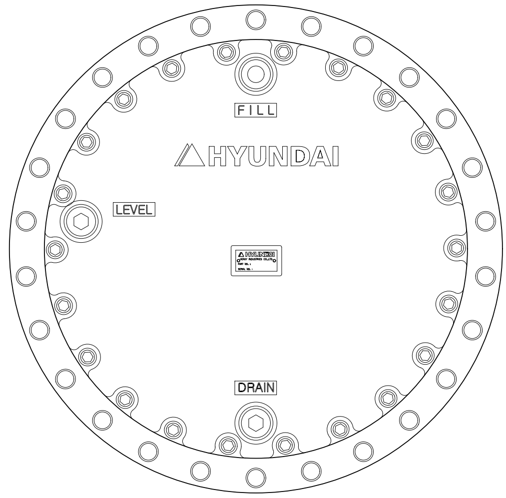
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.







HYDRAULIC CIRCUIT



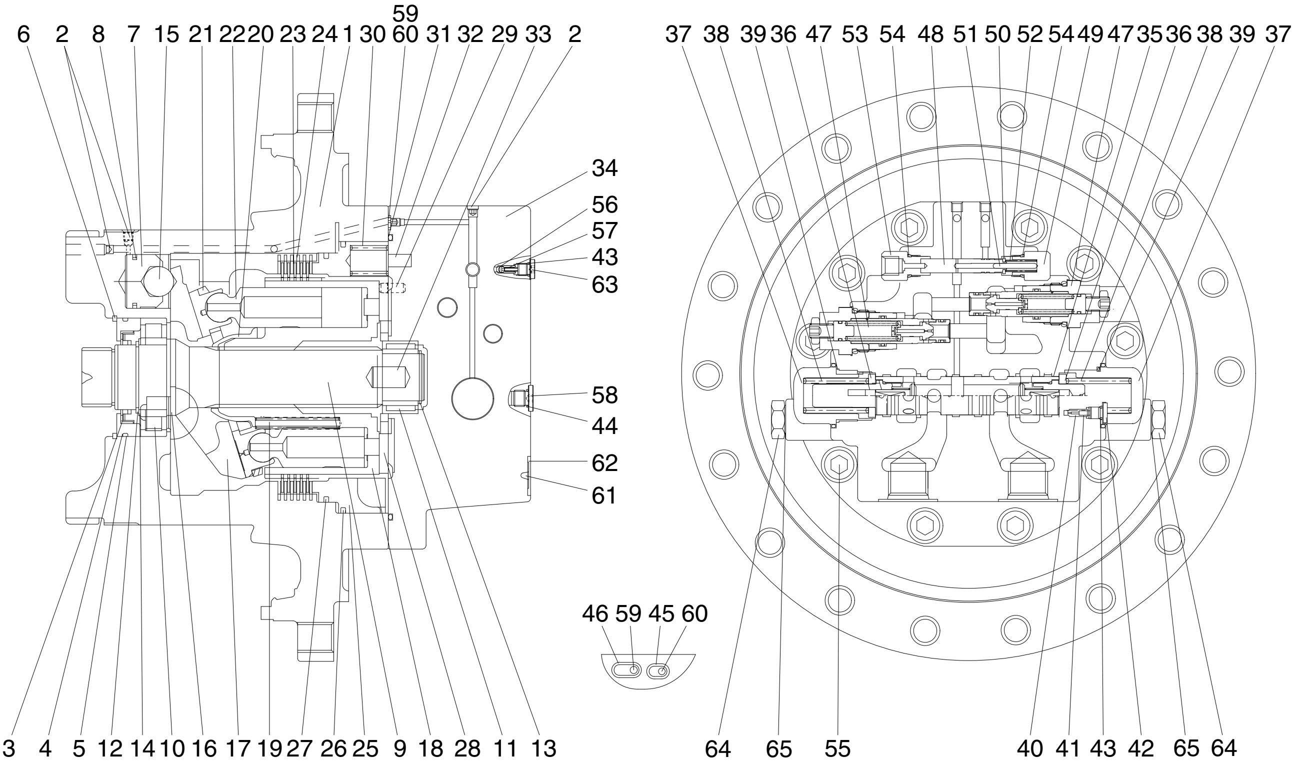
VIEW A

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

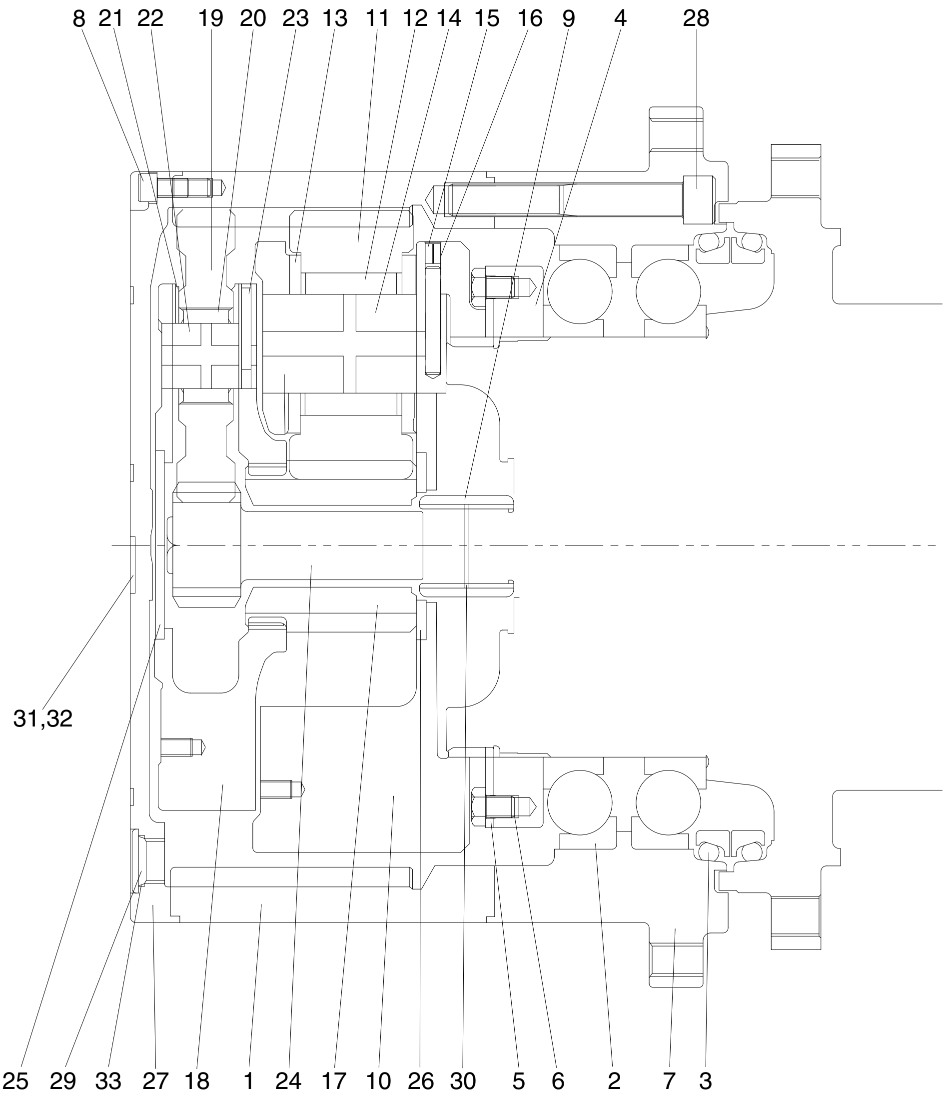
1) TRAVEL MOTOR



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 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
63 Plug
64 Plug
65 O-ring

2) TRAVEL REDUCTION GEAR



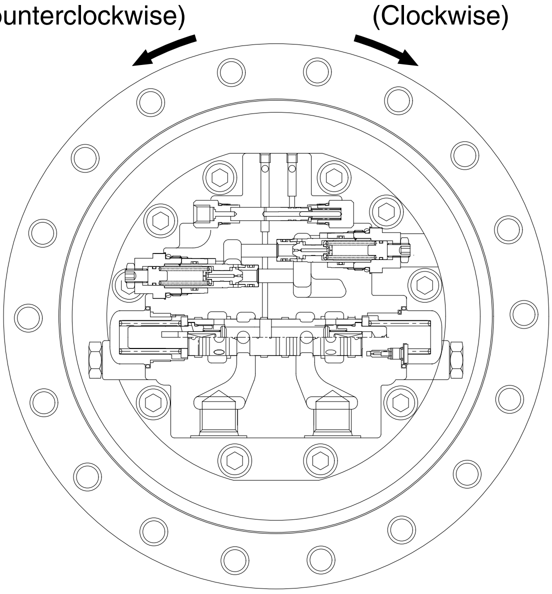
1	Gear ring	12	Needle bearing 2	23	Spring pin 1
2	Ball bearing	13	Thrust washer 2	24	Sun gear 1
3	Floating seal assy	14	Carrier pin 2	25	Thrust plate
4	Nut ring	15	Spring pin 2	26	Thrust plate
5	Lock plate	16	Solid pin 2	27	Cover
6	Hexagon socket head bolt	17	Sun gear 2	28	Hexagon socket head bolt
7	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.

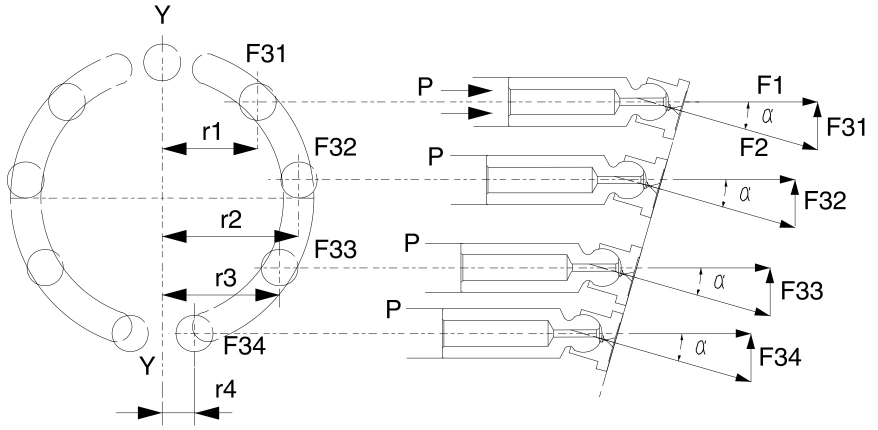
F1 = P × A (P : pressure, A : area of piston section)

The swash plate (17) with inclined angle of α divides this force F1 into thrust force F2 and radial force F31-34.

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

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

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

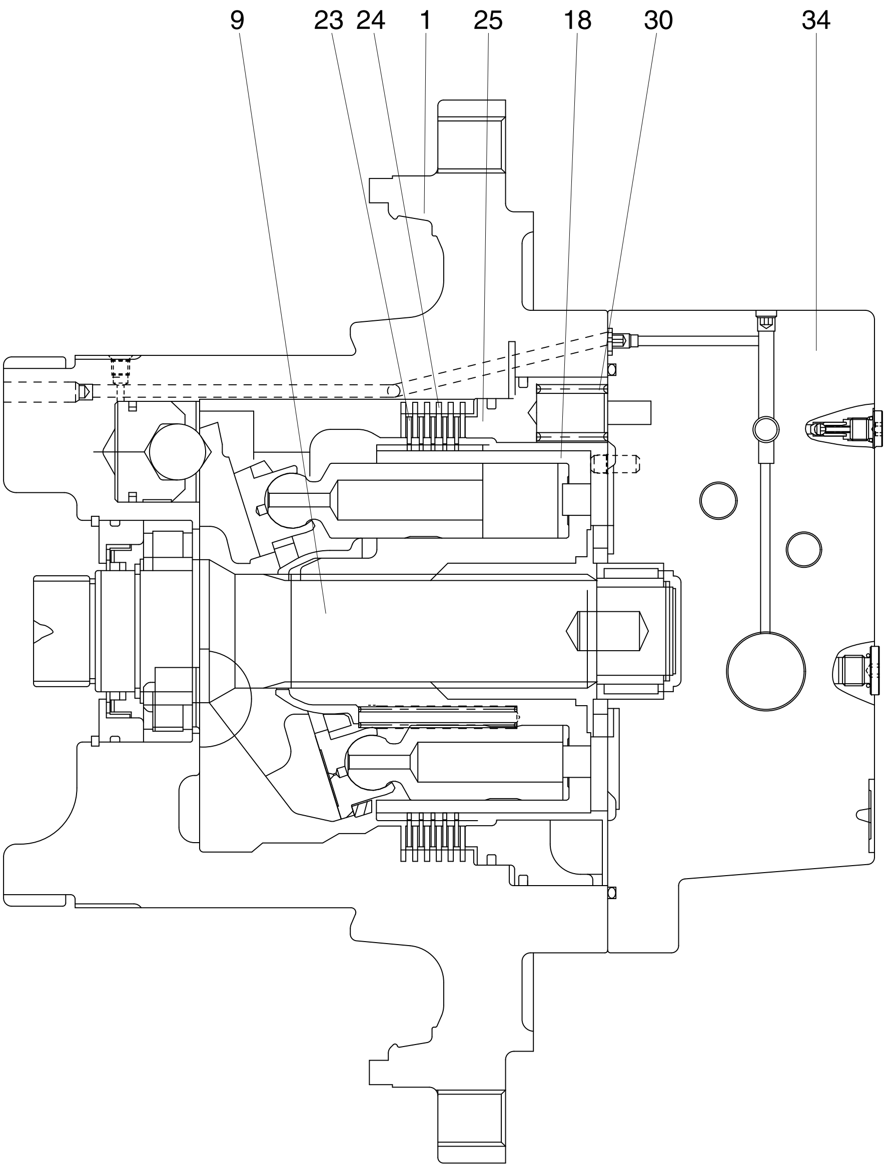


29092TM07

2) PARKING BRAKE

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

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



2609A2TM05

3) CAPACITY CONTROL MECHANISM

Figure typically shows the capacity control mechanism.

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

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

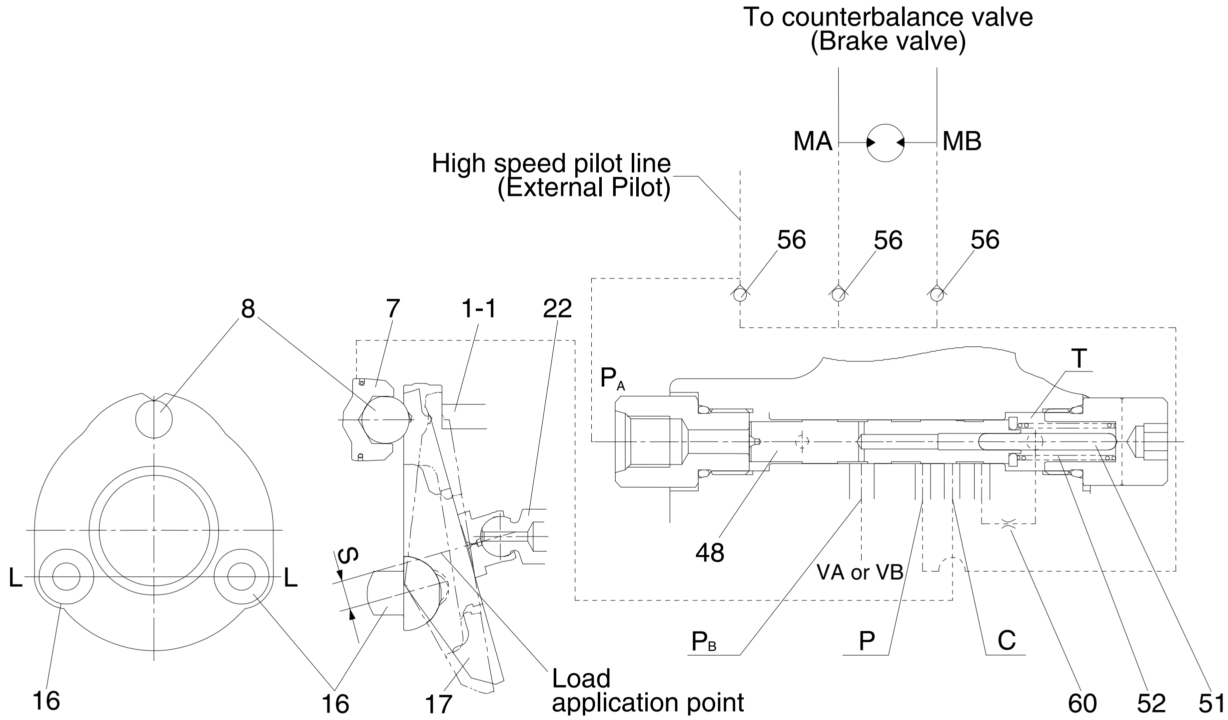
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

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

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

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

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

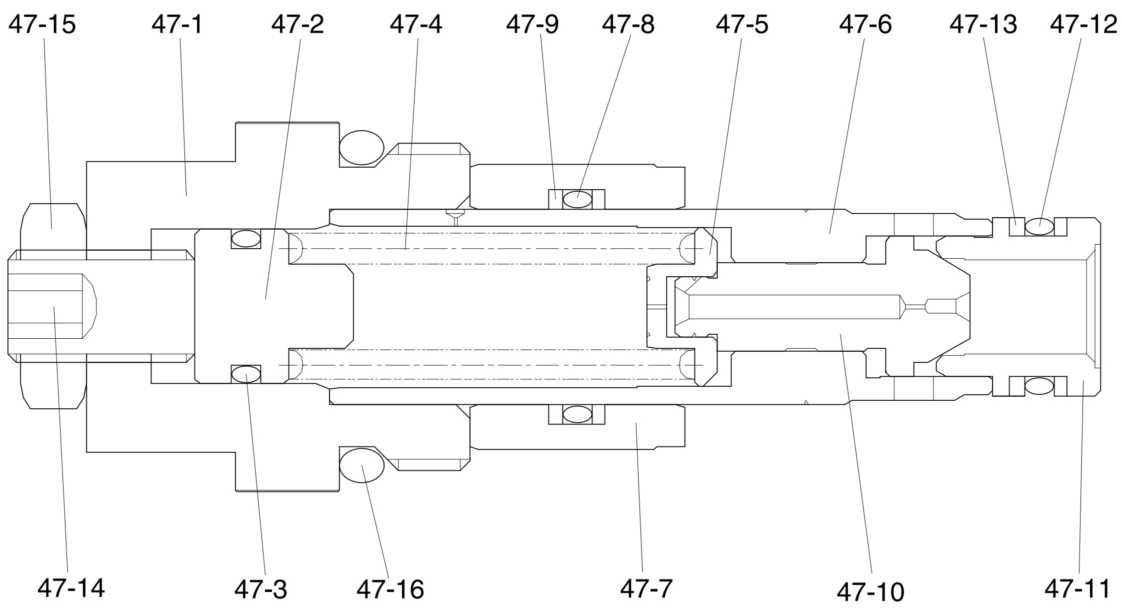


2609A2TM06

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

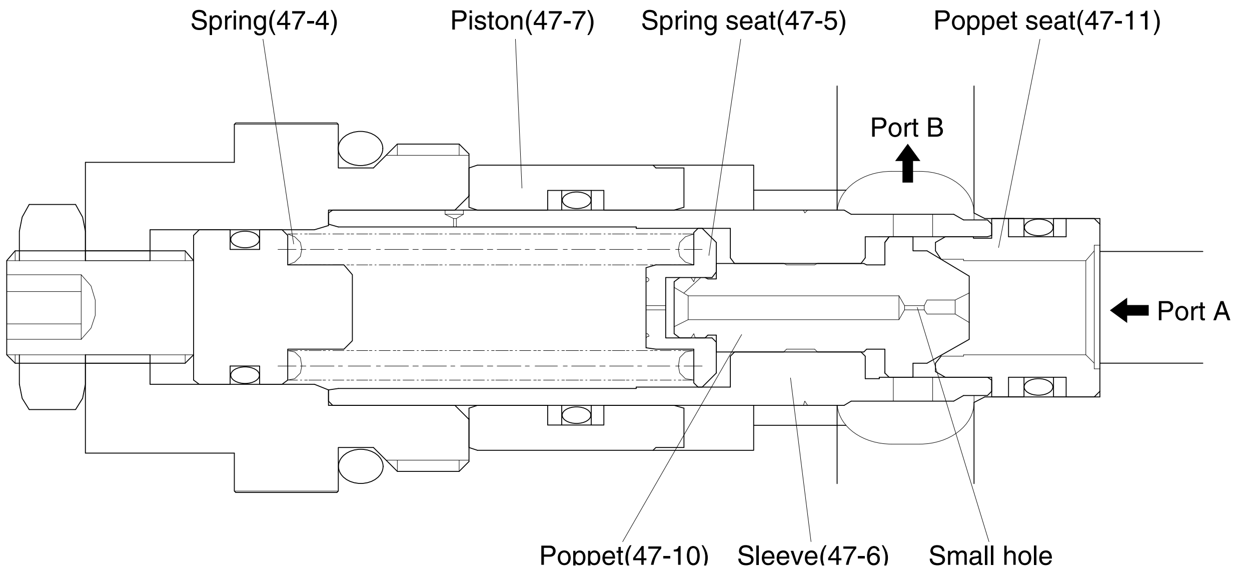
47-1	Plug	47-7	Piston	47-12	O-ring
47-2	Guide	47-8	O-ring	47-13	Back-up ring
47-3	O-ring	47-9	Back-up ring	47-14	Socket screw
47-4	Spring	47-10	Poppet	47-15	Hexagon nut
47-5	Spring seat	47-11	Poppet seat	47-16	O-ring
47-6	Sleeve				

(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:

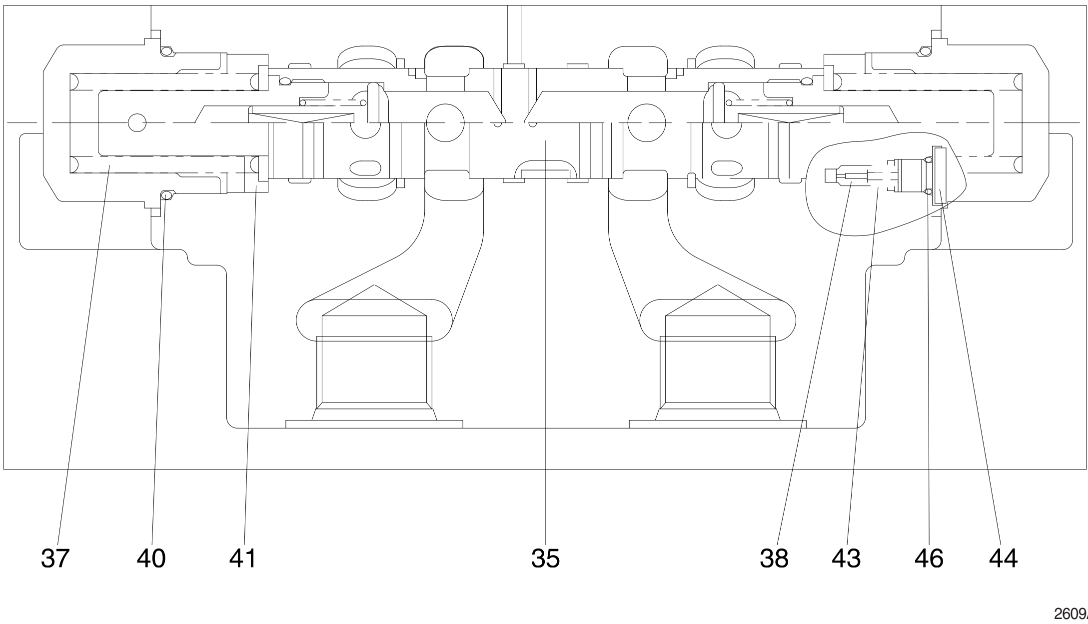
① Spool

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	39	O-ring	42	Plug
36	Spring seat	40	Restrictor	43	O-ring
38	Spring	41	Restrictor spring		

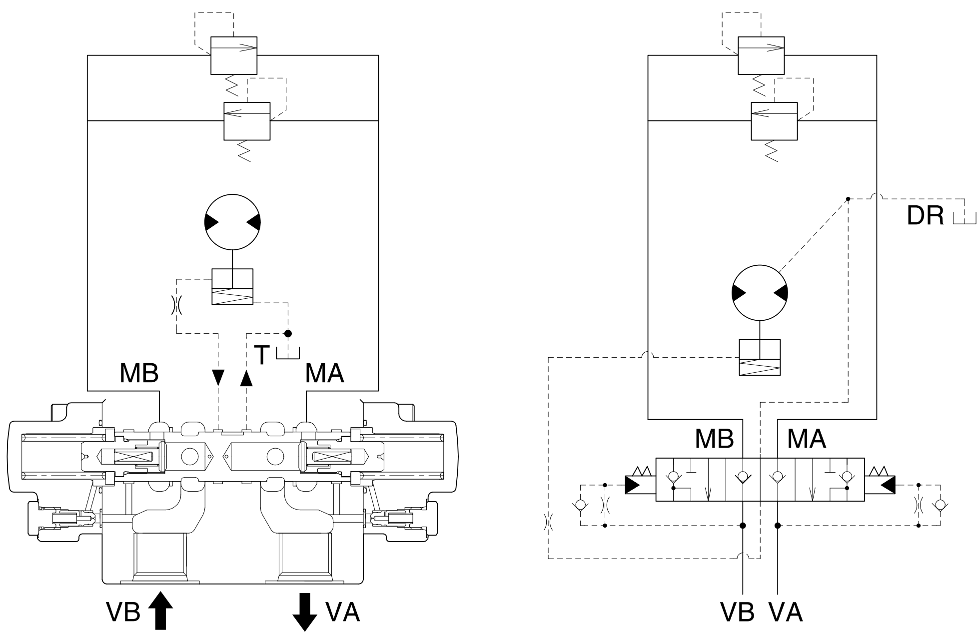
(2) Operation

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.



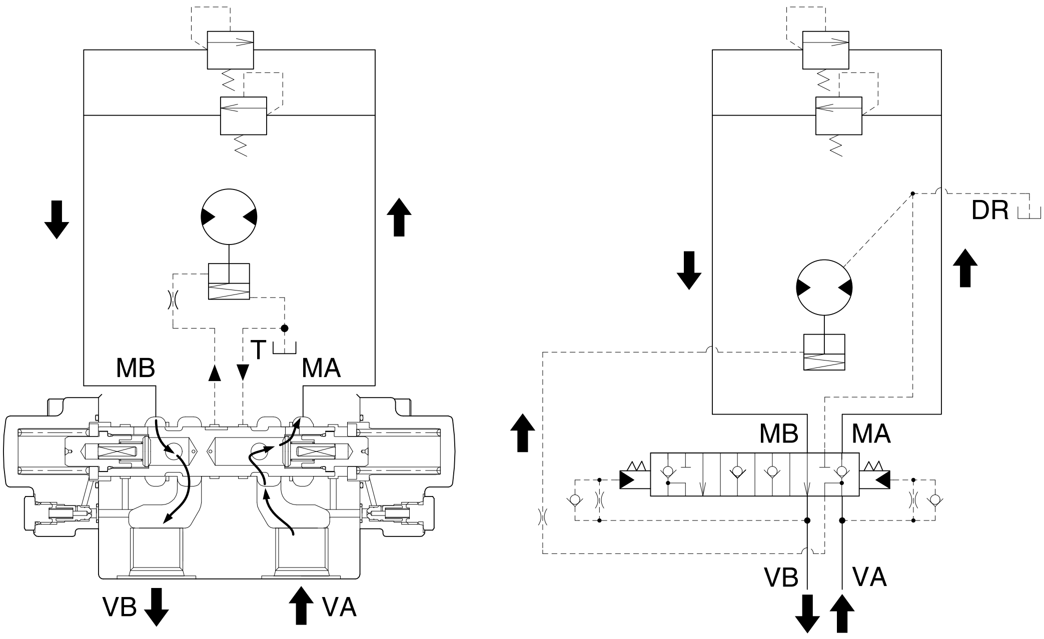
25092TM29

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.



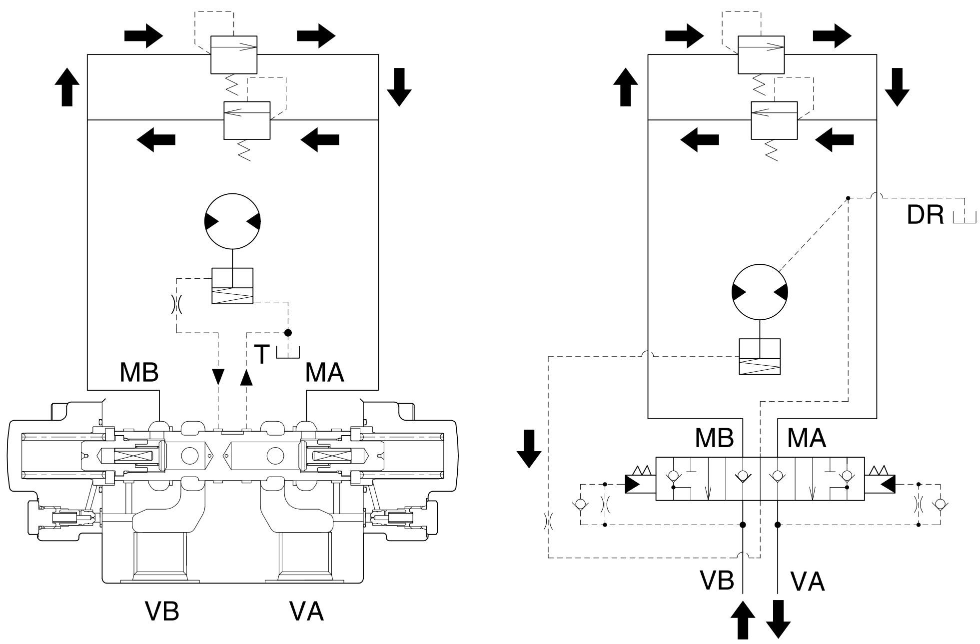
25092TM30

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.



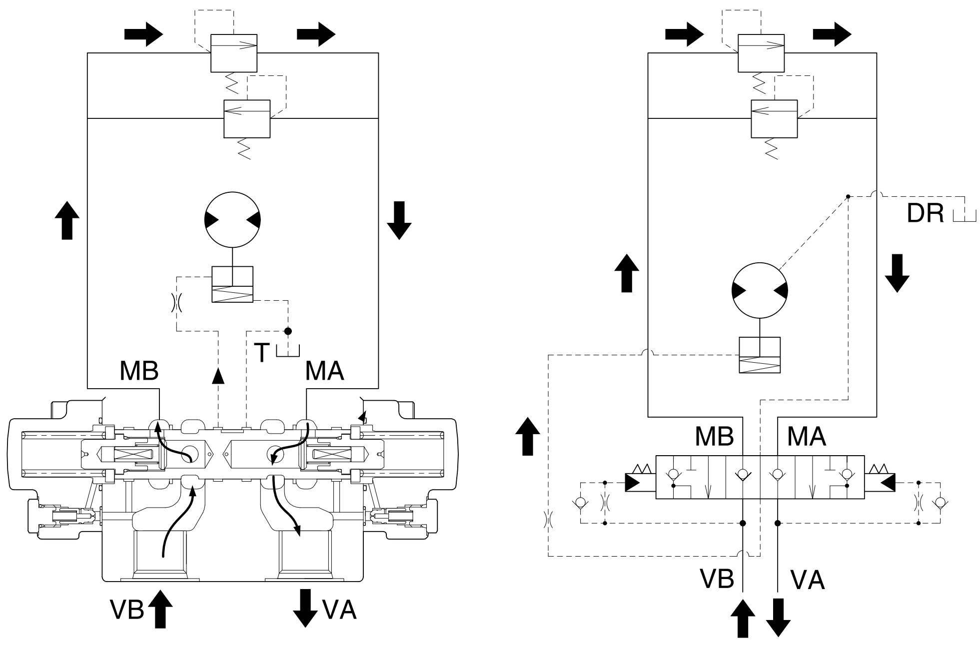
25092TM31

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.

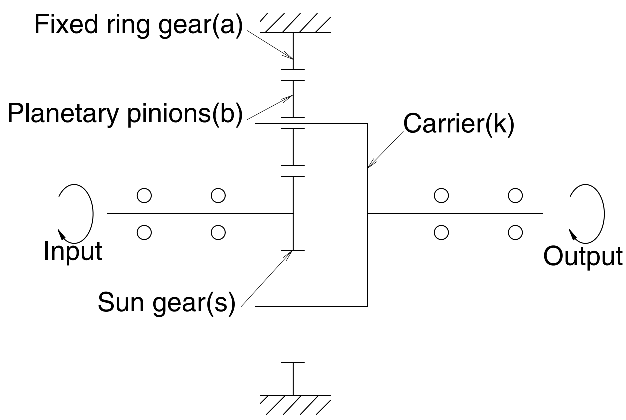
This reduction unit utilizes two stages, planetary reduction system.

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

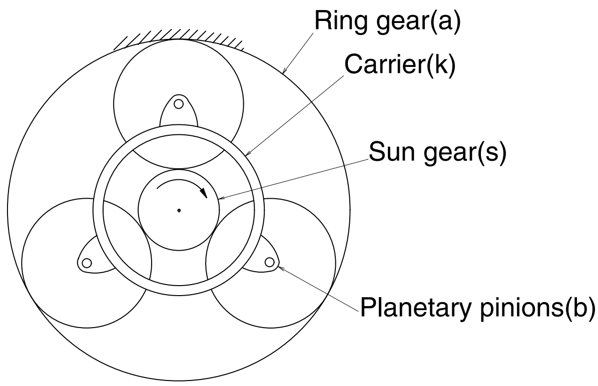
When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).

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

This mechanism is called planetary gear mechanism.



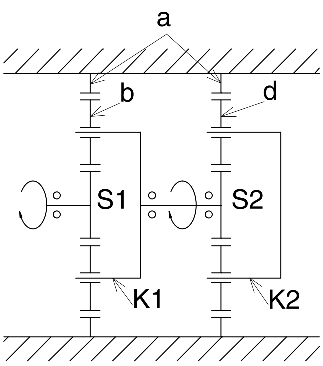
29072TM10



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

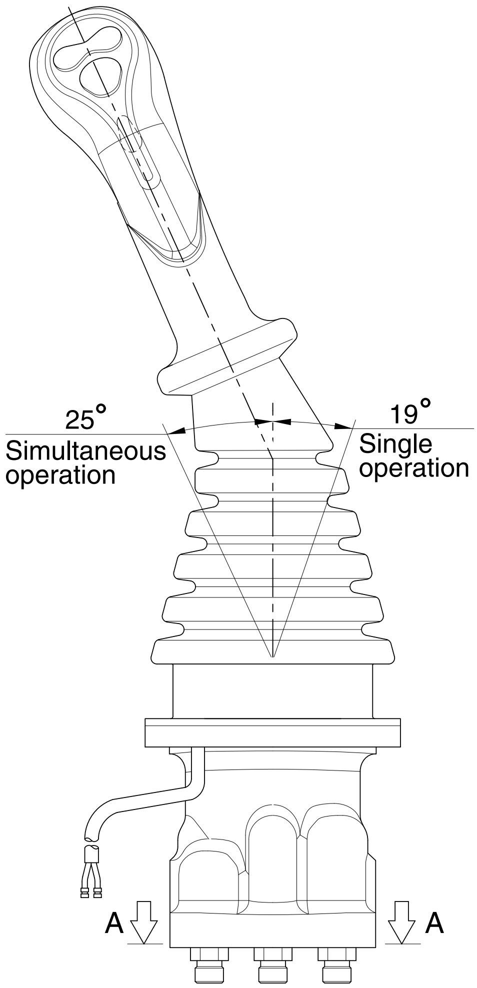
GROUP 5 RCV LEVER

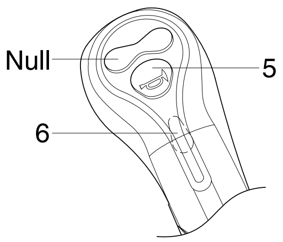
1. STRUCTURE

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

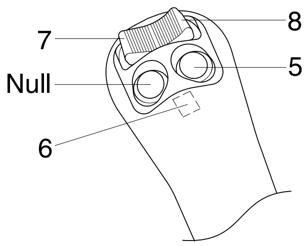
※ **Refer to the parts manual for the types of the RCV lever.**

1) TYPE M1, M5





TYPE M1

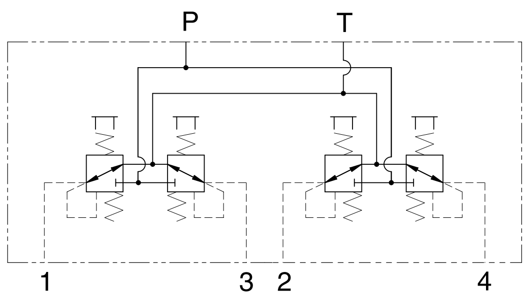


TYPE M5

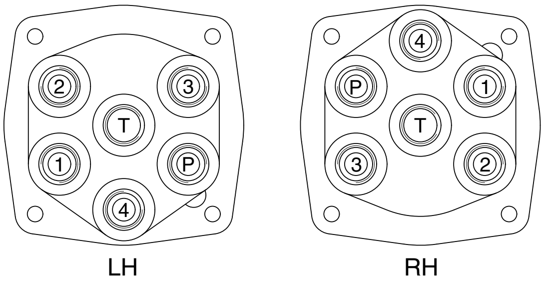
Switches

Type	No.	LH	RH
M1	5	One touch decel	Horn
	6	Power boost	Breaker
M5	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



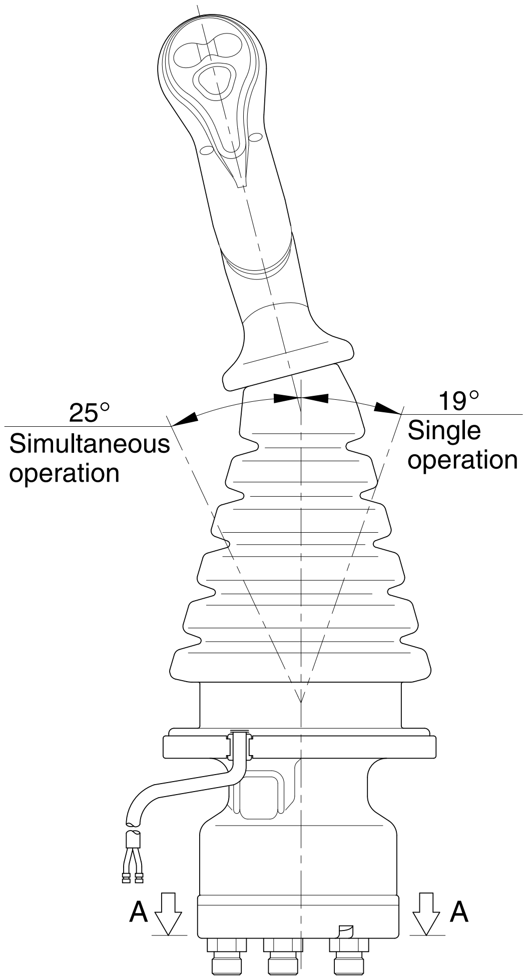
VIEW A-A

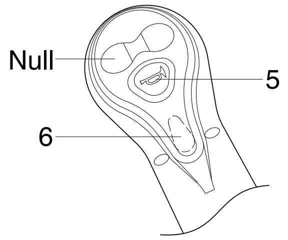
Pilot ports

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	

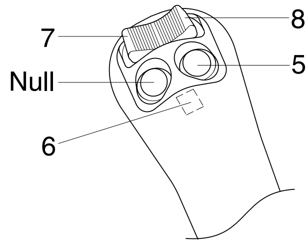
210A2RL01

2) TYPE M11, M12





TYPE M12

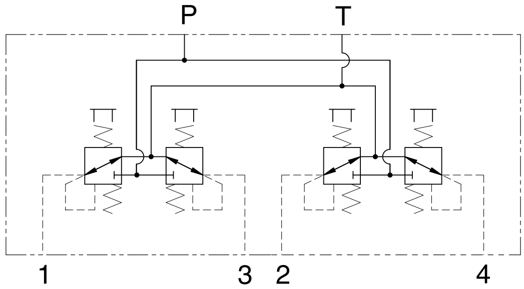


TYPE M11

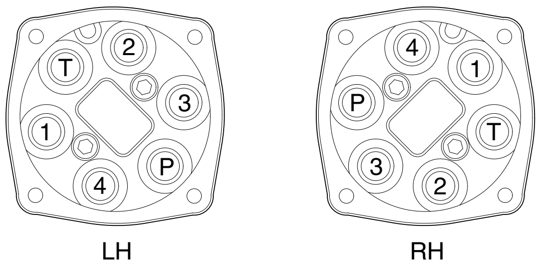
Switches

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

※ Number 7 and 8 : Option attachment



Hydraulic circuit



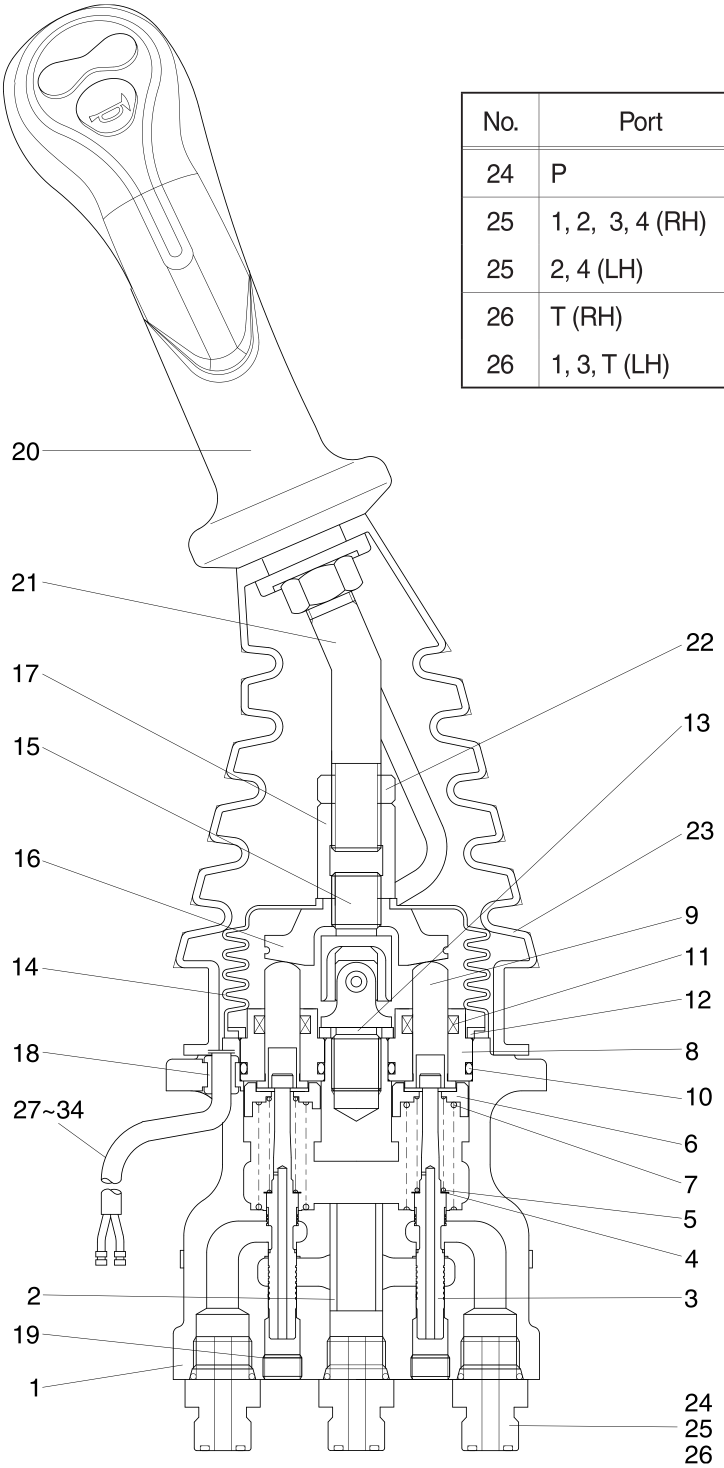
VIEW A-A

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	

210A2RL05

3) CROSS SECTION



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

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

210S2RL06

Item numbers are based on the type M1.

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

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

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

Item numbers are based on the type M1.

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

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

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

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

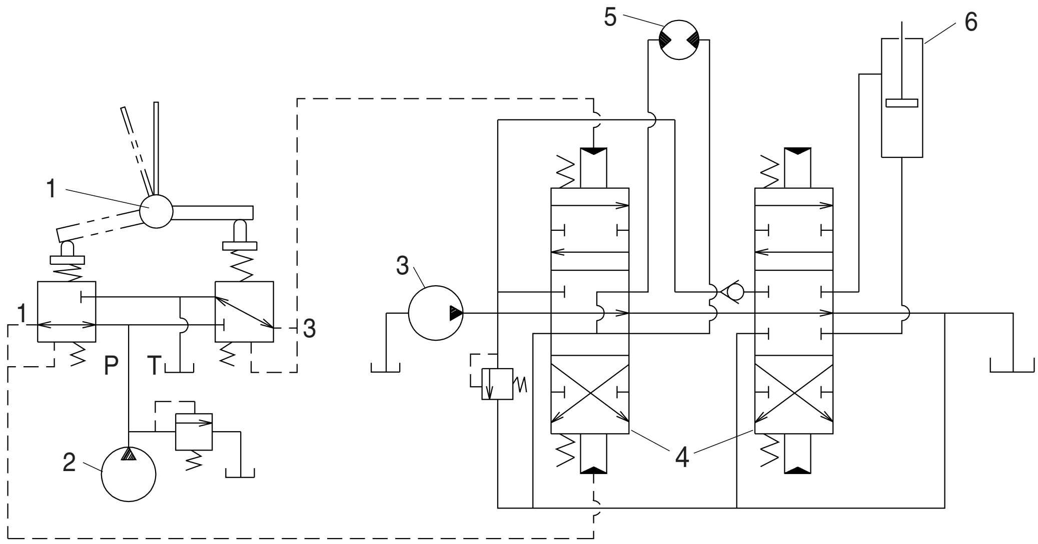
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

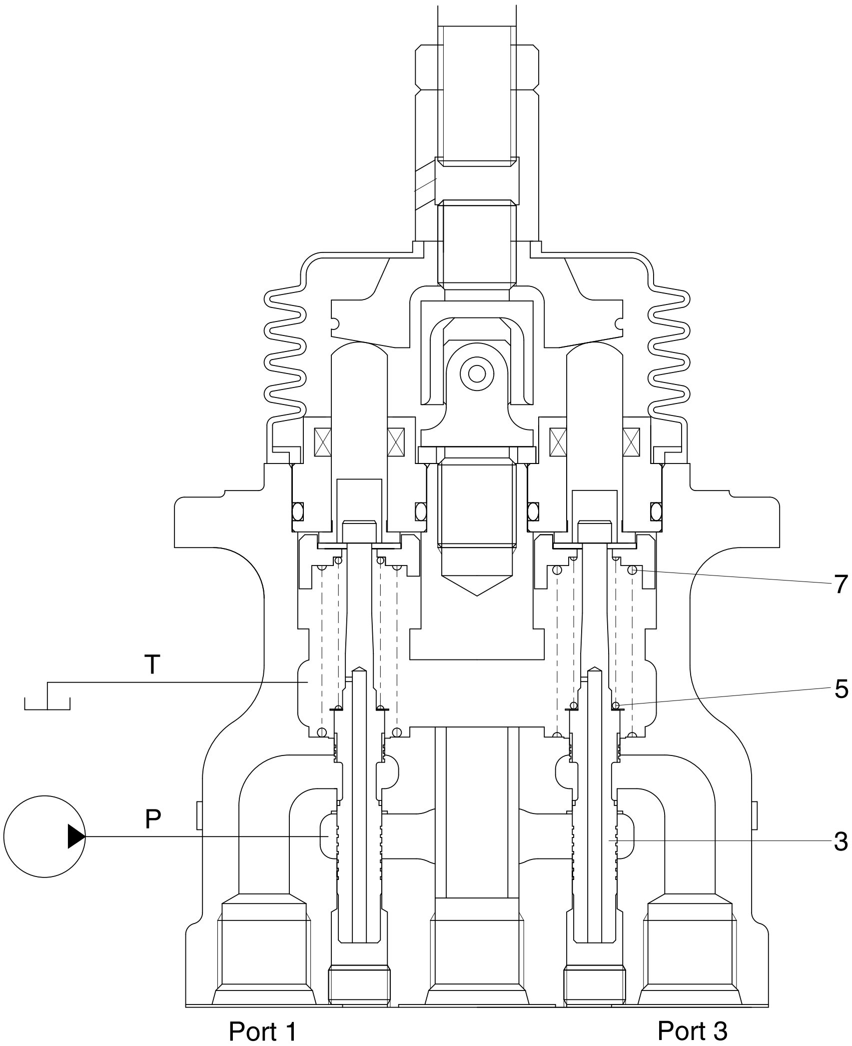
The diagram shown below is the typical application example of the pilot valve.



2-70

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

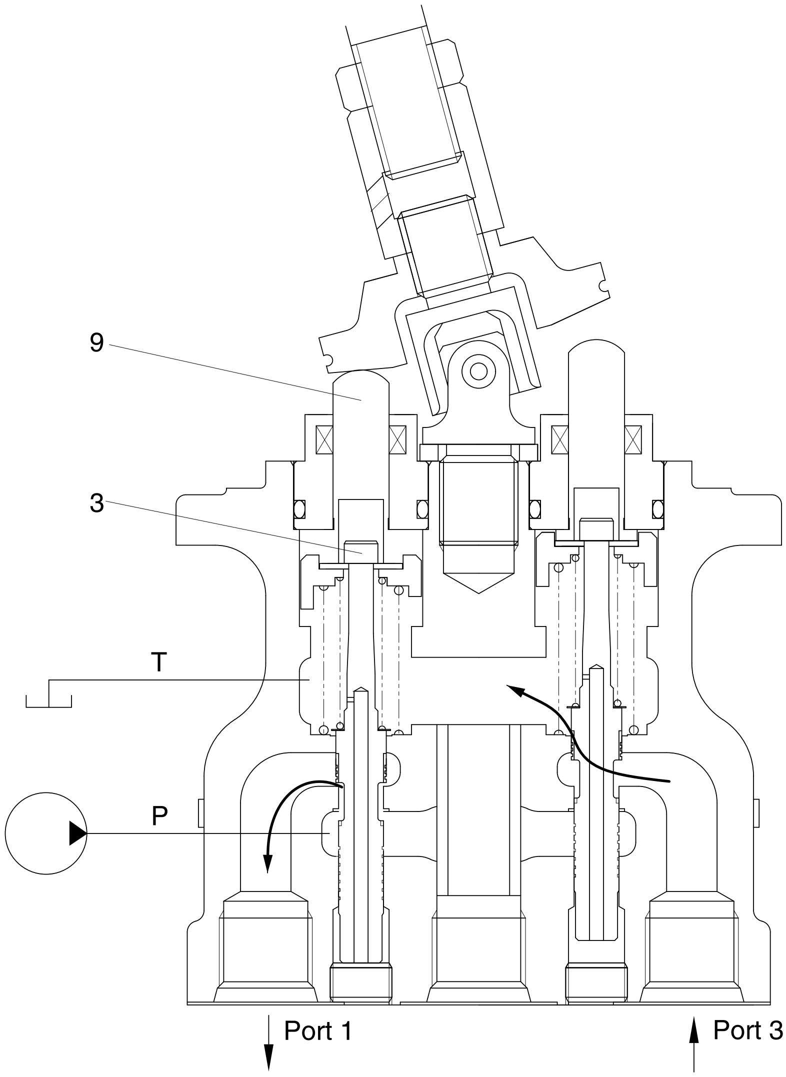
(1) Case where handle is in neutral position



300L2RL03

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

(2) Case where handle is tilted



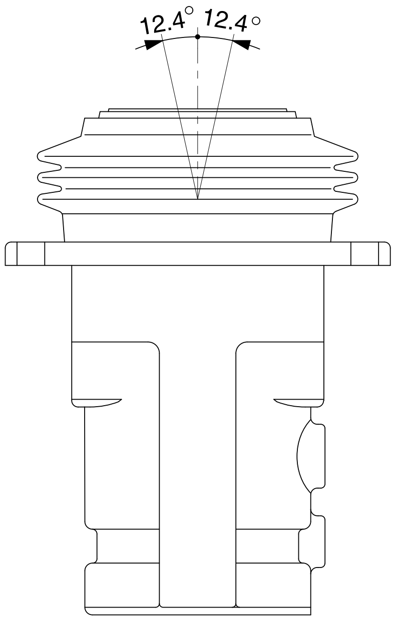
300L2RL04

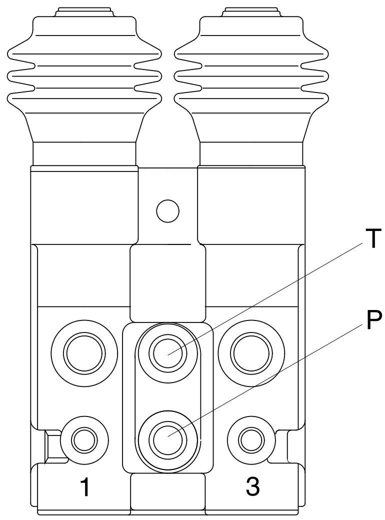
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle,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

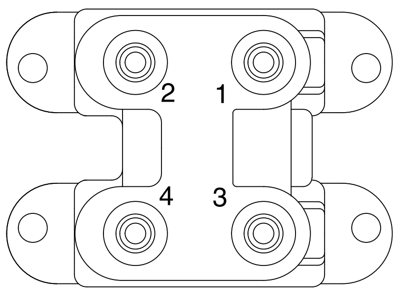
GROUP 6 RCV PEDAL

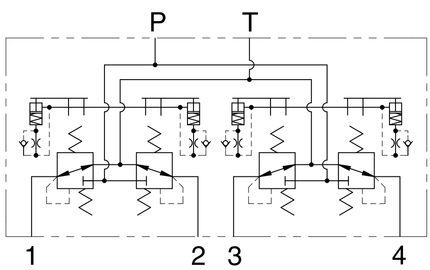
1. STRUCTURE

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









Hydraulic circuit

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

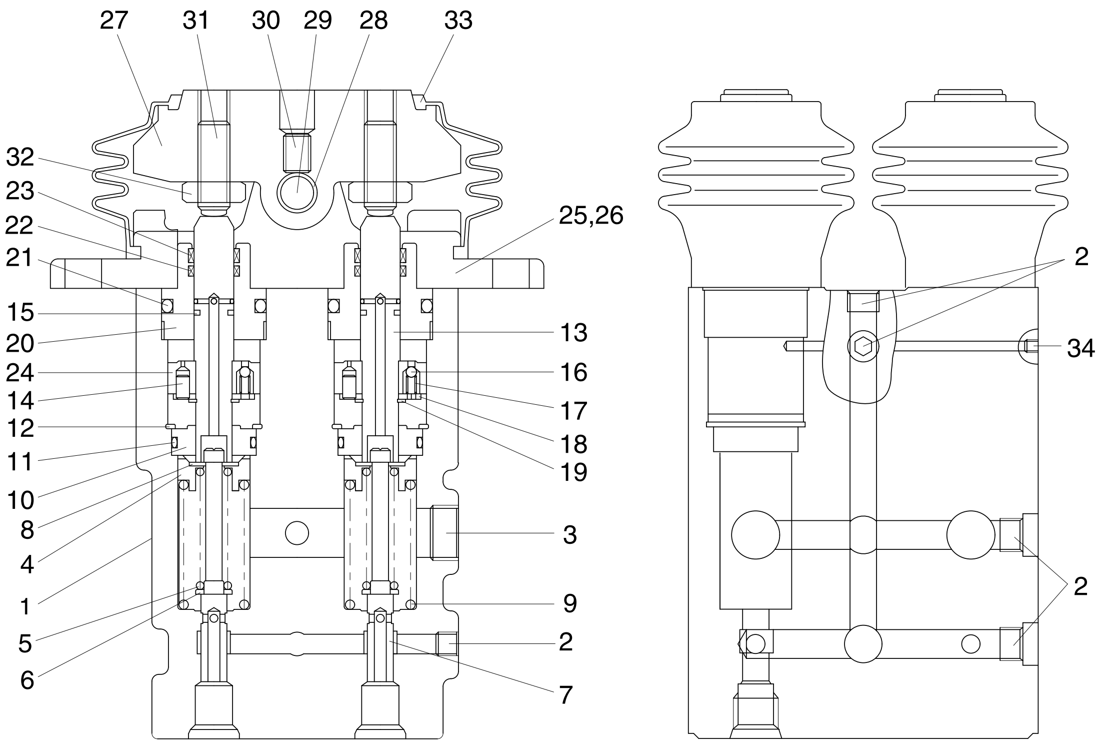
130ZF2RP01

CROSS SECTION

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

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

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



130ZF2RP02

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

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

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

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

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

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

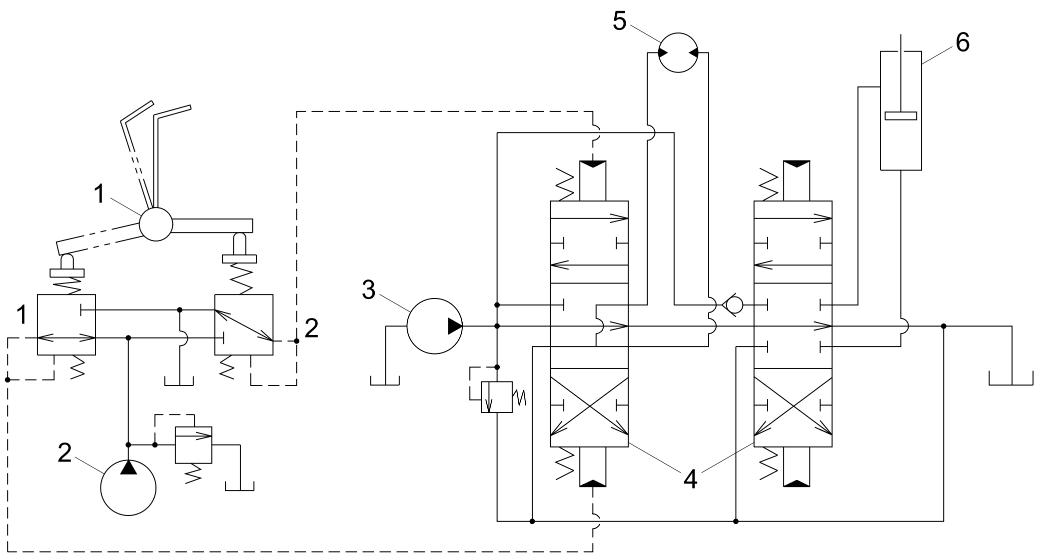
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

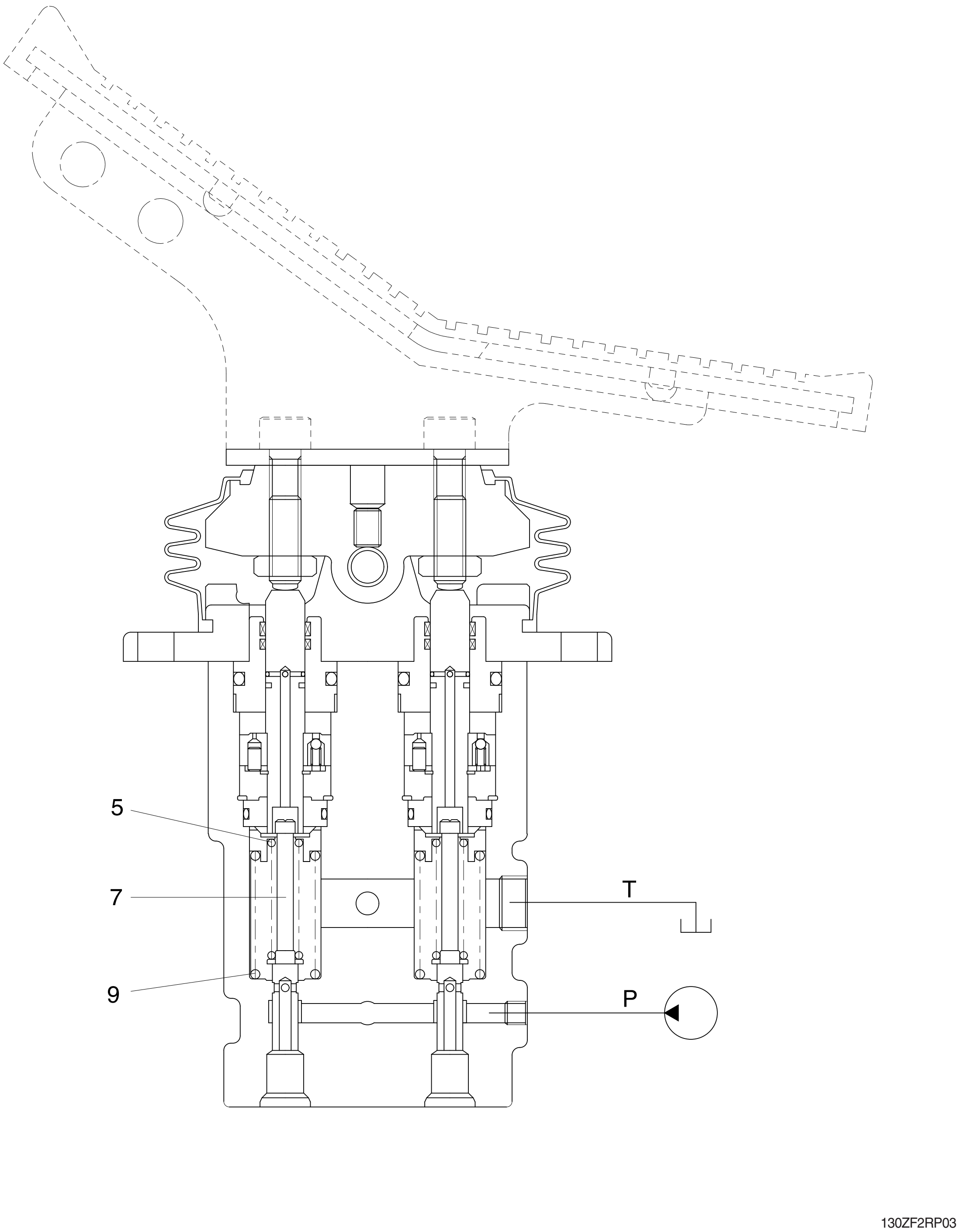
The diagram shown below is the typical application example of the pilot valve.



36072SF01

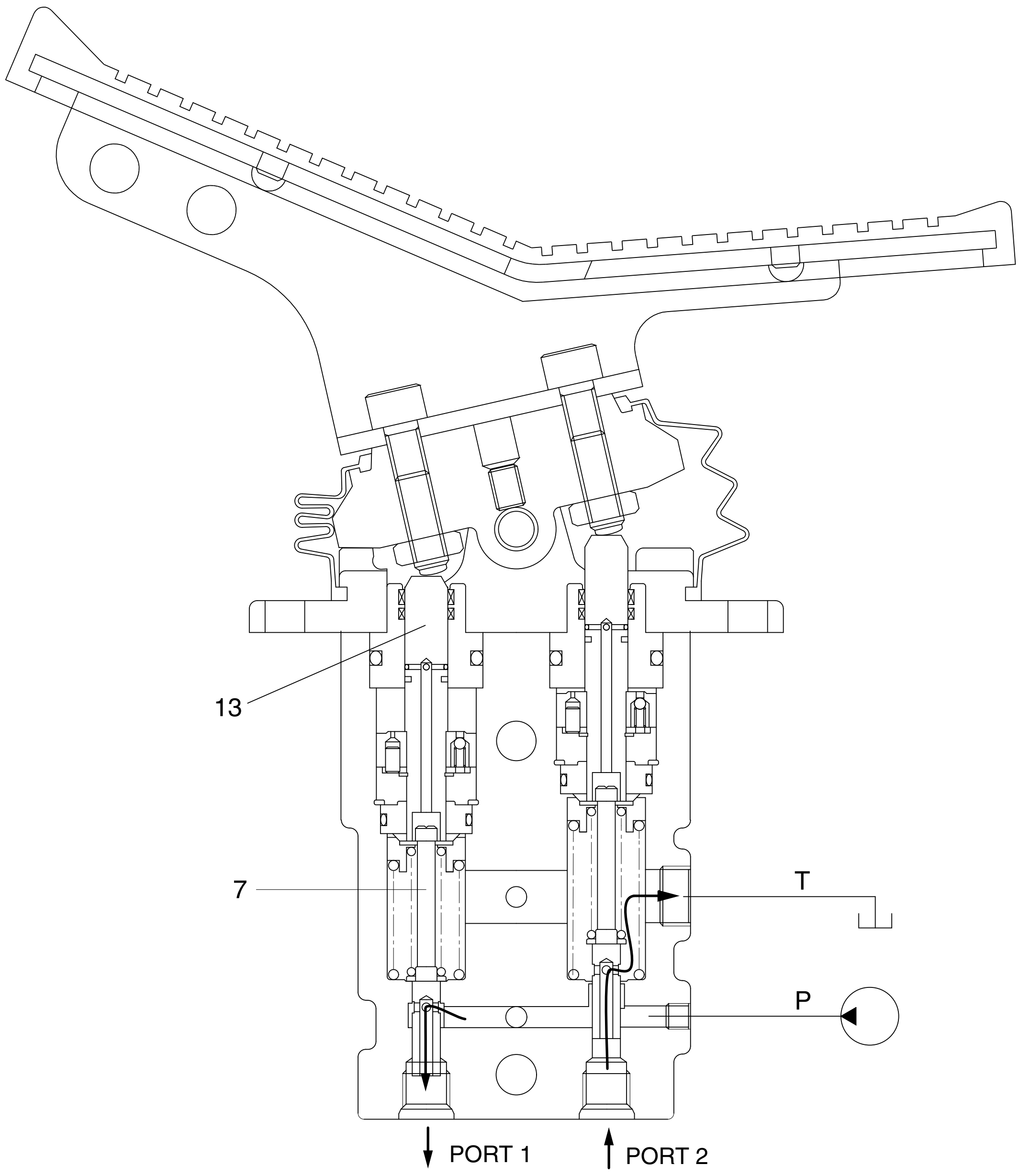
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where pedal is in neutral position



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

(2) Case where pedal is tilted



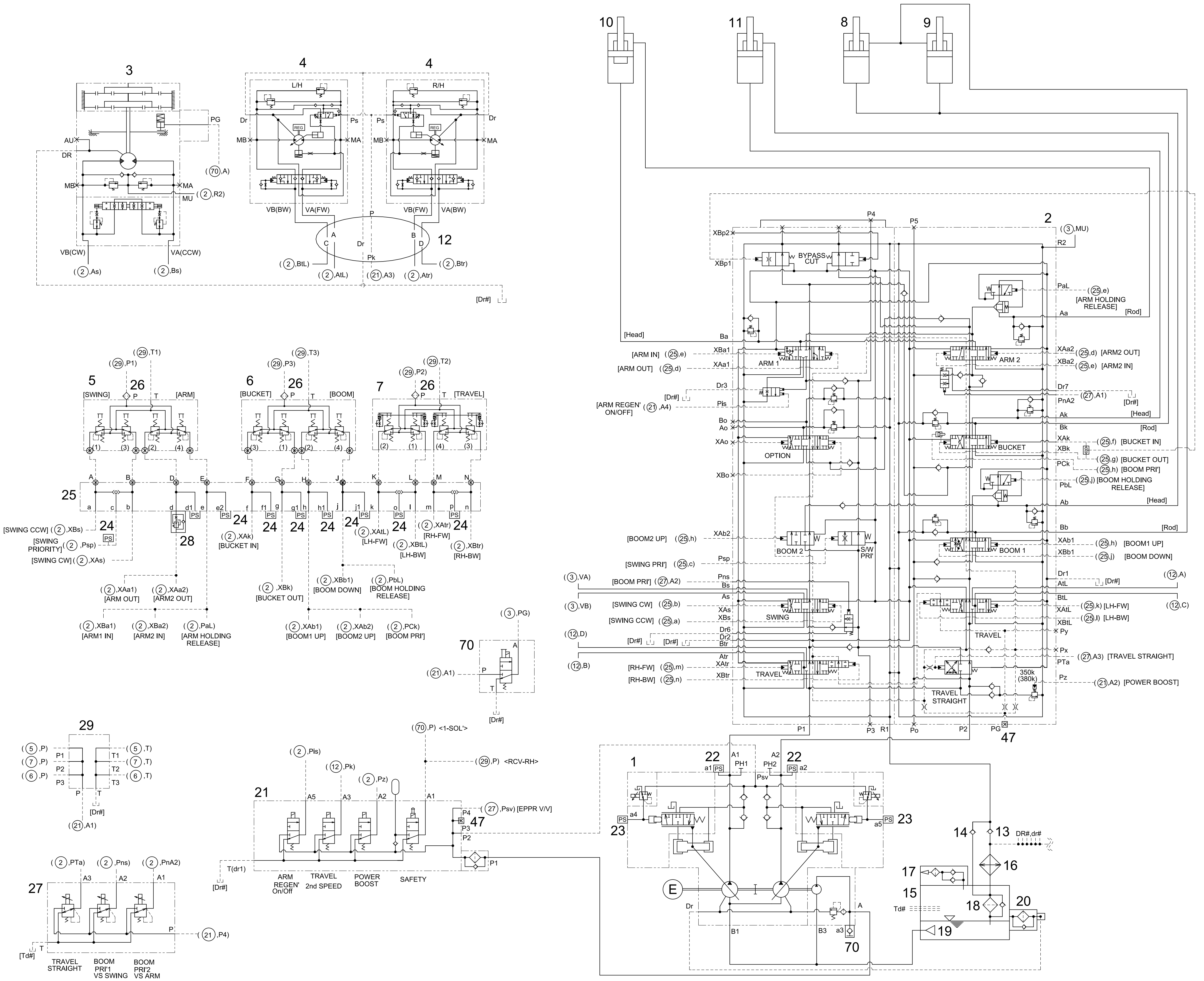
When the push rod (13) is stroked, the spool (7) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle,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

SECTION 3 HYDRAULIC SYSTEM

Group 1 Hydraulic Circuit ········· 3-1
Group 2 Main Circuit ········· 3-3
Group 3 Pilot Circuit ········· 3-6
Group 4 Single Operation ········· 3-17
Group 5 Combined Operation ········· 3-27

GROUP 1 HYDRAULIC CIRCUIT

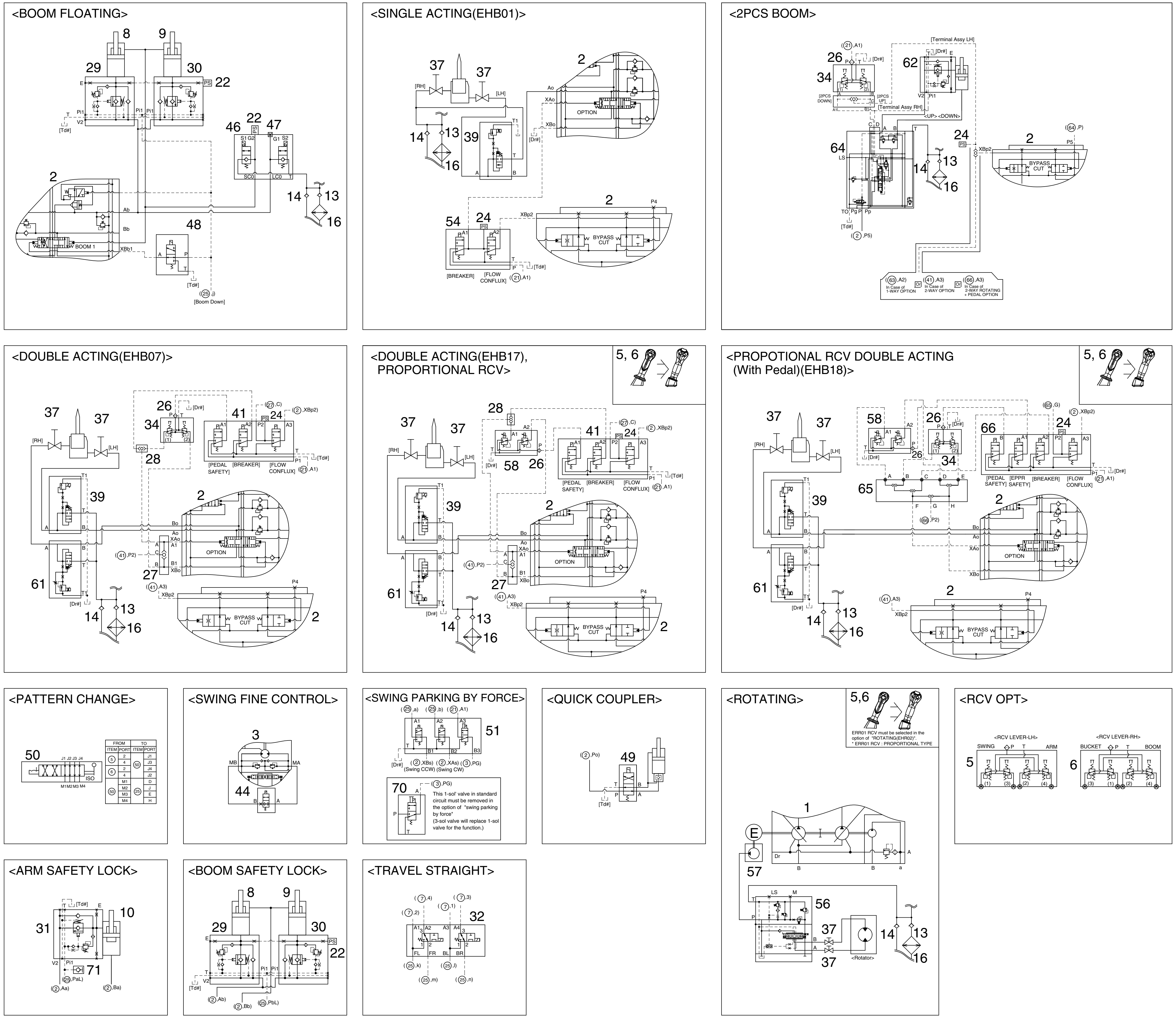
1. HYDRAULIC CIRCUIT (1/2)



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

30K7-27100-03A 1OF2

2. HYDRAULIC CIRCUIT (2/2)



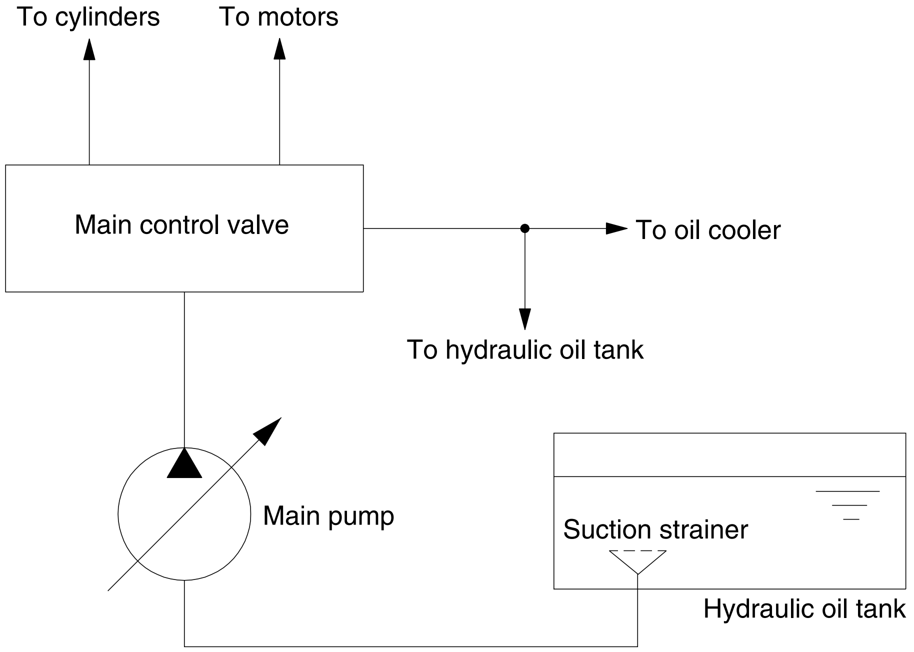
1 Main pump
2 Main control valve
3 Swing motor
5 RCV lever(LH)
6 RCV lever(RH)
8 Boom cylinder(LH)
9 Boom cylinder(RH)
10 Arm cylinder
13 Check valve
14 Check valve
16 Oil cooler
22 Pressure sensor
24 Pressure sensor
26 Last guard filter
27 Shuttle valve(option)
28 Tee shuttle(option)
29 Safety valve(option)
30 Safety valve(option)
31 Safety valve(option)
34 2 way pedal(option)
37 Stop valve(option)
39 Proportional relief valve(option)
41 Solenoid valve(option)
44 Solenoid valve(option)
46 Float cartridge valve(option)
47 Plug valve(option)
48 Solenoid valve(option)
49 Solenoid valve(option)
50 Pattern change valve(option)
51 Solenoid valve(option)
56 Proportional valve(option)
57 Gear pump(option)
58 2-EPPR valve(option)
61 Proportional relief valve(option)
62 Safety valve(option)
64 Control valve(option)
65 Shuttle block(option)
66 Solenoid valve(option)
70 Screw coupling(option)

30K7-27100-03 2OF2

GROUP 2 MAIN CIRCUIT

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

1. SUCTION AND DELIVERY CIRCUIT

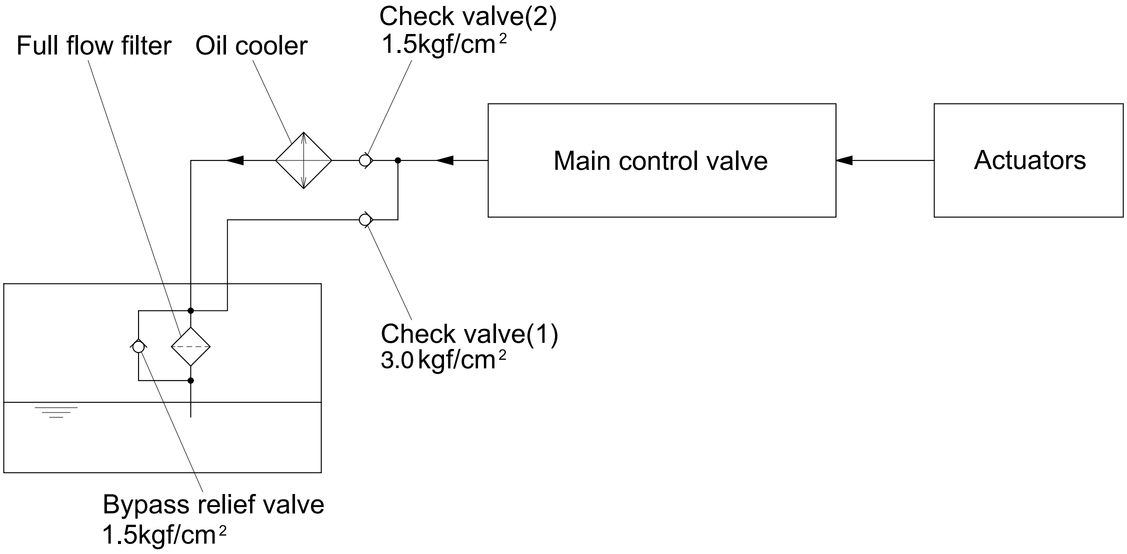


140L3CI01

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

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

2. RETURN CIRCUIT



220F3CI01

All oil returned from each actuator returns to the hydraulic tank through the main control valve.

The bypass check valves are provided in the return circuit.

The setting pressure of bypass check valves are 1.5 kgf/cm^2 (21 psi) and 3.0 kgf/cm^2 (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

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

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

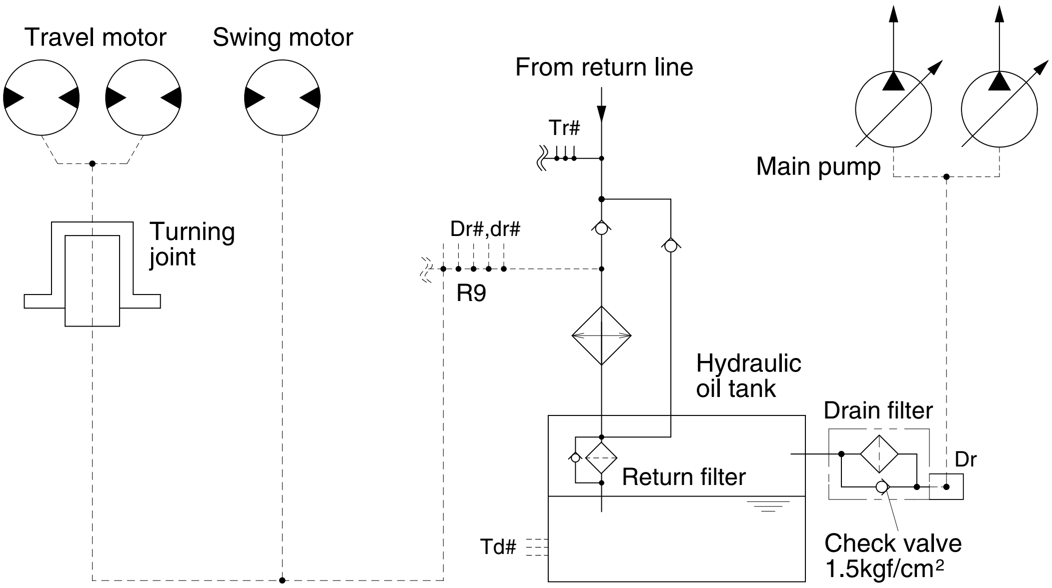
The full-flow filter and bypass relief valve are provided in the hydraulic tank.

The oil returned from right and left side of control valve is combined and filtered by the full-flow filter. A bypass relief valve is provided in the full-flow filter.

When the filter element is clogged, the bypass relief valve opens at 1.5 kgf/cm^2 (21 psi) differential pressure.

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

3. DRAIN CIRCUIT



260A3CI02

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

1) TRAVEL AND SWING MOTOR DRAIN CIRCUIT

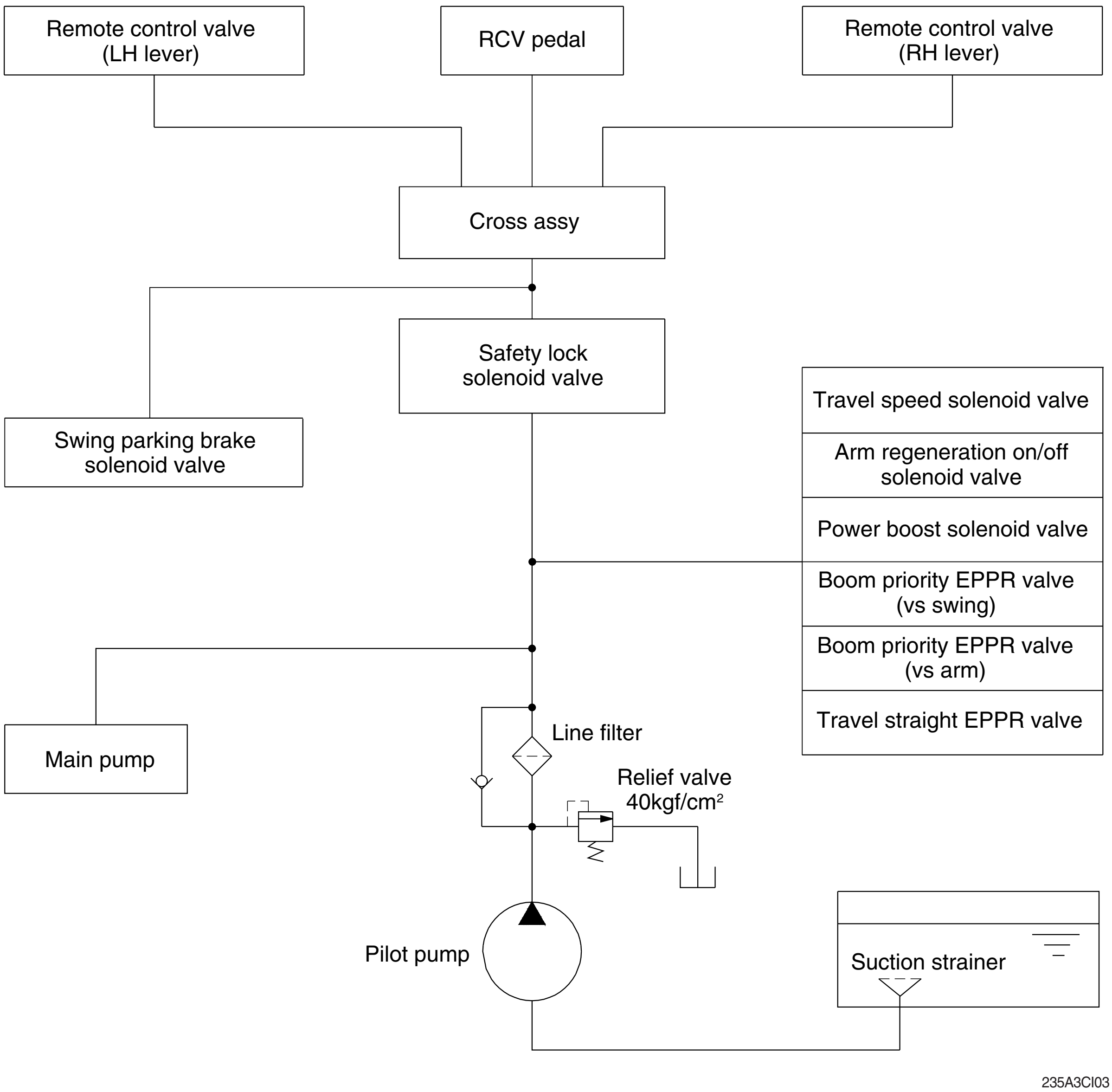
Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and join with oil leak line of the swing motor and return to the hydraulic tank through the oil cooler and return filter.

2) MAIN PUMP DRAIN CIRCUIT

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

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

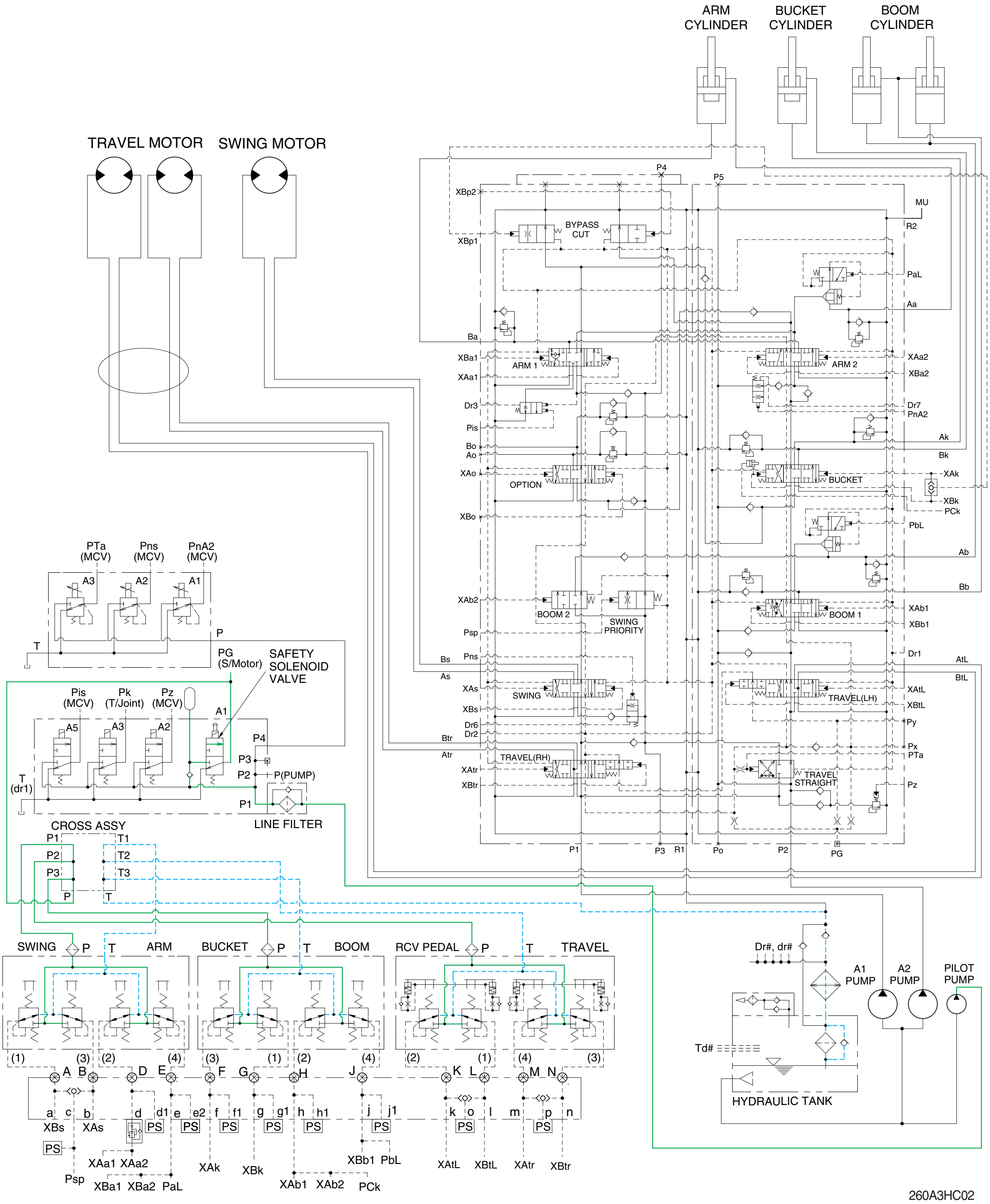
GROUP 3 PILOT CIRCUIT



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

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



260A3HC02

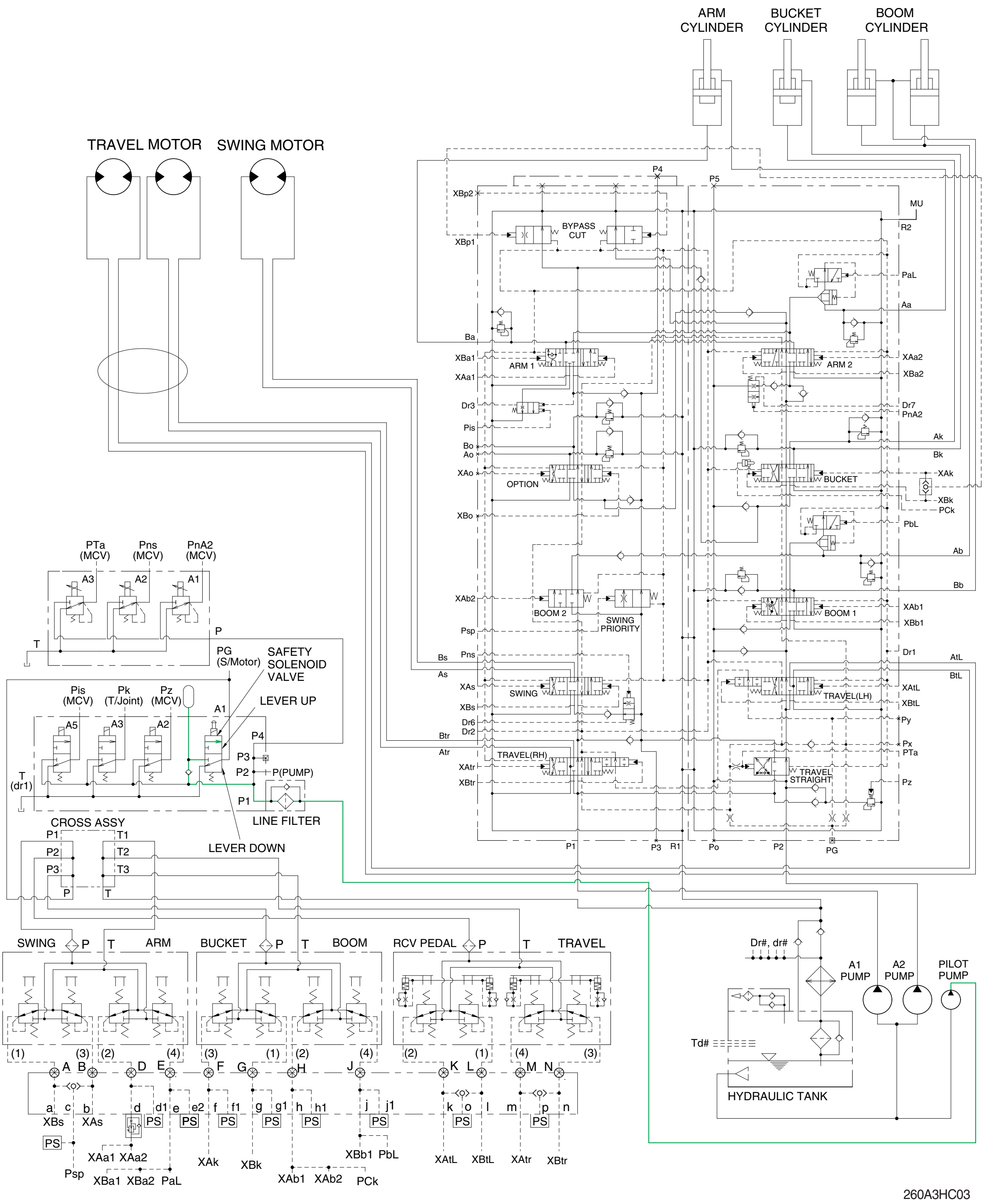
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

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

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

2. SAFETY VALVE (SAFETY LEVER)

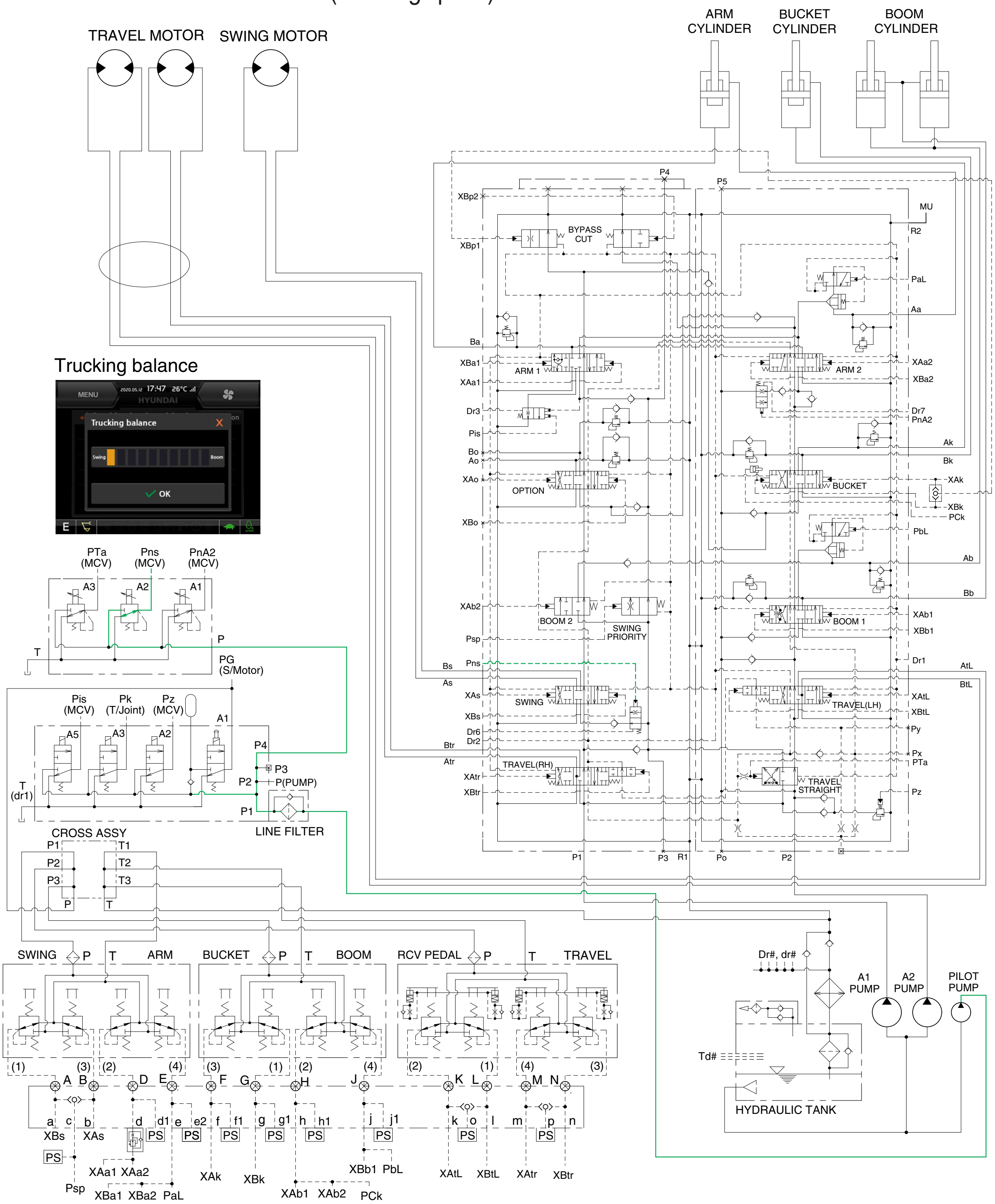


When the lever of the safety solenoid valve is moved upward, oil flows into the remote control valve through the line filter, safety solenoid valve and cross assy.

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

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

3. BOOM PRIORITY SYSTEM (vs swing speed)

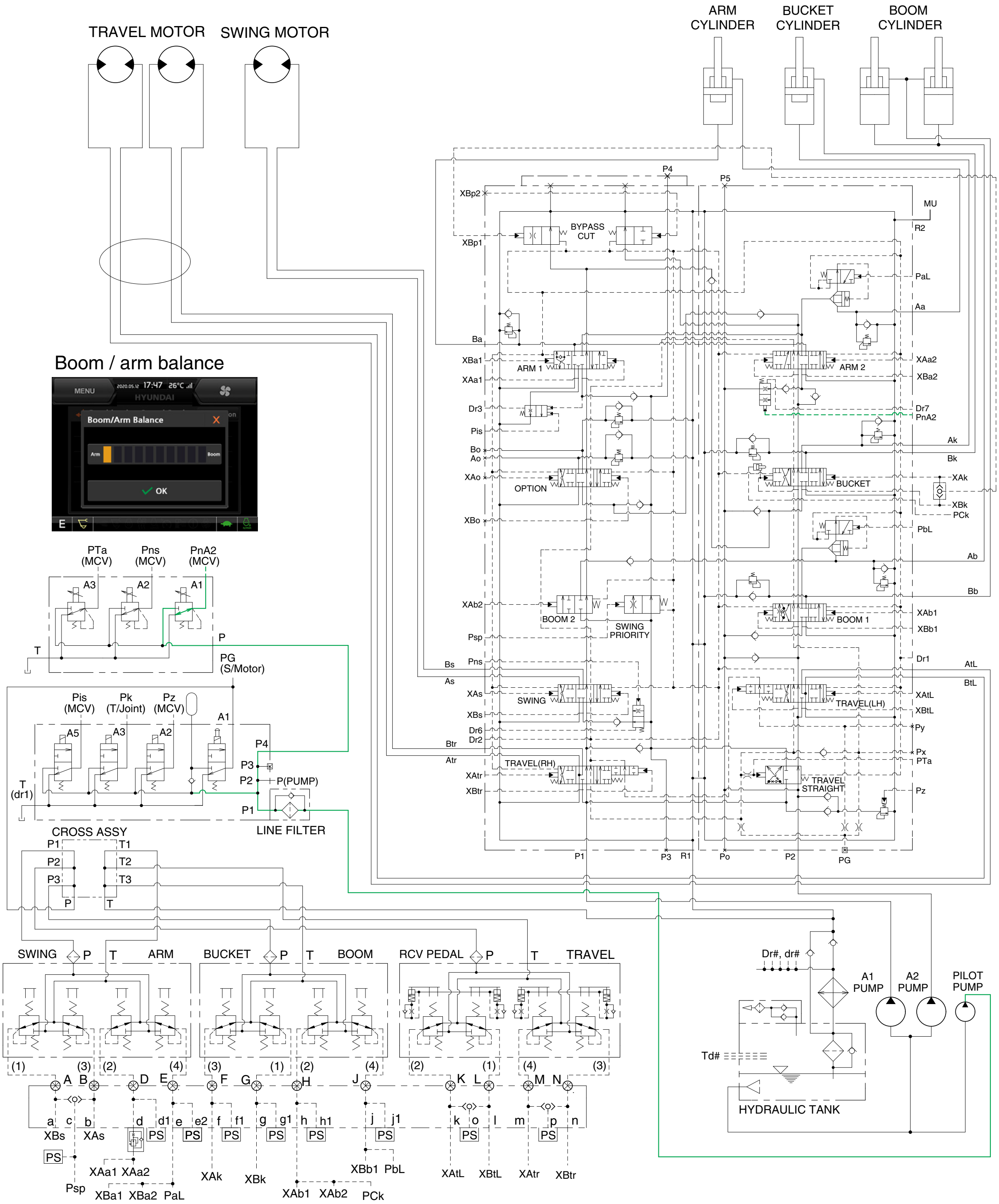


260A3HC04

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 **Pns** port in main control valve through boom priority (vs swing) EPPR valve. **Pns** oil pressure moves swing reducing spool to lower position and oil flow rate to the swing motor decreased.
Then, the boom up speed is increased. This is called the boom priority system (trucking balance).
The trucking balance can be adjusted by the cluster. Refer to page 3-21-1 of the operator's manual.

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

4. BOOM PRIORITY SYSTEM (vs arm speed)



260A3HC05

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

To increase working efficiency, arm in speed reducing system is used.

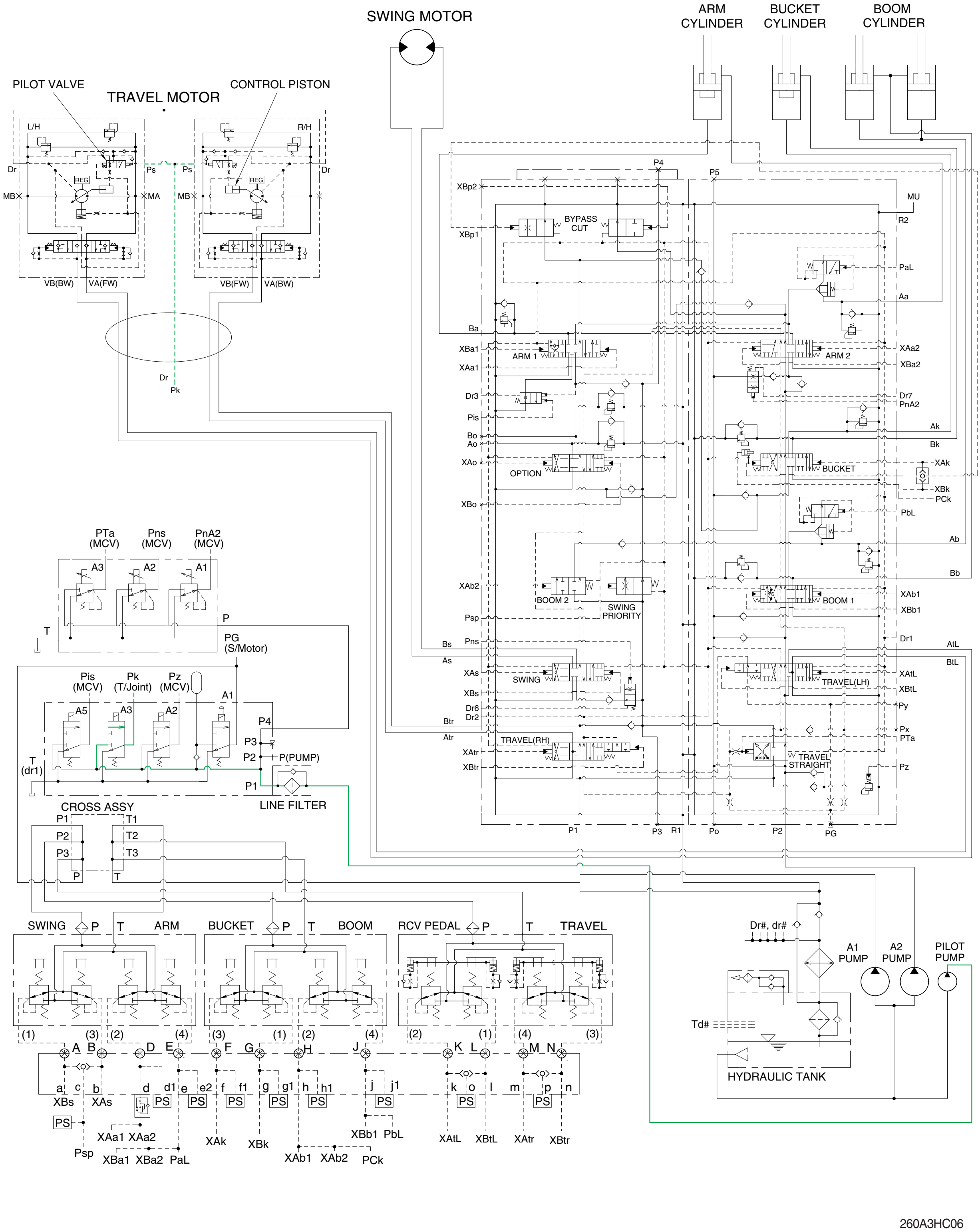
The pilot oil from pilot pump flow into **PnA2** port in main control valve through boom priority (vs arm) EPPR valve. **PnA2** oil pressure moves swing reducing spool to lower position and oil flow rate to the swing motor decreased.

Then, the boom up speed is increased. This is called the boom priority system (boom/arm balance).

The boom/arm balance can be adjusted by the cluster. Refer to page 3-21-1 of the operator's manual.

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

5. TRAVEL SPEED CONTROL SYSTEM

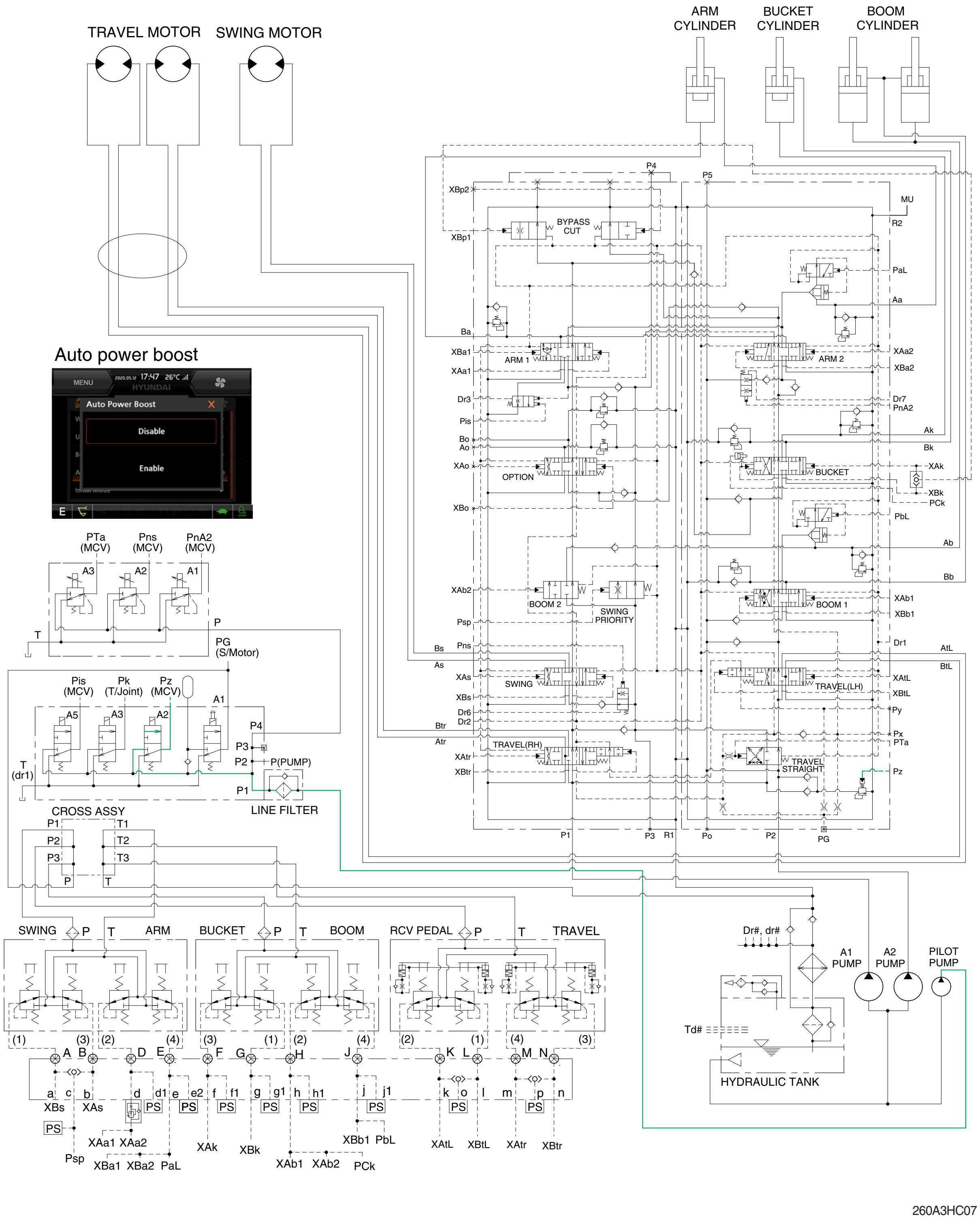


When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston are pushed left and right, thus minimizing the displacement.

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

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

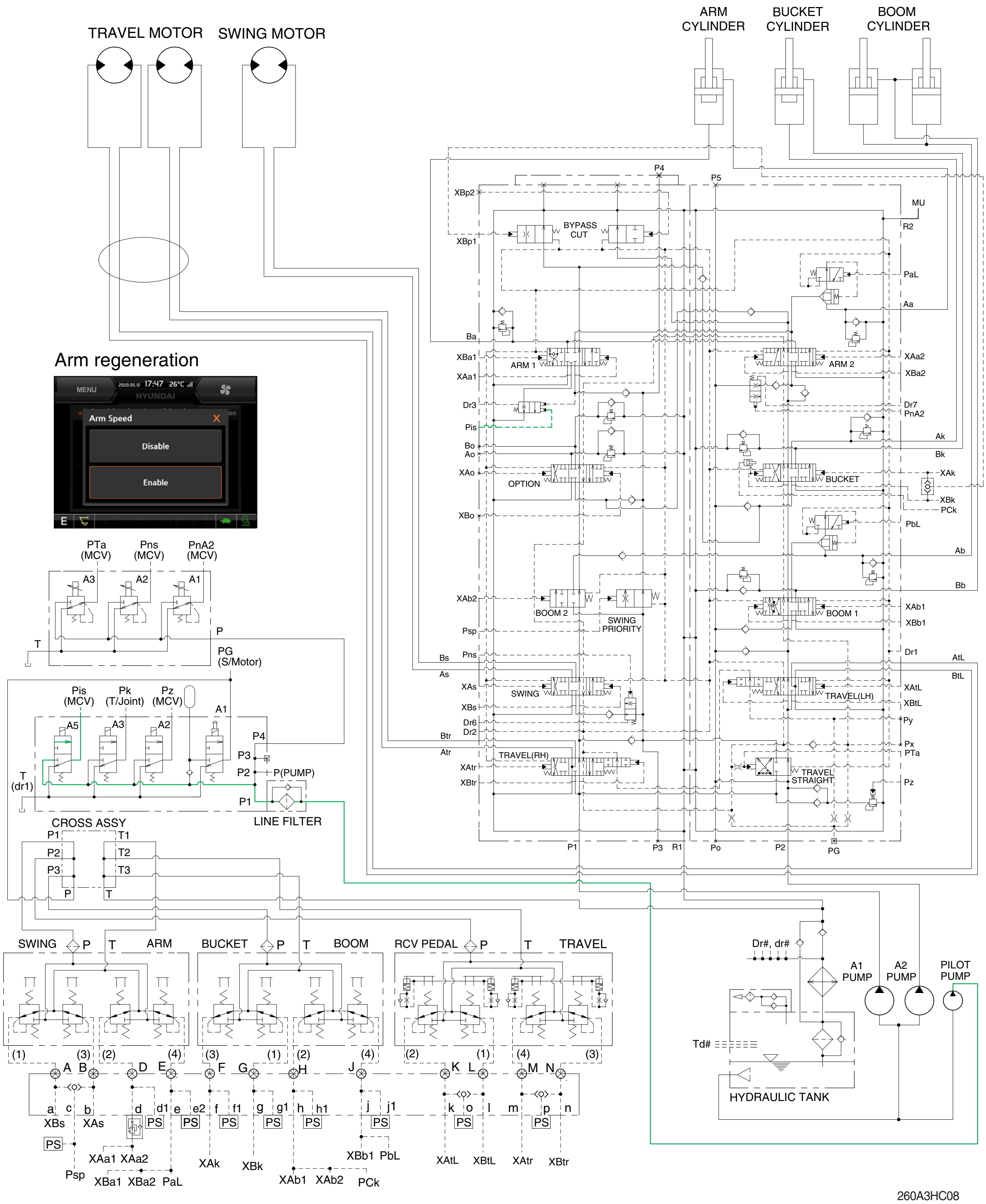
6. MAIN RELIEF PRESSURE CHANGE SYSTEM



When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pz** port of the main relief valve of main control valve; then the setting pressure of the main relief valve is raised from 350 kgf/cm² (4980 psi) to 380 kgf/cm² (5400 psi) for increasing the digging power.
And even when pressed switch continuously, it is canceled after 8 seconds.
When the auto power boost function is selected to enable on the cluster, the pressure of the main relief pressure is automatically increased to 380 kgf/cm² (5400 psi) as working condition by the MCU. It is operated max 8 seconds.

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

7. 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 **Pis** port in main control valve through solenoid valve and the arm regeneration spool is shifted to left.

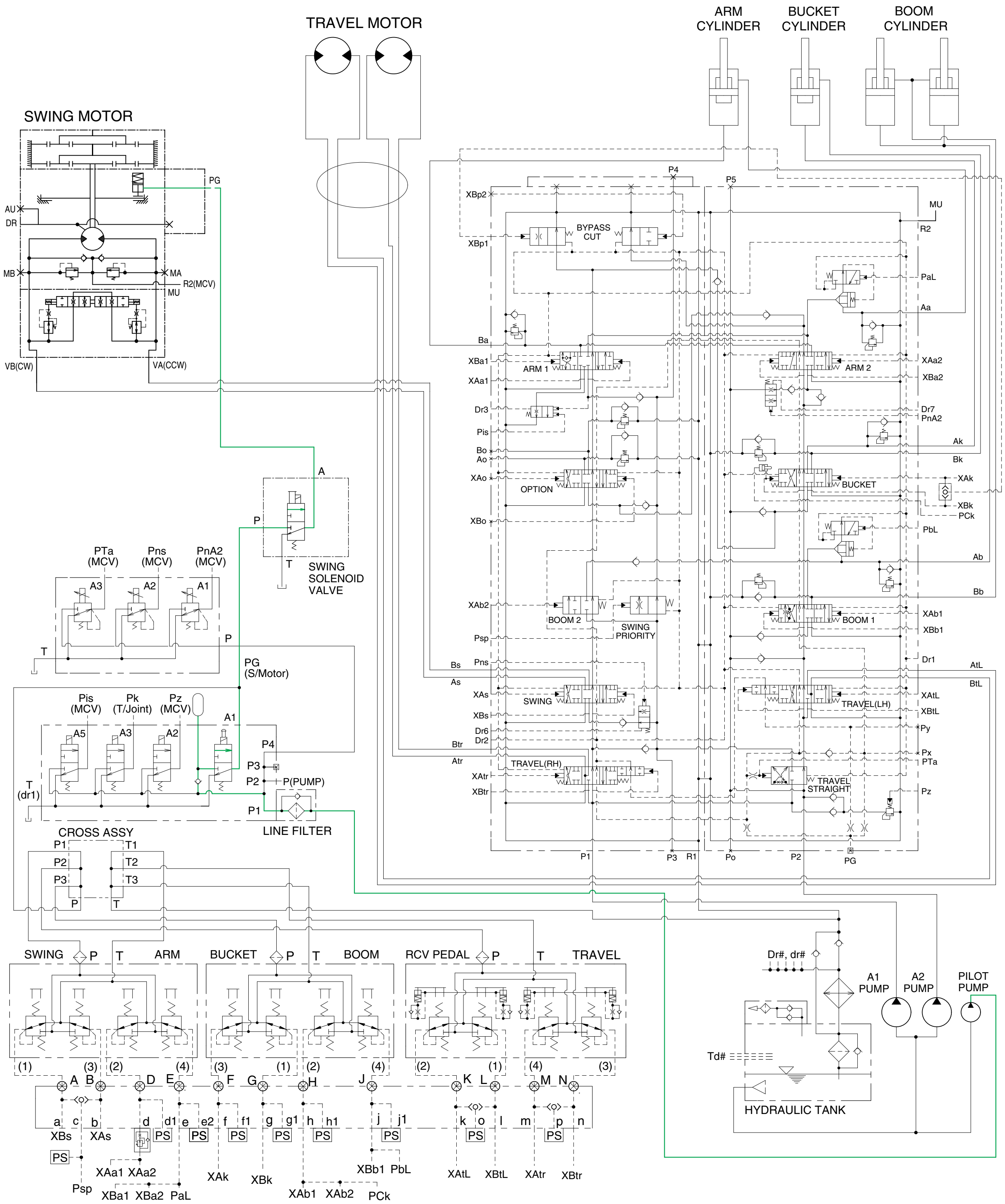
Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

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

Refer to page 2-33 for the arm regeneration function.

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

8. SWING PARKING BRAKE RELEASE



260A3HC09

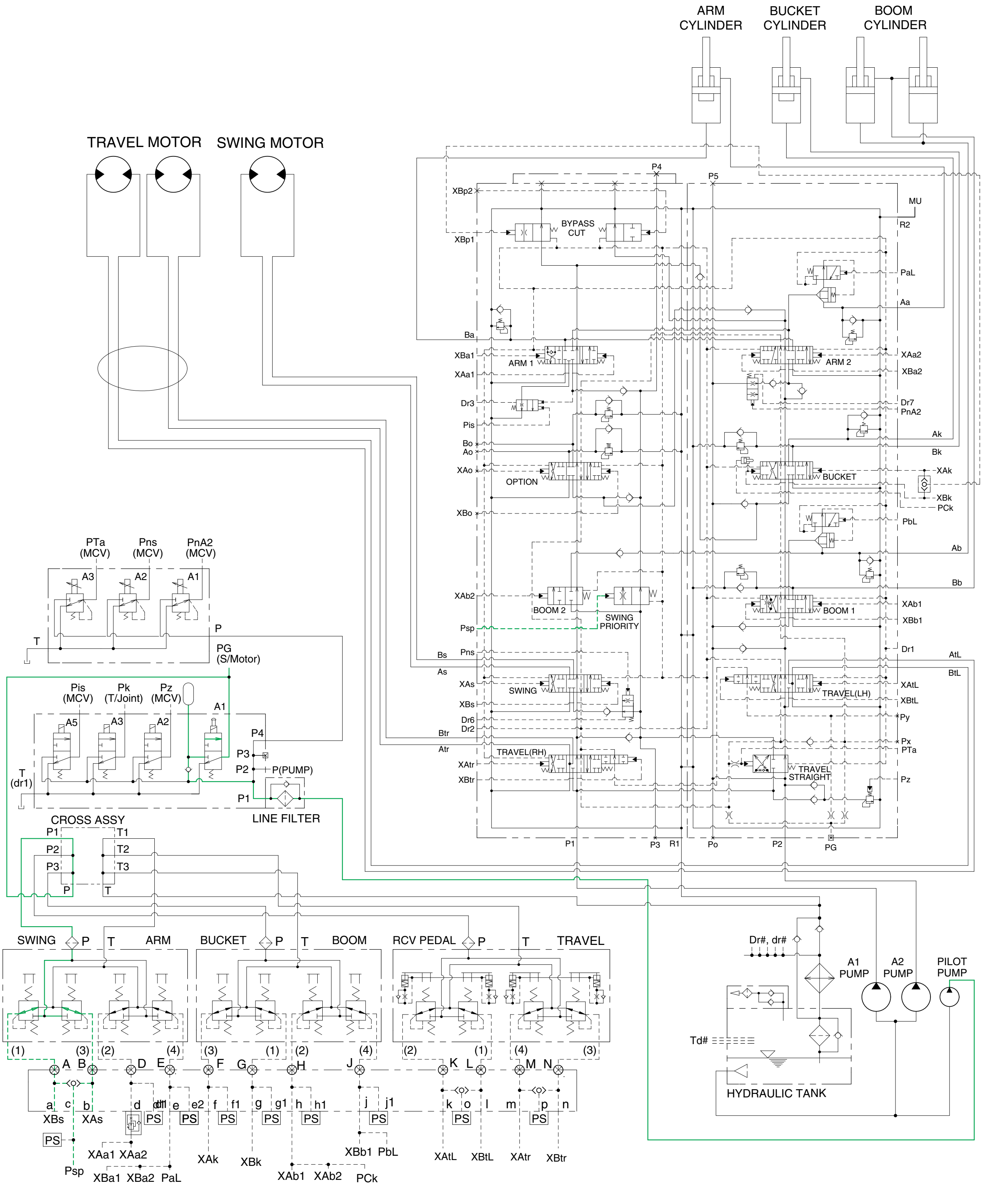
When the swing control lever is tilted, the swing solenoid valve is shifted to the down ward by the MCU that senses the pilot pressure of the swing control lever.

The discharged oil from pilot pump flows to swing motor PG port through the swing solenoid valve. This pressure is applied to swing motor disc, thus the brake is released.

When the swing control lever is set in the neutral position, the swing solenoid valve is shifted to the up ward, oil in the swing motor disc cylinder is drained through the the swing solenoid valve, thus the brake is applied.

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

9. SWING PRIORITY SYSTEM



260A3HC09A

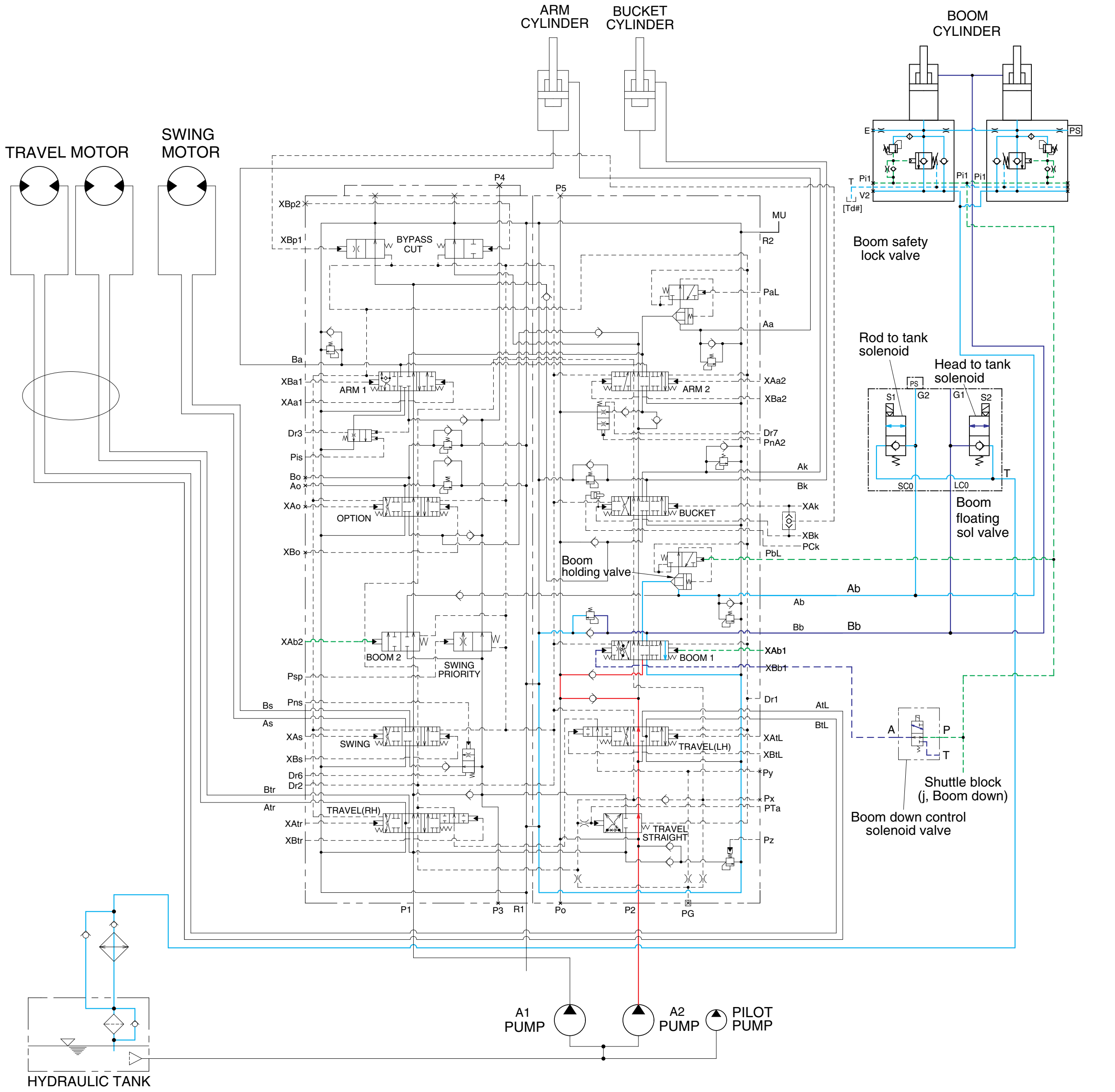
When carrying out the combined operation of swing and arm of the left control valve, the swing speed can be lowered than operating speed of arm.

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

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

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

10. BOOM FLOATING SYSTEM



260A3HC30

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

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

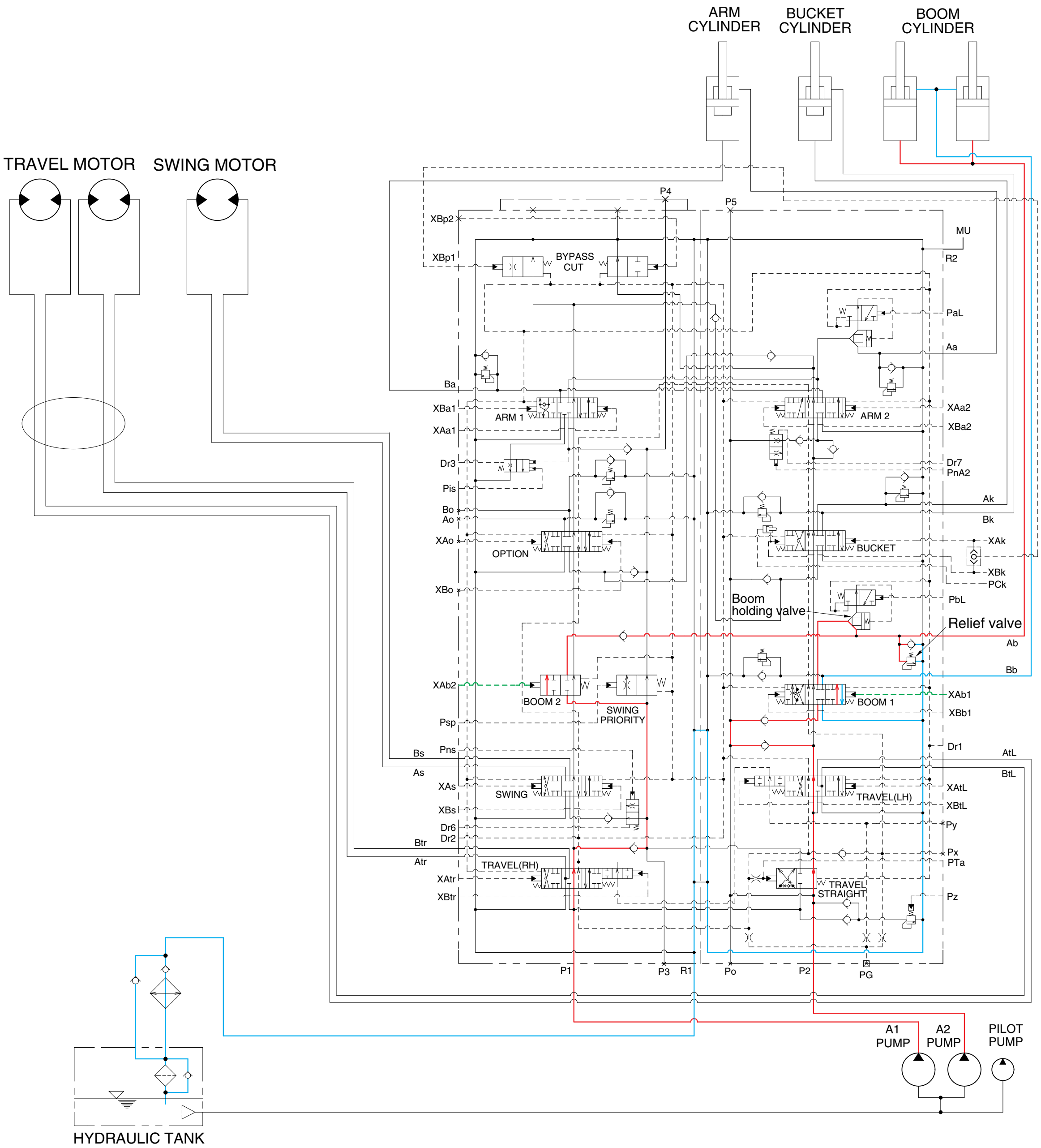
"Rod to tank solenoid" and "Head to tank solenoid" are active. So the hydraulic oil of rod and head goes to tank, and floating is accomplished. In the mode, boom down cut-off solenoid is active so that boom down pilot pressure is cut.

For more details, refer to page 5-13.

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

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION



260A3HC10

When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure (XAb1, XAb2) from the remote control valve.

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

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

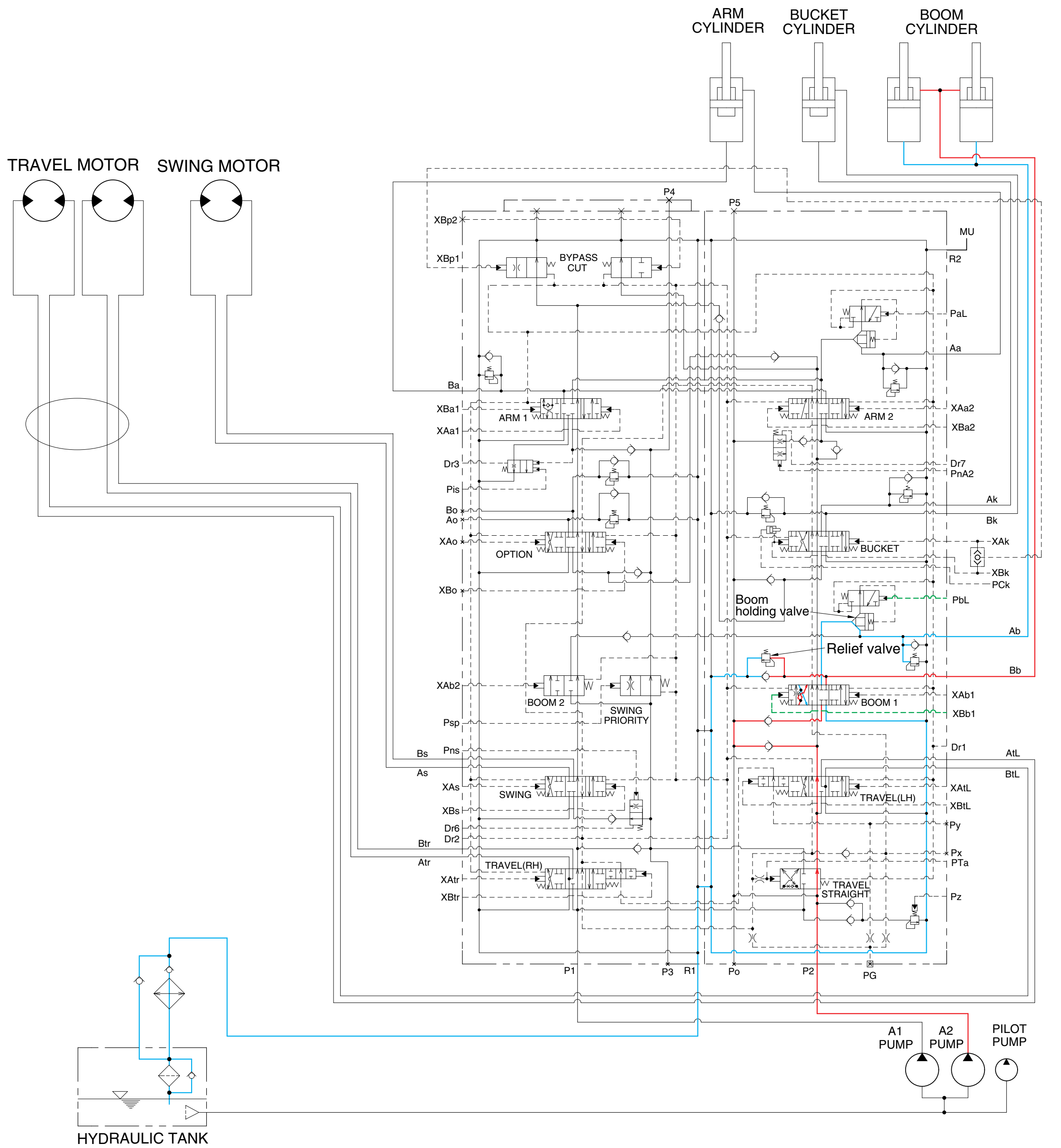
The excessive pressure in the boom cylinder head side is prevented by relief valve.

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

This prevents the hydraulic drift of boom cylinder.

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

2. BOOM DOWN OPERATION

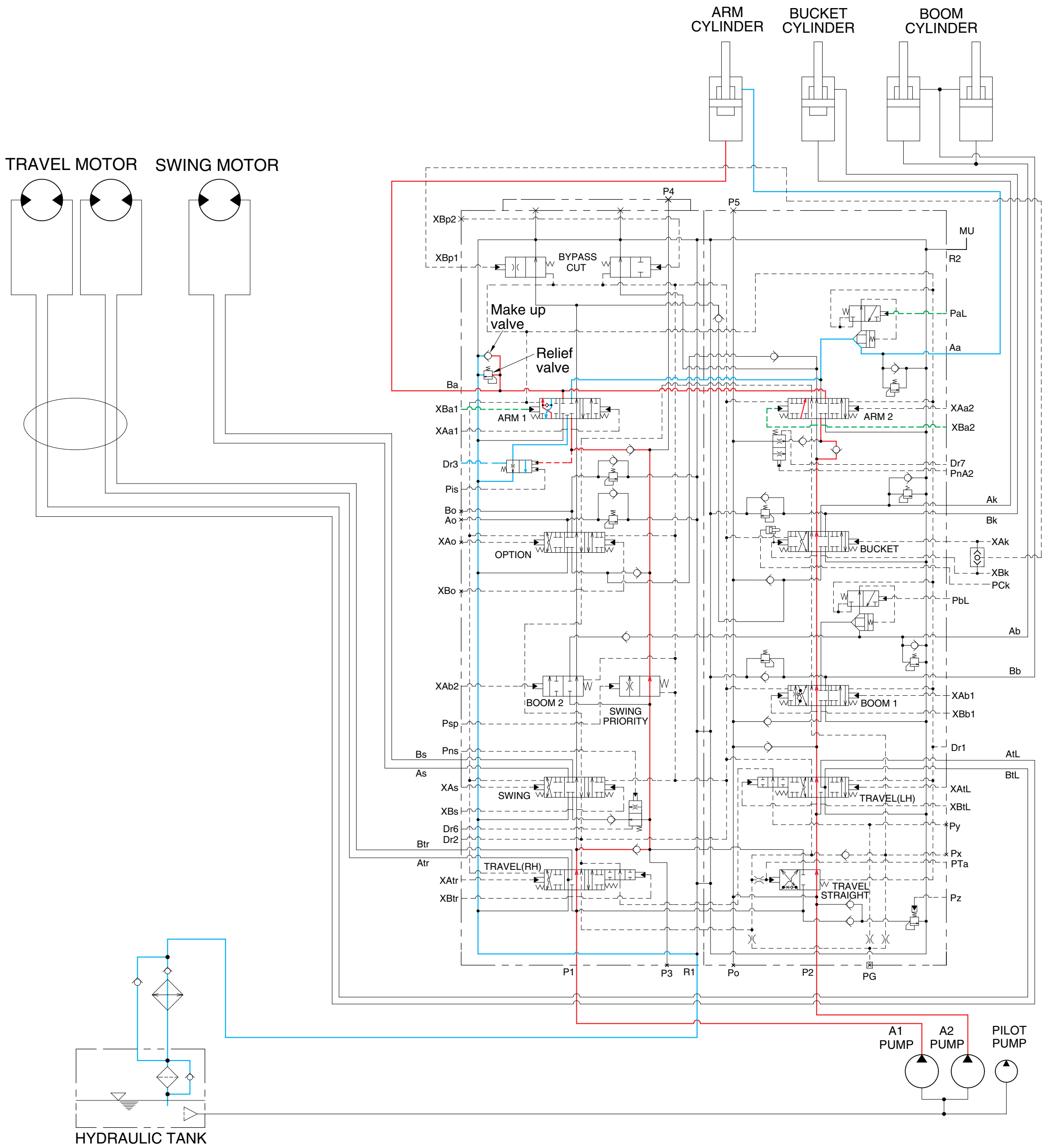


260A3HC11

When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure (XBb1) 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 A2 pump, and flows into the small chamber of the cylinder.
This prevents cylinder cavitation by the negative pressure when the A2 pump flow can not match the boom down speed. And the excessive pressure in the boom cylinder rod side is prevented by the relief valve.

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

3. ARM IN OPERATION



260A3HC12

When the left control lever is pulled back, the arm spools in the main control valve are moved to the roll in position by the pilot oil pressure (XBa1, XBa2) from the remote control valve.

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

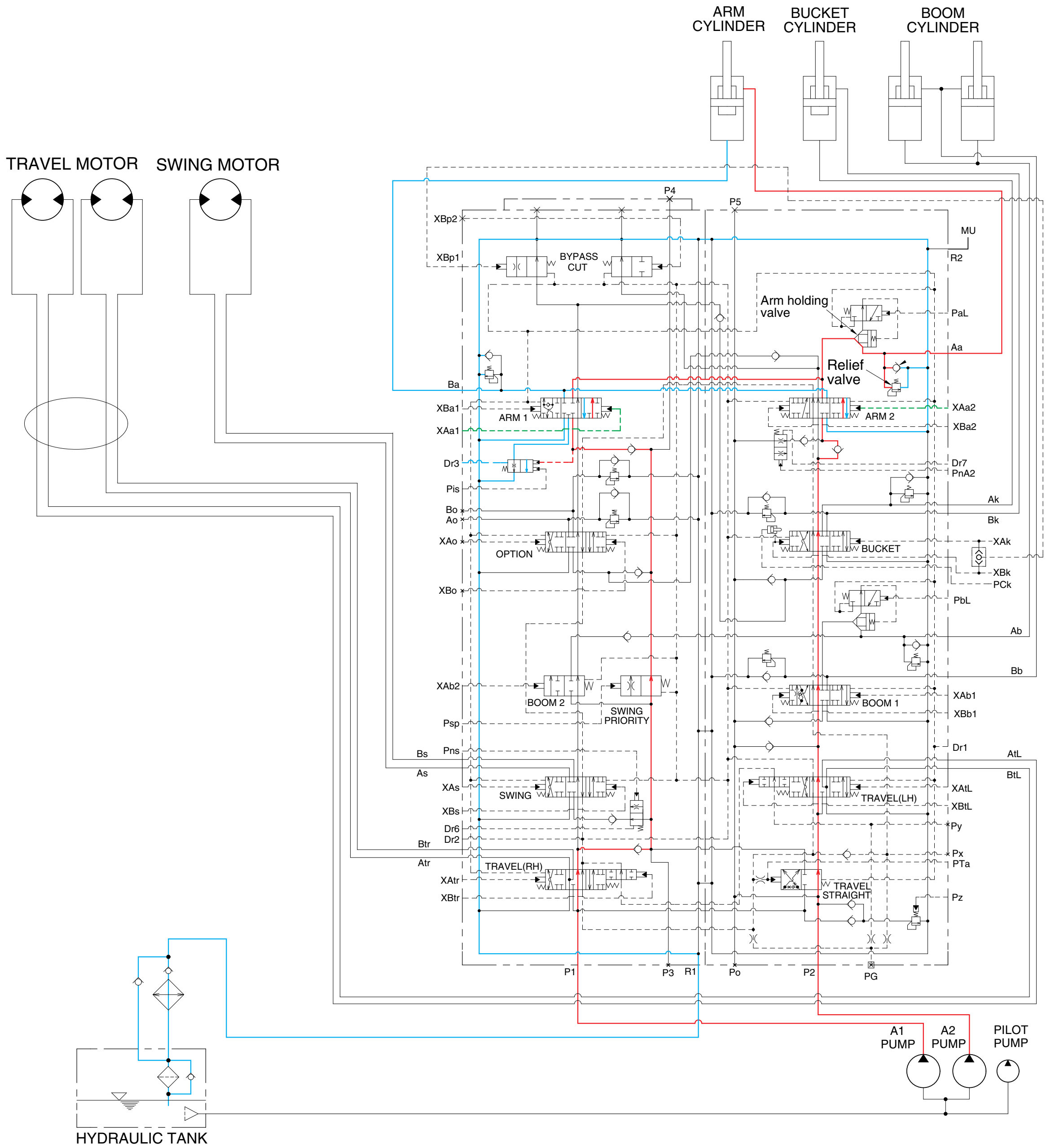
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

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

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

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

4. ARM OUT OPERATION



260A3HC13

When the left control lever is pushed forward, the arm spools in the main control valve are moved to the roll out position by the pilot oil pressure (XAa1, XAa2) from the remote control valve.

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

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

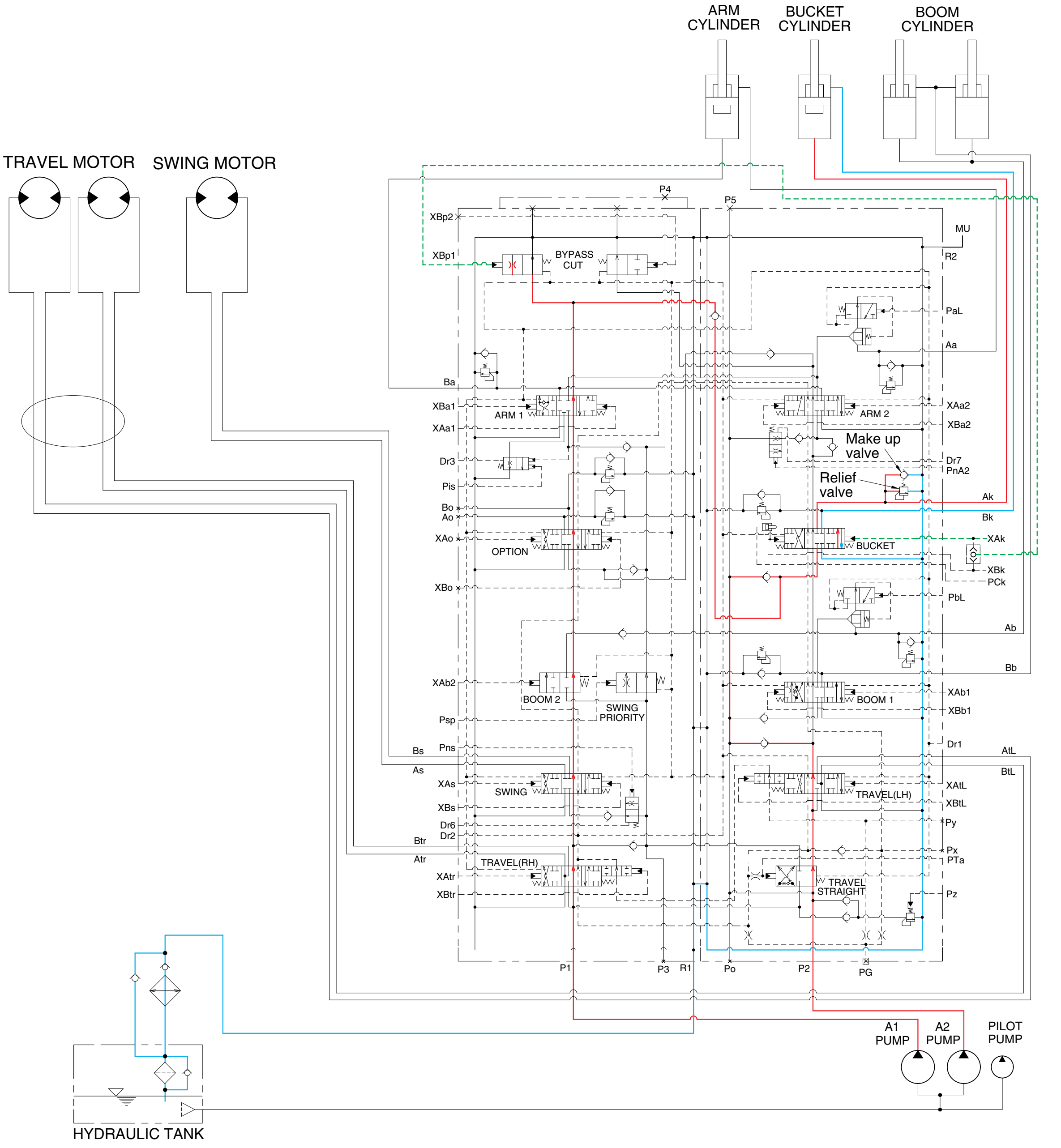
The excessive pressure in the arm cylinder rod side is prevented by relief valve.

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

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

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

5. BUCKET IN OPERATION



260A3HC14

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

The oil from the A2 pump flows into the main control valve and then goes to the large chamber of bucket cylinder. The oil from the A1 pump flows into the large chamber of bucket cylinder through confluence oil passage in the main control valve by bypass cut pilot pressure (XBp1).

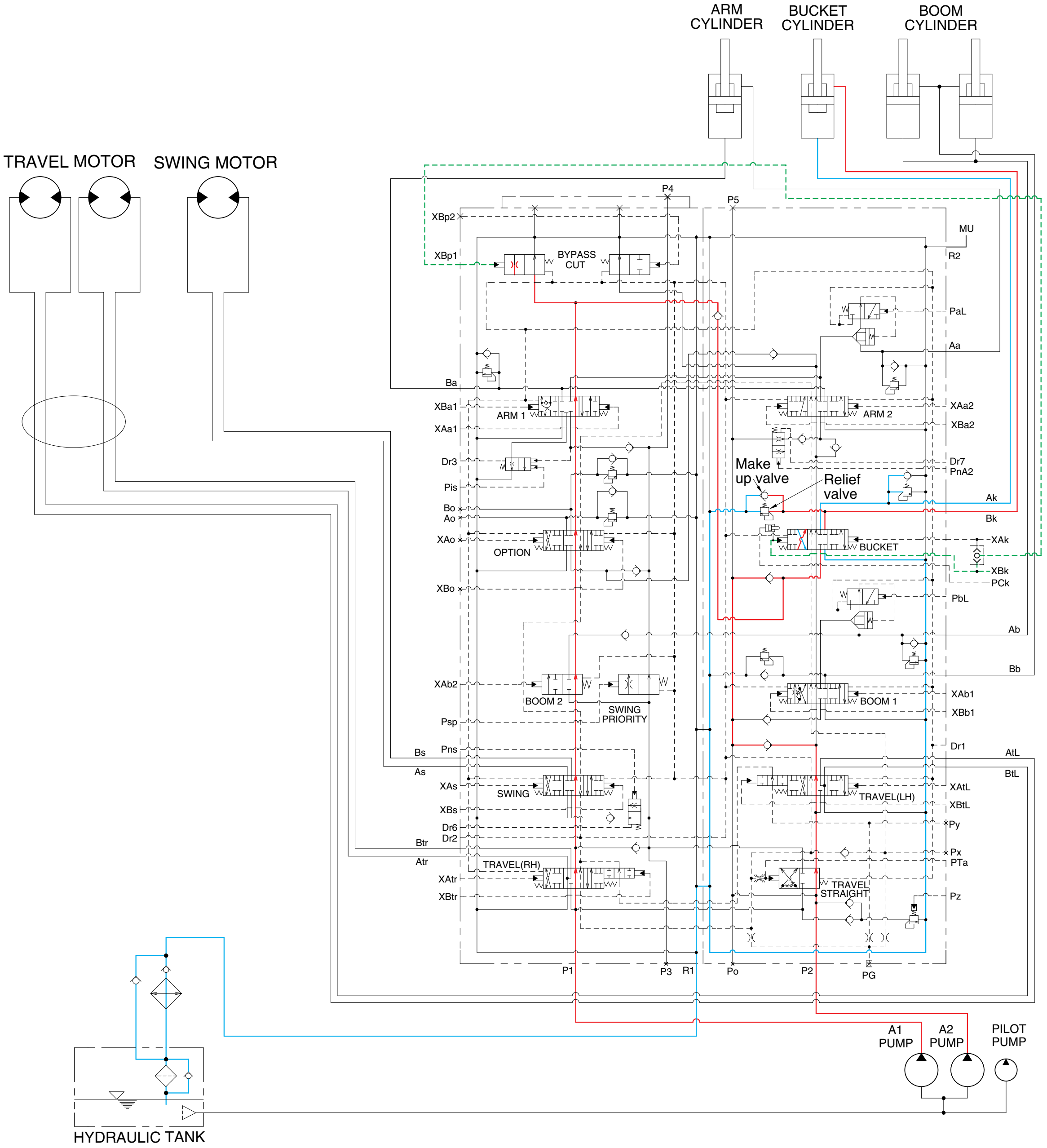
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

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

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

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

6. BUCKET OUT OPERATION



260A3HC15

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

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

The oil from the A1 pump flows into the large chamber of bucket cylinder through confluence oil passage in the main control valve by bypass cut pilot pressure (XBp1).

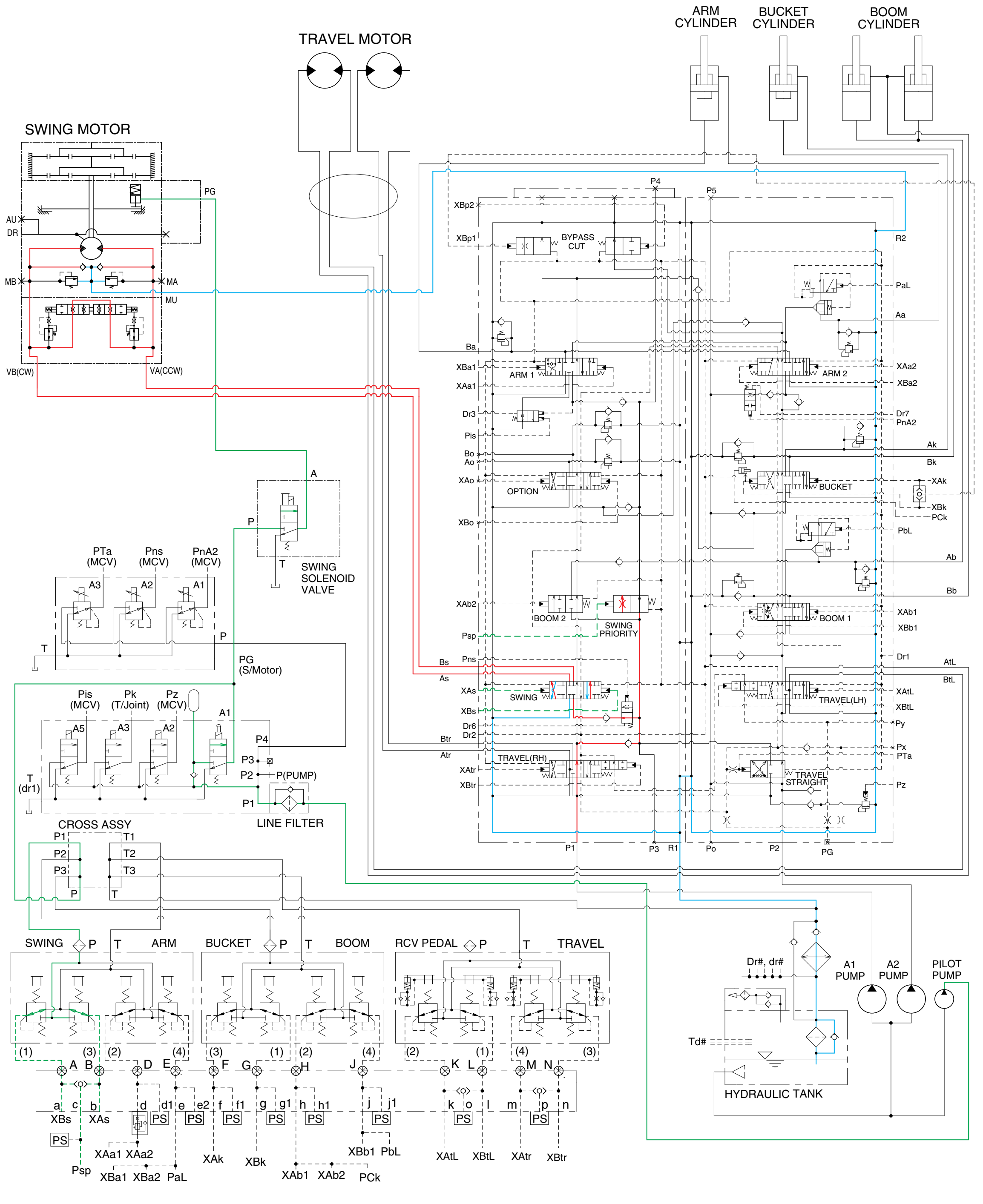
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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

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

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

7. SWING OPERATION



260A3HC16

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

Also the swing operation preference function is operated by the pilot pressure PCsp (refer to page 2-39).

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

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

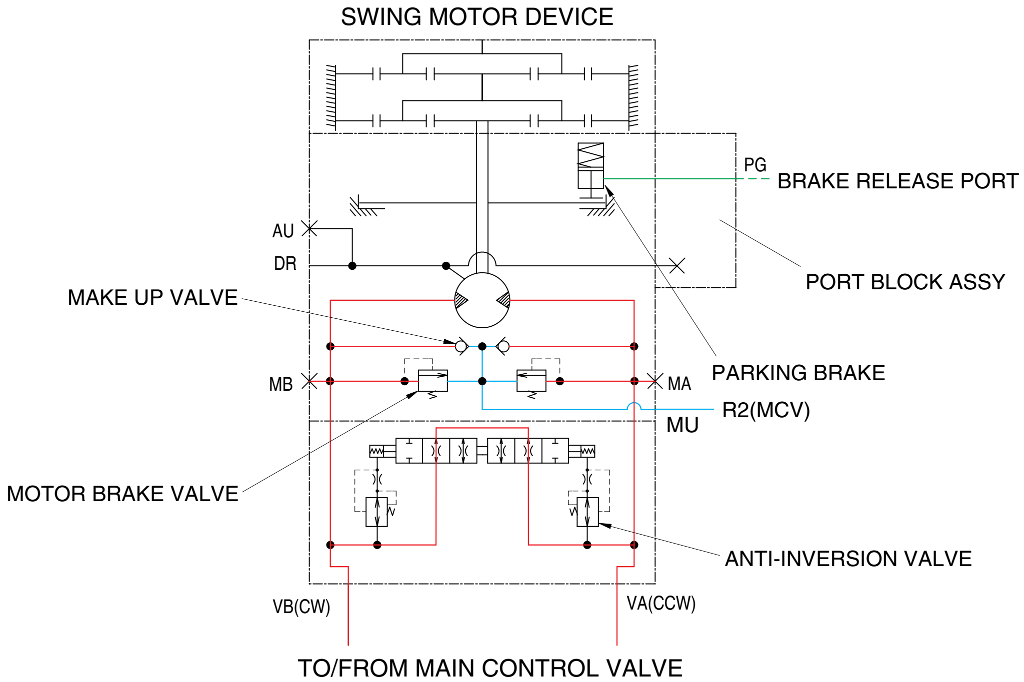
When this happens, the upper structure swings to the left or right.

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

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

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

SWING CIRCUIT OPERATION



260A3HC16A

1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation and controls the swing motor operating pressure to 300 kgf/cm^2 (4267 psi).

2) MAKE UP VALVE

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

3) PARKING BRAKE

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

PARKING BRAKE "OFF" OPERATION

When the swing control lever is tilted, the swing solenoid valve is energized by the MCU that senses the pilot oil pressure of the swing control lever.

The discharged oil from pilot pump flows to swing motor PG port through the swing solenoid valve. This pressure is applied to swing parking brake piston, thus the brake is released.

PARKING BRAKE "ON" OPERATION

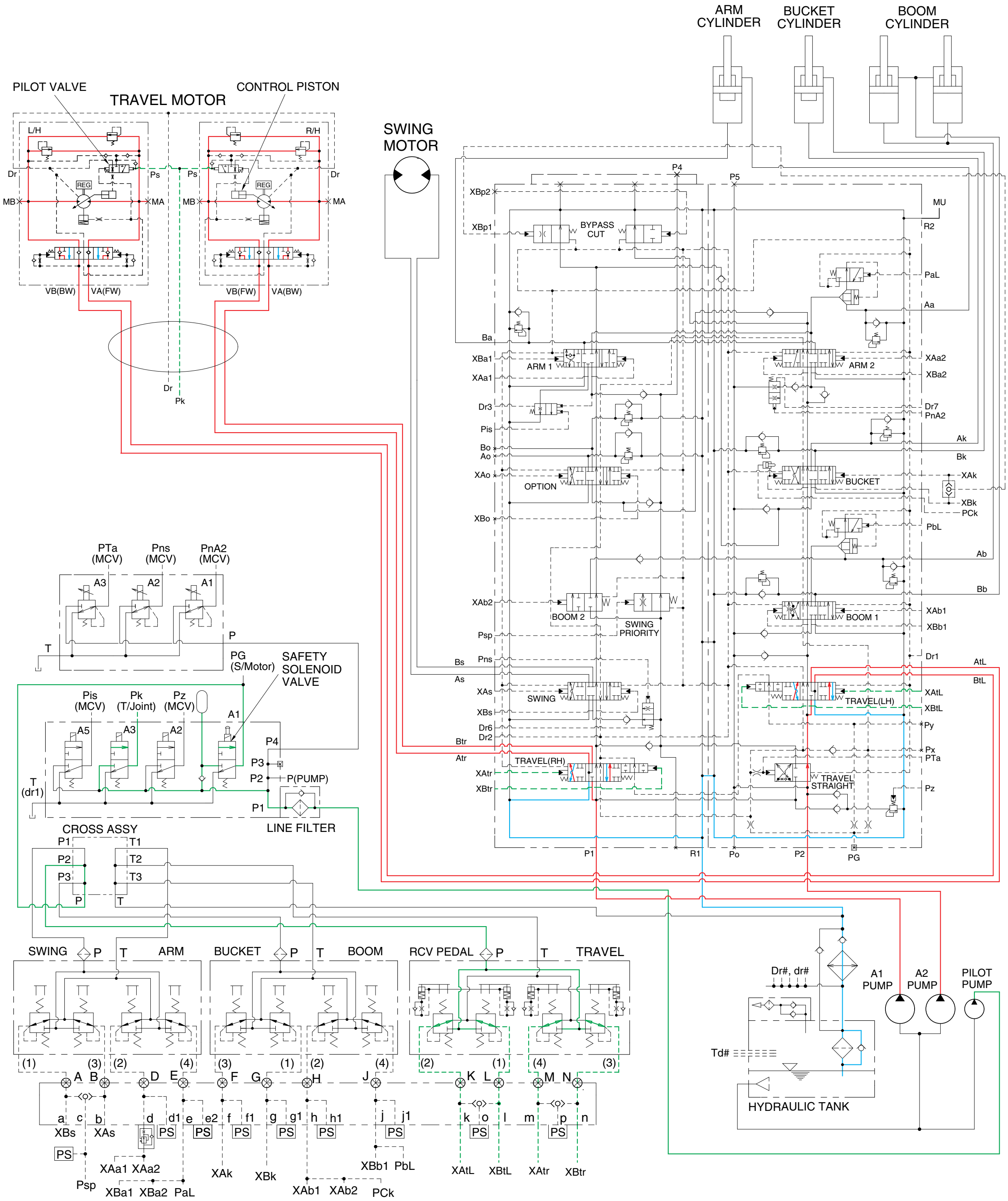
When the swing control lever is set in the neutral position, the swing solenoid valve is de-energized, oil in the swing parking brake chamber is drained through the the swing solenoid valve, thus the brake is applied by spring force.

4) ANTI-INVERSION VALVE

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

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

8. TRAVEL FORWARD AND REVERSE OPERATION



260A3HC17

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

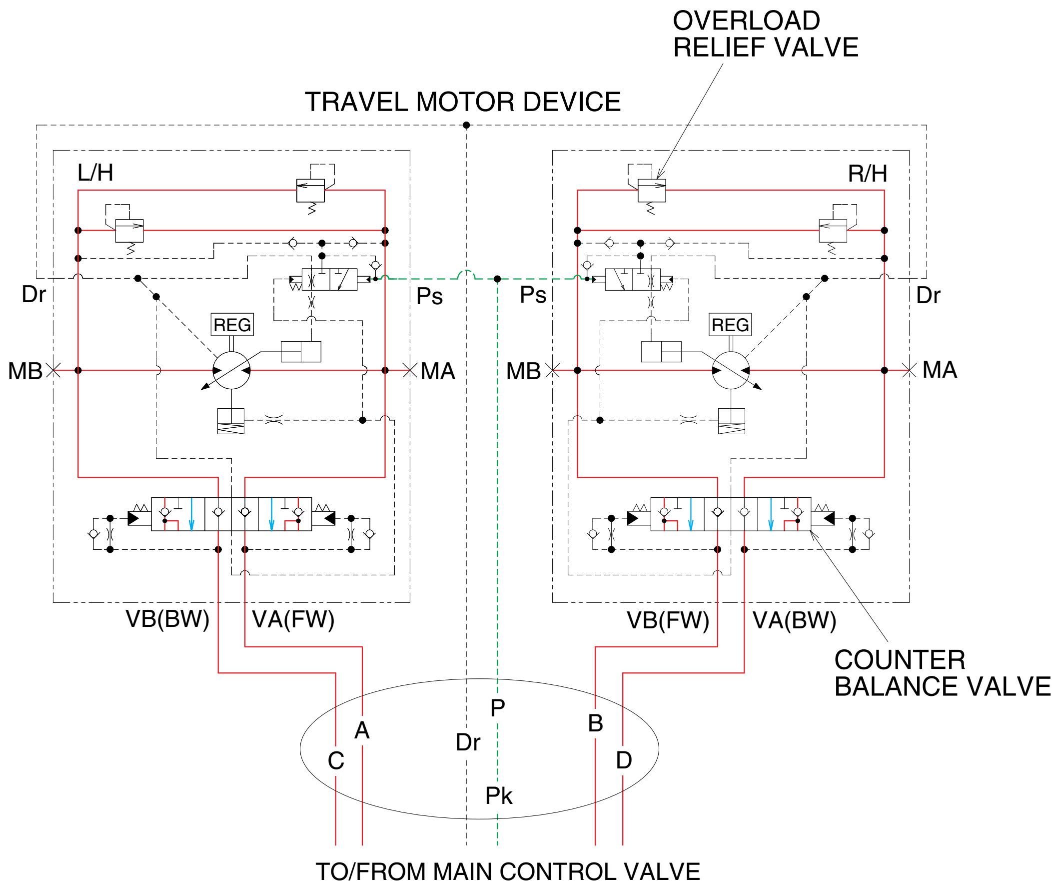
The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

The return oil from both travel motors returns to the hydraulic oil tank through the turning joint and the travel spools in the main control valve.

When this happens, the machine moves to the forward or reverse.

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

TRAVEL CIRCUIT OPERATION



220F3HC17A

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

1) COUNTER BALANCE VALVE

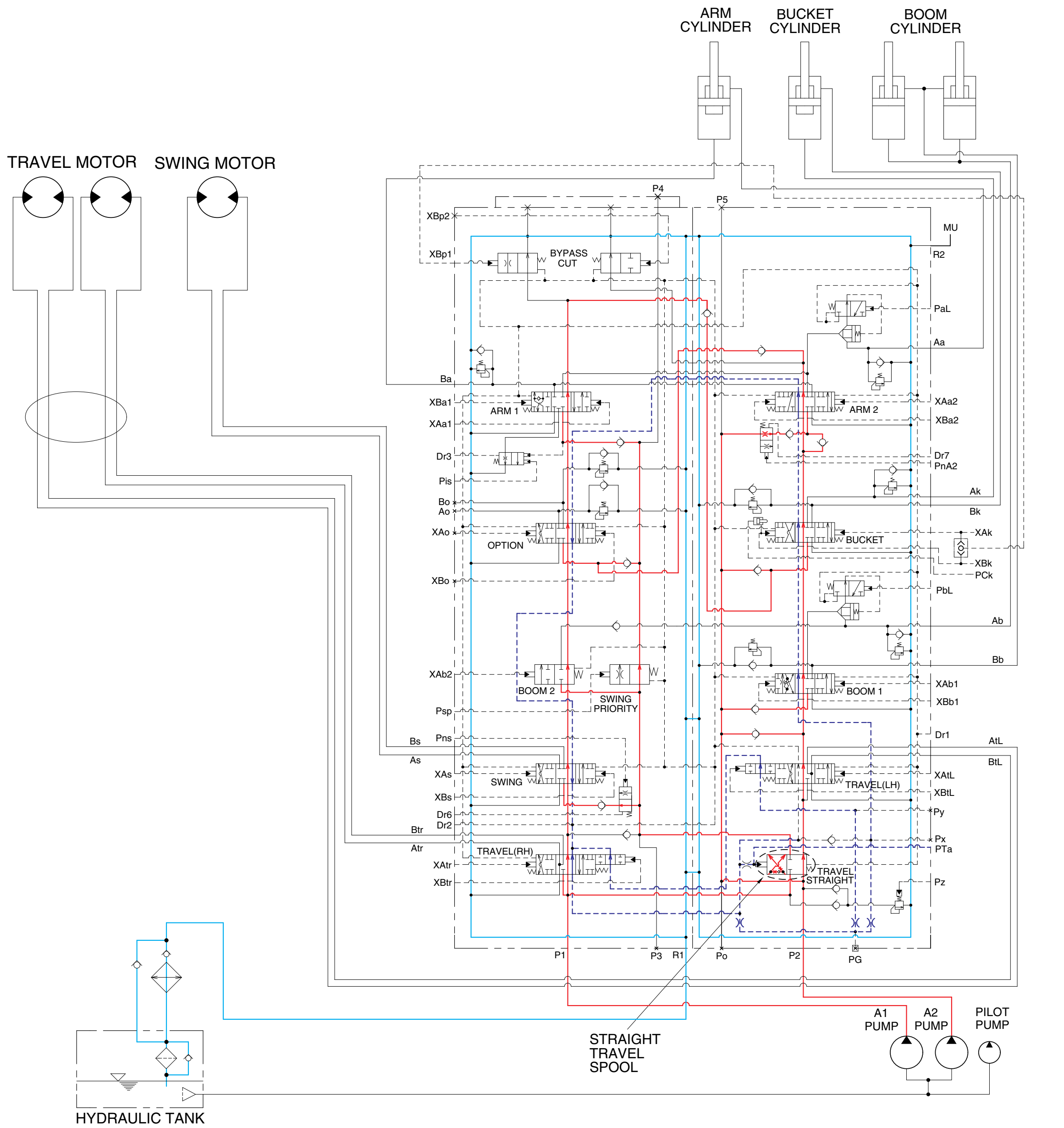
When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 350 kgf/cm^2 (4980 psi) to prevent high pressure generated at a time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

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

1. OUTLINE



260A3HC20

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

STRAIGHT TRAVEL SPOOL

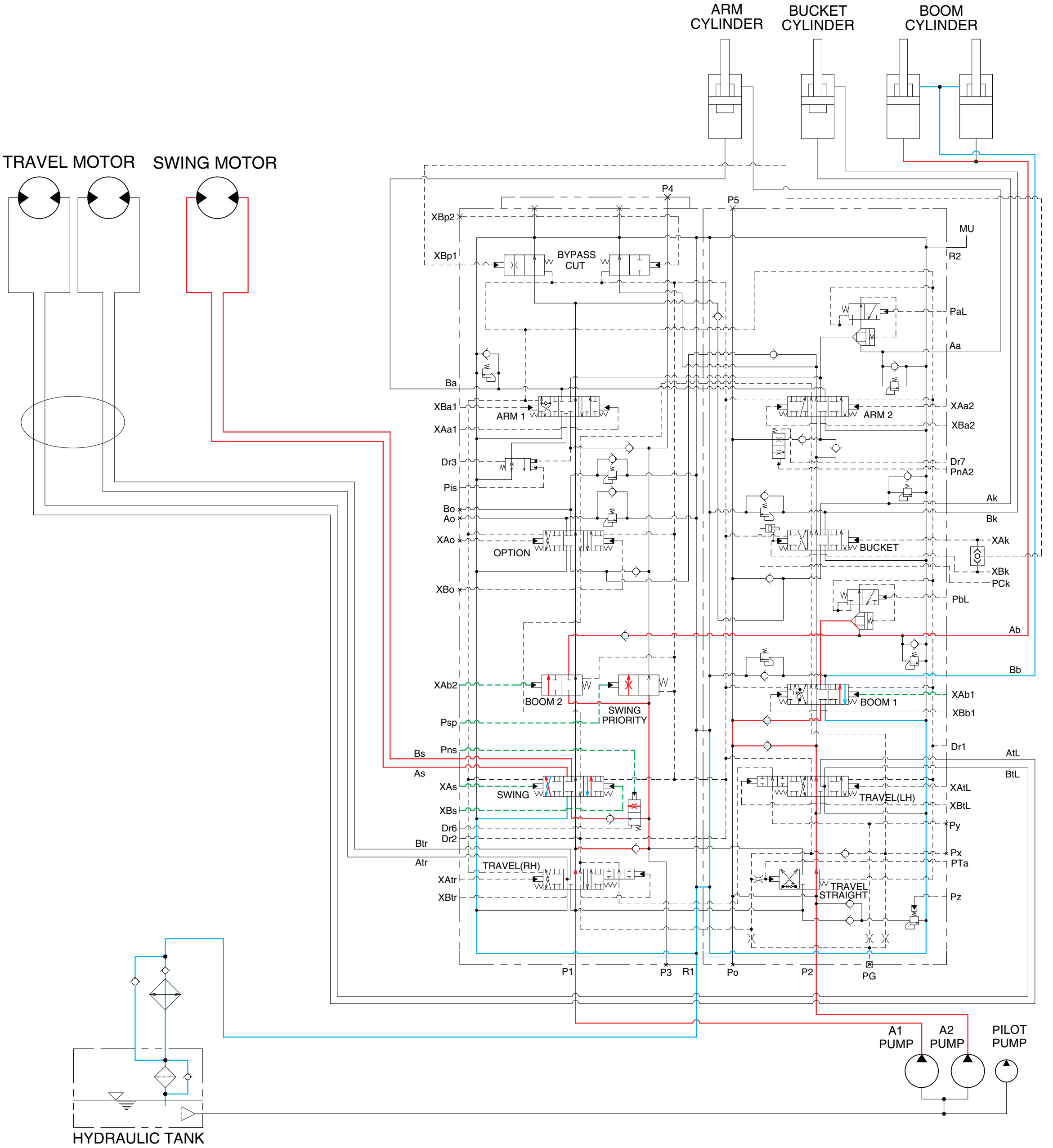
This straight travel spool for straight travel is provided in the main control valve.

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

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

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

2. COMBINED SWING AND BOOM UP OPERATION



260A3HC21

When the swing and boom up functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure (XAb1, XAs, XBs) from the remote control valve.

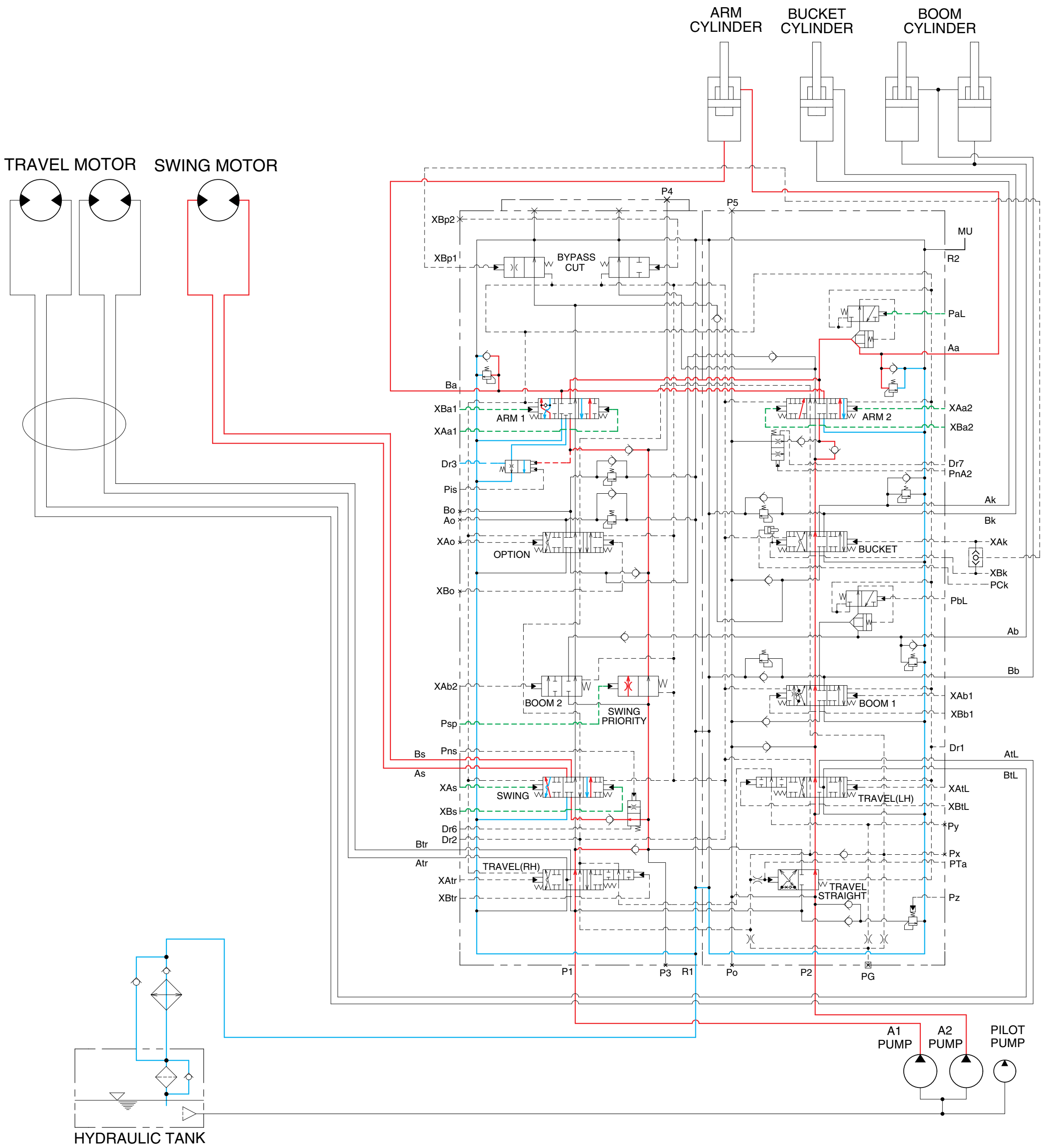
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

The oil from the A2 pump flows into the boom cylinders through the boom 1 spool in the right control valve. The upper structure swings and the boom is operated.

Refer to page 3-10 for the boom priority system.

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

3. COMBINED SWING AND ARM OPERATION



260A3HC22

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 (XAs, XBs, XAa1, XBa1, XAa2, XBa2) from the remote control valve.

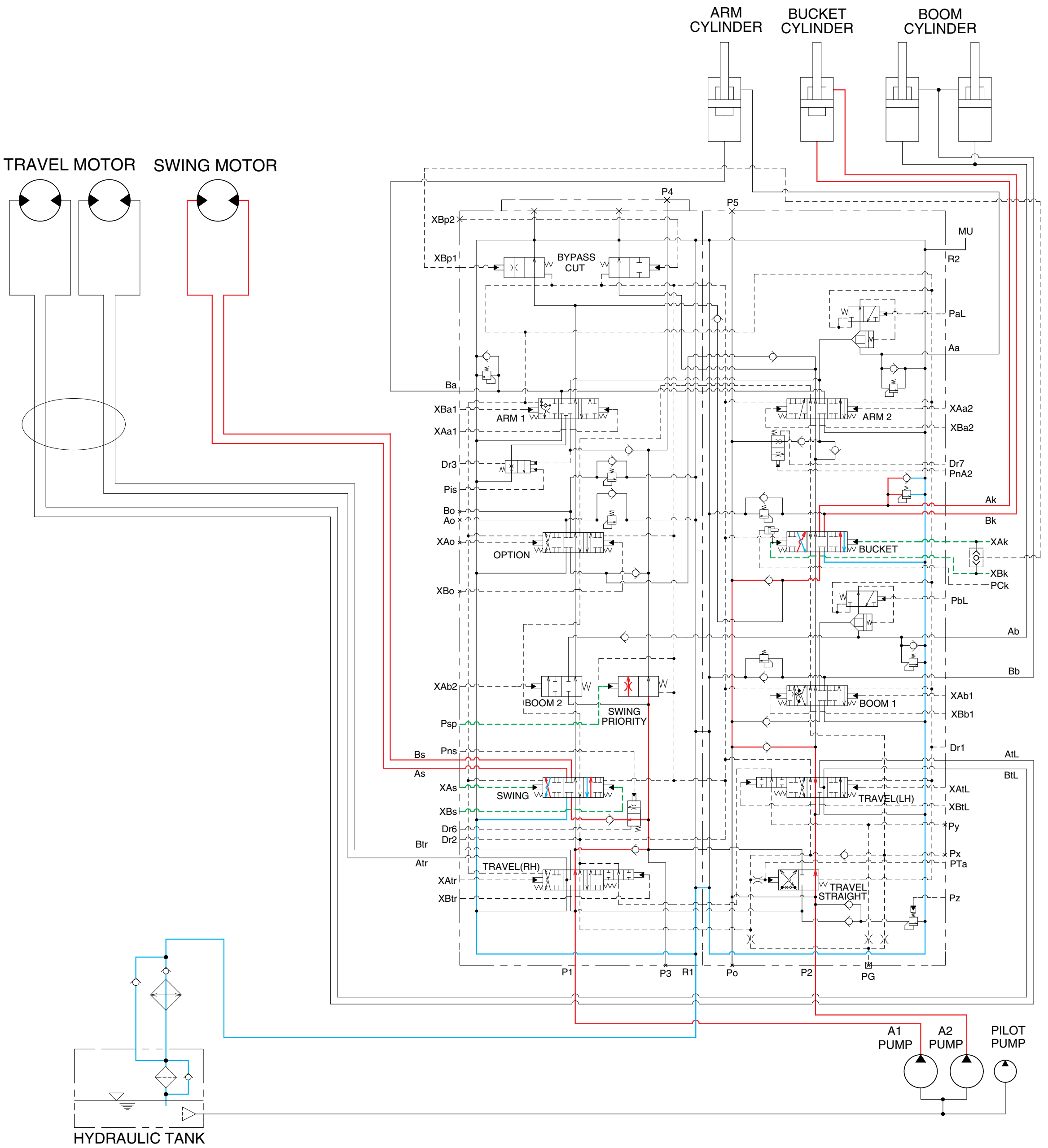
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

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

Refer to page 2-39 for the swing operation preference function.

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

4. COMBINED SWING AND BUCKET OPERATION



260A3HC23

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

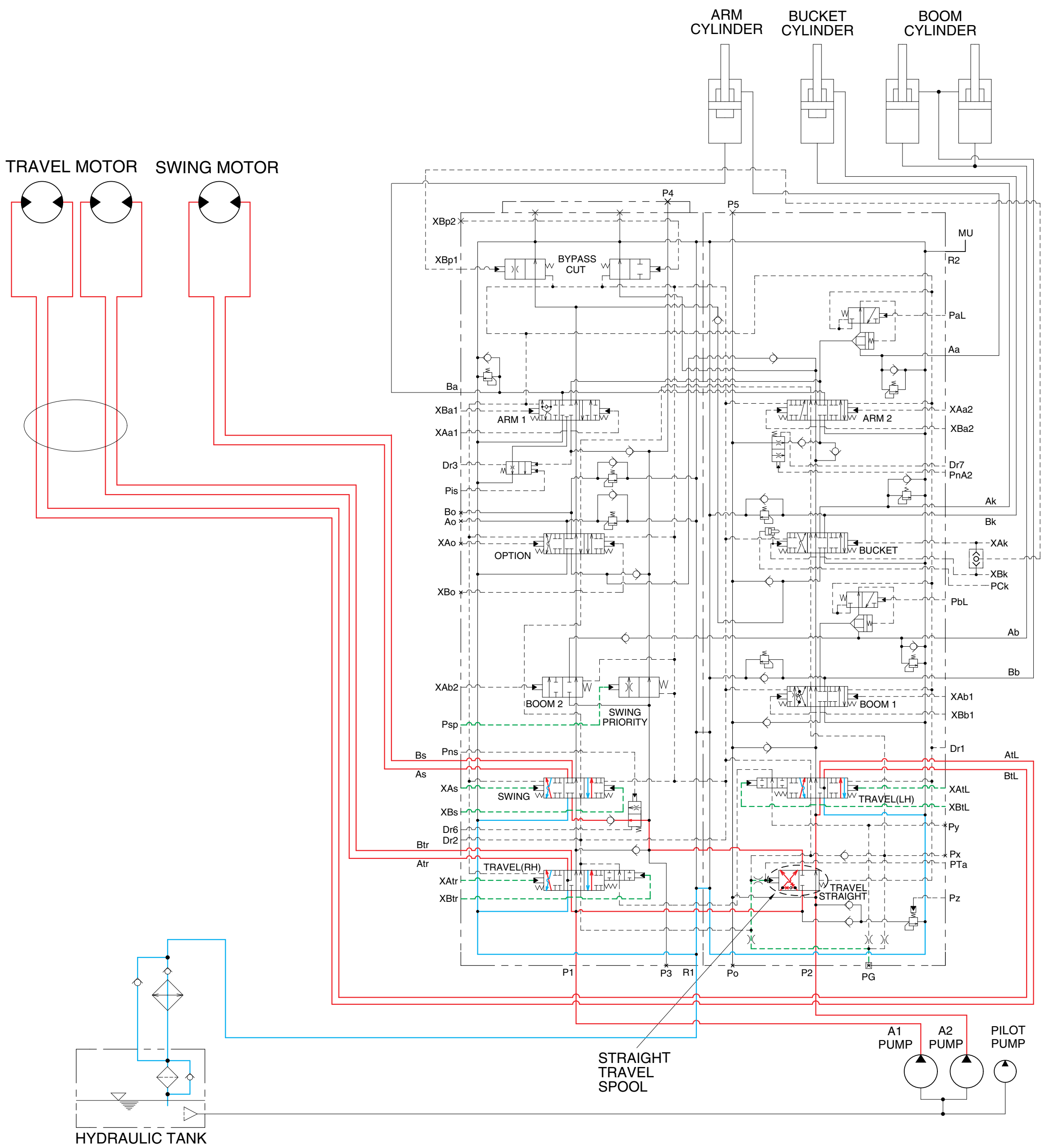
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

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

The upper structure swings and the bucket is operated.

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

5. COMBINED SWING AND TRAVEL OPERATION



260A3HC24

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 (XAs, XBs, XAtr, XBtr, XAtL, XBtL) from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure (PG) from the pilot pump.

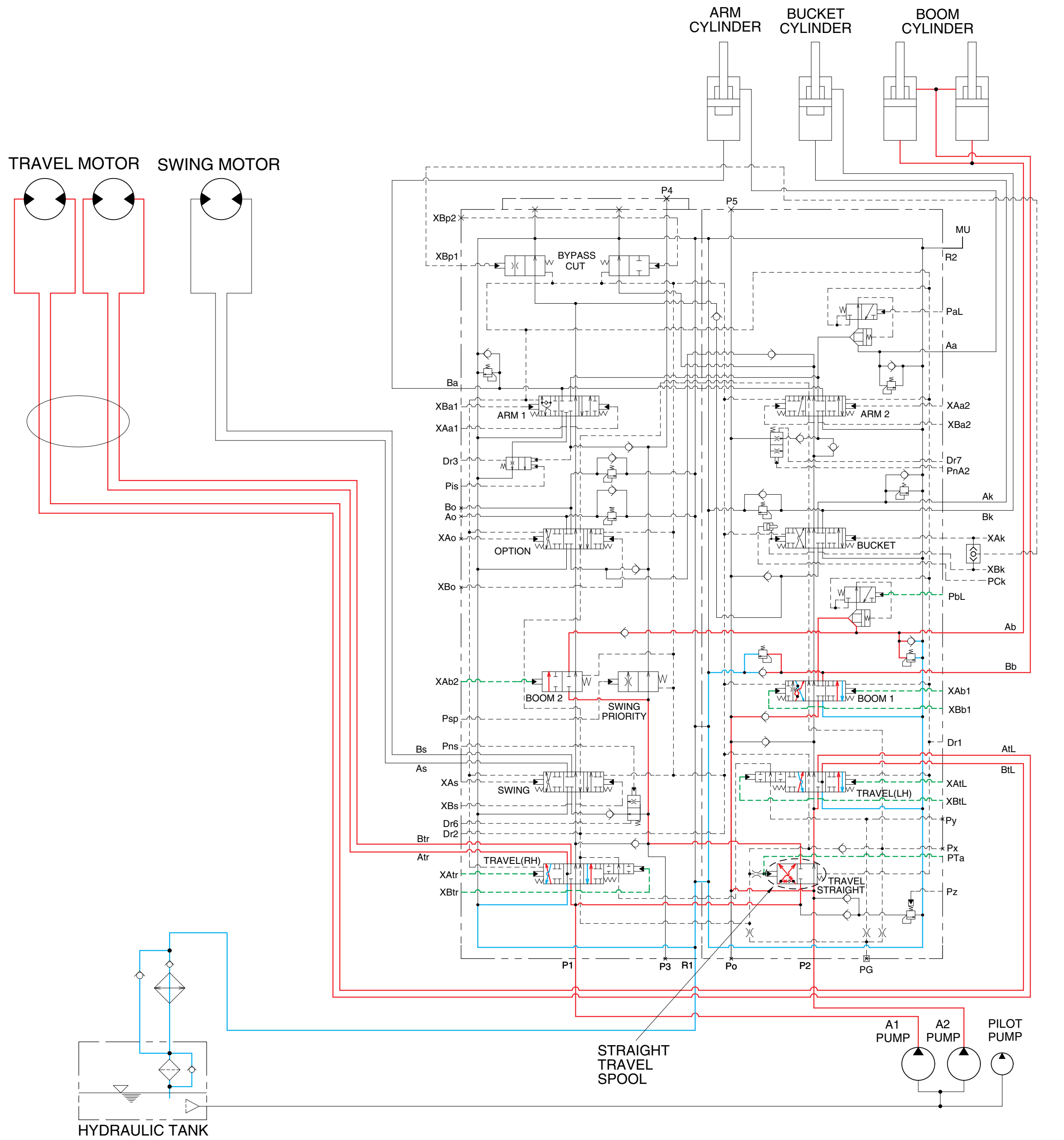
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the swing motor through the swing spool and travel motor through the LH travel spool via the check valve and orifice in the straight travel spool.

The upper structure swings and the machine travels straight.

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

6. COMBINED BOOM AND TRAVEL OPERATION



260A3HC25

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 (XAb1, XBb1, XBb2, XAtr, XBtr, XAtL, XBtL) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure (PG) from pilot pump.

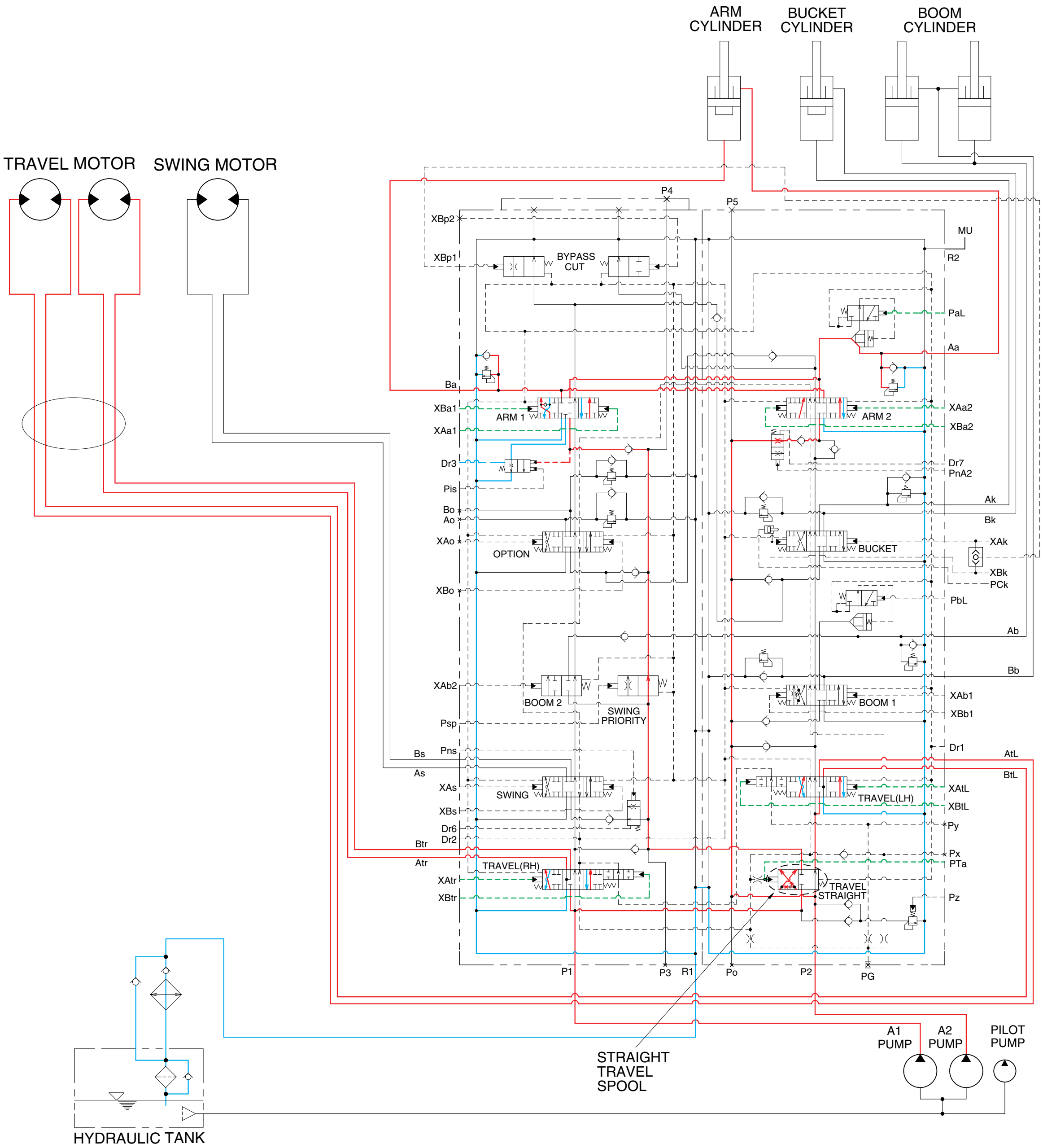
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence oil passage in case boom up operation. Also, the oil from the A2 pump flows into the travel motors through the LH travel spool via the check valve and orifice in the straight travel spool.

The boom is operated and the machine travels straight.

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

7. COMBINED ARM AND TRAVEL OPERATION



260A3HC26

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 (XAa1, XBa1, XAa2, XBa2, XAtr, XBtr, XAtL, XBtL) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure (PG) from pilot pump.

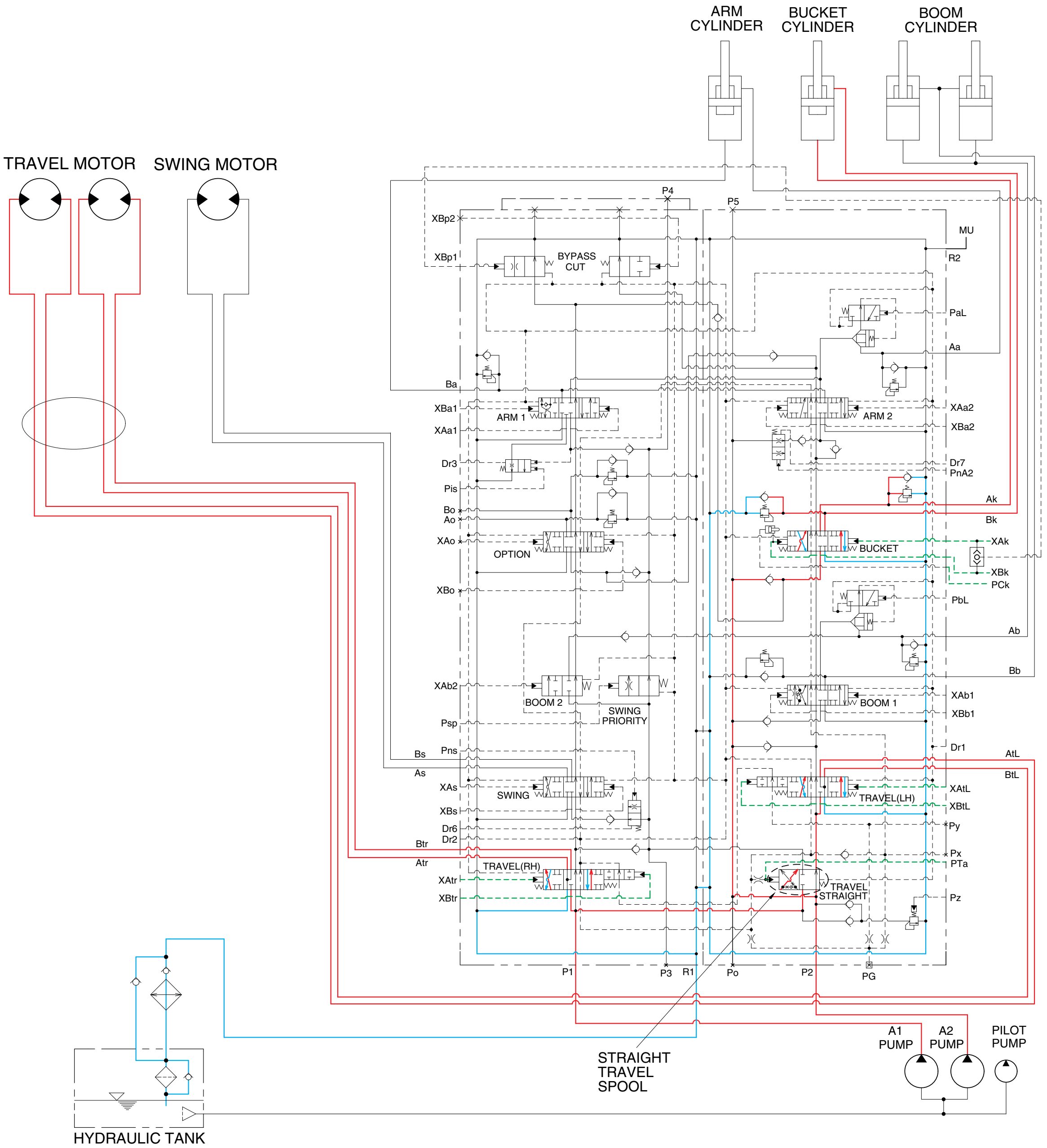
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

The oil from the A2 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage. Also, the oil from the rear pump flows into the travel motors through the LH travel spool via the check valve and orifice in the straight travel spool.

The arm is operated and the machine travels straight.

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

8. COMBINED BUCKET AND TRAVEL OPERATION



260A3HC27

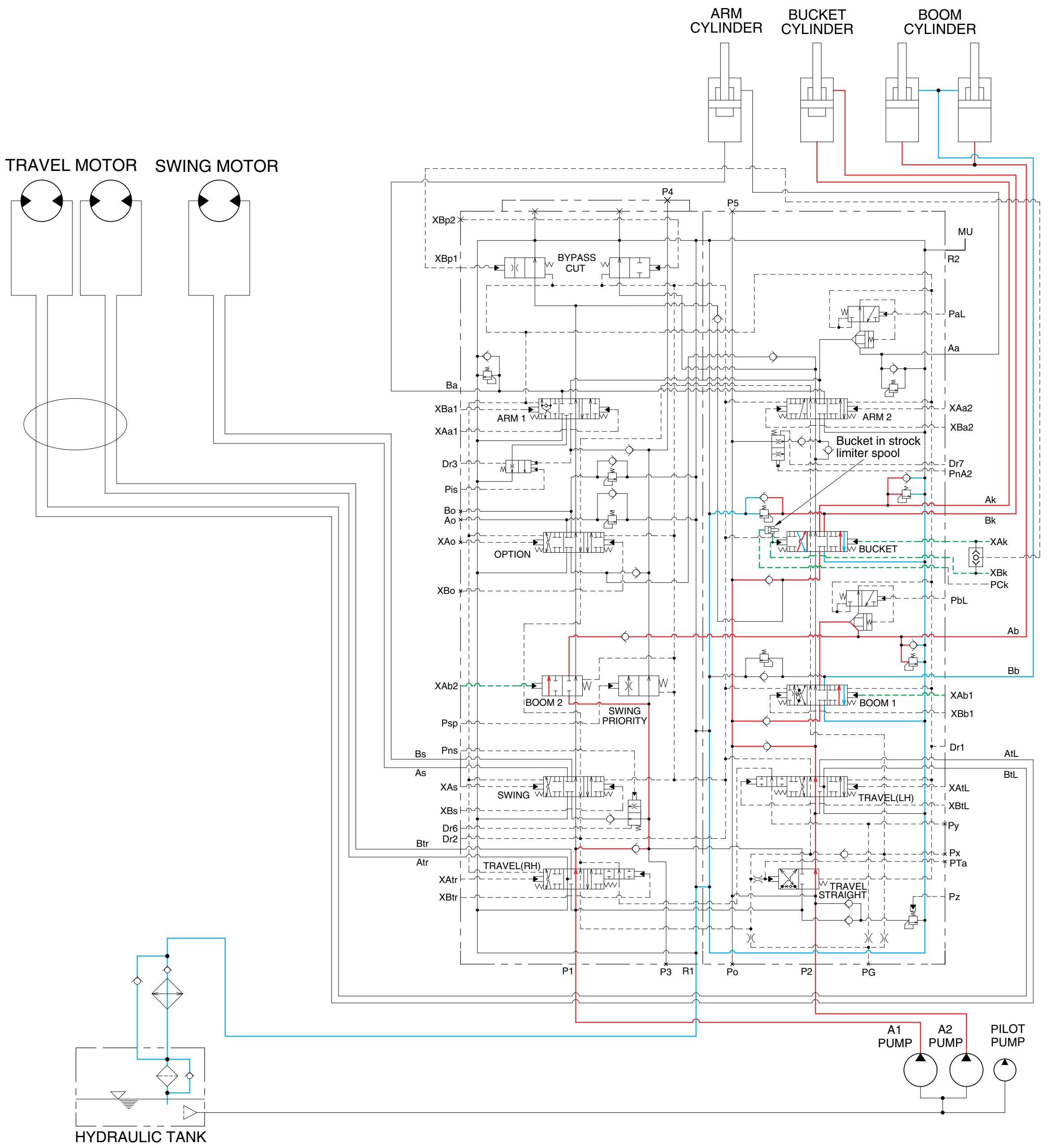
When the bucket and travel functions are operated, simultaneously the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (XAk, XBk, XAtr, XBtr, XAtL, XBtL) from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure (PG) from pilot pump. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool of the control valve.

The oil from the A2 pump flows into the bucket cylinder through the bucket spool via the confluence oil passage. Also, the oil from the A2 pump flows into the travel motors through the LH travel spool via the check valve and orifice in the straight travel spool.

The bucket is operated and the machine travels straight.

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

9. COMBINED BOOM UP AND BUCKET OPERATION



260A3HC28

When the boom up and bucket functions are operated, simultaneously each spool in the main control valve is moved to the functional position by the pilot oil pressure (XAk, XBk, XAb1, XAb2) from the remote control valve. Also, the boom up operation preference function is operated by the pilot pressure PCk (refer to page 2-36).

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

The boom and bucket are operated.

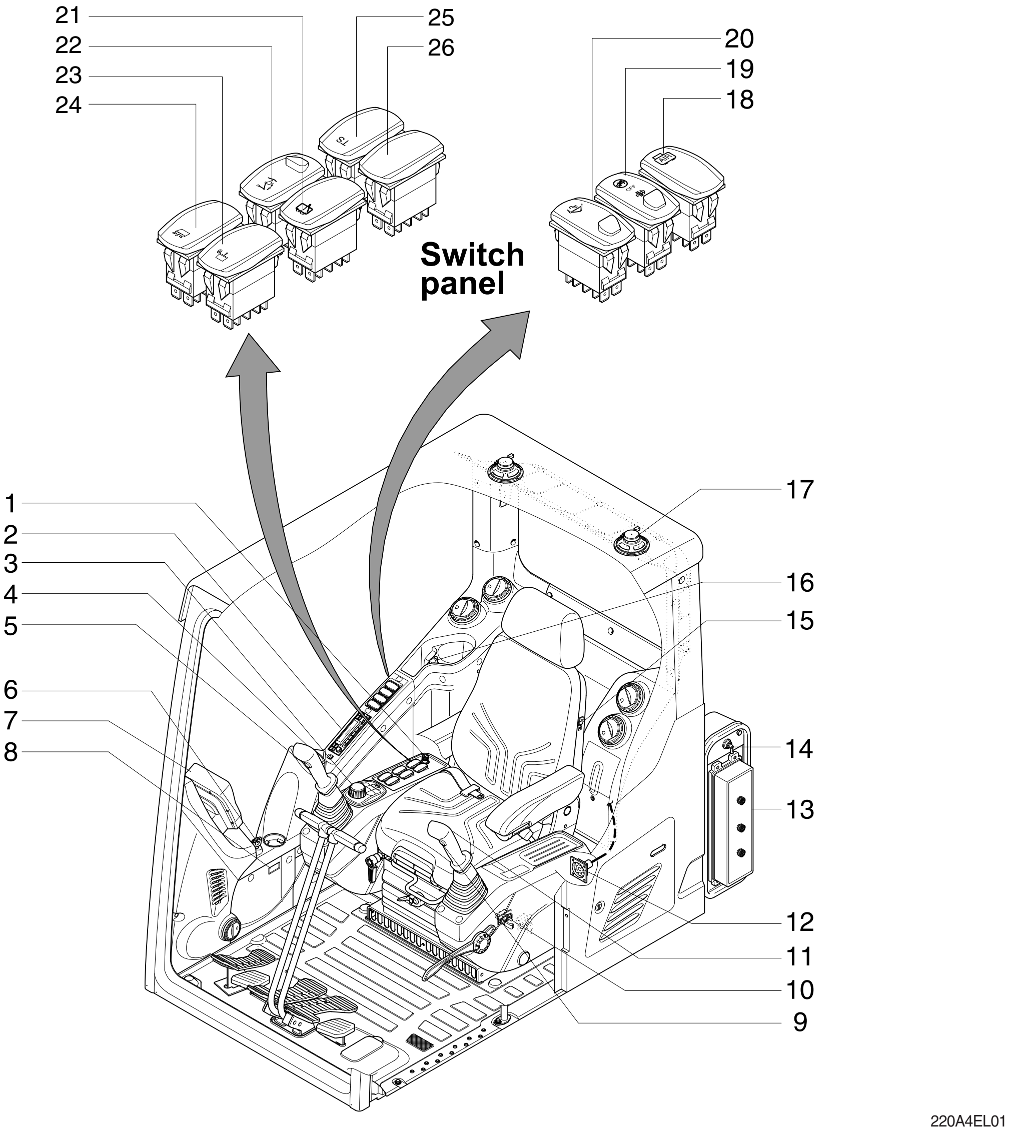
※ The circuit diagram may differ from the equipment, so please check before a repair.

SECTION 4 ELECTRICAL SYSTEM

Group 1 Component Location ········· 4-1
Group 2 Electrical Circuit ········· 4-3
Group 3 Electrical Component Specification ········· 4-23
Group 4 Connectors ········· 4-36

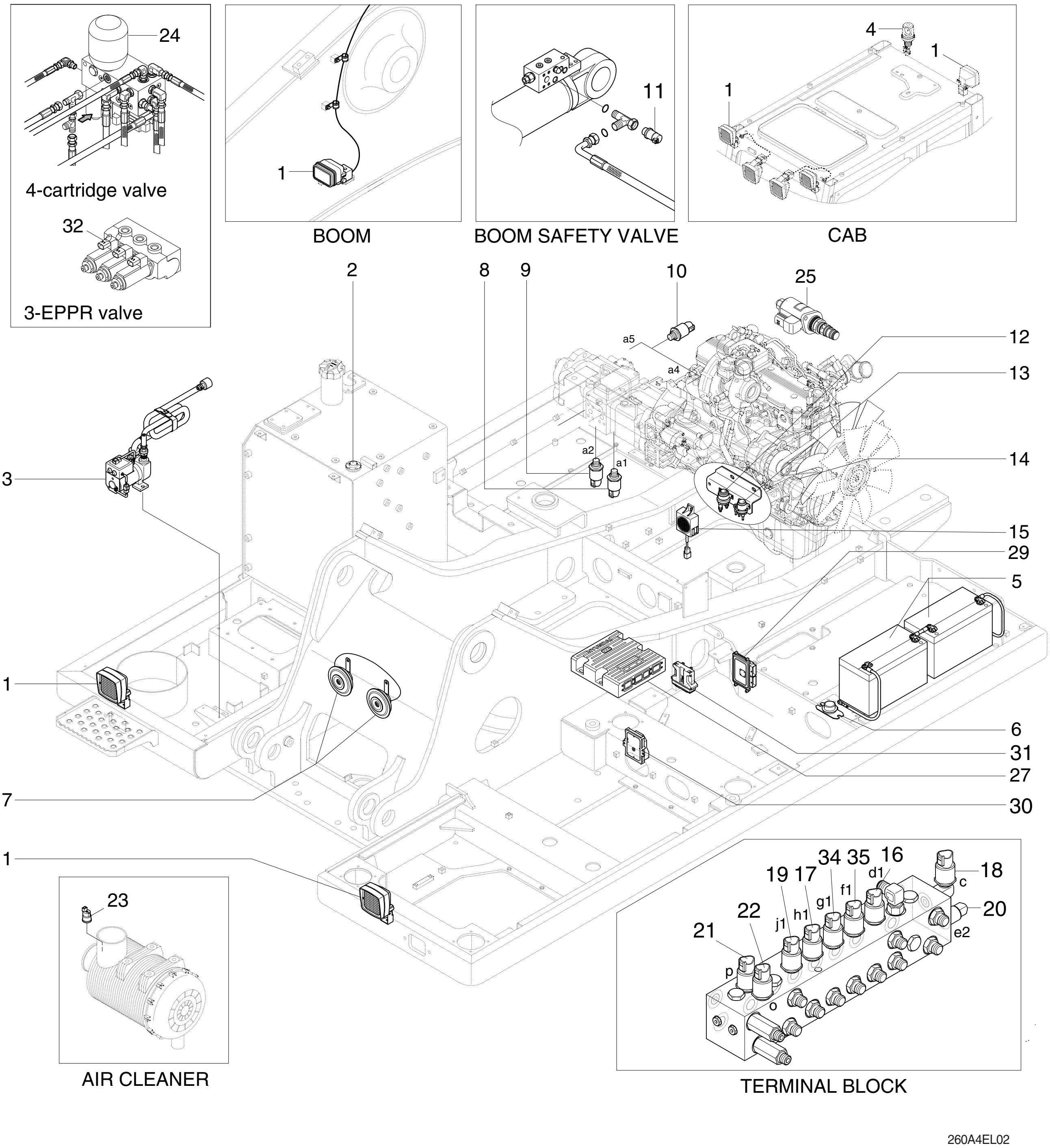
GROUP 1 COMPONENT LOCATION

1. LOCATION 1



1	Cigar lighter	10	Emergency engine stop switch	19	SCR system cleaning switch
2	Radio & USB player	11	One touch decel switch	20	Quick coupler switch
3	Jog dial module	12	RS232 & J1939 service socket	21	Lower wiper & washer switch
4	Horn switch	13	Fuse & relay box	22	Boom floating switch
5	Breaker operation switch	14	Master switch	23	Swing lock switch
6	Starting switch	15	Seat heater switch	24	Free/fine swing switch
7	Cluster	16	Power socket	25	Travel straight switch
8	Service meter	17	Speaker	26	Option attach switch
9	Power max switch	18	Air compressor switch		

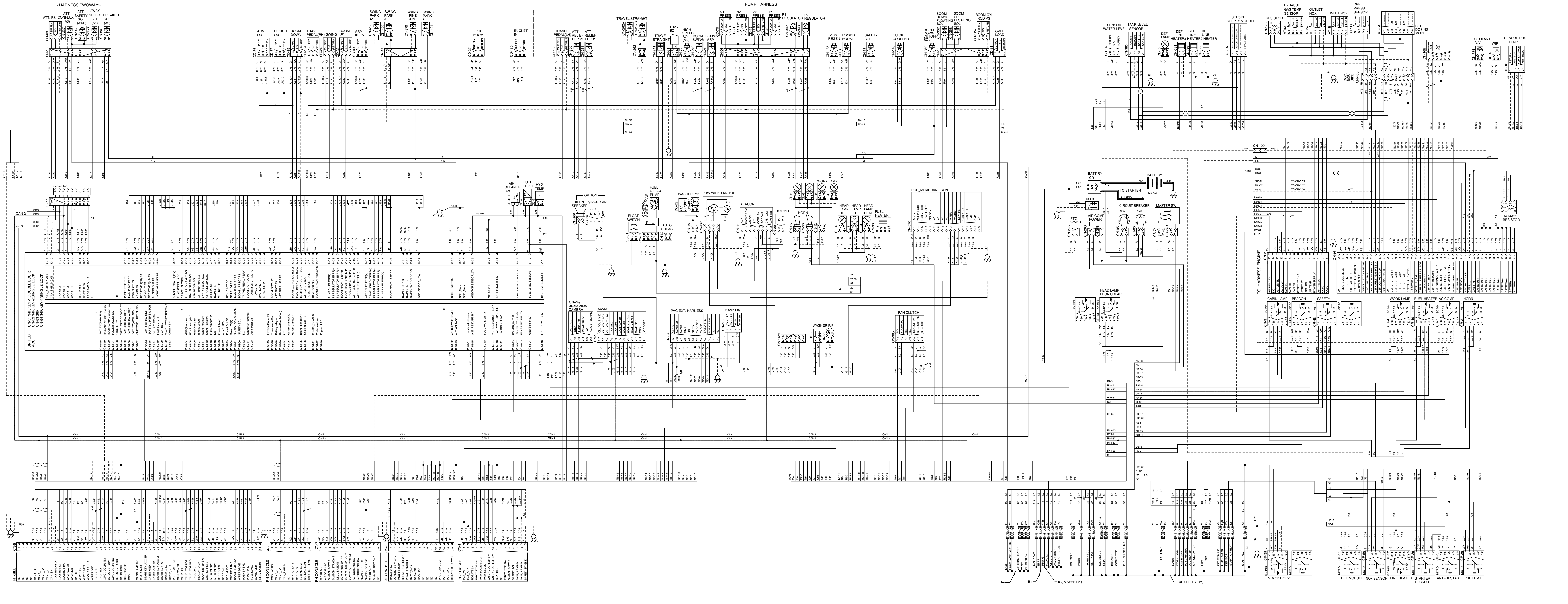
2. LOCATION 2



1 Lamp
2 Fuel sender
3 Fuel filler pump
4 Beacon lamp
5 Battery
6 Battery relay
7 Horn
8 P1 pressure sensor
9 P2 pressure sensor
10 EPPR pressure sensor
11 Overload pressure sensor
12 Start relay
13 Heater relay
14 Alternator
15 Travel alarm buzzer
16 Arm out pressure sensor
17 Boom up pressure sensor
18 Swing pressure sensor
19 Boom down pressure sensor
20 Arm in pressure sensor
21 RH travel pressure sensor
22 LH travel pressure sensor
23 Air cleaner sensor
24 4-cartridge valve
25 Pump EPPR valve
27 United MCU
29 AAVM controller
30 RDU assy
31 PVG32 controller
32 3-EPPR valve
34 Bucket out pressure sensor
35 Bucket in pressure sensor

· ELECTRICAL CIRCUIT (1/3)

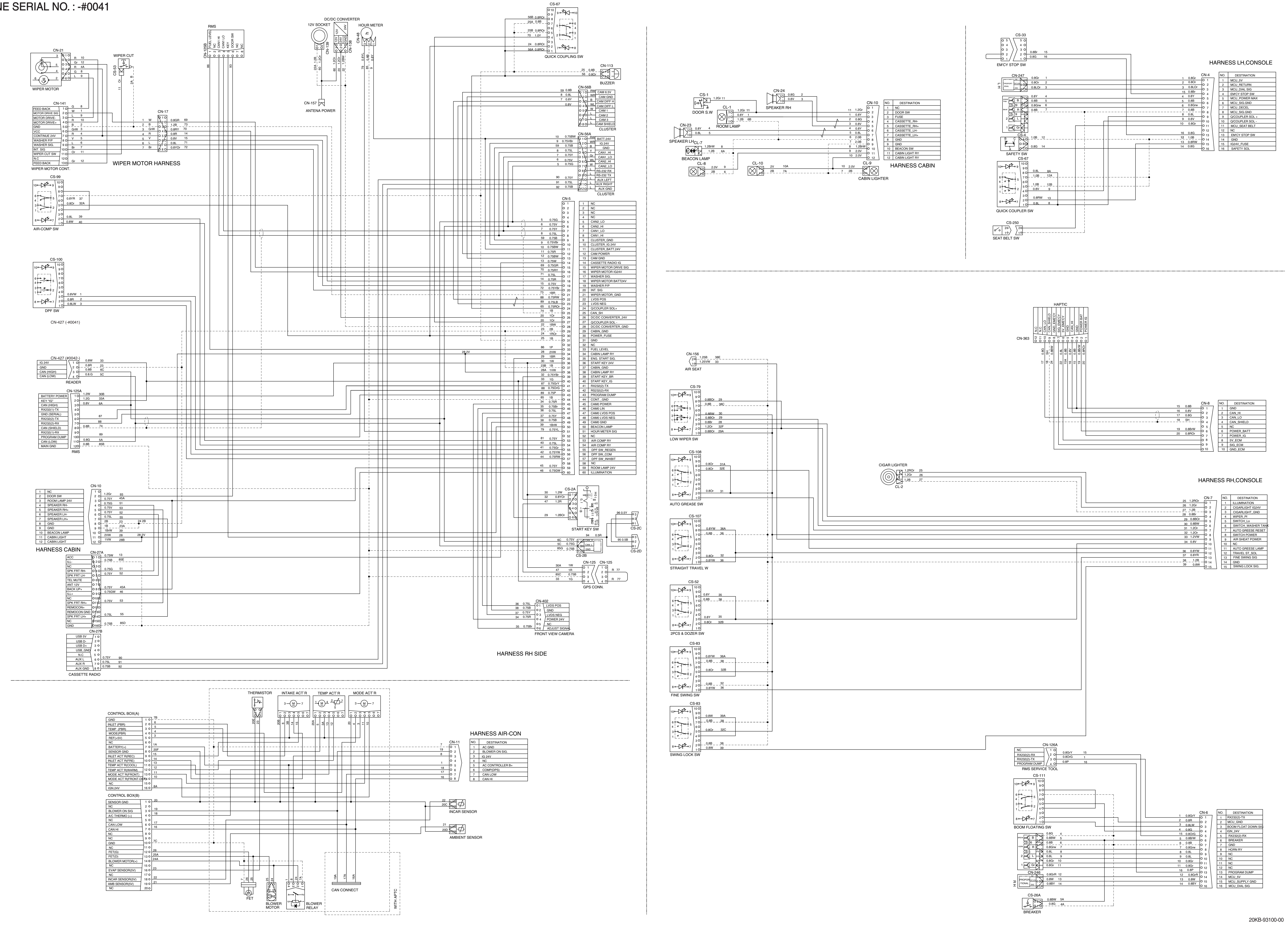
- MACHINE SERIAL NO. : #0001-



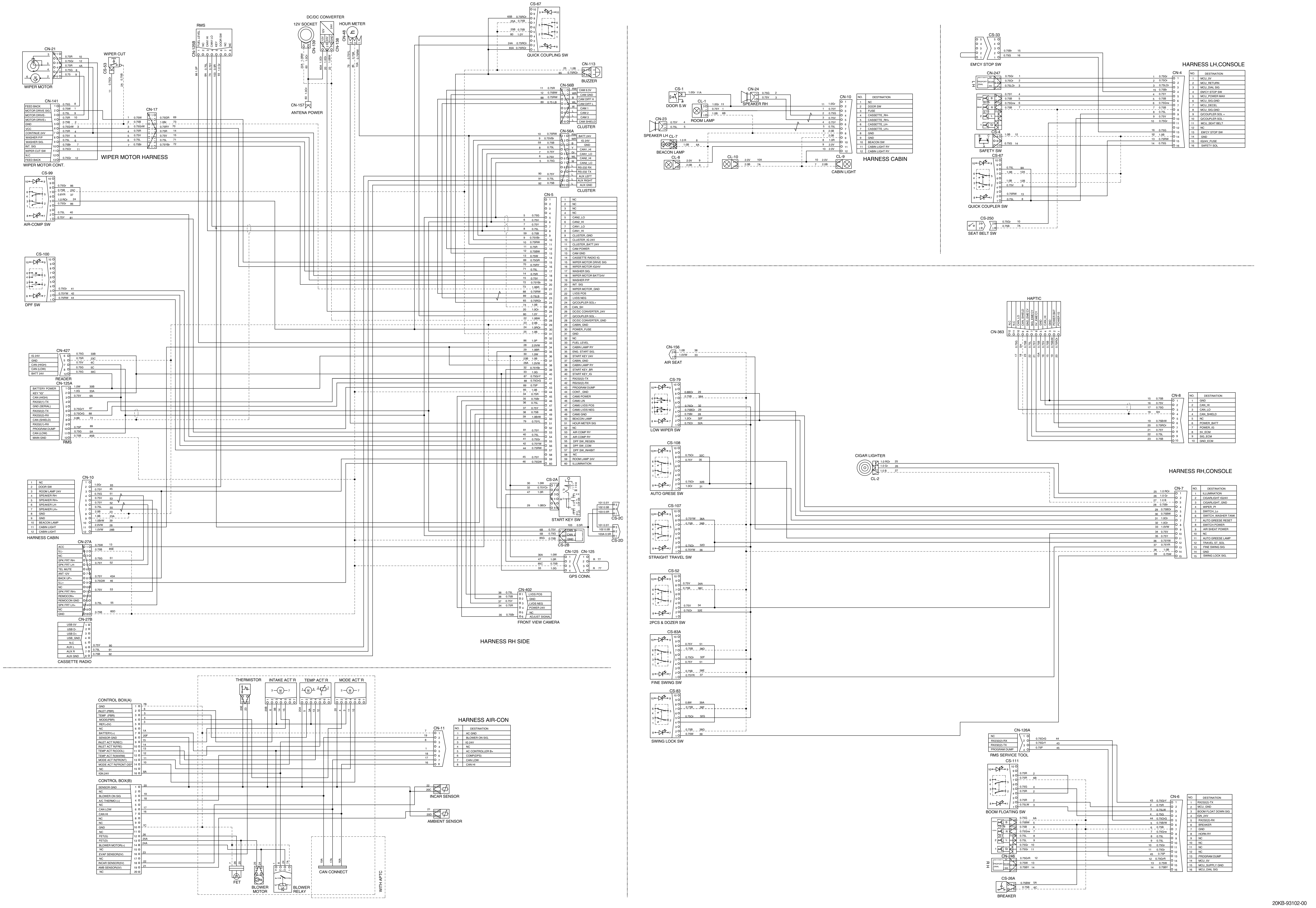
20K6-97201-00

· ELECTRICAL CIRCUIT (2/3)

- MACHINE SERIAL NO. : -#0041

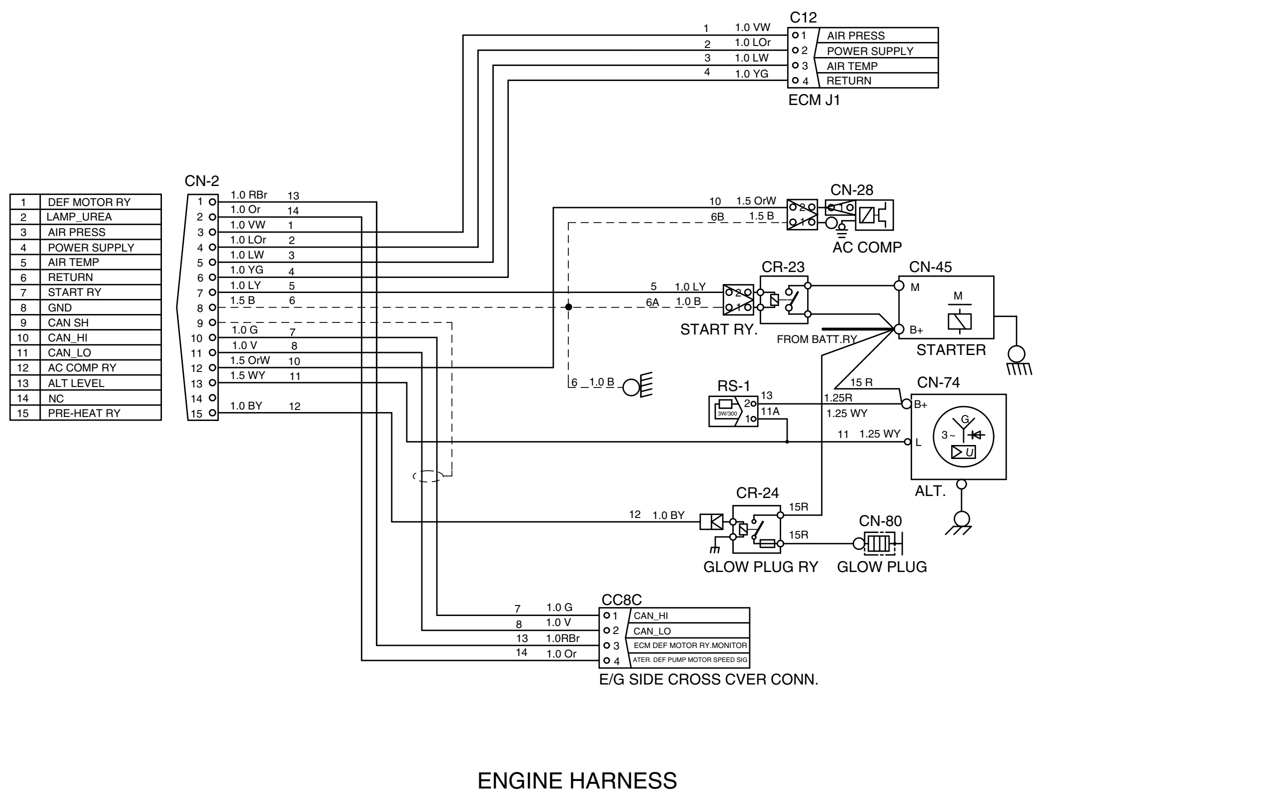


- MACHINE SERIAL NO. : #0042-

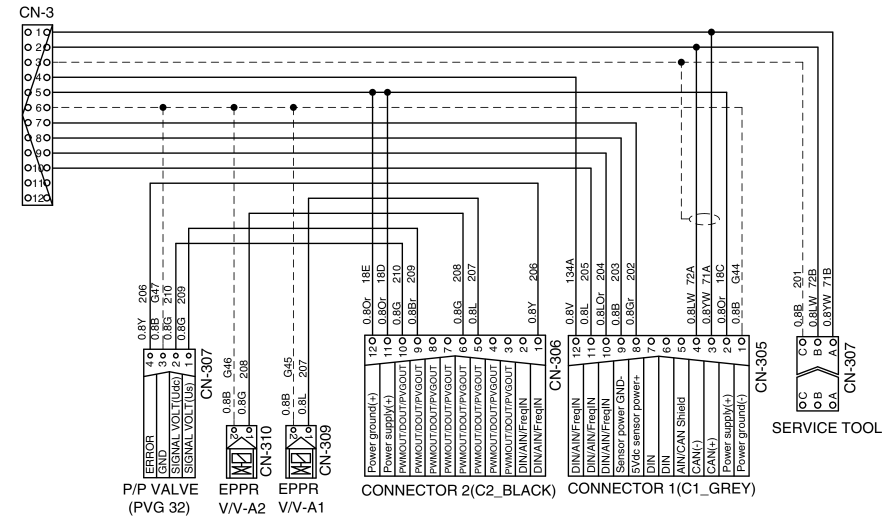


· ELECTRICAL CIRCUIT (3/3)

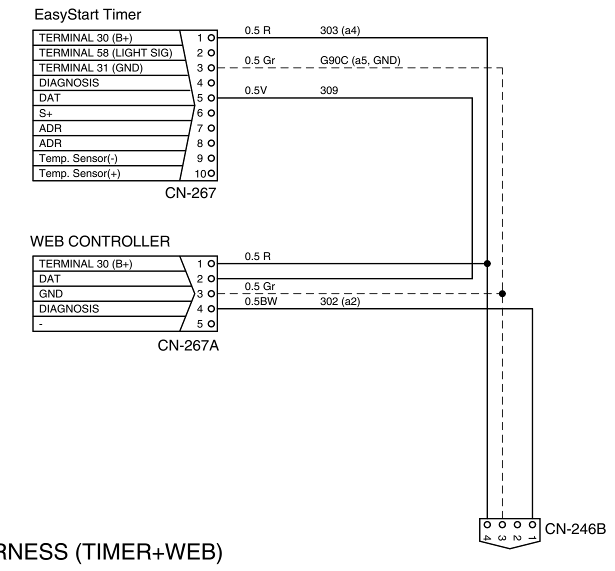
- MACHINE SERIAL NO. : -#0003



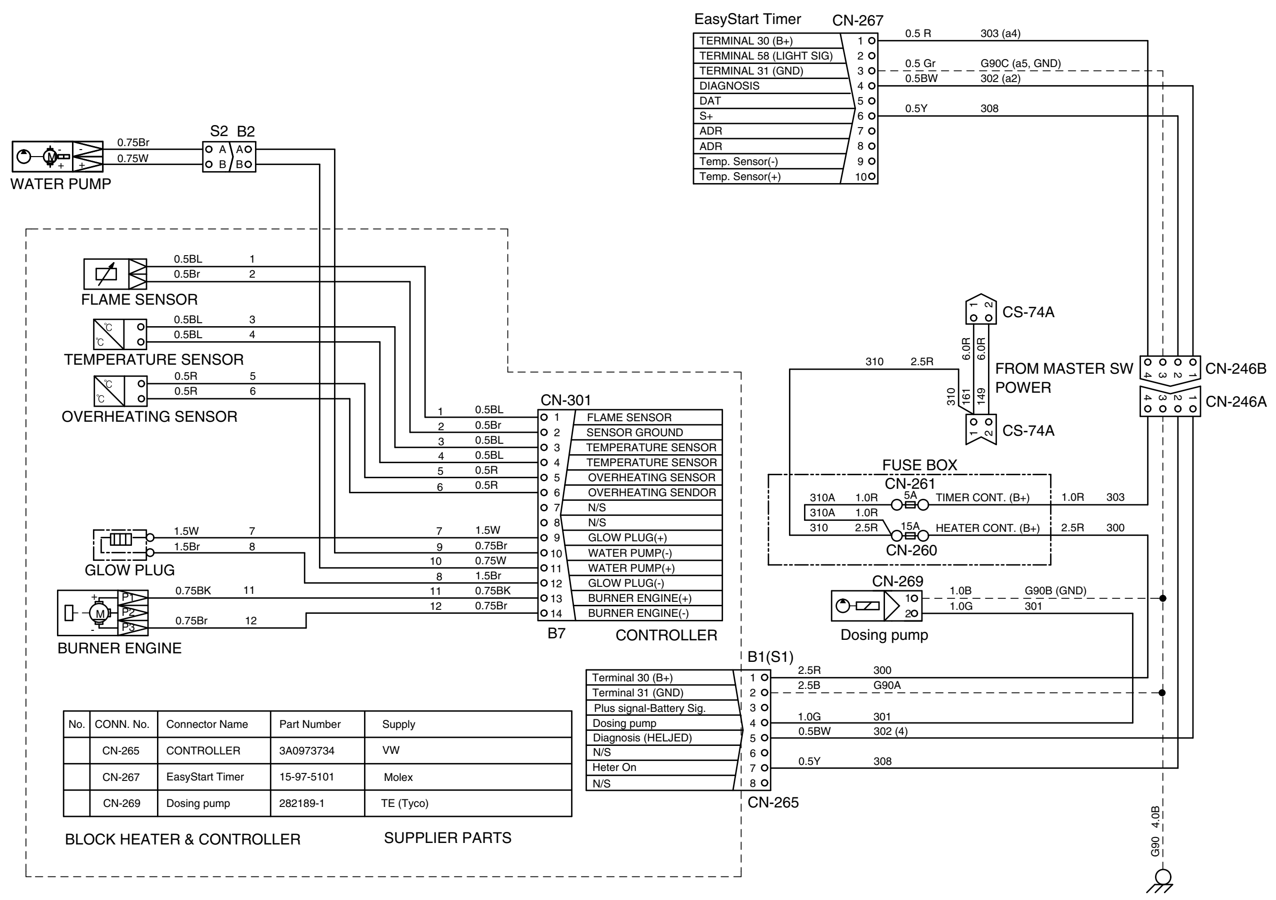
ENGINE HARNESS



PROPORTIONAL VALVE & LEVER

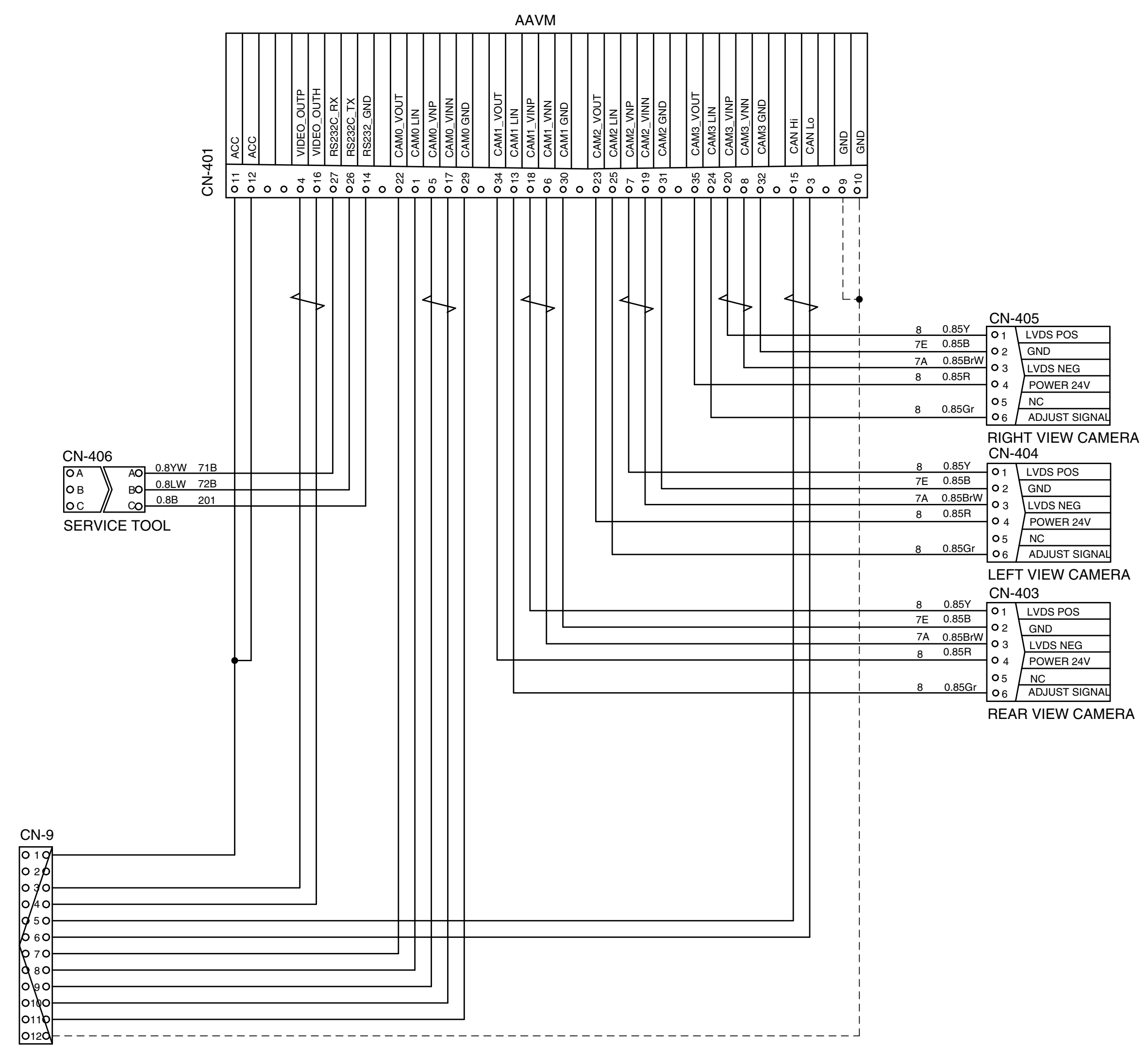


PREHEATER HARNESS (TIMER+WEB)

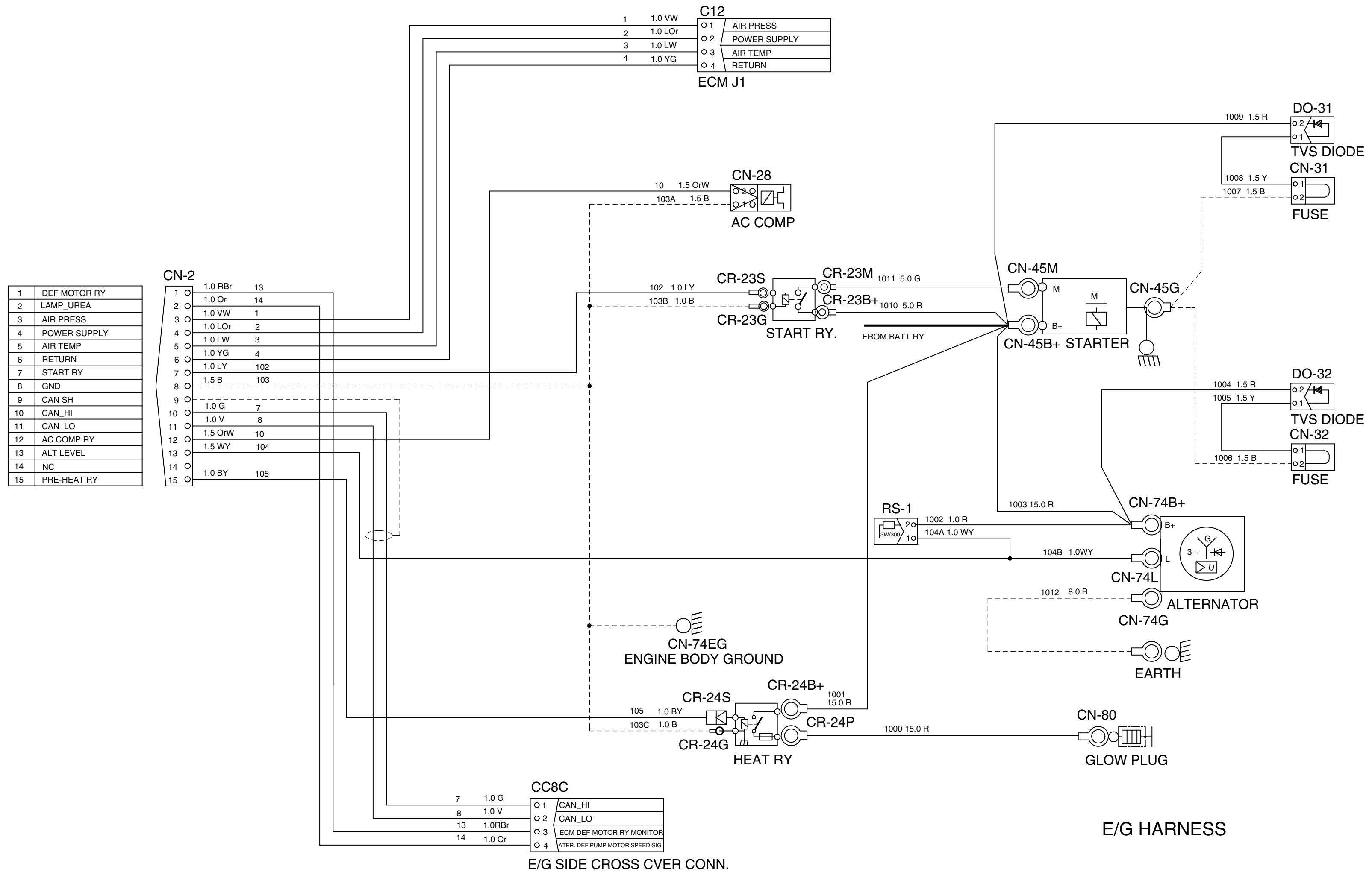


Engine Block Heater

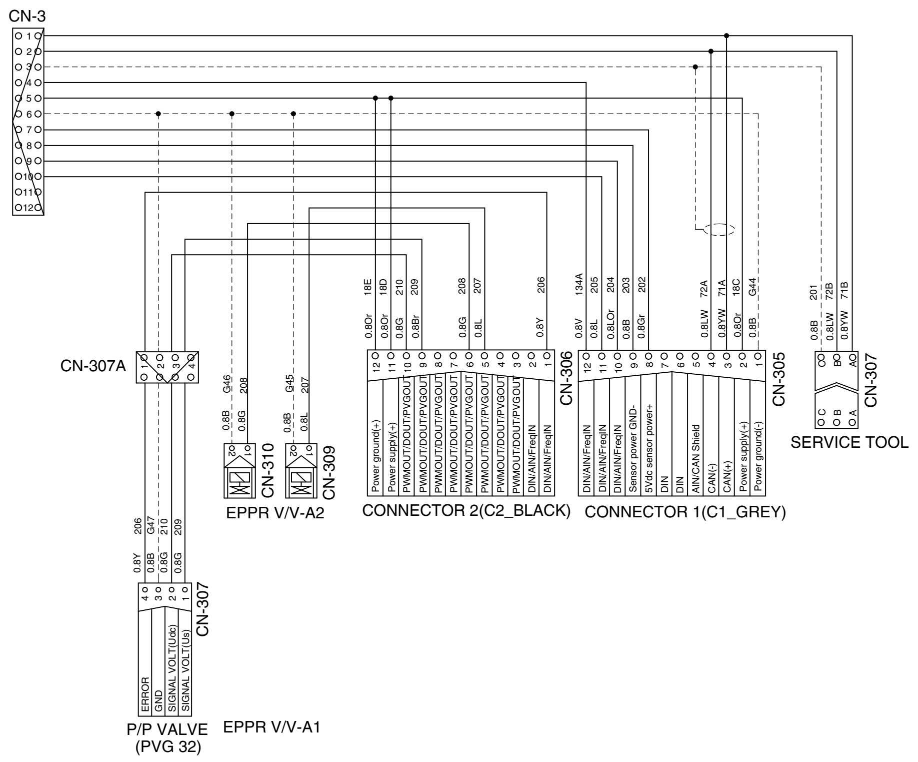
PREHEATER HARNESS (ONLY TIMER)



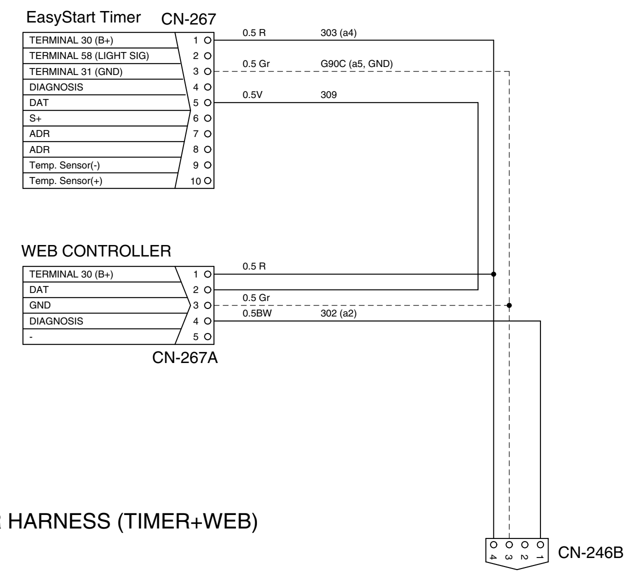
- MACHINE SERIAL NO. : #0004-



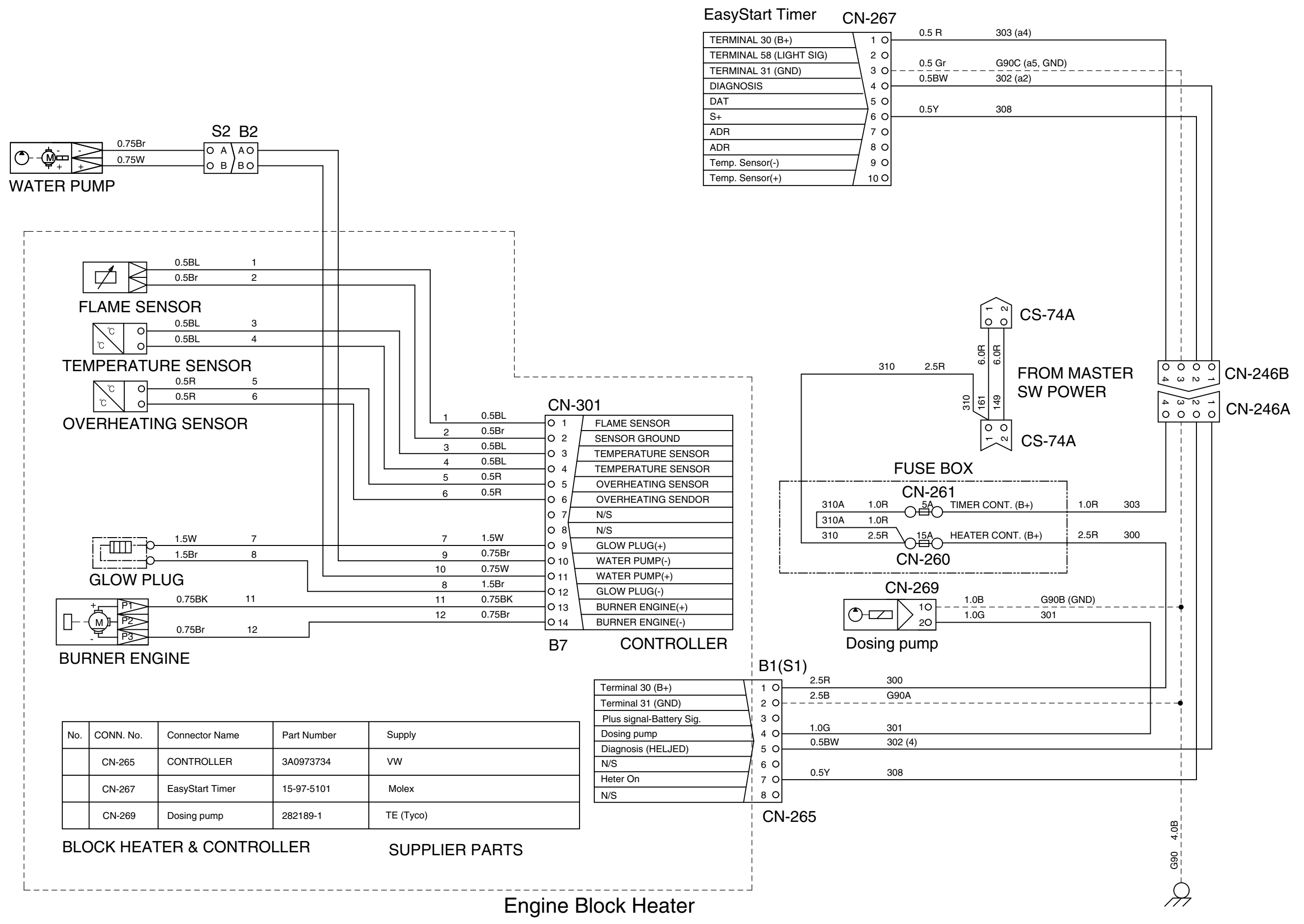
E/G HARNESS



PROPORTIONAL VALVE & LEVER

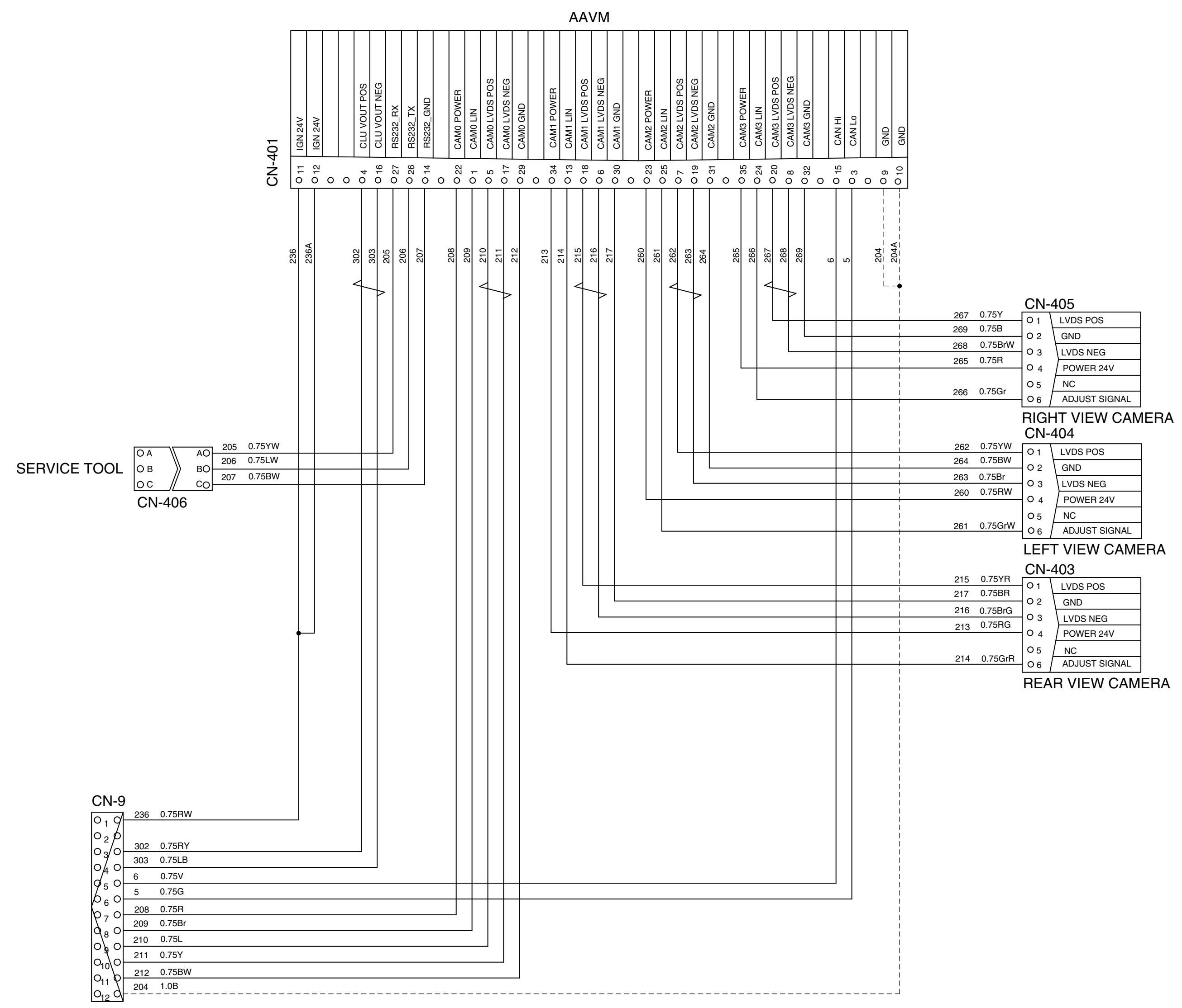


PREHEATER HARNESS (TIMER+WEB)



Engine Block Heater

PREHEATER HARNESS (ONLY TIMER)



20K8-95302-01

MEMORANDUM

1. POWER CIRCUIT (MACHINE SERIAL NO. : -#0041)

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

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

1) OPERATING FLOW

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

- → Fuse box [No.1] → Engine ECM [CN-93 (1, 25, 26, 27, 28)]
- → Fuse box [No.2] → United MCU [CN-51 (01)]
- → Fuse box [No.3]
  - → DEF module relay [CR-51 (2, 3)]
  - → Urea purging lamp [CL-40 (1)]
- → Fuse box [No.4] → I/conn [CN-5 (59)]
  - → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
    - → Door switch [CS-1]
    - → I/conn [CN-10 (2)] → RMS [CN-125B (6)]
  - → Radio & USB player [CN-27A (8)]
- → Fuse box [No.5] → Line heater relay [CR-52 (30, 86)
- → Fuse box [No.6]
  - → Master switch [CS-74B] → I/conn [CN-5 (36)]
    - → Start switch [CS-2A(1)]
    - → RMS [CN-125A (1)]
    - → GPS connection [CN-125 (1)]
  - → Power relay [CR-35 (30)]
- → Fuse box [No.7] → I/conn [CN-11 (5)]
  - → AC & Heater controller box A (7)
  - → Blower relay (4)
- → Fuse box [No.8] → I/conn [CN-5 (18)] → I/conn [CN-17 (5)]
  - → Wiper motor controller [CN-141 (7)]
  - → Wiper motor [CN-21 (4)]
- → Fuse box [No.9]
  - → I/conn [CN-5 (11)]
    - → Cluster [CN-56A (1)]
    - → Hour meter [CN-48 (1)]
  - → I/conn [CN-8 (6)] → Jog dial module [CN-363 (1)]
- → Fuse box [No.10] → NOx sensor relay [CR-50 (3)]
- → Fuse box [No.11] → United MCU [CN-54 (18)]

※ I/conn : Intermediate connector

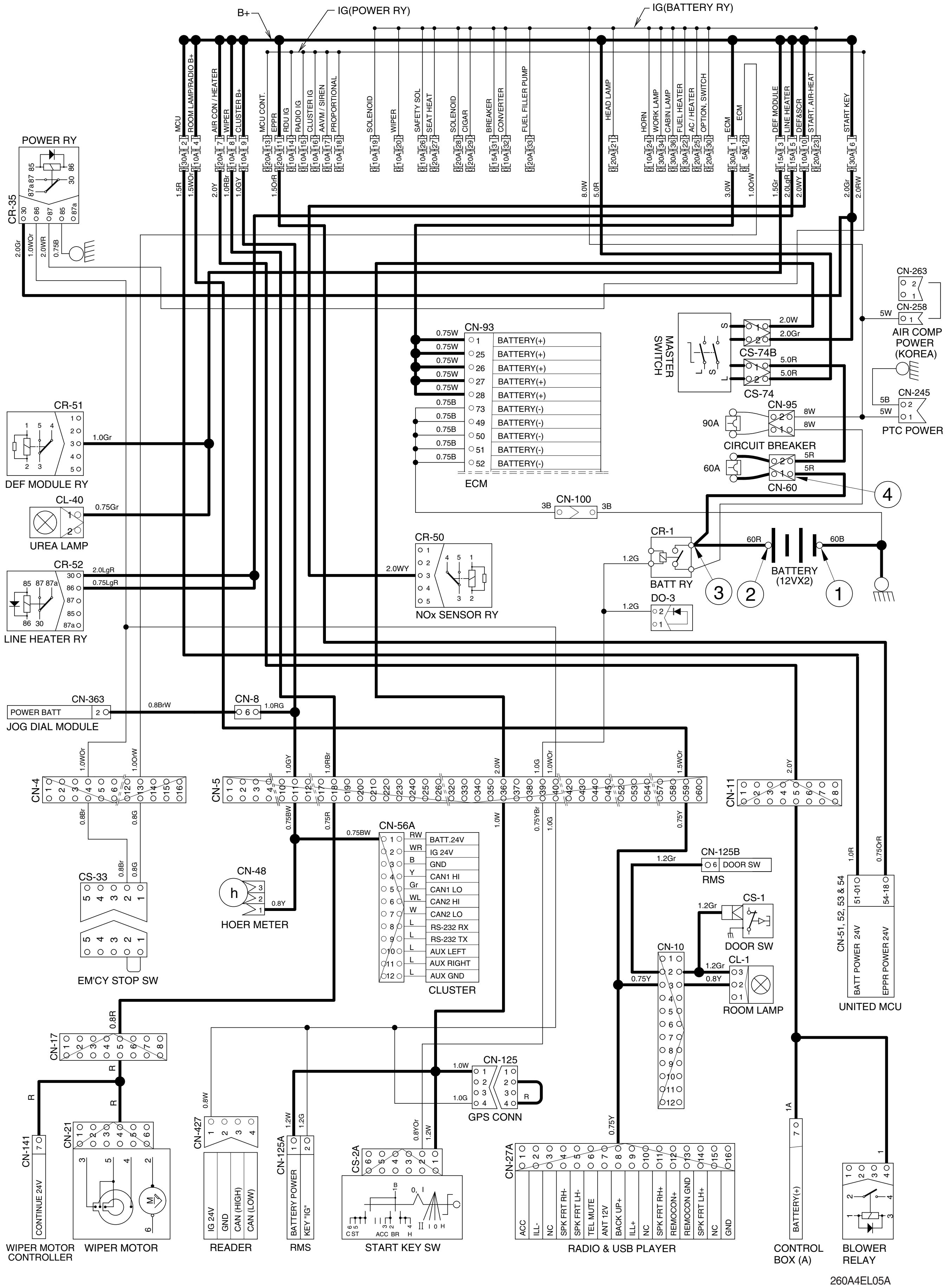
2) CHECK POINT

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

※ GND : Ground

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

POWER CIRCUIT (MACHINE SERIAL NO. : -#0041)



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

POWER CIRCUIT (MACHINE SERIAL NO. : #0042-)

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

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

1) OPERATING FLOW

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

- → Fuse box [No.1] → Engine ECM [CN-93 (1, 25, 26, 27, 28)]
- → Fuse box [No.2] → United MCU [CN-51 (01)]
- → Fuse box [No.3]
  - → DEF module relay [CR-51 (2, 3)]
  - → Urea purging lamp [CL-40 (1)]
- → Fuse box [No.4] → I/conn [CN-5 (59)]
  - → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
    - → Door switch [CS-1]
    - → I/conn [CN-10 (2)] → RMS [CN-125B (6)]
  - → Radio & USB player [CN-27A (8)]
- → Fuse box [No.5] → Line heater relay [CR-52 (30, 86)
- → Fuse box [No.6]
  - → Master switch [CS-74B] → I/conn [CN-5 (36)]
    - → Start switch [CS-2A(1)]
    - → RMS [CN-125A (1)]
    - → GPS connection [CN-125 (1)]
    - → Reader [CN-427 (12)]
  - → Power relay [CR-35 (30)]
- → Fuse box [No.7] → I/conn [CN-11 (5)]
  - → AC & Heater controller box A (7)
  - → Blower relay (4)
- → Fuse box [No.8] → I/conn [CN-5 (18)] → I/conn [CN-17 (5)]
  - → Wiper motor controller [CN-141 (7)]
  - → Wiper motor [CN-21 (4)]
- → Fuse box [No.9]
  - → I/conn [CN-5 (11)]
    - → Cluster [CN-56A (1)]
    - → Hour meter [CN-48 (1)]
  - → I/conn [CN-8 (6)] → Jog dial module [CN-363 (2)]
- → Fuse box [No.10] → NOx sensor relay [CR-50 (3)]
- → Fuse box [No.11] → United MCU [CN-54 (18)]

※ I/conn : Intermediate connector

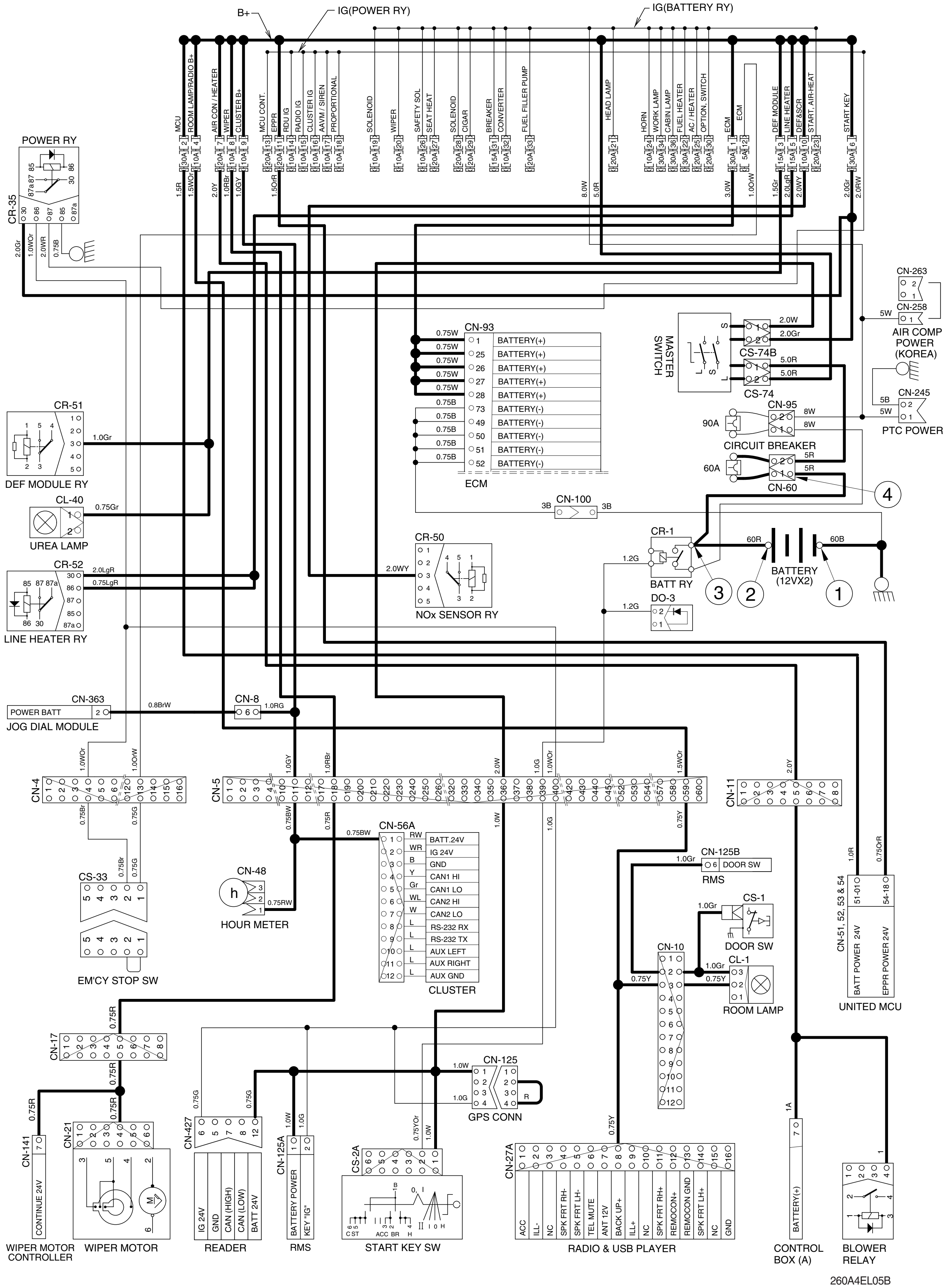
2) CHECK POINT

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

※ GND : Ground

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

POWER CIRCUIT (MACHINE SERIAL NO. : #0042-)



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

2. STARTING CIRCUIT (MACHINE SERIAL NO. : -#0002)

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.6] ┬→ Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
└→ Power relay [CR-35 (30)]

(1) When start key switch is in ON position

┬→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
→ Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
└→ Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)

┬→ I/conn [CN-5 (40)] ┬→ Power relay [CR-35 (86) → (87)]
→ Fuse box [IG (power)]
└→ I/conn [CN-4 (4)]
→ Emergency engine stop sw [CS-33 (2)→(1)] → I/conn [CN-4 (13)]
→ Fuse box [No. 12] → Engine ECM [CN-93 (5)]
├→ Reader [CN-427 (1)]
└→ RMS [CN-125A (2)]

(2) When start key switch is in START position

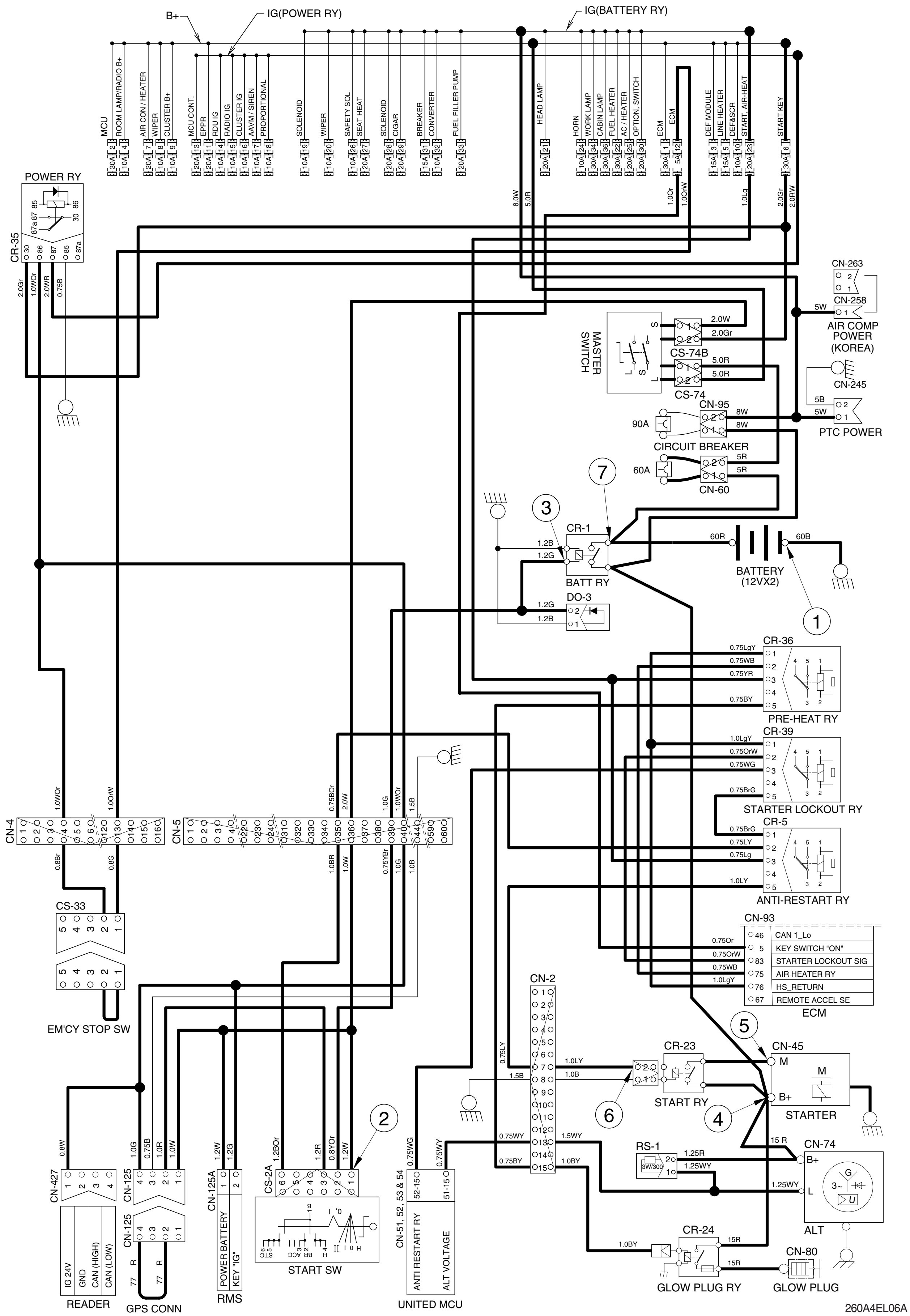
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn [CN-2 (7)] → Start relay [CR-23 (2)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT (MACHINE SERIAL NO. : -#0002)



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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0003-#0041)

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.6] ┬→ Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
└→ Power relay [CR-35 (30)]

(1) When start key switch is in ON position

┬→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
→ Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
└→ Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)]
┬→ I/conn [CN-5 (40)] ┬→ Power relay [CR-35 (86)→(87)]
→ Fuse box [IG (power)]
└→ I/conn [CN-4 (4)]
→ Emergency engine stop sw [CS-33 (2)→(1)] → I/conn [CN-4 (13)]
→ Fuse box [No. 12] → Engine ECM [CN-93 (5)]
├→ Reader [CN-427 (1)]
└→ RMS [CN-125A (2)]

(2) When start key switch is in START position

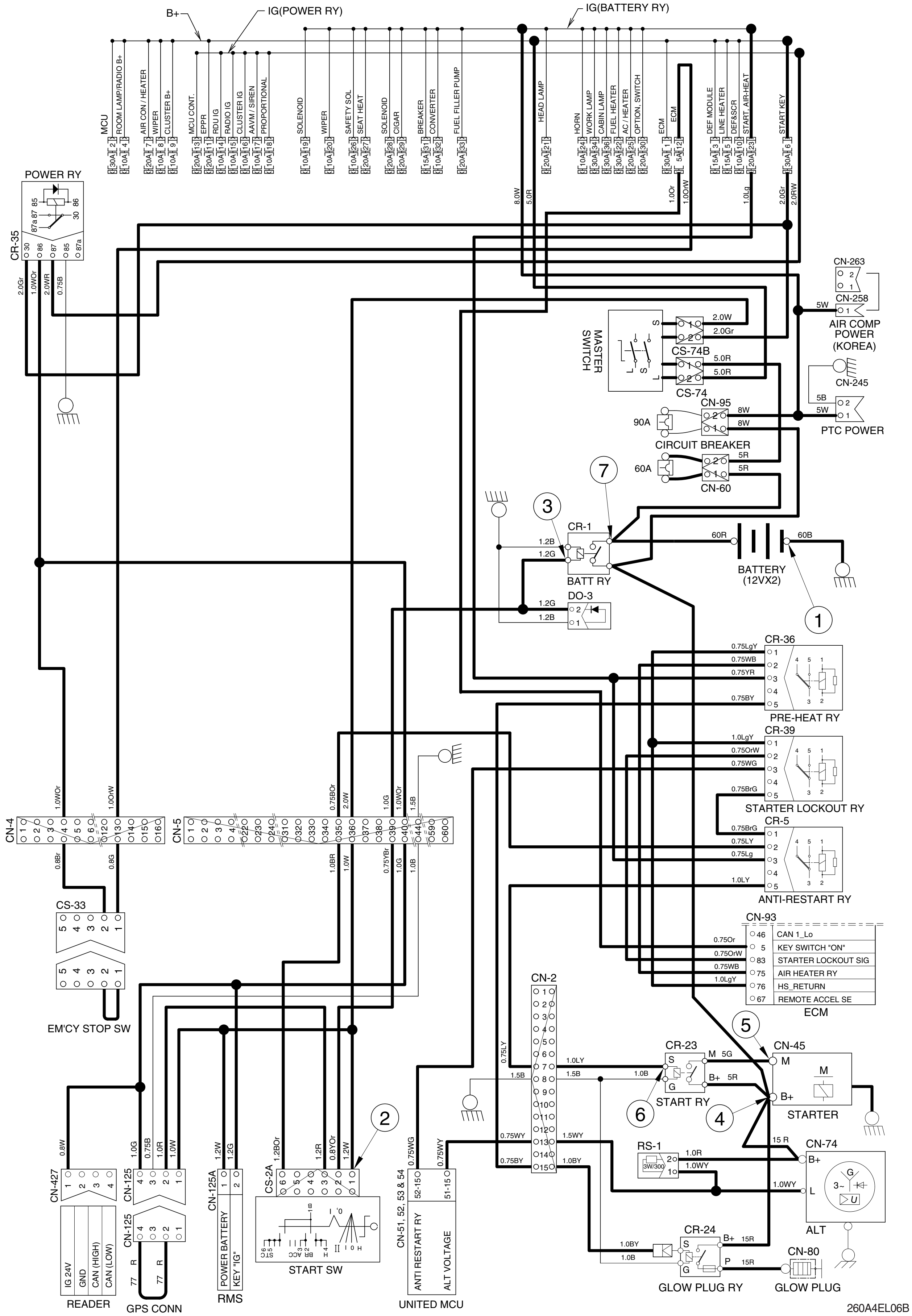
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn [CN-2 (7)] → Start relay [CR-23 (S)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0003-#0041)



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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0042-)

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.6] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
→ Power relay [CR-35 (30)]

(1) When start key switch is in ON position

→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
→ Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)]
→ I/conn [CN-5 (40)] → Power relay [CR-35 (86) → (87)]
→ Fuse box [IG (power)]
→ I/conn [CN-4 (4)]
→ Emergency engine stop sw [CS-33 (2)→(1)] → I/conn [CN-4 (13)]
→ Fuse box [No. 12] → Engine ECM [CN-93 (5)]
→ Reader [CN-427 (6)]
→ RMS [CN-125A (2)]

(2) When start key switch is in START position

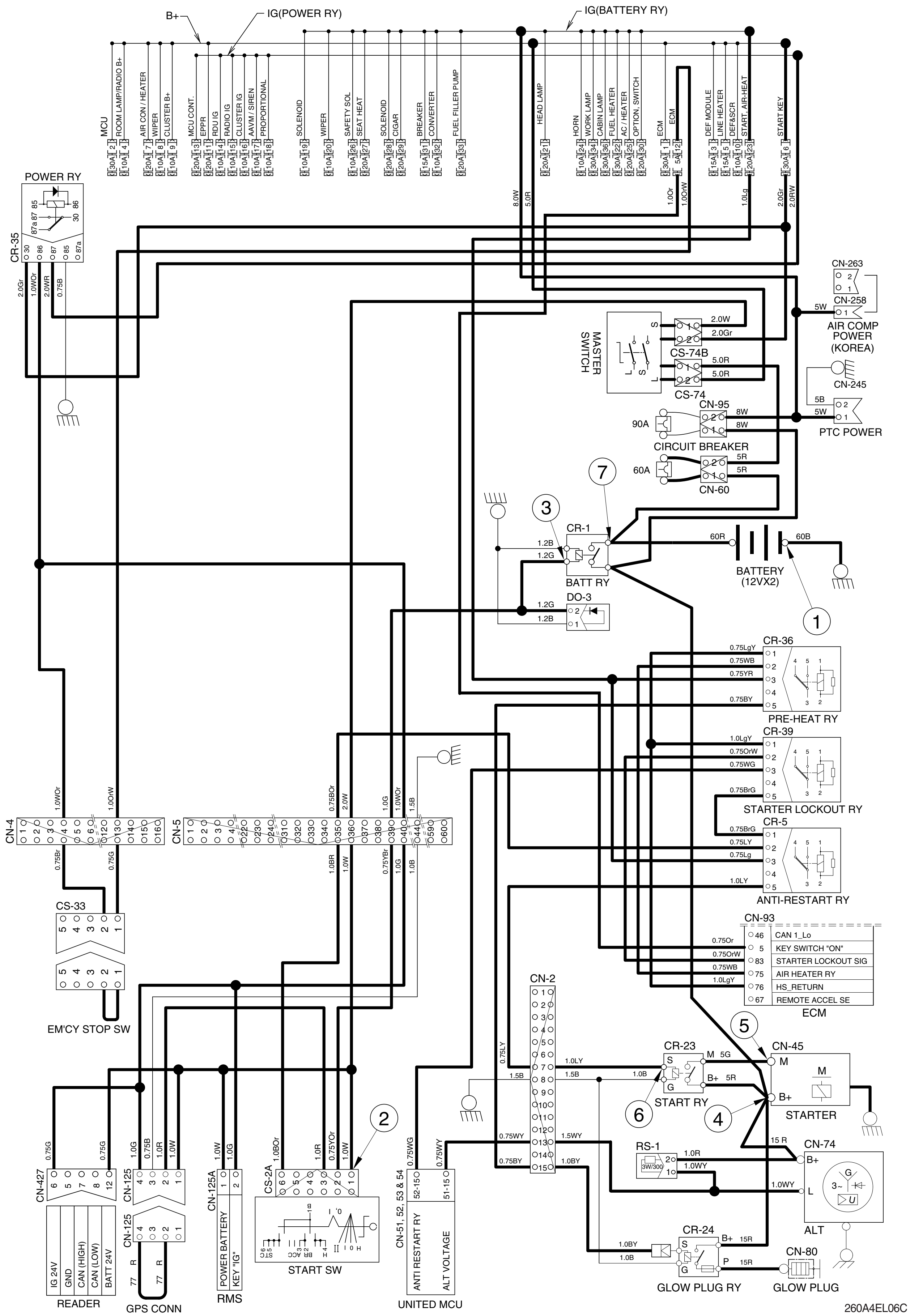
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn [CN-2 (7)] → Start relay [CR-23 (S)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT (MACHINE SERIAL NO. : #0042-)



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

3. CHARGING CIRCUIT (MACHINE SERIAL NO. : -#0002)

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

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

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

1) OPERATING FLOW

(1) Warning flow

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

(2) Charging flow

Alternator "B+" terminal → Starter [CN-45 (B+)] → Battery relay (CR-1)
├→ Battery (+) terminal
├→ Circuit breaker [CN-60] → Master switch [CS-74] → Fuse box [B+]
└→ Circuit breaker [CN-95] ┬→ Fuse box [IG, battery] → Power relay [CR-35 (30→87)]
　　→ Fuse box [IG, power]
├→ PTC power [CN-245 (1)]
└→ Air comp power [CN-258 (1)]

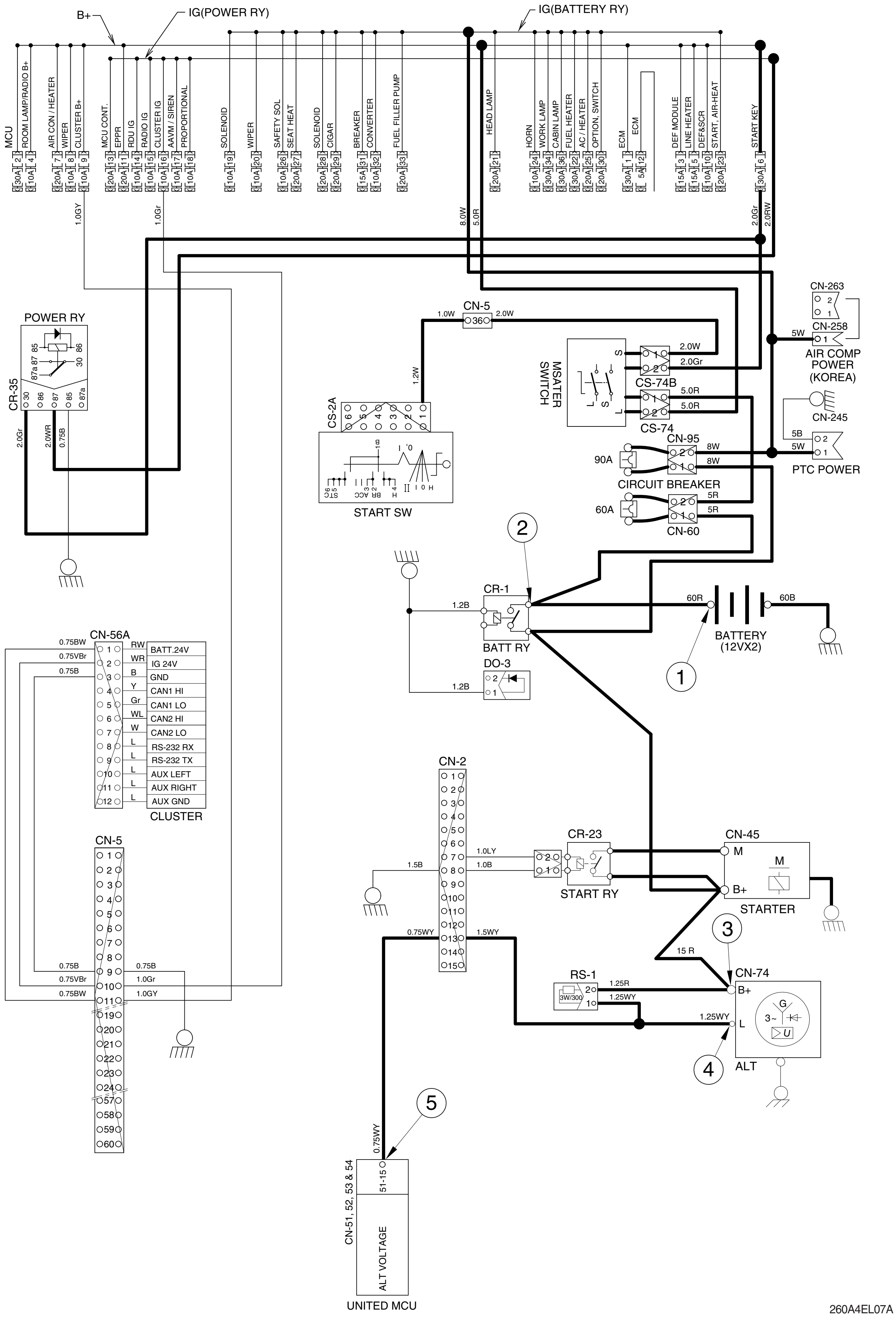
2) CHECK POINT

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

※ GND : Ground

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

CHARGING CIRCUIT (MACHINE SERIAL NO. : -#0002)



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

CHARGING CIRCUIT (MACHINE SERIAL NO. : #0003-)

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

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

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

1) OPERATING FLOW

(1) Warning flow

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

(2) Charging flow

Alternator "B^+" terminal → Starter [CN-45 (B^+)] → Battery relay (CR-1)
→ Battery (+) terminal
→ Circuit breaker [CN-60] → Master switch [CS-74] → Fuse box [B^+]
→ Circuit breaker [CN-95] → Fuse box [IG, battery] → Power relay [CR-35 (30→87)]
→ Fuse box [IG, power]
→ PTC power [CN-245 (1)]
→ Air comp power [CN-258 (1)]

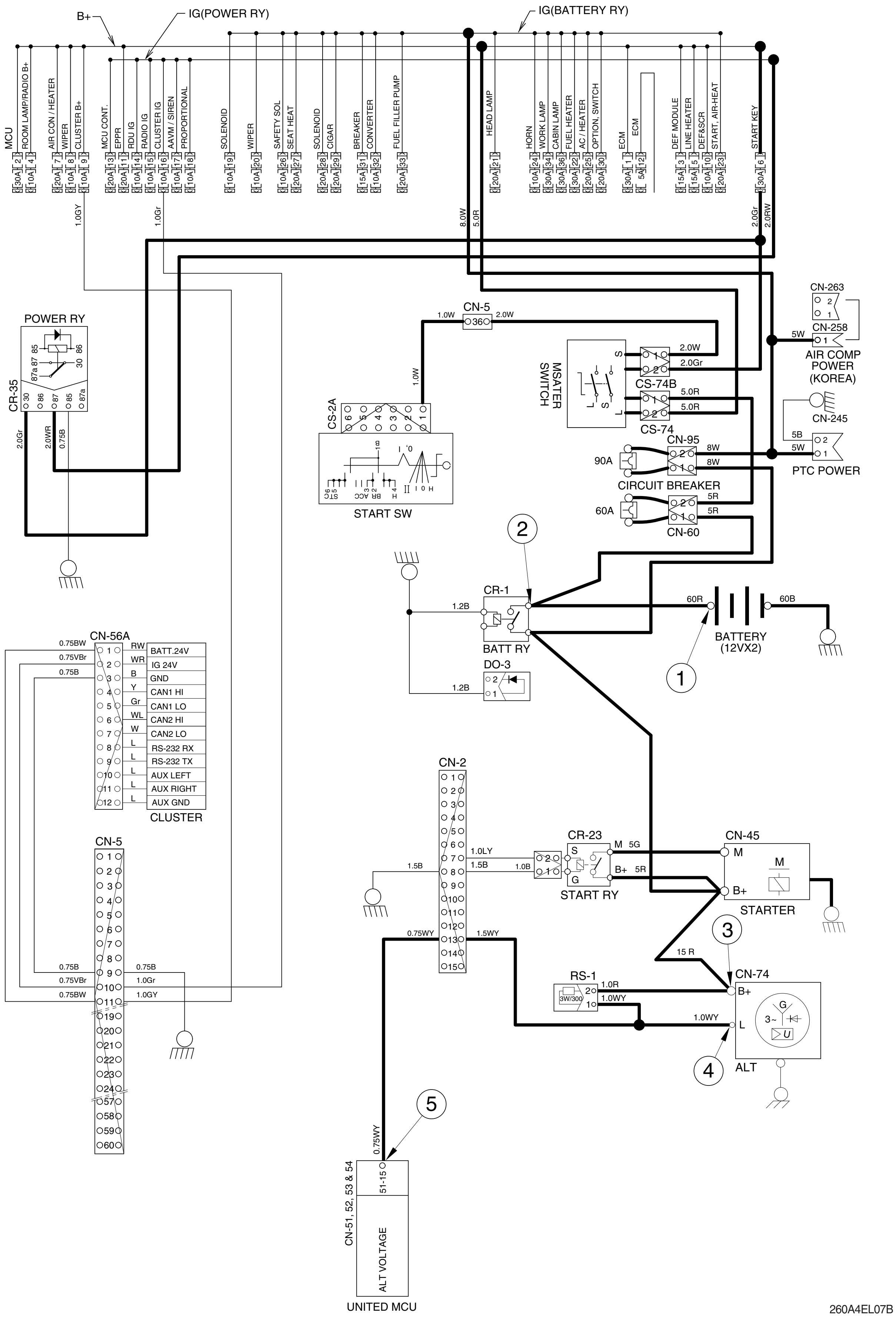
2) CHECK POINT

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

※ GND : Ground

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

CHARGING CIRCUIT (MACHINE SERIAL NO. : #0003-)



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

4. HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0041)

1) OPERATING FLOW

Fuse box (No.21) → Head light relay [CR-13 (30, 86)]
Fuse box (No.34) → Work light relay [CR-4 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Head light switch ON

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

(2) Work light switch ON

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

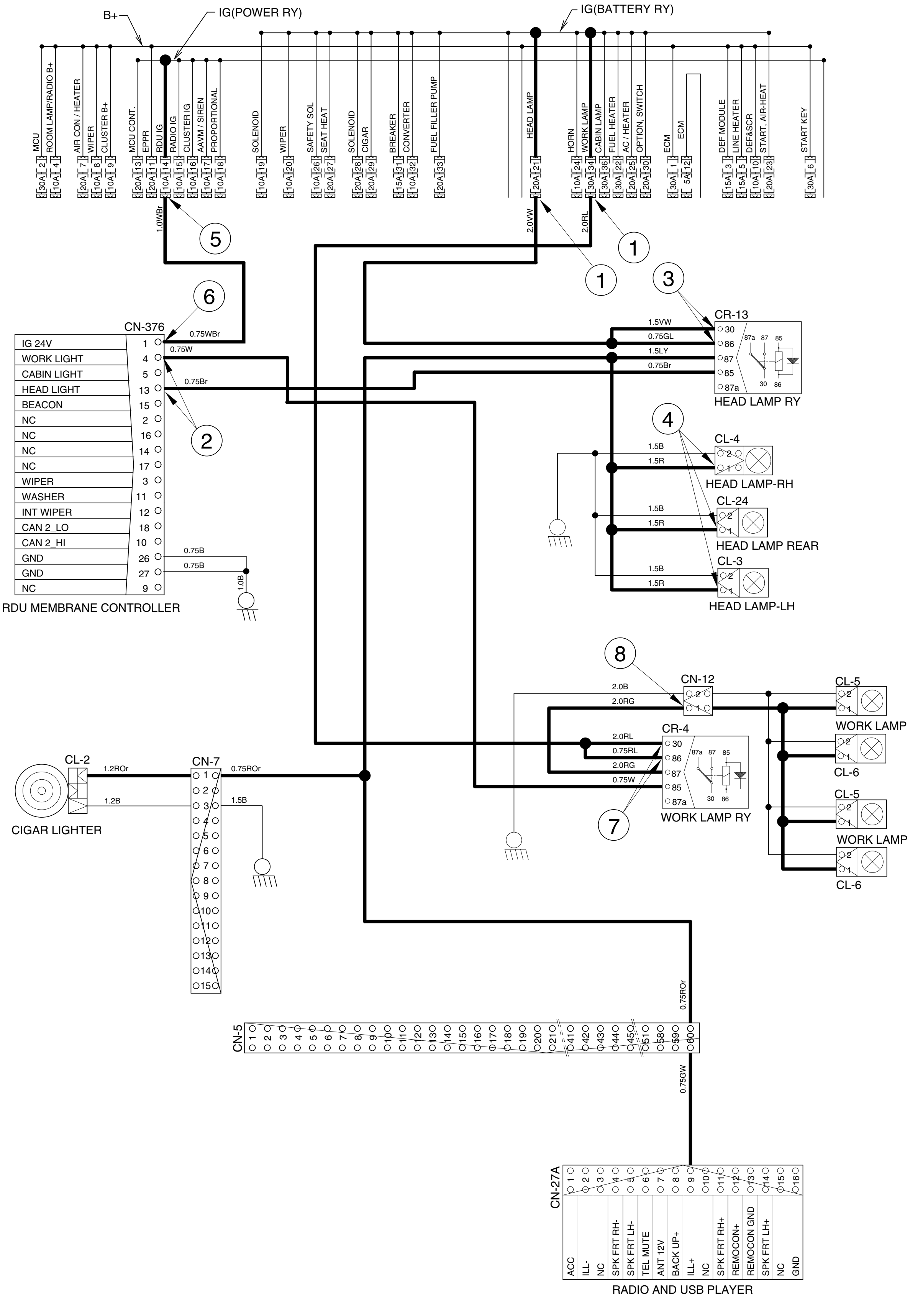
2) CHECK POINT

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

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0041)



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

HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : #0042-)

1) OPERATING FLOW

Fuse box (No.21) → Head light relay [CR-13 (30, 86)]
Fuse box (No.34) → Work light relay [CR-4 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Head light switch ON

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

(2) Work light switch ON

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

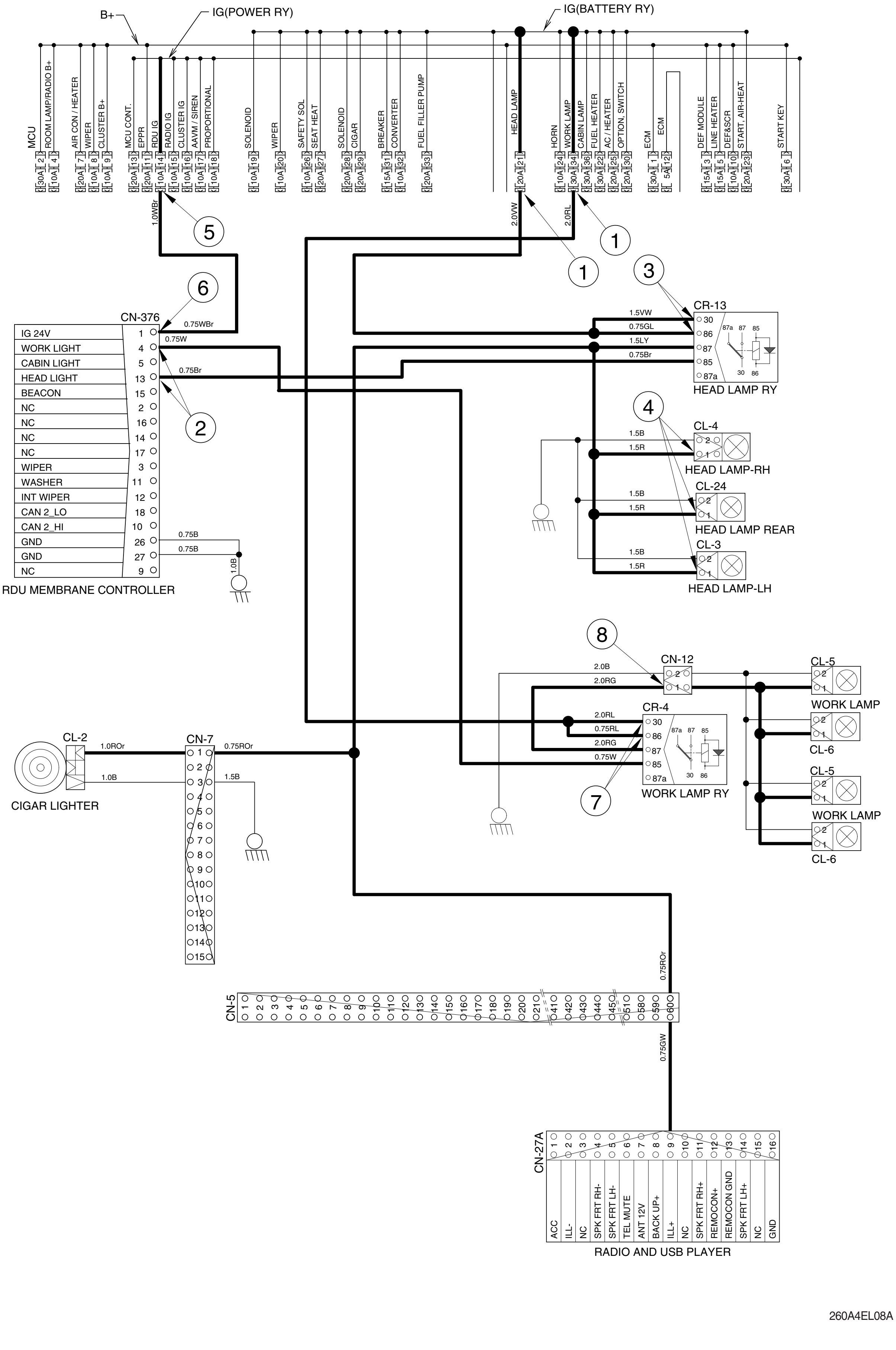
2) CHECK POINT

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

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT (MACHINE SERIAL NO. : #0042-)



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

5. BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0041)

1) OPERATING FLOW

Fuse box (No.30) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.36) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

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

(2) Cab light switch ON

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

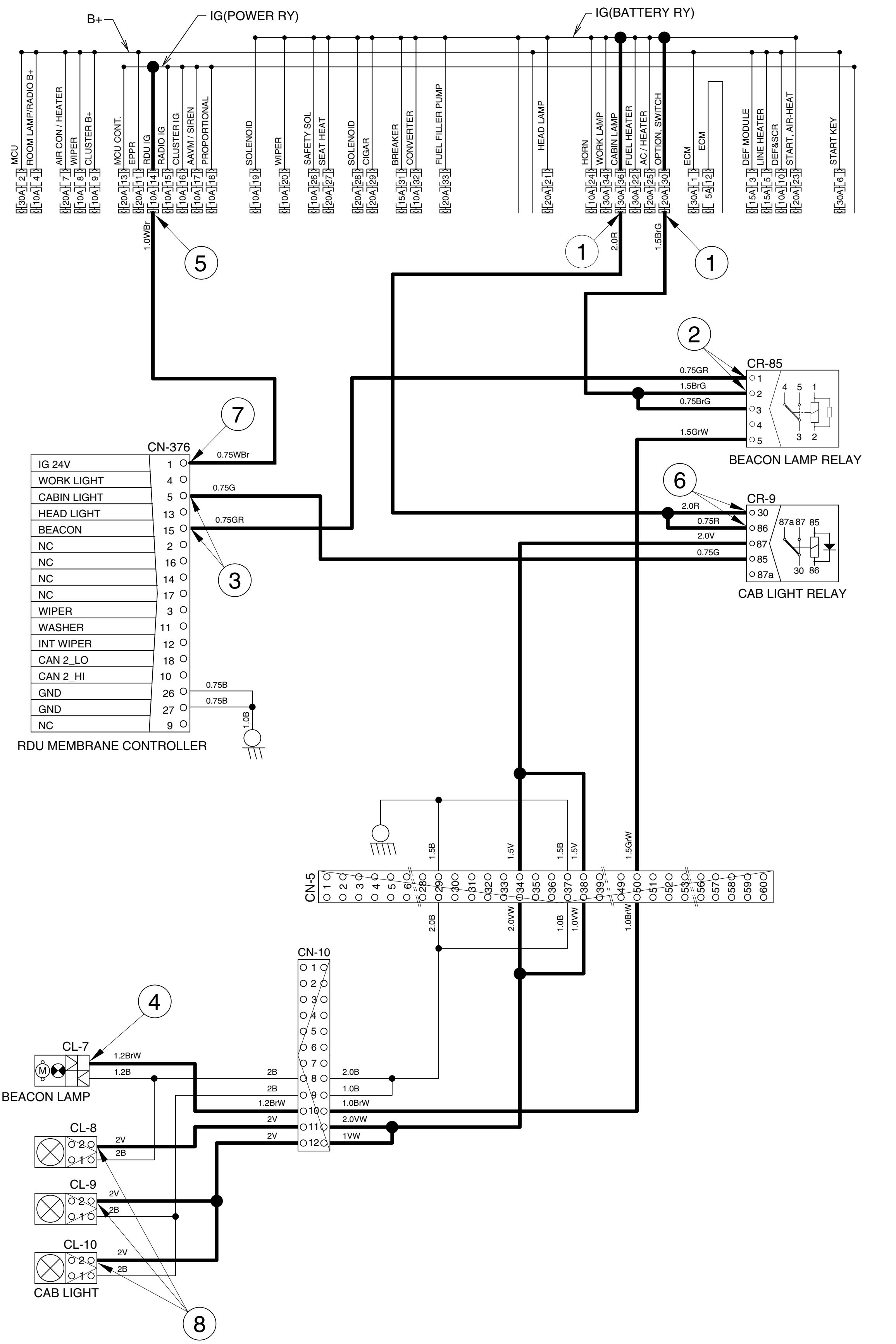
2) CHECK POINT

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

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : -#0041)



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

BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : #0042-)

1) OPERATING FLOW

Fuse box (No.30) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.36) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.14) → RDU membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-376 (15)] → Beacon lamp relay [CR-85 (1)→(5)]
→ I/conn [CN-5 (50)] → I/conn [CN-10 (10)] → Beacon lamp ON [CL-7 (2)]

(2) Cab light switch ON

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

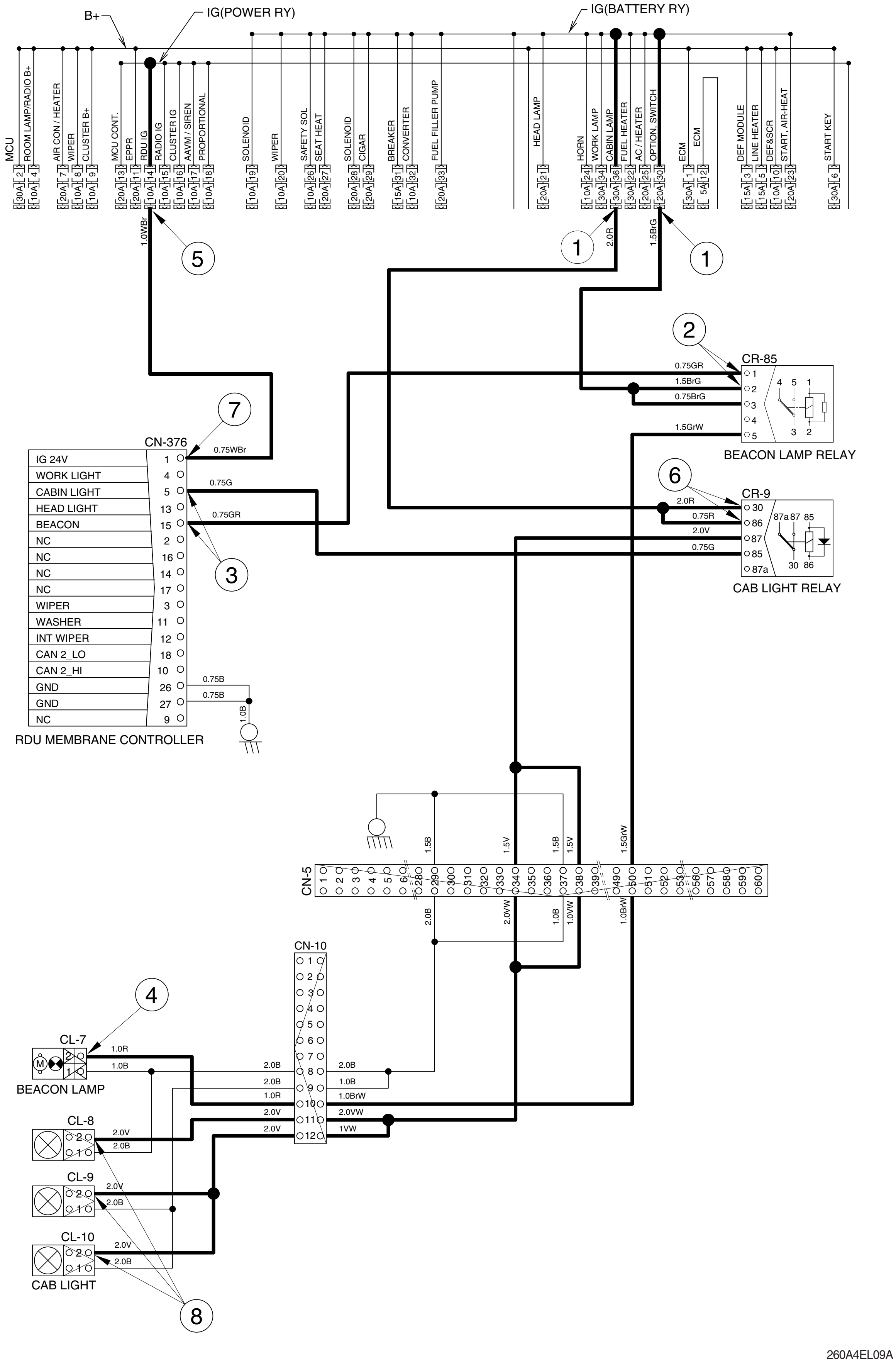
2) CHECK POINT

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

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT CIRCUIT (MACHINE SERIAL NO. : #0042-)



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

6. WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : -#0041)

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.14) → RDU membrance controller [CN-376 (1)]

Fuse box (No.8) → I/conn [CN-5 (18)] → I/conn [CN-17 (5)] → Wiper motor controller [CN-141 (7)]
→ Wiper motor [CN-21 (4)]

Fuse box (No.20) → I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
→ Low wiper motor [CN-407 (3)]
→ Washer pump [CN-22 (2)]

(2) Wiper switch ON (Intermittent)

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

(3) Wiper switch ON (continual)

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

(4) Washer switch ON

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

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

(5) Auto parking (when switch OFF)

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

2) OPERATING FLOW (LOW WIPER)

(1) Key switch ON

Fuse box (No. 30) → I/conn [CN-7 (8)] → Low wiper switch [CS-79 (1, 5)]

(2) Wiper switch ON (1st)

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

(3) Wiper switch ON (2nd)

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

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

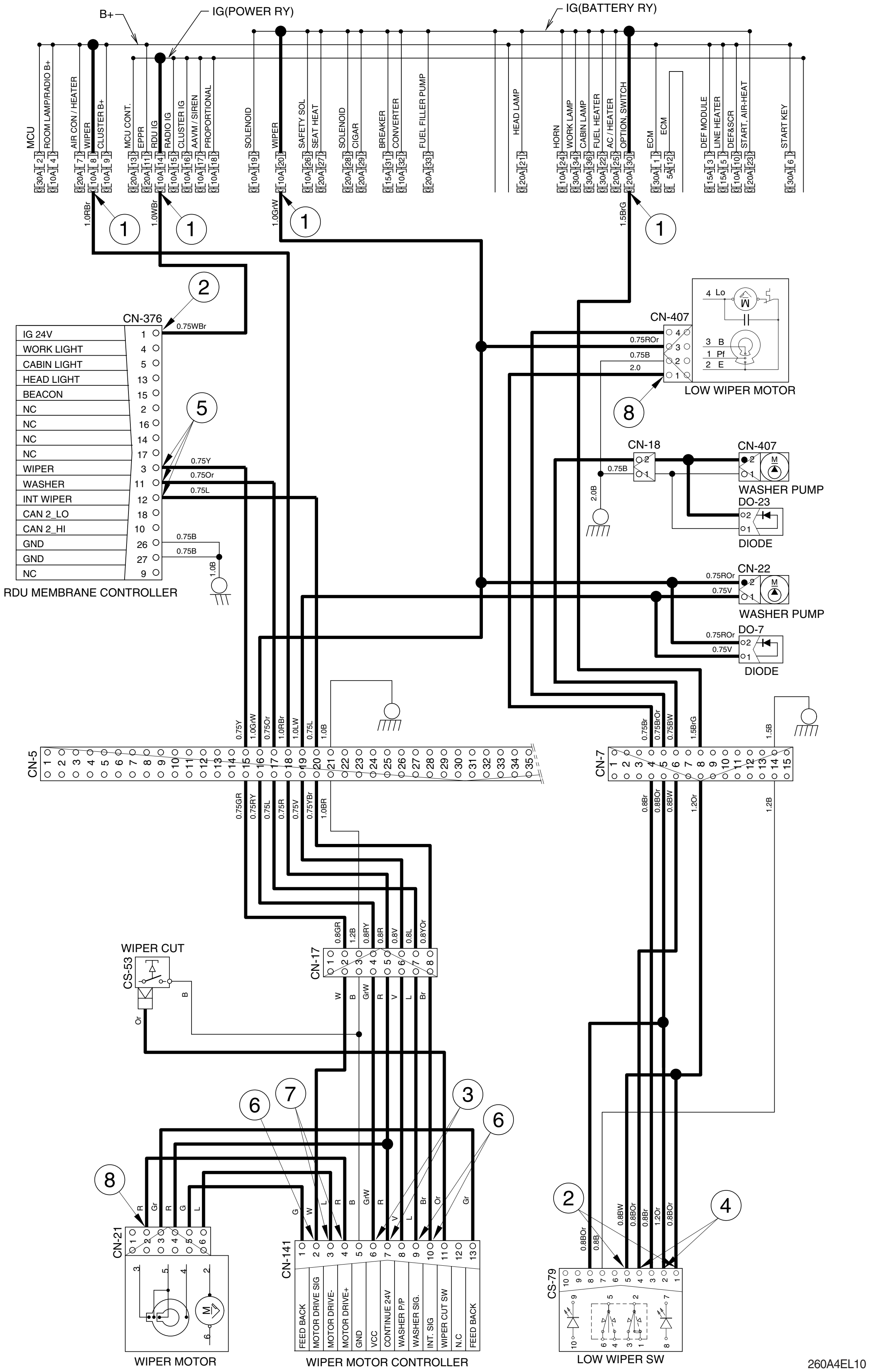
3) CHECK POINT

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

※ GND : Ground

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

WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : -#0041)



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

WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : #0042-)

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.14) → RDU membrance controller [CN-376 (1)]

Fuse box (No.8) → I/conn [CN-5 (18)] → I/conn [CN-17 (5)] → Wiper motor controller [CN-141 (7)]
→ Wiper motor [CN-21 (4)]

Fuse box (No.20) → I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
→ Low wiper motor [CN-407 (3)]
→ Washer pump [CN-22 (2)]

(2) Wiper switch ON (Intermittent)

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

(3) Wiper switch ON (continual)

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

(4) Washer switch ON

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

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

(5) Auto parking (when switch OFF)

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

2) OPERATING FLOW (LOW WIPER)

(1) Key switch ON

Fuse box (No. 30) → I/conn [CN-7 (8)] → Low wiper switch [CS-79 (1, 5)]

(2) Wiper switch ON (1st)

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

(3) Wiper switch ON (2nd)

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

Wiper switch ON [CS-79 (1 → 2)] → I/conn [CN-7 (5)] → Wiper motor [CN-407 (4)] → Wiper operating

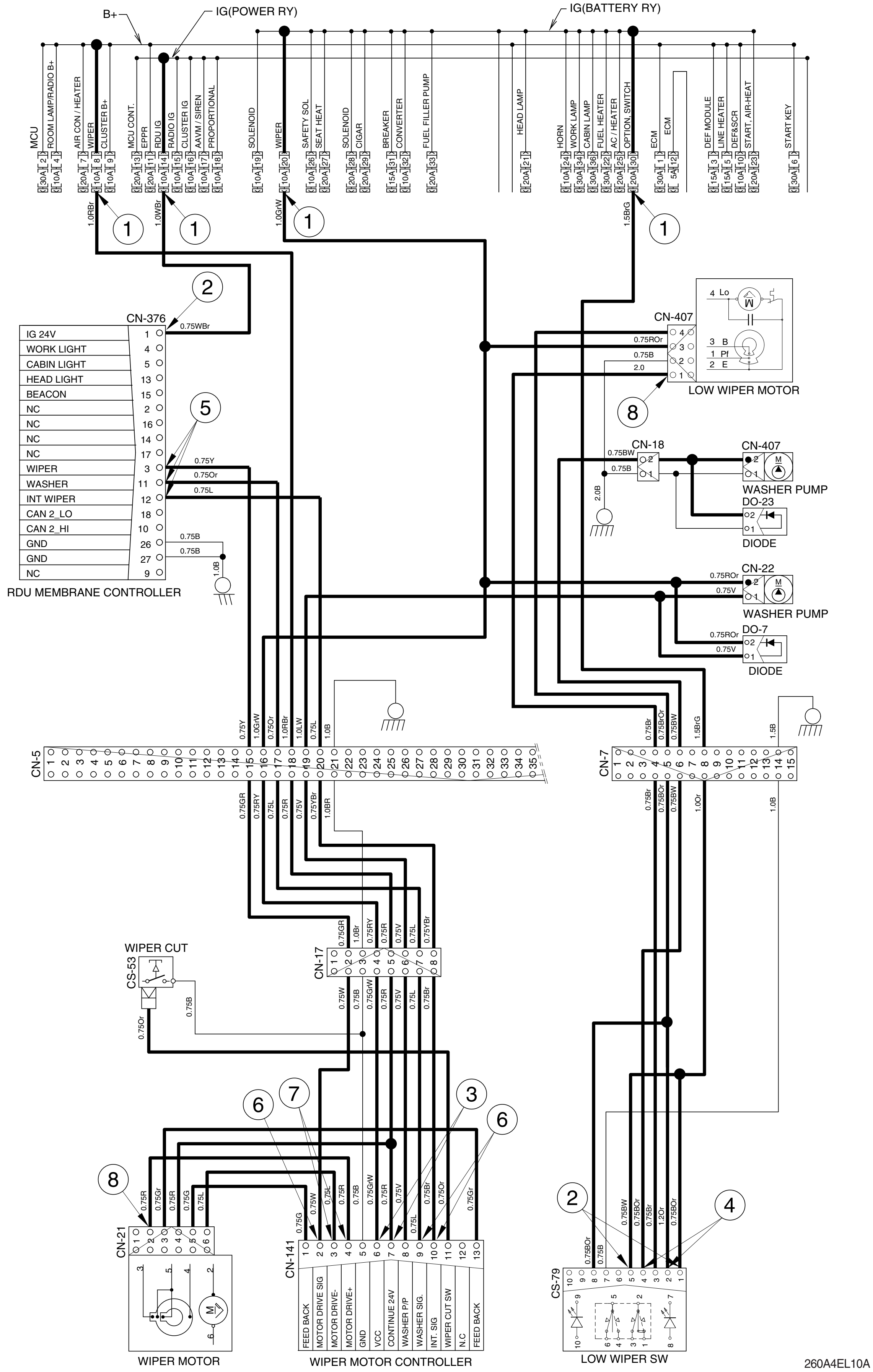
3) CHECK POINT

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

※ GND : Ground

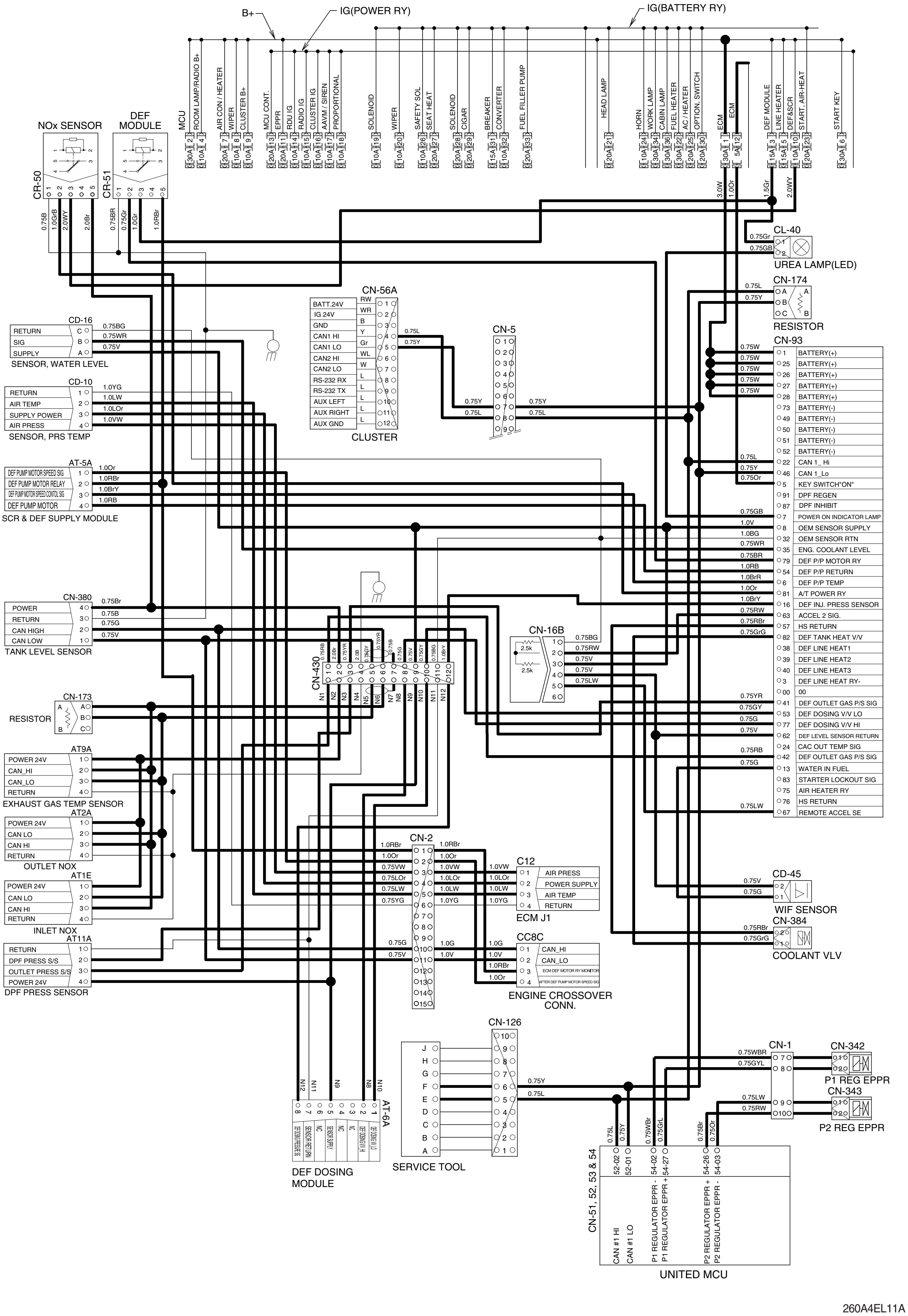
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT (MACHINE SERIAL NO. : #0042-)



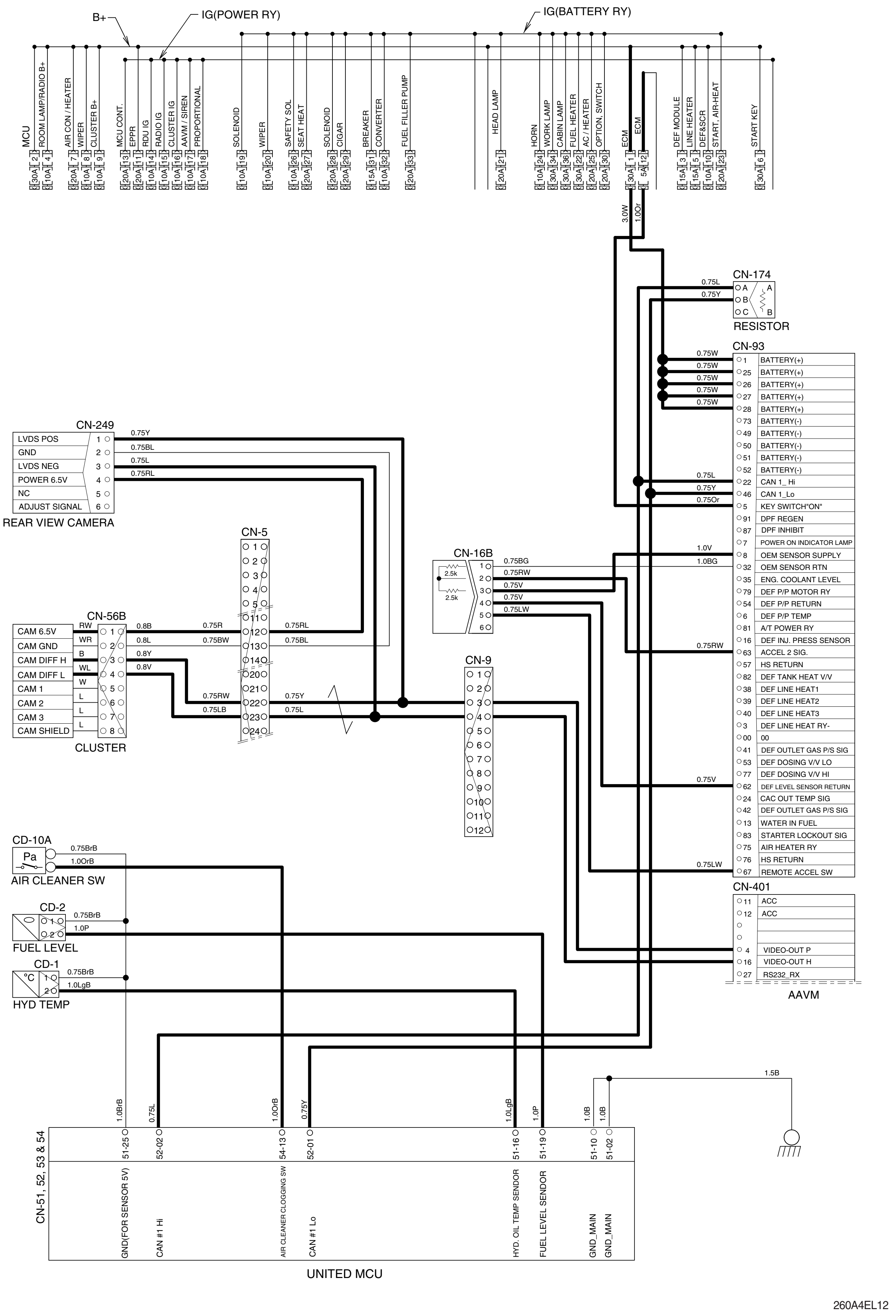
※ The circuit diagram may differ from the equipment, so please check before a repair.

7. CONTROLLER CIRCUIT (MACHINE SERIAL NO. : #0001-)



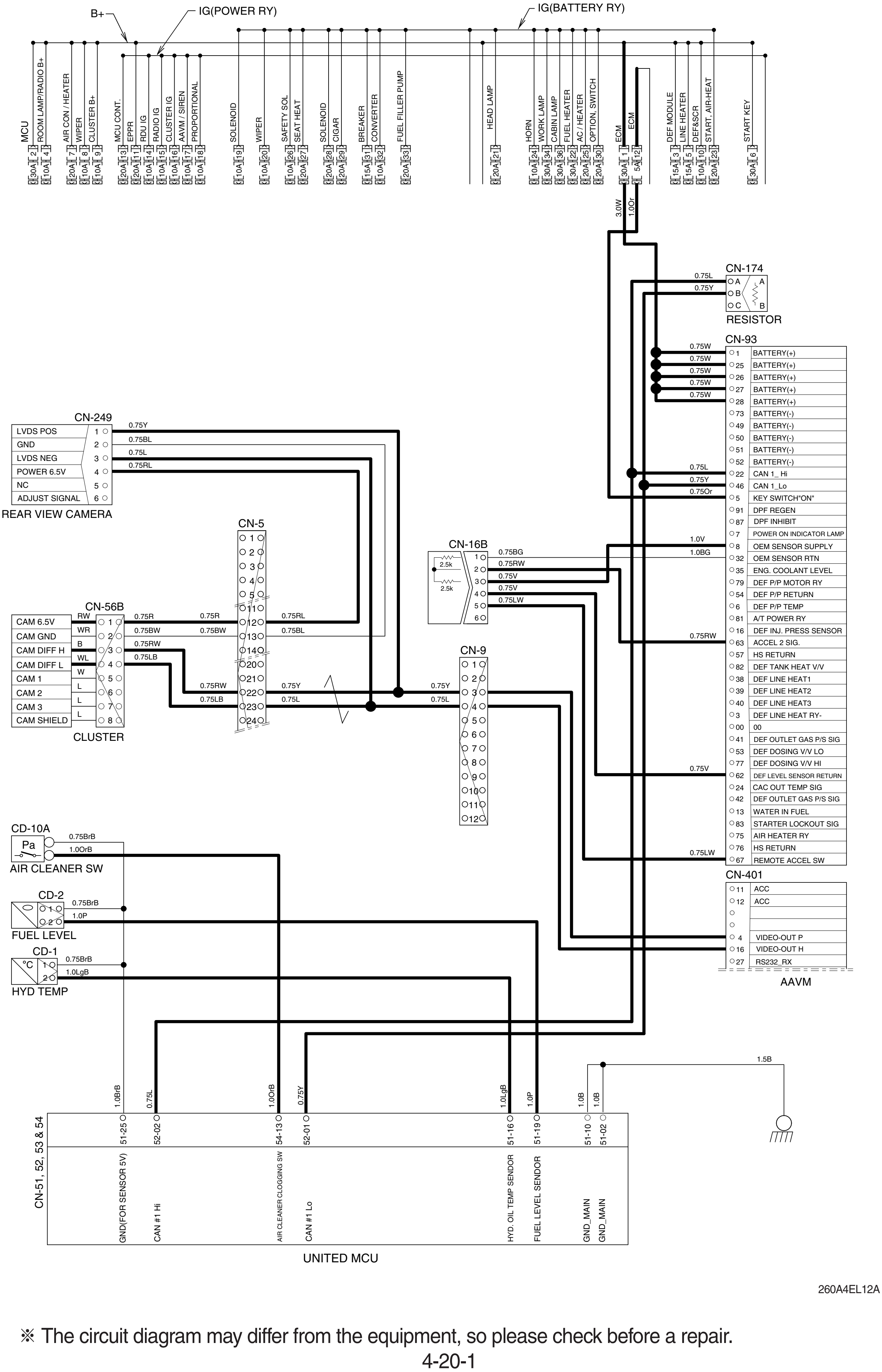
※ The circuit diagram may differ from the equipment, so please check before a repair.

8. MONITORING CIRCUIT (MACHINE SERIAL NO. : -#0041)



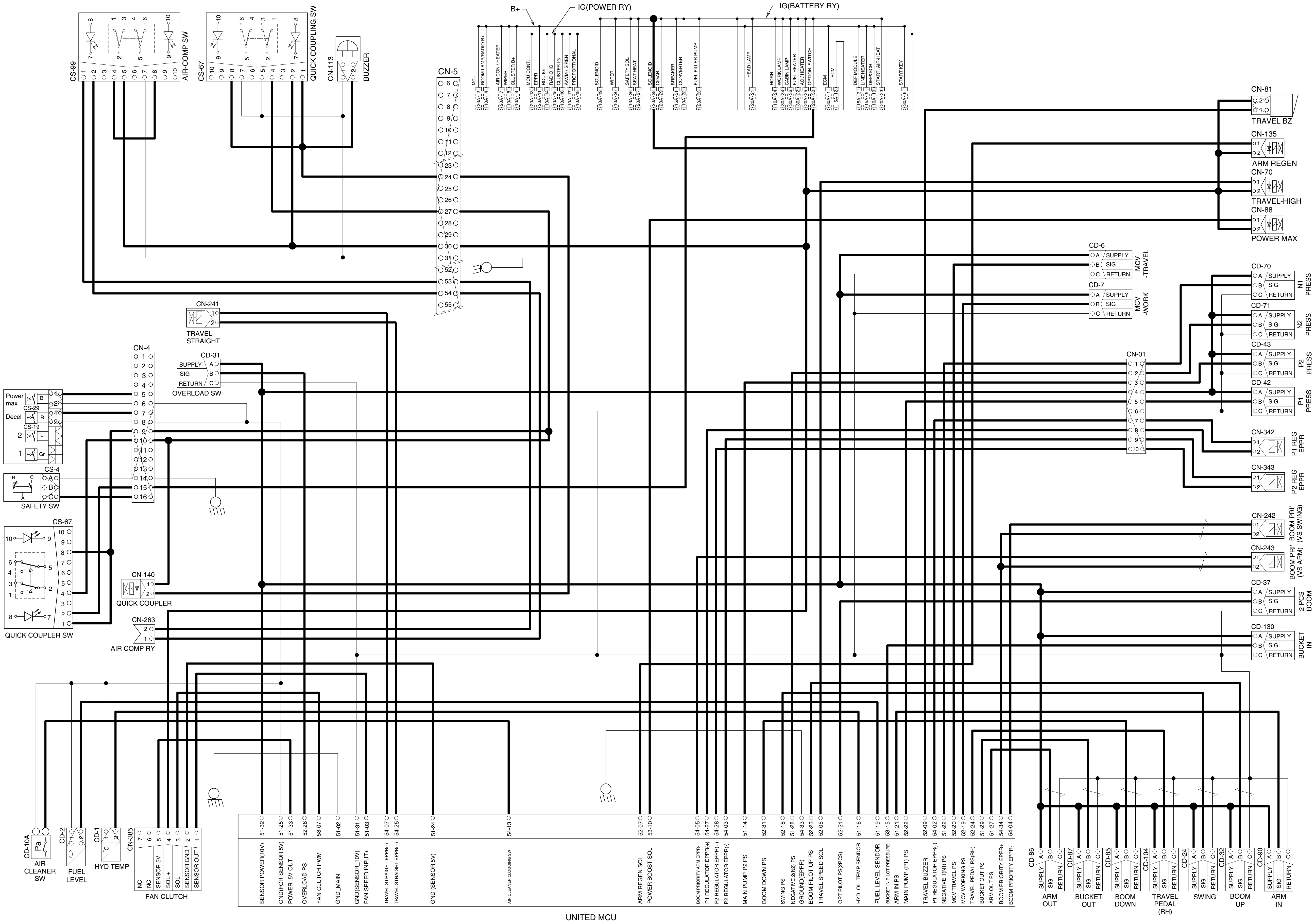
※ The circuit diagram may differ from the equipment, so please check before a repair.

MONITORING CIRCUIT (MACHINE SERIAL NO. : #0042-)



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

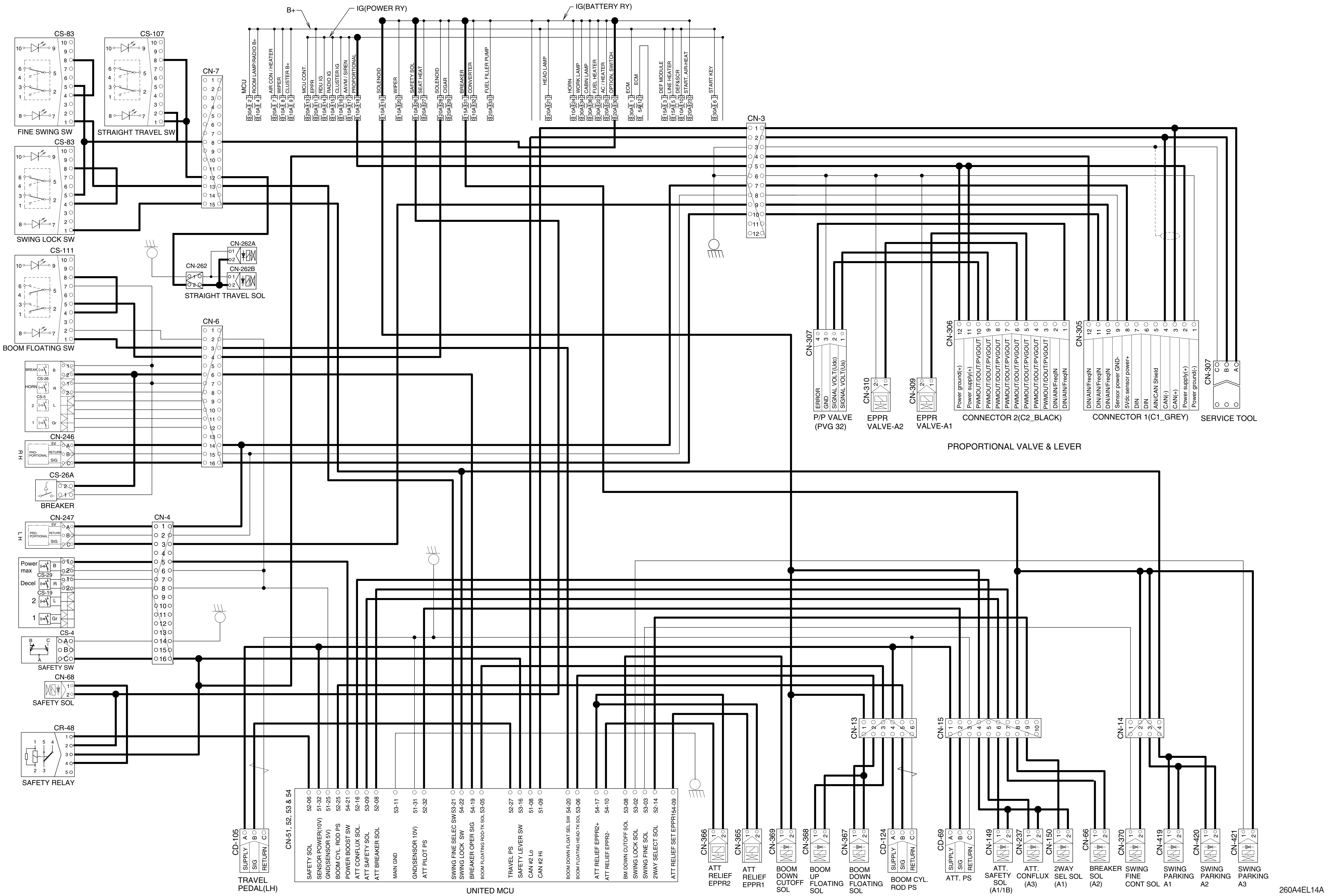
9. ELECTRIC CIRCUIT FOR HYDRAULIC (1/2, MACHINE SERIAL NO. : #0001-)



260A4EL13A

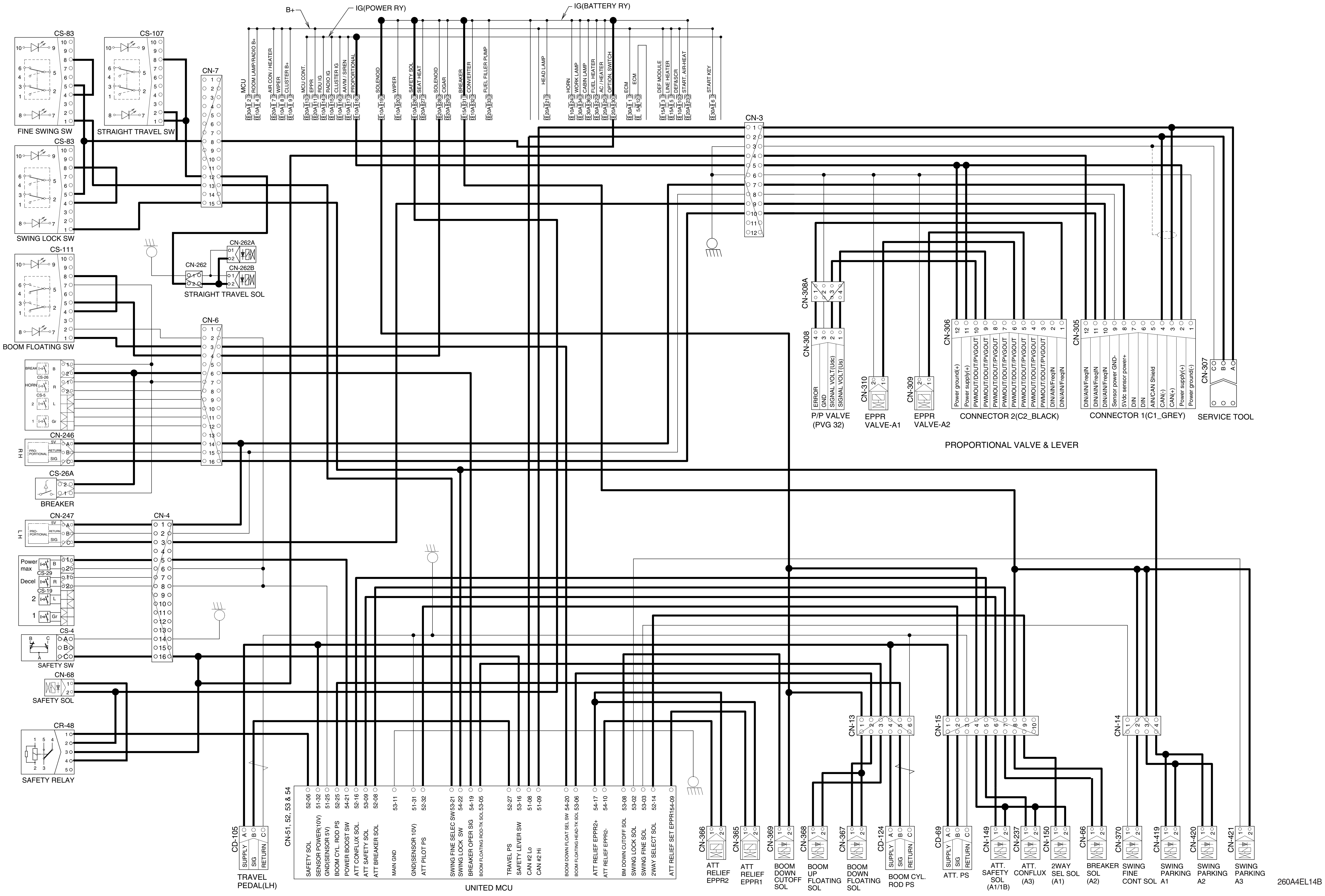
※ The circuit diagram may differ from the equipment, so please check before a repair.

10. ELECTRIC CIRCUIT FOR HYDRAULIC (2/2, MACHINE SERIAL NO. : -#0002)



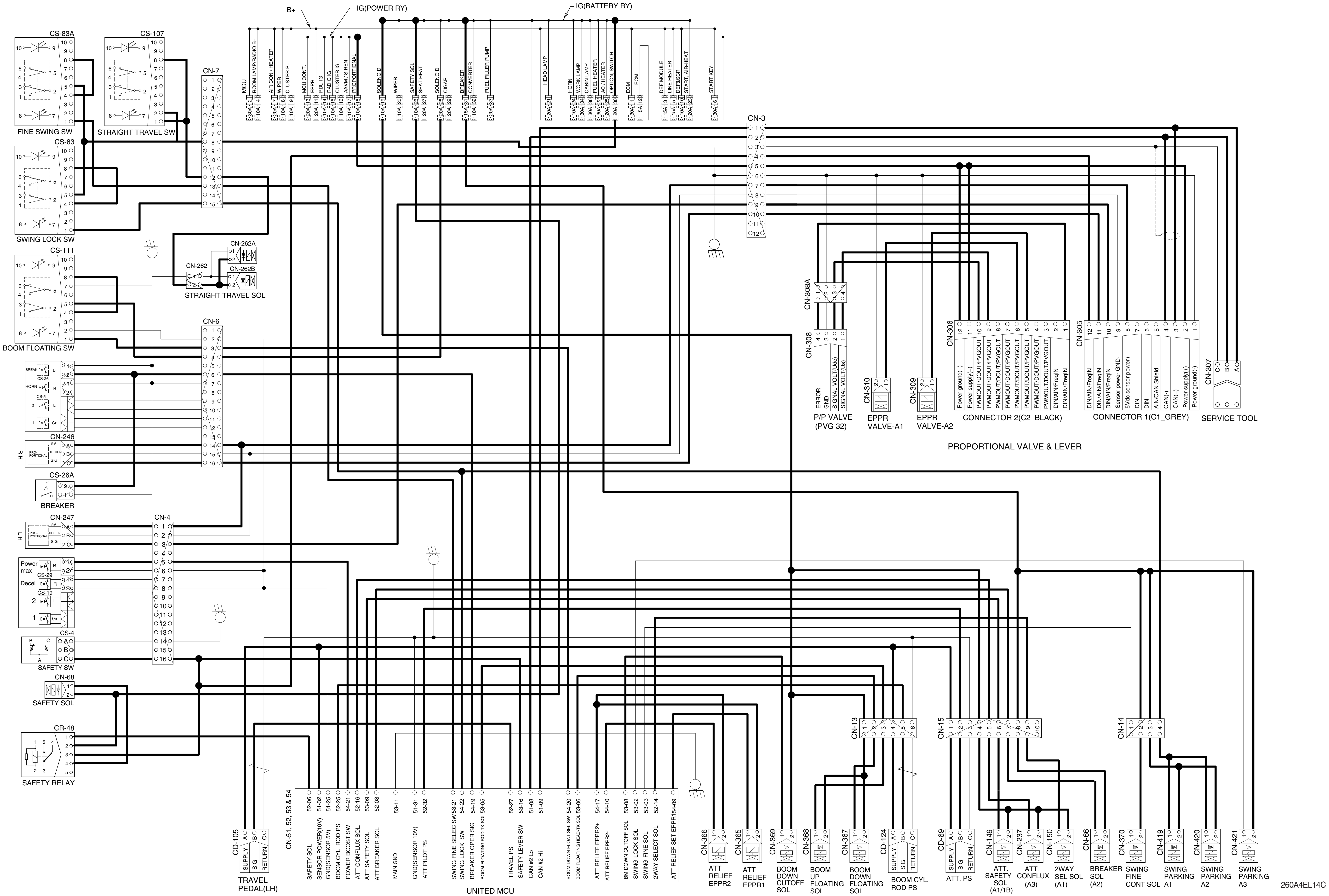
※ The circuit diagram may differ from the equipment, so please check before a repair.

ELECTRIC CIRCUIT FOR HYDRAULIC (2/2, MACHINE SERIAL NO. : #0003-#0041)



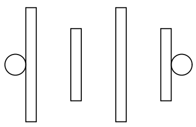
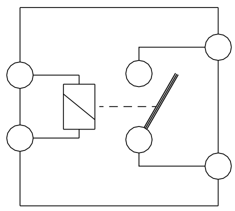
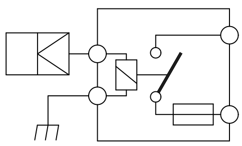
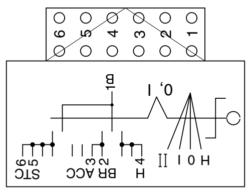
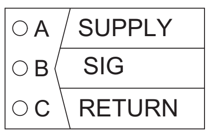
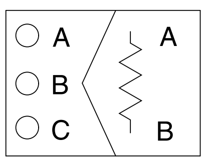
※ The circuit diagram may differ from the equipment, so please check before a repair.

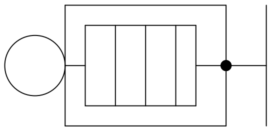
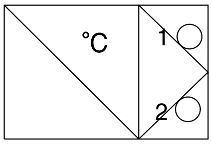
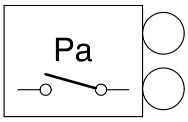
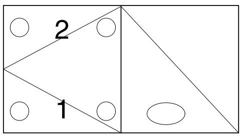
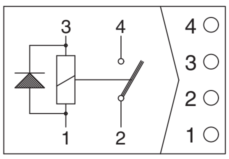
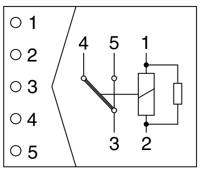
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2, MACHINE SERIAL NO. : #0042-)

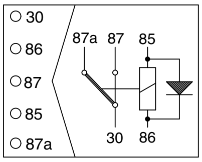
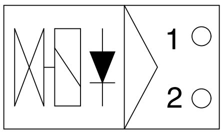
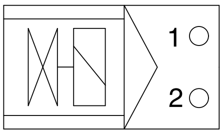
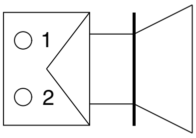
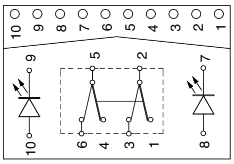
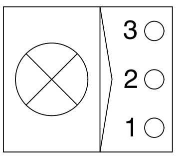


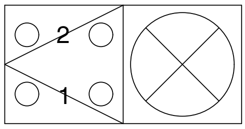
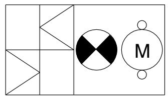
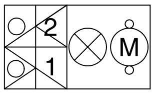
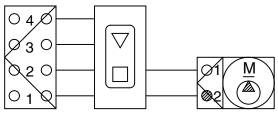
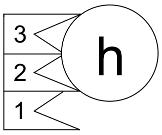
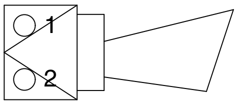
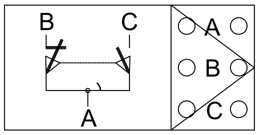
※ The circuit diagram may differ from the equipment, so please check before a repair.

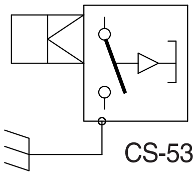
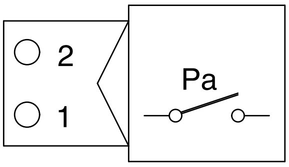
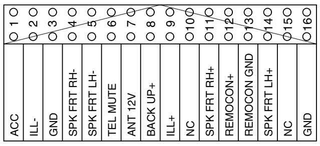
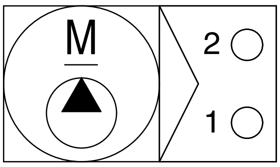
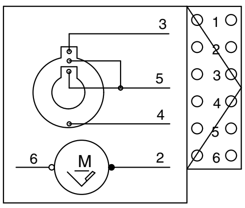
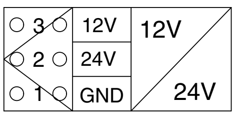
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

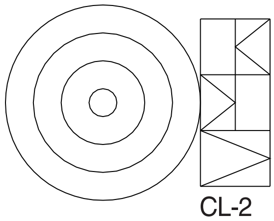
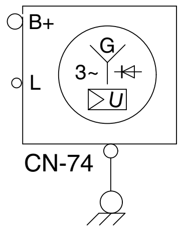
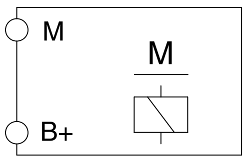
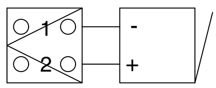
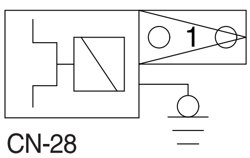
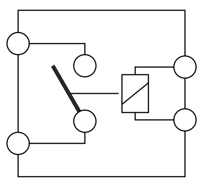
Part name	Symbol	Specifications	Check
Battery		12V×160Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Glow plug relay	 CR-24	24V 200A	※ Check contact Normal : 0.942Ω (for terminal 1-GND)
Start key	 CS-2A	B-BR : 24V 1A B-ACC : 24V 10A B-ST : 24V 40A	※ Check contact OFF : ∞Ω (for each terminal) ON : 0Ω (for terminal 1-3 and 1-2) START : 0Ω (for terminal 1-6)
Pressure sensor	 CD-16 CD-24 CD-31 CD-32 CD-37 CD-42 CD-43 CD-69 CD-70 CD-71 CD-85 CD-86 CD-87 CD-90 CD-104 CD-105 CD-124 CD-130	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 CN-173 CN-174	3W	※ Check resistance A-B : 120Ω

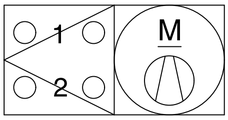
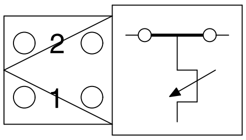
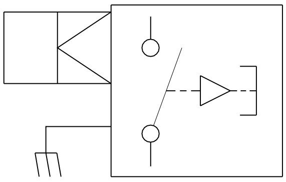
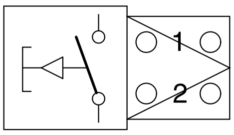
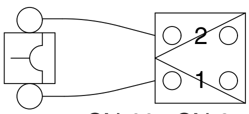
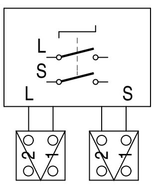
Part name	Symbol	Specifications	Check
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner pressure switch	 CD-10A	N.O TYPE	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel level sender	 CD-2	-	※ Check resistance Full : 50Ω 6/12 : 350Ω 11/12 : 100Ω 5/12 : 400Ω 10/12 : 150Ω 4/12 : 450Ω 9/12 : 200Ω 3/12 : 500Ω 8/12 : 250Ω 2/12 : 550Ω 7/12 : 300Ω 1/12 : 600Ω Empty warning : 700Ω
Relay (air con blower)		24V 20A	※ Check resistance Normal : About 200Ω (for terminal 1-3) ∞Ω (for terminal 2-4)
Relay	 CR-2 CR-5 CR-36 CR-39 CR-48 CR-50 CR-51 CR-85	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0Ω (for terminal 3-4) ∞Ω (for terminal 3-5)

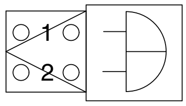
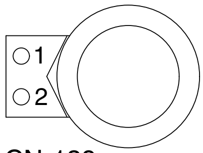
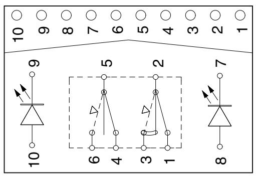
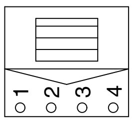
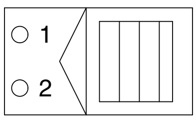
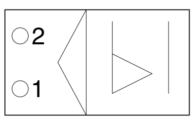
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-7 CR-9 CR-13 CR-35 CR-46 CR-52	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω (for terminal 30-87a) ∞ Ω (for terminal 30-87)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-135 CN-140 CN-149 CN-150 CN-237 CN-262A CN-262B CN-367 CN-368 CN-369 CN-370 CN-419 CN-420 CN-421	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-81 CN-242 CN-243 CN-309 CN-310 CN-342 CN-343 CN-365 CN-366	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-260 CN-24(RH)	20W	※ Check resistance Normal : A few Ω
Switch (locking type)	 CS-52 CS-67 CS-73 CS-83 CS-83A (#0042-) CS-99 CS-107 CS-108 CS-111	24V 15A	※ Check contact Normal ON : 0 Ω (for terminal 2-3, 5-6) ∞ Ω (for terminal 2-1, 5-4) OFF : ∞ Ω (for terminal 2-3, 5-6) 0 Ω (for terminal 2-1, 5-4)
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0Ω ON : 0Ω (For terminal 1-2) ∞ Ω (For terminal 1-3) OFF : ∞ Ω (For terminal 1-2) 0Ω (For terminal 1-3)

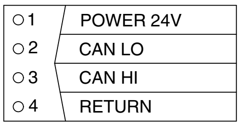
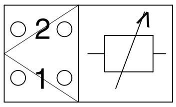
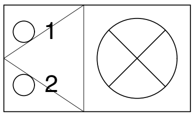
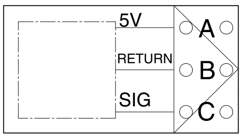
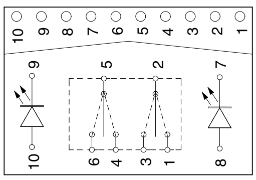
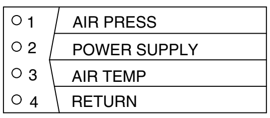
Part name	Symbol	Specifications	Check
Head lamp, Work lamp, Cab lamp	 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10 CL-24	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	-#0041  #0042-  CL-7	21V 70W (H1 Type)	※ Check disconnection Normal : A fewΩ
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Hour meter	 CN-48	16~32V	※ Check operation Supply power(24V) to terminal No.1 and connect terminal No.2 and ground
Horn	 CN-20 CN-25	DC22~28V 2A	※ Check operation Supply power(24V) to each terminal and connect ground.
Safety switch	 CS-4	24V 15A (N.C TYPE)	※ Check contact Normal : 0Ω(for terminal A-B) ∞Ω(for terminal A-C) Operating : ∞Ω(for terminal A-B) 0Ω(for terminal A-C)

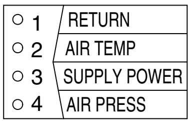
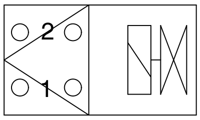
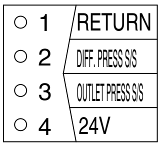
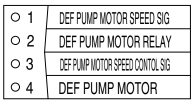
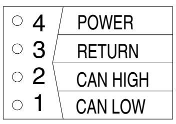
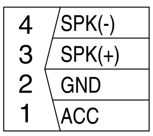
Part name	Symbol	Specifications	Check
Wiper cut switch	 CS-53	24V (N.O TYPE)	※ Check contact Normal : 0Ω(one pin to ground)
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27A	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22 CN-407	24V 3.8A	※ Check contact Normal : 10.7Ω(for terminal 1-2)
Wiper motor	 CN-21	24V 2A	※ Check disconnection Normal : 7Ω(for terminal 2-6)
DC/DC Converter	 CN-138	12V 3A	※ Check voltage 24V (for terminal 1-2) 12V (for terminal 1-3)

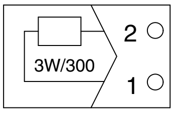
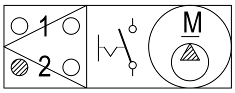
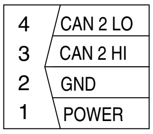
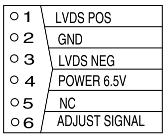
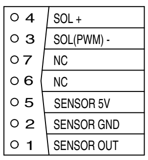
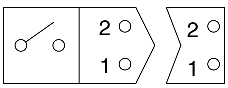
Part name	Symbol	Specifications	Check
Cigar lighter	 CL-2	24V 5A 1.4W	※ Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Alternator	 CN-74	Denso 24V 95A	※ Check contact Normal : 0Ω (for terminal B^{+}-L) Normal : 24~27.5V
Starter	 CN-45	Denso 24V 4.8kW	※ Check contact Normal : 0.1Ω
Travel alarm	 CN-81	24V 0.5A	※ Check contact Normal : 5.2Ω
Air conditioner compressor	 CN-28	24V 79W	※ Check contact Normal : 13.4Ω
Start relay	 CR-23	24V 300A	※ Check contact Normal : 0.94Ω(for terminal 1-2)

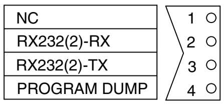
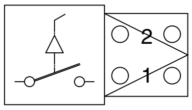
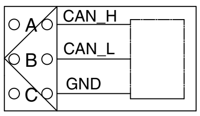
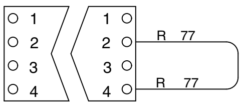
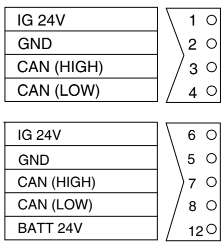
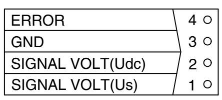
Part name	Symbol	Specifications	Check
Blower motor		24V 9.5A	※ Check resistance Normal : 2.5Ω (for terminal 1-2)
Thermistor (switch)		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω (for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch	 CS-1	24V 2W	※ Check resistance Normal : About 5MΩ
Switch (power max, one touch decel, horn, breaker)	 CS-5 CS-19 CS-26 CS-29	24V 6A	※ Check resistance Normal : ∞Ω
Circuit breaker	 CN-60 CN-95	CN-60 : 60A CN-95 : 90A	※ Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Master switch	 CN-74 CN-74B	6-36V	※ Check disconnection Normal : 0.1Ω

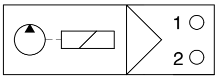
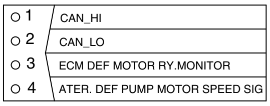
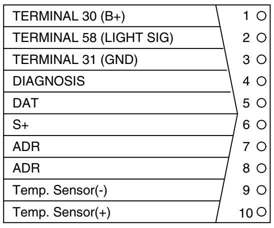
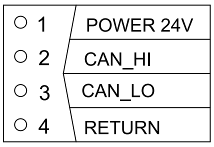
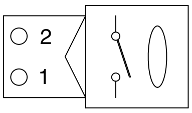
Part name	Symbol	Specifications	Check
Quick coupler buzzer	 CN-113	24V 200mA 107±4dB	-
Socket	 CN-139	12V 10A	-
Switch	 CS-100	24V 8A	※ Check contact Normal ON : 0Ω(for terminal 2-3, 5-6) ∞Ω(for terminal 2-1, 5-4) OFF : ∞Ω(for terminal 2-3, 5-6) 0Ω(for terminal 2-1, 5-4)
Fuel heater	 CN-96	-	-
DEF/AdBlue® line heater	 CN-381 CN-382 CN-383	-	-
WIF sensor	 CD-45	-	-

Part name	Symbol	Specifications	Check
Nox sensor	 AT1E AT2A	-	-
Temperature sensor (A/C)		-	-
DEF/AdBlue® lamp (LED)	 CL-40	-	-
Proportional valve sensor	 CN-246 CN-247	-	-
EPPR valve	 CS-79	24V 8A	※Check contact Normal OFF : ∞Ω (for terminal 1-2, 4-5)
Sensor	 C12	-	-

Part name	Symbol	Specifications	Check
Pressure temp sensor	 CD-10	-	
Coolant valve	 CN-384	-	
DPF pressure sensor	 AT11A	-	
SCR and DEF supply module	 AT-5A	-	
Tank level sensor	 CN-380	-	
Siren AMP	 CN-261	-	

Part name	Symbol	Specifications	Check
Resistor	 RS-1	3W	※ Check resistance Normal : 300Ω
Fuel filler pump	 CN-61	-	
2D/3D MG	 CN-270	-	
Camera (front, rear, side)	 CN-249 CN-402 CN-403 CN-404 CN-405	-	
Fan clutch	 CN-385	-	
Seat belt sw	 CS-250	-	

Part name	Symbol	Specifications	Check
RMS service tool	 CN-126A	-	
Breaker switch	 CS-26A	-	
Start button	 CS-2B	-	
GPS connector	 CN-125	-	
Reader	-#0041 #0042-  CN-427	-	
Proportional valve	 CN-307	-	

Part name	Symbol	Specifications	Check
Dosing pump	 CN-269	-	
Engine side cross over connector	 CC8C	-	
Easystart timer	 CN-267	-	
Exhaust gas temp sensor	 AT9A	-	
Float switch	 CS-61	-	

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	10	I/conn (Frame harness-Pump PS harness)	S816-010002	S816-110002
CN-2	AMP	15	I/conn (Frame harness-Engine harness)	2-85262-1	368301-1
CN-3	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 (Frame harness-Side harness RH)	DRB16-60SAE-L018	DRB14-60PAE-L018
CN-6	AMP	16	I/conn (Console harness RH-Frame harness)	368047-1	368050-1
CN-7	AMP	15	I/conn (Console harness RH-Frame harness)	2-85262-1	368301-1
CN-8	AMP	10	I/conn (Console harness RH-Frame harness)	S816-010002	174657-2
CN-9	DEUTSCH	12	I/conn (Frame harness- AAVM 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-E005
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire 2 pcs)	DT06-2S-EP06	DT04-2P-E004
CN-13	AMP	6	I/conn (Frame harness-Boom floating harness)	174262-2	174264-2
CN-14	AMP	4	I/conn (Frame harness-S/f & parking harness)	174257-2	174259-2
CN-15	AMP	10	I/conn (Frame harness-2-way harness)	174655-2	174657-2
CN-16	AMP	6	Emergency engine start & speed control	S816-006002	S816-106002
CN-17	AMP	8	I/conn (Side harness RH-Wiper harness)	S816-008002	S816-108002
CN-18	AMP	2	Washer tank 2	174352-2	174354-2
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer tank 1	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	Radio & USB player	-	174984-2
CN-28	KUM	1	Aircon compressor	MG610320	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse & relay box	21Q7-10910	-
CN-45	RING-TERM	-	Starter motor	ST710246-2 S820-31000	ST710384-2 ST710246-2
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	TE	34	United MCU	2-1473285-3	-
CN-52	TE	34	United MCU	4-1437290-1	-
CN-53	TE	26	United MCU	1473416-1	-
CN-54	TE	34	United MCU	4-1437290-0	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	YAZAKI	2	Circuit breaker	-	7222-4220-30
CN-61	DEUTSCH	4	Fuel filler pump	DT06-4S-EP06	DT04-4P-E005
CN-66	DEUTSCH	2	Breaker (A2)	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid (A1)	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid (A3)	DT06-2S-EP06	-
CN-74	RING-TERM	1	Alternator "B+" terminal	S820-108000	-
CN-74	RING-TERM	1	Alternator "L" terminal	S820-105000	-
CN-80	RING-TERM	-	Glow plug	S820-306000	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	-
CN-88	DEUTSCH	2	Power max solenoid (A2)	DT06-2S-EP06	-
CN-93	DELPHI	-	ECM	13964577	-
CN-95	YAZAKI	2	Circuit breaker	-	7222-4220-30
CN-96	AMP	4	Fuel heater	2-967325-3	-
CN-100	KET	1	ECM ground	MG640944-5	-
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	RMS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	RMS	DT06-12S-P021	DT04-12PA-P021
CN-125B	DEUTSCH	8	RMS	DT06-8S	DT04-8P
CN-126	TE/AMP	10	Service tool	1473416-1	S816-110002
CN-126A	DEUTSCH	4	RMS service tool	DT06-4S	DT04-4P
CN-135	DEUTSCH	2	Arm regeneration solenoid (A5)	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick coupler solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-147	-	2	Fuel heater	15300027	-
CN-149	DEUTSCH	2	Attachment safety (A1)	DT06-2S-EP06	-
CN-150	DEUTSCH	2	Pedal safety (B)	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	Attachment conflux (A3)	DT06-2S-EP06	-
CN-241	DEUTSCH	2	Travel straight solenoid (A3)	DT06-2S-EP06	-
CN-242	DEUTSCH	2	Boom swing solenoid (A2)	DT06-2S-EP06	-
CN-243	DEUTSCH	2	Boom arm solenoid (A1)	DT06-2S-EP06	-
CN-245	FCI	4	PTC power	180900-0	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-246A	DEUTSCH	4	Preheater harness	DT06-4S-EP06	-
CN-246B	DEUTSCH	4	Preheater harness	-	DT04-4P-EP06
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-E005
CN-250	DEUTSCH	2	Auto grease	DT06-2S-EP06	-
CN-258	KET	1	Air compressor power	MG640944-5	MG650943-5
CN-260	MTA	4	Siren speaker	03 01315	-
CN-260	MTA	2	Heater cont (B+)	03 01305	-
CN-261	MTA	4	Siren AMP	MG610047	-
CN-261	MTA	2	Timer cont (B+)	03 01315	-
CN-262	DEUTSCH	2	I/conn (Frame harness - S/travel harness)	DT06-2S-EP06	DT04-2P-E005
CN-262A	DEUTSCH	2	Straight travel solenoid 1	DT06-2S-EP06	-
CN-262B	DEUTSCH	2	Straight travel solenoid 2	DT06-2S-EP06	-
CN-263	DEUTSCH	2	Air compressor relay	DT06-2S-EP06	DT04-2P-E005
CN-265	VW	8	Controller	3A0973734	-
CN-267	MOLEX	10	Preheater timer	15-97-5101	-
CN-269	TE	2	Dosing pump	282189-1	-
CN-270	DEUTSCH	4	2D/3D MG	DT06-4S-EP06	DT04-4P-E005
CN-305	DEUTSCH	12	Proportional-connector-1	DTM06-12SA	-
CN-306	DEUTSCH	12	Proportional-connector-2	DTM06-12SB	-
CN-307	DEUTSCH	3	Proportional-service tool	DT06-3S-EP06	DT06-3P-E005
CN-307	AMP	4	Proportional-PVG32	2-967059-1	-
CN-309	DEUTSCH	2	Proportional-EPPR valve-A1	DT06-2S-EP06	-
CN-310	DEUTSCH	2	Proportional-EPPR valve-A2	DT06-2S-EP06	-
CN-342	AMP	2	P1 pump regulator solenoid	S816-002002	-
CN-343	AMP	2	P2 pump regulator solenoid	S816-002002	-
CN-363	AMP	12	Jog dial module	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	AMP	2	Boom down floating solenoid	85202-1	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	23	Membrane controller	7706087-2	-
CN-380	DEUTSCH	4	DEF tank level sensor	DT06-4S-EP06	-
CN-381	DEUTSCH	2	DEF line heater 3	DT06-2S-EP06	-
CN-382	DEUTSCH	2	DEF line heater 2	DT06-2S-EP06	-
CN-383	DEUTSCH	2	DEF line heater 1	DT06-2S-EP06	-

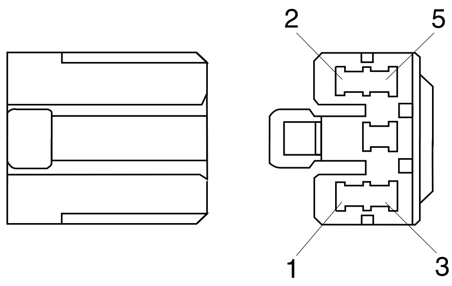
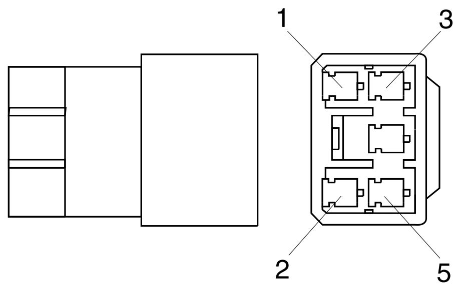
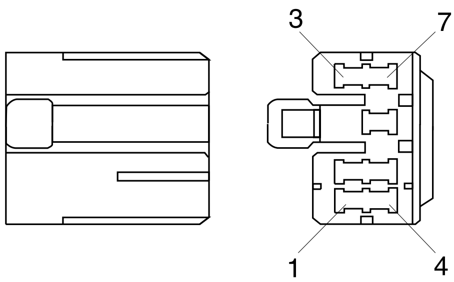
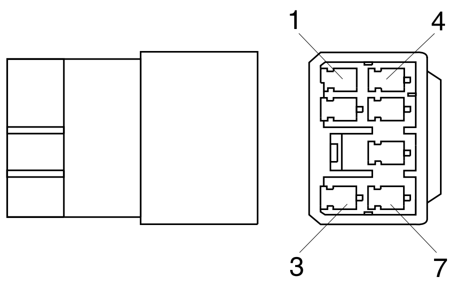
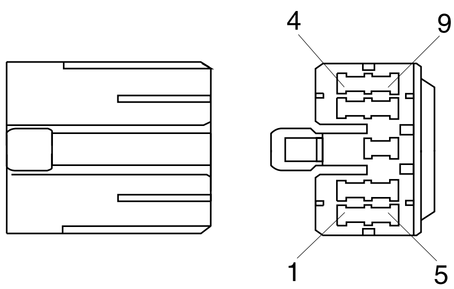
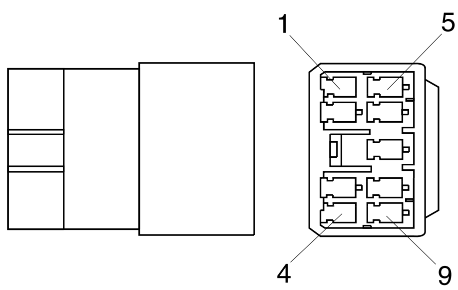
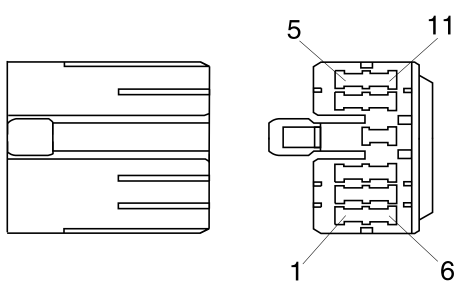
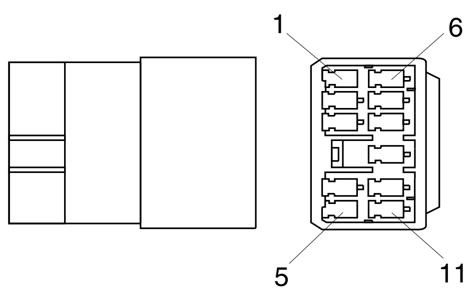
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-384	TE	2	Coolant valve solenoid	1-967325-3	-
CN-385	-	7	Fan clutch	965570	-
CN-401	TE	35	AAVM controller	776164-1	-
CN-402	DEUTSCH	6	Front view camera	DT06-6S-P021	DT04-6P-P021
CN-403	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP14
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-406	DEUTSCH	3	Service tool	DT06-3S-EP05	DT04-3P-E005
CN-407	DEUTSCH	4	Low wiper motor	DT06-4S-EP06	DT04-4P-E005
CN-419	DEUTSCH	2	Swing parking-A1	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking-A3	DT06-2S-EP06	-
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
		12		5557-12R	5559-12P
CN-430	AMP/Econoseal J	12	I/conn (Frame harness - DEF harness)	174661	S816-112002
AT-1E	TYCO	4	DOC NOx sensor (inlet)	2-1418390-1	-
AT-2A	TYCO	4	SCR NOx sensor (outlet)	1-1418390-1	-
AT-5A	TYCO	4	SCR supply module	2-418390-1	-
AT-6A	TYCO	8	DEF dosing module	1-1418479-1	-
AT-9A	TYCO	4	SCR temperature sensor	4-1418390-1	-
AT-11A	DELPHI	4	DEF pressure sensor	F715600	-
C12	FCI	4	Air cleaner	-	54200419
CC8C	DEUTSCH	4	Cross over connector - Engine side	DT06-4S-EP06	-
· Relay					
CR-1	RING-TERM	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	-	-
CR-13	-	5	Head lamp relay	-	-
CR-23	KET	2	Start relay	MG610320	S814-102001
CR-24	RING TERM	1	Preheat relay	S822-014000	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-39	-	5	Starter lock out relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-48	-	5	Satety ralay	-	-
CR-50	-	5	NOx sensor relay	-	-

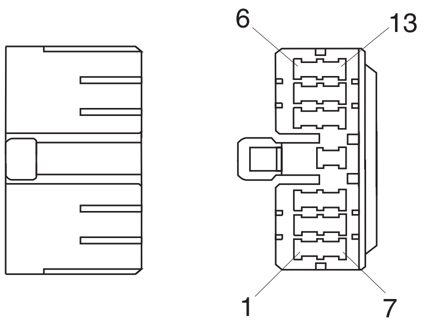
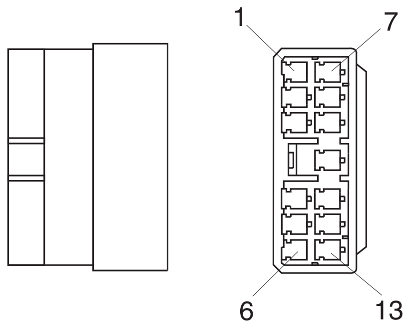
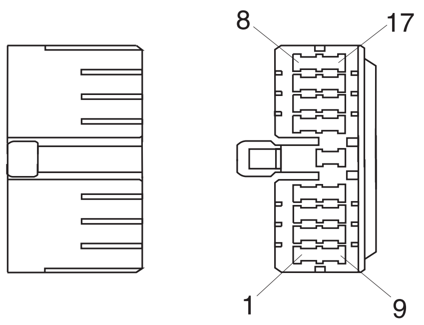
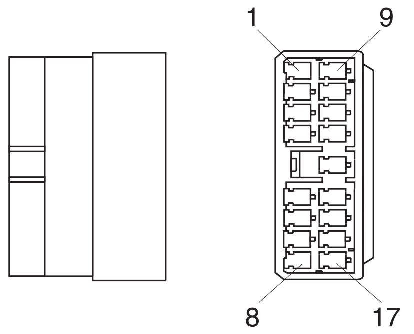
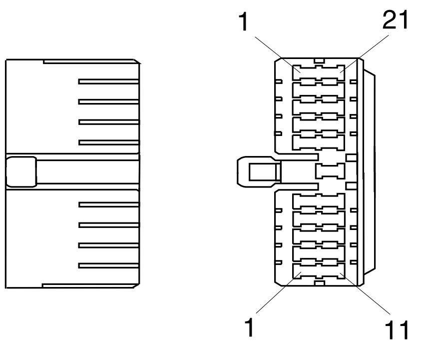
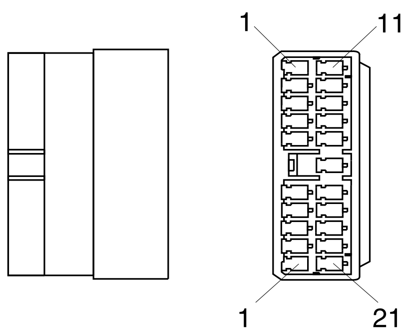
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-51	-	5	DEF module relay	-	-
CR-52	-	5	Line heater relay	-	-
CR-85	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2A	WP	6	Start switch	S814-006100	-
CS-2B	DEUTSCH	3	Start button	DT06-3S-EP06	DT04-3P-E005
CS-2C	KET	3	BKCU	MG651032	-
CS-2D	KET	3	Button key	-	M6641035
CS-4	DEUTSCH	3	Safety switch	DT06-3S	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P
CS-19	DEUTSCH	2	One touch decel switch	-	DT04-2P
CS-26	DEUTSCH	2	Breaker switch	DT06-2S	-
CS-26A	AMP	2	Breaker pedal switch	S816-002002	S816-102002
CS-29	DEUTSCH	2	Power max switch	DT06-2S	-
CS-33	AMP	5	Emergency engine stop switch	S816-005002	S816-105002
CS-52	CARLING	10	Adjust & dozer switch	VC2-01	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-61	AMP	2	Floating switch	174352-2	174354-2
CS-67	CARLING	10	Quick coupler switch	VC2-01	-
CS-73	CARLING	10	Swing lock switch	VC2-01	-
CS-73A	CARLING	10	Fine swing switch	VC2-01	-
CS-74	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-74A	TYCO/KET	2	Power connector	7706087-2	MG610557
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-79	CARLING	10	Lower wiper 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	-
CS-250	DEUTSCH	2	Seat switch	DT06-2S	-
· Light					
CL-1	KET	3	Room lamp	MG651032	-
CL-2	AMP	1	Cigar lighter	S822-014002	S822-114002
CL-2	AMP	1	Cigar lighter	S810-001202	-
CL-3	DEUTSCH	2	Head lamp-LH	DT06-2S-EP06	-
CL-4	DEUTSCH	2	Head lamp-RH	DT06-2S-EP06	-
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	-
CL-7	SHUR	1	Beacon lamp	S822-014002	S822-114002
CL-8	DEUTSCH	2	Cab lighter-LH	DT06-2S-EP06	DT04-2P
CL-9	DEUTSCH	2	Cab lighter-RH	DT06-2S-EP06	DT04-2P
CL-10	DEUTSCH	2	Cab lighter-RH	DT06-2S-EP06	DT04-2P
CL-24	DEUTSCH	2	Head lamp - rear	DT06-2S-EP06	DT04-2P-E005
CL-40	DEUTSCH	2	DEF/AdBlue® purging 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 pilot pressure sw (Py)	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Travel pilot pressure sw (Px)	DT06-3S-EP06	-
CD-10	SUMITOMO	4	Air cleaner switch	6908-0144	-
CD-10A	AMP	2	Air cleaner switch	85202-1	-
CD-16	AMP	3	Water level sensor	1211 0293	-
CD-24	DEUTSCH	3	Swing pilot pressure sw	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload pressure sensor	DT06-3S-EP06	DT04-3P-E005
CD-32	DEUTSCH	3	Boom up pilot pressure sw	DT06-3S-EP06	-
CD-37	DEUTSCH	3	2 pcs boom perssure switch	DT06-3S-EP06	DT04-3P-E005
CD-42	DEUTSCH	3	P1 pump delivery pressure sw	DT06-3S-EP06	-
CD-43	DEUTSCH	3	P2 pump delivery pressure sw	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 regulator pressure sensor (A4)	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 regulator pressure sensor (A5)	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down pilot pressure sw	DT06-3S-EP06	-
CD-86	DEUTSCH	3	Arm out pilot pressure sw	DT06-3S-EP06	-
CD-87	DEUTSCH	3	Bucket out pilot pressure sw	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pilot pressure sw	DT06-3S-EP06	-
CD-104	DEUTSCH	3	RH travel pilot pressure sw	DT06-3S-EP06	-
CD-105	DEUTSCH	3	LH travel pilot pressure sw	DT06-3S-EP06	-
CD-124	DEUTSCH	3	Boom cylinder rod pressure sensor	DT06-3S-EP06	-
CD-130	DEUTSCH	3	Bucket in pilot pressure sw	DT06-3S-EP06	-

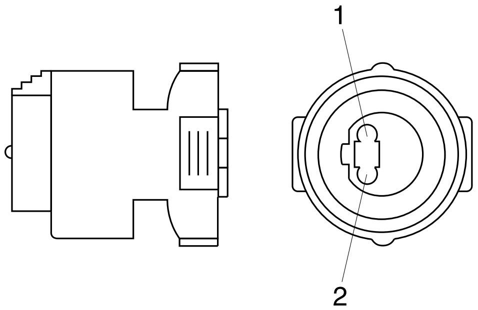
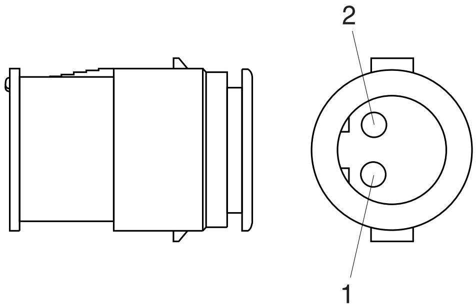
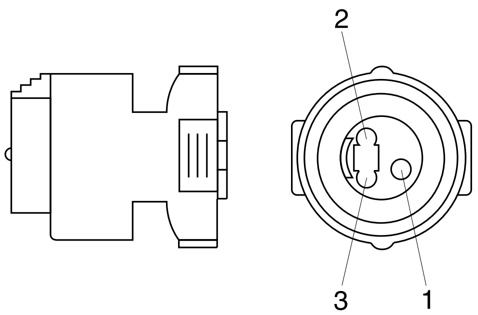
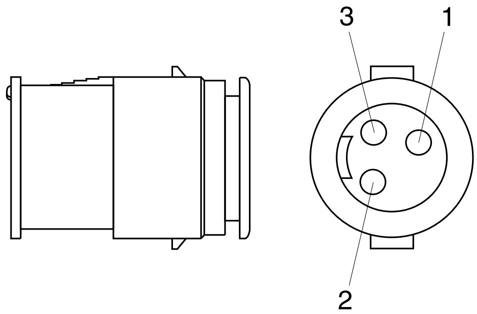
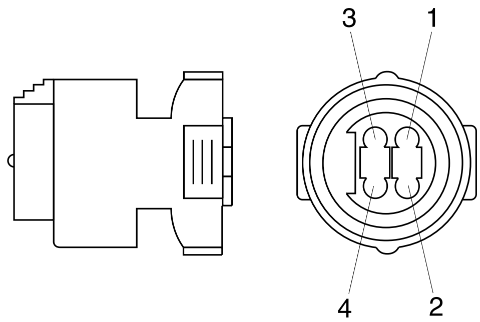
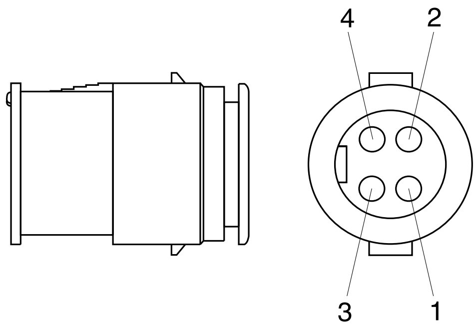
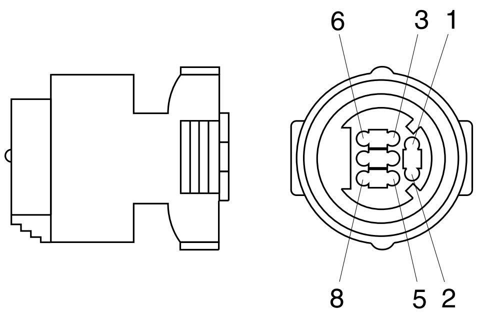
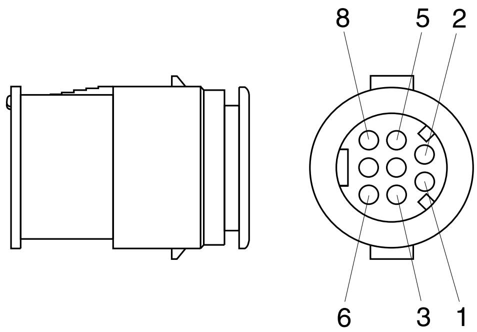
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

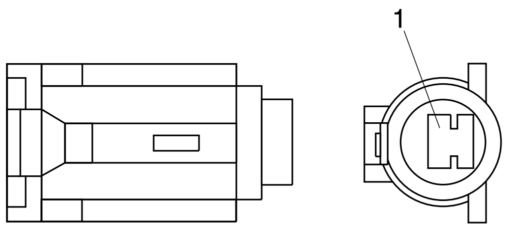
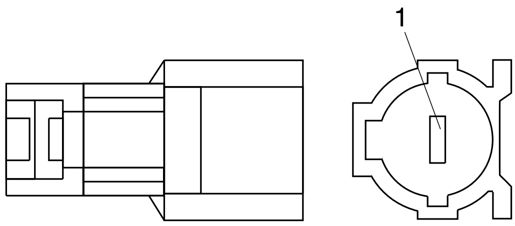
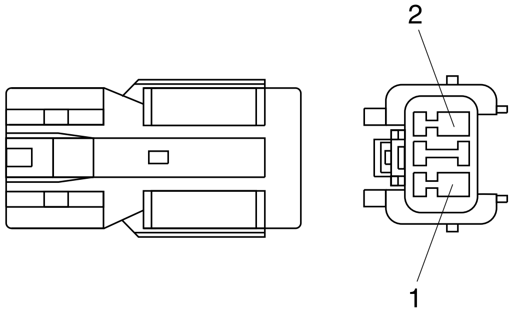
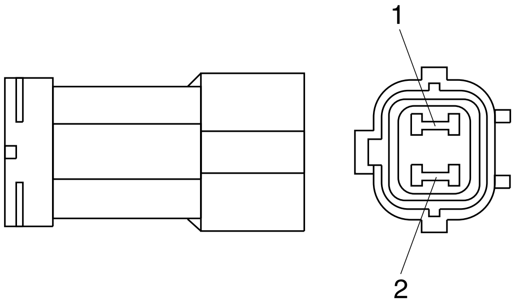
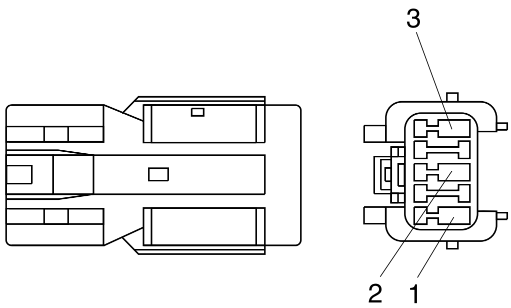
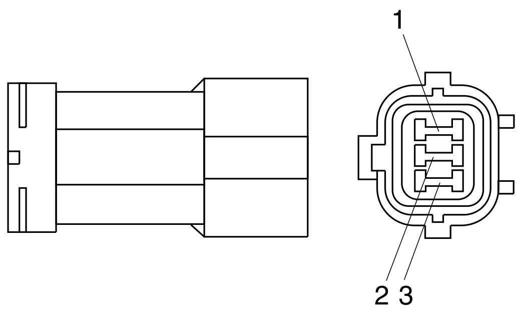
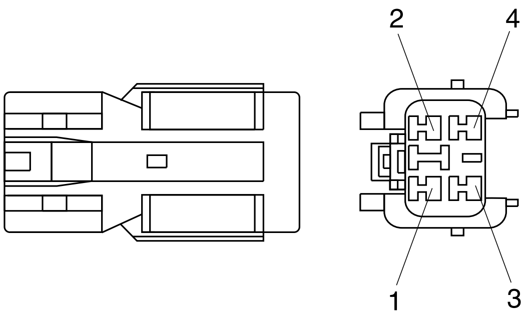
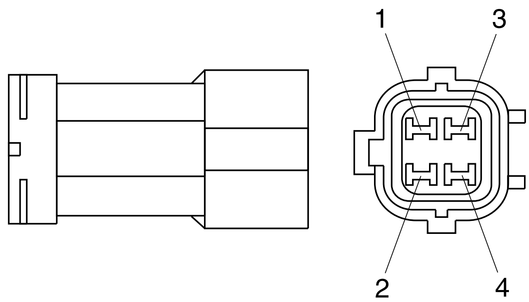
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

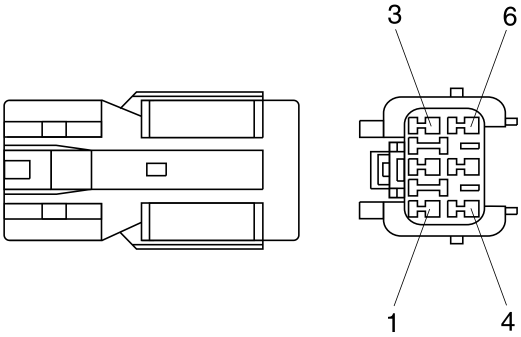
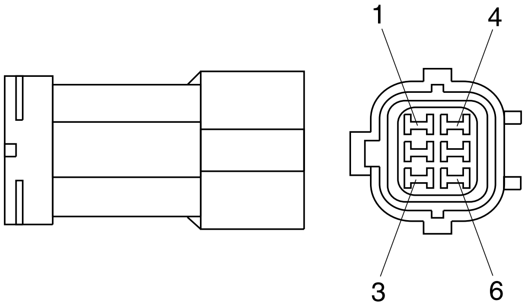
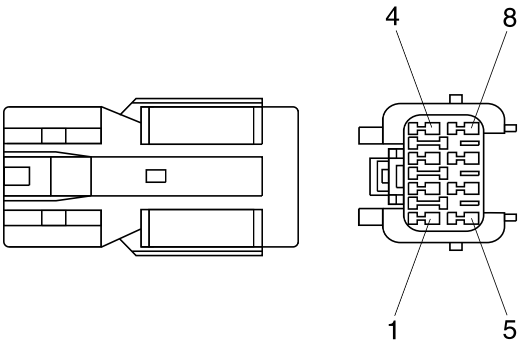
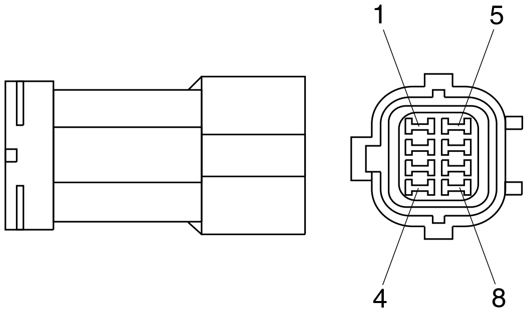
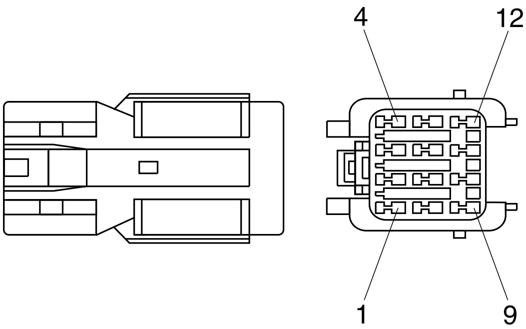
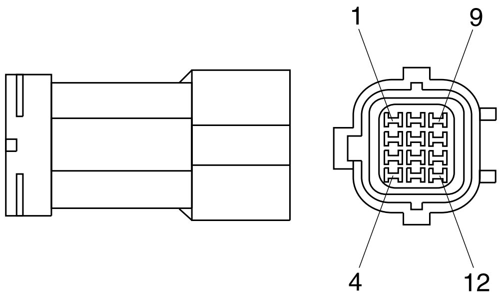
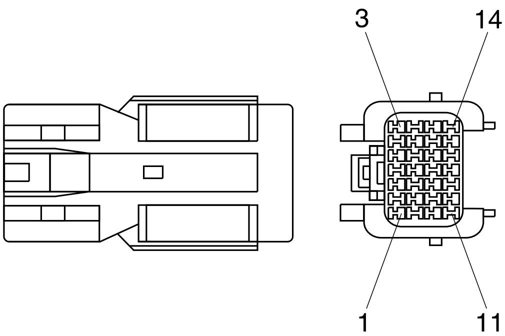
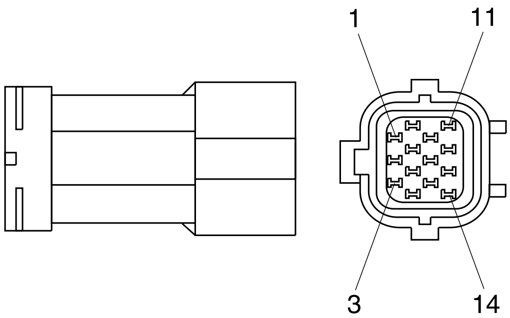
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

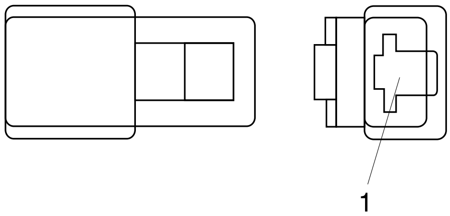
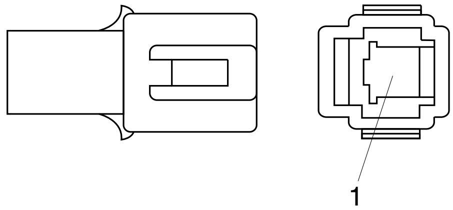
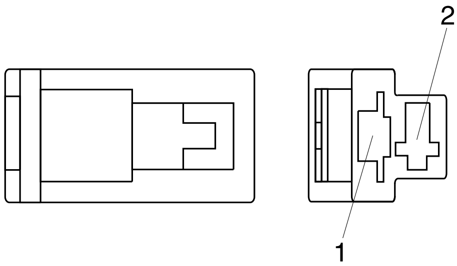
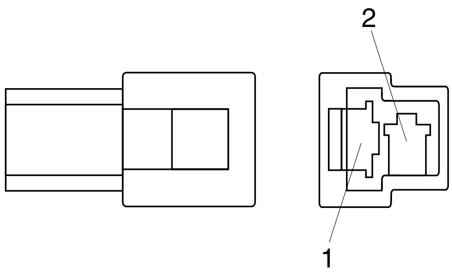
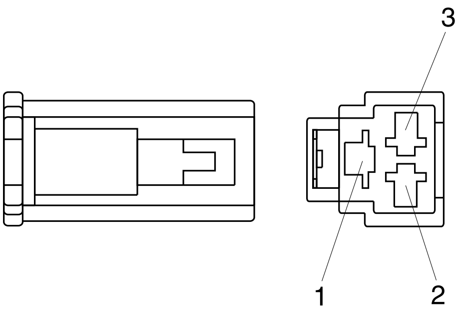
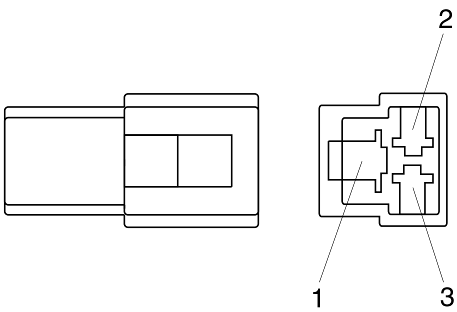
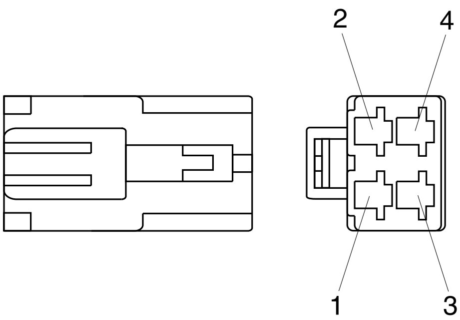
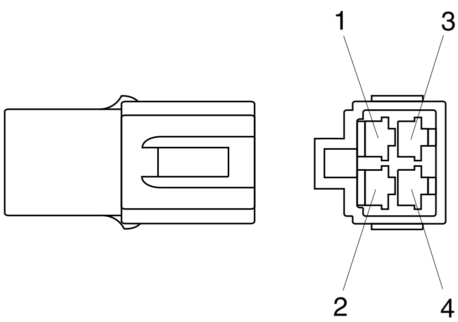
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

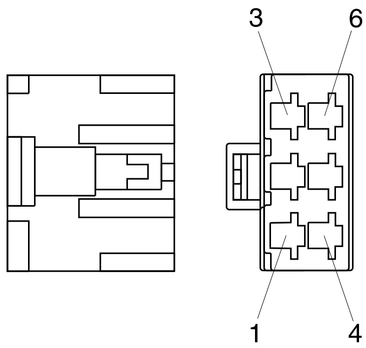
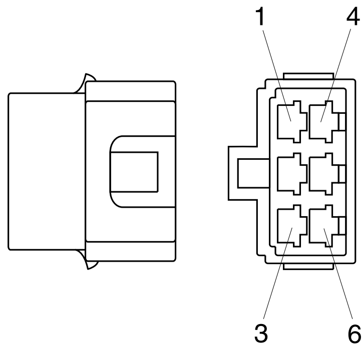
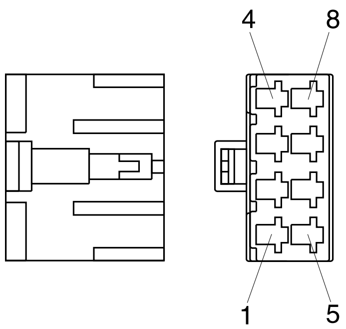
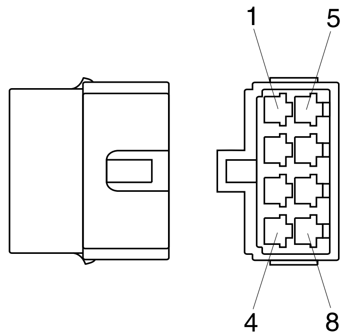
3) SWP TYPE CONNECTOR

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

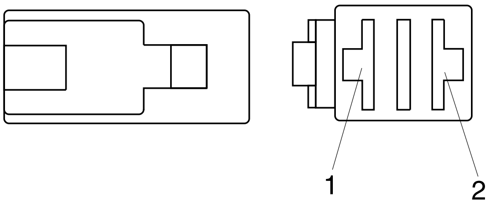
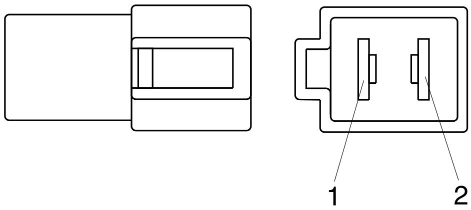
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

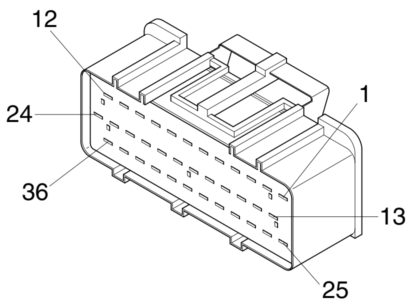
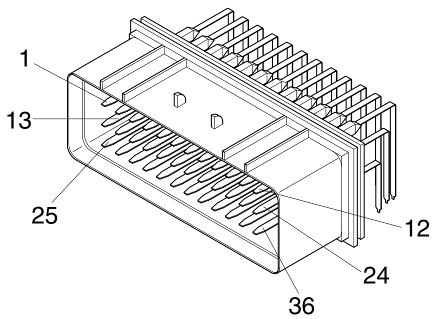
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

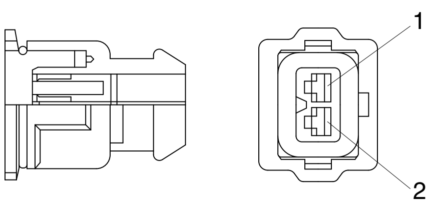
5) 375 FASTEN TYPE CONNECTOR

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

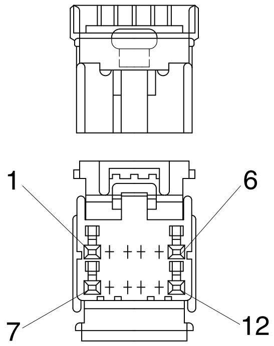
6) AMP ECONOSEAL CONNECTOR

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

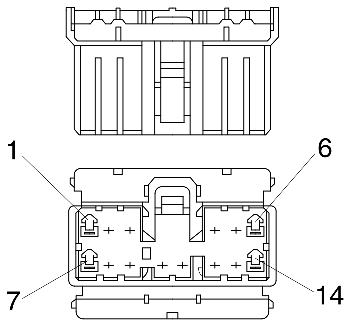
7) AMP TIMER CONNECTOR

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

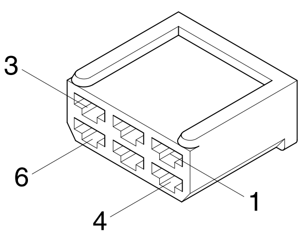
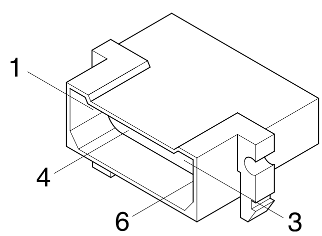
8) AMP 040 MULTILOCK CONNECTOR

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

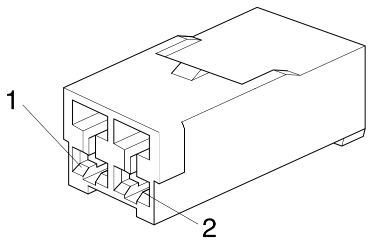
9) AMP 070 MULTILOCK CONNECTOR

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

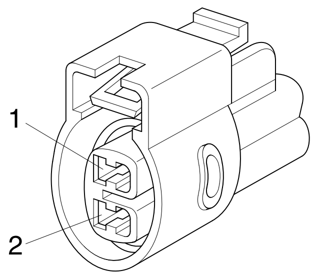
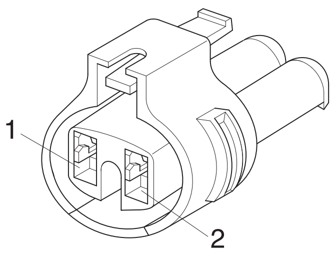
10) AMP FASTIN - FASTON CONNECTOR

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

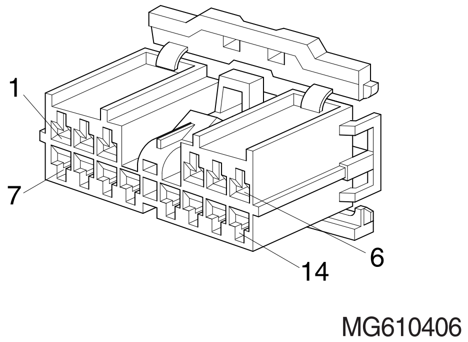
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

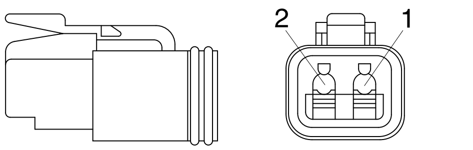
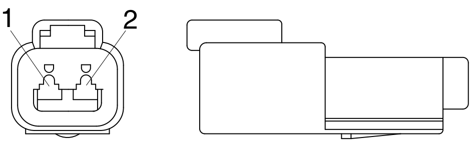
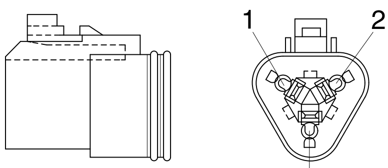
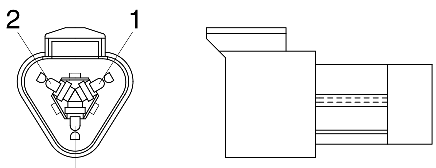
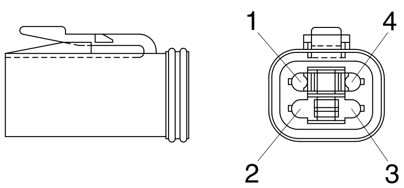
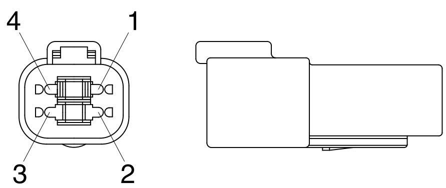
14) DEUTSCH DT CONNECTORS

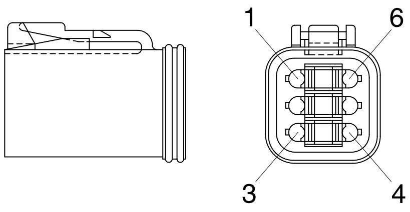
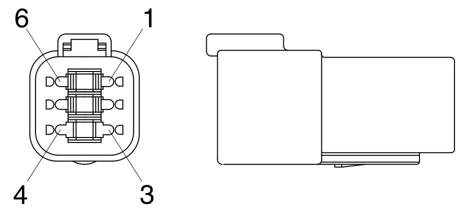
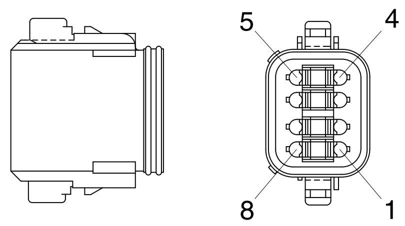
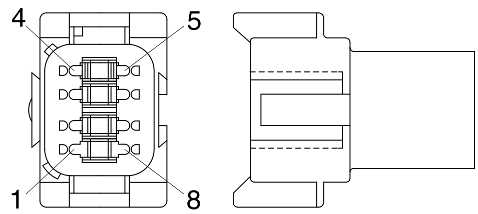
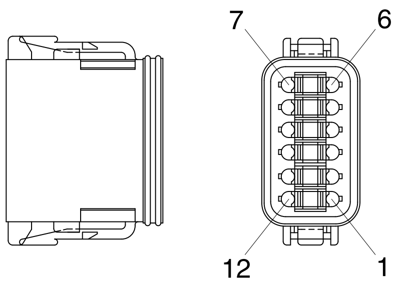
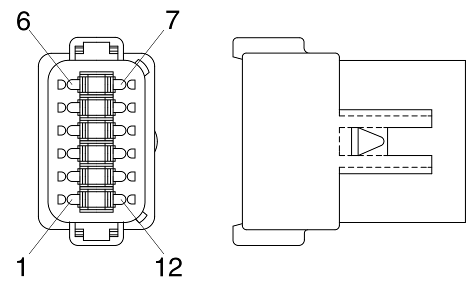
DT 06 - 3S - ★★★★

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

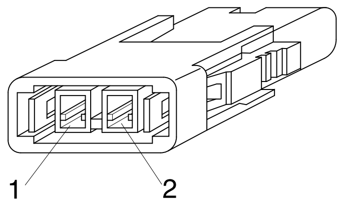
※ Modification

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

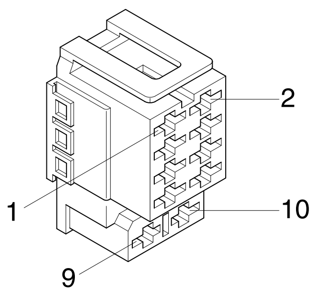
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

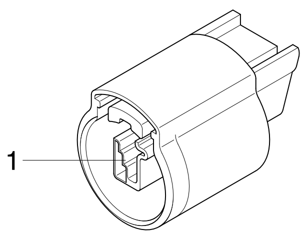
15) MOLEX 2CKTS CONNECTOR

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

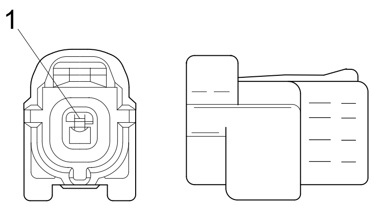
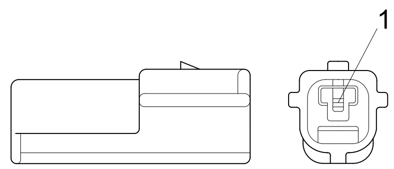
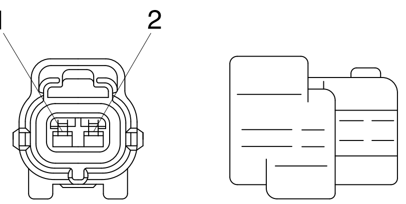
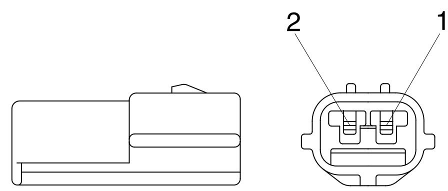
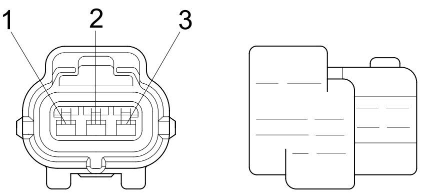
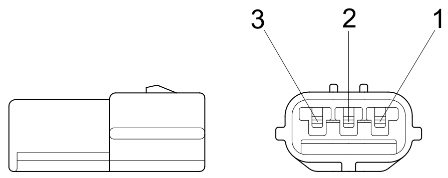
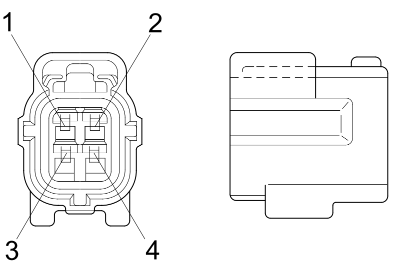
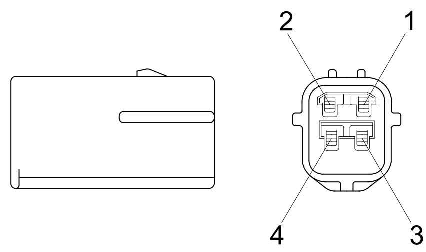
16) ITT SWF CONNECTOR

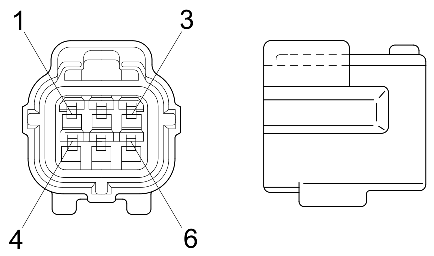
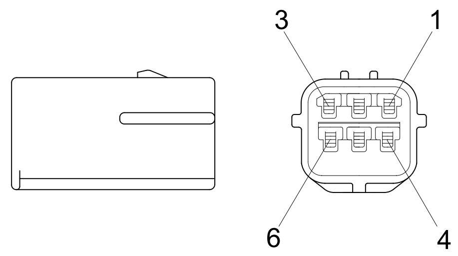
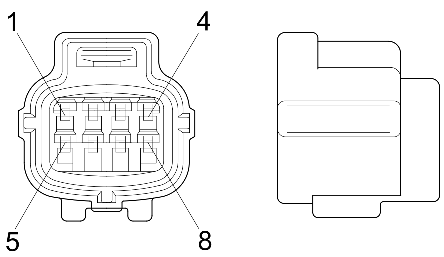
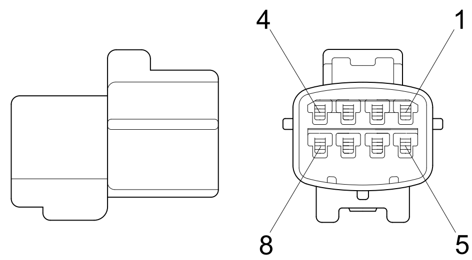
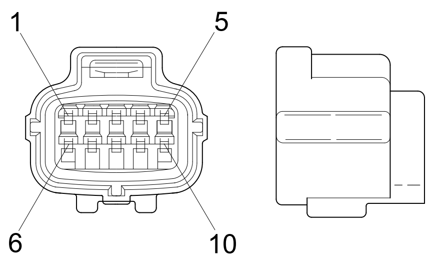
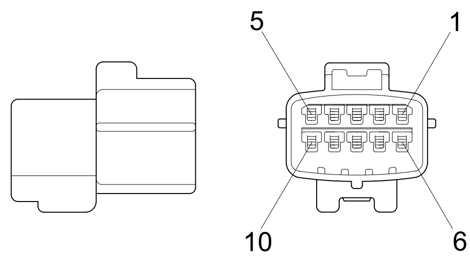
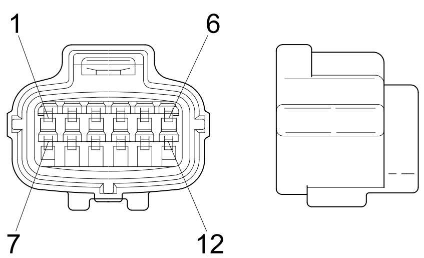
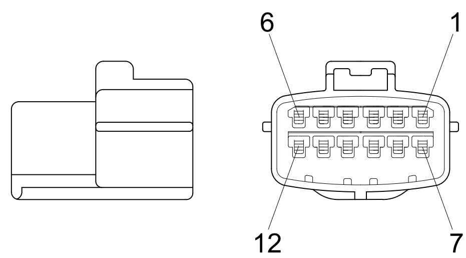
No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

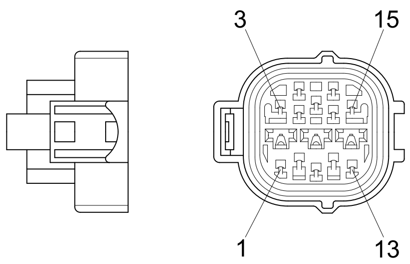
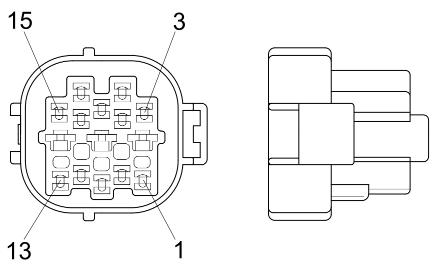
17) MWP NMWP CONNECTOR

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

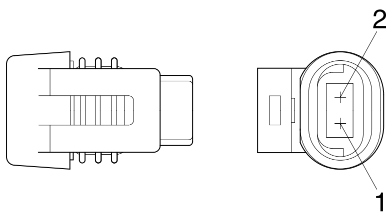
18) ECONOSEAL J TYPE CONNECTORS

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

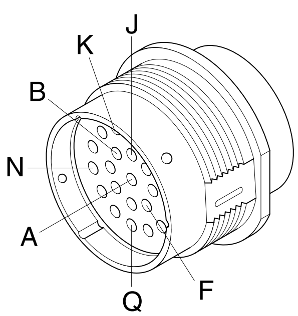
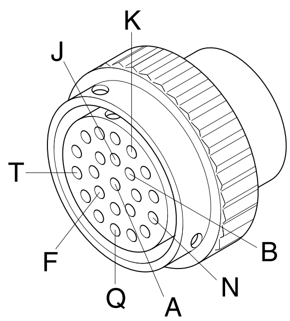
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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

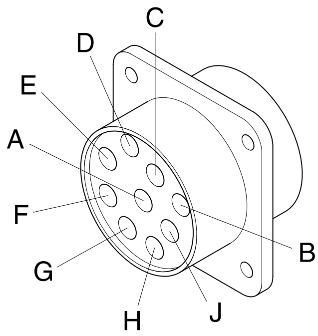
19) METRI-PACK TYPE CONNECTOR

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

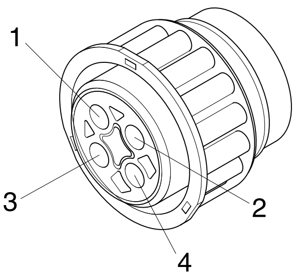
20) DEUTSCH HD30 CONNECTOR

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

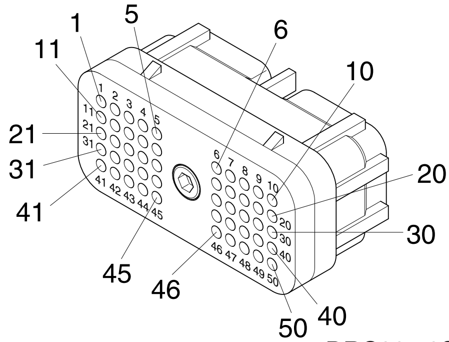
21) DEUTSCH SERVICE TOOL CONNECTOR

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

22) AMP FUEL WARMER CONNECTOR

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

23) DEUTSCH ENGINE ECM CONNECTOR

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

24) DEUTSCH INTERMEDIATE CONNECTOR

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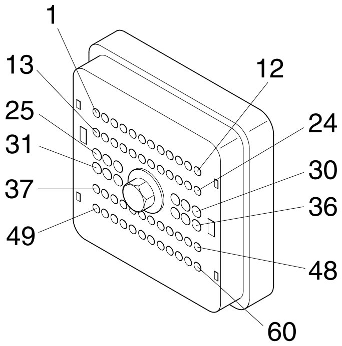
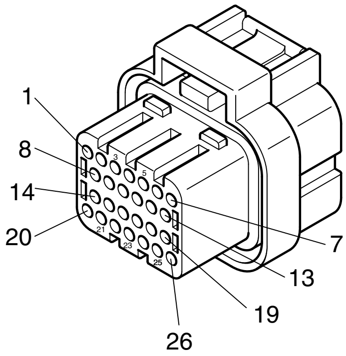
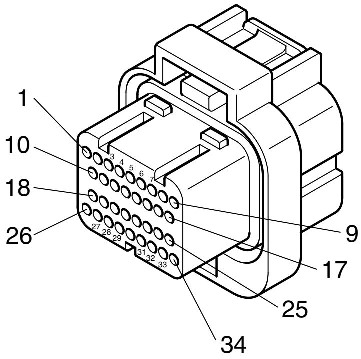
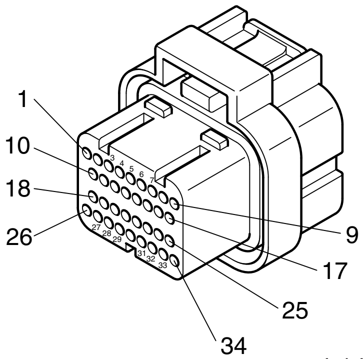
60	 DRB16-60SAE-L018	

25) TE MCU CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
26	 1473416-1	
34	 2-1437285-3 4-1437290-0	
34	 4-1437290-1	

SECTION 5 MECHATRONICS SYSTEM

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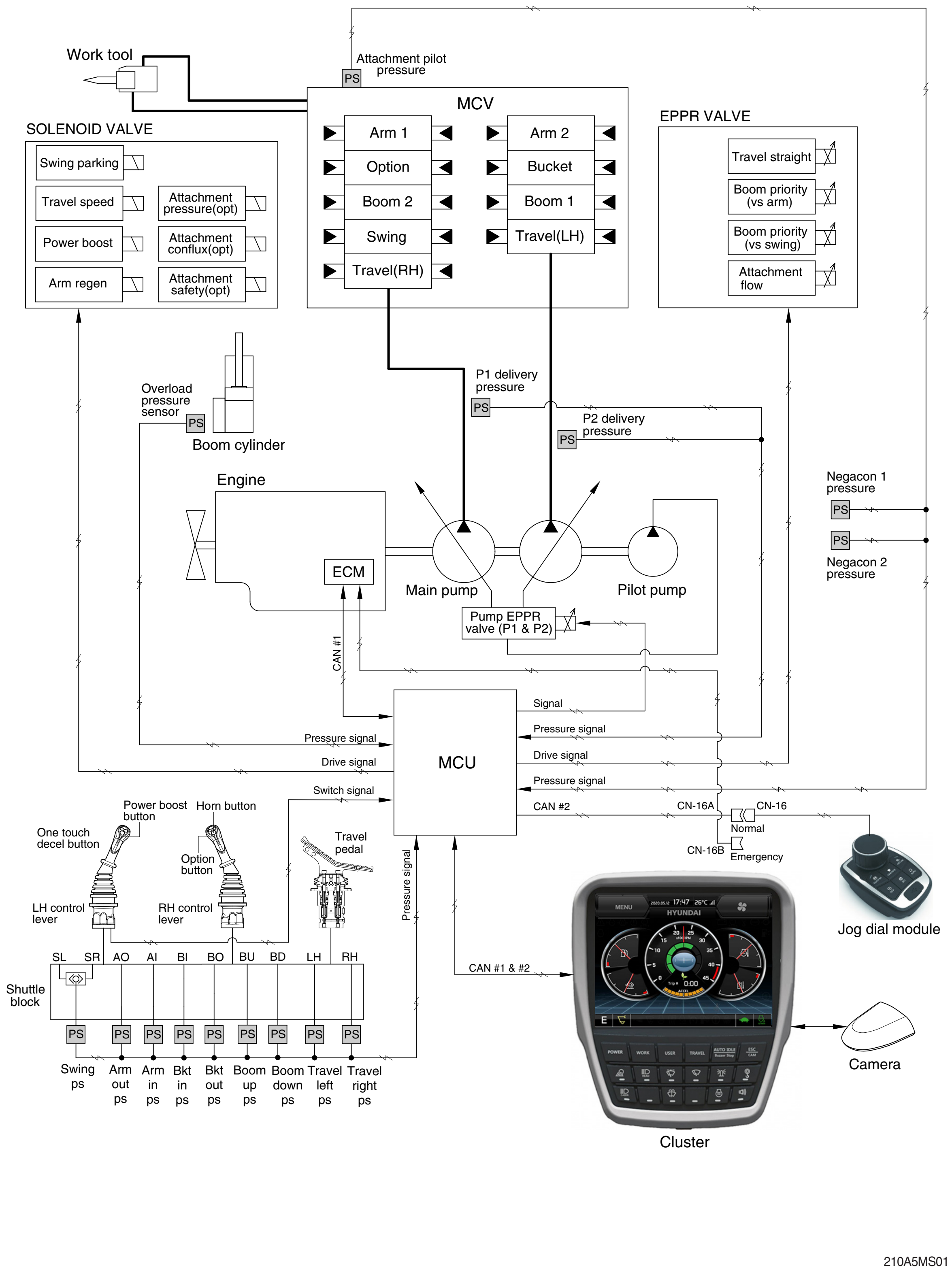
SECTION 5 MECHATRONICS SYSTEM

GROUP 1 OUTLINE

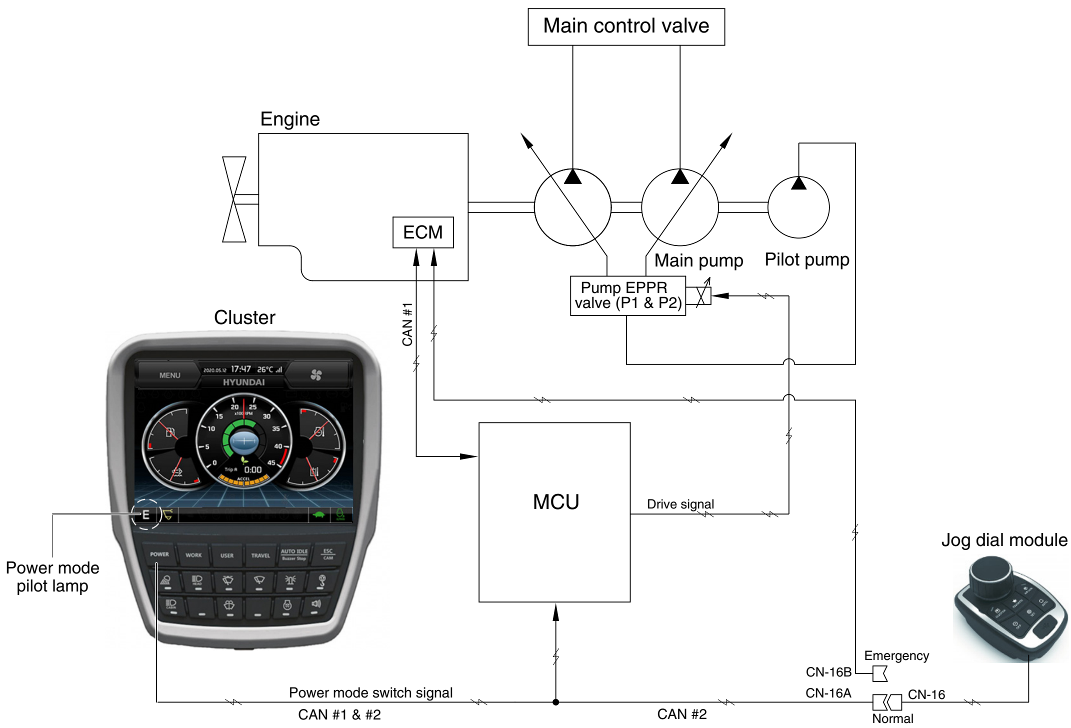
The ADVANCED CAPO (Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature,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



1. POWER MODE SELECTION SYSTEM



210A5MS02

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 jog dial modulemakes 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.

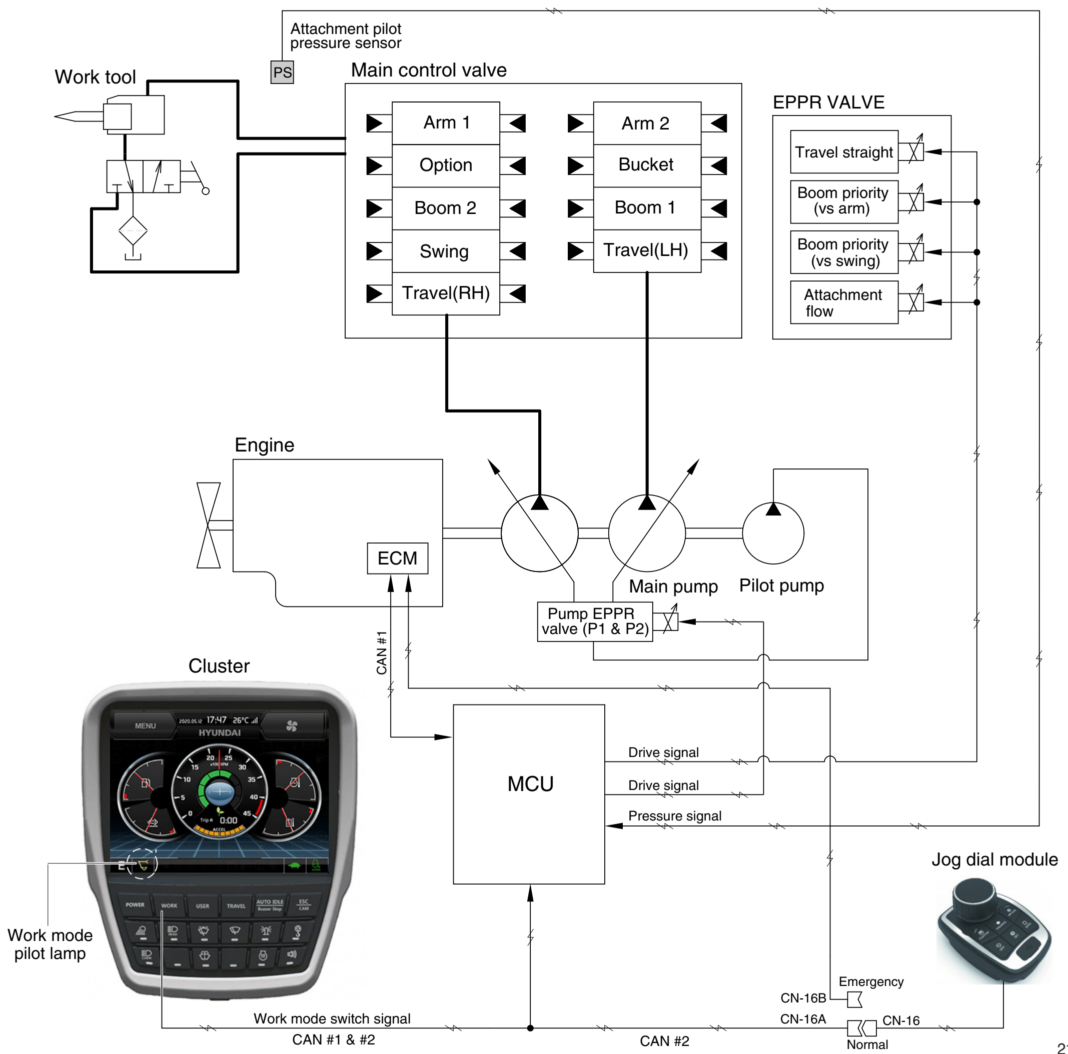
Power mode	Application	Engine rpm			
		Standard		Option	
		Unload	Load	Unload	Load
P	Heavy duty power	1700±50	1700±50	2000±50	2000±50
S	Standard power	1600±50	1600±50	1900±50	1900±50
E	Economy operation	1500±50	1500±50	1600±50	1600±50
AUTO DECEL	Engine deceleration	1100±100	-	1100±100	-
One touch decel	Engine quick deceleration	1000±100	-	1000±100	-
KEY START	Key switch start position	1000±100	-	1000±100	-

※ 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).



210A5MS03

1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

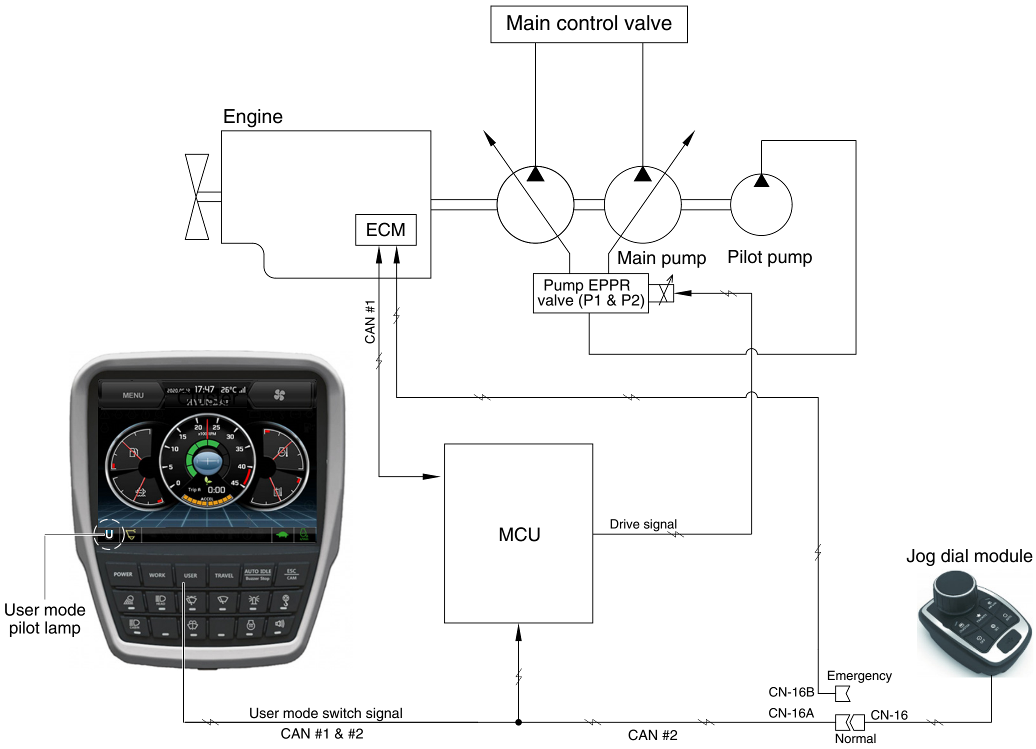
2) ATT WORK MODE (breaker, crusher)

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



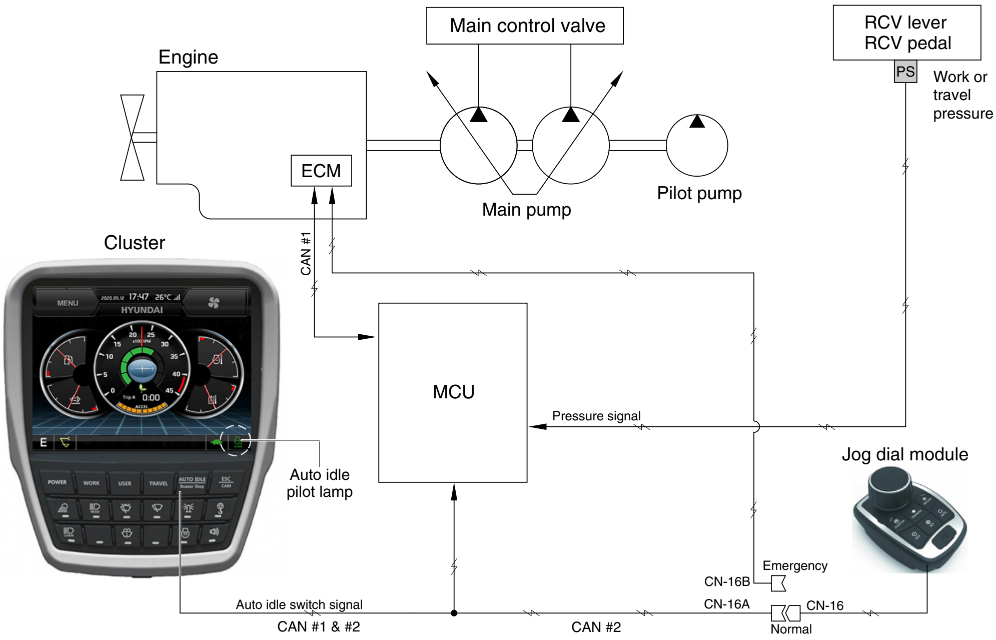
1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift
1	1300	750	10%
2	1400	800	20%
3	1500	850	30%
4	1600	900	40%
5	1700	950	50%
6	1800	1000	60%
7	1850	1050	70%
8	1900	1100 (auto decel)	80%
9	1950	1150	85%
10	2000	1200	90%

※ Refer to page 5-91.

GROUP 3 AUTOMATIC DECELERATION SYSTEM

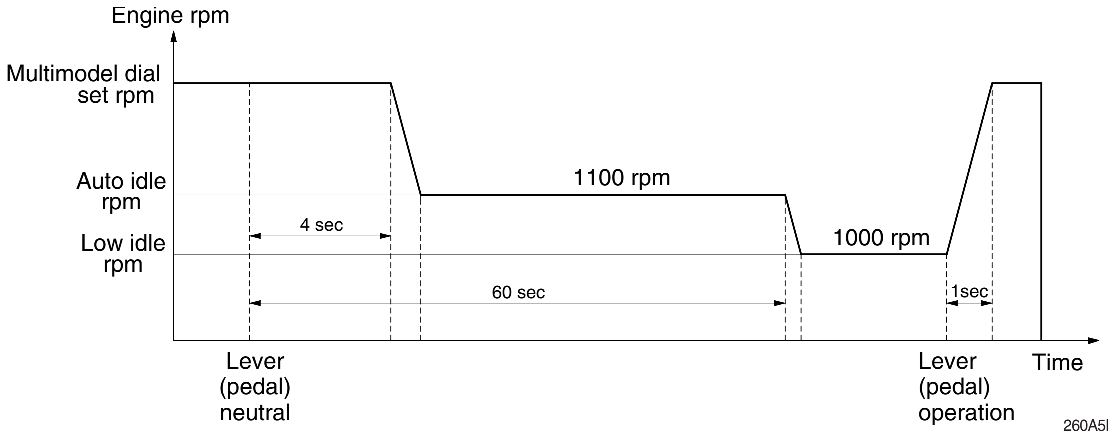


210A5MS05

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.



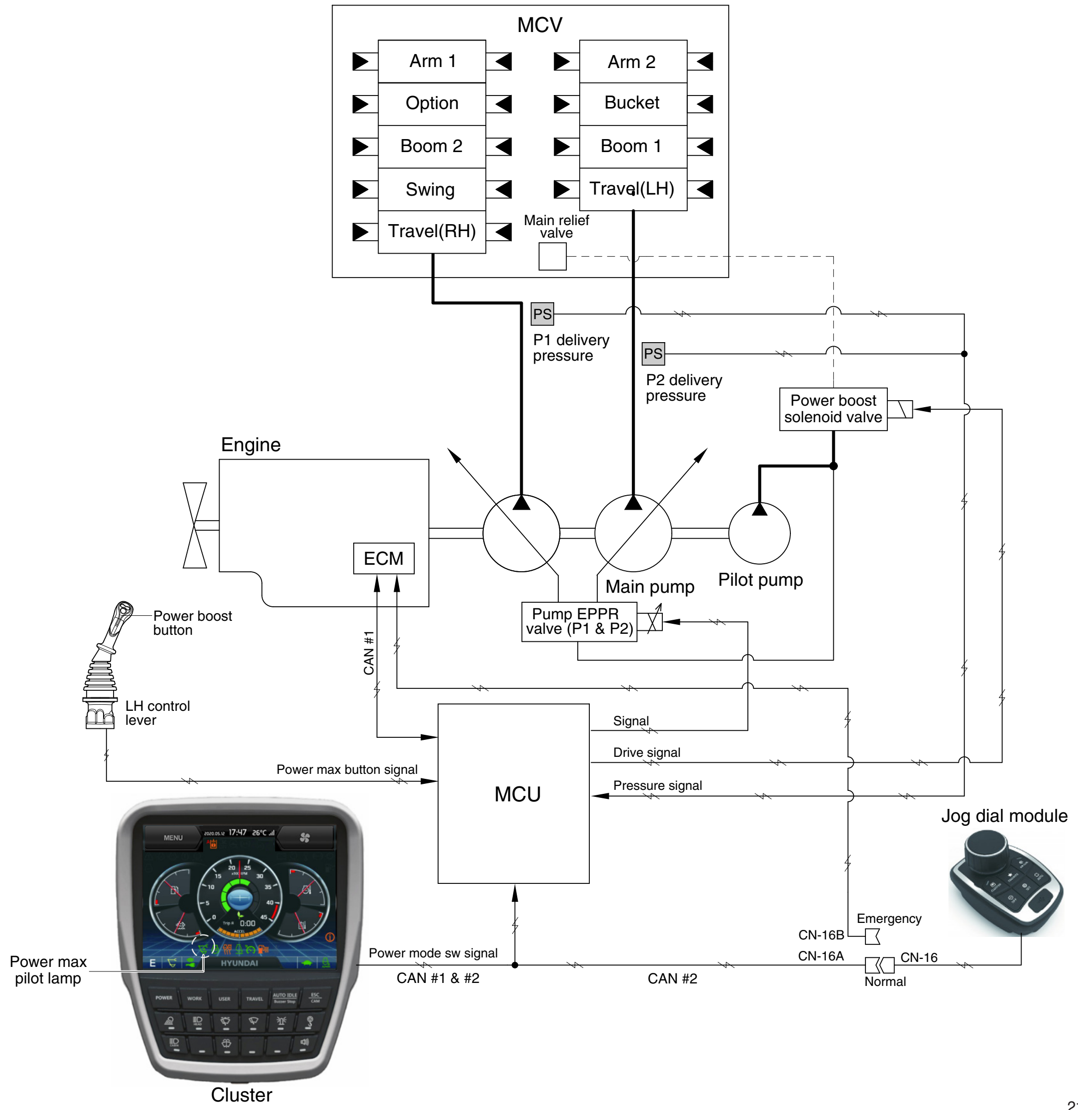
260A5MS105

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



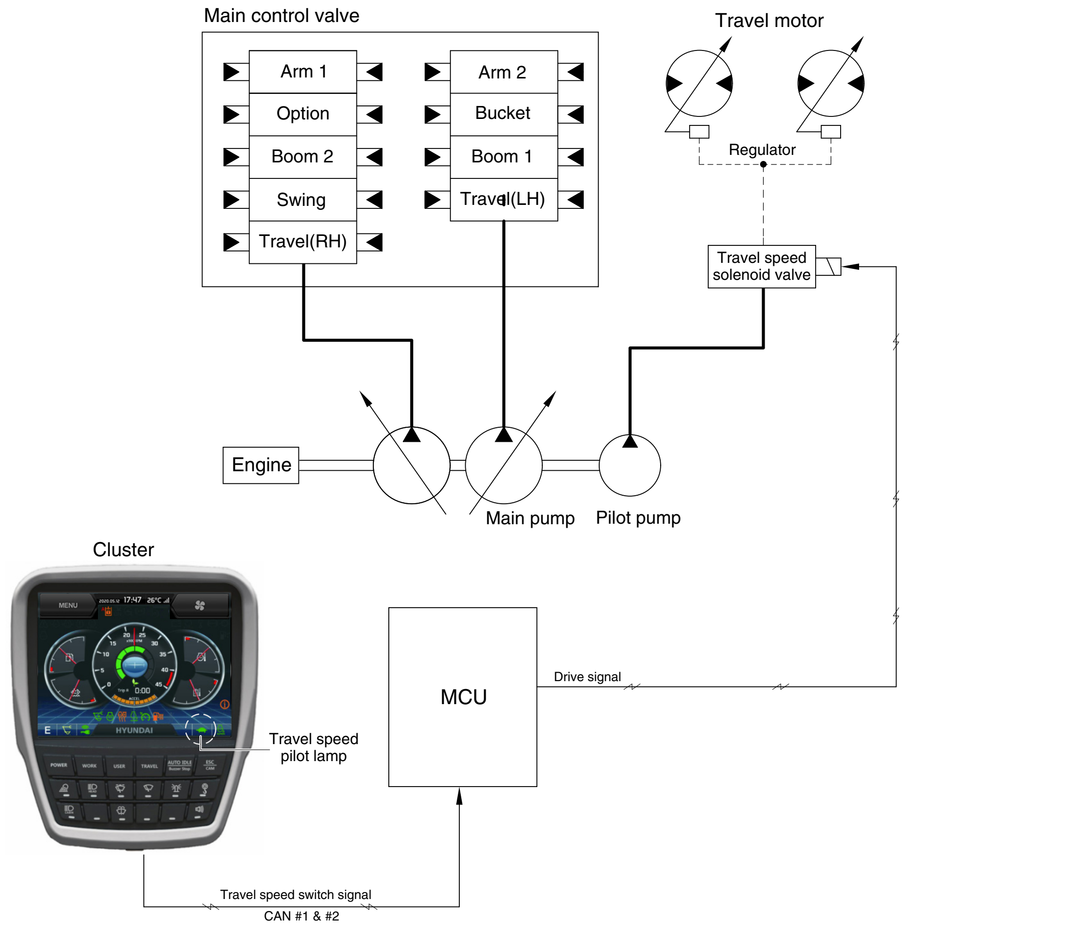
210A5MS06

· 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.



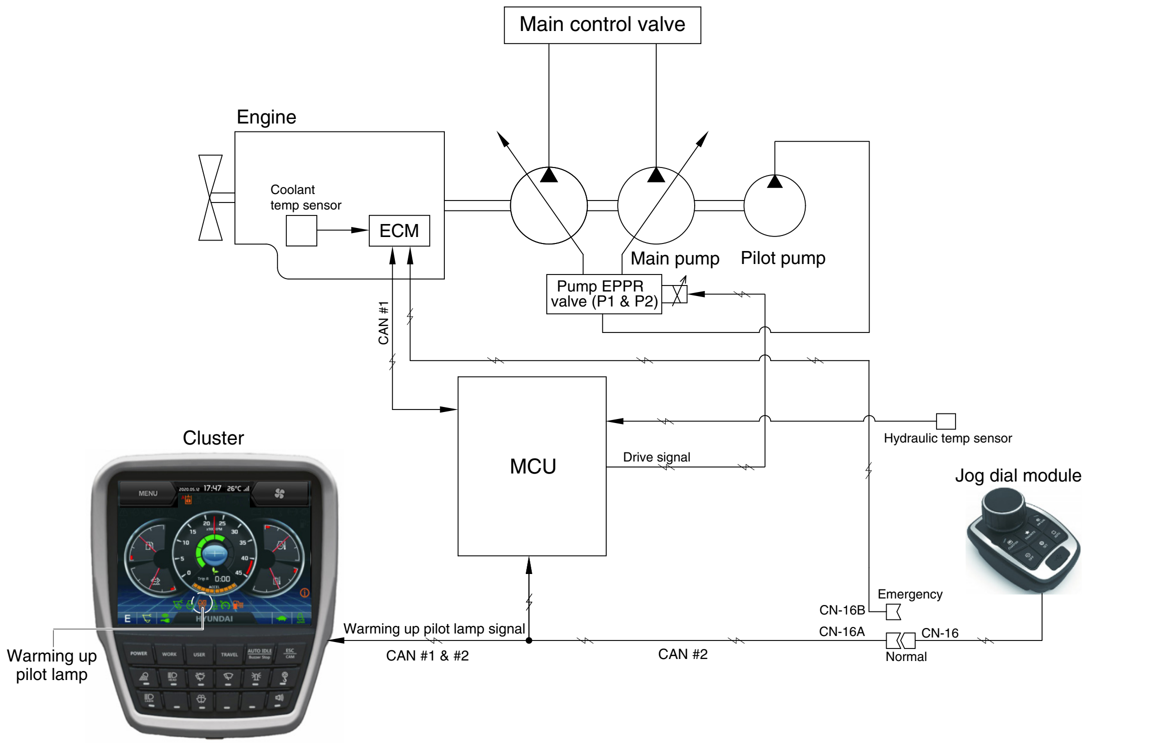
210A5MS09

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



210A5MS08

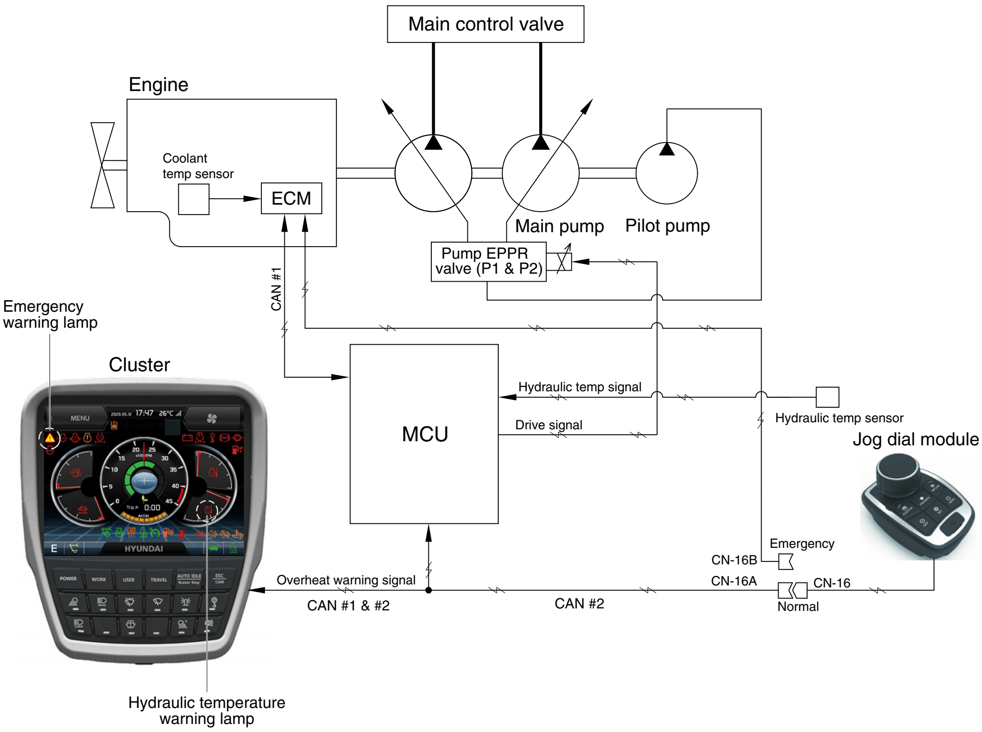
1. The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1100 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

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



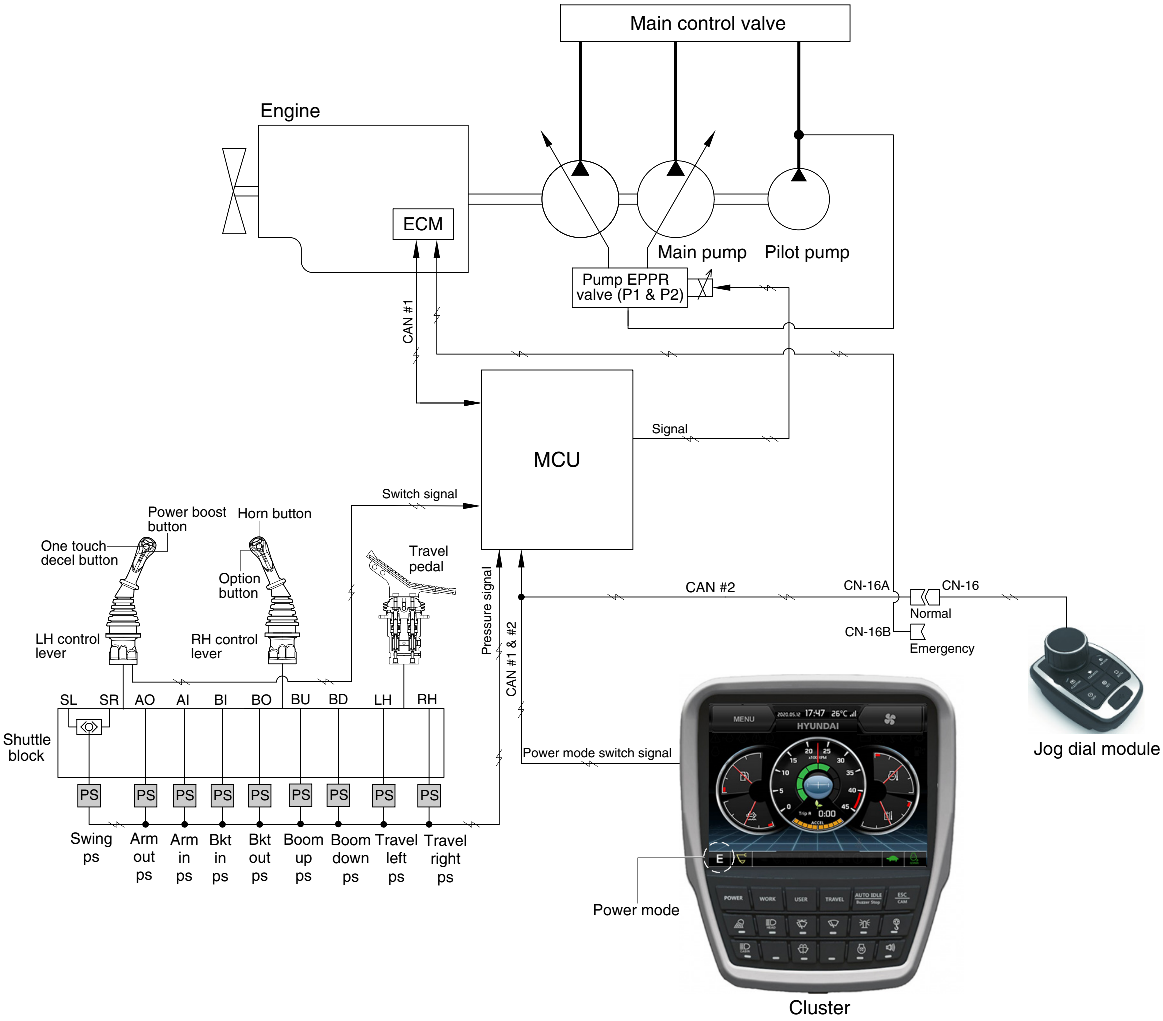
210A5MS09

1. If the engine coolant temperature is overheated over 103˚C or the hydraulic oil temperature is overheated over 100˚C, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

2. LOGIC TABLE

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

GROUP 8 VARIABLE POWER CONTROL SYSTEM



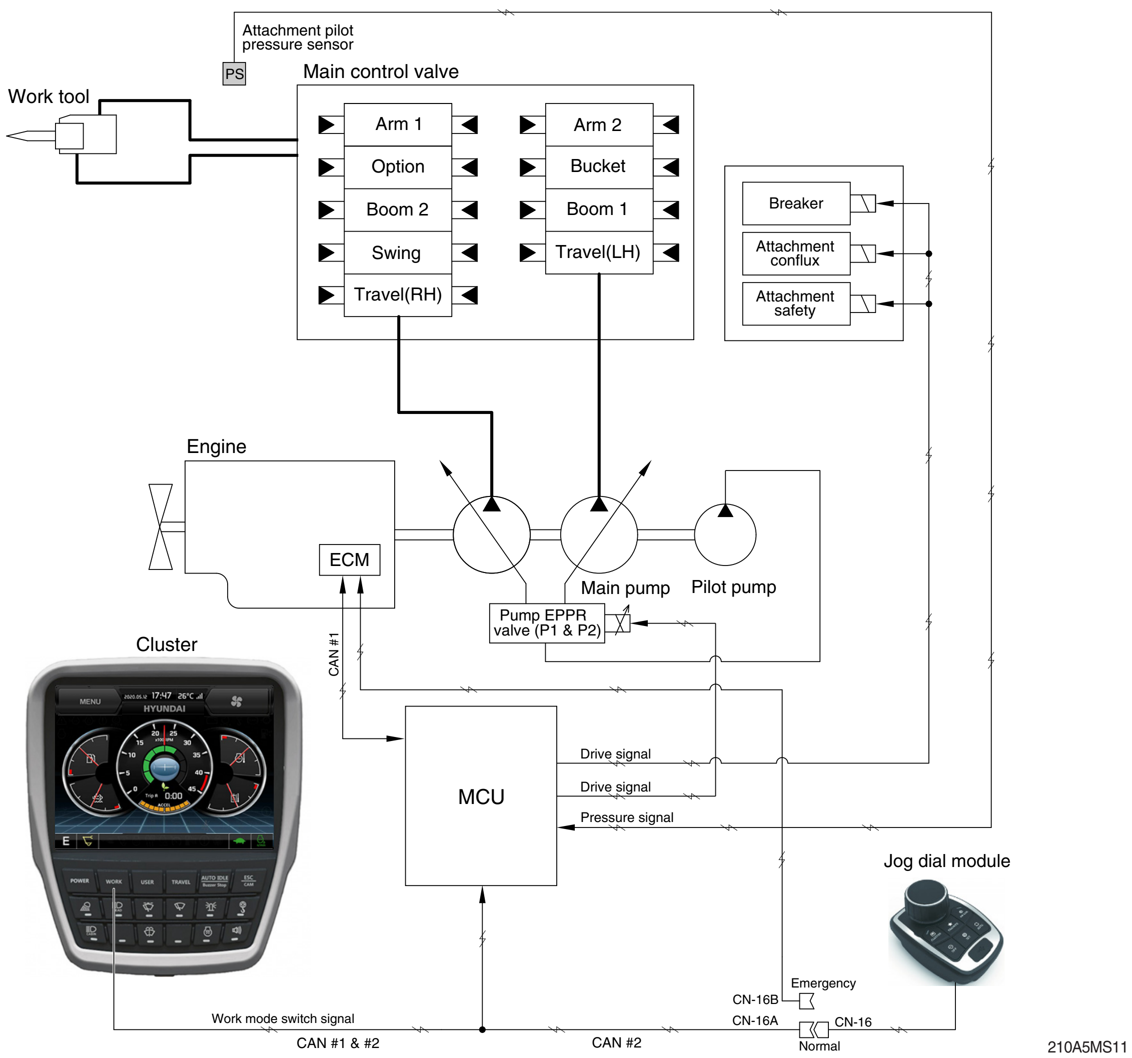
210A5MS10

· 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



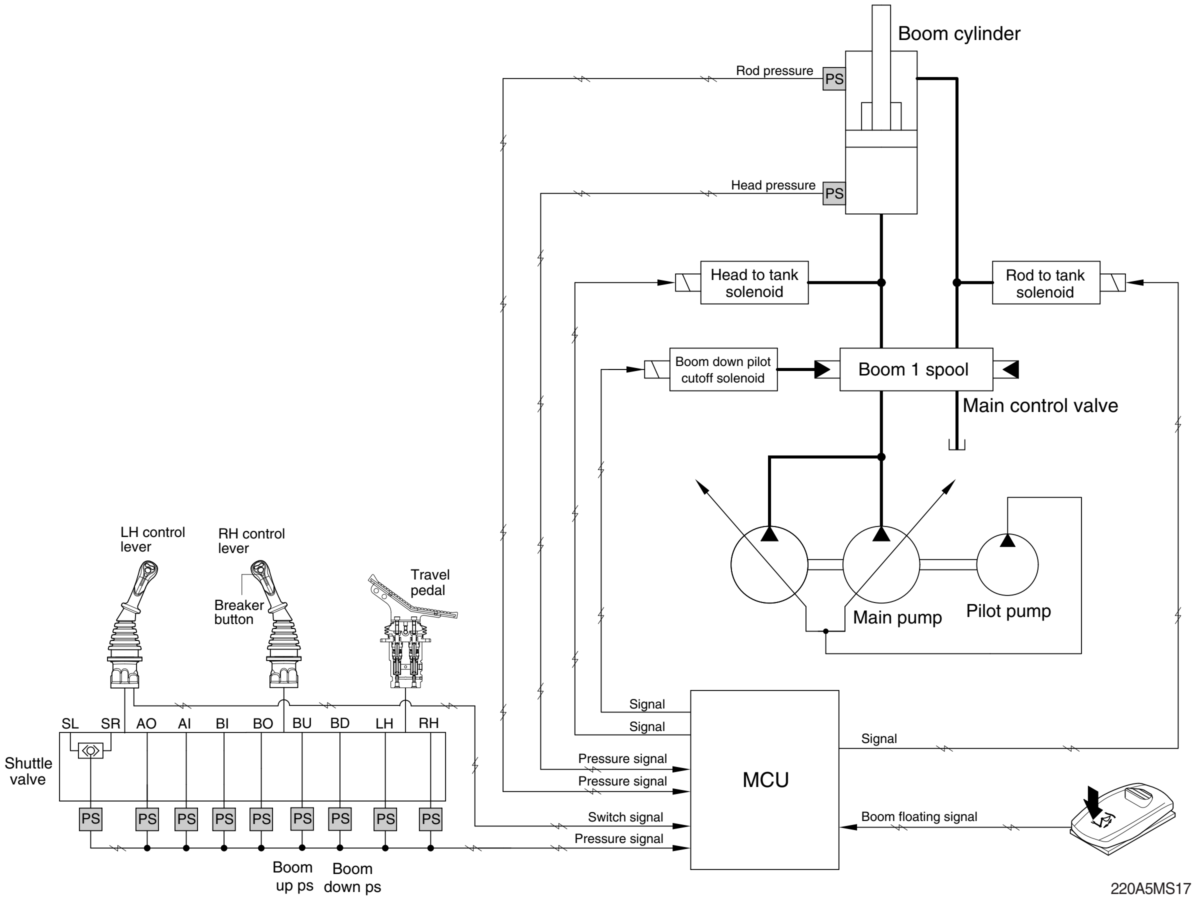
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

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

※ Refer to the page 5-90 for the attachment kinds and max flow.

★ When breaker operating button is pushed.

GROUP 10 BOOM FLOATING CONTROL SYSTEM



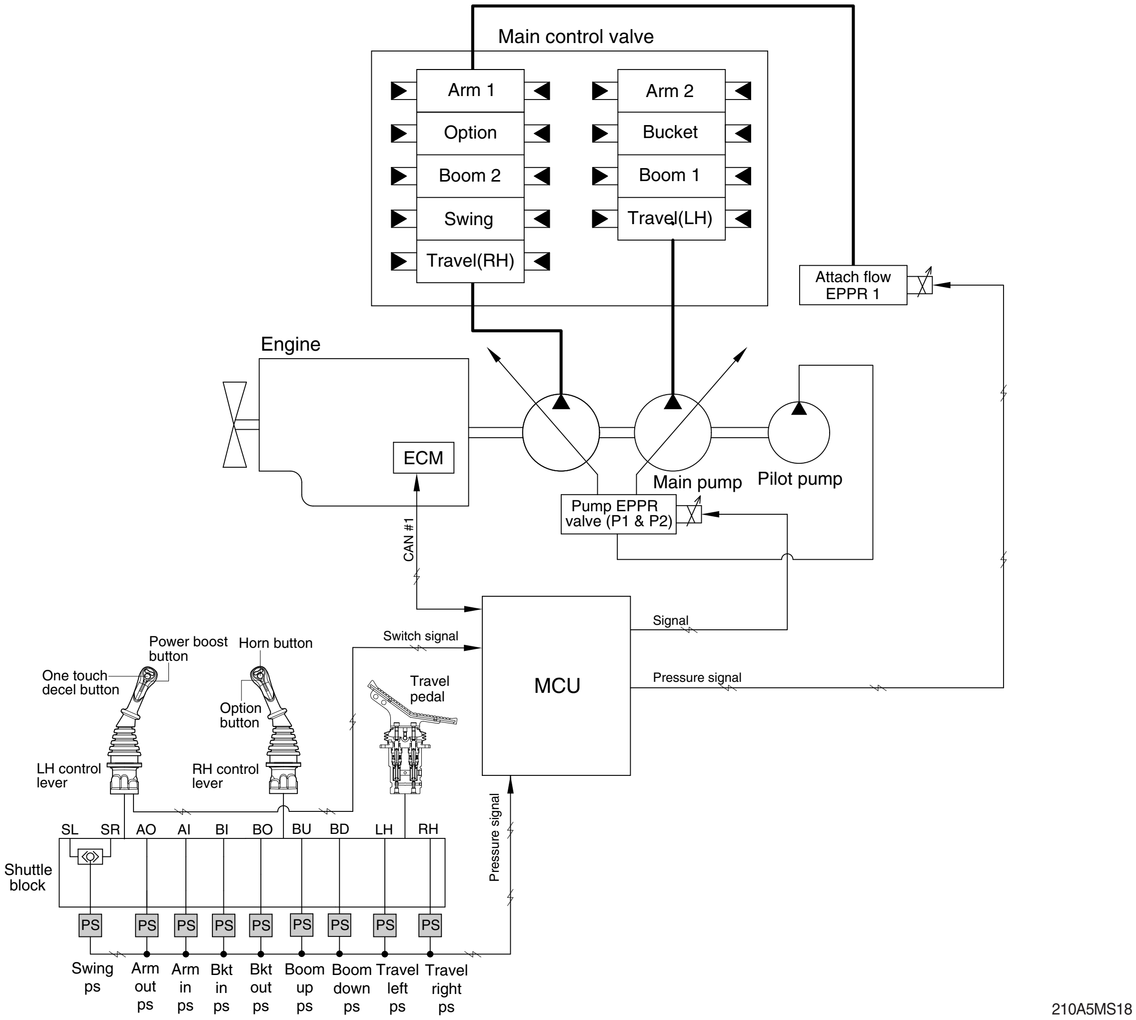
· Boom floating automatically controls boom cylinder along the ground by operating arm cylinder only.

Description		Condition	Function
Work mode★1	Floating mode		
General mode	Boom up floating★2	Floating mode sw : ON	Rod to tank solenoid : ON Head to tank solenoid : OFF Boom down cutoff solenoid : OFF
	Boom up/down floating★2	Floating mode sw : ON Breaker button : Pressed Boom down pilot pressure > 25 bar Boom up pilot pressure < 5 bar	Rod to tank solenoid : ON Head to tank solenoid : ON Boom down cutoff solenoid : ON
Breaker mode	Boom down floating	Floating mode sw : ON Breaker button : Pressed Boom down pilot pressure > 25 bar Boom up pilot pressure < 5 bar	Rod to tank solenoid : OFF Head to tank solenoid : ON Boom down cutoff solenoid : ON
Temporarily canceled		During operation of boom floating Boost sw : Pressed	Rod to tank solenoid : OFF Head to tank solenoid : OFF Boom down cutoff solenoid : OFF

★1 Boom floating is not activated when work mode is crusher mode.

★2 These functions are activated just in case the excavator is not in jack up status.

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. The function works only in Balance or Efficiency mode.

Condition	Function
Arm in with boom up	Limitation of pump flow rate : Activated
Boom down with other actuator	
None of upper condition	Limitation of pump flow rate : Canceled

1) ARM IN WITH BOOM UP

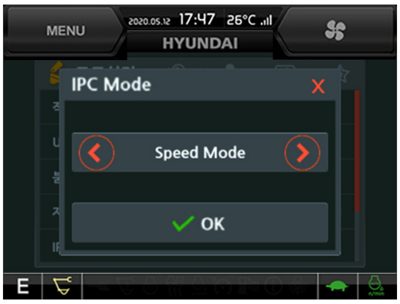
A fuel efficiency is improved by maximizing arm regeneration by reducing pump flow rate during boom up and arm in combination operation.

2) BOOM DOWN WITH OTHER ACTUATOR

The flow for boom-down is replaced with regeneration-flow as much as possible, and fuel consumption is reduced by reducing the flow rate of the pump.

2. IPC MODE SELECTION

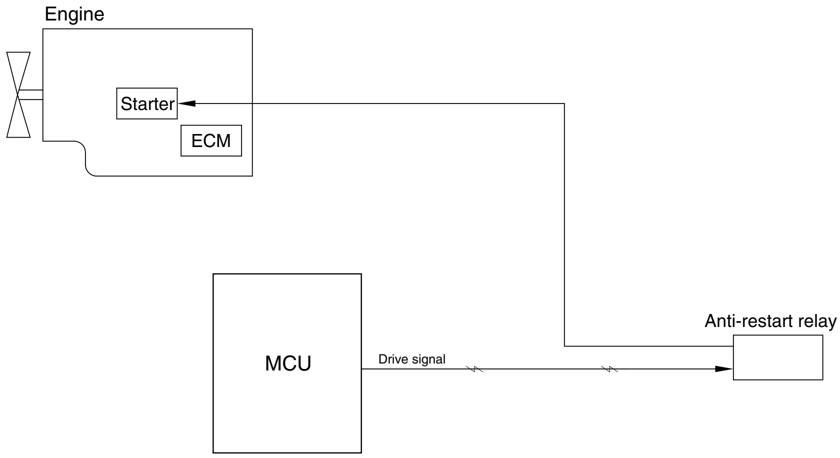
The levels of flow rate limit depends on at IPC mode.



300A3CD52A

IPC mode	Description
Balance mode	Fuel eifficiency ON, limit level 1
Efficiency mode	Fuel eifficiency ON, limit level 2
Speed mode	Fuel eifficiency OFF

GROUP 12 ANTI-RESTART SYSTEM



220A5MS12

1. ANTI-RESTART FUNCTION

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

1. OUTLINE

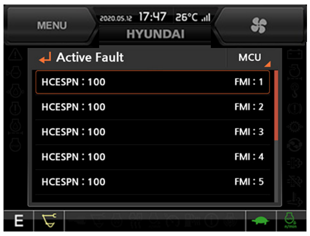
When any abnormality occurs in the ADVANCED CAPO system caused by electric parts malfunction and by open or short circuit, the MCU diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

2. MONITORING

1) Active fault

300A3CD65A

300A3CD66A

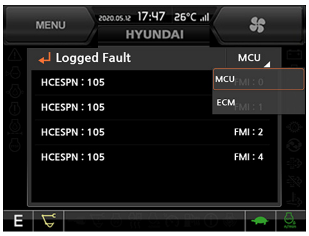


300A3CD67A

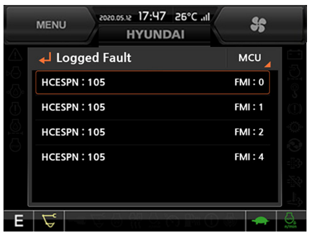
· The active faults of the MCU, engine ECM or air conditioner can be checked by this menu.

2) Logged fault

300A3CD68A



300A3CD69A

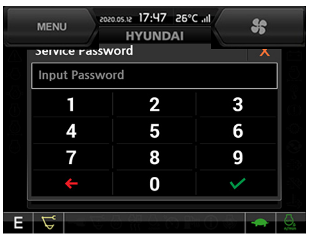


300A3CD70A

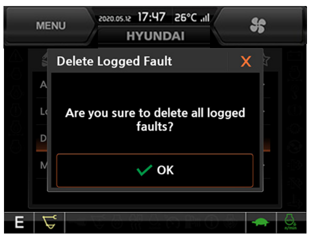
· The logged faults of the MCU, engine ECM or air conditioner can be checked by this menu.

3) Delete logged fault

300A3CD71A



300A3CD72A



300A3CD73A

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

3. MACHINE ERROR CODES TABLE

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">101</td><td>3</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Hydraulic oil temperature display failure
2. Control Function – Fan revolutions control failure
(Checking list)
1. CD-1 (#2) - CN-51 (#16) Checking Open/Short
2. CD-1 (#1) - CN-51 (#25) Checking Open/Short</td></tr>
<tr><td rowspan="4">105
(#0018-)</td><td>0</td><td>10 seconds continuous, Working 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≤ Working Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Working Pilot 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-32 (#B) – CN-52 (#23) Checking Open/Short
2. CD-32 (#A) – CN-51 (#32) Checking Open/Short
3. CD-32 (#C) – CN-51 (#31) Checking Open/Short</td></tr>
<tr><td rowspan="4">108
(#0018-)</td><td>0</td><td>10 seconds continuous, Travel 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 ≤ Travel Pilot 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-104 or 105 (#B) – CN-52 (#24 or 27) Checking Open/Short
2. CD-104 or 105 (#A) – CN-51 (#32) Checking Open/Short
3. CD-104 or 105 (#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

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
120	0	10 seconds continuous, P1 pump delivery pressure sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ P1 pump delivery pressure sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, P1 pump delivery pressure sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – P1 pump delivery Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-42 (#B) – CN-52 (#22) Checking Open/Short 2. CD-42 (#A) – CN-51 (#32) Checking Open/Short 3. CD-42 (#C) – CN-51 (#31) Checking Open/Short			
121	0	10 seconds continuous, P2 pump delivery pressure sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ P2 pump delivery pressure sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, P2 pump delivery pressure sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – P2 pump delivery Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-51 (#14) Checking Open/Short 2. CD-43 (#A) – CN-51 (#32) Checking Open/Short 3. CD-43 (#C) – CN-51 (#31) Checking Open/Short			
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#28) Checking Open/Short 2. CD-31 (#A) – CN-51 (#32) Checking Open/Short 3. CD-31 (#C) – CN-51 (#31) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
123	0	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 1 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 1 Press. display failure 2. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CD-70 (#B) – CN-51 (#22) Checking Open/Short 2. CD-70 (#A) – CN-51 (#32) Checking Open/Short 3. CD-70 (#C) – CN-51 (#31) Checking Open/Short				
124	0	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 2 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 2 Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-71 (#B) – CN-51 (#28) Checking Open/Short 2. CD-71 (#A) – CN-51 (#32) Checking Open/Short 3. CD-71 (#C) – CN-51 (#31) Checking Open/Short				
127	0	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Boom Up Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Up Pilot Press. display failure 2. Control Function – Engine/Pump variable horse power control operation failure, IPC operation failure, Boom first operation failure (Checking list) 1. CD-32 (#B) – CN-52 (#23) Checking Open/Short 2. CD-32 (#A) – CN-51 (#32) Checking Open/Short 3. CD-32 (#C) – CN-5 1(#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<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-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</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-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</td></tr>
<tr><td rowspan="4">133</td><td>0</td><td>10 seconds continuous,
Arm Out 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 Out Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous,
Arm Out 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-86 (#B) – CN-51 (#27) Checking Open/Short
2. CD-86 (#A) – CN-51 (#32) Checking Open/Short
3. CD-86 (#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

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">135</td><td>0</td><td>10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Swing Pilot Press. display failure
2. Control Function – IPC operation, Boom first operation failure
(Checking list)
1. CD-24 (#B) – CN-52 (#18) Checking Open/Short
2. CD-24 (#A) – CN-51 (#32) Checking Open/Short
3. CD-24 (#C) – CN-51 (#31) Checking Open/Short</td></tr>
<tr><td rowspan="4">138</td><td>0</td><td>Monitor – Select Attachment(breaker / crusher)
10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>Monitor – Select Attachment(breaker / crusher)
10 seconds continuous, 0.3V≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>Monitor – Select Attachment(breaker / crusher)
10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Attachment Pilot Press. display failure
2. Control Function – Option attachment flow control operation failure
(Checking list)
1. CD-69 (#B) – CN-52 (#32) Checking Open/Short
2. CD-69 (#A) – CN-51 (#32) Checking Open/Short
3. CD-69 (#C) – CN-51 (#31) Checking Open/Short</td></tr>
<tr><td rowspan="3">139
(N.A)</td><td>1</td><td>10 seconds continuous, 0.3V≤ Option Pilot Press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td>●</td></tr>
<tr><td>4</td><td>10 seconds continuous, Option Pilot Press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Option Pilot Press. display failure
2. Control Function – Auto Idle operation failure
(Checking list)
1. CD-100 (#B) – CN-52 (#21) Checking Open/Short
2. CD-100 (#A) – CN-51 (#3) Checking Open/Short
3. CD-100 (#C) – CN-1 (#6) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General　　C : Crawler Type　　W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
140	5	(Detection) (When Pump regulator EPPR Current is more than 10 mA) 10 seconds continuous, Pump regulator EPPR drive current < 0 mA (Cancellation) (When Pump regulator EPPR Current is more than 10 mA) 3 seconds continuous, Pump regulator EPPR drive current ≥10 mA	●		
	6	(Detection) 10 seconds continuous, Pump regulator EPPR drive current > 1.0A (Cancellation) 3 seconds continuous, Pump regulator EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Pump horse power setting specification difference (Fuel efficiency/speed specification failure) (Checking list) 1. CN-342 (#1)-CN-54 (#02) or CN-343 (#1)-CN-54 (#03) Checking Open/Short 2. CN-342 (#2)-CN-54 (#27) or CN-343 (#2)-CN-54 (#26) Checking Open/Short				
141	5	(Model Parameter) mounting Boom Priority EPPR (Detection) (When Boom Priority EPPR Current is more than 10 mA) 10 seconds continuous, Boom Priority EPPR drive current < 0 mA (Cancellation) (When Boom Priority EPPR Current is more than 10 mA) 3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Boom Priority EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Boom first control operation failure (Checking list) 1. CN-242 (#1)-CN-54 (#04) or CN-243 (#1)-CN-54 (#05) Checking Open/Short 2. CN-242 (#2)-CN-54 (#34) or CN-243 (#2)-CN-54 (#34) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">143
(N.A)</td><td>5</td><td>(Detection)
(When Travel EPPR Current is more than 10 mA)
10 seconds continuous, Travel EPPR drive current = 0 mA
(Cancellation)
(When Travel EPPR Current is more than 100 mA)
3 seconds continuous, Travel EPPR drive current ≥ 10 mA</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Travel EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Travel EPPR drive current ≤ 1.0 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – cruise control operation failure
(Checking list)
1. CN-246 (#2) – CN-54 (#39) Checking Open/Short
2. CN-246 (#1) – CN-51 (#40) Checking Open/Short</td></tr>
<tr><td rowspan="3">145</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. CN-385 (#3) – CN-51 (#07) Checking Open/Short
2. CN-385 (#1) – CN-51 (#03) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

<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 High Speed Solenoid is Off)
10 seconds continuous, Travel High Speed Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Travel High Speed Solenoid is Off)
3 seconds continuous, Travel High 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 High Speed Solenoid is Off)
10 seconds continuous, Travel High Speed Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Travel High Speed Solenoid is Off)
3 seconds continuous, Travel High Speed Solenoid drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Travel High Speed Solenoid is On)
10 seconds continuous, Travel High Speed Solenoid drive current > 4.5 A
(Cancellation)
(When Travel High Speed Solenoid is On)
3 seconds continuous, Travel High 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>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
169	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Attachment Conflux Solenoid is Off) 10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Conflux Solenoid is Off) 3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Attachment Conflux Solenoid is On) 10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A (Cancellation) (When Attachment Conflux Solenoid is On) 3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A	●		
	(Results / symptoms) 1. Control Function – Option attachment flow control – Joining operation failure (Eco breaker mode, crusher mode) (Checking list) 1. CN-237 (#1) – CN-52 (#16) Checking Open/Short 2. CN-237 (#2) – Fuse box (#19) Checking Open/Short				
170	4	(Model Parameter) mounting Arm Regenerating Solenoid (Detection) (When Arm Regeneration Solenoid is Off) 10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Arm Regeneration Solenoid is Off) 3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Arm Regeneration Solenoid is On) 10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A (Cancellation) (When Arm Regeneration Solenoid is On) 3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A	●		
	(Results / symptoms) 1. Control Function – Arm regeneration operation failure (Checking list) 1. CN-135 (#1) – CN-52 (#07) Checking Open/Short 2. CN-135 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<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>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
181 (N.A)	4	(Model Parameter) mounting Reverse Cooling Fan Solenoid (Detection) (When Reverse Cooling Fan Solenoid is Off) 10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Reverse Cooling Fan Solenoid is Off) 3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Reverse Cooling Fan Solenoid is On) 10 seconds continuous, Reverse Cooling Fan Solenoid drive current > 4.5 A (Cancellation) (When Reverse Cooling Fan Solenoid is On) 3 seconds continuous, Reverse Cooling Fan Solenoid drive current ≤ 4.5 A	●		
		(Results / Symptoms) 1. Control Function – Cooling Fan reverse control operation failure (not applicable)			
188	5	(Detection) (When Pump P1 regulator EPPR current is equal or more than 300 mA) 10 seconds continuous, Pump P1 regulator EPPR drive current < 100 mA (Cancellation) (When Pump P1 regulator EPPR current is equal or more than 300 mA) 3 seconds continuous, Pump P1 regulator EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, 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-342 (#2) – CN-54 (#27) Checking Open/Short 2. CN-342 (#1) – CN-54 (#02) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General　　C : Crawler Type　　W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">189</td><td>5</td><td>(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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A
(Cancellation)
3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control operation failure
(Checking list)
1. CN-343 (#2) – CN-54 (#26) Checking Open/Short
2. CN-343 (#1) – CN-54 (#03) Checking Open/Short</td></tr>
<tr><td rowspan="4">196
(N.A)</td><td>0</td><td>HW145
10 seconds continuous,
Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V</td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>HW145
10 seconds continuous,
0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>HW145
10 seconds continuous,
Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Driving second pump joining function operation failure
(Checking list)
1. CD-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</td></tr>
<tr><td rowspan="4">200
(N.A)</td><td>0</td><td>10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Pump EPPR Press. display failure
2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Fuel efficiency/speed performance failure)
(Checking list)
1. CD-44 (#B) – CN-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</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205	0	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V	●		
	1	(Mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V	●		
	4	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Cylinder Rod Press. display failure 2. Control Function – Boom floating control operation failure (Checking list) 1. CD-124 (#B) – CN-52 (#25) Checking Open/Short 2. CD-124 (#A) – CN-51 (#32) Checking Open/Short 3. CD-124 (#C) – CN-51 (#31) Checking Open/Short				
218	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Up Floating Solenoid is On) 10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A (Cancellation) (When Boom Up Floating Solenoid is On) 3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-368 (#1) – CN-53 (#05) Checking Open/Short 2. CN-368 (#2) – Fuse box (#19) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<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 (#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>
</table>

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G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">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

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
525 (N.A)	4	(Detection) (When Ram Lock Solenoid is Off) 10 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Ram Lock Solenoid is Off) 3 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Ram Lock Solenoid is On) 10 seconds continuous, Ram Lock Solenoid drive current > 6.5 A (Cancellation) (When Ram Lock Solenoid is On) 3 seconds continuous, Ram Lock Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Ram lock control operation failure (Checking list) 1. CN-69 (#1) – CN-53 (#12) Checking Open/Short 2. CN-69 (#2) – Fuse box (#33) Checking Open/Short				
527 (N.A)	4	(Detection) (When Creep Solenoid is Off) 10 seconds continuous, Creep Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Creep Solenoid is Off) 3 seconds continuous, Creep Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Creep Solenoid is On) 10 seconds continuous, Creep Solenoid drive current > 6.5 A (Cancellation) (When Creep Solenoid is On) 3 seconds continuous, Creep Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Creep mode operation failure (Checking list) 1. CN-206 (#1) – CN-52 (#17) Checking Open/Short 2. CN-206 (#2) – Fuse box (#30) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
530 (N.A)	0	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			●
		(Results / Symptoms) 1. Monitor – Travel Forward Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-73 (#B) – CN-51 (#20) Checking Open/Short 2. CD-73 (#A) – CN-51 (#32) Checking Open/Short 3. CD-73 (#C) – CN-51 (#31) Checking Open/Short			
531 (N.A)	1	10 seconds continuous, 0.3V≤ Travel Reverse Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Reverse Press. Sensor Measurement Voltage < 0.3V			●
		(Results / Symptoms) 1. Monitor – Travel Reverse Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-74 (#B) – CN-51 (#20) Checking Open/Short 2. CD-74 (#A) – CN-51 (#32) Checking Open/Short 3. CD-74 (#C) – CN-51 (#31) Checking Open/Short			
705	0	10 seconds continuous, Battery input Voltage > 35V	●		
	1	10 seconds continuous, Battery input Voltage < 18V	●		
		(Results / Symptoms) 1. Control Function – Startup impossibility (Checking list) 1. CS-74 (#1) – CN-51 (#01) Checking Open/Short			
707	1	(When Engine is equal or more than 400 rpm) 10 seconds continuous, Alternator Node I Measurement Voltage < 18V (In case 12v goods, Alternator Node I Measurement Voltage < 9V)	●		
		(Results / Symptoms) 1. Control Function – Battery charging circuit failure (Checking list) 1. CS-74 (#1) – CN-51 (#26) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<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
(N.A)</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 (#33) 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 (#09) 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 (#09) Checking Open/Short
2. CN-11 (#7) – CN-51 (#08) 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 (#5) – CN-52 (#01) Checking Open/Short
2. CN-56A (#4) – CN-52 (#02) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="2">841</td><td>2</td><td>10 seconds continuous, ECM Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – ECM operation failure
(Checking list)
1. CN-93 (#22) – CN-52 (#02) Checking Open/Short
2. CN-93 (#46) – CN-52 (#01) Checking Open/Short</td></tr>
<tr><td rowspan="2">848</td><td>2</td><td>(When mounting the Jog Dial Module)
60 seconds continuous, Jog Dial Module Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Jog Dial Module operation failure
(Checking list)
1. CN-363 (#4) – CN-51 (#09) Checking Open/Short
2. CN-363 (#10) – CN-51 (#08) Checking Open/Short</td></tr>
<tr><td rowspan="2">850</td><td>2</td><td>(When mounting the RMCU)
60 seconds continuous, RMCU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Resuluts / Symptoms)
1. Control Function – RMCU operation failure
(Checking list)
1. CN-125A (#3) – CN-51 (#09) Checking Open/Short
2. CN-125A (#11) – CN-51 (#08) Checking Open/Short</td></tr>
<tr><td rowspan="2">866</td><td>2</td><td>(When mounting the AAVM)
60 seconds continuous, AAVM communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – AAVM operation failure
(Checking list)
1. CN-9 (#5) – CN-51 (#09) Checking Open/Short
2. CN-9 (#6) – CN-51 (#08) Checking Open/Short</td></tr>
<tr><td rowspan="2">867</td><td>2</td><td>60 seconds continuous, RDU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – RDU operation failure
(Checking list)
1. CN-376 (#10) – CN-51 (#09) Checking Open/Short
2. CN-376 (#18) – CN-51 (#08) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="2">868</td><td>2</td><td>60 seconds continuous, Switch Controller communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Switch Controller operation failure
(Checking list)
1. CN-56A (#7) – CN-51 (#08) Checking Open/Short
2. CN-56A (#6) – CN-51 (#09) Checking Open/Short</td></tr>
<tr><td rowspan="2">869</td><td>2</td><td>(When mounting the BKCU)
60 seconds continuous, BKCU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – BKCU operation failure
(Checking list)
1. CS-2B (#A) – CN-51 (#09) Checking Open/Short
2. CS-2B (#B) – CN-51 (#08) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

Fault code J1939 SPN J1939 FMI	Item	Description
111 629 12	Engine control module critical internal failure	Bad intelligent device or component
122 102 3	Intake manifold 1 pressure sensor circuit	Voltage above normal, or shorted to high source
123 102 4	Intake manifold 1 pressure sensor circuit	Voltage below normal, or shorted to low source
133 974 3	Remote accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
134 974 4	Remote accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
135 100 3	Engine oil rifle pressure 1 sensor circuit	Voltage above normal, or shorted to high source
141 100 4	Engine oil rifle pressure 1 sensor circuit	Voltage below normal, or shorted to low source
143 100 18	Engine oil rifle pressure	Data valid but below normal operating range - moderately severe level
144 110 3	Engine coolant temperature 1 sensor circuit	Voltage above normal, or shorted to high source
145 110 4	Engine coolant temperature 1 sensor circuit	Voltage below normal, or shorted to low source
146 110 16	Engine coolant temperature	Data valid but above normal operating range - moderately severe level
147 91 1	Accelerator pedal or lever position 1 sensor circuit frequency	Data valid but below normal operating range
148 91 0	Accelerator pedal or lever position sensor 1	Data valid but above normal operational range - most severe level
151 110 0	Engine coolant temperature	Data valid but above normal operational range - most severe level
153 105 3	Intake manifold 1 temperature sensor circuit	Voltage above normal, or shorted to high source
154 105 4	Intake manifold 1 temperature sensor circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
187 3510 4	Sensor supply 2 circuit	Voltage below normal, or shorted to low source
197 111 18	Coolant level	Data valid but below normal operating range - moderately severe level
227 3510 3	Sensor supply 2 circuit	Voltage above normal, or shorted to high source
234 190 0	Engine crankshaft speed/position	Data valid but above normal operational range - most severe level
235 111 1	Coolant level	Data valid but below normal operational range - most severe level
237 644 2	External speed command input (Multiple unit synchronization)	Data erratic, intermittent or incorrect
238 3511 4	Sensor supply 3 circuit	Voltage below normal, or shorted to low source
239 3511 3	Sensor supply 3 circuit	Voltage above normal, or shorted to high source
241 84 2	Wheel-based vehicle speed	Data erratic, intermittent or incorrect
242 84 10	Wheel-based vehicle speed sensor circuit tampering has been detected	Abnormal rate of change
271 1347 4	Engine fuel pump pressurizing assembly 1 circuit	Voltage below normal, or shorted to low source
272 1347 3	Engine fuel pump pressurizing assembly 1 circuit	Voltage above normal, or shorted to high source
285 639 9	SAE J1939 multiplexing pgn timeout error	Abnormal update rate
286 639 13	SAE J1939 multiplexing configuration error	Out of calibration
288 974 19	SAE J1939 multiplexing remote accelerator pedal or lever position sensor system	Received network data in error
293 441 3	Auxiliary temperature sensor input 1 circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
294 441 4	Auxiliary temperature sensor input 1 circuit	Voltage below normal, or shorted to low source
297 1388 3	Auxiliary pressure sensor input 2 circuit	Voltage above normal, or shorted to high source
298 1388 4	Auxiliary pressure sensor input 2 circuit	Voltage below normal, or shorted to low source
322 651 5	Injector solenoid driver cylinder 1 circuit	Current below normal or open circuit
323 655 5	Injector solenoid driver cylinder 5 circuit	Current below normal or open circuit
324 653 5	Injector solenoid driver cylinder 3 circuit	Current below normal or open circuit
325 656 5	Injector solenoid driver cylinder 6 circuit	Current below normal or open circuit
331 652 5	Injector solenoid driver cylinder 2 circuit	Current below normal or open circuit
332 654 5	Injector solenoid driver cylinder 4 circuit	Current below normal or open circuit
334 110 2	Engine coolant temperature	Data erratic, intermittent or incorrect
343 629 12	Engine control module warning internal hardware failure	Bad intelligent device or component
349 191 16	Transmission output shaft speed	Data valid but above normal operating range - moderately severe level
351 3597 12	Injector power supply	Bad intelligent device or component
352 3509 4	Sensor supply 1 circuit	Voltage below normal, or shorted to low source
386 3509 3	Sensor supply 1 circuit	Voltage above normal, or shorted to high source
415 100 1	Engine oil rifle pressure	Data valid but below normal operational range - most severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
418 97 15	Water in fuel indicator	Data valid but above normal operating range - least severe level
428 97 3	Water in fuel indicator sensor circuit	Voltage above normal, or shorted to high source
429 97 4	Water in fuel indicator sensor circuit	Voltage below normal, or shorted to low source
431 558 2	Accelerator pedal or lever idle validation switch	Data erratic, intermittent or incorrect
432 558 13	Accelerator pedal or lever idle validation switch circuit	Out of calibration
435 100 2	Engine oil rifle pressure	Data erratic, intermittent or incorrect
451 157 3	Injector metering rail 1 pressure sensor circuit	Voltage above normal, or shorted to high source
452 157 4	Injector metering rail 1 pressure sensor circuit	Voltage below normal, or shorted to low source
483 1349 3	Injector metering rail 2 pressure sensor circuit	Voltage above normal, or shorted to high source
484 1349 4	Injector metering rail 2 pressure sensor circuit	Voltage below normal, or shorted to low source
488 105 16	Intake manifold 1 temperature	Data valid but above normal operating range - moderately severe level
489 191 18	Transmission output shaft speed	Data valid but below normal operating range - moderately severe level
497 1377 2	Multiple unit synchronization switch	Data erratic, intermittent or incorrect
515 3514 3	Sensor supply 6 circuit	Voltage above normal, or shorted to high source
516 3514 4	Sensor supply 6 circuit	Voltage below normal, or shorted to low source
527 702 3	Auxiliary input/output 2 circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
529 703 3	Auxiliary input/output 3 circuit	Voltage above normal, or shorted to high source
553 157 16	Injector metering rail 1 pressure	Data valid but above normal operating range - moderately severe level
555 101 16	Crankcase pressure	Data valid but above normal operating range - moderately severe level
556 101 0	Crankcase pressure	Data valid but above normal operational range - most severe level
559 157 18	Injector metering rail 1 pressure	Data valid but below normal operating range - moderately severe level
584 677 3	Starter relay driver circuit	Voltage above normal, or shorted to high source
585 677 4	Starter relay driver circuit	Voltage below normal, or shorted to low source
595 103 16	Turbocharger 1 speed	Data valid but above normal operating range - moderately severe level
599 640 14	Auxiliary commanded dual output shutdown	Special instructions
611 1383 31	Engine shut down hot	Condition exists
649 1378 31	Engine oil change interval	Condition exists
687 103 18	Turbocharger 1 speed	Data valid but below normal operating range - moderately severe level
689 190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect
691 1172 3	Turbocharger 1 compressor intake temperature circuit	Voltage above normal, or shorted to high source
692 1172 4	Turbocharger 1 compressor intake temperature circuit	Voltage below normal, or shorted to low source
693 1172 7	Turbocharger 1 compressor intake temperature	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
731 723 7	Engine speed / position camshaft and crankshaft misalignment	Mechanical system not responding or out of adjustment
741 1176 3	Turbocharger 1 compressor intake pressure circuit	Voltage above normal, or shorted to high source
742 1176 4	Turbocharger 1 compressor intake pressure circuit	Voltage below normal, or shorted to low source
743 1176 2	Turbocharger 1 compressor intake pressure	Data erratic, intermittent or incorrect
769 597 3	Brake switch circuit	Voltage above normal, or shorted to high source
771 597 4	Brake switch circuit	Voltage below normal, or shorted to low source
778 723 2	Engine camshaft speed / position sensor	Data erratic, intermittent or incorrect
1117 3597 2	Power supply lost with ignition on	Data erratic, intermittent or incorrect
1239 2623 3	Accelerator pedal or lever position sensor 2 circuit	Voltage above normal, or shorted to high source
1241 2623 4	Accelerator pedal or lever position sensor 2 circuit	Voltage below normal, or shorted to low source
1242 91 2	Accelerator pedal or lever position sensor 1	Data erratic, intermittent or incorrect
1358 91 3	Accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
1359 91 4	Accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
1515 91 19	SAE J1939 multiplexed accelerator pedal or lever sensor system	Received network data in error
1539 1387 3	Auxiliary pressure sensor input 1 circuit	Voltage above normal, or shorted to high source
1621 1387 4	Auxiliary pressure sensor input 1 circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
1668 1761 4	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage below normal, or shorted to low source
1669 1761 3	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage above normal, or shorted to high source
1673 1761 1	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operational range -most severe level
1677 3031 4	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage below normal, or shorted to low source
1678 3031 3	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage above normal, or shorted to high source
1679 3031 2	Aftertreatment 1 diesel exhaust fluid tank temperature	Data erratic, intermittent or incorrect
1682 3362 31	Aftertreatment 1 diesel exhaust fluid dosing unit input lines	Condition exists
1685 3364 4	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage below normal, or shorted to low source
1686 3364 3	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage above normal, or shorted to high source
1695 3513 3	Sensor supply 5	Voltage above normal, or shorted to high source
1696 3513 4	Sensor supply 5	Voltage below normal, or shorted to low source
1713 3363 16	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but above normal operating range - moderately severe level
1714 3364 13	Aftertreatment diesel exhaust fluid quality	Out of calibration
1715 3364 11	Aftertreatment diesel exhaust fluid quality	Root cause not known
1843 101 3	Crankcase pressure circuit	Voltage above normal, or shorted to high source
1844 101 4	Crankcase pressure circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
1852 97 16	Water in fuel indicator	Data valid but above normal operating range - moderately severe level
1879 3251 3	Aftertreatment diesel particulate filter differential pressure sensor circuit	Voltage above normal
1881 3251 4	Aftertreatment diesel particulate filter differential pressure sensor circuit	Voltage below normal
1883 3251 2	Aftertreatment diesel particulate filter differential pressure sensor	Data erratic, intermittent or incorrect
1885 3216 4	Aftertreatment 1 intake NOx sensor circuit	Voltage below normal, or shorted to low source
1887 3226 4	Aftertreatment 1 outlet NOx sensor circuit	Voltage below normal, or shorted to low source
1898 641 13	VGT actuator controller	Out of calibration
1921 3251 16	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
1922 3251 0	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
1976 641 15	VGT actuator driver over temperature (calculated)	Data valid but above normal operating range - least severe level
1993 4795 31	Aftertreatment 1 diesel particulate filter missing	Condition exists
2185 3512 3	Sensor supply 4 circuit	Voltage above normal, or shorted to high source
2186 3512 4	Sensor supply 4 circuit	Voltage below normal, or shorted to low source
2198 641 11	VGT actuator driver circuit	Root cause not known
2311 633 31	Electronic fuel injection control valve circuit	Condition exists
2321 190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
2322 723 2	Engine camshaft speed / position sensor	Data erratic, intermittent or incorrect
2373 1209 3	Exhaust gas pressure sensor 1 circuit	Voltage above normal, or shorted to high source
2374 1209 4	Exhaust gas pressure sensor 1 circuit	Voltage below normal, or shorted to low source
2387 641 7	VGT actuator driver circuit (motor)	Mechanical system not responding or out of adjustment
2448 111 17	Coolant level	Data valid but below normal operating range - least severe level
2468 190 16	Engine speed	Engine crankshaft speed/position - data valid but above normal operating range - moderately severe level
2554 1209 2	Exhaust gas pressure 1	Data erratic, intermittent or incorrect
2557 697 3	Auxiliary PWM driver 1 circuit	Voltage above normal, or shorted to high source
2558 697 4	AuxiliaryPWM driver 1 circuit	Voltage below normal, or shorted to low source
2571 2630 3	Engine charge air cooler outlet temperature	Voltage above normal, or shorted to high source
2572 2630 4	Engine charge air cooler outlet temperature	Voltage below normal, or shorted to low source
2634 641 12	VGT actuator controller	Bad intelligent device or component
2636 641 9	VGT actuator driver circuit	Abnormal update rate
2638 5298 17	Aftertreatment 1 diesel oxidation catalyst conversion efficiency	Data valid but below normal operating range - moderately severe level
2639 3251 15	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
2771 3226 9	Aftertreatment 1 outlet NOx sensor	Abnormal update rate

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
2778 3481 16	Aftertreatment fuel rate	Data valid but above normal operating range - moderately severe level
2973 102 2	Intake manifold 1 pressure	Data erratic, intermittent or incorrect
3133 3610 3	Aftertreatment 1 diesel particulate filter outlet pressure sensor circuit	Voltage above normal, or shorted to high source
3134 3610 4	Aftertreatment 1 diesel particulate filter outlet pressure sensor circuit	Voltage below normal, or shorted to low source
3135 3610 2	Aftertreatment 1 diesel particulate filter outlet pressure	Data erratic, intermittent or incorrect
3139 3667 3	Engine air shutoff circuit	Voltage above normal, or shorted to high source
3141 3667 4	Engine air shutoff circuit	Voltage below normal, or shorted to low source
3142 4360 3	Aftertreatment 1 SCR intake temperature sensor circuit	Voltage above normal, or shorted to high source
3144 4360 2	Aftertreatment 1 SCR intake temperature sensor	Data erratic, intermittent or incorrect
3146 4363 3	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage above normal, or shorted to high source
3147 4363 4	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage below normal, or shorted to low source
3148 4363 2	Aftertreatment 1 SCR outlet temperature sensor	Data erratic, intermittent or incorrect
3151 4974 31	Aftertreatment 1 SCR catalyst system missing	Condition exists
3165 4363 0	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operational range - most severe
3232 3216 9	Aftertreatment 1 intake NOx sensor	Abnormal update rate
3235 4363 16	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operating range - moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3251 4765 16	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data valid but above normal operating range
3253 3242 16	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operating range
3255 3246 16	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operating range
3311 3242 0	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operation
3312 3246 0	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operation
3313 4765 4	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage below normal, or shorted to low source
3314 4765 3	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage above normal, or shorted to high source
3315 4765 2	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data erratic, intermittent or incorrect
3316 3242 4	Aftertreatment 1 diesel particulate filter intake temperature sensor circuit	Voltage below normal, or shorted to low source
3317 3242 3	Aftertreatment 1 diesel particulate filter intake temperature sensor circuit	Voltage above normal, or shorted to high source
3318 3242 2	Aftertreatment 1 diesel particulate filter intake temperature	Data erratic, intermittent or incorrect
3319 3246 3	Aftertreatment 1 diesel particulate filter outlet temperature sensor circuit	Voltage above normal, or shorted to high source
3321 3246 4	Aftertreatment 1 diesel particulate filter outlet temperature sensor circuit	Voltage below normal, or shorted to low source
3322 3246 2	Aftertreatment 1 diesel particulate filter outlet temperature	Data erratic, intermittent or incorrect
3326 91 9	SAE J1939 multiplexed accelerator pedal or lever sensor system	Abnormal update rate
3341 107 16	Engine air filter differential pressure - data valid but above normal operating range	Moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3375 5397 31	Aftertreatment diesel particulate filter regeneration too frequent	Condition exists
3376 5319 31	Aftertreatment diesel particulate filter incomplete regeneration	Condition exists
3419 5125 3	Sensor supply 7 circuit	Voltage above normal, or shorted to high source
3421 5125 4	Sensor supply 7 circuit	Voltage below normal, or shorted to low source
3497 1761 17	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - least severe level
3498 1761 18	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - moderately severe level
3527 558 19	Accelerator pedal or lever idle validation switch	Received network data in error
3528 558 9	Accelerator pedal or lever idle validation switch	Abnormal update rate
3542 51 2	Engine intake throttle actuator position sensor	Data erratic, intermittent, or incorrect
3545 3226 31	Aftertreatment 1 outlet NOx sensor	Abnormal rate of change
3547 4096 31	Aftertreatment diesel exhaust fluid tank empty	Condition exists
3558 3361 3	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage above normal, or shorted to high source
3559 3361 4	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage below normal, or shorted to low source
3565 5394 3	Aftertreatment 1 diesel exhaust fluid dosing valve 1 circuit	Voltage above normal or shorted to high source
3567 5394 5	Aftertreatment diesel exhaust fluid dosing valve	Current below normal or open circuit
3568 5394 7	Aftertreatment diesel exhaust fluid dosing valve	Mechanical system not responding or out of adjustment

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3571 4334 3	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage above normal, or shorted to high source
3572 4334 4	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage below normal, or shorted to low source
3574 4334 18	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but below normal operating range
3575 4334 16	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but above normal operating range
3583 5031 10	Aftertreatment 1 outlet nox sensor heater	Abnormal rate of change
3596 4334 2	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data erratic, intermittent or incorrect
3641 748 9	Transmission output retarder	Abnormal update rate
3649 5024 10	Aftertreatment 1 intake NOx sensor heater	Abnormal rate of change
3681 3228 2	Aftertreatment 1 outlet NOx sensor power supply	Data erratic, intermittent or incorrect
3682 3218 2	Aftertreatment 1 intake NOx sensor power supply	Data erratic, intermittent or incorrect
3697 630 12	Engine control module calibration memory	Bad intelligent device or component
3712 5246 0	Aftertreatment SCR operator inducement	Data valid but above normal operational range - most severe level
3714 1569 31	Engine protection torque derate	Condition exists
3725 3216 10	Aftertreatment 1 intake NOx sensor	Abnormal rate of change
3727 5571 7	High pressure common rail fuel pressure relief valve	Mechanical system not responding or out of adjustment
3737 1675 31	Engine starter mode overcrank protection	Condition exists

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3741 5571 0	High pressure common rail fuel pressure relief valve	Data valid but above normal operational range
3748 3216 20	Aftertreatment 1 intake NOx sensor	Data not rational - drifted high
3765 442 3	Auxiliary temperature sensor input 2 circuit	Voltage above normal, or shorted to high source
3766 442 4	Auxiliary temperature sensor input 2 circuit	Voltage below normal, or shorted to low source
3838 2978 9	Estimated engine parasitic losses - percent torque	Abnormal update rate
3841 596 2	Cruise control enable switch	Data erratic, intermittent or incorrect
3843 5603 9	Cruise control disable command	Abnormal update rate
3845 5603 31	Cruise control disable command	Condition exists
3866 3364 1	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operational range - most severe level
3868 3364 9	Aftertreatment diesel exhaust fluid quality	Abnormal update rate
3878 3364 2	Aftertreatment diesel exhaust fluid quality	Data erratic, intermittent or incorrect
4151 5742 9	Aftertreatment diesel particulate filter temperature sensor module	Abnormal update rate
4152 5743 9	Aftertreatment selective catalytic reduction temperature sensor module	Abnormal update rate
4158 5742 12	Aftertreatment diesel particulate filter temperature sensor module	Bad intelligent device or component
4159 5743 12	Aftertreatment selective catalytic reduction temperature sensor module	Bad intelligent device or component
4161 5742 3	Aftertreatment diesel particulate filter temperature sensor module	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4162 5742 4	Aftertreatment diesel particulate filter temperature sensor module	Voltage below normal, or shorted to low source
4163 5742 16	Aftertreatment diesel particulate filter temperature sensor module	Data valid but above normal operating range
4164 5743 3	Aftertreatment selective catalytic reduction temperature sensor module	Voltage above normal, or shorted to high source
4165 5743 4	Aftertreatment selective catalytic reduction temperature sensor module	Voltage below normal, or shorted to low source
4166 5743 16	Aftertreatment selective catalytic reduction temperature sensor module	Data valid but above normal
4259 5742 11	Aftertreatment diesel particulate filter temperature sensor module	Root cause not known
4261 5743 11	Aftertreatment selective catalytic reduction temperature sensor module	Root cause not known
4262 5571 3	High pressure common rail fuel pressure relief valve	Voltage above normal, or shorted to high source
4263 5571 4	High pressure common rail fuel pressure relief valve	Voltage below normal, or shorted to low source
4265 5571 11	High pressure common rail fuel pressure relief valve	Root cause not known
4277 3364 10	Aftertreatment diesel exhaust fluid quality	Abnormal rate of change
4284 5793 9	Desired engine fueling state	Abnormal update rate
4452 3226 7	Aftertreatment 1 outlet NOx sensor closed loop operation	Condition exists
4484 3667 7	Engine air shutoff	Mechanical system not responding or out of Adjustment
4526 521 2	Brake pedal position	Data erratic, intermittent or incorrect
4572 3031 9	Aftertreatment 1 diesel exhaust fluid tank temperature	Abnormal update rate

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4584 3936 14	Aftertreatment diesel particulate filter system	Special instructions
4585 4792 14	Aftertreatment 1 SCR catalyst system	Special instructions
4677 1761 9	SAE J1939 multiplexing pgn timeout error	Abnormal update rate
4724 702 5	Auxiliary input/output 2 circuit	Current below normal or open circuit
4725 702 6	Auxiliary input/output 2 circuit	Current above normal or grounded circuit
4731 3031 13	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Out of calibration
4734 701 14	Auxiliary input/output 1	Special instructions
4737 3031 11	Aftertreatment 1 diesel exhaust fluid tank temperature	Root cause not known
4739 1761 11	Aftertreatment 1 diesel exhaust fluid tank level sensor	Root cause not known
4747 3217 20	Aftertreatment intake oxygen sensor	Data not rational - drifted high
4748 3217 21	Aftertreatment intake oxygen sensor	Data not rational - drifted low
4749 3227 20	Aftertreatment outlet oxygen	Data not rational - drifted high
4751 3227 21	Aftertreatment outlet oxygen	Data not rational - drifted low
4768 3521 11	Aftertreatment 1 diesel exhaust fluid property	Root cause not known
4769 1761 10	Aftertreatment 1 diesel exhaust fluid tank level sensor	Abnormal rate of change
4842 3364 15	Aftertreatment diesel exhaust fluid quality	Data valid but above normal operating range - Least severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4863 5245 31	Aftertreatment diesel exhaust fluid tank low level indicator	-
4867 5571 31	High pressure common rail fuel pressure relief valve	Condition exists
4953 3353 3	Alternator 1 status	Voltage above normal, or shorted to high source
4954 3353 4	Alternator 1 status	Voltage below normal, or shorted to low source
4956 6713 13	Variable geometry turbocharger actuator software	Out of calibration
4957 6713 31	Variable geometry turbocharger actuator software	Condition exists
5177 6713 9	VGT actuator driver circuit	Abnormal update rate
5248 1623 13	Tachograph output shaft speed	Out of calibration
5292 520809 31	Excessive time since last engine air shutoff maintenance test	Condition exists
5383 3720 15	Aftertreatment 1 diesel particulate filter ash load percent	Data valid but above normal operating range - least severe level
5576 107 15	Engine air filter differential pressure	Data valid but above normal operating range - least severe level
5632 6918 31	SCR system cleaning inhibited due to inhibit switch	Condition exists
5652 1209 15	Exhaust pressure 1	Data valid but above normal operating range - least severe level
5653 6881 9	SCR operator inducement override switch	Abnormal update rate
5654 6881 13	SCR operator inducement override switch	Out of calibration
5655 4364 31	Aftertreatment 1 scr conversion efficiency	Condition exists

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
5689 3226 11	Aftertreatment 1 outlet nox sensor	Root cause not known
5715 3521 10	Aftertreatment 1 diesel particulate filter differential pressure	Abnormal rate of change
5716 3610 10	Aftertreatment 1 diesel particulate filter outlet pressure	Abnormal rate of change
5864 4375 3	Aftertreatment 1 diesel exhaust fluid pump command circuit	Voltage above normal or shorted to high source
5865 4375 4	Aftertreatment 1 diesel exhaust fluid pump command circuit	Voltage below normal or shorted to low source
5866 520953 3	Aftertreatment diesel exhaust fluid dosing unit relay feedback	Voltage above normal or shorted to high source
5867 520953 4	Aftertreatment diesel exhaust fluid dosing unit relay feedback	Voltage below normal or shorted to low source.
5868 4339 7	Aftertreatment 1 scr feedback control status	Mechanical system not responding or out of adjustment
5879 3464 3	Electronic throttle control actuator driver circuit	Voltage above normal or shorted to high source
5881 3464 4	Electronic throttle control actuator driver circuit	Voltage below normal or shorted to low source
5935 4334 7	Aftertreatment 1 diesel exhaust fluid pressure	Mechanical system not responding or out of adjustment
5936 4334 15	Aftertreatment 1 diesel exhaust fluid pressure	Data valid but above normal operating range - least severe level
5938 3750 14	Aftertreatment 1 diesel particulate filter conditions not met for active regeneration	Special instructions
5939 520968 9	Machine constrained operation	Abnormal update rate. No communication or an Invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine
5941 520968 19	Machine constrained operation	Received network data in error. The received J1939 datalink message was not valid.
6256 168 15	Battery 1 voltage	Data valid but below normal operating range - moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6257 168 17	Battery 1 voltage	Data valid but below normal operating range - moderately severe level
6263 647 3	Fan control circuit	Voltage above normal, or shorted to high source
6264 647 4	Fan control circuit	Voltage below normal, or shorted to low source
6456 5484 3	Engine fan clutch 2 control circuit	Voltage above normal, or shorted to high source
6457 5484 4	Engine fan clutch 2 control circuit	Voltage below normal, or shorted to low source
6467 1639 15	Fan speed	Data valid but above normal operational range - most severe level
6468 1639 17	Fan speed	Data valid but below normal operational range - most severe level
6471 6799 3	Fan blade pitch position sensor circuit	Voltage above normal, or shorted to high source
6472 6799 4	Fan blade pitch position sensor circuit	Voltage below normal, or shorted to low source
6475 3363 7	Aftertreatment 1 diesel exhaust fluid tank heater	Mechanical system not responding or out of adjustment
6476 3363 18	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but below normal operating range - moderately severe level
6477 5491 3	Aftertreatment diesel exhaust fluid line heater relay	Voltage above normal, or shorted to high source
6478 5491 4	Aftertreatment diesel exhaust fluid line heater relay	Voltage below normal, or shorted to low source
6479 3363 3	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage above normal, or shorted to high source
6481 3363 4	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage below normal, or shorted to low source
6497 51 3	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6498 51 4	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to low source
6499 3597 17	ECU power output supply voltage 1	Data valid but below normal operating range - moderately severe level
6511 6655 3	Maintain ECM power lamp	Voltage above normal, or shorted to high source
6512 6655 4	Maintain ECM power lamp	Voltage below normal, or shorted to low source
6522 111 3	Coolant level sensor 1 circuit	Voltage above normal, or shorted to high source
6523 111 4	Coolant level sensor 1 circuit	Voltage below normal, or shorted to low source
6526 1761 13	Aftertreatment 1 diesel exhaust fluid tank level sensor	Out of calibration
6531 4340 3	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage above normal, or shorted to high source
6532 4340 4	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage below normal, or shorted to low source
6533 4342 3	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage above normal, or shorted to high source
6534 4342 4	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage below normal, or shorted to low source
6535 4344 3	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage above normal, or shorted to high source
6536 4344 4	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage below normal, or shorted to low source
6556 729 3	Engine intake air heater 1 circuit	Voltage above normal, or shorted to high source
6557 729 4	Engine intake air heater 1 circuit	Voltage below normal, or shorted to low source
6563 976 2	Auxiliary intermediate (PTO) speed switch validation	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6568 3695 2	Aftertreatment regeneration inhibit switch	Data erratic, intermittent or incorrect
6583 441 14	Auxiliary temperature sensor input 1	Special instructions
6584 1388 14	Auxiliary pressure sensor input 2	Special instructions
6595 190 11	Engine speed	Root cause not known
6596 3713 31	Diesel particulate filter active regeneration inhibited due to system timeout	Condition exists
6599 521002 31	Engine cranks slowly	Condition exists
6611 6385 3	Engine starter motor relay control circuit	Voltage above normal or shorted to high source
6612 6385 4	Engine starter motor relay control circuit	Voltage below normal or shorted to low source
6613 5842 14	SCR monitoring system malfunction	Special instructions
6618 70 2	Parking brake switch	Data erratic, intermittent, or incorrect
6619 3515 10	Aftertreatment 1 diesel exhaust fluid temperature 2	Abnormal rate of change
6726 4796 31	Aftertreatment 1 diesel oxidation catalyst missing	Condition exists
6752 3364 18	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operating range - moderately severe level
6771 521032 14	Aftertreatment system assembly	Special instructions
6938 5793 9	Desired engine fueling state	Abnormal update rate
6939 7745 9	Engine start request	Abnormal update rate

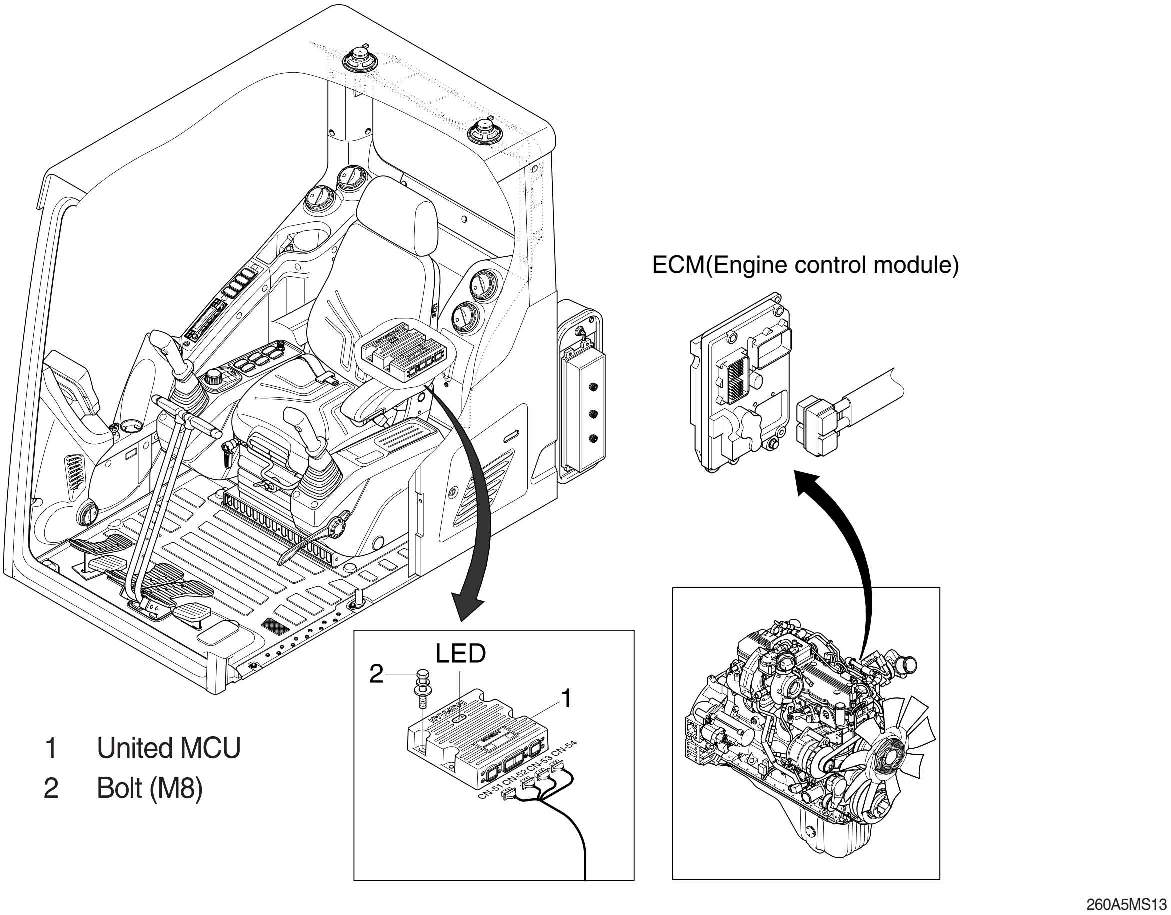
※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
7133 7745 13	Engine start request	Out of calibration
7134 7746 13	Engine start consent	Out of calibration
7135 103 15	Engine turbocharger speed	Data valid but above normal operating range - least severe level
7745 1569 14	Engine protection torque derate	Special instructions
7393 7745 9	Engine start request	Abnormal update rate
7453 3242 15	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operating range - least severe level
7454 3246 15	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operating range - least severe level

※ Some fault codes are not applied to this machine.

GROUP 14 ENGINE CONTROL SYSTEM

1. UNITED MCU AND ENGINE ECM



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 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.

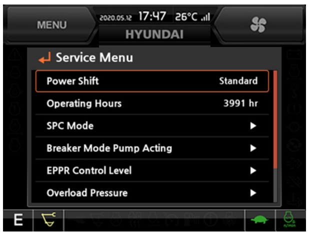
2) HOW TO SWITCH THE POWER SHIFT (STANDARD ↔ OPTION) ON THE CLUSTER

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

- Management
  · Service menu

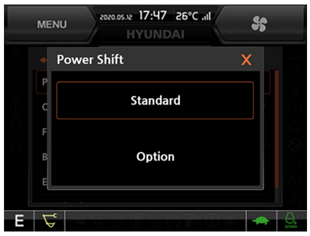
300A3CD105A

→



Enter the password 300A3CD106A

→

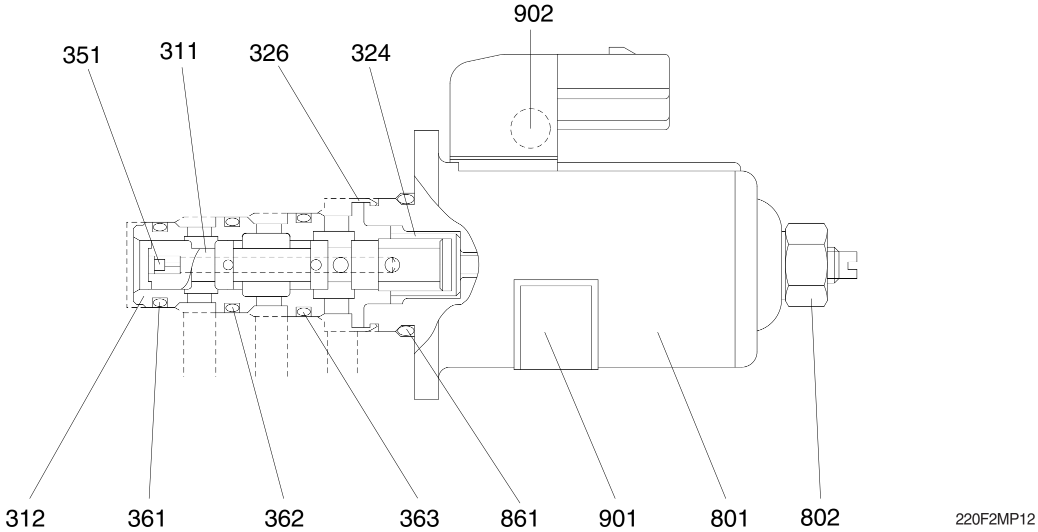


300A3CD107A

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

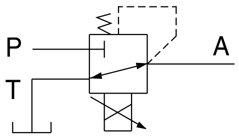
3) OPERATING PRINCIPLE (P1 and P2 pump EPPR valve)

(1) Structure



220F2MP12

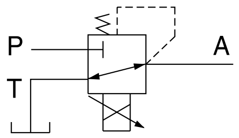
311	Spool	361	O-ring	801	Seal nut
312	Sleeve	362	O-ring	861	O-ring
324	Spring	363	O-ring	901	Name plate
326	Retaining ring	801	Solenoid	902	Function name plate
351	Orifice				

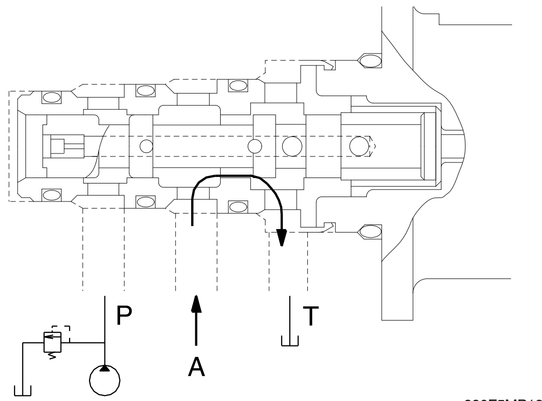


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

Pressure line is blocked and A oil returns to tank.

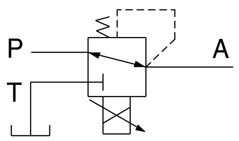


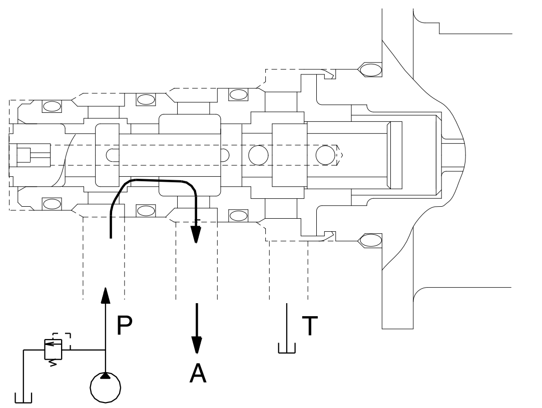


220F5MP13

(3) Operating

Secondary pressure enters into A.





220F5MP14

4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-342 (or 343) from EPPR valve.

② Insert the adapter to CN-342 (or 343) and install multimeter as figure.

③ Start engine.

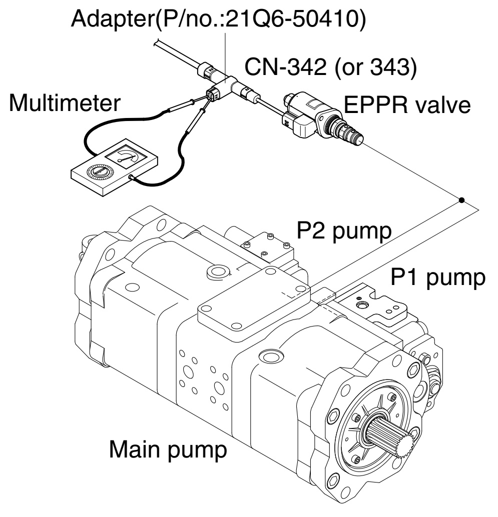
④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

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

⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA



CN-342 for P1 pump
CN-343 for P2 pump

220A5MS21

(2) Check pressure at EPPR valve

① Remove plug and connect pressure gauge as figure.

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

② Start engine.

③ Set S-mode and cancel auto decel mode.

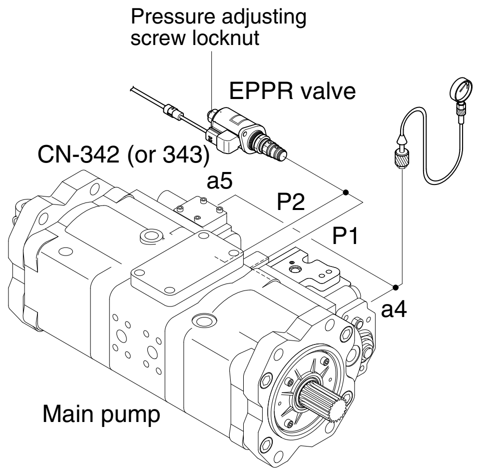
④ Position the multimodal dial at 10.

⑤ If tachometer show approx 1600±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

⑦ After adjust, test the machine.

Spec : 2~25 kgf/cm² (30~350 psi)



a4 for P1 pump
a5 for P2 pump

220A5MS22

2. BOOM PRIORITY EPPR VALVE

1) COMPOSITION

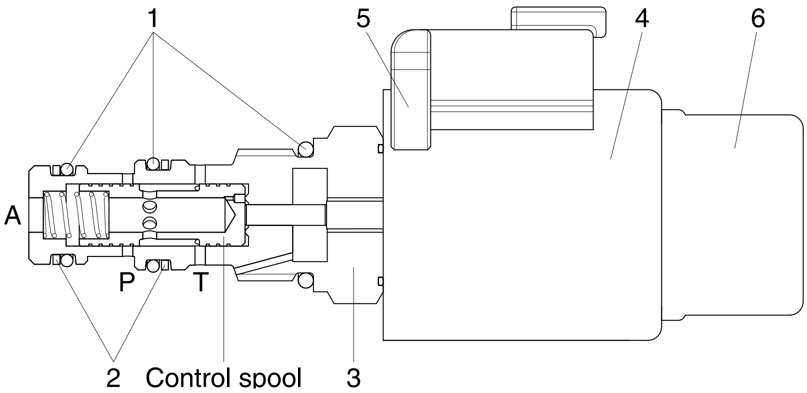
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

2) CONTROL

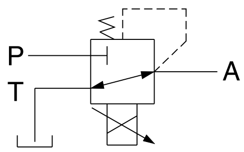
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at 30Ω and 24 V.

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-242 (or 243) from EPPR valve.

② Insert the adapter to CN-242 (or 243) and install multimeter as figure.

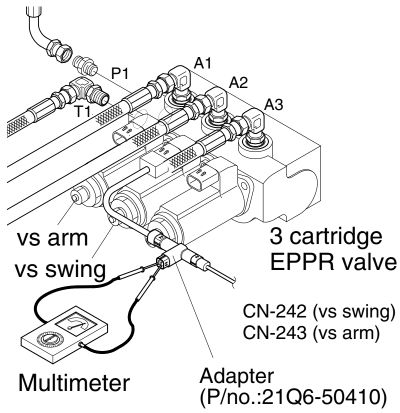
③ Start engine.

④ Set S-mode and cancel auto decel mode.

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

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

Spec : 400~600 mA
(combined boom up and swing operation)



220A5MS15

(2) Check pressure at EPPR valve

① Remove hose from A5 port and connect pressure gauge as figure.
- Gauge capacity : 0 to 50 kgf/cm^2 (0 to 725 psi)

② Start engine.

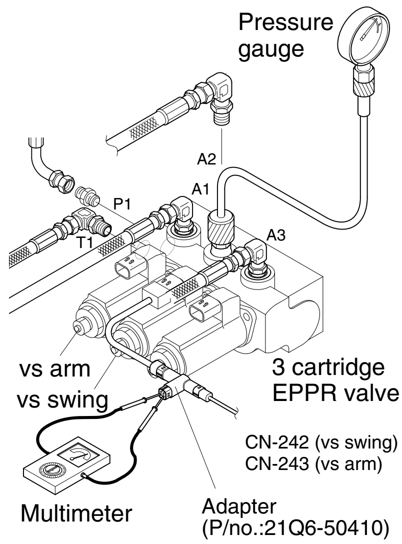
③ Set S-mode and cancel auto decel mode.

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

⑤ If pressure is not correct, adjust it.

⑥ After adjust, test the machine.

Spec : 12~37 kgf/cm^2 (170~530 psi)
(combined boom up and swing operation)



220A5MS16

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.

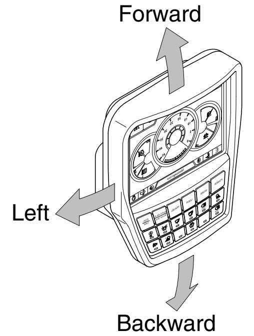
2. CLUSTER

1) MONITOR PANEL

260A5CD20A

※ The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem.
The warning lamp blinks until the problem is cleared. Refer to page 5-75 for details.

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



290F3CD47

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor

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

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

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

a. Engine rpm display : 0 rpm

b. Engine coolant temperature gauge : White range

c. Hydraulic oil temperature gauge : White range

d. Fuel level gauge : White range

③ Indicating lamp state

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

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

c. Travel speed pilot lamp : Low (turtle)

(2) Start of engine

① Check machine condition

a. RPM display indicates at present rpm

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

※ When normal condition : All warning lamp OFF

c. Work mode selection : General work

d. Power mode selection : E mode or U mode

e. Travel speed pilot lamp : Low (turtle)

② When warming up operation

a. Warming up pilot lamp : ON

b. After engine started, engine speed increases 1100 rpm.

※ Others same as above.

③ When abnormal condition

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

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

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

3) CLUSTER CONNECTOR

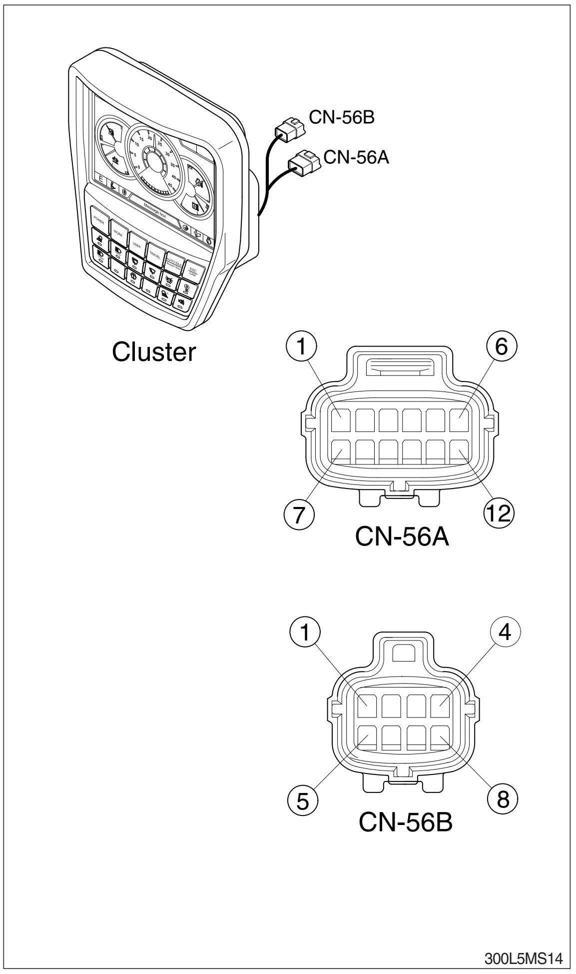
(1) CN-56A

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

(2) CN-56B

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

NTSC : National Television System Committee



4) GAUGE

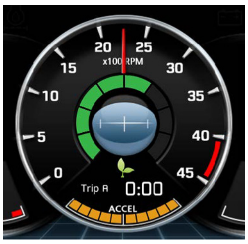
(1) Operation screen

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

300A3CD21A

1	RPM / Speed gauge	5	DEF/AdBlue® level gauge
2	Engine coolant temperature gauge	6	Tripmeter display
3	Hydraulic oil temperature gauge	7	Eco guage
4	Fuel level gauge	8	Accel dial gauge

(2) RPM / Speed gauge



300A3CD22

① This display the engine speed.

(3) Engine coolant temperature gauge

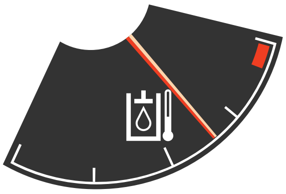
290F3CD53

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

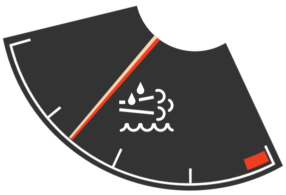
290F3CD55

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® overfull.

※ Refer to page 5-80.

※ 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 5-105 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

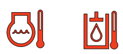
290F3CD59

① This gauge indicates the level of accel dial.

5) WARNING LAMPS

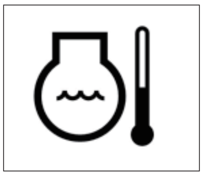
300A3CD23B

※ Warning lamps and buzzer

Warnings	When error happened	Lamps and buzzer
All warning lamps except below	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position and blinks, and the buzzer stops when ; - the buzzer stop switch  is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position and light ON or blinks, and the buzzer stops when ; - the buzzer stop switch  is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched ※ **Refer to page 5-80 for details.**
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position 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	· Cluster displays this pop-up when it has communication error with MCU. · If communication with MCU become normal state, it will disappear automatically.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	※ **Refer to page 5-76 for details.**
	Warning lamp lights ON and the buzzer sounds	※ **Refer to page 5-80 for details.**

※ Refer to page 5-87 for the buzzer stop switch  and operator's manual page 3-66 for the jog dial module.

(1) Engine coolant temperature warning lamp



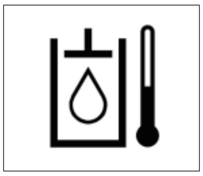
290F3CD61

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 AUTO IDLE Buzzer Stop 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



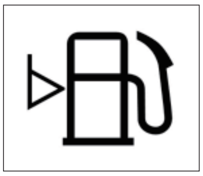
290F3CD62

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 AUTO IDLE Buzzer Stop 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

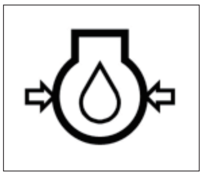
290F3CD64

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 AUTO IDLE Buzzer Stop is pushed. And the buzzer stops.**

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

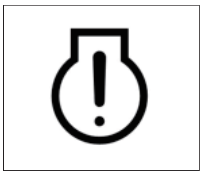
(5) Engine oil pressure warning lamp



290F3CD65

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

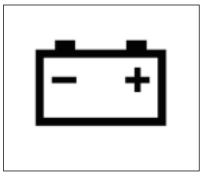
(6) Check engine warning lamp



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.

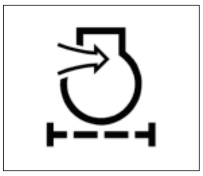
(7) Battery charging warning lamp



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.

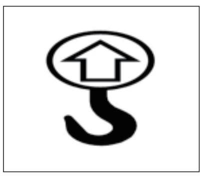
(8) Air cleaner warning lamp



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.

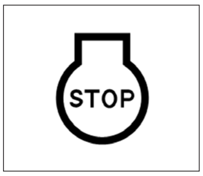
(9) Overload warning lamp (opt)



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 5-80.**

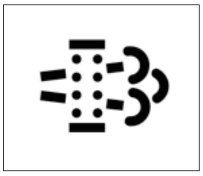
③ This lamp pops up and the buzzer sounds when the stationary SCR system cleaning is not performed.

※ **Refer to page 5-78.**

※ **Please contact your HD Hyundai Construction Equipment service center or local dealer.**

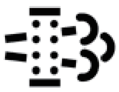
※ **"Engine shutdown" cluster message up when the exhaust gas temperature reaches above 800℃.**

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

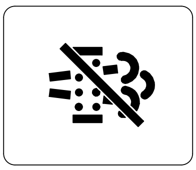


290F3CD70

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 5-79.**
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 challenging 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

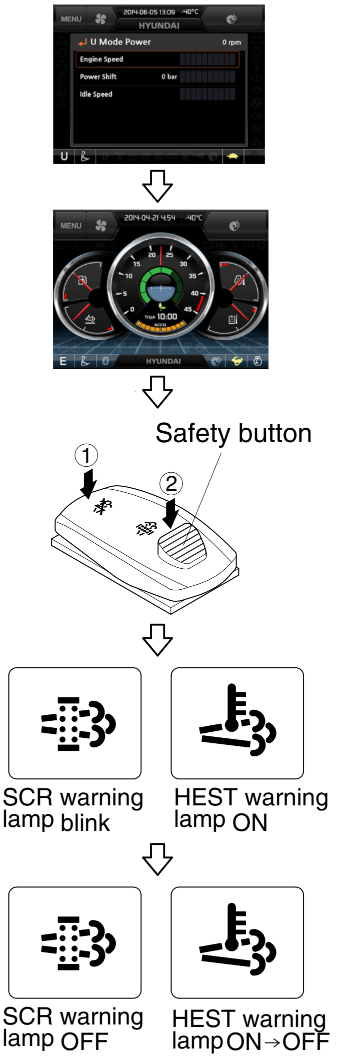


2609A3CD20

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 3-42 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.

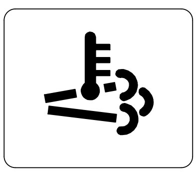
※ Refer to the operator's manual page 3-41 for the SCR system cleaning switch operation.

※ 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.

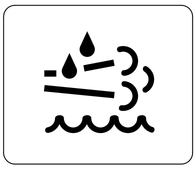
② The lamp will also illuminate during a manual SCR system cleaning.

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.

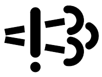
(14) DEF/AdBlue® level warning lamp



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
Fail in SCR system 	DEF/AdBlue® level 	Check engine 	Stop engine 	
On	On	Off	Off	· The DEF/AdBlue® level has fallen below the initial warning level (10%).
On	On	On	Off	· The DEF/AdBlue® level has fallen below the initial derate level (2.5%). · The engine power will be limited automatically.
On	Blink	On	On	· This 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) Water in fuel warning lamp

300A3CD24A

① This warning lamp lights ON and the buzzer sounds when the water separator is full of water or malfunctioning.

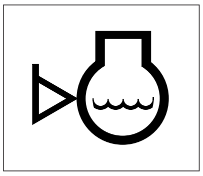
※ When this lamp lights ON, stop the machine and spill water out of the separator.

(16) Seat belt reminder warning lamp

300A3CD25

① When operator don’t fasten the seat belt, the seat belt reminder warning lamp pops up and the buzzer sounds.
② Fasten the seat belt.

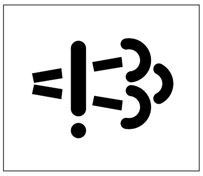
(17) Coolant level warning lamp



760F3CD58

① This warning lamp indicates lack of coolant.
② Check and refill coolant.

(18) Fail in SCR system warning lamp



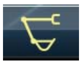
300A3CD15

① This warning lamp indicates there are faults related to SCR system.
② The lamp lights ON when each of the below warnings is happened.
a. Low DEF/AdBlue® level
b. Poor quality of DEF/AdBlue®
c. Tempering or malfunction in the aftertreatment system
③ Once the lamp lights ON, the engine will derate shortly.
※ Please contact your HD Hyundai Construction Equipment service center or local dealer.

6) PILOT LAMPS

300A3CD26A

(1) Mode pilot lamps

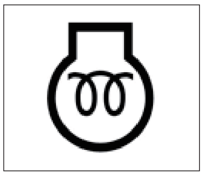
No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
		E	Economy power mode
2	User mode	U	User preferable power mode
3	Work mode		General operation - IPC speed mode
			General operation - IPC balance mode
			General operation - IPC efficiency mode
			Breaker operation mode
			Crusher operation mode
			Lifting mode
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp


300A3CD32

① The lamp will be ON when pushing power max switch on the LH RCV lever.
② The power max function is operated maximum 8 seconds.
※ Refer to the operator's manual page 3-45 for power max function.

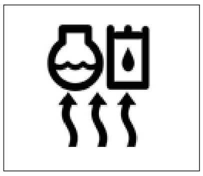
(3) Preheat pilot lamp



290F3CD79

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

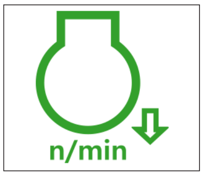
(4) Warming up pilot lamp



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.

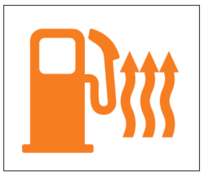
(5) Decel pilot lamp



300A3CD33

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 3-45

(6) Fuel warmer pilot lamp



300A3CD34

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

300A3CD35

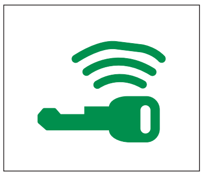
① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.
② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.
※ Refer to the page 5-98.

(8) RMCU signal strength pilot lamp (mobile only)

220A3CD200

① This lamp indicates RMCU signal strength as below.
: Searching
: Bad
: Normal
: Good
: Excellent

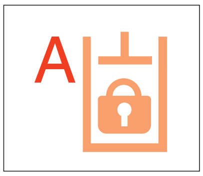
(9) Smart key pilot lamp (opt)



300A3CD36A

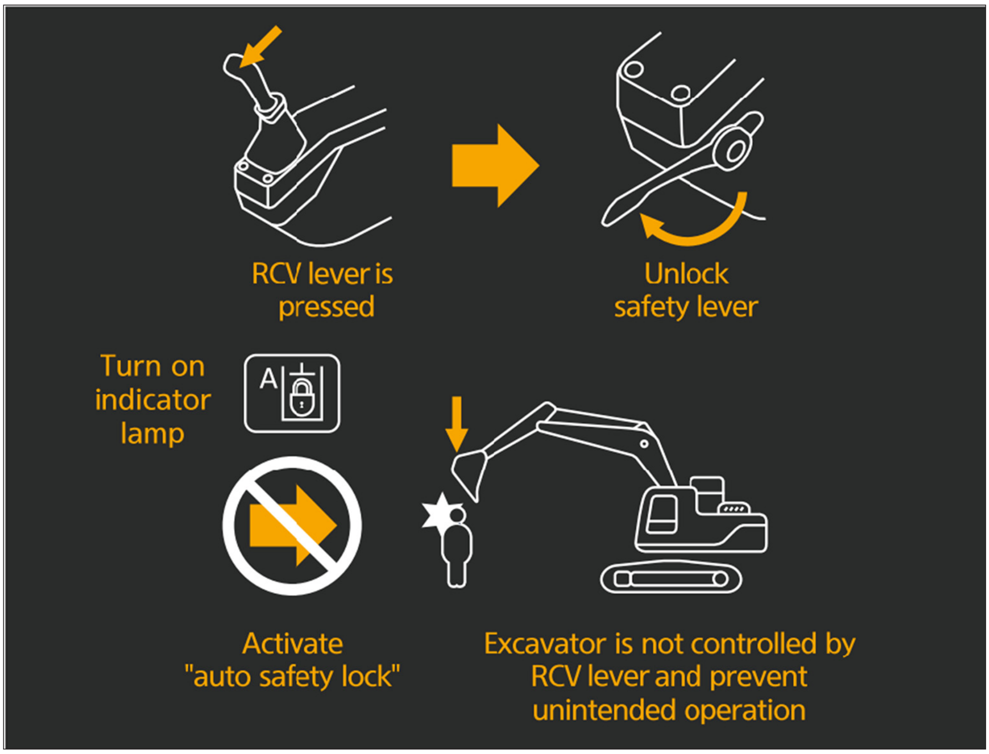
① This lamp is ON when the engine is started by the start button.
② This lamp is red when the a authentication fails, green when succeeds.
※ Refer to the page 5-99.

(10) Auto safety lock pilot lamp



300A3CD37A

① Auto safety lock system prevents unintended operation of the machine in order to improve safety.
② Engine will only start if safety knob is locked.
③ If operator unlocks safety knob when RCV lever is pressed, machine is not controlled by RCV lever.
⚠ If operator unlocks safety knob while any control/function is being operated, the machine will move violently. This could cause serious injury, death or damage to property.
④ The function is released only by turning the safety knob to the UNLOCK position and the LOCK position again.



300A3CD38

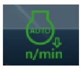
(11) Auto engine shutdown pilot lamp

220A3CD202A

① This lamp is turned ON when the auto engine shutdown is activated.

※ Refer to the page 5-94.

(12) Engine rpm state

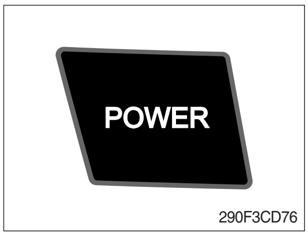
Function	Safety Knob	Auto Idle Mode	One Touch Decel	RPM State
				
State 1	Unlock	OFF	OFF	High rpm
State 2	Unlock	OFF	ON	Low rpm
State 3	Unlock	ON	OFF	Auto Idle rpm
State 4	Lock	ON	OFF	Low rpm
State 5	Lock	OFF	ON	Low rpm
State 6	Unlock	ON	ON	Low rpm
State 7	Lock → Unlock	ON	ON	Low → High → Low rpm (few seconds later)
State 8	Lock	ON	OFF	Low rpm
State 9	Lock	ON	ON	Low rpm

7) SWITCHES

300A3CD39A

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-82 for details.

(1) Power mode switch



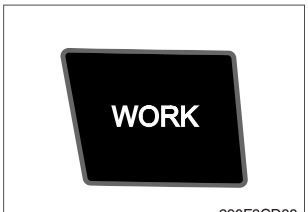
290F3CD76

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)
· : Lifting mode
· Not installed : Breaker or crusher is not installed.

※ Refer to the operator's manual page 2-7 for details.

300A3CD168

② If you press this switch for a time (1 second), quick pop-up will appear. When you select an attachment from the popup, the operation mode will immediately switch to selected attachment.

(3) User mode switch

290F3CD89

① This switch is used to select the user mode.
② Refer to page 5-91 for another set of the 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

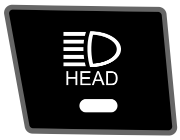
① This switch is used to return to the previous menu or parent menu.
② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped). Please refer to page 5-105 for the camera.
③ If the camera is not installed, this switch is used only ESC function.

(7) Work light switch

290F3CD93

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

(8) Head light switch



290F3CD94

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

(9) Intermittent wiper switch


290F3CD95

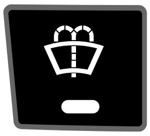
① This switch is used to wipe operates intermittently.
② The pilot lamp is turned ON when operating the switch.

(10) Wiper switch


290F3CD96

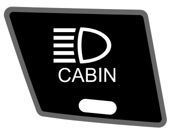
① This switch is used to operate the window wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp is turned ON when operating the switch.
※ If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause.
If the switch remains ON, motor failure can result.

(11) Washer switch


290F3CD100

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

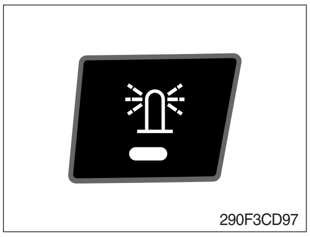
(12) Cab light switch



290F3CD99

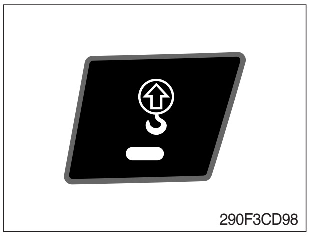
① This switch turns ON the cab light on the cab.
② The pilot lamp is turned ON when operating the switch.

(13) Beacon switch


290F3CD97

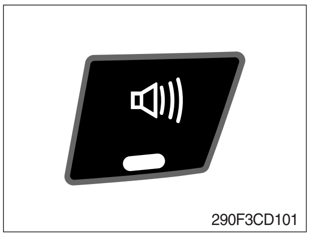
① This switch turns ON the rotary light on the cab.
② The pilot lamp is turned ON when operating the switch.

(14) Overload switch


290F3CD98

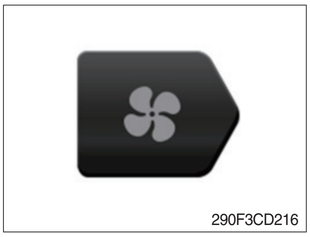
① When this switch turned ON, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.
② When it turned OFF, buzzer stops and warning lamp goes out.
⚠ **Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.**

(15) Travel alarm switch


290F3CD101

① This switch is to activate travel alarm function surrounding when the machine travels.
· ON : The travel alarm function is activated.
· OFF : The travel alarm function is not activated.

(16) Air conditioner quick touch switch


290F3CD216

① This switch used to select air conditioner control mode.
※ Refer to the page 5-107.

(17) Main menu quick touch switch

290F3CD217

① This switch is to activate the main menu in the cluster.
※ Refer to the page 5-90.

8) MAIN MENU

※ You can select or set the menu by the jog dial module or touch screen.
On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

· Operation screen

300A3CD40A

※ Please refer to the jog dial module, operator's manual page 3-66 for selection and change of menu and input value.

(1) Structure

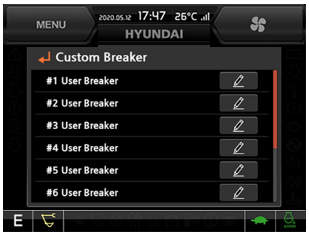
No	Main menu	Sub menu	Description
1	 Mode 290F3CD103	Work tool U mode power Combination speed setting Auto power boost IPC mode Auto engine shutdown Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Load sensitivity, Trucking balance, Boom/Arm balance, Arm speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode / initial work mode, Accel initial mode / step Switch function
2	 Monitoring 290F3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, Engine ECM, FATC, AAVM (option) MCU, Engine ECM, FATC, AAVM (option) All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 290F3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor, jog dial module, switch controller, RMCU, Relay drive unit, FATC, AAVM (option) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure, Optional piping pressure removal, Fine swing Clinometer setting Cluster, ETC device
4	 Display 290F3CD106	Display item Clock Brightness Unit setup Language selection Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, ETC A type, B type
5	 Utilities 290F3CD107	Tripmeter Camera Auto idle time setting	3 kinds (A, B, C) Camera setting, Auto mode (travel) Time setting

(2) Mode setup

① Work tool (Machine Serial No. : -#0205)

300A3CD41A

A



300A3CD42A

B

300A3CD43A

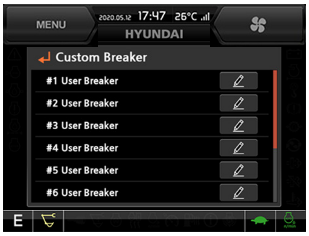
· Select installed optional attachment
  - A : It can set the user's attachment.
    It is available in setting #1~#10.
  - B : Max flow - Set the maximum flow for the attachment.
    Relief pressure - Set the relief pressure.

(2) Mode setup

① Work tool (Machine Serial No. : #0206-)

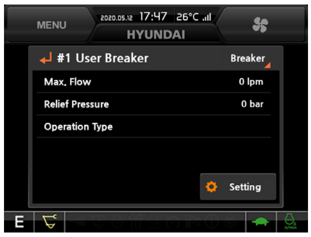
300A3CD41A

A



300A3CD42A

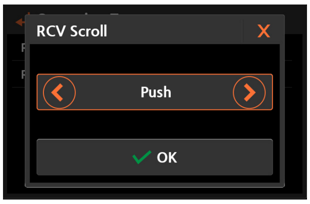
B



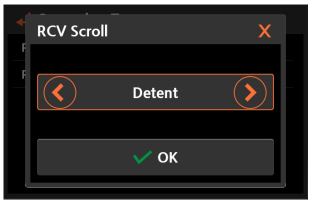
3003CD43B

· Select installed optional attachment
  - A : It can set the user's attachment.
    It is available in setting #1~#10.
  - B : Max flow - Set the maximum flow for the attachment.
    Relief pressure - Set the relief pressure.
    Operation type - Set the operation type for attachment.

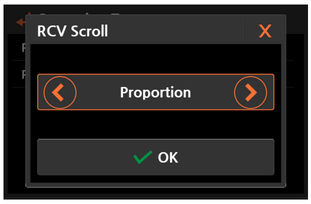
300A3CD651



140WA3CD654A



140WA3CD653A

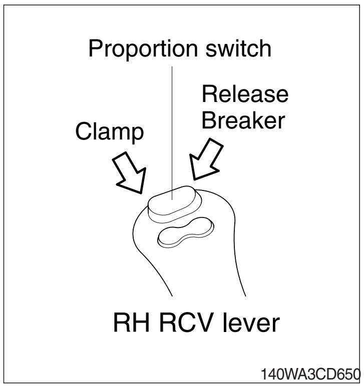


140WA3CD652A

■ Operation type

Operation type is used to set the operation of the proportion switch on the RCV lever if equipped proportional function.

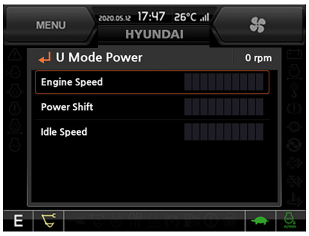
- Push : Switch actuation will be deactivated when the proportion switch is released.
- Detent : Switch actuation will remain even if the proportion switch is released.
  To deactivate, move the switch in the same direction again or to the opposite direction.
- Proportion : Switch actuation is proportional to the movement of the proportion switch.



140WA3CD650

② U mode power

300A3CD44A



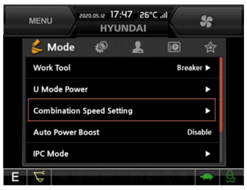
300A3CD45B

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

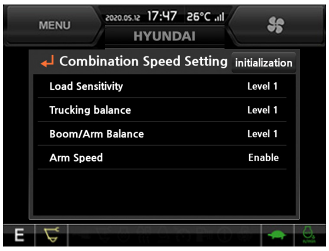
Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift
1	1300	750	10%
2	1400	800	20%
3	1500	850	30%
4	1600	900	40%
5	1700	950	50%
6	1800	1000	60%
7	1850	1050	70%
8	1900	1100 (auto decel)	80%
9	1950	1150	85%
10	2000	1200	90%

※One touch decel & low idle : 1000 rpm

③ Combination speed setting



220A3CD300A



220A3CD301A

220A3CD302A

· Load sensitivity
- It changes fine control sensitivity. (boom up or arm out operation)
- When the segment is close to high, the fine operation speed is increased. (Load sensitivity is high.)
- It is reccomended to set high segment when lifting heavy duty equipment or load.

⚠ The fine control speed is able to be unexpectedly fast by high setting and load condition. Do use the function through fine control test considering the condition.

· Trucking balance

This is control the swing and boom up speed when the combined operation is activated.

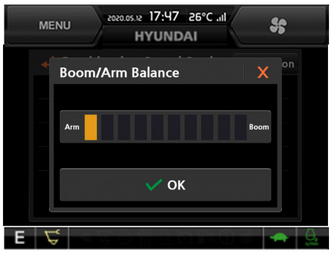
- It adjusts the ratio of relative speed in the boom up and swing combination operation.
- The segment is close to swing, the swing speed has a priority.
- The segment of swing is recommended for use in work environments that require high swing speed and acceleration, some slow boom up, and more than 45 degrees.
- The segments are close to boom, the boom up speed has a priority.
- The segment of boom is mainly used in work environments that require high boom up work at a short swing angle of about 45 degrees.

220A3CD303A

· Boom / Arm balance

This is control the boom up and arm in speed when the combined operation is activated. It is effective in work place mainly for leveling work.

- When the level is closer to arm, arm in operation speed has more priority than boom up operation.
- When the level is closer to boom, boom up operation speed has more priority than arm in operation.

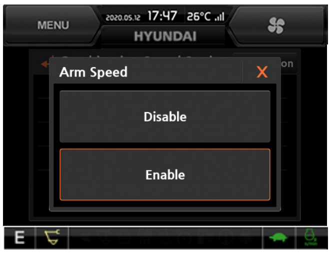


220A3CD304A

· Arm speed

This provides ON and OFF of the regeneration function of the arm in operation.

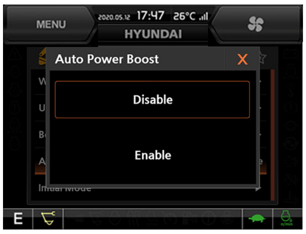
- Enable means that regeneration is ON, and an energy can be used efficiently through automatic regeneration according to the load.
- Disable means that regeneration is always OFF, and it can be effective for heavy digging work.



220A3CD305A

④ Auto power boost

300A3CD49A

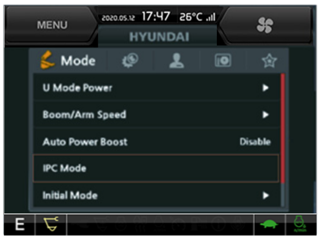


300A3CD50A

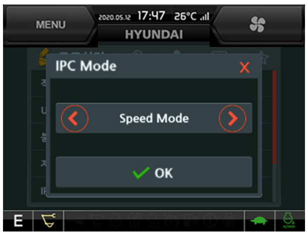
· The power boost function can be activated or cancelled.
  - Enable : The digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds
  - Disable : Not operated.

※ The auto power boost function is activated in P mode. It does not work in S mode and E mode.

⑤ IPC mode

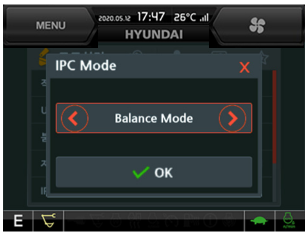


300A3CD51A



300A3CD52A

210A3CD53A



300A3CD54A

210A3CD55A

300A3CD56A

210A3CD57A

· The operator can improve fuel consumption and working speed through IPC mode.
· IPC mode is working by using inertial energy in specific case.
· The IPC mode can be selected by this menu.
  - Speed mode / Balance mode / Efficiency mode
· The effect of IPC mode is different at power mode. The fuel efficiency is about 5% in P mode and about 3% in E mode based on Balance mode against Speed mode.
· The manufacturer recommends using the balance mode in IPC mode.

※ The effect is the result of the standard operation. Depending on the operator's working conditions and machine options, the results could be different.

※ Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to page 5-101.

⑥ Automatic engine shutdown (option)

300A3CD58A

300A3CD59A

300A3CD60A

· The automatic engine shutdown function can be set by this menu.
  - One time
  - Always
  - Disable
  - Wait time setting : Max 40 minutes, min 2 minutes

⑦ Initial mode

300A3CD61A

300A3CD62B

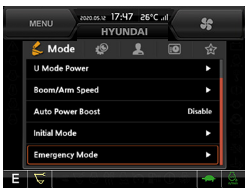
· Key on initial mode
  - Selected the power mode is activated when the engine is started.

· Key on initial work mode
  - Not installed
  - Last setting
  - Work mode

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

· Accel initial step
  - 0~9 step

⑧ Emergency mode



300A3CD63A

300A3CD64A

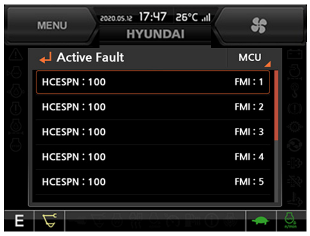
· This mode can be use when the switches are abnormal on the cluster.
· The cluster switches will be selected by touched each icon.

(3) Monitoring

① Active fault

300A3CD65A

300A3CD66A

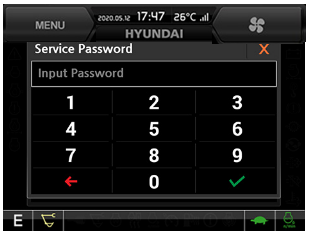


300A3CD67A

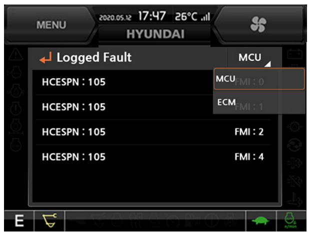
· The active faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

② Logged fault

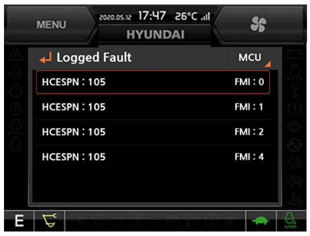
300A3CD68A



300A3CD72A



300A3CD69A

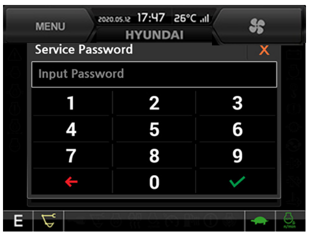


300A3CD70A

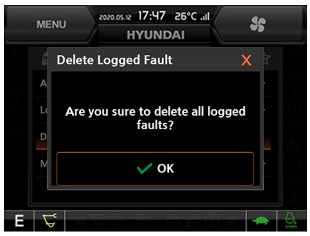
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

③ Delete logged fault

300A3CD71A



300A3CD72A

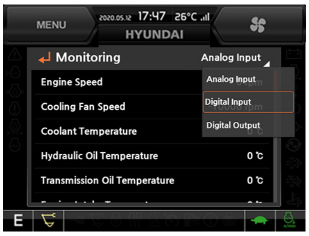


300A3CD73A

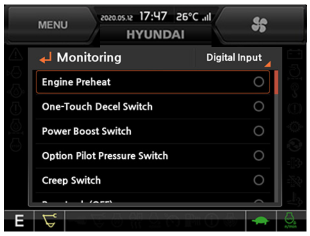
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be deleted by this menu.

④ Monitoring

300A3CD74A



300A3CD75A



300A3CD76A

· The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).

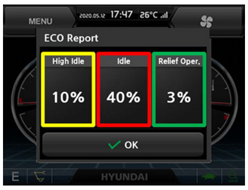
· The switch status or output status can be confirmed by this menu (Digital input & Digital output).

· The activated switch or output pilot lamps ● are light ON.

(4) Management

① ECO report

This reports the machine's inefficient operation status in order to improve operator's improper working habit.



300A3CD77A

High idle

300A3CD78A

· Show each usage ratio of high idle, idle and relief operation when monitor is turned ON.

· Show the usage ratio's daily record for 7 days and accumulated record from the first operation.

Idle

300A3CD79A

Relief operation

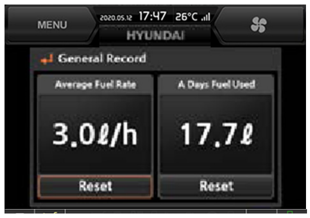
300A3CD80A

② Fuel rate information

300A3CD81A

300A3CD82A

A



300A3CD83A

· 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

300A3CD84A

· 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

300A3CD85A

· 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".

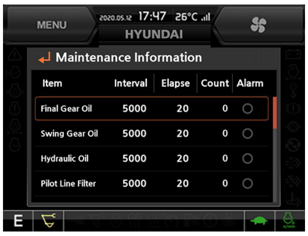
D

300A3CD86A

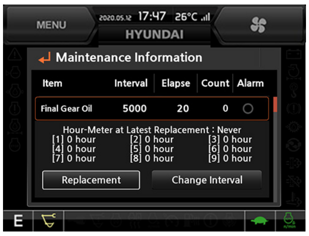
· Mode record (D)
- Average fuel rate for each power mode/accel dial (at least 7) from "Reset" to now.
- No record during idle.
- All mode records deletion by "Reset".

③ Maintenance information

300A3CD87A



300A3CD88A



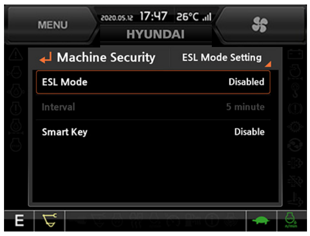
300A3CD89A

· Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
· Replacement : The elapsed time will be reset to zero (0).
· Change interval : The change or replace interval can be changed in the unit of 50 hours.
· Change or relpace interval : Refer to maintenance.

④ Machine security

300A3CD90A

300A3CD91A



300A3CD92A

300A3CD93A

300A3CD94A

· 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.

300A3CD95A

300A3CD96A

300A3CD91A

Enter the current password

300A3CD98A

Enter the new password again

300A3CD99A

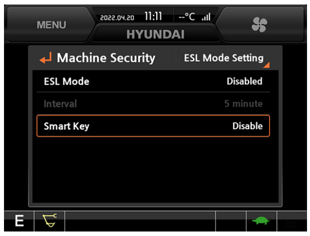
Enter the new password

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

- Smart key

300A3CD90A

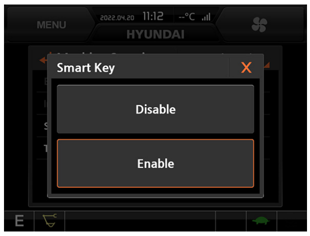
300A3CD91A



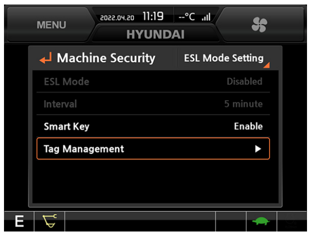
300A3CD001

· 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.

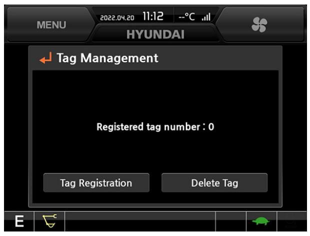
- Tag management
· When registering a tag : Only the tag you want to register must be in the cabin.
· When deleting a tag : All registered tags are deleted.



300A3CD002

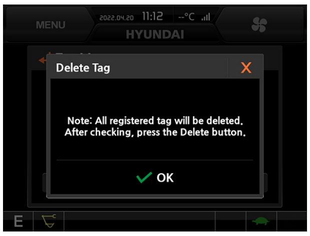


300A3CD003



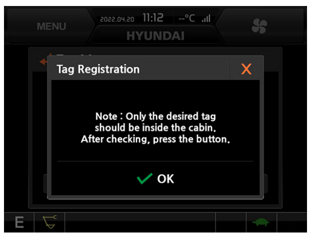
300A3CD004

Deleting



300A3CD006

Registering



300A3CD005

※ Engine Starting Condition

Case	ESL Mode	Smart Key	Condition
1	Disable	Disable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started without password input.
2	Disable	Enable	If Smart Key is enabled, ESL Mode is automatically enabled. This Case 2 work the same as the Case 4.
3	Enable	Disable	- With registered tag : Engine can be started with password input. - Without registered tag : Engine can be started with password input.
4	Enable	Enable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started with password input.

⑤ Machine Information

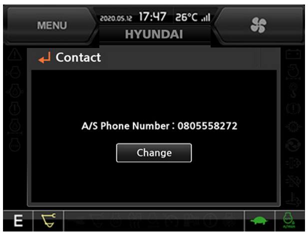
300A3CD100A

300A3CD101A

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

⑥ Contact (A/S phone number)

300A3CD102A



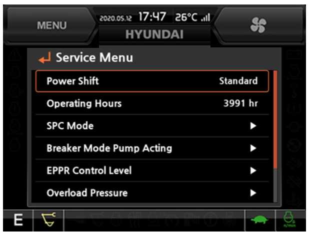
300A3CD103A

300A3CD104A

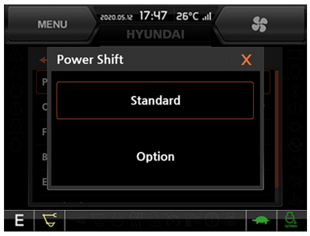
Enter the new A/S phone number

⑦ Service menu

300A3CD105A



300A3CD106A



300A3CD107A

※ This menu can be used only HCE service man and can not be accessible by the owner and the operator.

- Power shift (standard / option) : Power shift pressure can be set by option menu.
- Operating hours : Operating hours since the machine line out can be checked by this menu.
- Breaker mode pump acting (1 pump / 2 pump)
- EPPR current level (attach flow EPPR 1 & 2, boom priority EPPR, attach relief pressure EPPR 1& 2)
- Overload pressure : 100 ~ 350 bar
- Opitonal piping pressure removal (Disable / Enable)
  It is removing the residual pressure remaining in the option line when the quick coupler is operated.
- Fine swing (Disable / Enable)

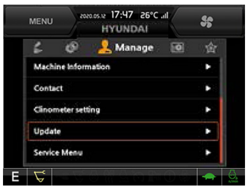
⑧ Clinometer

300A3CD108A

300A3CD109A

- When the machine is on the flatland, if you touch "initialization" on cluster, the values of X, Y will reset to "O".
- You can confirm tilt of machine in cluster's operating screen.

⑨ Update (cluster & ETC devices)

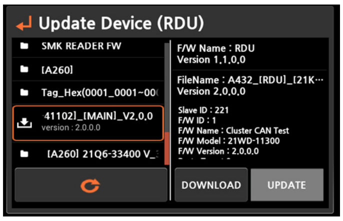


300A3CD110A

300A3CD111A

300A3CD112A

300A3CD114A



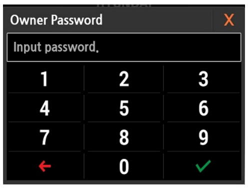
380F3CD06

· ETC devices and cluster can be updated through CAN 2 network.
· Insert USB memory stick which includes program files, start download.

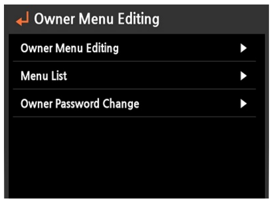
⑩ OME (owner menu editing)

The owner of machine can restrict operator access to set functions.

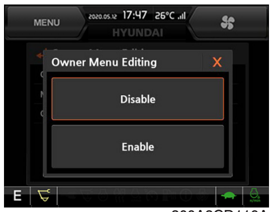
300A3CD115A



300A3CD115B



300A3CD115C



300A3CD116A

300A3CD117A

300A3CD118A

· Owner can set the status of the function.
  - Enable
  - Disable
· In the menu, owner can set the list of functions in which they would like to lock or leave unlocked.
· Owner password (default password : 11111)
  - Owner can manage and change the password.
  - Necessary to input the password to access function menu.

· Password change

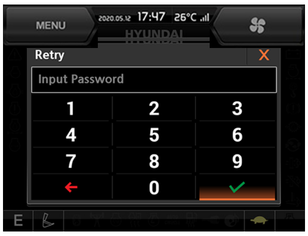
- The password is 5~10 digits.

210WF3CD190A

290F3CD140A

290F3CD135A

Enter the current password



290F3CD143A

Enter the new password again

290F3CD142A

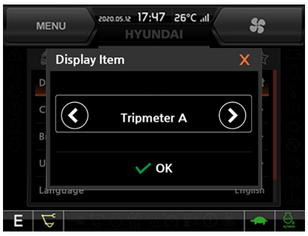
Enter the new password

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

(5) Display

① Display item

300A3CD119A



300A3CD120A

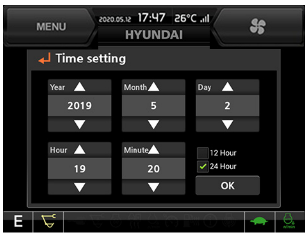
300A3CD121A

· The center display type of the LCD can be selected by this menu.

· The engine speed or each of the tripmeter (A,B,C) is displayed on the center display.

② Clock

300A3CD122A



300A3CD123A

· The first line's three spots "**/**/****" represent Month/Day/Year each.

· The second line shows the current time. (0:00~23:59)

③ Brightness

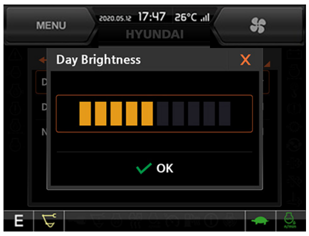
300A3CD124A

300A3CD125A

300A3CD126A

300A3CD127A

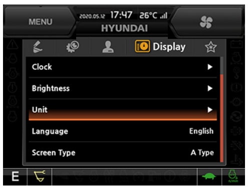
300A3CD128A



300A3CD129A

· If "Auto" is chosen, brightness for day and night can be 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



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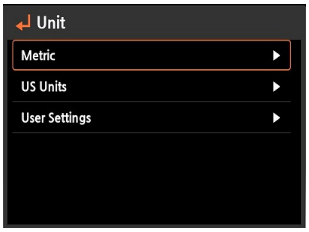
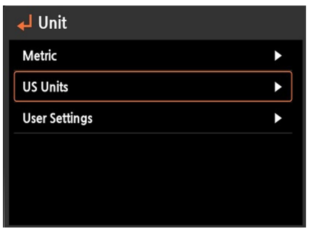


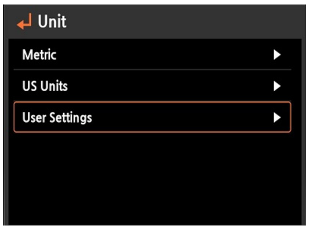
300A3CD130B

300A3CD130C

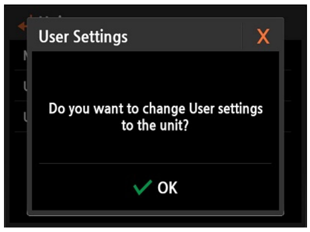


300A3CD130D

300A3CD130E

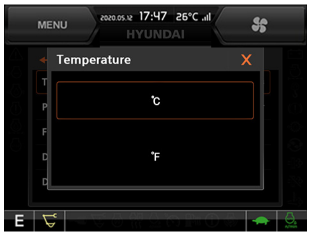


300A3CD130F



300A3CD130G

300A3CD131A



300A3CD132A

· 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

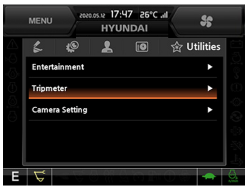
300A3CD133A

300A3CD134A

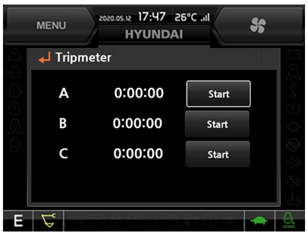
· User can select preferable language and all displays are changed the selected language.

(6) Utilities

① Tripmeter



300A3CD143A

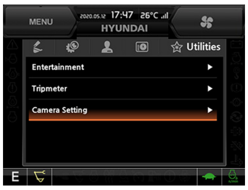


300A3CD144A

· 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.

② Camera setting

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



300A3CD145A

300A3CD146B

300A3CD147A

· Auto Mode (Travel) : Enable
The cluster will automatically shows camera view while machine is traveling.
· In the operation screen, rear camera screen show up when ESC/CAM switch is pushed.

300A3CD97A

290F3CD221

③ Auto idle time setting

300A3CD166

300A3CD167

· The auto idle time is can be set by this menu.
· Time : 3~30 seconds

④ AAVM (Advanced Around View Monitoring, option)

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

Buzzer stop switch

Escape switch

300A3CD149A

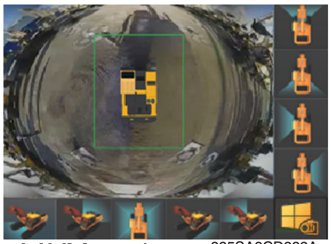
- **Escape switch**

· Activates AAVM mode from the beginning if AAVM is installed.

· While in the AAVM mode, select the ESC switch to return to the home screen.

300A3CD97A

Home screen

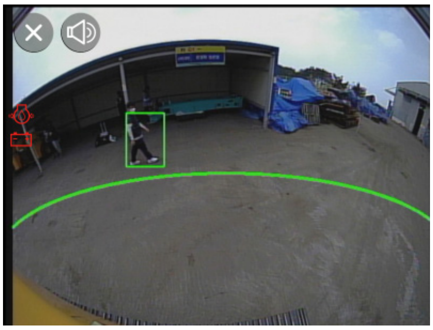


AAVM mode 235SA3CD222A

- **Buzzer stop switch**

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

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



220A3CD246

· When a worker/pedestrian reaches the green line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a blue rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

220A3CD247

· When a worker/pedestrian reaches the red line, which is an internal danger area equipped on the cluster, warning buzzer sounds and it displays a red rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

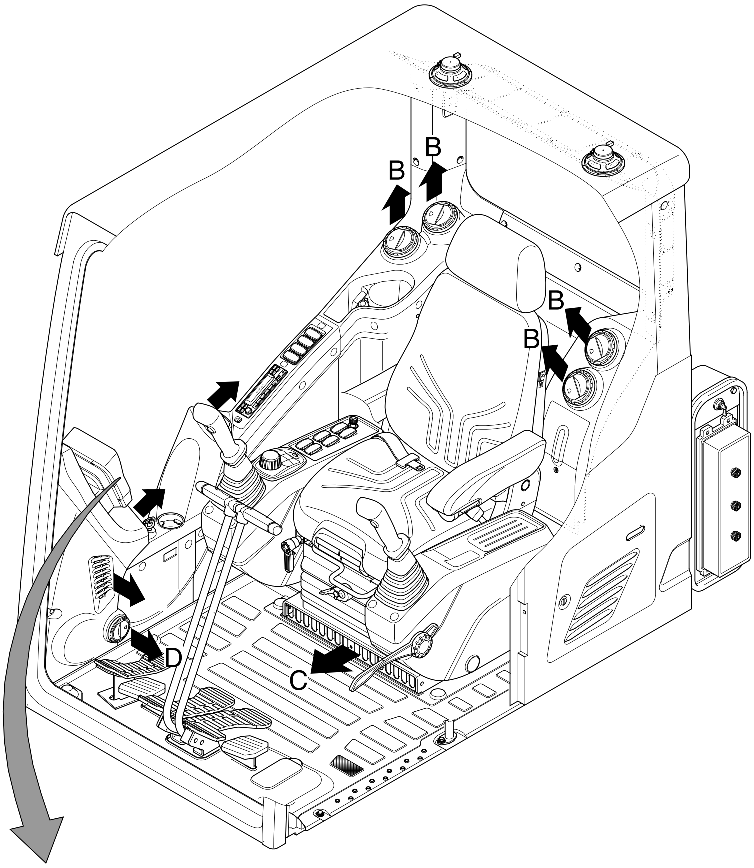
⚠ Failure to comply may result in serious injury or death.

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

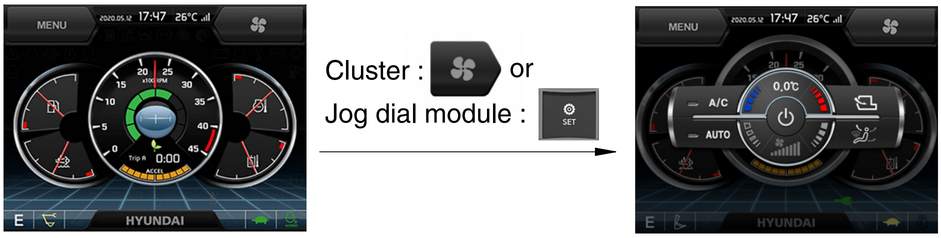
9) AIR CONDITIONER AND HEATER

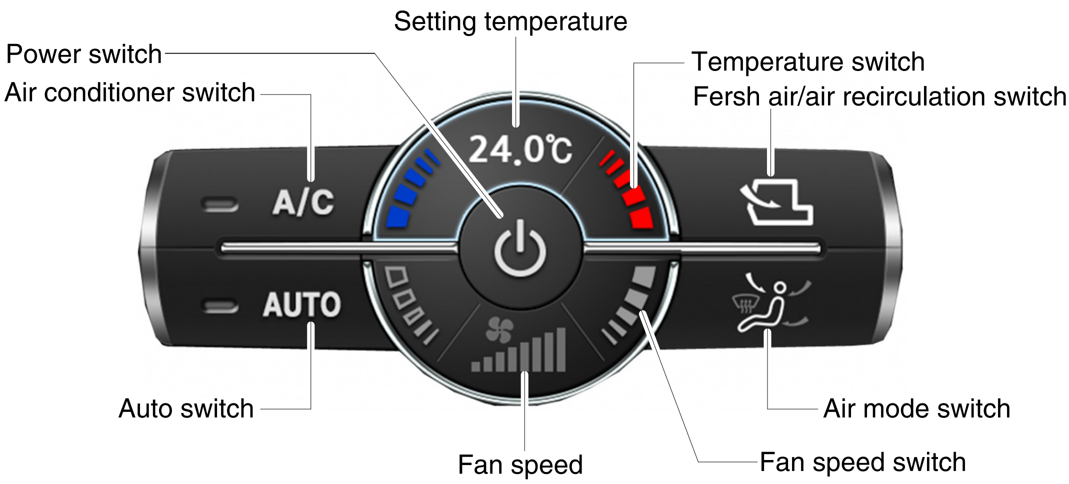
Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

· Location of air flow ducts



Cluster LCD





220A3CD21A

※ Jog dial module : Refer to page 3-66.

(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.

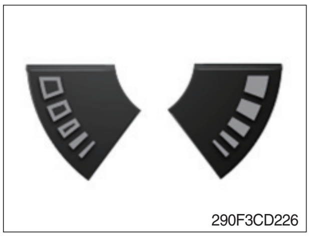
Temperature	Compressor	Fan speed	In/outlet	Mode
Max cool	ON	Hi (8 step)	Recirculation	Face
Max warm	OFF	Hi (7 step)	Fresh	Def/Foot

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)

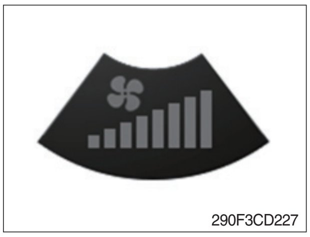
(6) Fan speed switch



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.

(10) Self diagnosis function

① Diagnostic methods : Diagnostic information window, select
② Diagnostic indication (Displays fault)

Fault code	Description	Fail safe function
F01	Ambient temperature sensor open	20˚C alternate value control
F02	Ambient temperature sensor short	
F03	Cab inside temperature sensor open	25˚C alternate value control
F04	Cab inside temperature sensor short	
F05	Evaporate temperature sensor open	0˚C alternate value control
F06	Evaporate temperature sensor short	
F07	Null	-
F08	Null	-
F09	Mode 1 actuator open/short	The alternate value is face
F10	Mode 1 actuator drive circuit malfunction	If not, the alternate value is Def/Foot
F11	Intake actuator open/short	The alternate value is air recirculation
F12	Intake actuator drive circuit malfunction	The alternate fresh air
F13	Temperature actuator open/short	If opening amount is 0 %, the alternate value is 0 %
F14	Temperature actuator drive circuit malfunction	If not, the alternate value is 100 %
F15	Null	-
F16	Null	-

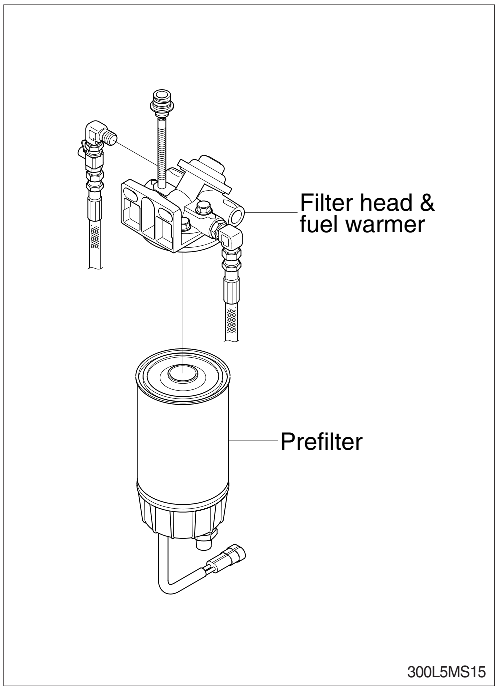
GROUP 17 FUEL WARMER SYSTEM

1. SPECIFICATION

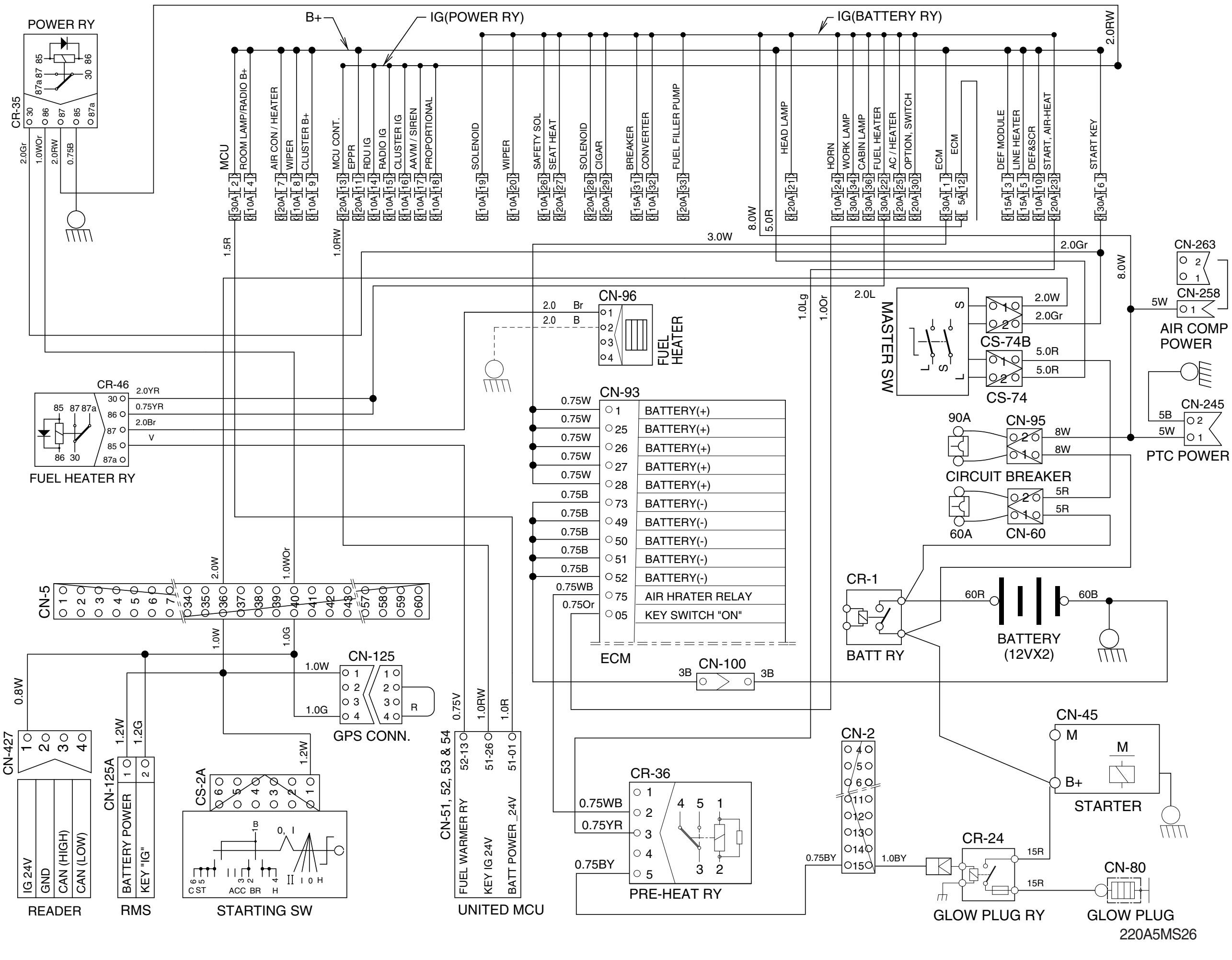
1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A

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



GROUP 18 1 or 2-WAY OPTIONAL PIPING PRESSURE REMOVAL SYSTEM

1. OUTLINE

This system can be removed the residual pressure of the optional attachment hydraulic piping when the quick coupler is operated by the switch of the RCV lever and then the oil quick function of the optional attachment is performed.

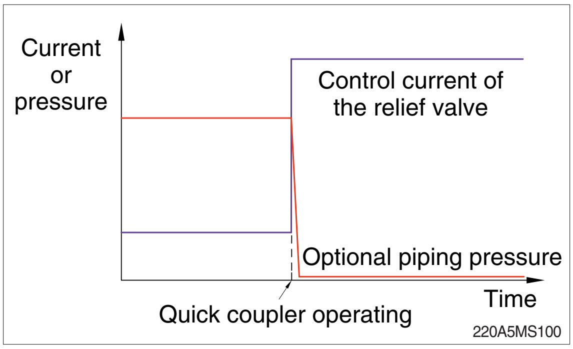
※ Oil quick function

In a convention work, the optional attachments such as breaker or grab are installed on the machine and needed to connect hydraulic piping additionally.

But currently, the hydraulic piping connection is not needed by the work man. The attachment is installed on the machine and the hydraulic pipings are connected by a coupler that is built in the quick coupler automatically and the attachment can be ready to operate immediately. This is called the oil quick function.

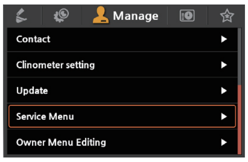
2. OPERATING PRINCIPLE

This is operated by controlling the setting pressure of the electric type relief valve when you operate the quick coupler with the switch of the RCV lever.

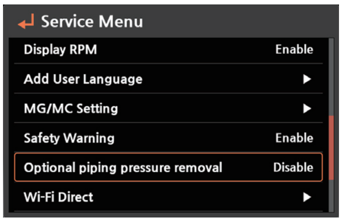


220A5MS100

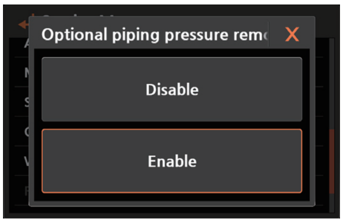
3. SETTING METHOD



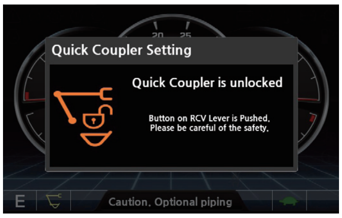
220A5MS101



220A5MS102



220A5MS103



220A5MS104

1) Optional piping pressure removal is set to Disable in the factory.
2) Optional piping pressure removal is set to Enable then the oil quick function is operated. Also, the caution letter is display on the lower side of the cluster.
3) The setting condition is saved even if shut the engine off.

4. CAUTION

1) When the oil quick function is used, the hydraulic drift and etc can be occurred as the modified equipment specification.
2) The status of the cluster must be changed by a manager that is well-acquainted with the function and the operator must be well-informed of the oil quick function and safety work.

SECTION 6 TROUBLESHOOTING

Group 1 Before Troubleshooting ········· 6-1
Group 2 Hydraulic and Mechanical System ········· 6-4
Group 3 Electrical System ········· 6-25
Group 4 Mechatronics System ········· 6-44
Group 5 Air conditioner and Heater System ········· 6-72

SECTION 6 TROUBLESHOOTING

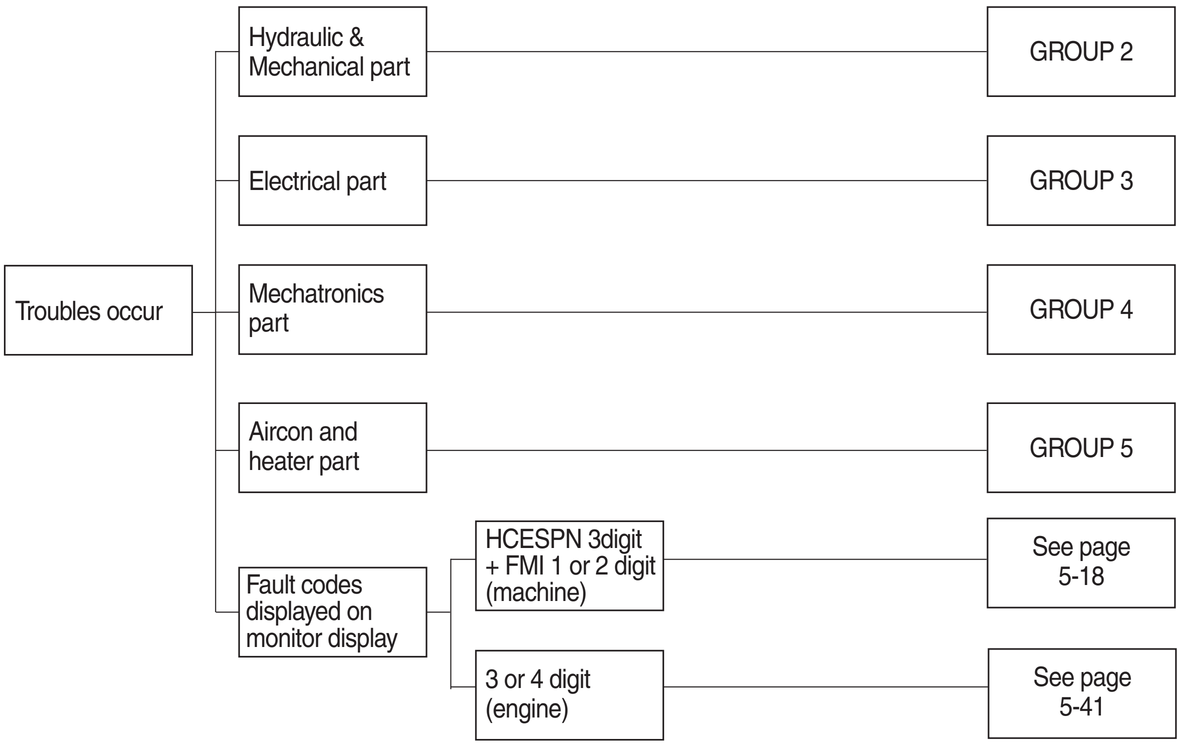
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

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

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

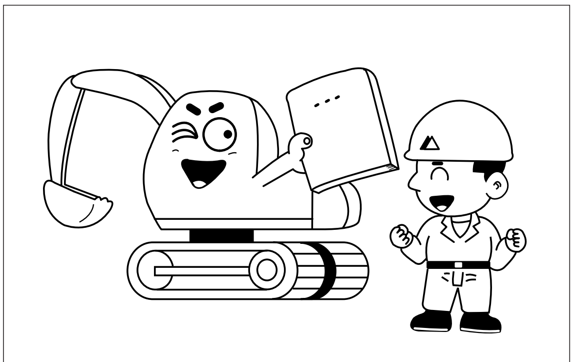


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

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

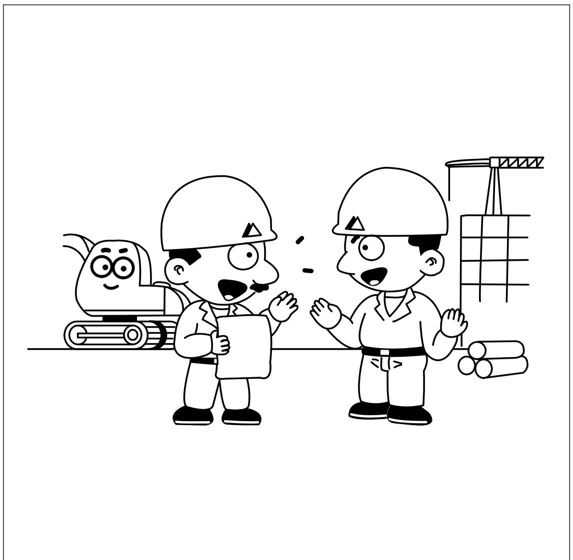


13031SH02

STEP 2. Ask the operator

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

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

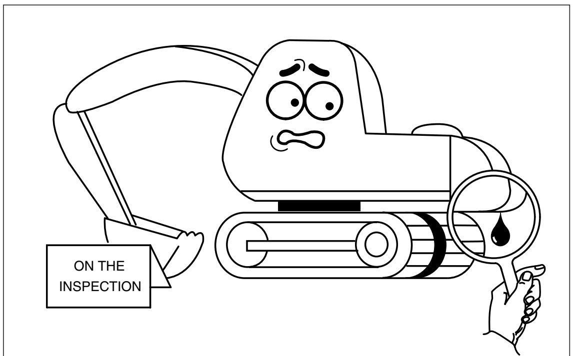


13031SH03

STEP 3. Inspect the machine

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

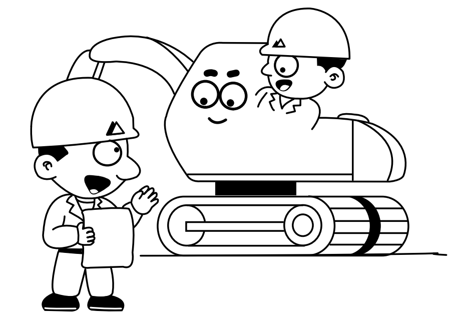
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

STEP 4. Inspect the trouble actually on the machine

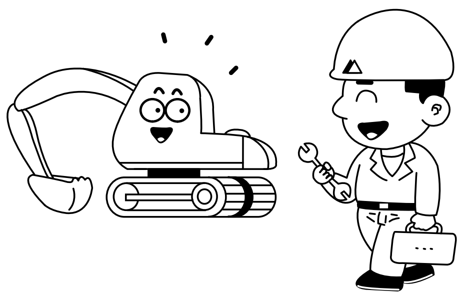
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



(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.

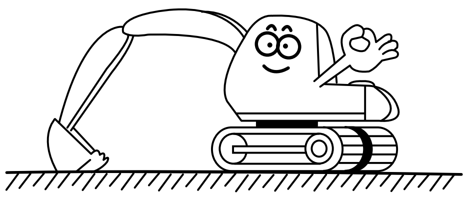


13031SH05

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.

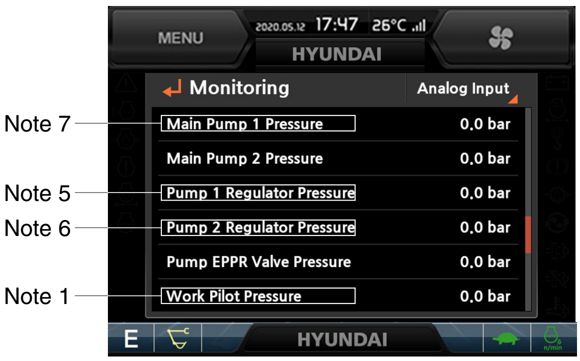
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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?

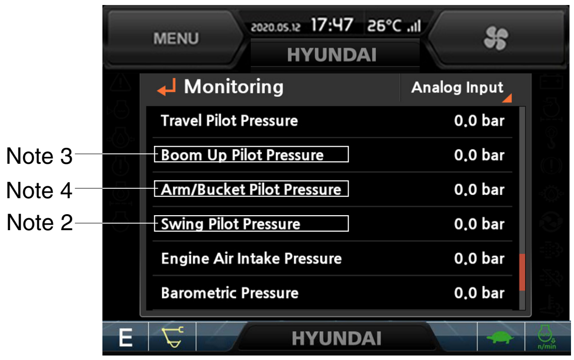
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

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

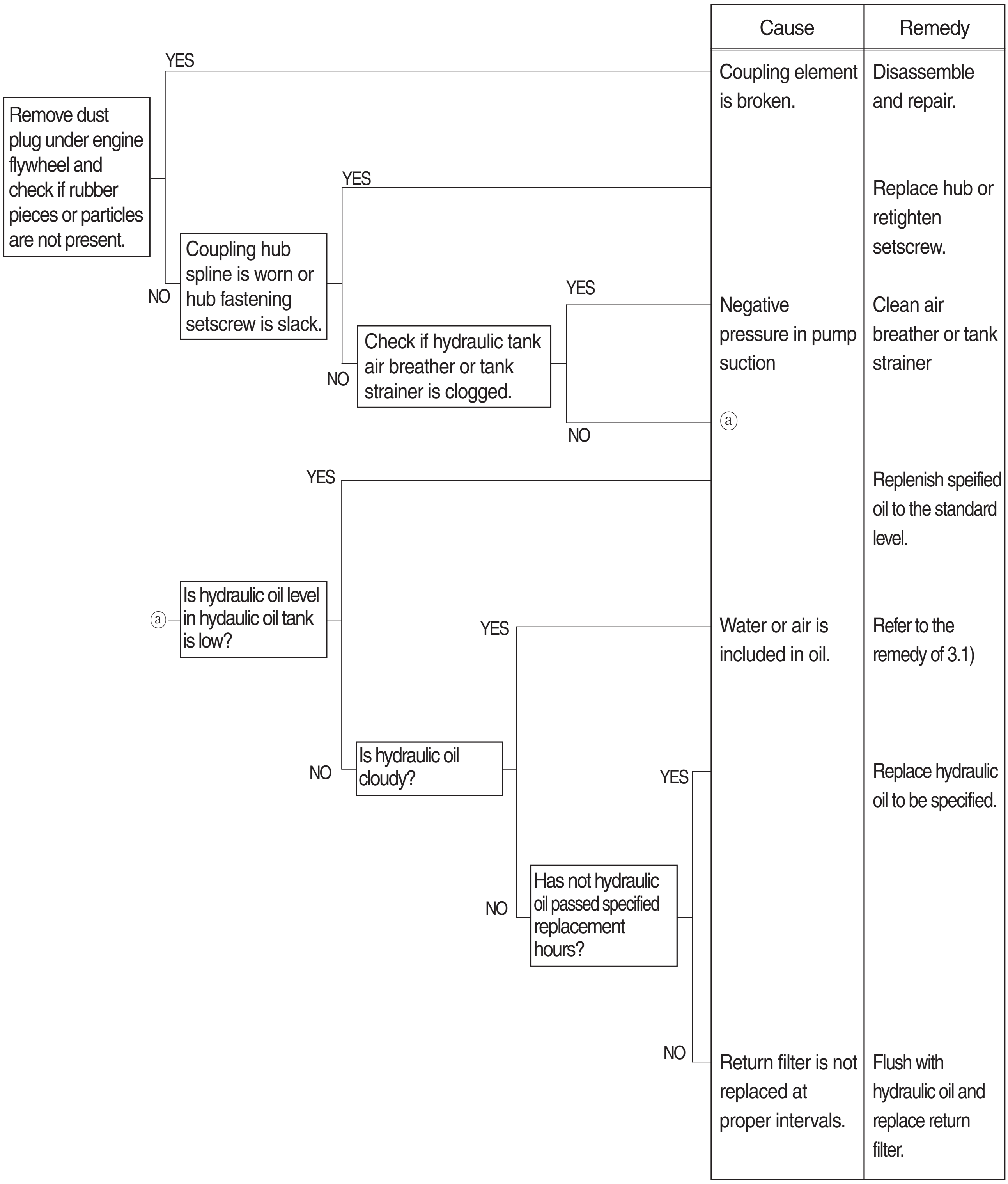
220A6HS01

(2) Specification

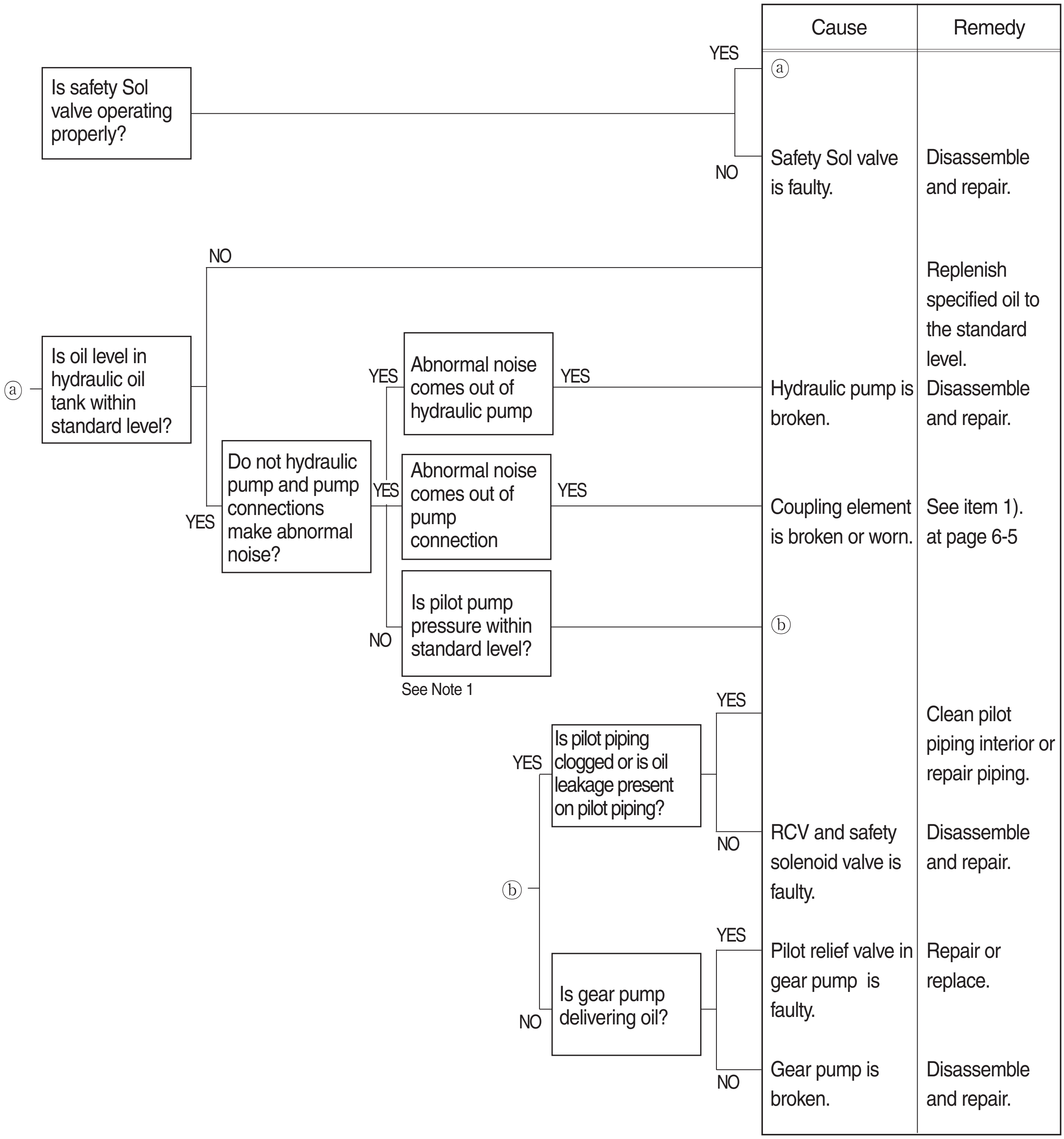
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION

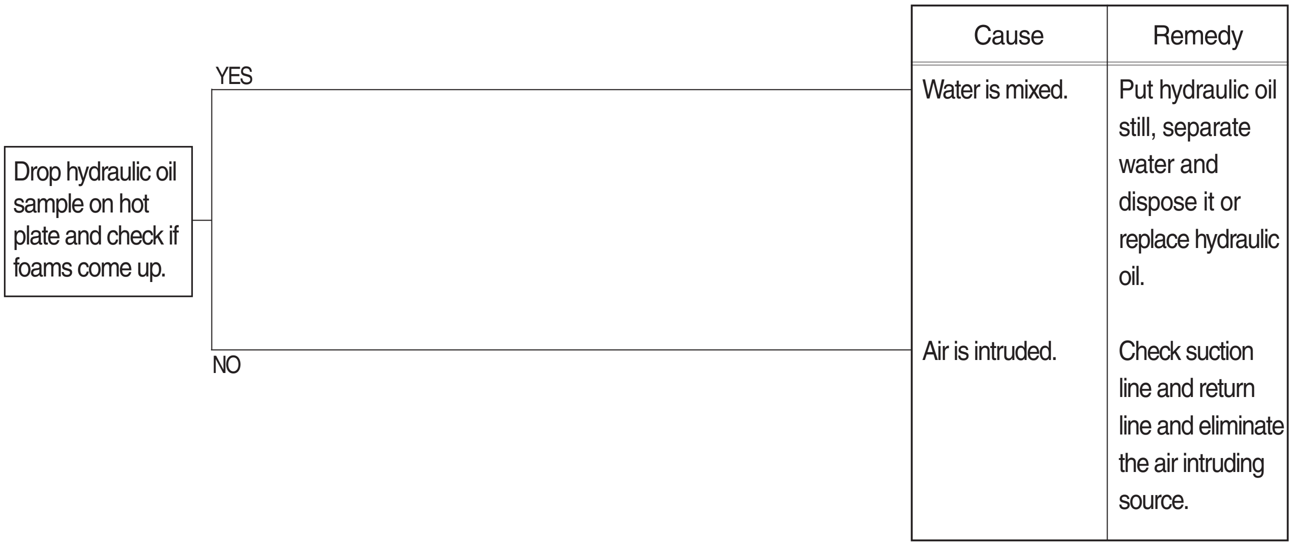


2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

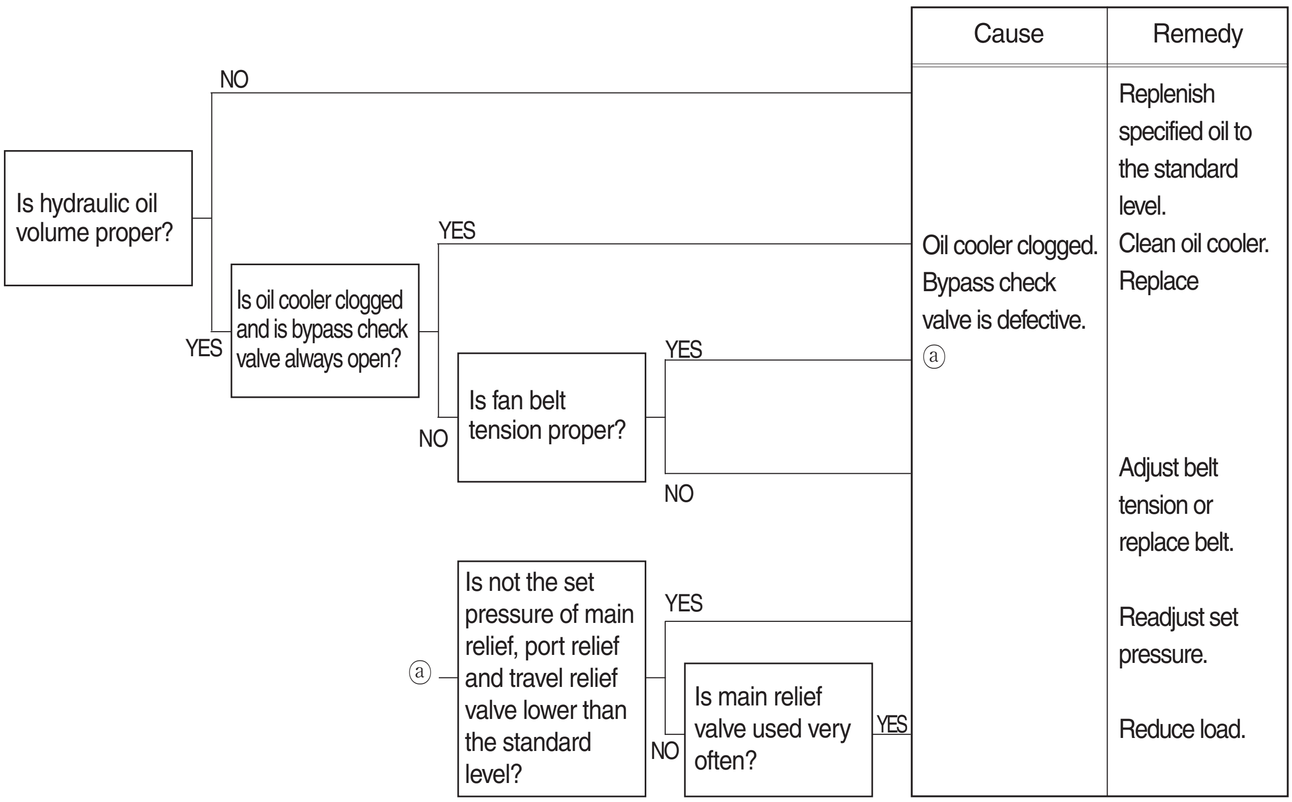


3. HYDRAULIC SYSTEM

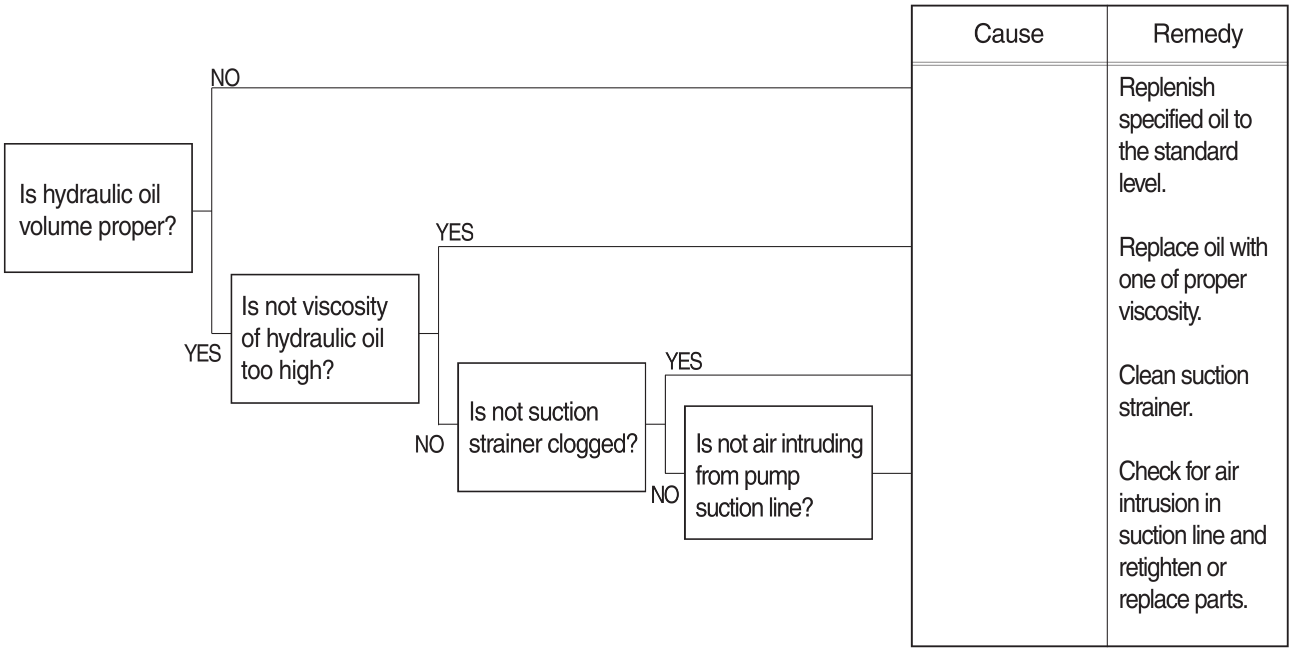
1) HYDRAULIC OIL IS CLOUDY



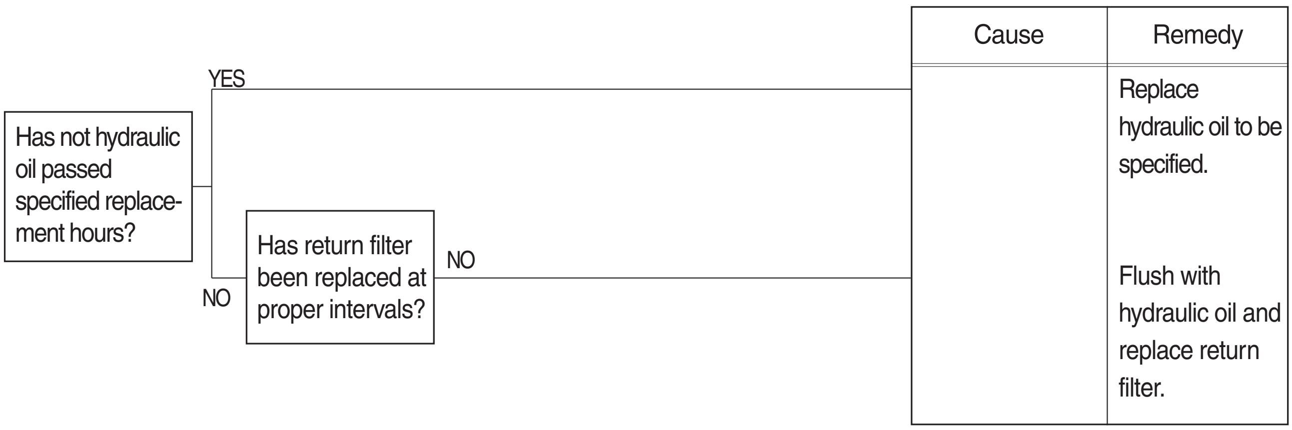
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

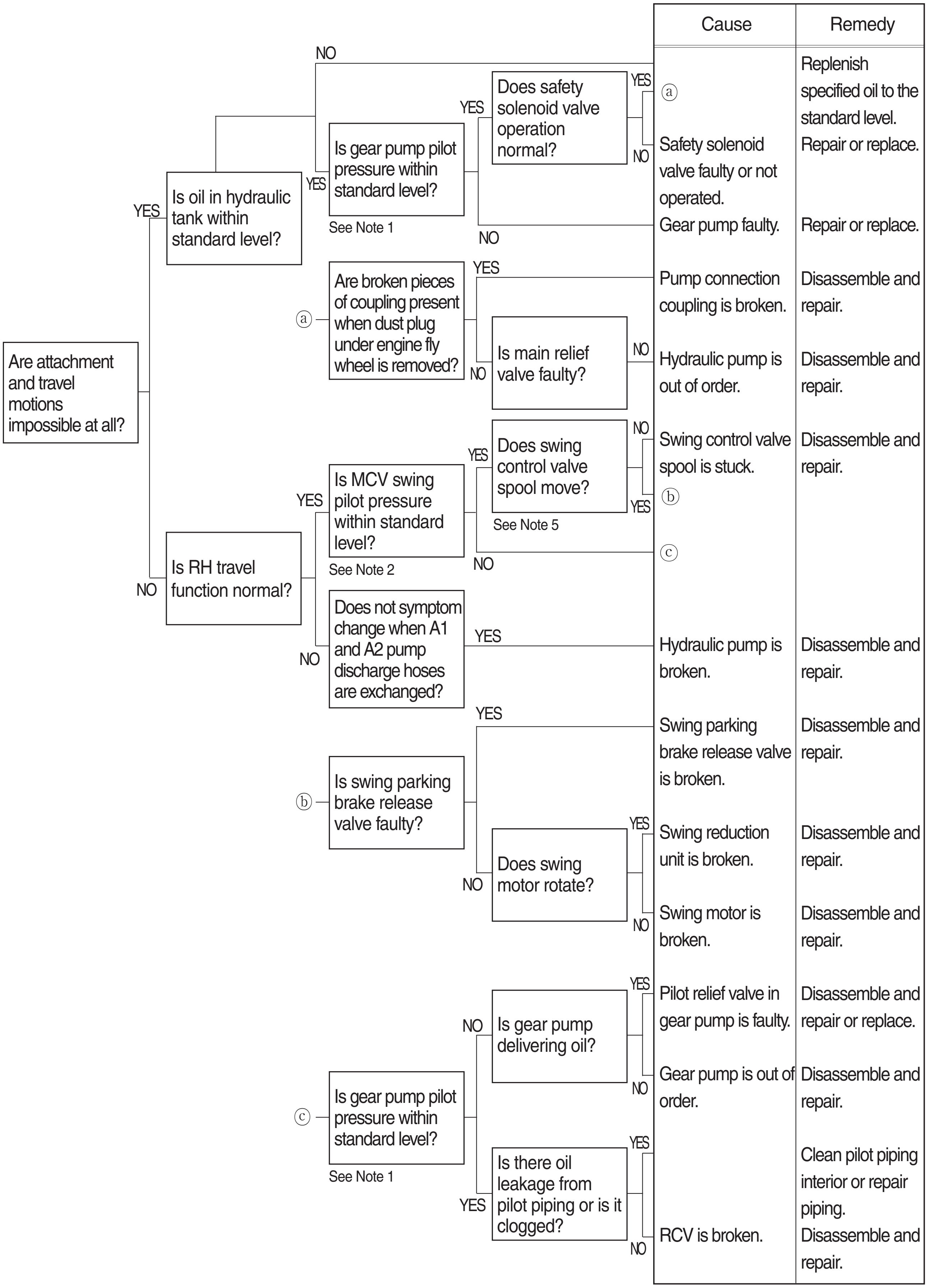


4) HYDRAULIC OIL IS CONTAMINATED

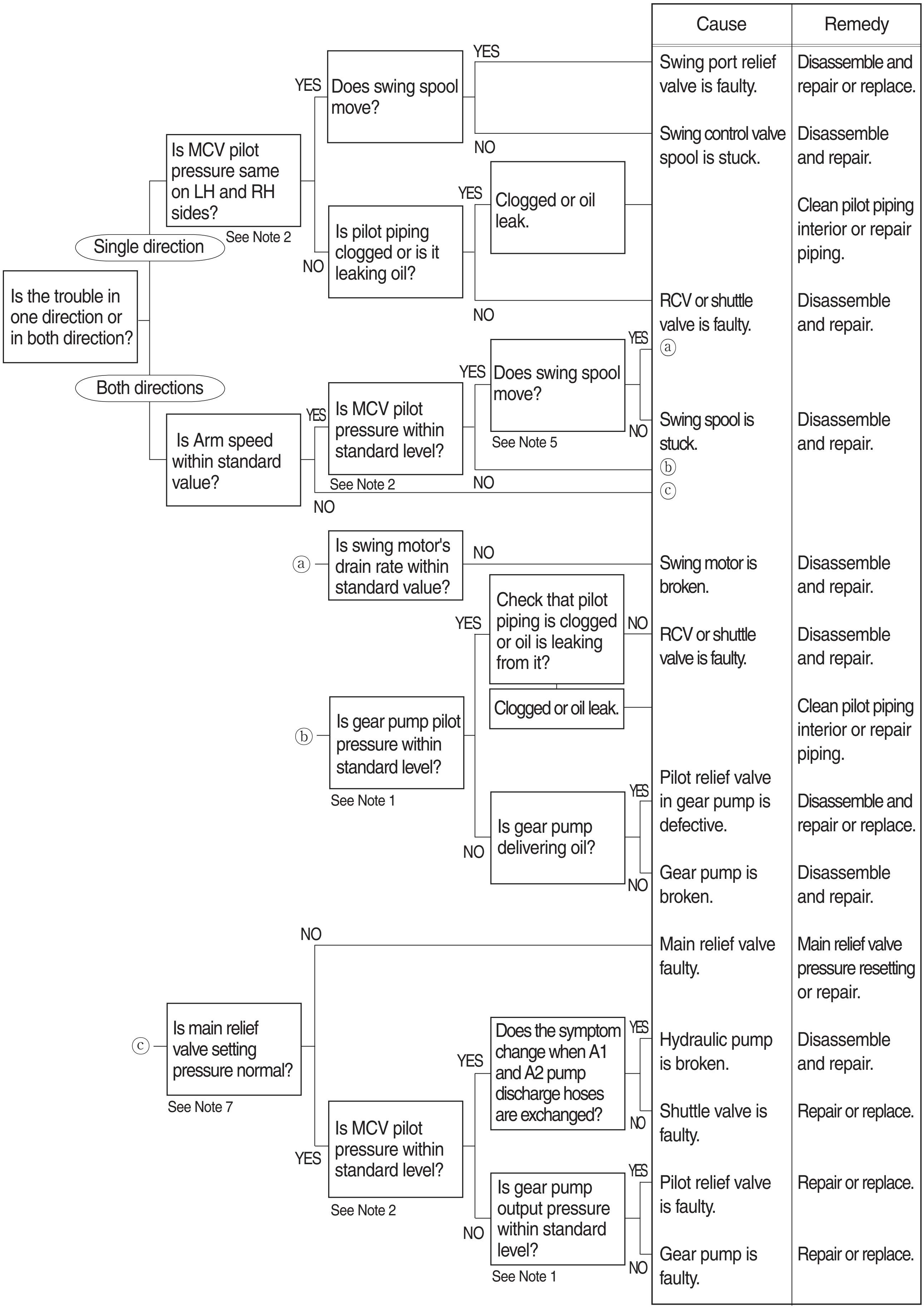


4. SWING SYSTEM

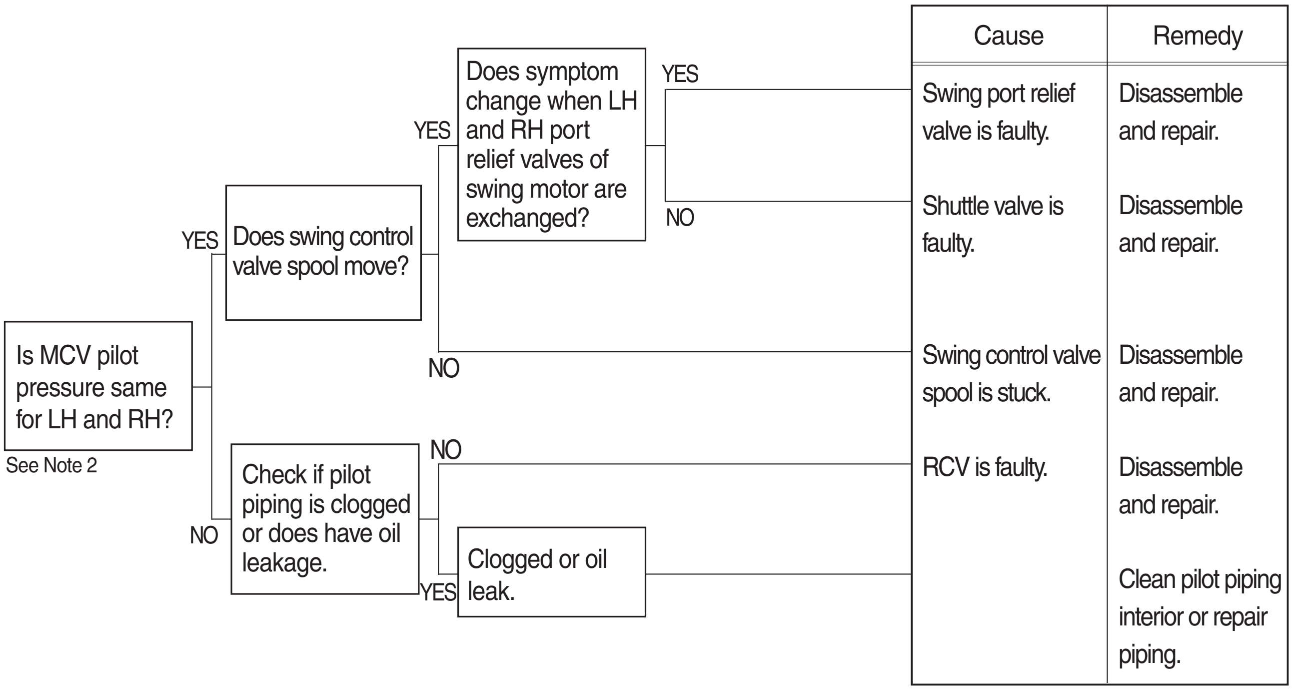
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



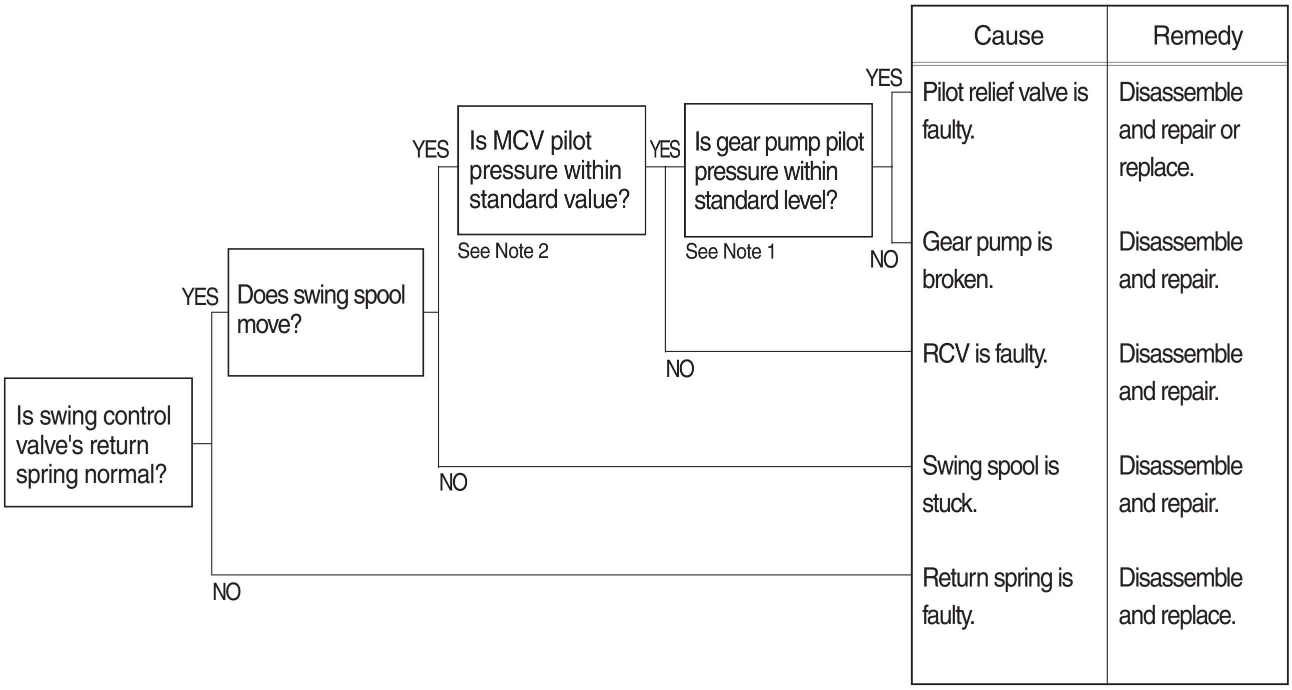
2) SWING SPEED IS LOW



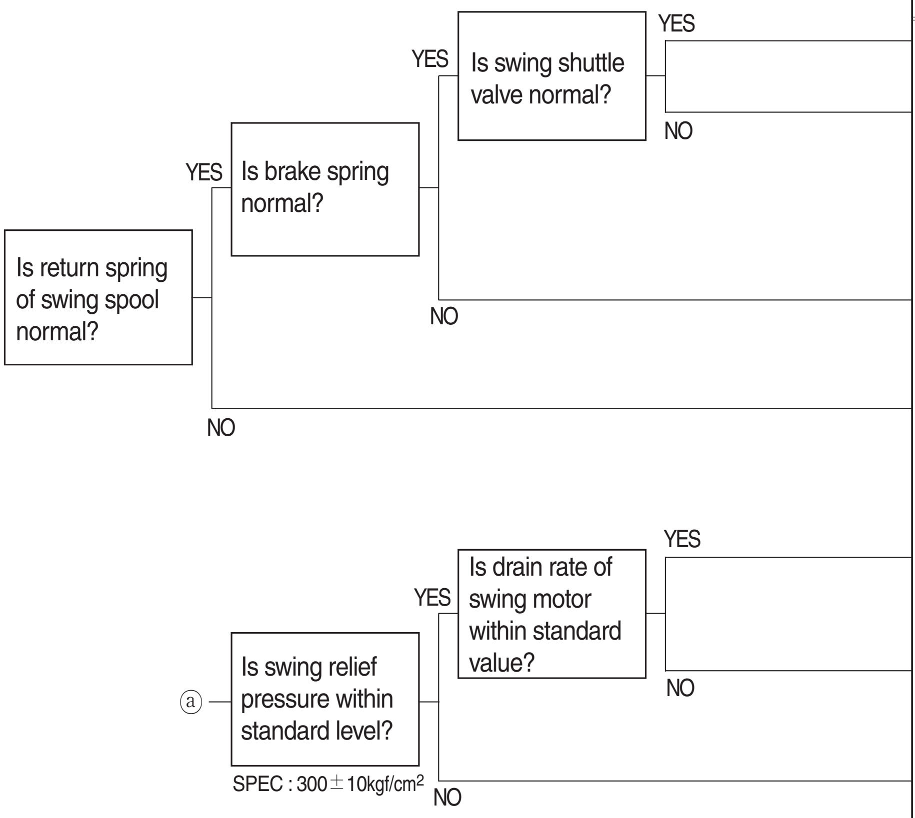
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP

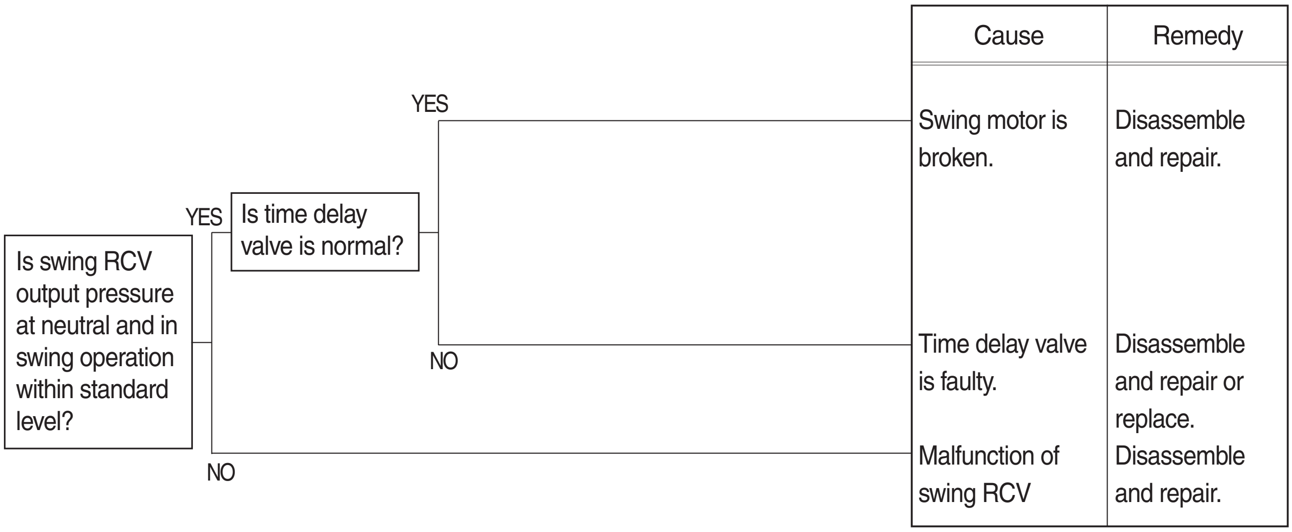


5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE

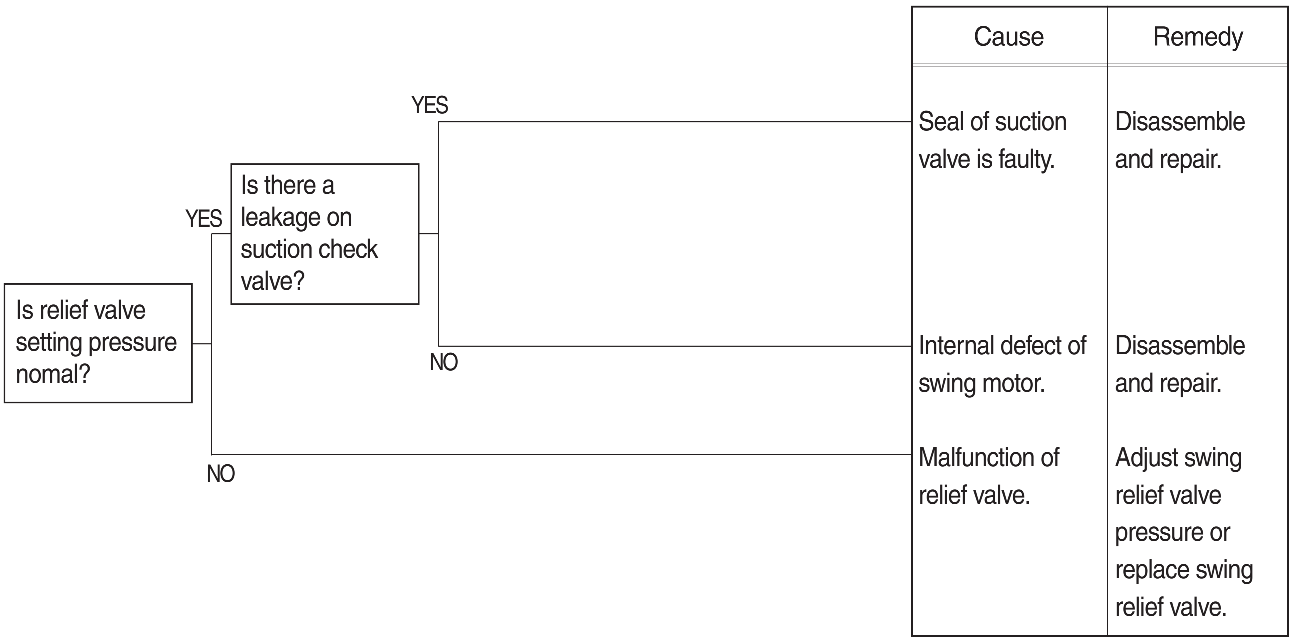


Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing port relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.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

6) LARGE SHOCK OCCURS WHEN STOP SWINGING

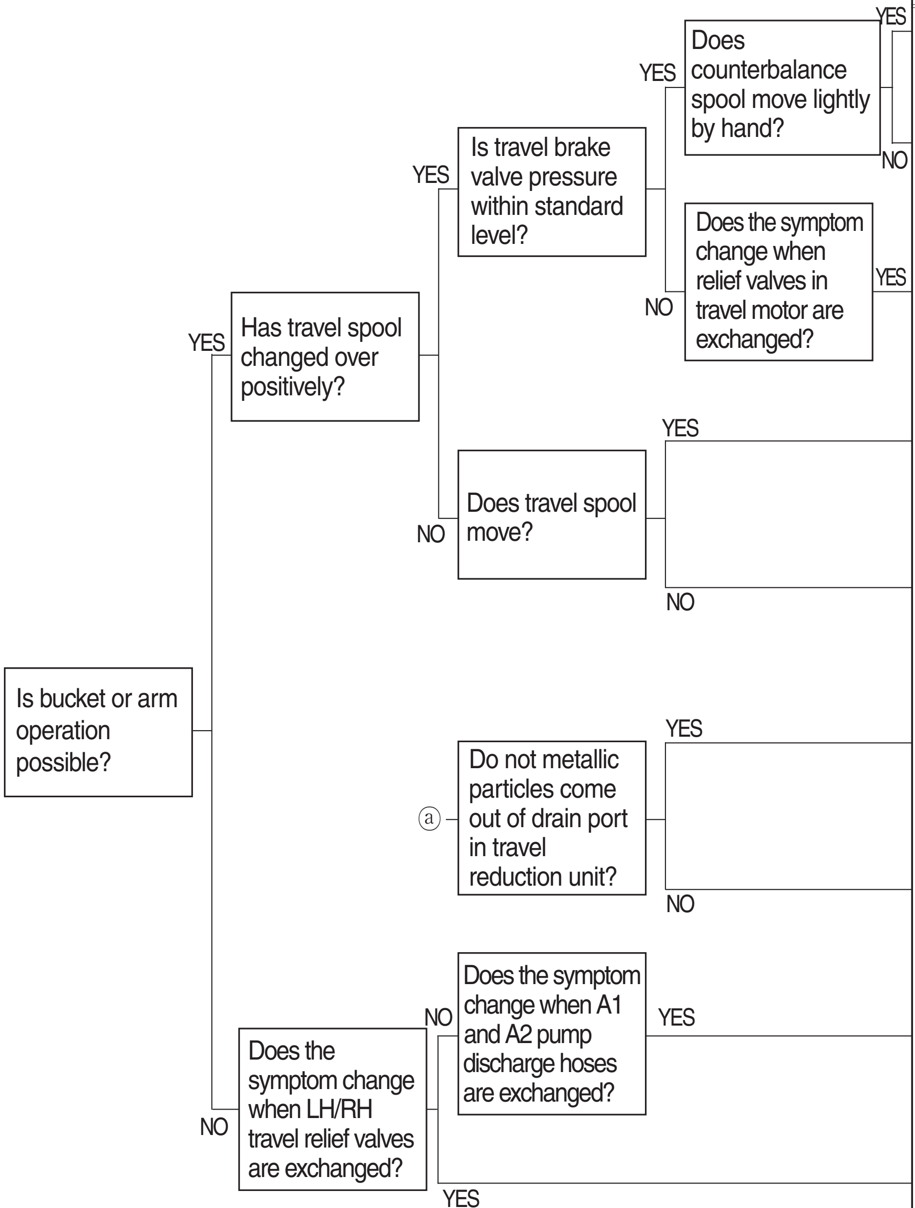


7) LARGE SOUND OCCURS WHEN STOP SWINGING



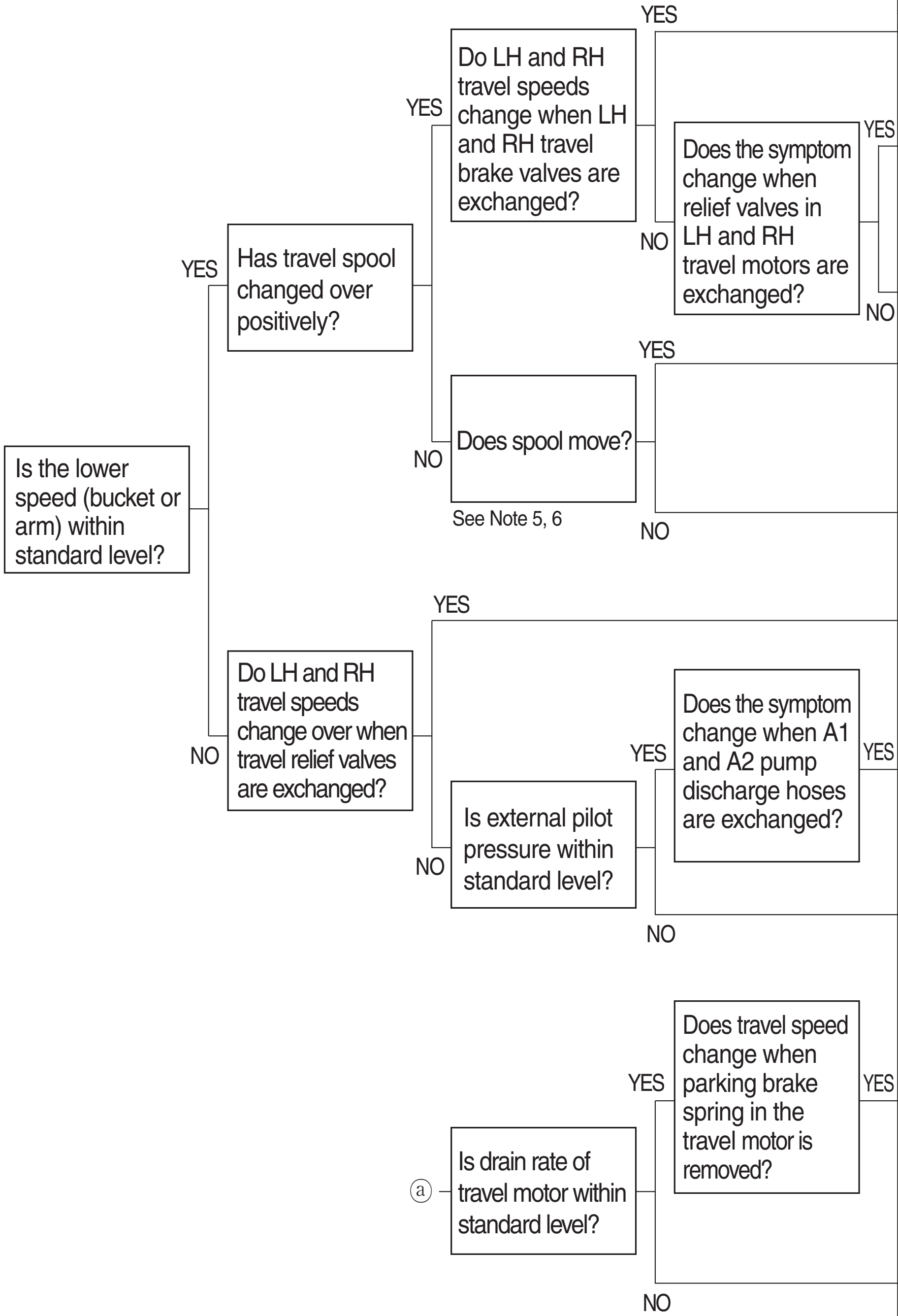
5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



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

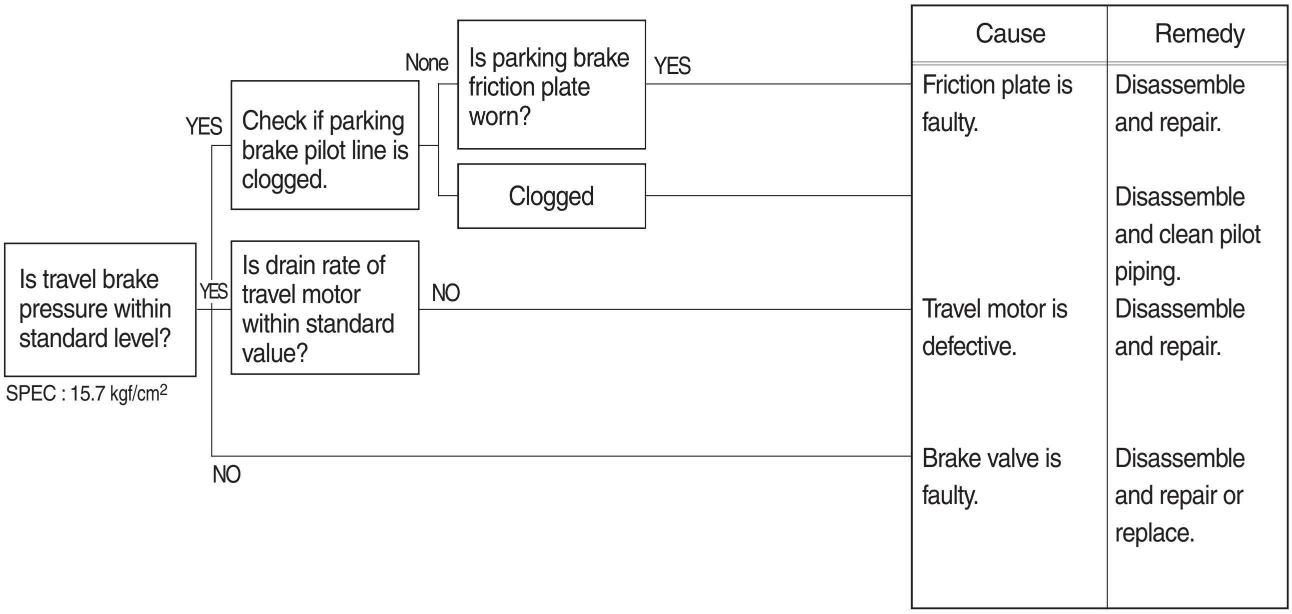
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



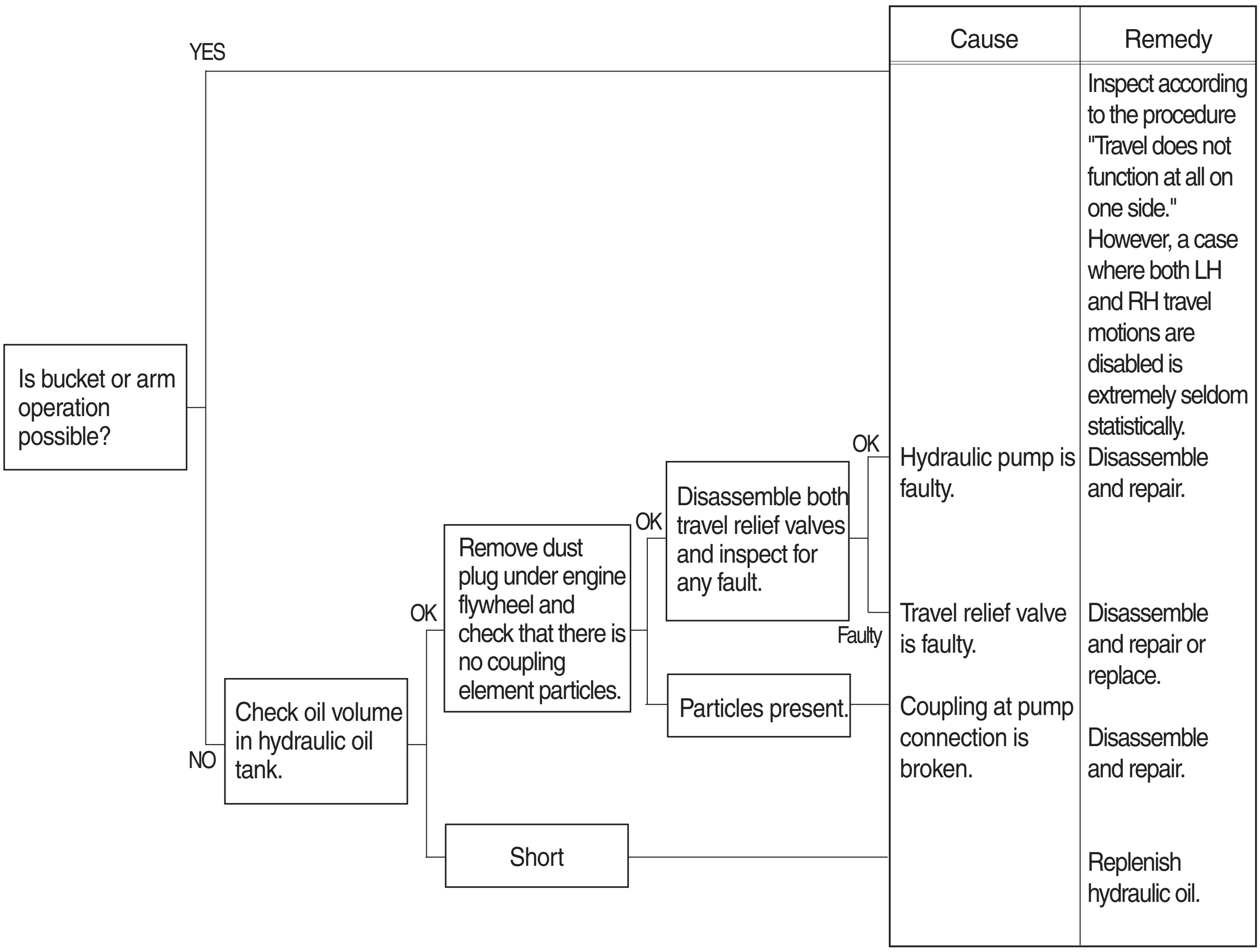
Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
ⓐ	
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic pump is broken.	Disassemble and repair.
External pilot piping is clogged or oil is leaking from it.	Disassemble and clean.
Travel motor's parking brake is not released properly.	Disassemble and clean pilot piping.
Travel motor is faulty.	Disassemble and repair.

3) MACHINE DOES NOT STOP ON A SLOPE

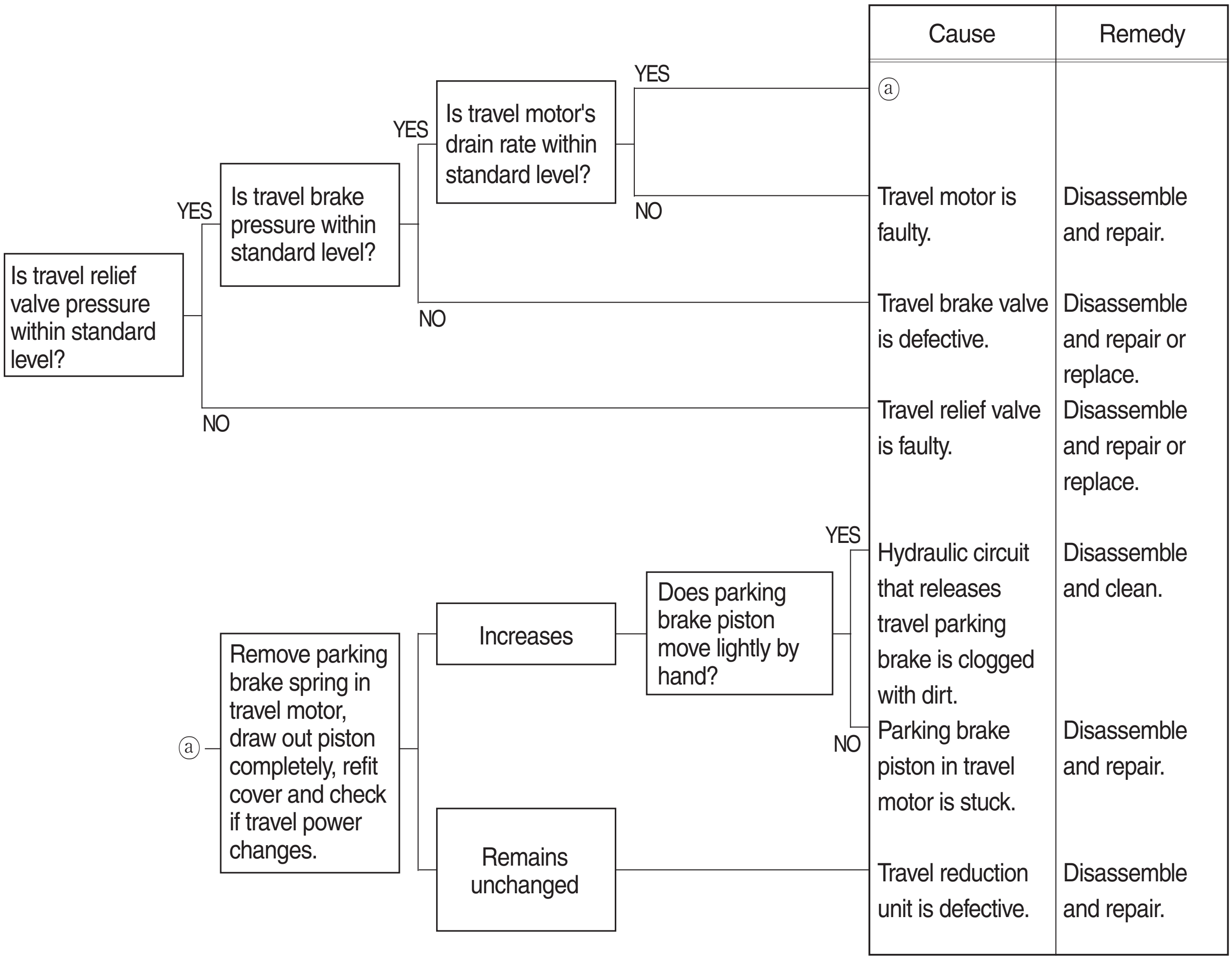
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

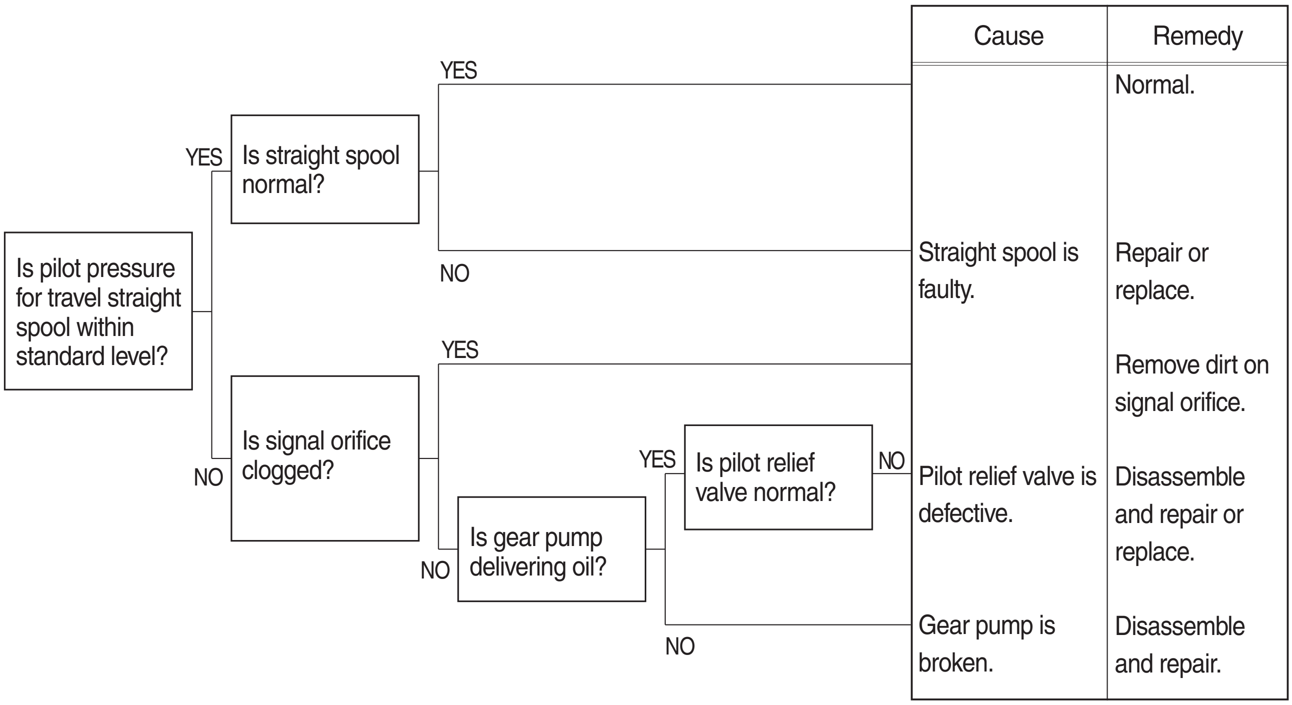


5) TRAVEL ACTION IS POWERLESS (travel only)



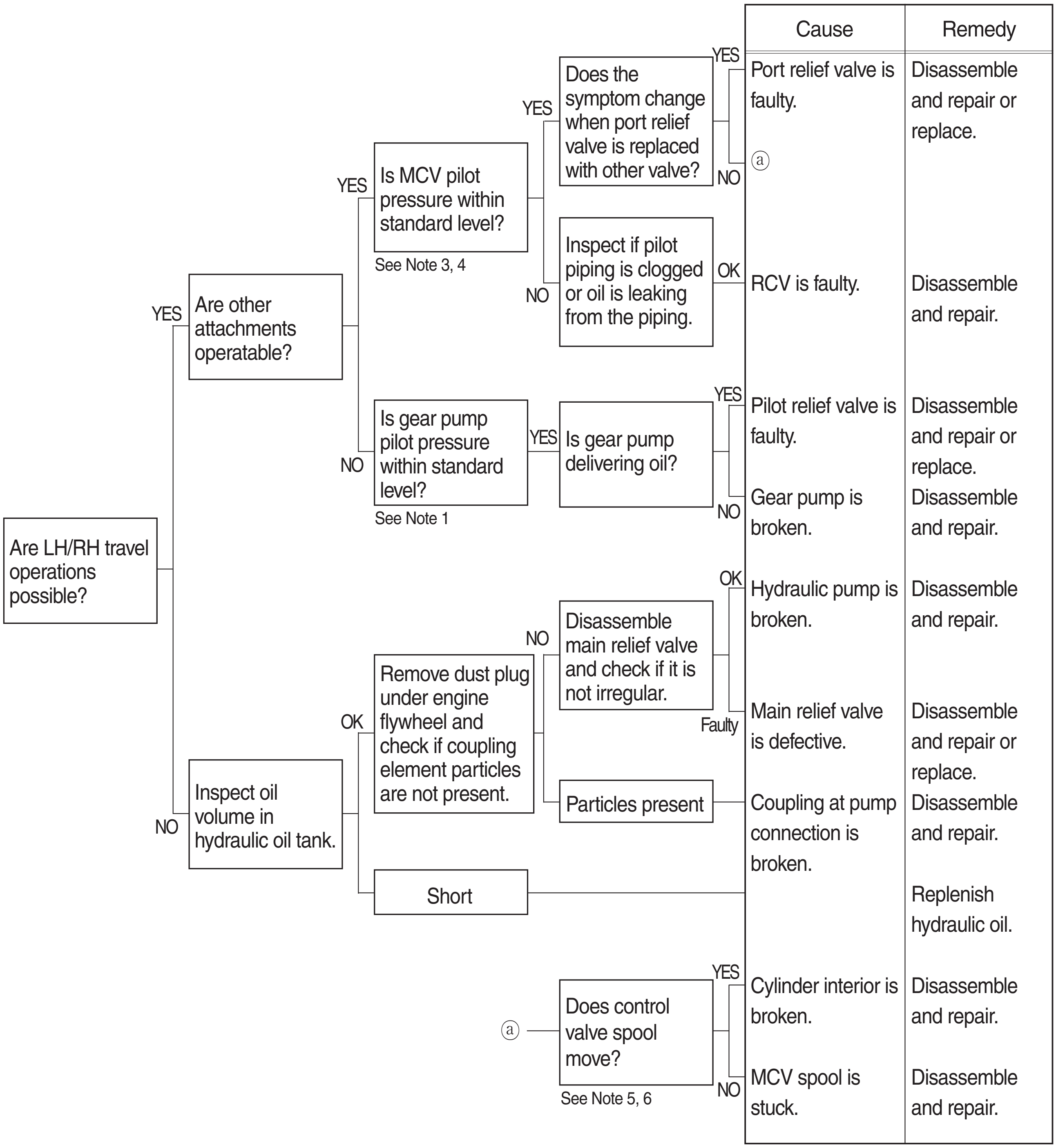
6) MACHINE RUNS RECKLESSLY ON A SLOPE

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

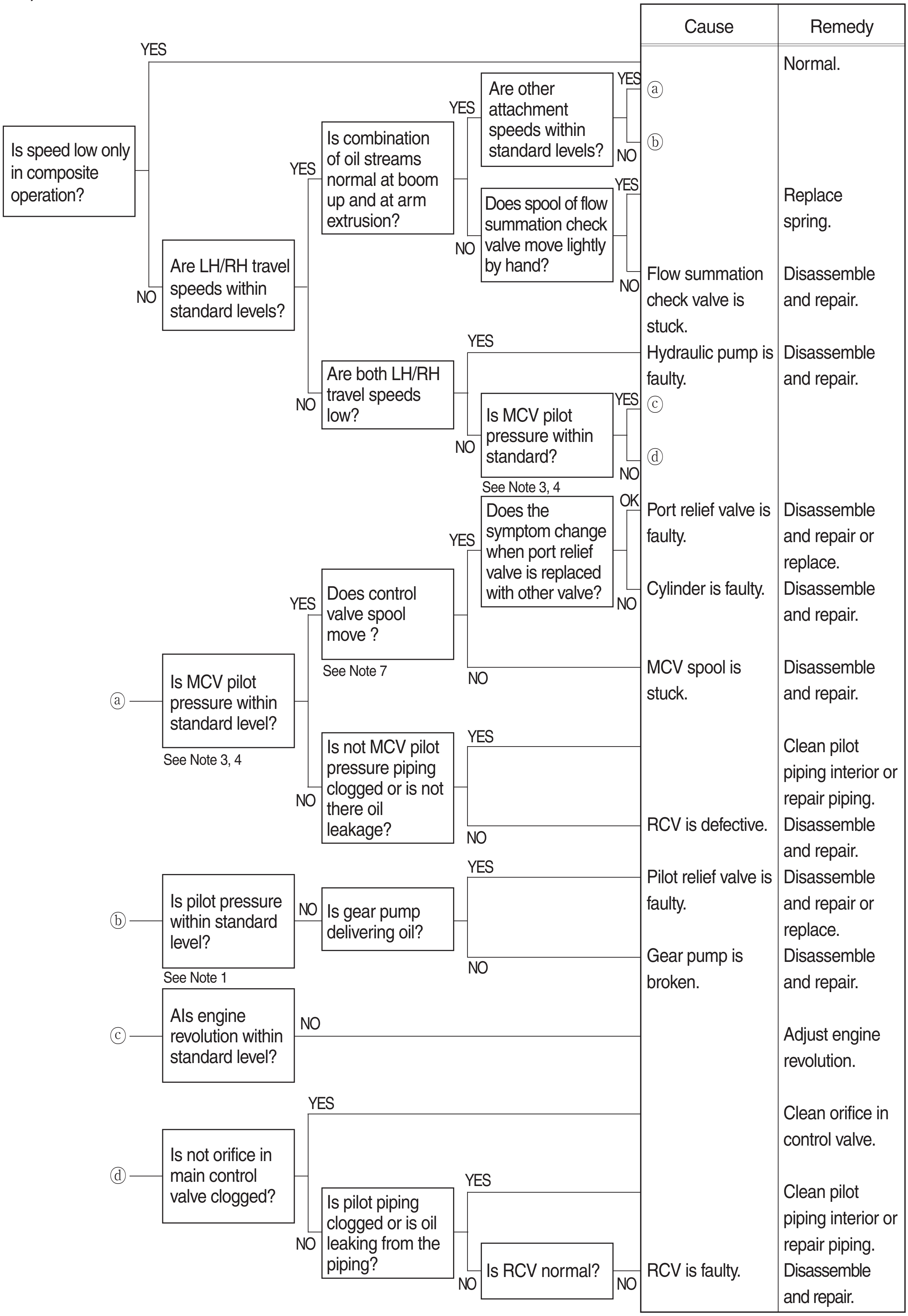


6. ATTACHMENT SYSTEM

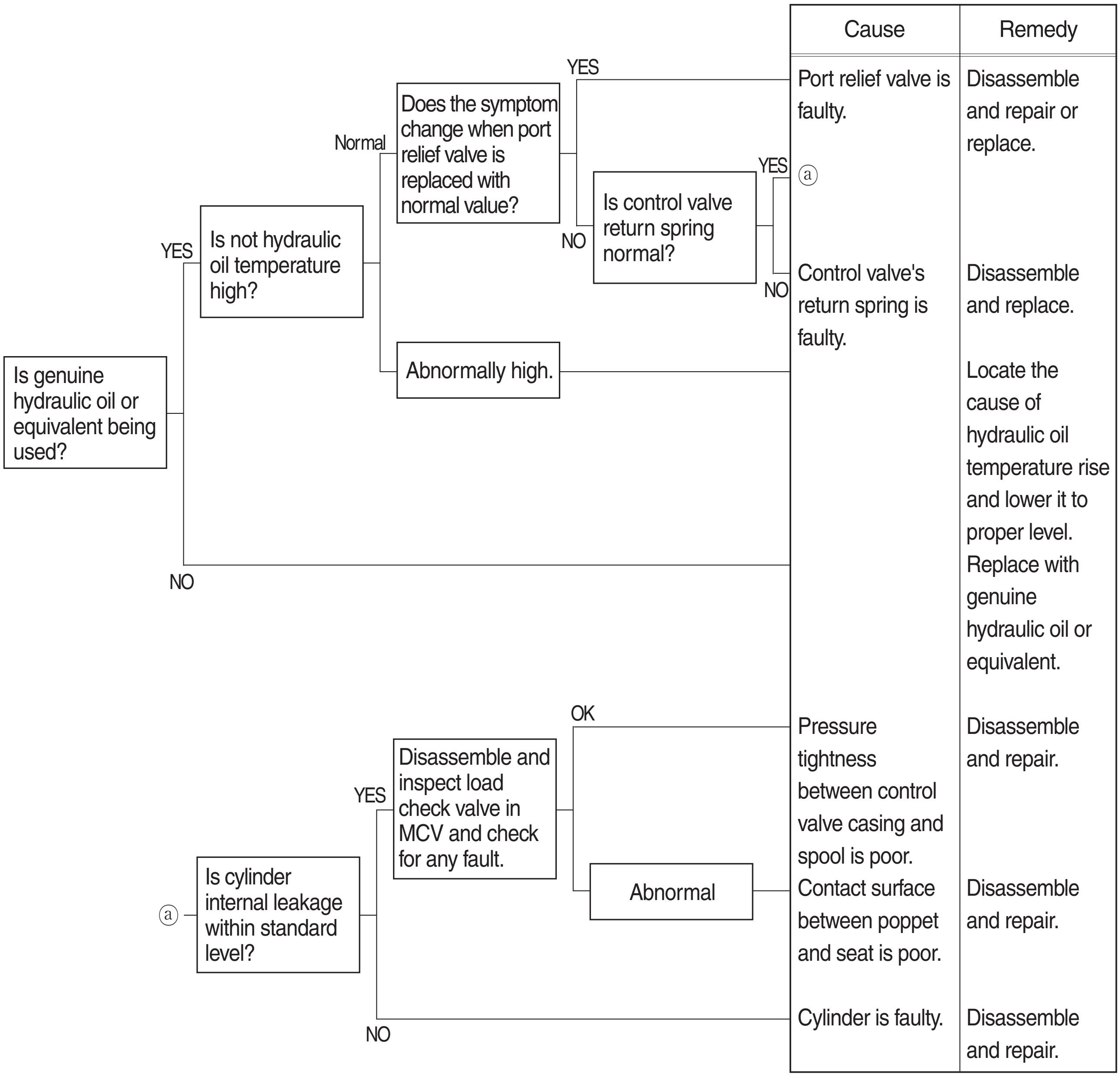
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



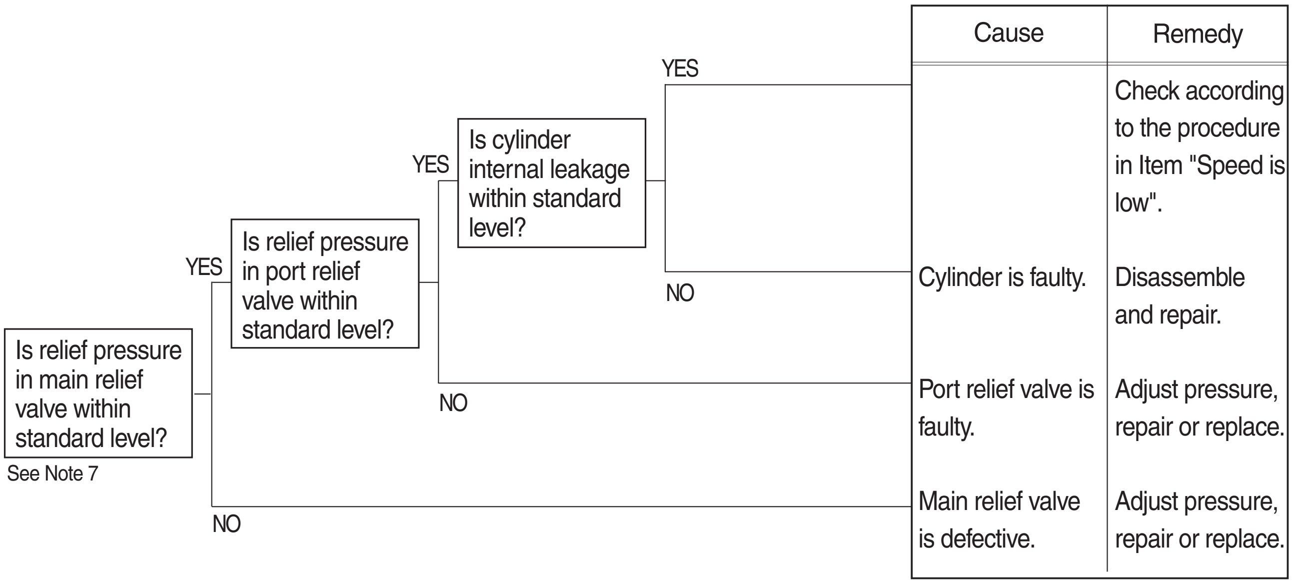
2) BOOM, ARM OR BUCKET SPEED IS LOW



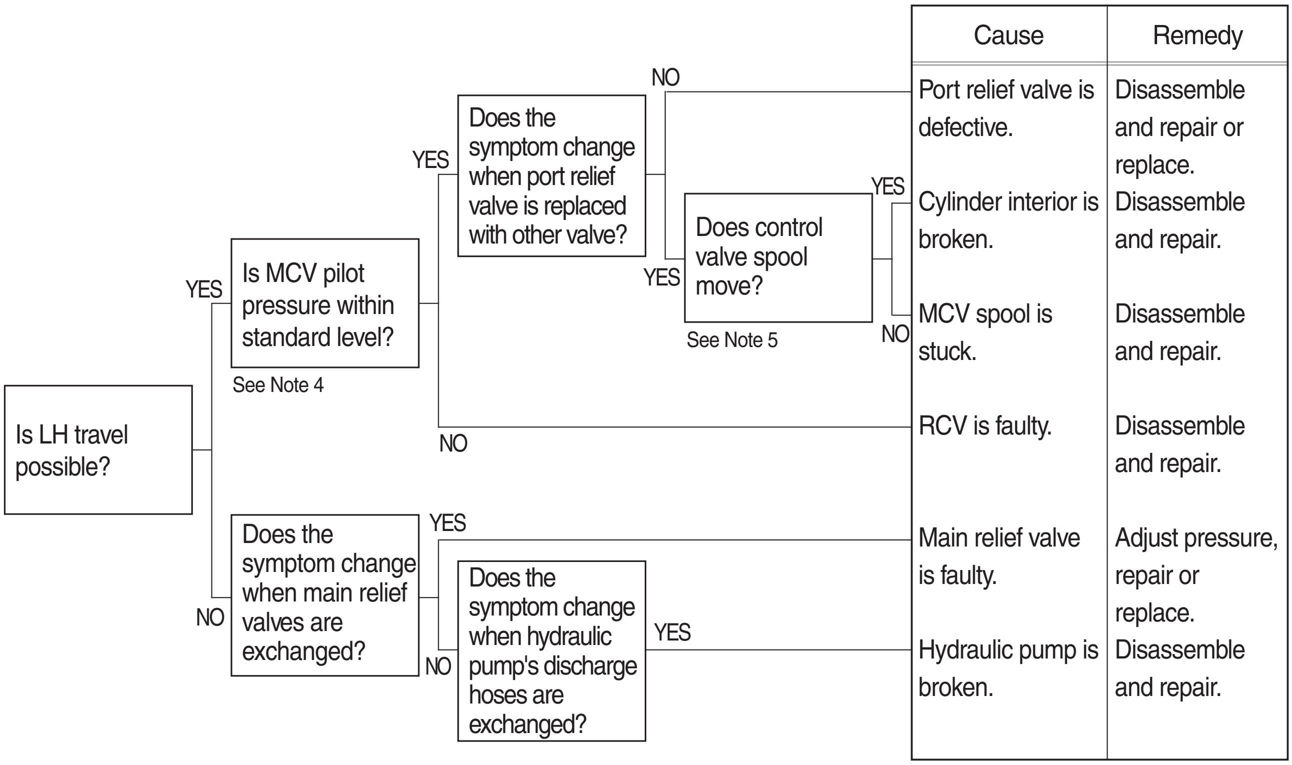
3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

Is boom foot pin greased sufficiently?

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

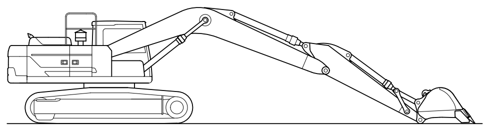
7) TIME LAG OF MACHINE WORKING IS LARGE.

Is overload relief valve for each spool working properly?

	Cause	Remedy
YES		Refer to 2)
NO	Overload relief valve is faulty.	Disassemble and repair.

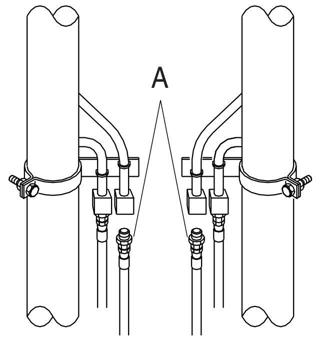
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



300L6TS01

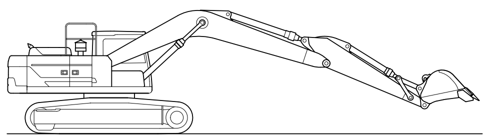
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



(210-7) 6-20(2)

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

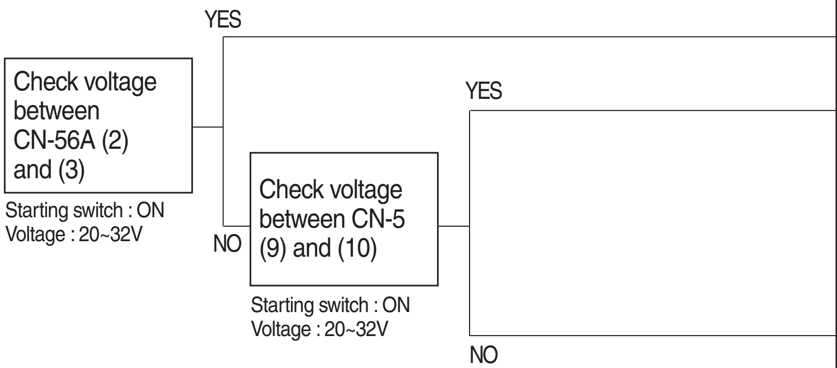
   If oil leaks from piping side and boom cylinder rod is retracted there is an internal leak in the cylinder.
   If no oil leaks from piping side and boom cylinder rod is retracted, there is an internal leak in the control valve.



300L6TS02

1. WHEN STARTING SWITCH IS TURNED ON, CLUSTER DISPLAY DOES NOT APPEAR

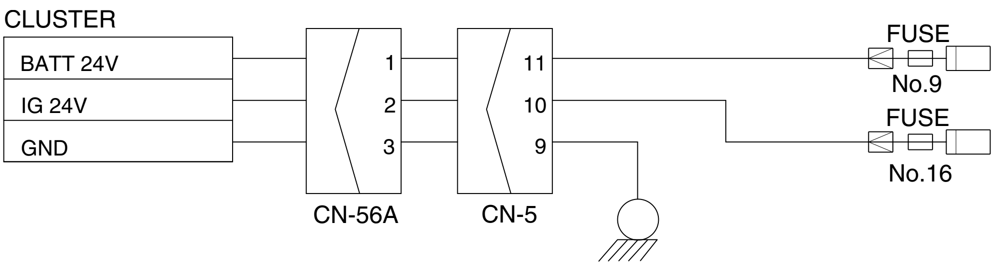
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 9, 16.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-5-CN-56A	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-5 (9) -GND or fuse No. 9, 16	Repair or replace (after clean)

Check voltage

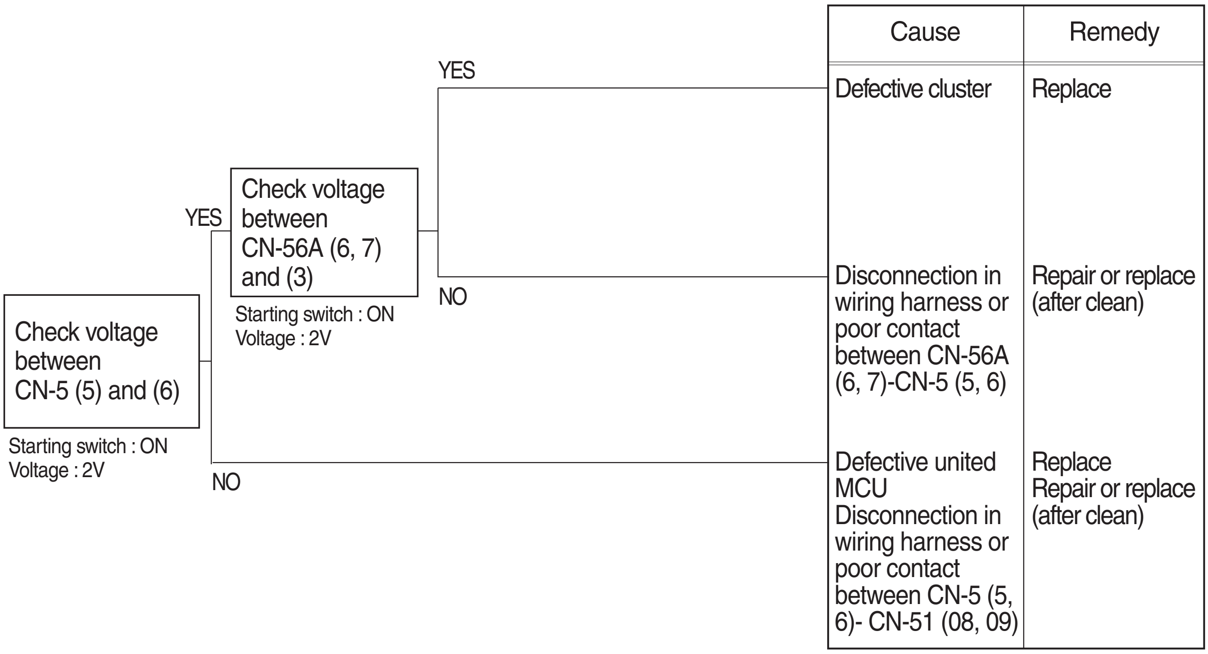
YES	20~32V
NO	0V



300L6ES101

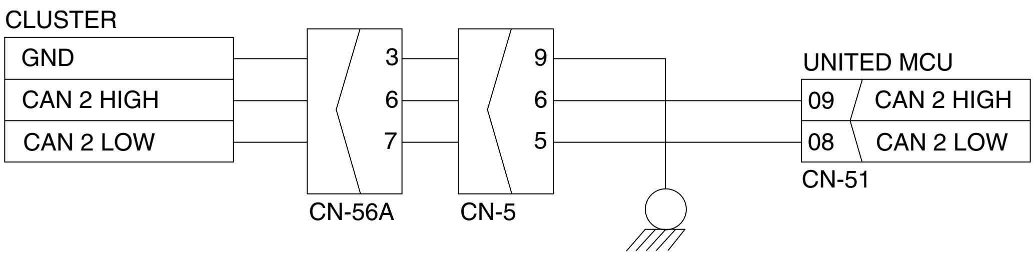
2. ⚠ COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

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



Check voltage

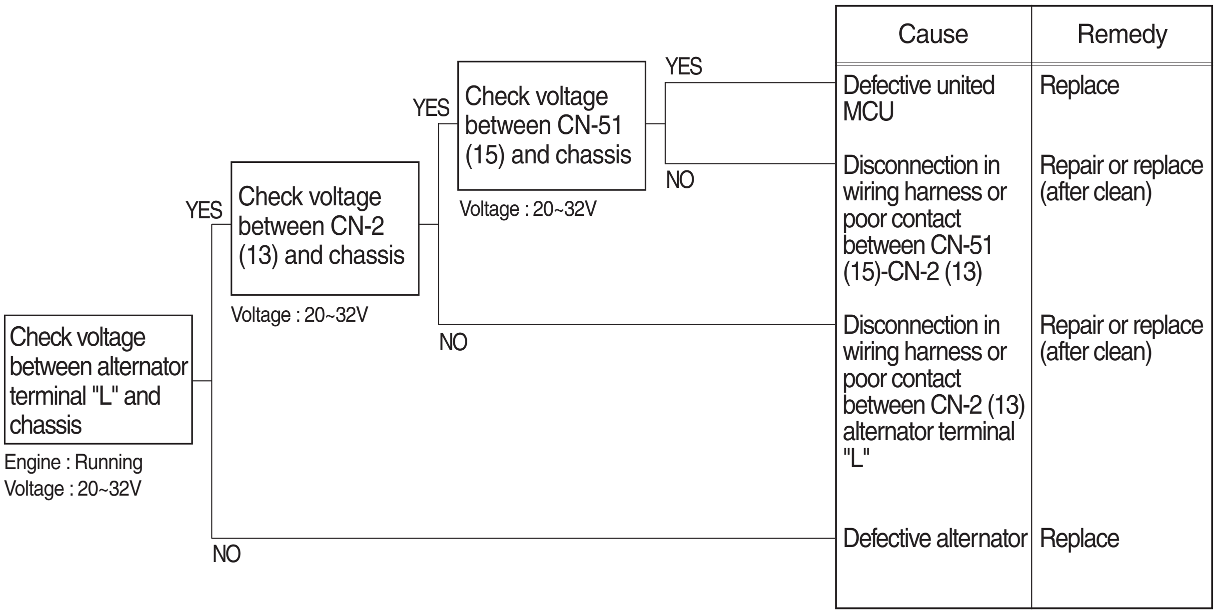
YES	2V
NO	0V



140L6ES102

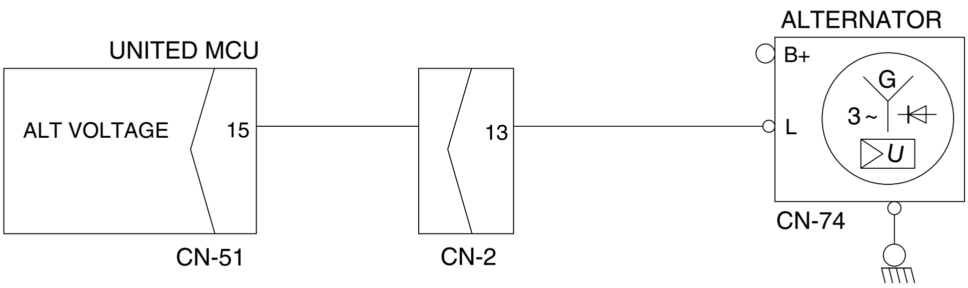
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

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



Check voltage

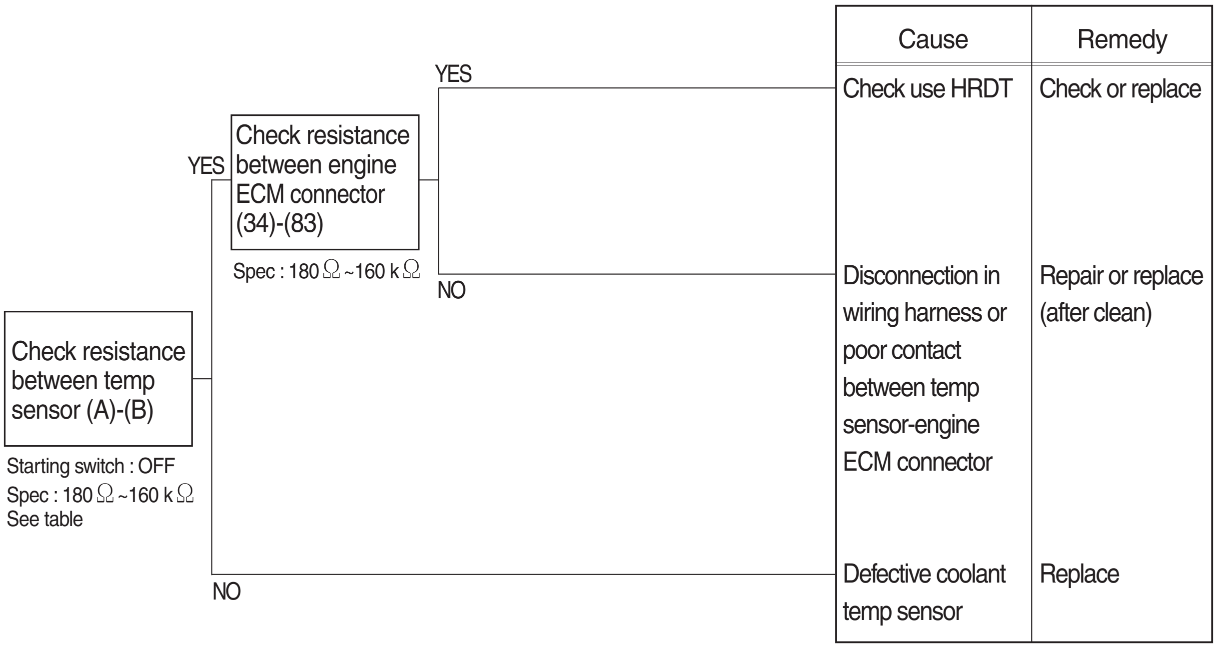
YES	20~32V
NO	0V



220F6ES103

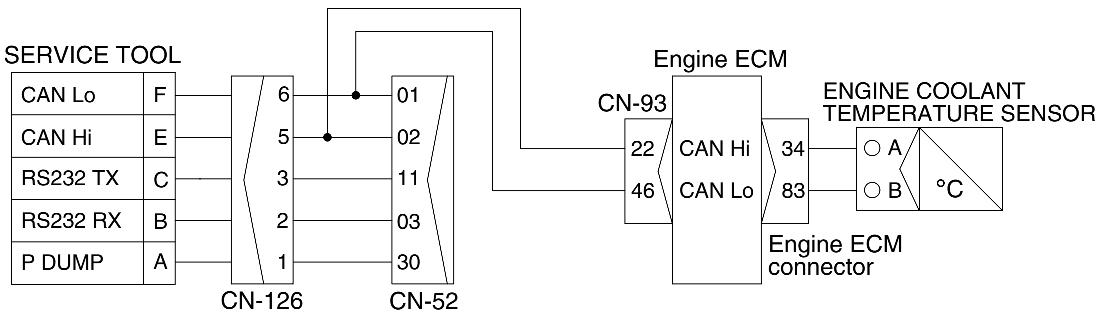
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

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



Check Table

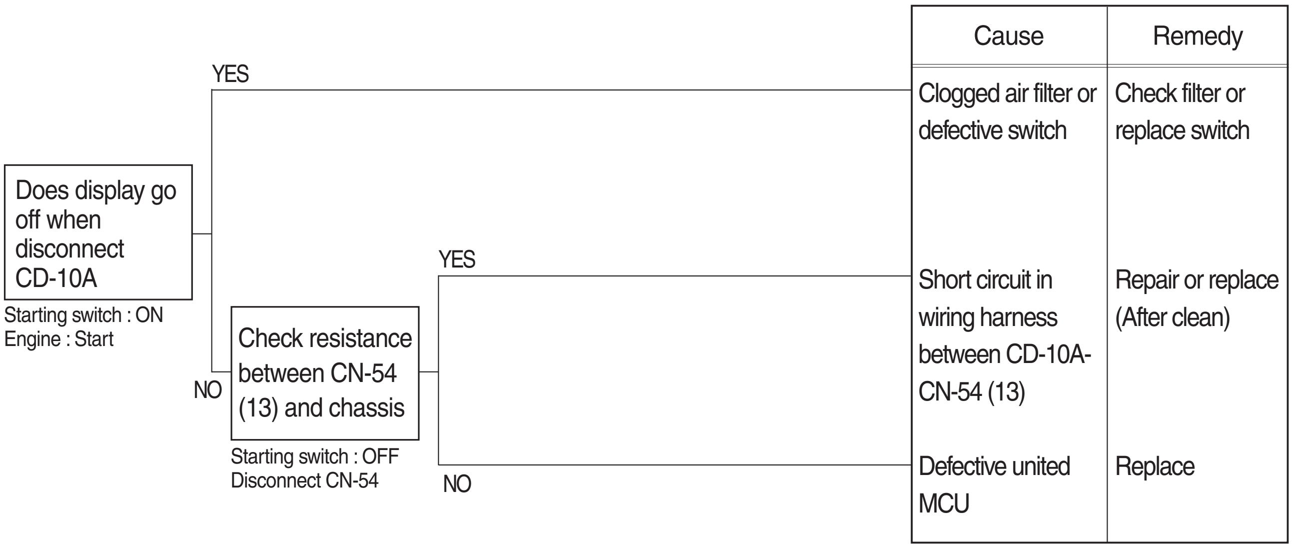
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



300L6ES104

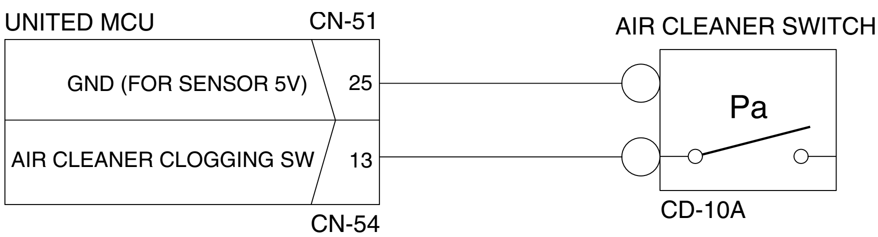
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

· 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

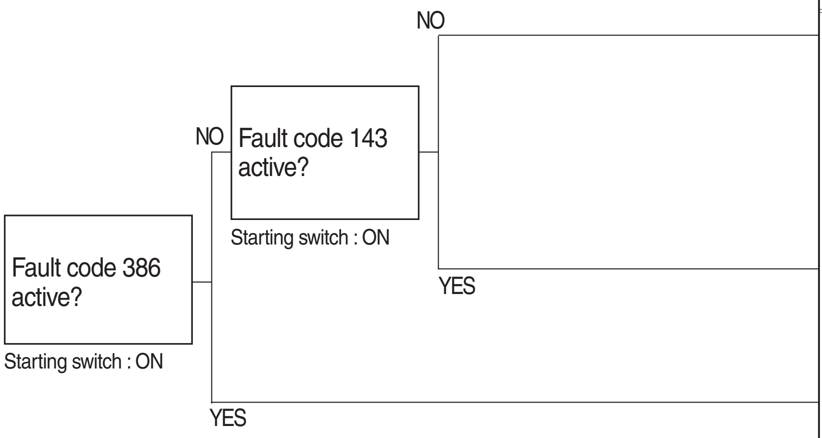
YES	MAX 1Ω
NO	MIN 1MΩ



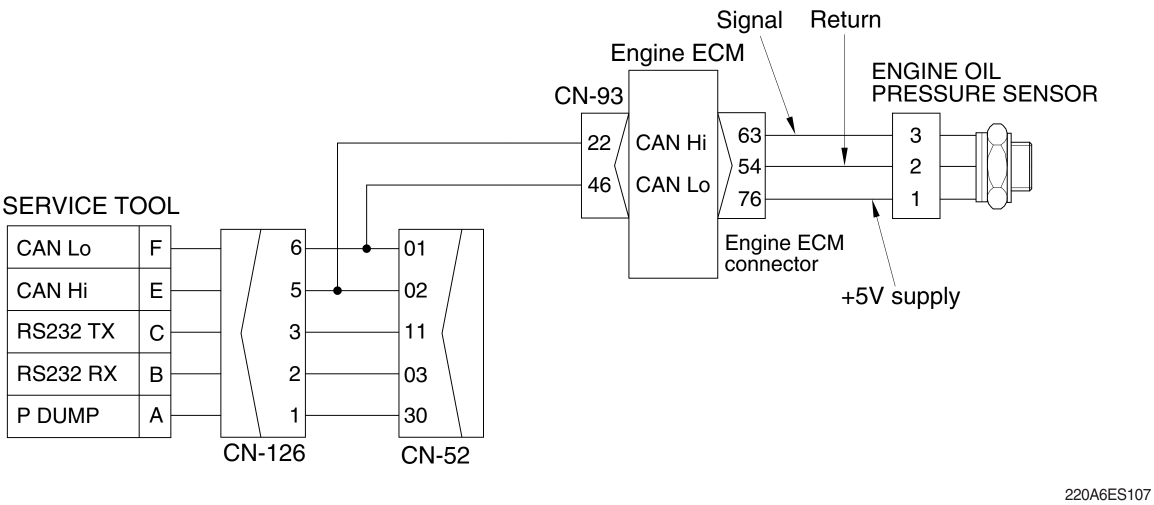
140L6ES106

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.

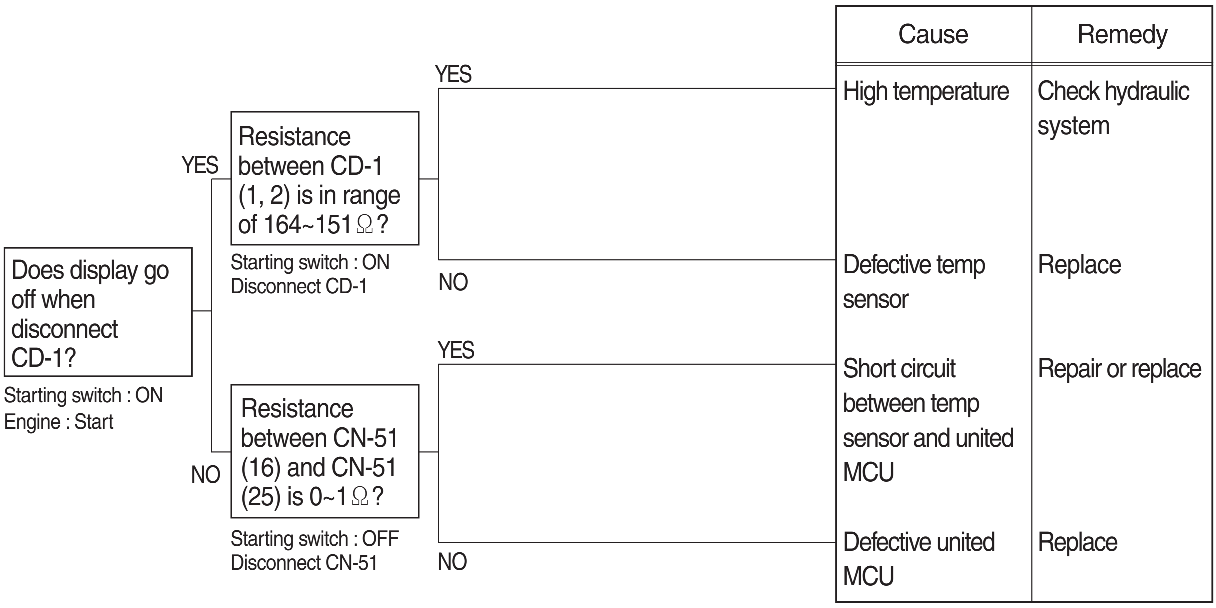


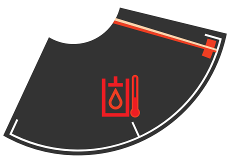
Cause	Remedy
Defective circuit, sensor or ECM.	Contact Cummins.
Voltage above normal or shorted to high source	Refer to engine fault code 143
Voltage above normal or shorted to high source	Refer to engine fault code 386



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

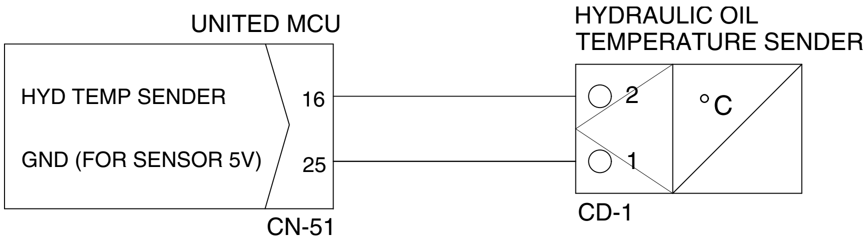
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

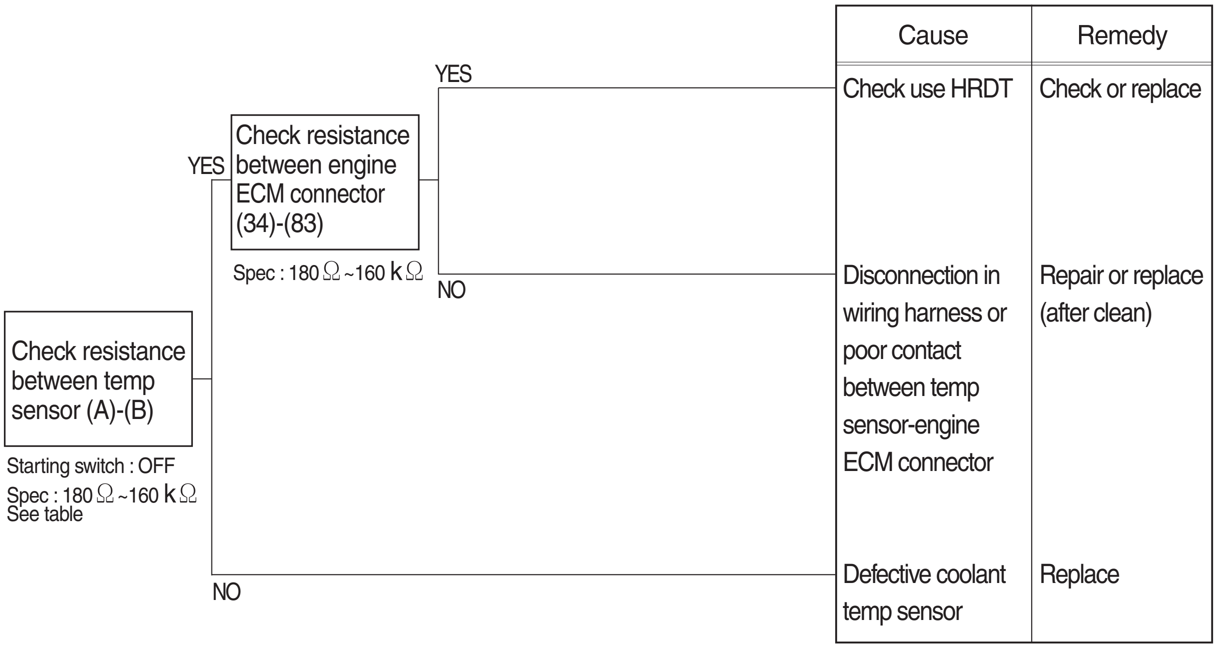
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 ~0.151



140L6ES108

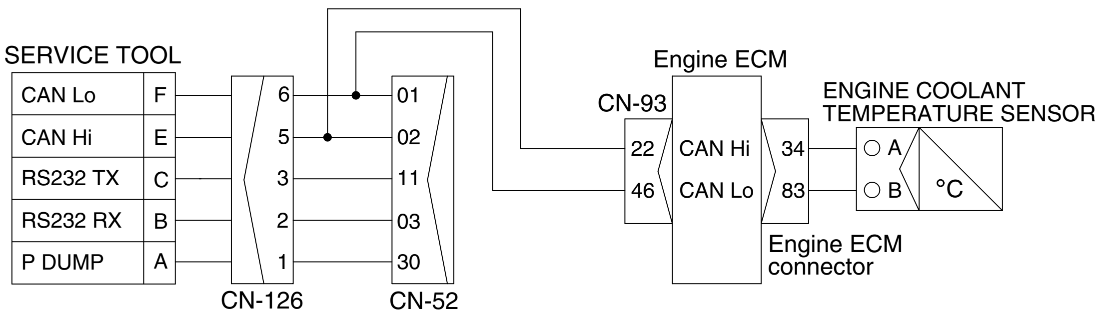
8. WHE RE GAUGE DOES NOT OPERATE

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



Check Table

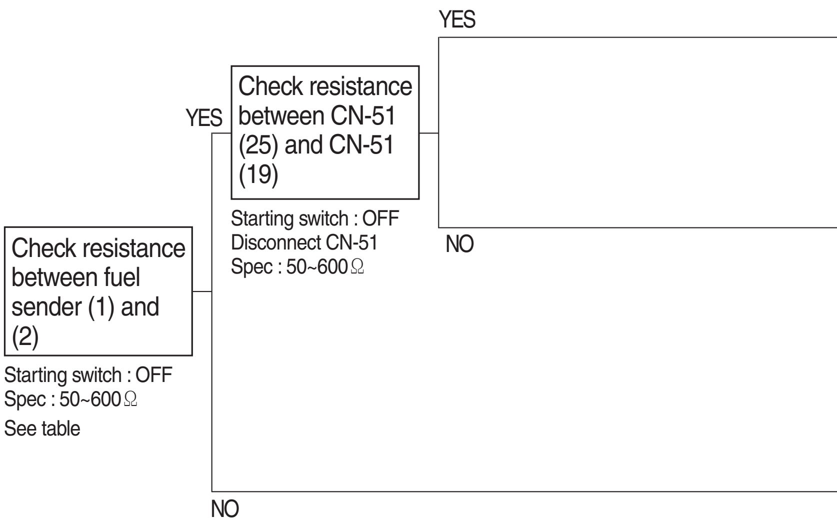
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



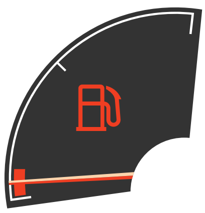
220A6ES104

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.

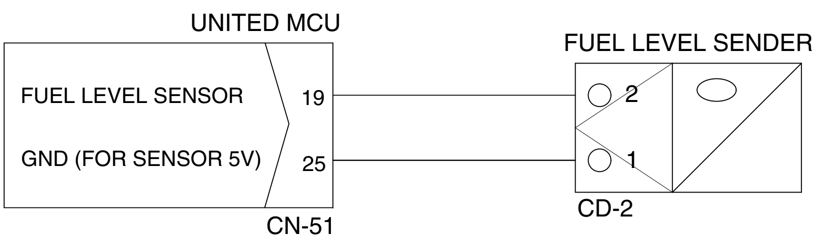


Cause	Remedy
Defective united MCU or cluster	Replace
Disconnection in wiring harness or poor contact between fuel sender-united MCU	Repair or replace
Defective fuel sender	Replace



Check Table

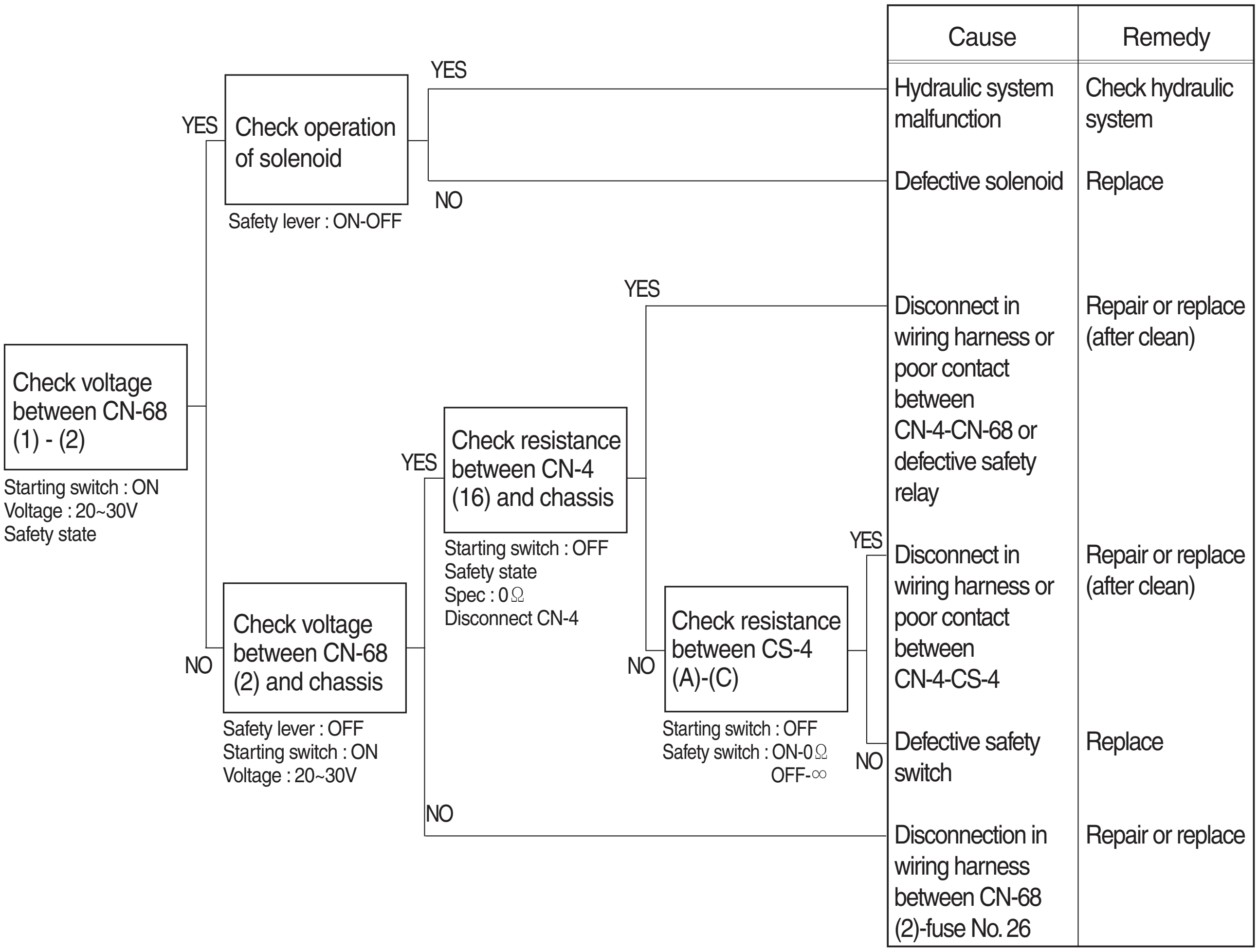
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-

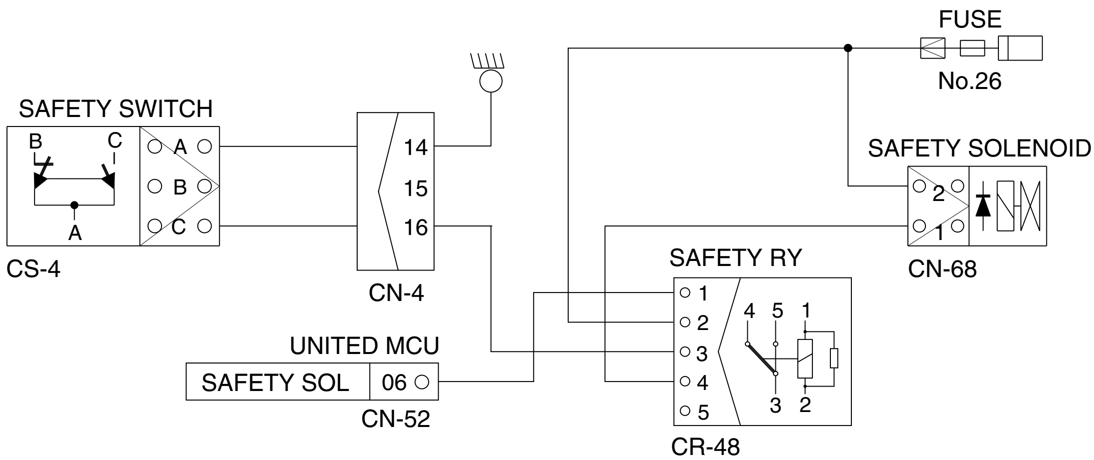


140L6ES110

10. WHEN SAFETY SOLENOID DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 26.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.
- Auto safety lock function execution condition : When the RCV pilot pressure increases above certain pressure within the standard time after changing the safety knob LOCK → UNLOCK
- Under the above conditions, the electric current is turned off to the safety solenoid, and the function of RCV and pedal is disabled.

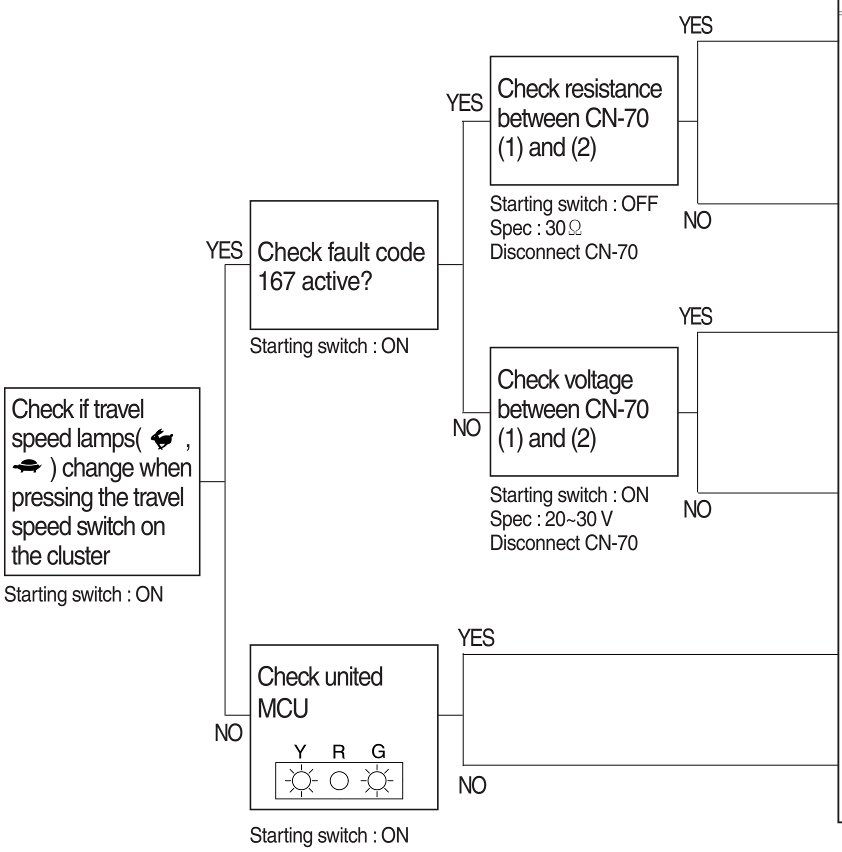




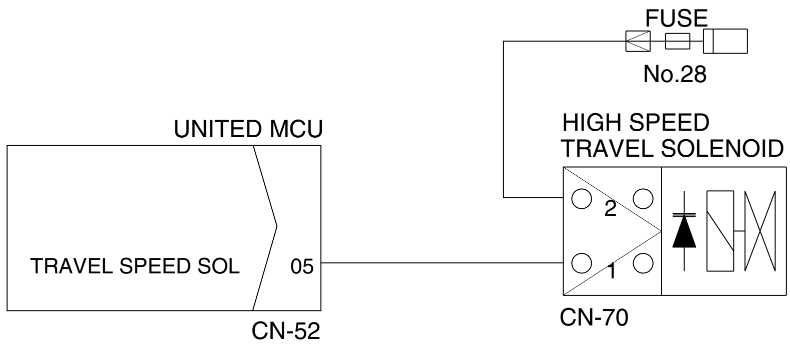
220A6ES109

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.



Cause	Remedy
Disconnection in wiring harness or poor contact between CN-70-CN-52	Repair or replace
Defective solenoid	Replace
Defective hydraulic system	Check hydraulic system
Disconnection in wiring harness or poor contact between CN-70-fuse No. 28	Repair or replace
Defective cluster	Replace
Defective united MCU	Replace



140L6ES107

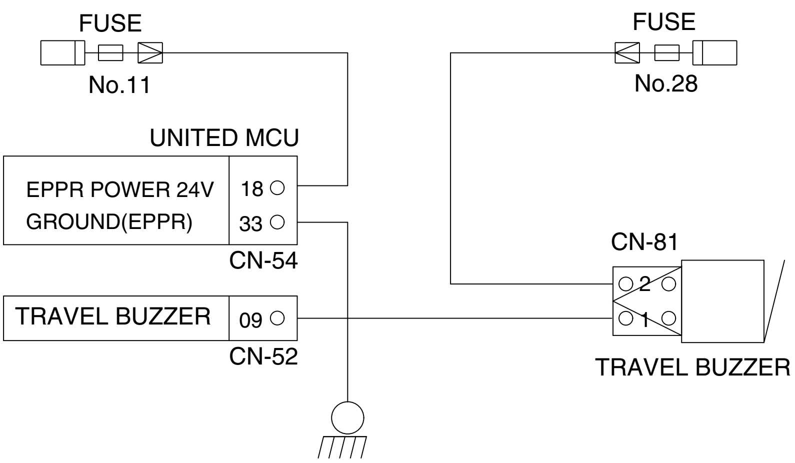
12. TRAVEL ALARM DOES NOT SOUND OR DOES NOT STOP SOUNDING

Check the fuse for travel alarm inside fuse box whether fuse is blown or not

- YES → The fuse is blown
- NO → Check the signal of MCU's pin for back buzzer whether ground signal (DO) generate or not when machine travel mode.
  - YES → The travel alarm signal of united MCU is defective
  - NO → * Prepare with starting switch OFF, then turn start engine and carry out troubleshooting : Between CN-81 (2) - chassis ground : 20-30 voltage . Between CN-81 (1) - chassis ground : Max 1 Ω (resistance) Is the above value normal?

    ** Note : Since voltage value , connector number and pin number varies with each model, should refer to the electric circuit of each model.
    - YES → The travel buzzer is defective
    - NO → * Prepare with starting switch OFF, then carry out trouble-shooting without turning starting switch ON : 1. Disconnection in wiring or defective contact in connector between CN-81 (2) inline connector-end connector : Max 1 Ω (resistance) 2. Short circuit with ground circuit between CN-81 (2) inline connector-end connector - chassis ground : Min 1MΩ (resistance)
      - NO → In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit

Cause	Remedy
The fuse is blown	Replace the fuse
The travel alarm signal of united MCU is defective	Check the united MCU program
The travel buzzer is defective	Replace the travel buzzer
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector Connect the wire



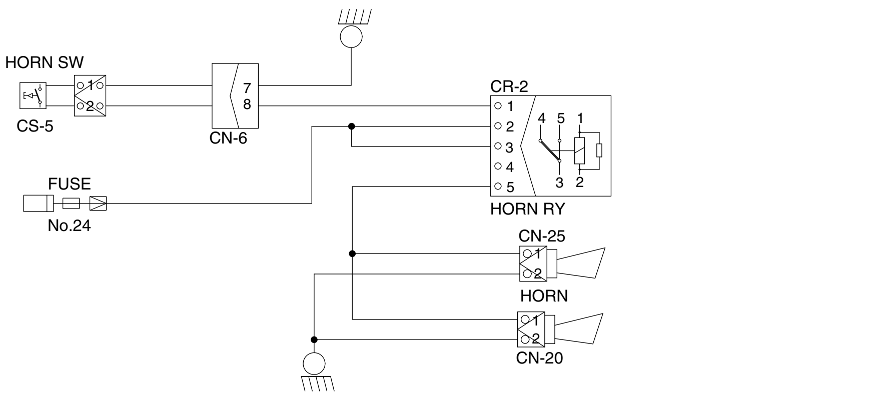
220A6ES150

13. HORN DOES NOT SOUND

Check the fuse for horn inside fuse box whether fuse is blown or not

- YES → The fuse is blown → Replace the fuse
- NO → After replacing the relay for horn, check the horn operate
  - YES → The relay is broken → Replace the relay
  - NO → * Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting : Between CN-20 (1) or CN-25 (1) - chassis ground (with horn switch turned ON) : 20-30 voltage * Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON : Between CN-20 (2) or CN-25 (2)- chassis ground : Max 1 Ω (resistance) Is the above value normal? ** Note : Since voltage value , connector number and pin number varies with each model, should refer to the wiring diagram of each model. <CN-20 (1)/ CN-25 (1) : Horn connector (+) terminal CN-20 (2) /CN-25 (2) : Horn connector (-) terminal>
    - YES → The horn is defective → Replace the horn
    - NO → * Prepare with starting switch OFF, then carry out trouble-shooting without turning starting switch ON : 1. Disconnection in wiring or defective contact in connector between CN-20 (1) or CN-25 (1) - inline connector-end connector : Max 1 Ω (resistance) 2. Short circuit with ground circuit between CN-20 (1) or CN-25 (1) - inline connector-end connector - chassis ground : Min 1M Ω (resistance)
      - NO → In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit → Replace connector. Connect the wire

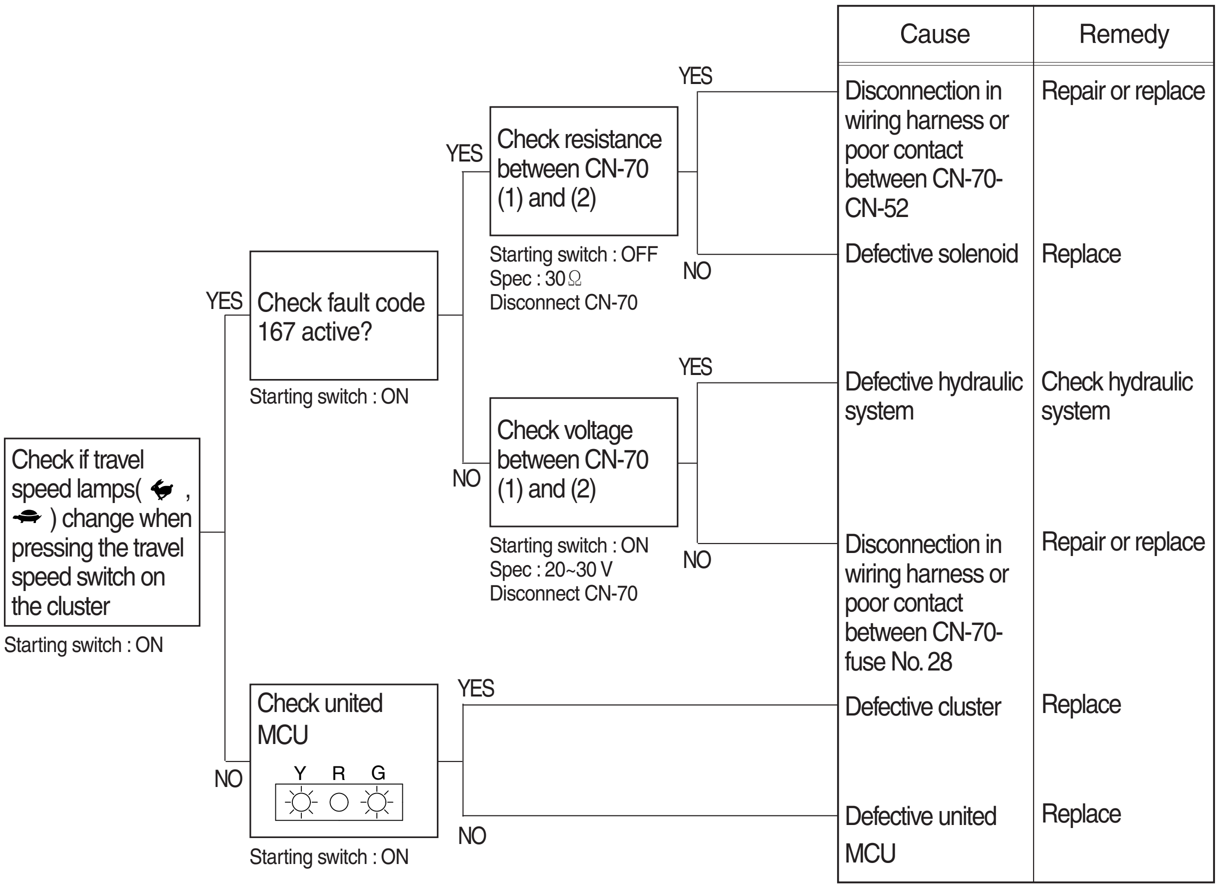
Cause	Remedy
The fuse is blown	Replace the fuse
The relay is broken	Replace the relay
The horn is defective	Replace the horn
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector. Connect the wire

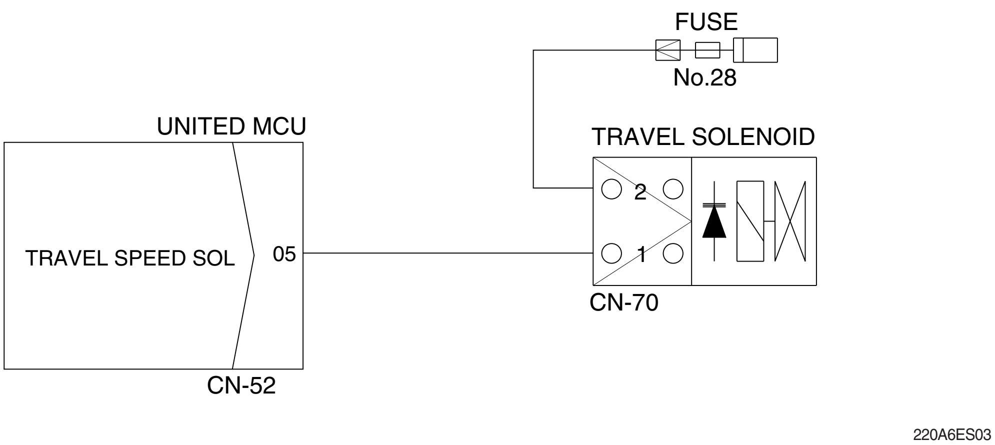


220A6ES151

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

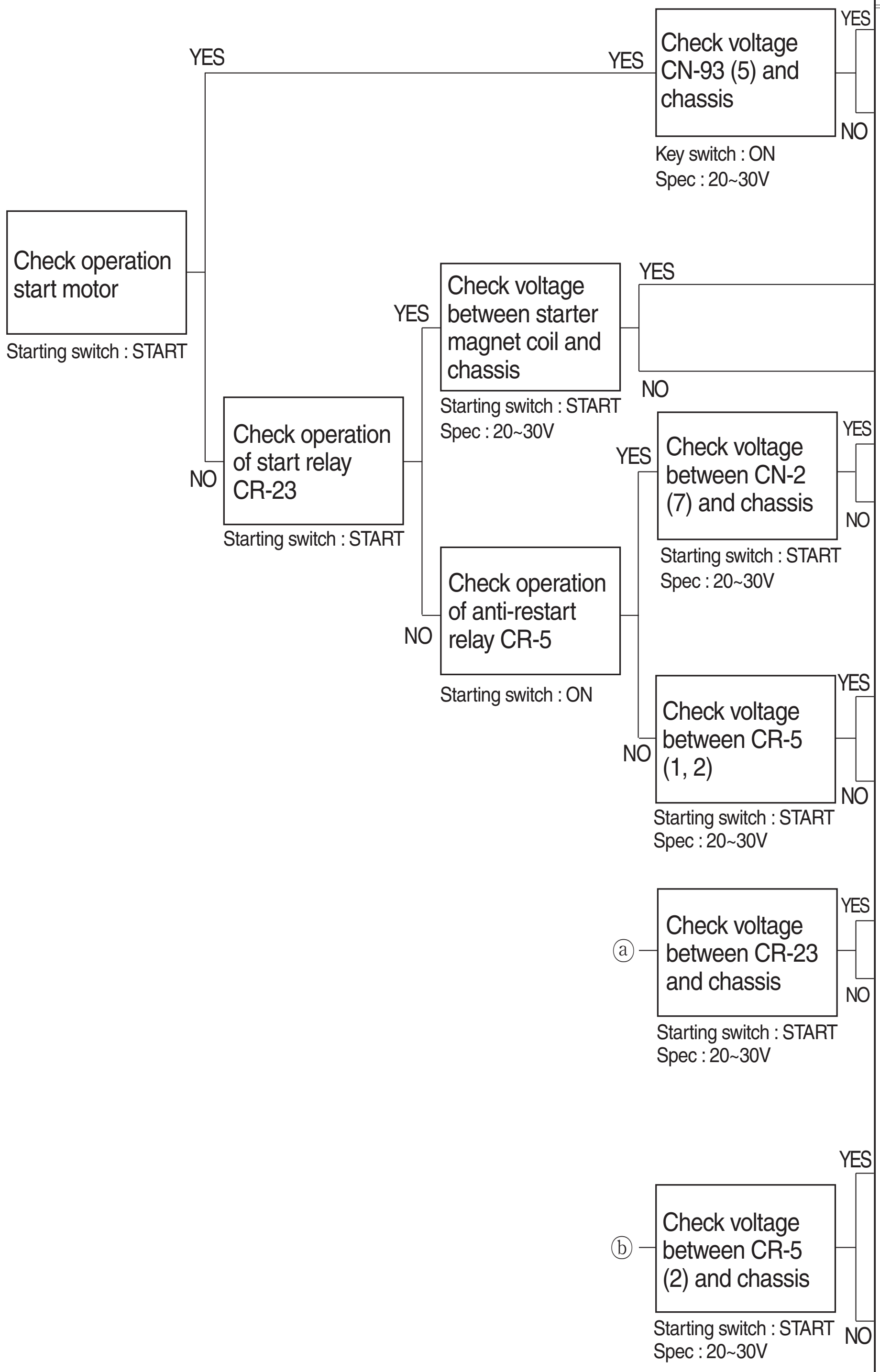
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 28.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



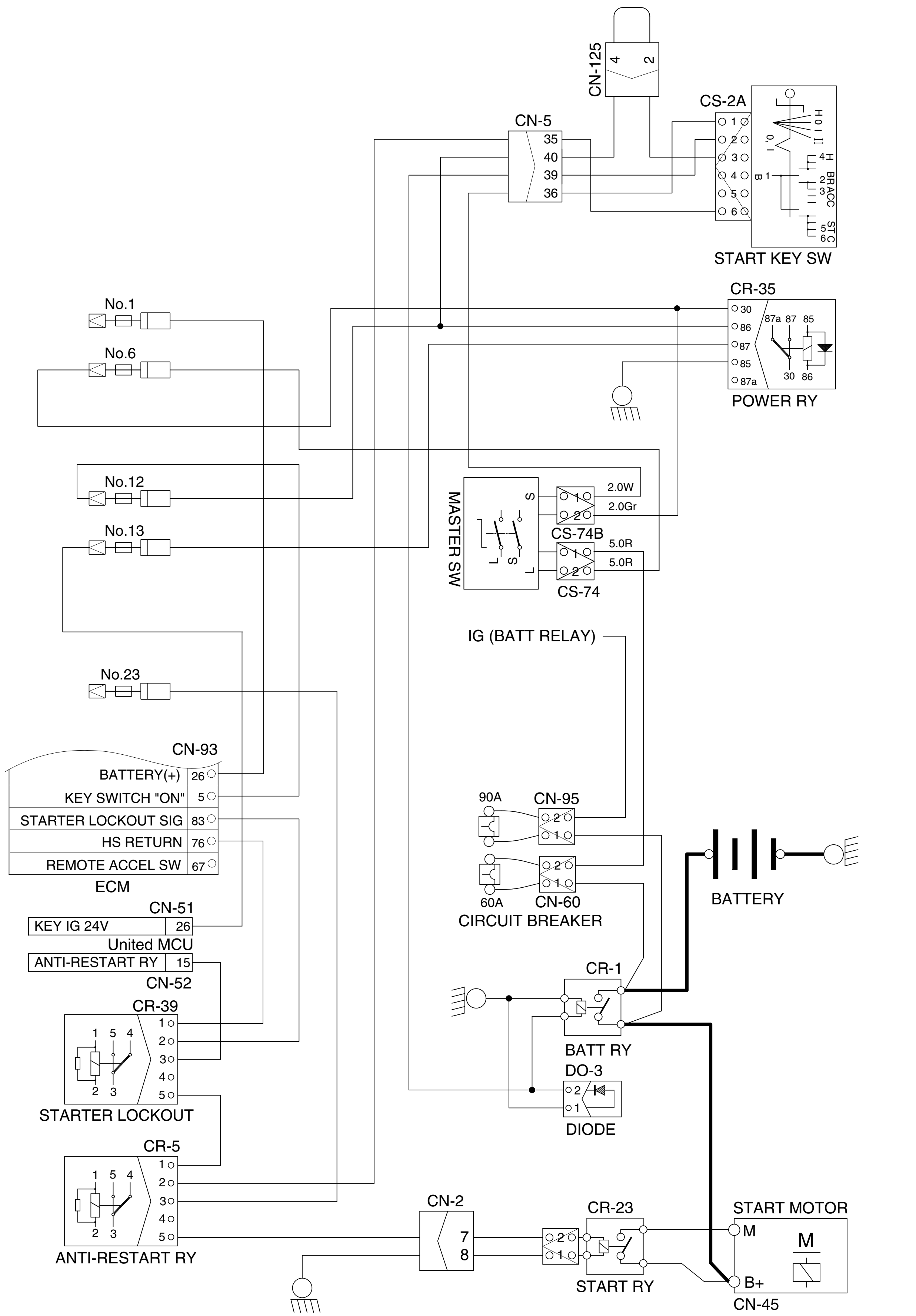


15. WHEN ENGINE DOES NOT START ([- +] lights up condition)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 1, 6, 12, 13, 23.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



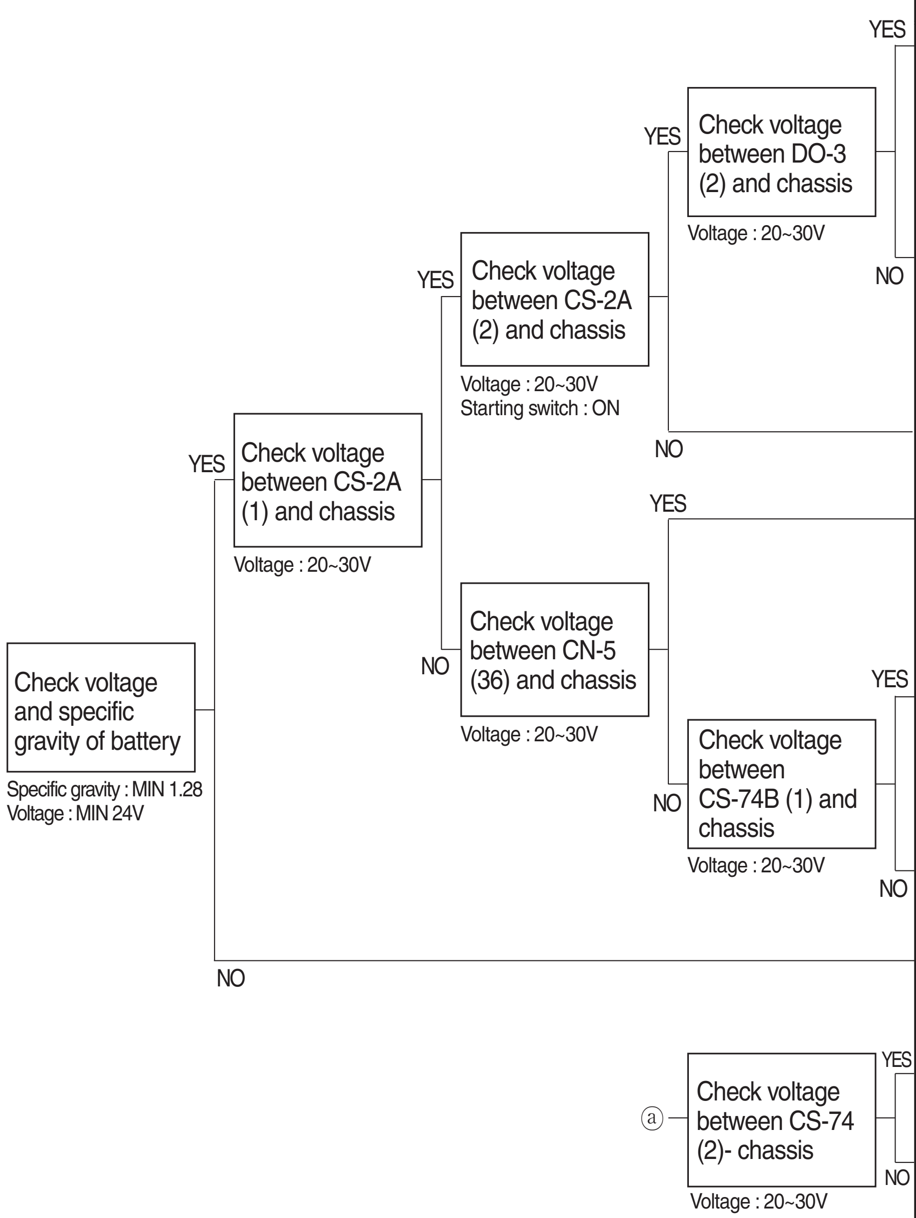
Cause	Remedy
Defective ECM or battery	Replace
Disconnection in wiring harness or poor contact between CR-35 (86) -CN-93 (5)	Repair or replace
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CN-2 (7) -CR-5 (5)	Repair or replace
Defective anti-restart relay	Replace
ⓑ	
Defective start relay	Replace
Disconnection in wiring harness or poor contact between CN-2 (7) -CR-5 (5)	Repair or replace
Disconnection in wiring harness or poor contact between CN-52 (15)-CR-5 (1)	Repair or replace
Disconnection in wiring harness or poor contact between CS-2A (6)- CR-5 (2)	Repair or replace



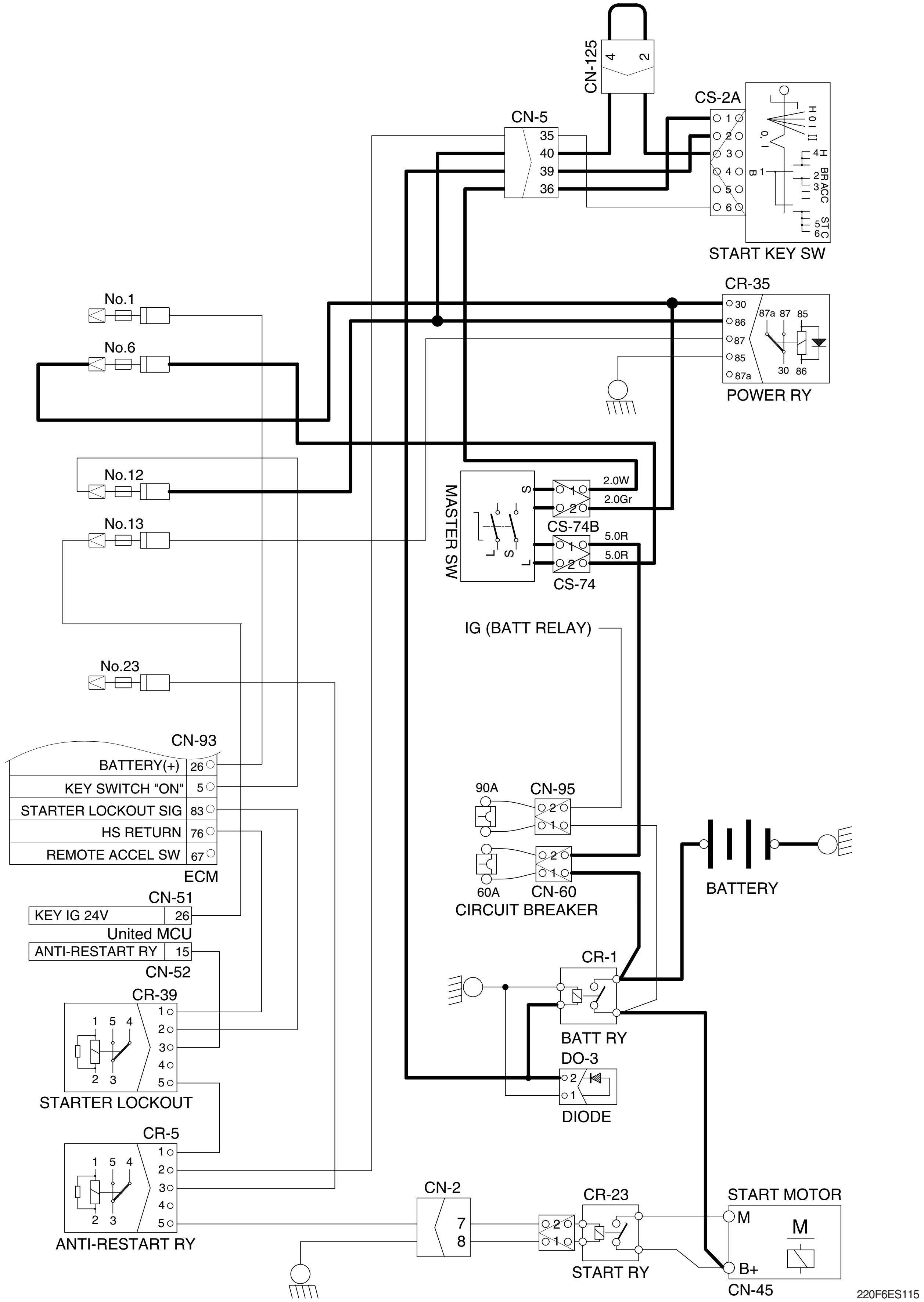
220F6ES114

16. WHEN STARTING SWITCH ON DOES NOT OPERATE

- · Before disconnecting the connector, always turn the starting switch OFF.
- · Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of circuit breaker (CN-60).
- · After checking, insert the disconnected connectors again immediately unless otherwise specified.

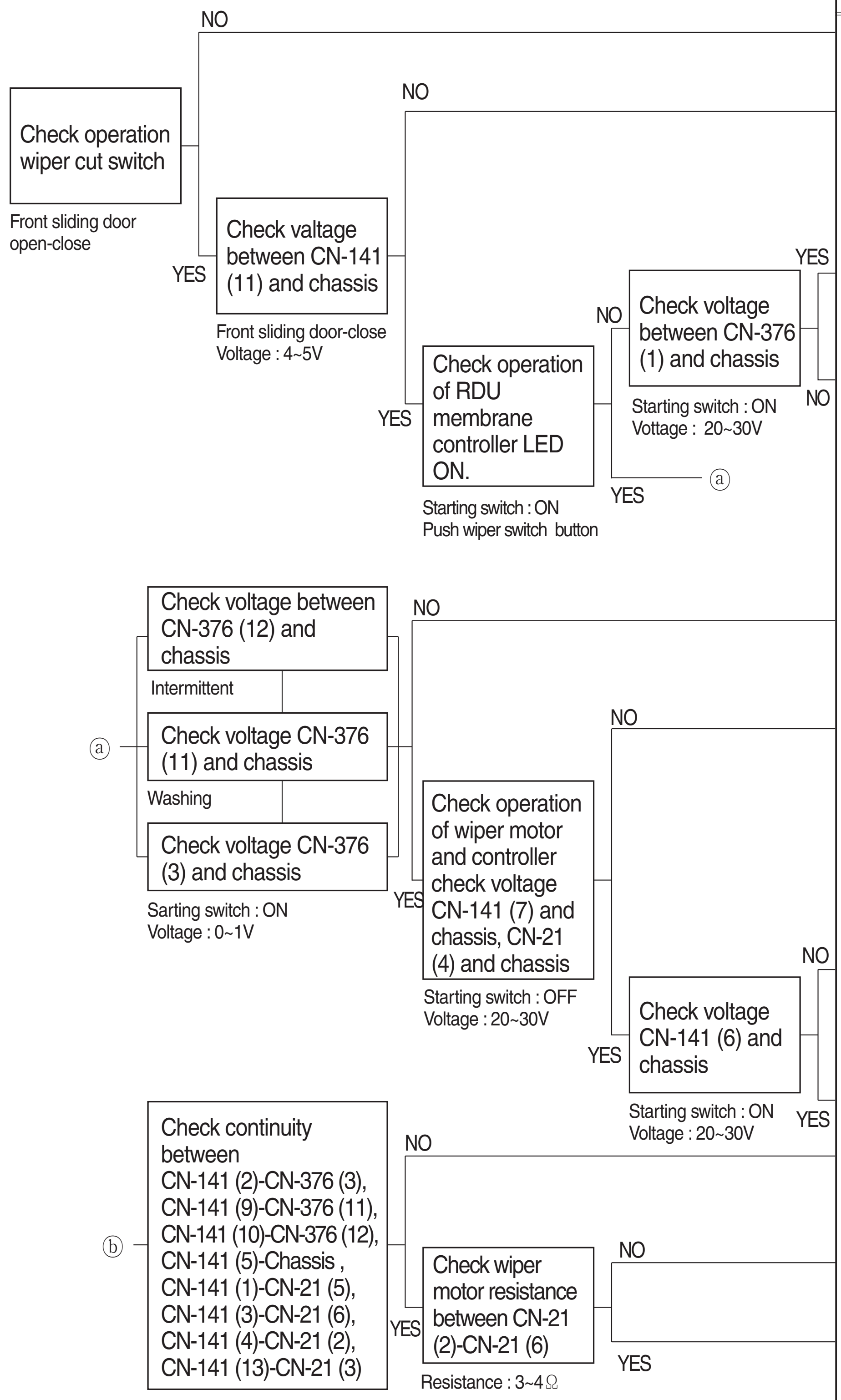


Cause	Remedy
Disconnection in wiring harness or poor contact between DO-3 (2)-CR-1 or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2A (2)-CN-5(39)- DO-3 (2)	Repair or replace (after clean)
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2A (1)-CN-5 (36)	Replace
Disconnection in wiring harness or poor contact between CS-74B (1) -CN-5 (36)	Charge or replace (after clean)
ⓐ	
Battery capacity too low	Charge or replace (after clean)
Defective master switch	Replace
Disconnection in wiring harness or poor contact between CS-74 (2) -CR-1	Charge or replace (after clean)

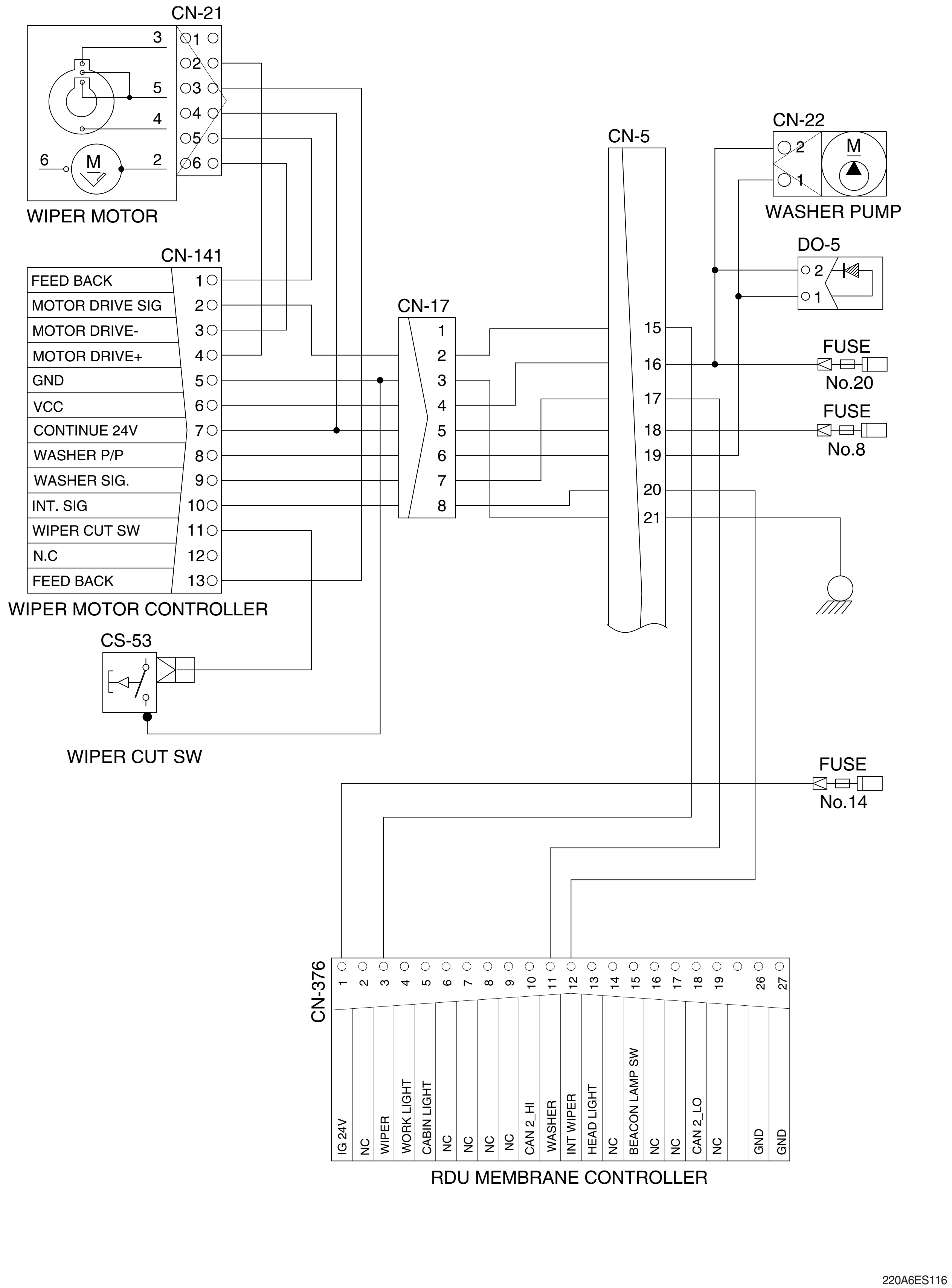


17. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No. 8, 14 and 20 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

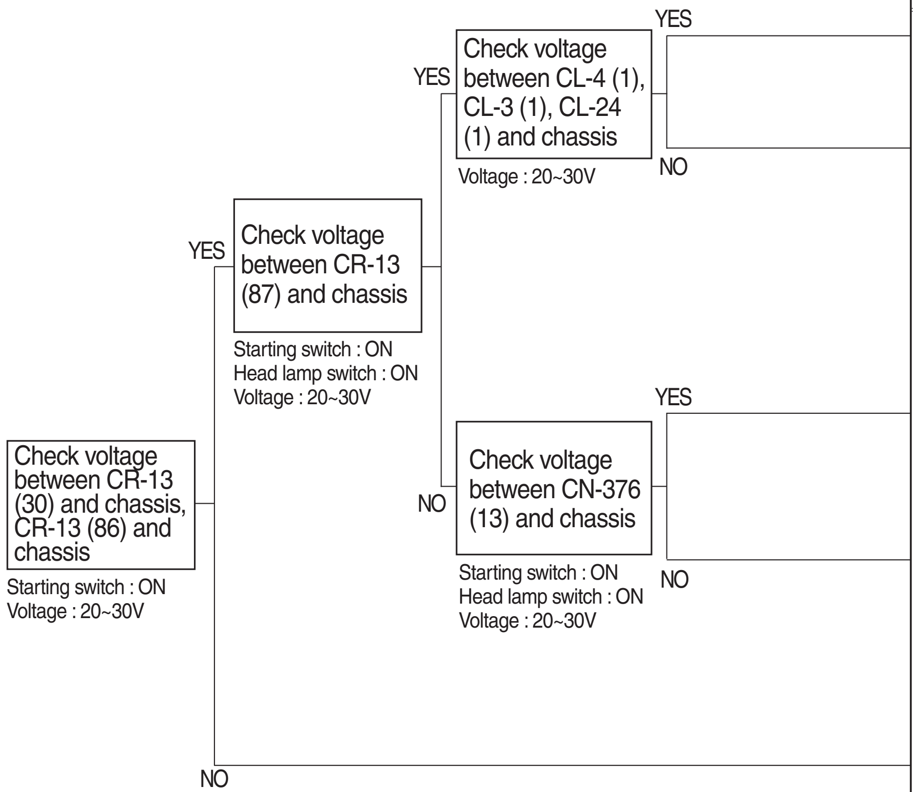


Cause	Remedy
Defective wiper cut switch	Replace
Short circuit in wiring harness or poor contact between CN-141 (11)- CS-53	Repair or replace (after clean)
Defective RDU membrane controller	Replace
1)Recheck fuse No.14	Replace
2)Disconnection in wiring harness or poor contact between CN-376(1)-Fuse No.14	Repair or replace (after clean)
Defective RDU membrane controller	Replace
1) Recheck fuse No.8	Replace
2) Disconnection in wiring harness or poor contact between CN-141(7)-Fuse, CN-21(4)-Fuse	Repair or replace (after clean)
1) Recheck fuse No.20	Replace
2) Disconnection CN-141(6)-Fuse No.20 ⓑ	Repair or replace (after clean)
Disconnection in wiring harness or poor contact	Repair or replace (after clean)
Defective wiper motor	Replace
Defective wiper motor controller	Replace

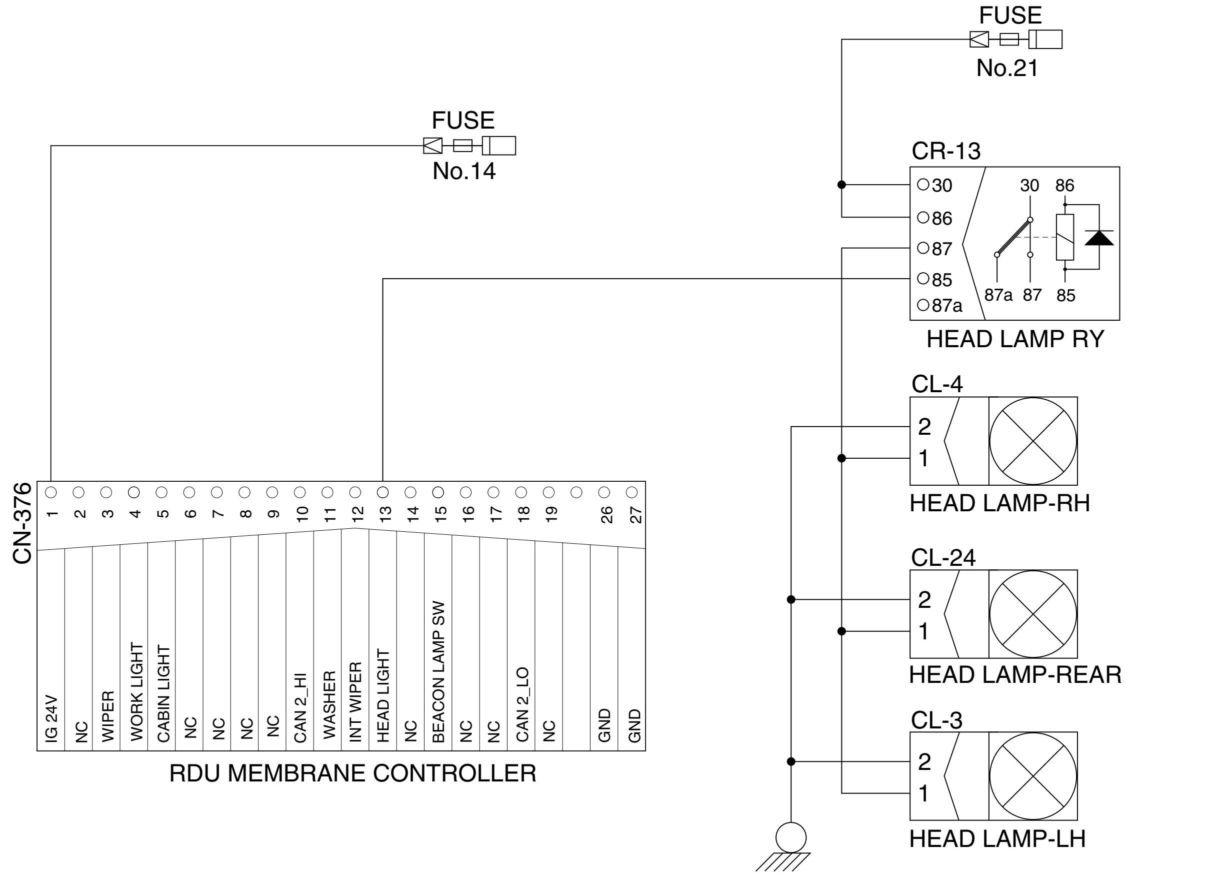


18. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.14 & 21.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-13 (87)-CL-4 (1), 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



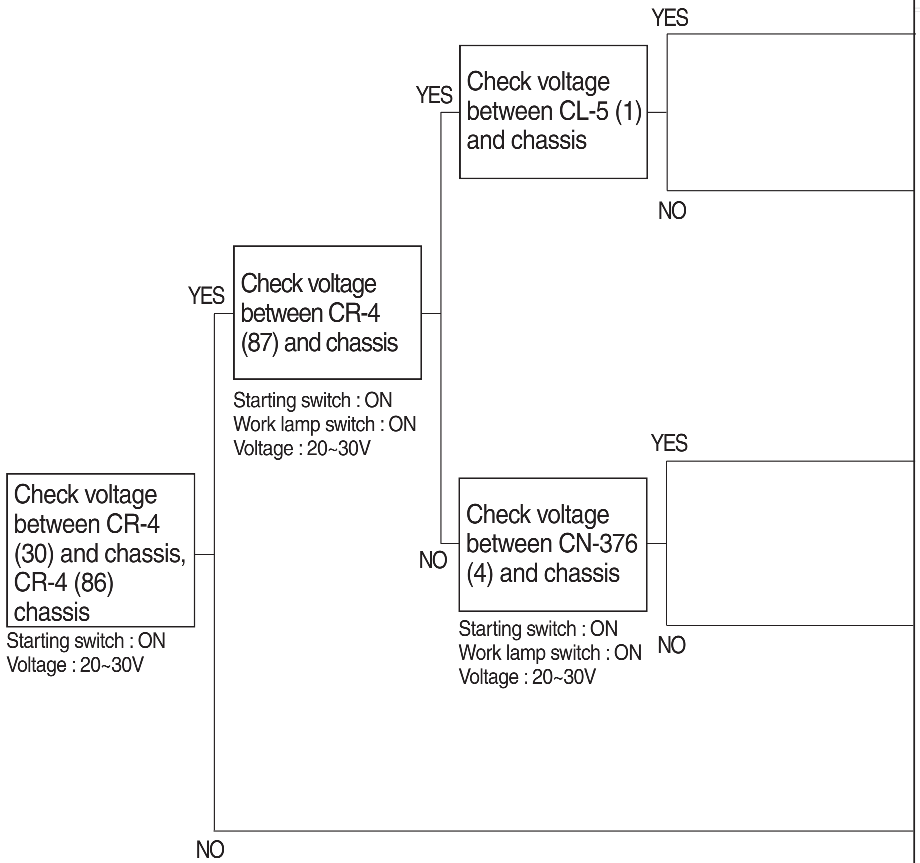
220A6ES117

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

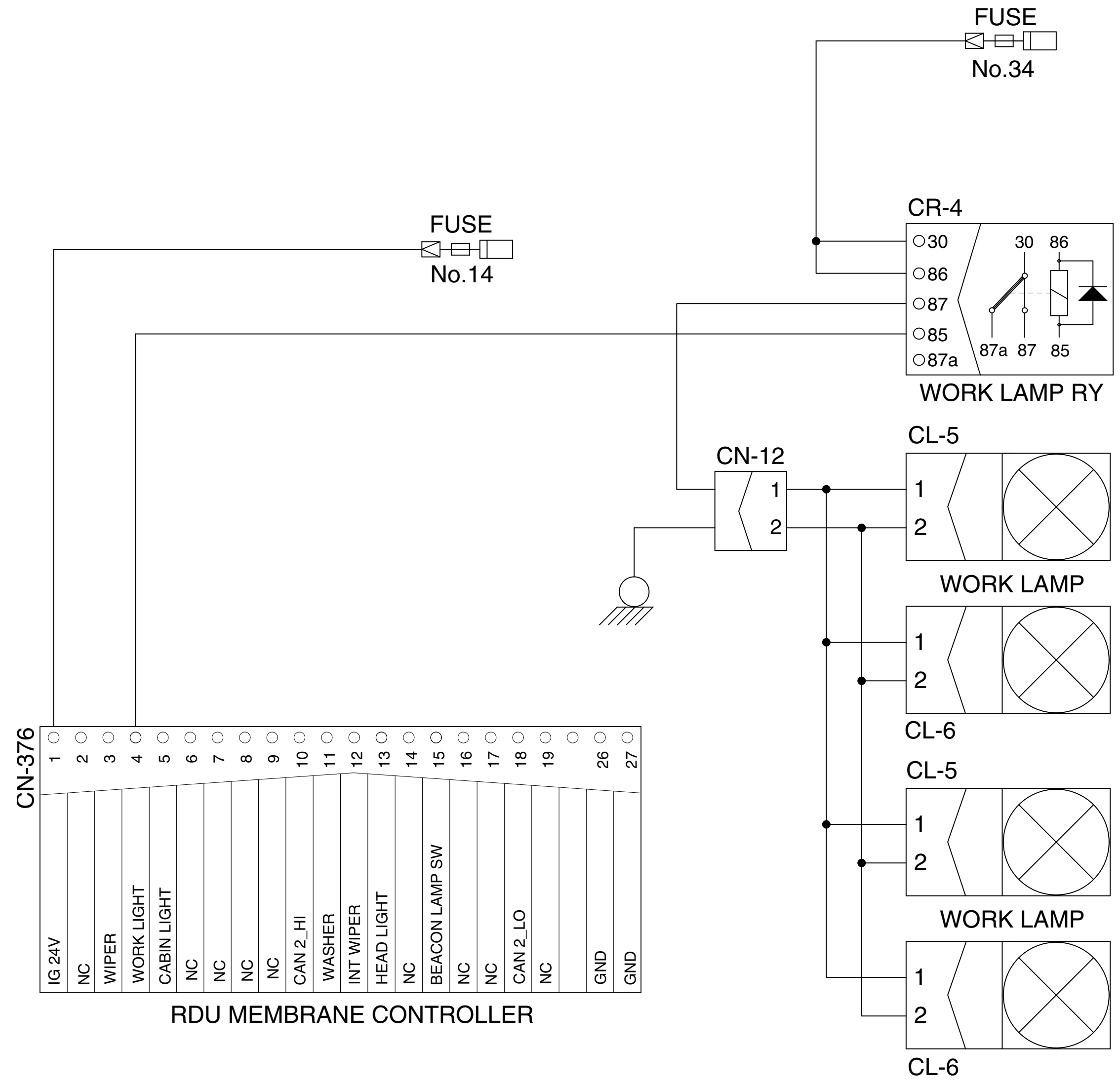
· Before disconnecting the connector, always turn the starting switch OFF.

· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.14 & 34.

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



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CL-5 (1)	Repair or replace (after clean)
Defective RDU membrane controller	Replace
Disconnection in wiring harness or poor contact between CR-4 (85)-CN-376 (4)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-4 (30) and chassis or CR-4 (86) and chassis	Repair or replace (after clean)
Recheck fuse No.34	Replace



220A6ES118

GROUP 4 MECHATRONICS SYSTEM

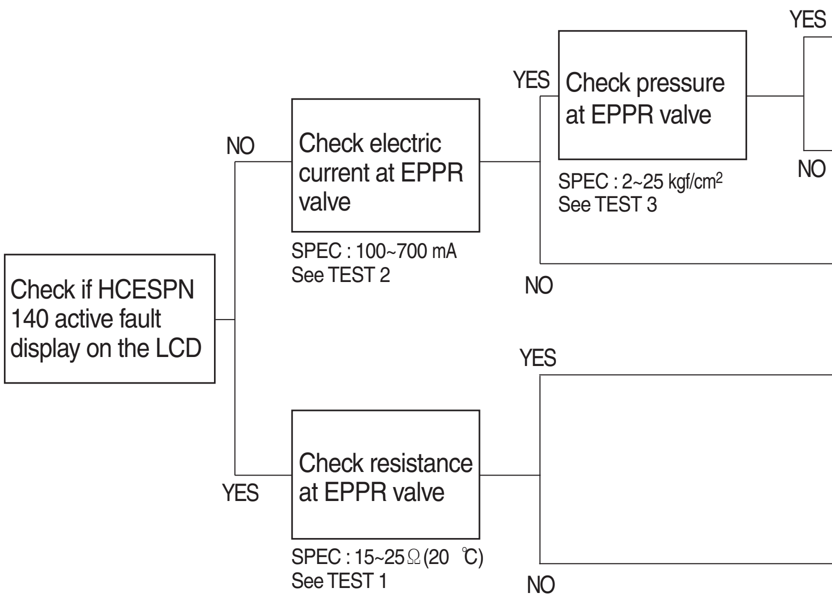
1. ALL ACTUATORS SPEED ARE SLOW

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

※ Spec : P-mode 1700 ± 50 rpm S -mode 1600 ± 50 rpm E-mode 1600 ± 50 rpm

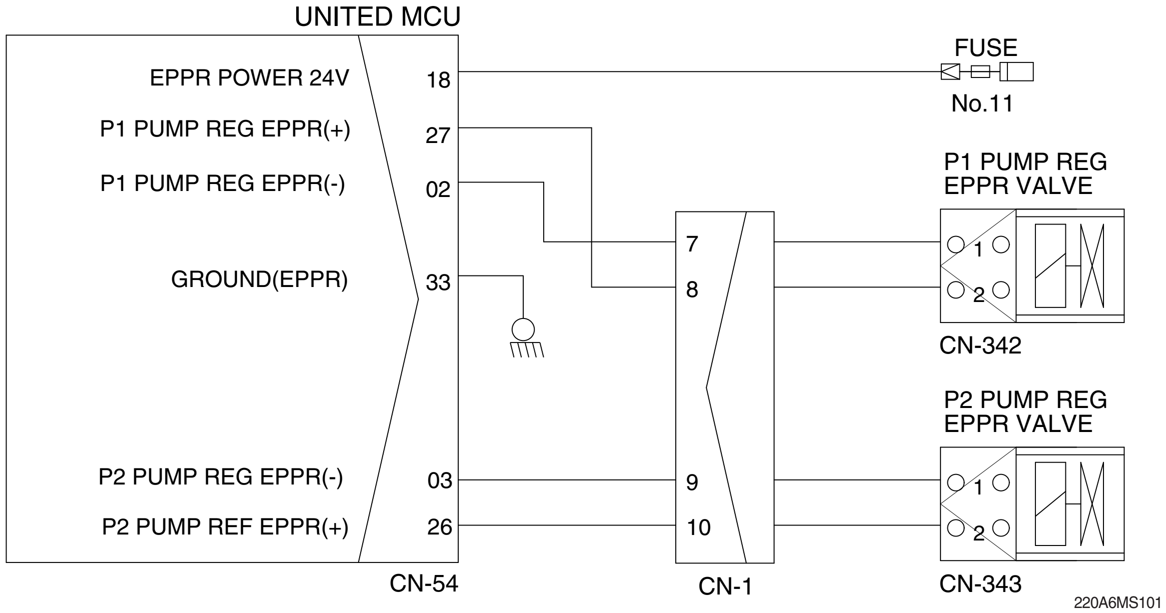
※ Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective hydraulic system	
Defective EPPR valve	Replace
Defective united MCU	Replace
Short circuit or poor connection between CN-54 -CN-342 (or 343)	Check & repair wire harness or between CN-54 -CN-342 (or 343)
Defective EPPR valve	Replace

Wiring diagram



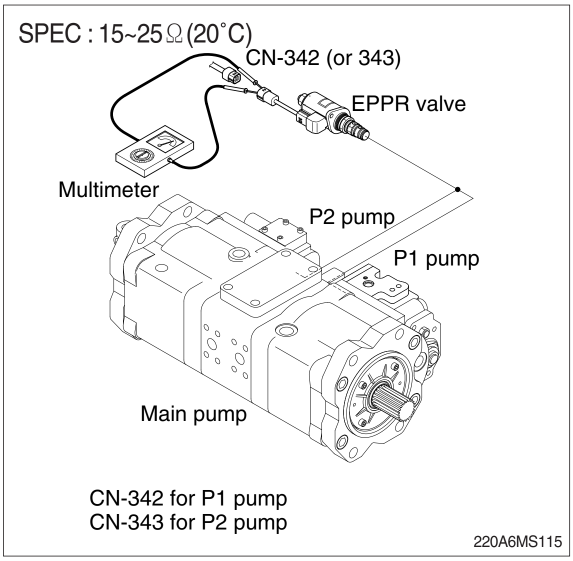
2) TEST PROCEDURE

(1) Test 1 : Check resistance at connector CN-342 (or 343).

① Starting switch OFF.

② Disconnect connector CN-342 (or 343) 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-342 (or 343) from EPPR valve.

② Insert the adapter to CN-342 (or 343) and install multimeter as figure.

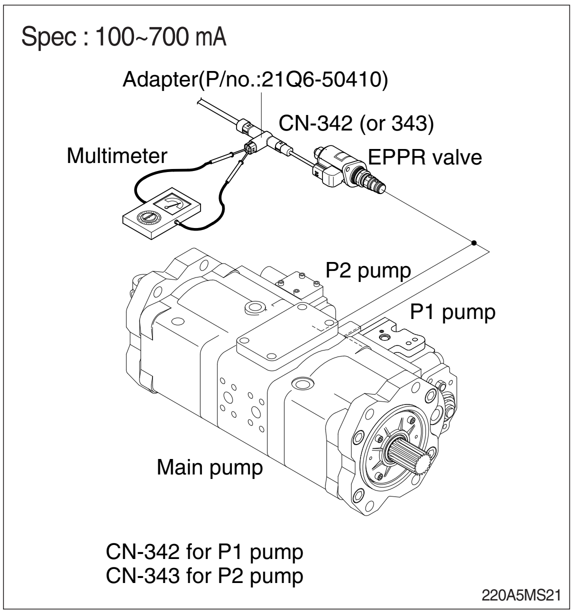
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If tachometer show approx 1600±50 rpm disconnect one wire harness from EPPR valve.

⑦ Check electric current at bucket circuit relief position.



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

① Remove plug and connect pressure gauge as figure.

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

② Start engine.

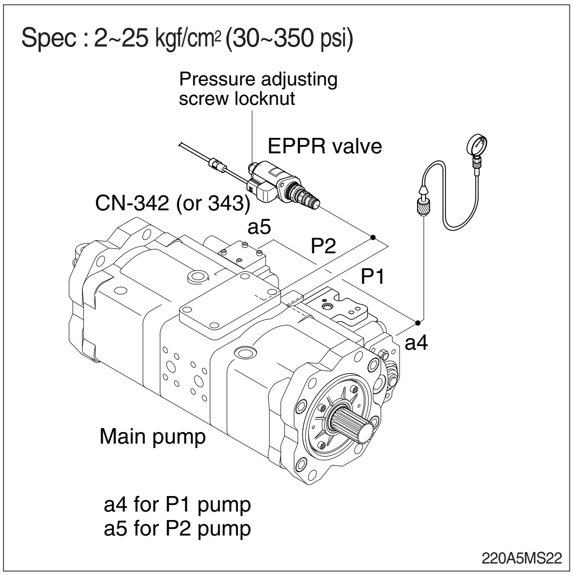
③ Set S-mode and cancel auto decel mode.

④ Position the multimodal dial at 10.

⑤ If tachometer show approx 1600±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

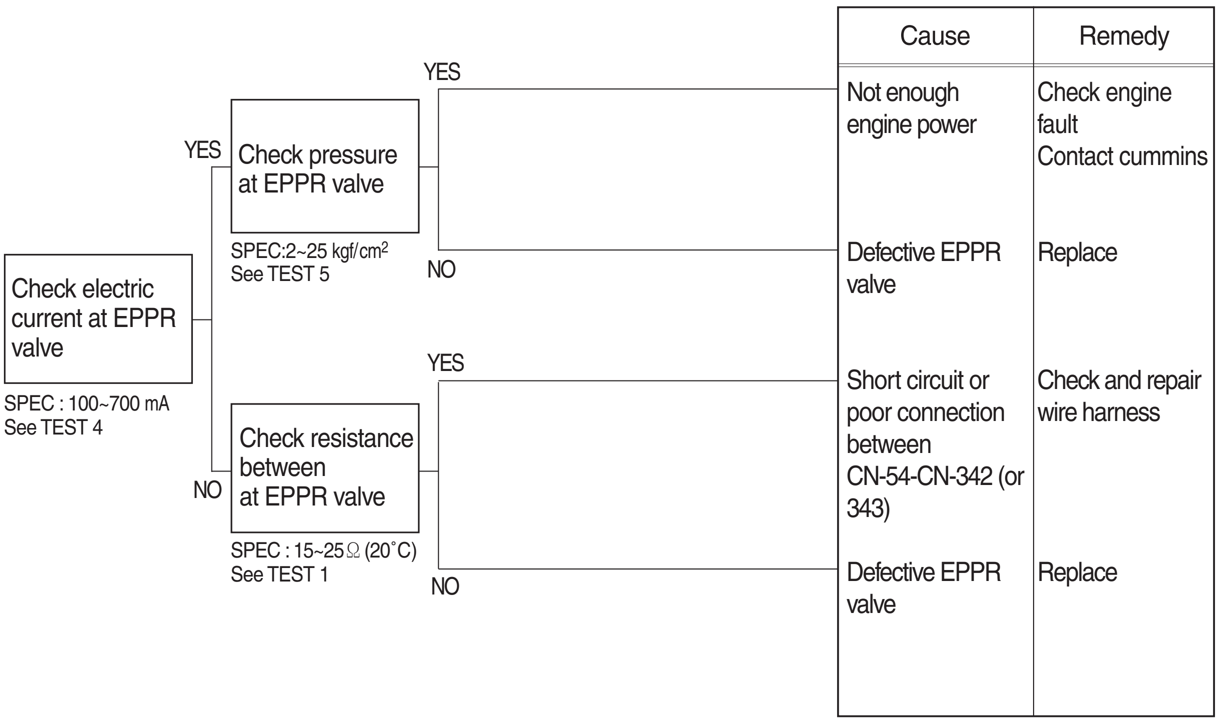
⑦ After adjust, test the machine.



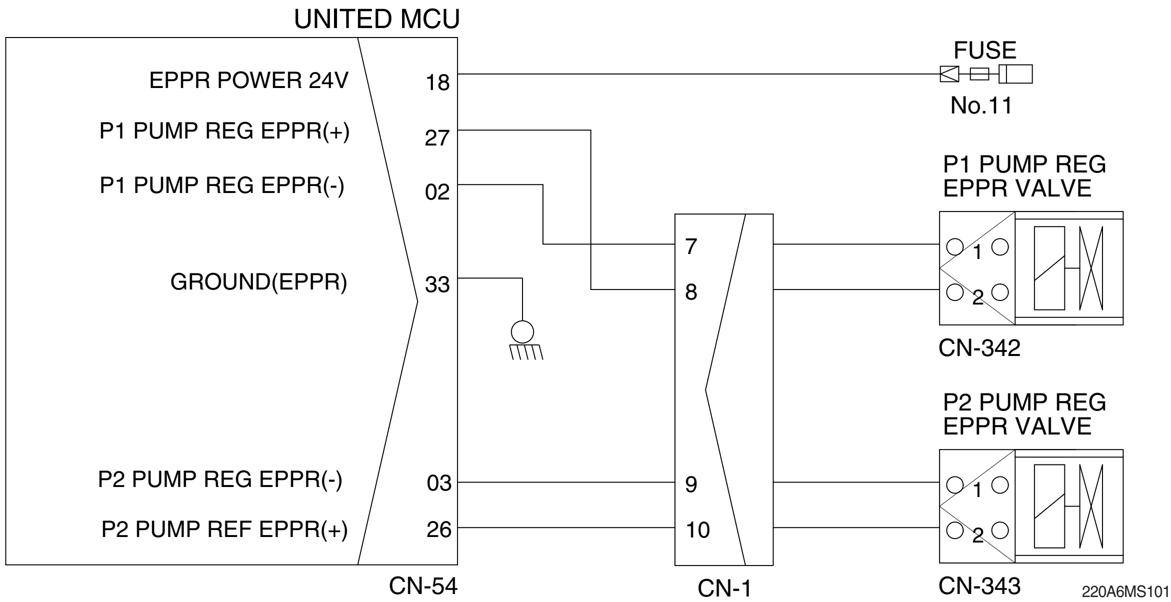
2. ENGINE STALL

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

1) INSPECTION PROCEDURE



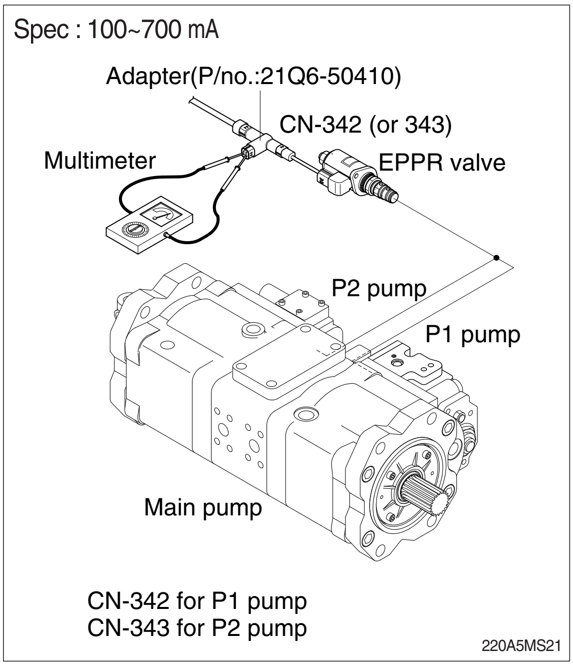
Wiring diagram



2) TEST PROCEDURE

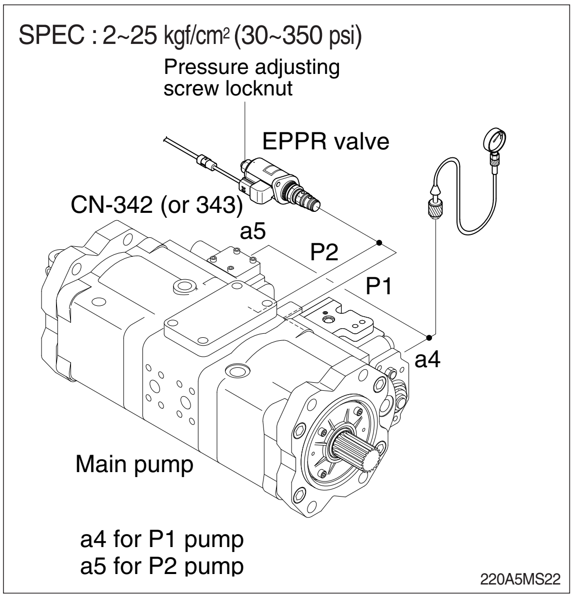
(1) Test 4 : Check electric current at EPPR valve.

① Disconnect connector CN-342 (or 343) from EPPR valve.
② Insert the adapter to CN-342 (or 343) 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 1600±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.

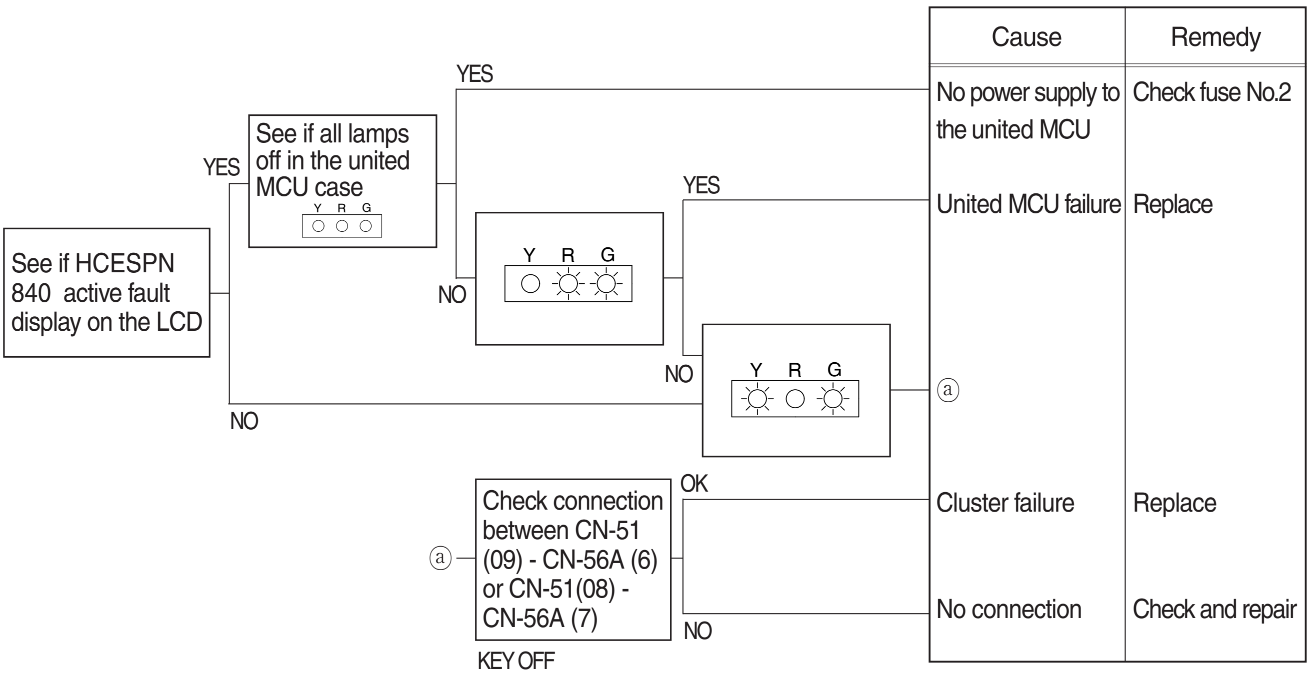
① Remove plug and connect pressure gauge as figure.
 · Gauge capacity : 0 to 50 kgf/cm^2 (0 to 725 psi)
② Start engine.
③ Set S-mode and cancel auto decel mode.
④ Position the multimodal dial at 10.
⑤ If rpm show approx 1600±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.



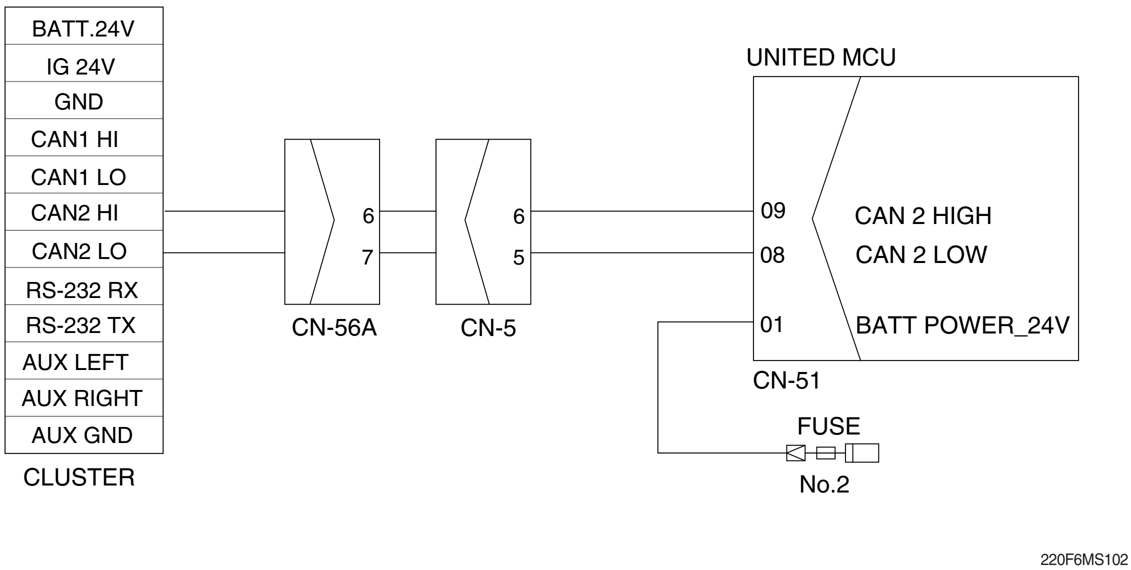
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

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

1) INSPECTION PROCEDURE



Wiring diagram

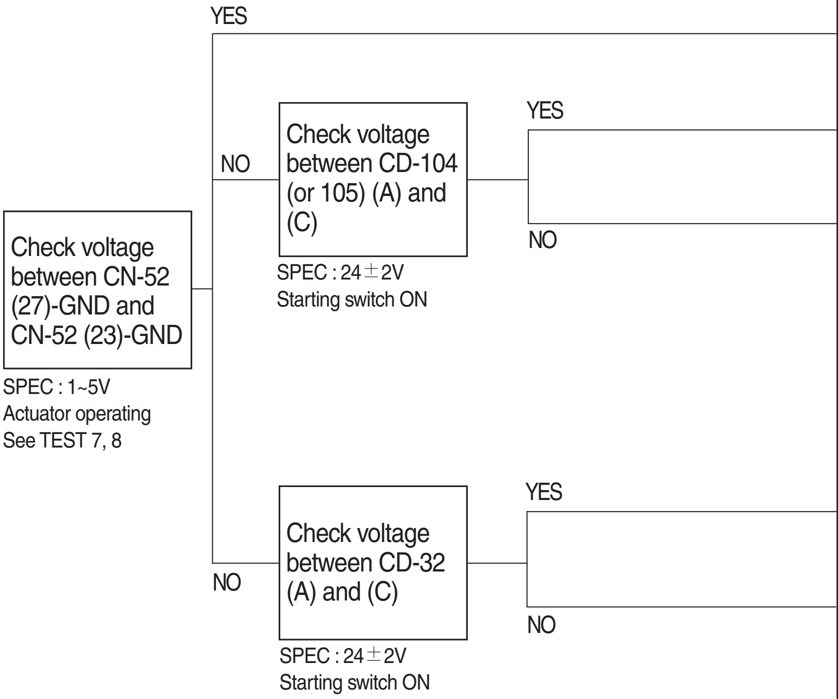


4. AUTO DECEL SYSTEM DOES NOT WORK

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

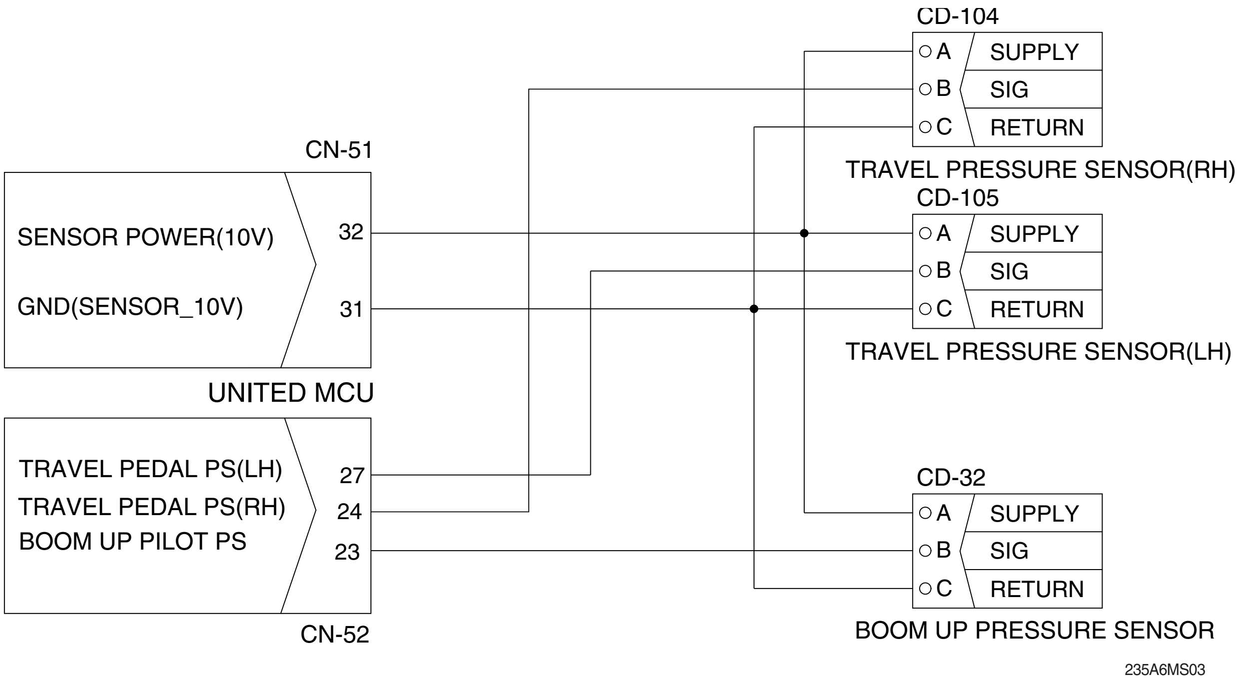
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Defective travel pressure sensor	Replace
Short circuit or poor connection between CN-51 (32)-CD-104 (or 105) (A) and / or CN-51 (31)-CD-104 (or 105) (C) (fault code 108 displayed)	Replace or repair
Defective work pressure sensor	Replace
Short circuit or poor connection between CN-51 (32)-CD-32 (A) and / or CN-51 (31)-CD-32 (C) (fault code 105 displayed)	Replace or repair

Wiring diagram



2) TEST PROCEDURE

(1) Test 7 : Check voltage at CN-52 (24 or 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 (24 or 27) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

(2) Test 8 : Check voltage at CN-52 (19) and ground.

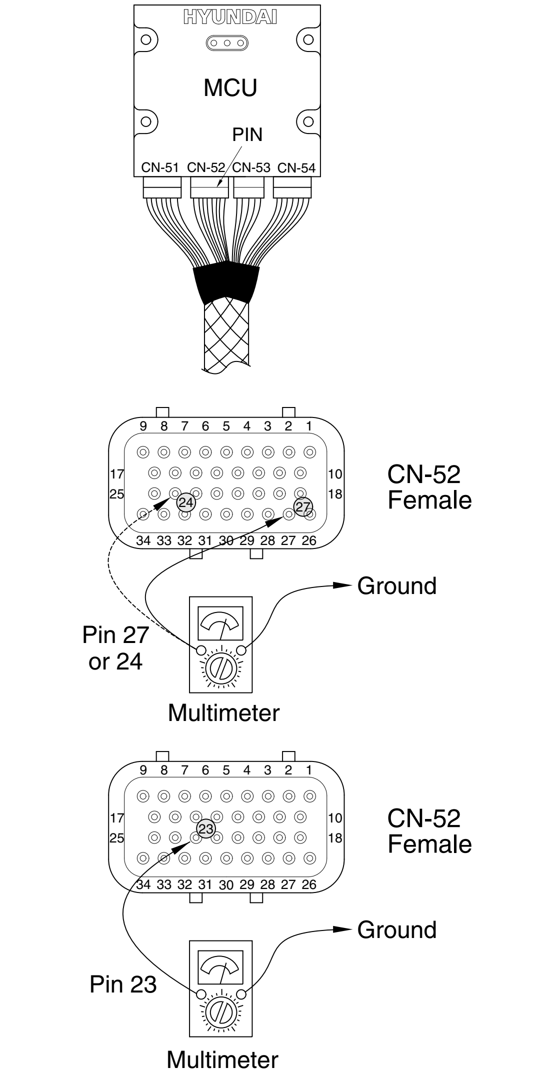
① Prepare 1 piece of thin sharp pin, steel or copper

② Insert prepared pin to rear side of connectors : One pin to (23) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



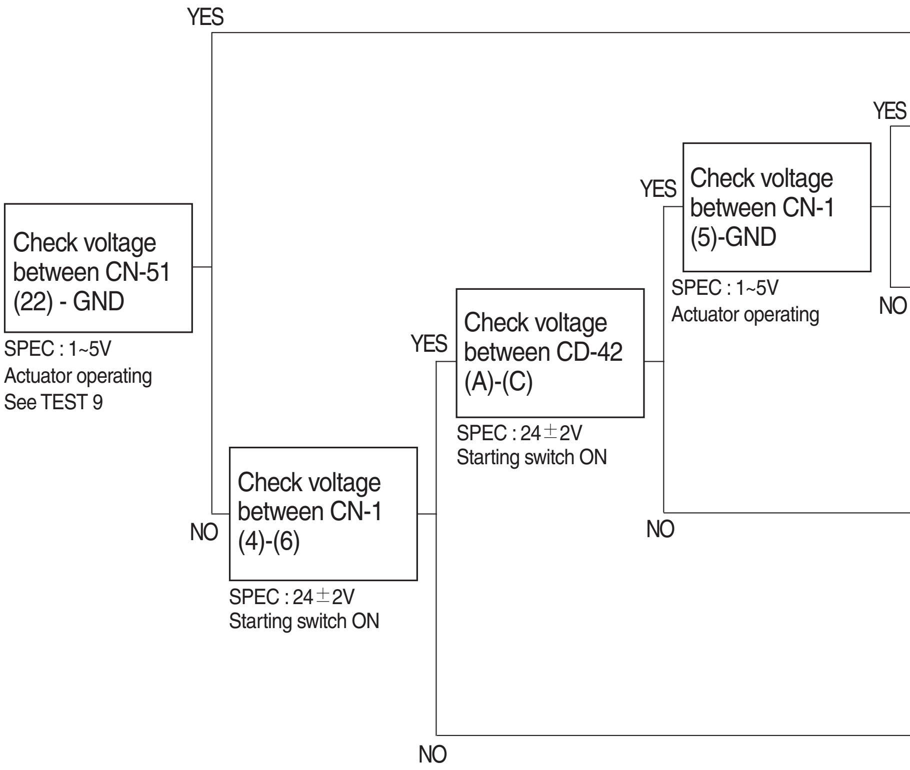
235A6MS104

5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

· Fault code : HCESPN 120, FMI 0~4

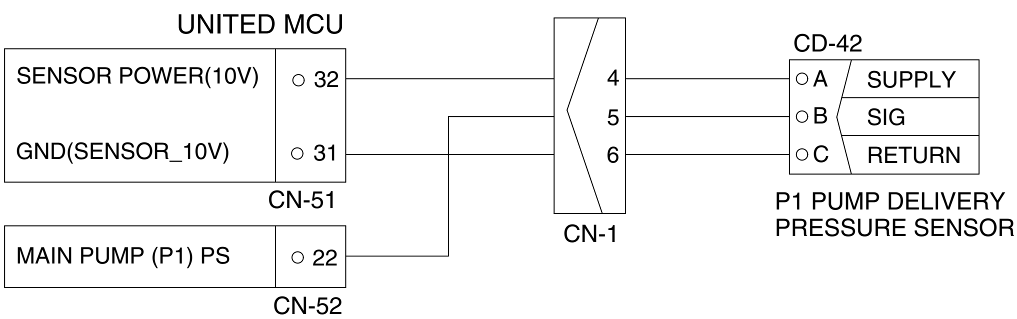
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Short circuit or poor connection between CN-51 (31)-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-52 (31)	Replace or repair

Wiring diagram



220A6MS105

2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (22) and ground.

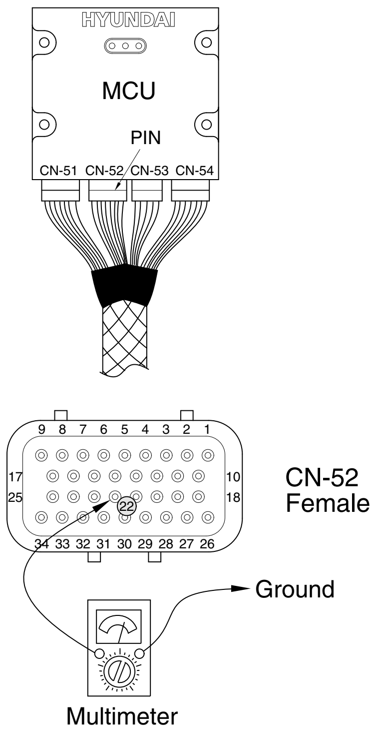
① Prepare 1 piece of thin sharp pin, steel or copper.

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



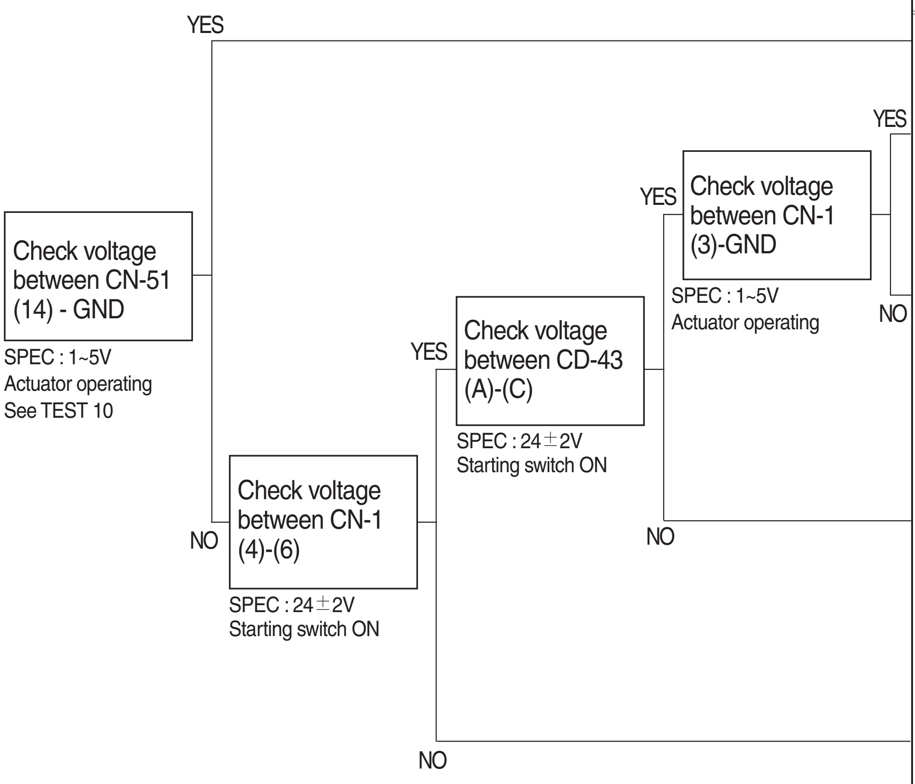
220A6MS106

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

· Fault code : HCESPN 121, FMI 0~4

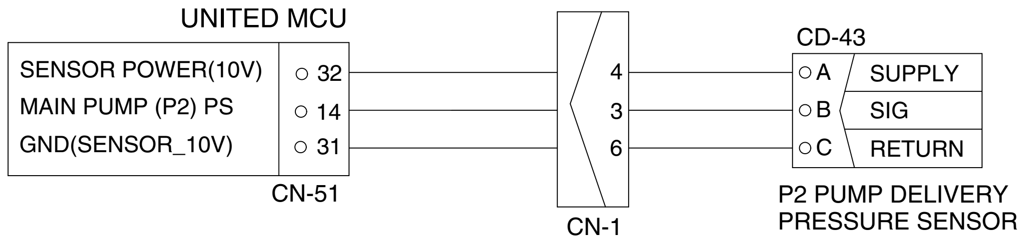
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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 (8)	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



220A6MS107

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-51 (14) and ground.

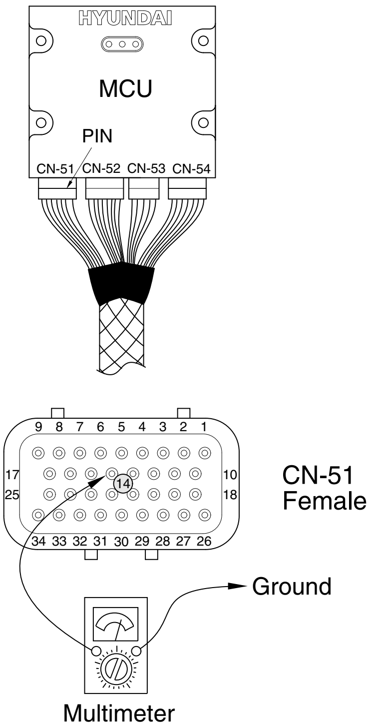
① Prepare 1 piece of thin sharp pin, steel or copper.

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



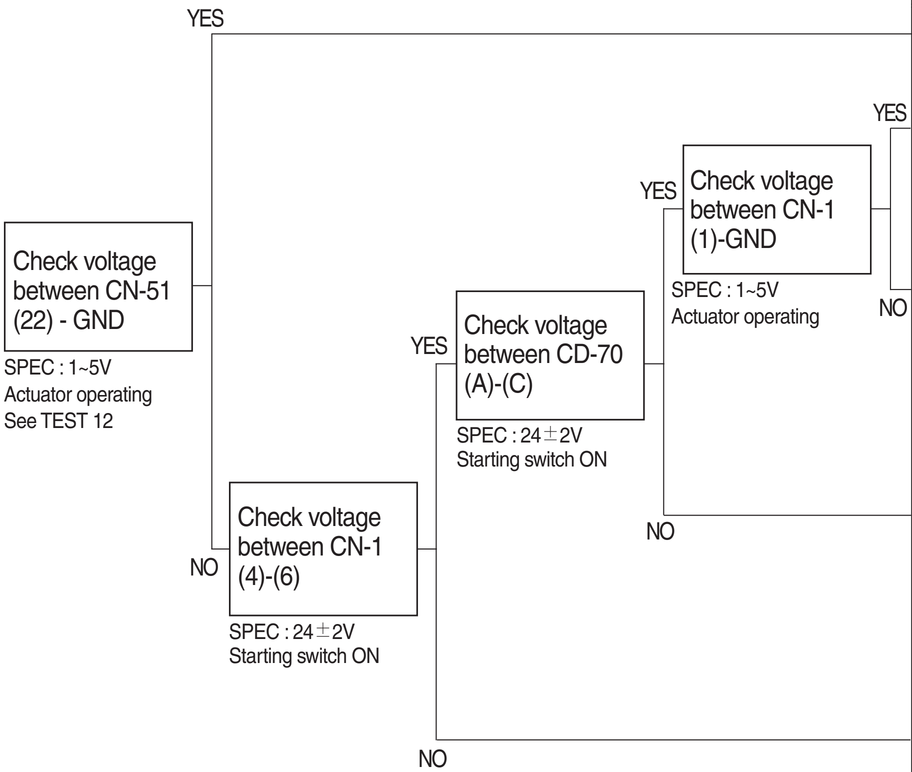
220A6MS108

7. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

· Fault code : HCESPN 123, FMI 0~4

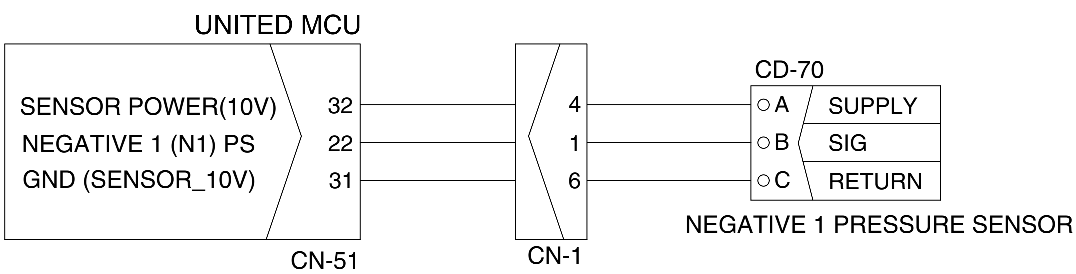
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



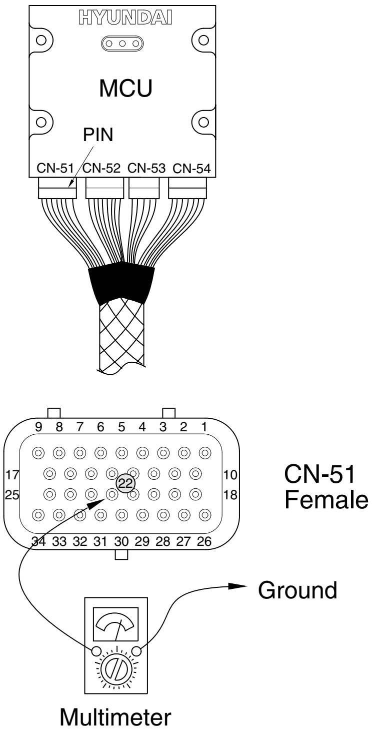
260A6MS111

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



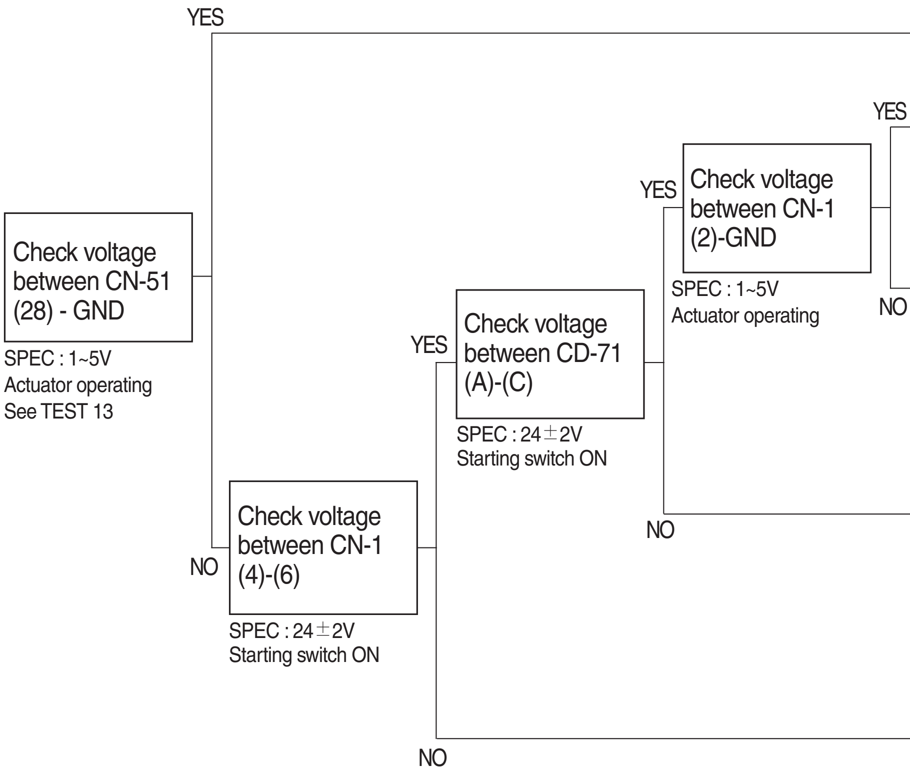
140L6MS112

8. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

· Fault code : HCESPN 124, FMI 0~4

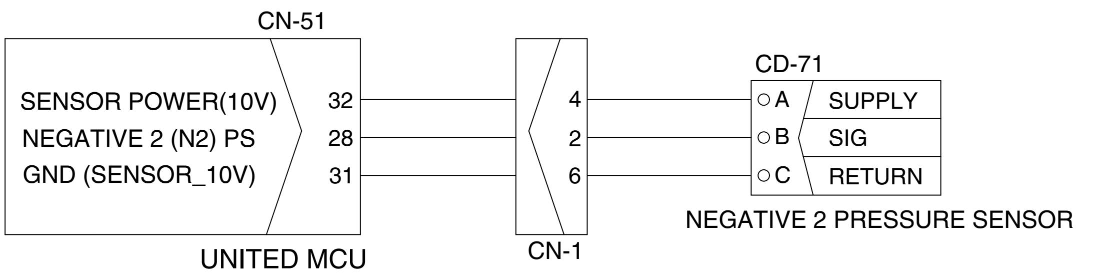
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



220A6MS113

2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-51 (28) and ground.

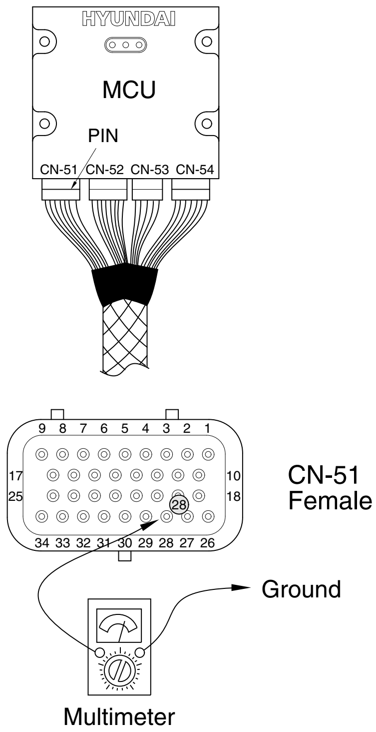
① Prepare 1 piece of thin sharp pin, steel or copper.

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



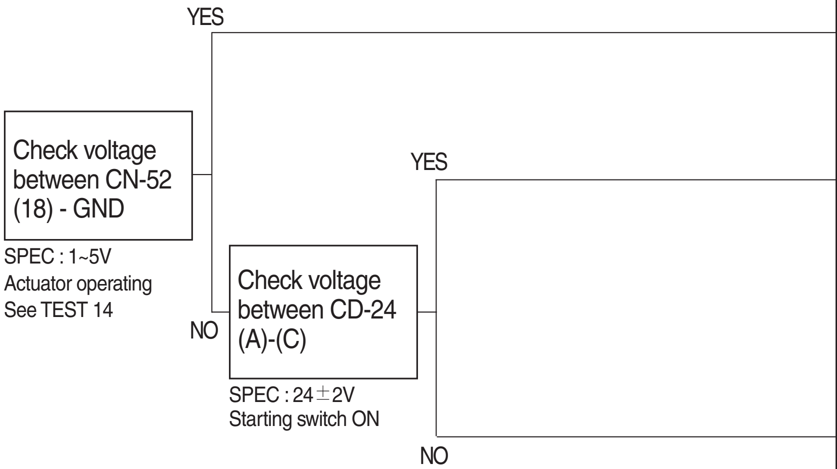
140L6MS114

9. MALFUNCTION OF SWING PRESSURE SENSOR

· Fault code : HCESPN 135, FMI 0~4

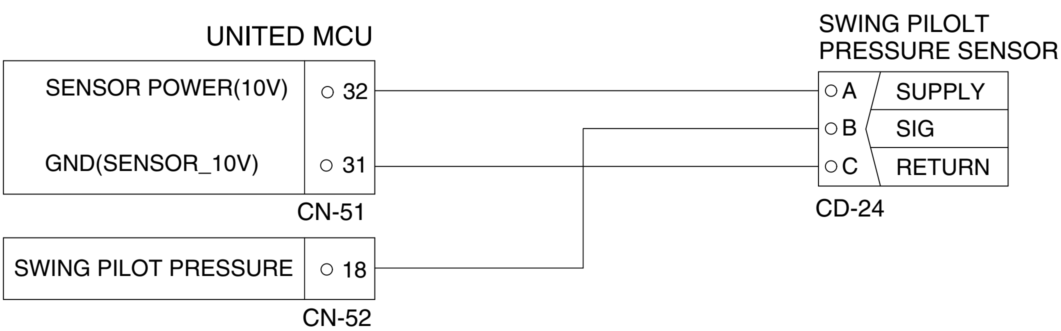
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



220A6MS114

2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (18) and ground.

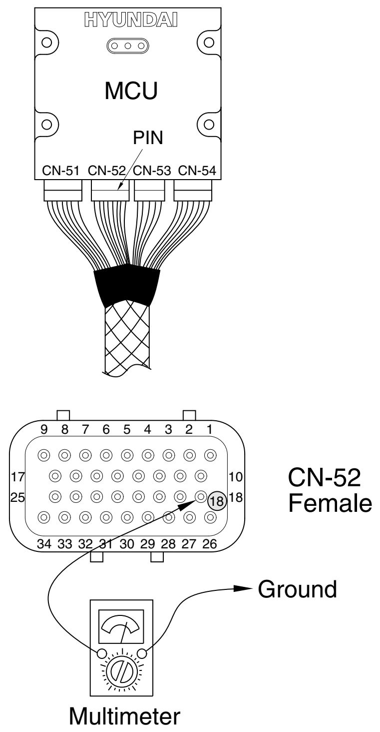
① Prepare 1 piece of thin sharp pin, steel or copper.

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



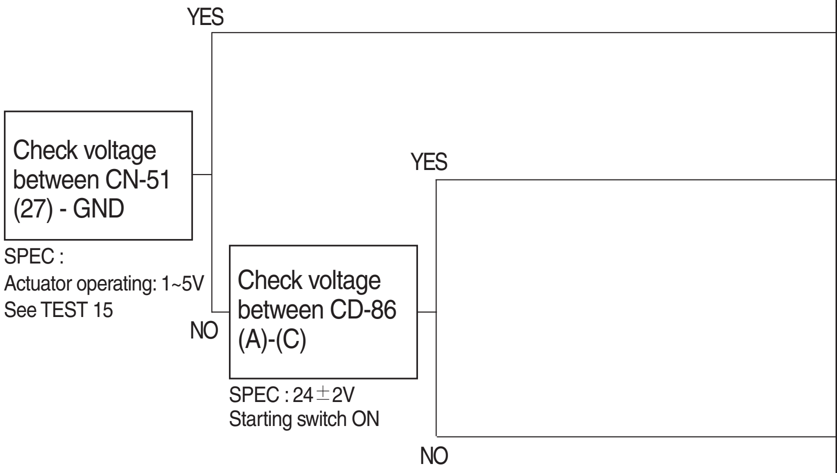
220A6MS116

10. MALFUNCTION OF ARM OUT PRESSURE SENSOR

· Fault code : HCESPN 133, FMI 0~4

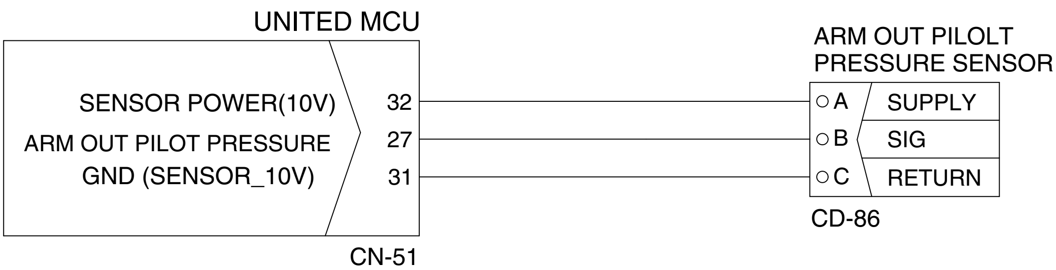
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective arm in/out & bucket in pressure sensor	Replace or repair
Short circuit or poor connection between CN-51 (27)-CD-86 (B)	Replace or repair
Short circuit or poor connection between CD-86 (A)-CN-51 (32) or CD-86 (C)-CN-51 (31)	Replace or repair

Wiring diagram



220A6MS117

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-51 (27) and ground.

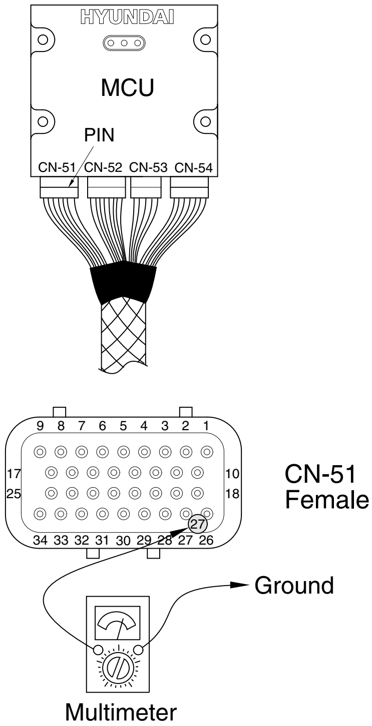
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (27) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



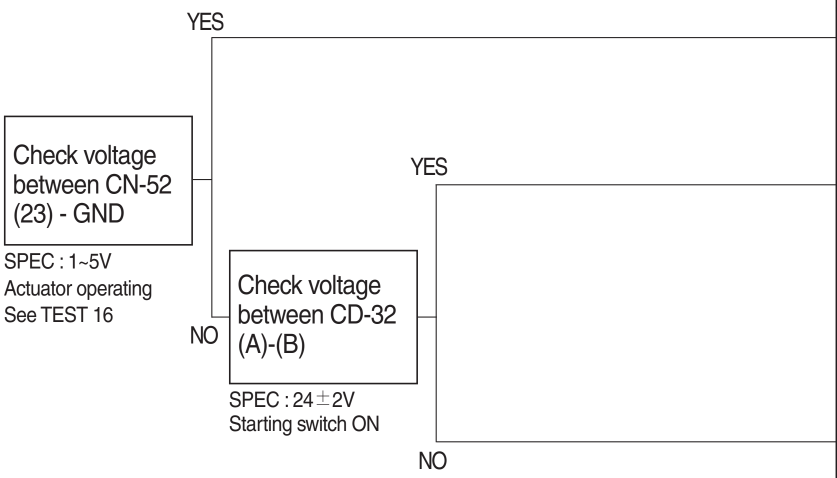
220A6MS118

11. MALFUNCTION OF BOOM UP PRESSURE SENSOR

· Fault code : HCESPN 127, FMI 0~4

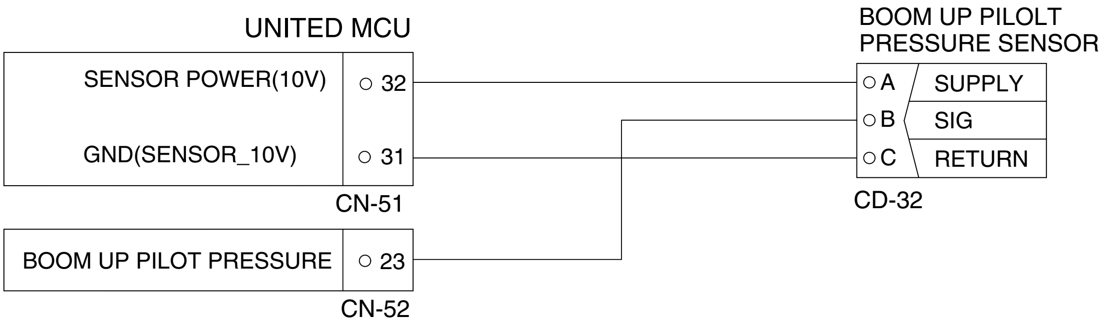
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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



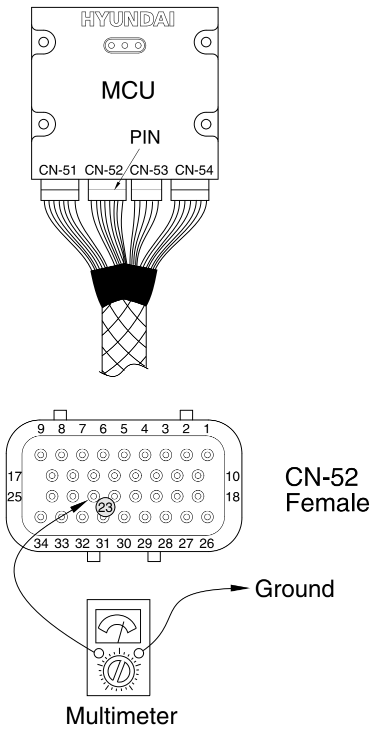
220A6MS119

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



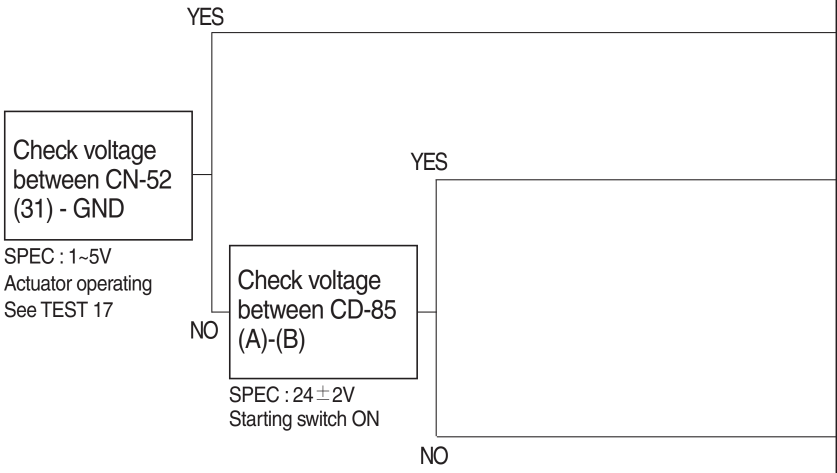
220A6MS120

12. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

· Fault code : HCESPN 128, FMI 0~4

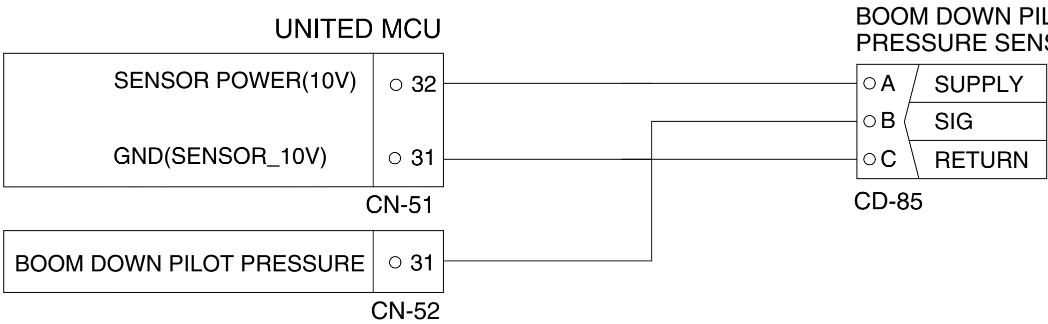
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



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



220A6MS121

2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-52 (31) and ground.

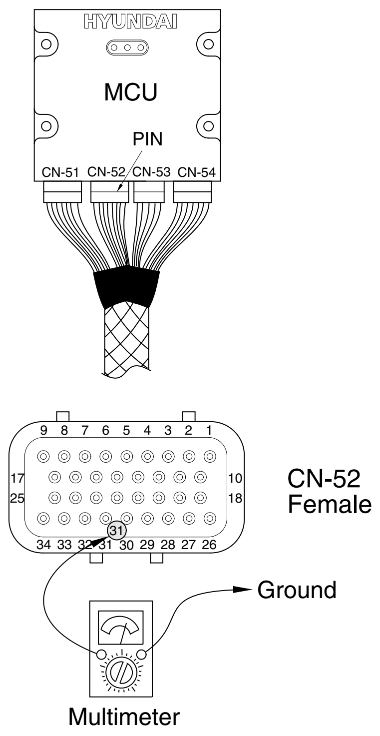
① Prepare 1 piece of thin sharp pin, steel or copper.

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



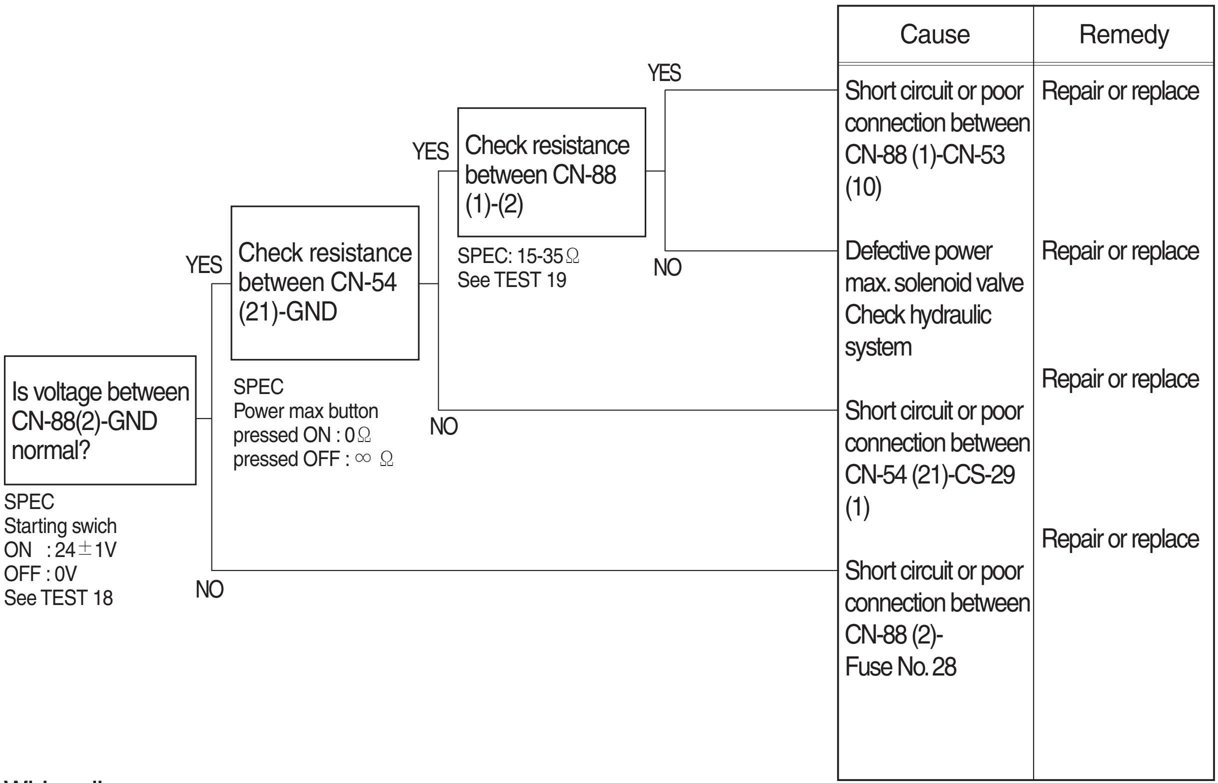
220A6MS122

13. MALFUNCTION OF POWER MAX

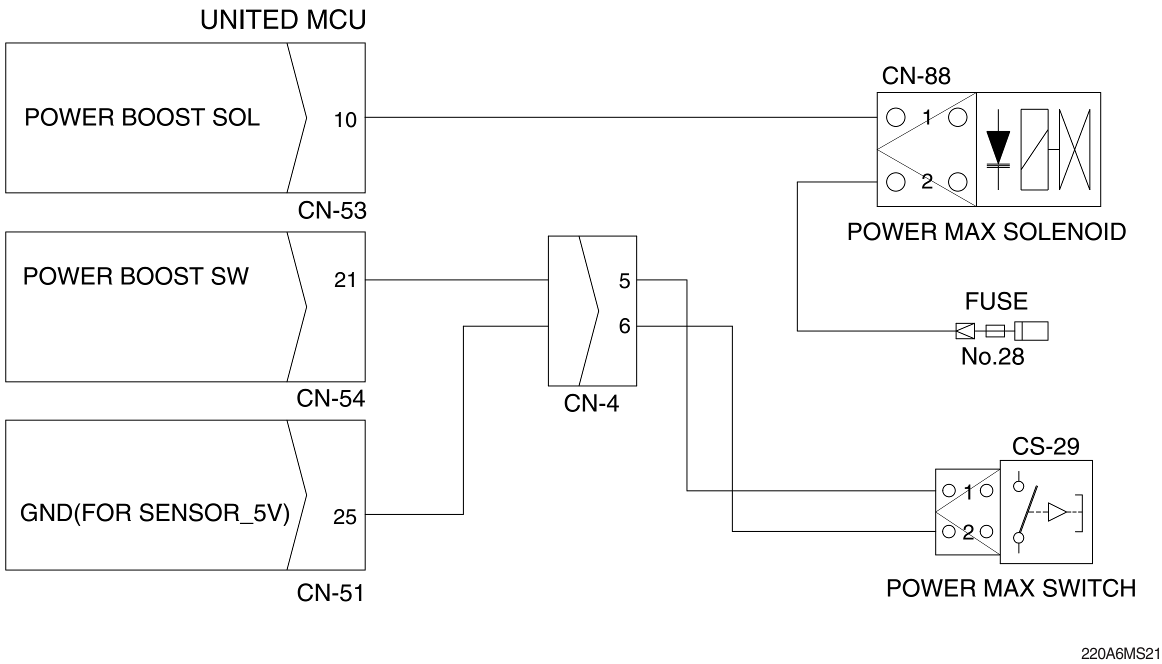
· Fault code : HCESPN 166, FMI 4 or 6

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

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE

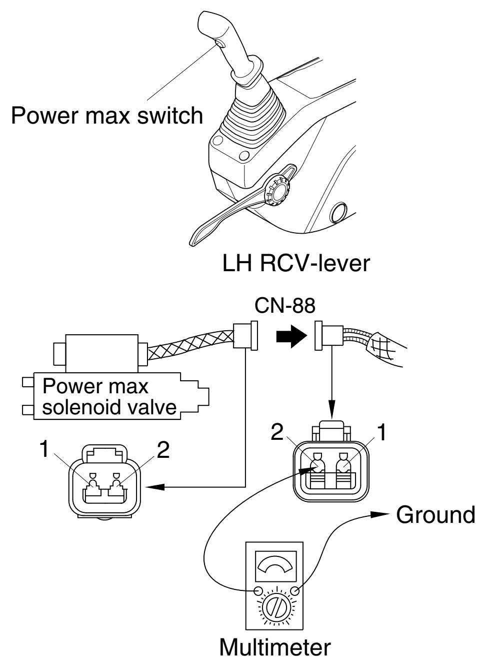
(1) Test 18: Check voltage between connector CN-88 (2) - GND.

① Disconnect connector CN-88 from power max solenoid valve.

② Start switch ON.

③ Check voltage as figure.

SPEC : Starting switch ON : 24±1V
Starting switch OFF : 0V



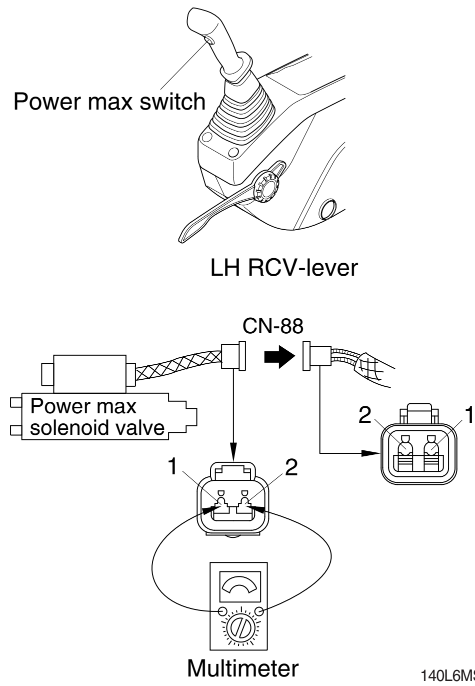
(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting switch OFF.

② Disconnect connector CN-88 from power max solenoid valve.

③ Check resistance as figure.

SPEC : 15~35Ω



14. MALFUNCTION OF BOOM PRIORITY EPPR VALVE

· Fault code : HCESPN 141, FMI 5 or 6

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

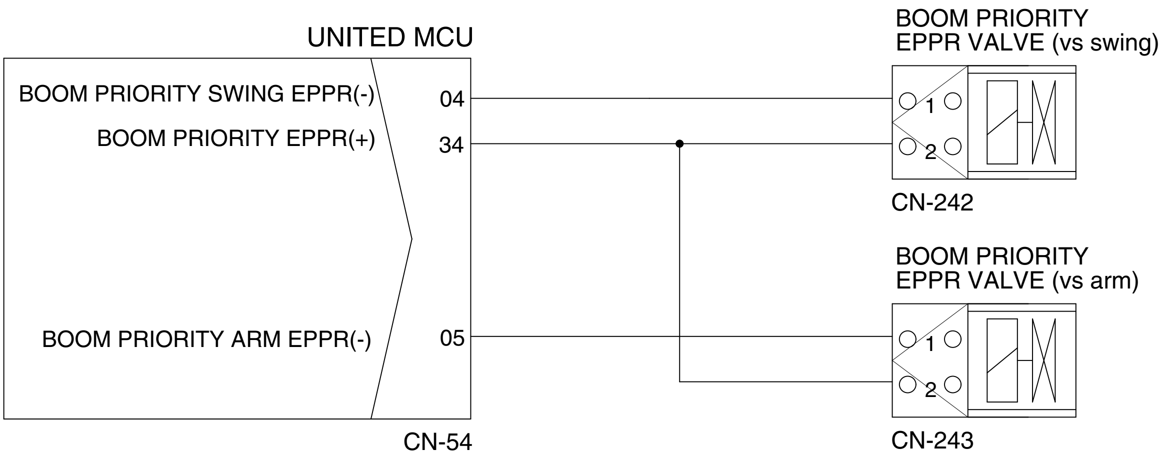
1) INSPECTION PROCEDURE

Check resistance between CN-242 (1)-(2) or CN-243 (1)-(2)

SPEC : 20~30V
Starting switch ON

	Cause	Remedy
YES	Short circuit or poor connection between CN-54 (04)-CN-242 (1) or CN-54 (34)-CN-242 (2) or CN-54 (05)-CN-243 (1) or CN-54 (34)-CN-243 (2)	Repair or replace
NO	Defective EPPR valve	Repair or replace

Wiring diagram



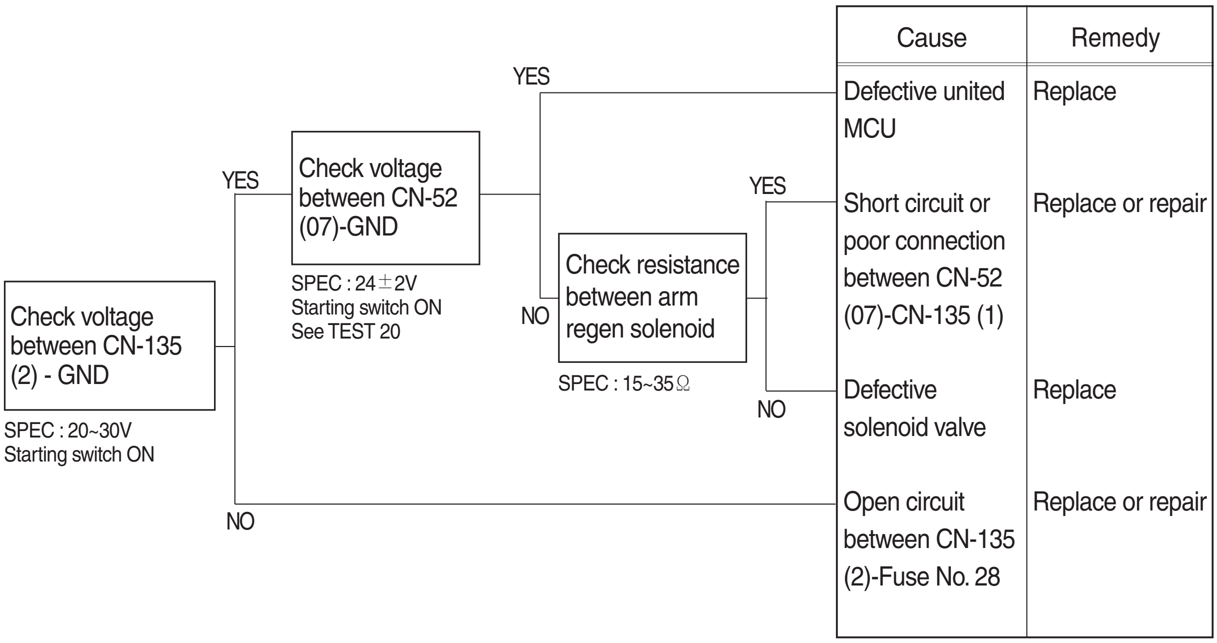
220A6MS123

15. MALFUNCTION OF ARM REGENERATION SOLENOID

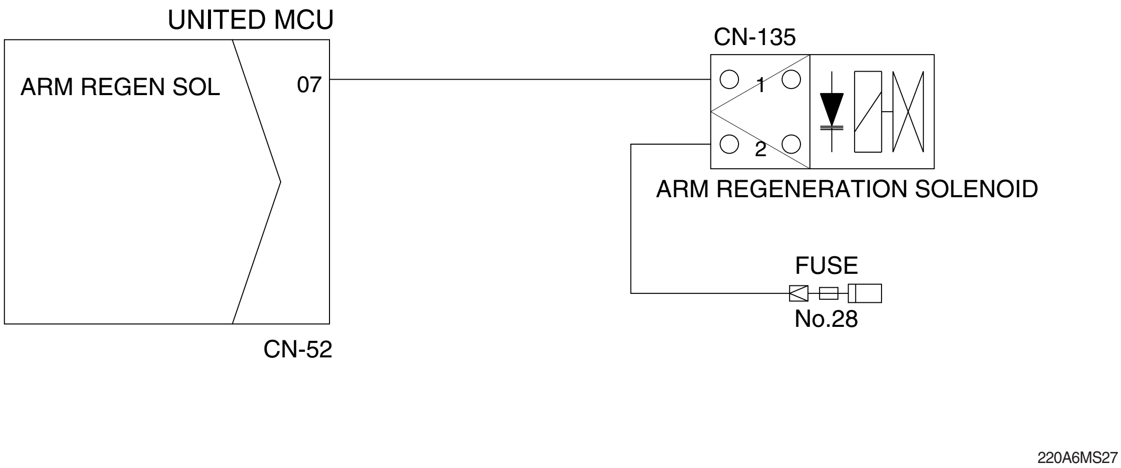
· Fault code : HCESPN 170, FMI 4 or 6

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

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE

(1) Test 20 : Check voltage at CN-52 (07) and ground.

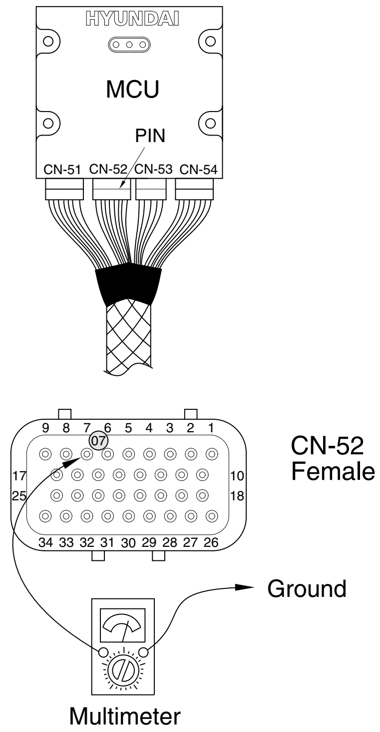
① Prepare 1 piece of thin sharp pin, steel or copper.

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.

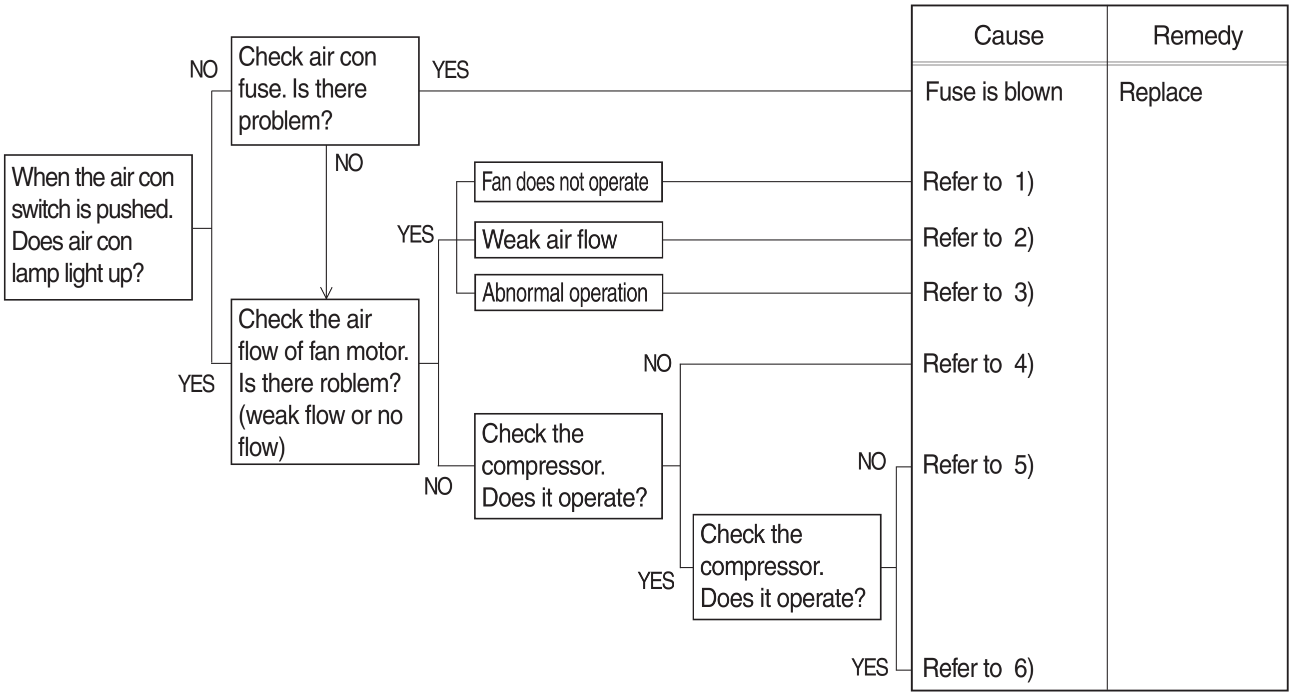
SPEC : Key ON : 24±2 V



140L6MS128

GROUP 5 AIR CONDITIONER & HEATER SYSTEM

1. AIR CONDITIONER DOES NOT OPERATE



1) FAN DOES NOT OPERATE

Cause	Check	Remedy
Fuse is blown or abnormal relay operation	* Fuse * Does relay normally operate?	Replace
Harness short or poor contact	Check any harness short or abnormal contact of connnector	Repair shortage
Fan motor failure	Supply 24V to 2 lead wire from motor and check the operation	Replace
Resistor is broken	Check current flow of resistor with tester	Replace
Fan switch failure	Push fan switch by turn and check the operation	Replace

2) WEAK AIR FLOW FROM FAN MOTOR

Cause	Check	Remedy
Clogged evaporator or obstacles around air inlet	Check if evaporator is contaminated	Clean
Leakage of air flow	Check HVAC case assembly	Adjust
Duct sensor failure	Check if evaporator is frozen	Replace

3) ABNORMAL OPERATION OF FAN MOTOR

Cause	Check	Remedy
Abnormal operation of each step of control	4 step only operate	Replace resistor
	1 or 2 step does not operate	Replace control
	3 or 4 step does not operate	Replace relay

4) COMPRESSOR DOES NOT ROTATE OR HARDLY ROTATE

Cause	Check	Remedy
Loose belt	Belt shaking is severe	Adjust tension
Failure of compressor itself	Belt slip	Repair or Replace
Low voltage of battery	Slip when rotate	Charge battery
Fieldcoil short	Slip when rotate	Replace magnetic clutch
Oily clutch face	Contamination around clutch	Replace magnetic clutch, clean
Fieldcoil is broken	Magnetic clutch does not operate or "∞" resistance	Replace compressor
Leakage of refrigerant or oil inside	Check if wet with oil	Replace compressor Charge refrigerant

5) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Shortage of refrigerant	When air con operate during 5~10 min small temperature difference between high and low pressure pipes.	Repair leakage joint Charge refrigerant
Overcharge of refrigerant	*Magnetic clutch on/off rapidly *High pressure over specification *Lukewarm air from nozzle	Recharge refrigerant following specification
Lower pressure than normal condition at low side	Shortage of refrigerant	Make up refrigerant
	Clogged receive dryer	Replace receive dryer
	Clogged expansion valve	Replace expansion valve
	Clogged or crushed pipe	Replace pipe or clean
	Failure of duct sensor	Replace duct sensor

6) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Lower pressure than normal condition at low side	Failure of duct sensor Magnetic clutch off before air temperature sufficiently down	Replace duct sensor or adjust location
	Defective compressor gasket When compressor off, high and low pressure balance immediatly	Repair compressor or Replace
Higher pressure than normal condition at high side	Failure of condensing Contamination on condenser or insufficient air flow from fan	Clean the condenser Repair fan
	Overcharge of refrigerant	Adjust refrigerant
	Entrained air	Vacuum and recharge
Lower pressure than normal condition at high side	Shortage of refrigerant	Make up refrigerant

SECTION 7 MAINTENANCE STANDARD

Group 1 Operational Performance Test ································ 7-1
Group 2 Major Components ································ 7-21
Group 3 Track and Work Equipment ································ 7-30

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.

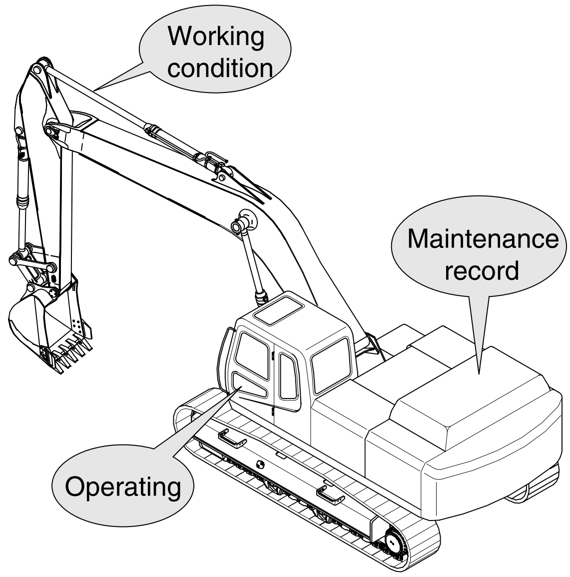
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

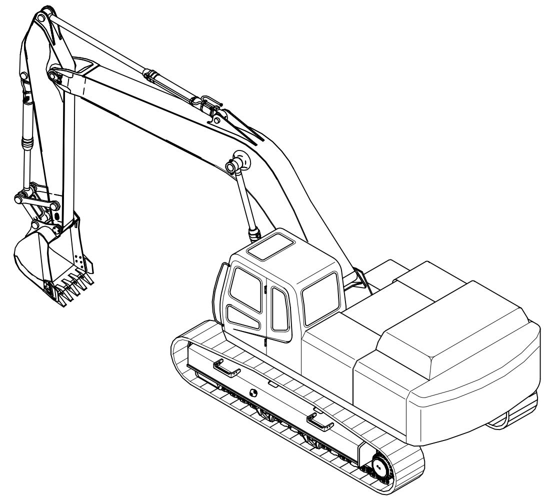


21077MS01

2. TERMINOLOGY

1) STANDARD

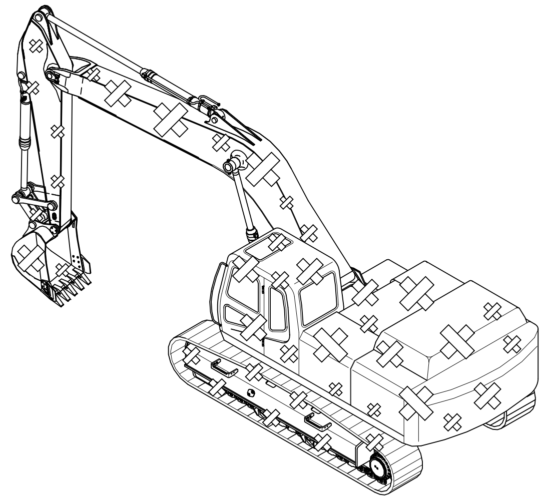
Specifications applied to the brand-new machine, components and parts.



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.

The machine

(1) Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(2) Test area

① Select a hard, flat surface.

② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.

③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(3) Precautions

① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.

② Operate the machine carefully and always give first priority to safety.

③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.

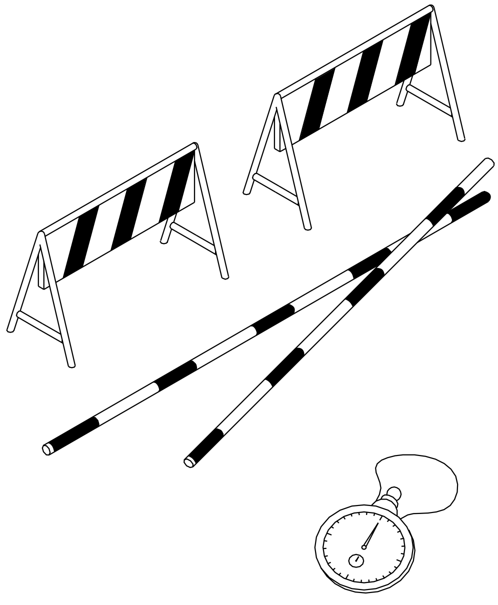
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements

① Accurately calibrate test instruments in advance to obtain correct data.

② Carry out tests under the exact test conditions prescribed for each test item.

③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



(290-7TIER) 7-3

2) ENGINE SPEED

(1) Measure the engine speed at each power mode

※ The engine speed at each power mode must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.

(2) Preparation

① Warm up the machine, until the engine coolant temperature reaches 50˚C or more, and the hydraulic oil is 50±5˚C.

② Set the multimodal dial at 10 (Max) position.

③ Measure the engine RPM.

(3) Measurement

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

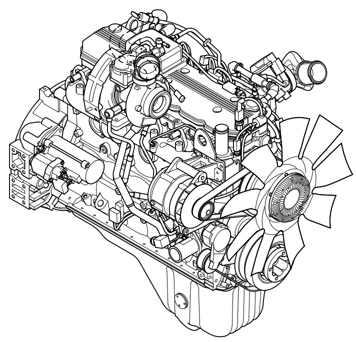
② Measure and record the engine speed at each mode (P, S, E).

③ Select the P-mode.

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

⑤ Measure and record the auto deceleration speed.

CLUSTER



260A7MS01

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX260A L	Start idle	1000±100	
	P mode	1700±50	
	S mode	1600±50	
	E mode	1500±50	
	Auto decel	1100±100	
	One touch decel	1000±100	

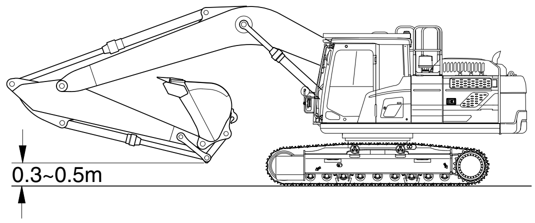
Condition : Set the multimodal dial at 10 (Max) position.

3) TRAVEL SPEED

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

(2) Preparation

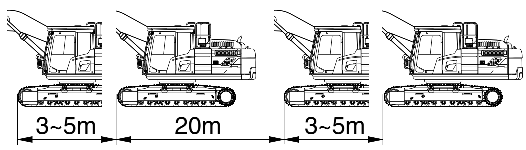
① Adjust the tension of both tracks to be equal.
② Prepare a flat and solid test track 20 ㎧ in length, with extra length of 3 to 5 ㎧ on both ends for machine acceleration and deceleration.
③ Hold the bucket 0.3 to 0.5 ㎧ above the ground with the arm and bucket rolled in.
④ Keep the hydraulic oil temperature 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
HX260A L	1 Speed	22.2±2.0	26.5	
	2 Speed	12.8±1.0	15	

4) TRACK REVOLUTION SPEED

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

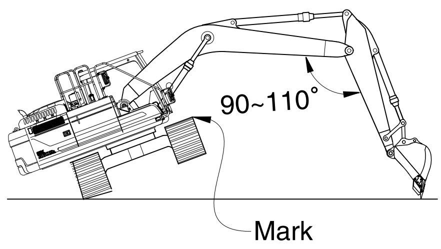
(2) Preparation

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.



260A7MS04

(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
HX260A L	1 Speed	32±2.0	37.5
	2 Speed	18.9±2.0	21.8

5) TRAVEL DEVIATION

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

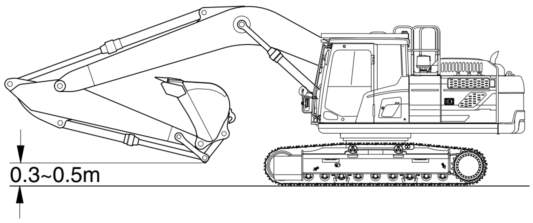
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 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 the amount of mistracking at high and low travel speeds.

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

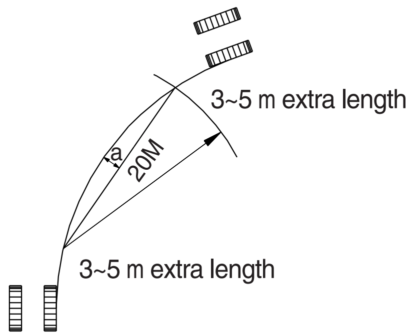
· Power mode switch : P mode

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the distance between a straight 20 ㎙ 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 : ㎜ / 20 ㎙

Model	Standard	Maximum allowable	Remarks
HX260A L	200 below	240	-

6) SWING SPEED

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

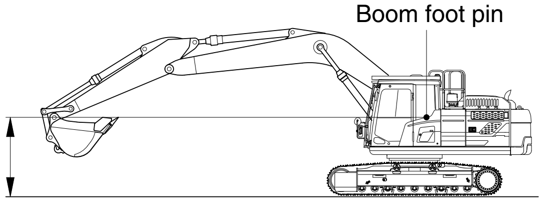
(2) Preparation

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.



(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
HX260A L	P mode	16.1±1.5	20.8

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.

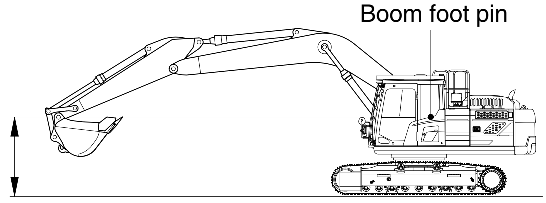
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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.



260A7MS05

(3) Measurement

① Conduct this test in the M mode.

② Select the following switch positions.

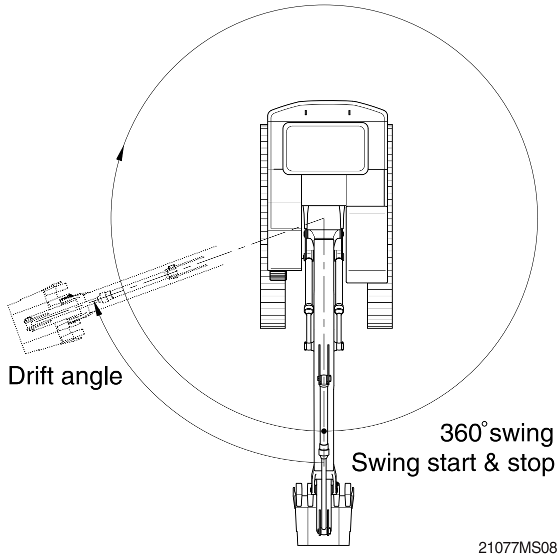
· Power mode switch : P mode

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

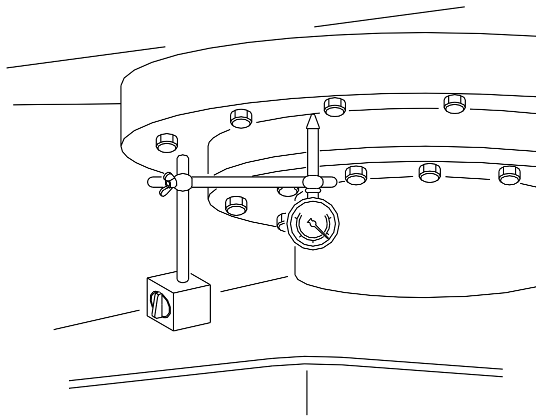
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX260A 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.



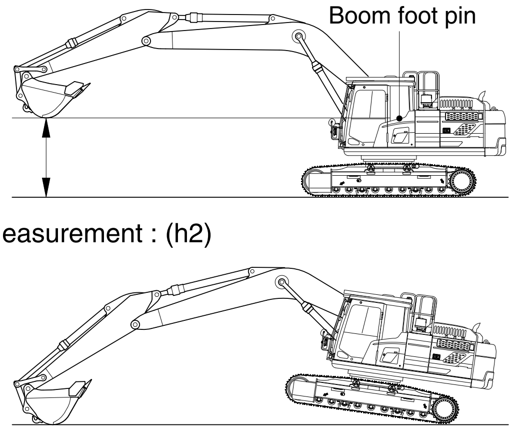
(210-7) 7-10(1)

(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



260A7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX260A 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.

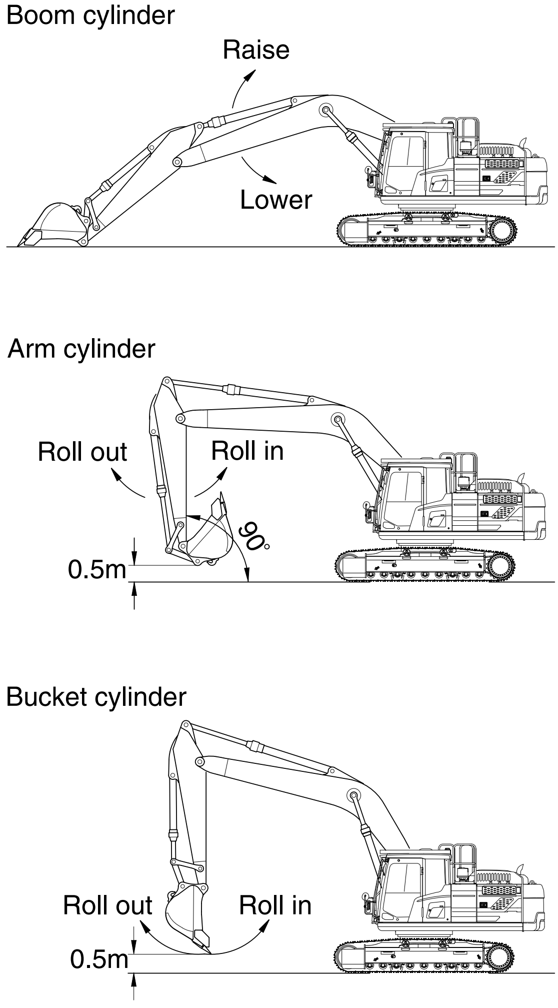
(2) Preparation

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.



260A7MS07

(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
HX260A L	Boom raise		4.0±0.4	4.3	
	Boom lower		2.9±0.4	4.0	
	Arm in	Regen ON	3.0±0.4	3.8	
		Regen OFF	3.3±0.4	4.0	
	Arm out		2.9±0.3	3.9	
	Bucket in		3.0±0.4	3.3	
	Bucket out		2.5±0.3	3.4	

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.

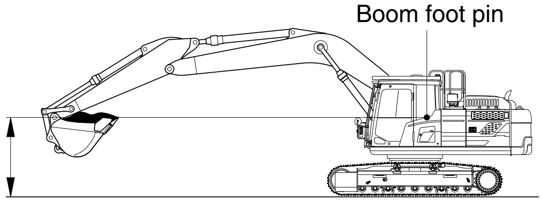
· W=M3×1.5
Where :
M3 =Bucket heaped capacity (m3)
1.5=Soil specific gravity

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.



260A7MS08

(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 / 5 min

Model	Drift to be measured	Standard	Maximum allowable	Remarks
HX260A 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
HX260A L	Boom lever	1.4 or below	2.0	
	Arm lever	1.4 or below	2.0	
	Bucket lever	1.4 or below	2.0	
	Swing lever	1.4 or below	2.0	
	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
HX260A L	Boom lever	90±10	113	
	Arm lever	90±10	113	
	Bucket lever	90±10	113	
	Swing lever	90±10	113	
	Travel lever	139±10	174	

13) PILOT PRIMARY PRESSURE

(1) Preparation

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

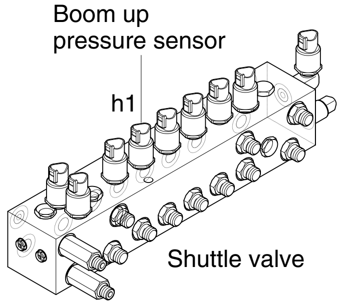
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Auto decel switch : OFF

② Slowly operate the boom control lever of boom up functions at full stroke over relief and measure the primary pilot pressure by the monitoring menu of the cluster.



210A7MS13

(3) Evaluation

The average measured pressure should meet the following specifications:

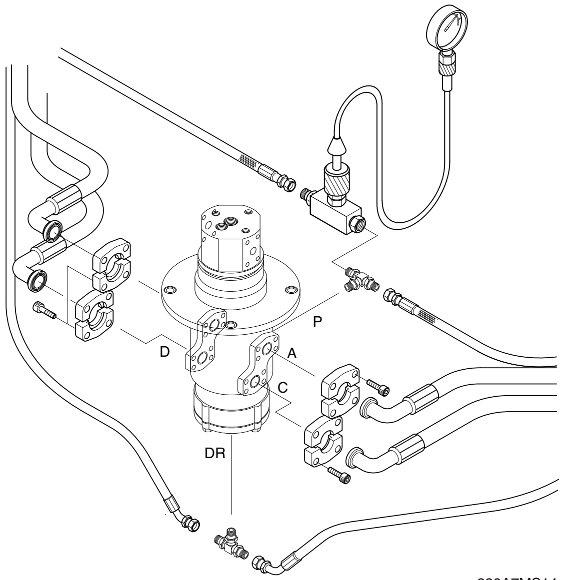
Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX260A 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.



220A7MS14

(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.

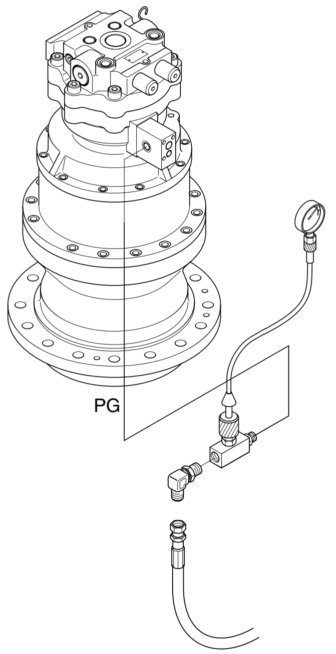
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX260A 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 PG port, as shown.
⑤ Start the engine and check for oil leakage from the adapter.
⑥ Keep the hydraulic oil temperature at 50±5˚C.



210A7MS15

(2) Measurement

① Select the following switch positions.
· Power mode switch : P mode
② Operate the swing function and measure the swing brake release pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
Repeat step ② three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Description	Standard	Allowable limits	Remarks
HX260A L	Brake disengaged	30	Over 4	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

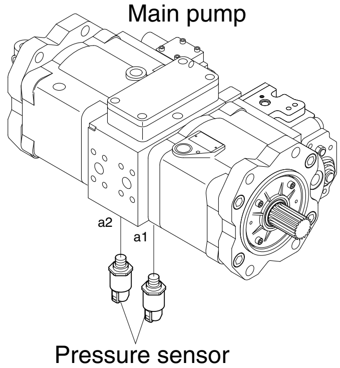
① Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Measure the main pump delivery pressure in the P mode (high idle).



210A7MS16

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm2

Model	Engine speed	Standard	Allowable limits	Remarks
HX260A L	High idle	Under 10	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

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

(2) Measurement

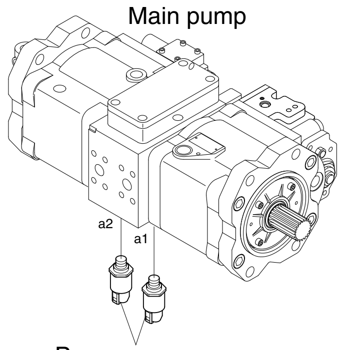
① Select the following switch positions.

· 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.



210A7MS16

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

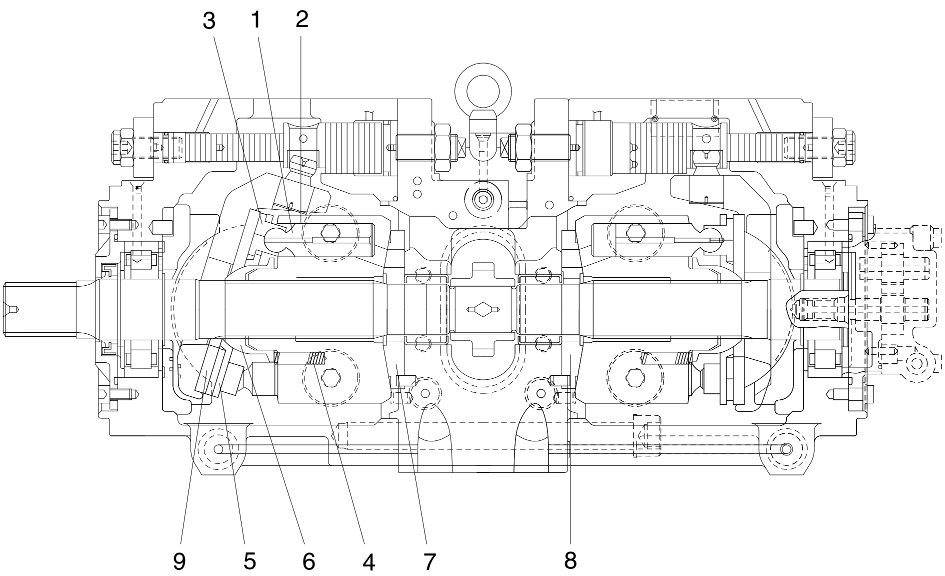
Model	Function to be tested	Standard	Port relief setting
HX260A L	Boom, Arm, Bucket	350 (380)±10	400±10
	Travel	350±10	-
	Swing	300±10	-

(　) : Power boost

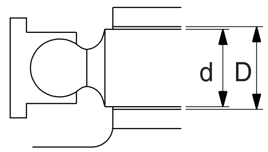
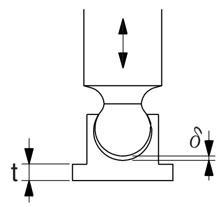
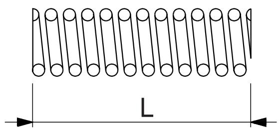
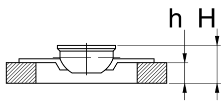
GROUP 2 MAJOR COMPONENT

1. MAIN PUMP

1) WEARING PARTS



220F7MP01

Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston (1) & cylinder bore (2) (D-d)		0.039	0.067	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)		4.9	4.7	
Free height of cylinder spring (4) (L)		41.1	40.3	Replace cylinder spring.
Combined height of set plate (5) & spherical bushing (6) (H-h)		23.3	22.0	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) TROUBLESHOOTING

(1) Overload of prime mover

Cause	Countermeasure	Caution
The speed or pressure is higher than their specified values.	Set them as specified.	
The torque setting of the regulator is higher than specified value.	Adjust the regulator.	See the pump device of the section 2.
Seizure or damage of a part inside the pump.	Replace the damaged part.	Check the filter and drain oil for abnormal worn metal particles.
Wrong fitting of the regulator piping.	Correct the regulator piping.	

(2) Extreme decrease of pump delivery flow or delivery pressure does not increase.

Cause	Countermeasure	Caution
Failure of the regulator.	Repair the regulator.	See the pump device of the section 2.
Seizure or damage of a part inside the pump.	Replace the damaged parts.	Check the filters and drain oil.
Failure of the attached pump.	Replace the damaged parts.	Remove the attached pump and check the shaft coupling.
Failure of the accessory valve.	Replace the accessory valves. Especially, check the poppets, seats and springs.	See the pump device of the section 2.
Wrong fitting of the regulator piping.	Correct the regulator piping.	

(3) Abnormal noise and abnormal vibrations

Cause	Countermeasure	Caution
Cavitation	Prevention from cavitation. Check working oil for emulsion.	Low boost press.
Damage in the caulking section of the shoe.	Replace the piston, shoe, shoe plate, etc.	Failure of the attached pump.
Cracking of the cylinder.	Replace the cylinder.	Air leakage at the suction pipe.
Wrong installation of the pump.	Correct installation.	Increased suction resistance.
Hunting of the regulator.	Repair the regulator.	See the pump device of the section 2.
Hunting of the relief valve of the accessory valve.	Repair the accessory valve.	See the pump device of the section 2.
Damage of the gear.	Replace the gear.	

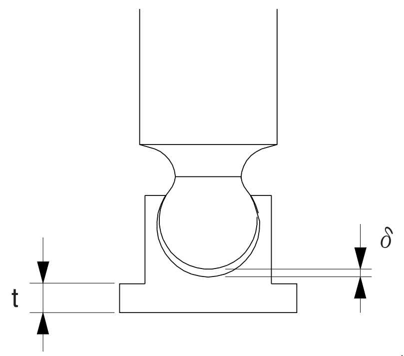
2. MAIN CONTROL VALVE

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. · Defect of spring. · O-rings and back up rings.	· Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement. · 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	0.028	0.058	Replace piston or cylinder block
Play between piston and shoe caulking section (δ)	0	0.3	Replace assembly of piston and shoe
Thickness of shoe (t)	5.5	5.3	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H)	6.5	6.0	Replace set of retainer plate and sperical bushing
Thickness of friction plate (h)	4.0	3.6	Replace



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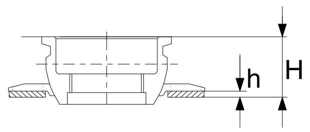

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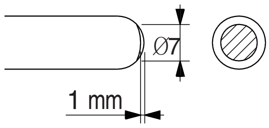
2) SLIDING PARTS

Part name	Standard roughness	Allowable roughness	Remark
Shoe	0.8-Z (Ra=0.2) (LAPPING)	3-Z (Ra=0.8)	
Shoe plate	0.4-Z (Ra=0.1) (LAPPING)	3-Z (Ra=0.8)	
Cylinder	1.6-Z (Ra=0.4) (LAPPING)	12.5-Z (Ra=3.2)	
Valve plate	0.8-Z (Ra=0.2) (LAPPING)	6.3-Z (Ra=1.6)	

4. TRAVEL MOTOR

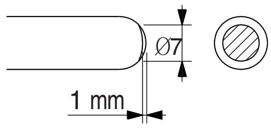
Problem		Cause	Remedy
Does not start	Pressure is not developed	· Pump failure · Control valve malfunction	· Check if action other than traveling is available. If faulty, repair. · Check if spool moves correctly. Repair if necessary.
	Pressure in developed	· Brake valve failure -Sleeve stick -Check valve stick · Motor failure -Valve seat seizure · Gear broken and fragment locked · Overloaded	· Replace brake valve · Replace -Check hydraulic oil for contamination · Replace reduction gear · Reduce load
Oil leakage	Leakage from engaging surfaces	· Scratch on engaging surfaces · Loosening by poor bolt tightening	· Correct surfaces by oilstone or sandpaper or replace · Check after retightening
	Leakage from casing	· Plug loosened · Crack formed by stone	· Retighten · Replace reduction gear
	Leakage from floating seal	· Sliding surfaces worn · Creep on O-ring	· Replace reduction gear · Replace floating seal
	Leakage from hydraulic motor	· Bolt loosened · O-ring damaged · Sealing surface scratched	· Tighten properly · Replace O-ring · Correct by oilstone or sandpaper
Coasts on slope excessively		· Poor volumetric efficiency of hydraulic motor · Increase of internal leakage of brake valve · Parking brake not actuated -Spring breakage -Wear of friction plate	· Replace hydraulic motor · Replace brake valve · Replace spring · Replace parking brake
Excessive temperature on reduction gear case		· Pitting on bearing · Lack of gear oil · Hydraulic oil introduced to gear case	· Replace reduction gear · Supply gear oil properly · Check motor and replace oil seal
Meanders	Meanders at low pressure	· Delivery rate is different between right and left · Motor drain rate is different between right and left	· Repair pump · Replace motor
	Meanders at high pressure	· Delivery rate is different between right and left · Motor drain rate is different between right and left	· Repair regulator or pump · Replace motor
	Meanders at high pressure	· Relief pressure dropped at right and left brake valve · Main relief pressure dropped at right or left of control valve	· Replace brake valve · Replace main relief valve
Pump delivery is poor		· Regulator operation poor · External leakage of pump is excessive	· Repair regulator · Repair pump
External leakage of motor is excessive		-	· Replace motor

5. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000 cc/m at neutral handle position, or more than 2000 cc/m during operation.	Conditions : Primary pressure : 40 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6. Troubleshooting, replace the related parts.	

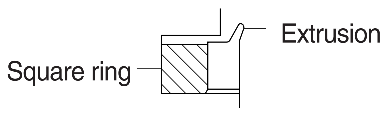
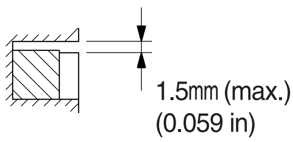
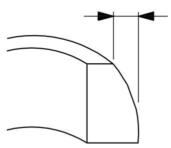
Notes
1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.
2. When loosening the hexagon socket head cap screw (125), replace the seal washers (121) without fail.

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

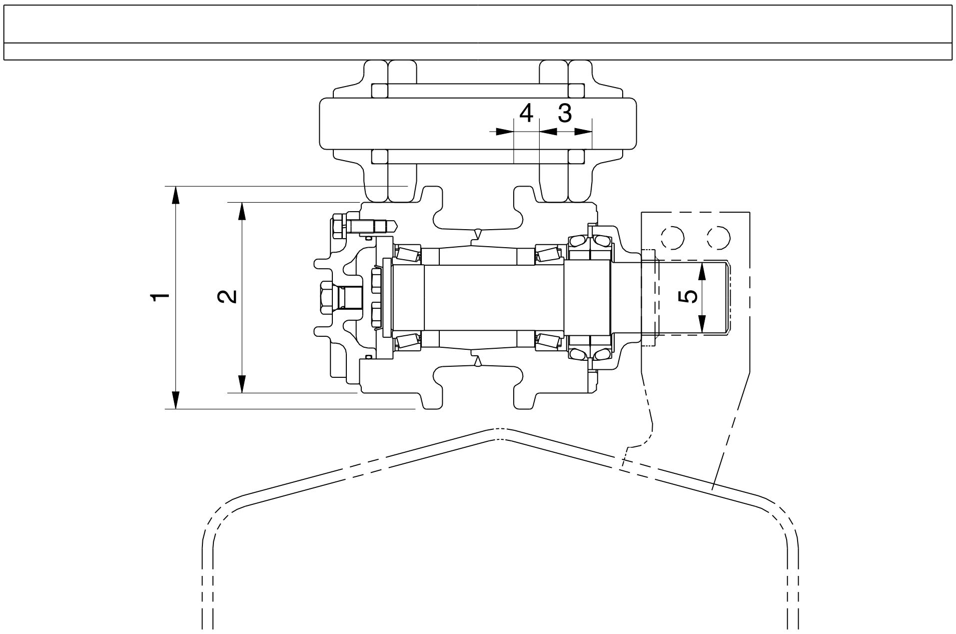
8. CYLINDER

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) UPPER ROLLER



21037MS02

Unit : ㎜

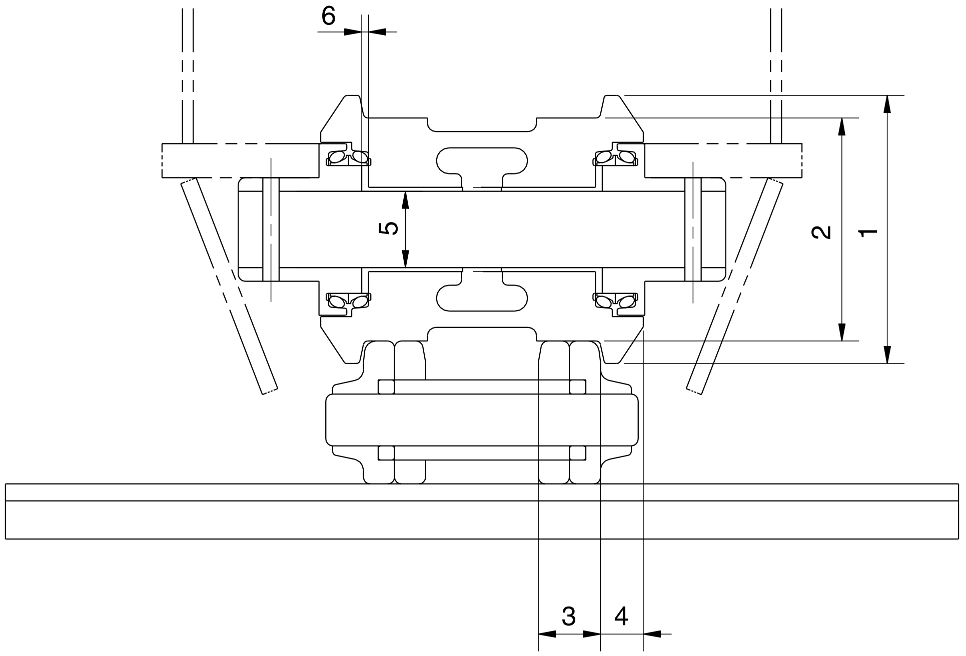
<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="4">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="4">Ø169</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="4">Ø144</td><td colspan="2">Ø134</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="4">44</td><td colspan="2">49</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="4">17</td><td colspan="2">–</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Clearance between shaft and busing</td><td colspan="4">Standard size & Tolerance</td><td rowspan="3">Standard clearance</td><td rowspan="3">Clearance limit</td><td rowspan="4">Replace bushing</td></tr>
<tr><td colspan="2">Shaft</td><td colspan="2">Hole</td></tr>
<tr><td>Dimension</td><td>Tolerance</td><td>Dimension</td><td>Tolerance</td></tr>
<tr><td>Ø55</td><td>-0.05
-0.1</td><td>Ø55</td><td>0.3
0.1</td><td>0.15~0.40</td><td>1.2</td></tr>
</table>

(Mahcine Serial No. #0235-)

Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="4">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="4">Ø169</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="4">Ø142</td><td colspan="2">Ø132</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="4">51.5</td><td colspan="2">56.5</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="4">17</td><td colspan="2">–</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Clearance between shaft and busing</td><td colspan="4">Standard size & Tolerance</td><td rowspan="3">Standard clearance</td><td rowspan="3">Clearance limit</td><td rowspan="4">Replace bushing</td></tr>
<tr><td colspan="2">Shaft</td><td colspan="2">Hole</td></tr>
<tr><td>Dimension</td><td>Tolerance</td><td>Dimension</td><td>Tolerance</td></tr>
<tr><td>Ø54.5</td><td>0
-0.03</td><td>Ø54.8</td><td>0.08
0.03</td><td>0.33~0.41</td><td>2.0</td></tr>
</table>

2) LOWER ROLLER



21037MS01

Unit : ㎜

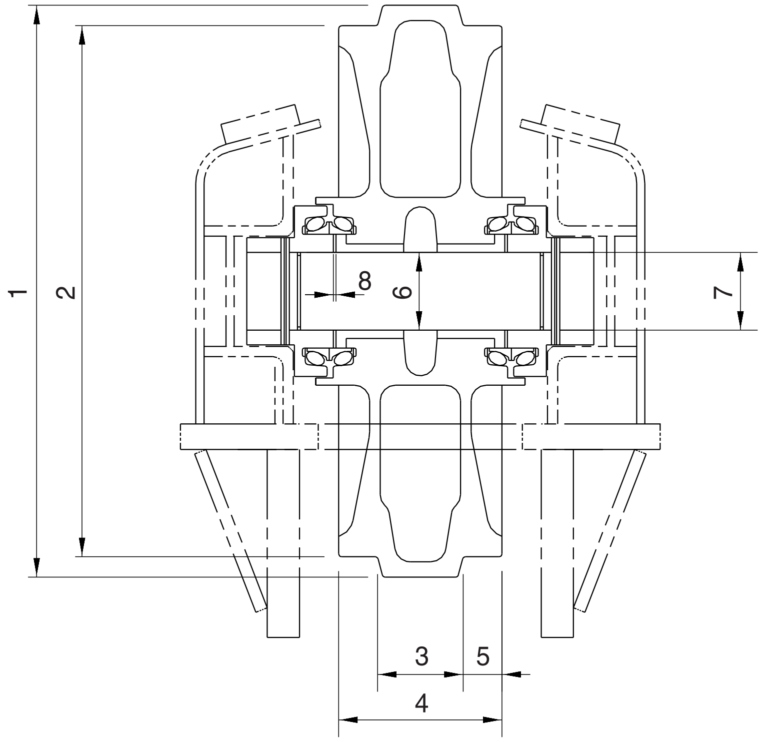
No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø195				–		
2	Outside diameter of tread	Ø160				Ø148		
3	Width of tread	44				50		
4	Width of flange	33.3				–		
5	Clearance between shaft and bushing	Standard size and tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø70	0 -0.03	Ø70	0.35 0.3	0.3~0.38	2.0	
6	Side clearance of roller (both side)	Standard clearance				Clearance limit		Replace
		0.26~1.22				2.0		

(Mahcine Serial No. #0235-)

Unit : ㎜

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø195				–		
2	Outside diameter of tread	Ø160				Ø150		
3	Width of tread	49				55		
4	Width of flange	29				–		
5	Clearance between shaft and bushing	Standard size and tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø70	-0.06 -0.09	Ø70	0.38 0.33	0.39~0.47	2.0	
6	Side clearance of roller (both side)	Standard clearance				Clearance limit		Replace
		0.04~1.55				2.0		

3) IDLER



21037MS03

Unit : ㎜

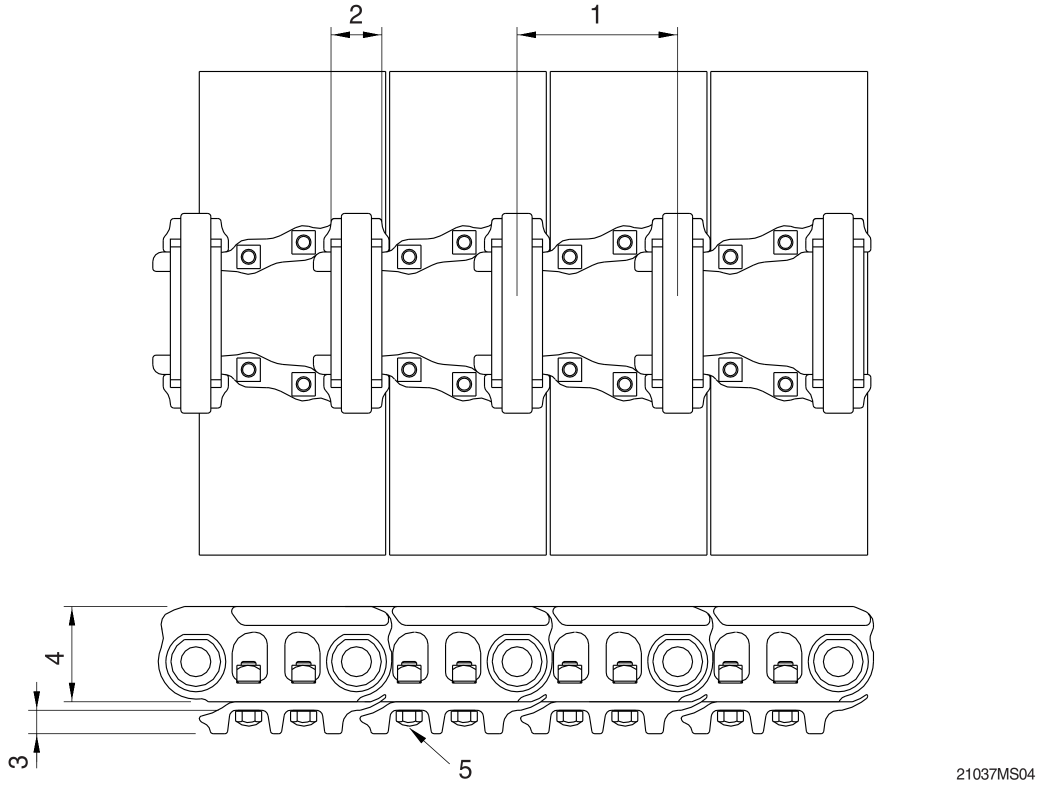
No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø560				–		
2	Outside diameter of tread	Ø520				Ø510		
3	Width of protrusion	82				–		
4	Total width	160				–		
5	Width of tread	39				44		
6	Clearance between shaft and bushing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø75	0 -0.03	Ø75	0.42 0.35	0.35~0.45	2.0	
7	Clearance between shaft and support	Ø75	0 -0.03	Ø75	0.07 0.03	0.03~0.1	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance				Clearance limit		Replace bushing
		0.4~1.2				2.0		

(Mahcine Serial No. #0235-)

Unit : ㎜

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø541.6				–		
2	Outside diameter of tread	Ø500				Ø490		
3	Width of protrusion	85				–		
4	Total width	160				–		
5	Width of tread	37.5				42.5		
6	Clearance between shaft and bushing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø75	0 -0.03	Ø75	0.415 0.37	0.37~0.445	2.0	
7	Clearance between shaft and support	Ø75	0 -0.03	Ø75	0.06 0	0~0.09	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance				Clearance limit		Replace bushing
		0.3~0.8				2.0		

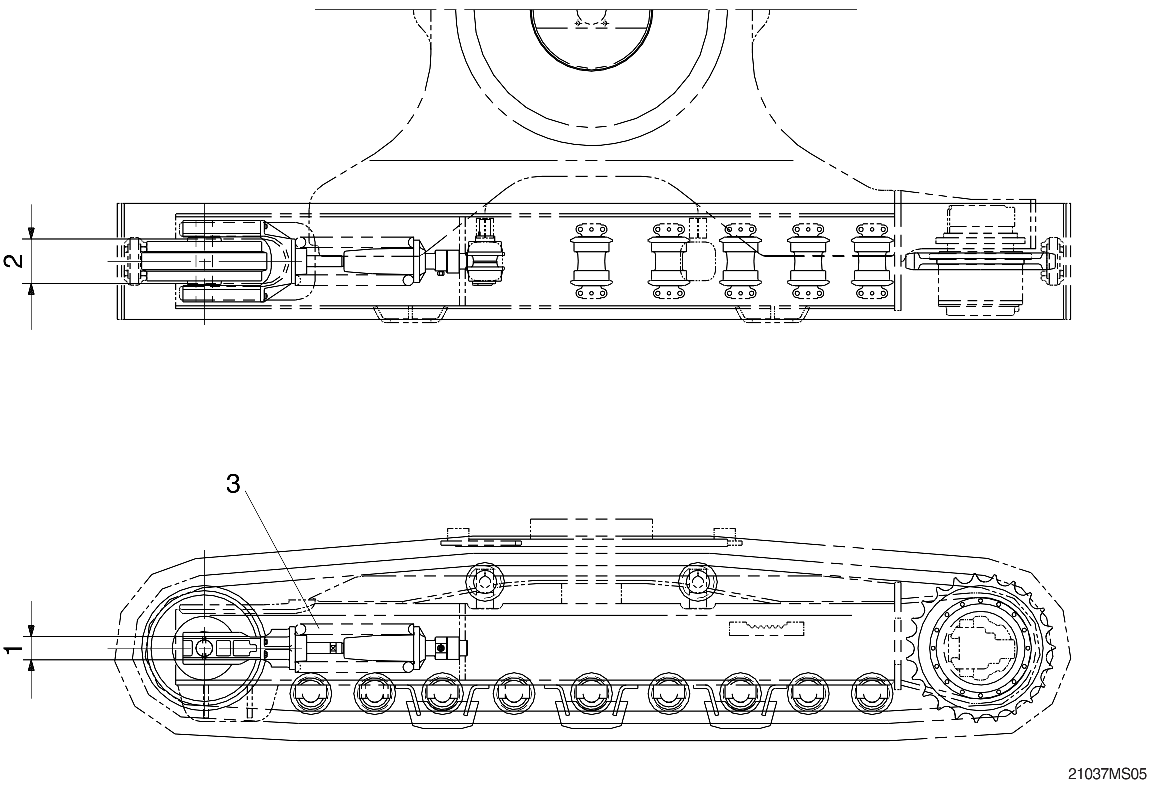
4) TRACK



Unit : mm

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		190	194.4	
2	Outside diameter of bushing	Ø59	Ø51	Rebuild or replace
3	Height of grouser	26	16	
4	Height of link	105	97	
5	Tightening torque	Initial tightening torque : 78±8 kgf · m		Retighten

5) TRACK FRAME AND RECOIL SPRING



Unit : mm

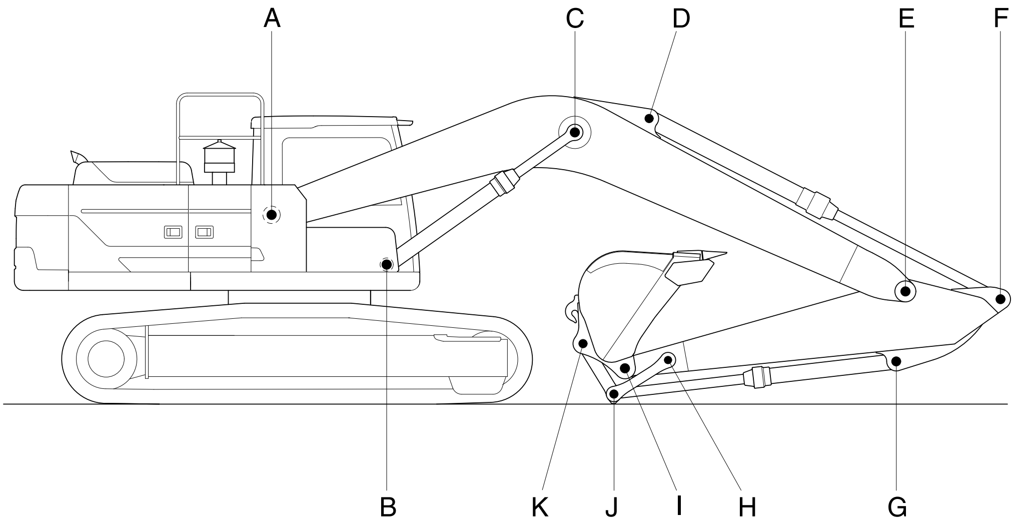
No.	Check item	Criteria					Remedy
1	Vertical width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		113	2.0 0	117	
		Idler support		110	-0.5 -1.5	106	
2	Horizontal width of idler guide	Track frame		272	2.0 0	276	
		Idler support		270	0.5 -0.5	267	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		627	508	16315 kg	−	13052 kg	

(Mahcine Serial No. #0235-)

Unit : mm

No.	Check item	Criteria					Remedy
1	Vertical width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		112	2.0 0	116	
		Idler support		110	0 -0.5	106	
2	Horizontal width of idler guide	Track frame		220	2.0 0	224	
		Idler support		217	−	214	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		614	521	17818 kg	−	14254 kg	

2. WORK EQUIPMENT



Unit : ㎜

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom rear	100	99	98.5	100.5	101	Replace
B	Boom cylinder head	90	89	88.5	90.5	91	Replace
C	Boom cylinder rod	100	99	98.5	100.5	101	Replace
D	Arm cylinder head	90	89	88.5	90.5	91	Replace
E	Boom front	100	99	98.5	100.5	101	Replace
F	Arm cylinder rod	90	89	88.5	90.5	91	Replace
G	Bucket cylinder head	90	89	88.5	90.5	91	Replace
H	Arm link	80	79	78.5	80.5	81	Replace
I	Bucket and arm link	90	89	88.5	90.5	91	Replace
J	Bucket cylinder rod	80	79	78.5	80.5	81	Replace
K	Bucket link	90	89	88.5	90.5	91	Replace

SECTION 8 DISASSEMBLY AND ASSEMBLY

Group 1 Precaution ········· 8-1
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Group 3 Pump Device ········· 8-7
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Group 10 Undercarriage ········· 8-161
Group 11 Work Equipment ········· 8-173

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

1) Lower the work equipment completely to the ground.
If the coolant contains antifreeze, dispose of it correctly.

2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.

3) When draining oil, prepare a container of adequate size to catch the oil.

4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.

5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.

6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.

7) Check the number and thickness of the shims, and keep in a safe place.

8) When raising components, be sure to use lifting equipment of ample strength.

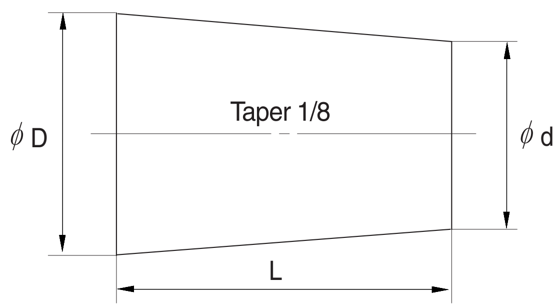
9) When using forcing screws to remove any components, tighten the forcing screws alternately.

10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.

12) If the part is not under hydraulic pressure, the following corks can be used.

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. COMPLETING WORK

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

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

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

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket)	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	M18×2.5	32±1.0	231±7.2
6		Fuel tank mounting bolt	M20×2.5	57.8±5.8	418±42
7	Hydraulic system	Main pump housing mounting bolt	M10×1.5	6.5±0.7	47.0±5.1
8		Main pump mounting socket bolt	M20×2.5	57.9±8.7	419±62.9
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	57.8±5.8	418±42.0
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	M24×3.0	97.8±10	707±72.3
13		Swing bearing upper part mounting bolt	M22×2.5	77.4±8.0	560±57.9
14		Swing bearing lower part mounting bolt	M24×3.0	100±10	723±72.3
15		Travel motor mounting bolt	M16×2.0	23±2.5	166±18.1
		Travel motor mounting bolt (high walker)	M24×3.0	84±8.0	608±57.8
16		Sprocket mounting bolt	M16×2.0	29.7±3.0	215±21.7
		Sprocket mounting bolt (high walker)	M20×2.5	57.9±6.0	419±43.4
17	Under carriage	Upper roller mounting bolt, nut	M16×2.0 M20×2.5★	29.7±3.0 57.9±6.0★	215±21.7 419±43.4★
18		Lower roller mounting bolt, nut	M20×2.5 M16×2.0★	57.9±6.0 29.7±3.0★	419±43.4 215±21.7★
19		Track tension cylinder mounting bolt	M16×2.0	29.7±3.0	215±21.7
20		Track shoe mounting bolt, nut	M20×1.5	78±8.0	564±57.9
		Track shoe mounting bolt, nut (high walker/triple grouser)	M22×1.5	123±6.0	890±43.4
		Track shoe mounting bolt, nut (high walker/triple grouser, 700 mm only)	M24×1.5	140±10	1013±72.3
21		Track guard mounting bolt	M20×2.5	57.9±8.7	419±62.9
		Track guard mounting bolt (high walker)	M24×3.0	100±15	1013±108
22	Others	Counterweight mounting bolt	M36×3.0	337±33	2438±239
23		Cab mounting bolt	M12×1.75	12.8±3.0	92.6±21.7
24		Operator's seat mounting bolt	M8×1.25	4.05±0.8	29.3±5.8
25		Under cover mounting bolt	M12×1.75	12.8±3.0	92.6±21.7

★ : Machine Serial No. #0235-

※ 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.

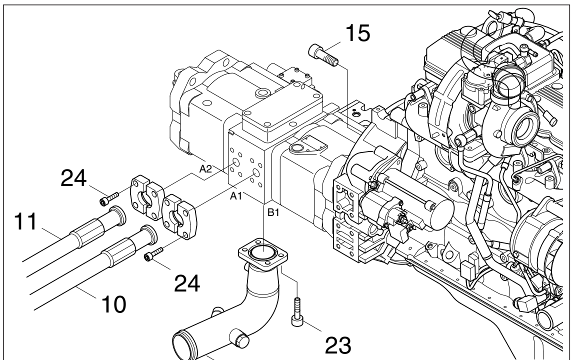
⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

13031GE18

(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 : 160 ℓ (42.3 U.S gal)



260A8MP01

(6) Remove socket bolts (24) and disconnect pipe (10, 11).

(7) Disconnect pilot line hoses (2, 3, 4, 5).

(8) Remove socket bolts (23) and disconnect pump suction tube (1).

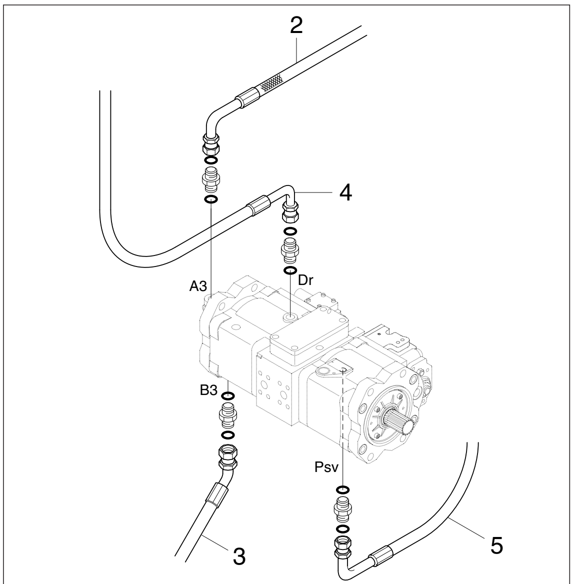
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(9) Sling the pump assembly and remove the pump mounting bolts (15).

· Weight : 140 kg (309 lb)

· Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)

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



220F8MP02

2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

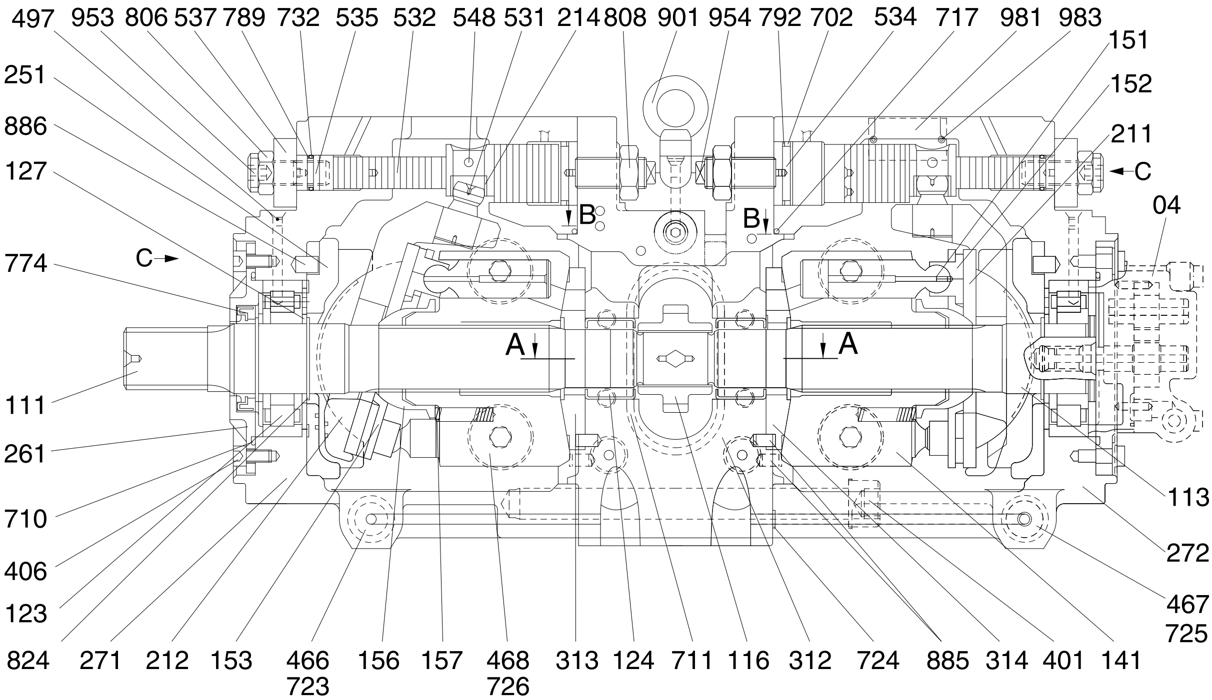
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

(8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. MAIN PUMP (1/2)

1) STRUCTURE

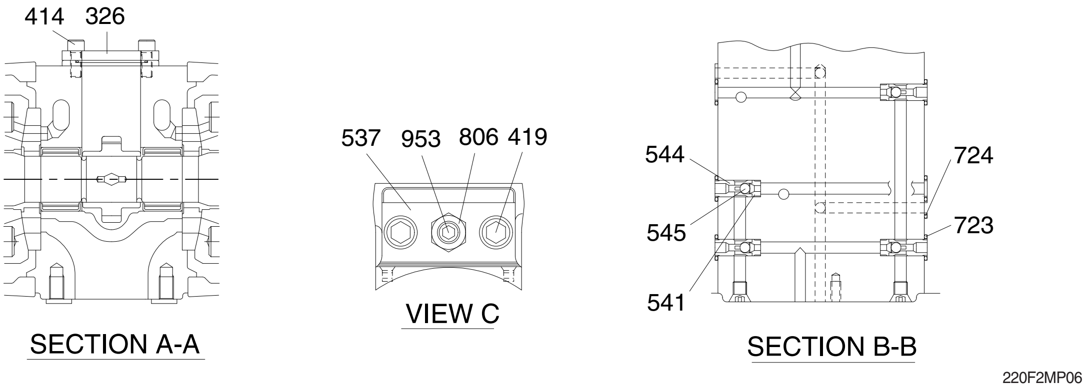


※ Section A-A, B-B, view C : see next page.

220F2MP05

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

MAIN PUMP (2/2)

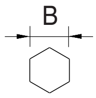


326	Cover	541	Seat	724	Square ring
414	Hexagon socket bolt	544	Stopper 1	806	Hexagon head nut
419	Hexagon socket bolt	545	Steel ball	953	Set screw
537	Servo cover	723	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the following list.

Tool name & size		Part name		
Name	B	Hexagon socket head bolt	ROH, VP plug (Parallel thread)	Hexagon socket head setscrew
Allen wrench 	6	M 8	PF 1/4	M12, M14
	8	M10	PF 3/8	M16, M18
	10	M12	PF 1/2	M20
	14	M16, M18	PF 3/4	-
	17	M20, M22	PF 1	-
Adjustable angle wrench		Medium size, 1 set		
Screw driver		Minus type screw driver, Medium size, 2 pieces		
Hammer		Plastic hammer, 1 pieces		
Pliers		For snap ring, TSR-160		
Torque wrench		Capable of tightening with the specified torques		

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.3	118	0.47	12
	M16	23.5	170	0.55	14
	M18	33.7	244	0.55	14
	M20	43.8	317	0.67	17
ROH Plug PF 3/8 or under : S45C PF 1/2 or over : SCM435	PF 1/4	3.0	21.7	0.24	6
	PF 3/8	7.5	54.2	0.31	8
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.3	111	0.47	12

3) DISASSEMBLY

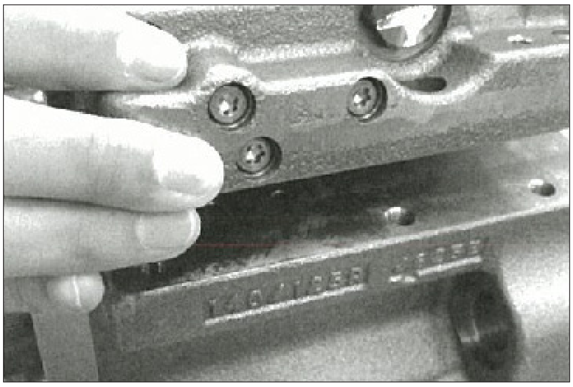
For disassembling the pump, read this section thoughly and then disassemble it in the following sequence. The figures in parentheses after part names show the item in structure drawing.

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

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

(3) Remove drain port plug (468) and let the oil out from pump casing (271, 272).
※ For tandem type pump, remove plugs of both front and rear pumps.

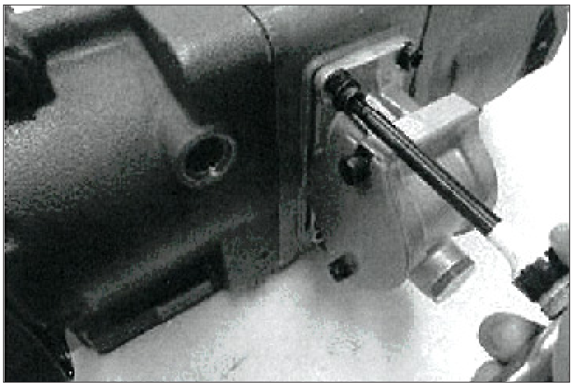
(4) Remove hexagon socket head bolts (412) and remove regulator.
※ Refer to page 8-28 for disassemble regulator.



220F8MP11

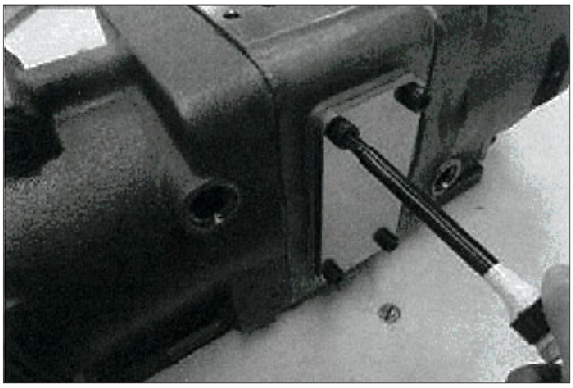
(5) Place the pump horizontally on workbench with its regulator-fitting surface down, and remove PTO unit from valve block (if equipped).

※ Before bringing regulator-fitting surface down, spread rubber sheet on workbench to avoid damaging the surface.



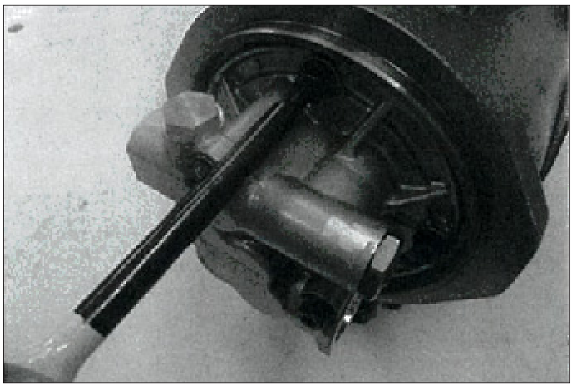
220S8MP13

※ In case the pump is provided without PTO unit, remove the cover (326) with the hexagon socket head cap screws.



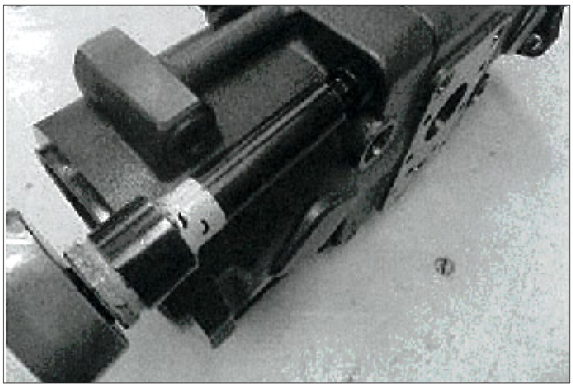
220S8MP14

(6) Remove flange sockets (435) and the gear pump (04).



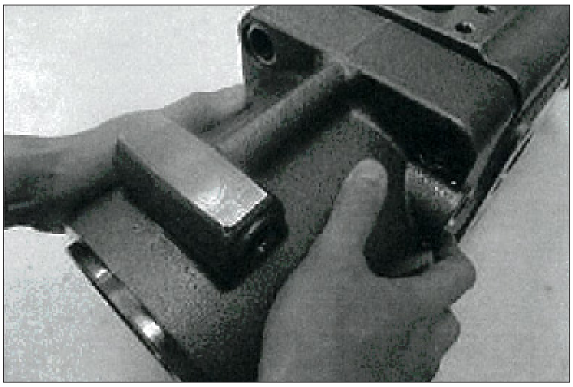
220S8MP15

(7) Loosen hexagon socket head bolts (401) which tighten pump casing (F, 271) pump casing (R, 272), and valve block (312).



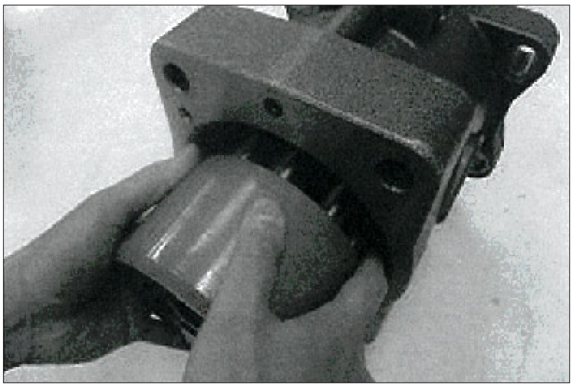
220S8MP16

(8) Separate pump casing (F, 271), pump casing (272), from valve block (312)
※ Remove the 1st gear (116), when pump casings are separated from valve block.



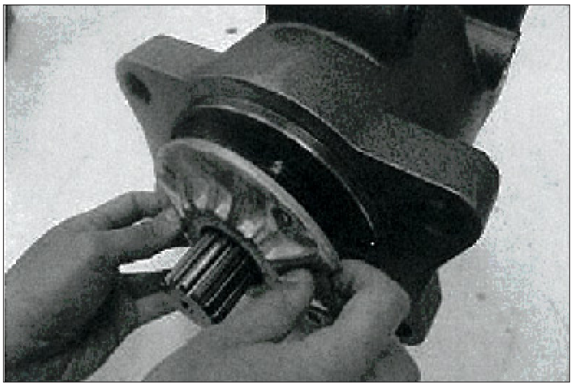
220S8MP17

(9) Pull out cylinder block (141), piston-shoes (011), set plate (153), spherical bushng (156), and cylinder springs (157) simultaneously from pump casing (F, 271) and (R, 272), straightly over drive shaft (111, 113)
※ Take care not to damage sliding surface of cylinder block (141), spherical bushing (156), piston-shoes (011), swash plate (212), drive shaft (111, 113), etc.



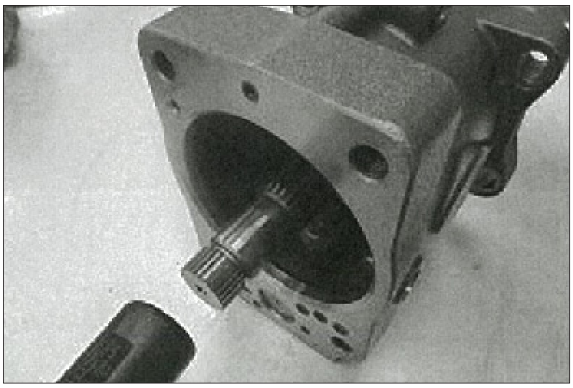
220S8MP18

(10) Remove hexagon socket head bolts (406) and seal cover (F, 261).
※ In the case it is difficult to remove, put flat-blade screwdriver into the notch of seal cover. Then the cover can be removed easily.
※ Since oil seal is fitted on seal cover (F, 261), take care not to damage it while removing cover.



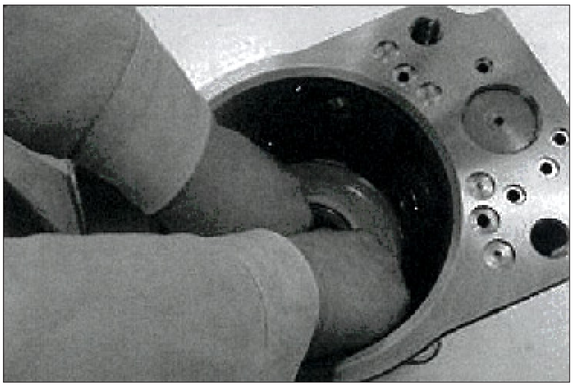
220S8MP19

(11) Remove the drive shafts (111, 113) from the pump casing (271, 272), lightly with plastic hammer, remove them from pump casing (271, 272)
※ In the case it is difficult to remove, tap the end of the drive shaft lightly with plastic hammer.

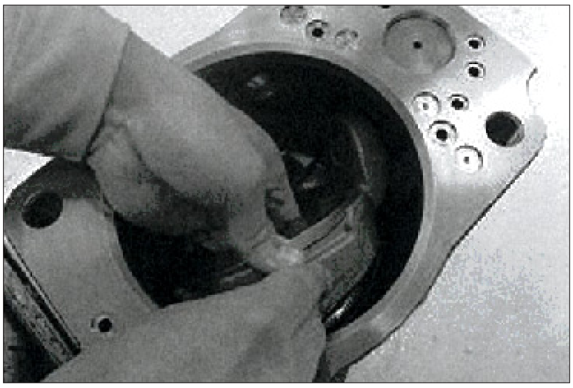


220F8MP20

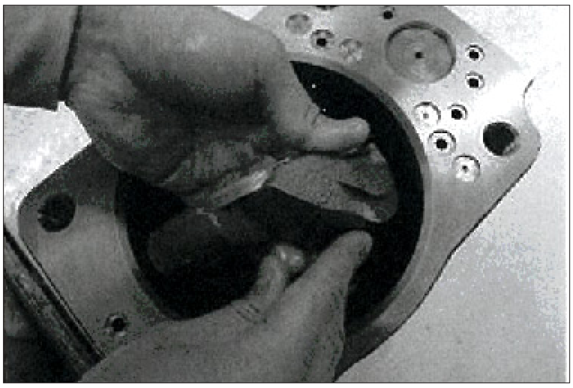
(12) Remove the swash plates (212) and shoe plates (211) from swash plate support (251), and pull out the swash plates with turning shown in this picture from casing.



220S8MP21



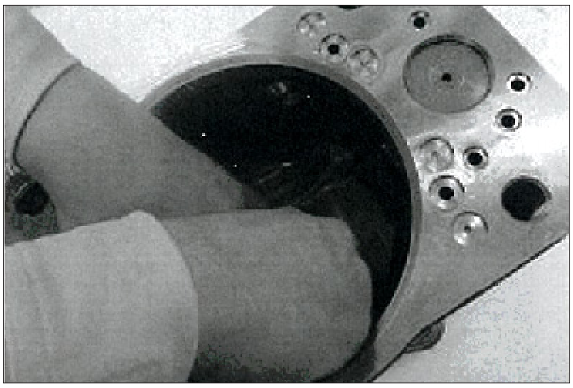
220S8MP22



220S8MP23

(13) Remove swash plate supports (251) from pump casing.

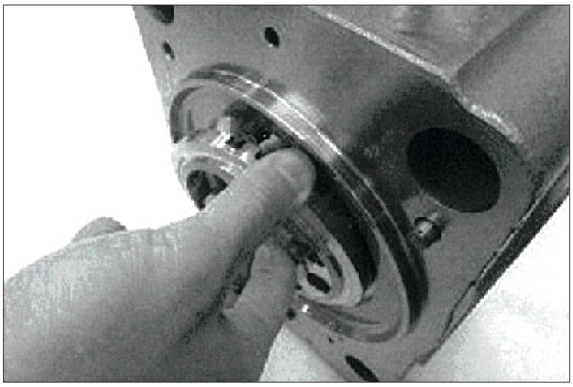
※ In the case it is difficult to remove, tap the opposite side of the swash plate support (251) with plastic hammer to remove it from pump casing easily.



220S8MP24

(14) Remove valve plates (313, 314) from valve block (312)

※ There may be removed in work (7).



220S8MP25

(15) If necessary, remove the servo covers (537), stopper (L, 534), stopper (S, 535), and servo piston sub (530) from pump casing (271, 272).

※ Do not remove needle bearing (124) as far as possible, except the case that the bearing is considered to be out of its life-time.

※ Do not loosen hexagon nuts of valve block (312) and servo cover (537). If loosened, flow setting will be changed.

4) REASSEMBLY

(1) For reassembling reverse the disassembling procedures, paying attention to the following.

① Do not fail to repair the parts damaged during dissassembling, and repair replacement part in advance.

② Clean each part fully with cleaning oil and dry it with compressed air.

③ Apply clean working oil to sliding sections, bearings, etc. before assembling them.

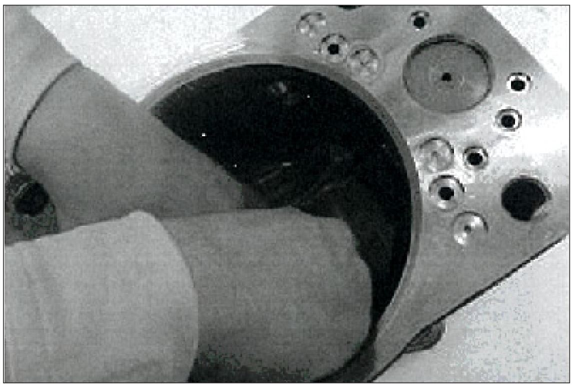
④ In general rule, replace the sealing parts, such as O-ring, oil seal, etc.

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

⑥ For the tandem type pump, take care not to mix up parts of the front pump with those of the rear pump

(2) Insert swash plate supports (251) into the casing (F, 271) and (R, 272) with fitting.

※ If the servo piston, stopper (L), stopper (S), and servo cover are removed, fit them to pump casing in advance for reassembling.



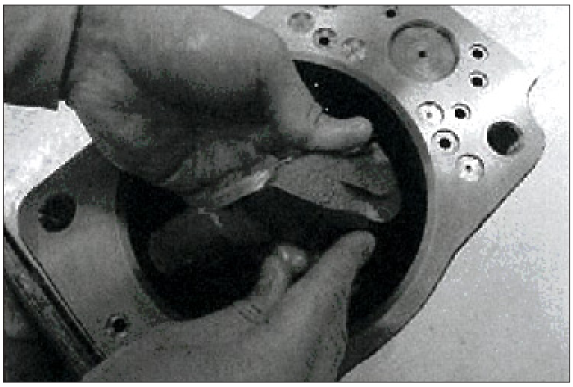
220S8MP24

(3) Attach shoe plate (211) to swash plate (212) and insert tilting pin (531) to tilting bushing (214) of servo piston (532). As shown in the right figure, attach to swash plate support (251) correctly, leaning swash plate and shoe plate.

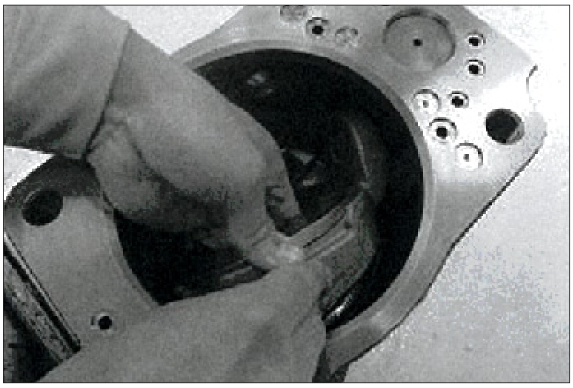
※ Confirm with fingers of both hands that swash plate can moved smoothly.

※ Apply grease to sliding sections of swash plate and swash plate support, to assemble the drive shaft easily.

※ Take care not to damage the sliding surface of the shoe plate.



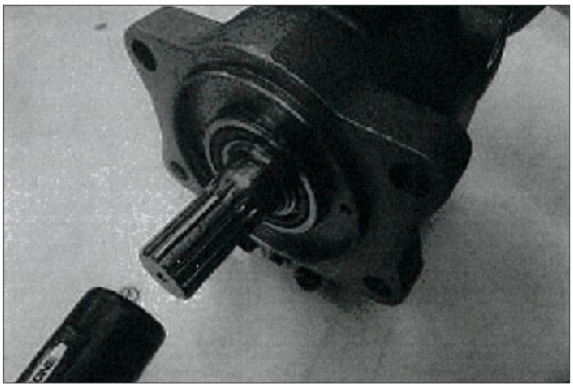
220S8MP23



220S8MP22

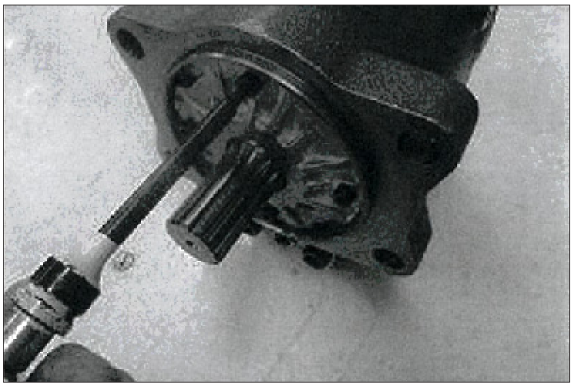
220S8MP21

(4) Fit drive shaft (111, 113) where bearing (123), bearing spacer (127), snap ring (824) were set to pump casing (271, 272).



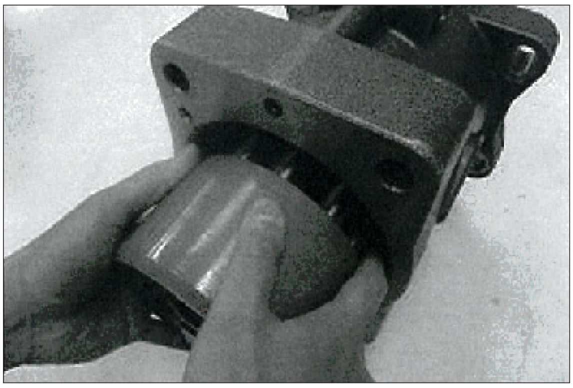
220S8MP20

(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.



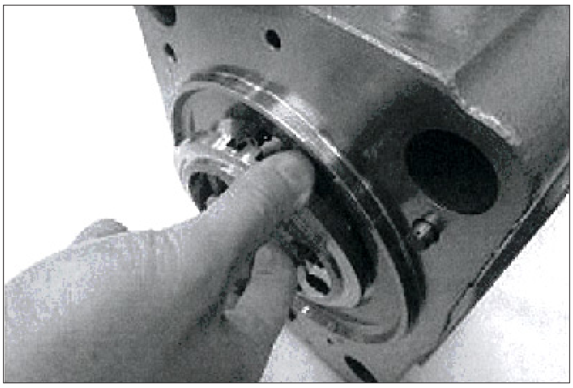
220S8MP26

(6) Assemble piston cylinder sub assembly [cylinder (141), piston sub assembly (151, 152), set plate (153), spherical bushing (156) and cylinder spring (157)].
※ Fit spline phases of spherical bushing and cylinder.
※ Then, insert piston cylinder subassembly into pump casing.



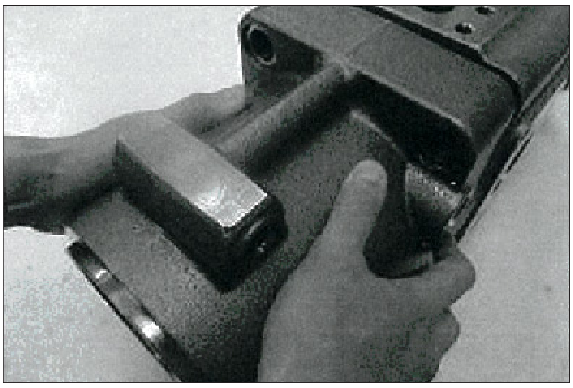
220S8MP18

(7) Fit valve plate (313) to valve block (312) according to pin (885).
※ Take care not to mistake suction/delivery directions of valve plate.



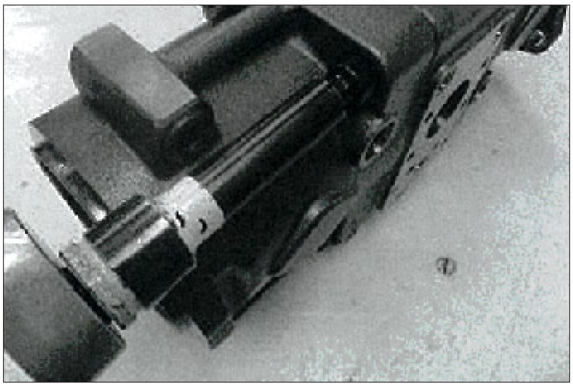
220S8MP27

(8) Place pump horizontally on workbench with its regulator-fitting surface down, and attach pump casing (271) to valve block (312).
※ Before bringing regulator-fitting surface down, spread rubber sheet on workbench and do not damage this surface.
※ Take care not to mistake direction of valve block. [clockwise rotation (viewed from input shaft side)]. Fit the valve block with suction flange left when regulator side below, viewed from front side.
※ Fit 1st gear simultaneously.



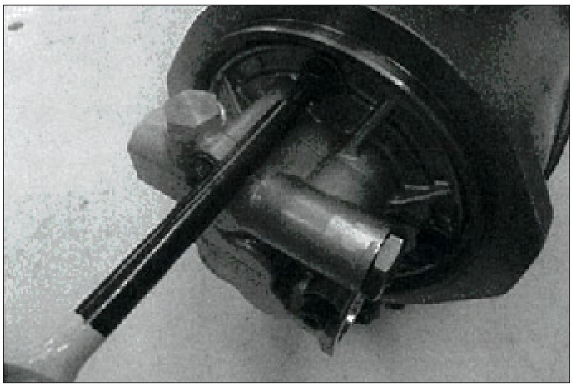
220S8MP17

(9) Fit valve block (312) to pump casing (271, 272) with hexagon socket head bolts (401, 402).



220S8MP16

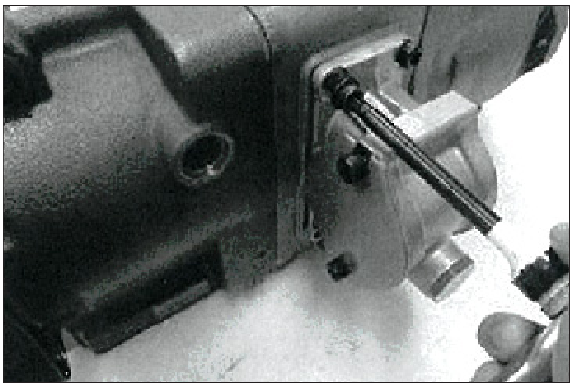
(10) Fit gear pump (04) to pump casing (271) with hexagon socket head bolts.



220S8MP15

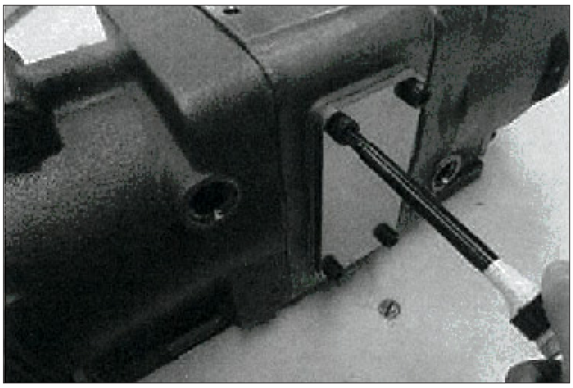
(11) Attach the PTO unit (05) by fastening the flange socket to the valve block (312).

※ Be careful about the attaching direction of the PTO unit.



220S8MP13

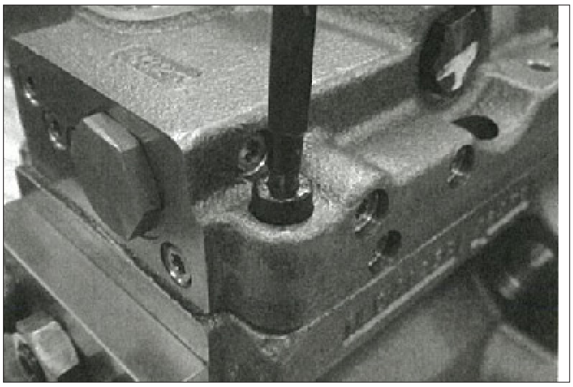
In case the pump is not provided with the PTO unit (05), attach the cover (326) with the hexagon socket head cap screws (414).



220S8MP14

(12) Putting feedback lever of regulator into feedback pin (548) of tilting pin (531), fit regulator with hexagon socket head bolts.

※ Take care not to mix up regulator of front pump with another.



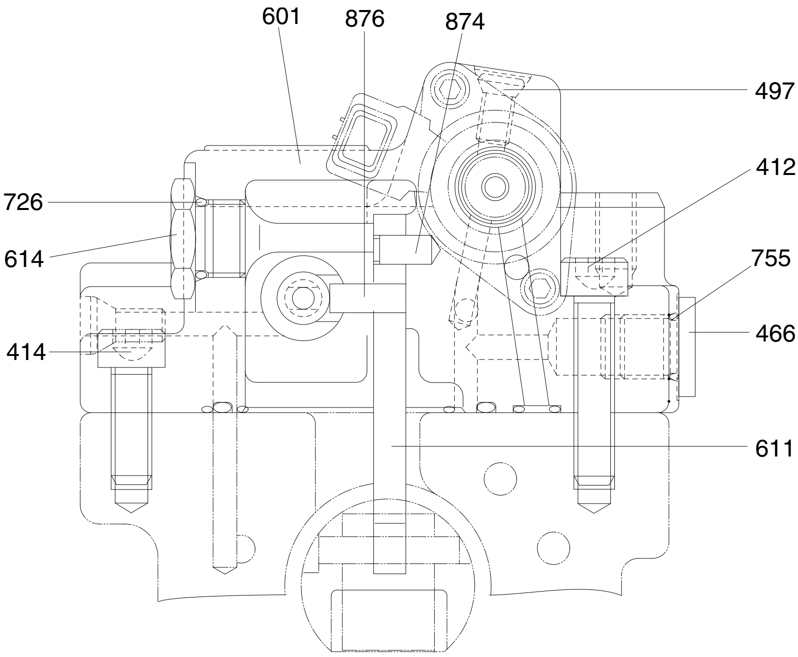
220F8MP28

(13) Fit drain port plug (467).

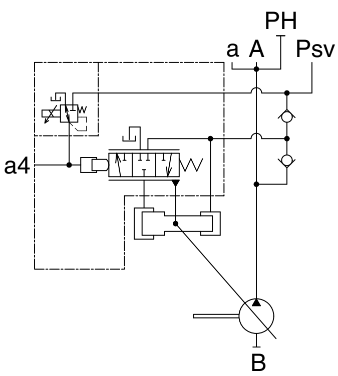
This is the end of reassembling procedure.

3. REGULATOR

1) STRUCTURE (1/2)



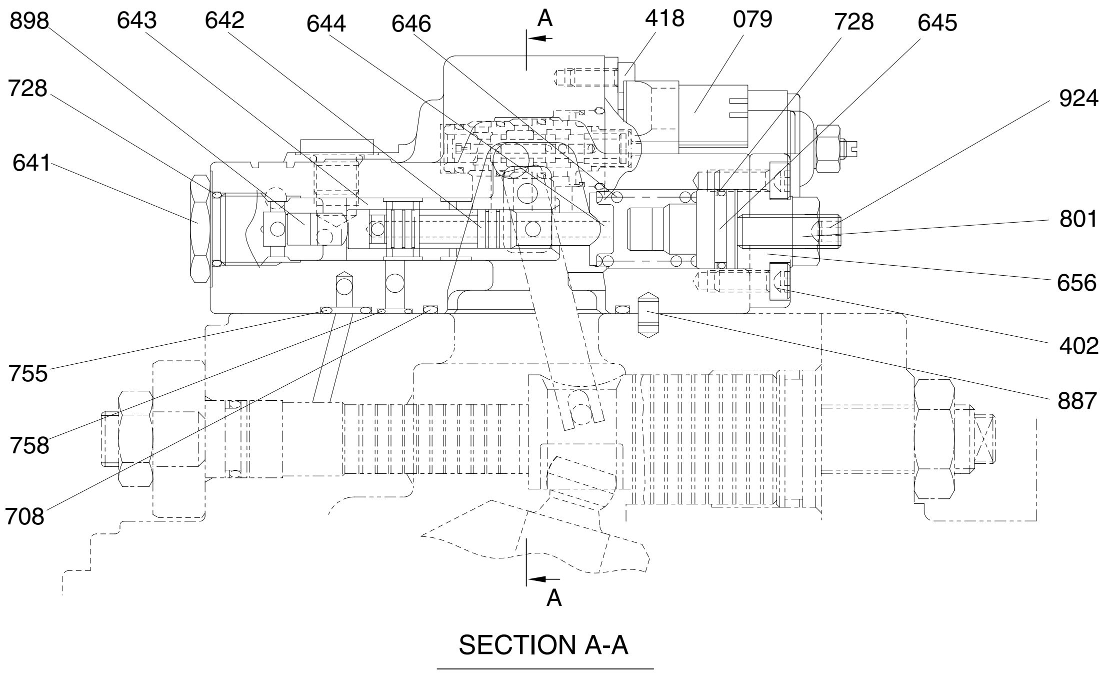
SECTION A-A



220F2MP08

412	Hexagon socket screw	601	Casing	755	O-ring
414	Hexagon socket screw	611	Feedback lever	874	Pivot pin
466	Plug	614	Adjust plug	876	Pin
497	Plug	726	O-ring		

STRUCTURE (2/2)



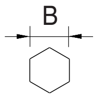
220F2MP09

402	Hexagon socket screw		645	Adjust stem (Q)		758	Square ring
418	Hexagon socket screw		646	Pilot spring		801	Nut
641	Pilot plug		656	Cover		887	Pin
642	Pilot spool		708	O-ring		898	Pilot piston
632	Pilot sleeve		728	O-ring		924	Set serew
644	Spring seat (Q)		755	O-ring			

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the following list.

Tool name & size		Part name		
Name	B	Hexagon socket head cap screw	Pressure plug (taper thread)	Hexagon socket head set screw
Allen wrench Spanner 	4	M 5	-	M8
	5	M 6	-	M10
	6	M 8	ROH 1/4	M12, M14
	22	-	VP 3/8	-
	27	M18	VP 1/2	-
Adjustable angle wrench		Medium size, 1 set		
Torque wrench		Capable of tightening with the specified torques		
Hexagon socket head cap screw		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 7	3.0	21.7	0.24	6
	M 8	5.8	42	0.31	8
	M 9	10.0	72.3	0.39	10
	M14	16.3	118	0.47	12
	M16	23.5	170	0.55	14
	M18	33.7	244	0.55	14
	M20	43.8	317	0.67	17
	M22	64.2	464	0.67	17
PT Plug (Material : S45C) ※Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/8	1.2	8.7	0.20	5
	PT 1/4	2.2	15.9	0.24	6
	PT 3/8	4.5	32.5	0.31	8
	PT 1/2	6.6	47.7	0.39	10
ROH Plug PF 3/8 or under : S45C PF 1/2 or over : SCM435	PF 1/4	3.5	25.3	0.24	6
	PF 3/8	7.5	54.2	0.31	8
	PF 1/2	11.2	81.0	0.39	10
	PF 3/4	17.3	125	0.55	14

3) DISASSEMBLY

(1) Preparation for disassembling

① Since the regulator consists of small, precision, and well-finished parts, disassembling and assembling are rather complicated. For this reason, replacement of a regulator assembly is recommended, unless there is a special reason. If in case disassembling is necessary for an unavoidable special reason, read through this manual to the end before starting disassembling.

② Since the regulators on the front pump and the rear pump are set at different pressure and flow values, mark each of them so as not to mix up one of front pump with another.

③ For reason that regulator contain two parts which are tightened with large torque, prepare a vise to hold the regulator stable.

④ The numbers in parentheses after part names represent those in the cross-sectional drawings (on page 8-23, 24)

(2) Select a place for disassembling.

※ Select clean place.

※ Spread rubber sheet or cloth to cover the workbench to prevent parts from being damaged.

(3) Remove dust, rust, etc. from surfaces of regulator with clean oil.

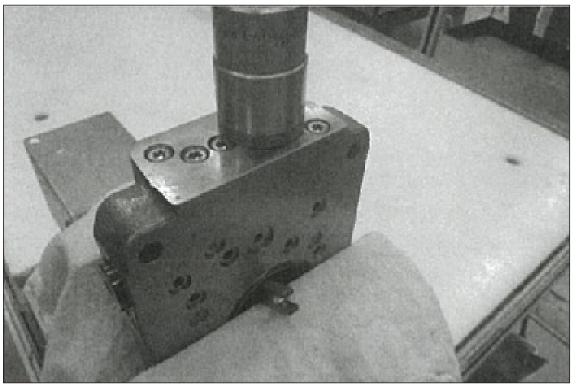
(4) Remove hexagon socket head cap screws (412, 414) and remove regulator from the pump.

※ If the pump is disassembled, check the page 7-21 for this axial piston pump.

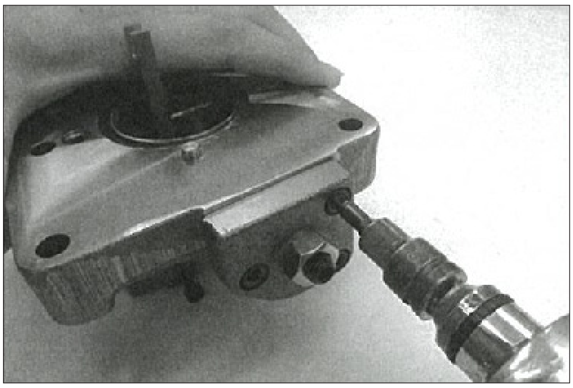
※ Take care not to lose O-ring while removing regulator.

(5) Remove hexagon socket head cap screws (418) and remove the proportion reducing valve.
※ Do not damage to the proportional reducing valve's connector.

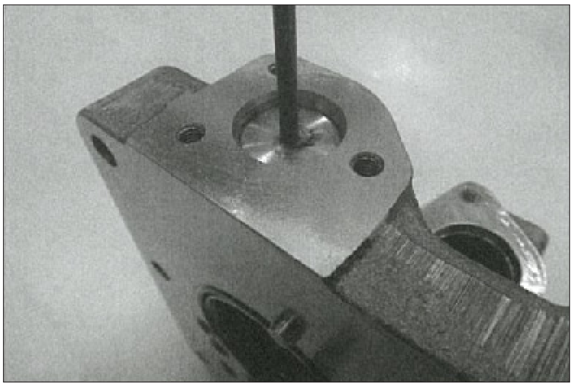
(6) Loosen the pilot plug (641).
※ Do not remove the pilot plug (641). If it is removed, the pilot spring (646) and the spring stem (Q, 644) will fall from casing.
※ Be careful not to damage regulator casing (601) while loosening the pilot plug (641).
※ Do not damage to the regulator casing while using a vise.


220F8MP30

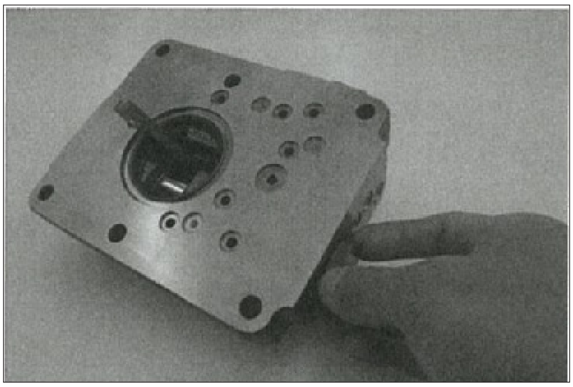
(7) Remove hexagon socket head cap screws (402) and remove cover (656)
※ Cover (656) is fixed with adjusting screw (924), hexagon nut (801). Do not loosen screw and nut. If they are loosened, adjusted pressure-flow setting will be changed.


220F8MP31

(8) Remove the adjusting stem (Q, 645), the pilot spring (646), and the spring seat (Q, 644) from regulator.
※ Adjusting stem (Q, 645) can easily be drawn out with M4 screw.
※ Take care not to lose the pilot spring (646) and the spring stem (Q, 644) which they fall from casing when the adjusting stem (Q, 645) is removed.

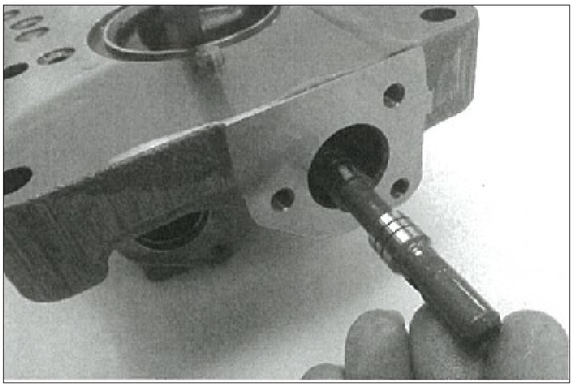

220F8MP32

(9) Remove the pilot plug (641) and the pilot piston (898).
※ Take care not to lose the pilot piston (898) because of its smallness.



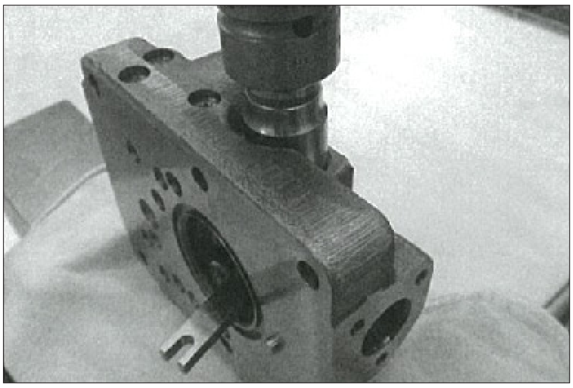
220F8MP33

(10) Remove the pilot spool (642) from pilot section.



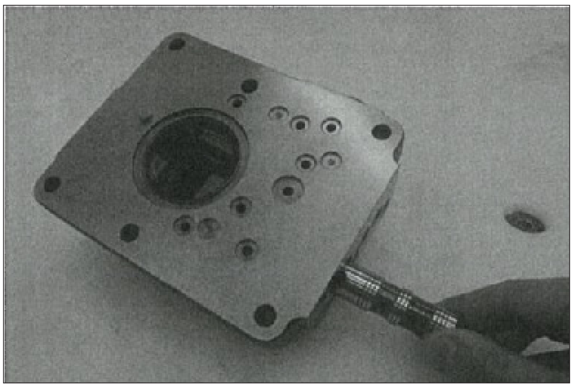
220F8MP34

(11) Remove the adjusting plug (614) and feedback lever (611) from the casing.
※ Be careful not to damage regulator casing (601) while loosening the adjusting plug (614).
※ Do not remove the pin (876) from the feedback lever (611).



220F8MP35

(12) Remove the pilot sleeve (643).
※ This completes operation.



220F8MP36

※ Since component part are small, take care not to them.

4) REASSEMBLY

(1) For assembling, reverse disassembling procedures. But pay attention to the following.

① Repair parts that were damaged at disassembling.
Prepare replacement parts beforehand.

② Contamination will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Tighten screws, plugs, etc. with their specified torques.

④ Replace seals such as O-ring with new ones as a general rule.

(2) Select a place for assembling.

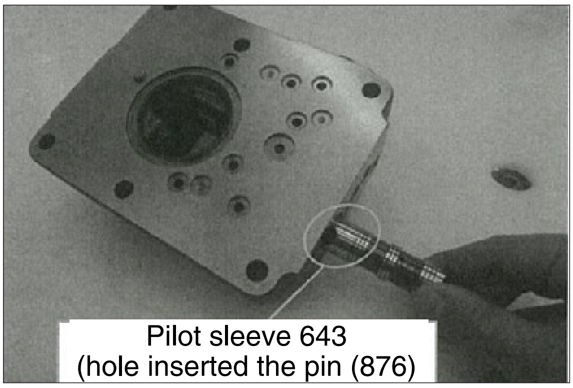
※ Select clean place.

※ Spread rubber sheet or cloth to cover the workbench to prevent parts from being damaged.

(3) Fit the pilot sleeve (643) into pilot section of the casing (601).

※ Be careful not to fit the pilot sleeve (643) with the wrong way.

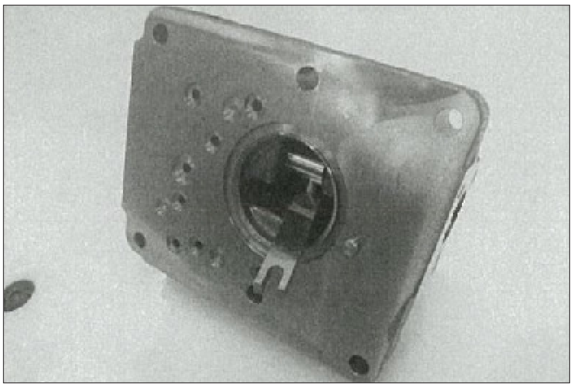
※ Confirm the the sleeve slides smoothly in casing without sticking.



220F8MP37

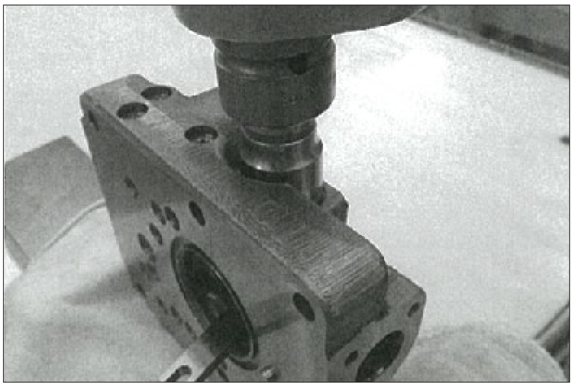
(4) Insert the pin (876) fixed on feedback lever (611) to the oval shaped hole of the sleeve (643) and fit the hole of the feedback lever to the pin (874) fixed inside the casing (601).

※ If the pilot spool (642) is in the pilot sleeve (643), the pin (876) can not be inserted to the pilot sleeve.

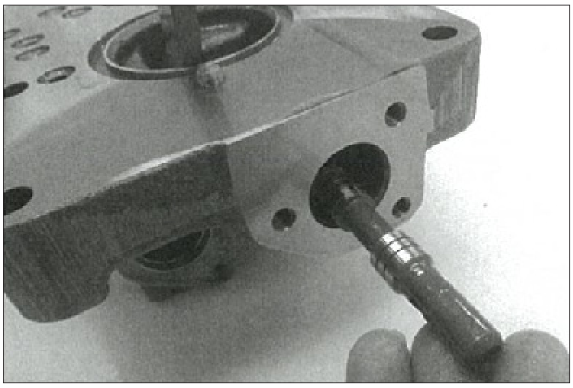


220F8MP38

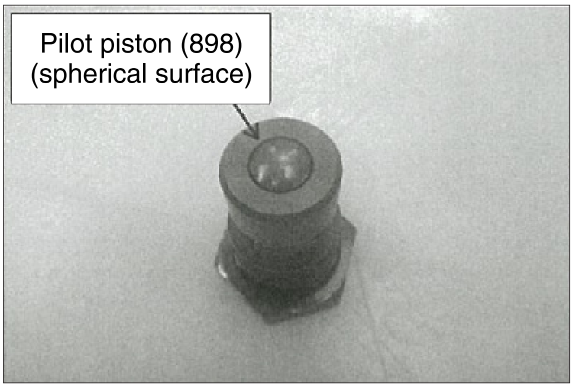
(5) Tighten the adjusting plug (614) to the casing (601).
※ Be careful not to damage regulator casing (601) while tightening the adjusting plug (614).
※ Confirm that the sleeve slides smoothly in casing without sticking or excess play among parts.


220F8MP39

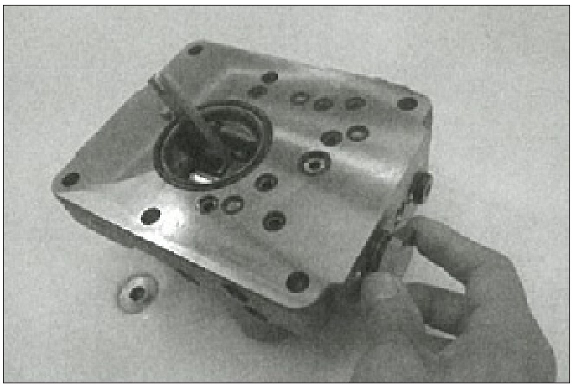
(6) Fit the pilot spool (642) into the pilot sleeve (643).
※ Be careful not to fit the pilot spool (642) with the wrong way.


220F8MP40

(7) After the pilot piston (898) is fitted into the pilot plug (641), put the plug to the casing (601).
※ Be careful not to fit the pilot piston (898) with the wrong way.
※ At the present stage, it is no need to tighten the pilot plug (641) with recommended torque.

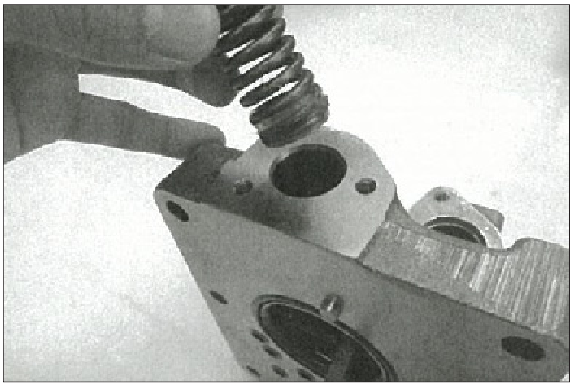


220F8MP41


220F8MP42

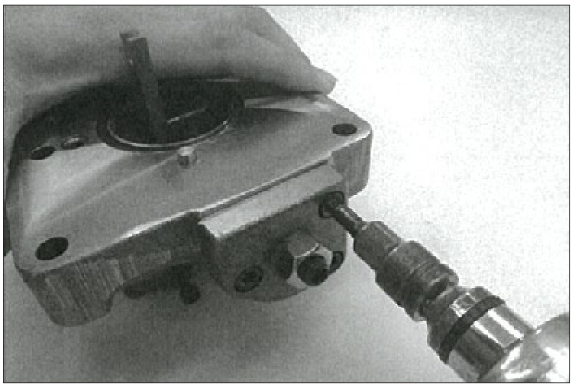
(8) Put the spring seat (Q, 644) and the pilot spring (646) into the pilot section of the casing (601).

※ Be careful not to fall the spring seat (Q). Recommended to apply grease to the spring seat to prevent falling.



220F8MP43

(9) Put the adjusting stem (Q, 645), and tighten the cover (656) with the adjusting screw (924) and the hexagon nut (801) with hexagon socket head cap screws (402).

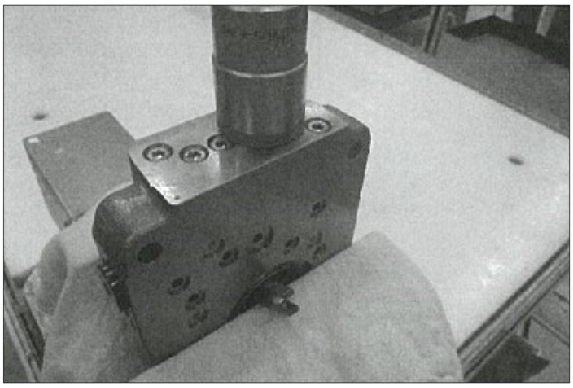


220F8MP44

(10) Tight the pilot plug (641) to the casing (601).

※ Be careful not to damage regulator casing (601) while tightening the pilot plug (641).

※ Do not damage to the regulator casing while using a vise.



220F8MP45

(11) Tighten the proportional reducing valve with hexagon socket head cap screw (418).

※ This completes assembling.

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.

⚠ **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 mounting bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

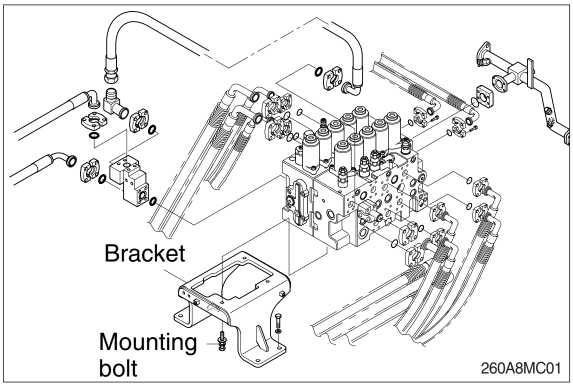
(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.

· Weight : 220kg(485lb)

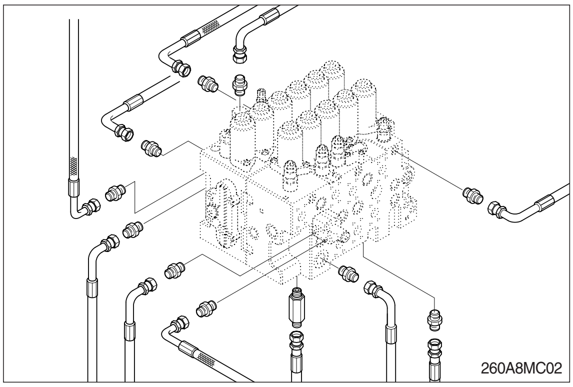
· Tightening torque : 12.3 ± 1.3 kgf·m (89.0 ± 9.4 lbf·ft)

(9) Remove the control valve assembly. When removing the control valve assembly, check that all the piping have been disconnected.

13031GE18



260A8MC01



260A8MC02

2) INSTALL

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

(2) Bleed the air from below items.

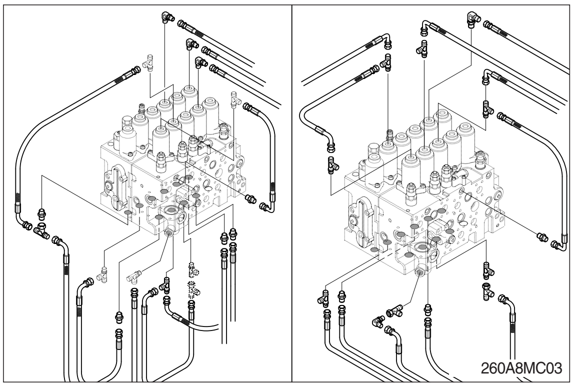
① Cylinder (boom, arm, bucket)

② Swing motor

③ Travel motor

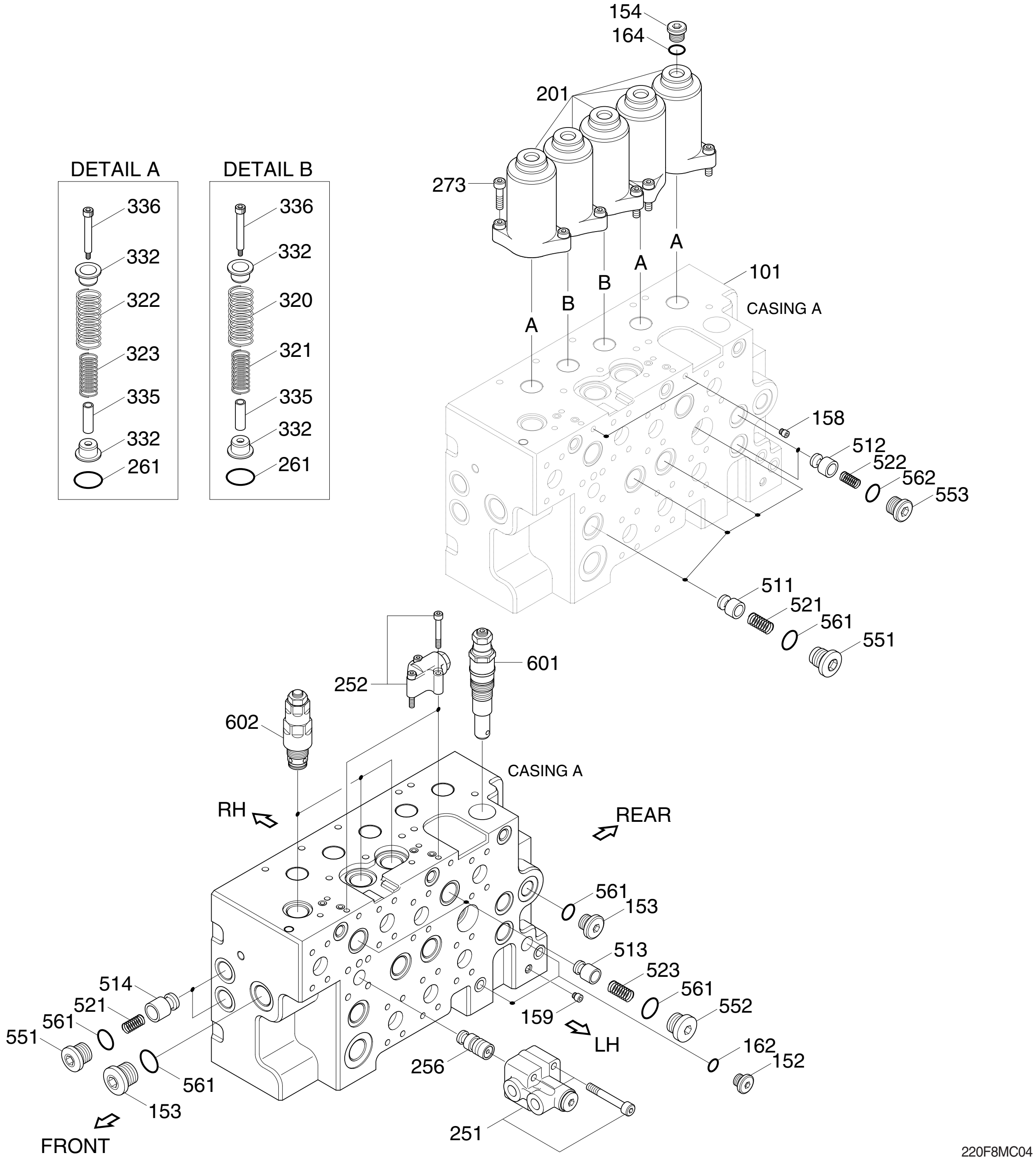
※ See each item removal and install.

(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



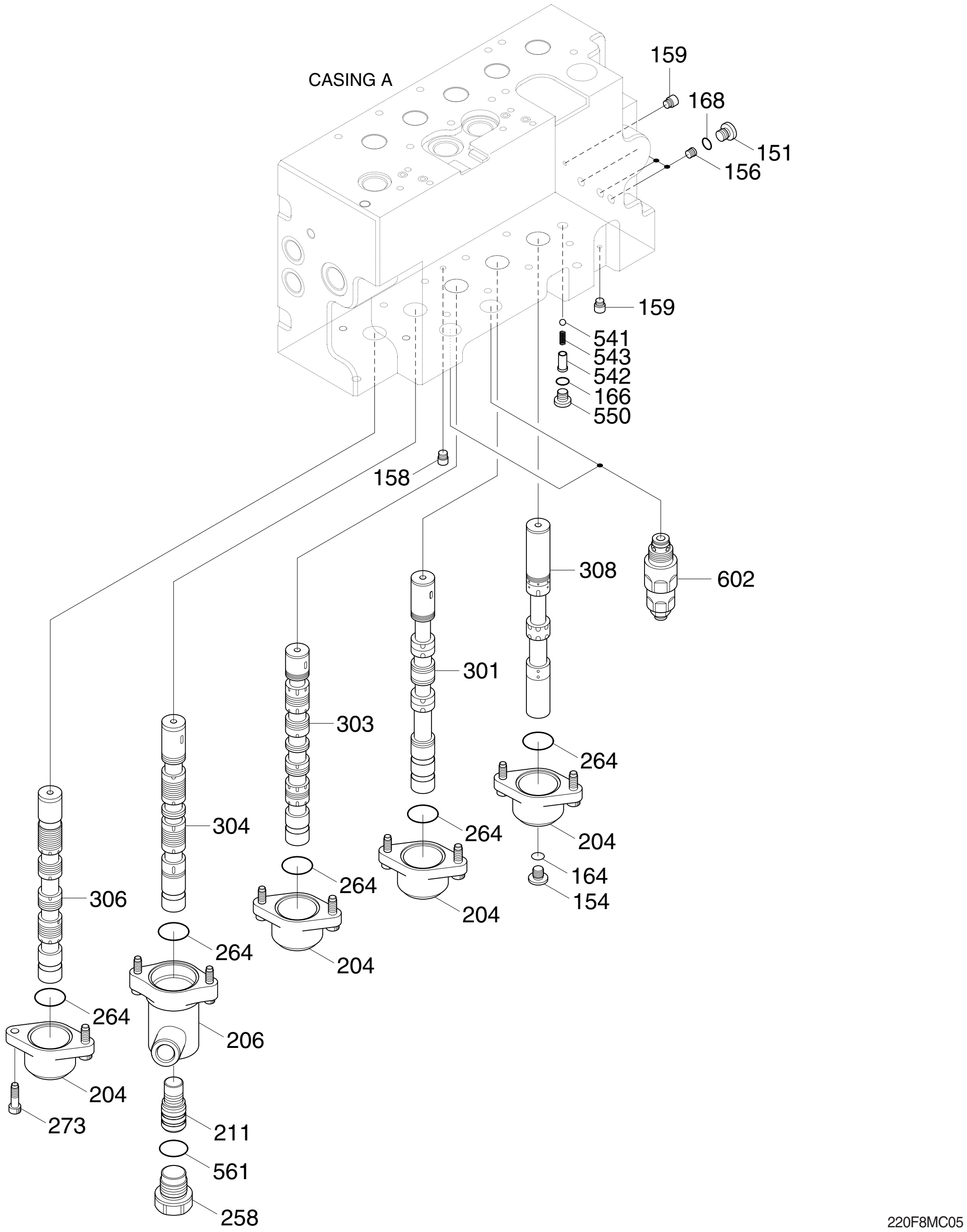
260A8MC03

2. STRUCTURE (1/4)



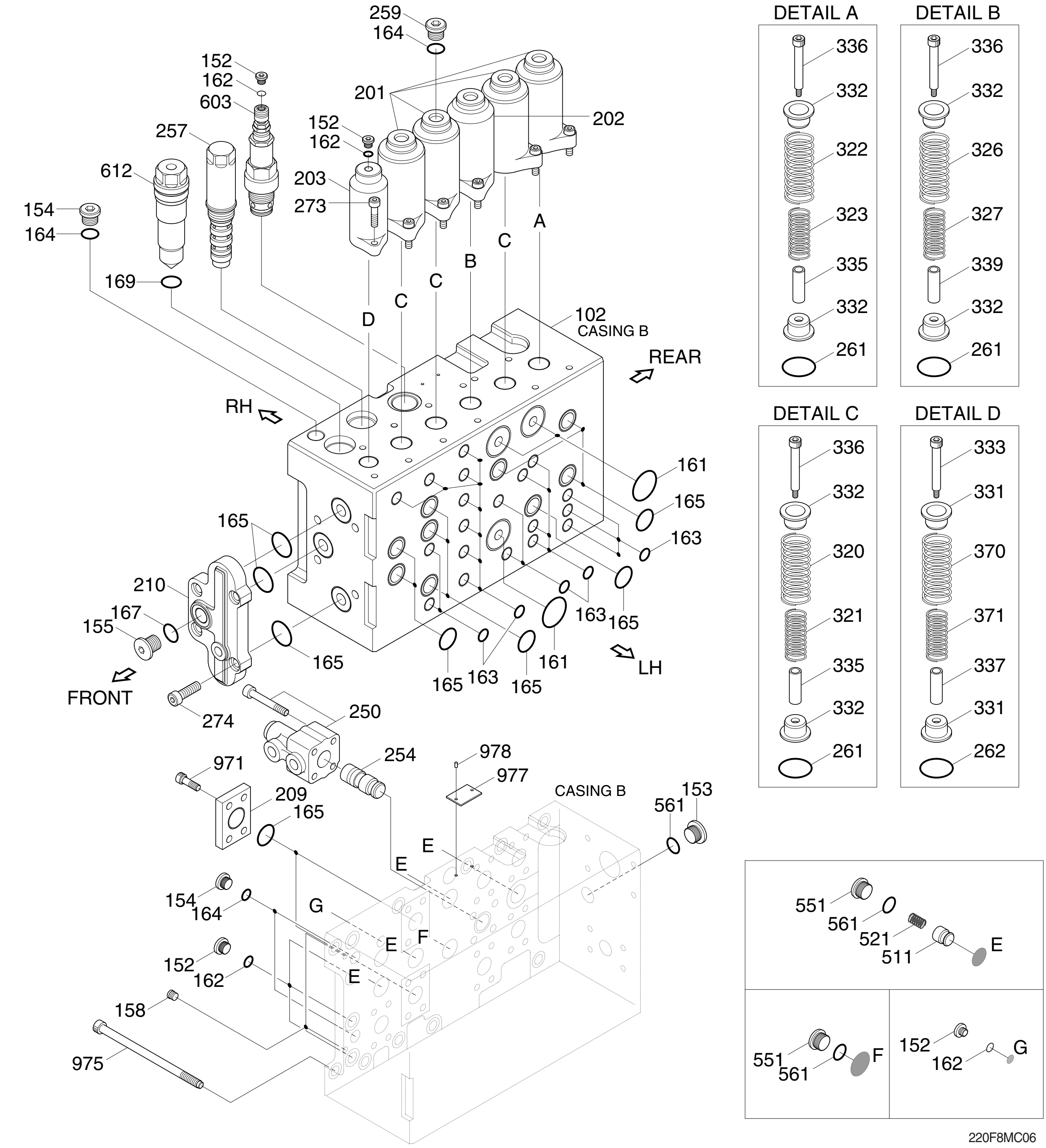
101	Casing A	261	O-ring	514	Poppet
152	Plug	273	Socket screw	521	Spring
153	Plug	320	Spring	522	Spring
154	Plug	321	Spring	523	Spring
158	Plug	322	Spring	551	Plug
159	Plug	323	Spring	552	Plug
162	O-ring	332	Seat	553	Plug
164	O-ring	335	Stopper	561	O-ring
201	Spring cover	336	Bolt	562	O-ring
251	Logic control valve	511	Poppet	601	Main relief valve
252	Selector lock valve	512	Poppet	602	Port relief valve
256	Logic poppet	513	Poppet		

STRUCTURE (2/4)



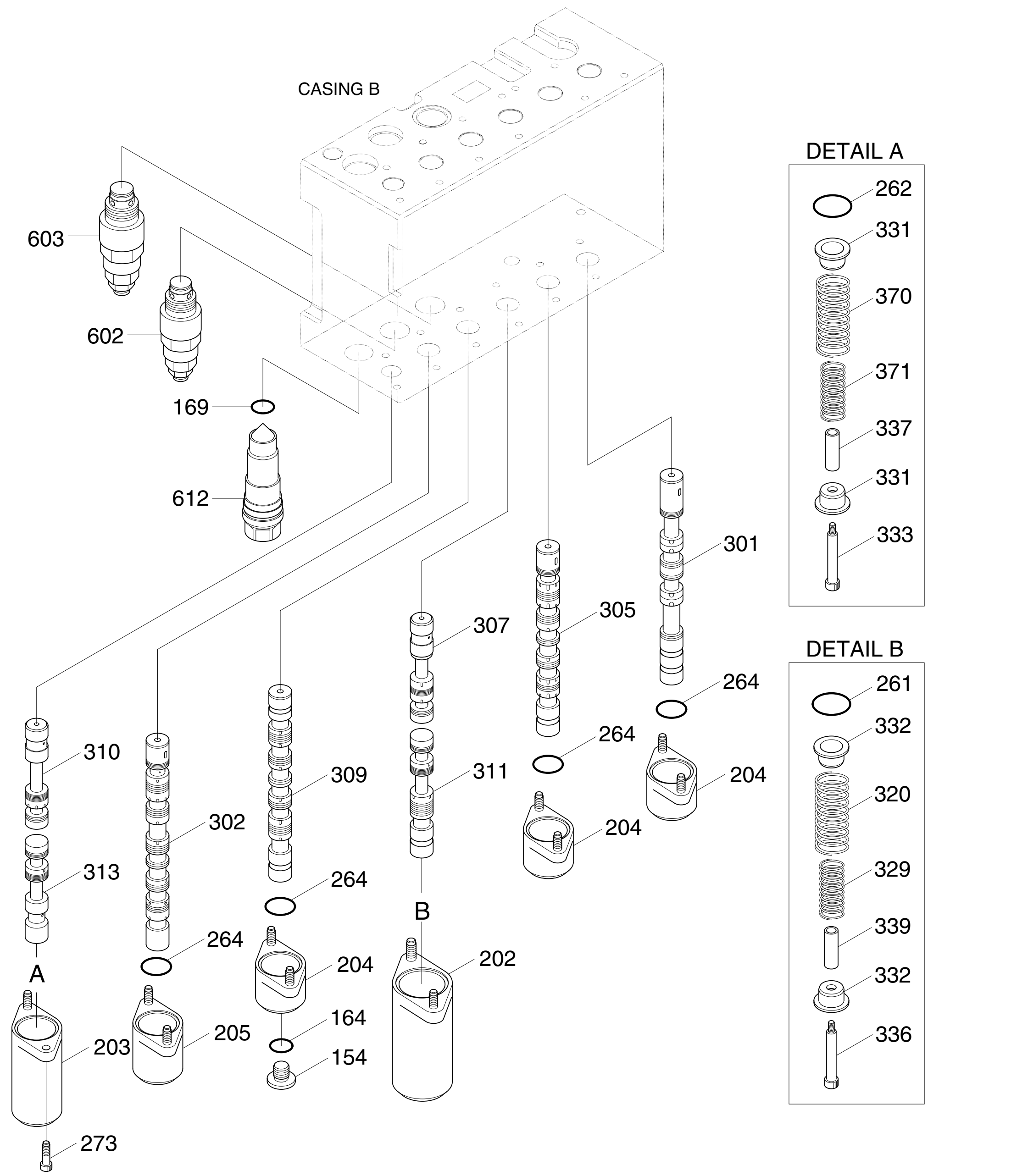
151	Plug	206	Spool cover	308	Straight travel spool
154	Plug	211	Piston	541	Steel ball
156	Orifice	258	Plug	542	Spring seat
158	Plug	264	Square ring	543	Spring
159	Plug	273	Socket screw	550	Plug
164	O-ring	301	Travel, LH spool	561	O-ring
166	O-ring	303	Boom 1 spool	602	Port relief valve
168	O-ring	304	Bucket spool		
204	Spool cover	306	Arm 2 spool		

STRUCTURE (3/4)



102 Casing B
152 Plug
153 Plug
154 Plug
155 Plug
158 Plug
161 O-ring
162 O-ring
163 O-ring
164 O-ring
165 O-ring
167 O-ring
169 O-ring
201 Spring cover
202 Spring cover
203 Spring cover
209 Flange
210 Plate
250 Logic control valve
254 Logic poppet
257 Arm regen cut sub
259 Plug
261 O-ring
262 O-ring
273 Socket screw
274 Socket screw
320 Spring
321 Spring
322 Spring
323 Spring
326 Spring
327 Spring
331 Seat
332 Seat
333 Spacer bolt
335 Stopper
336 Bolt
337 Stopper
339 Stopper
370 Spring
371 Spring
511 Poppet
521 Spring
551 Plug
561 O-ring
603 Port relief valve
612 Plug
971 Socket screw
975 Socket screw

STRUCTURE (4/4)



154	Plug	301	Travel, RH spool	332	Seat
164	O-ring	302	Arm 1 spool	333	Spacer bolt
169	O-ring	305	Swing spool	336	Spacer bolt
202	Spring cover	307	Boom 2 spool	337	Stopper
203	Spring cover	309	Option spool	339	Stopper
204	Spool cover	310	Bypass cut spool	370	Spring
205	Spool cover	311	Swing priority spool	371	Spring
261	O-ring	313	Bypass cut spool	602	Port relief valve
262	O-ring	320	Spring	603	Port relief valve
264	O-ring	329	Spring	612	Plug
273	Socket screw	331	Seat		

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) All hydraulic components are manufactured to a high precision working. Then, before disassembling and assembling them, it is essential to select an especially clean place.

(2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(3) When a control valve is to be removed from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working, spread a paper or rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully when carrying or transferring and so on of the control valve. Do not support the lever exposed spool, end cover section or so on without fail.

(5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Besides, always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) TOOLS

Before disassembling the control valve, prepare the following tools beforehand.

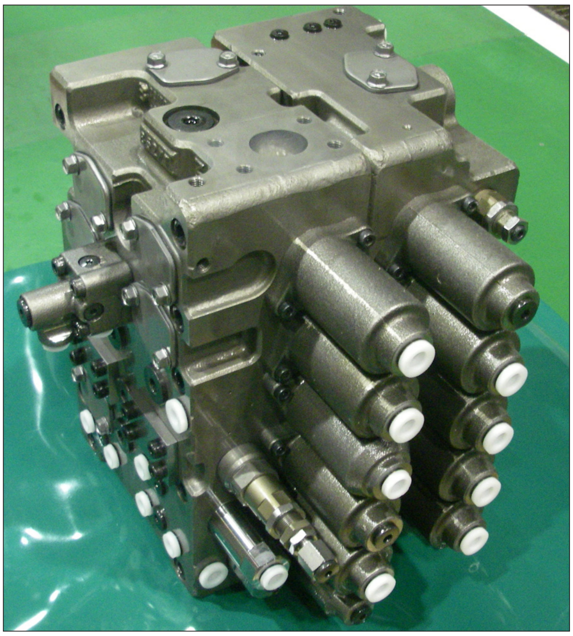
Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Box wrench	Each 1 piece	24, 32, 36
Hexagon key wrench	Each 1 piece	4, 5, 6, 8, 10 and 12
Loctite #262	1 piece	-
Spanner	Each 1 piece	32 (main relief valve, 601) 36 (port relief valve, 603)

3) DISASSEMBLY

The figure in ( ) shown after the part name in the explanation sentence shows its number in the structure figures (8-34~37).

(1) Place control valve on working bench.

※ Disassemble it in clean place and pay attention not to damage flange faces and plate faces.



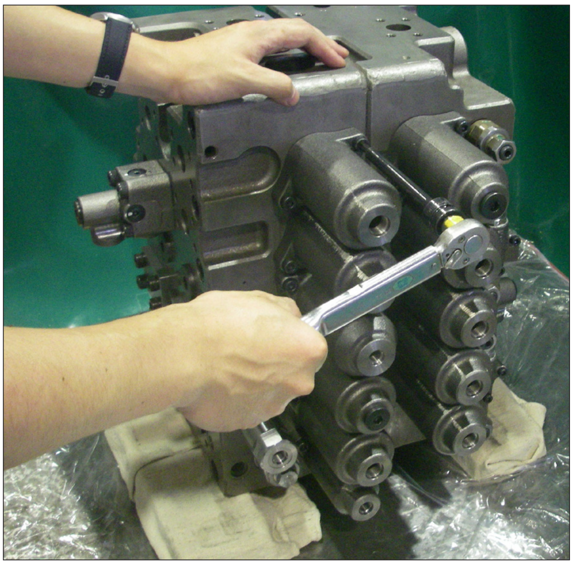
21098MC37

(2) Disassembling of main spools

· Travel (301), bucket (304), swing (305), option (309), arm 2 (306), boom 2 (307), swing priority (311).

① Loosen the hexagon the socket head screw (273) and remove the spring cover (201, 202) and the O-ring (261).

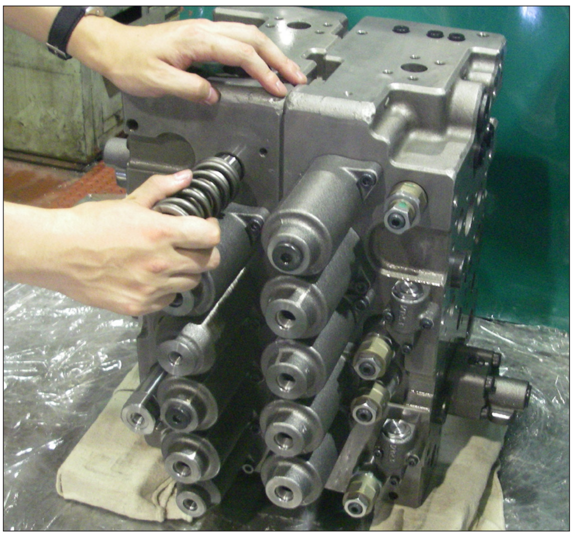
· Hexagon key wrench : 6 mm



21098MC38

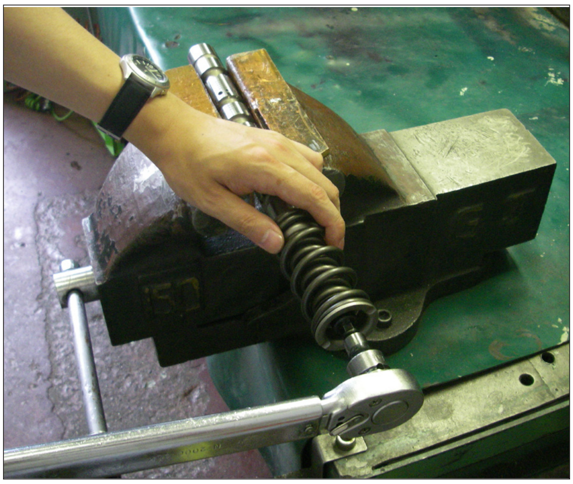
② Pull out the spool, spring, spring seats (331 or 332), stopper (335 or 339) and spacer bolt (336) in the spool assembly condition from the casing.

※ When pulling out the spool assembly from casing, pay attention not to damage the casing.



21078MC11

③ Hold the spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336) and disassemble the stopper (335 or 339) and spring seats (332).
  · Hexagon key wrench : 10 mm



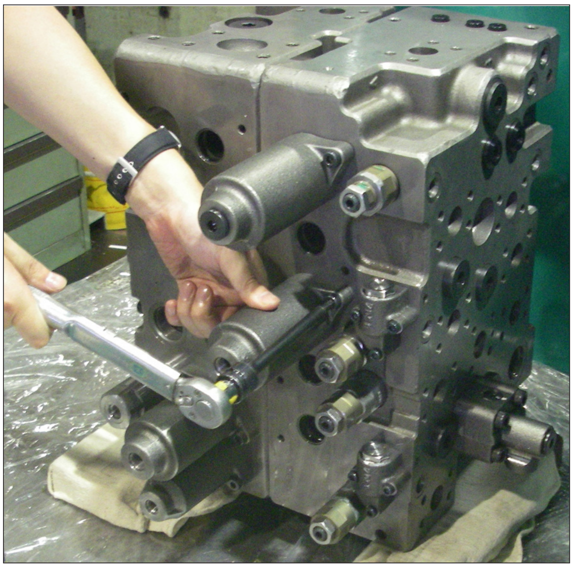
21098MC40

(3) Disassembling of boom 1 spool (303):

① Loosen the hexagon socket head screw (273), and remove the spring cover (201) and the O-ring (261).
  · Hexagon key wrench : 6 mm

② Pull out the boom 1 spool (303), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the casing A (101).

※ When pulling out the spool assembly from casing A (101), pay attention not to damage casing.

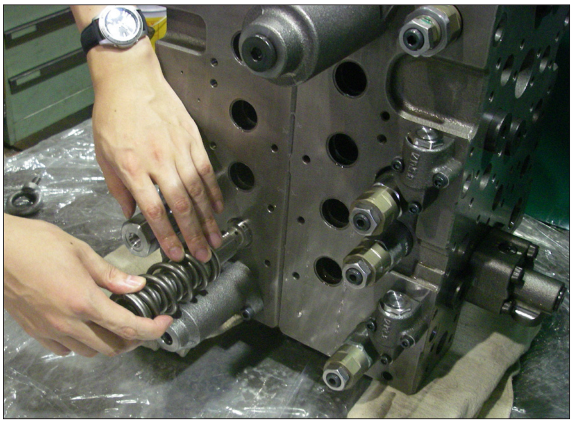


21098MC41

③ Hold the boom1 spool (303) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).
  · Hexagon key wrench : 10 mm

④ Do not consecutively disassemble the boom1 spool (303) above ③.

(4) Disassembling of arm 1 spool (302):



21098MC42

① Loosen the hexagon socket head screw (273), and remove the spring cover (201) and the O-ring (261).
  · Hexagon key wrench : 6 ㎜

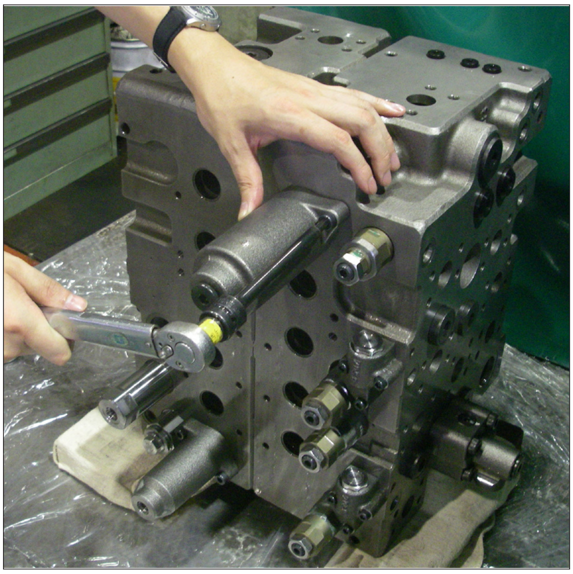
② Pull out the arm 1 spool (302), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the casing B (102).

※ When pulling out the spool assembly from casing B (102), pay attention not to damage casing.

③ Hold the arm 1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).
  · Hexagon key wrench : 10 ㎜

④ Do not consecutively disassemble the arm 1 spool (302) above ③.

(5) Disassembling of travel straight spool (308):



21098MC43

① Loosen the hexagon socket head screw (273), and remove the spring cover (201) and the O-ring (261).
  · Hexagon key wrench : 6 ㎜

② Pull out the travel straight spool (308), spring (322, 323), spring seat (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the casing A (101).

※ When pulling out the spool assembly from casing A (101), pay attention not to damage casing.

③ Hold the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (336) and disassemble the spring (322, 323), spring seats(332) and stopper (335).
· Hexagon key wrench : 10 mm

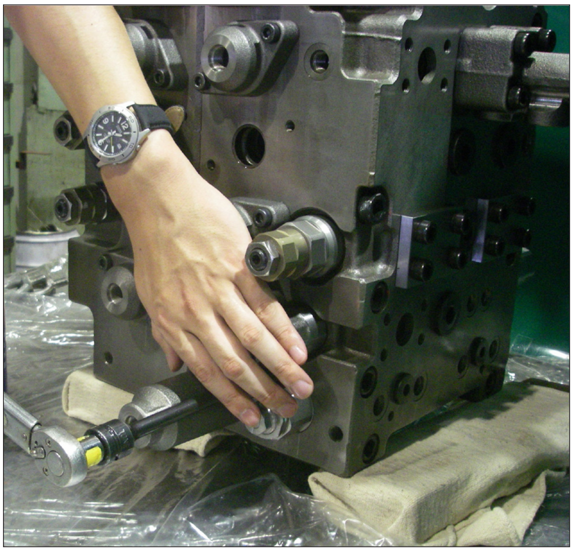
④ Do not consecutively disassemble the travel straight spool (308) above ③.

(6) Disassembling of bypass cut spool (310, 313):

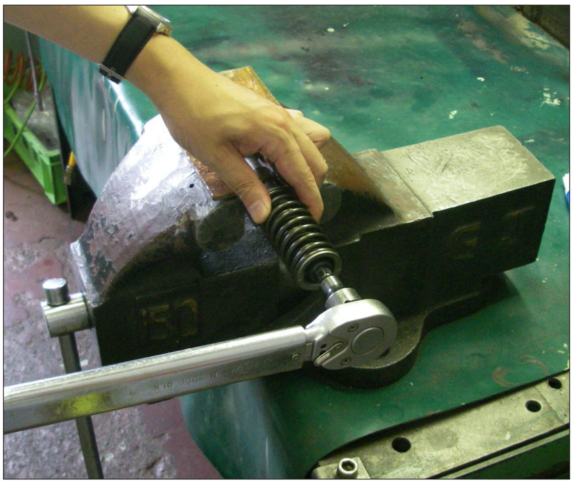
① Loosen the hexagon socket head screw (273), and remove the spring cover (203) and the O-ring (262).
· Hexagon key wrench : 6 mm

② Pull out the bypass cut spool (310, 313), spring (370, 371), spring seats (331), stopper (337) and spacer bolt (333) in the spool assembly condition from the casing B (102).

※ When pulling out the spool assembly from casing B (102), pay attention not to damage casing.


21098MC44

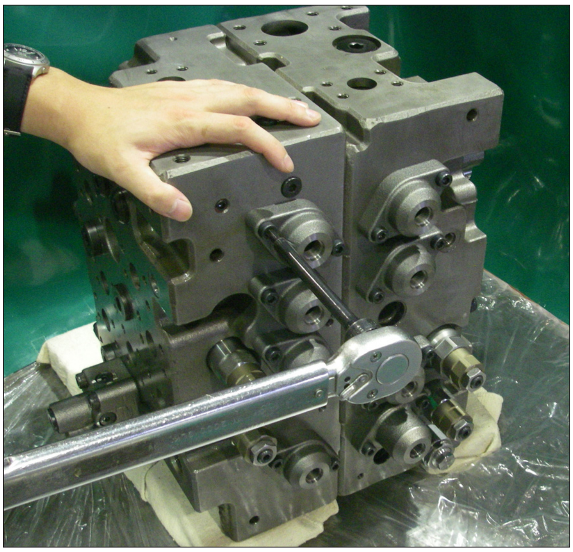
③ Hold the bypass cut spool (310, 313) in the mouthpiece-attached vise applying a protection plate (aluminum plate and the like) in between. Remove the spacer bolt (333) and disassemble the spring (370, 371), spring seats (331) and stopper (337).
· Hexagon key wrench : 10 mm


21098MC45

(7) Disassembling of spool covers (204, 205, 206):

① Remove the hexagon socket head screw (273), and remove the spool cover (204, 205, 206) and the O-ring (264).
· Hexagon key wrench : 6 mm

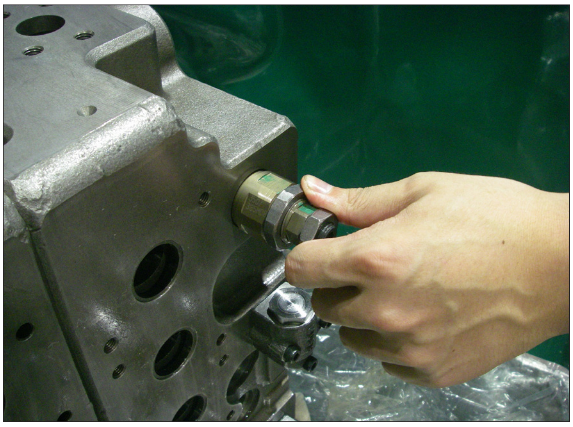
② In removing the bucket spool cover (206), at first loosen the plug (258) before it is removed from the casing B (102). After removing the bucket spring cover (206) remove the plug (551), and take out the piston (211).
· Box wrench : 32 mm



21098MC46

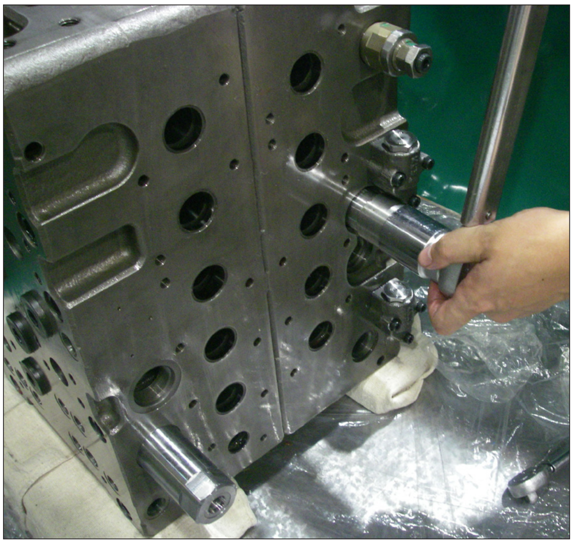
(8) Removal of main relief valve (601) and port relief valves (602, 603) :

① Remove the main relief valve (601) and the port relief valves (602, 603) from the casing.
Main relief valve (601) : spanner 32 mm
Port relief valve (602) : spanner or box wrench 32 mm
Port relief valve (603) : spanner 36 mm

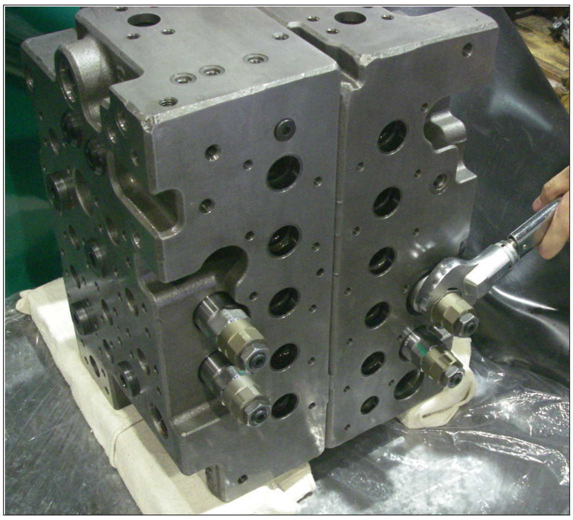


21098MC47

② Do not consecutively disassemble the relief valves after the above ①.



21098MC48



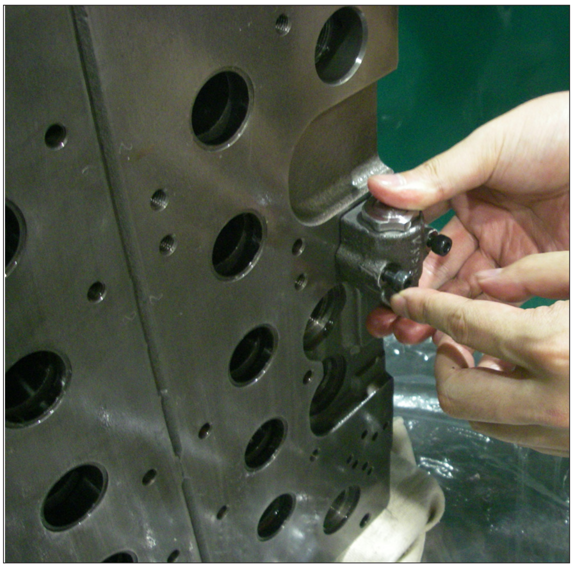
21098MC49

(9) Removal of lock valve selector (252):

① Loosen the hexagon socket head screw (252-171) and remove the lock valve selector (252) and the O-rings (252-161).

· Hexagon key wrench : 5 mm

② Do not consecutively disassemble the lock valve selector (252) after the above ①.

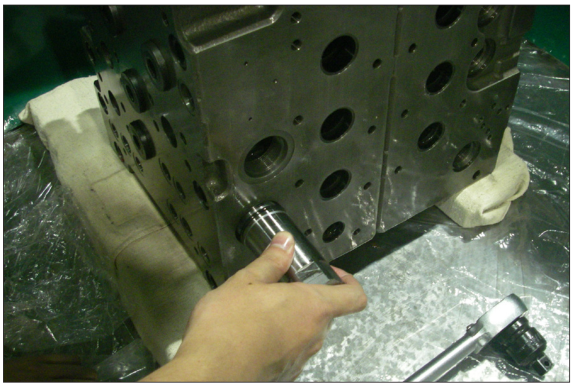


21098MC50

(10) Removal of arm regeneration cut valve (257):

Remove the plug (257-253), spring (257-231), spool (257-211), and sleeve (257-212) from the casing B (102).

· Box wrench : 36 mm

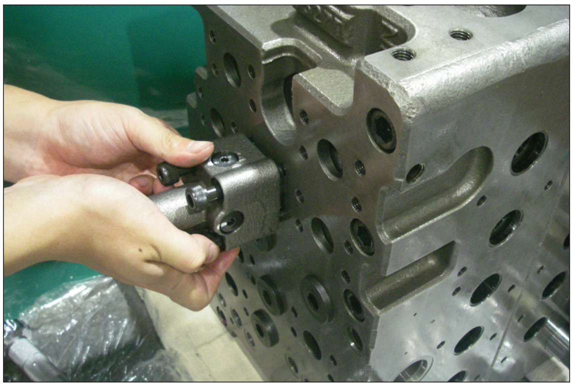


21098MC52

(11) Disassembly of logic control valve (250, 251) and logic poppet (254, 256):

① Loosen the hexagon socket head screw (250-120, 251-120) and remove the logic control valve (250, 251) and the O-rings (250-112 and 113, 251-112 and 113).

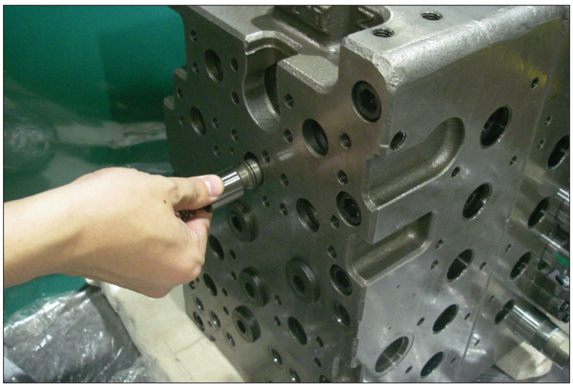
· Hexagon key wrench : 8 mm



21098MC53

② Pull out the logic poppet (254, 256), spring (254-106, 256-106) and spring seat (254-103, 256-103) from the casing.

③ Do not consecutively disassemble the logic control valve and the logic poppet above ②.



21098MC54

(12) Disassembly of check valve :

① CP1, C2, CCb, LCb, LCo, LCk, LCa, LCAT2

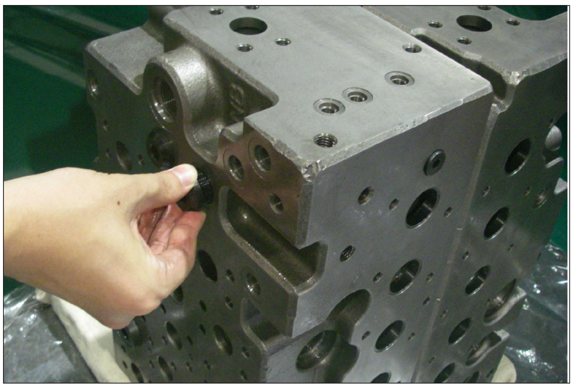
Remove the plug (551) and take out the poppet (511) and the spring (521).

· Hexagon key wrench : 12 mm

② CMR1, CMR2

Remove the plug (553) and take out the poppet (512) and the spring (522).

· Hexagon key wrench : 10 mm

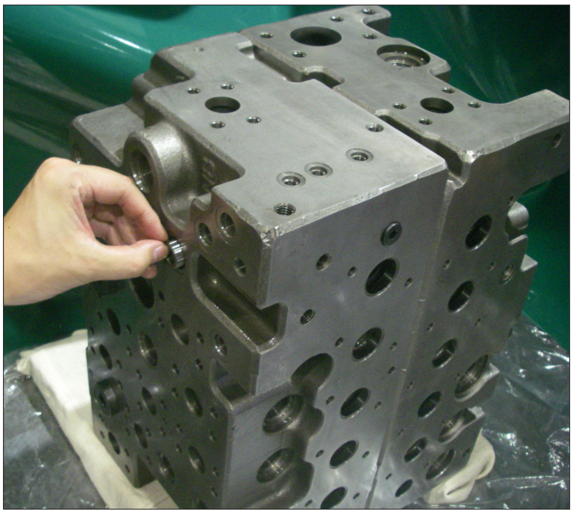


21098MC55

③ CRa, CRb

Remove the plug (552) and take out the poppet (513) and the spring (523).

· Hexagon key wrench : 12 mm



21098MC56

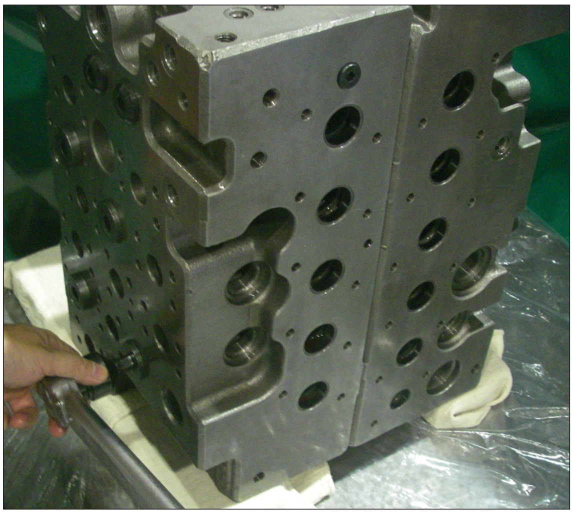
④ CCk, CCo

Remove the plug (551) and take out poppet (514) and the spring (521).

· Hexagon key wrench : 12 mm

⑤ Remove the plug (550) and take out the ball (541), spring (543) and spring seat (542).

· Hexagon key wrench : 6 mm



21098MC57

(13) Disassembly of flanges (209) :

Loosen the hexagon socket head screw (971) and remove the flange (209) and the O-ring (165).

· Hexagon key wrench : 8 mm

(14) Disassembly of plate (210) :

Loosen the hexagon socket head screw (274) and remove the plate (210) and the O-rings (165).

· Hexagon key wrench : 10 mm

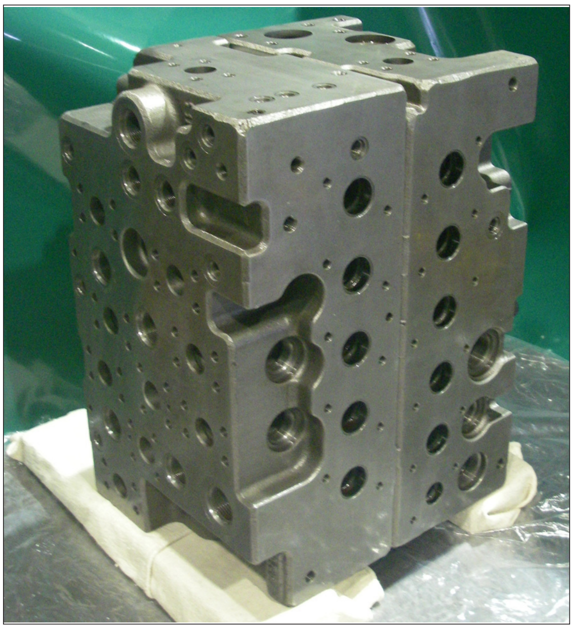
(15) Disassembly of orifices for signal line :

Do not disassemble the plug (151) and orifice (156), except for particular case.

(16) Disassembly of casing :

① Except for particular case, do not disassemble the tie screw of the casing B (102).

② Regarding the plugs not described in above disassembling procedures, the blind plugs for sacrifice holes and for the casing sanitation, do not disassemble them as far as not required specially.



21098MC58

(17) Inspection after disassembling

Clean all the disassembled parts with clean mineral oil fully, and dry them with compressed air. Then, place them on clean papers or cloths for inspection.

① Control valve

a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.
b. Confirm that the seal groove faces of the housing and the covers are smooth and free of dust, dent, rust etc.
c. Correct dents and damages on check seat faces of casing, if any, by lapping.
※ Pay attention not to leave lapping agent in the casing.
d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from foreign matter.
e. If any spring is broken or deformed, replace it with new one.
f. When a relief valve does not function properly, repair it, following its inspection procedures.
g. Replace all the O-rings with new ones.

② Relief valve

a. Confirm that all seat faces at ends of all poppets and seats are free of defects and are uniform contact faces.
b. Confirm manually that main poppet and seat can slide lightly and smoothly.
c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.
d. Confirm that orifices of the main poppet and seat section are not clogged with foreign matter.
e. Replace all O-rings with new ones.
f. When any light damage is found in above inspections, correct it by lapping.
g. When any abnormal part is found, replace it with a relief valve assembly.

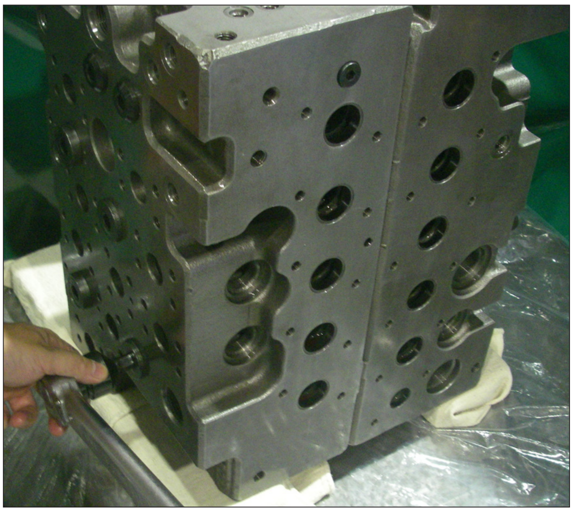
4) ASSEMBLY

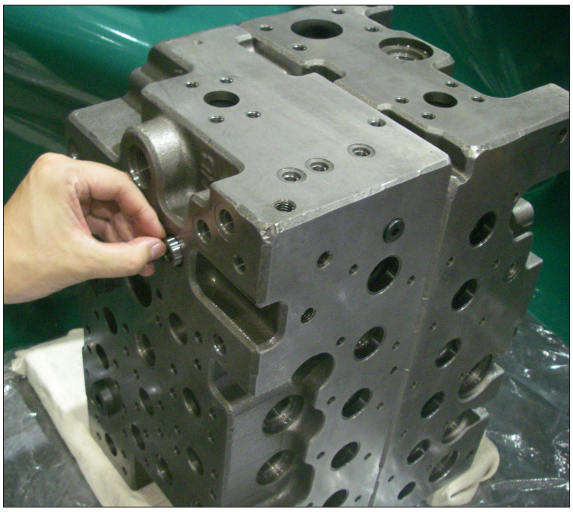
① In this assembling section, explanation only is shown. Refer to figures and photographs shown in disassembling section.
② Figure in ( ) shown after part name in explanation sentence shows number in structure figure.
③ Cautions in assembling O-rings
  a. Pay attention to keep O-rings free from defects in its forming and damages in its handling.
  b. Apply grease, hydraulic oil or so on to O-rings and seal-fitting sections for full lubrication.
  c. Do not stretch O-rings so much to deform them permanently.
  d. In fitting O-ring, pay attention not to roll it into its position. In addition, twisted O-ring cannot remove its twisting naturally with ease after being fitted, and causes oil leakage.
  e. Tighten fixing the bolts for all sections with a torque wrench to their respective tightening torque.

(1) Assembly of check valve :
① Assemble the poppets (511, 512, 513, 514) and the springs (521, 522, 523) : Put the O-rings (561) onto the plugs (551, 552). Put the O-rings (562) onto the plugs (553). Tighten the plugs (551, 552, 553) with their specified torques.
※ Use the poppets, springs and plugs in following groups.

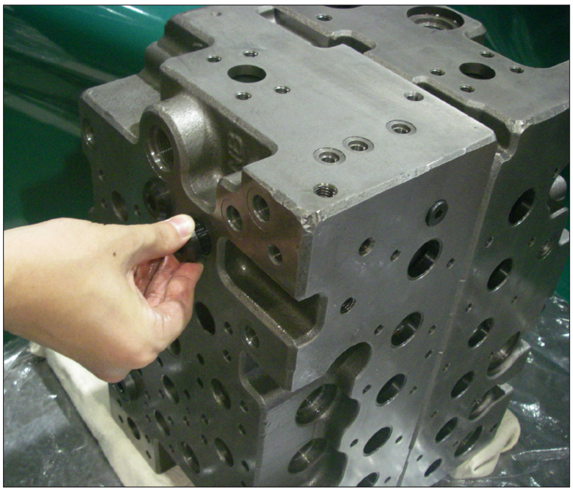
Poppet	Spring	Plug	Remember that
511	521	551	511 in 8 positions
512	522	553	512 in 2 positions
513	523	552	513 in 2 positions
514	521	551	514 in 2 positions

Plug No.	Hexagon key wrench (mm)	Tightening torque (kgf·m)
551	12	23.5 ~ 26.5
552	12	23.5 ~ 26.5
553	10	13.3 ~ 15.3


21098MC57


21098MC56

② Assemble of ball (541), spring seat (542) and spring (543) : Put the O-ring (166) onto the plug (550), and tighten the plug (550) with specified torque.
- Hexagon key wrench : 6 mm
- Tightening torque : 2.55 ~ 2.96 kgf·m (18.4~21.4 lbf·ft)



21098MC55

(2) Assembly of plate (210) :

Fit the O-rings (165) to the casing B (102), and tighten the hexagon socket head screw (274) with specified torque.
- Hexagon key wrench : 10 mm
- Tightening torque : 10.0 ~ 12.2 kgf·m (72.3~88.2 lbf·ft)

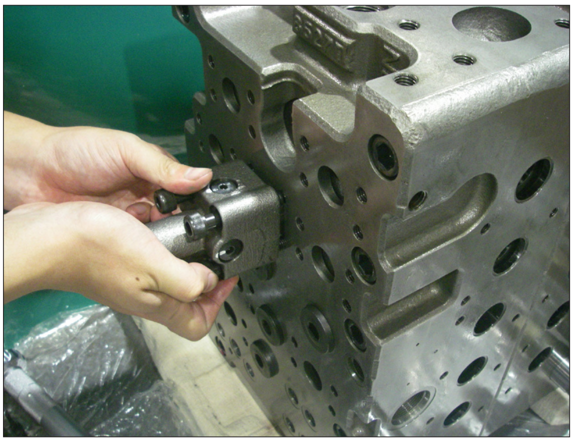
If this plate face looks downward, turn the control valve.

(3) Assembly of flange (209) :

Fit the O-rings (165) to the flange (209), and tighten the hexagon socket head screw (971) with specified torque.
- Hexagon key wrench : 8 mm
- Tightening torque : 5.0 ~ 6.6 kgf·m (36.2~47.7 lbf·ft)

(4) Assemble of logic control valve :

① Put the O-ring (250-115, 251-115) onto the plug (250-111, 251-111).

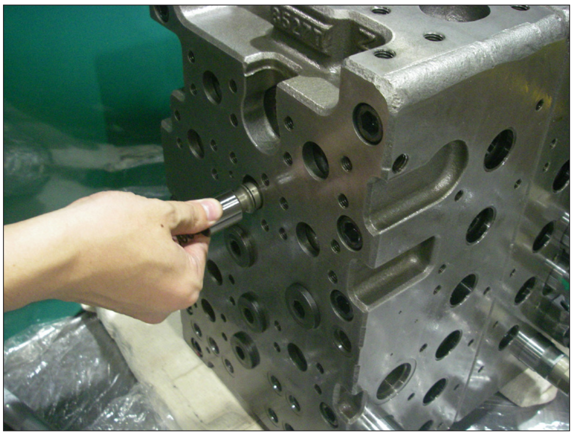


21098MC53

② Assemble the spool (250-102, 251-102), spring seat (250-104, 251-104) and spring (251-105, 251-105) into the casing (250-101, 251-101) of the logic control valve, and tighten the plug (250-111, 251-111) with specified torque.

· Hexagon key wrench : 8 mm

· Tightening torque : 7.0 ~ 8.1 kgf·m
(50.6~58.6 lbf·ft)



21098MC54

③ Assemble the logic poppet (254; poppet, spring, spring seat) into the casing of the control valve.

④ Fit the O-rings (250-112 and 113, 251-112 and 113) to the casing (250-101, 251-101) of the logic control valve, and tighten the hexagon socket head screw (250-120, 251-120) with specified torque.

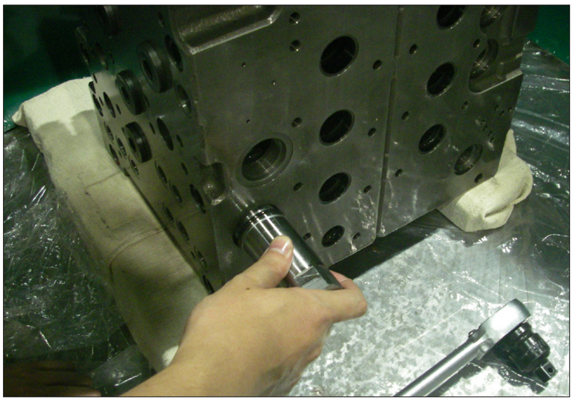
· Hexagon key wrench : 8 mm

· Tightening torque : 5.0 ~ 6.6 kgf·m
(36.2~47.7 lbf·ft)

(5) Assembly of arm regeneration cut valve (257) :

Assemble the sleeve (257-212), spool (257-211), and spring (257-231) into the casing B (102). Put the O-ring (265) onto the plug (257-253), and tighten with specified torque.

· Box wrench : 36 mm
· Tightening torque : 7.0 ~ 8.0 kgf·m (50.6~57.9 lbf·ft)

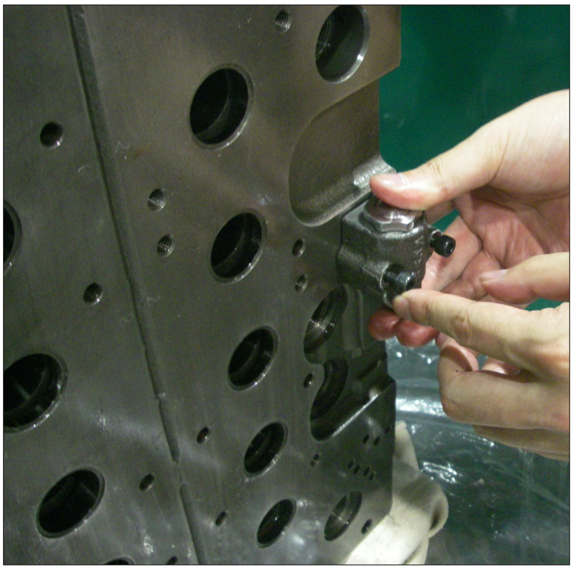


21098MC52

(6) Assembling of lock valve selector (252) :

Fit the O-rings (252-161) to the lock valve selector (252) and tighten the hexagon socket head screw (252-171) with specified torque.

· Hexagon key wrench : 5 mm
· Tightening torque : 1.0 ~ 1.4 kgf·m (7.2~10.1 lbf·ft)

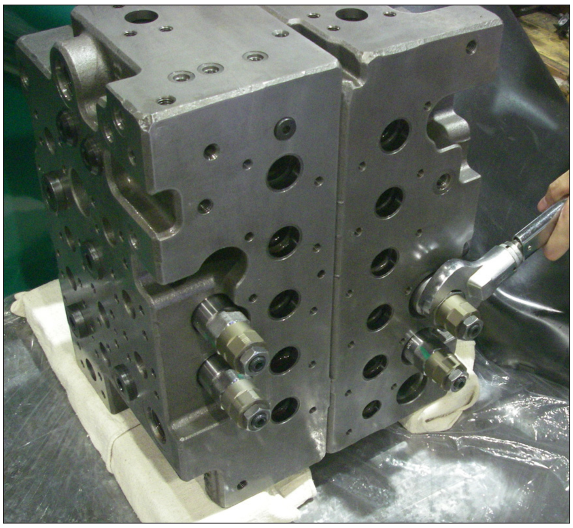


21098MC50

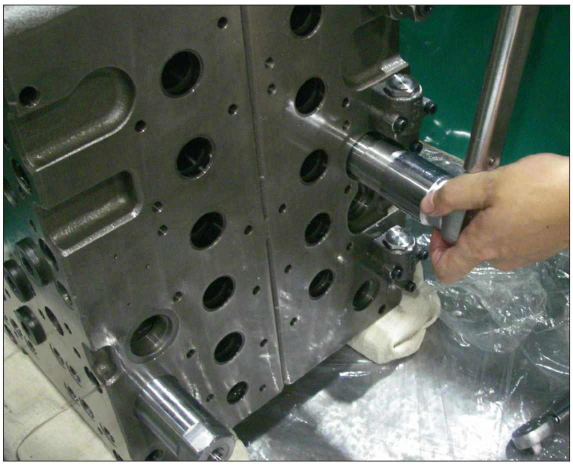
(7) Assembling of main relief valve (601) and port relief valve (602, 603) :

Assemble the main relief valve (601) and the port relief valves (602, 603) to the casing, and tighten them with specified torque.

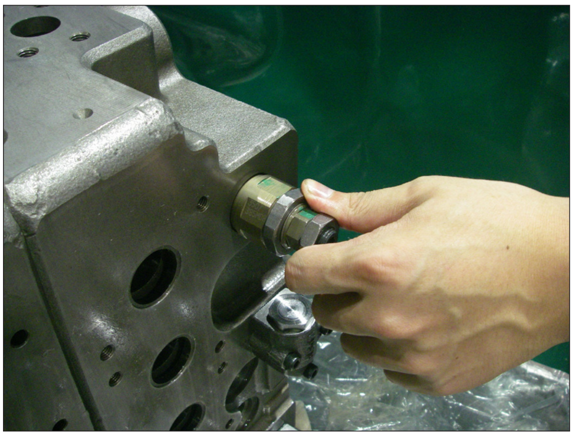
Item	Tool	Tightening torque (kgf·m)
Main relief valve (601)	Spanner 32	7.0 ~ 8.1
Port relief valve (602)	Spanner 32 or box wrench 32	7.0 ~ 8.1
Port relief valve (603)	Spanner 36	12.2 ~14.3



21098MC49



21098MC48



21098MC47

(8) Assemble of travel straight spool (308) :

① Hold the middle of the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate and so on) in between. Attach the spring seats (332), springs (322, 323) and stopper (335), and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

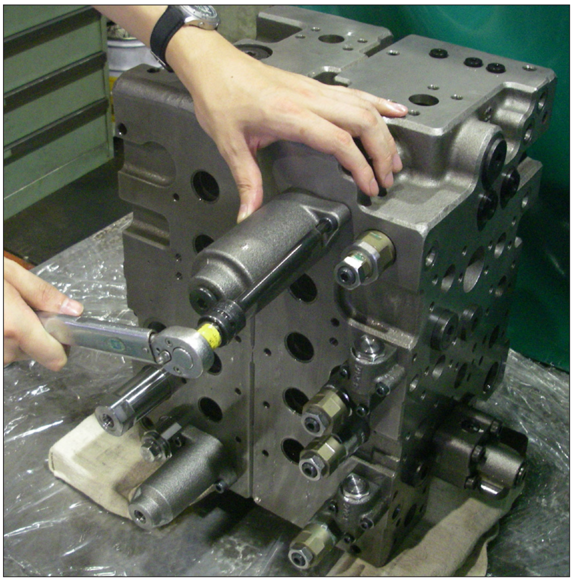
· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Pay attention not to fasten the vise excessively to the shape of the travel straight spool (308) is deformed.

② Insert the spool assemblies of ① items above into the casing A (101).

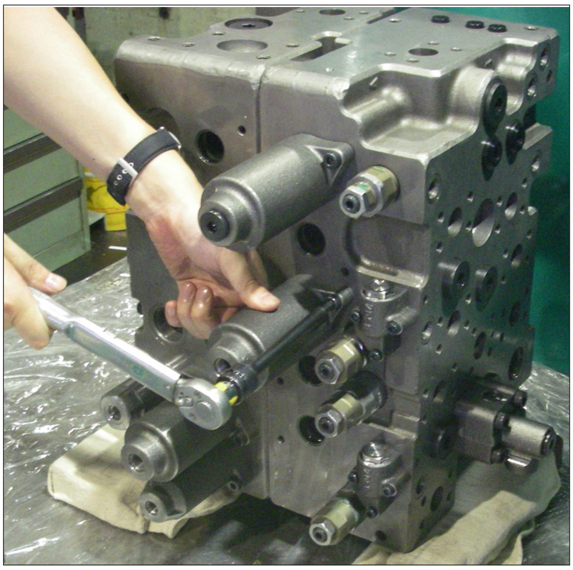
※ Fit spool assemblies into casing A (101) carefully and slowly.

※ Do not push them forcibly without fail.



21098MC43

(9) Assembling of boom 1 spool (303) :



21098MC41

① Hold the middle of the boom1 spool (303) in the mouthpiece-attached vise applying a protection plate (aluminum plate and so on) in between. Attach the spring seats (332), springs (320, 321) and stopper (335), and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

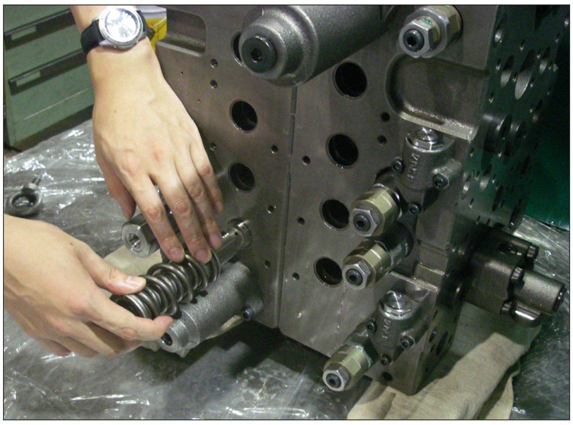
※ Pay attention not to fasten the vise excessively to the shape of the boom 1 spool (303) is deformed.

② Insert the spool assemblies of items ① above into the casing A (101).

※ Fit spool assemblies into the casing A (101) carefully and slowly.

※ Do not push them forcibly without fail.

(10) Assembling of arm 1 spool (302) :



21098MC42

① Hold the middle of the arm1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate and so on) in between. Attach the spring seats (332), springs (320, 321) and stopper (335) and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Pay attention not to fasten the vise excessively to the shape of the arm 1 spool (302) is deformed.

② Insert the spool assemblies of items ① above into the casing B (102).

※ Fit spool assemblies into the casing B (102) carefully and slowly.

※ Do not push them forcibly without fail.

(11) Assembling of main spool (travel (301), bucket (304), swing (305), option (309), arm 2 (306), boom 2 (307), swing priority (311)):

① Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and so on) in between. Attach the spring seats (332), springs and stopper (335 or 339) and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

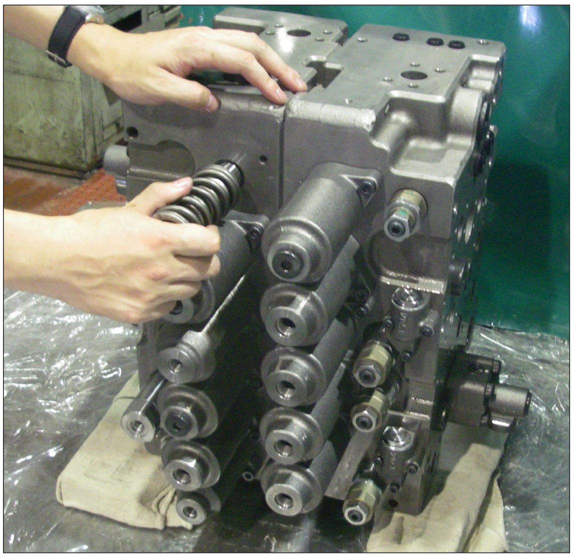
· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Pay attention not to fasten the vise excessively to the shape of the spool is deformed.

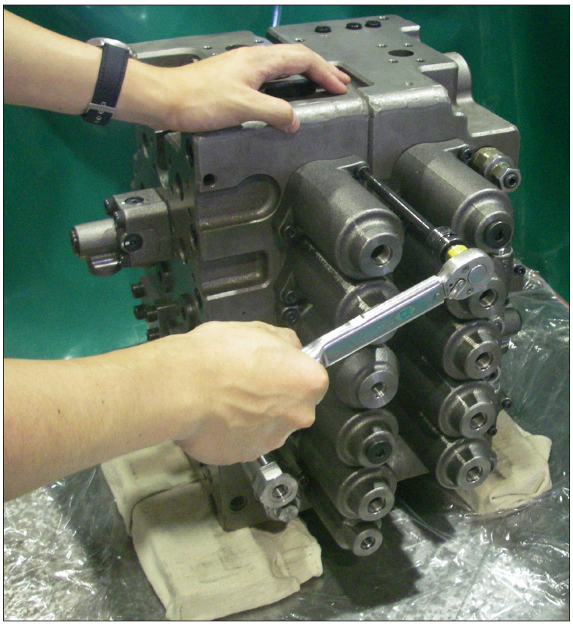
② Insert the spool assemblies of items ① above into the casing A (101) and casing B (102).

※ Fit spool assemblies into casing A (101) and casing B (102) carefully and slowly.

※ Do not push them forcibly without fail.



21098MC39



21098MC38

(12) Assembling of bypass cut spool (310, 313) :

① Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate and so on) in between. Attach the spring seats (331), springs (370, 371) and stopper (337) and tighten the spacer bolt (333) with specified torque.

※ Before tightening the spacer bolt (333), apply loctite #262 to it.

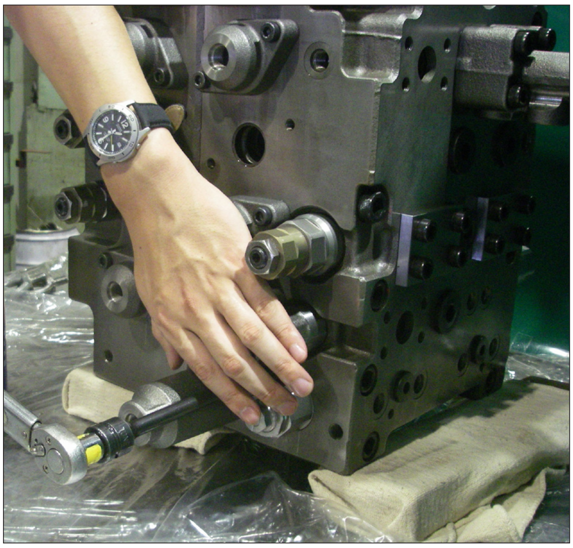
· Hexagon key wrench : 10 mm
· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Pay attention not to fasten the vise excessively to the shape of the bypass cut spool (310, 313) is deformed.

② Insert the spool assemblies of Items ① above into the casing B (102).

※ Fit spool assemblies into the casing B (102) carefully and slowly.

※ Do not push them forcibly without fail.



21098MC44

(13) Assembling of covers :

① Fit the O-rings (264) to the spool covers (204, 205, 206) to sides reverse to the spring sides of spools, and tighten the hexagon socket head screw (273) with specified torque.

※ Confirm that O-rings (264) have been fitted to the spool covers (204, 205, 206).

· Hexagon key wrench : 6 mm
· Tightening torque : 2.5 ~ 3.5 kgf·m (18.1~25.3 lbf·ft)

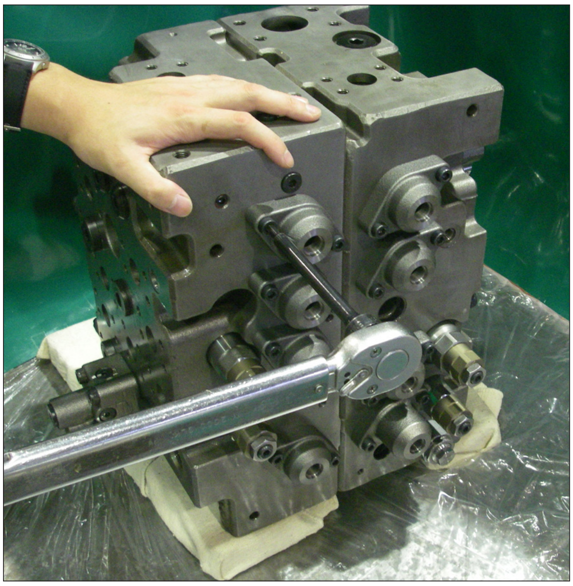
② Bucket spool cover (206) : Assemble piston (355) into bucket spool cover (206). Put O-ring (561) onto plug (258) and tighten it with specified torque.

· Box wrench : 32 mm
· Tightening torque : 15.3 ~ 18.4 kgf·m (111~133 lbf·ft)

③ Fit the O-rings (261, 262) to spring covers (201, 202, 203) to the spring sides of spools, and tighten the hexagon socket head screw (273) with specified torque.

※ Confirm that O-rings (261,262) have been fitted to spring covers (204, 205, 206).

· Hexagon key wrench : 6 mm
· Tightening torque : 2.5 ~ 3.5 kgf·m (18.1~25.3 lbf·ft)



21098MC46

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

13031GE18

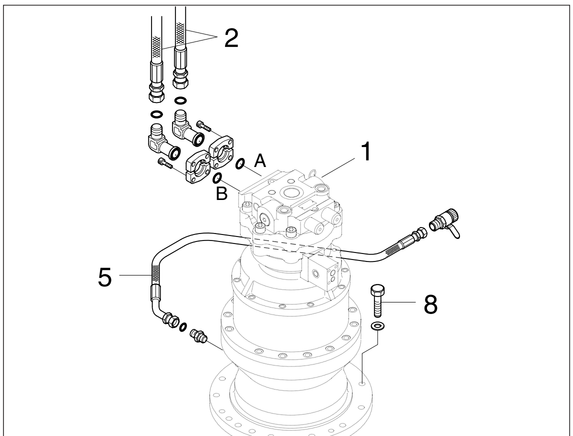
(4) Disconnect hose assembly (2).

(5) Disconnect pilot line hoses (3, 4, 5, 6, 7).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (8).

· Motor device weight : 61 kg (135 lb)

· Tightening torque : 57.9 ± 5.8 kgf·m (419 ± 42 lbf·ft)



260A8SM01

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.

2) INSTALL

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

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

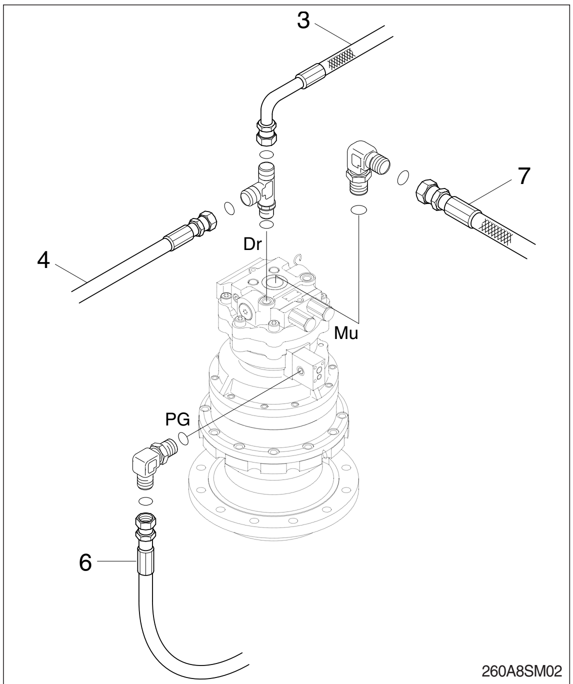
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

④ Start the engine, run at low idling and check oil come out from plug.

⑤ Tighten plug fully.

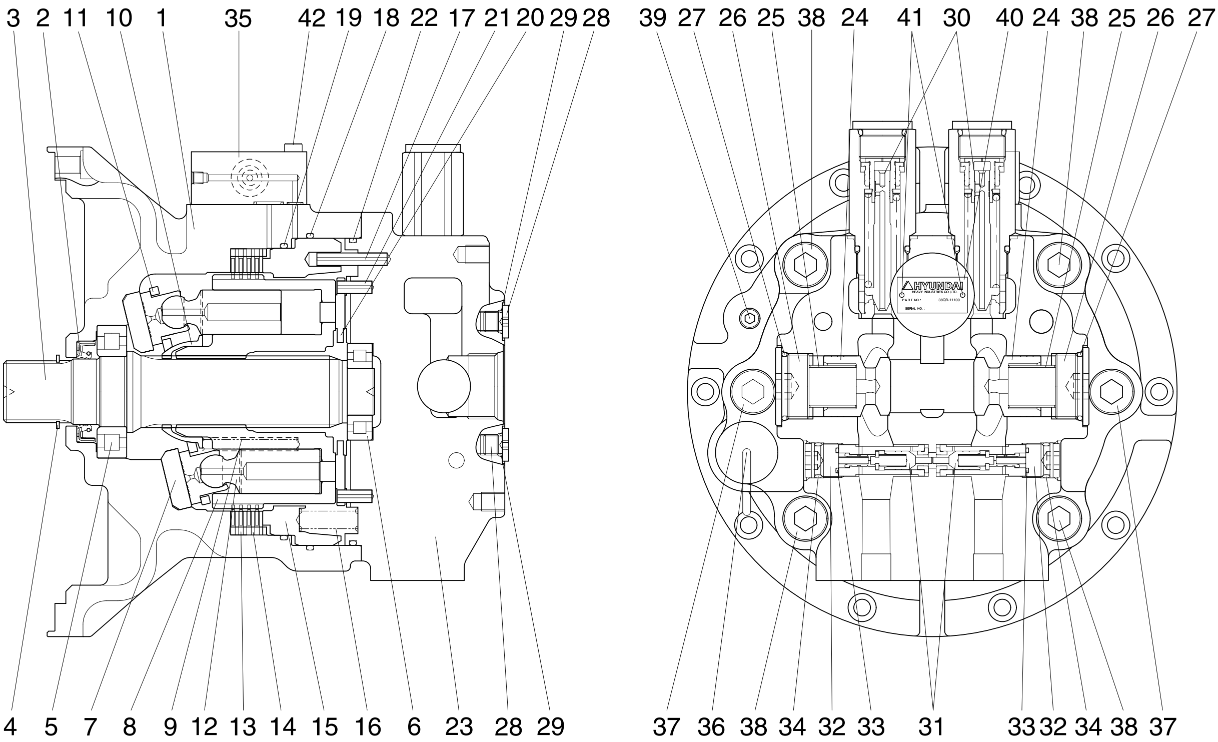
(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



260A8SM02

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



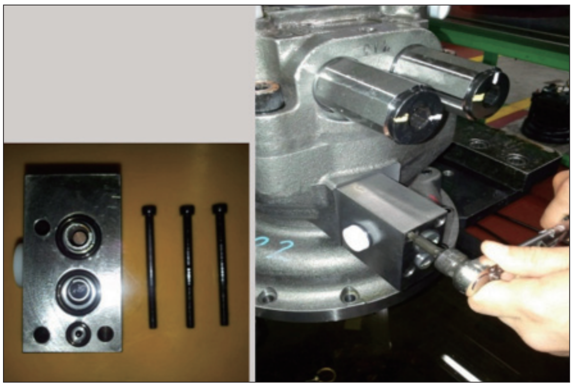
260A2SM02

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

2) DISASSEMBLY

(1) Disassemble drive shaft

① Unloosing socket bolt (port block assy, 42) and disassemble port block assy (35) from casing (1).



2209A8SM51

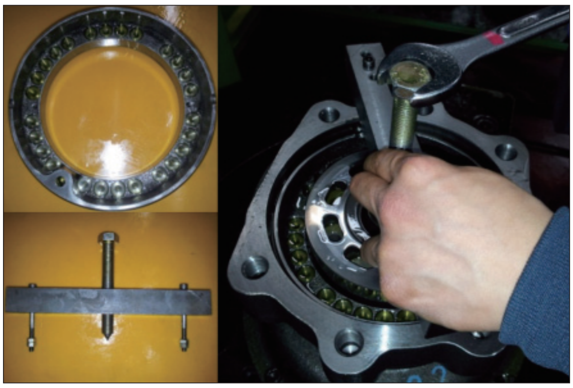
② Disassemble level gauge assy (36) from casing (1).

2209A8SM52

③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).

2209A8SM53

④ Disassemble brake spring (16) and using a jig, disassemble parking piston (15) from casing (1).



2209A8SM54

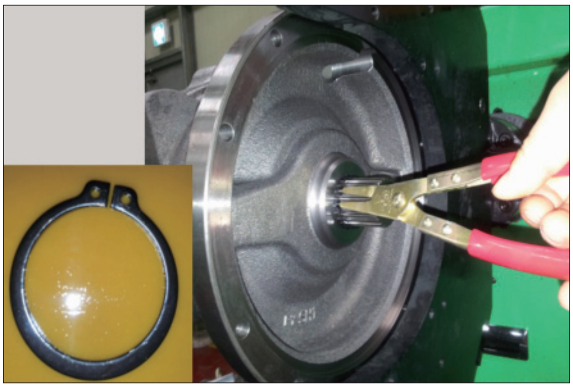
⑤ Disassemble respectively cylinder block sub (8), friction plate (13), separate plate (14) from casing (1).

2209A8SM55

⑥ Disassemble swash plate (7) from casing (1).

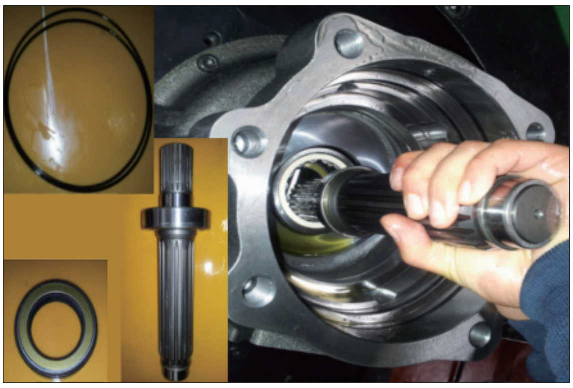
2209A8SM56

⑦ Using a plier jig, disassemble snap ring (4) from casing (1).



2209A8SM57

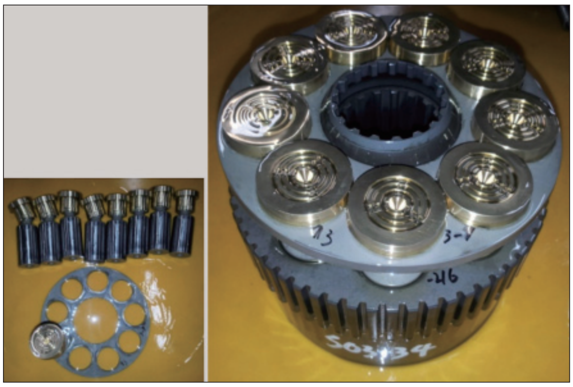
⑧ Disassemble shaft assy (3), oil seal (2) and O-ring (18, 22) from casing (1).



2209A8SM58

(2) Disassemble cylinder block sub

① Disassemble piston assy (12) from cylinder block (8).



2209A8SM59

② Disassemble ball guide (10) and spring (cylinder block, 9) from cylinder block (8).

· Ball guide × 1EA
· Spring × 9EA

2209A8SM60

(3) Disassemble valve casing sub

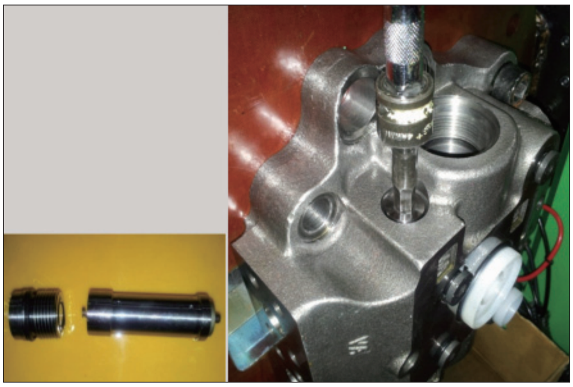
① Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).

2209A8SM61

② Using a torque wrench, disassemble relief valve assy (30) from valve casing (23).

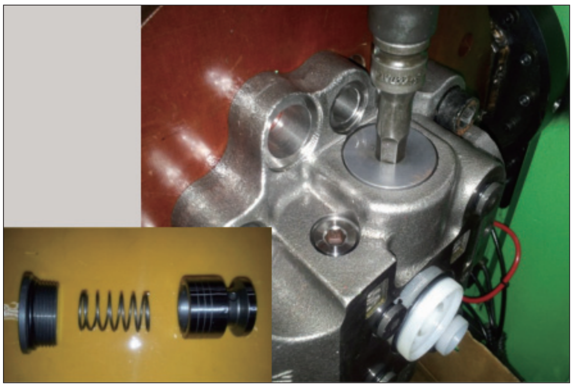
2209A8SM62

③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and reactionless valve assy (31).



2209A8SM63

④ Using a torque wrench, disassemble check valve (24) from valve casing (23).



2209A8SM64

⑤ Disassemble plug (28), O-ring (29) from valve casing (23).

2209A8SM65

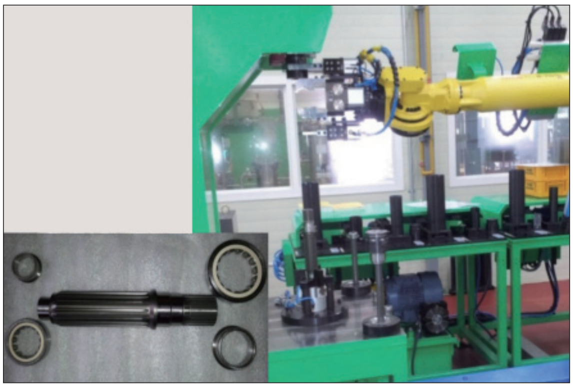
3) ASSEMBLING

(1) Assemble shaft sub

① Put roller bearing (5) on preheater and provide heat to inner race.
(Temperature in conveyor : 120°C for 3~5 minutes)

2209A8SM66

② Using a robot machine, assemble and press preheated roller bearing (5) into shaft (3).

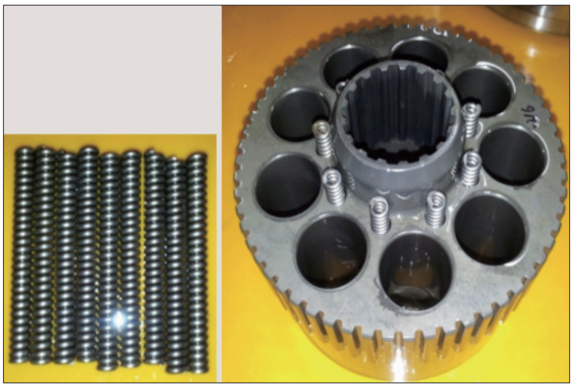


2209A8SM67

(2) Assemble cylinder block sub

① Assemble 9 springs (cylinder block, 9) into cylinder block (8).

- Spring×9EA



2209A8SM68

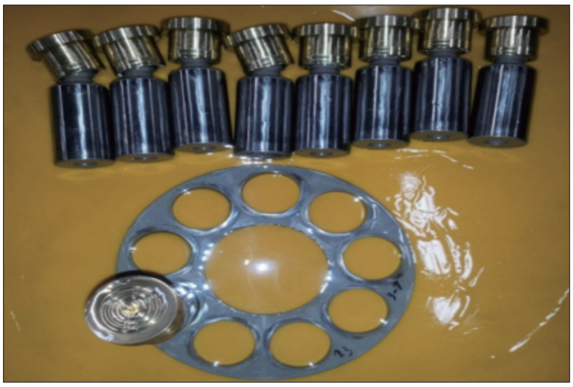
② Assemble ball guide (10) into cylinder block (8).

- Ball guide×1EA

2209A8SM69

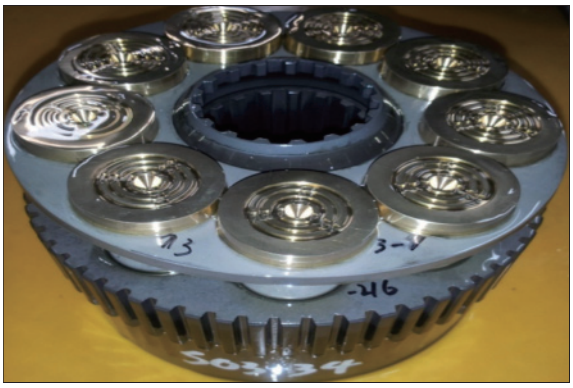
③ Assemble 9 piston assy (12) into retainer plate (11).

- 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.

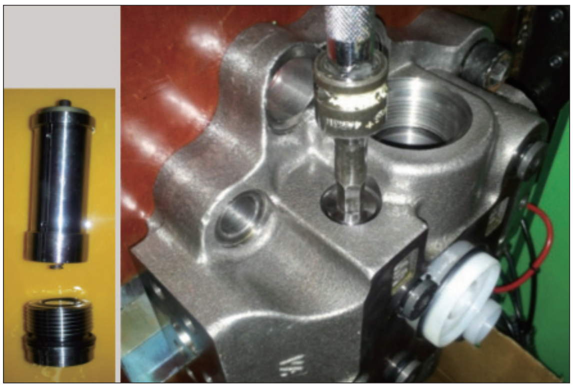
- Make up check valve × 2EA
- Spring × 2EA
- Plug × 2EA
- O-ring × 2EA

2209A8SM72

② **Assemble anti-rotation valve assy**

Assemble anti-rotation 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



2209A8SM73

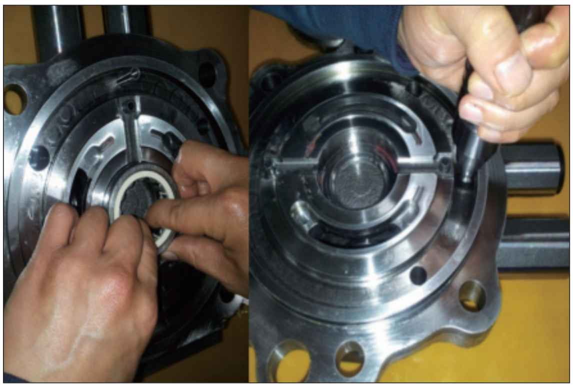
③ Using a torque wrench, assemble relief valve (30) 2 sets into valve casing (23).
· Relief valve (30) × 2EA


2209A8SM74

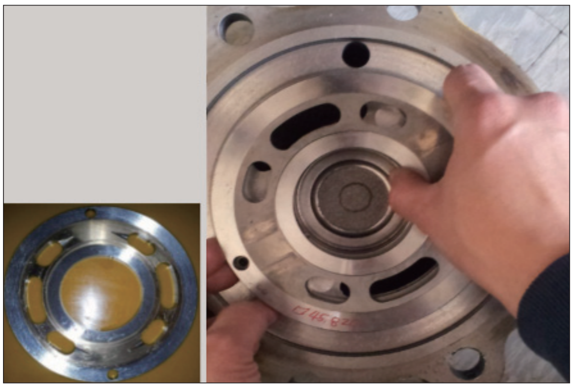
④ Assemble plug (28) and O-ring (27) into valve casing (23).
· Plug (28) × 3EA
· O-ring (27) × 3EA


2209A8SM75

⑤ Assemble roller bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).
· Roller bearing (6) × 1EA
· Spring pin (17, 21) × 1EA


2209A8SM76

⑥ Apply some grease valve plate (20) and assemble it into valve casing (23).

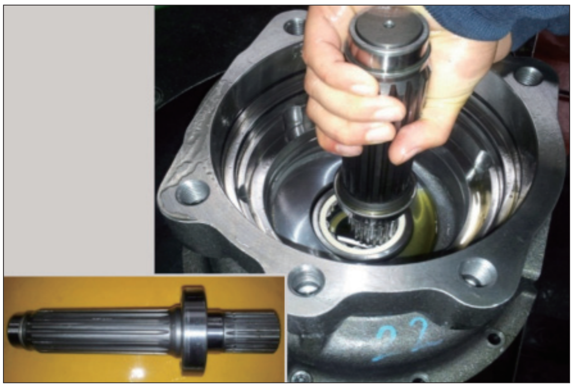

2209A8SM77

(4) Assemble drive shaft sub

① Using a jig, assemble oil sealing (2) into casing (1).

2209A8SM78

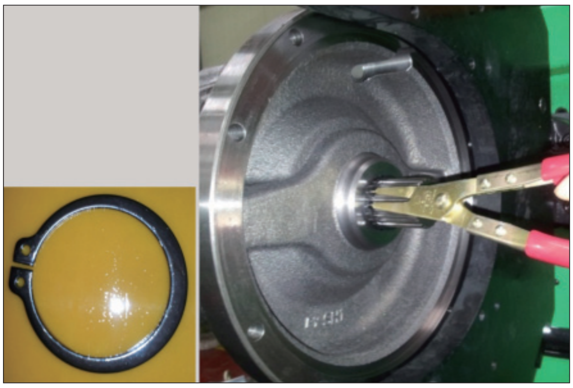
② Fit shaft sub (shaft+roller bearing) into casing (1).



2209A8SM79

③ Using a plier jig, assemble snap ring (4) to shaft (3).

· Snap ring×1EA



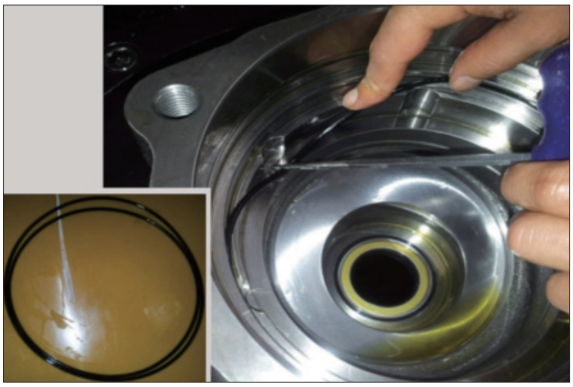
2209A8SM80

④ Apply some grease swash plate (7) and assemble it into casing (1).

· Swash plate×1EA

2209A8SM81

⑤ Insert O-ring (18, 19) into casing (1).
- O-ring (18) × 1EA
- O-ring (19) × 1EA



2209A8SM82

⑥ Assemble cylinder block (8) into casing (1).

2209A8SM83

⑦ Assemble separate plate (14) and friction plate (13) 4 sets into casing (1) and fit parking piston (15) into casing (1) by a jig or a press.
- Separate plate × 4EA
- Friction plate × 4EA
- Parking piston × 1EA

2209A8SM84

⑧ Assemble spring (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).

2209A8SM86

⑩ Assemble level gauge assy (36) and plug (39) into casing (1).

2209A8SM87

⑪ Assemble port block assy (35) into valve casing (23) with socket bolt (42).

- Port block assy × 1EA
- Socket bolt × 3EA

2209A8SM88

⑫ Air pressing test

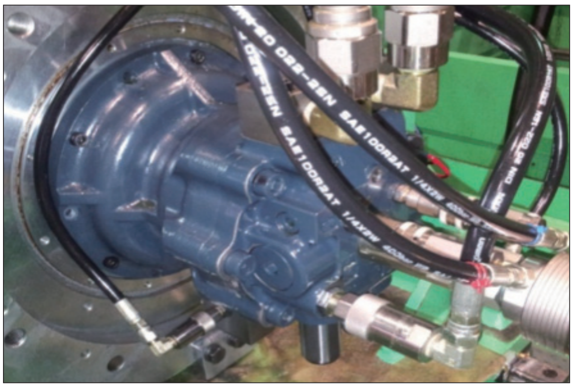
Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure : 2 kgf/cm^2).

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.

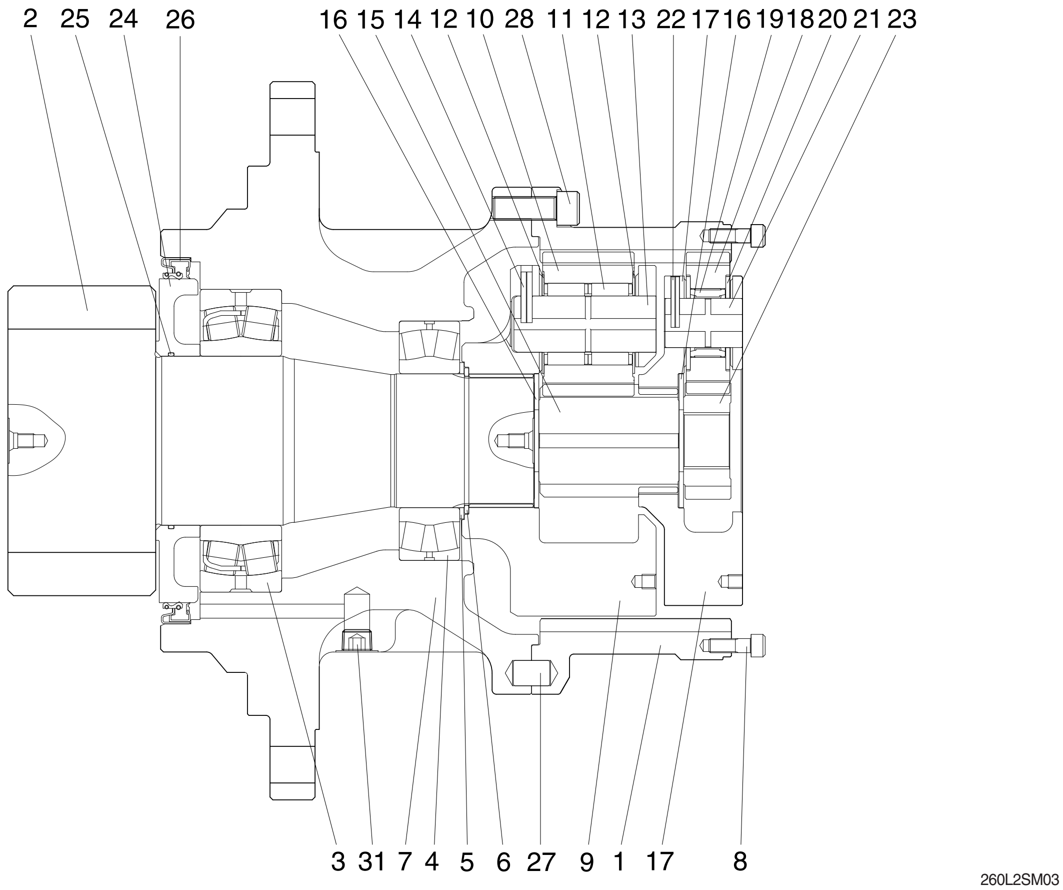

2209A8SM90

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

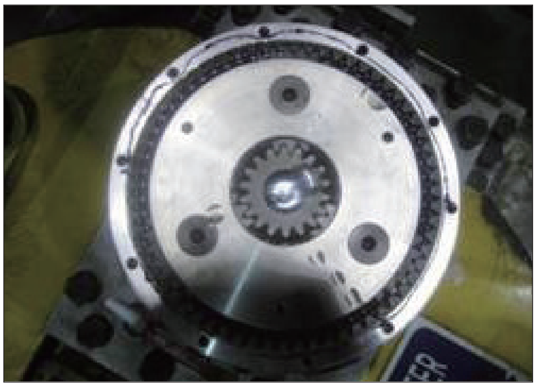


1	Ring gear	11	Needle bearing 2	21	Carrier pin 1
2	Drive shaft	12	Thrust washer 2	22	Spring pin 1
3	Roller bearing	13	Carrier pin 2	23	Sun gear 1
4	Roller bearing	14	Spring pin	24	Sleeve
5	Thrust plate	15	Sun gear 2	25	O-ring
6	Retainer ring	16	Thrust plate	26	Oil seal
7	Casing	17	Carrier 1	27	Parallel pin
8	Socket bolt	18	Planetary gear 1	28	Socket bolt
9	Carrier 2	19	Needle bearing 1	31	Socket plug
10	Planetary gear 2	20	Thrust washer 1		

2) DISASSEMBLY

(1) Preparation

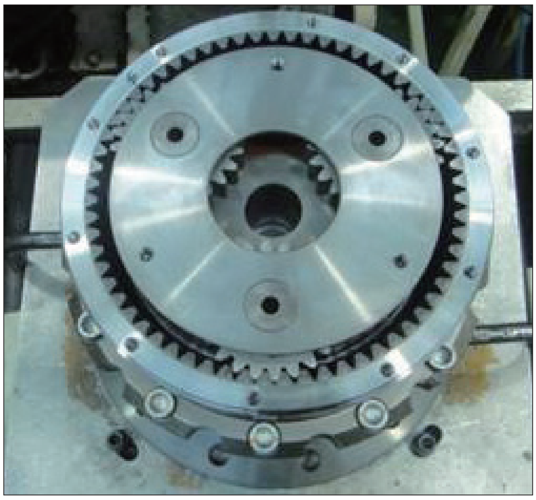
① The reduction gear removed from machine is usually covered with mud.
Wash out side of reduction gear and dry it.
② Setting reduction gear on work stand for disassembling.
③ Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.
⚠ Take great care not to pinch your hand between parts while disassembling not let fall parts on your foot while lifting them.



2209A8SM01

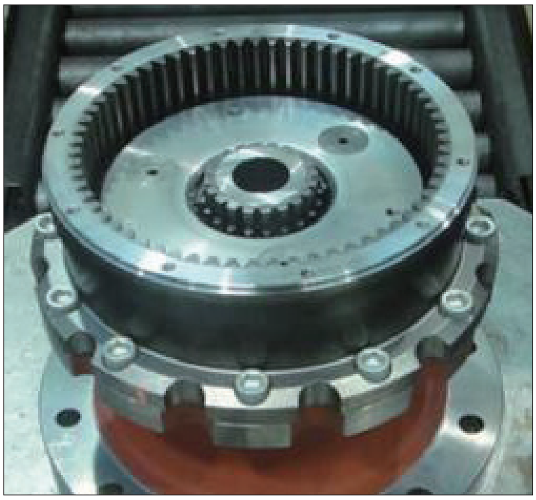
(2) Disassembly

① Remove every "Socket bolt (M10)" that secure swing motor and reduction gear.
② Removing carrier sub assy & sun gear
a. Removing No.1 sun gear from No.1 carrier sub assy.
※ Be sure maintaining it vertical with ground when disassembling No.1 sun gear.



2209A8SM02

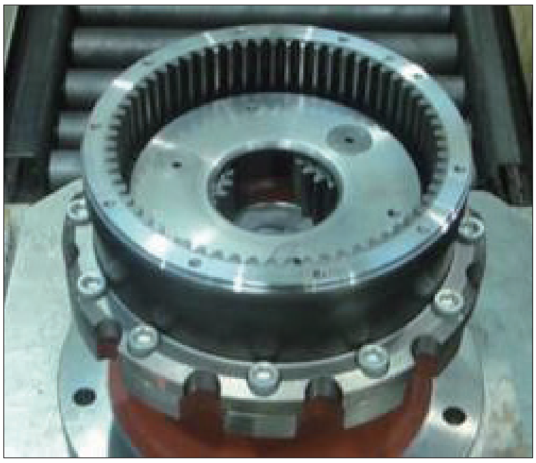
b. Removing No.1 carrier sub assy screwing I-bolt to tab hole (M10) in No.1 carrier.
Lifting it gradually maintaining it vertical with ground.
※ It's impossible to disassemble No.1 spring pin. If No.1 spring pin has problem, change whole No.1 carrier sub assy.



2209A8SM03

c. Removing No.2 sun gear from No.2 carrier sub assy.

※ Be sure maintaining it vertical with ground when disassembling No.2 sun gear.



2209A8SM04

d. Removing No.2 carrier sub assy screwing I-bolt to tab hole (M10) in No.2 carrier. Lifting it gradually maintaining it vertical with ground.

※ It's impossible to disassemble No.2 spring pin. If No.2 spring pin has problem, change whole No.2 carrier sub assy.

2209A8SM05

③ Removing ring gear

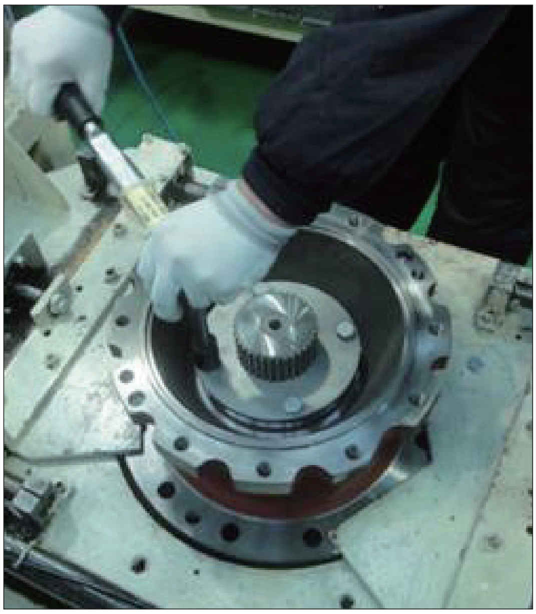
After unscrewing every socket bolt (M16), remove ring gear from casing.

※ Because of liquid gaskets between ring gear and casing, put sharp punch between ring gear and casing and tapping it to remove them.

2209A8SM06

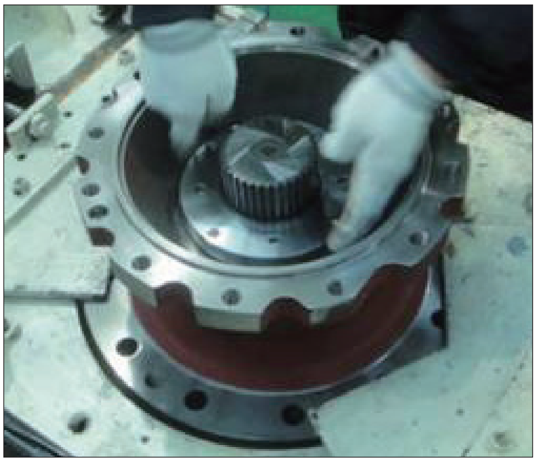
④ Removing drive shaft sub assy

a. Unscrew every hex head bolt (M12) to remove lock plate.



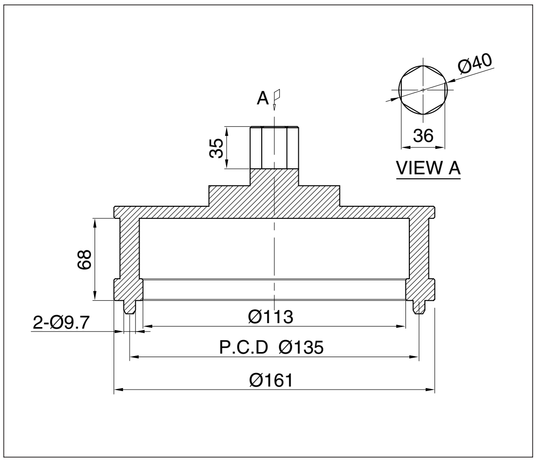
2209A8SM07

b. Rolling ring nut for removing them from drive shaft sub assy.



2209A8SM08

※ Use special tool to roll ring nut to counter clockwise.



220L8SM01

c. Remove drive shaft sub assy from casing.
※ Set a rack for flange of casing, and remove drive shaft sub assy from casing by using press.

2209A8SM09

d. Remove oil seal & taper bearing (small) from casing.
※ Do not re-use oil seal. It is impossible to dis-assemble drive shaft sub assy.

2209A8SM10

2209A8SM11

4. ASSEMBLY REDUCTION UNIT

1) GENERAL NOTES

(1) Clean every part by kerosene and dry them in a cool and dry place.

(2) Loctite on surface must be removed by solvent.

(3) Check every part for any abnormal.

(4) Each hexagon socket head bolt should be used with loctite #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 assembling.

Thrust washer

· Check the seizure, abnormal wear or uneven wear.
· Check the unallowable wear.

Gear

· Check the pitting or seizure on tooth surface.
· Check the cracks on the root of tooth.

Bearing

· Rotate it by hands to check such noise or uneven rotation.

2) ASSEMBLING NO.1 CARRIER SUB ASSY

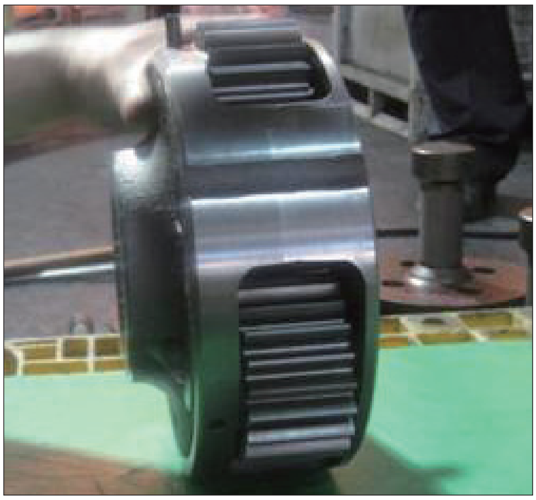
(1) Put thrust plate firmly in No.1 carrier.

(2) After assembling No.1 needle bearing to No.1 planetary gear, put a pair of No.1 thrust washer on both sides of bearing and install them to No.1 carrier.

2209A8SM12

2209A8SM13

(3) Make of spring pin hole No.1 pin and No.1 carrier of spring pin hole in line, press No.1 spring pin into the holes.
Make No.1 spring pin hole head for No.1 planetary gear.



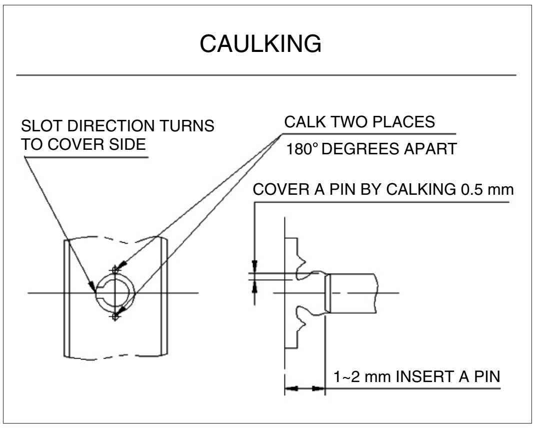
2209A8SM14

(4) Caulk carrier holes to make No.1 spring pin settle down stably.

2209A8SM15

※ Refer to "Caulking details"

Use paint marker for marking after caulking.



220SA8TM147

2) ASSEMBLING NO.2 CARRIER SUB ASSY

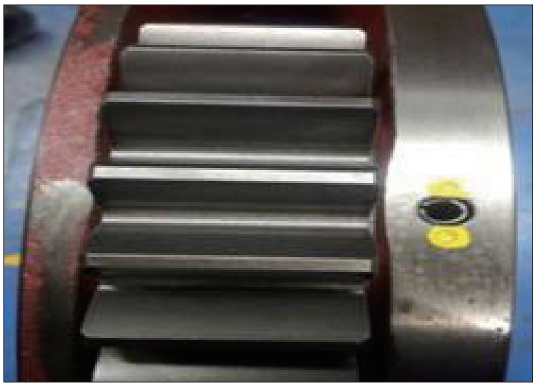
(1) Put thrust plate in firmly No.2 carrier.

2209A8SM17

(2) After assembling No.2 needle bearing to No.2 planetary gear, put 2 pieces of No.2 thrust washer on both sides of bearing and install them to No.2 carrier.

2209A8SM18

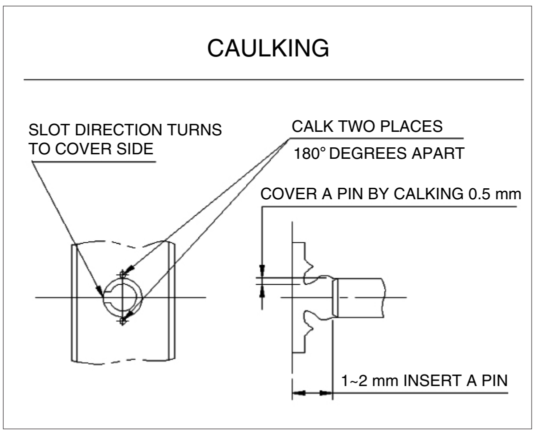
(3) Align No.2 spring pin hole and No.2 carrier spring pin hole, put No.2 spring pin into the holes.
Make No.2 spring pin cutting line face to No.2 planetary gear.



2209A8SM19

(4) Caulk carrier holes to make No.2 spring pin settle down stably.
※ Refer to “Caulking details”

Use paint marker for marking after caulking.



220SA8TM147

3) ASSEMBLING PINION GEAR SUB ASSY

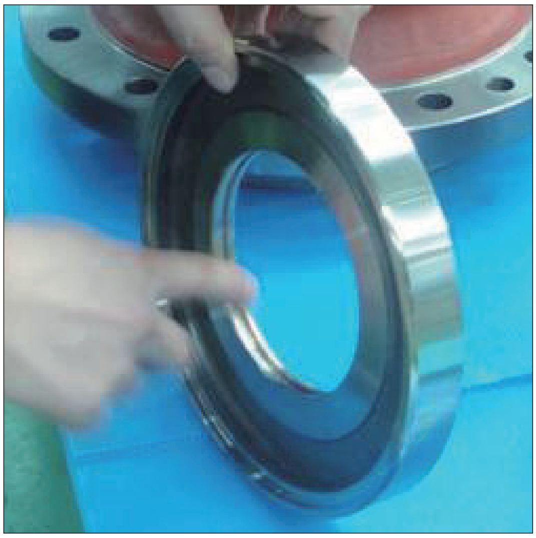
(1) Prepare drive shaft pinion gear vertical with ground.

2209A8SM21

(2) Fully apply grease (albania EP02) to O-ring groove of sleeve.

※ Be sure to maintain it vertical with ground when assembling it.

(3) Put O-ring into O-ring groove of sleeve.
Fully apply grease on O-ring.



2209A8SM22

(4) Assemble taper bearing and sleeve into drive shaft using press jig.
Use special jig for pressing. Leave no space between sleeve and taper bearing.

2209A8SM23

2209A8SM24

4) ASSEMBLING BEARING CUP & OIL SEAL (PRESSING)

(1) Put top, bottom bearing cup into casing. Use special jig for pressing. Pay attention to foreign materials while assembling bearing cup.

※ Flip over casing to assemble oil seal.

2209A8SM25

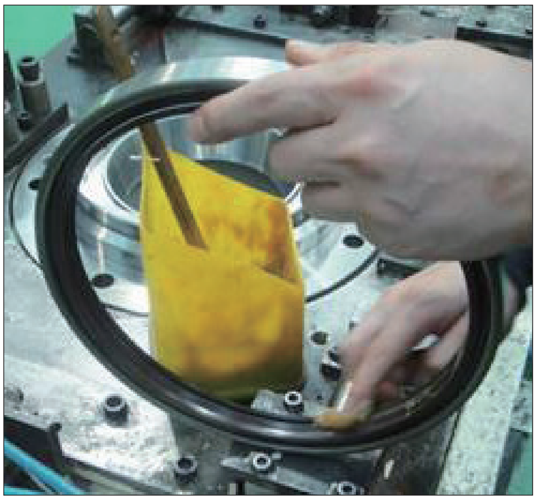
2209A8SM26

(2) Assemble oil seal to casing.
Use special jig for pressing. Pay attention to direction of dust seal and dent.


2209A8SM27

※WHILE ASSEMBLING OIL SEAL

1. Be sure to set dust seal to gear oil.
2. Before assembling, charge enough grease in oil seal.
3. Before assembling, apply enough grease inside and outside of oil seal.


2209A8SM28

5) ASSEMBLING SHAFT SUB ASSY & RING NUT

(1) After assembling casing & drive shaft sub assy, flip it over.


2209A8SM29

(2) Put drive shaft sub assy into casing.

※ Be sure to maintain it vertical with ground when assembling it.

2209A8SM30

(3) Put taper bearing into it.

Rotate bearing by hands for checking after assembly.

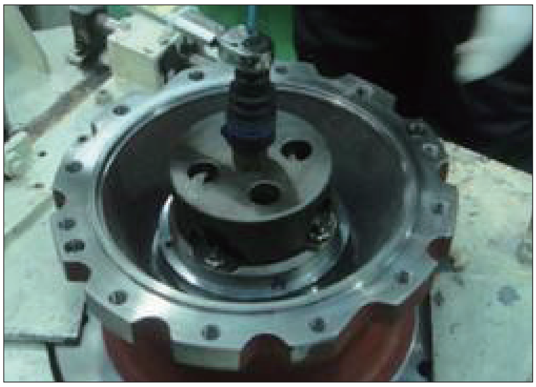
2209A8SM31

(4) Put ring nut into drive shaft sub assy by using special jig.

The tightening torque (M95) = 3.5±0.4 kgf·m (25.3±2.9 lbf·ft)

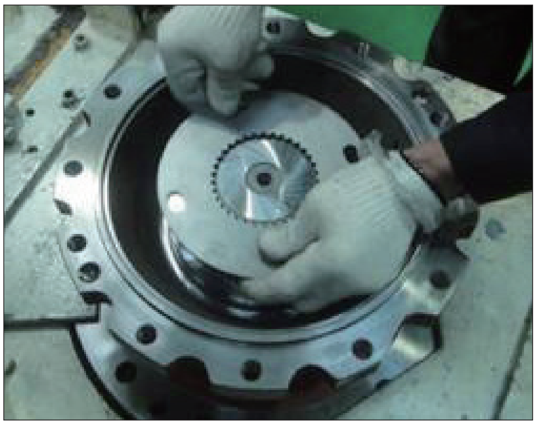
2209A8SM32

※ Apply enough loctite #242 before screwing bolts.

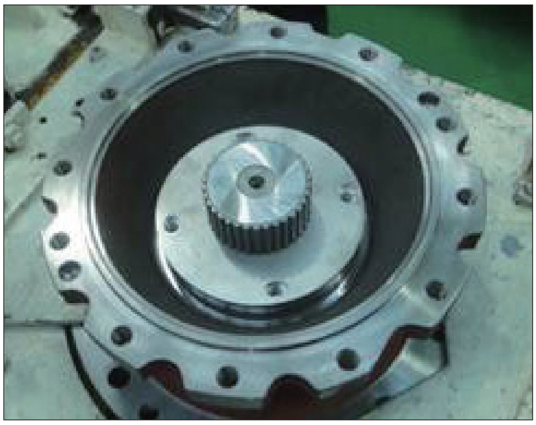


2209A8SM33

(5) Align bolt screw of ring nut with lock plate's hole.
In case of misalign between bolt screw ring nut and lock plate's hole, put lock plate as near as possible to hole of bolt screw of ring nut and make it in line by increasing tightening torque.



2209A8SM34



2209A8SM35

(6) Screw 4 bolts (M12×16) to connect ring nut and lock plate by using torque wrench.
Bolt (M12, 4EA) = 10.9T
The tightening torque = 8.8±0.9 kgf·m
(63.7±6.5 lbf·ft)

※ Apply enough loctite #242 before screwing bolts.

2209A8SM36

(7) Use paint marker for checking surplus parts after assembling.

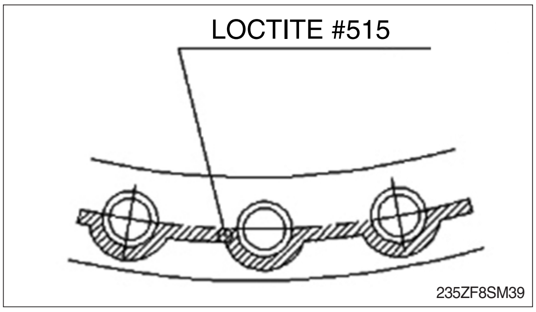
2209A8SM37

6) ASSEMBLING RING GEAR

(1) Apply loctite #515 bottom of casing sub assy contacting with ring gear without disconnection.

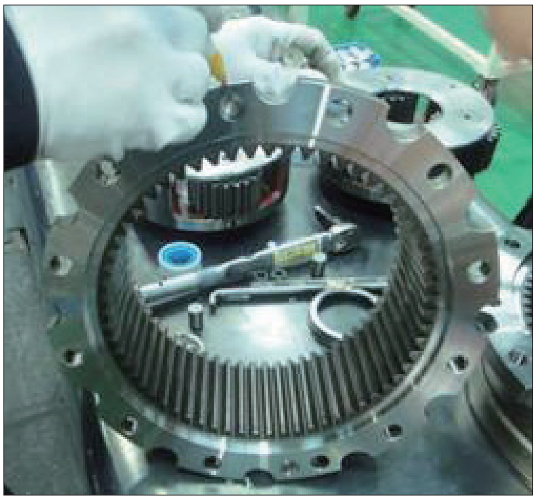
2209A8SM38

Refer to loctite detail.



235ZF8SM39

(2) Put parallel pin into hole of casing sub assy. Mark parallel pin position using paint marker.



2209A8SM40

(3) Align ring gear with parallel pin to put them into casing sub assy.

※ Be sure to maintain them vertical with ground while using press.

2209A8SM41

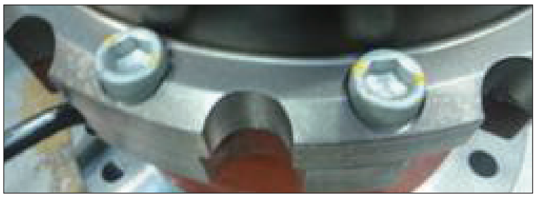
(4) Screw 12 bolts (M16×45) to connect casing sub assy and ring gear (01) by using torque wrench.
Bolt (M16, 12EA) = 12.9T
The tightening torque = 27±2.7 kgf·m
(195±19.5 lbf·ft)

※ Apply enough loctite #242 before screwing bolts.


2209A8SM42

(5) Use paint marker for checking surplus parts after assembling.


2209A8SM43


2209A8SM44

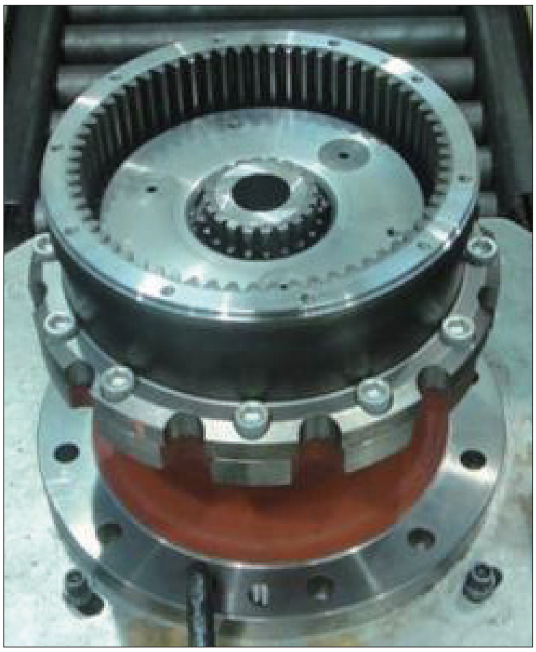
7) ASSEMBLING CARRIER SUB ASSY & SUN GEAR

(1) Put No.2 carrier sub assy along spline of drive shaft spline.

- Screw M10 I-bolt to No.2 carrier sub assy.
- Lifting up No.2 carrier sub assy and align planetary gear and tooth of ring gear by rotating planetary gear by hands.
- Rotate No.2 carrier sub assy by hands to fit No.2 carrier sub assy into drive shaft spline.

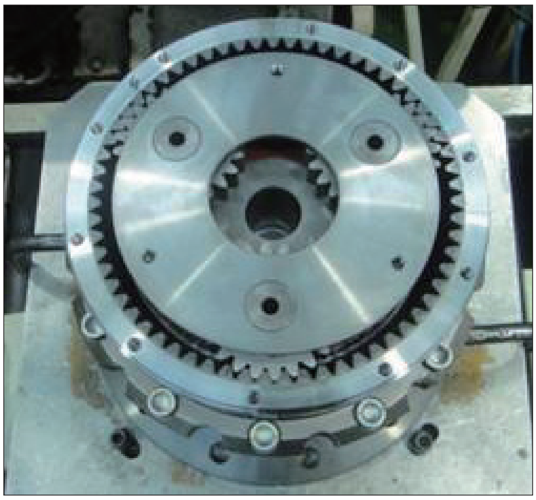
2209A8SM45

(2) Put No.2 sun gear into No.2 carrier sub assy.



2209A8SM46

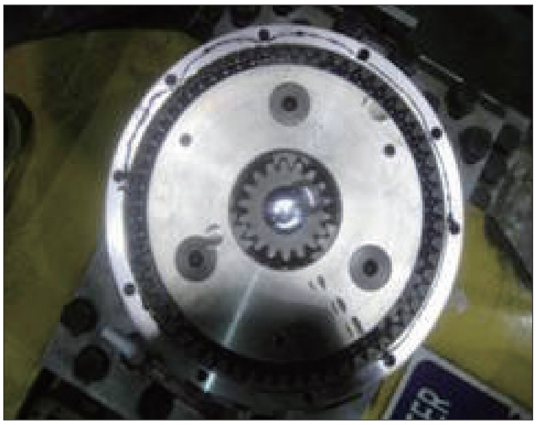
(3) Put No.1 carrier sub assy into No.2 sun gear along spline.
- Screw M10 I-bolt to No.1 carrier sub assy.
- Lifting up No.1 carrier sub assy and align planetary gear and tooth of ring gear by rotating planetary gear by hands.
- Rotate No.1 carrier sub assy by hands to fit No.1 carrier into No.2 sun gear spline.



2209A8SM47

(4) Put No.1 sun gear into No.1 carrier sub assy. Be sure to maintain it vertical with ground. And align with No.1 planetary gear spline.

(5) Rotate No.1 carrier sub assy by hands to check noise.



2209A8SM48

8) MEASURING CLEARANCE & ASSEMBLING NAME PLATE

(1) Check the clearance between ring gear and No.1 sun gear using a tool with dial gauge.

Check the clearance
Dial gauge = -0.3 ~ +2.95

2209A8SM49

GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

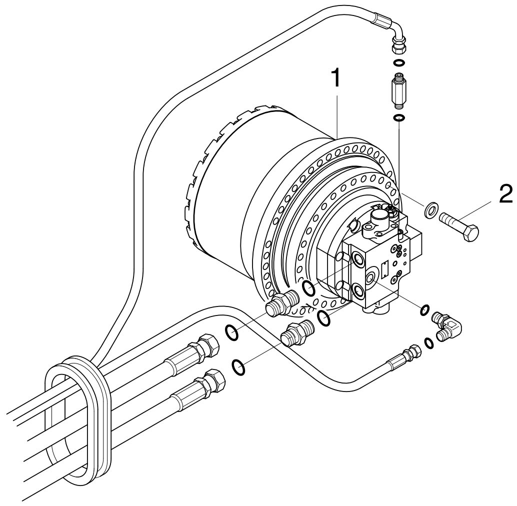
(1) Swing the work equipment 90° and lower it completely to the ground.

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



260A8TM01

(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 : 309 kg (681 lb)
· Tightening torque : 23 ± 2.5 kgf·m (166 ± 18.1 lbf·ft)

2) INSTALL

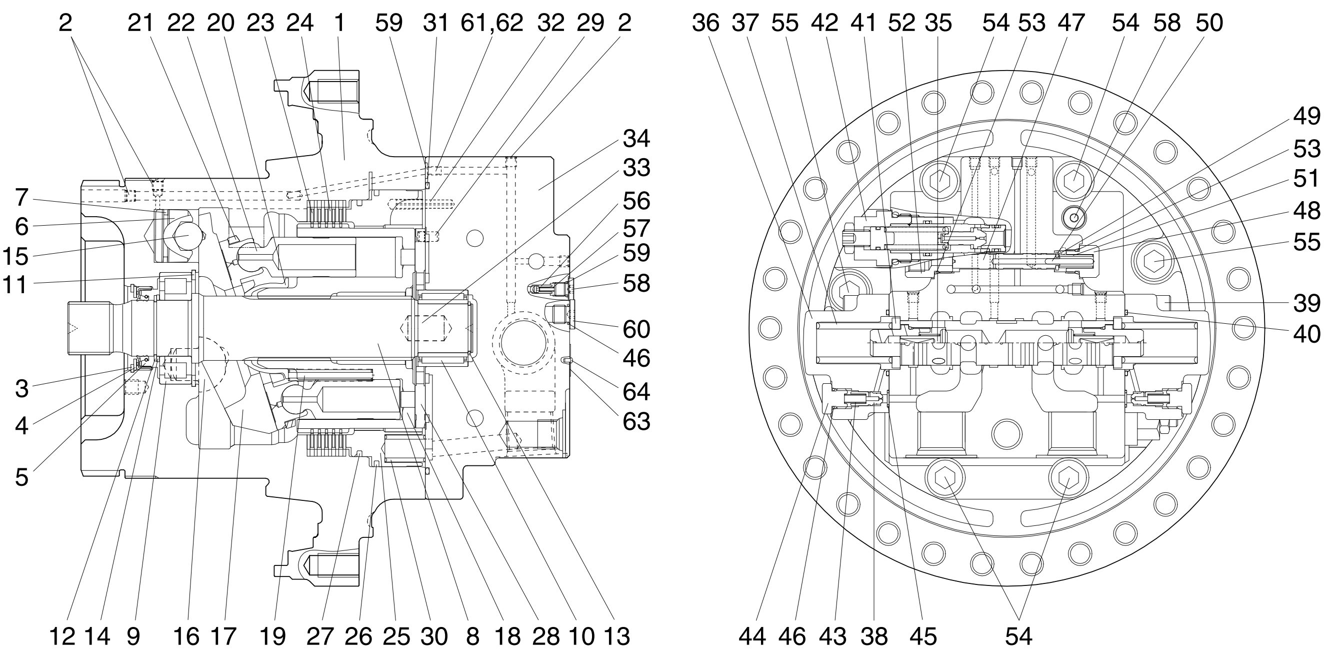
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

1) STRUCTURE

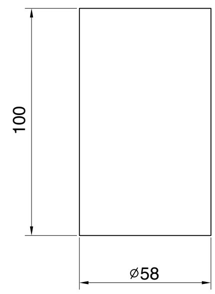
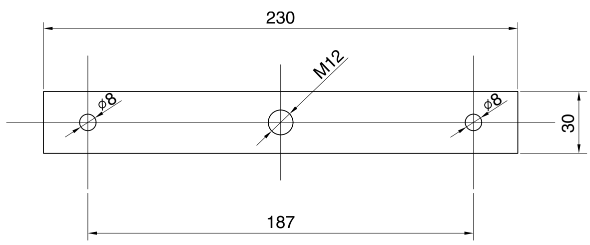
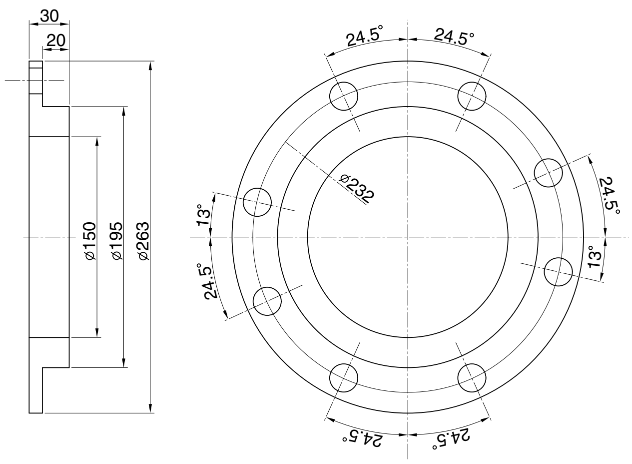


260L2TM02

1 Casing
2 Plug
3 Oil seal
4 Thrust plate
5 Snap ring
6 Piston
7 Piston seal
8 Shaft
9 Cylinder roller bearing
10 Needle bearing
11 Snap ring
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 Cover
37 Spring
38 Restrictor
39 Hexagon socket head bolt
40 O-ring
41 Spring seat
42 Relief valve assy
43 Spring
44 Plug
45 O-ring
46 O-ring
47 Spool
48 Plug
49 Spring seat
50 Parallel pin
51 Spring
52 Connector
53 O-ring
54 Hexagon socket head bolt
55 Hexagon socket head bolt
56 Check valve
57 Spring
58 Plug
59 O-ring
60 Plug
61 Restrictor
62 Restrictor
63 Name plate
64 Rivet

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark
Hexagon wrench	Width across flat 5, 6, 8, 10, 14 mm
Snap ring prier	For shaft Ø60~80 mm
Snap ring prier	For bore Ø32~58 mm
Plastic hammer	1 piece
Screw dirver	Minus (-), medium size, 2 pieces
Torque wrench	10 kgf·m (72.3 lbf·ft), 33 kgf·m (238.6 lbf·ft), 45 kgf·m (325.4 lbf·ft)
Gig for inserting oil seal	 25098TM31
Gig for inserting parking piston (M10×100 bolt 2EA, M12×100 bolt 1EA)	 25098TM32
Gig for pulling out brake piston	 25098TM33

(2) Tightening torque

Item	Name	Size	Torque	
			kgf · m	lbf · ft
2	Plug	NPTF 1/16	1.1±0.1	7.9±0.72
39	Hexagon socket head bolt	M12	1.0±1.0	72.3±7.2
42	Relief valve	1 5/16	1.0±1.0	72.3±7.2
44	Plug	PF 1/4	2.8±0.3	20.3±2.17
48	Plug	PF 3/8	5.5±0.5	39.8±3.6
52	Connector	PF 3/8	5.5±0.5	39.8±3.6
54	Hexagon socket head bolt	M18	38±3.8	275±27.5
55	Hexagon socket head bolt	M18	38±3.8	275±27.5
58	Plug	PF 1/8	1.5±0.1	10.8±0.72
60	Plug	PF 1/4	3±0.3	21.7±2.17

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.

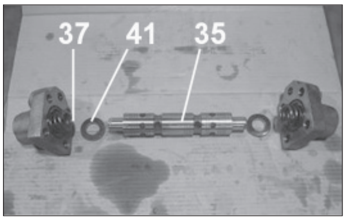
(3) Before disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in 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.

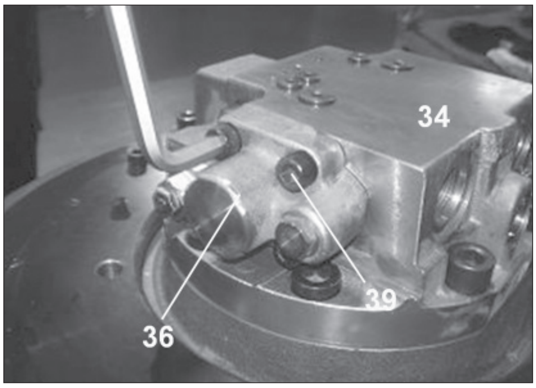
⚠ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

2) DISASSEMBLING TRAVEL MOTOR

(1) Disassemble the wrench bolt (39) to tighten the spool cover (36) and rear cover (34) by using the L-wrench or impact wrench and then disassemble the spring (37), spring seat (41) and main spool assy (35) in order.

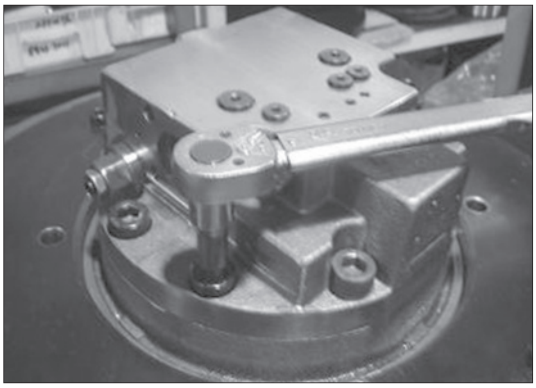


25098TM034



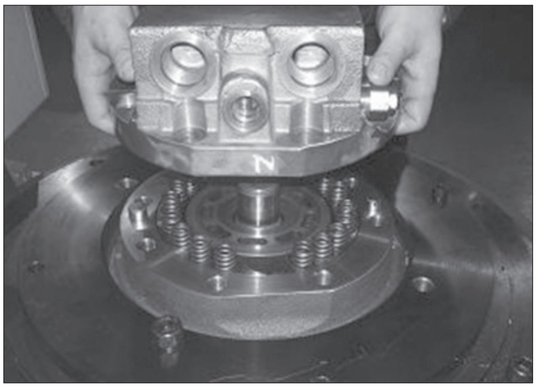
25098TM035

(2) Disassemble the wrench bolt (54, 55) to tighten the casing (1) and rear cover (34) by using the L-wrench or impact wrench.



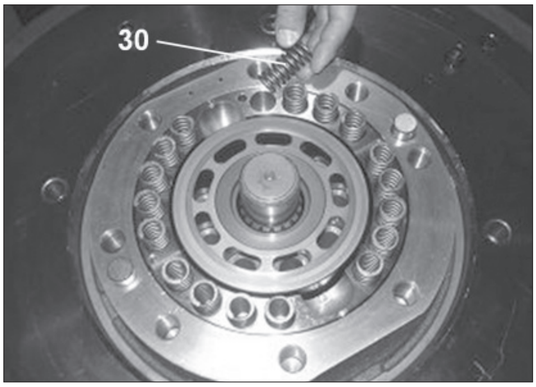
25098TM036

(3) Separate the casing (1) and rear cover (34).



25098TM037

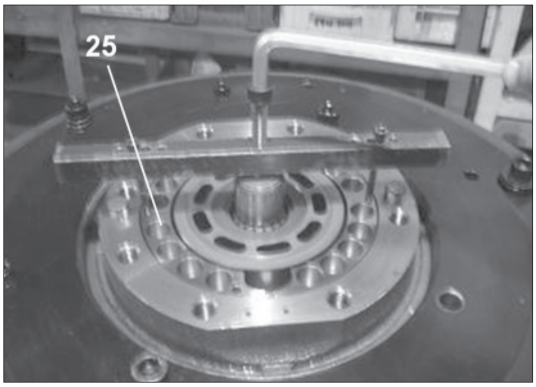
(4) Disassemble the brake spring (30, 18EA) from the piston.



25098TM118

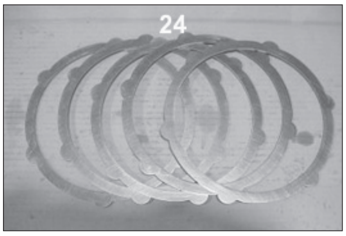
(5) Disassemble the parking piston (25) by using the jig for disassembling parking piston.

25098TM039

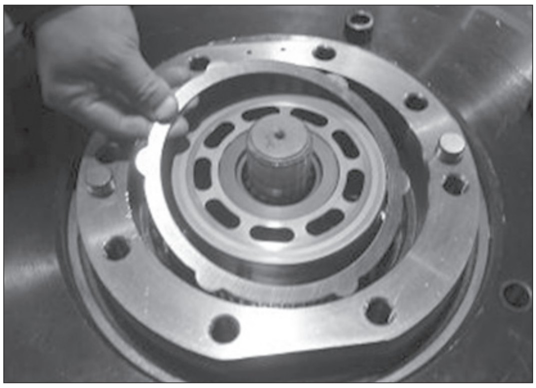


25098TM040

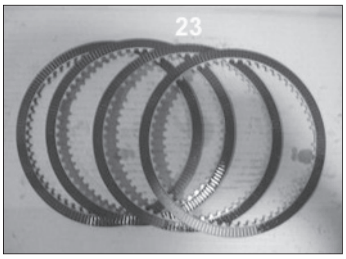
(6) Disassemble the separated plate (24, 5EA) and friction plate (23, 4EA) from the casing.



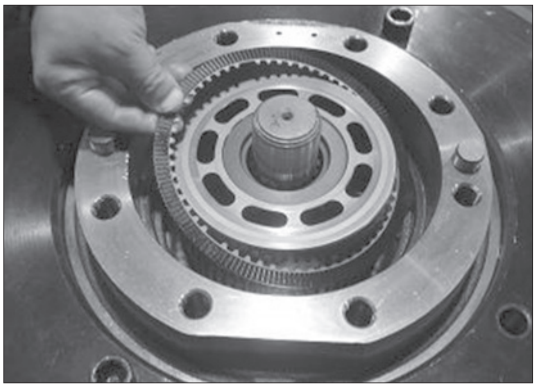
25098TM041



25098TM042

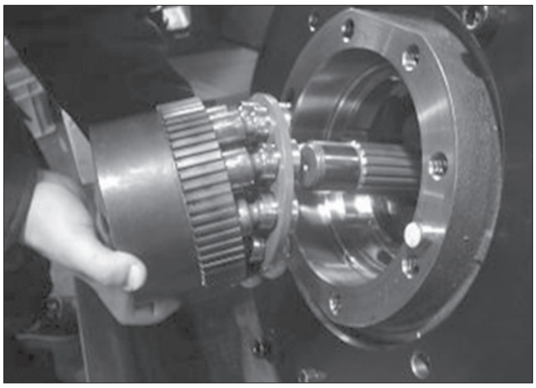


25098TM043



25098TM044

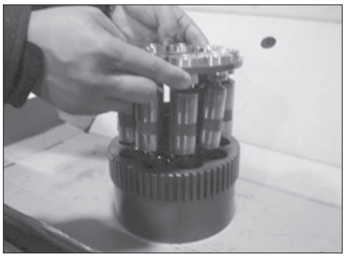
(7) Turn the casing (1) horizontal by using the assemble truck and disassemble the cylinder block kit form the casing (1).

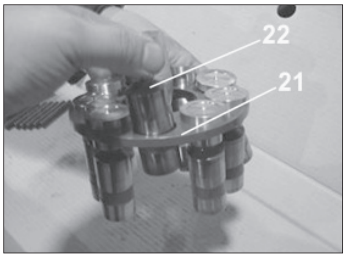


25098TM045

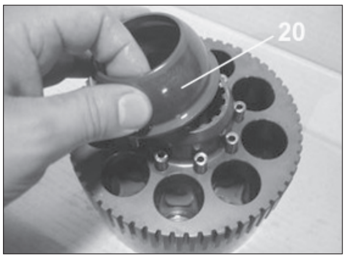
(8) Disassemble the cylinder block (18), retainer plate (21), piston assy (22), ball guide (20) and spring (19) from the cylinder block kit.


25098TM046


25098TM047



25098TM048



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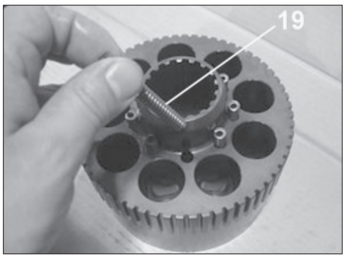
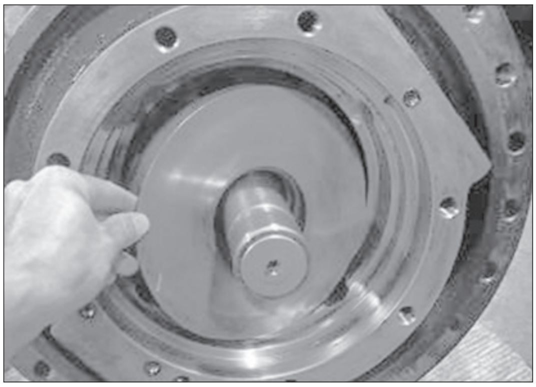


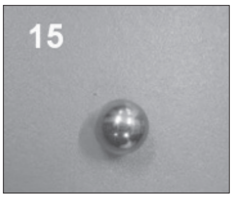
25098TM050

(9) Disassemble the swash plate (17) from the casing.

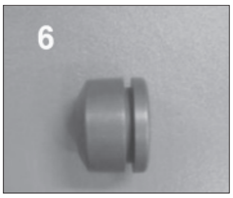
25098TM051


25098TM052

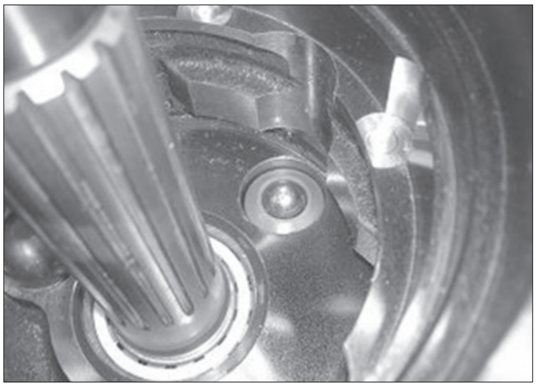
(10) Disassemble the steel ball (15) and swash piston (6) from the casing.



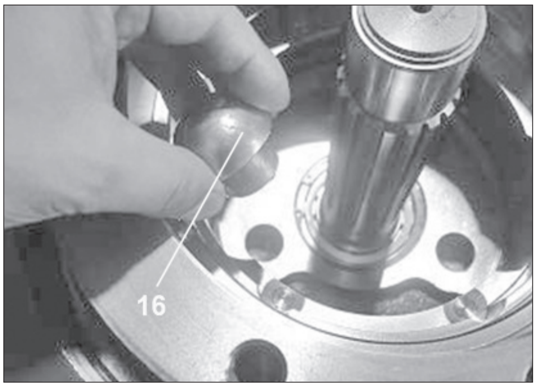
25098TM053



25098TM054

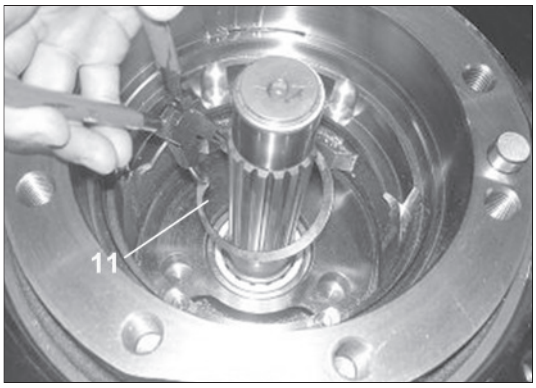

25098TM055

(11) Disassemble the pivot (16, 2EA) from the casing.



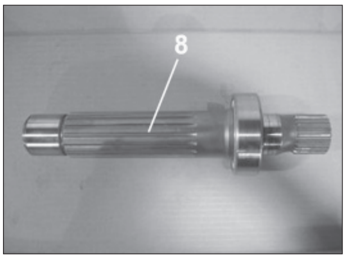
25098TM056

(12) Disassemble the snap ring (11) from the shaft (8) with the pryer for retaining ring.

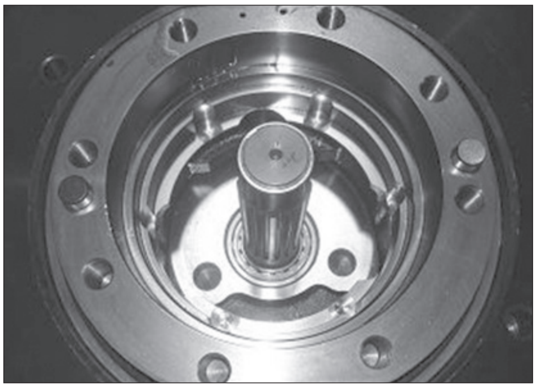


25098TM057

(13) Disassemble the shaft (8) from the casing (1).

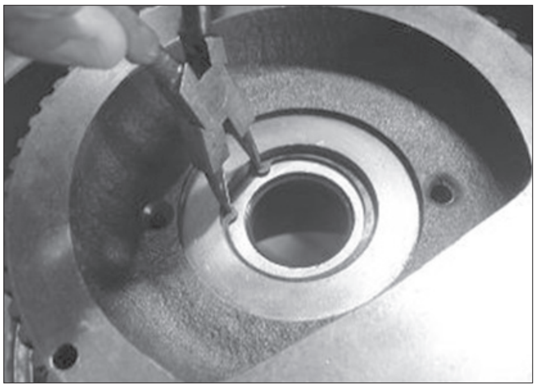


25098TM058



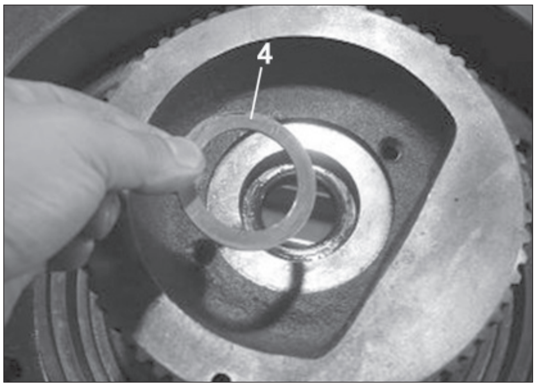
25098TM059

(14) Disassemble the snap ring (5) from the casing (1) with the pryer for retaining ring.



25098TM060

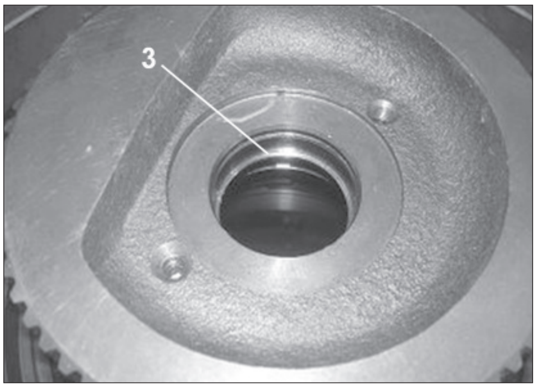
(15) Disassemble the thrust plate (4) from the casing (1).



25098TM061

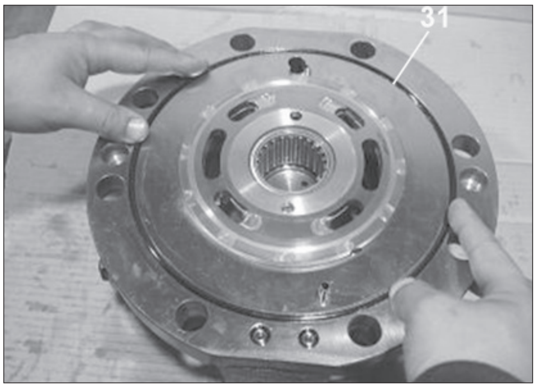
(16) Disassemble the oil seal (3) from the casing (1) with suitable tool.

25098TM062



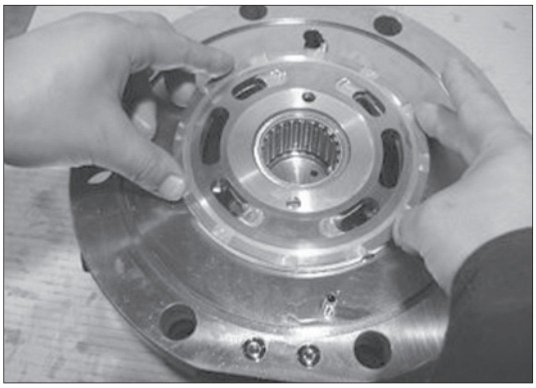
25098TM063

(17) Disassemble the O-ring (31) from the casing (1).



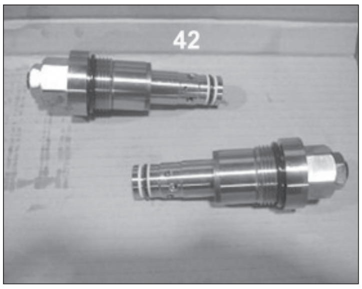
25098TM064

(18) Disassemble the valve plate (28) from the casing (1).

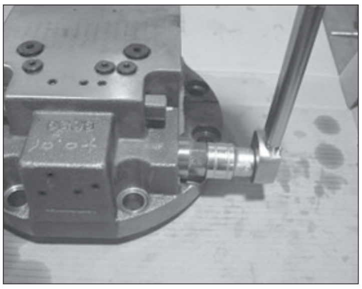


25098TM065

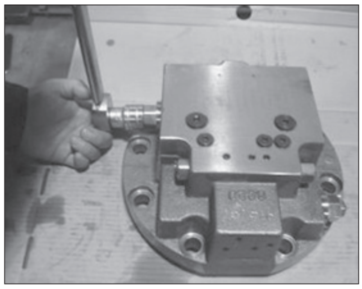
(19) Disassemble the relief valve (42, 2EA) from the rear cover (34) by using the torque wrench.



25098TM066

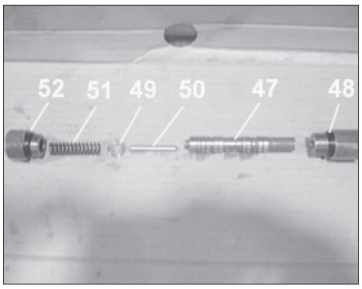


25098TM067

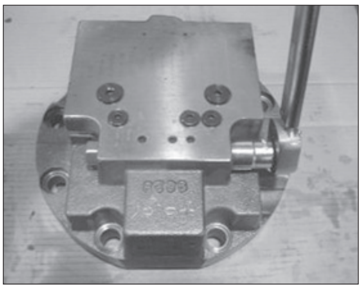


25098TM068

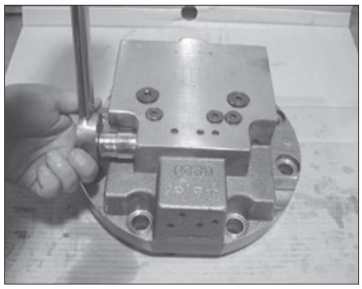
(20) Disassemble both side of the plug (48) and connector (52) from the rear cover (34) by using the torque wrench and then disassemble the spring (51), spring seat (49), parallel pin (50) and spool (47) in order.



25098TM069

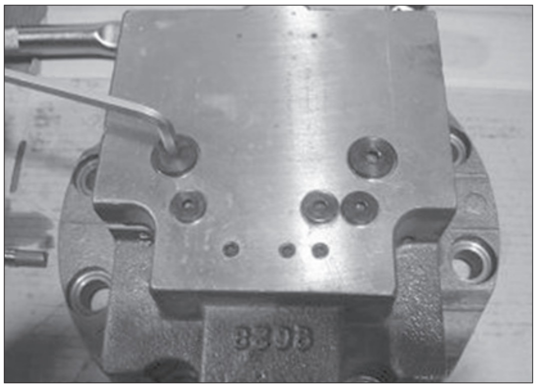


25098TM070



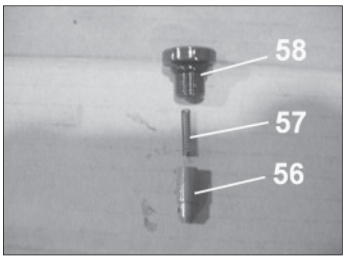
25098TM071

(21) Disassemble the plug (60) from the rear cover.

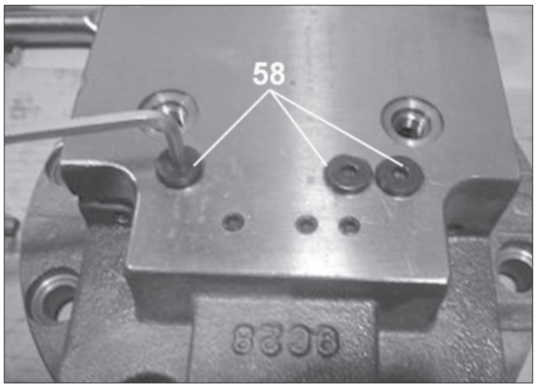


25098TM072

(22) Disassemble the plug (58) and then disassemble the spring (57) and check valve (56) from the rear cover in order.



25098TM073



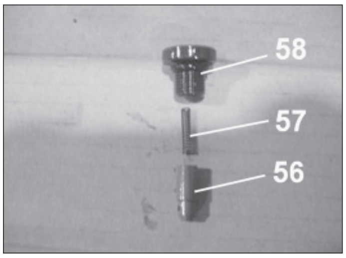
25098TM074

4. REASSEMBLING

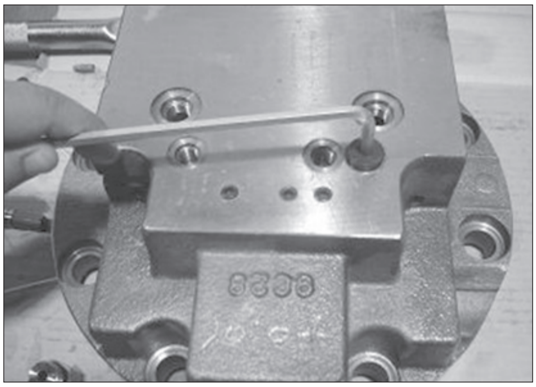
1) ASSEMBLING MOTOR

- REAR COVER ASSY

(1) Assemble the check valve (56) and the spring (57) to the rear cover and then tighten the plug (60) by using the L-wrench.

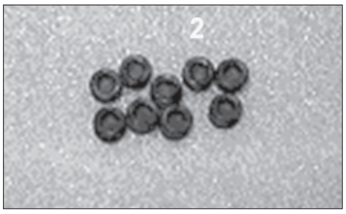


25098TM075

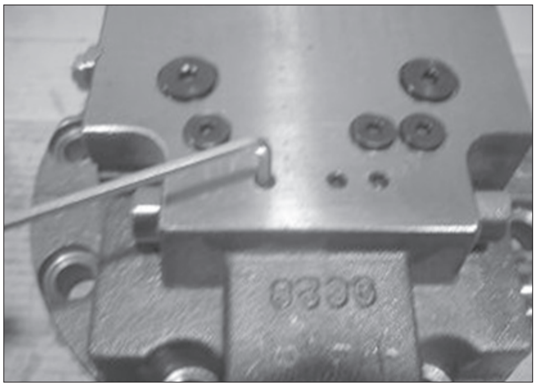


25098TM076

(2) Apply the loctite #242 on the NPTF 1/16 plug (2, 12EA) and tighten it.

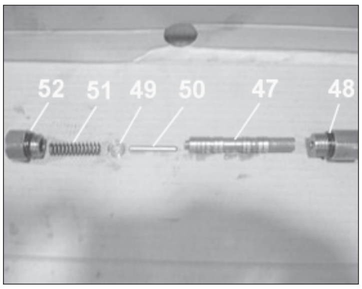


25098TM077

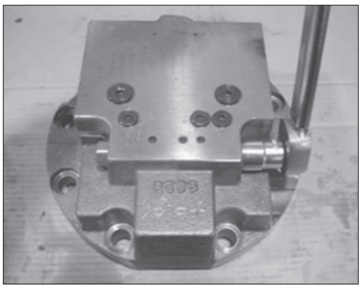


25098TM078

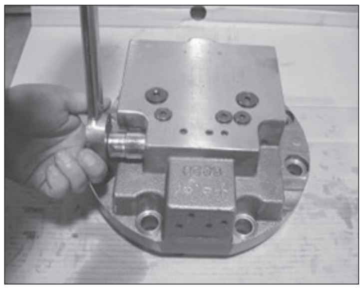
(3) Assemble the spool (47), parallel pin (50), spring seat (49) and spring (51) into the rear cover (34) and tighten both side of the plug (48) and connector (52) into the rear cover (34).



25098TM079

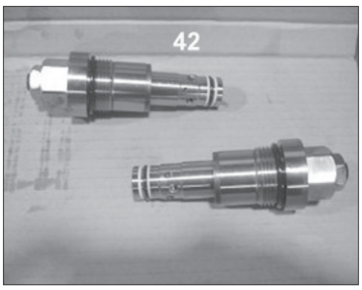


25098TM080

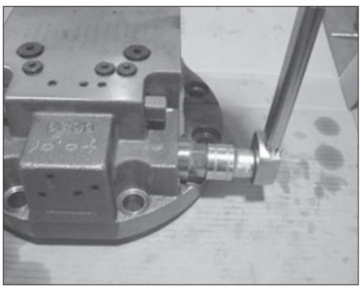


25098TM081

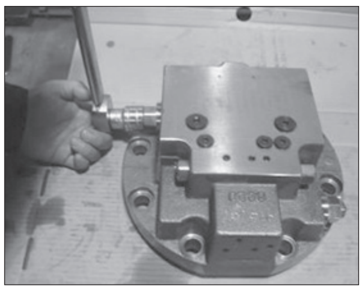
(4) Assemble the relief valve (42, 2EA) into rear cover (34).



25098TM082

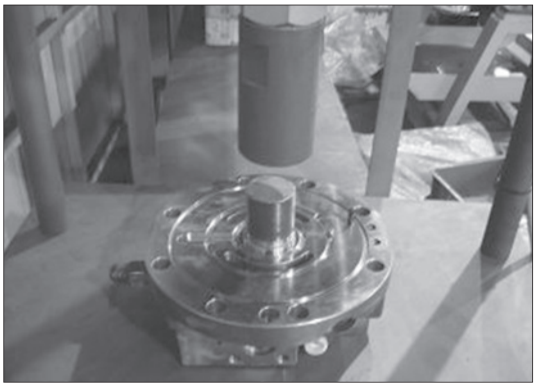


25098TM083



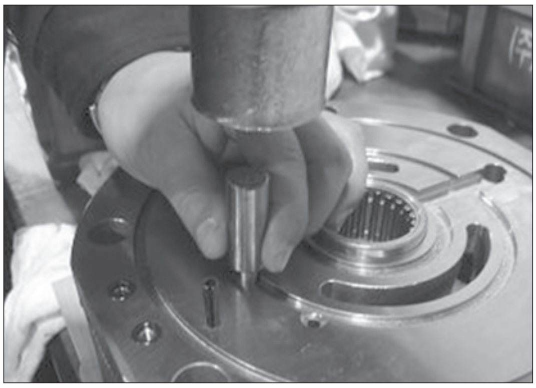
25098TM084

(5) Tight fit the needle bearing (10) into rear cover (34) by using pressing jig.



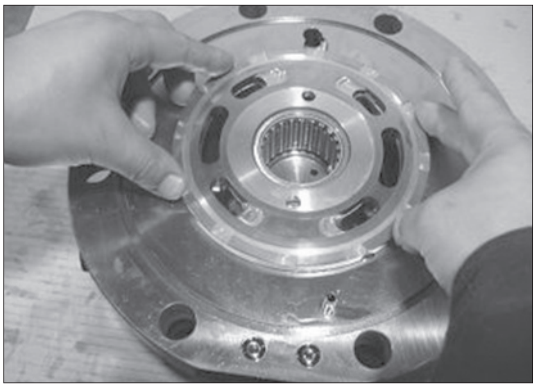
25098TM085

(6) Assemble the spring pin (32) and parallel pin (29) into rear cover (34) by using round bar or small hammer.



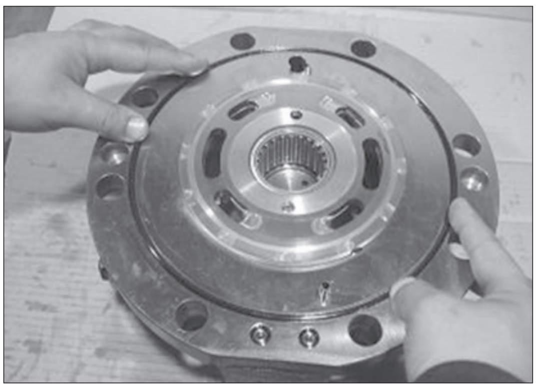
25098TM086

(7) Assemble the valve plate (28) into rear cover (34).
Before assembling, apply some grease on contact surface of the valve plate.



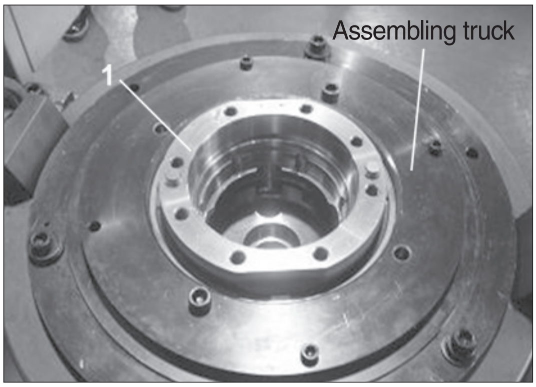
25098TM087

(8) Apply some grease on the O-ring and fit it into groove.



25098TM088

(9) Assemble the casing (1) on the assembling truck.



25098TM089

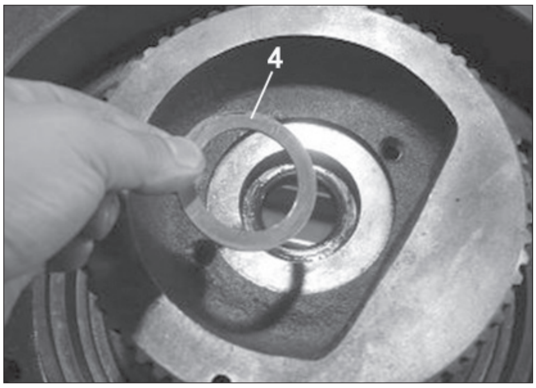
(10) Tight fit the oil seal (3) into the casing (1) by using jig.

※ Be careful direction of the oil seal.

25098TM090

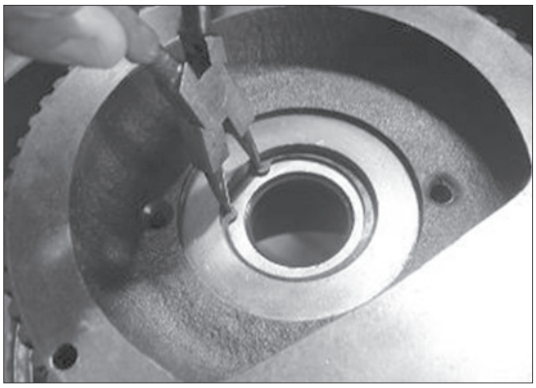

25098TM091

(11) Assemble the thrust plate (4) into the casing (1).



25098TM092

(12) Assemble the snap ring (5) into the casing (1) with the plier for retaining ring.

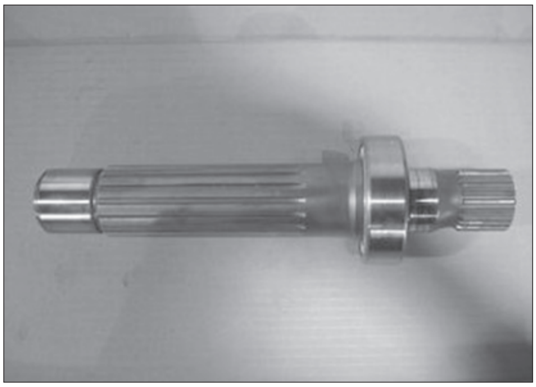

25098TM093

(13) Heat the roller bearing (9) and fit it into the shaft with shrink fitting.

a. Shrink fitting can be used induction heating system and set the temperature at 100°C.
b. Be careful not to damage the sliding surface of the oil seal of the shaft.

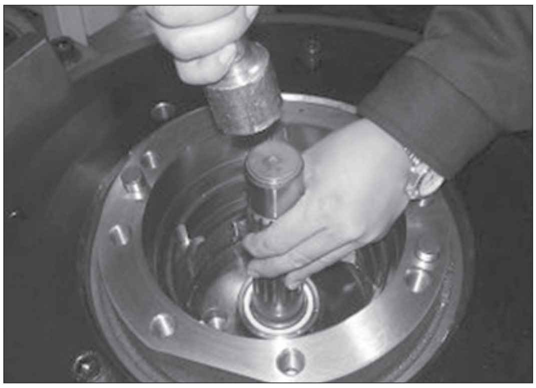
25098TM094

25098TM095



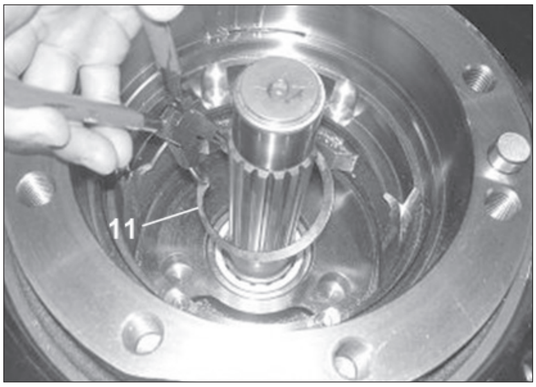
25098TM096

(14) Assemble the heat-fitted shaft (8) into casing (1).



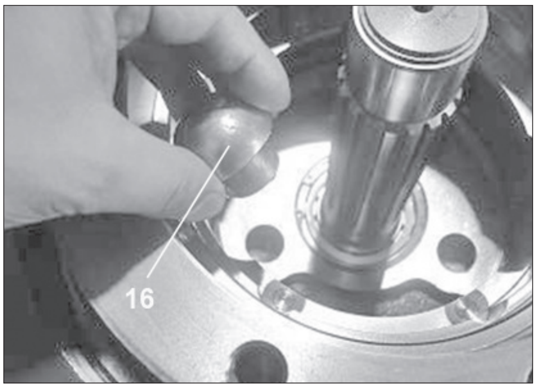
25098TM097

(15) Assemble the snap ring (11) into the casing (1) with the plier for retaining ring.



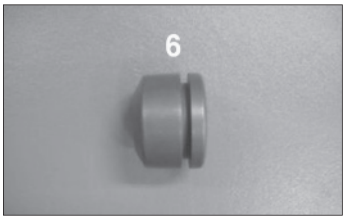
25098TM098

(16) Apply a little grease on the pivot (16, 2EA) and assemble it into the casing (1).

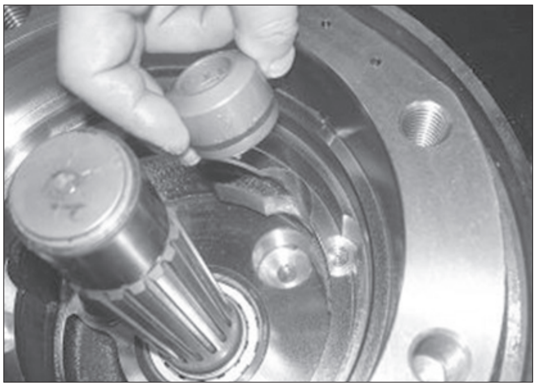


25098TM099

(17) Heat the piston seal (7) and fit it into the swash piston (6) and then tighten it a few minutes by band or tie. Loosen the band or tie and assemble it to the casing (1).

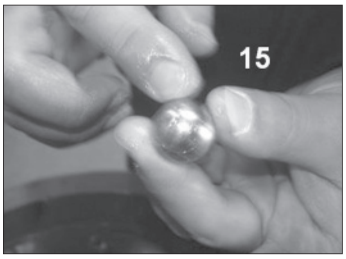


25098TM100

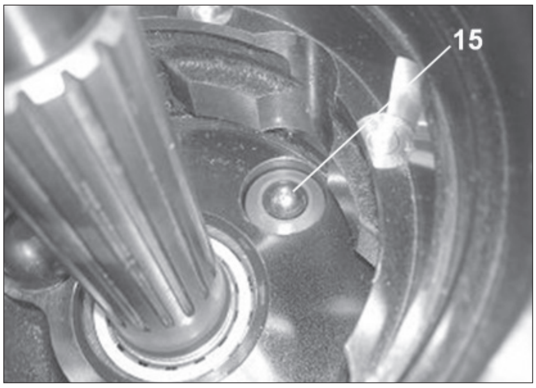


25098TM101

(18) Apply a little grease on the steel ball (15) and assemble it into the swash plate (17).



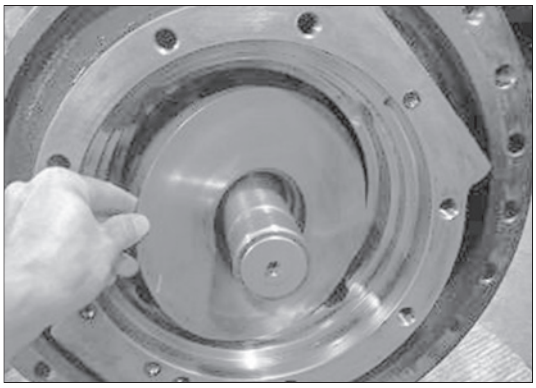
25098TM102



25098TM103

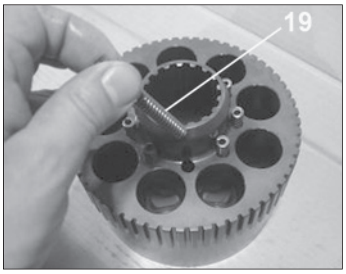
(19) Apply some grease on the steel ball hole of the swash plate (17) and assemble it casing (1).

25098TM104

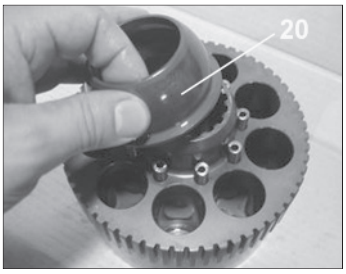


25098TM105

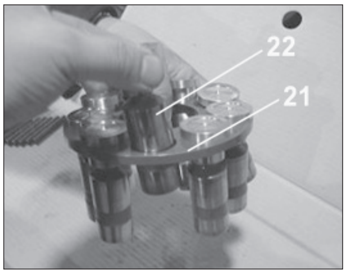
(20) Assemble the spring (19), ball guide (20), retainer plate (21) and piston assy (22) into cylinder block (18) in order.



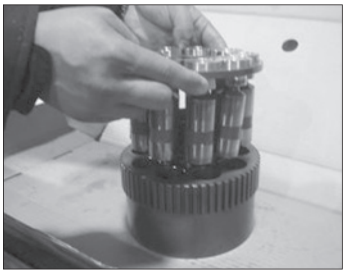
25098TM106



25098TM107



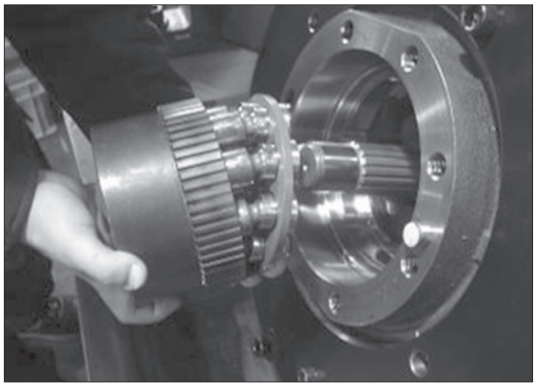
25098TM108



25098TM109

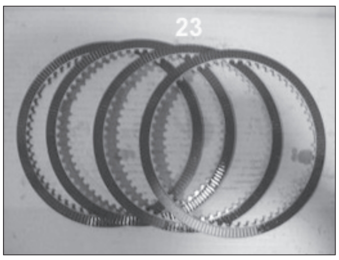
25098TM110

(21) Tilt the casing (1) sideways and assemble the cylinder block kit into the casing (1).

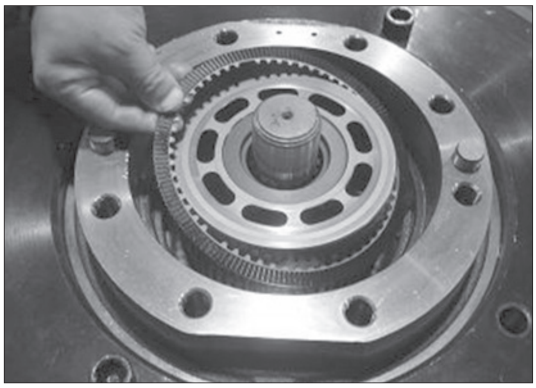


25098TM111

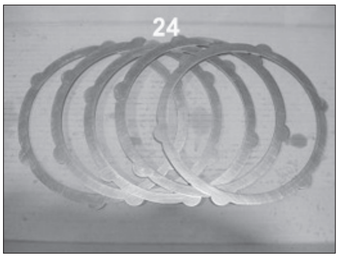
(22) Assemble the separated plate (24) and friction plate (23) into the cylinder block alternately.
Friction plate :
4EA
Separated plate :
5EA



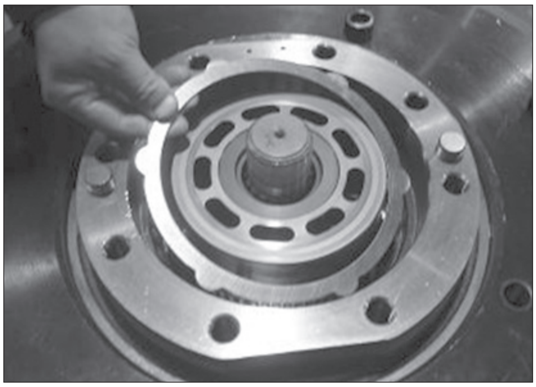
25098TM112



25098TM113

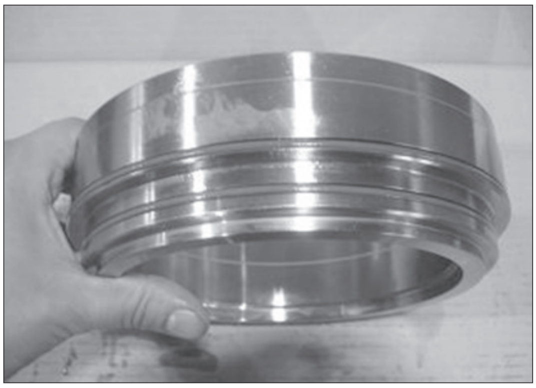


25098TM114



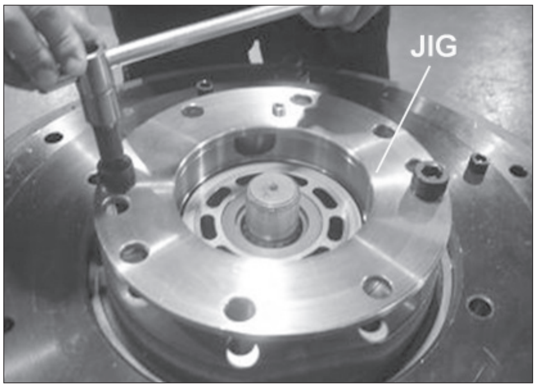
25098TM115

(23) Apply some grease on the D-ring and assemble it parking piston.



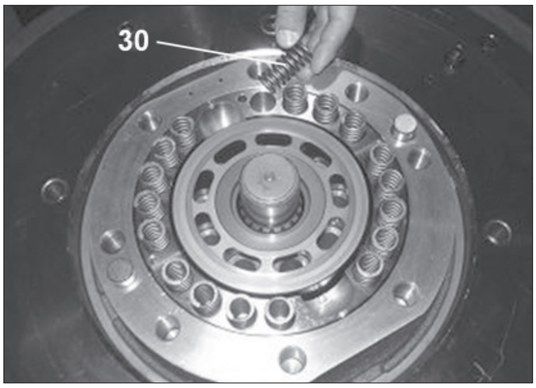
25098TM116

(24) Insert the parking piston into the casing and assemble it by using jig.



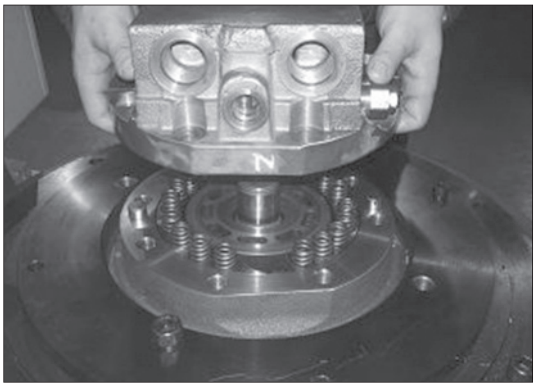
25098TM117

(25) Assemble the brake spring (30, 18EA) into the piston.



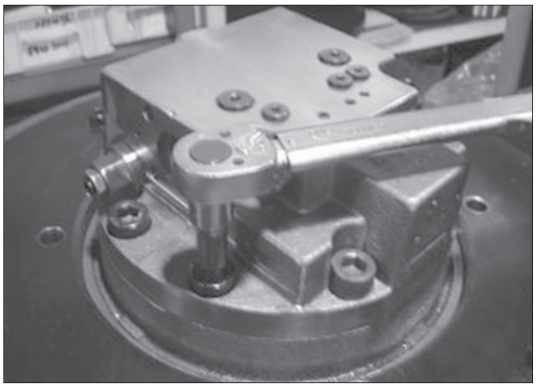
25098TM118

(26) Place the rear cover (34) on the casing (1).



25098TM119

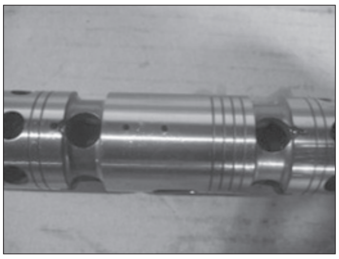
(27) Tighten the casing (1) and rear cover (34) specified torque with wrench bolt (54, 55) by using the impact wrench and torque wrench.



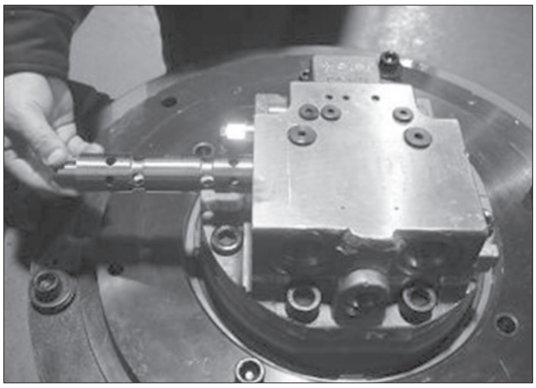
25098TM120

(28) Confirm the insert direction of the main spool assy (35) exactly and assemble it into the rear cover (34).

※ Assure that four balance hole is directed VA port.

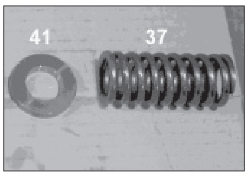


25098TM121

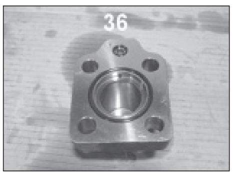


25098TM122

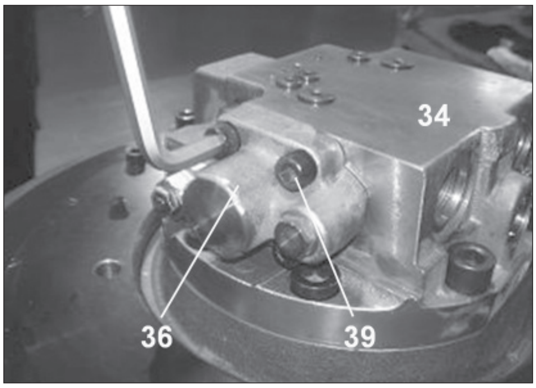
(29) Assemble the spring seat (41), spring (37) and main spool cover (36) into valve plate and tighten the wrench bolt (39, M12x35) by using L-wrench or impact wrench.



25098TM123

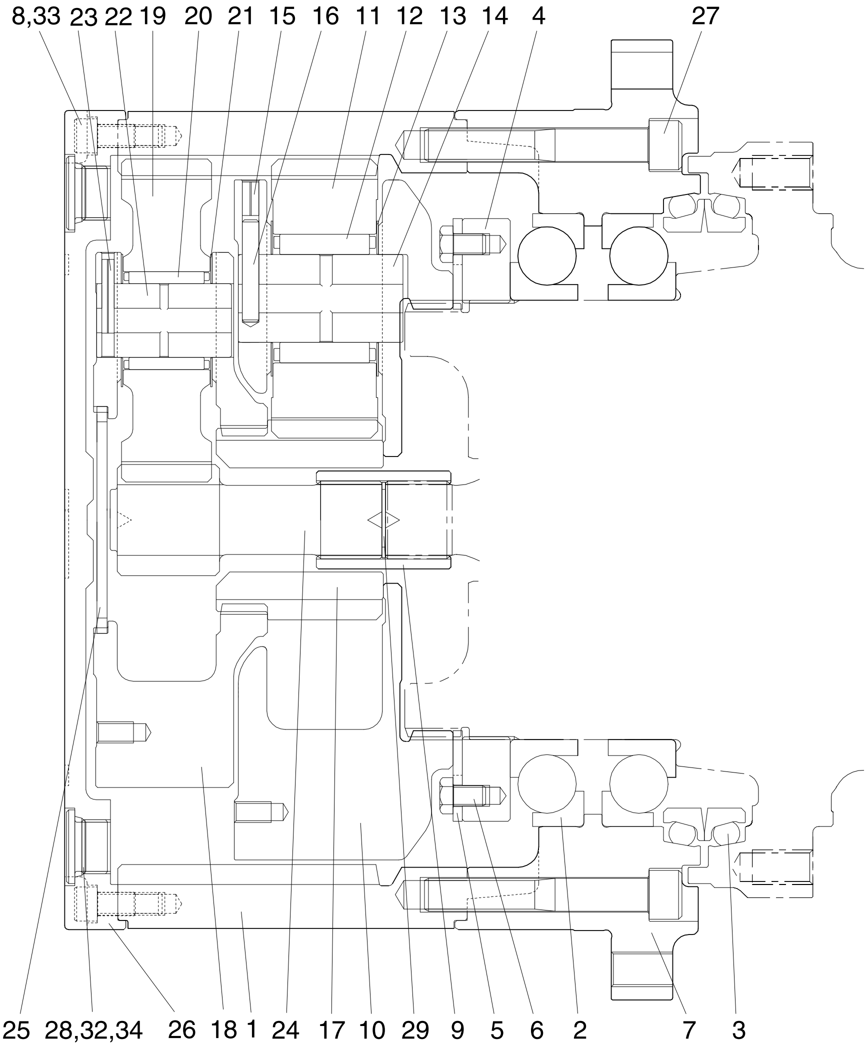


25098TM124



25098TM125

2) TRAVEL REDUCTION GEAR



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

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.

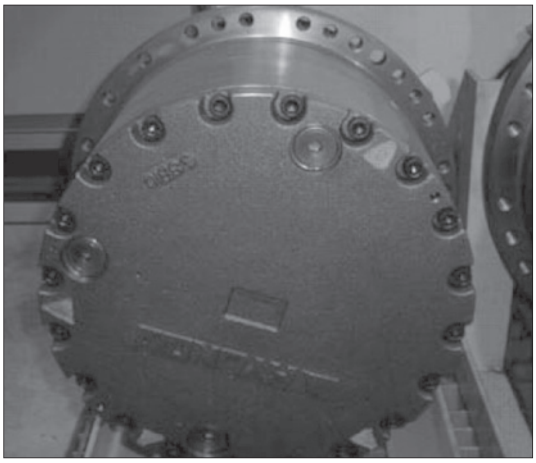
(1) Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather.
Tools and kerosene to wash parts should also be clean and handled with great care.

(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



25098TM126

① The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.

② Locate reducer in order for drain port to be at the lowest level, loosen taper screw plug of drain port, and drain oil from reduction gear.

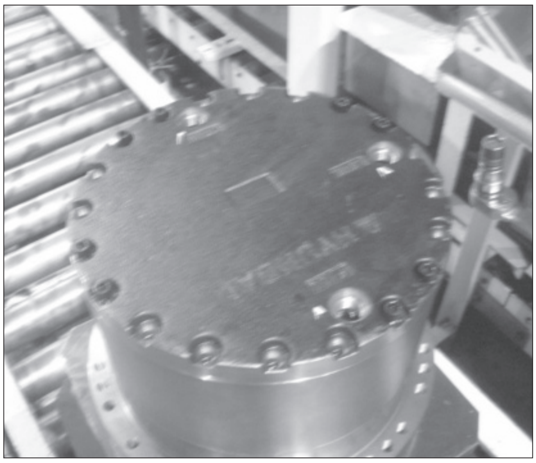
※ While oil is still hot, inside of the unit may be pressurized.

⚠ Take care of the hot oil gushing out of the unit when loosening the plug.

③ Mark for mating

Put marks on each mating parts when disassembling so as to reassemble correctly as before.

(2) Setting reduction unit (or whole propelling unit) on work stand for disassembling

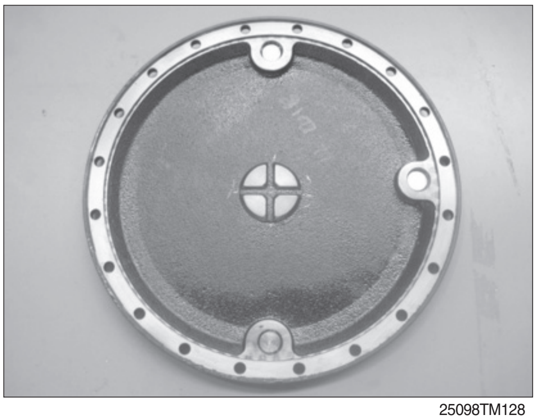


25098TM127

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



25098TM128

① Remove the rest of 7/16-14UNC hexagon socket head bolts that secure cover and ring gear. Loosen all the socket bolts and then, disassemble cover.

② As the cover is adhered to ring gear, disassemble ring gear and cover by lightly hammering slantwise upward using sharpen punch inserted between the cover and ring gear.

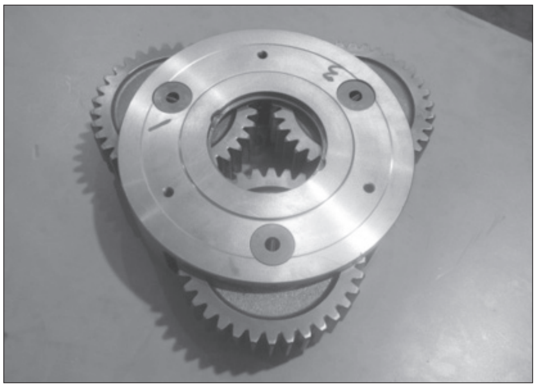
(4) Removing No.1 carrier sub assembly

① Screw three M10 eye-bolt in No.1 carrier and lift up and remove No.1 carrier assy.

25098TM129

② Remove No.1 sun gear.

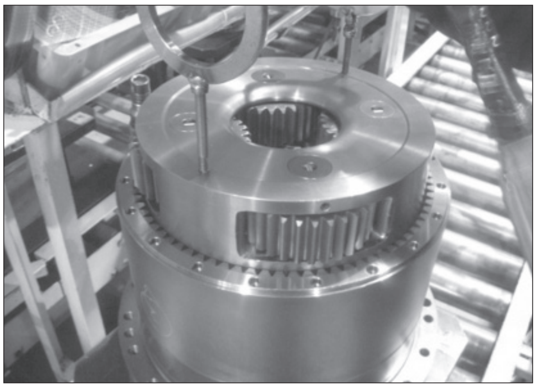
※ Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.



25098TM130

(5) Removing No.2 carrier sub assembly

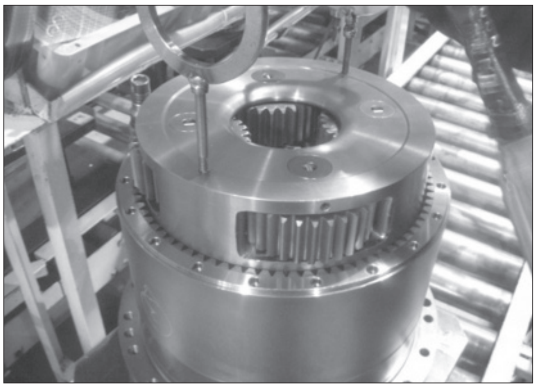
① Screw three M10 eye-bolt in No.2 carrier and lift up and remove No.2 carrier assy.



25098TM131

② Remove No.2 sun gear.

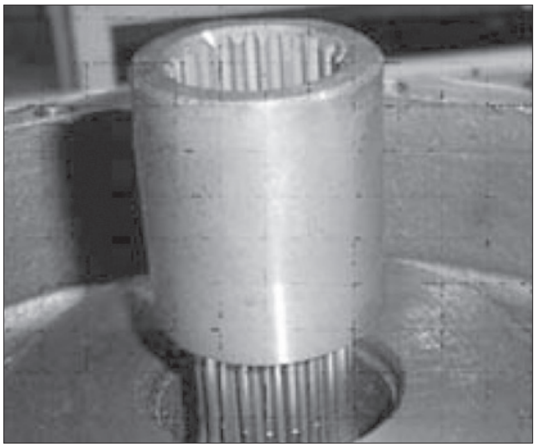
※ Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.



25098TM132

(6) Removing coupling

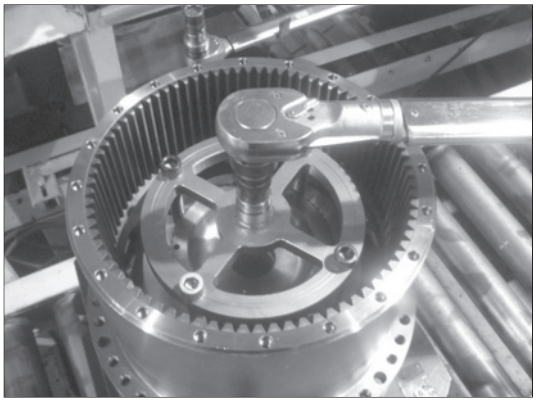
① Remove coupling.



25098TM133

(7) Removing ring nut & lock plate

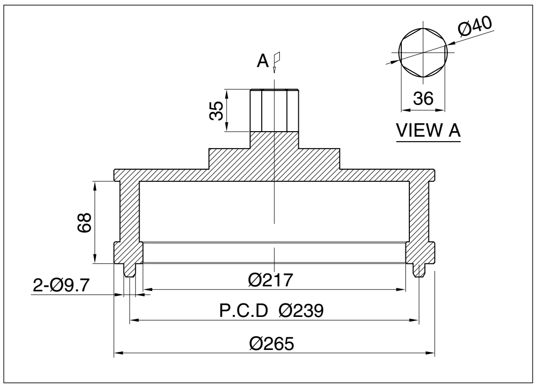
① Remove M12 hexagon head bolts that secure ring nut and lock plate.
② Remove lock plate.



25098TM134

③ Remove ring nut from motor casing.

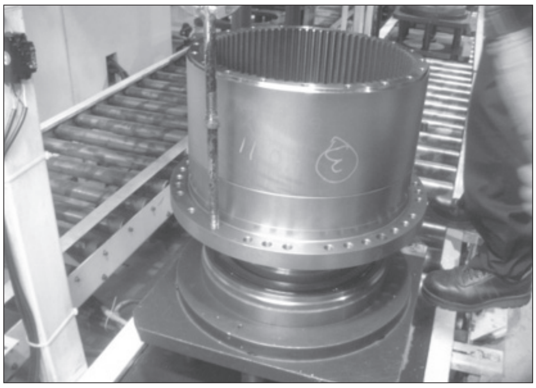
※ Remove the ring nut by using the special tool for removing the ring nut.



220L8TM01

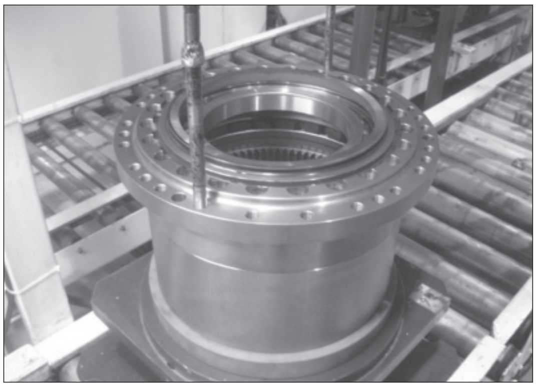
(8) Removing housing sub assembly & ring gear

① Screw 7/16-14UNC eye bolt in housing and lift up ring gear and housing assembly including anguler bearing and floating seal.



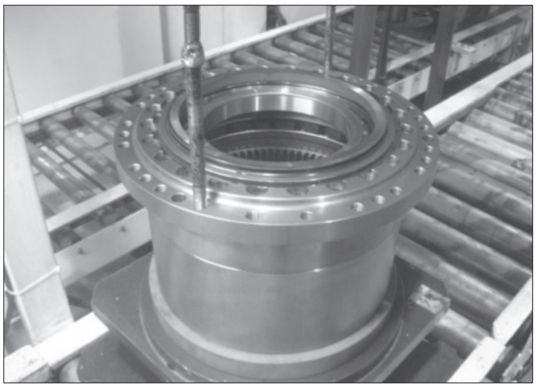
25098TM135

② Setting reduction unit on work stand for disassembling. Remove M16 hexagon socket head bolts that secure ring gear and housing assembly.



25098TM136

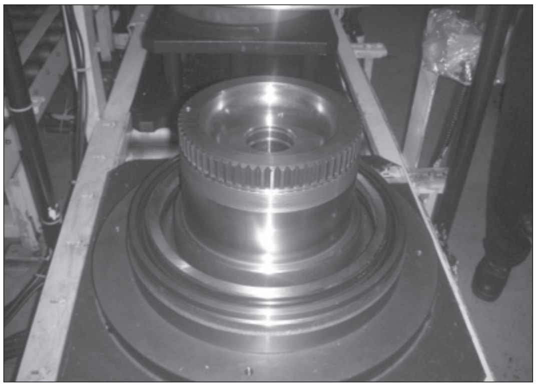
③ As the ring gear is adhered to housing assy, disassemble housing assy and ring gear by lightly hammering slantwise upward using sharpen punch inserted between the housing assy and ring gear.



25098TM137

(9) Removing floating seal

① Lift up a piece of floating seal of motor side.



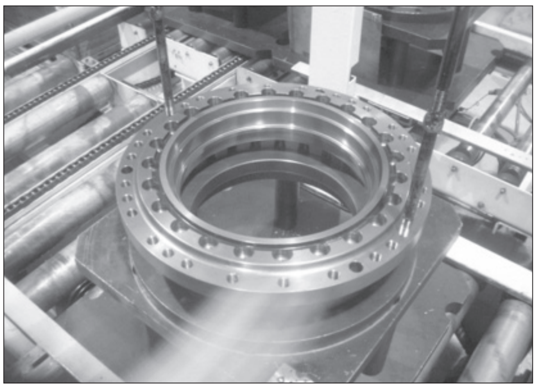
25098TM138

(10) Removing housing sub assembly

① Setting housing assembly on work stand for disassembling.

② After setting housing, lift up a piece of floating seal from housing and then remove it.

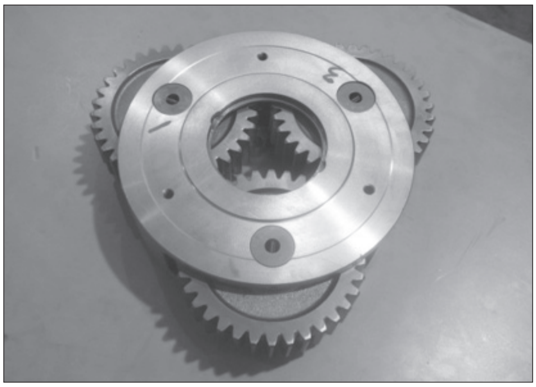
※ Don't disassemble angular bearing.



25098TM139

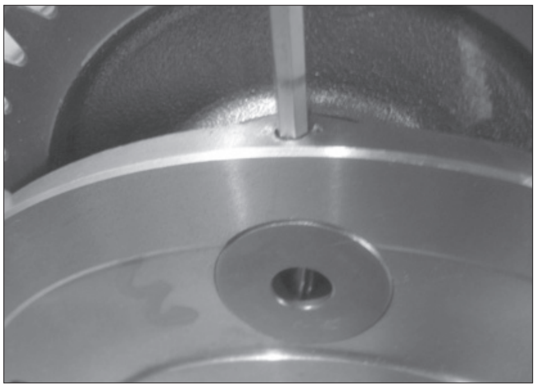
(11) Disassembling No.1 carrier

① Remove thrust plate.



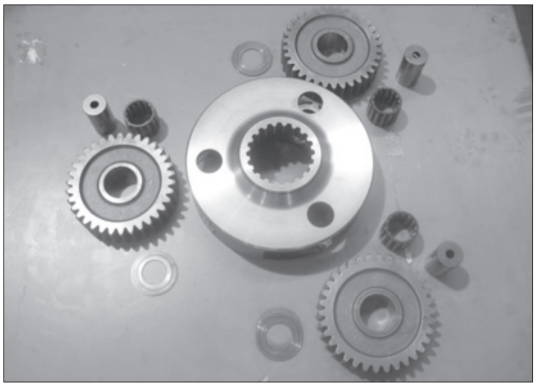
25098TM140

② Knock spring pin fully into No.1 pin.



25098TM141

③ Remove planetary, thrust washer, No.1 pin, bearing from carrier.



25098TM142

(12) Disassembling No.2 carrier

① Knock spring pin fully into No.2 pin.
② Remove No.2 solid pin.
③ Remove planetary, thrust washer, No.2 pin, bearing from carrier.

25098TM143

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.

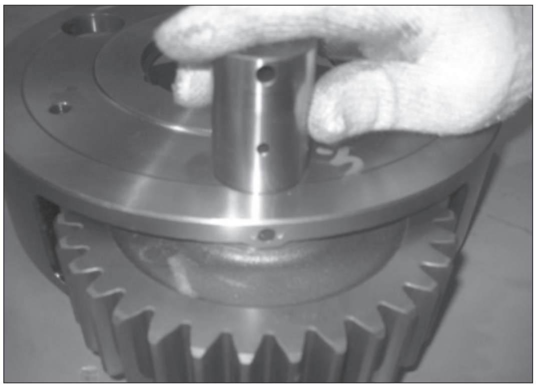
Bearing
· Rotate by hand to see if there are something unusual such as noise or uneven rotation.

Floating seal
· Check flaw or score on sliding surfaces or O-ring.

2) ASSEMBLING CARRIER 1 ASSY

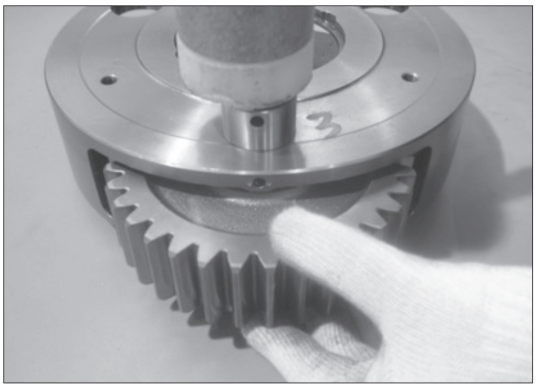
(1) Put No.1 carrier on a flat place.

(2) Install No.1 needle bearing into No.1 planetary gear, put 2EA of No.1 thrust washer on both sides of planetary gear, and then, install it into carrier.



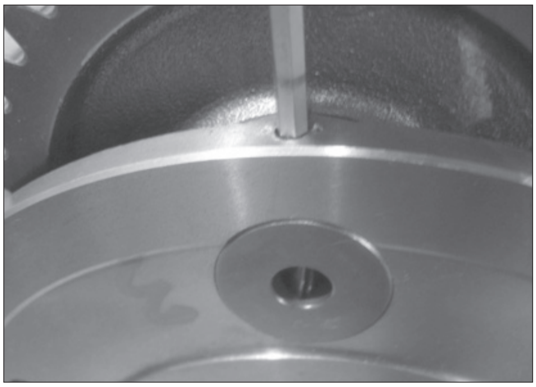
25098TM144

(3) Install No.1 pin into No.1 carrier where the holes for No.1 pin are to be in line with those of No.1 carrier, and then, install spring pins into the holes.



25098TM145

(4) Caulk carrier holes as shown on the picture.

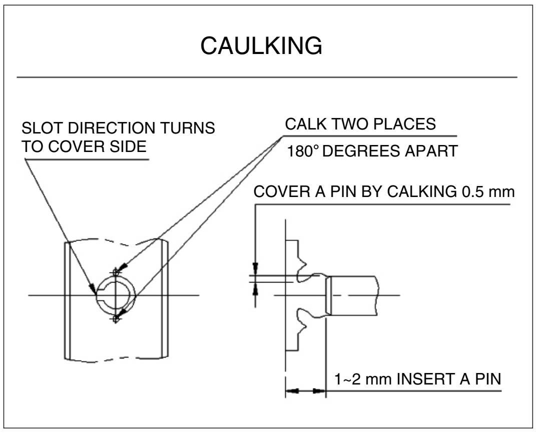


25098TM146

3) ASSEMBLING CARRIER 2 ASSY

(1) Put No.2 carrier on a flat place.

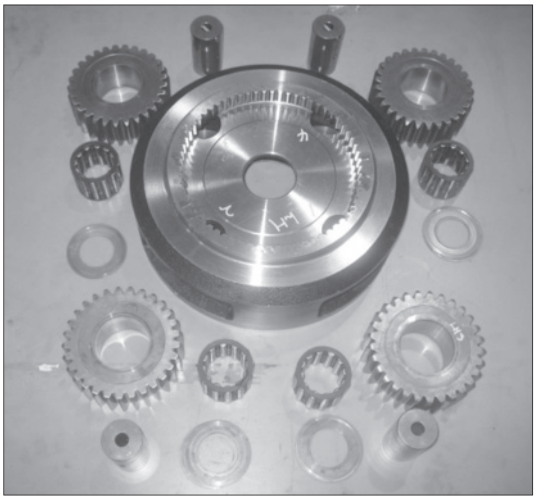
(2) Install No.2 needle bearing into No.2 planetary gear, put 2EA of No.2 thrust washer on both sides of planetary gear, and then, install it into carrier.



220SA8TM147

(3) After install solid pin into the holes, install No.2 pin into No.1 carrier where the holes for No.1 pin are to be in line with those of No.1 carrier, and then, install spring pins into the holes.

(4) Caulk carrier holes as shown on the picture.

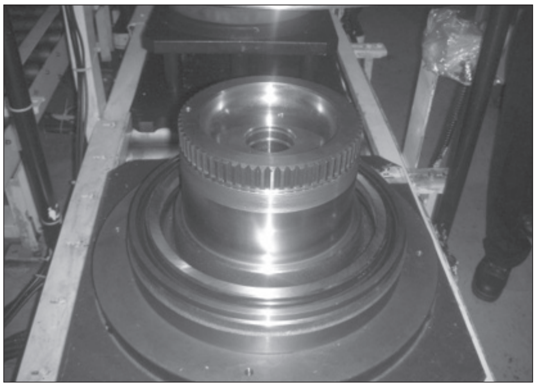


25098TM148

4) ASSEMBLING FLOATING SEAL

(1) Assemble floating seal into motor by use of pressing jig.
Grease the contact parts for floating seal which is assembled into motor.

※ Be sure to maintain it vertical with the ground when assembling bearing and floating seal.

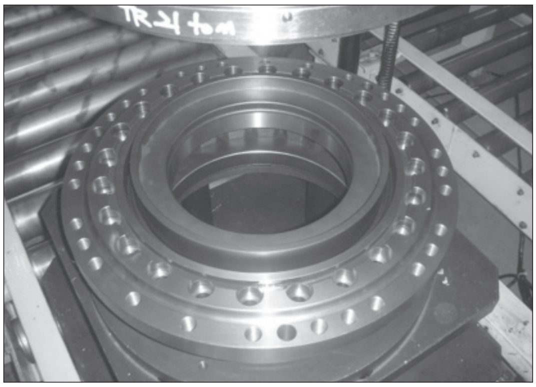


25098TM149

5) ASSEMBLING HOUSING

(1) Heat housing at 60~70˚C while clearing it out and then, assemble floating seal into housing by use of pressing jig.

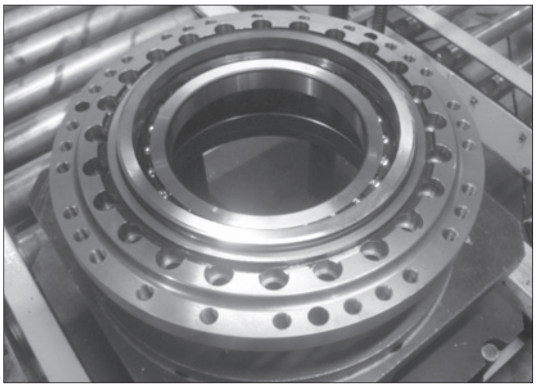
(2) Setting housing assembly on work stand for assembling.
Assemble angular bearing into housing by use of pressing jig.



25098TM150

(3) Assemble floating seal into housing by use of pressing jig.
Do not reuse the disassembling O-ring.
Grease the contact parts for floating seal which is assembled into housing.

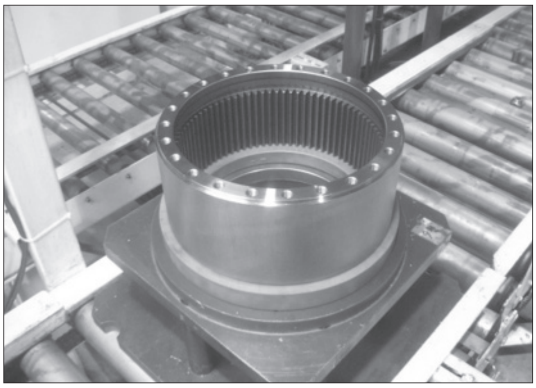
※ Be sure to maintain it vertical with the ground when assembling bearing and floating seal.



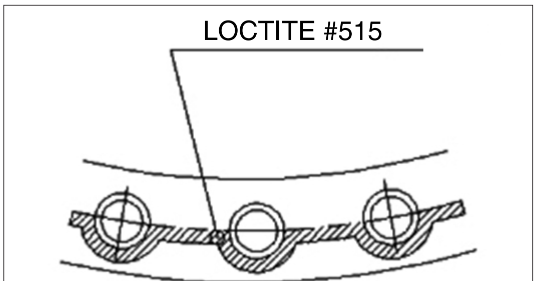
25098TM151

6) ASSEMBLING HOUSING ASSY AND RING GEAR

(1) Setting ring gear on work stand for assembling.
Apply loctite #515 on ring gear for housing without gap.



25098TM152

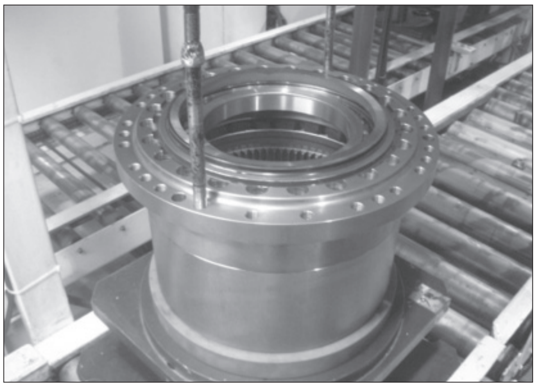


235ZF8SM39

(2) Install M16 eye-bolt on the tap of housing.

(3) Lift housing and then, assemble into housing in order for bolt hole of ring gear and bolt hole of housing to be in line.

(4) Apply loctite #242 on M16 hexagon socket head bolt, and then, bolt.



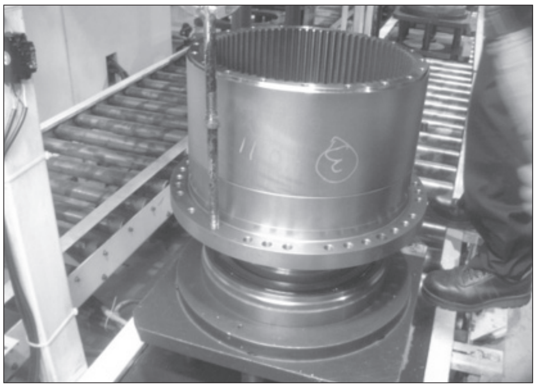
25098TM154

7) ASSEMBLING HOUSING ASSY AND MOTOR

(1) Install 7/16-14UNC eye-bolt on the tap of ring gear.

(2) Assemble housing assembly into motor by use of hoist and eye-bolt.

※ Be sure to tighten eye-bolt deep enough.



25098TM155

8) ASSEMBLING MAIN BEARING

(1) Assemble angular bearing into housing by use of pressing jig.

※ Be sure to maintain it vertical with the ground when assembling bearing.

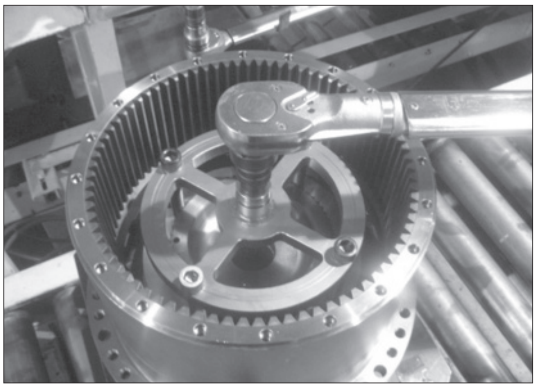
25098TM156

9) ASSEMBLING NUT RING AND LOCK PLATE

(1) Tighten nut ring to specified torque, utilizing special tool.

· Tightening torque : 60.3 kgf·m (436 lbf·ft)

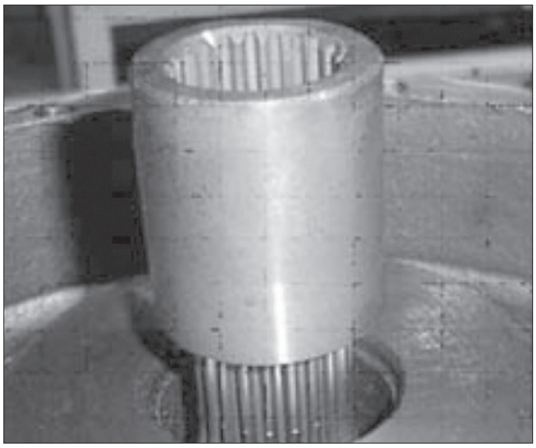
(2) After install lock plate, apply loctite #242 on M12 hexagon head bolt, and then, bolt.
Tighten M12 hexagon head bolt to specified torque, with torque wrench.



25098TM157

10) ASSEMBLING COUPLING

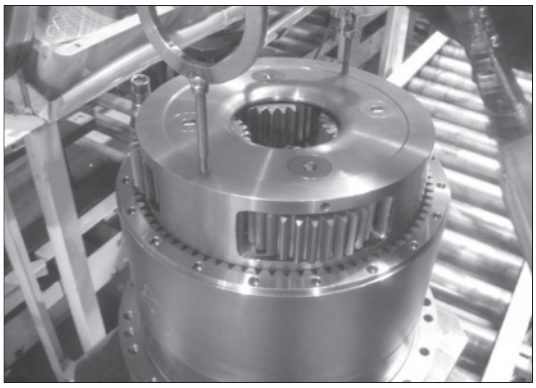
(1) Install coupling on spline of the motor.



25098TM158

11) ASSEMBLING NO.2 CARRIER SUB ASSEMBLY

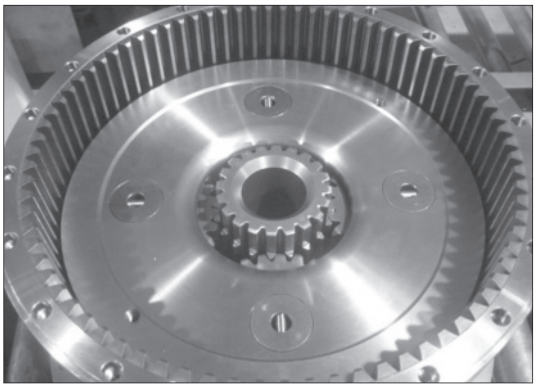
(1) Install M10 eye-bolt on No.2 carrier assembly.
(2) Lift No.2 carrier assembly and then, slowly put it down on ring gear.
(3) Rotate planetary gear by hands and install on ring gear.
(4) Rotate No.2 carrier assembly by hands and install on motor.
※ Match pin hole of No.2 carrier with main (A, B) port of motor.



25098TM159

12) ASSEMBLING NO.2 SUN GEAR

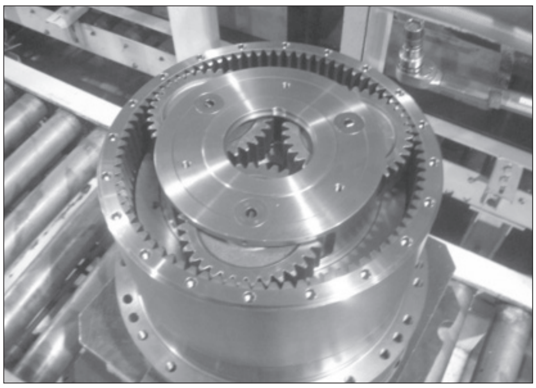
(1) Install No.2 sun gear on the No.2 planetary gear, matching teeth of them.



25098TM160

13) ASSEMBLING NO.1 CARRIER SUB ASSEMBLY

(1) Install M10 eye-bolt on No.1 carrier assembly.
(2) Lift No.1 carrier assembly and then, slowly put it down on ring gear.
(3) Rotate planetary gear by hands and install on ring gear.
(4) Rotate No.1 carrier assembly by hands and install on No.2 sun gear.



25098TM161

14) ASSEMBLING NO.1 SUN GEAR

(1) Put down No.1 sun gear on No.1 carrier, maintaining it vertical with spline of coupling.

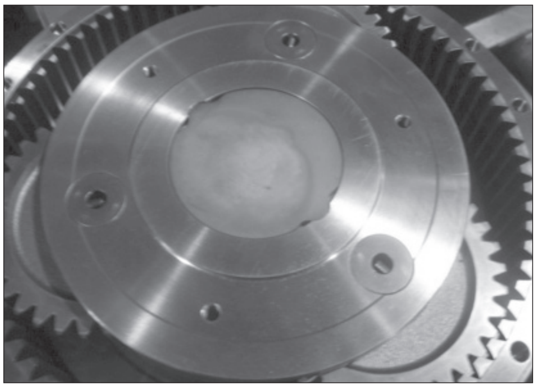
(2) Install No.1 sun gear on No.1 planetary gear, matching their teeth.

25098TM162

15) ASSEMBLING THRUST PLATE

(1) Assembly thrust plate into No.1 carrier.

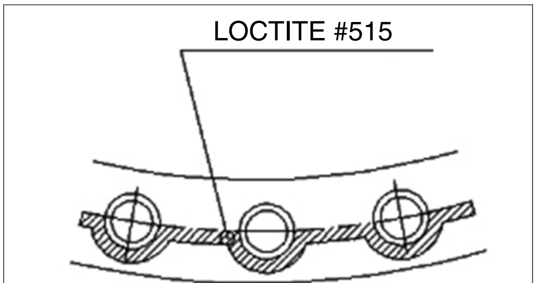
※ Edge of thrust plate direction turns to cover side.



25098TM163

16) ASSEMBLING COVER

(1) Apply loctite #515 on the ring gear for cover without gap.

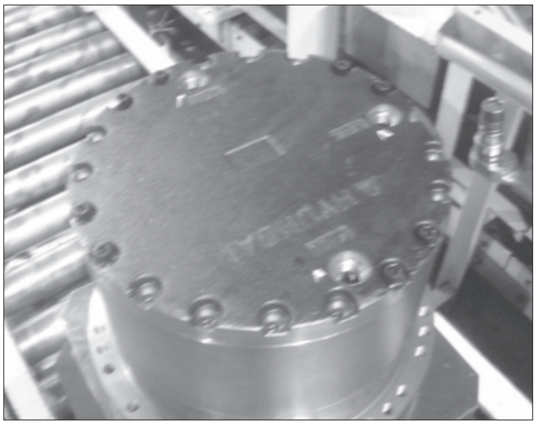


235ZF8SM39

(2) Put cover on ring gear, apply loctite #242 on 7/16-14UNC hexagon socket head bolt, and then, bolt.
Tighten 7/16-14UNC hexagon socket head bolt to specified torque, with torque wrench.

(3) Fill gear oil (6 liter) into drain port.

(4) Apply gear oil on PF3/4 hydraulic plug and then, bolt.



25098TM165

1. REMOVAL AND INSTALL

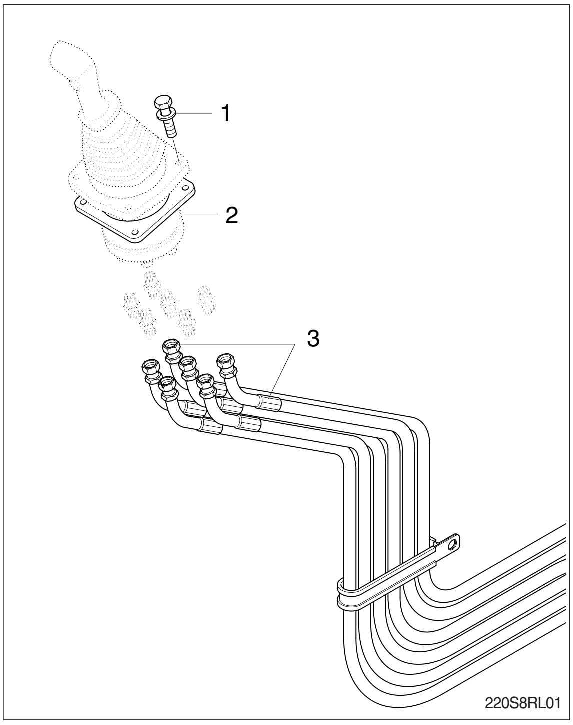
1) REMOVAL

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

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

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

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



(4) Loosen the socket bolt (1).
Tightening torque : 1.05 ± 0.2 kgf · m
(7.6 ± 1.45 lbf · ft)

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.

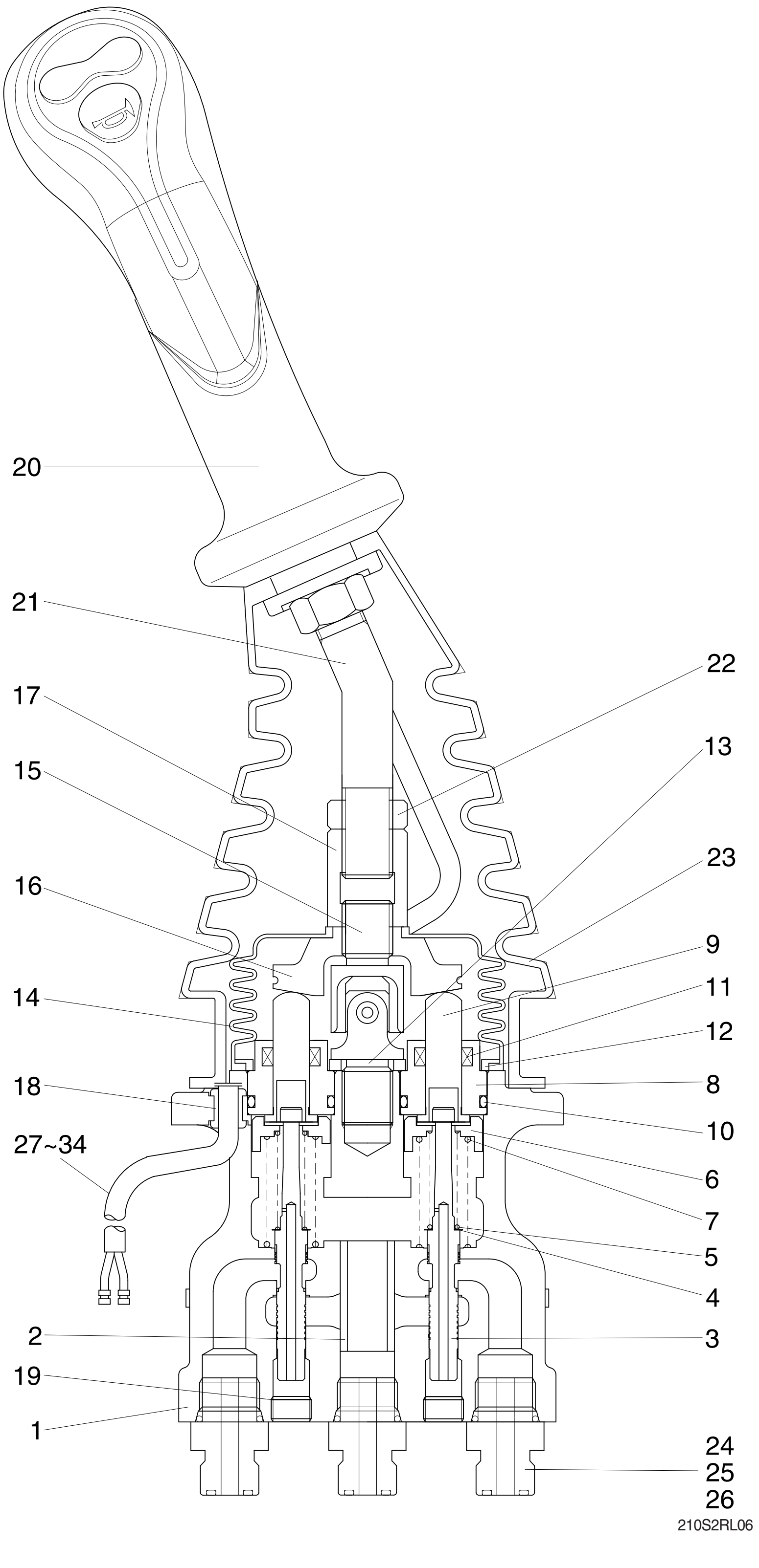
2) INSTALL

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

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

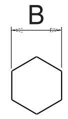
1) STRUCTURE



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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
Spanne	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	15	M14	3.8	27.5
Swash plate	16	M14	7.0±0.40	50.6±2.9
Adjusting nut	17	M14	7.0±0.40	50.6±2.9
Lock nut	22	M14	5.0±0.35	36.2±2.5

3) DISASSEMBLY

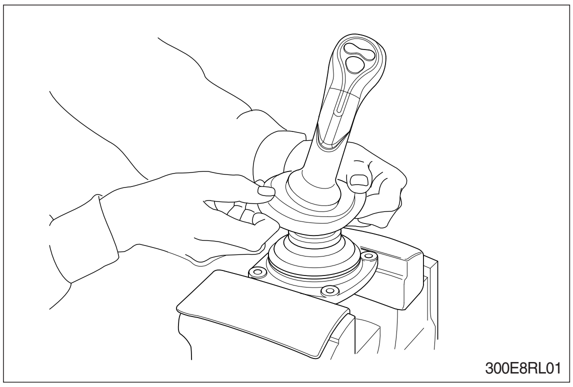
※ Procedures are based on the type M1.

(1) Clean pilot valve with kerosene.

※ Put blind plugs into all ports

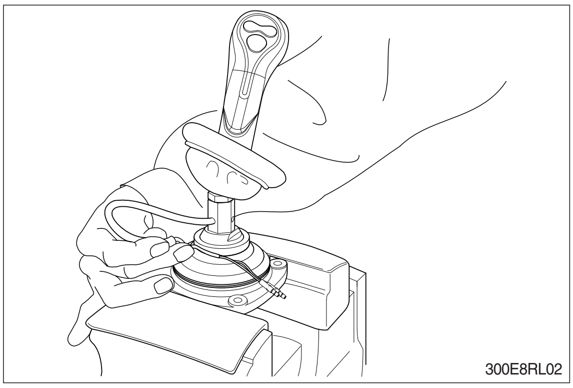
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (23) from case (1) and take it out upwards.



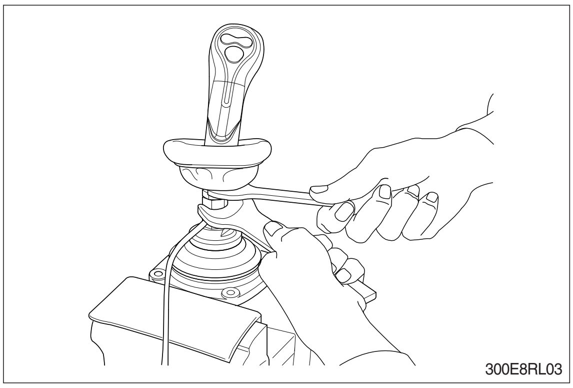
300E8RL01

※ For valve with switch, remove cord also through hole of casing.



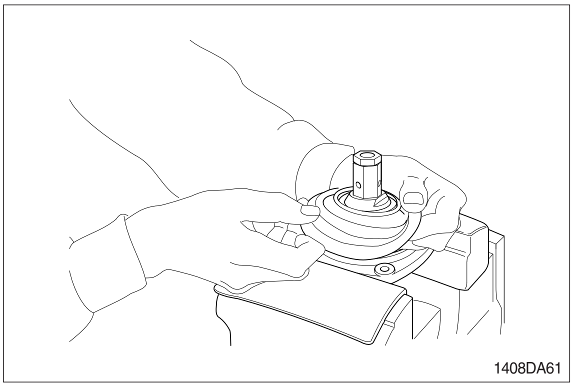
300E8RL02

(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



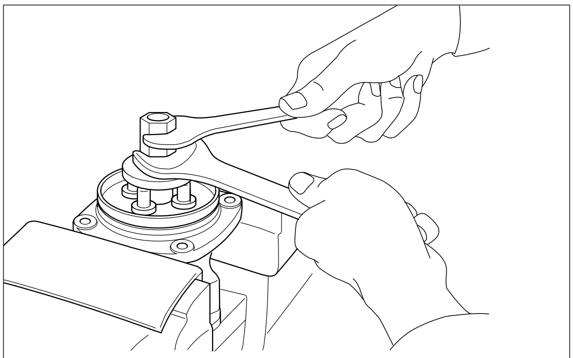
300E8RL03

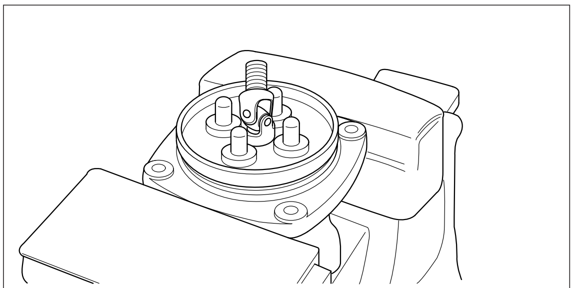
(5) Remove the boot (14).



1408DA61

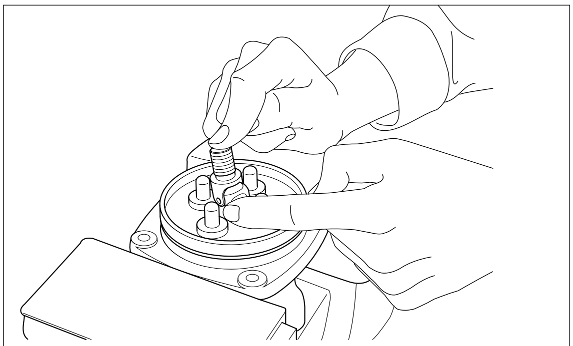
(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.

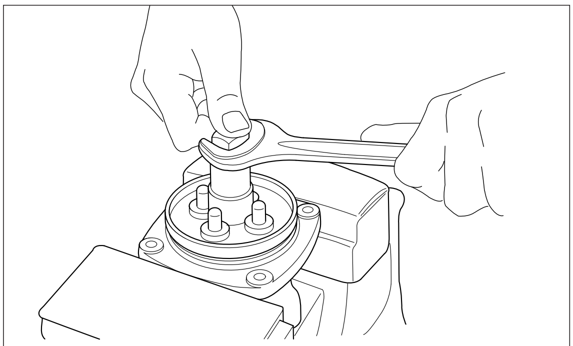

36078RL01


36078RL02

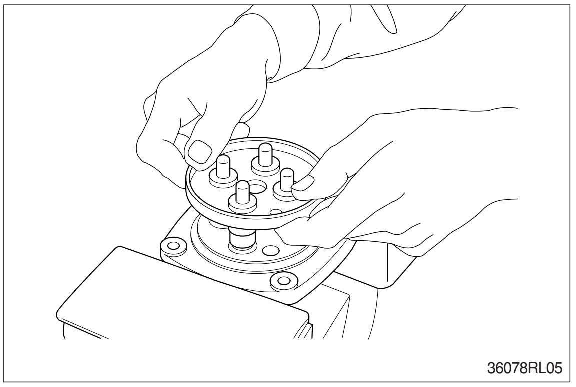
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ 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

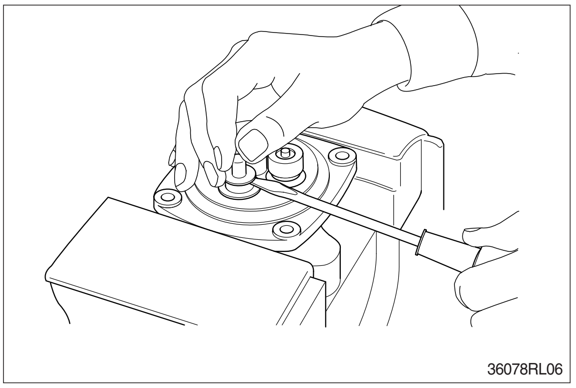

36078RL04

(8) Remove plate (12).



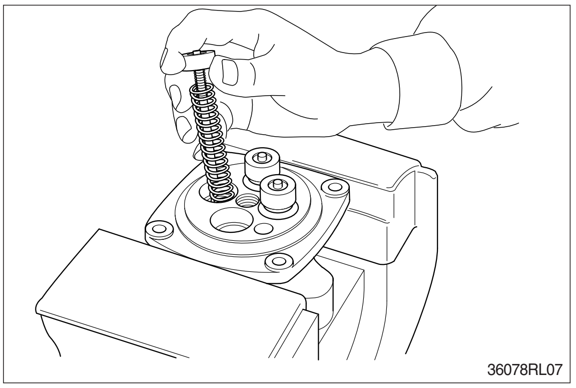
36078RL05

(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.



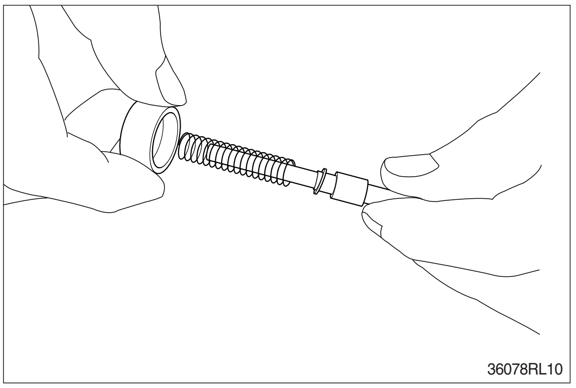
36078RL06

(10) Remove reducing valve subassembly and return spring (7) out of casing.
※ Record relative position of reducing valve subassembly and return springs.



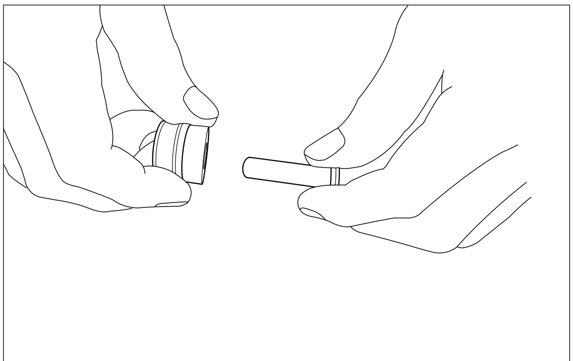
36078RL07

(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.



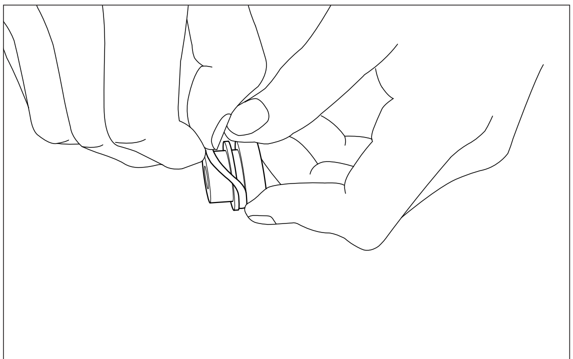
36078RL10

(12) Take push rod (9) out of plug (8).

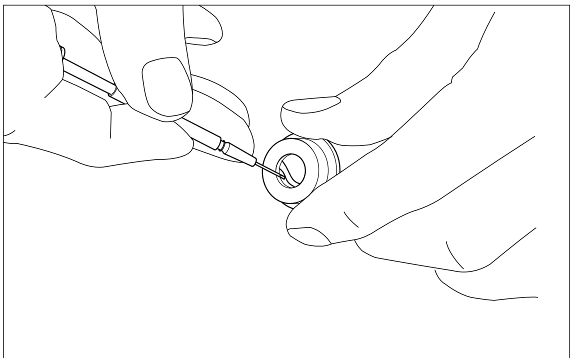


36078RL11

(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.

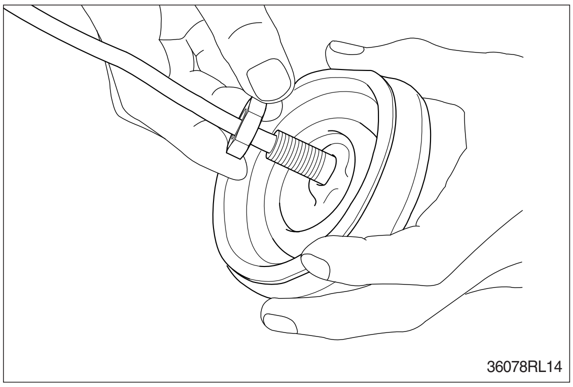


36078RL12

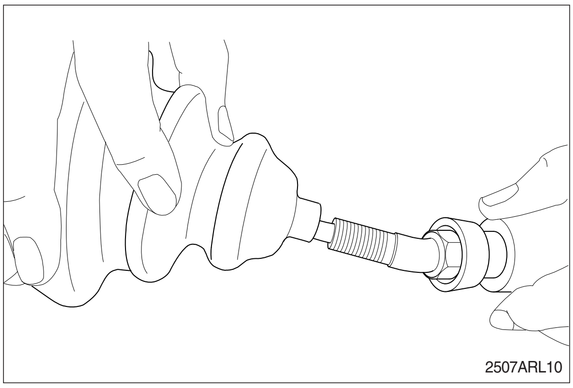


36078RL13

(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.

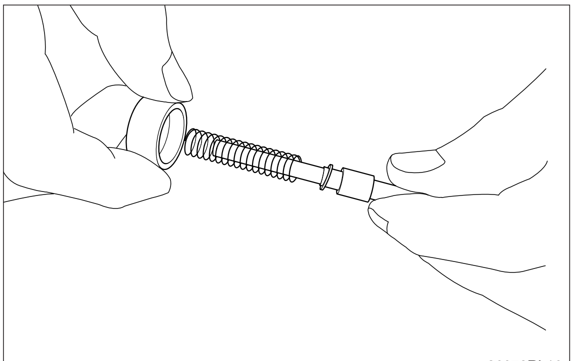
(16) Rust prevention of parts

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

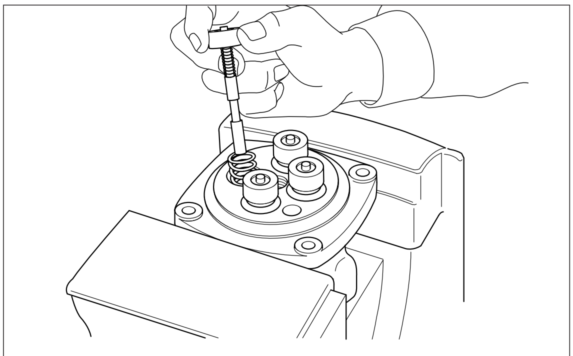
(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



36078RL16

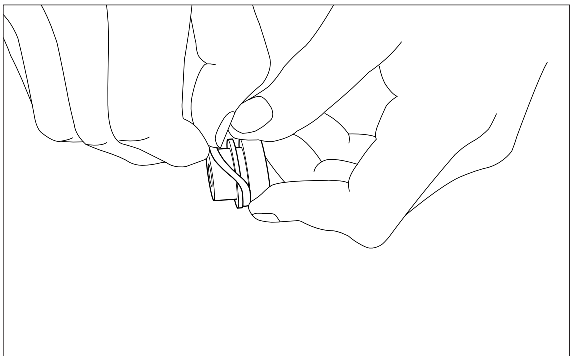
(2) Assemble spring (7) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



36078RL18

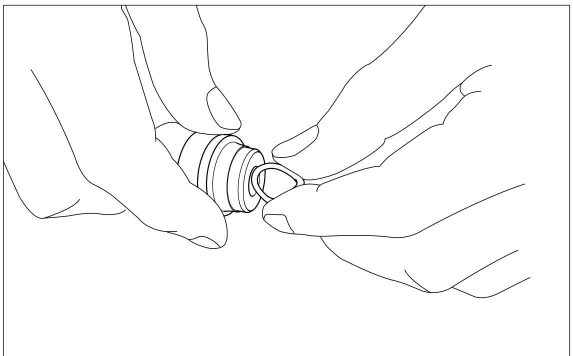
(3) Assemble O-ring (10) onto plug (8).



36078RL19

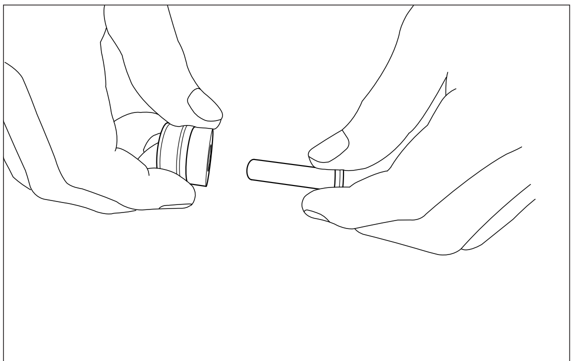
(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.

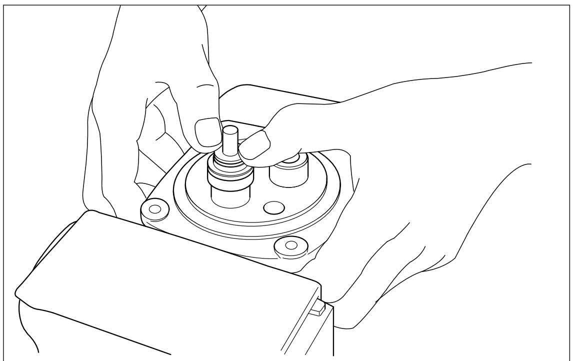


36078RL20

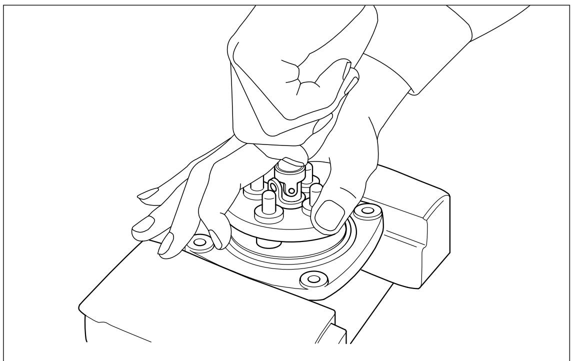
(5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.


36078RL21

(6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

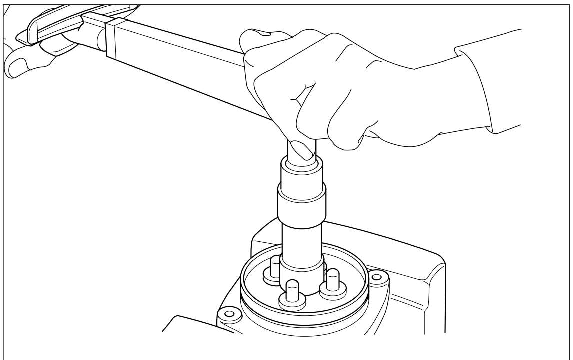

36078RL22

(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).

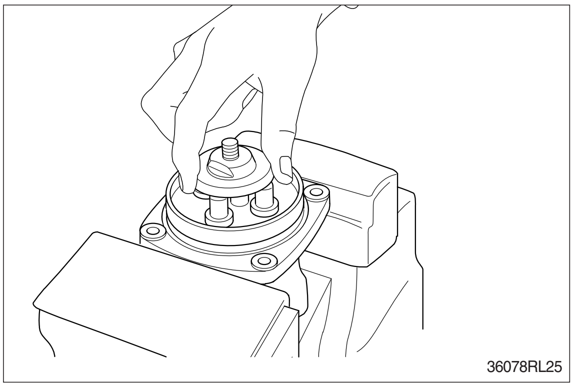
(9) Tighten joint (15) with the specified torque to casing, utilizing jig.


36078RL24

(10) Assemble swash plate (16) to joint (15).

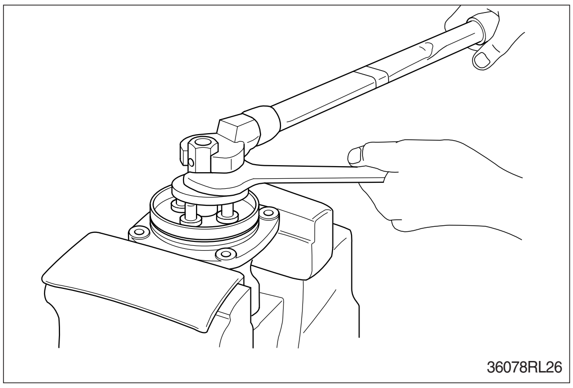
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

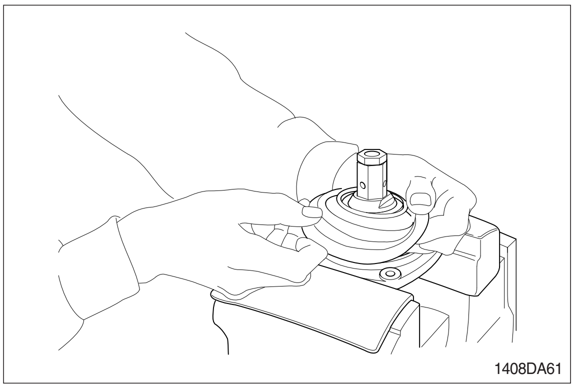


(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

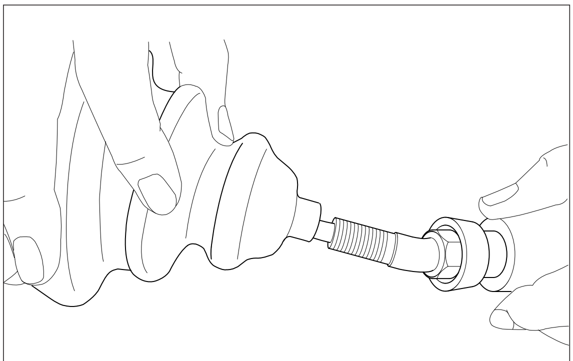
※ During tightening, do not change position of disk.



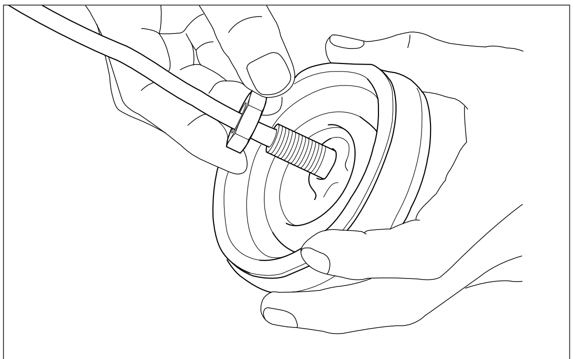
(12) Fit boot (14) to plate.



(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.

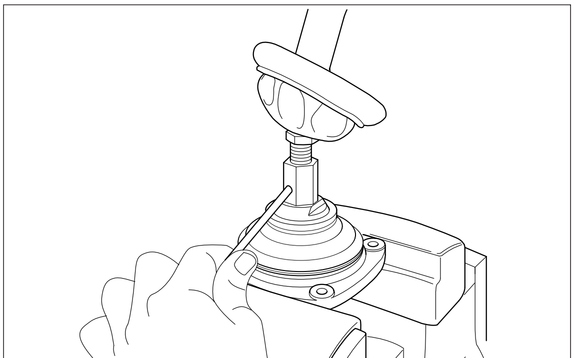


2507ARL10



36078RL27

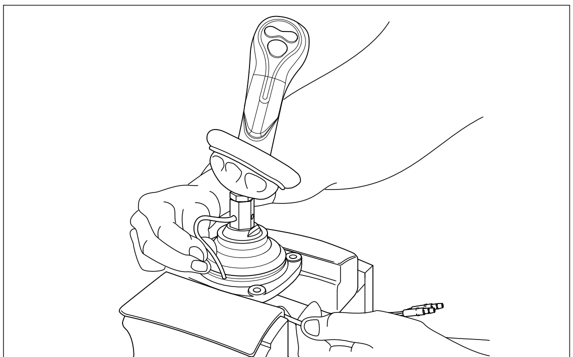
(14) Pull out cord and tube through adjusting nut hole provided in direction 60 °to 120 °from casing hole.



1408DA66

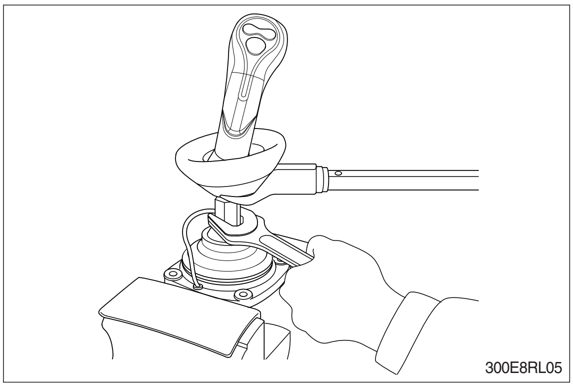
(15) Assemble bushing (18) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.

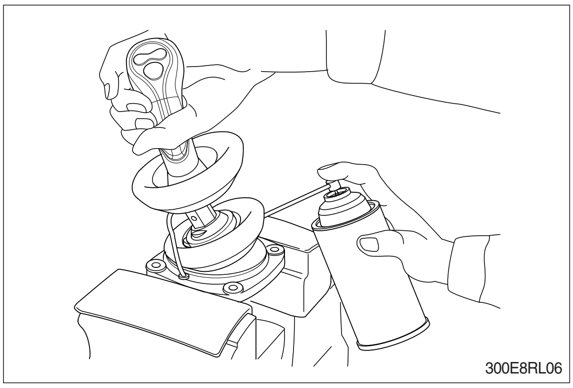


300E8RL04

(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

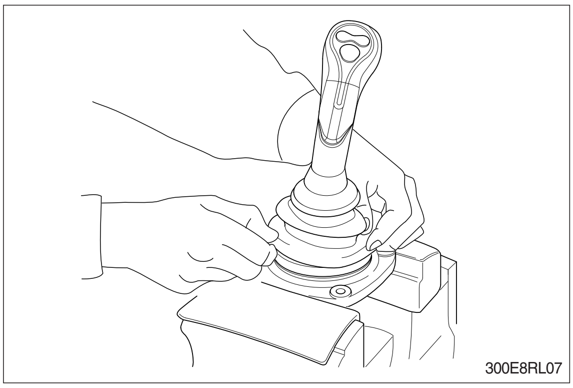


(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(18) Assemble lower end of bellows to casing.

(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

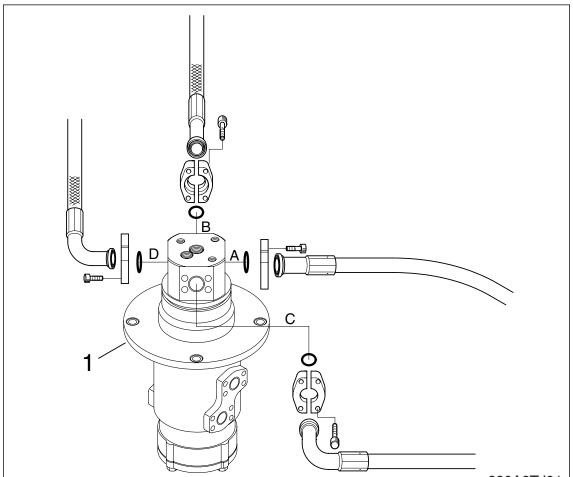
13031GE18

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

· Weight : 53 kg (117 lb)

· Tightening torque : 12.3 ± 1.3 kgf · m
(90.0 ± 9.4 lbf · ft)



220A8TJ01

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

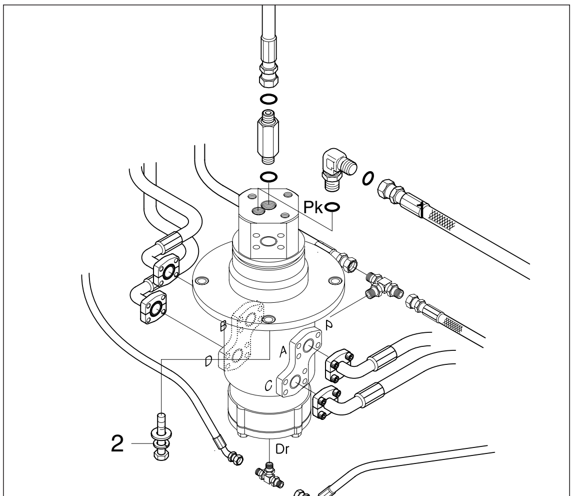
2) INSTALL

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

※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

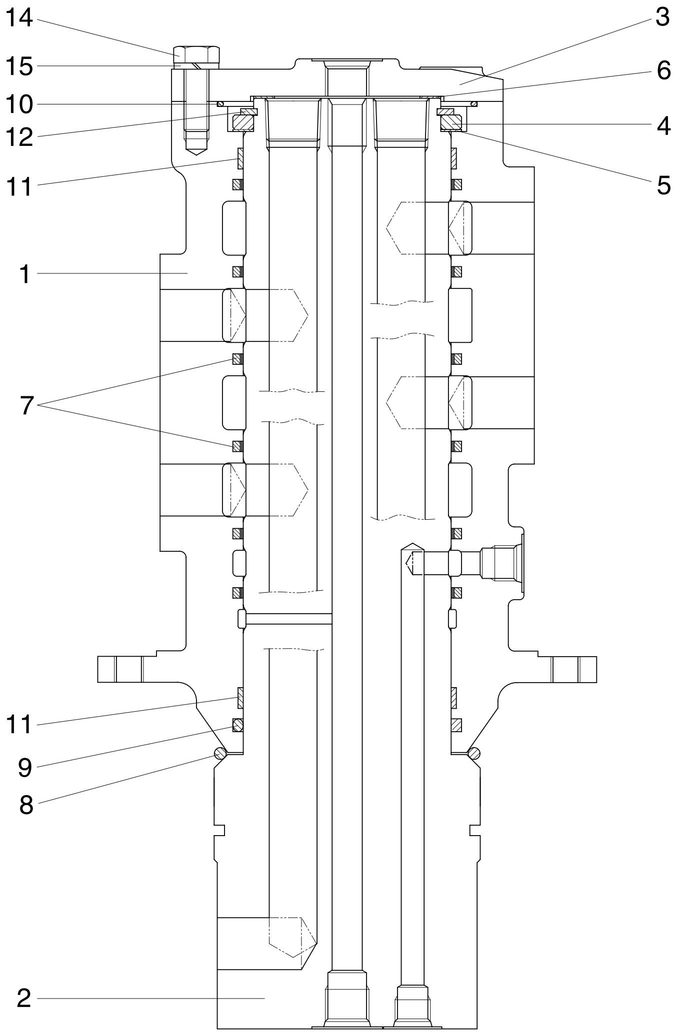
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



220A8TJ02

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



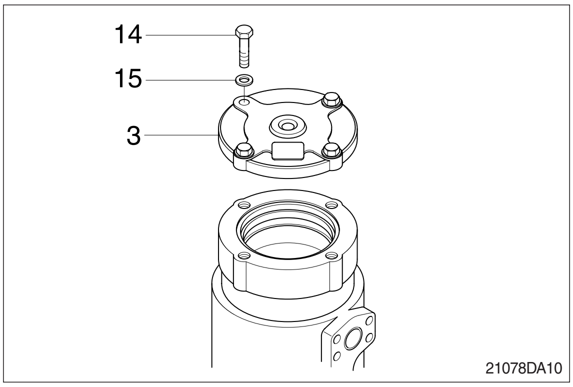
21098TJ01

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

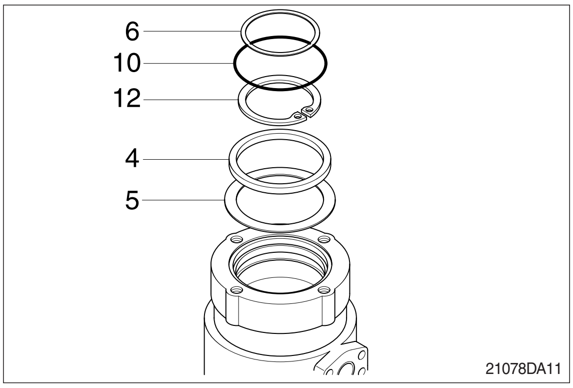
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (14), washer (15) and cover (3).



(2) Remove shim (6) and O-ring (10).

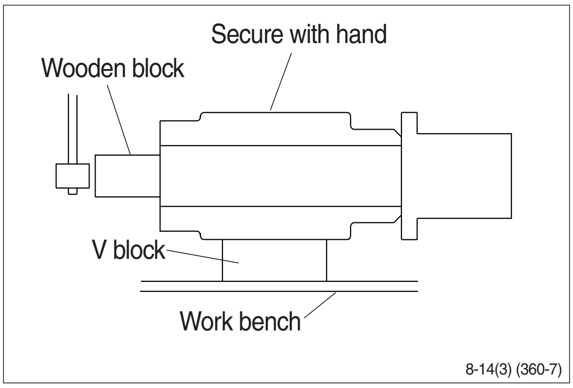
(3) Remove retainer ring (12), spacer (4) and shim (5).



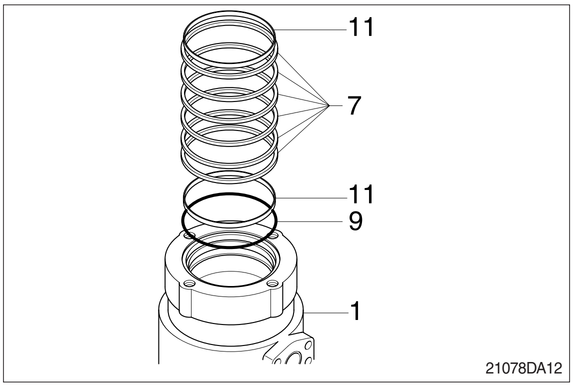
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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

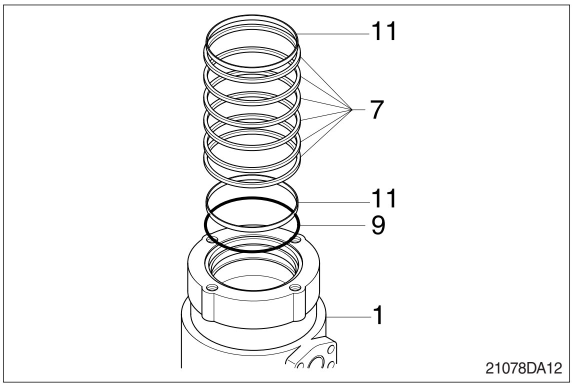
※ Clean all parts.

※ As a general rule, replace oil seals and O-ring.

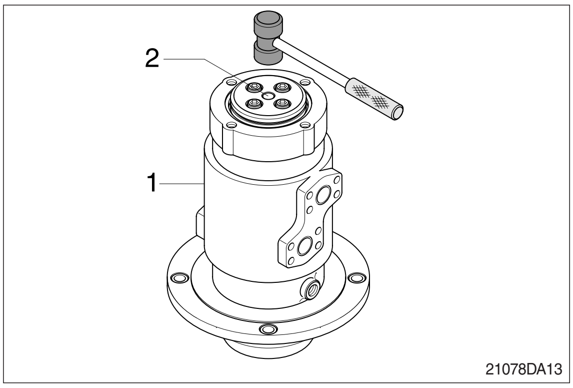
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(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).



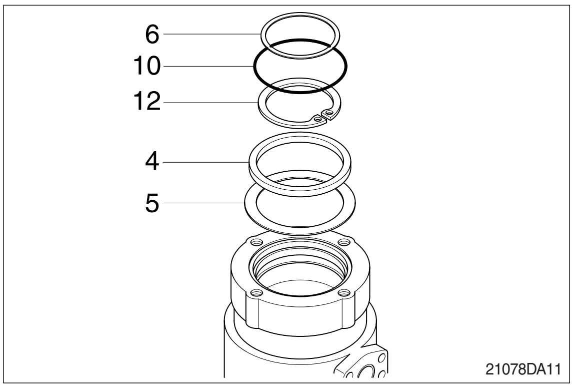
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

(5) Fit O-ring (10) to hub (1).

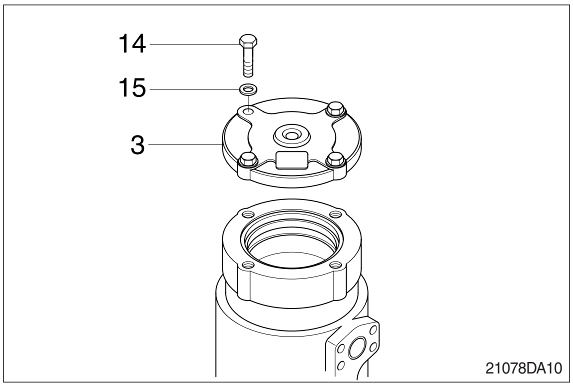
(6) Fit shim (6) to shaft (2).



(7) Install cover (3) to body (1) and tighten bolts (14).

· Torque : 10~12.5 kgf · m

(72.3~90.4 lbf · ft)



GROUP 9 BOOM, ARM AND BUCKET CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

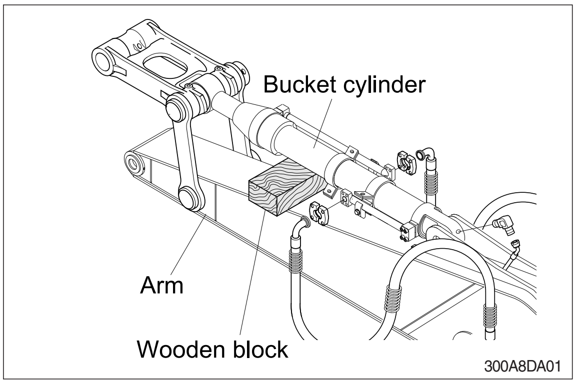
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

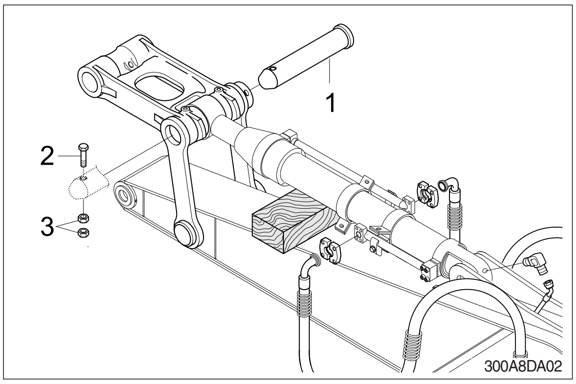
① Set block between bucket cylinder and arm.



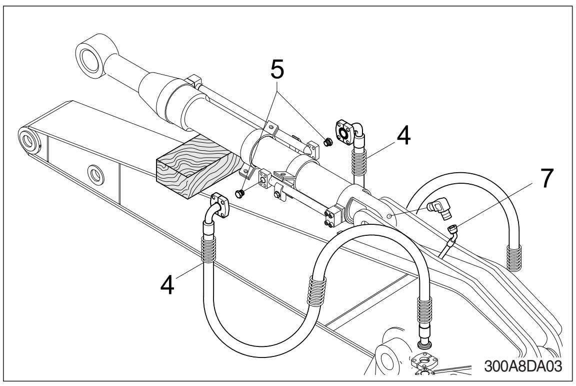
② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (2) : 57.9±8.7 kgf · m
(419±62.9 lbf · ft)

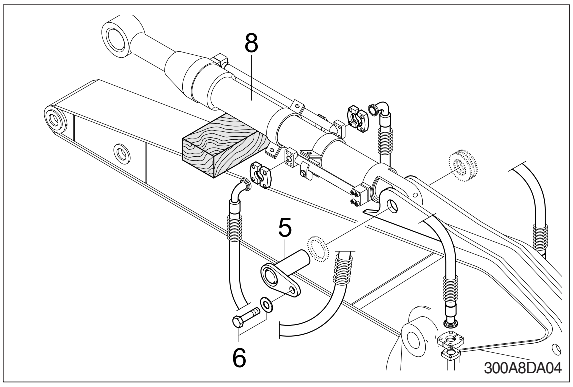


③ Disconnect bucket cylinder hoses (4), grease line hose (7) and put plugs (5) on cylinder pipe.



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
  · Tightening torque (6) : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

⑤ Remove bucket cylinder assembly (8).
  · Weight : 206 kg (453 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.

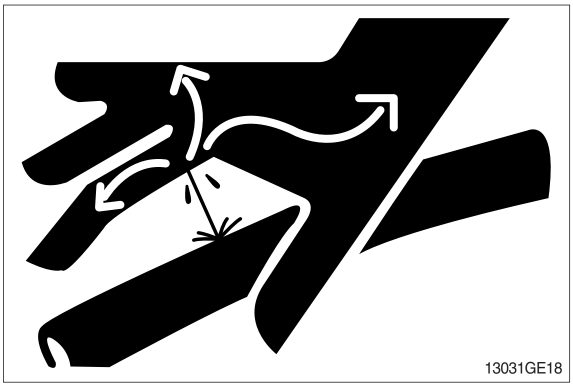
2) ARM CYLINDER

(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.

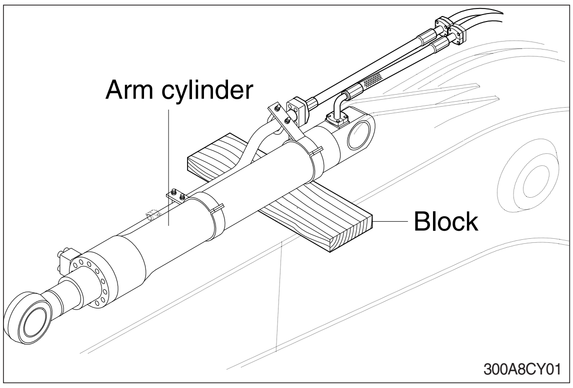


13031GE18

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



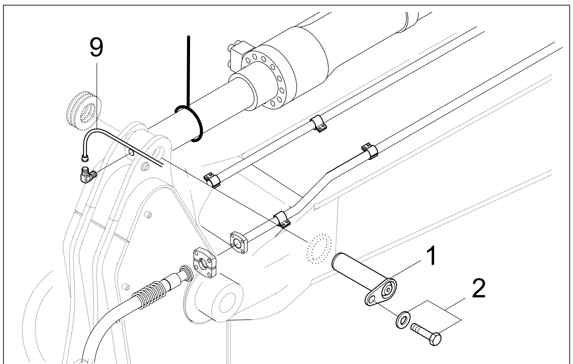
300A8CY01

② Disconnect grease line hose (9).

③ Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

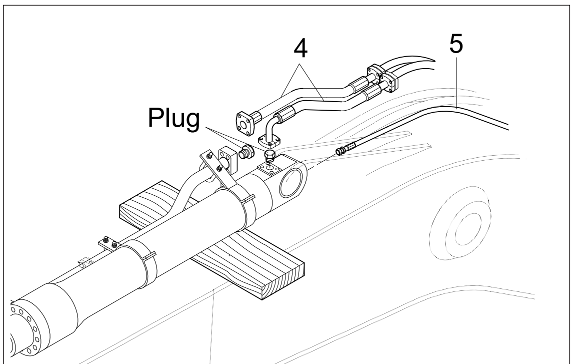
· Tightening torque (2) : 57.9±8.7 kgf · m (419±62.9 lbf · ft)



300A8CY02

④ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

⑤ Disconnect greasing pipings (5).



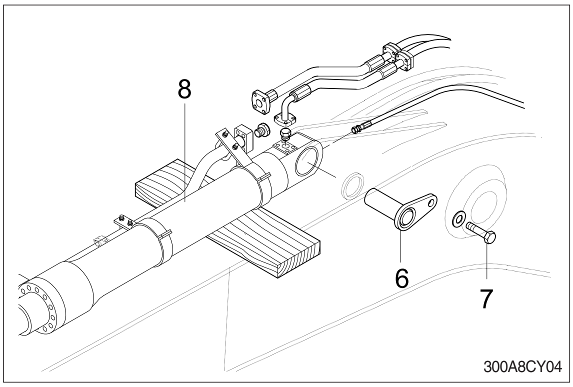
300A8CY03

⑥ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).

· Tightening torque (7) : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

⑦ Remove arm cylinder assembly (8).

· Weight : 334 kg (736 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

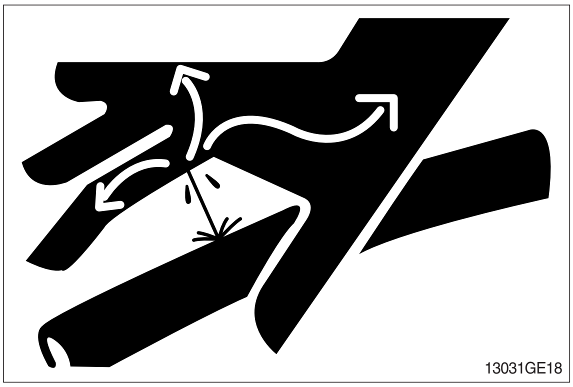
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.



13031GE18

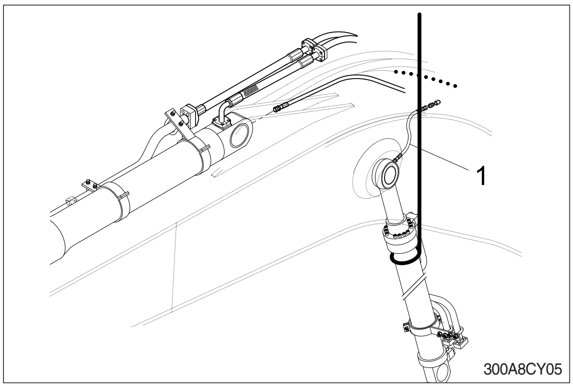
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

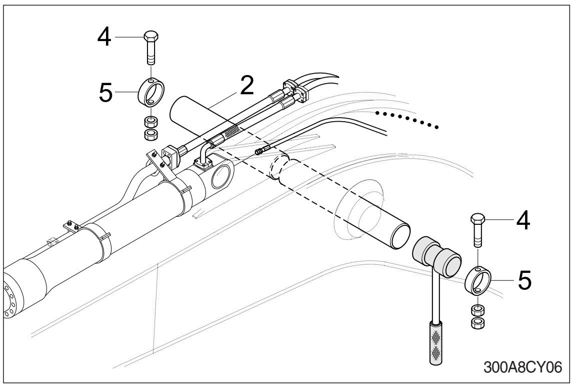


300A8CY05

③ Remove bolt (4), stopper (5) and pull out pin (2).

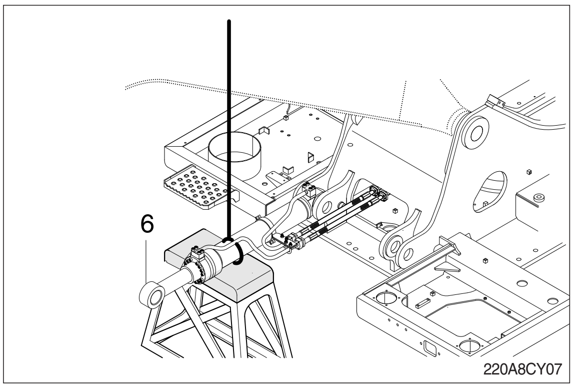
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (4) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)



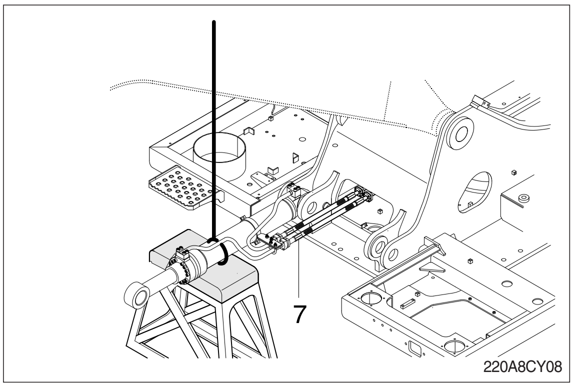
300A8CY06

④ Lower the boom cylinder assembly (6) on a stand.



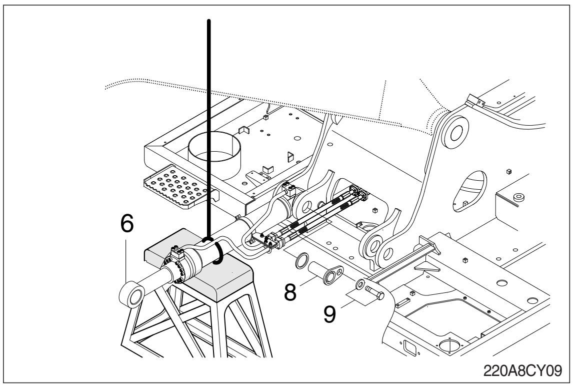
220A8CY07

⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



⑥ Remove bolt (9) and pull out pin (8).
  · Tightening torque (9) : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

⑦ Remove boom cylinder assembly (6).
  · Weight : 237 kg (522 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

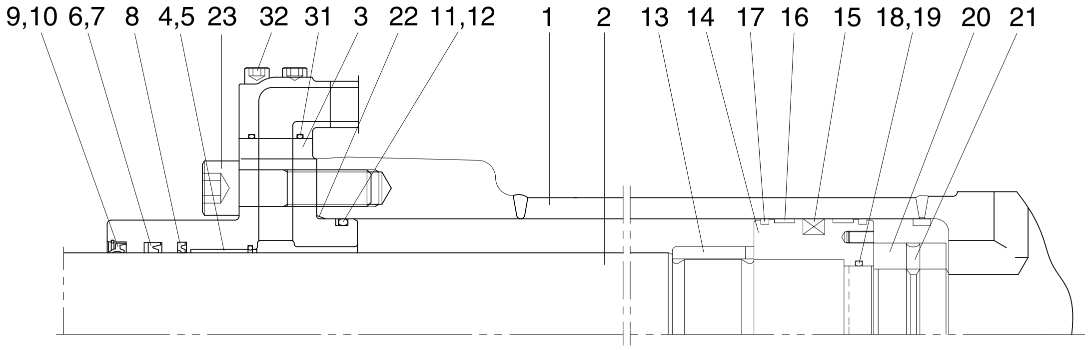
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

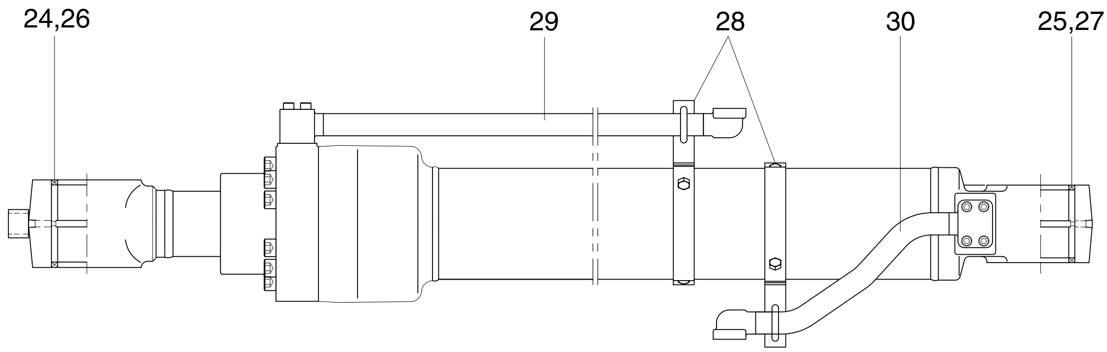
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder (CHANGZHOU)



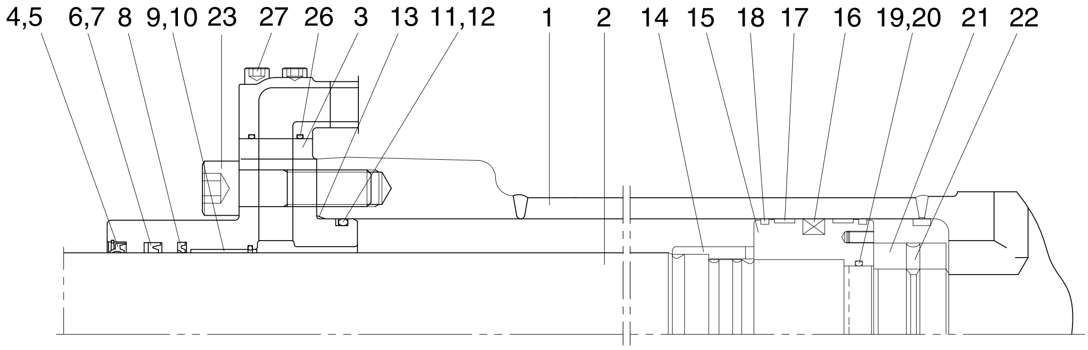
Internal detail



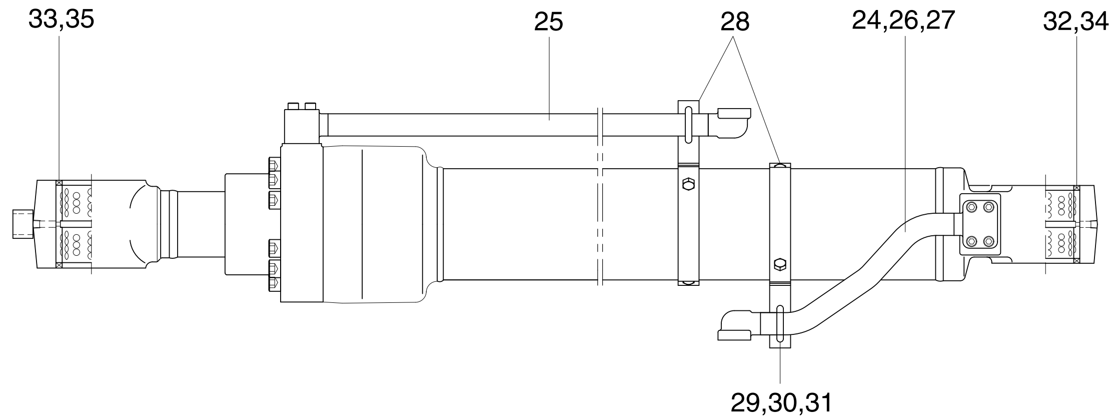
31Q7-60111CGG-01

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dimple bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Dust seal
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	29	Pipe assembly-R
8	Buffer ring	19	Back up ring	30	Pipe assembly-B
9	Dust wiper	20	Lock nut	31	O-ring
10	Snap ring	21	Hexagon socket set screw	32	Hexagon socket head bolt
11	O-ring	22	O-ring		

Bucket cylinder (SHPAC)



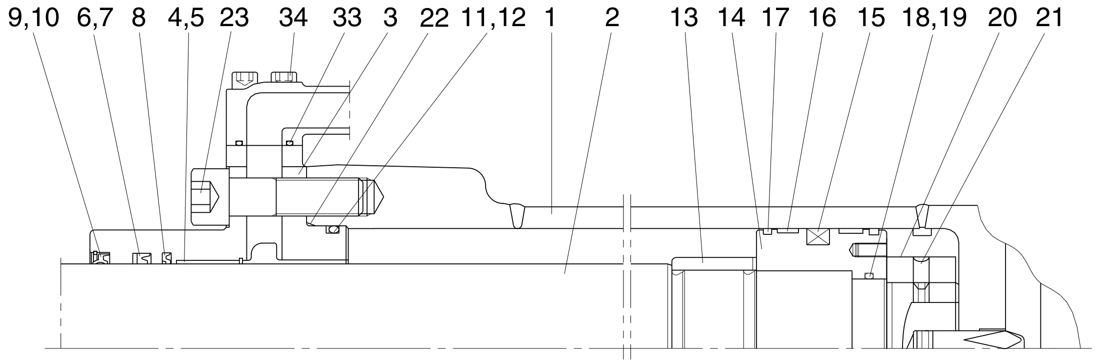
Internal detail



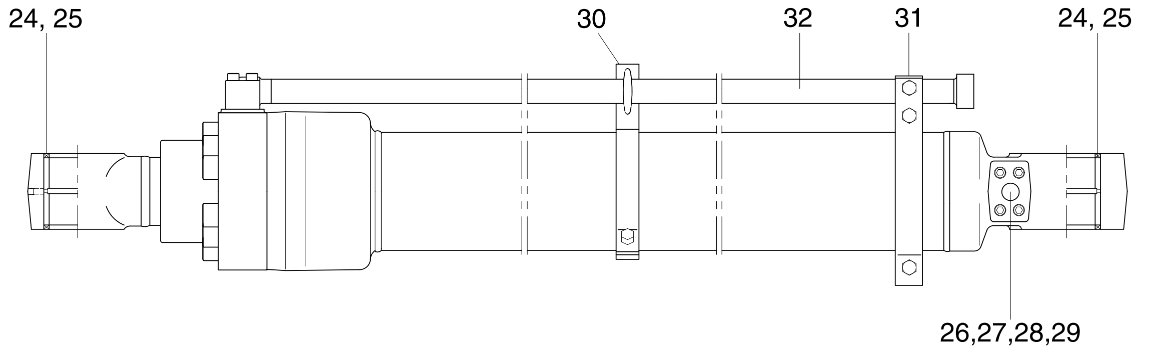
31Q7-60111EGG-01

1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	Dimple bushing
9	Dry bearing	21	Lock nut	33	Dimple bushing
10	Retaining ring	22	Hexagon socket set screw	34	Dust seal
11	O-ring	23	Hexagon socket head bolt	35	Dust seal
12	Back up ring	24	Pipe assembly-B		

(2) Arm cylinder (CHANGZHOU)



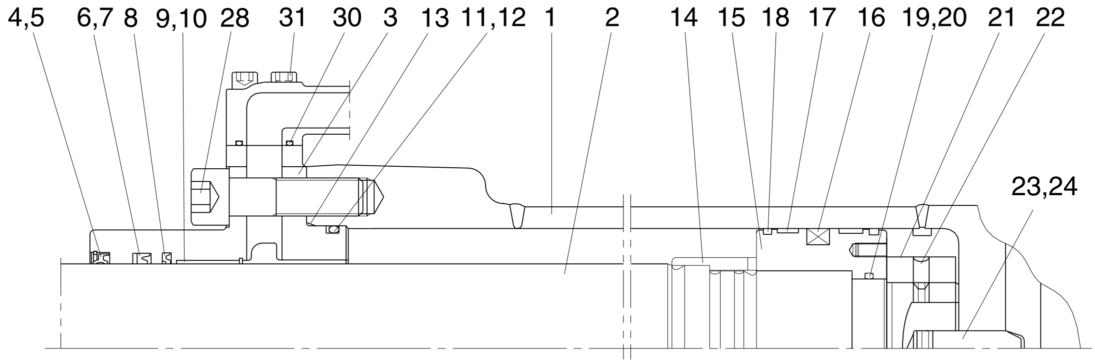
Internal detail



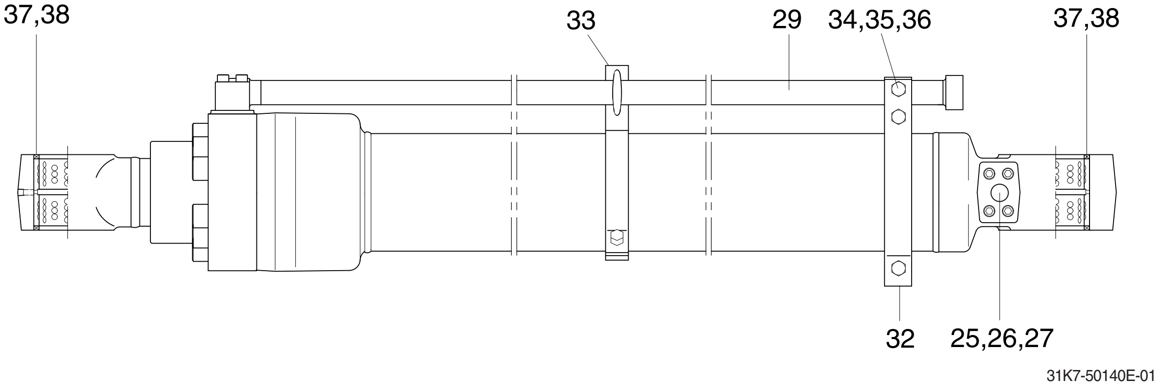
31K7-50140C-01

1 Tube assembly
2 Rod assembly
3 Gland
4 DD2 bushing
5 Snap ring
6 Rod seal
7 Back up ring
8 Buffer ring
9 Dust wiper
10 Snap ring
11 O-ring
12 Back up ring
13 Cushion ring
14 Piston
15 Piston seal
16 Wear ring
17 Dust ring
18 O-ring
19 Back up ring
20 Lock nut
21 Hexagon socket set screw
22 O-ring
23 Hexagon socket head bolt
24 Pin bushing
25 Dust seal
26 Check valve
27 Coil spring
28 O-ring
29 Plug
30 Band assembly-R
31 Band assembly-B
32 Pipe assembly-R
33 O-ring
34 Hexagon socket head bolt

Arm cylinder (SPHAC)

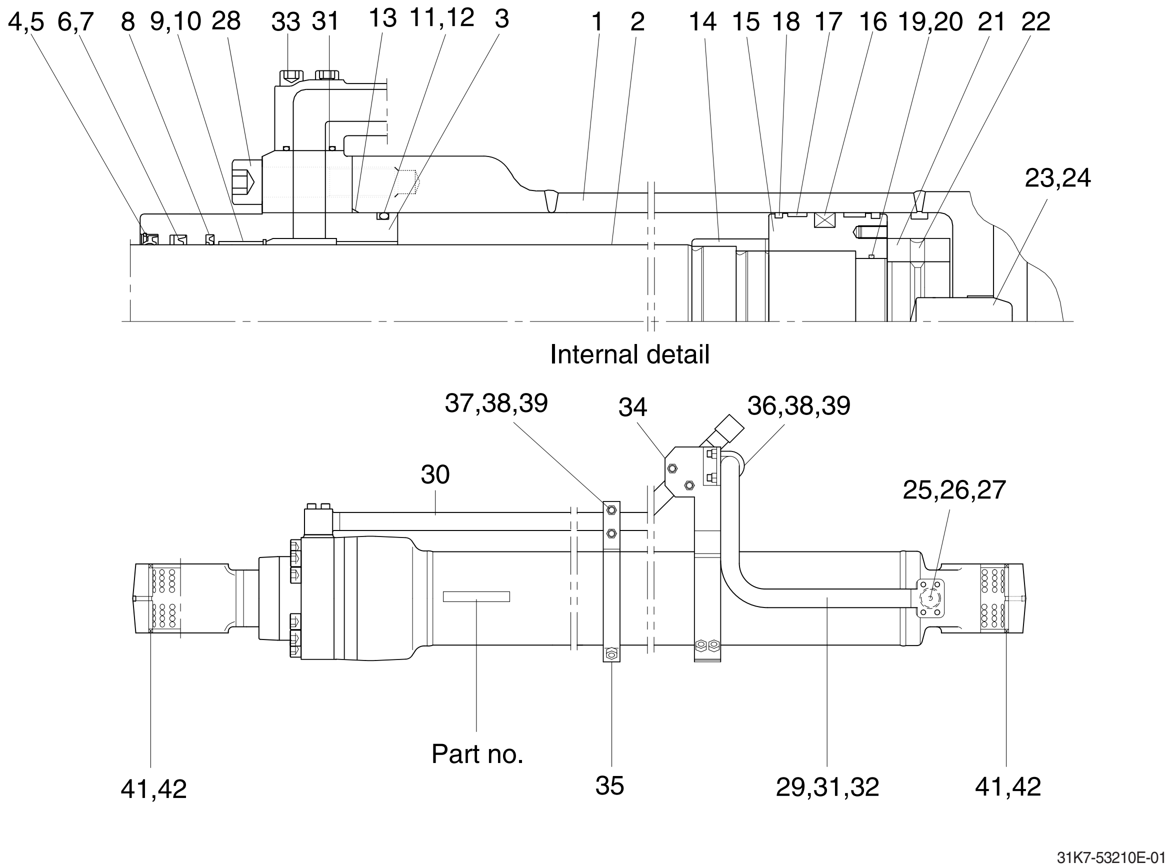


Internal detail



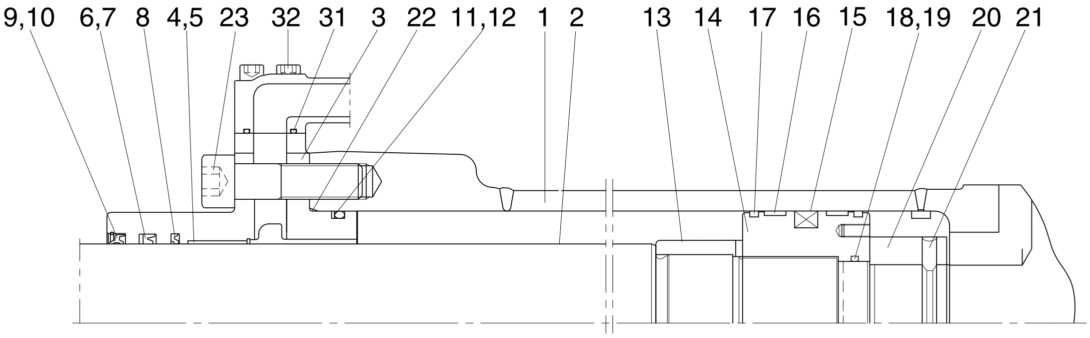
1	Tube assembly	14	Cushion ring	27	Plug
2	Rod assembly	15	Piston	28	Hexagon socket head bolt
3	Gland	16	Piston seal	29	Pipe assembly-R
4	Dust wiper	17	Wear ring	30	O-ring
5	Retainring ring	18	Dust ring	31	Hexagon socket head bolt
6	Rod seal	19	O-ring	32	Band assembly-B
7	Back up ring	20	Back up ring	33	Band assembly-R
8	Buffer ring	21	Lock nut	34	U-bolt
9	Dry bearing	22	Hexagon socket set screw	35	Hexagon nut
10	Retainring ring	23	Cushion plunger	36	Spring washer
11	O-ring	24	Stop ring	37	Dimple bushing
12	Back up ring	25	Check valve	38	Dust seal
13	O-ring	26	Coil spring		

Arm cylinder (2-piece)

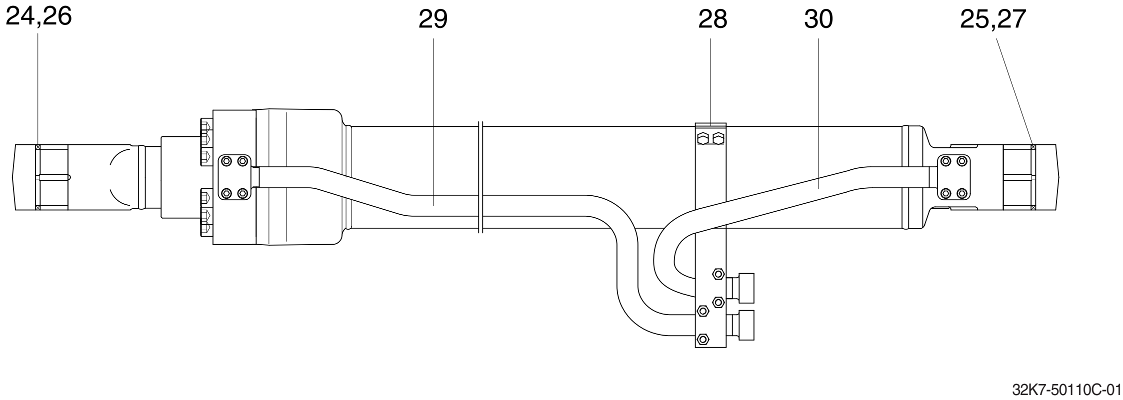


1	Tube assembly	15	Piston	29	Pipe assembly-B
2	Rod assembly	16	Piston seal	30	Pipe assembly-R
3	Gland	17	Wear ring	31	O-ring
4	Dust wiper	18	Dust ring	32	Hexagon socket head bolt
5	Retainring ring	19	O-ring	33	Hexagon socket head bolt
6	Rod seal	20	Back up ring	34	Band assembly-B
7	Back up ring	21	Lock nut	35	Band assembly-R
8	Buffer ring	22	Hexagon socket set screw	36	U-bolt
9	Dry bearing	23	Cushion plunger	37	U-bolt
10	Retainring ring	24	Stop ring	38	Hexagon nut
11	O-ring	25	Check valve	39	Spring washer
12	Back up ring	26	Coil spring\	40	O-ring
13	O-ring	27	Plug	41	Dimple bushing
14	Cushion ring	28	Hexagon socket head bolt	42	Dust seal

(3) Boom cylinder (CHANGZHOU)

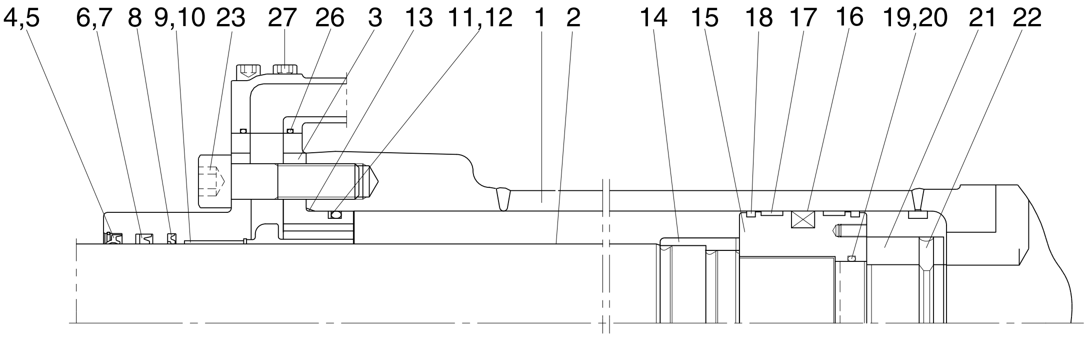


Internal detail

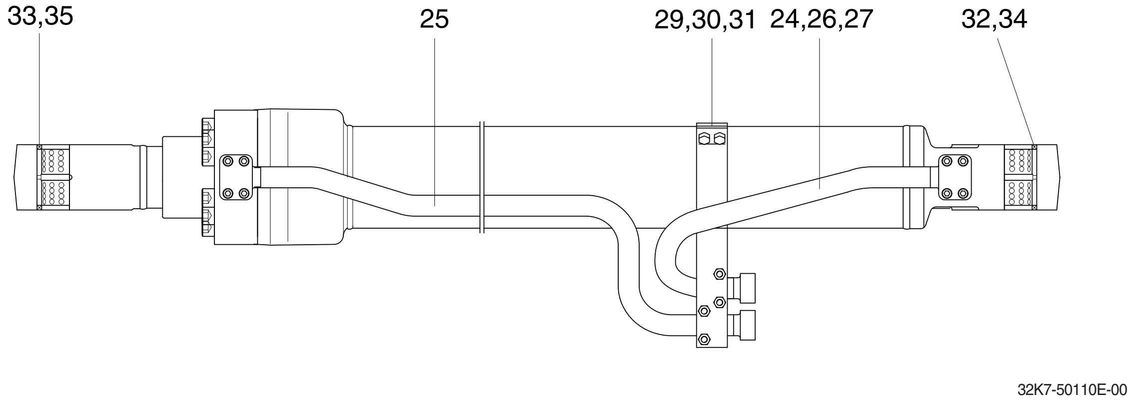


1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dimple bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Dust seal
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	29	Pipe assembly-R, LH/RH
8	Buffer ring	19	Back up ring	30	Pipe assembly-B, LH/RH
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		

Boom cylinder (SHPAC)

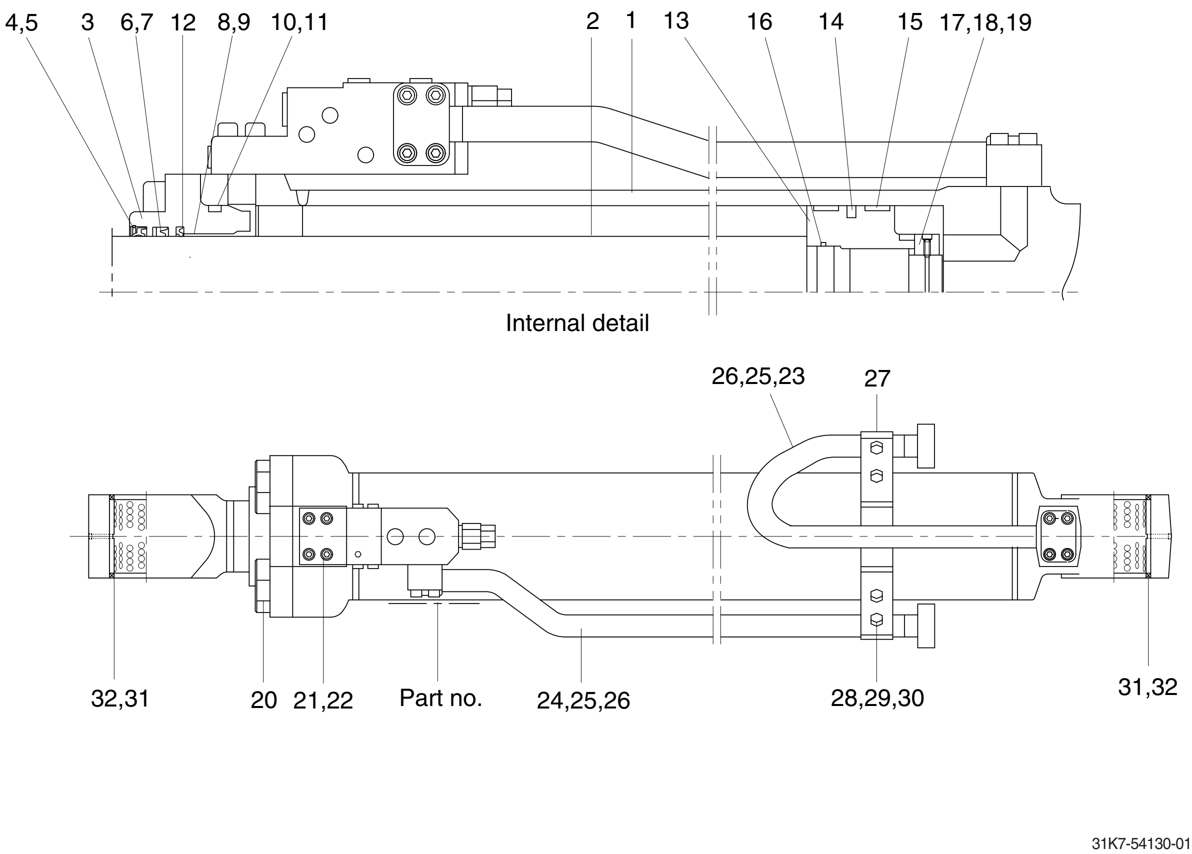


Internal detail



1	Tube assembly	13	O-ring	25	Pipe assembly-R, LH/RH
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	Dimple bushing
9	Dry bearing	21	Lock nut	33	Dimple bushing
10	Retaining ring	22	Hexagon socket set screw	34	Dust seal
11	O-ring	23	Hexagon socket head bolt	35	Dust seal
12	Back up ring	24	Pipe assembly-B, LH/RH		

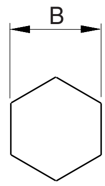
(4) Adjust cylinder



1	Tube assembly	12	Buffer ring	23	Pipe assembly-B, LH/RH
2	Rod assembly	13	Piston	24	Pipe assembly-R, LH/RH
3	Gland	14	Piston seal	25	Hexagon socket head bolt
4	Dust wiper	15	Wear ring	26	O-ring
5	Retaining ring	16	O-ring	27	Band assembly
6	Rod seal	17	Lock nut	28	U-bolt
7	Back up ring	18	Lock washer	29	Hexagon nut
8	Dry bearing	19	Hexagon socket set screw	30	Spring washer
9	Retaining ring	20	Hexagon socket head bolt	31	Dimple bushing
10	O-ring	21	Safety valve	32	Dust seal
11	Back up ring	22	Hexagon socket head bolt		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools	Remark	
Allen wrench	6	
	8	
	10	
	12	
	14	
	17	
Spanner	7	
	8	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	23★1★3 23★1★4	M18 M18	32±3.0 38±3.8	232±21.7 275±27.5
		32★3 27★4	M12 M12	9.4±1 11.3±1.1	68.0±7.2 81.7±8.0
	Boom cylinder	23★1★3 23★1★4	M18 M18	32±3 38±3.8	232±21.7 275±27.5
		32★3 27★4	M12 M12	9.4±1 11.3±1.1	68.0±7.2 81.7±8.0
	Arm cylinder	23★1★3 28★1★4 28★1★5	M20 M20 M20	48.0±5 52.2±5.2 52.2±5.2	347±36.2 378±37.6 378±37.6
		34★3 31★4 33★5	M12 M12 M12	9.4±1.0 11.3±1.1 11.3±1.1	68.0±7.2 81.7±8.0 81.7±8.0
	Adjustment cylinder	20★1★4 22★4	M20 M12	52.2±5.2 11.3±1.1	378±37.6 81.7±8.0

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU
★4 : SHPAC
★5 : 2-piece boom

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Lock nut	Bucket cylinder	20★3 21★4	- M65	100±10.0 100±10.0	723±72.3 723±72.3
	Boom cylinder	20★3 21★4	- M65	100±10.0 100±10.0	723±72.3 723±72.3
	Arm cylinder	20★3 21★4 21★5	- M76 M76	150±15.0 150±15.0 150±15.0	1085±108 1085±108 1085±108
	Adjustment cylinder	17★4	M65	62±6.0	448±43.4
Piston	Bucket cylinder	14★3 15★4	- M80	150±15.0 150±15.0	1085±108 1085±108
	Boom cylinder	14★3 15★4	- M85	150±15.0 150±15.0	1085±108 1085±108
	Arm cylinder	14★3 15★4 15★5	- M95 M95	200±20.0 200±20.0 200±20.0	1447±145 1447±145 1447±145
	Adjustment cylinder	13★4	M75	97±10	702±72.3
Set screw	Bucket cylinder	21★3 22★4	M10 M10	5.4±0.5 2.5±0.3	39.1±3.6 18.1±2.2
	Boom cylinder	21★3 22★4	M10 M10	5.4±0.5 2.5±0.3	39.1±3.6 18.1±2.2
	Arm cylinder	21★3 22★4 22★5	M10 M10 M10	5.4±0.5 2.5±0.3 2.5±0.3	39.1±3.6 18.1±2.2 18.1±2.2
	Adjustment cylinder	19★4	M8	1.7±0.2	12.3±1.4

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU
★4 : SHPAC
★5 : 2-piece boom

3) DISASSEMBLY

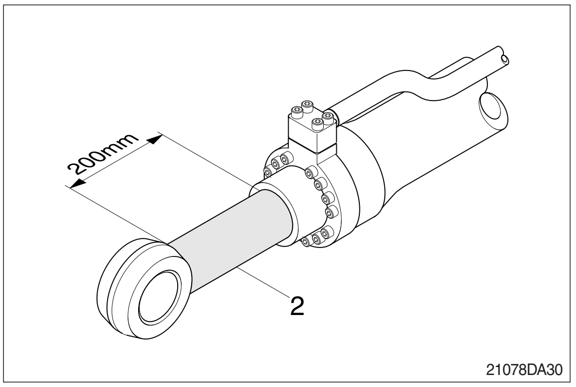
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder. (CHANGZHOU type)

① Hold the clevis section of the tube in a vise.

※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



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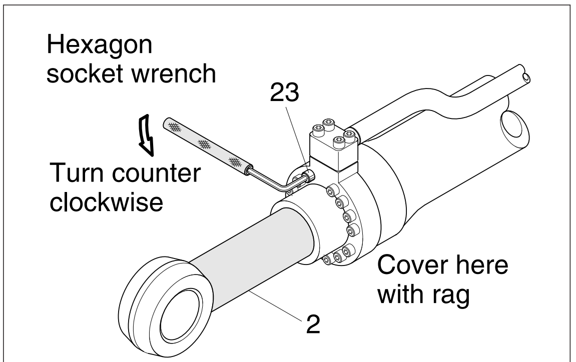
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



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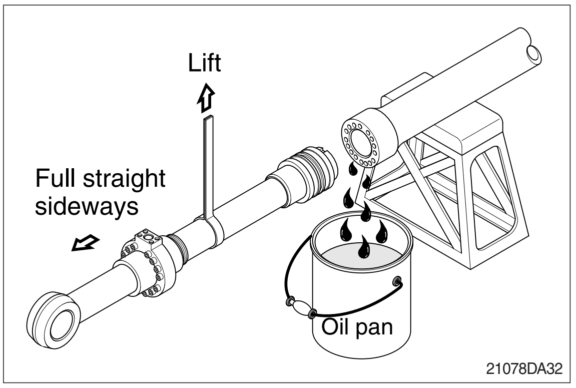
④ Draw out cylinder head and rod assembly together from tube assembly (1).

※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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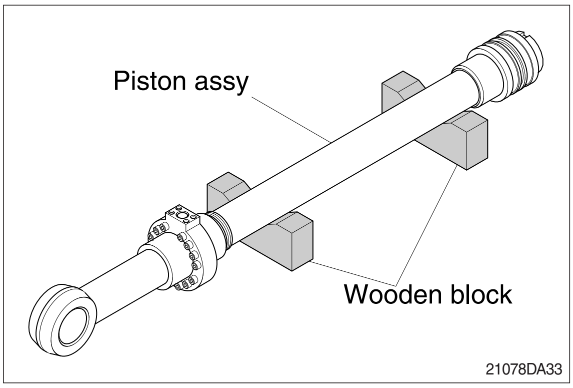
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.



(2) Remove piston and cylinder head

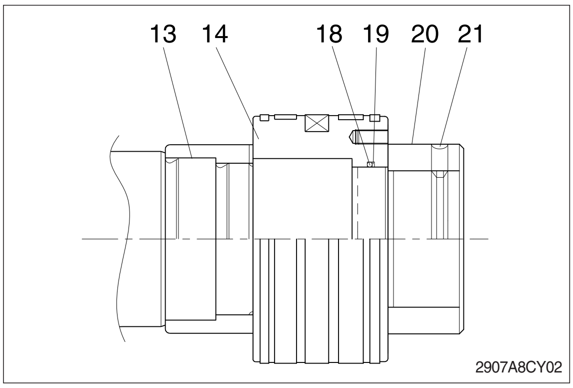
① Remove set screw (21).

② Remove lock nut (20).

※ Since piston (14) and lock nut (20) are tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the piston (14) and lock nut (20).

③ Remove piston assembly (14), back up ring (19), and O-ring (18).

④ Remove cushion ring (13).

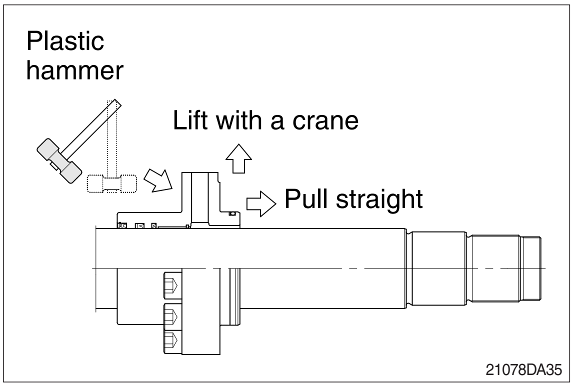


⑤ Remove the cylinder head assembly from rod assembly (2).

※ 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).

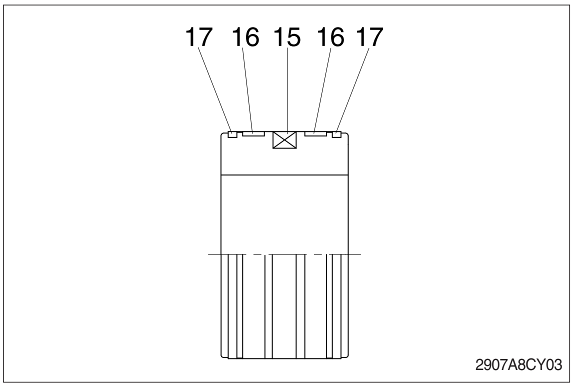


(3) Disassemble the piston assembly

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), O-ring (11) and O-ring (22).

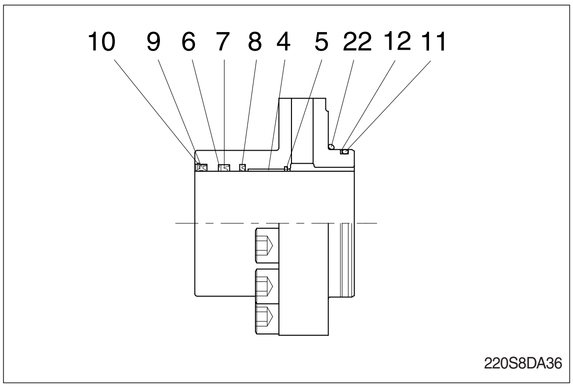
② Remove snap ring (10), dust wiper (9).

③ Remove back up ring (7), rod seal (6) and buffer ring (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

※ Do not remove bushing (4).

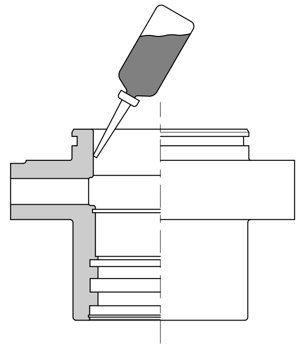


3) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

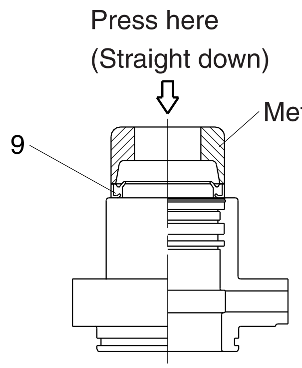
① Coat the inner face of gland (3) with hydraulic oil.



21078DA37

② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

③ Fit snap ring (10) to the stop face.

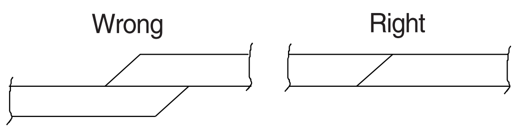


8-157(2)

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.

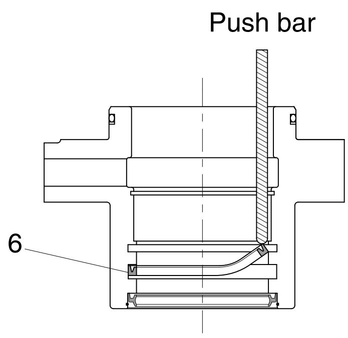
※ Insert the backup ring until one side of it is inserted into groove.



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.

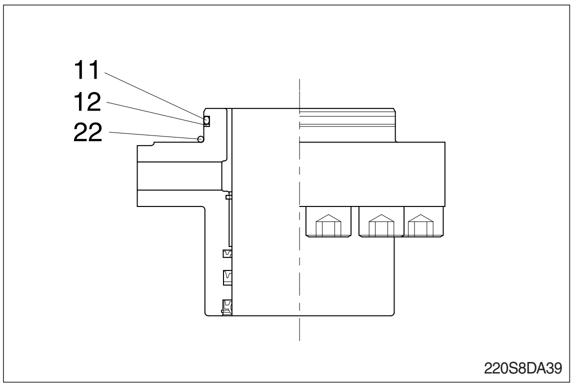


21078DA38

⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

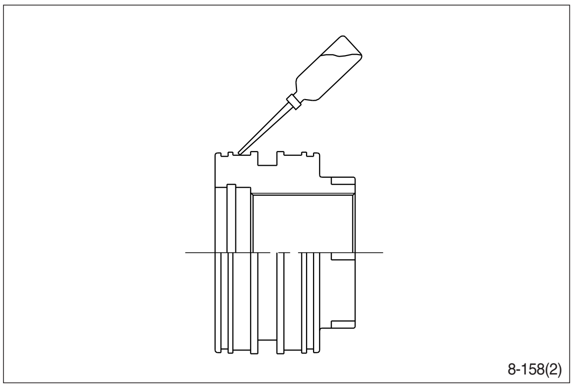
⑥ Fit O-ring (11) and O-ring (22) to gland (3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

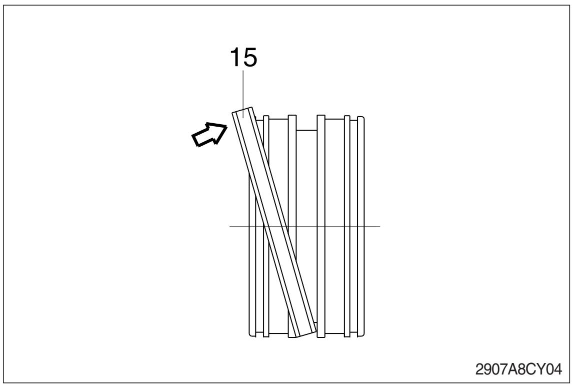
① Coat the outer face of piston (14) with hydraulic oil.



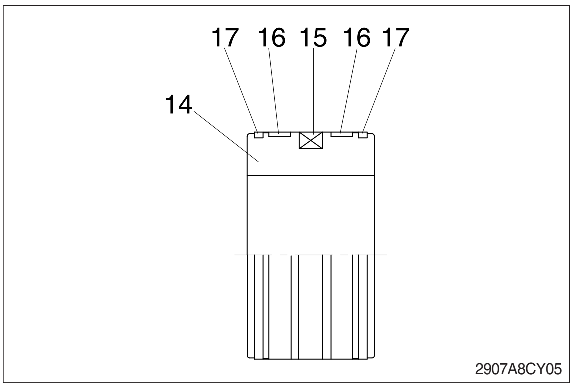
② Fit piston seal (15) to piston.

※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.

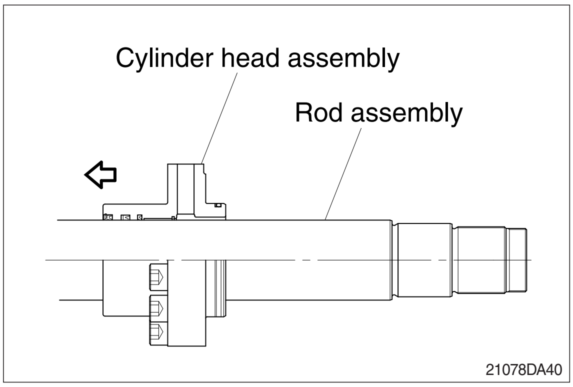


③ Fit wear ring (16) and dust ring (17) to piston (14).

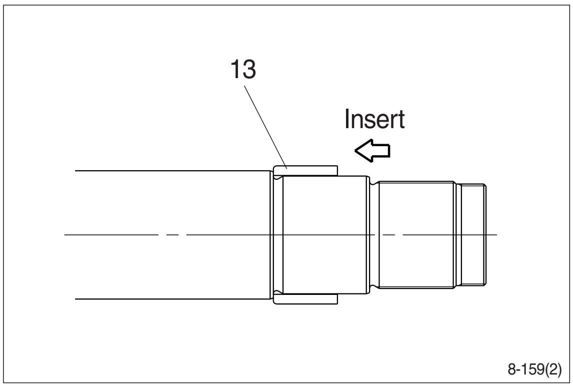


(3) Install piston and cylinder head

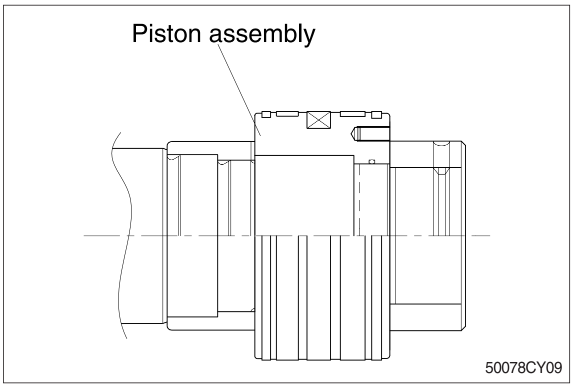
① Fix the rod assembly to the work bench.
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
③ Insert cylinder head assembly to rod assembly.



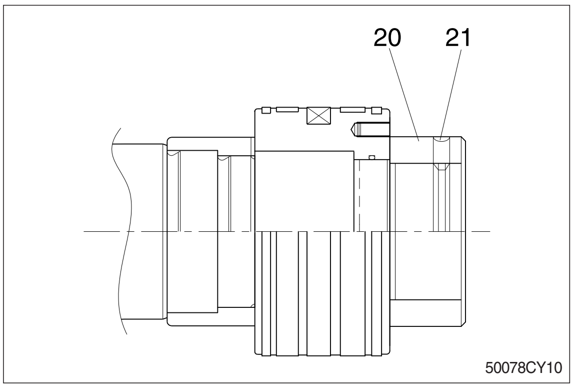
④ Insert cushion ring (13) to rod assembly.
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.
· Tightening torque : 150±15.0 kgf · m (1085±108 lbf · ft)
※ Refer to page 8-152.



⑥ Fit lock nut (20) and tighten the screw (21).
· Tightening torque :
Item 20 : 100±10.0 kgf·m (723±72.3 lbf·ft)
Item 21 : 5.4±0.5 kgf·m (39.1±3.6 lbf·ft)
※ Refer to page 8-152.



(3) Overall assemble

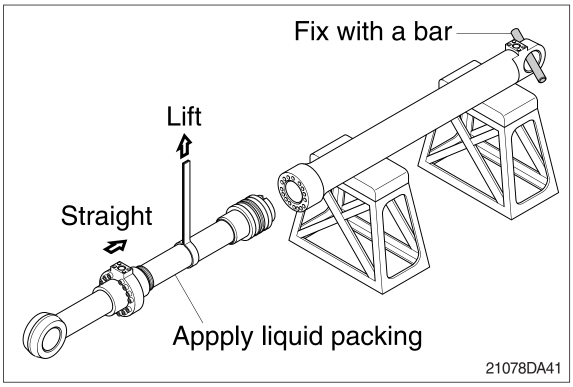
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

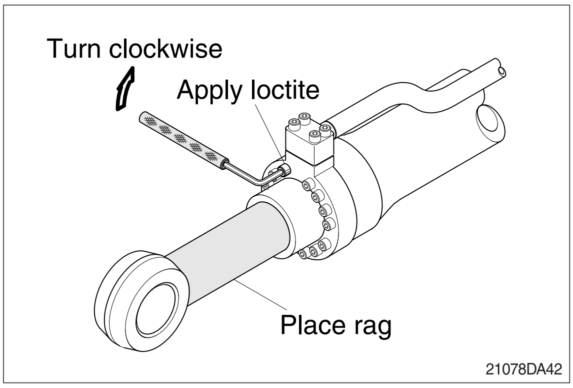
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ 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

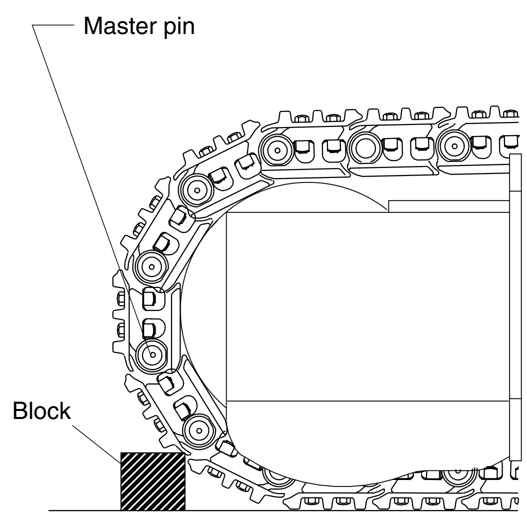
(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(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.

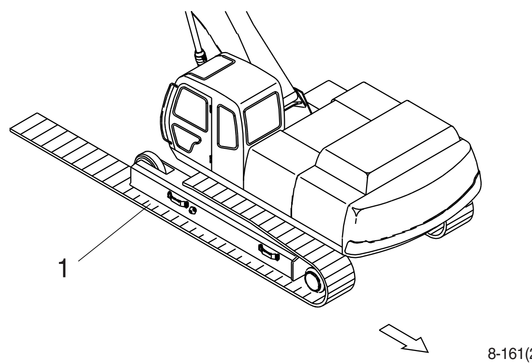


220S8UC01

(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.

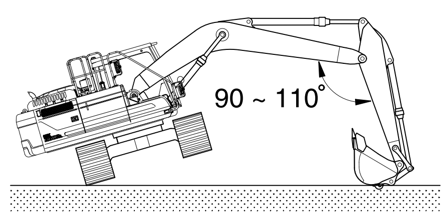


8-161(2)

2) INSTALL

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

※ Adjust the tension of the track link.

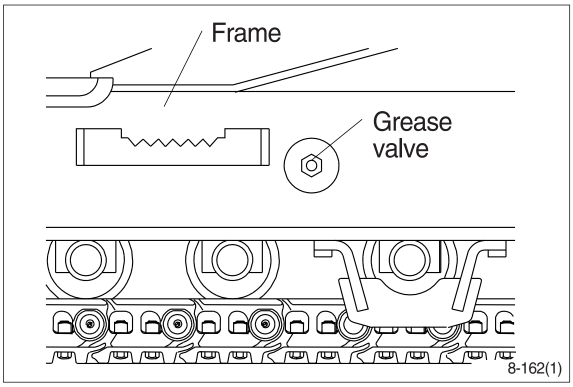


260A4OP09

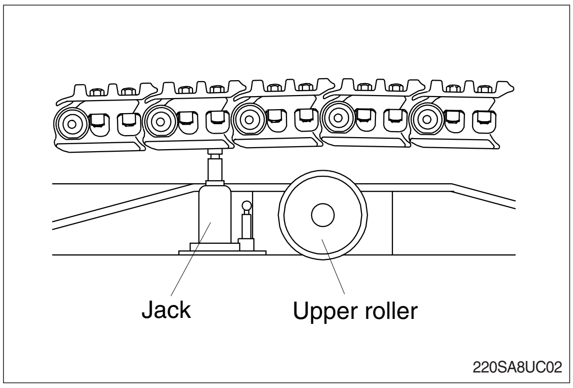
2. UPPER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



(2) Jack up the track link height enough to permit upper roller removal.

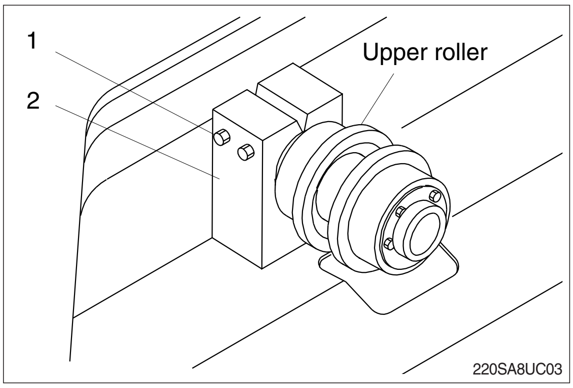


(3) Loosen the lock nut (1).

(4) Open bracket(2) with a screwdriver, push out from inside, and remove upper roller assembly.

· Weight : 41 kg (90.4 lb)

· Tightening torque : 29.7±4.5 kgf·m (215±32.5 lbf · ft)



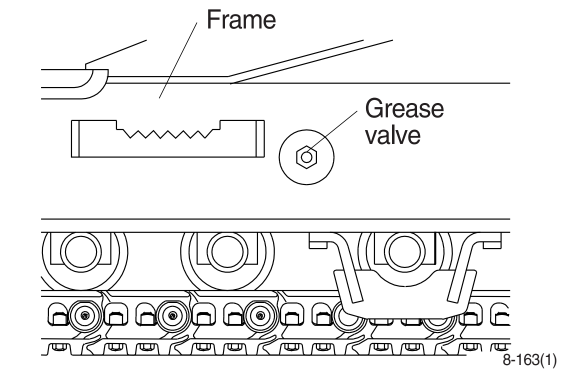
2) INSTALL

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

3. LOWER ROLLER

1) REMOVAL

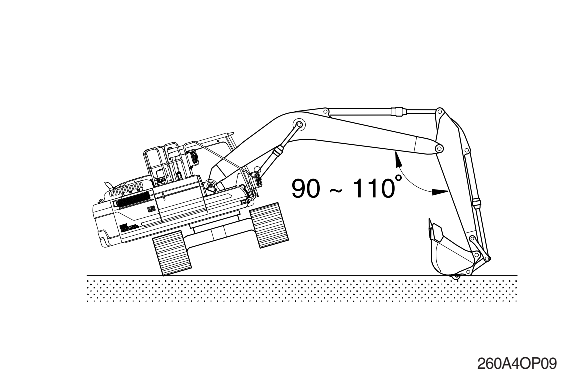
(1) Loosen tension of the track link.



8-163(1)

(2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.

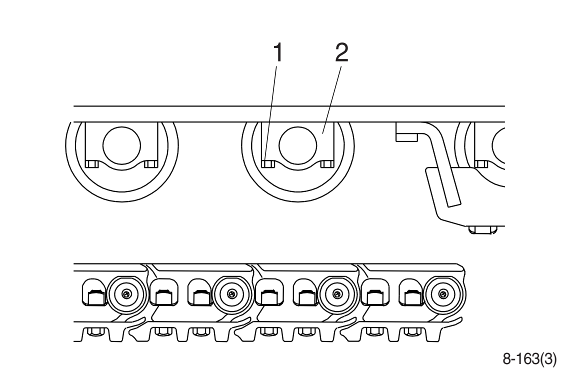


260A4OP09

(3) Remove the mounting bolt (1) and draw out the lower roller (2).

· Weight : 47.5 kg (105 lb)

· Tightening torque : 57.9±8.7 kgf·m (419±62.9 lbf · ft)



8-163(3)

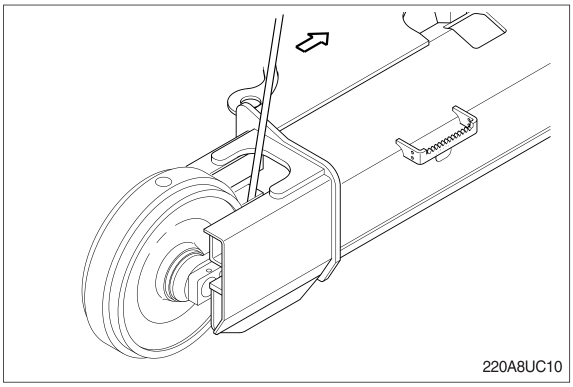
2) INSTALL

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

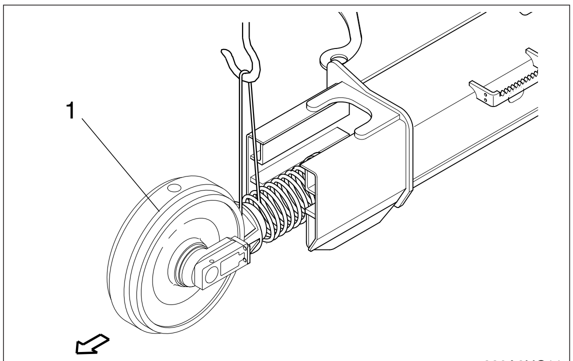
4. IDLER AND RECOIL SPRING

1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.

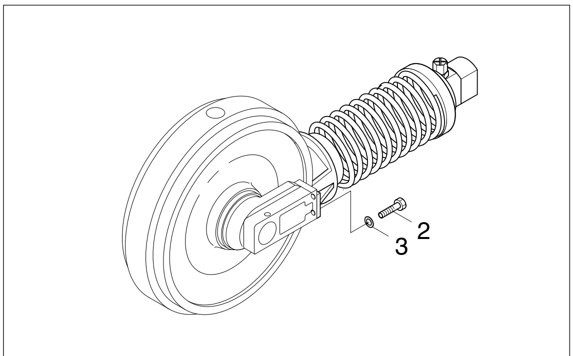

220A8UC10

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 314 kg (692 lb)



220A8UC11

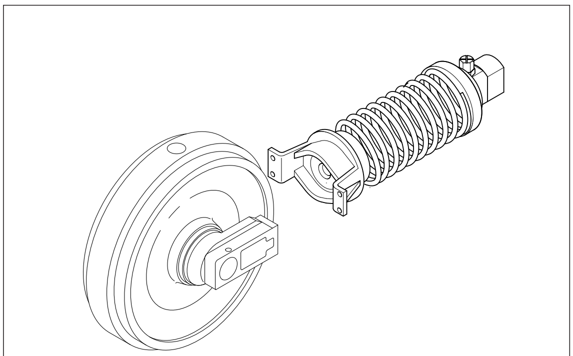
(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.
· Tightening torque : 29.7±4.5 kgf·m
(215±32.5 lbf · ft)



220A8UC12

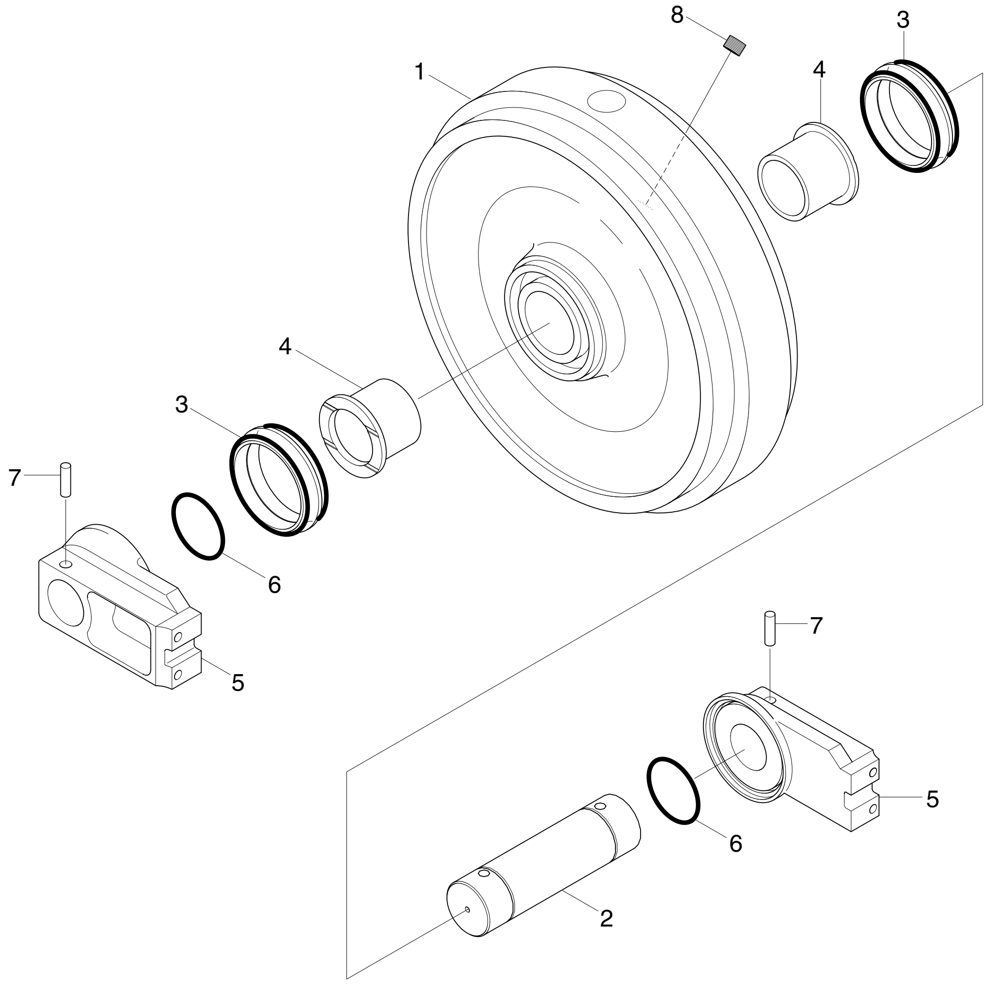
2) INSTALL

(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.


220A8UC13

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



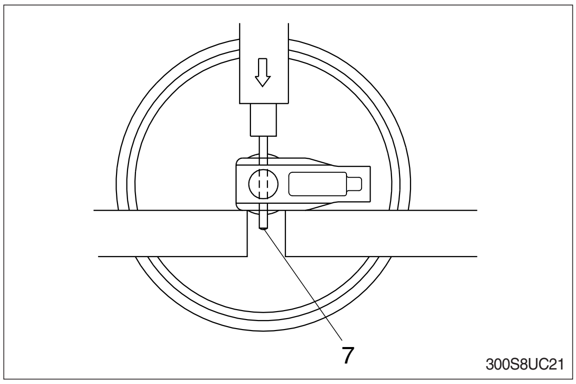
220S8DA43

1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Bracket	8	Plug
3	Seal assembly	6	O-ring		

(2) Disassembly

① Remove plug and drain oil.

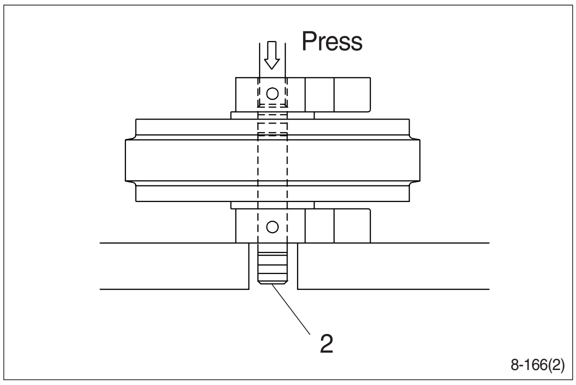
② Draw out the spring pin (7), using a press.



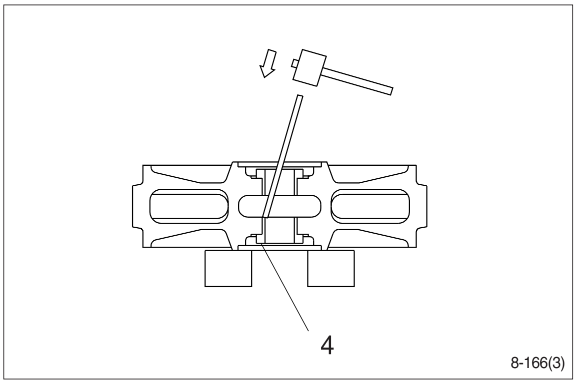
③ Pull out the shaft (2) with a press.

④ Remove seal (3) from idler (1) and bracket (5).

⑤ Remove O-ring (6) from shaft.



⑥ Remove the bushing (4) from idler, using a special tool.
Only remove bushing if replacement is necessity.

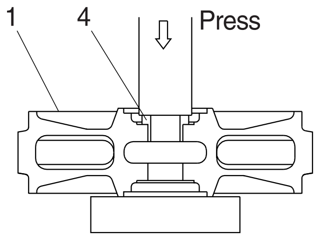


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

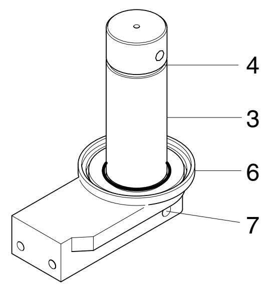
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1)

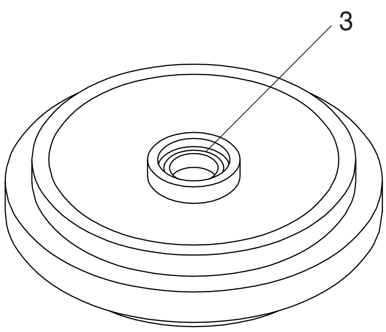
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



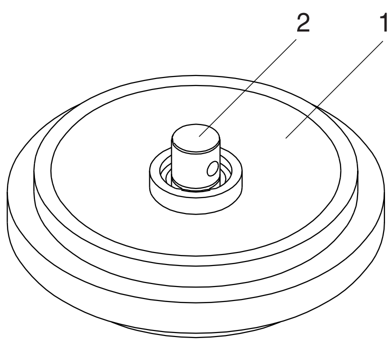
300S8UC22

④ Install seal (3) to shell (1) and bracket (5).



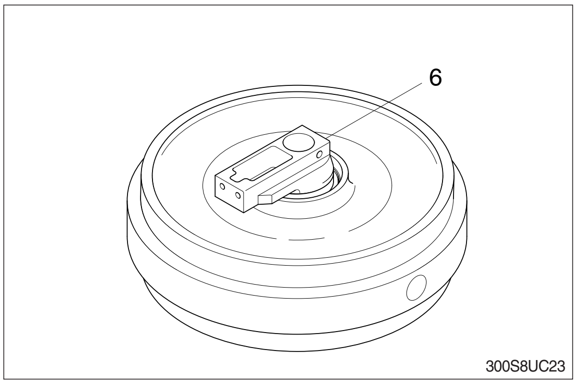
8-167(3)

⑤ Install shaft (2) to shell (1).

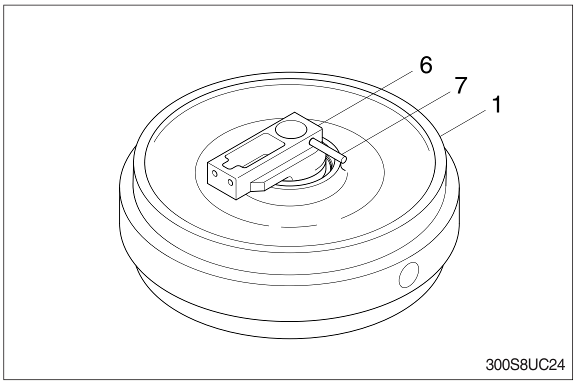


8-167(4)

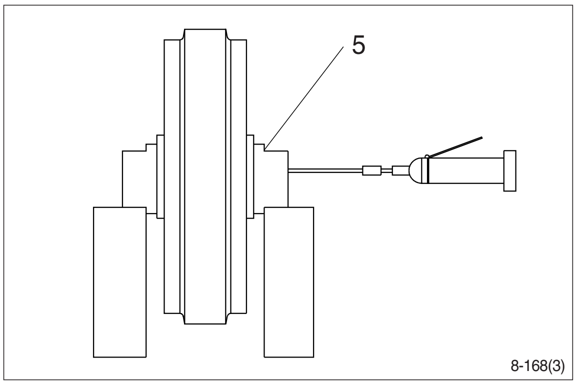
⑥ Install bracket (5) attached with seal (3).



⑦ Knock in the spring pin (7) with a hammer.

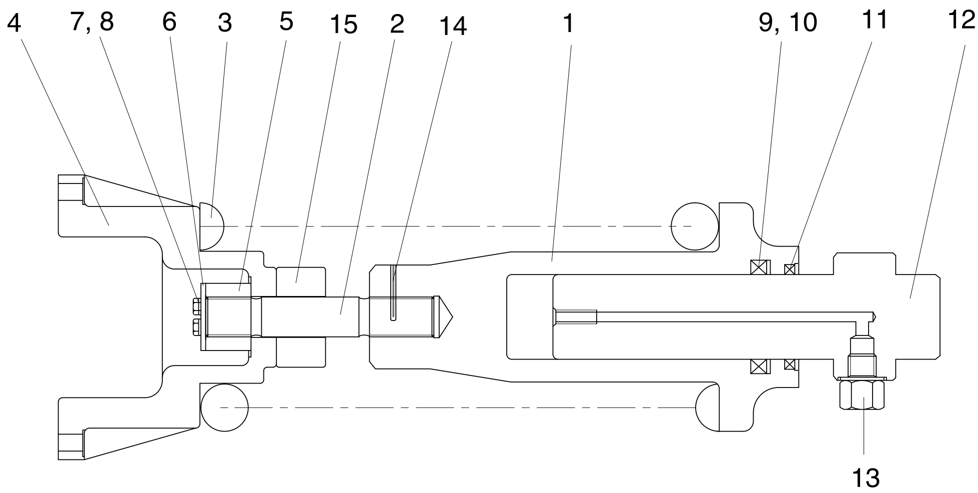


⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



220L8UC101

1	Body	6	Lock plate	11	Dust seal
2	Tie bar	7	Bolt	12	Rod
3	Spring	8	Spring washer	13	Grease valve
4	Bracket	9	Rod seal	14	Spring pin
5	Lock nut	10	Back up ring	15	Stopper

(2) Disassembly

※ The illustrations are base on the standa-rd.

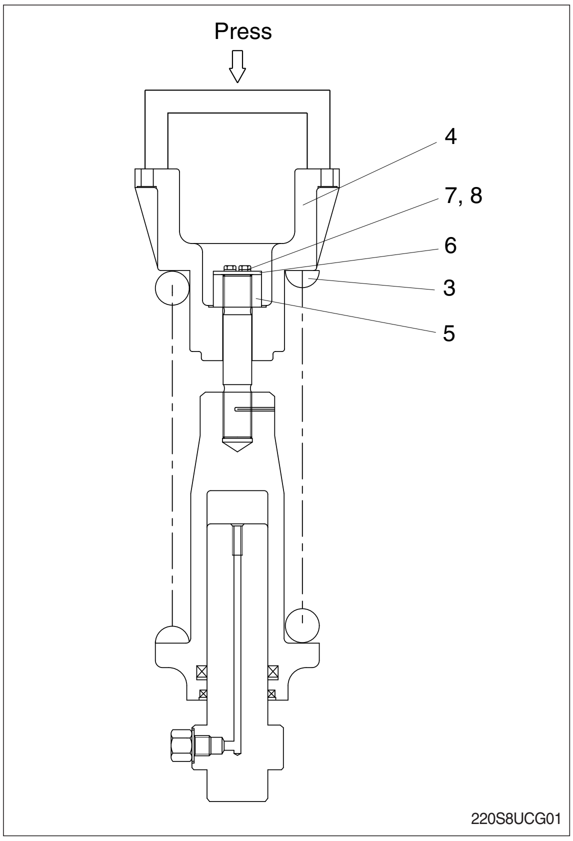
① Apply pressure on spring (3) with a press.

※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

② Remove bolt (7), spring washer (8) and lock plate (6).

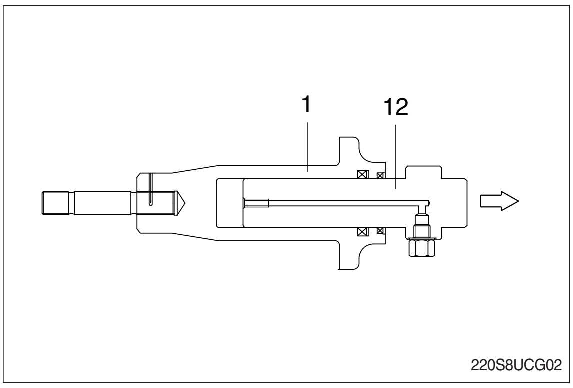
③ Remove lock nut (5).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove bracket (4) and spring (3).

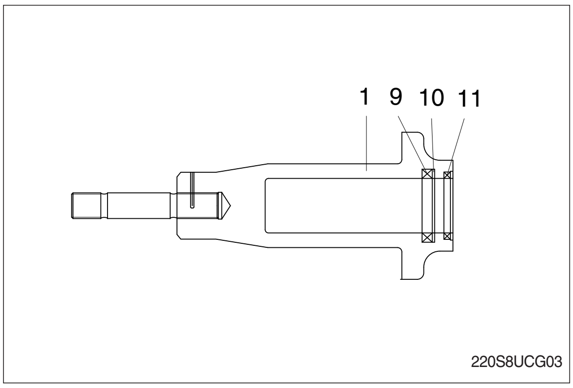


⑤ Remove rod (12) from body (1).

⑥ Remove grease valve (13) from rod (12).



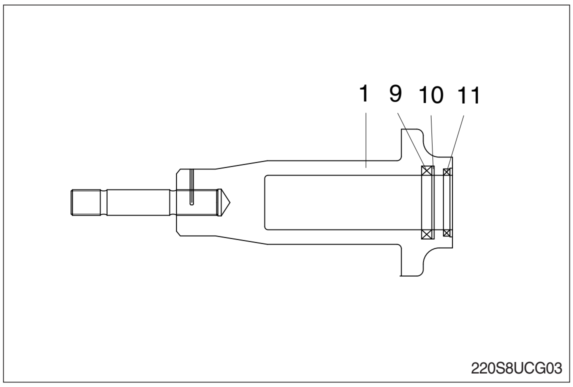
⑦ Remove rod seal (9), back up ring (10) and dust seal (11).



(3) Assembly

Install dust seal (11), back up ring (10) and rod seal (9) to body (1).

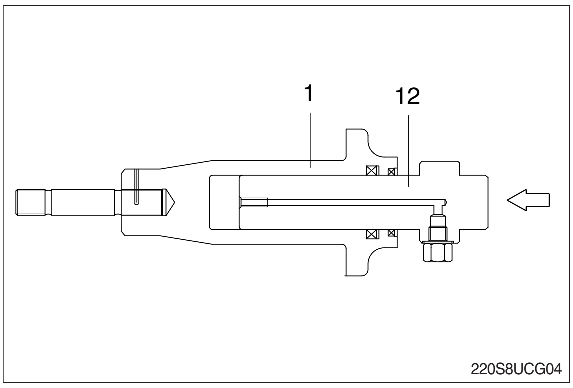
※ When installing dust seal (11) and rod seal (9), take full care so as not to damage the lip.



② Pour grease into body (1), then push in rod (12) by hand.
After take grease out of grease valve mounting hole, let air out.

※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve (13) to rod (12).
· Tightening torque
13±0.5 kgf·m (94±3.6 lbf·ft)

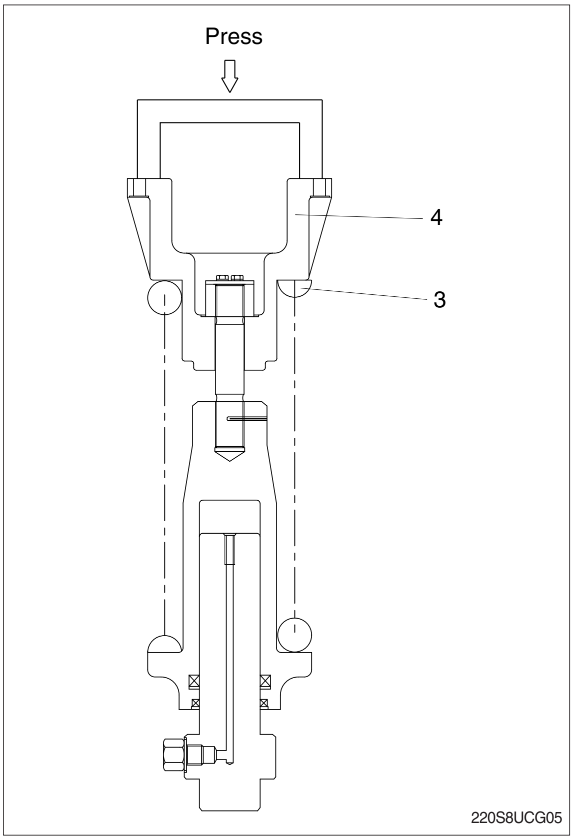


④ Install spring (3) and bracket (4) to body (1).

⑤ Apply pressure to spring (3) with a press and tighten lock nut (5).
· Spring set load
16315 kg (35968 lb)

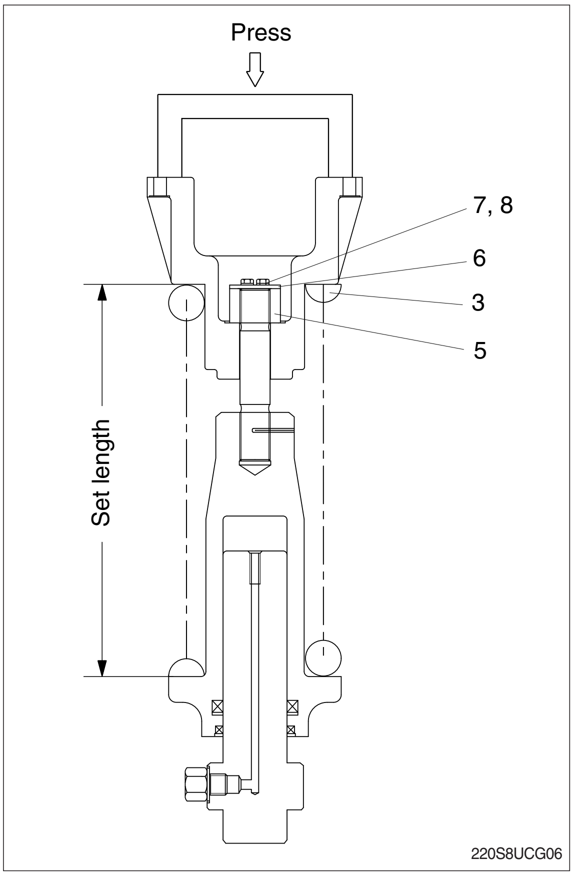
※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.



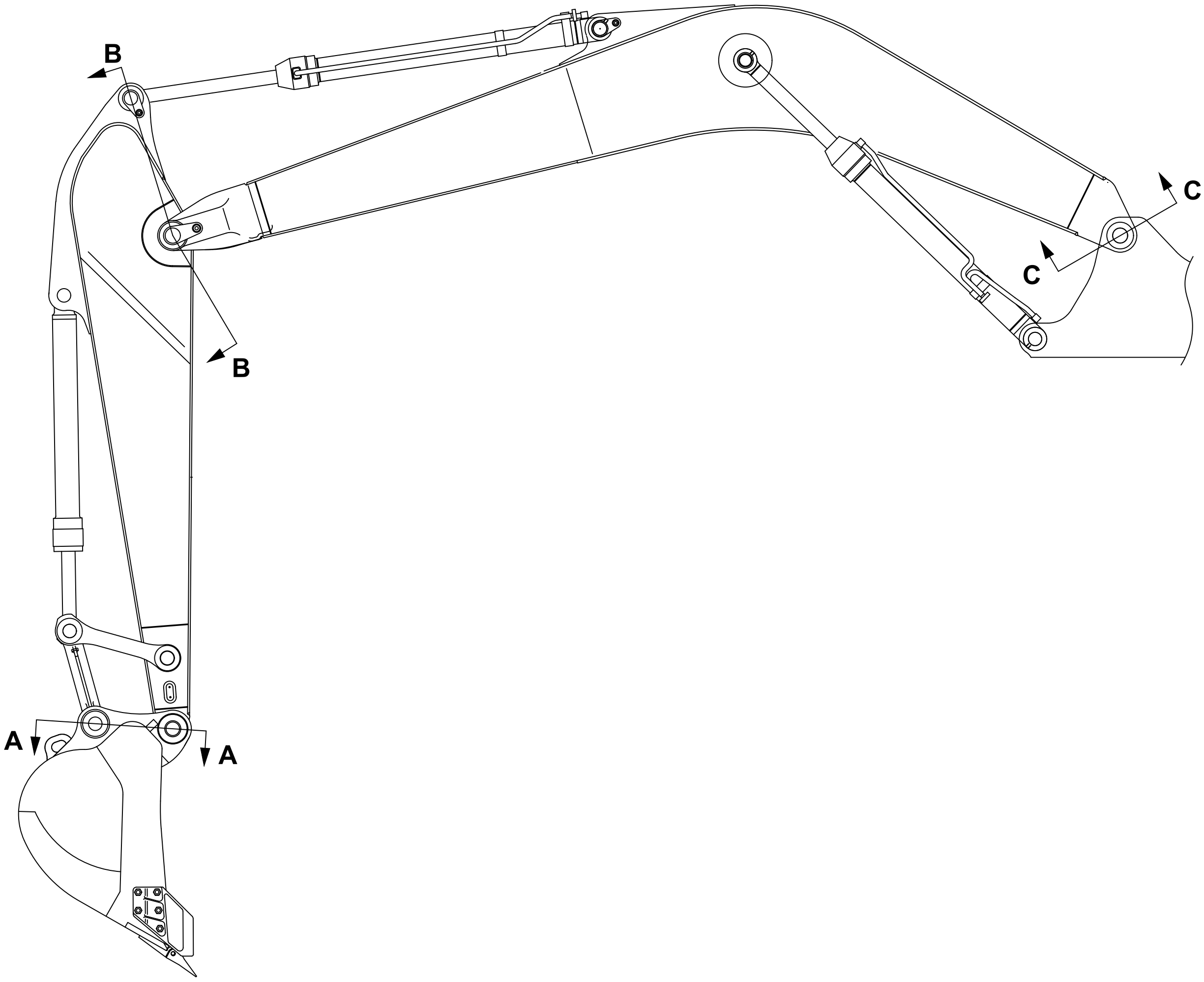
⑥ Lighten the press load and confirm the set length of spring (3).
- Set length : 508 ± 1.5 mm

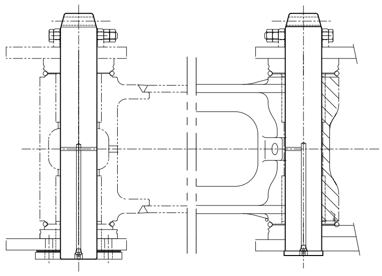
⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).
· Tightening torque : 15±0.5 kgf·m (108±3.6 lbf·ft)



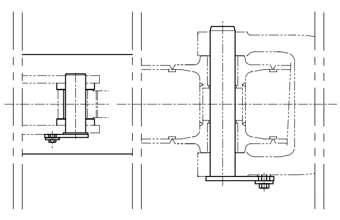
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

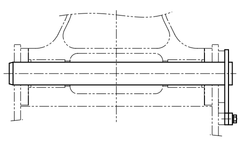




SECTION A



SECTION B



SECTION C

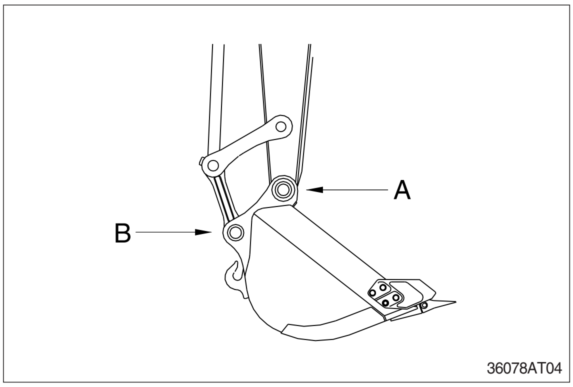
220A8WE10

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

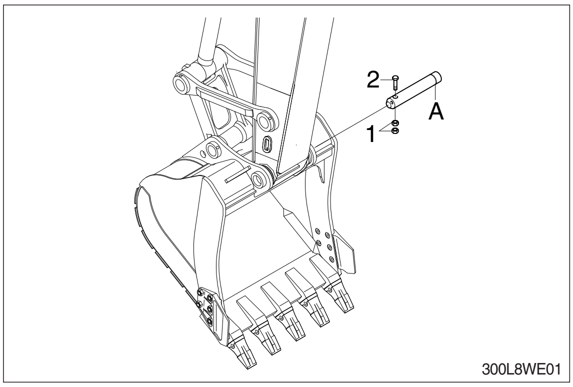
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



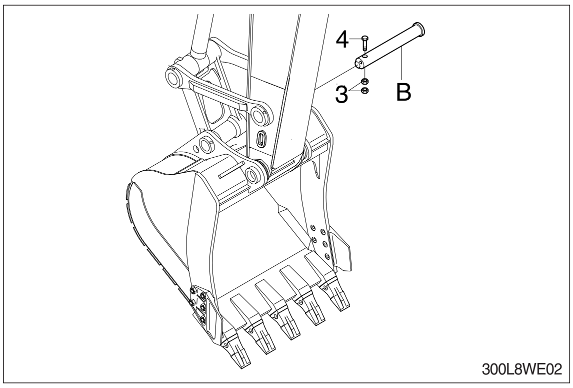
② Remove nut (1), bolt (2) and draw out the pin (A).

· Tightening torque (1) : 57.9±8.7 kgf·m (419± 62.9 lbf·ft)



③ Remove nut (3), bolt (4) and draw out the pin (B).

· Tightening torque (3) : 57.9±8.7 kgf·m (419± 62.9 lbf·ft)

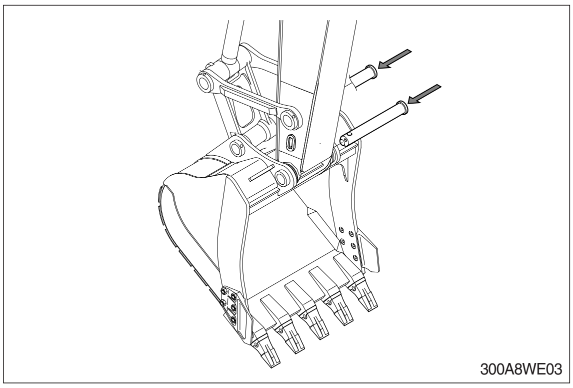


(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Adjust the bucket clearance.
For detail, see operation manual.



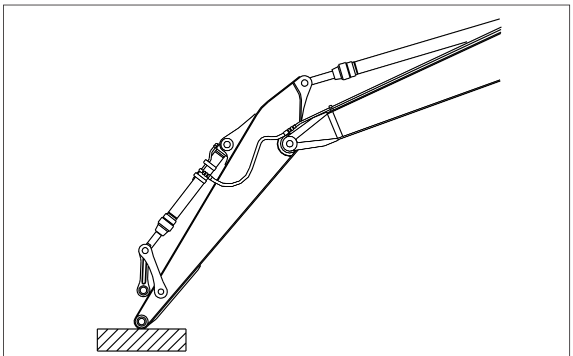
2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

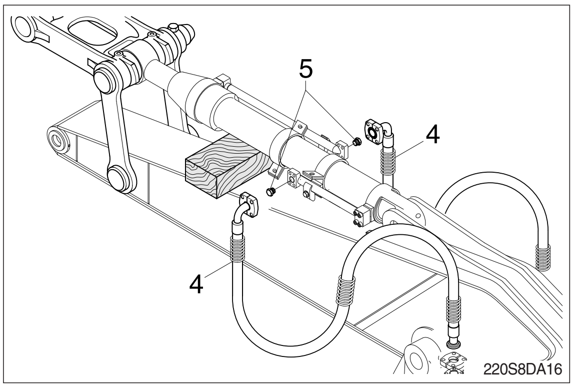
① Remove bucket assembly.
For details, see removal of bucket assembly.



8-175(1)

② Disconnect bucket cylinder hose (1).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**



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③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

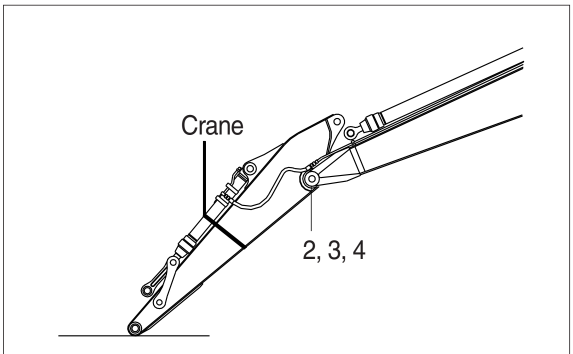
※ Tie the rod with wire to prevent it from coming out.

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 : 1540 kg (3400 lb)
· Tightening torque (2) : 29.7±45 kgf·m (215± 32.5 lbf·ft)

※ When lifting the arm assembly, always lift the center of gravity.



8-175(3)

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

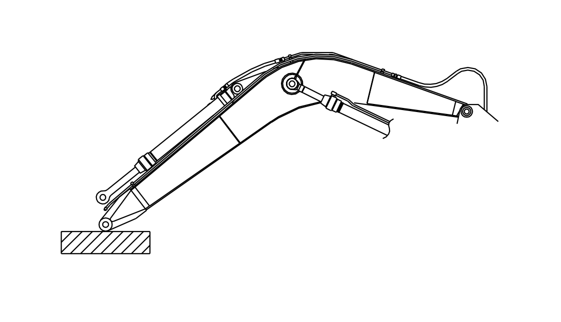
※ Bleed the air from the cylinder.

3) BOOM ASSEMBLY

(1) Removal

① Remove arm and bucket assembly.
For details, see removal of arm and bucket assembly.

② Remove boom cylinder assembly from boom.
For details, see removal of boom cylinder assembly.

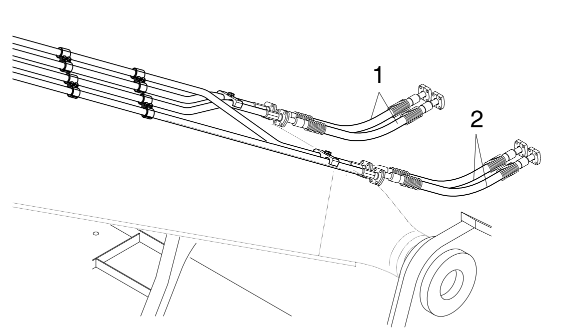

8-176(1)

③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



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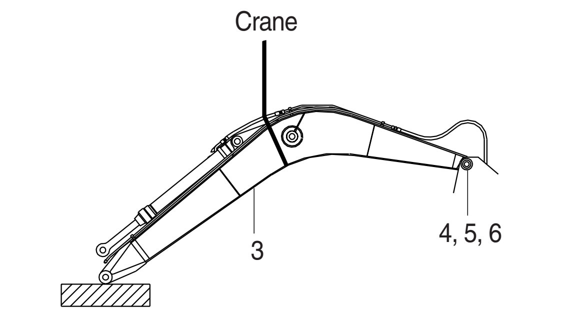
⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
- · Weight :2460 ㎏ (5420 ㏌)
- · Tightening torque (4) : 29.7±45 kgf·m (215± 32.5 lbf·ft)

※ When lifting the boom assembly always lift the center of gravity.



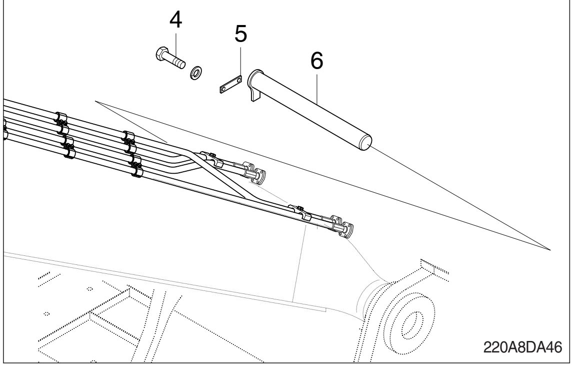
8-176(3)

(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.



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